

RISSO'S DOLPHIN (*Grampus griseus*): Western North Atlantic Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

Risso's dolphins are distributed worldwide in tropical and temperate seas, and in the Northwest Atlantic occur from Florida to eastern Newfoundland (Leatherwood *et al.* 1976; Baird and Stacey 1990). Off the northeast U.S. coast, Risso's dolphins are distributed along the continental shelf edge from Cape Hatteras northward to Georges Bank during spring, summer, and autumn (CETAP 1982; Payne *et al.* 1984). In winter, the range is in the mid-Atlantic Bight and extends outward into oceanic waters (Payne *et al.* 1984). In general, the population occupies the mid-Atlantic continental shelf edge year round, and is rarely seen in the Gulf of Maine (Payne *et al.* 1984). During 1990, 1991 and 1993, spring/summer surveys conducted along the continental shelf edge and in deeper oceanic waters sighted Risso's dolphins associated with strong bathymetric features, Gulf Stream warm-core rings, and the Gulf Stream north wall (Waring *et al.* 1992; Waring 1993). There is no information on stock structure of Risso's dolphin in the western North Atlantic, or to determine if separate stocks exist in the Gulf of Mexico and Atlantic. In 2006, a rehabilitated adult male Risso's dolphin stranded and released in the Gulf of Mexico off Florida was tracked via satellite to waters off Delaware (Wells 2006).

POPULATION SIZE

Total numbers of Risso's dolphins off the U.S. or Canadian Atlantic coast are unknown, although eight abundance estimates are available from selected regions for select time periods. Sightings were almost exclusively in the continental shelf edge and continental slope areas (Figure 1). The best abundance estimate for Risso's dolphins is the sum of the estimates from the two 2004 U.S. Atlantic surveys, 20,479 (CV=0.59), where the estimate from the northern U.S. Atlantic is 15,053 (CV=0.78), and from the southern U.S. Atlantic is 5,426 (CV =0.54). This joint estimate is considered best because these two surveys together have the most complete coverage of the population's habitat.

Earlier abundance estimates

An abundance estimate of 4,980 Risso's dolphins (CV=0.34) was obtained from an aerial survey program conducted from 1978 to 1982 on the continental shelf and shelf edge waters between Cape Hatteras, North Carolina and Nova Scotia (CETAP 1982). An abundance estimate of 11,017 (CV=0.58) Risso's dolphins was obtained from a June and July 1991 shipboard line-transect sighting survey conducted primarily between the 200 and 2,000 m isobaths from Cape Hatteras to Georges Bank (Waring *et al.* 1992; Waring 1998). Abundance estimates of 6,496 (CV=0.74) and 16,818 (CV=0.52) Risso's dolphins were obtained from line-transect aerial surveys conducted from August to September 1991 using the Twin Otter and AT-11 aircraft (NMFS 1991). An abundance estimate of 212 (CV=0.62) Risso's dolphins was obtained from a June and July 1993 shipboard line-transect sighting survey

