APPENDIX U
ICHTYOPLANKTON ASSESSMENT

APPENDIX U – ICHTHYOPLANKTON ASSESSMENT

VOLUME II – ENVIRONMENTAL EVALUATION

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BWTT	Bluewater Texas Terminal, LLC
cm	centimeter
DWPA	Deepwater Port Act
EAM	equivalent adult model
EIS	Environmental Impact Statement
ft	feet
gpm	gallons per minute
kg	kilograms
km	kilometer
lbs	pounds
LCL	lower confidence limit
LDWF	Louisiana Department of Fish and Wildlife
LNG	liquefied natural gas
m	meter
m^2	square meter
m^3	cubic meters
MARAD	Maritime Administration
mi	mile
mm	millimeter
nm	nautical mile
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
Project	Bluewater Single Point Mooring (SPM) Project
SEAMAP	Southeast Area Monitoring and Assessment Program
SPM	single point mooring
UCL	upper confidence limit
USCG	U.S. Coast Guard
VLCC	Very Large Crude Carriers
ZSIOP	Sea Fisheries Institute, Plankton Sorting and Identification Center

1 Introduction

This Ichthyoplankton Assessment describes the National Oceanic and Atmospheric Administration (NOAA) National Marine Fisheries Service's (NMFS) Southeast Area Monitoring and Assessment Program (SEAMAP) ichthyoplankton sampling, a description of the study area and why it was chosen, and the specific approaches used to analyze the SEAMAP data for fish egg and larval densities. These densities are used in conjunction with the estimated annual seawater intake from the Very Large Crude Carriers (VLCC) calling at the port, which is used to estimate potential levels of annual impingement and entrainment losses from the presence of the Bluewater Single Point Mooring (SPM) Project (Proposed Project).

Losses are calculated for four target species (see Section 2.5 below for additional information):

- Red drum (*Sciaenops ocellatus*);
- Red snapper (*Lutjanus campechanus*);
- Bay anchovy (*Anchoa mitchilli*); and
- Gulf menhaden (*Brevoortia patronus*).

The Proposed Project includes two SPM buoy systems that will be moored to the seafloor and used for crude oil loading operations. The SPM buoy systems will not require seawater intakes for operation. However, one VLCC at a time will be attached to each SPM buoy system as it is loaded with product. During the loading process, VLCCs will require the intake of seawater for various uses, as indicated in Table 1. Conservatively assuming that 192 port calls will occur annually between the two SPM buoy systems, the amount of seawater withdrawn is estimated to be about 1.04 billion gallons per year, representing only a small fraction of the amount of water available within the Proposed Project area. Although the VLCCs calling at the Proposed Project will be part of an existing fleet and will not be dedicated to the Proposed Project itself, impacts on ichthyoplankton were assessed based on the volume of water that they will potentially draw in during loading.

Table 1: Water Intake Requirements for the VLCCs

Water Use	Average Flow	Frequency	Total Estimated Annual Intake for 192 loading events (million gallons)
IG Deck Seal	32 gallons per minute (gpm)	Continuous	14.8
IGG Scrubber	1,202 gpm	Not during normal loading operations.	0.0
Main Engine Cooling Water (idling)	1,761 gpm	Continuous, while idling	811.6
Fire water system (pressurized)	1,541 gpm	Continuous, for open loop fire main	213.1
		Total	**1,040**

2 Data Selection and Management

Outlined below is a description of the SEAMAP ichthyoplankton studies, the study area, and the procedures used to calculate fish egg and larval densities from the SEAMAP samples taken from the defined source waterbody.

2.1 SEAMAP Program

Ichthyoplankton sampling has been conducted in the Gulf of Mexico as part of SEAMAP (Rester et al. 2015) since 1982. The sampling is conducted at standard stations, which are located at 30-mile (mi) (48-kilometer [km]), or 0.5 degree intervals comprising a fixed, systematic grid across the Gulf of Mexico. Occasionally, samples are taken at non-standard locations, or stations are moved to avoid navigational hazards. Samples are taken upon arrival at a station, regardless of time of day. Sampling cruises are routinely made during the summer and fall (June through November). July and September are typically the focal months of these surveys. The SEAMAP data represent fish eggs and larvae only; the data do not include other taxa (e.g., shrimp or crab species).

Lyczkowski-Shultz et al. (2004) reported that the sampling gear and methodology used for SEAMAP ichthyoplankton surveys follow Kramer et al. (1972), Smith and Richardson (1977), and Posgay and Marck (1980). A 24-inch (61-centimeter [cm]) bongo net fitted with 0.333-millimeter (mm) mesh is fished in an oblique tow path to a maximum depth of 656 feet (ft) (200 meters [m]) or to 6.56 to 16.4 ft (2 to 5 m) off the bottom at depths less than 656 ft (200 m). A mechanical flow meter is mounted off-center in the mouth of each bongo net to record the volume of water filtered. The volume of water filtered varies between approximately 20 to 600 cubic meters (m^3), but is typically 30 to 40 m^3 at the shallowest stations and 300 to 400 m^3 at the deepest stations. These data provide density estimates (i.e., the number of larvae or eggs per m^3). In addition to the bongo net sampling, a single or double 2- by 1-meter pipe-frame neuston net fitted with 0.04-inch (0.947-mm) mesh is towed at the surface with the frame half submerged for 10 minutes. These data yield catch-per-unit effort rather than density indices. Catches from bongo nets are standardized to account for sampling effort (i.e., volume filtered) and then expressed as number of larvae under 10 square meter (m^2) of sea surface (Lyczkowski-Shultz et al. 2004). This is accomplished by dividing the number of larvae of each taxon caught in a sample by the volume of water filtered during the tow, and then multiplying the result by the maximum depth of the tow in meters and a factor of 10. For the purposes of this Ichthyoplankton Assessment, the density estimate (number/m^3) is the value of interest. Initial processing of SEAMAP plankton samples is carried out at the Sea Fisheries Institute, Plankton Sorting and Identification Center (ZSIOP), in Szczecin, Poland, and the Louisiana Department of Wildlife and Fisheries (LDWF) (Lyczkowski-Shultz et al. 2004). Vials of eggs and identified larvae, plankton displacement volumes, total egg counts, and counts and length measurements of identified larvae are sent to the SEAMAP archive at the Florida Marine Research Institute in St. Petersburg, Florida. These data are entered into the SEAMAP database, and specimens are preserved and loaned to interested scientists. Data files containing specimen identifications and lengths are sent to the NMFS' Mississippi Laboratories where these data are combined with field collection data and edited according to established SEAMAP editing routines. SEAMAP survey data are currently maintained in dBase file structures, but conversion to an Oracle-based system is underway.

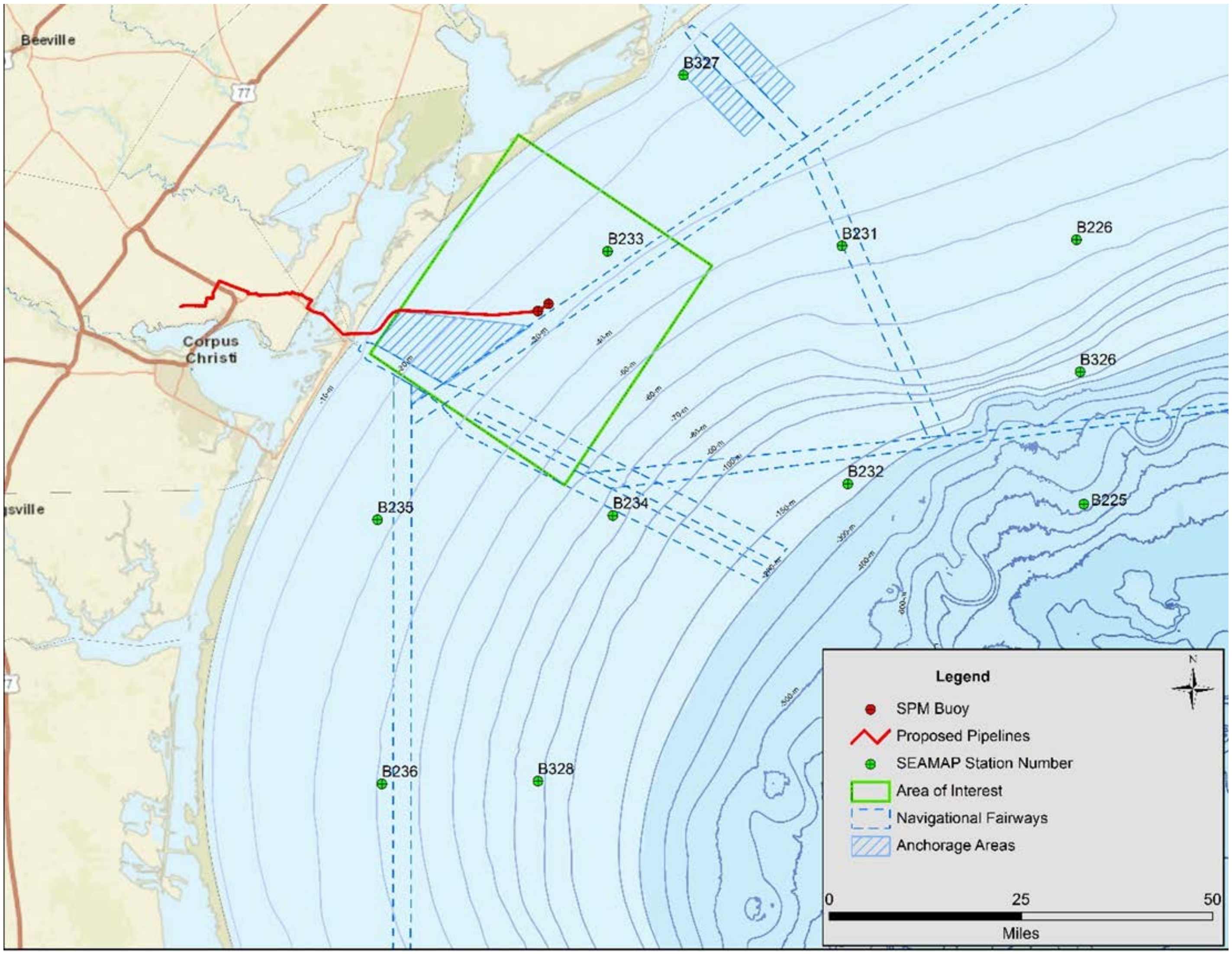
2.2 SEAMAP Data Procurement

The data used for the Ichthyoplankton Assessment was provided directly by the NMFS in April and May of 2018 (GSMFC 2018). The data requested and received spanned the timeframe between 1986 and 2014, and included relevant information from multiple SEAMAP data files (STAREC, ISTRWK, ISARWK) combined into one file for larval data and one file for egg data; these data were used to together to estimate the fish larvae and egg densities identified within this report.

2.3 Study Area

Upon review of the available SEAMAP stations, it was determined that Station B235 is the only station with a 30- by 30-nautical mile (nm) (56- by 56-km) block centered on the Project; therefore, Station B233 was the only station assessed to determine local ichthyoplankton abundance (see Figure 1). The study area selected is a block defined by the following corner coordinates: 27° 48’ 51.47” N, 97° 0’ 37.70” W; 28° 13’ 23.75” N, 96° 41’ 8.83” W; 27° 58’ 6.42” N, 96° 16’ 42.97” W; 27° 33’ 32.86” N, 96° 36’ 7.68” W.

Figure 1: Study Area – Source Waterbody



2.4 Ichthyoplankton Densities and Taxa Composition

SEAMAP data are available along the Texas Coast from 1986 to 2014 (GSMFC 2018). As noted above, Station B233 was assessed for ichthyoplankton abundance given its proximity to the Proposed Project. Station B233 has been sampled once per year in August or September, with the exception of 4 years in which the station was sampled twice (2002, 2007, 2012, and 2014). Based on the bongo net data from the 26 samples taken over 24 years, the overall, the density of fish larvae averaged 7.6 larvae/m^3 and the density of fish eggs averaged 4.9 eggs/m^3. Within these samples, a total of 111 taxa of fish, as well as a category for unidentified fish, were collected; 20 taxa made up over 95 percent of the collection; eggs are not identified to taxa. Species abundance varies throughout the year and the prevalence and diversity of species likely changes depending on the seasons; however, as peak occurrence for most species is in the summer/fall months, the overall abundance of ichthyoplankton will likely decrease in cooler months.

2.5 Species of Concern

Species of concern include those that are of ecological and/or economic importance and those for which life history data were readily available for use in the model. In accordance with similar assessments for other deepwater ports, the species of concern considered in this assessment include red drum, red snapper, Gulf menhaden, and bay anchovy. Bay anchovy have ecological value as a prey species, while Gulf menhaden have commercial as well as prey value. Red drum and red snapper are managed, high-value, recreational and/or commercial species.

Importantly, and from a very conservative perspective, data used for each species of concern included all relevant taxonomic categories for each of the four selected species. Because SEAMAP samples cannot always be identified to species level, data are also reported at genus and/or family levels and, therefore, may or may not actually be the species of concern. For example, for red drum, taxonomic search categories used in the analysis included family (Sciaenidae), genus (*Sciaenops*) and species (*ocellatus*) names. For all 26 samples, the taxonomic categories, Sciaenidae and *S. ocellatus*, were reported by NOAA's contracting laboratory for the samples used in this analysis. Hoese and Moore (1998) report that croakers [F. Sciaenidae] "*are perhaps the most characteristic group of northern Gulf inshore fishes. In numbers they exceed all other families, and in number of individuals, or biomass, they are among the top three* [*besides mullet and anchovies*]." Sciaenids include sand drum, Atlantic croaker, whiting, black drum, spotted seatrout, silver seatrout and several other ubiquitous species. Generally, red drum eggs and larvae are found near mouths and inlets of bays, and develop to post-larvae within estuarine marshes for the first several weeks after hatching. Several studies report that red drum larvae are abundant within tidal inlets during late fall periods (Holt et al. 1989). This information suggests that entrainment, and subsequently determined loss of age-1 equivalents for red drum, are likely overly conservative to unreliable, at best.

Similar taxonomic issues in the SEAMAP data were observed for red snapper. Of the 24 reported records for the three taxonomic categories, Lutjanidae, *Lutjanus* spp., and *L. campechanus*, only 17 percent (4) of the records were for 'true' red snapper; 83 percent (20) were for the other two taxonomic groups identified, which could include any of the two other *Lutjanus* species, including mutton (*L. analis*), and gray (*L. griseus*). Again, as with red drum, the data query approach (per the U.S. Coast Guard [USCG] and Maritime Administration [MARAD] 2004) will likely result in a subsequent loss of age-1 equivalents that is overly conservative. For anchovy, the family Engraulidae, as well as the genus *Anchoa* was included; menhaden included the family Clupeidae and the genus *Brevortia*.

3 Calculation of Potential Entrainment Estimates

In order to use the fish larvae data in the analysis, records were restricted to only those entries containing a value for VOL_FILT. The variable MEAS and NOT.MEAS were adjusted to zero values where the value in the record is -9, added together to create the total count variable, then adjusted by the ALIQUOT variable factor to represent a whole sample. Egg samples were filtered and adjusted in the same manner.

Fish larvae catch for each sample were aggregated, and divided by the sample VOL FILT parameter to create the sample catch per cubic meter of water filtered; i.e., cpue or density. For each taxa, larval densities were estimated as arithmetic means across the 24-year time series (1986 to 2014, excepting years where no sampling occurred at Station B233). Using simple arithmetic means as opposed to other metrics of central tendency based on a zero-inflated lognormal distribution assumes a worst-case scenario with respect to larval entrainment. That is, the arithmetic mean in this case will be greater than the expected value estimated for a skewed distribution. Non-parametric bootstrapped confidence intervals around these means were estimated as per Efron and Tibshirani (1994), which required no assumption regarding the underlying distribution of the data. Random samples, each with an n=24, were created by randomly sampling with replacement from the original time series. In total, 10,000 randomly created samples were used to permute a distribution from which the 2.5 and 97.5 percentiles were identified as the lower confidence limit (LCL) and upper confidence limit (UCL), respectively.

