Northeast Fisheries Science Center Reference Document 08-17

# Preparation of the Northeast Fisheries Observer Program Gillnet Data for Use in Bycatch Analyses of Protected Species

by Melissa L. Warden and Christopher D. Orphanides

August 2008

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## ABSTRACT

Bycatch analyses of protected species (marine mammals, sea turtles, and seabirds) in domestic commercial fisheries off the Atlantic coast of the USA are usually conducted using data collected by the Northeast Fisheries Observer Program (NEFOP). In this paper, the preparation of a standard dataset of the 1989–2006 NEFOP gillnet data is described for use in bycatch estimation. Dressed landed weights were converted to live weights using established conversion factors, resulting in a 3.76% increase in observed weights in the NEFOP gillnet database. Data on additional variables such as bathymetry, sea surface temperature, chlorophyll *a* concentrations, oceanographic fronts, and distances from the coastline and bottom depth contours were obtained through Geographic Information Systems. Approximately 93% of missing depth and sea surface temperature values were replaced by GIS-acquired values. Other missing values were imputed through medians from representative strata. The standard dataset will reduce data preparation effort for bycatch assessments and enable consistency and reproducibility of bycatch estimates and other related analyses.

# 1. INTRODUCTION

Gillnet fisheries are major components of the U.S. Northeast and Mid-Atlantic commercial fisheries. Incidental bycatch of seabirds, sea turtles, and marine mammals in gillnets are recorded by the Northeast Fisheries Observer Program (NEFOP). This is the only reliable source of fishery bycatch information for this region. The Protected Species Branch (PSB) of the Northeast Fisheries Science Center (NEFSC) regularly uses NEFOP data to estimate marine mammal bycatch (Belden 2007; Belden and Orphanides 2007; Belden et al. 2006; Bisack 2003; Rossman and Merrick 1999) and is also using the data to estimate seabird (Warden in prep) and sea turtle bycatch (Murray in prep).

The NEFSC Sea Sampling Observer Program, presently known as NEFOP, was initiated in 1989 to document the bycatch of fish, marine mammals, turtles, seabirds, and invertebrates taken during commercial fishing operations (Waring et al. 2007). Observer-acquired information also includes fishery-related data such as landings and discards, as well as habitat, gear, and vessel characteristics (NEFSC 2008). Although the NEFOP database has a small percentage of missing values, the wealth of information in the database enables the derivation of additional variables useful in bycatch estimation.

This document outlines the augmentation of the NEFOP gillnet dataset for use in bycatch analysis. The creation of new variables from existing variables is described, as well as the addition of environmental data from outside sources and the imputation of missing values. The approaches described may also serve as a template for possible augmentations to other fisheries datasets.

# 2. METHODS

## 2.1 Data

The NEFOP data represent observed fishing activity in state and federal waters from Maine to North Carolina (Figure 1). The highest concentrations of observed hauls are in the Gulf of Maine off of northern and central Massachusetts, and southeast of Cape Cod. The Mid-Atlantic gillnet fishery is primarily coastal with the highest densities of observed hauls off of Cape Hatteras and in the mouth of Chesapeake Bay.

From 1989 through 2006, NEFOP observed nearly 90,000 gillnet hauls (Table 1). Estimated observer coverage in the gillnet fishery (% by weight of total annual gillnet landings in observed hauls) varied annually from 1–7% in the Northeast region and 1–5% in the Mid-Atlantic (Table 2). During the 18-year period, observers recorded more than 4,500 incidental takes, including more than 2,700 seabirds, 900 cetaceans, 900 pinnipeds, and 70 sea turtles (Figure 2).

## 2.2 New Variable Creation

### *2.2.1 Geographical and Regulatory Variables*

Regional closures and seasonal gear restrictions define important spatial and temporal features in the NEFOP gillnet data. Variables were added to the dataset to delineate the following: (1) regions within the study area; (2) harbor porpoise and large whale regulatory areas; and (3) the percentage of active marine mammal acoustic deterrent devices (i.e., pingers) on a net relative to the required amount. Appendix A provides full descriptions of the new variables created.

### *2.2.2 Landings Converted from Dressed Weight to Live Weight*

The NEFOP database is frequently used to estimate bycatch rates, which are subsequently applied to fishery effort/catch data to derive fishery-wide bycatch estimates for various species. Databases such as the Northeast Region Vessel Trip Report (VTR) database and the Commercial Fisheries Database System (CFDBS) are the principal sources for the detailed information on fishing effort and catch usually used in developing these estimates.

Landings are often used as a unit of effort in the gillnet fishery, as landings data are generally more complete and available than “true” effort data (i.e., time spent fishing). The landings can be whole or processed—defined in the NEFOP data as round or dressed, respectively. Dressed landings might be headed or gutted fish, mollusk meats, or parts such as monkfish tails or livers. In the VTR and CFDBS databases, dressed weights are converted to round weights (also known as live weights). For NEFOP landings to be directly comparable to landings in the VTR and CFDBS databases, dressed weights recorded by observers were also converted to live weights.

The conversion from dressed weight to live weight was based on three factors:

1) A common species code indicating the species and condition (i.e., round, gutted, tails, livers, etc.) of the landed product;
2) A NEFOP variable indicating whether the catch was round or dressed;[1] and
3) The CFDBS conversion factor[2] for dressed to live weight for the species and product condition.

The product condition in the CFDBS table is called the grade. Table 3 lists CFDBS species codes, grades, and factors for converting dressed pounds to live pounds for major species affected by the conversion. The first three digits of the species code represent the species, and the final digit represents the grade. Grade indicators are not consistent across species (e.g., ‘0’ indicates tails for monkfish, but round weight for bluefish).

Grade indicators are not widely used as part of NEFOP species codes. For most species, NEFOP uses only the species code with the grade indicator for round catch (e.g., all landings of cod are recorded with a species code of 0818). The dressed/round variable must be relied upon to distinguish dressed weight from live weight. Major exceptions are monkfish and skates: NEFOP species codes for monkfish indicate whether the grade is round, tails, livers, cheeks, or belly flaps (note that gutted monkfish is not indicated—more on that type of conversion below); skate species codes indicate whether the grade is round or wings.

The monkfish and skate conversions from dressed to live weight were the simplest because their NEFOP species codes with grade indicators matched the species codes with grade indicators in the CFDBS table. For example, monkfish tails have the same species code (0120) in both databases and the conversion factor in the CFDBS table is 3.32 live pounds per dressed pound. Therefore, to derive a comparable weight between the databases, 100 lbs of monkfish tails in the NEFOP database was converted to 332 lbs (3.32*100) of live monkfish.

The grade portion of the species codes for skates sometimes contradicted the dressed/round variable. NEFOP is currently investigating the discrepancies, but for the 1989–

[1] The dressed/round flag is not available before 1994 so the early data were not adjusted.
[2] The same factor used to adjust the VTR and CFDBS landings.

2006 dataset used in the present undertaking, skate landings were converted only if the species code and the dressed/round variable agreed in indicating that the catch was landed as dressed (in this case, as wings).

Conversions for other species were more complex because the NEFOP species codes did not contain grade indicators. If catch was flagged as dressed according to the dressed/round variable, a grade was assigned from the CFDBS table using the smallest conversion factor for that species. To enable the conversion, the species code in the NEFOP data was changed to match the species code for the appropriate grade in the CFDBS table. For example, 100 lbs of dressed cod in the NEFOP data has the same species code as round cod (0818), but the dressed/round variable indicates that the catch is dressed. In Table 3, the grades for cod include both “dressed” and “gutted,” with conversion factors of 1.6 and 1.17, respectively. To avoid overinflating landings, the conversion from an unspecified form of dressed weight to a live weight would assume the catch to be gutted (as it has the smaller conversion factor). The species code for these 100 lbs would be changed to the CFDBS species code for gutted cod (0817) and the NEFOP landings would then be multiplied by 1.17 for a total of 117 lbs of live cod. This type of conversion was applied to monkfish, bluefish, cod, haddock, white hake, pollock, smooth dogfish, spiny dogfish, and silver hake (also known as whiting). A few other minor species were infrequently identified as dressed, but the catch amounts were so minimal over the time series that these were not converted.

After all dressed weights were converted to live weights, the live weight for all kept catch in each observed haul was summed, as was the live weight for all discarded catch in each haul. Catch recorded as kept but not landed in port[3] was treated as discarded, as the VTR and CFDBS databases contain only landed catch. Prior to 2001, all kept catch was listed with the same fish disposition so it was not possible to determine whether the catch was landed in port. For these years, all catch not discarded was assumed landed.

### *2.2.3 Environmental Data*

A number of environmental variables from external sources were added to the NEFOP gillnet dataset for use in analyzing the effect of environmental factors on bycatch patterns. These included the following: sea surface temperature (SST), sea bottom temperature, indications of oceanographic fronts, surface chlorophyll *a* concentrations, bottom depth, bottom slope, distances from the coast and bottom depth contours, and North Atlantic Oscillation (NAO) values. The bottom depth and SST data from external sources were used to fill in missing values in the NEFOP bottom depth and SST variables (refer to section 2.3 for details).

Bottom depth, bottom slope, distances from the coast, and distances from bottom depth contours were added to the NEFOP database using electronic depth maps. Depth measurements were extracted from three topography datasets (in order of increasing spatial resolution): the NGDC ETOPOv2[4] dataset; the Shuttle Radar Topography Mission[5] bathymetry dataset; and the National Geophysical Data Center (NGDC) Coastal Relief[6] dataset. Bottom slope in degrees of angle was calculated by applying the ArcGIS 9.2 Slope function to the ETOPOv2 dataset. Distance rasters for bottom depth contours and the coastline were generated using the ETOPOv2

[3] This information is revealed by fish disposition categories: general kept; kept, transferred to another vessel; kept, used for bait; kept, eaten by the crew. Anything but general kept was treated as a discard.
[4] http://www.ngdc.noaa.gov/mgg/image/2minrelief.html
[5] http://topex.ucsd.edu/WWW_html/srtm30_plus.html
[6] http://www.ngdc.noaa.gov/mgg/coastal/coastal.html

dataset and the ArcGIS Euclidean Distance tool. Distances for fishing locations were retrieved from the rasters using the Extract Values to Points tool.

Sea surface temperatures for NEFOP records were retrieved from satellite data. Five-day median SST image composites were created by merging SST from MODIS Aqua[7], MODIS Terra[8], GOES[9], and AVHRR Pathfinder[10] satellite data sources. SST data were also retrieved from a NASA Jet Propulsion Laboratory climatology dataset.[11] Using ArcGIS 9.2 and IDL 6.3 software, SST was extracted from satellite images for each fishing location in the NEFOP database if the satellite data were available for that time and location. Point estimates for SST (derived from the value of one pixel, roughly 4 km x 4 km) were extracted from SST images, in addition to the median of the surrounding area (covering roughly 12 km x 12 km). For the final SST variable, point SST data were preferred over a 12 km x 12 km median temperature and five-day median images were preferred over climatology data. For a secondary SST variable, the best five-day median value was compared to the best climatology value and if the absolute difference was greater than 2.5˚C, the five-day median was deemed unreliable and the climatology was used for the final SST value. A third SST variable was created using the same process, but with a difference cutoff of 10˚C.

The strength and direction of oceanographic fronts were estimated from the five-day SST composites using Python scripts run in ArcGIS 9.2. The output frontal strength values were the maximum difference in temperature between a center SST pixel and its adjacent pixels, covering a roughly 12 km x 12 km area. The direction (aspect) of the frontal gradient was recorded as a compass value, 0°-359°, where 0° is due north.

Based on the TEMPEST routine (Mountain 1989), estimated climatological bottom water temperature was retrieved from the Marine Resources Monitoring, Assessment, and Prediction (MARMAP) dataset. The MARMAP data represent bottom temperature distributions generated from survey cruises conducted from 1977 to 1987 (Mountain and Holzwarth 1989). These bottom temperature measurements were also used in combination with SST data and bottom depth measurements to create new variables that document surface to bottom temperature differences and surface to bottom temperature change per meter of water depth, both of which reflect stratification of the water column.

Chlorophyll *a* image data were created using SeaWiFS and MODIS satellite data when available to create five-day composites for 1997–2005, and SeaWiFS high resolution data were used to create five-day composites for 2006.[12] A chlorophyll variable was created by sampling the chlorophyll at point locations and in a roughly 12 km x 12 km area surrounding the fishing locations. Point locations were assumed to be more representative of actual conditions and were used for the final chlorophyll value if available; if not, geometric mean values for the surrounding area were used. The final chlorophyll value was also $\log_{10}$ transformed for use in statistical analysis.[13]

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[7] http://podaac-www.jpl.nasa.gov/PRODUCTS/p184.html
[8] http://podaac-www.jpl.nasa.gov/PRODUCTS/p162.html
[9] http://www.class.noaa.gov/saa/products/welcome
[10] http://podaac-www.jpl.nasa.gov/PRODUCTS/p216.html
[11] http://podaac-www.jpl.nasa.gov/PRODUCTS/p112.html
[12] All chlorophyll data used in these images accessed through the NASA's OceanColor website (http://oceancolor.gsfc.nasa.gov).
[13] Chlorophyll *a* concentrations span several orders of magnitude. A logarithmic scale results in a more manageable range. Log-transformed values generally follow a normal distribution (Campbell 1995).

Three types of North Atlantic Oscillation variables were created for the NEFOP dataset: the monthly mean NAO index,[14] three-month running averages of the monthly means, and a winter index. The winter NAO index averages the monthly means for December through March and is less noisy than the monthly index (Sandvik and Erikstad 2008).

Researchers have linked the NAO to variations in the abundance and distribution of the prey of marine mammals (GoMOOS, date unknown) and seabirds (Durant et al. 2004) via the influence of the NAO on surface water circulation patterns, but a time lag of several years may be evident. To account for delayed effects, one-year and two-year lags were created for all three NAO variables.

Additional details and descriptions of the environmental variables are provided in Appendix A.

## 2.3 Missing Values

Missing values are inevitable in a dataset as extensive as the NEFOP database. However, for analysis of rare events such as bycatch, it is important to have as complete information as possible about each observed incidental take. In recent years, seabird, sea turtle, and marine mammal bycatch has often been estimated using a model-based approach (Murray 2004, 2005, 2006; Orphanides in prep.; Palka and Rossman 2001; Rossman in prep; Warden in prep.). When developing a model, a researcher may not have prior knowledge of which variables are most important in affecting bycatch rates, and may need to evaluate or test several potential variables. To allow the greatest flexibility in conducting such analyses on all documented bycatch events, an effort was made to replace missing values in the NEFOP database with the best imputed values. For continuous variables, the following hierarchy was used:

1) GIS-acquired data[15]
2) median from the same fishing trip
3) median from the same vessel and gear type in the same year and month
4) median from the same vessel and gear type in the same year
5) median from the same vessel in the same year only if the variability within the vessel/year stratum was low (defined as the coefficient of variation (CV) for the stratum equal to 0.10 or less, where CV = standard deviation divided by mean).