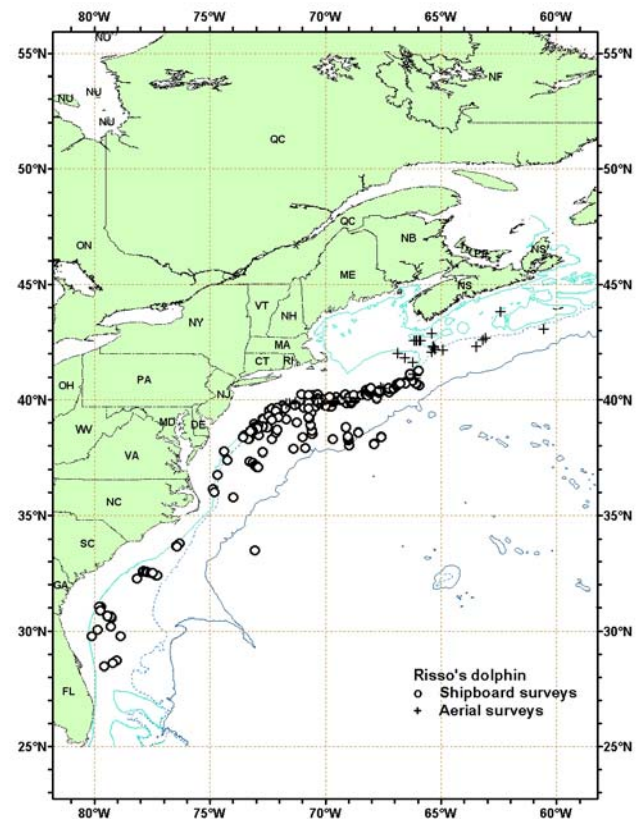


Figure 1. Distribution of Risso's dolphin sightings from NEFSC and SEFSC shipboard and aerial surveys during the summer of 1998, 1999, 2002, 2004 and 2006. Isobaths are the 100 m, 1,000 m, and 4,000 m depth contours.

conducted principally between the 200 and 2,000 m isobaths from the southern edge of Georges Bank, across the Northeast Channel, to the southeastern edge of the Scotian Shelf (NMFS 1993). A 1995 abundance estimate of 5,587 (CV=1.16) Risso's dolphins was obtained from a July to September 1995 sighting survey conducted by two ships and an airplane that covered waters from Virginia to the mouth of the Gulf of St. Lawrence. An abundance estimate of 28,164 (CV=0.29) Risso's dolphins was obtained from the sum of the estimate of 18,631 (CV=0.35) Risso's dolphins from a line-transect sighting survey conducted during 6 July to 6 September 1998 by a ship and plane that surveyed 15,900 km of track line in waters north of Maryland (38°N) (Palka 2006), and the estimate of 9,533 (CV=0.50) Risso's dolphins, estimated from a shipboard line-transect sighting survey conducted between 8 July and 17 August 1998 that surveyed 4,163 km of track line in waters south of Maryland (38°N) (Mullin and Fulling 2003). As recommended in the GAMMS Workshop Report (Wade and Angliss 1997), estimates older than eight years are deemed unreliable, therefore should not be used for PBR determinations. Further, due to changes in survey methodology these data should not be used to make comparisons to more current estimates.

Recent surveys and abundance estimates

An abundance estimate of 69,311 (CV=0.76) Risso's dolphins was obtained from an aerial survey conducted in July and August 2002 which covered 7,465 km of trackline over waters from the 1000 m depth contour on the southern edge of Georges Bank to Maine (Table 1; Palka 2006). The value of $g(0)$ used for this estimation was derived from the pooled data of 2002, 2004 and 2006 aerial survey data.

An abundance estimate of 15,054 (CV=0.78) Risso's dolphins was obtained from a line-transect sighting survey conducted during 12 June to 4 August 2004 by a ship and plane that surveyed 10,761km of track line in waters north of Maryland (38°N) to the Bay of Fundy (45°N) (Table 1; Palka 2006). Shipboard data were collected using the two independent team line transect method and analyzed using the modified direct duplicate method (Palka 1995) accounting for biases due to school size and other potential covariates, reactive movements (Palka and Hammond 2001), and $g(0)$, the probability of detecting a group on the track line. Aerial data were collected using the Hiby circle-back line transect method (Hiby 1999) and analyzed accounting for $g(0)$ and biases due to school size and other potential covariates (Palka 2005).

A shipboard survey of the U.S. Atlantic outer continental shelf and continental slope (water depths > 50m) between Florida and Maryland (27.5 and 38°N latitude) was conducted during June-August 2004. The survey employed two independent visual teams searching with 50x bigeye binoculars. Survey effort was stratified to include increased effort along the continental shelf break and Gulf Stream front in the mid-Atlantic. The survey included 5,659 km of trackline, and accomplished a total of 473 cetacean sightings. Sightings were most frequent in waters north of Cape Hatteras, North Carolina along the shelf break. Data were analyzed to correct for visibility bias ($g(0)$) and group-size bias employing line-transect distance analysis and the direct duplicate estimator (Palka, 1995; Buckland *et al.* 2001). The resulting abundance estimate for Risso's dolphins between Florida and Maryland was 5,426 (CV =0.54).