The potential entrainment estimates for larvae and eggs were obtained by multiplying the observed densities by the daily average intake volume by the days of exposure. Net extrusion effects were accounted for by multiplying the observed densities by a factor of 3. These estimates include three assumptions, in addition to the net extrusion adjustment factor. These additional assumptions include:

1. The depth-integrated samples reflect the densities that will be encountered at the depth of the intake location;
2. The densities obtained from the summer-fall collections are considered representative of the average density over the whole year; and
3. Exposure will occur intermittently over the entire year.

However, Assumption 2 concerning densities is likely not true (see Section 2.4), and Assumption 1 likely results in an overestimate of the actual ichthyoplankton densities found at the intake location since the depth-integrated sample accounts for the density across the entire water column.

3.1 Annual Estimates

Given the above, the annual estimates of impingement and entrainment of fish eggs and larvae for the Proposed Project area are provided in Table 2. Expected average larval densities, along with upper and lower confidence intervals, for the four species of concern are provided in Table 3.

Table 2: Projected Annual Estimates of Impingement and Entrainment within VLCC Systems Calling at the Proposed Project

Entrained Stage	LCL	Annual Mean	UCL
Fish Eggs	42,735,293	57,870,956	69,074,742
Fish Larvae	61,306,456	89,951,217	122,802,582

Table 3: Projected Annual Estimates of Larval Impingement and Entrainment within VLCC Systems Calling at the Proposed Project

Species	Associated Taxa In SEAMAP Data	Annual		
		LCL	Mean	UCL
Bay anchovy	F. Engraulidae, *Anchoa* spp.	18,868,587	40,039,158	65,206,656
Gulf menhaden	F. Clupeidae, *Brevoortia patronus*	9,697	96,046	233,909
Red drum	*S. ocellatus* and Sciaenids	795,092	1,457,729	2,262,363
Red snapper	*L. campechanus* and F. Lutjanidae	70,504	205,817	373,399

Because eggs were not identified to species, species-specific egg entrainment was determined by first calculating the ratio of total eggs to total larvae for the SEAMAP database. Respective densities were adjusted by a multiple of 3 for net extrusion. This yielded estimates of larvae and egg entrainment for the average, UCL, and LCL cases from which egg/larvae ratios were determined. Egg/larvae ratios (0.64) were multiplied by annual larval entrainment for each species and each entrainment scenario (LCL, average, and UCL) to yield the projected egg entrainment for each representative species, as presented in Table 4.

Table 4: Projected Annual Egg Entrainment within VLCC Systems Calling at the Proposed Project

Species	Associated Taxa In SEAMAP Data	Annual		
		LCL[1]	Mean	UCL[1]
Bay anchovy	F. Engraulidae, *Anchoa* spp.	12,139,281	25,759,566	41,951,311
Gulf menhaden	F. Clupeidae, *Brevoortia patronus*	6,238	61,792	150,487
Red drum	*S. ocellatus* and Sciaenids	511,530	937,844	1,455,512
Red snapper	*L. campechanus* and F. Lutjanidae	45,359	132,415	240,230

Notes:

Values are derived by multiplying larval entrainment by species from Table 2 by the egg-to-larvae ratio for each entrainment scenario.

[1] Confidence limits for the mean are an interval estimate for the mean. Interval estimates are often desirable because the estimate of the mean varies from sample to sample. Instead of a single estimate for the mean, a confidence interval generates a lower and upper limit for the mean. The interval estimate gives an indication of how much uncertainty there is in our estimate of the true mean. The narrower the interval, the more precise is our estimate.

4 Ichthyoplankton Assessment Model Methods

E2M, a consultant to the USCG, developed an Ichthyoplankton Assessment Model for specific taxa in association with the formerly proposed Gulf Landing LNG facility (USCG and MARAD 2004). The USCG has instructed that this model be used without change in the assessment process for new liquefied natural gas (LNG) projects so that impact assessments among projects will be comparable; although the Proposed Project is an oil terminal, USCG has previously requested that assessments be prepared for oil terminals as well. Therefore, in this section, we apply the USCG and MARAD (2004) model as amended by USCG and MARAD (2005) to the same taxa treated in the Gulf Landing Final Environmental Impact Statement (EIS). The model involves calculating age-1 equivalents and equivalent yield (for the taxa based on the entrainment estimates and life history characteristics of the taxa).

The equivalent yield analysis begins with the larval impacts associated with the Proposed Project and is expressed as the number of age-1 fish eggs and larvae that would have become adults if they had not been entrained and killed. The yield that these fish would have contributed over time is estimated and expressed as an equivalent increase in fishing pressure. In other words, an equivalent yield estimate represents 2 percent fishing pressure on the population when compared to that harvest, not a 2 percent loss of that harvest (USCG and MARAD 2004).

4.1 Life History Tables

Calculations of both age-1 equivalents and equivalent yield use stage-specific mortality rates to project the number of entrained eggs and larvae that otherwise would have been expected to survive to age-1 or would have been caught in a commercial or recreational fishery. The two critical life history values of importance for both estimates are daily, instantaneous mortality rates for identified stages and duration in days for each stage (e.g., USCG and MARAD 2004, Table G-13, as amended). Total mortality per stage is the product of daily instantaneous mortality and stage duration. Calculating total natural mortality is a prerequisite for estimating both age-1 equivalents and equivalent yield.

To address variability in recruitment, the critical life histories are determined for three separate scenarios:

- A base mortality case;
- A low mortality case; and
- A high mortality case.

The base mortality case provides estimates of daily mortality and stage duration based on average values provided in the scientific literature (e.g., USCG and MARAD 2004, Table G-13, as amended). In the low mortality case, critical values are based on low or lower-end estimates of mortality provided in the scientific literature (e.g., USCG and MARAD 2004 Table G-13 as amended), whereas high mortality critical values are determined from high or higher end estimates (e.g., USCG and MARAD 2004, Table G-13, as amended).

Three additional critical life history values are required for calculating the equivalent yield of taxa that are commercially or recreationally fished:

- Natural mortality rate per stage for individuals age-1 and older;
- Fishing mortality rate per stage for individuals age-1 and older; and
- Weight at median age of death per stage for individuals age-1 and older (e.g., USCG and MARAD 2004, Table G-16, as amended).

Within individual taxa, these critical values remain constant regardless of whether it is the base, low, or high mortality case for stages younger than age-1. It is assumed that fish age-1 and older are not subject to entrainment; therefore, parameter values are independent of the entrainment process. Critical life history values used in this Ichthyoplankton Assessment were taken directly from tables provided in USCG and MARAD (2004), as amended.

4.1.1 Red Drum

Instantaneous daily mortality and stage duration values for five initial stages of red drum are provided in USCG and MARAD 2004, Table G-13, as amended, along with the references used to determine those estimates. These data are for the base case mortality, low mortality, and high mortality scenario; they use average values of instantaneous daily mortality and stage duration. Additional critical values for individuals age-1 and older that are needed to calculate equivalent yield are provided in USCG and MARAD 2004, Table G-16, as amended.

4.1.2 Red Snapper

Critical life history values for four initial stages of red snapper are provided in USCG and MARAD 2004, Table G-58, as amended for the base, low, and high mortality cases. Additional critical values (natural mortality, fishing mortality, weight at median age of death) for individuals age-1 and older needed to calculate equivalent yield are provided in USCG and MARAD 2004, Table G-59, as amended.

4.1.3 Bay Anchovy

Critical life history values for three initial stages of bay anchovy are provided in USCG and MARAD 2004, Table G-34, as amended, for the base, low, and high mortality cases.

4.1.4 Gulf Menhaden

Critical life history values for three initial stages of Gulf menhaden are provided in USCG and MARAD 2004, Table G-42, as amended, for the base, low, and high mortality cases. Additional critical values for individuals age-1 and older that are needed to calculate equivalent yield are provided in USCG and MARAD 2004, Table G-43, as amended.

4.2 Age-1 Equivalent Analysis

Age-1 equivalents represent the number of individuals of each taxon that would have been expected to survive to age-1 had they not been entrained (see Attachment C). The variables and parameters used to calculate the number of age-1 equivalents are detailed in Section 3.1 of USCG and MARAD (2004). To describe the analysis, the age-1 equivalent table for the red drum base mortality case (USCG and MARAD 2004, Table A3.1 in Attachment 3) was used as an example.

As discussed above, critical values for instantaneous daily mortality and stage duration (days) were taken from the appropriate table in USCG and MARAD (2005). For the red drum base mortality case, this is Table G-13 in USCG and MARAD (2005).

The product of instantaneous daily mortality and stage duration yields total natural mortality per stage. By definition, Total Mortality is the sum of natural mortality and fishing mortality. Since fishing mortality for fish under the age of 1 is always zero, total mortality per stage is the natural mortality per stage. The fraction of individuals surviving a stage (Fraction Surviving) is defined by Equation 6 in USCG and MARAD (2004):

FRACTION SURVIVING = EXP (-TOTAL MORTALITY) (1)

"Correction" is an adjustment factor used to account for underestimation of mortality based on the model assumption that all larvae are at the beginning of a life history stage when entrained. In fact, this may not be the actual case. The Correction represents a revised Fraction Surviving and is defined by Equation 4 in USCG and MARAD (2004):

CORRECTION = 2 * FRACTION SURVIVING * EXP (-LOG(1 + FRACTION SURVIVING)) (2)

The number potentially entrained is the estimated number of entrained red drum, expressed as the mean, LCL, and UCL (see Tables 2 and 3). Fraction Surviving to Age 1 is the product of all values of Fraction Surviving for all stages remaining in the table beyond and including the stage of interest. Note that, for the stage of interest, the Correction value is used; but for all the remaining stages, the Fraction Surviving values are used. In Table A3.1 in

Attachment 3 of USCG and MARAD (2004), the Fraction Surviving to Age-1 for Larvae is calculated as the Larvae Correction multiplied by the Juvenile 1 Fraction Surviving multiplied by the Juvenile 2 Fraction Surviving multiplied by the Juvenile 3 Fraction Surviving. The Number Surviving for each stage is the product of the Number Potentially Entrained and the Fraction Surviving to Age 1. These values are calculated for both the egg and larvae stages and are summed to yield the total number of age-1 equivalents.

4.3 Equivalent Yield Analysis

Equivalent yield takes the estimated larval impacts associated with the intake of seawater and adjusts those impacts forward in time to resemble a fishery yield or harvest. The equivalent yield estimate is used as a base for reasonable comparison to other fisheries to help assess potential stress or pressure on the population. Equivalent yield is in no way intended for, or capable of, predicting direct losses to fish landings or harvest.

The analysis begins with an age-1 equivalent analysis. The variables and parameters used to calculate the number of age-1 equivalents are detailed in Section 3.2 of USCG and MARAD (2004), as amended, and as summarized above. For this report, a tabular equivalent yield model is provided as Attachment D.

4.4 Sensitivity Analyses

To address variability in recruitment, low and high ranges of mortality and entrainment were compared in order to assess differences in extreme ranges in entrainment loss relative to the base scenario as per USCG and MARAD (2004). These analyses are presented in summary tables, along with summaries of age-1 equivalent and equivalent yield analysis. The upper extreme estimate is for UCL entrainment and low stage mortality. In such a case there would be maximum entrainment and minimum natural mortality, which would result in the highest proportionate loss of fish due to entrainment or the highest losses in terms of age-1 equivalents and equivalent yield. The converse would be for the LCL entrainment and high natural mortality scenario. Under high natural mortality, most of the entrained fish would have been lost anyway thereby minimizing the loss attributed to entrainment. Both scenarios are considered extreme and unlikely (USCG and MARAD 2004).

Five other cases represent a range of entrainment alternatives that are more likely to occur than the previous cases. Three of those cases used basic life history parameters and either average entrainment, UCL entrainment, or LCL entrainment. The final two cases used either high or low larval mortality but used basic life history parameters for all other stages. The entrainment losses from these seven cases represent the average, maximum, and minimum losses that might occur given the inherent variability in the SEAMAP data.

5 Model Results

Detailed results of the age-1 equivalent and equivalent yield analyses for the four primary species of concern are provided in Attachments A and B, respectively. The following is a summary of the results by species.

5.1 Red Drum

Using the average entrainment estimates and base case life history values, it is estimated that 1,457,729 red drum (and F. Sciaenidae) larvae and 937,844 eggs will be entrained. It should be noted that this estimate assumes that all larvae identified in the family Sciaenidae are in fact red drum, which is highly unlikely given the abundance of other sciaenids (including Atlantic croaker [*Micropogonias undulates*] and spot croaker [*Leiostomus xanthurus*]) found in the shallow continental shelf waters of the northern Gulf of Mexico. Under base case parameters, the Proposed Project will reduce the number of red drum age-1 equivalents by 1,429 individuals, which equates to about 7,146 pounds (lbs) (3,241 kilograms [kg]) of fish. The latest fisheries report from NMFS (2019a) available on the price of landed red drum was $1.64/lb. Based on this information, the Proposed Project's economic impact from estimated annual population reduction would be approximately $11,719.44. Based on these values, impacts to the red drum recreational fishery are not considered significant. Additional scenarios are presented in Table 5.

Table 5: Summary of Sensitivity Analysis for Red Drum

Model Run	Likelihood of Occurrence	Number of Age-1 Fish Lost	Total Biomass of Age-1 Fish Lost (pounds)
Basic life history/average entrainment	Average	1,429	7,146
Base life history (low larval mortality)/average entrainment	Likely	6,930	34,662
Base life history (high larval mortality)/average entrainment	Likely	290	1,449
Basic life history/UCL entrainment	Likely	2,217	11,090
Basic life history/LCL entrainment	Likely	779	3,898
Low stage mortality/UCL entrainment	Unlikely	14,264	71,342
High stage mortality/LCL entrainment	Unlikely	46	232

5.2 Red Snapper

Using the average entrainment estimates and base case life history values, it is estimated that 205,817 red snapper larvae and 132,415 eggs will be entrained. In this case, 90 age-1 equivalents are represented and would have had an equivalent yield of 156 lbs (71 kg). According to the 2016 annual landings by species database (NMFS 2019b), the price of Gulf Coast red snapper is $4.42/lb. Therefore, the estimated annual economic impact from the entrainment and impingement of red snapper would be approximately $689.52. Based on this amount, the Proposed Project's impact to the red snapper commercial and recreational fisheries will not be significant. Additional scenarios are presented in Table 6.

Table 6: Summary of Sensitivity Analysis for Red Snapper

Estimate	Likelihood of Occurrence	Number of Age-1 Fish Lost	Total Biomass of Age-1 Fish Lost (pounds)
Basic life history/average entrainment	Average	90	156
Base life history (low larval mortality)/average entrainment	Likely	493	851
Base life history (high larval mortality)/average entrainment	Likely	13	23
Basic life history/UCL entrainment	Likely	164	283

Basic life history/LCL entrainment	Likely	31	53
Low stage mortality/UCL entrainment	Unlikely	6,289	10,842
High stage mortality/LCL entrainment	Unlikely	1	2

5.3 Gulf Menhaden

Using the average entrainment estimates and base case life history values, it is estimated that 96,046 Gulf menhaden larvae and 61,792 eggs will be entrained. In this case, 92 age-1 equivalents are represented and would have had an equivalent yield of 15 lbs (7 kg). This population reduction is a very small percentage of the total population in the Gulf of Mexico, and no change will occur in the standing crop. The Gulf menhaden fishery is primarily harvested commercially, with no significant recreational harvesting in the Gulf of Mexico. Federal and state regulations are focused on area and seasonal closures with few restrictions, if any, on size or total trip limits; therefore, the fishery is similar to an open access fishery (GSMFC 2002).

In 2016, the price per pound of Gulf menhaden was $1.37 (NMFS 2018). The economic impact from Gulf menhaden entrainment and impingement from the annual reduction in population would be about $126.04. Therefore, the impact to the Gulf menhaden commercial fishery from the operation of the Proposed Project will not be significant. Additional scenarios are presented in Table 7.

