Chapter 4: High resolution digital video aerial survey data protocols

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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 Chapters 10 through 14 of this report.

Study goal/objectives addressed in this chapter

Provide the detailed protocol for analysis, data management, and audits used for the high resolution digital aerial surveys in the Mid-Atlantic.

Highlights

- Aerial video data were collected on abundance and behaviors of marine birds, mammals, turtles, and other wildlife within the Mid-Atlantic Baseline Studies and Maryland Project areas.
- 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.

Implications

Results from the data collected following these protocols are presented in Chapter 5 and Part IV of this report.

[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 used for the data analysis process, the procedure used 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) and the Maryland Project (2013-2015) was 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 were 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) conducted large-scale surveys across the entire study area using high resolution video on an aerial platform. HiDef's technique used an array of four high resolution video cameras (which were 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 were conducted at 2,000 feet above sea level (Chapter 3). Wildlife were observed in the video footage, georeferenced, and identified to species or lowest taxonomic order. This technique also allowed assessment of individual behavior and estimation of animal flight height.

Some components of the survey and analysis procedures were conducted by HiDef, while others were 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 continued to be developed as techniques and technologies continued to be refined. In order to provide transparency and accountability for all video data review conducted by BRI during the project, Video Review Lab personnel developed detailed data protocols for the components of the data analysis and data management processes for which they were responsible.

Overview of data analysis process

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

I. HiDef Aerial Surveying Ltd.

a) HiDef worked 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 shipped the video footage to HiDef in the UK, and also made hard drive copies of the video and shipped them to the BRI office in Maine.
c) The HiDef review team viewed each frame to mark visible objects (or *targets*) using proprietary video processing software, and noted object categories (e.g., Bird, Buoy, Fish). These data were outputted to an Excel spreadsheet, and the markers generated through this process were 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 were re-reviewed (blind) by a second HiDef observer to determine the rate of agreement between observers. Agreement was at least 90% for the audit to pass. All objects found by both the observer and the auditor were included in the final file sent to BRI regardless of whether the audit passed. If the audit was not passed, that observer's recent data were examined for consistent errors and issues were addressed.
e) Spreadsheets with marked data were sent to BRI for object identifications (Appendix 4B).

II. Biodiversity Research Institute

a) The BRI review team examined video frames which contained marked targets. Each target was 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 was associated with each identification. If possible, ancillary data, such as the animal's behavior, direction of movement, and age and sex, were also noted (Appendix 4B, Table 4B-2). Direction of movement was noted in relation to the viewing screen (e.g., up, down, left or right).
b) The identification data spreadsheets were returned to HiDef in the UK.
c) Twenty percent of the objects originally categorized as animals by the HiDef review team were re-reviewed by additional BRI reviewers to determine the rate of agreement between observers. Agreement was defined according to relationships described in the QA/QC Review Protocol below. If <90% agreement was obtained for a given survey, supplementary audit and review processes were conducted as outlined in this protocol.

III. HiDef Aerial Surveying Ltd.

a) HiDef calculated flight altitude for flying targets listed in the identification data spreadsheets, using their proprietary parallax technology (Hatch et al. 2013), and georeferenced each video frame containing target objects using GPS data from the survey flight. Direction of movement was 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 were returned to BRI with added parallax, location, and direction of movement information.

IV. Biodiversity Research Institute

a) These data were joined to the audited data held by BRI and complete datasets were added to the Northwest Atlantic Seabird Catalog (formerly the Compendium of Avian Information), a publicly held database housed by the USFWS (O'Connell et al. 2009), 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 was stored on external hard drives and shipped between the aerial operator, BRI, and HiDef. These hard drives were uploaded to the server at BRI upon arrival, and data were accessed by the review team through this server. When data analysis and management was completed for a survey, the video data were 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 were in the following format: ZoneID#_Month#_SurveyDay_CameraNumber_Year (example: Zone19_M03_S01_D01_C2_12). Sequences, which contained camera reels, were named in the format 10-15-43.796.

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

Excel spreadsheets

Each camera for each day had an associated spreadsheet for analysis. HiDef completed 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 was protected to prevent changes being made to the columns that were needed for later processing. Columns (Appendix 4B) were filled out by the review team. Spreadsheets were stored on the BRI server in their respective year, survey, month, day and camera folders and were accessible to the entire review team.

[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.

Reel selection

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

Frame review

Each object had a marker number and a frame number associated with it. The frame number referred to the frame that the HiDef reviewer marked as containing an object for review (e.g., the frame in which the object was closest to the red center line that bisected 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) was also assigned a frame number. Some frames contained zero or a single marker identified, while others contained multiple markers, when there were numerous animals in the frame (Appendix 4C). The frame number from the spreadsheet was equivalent to the number in the file header information located at the top of the proprietary video processing software.

Identification of a marked target

For each frame that featured a target marked by the HiDef review team, a BRI reviewer entered the frame number into the proprietary video processing software to view the object. The reviewer closely examined each target for features (size, shape, color, behavior, flight pattern) that allowed for identification to species according to defined criteria (Appendix 4E). When the object was not identified to species, the object was categorized to a higher taxon level or a broad category (e.g., "UNKN; Unknown"). The aim was to identify targets to the lowest taxonomic level possible, with accuracy. Reviewers moved through all of the frames in which that object was recorded to get a sense of the target's movement, and to find the clearest images for review. Using proprietary video processing software, reviewers adjusted 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 were obscured (Appendix III).

Data fields completed by BRI

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

Marker Number

When an object was missed at the review stage and crossed the red line, a marker number was 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 was added to the screen by clicking on the object and selecting "Ok" (Appendix 4C). Marker numbers were generated automatically by the proprietary video processing software and advanced sequentially. The marker number was added to the marker number column in the spreadsheet.

ID Category

Objects were identified to species, when possible, based on the animal's size, coloring, movement, general shape, and movement/flight pattern. Options included 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 were also used; these corresponded to groups of species that were difficult to differentiate. For example, the "SMTU" code ("small turtle") included green, Kemp's ridley, hawksbill, and loggerhead sea turtle species, and was used in cases where more definitive species identifications were deemed to be impossible. Other group codes included:

> CESS; Cetacean/Seal/Shark - Animal was too obscured to discern between a cetacean, a seal, a shark, or a large fish
>
> UNBI; Unidentified Bird – Object was a bird but no further taxonomic distinctions were determined

In addition, non-object codes were used for marked objects that were not placed in a biotic category:

> Nothing; Nothing – Something was marked as an object, but there was nothing there. This was also used when a wave or feces was marked as an object.
>
> ERRO; Error – This was used to identify objects in an inoperable or damaged reel that was unable to be repaired. This was also used to identify objects on land.

