LOUISIANA WILDLIFE AND FISHERIES COMMISSION

MINUTES

February 6, 2014

Billy Broussard
CHAIRMAN

BATON ROUGE, LOUISIANA

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AGENDA
LOUISIANA WILDLIFE AND FISHERIES COMMISSION
BATON ROUGE, LA
February 6, 2014 9:30 AM

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MINUTES OF THE MEETING
OF
LOUISIANA WILDLIFE AND FISHERIES COMMISSION

Thursday, February 6, 2014

Chairman Billy Broussard presiding

Billy Broussard
Pat Manuel
Will Drost
Dan Davis

Secretary Barham was also present

Wendy Brogdon Called Roll

Chairman Broussard called for a motion for approval of the **January 9, 2014 Commission Minutes**. A motion for approval was made by Commissioner Manuel and seconded by Commissioner Drost. Chairman Broussard called for a vote and the motion passed with no opposition.

❖

For the agenda item, **Commission Special Announcements/Personal Privilege**
Chairman Broussard announced that the Manager of the Rockefeller WMA, Ton Hess, is in ill health and needs prayers
There were no other comments heard

❖

Lt. Col. Joey Broussard stated, for the agenda item, **To Hear Enforcement & Aviation Reports/January**, the department's planes flew a total of 83.0 aviation hours for the month. There were Six (6) boating accidents reported with Seven (7) injuries and Zero (0) Fatalities. There were 1320 total cases for the month of January with 294 Written Warnings issued and 31Public Assistance.
Three (3) news releases were discussed

First, LDWF Enforcement Division Agents arrested a Sulphur man on January 29th for alleged deer hunting violations in Sulphur.

The second News Release, LDWF Enforcement Division Agents cited a Louisiana man on January 29th for alleged duck hunting violations in Jefferson Parish.

The Third News Release: LDWF Enforcement Division agents concluded an extensive investigation into the illegal sale of spotted sea trout and red drum on January 24, 2014. Agents arrested a Marrero man for alleged commercial fishing violations.

The next item, To Consider an Amendment to the Deer Season Dates in Area 4 was handled by Tommy Tuma.
Mr. Tuma informed the group that in Section 101 and 103, overlapping language was being removed due to Five (5) Saturdays in November.
There were no comments or questions heard. A motion for approval was made by Commissioner Drost and seconded by Commissioner Davis. Chairman Broussard called for a vote and the motion passed with no opposition.

❖

Chairman Broussard announced the next item, To Consider a Resolution of Support for Sustainability Certification of Louisiana Blue Crab**,** to be presented by Mr. Marty Bourgeois
Mr. Bourgeois stated,

The Louisiana Blue Crab fishery is one of the largest fisheries by volume and value in the state and in the Gulf of Mexico Region

The 2011 stock assessment of the Louisiana blue crab fishery is the best available information on the stock status, using fisheries independent and dependent data collected through the Department of Wildlife and Fisheries

Actions taken by the Wildlife and Fisheries Commission will assist in maintaining the blue crab fishery within the conservation standards as described in the Louisiana assessment, and

Maintaining a healthy blue crab stock is in the best interests of the State of Louisiana as it provides sustainable harvest levels and improves economics within the fishery, and

Sustainability certification standards for fisheries require specific management harvest control rules in response to overfishing or overfished stocks

There were no comments or questions heard. A motion for approval was made by Commissioner Manuel and seconded by Commissioner Davis. Chairman Broussard called for a vote and the motion passed with no opposition.

(The full text of this Resolution is made a part of the record)

Resolution of Support for Sustainability Certification of Louisiana Blue Crab

WHEREAS, the Louisiana Blue Crab fishery is one of the largest fisheries by volume and value in the state and in the Gulf of Mexico Region, and

WHEREAS, the 2011 stock assessment of the Louisiana blue crab fishery is the best available information on the stock status, using fisheries independent and dependent data collected through the Department of Wildlife and Fisheries, and

WHEREAS, the Louisiana Blue Crab Stock Assessment establishes conservation benchmarks for overfishing and overfished status for the blue crab fishery, and

WHEREAS, actions taken by the Wildlife and Fisheries Commission will assist in maintaining the blue crab fishery within the conservation standards as described in the Louisiana assessment, and

WHEREAS, maintaining a healthy blue crab stock is in the best interests of the State of Louisiana as it provides sustainable harvest levels and improves economics within the fishery, and

WHEREAS, sustainability certification standards for fisheries require specific management harvest control rules in response to overfishing or overfished stocks, and

WHEREAS, R.S. 56.6(25a) provides the Wildlife and Fisheries Commission with authority to set seasons, times, places, size limits, quotas, daily take, and possession limits, based upon biological and technical data, for all wildlife and fish, now

THEREFORE BE IT RESOLVED that the Louisiana Wildlife and Fisheries Commission does hereby accept and endorse the Louisiana Blue Crab Stock Assessment as the best available information on the fishery, and

BE IT FURTHER RESOLVED that should the fishing mortality or exploitable biomass exceed the overfished or overfishing limits, or exceed the targets for three consecutive years, as defined in the most current Louisiana blue crab stock assessment, the Louisiana Department of Wildlife and Fisheries shall come before the Commission with an updated assessment and a series of management options for the Commission to review and act upon, intended to keep the fishery from becoming overfished, and

BE IT FURTHER RESOLVED that management options for review and action shall include provisions for emergency closures, time based closures and spatial closures.

Chairman Broussard announced the next item, **To Hear the Annual Stock Assessment Report for Striped Mullet**, to be presented by Jason Adriance

Mr. Adriance stated that the attached report is for review prior to transmittal to the legislature.
He also stated that the stock is not overfished.

Commissioner Drost asked “How long is the report out on external review”, and Mr. Adriance answered, “Two Weeks”.

Chairman Broussard asked “Are there any licensed commercial fisherman”, and Mr. Adriance answered, “Not Many”.

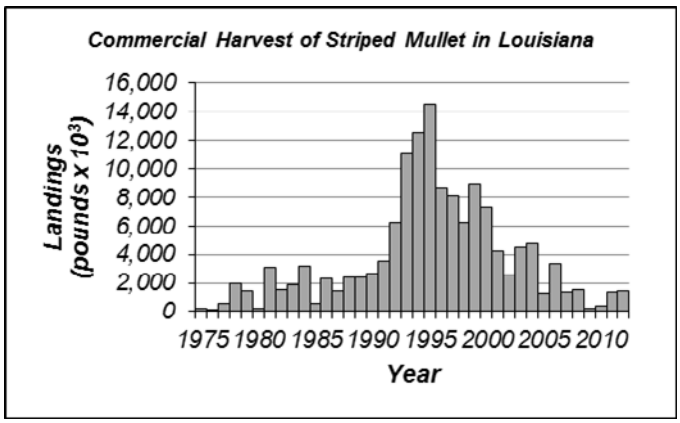
There were no other comments or questions heard.

(The full report is made a part of the record)

Assessment of Striped Mullet *Mugil cephalus* in Louisiana Waters
2014 Report

Executive Summary

Commercial landings of striped mullet (*Mugil cephalus*) in Louisiana have significantly decreased in the last 20 years, with the highest harvest observed in 1995. The passages of Hurricanes Katrina and Rita caused substantial reduction in the directed effort of the commercial fleet when compared to previous years. Since 2007, annual harvest has remained below two-million pounds, with extremely low landings in 2009 and 2010. Since 2010, landings have increased, but remain at historically low levels.



A statistical catch at age model is used in this assessment to describe the dynamics of the Louisiana striped mullet stock (1996-2012). This model uses a maximum likelihood fitting criterion to forward calculate population size from abundance estimates in the initial year and recruitment estimates in subsequent years. Fishing mortality is estimated as year and age-specific components. Landings are taken from the Louisiana Department of Wildlife and Fisheries (LDWF) Trip Ticket Program and National Marine Fisheries Service commercial statistical records. An index of abundance is developed from the LDWF fishery-independent marine gillnet survey. Age composition of fishery and survey catches are estimated with age-length keys developed from samples directly from the fishery and a von Bertalanffy growth function.

The conservation threshold established by the Louisiana Legislature for striped mullet is a 30% spawning potential ratio. Based on results of this assessment, the Louisiana striped mullet stock is currently neither overfished or experiencing overfishing. The marked decline in commercial landings since 2000 can be attributed to impacts from several hurricanes, increases in operating costs, and decreases in the demand and price of roe.

Summary of Changes from 2013 Assessment

In the previous assessment (Blanchet 2013), a virtual population analysis (VPA2, NOAA Fisheries Toolbox) was used to assess status of the stock. The catches and associated age compositions in a VPA model are assumed to be measured with negligible error. In this assessment, we use a statistical catch at age model (ASAP3; NOAA Fisheries

Toolbox) to estimate F-at-age and population size where observation error is allowed and incorporated into the model. A continuity case is also presented in this report examining the results of last year's VPA and this year's base assessment model run.

Assessment of Striped Mullet *Mugil cephalus* in Louisiana Waters
2014 Report

Joe West
Jason Adriance
Office of Fisheries
Louisiana Department of Wildlife and Fisheries

Kristy Lewis
Joseph E. Powers
School of Coast and Environment
Department of Oceanography and Coastal Sciences
Louisiana State University

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1. Introduction

A statistical catch-at-age model (ASAP3; NOAA Fisheries Toolbox) is used in this assessment to describe the dynamics of the Louisiana (LA) striped mullet *Mugil cephalus* (SM) stock. A continuity case is also presented comparing results of the statistical catch-at-age model used in this assessment and the results of the virtual population analysis (VPA2; NOAA Fisheries Toolbox) used in the previous assessment (Blanchet 2013).

1.1 Fishery Status

A comprehensive history of the SM resource and associated fishery within LA is described in Mapes *et al.* (2001) and for the GOM in GSMFC (1995). A current summary of the LA SM fishery is presented below.

Commercial

Mapes *et al.* (2001) describe in detail the progression of the Louisiana commercial SM fishery from an underutilized fishery into a viable fishery after the development of a mullet roe market in 1976. However, regulatory changes enacted in 1995, recent hurricanes, and fuel and roe prices have led to higher variability in the commercial effort directed at SM harvest in Louisiana. Louisiana commercial SM landings declined significantly after regulations were implemented in August 1995 that eliminated the harvest of mullet with entanglement nets outside of the period between the 3rd Monday in October through the 3rd Monday of the following January with no harvest allowed on the weekends or at night.

The passages of Hurricanes Katrina and Rita caused substantial damage to LA marine fishery infrastructure causing a reduction in the directed effort of the LA commercial SM fleet. Higher fuel prices coupled with a decline of the price of roe in recent years have also contributed to a more variable fishery. Furthermore, Australian wild-caught and Asian farm-raised SM have gained a share of the worldwide market. Overall, the commercial SM fishery in Louisiana is currently operating well below the peak in landings observed during the 1990s.

Recent regulatory changes enacted in 2012 established a year-round commercial cast-net season for the harvest of live SM for recreational bait purposes only. This fishery follows the same weekday and daytime harvest restrictions as the commercial strike net fishery.

Recreational

Only limited recreational effort is directed toward SM harvest in Louisiana (NMFS 2012b). Recreational harvest that does occur is likely taken for bait purposes only (Mapes *et al.* 2001; GSMFC 1995).

1.2 Fishery Regulations

The LA SM fishery is governed by the Louisiana State Legislature, the Wildlife and Fisheries Commission and the LDWF. A review of LA commercial and recreational SM fishery regulations are presented below; full descriptions of historical regulations can be found in Mapes *et al*. (2001) and GSMFC (1995).

Commercial

1980 – Special permits granted allowing the use of experimental gear. This usually involved seines and spotter planes for the SM fishery.

1984 – Permit restrictions limited use of purse seines in state waters.

1986 – Elimination of special permits for experimental gears.

1990 – Use of spotter planes banned except for use in the commercial menhaden fishery.

1995 - Limited access program established to commercially fish for SM with strike nets, harvest times limited to after sunrise and before sunset with no commercial fishing for SM allowed on Saturday or Sunday in state waters. Season established to run from the third Monday in October until the third Monday in January.

2012 – Year round commercial cast net fishery established for the capture of live mullet for sale as recreational bait only.

Recreational

1992 – A daily recreational take and possession limit of 100 pounds is established.

1.3 Trends in Harvest

Commercial

Commercial landings of SM in Louisiana rarely exceeded 250,000 pounds prior to 1977 (Figure 1; NMFS 2012a). When the mullet roe market developed after 1978, LA commercial SM landings increased to an average of 1.25 million pounds per year (1978-1980). From 1981-1991, LA commercial SM landings averaged 2.26 million pounds per year. In the 1990s, with an increased demand for mullet roe, the LA commercial SM fishery developed further and averaged 9.30 million pounds harvested per year (1992-2000). After 1995 legislation was enacted which limited the use of entangling nets and established the current structure of the mullet season, landings began to decrease to a minimum of 0.36 million pounds observed in 2005. Louisiana commercial SM landings currently remain at levels well below those observed during the 1990s.

