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BOEM 2013-207

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An Assessment Method and Database

U.S. Department of the Interior
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ABOUT THE COVER

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Abstract

Offshore wind facilities during both construction and operation may impact bird populations directly through mortality from collisions and indirectly through displacement that affects population fitness. We present data on population size, conservation importance, and ecological traits of bird species found in the vicinity of the Atlantic Outer Continental Shelf and a method of ranking their relative sensitivity to the impacts of collision and displacement. Based on both our literature synthesis and the collision sensitivity rank, avoidance behavior and flight height appear to be key factors that influence vulnerability to collision. More data are needed for both of these behavioral traits. The collision sensitivity rank identified that populations of gulls, phalaropes, cormorants, and jaegers are of particularly high concern on the Atlantic Outer Continental Shelf. Available literature and the displacement sensitivity rank both suggest that avoidance of wind facilities and habitat flexibility appear to be key behavioral traits causing potential loss of population fitness through displacement. The displacement sensitivity rank identified that populations of sea ducks, loons, and some alcid species are most vulnerable. The impacts of displacement on populations will be less immediate and less obvious than those of mortality from collision; therefore, we hope that the approach developed here for the Bureau of Ocean Energy Management will help prioritize monitoring programs of vulnerable species before, during, and after construction and assist with informing siting decisions for offshore wind facilities. It would be possible to refine this model to fit specific needs by focusing on certain species or locations. Our research also uncovered data gaps and conflicting data among sources for most of the metrics we analyzed in our study. Specifically, more data are urgently needed on species-specific flight altitude and species-specific avoidance behavior, and we recommend that studies conducted by the Bureau of Ocean Energy Management target these two areas of knowledge gaps using standardized and cross-study comparable methodologies. Given the data gaps and associated levels of uncertainty present within the available data, our results should be interpreted while considering the levels of variation and uncertainty present within currently available data.

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Abbreviations and Acronyms

AO	Annual Occurrence (hours in AOCS)
AOCS	Atlantic Outer Continental Shelf
AOCS	Proportion of Population in the AOCS
BOEM	Bureau of Ocean Energy Management
BR	Breeding and Feeding time in the AOCS
DFR	Diurnal Flight Ranking
DI	Disturbance Ranking
FWS	U.S. Fish and Wildlife Service
GPS	Global Population Size
HF	Habitat Flexibility
IUCN	International Union for Conservation of Nature
MA	Macro Avoidance of Wind Turbines
NFR	Nocturnal Flight Ranking
RSZ	Rotor Swept Zone
RSZ	Percent Time in the Rotor Swept Zone of Turbines
SR	Survival Ranking
TR	Threat Ranking

1 Introduction

Normandeau Associates was contracted by the Bureau of Ocean Energy Management (BOEM) to assess the sensitivity of birds to offshore wind energy projects on the Atlantic Outer Continental Shelf (AOCS) (see Figure 1). Offshore wind energy has the potential to provide a significant source of energy to the coastal areas of the mid-Atlantic and northeastern United States. Although there are currently no operational offshore wind facilities in the United States, a number of other countries, particularly in Europe, have been harnessing the energy of offshore wind for several decades. Globally, there are 84 operational offshore wind facilities with an additional 864 in the planning or construction stage (The Wind Power 2013). The largest operational wind facility to date, The London Array off the southeastern coast of the United Kingdom, has 175 turbines with a 630 MW capacity (RenewableUK 2013). Distance from the shore varies by wind facility, but the farthest offshore is the Belwind Wind Farm, which is 46 km offshore of Belgium at a water depth of 15 to 37 m (The Maritime Executive 2013). The deepest waters currently containing bottom-mounted turbines are 45 m deep at Beatrice Wind Farm Demonstrator Project (Talisman Sinopec Energy UK Limited 2013), but the development of floating wind turbines could make deeper water more accessible for development. The AOCS is therefore a rich potential resource for offshore wind energy projects.

This report presents the data gathered to date on aspects of bird species ecology that influence their vulnerability to population-level impacts from offshore wind developments and presents a method for assessing and ranking this vulnerability for birds that spend time in the vicinity of the AOCS. This measure of vulnerability, called a sensitivity rank, can assist BOEM with predicting the likely ornithological impact of developments using objective scientific criteria. The procedure for deriving the sensitivity rank underwent peer review of the proposed methods and resulting data during a developmental phase for an initial limited selection of bird species. As a result of this peer review, the assessment method was revised and additional data were evaluated to create the final sensitivity rank.

Information on the relative vulnerabilities of seabird species to offshore development on the AOCS is deficient since no offshore wind facilities are currently installed in the region and there has consequently been no research on their impacts to regional bird species. Data from other bird research on the AOCS are also very limited, with few research projects in the region and a limited number of surveys conducted across the entire AOCS. The few data that have been gathered are difficult to access. Offshore wind facilities in Europe and research conducted at those locations provide some level of surrogate data potentially relevant for the AOCS, but there may be differences in how the same or similar species interact with wind facilities on the AOCS due in part to different migratory strategies of birds at European study sites. For this reason, we have created what we hope to be a dynamic database and assessment method, both of which can be updated as new data become available.

Our approach draws on methods used by several European researchers including Garthe and Hüppop (2004), Desholm (2009), Furness and Wade (2012), and Furness et al. (2013), which use knowledge of species' life history and documented interactions with wind facilities to assess the relative vulnerability of those species to wind facilities. These pioneering studies are briefly reviewed here as a basis for understanding how our approach was developed. Garthe and Hüppop (2004) scored nine

factors based on attributes of 26 bird species in the North Sea, including flight maneuverability, flight altitude, percentage of time spent flying, nocturnal flight activity, sensitivity to disturbance by ship and helicopter, flexibility in habitat use, biogeographical population size, adult survival rate, and European conservation status. Five of these factors were based on empirical published data and four were subjective based on the authors' experience. Each factor was scored from 1 (low vulnerability) to 5 (high vulnerability), except for flight height, where a six point system was used before conversion to a five point scale using the median and 90th percentile values. These factors were combined to give a single final sensitivity score for each species, and scores were mapped across the North Sea study region showing that coastal waters were more sensitive to wind facility development than waters farther offshore (farther than approximately 50 km offshore). When this study was published, there were nine operational offshore wind facilities in Europe, limited information about the effects on the marine environment, and no information for sites farther than 10 km offshore.

Desholm (2009) used a somewhat different approach, assessing 38 species of migratory birds that were recorded in the vicinity of Nysted Wind Farm in Denmark. He used two indicators of species sensitivity: relative abundance and demographic sensitivity. Relative abundance represented the number of individuals passing through the wind facility area as a percentage of a reference population, with the latter defined as the number of individuals from the breeding area occupied by the birds passing the migration study site. Demographic sensitivity was based on the proportional change in growth rate as a result of a theoretical change in adult survival rate due to increased mortality from turbine collisions and was derived using population models requiring data on fecundity and survival rates. Desholm (2009) concluded that adult survival rate, rather than fecundity, had the stronger effect on population growth rates. In general, species with high adult survival rates and that occurred at high relative abundance within the study area were identified as high priorities in terms of a potential negative impact from wind facilities.

Furness and Wade (2012) and Furness et al. (2013) were similar in principle to Garthe and Hüppop (2004). The first two studies used a mean of four factors, namely European conservation importance, the percentage of the biogeographic population in English waters, adult survival, and British conservation status as a measure of conservation significance. Vulnerability to collision was assessed by scoring flight altitude, flight maneuverability, percentage of time flying, and nocturnal flight activity. Habitat displacement sensitivity was assessed by scoring disturbance from wind facility structures and ship and helicopter traffic and then multiplied by a score for habitat specialization. All factors were scored from 1 to 5, except for flight altitude, which was represented as a percentage of time spent flying within the height of turbine blades (rotor swept zone). Where data were insufficient, they used data from closely related species, and they acknowledged that the percentage of time spent flying may vary seasonally, but a lack of data precluded consideration of such temporal variation. Furness and Wade (2012) and Furness et al. (2013) calculated separate collision and displacement sensitivity indices, but their approach was otherwise similar to that of Garthe and Hüppop (2004).

These four approaches differ somewhat from one another, and thus we suggested and included further methodological changes in our study. These changes included (1) assessing the sensitivity of all bird species exposed on the AOCS, not just seabirds, (2) including a temporal component that assesses the length of time an individual of a species occurs on the AOCS throughout the year and is

thus exposed to potential impacts of developments, (3) incorporating breeding status, (4) incorporating macro-avoidance behavior in both collision and displacement indices, and (5) including uncertainty measures in our vulnerability assessments to represent either lack of data or data containing conflicting information. The set of scoring criteria and provisional scores for bird species is based on evidence taken from reviewed literature. We started with the methodological structure established by Furness and Wade (2012) and Furness et al. (2013), then reviewed all scores allocated by Garthe and Hüppop (2004), Furness and Wade (2012), and Furness et al. (2013), and assessed which of these were appropriate in the context of the AOCS geographic scope (Figure 1).

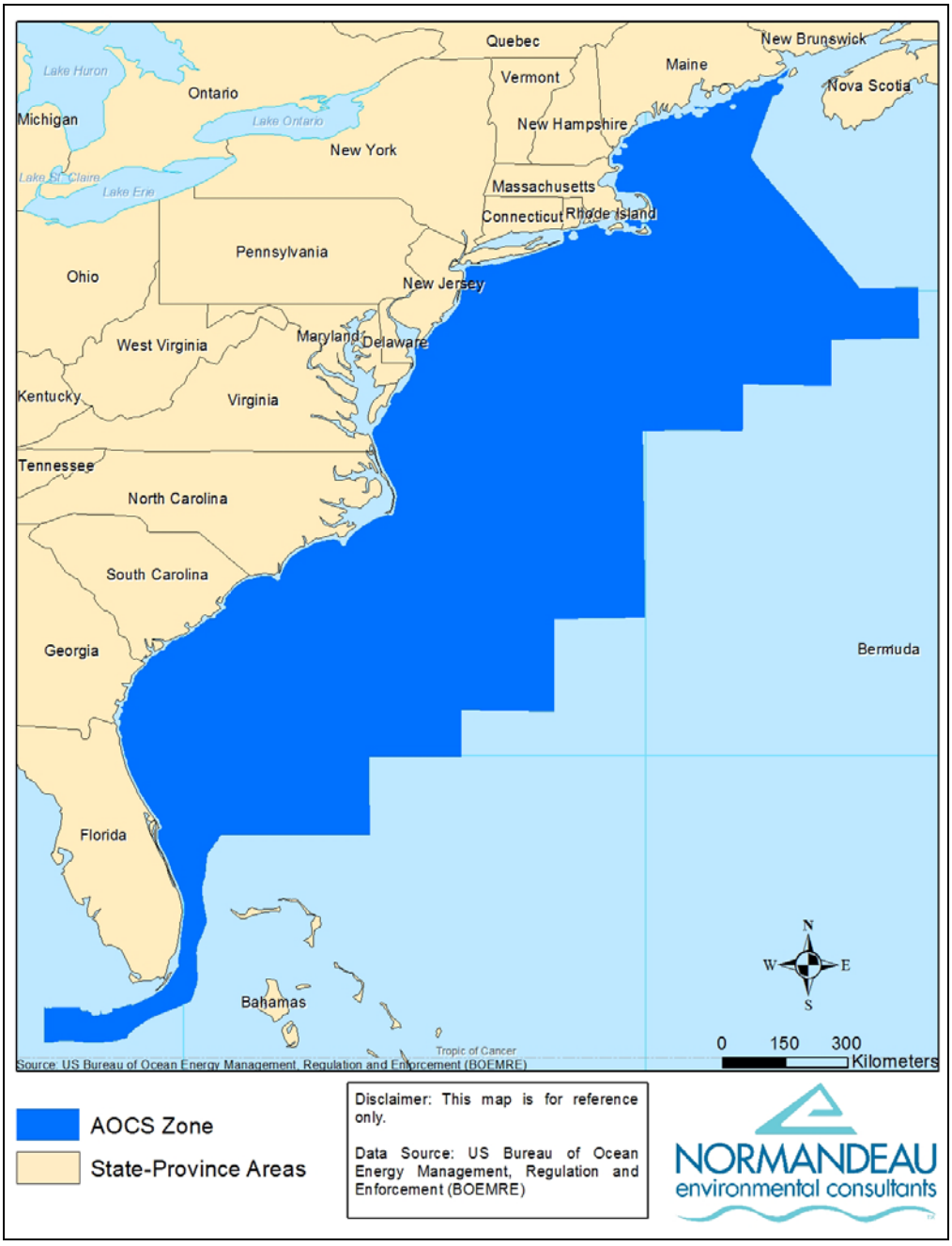

Figure 1. The geographic scope of the Atlantic Outer Continental Shelf.

2 Methods

2.1 Species Selection

2.1.1 Seabirds and Shorebirds

Two studies commissioned by BOEM contained data relevant to seabird (O'Connell et al. 2009) and shorebird (O'Connell et al. 2011) occurrence in the AOCS. Both of these documents were used to initially identify species in these groups that should be assessed for our sensitivity rank, as the data contained in them were derived from all known AOCS surveys and available literature (Table A–1).

2.1.2 Landbirds and Waterfowl

An initial list of species of landbirds and waterfowl was compiled representing a broad range of taxa that cross the AOCS. We began with species listed in Watts (2010), which has a focus on offshore wind and the Atlantic flyway. For analysis, Watts selected 164 species of waterbirds that regularly use the Atlantic flyway. We added several species (e.g., falcons, songbirds, Brown Booby) to this to include representative members of different groups that cross the AOCS and those species identified by O'Connell et al. (2009, 2011) (Table A–1). For additional birds likely to cross the AOCS but not discussed in O'Connell et al. (2009, 2011), we used lists from eBird (2012), a citizen science database with millions of bird observations. We selected the most common migrant bird species reported as occurring in islands in The Bahamas and the Caribbean (Dominican Republic and Puerto Rico) and northeastern United States (Block Island, Rhode Island, and Martha's Vineyard and Nantucket, Massachusetts) (Figure 2).

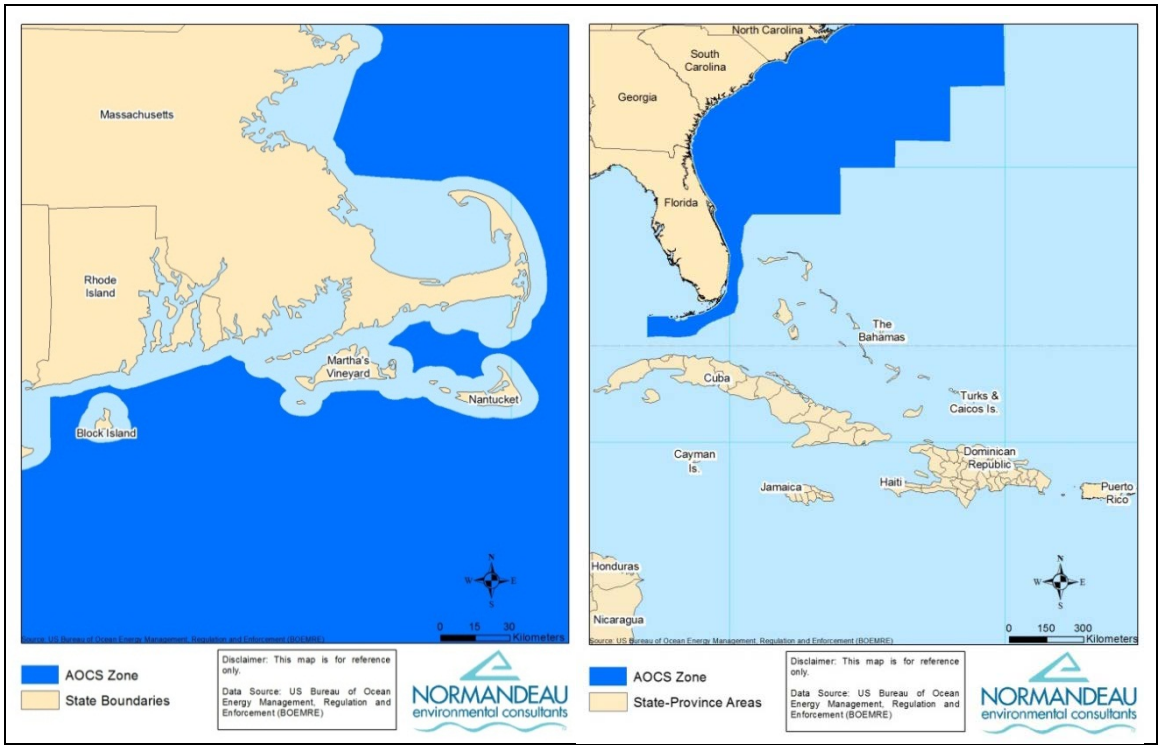

Figure 2. Locations of Rhode Island, Block Island, Martha's Vineyard, Nantucket, Bahamas, Dominican Republic, Puerto Rico, Cuba and Jamaica.

Minimum distances to the nearest land in North America (crossing the AOCS) are as follows:

Bahamas: 100 km to Florida
Dominican Republic: 1,000 km to Florida
Puerto Rico: 1,500 km to Florida
Block Island: 15 km to Rhode Island
Nantucket: 35 km to Massachusetts
Martha's Vineyard: 5 km to Massachusetts

The final list of species used for analysis (Table A–2) reflects the advice of reviewers. Some species that potentially migrate through the AOCS have been added, notably long-legged waders (herons, egrets, and relatives), rails (Black Rail, Clapper Rail, Sora, Common Gallinule, and American Coot), dabbling ducks (e.g., Wood Duck, Gadwall, Mallard, and teal), and diving ducks (e.g., Canvasback and Redhead). Many passerine species that rarely cross the AOCS have been removed from the list. The remaining birds eliminated from the original list are very rare in the AOCS (e.g., Ross's Goose, Trumpeter Swan, White-faced Storm-Petrel, Masked Booby, and Long-billed Curlew), having a more westerly distribution in the United States.

2.2 Species Sensitivity Assessment Method

Three suites of metrics were used to classify seabird vulnerability to wind turbines in the AOCS: population sensitivity indices, collision indices, and displacement indices (Table 1). Data were taken from existing wind facility studies from Europe for elements of the collision and displacement sensitivity; only wind facilities greater than 4.8 km offshore were used. Coastal wind facilities were not considered representative of the data required for this study. When ranges of values for each metric were reported in the literature, we assigned a rank based on a conservative interpretation of the data. This approach was consistently applied for all metrics and all species. Because of the consistent application of the method, the use of conservative estimates should not produce an aberrantly worst case scenario for some species because only the relative differences in sensitivity scores are what have meaning. Interpretation of the sensitivity scores should consider that numerical differences among species represent a relative difference in sensitivity. At no point should numbers be interpreted as an absolute measure of sensitivity or vulnerability.

A separate sensitivity rank was computed for each suite of metrics, addressing the BOEM request for separate indices for collision and displacement sensitivity. The population sensitivity rank was factored into calculations for both collision and displacement sensitivity. We multiply both the collision sensitivity and the displacement sensitivity by population sensitivity to give a best-estimate population sensitivity score for collision and a best-estimate population sensitivity score for displacement. The best-estimate reflects the result of the calculation using the indices alone without considering uncertainty. Multiplication was used so that population sensitivity would act as a weight when calculating final collision and displacement sensitivity. The results are presented in Section 3.

In addition to assigning a best-estimate value to each metric, we also estimated and calculated uncertainty values associated with the data. All data inherently have uncertainty. Uncertainty values were assigned to each species-metric combination based on the amount of data available, the range of estimates available for each metric, and expert opinion. This information was used to classify each best-estimate value as having a low (10%), medium (25%), or high (50%) degree of uncertainty. The

uncertainty values are largely arbitrary, but reflect a range of values from low to high and are chosen individually for each species-metric combination using criteria described above; no other *a priori* information were available to suggest an alternate range of uncertainty values. For each species, uncertainty values for each metric (10%, 25%, and 50%) were multiplied by the best-estimate value and then added and subtracted to derive minimum and maximum estimates for each metric (Table 2). The range of estimates was capped so they did not exceed the limits initially available for assigning the best-estimate (1–5 for most metrics). The range of values for each metric reflects the available resolution in the current best available data.

Table 1.

Summary of metrics used in calculating population, collision, and displacement sensitivity.

POPULATION SENSITIVITY		COLLISION SENSITIVITY		DISPLACEMENT SENSITIVITY	
Metric*	**Definition**	**Metric***	**Definition**	**Metric***	**Definition**
GPS	Global Population Size	*AO*	Annual Occurrence (hours in AOCS)	*DI*	Disturbance Ranking
AOCS	Proportion of Population in the AOCS	*NFR*	Nocturnal Flight Ranking	*MA*	Macro Avoidance
TR	Threat Ranking	*DFR*	Diurnal Flight Ranking	*HF*	Habitat Flexibility
SR	Survival Ranking	*RSZ*	Percent Time in the Rotor Swept Zone of Turbines	*AO*	Annual Occurrence (hours in AOCS)
		MA	Macro Avoidance of Wind Turbines	*BR*	Breeding and Feeding time in the AOCS
		BR	Breeding and Feeding time in the AOCS		

*Additional details about each metric are provided in their respective sections that follow.

Table 2.

Range of values associated with varying levels of uncertainty for each metric.

Value of Metric	Low Uncertainty (10%)	Medium Uncertainty (25%)	High Uncertainty (50%)
1	1–1.1	1–1.25	1–1.5
2	1.8–2.2	1.5–2.5	1–3
3	2.7–3.3	2.25–3.75	1.5–4.5
4	3.6–4.4	3–5	2–5
5	4.5–5	3.75–5	2.5–5

The range of values for each metric is based on a given level of uncertainty (10%, 25%, and 50%)

2.2.1 Population Sensitivity

A measure of population sensitivity is needed to discriminate among widespread and common bird species where effects of collision and displacement would have a minimal impact on population dynamics and more restricted-range species with smaller populations, where such effects might have a much more significant impact. We used four metrics to create a sensitivity score that are useful in predicting the long-term effects of collisions and/or displacement on populations: global population size, percent of population present in the AOCS, threat ranking, and survival ranking. Taking adult survival into account follows the approach of Garthe and Hüppop (2004), Furness and Wade (2012), and Furness et al. (2013), recognizing that added mortality of adult birds with high natural survival rates (and corresponding low productivity) has a greater impact on population dynamics than added mortality to populations with low survival rates (Furness et al. 2013). The following equation was derived to reflect that all variables have equal weight in the final index. This was done because we did not have *a priori* information to suggest an alternative weighting scheme and our calculations are similar to Garthe and Hüppop (2004) and Furness et al. (2013).

Additionally, we included an upper and lower range of scores that were created by adding and subtracting the uncertainty metric respectively. Population sensitivity was calculated as follows (see Section 3.1.1):

$$Population\ Sensitivity = \frac{[(GPS \pm GPS_u) + (AOCS \pm AOCS_u) + TR + (SR \pm SR_u)]}{4}$$

where,

GPS = Global Population Size
$AOCS$ = Proportion of Population in the AOCS
TR = Threat Ranking
SR = Survival Ranking
u = the uncertainty value for each metric

All metrics are further described below.

Global Population Size (*GPS*)

Numbers for the size of the global population (*GPS*) were taken from several sources, initially BirdLife International (2012) and then several additional sources (Table A–3). These sources included Rich et al. (2004) for landbird population estimates, ABC (2012) and Watts (2010) for population estimates of all species groups, and Morrison et al. (2006) for population estimates of North American shorebirds. These sources are rarely in close agreement for global population numbers. BirdLife International (2012) was chosen as the primary resource because it is an internationally respected scientific organization and its population estimates draw from a wide range of cited sources. BirdLife usually indicates areas of uncertainty in population estimates and gives a range of numbers from the lowest to the highest estimate. Due to the often diverse range of population estimates in BirdLife and other sources, we incorporate the measure for uncertainty within these ranges. We use a conservative score value if ranges exceeded the population estimates within one rank.

We used the following ranges representing the GPS metric from 1 to 5. These ranges were used by Garthe and Hüppop (2004) and were used in this study so that values would remain comparable among studies.

1 = >3 million individuals
2 = 1–3 million individuals
3 = >500,000 to <1 million individuals
4 = 100,000–500,000 individuals
5 = <100,000 individuals

As these categories already represent a range of values, uncertainty (GPS_u) was determined by assessing the fit of observed data to the data range of each category as follows:

10% = if published data variation falls within a single category range, or limited data are supported by further evidence from published data sources or studies

25% = if published data variation extends beyond the limits of two of the category ranges but is supported by further evidence from published data sources or studies, or data are barely within a range and supported by a single data source

50% = if published data variation extends beyond three of the category ranges or supporting evidence is sparse or absent

Proportion of Population in AOCS (*AOCS*)

For most bird species, no data exist for the percentage of the population that would be likely to cross the AOCS. We used a combination of sources (e.g., Poole 2005; DeGraaf and Rappole 1995) to estimate the percentage of the global population that might cross the AOCS at some time (see Table A–3 and Table A–4). In many cases (e.g., Royal Tern) existing range maps were not adequate to assess potential for a species to cross the AOCS because it was unclear what percentage of the species was resident on the wintering grounds. We also used eBird range maps from different times of year to very roughly estimate migratory pathways for birds. For example, if a bird was absent from the Caribbean during the summer months but common during the winter months we assumed it was a migrant. When considering songbirds that migrate through the eastern United States to spend the winter in the Caribbean or Central America, we used the conservative estimate that >99% of the

population could cross the AOCS. In cases where literature implied, though did not directly state, a percent of the bird's population in the AOCS, we reduced the uncertainly if the inferred percent population in AOCS fit well within one category. Low (10%) uncertainly is especially notable in species with an AOCS score of 1 in which the vast majority of the population spends no time in the AOCS.

We used numbers from Watts (2010) for the reference population for the Atlantic flyway. Although much of the bird movement in this flyway occurs along the coast (Watts 2010), many of these species are concentrated on inshore or terrestrial habitats. Of 118 nonhunted bird species in the Atlantic flyway, Watts (2010) was able to find enough information to assess sustainable mortality limits for only 46 species. The following example from Goetz (2012) illustrates how this proportion of the population in the AOCS was derived for the Black-capped Petrel: authors van Halewyn and Norton (1984) suggested a range of 2,000–25,000 pairs, and Lee (2000) estimated the global population at 600–2,000 pairs, with the lower end of this range currently thought to be more likely (Lee pers. comm.). From this example, we used 600 pairs or 1,800 total birds. When only numbers of pairs were given in the literature, we multiplied this number by 3 to approximate males, females, and immatures (Meininger et al. 1995). To be conservative in our estimate of the proportion of population in the AOCS, we used the upper end of the range of population estimates in the AOCS from Watts (2010) or other sources when a range was given.

We used population estimates from ABC (2012) or Poole (2005) when BirdLife (2013) or Watts (2010) numbers appeared to be inaccurate. For example, Watts estimated the Atlantic flyway population of Wood Duck as 3.6 million total individuals, while ABC estimated the total world population to be 3.5 million individuals, and BirdLife (2012) did not give an estimate. In several other cases Watts (2010) lists the Atlantic flyway population as being equal to the World Population or North American Population, when in fact a large portion of the population of the referenced species may not spend time in the Atlantic flyway and instead winters in the western United States or Mexico (e.g., Pied-billed Grebe, Hooded Merganser, American Wigeon, and Surf Scoter). In cases such as these we used numbers and/or information about population distribution from the BNA species accounts (Poole 2005) to draw conclusions about potential populations that could use the AOCS. We assumed that birds strongly associated with aquatic coastal habitats, even if they were mostly nearshore (e.g., seagrass beds and bays), could cross the AOCS during the time they were on the coast to reach other nearshore areas on islands such as Nantucket or the Bahamas.

The ranges were chosen for the AOCS metric to best fit the available data and focal species in our study. Many species have a negligible proportion of their population in the AOCS (1) or almost all their population in the AOCS (5) so values 1 and 5 were assigned to those species respectively. The ranges used for the intermediate values (2–4) represent an equal interval classification between 1 and 99%. To measure the proportion of the global population present in the AOCS (*AOCS*) (Table A–3 and Table A–4) we used a scoring system with categories representing ranges of values as follows:

1 = <1% in AOCS (e.g., Canada Goose, which has a very large world population, but few are present in AOCS)

2 = 1–33%

3 = 34–66%

4 = 67–99%

5 = >99% of population use or cross AOCS (e.g., Kirtland's Warbler, which all migrate to Bahamas)

As these categories already represent a range of values, uncertainty ($AOCS_u$) was determined by assessing the fit of observed data to the data range of each category as follows:

10% = if published data variation falls within a single category range, or limited data are supported by further evidence from published data sources or studies

25% = if published data variation extends beyond the limits of two of the category ranges but are supported by further evidence from published data sources or studies

50% = if published data variation extends beyond three of the category ranges, or supporting evidence is sparse

To be conservative in our estimate of the proportion of population in the AOCS, we used the upper end of the range when a range was given (Table A–3 and Table A–4).

Threat Ranking (*TR*)

For ranking threat status (*TR*) (Table A–5) we used the International Union for Conservation of Nature (IUCN) ranking and U.S. Fish and Wildlife Service (FWS) threat status. Where the FWS threat status was higher than the IUCN threat status, this was given scoring priority over the IUCN threat status.

The threat ranking categories represent the following threat status combinations:

1 = IUCN Least Concern (LC) and FWS None
2 = IUCN Near-Threatened (NT)
3 = IUCN Vulnerable (VU) and/or FWS candidate species (C)
4 = IUCN Endangered (EN) and/or FWS Threatened (T)
5 = IUCN Critical (CR) and/or FWS Endangered (E)

No uncertainty measure was used in this category.

Survival Ranking (*SR*)

This metric was chosen to reflect the vulnerability of species to any increase in mortality above natural mortality. Species with low adult survival rates tend to have an early age of first breeding and high reproductive output and thus are less vulnerable to additional mortality. For most species we felt it important to use survival rates from North America, where available. Where no published North American survival rates were available, species with similar life histories or survival rates from other continents were used (see Table A–6). In general, data on adult survival were sparse, as in other studies; for example, Garthe and Hüppop (2004) found no such data for five of the 26 species that they reviewed. We incorporated an uncertainty score (SR_u) in this category.

The ranges of survival for each value of this metric were chosen because they best fit the ranges of annual survival values that are reported for our focal species. Following protocols in Garthe and

Hüppop (2004), published data on annual adult survival rate (*SR*) (Table A–6) were used and categorized as follows:

1= <0.75
2= 0.75 to 0.80
3= >0.80 to 0.85
4= >0.85 to 0.90
5= >0.90

As these categories already represent a range of values, uncertainty (SR_u) was determined by assessing the fit of observed data to the data range of each category as follows:

10% = if published and relevant data variation fall within a single category range and/or are supported by large data size, further evidence from published data sources, and life-history studies

25% = if published data variation extends beyond the limits of two of the category ranges but is supported by further evidence from published data sources or studies, and this level of uncertainty was also chosen for most passerine species where survival data were sparse

50% = if published data variation extends beyond three of the category ranges, supporting evidence is sparse or absent, or the sample size or study location was of limited relevance

2.2.2 Collision Sensitivity

Sensitivity to collision is a subject of intensive debate, and as yet there is no consensus on what should be used as realistic avoidance rates for species travelling through areas with offshore wind facilities. Post-construction monitoring has been carried out at the offshore wind facilities of Egmond ann Zee, alpha ventus, and Horns Rev, North Sea, and Nysted in Denmark (BSG 2011; BSH 2011; Blew et al. 2008; Christensen et al. 2002, 2003, 2004, 2006; Christensen and Hounisen 2005; Desholm and Kahlert 2005; Desholm 2005; Krijgsveld et al. 2009, 2010, 2011, 2012). Radar track data from Pettersson (2011) show avoidance of the offshore turbines at Utgrunden in southern Kalmar Sound both at night and in poor weather conditions. In most of these reports, macro avoidance (i.e., avoiding the wind facility completely and not entering at all into the turbine array) is reported. Micro avoidance, the action taken by a bird to avoid an individual turbine once it has entered into a wind facility (Band 2011; Cook et al. 2012), is more difficult to assess, but none of these reports suggest that any species frequently collide with turbines. Desholm (2005) used thermal imaging to try to assess micro avoidance, albeit with a small sample size, concluding that micro avoidance is greater than 99%, which in conjunction with rates for macro avoidance suggest a very high overall avoidance for most species groups. Petterson (2005) reported one Common Eider collision out of approximately 2 million sea ducks recorded at an offshore wind facility in southern Kalmar Sound, Sweden.

Many wind turbine-wildlife collision models have been developed by researchers in the past two decades. These models range from mechanistic to empirical models, and some were built specifically to address questions about a particular wind facility (e.g., Bolker et al. 2006). Collision risk models

have been built to use a variety of inputs including bird anatomy, flight characteristics, avoidance rates, turbine dimensions, field data, and landscape composition.

The Band model developed by Scottish Natural Heritage is one of the most popular collision risk models (Band et al. 2007). It is an empirical model that accommodates behavioral avoidance, field data, flight characteristics, and wind turbine dimensions. Outputs for the model are a predicted number of birds in the rotor swept area and their collision probabilities with and without avoidance. Other popular models include the Tucker model (Tucker 1996), which is mechanistic and outputs a turbine-specific probability based on bird anatomical and flight characteristics, and the Bolker model (Bolker et al. 2006), which predicts number of turbine encounters based on flight and turbine characteristics.

Collision risk modeling has applicability to our database development by providing guidance on the variables that are thought to influence collision risk and therefore vulnerability. Many of the variables used in building collision risk models were used in our vulnerability database including flight height, avoidance rate, and occurrence. Other variables used in collision risk modeling, such as turbine characteristics that differ for every wind facility, were outside the scope of this research.

We scored six factors that represent aspects of species' behavior that contribute to their potential vulnerability to collision (see Section 3.2.2):

$$Collision\ Senstivity = AO \times \left[\frac{(NFR \pm NFR_u) + (DFR \pm DFR_u)}{(RSZ \pm RSZ_u)}\right] \times [(MA \pm MA_u) \times BR]$$

where,

AO = Annual Occurrence
NFR = Nocturnal Flight Ranking
DFR = Diurnal Flight Ranking
RSZ = amount of time spent in the Rotor Swept Zone
MA = Macro Avoidance (ranks are inverted for this metric)
BR = Breeding and Feeding score
u = the uncertainty value for each metric

Annual occurrence represents a weight for collision sensitivity with birds occurring more in the AOCS being more likely to collide with turbines. The sum of nocturnal and diurnal flight ranking divided by the amount of time in the rotor swept zone represents a ratio of flight activity to the amount of time spent in the rotor swept zone. The macro avoidance score and breeding and feeding score are also weights in the equation due to their influence on collision sensitivity. Macro avoidance is extremely important with respect to collision sensitivity because avoidance behavior dramatically lowers a bird's exposure to turbine blades. The effect on breeding birds is also important because the loss of a breeding bird impacts not only the breeding bird, but also the offspring of those breeding birds.

All metrics are further described below.

Annual Occurrence (*AO*)

We assumed that a bird spending all of the year foraging and resting on the AOCS will have a greater chance of encountering an offshore wind facility than one passing over in one migratory movement. Therefore, we use the number of hours in a year that an individual bird may spend over the AOCS (Annual Occurrence, or *AO*) in our metric for assessing collision vulnerability. There are three broad classes of birds that occur at some time of the year over the AOCS, with greatly differing annual occurrences among groups. These classes include passage birds moving from feeding and breeding grounds that are unable to use the AOCS to rest or forage (e.g., migrant passerines and shorebirds that cannot stop on the water), seasonally resident birds that use the AOCS to feed and prepare for their next breeding season (e.g., loons and grebes), and year-resident birds that might represent immature, nonbreeding, or locally breeding birds that will forage during the whole year over the AOCS (e.g., alcids, gulls, and petrels).

Passage migrants were either classified as occurring in the AOCS in spring and fall, or from spring through fall, if they were resident near the AOCS during the summer. While less movement of spring through fall migrants would be expected to occur in early or mid-summer, this entire date range was maintained in many cases to account for late arriving breeders or early departing breeders. For birds wintering in or near the AOCS, the entire season during which they would be expected to remain in the area is used for their temporal occurrence to account for late arrivals and early departures. The influence of this variable is applied consistently throughout all of the calculations thus maintaining the same relative influence among species.

For species that do not stop in the AOCS, hourly occurrence in AOCS was calculated by estimating the distance flown across the AOCS divided by the bird's average flight speed. Distance across the AOCS is highly variable. Between the coast of Florida and the Bahamas and Cuba, the AOCS is only about 50 km wide, while from North Florida to the central Maine coast, the AOCS is several hundred kilometers wide. In cases where birds fly from the mainland to an offshore island in the northeastern United States water (e.g., off Maine or Massachusetts) distances flown across the AOCS are less than 30 km. To be conservative, it was assumed that most birds crossed the AOCS at the lower end of their flight speed range estimates (Table 3) because migratory birds likely perform flights at lower speeds compared with the maximum speed at which they may be able to fly (e.g., while being chased) (Lincoln et al. 1998).

Table 3.

Flight speeds of select taxonomic groups.

Taxon	Flight speed range (km/hr)
Waterfowl	65 to 80
Herons	16 to 40
Hawks	16 to 40
Shorebirds	70
Songbirds	16 to 50

Source: Lincoln et al. (1998).

To better estimate average flight speeds of migrant songbirds crossing the AOCS, we used the migration of birds across the Gulf of Mexico to calculate flight speeds. We used the approximate distance across the Gulf (1,000 km) divided by the time it takes most migrants to cross (18 to 24 hours) (Moore and Kerlinger 1987). Using the most conservative flight crossing time of 24 hours gives a migratory flight speed over water of 40 km per hour. Therefore, crossing the800 km of AOCS would take, at most, 12 hours. As many birds cross more of the AOCS on their southbound flight than on their northbound flight (Lincoln et al. 1998), a very conservative estimate of 20 hours in the AOCS for most Neotropical migrant songbirds was used. Two well-known examples of the circular route south over the Atlantic to South America then returning north over a more westerly route are the Blackpoll Warbler (Hunt et al. 1999) and the American Golden-Plover (Johnson and Connors 2010). For shorebirds and falcons that fly faster than songbirds, we used 15 hours in the AOCS as a conservative estimate. For terns that feed near shore instead of in the AOCS, we assumed a slow flight and 20 hours in the AOCS.

For species that cross to the Bahamas or Caribbean, the distance across the AOCS is no more than 60 km. Using the distance across the AOCS to reach these Caribbean islands (60 km) divided by the flight speed estimate of 40 km per hour results in a time of no more than 2 hours to cross the AOCS for the slowest species or individuals taking the least direct route. Much variation in flight speed would be expected to occur based on an individual bird's fitness and, more importantly, wind speed. Since birds in general attempt flights over water with favorable winds, the actual amount of time for a bird to cross the AOCS could be much less. For example, a fast-flying songbird with even a moderate (10 km per hour) tailwind would cross the AOCS on its way to Cuba in approximately 1 hour. The estimate of 2 hours to cross the AOCS for herons, hawks, and songbirds is therefore conservative.

Exact migration routes are unknown for many species, and not all species take the most direct route from North America to their wintering grounds. In cases where migration routes were not well known, we assumed a bird might fly over a 500 km stretch of the AOCS—its approximate average width off most of the East Coast. Shorebirds flying at 70 km per hour would take about 7 hours to cross, while songbirds flying 16 km per hour would take as long as 30 hours to cross.

Due to the relatively high flight speeds of waterfowl and the short distances across the AOCS between the mainland and islands, a flight time of 1 hour each way was estimated for waterfowl that spend part of the year on islands in the AOCS. To account for the return trip, one more hour was added to this travel time to give a total of 2 hours in the AOCS for nearshore waterfowl.

Some taxa not listed in Table 3 (e.g., loons, gulls, alcids) can alight on water and could spend more time in the AOCS than their flight speeds might indicate. Many ducks spend the vast majority of their time either inland (e.g., dabbling ducks) or near shore (e.g., many diving ducks such as goldeneye, Canvasback, etc.). For these species, use of the AOCS was restricted to crossing.

For birds with unknown migratory routes, we assumed the most direct route across the AOCS would be taken. This route between the mainland and the nearest islands was rarely more than 50 km long. For birds with little information on flight speeds, slow flight speeds (20 km per hour) were assumed. Therefore for rails, the estimate of 2.5 hours to cross the AOCS resulted in a total of 5 hours per year in the AOCS.

Most birds that never alight on water spend very little time in the AOCS. Exceptions apply such as Magnificent Frigatebird, which forage extensively over the water. Examples of birds that cross the AOCS for very brief periods of time include songbirds and waterfowl such as dabbling ducks that spend part of the year onshore or in near shore waters around islands off the northeastern United States (e.g., Nantucket). Other examples are neotropical songbirds that winter in the Caribbean or Central America that often fly across the AOCS in the Florida Keys, and other birds (i.e., raptors, some ducks) that might cross the AOCS in either the northeastern United States or Caribbean and cross very quickly. For faster flying birds such as waterfowl and shorebirds, we used a conservative estimate of 1 hour to cross the AOCS, totaling 2 hours per year because the birds would cross the AOCS twice a year. For slower flying birds such as songbirds, we used 30 hours as the time required to cross the AOCS based on slower flight speeds for songbirds and direction and distance of travel, which influences the amount of the AOCS crossed—in some cases up to 500 km on their southward migrations (see Table A–7). On the northerly migration, most of these same species cross the Caribbean and only marginally, if at all, cross the AOCS.

All temporal occurrence data need to be interpreted with caution due to the potential for error associated with lack of available information on distribution of birds in the AOCS. eBird data are dependent upon sample size and temporal distribution of samples, while BNA species accounts (Poole 2005) often do not adequately cover a species' occurrence in the AOCS. Other sources (Howell 2012; Howell and Dunn 2007) were also consulted when assessing temporal occurrence and distribution (Table A–7).

Nocturnal Flight (*NFR*) and Diurnal Flight (*DFR*)

Both nocturnal flight activity (*NFR*) and diurnal flight activity (*DFR*) have been assumed to indicate risk of collision, with species spending more time in flight assumed to be more at risk. These assumptions follow Garthe and Hüppop (2004), Furness and Wade (2012), and Furness et al. (2013) (Table A–8 and Table A–9).

Landbirds and shorebirds crossing the ocean will spend their time over the sea in continuous flight both during the day and at night. Phalaropes are an exception since these birds rest on the water, but other shorebirds and landbirds spend 100% of their time over the sea in flight. Other flight activity information came from multiple sources and often had to be inferred from other information (e.g., behavior, foraging, etc.), and many data were imprecise or incomplete. GPS logger data were available for some species of seabirds (Kotzerka et al. 2010; Mackley et al. 2010, 2011), and we have attempted to use all available resources (see Table A–8 and Table A–9). To accommodate imprecision, our categories represent ranges of activity, and we included an uncertainty score.

The range of values for each value of the nocturnal flight ranking metric was chosen because they represent equal intervals from 0 to 100%. The nocturnal flight ranking represents the percentage of time a species spends in flight over the AOCS during the night:

1 = 0 to 20%
2 = 21 to 40%
3 = 41 to 60%
4 = 61 to 80%
5 = 81 to 100%

As these categories already represent a range of values, uncertainty (NFR_u) was ranked as an assessment of fit of observed data to the data range of each category as follows:

10% = if published data variation fall within a single category range or limited data are supported by further evidence from published data sources or studies

25% = if published data variation extends beyond the limits of two of the category ranges, but are supported by further evidence from published data sources or studies

50% = if published data variation extends beyond three of the category ranges or supporting evidence is sparse or absent

The range of values for each value of the diurnal flight ranking metric was chosen because they represent equal intervals from 0 to 100%. The diurnal flight ranking represents the percentage of time a species spends in flight over the AOCS during the day:

1 = 0 to 20%
2 = 21 to 40%
3 = 41 to 60%
4 = 61 to 80%
5 = 81 to 100%

As these categories already represent a range of values, uncertainty (DFR_u) was ranked as an assessment of fit of observed data to the data range of each category as follows:

10% = if published data variation fall within a single category range or are supported by further evidence from published data sources or studies

25% = if published data variation extends beyond the limits of two of the category ranges, but are supported by further evidence from published data sources or studies

50% = if published data variation extends beyond three of the category ranges or supporting evidence is sparse or absent

Rotor Swept Zone (*RSZ*)

Due to the shortage of data available on flight heights of birds over the ocean and the variability of available estimates, flight height categories were very broad and levels of uncertainty were often very high. Three categories were chosen based on natural groupings that were often coincident with taxonomic limits. In general, most songbirds spend very little time (much less than 5%) flying in the RSZ when over the ocean 4.8 km or more from land. Many sea ducks (especially scoters) spend approximately 5% or more (but less than 20%) of the time flying in the RSZ, so the second category was used as a conservative estimate in these cases. Estimated flight heights of other ducks varied more widely in the published literature and were assigned to the more conservative category of >20% of the time in the RSZ with a high uncertainty score. Some species such as gulls, terns, and gannets spend much of their time in flight in the RSZ, so the 20% and greater category was used for most species in these groups as a conservative estimate. Scores other than the most conservative 5 (>20% of time in RSZ) were given to species in these groups only when literature clearly indicated that another score was more appropriate.

Estimates of flight height are extremely variable. For any individual species, flight heights depend on many compounding factors including but not limited to location, season, direction of flight, length of intended flight, time of day, distance from shore, weather (wind, rain, fog), and the bird's behavior at the time (Able 2004; Cooper and Ritchie 1995; Garthe and Hüppop 2004; Gudmundsson 2002; Hüppop *et al*. 2006; Krijgsveld 2005; Wright et al. 2005). Even within a site, flight altitudes vary widely. For example, Krijgsveld (2005) found that for cormorants, geese and swans, gulls, shorebirds, and ducks other than sea ducks, flight altitudes often varied between 0 and 200 m. Some of this difference in waterfowl and shorebirds was attributed to wind direction, but sources of other variation were not noted. To obtain an estimate at any single site of bird composition and behavior, fieldwork should be conducted at that site over several seasons to take into account local weather and bird movement patterns and other factors that could influence bird vulnerability at the site (Exo et al. 2003).

In general, when migrating, birds likely fly at altitudes where winds are in favorable directions to minimize flight cost (Gauthreaux 1991; Hüppop 2006). Due to this high degree of variability and the lack of information for flight heights over the AOCS, we chose to use the most conservative estimate (highest percentage of time in RSZ) for flight height. Very few studies that estimate flight height have been conducted offshore, with Winiarski et al. (2011) being a notable exception in United States waters.

The following example illustrates the variability of percent of time spent flying in the RSZ for Herring Gulls:

Bergh et al. 2002 (33%, n=71, land-based obs. at Slufterdam)
Bergh et al. 2002 (84%, n=7327, land-based obs. at Slag Dobbelsteen)
Garthe and Hüppop 2004 (score of 4, median height 10–20 m with 10% above 50 m)
Krijgsveld et al. 2005 (50%, n=2223, radar, excludes birds following fishing boats)
Sadoti et al. 2005a (22%, n=63, boat-based obs.)
Sadoti et al. 2005b (5%, n=63, boat-based obs.)
Npower Renewables 2006 (37%, n=142, boat-based obs.)
Rothery et al. 2009 (33%, n=1408, land-based obs.)
Paton et al. 2010 (15.0%, n=51036 land-based obs.)
Paton et al. 2010 (13.8%, n=1652 ship-based obs.)
Krijgsveld et al. 2011 (55%, no sample size, radar)
Cook et al. 2012 (estimated 28.4%; 16–48%, n=25252 ship-based obs.)
Garthe et al. 2012 (40%, no sample size, boat-based obs.)

While many visually observed songbirds fly at or below the RSZ (Paton 2010), the most likely reason for this is that songbirds flying much higher than 100 m become difficult to see. Radar studies have found that most songbirds fly very high (Able 2004; Kerlinger and Moore 1989), far above the limit of human sight. This may be the case for other taxa such as shorebirds, which have also been known to fly high during migration (Lincoln et al. 1998).

If the literature implied that a species almost always flew below the RSZ and was only rarely in the RSZ, <5% of the time was used as the flight height category. For example, Haney (1987) writes that Black-capped Petrels "occasionally rose to 20–25 m above the sea at the peaks of their arcs" and "rarely" were observed soaring from 50 to 100 m above the sea, implying that the vast majority of

their time was spent below 20 to 25 m. Of other sources, Hüppop (2005) states that petrels fly mainly below 10 m.

Estimates of flight height vary depending on the method used to estimate height. Humans are most likely to detect flying birds that are close to the observer while radar detects birds flying out of human sight, but not very low. Some satellite GPS transmitters are equipped to record flight height data, but these are expensive and have only been used for a small number of species.

For flight height estimates, it is assumed that flight will be over unlit structures or structures lit with flashing red lights or other lighting that does not attract birds. Many birds, especially passerines and seabirds, are attracted to white light and are much more susceptible to collision with lit structures than structures with no lighting or bird-friendly lighting (Kerlinger et al. 2010).

Using published and unpublished literature, we estimated the percentage of flight time spent in the RSZ (*RSZ*), assuming that more time spent at altitudes within the RSZ increases a species' exposure (Table A–10). The RSZ range in this case is between 20 and 200 m to cover all possible turbine sizes and tidal effects. Previous studies have assumed a minimum rotor blade height as 20 m and a maximum blade height of 150 m (e.g., Cook et al. 2012), but it seems likely that new turbine designs will soon have a greater maximum rotor blade height.

Because *RSZ* exists within the denominator of the collision sensitivity equation, a higher *RSZ* value will result in a lower collision sensitivity and vice versa. Because this association is counterintuitive, we reversed the scaling for the *RSZ* metric so that a greater amount of time in the RSZ is scaled lower and less time in the RSZ is scaled higher (see Table A–10). The range of values used for each value of the RSZ metric represent the range of values reported in the literature for our focal species. Three categories represent percentage time spent in the RSZ:

1 = >20%
3 = 5 to 20%
5 = <5%

As these categories already represent a range of values, uncertainty (RSZ_u) was ranked as an assessment of fit of observed data to the data range of each category as follows:

10% = if published data variation falls within a single category range or limited data are supported by further evidence from published data sources or studies

25% = if published data variation extends into two of the category ranges, but are supported by further evidence from published data sources or studies

50% = if published data variation extends into three of the category ranges, or supporting evidence is sparse or absent

Macro Avoidance (*MA*)

As published data for micro avoidance are limited, and those data that are available may vary by up to 75% depending on turbine specification (Cook et al. 2012), we decided to use only macro avoidance (*MA*) data. While developing our collision sensitivity rank we initially used an assessment of species flight maneuverability to represent potential for micro avoidance, consistent with Garthe and Hüppop (2004), Furness and Wade (2012), and Furness et al. (2013). However, when the final

sensitivity scores were reviewed by both American and European experts, some species appeared to be more or less sensitive to collision than shown in multiple studies to date. Some species with a high wing loading and low maneuverability can also show high avoidance rates and consequently lower collision susceptibility than maneuverability alone suggests. Regardless of their remarkable flight abilities, some individual birds collide with wind turbines. Visual acuity, hearing capacity, high winds, and other weather variables or other distractions in the vicinity of an individual bird will affect its ability to react to a moving turbine blade once it is in close proximity. Slower bird flight speeds are thought to render the individual more prone to turbine collision (Chamberlain et al. 2005), but collision data from Kingsley and Whitham (2007) summarizing fatalities of swallow and swift species show that even such highly maneuverable and rapid flying species will collide with turbines. Because ground-truthing for species identification in the offshore environment is fraught with logistical difficulties and most avoidance data are gathered by radar, all avoidance data need uncertainty values. Long-term post-construction collision monitoring, data gathering, and interpretation such as the efforts of Krijgsveld et al. (2005, 2009, 2010, 2011, 2012) at Egmond aan Zee, are the only means to help fill the gaps in our knowledge of avoidance rates. We used these data and compared them with older studies at Horns Rev and Nysted (Christensen et al. 2004; Desholm and Kahlert 2005; Petersen et al. 2006; Larsen and Guillemette 2007) for our analysis (Table A–11 and Table A–12).

