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. They generally have an oceanic range, and occur along the Atlantic coast of North America 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 the spring, summer, and autumn (CETAP 1982; Payne *et al.* 1984). In winter, the range begins at the Mid-Atlantic bight and extends further 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 in continental shelf edge and deeper oceanic waters had sightings of 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 differentiation of Risso's dolphin in the western North Atlantic.

POPULATION SIZE

Total numbers of Risso's dolphins off the U.S. or Canadian Atlantic coast are unknown, although eight estimates from selected regions of the habitat do exist for select time periods. Sightings were almost exclusively in the continental shelf edge and continental slope areas (Figure 1). An abundance of 4,980 Risso's dolphins (CV=0.34) was estimated 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 of 11,017 (CV=0.58) Risso's dolphins was estimated from a June and July 1991 shipboard line transect sighting survey conducted primarily between the 200 and 2,000m isobaths from Cape Hatteras to Georges Bank (Waring *et al.* 1992; Waring 1998). An abundance of 6,496 (CV=0.74) and 16,818 (CV=0.52) Risso's dolphins was estimated from

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

line transect aerial surveys conducted from August to September 1991 using the Twin Otter and AT-11, respectively (NMFS 1991). As recommended in the GAMS 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.

An abundance of 212 (CV=0.62) Risso's dolphins was estimated from a June and July 1993 shipboard line transect sighting survey conducted principally between the 200 and 2,000m isobaths from the southern edge of Georges Bank, across the Northeast Channel to the southeastern edge of the Scotian Shelf (NMFS 1993). Data were collected by two alternating teams that searched with 25x150 binoculars and were analyzed using DISTANCE (Buckland *et al.* 1993; Laake *et al.* 1993). Estimates include school-size bias, if applicable, but do not include corrections for *g(0)* or dive-time. Variability was estimated using bootstrap resampling techniques.

An abundance of 5,587 (CV=1.16) Risso's dolphins was estimated 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 (Table 1; Palka *et al.* Unpub. Ms.). Total track line length was 32,600km. The ships covered waters between the 50 and 1000 fathom depth contour lines, the northern edge of the Gulf Stream, and the northern Gulf of Maine/Bay of Fundy region. The airplane covered waters in the Mid-Atlantic from the coastline to the 50 fathom depth contour line, the southern Gulf of Maine, and shelf waters off Nova Scotia from the coastline to the 1000 fathom depth contour line. Data collection and analysis methods used were described in Palka (1996).

An abundance of 18,631 (CV=0.35) Risso's dolphins was estimated 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
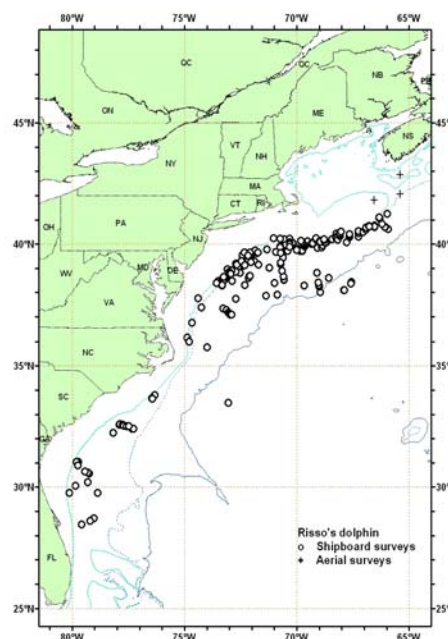
(38ºN) (Figure 1; Palka *et al.* Unpubl. Ms.). Shipboard data were analyzed using the modified direct duplicate method (Palka 1995) that accounts for school size bias and *g(0)*, the probability of detecting a group on the track line. Aerial data were not corrected for *g(0)*.

An abundance of 10,479 (CV=0.51) Risso's dolphins was estimated from a shipboard line transect sighting survey conducted between 8 July and 17 August 1998 that surveyed 5,570 km of track line in waters south of Maryland (38ºN) (Figure 1; Mullin and Fulling 2003). Abundance estimates were made using the program DISTANCE (Buckland *et al.* 1993; Laake *et al.* 1993) where school size bias and ship attraction were accounted for.

The best available abundance estimate for Risso's dolphins, 29,110 (CV=0.29), is the sum of the estimates from the two 1998 U.S. Atlantic surveys where the estimate from the northern U.S. Atlantic is 18,631 (CV=0.35) and from the southern U.S. Atlantic is 10,479 (CV=0.51). This joint estimate is considered best because together these two surveys have the most complete coverage of the species' habitat.

An abundance of 15,053 (CV=0.78) for Risso's dolphins was estimated from a line transect sighting survey conducted during 12 June to 4 August 2004 by a ship and plane that surveyed 10,761 km of track line in waters north of Maryland (38ºN) to the Bay of Fundy (45ºN) (Figure 1; Palka Unpubl. Ms.). 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 (Figure 1; Palka Unpubl. Ms.).

A survey of the U.S. Atlantic outer continental shelf and continental slope (water depths > 50m) between Florida and Maryland (27.5 and 38ºN) was conducted during June-August, 2004. The survey employed two independent visual teams searching with 50x bigeye binocluars. 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 there was 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*)*.

The best 2004 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 together these two surveys have the most complete coverage of the species' habitat.

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**
Jul-Sep 1998	Maryland to Gulf of St. Lawrence	18,631	0.35
Jul-Aug 1998	Florida to Maryland	10,479	0.51
Jul-Sep 1998	Florida to Gulf of St. Lawrence (COMBINED)	29,110	0.29
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

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). The minimum population estimate for the western North Atlantic Risso's dolphin is 12,920.

