

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

STOCK DEFINITION AND GEOGRAPHIC RANGE

Risso's dolphin is distributed worldwide in tropical and temperate seas. Risso's dolphins 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 dolphin is 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

The total number of Risso's dolphins off the eastern U.S. and Canadian Atlantic coast is unknown, although four estimates are available from selected regions during spring and summer 1978-82, June-July 1991, August-September 1991, and June-July 1993.

A population size of 4,980 (CV = 0.34) Risso's dolphins 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 (Table 1; CETAP 1982). The estimate is based on an inverse variance weighted pooling of spring and summer data. An average of these seasons were chosen because the greatest proportion of the population off the northeast U.S. coast appeared in the study area during these seasons. This estimate does not include a correction for dive-time or $g(0)$, the probability of detecting an animal group on the track line. This estimate may not reflect the current true population size because of its old age, and it was estimated just after cessation of extensive foreign fishing operations in the region.

A population size 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 (Table 1; Waring *et al.* 1992; Waring 1998). Data were collected by one team that searched by naked eye and analyzed using DISTANCE (Buckland *et al.* 1993; Laake *et al.* 1993). Estimates include school size-bias, if applicable, but no corrections for $g(0)$ or dive-time. Variability was estimated using bootstrap resampling techniques.

A population size of 6,496 (CV=0.74) and 16,818 (CV=0.52) Risso's dolphins was estimated from line transect aerial surveys conducted from August to September 1991 using the Twin Otter and AT-11, respectively (Table 1; Anon. 1991). The study area included that covered in the CETAP study plus several additional continental slope survey

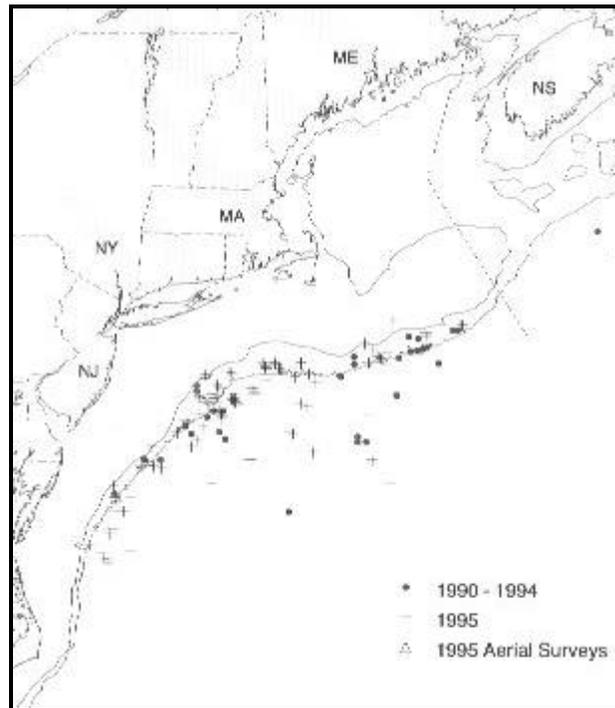


Figure 2. Distribution of Risso's dolphin sightings from NEFSC shipboard and aerial surveys during the summer in 1990-1995. Isobaths are at 100m and 1,000 m.

blocks. Due to weather and logistical constraints, several survey blocks south and east of Georges Bank were not surveyed. The data were analyzed using DISTANCE (Buckland *et al.* 1993; Laake *et al.* 1993), where the CV was estimated using the bootstrap option. The abundance estimates do not include $g(0)$ and were not pooled over platforms because the inter-platform calibration analysis has not been conducted.

A population size 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 (Table 1; Anon. 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.

The few Risso's dolphin sightings made during August 1990 and 1994 were widely scattered, and therefore were not used to obtain abundance estimates. It should be noted, however, that nearly all of the sightings in these two years were in deeper oceanic waters (Waring 1993; Anon. 1994).

A population size 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; NMFS unpublished data). Total track line length was 32,600 km (17,600 nmi). The ships covered waters between the 50 and 1000 fathom 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 contour line, the southern Gulf of Maine, and shelf waters off Nova Scotia from the coastline to the 1000 fathom contour line. Shipboard data were collected using a two independent sighting team procedure and were analyzed using the product integral method (Palka 1995) and DISTANCE (Buckland *et al.* 1993). Shipboard estimates were corrected for $g(0)$ and, if applicable, also for school size-bias. Standard aerial sighting procedures with two bubble windows and one belly window observer were used during the aerial survey. An estimate of $g(0)$ was not made for the aerial portion of the survey. Estimates do not include corrections for dive-time. Variability was estimated using bootstrap resampling techniques.