Species Confidence

All objects were assigned a confidence level (Table 4-1). For non-species based identifications (e.g., "DUPL; Duplicate," "NA; Not Applicable"), "Definite" was used as the confidence.

Behavior

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

Flying at Sea Level

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

Submerged

Reviewers noted whether the animal was submerged or surfacing within the recorded frames. This designator was only used for aquatic animals.

Approximate Age

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

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

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

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

Measurements
When an on-screen measurement of an object was taken during the ID process using the proprietary point-to-point caliper module, the measurement was 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) were placed in the comments field.

Outside Zone
Animals were occasionally marked that did not cross the red line. When that happened, reviewers indicated this by choosing "Yes" here.

Flag
Flags were used to mark an animal that reviewers wanted to revisit for any reason. The reason for flagging was noted in the comments.

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

Comments
Reviewers filled out comments on the object when necessary. Reel names of any missing objects were included here. In addition, when changes were made to the data after they were sent back to HiDef for parallax and georeferencing, (for example, as the result of an audit arbitration; see QA/QC Review Protocol below) reviewers used 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 changed the ID Category fill color to dark green.

[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 entered the date of identification for every line of data.

Identifier
Reviewers entered their initials here for every line of data at the time it was 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 sent data spreadsheets to the HiDef head office in the United Kingdom. The UK office georeferenced all frames with target objects, and estimated the approximate flight height of flying objects using a proprietary parallax technique (Hatch et al. 2013). The columns produced through this process were Latitude, Longitude, Flight Height, Flight Height Confidence, and a modified field for Behavior that included cardinal direction of movement where applicable (Appendix 4B, Table 4B-3). While HiDef was completing these data analyses for the survey, BRI concurrently began 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
The goals of QA/QC were to ensure:

1. Data were consistent, accurate, valid, and repeatable
2. Problem areas and successes were identified, addressed, documented, and reported
3. ID criteria and SOPs were up to date and applied consistently by each reviewer
4. Exceptional data quality was 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” represented the year in which the survey was flown, “M09” represented the month in which the survey was flown. “Audit” or “Arbitration” was the task performed. “JGO” represented 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 was locked and drop-down menus were used in fields with analyzable data. In addition, drop-down menus were extracted from a master code database, which was updated with definitions and codes on a regular basis (Appendix 4D). Ancillary data within the reviewer spreadsheet, such as measurements or

comments, were recorded as text. To ensure repeatability and consistency, all reviewers referred to the same reference documents, such as measurement charts, seasonal distribution maps, and a "Confidence and Identification Criteria" document (Appendix 4E), which was 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' needed to be met. Otherwise, it was either downgraded to a lower confidence level or a higher taxonomic grouping, such as 'Unidentified Alcid'.

Data completion QA/QC

Reviewers checked for common data errors using a checklist (Appendix 4G). After target identification was complete, the QA/QC manager compiled the data by month and double-checked for errors, such as those listed in Appendix 4G. Errors were corrected by the original identifier, when available, and any corrections to the data by the team leader or QA/QC manager were 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 were filtered for objects originally characterized by Hi-Def reviewers as biota. Buoys, boats, and reel locations did not qualify for audit. Twenty percent of the remaining objects were eligible for audit and this number was noted. In order to maximize the audit effort, and to reduce audit technical error, other objects were exempt from the audit, such as duplicate objects, outside zone objects, and objects that were not identified due to reel or marker number errors. Next, a formula was used to assign a random number to all eligible objects. Once those numbers were generated, the spreadsheet was sorted in numerical order by the random-generated number. The top 20% were chosen and pasted into a new tab. The original compiled spreadsheet was sorted for threatened and endangered (T&E) species and any T&E objects that did not get chosen for the random-generated audit were also added to the random audit. The objects were assigned a second random number and sorted in ascending order by the random-generated number. The spreadsheet was filtered by each original reviewer and those objects were evenly distributed to other BRI reviewers. All original answers were removed, new fields for audit identification were added, and a new "blind" spreadsheet was generated for each auditor. Auditors followed the same identification protocol as for the target ID process above, and their identifications were compared to the original identifications to determine how often the first and second reviewers agreed. A "pass" grade occurred when auditors agreed 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 was conducted via MS Access using pre-determined answer agreements (Appendix 4H; these were based on the 'Confidence and Identification Criteria' document and rules that applied to all biotic objects). The rules were (see Table 4-3 for examples):

1. Specific species identifications were considered to equal the next available higher taxonomic grouping as long as the next available grouping was not "UNBI; Unidentified Bird", "ID

Impossible; ID Impossible", or "CESS; Cetacean/Seal/Shark". In those instances, the species only equaled itself. For example, some species such as "NOGA; Northern Gannet" and "REBA; Red Bat" were singly defined in the audit answer status (see Appendix 4H) because they had no known similar species in the study area during the project period. Fully defined species such as "BODO; Bottlenose Dolphin" passed as an "SBCE; Small beaked Cetacean to 3m" in an audit.

2. Higher taxonomic grouping identifications were considered equal to the next lowest taxonomic level as well as next highest taxonomic grouping. For example, SBCE; Small beaked Cetacean to 3m equaled CODO; Common Dolphin or BODO; Bottlenose Dolphin, and also equaled UNDO; Unidentified Dolphin. However, it was not be a match to an even broader taxonomic category such as UNCE; Unidentified Cetacean.
3. Biota did not equal abiota.
4. For higher flying birds, such as gulls and terns, measurements had overlapping measurement error values, which were further exacerbated by unknown flight height of the bird at the time of identification. Therefore, groupings with size designations crossed sizes in the audit agreement rules and also equaled the next available higher taxonomic grouping. For example, UNMT; Unidentified Medium Tern: 32-45cm equaled 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 only equaled themselves.