Table 7: Summary of Sensitivity Analysis for Gulf Menhaden

Estimate	Likelihood of Occurrence	Number of Age-1 Fish Lost	Total Biomass of Age-1 Fish Lost (pounds)
Basic life history/average entrainment	Average	92	15
Base life history (low larval mortality)/average entrainment	Likely	221	35
Base life history (high larval mortality)/average entrainment	Likely	42	7
Basic life history/UCL entrainment	Likely	223	35
Basic life history/LCL entrainment	Likely	9	1
Low stage mortality/UCL entrainment	Unlikely	513	81
High stage mortality/LCL entrainment	Unlikely	4	1

5.4 Bay Anchovy

As anchovies are not fished, we provide age-1 equivalent values, but do not calculate equivalent yield losses. For the average entrainment and base mortality case, total entrainment was estimated at 40,039,158 anchovy larvae and 25,759,566 eggs. In terms of age-1 equivalents, the expected loss to the system will be 22,743 anchovies in the average likelihood scenario.

The bay anchovy is not commercially or recreationally fished; however, it is an important food source for a number of commercially and recreationally harvested species. The bay anchovy, itself, will not cause an economic loss as it is not commercially or recreationally fished. Based on these values, impacts to bay anchovy from the Proposed Project will not be significant. Additional scenarios are presented in Table 8.

Table 8: Summary of Sensitivity Analysis for Bay Anchovies

Estimate	Likelihood of Occurrence	Number of Age-1 Fish Lost
Basic life history/average entrainment	Average	22,743
Base life history (low larval mortality)/average entrainment	Likely	99,145

Base life history (high larval mortality)/average entrainment	Likely	9,692
Basic life history/UCL entrainment	Likely	37,039
Basic life history/LCL entrainment	Likely	10,718
Low stage mortality/UCL entrainment	Unlikely	165,771
High stage mortality/LCL entrainment	Unlikely	584

5.5 Summary

A summary of the Proposed Project's economic impacts on commercial and recreational fishing, including potential impacts on red drum, red snapper, Gulf menhaden, and bay anchovy, is provided in Table 9. Overall, the biological and economic impacts the fisheries from entrainment and impingement of the representative species from the operation of the Proposed Project will not be significant.

Table 9: Summary of Annual Economic Impacts to Fishery from the Proposed Project

Species	Age-1 Equivalents Lost (average entrainment/base case mortality)	Pounds of Fish Lost	Estimated Economic Impact
Red Drum	1,429	7,146	$11,719.44
Red Snapper	90	156	$689.52
Gulf menhaden	92	92	$126.04
Bay anchovy	22,743	N/A	N/A

N/A = not applicable

6 Conclusion

The Proposed Project does not require the use of seawater for normal operations of the designated equipment. However, VLCCs that are part of the existing oil tanker fleet will call at the port and will require seawater intake during loading operations. This report concludes that the impacts on ichthyoplankton and fisheries resources from VLCC water intake are insignificant. The overall water use expected from the estimated 192 port calls by VLCCs at the Proposed Project will be about 1.04 billion gallons; this volume of water is likely similar to other commercial fleet vessels that regularly transit the Gulf of Mexico.

The various assumptions used in the Ichthyoplankton Assessment, including the cumulative use of related taxonomic categories (e.g., inclusion of all taxa identified to a given family as the species of interest), the use of a net extrusion factor of 3 for baseline entrainment values, and use of depth-integrated SEAMAP data for surface-oriented intakes, likely results in over-estimates of entrainment. These worst-case scenario assumptions likely lead to estimates for lost age-1 individuals and equivalent yield values that are biased high. Importantly, the current forward-projecting equivalent adult model (EAM) used by the USCG has been critically evaluated, and its inadequacy has been demonstrated within peer-reviewed technical papers (see Gallaway et al. 2007). Gallaway et al. (2007) noted that forward-projecting EAMs are likely inappropriate and lead to gross over-estimates of predicted losses. For example, Gallaway et al. (2007) notes that, based on review of seven proposed offshore LNG terminals, forward-projecting EAMs were 387 times greater than if a fecundity hindcast model would have been used. The primary issue noted by Gallaway et al. is that the EAMs do not include any density-dependent compensation (i.e., compensatory mortality) in that the models are strictly linear or density independent. The more life history parameters required (e.g., age-specific mortality estimates), the greater the chance of bias in their estimation, as well as inflation of propagated variance. Hindcasting models are more reliable simply because they require fewer life history parameters.

Bluewater Texas Terminal, LLC (BWTT) has applied USCG's forward-projecting EAM model based on its historical application during previous Deepwater Port Act (DWPA) application proceedings, but believes that the model skews the understanding of "real world" impacts toward a worst-case scenario than is warranted by the data. This belief is supported by recent peer-reviewed scientific studies considering this topic (see Gallaway et al. 2007). Regardless, the predicted fisheries impacts from the Proposed Project were evaluated as insignificant. Considering the high degree of uncertainty associated with the historically used USCG/MARAD model, and issues brought to bear concerning its use for estimating fisheries' population impacts, the impacts expected from entrainment and impingement for the four species of concern are considered inconsequential.

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Attachment A Age-1 Equivalent Calculations

Table A1. Age-1 equivalents for red drum (*Sciaenops ocellatus*) using base mortality estimates (i.e., base life history) for all life stages

Stage	Instantaneous Mortality	Duration (Days)	Natural Mortality per Stage	Fishing Mortality per Stage	Total Mortality per Stage	Fraction Surviving	Correction
Egg	0.4984	1	0.4984	0	0.4984	0.6075	0.7558
Larvae	0.25	20	5.0000	0	5.0000	0.0067	0.0134
Juvenile 1	0.1365	12	1.6380	0	1.6380	0.1944	0.3255
Juvenile 2	0.0054	166	0.8964	0	0.8964	0.4080	0.5796
Juvenile 3	0.0018	166	0.2988	0	0.2988	0.7417	0.8517
	Total =	365		Total =	8.3316		

Stage	Number Potentially Entrained			Fraction Surviving to Age 1+	Number Surviving to Age 1+		
	LCL	Mean	UCL		LCL	Mean	UCL
Egg	511,530	937,844	1,455,512	3.00E-04	153	281	436
Larvae	795,092	1,457,729	2,262,363	7.87E-04	626	1,148	1,781
Juvenile 1							
Juvenile 2							
Juvenile 3							
				Total =	779	1,429	2,217

Table A2. Age-1 equivalents for red drum (*Sciaenops ocellatus*) using low mortality estimates (i.e., low mortality life history) across all life stages

Stage	Instantaneous Mortality	Duration (Days)	Natural Mortality per Stage	Fishing Mortality per Stage	Total Mortality per Stage	Fraction Surviving	Correction
Egg	0.4984	1	0.4984	0	0.4984	0.6075	0.7558
Larvae	0.17	20	3.4000	0	3.4000	0.0334	0.0646
Juvenile 1	0.134	12	1.6080	0	1.6080	0.2003	0.3337
Juvenile 2	0.00478	166	0.7935	0	0.7935	0.4523	0.6228
Juvenile 3	0.0009	166	0.1494	0	0.1494	0.8612	0.9254
	Total =	365		Total =	6.44928		

Stage	Number Potentially Entrained			Fraction Surviving to Age 1+	Number Surviving to Age 1+		
	LCL	Mean	UCL		LCL	Mean	UCL
Egg	511,530	937,844	1,455,512	1.97E-03	1,007	1,846	2,864
Larvae	795,092	1,457,729	2,262,363	5.04E-03	4,006	7,345	11,400
Juvenile 1							
Juvenile 2							
Juvenile 3							
				Total =	5,013	9,191	14,264

Table A3. Age-1 equivalents for red drum (*Sciaenops ocellatus*) using high mortality estimates (high mortality life history) across all life stages

Stage	Instantaneous Mortality	Duration (Days)	Natural Mortality per Stage	Fishing Mortality per Stage	Total Mortality per Stage	Fraction Surviving	Correction
Egg	0.4984	1	0.4984	0	0.4984	0.6075	0.7558
Larvae	0.33	20	6.6000	0	6.6000	0.0014	0.0027
Juvenile 1	0.139	20	2.7800	0	2.7800	0.0620	0.1168
Juvenile 2	0.00609	162	0.9866	0	0.9866	0.3728	0.5432
Juvenile 3	0.0018	162	0.2916	0	0.2916	0.7471	0.8552
	Total =	365		Total =	11.15658		

Stage	Number Potentially Entrained			Fraction Surviving to Age 1+	Number Surviving to Age 1+		
	LCL	Mean	UCL		LCL	Mean	UCL
Egg	511,530	937,844	1,455,512	1.78E-05	9	17	26
Larvae	795,092	1,457,729	2,262,363	4.70E-05	37	68	106
Juvenile 1							
Juvenile 2							
Juvenile 3							
				Total =	46	85	132

Table A4. Age-1 equivalents for red drum (*Sciaenops ocellatus*) using low larval mortality rates and base mortality estimates (base life history) across all other life stages

Stage	Instantaneous Mortality	Duration (Days)	Natural Mortality per Stage	Fishing Mortality per Stage	Total Mortality per Stage	Fraction Surviving	Correction
Egg	0.4984	1	0.4984	0	0.4984	0.6075	0.7558
Larvae	0.17	20	3.4000	0	3.4000	0.0334	0.0646
Juvenile 1	0.1365	12	1.6380	0	1.6380	0.1944	0.3255
Juvenile 2	0.0054	166	0.8964	0	0.8964	0.4080	0.5796
Juvenile 3	0.0018	166	0.2988	0	0.2988	0.7417	0.8517
	Total =	365		Total =	6.7316		

Stage	Number Potentially Entrained			Fraction Surviving to Age 1+	Number Surviving to Age 1+		
	LCL	Mean	UCL		LCL	Mean	UCL
Egg	511,530	937,844	1,455,512	1.48E-03	759	1,392	2,160
Larvae	795,092	1,457,729	2,262,363	3.80E-03	3,021	5,539	8,596
Juvenile 1							
Juvenile 2							
Juvenile 3							
				Total =	3,780	6,930	10,756

Table A5. Age-1 equivalents for red drum (*Sciaenops ocellatus*) using high larval mortality rates and base mortality estimates (base life history) across all otherstages

Stage	Instantaneous Mortality	Duration (Days)	Natural Mortality per Stage	Fishing Mortality per Stage	Total Mortality per Stage	Fraction Surviving	Correction
Egg	0.4984	1	0.4984	0	0.4984	0.6075	0.7558
Larvae	0.33	20	6.6000	0	6.6000	0.0014	0.0027
Juvenile 1	0.1365	12	1.6380	0	1.6380	0.1944	0.3255
Juvenile 2	0.0054	166	0.8964	0	0.8964	0.4080	0.5796
Juvenile 3	0.0018	166	0.2988	0	0.2988	0.7417	0.8517
	Total =	365		Total =	9.9316		

Stage	Number Potentially Entrained			Fraction Surviving to Age 1+	Number Surviving to Age 1+		
	LCL	Mean	UCL		LCL	Mean	UCL
Egg	511,530	937,844	1,455,512	6.05E-05	31	57	88
Larvae	795,092	1,457,729	2,262,363	1.60E-04	127	233	362
Juvenile 1							
Juvenile 2							
Juvenile 3							
				Total =	158	290	450

Table A6. Age-1 equivalents for red snapper (*Lutjanus campechanus*) using base mortality estimates (base life history) across all life stages

Stage	Instantaneous Mortality	Duration (Days)	Natural Mortality per Stage	Fishing Mortality per Stage	Total Mortality per Stage	Fraction Surviving	Correction
Egg	0.4984	1	0.4984	0	0.4984	0.6075	0.7558
Larvae	0.205	28	5.7400	0	5.7400	0.0032	0.0064
Juvenile 1	0.1	24	2.4000	0	2.4000	0.0907	0.1663
Juvenile 3	0.0016	312	0.4992	0	0.4992	0.6070	0.7555
	Total =	365		Total =	9.1376		

Stage	Number Potentially Entrained			Fraction Surviving to Age 1+	Number Surviving to Age 1+		
	LCL	Mean	UCL		LCL	Mean	UCL
Egg	45,359	132,415	240,230	1.34E-04	6	18	32
Larvae	70,504	205,817	373,399	3.53E-04	25	73	132
Juvenile 1							
Juvenile 3							
				Total =	31	90	164

Table A7. Age-1 equivalents for red snapper (*Lutjanus campechanus*) using low mortality estimates (low mortality life history) across all life stages

Stage	Instantaneous Mortality	Duration (Days)	Natural Mortality per Stage	Fishing Mortality per Stage	Total Mortality per Stage	Fraction Surviving	Correction
Egg	0.4984	1	0.4984	0	0.4984	0.6075	0.7558
Larvae	0.155	26	4.0300	0	4.0300	0.0178	0.0349
Juvenile 1	0.045	10	0.4500	0	0.4500	0.6376	0.7787
Juvenile 3	0.00163	307	0.5004	0	0.5004	0.6063	0.7549
	Total =	344		Total =	5.47881		

Stage	Number Potentially Entrained			Fraction Surviving to Age 1+	Number Surviving to Age 1+		
	LCL	Mean	UCL		LCL	Mean	UCL
Egg	45,359	132,415	240,230	5.19E-03	236	688	1,248
Larvae	70,504	205,817	373,399	1.35E-02	952	2,779	5,042
Juvenile 1							
Juvenile 3							
				Total =	1,188	3,467	6,289

Table A8. Age-1 equivalents for red snapper (*Lutjanus campechanus*) using high mortality estimates (high mortality life history) across all life stages

Stage	Instantaneous Mortality	Duration (Days)	Natural Mortality per Stage	Fishing Mortality per Stage	Total Mortality per Stage	Fraction Surviving	Correction
Egg	0.4984	1	0.4984	0	0.4984	0.6075	0.7558
Larvae	0.255	30	7.6500	0	7.6500	0.0005	0.0010
Juvenile 1	0.12	31	3.7200	0	3.7200	0.0242	0.0473
Juvenile 3	0.00154	324	0.4990	0	0.4990	0.6072	0.7556
	Total =	386		Total =	12.36736		

Stage	Number Potentially Entrained			Fraction Surviving to Age 1+	Number Surviving to Age 1+		
	LCL	Mean	UCL		LCL	Mean	UCL
Egg	45,359	132,415	240,230	5.29E-06	0	1	1
Larvae	70,504	205,817	373,399	1.40E-05	1	3	5
Juvenile 1							
Juvenile 3							
				Total =	1	4	7

Table A9. Age-1 equivalents for red snapper (*Lutjanus campechanus*) using low larval mortality rates and base mortality estimates (base life history) across all other life stages

Stage	Instantaneous Mortality	Duration (Days)	Natural Mortality per Stage	Fishing Mortality per Stage	Total Mortality per Stage	Fraction Surviving	Correction
Egg	0.4984	1	0.4984	0	0.4984	0.6075	0.7558
Larvae	0.155	26	4.0300	0	4.0300	0.0178	0.0349
Juvenile 1	0.1	24	2.4000	0	2.4000	0.0907	0.1663
Juvenile 3	0.0016	312	0.4992	0	0.4992	0.6070	0.7555
			0.0000	0	0.0000	1.0000	1.0000
	Total =	363		Total =	7.4276		

Stage	Number Potentially Entrained			Fraction Surviving to Age 1+	Number Surviving to Age 1+		
	LCL	Mean	UCL		LCL	Mean	UCL
Egg	45,359	132,415	240,230	7.40E-04	34	98	178
Larvae	70,504	205,817	373,399	1.92E-03	136	396	718
Juvenile 1							
Juvenile 3							
				Total =	169	494	896

Table A10. Age-1 equivalents for red snapper (*Lutjanus campechanus*) usinghigh larval mortality rates and base mortality estimates (base life history) across all other life stages

