



Northeast Fisheries Science Center Reference Document 20-04

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by Marjorie C Lyssikatos¹, Samuel Chavez-Rosales², and Joshua Hatch¹

¹NOAA Fisheries, Northeast Fisheries Science Center, 166 Water Street,
Woods Hole, MA 02543

²Integrated Statistics, 16 Sumner Street, Woods Hole, MA 02543

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This report provides bycatch estimates, calculated by using mortality and serious injuries combined, for 6 cetacean and 2 pinniped species incidentally captured by Northeast bottom trawl (NEBT) and Mid-Atlantic bottom trawl (MABT) fishing operations from 2013 to 2017. These estimates are an update from Chavez-Rosales et al. (2018) which covers the fishing operations from 2012 to 2016. The bycatch estimation methodology does not differ from earlier years dating back to 2008 (Lyssikatos 2015; Chavez-Rosales et al. 2017). For details on the bycatch estimation methodology, please refer to recent documentation in Chavez-Rosales et al. 2018. The marine mammal species included for the 2013-2017 time period are: Atlantic white-sided dolphin (*Lagenorhynchus acutus*), common dolphin (*Delphinus delphis delphis*), offshore stock common bottlenose dolphin (*Tursiops truncatus truncatus*), Risso's dolphin (*Grampus griseus*), long-finned pilot whale (*Globicephala melas*), harbor porpoise (*Phocoena phocoena phocoena*), harbor seal (*Phoca vitulina vitulina*), and gray seal (*Halichoerus grypus atlantica*). The aim of this report is to document bycatch estimates for the 5-year period 2013 through 2017 to support the US Atlantic and Gulf of Mexico 2019 marine mammal stock assessment reports.

Mean annual bycatch estimates from the NEBT fishery were 14.36 (coefficient of variation [CV] = 0.25) common dolphins, 4.18 (CV = 0.73) Risso's dolphins, 15.39 (CV = 0.30) long-finned pilot whales, 2.54 (CV = 0.67) harbor porpoises, 21.36 (CV = 0.21) Atlantic white-sided dolphins, 10.42 (CV = 0.62) offshore common bottlenose dolphins, 15.47 (CV = 0.24) gray seals, and 4.64 (CV = 0.48) harbor seals. Mean annual bycatch estimates in the MABT fishery were 278.07 (CV = 0.13) common dolphins, 37.09 (CV = 0.29) Risso's dolphins, 10.89 (CV = 0.42) offshore common bottlenose dolphins, 1.93 (CV = 0.94) Atlantic white-sided dolphins, 16.91 (CV = 0.30) gray seals, and 5.60 (CV = 0.56) harbor seals (Table 1).

Observer coverage, defined as the percentage of the Vessel Trip Report trips in which an observer was onboard a fishing vessel, averaged 15.46% for the Northeast (MA), ranging from 12.12% for 2016 to maximum coverage of 19.30% in 2014. For the Mid-Atlantic (MA) region, average coverage was 9.60%, ranging from 7.18% for 2013 to maximum coverage 13.93% in 2017 (Table 2). Total observer coverage continued to be higher in the Gulf of Maine and Georges Bank ecoregions than in the MA because of the allocation of at-sea monitors in addition to traditional fisheries observers in the NE region. However, observer coverage in MABT fisheries continued to increase from 2013 to 2017 as a result of increased allocation of observer sea days to monitor bycatch sea turtles and federally regulated species (NEFSC-GARFO 2018).

The 2013 to 2017 NEBT estimates are based on observed bycatch (mortalities and serious injuries) consisting of 20 white-sided, 13 common, 2 Risso's, and 7 offshore bottlenose dolphins; 2 harbor porpoise; 13 pilot whales; and 4 harbor and 15 gray seals. MABT estimates are based on observed bycatch consisting of 1 white-sided, 176 common, 21 Risso's, and 7 offshore bottlenose dolphins, and 3 harbor and 11 gray seals. (Table 2; Figure 1). Refer to Josephson et al. (2019) for details on serious injury determinations attributed to interactions with bottom trawl gear.

Stratified bycatch estimates were produced by using a ratio estimator by region, year, trimester, and ecoregion (Table 3). Total annual bycatch estimate and composite coefficient of variation for each species and annual estimate are shown in Table 1. There was no significant change in temporal or spatial bycatch patterns attributed to NEBT and MABT gear among all 8 species described in this report (Figures 2-3), comparable to the values reported in Lyssikatos (2015) and Chavez-Rosales et al. (2017, 2018).

