Assessing the Relative Vulnerability of Migratory Bird Species to Offshore Wind Energy Projects on the Atlantic Outer Continental Shelf

NORMANDEAU ASSOCIATES
Environmental Consultants

Purpose of Study

BOEM
Bureau of Ocean Energy Management

Initiated study

Offshore wind could provide a significant source of energy to the mid-Atlantic and northeastern United States

Sensitivity assessments from UK and Europe

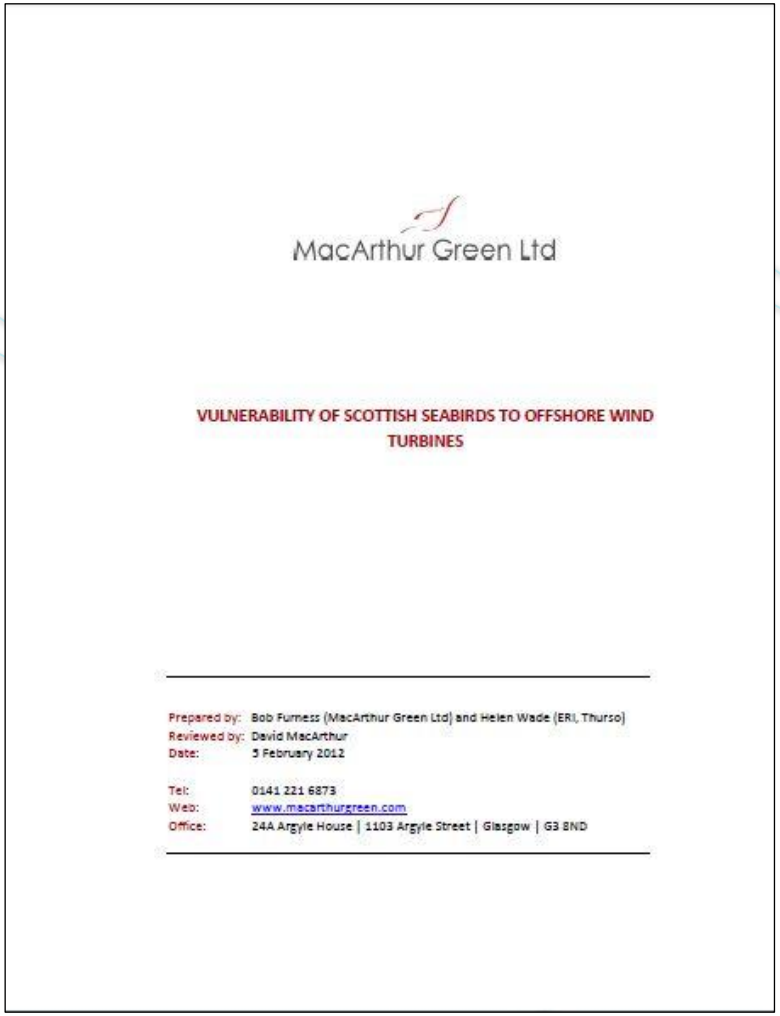
Need for a sensitivity index for birds offshore in AOCS

Project development

- Review and synthesis of previous studies
- Development of new suite of metrics of sensitivity
- Expert review of our proposed methods
- Refinement of methods and extension across 177 species of AOCS

Previous Studies from Europe include:

- Garthe and Hüppop (2004)
- Desholm (2009)
- Furness and Wade (2012)
- Furness, Wade, and Masden (2013)



MacArthur Green Ltd

VULNERABILITY OF SCOTTISH SEABIRDS TO OFFSHORE WIND TURBINES

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Data were assessed as to how appropriate they were in context of AOCS geographic scope

Geographic scope includes South Florida and the Keys

Four Reviewers from BOEM

Two Reviewers from USFWS

One Reviewer from USGS

Mark Rehfisch (APEM, Ltd)

Bob Furness (MacArthur Green)

Chris Thaxter (British Trust for Ornithology)

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Three Suites of Metrics:

- **Population sensitivity**
  - Widespread and common species
  - More restricted-range species with smaller populations
- **Collision sensitivity**
  - Direct loss of an individual
- **Displacement sensitivity**
  - Fitness consequences

Population Sensitivity

Four Metrics

- Global Population Size
- Percent of Population in AOCS
- Threat Ranking
- Adult Survival

Global Population

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

Data sources: Birdlife International (2013), Rich et al. (2004), ABC (2012), Watts (2010), Morrison et al. (2006)

Uncertainty

10% = Data fall within a single category

25% = Data extend beyond limits of two categories or come from few sources

50% = Data extend beyond three categories or supporting evidence is sparse

Global Population

Examples:

