Northeast Fisheries Science Center Reference Document 07-19

# Allocating Observer Sea Days to Bottom Trawl and Gillnet Fisheries in the Northeast and Mid-Atlantic Regions to Monitor and Estimate Incidental Bycatch of Marine Mammals

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**U.S. DEPARTMENT OF COMMERCE**
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Northeast Fisheries Science Center
Woods Hole, Massachusetts

November 2007

## Northeast Fisheries Science Center Reference Documents

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**This document's publication history is as follows**: manuscript submitted for review September 10, 2007; manuscript accepted through technical review October 23, 2007; manuscript accepted through policy review October 30, 2007; and final copy submitted for publication October 30, 2007. This document may be cited as:

Rossman MC. 2007. Allocating observer sea days to bottom trawl and gillnet fisheries in the Northeast and Mid-Atlantic regions to monitor and estimate incidental bycatch of marine mammals. US Dept Commer, *Northeast Fish Sci Cent Ref Doc*. 07-19; 17 p. Available from: National Marine Fisheries Service, 166 Water Street, Woods Hole, MA 02543-1026.

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## List of Acronyms

| | | |
|---|---|---|
| CV | = | coefficient of variation |
| MMPA | = | Marine Mammal Protection Act |
| NOP | = | National Observer Program |
| NEFOP | = | Northeast Fisheries Observer Program |
| NEFSC | = | Northeast Fisheries Science Center |
| NER | = | Northeast Region |
| NMFS | = | NOAA National Marine Fisheries Service |
| PBR | = | Potential Biological Removal |
| PSB | = | Protected Species Branch |
| TRP | = | Take Reduction Plan |

## Abstract

Estimating marine mammal bycatch mortality with low levels of uncertainty is important in attaining the conservation goals of the Marine Mammal Protection Act. The Protected Species Branch at the Northeast Fisheries Science Center allocates fishery observer sea days to achieve a 30% precision on estimates of incidental marine mammal bycatch in US gillnet and bottom trawl fisheries conducted off the Atlantic coast of the United States. A three-step process is used to: (1) project sample sizes; (2) proportionally allocate projected sea days to fishery strata; and (3) assign allocated sea days to ports and months within strata proportional to fishing effort. Under conditions of limited observer funding, a set of decision rules is followed to establish which fisheries will receive observer coverage. The amount of observer coverage (in sea days) needed to achieve a 30% precision in the bycatch estimates varies widely among fishery strata. In the 2007 fiscal year (October 2006 – September 2007), funding was only available for 802 observer sea days, although nearly 57,000 sea days are required provide a 30% precision in the bycatch estimates of harbor porpoise *(Phocoena phocoena)* and bottlenose dolphin *(Tursiops truncatus)* in the Northeast and Mid-Atlantic gillnet fisheries, and for pilot whales (*Globicephala* spp.), white-sided dolphin (*Lagenorhynchus acutus*), and common dolphin (*Delphinus delphis*) in the Northeast and Mid-Atlantic bottom trawl fisheries. After the decision rules were applied in FY07, all 802 observer sea days were allocated to coverage of the gillnet fisheries; 47% (377 days) was allotted to the Northeast gillnet fishery and 53% (425 days) to the Mid-Atlantic gillnet fishery. Due to the very large amount of fishing effort in the Northeast and Mid-Atlantic bottom trawl fisheries, a substantial increase in annual sampling coverage is required for monitoring what are essentially rare marine mammal bycatch events in these fisheries.

## Introduction

The Northeast and Mid-Atlantic regions of the Northeast continental shelf are home to around 30 stocks of marine mammals (Figure 1; Waring et al. 2007). Documentation of annual marine mammal mortality estimates attributed to commercial fishing operations in these regions dates back to the late 1980s (Blaylock 1995; Bravington and Bisack 1996; Bisack 1997; Belden et al. 2006; Belden 2007).

The 1994 amendments to the Marine Mammal Protection Act (MMPA) require the monitoring of bycatch mortality of marine mammals in U.S. commercial fisheries. In 2004, NOAA National Marine Fisheries Service (NMFS) published a report (NMFS 2004), which recommended that benchmark levels of precision on bycatch estimates should be about 30%.

This report documents the analytical approach that the Protected Species Branch (PSB) at the Northeast Fisheries Science Center (NEFSC) uses to allocate fishery observer coverage (in sea days) to facilitate precise estimation of bycatch mortality estimates of marine mammals in the Northeast (Maine to Connecticut) and Mid-Atlantic (New York to North Carolina) gillnet and bottom trawl fisheries (Figure 1).

## Methods

Several marine mammal species are incidentally captured in U.S. commercial gillnet and bottom otter trawl fisheries operating off the Atlantic coast (Waring et al. 2007). In this region, marine mammal species are considered for observer coverage based on either their MMPA status (endangered, threatened, strategic, or depleted), or because of Take Reduction Plan (TRP) monitoring requirements. Five species typically qualify for observer coverage: harbor porpoise (*Phocoena phocoena*); coastal bottlenose dolphin (*Tursiops truncatus*); pilot whale (*Globicephala* spp.); white-sided dolphin (*Lagenorynchus acutus*); and common dolphin (*Delphinus delphis*).

The analytical approach used annually in allocating observer coverage involves a three-step process:

(1) The number of observed fishing trips needed to achieve a 30% coefficient of variation (CV) for a bycatch estimate (within an appropriate fishery/time/area stratum) is determined from data collected in previous years (i.e., the number of observer trips and the CV of previous bycatch estimates).

(2) The number of sea days to be observed for each species (within each fishery/time/area stratum) is proportionally allocated based on: (a) the projected number of trips needed to achieve a 30% CV (step 1); (b) the average duration of a trip (in days); the amount of observer funding available; and (d) the cost of a sea day.

(3) The available sea days (step 2) are allotted to port groups and months (within a fishery/time/area stratum) proportional to the number of fishing trips (based on dealer records) previously reported in each port group/month stratum.

