Introduction to Part II
Examining wildlife distributions and relative abundance from a digital video aerial survey platform

Report structure

The chapters in this report represent a broad range of study efforts focused on understanding wildlife population distributions in Atlantic waters offshore of Maryland (and elsewhere in the Mid-Atlantic United States). Some chapters are purely methodological in nature, while others present a variety of analyses and results (Figure I). Part I of this report (the Executive Summary and Chapters 1-2) summarizes and synthesizes project results. The 12 subsequent chapters and their relationships to each other are shown in Figure I. In Parts II (Chapters 3-5) and III (Chapters 6-9), we describe methods and results for high resolution digital video aerial surveys and boat-based surveys, respectively. Part IV of this report (Chapters 10-14) combines data from both survey approaches to develop a comprehensive understanding of marine wildlife populations that use the Mid-Atlantic study area.

Part II: Examining wildlife distributions and relative abundance from a digital video aerial survey platform

High resolution digital video aerial surveys are a relatively new method for collecting distribution and abundance data on animals (Thaxter and Burton 2009, Buckland et al. 2012), and ours was the first study to use this method on a broad scale in the U.S. The technology used in this study, one of several different digital aerial survey methodologies, was developed by HiDef Aerial Surveying, Ltd., in the UK. Digital aerial survey approaches have largely replaced visual aerial surveys for offshore wind energy research in Europe, as their higher flight speeds and much higher flight altitudes make them safer to conduct than visual aerial surveys, and reduces or eliminates disturbance to wildlife compared to visual aerial or boat survey approaches. They also produce archivable data, which allow for a robust quality assurance and audit process. There are still limitations to this method, however, including difficulties identifying some species, and a lack of defined statistical approaches for utilizing the data for some purposes, due to the relative novelty of the survey method.

There are three chapters in Part II of this report, focused on the use of digital video aerial surveys to examine wildlife distributions and relative abundance:

Methods and protocols

Chapter 3 briefly describes the survey methods employed for high resolution digital video aerial surveys, which are referenced throughout the following chapters. Surveys were flown in twin-engine Cessnas at 250 km/hr and an altitude of approximately 610 m (Figure II), which is much higher than traditional visual aerial surveys. While analysis and management of video require substantial personnel time, the resulting data are quality-controlled and audited much more intensively than is possible with visual observation data (Chapter 4).

Results from Mid-Atlantic digital video aerial surveys

Surveys detected a wide variety of taxa, including marine mammals, sea turtles, rays, sharks, fish, bats, seabirds, shorebirds, and raptors (Chapter 5). Some taxa were notable for their unexpected abundance within the survey dataset (e.g., Cownose Rays, *Rhinoptera bonasus*, and sea turtles). Other taxa were not expected to be observed in surveys at all (e.g., bats; Chapter 5; Hatch et al. 2013). Flight heights of flying animals could be estimated from the aerial video using parallax, or the movement of animals relative to the ocean background (Chapter 5; Hatch et al. 2013). This information may be helpful in understanding the potential for interactions between flying animals and offshore wind turbines. For example, 56% of all birds with estimable flight heights in the Maryland study area were observed within 0 and 20 meters above sea level, which is below rotor height for most turbine designs. This type of flight height data is often used alongside information on avoidance behaviors, turbine specifications, and other data in models that attempt to estimate avian collision risk for offshore wind energy projects in Europe (e.g., Band 2012), although there is still debate in the European literature regarding the factors that best predict this risk (e.g., Cook et al. 2012, Douglas et al. 2012, Langston 2013, Furness et al. 2013).

Identification of animals to species in the video aerial survey data was variable by survey, season, and taxon (Chapter 5). In part, this is likely due to variations in image quality and other factors, some of which are being addressed through technological advances in the field; the current generation of cameras being used in Europe have much higher resolution and color rendition than the cameras used in this study, with better identification rates as a result (95% for all seabirds, on average; A. Webb pers. comm.). Unlike observations made from video, however, observational data from boat or visual aerial surveys are not replicable, and species identifications made by observers in the moment can seldom be verified after the fact. The exhaustive quality assurance and audit protocol followed by aerial video reviewers, as well as characteristics inherent to the video review process itself (such as the use of multiple levels of “certainty” criteria in identifications), ultimately lead to fewer definitive identifications than observational approaches (Chapter 10). However, this also recognizes the inherent uncertainty in the identification process, which can be difficult to account for in unrecorded visual surveys. This uncertainty is generally under-recognized or ignored, as it can be difficult to measure, but in some cases species misclassification in visual surveys may actually lead to less reliable density estimates than classifying animals as "unknown" (Conn et al. 2013).