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Table 1. Total and mean annual bycatch estimates in Northeast and Mid-Atlantic commercial bottom trawl trips for years 2013-2017 by species and region. The annual coefficients of variation (CV) are in parentheses. NA = not applicable.

Species	Region	2013	2014	2015	2016	2017	5 year Total Bycatch	Annual Mean Bycatch	CV
Common dolphin (<i>Delphinus delphis delphis</i>)	Northeast	16.84 (0.54)	17.47 (0.53)	21.58 (0.45)	15.93 (0.46)	0.00 (NA)	71.82	14.36	0.25
	Mid-Atlantic	254.29 (0.29)	328.81 (0.29)	250.11 (0.32)	177.17 (0.33)	379.99 (0.23)	1390.37	278.07	0.13
Risso's dolphin (<i>Grampus griseus</i>)	Northeast	0.00 (NA)	4.16 (0.91)	0.00 (NA)	16.73 (0.88)	0.00 (NA)	20.89	4.18	0.73
	Mid-Atlantic	42.08 (0.71)	21.15 (0.93)	40.08 (0.63)	38.96 (0.56)	43.23 (0.51)	185.47	37.09	0.29
Long-finned pilot whale (<i>Globicephala melas</i>)	Northeast	16.16 (0.42)	31.75 (0.44)	0.00 (NA)	29.05 (0.58)	0.00 (NA)	76.96	15.39	0.30
Gray seal (<i>Halichoerus grypus atlantica</i>)	Northeast	19.96 (0.37)	19.01 (0.45)	22.69 (0.46)	0.00 (NA)	15.71 (0.66)	77.37	15.47	0.24
	Mid-Atlantic	25.19 (0.67)	6.96 (0.96)	0.00 (NA)	25.94 (0.57)	26.44 (0.40)	84.53	16.91	0.30
Harbor porpoise (<i>Phocoena phocoena phocoena</i>)	Northeast	7.18 (0.98)	5.50 (0.86)	0.00 (NA)	0.00 (NA)	0.00 (NA)	12.68	2.54	0.67
Atlantic white-sided dolphin (<i>Lagenorhynchus acutus</i>)	Northeast	33.24 (0.31)	16.21 (0.50)	14.86 (0.52)	27.65 (0.46)	14.83 (0.64)	106.79	21.36	0.21
	Mid-Atlantic	0.00 (NA)	9.67 (0.94)	0.00 (NA)	0.00 (NA)	0.00 (NA)	9.67	1.93	0.94
Harbor seal (<i>Phoca vitulina vitulina</i>)	Northeast	4.19 (0.89)	10.70 (0.63)	0.00 (NA)	0.00 (NA)	8.30 (0.96)	23.19	4.64	0.48
	Mid-Atlantic	10.90 (0.96)	9.67 (0.95)	7.41 (1.00)	0.00 (NA)	0.00 (NA)	27.98	5.60	0.56
Common bottlenose dolphin offshore stock (<i>Tursiops truncatus truncatus</i>)	Northeast	0.00 (NA)	0.00 (NA)	18.65 (0.65)	33.47 (0.89)	0.00 (NA)	52.12	10.42	0.62
	Mid-Atlantic	0.00 (NA)	24.62 (0.66)	0.00 (NA)	7.33 (0.93)	22.11 (0.66)	54.06	10.89	0.42

Table 2. Total number of observed marine mammals bycaught, excluding decomposed animals, in Northeast and Mid-Atlantic commercial bottom trawl gear, 2013-2017. Observer coverage (Obs Cov%) is the percentage of observed trips relative to total Vessel Trip Report (VTR) trips.

