

**Supplement to Final Report BOEM
2021-051**

**Atlantic Marine Assessment Program
for Protected Species: 2015-2019**

**Appendix III: Distribution and
Abundance Patterns by Wind Energy
Areas**

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1 General Description

This appendix focuses on the cetacean abundance and distribution within and around the wind-energy study areas (Figure 1-1 in this Appendix). The study areas refer to the BOEM (Bureau of Ocean Energy Management) wind energy areas (WEA; as defined on 30 March 2020) and a 10 km buffer around the WEAs. The size of an appropriate buffer is dependent on a variety of factors. The dependent factors include species-specific factors, such as the species of interest, individual animal's activity and natural short-term foraging and movement patterns that could then influence the animal's response and sensitivity to a wind-energy related activity. Other dependent factors include operation-specific factors, such as sound source levels, sound propagation properties, and types of activity conducted in the wind energy area. In addition, dependent factors include area-specific factors, such as the physical topography and oceanographic features within and surrounding the wind energy areas. For example, several studies indicate 20 km may be an appropriate buffer when interested in effects of pile driving on harbor porpoises (Brandt et al. 2011; 2016), and perhaps no buffer would be needed for less mobile species or during the operation phase. Another practical reason for the 10 km buffer is, since the model output is for 10 x 10 km² cells, the buffer ensures all of the irregularly shaped wind energy areas are included in the wind-energy study area.

The density and abundance estimates provided in this Appendix are absolute estimates corrected for perception and availability bias. We derived the estimates from the Generalized Additive Model density habitat models as documented in Chapter 6, using the shipboard and aerial line transect data collected under AMAPPS (Atlantic Marine Assessment Program for Protected Species) during 2010 to 2017. For several species, the most recent patterns were from part of this timeframe because the density patterns changed dramatically within 2010 to 2017. The recent timeframe is 2014 to 2017 for sei whales and harbor porpoises, 2015 to 2017 for long-finned pilot whales, and 2010 to 2017 for all other species.

We defined the spring season as March through May, summer as June through August, fall as September through November, and winter as December through February.

For each WEA study area and surrounding regions, we plotted the seasonal survey effort per 10 x 10 km² spatial stratum for each season. We also summarized by season and survey platform, the length of the survey track lines (km), in addition to the numbers of individuals of cetaceans, sea turtles, and seals that we detected at sea during those surveys.

For each WEA study area in the recent timeframe and for each species, we summarized the average seasonal density (animals/km²), abundance (animals), and group size, including the associated coefficient of variation (CV), and plotted the average annual trend in abundance.

In addition, for the areas in and around the WEAs, we plotted the density within each 10 x 10km² spatial stratum for various functional groups of cetaceans, averaged over the most recent timeframe within each season. The functional groups included species defined as threatened or endangered under the Endangered Species Act (ESA), as strategic now or recently in the past under the Marine Mammal Protection Act (MMPA). Functional groups also included species that are sensitive to low, medium, and high frequency sounds.

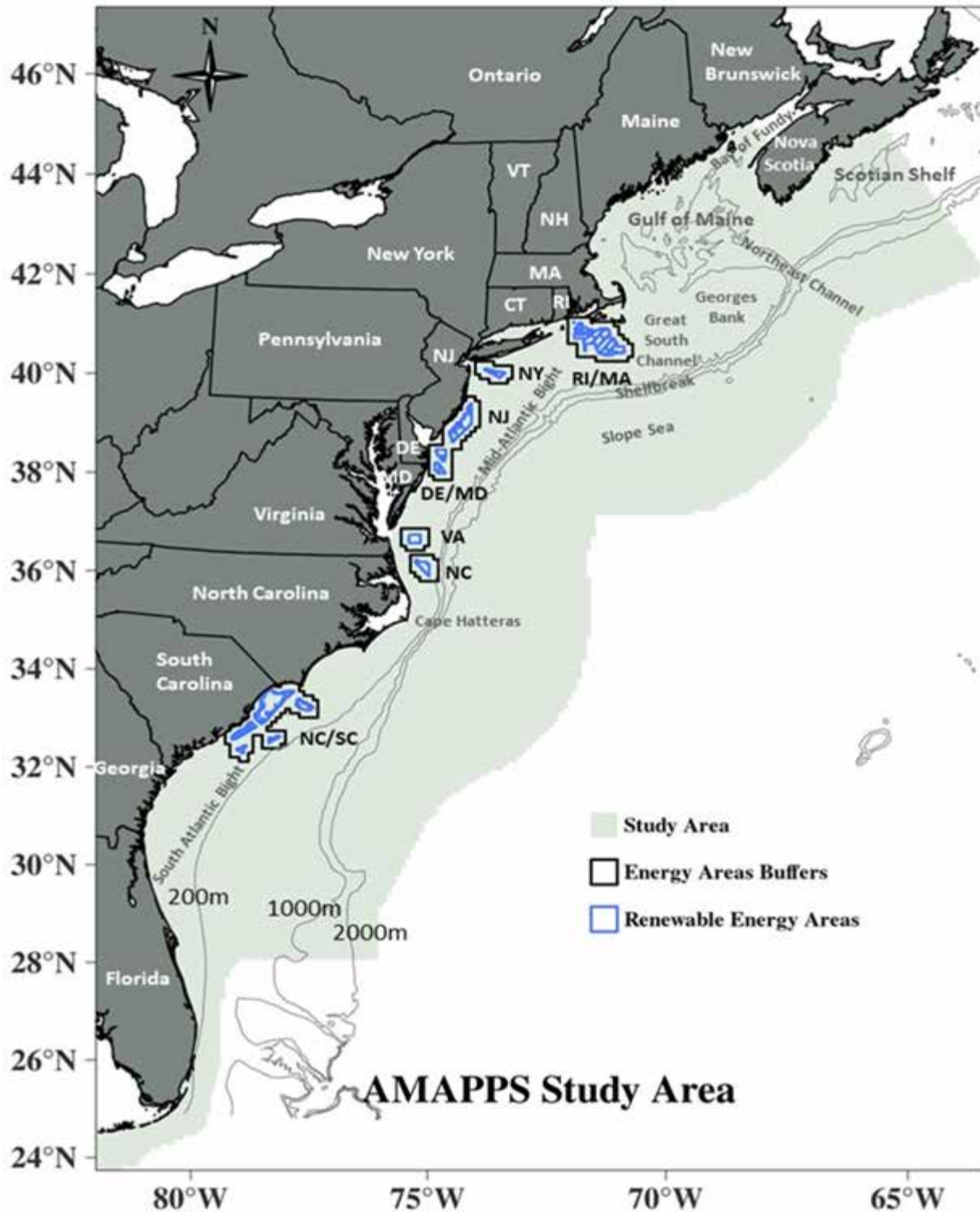


Figure 1-1 AMAPPS study area

We identified the offshore wind energy areas (blue) along with a 10 km buffer (black) in relationship to the AMAPPS study area (green shaded).

2 Rhode Island/Massachusetts (RI/MA) Wind Energy Study Area

2.1 Data Collection

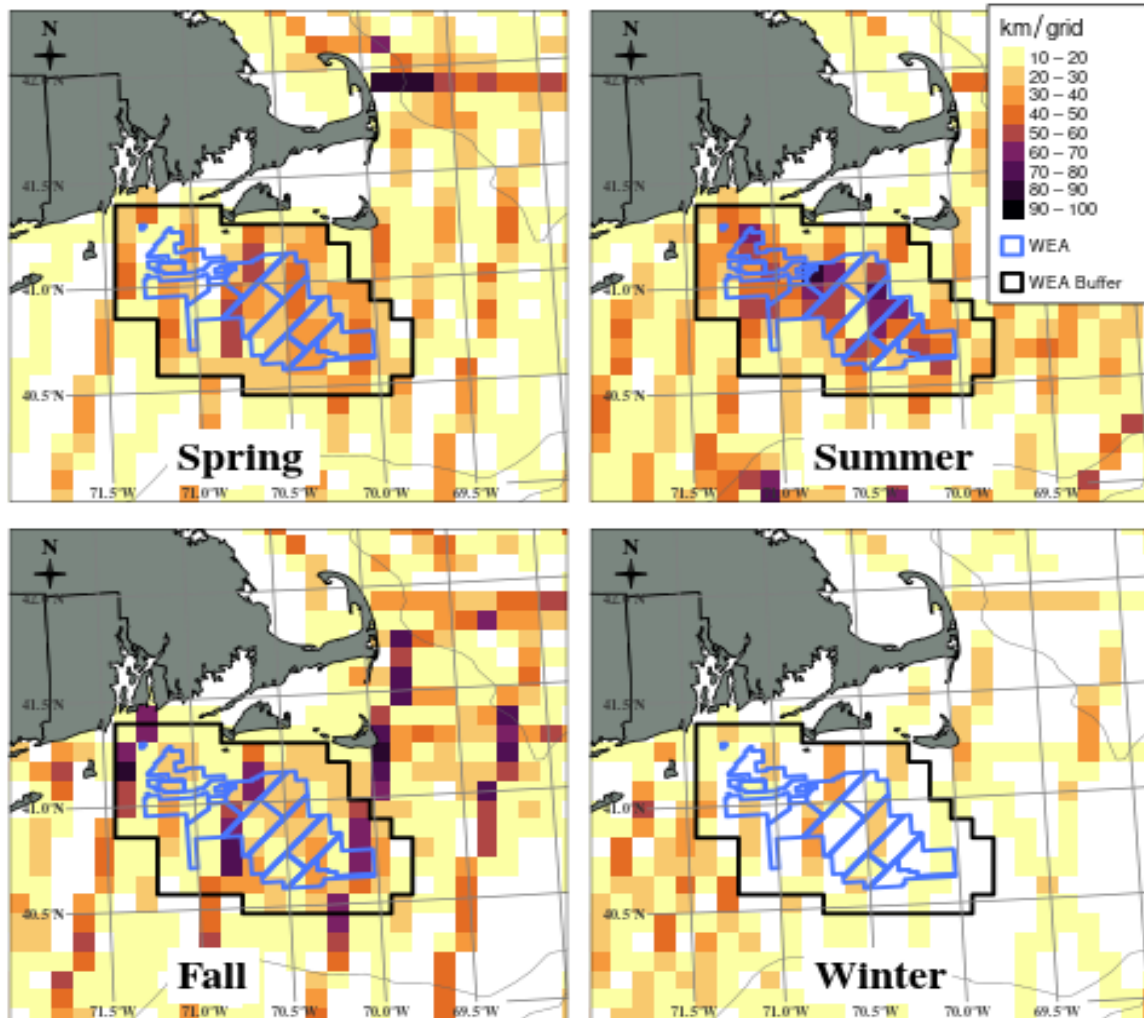


Figure 2-1 Seasonal survey effort in and around the RI/MA WEA study area, 2010 to 2017

One map per season, with the wind energy area, 10 km buffer zone, and 100 m depth contour overlaying 10 x 10 km² grid cells.

Table 2-1 AMAPPS research effort in RI/MA WEA study area and sightings detected

Numbers of animals are the total number of individuals detected during 2010 to 2017.

Survey	Season	Effort (km)	Number of Cetaceans	Number of Turtles	Number of Seals
NE Shipboard	Spring	673	11	0	9
NE Shipboard	Summer	1,084	145	16	1
NE Aerial	Spring	1,541	50	0	110
NE Aerial	Summer	1,965	12	17	1
NE Aerial	Fall	2,691	75	24	13
NE Aerial	Winter	419	11	0	3
TOTAL		8,373	304	57	137

2.2 Seasonal Abundance Estimates by Species

Table 2-2 Spring average abundance and group size estimates in RI/MA WEA study area
Spring is March through May.

Species	Average Density (animals/km ²)	Average Abundance	CV (Density and Abundance)	Average Group Size	CV (Average Group Size)
Atlantic spotted dolphin	0.00010	1.1	0.42	17.6	1.00
Atlantic white-sided dolphin	0.00510	53.5	0.61	5.5	0.67
Bottlenose dolphin	0.00834	87.6	0.48	2.0	0.00
Common dolphin	0.03393	356.3	0.31	35.0	0.00
Fin whale	0.00060	6.3	0.35	1.0	0.00
Harbor porpoise	0.07971	837.0	0.52	1.3	0.48
Humpback whale	0.00119	12.5	0.46	1.0	0.87
Minke whale	0.00150	15.7	0.44	1.2	0.37
Pilot whale, long-finned	0.00045	4.7	0.58	6.7	0.83
Pilot whale, short-finned	0.00016	1.7	0.47	21.5	1.19
Risso's dolphin	0.00020	2.1	0.37	1.8	0.55
Sei whale	0.00106	11.1	0.43	1.0	0.00
Sperm whale	0.00002	0.2	0.42	2.0	0.71
Striped dolphin	0.00009	0.9	0.61	46.0	1.03

Table 2-3 Summer average abundance and group size estimates in RI/MA WEA study area
Summer is June through August.

Species	Average Density (animals/km ²)	Average Abundance	CV (Density and Abundance)	Average Group Size	CV (Average Group Size)
Atlantic spotted dolphin	0.00019	2.0	0.39	29.1	0.92
Atlantic white-sided dolphin	0.00187	19.6	0.54	50.0	0.00
Bottlenose dolphin	0.02180	228.9	0.24	21.6	0.66
Common dolphin	0.24140	2534.7	0.26	31.0	1.51
Fin whale	0.00095	10.0	0.33	1.5	0.45
Harbor porpoise	0.02446	256.8	0.41	1.5	0.69
Humpback whale	0.00181	19.0	0.41	1.6	1.33
Minke whale	0.00125	13.1	0.34	1.0	0.00
Pilot whale, long-finned	0.00106	11.1	0.63	12.4	1.00
Pilot whale, short-finned	0.00030	3.2	0.43	12.1	1.33
Risso's dolphin	0.00088	9.2	0.33	1.7	0.49
Sei whale	0.00086	9.0	0.41	1.0	0.00
Sperm whale	0.00010	1.0	0.35	2.0	0.71
Striped dolphin	0.00019	1.3	0.56	45.2	0.87

Table 2-4 Fall average abundance and group size estimates in RI/MA WEA study area

Fall is September through November.

Species	Average Density (animals/km ²)	Average Abundance	CV (Density and Abundance)	Average Group Size	CV (Average Group Size)
Atlantic spotted dolphin	0.00010	1.0	0.40	22.1	1.06
Atlantic white-sided dolphin	0.00170	17.9	0.56	9.5	0.52
Bottlenose dolphin	0.01211	127.2	0.24	11.5	0.94
Common dolphin	0.17001	1785.1	0.26	26.3	1.04
Fin whale	0.00040	4.2	0.33	1.0	0.00
Harbor porpoise	0.02527	265.3	0.52	6.0	0.00
Humpback whale	0.00055	5.8	0.44	1.0	0.00
Minke whale	0.00064	6.7	0.36	2.0	0.00
Pilot whale, long-finned	0.00050	5.3	0.59	4.4	1.11
Pilot whale, short-finned	0.00006	0.6	0.42	16.7	1.70
Risso's dolphin	0.00043	4.5	0.34	1.8	0.55
Sei whale	0.00056	5.9	0.43	1.0	0.00
Sperm whale	0.00005	0.5	0.37	2.0	0.71
Striped dolphin	0.00005	0.5	0.65	46.4	1.02

Table 2-5 Winter average abundance and group size estimates in RI/MA WEA study area

Winter is December through February.

Species	Average Density (animals/km ²)	Average Abundance	CV (Density and Abundance)	Average Group Size	CV (Average Group Size)
Atlantic spotted dolphin	0.00003	0.3	0.52	23.1	1.71
Atlantic white-sided dolphin	0.00180	18.9	0.65	11.3	1.32
Bottlenose dolphin	0.00790	83.0	0.60	13.9	0.92
Common dolphin	0.04905	515.0	0.26	4.8	1.44
Fin whale	0.00018	1.9	0.34	1.4	0.43
Harbor porpoise	0.08736	917.3	0.53	1.0	0.00
Humpback whale	0.00017	1.8	0.45	1.6	1.39
Minke whale	0.00050	5.3	0.40	1.2	0.34
Pilot whale, long-finned	0.00008	0.8	0.67	1.2	0.37
Pilot whale, short-finned	0.00001	0.1	0.63	7.6	0.58
Risso's dolphin	0.00011	1.2	0.37	1.8	0.55
Sei whale	0.00046	4.8	0.54	1.0	0.00
Sperm whale	0.00003	0.3	0.38	2.0	0.71
Striped dolphin	0.00010	1.1	0.56	25.0	0.00

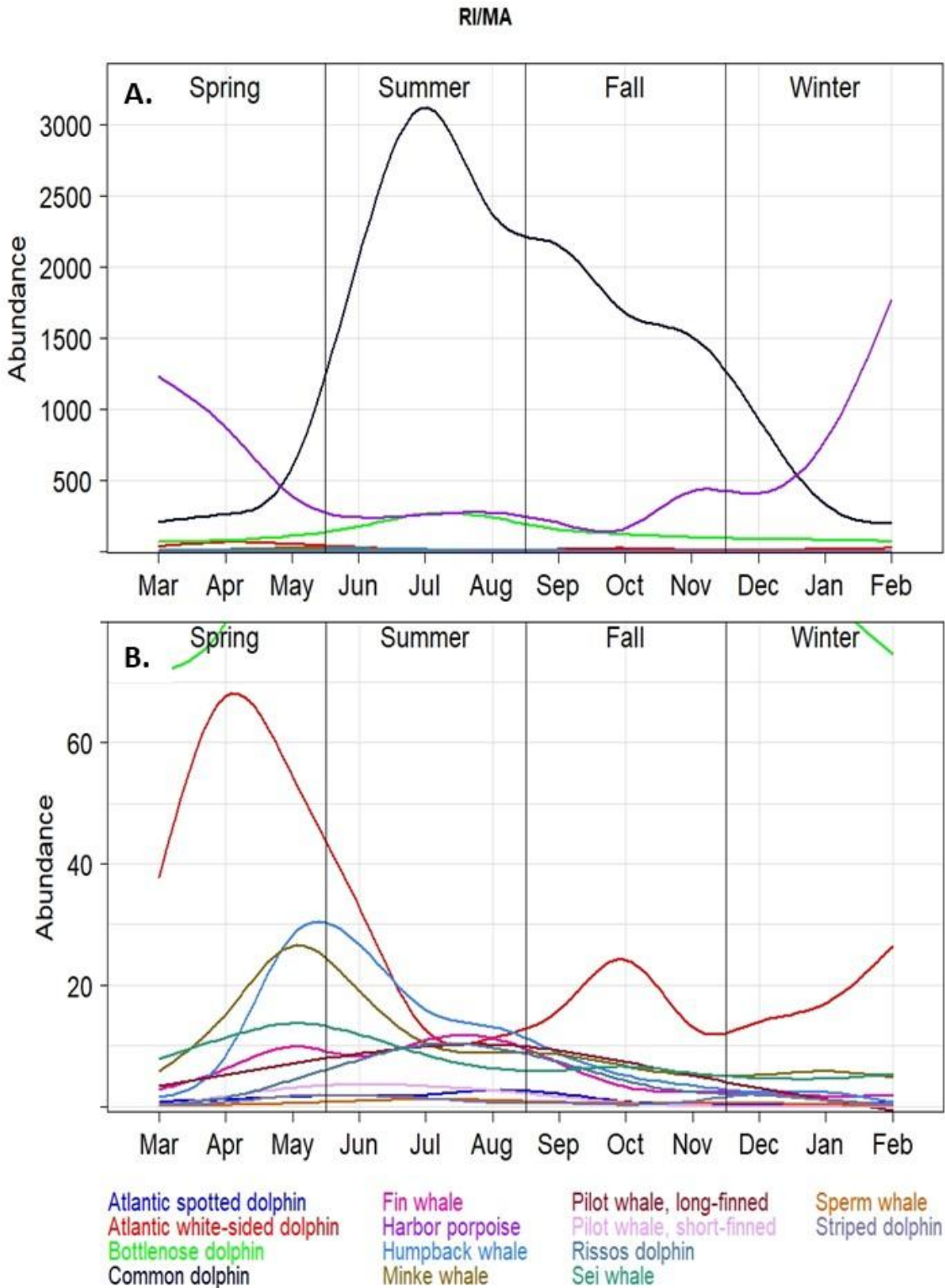


Figure 2-2 Average annual abundance trends in RI/MA WEA study area, by species
 (A) All species. (B) Blow up of species with small abundance estimates.