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

When there was at least 90% agreement, then the audit was passed for that survey and no further analysis was needed. When the overall audit was 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 represented ≥20% overall object composition within the survey but had <90% agreement were discussed by the team to determine better methods for identification (see Table 4-4 for an example). After ID criteria were clarified and the 'Confidence and Identification Criteria' document was revised, all objects from those taxonomic groups were re-reviewed in the original data. After a repeated review of those target taxa, 20% of the target taxa that were not in the original audit were audited. When 90% agreement was achieved in this second audit, no further analysis was needed. When audit disagreement continued, the taxonomic grouping went into arbitration, whereby the object(s) in question were independently reviewed again by the entire team and a final answer was determined based on those results. Mismatches from taxa that did not represent ≥20% overall object composition within the survey were team-reviewed in order to improve identification methods and criteria.

Audit analysis: T&E species

All objects that were identified as state- and federally-listed species were included in the audit alongside randomly chosen objects[4]. Audit agreement had to be 100% for T&E species and in most cases, the T&E species had to match exactly. Since all sea turtles are federally listed, audit agreement allowed for a specific species of turtle to match "SMTU; small turtle" and vice versa. However, a specific species did not match another species in the turtle grouping. All mismatches of T&E species automatically went to arbitration.

Arbitration

Arbitration occurred when there was 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 were independently reviewed again by the entire team and final answers were determined based on those results.

Each arbitrator received a new spreadsheet with all audit mismatches and each object was reviewed on the video footage again. Each object mismatch was reviewed by the original reviewer, original auditor, a new informed reviewer, and a new uninformed reviewer. For those objects where the arbitrator role was original reviewer, original auditor or informed reviewer, the arbitrator viewed the original reviewer's identification category and comments, as well as the original auditor's identification category and comments. The arbitrators reviewed the video footage, assessed the original reviewer and auditor answers, and either chose 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 were omitted.

Once the arbitration spreadsheets were complete, the final answers were determined by the level of Identification Category agreement. When the majority of the arbitrators chose the same Identification Category, then this was the final answer. In instances when there was no majority agreement, then the Identification Category with the highest taxonomic value was chosen. When the original answer was overturned in arbitration, corrections were then made to the original reviewer spreadsheet.

[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.

Literature cited

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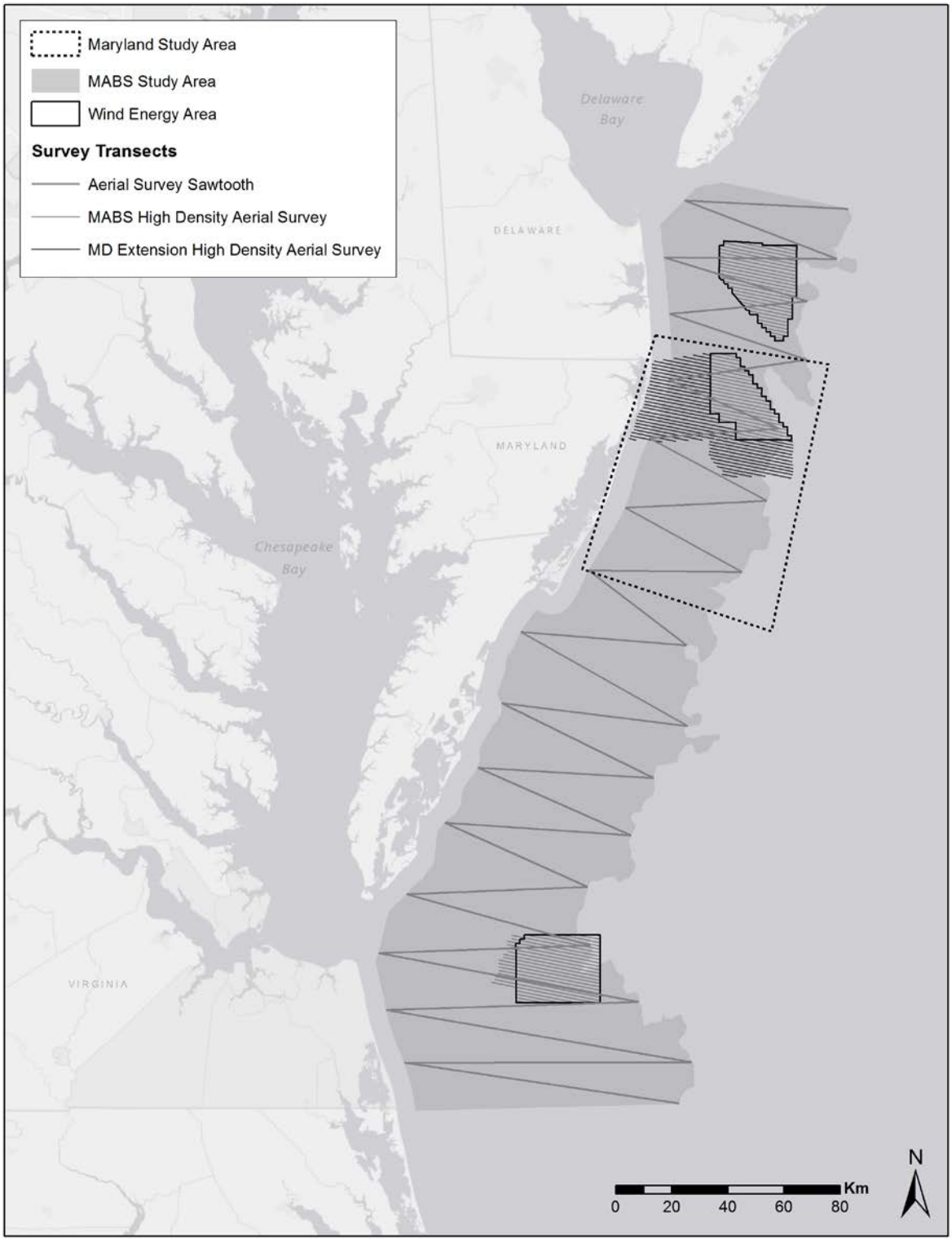

Figure 4-1. Map of digital video aerial survey transects for the Mid-Atlantic Baseline Studies and Maryland Projects (2012-2014). Mid-Atlantic Baseline Studies transects are shown in light gray. High-density Maryland transects are shown in dark gray.