For categorical variables, the following hierarchy was used:

1) value from temporally nearest haul with the same gear type on the same trip
2) value from temporally nearest haul from the same vessel and gear type in the same year and month
3) value from temporally nearest haul from the same vessel and gear type in the same year.

Several steps were taken to ensure flexibility and transparency for data users. First, all variables were copied before being modified. Second, any modified variable was assigned an additional variable to indicate the source (i.e., observed, obtained through GIS, or imputed) of the value for each haul. For a handful of variables, atypical observations were corrected from the observer log or recalculated from available data and the source variable indicates these changes.

[14] Calculated by the Climate Prediction Center (see http://www.cpc.ncep.noaa.gov/data/teledoc/teleindcalc.shtml for method). This data was retrieved from the CPC website (http://www.cpc.ncep.noaa.gov/products/precip/CWlink/pna/nao, accessed 03/21/07).

[15] Bottom depth and sea surface temperature only

In addition to the source variable, a corresponding CV variable was created which reflects the coefficient of variation of the stratum from which a replacement median originated. This provides users with a way of detecting imputed values with high variability in the source.[16]

Appendixes B.1 and B.2 provide a list of variables that were processed for missing values, descriptions of these variables, and specifics on how certain missing variables were imputed.

## 3. RESULTS AND DISCUSSION

### 3.1 Landings Converted from Dressed Weight to Live Weight

Converting dressed weights to live weights resulted in a 3.76% increase in total landed weights during 1994–2006. By species, the percent increase was as follows: skates 26%; smooth dogfish 6.4%; monkfish 5%; groundfish (cod, haddock, hake, pollock) 3.5%; bluefish 0.12%; and spiny dogfish 0.03%. The increase in monkfish weights was despite almost 30,000 pounds (0.5% of reported monkfish landings) of livers, cheeks, and belly flaps being removed because they do not contribute to the live weight (their conversion factors are 0).

The affected species were primarily in the Northeast, so the live weight conversion had little effect on landings in the Mid-Atlantic (4.5–5% increase in the Northeast and southern New England areas vs. 0.3% in the Mid-Atlantic area; see Figure 3 for regions). Annually, the greatest percentage increase in converted weights occurred in 2003 (8.6%) and 2004 (9.3%) and the least in 1995 (1.4%) and 1996 (1.7%) (Table 4).

Approximately 2,600 hauls (3% of all hauls) in the NEFOP gillnet database have no kept catch. About 150 of these hauls (0.17% of all hauls) resulted because beginning in 2001 kept catch not landed in port was considered to be discarded. These additional discards constituted approximately 77,000 pounds (0.55% of total landings during 2001–2006). Hauls with no catch pose complications when landings are used as a unit of effort in a bycatch model. In these models, landings serve as the denominator for the bycatch rate and thus to avoid division by zero, hauls with no catch are generally either omitted from the analysis or their landings incremented from zero by a small amount.

Despite the conversions for dressed weights, total landings in live pounds should be considered a slight underrepresentation of the actual observed catches. This is because some skate landings that were likely wings were not adjusted due to the discrepancies between the NEFOP species code and the dressed/round indicator variable. The NEFSC is currently developing a comprehensive table for converting dressed weights to live weights in the NEFOP data, and this undertaking will address the discrepancies and minor species that were bypassed in the current dataset. This table will be applied to future NEFOP datasets and is an improvement over the current method.

[16] If the median was derived from a single nonmissing value the CV will be missing because the standard deviation does not exist; the CV will also be missing if the mean used in calculating the CV is 0.

## 3.2 Missing Values

Most variables processed for missing values (as listed in Appendix B.1) had less than 4% of their values missing, some less than 1%. Water temperature (wtmp) had the most missing values (25.5%) over the time series (1989–2006), but this variable was not recorded until May 1994.[17] During 1995–2006, 6.1% of the water temperature values were missing—still highest among the variables examined.

Acquisition of GIS-based variables was dependent upon nonmissing point locations as well as available data for the locations. Only about 2% of hauls were missing longitude and latitude information; in 14% of these cases, the median longitude/latitude values for the fishing trip were used to replace the missing data. SST and bathymetry values acquired through GIS were widely used in filling gaps in the observer-recorded water temperature and bottom depth: 93% of missing wtmp values were filled in by the GIS-acquired SST, while 92% of missing depths were replaced with GIS-acquired bathymetry data. Summaries of missing and replacement values for all variables examined are provided in Appendix B.2.

For filling in missing values with representative medians, strata were designed to capture consistency in vessel fishing patterns. Low variability within a stratum indicates high consistency. For more than 50% of variables examined, the stratum with the lowest variability (as determined by the average CV across observations in that stratum) was vessel and year. This is because medians for this stratum were accepted only if the variability was low. On average, hauls from the same trip, and hauls from the same vessel, gear, year, and month show similar variability. For more than 60% of the variables, the stratum with the highest variability was the same vessel, gear, and year. Gear characteristics such as mesh size, number of vertical meshes on the net, and number of nets tend to show the least variability. Haul characteristics such as soak duration, haul duration, and bottom depth tend to exhibit the most variability. Appendix B.2 provides complete summaries of the variability across strata for all variables examined.

The imputation of missing values for the NEFOP gillnet dataset was undertaken to serve the needs of multiple users examining different outcomes (i.e., bycatch of different species). The approach taken was a type of conditional mean imputation, in which the means (or medians) from meaningful class levels of other observed covariates replaced missing values. Little and Rubin (2002) noted that conditional mean imputation can generate good point estimates of missing values, but such an approach ignores the uncertainty of the replacement values and may result in underestimation of standard errors, making inference invalid. However, Ambler et al. (2007) found that conditional mean imputation performed well on simulated datasets with either 50% or 25% complete cases, and the logistic regression coefficients in their evaluation were unbiased and coverage for estimated confidence intervals was good.[18] Nonetheless, because of the possible bias in standard errors, they caution against using p-values as criteria in model selection. In a simulation study (Schafer and Schenker 2000) involving bivariate normal variables with missing values on one variable, conditionally mean-imputed data showed minimal differences from complete data in the width and coverage of confidence intervals at a missing value rate of 5%, but performance deteriorated when 10% or more of the data were missing. While neither simulation study is directly applicable to the NEFOP imputed dataset, the results

[17] Other variables not recorded until 1994 are noted in Appendix B.1.
[18] Coverage of the estimated confidence interval was calculated as the proportion of 1000 simulated datasets for which the 90% confidence interval included the true regression coefficient.

provide a general sense that conditional mean imputation performs well and has minimal bias on estimates of variances when missing data problems are minor, as in the NEFOP dataset. However, information-based criteria (e.g., AIC) for model selection are recommended over hypothesis testing.

Even though conditional mean imputation is acceptable for minor missing data problems, methods of multiple imputation are generally recommended (Ambler et al. 2007; Little and Rubin 2002; Schafer 1997). In multiple imputation, several (typically 3-10) datasets are generated from an imputation model and analyses are performed on each dataset. Parameter estimates and standard errors are then pooled, incorporating the imputation variability. This method requires the outcome variable to be part of the modeling and so was not practical to implement for the current multiple-outcome dataset. Therefore, with the NEFOP imputed dataset, end users will need to decide between using the conditionally imputed medians and implementing an alternate imputation method.

## 4. CONCLUSION

In augmenting the NEFOP gillnet dataset, a consistent set of variables was provided. The scope of habitat-related variables was broadened to help explain bycatch patterns, and NEFOP landings data were standardized to a measure congruent with other regional fisheries databases. A template was established for treating missing values, and imputed values were then substituted for missing data. The standard dataset will reduce data preparation effort for bycatch assessments and enable consistency and reproducibility of bycatch estimates and other related analyses.

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**Table 1. Number of hauls observed 1989–2006 with the specified type of gillnet gear**

| | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Anchored, sink | 470 | 638 | 4547 | 5873 | 3963 | 6185 | 6188 | 5358 | 5698 | 6140 | 5240 | 5561 | 3935 | 3036 | 3270 | 6063 | 5397 | 3446 | 81,008 |
| Anchored, float | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 69 | 32 | 0 | 16 | 24 | 29 | 170 |
| Drift, small mesh * | 26 | 0 | 2 | 8 | 0 | 10 | 85 | 60 | 49 | 50 | 105 | 261 | 0 | 0 | 0 | 0 | 0 | 0 | 656 |
| Drift, float | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 34 | 138 | 120 | 36 | 141 | 469 |
| Drift, sink | 0 | 0 | 0 | 0 | 0 | 0 | 8 | 11 | 0 | 1 | 1 | 0 | 668 | 325 | 570 | 1164 | 1550 | 1259 | 5557 |
| All | 496 | 638 | 4549 | 5881 | 3963 | 6195 | 6281 | 5429 | 5747 | 6191 | 5346 | 5822 | 4672 | 3427 | 3978 | 7363 | 7007 | 4875 | 87,860 |

*defunct as of 2001

**Table 2. Estimated percentage of the gillnet fishing fleet observed, 1990–2006**

| | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Northeast | 1 | 6 | 7 | 5 | 7 | 5 | 4 | 6 | 5 | 6 | 6 | 4 | 2 | 3 | 6 | 7 | 4 |
| Mid-Atlantic | - | - | - | - | - | 5 | 4 | 3 | 5 | 2 | 2 | 2 | 1 | 1 | 2 | 3 | 4 |

The first full year of observer coverage was 1990 in the Northeast and 1995 in the Mid-Atlantic. 1990–2005 figures from Waring et al. 2007; 2006 figures from Belden and Orphanides 2007.

**Table 3. Selected CFDBS species, grades, and factors for converting dressed pounds to live pounds**

| Species Code | Species name | Grade | Factor |
|---|---|---|---|
| 0120 | Goosefish (Monkfish) | tails | 3.32 |
| 0123 | Goosefish (Monkfish) | livers | 0 |
| 0124 | Goosefish (Monkfish) | round | 1 |
| 0125 | Goosefish (Monkfish) | cheeks | 0 |
| 0127 | Goosefish (Monkfish) | belly flaps | 0 |
| 0128 | Goosefish (Monkfish) | gutted, head on | 1.14 |
| 0129 | Goosefish (Monkfish) | dressed | 2 |
| 0230 | Bluefish | round | 1 |
| 0232 | Bluefish | gutted | 1.09 |
| 0812 | Cod, Atlantic | cheeks | 0 |
| 0816 | Cod, Atlantic | dressed | 1.6 |
| 0817 | Cod, Atlantic | gutted | 1.17 |
| 0818 | Cod, Atlantic | round | 1 |
| 1477 | Haddock | round | 1 |
| 1479 | Haddock | gutted | 1.14 |
| 1533 | Hake, Atlantic, White | gutted | 1.13 |
| 1538 | Hake, Atlantic, White | dressed | 1.34 |
| 1539 | Hake, Atlantic, White | round | 1 |
| 2692 | Pollock, Atlantic | gutted, head off | 1.37 |
| 2693 | Pollock, Atlantic | drawn | 1.13 |
| 2695 | Pollock, Atlantic | round | 1 |
| 3510 | Dogfish, Smooth | gutted | 1.2 |
| 3511 | Dogfish, Smooth | round | 1 |
| 3513 | Dogfish, Smooth | gutted – cores | 2 |
| 3520 | Dogfish, Spiny | dressed | 1.2 |
| 3521 | Dogfish, Spiny | round | 1 |
| 3522 | Dogfish, Spiny | belly flaps | 16.67 |
| 3523 | Dogfish, Spiny | gutted | 1.2 |
| 3640 | Skate, Rosette | round | 1 |
| 3641 | Skate, Rosette | wings | 2.27 |
| 3650 | Skates | round | 1 |
| 3651 | Skates | wings | 2.27 |
| 3659 | Skates | heads | 0 |
| 3660 | Skate, Little | round | 1 |
| 3661 | Skate, Little | wings | 2.27 |
| 3670 | Skate, Winter | round | 1 |
| 3671 | Skate, Winter | wings | 2.27 |
| 3680 | Skate, Barndoor | round | 1 |
| 3681 | Skate, Barndoor | wings | 2.27 |
| 3700 | Skate, Thorny | round | 1 |
| 3701 | Skate, Thorny | wings | 2.27 |
| 3720 | Skate, Clearnose | round | 1 |
| 3721 | Skate, Clearnose | wings | 2.27 |
| 5090 | Hake, Silver (Whiting) | round | 1 |
| 5093 | Hake, Silver (Whiting) | dressed | 1.66 |

**Table 4. Difference in total annual landings with dressed weights (Total pounds) versus dressed weights converted to live weights (Total live pounds) for 1994–2006 NEFOP gillnet data. Considers landed catch only.**

| Year | Total pounds | Total live pounds | Difference | Percent increase |
|---|---|---|---|---|
| 1994 | 2,466,582.2 | 2,525,033.12 | 58,450.92 | 2.37 |
| 1995 | 2,937,244.4 | 2,978,699.46 | 41,455.06 | 1.41 |
| 1996 | 2,725,084.2 | 2,770,436.20 | 45,352.0 | 1.66 |
| 1997 | 3,086,732.9 | 3,203,528.57 | 116,795.67 | 3.78 |
| 1998 | 3,732,039.8 | 3,812,054.90 | 80,015.10 | 2.14 |
| 1999 | 2,755,426.4 | 2,835,275.37 | 79,848.96 | 2.90 |
| 2000 | 2,105,678.2 | 2,179,288.38 | 73,610.18 | 3.50 |
| 2001 | 1,742,144.8 | 1,811,673.95 | 69,529.15 | 3.99 |
| 2002 | 1,227,429.9 | 1,283,819.53 | 56,389.63 | 4.59 |
| 2003 | 1,722,487.6 | 1,870,056.80 | 147,569.2 | 8.57 |
| 2004 | 3,229,012.3 | 3,528,293.02 | 299,280.72 | 9.27 |
| 2005 | 3,369,280.6 | 3,469,303.39 | 100,022.79 | 2.97 |
| 2006 | 1,996,763.0 | 2,071,859.44 | 75,096.43 | 3.76 |
| total | 33,095,906.3 | 34,339,322.13 | 1,243,415.81 | 3.76 |