Recreational

Total marine recreational fishing effort has averaged over 3 million angler trips in Louisiana since 1981 (NMFS 2012b). Over this time period, only 0.5% of the LA marine recreational directed effort either targeted or caught SM. Resulting LA recreational SM landings estimates have rarely exceeded 300 thousand pounds (Table 1). Recreational SM mullet landings of other GOM states are also relatively low when compared to LA with the exception of the west coast of Florida where landings below 1 million pounds are infrequently observed (Figure 2).

2. Data Sources

2.1 Fishery Independent

The LDWF fishery-independent marine gillnet survey is used in this assessment to develop an index of abundance for use in ASAP. Below is a brief description of this surveys methodology. Complete details can be found in LDWF (2002).

For sampling purposes, coastal Louisiana is currently divided into five LDWF coastal study areas (CSAs). The definitions of those CSAs are different from that found in the 2002 field procedures manual (LDWF 2002). Current CSA definitions are as follows: CSA 1 – Mississippi State line to South Pass of the Mississippi River (Pontchartrain Basin); CSA 3 – South Pass of the Mississippi River to Bayou Lafourche (Barataria Basin); CSA 5 – Bayou Lafourche to eastern shore of Atchafalaya Bay (Terrebonne Basin); CSA 6 – Atchafalaya Bay to western shore of Vermillion Bay (Vermillion/Teche/Atchafalaya Basins); CSA 7 – western shore of Vermillion Bay to Texas State line (Mermentau/Calcasieu/Sabine Basins). The LDWF Marine Fisheries Section conducts routine standardized sampling within each CSA as part of a long-term comprehensive monitoring program to collect life-history information and measure relative abundance/size distributions of recreationally and commercially important species. These include the experimental marine gillnet, trammel net, and beach seine surveys.

In this assessment, only the fishery-independent (FI) marine gillnet survey is used. This survey is conducted with standardized design twice monthly April-September and monthly October-March at fixed sampling locations. Hydrological and climatological measurements are taken with each biological sample, including water temperature, turbidity, conductivity and salinity. Survey gear is a 750’ monofilament gillnet comprised of five 150-foot panels of 1.0, 1.25, 1.5, 1.75, and 2.0 inch bar meshes. Samples are taken by ‘striking’ the net; where the net is set either parallel to the shore (or reef) or set in a crescent-shape. The vessel is then maneuvered both inside and outside of the net in gradually tightening circles a minimum of three times to force fish into the net. All captured SM are enumerated and a maximum of 30 randomly selected SM per mesh panel are collected for length measurements, gender determination, and maturity information. When more than 30 SM are captured per mesh panel, catch-at-size is derived as the product of total catch and proportional subsample-at-size.

2.2 Fishery Dependent

Commercial

Commercial SM landings are taken from NMFS commercial statistical records (NMFS 2013a) and the LDWF Trip Ticket Program (Figure 1). Annual size compositions of commercial catches (Table 2) are derived from the Trip Interview Program (TIPS; 1996-2001), the Fishery Information Network (FIN; 2007-2012), and by combination of data collection programs (TIPS+FIN; 2002-2006). Ages of commercial SM landings are derived from otoliths collected from LDWF sampling effort (see *Catch at Age Estimation*).

Recreational

As in prior assessments, the effects of recreational harvest on the stock were not considered. The MRFSS/MRIP harvest data (Type A+B1 only) indicates that LA recreational harvest is minimal relative to commercial harvest (Table 1; NMFS 2013b). Furthermore, only limited recreational size composition information is available from MRFSS/MRIP. The size information that is available indicates most of the recreational harvest is taken at sizes (age-0) prior to entering the commercial fishery (age-1+).

3. Life History Information

3.1 Unit Stock Definition

Striped mullet are a catadromous schooling fish common in warm, temperate coastal waters throughout the world. They are ubiquitous in the Gulf of Mexico (GOM) and can be found along extreme salinity gradients, from fresh to hyper-saline. Little or no genetic sub-structuring has been documented for GOM striped mullet. Thompson *et al.* (1991) found no differences in enzyme polymorphisms in striped mullet collected from various locations across Louisiana, or between those areas and mullet collected from the Pascagoula River, Mississippi, Mobile Bay, Alabama, and Charleston Bay (South Carolina). Campton and Mahmoudi (1991) also found little evidence for genetic sub-structuring of striped mullet populations between the Atlantic and GOM coasts of Florida. For the purpose of this assessment, the unit stock is defined as those female SM occurring in LA waters. This approach is consistent with the current spawning potential conservation standard and statewide management strategy.

3.2 Morphometrics

Weight-length regressions for LA SM were developed by Thompson *et al.* (1991). Regression equation slopes comparing males and females were not significantly different (P<0.05). For the purpose of this assessment, the non-sex-specific formulation is used with weight calculated from size as:

$$W = 2.1 \times 10^{-5}([FL])^{2.93} \quad [1]$$

where W is total weight in grams and FL is fork length in mm. Fish with only FL measurements available are converted to TL using the relationship provided by Thompson *et al*. (1991) where:

$$TL = 1.13 \times (FL) - 3.40 \quad [2]$$

3.3 Growth

Von Bertalanffy growth functions for female LA SM collected from fishery-independent data sources were developed by Thompson *et al.* (1991) with size-at-age calculated from:

$$FL_a = 471.76 \times (1 - e^{-0.28(a-0.08)}) \quad [3]$$

where FL_a is FL-at-age in mm and years.

3.4 Sex Ratio

The probability of being female at a specific size is estimated with a logistic function using gender and size information collected from the long-term monitoring stations of the LDWF FI gillnet survey (1988-2009). Earlier observations (1986-1987) were excluded from model estimation due to inconsistencies with mesh sizes (*i.e.*, gear selectivity) used in later years. The probability of being female at a specific total length was calculated from:

$$P_i(fem, l) = 1/[1 + e^{[-0.24(TL - 10.04)]}] \quad [4]$$

where $P_{fem,l}$ is the estimated proportion of females in 1 inch TL intervals, 0.24 is the rate of change, and 10.04 is the inflection point. The minimum sex ratio-at-size is assumed as 50:50. The model was fit to the data using the SAS nonlinear approximation procedure (PROC NLIN; SAS 1994). Length intervals were excluded from model estimation when sample size per length interval was <5.

3.5 Fecundity/Maturity

Per capita fecundity functions for LA SM were developed by Thompson *et al*. (1991) with fecundity-at-size computed as:

$$f_l = 5.6 \times 10^{-8}(FL)^{3.18} \quad [5]$$

Where f_l is the average fecundity of a size l female in FL. Fecundity-at-age f_a is then computed by substituting equation [5] into equation [3]. Female SM maturity is assumed knife-edged at age-2.

3.6 Natural Mortality

In previous assessments (Blanchet 2011, 2012, 2013), the natural morality rate was assumed constant across ages; however, an allometric relationship between natural mortality and fish size in natural ecosystems has been demonstrated (Lorenzen 1996). In this assessment, an estimate of constant M from the previous assessment is assumed (M=0.3), but is allowed to vary with weight-at-age to calculate a declining natural mortality rate with age. This natural mortality rate is consistent with those reported in the literature. Pauly (1980) cites Ih-Hsiu (1970) as reporting an M of 0.31 for male striped mullet from Taiwan. Mahmoudi (1991) estimated M as 0.30 using tagging data from southwest Florida. Following SEDAR 12 (SEDAR 2006), the estimate is rescaled where the average mortality rate over ages vulnerable to the fishery is equivalent to the constant rate over ages as:

$$M_a = M\frac{nL(a)}{\sum_{a_c}^{a_{max}} L(a)} \quad [6]$$

where M is a constant natural mortality rate over exploitable ages a , a_{max} is the oldest age-class, a_c is the first fully-exploited age-class, and n is the number of exploitable ages. The Lorenzen curve as a function of age is calculated from:

$$L(a) = W_a^{-0.288} \quad [7]$$

where -0.288 is the allometric exponent estimated for natural ecosystems (Lorenzen 1996). To approximate model/fishery timing, M_a is evaluated at the end-point of each age interval.

4. Abundance Index Development

An index of abundance (IOA) was developed from the LDWF FI marine gillnet survey for use in ASAP. To account for various forms of uncertainty, the IOA was standardized using methods described below.

Only those CSAs, months, and mesh panels with $\geq$ 5% positive samples are included in index development. Stations not sampled regularly through time are also excluded. For purposes of this assessment, catch-per-unit effort (CPUE) is defined as the number of female SM caught per gillnet sample. The number of female mullet caught per gillnet sample is calculated from each samples catch at size and equation [4].

A delta lognormal approach (Lo *et al.* 1992; Ingram *et al.* 2010) is used to standardize female SM catch-rates in each year as:

$$I_y = c_y p_y \quad [8]$$

where c_y are estimated annual mean CPUEs of non-zero female SM catches assumed as lognormal distributions and p_y are estimated annual mean probabilities of female SM capture assumed as binomial distributions. The

lognormal and binomial means and their standard errors are estimated with generalized linear models as least squares means and back transformed. The lognormal model considers only samples in which SM were captured; the binomial model considers all samples. The IOA is then computed from equation [8] with variances approximated from a Monte Carlo resampling routine (2000 iterations) using the estimated least-squares means and standard errors.

Variables considered in model inclusion were:

Factor	Levels	Value
Year	24	1988-2012
Month	4	November-February
Area	4	CSAs 1,5,6,7
Gear	4	1.0, 1.25, 1.5, 1.75" bar meshes
Salinity	Continuous	--
Temperature	Continuous	--

January and February samples are grouped with the previous year's November and December samples for IOA development. This approximates survey timing at the end of the calendar year (December 31st).

To determine the most appropriate models, factors were selected using a forward step-wise approach where each factor was added to each sub-model individually and the resulting reduction in deviance per degree of freedom (Dev/DF) analyzed. The factor causing the greatest reduction in Dev/DF was then added to the base model. Criteria for model inclusion also included a reduction in Dev/DF $\geq$ 1% and a Chi-Square significance test $\leq$ 0.05. This procedure was then repeated until no factor met criteria for model inclusion. We assume that there are no significant interaction terms with year in this model and considered only the main effects.

Resulting sub-models are as follows:

$$c \sim Year + Area + Gear \quad [9]$$

$$p \sim Year + Area + Month + Gear + Salinity \quad [10]$$

Sub-models were estimated with the SAS generalized linear modeling procedure (PROC GENMOD; SAS 1994). Sample sizes, proportion positive samples, nominal CPUE, standardized index, and coefficients of variation of the standardized index are presented (Table 3). Standardized and nominal CPUEs, normalized to 1 for comparison, are also presented (Figure 3).

5. Catch at Age Estimation

Age-length-keys (ALKs) are developed to estimate the annual age composition/catch-at-age of fishery and survey catches as described below.

5.1 Fishery

Only female SM otoliths collected from fishery dependent sources were used in age assignments of fishery landings. Ages were assigned by assuming a January 1st birthday, where SM spawned the previous year become age-1 on January 1st and remain age-1 until the beginning of the following year.

Probabilities of age given length for annual fishery landings are computed as:

$$P(a|l)_y = \frac{n_{lay}}{\sum_a n_{lay}} \quad [11]$$

where n_{lay} are annual female SM sample sizes occurring in each length/age bin (Tables 4 and 5). Table 4 is used to calculate $P(a|l)_y$ for 1996-2002, where limited annual sample sizes preclude use of annual ALKs. Annual fishery catch-at-age (females only) is then taken as:

$$C_{ay} = \sum_l P_{fem,l} C_{ly} P(a|l)_y \quad [12]$$

where $P_{fem,l}$ is taken from equation [4], C_{ly} is annual fishery catch-at-size, and $P(a|l)_y$ are taken from equation [13]. Resulting annual fishery catch-at-age and associated mean weights-at-age are presented (Tables 6 and 7).

5.2 Survey

Probabilities of age given length for female SM catches of the LDWF marine gillnet survey are computed as:

$$P(a|l) = \frac{P(l|a)}{\sum_a P(l|a)} \quad [13]$$

with the probability of length given age estimated from a normal probability density as:

$$P(l|a) = \frac{1}{\sigma_a\sqrt{2\pi}} \int_{l-d}^{l+d} exp\left[-\frac{(l-l_a)^2}{2\sigma_a^2}\right] dl \quad [14]$$

where length bins are 1 inch TL intervals with midpoint l, maximum $l+d$, and minimum $l-d$ lengths. Mean length-at-age l_a is estimated from Equation [3]. The standard deviation in length-at-age is approximated from $\sigma_a = l_a CV_l$, where the coefficient of variation in length-at-age is assumed constant (in this case 0.05). To approximate changes in growth with the timing of the survey, mean l_a is calculated at the end of the year (i.e.,

age=$a + 1.0$). Resulting survey $P(l|a)$ is presented (Table 8). Annual survey female catch-at-age is then taken from equation [12] with annual survey catch-at-size as C_{ly} . Annual survey catch-at-size is derived using only those samples included in abundance index development. Annual survey catch-at-size and resulting annual survey age compositions (females only) are presented (Tables 9 and 10).