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 was 80%. Loons represented ≥20% overall object composition and received <90% agreement, resulted 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 reviewed
Gannets (Sulidae)	71	4%	3	8	11	73%	Team reviewed
Gulls and Terns (Laridae)	341	18%	17	54	71	76%	Team reviewed
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 reviewed
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 reviewed mismatches
Turtles (Testudines)	**293**	**16%**	**3**	**56**	**59**	**95%**	**Arbitration**
Unidentified Birds (Aves spp.)	152	8%	10	20	30	67%	Team reviewed mismatches
Unidentified Marine Mammal or	20	1%	1	2	3	67%	Team reviewed mismatches
Unidentified Whale (Cetacea)	2	0%	1	0	1	0%	Team reviewed 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 was audited by a second observer, and objects on which the reviewers disagreed were re-reviewed in an arbitration process (the exact process varied 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 was random. Threatened and Endangered Species audits (in which all species initially identified as a listed species of concern at the state or federal level were reviewed by a second observer) were comprehensive, and included 100% of these identified species for each audit.

BRI – Biodiversity Research Institute, the nonprofit research organization based in Maine that oversaw the Mid-Atlantic Baseline Studies and Maryland Projects (www.briloon.org).

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

GSD – ground sample distance, affected image resolution.

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

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

Maryland Project – Two year (2013-2015) extension to the Mid-Atlantic Baseline Studies Project funded by the Maryland Department of Natural Resources and the Maryland Energy Adminstration. 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 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 included 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 crossed to be included within the survey area- this red line represented 50 meters wide for 2 cm GSD, 75 meters wide for 3 cm GSD.

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

SOP – standard operating procedure.

T&E – threatened and endangered species.

Transect – line flown by aircraft during surveys. There were 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 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*
[redacted]	Zone surveyed.	*Zone 19*
[redacted]	Date of survey – mm/dd/yyyy.	*03/26/2012*
[redacted]	Number assigned to each camera in an array.	*1*
[redacted]	Ground sample distance in cm	*2cm*
[redacted]	Local time at start of reel. Noted as hours-minutes-decimal seconds in 24 hour time.	*11-36-07.796*
[redacted]	Initials of the HiDef reviewer.	*DC*
[redacted]	[redacted]	[redacted]
[redacted]	Frame number in which an object was marked. Frames were numbered sequentially at the beginning of each reel.	*159*
[redacted]	General category describing observation. Start and end of reels were also noted in this field.	*bird*
[redacted]	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) were 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. Included 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 had 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	Selected appropriate option from list.	Drop-down	Male, Female
Measurements	Estimated length or wingspan, in cm.	Number	105
Outside Zone	Marked when object did 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 was 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 was 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) was the marker with a marker number. Animals were marked when they were close to the red midline, as shown in this picture.

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

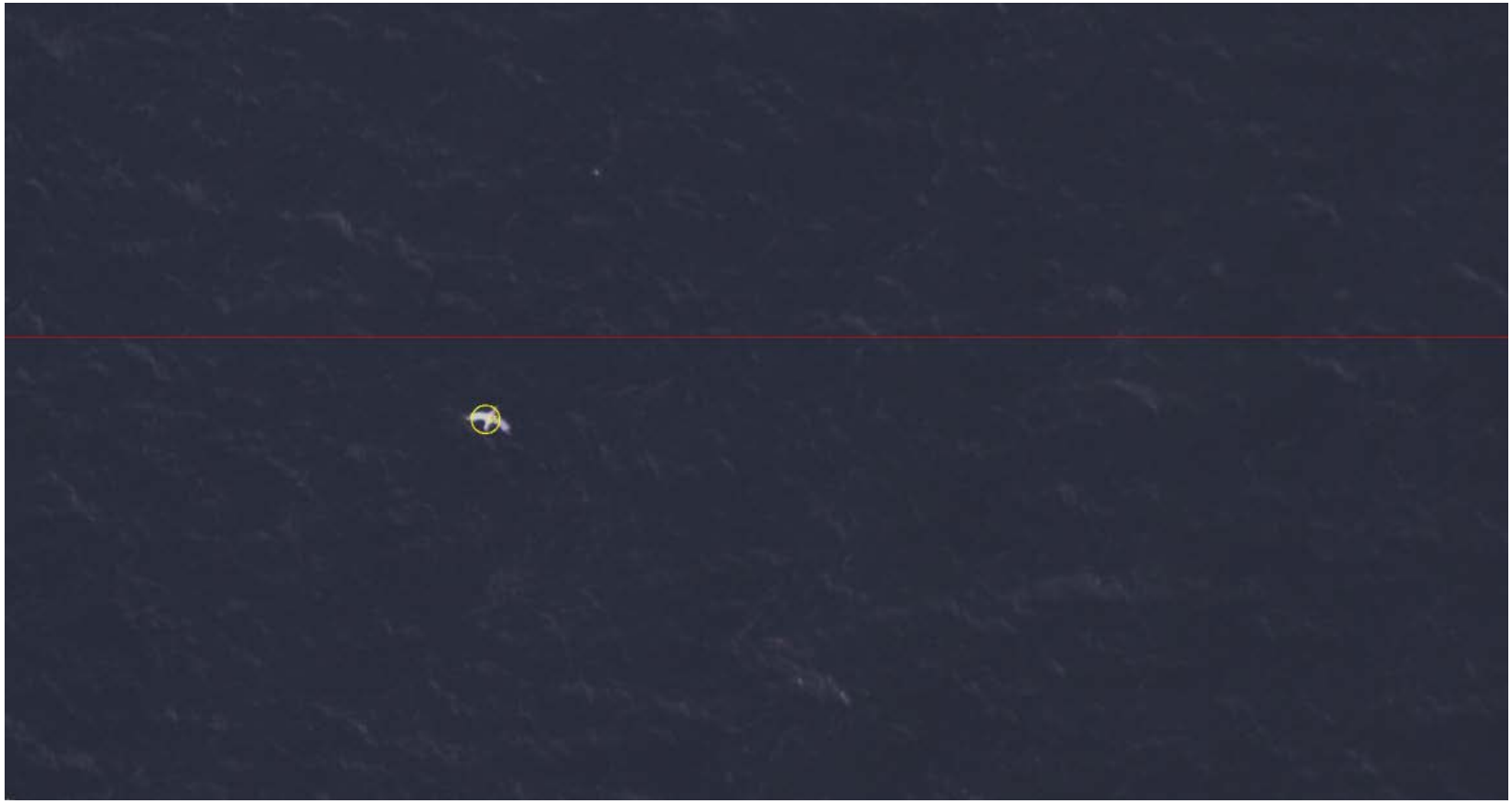

Figure 4C-3. Adjusting the Gain and Gamma gave greater overall contrast especially when viewing flying objects vs. submerged objects. The Gain adjusted the brightness of highlights or whites, while gamma was adjusted to deal with the brightness of mid-tones. In this image the Gain was lowered compared to **Figure 4C-2** and the Gamma was decreased. The adjustments allowed for the yellow coloration on the head and the black wing tips to stand out.