Implications and uses of digital video aerial survey data elsewhere in this report

In addition to the three chapters in this section, the digital video aerial survey data are used in analytical efforts in Chapters 10-14. Several chapters focus on contrasting the two survey approaches (Chapters 10 and 13). In some cases, digital aerial survey data are used independently to analyze wildlife distributions and relative abundance (e.g., in the case of sea turtles, which were much more easily detected in video than from boat surveys; Chapters 11 and 12). In other cases, digital video aerial survey data and boat survey data are used jointly (Chapters 11 and 14) to describe distributions and abundance of animals across the study area.

Our application of these methods in the Mid-Atlantic is expected to be useful for understanding wildlife populations and minimizing impacts to those populations from anthropogenic activities in the offshore environment in several ways:

- First, this study has developed U.S.-based technological resources for future wildlife monitoring efforts, and explored technological advancements and assessment methods that could simplify or minimize the cost of environmental risk assessments.
- Second, we identify species that are likely to be exposed to development activities in the Maryland study area, along with their important habitat use or aggregation areas and temporal variation in distribution patterns. This information can be helpful for:
    - Informing the siting of future projects, by incorporating wildlife patterns into marine spatial planning and decision making, and by using exposure data as a first step towards defining relative risk by location;
    - Informing the permitting process for development projects, by contributing data towards National Environmental Protection Act (NEPA) and other regulatory requirements, and by helping to define target taxa or research priorities on which to focus on during site-specific pre- and post-construction monitoring studies; and
    - Informing mitigation efforts, by presenting temporal data on community composition, distributions, and abundance that can be used to time certain activities to coincide with reduced potential for exposure of key taxa.

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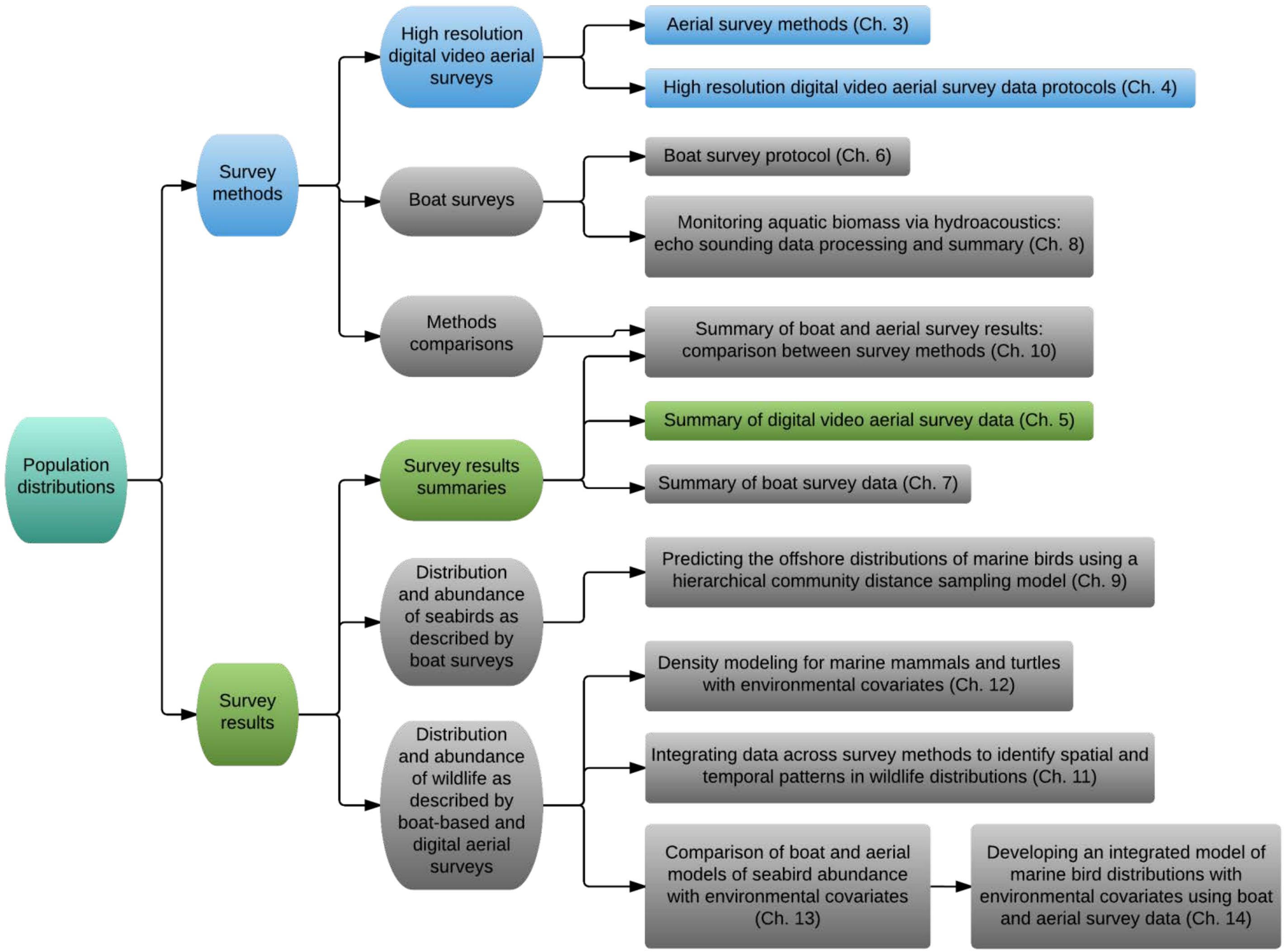

Figure I. Organization of chapters within this final report.