Species	Region	2013	2014	2015	2016	2017	Total
Atlantic white-sided dolphin (<i>Lagenorhynchus acutus</i>)	Northeast	8	3	3	4	2	20
	Mid-Atlantic	0	1	0	0	0	1
Common dolphin (<i>Delphinus delphis</i>)	Northeast	4	3	4	2	0	13
	Mid-Atlantic	24	38	26	22	66	176
Risso's dolphin (<i>Grampus griseus</i>)	Northeast	0	0	0	2	0	2
	Mid-Atlantic	4	3	3	4	7	21
Offshore Common bottlenose dolphin (<i>Tursiops truncatus</i>)	Northeast	0	0	3	4	0	7
	Mid-Atlantic	0	3	0	1	3	7
Harbor porpoise (<i>Phocoena phocoena</i>)	Northeast	1	1	0	0	0	2
Long-finned pilot whale (<i>Globicephala melas</i>)	Northeast	4	5	0	4	0	13
Harbor seal (<i>Phoca vitulina vitulina</i>)	Northeast	1	2	0	0	1	4
	Mid-Atlantic	1	1	1	0	0	3
Gray seal (<i>Halichoerus grypus atlantica</i>)	Northeast	5	4	4	0	2	15
	Mid-Atlantic	2	1	0	3	5	11
Observed Trips	Northeast	953	1,092	857	590	635	4,127
	Mid-Atlantic	877	1,096	904	1,078	1,197	5,152
Observed Tows	Northeast	11,659	12,215	10,361	5,926	6,151	46,312
	Mid-Atlantic	5,521	7,236	5,486	6,834	7,984	33,061
Total VTR Trips	Northeast	6,361	5,657	4,611	4,868	5,201	26,698
	Mid-Atlantic	12,220	12,191	9,572	11,069	8,592	53,644
Obs Cov %	Northeast	14.98	19.30	18.59	12.12	12.21	15.46
	Mid-Atlantic	7.18	8.99	9.44	9.74	13.93	9.60

Table 3. Stratified observed bycatch (OBS Byc), bycatch rates (Byc Rate), total (VTR DF) and observed days fished (OBS DF), percent coverage (Cov %), total bycatch mortality (M), and coefficient of variation (CV) by species, region (NE = Northeast, MA = Mid-Atlantic; shaded rows), year (2013-2017), season (w = January-April, s = May-August, f = September-December), and ecoregion (ECO; GOM = Gulf of Maine, GB = Georges Bank, MA = Mid-Atlantic) in Northeast and Mid-Atlantic commercial bottom trawl trips. Years and seasons absent from the 5-year time series mean no bycatch events were observed; thus, the estimated total bycatch for that period is defined as zero.

Species	Region	Year	Season	ECO	VTR DF	OBS DF	Cov %	OBS Byc	Byc Rate	M	CV
Common dolphin (<i>Delphinus delphis delphis</i>)	NE	2013	f	GB	858	188	21.86	2	0.0107	9.15	0.64
	NE	2013	s	GB	1009	262	25.99	2	0.0076	7.69	0.92
	NE	2014	f	GB	947	145	15.31	2	0.0137	12.97	0.65
	NE	2014	f	GOM	2144	471	21.97	1	0.0021	4.50	0.89
	NE	2015	f	GB	881	141	16.00	1	0.0071	6.26	0.88
	NE	2015	s	GB	1183	229	19.36	2	0.0087	10.29	0.66
	NE	2015	w	GOM	2397	481	20.07	1	0.0021	5.03	0.89
	NE	2016	f	GOM	1626	203	12.48	2	0.0098	15.93	0.67
	MA	2013	f	MA	2029	206	10.18	10	0.0484	98.28	0.51
	MA	2013	s	MA	1943	154	7.94	2	0.0130	25.19	0.97
	MA	2013	w	MA	2040	187	9.17	12	0.0641	130.82	0.37
	MA	2014	f	MA	1990	285	14.32	19	0.0666	132.53	0.25
	MA	2014	s	MA	2274	214	9.41	13	0.0607	138.03	0.65
	MA	2014	w	MA	2249	231	10.27	6	0.0259	58.25	0.54
	MA	2015	f	MA	1808	207	11.45	16	0.0775	140.12	0.47
	MA	2015	s	MA	2320	93	4.01	2	0.0216	50.11	0.67
	MA	2015	w	MA	1901	254	13.36	8	0.0315	59.88	0.41
	MA	2016	f	MA	1789	247	13.81	15	0.0608	108.77	0.32
	MA	2016	w	MA	2265	232	10.24	7	0.0302	68.4	0.68
	MA	2017	f	MA	1339	237	17.70	52	0.2190	293.0	0.27
MA	2017	s	MA	1612	306	19.00	8	0.0262	42.2	0.78	
MA	2017	w	MA	1675	227	13.60	6	0.0265	44.4	0.53	