2.3 Seasonal Density Patterns by Functional Groups

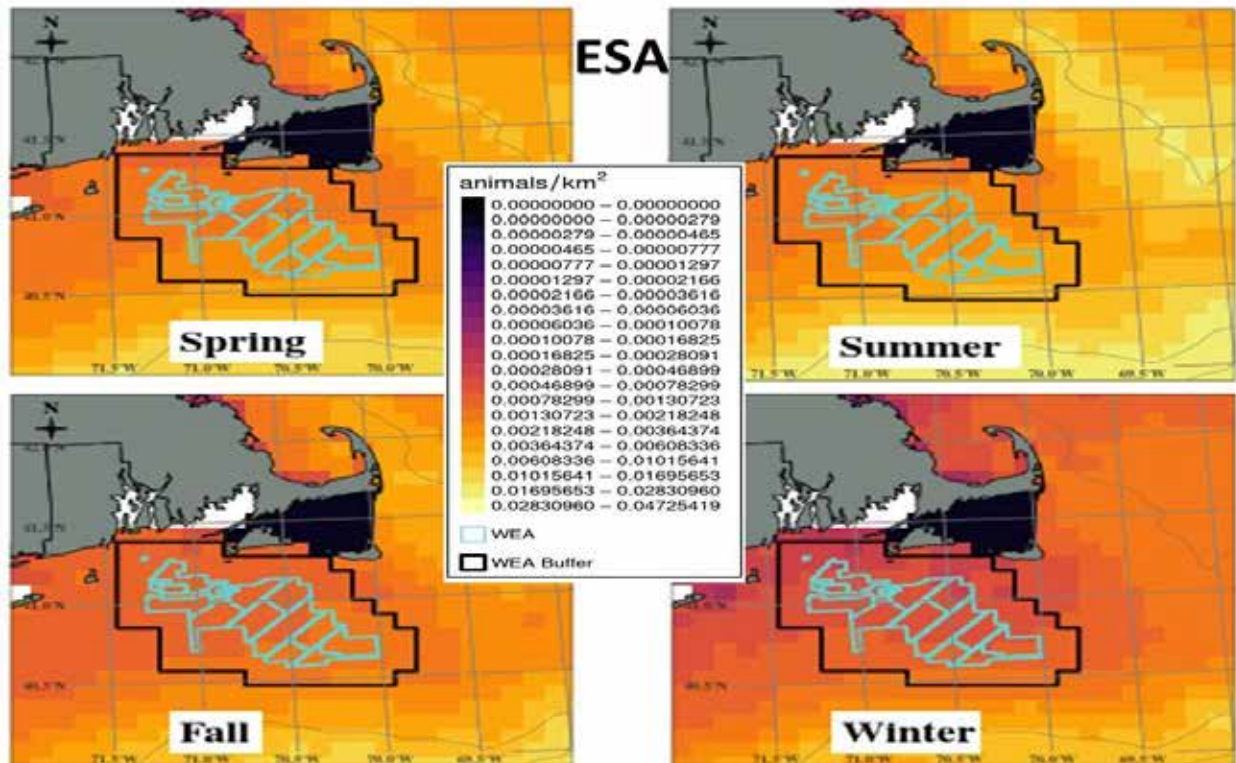


Figure 2-3 Average density of ESA species, RI/MA WEA
ESA species include fin, humpback, sei, and sperm whales.

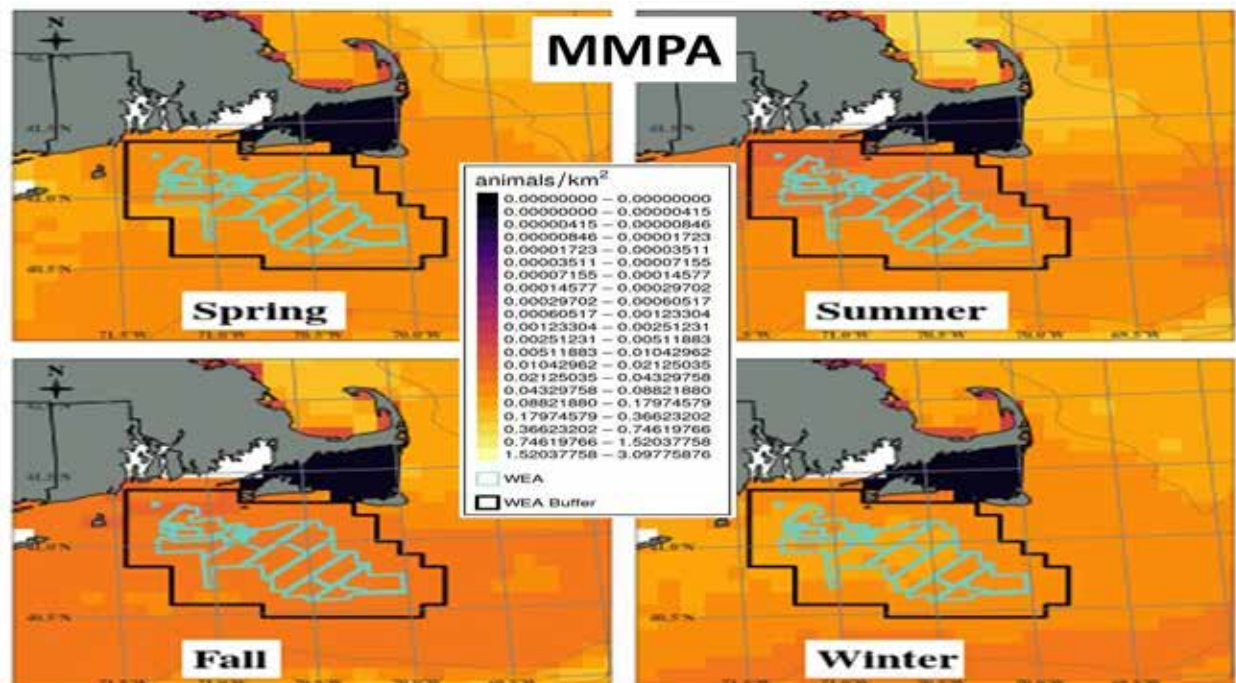


Figure 2-4 Average density of MMPA species, RI/MA WEA
MMPA species include Atlantic white-sided dolphins, common bottlenose dolphins, common dolphins, and short-finned pilot whales.

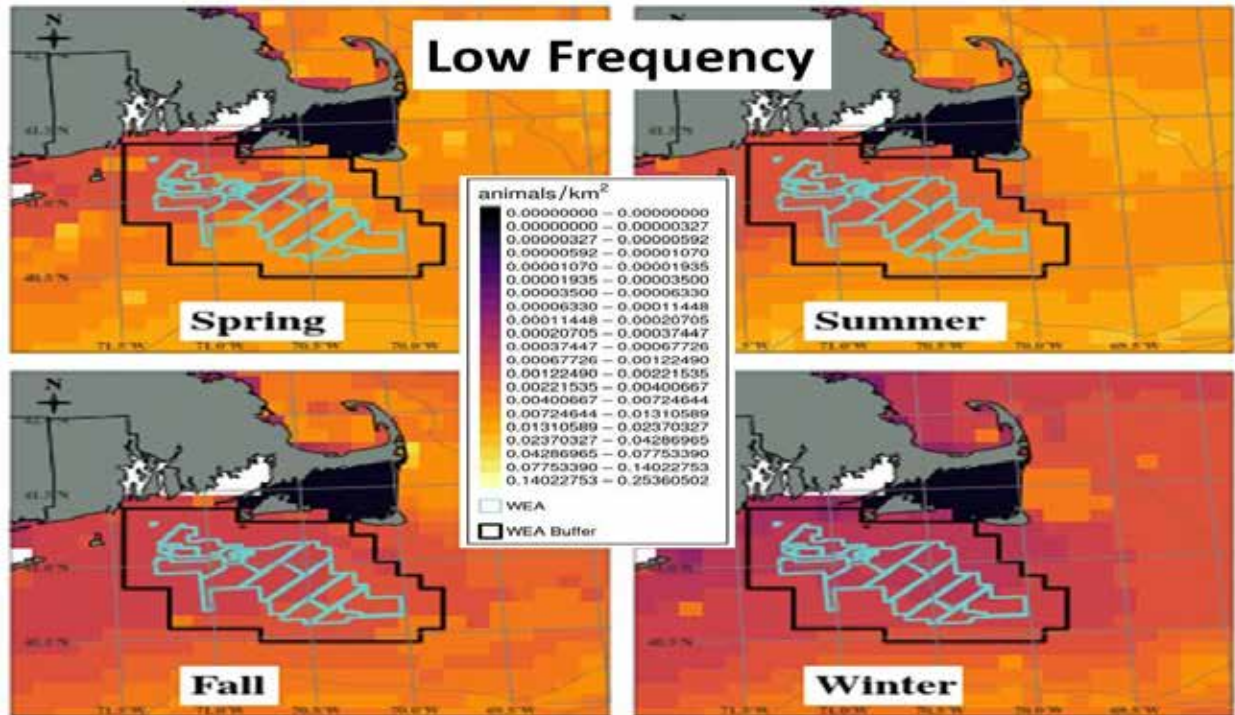


Figure 2-5 Average density of low frequency sensitive species, RI/MA WEA
Species sensitive to low frequency sounds include fin, humpback, minke, and sei whales.

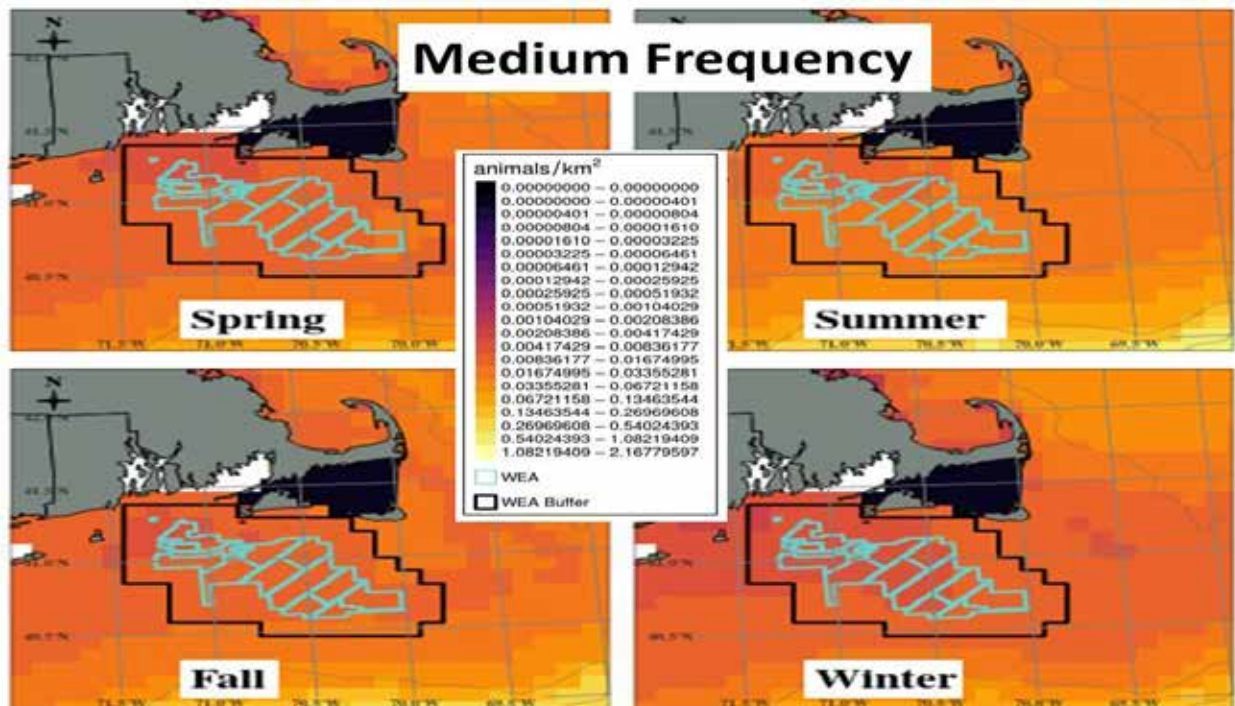


Figure 2-6 Average density of medium frequency sensitive species, RI/MA WEA
Species sensitive to medium frequency sounds include Atlantic spotted dolphins, Atlantic white-sided dolphins, common bottlenose dolphins, common dolphins, Cuvier's beaked whales, long-finned pilot whales, Risso's dolphins, short-finned pilot whales, Sowerby's beaked whales, sperm whales, striped dolphins, and unidentified beaked whales.

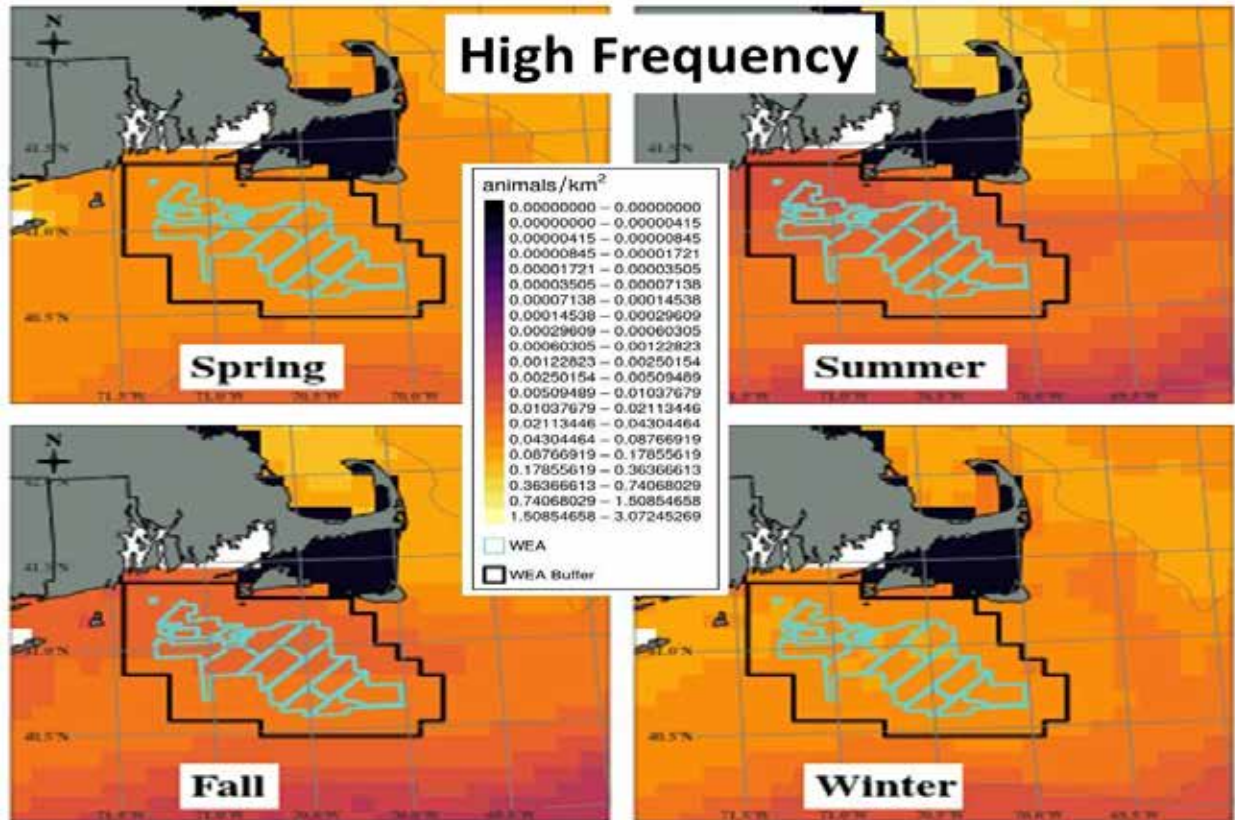


Figure 2-7 Average density of high frequency sensitive species, RI/MA WEA

Species sensitive to high frequency sounds include dwarf sperm whales, harbor porpoises, and pygmy sperm whales.

3 New York to Maryland Wind Energy Study Areas

This covers the New York (NY), New Jersey (NJ), and Delaware/Maryland (DE/MD) WEA study areas.