Stage	Instantaneous Mortality	Duration (Days)	Natural Mortality per Stage	Fishing Mortality per Stage	Total Mortality per Stage	Fraction Surviving	Correction
Egg	0.4984	1	0.4984	0	0.4984	0.6075	0.7558
Larvae	0.255	30	7.6500	0	7.6500	0.0005	0.0010
Juvenile 1	0.1	24	2.4000	0	2.4000	0.0907	0.1663
Juvenile 3	0.0016	312	0.4992	0	0.4992	0.6070	0.7555
			0.0000	0	0.0000	1.0000	1.0000
	Total =	367		Total =	11.0476		

Stage	Number Potentially Entrained			Fraction Surviving to Age 1+	Number Surviving to Age 1+		
	LCL	Mean	UCL		LCL	Mean	UCL
Egg	45,359	132,415	240,230	1.98E-05	1	3	5
Larvae	70,504	205,817	373,399	5.24E-05	4	11	20
Juvenile 1							
Juvenile 3							
				Total =	5	13	24

Table A11. Age-1 equivalents for Gulf menhaden (*Brevoortia patronus)* using base mortality estimates (Base life history) across all life stages

Stage	Instantaneous Mortality	Duration (Days)	Natural Mortality per Stage	Fishing Mortality per Stage	Total Mortality per Stage	Fraction Surviving	Correction
Egg	1.044	1.75	1.8270	0	1.8270	0.1609	0.2772
YSL	0.059	65	3.8350	0	3.8350	0.0216	0.0423
Juvenile 1	0.013	298.3	3.8779	0	3.8779	0.0207	0.0405
	Total =	365.05		Total =	9.5399		

Stage	Number Potentially Entrained			Fraction Surviving to Age 1+	Number Surviving to Age 1+		
	LCL	Mean	UCL		LCL	Mean	UCL
Egg	6,238	61,792	150,487	1.24E-04	1	8	19
YSL	9,697	96,046	233,909	8.75E-04	8	84	205
Juvenile 1							
				Total =	9	92	223

Table A12. Age-1 equivalents for Gulf menhaden *(Brevoortia patronus)* using low mortality estimates (low mortality life history) across all life stages

Stage	Instantaneous Mortality	Duration (Days)	Natural Mortality per Stage	Fishing Mortality per Stage	Total Mortality per Stage	Fraction Surviving	Correction
Egg	1.044	1.5	1.5660	0	1.5660	0.2089	0.3456
YSL	0.0488	60	2.9280	0	2.9280	0.0535	0.1016
Juvenile 1	0.013	303.5	3.9455	0	3.9455	0.0193	0.0379
0							
0							
	Total =	365		Total =	8.4395		

Stage	Number Potentially Entrained			Fraction Surviving to Age 1+	Number Surviving to Age 1+		
	LCL	Mean	UCL		LCL	Mean	UCL
Egg	6,238	61,792	150,487	3.58E-04	2	22	54
YSL	9,697	96,046	233,909	1.96E-03	19	189	460
Juvenile 1							
				Total =	21	211	513

Table A13. Age-1 equivalents for Gulf menhaden *(Brevoortia patronus)* using high mortality estimates (high mortality life history) across all life stages.

Stage	Instantaneous Mortality	Duration (Days)	Natural Mortality per Stage	Fishing Mortality per Stage	Total Mortality per Stage	Fraction Surviving	Correction
Egg	6.21	2	12.4200	0	12.4200	0.0000	0.0000
YSL	0.077	60	4.6200	0	4.6200	0.0099	0.0195
Juvenile 1	0.013	303	3.9390	0	3.9390	0.0195	0.0382
	Total =	365		Total =	20.979		

Stage	Number Potentially Entrained			Fraction Surviving to Age 1+	Number Surviving to Age 1+		
	LCL	Mean	UCL		LCL	Mean	UCL
Egg	6,238	61,792	150,487	1.55E-09	0	0	0
YSL	9,697	96,046	233,909	3.80E-04	4	36	89
Juvenile 1							
				Total =	4	36	89

Table A14. Age-1 equivalents for Gulf menhaden (*Brevoortia patronus*) using low larval mortality rates and base mortality estimates (Base life history) across all other life stages

Stage	Instantaneous Mortality	Duration (Days)	Natural Mortality per Stage	Fishing Mortality per Stage	Total Mortality per Stage	Fraction Surviving	Correction
Egg	1.044	1.75	1.8270	0	1.8270	0.1609	0.2772
YSL	0.0488	60	2.9280	0	2.9280	0.0535	0.1016
Juvenile 1	0.013	298.3	3.8779	0	3.8779	0.0207	0.0405
	Total =	360.05		Total =	8.6329		

Stage	Number Potentially Entrained			Fraction Surviving to Age 1+	Number Surviving to Age 1+		
	LCL	Mean	UCL		LCL	Mean	UCL
Egg	6,238	61,792	150,487	3.07E-04	2	19	46
YSL	9,697	96,046	233,909	2.10E-03	20	202	492
Juvenile 1							
				Total =	22	221	538

Table A15. Age-1 equivalents for Gulf menhaden (*Brevoortia patronus*) using high larval mortality rates and base mortality estimates (Base life history) across all other life stages

Stage	Instantaneous Mortality	Duration (Days)	Natural Mortality per Stage	Fishing Mortality per Stage	Total Mortality per Stage	Fraction Surviving	Correction
Egg	1.044	1.75	1.8270	0	1.8270	0.1609	0.2772
YSL	0.077	60	4.6200	0	4.6200	0.0099	0.0195
Juvenile 1	0.013	298.3	3.8779	0	3.8779	0.0207	0.0405
	Total =	360.05		Total =	10.3249		

Stage	Number Potentially Entrained			Fraction Surviving to Age 1+	Number Surviving to Age 1+		
	LCL	Mean	UCL		LCL	Mean	UCL
Egg	6,238	61,792	150,487	5.65E-05	0	3	9
YSL	9,697	96,046	233,909	4.04E-04	4	39	94
Juvenile 1							
				Total =	4	42	103

Table A16. Age-1 equivalents for bay anchovy (*Anchoa* sp.) using base mortality estimates (Base life history) across all life stages

Stage	Instantaneous Mortality	Duration (Days)	Natural Mortality per Stage	Fishing Mortality per Stage	Total Mortality per Stage	Fraction Surviving	Correction
Egg	1.044	1	1.0440	0	1.0440	0.3520	0.5208
Larvae	0.2059	34	7.0006	0	7.0006	0.0009	0.0018
Juvenile 1	0.004	330	1.3200	0	1.3200	0.2671	0.4216
	Total =	365		Total =	9.3646		

Stage	Number Potentially Entrained			Fraction Surviving to Age 1+	Number Surviving to Age 1+		
	LCL	Mean	UCL		LCL	Mean	UCL
Egg	12,139,281	25,759,566	41,951,311	1.27E-04	1,539	3,266	5,319
Larvae	18,868,587	40,039,158	65,206,656	4.86E-04	9,179	19,477	31,720
Juvenile 1							
				Total =	10,718	22,743	37,039

Table A17. Age-1 equivalents for bay anchovy (A*nchoa* sp.) using low mortality estimates (low mortality life history) across all life stages

Stage	Instantaneous Mortality	Duration (Days)	Natural Mortality per Stage	Fishing Mortality per Stage	Total Mortality per Stage	Fraction Surviving	Correction
Egg	0.69	1	0.6900	0	0.6900	0.5016	0.6681
Larvae	0.1804	30.63	5.5257	0	5.5257	0.0040	0.0079
Juvenile 1	0.004	333.4	1.3336	0	1.3336	0.2635	0.4171
	Total =	365.03		Total =	7.549252		

Stage	Number Potentially Entrained			Fraction Surviving to Age 1+	Number Surviving to Age 1+		
	LCL	Mean	UCL		LCL	Mean	UCL
Egg	12,139,281	25,759,566	41,951,311	7.01E-04	8,513	18,064	29,419
Larvae	18,868,587	40,039,158	65,206,656	2.09E-03	39,456	83,725	136,352
Juvenile 1							
				Total =	47,968	101,789	165,771

Table A18. Age-1 equivalents for bay anchovy (*Anchoa* sp.) using high mortality estimates (high mortality life history) across all life stages

Stage	Instantaneous Mortality	Duration (Days)	Natural Mortality per Stage	Fishing Mortality per Stage	Total Mortality per Stage	Fraction Surviving	Correction
Egg	1.94	1	1.9400	0	1.9400	0.1437	0.2513
Larvae	0.231	34	7.8540	0	7.8540	0.0004	0.0008
Juvenile 1	0.01	330	3.3000	0	3.3000	0.0369	0.0711
	Total =	365		Total =	13.094		

Stage	Number Potentially Entrained			Fraction Surviving to Age 1+	Number Surviving to Age 1+		
	LCL	Mean	UCL		LCL	Mean	UCL
Egg	12,139,281	25,759,566	41,951,311	3.60E-06	44	93	151
Larvae	18,868,587	40,039,158	65,206,656	2.86E-05	540	1,146	1,867
Juvenile 1							
				Total =	584	1,239	2,017

Table A19. Age-1 equivalents for bay anchovy (A*nchoa* sp.) using low larval mortality rates and base mortality estimates (Base life history) across all other lifestages

Stage	Instantaneous Mortality	Duration (Days)	Natural Mortality per Stage	Fishing Mortality per Stage	Total Mortality per Stage	Fraction Surviving	Correction
Egg	1.044	1	1.0440	0	1.0440	0.3520	0.5208
Larvae	0.1804	30.63	5.5257	0	5.5257	0.0040	0.0079
Juvenile 1	0.004	330	1.3200	0	1.3200	0.2671	0.4216
	Total =	361.63		Total =	7.889652		

Stage	Number Potentially Entrained			Fraction Surviving to Age 1+	Number Surviving to Age 1+		
	LCL	Mean	UCL		LCL	Mean	UCL
Egg	12,139,281	25,759,566	41,951,311	5.54E-04	6,727	14,274	23,246
Larvae	18,868,587	40,039,158	65,206,656	2.12E-03	39,996	84,871	138,219
Juvenile 1							
				Total =	46,722	99,145	161,465

Table A20. Age-1 equivalents for bay anchovy (A*nchoa* sp.) using high larval mortality rates and base mortality estimates (Base life history) across all other lifestages

Stage	Instantaneous Mortality	Duration (Days)	Natural Mortality per Stage	Fishing Mortality per Stage	Total Mortality per Stage	Fraction Surviving	Correction
Egg	1.044	1	1.0440	0	1.0440	0.3520	0.5208
Larvae	0.231	34	7.8540	0	7.8540	0.0004	0.0008
Juvenile 1	0.004	330	1.3200	0	1.3200	0.2671	0.4216
	Total =	365		Total =	10.218		

Stage	Number Potentially Entrained			Fraction Surviving to Age 1+	Number Surviving to Age 1+		
	LCL	Mean	UCL		LCL	Mean	UCL
Egg	12,139,281	25,759,566	41,951,311	5.40E-05	656	1,391	2,265
Larvae	18,868,587	40,039,158	65,206,656	2.07E-04	3,912	8,301	13,519
Juvenile 1							
				Total =	4,567	9,692	15,784

Attachment B Equivalent Yield Analysis

Table B1. Base Life History (Base Mortality Rates) Table and Average Entrainment Estimate for Red Drum (*Sciaenops ocellatus*)

Life History Stage or Age	Natural Mortality per Stage or Age (M)	Fishing Mortality per Stage or Age (F)	% Vulnerability to the Fishery	Total Mortality per Stage (z)	Fraction Surviving at Stage or Age	Corrected Survival Fraction	Number Potentially Entrained at Stage or Age	Cumulative Survival at Stage or Age	Projected Mortality of Age-1 fish	Weight of an Individual fish at Median Age of Death	Number Potentially Lost to Fishing Mortality	Number Potentially Lost to Natural Mortality	Number That Might Have Remained in the Population at the End of Year	Total Number at Age	Weight of Fish Potentially Lost to Fishing Mortality	Weight of Fish Potentially Lost to Natural Mortality	Weight of Fish That Might Have Remained in the Population at the End of Year
Egg	0.4984	0	1	0.50	0.61	0.76	937,844	0.00030	281	NA	NA	NA	NA	NA	NA	NA	NA
Larvae	5.0000	0	1	5.00	0.01	0.01	1,457,729	0.00079	1148	NA	NA	NA	NA	NA	NA	NA	NA
Juvenile 1	1.6380	0	1	1.64	0.19	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Juvenile 2	0.8964	0	1	0.90	0.41	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Juvenile 3	0.2988	0	1	0.30	0.74	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1	0.27	0.621	1	0.89	0.41	NA	NA	NA	NA	2.59458	587	255	586	1,429	1,524	663	1,521
2	0.19	1.149	1	1.34	0.26	NA	NA	NA	NA	6.88424	371	61	154	586	2,555	423	1,058
3	0.16	0.324	1	0.48	0.62	NA	NA	NA	NA	10.23435	39	19	95	154	404	199	969
4	0.16	0.190	1	0.35	0.70	NA	NA	NA	NA	11.45316	15	13	67	95	174	146	764
5	0.15	0.036	1	0.19	0.83	NA	NA	NA	NA	12.62000	2	9	55	67	28	115	699
6	0.14	0.117	1	0.26	0.77	NA	NA	NA	NA	13.72648	6	7	43	55	78	94	588
7	0.14	0.117	1	0.26	0.77	NA	NA	NA	NA	14.76732	4	5	33	43	65	78	489
8	0.14	0.117	1	0.26	0.77	NA	NA	NA	NA	15.73977	3	4	26	33	54	64	403
9	0.14	0.117	1	0.26	0.77	NA	NA	NA	NA	16.64306	3	3	20	26	44	53	330
10	0.14	0.117	1	0.26	0.77	NA	NA	NA	NA	17.47794	2	2	15	20	36	43	268
11	0.14	0.117	1	0.26	0.77	NA	NA	NA	NA	18.24628	2	2	12	15	29	35	216
12	0.14	0.117	1	0.26	0.77	NA	NA	NA	NA	18.95076	1	1	9	12	23	28	174
13	0.14	0.117	1	0.26	0.77	NA	NA	NA	NA	19.59460	1	1	7	9	19	22	139
14	0.14	0.117	1	0.26	0.77	NA	NA	NA	NA	20.18136	1	1	5	7	15	18	111
15	0.14	0.117	1	0.26	0.77	NA	NA	NA	NA	20.71480	1	1	4	5	12	14	88
16	0.14	0.117	1	0.26	0.77	NA	NA	NA	NA	21.19871	0	1	3	4	9	11	70
17	0.14	0.117	1	0.26	0.77	NA	NA	NA	NA	21.63685	0	0	3	3	7	9	55
18	0.14	0.117	1	0.26	0.77	NA	NA	NA	NA	22.03290	0	0	2	3	6	7	43
19	0.14	0.117	1	0.26	0.77	NA	NA	NA	NA	22.39038	0	0	2	2	5	5	34
20	0.14	0.117	1	0.26	0.77	NA	NA	NA	NA	22.71262	0	0	1	2	4	4	27
									1429	Total =	1,040	388	1	1,429	5,089	2,030	27
											Population in Numbers				Population in Pounds		
											Mean Weight (pounds)				4.89	5.24	7.05

Total Weight Lost	7,146
To Fishing Mortality	5,089
To Natural Mortality	2,030

Table B2. Low Larval Mortality and Base Life History (Base Mortality Rates) Across All Other Stages and Average Entrainment Estimate for Red Drum (*Sciaenops ocellatus*)