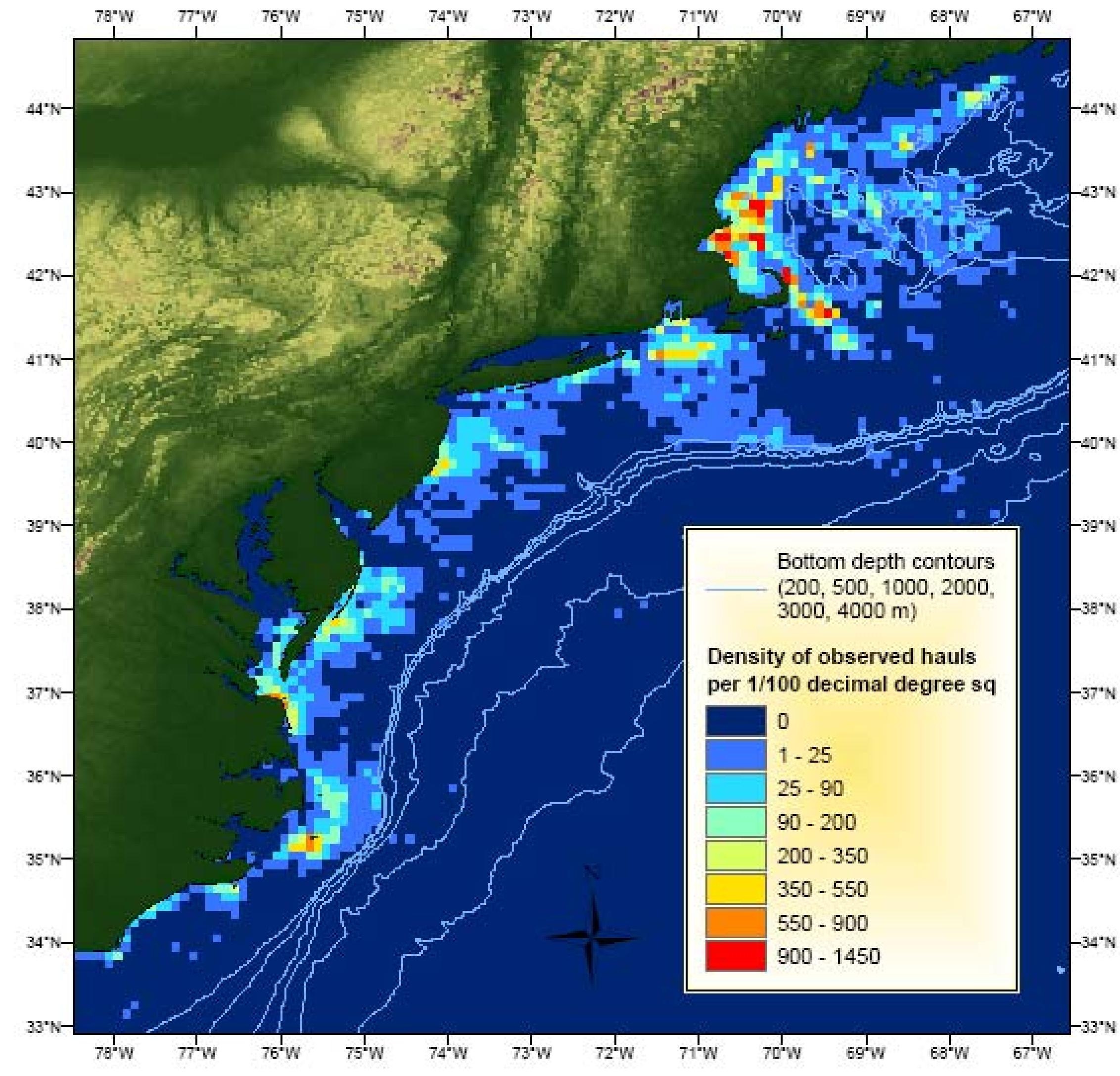


**Figure 1. Distribution of NEFOP observer effort for the Northeast and Mid-Atlantic gillnet fisheries, 1989–2006**

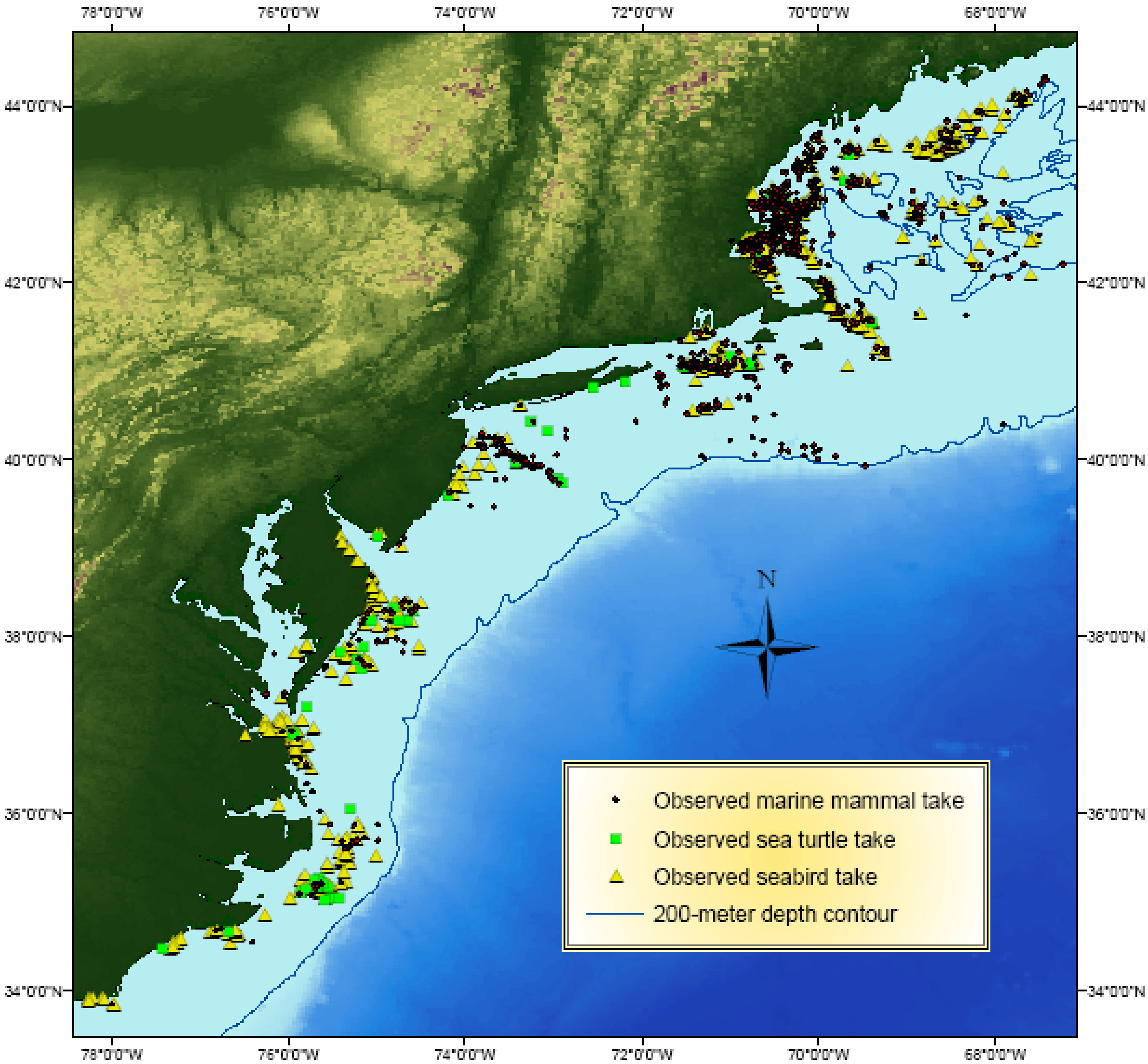


**Figure 2. Observed incidental takes in Northeast and Mid-Atlantic gillnet fisheries, 1989–2006**

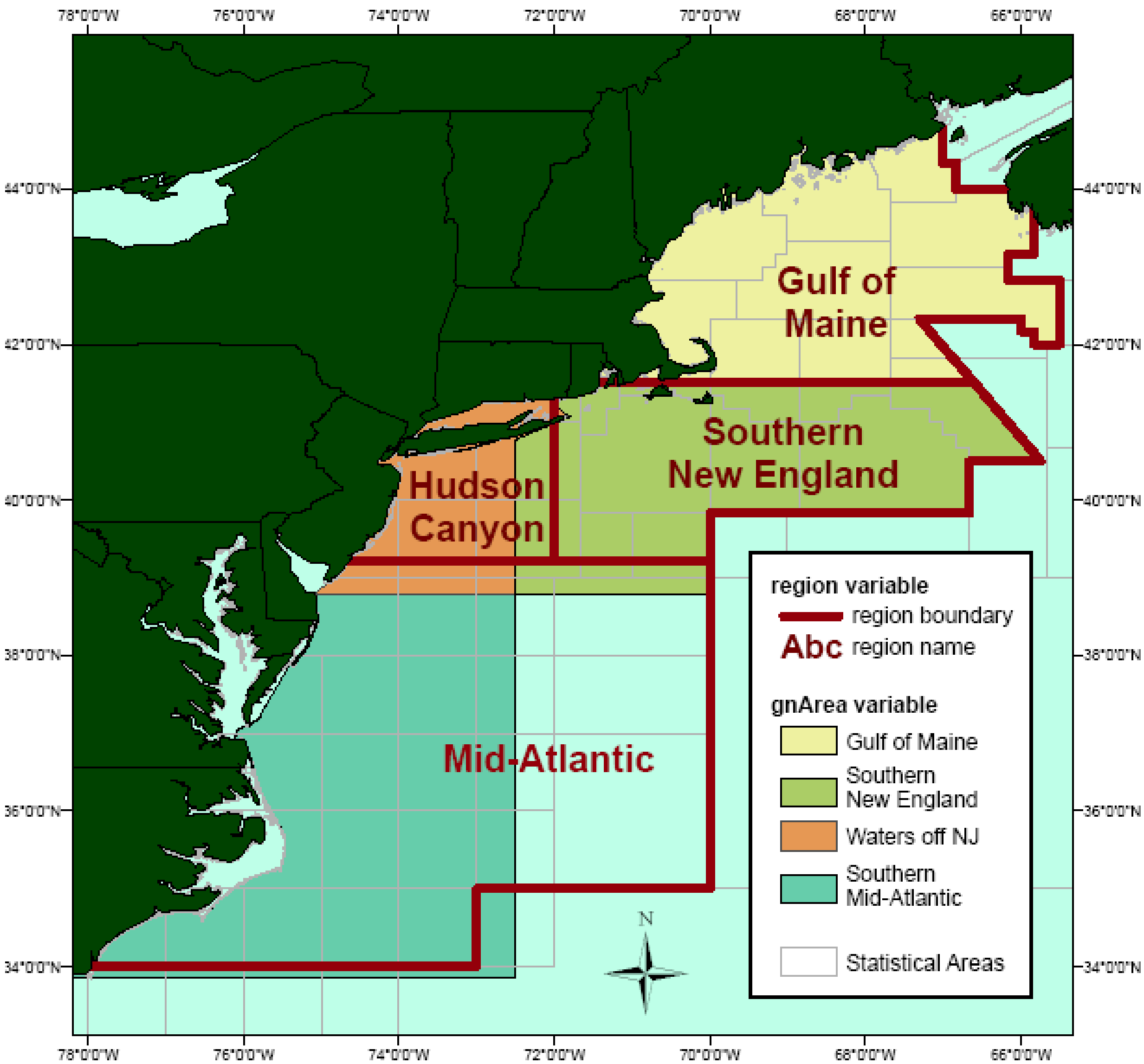


**Figure 3. Delineation of "region" and "gnArea" variables created for NEFOP gillnet dataset. For "region2" variable, Hudson Canyon is incorporated into Southern New England.**

## APPENDIX A
## Variables added to the NEFOP dataset

| Variable name | Variable description |
|---|---|
| BotTemp | climatological sea bottom temperature in degrees Celsius |
| btm_dpth | bathymetry from the National Geophysical Data Center’s ETOPOv2; in negative meters; resolution 2 arc minute (~4 kilometers) |
| btm_slp | bottom slope |
| chl_final | chlorophyll *a* concentration in milligrams/cubic meter (post-1996 only) |
| chl_final_log10 | $\log_{10}$ of chl_final |
| closure_all | all closures and gear modification areas defined by the Harbor Porpoise Take Reduction Plan:[19]<br>Cape Cod South, Cashes Ledge, Massachusetts Bay, Mid-Coast, New Jersey Mudhole, Northeast, Offshore, southern Mid-Atlantic, Waters off New Jersey<br><br>all closures defined by the Atlantic Large Whale Take Reduction Plan:<br>Cape Cod Bay Critical Habitat Area, Great South Channel Critical Habitat Area |
| closure_ma | Mid-Atlantic closures from the Harbor Porpoise or Large Whale Take Reduction Plan |
| closure_ne | Northeast closures from the Harbor Porpoise or Large Whale Take Reduction Plan |
| d_b50 | distance in either direction from the 50-meter depth contour line; in meters; resolution 100 meters |
| d_b100 | distance in either direction from the 100-meter depth contour line; in meters; resolution 100 meters |
| d_b200 | distance in either direction from the 200-meter depth contour line; in meters; resolution 1000 meters |
| d_b500 | distance in either direction from the 500-meter depth contour line; in meters; resolution 1000 meters |
| d_coast | distance from the coast; in meters; resolution 1000 meters |
| dep_cr | bathymetry from the National Geophysical Data Center’s Coastal Relief; in negative meters; resolution 3 arc second (~90 meters) |
| dep_srtm | bathymetry from the United States Geological Survey's SRTM30 v.1; in negative meters; resolution 30 arc second (~1000 meters) |
| final_asp | compass direction of surface temperature difference, providing an indication of oceanographic fronts |
| final_fnt | strength of surface temperature difference in degrees Celsius, providing an indication of oceanographic fronts |
| fshdiscliv | total live pounds of catch discarded on a haul |
| fshkeptliv | total live pounds of catch kept on a haul; kept = landed in port (post-2000) |
| gnArea | regions that correspond to regulations for gear restrictions in the Harbor Porpoise Take Reduction Plan. Regions are Gulf of Maine, waters off NJ, southern Mid-Atlantic, and southern New England (GOM, NJ, SMA, SNE). See Figure 3. |
| hailwtliv | hailwt converted from dressed to live weight. Differs from hailwt only if the dressed/round flag indicates a dressed weight (drflag = 1). |

[19] See http://www.nero.noaa.gov/prot_res/porptrp/finalrule.pdf for a map of closure areas.

