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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, 2014), and in the Northwest Atlantic occur from Florida to eastern Newfoundland (Leatherwood *et al*. 1976; Baird and Stacey 1991). Off the northeastern 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) (Figure 1). 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 that 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.

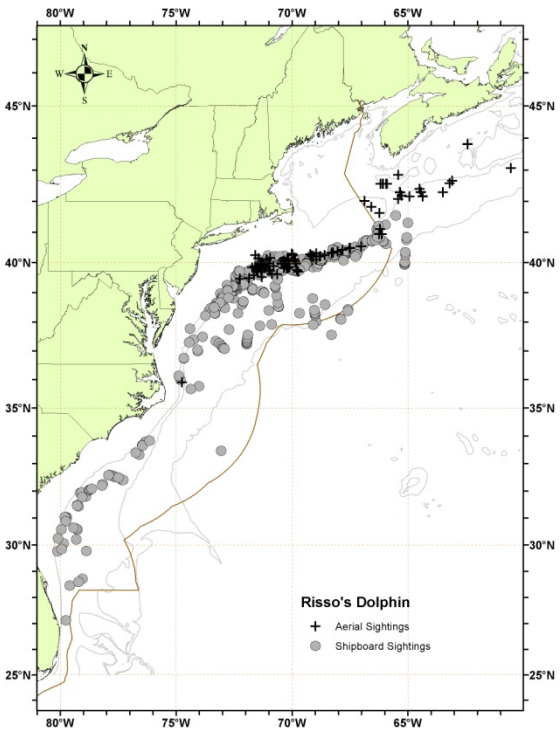

Figure 1. *Distribution of Risso's dolphin sightings from NEFSC and SEFSC shipboard and aerial surveys during the summers of 1995, 1998, 1999, 2002, 2004, 2006, 2007, 2008 2010 and 2011. Isobaths are the 100-m, 1,000-m, and 4,000-m depth contours.*

POPULATION SIZE

The best abundance estimate for Risso's dolphins is the sum of the estimates from 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. As recommended in the GAMMS II Workshop Report (Wade and Angliss 1997), estimates older than eight years are deemed unreliable for the determination of the current PBR.

Recent surveys and abundance estimates

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 25×150 "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 recent abundance estimates for the western North Atlantic Risso's dolphin (*Grampus griseus*), by 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
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 is 0.5, the default value for stocks of unknown status relative to OSP, and 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 2010–2014 was 53.6 Risso's dolphins, derived from 2 components: 1) 53 estimated mortalities in observed fisheries (CV = 0.28; Table 2) and 2) 0.6 from average 2010–2014 non-fishery related, human interaction stranding mortalities (NOAA National Marine Mammal Health and Stranding Response Database, accessed 08 October 2015)

Fishery Information

Detailed fishery information is reported in Appendix III.

Earlier Interactions

One Risso's dolphin mortality was observed in the mid-Atlantic midwater trawl fishery in 2008. No bycatch estimate was developed, so the 2008 average annual serious injury and mortality attributed to the mid-Atlantic midwater trawl was calculated as a minimum value of 1 animal.

Historically, fishery interactions have been documented with Risso's dolphins in squid and mackerel trawl activities (1977–1991), the pelagic drift gillnet fishery (1989–1998), the pelagic pair trawl fishery (1992), and the mid-Atlantic gillnet fishery (2007). See Appendix V for more information on historical takes.

Pelagic Longline

Pelagic longline bycatch estimates of Risso's dolphins for 2010–2014 are documented in Garrison and Stokes (2012a, 2012b, 2013, 2014, 2016). Most of the estimated marine mammal bycatch was from U.S. Atlantic EEZ waters between South Carolina and Cape Cod. There is a high likelihood that dolphins released alive with ingested gear or gear wrapped around appendages will not survive (Wells *et al.* 2008). See Table 2 for bycatch estimates and observed mortality and serious injury for the current 5-year period, and Appendix V for historical bycatch information.

Northeast Bottom Trawl

One Risso's dolphin was observed taken in northeast bottom trawl fisheries in 2010 and one in 2014 (Table 2). Annual Risso's dolphin mortalities were estimated using annual stratified ratio-estimator methods (Lyssikatos 2015).See Table 2 for bycatch estimates and observed mortality and serious injury for the current 5-year period, and Appendix V for historical bycatch information.

Mid-Atlantic Bottom Trawl

Risso's dolphinss have been observed taken in mid-Atlantic bottom trawl fisheries (Table 2). 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 fleet 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 (methodology is detailed in Lyssikatos 2015). Annual Risso's dolphin mortalities were estimated using annual stratified ratio-estimator methods (Lyssikatos 2015). See Table 2 for bycatch estimates and observed mortality and serious injury for the current 5-year period, and Appendix V for historical bycatch information.