Table 3, continued. Stratified observed bycatch (OBS Byc), bycatch rates (Byc Rate), total (VTR DF) and observed days fished (OBS DF), percent coverage (Cov %), total bycatch mortality (M), and coefficient of variation (CV) by species, region (NE = Northeast, MA = Mid-Atlantic; shaded rows), year (2013-2017), season (w = January-April, s = May-August, f = September-December), and ecoregion (ECO; GOM = Gulf of Maine, GB = Georges Bank, MA = Mid-Atlantic) in Northeast and Mid-Atlantic commercial bottom trawl trips. Years and seasons absent from the 5-year time series mean no bycatch events were observed; thus, the estimated total bycatch for that period is defined as zero.

Species	Region	Year	Season	ECO	VTR DF	OBS DF	Cov %	OBS Byc	Byc Rate	M	CV
Long-finned pilot whale (<i>Globicephala melas</i>)	NE	2013	f	GOM	1612	432	26.81	2	0.0046	7.46	0.59
	NE	2013	s	GOM	1481	340	22.98	2	0.0059	8.70	0.60
	NE	2014	w	GB	478	40	8.37	1	0.0252	12.05	1.01
	NE	2014	f	GOM	2144	471	21.97	2	0.0042	9.00	0.63
	NE	2014	w	GOM	3058	570	18.64	2	0.0035	10.70	0.64
	NE	2016	f	GOM	1626	203	12.48	2	0.0098	15.93	0.92
	NE	2016	w	GOM	2262	344	15.21	2	0.0058	13.12	0.65
Atlantic white-sided dolphin (<i>Lagenorhynchus acutus</i>)	NE	2013	f	GOM	1612	432	26.81	1	0.0023	3.73	0.85
	NE	2013	s	GOM	1481	340	22.98	1	0.0029	4.35	0.84
	NE	2013	w	GOM	2552	609	23.85	6	0.0099	25.15	0.36
	NE	2014	w	GOM	3058	570	18.64	3	0.0053	16.21	0.51
	NE	2015	w	GOM	2397	481	20.07	3	0.0062	14.86	0.52
	NE	2016	f	GOM	1626	203	12.48	1	0.0049	7.97	0.93
	NE	2016	w	GOM	2262	344	15.21	3	0.0087	19.68	0.53
	NE	2017	s	GB	656	88	13.4	2	0.0226	14.80	0.64
	MA	2014	w	MA	2249	231	10.27	1	0.0043	9.67	0.95

Table 3, continued. Stratified observed bycatch (OBS Byc), bycatch rates (Byc Rate), total (VTR DF) and observed days fished (OBS DF), percent coverage (Cov %), total bycatch mortality (M), and coefficient of variation (CV) by species, region (NE = Northeast, MA = Mid-Atlantic; shaded rows), year (2013-2017), season (w = January-April, s = May-August, f = September-December), and ecoregion (ECO; GOM = Gulf of Maine, GB = Georges Bank, MA = Mid-Atlantic) in Northeast and Mid-Atlantic commercial bottom trawl trips. Years and seasons absent from the 5-year time series mean no bycatch events were observed; thus, the estimated total bycatch for that period is defined as zero.

Species	Region	Year	Season	ECO	VTR DF	OBS DF	Cov %	OBS Byc	Byc Rate	M	CV
Risso's Dolphin <i>Grampus griseus</i>	NE	2014	s	GB	1299	310	23.86	1	0.0032	4.16	0.89
	NE	2016	w	GB	461	55	11.93	2	0.0363	16.73	0.89
	MA	2013	f	MA	2029	206	10.18	3	0.0145	29.48	0.95
	MA	2013	s	MA	1843	154	7.94	1	0.0065	12.60	0.92
	MA	2014	s	MA	2274	214	9.41	2	0.0093	21.15	0.98
	MA	2015	s	MA	2320	93	4.01	1	0.0108	25.06	0.93
	MA	2015	w	MA	1901	254	13.36	2	0.0079	15.02	0.63
	MA	2016	w	MA	2265	232	10.24	4	0.0172	38.96	0.56
	MA	2017	s	MA	1612	306	19.0	4	0.0131	21.1	0.89
	MA	2017	w	MA	1675	227	13.6	3	0.0132	22.1	0.53
Offshore common bottlenose dolphin <i>Tursiops truncatus truncatus</i>	NE	2015	f	GB	881	141	16.00	2	0.0142	12.51	0.88
	NE	2015	w	GB	458	74	16.16	1	0.0134	6.14	0.90
	NE	2016	w	GB	461	55	11.93	4	0.0726	33.47	0.89
	MA	2014	f	MA	1990	285	14.32	2	0.0070	13.93	0.92
	MA	2014	s	MA	2274	214	9.41	1	0.0047	10.69	0.97
	MA	2016	f	MA	1789	247	13.81	1	0.0041	7.33	0.91
	MA	2017	w	MA	1675	227	13.60	3	0.0132	22.10	0.68
Harbor porpoise <i>Phocoena phocoena phocoena</i>	NE	2013	w	GB	625	87	13.92	1	0.0115	7.18	0.98
	NE	2014	w	GOM	3058	570	18.64	1	0.0018	5.50	0.87