| | |
|---|---|
| nao | monthly mean NAO index |
| nao_1 | one-year lag of monthly mean NAO index |
| nao_2 | two-year lag of monthly mean NAO index |
| pingperc | percentage of active marine mammal deterrent devices on a net relative to how many should be on a net per regulations |
| r3nao | three-month running average of monthly mean NAO index |
| r3nao_1 | one-year lag of three-month running average NAO |
| r3nao_2 | two-year lag of three-month running average NAO |
| region | NEFSC study area divided into four regions: Gulf of Maine, Hudson Canyon, southern New England, and Mid-Atlantic (GOM, HUD, SNE, MAT). See Figure 3. |
| region2 | same as region but with HUD combined into SNE |
| sbt_diff | difference between sea surface and bottom temperature in degrees Celsius; calculated as wtmp minus BotTemp (see Appendix B for description of wtmp) |
| sbt_dpm | difference in sea surface and bottom temperature per meter; calculated as sbt_diff divided by depth (see Appendix B for description of depth) |
| sst_final | sea surface temperature in degrees Celsius; acquired from satellite data |
| wnao | winter NAO index (average of monthly mean NAO index for December through March) |
| wnao_1 | one-year lag of winter NAO index |
| wnao_2 | two-year lag of winter NAO index |

## APPENDIX B.1
## NEFOP variables processed to fill in missing values

| Variable name | Comments on final variable or how it was processed for missing values |
|---|---|
| anchusd | none |
| BotTemp | none |
| btm_slp | none |
| d_b50, d_b100, d_b200, d_b500, d_coast | none |
| depth | units are in negative meters to match bathymetry data;<br>uses following hierarchy for source: observed value, Coastal Relief, SRTM30 v.1, ETOPOv2, medians from strata as outlined for numerical variables |
| gearlentot | missing prior to May 1994 |
| hauldur | records with outlying values were recalculated if the haul begin and end times were available |
| hngratio | none |
| latdd/londd | hierarchy of locations used to determine the latitude and longitude in decimal degrees: haul begin, haul end, set begin, set end. For filling in missing values, limited to the median for hauls on the same trip. |
| mcvert | none |
| mswgtavg | Not calculated prior to 1994 so a straight average of the minimum and maximum mesh size on the string was calculated, then the variable was processed for missing values. |
| netlen | none |
| nnets | missing prior to May 1994 |
| soakdur | The first step in filling missing values (and verifying atypical values) was to calculate soakdur from available set and haul times. Soak duration is defined as the time between the end of the set and the beginning of the haul. If the haul begin time was missing then the haul end time was used if it was nonmissing. If the set end time was missing then the set begin time was used if it was nonmissing. Recalculating soakdur was restricted to records in which the haul began and ended on the same day and the set began and ended on the same day. (There were very few records for which this was not the case.) If the set and haul occurred on different days, this was taken into account. If the haul was not on the same day as the set and both the set begin and end times were missing, the record was assigned a set time of noon. After soakdur was recalculated in this manner it was processed for missing values using the hierarchy of medians for numerical variables. |
| spaceusd | missing prior to May 1994 |
| tiednusd | missing prior to May 1994 |
| wtmp | missing prior to May 1994; units are Celsius to match satellite data;<br>uses following hierarchy for source: observed value, satellite value, medians limited to same trip or same month |
| wtmp2 | new variable that is the same as wtmp but a climatology value was substituted if wtmp differed from the climatology by more than ±2.5° C |
| wtmp3 | new variable that is the same as wtmp but a climatology value was substituted if wtmp differed from the climatology by more than ±10° C |

## APPENDIX B.2
## Frequencies of sources for NEFOP variables processed to fill in missing values

### Sources for Value of BotTemp Variable, Gillnet Observer Data, 1989-2006

| Source of BotTemp value | 1989-94 | | 1995 | | 1996 | | 1997 | | 1998 | | 1999 | | 2000 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % |
| **Missing** | 2025 | 9.32 | 235 | 3.74 | 271 | 4.99 | 143 | 2.49 | 790 | 12.76 | 924 | 17.28 | 802 | 13.78 |
| **Median for the trip** | 1283 | 5.91 | 366 | 5.83 | 351 | 6.47 | 449 | 7.81 | 303 | 4.89 | 180 | 3.37 | 269 | 4.62 |
| **Median for the vessel, gear, year, and month** | 449 | 2.07 | 114 | 1.81 | 90 | 1.66 | 95 | 1.65 | 148 | 2.39 | 87 | 1.63 | 110 | 1.89 |
| **MARMAP** | 17965 | 82.70 | 5566 | 88.62 | 4717 | 86.89 | 5060 | 88.05 | 4950 | 79.95 | 4155 | 77.72 | 4641 | 79.71 |

| | 2001 | | 2002 | | 2003 | | 2004 | | 2005 | | 2006 | | All | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % |
| **Missing** | 566 | 12.11 | 294 | 8.58 | 527 | 13.25 | 881 | 11.97 | 744 | 10.62 | 862 | 17.68 | 9064 | 10.32 |
| **Median for the trip** | 238 | 5.09 | 107 | 3.12 | 180 | 4.52 | 375 | 5.09 | 330 | 4.71 | 246 | 5.05 | 4677 | 5.32 |
| **Median for the vessel, gear, year, and month** | 74 | 1.58 | 62 | 1.81 | 59 | 1.48 | 91 | 1.24 | 114 | 1.63 | 125 | 2.56 | 1618 | 1.84 |
| **MARMAP** | 3794 | 81.21 | 2964 | 86.49 | 3212 | 80.74 | 6016 | 81.71 | 5819 | 83.05 | 3642 | 74.71 | 72501 | 82.52 |

### Variability of BotTemp Values Used to Fill Missing Values

### Distribution of cv for BotTemp sources

| CV=sd/mean for nonmissing values | Min | Q1 | Mean | Q3 | Max |
|---|---|---|---|---|---|
| **Median for the trip** | 0.00 | 0.00 | 0.03 | 0.03 | 0.66 |
| **Median for the vessel, gear, year, and month** | 0.00 | 0.00 | 0.03 | 0.04 | 0.23 |

**Sources for Value of btm_slp Variable, Gillnet Observer Data, 1989-2006**

| Source of btm_slp value | 1989-94 | | 1995 | | 1996 | | 1997 | | 1998 | | 1999 | | 2000 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % |
| **Missing** | 1191 | 5.48 | 2 | 0.03 | 0 | 0 | 4 | 0.07 | 210 | 3.39 | 74 | 1.38 | 36 | 0.62 |
| **Median for the trip** | 137 | 0.63 | 61 | 0.97 | 33 | 0.61 | 41 | 0.71 | 66 | 1.07 | 32 | 0.60 | 48 | 0.82 |
| **Median for the vessel, gear, year, and month** | 62 | 0.29 | 45 | 0.72 | 0 | 0 | 21 | 0.37 | 33 | 0.53 | 27 | 0.51 | 38 | 0.65 |
| **Median for the vessel, gear, and year** | 159 | 0.73 | 26 | 0.41 | 0 | 0 | 14 | 0.24 | 43 | 0.69 | 94 | 1.76 | 46 | 0.79 |
| **Median for the vessel and year** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **GIS** | 20173 | 92.87 | 6147 | 97.87 | 5396 | 99.39 | 5667 | 98.61 | 5839 | 94.31 | 5119 | 95.75 | 5654 | 97.11 |

| | 2001 | | 2002 | | 2003 | | 2004 | | 2005 | | 2006 | | All | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % |
| **Missing** | 151 | 3.23 | 157 | 4.58 | 112 | 2.82 | 36 | 0.49 | 53 | 0.76 | 129 | 2.65 | 2155 | 2.45 |
| **Median for the trip** | 46 | 0.98 | 88 | 2.57 | 27 | 0.68 | 27 | 0.37 | 31 | 0.44 | 56 | 1.15 | 693 | 0.79 |
| **Median for the vessel, gear, year, and month** | 22 | 0.47 | 54 | 1.58 | 25 | 0.63 | 15 | 0.20 | 12 | 0.17 | 17 | 0.35 | 371 | 0.42 |
| **Median for the vessel, gear, and year** | 44 | 0.94 | 58 | 1.69 | 36 | 0.90 | 42 | 0.57 | 14 | 0.20 | 100 | 2.05 | 676 | 0.77 |
| **Median for the vessel and year** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 0.12 | 6 | 0.01 |
| **GIS** | 4409 | 94.37 | 3070 | 89.58 | 3778 | 94.97 | 7243 | 98.37 | 6897 | 98.43 | 4567 | 93.68 | 83959 | 95.56 |

**Variability of btm_slp Values Used to Fill Missing Values**

**Distribution of cv for btm_slp sources**

| CV=sd/mean for nonmissing values | Min | Q1 | Mean | Q3 | Max |
|---|---|---|---|---|---|
| **Median for the trip** | 0.00 | 0.00 | 0.19 | 0.32 | 1.17 |
| **Median for the vessel, gear, year, and month** | 0.00 | 0.05 | 0.24 | 0.39 | 0.84 |
| **Median for the vessel, gear, and year** | 0.00 | 0.10 | 0.40 | 0.63 | 1.48 |
| **Median for the vessel and year** | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

**Sources for Value of d_b50 Variable, Gillnet Observer Data, 1989-2006**

| Source of d_b50 value | 1989-94 | | 1995 | | 1996 | | 1997 | | 1998 | | 1999 | | 2000 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % |
| **Missing** | 1175 | 5.41 | 0 | 0 | 0 | 0 | 0 | 0 | 210 | 3.39 | 68 | 1.27 | 17 | 0.29 |
| **Median for the trip** | 4 | 0.02 | 0 | 0 | 0 | 0 | 1 | 0.02 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Median for the vessel, gear, year, and month** | 55 | 0.25 | 21 | 0.33 | 0 | 0 | 0 | 0 | 15 | 0.24 | 18 | 0.34 | 6 | 0.10 |
| **Median for the vessel, gear, and year** | 99 | 0.46 | 0 | 0 | 0 | 0 | 9 | 0.16 | 35 | 0.57 | 90 | 1.68 | 22 | 0.38 |
| **Median for the vessel and year** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **GIS** | 20389 | 93.86 | 6260 | 99.67 | 5429 | 100.0 | 5737 | 99.83 | 5931 | 95.80 | 5170 | 96.71 | 5777 | 99.23 |

| | 2001 | | 2002 | | 2003 | | 2004 | | 2005 | | 2006 | | All | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % |
| **Missing** | 133 | 2.85 | 157 | 4.58 | 108 | 2.71 | 24 | 0.33 | 43 | 0.61 | 93 | 1.91 | 2028 | 2.31 |
| **Median for the trip** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 0.07 | 0 | 0 | 10 | 0.01 |
| **Median for the vessel, gear, year, and month** | 12 | 0.26 | 30 | 0.88 | 12 | 0.30 | 13 | 0.18 | 11 | 0.16 | 17 | 0.35 | 210 | 0.24 |
| **Median for the vessel, gear, and year** | 44 | 0.94 | 58 | 1.69 | 36 | 0.90 | 42 | 0.57 | 11 | 0.16 | 64 | 1.31 | 510 | 0.58 |
| **Median for the vessel and year** | 0 | 0 | 0 | 0 | 4 | 0.10 | 0 | 0 | 6 | 0.09 | 6 | 0.12 | 16 | 0.02 |
| **GIS** | 4483 | 95.95 | 3182 | 92.85 | 3818 | 95.98 | 7284 | 98.93 | 6931 | 98.92 | 4695 | 96.31 | 85086 | 96.84 |

**Variability of d_b50 Values Used to Fill Missing Values**

**Distribution of cv for d_b50 sources**

| CV=sd/mean for nonmissing values | Min | Q1 | Mean | Q3 | Max |
|---|---|---|---|---|---|
| **Median for the trip** | 0.01 | 0.01 | 0.13 | 0.21 | 0.58 |
| **Median for the vessel, gear, year, and month** | 0.00 | 0.01 | 0.13 | 0.16 | 0.95 |
| **Median for the vessel, gear, and year** | 0.00 | 0.01 | 0.13 | 0.18 | 0.77 |
| **Median for the vessel and year** | 0.00 | 0.00 | 0.01 | 0.02 | 0.02 |

**Sources for Value of d_b100 Variable, Gillnet Observer Data, 1989-2006**

| Source of d_b100 value | 1989-94 | | 1995 | | 1996 | | 1997 | | 1998 | | 1999 | | 2000 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % |
| **Missing** | 1175 | 5.41 | 0 | 0 | 0 | 0 | 0 | 0 | 210 | 3.39 | 68 | 1.27 | 17 | 0.29 |
| **Median for the trip** | 4 | 0.02 | 0 | 0 | 0 | 0 | 1 | 0.02 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Median for the vessel, gear, year, and month** | 55 | 0.25 | 21 | 0.33 | 0 | 0 | 0 | 0 | 15 | 0.24 | 18 | 0.34 | 6 | 0.10 |
| **Median for the vessel, gear, and year** | 99 | 0.46 | 0 | 0 | 0 | 0 | 9 | 0.16 | 35 | 0.57 | 90 | 1.68 | 22 | 0.38 |
| **Median for the vessel and year** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **GIS** | 20389 | 93.86 | 6260 | 99.67 | 5429 | 100.0 | 5737 | 99.83 | 5931 | 95.80 | 5170 | 96.71 | 5777 | 99.23 |

| | 2001 | | 2002 | | 2003 | | 2004 | | 2005 | | 2006 | | All | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % |
| **Missing** | 133 | 2.85 | 157 | 4.58 | 108 | 2.71 | 24 | 0.33 | 39 | 0.56 | 93 | 1.91 | 2024 | 2.30 |
| **Median for the trip** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 0.07 | 0 | 0 | 10 | 0.01 |
| **Median for the vessel, gear, year, and month** | 12 | 0.26 | 30 | 0.88 | 12 | 0.30 | 13 | 0.18 | 11 | 0.16 | 17 | 0.35 | 210 | 0.24 |
| **Median for the vessel, gear, and year** | 44 | 0.94 | 58 | 1.69 | 36 | 0.90 | 42 | 0.57 | 11 | 0.16 | 64 | 1.31 | 510 | 0.58 |
| **Median for the vessel and year** | 0 | 0 | 0 | 0 | 4 | 0.10 | 0 | 0 | 10 | 0.14 | 6 | 0.12 | 20 | 0.02 |
| **GIS** | 4483 | 95.95 | 3182 | 92.85 | 3818 | 95.98 | 7284 | 98.93 | 6931 | 98.92 | 4695 | 96.31 | 85086 | 96.84 |

**Variability of d_b100 Values Used to Fill Missing Values**

**Distribution of cv for d_b100 sources**

| CV=sd/mean for nonmissing values | Min | Q1 | Mean | Q3 | Max |
|---|---|---|---|---|---|
| **Median for the trip** | 0.00 | 0.00 | 0.09 | 0.16 | 0.37 |
| **Median for the vessel, gear, year, and month** | 0.00 | 0.01 | 0.09 | 0.08 | 1.75 |
| **Median for the vessel, gear, and year** | 0.00 | 0.01 | 0.10 | 0.08 | 0.88 |
| **Median for the vessel and year** | 0.00 | 0.00 | 0.02 | 0.02 | 0.08 |