The range of values used for each value of the avoidance metric represent the range of values reported in the literature for our focal species. The macro avoidance categories follow protocols in Garthe and Hüppop (2004), Furness and Wade (2012), and Furness et al. (2013):

1 = >40% avoidance
2 = 30 to 40% avoidance
3 = 18 to 29% avoidance
4 = 6 to 17% avoidance
5 = 0 to 5% avoidance

A macro avoidance uncertainty score (MA_u) was used to account for disagreement between data sets. Because the macro avoidance categories already represent a range of values, uncertainty was ranked as an assessment of fit of observed data to the data range of each category as follows:

10% = if published data variation fall within a single category range or are supported by further evidence from published data sources or studies

25% = if published data variation extends beyond the limits of two of the category ranges but are supported by further evidence from published data sources or studies

50% = if published data variation extends beyond three of the category ranges, or supporting evidence is sparse or absent

Breeding (*BR*)

Some species potentially breed near and forage in the AOCS to feed young. The loss of a breeding adult has an impact on dependent offspring, so we incorporated some of this impact into the assessment method. We reviewed species' likelihood of nesting in proximity to the AOCS and used the score as a multiplier (Table A–13). Species were scored as follows:

1 = unlikely to be foraging in the AOCS to feed young
1.5 = some individuals will forage in the AOCS to feed young
2 = individuals are regularly known to forage in the AOCS to feed young

Final Collision Scores

Final collision scores were calculated by multiplying the population sensitivity score by the collision sensitivity score. Multiplying the lower and upper ranges of population sensitivity by the lower and upper range of collision sensitivity was also performed. This step accounts for the overall impact of collision by considering not only the environmental factors that can influence collision *per se*, but also the implications of collisions and concomitant mortality for a species. Final collision was calculated as follows (see Sections 3.2.2 and 3.2.3):

$$Final\ Collision\ Score = \text{Collision Sensitivity Score} \times \text{Population Sensitivity}$$

(Range: Maximum 4380000, Minimum 4)

2.2.3 Displacement Sensitivity

The displacement of birds from foraging grounds during construction and operation of a wind facility has complex and indirect pathways before noticeably impacting some bird species. Displacement potentially has fitness consequences, changing survival likelihood over the long-term and reducing future reproductive output through energy expenditure caused by relocation of foraging grounds or the effort expended to get prey in less profitable areas (McDonald et al. 2012). Because more recent studies provide evidence that some species are more sensitive to displacement by wind facilities than others, we decided to incorporate more factors in our displacement assessment method than were used in previous studies. Petersen and Fox (2007) showed that changes in the spatial distribution of foraging Common Scoter (until recently, regarded as conspecific with Black Scoter in the United States) and Common Eider at Horns Rev wind facility in Denmark correlated with the shifting distribution of razor clam beds on which these birds feed. However, displacement from wind facilities in Europe has frequently shown to be a temporary phenomenon. Cumulative impacts in the short term have caused some anxiety, but more data from long-term studies are showing the often temporary nature of displacement. Clough (2012) presented abundance data gathered for Red-throated Loon by APEM Ltd over five years at Kentish Flats, United Kingdom. These data initially showed displacement in years 2005 to 2008. However, data gathered in 2008 to 2009 showed the same density as during preconstruction studies, but with a slightly different distribution. Pre- and post-construction variation in distribution data presented by Petersen et al. (2011) on Long-tailed Duck at Nysted was not attributable to any one particular cause, but potentially to a combination of avoidance of turbines, disturbance from increased traffic, changes in food supply, or predators.

Whatever the causes, certain species have more restricted feeding niches and are strongly affected by shifts in food distribution and consequent loss of habitat, some are more prone to avoid wind facility structures themselves, and some have more dependence on long-term foraging in the AOCS. Disturbance essentially causes displacement, and sensitivity to habitat loss (i.e., habitat flexibility or the ability to feed on diverse or restricted prey items) determines in part the potential mortality following displacement. Macro avoidance acts in the same way as disturbance by boat or helicopter traffic, driving birds from an area in which they could potentially be resting or feeding. Consequently, we believe that avoidance and disturbance have equal weight in terms of driving

displacement. However, the ability to feed on multiple food sources in multiple habitat types (habitat flexibility) means that some species are more or less affected by displacement. Generalist feeders are less likely to be affected by lack of food resources than those species that have very constrained and specific food requirements. For this reason we believe that habitat flexibility is a very important factor, which is in line with current European thinking (i.e., Furness and Wade [2012] and Furness et al. [2013]). In the same way as the amount of time spent over the AOCS increases the chances of collision, the amount of time spent in the AOCS also increases the potential long-term effects of food and rest deprival caused by displacement, possibly contributing to increased mortality risk. Additionally, it seemed important to differentiate between those species whose adults are foraging only for themselves and those species that are also foraging for dependent chicks. The potential for mortality caused by displacement and lack of habitat flexibility is twofold, affecting the health and potential mortality of the adult and the chick or chicks.

Despite the potential for the adverse effects of displacement, many of our focal species only cross the AOCS during migration and do not breed and feed in the AOCS. For these species, we calculated a displacement score of zero. Only 69 of our focal species have a non-zero displacement score.

Displacement Sensitivity was calculated as follows (see Section 3.3.1):

$$Displacement = AO \times \left[\frac{(DI \pm DI_u) + (MA \pm MA_u)}{2}\right] \times [(HF \pm HF_u) \times BR]$$

where,

- DI = disturbance ranking defined by the degree of influence that boat and helicopter traffic is known to have on a bird
- MA = macro avoidance of a wind facility (not micro avoidance of individual wind turbines)
- HF = habitat flexibility (habitat generalist versus habitat specialist)
- AO = annual occurrence in the AOCS
- BR = a score indicating whether or not the species spends much time breeding and feeding in the AOCS
- u = the uncertainty value for each metric

Annual occurrence represents a weight for displacement sensitivity with birds occurring more in the AOCS being more likely to be displaced from wind facilities or activity associated with wind facilities. The sum of disturbance and macro avoidance was divided by 2 so that both metrics would contribute equally to the displacement sensitivity index; we could not find evidence that one should be weighted more than the other. The habitat flexibility score and breeding and feeding score are also weights in the equation due to their influence on displacement. Habitat flexibility is extremely important with respect to displacement because it drives the effect of displacement; birds with low habitat flexibility are more susceptible to displacement. The effect on breeding birds is also important because the displacement of a breeding bird impacts not only the breeding bird, but also the offspring of those breeding birds.

Annual Occurrence (*AO*)

A bird spending all of the year foraging and resting on the AOCS will have a greater chance of encountering an offshore wind facility than one passing over in one migratory movement. Therefore,

we use the number of hours in a year that an individual bird may spend over the AOCS (annual occurrence, or *AO*) in our metric for assessing displacement vulnerability.

There are three broad classes of birds that occur at some time of the year over the AOCS with greatly differing annual occurrences among groups (see Annual Occurrence for Collision Sensitivity in Section 2.2.2 for discussion).

Disturbance (*DI*)

Both Garthe and Hüppop (2004) and Furness and Wade (2012) use disturbance reactions to ships and helicopters as an element of scoring potential displacement from areas in and near offshore wind facilities. Bird species show varying reactions to offshore wind facilities and the ship and helicopter traffic that occurs during maintenance of the turbines. Birds that show strong escape and avoidance reactions to traffic, fleeing great distances, are more likely to have foraging and resting activity impacts from increased traffic during maintenance operations. Reaction distance and fleeing distance vary by species, with loons exhibiting very different sensitivity to boat traffic (Austin et al. 2000; Garthe and Hüppop 2004; Ronconi et al. 2009; Topping and Petersen 2011) compared to species such as White-tailed Tropicbird, which can be attracted by boat traffic (Pyle 2007). We score some species as unaffected by boat traffic if they are not foraging or resting in the offshore environment but are flying over the AOCS between habitats or during migration and are consequently not displaced from foraging sites by an offshore wind facility. Scores are assigned from data in published and unpublished literature. Where suitable, we used scores assigned by Garthe and Hüppop (2004), Furness and Wade (2012), Furness et al. (2013), or other published literature and from consultation with researchers with many hours of experience with pelagic bird surveys, who reviewed the scores and made suggested alterations (see Table A–14). Our categories are necessarily qualitative and, other than the initial 0 ranking, follow Garthe and Hüppop (2004), Furness and Wade (2012), and Furness et al. (2013) as follows:

0 = unaffected by boat and helicopter traffic
1 = hardly any escape/avoidance behavior and low fleeing distance if any
2 to 4 = grades of behavior between scores 1 and 5
5 = strong escape/avoidance and large fleeing distance

Uncertainty scores (DI_u) were used to account for data deficiency or uncertainty within published literature and were assigned as follows:

10% = confident in data presented in published literature or by expert opinion

25% = an element of uncertainty in ascribing a behavioral score because of conflicting data or opinion

50% = where no data are available and an assumption is made based on similar species

Macro Avoidance (*MA*)

To populate the macro avoidance categories, we used the same data from collision sensitivity and followed the same proportional relationship protocols as Garthe and Hüppop (2004), Furness and Wade (2012), and Furness et al. (2013). However, here they represent a heightened risk for displacement from feeding areas, so a high avoidance rate correlates with a high score and the scoring system is the opposite of that used in collision sensitivity (see Table A–11 and Table A–12).

The range of values used for each value of the avoidance metric represents the range of values reported in the literature for our focal species.

1 = 0 to 5% avoidance
2 = 6 to 17% avoidance
3 = 18 to 29% avoidance
4 = 30 to 40% avoidance
5 = >40% avoidance

A macro avoidance uncertainty score (MA_u) was used to account for disagreement between data sets. As the macro avoidance categories already represent a range of values, uncertainty was ranked as an assessment of fit of observed data to the data range of each category as follows:

10% = if published data variation fall within a single category range, or limited data are supported by further evidence from published data sources or studies

25% = if published data variation extends beyond the limits of two of the category ranges but are supported by further evidence from published data sources or studies

50% = if published data variation extends beyond three of the category ranges, or supporting evidence is sparse or absent

Habitat Flexibility (*HF*)

The range of habitats used by species in the AOCS varies. Some species show habitat-specific feeding requirements such as shallow banks with bivalve communities, which are necessary for species such as Black Scoter and Common Eider (Petersen and Fox 2007). Other species forage over large areas and have little or no association with any particular habitat. Such species include gulls and petrels where prey availability is contingent upon nonuniform ocean conditions such as changing currents, *Sargassum* distribution, and water temperatures. While certain locations are known to have high concentrations of seabirds (e.g., up-welling areas), much seabird distribution is unpredictable. Migrant landbirds do not forage while over the ocean and therefore have no association with a particular habitat.

Our scoring for habitat flexibility follows Furness and Wade (2012) and Furness et al. (2013), but we have added a score of 0 as follows:

0 = species that do not forage in the AOCS

1 = species that use a wide range of habitats over a large area and usually having a wide range of prey available to them

2 to 4 = grades of behavior between scores 1 and 5

5 = species with habitat- and prey-specific requirements that do not have much flexibility in diving-depth or prey-species choices (Table A–15)

Uncertainty scores (HF_u) were used to account for data deficiency or uncertainty within published literature and were assigned as follows:

10% = confident in data presented in published literature

25% = an element of uncertainty with ascribing a behavioral score because of conflicting data or opinion

50% = where no data are available and an assumption is made based on data for similar species

Breeding (*BR*)

As described in Section 2.2.2 referring to collision sensitivity, displacement of a breeding adult has an impact on dependent offspring, so we incorporated some of this impact into the assessment method (see Table A–13) and used the score as a multiplier. Species were scored as follows:

1 = unlikely to be foraging in the AOCS to feed young
1.5 = some individuals will forage in the AOCS to feed young
2 = individuals are regularly known to forage in the AOCS to feed young

Final Displacement Scores

Final displacement scores were calculated by multiplying the population sensitivity score by the displacement sensitivity score. Multiplying the lower and upper ranges of population sensitivity by the lower and upper range of displacement sensitivity was also performed. This step accounts for the overall impact of displacement by considering not only the environmental factors that can influence displacement *per se*, but also the implications of displacement for a given species. Final displacement was calculated as follows (see Section 3.3.2):

$$Final\ Displacement\ Score = \text{Displacement Sensitivity Score} \times \text{Population Sensitivity}$$

2.2.4 Collision and Displacement Sensitivity Ranking

Both collision and displacement sensitivity indices were ranked on a scale of 1 to 10. Ranking for collision and displacement indices was performed on the best value between the minimum and maximum value. The ranking reflects the relative position between 0 and 1 of a given rank value within the range of values across all species. Percentages were multiplied by 10 to convert the ranks to a scale of 1 to 10.

Displacement ranking was done similarly to collision ranking except zero values were excluded from the 1 to 10 rank; indices with a value of zero were simply ranked zero. The zero values represent displacement sensitivity of birds that only occur in the AOCS when flying through the area and therefore are not subject to habitat displacement. Ranking was performed only on the nonzero displacement sensitivity scores and ranked 1 to 10 as described for collision.

To supplement the quantitative ranks between 1 and 10, we also provided a qualitative rank for each species (i.e., low, medium, and high) to make the rankings more comprehensible and understandable. Qualitative ranking was done by converting the 1–10 rank scale to a 0–3 rank scale and assigning values ranging between 0 and 1, low; >1 and 2, medium; and >2, high; the qualitative ranking was based on the best estimate from our calculations and not the upper or lower values within the range.

Both qualitative and quantitative ranks are relative among the select species in our database. This means that ranks do not reflect absolute levels of risk on the AOCS. For example, a species with a

"high" rank only reflects the vulnerability relative to other species in our database and not an absolute level of vulnerability. Our results should be interpreted with this caveat in mind.

3 Results

Because these indices measure different kinds of impacts on species, we do not attempt to combine them or make them comparable, except of course in the overall ranking that each provides for species sensitivity.

3.1 Population Sensitivity

3.1.1 Population Sensitivity Scores in Taxonomic Order

Table 4 shows the population sensitivity scores for species in taxonomic order as calculated by

$$Population\ Sensitivity = \frac{[(GPS \pm GPS_u) + (AOCS \pm AOCS_u) + TR + (SR \pm SR_u)]}{4}$$

where,

GPS = Global Population Size
$AOCS$ = Proportion of Population in the AOCS
TR = Threat Ranking
SR = Survival Ranking
u = the uncertainty value for each metric

Table 4.

Population sensitivity scores in taxonomic order (range: maximum 5.00; minimum 1.00).

Common Name	*GPS*		*AOCS*		*TR* Score	*SR*		Population Sensitivity Score		
	Score	Uncert.	Score	Uncert.		Score	Uncert.	Lower	Best Estimate	Upper
Snow Goose	1	10	2	10	1	4	50	1.45	2.00	2.33
Brant	3	10	2	10	1	3	50	1.75	2.25	2.75
Canada Goose	1	10	1	10	1	3	50	1.13	1.50	1.93
Tundra Swan	4	10	2	10	1	5	10	2.73	3.00	3.15
Wood Duck	1	25	1	10	1	1	10	1.00	1.00	1.11
Gadwall	1	10	1	10	1	2	25	1.13	1.25	1.43
American Wigeon	1	25	1	10	1	1	10	1.00	1.00	1.11
American Black Duck	3	25	1	10	1	1	10	1.31	1.50	1.74
Mallard	1	10	1	10	1	1	10	1.00	1.00	1.08
Blue-winged Teal	1	10	2	25	1	1	10	1.13	1.25	1.43

Table 4. (continued)

Common Name	*GPS*		*AOCS*		*TR* Score	*SR*		Population Sensitivity Score		
	Score	Uncert.	Score	Uncert.		Score	Uncert.	Lower	Best Estimate	Upper
Northern Shoveler	1	10	1	10	1	1	25	1.00	1.00	1.11
Northern Pintail	1	10	1	10	1	2	50	1.00	1.25	1.55
Green-winged Teal	1	10	1	10	1	1	10	1.00	1.00	1.08
Canvasback	3	25	2	10	1	2	50	1.51	2.00	2.49
Redhead	2	25	1	10	1	2	25	1.25	1.50	1.78
Ring-necked Duck	2	10	1	10	1	1	10	1.20	1.25	1.35
Greater Scaup	2	10	3	50	1	1	10	1.33	1.75	2.20
Lesser Scaup	1	10	3	50	1	1	10	1.13	1.50	1.93
King Eider	3	25	3	50	1	5	25	2.13	3.00	3.56
Common Eider	1	25	2	25	1	4	25	1.63	2.00	2.44
Harlequin Duck	4	10	2	50	1	4	50	1.90	2.75	3.35
Surf Scoter	3	50	3	50	1	5	50	1.63	3.00	3.75
White-winged Scoter	3	50	2	50	1	5	50	1.50	2.75	3.38
Black Scoter	3	50	2	50	2	3	25	1.69	2.50	3.31
Long-tailed Duck	1	10	2	50	3	1	25	1.50	1.75	2.09
Bufflehead	2	10	2	50	1	2	50	1.20	1.75	2.30
Common Goldeneye	1	25	2	50	1	2	25	1.13	1.50	1.94
Barrow's Goldeneye	4	25	2	50	1	1	50	1.50	2.00	2.63
Hooded Merganser	4	25	1	10	1	1	50	1.50	1.75	2.15
Common Merganser	2	10	1	10	1	1	50	1.20	1.25	1.45
Red-breasted Merganser	3	10	3	50	1	2	50	1.55	2.25	2.95
Ruddy Duck	3	25	2	50	1	2	50	1.31	2.00	2.69
Red-throated Loon	4	25	2	25	1	3	25	1.94	2.50	3.06
Common Loon	3	25	2	25	1	5	10	2.31	2.75	3.06
Pied-billed Grebe	5	25	1	10	1	2	50	1.69	2.25	2.53
Horned Grebe	3	50	2	25	1	1	50	1.25	1.75	2.38
Red-necked Grebe	4	10	1	10	1	4	50	1.90	2.50	2.88
Northern Fulmar	1	10	2	25	1	5	25	1.81	2.25	2.40
Bermuda Petrel	5	10	2	25	5	5	10	3.88	4.25	4.38
Black-capped Petrel	5	10	4	10	4	5	50	3.65	4.50	4.60
Cory's Shearwater	4	50	4	10	1	5	50	2.28	3.50	3.85
Great Shearwater	1	10	4	10	1	5	50	2.03	2.75	2.88
Sooty Shearwater	1	10	2	50	2	5	50	1.63	2.50	2.78
Manx Shearwater	3	25	2	50	1	5	25	2.00	2.75	3.19
Audubon's Shearwater	5	25	2	50	1	5	50	2.06	3.25	3.50

Table 4. (continued)

Common Name	*GPS*		*AOCS*		*TR* Score	*SR*		Population Sensitivity Score		
	Score	Uncert.	Score	Uncert.		Score	Uncert.	Lower	Best Estimate	Upper
Wilson's Storm-Petrel	1	10	4	50	1	4	50	1.50	2.50	3.03
Leach's Storm-Petrel	1	10	2	50	1	4	25	1.50	2.00	2.53
Band-rumped Storm-Petrel	4	25	3	50	3	5	10	3.00	3.75	4.38
White-tailed Tropicbird	5	10	2	50	1	5	10	2.75	3.25	3.50
Red-billed Tropicbird	5	10	1	10	1	5	50	2.25	3.00	3.03
Brown Booby	4	25	1	10	1	5	25	2.19	2.75	3.03
Northern Gannet	3	25	2	50	1	5	10	2.19	2.75	3.19
Double-crested Cormorant	2	10	2	50	1	3	25	1.51	2.00	2.49
Great Cormorant	2	10	2	50	1	3	10	1.63	2.00	2.38
Brown Pelican	4	25	1	10	1	4	25	2.00	2.50	3.03
American Bittern	2	25	1	10	1	2	50	1.13	1.50	1.90
Least Bittern	4	25	1	10	1	2	50	1.50	2.00	2.53
Great Blue Heron	1	10	1	10	1	2	50	1.00	1.25	1.55
Great Egret	3	25	1	50	1	1	50	1.31	1.50	1.94
Snowy Egret	2	25	1	10	1	1	25	1.13	1.25	1.46
Little Blue Heron	4	10	1	10	1	1	50	1.65	1.75	2.00
Tricolored Heron	4	25	1	10	1	1	25	1.50	1.75	2.09
Green Heron	5	50	2	10	1	1	50	1.58	2.25	2.43
Black-crowned Night-Heron	2	25	1	50	1	1	50	1.13	1.25	1.63
Yellow-crowned Night-Heron	5	25	1	10	1	2	50	1.69	2.25	2.53
White Ibis	4	25	2	25	1	2	50	1.63	2.25	2.88
Glossy Ibis	2	25	1	10	1	2	50	1.13	1.50	1.90
Roseate Spoonbill	4	25	2	25	1	4	50	1.88	2.75	3.38
Osprey	2	25	1	25	1	4	50	1.38	2.00	2.44
Northern Harrier	2	25	1	10	1	3	50	1.25	1.75	2.28
Black Rail	5	25	2	25	2	2	50	2.06	2.75	3.13
Clapper Rail	5	10	1	50	1	2	50	1.88	2.25	2.63
King Rail	5	50	1	50	1	2	50	1.38	2.25	2.63
Virginia Rail	5	50	1	50	1	2	50	1.38	2.25	2.63
Sora	5	50	2	50	1	2	50	1.38	2.50	3.00
Purple Gallinule	4	25	1	25	1	2	50	1.50	2.00	2.56
Common Gallinule	1	10	1	25	1	2	50	1.00	1.25	1.59
American Coot	1	10	2	25	1	2	50	1.13	1.50	1.90
Black-bellied Plover	3	10	2	25	1	2	50	1.55	2.00	2.45
American Golden-Plover	4	10	5	25	1	2	50	2.34	3.00	3.35

Table 4. (continued)

Common Name	*GPS*		*AOCS*		*TR* Score	*SR*		Population Sensitivity Score		
	Score	Uncert.	Score	Uncert.		Score	Uncert.	Lower	Best Estimate	Upper
Wilson's Plover	5	10	2	50	1	2	50	1.88	2.50	3.00
Semipalmated Plover	4	10	2	50	1	1	25	1.65	2.00	2.41
Piping Plover	5	10	2	50	4	1	25	2.63	3.00	3.31
Killdeer	2	25	1	50	1	2	50	1.13	1.50	2.00
American Oystercatcher	5	10	2	25	1	4	50	2.25	3.00	3.38
Black-necked Stilt	3	50	2	25	1	2	50	1.25	2.00	2.75
American Avocet	4	10	1	10	1	2	50	1.65	2.00	2.38
Spotted Sandpiper	4	25	3	50	1	2	50	1.63	2.50	3.38
Solitary Sandpiper	4	25	3	50	1	2	50	1.63	2.50	3.38
Greater Yellowlegs	4	25	2	50	1	4	50	1.75	2.75	3.50
Willet	4	10	2	50	1	4	50	1.90	2.75	3.35
Lesser Yellowlegs	4	10	2	50	1	4	50	1.90	2.75	3.35
Upland Sandpiper	4	10	1	25	1	4	50	1.90	2.50	2.91
Whimbrel	2	10	2	50	1	4	50	1.45	2.25	2.80
Hudsonian Godwit	5	10	2	10	1	4	25	2.58	3.00	3.30
Marbled Godwit	4	25	1	10	1	2	25	1.63	2.00	2.40
Ruddy Turnstone	4	25	2	10	1	2	50	1.70	2.25	2.80
Red Knot	4	10	2	25	1	2	50	1.78	2.25	2.73
Sanderling	3	10	2	25	1	3	50	1.68	2.25	2.83
Semipalmated Sandpiper	2	10	4	10	2	1	50	2.10	2.25	2.53
Western Sandpiper	1	10	4	50	1	2	50	1.25	2.00	2.53
Least Sandpiper	3	10	2	25	1	1	50	1.55	1.75	2.08
White-rumped Sandpiper	2	10	4	10	1	1	50	1.85	2.00	2.28
Baird's Sandpiper	4	10	4	25	1	1	50	2.15	2.50	2.98
Pectoral Sandpiper	5	50	2	50	1	1	50	1.38	2.25	2.63
Purple Sandpiper	5	10	1	10	1	2	50	1.88	2.25	2.53
Dunlin	1	10	2	25	1	2	50	1.13	1.50	1.90
Stilt Sandpiper	3	10	2	25	1	2	50	1.55	2.00	2.45
Buff-breasted Sandpiper	5	10	1	25	2	1	50	2.13	2.25	2.44
Short-billed Dowitcher	4	10	3	25	1	2	50	1.96	2.50	3.04
Long-billed Dowitcher	4	10	1	25	1	2	50	1.65	2.00	2.41
Wilson's Snipe	2	10	2	50	1	2	50	1.20	1.75	2.30
American Woodcock	1	10	1	10	1	2	50	1.00	1.25	1.55
Red-necked Phalarope	1	10	3	25	1	1	25	1.31	1.50	1.78
Red Phalarope	2	10	4	50	1	1	25	1.45	2.00	2.36

Table 4. (continued)

Common Name	*GPS*		*AOCS*		*TR* Score	*SR*		Population Sensitivity Score		
	Score	Uncert.	Score	Uncert.		Score	Uncert.	Lower	Best Estimate	Upper
Black-legged Kittiwake	1	10	1	50	1	3	25	1.31	1.50	1.84
Sabine's Gull	4	25	1	10	1	3	50	1.63	2.25	2.90
Bonaparte's Gull	4	25	1	10	1	3	50	1.63	2.25	2.90
Black-headed Gull	1	10	1	10	1	3		1.13	1.50	1.93
Little Gull	2	25	1	10	1	3	50	1.25	1.75	2.28
Laughing Gull	3	10	2	50	1	3	50	1.55	2.25	2.95
Ring-billed Gull	2	10	1	10	1	3	50	1.33	1.75	2.20
Herring Gull	2	25	2	25	1	5	50	1.63	2.50	2.75
Iceland Gull	4	10	1	10	1	5	50	2.03	2.75	2.88
Lesser Black-backed Gull	3	25	1	10	1	5		2.00	2.50	2.71
Glaucous Gull	3	50	1	10	1	5	50	1.50	2.50	2.90
Great Black-backed Gull	3	25	1	10	1	5	25	2.00	2.50	2.71
Brown Noddy	3	50	1	25	1	5	50	1.50	2.50	2.94
Sooty Tern	1	10	1	10	1	5	50	1.38	2.00	2.05
Bridled Tern	3	25	1	10	1	5	50	1.69	2.50	2.71
Least Tern	5	10	3	50	5	4	50	3.25	4.25	4.88
Gull-billed Tern	4	25	1	25	1	5	50	1.88	2.75	3.06
Caspian Tern	4	10	1	25	1	4	50	1.90	2.50	2.91
Black Tern	3	50	2	50	1	4	50	1.38	2.50	3.38
Roseate Tern	5	10	2	50	5	4	25	3.38	4.00	4.50
Common Tern	2	25	2	50	1	4	25	1.63	2.25	2.88
Arctic Tern	2	10	2	25	1	4	25	1.83	2.25	2.68
Forster's Tern	4	10	2	50	1	3	50	1.78	2.50	3.23
Royal Tern	4	10	2	50	1	5	50	2.03	3.00	3.35
Sandwich Tern	4	25	2	50	1	4	25	2.00	2.75	3.50
Black Skimmer	4	10	1	10	1	3	50	1.78	2.25	2.75
Great Skua	5	10	1	10	1	4	10	2.53	2.75	2.88
South Polar Skua	5	10	1	10	1	5	25	2.56	3.00	3.03
Pomarine Jaeger	3	50	3	50	1	4	50	1.50	2.75	3.75
Parasitic Jaeger	1	50	2	50	1	4	25	1.50	2.00	2.63
Long-tailed Jaeger	1	50	3	50	1	4	25	1.63	2.25	3.00
Dovekie	1	10	2	50	1	3	50	1.13	1.75	2.40
Common Murre	1	10	2	25	1	3	50	1.25	1.75	2.28
Thick-billed Murre	1	10	2	50	1	5	25	1.69	2.25	2.53
Razorbill	2	25	2	50	1	5	10	2.00	2.50	2.88

Table 4. (continued)

Common Name	*GPS*		*AOCS*		*TR* Score	*SR*		Population Sensitivity Score		
	Score	Uncert.	Score	Uncert.		Score	Uncert.	Lower	Best Estimate	Upper
Black Guillemot	3	25	2	50	1	4	25	1.81	2.50	3.19
Atlantic Puffin	1	10	2	50	1	5	10	1.88	2.25	2.53
American Kestrel	1	10	1	10	1	1	50	1.00	1.00	1.18
Merlin	2	10	1	10	1	1	10	1.20	1.25	1.35
Peregrine Falcon	2	10	2	25	1	4	50	1.58	2.25	2.68
Barn Swallow	1	10	1	10	1	1	25	1.00	1.00	1.11
Blue-gray Gnatcatcher	1	10	2	25	1	1	10	1.13	1.25	1.43
Bicknell's Thrush	5	10	5	10	3	1	10	3.25	3.50	3.53
Ovenbird	1	10	4	50	1	1	10	1.25	1.75	2.05
Northern Waterthrush	1	10	4	50	1	1	50	1.25	1.75	2.15
Common Yellowthroat	1	10	3	50	1	1	50	1.13	1.50	2.03
American Redstart	1	10	4	25	1	1	50	1.50	1.75	2.15
Kirtland's Warbler	5	10	5	10	5	1	10	3.75	4.00	4.03
Cape May Warbler	1	10	5	10	1	1	50	1.88	2.00	2.15
Northern Parula	1	10	4	50	1	1	10	1.25	1.75	2.05
Blackburnian Warbler	1	10	5	10	1	1	25	1.88	2.00	2.09
Blackpoll Warbler	1	10	5	10	1	1	25	1.88	2.00	2.09
Palm Warbler	1	10	3	25	1	1	25	1.31	1.50	1.78
Yellow-rumped Warbler	1	10	2	25	1	1	25	1.13	1.25	1.46
Canada Warbler	1	10	5	25	1	1	25	1.69	2.00	2.09
Chipping Sparrow	1	10	1	10	1	1	25	1.00	1.00	1.11
Savannah Sparrow	1	10	1	10	1	1	10	1.00	1.00	1.08
Song Sparrow	1	10	1	10	1	1	25	1.00	1.00	1.11
White-throated Sparrow	1	10	1	10	1	1	10	1.00	1.00	1.08
Indigo Bunting	1	10	3	50	1	1	10	1.13	1.50	1.93
Baltimore Oriole	1	10	3	50	1	1	25	1.13	1.50	1.96
American Goldfinch	1	10	1	10	1	1	25	1.00	1.00	1.11

3.1.2 Final Population Sensitivity in Ranked Order

Table 5 shows the final population sensitivity for species in ranked order.

Table 5.

Final population sensitivity in ranked order.

Common Name	Lower Final Population Sensitivity	Best Estimate Final Population Sensitivity	Upper Final Population Sensitivity
Black-capped Petrel	3.65	4.50	4.60
Bermuda Petrel	3.88	4.25	4.38
Least Tern	3.25	4.25	4.88
Roseate Tern	3.38	4.00	4.50
Kirtland's Warbler	3.75	4.00	4.03
Band-rumped Storm-Petrel	3.00	3.75	4.38
Cory's Shearwater	2.28	3.50	3.85
Bicknell's Thrush	3.25	3.50	3.53
Audubon's Shearwater	2.06	3.25	3.50
White-tailed Tropicbird	2.75	3.25	3.50
Tundra Swan	2.73	3.00	3.15
King Eider	2.13	3.00	3.56
Surf Scoter	1.63	3.00	3.75
Red-billed Tropicbird	2.25	3.00	3.03
American Golden-Plover	2.34	3.00	3.35
Piping Plover	2.63	3.00	3.31
American Oystercatcher	2.25	3.00	3.38
Hudsonian Godwit	2.58	3.00	3.30
Royal Tern	2.03	3.00	3.35
South Polar Skua	2.56	3.00	3.03
Harlequin Duck	1.90	2.75	3.35
White-winged Scoter	1.50	2.75	3.38
Common Loon	2.31	2.75	3.06
Great Shearwater	2.03	2.75	2.88
Manx Shearwater	2.00	2.75	3.19
Brown Booby	2.19	2.75	3.03
Northern Gannet	2.19	2.75	3.19
Roseate Spoonbill	1.88	2.75	3.38
Black Rail	2.06	2.75	3.13

Table 5. (continued)

Common Name	Lower Final Population Sensitivity	Best Estimate Final Population Sensitivity	Upper Final Population Sensitivity
Greater Yellowlegs	1.75	2.75	3.50
Willet	1.90	2.75	3.35
Lesser Yellowlegs	1.90	2.75	3.35
Iceland Gull	2.03	2.75	2.88
Gull-billed Tern	1.88	2.75	3.06
Sandwich Tern	2.00	2.75	3.50
Great Skua	2.53	2.75	2.88
Pomarine Jaeger	1.50	2.75	3.75
Black Scoter	1.69	2.50	3.31
Red-throated Loon	1.94	2.50	3.06
Red-necked Grebe	1.90	2.50	2.88
Sooty Shearwater	1.63	2.50	2.78
Wilson's Storm-Petrel	1.50	2.50	3.03
Brown Pelican	2.00	2.50	3.03
Sora	1.38	2.50	3.00
Wilson's Plover	1.88	2.50	3.00
Spotted Sandpiper	1.63	2.50	3.38
Solitary Sandpiper	1.63	2.50	3.38
Upland Sandpiper	1.90	2.50	2.91
Baird's Sandpiper	2.15	2.50	2.98
Short-billed Dowitcher	1.96	2.50	3.04
Herring Gull	1.63	2.50	2.75
Lesser Black-backed Gull	2.00	2.50	2.71
Glaucous Gull	1.50	2.50	2.90
Great Black-backed Gull	2.00	2.50	2.71
Brown Noddy	1.50	2.50	2.94
Bridled Tern	1.69	2.50	2.71
Caspian Tern	1.90	2.50	2.91
Black Tern	1.38	2.50	3.38
Forster's Tern	1.78	2.50	3.23
Razorbill	2.00	2.50	2.88
Black Guillemot	1.81	2.50	3.19
Brant	1.75	2.25	2.75

Table 5. (continued)

Common Name	Lower Final Population Sensitivity	Best Estimate Final Population Sensitivity	Upper Final Population Sensitivity
Red-breasted Merganser	1.55	2.25	2.95
Pied-billed Grebe	1.69	2.25	2.53
Northern Fulmar	1.81	2.25	2.40
Green Heron	1.58	2.25	2.43
Yellow-crowned Night-Heron	1.69	2.25	2.53
White Ibis	1.63	2.25	2.88
Clapper Rail	1.88	2.25	2.63
King Rail	1.38	2.25	2.63
Virginia Rail	1.38	2.25	2.63
Whimbrel	1.45	2.25	2.80
Ruddy Turnstone	1.70	2.25	2.80
Red Knot	1.78	2.25	2.73
Sanderling	1.68	2.25	2.83
Semipalmated Sandpiper	2.10	2.25	2.53
Pectoral Sandpiper	1.38	2.25	2.63
Purple Sandpiper	1.88	2.25	2.53
Buff-breasted Sandpiper	2.13	2.25	2.44
Sabine's Gull	1.63	2.25	2.90
Bonaparte's Gull	1.63	2.25	2.90
Laughing Gull	1.55	2.25	2.95
Common Tern	1.63	2.25	2.88
Arctic Tern	1.83	2.25	2.68
Black Skimmer	1.78	2.25	2.75
Long-tailed Jaeger	1.63	2.25	3.00
Thick-billed Murre	1.69	2.25	2.53
Atlantic Puffin	1.88	2.25	2.53
Peregrine Falcon	1.58	2.25	2.68
Snow Goose	1.45	2.00	2.33
Canvasback	1.51	2.00	2.49
Common Eider	1.63	2.00	2.44
Barrow's Goldeneye	1.50	2.00	2.63
Ruddy Duck	1.31	2.00	2.69
Leach's Storm-Petrel	1.50	2.00	2.53

Table 5. (continued)

Common Name	Lower Final Population Sensitivity	Best Estimate Final Population Sensitivity	Upper Final Population Sensitivity
Double-crested Cormorant	1.51	2.00	2.49
Great Cormorant	1.63	2.00	2.38
Least Bittern	1.50	2.00	2.53
Osprey	1.38	2.00	2.44
Purple Gallinule	1.50	2.00	2.56
Black-bellied Plover	1.55	2.00	2.45
Semipalmated Plover	1.65	2.00	2.41
Black-necked Stilt	1.25	2.00	2.75
American Avocet	1.65	2.00	2.38
Marbled Godwit	1.63	2.00	2.40
Western Sandpiper	1.25	2.00	2.53
White-rumped Sandpiper	1.85	2.00	2.28
Stilt Sandpiper	1.55	2.00	2.45
Long-billed Dowitcher	1.65	2.00	2.41
Red Phalarope	1.45	2.00	2.36
Sooty Tern	1.38	2.00	2.05
Parasitic Jaeger	1.50	2.00	2.63
Cape May Warbler	1.88	2.00	2.15
Blackburnian Warbler	1.88	2.00	2.09
Blackpoll Warbler	1.88	2.00	2.09
Canada Warbler	1.69	2.00	2.09
Greater Scaup	1.33	1.75	2.20
Long-tailed Duck	1.50	1.75	2.09
Bufflehead	1.20	1.75	2.30
Hooded Merganser	1.50	1.75	2.15
Horned Grebe	1.25	1.75	2.38
Little Blue Heron	1.65	1.75	2.00
Tricolored Heron	1.50	1.75	2.09
Northern Harrier	1.25	1.75	2.28
Least Sandpiper	1.55	1.75	2.08
Wilson's Snipe	1.20	1.75	2.30
Little Gull	1.25	1.75	2.28
Ring-billed Gull	1.33	1.75	2.20

Table 5. (continued)

Common Name	Lower Final Population Sensitivity	Best Estimate Final Population Sensitivity	Upper Final Population Sensitivity
Dovekie	1.13	1.75	2.40
Common Murre	1.25	1.75	2.28
Ovenbird	1.25	1.75	2.05
Northern Waterthrush	1.25	1.75	2.15
American Redstart	1.50	1.75	2.15
Northern Parula	1.25	1.75	2.05
Canada Goose	1.13	1.50	1.93
American Black Duck	1.31	1.50	1.74
Redhead	1.25	1.50	1.78
Lesser Scaup	1.13	1.50	1.93
Common Goldeneye	1.13	1.50	1.94
American Bittern	1.13	1.50	1.90
Great Egret	1.31	1.50	1.94
Glossy Ibis	1.13	1.50	1.90
American Coot	1.13	1.50	1.90
Killdeer	1.13	1.50	2.00
Dunlin	1.13	1.50	1.90
Red-necked Phalarope	1.31	1.50	1.78
Black-legged Kittiwake	1.31	1.50	1.84
Black-headed Gull	1.13	1.50	1.93
Common Yellowthroat	1.13	1.50	2.03
Palm Warbler	1.31	1.50	1.78
Indigo Bunting	1.13	1.50	1.93
Baltimore Oriole	1.13	1.50	1.96
Gadwall	1.13	1.25	1.43
Blue-winged Teal	1.13	1.25	1.43
Northern Pintail	1.00	1.25	1.55
Ring-necked Duck	1.20	1.25	1.35
Common Merganser	1.20	1.25	1.45
Great Blue Heron	1.00	1.25	1.55
Snowy Egret	1.13	1.25	1.46
Black-crowned Night-Heron	1.13	1.25	1.63
Common Gallinule	1.00	1.25	1.59

Table 5. (continued)

Common Name	Lower Final Population Sensitivity	Best Estimate Final Population Sensitivity	Upper Final Population Sensitivity
American Woodcock	1.00	1.25	1.55
Merlin	1.20	1.25	1.35
Blue-gray Gnatcatcher	1.13	1.25	1.43
Yellow-rumped Warbler	1.13	1.25	1.46
Wood Duck	1.00	1.00	1.11
American Wigeon	1.00	1.00	1.11
Mallard	1.00	1.00	1.08
Northern Shoveler	1.00	1.00	1.11
Green-winged Teal	1.00	1.00	1.08
American Kestrel	1.00	1.00	1.18
Barn Swallow	1.00	1.00	1.11
Chipping Sparrow	1.00	1.00	1.11
Savannah Sparrow	1.00	1.00	1.08
Song Sparrow	1.00	1.00	1.11
White-throated Sparrow	1.00	1.00	1.08
American Goldfinch	1.00	1.00	1.11

3.2 Collision Sensitivity

3.2.1 Collision Sensitivity Scores in Taxonomic Order

Table 6 shows the collision sensitivity scores for species in taxonomic order, calculated as follows:

$$Collision\ Senstivity = AO \times \left[\frac{(NFR \pm NFR_u) + (DFR \pm DFR_u)}{(RSZ \pm RSZ_u)}\right] \times [(MA \pm MA_u) \times BR]$$

where,

AO = Annual Occurrence
NFR = Nocturnal Flight Ranking
DFR = Diurnal Flight Ranking
RSZ = amount of time spent in the Rotor Swept Zone
MA = Macro Avoidance (ranks are inverted for this metric)
BR = Breeding and Feeding score
u = the uncertainty value for each metric

Table 6.

Collision sensitivity scores in taxonomic order (range: maximum 876000; minimum 4).

Common Name	*AO*	*NFR*		*DFR*		*RSZ*		*MA*		*BR* Multiplier	Collision Sensitivity Score		
		Score	Uncertainty	Score	Uncertainty	Score	Uncertainty	Collision	Uncertainty		Lower	Best Estimate	Upper
Snow Goose	2	1	50	1	10	1	50	1	25	1	2.67	4.00	6.50
Brant	2	1	50	1	50	3	50	1	25	1.5	1.33	2.00	7.50
Canada Goose	2	3	50	3	25	1	50	1	25	1	5.00	12.00	20.63
Tundra Swan	2	5	25	5	25	1	50	1	50	1	10.00	20.00	30.00
Wood Duck	2	5	50	5	50	1	50	1	50	1	6.67	20.00	30.00
Gadwall	2	5	50	1	10	1	50	1	51	1	4.67	12.00	18.42
American Wigeon	2	3	50	5	10	1	50	1	52	1	8.00	16.00	28.88
American Black Duck	2	5	50	1	10	1	50	1	53	1	4.67	12.00	18.67
Mallard	2	1	25	3	25	1	50	1	25	1	4.33	8.00	12.50
Blue-winged Teal	2	5	25	3	25	1	50	1	50	1	8.00	16.00	26.25
Northern Shoveler	2	5	10	5	10	1	50	1	25	1	12.00	20.00	25.00
Northern Pintail	2	5	10	1	10	1	50	1	25	1	7.33	12.00	15.25
Green-winged Teal	2	5	25	2	25	1	50	1	25	1	7.00	14.00	18.75
Canvasback	2	3	50	2	50	1	50	1	50	1	3.33	10.00	22.50
Redhead	2	3	50	3	50	1	50	1	50	1	4.00	12.00	27.00
Ring-necked Duck	2	5	10	1	10	1	50	1	50	1	7.33	12.00	18.30
Greater Scaup	6480	5	25	2	25	1	50	1	25	1	22680.00	45360.00	60750.00
Lesser Scaup	6480	5	10	1	10	1	50	1	25	1	23760.00	38880.00	49410.00
King Eider	4320	5	25	5	25	1	50	1	50	1	21600.00	43200.00	64800.00
Common Eider	8760	3	10	2	10	3	50	1	10	2	17520.00	29200.00	70664.00
Harlequin Duck	1800	5	50	5	50	1	50	1	50	1	6000.00	18000.00	27000.00
Surf Scoter	6480	3	50	2	50	1	50	1	25	1	10800.00	32400.00	60750.00
White-winged Scoter	6480	3	50	2	25	1	50	1	25	1	12960.00	32400.00	56700.00
Black Scoter	6480	3	50	3	50	3	50	1	25	1	4320.00	12960.00	48600.00
Long-tailed Duck	5760	4	50	3	25	1	50	1	10	1	16320.00	40320.00	55440.00
Bufflehead	5760	3	10	1	10	1	50	2	50	1	14208.00	46080.00	76032.00
Common Goldeneye	2	3	25	2	25	1	50	2	50	1	5.00	20.00	37.50
Barrow's Goldeneye	2	5	10	2	50	1	50	2	50	1	7.33	28.00	48.00
Hooded Merganser	2	5	10	1	50	1	50	2	50	1	7.33	24.00	39.00
Common Merganser	4320	1	25	1	25	1	50	2	50	1	5760.00	17280.00	32400.00
Red-breasted Merganser	5760	1	10	1	10	1	50	2	50	1	7680.00	23040.00	38016.00

Table 6. (continued)

Common Name	*AO*	*NFR*		*DFR*		*RSZ*		*MA*		*BR* Multiplier	Collision Sensitivity Score		
		Score	Uncertainty	Score	Uncertainty	Score	Uncertainty	Collision	Uncertainty		Lower	Best Estimate	Upper
Ruddy Duck	2	5	10	1	25	1	50	2	50	1	7.33	24.00	37.50
Red-throated Loon	5760	1	25	2	25	3	50	1	10	1	3200.00	5760.00	15840.00
Common Loon	6480	1	50	2	50	3	50	1	10	1	2880.00	6480.00	21384.00
Pied-billed Grebe	12	1	25	1	50	3	25	2	50	1	6.40	16.00	44.00
Horned Grebe	5040	2	50	2	50	3	25	1	25	1	2688.00	6720.00	16800.00
Red-necked Grebe	5040	1	50	1	50	3	25	1	25	1	2688.00	3360.00	8400.00
Northern Fulmar	8760	4	25	2	25	5	50	1	25	1	7884.00	10512.00	32850.00
Bermuda Petrel	3960	5	50	5	50	5	25	3	50	2	11880.00	47520.00	95040.00
Black-capped Petrel	8760	5	50	5	50	5	25	1	50	2	17520.00	35040.00	70080.00
Cory's Shearwater	5040	3	25	3	25	5	10	1	50	1	4536.00	6048.00	12600.00
Great Shearwater	5040	3	50	3	25	5	10	1	50	2	7560.00	12096.00	27720.00
Sooty Shearwater	5040	3	25	3	25	3	10	1	25	1	6872.73	10080.00	17500.00
Manx Shearwater	8760	3	25	3	25	5	10	1	25	2	15768.00	21024.00	36500.00
Audubon's Shearwater	5040	3	50	3	50	5	10	1	50	2	6048.00	12096.00	30240.00
Wilson's Storm-Petrel	5040	4	25	3	25	5	10	1	25	1	5292.00	7056.00	12250.00
Leach's Storm-Petrel	4320	4	25	3	25	5	10	1	25	2	9072.00	12096.00	21000.00
Band-rumped Storm-Petrel	4320	4	50	3	25	5	10	1	25	1	3672.00	6048.00	10500.00
White-tailed Tropicbird	3600	2	50	3	50	3	50	3	50	1	3000.00	18000.00	81000.00
Red-billed Tropicbird	6480	2	50	5	50	3	50	3	50	1	7560.00	45360.00	155520.00
Brown Booby	4320	2	50	3	50	3	25	2	50	1.5	4320.00	21600.00	64800.00
Northern Gannet	8760	2	25	3	25	1	25	1	10	2	52560.00	87600.00	120450.00
Double-crested Cormorant	4320	1	10	5	10	3	50	3	50	1.5	11880.00	38880.00	118584.00
Great Cormorant	8760	1	25	2	25	3	50	3	10	1.5	19710.00	39420.00	108405.00
Brown Pelican	4320	1	25	3	25	3	50	5	50	1.5	11700.00	43200.00	108000.00
American Bittern	4	5	50	5	50	1	50	5	50	1	33.33	200.00	200.00
Least Bittern	4	5	50	5	50	1	50	5	50	1	33.33	200.00	200.00
Great Blue Heron	4	5	10	5	10	1	50	5	25	1	90.00	200.00	200.00
Great Egret	4	5	10	5	25	1	50	5	50	1	55.00	200.00	200.00
Snowy Egret	4	5	10	5	50	1	50	5	50	1	46.67	200.00	200.00
Little Blue Heron	4	5	50	5	10	1	50	5	50	1	46.67	200.00	200.00
Tricolored Heron	4	5	50	5	50	1	50	5	50	1	33.33	200.00	200.00
Green Heron	4	5	10	5	10	1	50	5	50	1	60.00	200.00	200.00
Black-crowned Night-Heron	4	5	10	5	10	1	50	5	50	1	60.00	200.00	200.00
Yellow-crowned Night-Heron	4	5	10	5	10	1	50	5	50	1	60.00	200.00	200.00
White Ibis	4	5	10	5	10	1	50	5	50	1	60.00	200.00	200.00

Table 6. (continued)

Common Name	*AO*	*NFR*		*DFR*		*RSZ*		*MA*		*BR* Multiplier	Collision Sensitivity Score		
		Score	Uncertainty	Score	Uncertainty	Score	Uncertainty	Collision	Uncertainty		Lower	Best Estimate	Upper
Glossy Ibis	4	5	10	5	10	1	50	5	50	1	60.00	200.00	200.00
Roseate Spoonbill	4	5	50	5	50	1	50	5	50	1	33.33	200.00	200.00
Osprey	4	5	50	5	50	1	10	3	25	1	40.91	120.00	150.00
Northern Harrier	4	5	10	5	10	1	25	3	25	1	64.80	120.00	150.00
Black Rail	5	5	10	5	50	1	50	5	50	1	58.33	250.00	250.00
Clapper Rail	5	5	10	5	10	1	50	5	50	1	75.00	250.00	250.00
King Rail	5	5	10	5	10	1	50	5	50	1	75.00	250.00	250.00
Virginia Rail	5	5	10	5	10	1	50	5	50	1	75.00	250.00	250.00
Sora	5	5	10	5	10	1	50	5	50	1	75.00	250.00	250.00
Purple Gallinule	5	5	10	5	10	1	50	5	50	1	75.00	250.00	250.00
Common Gallinule	5	5	10	5	10	1	50	5	50	1	75.00	250.00	250.00
American Coot	5	5	10	5	10	1	50	5	50	1	75.00	250.00	250.00
Black-bellied Plover	15	5	50	5	50	1	50	3	50	1	75.00	450.00	675.00
American Golden-Plover	15	5	10	5	10	1	50	3	50	1	135.00	450.00	675.00
Wilson's Plover	15	5	10	5	10	1	50	3	50	1	135.00	450.00	675.00
Semipalmated Plover	15	5	10	5	10	1	50	3	50	1	135.00	450.00	675.00
Piping Plover	15	5	50	5	50	3	50	3	50	1	25.00	150.00	450.00
Killdeer	15	5	10	5	10	1	50	3	50	1	135.00	450.00	675.00
American Oystercatcher	15	5	50	5	50	1	50	3	50	1	75.00	450.00	675.00
Black-necked Stilt	15	5	50	5	50	1	50	3	50	1	75.00	450.00	675.00
American Avocet	15	5	50	5	50	1	50	3	50	1	75.00	450.00	675.00
Spotted Sandpiper	15	5	10	5	10	1	50	3	50	1	135.00	450.00	675.00
Solitary Sandpiper	15	5	10	5	50	1	50	3	50	1	105.00	450.00	675.00
Greater Yellowlegs	15	5	10	5	50	1	50	3	50	1	105.00	450.00	675.00
Willet	15	5	10	5	50	1	50	3	50	1	105.00	450.00	675.00
Lesser Yellowlegs	15	5	10	5	10	1	50	3	50	1	135.00	450.00	675.00
Upland Sandpiper	15	5	10	5	50	1	50	3	50	1	105.00	450.00	675.00
Whimbrel	15	5	50	5	50	1	50	3	50	1	75.00	450.00	675.00
Hudsonian Godwit	15	5	10	5	10	1	50	3	50	1	135.00	450.00	675.00
Marbled Godwit	15	5	50	5	50	1	50	3	50	1	75.00	450.00	675.00
Ruddy Turnstone	15	5	50	5	50	1	50	3	50	1	75.00	450.00	675.00
Red Knot	15	5	50	5	50	3	50	3	50	1	25.00	150.00	450.00
Sanderling	15	5	10	5	10	1	50	3	50	1	135.00	450.00	675.00
Semipalmated Sandpiper	15	5	10	5	10	1	50	3	50	1	135.00	450.00	675.00
Western Sandpiper	15	5	50	5	50	1	50	3	50	1	75.00	450.00	675.00