Although the 1991, 1993, and 1995 surveys did not sample exactly the same areas or encompass the entire Risso's dolphin habitat, they did focus on segments of known or suspected high-use habitats off the northeastern U.S. coast. The collective data suggest that at least several thousand Risso's dolphins occupy these waters seasonally; however, survey coverage to date was not judged adequate to provide a definitive estimate of Risso's dolphin abundance in the western North Atlantic.

The best available current abundance estimate for Risso's dolphins is 16,818 (CV=0.52) as estimated from the August to September 1991 aerial line transect survey in the AT-11 because this survey provided the most complete coverage of the known 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
spring & summer 1978-82	Cape Hatteras, NC to Nova Scotia	4,980	0.34
Jun-Jul 1991	Cape Hatteras, NC to Georges Bank, shelf edge only	11,017	0.58
Aug-Sep 1991	Cape Hatteras, NC to Nova Scotia	6,496 and 16,818*	0.74 and 0.52*
Jun-Jul 1993	Georges Bank to Scotian shelf, shelf edge only	212	0.62
Jul-Sep 1995	Virginia to Gulf of St. Lawrence	5587	1.16

* from data collected on the Twin Otter and AT-11, respectively.

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 16,818 (CV=0.52). The minimum population estimate for the western North Atlantic Risso's dolphin is 11,140 (CV=0.52).

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 11,140 (CV=0.52). 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 this stock is of unknown status. PBR for the western North Atlantic Risso's dolphin is 111.

ANNUAL HUMAN-CAUSED MORTALITY

Total annual estimated average fishery-related mortality to this stock during 1992-1996 was 18 Risso's dolphins (CV = 0.17; Table 2).

Fishery Information

Prior to 1977, there was no documentation of marine mammal by-catch 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 has recorded fishery data and information of incidental by-catch 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. From 1977 through 1982, an average of 120 different foreign vessels per year (range 102-161) operated within the U.S. Atlantic EEZ. In 1982, there were 112 different foreign vessels; 16%, or 18, were Japanese tuna longline vessels operating along the U.S. east coast. This was the first year that the Northeast Regional Observer Program assumed responsibility for observer coverage of the longline vessels. Between 1983 and 1991, the numbers of foreign vessels operating within U.S. Atlantic EEZ each year were 67, 52, 62, 33, 27, 26, 14, 13, and 9, respectively. Between 1983 and 1988, the numbers of DWF vessels included 3, 5, 7, 6, 8, and 8, respectively, Japanese longline vessels. Observer coverage on DWF vessels was 25-35% during 1977-82, and increased to 58%, 86%, 95%, and 98%, respectively, in 1983-86. From 1987-91, 100% observer coverage was maintained. Foreign fishing operations for squid and mackerel ceased at the end of the 1986 and 1991 fishing seasons, respectively. 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.

Data on current incidental takes in U.S. fisheries are available from several sources. In 1986, NMFS established a mandatory self-reported fishery 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.

By-catch has been observed by NMFS Sea Samplers in the pelagic drift gillnet fishery, pelagic pair trawl fishery, and pelagic longline fishery, but no mortalities or serious injuries have been documented in the New England multispecies sink gillnet, mid-Atlantic coastal sink gillnet, or North Atlantic bottom trawl observed fisheries.