Bermuda Petrel
142 individuals
Score 5
Uncertainty 10%

Pectoral Sandpiper
25,000-1,000,000
Score 5
Uncertainty 50%

Northern Gannet
526,000-1,200,000
Score 3
Uncertainty 25%

American Goldfinch
42,000,000
Score 1
Uncertainty 10%

Percent of Population in AOCS

1 = <1% in AOCS (e.g., Canada Goose)

2 = 1–33% (e.g., Bermuda Petrel, Northern Gannet)

3 = 34–66%

4 = 67–99% (Black-capped Petrel)

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

Threat Ranking

1 = IUCN Least Concern (LC) and FWS None
(e.g., Barn Swallow)

2 = IUCN Near-Threatened (NT)
(e.g., Sooty Shearwater)

3 = IUCN Vulnerable (VU) and/or FWS candidate species (C)
(e.g., Bicknell's Thrush)

4 = IUCN Endangered (EN) and/or FWS Threatened (T)
(e.g., Piping Plover, Black-capped Petrel)

5 = IUCN Critical (CR) and/or FWS Endangered (E)
(e.g., Kirtland's Warbler and Bermuda Petrel)

Adult Survival

1 = <0.75

2 = 0.75 to 0.80

3 = >0.80 to 0.85

4 = >0.85 to 0.90 (e.g., Brown Pelican)

5 = >0.90 (e.g., Bermuda Petrel)

Population Sensitivity Results

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

Common Name	Lower	Middle Value	Upper
1. Black-capped Petrel	3.65	4.50	4.60
2. Bermuda Petrel	3.88	4.25	4.38
3. Least Tern	3.25	4.25	4.88
4. Roseate Tern	3.38	4.00	4.5
5. Kirtland's Warbler	3.75	4.00	4.03
8. Bicknell's Thrush	3.25	3.50	3.53
27. Northern Gannet	2.19	2.75	3.19
177. American Goldfinch	1.00	1.00	1.11

Collision Sensitivity

Six Factors

Measure of Uncertainty for each Factor

- Annual Occurrence
- Nocturnal Flight Activity
- Diurnal Flight Activity
- Amount of time spent flying in the RSZ
- Macro Avoidance Figures
- Breeding and Feeding Score

Annual Occurrence

Range:

Maximum 8,760 Hours in AOCS

(e.g., Common Eider, Northern Gannet, Black-capped Petrel, Manx Shearwater)

Minimum 2 Hours in AOCS

Short-distance migrants: 4 hours

(e.g., Least Bittern)

Nocturnal and Diurnal Flight Ranking

1 = 0 to 20% (e.g., Great Cormorant)

2 = 21 to 40%

3 = 41 to 60%

4 = 61 to 80% (e.g., storm petrels)

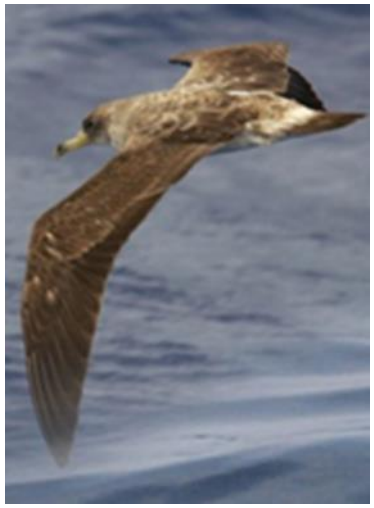
5 = 81 to 100% (e.g., Bridled Tern and all migrant passerines and shorebirds)

Amount of Time in RSZ

1 = >20% (e.g., gulls, terns, shorebirds)

3 = 5 to 20% (e.g., loons)

5 = <5% (e.g., petrels such as Black-capped and Bermuda, shearwaters, and nocturnal migrant passerines