An abundance estimate of 14,408 (CV=0.38) Risso's dolphins was obtained from an aerial survey conducted in August 2006 which covered 10,676 km of trackline in the region from the 2000 m depth contour on the southern edge of Georges Bank to the upper Bay of Fundy and to the entrance of the Gulf of St. Lawrence. (Table 1; Palka pers. comm.)

Table 1. Summary of abundance estimates for the western North Atlantic Risso's dolphin. Month, year, and area covered during each abundance survey, resulting abundance estimate (N_{best}) and coefficient of variation (CV).			
Month/Year	Area	N_{best}	CV
Aug 2002	Georges Bank to Maine coast	9,311	0.76
Jun-Aug 2004	Maryland to Bay of Fundy	15,053	0.78
Jun-Aug 2004	Florida to Maryland	5,426	0.54
Jun-Aug 2004	Florida to Bay of Fundy (COMBINED)	20,479	0.59

Aug 2006	S. Gulf of Maine to upper Bay of Fundy to Gulf of St. Lawrence	14,408	0.38
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Minimum Population Estimate

The minimum population estimate is the lower limit of the two-tailed 60% confidence interval of the log-normally distributed best abundance estimate. This is equivalent to the 20th percentile of the log-normal distribution as specified by Wade and Angliss (1997). The best estimate of abundance for Risso's dolphins is 20,479 (CV=0.59), obtained from the 2004 surveys. The minimum population estimate for the western North Atlantic Risso's dolphin is 12,920.

Current Population Trend

There are insufficient data to determine population trends for this species.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are unknown for this stock. For purposes of this assessment, the maximum net productivity rate was assumed to be 0.04. This value is based on theoretical modeling showing that cetacean populations may not grow at rates much greater than 4% given the constraints of their reproductive life history (Barlow *et al.* 1995).

POTENTIAL BIOLOGICAL REMOVAL

Potential Biological Removal (PBR) is the product of minimum population size, one-half the maximum productivity rate, and a "recovery" factor (MMPA Sec. 3. 16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size is 12,920. The maximum productivity rate is 0.04, the default value for cetaceans (Barlow *et al.* 1995). The "recovery" factor, which accounts for endangered, depleted, threatened stocks, or stocks of unknown status relative to optimum sustainable population (OSP) is assumed to be 0.5 because the CV of the average mortality estimate is less than 0.3 (Wade and Angliss 1997). PBR for the western North Atlantic stock of Risso's dolphin is 129.

ANNUAL HUMAN-CAUSED MORTALITY

Total annual estimated average fishery-related mortality or serious injury to this stock during 2001-2005 was 40 Risso's dolphins (CV=0.28); Table 2).

Fishery Information

Detailed fishery information is reported in Appendix III.

Earlier Interactions

Prior to 1977, there was no documentation of marine mammal bycatch in distant-water fleet (DWF) activities off the northeast coast of the U.S. With implementation of the Magnuson-Stevens Fisheries Conservation and Management Act (MS-FCMA) in that year, an observer program was established which recorded fishery data and information on incidental bycatch of marine mammals. NMFS foreign-fishery observers have reported four deaths of Risso's dolphins incidental to squid and mackerel fishing activities in the continental shelf and continental slope waters between March 1977 and December 1991 (Waring *et al.* 1990; NMFS unpublished data). Three animals were taken by squid trawlers and a single animal was killed in longline fishing operations.

In the pelagic drift gillnet fishery fifty-one Risso's dolphin mortalities were observed between 1989 and 1998. One animal was entangled and released alive. Bycatch occurred during July, September and October along continental shelf edge canyons off the southern New England coast. Estimated annual mortality and serious injury (CV in parentheses) attributable to the drift gillnet fishery was 87 in 1989 (0.52), 144 in 1990 (0.46), 21 in 1991 (0.55), 31 in 1992 (0.27), 14 in 1993 (0.42), 1.5 in 1994 (0.16), 6 in 1995 (0), 0 in 1996, no fishery in 1997, 9 in 1998 (0).