6. Assessment Model

In prior assessments, a virtual population analysis (VPA-2BOX, NOAA) was used to estimate fishing mortality rates and population size. In this assessment, the Age-Structured Assessment Program (ASAP3 Version 3.0.12; NOAA Fisheries Toolbox http://nft.nefsc.noaa.gov) is used to describe the dynamics of the female proportion of the LA SM stock. Results of this assessment are compared to estimates from the previous assessment (see *Continuity Case*). As in earlier assessments, only the years 1996-2012 are modeled due to the limited size and age information available from earlier years of the fishery.

ASAP is a statistical catch-at-age model that allows internal estimation of a Beverton-Holt stock recruitment relationship and MSY-related reference points. Minimum data requirements are fishery catch-at-age, corresponding mean-weights-at-age, and a tuning index. ASAP does allow multiple fisheries, tuning indices, and discards to be modeled; however, for this assessment only a single fleet and tuning index are modeled. ASAP forward calculates abundance at age from estimates of abundance in the initial year of the time-series and recruitment estimates in subsequent years. The model is fit to the data with a maximum likelihood fitting criterion.

An overview of the basic model configuration, equations, and their estimation, as applied in this assessment, are provided below. Specific details and full capabilities of ASAP can be found in the technical documentation (ASAP3; NOAA Fisheries Toolbox).

6.1 Model Configuration

The model is configured with annual time-steps (1996-2012) and a calendar year time frame. Since the commercial SM strike net fishery season runs from the 3rd Monday in October through the 3rd Monday of the following January, SM harvested in January are grouped with the previous year's landings for use in ASAP.

Mortality

Fishing mortality is assumed separable by age a and year y as:

$$F_{ay} = v_a Fmult_y \quad [15]$$

where v_a are fishery selectivities and $Fmult_y$ are apical fishing mortality rates. Apical fishing mortality is estimated in the initial year and as deviations from the initial estimate in subsequent years.

Age-specific fishery selectivities are modeled with a single logistic function as:

$$v_a = \frac{1}{1 + e^{-\frac{a-\alpha}{\beta}}} \quad [16]$$

Total mortality for each age and year is estimated from the age-specific natural mortality rate M_a and estimated fishing mortalities as:

$$Z_{ay} = M_a + F_{ay} \quad [17]$$

For reporting purposes, annual fishing mortalities are averaged by weighting by population abundance as:

$$F_y = \frac{\sum_a F_{ay} N_{ay}}{\sum_a N_{ay}} \quad [18]$$

Abundance

Abundance in the initial year of the time series and recruitment in subsequent years are estimated and used to forward calculate the remaining numbers at age from the age and year specific total mortality rates as:

$$N_{ay} = N_{a-1,y-1} e^{-Z_{a-1,y-1}} \quad [19]$$

Numbers in the plus group A are calculated from:

$$N_{Ay} = N_{A-1,y-1} e^{-Z_{A-1,y-1}} + N_{A,y-1} e^{-Z_{A,t-1}} \quad [20]$$

Stock Recruitment

Expected recruitment is calculated from the Beverton-Holt stock recruitment relationship, reparameterized by Mace and Doonan (1988), with annual lognormal deviations as:

$$\hat{R}_{y+1} = \frac{\alpha SS_y}{\beta + SS_y} + e^{\delta_{y+1}} \quad [21]$$

$$\alpha = \frac{4\tau\left(\frac{SS_0}{SPR_0}\right)}{5\tau - 1} \text{ and } \beta = \frac{SS_0(1-\tau)}{5\tau - 1}$$

where SS_0 is unexploited spawning stock, SPR_0 is unexploited spawning stock per recruit, τ is steepness, and $e^{\delta_{y+1}}$ are annual lognormal recruitment deviations..

Spawning Stock

Spawning stock in each year is calculated from:

$$SS_y = \sum_{t=1}^{A} N_{ay} \Phi_{ay} e^{-Z_{ay}(0,0)} \qquad [22]$$

where Φ_{ay} is per capita fecundity at age, and $-Z_{ay}(0,0)$ is the proportion of total mortality occurring prior to spawning on January 1st .

Catch

Expected fishery catches are estimated from the Baranov catch equation as:

$$\hat{C}_{ay} = N_{ay} F_{ay} \frac{\left(1 - e^{-Z_{ay}}\right)}{Z_{ay}} \quad [23]$$

Expected age composition of fishery catches are then calculated from $\frac{\hat{C}_{ay}}{\sum_a \hat{C}_{ay}}$. Expected yields are then computed as $\sum_a \hat{C}_{ay} \overline{W}_{ay}$, where $\overline{W}_{ay}$ are observed mean catch weights.

Catch-rates

Expected survey catch-rates are computed from:

$$\hat{I}_{ay} = q \sum_a N_{ay} \left(1 - e^{-Z_{ay}(1.0)}\right) v_a \quad [24]$$

where v_a are the age-specific survey selectivities, q is the estimated catchability coefficient, and $-Z_{ay}(1.0)$ is the proportion of the total mortality occurring prior to the time of the survey (December 31st midpoint) . Age-specific survey selectivities are modeled with a double logistic function as:

$$v_a = \left(\frac{1}{1 + e^{-\frac{a - \alpha}{\beta}}}\right)\left(1 - \frac{1}{1 + e^{-\frac{a - \alpha 2}{\beta 2}}}\right) \quad [25]$$

Expected survey age composition is then calculated as $\frac{\hat{I}_{ay}}{\sum_a \hat{I}_{ay}}$.

Parameter Estimation

The number of parameters estimated is dependent on the length of the time-series, number of fisheries and selectivity blocks modeled, and number of tuning indices modeled. Parameters are estimated in log-space and then back transformed. In this assessment, 48 parameters are estimated:

1. 6 selectivity parameters (2 for the fishery; 4 for the survey)
2. 17 apical fishing mortality rates (F_{mult} in the initial year and 16 deviations in subsequent years)
3. 17 recruitment deviations (1986-2012)
4. 6 initial population abundance deviations (age-2 through 7-plus)
5. 1 catchability coefficient
6. 1 stock-recruitment parameter (virgin stock size; the steepness parameter is fixed at 0.99 for the base run).

The model is fit to the data by minimizing the objective function:

$$-ln(L) = \sum_i \lambda_i(-ln L_i) + \sum_j (-ln L_j) \quad [26]$$

where $ln(L)$ is the entire negative log-likelihood , lnL_i are log-likelihoods of lognormal estimations, λ_i are user-defined weights applied to lognormal estimations, and lnL_j are log-likelihoods of multinomial estimations.

Negative log-likelihoods with assumed lognormal error are derived (ignoring constants) as:

$$-ln(L_i) = 0.5 \sum_i \frac{[ln(obs_i) - ln(pred_i)]^2}{\sigma^2} \quad [27]$$

where obs_i and $pred_i$ are observed and predicted values; standard deviations σ are user-defined CVs as $\sqrt{ln(CV^2 + 1)}$.

Negative log-likelihoods with assumed multinomial error are derived (ignoring constants) as:

$$-ln(L_j) = -ESS \sum_{i=1}^{L} p_i \, ln(\hat{p}_i) \quad [28]$$

where p_i and $\hat{p}_i$ are observed and predicted age composition. Effective sample-sizes ESS are used to create the expected numbers $\hat{n}_a$ in each age bin and act as multinomial weighting factors.

6.2 Model Assumptions/Inputs

Model assumptions include: 1) the unit stock is adequately defined and closed to migration, 2) observations are unbiased, 3) errors are independent and their structures are adequately specified, 4) fishery vulnerabilities are flat topped; survey vulnerabilities are dome-shaped, 5) abundance indices are proportional to absolute abundance, and 6) natural mortality, fecundity, growth and sex ratio at size/age do not vary significantly with time. Lognormal error is assumed for catches, abundance indices, the stock-recruitment relationship, apical fishing mortality, selectivity parameters, the initial abundance deviation, and catchability. Multinomial error is assumed for fishery and survey age compositions.

The base model was defined with an age-7 plus group, steepness fixed at 0.99, one fishery selectivity block, one survey selectivity block, and input levels of error and weighting factors as described below.

Input levels of error for fishery landings were specified with CV's of 0.05 for each year of the time-series; annual recruitment deviations were specified with CV's of 0.5. All lambdas for lognormal components included in the objective function were equally weighted (=1). Input effective sample sizes for estimation of fishery age compositions were specified as ESS=50 for years where annual ALKs were available (2003-2012) and down weighted to ESS=25 for years where the pooled ALK was used (1996-2002). Input effective sample size for

estimation of survey age compositions, where ages were assigned from a von Bertalanffy growth function, were specified as ESS=10.

6.3 Model Results

Objective function components, weighting factors, and likelihood values of the base model are summarized in Table 11.

Model Fit

The base model provides an overall reasonable fit to the data. Predicted catches match the observations well, with no strong pattern in residuals (Figure 4). Predicted survey catch-rates also match the data well with no strong pattern in residuals, but fail to fit the high catch rate observed in 2005 (Figure 5). Predicted fishery and survey age compositions provide good fits to the input age proportions (Figures 6 and 7).

Selectivities

Estimated fishery and survey selectivities are presented in Figure 8. Fishery estimates indicate full-vulnerability to the commercial gill net fishery at age 5 with over 50% vulnerable at age 3. Survey estimates indicate full vulnerability to the FI survey gear at age 2.

Abundance, Recruitment, and Spawning Stock

Total stock size and abundance at age estimates from the base model are presented in Table 12. Stock size has varied over the time-series. Stock size decreased from 16.62 million females in 1996 to a minimum of 10.51 million females in 2006. Since 2006, stock size has increased to 14.62 million females in 2012.

Recruitment estimates from the base model are presented in Figure 9. Recruitment has also varied over the time-series. Recruitment decreased from 7.03 million age-1 females in 1996 to a minimum of 3.58 million in 2003. Since 2003, recruitment has increased with a peak of 8.57 million age-1 females estimated in 2006.

Spawning stock estimates (total egg production) are presented in Figure 10. Spawning stock has varied over the time series with a decreasing trend in early years to an increasing trend in later years. Spawning stock decreased from 2.68 trillion eggs in 1996 to a minimum of 1.83 trillion eggs in 2001. Since 2001, the overall trend has been upward with an estimate of 5.58 trillion eggs in 2012.

Fishing Mortality

Estimated fishing mortality rates are presented in Table 13 (apical, average, and age-specific) and Figure 11 (average only). Average rates are weighted by population numbers at age. Average fishing mortality has varied over the time-series with an overall decreasing trend. The highest estimates of F were in earlier years of the time series with a peak observed in 1999 (F=0.27 years^{-1}). Since 1999, average fishing mortality has decreased to a minimum in 2009 (F=0.003 years^{-1}) and has remained low.

Stock-Recruitment

No relationship is observed between spawning stock and subsequent age-1 recruitment (Figure 12). The ASAP base model was run with steepness fixed at 0.99. The estimated virgin spawning stock was 7.22×10^{-12} (total egg production). When allowed to directly solve for steepness ASAP failed to converge. Alternate runs with steepness values fixed at 0.9, 0.8, and 0.7 are discussed in the *Model Diagnostics* Section below.

Parameter Uncertainty

In the ASAP base model, 43 parameters were estimated. Asymptotic standard errors for the time-series of recruitment (age-1 females) are presented in Figure 9. Markov Chain Monte Carlo derived confidence intervals (95%) for the average fishing mortality and spawning stock time-series are presented in Figures 10 and 11.

6.4 Management Benchmarks

The conservation standard established by the LA Legislature for striped mullet (RS 56:333) is a 30% spawning potential ratio (SPR; Goodyear 1993). Methodology used in this assessment to estimate equilibrium yield, spawning stock (total egg production), and fishing mortality rates that lead to a 30% SPR are described below.

When the stock is in equilibrium, equation [22] can be solved, excluding the year index, for any given exploitation rate as:

$$\frac{SS}{R(F)} = \sum_{a=1}^{A} N_a \Phi_a e^{-Z_a(0.0)} \qquad [29]$$

where total mortality at age Z_a is computed as $M_a + v_a Fmult$; v_a is the estimated fishery selectivity at age. Per recruit abundance-at-age is estimated as $N_a = S_a$, where survivorship at age is calculated recursively from $S_a = S_{a-1} e^{-Z_a}$, $S_1 = 1$. Per recruit catch-at-age is then calculated with the Baranov catch equation [23], excluding the year index. Yield per recruit (Y/R) is then taken as $\sum_a C_a \overline{W}_a$ where $\overline{W}_a$ are mean fishery weights at age taken from the terminal year of the assessment.