## Step 1

For each of the five cetacean species, the first step projects the number of sampled fishing trips required to achieve a 30% CV for the bycatch estimate. The fishing trip is the sampling platform upon which the fisheries observer is deployed, and where fisheries bycatch data are recorded.

The observer sea day projections rely heavily on the mortality analyses available for each of the five cetacean species. These have been developed using different time frames for each species and subject to varying types of data constraints. Hence, the methods used to estimate bycatch rates differ among the five species. For example, harbor porpoise bycatch rates in the gillnet fisheries are estimated using a traditional ratio estimator (Cochran 1963; Rossman and Merrick 1999), while cetacean and coastal bottlenose dolphin bycatch rates in the bottom trawl and gillnet fisheries are estimated by regressing observed takes on significant covariates using generalized linear models (Palka and Rossman 2001). As bycatches of cetaceans are rare events, pooling data over years was necessary in some cases due to sparse data. The methods used to estimate bycatch mortality for pilot whales, white-sided dolphins, and common dolphins in U.S. Atlantic bottom trawl fisheries have been documented but not published.[1]

All the bycatch analyses use stratified data. The stratification scheme (Table 1) is an implicit way to optimally allocate observer sea days, as it accounts for the inherent spatial/ temporal variability characteristic of the bycatch interactions.

The stratified bycatch rates and their associated levels of precision (referred to as the 'input baseline data') are used in the sea day projection equation. The input baseline data are derived from observations recorded by staff of the Northeast Fisheries Observer Program (NEFOP).

The projected CV for a fishery/time/area stratum is defined as the product of the observed (baseline) CV and the inverse square root of $n$ from that fishery/time/area[2]:

$$cv_{projected} = cv_{observed} \bullet \frac{1}{\sqrt{n_{relative}}} \qquad (1)$$

where $cv_{projected}$ = projected CV, $cv_{observed}$ = observed (baseline) CV, and $n_{relative}$ = relative change in the number of sampled trips (= $n_{projected}/n_{observed}$).

In the Mid-Atlantic gillnet fishery, the projected number of trips needed to achieve a 30% CV for the coastal bottlenose dolphin bycatch rates was limited to fishing trips within state waters in the coastal bottlenose dolphin habitat (Palka and Rossman 2001). However, it is also necessary to observe gillnet trips fishing in federal waters outside of coastal bottlenose habitat, because harbor porpoise interactions typically occur here (Belden 2007). This area, however, is restricted to a single stratum in the entire Mid-Atlantic region. Therefore, the projected number of trips in FY07 needed in federal waters outside of the coastal bottlenose dolphin habitat was defined to be the same coverage as occurred in 2005; that is, the projected number of observed

[1] Rossman MC. Estimated bycatch of cetaceans in Northeast U.S. bottom trawl fishing gear. Unpublished ms.

[2] Fogarty MJ, Gabriel W. 2002. Relative precision of discard estimates for the Northeast groundfish complex. Report of the National Marine Fisheries Service, Northeast Fisheries Science Center, Woods Hole MA. Unpublished ms.

trips in 2007 was calculated as the product of the total number of Mid-Atlantic observed gillnet trips fished in 2005 multiplied by the proportion of trips observed fishing in federal waters only.

In the Northeast gillnet fishery, harbor porpoise bycatch rarely occurs during the summer months (Belden et al. 2006; Belden 2007) As a result, only the winter (January–May) and fall (September–December) harbor porpoise strata were included in this analysis.

### Step 2

In step 2, observer sea days are allocated to strata (those defined in step one), within the constraints of the annual available marine mammal observer funds. To accomplish this, the projected number of sea days needed to obtain a 30% CV are estimated by multiplying the projected number of trips needed in each stratum (from step 1) by the average length of a trip within that stratum. Average trip duration is derived from observed trip length data (reported as days absent) recorded by the NEFOP. The total amount of sea days available (defined by the available funds and the cost of an observer sea day) are then allocated to strata proportional to the projected number of sea days in each stratum needed to obtain a 30% CV.

From a practical perspective, there have never been sufficient funds to allocate observer coverage at the level required to achieve 30% precision in each of the 23 marine mammal bycatch strata (Table 2). Overall, the number of observer trips would be need to be doubled (15,315 to 34,001 trips), and some strata would require greater than a 5-fold increase in the number of observer trips to achieve a 30% CV (i.e., strata 6, 8, 11, 13, and 18). Hence, apart from allocating coverage within existing financial constraints, it has also been necessary to prioritize the selection of the protected species requiring observer coverage for monitoring bycatch. For the five cetacean species considered in this report, three decision rules are used to determine which strata have priority for annual monitoring of their incidental takes. First, if a species is managed under a TRP (because the stock has been classified under the MMPA as endangered, threatened, depleted, or strategic), the species is treated as a high priority for bycatch monitoring using observer coverage. Second, if annual commercial bycatch mortality of a species is 10% or greater than its Potential Biological Removal (PBR) level, the species is also considered a high priority for monitoring. The third decision rule considers whether other sampling programs exist that could supplement or enhance those already in place to monitor marine mammal bycatch.

The total quantity of available observer sea days is determined by dividing the total amount of observer funds available by the cost of a sea day (which is determined by the NEFOP.)

In FY07, the resulting total number of sea days available for observing protected species interactions was 802 days.

### Step 3

The third and final step allocates the total number of available observer sea days (from step 2) across port group/month strata in proportion to the number of fishing trips in each port group/month stratum as reported in dealer records during the most recent year for which the dealer data are complete (in FY07, data from 2005 were used). The Northeast Region (NER)

dealer database contains records of all seafood transactions from commercial fishing trips landing federally regulated species. This database is considered to represent a complete census of commercial fishing trips, and therefore is used to determine the proportion of fishing effort (trips) by port and month. Because some fishing effort in North Carolina is not reported in the NER dealer database due to non-federally regulated fisheries and confidentiality requirements, North Carolina Division of Marine Fisheries trip ticket data are used (in conjunction with the NER dealer data) to quantify the number of trips from North Carolina.

