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, 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. 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 et al. 2008b). The Gulf of Mexico and Atlantic stocks are currently being treated as two separate stocks.

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 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
Please see appendix IV for earlier abundance estimates. 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 9,311 (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 1,000-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 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 10,761 km of trackline 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 trackline. 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 >50 m) 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 25x 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 recorded 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 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, NEFSC, pers. comm.). The value of g(0) used for this estimation was derived from the pooled 2002, 2004 and 2006 aerial survey data.

<table>
<thead>
<tr>
<th>Month/Year</th>
<th>Area</th>
<th>N_{best}</th>
<th>CV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aug 2002</td>
<td>Georges Bank to Maine coast</td>
<td>9,311</td>
<td>0.76</td>
</tr>
<tr>
<td>Jun-Aug 2004</td>
<td>Maryland to Bay of Fundy</td>
<td>15,053</td>
<td>0.78</td>
</tr>
<tr>
<td>Jun-Aug 2004</td>
<td>Florida to Maryland</td>
<td>5,426</td>
<td>0.54</td>
</tr>
<tr>
<td>Jun-Aug 2004</td>
<td>Florida to Bay of Fundy (COMBINED)</td>
<td>20,479</td>
<td>0.59</td>
</tr>
<tr>
<td>Aug 2006</td>
<td>S. Gulf of Maine to upper Bay of Fundy to Gulf of St. Lawrence</td>
<td>14,408</td>
<td>0.38</td>
</tr>
</tbody>
</table>

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 0.48 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 stock of Risso’s dolphin is 124.

ANNUAL HUMAN-CAUSED MORTALITY

Total annual estimated average fishery-related mortality or serious injury to this stock during 2004-2008 was 21 Risso’s dolphins (CV=0.35; 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 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 fishing 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 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.

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 2001-2008 were obtained from Garrison (2003), Garrison and Richards (2004), Garrison (2005), Fairfield Walsh and Garrison (2006), Fairfield Walsh and Garrison (2007), Fairfield and Garrison (2008), and (Garrison et al. 2009). 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 2008 were, respectively, 2, 0, 6, 4, 1, 0, 1, 1, 1, 6, 4, 2, 2, 0, 0, 1 and 3 (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; Fairfield Walsh and Garrison 2006; Fairfield Walsh and Garrison 2007; Fairfield and Garrison 2008) (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 2008 (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 (0.72) in 2004, 3 (1.0), 0 in 2005, 0 in 2006, 9 in 2007, and 17 in 2008 (Table 2). There is a high likelihood that dolphins released alive with ingested gear or gear wrapped around appendages will not survive (Wells et al. 2008a). The annual average combined mortality
and serious injury for 2004-2008 is 11 Risso’s dolphins (CV=0.43; 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, 15 in 2005 (0.93), and 0 in 2006 through 2008 (Table 2). The 2004-2008 average mortality in this fishery is 3 Risso’s dolphins (CV=0.93).

Mid-Atlantic Gillnet
A Risso’s dolphin mortality was observed in this fishery for the first time in 2007. The resulting estimated annual mortality for 2007 was 34 (CV=0.73). The 2004-2008 average mortality in this fishery is 7 Risso’s dolphins (CC=0.73).

Mid-Atlantic Mid-water Trawl
A Risso’s dolphin mortality was observed in this fishery for the first time in 2008. No bycatch estimate has been generated.

Table 2. Summary of the incidental mortality of Risso’s dolphin (Grampus griseus) by commercial fishery including the years sampled (Years), 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, the estimated CV of the combined estimates (Estimated CVs) and the mean of the combined estimates (CV in parentheses).