Equilibrium spawning stock SS_{eq} is calculated by substituting SS/R estimated from equation [29] into the Beverton-Holt stock recruitment relationship as $\alpha \times SS/R - \beta$. Equilibrium recruitment R_{eq} and yield Y_{eq} are then taken as $SS_{eq} \div SS/R$ and $Y/R \times R_{eq}$. Fishing mortality is averaged as $\sum_a \frac{F_a N_a}{\sum_a N_a}$. Equilibrium SPR is then computed as the ratio of SS/R when F>0 to SS/R when F=0.

As reference points to guide management, we estimate the average fishing mortality rate, spawning stock size, and yield that lead to a 30% SPR ($F_{30\%}$, $SS_{30\%}$, and $Y_{30\%}$). These estimates are presented in Figure 14 relative to each respective time-series. Also presented are a plot of the stock recruitment data, equilibrium recruitment, and diagonals from the origin intersecting R_{eq} at the minimum and maximum SS estimates of the time-series, corresponding with a minimum equilibrium SPR of 25% and a maximum of 75% (Figure 13). Estimates of $F_{30\%}$ and $SS_{30\%}$ are also presented in Table 14.

6.5 Model Diagnostics

Sensitivity Analysis

A series of sensitivity runs are used to explore uncertainty in the base model's configuration. The ASAP base model was run with steepness fixed at 0.99. ASAP failed to converge when allowed to directly solve for the steepness parameter. Alternate runs were conducted examining reference point estimates ($F_{30\%}$, $SS_{30\%}$, $Y_{30\%}$, $F_{current}/F_{30\%}$, and $SS_{current}/SS_{30\%}$) with steepness fixed at 0.9, 0.8 and 0.7. Current estimates are taken from the terminal year of the assessment. Additional sensitivity runs were conducted by separately increasing the lognormal weighting factors of the catch and IOA components of the base models objective function (*i.e.*, lambdas increased from 1 to 4).

Results of the sensitivity analysis are presented in Table 15. The model failed to converge when steepness was fixed at 0.8. Reference point estimates from all other sensitivity runs indicate the stock is currently above $SS_{30\%}$ and the fishery is currently operating below $F_{30\%}$. Estimates of $F_{30\%}$, $SS_{30\%}$, and $Y_{30\%}$ for each sensitivity run were similar in magnitude (0.15 year^{-1}, 2.21 trillion eggs, and 3.8 million pounds).

Retrospective Analysis

A retrospective analysis was conducted by sequentially truncating the base model by a year (terminal years 2009-2012). Retrospective estimates of recruitment, $SS/SS_{30\%}$, and $F/F_{30\%}$ are presented in Figure 15, where $SS_{30\%}$ and $F_{30\%}$ are computed from the base model run. Retrospective bias was evaluated using the relative error between each runs terminal year estimates.

Estimated terminal year $SS/SS_{30\%}$, $F/F_{30\%}$, and recruitment differed from the full base run. Terminal year $SS/SS_{30\%}$ estimates indicate positive bias for the 2011-2009 retrospective runs (4, 6, and 20% respectively), where $SS/SS_{30\%}$ decreases as more years are added to the model. Terminal year $F/F_{30\%}$ estimates indicate negative bias for the 2011-2010 retrospective runs (-6 and -26% respectively) and no bias for the 2009 run, where $F/F_{30\%}$ generally decreases as more years are added to the model. Terminal year recruitment estimates indicate positive bias for the 2011 and 2010 runs (2 and 78% respectively) and negative bias for the 2009 run (-4%).

Continuity Case

A continuity case is presented examining the results of last year's virtual population analysis (Blanchet 2013) and this year's ASAP base model run. It's important to point out that model inputs for the previous and current assessments varied to some degree. In the previous assessment, natural morality was assumed constant across ages and multiple tuning indices (both fishery dependent and independent) were used. In the current assessment, natural mortality is allowed to decline with age, a single fishery independent tuning index is modeled, and fishery and survey female catch at size is calculated. Furthermore, estimation of survey age composition differed in the current assessment (see *Catch at Age Estimation*), where the previous assessment assigned age to survey catches using fishery-independent age composition information pooled from multiple years with relatively low sample sizes.

Time-series of recruitment, average fishing mortality rates (weighted by population numbers at age), and spawning stock size estimates are presented in Figure 16. Estimates from the previous assessment generally follow the same trends and have the same scale as the ASAP base run. However, differences due exist. Spawning stock size estimates from the previous year's VPA model are higher in earlier years of the time-series and lower in more recent years when compared to the ASAP base run. Fishing mortality rate estimates from the previous year's VPA model are higher than the ASAP estimates across the time-series. Another primary difference between the two models is the estimated fishery selectivities at age. In the VPA model, selectivity at age estimates were substantially lower for ages 2, 3, and 4 when compared to the estimates from the ASAP base run (Figure 17). This resulted in lower estimates of F for those ages and higher estimates of SPR and associated reference points when compared to the ASAP base run. Additionally, reference point calculations differed between assessments. In the previous assessment, spawning stock size (total egg production) per recruit was computed from the average relative abundance at age rather than relative abundance at time of spawning (*i.e.*, January 1st).

7. Stock Status

The history of the LA striped mullet stock relative to $F/F_{30\%}$ and $SS/SS_{30\%}$ is presented in Figure 18. Given the established conservation standard of 30% SPR, fishing mortality rates exceeding $F_{30\%}$ ($F/F_{30\%}>1.0$) are defined as overfishing; spawning stock sizes below $SS_{30\%}$ ($SS/SS_{30\%}< 1.0$) are defined as the overfished condition.

Overfishing Status

Using results of the ASAP model presented in this assessment, the 2012 estimate of $F/F_{30\%}$ is <1.0, suggesting the stock is currently not undergoing overfishing. However, the current assessment model indicates that the stock did experience overfishing in earlier years of the time-series (1996-2000, and 2003-2004).

Overfished Status

The 2012 estimate of $SS/SS_{30\%}$ is >1.0, suggesting the stock is currently not in an overfished state. However, the current assessment model indicates that the stock was in an overfished state in earlier years of the time-series (2000-2002, and 2004-2005).

Control Rules

As specified in RS 56:333 (http://www.legis.la.gov/Legis/Law.aspx?d=105230), if the annual LDWF striped mullet stock assessment indicates that the current spawning potential ratio is <30%, the department shall close the season within two weeks for a period of at least one year.

8. Research and Data Needs

As with any analysis, the accuracy of this assessment is dependent on the accuracy of the information of which it is based. Mapes et al. (1998) identify several areas for research to address. Below we list additional recommendations to improve future LA assessments of striped mullet.

Only limited age data are available from the LDWF marine gillnet survey. Ages of survey catches in this assessment were assigned from a von Bertalanffy growth function. Age samples collected directly from the survey in question would allow a more accurate representation of survey age composition in future assessments.

Methods to characterize fishery catch at age for years prior to 1996 need to be examined. Inclusion of years prior to the 1995 peak in commercial striped mullet landings in the assessment model would provide better contrast in spawning stock size and allow more certainty in reference point estimation.

Factors that influence year-class strength of striped mullet are poorly understood. Investigation of these factors, including inter-annual variation in seasonal factors and the influence of environmental perturbations such as the Deepwater horizon oil spill, could elucidate causes of inter-annual variation in abundance, as well as the species stock-recruitment relationship.

Fishery-dependent data alone is not a reliable source of information to assess status of a fish stock. Consistent fishery-dependent and fishery-independent data sources, in a comprehensive monitoring plan, are essential to understanding the status of fishery. A new LDWF fishery-independent survey methodology was implemented in

2013. This methodology should be assessed for adequacy with respect to its ability to evaluate stock status, and modified if deemed necessary.

9. References

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10. Tables

Table 1: Annual Louisiana commercial and recreational striped mullet *Mugil cephalus* landings (pounds x 10^3) derived from NMFS statistical records, LDWF trip ticket program, and MRFSS/MRIP. Recreational landings are A+B1 catches only.

	Harvest		
Year	Commercial	Recreational	%_Recreational
1981	3,051	1	0.0%
1982	1,533	17	1.1%
1983	1,887	0	0.0%
1984	3,157	3	0.1%
1985	579	8	1.3%
1986	2,278	53	2.3%
1987	1,439	0	0.0%
1988	2,367	106	4.3%
1989	2,414	75	3.0%
1990	2,646	296	10.1%
1991	3,563	26	0.7%
1992	6,215	121	1.9%
1993	11,026	185	1.7%
1994	12,560	98	0.8%
1995	14,546	90	0.6%
1996	8,659	217	2.4%
1997	8,083	130	1.6%
1998	6,252	15	0.2%
1999	8,954	49	0.5%
2000	7,253	88	1.2%
2001	4,260	116	2.6%
2002	2,555	59	2.3%
2003	4,524	3	0.1%
2004	4,754	3	0.1%
2005	1,238	13	1.0%
2006	3,361	2	0.1%
2007	1,375	391	22.1%
2008	1,503	1	0.1%
2009	189	36	16.2%
2010	362	12	3.2%
2011	1,385	18	1.3%
2012	1,394	50	3.5%

Table 2: Annual size frequency samples of Louisiana commercial striped mullet *Mugil cephalus* landings derived from the Trip Interview Program (TIPS; 1996-2001), the Fishery Information Network (FIN; 2007-2011), and by combination of data collection programs (TIPS+FIN; 2002-2006).

TL_in	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
6																	
7																	
8																	
9																	
10	3																
11	8	2	1										1				
12	59	44	1	10				3	1		10	8	7		1	1	1
13	271	183	5	20	1	3	11	30	22	11	25	25	35		26	22	19
14	518	537	45	37	9	20	37	101	68	61	53	78	103	1	50	39	45
15	401	595	73	114	40	41	49	142	122	151	107	194	150	10	23	40	112
16	308	453	110	244	83	40	53	169	267	182	164	256	155	49	41	94	153
17	202	230	126	248	87	75	31	151	342	154	135	187	160	165	33	254	260
18	121	108	94	259	73	41	7	110	209	117	117	127	106	215	34	330	244
19	61	36	36	148	43	18	4	36	58	19	47	74	37	134	6	118	63
20	14	14	6	49	16	1		8	20		15	12	16	79	1	19	5
21	6	3		13	2				2		1	2	1	20		3	
22	2			2	1							1		6			2
23													1	1			
24	1																
25																	
26																	
27	2																
28																	
Totals	1977	2205	497	1144	355	239	192	750	1111	695	674	964	772	680	215	920	904

Table 3: Annual sample size, proportion positive samples, nominal CPUE, index of abundance, and corresponding coefficients of variation derived from the LDWF fishery-independent marine gillnet survey. Nominal cpue and the index of abundance have been normalized to their individual long-term means for comparison.

Year	n	%Positive	Nominal CPUE	Index	CV
1988	901	21%	0.48	0.97	0.12
1989	939	19%	0.57	0.80	0.12
1990	987	20%	0.68	0.99	0.11
1991	1020	20%	0.81	0.85	0.11
1992	700	21%	0.71	0.84	0.14
1993	663	21%	0.67	0.78	0.13
1994	644	22%	1.35	0.93	0.13
1995	508	27%	1.45	1.44	0.14
1996	520	19%	0.43	0.55	0.16
1997	544	19%	2.51	1.26	0.16
1998	560	23%	0.90	1.00	0.14
1999	560	16%	1.04	1.08	0.17
2000	532	19%	1.15	1.37	0.16
2001	560	16%	1.55	0.65	0.16
2002	560	20%	0.83	0.64	0.15
2003	560	16%	1.12	0.70	0.17
2004	560	21%	0.80	0.85	0.15
2005	536	24%	1.01	2.16	0.15
2006	560	19%	1.25	1.02	0.15
2007	552	21%	0.98	1.14	0.15
2008	560	16%	0.86	1.03	0.16
2009	548	16%	0.74	0.43	0.17
2010	524	19%	1.73	1.48	0.16
2011	528	20%	0.75	1.11	0.16
2012	528	19%	0.60	0.92	0.15

Table 4: Length-at-age samples used for age assignments of commercial striped mullet *Mugil cephalus* landings 1996-2002 (females only).

1996-2002											
TL_in	Age_1	Age_2	Age_3	Age_4	Age_5	Age_6	Age_7	Age_8	Age_9	Age_10	Total
8											
9											
10											
11											
12		4	2	1							7
13		21	27	6	1						55
14		28	65	35	4	1		1			134
15	2	28	43	28	6	4	1				112
16	1	18	29	20	8	2					78
17		7	34	15	6	5	2				69
18		3	23	21	9	2					58
19		1	8	11	7	3	1				31
20				2	4	2		1			9
21			1	1	1		1	1			5
22											
23											
24											
25											
26											
Total	3	110	232	140	46	19	5	3	0	0	558

Table 5: Annual length-at-age samples for age assignments of commercial striped mullet *Mugil cephalus* landings 2003-2012 (females only).