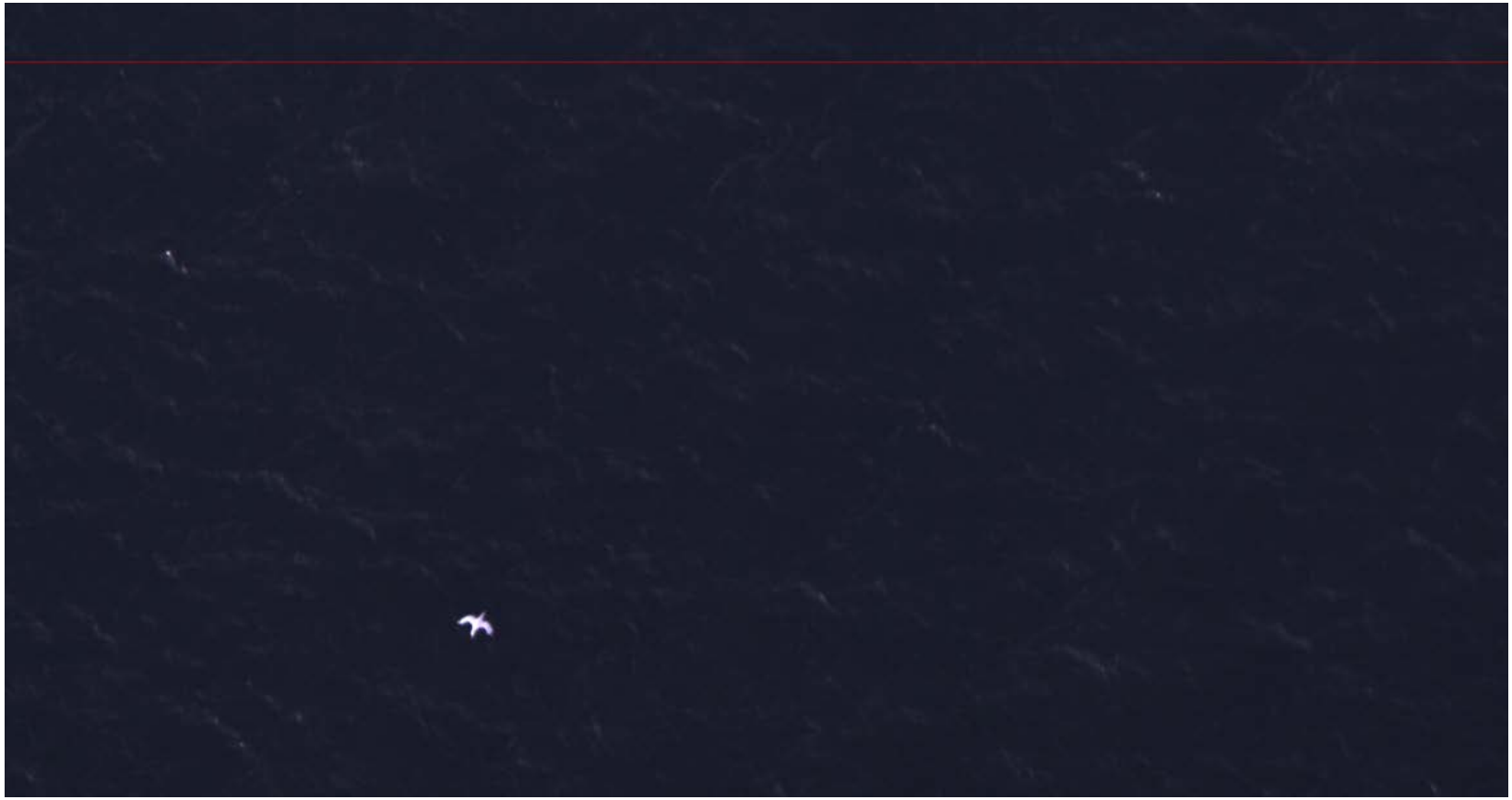

Figure 4C-4. Moving the footage backward and forward from the frame in which the object was marked allowed reviewers to examine animal movements such as wing flapping, diving, or turning a head. In this image the reviewer reversed to an earlier frame from the one shown in **Figure 4C-1**.

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

Figure 4C-6. Black Scoters (*Melanitta americana*) in flight with shadows visible. Each scoter in this image was counted as flying at sea level.