Table 6. (continued)

Common Name	*AO*	*NFR*		*DFR*		*RSZ*		*MA*		*BR* Multiplier	Collision Sensitivity Score		
		Score	Uncertainty	Score	Uncertainty	Score	Uncertainty	Collision	Uncertainty		Lower	Best Estimate	Upper
Least Sandpiper	15	5	50	5	50	1	50	3	50	1	75.00	450.00	675.00
White-rumped Sandpiper	15	5	50	5	50	1	50	3	50	1	75.00	450.00	675.00
Baird's Sandpiper	15	5	50	5	50	1	50	3	50	1	75.00	450.00	675.00
Pectoral Sandpiper	15	5	50	5	50	1	50	3	50	1	75.00	450.00	675.00
Purple Sandpiper	15	5	50	5	50	1	50	3	50	1	75.00	450.00	675.00
Dunlin	15	5	50	5	50	1	50	3	50	1	75.00	450.00	675.00
Stilt Sandpiper	15	5	10	5	10	1	50	3	50	1	135.00	450.00	675.00
Buff-breasted Sandpiper	15	5	10	5	50	1	50	3	50	1	105.00	450.00	675.00
Short-billed Dowitcher	15	5	10	5	10	1	50	3	50	1	135.00	450.00	675.00
Long-billed Dowitcher	15	5	10	5	10	1	50	3	50	1	135.00	450.00	675.00
Wilson's Snipe	15	5	10	5	10	1	50	3	50	1	135.00	450.00	675.00
American Woodcock	15	5	10	5	50	1	50	3	50	1	105.00	450.00	675.00
Red-necked Phalarope	5760	2	50	3	50	1	50	4	50	1	19200.00	115200.00	216000.00
Red Phalarope	7200	3	50	3	50	1	50	4	50	1	28800.00	172800.00	324000.00
Black-legged Kittiwake	3600	3	25	3	25	1	50	2	50	1	10800.00	43200.00	81000.00
Sabine's Gull	4320	2	50	2	50	3	50	2	50	1	1920.00	11520.00	51840.00
Bonaparte's Gull	20	2	50	1	50	3	50	2	50	1	8.89	40.00	180.00
Black-headed Gull	20	2	25	1	25	1	50	2	50	1.5	50.00	180.00	337.50
Little Gull	20	2	25	3	25	3	50	2	50	1	16.67	66.67	250.00
Laughing Gull	8760	3	25	3	25	3	50	2	50	1.5	13140.00	52560.00	197100.00
Ring-billed Gull	20	3	50	3	50	1	50	2	50	1	40.00	240.00	540.00
Herring Gull	8760	3	25	2	50	1	50	2	50	2	37960.00	175200.00	354780.00
Iceland Gull	8760	3	25	3	50	3	50	2	50	1	7300.00	35040.00	144540.00
Lesser Black-backed Gull	6480	3	25	2	50	3	50	2	50	1	4680.00	21600.00	87480.00
Glaucous Gull	4320	3	25	2	50	1	50	2	50	1	9360.00	43200.00	87480.00
Great Black-backed Gull	8760	3	25	2	50	1	50	2	50	2	37960.00	175200.00	354780.00
Brown Noddy	2160	5	25	4	50	3	50	1	50	2	5520.00	12960.00	43200.00
Sooty Tern	5760	5	50	5	25	3	50	1	50	2	16000.00	38400.00	115200.00
Bridled Tern	5760	5	25	5	25	3	50	1	50	2	19200.00	38400.00	115200.00
Least Tern	20	1	50	5	50	1	50	1	50	1.5	70.00	180.00	292.50
Gull-billed Tern	20	5	10	5	10	1	50	1	50	1	120.00	200.00	300.00
Caspian Tern	20	5	10	5	10	1	50	1	50	1	120.00	200.00	300.00
Black Tern	5040	1	25	5	25	1	50	1	50	1	15960.00	30240.00	47250.00
Roseate Tern	5760	1	25	5	25	1	50	1	50	2	36480.00	69120.00	108000.00
Common Tern	5760	1	25	5	25	1	50	1	50	2	36480.00	69120.00	108000.00

Table 6. (continued)

Common Name	*AO*	*NFR*		*DFR*		*RSZ*		*MA*		*BR* Multiplier	Collision Sensitivity Score		
		Score	Uncertainty	Score	Uncertainty	Score	Uncertainty	Collision	Uncertainty		Lower	Best Estimate	Upper
Arctic Tern	4320	1	25	5	25	1	50	1	50	2	27360.00	51840.00	81000.00
Forster's Tern	20	5	25	5	25	1	50	1	50	1.5	150.00	300.00	450.00
Royal Tern	20	4	25	4	25	1	50	1	50	1.5	120.00	240.00	450.00
Sandwich Tern	20	1	25	4	25	5	50	1	50	1.5	24.00	30.00	112.50
Black Skimmer	20	3	50	3	50	1	50	1	50	1	40.00	120.00	270.00
Great Skua	5040	1	10	4	10	3	10	5	25	1	26345.45	42000.00	51333.33
South Polar Skua	5040	1	50	4	50	3	25	5	50	1	10080.00	42000.00	72800.00
Pomarine Jaeger	5760	1	25	3	50	1	50	5	25	1	36000.00	115200.00	165600.00
Parasitic Jaeger	6480	1	50	5	50	1	50	5	25	1	56700.00	194400.00	210600.00
Long-tailed Jaeger	5040	1	25	5	25	1	50	5	25	1	59850.00	151200.00	157500.00
Dovekie	4320	1	10	3	25	5	10	1	50	1	2808.00	3456.00	6984.00
Common Murre	8760	2	50	1	50	5	10	1	10	1	3504.00	5256.00	9636.00
Thick-billed Murre	8760	1	50	1	10	5	10	1	50	1	3504.00	3504.00	7592.00
Razorbill	8760	1	25	2	25	3	50	1	10	1.5	7300.00	13140.00	36135.00
Black Guillemot	8760	1	25	1	25	5	10	1	10	2	7008.00	7008.00	10706.67
Atlantic Puffin	8760	1	25	1	25	5	10	1	10	2	7008.00	7008.00	10706.67
American Kestrel	15	2	50	5	10	1	50	3	25	1	123.75	315.00	450.00
Merlin	15	3	25	5	10	1	50	3	25	1	151.88	360.00	492.19
Peregrine Falcon	15	1	50	5	10	1	50	3	25	1	123.75	270.00	365.63
Barn Swallow	20	3	50	5	50	1	50	2	25	1	80.00	320.00	475.00
Blue-gray Gnatcatcher	20	5	50	5	50	5	25	2	50	1	20.00	80.00	160.00
Bicknell's Thrush	20	5	50	5	50	5	25	2	50	1	20.00	80.00	160.00
Ovenbird	20	5	10	5	50	5	25	2	50	1	28.00	80.00	160.00
Northern Waterthrush	20	5	10	5	50	5	25	2	50	1	28.00	80.00	160.00
Common Yellowthroat	20	5	10	5	50	5	25	2	50	1	28.00	80.00	160.00
American Redstart	20	5	10	5	50	5	25	2	50	1	28.00	80.00	160.00
Kirtland's Warbler	20	5	50	5	50	5	25	2	50	1	20.00	80.00	160.00
Cape May Warbler	20	5	50	5	50	5	25	2	50	1	20.00	80.00	160.00
Northern Parula	20	5	10	5	50	5	25	2	50	1	28.00	80.00	160.00
Blackburnian Warbler	20	5	10	5	10	5	25	2	50	1	36.00	80.00	160.00
Blackpoll Warbler	20	5	50	5	50	5	25	2	50	1	20.00	80.00	160.00
Palm Warbler	20	5	10	5	50	5	25	2	50	1	28.00	80.00	160.00
Yellow-rumped Warbler	20	5	10	5	50	5	25	2	50	1	28.00	80.00	160.00
Canada Warbler	20	5	10	5	50	5	25	2	50	1	28.00	80.00	160.00
Chipping Sparrow	20	5	10	5	10	5	25	2	50	1	36.00	80.00	160.00

Table 6. (continued)

Common Name	*AO*	*NFR*		*DFR*		*RSZ*		*MA*		*BR* Multiplier	Collision Sensitivity Score		
		Score	Uncertainty	Score	Uncertainty	Score	Uncertainty	Collision	Uncertainty		Lower	Best Estimate	Upper
Savannah Sparrow	20	5	10	5	10	5	25	2	50	1	36.00	80.00	160.00
Song Sparrow	20	5	10	5	10	5	25	2	50	1	36.00	80.00	160.00
White-throated Sparrow	20	5	10	5	50	5	25	2	50	1	28.00	80.00	160.00
Indigo Bunting	20	5	10	5	10	5	25	2	50	1	36.00	80.00	160.00
Baltimore Oriole	20	5	10	5	10	5	25	2	50	1	36.00	80.00	160.00
American Goldfinch	20	5	50	5	10	5	25	2	50	1	28.00	80.00	160.00

3.2.2 Final Collision Sensitivity Scores in Taxonomic Order

Table 7 shows the final collision sensitivity scores for species in taxonomic order, calculated as follows:

$$Final\ Collision\ Score = \text{Collision Sensitivity Score} \times \text{Population Sensitivity}$$

Table 7.

Final collision sensitivity scores in taxonomic order (range: maximum 4380000; minimum 4).

Common Name	Collision Sensitivity Score			Population Sensitivity Score			Final Collision Sensitivity Score		
	Lower	Best Estimate	Upper	Lower	Best Estimate	Upper	Lower	Best Estimate	Upper
Snow Goose	2.67	4.00	6.50	1.45	2.00	2.33	3.87	8.00	15.11
Brant	1.33	2.00	7.50	1.75	2.25	2.75	2.33	4.50	20.63
Canada Goose	5.00	12.00	20.63	1.13	1.50	1.93	5.63	18.00	39.70
Tundra Swan	10.00	20.00	30.00	2.73	3.00	3.15	27.25	60.00	94.50
Wood Duck	6.67	20.00	30.00	1.00	1.00	1.11	6.67	20.00	33.38
Gadwall	4.67	12.00	18.42	1.13	1.25	1.43	5.25	15.00	26.25
American Wigeon	8.00	16.00	28.88	1.00	1.00	1.11	8.00	16.00	32.13
American Black Duck	4.67	12.00	18.67	1.31	1.50	1.74	6.13	18.00	32.43
Mallard	4.33	8.00	12.50	1.00	1.00	1.08	4.33	8.00	13.44
Blue-winged Teal	8.00	16.00	26.25	1.13	1.25	1.43	9.00	20.00	37.41
Northern Shoveler	12.00	20.00	25.00	1.00	1.00	1.11	12.00	20.00	27.81
Northern Pintail	7.33	12.00	15.25	1.00	1.25	1.55	7.33	15.00	23.64

Table 7. (continued)

Common Name	Collision Sensitivity Score			Population Sensitivity Score			Final Collision Sensitivity Score		
	Lower	Best Estimate	Upper	Lower	Best Estimate	Upper	Lower	Best Estimate	Upper
Green-winged Teal	7.00	14.00	18.75	1.00	1.00	1.08	7.00	14.00	20.16
Canvasback	3.33	10.00	22.50	1.51	2.00	2.49	5.04	20.00	55.97
Redhead	4.00	12.00	27.00	1.25	1.50	1.78	5.00	18.00	47.93
Ring-necked Duck	7.33	12.00	18.30	1.20	1.25	1.35	8.80	15.00	24.71
Greater Scaup	22680.00	45360.00	60750.00	1.33	1.75	2.20	30051.00	79380.00	133650.00
Lesser Scaup	23760.00	38880.00	49410.00	1.13	1.50	1.93	26730.00	58320.00	95114.25
King Eider	21600.00	43200.00	64800.00	2.13	3.00	3.56	45900.00	129600.00	230850.00
Common Eider	17520.00	29200.00	70664.00	1.63	2.00	2.44	28470.00	58400.00	172243.50
Harlequin Duck	6000.00	18000.00	27000.00	1.90	2.75	3.35	11400.00	49500.00	90450.00
Surf Scoter	10800.00	32400.00	60750.00	1.63	3.00	3.75	17550.00	97200.00	227812.50
White-winged Scoter	12960.00	32400.00	56700.00	1.50	2.75	3.38	19440.00	89100.00	191362.50
Black Scoter	4320.00	12960.00	48600.00	1.69	2.50	3.31	7290.00	32400.00	160987.50
Long-tailed Duck	16320.00	40320.00	55440.00	1.50	1.75	2.09	24480.00	70560.00	115731.00
Bufflehead	14208.00	46080.00	76032.00	1.20	1.75	2.30	17049.60	80640.00	174873.60
Common Goldeneye	5.00	20.00	37.50	1.13	1.50	1.94	5.63	30.00	72.66
Barrow's Goldeneye	7.33	28.00	48.00	1.50	2.00	2.63	11.00	56.00	126.00
Hooded Merganser	7.33	24.00	39.00	1.50	1.75	2.15	11.00	42.00	83.85
Common Merganser	5760.00	17280.00	32400.00	1.20	1.25	1.45	6912.00	21600.00	46980.00
Red-breasted Merganser	7680.00	23040.00	38016.00	1.55	2.25	2.95	11904.00	51840.00	112147.20
Ruddy Duck	7.33	24.00	37.50	1.31	2.00	2.69	9.63	48.00	100.78
Red-throated Loon	3200.00	5760.00	15840.00	1.94	2.50	3.06	6200.00	14400.00	48510.00
Common Loon	2880.00	6480.00	21384.00	2.31	2.75	3.06	6660.00	17820.00	65488.50
Pied-billed Grebe	6.40	16.00	44.00	1.69	2.25	2.53	10.80	36.00	111.10
Horned Grebe	2688.00	6720.00	16800.00	1.25	1.75	2.38	3360.00	11760.00	39900.00
Red-necked Grebe	2688.00	3360.00	8400.00	1.90	2.50	2.88	5107.20	8400.00	24150.00
Northern Fulmar	7884.00	10512.00	32850.00	1.81	2.25	2.40	14289.75	23652.00	78840.00
Bermuda Petrel	11880.00	47520.00	95040.00	3.88	4.25	4.38	46035.00	201960.00	415800.00
Black-capped Petrel	17520.00	35040.00	70080.00	3.65	4.50	4.60	63948.00	157680.00	322368.00
Cory's Shearwater	4536.00	6048.00	12600.00	2.28	3.50	3.85	10319.40	21168.00	48510.00
Great Shearwater	7560.00	12096.00	27720.00	2.03	2.75	2.88	15309.00	33264.00	79695.00
Sooty Shearwater	6872.73	10080.00	17500.00	1.63	2.50	2.78	11168.18	25200.00	48562.50
Manx Shearwater	15768.00	21024.00	36500.00	2.00	2.75	3.19	31536.00	57816.00	116343.75
Audubon's Shearwater	6048.00	12096.00	30240.00	2.06	3.25	3.50	12474.00	39312.00	105840.00
Wilson's Storm-Petrel	5292.00	7056.00	12250.00	1.50	2.50	3.03	7938.00	17640.00	37056.25
Leach's Storm-Petrel	9072.00	12096.00	21000.00	1.50	2.00	2.53	13608.00	24192.00	53025.00
Band-rumped Storm-Petrel	3672.00	6048.00	10500.00	3.00	3.75	4.38	11016.00	22680.00	45937.50

Table 7. (continued)

Common Name	Collision Sensitivity Score			Population Sensitivity Score			Final Collision Sensitivity Score		
	Lower	Best Estimate	Upper	Lower	Best Estimate	Upper	Lower	Best Estimate	Upper
White-tailed Tropicbird	3000.00	18000.00	81000.00	2.75	3.25	3.50	8250.00	58500.00	283500.00
Red-billed Tropicbird	7560.00	45360.00	155520.00	2.25	3.00	3.03	17010.00	136080.00	470448.00
Brown Booby	4320.00	21600.00	64800.00	2.19	2.75	3.03	9450.00	59400.00	196020.00
Northern Gannet	52560.00	87600.00	120450.00	2.19	2.75	3.19	114975.00	240900.00	383934.38
Double-crested Cormorant	11880.00	38880.00	118584.00	1.51	2.00	2.49	17968.50	77760.00	294977.70
Great Cormorant	19710.00	39420.00	108405.00	1.63	2.00	2.38	32028.75	78840.00	257461.88
Brown Pelican	11700.00	43200.00	108000.00	2.00	2.50	3.03	23400.00	108000.00	326700.00
American Bittern	33.33	200.00	200.00	1.13	1.50	1.90	37.50	300.00	380.00
Least Bittern	33.33	200.00	200.00	1.50	2.00	2.53	50.00	400.00	505.00
Great Blue Heron	90.00	200.00	200.00	1.00	1.25	1.55	90.00	250.00	310.00
Great Egret	55.00	200.00	200.00	1.31	1.50	1.94	72.19	300.00	387.50
Snowy Egret	46.67	200.00	200.00	1.13	1.25	1.46	52.50	250.00	292.50
Little Blue Heron	46.67	200.00	200.00	1.65	1.75	2.00	77.00	350.00	400.00
Tricolored Heron	33.33	200.00	200.00	1.50	1.75	2.09	50.00	350.00	417.50
Green Heron	60.00	200.00	200.00	1.58	2.25	2.43	94.50	450.00	485.00
Black-crowned Night-Heron	60.00	200.00	200.00	1.13	1.25	1.63	67.50	250.00	325.00
Yellow-crowned Night-Heron	60.00	200.00	200.00	1.69	2.25	2.53	101.25	450.00	505.00
White Ibis	60.00	200.00	200.00	1.63	2.25	2.88	97.50	450.00	575.00
Glossy Ibis	60.00	200.00	200.00	1.13	1.50	1.90	67.50	300.00	380.00
Roseate Spoonbill	33.33	200.00	200.00	1.88	2.75	3.38	62.50	550.00	675.00
Osprey	40.91	120.00	150.00	1.38	2.00	2.44	56.25	240.00	365.63
Northern Harrier	64.80	120.00	150.00	1.25	1.75	2.28	81.00	210.00	341.25
Black Rail	58.33	250.00	250.00	2.06	2.75	3.13	120.31	687.50	781.25
Clapper Rail	75.00	250.00	250.00	1.88	2.25	2.63	140.63	562.50	656.25
King Rail	75.00	250.00	250.00	1.38	2.25	2.63	103.13	562.50	656.25
Virginia Rail	75.00	250.00	250.00	1.38	2.25	2.63	103.13	562.50	656.25
Sora	75.00	250.00	250.00	1.38	2.50	3.00	103.13	625.00	750.00
Purple Gallinule	75.00	250.00	250.00	1.50	2.00	2.56	112.50	500.00	640.63
Common Gallinule	75.00	250.00	250.00	1.00	1.25	1.59	75.00	312.50	396.88
American Coot	75.00	250.00	250.00	1.13	1.50	1.90	84.38	375.00	475.00
Black-bellied Plover	75.00	450.00	675.00	1.55	2.00	2.45	116.25	900.00	1653.75
American Golden-Plover	135.00	450.00	675.00	2.34	3.00	3.35	315.56	1350.00	2261.25
Wilson's Plover	135.00	450.00	675.00	1.88	2.50	3.00	253.13	1125.00	2025.00
Semipalmated Plover	135.00	450.00	675.00	1.65	2.00	2.41	222.75	900.00	1628.44
Piping Plover	25.00	150.00	450.00	2.63	3.00	3.31	65.63	450.00	1490.63
Killdeer	135.00	450.00	675.00	1.13	1.50	2.00	151.88	675.00	1350.00

Table 7. (continued)

Common Name	Collision Sensitivity Score			Population Sensitivity Score			Final Collision Sensitivity Score		
	Lower	Best Estimate	Upper	Lower	Best Estimate	Upper	Lower	Best Estimate	Upper
American Oystercatcher	75.00	450.00	675.00	2.25	3.00	3.38	168.75	1350.00	2278.13
Black-necked Stilt	75.00	450.00	675.00	1.25	2.00	2.75	93.75	900.00	1856.25
American Avocet	75.00	450.00	675.00	1.65	2.00	2.38	123.75	900.00	1603.13
Spotted Sandpiper	135.00	450.00	675.00	1.63	2.50	3.38	219.38	1125.00	2278.13
Solitary Sandpiper	105.00	450.00	675.00	1.63	2.50	3.38	170.63	1125.00	2278.13
Greater Yellowlegs	105.00	450.00	675.00	1.75	2.75	3.50	183.75	1237.50	2362.50
Willet	105.00	450.00	675.00	1.90	2.75	3.35	199.50	1237.50	2261.25
Lesser Yellowlegs	135.00	450.00	675.00	1.90	2.75	3.35	256.50	1237.50	2261.25
Upland Sandpiper	105.00	450.00	675.00	1.90	2.50	2.91	199.50	1125.00	1965.94
Whimbrel	75.00	450.00	675.00	1.45	2.25	2.80	108.75	1012.50	1890.00
Hudsonian Godwit	135.00	450.00	675.00	2.58	3.00	3.30	347.63	1350.00	2227.50
Marbled Godwit	75.00	450.00	675.00	1.63	2.00	2.40	121.88	900.00	1620.00
Ruddy Turnstone	75.00	450.00	675.00	1.70	2.25	2.80	127.50	1012.50	1890.00
Red Knot	25.00	150.00	450.00	1.78	2.25	2.73	44.38	337.50	1226.25
Sanderling	135.00	450.00	675.00	1.68	2.25	2.83	226.13	1012.50	1906.88
Semipalmated Sandpiper	135.00	450.00	675.00	2.10	2.25	2.53	283.50	1012.50	1704.38
Western Sandpiper	75.00	450.00	675.00	1.25	2.00	2.53	93.75	900.00	1704.38
Least Sandpiper	75.00	450.00	675.00	1.55	1.75	2.08	116.25	787.50	1400.63
White-rumped Sandpiper	75.00	450.00	675.00	1.85	2.00	2.28	138.75	900.00	1535.63
Baird's Sandpiper	75.00	450.00	675.00	2.15	2.50	2.98	161.25	1125.00	2008.13
Pectoral Sandpiper	75.00	450.00	675.00	1.38	2.25	2.63	103.13	1012.50	1771.88
Purple Sandpiper	75.00	450.00	675.00	1.88	2.25	2.53	140.63	1012.50	1704.38
Dunlin	75.00	450.00	675.00	1.13	1.50	1.90	84.38	675.00	1282.50
Stilt Sandpiper	135.00	450.00	675.00	1.55	2.00	2.45	209.25	900.00	1653.75
Buff-breasted Sandpiper	105.00	450.00	675.00	2.13	2.25	2.44	223.13	1012.50	1645.31
Short-billed Dowitcher	135.00	450.00	675.00	1.96	2.50	3.04	264.94	1125.00	2050.31
Long-billed Dowitcher	135.00	450.00	675.00	1.65	2.00	2.41	222.75	900.00	1628.44
Wilson's Snipe	135.00	450.00	675.00	1.20	1.75	2.30	162.00	787.50	1552.50
American Woodcock	105.00	450.00	675.00	1.00	1.25	1.55	105.00	562.50	1046.25
Red-necked Phalarope	19200.00	115200.00	216000.00	1.31	1.50	1.78	25200.00	172800.00	383400.00
Red Phalarope	28800.00	172800.00	324000.00	1.45	2.00	2.36	41760.00	345600.00	765450.00
Black-legged Kittiwake	10800.00	43200.00	81000.00	1.31	1.50	1.84	14175.00	64800.00	148837.50
Sabine's Gull	1920.00	11520.00	51840.00	1.63	2.25	2.90	3120.00	25920.00	150336.00
Bonaparte's Gull	8.89	40.00	180.00	1.63	2.25	2.90	14.44	90.00	522.00
Black-headed Gull	50.00	180.00	337.50	1.13	1.50	1.93	56.25	270.00	649.69
Little Gull	16.67	66.67	250.00	1.25	1.75	2.28	20.83	116.67	568.75

Table 7. (continued)

Common Name	Collision Sensitivity Score			Population Sensitivity Score			Final Collision Sensitivity Score		
	Lower	Best Estimate	Upper	Lower	Best Estimate	Upper	Lower	Best Estimate	Upper
Laughing Gull	13140.00	52560.00	197100.00	1.55	2.25	2.95	20367.00	118260.00	581445.00
Ring-billed Gull	40.00	240.00	540.00	1.33	1.75	2.20	53.00	420.00	1188.00
Herring Gull	37960.00	175200.00	354780.00	1.63	2.50	2.75	61685.00	438000.00	975645.00
Iceland Gull	7300.00	35040.00	144540.00	2.03	2.75	2.88	14782.50	96360.00	415552.50
Lesser Black-backed Gull	4680.00	21600.00	87480.00	2.00	2.50	2.71	9360.00	54000.00	237289.50
Glaucous Gull	9360.00	43200.00	87480.00	1.50	2.50	2.90	14040.00	108000.00	253692.00
Great Black-backed Gull	37960.00	175200.00	354780.00	2.00	2.50	2.71	75920.00	438000.00	962340.75
Brown Noddy	5520.00	12960.00	43200.00	1.50	2.50	2.94	8280.00	32400.00	126900.00
Sooty Tern	16000.00	38400.00	115200.00	1.38	2.00	2.05	22000.00	76800.00	236160.00
Bridled Tern	19200.00	38400.00	115200.00	1.69	2.50	2.71	32400.00	96000.00	312480.00
Least Tern	70.00	180.00	292.50	3.25	4.25	4.88	227.50	765.00	1425.94
Gull-billed Tern	120.00	200.00	300.00	1.88	2.75	3.06	225.00	550.00	918.75
Caspian Tern	120.00	200.00	300.00	1.90	2.50	2.91	228.00	500.00	873.75
Black Tern	15960.00	30240.00	47250.00	1.38	2.50	3.38	21945.00	75600.00	159468.75
Roseate Tern	36480.00	69120.00	108000.00	3.38	4.00	4.50	123120.00	276480.00	486000.00
Common Tern	36480.00	69120.00	108000.00	1.63	2.25	2.88	59280.00	155520.00	310500.00
Arctic Tern	27360.00	51840.00	81000.00	1.83	2.25	2.68	49932.00	116640.00	216675.00
Forster's Tern	150.00	300.00	450.00	1.78	2.50	3.23	266.25	750.00	1451.25
Royal Tern	120.00	240.00	450.00	2.03	3.00	3.35	243.00	720.00	1507.50
Sandwich Tern	24.00	30.00	112.50	2.00	2.75	3.50	48.00	82.50	393.75
Black Skimmer	40.00	120.00	270.00	1.78	2.25	2.75	71.00	270.00	742.50
Great Skua	26345.45	42000.00	51333.33	2.53	2.75	2.88	66522.27	115500.00	147583.33
South Polar Skua	10080.00	42000.00	72800.00	2.56	3.00	3.03	25830.00	126000.00	220220.00
Pomarine Jaeger	36000.00	115200.00	165600.00	1.50	2.75	3.75	54000.00	316800.00	621000.00
Parasitic Jaeger	56700.00	194400.00	210600.00	1.50	2.00	2.63	85050.00	388800.00	552825.00
Long-tailed Jaeger	59850.00	151200.00	157500.00	1.63	2.25	3.00	97256.25	340200.00	472500.00
Dovekie	2808.00	3456.00	6984.00	1.13	1.75	2.40	3159.00	6048.00	16761.60
Common Murre	3504.00	5256.00	9636.00	1.25	1.75	2.28	4380.00	9198.00	21921.90
Thick-billed Murre	3504.00	3504.00	7592.00	1.69	2.25	2.53	5913.00	7884.00	19169.80
Razorbill	7300.00	13140.00	36135.00	2.00	2.50	2.88	14600.00	32850.00	103888.13
Black Guillemot	7008.00	7008.00	10706.67	1.81	2.50	3.19	12702.00	17520.00	34127.50
Atlantic Puffin	7008.00	7008.00	10706.67	1.88	2.25	2.53	13140.00	15768.00	27034.33
American Kestrel	123.75	315.00	450.00	1.00	1.00	1.18	123.75	315.00	528.75
Merlin	151.88	360.00	492.19	1.20	1.25	1.35	182.25	450.00	664.45
Peregrine Falcon	123.75	270.00	365.63	1.58	2.25	2.68	194.91	607.50	978.05
Barn Swallow	80.00	320.00	475.00	1.00	1.00	1.11	80.00	320.00	528.44

Table 7. (continued)

Common Name	Collision Sensitivity Score			Population Sensitivity Score			Final Collision Sensitivity Score		
	Lower	Best Estimate	Upper	Lower	Best Estimate	Upper	Lower	Best Estimate	Upper
Blue-gray Gnatcatcher	20.00	80.00	160.00	1.13	1.25	1.43	22.50	100.00	228.00
Bicknell's Thrush	20.00	80.00	160.00	3.25	3.50	3.53	65.00	280.00	564.00
Ovenbird	28.00	80.00	160.00	1.25	1.75	2.05	35.00	140.00	328.00
Northern Waterthrush	28.00	80.00	160.00	1.25	1.75	2.15	35.00	140.00	344.00
Common Yellowthroat	28.00	80.00	160.00	1.13	1.50	2.03	31.50	120.00	324.00
American Redstart	28.00	80.00	160.00	1.50	1.75	2.15	42.00	140.00	344.00
Kirtland's Warbler	20.00	80.00	160.00	3.75	4.00	4.03	75.00	320.00	644.00
Cape May Warbler	20.00	80.00	160.00	1.88	2.00	2.15	37.50	160.00	344.00
Northern Parula	28.00	80.00	160.00	1.25	1.75	2.05	35.00	140.00	328.00
Blackburnian Warbler	36.00	80.00	160.00	1.88	2.00	2.09	67.50	160.00	334.00
Blackpoll Warbler	20.00	80.00	160.00	1.88	2.00	2.09	37.50	160.00	334.00
Palm Warbler	28.00	80.00	160.00	1.31	1.50	1.78	36.75	120.00	284.00
Yellow-rumped Warbler	28.00	80.00	160.00	1.13	1.25	1.46	31.50	100.00	234.00
Canada Warbler	28.00	80.00	160.00	1.69	2.00	2.09	47.25	160.00	334.00
Chipping Sparrow	36.00	80.00	160.00	1.00	1.00	1.11	36.00	80.00	178.00
Savannah Sparrow	36.00	80.00	160.00	1.00	1.00	1.08	36.00	80.00	172.00
Song Sparrow	36.00	80.00	160.00	1.00	1.00	1.11	36.00	80.00	178.00
White-throated Sparrow	28.00	80.00	160.00	1.00	1.00	1.08	28.00	80.00	172.00
Indigo Bunting	36.00	80.00	160.00	1.13	1.50	1.93	40.50	120.00	308.00
Baltimore Oriole	36.00	80.00	160.00	1.13	1.50	1.96	40.50	120.00	314.00
American Goldfinch	28.00	80.00	160.00	1.00	1.00	1.11	28.00	80.00	178.00

3.2.3 Final Collision Sensitivity Rank (Ranked by Sensitivity)

Table 8 shows the lower and upper final collision sensitivity rank for species.

Table 8.

Final collision sensitivity rank (range: maximum 10; minimum 1). The qualitative ranking is based on the best estimate.

Common Name	Lower Final Collision Sensitivity Rank	Best Estimate Final Collision Sensitivity Rank	Upper Final Collision Sensitivity Rank	Collision Sensitivity Qualitative Ranking
Herring Gull	8.35	9.81	10	Higher
Great Black-backed Gull	8.49	9.81	9.98	Higher
Parasitic Jaeger	8.64	9.75	9.9	Higher
Red Phalarope	7.98	9.69	9.96	Higher
Long-tailed Jaeger	8.77	9.67	9.86	Higher
Pomarine Jaeger	8.2	9.62	9.94	Higher
Roseate Tern	9	9.52	9.88	Higher
Northern Gannet	8.88	9.47	9.73	Higher
Bermuda Petrel	8.03	9.33	9.79	Higher
Red-necked Phalarope	7.62	9.26	9.71	Higher
Black-capped Petrel	8.37	9.18	9.64	Higher
Common Tern	8.32	9.16	9.58	Higher
Red-billed Tropicbird	7.22	9.09	9.84	Higher
King Eider	8	9.05	9.41	Higher
South Polar Skua	7.66	9.01	9.37	Higher
Laughing Gull	7.39	8.98	9.92	Higher
Arctic Tern	8.15	8.96	9.35	Higher
Great Skua	8.43	8.9	9.11	Higher
Brown Pelican	7.52	8.83	9.66	Higher
Glaucous Gull	7.05	8.83	9.49	Higher
Surf Scoter	7.28	8.75	9.39	Higher
Iceland Gull	7.15	8.73	9.77	Higher
Bridled Tern	7.81	8.71	9.6	Higher

Table 8. (continued)

Common Name	Lower Final Collision Sensitivity Rank	Best Estimate Final Collision Sensitivity Rank	Upper Final Collision Sensitivity Rank	Collision Sensitivity Qualitative Ranking
White-winged Scoter	7.37	8.66	9.3	Higher
Bufflehead	7.24	8.62	9.28	Higher
Greater Scaup	7.75	8.58	9.07	Higher
Great Cormorant	7.79	8.54	9.5	Higher
Double-crested Cormorant	7.33	8.52	9.56	Higher
Sooty Tern	7.49	8.5	9.43	Higher
Black Tern	7.47	8.47	9.2	Higher
Long-tailed Duck	7.6	8.45	8.92	Higher
Black-legged Kittiwake	7.07	8.39	9.13	Higher
Brown Booby	6.84	8.33	9.32	Higher
White-tailed Tropicbird	6.75	8.3	9.54	Higher
Common Eider	7.73	8.28	9.24	Higher
Lesser Scaup	7.69	8.26	8.69	Higher
Manx Shearwater	7.77	8.24	8.94	Higher
Lesser Black-backed Gull	6.83	8.2	9.45	Higher
Red-breasted Merganser	6.96	8.16	8.86	Higher
Harlequin Duck	6.92	8.13	8.67	Higher
Audubon's Shearwater	6.98	7.94	8.81	Higher
Great Shearwater	7.16	7.88	8.6	Higher
Razorbill	7.13	7.86	8.79	Higher
Black Scoter	6.69	7.81	9.22	Higher
Brown Noddy	6.77	7.81	9.03	Higher
Sabine's Gull	6.5	7.67	9.15	Higher
Sooty Shearwater	6.9	7.62	8.11	Higher
Leach's Storm-Petrel	7.03	7.58	8.18	Higher
Northern Fulmar	7.09	7.54	8.54	Higher
Band-rumped Storm-Petrel	6.88	7.5	8.01	Higher
Common Merganser	6.67	7.43	8.05	Higher
Cory's Shearwater	6.86	7.41	8.07	Higher
Common Loon	6.66	7.32	8.41	Higher

Table 8. (continued)

Common Name	Lower Final Collision Sensitivity Rank	Best Estimate Final Collision Sensitivity Rank	Upper Final Collision Sensitivity Rank	Collision Sensitivity Qualitative Ranking
Wilson's Storm-Petrel	6.73	7.3	7.92	Higher
Black Guillemot	7	7.26	7.9	Higher
Atlantic Puffin	7.01	7.18	7.71	Higher
Red-throated Loon	6.64	7.11	8.09	Higher
Horned Grebe	6.54	6.94	7.96	Higher
Common Murre	6.56	6.81	7.45	Higher
Red-necked Grebe	6.58	6.79	7.56	Higher
Thick-billed Murre	6.6	6.71	7.35	Higher
Dovekie	6.52	6.62	7.2	Medium
American Golden-Plover	3.81	5.79	6.37	Medium
American Oystercatcher	2.92	5.79	6.43	Medium
Hudsonian Godwit	4.09	5.79	6.35	Medium
Greater Yellowlegs	3.07	5.71	6.49	Medium
Willet	3.11	5.71	6.37	Medium
Lesser Yellowlegs	3.49	5.71	6.37	Medium
Wilson's Plover	3.47	5.56	6.32	Medium
Spotted Sandpiper	3.18	5.56	6.43	Medium
Solitary Sandpiper	2.94	5.56	6.43	Medium
Upland Sandpiper	3.11	5.56	6.28	Medium
Baird's Sandpiper	2.88	5.56	6.3	Medium
Short-billed Dowitcher	3.5	5.56	6.33	Medium
Whimbrel	2.35	5.41	6.22	Medium
Ruddy Turnstone	2.64	5.41	6.22	Medium
Sanderling	3.28	5.41	6.26	Medium
Semipalmated Sandpiper	3.6	5.41	6.16	Medium
Pectoral Sandpiper	2.26	5.41	6.18	Medium
Purple Sandpiper	2.75	5.41	6.13	Medium
Buff-breasted Sandpiper	3.24	5.41	6.07	Medium
Black-bellied Plover	2.41	5.2	6.09	Medium
Semipalmated Plover	3.2	5.2	6.03	Medium

Table 8. (continued)

Common Name	Lower Final Collision Sensitivity Rank	Best Estimate Final Collision Sensitivity Rank	Upper Final Collision Sensitivity Rank	Collision Sensitivity Qualitative Ranking
Black-necked Stilt	2.09	5.2	6.2	Medium
American Avocet	2.58	5.2	6	Medium
Marbled Godwit	2.56	5.2	6.01	Medium
Western Sandpiper	2.09	5.2	6.13	Medium
White-rumped Sandpiper	2.66	5.2	5.96	Medium
Stilt Sandpiper	3.15	5.2	6.09	Medium
Long-billed Dowitcher	3.2	5.2	6.03	Medium
Least Sandpiper	2.41	5.15	5.86	Medium
Wilson's Snipe	2.9	5.15	5.98	Medium
Least Tern	3.3	5.11	5.88	Medium
Forster's Tern	3.52	5.07	5.9	Medium
Royal Tern	3.39	5.03	5.94	Medium
Black Rail	2.54	5.01	5.13	Medium
Killdeer	2.79	4.96	5.79	Medium
Dunlin	2.01	4.96	5.77	Medium
Sora	2.26	4.81	5.07	Medium
Peregrine Falcon	3.09	4.79	5.39	Medium
Clapper Rail	2.75	4.66	4.88	Medium
King Rail	2.26	4.66	4.88	Medium
Virginia Rail	2.26	4.66	4.88	Medium
American Woodcock	2.33	4.66	5.54	Medium
Roseate Spoonbill	1.62	4.62	4.96	Medium
Gull-billed Tern	3.26	4.62	5.37	Medium
Purple Gallinule	2.39	4.49	4.83	Medium
Caspian Tern	3.33	4.49	5.18	Medium
Green Heron	2.13	4.35	4.47	Medium
Yellow-crowned Night-Heron	2.24	4.35	4.52	Medium
White Ibis	2.16	4.35	4.77	Medium
Piping Plover	1.66	4.35	5.92	Medium
Merlin	3.05	4.35	4.94	Medium

Table 8. (continued)

Common Name	Lower Final Collision Sensitivity Rank	Best Estimate Final Collision Sensitivity Rank	Upper Final Collision Sensitivity Rank	Collision Sensitivity Qualitative Ranking
Ring-billed Gull	1.5	4.33	5.67	Medium
Least Bittern	1.45	4.28	4.52	Medium
American Coot	2.01	4.16	4.45	Medium
Little Blue Heron	1.83	4.11	4.28	Medium
Tricolored Heron	1.45	4.11	4.32	Medium
Red Knot	1.35	4	5.69	Medium
Barn Swallow	1.84	3.83	4.58	Medium
Kirtland's Warbler	1.79	3.83	4.84	Medium
American Kestrel	2.58	3.79	4.6	Medium
Common Gallinule	1.79	3.75	4.26	Medium
American Bittern	1.2	3.66	4.18	Medium
Great Egret	1.75	3.66	4.22	Medium
Glossy Ibis	1.67	3.66	4.18	Medium
Bicknell's Thrush	1.64	3.58	4.73	Medium
Black-headed Gull	1.56	3.54	4.86	Medium
Black Skimmer	1.73	3.54	5.05	Medium
Great Blue Heron	2.05	3.41	3.73	Medium
Snowy Egret	1.49	3.41	3.64	Medium
Black-crowned Night-Heron	1.67	3.41	3.88	Medium
Osprey	1.56	3.37	4.15	Medium
Northern Harrier	1.96	3.16	4.01	Lower
Cape May Warbler	1.2	2.81	4.03	Lower
Blackburnian Warbler	1.67	2.81	3.94	Lower
Blackpoll Warbler	1.2	2.81	3.94	Lower
Canada Warbler	1.37	2.81	3.94	Lower
Ovenbird	1.03	2.67	3.9	Lower
Northern Waterthrush	1.03	2.67	4.03	Lower
American Redstart	1.32	2.67	4.03	Lower
Northern Parula	1.03	2.67	3.9	Lower
Common Yellowthroat	0.94	2.47	3.86	Lower

Table 8. (continued)

Common Name	Lower Final Collision Sensitivity Rank	Best Estimate Final Collision Sensitivity Rank	Upper Final Collision Sensitivity Rank	Collision Sensitivity Qualitative Ranking
Palm Warbler	1.16	2.47	3.62	Lower
Indigo Bunting	1.28	2.47	3.71	Lower
Baltimore Oriole	1.28	2.47	3.77	Lower
Little Gull	0.75	2.45	4.75	Lower
Blue-gray Gnatcatcher	0.77	2.18	3.32	Lower
Yellow-rumped Warbler	0.94	2.18	3.35	Lower
Bonaparte's Gull	0.47	2.05	4.56	Lower
Sandwich Tern	1.41	1.98	4.24	Lower
Chipping Sparrow	1.09	1.84	3	Lower
Savannah Sparrow	1.09	1.84	2.96	Lower
Song Sparrow	1.09	1.84	3	Lower
White-throated Sparrow	0.88	1.84	2.96	Lower
American Goldfinch	0.88	1.84	3	Lower
Tundra Swan	0.84	1.6	2.15	Lower
Barrow's Goldeneye	0.37	1.54	2.62	Lower
Ruddy Duck	0.33	1.41	2.22	Lower
Hooded Merganser	0.37	1.32	2	Lower
Pied-billed Grebe	0.35	1.09	2.37	Lower
Common Goldeneye	0.13	0.92	1.77	Lower
Wood Duck	0.18	0.64	1.01	Lower
Blue-winged Teal	0.32	0.64	1.18	Lower
Northern Shoveler	0.41	0.64	0.86	Lower
Canvasback	0.09	0.64	1.52	Lower
Canada Goose	0.13	0.58	1.26	Lower
American Black Duck	0.16	0.58	1	Lower
Redhead	0.07	0.58	1.39	Lower
American Wigeon	0.24	0.56	0.98	Lower
Gadwall	0.11	0.49	0.83	Lower
Northern Pintail	0.22	0.49	0.79	Lower
Ring-necked Duck	0.3	0.49	0.81	Lower

Table 8. (continued)

Common Name	Lower Final Collision Sensitivity Rank	Best Estimate Final Collision Sensitivity Rank	Upper Final Collision Sensitivity Rank	Collision Sensitivity Qualitative Ranking
Green-winged Teal	0.2	0.45	0.71	Lower
Snow Goose	0.01	0.24	0.54	Lower
Mallard	0.03	0.24	0.43	Lower
Brant	0	0.05	0.73	Lower

3.3 Displacement Sensitivity

3.3.1 Displacement Sensitivity Scores in Taxonomic Order

Table 9 shows the displacement sensitivity scores for species in taxonomic order as calculated by

$$Displacement = AO \times \left[\frac{(DI \pm DI_u) + (MA \pm MA_u)}{2}\right] \times [(HF \pm HF_u) \times BR]$$

where,

DI = disturbance ranking defined by the degree of influence that boat and helicopter traffic is known to have on a bird
MA = macro avoidance of a wind facility (not micro avoidance of individual wind turbines)
HF = habitat flexibility (habitat generalist versus habitat specialist)
AO = annual occurrence in the AOCS
BR = a score indicating whether or not the species spends much time breeding and feeding in the AOCS
u = the uncertainty value for each metric

Table 9.

Displacement sensitivity scores in taxonomic order (range: maximum 438000; minimum 0).