2003											
TL_in	Age_1	Age_2	Age_3	Age_4	Age_5	Age_6	Age_7	Age_8	Age_9	Age_10	Total
8											
9											
10											
11											
12		1	1	1							3
13		13	3	4	3						23
14		9	18	17	6						50
15		6	34	18	4	1					63
16		3	37	38	20	3					101
17		4	17	40	29	6		1			97
18		1	8	20	26	4	8	2			69
19		3	5	6	8	6	3				31
20				2	1	2	1				6
21											
22											
23											
24											
25											
26											
Total	0	40	123	146	97	22	12	3	0	0	443

2004											
TL_in	Age_1	Age_2	Age_3	Age_4	Age_5	Age_6	Age_7	Age_8	Age_9	Age_10	Total
8											
9											
10											
11											
12											
13		1	4								5
14		2	10	4	3	2					21
15		6	28	12	5	3					54
16		5	24	33	13	8					83
17		2	37	58	32	9					138
18			14	47	34	27	1				123
19			2	10	15	9	3				39
20				2	6	4	1				13
21						1					1
22											
23											
24											
25											
26											
Total	0	16	119	166	108	63	5	0	0	0	477

2005											
TL_in	Age_1	Age_2	Age_3	Age_4	Age_5	Age_6	Age_7	Age_8	Age_9	Age_10	Total
8											
9											
10											
11											
12											
13	1	1	1								3
14		18	4	7	4						33
15		53	34	41	12						140
16		14	50	69	30	11	2				176
17		4	35	62	36	8	6				151
18			8	49	37	16	5	1			116
19				2	9	2	4				17
20											
21											
22											
23											
24											
25											
26											
Total	1	90	132	230	128	37	17	1	0	0	636

Table 5 (continued):

2006											
TL_in	Age_1	Age_2	Age_3	Age_4	Age_5	Age_6	Age_7	Age_8	Age_9	Age_10	Total
8											
9											
10											
11											
12											
13		5	3	2	1						11
14	1	2	5	4	4						16
15		22	27	13	20	3	1				86
16		22	39	42	33	8	1				145
17		11	35	31	33	14	2	2			128
18		1	18	44	35	9	3				110
19				13	17	11	3	2			46
20					5	3	5				13
21								1			1
22											
23											
24											
25											
26											
Total	1	63	127	149	148	48	15	5	0	0	556

2007											
TL_in	Age_1	Age_2	Age_3	Age_4	Age_5	Age_6	Age_7	Age_8	Age_9	Age_10	Total
8											
9											
10											
11											
12		2	1	2							5
13	1	6	3		1	1					12
14	1	17	12	6	3	2					41
15	2	51	48	15	13	6					135
16		48	71	55	22	21	1			1	219
17		10	48	48	32	27	6				171
18	1	3	12	31	30	27	6	3			113
19	1	1	1	9	22	21	9				64
20				1	2	3	2	1	1		10
21		1	1								2
22						1					1
23											
24											
25											
26											
Total	6	139	197	167	125	109	24	4	1	1	773

2008											
TL_in	Age_1	Age_2	Age_3	Age_4	Age_5	Age_6	Age_7	Age_8	Age_9	Age_10	Total
8											
9											
10											
11											
12		1	2	1							4
13		4	17	6	1						28
14		4	55	26	2						87
15		9	93	19	6	2					129
16	1	8	84	36	4	4	1				138
17		1	73	43	16	6	2				141
18			33	37	7	10	2	1			90
19			9	7	10	5					31
20			3	3	2	3	1	2			14
21			1								1
22											
23			1								1
24											
25											
26											
Total	1	27	371	178	48	30	6	3	0	0	664

Table 5 (continued):

2009											
TL_in	Age_1	Age_2	Age_3	Age_4	Age_5	Age_6	Age_7	Age_8	Age_9	Age_10	Total
8											
9											
10											
11											
12											
13											
14											
15		1									1
16			3	4							7
17	1	2	25	17	4	1					50
18		1	15	45	4	1	1				67
19			2	25	5	3	1				36
20				9	8	1					18
21				2	1	3	2	1			9
22		1						2			3
23											
24											
25											
26											
Total	1	5	45	102	22	9	4	3	0	0	191

2010											
TL_in	Age_1	Age_2	Age_3	Age_4	Age_5	Age_6	Age_7	Age_8	Age_9	Age_10	Total
8											
9											
10											
11											
12					1						1
13		1	9	11	4	1					26
14		4	18	15	12	1					50
15			3	15	5						23
16		2	11	22	4	2					41
17			5	18	9	1					33
18				12	18	3		1			34
19					6						6
20						1					1
21											
22											
23											
24											
25											
26											
Total	0	7	46	93	59	9	0	1	0	0	215

2011											
TL_in	Age_1	Age_2	Age_3	Age_4	Age_5	Age_6	Age_7	Age_8	Age_9	Age_10	Total
8											
9											
10											
11											
12											
13	1	8	3								12
14		9	8	3	1						21
15		2	5	7	5		1				20
16		1	16	15	30	4	1	1			68
17		1	18	48	103	22	3	1			196
18		1		21	140	91	15	1			269
19			2	4	29	54	9				98
20					6	9	2				17
21				1		1					2
22											
23											
24											
25											
26											
Total	1	22	52	99	314	181	31	3	0	0	703

Table 5 (continued):

2012											
TL_in	Age_1	Age_2	Age_3	Age_4	Age_5	Age_6	Age_7	Age_8	Age_9	Age_10	Total
8											
9											
10											
11											
12											
13		3	1		1	1					6
14	1	15	16	5	1	.	1				39
15		29	47	14	9	5	2				106
16		7	55	37	21	12	6				138
17		3	24	69	60	49	10				215
18			4	23	39	96	31	1	1		195
19				1	6	17	18	2			44
20						1	2				3
21											
22			1								1
23											
24											
25											
26											
Total	1	57	148	149	137	181	70	3	1	0	747

Table 6: Commercial striped mullet *Mugil cephalus* catch-at-age and yield (females only).

	Commercial Catch-at-age (Females only)							
Year	Age_1	Age_2	Age_3	Age_4	Age_5	Age_6	Age_7+	Yield (lbs)
1996	16,068	608,173	1,172,649	669,617	196,688	81,487	29,233	6,846,722
1997	19,187	550,745	1,060,518	623,676	179,779	77,134	24,052	6,281,674
1998	9,095	250,466	699,765	470,127	189,170	81,829	23,091	5,169,024
1999	10,224	296,561	889,062	666,639	325,852	134,143	52,298	7,675,875
2000	9,109	237,135	720,167	533,092	260,253	111,369	38,840	6,153,888
2001	5,967	170,216	496,349	320,708	124,743	58,493	17,254	3,570,500
2002	6,493	163,918	336,000	198,413	60,272	26,983	7,465	2,052,607
2003	1	108,693	388,649	439,051	282,438	60,818	42,524	3,740,196
2004	1	51,504	357,472	465,828	280,957	154,872	10,519	4,005,370
2005	110	52,751	70,508	122,828	69,304	19,679	9,812	982,648
2006	4,217	115,998	223,230	253,902	249,902	77,253	31,696	2,823,283
2007	3,511	74,724	99,571	81,880	62,078	53,656	15,322	1,135,443
2008	623	16,868	233,381	115,363	32,289	20,613	6,319	1,209,670
2009	173	720	8,594	19,728	4,541	1,678	929	134,501
2010	1	3,180	20,510	43,294	27,847	3,950	601	265,275
2011	583	13,472	29,090	51,774	158,677	89,780	17,448	1,193,847
2012	436	27270	68717	75641	73280	100489	41836	1,201,669

Table 7: Mean weight-at-age (pounds) of commercial striped mullet *Mugil cephalus* landings (females only).

	Commercial Mean Weight-at-age (Females only)						
Year	Age_1	Age_2	Age_3	Age_4	Age_5	Age_6	Age_7+
1996	2.46	2.18	2.40	2.58	3.01	3.04	3.31
1997	2.46	2.28	2.43	2.54	2.88	2.90	3.05
1998	2.53	2.66	2.94	3.08	3.32	3.29	3.34
1999	2.56	2.72	3.10	3.31	3.62	3.60	4.10
2000	2.55	2.80	3.10	3.29	3.59	3.57	3.93
2001	2.48	2.67	2.95	3.07	3.28	3.22	3.22
2002	2.49	2.41	2.54	2.61	2.82	2.86	2.84
2003	0.00	2.33	2.60	2.83	3.08	3.44	3.69
2004	0.00	2.46	2.73	3.08	3.25	3.32	4.15
2005	1.67	2.29	2.71	2.91	3.10	3.25	3.46
2006	1.98	2.45	2.72	3.02	3.09	3.42	3.82
2007	2.55	2.43	2.67	2.98	3.21	3.31	3.80
2008	2.70	2.28	2.70	2.92	3.27	3.52	3.79
2009	3.11	3.42	3.25	3.71	4.10	4.34	4.78
2010	0.00	2.14	2.27	2.64	3.00	2.98	3.74
2011	1.67	2.06	2.66	3.07	3.37	3.71	3.64
2012	1.98	2.27	2.62	3.02	3.20	3.43	3.61

Table 8: Probabilities of age given length for age assignments of female striped mullet *Mugil cephalus* catches from the LDWF fishery-independent marine gillnet survey.

TL_in	Age_1	Age_2	Age_3	Age_4	Age_5	Age_6	Age_7+
6	1.00	0.00	0.00	0.00	0.00	0.00	0.00
7	1.00	0.00	0.00	0.00	0.00	0.00	0.00
8	1.00	0.00	0.00	0.00	0.00	0.00	0.00
9	1.00	0.00	0.00	0.00	0.00	0.00	0.00
10	0.00	1.00	0.00	0.00	0.00	0.00	0.00
11	0.00	1.00	0.00	0.00	0.00	0.00	0.00
12	0.00	0.81	0.19	0.00	0.00	0.00	0.00
13	0.00	0.01	0.96	0.03	0.00	0.00	0.00
14	0.00	0.00	0.69	0.30	0.01	0.00	0.00
15	0.00	0.00	0.07	0.74	0.17	0.02	0.00
16	0.00	0.00	0.00	0.31	0.48	0.16	0.05
17	0.00	0.00	0.00	0.02	0.31	0.34	0.33
18	0.00	0.00	0.00	0.00	0.05	0.20	0.76
19	0.00	0.00	0.00	0.00	0.00	0.04	0.96
20	0.00	0.00	0.00	0.00	0.00	0.00	1.00
21	0.00	0.00	0.00	0.00	0.00	0.00	1.00
22	0.00	0.00	0.00	0.00	0.00	0.00	1.00

Table 9: Annual female striped mullet *Mugil cephalus* catch-at-size derived from the LDWF fishery-independent marine gillnet survey.

TL_in	1996	1997	1998	1999	2000	2001	2001	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
5		1															
6													1				
7	2	2	6	8	2	63	16	20	3	5	8	8	19	7	9	24	6
8	25	32	43	94	26	124	87	83	31	52	118	98	62	30	103	87	49
9	16	23	43	47	27	37	37	47	23	38	46	56	22	21	75	24	23
10	24	90	88	42	97	110	46	95	64	103	103	82	57	66	204	35	40
11	16	178	43	38	58	85	23	65	42	62	84	50	36	56	91	25	42
12	21	296	54	56	64	60	26	25	58	92	49	52	51	34	96	35	42
13	23	155	54	30	54	15	35	22	36	61	30	30	30	14	28	29	13
14	13	73	37	15	45	9	36	14	25	41	25	19	12	11	9	14	4
15	9	37	14	6	37	9	22	7	18	20	15	15	3	2	8	9	3
16	5	30	19	4	23	3	8	2	24	3		4	1	1	3	7	1
17	1	20	19	1	3	1			13	2	1		1			2	
18	1	3	2		1		3		4	2	1	1		1			
19		1	1	1	1				1								
20	1			1													
21																	1
22																	
Totals	156	941	423	343	438	516	339	379	341	479	480	415	294	241	627	291	225

Table 10: Annual female striped mullet survey age composition and sample sizes derived from the LDWF fishery-independent marine gillnet survey.

Year	Age_1	Age_2	Age_3	Age_4	Age_5	Age_6	Age_7+	n
1996	0.27	0.37	0.23	0.08	0.03	0.01	0.01	156
1997	0.06	0.54	0.28	0.07	0.03	0.01	0.01	941
1998	0.22	0.41	0.21	0.07	0.04	0.02	0.02	423
1999	0.44	0.36	0.15	0.03	0.01	0.00	0.01	343
2000	0.13	0.47	0.22	0.11	0.04	0.01	0.01	438
2001	0.44	0.47	0.06	0.02	0.01	0.00	0.00	516
2002	0.41	0.27	0.19	0.09	0.02	0.01	0.01	339
2003	0.40	0.47	0.10	0.03	0.01	0.00	0.00	379
2004	0.17	0.45	0.19	0.09	0.06	0.03	0.03	341
2005	0.20	0.50	0.22	0.06	0.01	0.00	0.00	479
2006	0.36	0.47	0.12	0.04	0.01	0.00	0.00	480
2007	0.39	0.42	0.13	0.05	0.01	0.00	0.00	415
2008	0.35	0.45	0.16	0.02	0.00	0.00	0.00	294
2009	0.24	0.62	0.12	0.02	0.00	0.00	0.00	241
2010	0.30	0.59	0.08	0.02	0.00	0.00	0.00	627
2011	0.46	0.30	0.16	0.05	0.02	0.01	0.00	291
2012	0.35	0.52	0.11	0.02	0.00	0.00	0.00	225

Table 11: Summary of objective function components and negative log-likelihood values of the ASAP base model.