Life History Stage or Age	Natural Mortality per Stage or Age (M)	Fishing Mortality per Stage or Age (F)	% Vulnerability to the Fishery	Total Mortality per Stage (z)	Fraction Surviving at Stage or Age	Corrected Survival Fraction	Number Potentially Entrained at Stage or Age	Cumulative Survival at Stage or Age	Projected Mortality of Age-1 fish	Weight of an Individual fish at Median Age of Death	Number Potentially Lost to Fishing Mortality	Number Potentially Lost to Natural Mortality	Number That Might Have Remained in the Population at the End of Year	Total Number at Age	Weight of Fish Potentially Lost to Fishing Mortality	Weight of Fish Potentially Lost to Natural Mortality	Weight of Fish That Might Have Remained in the Population at the End of Year
Egg	0.4984	0	1	0.50	0.61	0.76	937,844	0.00148	1392	NA	NA	NA	NA	NA	NA	NA	NA
Larvae	3.4000	0	1	3.40	0.03	0.06	1,457,729	0.00380	5539	NA	NA	NA	NA	NA	NA	NA	NA
Juvenile 1	1.6380	0	1	1.64	0.19	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Juvenile 2	0.8964	0	1	0.90	0.41	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Juvenile 3	0.2988	0	1	0.30	0.74	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1	0.27	0.621	1	0.89	0.41	NA	NA	NA	NA	2.59458	2,849	1,239	2,843	6,930	7,391	3,213	7,377
2	0.19	1.149	1	1.34	0.26	NA	NA	NA	NA	6.88424	1,800	298	745	2,843	12,393	2,049	5,130
3	0.16	0.324	1	0.48	0.62	NA	NA	NA	NA	10.23435	191	95	459	745	1,959	967	4,700
4	0.16	0.190	1	0.35	0.70	NA	NA	NA	NA	11.45316	74	62	324	459	843	710	3,707
5	0.15	0.036	1	0.19	0.83	NA	NA	NA	NA	12.62000	11	44	269	324	134	559	3,391
6	0.14	0.117	1	0.26	0.77	NA	NA	NA	NA	13.72648	28	33	208	269	381	455	2,853
7	0.14	0.117	1	0.26	0.77	NA	NA	NA	NA	14.76732	21	26	161	208	317	379	2,373
8	0.14	0.117	1	0.26	0.77	NA	NA	NA	NA	15.73977	17	20	124	161	261	312	1,956
9	0.14	0.117	1	0.26	0.77	NA	NA	NA	NA	16.64306	13	15	96	124	213	255	1,600
10	0.14	0.117	1	0.26	0.77	NA	NA	NA	NA	17.47794	10	12	74	96	173	207	1,299
11	0.14	0.117	1	0.26	0.77	NA	NA	NA	NA	18.24628	8	9	57	74	140	167	1,049
12	0.14	0.117	1	0.26	0.77	NA	NA	NA	NA	18.95076	6	7	44	57	112	135	843
13	0.14	0.117	1	0.26	0.77	NA	NA	NA	NA	19.59460	5	5	34	44	90	108	674
14	0.14	0.117	1	0.26	0.77	NA	NA	NA	NA	20.18136	4	4	27	34	72	86	537
15	0.14	0.117	1	0.26	0.77	NA	NA	NA	NA	20.71480	3	3	21	27	57	68	426
16	0.14	0.117	1	0.26	0.77	NA	NA	NA	NA	21.19871	2	3	16	21	45	54	337
17	0.14	0.117	1	0.26	0.77	NA	NA	NA	NA	21.63685	2	2	12	16	36	42	266
18	0.14	0.117	1	0.26	0.77	NA	NA	NA	NA	22.03290	1	2	10	12	28	33	210
19	0.14	0.117	1	0.26	0.77	NA	NA	NA	NA	22.39038	1	1	7	10	22	26	165
20	0.14	0.117	1	0.26	0.77	NA	NA	NA	NA	22.71262	1	1	6	7	17	21	129
									6930	Total =	5,044	1,880	6	6,930	24,684	9,849	129
											Population in Numbers				Population in Pounds		
														Mean Weight (pounds)	4.89	5.24	7.05

Total Weight Lost	34,662
To Fishing Mortality	24,684
To Natural Mortality	9,849

Table B3. High Larval Mortality and Base Life History (Base Mortality Rates) Across All Other Life Stages and Average Entrainment Estimate for Red Drum (*Sciaenops ocellatus*)

Life History Stage or Age	Natural Mortality per Stage or Age (M)	Fishing Mortality per Stage or Age (F)	% Vulnerability to the Fishery	Total Mortality per Stage (z)	Fraction Surviving at Stage or Age	Corrected Survival Fraction	Number Potentially Entrained at Stage or Age	Cumulative Survival at Stage or Age	Projected Mortality of Age-1 fish	Weight of an Individual fish at Median Age of Death	Number Potentially Lost to Fishing Mortality	Number Potentially Lost to Natural Mortality	Number That Might Have Remained in the Population at the End of Year	Total Number at Age	Weight of Fish Potentially Lost to Fishing Mortality	Weight of Fish Potentially Lost to Natural Mortality	Weight of Fish That Might Have Remained in the Population at the End of Year
Egg	0.4984	0	1	0.50	0.61	0.76	937,844	0.00006	57	NA	NA	NA	NA	NA	NA	NA	NA
Larvae	6.6000	0	1	6.60	0.00	0.00	1,457,729	0.00016	233	NA	NA	NA	NA	NA	NA	NA	NA
Juvenile 1	1.6380	0	1	1.64	0.19	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Juvenile 2	0.8964	0	1	0.90	0.41	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Juvenile 3	0.2988	0	1	0.30	0.74	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1	0.27	0.621	1	0.89	0.41	NA	NA	NA	NA	2.59458	119	52	119	290	309	134	308
2	0.19	1.149	1	1.34	0.26	NA	NA	NA	NA	6.88424	75	12	31	119	518	86	214
3	0.16	0.324	1	0.48	0.62	NA	NA	NA	NA	10.23435	8	4	19	31	82	40	196
4	0.16	0.190	1	0.35	0.70	NA	NA	NA	NA	11.45316	3	3	14	19	35	30	155
5	0.15	0.036	1	0.19	0.83	NA	NA	NA	NA	12.62000	0	2	11	14	6	23	142
6	0.14	0.117	1	0.26	0.77	NA	NA	NA	NA	13.72648	1	1	9	11	16	19	119
7	0.14	0.117	1	0.26	0.77	NA	NA	NA	NA	14.76732	1	1	7	9	13	16	99
8	0.14	0.117	1	0.26	0.77	NA	NA	NA	NA	15.73977	1	1	5	7	11	13	82
9	0.14	0.117	1	0.26	0.77	NA	NA	NA	NA	16.64306	1	1	4	5	9	11	67
10	0.14	0.117	1	0.26	0.77	NA	NA	NA	NA	17.47794	0	0	3	4	7	9	54
11	0.14	0.117	1	0.26	0.77	NA	NA	NA	NA	18.24628	0	0	2	3	6	7	44
12	0.14	0.117	1	0.26	0.77	NA	NA	NA	NA	18.95076	0	0	2	2	5	6	35
13	0.14	0.117	1	0.26	0.77	NA	NA	NA	NA	19.59460	0	0	1	2	4	4	28
14	0.14	0.117	1	0.26	0.77	NA	NA	NA	NA	20.18136	0	0	1	1	3	4	22
15	0.14	0.117	1	0.26	0.77	NA	NA	NA	NA	20.71480	0	0	1	1	2	3	18
16	0.14	0.117	1	0.26	0.77	NA	NA	NA	NA	21.19871	0	0	1	1	2	2	14
17	0.14	0.117	1	0.26	0.77	NA	NA	NA	NA	21.63685	0	0	1	1	1	2	11
18	0.14	0.117	1	0.26	0.77	NA	NA	NA	NA	22.03290	0	0	0	1	1	1	9
19	0.14	0.117	1	0.26	0.77	NA	NA	NA	NA	22.39038	0	0	0	0	1	1	7
20	0.14	0.117	1	0.26	0.77	NA	NA	NA	NA	22.71262	0	0	0	0	1	1	5
									290	Total =	211	79	0	290	1,032	412	5
											Population in Numbers				Population in Pounds		
														Mean Weight (pounds)	4.89	5.24	7.05

Total Weight Lost	1,449
To Fishing Mortality	1,032
To Natural Mortality	412

Table B4. Base Life History (Base Mortality Rates) Table and UCL Entrainment Estimate for Red Drum (*Sciaenops ocellatus*)

Life History Stage or Age	Natural Mortality per Stage or Age (M)	Fishing Mortality per Stage or Age (F)	% Vulnerability to the Fishery	Total Mortality per Stage (z)	Fraction Surviving at Stage or Age	Corrected Survival Fraction	Number Potentially Entrained at Stage or Age	Cumulative Survival at Stage or Age	Projected Mortality of Age-1 fish	Weight of an Individual fish at Median Age of Death	Number Potentially Lost to Fishing Mortality	Number Potentially Lost to Natural Mortality	Number That Might Have Remained in the Population at the End of Year	Total Number at Age	Weight of Fish Potentially Lost to Fishing Mortality	Weight of Fish Potentially Lost to Natural Mortality	Weight of Fish That Might Have Remained in the Population at the End of Year
Egg	0.4984	0	1	0.50	0.61	0.76	1,455,512	0.00030	436	NA	NA	NA	NA	NA	NA	NA	NA
Larvae	5.0000	0	1	5.00	0.01	0.01	2,262,363	0.00079	1781	NA	NA	NA	NA	NA	NA	NA	NA
Juvenile 1	1.6380	0	1	1.64	0.19	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Juvenile 2	0.8964	0	1	0.90	0.41	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Juvenile 3	0.2988	0	1	0.30	0.74	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1	0.27	0.621	1	0.89	0.41	NA	NA	NA	NA	2.59458	911	396	910	2,217	2,365	1,028	2,360
2	0.19	1.149	1	1.34	0.26	NA	NA	NA	NA	6.88424	576	95	238	910	3,965	656	1,641
3	0.16	0.324	1	0.48	0.62	NA	NA	NA	NA	10.23435	61	30	147	238	627	310	1,504
4	0.16	0.190	1	0.35	0.70	NA	NA	NA	NA	11.45316	24	20	104	147	270	227	1,186
5	0.15	0.036	1	0.19	0.83	NA	NA	NA	NA	12.62000	3	14	86	104	43	179	1,085
6	0.14	0.117	1	0.26	0.77	NA	NA	NA	NA	13.72648	9	11	66	86	122	146	913
7	0.14	0.117	1	0.26	0.77	NA	NA	NA	NA	14.76732	7	8	51	66	101	121	759
8	0.14	0.117	1	0.26	0.77	NA	NA	NA	NA	15.73977	5	6	40	51	84	100	626
9	0.14	0.117	1	0.26	0.77	NA	NA	NA	NA	16.64306	4	5	31	40	68	82	512
10	0.14	0.117	1	0.26	0.77	NA	NA	NA	NA	17.47794	3	4	24	31	55	66	416
11	0.14	0.117	1	0.26	0.77	NA	NA	NA	NA	18.24628	2	3	18	24	45	54	336
12	0.14	0.117	1	0.26	0.77	NA	NA	NA	NA	18.95076	2	2	14	18	36	43	270
13	0.14	0.117	1	0.26	0.77	NA	NA	NA	NA	19.59460	1	2	11	14	29	34	216
14	0.14	0.117	1	0.26	0.77	NA	NA	NA	NA	20.18136	1	1	9	11	23	27	172
15	0.14	0.117	1	0.26	0.77	NA	NA	NA	NA	20.71480	1	1	7	9	18	22	136
16	0.14	0.117	1	0.26	0.77	NA	NA	NA	NA	21.19871	1	1	5	7	14	17	108
17	0.14	0.117	1	0.26	0.77	NA	NA	NA	NA	21.63685	1	1	4	5	11	14	85
18	0.14	0.117	1	0.26	0.77	NA	NA	NA	NA	22.03290	0	0	3	4	9	11	67
19	0.14	0.117	1	0.26	0.77	NA	NA	NA	NA	22.39038	0	0	2	3	7	8	53
20	0.14	0.117	1	0.26	0.77	NA	NA	NA	NA	22.71262	0	0	2	2	6	7	41
									2217	Total =	1,614	602	2	2,217	7,898	3,151	41
											Population in Numbers				Population in Pounds		
											Mean Weight (pounds)				4.89	5.24	7.05

Total Weight Lost	11,090
To Fishing Mortality	7,898
To Natural Mortality	3,151

Table B5. Base Life History (Base Mortality Rates) Table and LCL Entrainment Estimate forRed Drum (*Sciaenops ocellatus*)

Life History Stage or Age	Natural Mortality per Stage or Age (M)	Fishing Mortality per Stage or Age (F)	% Vulnerability to the Fishery	Total Mortality per Stage (z)	Fraction Surviving at Stage or Age	Corrected Survival Fraction	Number Potentially Entrained at Stage or Age	Cumulative Survival at Stage or Age	Projected Mortality of Age-1 fish	Weight of an Individual fish at Median Age of Death	Number Potentially Lost to Fishing Mortality	Number Potentially Lost to Natural Mortality	Number That Might Have Remained in the Population at the End of Year	Total Number at Age	Weight of Fish Potentially Lost to Fishing Mortality	Weight of Fish Potentially Lost to Natural Mortality	Weight of Fish That Might Have Remained in the Population at the End of Year
Egg	0.4984	0	1	0.50	0.61	0.76	511,530	0.00030	153	NA	NA	NA	NA	NA	NA	NA	NA
Larvae	5.0000	0	1	5.00	0.01	0.01	795,092	0.00079	626	NA	NA	NA	NA	NA	NA	NA	NA
Juvenile 1	1.6380	0	1	1.64	0.19	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Juvenile 2	0.8964	0	1	0.90	0.41	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Juvenile 3	0.2988	0	1	0.30	0.74	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1	0.27	0.621	1	0.89	0.41	NA	NA	NA	NA	2.59458	320	139	320	779	831	361	830
2	0.19	1.149	1	1.34	0.26	NA	NA	NA	NA	6.88424	202	33	84	320	1,394	230	577
3	0.16	0.324	1	0.48	0.62	NA	NA	NA	NA	10.23435	22	11	52	84	220	109	529
4	0.16	0.190	1	0.35	0.70	NA	NA	NA	NA	11.45316	8	7	36	52	95	80	417
5	0.15	0.036	1	0.19	0.83	NA	NA	NA	NA	12.62000	1	5	30	36	15	63	381
6	0.14	0.117	1	0.26	0.77	NA	NA	NA	NA	13.72648	3	4	23	30	43	51	321
7	0.14	0.117	1	0.26	0.77	NA	NA	NA	NA	14.76732	2	3	18	23	36	43	267
8	0.14	0.117	1	0.26	0.77	NA	NA	NA	NA	15.73977	2	2	14	18	29	35	220
9	0.14	0.117	1	0.26	0.77	NA	NA	NA	NA	16.64306	1	2	11	14	24	29	180
10	0.14	0.117	1	0.26	0.77	NA	NA	NA	NA	17.47794	1	1	8	11	19	23	146
11	0.14	0.117	1	0.26	0.77	NA	NA	NA	NA	18.24628	1	1	6	8	16	19	118
12	0.14	0.117	1	0.26	0.77	NA	NA	NA	NA	18.95076	1	1	5	6	13	15	95
13	0.14	0.117	1	0.26	0.77	NA	NA	NA	NA	19.59460	1	1	4	5	10	12	76
14	0.14	0.117	1	0.26	0.77	NA	NA	NA	NA	20.18136	0	0	3	4	8	10	60
15	0.14	0.117	1	0.26	0.77	NA	NA	NA	NA	20.71480	0	0	2	3	6	8	48
16	0.14	0.117	1	0.26	0.77	NA	NA	NA	NA	21.19871	0	0	2	2	5	6	38
17	0.14	0.117	1	0.26	0.77	NA	NA	NA	NA	21.63685	0	0	1	2	4	5	30
18	0.14	0.117	1	0.26	0.77	NA	NA	NA	NA	22.03290	0	0	1	1	3	4	24
19	0.14	0.117	1	0.26	0.77	NA	NA	NA	NA	22.39038	0	0	1	1	2	3	19
20	0.14	0.117	1	0.26	0.77	NA	NA	NA	NA	22.71262	0	0	1	1	2	2	15
									779	Total =	567	211	1	779	2,776	1,107	15
											Population in Numbers				Population in Pounds		