After the annual quantity of available observer sea days have been allocated across port group/month strata, fisheries observer coverage is assigned concordant with this schedule.

## Results

Table 1 is a summary of the baseline data used to project the annual observer coverage (in sea days) needed to estimate the bycatch rates of the five cetacean species in the U.S. Atlantic bottom trawl and gillnet fisheries (Figure 1). Table 2 compares the baseline coverage and associated bycatch CVs in each sampling stratum with the coverage required to achieve a 30% CV on the estimated bycatch rate.

The relative change in the number of observer trips to achieve 30% precision differs widely among the strata (Table 2). Some strata already have a precision level better than 30% (strata 14 and 16), so projected observer trips in these strata can actually be reduced. Stratum 8, which has the poorest baseline CV (1.61) requires the largest percentage increase in number of trips (28.8 fold relative change), but is a stratum with relatively low absolute baseline observer coverage (27 trips). This is in contrast to stratum 23 where the baseline observer effort is large (3,291 trips), and only a 4-fold increase in observer trips is needed to achieve a 30% CV. However, in this stratum, this increase translates into a very large number of trips (13,592).

The projected number of observer sea days needed to achieve a 30% CV also differs widely among fisheries, ranging from 825 sea days for the bycatch estimate of harbor porpoise in the Northeast gillnet fishery to 28,627 days for the bycatch estimate of pilot whales in the Northeast and Mid-Atlantic bottom trawl fisheries (Table 3).

Both harbor porpoise and coastal bottlenose dolphin are presently being managed by TRPs because of their MMPA status as strategic and depleted stocks, respectively. Recent annual bycatch mortality estimates for both species are also within 10% of PBR (Table 4). Although pilot whale, white-sided dolphin, and common dolphin mortality is greater than 10% of PBR they are not considered endangered, threatened, depleted, or strategic (Table 4).

Hence, based on the three decision rules in step 2, all of the 802 observer sea days available in FY07 were allocated to the monitoring harbor porpoise and coastal dolphin takes in the Northeast and Mid-Atlantic gillnet fisheries (Table 3). Forty-four percent of the observer days (352 days) was allotted to the Northeast gillnet fishery to monitor harbor porpoise bycatch, and 56% (450 days) was allocated to the Mid-Atlantic gillnet fishery to monitor bycatches of harbor porpoise and coastal bottlenose dolphin (Table 3). These allocations represent only 2-3% of the projected number of observer days needed to obtain a 30% CV on the bycatch rates for each of these species in these two fisheries.

Tables 5 through 8 provide further details to illustrate how the observer sea days for the Northeast and Mid-Atlantic gillnet fisheries in FY07 (Table 3) were assigned to port and month strata.

In the Northeast gillnet fishery, harbor porpoise bycatches occur in both winter (March–May) and fall (September–December). During winter, three ports account for the majority of fishing trips in the Northeast gillnet fishery: New Bedford/Westport/Fall River, MA (26%); Little Compton, RI (23%); and Gloucester/Marblehead/Rockport, MA (14%). During the fall, Gloucester, MA (46%), Portsmouth, NH (17%), and New Bedford, MA (9%) account for most of the Northeast gillnet trips (Table 5). Based on the proportion of Northeast gillnet fishing trips in 2005 that occurred in each month/port stratum (Table 5), the 377 available observer sea days (193+184) for covering the Northeast gillnet fishery in FY07 were subdivided within each season in each month/port strata (Table 6).

In the Mid-Atlantic fishery 38% of the fishing trips came from North Carolina counties, followed by Virginia (30%) and New Jersey ports (21%;Table 7). Of the 425 observer sea days allocated in FY07 to the Mid-Atlantic gillnet fishery, 144 days were allotted to monitoring coastal bottlenose dolphin bycatch and 281 days to monitoring bycatches of harbor porpoise (Table 3). Of the latter amount, 22 days were set aside to observe the North Carolina beach seine fishery. Based on the proportion of Mid-Atlantic gillnet fishing trips in 2005 that occurred in each month/port stratum (Table 7), the 403 available observer sea days (144 + 281 – 22) for covering the Mid-Atlantic gillnet fishery in FY07 were subdivided across month/port strata (Table 8).

## Discussion

### Rare Events

Unlike most finfish bycatch, the bycatch of marine mammals is a rare event. Rare events can generate large CVs depending on the fishery sampled, the amount of observer coverage, and the frequency of the rare events. To address the high uncertainty often associated with marine mammal bycatch mortality estimates, observer data are frequently pooled over several years before analysis. However, this can be problematic with respect to generating observer coverage deployments for annual sampling programs. Due to the very large amount of fishing effort in the Northeast and Mid-Atlantic bottom trawl fisheries, a substantial increase in annual sampling coverage is required to obtain precise and accurate bycatch estimates of what are essentially rare marine mammal bycatch takes in these fisheries. This might be addressed by implementing rotational sampling programs where selected fisheries are observed on a non-annual, but periodic basis (Didier et al. 1999). Under this scenario, a high level of observer coverage is deployed once every several years to a fishery where bycatch is very rare, but intensive sampling is necessary to accurately assess stock recovery (decline in bycatch mortality) under a TRP. However, this approach may conflict with current MMPA policy requirements (which require annual mortality estimates for strategic stocks), unless it is deemed acceptable to assume that fishery bycatch rates are identical between observed and non-observed years.

### Funding

Observer sea day allocations are affected by a number of factors, and observer funding can vary widely from year to year. Sometimes these effects can be buffered by utilizing other

bycatch programs (e.g., those observing finfish bycatches) to monitor marine mammal interactions.

Occasionally, observer funding to achieve a very specific objective becomes available. In 2006, for example, funds were provided by the National Observer Program (NOP) to observe 100 sea days in the *Illex* squid bottom trawl fishery. Similarly, in 2006 and 2007, dedicated funding was made available for 114 observer sea days to monitor the bycatch of coastal bottlenose dolphin off the coast of North Carolina.

