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 (Jefferson *et al*. 2008), and in the Northwest Atlantic occur from Florida to eastern Newfoundland (Leatherwood *et al*. 1976; Baird and Stacey 1991). 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, 1993; Hamazaki 2002). 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. Thus, it is plausible the stock could actually contain multiple demographically independent populations that should themselves be stocks, because the current stock spans multiple eco-regions (Longhurst 1998; Spalding *et al*. 2007). In 2006, a rehabilitated adult male Risso's dolphin stranded and released in the Gulf of Mexico off Florida was tracked via satellite-linked tag to waters off Delaware (Wells *et al*. 2009). The Gulf of Mexico and Atlantic stocks are currently being treated as two separate stocks.

Figure 1. *Distribution of Risso's dolphin sightings from NEFSC and SEFSC shipboard and aerial surveys during the summers of 1995, 1998, 1999, 2002, 2004, 2006, 2007, 2008 2010 and 2011. Isobaths are the 100-m, 1,000-m, and 4,000-m depth contours.*

POPULATION SIZE

Several abundance estimates are available for Risso's dolphins from selected regions for select time periods. Sightings were almost exclusively in continental shelf edge and continental slope areas (Figure 1). The best abundance estimate for Risso's dolphins is the sum of the 2011 surveys - 18,250 (CV = 0.46).
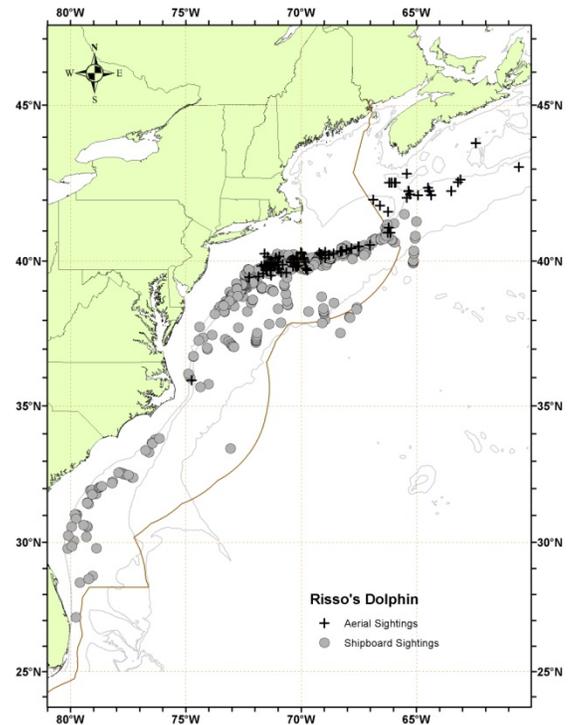
Earlier abundance estimates

Please see Appendix IV for a summary of abundance estimates, including earlier estimates and survey descriptions.

Recent surveys and abundance estimates

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 2,000-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.). The value of g(0) used for this estimation was derived from the pooled 2002, 2004 and 2006 aerial survey data.

An abundance estimate of 15,197 (CV = 0.55) Risso's dolphins was generated from a shipboard and aerial survey conducted during June–August 2011 (Palka 2012). The aerial portion that contributed to the abundance

estimate covered 5,313 km of tracklines that were over waters north of New Jersey from the coastline to the 100-m depth contour, through the U.S. and Canadian Gulf of Maine and up to and including the lower Bay of Fundy. The shipboard portion covered 3,107 km of tracklines that were in waters offshore of central Virginia to Massachusetts (waters that were deeper than the 100-m depth contour out to beyond the U.S. EEZ). Both sighting platforms used a double-platform data collection procedure, which allows estimation of abundance corrected for perception bias of the detected species (Laake and Borchers, 2004). Shipboard data were inspected to determine if there was significant responsive movement to the ship (Palka and Hammond 2001). Because there was evidence of responsive (evasive) movement of this species to the ship, estimation of the abundance was based on Palka and Hammond (2001) and the independent observer approach assuming full independence (Laake and Borchers 2004), and calculated using the mark-recapture distance sampling option in the computer program Distance (version 6.0, release 2, Thomas *et al.* 2009).

An abundance estimate of 3,053 (CV = 0.44) Risso's dolphins was generated from a shipboard survey conducted concurrently (June–August 2011) in waters between central Virginia and central Florida. This shipboard survey included shelf-break and inner continental slope waters deeper than the 50-m depth contour within the U.S. EEZ. The survey employed the double-platform methodology searching with 25× bigeye binoculars. A total of 4,445 km of tracklines was surveyed, yielding 290 cetacean sightings. The majority of sightings occurred along the continental shelf break with generally lower sighting rates over the continental slope. Estimation of the abundance was based on the independent observer approach assuming point independence (Laake and Borchers 2004) and calculated using the mark-recapture distance sampling option in the computer program Distance (version 6.0, release 2, Thomas *et al.* 2009).