Mean Weight (pounds)	4.89	5.24	7.05

Total Weight Lost	3,898
To Fishing Mortality	2,776
To Natural Mortality	1,107

Table B6. Low Mortality History (Low Mortality Rates Across All Life Stages) Table and UCL Entrainment Estimate for Red Drum (*Sciaenops ocellatus*)

Life History Stage or Age	Natural Mortality per Stage or Age (M)	Fishing Mortality per Stage or Age (F)	% Vulnerability to the Fishery	Total Mortality per Stage (z)	Fraction Surviving at Stage or Age	Corrected Survival Fraction	Number Potentially Entrained at Stage or Age	Cumulative Survival at Stage or Age	Projected Mortality of Age-1 fish	Weight of an Individual fish at Median Age of Death	Number Potentially Lost to Fishing Mortality	Number Potentially Lost to Natural Mortality	Number That Might Have Remained in the Population at the End of Year	Total Number at Age	Weight of Fish Potentially Lost to Fishing Mortality	Weight of Fish Potentially Lost to Natural Mortality	Weight of Fish That Might Have Remained in the Population at the End of Year
Egg	0.4984	0	1	0.50	0.61	0.76	1,455,512	0.00197	2864	NA	NA	NA	NA	NA	NA	NA	NA
Larvae	3.4000	0	1	3.40	0.03	0.06	2,262,363	0.00504	11400	NA	NA	NA	NA	NA	NA	NA	NA
Juvenile 1	1.6080	0	1	1.61	0.20	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Juvenile 2	0.7935	0	1	0.79	0.45	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Juvenile 3	0.1494	0	1	0.15	0.86	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1	0.27	0.621	1	0.89	0.41	NA	NA	NA	NA	2.59458	5,863	2,549	5,852	14,264	15,212	6,614	15,183
2	0.19	1.149	1	1.34	0.26	NA	NA	NA	NA	6.88424	3,705	613	1,534	5,852	25,508	4,218	10,559
3	0.16	0.324	1	0.48	0.62	NA	NA	NA	NA	10.23435	394	195	945	1,534	4,032	1,991	9,675
4	0.16	0.190	1	0.35	0.70	NA	NA	NA	NA	11.45316	152	128	666	945	1,736	1,462	7,629
5	0.15	0.036	1	0.19	0.83	NA	NA	NA	NA	12.62000	22	91	553	666	276	1,151	6,980
6	0.14	0.117	1	0.26	0.77	NA	NA	NA	NA	13.72648	57	68	428	553	783	937	5,871
7	0.14	0.117	1	0.26	0.77	NA	NA	NA	NA	14.76732	44	53	331	428	652	780	4,885
8	0.14	0.117	1	0.26	0.77	NA	NA	NA	NA	15.73977	34	41	256	331	537	643	4,027
9	0.14	0.117	1	0.26	0.77	NA	NA	NA	NA	16.64306	26	32	198	256	439	526	3,293
10	0.14	0.117	1	0.26	0.77	NA	NA	NA	NA	17.47794	20	24	153	198	357	427	2,674
11	0.14	0.117	1	0.26	0.77	NA	NA	NA	NA	18.24628	16	19	118	153	288	345	2,159
12	0.14	0.117	1	0.26	0.77	NA	NA	NA	NA	18.95076	12	15	92	118	231	277	1,734
13	0.14	0.117	1	0.26	0.77	NA	NA	NA	NA	19.59460	9	11	71	92	185	221	1,387
14	0.14	0.117	1	0.26	0.77	NA	NA	NA	NA	20.18136	7	9	55	71	147	176	1,105
15	0.14	0.117	1	0.26	0.77	NA	NA	NA	NA	20.71480	6	7	42	55	117	140	877
16	0.14	0.117	1	0.26	0.77	NA	NA	NA	NA	21.19871	4	5	33	42	93	111	694
17	0.14	0.117	1	0.26	0.77	NA	NA	NA	NA	21.63685	3	4	25	33	73	87	548
18	0.14	0.117	1	0.26	0.77	NA	NA	NA	NA	22.03290	3	3	20	25	58	69	431
19	0.14	0.117	1	0.26	0.77	NA	NA	NA	NA	22.39038	2	2	15	20	45	54	339
20	0.14	0.117	1	0.26	0.77	NA	NA	NA	NA	22.71262	2	2	12	15	35	42	266
									14264	Total =	10,382	3,870	12	14,264	50,805	20,271	266
											Population in Numbers				Population in Pounds		
														Mean Weight (pounds)	4.89	5.24	7.05

Total Weight Lost	71,342
To Fishing Mortality	50,805
To Natural Mortality	20,271

Table B7. High Mortality Life History (High Mortality Across All Life Stages) Table and LCL Entrainment Estimate for Red Drum (*Sciaenops ocellatus*)

Life History Stage or Age	Natural Mortality per Stage or Age (M)	Fishing Mortality per Stage or Age (F)	% Vulnerability to the Fishery	Total Mortality per Stage (z)	Fraction Surviving at Stage or Age	Corrected Survival Fraction	Number Potentially Entrained at Stage or Age	Cumulative Survival at Stage or Age	Projected Mortality of Age-1 fish	Weight of an Individual fish at Median Age of Death	Number Potentially Lost to Fishing Mortality	Number Potentially Lost to Natural Mortality	Number That Might Have Remained in the Population at the End of Year	Total Number at Age	Weight of Fish Potentially Lost to Fishing Mortality	Weight of Fish Potentially Lost to Natural Mortality	Weight of Fish That Might Have Remained in the Population at the End of Year
Egg	0.4984	0	1	0.50	0.61	0.76	511,530	0.00002	9	NA	NA	NA	NA	NA	NA	NA	NA
Larvae	6.6000	0	1	6.60	0.00	0.00	795,092	0.00005	37	NA	NA	NA	NA	NA	NA	NA	NA
Juvenile 1	2.7800	0	1	2.78	0.06	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Juvenile 2	0.9866	0	1	0.99	0.37	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Juvenile 3	0.2916	0	1	0.29	0.75	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1	0.27	0.621	1	0.89	0.41	NA	NA	NA	NA	2.59458	19	8	19	46	50	22	49
2	0.19	1.149	1	1.34	0.26	NA	NA	NA	NA	6.88424	12	2	5	19	83	14	34
3	0.16	0.324	1	0.48	0.62	NA	NA	NA	NA	10.23435	1	1	3	5	13	6	31
4	0.16	0.190	1	0.35	0.70	NA	NA	NA	NA	11.45316	0	0	2	3	6	5	25
5	0.15	0.036	1	0.19	0.83	NA	NA	NA	NA	12.62000	0	0	2	2	1	4	23
6	0.14	0.117	1	0.26	0.77	NA	NA	NA	NA	13.72648	0	0	1	2	3	3	19
7	0.14	0.117	1	0.26	0.77	NA	NA	NA	NA	14.76732	0	0	1	1	2	3	16
8	0.14	0.117	1	0.26	0.77	NA	NA	NA	NA	15.73977	0	0	1	1	2	2	13
9	0.14	0.117	1	0.26	0.77	NA	NA	NA	NA	16.64306	0	0	1	1	1	2	11
10	0.14	0.117	1	0.26	0.77	NA	NA	NA	NA	17.47794	0	0	0	1	1	1	9
11	0.14	0.117	1	0.26	0.77	NA	NA	NA	NA	18.24628	0	0	0	0	1	1	7
12	0.14	0.117	1	0.26	0.77	NA	NA	NA	NA	18.95076	0	0	0	0	1	1	6
13	0.14	0.117	1	0.26	0.77	NA	NA	NA	NA	19.59460	0	0	0	0	1	1	5
14	0.14	0.117	1	0.26	0.77	NA	NA	NA	NA	20.18136	0	0	0	0	0	1	4
15	0.14	0.117	1	0.26	0.77	NA	NA	NA	NA	20.71480	0	0	0	0	0	0	3
16	0.14	0.117	1	0.26	0.77	NA	NA	NA	NA	21.19871	0	0	0	0	0	0	2
17	0.14	0.117	1	0.26	0.77	NA	NA	NA	NA	21.63685	0	0	0	0	0	0	2
18	0.14	0.117	1	0.26	0.77	NA	NA	NA	NA	22.03290	0	0	0	0	0	0	1
19	0.14	0.117	1	0.26	0.77	NA	NA	NA	NA	22.39038	0	0	0	0	0	0	1
20	0.14	0.117	1	0.26	0.77	NA	NA	NA	NA	22.71262	0	0	0	0	0	0	1
									46	Total =	34	13	0	46	165	66	1
											Population in Numbers				Population in Pounds		
											Mean Weight (pounds)				4.89	5.24	7.05

Total Weight Lost	232
To Fishing Mortality	165
To Natural Mortality	66

Table B8. Base Life History (Base Mortality Rates) Table and Average Entrainment Estimate for Red Snapper (*Lutjanus campechanus*)

Life History Stage or Age	Natural Mortality per Stage or Age (M)	Fishing Mortality per Stage or Age (F)	% Vulnerability to the Fishery	Total Mortality per Stage (z)	Fraction Surviving at Stage or Age	Corrected Survival Fraction	Number Potentially Entrained at Stage or Age	Cumulative Survival at Stage or Age	Projected Mortality of Age-1 fish	Weight of an Individual fish at Median Age of Death	Number Potentially Lost to Fishing Mortality	Number Potentially Lost to Natural Mortality	Number That Might Have Remained in the Population at the End of Year	Total Number at Age	Weight of Fish Potentially Lost to Fishing Mortality	Weight of Fish Potentially Lost to Natural Mortality	Weight of Fish That Might Have Remained in the Population at the End of Year
Egg	0.4984	0	1	0.50	0.61	0.76	132,415	0.00013	18	NA	NA	NA	NA	NA	NA	NA	NA
Larvae	5.7400	0	1	5.74	0.00	0.01	205,817	0.00035	73	NA	NA	NA	NA	NA	NA	NA	NA
Juvenile 1	2.4000	0	1	2.40	0.09	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Juvenile 2	0.5001	0	1	0.50	0.61	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1	0.1	1.009	1	1.11	0.33	NA	NA	NA	NA	0.31220	55	5	30	90	17	2	9
2	0.1	0.073	1	0.17	0.84	NA	NA	NA	NA	1.07818	2	3	25	30	2	3	27
3	0.1	0.288	1	0.39	0.68	NA	NA	NA	NA	2.29954	6	2	17	25	14	5	39
4	0.1	0.537	1	0.64	0.53	NA	NA	NA	NA	3.86505	7	1	9	17	26	5	35
5	0.1	0.434	1	0.53	0.59	NA	NA	NA	NA	5.64309	3	1	5	9	17	4	30
6	0.1	0.289	1	0.39	0.68	NA	NA	NA	NA	7.51490	1	0	4	5	9	3	27
7	0.1	0.199	1	0.30	0.74	NA	NA	NA	NA	9.38663	1	0	3	4	6	3	25
8	0.1	0.147	1	0.25	0.78	NA	NA	NA	NA	11.19085	0	0	2	3	4	3	23
9	0.1	0.116	1	0.22	0.81	NA	NA	NA	NA	12.88340	0	0	2	2	3	2	21
10	0.1	0.084	1	0.18	0.83	NA	NA	NA	NA	14.43875	0	0	1	2	2	2	20
11	0.1	0.084	1	0.18	0.83	NA	NA	NA	NA	15.84531	0	0	1	1	2	2	18
12	0.1	0.084	1	0.18	0.83	NA	NA	NA	NA	17.10136	0	0	1	1	2	2	16
13	0.1	0.084	1	0.18	0.83	NA	NA	NA	NA	18.21177	0	0	1	1	1	2	15
14	0.1	0.084	1	0.18	0.83	NA	NA	NA	NA	19.18548	0	0	1	1	1	1	13
15	0.1	0.084	1	0.18	0.83	NA	NA	NA	NA	20.03372	0	0	1	1	1	1	11
									90	Total =	76	14	1	90	107	40	9
											Population in Numbers				Population in Pounds		

Mean Weight (pounds)	1.41	2.83	3.24

Total Weight Lost	156
To Fishing Mortality	107
To Natural Mortality	40

Table B9. Low Larval Mortality and Base Life History (Base Mortality Rates) Across All Other Stages and Average Entrainment Estimate for Red Snapper (*Lutjanus campechanus*)

Life History Stage or Age	Natural Mortality per Stage or Age (M)	Fishing Mortality per Stage or Age (F)	% Vulnerability to the Fishery	Total Mortality per Stage (z)	Fraction Surviving at Stage or Age	Corrected Survival Fraction	Number Potentially Entrained at Stage or Age	Cumulative Survival at Stage or Age	Projected Mortality of Age-1 fish	Weight of an Individual fish at Median Age of Death	Number Potentially Lost to Fishing Mortality	Number Potentially Lost to Natural Mortality	Number That Might Have Remained in the Population at the End of Year	Total Number at Age	Weight of Fish Potentially Lost to Fishing Mortality	Weight of Fish Potentially Lost to Natural Mortality	Weight of Fish That Might Have Remained in the Population at the End of Year
Egg	0.4984	0	1	0.50	0.61	0.76	132,415	0.00074	98	NA	NA	NA	NA	NA	NA	NA	NA
Larvae	4.0300	0	1	4.03	0.02	0.03	205,817	0.00192	396	NA	NA	NA	NA	NA	NA	NA	NA
Juvenile 1	2.4000	0	1	2.40	0.09	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Juvenile 2	0.5001	0	1	0.50	0.61	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1	0.1	1.009	1	1.11	0.33	NA	NA	NA	NA	0.31220	301	30	163	493	94	9	51
2	0.1	0.073	1	0.17	0.84	NA	NA	NA	NA	1.07818	11	15	137	163	12	16	148
3	0.1	0.288	1	0.39	0.68	NA	NA	NA	NA	2.29954	33	11	93	137	75	26	214
4	0.1	0.537	1	0.64	0.53	NA	NA	NA	NA	3.86505	37	7	49	93	143	27	190
5	0.1	0.434	1	0.53	0.59	NA	NA	NA	NA	5.64309	17	4	29	49	93	21	163
6	0.1	0.289	1	0.39	0.68	NA	NA	NA	NA	7.51490	7	2	20	29	52	18	147
7	0.1	0.199	1	0.30	0.74	NA	NA	NA	NA	9.38663	3	2	14	20	32	16	136
8	0.1	0.147	1	0.25	0.78	NA	NA	NA	NA	11.19085	2	1	11	14	21	14	127
9	0.1	0.116	1	0.22	0.81	NA	NA	NA	NA	12.88340	1	1	9	11	15	13	117
10	0.1	0.084	1	0.18	0.83	NA	NA	NA	NA	14.43875	1	1	8	9	10	12	109
11	0.1	0.084	1	0.18	0.83	NA	NA	NA	NA	15.84531	1	1	6	8	9	11	100
12	0.1	0.084	1	0.18	0.83	NA	NA	NA	NA	17.10136	0	1	5	6	8	10	90
13	0.1	0.084	1	0.18	0.83	NA	NA	NA	NA	18.21177	0	0	4	5	7	9	79
14	0.1	0.084	1	0.18	0.83	NA	NA	NA	NA	19.18548	0	0	4	4	6	8	70
15	0.1	0.084	1	0.18	0.83	NA	NA	NA	NA	20.03372	0	0	3	4	6	7	61
									493	Total =	414	76	3	493	583	217	51
											Population in Numbers				Population in Pounds		
											Mean Weight (pounds)				1.41	2.83	3.24

Total Weight Lost	851
To Fishing Mortality	583
To Natural Mortality	217

Table B10. High Larval Mortality and Base Life History (Base Mortality Rates) Across All Other Life Stages Table and Average Entrainment Estimate for Red Snapper (*Lutjanus campechanus*)