Objective function =1248			
Component	*Lambda*	*ESS*	*Obj_fun*
Catch_Fleet_Total	*1*		*-50.6*
Index_Fit_Total	*1*		*23.9*
Catch_Age_Comps		*675*	*1053.0*
Index_Age_Comps		*170*	*231.9*
Recruit_devs	*1*		*-10.3*

Table 12: Annual female striped mullet abundance-at-age and stock size estimates from the ASAP base model.

Year	*Age_1*	*Age_2*	*Age_3*	*Age_4*	*Age_5*	*Age_6*	*Age_7+*	*Totals*
1996	*7,032,810*	*4,328,780*	*3,194,050*	*1,421,920*	*434,051*	*153,398*	*56,354*	*16,621,363*
1997	*7,195,260*	*4,274,710*	*2,675,620*	*1,282,560*	*388,668*	*113,956*	*56,039*	*15,986,813*
1998	*5,492,870*	*4,372,400*	*2,634,870*	*1,055,790*	*340,178*	*98,833*	*44,008*	*14,038,949*
1999	*6,261,940*	*3,346,200*	*2,773,680*	*1,245,530*	*382,348*	*120,377*	*51,534*	*14,181,609*
2000	*5,080,310*	*3,805,360*	*2,063,320*	*1,097,040*	*331,684*	*97,641*	*44,682*	*12,520,037*
2001	*4,323,310*	*3,088,420*	*2,356,360*	*837,992*	*305,801*	*88,911*	*38,844*	*11,039,638*
2002	*5,091,450*	*2,636,530*	*1,983,590*	*1,204,000*	*347,047*	*124,769*	*53,179*	*11,440,565*
2003	*3,576,940*	*3,111,050*	*1,732,110*	*1,168,410*	*637,184*	*183,676*	*96,204*	*10,505,574*
2004	*4,931,800*	*2,181,700*	*2,001,710*	*895,080*	*493,391*	*265,398*	*118,990*	*10,888,069*
2005	*4,918,790*	*3,006,690*	*1,396,240*	*1,000,120*	*356,636*	*193,218*	*153,551*	*11,025,245*
2006	*8,565,050*	*3,009,830*	*2,008,100*	*912,112*	*632,684*	*228,097*	*227,094*	*15,582,967*
2007	*7,501,410*	*5,231,900*	*1,970,180*	*1,156,130*	*464,065*	*321,142*	*236,433*	*16,881,260*
2008	*3,838,720*	*4,591,100*	*3,502,660*	*1,306,600*	*750,640*	*305,109*	*375,343*	*14,670,172*
2009	*3,887,520*	*2,349,940*	*3,081,510*	*2,360,460*	*872,115*	*508,216*	*472,367*	*13,532,128*
2010	*6,486,280*	*2,381,470*	*1,590,080*	*2,185,010*	*1,719,980*	*648,055*	*746,948*	*15,757,823*
2011	*5,652,580*	*3,973,140*	*1,609,960*	*1,121,070*	*1,576,550*	*1,264,820*	*1,052,100*	*16,250,220*
2012	*3,852,220*	*3,461,100*	*2,673,690*	*1,102,850*	*769,689*	*1,099,830*	*1,655,910*	*14,615,289*

Table 13: Annual female striped mullet age-specific, apical, and average fishing mortality rates estimated from the ASAP base model.

Year	*Age_1*	*Age_2*	*Age_3*	*Age_4*	*Age_5*	*Age_6*	*Age_7+*	*Fmult*	*Avg. F*
1996	*0.01*	*0.09*	*0.57*	*0.99*	*1.05*	*1.05*	*1.05*	*1.05*	*0.26*
1997	*0.01*	*0.09*	*0.59*	*1.02*	*1.08*	*1.08*	*1.08*	*1.08*	*0.25*
1998	*0.01*	*0.07*	*0.41*	*0.71*	*0.75*	*0.75*	*0.75*	*0.75*	*0.18*
1999	*0.01*	*0.09*	*0.59*	*1.01*	*1.08*	*1.08*	*1.08*	*1.08*	*0.27*
2000	*0.01*	*0.09*	*0.56*	*0.97*	*1.03*	*1.03*	*1.03*	*1.03*	*0.25*
2001	*0.00*	*0.05*	*0.33*	*0.57*	*0.61*	*0.61*	*0.61*	*0.61*	*0.15*
2002	*0.00*	*0.03*	*0.19*	*0.33*	*0.35*	*0.35*	*0.35*	*0.35*	*0.09*
2003	*0.00*	*0.05*	*0.32*	*0.55*	*0.59*	*0.59*	*0.59*	*0.59*	*0.18*
2004	*0.00*	*0.06*	*0.35*	*0.61*	*0.65*	*0.65*	*0.65*	*0.65*	*0.18*
2005	*0.00*	*0.01*	*0.09*	*0.15*	*0.16*	*0.16*	*0.16*	*0.16*	*0.04*
2006	*0.00*	*0.03*	*0.21*	*0.37*	*0.39*	*0.39*	*0.39*	*0.39*	*0.08*
2007	*0.00*	*0.01*	*0.07*	*0.12*	*0.13*	*0.13*	*0.13*	*0.13*	*0.03*
2008	*0.00*	*0.01*	*0.05*	*0.09*	*0.10*	*0.10*	*0.10*	*0.10*	*0.03*
2009	*0.00*	*0.00*	*0.00*	*0.01*	*0.01*	*0.01*	*0.01*	*0.01*	*0.00*
2010	*0.00*	*0.00*	*0.01*	*0.02*	*0.02*	*0.02*	*0.02*	*0.02*	*0.01*
2011	*0.00*	*0.01*	*0.04*	*0.07*	*0.07*	*0.07*	*0.07*	*0.07*	*0.03*
2012	*0.00*	*0.01*	*0.04*	*0.07*	*0.07*	*0.07*	*0.07*	*0.07*	*0.03*

Table 14: Limit reference point estimates for the Louisiana striped mullet *Mugil cephalus* stock. Spawning stock units are eggs x 10^{12}. Fishing mortality units are year^{-1}.

Reference Points		
Parameter	*Derivation*	*Value/Estimate*
SPR_{limit}	*RS 56:333*	*30%*
$F_{30\%}$	*Equation 38 And* SPR_{limit}	*0.15*
$SS_{30\%}$	*Equation 38 And* SPR_{limit}	*2.21*

Table 15: Sensitivity analysis table. Current estimates are taken from the terminal year of the assessment (2012). Yield units are pounds ($x10^3$), fishing mortality units are $years^{-1}$, and spawning stock units are eggs x 10^{12}.

Model run	negLL	$Yield_{30\%}$	$F_{30\%}$	$SS_{30\%}$	$F_{current}/F_{30\%}$	$SS_{current}/SS_{30\%}$
Base Model	1248	3887.75	0.15	2.21	0.20	2.48
h=.9	1282	3894.35	0.15	2.21	0.16	2.70
h=.8	No convergence					
h=.7	1248	3887.55	0.15	2.21	0.20	2.47
Yield lambda (x4)	1096	3888.01	0.15	2.21	0.20	2.50
Survey lambda (x4)	1250	3896.00	0.15	2.21	0.17	2.95

11. Figures

Figure 1: Reported commercial striped mullet *Mugil cephalus* landings (pounds x 10^3) of the Gulf of Mexico derived from NMFS statistical records and the LDWF trip ticket program.

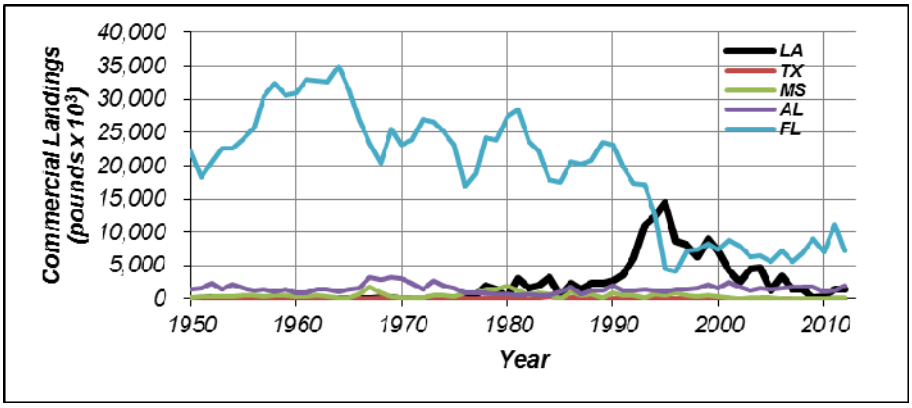


Figure 2: Estimated recreational striped mullet *Mugil cephalus* landings (pounds x 10^3) of the Gulf of Mexico derived from MRFSS/MRIP. Note: Texas does not participate in the MRFSS/MRIP survey.

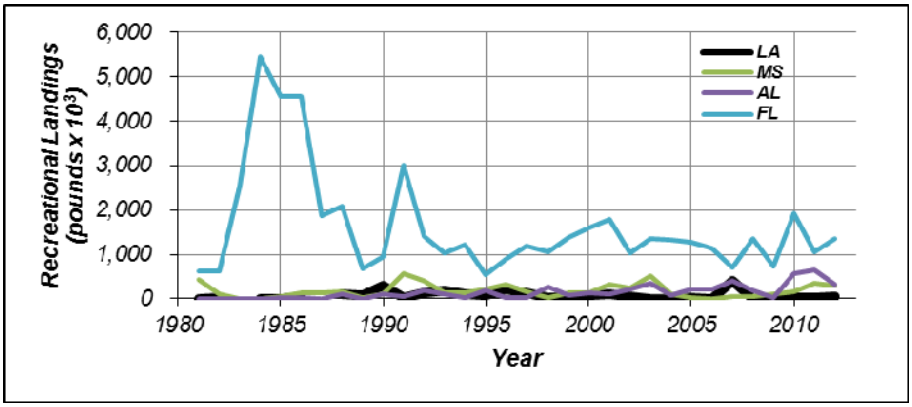


Figure 3: Standardized index of abundance, nominal catch-per-unit-effort, and 95% confidence intervals of the standardized index derived from the LDWF marine gillnet survey. Each time-series has been normalized to its individual long-term mean for comparison.

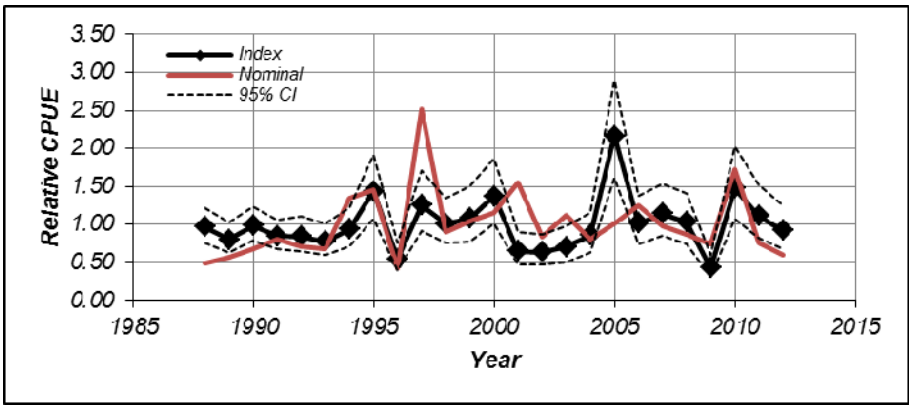


Figure 4: Observed and ASAP base model estimated commercial yield (females only; top) and standardized residuals (bottom).