Table 3, continued. Stratified observed bycatch (OBS Byc), bycatch rates (Byc Rate), total (VTR DF) and observed days fished (OBS DF), percent coverage (Cov %), total bycatch mortality (M), and coefficient of variation (CV) by species, region (NE = Northeast, MA = Mid-Atlantic; shaded rows), year (2013-2017), season (w = January-April, s = May-August, f = September-December), and ecoregion (ECO; GOM = Gulf of Maine, GB = Georges Bank, MA = Mid-Atlantic) in Northeast and Mid-Atlantic commercial bottom trawl trips. Years and seasons absent from the 5-year time series mean no bycatch events were observed; thus, the estimated total bycatch for that period is defined as zero.

Species	Region	Year	Season	ECO	VTR DF	OBS DF	Cov %	OBS Byc	Byc Rate	M	CV
Gray seal (<i>Halichoerus grypus atlantica</i>)	NE	2013	f	GB	858	188	21.86	1	0.0053	4.58	0.86
	NE	2013	s	GB	1009	262	25.99	4	0.0153	15.39	0.4
	NE	2014	s	GB	1299	310	23.86	2	0.0064	8.31	0.63
	NE	2014	w	GOM	3058	570	18.64	2	0.0035	10.70	0.63
	NE	2015	f	GB	881	141	16.00	1	0.0071	6.26	0.93
	NE	2015	s	GB	1183	229	19.36	2	0.0087	10.29	0.65
	NE	2015	w	GB	458	74	16.16	1	0.0134	6.14	0.90
	NE	2017	s	GB	656	88	13.4	1	0.0113	7.41	0.93
	NE	2017	w	GOM	2372	282	11.9	1	0.0035	8.30	0.95
	MA	2013	s	MA	1943	154	7.94	2	0.0130	25.19	0.67
	MA	2014	f	MA	1990	285	14.32	1	0.0035	6.96	0.94
	MA	2016	f	MA	1789	247	13.81	2	0.0081	14.49	0.67
	MA	2016	s	MA	1941	171	8.81	1	0.0059	11.45	1.00
	MA	2017	s	MA	1612	306	19.0	5	0.0164	26.4	0.39
Harbor seal (<i>Phoca vitulina vitulina</i>)	NE	2013	w	GOM	2552	609	23.85	1	0.0016	4.19	0.89
	NE	2014	w	GOM	3058	570	18.64	2	0.0035	10.70	0.64
	NE	2017	w	GOM	2372	282	11.9	1	0.0035	8.30	0.97
	MA	2013	w	MA	2040	187	9.17	1	0.0053	10.90	0.96
	MA	2014	w	MA	2249	231	10.27	1	0.0043	9.67	0.96
	MA	2015	w	MA	1901	254	13.36	1	0.0039	7.41	0.94