## Decision Rules

New decision rules to prioritize observer coverage among fisheries may be required in the future. If additional protected species meet the first and second criteria for monitoring, one or more additional decision rules may need to be developed. For example, if the white-sided dolphin stock was deemed to be strategic, new decision rules would have to be developed to select which strata (Table 2) would receive observer coverage, as it would be neither fiscally nor logistically possible to deploy sufficient coverage in all bottom trawl fishery sampling strata to achieve the desired 30% precision. One way to address such constraints is to evaluate the relative contribution of individual strata to the overall magnitude and imprecision of the bycatch mortality estimate for a particular species. That is, if a stratum contributes a large proportion of mortality to the total estimate and also has a high CV, this stratum should be considered a priority for receiving observer coverage. In contrast, if a stratum contributes only a small proportion of mortality to the total estimate but also has a high CV, allocation of observer coverage to this stratum might be considered as a lower, second priority. Such decisions would have to be evaluated in the context of the status (and available biological information) for the stock in question. Stocks with low PBRs are typically at more risk. In these cases, even strata contributing low mortality and possessing high uncertainty should be considered a priority for observer coverage.

## Strata Overlap

The current approach to allocating observer sea days does not account for the temporal and spatial overlap in sampling requirements among species across strata. For example, the projected number of observer days for monitoring pilot whale bycatch in the Northeast and Mid-Atlantic bottom trawl fisheries is independent of the projected observer coverage for white-sided and common dolphin bycatches, even though these projections are for the same fisheries, both in time and space. More work is needed to determine the extent of habitat and fishery strata overlap among these three species to optimize observer sea day allocations in the future.

As well, protected species observer coverage should be compared to observer coverage deployed in monitoring finfish bycatch. Potential spatial/temporal overlaps in coverage could result in the redirection of the duplicative observer days to other strata.

## Sampling Projections

Differences in projected observer coverage requirements largely reflect differences in the magnitude of fishing effort among the various fisheries in which marine mammals are incidentally taken. The bottom trawl fishery has many more vessels (and accomplishes many more fishing trips) than the gillnet fishery, and the average trip duration is much longer. Hence, from a cost perspective, increasing observer coverage to improve the precision of bycatch estimates in the bottom trawl fisheries is far more expensive than for the gillnet fisheries.

## Comparing Approaches to Observer Effort Allocation

The approaches for allocating observer coverage discussed in this report are not the only ones used in determining and assigning observer effort among fisheries. A holistic approach to monitoring bycatch (fishes, marine mammals, sea turtles, etc.) in all fisheries is presented in Wigley et al. (2007). However, it remains unclear whether a single, standardized approach is appropriate to monitor the bycatch of different taxa, and which types of estimators are best to employ in deriving bycatch values (several of these issues were discussed at an April 2006 joint meeting of the Science and Statistical Committees of the New England and Mid-Atlantic Fishery Management Councils[3]). As bycatch issues are now receiving increased attention world-wide, ongoing and future research will likely provide new insights on these approaches in the future.

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**Table 1**. Baseline data used as input to the process of allocating observer sea days by region and gear type, protected species of concern, year(s), stratified CV for the estimated bycatch rate, number of trips and sea days observed, mean observed trip duration, and stratum number.

| Region and Gear Type | Species | Year | Stratum | Bycatch Rate CV | Trips Observed | Sea Days Observed[b] | Mean Trip Duration (days) | Stratum Number |
|---|---|---|---|---|---|---|---|---|
| Northeast Gillnet | Harbor Porpoise | 2002 | Winter (Jan-May) | 0.55[a] | 125 | 125 | 1.00 | 1 |
| | | | Fall (Sept-Dec) | 0.53[a] | 130 | 130 | 1.00 | 2 |
| | | | | Total | 255 | 255 | | |
| Mid-Atlantic Gillnet | Coastal Bottlenose Dolphin | 2001-2002 (pooled) | North Carolina Management Unit - State waters Winter (Nov-Apr) | 0.39[a] | 41 | 42 | 1.02 | 3 |
| | | | Virginia Management Unit – State waters -Winter (Nov-Apr) | 0.57[a] | 29 | 29 | 1.00 | 4 |
| | | | Northern Migratory Management Unit – State waters - Summer (May-Oct) | 0.48[a] | 17 | 17 | 1.00 | 5 |
| | | | Northern North Carolina Management Unit – State waters - Summer (May-Oct) | 0.78[a] | 13 | 13 | 1.00 | 6 |
| | | | | Total | 100 | 101 | | |
| Northeast and Mid-Atlantic Bottom Trawl | Pilot Whale Spp. | 2000-2005 (pooled) | Steep Slope; Small VHP; Squid Spp. | 0.62 | 72 | 418 | 5.81 | 7 |
| | | | Steep Slope; Small and Large VHP; All Other Spp. | 1.61 | 27 | 112 | 4.15 | 8 |
| | | | Shallow Slope; Small VHP; Squid Spp. | 0.55 | 345 | 1,263 | 3.66 | 9 |
| | | | Shallow Slope; Small VHP; All Other Spp. | 0.39 | 3,997 | 14,429 | 3.61 | 10 |
| | | | Steep Slope; Large VHP; Squid Spp. | 0.80 | 12 | 110 | 9.17 | 11 |
| | | | Shallow Slope; Large VHP; Squid Spp. | 0.48 | 16 | 129 | 8.06 | 12 |
| | | | Shallow Slope; Large VHP; All Other Spp. | 0.86 | 48 | 357 | 7.44 | 13 |
| | | | | Total | 4,517 | 16,818 | | |
| | White-Sided Dolphin | 2000-2005 (pooled) | Low SST; Shallow Depth | 0.22 | 210 | 972 | 4.63 | 14 |
| | | | Mid SST; Shallow Depth | 0.60 | 611 | 3,385 | 5.54 | 15 |
| | | | High SST; Shallow Depth | 0.16 | 3,556 | 12,019 | 3.38 | 16 |
| | | | Low SST; Deep Depth | 0.40 | 137 | 1,108 | 8.09 | 17 |
| | | | Mid SST; Deep Depth | 0.67 | 430 | 3,173 | 7.38 | 18 |
| | | | High SST; Deep Depth | 0.35 | 952 | 6,693 | 7.03 | 19 |
| | | | | Total | 5,896 | 27,350 | | |
| | Common Dolphin | 2000-2005 (pooled) | Southern Georges Bank (area 525) | 0.43 | 475 | 3,710 | 7.81 | 20 |
| | | | Mid-Atlantic Shelf (areas 622, 627) | 0.35 | 167 | 905 | 5.42 | 21 |
| | | | Other Areas (areas 515, 537, 616) | 0.44 | 614 | 3,303 | 5.38 | 22 |
| | | | All other Statistical Areas | 0.61 | 3,291 | 11,7821 | 3.58 | 23 |
| | | | | Total | 4,547 | 19,700 | | |