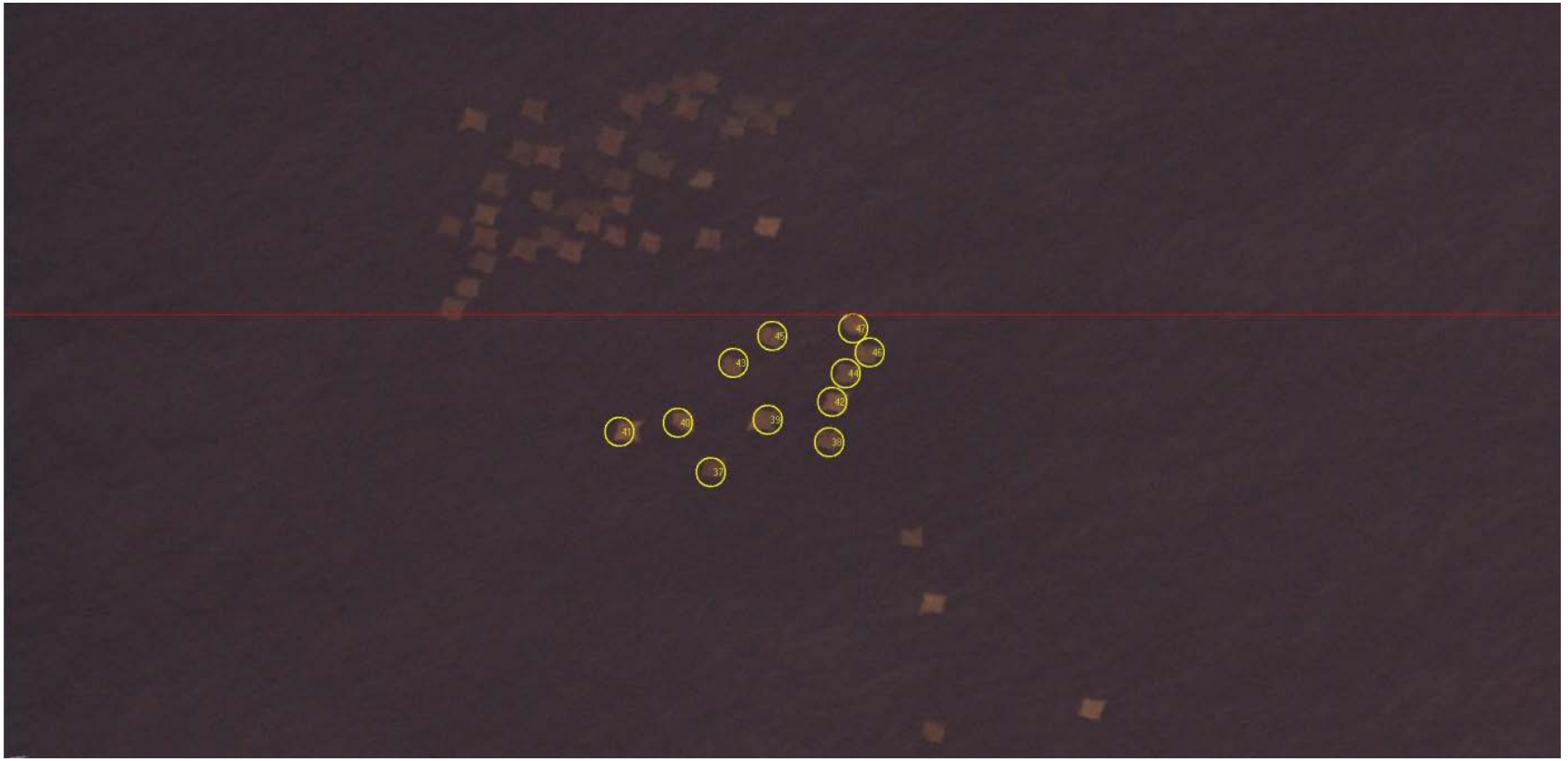

Figure 4C-7. Cownose Rays in a large school. Individuals that were close to the red midline were marked while those that passed or were approaching were marked in a different frame. This helped with data processing and identifying individual animals.

Figure 4C-8. Measurement of a Cownose Ray. Cownose Rays were measured from their widest point fin-to-fin, so it was important to choose a frame where both fin tips were seen. Note that this was a screen capture of the same rays as shown in the prior figure, but a few frames before it, so a different group of rays was 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 were added as the need arised. All species codes used in the species included column were obtained from the ID Category column. Bird species codes largely adhered to AOU (American Ornithologists' Union) four-letter alpha codes.

ID Category	Explanation or Species Included	Occurred in Project?
AKSH;Auk or Shearwater	Included 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
BOGU;Bonaparte's Gull		Yes
BOLO;boat--lobster		No

ID Category	Explanation or Species Included	Occurred in Project?
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. Included 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	Included all cetaceans/seals/sharks and fish.	Yes
CLDO;Clymene Dolphin		No
CODO;Common Dolphin	Short-beaked or Long-beaked Common Dolphin. Short-beaked was 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	Included AUSH,MASH,SOSH	No
DCCO;Double-crested Cormorant		Yes

ID Category	Explanation or Species Included	Occurred in Project?
DOVE;Dovekie		Yes
DOWI;Dowitcher spp.	Short-billed or Long-billed Dowitcher	Yes
DUPL;Duplicate	The same object was 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	Included 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)	Included BCPE,GRSH	Yes
GRCO;Great Cormorant		No
GRCS;Great or Cory's Shearwater (on water)	Included 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 Impossible;ID Impossible	Biotic object lacked enough detail to place in a broad taxonomic grouping	Yes
JASK;Jaeger or Skua	Included GRSK,LTJA,PAJA,POJA,SPSK	No

ID Category	Explanation or Species Included	Occurred in Project?
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	Used for objects that were waves or bird feces	Yes
OSPR;Osprey		Yes
PAJA;Parasitic Jaeger		Yes
PEFA;Peregrine Falcon		No
PKWH;Pygmy Killer Whale		No
POJA;Pomarine Jaeger		Yes

ID Category	Explanation or Species Included	Occurred in Project?
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. Included 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.	Included REPH,RNPH	Yes
SMTU;Small turtle	Included 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
SPSK;South Polar Skua		No
SPWH;Sperm Whale		No

ID Category	Explanation or Species Included	Occurred in Project?
STDO;Striped Dolphin		No
SUSC;Surf Scoter		Yes
SWAL;Unidentified Swallow	Included 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	Included ARTE,BLKI,BLTE,BOGU,BRTE,CATE,COTE, FOTE, LAGU,LETE,LIGU,RBGU,ROST,ROYT,SAGU,SATE, SOTE	Yes
UNAL;Unidentified Alcid	Included ATPU,BLGU,COMU,DOVE,RAZO,TBMU	Yes
UNBI;Unidentified Bird	Included all bird species	Yes
UNBW;Unidentified Baleen Whale	Members of Suborder Mysticeti	No
UNCE;Unidentified Cetacean	All whales and dolphins	Yes
UNCO;Unidentified Cormorant	Included DCCO,GRCO	No
UNDO;Unidentified Dolphin	Members of Family Delphinidae	Yes
UNDT;Dark Tern	Included BRTE,SOTE	No
UNDU;Unidentified Duck	Included BLSC,BUFF,COME,LTDU,RBME,SUSC,UNME, UNSC,WWSC	Yes
UNFS;Unidentified Fin/Sei	Fin or Sei Whale	Yes
UNGR;Unidentified Grebe	Included HOGR,RNGR	Yes
UNGU;Unidentified Gull	Included BLKI,BOGU,GBBG,GLGU,HERG,ICGU,LBBG, LAGU,LIGU,RBGU,SAGU	Yes
UNJA;Unidentified Jaeger	Included 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)	Included COMU,RAZO,TBMU	Yes
UNLG;Unidentified Large Gull	Included GBBG,GLGU,HERG,ICGU,LBBG,SAGU	Yes
UNLO;Unidentified Loon	Included COLO,RTLO	Yes
UNLT;Unidentified large Tern	Included CATE,ROYT	Yes
UNLW;Unidentified large whale	Large Cetacean > 10m	No
UNME;Unidentified Merganser	Included COME,RBME	No
UNMG;Medium Gull: 38-53 cm	Included BLKI,LAGU,RBGU,SAGU	Yes
UNMT;Medium Tern: 32-45 cm	Included ARTE,BRTE,COTE,FOTE,ROST,SATE,SOTE	Yes