3.1 Data Collection

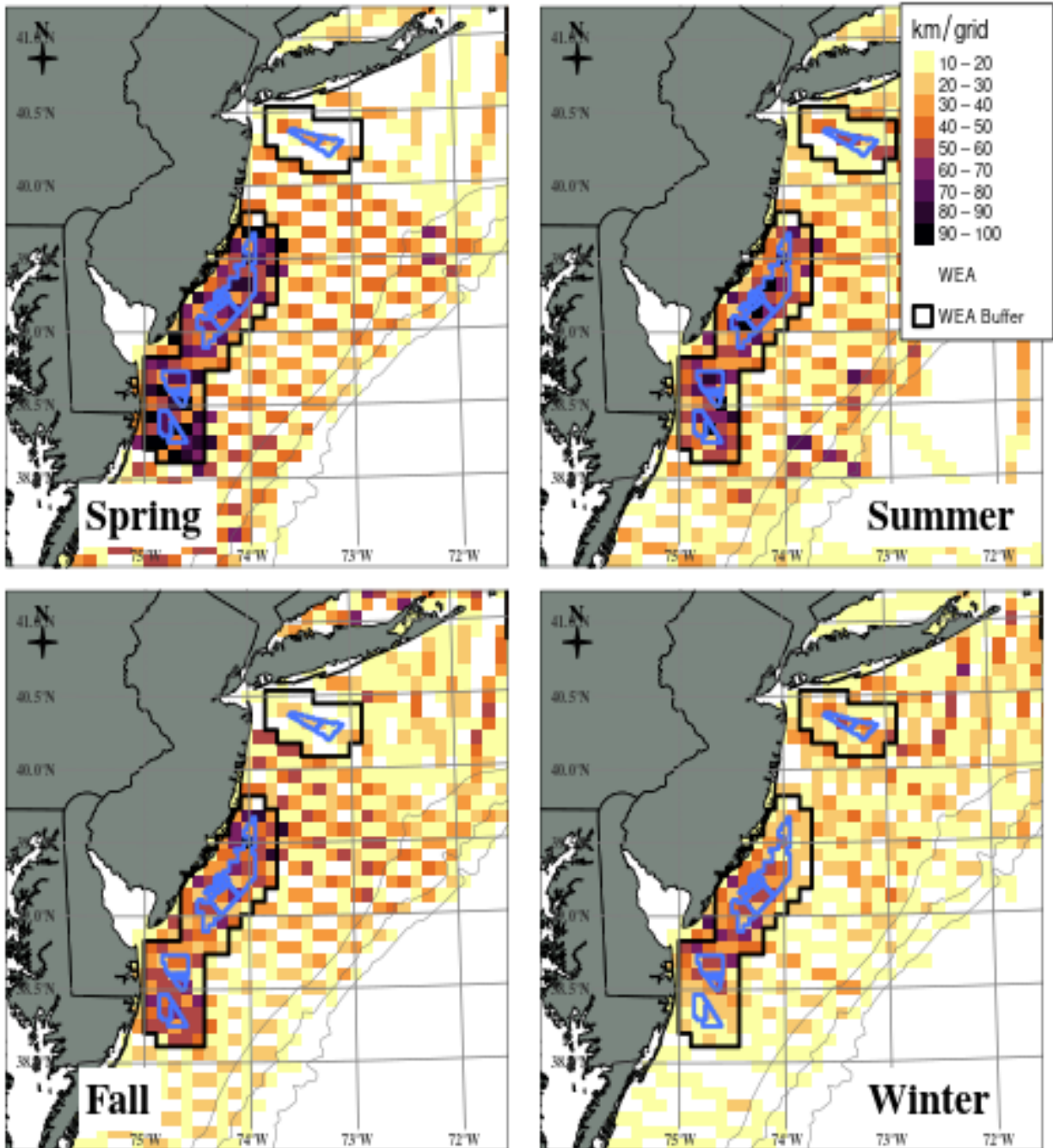


Figure 3-1 Seasonal survey effort around Northern Mid-Atlantic WEA study areas, 2010 to 2017

One map per season, with wind energy areas (NY, NJ, DE/MD), 10 km buffer zone, 100 m, 1000 m, and 2000 m depth contour overlaying 10 x 10 km² grid cells.

Table 3-1 AMAPPS research effort in NY WEA study area and sightings detected

Numbers of animals are the total number of individuals detected during 2010 to 2017.

Survey	Season	Effort (km)	Number of Cetaceans	Number of Turtles	Number of Seals
NE Shipboard	Spring	45	1	0	0
NE Aerial	Spring	160	4	0	0
NE Aerial	Summer	466	0	68	0
NE Aerial	Fall	463	16	7	0
NE Aerial	Winter	314	2	0	1
SE Aerial	Spring	28	0	0	0
SE Aerial	Summer	12	0	2	0
SE Aerial	Fall	8	0	0	0
SE Aerial	Winter	11	0	0	0
TOTAL		1507	23	77	1

Table 3-2 AMAPPS research effort in NJ WEA study area and sightings detected

Numbers of animals are the total number of individuals detected during 2010 to 2017.

Survey	Season	Effort (km)	Number of Cetaceans	Number of Turtles	Number of Seals
NE Shipboard	Spring	119	0	0	0
NE Shipboard	Summer	414	11	8	0
SE Aerial	Spring	3275	17	24	0
SE Aerial	Summer	2257	26	378	0
SE Aerial	Fall	2343	12	234	0
SE Aerial	Winter	1290	10	0	1
TOTAL		9698	76	644	1

Table 3-3 AMAPPS research effort in DE/MD WEA study area and sightings detected

Numbers of animals are the total number of individuals detected during 2010 to 2017.

Survey	Season	Effort (km)	Number of Cetaceans	Number of Turtles	Number of Seals
NE Shipboard	Summer	389	35	29	0
SE Aerial	Spring	2800	27	82	0
SE Aerial	Summer	1630	24	273	0
SE Aerial	Fall	1751	17	220	0
SE Aerial	Winter	781	3	0	0
TOTAL		7351	106	604	0

3.2 Seasonal Abundance Estimates by Species

3.2.1 NY Wind Energy Study Area

Table 3-4 Spring average abundance and group size estimates in NY WEA study area

Spring is March through May.

Species	Average Density (animals/km ²)	Average Abundance	CV (Density and Abundance)	Average Group Size	CV (Average Group Size)
Atlantic spotted dolphin	0.00010	0.3	0.43	17.6	1.00
Atlantic white-sided dolphin	0.00343	10.3	0.63	17.3	0.49
Bottlenose dolphin	0.00747	22.4	0.38	1.3	0.40
Common dolphin	0.02193	65.8	0.29	4.4	1.21
Fin whale	0.00017	0.5	0.37	1.0	0.00
Harbor porpoise	0.08900	267.0	0.62	1.0	0.00
Humpback whale	0.00087	2.6	0.50	1.6	0.71
Minke whale	0.00060	1.8	0.44	1.2	0.35
Pilot whale, long-finned	0.00010	0.3	0.62	6.7	0.83
Pilot whale, short-finned	0.00007	0.2	0.49	21.5	1.19
Risso's dolphin	0.00010	0.3	0.41	5.1	0.93
Sei whale	0.00043	1.3	0.46	1.6	1.67
Sperm whale	0.00000	0.0	0.44	1.1	0.30
Striped dolphin	0.00007	0.2	0.61	46.0	1.03

Table 3-5 Summer average abundance and group size estimates in NY WEA study area

Summer is June through August.

Species	Average Density (animals/km ²)	Average Abundance	CV (Density and Abundance)	Average Group Size	CV (Average Group Size)
Atlantic spotted dolphin	0.00023	0.7	0.41	29.1	0.92
Atlantic white-sided dolphin	0.00070	2.1	0.59	17.3	0.49
Bottlenose dolphin	0.02263	67.9	0.27	8.3	1.38
Common dolphin	0.05127	153.8	0.27	4.4	1.21
Fin whale	0.00030	0.9	0.39	1.0	0.00
Harbor porpoise	0.00547	16.4	0.48	1.0	0.00
Humpback whale	0.00067	2.0	0.49	2.0	4.25
Minke whale	0.00043	1.3	0.50	1.1	0.26
Pilot whale, long-finned	0.00007	0.2	0.66	12.4	1.00
Pilot whale, short-finned	0.00010	0.3	0.45	12.1	1.33
Risso's dolphin	0.00017	0.5	0.39	7.2	1.07
Sei whale	0.00023	0.7	0.43	1.4	0.51
Sperm whale	0.00003	0.1	0.41	1.8	1.22
Striped dolphin	0.00003	0.1	0.60	45.2	0.87

Table 3-6 Fall average abundance and group size estimates in NY WEA study area

Fall is September through November.

Species	Average Density (animals/km ²)	Average Abundance	CV (Density and Abundance)	Average Group Size	CV (Average Group Size)
Atlantic spotted dolphin	0.00010	0.3	0.43	22.1	1.06
Atlantic white-sided dolphin	0.00183	5.5	0.56	17.3	0.49
Bottlenose dolphin	0.00877	26.3	0.27	22.5	0.35
Common dolphin	0.03023	90.7	0.27	4.6	1.26
Fin whale	0.00010	0.3	0.40	1.0	0.00
Harbor porpoise	0.02053	61.6	0.65	1.0	0.00
Humpback whale	0.00043	1.3	0.51	1.4	0.42
Minke whale	0.00033	1.0	0.50	1.3	0.95
Pilot whale, long-finned	0.00010	0.3	0.65	4.4	1.11
Pilot whale, short-finned	0.00000	0.0	0.61	16.7	1.70
Risso's dolphin	0.00007	0.2	0.42	9.1	1.52
Sei whale	0.00023	0.7	0.45	2.0	1.22
Sperm whale	0.00000	0.0	0.46	2.5	0.84
Striped dolphin	0.00000	0.0	0.74	46.4	1.02

Table 3-7 Winter average abundance and group size estimates in NY WEA study area

Winter is December through February.

Species	Average Density (animals/km ²)	Average Abundance	CV (Density and Abundance)	Average Group Size	CV (Average Group Size)
Atlantic spotted dolphin	0.00003	0.1	0.48	23.1	1.71
Atlantic white-sided dolphin	0.00303	9.1	0.66	17.3	0.49
Bottlenose dolphin	0.00427	12.8	0.43	8.3	1.38
Common dolphin	0.01893	56.8	0.27	3.5	1.01
Fin whale	0.00003	0.1	0.38	1.0	0.00
Harbor porpoise	0.10317	309.5	0.59	1.0	0.00
Humpback whale	0.00013	0.4	0.48	1.0	0.00
Minke whale	0.00033	1.0	0.42	1.0	0.00
Pilot whale, long-finned	0.00003	0.1	0.68	1.2	0.37
Pilot whale, short-finned	0.00000	0.0	0.62	7.6	0.58
Risso's dolphin	0.00007	0.2	0.41	3.7	1.37
Sei whale	0.00027	0.8	0.46	2.0	0.87
Sperm whale	0.00000	0.0	0.43	1.7	1.19
Striped dolphin	0.00007	0.2	0.61	25.0	0.00

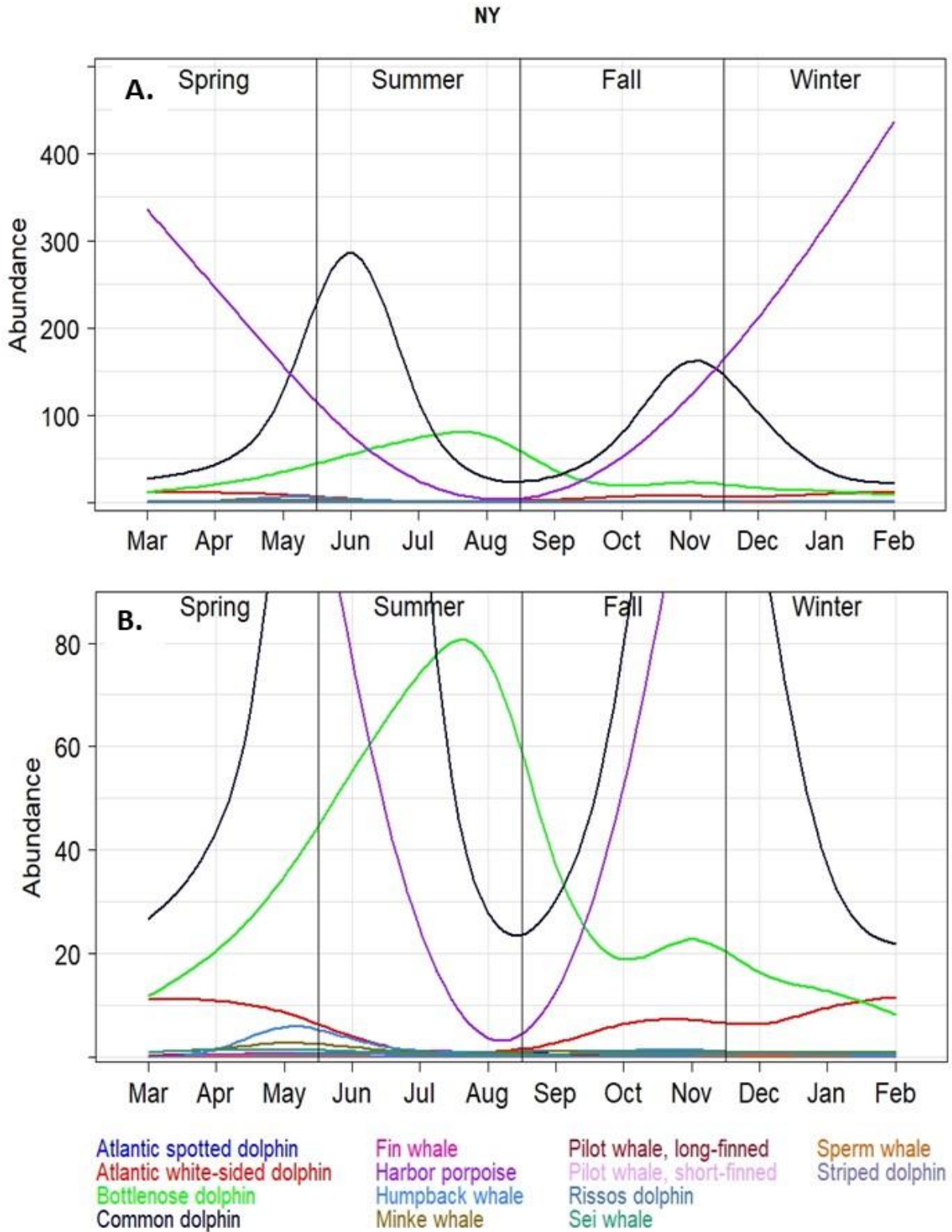


Figure 3-2 Average annual abundance trends in NY WEA study area, by species
 (A) All species. (B) Blow up of species with small abundance estimates.

3.2.2 NJ Wind Energy Study Area

Table 3-8 Spring average abundance and group size estimates in NJ WEA study area

Spring is March through May.

Species	Average Density (animals/km ²)	Average Abundance	CV (Density and Abundance)	Average Group Size	CV (Average Group Size)
Atlantic spotted dolphin	0.00038	2.1	0.39	17.6	1.00
Atlantic white-sided dolphin	0.00193	10.6	0.68	9.1	1.04
Bottlenose dolphin	0.02197	120.8	0.34	9.1	0.90
Common dolphin	0.02153	118.4	0.31	4.0	0.71
Fin whale	0.00029	1.6	0.36	1.0	0.00
Harbor porpoise	0.11669	641.6	0.68	1.5	1.17
Humpback whale	0.00060	3.3	0.49	1.0	0.00
Minke whale	0.00038	2.1	0.45	1.2	0.35
Pilot whale, long-finned	0.00000	0.0	0.81	6.7	0.83
Pilot whale, short-finned	0.00005	0.3	0.47	21.5	1.19
Risso's dolphin	0.00011	0.6	0.40	1.0	0.00
Sei whale	0.00005	0.3	0.66	1.6	1.67
Sperm whale	0.00002	0.1	0.39	1.1	0.30
Striped dolphin	0.00018	1.0	0.57	46.0	1.03

Table 3-9 Summer average abundance and group size estimates in NJ WEA study area

Summer is June through August.

Species	Average Density (animals/km ²)	Average Abundance	CV (Density and Abundance)	Average Group Size	CV (Average Group Size)
Atlantic spotted dolphin	0.00125	6.9	0.36	29.1	0.92
Atlantic white-sided dolphin	0.00029	1.6	0.66	12.1	1.21
Bottlenose dolphin	0.05451	299.7	0.28	11.9	1.38
Common dolphin	0.01035	56.9	0.32	12.9	1.05
Fin whale	0.00049	2.7	0.39	1.0	0.00
Harbor porpoise	0.00111	6.1	0.66	2.5	1.21
Humpback whale	0.00031	1.7	0.51	1.3	0.43
Minke whale	0.00025	1.4	0.53	1.1	0.26
Pilot whale, long-finned	0.00000	0.0	0.89	12.4	1.00
Pilot whale, short-finned	0.00000	0.0	0.58	12.1	1.33
Risso's dolphin	0.00005	0.3	0.44	1.0	0.00
Sei whale	0.00004	0.2	0.66	1.4	0.51
Sperm whale	0.00000	0.0	0.52	1.8	1.22
Striped dolphin	0.00000	0.0	0.93	45.2	0.87

Table 3-10 Fall average abundance and group size estimates in NJ WEA study area

Fall is September through November.

Species	Average Density (animals/km ²)	Average Abundance	CV (Density and Abundance)	Average Group Size	CV (Average Group Size)
Atlantic spotted dolphin	0.00060	3.3	0.38	22.1	1.06
Atlantic white-sided dolphin	0.00087	4.8	0.60	17.6	1.78
Bottlenose dolphin	0.02634	144.8	0.29	11.5	0.64
Common dolphin	0.01650	90.7	0.31	15.0	0.00
Fin whale	0.00024	1.3	0.38	1.0	0.00
Harbor porpoise	0.03510	193.0	0.74	3.6	1.41
Humpback whale	0.00031	1.7	0.50	1.7	0.35
Minke whale	0.00031	1.7	0.62	1.3	0.95
Pilot whale, long-finned	0.00000	0.0	0.81	4.4	1.11
Pilot whale, short-finned	0.00000	0.0	0.58	16.7	1.70
Risso's dolphin	0.00005	0.3	0.45	1.0	0.00
Sei whale	0.00004	0.2	0.66	2.0	1.22
Sperm whale	0.00002	0.1	0.44	2.5	0.84
Striped dolphin	0.00004	0.2	0.68	46.4	1.02

Table 3-11 Winter average abundance and group size estimates in NJ WEA study area

Winter is December through February.