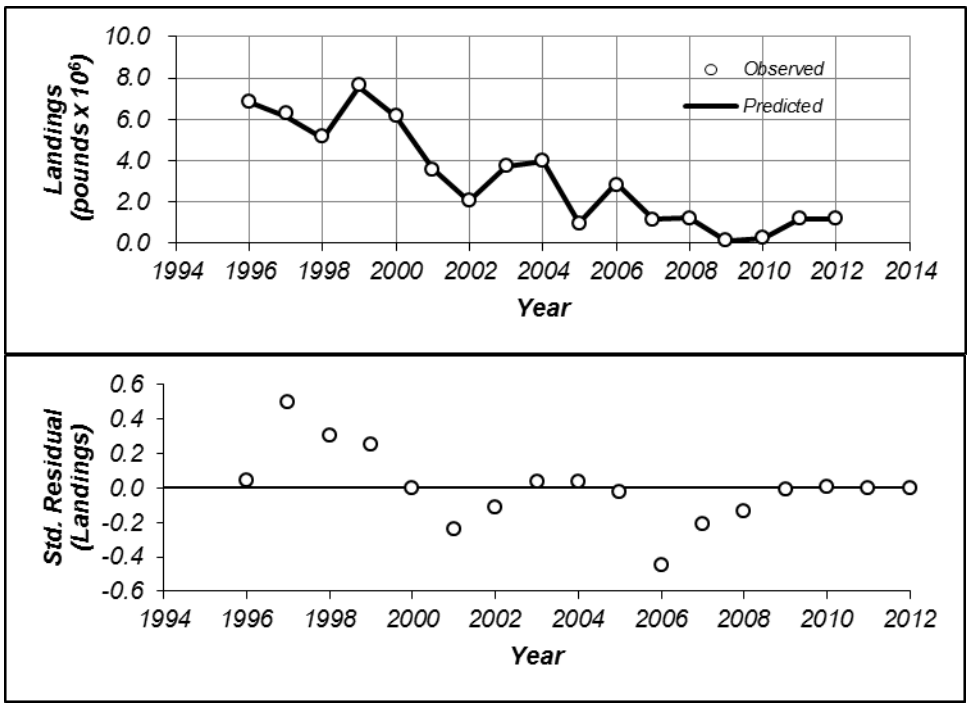


Figure 5: Observed and ASAP base model estimated fishery-independent CPUE (females only, top) and standardized residuals (bottom).

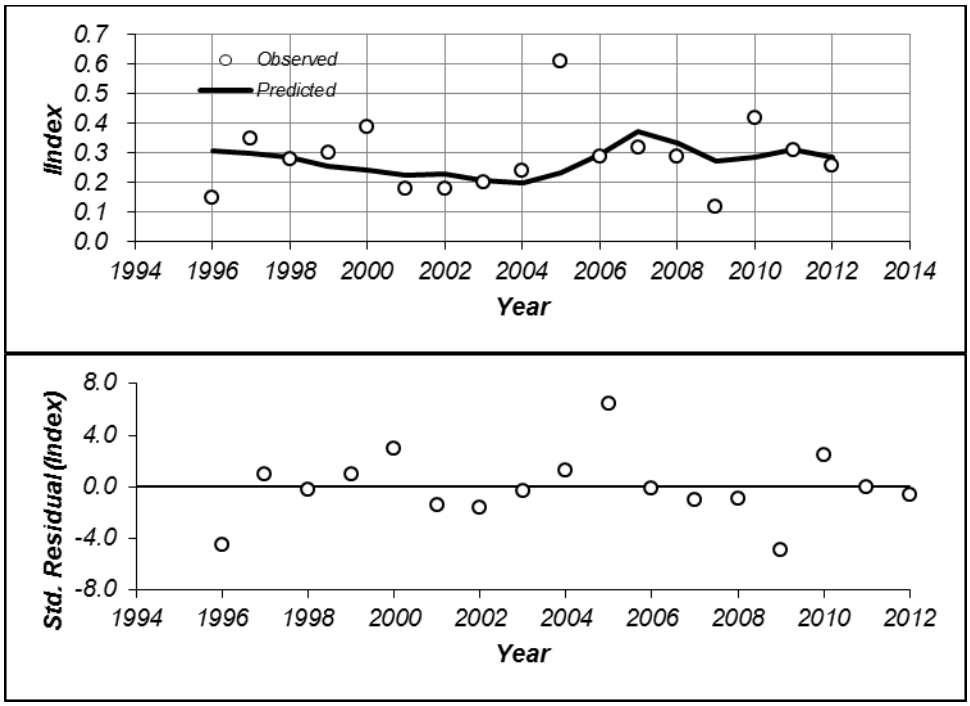

0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
Observed
Predicted
lIndex
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
Year
8.0
4.0
0.0
-4.0
-8.0
Std. Residual(lIndex)
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
Year

Figure 6: Annual input (open circles) and ASAP estimated (bold lines) commercial harvest age compositions.

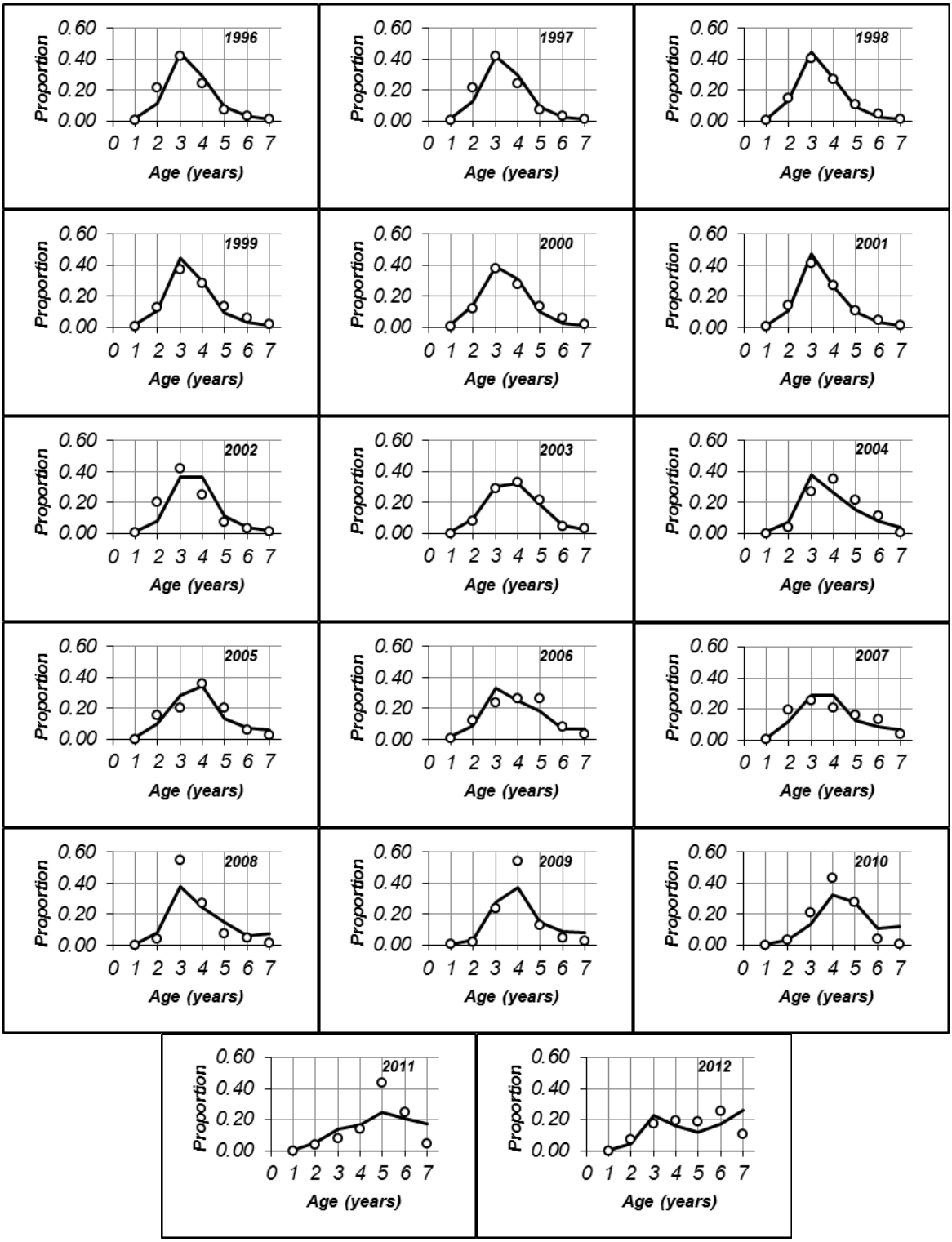


Figure 7: Annual input (open circles) and ASAP estimated (bold lines) survey age compositions.

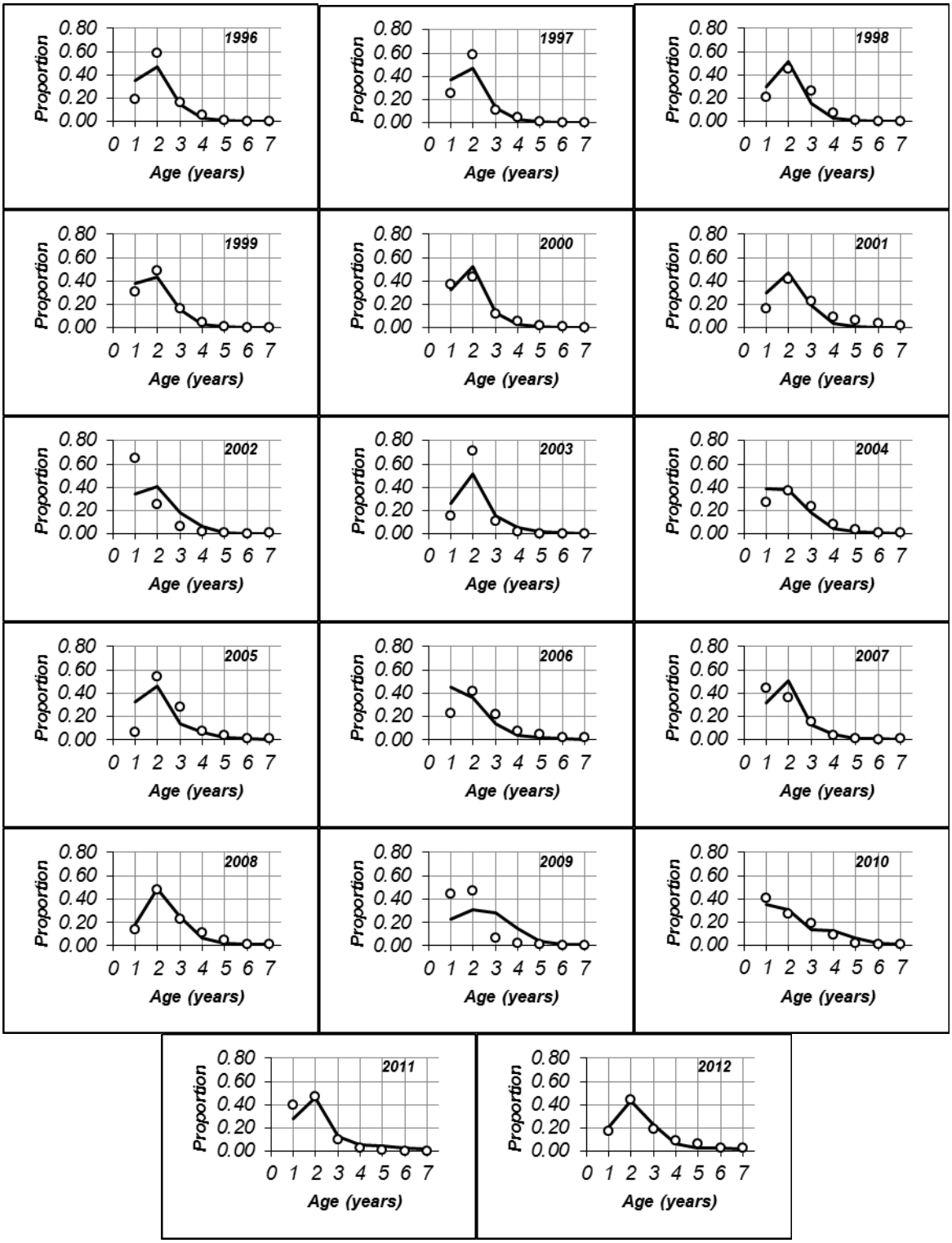


Figure 8: ASAP base model estimated fleet and survey selectivities (females only; ages 1-7+).

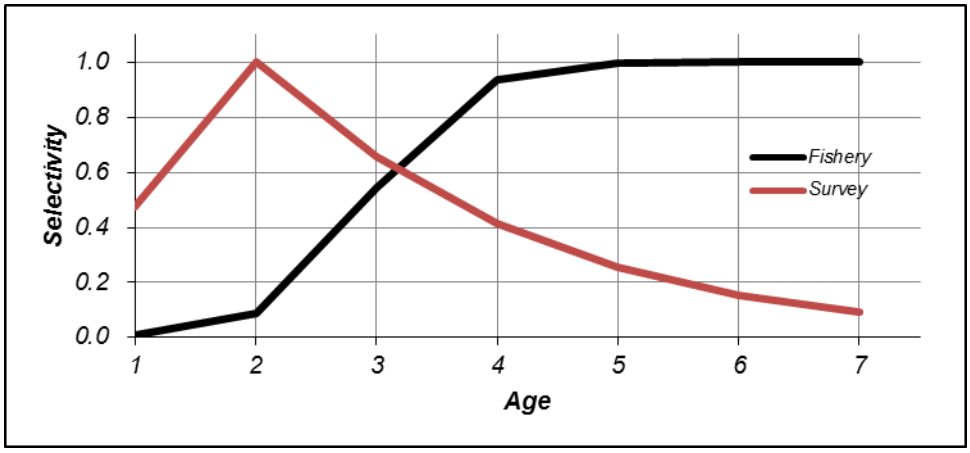


Figure 9: ASAP base model estimated recruitment (age-1 females). Dashed lines represent ± 1 asymptotic standard errors.