Common Name	*DI*		*MA*		*HF*		*AOCS*	*BR* Multiplier	Displacement Sensitivity Score		
	Score	Uncertainty	Score Displacement	Uncertainty	Score	Uncertainty			Lower	Best Estimate	Upper
Snow Goose	0	10	5	25	0	10	2	1	0	0	0
Brant	0	10	5	25	0	10	2	1.5	0	0	0

Table 9. (continued)

Common Name	*DI*		*MA*		*HF*		*AOCS*	*BR* Multiplier	Displacement Sensitivity Score		
	Score	Uncertainty	Score Displacement	Uncertainty	Score	Uncertainty			Lower	Best Estimate	Upper
Canada Goose	0	10	5	25	0	10	2	1	0	0	0
Tundra Swan	0	10	5	50	0	10	2	1	0	0	0
Wood Duck	0	10	5	50	0	10	2	1	0	0	0
Gadwall	0	10	5	51	0	10	2	1	0	0	0
American Wigeon	0	10	5	52	0	10	2	1	0	0	0
American Black Duck	0	10	5	53	0	10	2	1	0	0	0
Mallard	0	10	5	25	0	10	2	1	0	0	0
Blue-winged Teal	0	10	5	50	0	10	2	1	0	0	0
Northern Shoveler	0	10	5	25	0	10	2	1	0	0	0
Northern Pintail	0	10	5	25	0	10	2	1	0	0	0
Green-winged Teal	0	10	5	25	0	10	2	1	0	0	0
Canvasback	4	25	5	50	0	10	2	1	0	0	0
Redhead	4	25	5	50	0	10	2	1	0	0	0
Ring-necked Duck	4	25	5	50	0	10	2	1	0	0	0
Greater Scaup	4	25	5	25	4	10	6480	1	78732	116640	142560
Lesser Scaup	4	25	5	25	4	50	6480	1	43740	116640	162000
King Eider	3	25	5	50	4	50	4320	1	20520	69120	94500
Common Eider	3	10	5	10	4	10	8760	2	227059.2	280320	319915.2
Harlequin Duck	3	25	5	50	4	10	1800	1	15390	28800	34650
Surf Scoter	5	10	5	25	4	50	6480	1	53460	129600	162000
White-winged Scoter	5	10	5	25	3	10	6480	1	72171	97200	106920
Black Scoter	5	25	5	25	4	10	6480	1	87480	129600	142560
Long-tailed Duck	3	10	5	10	4	10	5760	1	74649.6	92160	105177.6
Bufflehead	4	25	4	50	3	25	5760	1	32400	69120	108000
Common Goldeneye	4	10	4	50	4	10	2	1	20.16	32	41.36
Barrow's Goldeneye	4	25	4	50	4	25	2	1	15	32	50
Hooded Merganser	4	25	4	50	0	10	2	1	0	0	0
Common Merganser	4	10	4	50	1	25	4320	1	9072	17280	25380
Red-breasted Merganser	3	25	4	50	1	50	5760	1	6120	20160	37800
Ruddy Duck	4	25	4	50	2	25	2	1	7.5	16	25
Red-throated Loon	5	25	5	10	4	10	5760	1	85536	115200	126720
Common Loon	5	10	5	10	3	10	6480	1	78732	97200	106920
Pied-billed Grebe	0	25	4	50	0	25	12	1	0	0	0
Horned Grebe	3	10	5	25	4	10	5040	1	58514.4	80640	92030.4

Table 9. (continued)

Common Name	*DI*		*MA*		*HF*		*AOCS*	*BR* Multiplier	Displacement Sensitivity Score		
	Score	Uncertainty	Score Displacement	Uncertainty	Score	Uncertainty			Lower	Best Estimate	Upper
Red-necked Grebe	3	10	5	25	3	10	5040	1	43885.8	60480	69022.8
Northern Fulmar	1	10	5	25	1	10	8760	1	18330.3	26280	29389.8
Bermuda Petrel	1	25	3	50	1	50	3960	2	4455	15840	34155
Black-capped Petrel	1	25	5	50	1	25	8760	2	21352.5	52560	68437.5
Cory's Shearwater	1	10	5	50	1	25	5040	1	6426	15120	19215
Great Shearwater	1	10	5	50	1	50	5040	2	8568	30240	46116
Sooty Shearwater	1	10	5	25	1	10	5040	1	10546.2	15120	16909.2
Manx Shearwater	1	10	5	25	1	10	8760	2	36660.6	52560	58779.6
Audubon's Shearwater	1	25	5	50	1	50	5040	2	8190	30240	47250
Wilson's Storm-Petrel	1	25	5	25	1	50	5040	1	5670	15120	23625
Leach's Storm-Petrel	1	10	5	25	1	10	4320	2	18079.2	25920	28987.2
Band-rumped Storm-Petrel	1	25	5	25	1	25	4320	1	7290	12960	16875
White-tailed Tropicbird	1	25	3	50	1	50	3600	1	2025	7200	15525
Red-billed Tropicbird	1	25	3	50	1	50	6480	1	3645	12960	27945
Brown Booby	2	25	4	50	1	25	4320	1.5	8505	19440	30375
Northern Gannet	2	10	5	10	1	10	8760	2	49669.2	61320	69379.2
Double-crested Cormorant	3	25	3	50	1	25	4320	1.5	9112.5	19440	33412.5
Great Cormorant	4	10	3	10	3	10	8760	1.5	111755.7	137970	166943.7
Brown Pelican	3	25	5	50	1	25	4320	1.5	11542.5	25920	35437.5
American Bittern	0	10	5	50	0	10	4	1	0	0	0
Least Bittern	0	10	5	50	0	10	4	1	0	0	0
Great Blue Heron	0	10	5	25	0	10	4	1	0	0	0
Great Egret	0	10	5	50	0	10	4	1	0	0	0
Snowy Egret	0	10	5	50	0	10	4	1	0	0	0
Little Blue Heron	0	10	5	50	0	10	4	1	0	0	0
Tricolored Heron	0	10	15	50	0	10	4	1	0	0	0
Green Heron	0	10	5	50	0	10	4	1	0	0	0
Black-crowned Night-Heron	0	10	5	50	0	10	4	1	0	0	0
Yellow-crowned Night-Heron	0	10	5	50	0	10	4	1	0	0	0
White Ibis	0	10	5	50	0	10	4	1	0	0	0
Glossy Ibis	0	10	5	50	0	10	4	1	0	0	0
Roseate Spoonbill	0	10	5	50	0	10	4	1	0	0	0
Osprey	0	10	3	25	0	10	4	1	0	0	0
Northern Harrier	0	10	3	25	0	10	4	1	0	0	0

Table 9. (continued)

Common Name	*DI*		*MA*		*HF*		*AOCS*	*BR* Multiplier	Displacement Sensitivity Score		
	Score	Uncertainty	Score Displacement	Uncertainty	Score	Uncertainty			Lower	Best Estimate	Upper
Black Rail	0	10	5	50	0	10	5	1	0	0	0
Clapper Rail	0	10	5	50	0	10	5	1	0	0	0
King Rail	0	10	5	50	0	10	5	1	0	0	0
Virginia Rail	0	10	5	50	0	10	5	1	0	0	0
Sora	0	10	5	50	0	10	5	1	0	0	0
Purple Gallinule	0	10	5	50	0	10	5	1	0	0	0
Common Gallinule	0	10	5	50	0	10	5	1	0	0	0
American Coot	0	10	5	50	0	10	5	1	0	0	0
Black-bellied Plover	0	10	3	50	0	10	15	1	0	0	0
American Golden-Plover	0	10	3	50	0	10	15	1	0	0	0
Wilson's Plover	0	10	3	50	0	10	15	1	0	0	0
Semipalmated Plover	0	10	3	50	0	10	15	1	0	0	0
Piping Plover	0	10	3	50	0	10	15	1	0	0	0
Killdeer	0	10	3	50	0	10	15	1	0	0	0
American Oystercatcher	0	10	3	50	0	10	15	1	0	0	0
Black-necked Stilt	0	10	3	50	0	10	15	1	0	0	0
American Avocet	0	10	3	50	0	10	15	1	0	0	0
Spotted Sandpiper	0	10	3	50	0	10	15	1	0	0	0
Solitary Sandpiper	0	10	3	50	0	10	15	1	0	0	0
Greater Yellowlegs	0	10	3	50	0	10	15	1	0	0	0
Willet	0	10	3	50	0	10	15	1	0	0	0
Lesser Yellowlegs	0	10	3	50	0	10	15	1	0	0	0
Upland Sandpiper	0	10	3	50	0	10	15	1	0	0	0
Whimbrel	0	10	3	50	0	10	15	1	0	0	0
Hudsonian Godwit	0	10	3	50	0	10	15	1	0	0	0
Marbled Godwit	0	10	3	50	0	10	15	1	0	0	0
Ruddy Turnstone	0	10	3	50	0	10	15	1	0	0	0
Red Knot	0	10	3	50	0	10	15	1	0	0	0
Sanderling	0	10	3	50	0	10	15	1	0	0	0
Semipalmated Sandpiper	0	10	3	50	0	10	15	1	0	0	0
Western Sandpiper	0	10	3	50	0	10	15	1	0	0	0
Least Sandpiper	0	10	3	50	0	10	15	1	0	0	0
White-rumped Sandpiper	0	10	3	50	0	10	15	1	0	0	0
Baird's Sandpiper	0	10	3	50	0	10	15	1	0	0	0

Table 9. (continued)

Common Name	*DI*		*MA*		*HF*		*AOCS*	*BR* Multiplier	Displacement Sensitivity Score		
	Score	Uncertainty	Score Displacement	Uncertainty	Score	Uncertainty			Lower	Best Estimate	Upper
Pectoral Sandpiper	0	10	3	50	0	10	15	1	0	0	0
Purple Sandpiper	0	10	3	50	0	10	15	1	0	0	0
Dunlin	0	10	3	50	0	10	15	1	0	0	0
Stilt Sandpiper	0	10	3	50	0	10	15	1	0	0	0
Buff-breasted Sandpiper	0	10	3	50	0	10	15	1	0	0	0
Short-billed Dowitcher	0	10	3	50	0	10	15	1	0	0	0
Long-billed Dowitcher	0	10	3	50	0	10	15	1	0	0	0
Wilson's Snipe	0	10	3	50	0	10	15	1	0	0	0
American Woodcock	0	10	3	50	0	10	15	1	0	0	0
Red-necked Phalarope	2	25	4	50	2	25	5760	1	15120	34560	54000
Red Phalarope	2	25	4	50	2	25	7200	1	18900	43200	67500
Black-legged Kittiwake	3	10	4	50	2	10	3600	1	15228	25200	32868
Sabine's Gull	2	25	4	50	2	25	4320	1	11340	25920	40500
Bonaparte's Gull	2	25	4	50	2	50	20	1	35	120	225
Black-headed Gull	2	10	4	50	2	10	20	1.5	102.6	180	237.6
Little Gull	1	10	4	50	3	25	20	1	65.25	150	228.75
Laughing Gull	2	25	4	50	1	25	8760	1.5	17246.25	39420	61593.75
Ring-billed Gull	1	25	4	50	1	25	20	1	20.625	50	78.125
Herring Gull	2	10	4	50	1	10	8760	2	29959.2	52560	69379.2
Iceland Gull	2	25	4	50	2	25	8760	1	22995	52560	82125
Lesser Black-backed Gull	2	10	4	50	1	10	6480	1	11080.8	19440	25660.8
Glaucous Gull	2	25	4	50	1	25	4320	1	5670	12960	20250
Great Black-backed Gull	2	10	4	50	2	10	8760	2	59918.4	105120	138758.4
Brown Noddy	2	25	5	50	2	25	2160	2	12960	30240	40500
Sooty Tern	2	25	5	50	2	25	5760	2	34560	80640	108000
Bridled Tern	1	10	5	50	3	25	5760	2	44064	103680	131760
Least Tern	2	10	5	50	0	10	20	1.5	0	0	0
Gull-billed Tern	2	25	5	50	0	10	20	1	0	0	0
Caspian Tern	2	25	5	50	0	10	20	1	0	0	0
Black Tern	1	10	5	50	3	25	5040	1	19278	45360	57645
Roseate Tern	1	10	5	50	3	10	5760	2	52876.8	103680	115948.8
Common Tern	1	10	5	50	3	10	5760	2	52876.8	103680	115948.8
Arctic Tern	1	10	5	50	3	10	4320	2	39657.6	77760	86961.6
Forster's Tern	2	25	5	50	0	10	20	1.5	0	0	0

Table 9. (continued)

Common Name	*DI*		*MA*		*HF*		*AOCS*	*BR* Multiplier	Displacement Sensitivity Score		
	Score	Uncertainty	Score Displacement	Uncertainty	Score	Uncertainty			Lower	Best Estimate	Upper
Royal Tern	2	25	5	50	0	10	20	1.5	0	0	0
Sandwich Tern	2	10	5	50	0	10	20	1.5	0	0	0
Black Skimmer	1	10	5	50	0	10	20	1	0	0	0
Great Skua	1	10	1	25	2	10	5040	1	8618.4	10080	13028.4
South Polar Skua	1	25	1	50	2	50	5040	1	4410	10080	20790
Pomarine Jaeger	1	10	1	25	2	50	5760	1	5472	11520	20304
Parasitic Jaeger	1	10	1	25	2	10	6480	1	11080.8	12960	16750.8
Long-tailed Jaeger	1	25	1	25	2	50	5040	1	4410	10080	18900
Dovekie	2	10	5	50	2	10	4320	1	16718.4	30240	34214.4
Common Murre	3	10	5	10	3	10	8760	1	85147.2	105120	119968.2
Thick-billed Murre	3	25	5	50	3	50	8760	1	31207.5	105120	172462.5
Razorbill	3	10	5	10	3	10	8760	1.5	127720.8	157680	179952.3
Black Guillemot	3	10	5	10	4	10	8760	2	227059.2	280320	319915.2
Atlantic Puffin	2	10	5	10	3	10	8760	2	149007.6	183960	208137.6
American Kestrel	0	10	3	25	0	10	15	1	0	0	0
Merlin	0	10	3	25	0	10	15	1	0	0	0
Peregrine Falcon	0	10	3	25	0	10	15	1	0	0	0
Barn Swallow	0	10	4	25	0	10	20	1	0	0	0
Blue-gray Gnatcatcher	0	10	4	50	0	10	20	1	0	0	0
Bicknell's Thrush	0	10	4	50	0	10	20	1	0	0	0
Ovenbird	0	10	4	50	0	10	20	1	0	0	0
Northern Waterthrush	0	10	4	50	0	10	20	1	0	0	0
Common Yellowthroat	0	10	4	50	0	10	20	1	0	0	0
American Redstart	0	10	4	50	0	10	20	1	0	0	0
Kirtland's Warbler	0	10	4	50	0	10	20	1	0	0	0
Cape May Warbler	0	10	4	50	0	10	20	1	0	0	0
Northern Parula	0	10	4	50	0	10	20	1	0	0	0
Blackburnian Warbler	0	10	4	50	0	10	20	1	0	0	0
Blackpoll Warbler	0	10	4	50	0	10	20	1	0	0	0
Palm Warbler	0	10	4	50	0	10	20	1	0	0	0
Yellow-rumped Warbler	0	10	4	50	0	10	20	1	0	0	0
Canada Warbler	0	10	4	50	0	10	20	1	0	0	0
Chipping Sparrow	0	10	4	50	0	10	20	1	0	0	0
Savannah Sparrow	0	10	4	50	0	10	20	1	0	0	0

Table 9. (continued)

Common Name	*DI*		*MA*		*HF*		*AOCS*	*BR* Multiplier	Displacement Sensitivity Score		
	Score	Uncertainty	Score Displacement	Uncertainty	Score	Uncertainty			Lower	Best Estimate	Upper
Song Sparrow	0	10	4	50	0	10	20	1	0	0	0
White-throated Sparrow	0	10	4	50	0	10	20	1	0	0	0
Indigo Bunting	0	10	4	50	0	10	20	1	0	0	0
Baltimore Oriole	0	10	4	50	0	10	20	1	0	0	0
American Goldfinch	0	10	4	50	0	10	20	1	0	0	0

3.3.2 Final Displacement Sensitivity Scores in Taxonomic Order

Table 10 shows the final displacement sensitivity scores for species in taxonomic order, calculated as follows:

$$Final\ Displacement\ Score = \text{Displacement Sensitivity Score} \times \text{Population Sensitivity}$$

Table 10.

Final displacement sensitivity scores in taxonomic order.

Common Name	Displacement Sensitivity Score			Population Sensitivity Score			Final Displacement Sensitivity Score		
	Lower	Best Estimate	Upper	Lower	Best Estimate	Upper	Lower	Best Estimate	Upper
Snow Goose	0	0	0	1.45	2.00	2.33	0	0	0
Brant	0	0	0	1.75	2.25	2.75	0	0	0
Canada Goose	0	0	0	1.13	1.50	1.93	0	0	0
Tundra Swan	0	0	0	2.73	3.00	3.15	0	0	0
Wood Duck	0	0	0	1.00	1.00	1.11	0	0	0
Gadwall	0	0	0	1.13	1.25	1.43	0	0	0
American Wigeon	0	0	0	1.00	1.00	1.11	0	0	0
American Black Duck	0	0	0	1.31	1.50	1.74	0	0	0
Mallard	0	0	0	1.00	1.00	1.08	0	0	0
Blue-winged Teal	0	0	0	1.13	1.25	1.43	0	0	0
Northern Shoveler	0	0	0	1.00	1.00	1.11	0	0	0
Northern Pintail	0	0	0	1.00	1.25	1.55	0	0	0
Green-winged Teal	0	0	0	1.00	1.00	1.08	0	0	0
Canvasback	0	0	0	1.51	2.00	2.49	0	0	0
Redhead	0	0	0	1.25	1.50	1.78	0	0	0

Table 10. (continued)

Common Name	Displacement Sensitivity Score			Population Sensitivity Score			Final Displacement Sensitivity Score		
	Lower	Best Estimate	Upper	Lower	Best Estimate	Upper	Lower	Best Estimate	Upper
Ring-necked Duck	0	0	0	1.20	1.25	1.35	0	0	0
Greater Scaup	78732	116640	142560	1.33	1.75	2.20	104319.9	204120	313632
Lesser Scaup	43740	116640	162000	1.13	1.50	1.93	49207.5	174960	311850
King Eider	20520	69120	94500	2.13	3.00	3.56	43605	207360	336656.25
Common Eider	227059.2	280320	319915.2	1.63	2.00	2.44	368971.2	560640	779793.3
Harlequin Duck	15390	28800	34650	1.90	2.75	3.35	29241	79200	116077.5
Surf Scoter	53460	129600	162000	1.63	3.00	3.75	86872.5	388800	607500
White-winged Scoter	72171	97200	106920	1.50	2.75	3.38	108256.5	267300	360855
Black Scoter	87480	129600	142560	1.69	2.50	3.31	147622.5	324000	472230
Long-tailed Duck	74649.6	92160	105177.6	1.50	1.75	2.09	111974.4	161280	219558.24
Bufflehead	32400	69120	108000	1.20	1.75	2.30	38880	120960	248400
Common Goldeneye	20.16	32	41.36	1.13	1.50	1.94	22.68	48	80.135
Barrow's Goldeneye	15	32	50	1.50	2.00	2.63	22.5	64	131.25
Hooded Merganser	0	0	0	1.50	1.75	2.15	0	0	0
Common Merganser	9072	17280	25380	1.20	1.25	1.45	10886.4	21600	36801
Red-breasted Merganser	6120	20160	37800	1.55	2.25	2.95	9486	45360	111510
Ruddy Duck	7.5	16	25	1.31	2.00	2.69	9.84375	32	67.1875
Red-throated Loon	85536	115200	126720	1.94	2.50	3.06	165726	288000	388080
Common Loon	78732	97200	106920	2.31	2.75	3.06	182067.75	267300	327442.5
Pied-billed Grebe	0	0	0	1.69	2.25	2.53	0	0	0
Horned Grebe	58514.4	80640	92030.4	1.25	1.75	2.38	73143	141120	218572.2
Red-necked Grebe	43885.8	60480	69022.8	1.90	2.50	2.88	83383.02	151200	198440.55
Northern Fulmar	18330.3	26280	29389.8	1.81	2.25	2.40	33223.6688	59130	70535.52
Bermuda Petrel	4455	15840	34155	3.88	4.25	4.38	17263.125	67320	149428.125
Black-capped Petrel	21352.5	52560	68437.5	3.65	4.50	4.60	77936.625	236520	314812.5
Cory's Shearwater	6426	15120	19215	2.28	3.50	3.85	14619.15	52920	73977.75
Great Shearwater	8568	30240	46116	2.03	2.75	2.88	17350.2	83160	132583.5
Sooty Shearwater	10546.2	15120	16909.2	1.63	2.50	2.78	17137.575	37800	46923.03
Manx Shearwater	36660.6	52560	58779.6	2.00	2.75	3.19	73321.2	144540	187359.975
Audubon's Shearwater	8190	30240	47250	2.06	3.25	3.50	16891.875	98280	165375
Wilson's Storm-Petrel	5670	15120	23625	1.50	2.50	3.03	8505	37800	71465.625
Leach's Storm-Petrel	18079.2	25920	28987.2	1.50	2.00	2.53	27118.8	51840	73192.68
Band-rumped Storm-Petrel	7290	12960	16875	3.00	3.75	4.38	21870	48600	73828.125
White-tailed Tropicbird	2025	7200	15525	2.75	3.25	3.50	5568.75	23400	54337.5
Red-billed Tropicbird	3645	12960	27945	2.25	3.00	3.03	8201.25	38880	84533.625
Brown Booby	8505	19440	30375	2.19	2.75	3.03	18604.6875	53460	91884.375

Table 10. (continued)

Common Name	Displacement Sensitivity Score			Population Sensitivity Score			Final Displacement Sensitivity Score		
	Lower	Best Estimate	Upper	Lower	Best Estimate	Upper	Lower	Best Estimate	Upper
Northern Gannet	49669.2	61320	69379.2	2.19	2.75	3.19	108651.375	168630	221146.2
Double-crested Cormorant	9112.5	19440	33412.5	1.51	2.00	2.49	13782.6563	38880	83113.5938
Great Cormorant	111755.7	137970	166943.7	1.63	2.00	2.38	181603.013	275940	396491.288
Brown Pelican	11542.5	25920	35437.5	2.00	2.50	3.03	23085	64800	107198.438
American Bittern	0	0	0	1.13	1.50	1.90	0	0	0
Least Bittern	0	0	0	1.50	2.00	2.53	0	0	0
Great Blue Heron	0	0	0	1.00	1.25	1.55	0	0	0
Great Egret	0	0	0	1.31	1.50	1.94	0	0	0
Snowy Egret	0	0	0	1.13	1.25	1.46	0	0	0
Little Blue Heron	0	0	0	1.65	1.75	2.00	0	0	0
Tricolored Heron	0	0	0	1.50	1.75	2.09	0	0	0
Green Heron	0	0	0	1.58	2.25	2.43	0	0	0
Black-crowned Night-Heron	0	0	0	1.13	1.25	1.63	0	0	0
Yellow-crowned Night-Heron	0	0	0	1.69	2.25	2.53	0	0	0
White Ibis	0	0	0	1.63	2.25	2.88	0	0	0
Glossy Ibis	0	0	0	1.13	1.50	1.90	0	0	0
Roseate Spoonbill	0	0	0	1.88	2.75	3.38	0	0	0
Osprey	0	0	0	1.38	2.00	2.44	0	0	0
Northern Harrier	0	0	0	1.25	1.75	2.28	0	0	0
Black Rail	0	0	0	2.06	2.75	3.13	0	0	0
Clapper Rail	0	0	0	1.88	2.25	2.63	0	0	0
King Rail	0	0	0	1.38	2.25	2.63	0	0	0
Virginia Rail	0	0	0	1.38	2.25	2.63	0	0	0
Sora	0	0	0	1.38	2.50	3.00	0	0	0
Purple Gallinule	0	0	0	1.50	2.00	2.56	0	0	0
Common Gallinule	0	0	0	1.00	1.25	1.59	0	0	0
American Coot	0	0	0	1.13	1.50	1.90	0	0	0
Black-bellied Plover	0	0	0	1.55	2.00	2.45	0	0	0
American Golden-Plover	0	0	0	2.34	3.00	3.35	0	0	0
Wilson's Plover	0	0	0	1.88	2.50	3.00	0	0	0
Semipalmated Plover	0	0	0	1.65	2.00	2.41	0	0	0
Piping Plover	0	0	0	2.63	3.00	3.31	0	0	0
Killdeer	0	0	0	1.13	1.50	2.00	0	0	0
American Oystercatcher	0	0	0	2.25	3.00	3.38	0	0	0
Black-necked Stilt	0	0	0	1.25	2.00	2.75	0	0	0
American Avocet	0	0	0	1.65	2.00	2.38	0	0	0

Table 10. (continued)

Common Name	Displacement Sensitivity Score			Population Sensitivity Score			Final Displacement Sensitivity Score		
	Lower	Best Estimate	Upper	Lower	Best Estimate	Upper	Lower	Best Estimate	Upper
Spotted Sandpiper	0	0	0	1.63	2.50	3.38	0	0	0
Solitary Sandpiper	0	0	0	1.63	2.50	3.38	0	0	0
Greater Yellowlegs	0	0	0	1.75	2.75	3.50	0	0	0
Willet	0	0	0	1.90	2.75	3.35	0	0	0
Lesser Yellowlegs	0	0	0	1.90	2.75	3.35	0	0	0
Upland Sandpiper	0	0	0	1.90	2.50	2.91	0	0	0
Whimbrel	0	0	0	1.45	2.25	2.80	0	0	0
Hudsonian Godwit	0	0	0	2.58	3.00	3.30	0	0	0
Marbled Godwit	0	0	0	1.63	2.00	2.40	0	0	0
Ruddy Turnstone	0	0	0	1.70	2.25	2.80	0	0	0
Red Knot	0	0	0	1.78	2.25	2.73	0	0	0
Sanderling	0	0	0	1.68	2.25	2.83	0	0	0
Semipalmated Sandpiper	0	0	0	2.10	2.25	2.53	0	0	0
Western Sandpiper	0	0	0	1.25	2.00	2.53	0	0	0
Least Sandpiper	0	0	0	1.55	1.75	2.08	0	0	0
White-rumped Sandpiper	0	0	0	1.85	2.00	2.28	0	0	0
Baird's Sandpiper	0	0	0	2.15	2.50	2.98	0	0	0
Pectoral Sandpiper	0	0	0	1.38	2.25	2.63	0	0	0
Purple Sandpiper	0	0	0	1.88	2.25	2.53	0	0	0
Dunlin	0	0	0	1.13	1.50	1.90	0	0	0
Stilt Sandpiper	0	0	0	1.55	2.00	2.45	0	0	0
Buff-breasted Sandpiper	0	0	0	2.13	2.25	2.44	0	0	0
Short-billed Dowitcher	0	0	0	1.96	2.50	3.04	0	0	0
Long-billed Dowitcher	0	0	0	1.65	2.00	2.41	0	0	0
Wilson's Snipe	0	0	0	1.20	1.75	2.30	0	0	0
American Woodcock	0	0	0	1.00	1.25	1.55	0	0	0
Red-necked Phalarope	15120	34560	54000	1.31	1.50	1.78	19845	51840	95850
Red Phalarope	18900	43200	67500	1.45	2.00	2.36	27405	86400	159468.75
Black-legged Kittiwake	15228	25200	32868	1.31	1.50	1.84	19986.75	37800	60394.95
Sabine's Gull	11340	25920	40500	1.63	2.25	2.90	18427.5	58320	117450
Bonaparte's Gull	35	120	225	1.63	2.25	2.90	56.875	270	652.5
Black-headed Gull	102.6	180	237.6	1.13	1.50	1.93	115.425	270	457.38
Little Gull	65.25	150	228.75	1.25	1.75	2.28	81.5625	262.5	520.40625
Laughing Gull	17246.25	39420	61593.75	1.55	2.25	2.95	26731.6875	88695	181701.563
Ring-billed Gull	20.625	50	78.125	1.33	1.75	2.20	27.328125	87.5	171.875
Herring Gull	29959.2	52560	69379.2	1.63	2.50	2.75	48683.7	131400	190792.8

Table 10. (continued)

Common Name	Displacement Sensitivity Score			Population Sensitivity Score			Final Displacement Sensitivity Score		
	Lower	Best Estimate	Upper	Lower	Best Estimate	Upper	Lower	Best Estimate	Upper
Iceland Gull	22995	52560	82125	2.03	2.75	2.88	46564.875	144540	236109.375
Lesser Black-backed Gull	11080.8	19440	25660.8	2.00	2.50	2.71	22161.6	48600	69604.92
Glaucous Gull	5670	12960	20250	1.50	2.50	2.90	8505	32400	58725
Great Black-backed Gull	59918.4	105120	138758.4	2.00	2.50	2.71	119836.8	262800	376382.16
Brown Noddy	12960	30240	40500	1.50	2.50	2.94	19440	75600	118968.75
Sooty Tern	34560	80640	108000	1.38	2.00	2.05	47520	161280	221400
Bridled Tern	44064	103680	131760	1.69	2.50	2.71	74358	259200	357399
Least Tern	0	0	0	3.25	4.25	4.88	0	0	0
Gull-billed Tern	0	0	0	1.88	2.75	3.06	0	0	0
Caspian Tern	0	0	0	1.90	2.50	2.91	0	0	0
Black Tern	19278	45360	57645	1.38	2.50	3.38	26507.25	113400	194551.875
Roseate Tern	52876.8	103680	115948.8	3.38	4.00	4.50	178459.2	414720	521769.6
Common Tern	52876.8	103680	115948.8	1.63	2.25	2.88	85924.8	233280	333352.8
Arctic Tern	39657.6	77760	86961.6	1.83	2.25	2.68	72375.12	174960	232622.28
Forster's Tern	0	0	0	1.78	2.50	3.23	0	0	0
Royal Tern	0	0	0	2.03	3.00	3.35	0	0	0
Sandwich Tern	0	0	0	2.00	2.75	3.50	0	0	0
Black Skimmer	0	0	0	1.78	2.25	2.75	0	0	0
Great Skua	8618.4	10080	13028.4	2.53	2.75	2.88	21761.46	27720	37456.65
South Polar Skua	4410	10080	20790	2.56	3.00	3.03	11300.625	30240	62889.75
Pomarine Jaeger	5472	11520	20304	1.50	2.75	3.75	8208	31680	76140
Parasitic Jaeger	11080.8	12960	16750.8	1.50	2.00	2.63	16621.2	25920	43970.85
Long-tailed Jaeger	4410	10080	18900	1.63	2.25	3.00	7166.25	22680	56700
Dovekie	16718.4	30240	34214.4	1.13	1.75	2.40	18808.2	52920	82114.56
Common Murre	85147.2	105120	119968.2	1.25	1.75	2.28	106434	183960	272927.655
Thick-billed Murre	31207.5	105120	172462.5	1.69	2.25	2.53	52662.6563	236520	435467.813
Razorbill	127720.8	157680	179952.3	2.00	2.50	2.88	255441.6	394200	517362.863
Black Guillemot	227059.2	280320	319915.2	1.81	2.50	3.19	411544.8	700800	1019729.7
Atlantic Puffin	149007.6	183960	208137.6	1.88	2.25	2.53	279389.25	413910	525547.44
American Kestrel	0	0	0	1.00	1.00	1.18	0	0	0
Merlin	0	0	0	1.20	1.25	1.35	0	0	0
Peregrine Falcon	0	0	0	1.58	2.25	2.68	0	0	0
Barn Swallow	0	0	0	1.00	1.00	1.11	0	0	0
Blue-gray Gnatcatcher	0	0	0	1.13	1.25	1.43	0	0	0
Bicknell's Thrush	0	0	0	3.25	3.50	3.53	0	0	0
Ovenbird	0	0	0	1.25	1.75	2.05	0	0	0

Table 10. (continued)

Common Name	Displacement Sensitivity Score			Population Sensitivity Score			Final Displacement Sensitivity Score		
	Lower	Best Estimate	Upper	Lower	Best Estimate	Upper	Lower	Best Estimate	Upper
Northern Waterthrush	0	0	0	1.25	1.75	2.15	0	0	0
Common Yellowthroat	0	0	0	1.13	1.50	2.03	0	0	0
American Redstart	0	0	0	1.50	1.75	2.15	0	0	0
Kirtland's Warbler	0	0	0	3.75	4.00	4.03	0	0	0
Cape May Warbler	0	0	0	1.88	2.00	2.15	0	0	0
Northern Parula	0	0	0	1.25	1.75	2.05	0	0	0
Blackburnian Warbler	0	0	0	1.88	2.00	2.09	0	0	0
Blackpoll Warbler	0	0	0	1.88	2.00	2.09	0	0	0
Palm Warbler	0	0	0	1.31	1.50	1.78	0	0	0
Yellow-rumped Warbler	0	0	0	1.13	1.25	1.46	0	0	0
Canada Warbler	0	0	0	1.69	2.00	2.09	0	0	0
Chipping Sparrow	0	0	0	1.00	1.00	1.11	0	0	0
Savannah Sparrow	0	0	0	1.00	1.00	1.08	0	0	0
Song Sparrow	0	0	0	1.00	1.00	1.11	0	0	0
White-throated Sparrow	0	0	0	1.00	1.00	1.08	0	0	0
Indigo Bunting	0	0	0	1.13	1.50	1.93	0	0	0
Baltimore Oriole	0	0	0	1.13	1.50	1.96	0	0	0
American Goldfinch	0	0	0	1.00	1.00	1.11	0	0	0

3.3.3 Final Displacement Sensitivity Rank (Ranked by Sensitivity)

Table 11 shows the lower and upper final displacement sensitivity rank for species.

Table 11.

Final displacement sensitivity rank (range: maximum 10; minimum 1). The qualitative ranking is based on the best estimate.

Common Name	Lower Final Displacement Sensitivity Rank	Best Estimate Final Displacement Sensitivity Rank	Upper Final Displacement Sensitivity Rank	Displacement Sensitivity Qualitative Value
Black Guillemot	9.42	9.9	10	Higher
Common Eider	9.13	9.8	9.95	Higher

Table 11. (continued)

Common Name	Lower Final Displacement Sensitivity Rank	Best Estimate Final Displacement Sensitivity Rank	Upper Final Displacement Sensitivity Rank	Displacement Sensitivity Qualitative Value
Roseate Tern	7.27	9.52	9.71	Higher
Atlantic Puffin	8.61	9.47	9.76	Higher
Razorbill	8.27	9.33	9.66	Higher
Surf Scoter	5.69	9.28	9.85	Higher
Black Scoter	6.79	8.85	9.61	Higher
Red-throated Loon	7.08	8.66	9.23	Higher
Great Cormorant	7.32	8.56	9.37	Higher
White-winged Scoter	6.02	8.42	9.09	Higher
Common Loon	7.41	8.42	8.89	Higher
Great Black-backed Gull	6.41	8.37	9.18	Higher
Bridled Tern	5.11	8.32	9.04	Higher
Black-capped Petrel	5.26	8.13	8.8	Higher
Thick-billed Murre	4.01	8.13	9.56	Higher
Common Tern	5.64	8.03	8.94	Higher
King Eider	3.49	7.75	8.99	Higher
Greater Scaup	5.88	7.7	8.75	Higher
Common Murre	5.93	7.46	8.51	Higher
Lesser Scaup	3.92	7.17	8.7	Higher
Arctic Tern	4.78	7.17	7.99	Higher
Northern Gannet	6.07	7.12	7.89	Higher
Long-tailed Duck	6.17	6.93	7.84	Higher
Sooty Tern	3.73	6.93	7.94	Higher
Red-necked Grebe	5.55	6.88	7.65	Higher
Manx Shearwater	4.92	6.69	7.51	Higher
Iceland Gull	3.63	6.69	8.08	Higher
Horned Grebe	4.83	6.65	7.79	Medium
Herring Gull	3.87	6.55	7.55	Medium
Bufflehead	3.34	6.45	8.22	Medium
Black Tern	2.58	6.22	7.6	Medium
Audubon's Shearwater	1.77	5.83	7.03	Medium

Table 11. (continued)

Common Name	Lower Final Displacement Sensitivity Rank	Best Estimate Final Displacement Sensitivity Rank	Upper Final Displacement Sensitivity Rank	Displacement Sensitivity Qualitative Value
Laughing Gull	2.63	5.74	7.36	Medium
Great Shearwater	1.91	5.5	6.6	Medium
Harlequin Duck	2.77	5.31	6.26	Medium
Brown Noddy	2.15	5.16	6.36	Medium
Bermuda Petrel	1.86	4.59	6.84	Medium
Brown Pelican	2.48	4.54	5.98	Medium
Northern Fulmar	2.96	4.4	4.68	Medium
Sabine's Gull	2	4.3	6.31	Medium
Red Phalarope	1.96	4.25	6.5	Medium
Brown Booby	2.05	4.16	5.78	Medium
Cory's Shearwater	1.67	4.06	5.07	Medium
Dovekie	2.1	4.06	5.4	Medium
Leach's Storm-Petrel	2.67	3.97	4.88	Medium
Band-rumped Storm-Petrel	2.34	3.77	5.02	Medium
Lesser Black-backed Gull	2.39	3.77	4.64	Medium
Red-breasted Merganser	1.43	3.58	6.12	Medium
Red-billed Tropicbird	1.19	3.34	5.59	Medium
Double-crested Cormorant	1.62	3.34	5.45	Medium
Sooty Shearwater	1.81	3.2	3.68	Lower
Wilson's Storm-Petrel	1.33	3.2	4.73	Lower
Black-legged Kittiwake	2.2	3.2	4.44	Lower
White-tailed Tropicbird	1.29	3.06	5.35	Lower
Red-necked Phalarope	1.57	3.01	4.97	Lower
Glaucous Gull	1.33	2.91	4.35	Lower
Pomarine Jaeger	1.24	2.87	5.21	Lower
South Polar Skua	1.53	2.82	4.49	Lower
Great Skua	2.29	2.72	3.15	Lower
Parasitic Jaeger	1.72	2.53	3.54	Lower
Long-tailed Jaeger	1.14	2.44	4.21	Lower
Common Merganser	1.48	2.24	3.11	Lower

Table 11. (continued)

Common Name	Lower Final Displacement Sensitivity Rank	Best Estimate Final Displacement Sensitivity Rank	Upper Final Displacement Sensitivity Rank	Displacement Sensitivity Qualitative Value
Black-headed Gull	0.76	0.95	1.1	Lower
Bonaparte's Gull	0.28	0.86	1.05	Lower
Little Gull	0.52	0.81	1	Lower
Ring-billed Gull	0.19	0.57	0.71	Lower
Barrow's Goldeneye	0.04	0.33	0.62	Lower
Common Goldeneye	0.09	0.23	0.47	Lower
Ruddy Duck	0	0.14	0.43	Lower
Snow Goose	0	0	0	Lower
Brant	0	0	0	Lower
Canada Goose	0	0	0	Lower
Tundra Swan	0	0	0	Lower
Wood Duck	0	0	0	Lower
Gadwall	0	0	0	Lower
American Wigeon	0	0	0	Lower
American Black Duck	0	0	0	Lower
Mallard	0	0	0	Lower
Blue-winged Teal	0	0	0	Lower
Northern Shoveler	0	0	0	Lower
Northern Pintail	0	0	0	Lower
Green-winged Teal	0	0	0	Lower
Canvasback	0	0	0	Lower
Redhead	0	0	0	Lower
Ring-necked Duck	0	0	0	Lower
Hooded Merganser	0	0	0	Lower
Pied-billed Grebe	0	0	0	Lower
American Bittern	0	0	0	Lower
Least Bittern	0	0	0	Lower
Great Blue Heron	0	0	0	Lower
Great Egret	0	0	0	Lower
Snowy Egret	0	0	0	Lower

Table 11. (continued)

Common Name	Lower Final Displacement Sensitivity Rank	Best Estimate Final Displacement Sensitivity Rank	Upper Final Displacement Sensitivity Rank	Displacement Sensitivity Qualitative Value
Little Blue Heron	0	0	0	Lower
Tricolored Heron	0	0	0	Lower
Green Heron	0	0	0	Lower
Black-crowned Night-Heron	0	0	0	Lower
Yellow-crowned Night-Heron	0	0	0	Lower
White Ibis	0	0	0	Lower
Glossy Ibis	0	0	0	Lower
Roseate Spoonbill	0	0	0	Lower
Osprey	0	0	0	Lower
Northern Harrier	0	0	0	Lower
Black Rail	0	0	0	Lower
Clapper Rail	0	0	0	Lower
King Rail	0	0	0	Lower
Virginia Rail	0	0	0	Lower
Sora	0	0	0	Lower
Purple Gallinule	0	0	0	Lower
Common Gallinule	0	0	0	Lower
American Coot	0	0	0	Lower
Black-bellied Plover	0	0	0	Lower
American Golden-Plover	0	0	0	Lower
Wilson's Plover	0	0	0	Lower
Semipalmated Plover	0	0	0	Lower
Piping Plover	0	0	0	Lower
Killdeer	0	0	0	Lower
American Oystercatcher	0	0	0	Lower
Black-necked Stilt	0	0	0	Lower
American Avocet	0	0	0	Lower
Spotted Sandpiper	0	0	0	Lower
Solitary Sandpiper	0	0	0	Lower
Greater Yellowlegs	0	0	0	Lower

Table 11. (continued)

Common Name	Lower Final Displacement Sensitivity Rank	Best Estimate Final Displacement Sensitivity Rank	Upper Final Displacement Sensitivity Rank	Displacement Sensitivity Qualitative Value
Willet	0	0	0	Lower
Lesser Yellowlegs	0	0	0	Lower
Upland Sandpiper	0	0	0	Lower
Whimbrel	0	0	0	Lower
Hudsonian Godwit	0	0	0	Lower
Marbled Godwit	0	0	0	Lower
Ruddy Turnstone	0	0	0	Lower
Red Knot	0	0	0	Lower
Sanderling	0	0	0	Lower
Semipalmated Sandpiper	0	0	0	Lower
Western Sandpiper	0	0	0	Lower
Least Sandpiper	0	0	0	Lower
White-rumped Sandpiper	0	0	0	Lower
Baird's Sandpiper	0	0	0	Lower
Pectoral Sandpiper	0	0	0	Lower
Purple Sandpiper	0	0	0	Lower
Dunlin	0	0	0	Lower
Stilt Sandpiper	0	0	0	Lower
Buff-breasted Sandpiper	0	0	0	Lower
Short-billed Dowitcher	0	0	0	Lower
Long-billed Dowitcher	0	0	0	Lower
Wilson's Snipe	0	0	0	Lower
American Woodcock	0	0	0	Lower
Least Tern	0	0	0	Lower
Gull-billed Tern	0	0	0	Lower
Caspian Tern	0	0	0	Lower
Forster's Tern	0	0	0	Lower
Royal Tern	0	0	0	Lower
Sandwich Tern	0	0	0	Lower
Black Skimmer	0	0	0	Lower

Table 11. (continued)

Common Name	Lower Final Displacement Sensitivity Rank	Best Estimate Final Displacement Sensitivity Rank	Upper Final Displacement Sensitivity Rank	Displacement Sensitivity Qualitative Value
American Kestrel	0	0	0	Lower
Merlin	0	0	0	Lower
Peregrine Falcon	0	0	0	Lower
Barn Swallow	0	0	0	Lower
Blue-gray Gnatcatcher	0	0	0	Lower
Bicknell's Thrush	0	0	0	Lower
Ovenbird	0	0	0	Lower
Northern Waterthrush	0	0	0	Lower
Common Yellowthroat	0	0	0	Lower
American Redstart	0	0	0	Lower
Kirtland's Warbler	0	0	0	Lower
Cape May Warbler	0	0	0	Lower
Northern Parula	0	0	0	Lower
Blackburnian Warbler	0	0	0	Lower
Blackpoll Warbler	0	0	0	Lower
Palm Warbler	0	0	0	Lower
Yellow-rumped Warbler	0	0	0	Lower
Canada Warbler	0	0	0	Lower
Chipping Sparrow	0	0	0	Lower
Savannah Sparrow	0	0	0	Lower
Song Sparrow	0	0	0	Lower
White-throated Sparrow	0	0	0	Lower
Indigo Bunting	0	0	0	Lower
Baltimore Oriole	0	0	0	Lower
American Goldfinch	0	0	0	Lower

4 Discussion and Implications

Our indices provide an assessment of the relative vulnerability of bird species to offshore wind development in the AOCS using multiple factors. This exercise proved to be useful for (1) gaining a better understanding of the environmental factors that likely influence the vulnerability of birds to wind turbines, (2) identifying gaps in knowledge of certain species' biology and life history, and (3) determining the most practical and relevant next phase of applied research using our vulnerability assessments.

Our scoring system is based on data ranges for each metric. Consequently, although data gaps exist across all metrics, a lack of precision is absorbed within the data ranges. The possible exception to data gaps includes threat status, although even threat status is often assigned based on incomplete information. Data gaps and variation in all metrics among sources often made uncertainty difficult to assign. For example, there was a high degree of uncertainty for species with respect to information on avoidance and flight height as large data gaps or conflicting data exist with these two metrics. This uncertainty created a wider range of scores between the lower and upper estimates, which limited our ability to provide a definitive ranking for some species. Species that scored highly in our population sensitivity indices are often from small biogeographic or global populations of high conservation importance and with high adult survival ranking. These include species such as Black-capped and Bermuda Petrels. Black-capped Petrel has a small global population (5,000) has an IUCN threat category of Endangered, is under threat review with FWS and has high adult survival. Bermuda Petrel also has a small global population size and is listed as Endangered by both IUCN and FWS. The lowest ranking species consisted of songbirds, waterfowl, and wading birds from large global populations and broad distributions. These results were not unexpected, but there was uncertainty associated with some species with limited data on AOCS population size and adult survival.

Consistent with the results of Garthe and Hüppop (2004), Furness and Wade (2012), and Furness et al. (2013), species with high scores for collision sensitivity included certain gulls, jaegers, and the Northern Gannet. Additional species in our database that also received high scores for collision sensitivity include phalaropes, tropicbirds, and the Brown Pelican. Behavioral traits that drove high collision sensitivity indices included high occurrence in the AOCS, low macro avoidance rates with high uncertainty and high amounts of time spent in the RSZ. Species with low collision sensitivity scores include many passerines that only cross the AOCS briefly during migration and typically fly above the RSZ. Many of these species also had large global populations, which are less sensitive to mortality in the AOCS than less common species.

Species identified as being vulnerable to displacement were similar to those identified by Garthe and Hüppop (2004), Furness and Wade (2012), and Furness et al. (2013). These included sea ducks and alcids with restricted prey availability and high macro avoidance traits, but other taxa that were ranked as highly vulnerable to displacement included species that have high annual occurrence and feed and breed in the AOCS. Jaegers in general appear to be less sensitive to displacement, mainly as none are shown to avoid wind facilities. Below jaegers in sensitivity are the species that had a zero displacement sensitivity score. These are species that have no habitat requirements in the AOCS such as passerines and shorebirds.

For all three sensitivity indices, there were significant areas of uncertainty with key data, particularly population size, adult survival, macro avoidance, and flight height. With this uncertainty in mind, our database was built to be dynamic, and it can therefore easily be updated as new information becomes available from offshore field studies.

Although we used a comprehensive set of metrics in our study, many other environmental factors could influence bird vulnerability to offshore wind facilities. Weather variables have a big influence on collisions with turbines, especially during periods of inclement weather with low visibility (Fox et al. 2006). Weather variables vary greatly both spatially and temporally, and a study of weather influences over the whole AOCS was outside the scope of this study. Factors specific to a wind facility such as lighting (Merkel and Johansen 2011) and area of the RSZ (USFWS 2012) may also affect birds' sensitivity to offshore turbines. These factors also vary over space, and with no offshore wind facilities in the AOCS at the time of this study, it was not possible to include them in our analysis.

While data on biology and life history of birds in the AOCS is incomplete for more in-depth assessments of vulnerability to offshore wind turbines (e.g., using demographic models), our work has applicability in focusing conservation efforts on certain species known or predicted to be most vulnerable to offshore turbines. Our predictions could be applied to a specific area by gathering field data to determine the species present and using our indices to assess the vulnerability of species recorded during the field studies (Desholm 2009). Minimization and mitigation efforts could be focused on those species determined to be most vulnerable. In addition, field data could be used to generate maps showing spatial variation in the sensitivity of individual species and total bird sensitivity in a study area, helping to assess likely impact as well as better design wind facilities to reduce that impact. At larger scales across the AOCS, such maps could inform broader policies concerning development of offshore wind energy facilities.

In 2012, the FWS released land-based wind energy guidelines for developing and operating wind projects with respect to minimizing wildlife impacts (USFWS 2012). These guidelines outline a tiered approach (Tiers 1–5) for planning, collecting, and evaluating wildlife studies at wind facilities. Each tier becomes more specific in scope as the study progresses. While there are no equivalent guidelines for offshore wind energy projects, it is reasonable to assume that a tiered approach, or equivalent, will eventually be developed for offshore wind energy projects. Our database and vulnerability ranks would be useful in implementing Tier 1 (or equivalent) studies that recommend a landscape-level assessment for species of concern including acquisition of comprehensive data sources (USFWS 2012). Our database could represent one of the data sources collected during Tier 1 studies by providing an overall assessment of the species that would be most vulnerable to an offshore wind facility. Our database could also be supplemented with spatial data on species' geographic range to further assess which vulnerable species are likely to occur at the location of a proposed wind facility. Site-specific studies would need to be conducted in order to thoroughly assess bird species vulnerability to offshore wind facilities.

Our research has also provided valuable information on data gaps that are present for many species occurring in the AOCS. Some of our metrics were not available for certain species, and estimates had to be inferred from similar species where information was available. Fortunately, our vulnerability indices can easily be updated and recalculated as new data and research become

available. This flexibility ensures that our sensitivity predictions reflect the best data available and therefore provide the most useful information to regulators, developers, and other stakeholders when siting wind facilities in the AOCS.

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6 Appendix: Primary Data Tables

Table A–1.

Species identified as being present in AOCS by OCS Study BOEM 2012-0076.*

Common Name	Scientific Name
Brant	*Branta bernicla*
Canada Goose	*Branta canadensis*
Greater Scaup	*Aythya marila*
Lesser Scaup	*Aythya affinis*
Common Eider	*Somateria mollissima*
Harlequin Duck	*Histrionicus histrionicus*
Surf Scoter	*Melanitta perspicillata*
White-winged Scoter	*Melanitta fusca*
Black Scoter	*Melanitta americana*
Long-tailed Duck	*Clangula hyemalis*
Bufflehead	*Bucephala albeola*
Common Merganser	*Mergus merganser*
Red-breasted Merganser	*Mergus serrator*
Red-throated Loon	*Gavia stellata*
Common Loon	*Gavia immer*
Horned Grebe	*Podiceps auritus*
Red-necked Grebe	*Podiceps grisegena*
Northern Fulmar	*Fulmarus glacialis*
Black-capped Petrel	*Pterodroma hasitata*
Cory's Shearwater	*Calonectris diomedea*
Great Shearwater	*Puffinus gravis*
Sooty Shearwater	*Puffinus griseus*
Manx Shearwater	*Puffinus puffinus*
Audubon's Shearwater	*Puffinus lherminieri*
Wilson's Storm-petrel	*Oceanites oceanicus*
White-faced Storm-petrel	*Pelagodroma marina*
Leach’s Storm-Petrel	*Oceanodroma leucorhoa*
Band-rumped Storm-petrel	*Oceanodroma castro*

Table A–1. (continued)

Common Name	Scientific Name
White-tailed Tropicbird	*Phaethon lepturus*
Masked Booby	*Sula dactylatra*
Brown Booby	*Sula leucogaster*
Northern Gannet	*Morus bassanus*
Double-crested Cormorant	*Phalacrocorax auritus*
Great Cormorant	*Phalacrocorax carbo*
Brown Pelican	*Pelecanus occidentalis*
Black-bellied Plover	*Pluvialis squatarola*
American Golden Plover	*Pluvialis dominica*
Wilson's Plover	*Charadrius wilsonia*
Semipalmated Plover	*Charadrius semipalmatus*
Piping Plover	*Charadrius melodus*
American Oystercatcher	*Haematopus palliatus*
Black-necked Stilt	*Himantopus mexicanus*
American Avocet	*Recurvirostra americana*
Spotted Sandpiper	*Actitis macularius*
Solitary Sandpiper	*Tringa solitaria*
Greater Yellowlegs	*Tringa melanoleuca*
Willet	*Tringa semipalmata*
Lesser Yellowlegs	*Tringa flavipes*
Whimbrel	*Numenius phaeopus*
Long-billed Curlew	*Numenius americanus*
Hudsonian Godwit	*Limosa haemastica*
Marbled Godwit	*Limosa fedoa*
Ruddy Turnstone	*Arenaria interpres*
Red Knot	*Calidris canutus*
Sanderling	*Calidris alba*
Semipalmated Sandpiper	*Calidris pusilla*
Western Sandpiper	*Calidris mauri*
Least Sandpiper	*Calidris minutilla*
White-rumped Sandpiper	*Calidris fuscicollis*
Baird's Sandpiper	*Calidris bairdii*
Pectoral Sandpiper	*Calidris melanotos*

Table A–1. (continued)

Common Name	Scientific Name
Purple Sandpiper	*Calidris maritima*
Dunlin	*Calidris alpina*
Stilt Sandpiper	*Calidris himantopus*
Buff-breasted Sandpiper	*Tryngites subruficollis*
Short-billed Dowitcher	*Limnodromus griseus*
Long-billed Dowitcher	*Limnodromus scolopaceus*
Wilson’s Phalarope	*Phalaropus tricolor*
Red-necked Phalarope	*Phalaropus lobatus*
Red Phalarope	*Phalaropus fulicarius*
Black-legged Kittiwake	*Rissa tridactyla*
Sabine's Gull	*Xema sabini*
Bonaparte's Gull	*Chroicocephalus philadelphia*
Little Gull	*Hydrocoloeus minutus*
Laughing Gull	*Leucophaeus atricilla*
Ring-billed Gull	*Larus delawarensis*
Herring Gull	*Larus argentatus*
Iceland Gull	*Larus glaucoides*
Lesser Black-backed Gull	*Larus fuscus*
Glaucous Gull	*Larus hyperboreus*
Great Black-backed Gull	*Larus marinus*
Brown Noddy	*Anous stolidus*
Sooty Tern	*Onychoprion fuscatus*
Bridled Tern	*Onychoprion anaethetus*
Least Tern	*Sternula antillarum*
Gull-billed Tern	*Gelochelidon nilotica*
Caspian Tern	*Hydroprogne caspia*
Black Tern	*Chlidonias niger*
Roseate Tern	*Sterna dougallii*
Common Tern	*Sterna hirundo*
Arctic Tern	*Sterna paradisaea*
Forster's Tern	*Sterna forsteri*
Royal Tern	*Thalasseus maximus*
Sandwich Tern	*Thalasseus sandvicensis*

Table A–1. (continued)

Common Name	Scientific Name
Great Skua	*Stercorarius skua*
South Polar Skua	*Stercorarius maccormicki*
Pomarine Jaeger	*Stercorarius pomarinus*
Parasitic Jaeger	*Stercorarius parasiticus*
Long-tailed Jaeger	*Stercorarius longicaudus*
Dovekie	*Alle alle*
Common Murre	*Uria aalge*
Thick-billed Murre	*Uria lomvia*
Razorbill	*Alca torda*
Black Guillemot	*Cepphus grylle*
Atlantic Puffin	*Fratercula arctica*
Barn Swallow	*Hirundo rustica*

*Source: O'Connell et al. 2009 and 2011

Table A–2.

Final list of species selected for analysis showing common name and scientific name.