Species	Average Density (animals/km ²)	Average Abundance	CV (Density and Abundance)	Average Group Size	CV (Average Group Size)
Atlantic spotted dolphin	0.00038	2.1	0.43	23.1	1.71
Atlantic white-sided dolphin	0.00200	11.0	0.73	8.9	1.07
Bottlenose dolphin	0.01231	67.7	0.47	2.3	0.25
Common dolphin	0.01308	71.9	0.30	13.6	1.03
Fin whale	0.00011	0.6	0.36	1.0	0.00
Harbor porpoise	0.17611	968.3	0.62	1.4	0.70
Humpback whale	0.00011	0.6	0.49	1.3	0.43
Minke whale	0.00029	1.6	0.44	1.0	0.00
Pilot whale, long-finned	0.00000	0.0	0.84	1.2	0.37
Pilot whale, short-finned	0.00002	0.1	0.52	7.6	0.58
Risso's dolphin	0.00007	0.4	0.41	1.0	0.00
Sei whale	0.00004	0.2	0.68	2.0	0.87
Sperm whale	0.00002	0.1	0.40	1.7	1.19
Striped dolphin	0.00020	1.1	0.57	25.0	0.00

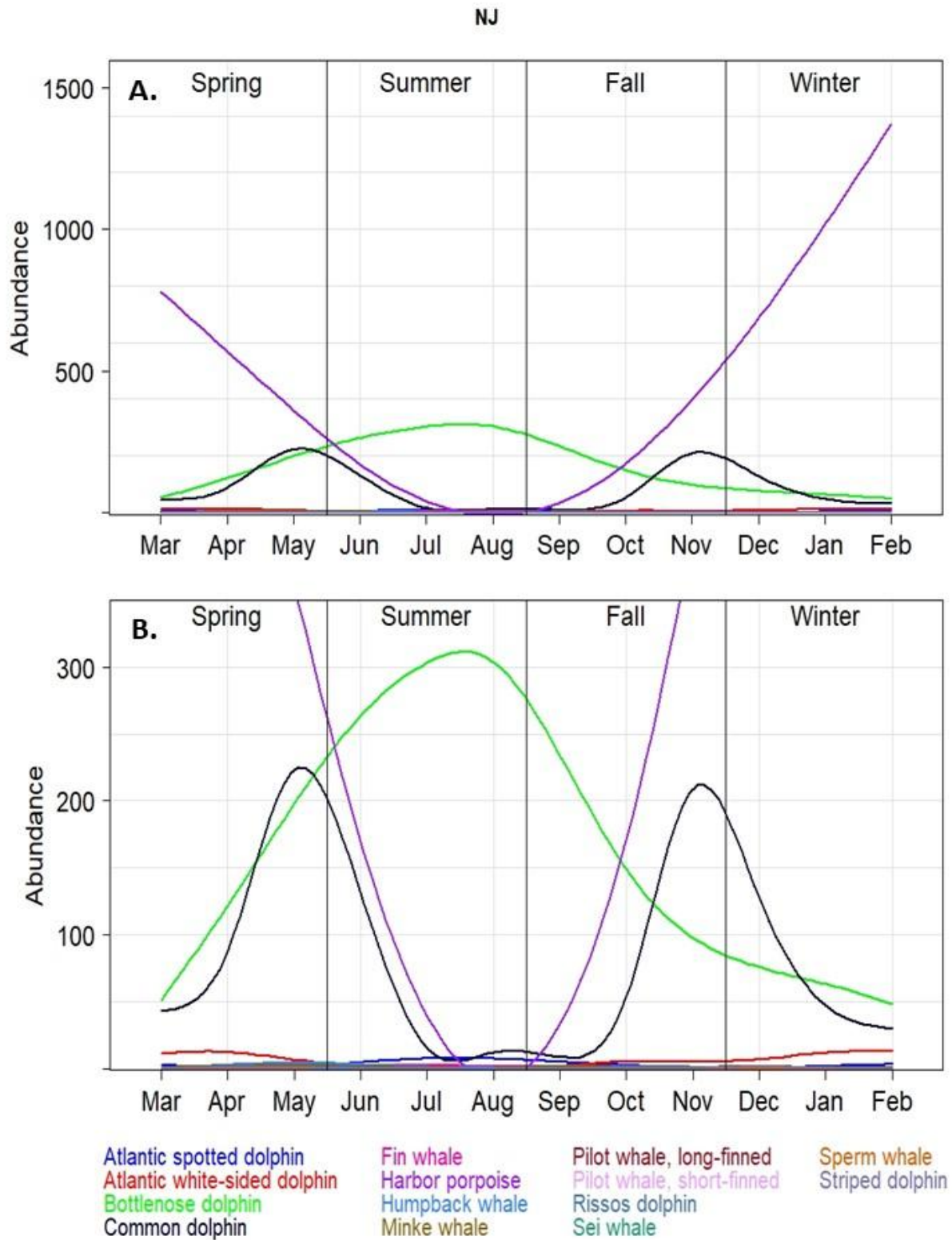


Figure 3-3 Average annual abundance trends in NJ WEA study area, by species
 (A) All species. (B) Blow up of species with small abundance estimates.

3.2.3 DE/MD Wind Energy Study Area

Table 3-12 Spring average abundance and group size estimates in DE/MD WEA study area

Spring is March through May.

Species	Average Density (animals/km ²)	Average Abundance	CV (Density and Abundance)	Average Group Size	CV (Average Group Size)
Atlantic spotted dolphin	0.00105	4.1	0.35	20.0	0.80
Atlantic white-sided dolphin	0.00110	4.3	0.69	9.1	1.04
Bottlenose dolphin	0.02249	87.7	0.33	15.2	1.05
Common dolphin	0.01913	74.6	0.33	48.3	1.01
Fin whale	0.00036	1.4	0.34	3.0	0.00
Harbor porpoise	0.09979	389.2	0.72	1.6	0.56
Humpback whale	0.00031	1.2	0.47	1.6	0.71
Minke whale	0.00033	1.3	0.44	1.0	0.00
Pilot whale, long-finned	0.00000	0.0	1.26	6.7	0.83
Pilot whale, short-finned	0.00010	0.4	0.43	21.5	1.19
Risso's dolphin	0.00018	0.7	0.36	5.1	0.93
Sei whale	0.00000	0.0	0.94	1.6	1.67
Sperm whale	0.00003	0.1	0.36	1.1	0.30
Striped dolphin	0.00018	0.7	0.58	46.0	1.03

Table 3-13 Summer average abundance and group size estimates in DE/MD WEA study area

Summer is June through August.

Species	Average Density (animals/km ²)	Average Abundance	CV (Density and Abundance)	Average Group Size	CV (Average Group Size)
Atlantic spotted dolphin	0.00354	13.8	0.31	20.0	0.80
Atlantic white-sided dolphin	0.00021	0.8	0.66	12.1	1.21
Bottlenose dolphin	0.05064	197.5	0.26	10.1	1.29
Common dolphin	0.00808	31.5	0.34	36.7	1.02
Fin whale	0.00064	2.5	0.36	2.0	0.00
Harbor porpoise	0.00056	2.2	0.83	1.8	0.55
Humpback whale	0.00015	0.6	0.49	2.0	4.25
Minke whale	0.00018	0.7	0.46	1.0	0.00
Pilot whale, long-finned	0.00000	0.0	1.24	12.4	1.00
Pilot whale, short-finned	0.00005	0.2	0.44	12.1	1.33
Risso's dolphin	0.00010	0.4	0.38	7.2	1.07
Sei whale	0.00005	0.0	0.91	1.4	0.51
Sperm whale	0.00000	0.0	0.46	1.8	1.22
Striped dolphin	0.00000	0.0	0.76	45.2	0.87

Table 3-14 Fall average abundance and group size estimates in DE/MD WEA study area

Fall is September through November.

Species	Average Density (animals/km ²)	Average Abundance	CV (Density and Abundance)	Average Group Size	CV (Average Group Size)
Atlantic spotted dolphin	0.00167	6.5	0.33	20.0	0.80
Atlantic white-sided dolphin	0.00049	1.9	0.61	17.6	1.78
Bottlenose dolphin	0.03164	123.4	0.28	19.3	1.46
Common dolphin	0.01349	52.6	0.34	36.7	1.02
Fin whale	0.00033	1.3	0.36	2.5	0.28
Harbor porpoise	0.03818	148.9	0.79	1.8	0.55
Humpback whale	0.00013	0.5	0.49	1.4	0.42
Minke whale	0.00018	0.7	0.53	1.0	0.00
Pilot whale, long-finned	0.00000	0.0	1.24	4.4	1.11
Pilot whale, short-finned	0.00000	0.0	0.59	16.7	1.70
Risso's dolphin	0.00008	0.3	0.41	9.1	1.52
Sei whale	0.00000	0.0	0.93	2.0	1.22
Sperm whale	0.00003	0.1	0.43	2.5	0.84
Striped dolphin	0.00003	0.1	0.70	46.4	1.02

Table 3-15 Winter average abundance and group size estimates in DE/MD WEA study area

Winter is December through February.

Species	Average Density (animals/km ²)	Average Abundance	CV (Density and Abundance)	Average Group Size	CV (Average Group Size)
Atlantic spotted dolphin	0.00092	3.6	0.39	20.0	0.80
Atlantic white-sided dolphin	0.00115	4.5	0.71	8.9	1.07
Bottlenose dolphin	0.01469	57.3	0.47	12.8	1.35
Common dolphin	0.01215	47.4	0.31	21.3	0.35
Fin whale	0.00018	0.7	0.33	2.5	0.28
Harbor porpoise	0.18044	703.7	0.70	1.8	0.55
Humpback whale	0.00008	0.3	0.47	1.0	0.00
Minke whale	0.00023	0.9	0.42	1.0	0.00
Pilot whale, long-finned	0.00000	0.0	1.28	1.2	0.37
Pilot whale, short-finned	0.00003	0.1	0.50	7.6	0.58
Rissos dolphin	0.00010	0.4	0.36	3.7	1.37
Sei whale	0.00000	0.0	0.96	2.0	0.87
Sperm whale	0.00003	0.1	0.38	1.7	1.19
Striped dolphin	0.00021	0.8	0.57	25.0	0.00

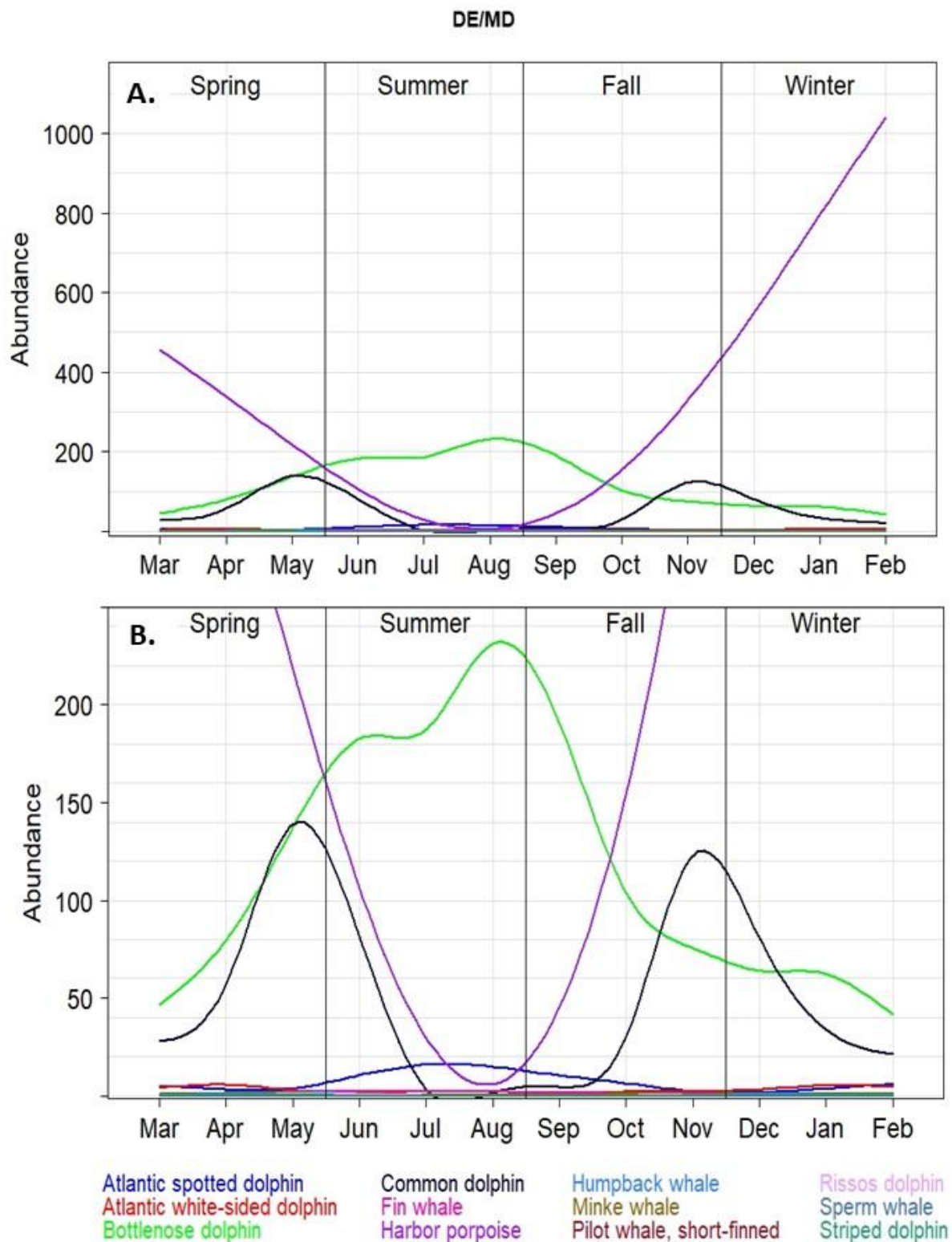


Figure 3-4 Average annual abundance trends in DE/MD WEA study area, by species
 (A) All species. (B) Blow up of species with small abundance estimates.

3.3 Seasonal Density Patterns by Functional Groups

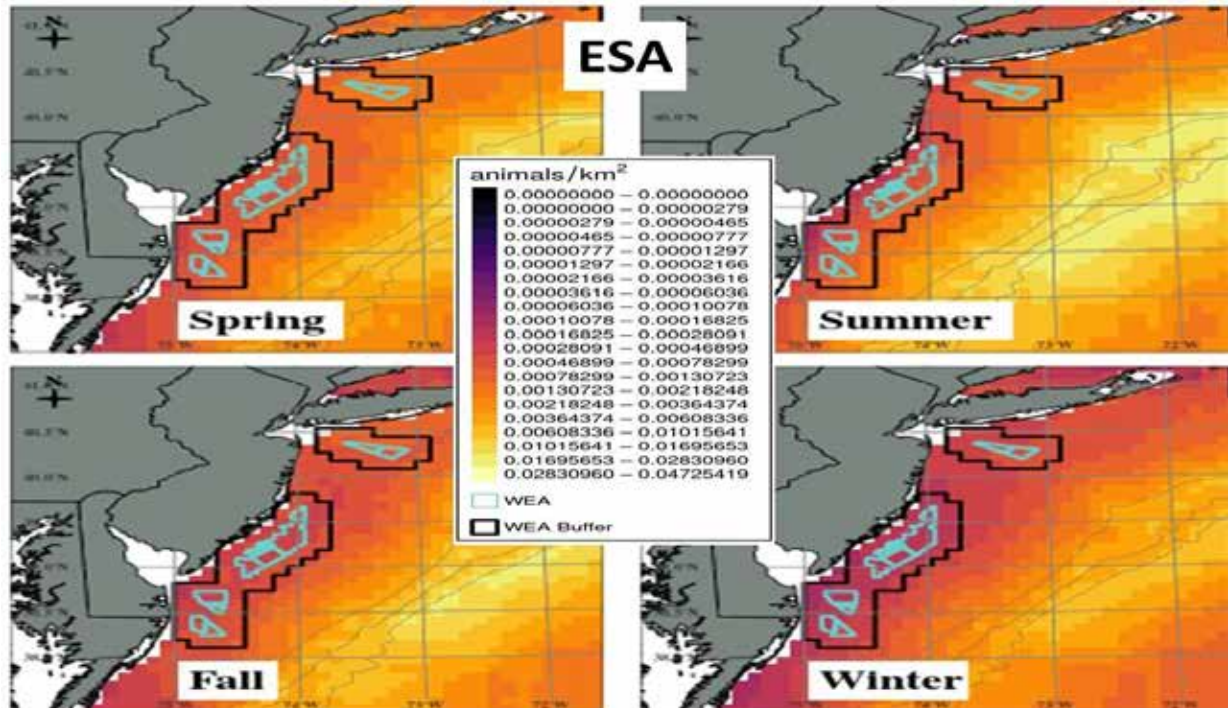


Figure 3-5 Average density of ESA species, New York to Maryland WEAs
ESA species include fin, humpback, sei, and sperm whales.

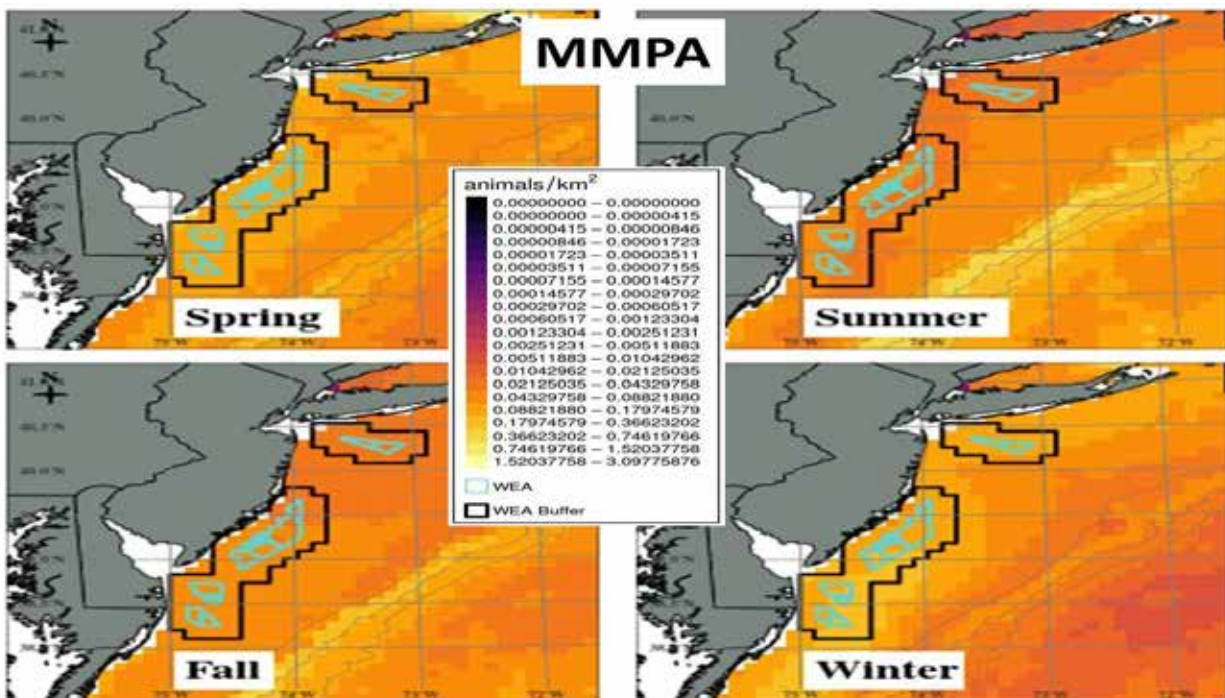


Figure 3-6 Average density of MMPA species, New York to Maryland WEAs
MMPA species include Atlantic white-sided dolphins, common bottlenose dolphins, common dolphins, and short-finned pilot whales.