**Sources for Value of d_b200 Variable, Gillnet Observer Data, 1989-2006**

| Source of d_b200 value | 1989-94 | | 1995 | | 1996 | | 1997 | | 1998 | | 1999 | | 2000 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % |
| **Missing** | 1175 | 5.41 | 0 | 0 | 0 | 0 | 0 | 0 | 210 | 3.39 | 68 | 1.27 | 17 | 0.29 |
| **Median for the trip** | 4 | 0.02 | 0 | 0 | 0 | 0 | 1 | 0.02 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Median for the vessel, gear, year, and month** | 55 | 0.25 | 21 | 0.33 | 0 | 0 | 0 | 0 | 15 | 0.24 | 18 | 0.34 | 6 | 0.10 |
| **Median for the vessel, gear, and year** | 99 | 0.46 | 0 | 0 | 0 | 0 | 9 | 0.16 | 35 | 0.57 | 90 | 1.68 | 22 | 0.38 |
| **Median for the vessel and year** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **GIS** | 20389 | 93.86 | 6260 | 99.67 | 5429 | 100.0 | 5737 | 99.83 | 5931 | 95.80 | 5170 | 96.71 | 5777 | 99.23 |

| | 2001 | | 2002 | | 2003 | | 2004 | | 2005 | | 2006 | | All | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % |
| **Missing** | 133 | 2.85 | 157 | 4.58 | 108 | 2.71 | 24 | 0.33 | 39 | 0.56 | 90 | 1.85 | 2021 | 2.30 |
| **Median for the trip** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 0.07 | 0 | 0 | 10 | 0.01 |
| **Median for the vessel, gear, year, and month** | 12 | 0.26 | 30 | 0.88 | 12 | 0.30 | 13 | 0.18 | 11 | 0.16 | 17 | 0.35 | 210 | 0.24 |
| **Median for the vessel, gear, and year** | 44 | 0.94 | 58 | 1.69 | 36 | 0.90 | 42 | 0.57 | 11 | 0.16 | 64 | 1.31 | 510 | 0.58 |
| **Median for the vessel and year** | 0 | 0 | 0 | 0 | 4 | 0.10 | 0 | 0 | 10 | 0.14 | 6 | 0.12 | 20 | 0.02 |
| **GIS** | 4483 | 95.95 | 3182 | 92.85 | 3818 | 95.98 | 7284 | 98.93 | 6931 | 98.92 | 4698 | 96.37 | 85089 | 96.85 |

**Variability of d_b200 Values Used to Fill Missing Values**

**Distribution of cv for d_b200 sources**

| CV=sd/mean for nonmissing values | Min | Q1 | Mean | Q3 | Max |
|---|---|---|---|---|---|
| **Median for the trip** | 0.01 | 0.01 | 0.10 | 0.17 | 0.19 |
| **Median for the vessel, gear, year, and month** | 0.00 | 0.01 | 0.03 | 0.05 | 0.25 |
| **Median for the vessel, gear, and year** | 0.00 | 0.01 | 0.09 | 0.09 | 1.84 |
| **Median for the vessel and year** | 0.01 | 0.01 | 0.02 | 0.02 | 0.07 |

**Sources for Value of d_b500 Variable, Gillnet Observer Data, 1989-2006**

| Source of d_b500 value | 1989-94 | | 1995 | | 1996 | | 1997 | | 1998 | | 1999 | | 2000 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % |
| **Missing** | 1175 | 5.41 | 0 | 0 | 0 | 0 | 0 | 0 | 210 | 3.39 | 68 | 1.27 | 17 | 0.29 |
| **Median for the trip** | 4 | 0.02 | 0 | 0 | 0 | 0 | 1 | 0.02 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Median for the vessel, gear, year, and month** | 55 | 0.25 | 21 | 0.33 | 0 | 0 | 0 | 0 | 15 | 0.24 | 18 | 0.34 | 6 | 0.10 |
| **Median for the vessel, gear, and year** | 99 | 0.46 | 0 | 0 | 0 | 0 | 9 | 0.16 | 35 | 0.57 | 90 | 1.68 | 22 | 0.38 |
| **Median for the vessel and year** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **GIS** | 20389 | 93.86 | 6260 | 99.67 | 5429 | 100.0 | 5737 | 99.83 | 5931 | 95.80 | 5170 | 96.71 | 5777 | 99.23 |

| | 2001 | | 2002 | | 2003 | | 2004 | | 2005 | | 2006 | | All | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % |
| **Missing** | 133 | 2.85 | 157 | 4.58 | 108 | 2.71 | 24 | 0.33 | 39 | 0.56 | 90 | 1.85 | 2021 | 2.30 |
| **Median for the trip** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 0.07 | 0 | 0 | 10 | 0.01 |
| **Median for the vessel, gear, year, and month** | 12 | 0.26 | 30 | 0.88 | 12 | 0.30 | 13 | 0.18 | 11 | 0.16 | 17 | 0.35 | 210 | 0.24 |
| **Median for the vessel, gear, and year** | 44 | 0.94 | 58 | 1.69 | 36 | 0.90 | 42 | 0.57 | 11 | 0.16 | 64 | 1.31 | 510 | 0.58 |
| **Median for the vessel and year** | 0 | 0 | 0 | 0 | 4 | 0.10 | 0 | 0 | 10 | 0.14 | 6 | 0.12 | 20 | 0.02 |
| **GIS** | 4483 | 95.95 | 3182 | 92.85 | 3818 | 95.98 | 7284 | 98.93 | 6931 | 98.92 | 4698 | 96.37 | 85089 | 96.85 |

**Variability of d_b500 Values Used to Fill Missing Values**

**Distribution of cv for d_b500 sources**

| CV=sd/mean for nonmissing values | Min | Q1 | Mean | Q3 | Max |
|---|---|---|---|---|---|
| **Median for the trip** | 0.00 | 0.00 | 0.03 | 0.03 | 0.15 |
| **Median for the vessel, gear, year, and month** | 0.00 | 0.01 | 0.02 | 0.02 | 0.10 |
| **Median for the vessel, gear, and year** | 0.00 | 0.00 | 0.04 | 0.04 | 0.93 |
| **Median for the vessel and year** | 0.01 | 0.01 | 0.01 | 0.02 | 0.02 |

**Sources for Value of d_coast Variable, Gillnet Observer Data, 1989-2006**

| Source of d_coast value | 1989-94 | | 1995 | | 1996 | | 1997 | | 1998 | | 1999 | | 2000 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % |
| **Missing** | 1175 | 5.41 | 0 | 0 | 0 | 0 | 0 | 0 | 210 | 3.39 | 68 | 1.27 | 17 | 0.29 |
| **Median for the trip** | 4 | 0.02 | 0 | 0 | 0 | 0 | 1 | 0.02 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Median for the vessel, gear, year, and month** | 55 | 0.25 | 21 | 0.33 | 0 | 0 | 0 | 0 | 15 | 0.24 | 18 | 0.34 | 6 | 0.10 |
| **Median for the vessel, gear, and year** | 99 | 0.46 | 0 | 0 | 0 | 0 | 9 | 0.16 | 35 | 0.57 | 90 | 1.68 | 22 | 0.38 |
| **Median for the vessel and year** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **GIS** | 20389 | 93.86 | 6260 | 99.67 | 5429 | 100.0 | 5737 | 99.83 | 5931 | 95.80 | 5170 | 96.71 | 5777 | 99.23 |

| | 2001 | | 2002 | | 2003 | | 2004 | | 2005 | | 2006 | | All | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % |
| **Missing** | 133 | 2.85 | 157 | 4.58 | 112 | 2.82 | 24 | 0.33 | 46 | 0.66 | 90 | 1.85 | 2032 | 2.31 |
| **Median for the trip** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 0.07 | 0 | 0 | 10 | 0.01 |
| **Median for the vessel, gear, year, and month** | 12 | 0.26 | 30 | 0.88 | 12 | 0.30 | 13 | 0.18 | 11 | 0.16 | 17 | 0.35 | 210 | 0.24 |
| **Median for the vessel, gear, and year** | 44 | 0.94 | 58 | 1.69 | 36 | 0.90 | 42 | 0.57 | 11 | 0.16 | 64 | 1.31 | 510 | 0.58 |
| **Median for the vessel and year** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0.04 | 6 | 0.12 | 9 | 0.01 |
| **GIS** | 4483 | 95.95 | 3182 | 92.85 | 3818 | 95.98 | 7284 | 98.93 | 6931 | 98.92 | 4698 | 96.37 | 85089 | 96.85 |

**Variability of d_coast Values Used to Fill Missing Values**

**Distribution of cv for d_coast sources**

| CV=sd/mean for nonmissing values | Min | Q1 | Mean | Q3 | Max |
|---|---|---|---|---|---|
| **Median for the trip** | 0.00 | 0.01 | 0.14 | 0.12 | 0.53 |
| **Median for the vessel, gear, year, and month** | 0.00 | 0.10 | 0.34 | 0.45 | 2.00 |
| **Median for the vessel, gear, and year** | 0.00 | 0.14 | 0.34 | 0.45 | 1.18 |
| **Median for the vessel and year** | 0.08 | 0.08 | 0.08 | 0.08 | 0.08 |

**Sources for Value of depth Variable, Gillnet Observer Data, 1989-2006**

| Source of depth value | 1989-94 | | 1995 | | 1996 | | 1997 | | 1998 | | 1999 | | 2000 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % |
| Missing | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 29 | 0.47 | 3 | 0.06 | 0 | 0 |
| ETOPOv2 | 2 | 0.01 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0.02 | 14 | 0.24 |
| Coastal Relief | 315 | 1.45 | 26 | 0.41 | 45 | 0.83 | 114 | 1.98 | 116 | 1.87 | 133 | 2.49 | 136 | 2.34 |
| SRTM30 v.1 | 7 | 0.03 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0.03 | 4 | 0.07 | 21 | 0.36 |
| Manual correction | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0.02 | 1 | 0.02 | 0 | 0 | 0 | 0 |
| Median for the trip | 1 | 0.00 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0.06 | 0 | 0 | 22 | 0.38 |
| Median for the vessel, gear, year, and month | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 | 0.16 | 4 | 0.07 | 0 | 0 |
| Median for the vessel, gear, and year | 0 | 0 | 0 | 0 | 0 | 0 | 9 | 0.16 | 2 | 0.03 | 0 | 0 | 1 | 0.02 |
| Median for the vessel and year | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Observer | 21397 | 98.50 | 6255 | 99.59 | 5384 | 99.17 | 5623 | 97.84 | 6027 | 97.35 | 5201 | 97.29 | 5628 | 96.67 |

| | 2001 | | 2002 | | 2003 | | 2004 | | 2005 | | 2006 | | All | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % |
| Missing | 0 | 0 | 0 | 0 | 6 | 0.15 | 0 | 0 | 0 | 0 | 3 | 0.06 | 41 | 0.05 |
| ETOPO2 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0.01 | 0 | 0 | 0 | 0 | 18 | 0.02 |
| Coastal Relief | 17 | 0.36 | 14 | 0.41 | 87 | 2.19 | 76 | 1.03 | 144 | 2.06 | 56 | 1.15 | 1279 | 1.46 |
| SRTM30 v.1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 34 | 0.04 |
| Manual correction | 0 | 0 | 0 | 0 | 1 | 0.03 | 4 | 0.05 | 1 | 0.01 | 0 | 0 | 8 | 0.01 |
| Median for the trip | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 27 | 0.03 |
| Median for the vessel, gear, year, and month | 0 | 0 | 0 | 0 | 1 | 0.03 | 0 | 0 | 0 | 0 | 1 | 0.02 | 16 | 0.02 |
| Median for the vessel, gear, and year | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11 | 0.23 | 23 | 0.03 |
| Median for the vessel and year | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 0.12 | 6 | 0.01 |
| Observer | 4655 | 99.64 | 3413 | 99.59 | 3883 | 97.61 | 7282 | 98.90 | 6862 | 97.93 | 4798 | 98.42 | 86408 | 98.35 |

**Variability of depth Values Used to Fill Missing Values**

**Distribution of cv for depth sources**

| CV=sd/mean for nonmissing values | Min | Q1 | Mean | Q3 | Max |
|---|---|---|---|---|---|
| **Median for the trip** | -1.93 | -1.44 | -0.58 | -0.03 | -0.02 |
| **Median for the vessel, gear, year, and month** | -0.13 | -0.10 | -0.04 | 0.00 | 0.00 |

| | Min | Q1 | Mean | Q3 | Max |
|---|---|---|---|---|---|
| **Median for the vessel, gear, and year** | -0.71 | -0.53 | -0.37 | -0.32 | 0.00 |
| **Median for the vessel and year** | -0.38 | -0.38 | -0.38 | -0.38 | -0.38 |

**Sources for Value of gearlentot Variable, Gillnet Observer Data, 1989-2006**

| Source of gearlentot value | 1989-94 | | 1995 | | 1996 | | 1997 | | 1998 | | 1999 | | 2000 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % |
| **Missing** | 15905 | 73.22 | 41 | 0.65 | 34 | 0.63 | 22 | 0.38 | 32 | 0.52 | 1 | 0.02 | 63 | 1.08 |
| **Manual correction** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0.05 | 0 | 0 | 0 | 0 |
| **Median for the trip** | 17 | 0.08 | 39 | 0.62 | 7 | 0.13 | 25 | 0.44 | 6 | 0.10 | 9 | 0.17 | 9 | 0.15 |
| **Median for the vessel, gear, year, and month** | 9 | 0.04 | 2 | 0.03 | 12 | 0.22 | 0 | 0 | 2 | 0.03 | 0 | 0 | 15 | 0.26 |
| **Median for the vessel, gear, and year** | 629 | 2.90 | 18 | 0.29 | 10 | 0.18 | 0 | 0 | 10 | 0.16 | 0 | 0 | 18 | 0.31 |
| **Median for the vessel and year** | 0 | 0 | 25 | 0.40 | 5 | 0.09 | 13 | 0.23 | 10 | 0.16 | 0 | 0 | 21 | 0.36 |
| **Observer** | 5162 | 23.76 | 6156 | 98.01 | 5361 | 98.75 | 5687 | 98.96 | 6128 | 98.98 | 5336 | 99.81 | 5696 | 97.84 |

| | 2001 | | 2002 | | 2003 | | 2004 | | 2005 | | 2006 | | All | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % |
| **Missing** | 12 | 0.26 | 31 | 0.90 | 11 | 0.28 | 17 | 0.23 | 12 | 0.17 | 2 | 0.04 | 16183 | 18.42 |
| **Manual correction** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0.00 |
| **Median for the trip** | 10 | 0.21 | 4 | 0.12 | 14 | 0.35 | 23 | 0.31 | 23 | 0.33 | 16 | 0.33 | 202 | 0.23 |
| **Median for the vessel, gear, year, and month** | 12 | 0.26 | 20 | 0.58 | 17 | 0.43 | 31 | 0.42 | 40 | 0.57 | 13 | 0.27 | 173 | 0.20 |
| **Median for the vessel, gear, and year** | 0 | 0 | 8 | 0.23 | 19 | 0.48 | 21 | 0.29 | 39 | 0.56 | 13 | 0.27 | 785 | 0.89 |
| **Median for the vessel and year** | 0 | 0 | 0 | 0 | 11 | 0.28 | 0 | 0 | 0 | 0 | 5 | 0.10 | 90 | 0.10 |
| **Observer** | 4638 | 99.27 | 3364 | 98.16 | 3906 | 98.19 | 7271 | 98.75 | 6893 | 98.37 | 4826 | 98.99 | 70424 | 80.15 |