In the pelagic pair trawl fishery, one mortality was observed in 1992. Estimated annual fishery-related mortality (CV in parentheses) attributable to the pelagic pair trawl fishery was 0.6 dolphins in 1991 (1.0), 4.3 in 1992 (0.76), 3.2 in 1993 (1.0), 0 in 1994 and 3.7 in 1995 (0.45).

Pelagic Longline

Pelagic longline bycatch estimates of Risso's dolphins in 1998, 1999, and 2000 were obtained from Yeung (1999), Yeung *et al.* (2000), and Yeung (2001), respectively. Bycatch estimates for 2001 and 2002, 2003, 2004 and 2005 were obtained from Garrison (2003), Garrison and Richards (2004), Garrison (2005), and Fairfield-Walsh and Garrison (2006). Most of the estimated marine mammal bycatch was from U.S. Atlantic EEZ waters between South Carolina and Cape Cod. Excluding the Gulf of Mexico, from 1992 to 2000 one mortality was observed in both 1994 and 2000, and 0 in other years. The observed numbers of seriously-injured but released alive individuals from 1992 to 2005 were, respectively, 2, 0, 6, 4, 1, 0, 1, 1, 1, 6, 4, 2, 2, and 0 (Cramer 1994; Scott and Brown 1997; Johnson *et al.* 1999; Yeung 1999; Yeung *et al.* 2000; Yeung 2001, Garrison 2003, Garrison and Richards 2004, Garrison 2005, and Fairfield-Walsh and Garrison 2006) (Table 2). Estimated annual fishery-related mortality (CV in parentheses) was 17 animals in 1994 (1.0), 41 in 2000 (1.0), 24 in 2001(1.0), 20 in 2002 (0.86), and 0 in 2003 to 2005 (Table 2). Seriously injured and released alive animals were estimated to be 54 dolphins (0.7) in 1992, 0 in 1993, 120 (0.57) in 1994, 103 (0.68) in 1995, 99 (1.0) in 1996, 0 in 1997, 57 (1.0) in 1998, 22 (1.0) in 1999, 23 (1.0) in 2000, 45 (0.7) in 2001, 8 (1.0) in 2002, 40 (0.63) in 2003 28(0.72) in 2004, and 3(1.0) in 2005 (Table 2). The annual average combined mortality and serious injury for 2001-2005 is 34 Risso's dolphins (CV =0.32; Table 2).

Northeast Sink Gillnet

Estimated annual mortalities (CV in parentheses) from this fishery are: 0 in 1999, 15 (1.06) in 2000, 0 in 2001-2004, and 15 in 2005 (0.93) (Table 2). The 2001-2005 average mortality in this fishery is 3 Risso's dolphins (CV =0.93).

Table 2. Summary of the incidental mortality of Risso's dolphin (<i>Grampus griseus</i>) by commercial fishery including the years sampled (Years), the number of vessels active within the fishery (Vessels), the type of data used (Data Type), the annual observer coverage (Observer Coverage), the observed mortalities and serious injuries recorded by on-board observers, the estimated annual mortality and serious injury, the combined annual estimates of mortality and serious injury (Estimated Combined Mortality), the estimated CV of the combined estimates (Estimated CVs) and the mean of the combined estimates (CV in parentheses).											
Fishery	Years	Vessels ^b	Data Type ^a	Observer Coverage	Observed Serious Injury	Observed Mortality	Estimated Serious Injury	Estimated Mortality	Estimated Combined Mortality	Estimated CVs	Mean Annual Mortality
Pelagic Longline (excluding NED-E) ^c	01-05	98, 87, 63, 60, 60	Obs. Data Logbook	.04, .05, .09, .09, .06	6, 4, 2, 2, 0	1, 0, 0, 0, 0	45, 8, 40, 28, 3	24, 20 ^d , 0, 0, 0	69, 28, 40, 28, 3	.57, .67, .63, .72, 1	34(0.32)
Pelagic Longline - NED-E area only ^c	01-03	9, 14, 11	Obs. Data Logbook	1, 1, 1	4, 3, 0	0, 0, 1	4, 3, 0	0, 0, 1	4, 3, 1	0, 0, 0	3
Northeast Sink Gillnet	01-05	1993=349 1998=301	Obs. Data Weighout Trip Logbook	.04, .02, .03, .06, .07	0,0,0, 0,0	0, 0, 0, 0, 1	0, 0, 0, 0, 0	0, 0, 0, 0, 15	0, 0, 0, 15	0, 0, 0, 0, 0.93	3 (0.93)
TOTAL											40 (0.28)