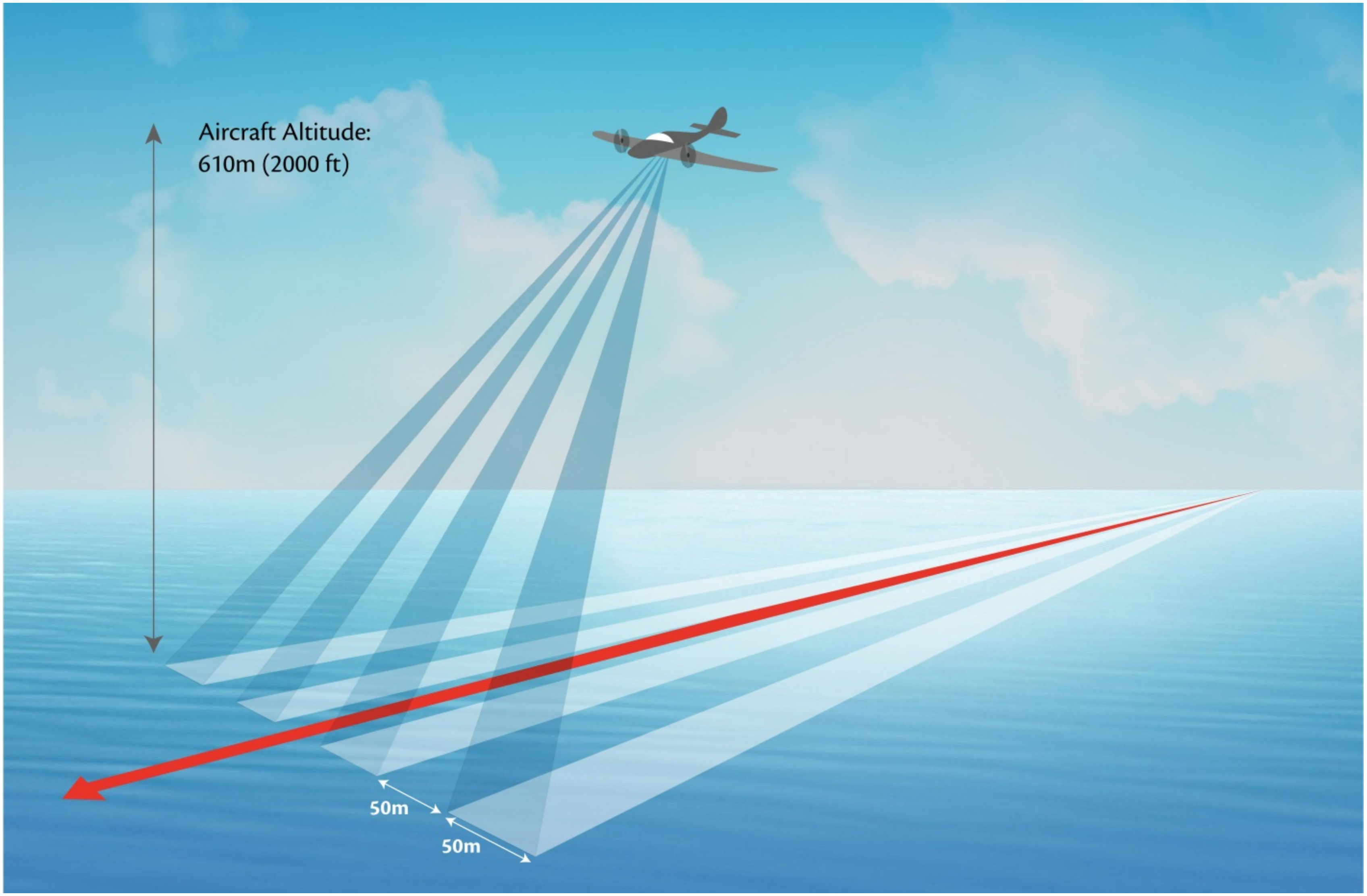

Figure II. Digital video aerial surveys were flown at 610 meters using a twin-engine aircraft with four belly mounted cameras. These cameras recorded non-overlapping 50 meter transect strips, for a 200 meter total transect strip width.