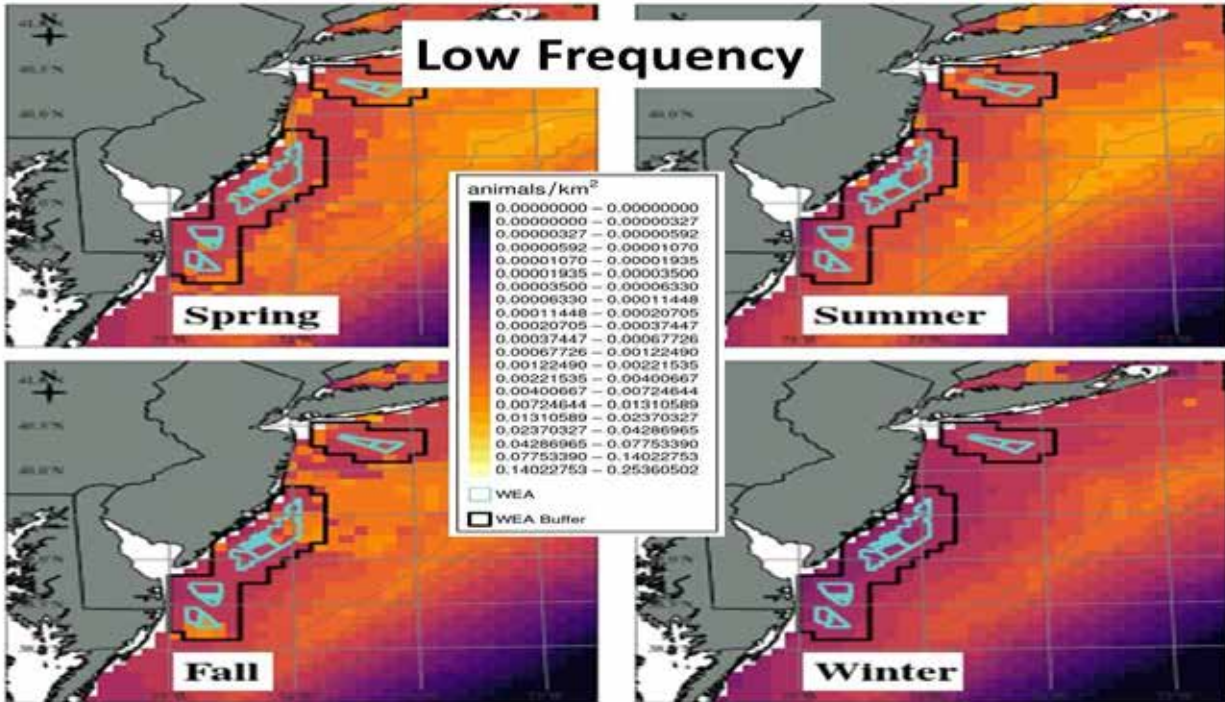


Figure 3-7 Average density of low frequency sensitive species, New York to Maryland WEAs
Species sensitive to low frequency sounds include fin, humpback, minke, and sei whales.

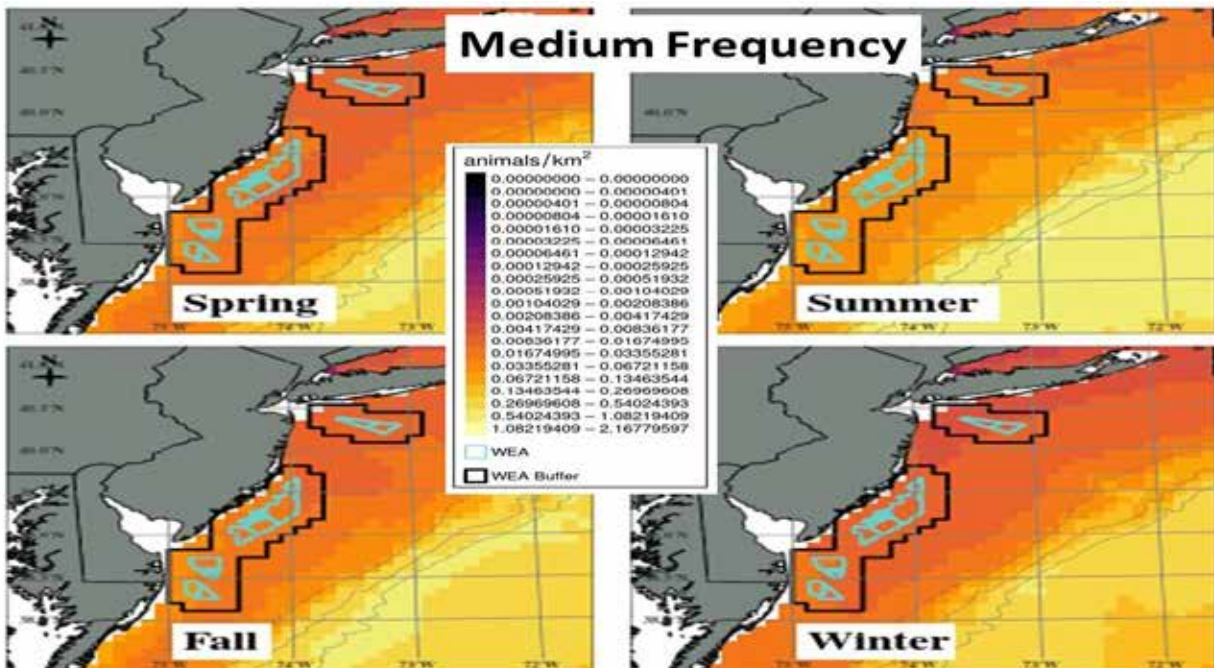


Figure 3-8 Average density of medium frequency sensitive species, New York to Maryland WEAs
Species sensitive to medium frequency sounds include Atlantic spotted dolphins, Atlantic white-sided dolphins, common bottlenose dolphins, common dolphins, Cuvier's beaked whales, long-finned pilot whales, Risso's dolphins, short-finned pilot whales, Sowerby's beaked whales, sperm whales, striped dolphins, and unidentified beaked whales.

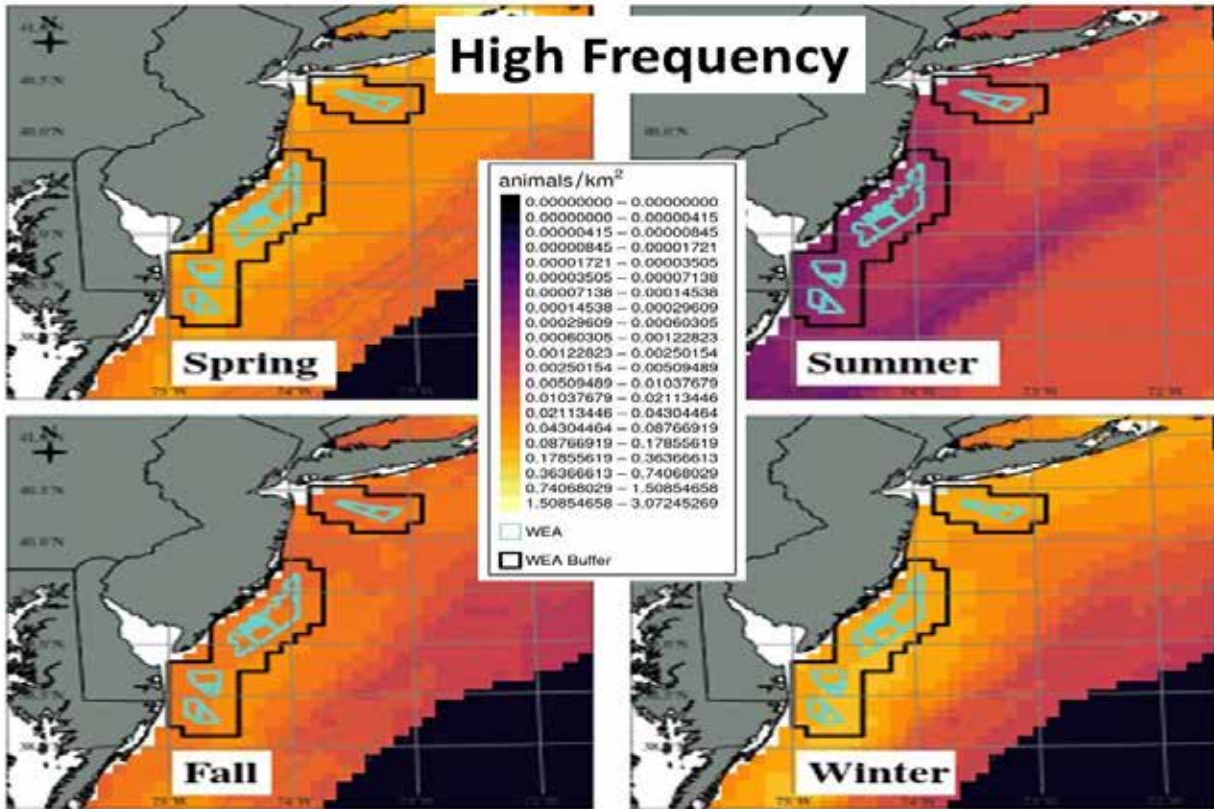


Figure 3-9 Average density of high frequency sensitive species, New York to Maryland WEAs
Species sensitive to high frequency sounds include dwarf sperm whales, harbor porpoises, and pygmy sperm whales.

4 Virginia (VA) to Northern North Carolina (NC) Wind Energy Study Areas

This covers the Virginia (VA), and North Carolina (NC) wind-energy study areas.

4.1 Data Collection

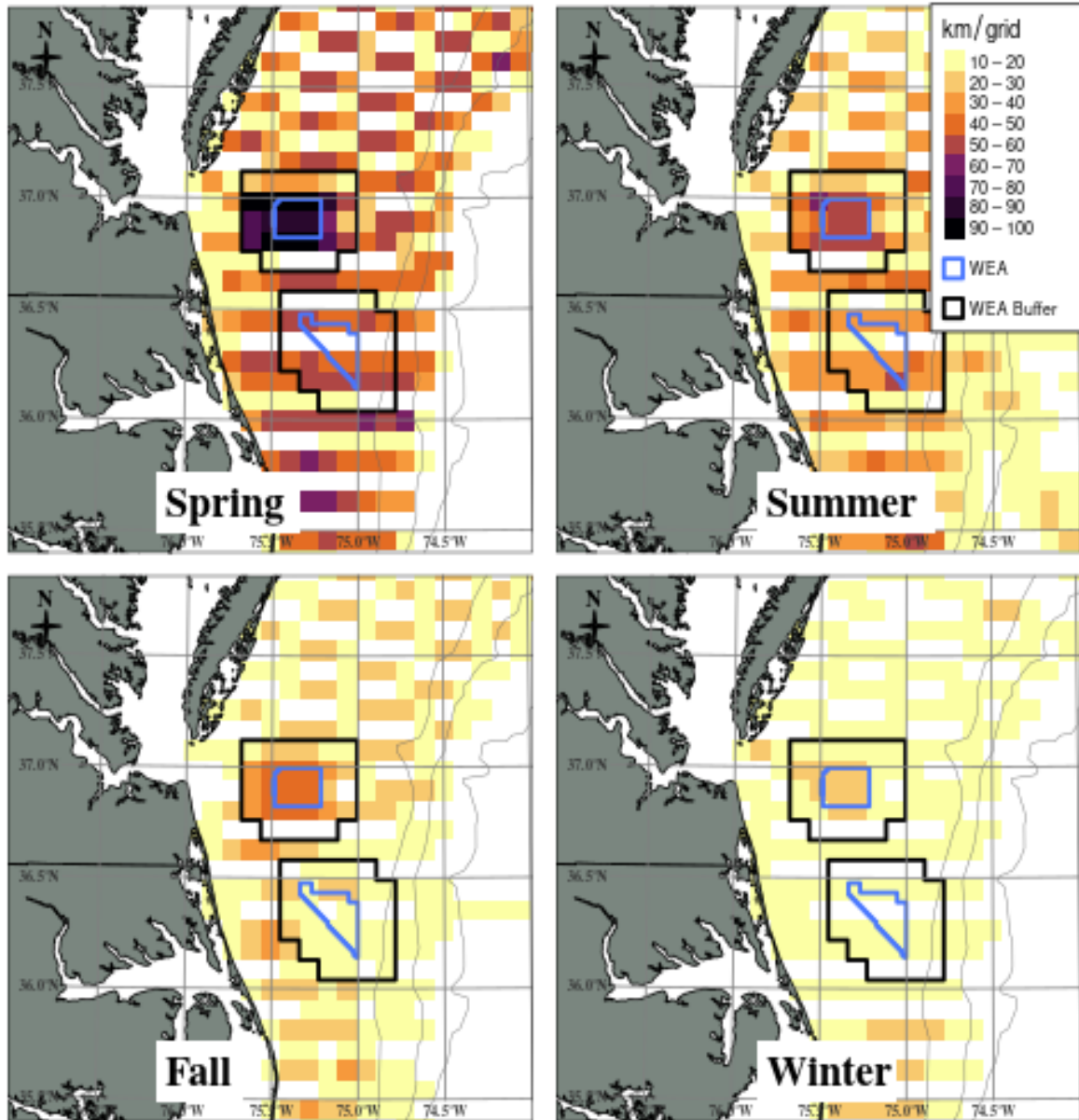


Figure 4-1 Seasonal survey effort in and around VA and NC WEA study areas, 2010 to 2017
One map per season, with the wind energy areas, 10 km buffer zone, 100 m, 1000 m, and 2000 m depth contours depicted overlaying 10 x 10 km² grid cells.

Table 4-1 AMAPPS research effort in VA WEA study area and sightings detected

Numbers of animals are the total number of individuals detected during 2010 to 2017.

Survey	Season	Effort (km)	Number of Cetaceans	Number of Turtles	Number of Seals
NE Shipboard	Spring	137	4	0	0
SE Shipboard	Summer	77	0	67	0
SE Aerial	Spring	1329	20	234	0
SE Aerial	Summer	806	3	250	0
SE Aerial	Fall	687	1	103	0
SE Aerial	Winter	344	1	0	0
TOTAL		3380	29	654	0

Table 4-2 AMAPPS research effort in NC WEA study area and sightings detected

Numbers of animals are the total number of individuals detected during 2010 to 2017.

Survey	Season	Effort (km)	Number of Cetaceans	Number of Turtles	Number of Seals
NE Shipboard	Spring	8	1	0	0
SE Shipboard	Summer	147	3	11	0
SE Shipboard	Fall	116	6	0	0
SE Aerial	Spring	710	18	389	0
SE Aerial	Summer	509	2	100	0
SE Aerial	Fall	204	1	17	0
SE Aerial	Winter	170	0	0	0
TOTAL		1864	31	517	0

4.2 Seasonal Abundance Estimates by Species

4.2.1 VA Wind Energy Study Area

Table 4-3 Spring average abundance and group size estimates in VA WEA study area

Spring is March through May.

Species	Average Density (animals/km ²)	Average Abundance	CV (Density and Abundance)	Average Group Size	CV (Average Group Size)
Atlantic spotted dolphin	0.00736	20.6	0.29	17.0	0.00
Atlantic white-sided dolphin	0.00043	1.2	0.81	9.1	1.04
Bottlenose dolphin	0.02464	69.0	0.29	3.7	0.83
Common dolphin	0.04711	131.9	0.36	24.5	0.83
Fin whale	0.00021	0.6	0.40	1.0	0.00
Harbor porpoise	0.07025	196.7	0.78	1.0	0.00
Humpback whale	0.00014	0.4	0.50	1.5	0.47
Minke whale	0.00014	0.4	0.56	1.2	0.35
Pilot whale, long-finned	0.00000	0.0	2.84	6.7	0.83
Pilot whale, short-finned	0.00061	1.7	0.41	21.5	1.19
Risso's dolphin	0.00054	1.5	0.29	5.5	0.64
Sei whale	0.00000	0.0	2.25	1.6	1.67
Sperm whale	0.00007	0.2	0.36	1.1	0.30
Striped dolphin	0.00007	0.2	0.63	46.0	1.03

Table 4-4 Summer average abundance and group size estimates in VA WEA study area

Summer is June through August.

Species	Average Density (animals/km ²)	Average Abundance	CV (Density and Abundance)	Average Group Size	CV (Average Group Size)
Atlantic spotted dolphin	0.02468	69.1	0.26	25.0	0.00
Atlantic white-sided dolphin	0.00007	0.2	0.73	12.1	1.21
Bottlenose dolphin	0.04771	133.6	0.24	24.7	0.86
Common dolphin	0.00618	17.3	0.40	24.5	0.83
Fin whale	0.00036	1.0	0.42	1.0	0.00
Harbor porpoise	0.00004	0.1	1.50	1.0	0.00
Humpback whale	0.00007	0.2	0.49	1.5	0.47
Minke whale	0.00004	0.1	0.56	1.1	0.26
Pilot whale, long-finned	0.00000	0.0	2.84	12.4	1.00
Pilot whale, short-finned	0.00014	0.4	0.45	12.1	1.33
Risso's dolphin	0.00018	0.5	0.36	5.5	0.64
Sei whale	0.00000	0.0	2.26	1.4	0.51
Sperm whale	0.00000	0.0	0.47	1.8	1.22
Striped dolphin	0.00000	0.0	0.91	45.2	0.87

Table 4-5 Fall average abundance and group size estimates in VA WEA study area

Fall is September through November.

Species	Average Density (animals/km ²)	Average Abundance	CV (Density and Abundance)	Average Group Size	CV (Average Group Size)
Atlantic spotted dolphin	0.01271	35.6	0.28	21.0	0.27
Atlantic white-sided dolphin	0.00018	0.5	0.74	17.6	1.78
Bottlenose dolphin	0.02689	75.3	0.25	80.0	0.00
Common dolphin	0.02175	60.9	0.39	24.5	0.83
Fin whale	0.00014	0.4	0.40	1.0	0.00
Harbor porpoise	0.05179	145.0	0.96	1.0	0.00
Humpback whale	0.00004	0.1	0.49	1.5	0.47
Minke whale	0.00004	0.1	0.57	1.3	0.95
Pilot whale, long-finned	0.00000	0.0	2.83	4.4	1.11
Pilot whale, short-finned	0.00004	0.1	0.60	16.7	1.70
Risso's dolphin	0.00014	0.4	0.36	5.5	0.64
Sei whale	0.00000	0.0	2.29	2.0	1.22
Sperm whale	0.00000	0.0	0.48	2.5	0.84
Striped dolphin	0.00000	0.0	0.92	46.4	1.02

Table 4-6 Winter average abundance and group size estimates in VA WEA study area

Winter is December through February.