Common Name	Scientific Name
Snow Goose	*Chen caerulescens*
Brant	*Branta bernicla*
Canada Goose	*Branta canadensis*
Tundra Swan	*Cygnus columbianus*
Wood Duck	*Aix sponsa*
Gadwall	*Anas strepera*
American Wigeon	*Anas americana*
American Black Duck	*Anas rubripes*
Mallard	*Anas platyrhynchos*
Blue-winged Teal	*Anas discors*
Northern Shoveler	*Anas clypeata*
Northern Pintail	*Anas acuta*
Green-winged Teal	*Anas crecca*
Canvasback	*Aythya valisineria*
Redhead	*Aythya americana*

Table A–2. (continued)

Common Name	Scientific Name
Ring-necked Duck	*Aythya collaris*
Greater Scaup	*Aythya marila*
Lesser Scaup	*Aythya affinis*
King Eider	*Somateria spectabilis*
Common Eider	*Somateria mollissima*
Harlequin Duck	*Histrionicus histrionicus*
Surf Scoter	*Melanitta perspicillata*
White-winged Scoter	*Melanitta fusca*
Black Scoter	*Melanitta americana*
Long-tailed Duck	*Clangula hyemalis*
Bufflehead	*Bucephala albeola*
Common Goldeneye	*Bucephala clangula*
Barrow's Goldeneye	*Bucephala islandica*
Hooded Merganser	*Lophodytes cucullatus*
Common Merganser	*Mergus merganser*
Red-breasted Merganser	*Mergus serrator*
Ruddy Duck	*Oxyura jamaicensis*
Red-throated Loon	*Gavia stellata*
Common Loon	*Gavia immer*
Pied-billed Grebe	*Podilymbus podiceps*
Horned Grebe	*Podiceps auritus*
Red-necked Grebe	*Podiceps grisegena*
Northern Fulmar	*Fulmarus glacialis*
Bermuda Petrel	*Pterodroma cahow*
Black-capped Petrel	*Pterodroma hasitata*
Cory's Shearwater	*Calonectris diomedea*
Great Shearwater	*Puffinus gravis*
Sooty Shearwater	*Puffinus griseus*
Manx Shearwater	*Puffinus puffinus*
Audubon's Shearwater	*Puffinus lherminieri*
Wilson's Storm-Petrel	*Oceanites oceanicus*
Leach's Storm-Petrel	*Oceanodroma leucorhoa*
Band-rumped Storm-Petrel	*Oceanodroma castro*

Table A–2. (continued)

Common Name	Scientific Name
White-tailed Tropicbird	*Phaethon lepturus*
Red-billed Tropicbird	*Phaethon aethereus*
Brown Booby	*Sula leucogaster*
Northern Gannet	*Morus bassanus*
Double-crested Cormorant	*Phalacrocorax auritus*
Great Cormorant	*Phalacrocorax carbo*
Brown Pelican	*Pelecanus occidentalis*
American Bittern	*Botaurus lentiginosus*
Least Bittern	*Ixobrychus exilis*
Great Blue Heron	*Ardea herodias*
Great Egret	*Ardea alba*
Snowy Egret	*Egretta thula*
Little Blue Heron	*Egretta caerulea*
Tricolored Heron	*Egretta tricolor*
Green Heron	*Butorides virescens*
Black-crowned Night-Heron	*Nycticorax nycticorax*
Yellow-crowned Night-Heron	*Nyctanassa violacea*
White Ibis	*Eudocimus albus*
Glossy Ibis	*Plegadis falcinellus*
Roseate Spoonbill	*Platalea ajaja*
Osprey	*Pandion haliaetus*
Northern Harrier	*Circus cyaneus*
Black Rail	*Laterallus jamaicensis*
Clapper Rail	*Rallus longirostris*
King Rail	*Rallus elegans*
Virginia Rail	*Rallus limicola*
Sora	*Porzana carolina*
Purple Gallinule	*Porphyrio martinica*
Common Gallinule	*Gallinula galeata*
American Coot	*Fulica americana*
Black-bellied Plover	*Pluvialis squatarola*
American Golden-Plover	*Pluvialis dominica*
Wilson's Plover	*Charadrius wilsonia*

Table A–2. (continued)

Common Name	Scientific Name
Semipalmated Plover	*Charadrius semipalmatus*
Piping Plover	*Charadrius melodus*
Killdeer	*Charadrius vociferus*
American Oystercatcher	*Haematopus palliatus*
Black-necked Stilt	*Himantopus mexicanus*
American Avocet	*Recurvirostra americana*
Spotted Sandpiper	*Actitis macularius*
Solitary Sandpiper	*Tringa solitaria*
Greater Yellowlegs	*Tringa melanoleuca*
Willet	*Tringa semipalmata*
Lesser Yellowlegs	*Tringa flavipes*
Upland Sandpiper	*Bartramia longicauda*
Whimbrel	*Numenius phaeopus*
Hudsonian Godwit	*Limosa haemastica*
Marbled Godwit	*Limosa fedoa*
Ruddy Turnstone	*Arenaria interpres*
Red Knot	*Calidris canutus*
Sanderling	*Calidris alba*
Semipalmated Sandpiper	*Calidris pusilla*
Western Sandpiper	*Calidris mauri*
Least Sandpiper	*Calidris minutilla*
White-rumped Sandpiper	*Calidris fuscicollis*
Baird's Sandpiper	*Calidris bairdii*
Pectoral Sandpiper	*Calidris melanotos*
Purple Sandpiper	*Calidris maritima*
Dunlin	*Calidris alpina*
Stilt Sandpiper	*Calidris himantopus*
Buff-breasted Sandpiper	*Tryngites subruficollis*
Short-billed Dowitcher	*Limnodromus griseus*
Long-billed Dowitcher	*Limnodromus scolopaceus*
Wilson's Snipe	*Gallinago delicata*
American Woodcock	*Scolopax minor*
Red-necked Phalarope	*Phalaropus lobatus*

Table A–2. (continued)

Common Name	Scientific Name
Red Phalarope	*Phalaropus fulicarius*
Black-legged Kittiwake	*Rissa tridactyla*
Sabine's Gull	*Xema sabini*
Bonaparte's Gull	*Chroicocephalus philadelphia*
Black-headed Gull	*Chroicocephalus ridibundus*
Little Gull	*Hydrocoloeus minutus*
Laughing Gull	*Leucophaeus atricilla*
Ring-billed Gull	*Larus delawarensis*
Herring Gull	*Larus argentatus*
Iceland Gull	*Larus glaucoides*
Lesser Black-backed Gull	*Larus fuscus*
Glaucous Gull	*Larus hyperboreus*
Great Black-backed Gull	*Larus marinus*
Brown Noddy	*Anous stolidus*
Sooty Tern	*Onychoprion fuscatus*
Bridled Tern	*Onychoprion anaethetus*
Least Tern	*Sternula antillarum*
Gull-billed Tern	*Gelochelidon nilotica*
Caspian Tern	*Hydroprogne caspia*
Black Tern	*Chlidonias niger*
Roseate Tern	*Sterna dougallii*
Common Tern	*Sterna hirundo*
Arctic Tern	*Sterna paradisaea*
Forster's Tern	*Sterna forsteri*
Royal Tern	*Thalasseus maximus*
Sandwich Tern	*Thalasseus sandvicensis*
Black Skimmer	*Rynchops niger*
Great Skua	*Stercorarius skua*
South Polar Skua	*Stercorarius maccormicki*
Pomarine Jaeger	*Stercorarius pomarinus*
Parasitic Jaeger	*Stercorarius parasiticus*
Long-tailed Jaeger	*Stercorarius longicaudus*
Dovekie	*Alle alle*

Table A–2. (continued)

Common Name	Scientific Name
Common Murre	*Uria aalge*
Thick-billed Murre	*Uria lomvia*
Razorbill	*Alca torda*
Black Guillemot	*Cepphus grylle*
Atlantic Puffin	*Fratercula arctica*
American Kestrel	*Falco sparverius*
Merlin	*Falco columbarius*
Peregrine Falcon	*Falco peregrinus*
Barn Swallow	*Hirundo rustica*
Blue-gray Gnatcatcher	*Polioptila caerulea*
Bicknell's Thrush	*Catharus bicknelli*
Ovenbird	*Seiurus aurocapilla*
Northern Waterthrush	*Parkesia noveboracensis*
Common Yellowthroat	*Geothlypis trichas*
American Redstart	*Setophaga ruticilla*
Kirtland's Warbler	*Setophaga kirtlandii*
Cape May Warbler	*Setophaga tigrina*
Northern Parula	*Setophaga americana*
Blackburnian Warbler	*Setophaga fusca*
Blackpoll Warbler	*Setophaga striata*
Palm Warbler	*Setophaga palmarum*
Yellow-rumped Warbler	*Setophaga coronata*
Canada Warbler	*Cardellina canadensis*
Chipping Sparrow	*Spizella passerina*
Savannah Sparrow	*Passerculus sandwichensis*
Song Sparrow	*Melospiza melodia*
White-throated Sparrow	*Zonotrichia albicollis*
Indigo Bunting	*Passerina cyanea*
Baltimore Oriole	*Icterus galbula*
American Goldfinch	*Spinus tristis*

Table A–3

Global population size (*GPS*), score, uncertainty, and references.

Common Name	*GPS* (Range Individuals)	*GPS* Score	*GPS* % Uncertainty	*GPS* References
Snow Goose	4,045,200	1	10	BirdLife 2013
Brant	518,500–>560,000	3	10	Watts 2010; Wetlands International 2006
Canada Goose	5,200,000–5,900,000	1	10	BirdLife 2013; Watts 2010
Tundra Swan	300,000	4	10	Watts 2010; Wetlands International 2006
Wood Duck	3,500,000	1	25	ABC 2012
Gadwall	3,200,000–4,965,000	1	10	Watts 2010; Wetlands International 2006
American Wigeon	3,100,000	1	25	Watts 2010
American Black Duck	910,000	3	25	Watts 2010
Mallard	22,930,000	1	10	Watts 2010; Wetlands International 2006
Blue-winged Teal	7,240,000	1	10	Watts 2010
Northern Shoveler	5,500,000–6,000,000	1	10	Watts 2010; Wetlands International 2006
Northern Pintail	5,300,000–5,900,000	1	10	BirdLife 2013; Watts 2010
Green-winged Teal	3,900,000	1	10	Watts 2010
Canvasback	700,000	3	25	Watts 2010
Redhead	1,200,000	2	25	Watts 2010
Ring-necked Duck	2,000,000	2	10	Watts 2010
Greater Scaup	1,200,000–1,410,000	2	10	Watts 2010; Wetlands International 2006
Lesser Scaup	4,400,000	1	10	Watts 2010

Table A–3. (continued)

Common Name	*GPS* (Range Individuals)	*GPS* Score	*GPS* % Uncertainty	*GPS* References
King Eider	790,000–1,215,000	3	25	Watts 2010; Wetlands International 2006
Common Eider	2,900,000–3,800,000	1	25	Watts 2010; Wetlands International 2006
Harlequin Duck	190,000–380,000	4	10	Watts 2010; Wetlands International 2006
Surf Scoter	250,000–1,300,000	3	50	Watts 2010; Wetlands International 2006
White-winged Scoter	250,000–2,200,000	3	50	BirdLife 2013; Watts 2010
Black Scoter	350,000–2,300,000	3	50	BirdLife 2013; Watts 2010
Long-tailed Duck	6,200,000–6,800,000	1	10	Delany and Scott 2006; Robertson and Savard 2002; Watts 2010
Bufflehead	>1,200,000–1,400,000	2	10	Watts 2010; Wetlands International 2006
Common Goldeneye	2,500,000–4,600,000	1	25	BirdLife 2013; Watts 2010
Barrow's Goldeneye	256,500	4	25	Watts 2010
Hooded Merganser	350,000	4	25	Watts 2010
Common Merganser	1,352,500–2,400,000	2	10	Watts 2010; Wetlands International 2006
Red-breasted Merganser	510,000–610,000	3	10	Watts 2010; Wetlands International 2006
Ruddy Duck	520,000–1,110,000	3	25	BirdLife 2013; Watts 2010
Red-throated Loon	200,000–590,000	4	25	Watts 2010; Wetlands International 2006
Common Loon	580,000	3	25	Watts 2010
Pied-billed Grebe	110,000–130,000	5	25	Watts 2010
Horned Grebe	140,000–2,100,000	3	50	Watts 2010; Wetlands International 2006

Table A–3. (continued)

Common Name	*GPS* (Range Individuals)	*GPS* Score	*GPS* % Uncertainty	*GPS* References
Red-necked Grebe	150,000–370,000	4	10	Watts 2010; Wetlands International 2006
Northern Fulmar	8,000,000–32,000,000	1	10	Watts 2010
Bermuda Petrel	142	5	10	BirdLife 2013
Black-capped Petrel	5,000	5	10	BirdLife 2013
Cory's Shearwater	280,000–1,200,000	4	50	BirdLife 2013; Watts 2010
Great Shearwater	>15,000,000–16,500,000	1	10	Brooke 2004; Watts 2010
Sooty Shearwater	>20,000,000	1	10	Brooke 2004; Watts 2010
Manx Shearwater	500,000–1,170,000	3	25	BirdLife 2004; Watts 2010
Audubon's Shearwater	60,000–500,000	5	25	BirdLife 2013; Watts 2010
Wilson's Storm-Petrel	6,000,000–30,000,000	1	10	Brooke 2004; Watts 2010
Leach's Storm-Petrel	8,000,000–>20,000,000	1	10	Brooke 2004; Watts 2010
Band-rumped Storm-Petrel	150,000	4	25	BirdLife 2013
White-tailed Tropicbird	<10,000 breeding; 50,000	5	10	del Hoyo et al. 1992; Watts 2010
Red-billed Tropicbird	5,000–20,000	5	10	BirdLife 2013
Brown Booby	>200,000	4	25	del Hoyo et al. 1992
Northern Gannet	526,000–1,200,000	3	25	BirdLife 2004; del Hoyo et al. 1992; Watts 2010
Double-crested Cormorant	1,100,000–2,200,000	2	10	Watts 2010
Great Cormorant	1,000,000–2,900,000	2	10	Watts 2010; Wetlands International 2006
Brown Pelican	300,000	4	25	ABC 2012

Table A–3. (continued)

Common Name	*GPS* (Range Individuals)	*GPS* Score	*GPS* % Uncertainty	*GPS* References
American Bittern	3,000,000	2	25	Watts 2010
Least Bittern	>130,000	4	25	Watts 2010
Great Blue Heron	Green status NAS	1	10	BirdLife 2004; NAS 2013
Great Egret	550,000–2,200,000	3	25	BirdLife 2013; Watts 2010
Snowy Egret	1,400,000	2	25	ABC 2012
Little Blue Heron	300,000–450,000	4	10	ABC 2012
Tricolored Heron	290,000	4	25	ABC 2012
Green Heron	500,000–5,000,000	5	50	ABC 2012
Black-crowned Night-Heron	Green status NAS, 430,000–3,600,000	2	25	Watts 2010; Wetlands International 2006
Yellow-crowned Night-Heron	85,000–160,000	5	25	Watts 2010
White Ibis	>200,000 breeding	4	25	Watts 2010
Glossy Ibis	1,100,000–3,300,000	2	25	Watts 2010
Roseate Spoonbill	103,500	4	25	Watts 2010
Osprey	500,000	2	25	BirdLife 2013
Northern Harrier	1,300,000	2	25	Rich et al. 2004
Black Rail	35,000–110,000	5	25	BirdLife 2013
Clapper Rail	2,300–2,500	5	10	BirdLife 2013
King Rail	6.6% annual decline. Absence of long-term monitoring data from much of the KR range. Threatened or Endangered in 13 states	5	50	Cooper 2006
Virginia Rail	2.2% population decline from 1982 to 1991	5	50	Conway et al. 1994
Sora	500,000–5,000,000	5	50	ABC 2012

Table A–3. (continued)

Common Name	*GPS* (Range Individuals)	*GPS* Score	*GPS* % Uncertainty	*GPS* References
Purple Gallinule	100,000–1,000,000	4	25	Watts 2010
Common Gallinule	3,900,000–8,100,000	1	10	BirdLife 2013
American Coot	3,000,000	1	10	Watts 2010
Black-bellied Plover	692,000	3	10	BirdLife 2013; Watts 2010
American Golden-Plover	200,000	4	10	Watts 2010; Wetlands International 2006
Wilson's Plover	6,000	5	10	U.S. National Biological Service n.d.
Semipalmated Plover	150,000–>150,000	4	10	Watts 2010; Wetlands International 2006
Piping Plover	5,945 (Watts 2010); 4,500 US sup pop (ABC)	5	10	ABC 2012; Watts 2010
Killdeer	1,000,000	2	25	BirdLife 2013; Watts 2010
American Oystercatcher	11,650	5	10	Watts 2010
Black-necked Stilt	175,000–2,000,000	3	50	BirdLife 2013; Watts 2010
American Avocet	450,000	4	10	Watts 2010
Spotted Sandpiper	150,000	4	25	Watts 2010
Solitary Sandpiper	150,000	4	25	Watts 2010
Greater Yellowlegs	100,000	4	25	Watts 2010
Willet	250,000	4	10	Watts 2010
Lesser Yellowlegs	400,000	4	10	Watts 2010
Upland Sandpiper	350,000	4	10	Watts 2010
Whimbrel	1,000,000–2,300,000	2	10	Watts 2010; Wetlands International 2006

Table A–3. (continued)

Common Name	*GPS* (Range Individuals)	*GPS* Score	*GPS* % Uncertainty	*GPS* References
Hudsonian Godwit	70,000	5	10	Watts 2010
Marbled Godwit	175,000	4	25	Watts 2010
Ruddy Turnstone	460,000–800,000	4	25	Watts 2010; Wetlands International 2006
Red Knot	120,000 US subspecies rufa; >1,100,000	2	10	Watts 2010; Wetlands International 2006
Sanderling	600,000–700,000	3	10	Watts 2010; Wetlands International 2006
Semipalmated Sandpiper	2,000,000–2,200,000	2	10	Morrison et al. 2006; Watts 2010
Western Sandpiper	3,500,000	1	10	Watts 2010
Least Sandpiper	700,000	3	10	Watts 2010
White-rumped Sandpiper	1,120,000	2	10	Watts 2010
Baird's Sandpiper	300,000	4	10	Watts 2010; Wetlands International 2006
Pectoral Sandpiper	25,000–1,000,000	5	50	Watts 2010; Wetlands International 2006
Purple Sandpiper	95,000	5	10	Watts 2010
Dunlin	4,600,000–6,500,000	1	10	Watts 2010; Wetlands International 2006
Stilt Sandpiper	820,000	3	10	Watts 2010
Buff-breasted Sandpiper	11,000–84,000	5	10	BirdLife 2013; Morrison et al. 2006; Watts 2010
Short-billed Dowitcher	153,000	4	10	Watts 2010
Long-billed Dowitcher	400,000–>400,000	4	10	Watts 2010; Wetlands International 2006
Wilson's Snipe	2,000,000	2	10	Watts 2010
American Woodcock	3,500,000	1	10	Watts 2010

Table A–3. (continued)

Common Name	*GPS* (Range Individuals)	*GPS* Score	*GPS* % Uncertainty	*GPS* References
Red-necked Phalarope	3,500,000–4,500,000	1	10	Watts 2010; Wetlands International 2006
Red Phalarope	1,100,000–2,000,000	2	10	Watts 2010; Wetlands International 2006
Black-legged Kittiwake	17,000,000–18,000,000	1	10	Watts 2010; Wetlands International 2006
Sabine's Gull	330,000–700,000	4	25	Watts 2010; Wetlands International 2006
Bonaparte's Gull	260,000–530,000	4	25	Watts 2010
Black-headed Gull	7,300,000–11,000,000	1	10	Watts 2010
Little Gull	97,000–1,700,000	3	25	Watts 2010; Wetlands International 2006
Laughing Gull	810,000–840,000	3	10	Watts 2010
Ring-billed Gull	2,600,000	2	10	Watts 2010
Herring Gull	2,600,000–5,700,000	2	25	BirdLife 2013; Watts 2010
Iceland Gull	190,000–400,000	4	10	BirdLife 2013; Watts 2010
Lesser Black-backed Gull	680,000–750,000	3	25	Watts 2010
Glaucous Gull	200,000–2,400,000	3	50	Watts 2010; Wetlands International 2006
Great Black-backed Gull	630,000–720,000	3	25	Watts 2010
Brown Noddy	180,000–1,375,000	3	50	Watts 2010; Wetlands International 2006
Sooty Tern	21,000,000–22,000,000	1	10	Watts 2010; Wetlands International 2006
Bridled Tern	610,000–1,500,000	3	25	Watts 2010; Wetlands International 2006
Least Tern	65,000–70,000	5	10	Watts 2010
Gull-billed Tern	79,000–420,000	4	25	Watts 2010; Wetlands International 2006

Table A–3. (continued)

Common Name	*GPS* (Range Individuals)	*GPS* Score	*GPS* % Uncertainty	*GPS* References
Caspian Tern	180,000–420,000	4	10	Watts 2010; Wetlands International 2006
Black Tern	45,000–1,300,000	3	50	Watts 2010
Roseate Tern	16,000 breeding North American subspecies dougalli; 70,000–82,000	5	10	Watts 2010; Wetlands International 2006
Common Tern	1,100,000–4,600,000	2	25	Watts 2010; Wetlands International 2006
Arctic Tern	1,000,000–>2,000,000	2	10	Watts 2010; Wetlands International 2006
Forster's Tern	120,000	4	10	Watts 2010
Royal Tern	280,000–310,000	4	10	Watts 2010
Sandwich Tern	460,000–500,000	4	25	Watts 2010
Black Skimmer	120,000–210,000	4	10	Watts 2010
Great Skua	10,000–48,000	5	10	BirdLife 2004; Watts 2010
South Polar Skua	6,000–20,000	5	10	BirdLife 2013; Watts 2010
Pomarine Jaeger	50,000–3,000,000	3	50	BirdLife 2004; Watts 2010
Parasitic Jaeger	500,000–10,000,000	1	50	BirdLife 2004; Watts 2010
Long-tailed Jaeger	100,000–5,000,000	1	50	BirdLife 2004; Watts 2010
Dovekie	16,000,000–36,000,000	1	10	del Hoyo et al. 1996; Watts 2010
Common Murre	18,000,000–>18,000,000	1	10	del Hoyo et al. 1996; Watts 2010
Thick-billed Murre	22,000,000–>22,000,000	1	10	del Hoyo et al. 1996; Watts 2010
Razorbill	1,500,000	2	25	Watts 2010
Black Guillemot	400,000–1,500,000	3	25	del Hoyo et al. 1996; Watts 2010
Atlantic Puffin	5,700,000–6,000,000	1	10	Watts 2010
American Kestrel	6,000,000	1	10	BirdLife 2004

Table A–3. (continued)

Common Name	*GPS* (Range Individuals)	*GPS* Score	*GPS* % Uncertainty	*GPS* References
Merlin	>1,300,000	2	10	Rich et al. 2004
Peregrine Falcon	1,200,000	2	10	Rich et al. 2004
Barn Swallow	190,000,000	1	10	Rich et al. 2004
Blue-gray Gnatcatcher	57,000,000	1	10	Rich et al. 2004
Bicknell's Thrush	63,300–84,000	5	10	BirdLife 2013
Ovenbird	24,000,000	1	10	Rich et al. 2004
Northern Waterthrush	19,000,000	1	10	ABC 2012
Common Yellowthroat	32,000,000	1	10	Rich et al. 2004
American Redstart	25,000,000	1	10	Rich et al. 2004
Kirtland's Warbler	2,300–2,400	5	10	BirdLife 2013
Cape May Warbler	7,100,000	1	10	ABC 2012
Northern Parula	7,300,000	1	10	Rich et al. 2004
Blackburnian Warbler	5,900,000	1	10	Rich et al. 2004
Blackpoll Warbler	20,000,000	1	10	Rich et al. 2004
Palm Warbler	20,000,000	1	10	Rich et al. 2004
Yellow-rumped Warbler	130,000,000	1	10	ABC 2012
Canada Warbler	3,700,000	1	10	ABC 2012
Chipping Sparrow	230,000,000	1	10	ABC 2012
Savannah Sparrow	80,000,000	1	10	BirdLife 2013
Song Sparrow	130,000,000	1	10	ABC 2012
White-throated Sparrow	140,000,000	1	10	Rich et al. 2004

Table A–3. (continued)

Common Name	*GPS* (Range Individuals)	*GPS* Score	*GPS* % Uncertainty	*GPS* References
Indigo Bunting	28,000,000	1	10	Rich et al. 2004
Baltimore Oriole	6,000,000	1	10	BirdLife 2013
American Goldfinch	42,000,000	1	10	ABC 2012

Table A–4.

Proportion of Population in AOCS (*AOCS*), score, uncertainty, and references.

Common Name	*AOCS* (Population Information)	% in AOCS	*AOCS* Score	*AOCS* % Uncertainty	*AOCS* References
Snow Goose	702,700	17	2	10	Mowbray et al. 2000; Watts 2010
Brant	163,800	1–33	2	10	Reed et al. 1998; Watts 2010
Canada Goose	1,178,300	<1	1	10	Mowbray et al. 2002; Watts 2010
Tundra Swan	103,400	30	2	10	Limpert and Earnst 1994; Watts 2010
Wood Duck	3,600,000	<1	1	10	Hepp and Bellrose 1995; Watts 2010
Gadwall	Mostly inland	Inferred*	1	10	eBird 2013; Leschack et al. 1997
American Wigeon	Mostly inland	Inferred*	1	10	eBird 2013; Mowbray 1999
American Black Duck	Winters on E coast	Inferred*	1	10	eBird 2013; Longcore et al. 2000
Mallard	13,000,000	<1	1	10	Drilling et al. 2002; Watts 2010
Blue-winged Teal	Winters thoughout West Indies	Inferred*	2	25	DeGraaf 1995; eBird 2013; Rohwer et al. 2002
Northern Shoveler	Mostly inland	Inferred*	1	10	Dubowy 1996; eBird 2013
Northern Pintail	Mostly inland	Inferred*	1	10	Austin and Miller 1995; eBird 2013

Table A–4. (continued)

Common Name	*AOCS* (Population Information)	% in AOCS	*AOCS* Score	*AOCS* % Uncertainty	*AOCS* References
Green-winged Teal	Mostly inland	Inferred*	1	10	DeGraaf 1995; eBird 2013; Johnson 1995
Canvasback	700,000	33	2	10	Mowbray 2002a; Watts 2010
Redhead	More common on Gulf than Atlantic	1	1	10	eBird 2013; Woodin and Michot 2002
Ring-necked Duck	2,000,000 however, winters on E coast; Watts not accurate	Inferred*	1	10	Roy et al. 2012; Watts 2010
Greater Scaup	800,000	57	3	50	Kessel et al. 2002; Watts 2010
Lesser Scaup	4,400,000	41	3	50	Austin et al. 1998; Watts 2010
King Eider	575,000	47	3	50	Powell and Suydam 2012; Watts 2010
Common Eider	300,000	10	2	25	Goudie et al. 2000; Watts 2010
Harlequin Duck	4,000	1	2	50	Robertson et al. 1999; Watts 2010
Surf Scoter	600,000	40	3	50	Savard et al. 1998; Watts 2010
White-winged Scoter	600,000	27	2	50	Brown and Fredrickson 1997; Watts 2010
Black Scoter	400,000	17	2	50	Bordage and Savard 2011; Watts 2010
Long-tailed Duck	1,000,000	16	2	50	Watts 2010; Wiley and Lee 1998
Bufflehead	1,400,000	23	2	50	Gauthier 1993; Watts 2010
Common Goldeneye	1,345,000	28	2	50	Eadie et al. 1995; Watts 2010
Barrow's Goldeneye	5,000	2	2	50	Eadie et al. 2000; Watts 2010
Hooded Merganser	350,000	100	1	10	Dugger et al. 2009; Watts 2010

Table A–4. (continued)

Common Name	*AOCS* (Population Information)	% in AOCS	*AOCS* Score	*AOCS* % Uncertainty	*AOCS* References
Common Merganser	1,000,000	Inferred*	1	10	Mallory and Metz 1999; Watts 2010
Red-breasted Merganser	250,000	45	3	50	Titman 1999; Watts 2010
Ruddy Duck	1,100,000	21	2	50	Watts 2010
Red-throated Loon	70,000	5–14	2	25	Barr et al. 2000; Watts 2010
Common Loon	7,400	1.2%	2	25	Evers et al. 2010; Watts 2010
Pied-billed Grebe	125,000	Inferred*	1	10	Muller and Storer 1999; Watts 2010
Horned Grebe	100,000	5–62	2	25	Stedman 2000; Watts 2010
Red-necked Grebe	20,000	Inferred*	1	10	Rubega et al. 2000; Watts 2010
Northern Fulmar	2,100,000 breeders	14	2	25	Watts 2010
Bermuda Petrel	No data	Inferred*	2	25	Madeiros 2012
Black-capped Petrel	1,500	67–99	4	10	Goetz 2012
Cory's Shearwater	Some stay in E Atlantic	67–99	4	10	eBird 2013; Howell 2012
Great Shearwater	Nearly entire population visits N Atlantic	Inferred*	4	10	eBird 2013; Howell 2012
Sooty Shearwater	2,800,000	14	2	50	Watts 2010
Manx Shearwater	500,000	6–49	2	50	Watts 2010
Audubon's Shearwater	6,000 breeders	1.2	2	50	Watts 2010
Wilson's Storm-Petrel	Common in N Atlantic; Nonbreeding season in N Atlantic and N Indian Ocean	Inferred*	4	50	BirdLife 2013; Howell 2012
Leach's Storm-Petrel	220,718 breeders	6	2	50	Watts 2010

Table A–4. (continued)

Common Name	*AOCS* (Population Information)	% in AOCS	*AOCS* Score	*AOCS* % Uncertainty	*AOCS* References
Band-rumped Storm-Petrel	Breeds in N Atlantic and potentially large % of population in AOCS	Inferred*	3	50	eBird 2013; Howell 2012
White-tailed Tropicbird	2,500	1.2	2	50	Lee and Walsh-Mcgehee 1998; Watts 2010
Red-billed Tropicbird	5,000 breeders	Inferred*	1	10	Watts 2010
Brown Booby	No data	Inferred*	1	10	eBird 2013; Schreiber and Norton 2002
Northern Gannet	107,640 breeders	20	2	50	Watts 2010
Double-crested Cormorant	1,100,000–2,200,000	10	2	50	Watts 2010
Great Cormorant	12,300 breeders	2–3	2	50	Watts 2010
Brown Pelican	1,008 breeders	<1	1	10	Shields 2002; Watts 2010
American Bittern	3,000,000	<1	1	10	Lowther et al. 2009
Least Bittern	128,000	Inferred*	1	10	Poole et al. 2009; Watts 2010
Great Blue Heron	42,232 breeders, about half in E North America, but most don't cross ocean	Inferred*	1	10	Watts 2010
Great Egret	9,146 breeders	16	1	50	Watts 2010
Snowy Egret	15,774 breeders	Inferred*	1	10	Parsons and Master 2000; Watts 2010
Little Blue Heron	200,000 breeders	Inferred*	1	10	Rodgers and Smith 2012; Watts 2010
Tricolored Heron	194,000 breeders	Inferred*	1	10	Frederick 1997; Watts 2010
Green Heron	No data	Inferred*	2	10	DeGraaf 1995; eBird 2013

Table A–4. (continued)

Common Name	*AOCS* (Population Information)	% in AOCS	*AOCS* Score	*AOCS* % Uncertainty	*AOCS* References
Black-crowned Night-Heron	50,000 breeders	29	1	50	Watts 2010
Yellow-crowned Night-Heron	50,000 breeders	Inferred*	1	10	Watts 2010; Watts 2011
White Ibis	100,000 breeders, mostly inland	Inferred*	2	25	Watts 2010
Glossy Ibis	13,000 breeders	<1	1	10	Watts 2010
Roseate Spoonbill	6,800 breeders	10	2	25	Watts 2010
Osprey	Mostly nearshore	<1	1	25	Poole et al. 2002
Northern Harrier	No data	Inferred*	1	10	eBird 2013; Smith et al. 2011
Black Rail	No data	Inferred*	2	25	DeGraaf 1995; eBird 2013
Clapper Rail	No data	Inferred*	1	50	Rush et al. 2012
King Rail	No data	Inferred*	1	50	Poole et al. 2005
Virginia Rail	No data	Inferred*	1	50	Conway 1995
Sora	No data	Inferred*	2	50	eBird 2013; Melvin and Gibbs 2012
Purple Gallinule	100,000–1,000,000	Inferred*	1	25	Watts 2010; West and Hess 2002
Common Gallinule	Some migrate to Caribbean	Inferred*	1	25	Bannor and Kiviat 2002
American Coot	3,000,000	Inferred*	2	25	Brisbin et al. 2002; Watts 2010
Black-bellied Plover	150,000	21	2	25	Watts 2010
American Golden-Plover	200,000	Inferred*	5	25	Watts 2010
Wilson's Plover	6,000	Inferred*	2	50	Watts 2010
Semipalmated Plover	150,000	Inferred*	2	50	Watts 2010
Piping Plover	2,953	50	2	50	Watts 2010
Killdeer	1,000,000	Inferred*	1	50	Watts 2010
American Oystercatcher	11,000	Inferred*	2	25	Watts 2010
Black-necked Stilt	175,000	Inferred*	2	25	Watts 2010

Table A–4. (continued)

Common Name	*AOCS* (Population Information)	% in AOCS	*AOCS* Score	*AOCS* % Uncertainty	*AOCS* References
American Avocet	4,500	Inferred*	1	10	Robinson et al. 1997
Spotted Sandpiper	150,000	Inferred*	3	50	Watts 2010
Solitary Sandpiper	21,000	Inferred*	3	50	Watts 2010
Greater Yellowlegs	100,000	Inferred*	2	50	Watts 2010
Willet	90,000	Inferred*	2	50	Watts 2010
Lesser Yellowlegs	20,100	Inferred*	2	50	Watts 2010
Upland Sandpiper	350,000	Inferred*	1	25	Watts 2010
Whimbrel	40,000	2	2	50	Watts 2010
Hudsonian Godwit	10,000	Inferred*	2	10	Watts 2010
Marbled Godwit	2,226	Inferred*	1	10	Watts 2010
Ruddy Turnstone	45,000	Inferred*	2	10	Watts 2010
Red Knot	20,000	16	2	25	Watts 2010
Sanderling	300,000	Inferred*	2	25	Watts 2010
Semipalmated Sandpiper	1,500,000	Inferred*	4	10	Watts 2010
Western Sandpiper	3,500,000	Inferred*	4	50	Watts 2010
Least Sandpiper	37,300	Inferred*	2	25	Watts 2010
White-rumped Sandpiper	1,120,000	Inferred*	4	10	Watts 2010
Baird's Sandpiper	300,000	Inferred*	4	25	Watts 2010
Pectoral Sandpiper	400,000	Inferred*	2	50	Watts 2010
Purple Sandpiper	15,000	Inferred*	1	10	Watts 2010
Dunlin	225,000	Inferred*	2	25	Watts 2010
Stilt Sandpiper	820,000	Inferred*	2	25	Watts 2010
Buff-breasted Sandpiper	30,000	Inferred*	1	25	Watts 2010
Short-billed Dowitcher	78,000	Inferred*	3	25	Watts 2010
Long-billed Dowitcher	400,000	Inferred*	1	25	Watts 2010
Wilson's Snipe	No data	Inferred*	2	50	Corbat and Berstrom 2000; eBird 2013
American Woodcock	3,500,000	Inferred*	1	10	Watts 2010
Red-necked Phalarope	2,500,000	Inferred*	3	25	Watts 2010
Red Phalarope	1,250,000	67–99	4	50	Watts 2010

Table A–4. (continued)

Common Name	*AOCS* (Population Information)	% in AOCS	*AOCS* Score	*AOCS* % Uncertainty	*AOCS* References
Black-legged Kittiwake	108,700 breeders	<1	1	50	Watts 2010
Sabine's Gull	200,000 breeders	Inferred*	1	10	Watts 2010
Bonaparte's Gull	260,000 breeders	Inferred*	1	10	Watts 2010
Black-headed Gull	No data	Inferred*	1	10	eBird 2013; Howell and Dunn 2007
Little Gull	100 breeders	Inferred*	1	10	Watts 2010
Laughing Gull	528,000 breeders	Inferred*	2	50	Watts 2010
Ring-billed Gull	1,700,000	Inferred*	1	10	Watts 2010
Herring Gull	246,000 breeders	20	2	25	Watts 2010
Iceland Gull	100,000	Inferred*	1	10	Watts 2010
Lesser Black-backed Gull	No data	Inferred*	1	10	eBird 2013; Howell and Dunn 2007
Glaucous Gull	70,000 breeders	Inferred*	1	10	Watts 2010
Great Black-backed Gull	152,918 breeders	Inferred*	1	10	Watts 2010
Brown Noddy	286,000 breeders	Inferred*	1	25	Watts 2010
Sooty Tern	No data	Inferred*	1	10	Schreiber et al. 2002
Bridled Tern	No data	Inferred*	1	10	Haney et al. 1999
Least Tern	16,018 breeders	Inferred*	3	50	Watts 2010
Gull-billed Tern	2,418 breeders	Inferred*	1	25	Watts 2010
Caspian Tern	19,500 breeders	Inferred*	1	25	Watts 2010
Black Tern	No data	Inferred*	2	50	eBird 2013; Heath et al. 2009
Roseate Tern	6,930 breeders	Inferred*	2	50	Watts 2010
Common Tern	173,240 breeders	Inferred*	2	50	Watts 2010
Arctic Tern	180,000	18	2	25	Watts 2010
Forster's Tern	16,690 breeders	Inferred*	2	50	Watts 2010

Table A–4. (continued)

Common Name	*AOCS* (Population Information)	% in AOCS	*AOCS* Score	*AOCS* % Uncertainty	*AOCS* References
Royal Tern	66,000 breeders	Inferred*	2	50	Watts 2010
Sandwich Tern	9,000 breeders	Inferred*	2	50	Watts 2010
Black Skimmer	10,058 breeders	Inferred*	1	10	Watts 2010
Great Skua	No data	Inferred*	1	10	eBird 2013; Harrison 1983
South Polar Skua	No data	Inferred*	1	10	eBird 2013; Harrison 1983
Pomarine Jaeger	20,000 breeders	Inferred*	3	50	Watts 2010
Parasitic Jaeger	No data	1–33	2	50	del Hoyo et al. 1996
Long-tailed Jaeger	150,000	Inferred*	3	50	Watts 2010
Dovekie	No data	Inferred*	2	50	eBird 2013; Montevecchi and Stenhouse 2002
Common Murre	63,200 breeders	1–5	2	25	Watts 2010
Thick-billed Murre	1,660 breeders	Inferred*	2	50	Watts 2010
Razorbill	75,000 breeders	Inferred*	2	50	Watts 2010
Black Guillemot	36,097 breeders	14–25	2	50	Watts 2010
Atlantic Puffin	6,898 breeders	Inferred*	2	50	Watts 2010
American Kestrel	No data	Inferred*	1	10	eBird 2013; Smallwood and Bird 2002
Merlin	No data	Inferred*	1	10	eBird 2013; Warkentin et al. 2005
Peregrine Falcon	No data	Inferred*	2	25	DeGraaf 1995; eBird 2013
Barn Swallow	No data	<1	1	10	
Blue-gray Gnatcatcher	No data	Inferred*	2	25	DeGraaf 1995; eBird 2013
Bicknell's Thrush	All winter in carribean	100	5	10	Rimmer et al. 2001
Ovenbird	No data	Inferred*	4	50	DeGraaf 1995; eBird 2013

Table A–4. (continued)

Common Name	*AOCS* (Population Information)	% in AOCS	*AOCS* Score	*AOCS* % Uncertainty	*AOCS* References
Northern Waterthrush	No data	Inferred*	4	50	DeGraaf 1995; eBird 2013
Common Yellowthroat	No data	Inferred*	3	50	DeGraaf 1995; eBird 2013
American Redstart	No data	Inferred*	4	25	DeGraaf 1995; eBird 2013
Kirtland's Warbler	No data	100	5	10	Mayfield 1992
Cape May Warbler	No data	Inferred*	5	10	DeGraaf 1995; eBird 2013
Northern Parula	No data	Inferred*	4	50	DeGraaf 1995; eBird 2013
Blackburnian Warbler	No data	Inferred*	5	10	DeGraaf 1995; eBird 2013
Blackpoll Warbler	No data	100	5	10	DeLuca et al. 2013
Palm Warbler	No data	Inferred*	3	25	DeGraaf 1995; eBird 2013
Yellow-rumped Warbler	No data	Inferred*	2	25	DeGraaf 1995; eBird 2013
Canada Warbler	No data	Inferred*	5	25	DeGraaf 1995; eBird 2013
Chipping Sparrow	No data	Inferred*	1	10	DeGraaf 1995; eBird 2013
Savannah Sparrow	No data	Inferred*	1	10	DeGraaf 1995; eBird 2013
Song Sparrow	No data	Inferred*	1	10	Arcese et al. 2002; eBird 2013
White-throated Sparrow	No data	Inferred*	1	10	eBird 2013; Falls and Kopachena 2010
Indigo Bunting	No data	Inferred*	3	50	DeGraaf 1995; eBird 2013
Baltimore Oriole	No data	Inferred*	3	50	eBird 2013; Rising and Flood 1998
American Goldfinch	No data	Inferred*	1	10	eBird 2013; McGraw and Middleton 2009

*Inferred from life history data from references in the AOCS references column

Table A–5.

Threat Ranking (*TR*), IUCN status, and FWS status.

Common Name	IUCN Status	FWS Status	*TR* Score
Snow Goose	LC		1
Brant	LC		1
Canada Goose	LC		1
Tundra Swan	LC		1
Wood Duck	LC		1
Gadwall	LC		1
American Wigeon	LC		1
American Black Duck	LC		1
Mallard	LC		1
Blue-winged Teal	LC		1
Northern Shoveler	LC		1
Northern Pintail	LC		1
Green-winged Teal	LC		1
Canvasback	LC		1
Redhead	LC		1
Ring-necked Duck	LC		1
Greater Scaup	LC		1
Lesser Scaup	LC		1
King Eider	LC		1
Common Eider	LC		1
Harlequin Duck	LC		1
Surf Scoter	LC		1
White-winged Scoter	LC		1
Black Scoter	NT		2
Long-tailed Duck	VU		3
Bufflehead	LC		1
Common Goldeneye	LC		1
Barrow's Goldeneye	LC		1
Hooded Merganser	LC		1

Table A–5. (continued)

Common Name	IUCN Status	FWS Status	*TR* Score
Common Merganser	LC		1
Red-breasted Merganser	LC		1
Ruddy Duck	LC		1
Red-throated Loon	LC		1
Common Loon	LC		1
Pied-billed Grebe	LC		1
Horned Grebe	LC		1
Red-necked Grebe	LC		1
Northern Fulmar	LC		1
Bermuda Petrel	EN	E	5
Black-capped Petrel	EN	Under review for candidate for T or E*	4
Cory's Shearwater	LC		1
Great Shearwater	LC		1
Sooty Shearwater	NT		2
Manx Shearwater	LC		1
Audubon's Shearwater	LC		1
Wilson's Storm-Petrel	LC		1
Leach's Storm-Petrel	LC		1
Band-rumped Storm-Petrel	LC	see*	3
White-tailed Tropicbird	LC		1
Red-billed Tropicbird	LC		1
Brown Booby	LC		1
Northern Gannet	LC		1
Double-crested Cormorant	LC		1
Great Cormorant	LC		1
Brown Pelican	LC		1
American Bittern	LC		1
Least Bittern	LC		1
Great Blue Heron	LC		1
Great Egret	LC		1
Snowy Egret	LC		1

Table A–5. (continued)

Common Name	IUCN Status	FWS Status	*TR* Score
Little Blue Heron	LC		1
Tricolored Heron	LC		1
Green Heron	LC		1
Black-crowned Night-Heron	LC		1
Yellow-crowned Night-Heron	LC		1
White Ibis	LC		1
Glossy Ibis	LC		1
Roseate Spoonbill	LC		1
Osprey	LC		1
Northern Harrier	LC		1
Black Rail	NT		2
Clapper Rail	LC		1
King Rail	LC		1
Virginia Rail	LC		1
Sora	LC		1
Purple Gallinule	LC		1
Common Gallinule	LC		1
American Coot	LC		1
Black-bellied Plover	LC		1
American Golden-Plover	LC		1
Wilson's Plover	LC		1
Semipalmated Plover	LC		1
Piping Plover	NT	T**	4
Killdeer	LC		1
American Oystercatcher	LC		1
Black-necked Stilt	LC		1
American Avocet	LC		1
Spotted Sandpiper	LC		1
Solitary Sandpiper	LC		1
Greater Yellowlegs	LC		1
Willet	LC		1

Table A–5. (continued)

Common Name	IUCN Status	FWS Status	*TR* Score
Lesser Yellowlegs	LC		1
Upland Sandpiper	LC		1
Whimbrel	LC		1
Hudsonian Godwit	LC		1
Marbled Godwit	LC		1
Ruddy Turnstone	LC		1
Red Knot	LC		1
Sanderling	LC		1
Semipalmated Sandpiper	NT		2
Western Sandpiper	LC		1
Least Sandpiper	LC		1
White-rumped Sandpiper	LC		1
Baird's Sandpiper	LC		1
Pectoral Sandpiper	LC		1
Purple Sandpiper	LC		1
Dunlin	LC		1
Stilt Sandpiper	LC		1
Buff-breasted Sandpiper	NT		2
Short-billed Dowitcher	LC		1
Long-billed Dowitcher	LC		1
Wilson's Snipe	LC		1
American Woodcock	LC		1
Red-necked Phalarope	LC		1
Red Phalarope	LC		1
Black-legged Kittiwake	LC		1
Sabine's Gull	LC		1
Bonaparte's Gull	LC		1
Black-headed Gull	LC		1
Little Gull	LC		1
Laughing Gull	LC		1
Ring-billed Gull	LC		1
Herring Gull	LC		1

Table A–5. (continued)

Common Name	IUCN Status	FWS Status	*TR* Score
Iceland Gull	LC		1
Lesser Black-backed Gull	LC		1
Glaucous Gull	LC		1
Great Black-backed Gull	LC		1
Brown Noddy	LC		1
Sooty Tern	LC		1
Bridled Tern	LC		1
Least Tern	LC	E*** Interior population E.	5
Gull-billed Tern	LC		1
Caspian Tern	LC		1
Black Tern	LC		1
Roseate Tern	LC	E	5
Common Tern	LC		1
Arctic Tern	LC		1
Forster's Tern	LC		1
Royal Tern	LC		1
Sandwich Tern	LC		1
Black Skimmer	LC		1
Great Skua	LC		1
South Polar Skua	LC		1
Pomarine Jaeger	LC		1
Parasitic Jaeger	LC		1
Long-tailed Jaeger	LC		1
Dovekie	LC		1
Common Murre	LC		1
Thick-billed Murre	LC		1
Razorbill	LC		1
Black Guillemot	LC		1
Atlantic Puffin	LC		1
American Kestrel	LC		1
Merlin	LC		1
Peregrine Falcon	LC		1

Table A–5. (continued)

Common Name	IUCN Status	FWS Status	*TR* Score
Barn Swallow	LC		1
Blue-gray Gnatcatcher	LC		1
Bicknell's Thrush	VU		3
Ovenbird	LC		1
Northern Waterthrush	LC		1
Common Yellowthroat	LC		1
American Redstart	LC		1
Kirtland's Warbler	NT	E	5
Cape May Warbler	LC		1
Northern Parula	LC		1
Blackburnian Warbler	LC		1
Blackpoll Warbler	LC		1
Palm Warbler	LC		1
Yellow-rumped Warbler	LC		1
Canada Warbler	LC		1
Chipping Sparrow	LC		1
Savannah Sparrow	LC		1
Song Sparrow	LC		1
White-throated Sparrow	LC		1
Indigo Bunting	LC		1
Baltimore Oriole	LC		1
American Goldfinch	LC		1

*Candidate for Hawaii's distinct population only
** Midwest population EN. NE population (most likely to cross AOCS) T
*** Population migratory movement uncertain so cautionary status given

Table A–6.

Survival ranking (*SR*), score, adult survival study ranges, uncertainty, additional information (maximum life expectancy : clutch size : age before breeding), and references.