Table 1. Summary of abundance estimates for the western North Atlantic Risso's dolphin (*Grampus griseus*). 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 2006	S. Gulf of Maine to upper Bay of Fundy to Gulf of St. Lawrence	14,408	0.38
Jun-Aug 2011	Central Virginia to lower Bay of Fundy	15,197	0.55
Jun-Aug 2011	Central Florida to Central Virginia	3,053	0.44
Jun-Aug 2011	Central Florida to lower Bay of Fundy (COMBINED)	18,250	0.46

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 18,250 (CV = 0.46), obtained from the 2011 surveys. The minimum population estimate for the western North Atlantic Risso's dolphin is 12,619.

Current Population Trend

A trend analysis has not been conducted for this stock. The statistical power to detect a trend in abundance for this stock is poor due to the relatively imprecise abundance estimates and long survey interval. For example, the power to detect a precipitous decline in abundance (i.e., 50% decrease in 15 years) with estimates of low precision (e.g., CV > 0.30) remains below 80% (alpha = 0.30) unless surveys are conducted on an annual basis (Taylor *et al.* 2007).

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 12,619. 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 126.

ANNUAL HUMAN-CAUSED MORTALITY

Total annual estimated average fishery-related mortality or serious injury to this stock during 2008-2012 was 51 Risso's dolphins (CV = 0.27; Table 2).

New Serious Injury Guidelines

NMFS updated its serious injury designation and reporting process, which uses guidance from previous serious injury workshops, expert opinion, and analysis of historic injury cases to develop new criteria for distinguishing serious from non-serious injury (Angliss and DeMaster 1998; Andersen *et al.* 2008; NOAA 2012). NMFS defines serious injury as an "*injury that is more likely than not to result in mortality*". Injury determinations for stock assessments revised in 2013 or later incorporate the new serious injury guidelines, based on the most recent 5-year period for which data are available.

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 activities off the northeast coast of the U.S. With implementation of the Fisheries Conservation and Management Act in that year, an observer program was established which recorded fishery data and information on incidental bycatch of marine mammals. NMFS foreign-fishery observers reported four deaths of Risso's dolphins incidental to squid and mackerel trawling activities in the continental shelf and continental slope waters between March 1977 and December 1991 (Waring *et al.* 1990; NMFS unpublished data).

In the pelagic drift gillnet fishery 51 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, and 9 in 1998 (0). This fishery was closed effective in 1999.

In the pelagic pair trawl fishery, one Risso's dolphin 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). This fishery ended as of 1996.

One Risso's dolphin mortality was observed in the mid-Atlantic gillnet fishery in 2007. The resulting estimated serious injury and mortality for 2007 was 34 (CV = 0.73).

Pelagic Longline

Pelagic longline bycatch estimates of Risso's dolphins for 2008—2011 were obtained from Garrison *et al.* (2009), Garrison and Stokes (2010), and Garrison and Stokes (2012a, 2012b). Most of the estimated marine mammal bycatch was from U.S. Atlantic EEZ waters between South Carolina and Cape Cod. Estimated annual fishery-related mortality (CV in parentheses) was 17 (0.73) in 2008, 11 (0.71) in 2009, 0 in 2010, 12 (0.63) in 2011, and 15 (1.0) in 2012. There is a high likelihood that dolphins released alive with ingested gear or gear wrapped around appendages will not survive (Wells *et al.* 2008). The annual average combined mortality and serious injury for 2008-2012 was 11 Risso's dolphins (0.41; Table 2).

Northeast Bottom Trawl

One Risso's dolphin was observed taken in northeast bottom trawl fisheries in 2010 (Table 2). This is the first time this species was observed taken in this fishery. New serious injury criteria were applied to all observed interactions retroactive back to 2007 (Waring *et al.* 2014). Estimated fishery-related serious injury and mortality

values (CV in parentheses) were 2 (0.56) in 2008, 3 (0.53) in 2009, 2 (0.55) in 2010, 3 (0.55) in 2011, and 0 in 2012. The 2008-2012 average annual serious injury and mortality attributed to the northeast bottom trawl was 2.0 animals (CV = 0.30; Table 2).

Mid-Atlantic Bottom Trawl

One Risso's dolphin was observed taken in mid-Atlantic bottom trawl fisheries in 2008, 15 in 2010, 2 in 2011, and 1 in 2012 (Table 2). New serious injury criteria were applied to all observed interactions retroactive back to 2007 (Waring *et al*. 2014). No seriously injured Risso's dolphins have been observed in this fishery. It was discovered in 2010 that a small segment of the mid-Atlantic bottom trawl feel was equipping fishing nets with acoustic deterrent devices (i.e., pingers). To the extent possible, the use of pingers on bottom trawl gear has been taken into account when estimating bycatch mortality of Risso's dolphins. The estimated annual fishery-related mortality and serious injury values attributable to the mid-Atlantic bottom trawl fishery (CV in parentheses) were 39 (0.69) in 2008, 23 (0.50) in 2009, 54 (0.74) in 2010, 62 (0.56) in 2011, and 7 (1.0) in 2012. The 2008-2012 average annual serious injury and mortality attributed to the mid-Atlantic bottom trawl was 37 animals (0.36; Table 2).