ID Category	Explanation or Species Included	Occurred in Project?
UNMW;Unidentified Medium Whale	Medium-sized Cetacea. Included species BBWH,CBWH,FKWH,GBWH,KIWH,LFPW,MIWH,NABW,SFWH,SBWH,TBWH	Yes
UNPA;Unidentified Passerine		Yes
UNPH;Unidentified Phalarope	Included REPH,RNPH	Yes
UNRA;Unidentified ray	Included members of superorder Batoidea	Yes
UNRO;Unidentified Rorqual	Members of Family Balaenopteridae	No
UNRS;Unidentified ray school	School of unidentified rays were marked (instead of individual animals within the schools) in situations where individuals were too small, deeply submerged, or otherwise poorly visible to be able to reliably distinguish individuals.	Yes
UNSA;Unidentified small alcid (Puffin/Dovekie)	Included ATPU,BLGU,DOVE	Yes
UNSC;Unidentified Scoter	Included BLSC,SUSC,WWSC	Yes
UNSG;Unidentified small gull	Included BOGU,LIGU,SAGU	Yes
UNSH;Unidentified Shearwater	Included AUSH,COSH,GRSH,MASH,SOSH	Yes
UNSK;Unidentified Skua	Included GRSK,SPSK	No
UNSP;Unidentified Storm-petrel	Included BRSP,LESP,WFSP,WISP	Yes
UNST;Unidentified small Tern	Included BLTE,LETE	Yes
UNSW;Unidentified small whale	Small-sized Cetacea	No
UNTE;Unidentified Tern	Included 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
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. When an object did not meet the "Definite" criteria for a particular ID category, then it went to the next lower confidence level. When the object did not meet even the "Possible" level criteria, then it went 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 arose	Not used	Not used	UNBI; Unidentified Bird
DOVE; Dovekie	Dark bird < 21 cm (approximate sitting size[5]) with some white in front. Reddish bill was ruled out.	Dark bird < 21 cm (approximate sitting size) with some white in front. Bill was 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: Bird was obscured due to position, orientation, or blurriness and the definite features were hard to discern.	Adult: General size and shape were present and buoy was ruled out.	UNBI; Unidentified Bird or UNKN;unknown
SUSC; Surf Scoter	Observed white patches on head. Observed yellow orange to red bill pixel. Shape, size, and color was like a scoter. Female was in close proximity to a definite male.	Shape, size, and color was like a scoter. Female or undetermined sex was 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 was in a SUSC flock.	UNSC; Unidentified Scoter
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 was 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 were fewer frames or image obscurities that didn't allow for higher identification confidence.	AKSH; Auk or Shearwater or UNBI;Unidentified Bird

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

AVIAN				
ID Category	**Definite (Sitting)**	**Probable (Sitting)**	**Possible (Sitting)**	**Next Higher Taxonomic Group**
UNBI; Unidentified Bird	Object had shape, color, head, bill, and bird-like movement. Image quality or other factors didn'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, had 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 were fewer frames or image obscurities that didn'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 with definite movement.	A more submerged or blurry bait ball.	Hard to determine definite movement. Speckling in the water was present but it was hard to determine if this was a bait ball. Reviewer most likely assessed whether this was 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. When feeding, the shape of the gills extended out.	Large, odd shaped shark that was 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 was associating with a definite BODO.	Large(>300, unless it was a juvenile) cetacean that was submerged or blurry cetacean and was non-descript.	SBCE; Small beaked Cetacean to 3 m
CODO; Common Dolphin	Hourglass pattern on the side was clearly seen.	Can see hourglass pattern in a few frames. There was no identification by association with this species.	A submerged common dolphin with a probable CODO patterning on the side. Ruled out BODO and Striped Dolphin patterning. There was no identification by association with this species. Associated species without a hint of patterning was identified as a SBCE identification.	SBCE; Small beaked Cetacean to 3 m
COWR; Cownose Ray	Cownose was visible and therefore direction of movement was known. This was a single ray or part of a group.	An individual that was not identified to species, but was associating with a school member that was a definite cownose ray.	A deep or blurry individual that was 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 often caused a lower confidence.	Not used	MARA; Unidentified Manta Ray
GRTU; Green Turtle	Head width was consistently small through frames. SCL>90cm. Carapace shape was 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 had a chunky appearance compared to other cetaceans.	The "no beak" appearance was seen in fewer frames. Since it was harder to definitively determine that a cetacean was non-beaked, reviewers more likely used the broader category, Unidentified Toothed Whale.	SNBC; Small non beaked Cetacean to 3 m
HASH; Hammerhead shark	Shark with a distinct hammer-shaped head was 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 was 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 was 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 was not able to be placed 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 looked round, but measurements indicated a more elliptical shape.	Turtle was more submerged or in fewer frames, but shape and size was still observed.	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 was still present.	Large, dark-colored object that was mostly leatherback-shaped. Ruled out Molas and manta rays. Leatherback turtles that were not identified to Possible were likely identified as ID Impossible when there was movement and UNKN (Unknown) when there was no discernible movement.	ID Impossible; ID Impossible
LOTU; Loggerhead Turtle	SCL >90 cm, head width large (up to 28 cm) and broad, overall carapace was heart-shaped	SCL > 65 and <90, head was broad	Loggerhead features (broad head, carapace shape and etc.) were 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 was too submerged to get an accurate size. Overall shape and color of a Mylobatidae spp. Reviewer unfamiliarity with this grouping resulted in a lower confidence.	Not used	CESS; Cetacean/Seal/Shark
MIWH; Minke Whale	Not used.	Slender, comparatively small whale with a pointed rostrum. Saw 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 was consistently and definitively was a MOLA in almost all frames.	MOLA that was angled a bit in the water column where it was hard to see the shape. A probable MOLA was more submerged or blurry in some of the frames.	Either deeply submerged or seen in fewer frames. Ruled out small turtle and rays. Due to the irregular shape, MOLA not identified to the Possible confidence went to a broader category such as ID Impossible. When fins were not seen and there was no discernible movement, it was possible for a MOLA to go to the UNKN (Unknown) identification category.	FISH; Unidentified fish
REBA; Red Bat	Tone or color was reddish or rusty brown. Body shape was oblong to oval, which gave it a chunky appearance. Wing coloration was grayish, white or blurry. Wing was angled proximally to the body giving it a triangular appearance. All aforementioned characteristics were consistent across frames or an arm was seen.	Tail shape is wedged or "V" shaped like a bat and there was a triangular appearance to the wings. Red color was present.	To distinguish from an UNBI or ID Impossible, tail shape was wedged or "V" shaped like a bat and there was a triangular appearance to the wings.	ID Impossible; ID Impossible