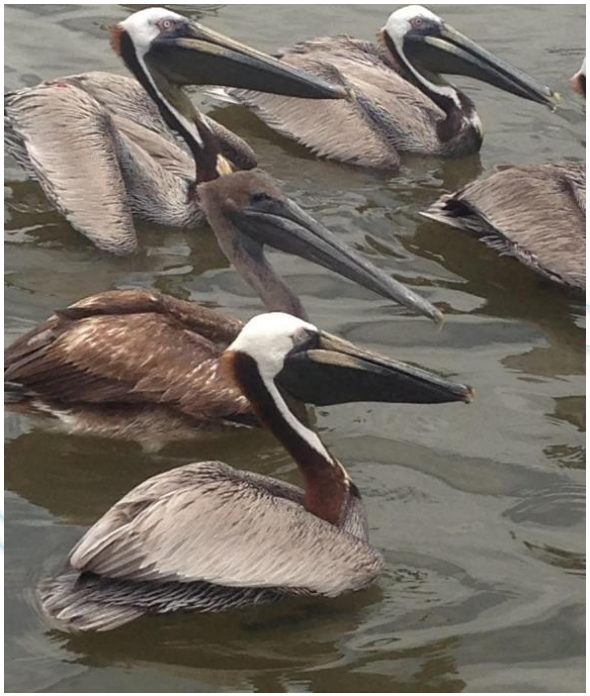


Amount of Time in RSZ- Herring Gull

From various sources within Furness et al. 2013

Number Observed	% in RSZ	Comment
71	33	land-based obs. at Slufterdam
7,327	84	land-based obs. at Slag Dobbelsteen
		median height 10–20 m; 10% above 50 m
2,223	50	radar, excl. birds following fishing boats
63	22	boat-based obs.
63	5	boat-based obs.
142	37	boat-based obs.
1,408	33	land-based obs.
51,036	15	land-based obs.
1,652	14	ship-based obs.
--	55	radar
25,252	28	ship-based obs.
--	40	boat-based obs.

Macro Avoidance



1 = >40% (ducks, loons, grebes and shearwater)

2 = 30 to 40% (gulls and migrant songbirds)

3 = 18 to 29% (shorebirds)

4 = 6 to 17% (phalaropes)

5 = 0 to 5% (Brown Pelican; precautionary with maximum uncertainty along with other under-represented species in the literature such as rails)

Breeding/Feeding

1 = unlikely to be foraging in the AOCS to feed young (e.g., tropicbirds, grebes shorebirds and passerines)

1.5 = some individuals will forage in the AOCS to feed young (e.g., Brown Pelican)

2 = individuals are regularly known to forage in the AOCS to feed young (e.g., Northern Gannet, Roseate Tern, and Common Tern)

Collision Sensitivity Results

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

Collision sensitivity scores (range: 4,380,000 to 2)

Common Name	Lower	Middle Value	Upper
1:Herring Gull	61,685	438,000	975,645
2:Great Black-backed Gull	75,920	438,000	962,340
3:Parasitic Jaeger	85,050	388,800	552,825
4:Red Phalarope	41,760	345,600	765,450
5:Long-tailed Jaeger	97,256	340,200	472,500
7: Roseate Tern	123,120	276,480	486,000
8: Northern Gannet	114,975	240,900	383,934
11: Black-capped Petrel	63,948	157,680	322,368
13: Common Tern	59,280	155,520	310,500
58: Red-throated Loon	6,200	14,400	48,510
60:Common Murre	4,380	9,198	21,922
65:American Oystercatcher	169	1,350	2,278
93: Wilson's Snipe	162	788	1,553
157: American Goldfinch	28	80	178
177: Brant	2	5	21

Displacement Sensitivity

Five Factors

- Disturbance from boats and aircraft
- Habitat Flexibility
- Macro Avoidance
- Annual Occurrence
- Breeding/Feeding

Disturbance from Boats and Aircraft

0 = unaffected by boat and helicopter traffic (e.g., migratory geese, herons, shorebirds and passerines)

1 = hardly any escape/avoidance behavior and low fleeing distance if any (e.g., shearwaters and jaegers)

2-4 = grades of behavior between scores 1 and 5 (e.g., 2=some gulls and most terns; 3=alcids, Brown Pelican; 4=scaup and goldeneye)

5 = strong escape/avoidance and large fleeing distance (e.g., scoters and loons)

Habitat Flexibility

0 = species that do not forage in the AOCS (e.g., migrant landbirds)

1 = species that use a wide range of habitats over a large area and usually having a wide range of prey available to them (e.g., gulls and petrels)

2-4 = 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 (e.g., Black Scoter, Common Eider)

Macro Avoidance

Same as in collision sensitivity BUT here represents heightened risk rather than lower risk

- Scores reversed

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

Annual Occurrence

Same as in collision sensitivity

Breeding/Feeding

Same as in collision sensitivity

Displacement Sensitivity Results

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

Common Name	Lower	Middle Value	Upper
1:Black Guillemot	411,544	700,800	1,019,729
2:Common Eider	368,971	560,640	779,793
3:Roseate Tern	178,459	414,720	521,769
4:Atlantic Puffin	279,389	413,910	525,547
5:Razorbill	255,441	394,200	517,362
8:Red-throated Loon	165,726	288,000	388,080
12:Great Black-backed Gull	119,837	262,800	376,382
14: Black-capped Petrel	77,937	236,520	314,813
16: Common Tern	85,925	233,280	333,353
19: Common Murre	106,434	183,960	272,928
34: Red Phalarope	27405	86400	159,468
59: Parasitic Jaeger	16621	25920	43,970

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Questions?

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