Northeast Sink Gillnet

In the northeast sink gillnet fishery, Risso's dolphin interactions have historically been rare, but in 2012 and 2013 one animal was observed each year in the waters south of Massachusetts (Hatch and Orphanides 2014, 2015, 2016). See Table 2 for bycatch estimates and observed mortality and serious injury for the current 5-year period, and Appendix V for historical bycatch information.

Table 2. Summary of the incidental serious injury and 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 [e]	Estimated Mortality	Estimated Combined Mortality	Estimated CVs	Mean Combined Annual Mortality
Pelagic Longline [c]	10-14	Obs. Data Logbook	.08, .09, .07, .09	0, 2, 1, 1, 1	0, 0, 0, 0, 0	0, 12, 15, 1.9, 7.7	0, 0, 0, 0. 0	0, 12, 15, 1.9, 7.7	0, .63, 1.0, 1.0, 1.0	7.3 (0.52)
Northeast Sink Gillnet	10-14	Obs. Data, Trip Logbook, Allocated Dealer Data	0.17, .19, .15, .11, .18	0, 0, 0, 0, 0	0, 0, 1, 1, 0	0, 0, 0, 0, 0	0, 0, 6, 23, 0	0, 0, 6, 23, 0	0, 0, .87, 1, 0	5.8 (0.79)
Northeast Bottom Trawl [c]	10-14	Obs. Data Dealer Data VTR Data	.16, .26, .17, .15, .17	0, 0, 0, 0, 0	1, 0, 0, 0, 1	0, 0, 0, 0, 0	2, 3, 0, 0, 4.2	2, 3, 0, 0, 4.2	.55, .55, 0, 0, .91	1.8 (0.47)
Mid-Atlantic Bottom Trawl [d]	10-14	Obs. Data Dealer Data	.06, .08, .05, .06, .08	0, 0, 0, 0 , 0	15, 2, 1, 4, 2	0, 0, 0, 0 , 0	54, 62, 7, 46, 21	54, 62, 7, 46, 21	.74, .56, 1.0, .71, .93	38 (.35)
TOTAL										53 (0.28)

[a] Observer data (Obs. Data) are used to measure bycatch rates and the data are collected within the Northeast Fisheries Observer Program. NEFSC collects landings data (unallocated Dealer Data and Allocated Dealer Data) which are used as a measure of total landings and mandatory Vessel Trip Reports (VTR) (Trip Logbook) are used to determine the spatial distribution of landings and fishing effort. Total landings are used as a measure of total effort for the coastal gillnet fishery.

[b] The observer coverages for the northeast and mid-Atlantic sink gillnet fishery are ratios based on tons of fish landed. Northeast bottom trawl, mid-Atlantic bottom trawl, northeast mid-water and mid-Atlantic mid-water trawl fishery coverages are ratios based on trips. Total observer coverage reported for gillnet and bottom trawl gear in the years starting in 2010 include samples collected from traditional fisheries observers in addition to fishery at-sea monitors through the Northeast Fisheries Observer Program (NEFOP). For 2010 only the NEFOP observed data were reported in this table, since the at-sea monitoring program just started in May 2010. Both at-sea monitor and traditional fisheries observer data were used for 2011 and onwards.

[c] Estimates can include data pooled across years, so years without observed SI or Mortality may still have an estimated value.

[d] Fishery related bycatch rates were estimated using an annual stratified ratio-estimator.

[e] Waring et al. 2014,2015, Wenzel *et al*. 2015, 2016.

Other Mortality

From 2010 to 2014, 30 Risso's dolphin strandings were recorded along the U.S. Atlantic coast (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 08 October 2015). Five animals had indications of human interaction, 2 of which were fishery interactions. Indications of human interaction are not necessarily the cause of death (Table 3).

Table 3. Risso's dolphin (*Grampus griseus*) reported strandings along the U.S. Atlantic coast and Puerto Rico, 2010-2014.

STATE	2010	2011	2012	2013	2014	TOTALS
Maine	0	0	0	0	0	0
Massachusetts[a]	0	0	0	3	2	5
New York	0	1	0	2	0	3
New Jersey	0	0	0	0	0	0
Maryland	1	0	0	1	0	2
Virginia[b]	4	1	0	0	1	6
North Carolina[c]	2	1	2	1	1	7
Georgia	0	0	0	0	0	0
Florida	0	2	2	2	0	6
Puerto Rico	0	1	0	0	0	1
TOTAL	**7**	**6**	**4**	**9**	**4**	**30**

a. One animal in 2014 was classified as human interaction due to signs of ear trauma.

b. One animal in 2014 classified as HI due to plastic injestion.

c. One animal in 2010 classified as human interaction due to beach mutilation. Two animals in 2012 showed signs of fishery 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

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 2010–2014 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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