NON-AVIAN				
ID Category	**Definite**	**Probable**	**Possible**	**Next Higher Taxonomic Group**
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. When a cetacean was approximately 300 cm, then this was generally classified to the broader group, SBCE (Small beaked Cetacean to 3m).When the cetacean was >300cm, then this went to the broader group, UNDO(Unidentified Dolphin).	SBCE; Small beaked Cetacean to 3 m
RIWH; Right Whale	A robust whale with callosities on the rostrum.	Not used	Not used	UNBW; Unidentified Baleen Whale
RSST; Roughtail or Southern Stingray	Ruled out skate by size (disc width>107 cm) and shape (pointed wings). Disc width overlapped between species. There were not enough features present 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 was less than 3m.	Unknown if beak was present or unknown size, but was associating with a definite SBCE.	Beak not seen consistently across frames or single animal was 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 was harder to ascertain due to submergence, blurriness or number of frames.	HASH; Hammerhead shark

NON-AVIAN				
ID Category	**Definite**	**Probable**	**Possible**	**Next Higher Taxonomic Group**
SHAR; Unidentified shark	Caudal fin was vertical and animal was greater than 198 cm. Or, if a smaller animal, there was consistent sinusoidal movement.	Shark was more submerged but size, shape or movement was shark-like.	Shark shape, size or movement was 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 was seen with the carapace shape), but other criteria were not met in order to classify to species. Or, SCL <50 cm, then immature SMTU. Mola and ray were ruled out.	Turtle shape was not consistently seen in all frames, but in most frames. Mola and ray were ruled out.	Mola and ray were ruled out. There was often turtle-like movement. If it was a juvenile turtle, macroalgae was ruled out.	ID Impossible; ID Impossible
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 appeared almost longer than the entire body was consistently seen across many frames.	Shark was more submerged and caudal fin was not seen consistently across frames.	Elongated upper caudal fin lobe was seen in fewer frames, was 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	Cetacean tail. Unknown size or beak status.	A blurry or more submerged cetacean that was associating with a known cetacean.	Not used	SEDO; Seal/Dolphin or CESS; Cetacean/Seal/Shark
UNDO; Unidentified Dolphin	Unknown if a beak was present. Harbor Porpoise was ruled out.	Was associating with a definite UNDO.	Blurry or submerged cetacean that was associating with a group of unidentified dolphins.	UNTW; Unidentified Toothed Whales

NON-AVIAN				
ID Category	**Definite**	**Probable**	**Possible**	**Next Higher Taxonomic Group**
UNFS; Unidentified Fin/Sei	Sizes overlapped between Fin and Sei Whale. Rostrum and tail obscured. Overall slender whale.	Not used	Not used	UNRO; Unidentified Rorqual
UNKN; unknown	Shape was 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 was unknown.	A blurry or obscured individual with a ray shape or movement that was associating with definite rays.	A single ray or small group that consistently had a ray shape or ray movement. Turtle, Mola and trash were 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
UNTW; Unidentified Toothed Whales	Unknown if a beak was present. Unknown size. Harbor Porpoise was ruled out.	A blurry or more submerged toothed whale with unknown size or beak, but was 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 guided 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 consisted of mixed species from the same genera. It had a lesser amount of species associated with the grouping than Group 2 and in general, the grouping contained <4 associated species. It was also the lowest taxonomic grouping. Group 2 consisted of mixed species and mixed genus groupings. This group contained a size or color designation that further split the family down into fewer species' associations. Group 3 consisted of mixed genus groupings. It had a lower number of associated species than Broad Group 4 and in general contained a subset to all members of the family. Group 4 consisted of mixed genus groupings. In addition, it had a high number of species associated with this group. This likely contained a subset to all members of the family. Group 5 consisted of mixed order and mixed family groupings. Group 6 was the highest taxonomic bird grouping. It consisted of all bird orders.

Table 4F-1. Excerpt from Hierarchal Matrix of Avian Taxonomic Groups. Birds not identified to Group 6 (Unidentified Bird) were either identified to ID Impossible if there was movement or UNKN;Unknown if there was 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 not identified to Group 8 (CESS;Cetacean/Seal/Shark) were either identified to ID Impossible if there was movement or UNKN;Unknown if there was no discernible movement. Group definitions: Group 1 consisted of mixed species and mixed genus groupings. Group 2 consisted of mixed genus groupings. Group 3 consisted of mixed genus and mixed family groupings. It had a lower number of associated species than Broad Group 4 and in general contained a subset to all members of the family. Group 4 consisted of sub-order groupings. Group 5 consisted of mixed sub-order groupings based on size class. Group 6 consisted of order groupings. Group 7 consisted of mixed order and some mixed class groupings. Group 8 consisted of mixed classes and contained 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. Upon completion of data, the following items were checked:

Missed objects were highlighted in yellow.
Missed objects had a frame number in the "Added Frame Number" column
All confidences were filled out.
Birds and bats were associated with appropriate behavior (flying, sitting, taking off, loafing, following vessel)
All objects in flight or taking off had a yes or no filled in the "Flying at sea level" field.
Birds did not have the submerged field filled out.
Non-avian biota were associated with appropriate behavior (stationary, moving, haul out)
All seals, sharks, turtles, cetaceans, and fish had the "Submerged" field filled out.
Made sure there were behaviors filled out for all animals.
Objects identified as Not Applicable, ID Impossible, UNKN, boats, balloons, FIGE, FLJE, MACR and buoys did not have behavior, flying at sea level, submerged, age, plumage, molt or sex filled out. Behaviors associated with UNKN, boats and ID Impossible were put in comments.
ID Impossible had a comment.
Made sure dates and initials were 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 were classified as "NA; Not Applicable" in the "ID Category" column.
Made sure age and plumage match each other if both have been filled out.
Performed a quick check in comments for misspellings.
Checked 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 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 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 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 needed