Common Name	*SR* Score	*SR* Range	*SR* % Uncertainty	*SR* Additional Data*	*SR* References
Snow Goose	4	0.83–0.94	50	26 : 2 to 6 : 2	Clapp et al. 1982; Clutton-Brock 1988; Cooke et al. 1995; Cooke et al. 2000; Francis et al. 1992; Hamann et al. 1986; Mowbray et al. 2000
Brant	3	0.59–0.98	50	21 : 4 : 2 to 4	Kirby et al. 1986; Klimkiewicz and Futcher 1989; Reed et al. 1998; Ward et al. 1997
Canada Goose	3	0.46–0.90	50	24 : 2 to 8 : 1 to 2	Allan 1962; Clapp et al. 1982; Cooper 1978; Hestbeck 1994; Moser and Rusch 1989; Mowbray et al. 2002
Tundra Swan	5	0.92	10	21 : 3 to 5 : nd	Earnst 1994; Lensink 1973; Limpert 1994; Nichols et al. 1992
Wood Duck	1	0.41–0.71	10	nd : 9 to 12 : 1	Bellrose 1976; Haramis and Thompson 1985; Nichols and Johnson 1990
Gadwall	2	0.69–0.75	25	19 : 8 to 12 : 1	Blohm 1979; Blohm 1982; Duebbert 1966; Hines and Mitchell 1983; Keith 1961; Klimkiewicz and Futcher 1989; Miller and Collins 1954; Szymczak and Rexstad 1991
American Wigeon	1	0.58–0.74	10	21 : 7 to 10 : 1	Ashcroft 1979; Campbell et al. 1990b; Gauthier and Aubry 1996; Kessel 1988; Peck and James 1983; Rienecker 1976; Stewart 1975; Wishart 1983
American Black Duck	1	0.58–0.68	10	25 : 1 to 11 : 1	Clapp et al. 1982; Coulter and Miller 1968; Francis et al. 1998; Krementz et al. 1991; Longcore et al. 2000
Mallard	1	0.54–0.68	10	29 : 1 to 13 : 1	Alisauskas and Ankney 1992; Anderson 1975; Arnold and Clark 1996; Drilling et al. 2002; Dzubin and Gollop 1972; Kennard 1975; Palmer 1976; Pehrsson 1991; Smith and Reynolds 1992
Blue-winged Teal	1	0.52–0.59	10	17 : 6 to 14 : 1	Arnold 1988; Arnold and Clark 1996; Batt and Afton 1992; Lokemoen et al. 1990; Rohwer et al. 2002
Northern Shoveler	1	<0.30	25	nd : 8 to 12 : 1	Blums and Clark 2004; Dubowy 1996; Miller and Collins 1954; WFVZ

Table A–6. (continued)

Common Name	*SR* Score	*SR* Range	*SR* % Uncertainty	*SR* Additional Data*	*SR* References
Northern Pintail	2	0.62–0.81	50	21 : 6 : 8 : 1	Austin and Miller 1995; Duncan 1987; Fuller 1953; Hestbeck 1993; Hunt and Naylor 1955; Keith 1961; Klimkiewicz and Futcher 1989; Miller et al. 1995; Petrula 1994; Rienecker 1987; Rienecker and Anderson 1960; Sowls 1955; Stoudt 1971; Williams and Marshall 1938
Green-winged Teal	1	0.50–0.72	10	16 : 4 to 7 : 1	Batt and Afton 1992; Bellrose 1976; Cramp and Simmons 1977; Moison et al. 1967; Toft et al. 1984
Canvasback	2	0.69–0.82	50	22 : 1 : 1	Campbell et al. 1990b; Clapp et al. 1982; Erickson 1948; Fournier and Hines 1998b; Hohman et al. 1993; Mowbray 2002; Reinecker 1985; Serie et al. 1992; Stoudt 1982; Trauger 1974
Redhead	2	0.72 (females)	25	21 : 5 to 12 : 1	Brechtel 1983; Burnham and Anderson 1979; Clapp et al. 1982; Lee et al. 1964; Rienecker 1968; Sorenson 1991; Weller 1959; Weller and Ward 1959; Woodin and Michot 2002
Ring-necked Duck	1	0.48–0.69	10	20 : 4 to 14 : 1	Conroy and Eberhardt 1983; Klimkiewicz and Futcher 1989; Mendall 1958; Roy et al. 2012
Greater Scaup	1	0.5	10	22 : 8 to 9 : 1	Cramp and Simmons 1977; Kessel et al. 2002
Lesser Scaup	1	0.46–0.58	10	18 : 4 to 6 : 1	Austin et al. 1998; Baird et al. 1905; Clapp et al. 1982; Hines 1977
King Eider	5	0.86–0.97	25	15 : 2 to 8 : 3	Bentzen and Powell 2012; Bianki 1992; Cramp and Simmons 1977; Lamothe 1973; Oppel et al. 2010; Salomonsen 1965
Common Eider	4	0.82–0.927	25	21 : 3.5 to 5 : 4	Baillie and Milne 1982; Cooch 1965; Cornish and Dickson 1997; Coulson 2010; Descamps et al. 2011; Freeman 1970; Gross 1938; Guignion 1968; Hario and Selin 2002; Hario et al. 2009; Kats et al. 2007; Klimkiewicz and Futcher 1989; Krementz et al. 1996; Lewis 1939; Milne and Reed 1974; Nakashima and Murray 1988; Paynter 1951; Reed 1986; Robertson 1995; Robertson and Gilchrist 1998; Schamel 1977; Wilson et al. 2007; Yoccoz et al. 2002

Table A–6. (continued)

Common Name	*SR* Score	*SR* Range	*SR* % Uncertainty	*SR* Additional Data*	*SR* References
Harlequin Duck	4	0.68–0.99	50	17 : 3 to 9 : 2	Bengtson 1972a; Bryant et al. 1999; Reichel 1997; Robertson et al. 1999; Smith 1998
Surf Scoter	5	As with most other seaducks, adult survival likely high	50	nd : 4 to 10 : 3	De La Cruz et al. 2013; Morrier et al. 1997; Savard et al. 1998
White-winged Scoter	5	0.76–0.80	50	18 : 4 to 10 : 3	Brown and Fredrickson 1989; Brown and Houston 1982; Kehoe 1989; Kehoe et al. 1989; Palmer 1976; Vermeer 1969
Black Scoter	3	0.73–0.81	25	nd : 8 to 9 : 2 to 3	Bianki 1992; Bordage and Savard 2011; Dement'ev and Gladkov 1967; Palmer 1976
Long-tailed Duck	1	0.72	25	nd : 7 to 8 : 2	Bengtson 1972b; Cramp and Simmons 1977; Wiley and Lee 1998
Bufflehead	2	0.54–0.78	50	14 : 6 to 11 : 2	Erskine 1972a; Gauthier 1989; Gauthier 1993; USGS and CWS
Common Goldeneye	2	0.77–0.83	25	15 : 7.4 to 10 : 2	Bräger 1986; Dow and Fredga 1984; Eadie 1995; Eadie et al. 1995; Grenquist 1963; Ludwichowski et al. 2002
Barrow's Goldeneye	1	0.59–0.73	50	18 : 7 to 11 : 2	Eadie et al. 2000; Palmer 1976; Savard and Eadie 1989; Thompson 1996; USGS and CWS
Hooded Merganser	1	0.59–0.73	50	11 : 6 to 12 : 2 to 3	Doty et al. 1984; Dugger et al. 1999; Dugger et al. 2009; Zicus 1990
Common Merganser	1	0.53–0.67	50	13 : 6 to 17 : 2 to 3	Bent 1925; Clapp et al. 1982; Dement'ev et al. 1952; Eriksson and Niittylä 1985; Erskine 1972b; Johnsgard 1978; Palmer 1976
Red-breasted Merganser	2	Estimate from related species	50	9 : 5 to 24 : 2 to 3	Cramp and Simmons 1977; Titman 1999
Ruddy Duck	2	Based on similar	50	13 : 6 to 10 : 1	Bennett 1938; Boon and Ankney 1999; Brua 1999; Brua 2002; Clapp et al. 1982; Joyner 1977; Keith 1961; Low 1941; Miller and Collins 1954; Misterek 1974; Rienecker and Anderson 1960; Siegfried 1976; Solberg and Higgins 1993; Tome 1981

Table A–6. (continued)

Common Name	*SR* Score	*SR* Range	*SR* % Uncertainty	*SR* Additional Data*	*SR* References
Red-throated Loon	3	0.84	25	23 : 2 : 3	Bundy 1978; Cramp and Simmons 1977; Hemmingsson and Eriksson 2002
Common Loon	5	0.92	10	23 : 2 : 6	Brooke 1990; Evers 2010; Evers et al. 2000; Evers et al. 2010; Mcintyre and Barr 2010; Mitro et al. 2008; Nelson 1983; Zicus et al. 1983
Pied-billed Grebe	2	Based on life history	50	13 : 5 to 7 : 1 to 2	Cramp and Simmons 1977; Fjeldså 1983; Glover 1953; MacVean 1988; MacVean 1990; Munro 1941; Otto 1983
Horned Grebe	1	Ranks 1 in Furness 2012; Based on life history	50	5 : 3 to 8 : 1	Clapp et al. 1982; Ferguson and Sealy 1983; Fjeldså 1973; Furness et al. 2012
Red-necked Grebe	4	0.61–1.0	50	nd : 4 to 5 : 2 to 3	Cramp and Simmons 1977; De Smet 1983; Fournier and Hines 1998a; Kevan 1970; Ohanjanian 1986; Palmer 1962; Riske 1976; Rubega et al. 2000; Stout et al. 1999
Northern Fulmar	5	0.972–0.986	25	31.8 : 1 : 5 to 12	Dunnet 1992; Hatch 1987; Mallory et al. 2012
Bermuda Petrel	5	98% adults returned to breed each year in 6–year study	10	nd : 1 : 3 to 7	Madeiros et al. 2012
Black-capped Petrel	5	0.93 based on other spp	50	nd : 1 : 4 to 7	Farnsworth 2010; Brooke 2004; Simons et al. 2013
Cory's Shearwater	5	0.95	50	24 : 1 : 9 to 13	Fransson 2010; Granadeiro 2000; Mougin et al. 1984; Mougin et al. 1987; Mougin et al. 2011
Great Shearwater	5	0.9	50	No data	Based on similar species
Sooty Shearwater	5	0.9	50	No data	Adams 2009; Botkin and Miller 1974
Manx Shearwater	5	0.9–0.905	25	36 : 1 : 5 to 6	Brooke 1990; Harris 1966a; Harris 1966b; Perrins et al. 1973

Table A–6. (continued)

Common Name	*SR* Score	*SR* Range	*SR* % Uncertainty	*SR* Additional Data*	*SR* References
Audubon's Shearwater	5	Estimate from related species	50	No data	Based on similar species
Wilson's Storm-Petrel	4	0.88	50	No data	Based on similar species
Leach's Storm-Petrel	4	0.88	25	36 : 1 : 6	Furness 1984; Huntington et al. 1996
Band-rumped Storm-Petrel	5	0.91–0.95	10	20 : 1 : 5	Allan 1962; Haley 1984; Harris 1969; Harrison 1990; Slotterback 2002
White-tailed Tropicbird	5	0.946	10	23 : 1 : 4	Catry et al. 2009; Harrison 1990; Klimkiewicz and Futcher 1989; Lee and Walsh-Mcgehee 1998
Red-billed Tropicbird	5	Based on life history and similar species	50	18 : 1 : 4 to 5	Castillo-Guerrero et al. 2011; Javed et al. 2008
Brown Booby	5	0.85 to 0.95	25	30 : 2 : 3 to 4	Schreiber and Norton 2002; Simmons 1967; Woodward 1972
Northern Gannet	5	0.9–0.92	10	21 : 1 : nd	Cramp and Simmons 1977; Nelson 1964; Nelson 1978; Wanless 1984; Wanless et al. 2006
Double-crested Cormorant	3	0.85	25	17 : 2 to 5 : 3	Blomme 1981; Brechtel 1983; Drent et al. 1964; Ellison and Cleary 1978; Henny et al. 1989; Klimkiewicz and Futcher 1989; McNeil and Léger 1987; Mitchell 1977; Pilon et al. 1983; Post and Seals 1991; Stenzel et al. 1995; van der Veen 1973; Weseloh and Ewins 1994
Great Cormorant	3	0.84–0.88	10	14 : 4 to 5 : 3	Clapp et al. 1982; Frederiksen andBregnballe 2000; Hatch et al. 2000; Krementz et al. 1989
Brown Pelican	4	0.85–0.88	25	43 : 2 to 4 : 3 to 5	Anderson and Hickey 1970; King et al. 1985; Schreiber and Mock 1988; Schreiber et al. 1989
American Bittern	2	Based on life history	50	8 : 2 to 7 : 1	Cramp and Simmons 1977; Klimkiewicz 2008; Lowther et al. 2009
Least Bittern	2	Based on life history	50	nd : 2 to 7 : 1	Hansen 1984; Kent 1951; Poole et al. 2009; Trautman 1940; Weller 1961

Table A–6. (continued)

Common Name	*SR* Score	*SR* Range	*SR* % Uncertainty	*SR* Additional Data*	*SR* References
Great Blue Heron	2	0.78	50	23 : 2 to 6 : 2 to 3	Henny 1972; Vennesland and Butler 2011
Great Egret	1	Based on life history	50	22 : 2 to 4 : 1	Bancroft et al. 1990; Black et al. 1984; Clapp et al. 1982; Custer and Frederick 1990; Frederick 1995; Girard and Taylor 1979; Gladstone 1979; Maxwell and Kale 1977; Palmer 1962; Simmons 1959; Smith and Collopy 1995; Teal 1965; Wiese 1975; Wiese 1976
Snowy Egret	1	0.476	25	22 : 3 to 5 : 1	Frederick et al. 1992; Jackson 1982; Jenni 1969; Maxwell and Kale 1977; Palmer 1962; Parsons and Master 2000; Ryder 1978
Little Blue Heron	1	Based on life history	50	13 : 2 to 5 : 1	Bancroft et al. 1990; Black et al. 1984; Clapp et al. 1982; Dusi and Dusi 1968; Frederick and Collopy 1989; Gaston and Johnson 1977; Hopkins 1971; Jenni 1969; Maxwell and Kale 1977; Meanley 1955; Neill 1949; Palmer 1962; Parsons 1994; Rodgers 1980b; Smith 1994; Werschkul 1977; Wiese 1977
Tricolored Heron	1	0.684	25	7 : 3 to 5 : 2	Clapp et al. 1982; Frederick 1997; Telfair 1979
Green Heron	1	Based on life history	50	7 : 3 to 5 : 2	Clapp et al. 1982; Cooke 1938; Davis and Kushlan 1994; Palmer 1962
Black-crowned Night-Heron	1	Based on life history	50	21 : 3 to 5 : 1 to 2	Erwin et al. 1996; Bent 1926; Bergstrom 1951; Clapp et al. 1982; Custer and Davis 1982; Gross 1923; Houston 1974; Nickell 1966; Noble and Wurm 1942
Yellow-crowned Night-Heron	2	Based on life history	50	16 : 2 to 6 : 2	Bull 1974; Rodgers 1980a; Watts 1987; Wingate 1982
White Ibis	2	Based on life history	50	16 : 2 to 5 : 2	Allen-Grimes 1982; Clapp et al. 1982; Frederick and Collopy 1989; Heath et al. 2009a; Kushlan 1977; Rudegeair 1975; Shields 1985
Glossy Ibis	2	Based on life history	50	19 : 3 to 4 : 2 to 3	Bent 1926; Byrd 1978; Clapp et al. 1982; Miller and Burger 1978; Rydzewski 1973
Roseate Spoonbill	4	Based on life history	50	7 : 1 to 5 : 3	Allen 1942; Bjork and Powell 1994; Chaney et al. 1978; Telfair and Swepston 1987; White et al. 1982

Table A–6. (continued)

Common Name	*SR* Score	*SR* Range	*SR* % Uncertainty	*SR* Additional Data*	*SR* References
Osprey	4	0.83–0.90	50	25 : 2 to 4 : 3	Newton 1989; Poole 1984; Poole 1989; Spitzer 1980
Northern Harrier	3	0.72–0.93	50	16 : 3 to 6 : 1 to 2	Apfelbaum and Seelbach 1983; Hamerstrom et al. 1985; Hammond and Henry 1949; Kantrud and Higgins 1992; Keran 1981; Palmer 1988a; Robinson 2005; Simmons et al. 1986
Black Rail	2	Based on life history	50	3 : 4 to 13 to 1	Bent 1926; Clark 1884; Eddleman et al. 1994; Flores and Eddleman 1991; Legare 1994; Wayne 1910; WFVZ
Clapper Rail	2	Based on life history	50	7 : 2 to 16 : 1	Clapp et al. 1982; Rush et al. 2012; WFVZ
King Rail	2	Based on similar species	50	No data	Reid 1989
Virginia Rail	2	Based on similar species	50	No data	Kaufmann 1989; Pospichal and Marshall 1954
Sora	2	Based on similar species	50	No data	Billard 1948; Kaufmann 1989; Lowther 1977; Pospichal and Marshall 1954; Tanner and Hendrickson 1956; Walkinshaw 1940
Purple Gallinule	2	Based on similar species	50	No data	Bent 1926; West and Hess 2002
Common Gallinule	2	Based on life history	50	10 : 5 to 10 : 1	Brackney and Bookhout 1982; Byrd and Zeillemaker 1981; Clapp et al. 1982; Cottam and Glazener 1959; Greij 1994; Helm et al. 1987; USGS and CWS
American Coot	2	Based on life history	50	22 : 5 to 10 : 1	Brisbin et al. 2002; Crawford 1980a; Hill 1988; Klimkiewicz and Futcher 1989
Black-bellied Plover	2	Based on life history	50	12 : 4 : 2	Burger and Olla 1984b; Clapp et al. 1982; Glutz von Blotzheim et al. 1975; Holland 1992; WFVZ
American Golden-Plover	2	Based on life history	50	13 : 4 : 1	Jehl and Smith 1970; Johnson 2010; Johnson and Connors 2010; Johnson et al. 2007; Moitoret et al. 1996; Parmelee et al. 1967
Wilson's Plover	2	Based on similar species	50	No data	Bergstrom 1988; Corbat 1990

Table A–6. (continued)

Common Name	*SR* Score	*SR* Range	*SR* % Uncertainty	*SR* Additional Data*	*SR* References
Semipalmated Plover	1	0.60–0.71	25	9 : 2 to 4 : 2 to 3	Flynn 1997; Flynn et al. 1999; Nol 1999; Nol and Blanken 1999; Nol et al. 1997
Piping Plover	1	0.664–0.731	25	11 : 4 : 1	Elliott-Smith and Haig 2004; Larson et al. 2000; Root et al. 1992; Wemmer et al. 2001; Wilcox 1959
Killdeer	2	Based on life history and similar species	50	11 : 4 : 1	Clapp et al. 1982; Jackson 2000; Miller 1933; Nickell 1943; Stone 1937
American Oystercatcher	4	0.50–0.90	50	17 : 1 to 6 : 3	McGowan 2004; Nol 1985; Nol 2012; Nol et al. 1984; Sabine et al. 2006; Smallwood 2002; Smallwood and Bird 2002; Zaradusky 1985
Black-necked Stilt	2	Based on life history and similar species	50	10 : 2 to 6 : 1 to 2	Coleman 1981; Grant 1982; James 1995; Reed 1999; Robinson et al. 1997; Robinson et al. 1999; Sordahl 1984; Ueoka et al. 1976
American Avocet	2	Based on life history and similar species	50	9 : 3 to 4 : 1 to 2	Robinson and Oring 1997; Robinson et al. 1997; Rydzewski 1978; Sordahl 1996; USGS and CWS
Spotted Sandpiper	2	Based on life history and similar species	50	12 : 4 : 1	Cialdini and Orians 1944; Clapp et al. 1982; Oring et al. 1991
Solitary Sandpiper	2	Based on similar species	50	No data	Bent 1929; Peck and James 1983
Greater Yellowlegs	4	Based on similar species	50	No data	Campbell et al. 1990b
Willet	4	0.76–0.96	50	10 : 4 : nd	Gratto-Trevor 2001; Howe 1982; Kantrud and Higgins 1992; Klimkiewicz 1997

Table A–6. (continued)

Common Name	*SR* Score	*SR* Range	*SR* % Uncertainty	*SR* Additional Data*	*SR* References
Lesser Yellowlegs	4	Based on life history and similar species	50	4 : 4 : 1 to 2	Bannerman 1961; Clapp et al. 1982; Tibbitts 1999
Upland Sandpiper	4	Based on life history and similar species	50	8 : 4 : nd	Ailes 1980; Bowen 1976; Bowen and Kruse 1993; Buhnerkempe and Westemeier 1988; Buss and Hawkins 1939; Dorio 1977; Higgins and Kirsch 1975; Houston et al. 1999; Jackson 2003
Whimbrel	4	Based on life history and similar species	50	12 : 2 to 4 : 3	Cramp and Simmons 1983; Grant 1991; Larsen and Moldsvor 1992; Pulliainen and Saari 1993; Skeel 1983; Skeel 1996; Skeel and Mallory 1996; Williamson 1946
Hudsonian Godwit	4	0.87–0.96 based on Marbled Godwit	25	29 : 2 to 4 : 2	Colwell et al. 1995; Cramp and Simmons 1983; Gratto-Trevor 2000; Haverschmidt 1963
Marbled Godwit	2	0.87–0.96	25	29 : 4 : nd	Colwell et al. 1995; Gratto-Trevor 2000
Ruddy Turnstone	2	0.664–0.85	50	19 : 4 : 2	Bent 1929; Bergman 1946; Bianki 1967; Boyd 1962a; Johnson 1979; Kessel 1989; Manniche 1910; Meltofte 1985; Metcalfe and Furness 1985; Nettleship 1973; Parmelee and MacDonald 1960; Parmelee et al. 1967; Rydzewski 1978; Thompson 1973
Red Knot	2	0.51–0.87	50	10 : 4 : 2	Harrington 2001; Johnson 1979; Parmelee and MacDonald 1960; Pollock et al. 1990
Sanderling	3	0.69–0.92	50	13 : 4 : 2	Boates and McNeil 1984; Burger and Olla 1984a; Meltofte 1985; Parmelee 1970
Semipalmated Sandpiper	1	0.7	50	17 : 4 : 1 to 3	Gratto 1988; Gratto et al. 1983; Gratto et al. 1985; Gratto-Trevor and Vacek 2001; Jehl 2007; Maclean 1972; Safriel 1971
Western Sandpiper	2	Based on life history	50	9 : 4 to 5 : 2	Bent 1927; Safriel 1971; USGS and CWS

Table A–6. (continued)

Common Name	*SR* Score	*SR* Range	*SR* % Uncertainty	*SR* Additional Data*	*SR* References
Least Sandpiper	1	Based on life history and similar species	50	16 : 4 : 1	Cooper 1993; Jehl 1970; Jehl and Smith 1970; Miller 1979; Miller and McNeil 1988; Philipp 1925
White-rumped Sandpiper	1	Based on life history and similar species	50	nd : 4 : 1	Parmelee 1992; Parmelee et al. 1968
Baird's Sandpiper	1	Based on life history and similar species	50	nd : 4 : 1	Norton 1973; Parmelee et al. 1967
Pectoral Sandpiper	1	Based on life history and similar species	50	nd : 4 : 1	Holmes and Pitelka 1998; Moitoret et al. 1996
Purple Sandpiper	2	Based on life history and similar species	50	20 : 3 to 4 : 1 to 2	Burton and Evans 1997; Løvenskiold 1964; Payne and Pierce 2002; Pierce 1993; Summers et al. 1987; Swanberg 1945
Dunlin	2	Based on life history and similar species	50	9 : 4 : 1 to 2	Jackson 1994; Jönsson 1991; Norton 1972; Soikkeli 1967; Stiefel and Scheufler 1989
Stilt Sandpiper	2	Based on life history and similar species	50	9 : 4 : 2	Clapp et al. 1982; Klima and Jehl 2012
Buff-breasted Sandpiper	1	Based on life history and similar species	50	nd : 4 : 1	Lanctot and Laredo 1994; Pruett-Jones 1988

Table A–6. (continued)

Common Name	*SR* Score	*SR* Range	*SR* % Uncertainty	*SR* Additional Data*	*SR* References
Short-billed Dowitcher	2	Based on life history and similar species	50	13 : 4 : 1 to 2	Jehl et al. 2001; Klimkiewicz and Futcher 1989; Randall 1961
Long-billed Dowitcher	2	Based on life history and similar species	50	7 : 4 : nd	Brandt 1943; Kessel 1989; Moitoret et al. 1996; USGS and CWS
Wilson's Snipe	2	Based on life history and similar species	50	12 : 4 : 1	Mueller 1999; Tuck 1972; WFVZ 2013
American Woodcock	2	Based on life history and similar species	50	8 : 4 : 1	Causey et al. 1974; Critcher and Quay 1953; Dwyer et al. 1982; Gates 1973; Gregg 1984; Keppie and Whiting 1994; Kock 1976; Mendall and Aldous 1943; Mosier and Martin 1980; Pettingill 1936; Pitts 1978; Sheldon 1967; Taylor 1977; Whitcomb 1974; Whiting and Boggus 1982
Red-necked Phalarope	1	Age of first breeding 1 year implies relatively low adult surivival compared to other marine birds	25	10 : 4 : 1	Hildén and Vuolanto 1972; Murphy 1981; Reynolds 1987; Sandercock 1997; Schamel and Tracy 1991
Red Phalarope	1	0.70 based on Red–necked Phalarope	25	6 : 4 : 1	Gillandt 1974; Tracy and Schamel 2002; Tracy et al. 2002; Whitfield 1995

Table A–6. (continued)

Common Name	*SR* Score	*SR* Range	*SR* % Uncertainty	*SR* Additional Data*	*SR* References
Black-legged Kittiwake	3	0.42–0.98	25	13 : 1 to 3 : 5	Aebischer and Coulson 1990; Coulson and Strowger 1999; Danchin and Monnat 1992; Frederiksen et al. 2005; Hatch et al. 1993; Hatch et al. 2009; Jacobsen et al. 1995; Oro and Furness 2002; Suryan et al. 2000
Sabine's Gull	3	Based on life history and similar species	50	nd : 2 to 3 : 2	Day et al. 2001; Forchhammer and Maagaard 1991; Hurley 1931; Kessel 1989; Parmelee et al. 1967; Reed 1986; Stenhouse et al. 2001; Sutton 1932
Bonaparte's Gull	3	Based on life history and similar species	50	nd : 2 to 3 : 2	Burger and Gochfeld 2002; Campbell et al. 1990b
Black-headed Gull	3	0.76–0.9	50	29 : 2 to 3 : 2	Flegg and Cox 1975; Glutz vonBlotzheim andBauer 1982; Prevot-Julliard et al. 1998; Robinson 2005
Little Gull	3	Based on life history and similar species	50	nd : 2 to 3 : 2 to 3	Berg 1937; Erdman 1976; Haverschmidt 1946; Scharf et al. 1979; Schladweiler 1986; Veen 1980; Weseloh 1994
Laughing Gull	3	Based on life history and similar species	50	19 : 2 to 4 : 3	Burger 1996; Dinsmore and Schreiber 1974; Montevecchi 1978; Morris 1984; Schreiber et al. 1979
Ring-billed Gull	3	Based on similar species	50	31 : 2 to 4 : 2	Farrand 1988; Ludwig 1964; Palmer and Fowler 1975; Pollet et al. 2012; Ryder 2012; Southern 1975
Herring Gull	5	0.88–0.93	50	30 : 3 : 5	Chabrzyk and Coulson 1976; Coulson and Butterfield 1986; Davis 1975; Glutz vonBlotzheim andBauer 1982; Harris 1970; Parsons 1971; Paynter 1966; Pierotti 1982; Terres 1980; Tinbergen 1960; Wanless et al. 1996

Table A–6. (continued)

Common Name	*SR* Score	*SR* Range	*SR* % Uncertainty	*SR* Additional Data*	*SR* References
Iceland Gull	5	Based on life history and similar species	50	nd : 2 to 3 : 4 to 5	Gaston et al. 1985; Salomonsen 1951; Snell 2002
Lesser Black-backed Gull	5	0.93	25	34 : 3 : 4	Robinson 2005; Wanless et al. 1996
Glaucous Gull	5	Based on life history and similar species	50	22 : 3 : 4 to 5	Gaston et al. 2009; Lyngs 2003; Uspenski 1958
Great Black-backed Gull	5	0.93	25	19 : 3 : 4 to 5	Cramp and Simmons 1983; Glutz von Blotzheim and Bauer 1982; Good 1998; Terres 1980
Brown Noddy	5	Based on life history and similar species	50	17 : 1 : 3 to 7	Brown and Robertson 1975; Chardine and Morris 1996; Clapp et al. 1982
Sooty Tern	5	Based on life history and similar species	50	34 : 1 : 4 to 5	Ashmole 1963; Cossee 1995; Harrington 1974; Terres 1982
Bridled Tern	5	Based on life history and similar species	50	14 : 1 : 4	Archer and Godman 1937; Clapp et al. 1983a; Diamond 1976; Dunlop and Jenkins 1994; Higgins and Davies 1996
Least Tern	4	Based on life history and similar species	50	24 : 2 to 3 : 3	Burger 1989; Corbat 1990; Klimkiewicz and Futcher 1989; Massey 1973; Massey 1974; Massey and Atwood 1981; Roche 1979
Gull-billed Tern	5	Based on life history and similar species	50	16 : 2 to 4 : 5	Molina et al. 2009; Møller 1975; Møller 1981; Rydzewski 1978; Stadtlander 1994

Table A–6. (continued)

Common Name	*SR* Score	*SR* Range	*SR* % Uncertainty	*SR* Additional Data*	*SR* References
Caspian Tern	4	Based on life history and similar species	50	20 : 1 to 3 : 3	Bent 1921; Bergstrom 1952; Clapp et al. 1983a; Gill and Mewaldt 1983; Ludwig 1942; Ludwig 1965
Black Tern	4	0.87	50	17 : 1 to 3 : 2	Bergman et al. 1970; Campbell et al. 1990b; Cramp 1985; Firstencel 1987; Goodwin 1960; Maxson 1993; Mosher 1986; Mossman 1980; Mossman 1981; Peck and James 1983; Servello 2000; van Rossem 1923
Roseate Tern	4	0.83–0.855	25	25 : 1 to 4 : 3	Eadie et al. 1995; Nisbet 1984; Nisbet 1988; Nisbet 1989; Nisbet 1998; Nisbet and Spendelow 1999; Ratcliffe et al. 2008; Safina et al. 1990
Common Tern	4	0.88–0.9	25	26 : 2 to 3 : 3	Anderson 2002; Austin and Austin 1956; Becker and Ludwigs 2004; Burger and Gochfeld 1991; Chapdelaine et al. 1985; Gochfeld and Ford 1974; Hall 1999; Morris et al. 1976; Nisbet 2002; Nisbet and Cam 2002; Nisbet and Drury 1972; Safina et al. 1989
Arctic Tern	4	0.875–0.9	25	34 : 1 to 3 : 2 to 4	Balmer and Peach 1997; Cullen 1956; Hatch 1974; Hatch 2002; Hawksley 1957
Forster's Tern	3	Based on life history and similar species	50	12 : 2 to 4 : 2	Bent 1921; Klimkiewicz and Futcher 1989; McNicholl 1971; Mcnicholl et al. 2001; Rockwell 1911
Royal Tern	5	Based on life history and similar species	50	28 : 1 : 2 to 6	Buckley and Buckley 1972; Buckley and Buckley 1976; Buckley and Buckley 2002
Sandwich Tern	4	0.898	25	23 : 1 to 2 : 4	Blus et al. 1979; Cramp 1985; Mathiasson 1980; Smith 1975

Table A–6. (continued)

Common Name	*SR* Score	*SR* Range	*SR* % Uncertainty	*SR* Additional Data*	*SR* References
Black Skimmer	3	Based on life history and similar species	50	20 : 1 to 5 : 2 to 3	Clapp et al. 1982; Gochfeld 1994; Gochfeld and Burger 1994
Great Skua	4	0.89–0.9	10	34 : 2 : 7	Ratcliffe et al. 2002; Robinson 2005
South Polar Skua	5	No Data	25	nd : 3 : 7 to 9	Ainley et al. 1990
Pomarine Jaeger	4	0.89	50	nd : 2 : 2 to 4	Maher 1974; Pitelka et al. 1955; Wiley and Lee 2000
Parasitic Jaeger	4	Based on life history and similar species	25	18 : 2 : 3 to 4	Cramp and Simmons 1983; Maher 1974; O'Donald 1983
Long-tailed Jaeger	4	0.9	25	8 : 2 : 3 to 5	Clapp et al. 1982; Wiley and Lee 1998
Dovekie	3	Based on life history and similar species	50	nd : 1 : 2 to 3	Montevecchi and Stenhouse 2002; Norderhaug 1980
Common Murre	3	Based on life history	50	26 : 1 : 3 to 4	Boekelheide et al. 1990; Clapp et al. 1982; Harris et al. 1994; Swann and Ramsay 1983; Wanless and Harris 1988
Thick-billed Murre	5	0.87–0.90	25	29 : 1 : 5 to 6	Gaston and Hipfner 2000; Gaston et al. 1994; Kampp 1991
Razorbill	5	0.9–0.905	10	41 : 2 : 4	Chapdelaine 1997; Lavers et al. 2009; Lloyd and Perrins 1977; Seabird Group Newsletter 2009
Black Guillemot	4	0.86–0.87	25	21 : 2 : 4	Frederiksen 1998; Frederiksen andPetersen 1999; Petersen 1981
Atlantic Puffin	5	0.924–0.95	10	31 : 1 : 4 to 5	Harris 1984; Harris et al. 1997; Klimkiewicz 2002; Kress and Nettleship 1988; Lowther et al. 2002; Petersen 1976
American Kestrel	1	0.55	50	11 : 5 : 1	Clapp et al. 1982; Henny 1972; Smallwood 2002; Smallwood and Bird 2002

Table A–6. (continued)

Common Name	*SR* Score	*SR* Range	*SR* % Uncertainty	*SR* Additional Data*	*SR* References
Merlin	1	0.51–0.73	10	8 : 1 to 8 : 1	Espie et al. 2000; James et al. 1989; Lieske et al. 1997; Lieske et al. 2000; Oliphant et al. 1993; Sodhi et al. 1992
Peregrine Falcon	4	0.80–0.90	50	20 : 3 to 4 : 1 to 2	Hickey 1969; Nelson 1988; Nelson 1990; Palmer 1988b; Tordoff and Redig 1997; Wendt and Septon 1991; White et al. 2002
Barn Swallow	1	Based on life history	25	8 : 4 to 5 : 1	Brown and Brown 1999; Clapp et al. 1983b; Shields 1987
Blue-gray Gnatcatcher	1	0.477–0.717	10	4 : 3 to 5 : 1	Kershner and Ellison 2012; Klimkiewicz et al. 1983; Michel et al. 2006
Bicknell's Thrush	1	Based on life history	10	7 to 8 : 3 to 4 : 1	Rimmer et al. 2001; Wallace 1939
Ovenbird	1	Based on life history	10	11 : 3 to 6 : 1	Bent 1953; Laughlin and Kibbe 1985; Michel et al. 2006; Porneluzi et al. 2011; USGS and CWS
Northern Waterthrush	1	Based on life history	50	8 : 1 to 5 : 1	Eaton 1995; Klimkiewicz and Futcher 1989; Peck and James 1987; Roberts 1971
Common Yellowthroat	1	Based on life history	50	11 : 4 to 6 : 1	Guzy and Ritchison 1999; Hofslund 1959; Klicka 1994; Klimkiewicz 1997
American Redstart	1	Based on life history	50	10 : 4 to 5 : 1	Baker 1944; Bent 1953; Klimkiewicz et al. 1983; Nichols 1981; Peck and James 1987; Sherry 1997; Sherry and Holmes 1997; Sturm 1945
Kirtland's Warbler	1	0.65	10	9 : 3 to 6 : 1	Mayfield 1960; Mayfield 1992; Walkinshaw 1983
Cape May Warbler	1	Based on life history	50	4 : 4 to 9 : 1	Baltz and Latta 1998; Bent 1953; Klimkiewicz et al. 1983; MacArthur 1958
Northern Parula	1	Based on life history	10	7 : 4 to 7 : 1	Faaborg and Arnendt 1984; Michel et al. 2006; Moldenhauer and Regelski 2012
Blackburnian Warbler	1	Based on life history	25	8 : 4 to 5 : nd	Bent 1953; Klimkiewicz and Futcher 1989; MacArthur 1958; Morse 1989; Peck and James 1989; Roberts 1971
Blackpoll Warbler	1	Based on life history	25	8 : 3 to 5 : 2	Eliason 1986; Eliason 2013; Hunt 2013; Klimkiewicz et al. 1983

Table A–6. (continued)

Common Name	*SR* Score	*SR* Range	*SR* % Uncertainty	*SR* Additional Data*	*SR* References
Palm Warbler	1	Based on life history	25	6 : 4 to 5 : nd	Klimkiewicz et al. 1983; Knight 1904; Knight 1908; Tufts 1986; Walkinshaw and Wolf 1957; Welsh 1971
Yellow-rumped Warbler	1	Based on life history	25	7 : 4 to 5 : nd	Harrison 1975; Hunt and Flaspohler 1998; Jewett et al. 1953; Peck and James 1987; Stewart 1988
Canada Warbler	1	Based on life history	25	7 : 4 to 5 : 1	Hallworth et al. 2008a; Hallworth et al. 2008b; Klimkiewicz et al. 1983; Reitsma et al. 2008; Reitsma et al. 2010
Chipping Sparrow	1	Based on life history	25	9 : 3 to 4 : 1	Middleton 1998; Terres 1980
Savannah Sparrow	1	0.28–0.70	10	8 : 2 to 6 : 1	Bedard and Lapointe 1984; Bellrose 1976; Dixon 1972; Odum and Hight 1957; Potter 1974; Stobo and McLaren 1975; Wheelwright 2008; Wheelwright and Rising 2008; Wheelwright and Schultz 1994; Wheelwright et al. 1992
Song Sparrow	1	Based on life history	25	9 : 3 to 5 : 1	Arcese et al. 2002; Clutton-Brock 1988; Halliburton and Mewaldt 1976; Hochachka et al. 1989; Johnston 1956a; Johnston 1956b; Marr 2002; Marr et al. 2002; Newton 1989; Nice 1937; Nice 1943; Sogge and Riper III 1988; Tompa 1964
White-throated Sparrow	1	0.26–0.47	10	9 : 4 to 5 : 1	Falls and Kopachena 2010; Klimkiewicz and Futcher 1987; Michel et al. 2006; Peck and James 1987
Indigo Bunting	1	0.34–0.61	10	11 : 3 to 4 : 1	Blohm 1979; Leberman et al. 1985; Newton 1989; Payne 2006; Payne and Payne 1990
Baltimore Oriole	1	Based on life history	25	11 : 3 to 6 : 1	Flood 1980; Klimkiewicz et al. 1987; Rising and Flood 1998; Sealy 1979
American Goldfinch	1	Based on life history	25	11 : 4 to 6 : 1	Jacobsen 1990; Middleton 1979; Middleton and Webb 1984

*(max life expectancy : clutch size : age before breeding)

Table A–7.

Annual occurrence (*AO*) and references.

Common Name	Months Potentially in AOCS	*AO* Hours on AOCS	*AO* Potential Months Reference
Snow Goose	Oct–Apr	2	eBird 2013
Brant	Oct–Apr	2	eBird 2013; Reed et al. 1998
Canada Goose	Oct–May	2	eBird 2013; Mowbray et al. 2002
Tundra Swan	Nov–Mar	2	eBird 2013
Wood Duck	All	2	eBird 2013
Gadwall	Sep–May	2	eBird 2013
American Wigeon	Sep–Apr	2	eBird 2013
American Black Duck	All	2	eBird 2013
Mallard	All	2	eBird 2013
Blue-winged Teal	Mar–Nov	2	eBird 2013
Northern Shoveler	Oct–Apr	2	eBird 2013
Northern Pintail	Oct–Apr	2	eBird 2013
Green-winged Teal	Mar–May Aug–Dec	2	eBird 2013
Canvasback	Oct–Nov Mar–Apr	2	eBird 2013
Redhead	Nov–Mar	2	eBird 2013
Ring-necked Duck	Oct–Apr	2	eBird 2013
Greater Scaup	Sep–May	6480	eBird 2013
Lesser Scaup	Sep–May	6480	eBird 2013
King Eider	Oct–Mar	4320	eBird 2013
Common Eider	All	8760	eBird 2013
Harlequin Duck	Nov–Mar	1800	eBird 2013
Surf Scoter	Sep–May	6480	eBird 2013
White-winged Scoter	Sep–May	6480	Brown and Fredrickson 1997
Black Scoter	Sep–May	6480	Bordage and Savard 2011
Long-tailed Duck	Oct–May	5760	eBird 2013

Table A–7. (continued)

Common Name	Months Potentially in AOCS	*AO* Hours on AOCS	*AO* Potential Months Reference
Bufflehead	Oct–May	5760	eBird 2013
Common Goldeneye	Nov–Apr	2	eBird 2013
Barrow's Goldeneye	Oct–Apr	2	eBird 2013
Hooded Merganser	All	2	eBird 2013
Common Merganser	Nov–Apr	4320	Mallory and Metz 1999
Red-breasted Merganser	Oct–May	5760	eBird 2013; Titman 1999
Ruddy Duck	Oct–Apr	2	eBird 2013
Red-throated Loon	Oct–May	5760	eBird 2013
Common Loon	Sep–May	6480	eBird 2013
Pied-billed Grebe	All	12	eBird 2013
Horned Grebe	Oct–Apr	5040	eBird 2013
Red-necked Grebe	Oct–Apr	5040	eBird 2013
Northern Fulmar	All	8760	eBird 2013
Bermuda Petrel	May–Sep	3960	eBird 2013
Black-capped Petrel	All	8760	Howell 2012; Lee 1986
Cory's Shearwater	May–Nov	5040	Howell 2012
Great Shearwater	May–Nov	5040	Howell 2012
Sooty Shearwater	May–Nov	5040	Howell 2012
Manx Shearwater	All	8760	Howell 2012
Audubon's Shearwater	Apr–Oct	5040	Howell 2012
Wilson's Storm-Petrel	Apr–Oct	5040	Howell 2012
Leach's Storm-Petrel	May–Oct	4320	Howell 2012
Band-rumped Storm-Petrel	Apr–Sep	4320	Howell 2012
White-tailed Tropicbird	May–Sep	3600	Lee and Walsh-Mcgehee 1998
Red-billed Tropicbird	Mar–Nov	6480	eBird 2013
Brown Booby	All	4320	eBird 2013
Northern Gannet	All	8760	eBird 2013
Double-crested Cormorant	All	4320	eBird 2013
Great Cormorant	All	8760	eBird 2013
Brown Pelican	All	4320	eBird 2013

Table A–7. (continued)

Common Name	Months Potentially in AOCS	*AO* Hours on AOCS	*AO* Potential Months Reference
American Bittern	Mar–Nov	4	Lowther et al. 2009
Least Bittern	Apr–Sep	4	eBird 2013
Great Blue Heron	All	4	eBird 2013
Great Egret	All	4	eBird 2013
Snowy Egret	Mar–Nov	4	Parsons and Master 2000
Little Blue Heron	Apr–Sep	4	eBird 2013
Tricolored Heron	May–Sep	4	eBird 2013
Green Heron	Apr–Oct	4	eBird 2013
Black-crowned Night-Heron	Apr–Nov	4	eBird 2013
Yellow-crowned Night-Heron	Apr–Oct	4	eBird 2013
White Ibis	Mar–Nov	4	eBird 2013
Glossy Ibis	Apr–Oct	4	eBird 2013
Roseate Spoonbill	Mar–Nov	4	Dumas 2000
Osprey	All	4	eBird 2013; Poole et al. 2002
Northern Harrier	Mar–Apr Aug–Nov	4	Smith et al. 2011
Black Rail	Mar–May Sep–Nov	5	Eddleman et al. 1994
Clapper Rail	Apr–Oct	5	eBird 2013
King Rail	Apr–Sep	5	eBird 2013
Virginia Rail	Apr–Sep	5	eBird 2013
Sora	Apr–Oct	5	eBird 2013
Purple Gallinule	Arp–Oct	5	West and Hess 2002
Common Gallinule	Apr–Oct	5	eBird 2013
American Coot	Arp–Oct	5	Brisbin et al. 2002
Black-bellied Plover	Apr–May Jul–Nov	15	eBird 2013; Lincoln et al. 1998
American Golden-Plover	Aug–Oct	15	eBird 2013
Wilson's Plover	Mar–May Aug–Oct	15	Corbat and Berstrom 2000
Semipalmated Plover	Mar–Nov	15	Nol and Blanken 1999

Table A–7. (continued)

Common Name	Months Potentially in AOCS	*AO* Hours on AOCS	*AO* Potential Months Reference
Piping Plover	Mar–Apr Jul–Oct	15	Elliott-Smith and Haig 2004; Lincoln et al. 1998
Killdeer	Feb–Apr Aug–Nov	15	Jackson and Jackson 2000
American Oystercatcher	Feb–Jun Aug–Nov	15	AOWG et al. 2012
Black-necked Stilt	Feb–Jun Aug–Oct	15	Robinson et al. 1999
American Avocet	Feb–Oct	15	Robinson et al. 1997
Spotted Sandpiper	Mar–Oct	15	Reed et al. 2013
Solitary Sandpiper	Mar–May Jul–Oct	15	Moskoff 2011
Greater Yellowlegs	Feb–Oct	15	Elphick and Tibbitts 1998
Willet	Mar–May Jul–Oct	15	Lowther et al. 2001
Lesser Yellowlegs	Mar–May Jul–Sep	15	Tibbitts and Moskoff 1999
Upland Sandpiper	Feb–May Jul–Aug	15	Houston et al. 2011
Whimbrel	Mar–Apr Jul–Oct	15	Harrington 2001; Lincoln et al. 1998; Skeel and Mallory 1996
Hudsonian Godwit	Jul–Sep	15	eBird 2013
Marbled Godwit	Mar–May Jul–Dec	15	O'Brien et al. 2006
Ruddy Turnstone	Mar–May Jul–Oct	15	eBird 2013
Red Knot	Apr–Oct	15	Harrington 2001; Lincoln et al. 1998
Sanderling	Mar–Oct	15	Macwhirter et al. 2002
Semipalmated Sandpiper	Apr–Oct	15	Hicklin and Gratto-Trevor 2010
Western Sandpiper	Mar–Oct	15	Wilson 1994
Least Sandpiper	Apr–Sep	15	Nebel and Cooper 2008
White-rumped Sandpiper	May–Nov	15	eBird 2013

Table A–7. (continued)

Common Name	Months Potentially in AOCS	*AO* Hours on AOCS	*AO* Potential Months Reference
Baird's Sandpiper	Aug–Sep	15	eBird 2013
Pectoral Sandpiper	Apr–May Jul–Oct	15	eBird 2013
Purple Sandpiper	Nov–Mar	15	eBird 2013
Dunlin	Mar–Nov	15	Warnock and Gill 1996
Stilt Sandpiper	Jul–Sep	15	Klima and Jehl 2012
Buff-breasted Sandpiper	Aug–Sep	15	eBird 2013
Short-billed Dowitcher	Mar–Oct	15	Jehl et al. 2001
Long-billed Dowitcher	Mar–May Jul–Nov	15	Takekawa and Warnock 2000
Wilson's Snipe	Feb–Jun Aug–Nov	15	Mueller 1999
American Woodcock	Feb–Apr Sep–Nov	15	Keppie and Whiting 1994
Red-necked Phalarope	Apr–Nov	5760	eBird 2013
Red Phalarope	Aug–May	7200	eBird 2013
Black-legged Kittiwake	Nov–Mar	3600	Hatch et al. 2009
Sabine's Gull	Jul–Dec	4320	Day et al. 2001
Bonaparte's Gull	Mar–May Jul–Dec	20	Burger and Gochfeld 2002
Black-headed Gull	Oct–Apr	20	Howell 2012
Little Gull	Nov–Apr	20	Howell 2012
Laughing Gull	All	8760	eBird 2013
Ring-billed Gull	All	20	eBird 2013
Herring Gull	All	8760	Pierotti and Good 1994
Iceland Gull	All	8760	Snell 2002
Lesser Black-backed Gull	Aug–Apr	6480	Howell 2012
Glaucous Gull	Nov–Apr	4320	eBird 2013
Great Black-backed Gull	All	8760	Good 1998
Brown Noddy	Mar–Aug	2160	eBird 2013
Sooty Tern	Feb–Sep	5760	eBird 2013
Bridled Tern	Apr–Nov	5760	eBird 2013

Table A–7. (continued)

Common Name	Months Potentially in AOCS	*AO* Hours on AOCS	*AO* Potential Months Reference
Least Tern	Mar–Sep	20	eBird 2013
Gull-billed Tern	Mar–Dec	20	Molina et al. 2009
Caspian Tern	Apr–May Jul–Oct	20	Cuthbert and Wires 1999
Black Tern	Apr–Oct	5040	eBird 2013
Roseate Tern	Mar–Oct	5760	Gochfeld et al. 1998
Common Tern	Apr–Nov	5760	eBird 2013
Arctic Tern	Apr–Sep	4320	eBird 2013
Forster's Tern	Sep–May	20	Mcnicholl et al. 2001
Royal Tern	All	20	Buckley and Buckley 2002
Sandwich Tern	Mar–May Jul–Nov	20	Shealer 1999
Black Skimmer	All	20	Gochfeld and Burger 1994
Great Skua	Aug–Feb	5040	eBird 2013
South Polar Skua	May–Nov	5040	eBird 2013
Pomarine Jaeger	May–Dec	5760	eBird 2013
Parasitic Jaeger	Apr–Dec	6480	Wiley and Lee 1999
Long-tailed Jaeger	May–Nov	5040	eBird 2013
Dovekie	Oct–Mar	4320	eBird 2013
Common Murre	All	8760	Ainley et al. 2002
Thick-billed Murre	All	8760	Gaston and Hipfner 2000
Razorbill	All	8760	Lavers et al. 2009
Black Guillemot	All	8760	Butler and Buckley 2002
Atlantic Puffin	All	8760	Lowther et al. 2002
American Kestrel	Mar–May Aug–Nov	15	Smallwood and Bird 2002
Merlin	Feb–Apr Aug–Nov	15	Warkentin et al. 2005
Peregrine Falcon	Mar–Jun Sep–Dec	15	White et al. 2002
Barn Swallow	All	20	eBird 2013; Williams et al. 1978

Table A–7. (continued)

Common Name	Months Potentially in AOCS	*AO* Hours on AOCS	*AO* Potential Months Reference
Blue-gray Gnatcatcher	Mar–May Aug–Oct	20	Kershner and Ellison 2012
Bicknell's Thrush	Nov–Apr	20	eBird 2013; Williams et al. 1978
Ovenbird	Apr–May Jul–Oct	20	Porneluzi et al. 2011
Northern Waterthrush	Mar–May Aug–Oct	20	eBird 2013
Common Yellowthroat	Apr–May Aug–Oct	20	Guzy and Ritchison 1999
American Redstart	Mar–Oct	20	Sherry and Holmes 1997
Kirtland's Warbler	Apr–May Aug–Oct	20	USFWS 2012; Williams et al. 1978
Cape May Warbler	Mar–May Sep–Oct	20	eBird 2013
Northern Parula	Feb–Nov	20	Moldenhauer and Regelski 2012
Blackburnian Warbler	Apr–Jun Aug–Nov	20	Morse 2004
Blackpoll Warbler	Apr–Jun Aug–Nov	20	eBird 2013; Williams et al. 1978
Palm Warbler	Mar–May Aug–Nov	20	Wilson 1996
Yellow-rumped Warbler	Sep–May	20	eBird 2013
Canada Warbler	Apr–May Aug–Oct	20	eBird 2013
Chipping Sparrow	Apr–May Sep–Nov	20	eBird 2013
Savannah Sparrow	Mar–Jun Aug–Nov	20	Wheelwright and Rising 2008
Song Sparrow	All	20	eBird 2013
White-throated Sparrow	Apr–May Sep–Nov	20	Falls and Kopachena 2010
Indigo Bunting	Apr–Jun Sep–Nov	20	Payne 2006

Table A–7. (continued)

Common Name	Months Potentially in AOCS	*AO* Hours on AOCS	*AO* Potential Months Reference
Baltimore Oriole	Apr–May Jul–Oct	20	Rising and Flood 1998
American Goldfinch	Sep–May	20	eBird 2013

Table A–8.

Nocturnal Flight Ranking (*NFR*) score, uncertainty, and references.