<table>
<thead>
<tr>
<th>Fishery</th>
<th>Years</th>
<th>Data Type</th>
<th>Observer Coverage</th>
<th>Observed Serious Injury</th>
<th>Observed Mortality</th>
<th>Estimated Serious Injury</th>
<th>Estimated Mortality</th>
<th>Estimated Combined Mortality</th>
<th>Estimated CVs</th>
<th>Mean Annual Mortality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pelagic Longline b</td>
<td>04-08</td>
<td>Obs. Data Logbook</td>
<td>.09, .06, .07, .07</td>
<td>2, 0, 0, 1, 0</td>
<td>0, 0, 0, 0, 0</td>
<td>28, 3, 0, 9, 17</td>
<td>0, 0, 0, 0, 0</td>
<td>28, 3, 0, 9, 17</td>
<td>.72, .65, .73</td>
<td>11 (0.43)</td>
</tr>
<tr>
<td>Northeast Sink Gillnet</td>
<td>04-08</td>
<td>Obs. Data Logbook</td>
<td>.06, .07, .04, .05</td>
<td>0, 0, 0, 0</td>
<td>0, 1, 0, 0, 0</td>
<td>0, 0, 0, 0, 0</td>
<td>0, 0, 0, 0, 0</td>
<td>0, 0, 0, 0, 0</td>
<td>.93, .0, .93, 0</td>
<td>3 (0.93)</td>
</tr>
<tr>
<td>Mid-Atlantic Gillnet</td>
<td>04-08</td>
<td>Obs. Data, Trip Logbook, Allocated Dealer Data</td>
<td>.02, .03, .04, .04, .03</td>
<td>0, 0, 0, 0</td>
<td>0, 0, 0, 0, 0</td>
<td>0, 0, 0, 0, 0</td>
<td>0, 0, 0, 0, 0</td>
<td>0, 0, 0, 0, 0</td>
<td>.73, .0, .73</td>
<td>7 (0.73)</td>
</tr>
<tr>
<td>Mid-Atlantic Midwater Trawl - Including Pair Trawl</td>
<td>04-08</td>
<td>Obs. Data Weighout Logbook</td>
<td>.064, .084, .089, .039, .133</td>
<td>0,0,0,0,0</td>
<td>0,0,0,0,1</td>
<td>na</td>
<td>na</td>
<td>na</td>
<td>na</td>
<td>na</td>
</tr>
</tbody>
</table>

TOTAL                                                                                     |       |                    |                   |                         |                   |                         |                    |                              |                  |                      |

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

Other Mortality
From 2004 to 2008, 71 Risso’s dolphin strandings were recorded along the U.S. Atlantic coast (NMFS unpublished data). Three animals during this time period had indications of human interaction, two of which were fishery interactions. Indications of human interaction are not necessarily the cause of death. In eastern Canada, one
Risso’s dolphin stranding was reported on Sable Island, Nova Scotia from 1970 to 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.

Table 3. Risso’s dolphin (Grampus griseus) reported strandings along the U.S. Atlantic coast, 2004-2008.

<table>
<thead>
<tr>
<th>STATE</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>TOTALS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maine</td>
<td>2</td>
<td></td>
<td>1</td>
<td></td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>Massachusetts&lt;sup&gt;ad&lt;/sup&gt;</td>
<td>4</td>
<td>8</td>
<td>1</td>
<td>3</td>
<td>8</td>
<td>24</td>
</tr>
<tr>
<td>Rhode Island</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>New York</td>
<td>3</td>
<td>4</td>
<td>1</td>
<td></td>
<td></td>
<td>8</td>
</tr>
<tr>
<td>New Jersey</td>
<td>5</td>
<td></td>
<td>2</td>
<td></td>
<td></td>
<td>7</td>
</tr>
<tr>
<td>Delaware</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>Maryland</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>Virginia&lt;sup&gt;b&lt;/sup&gt;</td>
<td>1</td>
<td>4</td>
<td>1</td>
<td>1</td>
<td></td>
<td>7</td>
</tr>
<tr>
<td>North Carolina&lt;sup&gt;c&lt;/sup&gt;</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td></td>
<td>6</td>
</tr>
<tr>
<td>Florida</td>
<td>3</td>
<td></td>
<td></td>
<td>1</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>EZ</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>TOTAL</td>
<td>19</td>
<td>27</td>
<td>6</td>
<td>8</td>
<td>11</td>
<td>71</td>
</tr>
</tbody>
</table>

a. One of the 2004 animals was mutilated, fluke cut off.
b. One of the 2005 animals showed signs of fishery interaction.
c. One of the 2006 animals 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**

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, cannot be considered to be insignificant and approaching a zero mortality and serious injury rate. The 2004-2008 average annual human-related mortality does not exceed PBR; therefore, this is not a strategic stock.

**REFERENCES CITED**