[a] The harbor porpoise and coastal bottlenose dolphin CVs are a composite derived from combining CVs over several individual strata. For example, the harbor porpoise seasonal CV's were derived by aggregating over several spatial strata (Belden 2006) using the formula described in Wade and Angliss 1997. This is in contrast to each individual stratum CV shown for the bottom trawl fisheries.

[b] Sea days observed was estimated by multiplying the actual number of trips observed by the mean trip duration.

**Table 2**. For each stratum defined in Table 1, the observed number of trips, mean trip duration, baseline CV, projected number of trips and relative change in (N) trips needed to achieve a 30% CV.

| Stratum Number | Observed (Baseline) CV | Observed Mean Trip Duration (days) | Observed Num of Trips (ObservedN) | Projected Num of Trips (ProjectN) | Relative Change (ProjectN/ ObservedN) |
|---|---|---|---|---|---|
| 1 | 0.55 | 1.00 | 125 | 420 | 3.36 |
| 2 | 0.53 | 1.00 | 130 | 405 | 3.12 |
| | | Subtotal | 255 | 825 | 3.23 |
| 3 | 0.39 | 1.02 | 41 | 69 | 1.69 |
| 4 | 0.57 | 1.00 | 29 | 105 | 3.61 |
| 5 | 0.48 | 1.00 | 17 | 43 | 2.56 |
| 6 | 0.78 | 1.00 | 13 | 88 | 6.76 |
| | | Subtotal | 100 | 305 | 3.05 |
| 7 | 0.62 | 5.81 | 72 | 307 | 4.27 |
| 8 | 1.61 | 4.15 | 27 | 778 | 28.80 |
| 9 | 0.55 | 3.66 | 345 | 1,159 | 3.36 |
| 10 | 0.39 | 3.61 | 3,997 | 6,755 | 1.69 |
| 11 | 0.80 | 9.17 | 12 | 85 | 7.11 |
| 12 | 0.48 | 8.06 | 16 | 41 | 2.56 |
| 13 | 0.86 | 7.44 | 48 | 395 | 8.22 |
| | | Subtotal | 4,517 | 9,520 | 2.11 |
| 14 | 0.22 | 4.63 | 210 | 113 | 0.54 |
| 15 | 0.60 | 5.54 | 611 | 2,444 | 4.00 |
| 16 | 0.16 | 3.38 | 3,556 | 996 | 0.28 |
| 17 | 0.40 | 8.09 | 137 | 244 | 1.78 |
| 18 | 0.67 | 7.38 | 430 | 2,146 | 4.99 |
| 19 | 0.35 | 7.03 | 952 | 1,295 | 1.36 |
| | | Subtotal | 5,896 | 7,238 | 1.23 |
| 20 | 0.43 | 7.81 | 475 | 974 | 2.05 |
| 21 | 0.35 | 5.42 | 167 | 227 | 1.36 |
| 22 | 0.44 | 5.38 | 614 | 1,320 | 2.15 |
| 23 | 0.61 | 3.58 | 3,291 | 13,592 | 4.13 |
| | | Subtotal | 4,547 | 16,113 | 3.54 |
| | | Total | 15,315 | 34,001 | 2.22 |

**Table 3**. For each fishery, protected species, time and area, observed mean trip duration, projected number of observer sea days needed to obtain a 30% CV, the number of sea days that could be funded with the available money during FY07, and the projected CV expected from the funded sea days. Funded observer sea days were allocated proportionally to the projected number of sea days.

| **Fishery** | **Species – season (water body)** | **Observed Mean Trip Duration (days)** | **Projected Observer Sea Days** (= ProjectN * mean obs. trip duration) | **Proportion Of Projected Observer Sea Days** | **Gillnet Only** Proportion of Observer Sea Days | **FY07** number of funded sea days (= gillnet proportion * **802**) | **Projected CV for FY07 funded sea days** |
|---|---|---|---|---|---|---|---|
| Northeast Gillnet | Harbor Porpoise – Winter (Jan-May) | 1.0 | 420[a] | 0.01 | 0.24 | **193** | **0.44** |
| | Harbor Porpoise – Fall (Sep-Dec) | 1.0 | 405[a] | 0.01 | 0.23 | **184** | **0.44** |
| Mid-Atlantic Gillnet | Coastal Bottlenose Dolphin – Jan-Dec (State coastal habitat) | 1.0 | 305[b] | 0.01 | 0.18 | **144** | **0.44** |
| | Harbor porpoise- Jan-Dec (Federal waters) | 1.5 | 612[c] | 0.01 | 0.35 | **281** | **0.44** |
| | **Gillnet Total** | | 1,742 | | 1.00 | **802** | |
| Northeast and Mid-Atlantic Bottom Trawl | Pilot Whale | 3.66, 3.61 | 28,627[d] | 0.50 | | | |
| | White-Sided Dolphin | 8.09, 7.38 | 17,811[e] | 0.31 | | | |
| | Common Dolphin | 5.42, 5.38 | 8,332[f] | 0.15 | | | |
| Total | | | 56,512 | 1.00 | | | |