Species	Average Density (animals/km²)	Average Abundance	CV (Density and Abundance)	Average Group Size	CV (Average Group Size)
Atlantic spotted dolphin	0.00382	10.7	0.30	21.0	0.27
Atlantic white-sided dolphin	0.00054	1.5	0.77	8.9	1.07
Bottlenose dolphin	0.02171	60.8	0.34	11.0	1.81
Common dolphin	0.04046	113.3	0.34	24.5	0.83
Fin whale	0.00007	0.2	0.41	1.0	0.00
Harbor porpoise	0.15100	422.8	0.72	1.0	0.00
Humpback whale	0.00004	0.1	0.48	1.5	0.47
Minke whale	0.00011	0.3	0.55	1.0	0.00
Pilot whale, long-finned	0.00000	0.0	2.83	1.2	0.37
Pilot whale, short-finned	0.00025	0.7	0.47	7.6	0.58
Risso's dolphin	0.00036	1.0	0.30	5.5	0.64
Sei whale	0.00000	0.0	2.32	2.0	0.87
Sperm whale	0.00007	0.2	0.36	1.7	1.19
Striped dolphin	0.00011	0.3	0.60	25.0	0.00

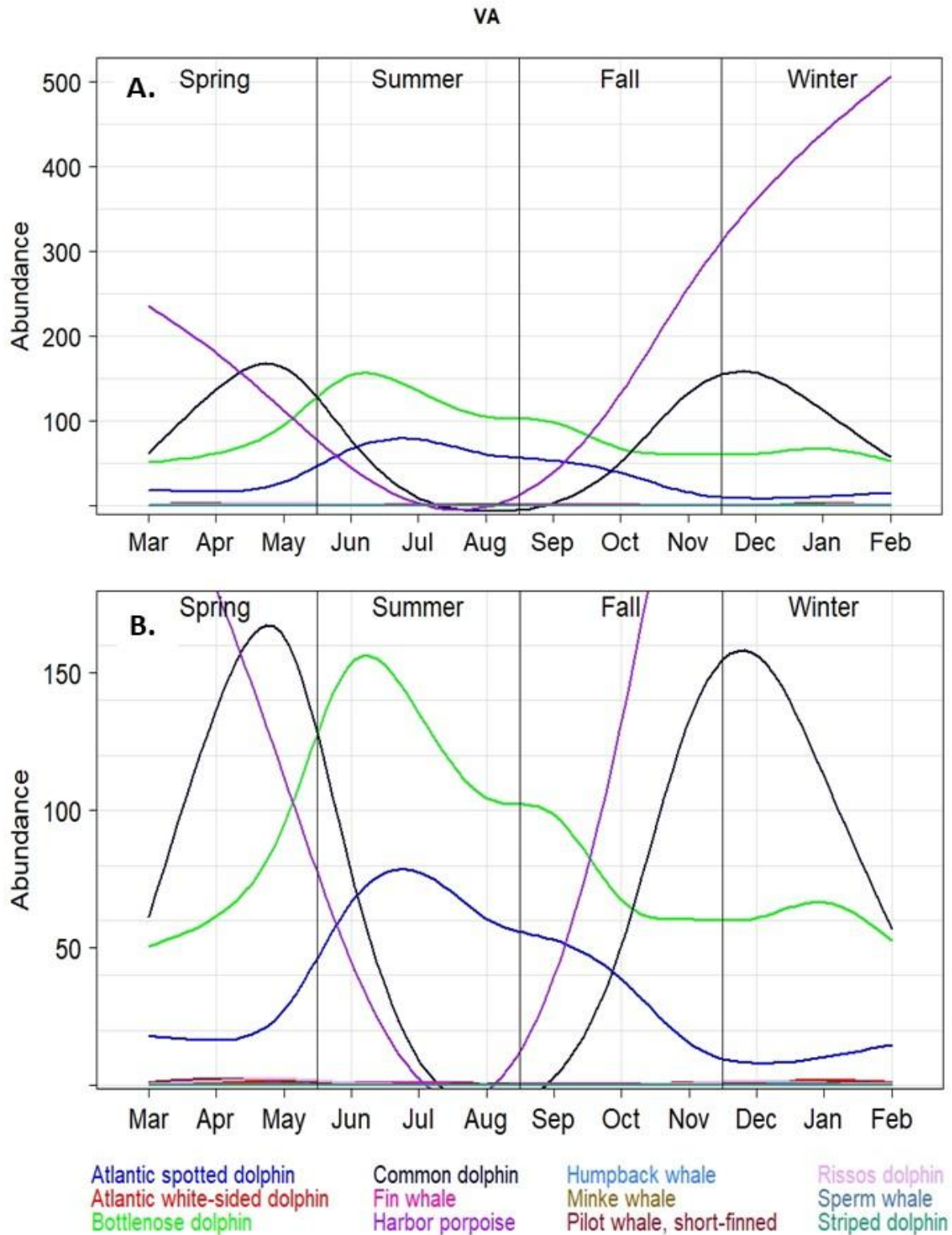


Figure 4-2 Average annual abundance trends in VA WEA study area, by species
 (A) All species. (B) Blow up of species with small abundance estimates. NC Wind Energy Study Area

4.2.2 NC Wind Energy Study Area

Table 4-7 Spring average abundance and group size estimates in NC WEA study area

Spring is March through May.

Species	Average Density (animals/km ²)	Average Abundance	CV (Density and Abundance)	Average Group Size	CV (Average Group Size)
Atlantic spotted dolphin	0.01638	52.4	0.28	49.6	0.76
Atlantic white-sided dolphin	0.00034	1.1	0.95	9.1	1.04
Bottlenose dolphin	0.05503	176.1	0.27	18.3	1.13
Common dolphin	0.09888	316.4	0.39	19.0	0.81
Fin whale	0.00016	0.5	0.50	2.0	0.00
Harbor porpoise	0.04647	148.7	0.74	1.5	1.17
Humpback whale	0.00025	0.8	0.52	1.6	0.71
Minke whale	0.00009	0.3	0.65	1.0	0.00
Pilot whale, long-finned	0.00000	0.0	3.76	6.7	0.83
Pilot whale, short-finned	0.00581	18.6	0.33	21.5	1.19
Risso's dolphin	0.00184	5.9	0.26	16.0	1.03
Sei whale	0.00000	0.0	3.01	1.6	1.36
Sperm whale	0.00019	0.6	0.33	1.1	0.30
Striped dolphin	0.00003	0.1	0.65	46.0	1.03

Table 4-8 Summer average abundance and group size estimates in NC WEA study area

Summer is June through August.

Species	Average Density (animals/km ²)	Average Abundance	CV (Density and Abundance)	Average Group Size	CV (Average Group Size)
Atlantic spotted dolphin	0.05922	189.5	0.25	60.0	0.68
Atlantic white-sided dolphin	0.00006	0.2	0.88	12.1	1.21
Bottlenose dolphin	0.10716	342.9	0.25	19.1	1.08
Common dolphin	0.02419	77.4	0.43	19.0	0.81
Cuvier's beaked whale	0.00003	0.1	0.74	2.6	0.61
Fin whale	0.00025	0.8	0.51	1.5	0.47
Harbor porpoise	0.00003	0.1	1.86	2.5	1.21
Humpback whale	0.00009	0.3	0.48	2.0	4.25
Kogia	0.00000	0.0	1.06	1.0	0.00
Minke whale	0.00003	0.1	0.64	1.0	0.00
Pilot whale, long-finned	0.00000	0.0	3.75	12.4	1.00
Pilot whale, short-finned	0.00753	24.1	0.34	12.1	1.33
Risso's dolphin	0.00147	4.7	0.27	16.0	1.03
Sei whale	0.00000	0.0	3.07	1.6	1.36
Sowerby's beaked whale	0.00003	0.1	0.93	1.0	0.00
Sperm whale	0.00013	0.4	0.37	1.8	1.22
Striped dolphin	0.00000	0.0	0.84	45.2	0.87
Unidentified beaked whale	0.00028	0.9	0.29	2.4	0.85

Table 4-9 Fall average abundance and group size estimates in NC WEA study area

Fall is September through November.

Species	Average Density (animals/km ²)	Average Abundance	CV (Density and Abundance)	Average Group Size	CV (Average Group Size)
Atlantic spotted dolphin	0.03172	101.5	0.27	26.3	0.55
Atlantic white-sided dolphin	0.00016	0.5	0.90	17.6	1.78
Bottlenose dolphin	0.05922	189.5	0.26	20.6	1.12
Common dolphin	0.04491	143.7	0.45	19.0	0.81
Fin whale	0.00009	0.3	0.54	1.0	0.00
Harbor porpoise	0.04053	129.7	0.98	3.6	1.41
Humpback whale	0.00003	0.1	0.50	1.4	0.42
Minke whale	0.00003	0.1	0.64	1.0	0.00
Pilot whale, long-finned	0.00000	0.0	3.74	4.4	1.11
Pilot whale, short-finned	0.00166	5.3	0.40	16.7	1.70
Risso's dolphin	0.00078	2.5	0.29	16.0	1.03
Sei whale	0.00000	0.0	3.06	1.6	1.36
Sperm whale	0.00006	0.2	0.43	2.5	0.84
Striped dolphin	0.00000	0.0	1.02	46.4	1.02

Table 4-10 Winter average abundance and group size estimates in NC WEA study area

Winter is December through February.

Species	Average Density (animals/km ²)	Average Abundance	CV (Density and Abundance)	Average Group Size	CV (Average Group Size)
Atlantic spotted dolphin	0.00569	18.2	0.30	49.6	0.76
Atlantic white-sided dolphin	0.00038	1.2	0.92	8.9	1.07
Bottlenose dolphin	0.03781	121.0	0.28	19.1	1.08
Common dolphin	0.08319	266.2	0.39	19.0	0.81
Fin whale	0.00006	0.2	0.53	1.5	0.47
Harbor porpoise	0.09753	312.1	0.76	1.4	0.70
Humpback whale	0.00006	0.2	0.50	1.0	0.00
Minke whale	0.00006	0.2	0.64	1.0	0.00
Pilot whale, long-finned	0.00000	0.0	3.76	1.2	0.37
Pilot whale, short-finned	0.00203	6.5	0.40	7.6	0.58
Sei whale	0.00000	0.0	3.07	1.6	1.36
Risso's dolphin	0.00131	4.2	0.27	16.0	1.03
Sperm whale	0.00016	0.5	0.36	1.7	1.19
Striped dolphin	0.00003	0.1	0.66	25.0	0.00

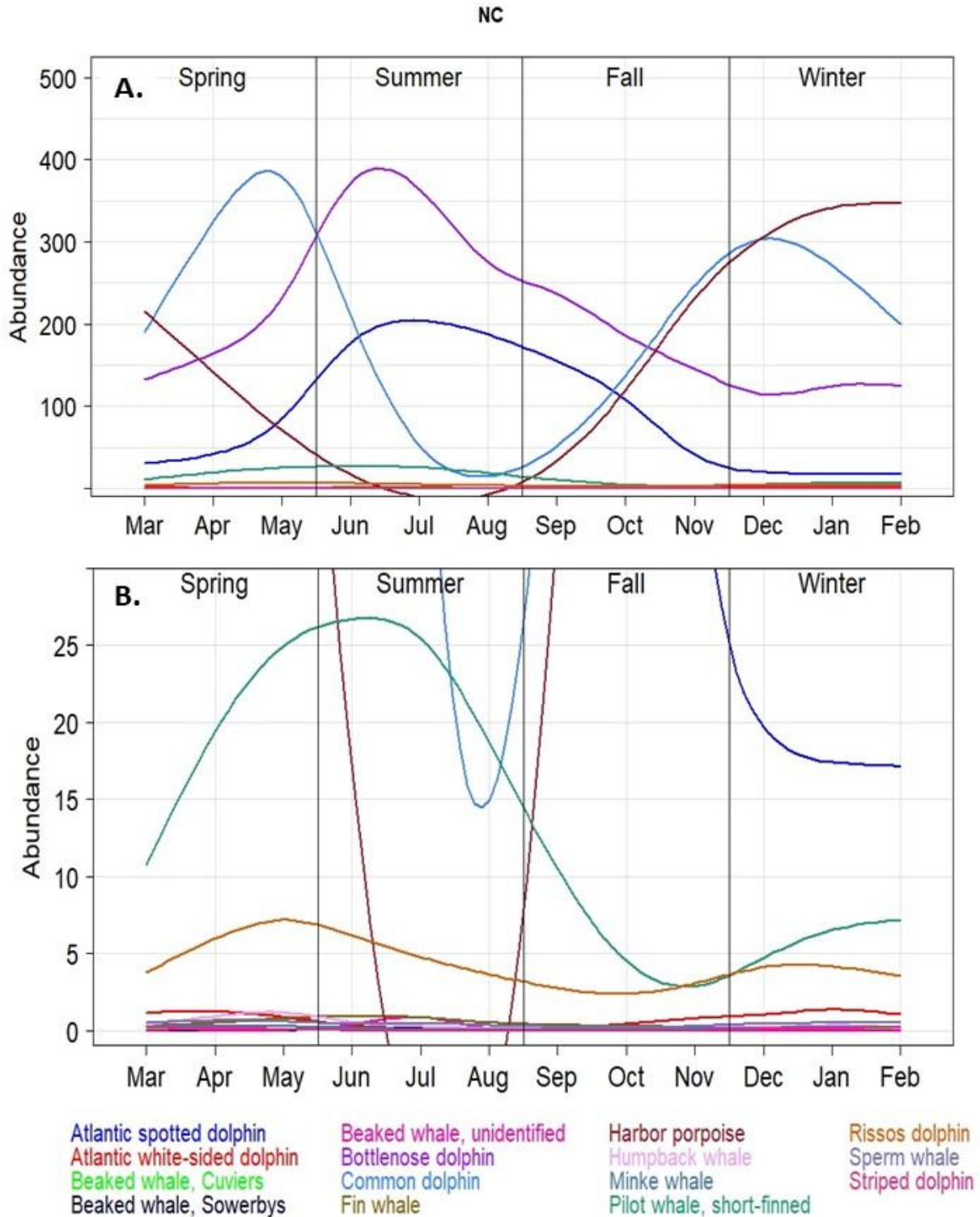


Figure 4-3 Average annual abundance trends in NC WEA study area, by species
 (A) All species. (B) Blow up of species with small abundance estimates.

4.3 Seasonal Density Patterns by Functional Groups

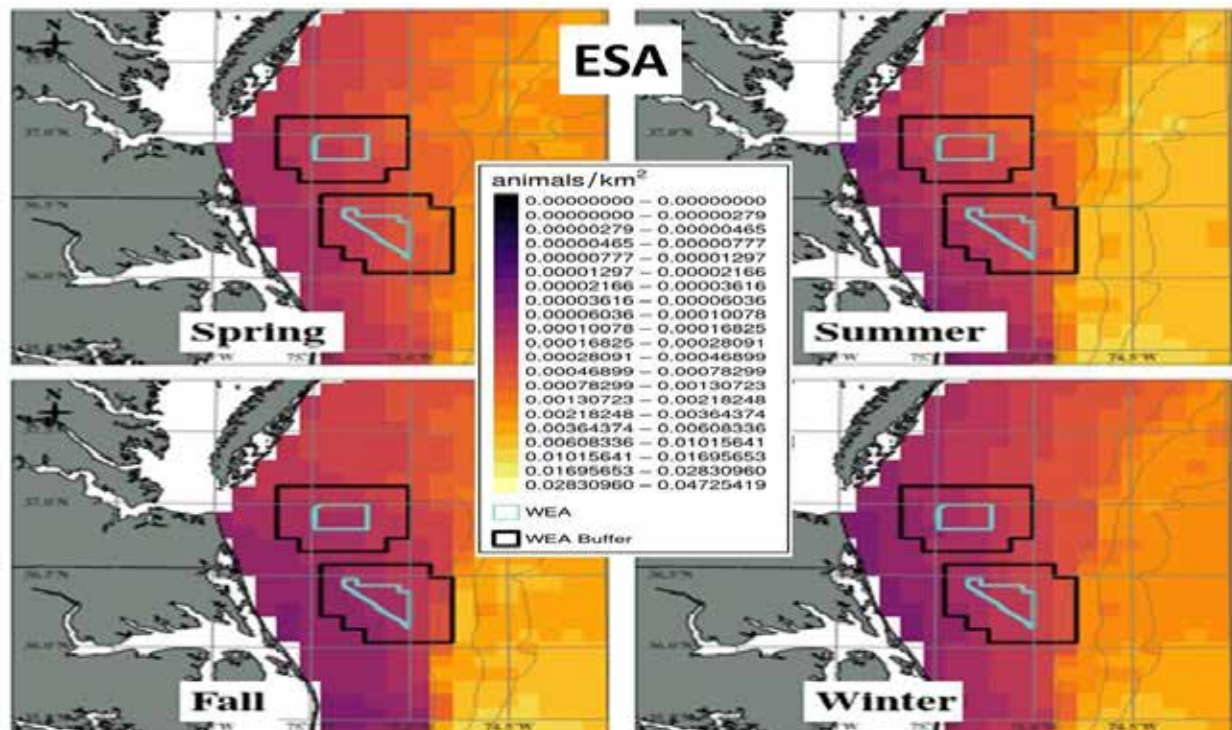


Figure 4-4 Average density of ESA species, VA and NC WEAs
ESA species include fin, humpback, sei, and sperm whales.

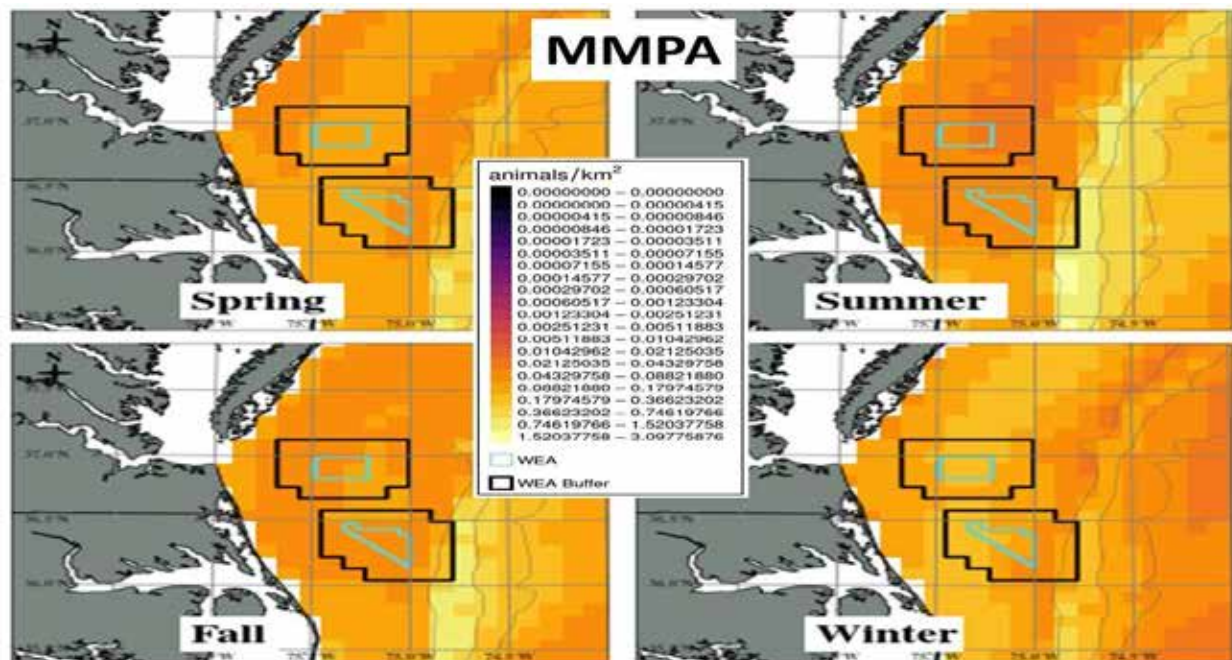


Figure 4-5 Average density of MMPA species, VA and NC WEAs
MMPA species include Atlantic white-sided dolphins, common bottlenose dolphins, common dolphins, and short-finned pilot whales.