Life History Stage or Age	Natural Mortality per Stage or Age (M)	Fishing Mortality per Stage or Age (F)	% Vulnerability to the Fishery	Total Mortality per Stage (z)	Fraction Surviving at Stage or Age	Corrected Survival Fraction	Number Potentially Entrained at Stage or Age	Cumulative Survival at Stage or Age	Projected Mortality of Age-1 fish	Weight of an Individual fish at Median Age of Death	Number Potentially Lost to Fishing Mortality	Number Potentially Lost to Natural Mortality	Number That Might Have Remained in the Population at the End of Year	Total Number at Age	Weight of Fish Potentially Lost to Fishing Mortality	Weight of Fish Potentially Lost to Natural Mortality	Weight of Fish That Might Have Remained in the Population at the End of Year
Egg	0.4984	0	1	0.50	0.61	0.76	132,415	0.00002	3	NA	NA	NA	NA	NA	NA	NA	NA
Larvae	7.6500	0	1	7.65	0.00	0.00	205,817	0.00005	11	NA	NA	NA	NA	NA	NA	NA	NA
Juvenile 1	2.4000	0	1	2.40	0.09	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Juvenile 2	0.5001	0	1	0.50	0.61	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1	0.1	1.009	1	1.11	0.33	NA	NA	NA	NA	0.31220	8	1	4	13	3	0	1
2	0.1	0.073	1	0.17	0.84	NA	NA	NA	NA	1.07818	0	0	4	4	0	0	4
3	0.1	0.288	1	0.39	0.68	NA	NA	NA	NA	2.29954	1	0	3	4	2	1	6
4	0.1	0.537	1	0.64	0.53	NA	NA	NA	NA	3.86505	1	0	1	3	4	1	5
5	0.1	0.434	1	0.53	0.59	NA	NA	NA	NA	5.64309	0	0	1	1	3	1	4
6	0.1	0.289	1	0.39	0.68	NA	NA	NA	NA	7.51490	0	0	1	1	1	0	4
7	0.1	0.199	1	0.30	0.74	NA	NA	NA	NA	9.38663	0	0	0	1	1	0	4
8	0.1	0.147	1	0.25	0.78	NA	NA	NA	NA	11.19085	0	0	0	0	1	0	3
9	0.1	0.116	1	0.22	0.81	NA	NA	NA	NA	12.88340	0	0	0	0	0	0	3
10	0.1	0.084	1	0.18	0.83	NA	NA	NA	NA	14.43875	0	0	0	0	0	0	3
11	0.1	0.084	1	0.18	0.83	NA	NA	NA	NA	15.84531	0	0	0	0	0	0	3
12	0.1	0.084	1	0.18	0.83	NA	NA	NA	NA	17.10136	0	0	0	0	0	0	2
13	0.1	0.084	1	0.18	0.83	NA	NA	NA	NA	18.21177	0	0	0	0	0	0	2
14	0.1	0.084	1	0.18	0.83	NA	NA	NA	NA	19.18548	0	0	0	0	0	0	2
15	0.1	0.084	1	0.18	0.83	NA	NA	NA	NA	20.03372	0	0	0	0	0	0	2
									13	Total =	11	2	0	13	16	6	1
											Population in Numbers				Population in Pounds		

Mean Weight (pounds)	1.41	2.83	3.24

Total Weight Lost	23
To Fishing Mortality	16
To Natural Mortality	6

Table B11. Base Life History (Base Mortality Rates) Table and UCL Entrainment Estimate for Red Snapper (*Lutjanus campechanus*)

Life History Stage or Age	Natural Mortality per Stage or Age (M)	Fishing Mortality per Stage or Age (F)	% Vulnerability to the Fishery	Total Mortality per Stage (z)	Fraction Surviving at Stage or Age	Corrected Survival Fraction	Number Potentially Entrained at Stage or Age	Cumulative Survival at Stage or Age	Projected Mortality of Age-1 fish	Weight of an Individual fish at Median Age of Death	Number Potentially Lost to Fishing Mortality	Number Potentially Lost to Natural Mortality	Number That Might Have Remained in the Population at the End of Year	Total Number at Age	Weight of Fish Potentially Lost to Fishing Mortality	Weight of Fish Potentially Lost to Natural Mortality	Weight of Fish That Might Have Remained in the Population at the End of Year
Egg	0.4984	0	1	0.50	0.61	0.76	240,230	0.00013	32	NA	NA	NA	NA	NA	NA	NA	NA
Larvae	5.7400	0	1	5.74	0.00	0.01	373,399	0.00035	132	NA	NA	NA	NA	NA	NA	NA	NA
Juvenile 1	2.4000	0	1	2.40	0.09	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Juvenile 2	0.4992	0	1	0.50	0.61	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1	0.1	1.009	1	1.11	0.33	NA	NA	NA	NA	0.31220	100	10	54	164	31	3	17
2	0.1	0.073	1	0.17	0.84	NA	NA	NA	NA	1.07818	4	5	45	54	4	5	49
3	0.1	0.288	1	0.39	0.68	NA	NA	NA	NA	2.29954	11	4	31	45	25	9	71
4	0.1	0.537	1	0.64	0.53	NA	NA	NA	NA	3.86505	12	2	16	31	47	9	63
5	0.1	0.434	1	0.53	0.59	NA	NA	NA	NA	5.64309	5	1	10	16	31	7	54
6	0.1	0.289	1	0.39	0.68	NA	NA	NA	NA	7.51490	2	1	6	10	17	6	49
7	0.1	0.199	1	0.30	0.74	NA	NA	NA	NA	9.38663	1	1	5	6	10	5	45
8	0.1	0.147	1	0.25	0.78	NA	NA	NA	NA	11.19085	1	0	4	5	7	5	42
9	0.1	0.116	1	0.22	0.81	NA	NA	NA	NA	12.88340	0	0	3	4	5	4	39
10	0.1	0.084	1	0.18	0.83	NA	NA	NA	NA	14.43875	0	0	3	3	3	4	36
11	0.1	0.084	1	0.18	0.83	NA	NA	NA	NA	15.84531	0	0	2	3	3	4	33
12	0.1	0.084	1	0.18	0.83	NA	NA	NA	NA	17.10136	0	0	2	2	3	3	30
13	0.1	0.084	1	0.18	0.83	NA	NA	NA	NA	18.21177	0	0	1	2	2	3	26
14	0.1	0.084	1	0.18	0.83	NA	NA	NA	NA	19.18548	0	0	1	1	2	3	23
15	0.1	0.084	1	0.18	0.83	NA	NA	NA	NA	20.03372	0	0	1	1	2	2	20
									164	Total =	138	25	1	164	194	72	17
											Population in Numbers				Population in Pounds		
														Mean Weight (pounds)	1.41	2.83	3.24

Total Weight Lost	283
To Fishing Mortality	194
To Natural Mortality	72

Table B12. Base Life History (Base Mortality Rates) Table and LCL Entrainment Estimate for Red Snapper (*Lutjanus campechanus*)

Life History Stage or Age	Natural Mortality per Stage or Age (M)	Fishing Mortality per Stage or Age (F)	% Vulnerability to the Fishery	Total Mortality per Stage (z)	Fraction Surviving at Stage or Age	Corrected Survival Fraction	Number Potentially Entrained at Stage or Age	Cumulative Survival at Stage or Age	Projected Mortality of Age-1 fish	Weight of an Individual fish at Median Age of Death	Number Potentially Lost to Fishing Mortality	Number Potentially Lost to Natural Mortality	Number That Might Have Remained in the Population at the End of Year	Total Number at Age	Weight of Fish Potentially Lost to Fishing Mortality	Weight of Fish Potentially Lost to Natural Mortality	Weight of Fish That Might Have Remained in the Population at the End of Year
Egg	0.4984	0	1	0.50	0.61	0.76	45,359	0.00013	6	NA	NA	NA	NA	NA	NA	NA	NA
Larvae	5.7400	0	1	5.74	0.00	0.01	70,504	0.00035	25	NA	NA	NA	NA	NA	NA	NA	NA
Juvenile 1	2.4000	0	1	2.40	0.09	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Juvenile 2	0.5001	0	1	0.50	0.61	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1	0.1	1.009	1	1.11	0.33	NA	NA	NA	NA	0.31220	19	2	10	31	6	1	3
2	0.1	0.073	1	0.17	0.84	NA	NA	NA	NA	1.07818	1	1	9	10	1	1	9
3	0.1	0.288	1	0.39	0.68	NA	NA	NA	NA	2.29954	2	1	6	9	5	2	13
4	0.1	0.537	1	0.64	0.53	NA	NA	NA	NA	3.86505	2	0	3	6	9	2	12
5	0.1	0.434	1	0.53	0.59	NA	NA	NA	NA	5.64309	1	0	2	3	6	1	10
6	0.1	0.289	1	0.39	0.68	NA	NA	NA	NA	7.51490	0	0	1	2	3	1	9
7	0.1	0.199	1	0.30	0.74	NA	NA	NA	NA	9.38663	0	0	1	1	2	1	9
8	0.1	0.147	1	0.25	0.78	NA	NA	NA	NA	11.19085	0	0	1	1	1	1	8
9	0.1	0.116	1	0.22	0.81	NA	NA	NA	NA	12.88340	0	0	1	1	1	1	7
10	0.1	0.084	1	0.18	0.83	NA	NA	NA	NA	14.43875	0	0	0	1	1	1	7
11	0.1	0.084	1	0.18	0.83	NA	NA	NA	NA	15.84531	0	0	0	0	1	1	6
12	0.1	0.084	1	0.18	0.83	NA	NA	NA	NA	17.10136	0	0	0	0	1	1	6
13	0.1	0.084	1	0.18	0.83	NA	NA	NA	NA	18.21177	0	0	0	0	0	1	5
14	0.1	0.084	1	0.18	0.83	NA	NA	NA	NA	19.18548	0	0	0	0	0	0	4
15	0.1	0.084	1	0.18	0.83	NA	NA	NA	NA	20.03372	0	0	0	0	0	0	4
									31	Total =	26	5	0	31	37	14	3
											Population in Numbers				Population in Pounds		
											Mean Weight (pounds)				1.41	2.83	3.24

Total Weight Lost	53
To Fishing Mortality	37
To Natural Mortality	14

Table B13. Low Mortality History (Low Mortality Rates Across All Life Stages) Table and UCL Entrainment Estimate for Red Snapper (*Lutjanus campechanus*)

Life History Stage or Age	Natural Mortality per Stage or Age (M)	Fishing Mortality per Stage or Age (F)	% Vulnerability to the Fishery	Total Mortality per Stage (z)	Fraction Surviving at Stage or Age	Corrected Survival Fraction	Number Potentially Entrained at Stage or Age	Cumulative Survival at Stage or Age	Projected Mortality of Age-1 fish	Weight of an Individual fish at Median Age of Death	Number Potentially Lost to Fishing Mortality	Number Potentially Lost to Natural Mortality	Number That Might Have Remained in the Population at the End of Year	Total Number at Age	Weight of Fish Potentially Lost to Fishing Mortality	Weight of Fish Potentially Lost to Natural Mortality	Weight of Fish That Might Have Remained in the Population at the End of Year
Egg	0.4984	0	1	0.50	0.61	0.76	240,230	0.00519	1248	NA	NA	NA	NA	NA	NA	NA	NA
Larvae	4.0300	0	1	4.03	0.02	0.03	373,399	0.01350	5042	NA	NA	NA	NA	NA	NA	NA	NA
Juvenile 1	0.4500	0	1	0.45	0.64	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Juvenile 2	0.5004	0	1	0.50	0.61	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1	0.1	1.009	1	1.11	0.33	NA	NA	NA	NA	0.31220	3,835	380	2,075	6,289	1,197	119	648
2	0.1	0.073	1	0.17	0.84	NA	NA	NA	NA	1.07818	139	191	1,745	2,075	150	205	1,882
3	0.1	0.288	1	0.39	0.68	NA	NA	NA	NA	2.29954	417	145	1,184	1,745	958	333	2,723
4	0.1	0.537	1	0.64	0.53	NA	NA	NA	NA	3.86505	470	88	626	1,184	1,817	338	2,420
5	0.1	0.434	1	0.53	0.59	NA	NA	NA	NA	5.64309	211	49	367	626	1,188	274	2,072
6	0.1	0.289	1	0.39	0.68	NA	NA	NA	NA	7.51490	88	30	249	367	660	229	1,870
7	0.1	0.199	1	0.30	0.74	NA	NA	NA	NA	9.38663	43	22	184	249	402	202	1,732
8	0.1	0.147	1	0.25	0.78	NA	NA	NA	NA	11.19085	24	16	144	184	269	183	1,613
9	0.1	0.116	1	0.22	0.81	NA	NA	NA	NA	12.88340	15	13	116	144	194	167	1,496
10	0.1	0.084	1	0.18	0.83	NA	NA	NA	NA	14.43875	9	11	97	116	129	153	1,395
11	0.1	0.084	1	0.18	0.83	NA	NA	NA	NA	15.84531	7	9	80	97	117	140	1,273
12	0.1	0.084	1	0.18	0.83	NA	NA	NA	NA	17.10136	6	7	67	80	105	126	1,143
13	0.1	0.084	1	0.18	0.83	NA	NA	NA	NA	18.21177	5	6	56	67	93	111	1,013
14	0.1	0.084	1	0.18	0.83	NA	NA	NA	NA	19.18548	4	5	46	56	82	97	888
15	0.1	0.084	1	0.18	0.83	NA	NA	NA	NA	20.03372	4	4	38	46	71	85	771
									6289	Total =	5,276	975	38	6,289	7,434	2,761	648
											Population in Numbers				Population in Pounds		

Mean Weight (pounds)	1.41	2.83	3.24

Total Weight Lost	10,842
To Fishing Mortality	7,434
To Natural Mortality	2,761

Table B14. High Mortality History (High Mortality Rates Across All Life Stages) Table and LCL Entrainment Estimate for Red Snapper (*Lutjanus campechanus*)

Life History Stage or Age	Natural Mortality per Stage or Age (M)	Fishing Mortality per Stage or Age (F)	% Vulnerability to the Fishery	Total Mortality per Stage (z)	Fraction Surviving at Stage or Age	Corrected Survival Fraction	Number Potentially Entrained at Stage or Age	Cumulative Survival at Stage or Age	Projected Mortality of Age-1 fish	Weight of an Individual fish at Median Age of Death	Number Potentially Lost to Fishing Mortality	Number Potentially Lost to Natural Mortality	Number That Might Have Remained in the Population at the End of Year	Total Number at Age	Weight of Fish Potentially Lost to Fishing Mortality	Weight of Fish Potentially Lost to Natural Mortality	Weight of Fish That Might Have Remained in the Population at the End of Year
Egg	0.4984	0	1	0.50	0.61	0.76	45,359	0.00001	0	NA	NA	NA	NA	NA	NA	NA	NA
Larvae	7.6500	0	1	7.65	0.00	0.00	70,504	0.00001	1	NA	NA	NA	NA	NA	NA	NA	NA
Juvenile 1	3.7200	0	1	3.72	0.02	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Juvenile 2	0.4990	0	1	0.50	0.61	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1	0.1	1.009	1	1.11	0.33	NA	NA	NA	NA	0.31220	1	0	0	1	0	0	0
2	0.1	0.073	1	0.17	0.84	NA	NA	NA	NA	1.07818	0	0	0	0	0	0	0
3	0.1	0.288	1	0.39	0.68	NA	NA	NA	NA	2.29954	0	0	0	0	0	0	1
4	0.1	0.537	1	0.64	0.53	NA	NA	NA	NA	3.86505	0	0	0	0	0	0	0
5	0.1	0.434	1	0.53	0.59	NA	NA	NA	NA	5.64309	0	0	0	0	0	0	0
6	0.1	0.289	1	0.39	0.68	NA	NA	NA	NA	7.51490	0	0	0	0	0	0	0
7	0.1	0.199	1	0.30	0.74	NA	NA	NA	NA	9.38663	0	0	0	0	0	0	0
8	0.1	0.147	1	0.25	0.78	NA	NA	NA	NA	11.19085	0	0	0	0	0	0	0
9	0.1	0.116	1	0.22	0.81	NA	NA	NA	NA	12.88340	0	0	0	0	0	0	0
10	0.1	0.084	1	0.18	0.83	NA	NA	NA	NA	14.43875	0	0	0	0	0	0	0
11	0.1	0.084	1	0.18	0.83	NA	NA	NA	NA	15.84531	0	0	0	0	0	0	0
12	0.1	0.084	1	0.18	0.83	NA	NA	NA	NA	17.10136	0	0	0	0	0	0	0
13	0.1	0.084	1	0.18	0.83	NA	NA	NA	NA	18.21177	0	0	0	0	0	0	0
14	0.1	0.084	1	0.18	0.83	NA	NA	NA	NA	19.18548	0	0	0	0	0	0	0
15	0.1	0.084	1	0.18	0.83	NA	NA	NA	NA	20.03372	0	0	0	0	0	0	0
									1	Total =	1	0	0	1	1	1	0
											Population in Numbers				Population in Pounds		