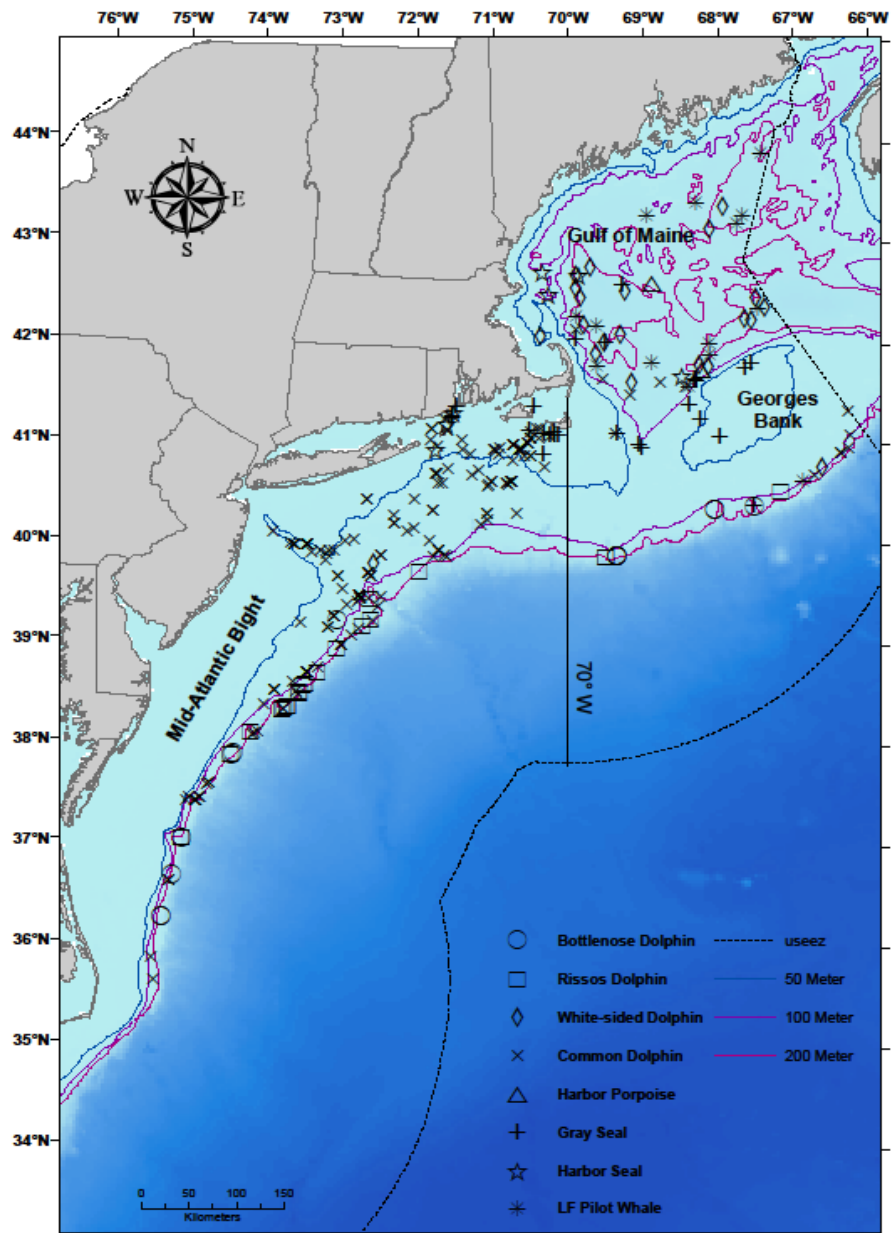


Figure 1. Incidental take locations from the observed commercial trips in the Northeast and Mid-Atlantic study areas during 2013-2017 for Atlantic white-sided dolphin (*Lagenorhynchus acutus*), common dolphin (*Delphinus delphis delphis*), long-finned pilot whale (*Globicephala melas*), offshore common bottlenose dolphin (*Tursiops truncatus truncatus*), Risso's dolphin (*Grampus griseus*), harbor seal (*Phoca vitulina vitulina*), harbor porpoise (*Phocoena phocoena phocoena*), and gray seal (*Halichoerus grypus atlantica*). The strata were delimited by the 70°W longitude.