**Variability of gearlentot Values Used to Fill Missing Values**

**Distribution of cv for gearlentot sources**

| CV=sd/mean for nonmissing values | Min | Q1 | Mean | Q3 | Max |
|---|---|---|---|---|---|
| **Median for the trip** | 0.00 | 0.00 | 0.06 | 0.11 | 0.47 |
| **Median for the vessel, gear, year, and month** | 0.00 | 0.00 | 0.08 | 0.15 | 0.39 |
| **Median for the vessel, gear, and year** | 0.00 | 0.06 | 0.16 | 0.21 | 1.19 |
| **Median for the vessel and year** | 0.00 | 0.00 | 0.03 | 0.08 | 0.08 |

**Sources for Value of hauldur Variable, Gillnet Observer Data, 1989-2006**

| Source of hauldur value | 1989-94 | | 1995 | | 1996 | | 1997 | | 1998 | | 1999 | | 2000 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % |
| **Manual calculation** | 1 | 0.00 | 0 | 0 | 1 | 0.02 | 9 | 0.16 | 12 | 0.19 | 8 | 0.15 | 7 | 0.12 |
| **Manual correction** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0.02 | 0 | 0 | 0 | 0 |
| **Median for the trip** | 16 | 0.07 | 7 | 0.11 | 25 | 0.46 | 2 | 0.03 | 1 | 0.02 | 7 | 0.13 | 21 | 0.36 |
| **Median for the vessel, gear, year, and month** | 12 | 0.06 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0.03 |
| **Median for the vessel, gear, and year** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0.02 |
| **Observer** | 21693 | 99.87 | 6274 | 99.89 | 5403 | 99.52 | 5736 | 99.81 | 6177 | 99.77 | 5331 | 99.72 | 5791 | 99.47 |

| | 2001 | | 2002 | | 2003 | | 2004 | | 2005 | | 2006 | | All | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % |
| **Manual calculation** | 1 | 0.02 | 0 | 0 | 0 | 0 | 1 | 0.01 | 0 | 0 | 0 | 0 | 40 | 0.05 |
| **Manual correction** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0.00 |
| **Median for the trip** | 12 | 0.26 | 14 | 0.41 | 34 | 0.85 | 39 | 0.53 | 16 | 0.23 | 21 | 0.43 | 215 | 0.24 |
| **Median for the vessel, gear, year, and month** | 0 | 0 | 0 | 0 | 1 | 0.03 | 0 | 0 | 0 | 0 | 0 | 0 | 15 | 0.02 |
| **Median for the vessel, gear, and year** | 0 | 0 | 0 | 0 | 4 | 0.10 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 0.01 |
| **Observer** | 4659 | 99.72 | 3413 | 99.59 | 3939 | 99.02 | 7323 | 99.46 | 6991 | 99.77 | 4854 | 99.57 | 87584 | 99.69 |

**Variability of hauldur Values Used to Fill Missing Values**

**Distribution of cv for hauldur sources**

| CV=sd/mean for nonmissing values | Min | Q1 | Mean | Q3 | Max |
|---|---|---|---|---|---|
| **Median for the trip** | 0.00 | 0.14 | 0.26 | 0.37 | 0.82 |
| **Median for the vessel, gear, year, and month** | 0.05 | 0.15 | 0.23 | 0.27 | 0.50 |
| **Median for the vessel, gear, and year** | 0.08 | 0.08 | 0.30 | 0.61 | 0.63 |

**Sources for Value of hngratio Variable, Gillnet Observer Data, 1989-2006**

| Source of hngratio value | 1989-94 | | 1995 | | 1996 | | 1997 | | 1998 | | 1999 | | 2000 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % |
| **Missing** | 91 | 0.42 | 43 | 0.68 | 12 | 0.22 | 21 | 0.37 | 66 | 1.07 | 82 | 1.53 | 198 | 3.40 |
| **Median for the trip** | 148 | 0.68 | 50 | 0.80 | 11 | 0.20 | 49 | 0.85 | 19 | 0.31 | 13 | 0.24 | 14 | 0.24 |
| **Median for the vessel, gear, year, and month** | 48 | 0.22 | 14 | 0.22 | 15 | 0.28 | 24 | 0.42 | 31 | 0.50 | 19 | 0.36 | 23 | 0.40 |
| **Median for the vessel, gear, and year** | 65 | 0.30 | 7 | 0.11 | 18 | 0.33 | 68 | 1.18 | 81 | 1.31 | 6 | 0.11 | 11 | 0.19 |
| **Median for the vessel and year** | 0 | 0 | 38 | 0.60 | 27 | 0.50 | 29 | 0.50 | 40 | 0.65 | 38 | 0.71 | 69 | 1.19 |
| **Observer** | 21370 | 98.38 | 6129 | 97.58 | 5346 | 98.47 | 5556 | 96.68 | 5954 | 96.17 | 5188 | 97.04 | 5507 | 94.59 |

| | 2001 | | 2002 | | 2003 | | 2004 | | 2005 | | 2006 | | All | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % |
| **Missing** | 15 | 0.32 | 6 | 0.18 | 30 | 0.75 | 90 | 1.22 | 48 | 0.69 | 64 | 1.31 | 766 | 0.87 |
| **Median for the trip** | 0 | 0 | 0 | 0 | 8 | 0.20 | 21 | 0.29 | 35 | 0.50 | 11 | 0.23 | 379 | 0.43 |
| **Median for the vessel, gear, year, and month** | 17 | 0.36 | 4 | 0.12 | 27 | 0.68 | 140 | 1.90 | 154 | 2.20 | 27 | 0.55 | 543 | 0.62 |
| **Median for the vessel, gear, and year** | 0 | 0 | 3 | 0.09 | 25 | 0.63 | 119 | 1.62 | 212 | 3.03 | 131 | 2.69 | 746 | 0.85 |
| **Median for the vessel and year** | 0 | 0 | 0 | 0 | 0 | 0 | 30 | 0.41 | 0 | 0 | 15 | 0.31 | 286 | 0.33 |
| **Observer** | 4640 | 99.32 | 3414 | 99.62 | 3888 | 97.74 | 6963 | 94.57 | 6558 | 93.59 | 4627 | 94.91 | 85140 | 96.90 |

**Variability of hngratio Values Used to Fill Missing Values**

**Distribution of cv for hngratio sources**

| CV=sd/mean for nonmissing values | Min | Q1 | Mean | Q3 | Max |
|---|---|---|---|---|---|
| **Median for the trip** | 0.00 | 0.00 | 0.01 | 0.00 | 0.25 |
| **Median for the vessel, gear, year, and month** | 0.00 | 0.00 | 0.03 | 0.00 | 0.22 |
| **Median for the vessel, gear, and year** | 0.00 | 0.00 | 0.08 | 0.20 | 0.49 |
| **Median for the vessel and year** | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

**Sources for Value of latdd Variable, Gillnet Observer Data, 1989-2006**

| Source of latdd value | 1989-94 | | 1995 | | 1996 | | 1997 | | 1998 | | 1999 | | 2000 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % |
| **Missing** | 185 | 0.85 | 21 | 0.33 | 0 | 0 | 9 | 0.16 | 250 | 4.04 | 176 | 3.29 | 45 | 0.77 |
| **Median for the trip** | 54 | 0.25 | 5 | 0.08 | 8 | 0.15 | 5 | 0.09 | 18 | 0.29 | 16 | 0.30 | 30 | 0.52 |
| **Observed haul begin** | 21464 | 98.81 | 6218 | 99.00 | 5417 | 99.78 | 5732 | 99.74 | 5912 | 95.49 | 5143 | 96.20 | 5728 | 98.39 |
| **Observed haul end** | 9 | 0.04 | 5 | 0.08 | 4 | 0.07 | 0 | 0 | 3 | 0.05 | 3 | 0.06 | 10 | 0.17 |
| **Observed set begin** | 9 | 0.04 | 32 | 0.51 | 0 | 0 | 1 | 0.02 | 8 | 0.13 | 8 | 0.15 | 8 | 0.14 |
| **Observed set end** | 1 | 0.00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0.02 |

| | 2001 | | 2002 | | 2003 | | 2004 | | 2005 | | 2006 | | All | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % |
| **Missing** | 189 | 4.05 | 235 | 6.86 | 160 | 4.02 | 72 | 0.98 | 71 | 1.01 | 177 | 3.63 | 1590 | 1.81 |
| **Median for the trip** | 14 | 0.30 | 5 | 0.15 | 26 | 0.65 | 28 | 0.38 | 29 | 0.41 | 17 | 0.35 | 255 | 0.29 |
| **Observed haul begin** | 4462 | 95.51 | 3181 | 92.82 | 3788 | 95.22 | 7247 | 98.42 | 6889 | 98.32 | 4666 | 95.71 | 85847 | 97.71 |
| **Observed haul end** | 3 | 0.06 | 0 | 0 | 4 | 0.10 | 14 | 0.19 | 18 | 0.26 | 13 | 0.27 | 86 | 0.10 |
| **Observed set begin** | 4 | 0.09 | 6 | 0.18 | 0 | 0 | 2 | 0.03 | 0 | 0 | 2 | 0.04 | 80 | 0.09 |
| **Observed set end** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0.00 |

**Variability of latdd Values Used to Fill Missing Values**

**Distribution of cv for latdd sources**

| CV=sd/mean for nonmissing values | Min | Q1 | Mean | Q3 | Max |
|---|---|---|---|---|---|
| **Median for the trip** | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 |

**Sources for Value of londd Variable, Gillnet Observer Data, 1989-2006**

| Source of londd value | 1989-94 | | 1995 | | 1996 | | 1997 | | 1998 | | 1999 | | 2000 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % |
| **Missing** | 185 | 0.85 | 21 | 0.33 | 0 | 0 | 9 | 0.16 | 250 | 4.04 | 176 | 3.29 | 45 | 0.77 |
| **Median for the trip** | 54 | 0.25 | 5 | 0.08 | 8 | 0.15 | 5 | 0.09 | 18 | 0.29 | 16 | 0.30 | 30 | 0.52 |
| **Observed haul begin** | 21464 | 98.81 | 6218 | 99.00 | 5417 | 99.78 | 5732 | 99.74 | 5912 | 95.49 | 5143 | 96.20 | 5728 | 98.39 |
| **Observed haul end** | 9 | 0.04 | 5 | 0.08 | 4 | 0.07 | 0 | 0 | 3 | 0.05 | 3 | 0.06 | 10 | 0.17 |
| **Observed set begin** | 9 | 0.04 | 32 | 0.51 | 0 | 0 | 1 | 0.02 | 8 | 0.13 | 8 | 0.15 | 8 | 0.14 |
| **Observed set end** | 1 | 0.00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0.02 |

| | 2001 | | 2002 | | 2003 | | 2004 | | 2005 | | 2006 | | All | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % |
| **Missing** | 189 | 4.05 | 235 | 6.86 | 160 | 4.02 | 72 | 0.98 | 71 | 1.01 | 177 | 3.63 | 1590 | 1.81 |
| **Median for the trip** | 14 | 0.30 | 5 | 0.15 | 26 | 0.65 | 28 | 0.38 | 29 | 0.41 | 17 | 0.35 | 255 | 0.29 |
| **Observed haul begin** | 4462 | 95.51 | 3181 | 92.82 | 3788 | 95.22 | 7247 | 98.42 | 6889 | 98.32 | 4666 | 95.71 | 85847 | 97.71 |
| **Observed haul end** | 3 | 0.06 | 0 | 0 | 4 | 0.10 | 14 | 0.19 | 18 | 0.26 | 13 | 0.27 | 86 | 0.10 |
| **Observed set begin** | 4 | 0.09 | 6 | 0.18 | 0 | 0 | 2 | 0.03 | 0 | 0 | 2 | 0.04 | 80 | 0.09 |
| **Observed set end** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0.00 |

**Variability of londd Values Used to Fill Missing Values**

**Distribution of cv for londd sources**

| CV=sd/mean for nonmissing values | Min | Q1 | Mean | Q3 | Max |
|---|---|---|---|---|---|
| **Median for the trip** | -0.01 | -0.00 | -0.00 | -0.00 | 0.00 |

**Sources for Value of mcvert Variable, Gillnet Observer Data, 1989-2006**

| Source of mcvert value | 1989-94 | | 1995 | | 1996 | | 1997 | | 1998 | | 1999 | | 2000 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % |
| **Missing** | 11 | 0.05 | 43 | 0.68 | 62 | 1.14 | 20 | 0.35 | 97 | 1.57 | 111 | 2.08 | 221 | 3.80 |
| **Median for the trip** | 221 | 1.02 | 76 | 1.21 | 38 | 0.70 | 61 | 1.06 | 47 | 0.76 | 37 | 0.69 | 46 | 0.79 |
| **Median for the vessel, gear, year, and month** | 58 | 0.27 | 63 | 1.00 | 18 | 0.33 | 18 | 0.31 | 22 | 0.36 | 24 | 0.45 | 19 | 0.33 |
| **Median for the vessel, gear, and year** | 148 | 0.68 | 27 | 0.43 | 10 | 0.18 | 10 | 0.17 | 105 | 1.70 | 26 | 0.49 | 32 | 0.55 |
| **Median for the vessel and year** | 0 | 0 | 29 | 0.46 | 0 | 0 | 13 | 0.23 | 11 | 0.18 | 1 | 0.02 | 46 | 0.79 |
| **Observer** | 21284 | 97.98 | 6043 | 96.21 | 5301 | 97.64 | 5625 | 97.88 | 5909 | 95.45 | 5147 | 96.28 | 5458 | 93.75 |

| | 2001 | | 2002 | | 2003 | | 2004 | | 2005 | | 2006 | | All | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % |
| **Missing** | 6 | 0.13 | 24 | 0.70 | 66 | 1.66 | 37 | 0.50 | 47 | 0.67 | 46 | 0.94 | 791 | 0.90 |
| **Median for the trip** | 5 | 0.11 | 2 | 0.06 | 21 | 0.53 | 48 | 0.65 | 38 | 0.54 | 16 | 0.33 | 656 | 0.75 |
| **Median for the vessel, gear, year, and month** | 1 | 0.02 | 18 | 0.53 | 5 | 0.13 | 50 | 0.68 | 92 | 1.31 | 37 | 0.76 | 425 | 0.48 |
| **Median for the vessel, gear, and year** | 0 | 0 | 12 | 0.35 | 44 | 1.11 | 89 | 1.21 | 144 | 2.06 | 57 | 1.17 | 704 | 0.80 |
| **Median for the vessel and year** | 0 | 0 | 0 | 0 | 0 | 0 | 11 | 0.15 | 0 | 0 | 5 | 0.10 | 116 | 0.13 |
| **Observer** | 4660 | 99.74 | 3371 | 98.37 | 3842 | 96.58 | 7128 | 96.81 | 6686 | 95.42 | 4714 | 96.70 | 85168 | 96.94 |