Northeast Sink Gillnet

In the northeast sink gillnet fishery, Risso's dolphin interactions were observed in 2000, 2005, 2006 and 2012. Estimated annual mortalities (CV in parentheses) from this fishery are: 0 in 1999, 15 (1.06) in 2000, 0 in 2001–2004, 15 in 2005 (0.93), 0 in 2006 through 2011 and 6 (0.87) in 2012 (Hatch and Orphanides 2014).

Mid-Atlantic Midwater Trawl

A Risso's dolphin mortality was observed in this fishery for the first time in 2008, and not again since. No bycatch estimate has been generated. Until this bycatch estimate can be developed, the 2008-2012 average annual serious injury and mortality attributed to the mid-Atlantic midwater trawl is calculated as 0.2 animals (1 animal/5 years).

Table 2. Summary of the incidental mortality of Risso's dolphin (*Grampus griseus*) by commercial fishery including the years sampled, the type of data used, the annual 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, the estimated CV of the combined estimates and the mean of the combined estimates (CV in parentheses).

Fishery	Years	Data Type [a]	Observer Coverage [b]	Observed Serious Injury	Observed Mortality	Estimated Serious Injury	Estimated Mortality	Estimated Combined Mortality	Estimated CVs	Mean Combined Annual Mortality
Pelagic Longline [c]	08-12	Obs. Data Logbook	.07, .14, .08, .09, .07	2, 2, 0, 2, 1	0, 0, 0, 0, 0	17, 11, 0, 12, 15	0, 0, 0, 0. 0	17, 11, 0, 12, 15	.73, .71, 0, .63, 1.0	11 (0.41)
Northeast Sink Gillnet	08-12	Obs. Data, Trip Logbook, Allocated Dealer Data	.05, .04, .17, .19, .15	0, 0, 0, 0, 0	0, 0, 0, 0, 1	0, 0, 0, 0, 0	0, 0, 0, 0, 6	0, 0, 0, 0, 6	0, 0, 0, 0, .87	1.2 (0.87)
Northeast Bottom Trawl	08-12	Obs. Data Dealer Data VTR Data	.08, .09, .16, .26, .17	0, 0, 0, 0, 0	0, 0, 1, 0, 0	0, 0, 0, 0, 0	2, 3, 2, 3, 0	2, 3, 2, 3, 0	.56, .53, .55, .55, 0	2.0 (0.30)
Mid-Atlantic Bottom Trawl [d]	08-12	Obs. Data Dealer Data	.03, .05, .06, .08, .05	0, 0, 0, 0, 0	1, 0, 15, 2, 1	0, 0, 0, 0, 0	39, 23, 54, 62, 7	39, 23, 54, 62, 7	.69, .50, .74, .56, 1.0	37 (.36)
Mid-Atlantic Midwater Trawl - Including Pair Trawl [e]	08-12	Obs. Data Trip Logbook	.133, .132, .25, .41, .21	0,0,0,0,0	1,0, 0, 0, 0	na	na	na	na	0.2 (na)
TOTAL										51 (0.27)

Other mortality

From 2008 to 2012, 39 Risso's dolphin strandings were recorded along the U.S. Atlantic coast (NMFS unpublished data). Seven animals had indications of human interaction, four of which were fishery interactions. Indications of human interaction are not necessarily the cause of death (Table 3).

In eastern Canada, one Risso's dolphin stranding (unmarked by net entanglement or propeller scarring) was reported on Sable Island, Nova Scotia from 1970 to1998 (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.

Table 3. Risso's dolphin (*Grampus griseus*) reported strandings along the U.S. Atlantic coast and Puerto Rico, 2008-2012.

STATE	2008	2009	2010	2011	2012	TOTALS
Maine	1	0	0	0	0	1
Massachusetts[a,d]	8	4	0	0	0	12
New York	0	0	0	1	0	1
New Jersey	0	1	0	0	0	1
Maryland	1	0	1	0	0	2
Virginia[b]	0	2	4	1	0	7
North Carolina[c]	1	3	2	1	2	9
Georgia	0	1	0	0	0	1
Florida	0	0	0	2	2	4
Puerto Rico	0	0	0	1	0	1
TOTAL	11	11	7	6	4	39

a. One of the 2009 animals had propeller wounds.

b. One of the 2009 animals showed signs of human interaction.

c. Two animals in 2009 showed signs of fishery interaction. One animal in 2010 was classified as human interaction. Two animals in 2012 showed signs of fishery interaction.

d. 2008 includes 4 animals mass stranded in Massachusetts, 3 of which were released alive.

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

Risso's dolphins are not listed as threatened or endangered under the Endangered Species Act and the Western North Atlantic stock is not considered strategic under the Marine Mammal Protection Act. The 2008-2012 average annual human-related mortality does not exceed PBR. The total U.S. fishery mortality and serious injury for this stock is not less than 10% of the calculated PBR and, therefore, cannot be considered to be insignificant and approaching a zero mortality and serious injury rate. The status of Risso's dolphins relative to OSP in the U.S. Atlantic EEZ is unknown. Population trends for this species have not been investigated.

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