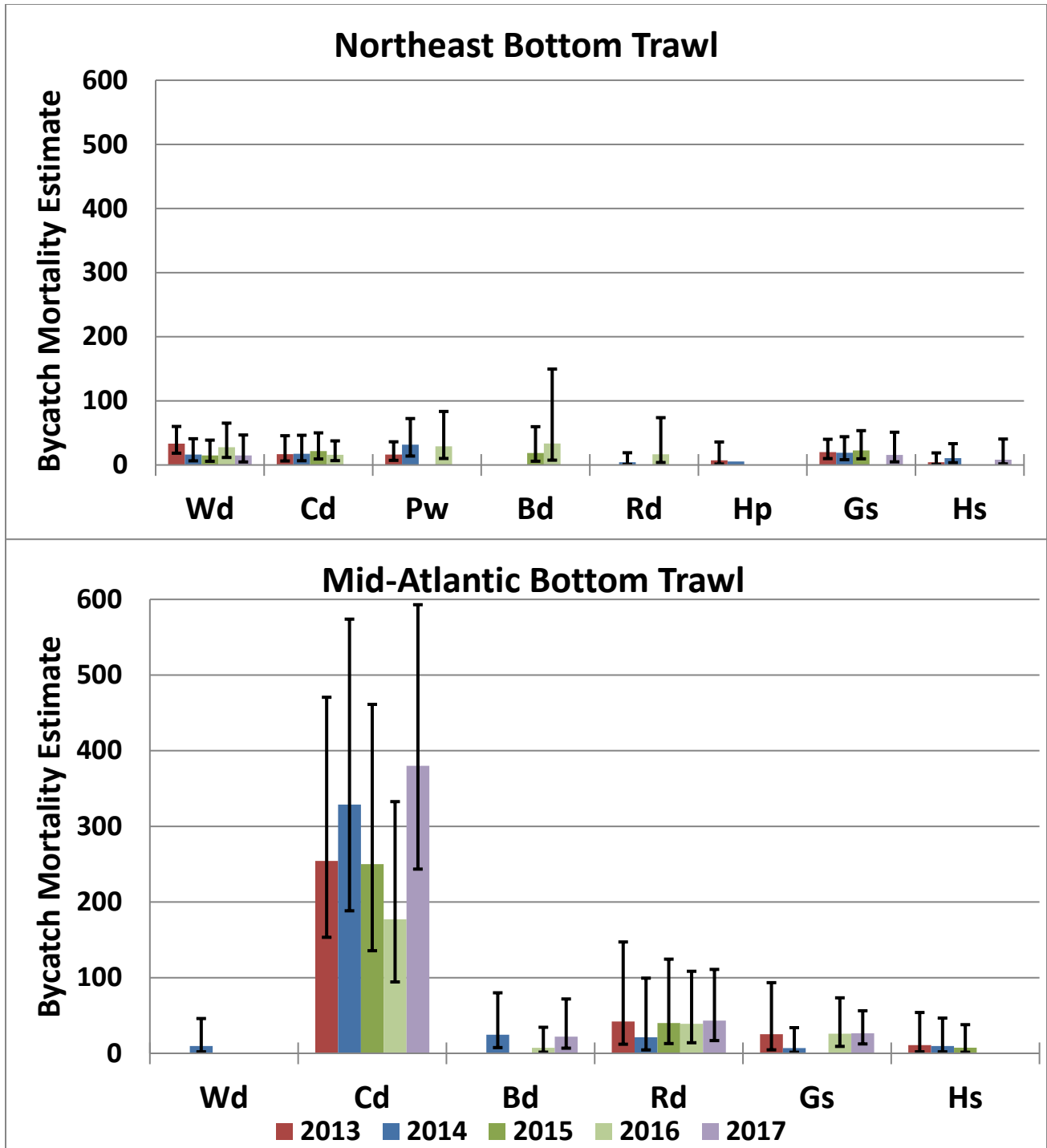


Figure 2. Annual bycatch mortality estimates (lognormal 95% Confidence interval) for bottom trawl gear by region, species and year in Northeast and Mid-Atlantic commercial bottom trawl trips, 2013-2017. Wd = Atlantic white-sided dolphin (*Lagenorhynchus acutus*), Cd = common dolphin (*Delphinus delphis delphis*), Pw = long-finned pilot whale (*Globicephala melas*), Bd = offshore common bottlenose dolphin (*Tursiops truncatus truncatus*), Rd = Risso's dolphin (*Grampus griseus*), Hp = harbor porpoise (*Phocoena phocoena phocoena*), Gs = gray seal (*Halichoerus grypus atlantica*), and Hs = harbor seal (*Phoca vitulina vitulina*).