Common Name	*NFR* Score	*NFR* % Uncertainty	*NFR* Reference
Snow Goose	1	50	Based on similar species
Brant	1	50	Based on similar species
Canada Goose	3	50	Based on similar species
Tundra Swan	5	25	Sladen et al. 1969
Wood Duck	5	50	Hepp and Bellrose 1995
Gadwall	5	50	Bellrose 1980
American Wigeon	3	50	Palmer 1976
American Black Duck	5	50	Longcore et al. 2000
Mallard	1	25	Drilling et al. 2002
Blue-winged Teal	5	25	Bellrose 1980
Northern Shoveler	5	10	Dubowy 1996
Northern Pintail	5	10	Austin and Miller 1995
Green-winged Teal	5	25	Bellrose 1976
Canvasback	3	50	Based on similar species
Redhead	3	50	Adair 1990; Adair et al. 1996
Ring-necked Duck	5	10	Roy et al. 2012
Greater Scaup	5	25	Nilsson 1970
Lesser Scaup	5	10	Austin et al. 1998; Custer et al. 1996; Hochbaum 1955; Siegfried 1974
King Eider	5	25	Johnson 1971; Powell and Suydam 2012; Thompson and Person 1963; Timson 1976

Table A–8. (continued)

Common Name	*NFR* Score	*NFR* % Uncertainty	*NFR* Reference
Common Eider	3	10	Garthe and Hüppop 2004
Harlequin Duck	5	50	Based on similar species
Surf Scoter	3	50	Butler and Savard 1985
White-winged Scoter	3	50	Based on similar species
Black Scoter	3	50	Based on similar species
Long-tailed Duck	4	50	Savard 2002
Bufflehead	3	10	Gauthier 1993
Common Goldeneye	3	25	Palmer 1976
Barrow's Goldeneye	5	10	Eadie et al. 2000
Hooded Merganser	5	10	Bellrose 1976
Common Merganser	1	25	Anderson et al. 1973; Bellrose 1980; Huntington and Roberts 1959; Nilsson 1970; Sjöberg 1985; Sjöberg 1989; White 1957
Red-breasted Merganser	1	10	Cramp and Simmons 1977; del Hoyo et al. 1992
Ruddy Duck	5	10	Brua 2002
Red-throated Loon	1	25	Garthe and Hüppop 2004; Reimchen and Douglas 1984
Common Loon	1	50	Based on similar species
Pied-billed Grebe	1	25	Muller and Storer 1999
Horned Grebe	2	50	Based on similar species
Red-necked Grebe	1	50	Based on similar species
Northern Fulmar	4	25	Garthe and Hüppop 2004
Bermuda Petrel	5	50	Based on similar species
Black-capped Petrel	5	50	Based on similar species
Cory's Shearwater	3	25	Cramp and Simmons 1977; del Hoyo et al. 1992
Great Shearwater	3	50	Cramp and Simmons 1977; del Hoyo et al. 1992
Sooty Shearwater	3	25	Cramp and Simmons 1977; del Hoyo et al. 1992
Manx Shearwater	3	25	Cramp and Simmons 1977; del Hoyo et al. 1992

Table A–8. (continued)

Common Name	*NFR* Score	*NFR* % Uncertainty	*NFR* Reference
Audubon's Shearwater	3	50	Based on similar species
Wilson's Storm-Petrel	4	25	Cramp and Simmons 1977; del Hoyo et al. 1992
Leach's Storm-Petrel	4	25	Cramp and Simmons 1977; del Hoyo et al. 1992
Band-rumped Storm-Petrel	4	50	Harris 1969; Slotterback 2002
White-tailed Tropicbird	2	50	Based on similar species
Red-billed Tropicbird	2	50	Based on similar species
Brown Booby	2	50	Based on similar species
Northern Gannet	2	25	Garthe and Hüppop 2004; Garthe et al. 2012
Double-crested Cormorant	1	10	Mendall 1936; Nisbet and Baird 1959
Great Cormorant	1	25	Cramp and Simmons 1977; del Hoyo et al. 1992
Brown Pelican	1	25	Carroll and Cramer 1985; Jaques 1994; Palmer 1962; Robert and McNeil 1989; Schnell et al. 1983; Shields 2002
American Bittern	5	50	Based on similar species
Least Bittern	5	50	Based on similar species
Great Blue Heron	5	10	Palmer 1962
Great Egret	5	10	Mccrimmon et al. 2011
Snowy Egret	5	10	Brady 1990; Brady 1992
Little Blue Heron	5	50	Based on similar species
Tricolored Heron	5	50	Based on similar species
Green Heron	5	10	Bent 1926; Griscom 1923; Palmer 1962; Scott 1890
Black-crowned Night-Heron	5	10	Kushlan 1978; Kushlan and Hancock 2005; Wetmore 1920a; White 1947
Yellow-crowned Night-Heron	5	10	Laubhan et al. 1991; Watts 2011
White Ibis	5	10	Kushlan 1977
Glossy Ibis	5	10	Cramp and Simmons 1977; Davis and Kricher 2000
Roseate Spoonbill	5	50	Based on similar species

Table A–8. (continued)

Common Name	*NFR* Score	*NFR* % Uncertainty	*NFR* Reference
Osprey	5	50	Based on similar species
Northern Harrier	5	10	Beske 1982; Kerlinger 1989; Russell 1991
Black Rail	5	10	Eddleman et al. 1994
Clapper Rail	5	10	Crawford et al. 1983; Meanley 1985
King Rail	5	10	Poole et al. 2005
Virginia Rail	5	10	Conway 1995
Sora	5	10	Avery et al. 1976; Robbins 1991; Stoddard and Norris 1967
Purple Gallinule	5	10	Belton 1984; Crawford 1981; West 2002
Common Gallinule	5	10	Bullis and Lincoln 1952; Taylor and Anderson 1973
American Coot	5	10	Brisbin et al. 2002
Black-bellied Plover	5	50	Based on similar species
American Golden-Plover	5	10	Johnson 2010; Johnson and Connors 2010; Sauer 1962
Wilson's Plover	5	10	Corbat and Berstrom 2000
Semipalmated Plover	5	10	Bent 1929
Piping Plover	5	50	Based on similar species
Killdeer	5	10	Jackson and Jackson 2000
American Oystercatcher	5	50	Based on similar species
Black-necked Stilt	5	50	Based on similar species
American Avocet	5	50	Based on similar species
Spotted Sandpiper	5	10	Reed et al. 2013
Solitary Sandpiper	5	10	Johnsgard 1981
Greater Yellowlegs	5	10	Brady 1990; Brady 1992
Willet	5	10	Lowther et al. 2001
Lesser Yellowlegs	5	10	Brady 1990; Stone 1937; Tibbitts and Moskoff 1999; Wetmore 1927
Upland Sandpiper	5	10	Stout et al. 1967
Whimbrel	5	50	Based on similar species
Hudsonian Godwit	5	10	Hagar 1966

Table A–8. (continued)

Common Name	*NFR* Score	*NFR* % Uncertainty	*NFR* Reference
Marbled Godwit	5	50	Based on similar species
Ruddy Turnstone	5	50	Based on similar species
Red Knot	5	50	Based on similar species
Sanderling	5	10	Macwhirter et al. 2002
Semipalmated Sandpiper	5	10	Lank 1989
Western Sandpiper	5	50	Based on similar species
Least Sandpiper	5	50	Based on similar species
White-rumped Sandpiper	5	50	Based on similar species
Baird's Sandpiper	5	50	Based on similar species
Pectoral Sandpiper	5	50	Based on similar species
Purple Sandpiper	5	50	Based on similar species
Dunlin	5	50	Based on similar species
Stilt Sandpiper	5	10	Klima and Jehl 2012
Buff-breasted Sandpiper	5	10	Hall 1960; Oring 1964; Rowan 1927
Short-billed Dowitcher	5	10	Brady 1994
Long-billed Dowitcher	5	10	Takekawa and Warnock 2000
Wilson's Snipe	5	10	Mueller 1999
American Woodcock	5	10	Keppie and Whiting 1994
Red-necked Phalarope	2	50	Cramp and Simmons 1983; del Hoyo et al. 1992; Rubega 2000; Rubega et al. 2000
Red Phalarope	3	50	Based on similar species
Black-legged Kittiwake	3	25	Garthe and Hüppop 1996; Garthe and Hüppop 2004; Kotzerka et al. 2010
Sabine's Gull	2	50	Cramp and Simmons 1983; del Hoyo et al. 1992; Lambert 1973
Bonaparte's Gull	2	50	Based on similar species
Black-headed Gull	2	25	Garthe and Hüppop 2004
Little Gull	2	25	Garthe and Hüppop 2004
Laughing Gull	3	25	Burger 1996; Burger and Staine 1993
Ring-billed Gull	3	50	Based on similar species
Herring Gull	3	25	Garthe and Hüppop 1996; Garthe and Hüppop 2004

Table A–8. (continued)

Common Name	*NFR* Score	*NFR* % Uncertainty	*NFR* Reference
Iceland Gull	3	25	Cramp and Simmons 1983; del Hoyo et al. 1992
Lesser Black-backed Gull	3	25	Garthe and Hüppop 1996; Garthe and Hüppop 2004
Glaucous Gull	3	25	Cramp and Simmons 1983; del Hoyo et al. 1992
Great Black-backed Gull	3	25	Garthe and Hüppop 1996; Garthe and Hüppop 2004
Brown Noddy	5	25	Stevenson and Anderson 1994
Sooty Tern	5	50	Schreiber et al. 2002
Bridled Tern	5	25	van den Berg et al. 1982
Least Tern	1	50	Based on similar species
Gull-billed Tern	5	10	Molina et al. 2009
Caspian Tern	5	10	Cuthbert and Wires 1999
Black Tern	1	25	Cramp 1985; del Hoyo et al. 1992
Roseate Tern	1	25	Similar to other terns
Common Tern	1	25	Garthe and Hüppop 2004; Pearson 1968
Arctic Tern	1	25	Garthe and Hüppop 2004
Forster's Tern	5	25	Mcnicholl et al. 2001
Royal Tern	4	25	Bent 1921; Buckley and Buckley 2002
Sandwich Tern	1	25	Garthe and Hüppop 2004; Pearson 1968
Black Skimmer	3	50	Burger and Gochfeld 1990; Gochfeld and Burger 1994
Great Skua	1	10	Garthe and Hüppop 2004
South Polar Skua	1	50	Based on similar species
Pomarine Jaeger	1	25	Cramp and Simmons 1983; del Hoyo et al. 1992
Parasitic Jaeger	1	50	Based on similar species
Long-tailed Jaeger	1	25	Cramp and Simmons 1983; del Hoyo et al. 1992
Dovekie	1	10	Evans 1981

Table A–8. (continued)

Common Name	*NFR* Score	*NFR* % Uncertainty	*NFR* Reference
Common Murre	2	50	Based on similar species
Thick-billed Murre	1	50	Based on similar species
Razorbill	1	25	Garthe and Hüppop 2004; Lloyd 1976; Thaxter et al. 2010; Wanless and Harris 1986
Black Guillemot	1	25	Similar to other alcids
Atlantic Puffin	1	25	Garthe and Hüppop 2004
American Kestrel	2	50	Based on similar species
Merlin	3	25	Clark 1985
Peregrine Falcon	1	50	Based on similar species
Barn Swallow	3	50	Based on similar species
Blue-gray Gnatcatcher	5	50	Based on similar species
Bicknell's Thrush	5	50	Based on similar species
Ovenbird	5	10	Brewer and Ellis 1958; Dinsmore et al. 1987; Goodpasture 1987; Stoddard 1962; Taylor and Kershner 1986
Northern Waterthrush	5	10	Eaton 1995
Common Yellowthroat	5	10	Guzy and Ritchison 1999
American Redstart	5	10	Getty 1993; Post and Gauthreaux 1989; Robbins 1991; Stevenson and Anderson 1994
Kirtland's Warbler	5	50	Based on similar species
Cape May Warbler	5	50	Based on similar species
Northern Parula	5	10	Moldenhauer and Regelski 2012
Blackburnian Warbler	5	10	Hall 1981
Blackpoll Warbler	5	50	Based on similar species
Palm Warbler	5	10	Wilson 1996
Yellow-rumped Warbler	5	10	Hunt and Flaspohler 1998
Canada Warbler	5	10	Land 1970
Chipping Sparrow	5	10	Bradstreet and Woodford 1970; Jewett et al. 1953; Stevenson and Anderson 1994; Stull 1968
Savannah Sparrow	5	10	Wheelwright and Rising 2008

Table A–8. (continued)

Common Name	*NFR* Score	*NFR* % Uncertainty	*NFR* Reference
Song Sparrow	5	10	Brewer and Ellis 1958; Crawford 1980b; Helms 1959; Seets and Bohlen 1977
White-throated Sparrow	5	10	Falls and Kopachena 2010
Indigo Bunting	5	10	Payne 2006
Baltimore Oriole	5	10	Audubon 1967; Ball et al. 1995; Bent 1958; Brewer et al. 1991; Crawford 1978; Gauthreaux 1972; Rising 1998; Stoddard and Norris 1967; Strnad 1975
American Goldfinch	5	50	Based on similar species

Table A–9.

Diurnal Flight Ranking (*DFR*) score, uncertainty, and references.

Common Name	*DFR* Score	*DFR* % Uncertainty	*DFR* Reference
Snow Goose	1	10	Bellrose 1980; Davis et al. 1989; Palmer 1976
Brant	1	50	Based on similar species
Canada Goose	3	25	Bellrose 1980; Mowbray et al. 2002; Palmer 1976; Wege and Raveling 1983
Tundra Swan	5	25	Limpert and Earnst 1994; Sladen et al. 1969
Wood Duck	5	50	Hepp and Bellrose 1995
Gadwall	1	10	LeSchack 1993; Leschack et al. 1997; Paulus 1984
American Wigeon	5	10	Mowbray 1999; Palmer 1976
American Black Duck	1	10	Conomy 1993; Hepp 1982; Hickey and Titman 1983; Jorde 1986; Longcore et al. 2000; Morton et al. 1989
Mallard	3	25	Drilling et al. 2002
Blue-winged Teal	3	25	Bellrose 1980

Table A–9. (continued)

Common Name	*DFR* Score	*DFR* % Uncertainty	*DFR* Reference
Northern Shoveler	5	10	Dubowy 1996
Northern Pintail	1	10	Austin and Miller 1995
Green-winged Teal	2	25	Johnson 1995; Rave and Baldassarre 1989; Tamisier 1976
Canvasback	2	50	Howerter 1990; Thornburg 1973
Redhead	3	50	Adair et al. 1996; Michot et al. 1994; Mitchell et al. 1992; Vázquez et al. 1996; Woodin 1994
Ring-necked Duck	1	10	Bergan et al. 1989; Christopher and Hill 1988; Hohman 1984; Jeske and Percival 1995
Greater Scaup	2	25	Kessel et al. 2002
Lesser Scaup	1	10	Afton 1998; Austin 1983; Austin et al. 1998; Custer et al. 1996; Siegfried 1974
King Eider	5	25	Johnson 1971; Powell and Suydam 2012; Thompson and Person 1963; Timson 1976
Common Eider	2	10	Garthe and Hüppop 2004
Harlequin Duck	5	50	Based on similar species
Surf Scoter	2	50	Savard et al. 1998
White-winged Scoter	2	25	Brown and Fredrickson 1997; MacKay 1891
Black Scoter	3	50	Based on similar species
Long-tailed Duck	3	25	Bergman 1974; Palmer 1976; Woodby and Divoky 1982
Bufflehead	1	10	Gauthier 1993
Common Goldeneye	2	25	Palmer 1976
Barrow's Goldeneye	2	50	Based on similar species
Hooded Merganser	1	50	Based on similar species
Common Merganser	1	25	Anderson et al. 1973; Bellrose 1980; Huntington and Roberts 1959; Nilsson 1970; Sjöberg 1985; Sjöberg 1989; White 1957
Red-breasted Merganser	1	10	Similar to other ducks

Table A–9. (continued)

Common Name	*DFR* Score	*DFR* % Uncertainty	*DFR* Reference
Ruddy Duck	1	25	Bellrose 1957
Red-throated Loon	2	25	Garthe and Hüppop 2004
Common Loon	2	50	Based on similar species
Pied-billed Grebe	1	50	Based on similar species
Horned Grebe	2	50	Based on similar species
Red-necked Grebe	1	50	Based on similar species
Northern Fulmar	2	25	Garthe and Hüppop 2004
Bermuda Petrel	5	50	Based on similar species
Black-capped Petrel	5	50	Based on similar species
Cory's Shearwater	3	25	Similar to other shearwaters
Great Shearwater	3	25	Similar to other shearwaters
Sooty Shearwater	3	25	Cramp and Simmons 1977
Manx Shearwater	3	25	Cramp and Simmons 1977
Audubon's Shearwater	3	50	Based on similar species
Wilson's Storm-Petrel	3	25	Similar to other storm-petrels
Leach's Storm-Petrel	3	25	Cramp and Simmons 1977
Band-rumped Storm-Petrel	3	25	Harris 1977; Lee 1984
White-tailed Tropicbird	3	50	Based on similar species
Red-billed Tropicbird	5	50	Based on similar species
Brown Booby	3	50	Based on similar species
Northern Gannet	3	25	Garthe and Hüppop 2004
Double-crested Cormorant	5	10	Hatch and Weseloh 1999; Nisbet and Baird 1959
Great Cormorant	2	25	Garthe and Hüppop 2004
Brown Pelican	3	25	Briggs et al. 1983; Carroll and Cramer 1985; Croll et al. 1986; Palmer 1962; Schnell et al. 1983; Shields 2002
American Bittern	5	50	Based on similar species
Least Bittern	5	50	Based on similar species
Great Blue Heron	5	10	Palmer 1962
Great Egret	5	25	del Hoyo et al. 1992
Snowy Egret	5	50	Based on similar species

Table A–9. (continued)

Common Name	*DFR* Score	*DFR* % Uncertainty	*DFR* Reference
Little Blue Heron	5	10	Rodgers and Smith 2012
Tricolored Heron	5	50	Based on similar species
Green Heron	5	10	Bent 1926; Griscom 1923; Palmer 1962; Scott 1890
Black-crowned Night-Heron	5	10	Hothem et al. 2010
Yellow-crowned Night-Heron	5	10	Laubhan et al. 1991; Watts 2011
White Ibis	5	10	Kushlan 1977
Glossy Ibis	5	10	Cramp and Simmons 1977; Davis and Kricher 2000
Roseate Spoonbill	5	50	Based on similar species
Osprey	5	50	Based on similar species
Northern Harrier	5	10	Beske 1982; Bildstein 2011; Collopy and Bildstein 1987; Haugh and Cade 1966; Hoffman et al. 1992; Kerlinger 1989; Russell 1991; Smith et al. 2011; Swem 1985
Black Rail	5	50	Based on similar species
Clapper Rail	5	10	Rush et al. 2012
King Rail	5	10	Poole et al. 2005
Virginia Rail	5	10	Conway 1995
Sora	5	10	Walkinshaw 1940
Purple Gallinule	5	10	Reagan 1977
Common Gallinule	5	10	Bannor and Kiviat 2002
American Coot	5	10	Brisbin et al. 2002
Black-bellied Plover	5	50	Based on similar species
American Golden-Plover	5	10	Johnson 2010; Johnson and Connors 2010
Wilson's Plover	5	10	Corbat and Berstrom 2000
Semipalmated Plover	5	10	Bent 1929
Piping Plover	5	50	Based on similar species
Killdeer	5	10	Jackson and Jackson 2000
American Oystercatcher	5	50	Based on similar species
Black-necked Stilt	5	50	Based on similar species

Table A–9. (continued)

Common Name	*DFR* Score	*DFR* % Uncertainty	*DFR* Reference
American Avocet	5	50	Based on similar species
Spotted Sandpiper	5	10	Reed et al. 2013
Solitary Sandpiper	5	50	Based on similar species
Greater Yellowlegs	5	50	Based on similar species
Willet	5	50	Based on similar species
Lesser Yellowlegs	5	10	Hutt 1991
Upland Sandpiper	5	50	Based on similar species
Whimbrel	5	50	Based on similar species
Hudsonian Godwit	5	10	Gochfeld et al. 1998
Marbled Godwit	5	50	Based on similar species
Ruddy Turnstone	5	50	Based on similar species
Red Knot	5	50	Based on similar species
Sanderling	5	10	Macwhirter et al. 2002
Semipalmated Sandpiper	5	10	Lank 1989
Western Sandpiper	5	50	Based on similar species
Least Sandpiper	5	50	Based on similar species
White-rumped Sandpiper	5	50	Based on similar species
Baird's Sandpiper	5	50	Based on similar species
Pectoral Sandpiper	5	50	Based on similar species
Purple Sandpiper	5	50	Based on similar species
Dunlin	5	50	Based on similar species
Stilt Sandpiper	5	10	Klima and Jehl 2012
Buff-breasted Sandpiper	5	50	Based on similar species
Short-billed Dowitcher	5	10	Brady 1994
Long-billed Dowitcher	5	10	Takekawa and Warnock 2000
Wilson's Snipe	5	10	Mueller 1999
American Woodcock	5	50	Based on similar species
Red-necked Phalarope	3	50	Rubega 2000; Rubega et al. 2000
Red Phalarope	3	50	Based on similar species
Black-legged Kittiwake	3	25	Garthe and Hüppop 2004
Sabine's Gull	2	50	Day et al. 2001; Lambert 1975
Bonaparte's Gull	1	50	Based on similar species

Table A–9. (continued)

Common Name	*DFR* Score	*DFR* % Uncertainty	*DFR* Reference
Black-headed Gull	1	25	Garthe and Hüppop 2004
Little Gull	3	25	Garthe and Hüppop 2004
Laughing Gull	3	25	Burger 1996; Burger and Staine 1993
Ring-billed Gull	3	50	Pollet et al. 2012
Herring Gull	2	50	Based on similar species
Iceland Gull	3	50	Snell 2002
Lesser Black-backed Gull	2	50	Garthe and Hüppop 2004
Glaucous Gull	2	50	Gaston et al. 1985
Great Black-backed Gull	2	50	Garthe and Hüppop 2004
Brown Noddy	4	50	Chardine and Morris 1996
Sooty Tern	5	25	Johnston 1979; Schreiber et al. 2002; Watson and Lashley 1915a
Bridled Tern	5	25	Haney 1999; Haney et al. 1999; Lee 1999; Murphy 1936
Least Tern	5	50	Based on similar species
Gull-billed Tern	5	10	Bent 1921; Molina et al. 2009
Caspian Tern	5	10	Cuthbert and Wires 1999
Black Tern	5	25	Garthe and Hüppop 2004
Roseate Tern	5	25	Similar to other terns
Common Tern	5	25	Garthe and Hüppop 2004
Arctic Tern	5	25	Garthe and Hüppop 2004
Forster's Tern	5	25	Mcnicholl et al. 2001
Royal Tern	4	25	Bent 1921; Buckley and Buckley 2002
Sandwich Tern	4	25	Garthe and Hüppop 2004
Black Skimmer	3	50	Burger and Gochfeld 1990; Gochfeld and Burger 1994
Great Skua	4	10	Garthe and Hüppop 2004
South Polar Skua	4	50	Based on similar species
Pomarine Jaeger	3	50	Barton 1982; Rankin and Duffey 1948; Wiley and Lee 2000; Wood 1989; Wynne-Edwards 1935
Parasitic Jaeger	5	50	Based on similar species

Table A–9. (continued)

Common Name	*DFR* Score	*DFR* % Uncertainty	*DFR* Reference
Long-tailed Jaeger	5	25	Bent 1921; Davenport 1992; Dean et al. 1976; Drury 1960; Løppenthin 1943; Manniche 1910; Wiley and Lee 1998; Wynne-Edwards 1935
Dovekie	3	25	Evans 1981; Montevecchi and Stenhouse 2002
Common Murre	1	50	Based on similar species
Thick-billed Murre	1	10	Croll 1990; Croll et al. 1992; Gaston and Hipfner 2000
Razorbill	2	25	Garthe and Hüppop 2004; Lavers et al. 2009; Swennen and Duiven 1977; Wanless et al. 1988
Black Guillemot	1	25	del Hoyo et al. 1996
Atlantic Puffin	1	25	Garthe and Hüppop 2004; Harris 1984; Lowther et al. 2002
American Kestrel	5	10	Smallwood and Bird 2002
Merlin	5	10	Clark 1985; Kerlinger et al. 1983
Peregrine Falcon	5	10	White et al. 2002
Barn Swallow	5	50	Based on similar species
Blue-gray Gnatcatcher	5	10	Kershner and Ellison 2012
Bicknell's Thrush	5	50	Based on similar species
Ovenbird	5	50	Based on similar species
Northern Waterthrush	5	50	Based on similar species
Common Yellowthroat	5	50	Based on similar species
American Redstart	5	50	Based on similar species
Kirtland's Warbler	5	50	Based on similar species
Cape May Warbler	5	50	Based on similar species
Northern Parula	5	50	Based on similar species
Blackburnian Warbler	5	10	Hall 1981
Blackpoll Warbler	5	50	Based on similar species
Palm Warbler	5	50	Based on similar species
Yellow-rumped Warbler	5	50	Based on similar species
Canada Warbler	5	50	Based on similar species

Table A–9. (continued)

Common Name	*DFR* Score	*DFR* % Uncertainty	*DFR* Reference
Chipping Sparrow	5	10	Bradstreet and Woodford 1970; Jewett et al. 1953; Stevenson and Anderson 1994; Stull 1968
Savannah Sparrow	5	10	Wheelwright and Rising 2008
Song Sparrow	5	10	Brewer and Ellis 1958; Crawford 1980b; Helms 1959; Seets and Bohlen 1977
White-throated Sparrow	5	50	Based on similar species
Indigo Bunting	5	10	Payne 2006
Baltimore Oriole	5	10	Audubon 1967; Ball et al. 1995; Bent 1958; Brewer et al. 1991; Crawford 1978; Gauthreaux 1972; Rising 1998; Stoddard and Norris 1967; Strnad 1975
American Goldfinch	5	10	McGraw and Middleton 2009

Table A–10.

Rotor Swept Zone (*RSZ*) range, score, uncertainty, and references.

Common Name	RSZ (Range)	RSZ Score	RSZ % Uncertainty	RSZ Reference
Snow Goose	75%	1	50	Wright et al. 2012
Brant	18–42%	3	50	Hüppop et al. 2006; Paton et al. 2010; Winiarski et al. 2011
Canada Goose	34–72%	1	50	Hüppop et al. 2006; Paton et al. 2010; Winiarski et al. 2011
Tundra Swan	34%	1	50	Winiarski et al. 2011; Wright et al. 2012
Wood Duck	30–50%	1	50	Winiarski et al. 2011; Wright et al. 2012
Gadwall	32–76%	1	50	Winiarski et al. 2011; Wright et al. 2012
American Wigeon	32–67%	1	50	Winiarski et al. 2011; Wright et al. 2012

Table A–10. (continued)

Common Name	RSZ (Range)	RSZ Score	RSZ % Uncertainty	RSZ Reference
American Black Duck	32–76%	1	50	Winiarski et al. 2011; Wright et al. 2012
Mallard	32–100%	1	50	Winiarski et al. 2011; Wright et al. 2012
Blue-winged Teal	32–100%	1	50	Winiarski et al. 2011; Wright et al. 2012
Northern Shoveler	32–100%	1	50	Winiarski et al. 2011; Wright et al. 2012
Northern Pintail	32–100%	1	50	Winiarski et al. 2011; Wright et al. 2012
Green-winged Teal	32–50%	1	50	Winiarski et al. 2011; Wright et al. 2012
Canvasback	10–78%	1	50	Winiarski et al. 2011; Wright et al. 2012
Redhead	10–78%	1	50	Winiarski et al. 2011; Wright et al. 2012
Ring-necked Duck	10–100%	1	50	Winiarski et al. 2011; Wright et al. 2012
Greater Scaup	10–50%	1	50	Dirksen et al. 1998; Winiarski et al. 2011; Wright et al. 2012
Lesser Scaup	10–50%	1	50	Winiarski et al. 2011; Wright et al. 2012
King Eider	10–50%	1	50	Winiarski et al. 2011; Wright et al. 2012
Common Eider	2–5%	3	50	Day et al. 2003; Desholm 2003; Garthe and Hüppop 2004; Krüger and Garthe 2001; Larsen and Guillemette 2007; Leopold et al. 2004; Paton et al. 2010; Petersen et al. 2006; Pettersson 2005; Rothery et al. 2009; Sadoti et al. 2005a; Winiarski et al. 2011
Harlequin Duck	1–50%	1	50	Wright et al. 2012
Surf Scoter	9–61%	1	50	Furness et al. 2013; Garthe and Hüppop 2004; Winiarski et al. 2011

Table A–10. (continued)

Common Name	RSZ (Range)	RSZ Score	RSZ % Uncertainty	RSZ Reference
White-winged Scoter	0–70%	1	50	Cook et al. 2012; Day et al. 2003; Garthe and Hüppop 2004; Paton et al. 2010; Sadoti et al. 2005a
Black Scoter	1–9%	3	50	Cook et al. 2012; Garthe and Hüppop 2004; Garthe et al. 2012; Krüger and Garthe 2001; Leopold et al. 2004; Npower renewables 2006; Paton et al. 2010; Rothery et al. 2009; Sadoti et al. 2005a; Winiarski et al. 2011
Long-tailed Duck	8–50%	1	50	Cook et al. 2012; Day et al. 2003; Paton et al. 2010; Sadoti et al. 2005a; Wright et al. 2012
Bufflehead	18–50%	1	50	Wright et al. 2012
Common Goldeneye	47–50%	1	50	Dirksen et al. 1998; Paton et al. 2010; Wright et al. 2012
Barrow's Goldeneye	50%	1	50	Wright et al. 2012
Hooded Merganser	31–50%	1	50	Wright et al. 2012
Common Merganser	50–100%	1	50	Wright et al. 2012
Red-breasted Merganser	23–60%	1	50	Dirksen et al. 1998; Paton et al. 2010; Wright et al. 2012
Ruddy Duck	50%	1	50	Wright et al. 2012
Red-throated Loon	2–67%	3	50	Cook et al. 2012; Garthe 2004; Garthe and Hüppop 2004; Krijgsveld et al. 2005; Krijgsveld et al. 2011; Krüger and Garthe 2001; Leopold et al. 2004; Npower renewables 2006; Paton et al. 2010; Sadoti et al. 2005a; Winiarski et al. 2011
Common Loon	18–62%	3	50	Cook et al. 2012; Furness et al. 2013; NJDEP 2010; Paton et al. 2010; Winiarski et al. 2011

Table A–10. (continued)

Common Name	RSZ (Range)	RSZ Score	RSZ % Uncertainty	RSZ Reference
Pied-billed Grebe	10%	3	25	Winiarski et al. 2011; Wright et al. 2012
Horned Grebe	20–24%	3	25	Furness et al. 2013; Hüppop et al. 2006; Paton et al. 2010; Winiarski et al. 2011
Red-necked Grebe	7%	3	25	Garthe and Hüppop 2004; Winiarski et al. 2011
Northern Fulmar	0–0.2%	5	50	Cook et al. 2012; Garthe and Hüppop 2004; Garthe et al. 2012; Krijgsveld et al. 2005; Krijgsveld et al. 2011; Leopold et al. 2004; Npower renewables 2006; Paton et al. 2010
Bermuda Petrel	<5%	5	25	Haney 1987
Black-capped Petrel	<5%	5	25	Haney 1987
Cory's Shearwater	<5%	5	10	Larkin et al. 1979; Paton et al. 2010; Winiarski et al. 2011
Great Shearwater	0.17%	5	10	Paton et al. 2010; Winiarski et al. 2011
Sooty Shearwater	5%	3	10	Cook et al. 2012; Paton et al. 2010; Winiarski et al. 2011
Manx Shearwater	0.04%	5	10	Cook et al. 2012; Paton et al. 2010; Winiarski et al. 2011
Audubon's Shearwater	0%	5	10	Winiarski et al. 2011
Wilson's Storm-Petrel	0%	5	10	Paton et al. 2010; Sadoti et al. 2005a; Winiarski et al. 2011
Leach's Storm-Petrel	0–2%	5	10	Paton et al. 2010; Winiarski et al. 2011
Band-rumped Storm-Petrel	0%	5	10	Winiarski et al. 2011
White-tailed Tropicbird	10–20 m 15–20 m	3	50	Lee et al. 1998; Sibley 2001

Table A–10. (continued)

Common Name	RSZ (Range)	RSZ Score	RSZ % Uncertainty	RSZ Reference
Red-billed Tropicbird	Captures most food by making deep vertical plunge into water from approximate height of 15–20 m	3	50	Lee et al. 1998
Brown Booby	Plunge–dives from 1 to 15 m above ocean surface	3	25	Schreiber et al. 2002
Northern Gannet	10–50%	1	25	Cook et al. 2012; Garthe and Hüppop 2004; Garthe et al. 2012; Krijgsveld et al. 2005; Krijgsveld et al. 2011; Leopold et al. 2004; NJDEP 2010; Npower renewables 2006; Paton et al. 2010; Rothery et al. 2009; Sadoti et al. 2005a; Winiarski et al. 2011
Double-crested Cormorant	4–78%	3	50	Cook et al. 2012; Krijgsveld et al. 2005; NJDEP 2010; Paton et al. 2010; Winiarski et al. 2011
Great Cormorant	4–78%	3	50	Cook et al. 2012; Garthe and Hüppop 2004; Krijgsveld et al. 2005; Krijgsveld et al. 2011; Leopold et al. 2004; Npower renewables 2006; Paton et al. 2010; Petersen et al. 2006; Rothery et al. 2009
Brown Pelican	Dive from up to 20m high; little data on average flight height	3	50	Shields 2002
American Bittern	10–49%	1	50	Winiarski et al. 2011; Wright et al. 2012
Least Bittern	10–49%	1	50	Winiarski et al. 2011; Wright et al. 2012

Table A–10. (continued)

Common Name	RSZ (Range)	RSZ Score	RSZ % Uncertainty	RSZ Reference
Great Blue Heron	10–49%	1	50	Winiarski et al. 2011; Wright et al. 2012
Great Egret	10–49%	1	50	Winiarski et al. 2011; Wright et al. 2012
Snowy Egret	10–49%	1	50	Winiarski et al. 2011; Wright et al. 2012
Little Blue Heron	10–49%	1	50	Winiarski et al. 2011; Wright et al. 2012
Tricolored Heron	10–49%	1	50	Winiarski et al. 2011; Wright et al. 2012
Green Heron	10–49%	1	50	Winiarski et al. 2011; Wright et al. 2012
Black-crowned Night-Heron	10–49%	1	50	Winiarski et al. 2011; Wright et al. 2012
Yellow-crowned Night-Heron	10–49%	1	50	Winiarski et al. 2011; Wright et al. 2012
White Ibis	10–49%	1	50	Winiarski et al. 2011; Wright et al. 2012
Glossy Ibis	10–49%	1	50	Winiarski et al. 2011; Wright et al. 2012
Roseate Spoonbill	10–49%	1	50	Winiarski et al. 2011; Wright et al. 2012
Osprey	31–96%	1	10	Kerlinger and Moore 1989; NJDEP 2010; Paton et al. 2010
Northern Harrier	76–100%	1	25	Wright et al. 2012
Black Rail	100%	1	50	Wright et al. 2012
Clapper Rail	100%	1	50	Wright et al. 2012
King Rail	100%	1	50	Wright et al. 2012
Virginia Rail	100%	1	50	Wright et al. 2012
Sora	100%	1	50	Wright et al. 2012
Purple Gallinule	100%	1	50	Wright et al. 2012
Common Gallinule	100%	1	50	Wright et al. 2012
American Coot	100%	1	50	Wright et al. 2012
Black-bellied Plover	9–75%	1	50	Kerlinger and Moore 1989; Paton et al. 2010; Winiarski et al. 2011; Wright et al. 2012

Table A–10. (continued)

Common Name	RSZ (Range)	RSZ Score	RSZ % Uncertainty	RSZ Reference
American Golden-Plover	9–75%	1	50	Kerlinger and Moore 1989; Paton et al. 2010; Winiarski et al. 2011; Wright et al. 2012
Wilson's Plover	9–75%	1	50	Kerlinger and Moore 1989; Paton et al. 2010; Winiarski et al. 2011; Wright et al. 2012
Semipalmated Plover	0–75%	1	50	Kerlinger and Moore 1989; Paton et al. 2010; Winiarski et al. 2011; Wright et al. 2012
Piping Plover	9–10%	3	50	Kerlinger and Moore 1989; Paton et al. 2010; Winiarski et al. 2011
Killdeer	9–95%	1	50	Kerlinger and Moore 1989; Paton et al. 2010; Winiarski et al. 2011; Wright et al. 2012
American Oystercatcher	9–75%	1	50	Winiarski et al. 2011; Wright et al. 2012
Black-necked Stilt	9–75%	1	50	Winiarski et al. 2011; Wright et al. 2012
American Avocet	9–75%	1	50	Winiarski et al. 2011; Wright et al. 2012
Spotted Sandpiper	0–75%	1	50	Winiarski et al. 2011; Wright et al. 2012
Solitary Sandpiper	9–75%	1	50	Winiarski et al. 2011; Wright et al. 2012
Greater Yellowlegs	9–100%	1	50	Winiarski et al. 2011; Wright et al. 2012
Willet	9–75%	1	50	Winiarski et al. 2011; Wright et al. 2012
Lesser Yellowlegs	9–75%	1	50	Winiarski et al. 2011; Wright et al. 2012
Upland Sandpiper	9–75%	1	50	Winiarski et al. 2011; Wright et al. 2012
Whimbrel	9–75%	1	50	Kerlinger and Moore 1989; Paton et al. 2010; Winiarski et al. 2011

Table A–10. (continued)

Common Name	RSZ (Range)	RSZ Score	RSZ % Uncertainty	RSZ Reference
Hudsonian Godwit	9–75%	1	50	Winiarski et al. 2011; Wright et al. 2012
Marbled Godwit	9–75%	1	50	Winiarski et al. 2011; Wright et al. 2012
Ruddy Turnstone	9–75%	1	50	Winiarski et al. 2011; Wright et al. 2012
Red Knot	9%	3	50	Kerlinger and Moore 1989; Winiarski et al. 2011
Sanderling	8–75%	1	50	Winiarski et al. 2011; Wright et al. 2012
Semipalmated Sandpiper	9–75%	1	50	Winiarski et al. 2011; Wright et al. 2012
Western Sandpiper	9–75%	1	50	Winiarski et al. 2011; Wright et al. 2012
Least Sandpiper	9–75%	1	50	Winiarski et al. 2011; Wright et al. 2012
White-rumped Sandpiper	0–75%	1	50	Winiarski et al. 2011; Wright et al. 2012
Baird's Sandpiper	9–75%	1	50	Winiarski et al. 2011; Wright et al. 2012
Pectoral Sandpiper	9–75%	1	50	Winiarski et al. 2011; Wright et al. 2012
Purple Sandpiper	0–75%	1	50	Winiarski et al. 2011; Wright et al. 2012
Dunlin	9–75%	1	50	Winiarski et al. 2011; Wright et al. 2012
Stilt Sandpiper	9–75%	1	50	Winiarski et al. 2011; Wright et al. 2012
Buff-breasted Sandpiper	9–75%	1	50	Winiarski et al. 2011; Wright et al. 2012
Short-billed Dowitcher	0–75%	1	50	Winiarski et al. 2011; Wright et al. 2012
Long-billed Dowitcher	9–75%	1	50	Winiarski et al. 2011; Wright et al. 2012
Wilson's Snipe	9–75%	1	50	Winiarski et al. 2011; Wright et al. 2012
American Woodcock	9–75%	1	50	Winiarski et al. 2011; Wright et al. 2012

Table A–10. (continued)

Common Name	RSZ (Range)	RSZ Score	RSZ % Uncertainty	RSZ Reference
Red-necked Phalarope	9–75%	1	50	Alerstam and Gudmundsson 1999; Day et al. 2003; Gudmundsson et al. 2002; Winiarski et al. 2011; Wright et al. 2012
Red Phalarope	9–75%	1	50	Alerstam and Gudmundsson 1999; Day et al. 2003; Gudmundsson et al. 2002; Paton et al. 2010; Winiarski et al. 2011; Wright et al. 2012
Black-legged Kittiwake	0–67%	1	50	Chamberlain et al. 2005; Cook et al. 2012; Day et al. 2003; Garthe and Hüppop 2004; Garthe et al. 2012; Krijgsveld et al. 2005; Krijgsveld et al. 2011; Leopold et al. 2004; Npower renewables 2006; Paton et al. 2010; Rothery et al. 2009; Winiarski et al. 2011
Sabine's Gull	13%	3	50	Day et al. 2003; Winiarski et al. 2011
Bonaparte's Gull	8–29%	3	50	Cook et al. 2012; Furness et al. 2013; Garthe and Hüppop 2004; Winiarski et al. 2011
Black-headed Gull	13–100%	1	50	Cook et al. 2012; Garthe and Hüppop 2004; Krijgsveld et al. 2011; Rothery et al. 2009; van den Bergh et al. 2002; Winiarski et al. 2011
Little Gull	5.5–13%	3	50	Cook et al. 2012; Garthe and Hüppop 2004; Garthe et al. 2012; Krijgsveld et al. 2005; Krijgsveld et al. 2011; Npower renewables 2006; Winiarski et al. 2011
Laughing Gull	6.4–42%	3	50	Winiarski et al. 2011
Ring-billed Gull	13–60.6%	1	50	Cook et al. 2012

Table A–10. (continued)

Common Name	RSZ (Range)	RSZ Score	RSZ % Uncertainty	RSZ Reference
Herring Gull	13–50%	1	50	Cook et al. 2012; Garthe and Hüppop 2004; Garthe et al. 2012; Krijgsveld et al. 2005; Krijgsveld et al. 2011; NJDEP 2010; Npower renewables 2006; Paton et al. 2010; Rothery et al. 2009; Sadoti et al. 2005a; Sadoti et al. 2005b; van den Bergh et al. 2002; Winiarski et al. 2011
Iceland Gull	0–13%	3	50	Furness et al. 2013; Winiarski et al. 2011
Lesser Black-backed Gull	0–25%	3	50	Cook et al. 2012; Garthe and Hüppop 2004; Garthe et al. 2012; Krijgsveld et al. 2005; Krijgsveld et al. 2011; Npower renewables 2006; van den Bergh et al. 2002; Winiarski et al. 2011
Glaucous Gull	13–100%	1	50	Cook et al. 2012; Day et al. 2003; Winiarski et al. 2011
Great Black-backed Gull	13–36%	1	50	Cook et al. 2012; Garthe and Hüppop 2004; Garthe et al. 2012; Krijgsveld et al. 2005; Krijgsveld et al. 2011; Npower renewables 2006; Paton et al. 2010; Rothery et al. 2009; Sadoti et al. 2005a; Sadoti et al. 2005b; Winiarski et al. 2011
Brown Noddy	Forages up to several m above water; but no description of transit flights	3	50	Chardine and Morris 1996

Table A–10. (continued)

Common Name	RSZ (Range)	RSZ Score	RSZ % Uncertainty	RSZ Reference
Sooty Tern	Generally remain 1–20m above water when hunting for food; dives used but never from very great height; no description of transit flights	3	50	Schreiber et al. 2002
Bridled Tern	During foraging bouts, dips from air at heights of 3–10m toward surface or hovers just above ocean while feeding; no description of transit flights	3	50	Haney et al. 1999
Least Tern	40%–75%	1	50	Furness et al. 2013; Thompson et al. 1997
Gull-billed Tern	Similar to other terns; no description of transit flights	1	50	Similar to other terns, no info on transit flights
Caspian Tern	100%; Flies at heights ranging from 3 to 30m over water	1	50	Cuthbert and Wires 1999
Black Tern	27%	1	50	Cook et al. 2012; Garthe and Hüppop 2004; Paton et al. 2010
Roseate Tern	12.5–62.5%	1	50	Cook et al. 2012; Paton et al. 2010; Winiarski et al. 2011

Table A–10. (continued)

Common Name	RSZ (Range)	RSZ Score	RSZ % Uncertainty	RSZ Reference
Common Tern	12.7–50%	1	50	Cook et al. 2012; Everaert and Stienen 2007; Garthe and Hüppop 2004; Garthe et al. 2012; Hatch and Brault 2007; Krüger and Garthe 2001; Leopold et al. 2004; Npower renewables 2006; Paton et al. 2010; Sadoti et al. 2005a; Sadoti et al. 2005b; van den Bergh et al. 2002; Winiarski et al. 2011
Arctic Tern	42–64%	1	50	Alerstam and Gudmundsson 1999; Cook et al. 2012; Garthe and Hüppop 2004; Gudmundsson et al. 2002; NJDEP 2010; Paton et al. 2010; Winiarski et al. 2011
Forster's Tern	42–64%	1	50	Cook et al. 2012; Paton et al. 2010; Winiarski et al. 2011
Royal Tern	67%	1	50	Similar to Sandwich Terns
Sandwich Tern	3.6%	5	50	Cook et al. 2012; Everaert and Stienen 2007; Garthe and Hüppop 2004; Garthe et al. 2012; Krijgsveld et al. 2005; Krijgsveld et al. 2011; Krüger and Garthe 2001; Leopold et al. 2004; Npower renewables 2006; Perrow et al. 2011a; Rothery et al. 2009
Black Skimmer		1	50	Similar to terns, forage by flying low over water
Great Skua	10%;	3	10	Cook et al. 2012; Garthe and Hüppop 2004
South Polar Skua		3	25	Similar to jaegers

Table A–10. (continued)

Common Name	RSZ (Range)	RSZ Score	RSZ % Uncertainty	RSZ Reference
Pomarine Jaeger	15–33.3%	1	50	Alerstam and Gudmundsson 1999; Gudmundsson et al. 2002; Paton et al. 2010; Winiarski et al. 2011
Parasitic Jaeger	3.8–40%	1	50	Furness et al. 2013; Garthe and Hüppop 2004; Winiarski et al. 2011
Long-tailed Jaeger	15–25%	1	50	Paton et al. 2010; Winiarski et al. 2011
Dovekie	0–0.03%	5	10	Cook et al. 2012; Winiarski et al. 2011
Common Murre	0–1.6%	5	10	Cook et al. 2012; Furness et al. 2013; Garthe and Hüppop 2004; Paton et al. 2010; Winiarski et al. 2011
Thick-billed Murre	0%	5	10	Winiarski et al. 2011
Razorbill	0.4–12.5%	3	50	Cook et al. 2012; Garthe and Hüppop 2004; Leopold et al. 2004; Npower renewables 2006; Paton et al. 2010; Sadoti et al. 2005a; Winiarski et al. 2011
Black Guillemot	0%	5	10	Cook et al. 2012; Paton et al. 2010; Winiarski et al. 2011
Atlantic Puffin	0–0.1%	5	10	Cook et al. 2012; Garthe and Hüppop 2004; Paton et al. 2010; Winiarski et al. 2011
American Kestrel	84–100%	1	50	Wright et al. 2012
Merlin	76–100%	1	50	Wright et al. 2012
Peregrine Falcon	76–100%	1	50	Wright et al. 2012
Barn Swallow	29–30%	1	50	Paton et al. 2010
Blue-gray Gnatcatcher	<5%: >1000m	5	25	Able 2004; Kerlinger and Moore 1989
Bicknell's Thrush	<5%: >1000m	5	25	Able 2004; Kerlinger and Moore 1989

Table A–10. (continued)

Common Name	RSZ (Range)	RSZ Score	RSZ % Uncertainty	RSZ Reference
Ovenbird	<5%: >1000m	5	25	Able 2004; Kerlinger and Moore 1989
Northern Waterthrush	<5%: >1000m	5	25	Able 2004; Kerlinger and Moore 1989
Common Yellowthroat	<5%: >1000m	5	25	Able 2004; Kerlinger and Moore 1989
American Redstart	<5%: >1000m	5	25	Able 2004; Kerlinger and Moore 1989
Kirtland's Warbler	<5%: >1000m	5	25	Able 2004; Kerlinger and Moore 1989
Cape May Warbler	<5%: >1000m	5	25	Able 2004; Kerlinger and Moore 1989
Northern Parula	<5%: >1000m	5	25	Able 2004; Kerlinger and Moore 1989
Blackburnian Warbler	<5%: >1000m	5	25	Able 2004; Kerlinger and Moore 1989
Blackpoll Warbler	<5%: >1000m	5	25	Able 2004; Kerlinger and Moore 1989
Palm Warbler	<5%: >1000m	5	25	Able 2004; Kerlinger and Moore 1989
Yellow-rumped Warbler	<5%: >1000m	5	25	Able 2004; Kerlinger and Moore 1989
Canada Warbler	<5%: >1000m	5	25	Able 2004; Kerlinger and Moore 1989
Chipping Sparrow	<5%: >1000m	5	25	Able 2004; Kerlinger and Moore 1989
Savannah Sparrow	<5%: >1000m	5	25	Able 2004; Kerlinger and Moore 1989
Song Sparrow	<5%: >1000m	5	25	Able 2004; Kerlinger and Moore 1989
White-throated Sparrow	<5%: >1000m	5	25	Able 2004; Kerlinger and Moore 1989
Indigo Bunting	<5%: >1000m	5	25	Able 2004; Kerlinger and Moore 1989
Baltimore Oriole	<5%: >1000m	5	25	Able 2004; Kerlinger and Moore 1989
American Goldfinch	<5%: >1000m	5	25	Able 2004; Kerlinger and Moore 1989

Table A–11.

Macro avoidance (*MA*) rates, data source, and references.

Species/Group	Wind Facility	Macro Avoidance Rate	Methodology	Notes	Ref.
Common Eider	Tunø Knob	53%	Visual Observations	Winter, 10 turbines, offshore	Larsen and Guillemette 2007
Common Scoter	Horns Rev	88.60%	Radar Observations	All year, 80 turbines, offshore	Petersen et al. 2006
Common Scoter	Horns Rev	90%	Radar Observations	All year, 80 turbines, offshore	Christensen et al. 2004
Northern Gannet	Egmond aan Zee	72%	Visual Observations	All Year, 36 turbines offshore	Krijgsveld et al. 2011
Northern Gannets	Egmond aan Zee	64%	Visual Observations (validated with radar)	All Year, 36 turbines offshore	Krijgsveld et al. 2011
Geese and Swans	Egmond aan Zee	41%	Visual Observations	All Year, 36 turbines offshore	Krijgsveld et al. 2011
Geese and Swans	Egmond aan Zee	68%	Visual Observations (validated with radar)	All Year, 36 turbines offshore	Krijgsveld et al. 2011
Other Ducks	Egmond aan Zee	37%	Visual Observations	All Year, 36 turbines offshore	Krijgsveld et al. 2011
Migrant Sea Duck	Nysted	90%	Radar Observations	Autumn, 72 turbines, offshore	Petersen et al. 2006
Migrant Sea Duck (Day)	Nysted	95.50%	Radar Observations	Autumn, 72 turbines, offshore	Desholm and Kahlert 2005
Migrant Sea Duck (Night)	Nysted	86.20%	Radar Observations	Autumn, 72 turbines, offshore	Desholm and Kahlert 2005

Table A–11. (continued)

Species/Group	Wind Facility	Macro Avoidance Rate	Methodology	Notes	Ref.
Sea Ducks	Egmond aan Zee	71%	Visual Observations (validated with radar)	All Year, 36 turbines offshore	Krijgsveld et al. 2011
Sea-ducks	Egmond aan Zee	56%	Visual Observations	All Year, 36 turbines offshore	Krijgsveld et al. 2011
Divers	Egmond aan Zee	52%	Visual Observations	All Year, 36 turbines offshore	Krijgsveld et al. 2011
Divers	Egmond aan Zee	68%	Visual Observations (validated with radar)	All Year, 36 turbines offshore	Krijgsveld et al. 2011
Grebes	Egmond aan Zee	50%	Visual Observations	All Year, 36 turbines offshore	Krijgsveld et al. 2011
Tubenoses	Egmond aan Zee	50%	Visual Observations	All Year, 36 turbines offshore	Krijgsveld et al. 2011
Cormorants	Egmond aan Zee	23%	Visual Observations	All Year, 36 turbines offshore	Krijgsveld et al. 2011
Raptors	Egmond aan Zee	18%	Visual Observations	All Year, 36 turbines offshore	Krijgsveld et al. 2011
Shorebirds	Egmond aan Zee	27%	Visual Observations	All Year, 36 turbines offshore	Krijgsveld et al. 2011
Gulls and Cormorants	Egmond aan Zee	18%	Radar Observations	All Year, 36 turbines offshore	Krijgsveld et al. 2011
Gulls	Egmond aan Zee	30%	Visual Observations	All Year, 36 turbines offshore	Krijgsveld et al. 2011
Gulls	Horns Rev	76.40%	Radar Observations	All year, 80 turbines, offshore	Petersen et al. 2006;
Terns	Egmond aan Zee	30%	Visual Observations	All Year, 36 turbines offshore	Krijgsveld et al. 2011

Table A–11. (continued)

Species/Group	Wind Facility	Macro Avoidance Rate	Methodology	Notes	Ref.
Terns	Horns Rev	69.50%	Radar Observations	All year, 80 turbines, offshore	Petersen et al. 2006
Skuas& Jaegers	Egmond aan Zee	0%	Visual Observations	All Year, 36 turbines offshore	Krijgsveld et al. 2011
Alcids	Egmond aan Zee	45%	Visual Observations	All Year, 36 turbines offshore	Krijgsveld et al. 2011
Alcids	Egmond aan Zee	68%	Visual Observations (validated with radar)	All Year, 36 turbines offshore	Krijgsveld et al. 2011
Landbirds	Egmond aan Zee	35%	Visual Observations	All Year, 36 turbines offshore	Krijgsveld et al. 2011

Table A–12.

Macro avoidance (*MA*) and uncertainty scores (for both collision and displacement sensitivity).