Pelagic Drift Gillnet

The estimated total number of hauls in the pelagic drift gillnet fishery increased from 714 in 1989 to 1,144 in 1990; thereafter, with the introduction of quotas, effort was severely reduced. The estimated number of hauls in 1991, 1992, 1993, 1994, 1995, and 1996 were 233, 243, 232, 197, 164, and 149 respectively. Fifty-nine different vessels participated in this fishery at one time or another between 1989 and 1993. Since 1994, between 10 and 12 vessels have participated in the fishery (Table 2). Observer coverage, expressed as percent of sets observed, was 8% in 1989, 6% in 1990, 20% in 1991, 40% in 1992, 42% in 1993, 87% in 1994, 99% in 1995, and 64% in 1996. Effort was concentrated along the southern edge of Georges Bank and off Cape Hatteras. Examination of the species composition of the catch and locations of the fishery throughout the year, suggested that the pelagic drift gillnet fishery be stratified into two strata, a southern or winter stratum, and a northern or summer stratum. Estimates of the total by-catch, for each year from 1989 to 1993, were obtained using the aggregated (pooled 1989-1993) catch rates, by strata (Northridge 1996). Estimates of total annual by-catch for 1994 and 1995 were estimated from the sum of the observed caught and the product of the average bycatch per haul and the number of unobserved hauls as recorded in self-reported fishery information. Variances were estimated using bootstrap re-sampling techniques. Forty two Risso's dolphin mortalities were observed between 1989 and 1996. One animal was entangled and released alive. By-catch 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), and 0 in 1996. The 1992-1996 total average estimated annual fishery-related mortality of Risso's dolphins in the U.S. EEZ was 10.5 (CV = 0.20) (Table 2). The 1992-1996 period provides a better characterization of the current pelagic drift gillnet fishery. Table 3 summarizes the number of animals released alive and classified as injured or non-injured. It also includes the ratio of observed to estimated mortalities for this fishery.

Pelagic Pair Trawl

Effort in the pelagic pair trawl fishery increased during the period 1989 to 1993, from zero hauls in 1989 and 1990, to an estimated 171 hauls in 1991, and then to an estimated 536 hauls in 1992, 586 in 1993, 407 in 1994, and 440 in 1995, respectively. This fishery ceased operations in 1996, when NMFS rejected a petition to consider pair trawl gear as an authorized gear type in Atlantic tunas fishery. The fishery operated from August-November in 1991, from June-November in 1992, from June-October in 1993 (Northridge 1996), and from mid-summer to November in 1994 and 1995. Sea sampling began in October 1992 (Gerrior *et al.* 1994), and 48 sets (9% of the total) were sampled in that season, 102 hauls (17% of the total) were sampled in 1993. In 1994 and 1995, 52% (212) and 55% (238), respectively, of the sets were observed. Nineteen vessels have operated in this fishery. The fishery extends from 35°N to 41°N, and from 69°W to 72°W. Approximately 50% of the total effort was within a one degree square at 39°N, 72°W, around Hudson Canyon. Examination of the locations and species composition of the by-catch, showed little seasonal change for the six months of operation and did not warrant any seasonal or areal stratification of this fishery (Northridge 1996). One mortality was observed in 1992. Estimated annual fishery-related mortality (CV in parentheses) 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). The 1992-1995 estimated mean annual Risso's dolphin mortality attributable to this fishery is 2.8 (CV= 0.44) (Table 2). Table 3 summarizes the number of animals released alive and classified as injured or non-injured. It also includes the ratio of observed to estimated mortalities for this fishery.

During the 1994 and 1995 experimental fishing seasons, fishing gear experiments were conducted to collect data on environmental parameters, gear behavior, and gear handling practices to evaluate factors affecting catch and bycatch (Goudy 1995, 1996). Results of these studies were inconclusive in identifying factors responsible for marine mammal bycatch.

Pelagic Longline

Total effort for the pelagic longline fishery, based on mandatory self-reported fishery information, was 11,279 sets in 1991, 10,605 sets in 1992, 11,538 sets in 1993, 11,231 sets in 1994, and 12,713 in 1995 (Cramer 1994; Scott and Brown 1997). The fishery has been observed from January to March off Cape Hatteras, in May and June in the entire Mid-Atlantic, and in July through December in the Mid-Atlantic Bight and off Nova Scotia. This fishery has been monitored with about 5% observer coverage, in terms of trips observed, since 1992. Most of the estimated marine mammal by-catch was from EEZ waters between South Carolina and Cape Cod. From 1992-1995 two mortalities were observed, one each in 1993 and 1994 (Cramer 1994; Scott and Brown 1997) (Table 2). Estimated annual fishery-related mortality (CV in parentheses) was 0 in 1992 (0), 13 in 1993 (0.19), 7 in 1994 (1.0) and 0 in 1995 (0). The 1992-1995 estimated mean annual Risso's dolphin mortality attributable to this fishery is 5.0 (CV= 0.37) (Table 2). Injured and released alive animals are not included in the Table 2 mortality estimates. Total average annual total fishery-related mortality is 18.3 Risso's dolphins (CV = 0.17).

Table 3 summarizes the number of animals released alive and classified as injured or non-injured. It also includes the ratio of observed to estimated mortalities for this fishery.