**Variability of mcvert Values Used to Fill Missing Values**

**Distribution of cv for mcvert sources**

| CV=sd/mean for nonmissing values | Min | Q1 | Mean | Q3 | Max |
|---|---|---|---|---|---|
| **Median for the trip** | 0.00 | 0.00 | 0.06 | 0.06 | 0.95 |
| **Median for the vessel, gear, year, and month** | 0.00 | 0.00 | 0.06 | 0.10 | 0.87 |
| **Median for the vessel, gear, and year** | 0.00 | 0.00 | 0.13 | 0.18 | 0.89 |
| **Median for the vessel and year** | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

**Sources for Value of mswgtavg Variable, Gillnet Observer Data, 1989-2006**

| Source of mswgtavg value | 1989-94 | | 1995 | | 1996 | | 1997 | | 1998 | | 1999 | | 2000 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % |
| **Missing** | 0 | 0 | 30 | 0.48 | 39 | 0.72 | 20 | 0.35 | 4 | 0.06 | 22 | 0.41 | 55 | 0.94 |
| **Median for the trip** | 224 | 1.03 | 54 | 0.86 | 10 | 0.18 | 24 | 0.42 | 13 | 0.21 | 11 | 0.21 | 5 | 0.09 |
| **Median for the vessel, gear, year, and month** | 98 | 0.45 | 2 | 0.03 | 12 | 0.22 | 5 | 0.09 | 20 | 0.32 | 4 | 0.07 | 9 | 0.15 |
| **Median for the vessel, gear, and year** | 299 | 1.38 | 7 | 0.11 | 10 | 0.18 | 0 | 0 | 9 | 0.15 | 8 | 0.15 | 14 | 0.24 |
| **Median for the vessel and year** | 0 | 0 | 31 | 0.49 | 0 | 0 | 13 | 0.23 | 38 | 0.61 | 1 | 0.02 | 43 | 0.74 |
| **Observer: average of minimum and maximum** | 16075 | 74.00 | 118 | 1.88 | 23 | 0.42 | 195 | 3.39 | 220 | 3.55 | 175 | 3.27 | 240 | 4.12 |
| **Observer** | 5026 | 23.14 | 6039 | 96.15 | 5335 | 98.27 | 5490 | 95.53 | 5887 | 95.09 | 5125 | 95.87 | 5456 | 93.71 |

| | 2001 | | 2002 | | 2003 | | 2004 | | 2005 | | 2006 | | All | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % |
| **Missing** | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0.03 | 0 | 0 | 1 | 0.02 | 173 | 0.20 |
| **Median for the trip** | 21 | 0.45 | 14 | 0.41 | 3 | 0.08 | 6 | 0.08 | 3 | 0.04 | 1 | 0.02 | 389 | 0.44 |
| **Median for the vessel, gear, year, and month** | 1 | 0.02 | 11 | 0.32 | 0 | 0 | 0 | 0 | 6 | 0.09 | 0 | 0 | 168 | 0.19 |
| **Median for the vessel, gear, and year** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 347 | 0.39 |
| **Median for the vessel and year** | 0 | 0 | 3 | 0.09 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 129 | 0.15 |
| **Observer: average of minimum and maximum** | 28 | 0.60 | 55 | 1.60 | 185 | 4.65 | 102 | 1.39 | 121 | 1.73 | 46 | 0.94 | 17583 | 20.01 |
| **Observer** | 4622 | 98.93 | 3344 | 97.58 | 3790 | 95.27 | 7253 | 98.51 | 6877 | 98.14 | 4827 | 99.02 | 69071 | 78.61 |

**Variability of mswgtavg Values Used to Fill Missing Values**

**Distribution of cv for mswgtavg sources**

| CV=sd/mean for nonmissing values | Min | Q1 | Mean | Q3 | Max |
|---|---|---|---|---|---|
| **Median for the trip** | 0.00 | 0.00 | 0.03 | 0.03 | 0.36 |
| **Median for the vessel, gear, year, and month** | 0.00 | 0.00 | 0.01 | 0.03 | 0.10 |
| **Median for the vessel, gear, and year** | 0.00 | 0.00 | 0.06 | 0.11 | 0.14 |
| **Median for the vessel and year** | 0.00 | 0.00 | 0.03 | 0.06 | 0.07 |

**Sources for Value of netlen Variable, Gillnet Observer Data, 1989-2006**

| Source of netlen value | 1989-94 | | 1995 | | 1996 | | 1997 | | 1998 | | 1999 | | 2000 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % |
| **Missing** | 0 | 0 | 35 | 0.56 | 3 | 0.06 | 10 | 0.17 | 2 | 0.03 | 0 | 0 | 47 | 0.81 |
| **Manual correction** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0.05 | 0 | 0 | 0 | 0 |
| **Median for the trip** | 27 | 0.12 | 39 | 0.62 | 6 | 0.11 | 24 | 0.42 | 5 | 0.08 | 8 | 0.15 | 4 | 0.07 |
| **Median for the vessel, gear, year, and month** | 20 | 0.09 | 2 | 0.03 | 12 | 0.22 | 0 | 0 | 2 | 0.03 | 0 | 0 | 0 | 0 |
| **Median for the vessel, gear, and year** | 1 | 0.00 | 7 | 0.11 | 10 | 0.18 | 0 | 0 | 4 | 0.06 | 0 | 0 | 14 | 0.24 |
| **Median for the vessel and year** | 0 | 0 | 31 | 0.49 | 36 | 0.66 | 25 | 0.44 | 40 | 0.65 | 1 | 0.02 | 37 | 0.64 |
| **Observer** | 21674 | 99.78 | 6167 | 98.19 | 5362 | 98.77 | 5688 | 98.97 | 6135 | 99.10 | 5337 | 99.83 | 5720 | 98.25 |

| | 2001 | | 2002 | | 2003 | | 2004 | | 2005 | | 2006 | | All | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % |
| **Missing** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0.04 | 99 | 0.11 |
| **Manual correction** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0.00 |
| **Median for the trip** | 0 | 0 | 2 | 0.06 | 5 | 0.13 | 6 | 0.08 | 6 | 0.09 | 6 | 0.12 | 138 | 0.16 |
| **Median for the vessel, gear, year, and month** | 0 | 0 | 0 | 0 | 5 | 0.13 | 0 | 0 | 13 | 0.19 | 0 | 0 | 54 | 0.06 |
| **Median for the vessel, gear, and year** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 | 0.14 | 0 | 0 | 46 | 0.05 |
| **Median for the vessel and year** | 12 | 0.26 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 0.10 | 187 | 0.21 |
| **Observer** | 4660 | 99.74 | 3425 | 99.94 | 3968 | 99.75 | 7357 | 99.92 | 6978 | 99.59 | 4862 | 99.73 | 87333 | 99.40 |

**Variability of netlen Values Used to Fill Missing Values**

**Distribution of cv for netlen sources**

| CV=sd/mean for nonmissing values | Min | Q1 | Mean | Q3 | Max |
|---|---|---|---|---|---|
| **Median for the trip** | 0.00 | 0.00 | 0.01 | 0.00 | 0.27 |
| **Median for the vessel, gear, year, and month** | 0.00 | 0.00 | 0.02 | 0.00 | 0.17 |
| **Median for the vessel, gear, and year** | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Median for the vessel and year** | 0.00 | 0.00 | 0.00 | 0.00 | 0.05 |

**Sources for Value of nnets Variable, Gillnet Observer Data, 1989-2006**

| Source of nnets value | 1989-94 | | 1995 | | 1996 | | 1997 | | 1998 | | 1999 | | 2000 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % |
| **Missing** | 15905 | 73.22 | 36 | 0.57 | 34 | 0.63 | 22 | 0.38 | 32 | 0.52 | 1 | 0.02 | 63 | 1.08 |
| **Median for the trip** | 13 | 0.06 | 34 | 0.54 | 7 | 0.13 | 19 | 0.33 | 3 | 0.05 | 6 | 0.11 | 3 | 0.05 |
| **Median for the vessel, gear, year, and month** | 3 | 0.01 | 1 | 0.02 | 12 | 0.22 | 0 | 0 | 2 | 0.03 | 0 | 0 | 0 | 0 |
| **Median for the vessel, gear, and year** | 629 | 2.90 | 7 | 0.11 | 10 | 0.18 | 0 | 0 | 4 | 0.06 | 0 | 0 | 14 | 0.24 |
| **Median for the vessel and year** | 0 | 0 | 25 | 0.40 | 5 | 0.09 | 13 | 0.23 | 10 | 0.16 | 0 | 0 | 21 | 0.36 |
| **Observer** | 5172 | 23.81 | 6178 | 98.36 | 5361 | 98.75 | 5693 | 99.06 | 6140 | 99.18 | 5339 | 99.87 | 5721 | 98.27 |

| | 2001 | | 2002 | | 2003 | | 2004 | | 2005 | | 2006 | | All | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % |
| **Missing** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 16093 | 18.32 |
| **Median for the trip** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0.02 | 86 | 0.10 |
| **Median for the vessel, gear, year, and month** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 18 | 0.02 |
| **Median for the vessel, gear, and year** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0.04 | 0 | 0 | 667 | 0.76 |
| **Median for the vessel and year** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 74 | 0.08 |
| **Observer** | 4672 | 100.0 | 3427 | 100.0 | 3978 | 100.0 | 7363 | 100.0 | 7004 | 99.96 | 4874 | 99.98 | 70922 | 80.72 |

**Variability of nnets Values Used to Fill Missing Values**

**Distribution of cv for nnets sources**

| CV=sd/mean for nonmissing values | Min | Q1 | Mean | Q3 | Max |
|---|---|---|---|---|---|
| **Median for the trip** | 0.00 | 0.00 | 0.06 | 0.11 | 0.47 |
| **Median for the vessel, gear, year, and month** | 0.00 | 0.00 | 0.01 | 0.00 | 0.16 |
| **Median for the vessel, gear, and year** | 0.00 | 0.05 | 0.15 | 0.21 | 0.60 |
| **Median for the vessel and year** | 0.00 | 0.00 | 0.03 | 0.08 | 0.08 |

**Sources for Value of soakdur Variable, Gillnet Observer Data, 1989-2006**

| Source of soakdur value | 1989-94 | | 1995 | | 1996 | | 1997 | | 1998 | | 1999 | | 2000 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % |
| **Missing** | 3 | 0.01 | 4 | 0.06 | 0 | 0 | 0 | 0 | 0 | 0 | 35 | 0.65 | 1 | 0.02 |
| **Manual calculation** | 44 | 0.20 | 251 | 4.00 | 99 | 1.82 | 87 | 1.51 | 98 | 1.58 | 192 | 3.59 | 301 | 5.17 |
| **Median for the trip** | 10 | 0.05 | 24 | 0.38 | 13 | 0.24 | 15 | 0.26 | 9 | 0.15 | 2 | 0.04 | 36 | 0.62 |
| **Median for the vessel, gear, year, and month** | 6 | 0.03 | 0 | 0 | 6 | 0.11 | 0 | 0 | 0 | 0 | 2 | 0.04 | 3 | 0.05 |
| **Median for the vessel, gear, and year** | 4 | 0.02 | 3 | 0.05 | 6 | 0.11 | 2 | 0.03 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Median for the vessel and year** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 8 | 0.13 | 0 | 0 | 0 | 0 |
| **Observer** | 21655 | 99.69 | 5999 | 95.51 | 5305 | 97.72 | 5643 | 98.19 | 6076 | 98.14 | 5115 | 95.68 | 5481 | 94.14 |

| | 2001 | | 2002 | | 2003 | | 2004 | | 2005 | | 2006 | | All | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % |
| **Missing** | 0 | 0 | 0 | 0 | 6 | 0.15 | 12 | 0.16 | 0 | 0 | 0 | 0 | 61 | 0.07 |
| **Manual calculation** | 42 | 0.90 | 44 | 1.28 | 38 | 0.96 | 56 | 0.76 | 114 | 1.63 | 119 | 2.44 | 1485 | 1.69 |
| **Median for the trip** | 8 | 0.17 | 24 | 0.70 | 18 | 0.45 | 39 | 0.53 | 41 | 0.59 | 25 | 0.51 | 264 | 0.30 |
| **Median for the vessel, gear, year, and month** | 0 | 0 | 0 | 0 | 5 | 0.13 | 19 | 0.26 | 24 | 0.34 | 7 | 0.14 | 72 | 0.08 |
| **Median for the vessel, gear, and year** | 0 | 0 | 2 | 0.06 | 44 | 1.11 | 21 | 0.29 | 6 | 0.09 | 6 | 0.12 | 94 | 0.11 |
| **Median for the vessel and year** | 0 | 0 | 0 | 0 | 2 | 0.05 | 1 | 0.01 | 0 | 0 | 0 | 0 | 11 | 0.01 |
| **Observer** | 4622 | 98.93 | 3357 | 97.96 | 3865 | 97.16 | 7215 | 97.99 | 6822 | 97.36 | 4718 | 96.78 | 85873 | 97.74 |

**Variability of soakdur Values Used to Fill Missing Values**

**Distribution of cv for soakdur sources**

| CV=sd/mean for nonmissing values | Min | Q1 | Mean | Q3 | Max |
|---|---|---|---|---|---|
| **Median for the trip** | 0.00 | 0.00 | 0.43 | 0.62 | 2.44 |
| **Median for the vessel, gear, year, and month** | 0.00 | 0.00 | 0.31 | 0.50 | 1.00 |
| **Median for the vessel, gear, and year** | 0.00 | 0.00 | 0.29 | 0.44 | 1.48 |
| **Median for the vessel and year** | 0.00 | 0.00 | 0.06 | 0.08 | 0.08 |