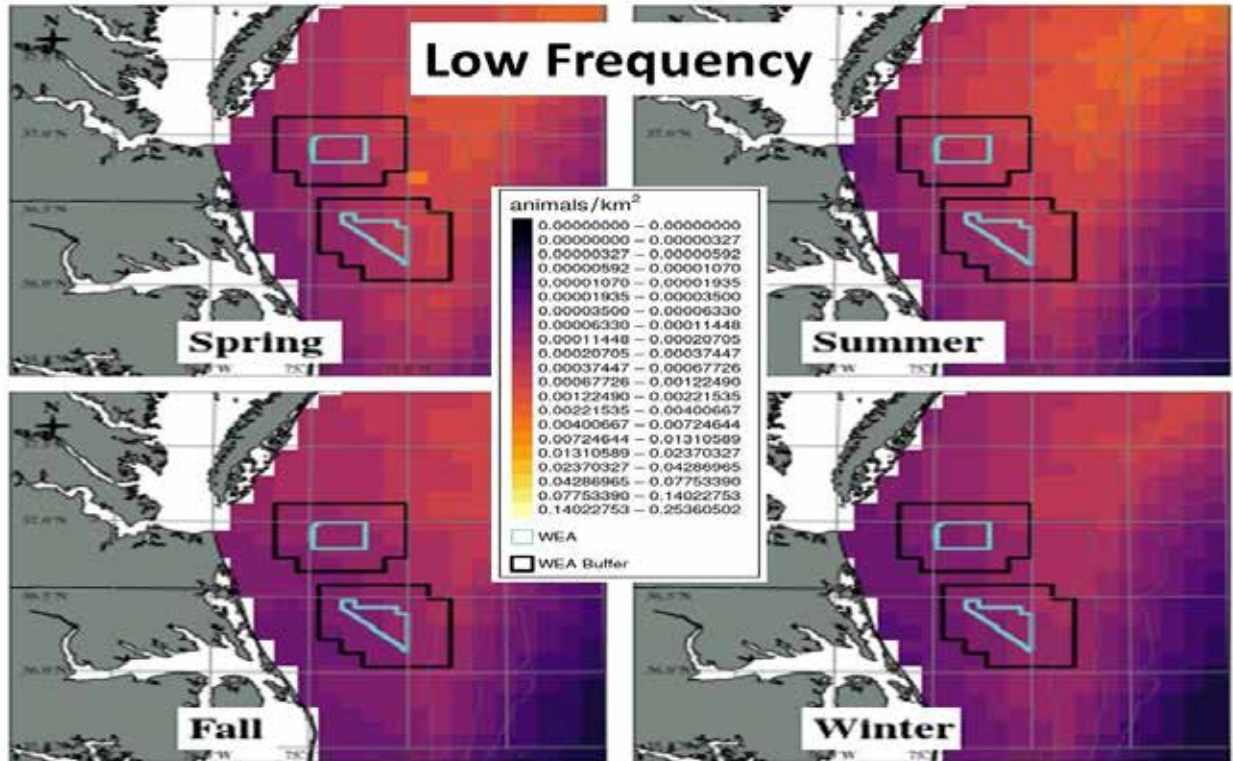


Figure 4-6 Average density of low frequency sensitive species, VA and NC WEAs
Species sensitive to low frequency sounds include fin, humpback, minke, and sei whales.

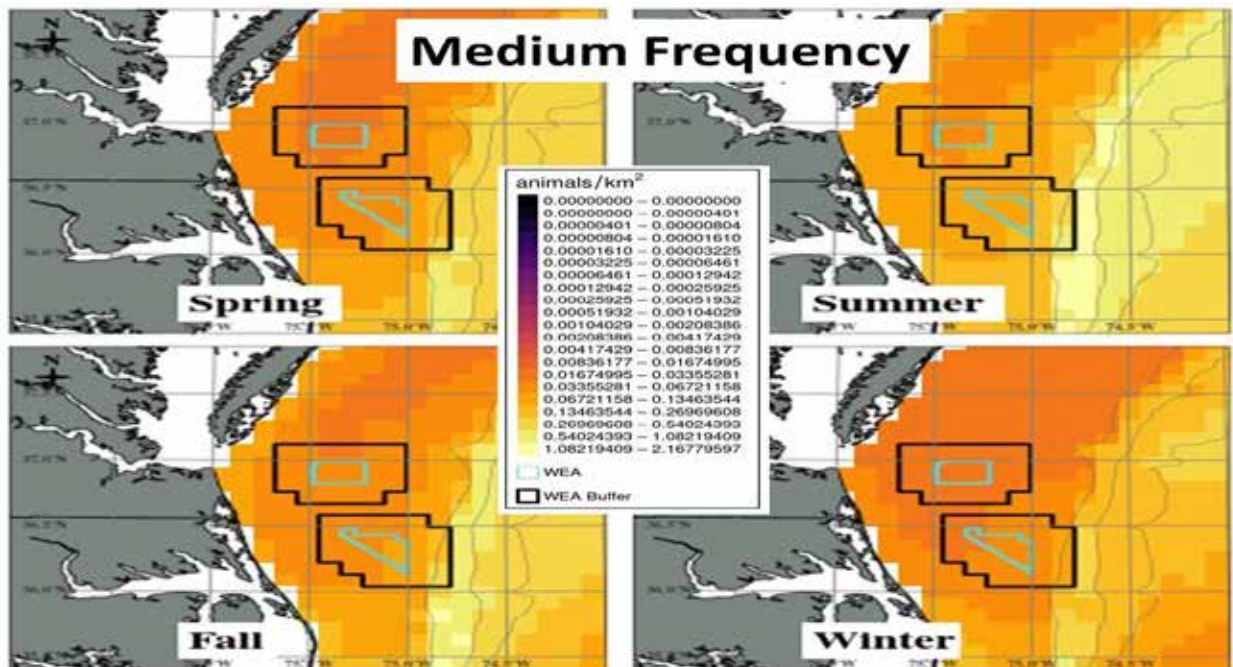


Figure 4-7 Average density of medium frequency sensitive species, VA and NC WEAs
Species sensitive to medium frequency sounds include Atlantic spotted dolphins, Atlantic white-sided dolphins, common bottlenose dolphins, common dolphins, Cuvier's beaked whales, long-finned pilot whales, Risso's dolphins, short-finned pilot whales, Sowerby's beaked whales, sperm whales, striped dolphins, and unidentified beaked whales.

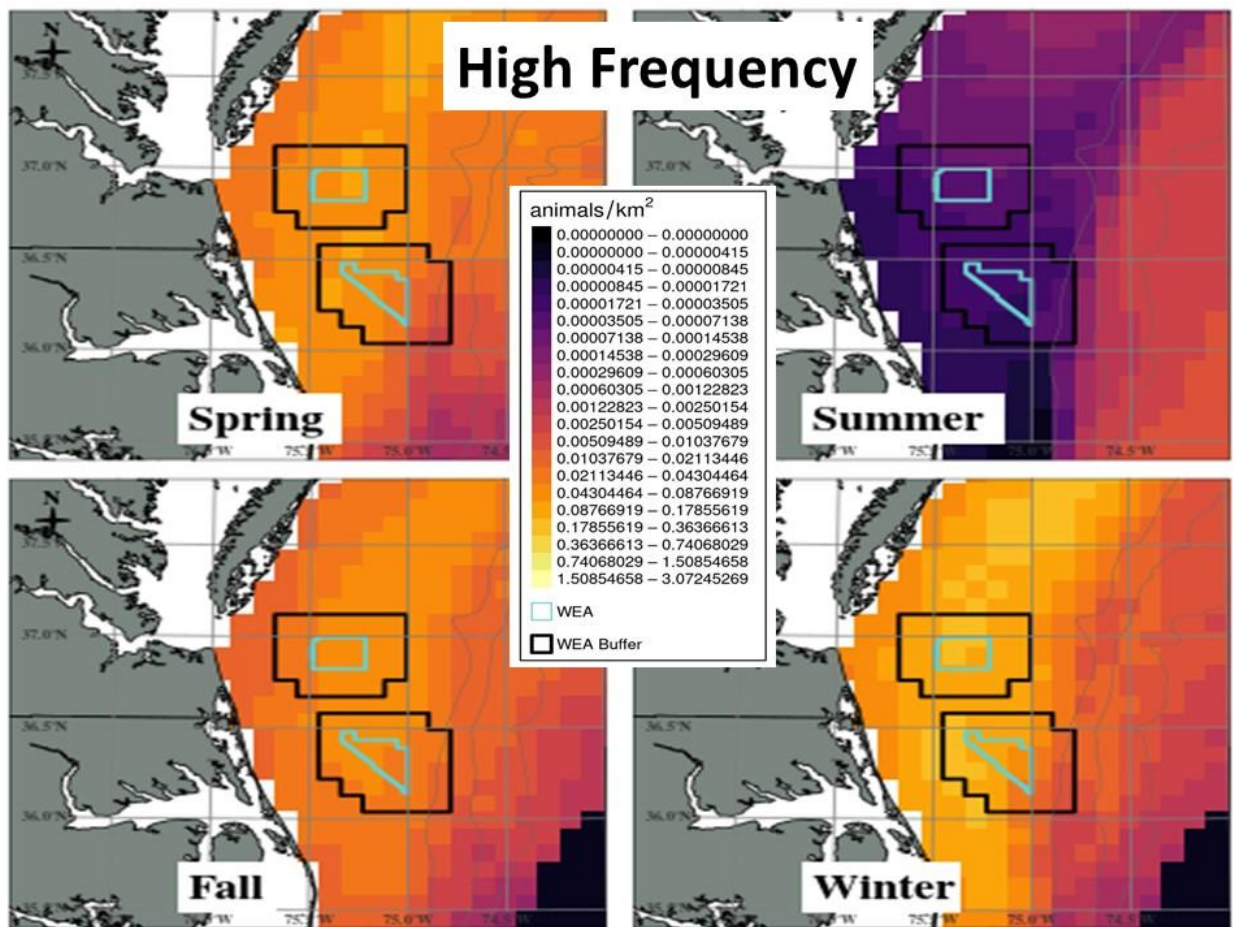


Figure 4-8 Average density of high frequency sensitive species, VA and NC WEAs

Species sensitive to high frequency sounds include dwarf sperm whales, harbor porpoises, and pygmy sperm whales.

5 Southern North Carolina to Georgia (NC/SC) Wind Energy Areas

5.1 Data Collection

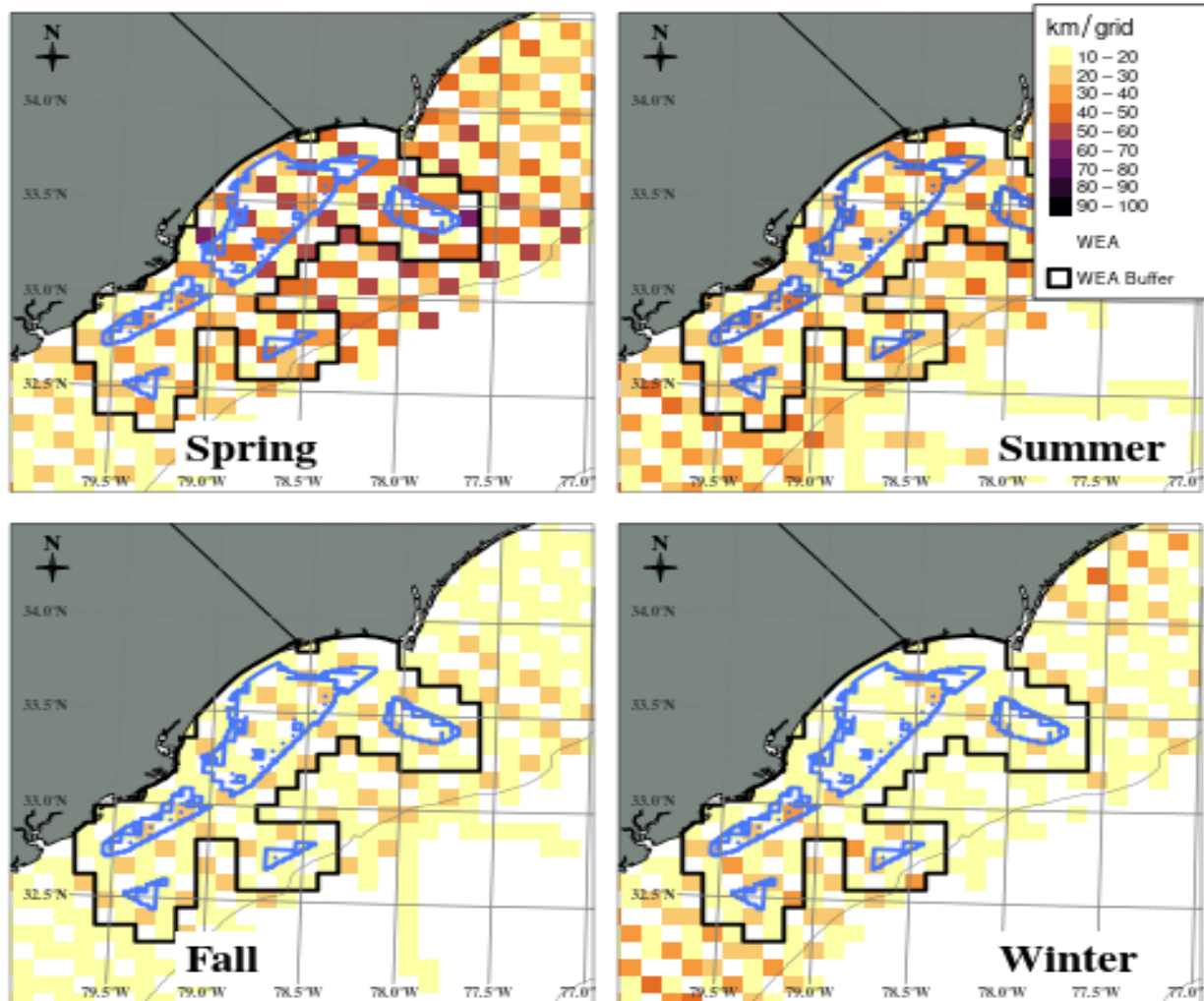


Figure 5-1 Seasonal survey effort in and around NC/SC WEA study area, 2010 to 2017

One map per season, with the wind energy area, 10 km buffer zone, and 100 m depth contour overlaying 10 x 10 km² grid cells.

Table 5-1 AMAPPS research effort in NC/SC WEA study area and sightings detected

Numbers of animals are the total number of individuals detected during 2010 to 2017.

Survey	Season	Effort (km)	Number of Cetaceans	Number of Turtles	Number of Seals
SE Shipboard	Summer	73	2	1	0
SE Shipboard	Fall	87	3	0	0
SE Aerial	Spring	3166	69	186	0
SE Aerial	Summer	1497	32	136	0
SE Aerial	Fall	1456	35	71	0
SE Aerial	Winter	835	13	51	0
TOTAL		7114	154	445	0

5.2 Seasonal Abundance Estimates by Species

Table 5-2 Spring average abundance and group size estimates in NC/SC WEA study area
Spring is March through May.

Species	Average Density (animals/km ²)	Average Abundance	CV (Density and Abundance)	Average Group Size	CV (Average Group Size)
Atlantic spotted dolphin	0.02081	328.5	0.24	10.5	1.02
Common dolphin	0.00000	0.0	1.74	19.0	0.81
Bottlenose dolphin	0.04781	754.7	0.27	6.0	1.40
Fin whale	0.00000	0.0	1.05	1.4	0.59
Harbor porpoise	0.00048	7.5	1.03	1.5	1.17
Humpback whale	0.00001	0.1	0.77	1.6	0.71
Minke whale	0.00000	0.0	1.74	1.2	0.35
Pilot whale, long-finned	0.00000	0.0	10.74	6.7	0.83
Pilot whale, short-finned	0.00004	0.6	0.61	21.5	1.19
Risso's dolphin	0.00016	2.5	0.35	5.1	0.93
Sperm whale	0.00000	0.0	0.61	1.1	0.30
Striped dolphin	0.00000	0.0	2.52	46.0	1.03

Table 5-3 Summer average abundance and group size estimates in NC/SC WEA study area
Summer is June through August.

Species	Average Density (animals/km ²)	Average Abundance	CV (Density and Abundance)	Average Group Size	CV (Average Group Size)
Atlantic spotted dolphin	0.03031	478.4	0.24	12.1	0.67
Common dolphin	0.00000	0.0	2.25	19.0	0.81
Bottlenose dolphin	0.11935	1883.8	0.27	7.9	1.01
Fin whale	0.00001	0.1	1.07	1.5	0.59
Harbor porpoise	0.00000	0.0	4.50	2.5	1.21
Humpback whale	0.00000	0.0	0.79	2.0	4.25
Minke whale	0.00000	0.0	1.79	1.1	0.26
Pilot whale, long-finned	0.00000	0.0	10.85	12.4	1.00
Pilot whale, short-finned	0.00001	0.2	0.62	12.1	1.33
Risso's dolphin	0.00012	1.9	0.32	7.2	1.07
Sperm whale	0.00000	0.0	0.63	1.8	1.22
Striped dolphin	0.00000	0.0	8.16	45.2	0.87

Table 5-4 Fall average abundance and group size estimates in NC/SC WEA study area

Fall is September through November.