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 mortalities recorded by on-board observers (Observed Mortality), the estimated annual mortality (Estimated Mortality), the estimated CV of the annual mortality (Estimated CVs) and the mean annual mortality (CV in parentheses).

Fishery	Years	Vessels	Data Type ¹	Observer Coverage ²	Observed Mortality	Estimated ⁵ Mortality	Estimated CVs	Mean Annual Mortality
Pelagic Drift Gillnet	92-96	1994=12 ³ 1995=11 1996=10	Obs. Data Logbook	.40, .42, .87, .99, .64	15, 1, 1, 6, 0	31, 14, 1.5 6 ⁴ , 0	.27, .42, .16, 0, 0	10.5 (.20)
Pelagic Pair Trawl	92-95	12	Obs. Data Logbook	.10, .18, .52, .54	1, 0, 0, 2	4.3, 3.2, 0, 3.7	.76, 1.0, 0, .45	2.8 (.44)
Longline	92-95		Obs. Data Logbook	.05	0, 1, 1, 0	0, 13, 7, 0	0, .19, 1.0, 0	5.0 (.37)
TOTAL								18.3 (.17)

¹ 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 weighout (Weighout) landings data, and total landings are used as a measure of total effort for the coastal gillnet fishery and days fished are used as total effort for the North Atlantic bottom trawl fishery. Mandatory logbook (Logbook) data are used to measure total effort for the pelagic drift gillnet fishery, and these data are collected at the Southeast Fisheries Science Center (SEFSC).

² The observer coverage for the pelagic drift gillnet and pair trawl fishery is measured in terms of sets, and the North Atlantic bottom trawl fishery is in days fished. Assessments for the coastal gillnet fishery have not been completed. The number of trips sampled by the NEFSC Sea Sampling Program are reported here.

³ 1994 -1996 shown, other years not available on an annual basis.

⁴ One vessel was not observed and recorded 1 set in a 10 day trip in the SEFSC mandatory logbook. If you assume the vessel fished 1.4 sets per day as estimated from the 1995 SS data, the point estimate may increase by 0.42 animals. However, the SEFSC mandatory logbook data was taken at face value, and therefore it was assumed that 1 set was fished within this trip, and the point estimate would then increase by 0.03 animals.

⁵ Injured and released alive animals are not included in the Table 2 mortality estimates.

Table 3. Summary of Risso's dolphin (*Grampus griseus*) released alive, by commercial fishery, years sampled (Years), ratio of observed mortalities recorded by on-board observers to the estimated mortality (Ratio), the number of observed animals released alive and injured (Injured), and the number of observed animals released alive and uninjured (Uninjured)

Fishery	Years	Ratio	Injured ²	Uninjured
Pelagic Longline	92-95	0, 1/13, 1/7, 0	0, 0, 6 ¹ , 2 ¹	0, 0, 0, 2 ¹

¹ Summary of observer comments for each animal as reported in Scott and Brown (1997): 1994 Trip A44004 (2 animals)- released alive, hooked in dorsal fin; mainline wrapped around body immediately adjacent to flukes; #2 released alive, hooked in tail fluke and mainline; gear cut to release animal, swam away with mainline and leader around tail; Trip A53037 - released alive; gear wrapped around animal, cut loose by crew, swam away quickly; Trip A62002 (3 animals)- a good amount of mainline was tangled around animal, released with a fair amount of mainline around fluke, some blood noticed around caudal peduncle; #2 hooked in mouth, animal released with hook in mouth and approximately 7 fathoms of 400 lb test line trailing from mouth; #3 apparently hooked in mouth, appeared to be wound up the midsection of the body with line, animal swam off quite sluggishly. 1995 Trip A411031 - hooked in mouth, gangion cut to free animal, alive; Trip #A44040 - alive, mainline and gangion wrapped around tail, all gear cut before animal released; Trip 62058 - gear cut from animal, alive; Trip A41032 - mouth hooked, line snapped and animal swam off; Trip A44043 - #1 mainline cut from around tail flukes and pulled from mouth, animal swam away quickly; #2 mainline cut from around tail flukes, animal swam off slowly after blowing.

² Injured and released alive animals are not included in the Table 2 mortality estimates.

Other mortality

From 1995-1996, three Risso's dolphins stranding were recorded along the Atlantic coast (NMFS unpublished data).

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, cannot be considered to be insignificant and approaching a zero mortality and serious injury rate. The 1992-1996 average annual fishery-related mortality did not exceed PBR; therefore, this is not a strategic stock.

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