[a] Number of projected trips to achieve a CV near 30% from Table 2 multiplied by mean trip duration in the Northeast, which was one day.
[b] Sum of projected trips from strata 3-6 (305 trips) multiplied by 1.00 (mean observed trip duration from state waters within coastal bottlenose dolphin habitat only) = 305 observer sea days.
[c] Total trips observed in 2005 (= 474) multiplied by 0.86 (the proportion of trips observed in federal waters only) = 408 trips to be allocated to mid-Atlantic federal waters , then multiplied by 1.5 (mean observed trip duration in the mid-Altantic) = 612 observer sea days.
[d] Only strata 9 and 10 were selected based on the higher levels of mortality from these strata. The mean observed trip duration from strata 9 and 10 was 3.66 and 3.61 days, respectively.
[e] Only strata 17 and 18 were selected based on the higher levels of mortality from these strata. The mean observed trip duration from strata 17 and 18 was 8.09 and 7.38 days, respectively.
[f] Only strata 21 and 22 were selected based on the higher levels of mortality from these strata. The mean observed trip duration from strata 21 and 22 was 5.42 and 5.38 days, respectively.

**Table 4**. Biological and conservation status associated with Western North Atlantic cetacean species considered for annual fisheries bycatch monitoring. PBR=Potential Biological Removal; E=endangered; T=Threatened; D=Depleted; S=Strategic; A=mortality >=10% of PBR; TRP=Take Reduction Plan. These data are posted in Marine Mammal Stock Assessment final draft 2007 report, available online at http://www.nmfs.noaa.gov/pr/pdfs/sars/ao2007_draft.pdf.

| Species of Concern | Stock or Management Unit | PBR | Mean Annual Mortality Estimate (CV) | Status (E, T, D, S, or A) | TRP |
|---|---|---|---|---|---|
| Harbor Porpoise (*Phocoena phocoena*) | Gulf of Maine/Bay of Fundy | 610 | 734 (0.16) | S | Yes |
| Bottlenose Dolphin Coastal Morphotype (*Tursiops truncatus*) | Northern Migratory | 73.1 | 15 (0.16) | D and S | Yes |
| | Northern North Carolina | 19.6 | 9 (0.41) | D and S | Yes |
| | Southern North Carolina | 7.9 | Unk (NA) | D and S | Yes |
| | North Carolina Mixed | 67.8 | 37 (0.22) | D and S | Yes |
| Pilot Whale spp. (*Globicephala spp.*) | Western North Atlantic | 249 | 163 (0.09) | A | Yes[a] |
| White-sided Dolphin (*Lagenorynchus acutus*) | Western North Atlantic | 509 | 357 (0.11) | A | No[a] |
| Common Dolphin (*Delphinus delphis*) | Western North Atlantic | 1000 | 151 (0.11) | A | No[a] |

[a] A take reduction strategy document is presently being prepared by the Northeast Regional office and the Atlantic Trawl Gear Take Reduction Team (ATGTRT). Although none of the cetacean species interactiong with this gear are classified as strategic at the present time, the ATGTRT is being proactive by developing a strategy document to continue monitoring and research of commercial trawl fisheries to reduce incidental bycatch of protected species.

**Table 5**. Proportion of 2005 dealer reported trips (converted to sea days) by month and port group for the Northeast gillnet fishery. The observer sea days to monitor harbor porpoise bycatch during the winter (193[a]) and fall (184) season (Table 4) are applied to the following proportions.

| | Winter | | | | Fall | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Port Group** | **Mar** | **Apr** | **May** | **Total** | **Sep** | **Oct** | **Nov** | **Dec** | **Total** |
| **Camp Ellis, Cape Porpoise, ME** | 0.000 | 0.006 | 0.000 | 0.006 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| **Portland (Harpswell), ME** | 0.011 | 0.028 | 0.011 | 0.051 | 0.016 | 0.008 | 0.000 | 0.000 | 0.023 |
| **Portsmouth, Hampton, Seabrook, Rye, NH** | 0.011 | 0.023 | 0.006 | 0.040 | 0.055 | 0.055 | 0.039 | 0.023 | 0.172 |
| **Chatham, MA** | 0.000 | 0.023 | 0.040 | 0.063 | 0.031 | 0.023 | 0.016 | 0.008 | 0.078 |
| **Gloucester, Marblehead (Rockport), MA** | 0.074 | 0.023 | 0.040 | 0.136 | 0.109 | 0.109 | 0.117 | 0.125 | 0.461 |
| **New Bedford, Westport, (Fall River), MA** | 0.063 | 0.068 | 0.131 | 0.261 | 0.016 | 0.016 | 0.031 | 0.031 | 0.094 |
| **Scituate, Plymouth, (Marshfield), MA** | 0.045 | 0.017 | 0.034 | 0.097 | 0.016 | 0.000 | 0.000 | 0.016 | 0.031 |
| **Little Compton, Tiverton, Newport, RI** | 0.000 | 0.040 | 0.188 | 0.227 | 0.023 | 0.023 | 0.008 | 0.008 | 0.063 |
| **Pt. Judith, New Shoreham, RI** | 0.006 | 0.028 | 0.080 | 0.114 | 0.016 | 0.016 | 0.016 | 0.000 | 0.047 |
| **Mystic, New London, Stonington, Waterford, CT** | 0.000 | 0.000 | 0.006 | 0.006 | 0.008 | 0.008 | 0.008 | 0.008 | 0.031 |
| **Total** | 0.210 | 0.256 | 0.534 | 1.000 | 0.289 | 0.258 | 0.234 | 0.219 | 1.000 |

[a] Funding often doesn't become available for allocating sea days until late in the first quarter of the calendar year. As a result, the schedule of sea days begins in the month of March. Observer sea days for the months of January and February are generally covered by funds carried over from the previous fiscal year.