Current Population Trend

There are insufficient data to determine the 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 0.48 because the CV of the average mortality estimate is between 0.3 and 0.6 (Wade and Angliss 1997). PBR for the western North Atlantic Risso's dolphin is 124.

ANNUAL HUMAN-CAUSED MORTALITY

Total annual estimated average fishery-related mortality or serious injury to this stock during 1999-2003 was 51 Risso's dolphins (CV= 0.34); 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 Fisheries Conservation and Management Act (MFCMA) in that year, an observer program was established which recorded fishery data and information on incidental bycatch of marine mammals. DWF effort in the U.S. Atlantic Exclusive Economic Zone (EEZ) under MFCMA has been directed primarily towards Atlantic mackerel and squid.

Data on current incidental takes in U.S. fisheries are available from several sources. In 1986, NMFS established a mandatory self-reported fisheries information system for large pelagic fisheries. Data files are maintained at the Southeast Fisheries Science Center (SEFSC). The Northeast Fisheries Science Center (NEFSC) Sea Sampling Observer Program was initiated in 1989, and since that year several fisheries have been covered by the program. In late 1992 and in 1993, the SEFSC provided observer coverage of pelagic longline vessels fishing off the Grand Banks (Tail of the Banks) and provides observer coverage of vessels fishing south of Cape Hatteras.

Pelagic Drift Gillnet

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). Since this fishery no longer exists, it has been excluded from Table 2.

Pelagic Pair Trawl

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)(Northridge 1996).

Pelagic Longline

The 1993-1997 estimated take was based on a revised analysis of the observed incidental take and self-reported incidental take and effort data, and replaces previous estimates for the 1990-1993 and 1994-1995 periods (Cramer 1994; Scott and Brown 1997; Johnson *et al.* 1999). Further, Yeung (1999b), revised the 1992-1997 fishery mortality estimates in Johnson *et al.* (1999) to include seriously injured animals. The 1998, 1999 and 2000 bycatch estimates were from Yeung (1999a), Yeung *et al.* (2000) and Yeung (2001), respectively. 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 1992-2000 one mortality was observed in both 1994 and 2000, and 0 in other years. The observed number of seriously-injured but released alive individuals from 1992-2000 was, respectively, 2, 0, 6, 4, 1, 0, 1, 1 and 1 (Cramer 1994; Scott and Brown 1997; Johnson *et al.* 1999; Yeung 1999a; Yeung *et al.* 2000; Yeung 2001)) (Table 2). Estimated annual fishery-related mortality (CV in parentheses) was 17 in 1994 (1.0), 41 in 2000 (1.0), 24 (1.0) in 2001, 20 (0.86) in 2002, and 0 in 2003

(Table 2). Seriously injured and released alive animals were estimated to be 54 (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, and 40 (0.63) in 2003 (Table 2). The average combined mortality for 1999-2003 is 45 Risso's dolphins (CV =0.38; Table2).

Northeast Sink Gillnet

Estimated annual mortalities (CV in parentheses) from this fishery are: 0 in 1999, 15 (1.06) in 2000, and 0 in 2001-2003 (Table 2). The 1999-2003 average mortality in this fishery is 3 Risso's dolphins (CV =1.06).

Table 2. Summary of the incidental mortality of Risso's dolphin (*Grampus griseus*) 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[c]	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[b] (excluding NED-E)[d]	99-03	205, 193, 70, 54, 21	Obs. Data Logbook	.04, .04, .02, .04, .02	1, 1, 2, 1, 3	0, 1, 1, 0, 0	22, 23, 45, 8, 40	0, 41, 24, 20, 0	22, 64, 69, 28, 40	1.0, 1.0, 0.57, 0.86, 0.63	45 (0.38)
Pelagic Longline - NED-E area only[d]	2001-2003	180, 482, 535 sets	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 (0)
Northeast Sink Gillnet	99-03	1993=349 1998=301	Obs. Data Weighout Trip Logbook	.06, .06, .04, .02, .03	0,0,0, 0,0	0, 1, 0, 0, 0	0,0,0, 0,0	0, 15, 0, 0, 0	0, 15, 0, 0, 0	0, 1.06, 0, 0, 0	3 (1.06)
TOTAL											51 (0.34)

a Observer data (Obs. Data) are used to measure bycatch rates and the data are collected within the Northeast Fisheries Science Center (NEFSC) Sea Sampling Program. NEFSC collects landings data (Weighout), and total landings are used as a measure of total effort for the coastal gillnet fishery.
b 1999 mortality estimates were taken from Table 9 in Yeung *et al.* (NMFS Miami Laboratory PRD 99/00-13), and exclude the Gulf of Mexico. 2000 mortality estimates were taken from Table 10 in Yeung (2001).
c Number of vessels in the fishery is based on vessels reporting effort to the pelagic longline logbook.
d 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).

Other mortality

From 1999-2003, twenty 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).

Table 3. Risso's dolphin (*Grampus griseus*) strandings along the U.S. Atlantic coast 2000-2003.						
STATE	**1999**	**2000**	**2001**	**2002**	**2003**	**TOTAL**
Massachusetts			1[a]	5		6
New York				1		1
New Jersey		1				1
Maryland			1	1		2
Virginia			1			1
North Carolina	1		3	2	1	7
Florida			1	1	1	3
TOTAL	1	1	7	10	2	21
a Mass. 2001 - had 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 the population trends for this species. The total 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 1999-2003 average annual fishery-related mortality does not exceed PBR; therefore, this is not a strategic stock.

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