Species	Average Density (animals/km ²)	Average Abundance	CV (Density and Abundance)	Average Group Size	CV (Average Group Size)
Atlantic spotted dolphin	0.02278	359.5	0.27	23.8	1.32
Common dolphin	0.00000	0.0	1.67	19.0	0.81
Bottlenose dolphin	0.08449	1333.6	0.26	12.3	1.17
Fin whale	0.00000	0.0	1.05	1.3	0.58
Harbor porpoise	0.00003	0.5	1.48	3.6	1.41
Humpback whale	0.00000	0.0	0.78	1.4	0.42
Minke whale	0.00000	0.0	1.74	1.3	0.95
Pilot whale, long-finned	0.00000	0.0	10.73	4.4	1.11
Pilot whale, short-finned	0.00001	0.1	0.69	16.7	1.70
Risso's dolphin	0.00006	1.0	0.36	9.1	1.52
Sperm whale	0.00000	0.0	0.74	2.5	0.84
Striped dolphin	0.00000	0.0	2.74	46.4	1.02

Table 5-5 Winter average abundance and group size estimates in NC/SC WEA study area

Winter is December through February

Species	Average Density (animals/km ²)	Average Abundance	CV (Density and Abundance)	Average Group Size	CV (Average Group Size)
Atlantic spotted dolphin	0.01055	166.5	0.27	42.5	1.55
Common dolphin	0.00000	0.0	1.73	19.0	0.81
Bottlenose dolphin	0.03521	555.7	0.27	8.0	0.71
Fin whale	0.00000	0.0	1.05	1.0	0.00
Harbor porpoise	0.00025	3.9	1.13	1.4	0.70
Humpback whale	0.00001	0.1	0.77	1.0	0.00
Minke whale	0.00000	0.0	1.72	1.0	0.00
Pilot whale, long-finned	0.00000	0.0	10.88	1.2	0.37
Pilot whale, short-finned	0.00006	0.9	0.58	7.6	0.58
Risso's dolphin	0.00016	2.6	0.37	3.7	1.37
Sperm whale	0.00000	0.0	0.57	1.7	1.19
Striped dolphin	0.00000	0.0	2.49	25.0	0.00

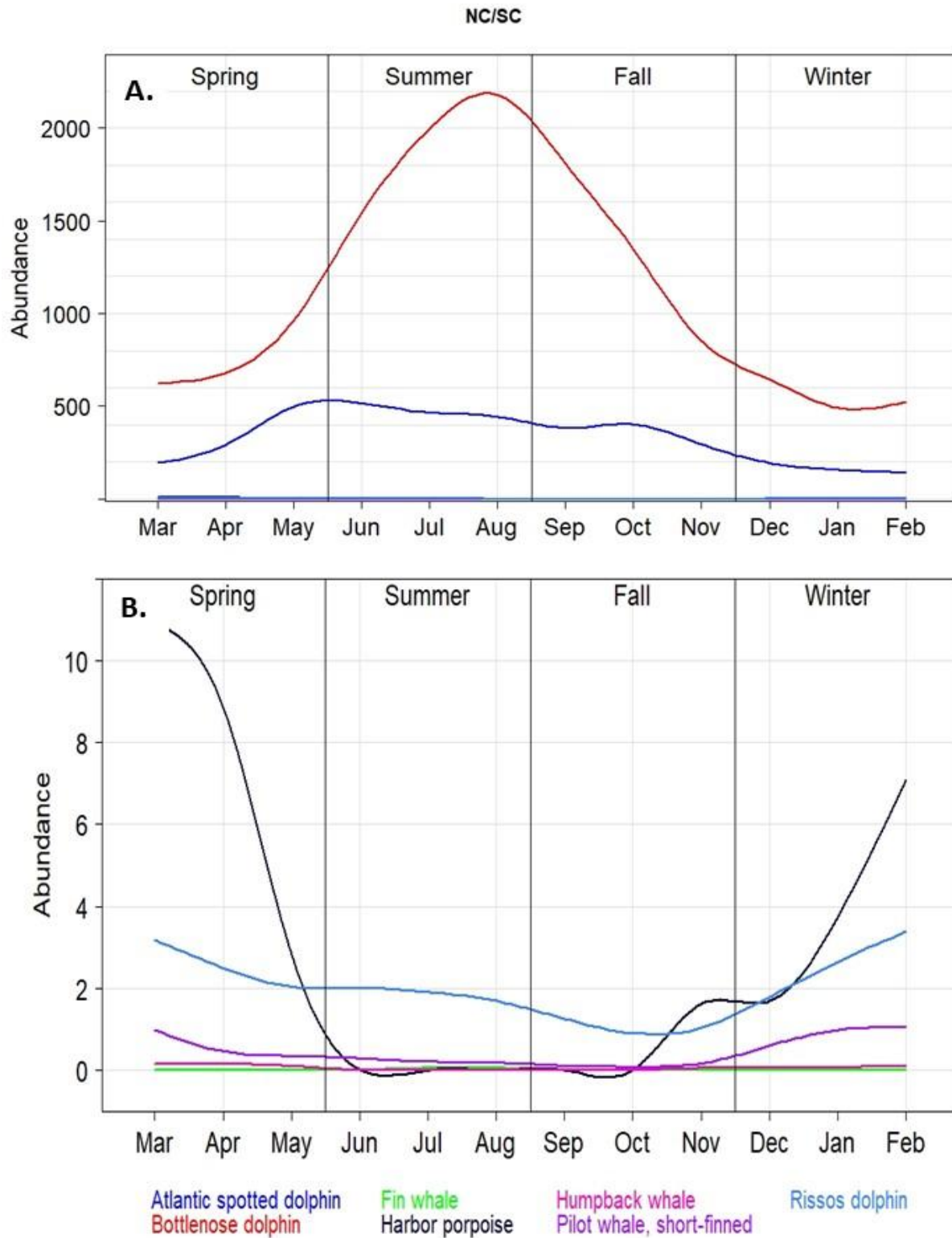


Figure 5-2 Average annual abundance trends in NC/SC WEA study area, by species
 (A) All species. (B) Blow up of species with small abundance estimates.

5.3 Seasonal Density Patterns by Functional Groups

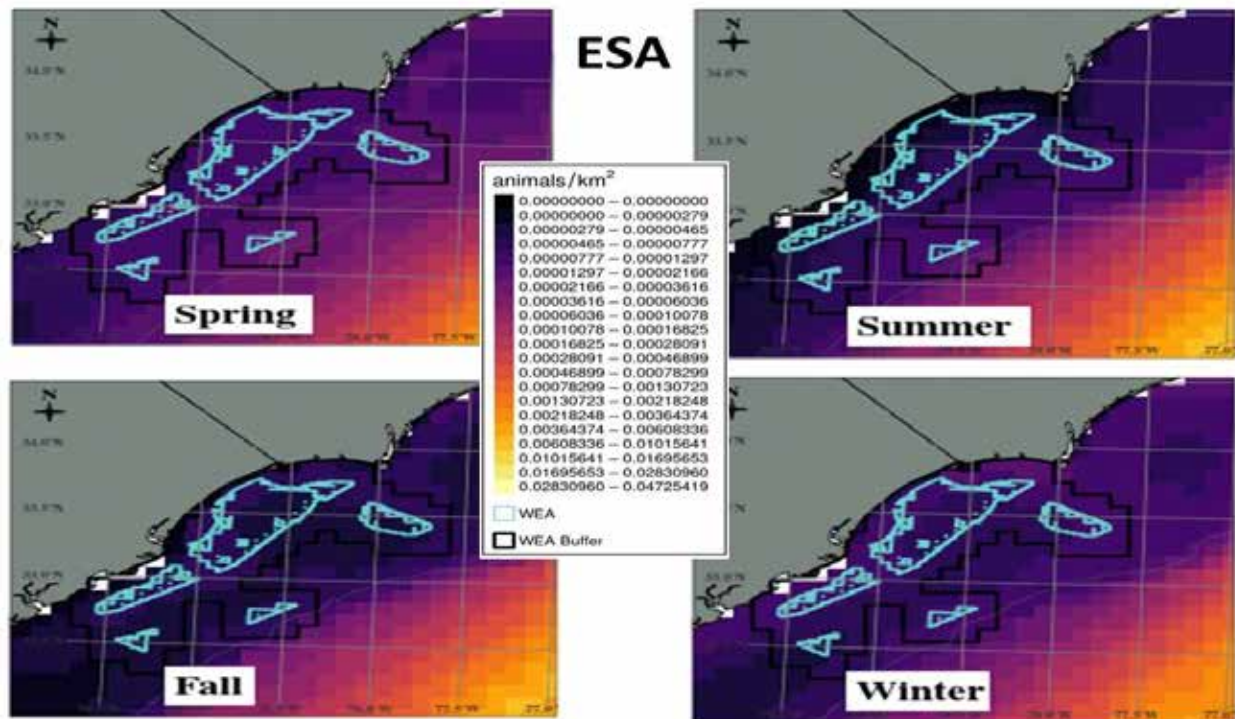


Figure 5-3 Average density of ESA species, NC/SC WEA
ESA species include fin, humpback, sei, and sperm whales.

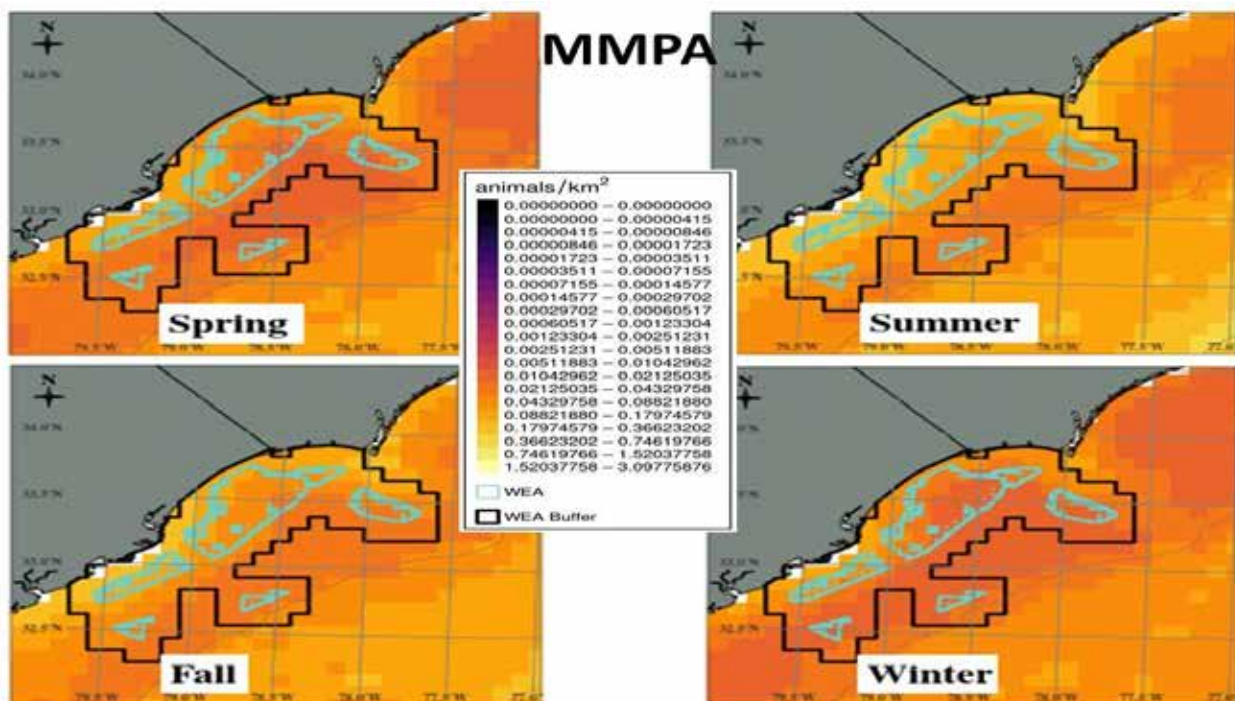


Figure 5-4 Average density of MMPA species, NC/SC WEA
MMPA species include Atlantic white-sided dolphins, common bottlenose dolphins, common dolphins, and short-finned pilot whales.

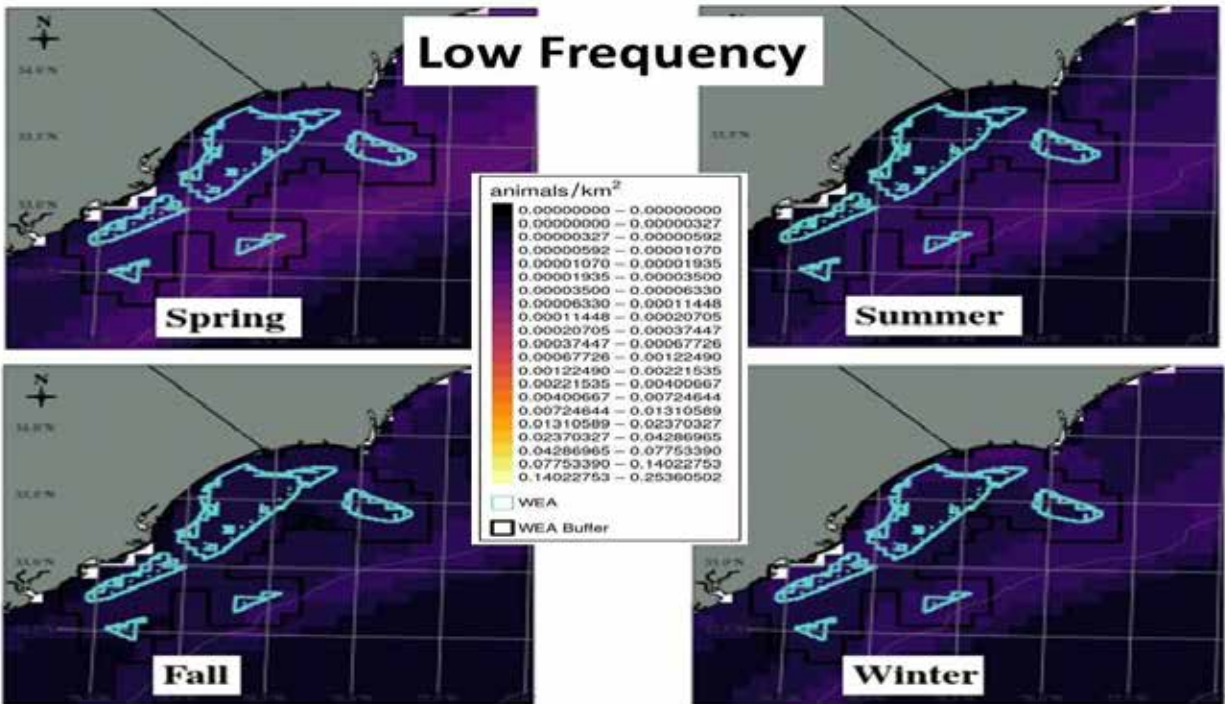


Figure 5-5 Average density of low frequency sensitive species, NC/SC WEA
Species sensitive to low frequency sounds include fin, humpback, minke, and sei whales.

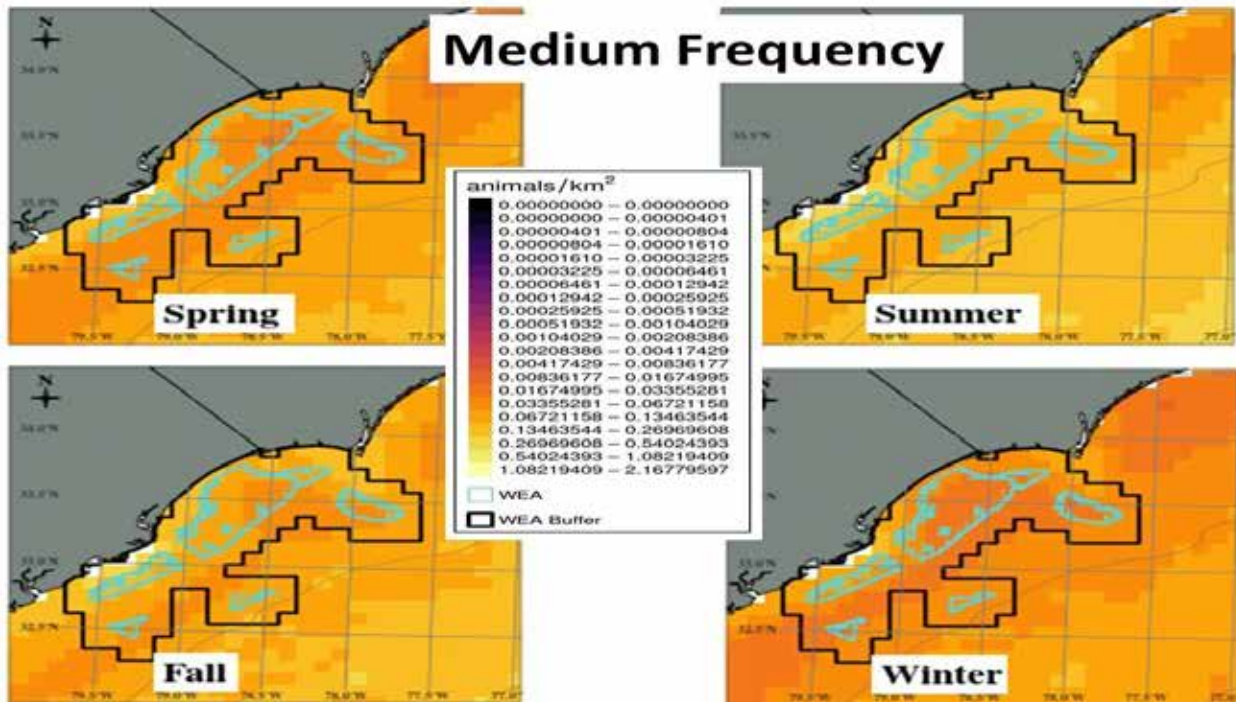


Figure 5-6 Average density of medium frequency sensitive species, NC/SC WEA
Species sensitive to medium frequency sounds include Atlantic spotted dolphins, Atlantic white-sided dolphins, common bottlenose dolphins, common dolphins, Cuvier's beaked whales, long-finned pilot whales, Risso's dolphins, short-finned pilot whales, Sowerby's beaked whales, sperm whales, striped dolphins, and unidentified beaked whales.

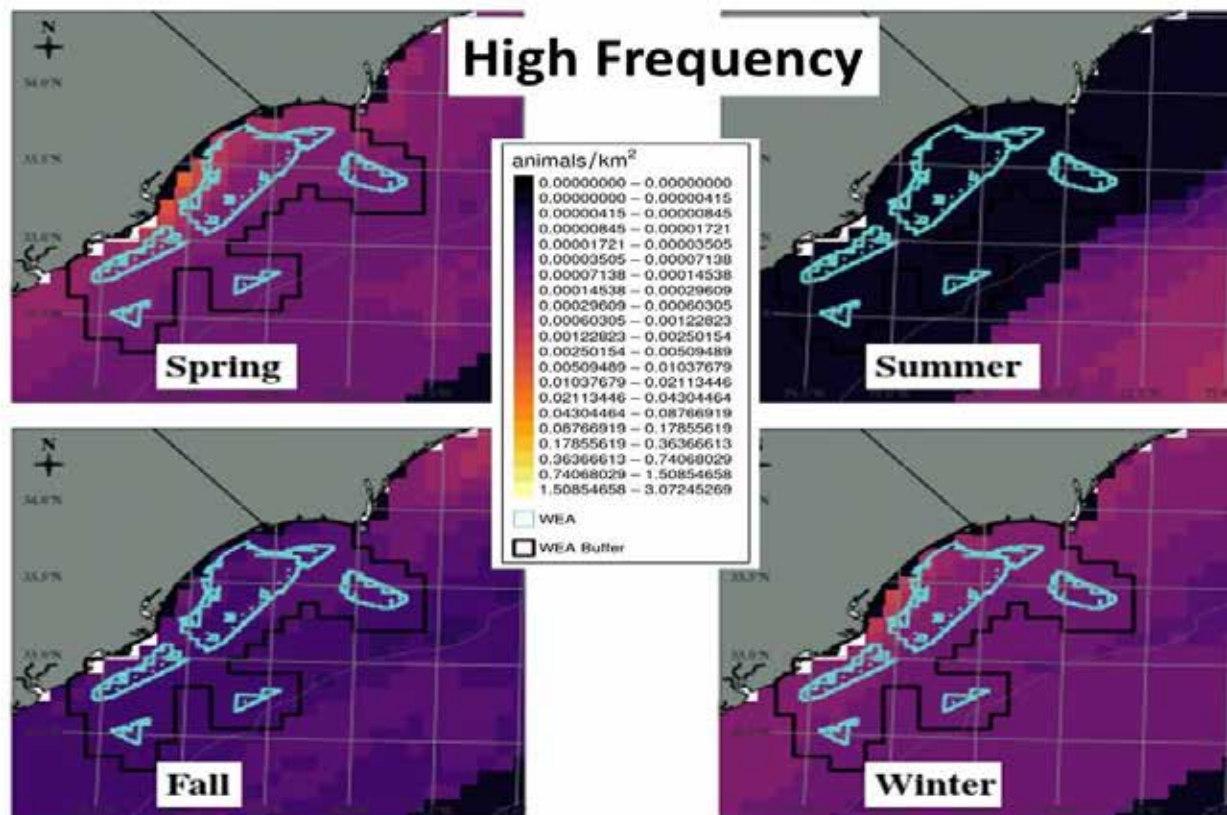


Figure 5-7 Average density of high frequency sensitive species, NC/SC WEA

Species sensitive to high frequency sounds include dwarf sperm whales, harbor porpoises, and pygmy sperm whales.



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