**Table 6.** Sea day allocation schedule for the Northeast gillnet fishery to monitor bycatch of harbor porpoise. The proportions from Table 5 were applied to the winter (193) and fall (184) sea days outlined in Table 4.

| Port Group | Mar | Apr | May | Total | Sep | Oct | Nov | Dec | Total |
|---|---|---|---|---|---|---|---|---|---|
| **Camp Ellis, Cape Porpoise, ME** | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| **Portland (Harpswell), ME** | 2 | 5 | 2 | 10 | 3 | 1 | 0 | 0 | 4 |
| **Portsmouth, Hampton, Seabrook, Rye, NH** | 2 | 4 | 1 | 8 | 10 | 10 | 7 | 4 | 32 |
| **Chatham, MA** | 0 | 4 | 8 | 12 | 6 | 4 | 3 | 1 | 14 |
| **Gloucester, Marblehead (Rockport), MA** | 14 | 4 | 8 | 26 | 20 | 20 | 22 | 23 | 85 |
| **New Bedford, Westport, (Fall River), MA** | 12 | 13 | 25 | 50 | 3 | 3 | 6 | 6 | 17 |
| **Scituate, Plymouth, (Marshfield), MA** | 9 | 3 | 7 | 19 | 3 | 0 | 0 | 3 | 6 |
| **Little Compton, Tiverton, Newport, RI** | 0 | 8 | 36 | 44 | 4 | 4 | 1 | 1 | 12 |
| **Pt. Judith, New Shoreham, RI** | 1 | 5 | 15 | 22 | 3 | 3 | 3 | 0 | 9 |
| **Mystic, New London, Stonington, Waterford, CT** | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 6 |
| **Total** | 41 | 49 | 103 | 193 | 53 | 47 | 43 | 40 | 184 |

**Table 7**. Proportion of 2005 dealer reported trips (converted to sea days) by month and port group for the mid-Atlantic gillnet fishery. The 425[a] total observer sea days to monitor coastal bottlenose dolphins (144) and harbor porpoise bycatch (281) (Table 4) are applied to the following proportions.

| Geographic Area | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Freeport, NY** | 0.000 | 0.002 | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 | 0.000 | 0.035 |
| **Hampton Bay, Islip, Montauk, Greenport, Ammagansett, NY** | 0.000 | 0.002 | 0.014 | 0.012 | 0.007 | 0.005 | 0.000 | 0.000 | 0.005 | 0.005 | 0.049 |
| **Cape May, Wildwood, Sea Isle C., NJ** | 0.000 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.000 | 0.019 |
| **Long Beach, Barnegat Light, Point Pleasant, Watertown, other Ocean/Monmouth county, NJ** | 0.000 | 0.014 | 0.026 | 0.026 | 0.016 | 0.016 | 0.021 | 0.021 | 0.028 | 0.019 | 0.187 |
| **Ocean city, other Worcester County, MD** | 0.002 | 0.002 | 0.002 | 0.000 | 0.000 | 0.002 | 0.005 | 0.002 | 0.005 | 0.002 | 0.023 |
| **Indian River, Lewes, other Sussex County, DE** | 0.005 | 0.005 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.009 |
| **Chincoteague, Wachapreague, Other Accomac, VA** | 0.002 | 0.007 | 0.030 | 0.014 | 0.012 | 0.016 | 0.014 | 0.014 | 0.012 | 0.007 | 0.129 |
| **Matthews County, VA** | 0.005 | 0.009 | 0.009 | 0.005 | 0.007 | 0.012 | 0.009 | 0.009 | 0.005 | 0.000 | 0.070 |
| **Norfolk County, VA** | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.002 | 0.002 | 0.005 | 0.002 | 0.002 | 0.014 |
| **Hampton VA - oceanside effort** | 0.009 | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 | 0.009 | 0.014 | 0.065 |
| **Northampton County, VA** | 0.000 | 0.002 | 0.005 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.000 | 0.000 | 0.019 |
| **VA Beach, Lynnhaven, Newport News, Other York County, VA** | 0.005 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.005 | 0.007 | 0.005 | 0.009 | 0.042 |
| **Brunswick, NC** | 0.005 | 0.007 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.009 | 0.009 | 0.002 | 0.044 |
| **Carteret, NC** | 0.005 | 0.005 | 0.005 | 0.000 | 0.000 | 0.000 | 0.002 | 0.009 | 0.007 | 0.002 | 0.035 |
| **Dare County, NC** | 0.030 | 0.021 | 0.021 | 0.014 | 0.012 | 0.007 | 0.012 | 0.033 | 0.021 | 0.026 | 0.196 |
| **Hyde County, NC** | 0.005 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.002 | 0.002 | 0.005 | 0.014 |
| **New Hanover, NC** | 0.002 | 0.007 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.007 | 0.005 | 0.000 | 0.021 |
| **Onslow, NC** | 0.005 | 0.014 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.005 | 0.005 | 0.000 | 0.028 |
| **Total** | 0.079 | 0.107 | 0.129 | 0.089 | 0.072 | 0.079 | 0.086 | 0.138 | 0.126 | 0.093 | 1.000 |

[a] Funding often doesn't become available for allocating sea days until late in the first quarter of the calendar year. As a result, the schedule of sea days begins in the month of March. Observer sea days for the months of January and February are generally covered by funds carried over from the previous fiscal year.