a	Observer data (Obs. Data) are used to measure bycatch rates and the data are collected within the Northeast Fisheries Observer Program. The Observer Program collects landings data (Weighout), and total landings are used as a measure of total effort for the coastal gillnet fishery.
b	Number of vessels in the fishery are based on vessels reporting effort to the pelagic longline logbook.
c	An experimental program to test effects of gear characteristics, environmental factors, and fishing practices on marine turtle bycatch rates in the Northeast Distant (NED-E) water component of the fishery was conducted from June 1, 2001-December 31, 2003. Observer coverage was 100% during this experimental fishery. Summaries are provided for the pelagic longline EXCLUDING the NED-E area in one row and for ONLY the NED in the second row (Garrison 2003; Garrison and Richards 2004) The NED area was reopened in June 2004, so '04 and '05 bycatch analysis includes this area.
d	Note that the 2002 estimate of Risso's dolphin mortality is estimated from observed mortality rates in previous years (1998-2002) due to a gap in coverage during the 3 rd quarter of 2002.

Other mortality

From 2001-2005, 65 Risso's dolphin strandings were recorded along the U.S. Atlantic coast (NMFS unpublished data). In eastern Canada, one Risso's dolphin stranding was reported on Sable Island, Nova Scotia from 1970-1998 (Lucas and Hooker 2000).

A Virginia Coastal Small Cetacean Unusual Mortality Event (UME) occurred along the coast of Virginia from 1 May to 31 July 2004, when 66 small cetaceans, including one Risso's dolphin, stranded mostly along the outer (eastern) coast of Virginia's barrier islands

A Mid-Atlantic Offshore Small Cetacean UME was declared when 33 small cetaceans stranded from Maryland to Georgia between July and September 2004. The species involved are generally found offshore and are not expected to strand along the coast. Three Risso's dolphins were involved in this UME.

STATE	2001	2002	2003	2004	2005	TOTALS
Maine	0	0	0	2	0	2
New Hampshire	0	0	0	0	0	0
Massachusetts ^a	1	5	0	4	8	18
Rhode Island	0	0	0	1	1	2
Connecticut	0	0	0	0	0	0
New York	0	1	0	3	4	8
New Jersey	0	0	0	0	5	5
Delaware	0	0	0	1	1	2
Maryland	1	1	0	1	2	5
Virginia ^b	1	0	0	1	4	6
North Carolina	3	2	1	2	2	10
South Carolina	0	0	0	0	0	0
Georgia	0	0	0	0	0	0
Florida	1	1	1	3	0	6
EZ	0	0	0	1	0	1
TOTAL	7	10	2	19	27	65

a. 2001 animal had signs of human interaction, and one of the 2004 animals was mutilated, fluke cut off.
b. One of the 2005 animals was showed signs of human interaction.

Stranding data probably underestimate the extent of fishery-related mortality and serious injury because all of the marine mammals that die or are seriously injured may not wash ashore, nor will all of those that do wash ashore

necessarily show signs of entanglement or other fishery-interaction. Finally, the level of technical expertise among stranding network personnel varies widely as does the ability to recognize signs of fishery interaction.

STATUS OF STOCK

The status of Risso's dolphins relative to OSP in the U.S. Atlantic EEZ is unknown. The species is not listed as threatened or endangered under the Endangered Species Act. There are insufficient data to determine population trends for this species. The total U. S. fishery mortality and serious injury for this stock is not less than 10% of the calculated PBR and, therefore, can not be considered to be insignificant and approaching a zero mortality and serious injury rate. The 2001-2005 average annual human-related mortality does not exceed PBR; therefore, this is not a strategic stock.

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