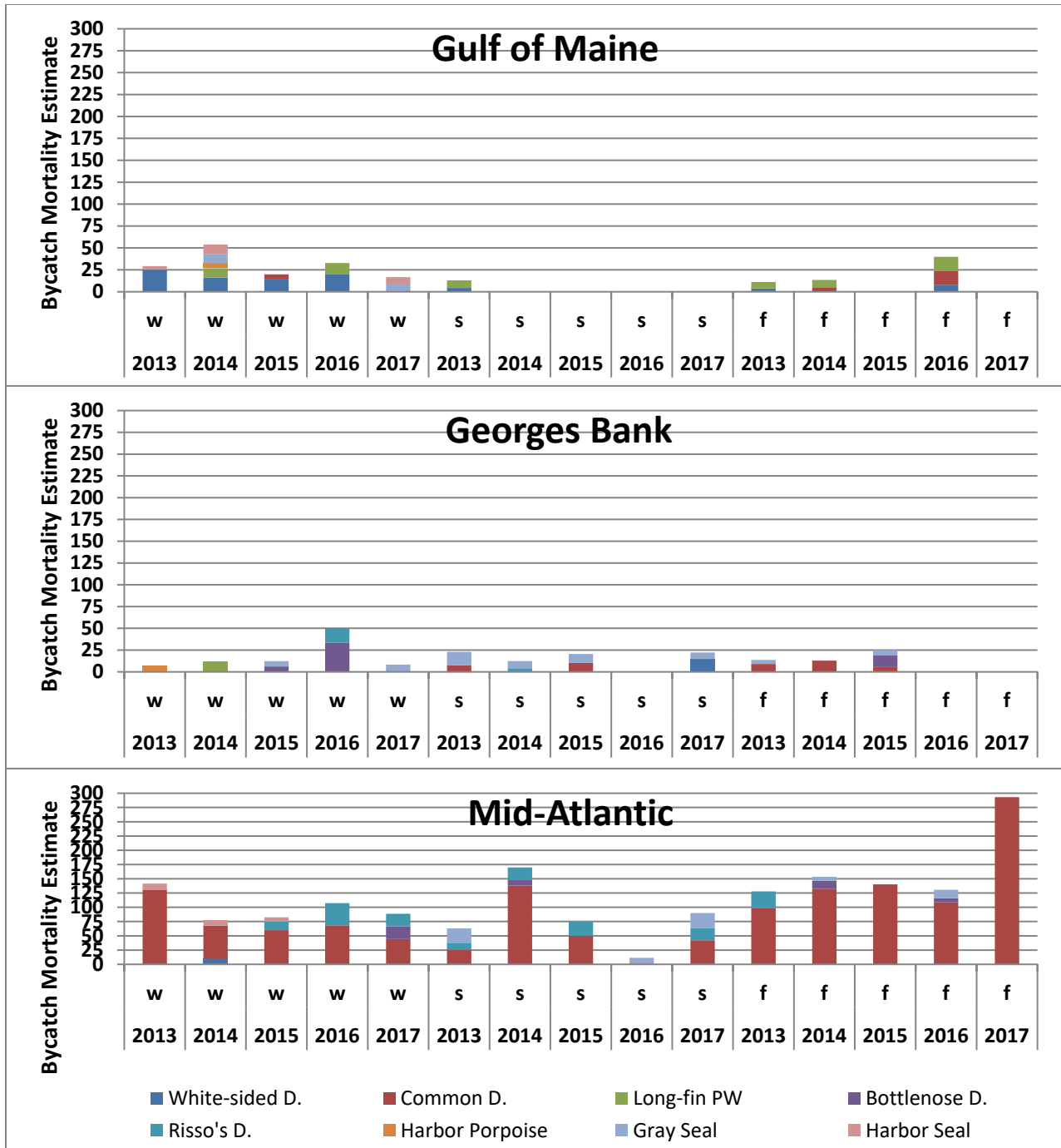


Figure 3. Bycatch mortality estimates for 2013-2017 in Northeast and Mid-Atlantic commercial bottom trawl trips stratified by ecoregion, year, season (w = January-April, s = May-August, f = September-December), and species (Atlantic white-sided dolphin [*Lagenorhynchus acutus*], common dolphin [*Delphinus delphis delphis*], long-finned pilot whale [*Globicephala melas*], offshore common bottlenose dolphin [*Tursiops truncatus truncatus*], Risso's dolphin [*Grampus griseus*], harbor porpoise [*Phocoena phocoena phocoena*], gray seal [*Halichoerus grypus atlantica*], and harbor seal [*Phoca vitulina vitulina*]).

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