Mean Weight (pounds)	1.41	2.83	3.24

Total Weight Lost	2
To Fishing Mortality	1
To Natural Mortality	1

Table B15. Base Life History (Base Mortality Rates) Table and Average Entrainment Estimate for Gulf Menhaden (*Brevoortia patronus*)

Life History Stage or Age	Natural Mortality per Stage or Age (M)	Fishing Mortality per Stage or Age (F)	% Vulnerability to the Fishery	Total Mortality per Stage (z)	Fraction Surviving at Stage or Age	Corrected Survival Fraction	Number Potentially Entrained at Stage or Age	Cumulative Survival at Stage or Age	Projected Mortality of Age-1 fish	Weight of an Individual fish at Median Age of Death	Number Potentially Lost to Fishing Mortality	Number Potentially Lost to Natural Mortality	Number That Might Have Remained in the Population at the End of Year	Total Number at Age	Weight of Fish Potentially Lost to Fishing Mortality	Weight of Fish Potentially Lost to Natural Mortality	Weight of Fish That Might Have Remained in the Population at the End of Year
Egg	1.8270	0	1	1.83	0.16	0.28	61,792	0.00012	8	NA	NA	NA	NA	NA	NA	NA	NA
Larvae	3.8350	0	1	3.84	0.02	0.04	96,046	0.00088	84	NA	NA	NA	NA	NA	NA	NA	NA
Juvenile 1	3.8779	0	1	3.88	0.02	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1	0.8	0.800	1	1.60	0.20	NA	NA	NA	NA	0.13118	37	37	19	92	5	5	2
2	0.8	0.800	1	1.60	0.20	NA	NA	NA	NA	0.24199	7	7	4	19	2	2	1
3	0.8	0.800	1	1.60	0.20	NA	NA	NA	NA	0.34807	1	1	1	4	1	1	0
4	0.8	0.800	1	1.60	0.20	NA	NA	NA	NA	0.43762	0	0	0	1	0	0	0
5	0.8	0.800	1	1.60	0.20	NA	NA	NA	NA	0.50799	0	0	0	0	0	0	0
									92	Total =	46	46	0	92	7	7	0
											Population in Numbers				Population in Pounds		

Mean Weight (pounds)	0.16	0.16	0.16

Total Weight Lost	15
To Fishing Mortality	7
To Natural Mortality	7

Table B16. Low Larval Mortality and Base Life History (Base Mortality Rates) Across All Other Life Stages Table and Average Entrainment Estimate for Gulf Menhaden (*Brevoortia patronus*)

Life History Stage or Age	Natural Mortality per Stage or Age (M)	Fishing Mortality per Stage or Age (F)	% Vulnerability to the Fishery	Total Mortality per Stage (z)	Fraction Surviving at Stage or Age	Corrected Survival Fraction	Number Potentially Entrained at Stage or Age	Cumulative Survival at Stage or Age	Projected Mortality of Age-1 fish	Weight of an Individual fish at Median Age of Death	Number Potentially Lost to Fishing Mortality	Number Potentially Lost to Natural Mortality	Number That Might Have Remained in the Population at the End of Year	Total Number at Age	Weight of Fish Potentially Lost to Fishing Mortality	Weight of Fish Potentially Lost to Natural Mortality	Weight of Fish That Might Have Remained in the Population at the End of Year
Egg	1.8270	0	1	1.83	0.16	0.28	61,792	0.00031	19	NA	NA	NA	NA	NA	NA	NA	NA
Larvae	2.9280	0	1	2.93	0.05	0.10	96,046	0.00210	202	NA	NA	NA	NA	NA	NA	NA	NA
Juvenile 1	3.8779	0	1	3.88	0.02	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1	0.8	0.800	1	1.60	0.20	NA	NA	NA	NA	0.13118	88	88	45	221	12	12	6
2	0.8	0.800	1	1.60	0.20	NA	NA	NA	NA	0.24199	18	18	9	45	4	4	2
3	0.8	0.800	1	1.60	0.20	NA	NA	NA	NA	0.34807	4	4	2	9	1	1	1
4	0.8	0.800	1	1.60	0.20	NA	NA	NA	NA	0.43762	1	1	0	2	0	0	0
5	0.8	0.800	1	1.60	0.20	NA	NA	NA	NA	0.50799	0	0	0	0	0	0	0
									221	Total =	110	110	0	221	18	18	0
											Population in Numbers				Population in Pounds		

Mean Weight (pounds)	0.16	0.16	0.16

Total Weight Lost	35
To Fishing Mortality	18
To Natural Mortality	18

Table B17. High Larval Mortality and Base Life History (Base Mortality Rates) Across All Other Life Stages Table and Average Entrainment Estimate for Gulf Menhaden (*Brevoortia patronus*)

Life History Stage or Age	Natural Mortality per Stage or Age (M)	Fishing Mortality per Stage or Age (F)	% Vulnerability to the Fishery	Total Mortality per Stage (z)	Fraction Surviving at Stage or Age	Corrected Survival Fraction	Number Potentially Entrained at Stage or Age	Cumulative Survival at Stage or Age	Projected Mortality of Age-1 fish	Weight of an Individual fish at Median Age of Death	Number Potentially Lost to Fishing Mortality	Number Potentially Lost to Natural Mortality	Number That Might Have Remained in the Population at the End of Year	Total Number at Age	Weight of Fish Potentially Lost to Fishing Mortality	Weight of Fish Potentially Lost to Natural Mortality	Weight of Fish That Might Have Remained in the Population at the End of Year
Egg	1.8270	0	1	1.83	0.16	0.28	61,792	0.00006	3	NA	NA	NA	NA	NA	NA	NA	NA
Larvae	4.6200	0	1	4.62	0.01	0.02	96,046	0.00040	39	NA	NA	NA	NA	NA	NA	NA	NA
Juvenile 1	3.8779	0	1	3.88	0.02	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1	0.8	0.800	1	1.60	0.20	NA	NA	NA	NA	0.13118	17	17	9	42	2	2	1
2	0.8	0.800	1	1.60	0.20	NA	NA	NA	NA	0.24199	3	3	2	9	1	1	0
3	0.8	0.800	1	1.60	0.20	NA	NA	NA	NA	0.34807	1	1	0	2	0	0	0
4	0.8	0.800	1	1.60	0.20	NA	NA	NA	NA	0.43762	0	0	0	0	0	0	0
5	0.8	0.800	1	1.60	0.20	NA	NA	NA	NA	0.50799	0	0	0	0	0	0	0
									42	Total =	21	21	0	42	3	3	0
											Population in Numbers				Population in Pounds		

Mean Weight (pounds)	0.16	0.16	0.16

Total Weight Lost	7
To Fishing Mortality	3
To Natural Mortality	3

Table B18. Base Life History (Base Mortality Rates) Table and UCL Entrainment Estimate for Gulf Menhaden (*Brevoortia patronus*)

Life History Stage or Age	Natural Mortality per Stage or Age (M)	Fishing Mortality per Stage or Age (F)	% Vulnerability to the Fishery	Total Mortality per Stage (z)	Fraction Surviving at Stage or Age	Corrected Survival Fraction	Number Potentially Entrained at Stage or Age	Cumulative Survival at Stage or Age	Projected Mortality of Age-1 fish	Weight of an Individual fish at Median Age of Death	Number Potentially Lost to Fishing Mortality	Number Potentially Lost to Natural Mortality	Number That Might Have Remained in the Population at the End of Year	Total Number at Age	Weight of Fish Potentially Lost to Fishing Mortality	Weight of Fish Potentially Lost to Natural Mortality	Weight of Fish That Might Have Remained in the Population at the End of Year
Egg	1.8270	0	1	1.83	0.16	0.28	150,487	0.00012	19	NA	NA	NA	NA	NA	NA	NA	NA
Larvae	3.8350	0	1	3.84	0.02	0.04	233,909	0.00088	205	NA	NA	NA	NA	NA	NA	NA	NA
Juvenile 1	3.8779	0	1	3.88	0.02	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1	0.8	0.800	1	1.60	0.20	NA	NA	NA	NA	0.13118	89	89	45	223	12	12	6
2	0.8	0.800	1	1.60	0.20	NA	NA	NA	NA	0.24199	18	18	9	45	4	4	2
3	0.8	0.800	1	1.60	0.20	NA	NA	NA	NA	0.34807	4	4	2	9	1	1	1
4	0.8	0.800	1	1.60	0.20	NA	NA	NA	NA	0.43762	1	1	0	2	0	0	0
5	0.8	0.800	1	1.60	0.20	NA	NA	NA	NA	0.50799	0	0	0	0	0	0	0
									223	Total =	112	112	0	223	18	18	0
											Population in Numbers				Population in Pounds		
														Mean Weight (pounds)	0.16	0.16	0.16

Total Weight Lost	35
To Fishing Mortality	18
To Natural Mortality	18

Table B19. Base Life History (Base Mortality Rates) Table and LCL Entrainment Estimate for Gulf Menhaden (*Brevoortia patronus*)

Life History Stage or Age	Natural Mortality per Stage or Age (M)	Fishing Mortality per Stage or Age (F)	% Vulnerability to the Fishery	Total Mortality per Stage (z)	Fraction Surviving at Stage or Age	Corrected Survival Fraction	Number Potentially Entrained at Stage or Age	Cumulative Survival at Stage or Age	Projected Mortality of Age-1 fish	Weight of an Individual fish at Median Age of Death	Number Potentially Lost to Fishing Mortality	Number Potentially Lost to Natural Mortality	Number That Might Have Remained in the Population at the End of Year	Total Number at Age	Weight of Fish Potentially Lost to Fishing Mortality	Weight of Fish Potentially Lost to Natural Mortality	Weight of Fish That Might Have Remained in the Population at the End of Year
Egg	1.8270	0	1	1.83	0.16	0.28	6,238	0.00012	1	NA	NA	NA	NA	NA	NA	NA	NA
Larvae	3.8350	0	1	3.84	0.02	0.04	9,697	0.00088	8	NA	NA	NA	NA	NA	NA	NA	NA
Juvenile 1	3.8779	0	1	3.88	0.02	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1	0.8	0.800	1	1.60	0.20	NA	NA	NA	NA	0.13118	4	4	2	9	0	0	0
2	0.8	0.800	1	1.60	0.20	NA	NA	NA	NA	0.24199	1	1	0	2	0	0	0
3	0.8	0.800	1	1.60	0.20	NA	NA	NA	NA	0.34807	0	0	0	0	0	0	0
4	0.8	0.800	1	1.60	0.20	NA	NA	NA	NA	0.43762	0	0	0	0	0	0	0
5	0.8	0.800	1	1.60	0.20	NA	NA	NA	NA	0.50799	0	0	0	0	0	0	0
									9	Total =	5	5	0	9	1	1	0
											Population in Numbers				Population in Pounds		

Mean Weight (pounds)	0.00	0.00	0.00

Total Weight Lost	1
To Fishing Mortality	1
To Natural Mortality	1

Table B20. Low Mortality History (Low Mortality Rates Across All Life Stages) Table and UCL Entrainment Estimate for Gulf Menhaden (*Brevoortia patronus*)

Life History Stage or Age	Natural Mortality per Stage or Age (M)	Fishing Mortality per Stage or Age (F)	% Vulnerability to the Fishery	Total Mortality per Stage (z)	Fraction Surviving at Stage or Age	Corrected Survival Fraction	Number Potentially Entrained at Stage or Age	Cumulative Survival at Stage or Age	Projected Mortality of Age-1 fish	Weight of an Individual fish at Median Age of Death	Number Potentially Lost to Fishing Mortality	Number Potentially Lost to Natural Mortality	Number That Might Have Remained in the Population at the End of Year	Total Number at Age	Weight of Fish Potentially Lost to Fishing Mortality	Weight of Fish Potentially Lost to Natural Mortality	Weight of Fish That Might Have Remained in the Population at the End of Year
Egg	1.5660	0	1	1.57	0.21	0.35	150,487	0.00036	54	NA	NA	NA	NA	NA	NA	NA	NA
Larvae	2.9280	0	1	2.93	0.05	0.10	233,909	0.00196	460	NA	NA	NA	NA	NA	NA	NA	NA
Juvenile 1	3.9455	0	1	3.95	0.02	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1	0.8	0.800	1	1.60	0.20	NA	NA	NA	NA	0.13118	205	205	104	513	27	27	14
2	0.8	0.800	1	1.60	0.20	NA	NA	NA	NA	0.24199	41	41	21	104	10	10	5
3	0.8	0.800	1	1.60	0.20	NA	NA	NA	NA	0.34807	8	8	4	21	3	3	1
4	0.8	0.800	1	1.60	0.20	NA	NA	NA	NA	0.43762	2	2	1	4	1	1	0
5	0.8	0.800	1	1.60	0.20	NA	NA	NA	NA	0.50799	0	0	0	1	0	0	0
									513	Total =	257	257	0	513	41	41	0
											Population in Numbers				Population in Pounds		
											Mean Weight (pounds)				0.16	0.16	0.16

Total Weight Lost	81
To Fishing Mortality	41
To Natural Mortality	41

Table B21. High Mortality History (High Mortality Across All Life Stages) Table and LCL Entrainment Estimate for Gulf Menhaden (*Brevoortia patronus*)

Life History Stage or Age	Natural Mortality per Stage or Age (M)	Fishing Mortality per Stage or Age (F)	% Vulnerability to the Fishery	Total Mortality per Stage (z)	Fraction Surviving at Stage or Age	Corrected Survival Fraction	Number Potentially Entrained at Stage or Age	Cumulative Survival at Stage or Age	Projected Mortality of Age-1 fish	Weight of an Individual fish at Median Age of Death	Number Potentially Lost to Fishing Mortality	Number Potentially Lost to Natural Mortality	Number That Might Have Remained in the Population at the End of Year	Total Number at Age	Weight of Fish Potentially Lost to Fishing Mortality	Weight of Fish Potentially Lost to Natural Mortality	Weight of Fish That Might Have Remained in the Population at the End of Year
Egg	12.4200	0	1	12.42	0.00	0.00	6,238	0.00000	0	NA	NA	NA	NA	NA	NA	NA	NA
Larvae	4.6200	0	1	4.62	0.01	0.02	9,697	0.00038	4	NA	NA	NA	NA	NA	NA	NA	NA
Juvenile 1	3.9390	0	1	3.94	0.02	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1	0.8	0.800	1	1.60	0.20	NA	NA	NA	NA	0.13118	1	1	1	4	0	0	0
2	0.8	0.800	1	1.60	0.20	NA	NA	NA	NA	0.24199	0	0	0	1	0	0	0
3	0.8	0.800	1	1.60	0.20	NA	NA	NA	NA	0.34807	0	0	0	0	0	0	0
4	0.8	0.800	1	1.60	0.20	NA	NA	NA	NA	0.43762	0	0	0	0	0	0	0
5	0.8	0.800	1	1.60	0.20	NA	NA	NA	NA	0.50799	0	0	0	0	0	0	0
									4	Total =	2	2	0	4	0	0	0
											Population in Numbers				Population in Pounds		

Mean Weight (pounds)	0.00	0.00	0.00

Total Weight Lost	1
To Fishing Mortality	0
To Natural Mortality	0