**Table 8**. Sea day allocation schedule for the mid-Atlantic gillnet fishery to monitor bycatch of coastal bottlenose dolphin and harbor porpoise. The proportions from Table 7 were applied to the 403 sea days (144+281-22[a]) outlined in Table 4.

| Geographic Area | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Freeport, NY** | 0 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 0 | 14 |
| **Hampton Bay, Islip, Montauk, Greenport, Ammagansett, NY** | 0 | 1 | 6 | 5 | 3 | 2 | 0 | 0 | 2 | 2 | 20 |
| **Cape May, Wildwood, Sea Isle C., NJ** | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 8 |
| **Long Beach, Barnegat Light, Point Pleasant, Watertown, other Ocean/Monmouth county, NJ** | 0 | 6 | 10 | 10 | 7 | 7 | 8 | 8 | 11 | 8 | 75 |
| **Ocean city, other Worcester County, MD** | 1 | 1 | 1 | 0 | 0 | 1 | 2 | 1 | 2 | 1 | 9 |
| **Indian River, Lewes, other Sussex County, DE** | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 |
| **Chincoteague, Wachapreague, Other Accomac, VA** | 1 | 3 | 12 | 6 | 5 | 7 | 6 | 6 | 5 | 3 | 52 |
| **Matthews County, VA** | 2 | 4 | 4 | 2 | 3 | 5 | 4 | 4 | 2 | 0 | 28 |
| **Norfolk County, VA** | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 2 | 1 | 1 | 6 |
| **Hampton VA - oceanside effort** | 4 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 4 | 6 | 26 |
| **Northampton County, VA** | 0 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 8 |
| **VA Beach, Lynnhaven, Newport News, Other York County, VA** | 2 | 1 | 1 | 1 | 1 | 1 | 2 | 3 | 2 | 4 | 17 |
| **Brunswick, NC** | 2 | 3 | 1 | 1 | 1 | 1 | 1 | 4 | 4 | 1 | 18 |
| **Carteret, NC** | 2 | 2 | 2 | 0 | 0 | 0 | 1 | 4 | 3 | 1 | 14 |
| **Dare County, NC** | 12 | 8 | 8 | 6 | 5 | 3 | 5 | 13 | 8 | 10 | 79 |
| **Hyde County, NC** | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 2 | 6 |
| **New Hanover, NC** | 1 | 3 | 0 | 0 | 0 | 0 | 0 | 3 | 2 | 0 | 8 |
| **Onslow, NC** | 2 | 6 | 0 | 0 | 0 | 0 | 0 | 2 | 2 | 0 | 11 |
| **Total** | 32 | 43 | 52 | 36 | 29 | 32 | 35 | 56 | 51 | 38 | 403 |

[a] A total of 22 days were set aside to observe the North Carolina Beach Seine fishery.

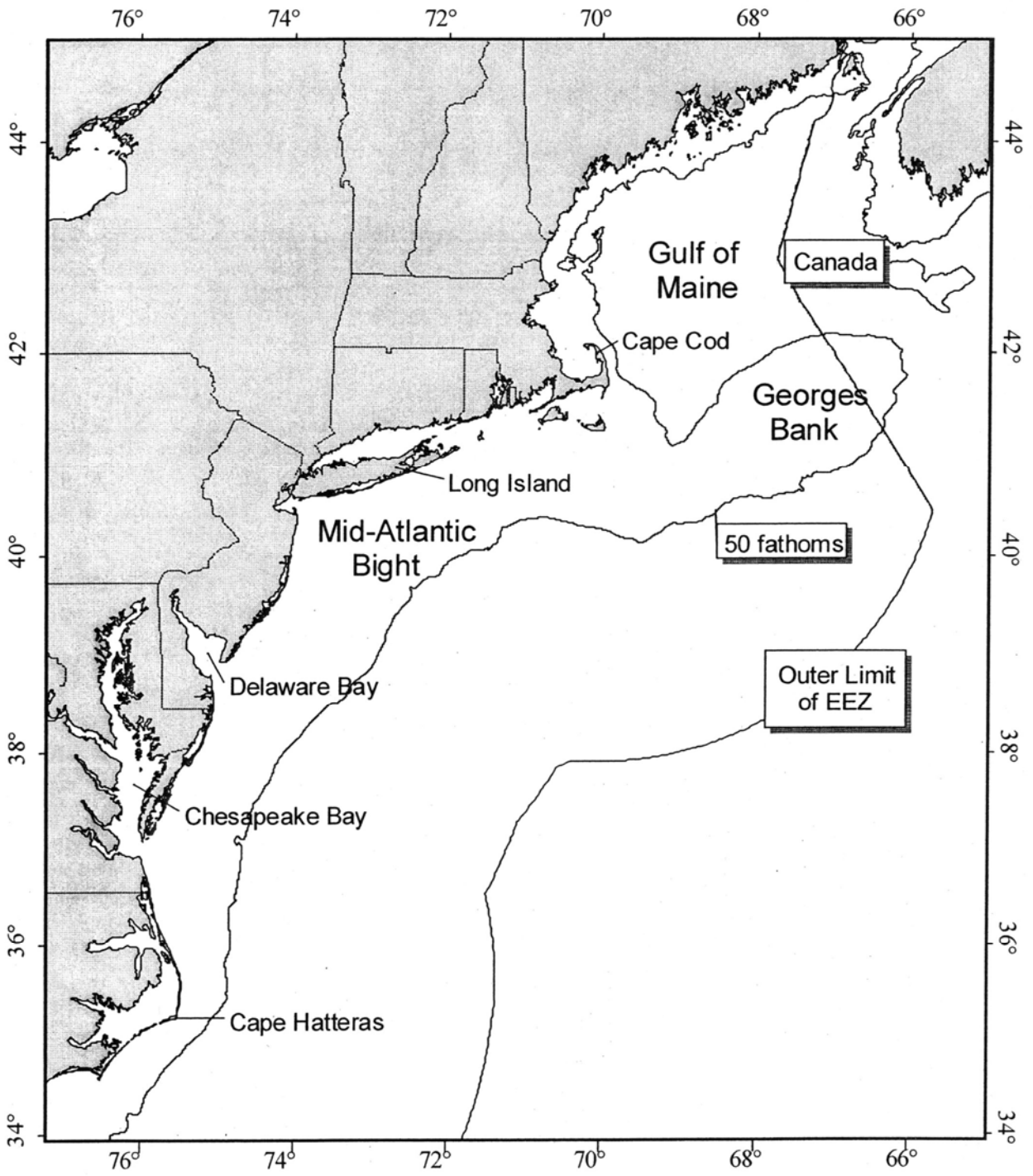


**Figure 1**. U.S. Northeast Continental Shelf, showing the EEZ (200 nautical miles), and the Gulf of Maine, Georges Bank, and Mid-Atlantic Bight. Source: Stevenson et al. 2004.

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