Common Name	Avoidance Ranges	*MA* Score Collision	*MA* Score Displacement	% Uncertainty	References
Snow Goose	41–68%	1	5	25	Krijgsveld et al. 2011
Brant	41–68%	1	5	25	Krijgsveld et al. 2011
Canada Goose	41–68%	1	5	25	Krijgsveld et al. 2011
Tundra Swan	41–68%	1	5	50	Krijgsveld et al. 2011
Wood Duck	56–71–90%	1	5	50	Krijgsveld et al. 2011; Petersen et al. 2006
Gadwall	56–71–90%	1	5	51	Krijgsveld et al. 2011; Petersen et al. 2006
American Wigeon	56–71–90%	1	5	52	Krijgsveld et al. 2011; Petersen et al. 2006
American Black Duck	56–71–90%	1	5	53	Krijgsveld et al. 2011; Petersen et al. 2006

Table A–12. (continued)

Common Name	Avoidance Ranges	*MA* Score Collision	*MA* Score Displacement	% Uncertainty	References
Mallard	56–71–90%	1	5	25	Krijgsveld et al. 2011; Petersen et al. 2006
Blue-winged Teal	56–71–90%	1	5	50	Krijgsveld et al. 2011; Petersen et al. 2006
Northern Shoveler	56–71–90%	1	5	25	Krijgsveld et al. 2011; Petersen et al. 2006
Northern Pintail	56–71–90%	1	5	25	Krijgsveld et al. 2011; Petersen et al. 2006
Green-winged Teal	56–71–90%	1	5	25	Krijgsveld et al. 2011; Petersen et al. 2006
Canvasback	56–71–90%	1	5	50	Krijgsveld et al. 2011; Petersen et al. 2006
Redhead	56–71–90%	1	5	50	Krijgsveld et al. 2011; Petersen et al. 2006
Ring-necked Duck	56–71–90%	1	5	50	Krijgsveld et al. 2011; Petersen et al. 2006
Greater Scaup	56–71–90%	1	5	25	Krijgsveld et al. 2011; Petersen et al. 2006
Lesser Scaup	56–71–90%	1	5	25	Krijgsveld et al. 2011; Petersen et al. 2006
King Eider	53–56–71–90%	1	5	50	Krijgsveld et al. 2011; Larsen and Guillemette 2007; Petersen et al. 2006
Common Eider	53–56–71–90%	1	5	10	Krijgsveld et al. 2011; Larsen and Guillemette 2007; Petersen et al. 2006
Harlequin Duck	56–71–86 (night)–90–95.5%	1	5	50	Desholm and Kahlert 2005; Krijgsveld et al. 2011; Petersen et al. 2006
Surf Scoter	56–71–86 (night)–90–95.5%	1	5	25	Desholm and Kahlert 2005; Krijgsveld et al. 2011; Petersen et al. 2006
White-winged Scoter	56–71–86 (night)–90–95.5%	1	5	25	Desholm and Kahlert 2005; Krijgsveld et al. 2011; Petersen et al. 2006

Table A–12. (continued)

Common Name	Avoidance Ranges	*MA* Score Collision	*MA* Score Displacement	% Uncertainty	References
Black Scoter	56–71–86 (night)–90–95.5%	1	5	25	Desholm and Kahlert 2005; Krijgsveld et al. 2011; Petersen et al. 2006
Long-tailed Duck	56–71–86 (night)–90–95.5%	1	5	10	Desholm and Kahlert 2005; Krijgsveld et al. 2011; Petersen et al. 2006
Bufflehead	37%	2	4	50	Krijgsveld et al. 2011
Common Goldeneye	37%	2	4	50	Krijgsveld et al. 2011
Barrow's Goldeneye	37%	2	4	50	Krijgsveld et al. 2011
Hooded Merganser	37%	2	4	50	Krijgsveld et al. 2011
Common Merganser	37%	2	4	50	Krijgsveld et al. 2011
Red-breasted Merganser	37%	2	4	50	Krijgsveld et al. 2011
Ruddy Duck	No data	2	4	50	Desholm and Kahlert 2005; Krijgsveld et al. 2011; Petersen et al. 2006
Red-throated Loon	52–68%	1	5	10	Krijgsveld et al. 2011
Common Loon	52–68%	1	5	10	Krijgsveld et al. 2011
Pied-billed Grebe	No data	2	4	50	Assuming similar to similar species and taking a precautionary score with high uncertainty
Horned Grebe	50%	1	5	25	Krijgsveld et al. 2011
Red-necked Grebe	50%	1	5	25	Krijgsveld et al. 2011
Northern Fulmar	50%	1	5	25	Krijgsveld et al. 2011
Bermuda Petrel	No data	3	3	50	Taking precautionary with high uncertainty

Table A–12. (continued)

Common Name	Avoidance Ranges	*MA* Score Collision	*MA* Score Displacement	% Uncertainty	References
Black-capped Petrel	50%	1	5	50	Krijgsveld et al. 2011
Cory's Shearwater	50%	1	5	50	Krijgsveld et al. 2011
Great Shearwater	50%	1	5	50	Krijgsveld et al. 2011
Sooty Shearwater	50%	1	5	25	Krijgsveld et al. 2011
Manx Shearwater	50%	1	5	25	Krijgsveld et al. 2011
Audubon's Shearwater	50%	1	5	50	Krijgsveld et al. 2011
Wilson's Storm-Petrel	50%	1	5	25	Krijgsveld et al. 2011
Leach's Storm-Petrel	50%	1	5	25	Krijgsveld et al. 2011
Band-rumped Storm-Petrel	50%	1	5	25	Krijgsveld et al. 2011
White-tailed Tropicbird	No data	3	3	50	Taking precautionary with high uncertainty
Red-billed Tropicbird	No data	3	3	50	Taking precautionary with high uncertainty
Brown Booby	No data	2	4	50	Taking precautionary with high uncertainty
Northern Gannet	64–72%	1	5	10	Krijgsveld et al. 2011
Double-crested Cormorant	18–23%	3	3	50	Krijgsveld et al. 2011
Great Cormorant	18–23%	3	3	10	Krijgsveld et al. 2011
Brown Pelican	No data	5	5	50	Taking precautionary with high uncertainty
American Bittern	No data	5	5	50	Taking precautionary with high uncertainty
Least Bittern	No data	5	5	50	Taking precautionary with high uncertainty

Table A–12. (continued)

Common Name	Avoidance Ranges	*MA* Score Collision	*MA* Score Displacement	% Uncertainty	References
Great Blue Heron	No data	5	5	25	Brown and Hamilton 2006, precautionary as based on terrestrial turbine data
Great Egret	No data	5	5	50	Taking precautionary with high uncertainty
Snowy Egret	No data	5	5	50	Taking precautionary with high uncertainty
Little Blue Heron	No data	5	5	50	Taking precautionary with high uncertainty
Tricolored Heron	No data	5	15	50	Taking precautionary with high uncertainty
Green Heron	No data	5	5	50	Taking precautionary with high uncertainty
Black-crowned Night-Heron	No data	5	5	50	Kingsley and Whittam 2007 and precautionary with high uncertainty
Yellow-crowned Night-Heron	No data	5	5	50	Assumed similar to BCNH and high uncertainty
White Ibis	No data	5	5	50	Taking precautionary with high uncertainty
Glossy Ibis	No data	5	5	50	Taking precautionary with high uncertainty
Roseate Spoonbill	No data	5	5	50	Taking precautionary with high uncertainty
Osprey	18%	3	3	25	Krijgsveld et al. 2011
Northern Harrier	18%	3	3	25	Krijgsveld et al. 2011
Black Rail	No data	5	5	50	Taking precautionary with high uncertainty
Clapper Rail	No data	5	5	50	Taking precautionary with high uncertainty
King Rail	No data	5	5	50	Taking precautionary with high uncertainty
Virginia Rail	No data	5	5	50	Taking precautionary with high uncertainty

Table A–12. (continued)

Common Name	Avoidance Ranges	*MA* Score Collision	*MA* Score Displacement	% Uncertainty	References
Sora	No data	5	5	50	Taking precautionary with high uncertainty
Purple Gallinule	No data	5	5	50	Taking precautionary with high uncertainty
Common Gallinule	No data	5	5	50	Taking precautionary with high uncertainty
American Coot	No data	5	5	50	Taking precautionary with high uncertainty
Black-bellied Plover	27%	3	3	50	Krijgsveld et al. 2011
American Golden-Plover	27%	3	3	50	Krijgsveld et al. 2011
Wilson's Plover	27%	3	3	50	Krijgsveld et al. 2011
Semipalmated Plover	27%	3	3	50	Krijgsveld et al. 2011
Piping Plover	27%	3	3	50	Krijgsveld et al. 2011
Killdeer	27%	3	3	50	Krijgsveld et al. 2011
American Oystercatcher	27%	3	3	50	Krijgsveld et al. 2011
Black-necked Stilt	27%	3	3	50	Krijgsveld et al. 2011
American Avocet	27%	3	3	50	Krijgsveld et al. 2011
Spotted Sandpiper	27%	3	3	50	Krijgsveld et al. 2011
Solitary Sandpiper	27%	3	3	50	Krijgsveld et al. 2011
Greater Yellowlegs	27%	3	3	50	Krijgsveld et al. 2011
Willet	27%	3	3	50	Krijgsveld et al. 2011
Lesser Yellowlegs	27%	3	3	50	Krijgsveld et al. 2011
Upland Sandpiper	27%	3	3	50	Krijgsveld et al. 2011
Whimbrel	27%	3	3	50	Krijgsveld et al. 2011
Hudsonian Godwit	27%	3	3	50	Krijgsveld et al. 2011

Table A–12. (continued)

Common Name	Avoidance Ranges	*MA* Score Collision	*MA* Score Displacement	% Uncertainty	References
Marbled Godwit	27%	3	3	50	Krijgsveld et al. 2011
Ruddy Turnstone	27%	3	3	50	Krijgsveld et al. 2011
Red Knot	27%	3	3	50	Krijgsveld et al. 2011
Sanderling	27%	3	3	50	Krijgsveld et al. 2011
Semipalmated Sandpiper	27%	3	3	50	Krijgsveld et al. 2011
Western Sandpiper	27%	3	3	50	Krijgsveld et al. 2011
Least Sandpiper	27%	3	3	50	Krijgsveld et al. 2011
White-rumped Sandpiper	27%	3	3	50	Krijgsveld et al. 2011
Baird's Sandpiper	27%	3	3	50	Krijgsveld et al. 2011
Pectoral Sandpiper	27%	3	3	50	Krijgsveld et al. 2011
Purple Sandpiper	27%	3	3	50	Krijgsveld et al. 2011
Dunlin	27%	3	3	50	Krijgsveld et al. 2011
Stilt Sandpiper	27%	3	3	50	Krijgsveld et al. 2011
Buff-breasted Sandpiper	27%	3	3	50	Krijgsveld et al. 2011
Short-billed Dowitcher	27%	3	3	50	Krijgsveld et al. 2011
Long-billed Dowitcher	27%	3	3	50	Krijgsveld et al. 2011
Wilson's Snipe	No data	3	3	50	Krijgsveld et al. 2011
American Woodcock	No data	3	3	50	Krijgsveld et al. 2011
Red-necked Phalarope	27%	4	4	50	Krijgsveld et al. 2011
Red Phalarope	27%	4	4	50	Krijgsveld et al. 2011
Black-legged Kittiwake	18–30–76.4%	2	4	50	Krijgsveld et al. 2011; Petersen et al. 2006
Sabine's Gull	18–30–76.4%	2	4	50	Krijgsveld et al. 2011; Petersen et al. 2006

Table A–12. (continued)

Common Name	Avoidance Ranges	*MA* Score Collision	*MA* Score Displacement	% Uncertainty	References
Bonaparte's Gull	18–30–76.4%	2	4	50	Krijgsveld et al. 2011; Petersen et al. 2006
Black-headed Gull	18–30–76.4%	2	4	50	Krijgsveld et al. 2011; Petersen et al. 2006
Little Gull	18–30–76.4%	2	4	50	Krijgsveld et al. 2011; Petersen et al. 2006
Laughing Gull	18–30–76.4%	2	4	50	Krijgsveld et al. 2011; Petersen et al. 2006
Ring-billed Gull	18–30–76.4%	2	4	50	Krijgsveld et al. 2011; Petersen et al. 2006
Herring Gull	18–30–76.4%	2	4	50	Krijgsveld et al. 2011; Petersen et al. 2006
Iceland Gull	18–30–76.4%	2	4	50	Krijgsveld et al. 2011; Petersen et al. 2006
Lesser Black-backed Gull	18–30–76.4%	2	4	50	Krijgsveld et al. 2011; Petersen et al. 2006
Glaucous Gull	18–30–76.4%	2	4	50	Krijgsveld et al. 2011; Petersen et al. 2006
Great Black-backed Gull	18–30–76.4%	2	4	50	Krijgsveld et al. 2011; Petersen et al. 2006
Brown Noddy	No data	1	5	50	Assumed similar to terns
Sooty Tern	30–69.5%	1	5	50	Krijgsveld et al. 2011; Petersen et al. 2006
Bridled Tern	30–69.5%	1	5	50	Krijgsveld et al. 2011; Petersen et al. 2006
Least Tern	30–69.5%	1	5	50	Krijgsveld et al. 2011; Petersen et al. 2006
Gull-billed Tern	30–69.5%	1	5	50	Krijgsveld et al. 2011; Petersen et al. 2006
Caspian Tern	30–69.5%	1	5	50	Krijgsveld et al. 2011; Petersen et al. 2006
Black Tern	30–69.5%	1	5	50	Krijgsveld et al. 2011; Petersen et al. 2006
Roseate Tern	30–69.5%	1	5	50	Krijgsveld et al. 2011; Petersen et al. 2006
Common Tern	30–69.5%	1	5	50	Krijgsveld et al. 2011; Petersen et al. 2006

Table A–12. (continued)

Common Name	Avoidance Ranges	*MA* Score Collision	*MA* Score Displacement	% Uncertainty	References
Arctic Tern	30–69.5%	1	5	50	Krijgsveld et al. 2011; Petersen et al. 2006
Forster's Tern	30–69.5%	1	5	50	Krijgsveld et al. 2011; Petersen et al. 2006
Royal Tern	30–69.5%	1	5	50	Krijgsveld et al. 2011; Petersen et al. 2006
Sandwich Tern	30–69.5%	1	5	50	Krijgsveld et al. 2011; Petersen et al. 2006
Black Skimmer	No data	1	5	50	Assumed similar to ternsTaking precautionary with high uncertainty
Great Skua	0%	5	1	25	Krijgsveld et al. 2011
South Polar Skua	0%	5	1	50	Krijgsveld et al. 2011
Pomarine Jaeger	0%	5	1	25	Krijgsveld et al. 2011
Parasitic Jaeger	0%	5	1	25	Krijgsveld et al. 2011
Long-tailed Jaeger	0%	5	1	25	Krijgsveld et al. 2011
Dovekie	45–68%	1	5	50	Krijgsveld et al. 2011
Common Murre	45–68%	1	5	10	Krijgsveld et al. 2011
Thick-billed Murre	45–68%	1	5	50	Krijgsveld et al. 2011
Razorbill	45–68%	1	5	10	Krijgsveld et al. 2011
Black Guillemot	45–68%	1	5	10	Krijgsveld et al. 2011
Atlantic Puffin	45–68%	1	5	10	Krijgsveld et al. 2011
American Kestrel	18%	3	3	25	Krijgsveld et al. 2011
Merlin	18%	3	3	25	Krijgsveld et al. 2011
Peregrine Falcon	18%	3	3	25	Krijgsveld et al. 2011
Barn Swallow	35%	2	4	25	Krijgsveld et al. 2011
Blue-gray Gnatcatcher	35%	2	4	50	Krijgsveld et al. 2011

Table A–12. (continued)

Common Name	Avoidance Ranges	*MA* Score Collision	*MA* Score Displacement	% Uncertainty	References
Bicknell's Thrush	35%	2	4	50	Krijgsveld et al. 2011
Ovenbird	35%	2	4	50	Krijgsveld et al. 2011
Northern Waterthrush	35%	2	4	50	Krijgsveld et al. 2011
Common Yellowthroat	35%	2	4	50	Krijgsveld et al. 2011
American Redstart	35%	2	4	50	Krijgsveld et al. 2011
Kirtland's Warbler	35%	2	4	50	Krijgsveld et al. 2011
Cape May Warbler	35%	2	4	50	Krijgsveld et al. 2011
Northern Parula	35%	2	4	50	Krijgsveld et al. 2011
Blackburnian Warbler	35%	2	4	50	Krijgsveld et al. 2011
Blackpoll Warbler	35%	2	4	50	Krijgsveld et al. 2011
Palm Warbler	35%	2	4	50	Krijgsveld et al. 2011
Yellow-rumped Warbler	35%	2	4	50	Krijgsveld et al. 2011
Canada Warbler	35%	2	4	50	Krijgsveld et al. 2011
Chipping Sparrow	35%	2	4	50	Krijgsveld et al. 2011
Savannah Sparrow	35%	2	4	50	Krijgsveld et al. 2011
Song Sparrow	35%	2	4	50	Krijgsveld et al. 2011
White-throated Sparrow	35%	2	4	50	Krijgsveld et al. 2011
Indigo Bunting	35%	2	4	50	Krijgsveld et al. 2011
Baltimore Oriole	35%	2	4	50	Krijgsveld et al. 2011
American Goldfinch	35%	2	4	50	Krijgsveld et al. 2011

Table A–13.

Breeding (*BR*) score and references.

Common Name	*BR* Score	*BR* Reference
Snow Goose	1	Mowbray et al. 2000
Brant	1.5	Reed et al. 1998
Canada Goose	1	Mowbray et al. 2002
Tundra Swan	1	Limpert and Earnst 1994
Wood Duck	1	Hepp and Bellrose 1995
Gadwall	1	Leschack et al. 1997
American Wigeon	1	Mowbray 1999
American Black Duck	1	Longcore et al. 2000
Mallard	1	Drilling et al. 2002
Blue-winged Teal	1	Rohwer et al. 2002
Northern Shoveler	1	Dubowy 1996
Northern Pintail	1	Austin and Miller 1995
Green-winged Teal	1	Johnson 1995
Canvasback	1	Mowbray 2002a
Redhead	1	Woodin and Michot 2002
Ring-necked Duck	1	Roy et al. 2012
Greater Scaup	1	Kessel et al. 2002
Lesser Scaup	1	Austin et al. 1998
King Eider	1	Powell and Suydam 2012
Common Eider	2	Goudie et al. 2000
Harlequin Duck	1	Robertson et al. 1999
Surf Scoter	1	Savard et al. 1998
White-winged Scoter	1	Brown and Fredrickson 1997
Black Scoter	1	Bordage and Savard 2011
Long-tailed Duck	1	Robertson and Savard 2002
Bufflehead	1	Gauthier 1993
Common Goldeneye	1	Eadie et al. 1995
Barrow's Goldeneye	1	Eadie et al. 2000
Hooded Merganser	1	Dugger et al. 2009
Common Merganser	1	Mallory and Metz 1999

Table A–13. (continued)

Common Name	*BR* Score	*BR* Reference
Red-breasted Merganser	1	Titman 1999
Ruddy Duck	1	Brua 2002
Red-throated Loon	1	Barr et al. 2000
Common Loon	1	Evers et al. 2010
Pied-billed Grebe	1	Muller and Storer 1999
Horned Grebe	1	Stedman 2000
Red-necked Grebe	1	Stout et al. 1999
Northern Fulmar	1	Howell 2012
Bermuda Petrel	2	Howell 2012
Black-capped Petrel	2	Howell 2012
Cory's Shearwater	1	Howell 2012
Great Shearwater	2	Howell 2012
Sooty Shearwater	1	Howell 2012
Manx Shearwater	2	Howell 2012
Audubon's Shearwater	2	Howell 2012
Wilson's Storm-Petrel	1	Howell 2012
Leach's Storm-Petrel	2	Howell 2012
Band-rumped Storm-Petrel	1	Howell 2012
White-tailed Tropicbird	1	Lee and Walsh-Mcgehee 1998
Red-billed Tropicbird	1	BirdLife 2013
Brown Booby	1.5	Schreiber and Norton 2002
Northern Gannet	2	Mowbray 2002b
Double-crested Cormorant	1.5	Hatch and Weseloh 1999
Great Cormorant	1.5	Hatch et al. 2000
Brown Pelican	1.5	Shields 2002
American Bittern	1	Lowther et al. 2009
Least Bittern	1	Poole et al. 2009
Great Blue Heron	1	Vennesland and Butler 2011
Great Egret	1	Mccrimmon et al. 2011
Snowy Egret	1	Parsons and Master 2000
Little Blue Heron	1	Rodgers et al. 2012
Tricolored Heron	1	Frederick 1997
Green Heron	1	Davis and Kushlan 1994

Table A–13. (continued)

Common Name	*BR* Score	*BR* Reference
Black-crowned Night-Heron	1	Hothem et al. 2010
Yellow-crowned Night-Heron	1	Watts 2011
White Ibis	1	Heath et al. 2009a
Glossy Ibis	1	Davis and Kricher 2000
Roseate Spoonbill	1	Dumas 2000
Osprey	1	Poole et al. 2002
Northern Harrier	1	Smith et al. 2011
Black Rail	1	Eddleman et al. 1994
Clapper Rail	1	Rush et al. 2012
King Rail	1	Poole et al. 2005
Virginia Rail	1	Conway 1995
Sora	1	Melvin and Gibbs 2012
Purple Gallinule	1	West and Hess 2002
Common Gallinule	1	Bannor and Kiviat 2002
American Coot	1	Brisbin et al. 2002
Black-bellied Plover	1	Paulson 1995
American Golden-Plover	1	Johnson and Connors 2010
Wilson's Plover	1	Corbat and Berstrom 2000
Semipalmated Plover	1	Nol and Blanken 1999
Piping Plover	1	Elliott-Smith and Haig 2004
Killdeer	1	Jackson and Jackson 2000
American Oystercatcher	1	AOWG et al. 2013
Black-necked Stilt	1	Robinson et al. 1999
American Avocet	1	Robinson et al. 1997
Spotted Sandpiper	1	Reed et al. 2013
Solitary Sandpiper	1	Moskoff 2011
Greater Yellowlegs	1	Elphick and Tibbitts 1998
Willet	1	Lowther et al. 2001
Lesser Yellowlegs	1	Tibbitts and Moskoff 1999
Upland Sandpiper	1	Houston et al. 2011
Whimbrel	1	Skeel and Mallory 1996
Hudsonian Godwit	1	Walker et al. 2011

Table A–13. (continued)

Common Name	*BR* Score	*BR* Reference
Marbled Godwit	1	Gratto-Trevor 2000
Ruddy Turnstone	1	Nettleship 2000
Red Knot	1	Harrington 2001
Sanderling	1	Macwhirter et al. 2002
Semipalmated Sandpiper	1	Hicklin and Gratto-Trevor 2010
Western Sandpiper	1	Wilson 1994
Least Sandpiper	1	Nebel and Cooper 2008
White-rumped Sandpiper	1	Parmelee 1992
Baird's Sandpiper	1	Moskoff and Montgomerie 2002
Pectoral Sandpiper	1	Holmes and Pitelka 1998
Purple Sandpiper	1	Payne and Pierce 2002
Dunlin	1	Warnock and Gill 1996
Stilt Sandpiper	1	Klima and Jehl 2012
Buff-breasted Sandpiper	1	Lanctot and Laredo 1994
Short-billed Dowitcher	1	Jehl et al. 2001
Long-billed Dowitcher	1	Takekawa and Warnock 2000
Wilson's Snipe	1	Mueller 1999
American Woodcock	1	Keppie and Whiting 1994
Red-necked Phalarope	1	Rubega et al. 2000
Red Phalarope	1	Tracy et al. 2002
Black-legged Kittiwake	1	Hatch et al. 2009
Sabine's Gull	1	Day et al. 2001
Bonaparte's Gull	1	Burger and Gochfeld 2002
Black-headed Gull	1.5	Howell and Dunn 2007
Little Gull	1	Ewins and Weseloh 1999
Laughing Gull	1.5	Burger 1996
Ring-billed Gull	1	Pollet et al. 2012
Herring Gull	2	Pierotti and Good 1994
Iceland Gull	1	Snell 2002
Lesser Black-backed Gull	1	Based on similar species
Glaucous Gull	1	Weiser and Gilchrist 2012
Great Black-backed Gull	2	Good 1998
Brown Noddy	2	Chardine and Morris 1996

Table A–13. (continued)

Common Name	*BR* Score	*BR* Reference
Sooty Tern	2	Schreiber et al. 2002
Bridled Tern	2	Haney et al. 1999
Least Tern	1.5	Thompson et al. 1997
Gull-billed Tern	1	Molina et al. 2009
Caspian Tern	1	Cuthbert and Wires 1999
Black Tern	1	Heath et al. 2009b
Roseate Tern	2	Gochfeld et al. 1998
Common Tern	2	Nisbet 2002
Arctic Tern	2	Hatch 2002
Forster's Tern	1.5	Mcnicholl et al. 2001
Royal Tern	1.5	Buckley and Buckley 2002
Sandwich Tern	1.5	Shealer 1999
Black Skimmer	1	Gochfeld and Burger 1994
Great Skua	1	BirdLife 2013
South Polar Skua	1	BirdLife 2013
Pomarine Jaeger	1	Wiley and Lee 2000
Parasitic Jaeger	1	Wiley and Lee 1999
Long-tailed Jaeger	1	Wiley and Lee 1998
Dovekie	1	Montevecchi and Stenhouse 2002
Common Murre	1	Ainley et al. 2002
Thick-billed Murre	1	Gaston and Hipfner 2000
Razorbill	1.5	Lavers et al. 2009
Black Guillemot	2	Butler and Buckley 2002
Atlantic Puffin	2	Lowther et al. 2002
American Kestrel	1	Smallwood and Bird 2002
Merlin	1	Warkentin et al. 2005
Peregrine Falcon	1	White et al. 2002
Barn Swallow	1	Brown and Brown 1999
Blue-gray Gnatcatcher	1	Kershner and Ellison 2012
Bicknell's Thrush	1	Rimmer et al. 2001
Ovenbird	1	Porneluzi et al. 2011
Northern Waterthrush	1	Eaton 1995
Common Yellowthroat	1	Guzy and Ritchison 1999

Table A–13. (continued)

Common Name	*BR* Score	*BR* Reference
American Redstart	1	Sherry and Holmes 1997
Kirtland's Warbler	1	Mayfield 1992
Cape May Warbler	1	Baltz and Latta 1998
Northern Parula	1	Moldenhauer and Regelski 2012
Blackburnian Warbler	1	Morse 2004
Blackpoll Warbler	1	DeLuca et al. 2013
Palm Warbler	1	Wilson 1996
Yellow-rumped Warbler	1	Hunt and Flaspohler 1998
Canada Warbler	1	Reitsma et al. 2010
Chipping Sparrow	1	Middleton 1998
Savannah Sparrow	1	Wheelwright and Rising 2008
Song Sparrow	1	Arcese et al. 2002
White-throated Sparrow	1	Falls and Kopachena 2010
Indigo Bunting	1	Payne 2006
Baltimore Oriole	1	Rising and Flood 1998
American Goldfinch	1	McGraw and Middleton 2009

Table A–14.

Disturbance (*DI*) score, uncertainty, and references.

Common Name	*DI* Score	*DI* % Uncertainty	*DI* Reference
Snow Goose	0	10	Not feeding, and unlikely to be resting on water in AOCS
Brant	0	10	Not feeding, and unlikely to be resting on water in AOCS
Canada Goose	0	10	Not feeding, and unlikely to be resting on water in AOCS
Tundra Swan	0	10	Not feeding, and unlikely to be resting on water in AOCS
Wood Duck	0	10	Not feeding, and unlikely to be resting on water in AOCS

Table A–14. (continued)

Common Name	*DI* Score	*DI* % Uncertainty	*DI* Reference
Gadwall	0	10	Not feeding, and unlikely to be resting on water in AOCS
American Wigeon	0	10	Not feeding, and unlikely to be resting on water in AOCS
American Black Duck	0	10	Not feeding, and unlikely to be resting on water in AOCS
Mallard	0	10	Not feeding, and unlikely to be resting on water in AOCS
Blue-winged Teal	0	10	Not feeding, and unlikely to be resting on water in AOCS
Northern Shoveler	0	10	Not feeding, and unlikely to be resting on water in AOCS
Northern Pintail	0	10	Not feeding, and unlikely to be resting on water in AOCS
Green-winged Teal	0	10	Not feeding, and unlikely to be resting on water in AOCS
Canvasback	4	25	Based on other Aythya-spp
Redhead	4	25	Based on other Aythya-spp
Ring-necked Duck	4	25	Based on other Aythya-spp
Greater Scaup	4	25	Based on other Aythya-spp
Lesser Scaup	4	25	Based on other Aythya-spp
King Eider	3	25	Based on Common Eider
Common Eider	3	10	Furness and Wade 2012; Garthe and Hüppop 2004
Harlequin Duck	3	25	Based on experience
Surf Scoter	5	10	Furness and Wade 2012; Garthe and Hüppop 2004
White-winged Scoter	5	10	Furness and Wade 2012; Garthe and Hüppop 2004
Black Scoter	5	25	Based on similar species
Long-tailed Duck	3	10	Schwemmer et al. 2011 (293 m median flush distance from ships)
Bufflehead	4	25	Based on similar species
Common Goldeneye	4	10	Furness et al. 2013; Platteeuw and Beekman 1994

Table A–14. (continued)

Common Name	*DI* Score	*DI* % Uncertainty	*DI* Reference
Barrow's Goldeneye	4	25	Based on similar species
Hooded Merganser	4	25	Based on similar species
Common Merganser	4	10	Furness et al. 2013
Red-breasted Merganser	3	25	Furness and Wade 2012
Ruddy Duck	4	25	Based on similar species
Red-throated Loon	5	25	Schwemmer et al. 2011; Topping and Petersen 2011
Common Loon	5	10	Furness and Wade 2012
Pied-billed Grebe	0	25	Based on similar species
Horned Grebe	3	10	Furness and Wade 2012
Red-necked Grebe	3	10	Garthe and Hüppop 2004
Northern Fulmar	1	10	Furness and Wade 2012; Furness et al. 2013; Garthe and Hüppop 2004
Bermuda Petrel	1	25	Based on similar species
Black-capped Petrel	1	25	Based on similar species
Cory's Shearwater	1	10	Winiarski et al. 2011
Great Shearwater	1	10	Winiarski et al. 2011
Sooty Shearwater	1	10	Cramp and Simmons 1977; del Hoyo et al. 1992; Furness and Wade 2012; Furness et al. 2013; Winiarski et al. 2011
Manx Shearwater	1	10	Cramp and Simmons 1977; del Hoyo et al. 1992; Furness and Wade 2012; Furness et al. 2013; Winiarski et al. 2011
Audubon's Shearwater	1	25	Based on experience
Wilson's Storm-Petrel	1	25	Winiarski et al. 2011 and experience
Leach's Storm-Petrel	1	10	Furness and Wade 2012; Furness et al. 2013; Winiarski et al. 2011
Band-rumped Storm-Petrel	1	25	Based on experience
White-tailed Tropicbird	1	25	Based on experience

Table A–14. (continued)

Common Name	*DI* Score	*DI* % Uncertainty	*DI* Reference
Red-billed Tropicbird	1	25	Based on similar species
Brown Booby	2	25	Based on similar species
Northern Gannet	2	10	Furness and Wade 2012; Furness et al. 2013; Garthe and Hüppop 2004
Double-crested Cormorant	3	25	Winiarski et al. 2011 and experience
Great Cormorant	4	10	Furness and Wade 2012; Furness et al. 2013; Garthe and Hüppop 2004
Brown Pelican	3	25	Based on experience
American Bittern	0	10	Not feeding, and unable to rest on water in AOCS
Least Bittern	0	10	Not feeding, and unable to rest on water in AOCS
Great Blue Heron	0	10	Not feeding, and unable to rest on water in AOCS
Great Egret	0	10	Not feeding, and unable to rest on water in AOCS
Snowy Egret	0	10	Not feeding, and unable to rest on water in AOCS
Little Blue Heron	0	10	Not feeding, and unable to rest on water in AOCS
Tricolored Heron	0	10	Not feeding, and unable to rest on water in AOCS
Green Heron	0	10	Not feeding, and unable to rest on water in AOCS
Black-crowned Night-Heron	0	10	Not feeding, and unable to rest on water in AOCS
Yellow-crowned Night-Heron	0	10	Not feeding, and unable to rest on water in AOCS
White Ibis	0	10	Not feeding, and unable to rest on water in AOCS
Glossy Ibis	0	10	Not feeding, and unable to rest on water in AOCS
Roseate Spoonbill	0	10	Not feeding, and unable to rest on water in AOCS

Table A–14. (continued)

Common Name	*DI* Score	*DI* % Uncertainty	*DI* Reference
Osprey	0	10	Not feeding, and unable to rest on water in AOCS
Northern Harrier	0	10	Not feeding, and unable to rest on water in AOCS
Black Rail	0	10	Not feeding, and unable to rest on water in AOCS
Clapper Rail	0	10	Not feeding, and unable to rest on water in AOCS
King Rail	0	10	Not feeding, and unable to rest on water in AOCS
Virginia Rail	0	10	Not feeding, and unable to rest on water in AOCS
Sora	0	10	Not feeding, and unable to rest on water in AOCS
Purple Gallinule	0	10	Not feeding, and unable to rest on water in AOCS
Common Gallinule	0	10	Not feeding, and unable to rest on water in AOCS
American Coot	0	10	Not feeding, and unable to rest on water in AOCS
Black-bellied Plover	0	10	Not feeding, and unable to rest on water in AOCS
American Golden-Plover	0	10	Not feeding, and unable to rest on water in AOCS
Wilson's Plover	0	10	Not feeding, and unable to rest on water in AOCS
Semipalmated Plover	0	10	Not feeding, and unable to rest on water in AOCS
Piping Plover	0	10	Not feeding, and unable to rest on water in AOCS
Killdeer	0	10	Not feeding, and unable to rest on water in AOCS
American Oystercatcher	0	10	Not feeding, and unable to rest on water in AOCS
Black-necked Stilt	0	10	Not feeding, and unable to rest on water in AOCS

Table A–14. (continued)

Common Name	*DI* Score	*DI* % Uncertainty	*DI* Reference
American Avocet	0	10	Not feeding, and unable to rest on water in AOCS
Spotted Sandpiper	0	10	Not feeding, and unable to rest on water in AOCS
Solitary Sandpiper	0	10	Not feeding, and unable to rest on water in AOCS
Greater Yellowlegs	0	10	Not feeding, and unable to rest on water in AOCS
Willet	0	10	Not feeding, and unable to rest on water in AOCS
Lesser Yellowlegs	0	10	Not feeding, and unable to rest on water in AOCS
Upland Sandpiper	0	10	Not feeding, and unable to rest on water in AOCS
Whimbrel	0	10	Not feeding, and unable to rest on water in AOCS
Hudsonian Godwit	0	10	Not feeding, and unable to rest on water in AOCS
Marbled Godwit	0	10	Not feeding, and unable to rest on water in AOCS
Ruddy Turnstone	0	10	Not feeding, and unable to rest on water in AOCS
Red Knot	0	10	Not feeding, and unable to rest on water in AOCS
Sanderling	0	10	Not feeding, and unable to rest on water in AOCS
Semipalmated Sandpiper	0	10	Not feeding, and unable to rest on water in AOCS
Western Sandpiper	0	10	Not feeding, and unable to rest on water in AOCS
Least Sandpiper	0	10	Not feeding, and unable to rest on water in AOCS
White-rumped Sandpiper	0	10	Not feeding, and unable to rest on water in AOCS
Baird's Sandpiper	0	10	Not feeding, and unable to rest on water in AOCS

Table A–14. (continued)

Common Name	*DI* Score	*DI* % Uncertainty	*DI* Reference
Pectoral Sandpiper	0	10	Not feeding, and unable to rest on water in AOCS
Purple Sandpiper	0	10	Not feeding, and unable to rest on water in AOCS
Dunlin	0	10	Not feeding, and unable to rest on water in AOCS
Stilt Sandpiper	0	10	Not feeding, and unable to rest on water in AOCS
Buff-breasted Sandpiper	0	10	Not feeding, and unable to rest on water in AOCS
Short-billed Dowitcher	0	10	Not feeding, and unable to rest on water in AOCS
Long-billed Dowitcher	0	10	Not feeding, and unable to rest on water in AOCS
Wilson's Snipe	0	10	Not feeding, and unable to rest on water in AOCS
American Woodcock	0	10	Not feeding, and unable to rest on water in AOCS
Red-necked Phalarope	2	25	Based on experience
Red Phalarope	2	25	Based on experience
Black-legged Kittiwake	3	10	Furness and Wade 2012
Sabine's Gull	2	25	Based on similar species
Bonaparte's Gull	2	25	Based on similar species
Black-headed Gull	2	10	Furness and Wade 2012; Furness et al. 2013; Garthe and Hüppop 2004
Little Gull	1	10	Garthe and Hüppop 2004
Laughing Gull	2	25	Winiarski et al. 2011 and experience
Ring-billed Gull	1	25	Based on experience
Herring Gull	2	10	Furness and Wade 2012; Furness et al. 2013; Garthe and Hüppop 2004
Iceland Gull	2	25	Based on similar species
Lesser Black-backed Gull	2	10	Furness and Wade 2012; Furness et al. 2013; Garthe and Hüppop 2004

Table A–14. (continued)

Common Name	*DI* Score	*DI* % Uncertainty	*DI* Reference
Glaucous Gull	2	25	Based on similar species
Great Black-backed Gull	2	10	Furness and Wade 2012; Furness et al. 2013; Garthe and Hüppop 2004
Brown Noddy	2	25	Based on similar species
Sooty Tern	2	25	Based on similar species
Bridled Tern	1	10	Based on experience
Least Tern	2	10	Furness and Wade 2012
Gull-billed Tern	2	25	Based on similar species
Caspian Tern	2	25	Based on experience
Black Tern	1	10	Garthe and Hüppop 2004
Roseate Tern	1	10	Furness and Wade 2012; Furness et al. 2013; Garthe and Hüppop 2004; Perrow et al. 2011b
Common Tern	1	10	Garthe and Hüppop 2004; Furness and Wade 2012; Furness et al. 2013; Perrow et al. 2011b
Arctic Tern	1	10	Furness and Wade 2012; Furness et al. 2013; Garthe and Hüppop 2004; Perrow et al. 2011b
Forster's Tern	2	25	Based on similar species
Royal Tern	2	25	Based on similar species
Sandwich Tern	2	10	Furness and Wade 2012; Furness et al. 2013; Garthe and Hüppop 2004
Black Skimmer	1	10	Based on similar species
Great Skua	1	10	Furness and Wade 2012; Furness et al. 2013; Garthe and Hüppop 2004
South Polar Skua	1	25	Based on similar species
Pomarine Jaeger	1	10	Based on experience
Parasitic Jaeger	1	10	Based on experience
Long-tailed Jaeger	1	25	Based on similar species
Dovekie	2	10	Cramp and Simmons 1980; del Hoyo et al. 1996; Evans and Nettleship 1985; Furness et al. 2013

Table A–14. (continued)

Common Name	*DI* Score	*DI* % Uncertainty	*DI* Reference
Common Murre	3	10	Barrett and Vader 1984; Bellefleur et al. 2009; Carney and Sydeman 1999; Evans and Nettleship 1985; Furness and Wade 2012; Furness et al. 2013; Garthe and Hüppop 2004; Rojek et al. 2007; Ronconi and Clair 2002; Thayer et al. 1999
Thick-billed Murre	3	25	Based on similar species
Razorbill	3	10	Barrett and Vader 1984; Bellefleur et al. 2009; Carney and Sydeman 1999; Evans and Nettleship 1985; Garthe and Hüppop 2004; Furness and Wade 2012; Furness et al. 2013; Ronconi and Clair 2002
Black Guillemot	3	10	Barrett and Vader 1984; Bellefleur et al. 2009; Carney and Sydeman 1999; Evans and Nettleship 1985; Furness and Wade 2012; Furness et al. 2013; Ronconi and Clair 2002
Atlantic Puffin	2	10	Barrett and Vader 1984; Carney and Sydeman 1999; Evans and Nettleship 1985; Furness and Wade 2012; Furness et al. 2013; Garthe and Hüppop 2004
American Kestrel	0	10	Not feeding, and unable to rest on water in AOCS
Merlin	0	10	Not feeding, and unable to rest on water in AOCS
Peregrine Falcon	0	10	Not feeding, and unable to rest on water in AOCS
Barn Swallow	0	10	Not feeding, and unable to rest on water in AOCS
Blue-gray Gnatcatcher	0	10	Not feeding, and unable to rest on water in AOCS
Bicknell's Thrush	0	10	Not feeding, and unable to rest on water in AOCS
Ovenbird	0	10	Not feeding, and unable to rest on water in AOCS
Northern Waterthrush	0	10	Not feeding, and unable to rest on water in AOCS

Table A–14. (continued)

Common Name	*DI* Score	*DI* % Uncertainty	*DI* Reference
Common Yellowthroat	0	10	Not feeding, and unable to rest on water in AOCS
American Redstart	0	10	Not feeding, and unable to rest on water in AOCS
Kirtland's Warbler	0	10	Not feeding, and unable to rest on water in AOCS
Cape May Warbler	0	10	Not feeding, and unable to rest on water in AOCS
Northern Parula	0	10	Not feeding, and unable to rest on water in AOCS
Blackburnian Warbler	0	10	Not feeding, and unable to rest on water in AOCS
Blackpoll Warbler	0	10	Not feeding, and unable to rest on water in AOCS
Palm Warbler	0	10	Not feeding, and unable to rest on water in AOCS
Yellow-rumped Warbler	0	10	Not feeding, and unable to rest on water in AOCS
Canada Warbler	0	10	Not feeding, and unable to rest on water in AOCS
Chipping Sparrow	0	10	Not feeding, and unable to rest on water in AOCS
Savannah Sparrow	0	10	Not feeding, and unable to rest on water in AOCS
Song Sparrow	0	10	Not feeding, and unable to rest on water in AOCS
White-throated Sparrow	0	10	Not feeding, and unable to rest on water in AOCS
Indigo Bunting	0	10	Not feeding, and unable to rest on water in AOCS
Baltimore Oriole	0	10	Not feeding, and unable to rest on water in AOCS
American Goldfinch	0	10	Not feeding, and unable to rest on water in AOCS

Table A–15.

Habitat flexibility (*HF*) score, uncertainty, and references.

Common Name	*HF* Score	*HF* Uncertainty	*HF* Reference
Snow Goose	0	10	AO < 20
Brant	0	10	AO < 20
Canada Goose	0	10	AO < 20
Tundra Swan	0	10	AO < 20
Wood Duck	0	10	AO < 20
Gadwall	0	10	AO < 20
American Wigeon	0	10	AO < 20
American Black Duck	0	10	AO < 20
Mallard	0	10	AO < 20
Blue-winged Teal	0	10	AO < 20
Northern Shoveler	0	10	AO < 20
Northern Pintail	0	10	AO < 20
Green-winged Teal	0	10	AO < 20
Canvasback	0	10	AO < 20
Redhead	0	10	AO < 20
Ring-necked Duck	0	10	AO < 20
Greater Scaup	4	10	Furness and Wade 2012; Furness et al. 2013
Lesser Scaup	4	50	Austin et al. 1998
King Eider	4	50	Based on similar species
Common Eider	4	10	Garthe and Hüppop 2004; Furness and Wade 2012; Furness et al. 2013
Harlequin Duck	4	10	Robertson et al. 1999
Surf Scoter	4	50	Based on similar species
White-winged Scoter	3	10	Garthe and Hüppop 2004;Forrester et al. 2007; Furness and Wade 2012; Furness et al. 2013
Black Scoter	4	10	Garthe and Hüppop 2004; Furness and Wade 2012; Furness et al. 2013
Long-tailed Duck	4	10	Garthe 2006; Furness et al. 2013

Table A–15. (continued)

Common Name	*HF* Score	*HF* Uncertainty	*HF* Reference
Bufflehead	3	25	Gauthier 1993
Common Goldeneye	4	10	Jones and Drobney 1986; Furness et al. 2013
Barrow's Goldeneye	4	25	Eadie et al. 2000
Hooded Merganser	0	10	AO < 20
Common Merganser	1	25	Mallory and Metz 1999
Red-breasted Merganser	1	50	Based on similar species
Ruddy Duck	2	25	Brua 2002
Red-throated Loon	4	10	Garthe and Hüppop 2004; Furness and Wade 2012; Furness et al. 2013
Common Loon	3	10	Forrester et al. 2007; Furness et al. 2013
Pied-billed Grebe	0	25	Muller and Storer 1999
Horned Grebe	4	10	Forrester et al. 2007; Furness and Wade 2012
Red-necked Grebe	3	10	Stout et al. 1999; Garthe and Hüppop 2004
Northern Fulmar	1	10	Garthe and Hüppop 2004; Furness and Wade 2012
Bermuda Petrel	1	50	Based on similar species
Black-capped Petrel	1	25	Haney 1987
Cory's Shearwater	1	25	Based on similar species
Great Shearwater	1	50	Based on similar species
Sooty Shearwater	1	10	Forrester et al. 2007; Furness et al. 2013
Manx Shearwater	1	10	Forrester et al. 2007; Furness and Wade 2012
Audubon's Shearwater	1	50	Based on similar species
Wilson's Storm-Petrel	1	50	Based on similar species
Leach's Storm-Petrel	1	10	Forrester et al. 2007; Furness and Wade 2012; Furness et al. 2013
Band-rumped Storm-Petrel	1	25	Slotterback 2002

Table A–15. (continued)

Common Name	*HF* Score	*HF* Uncertainty	*HF* Reference
White-tailed Tropicbird	1	50	Based on similar species
Red-billed Tropicbird	1	50	Based on similar species
Brown Booby	1	25	Schreiber and Norton 2002
Northern Gannet	1	10	Garthe and Hüppop 2004; Furness and Wade 2012; Furness et al. 2013
Double-crested Cormorant	1	25	Hatch and Weseloh 1999
Great Cormorant	3	10	Garthe and Hüppop 2004; Forrester et al. 2007; Furness and Wade 2012; Furness et al. 2013
Brown Pelican	1	25	Shields 2002
American Bittern	0	10	AO < 20
Least Bittern	0	10	AO < 20
Great Blue Heron	0	10	AO < 20
Great Egret	0	10	AO < 20
Snowy Egret	0	10	AO < 20
Little Blue Heron	0	10	AO < 20
Tricolored Heron	0	10	AO < 20
Green Heron	0	10	AO < 20
Black-crowned Night-Heron	0	10	AO < 20
Yellow-crowned Night-Heron	0	10	AO < 20
White Ibis	0	10	AO < 20
Glossy Ibis	0	10	AO < 20
Roseate Spoonbill	0	10	AO < 20
Osprey	0	10	AO < 20
Northern Harrier	0	10	AO < 20
Black Rail	0	10	AO < 20
Clapper Rail	0	10	AO < 20
King Rail	0	10	AO < 20
Virginia Rail	0	10	AO < 20
Sora	0	10	AO < 20

Table A–15. (continued)

Common Name	*HF* Score	*HF* Uncertainty	*HF* Reference
Purple Gallinule	0	10	AO < 20
Common Gallinule	0	10	AO < 20
American Coot	0	10	AO < 20
Black-bellied Plover	0	10	AO < 20
American Golden-Plover	0	10	AO < 20
Wilson's Plover	0	10	AO < 20
Semipalmated Plover	0	10	AO < 20
Piping Plover	0	10	AO < 20
Killdeer	0	10	AO < 20
American Oystercatcher	0	10	AO < 20
Black-necked Stilt	0	10	AO < 20
American Avocet	0	10	AO < 20
Spotted Sandpiper	0	10	AO < 20
Solitary Sandpiper	0	10	AO < 20
Greater Yellowlegs	0	10	AO < 20
Willet	0	10	AO < 20
Lesser Yellowlegs	0	10	AO < 20
Upland Sandpiper	0	10	AO < 20
Whimbrel	0	10	AO < 20
Hudsonian Godwit	0	10	AO < 20
Marbled Godwit	0	10	AO < 20
Ruddy Turnstone	0	10	AO < 20
Red Knot	0	10	AO < 20
Sanderling	0	10	AO < 20
Semipalmated Sandpiper	0	10	AO < 20
Western Sandpiper	0	10	AO < 20
Least Sandpiper	0	10	AO < 20
White-rumped Sandpiper	0	10	AO < 20
Baird's Sandpiper	0	10	AO < 20
Pectoral Sandpiper	0	10	AO < 20

Table A–15. (continued)

Common Name	*HF* Score	*HF* Uncertainty	*HF* Reference
Purple Sandpiper	0	10	AO < 20
Dunlin	0	10	AO < 20
Stilt Sandpiper	0	10	AO < 20
Buff-breasted Sandpiper	0	10	AO < 20
Short-billed Dowitcher	0	10	AO < 20
Long-billed Dowitcher	0	10	AO < 20
Wilson's Snipe	0	10	AO < 20
American Woodcock	0	10	AO < 20
Red-necked Phalarope	2	25	Rubega et al. 2000
Red Phalarope	2	25	Tracy et al. 2002
Black-legged Kittiwake	2	10	Garthe and Hüppop 2004; Furness and Wade 2012; Furness et al. 2013
Sabine's Gull	2	25	Day et al. 2001
Bonaparte's Gull	2	50	Based on similar species
Black-headed Gull	2	10	AO < 20
Little Gull	3	25	Garthe and Hüppop 2004
Laughing Gull	1	25	Burger 1996
Ring-billed Gull	1	25	Pollet et al. 2012
Herring Gull	1	10	Garthe and Hüppop 2004; Furness and Wade 2012; Furness et al. 2013
Iceland Gull	2	25	Snell 2002
Lesser Black-backed Gull	1	10	Garthe and Hüppop 2004; Furness and Wade 2012; Furness et al. 2013
Glaucous Gull	1	25	Weiser and Gilchrist 2012
Great Black-backed Gull	2	10	Garthe and Hüppop 2004; Furness and Wade 2012; Furness et al. 2013
Brown Noddy	2	25	Chardine and Morris 1996
Sooty Tern	2	25	Schreiber et al. 2002
Bridled Tern	3	25	Haney et al. 1999
Least Tern	0	10	AO < 20
Gull-billed Tern	0	10	AO < 20

Table A–15. (continued)

Common Name	*HF* Score	*HF* Uncertainty	*HF* Reference
Caspian Tern	0	10	AO < 20
Black Tern	3	25	Heath et al. 2009b
Roseate Tern	3	10	Forrester et al. 2007; Furness and Wade 2012; Furness et al. 2013
Common Tern	3	10	Forrester et al. 2007; Furness and Wade 2012; Furness et al. 2013
Arctic Tern	3	10	Garthe and Hüppop 2004; Furness and Wade 2012; Furness et al. 2013
Forster's Tern	0	10	AO < 20
Royal Tern	0	10	AO < 20
Sandwich Tern	0	10	AO < 20
Black Skimmer	0	10	AO < 20
Great Skua	2	10	Garthe and Hüppop 2004; Furness and Wade 2012; Furness et al. 2013
South Polar Skua	2	50	Similar to Great Skua
Pomarine Jaeger	2	50	Similar to Parasitic Jaeger
Parasitic Jaeger	2	10	Furness and Wade 2012; Furness et al. 2013
Long-tailed Jaeger	2	50	Similar to Parasitic Jaeger
Dovekie	2	10	Forrester et al. 2007; Furness and Wade 2012; Furness et al. 2013
Common Murre	3	10	Garthe and Hüppop 2004; Forrester et al. 2007; Furness and Wade 2012; Furness et al. 2013
Thick-billed Murre	3	50	Based on similar species
Razorbill	3	10	Garthe and Hüppop 2004; Furness and Wade 2012; Furness et al. 2013
Black Guillemot	4	10	Forrester et al. 2007; Furness and Wade 2012; Furness et al. 2013
Atlantic Puffin	3	10	Garthe and Hüppop 2004; Furness and Wade 2012; Furness et al. 2013
American Kestrel	0	10	Based on similar species
Merlin	0	10	Based on similar species
Peregrine Falcon	0	10	Based on similar species
Barn Swallow	0	10	Based on similar species

Table A–15. (continued)

Common Name	*HF* Score	*HF* Uncertainty	*HF* Reference
Blue-gray Gnatcatcher	0	10	Based on similar species
Bicknell's Thrush	0	10	Based on similar species
Ovenbird	0	10	Based on similar species
Northern Waterthrush	0	10	Based on similar species
Common Yellowthroat	0	10	Based on similar species
American Redstart	0	10	Based on similar species
Kirtland's Warbler	0	10	Based on similar species
Cape May Warbler	0	10	Based on similar species
Northern Parula	0	10	Based on similar species
Blackburnian Warbler	0	10	Based on similar species
Blackpoll Warbler	0	10	Based on similar species
Palm Warbler	0	10	Based on similar species
Yellow-rumped Warbler	0	10	Based on similar species
Canada Warbler	0	10	Based on similar species
Chipping Sparrow	0	10	Based on similar species
Savannah Sparrow	0	10	Based on similar species
Song Sparrow	0	10	Based on similar species
White-throated Sparrow	0	10	Based on similar species
Indigo Bunting	0	10	Based on similar species
Baltimore Oriole	0	10	Based on similar species
American Goldfinch	0	10	Based on similar species

The Department of the Interior Mission

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the sound use of our land and water resources, protecting our fish, wildlife and biological diversity; preserving the environmental and cultural values of our national parks and historical places; and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to ensure that their development is in the best interests of all our people by encouraging stewardship and citizen participation in their care. The Department also has a major responsibility for American Indian reservation communities and for people who live in island communities.

The Bureau of Ocean Energy Management

The Bureau of Ocean Energy Management (BOEM) works to manage the exploration and development of the nation's offshore resources in a way that appropriately balances economic development, energy independence, and environmental protection through oil and gas leases, renewable energy development and environmental reviews and studies.

www.boem.gov