**Sources for Value of wtmp Variable, Gillnet Observer Data, 1989-2006**

| Source of wtmp value | 1989-94 | | 1995 | | 1996 | | 1997 | | 1998 | | 1999 | | 2000 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % |
| **Missing** | 1266 | 5.83 | 8 | 0.13 | 0 | 0 | 4 | 0.07 | 64 | 1.03 | 8 | 0.15 | 8 | 0.14 |
| **Manual correction** | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0.02 | 0 | 0 | 1 | 0.02 | 3 | 0.05 |
| **Median for the trip** | 28 | 0.13 | 1 | 0.02 | 9 | 0.17 | 3 | 0.05 | 55 | 0.89 | 12 | 0.22 | 4 | 0.07 |
| **Median for the vessel, gear, year, and month** | 55 | 0.25 | 0 | 0 | 2 | 0.04 | 0 | 0 | 4 | 0.06 | 0 | 0 | 6 | 0.10 |
| **Satellite** | 17035 | 78.42 | 533 | 8.49 | 566 | 10.43 | 230 | 4.00 | 461 | 7.45 | 328 | 6.14 | 665 | 11.42 |
| **Observer** | 3338 | 15.37 | 5739 | 91.37 | 4852 | 89.37 | 5509 | 95.86 | 5607 | 90.57 | 4997 | 93.47 | 5136 | 88.22 |

| | 2001 | | 2002 | | 2003 | | 2004 | | 2005 | | 2006 | | All | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % |
| **Missing** | 20 | 0.43 | 0 | 0 | 3 | 0.08 | 0 | 0 | 0 | 0 | 16 | 0.33 | 1397 | 1.59 |
| **Manual correction** | 1 | 0.02 | 1 | 0.03 | 0 | 0 | 0 | 0 | 2 | 0.03 | 0 | 0 | 9 | 0.01 |
| **Median for the trip** | 4 | 0.09 | 0 | 0 | 2 | 0.05 | 14 | 0.19 | 2 | 0.03 | 1 | 0.02 | 135 | 0.15 |
| **Median for the vessel, gear, year, and month** | 17 | 0.36 | 13 | 0.38 | 4 | 0.10 | 2 | 0.03 | 0 | 0 | 0 | 0 | 103 | 0.12 |
| **Satellite** | 195 | 4.17 | 64 | 1.87 | 123 | 3.09 | 244 | 3.31 | 234 | 3.34 | 143 | 2.93 | 20821 | 23.70 |
| **Observer** | 4435 | 94.93 | 3349 | 97.72 | 3846 | 96.68 | 7103 | 96.47 | 6769 | 96.60 | 4715 | 96.72 | 65395 | 74.43 |

**Variability of wtmp Values Used to Fill Missing Values**

**Distribution of cv for wtmp sources**

| CV=sd/mean for nonmissing values | Min | Q1 | Mean | Q3 | Max |
|---|---|---|---|---|---|
| **Median for the trip** | 0.00 | 0.00 | 0.01 | 0.01 | 0.07 |
| **Median for the vessel, gear, year, and month** | 0.00 | 0.00 | 0.02 | 0.06 | 0.07 |

**Sources for Value of wtmp2 Variable, Gillnet Observer Data, 1989-2006**

| Source of wtmp2 value | 1989-94 | | 1995 | | 1996 | | 1997 | | 1998 | | 1999 | | 2000 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % |
| **Missing** | 1266 | 5.83 | 8 | 0.13 | 0 | 0 | 4 | 0.07 | 64 | 1.03 | 8 | 0.15 | 8 | 0.14 |
| **Manual correction** | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0.02 | 0 | 0 | 1 | 0.02 | 2 | 0.03 |
| **Median for the trip** | 28 | 0.13 | 1 | 0.02 | 9 | 0.17 | 3 | 0.05 | 55 | 0.89 | 12 | 0.22 | 4 | 0.07 |
| **Median for the vessel, gear, year, and month** | 55 | 0.25 | 0 | 0 | 2 | 0.04 | 0 | 0 | 4 | 0.06 | 0 | 0 | 6 | 0.10 |
| **Satellite** | 17493 | 80.53 | 1401 | 22.31 | 1508 | 27.78 | 970 | 16.88 | 1557 | 25.15 | 1617 | 30.25 | 1869 | 32.10 |
| **Observer** | 2880 | 13.26 | 4871 | 77.55 | 3910 | 72.02 | 4769 | 82.98 | 4511 | 72.86 | 3708 | 69.36 | 3933 | 67.55 |

| | 2001 | | 2002 | | 2003 | | 2004 | | 2005 | | 2006 | | All | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % |
| **Missing** | 20 | 0.43 | 0 | 0 | 3 | 0.08 | 0 | 0 | 0 | 0 | 16 | 0.33 | 1397 | 1.59 |
| **Manual correction** | 1 | 0.02 | 1 | 0.03 | 0 | 0 | 0 | 0 | 2 | 0.03 | 0 | 0 | 8 | 0.01 |
| **Median for the trip** | 4 | 0.09 | 0 | 0 | 2 | 0.05 | 14 | 0.19 | 2 | 0.03 | 1 | 0.02 | 135 | 0.15 |
| **Median for the vessel, gear, year, and month** | 17 | 0.36 | 13 | 0.38 | 4 | 0.10 | 2 | 0.03 | 0 | 0 | 0 | 0 | 103 | 0.12 |
| **Satellite** | 1122 | 24.02 | 635 | 18.53 | 714 | 17.95 | 1322 | 17.95 | 1755 | 25.05 | 1214 | 24.90 | 33177 | 37.76 |
| **Observer** | 3508 | 75.09 | 2778 | 81.06 | 3255 | 81.83 | 6025 | 81.83 | 5248 | 74.90 | 3644 | 74.75 | 53040 | 60.37 |

**Variability of wtmp2 Values Used to Fill Missing Values**

**Distribution of cv for wtmp2 sources**

| CV=sd/mean for nonmissing values | Min | Q1 | Mean | Q3 | Max |
|---|---|---|---|---|---|
| **Median for the trip** | 0.00 | 0.00 | 0.01 | 0.02 | 0.08 |
| **Median for the vessel, gear, year, and month** | 0.00 | 0.00 | 0.02 | 0.06 | 0.07 |

**Sources for Value of wtmp3 Variable, Gillnet Observer Data, 1989-2006**

| Source of wtmp3 value | 1989-94 | | 1995 | | 1996 | | 1997 | | 1998 | | 1999 | | 2000 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % |
| **Missing** | 1266 | 5.83 | 8 | 0.13 | 0 | 0 | 4 | 0.07 | 64 | 1.03 | 8 | 0.15 | 8 | 0.14 |
| **Manual correction** | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0.02 | 0 | 0 | 1 | 0.02 | 3 | 0.05 |
| **Median for the trip** | 28 | 0.13 | 1 | 0.02 | 9 | 0.17 | 3 | 0.05 | 55 | 0.89 | 12 | 0.22 | 4 | 0.07 |
| **Median for the vessel, gear, year, and month** | 55 | 0.25 | 0 | 0 | 2 | 0.04 | 0 | 0 | 4 | 0.06 | 0 | 0 | 6 | 0.10 |
| **Satellite** | 17043 | 78.46 | 669 | 10.65 | 753 | 13.87 | 270 | 4.70 | 562 | 9.08 | 361 | 6.75 | 780 | 13.40 |
| **Observer** | 3330 | 15.33 | 5603 | 89.21 | 4665 | 85.93 | 5469 | 95.16 | 5506 | 88.94 | 4964 | 92.85 | 5021 | 86.24 |

| | 2001 | | 2002 | | 2003 | | 2004 | | 2005 | | 2006 | | All | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % |
| **Missing** | 20 | 0.43 | 0 | 0 | 3 | 0.08 | 0 | 0 | 0 | 0 | 16 | 0.33 | 1397 | 1.59 |
| **Manual correction** | 1 | 0.02 | 1 | 0.03 | 0 | 0 | 0 | 0 | 2 | 0.03 | 0 | 0 | 9 | 0.01 |
| **Median for the trip** | 4 | 0.09 | 0 | 0 | 2 | 0.05 | 14 | 0.19 | 2 | 0.03 | 1 | 0.02 | 135 | 0.15 |
| **Median for the vessel, gear, year, and month** | 17 | 0.36 | 13 | 0.38 | 4 | 0.10 | 2 | 0.03 | 0 | 0 | 0 | 0 | 103 | 0.12 |
| **Satellite** | 291 | 6.23 | 68 | 1.98 | 170 | 4.27 | 361 | 4.90 | 421 | 6.01 | 179 | 3.67 | 21928 | 24.96 |
| **Observer** | 4339 | 92.87 | 3345 | 97.61 | 3799 | 95.50 | 6986 | 94.88 | 6582 | 93.93 | 4679 | 95.98 | 64288 | 73.17 |

**Variability of wtmp3 Values Used to Fill Missing Values**

**Distribution of cv for wtmp3 sources**

| CV=sd/mean for nonmissing values | Min | Q1 | Mean | Q3 | Max |
|---|---|---|---|---|---|
| **Median for the trip** | 0.00 | 0.00 | 0.01 | 0.01 | 0.07 |
| **Median for the vessel, gear, year, and month** | 0.00 | 0.00 | 0.02 | 0.06 | 0.07 |

Note: The categorical variables anchusd, spaceusd, and tiednusd sometimes carry a value of "9" that was recorded by the observer. This is equal to "unknown" and is considered as missing in the tables below. Spaceusd and tiednusd were not recorded before May 1994. All hauls prior to that are reflected here as missing, although in the database they carry a value of "9".

**Sources for Value of anchusd Variable, Gillnet Observer Data, 1989-2006**

| Source of anchusd value | 1989-94 | | 1995 | | 1996 | | 1997 | | 1998 | | 1999 | | 2000 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % |
| **Missing** | 1257 | 5.79 | 93 | 1.48 | 64 | 1.18 | 58 | 1.01 | 58 | 0.94 | 10 | 0.19 | 94 | 1.61 |
| **Nearest haul on the trip** | 23 | 0.11 | 17 | 0.27 | 2 | 0.04 | 0 | 0 | 0 | 0 | 5 | 0.09 | 3 | 0.05 |
| **Nearest haul for the vessel, gear, and year** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 14 | 0.24 |
| **Nearest haul for the vessel, gear, year, month** | 9 | 0.04 | 1 | 0.02 | 3 | 0.06 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Observer** | 20433 | 94.07 | 6170 | 98.23 | 5360 | 98.73 | 5689 | 98.99 | 6133 | 99.06 | 5331 | 99.72 | 5711 | 98.09 |

| | 2001 | | 2002 | | 2003 | | 2004 | | 2005 | | 2006 | | All | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % |
| **Missing** | 0 | 0 | 0 | 0 | 1 | 0.03 | 0 | 0 | 8 | 0.11 | 0 | 0 | 1643 | 1.87 |
| **Nearest haul on the trip** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 50 | 0.06 |
| **Nearest haul for the vessel, gear, and year** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 14 | 0.02 |
| **Nearest haul for the vessel, gear, year, month** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 13 | 0.01 |
| **Observer** | 4672 | 100.0 | 3427 | 100.0 | 3977 | 99.97 | 7363 | 100.0 | 6999 | 99.89 | 4875 | 100.0 | 86140 | 98.04 |

**Sources for Value of spaceusd Variable, Gillnet Observer Data, 1989-2006**

| Source of spaceusd value | 1989-94 | | 1995 | | 1996 | | 1997 | | 1998 | | 1999 | | 2000 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % |
| **Missing** | 16534 | 76.12 | 85 | 1.35 | 60 | 1.11 | 53 | 0.92 | 50 | 0.81 | 105 | 1.96 | 265 | 4.55 |
| **Nearest haul on the trip** | 13 | 0.06 | 17 | 0.27 | 2 | 0.04 | 0 | 0 | 0 | 0 | 5 | 0.09 | 3 | 0.05 |
| **Nearest haul for the vessel, gear, year, month** | 3 | 0.01 | 1 | 0.02 | 3 | 0.06 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Observer** | 5172 | 23.81 | 6178 | 98.36 | 5364 | 98.80 | 5694 | 99.08 | 6141 | 99.19 | 5236 | 97.94 | 5554 | 95.40 |

| | 2001 | | 2002 | | 2003 | | 2004 | | 2005 | | 2006 | | All | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % |
| **Missing** | 0 | 0 | 0 | 0 | 5 | 0.13 | 16 | 0.22 | 17 | 0.24 | 10 | 0.21 | 17200 | 19.58 |
| **Nearest haul on the trip** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 40 | 0.05 |
| **Nearest haul for the vessel, gear, year, month** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 0.01 |
| **Observer** | 4672 | 100.0 | 3427 | 100.0 | 3973 | 99.87 | 7347 | 99.78 | 6990 | 99.76 | 4865 | 99.79 | 70613 | 80.37 |

**Sources for Value of tiednusd Variable, Gillnet Observer Data, 1989-2006**

| Source of tiednusd value | 1989-94 | | 1995 | | 1996 | | 1997 | | 1998 | | 1999 | | 2000 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % |
| **Missing** | 16553 | 76.20 | 100 | 1.59 | 87 | 1.60 | 74 | 1.29 | 99 | 1.60 | 126 | 2.36 | 292 | 5.02 |
| **Nearest haul on the trip** | 13 | 0.06 | 17 | 0.27 | 2 | 0.04 | 0 | 0 | 0 | 0 | 5 | 0.09 | 3 | 0.05 |
| **Nearest haul for the vessel, gear, year, month** | 3 | 0.01 | 1 | 0.02 | 3 | 0.06 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Observer** | 5153 | 23.72 | 6163 | 98.12 | 5337 | 98.31 | 5673 | 98.71 | 6092 | 98.40 | 5215 | 97.55 | 5527 | 94.93 |

| | 2001 | | 2002 | | 2003 | | 2004 | | 2005 | | 2006 | | All | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % | Hauls | % |
| **Missing** | 0 | 0 | 0 | 0 | 7 | 0.18 | 13 | 0.18 | 28 | 0.40 | 6 | 0.12 | 17385 | 19.79 |
| **Nearest haul on the trip** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 40 | 0.05 |
| **Nearest haul for the vessel, gear, year, month** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 0.01 |
| **Observer** | 4672 | 100.0 | 3427 | 100.0 | 3971 | 99.82 | 7350 | 99.82 | 6979 | 99.60 | 4869 | 99.88 | 70428 | 80.16 |

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