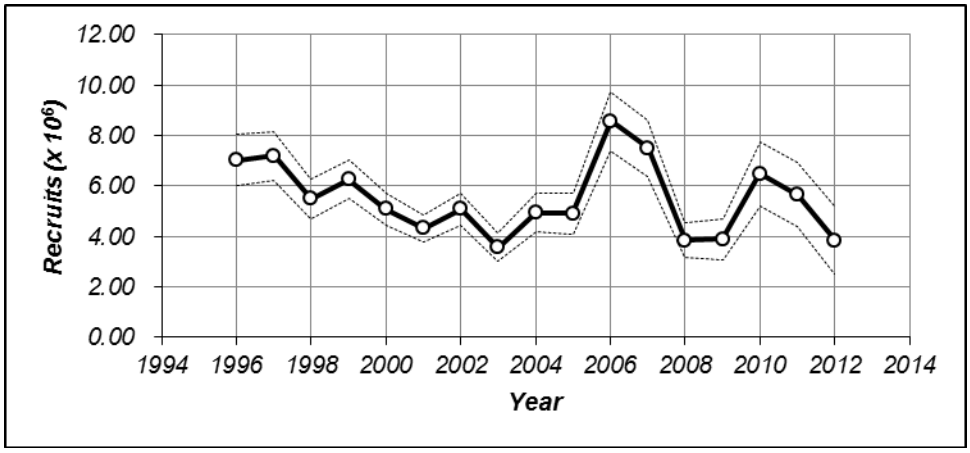


Figure 10: ASAP base model estimated egg production (MCMC median). Dashed lines represent 95% MCMC derived confidence intervals.

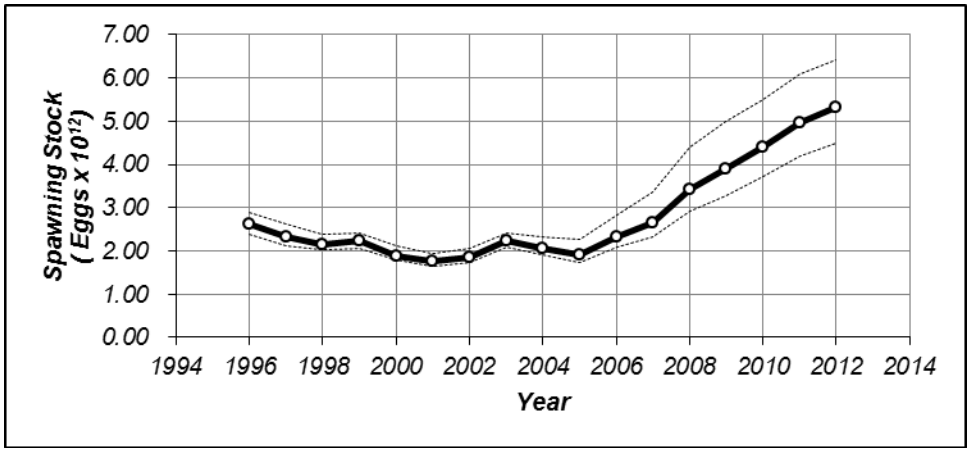


Figure 11: ASAP base model estimated average fishing mortality (MCMC median). Dashed lines represent 95% MCMC derived confidence intervals.

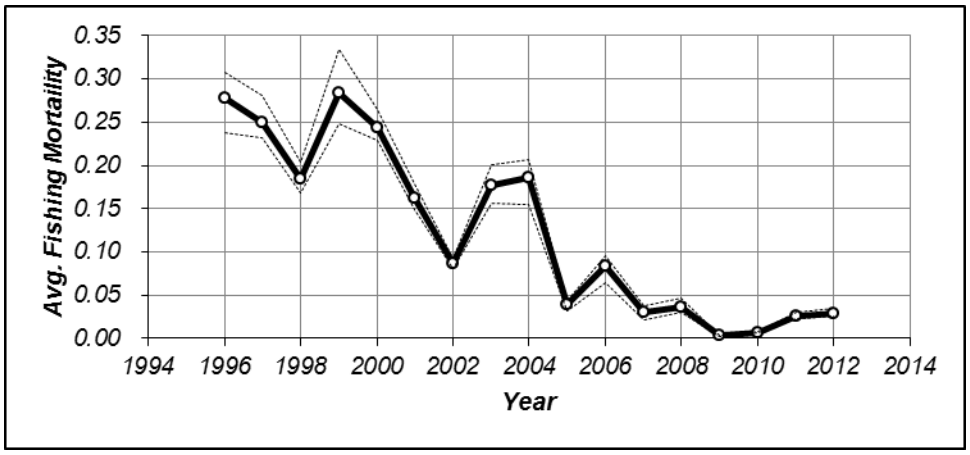


Figure 12: ASAP base model estimated age-1 recruits and spawning stock (total egg production). Arrows represent direction of the time-series. The yellow circle represents the most current data pair.

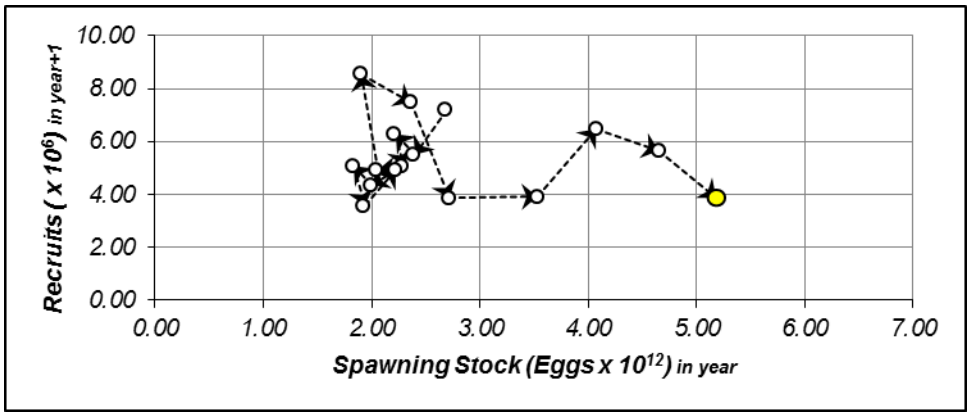


Figure 13: ASAP base model estimated age-1 recruits and spawning stock (open circles). Equilibrium recruitment is represented by the bold horizontal. Current egg production (2012) is represented by the yellow triangle. Equilibrium recruitment per spawning stock corresponding with the minimum and maximum spawning stock estimates are represented by the slopes of the dashed diagonals (min. spawning stock=25%SPR; max. spawning stock=75%SPR).

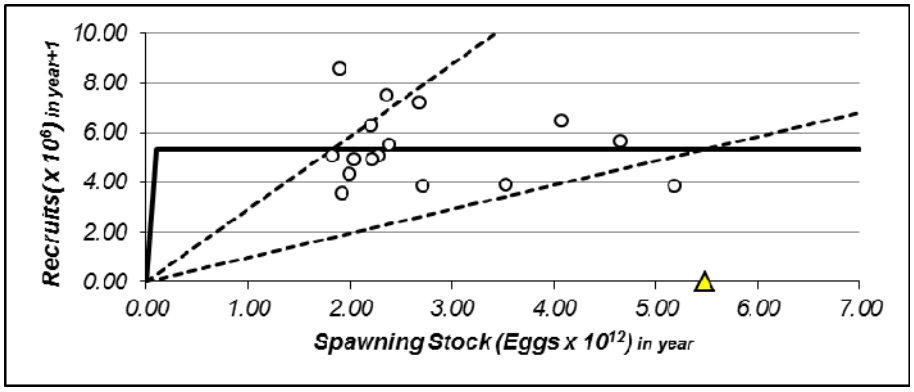


Figure 14: Time-series of ASAP base model estimated average fishing mortality rates, spawning stock sizes, and commercial yield (females only) relative to 30% spawning potential ratio reference points ($F_{30\%}$, $SS_{30\%}$, and $Y_{30\%}$).

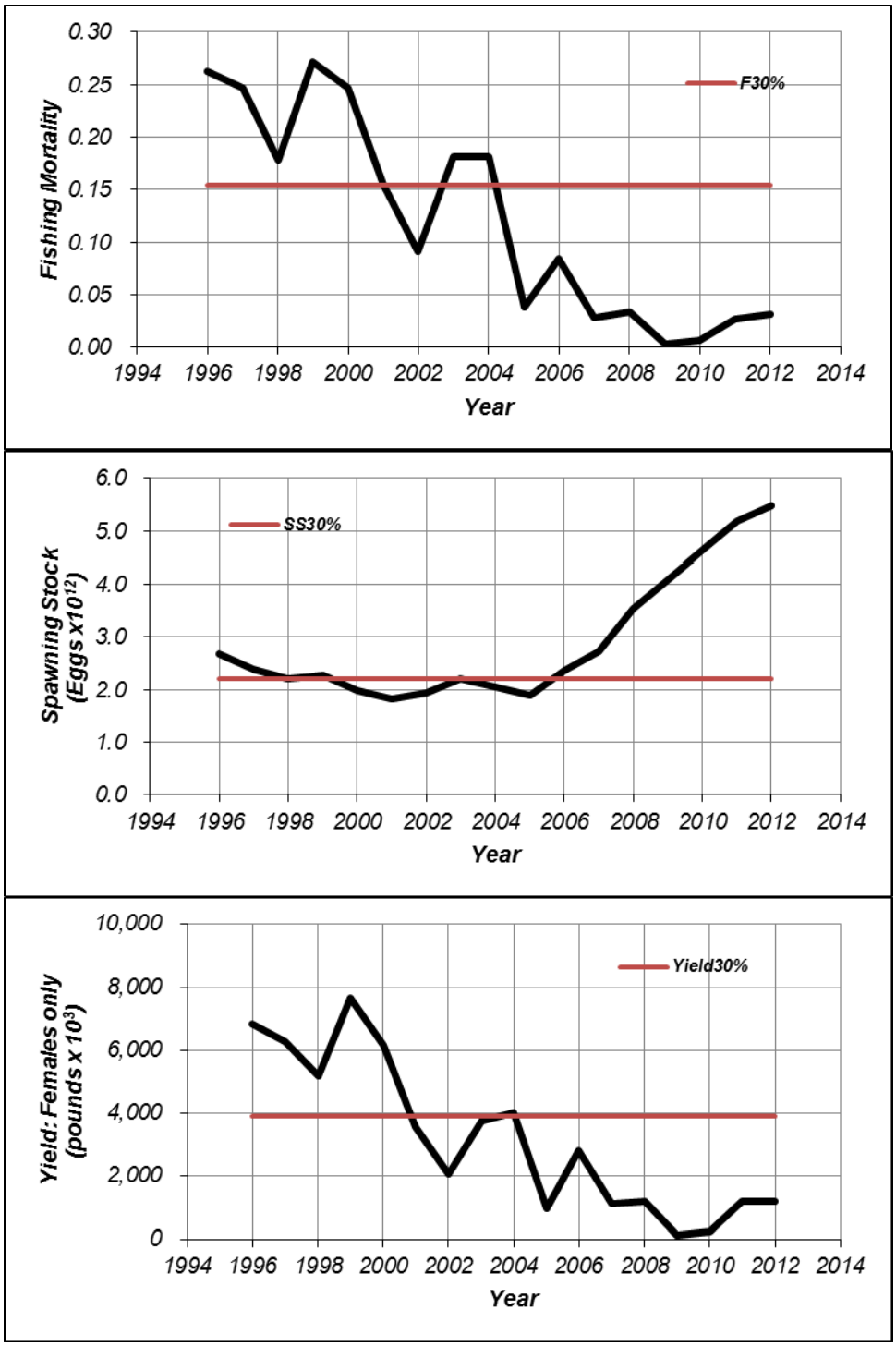

Fishing Mortality
0.30
0.25
0.20
0.15
0.10
0.05
0.00
F30%
1994 1996 1998 2000 2002 2004 2006 2008 2010 2012 2014
Year
Spawning Stock (Eggs x10^12)
6.0
5.0
4.0
3.0
2.0
1.0
0.0
SS30%
1994 1996 1998 2000 2002 2004 2006 2008 2010 2012 2014
Year
Yield: Females only (pounds x 10^3)
10,000
8,000
6,000
4,000
2,000
0
Yield30%
1994 1996 1998 2000 2002 2004 2006 2008 2010 2012 2014
Year

Figure 15: Retrospective analysis of ASAP base model. Top graphics depict estimated ratios of annual average fishing mortality to $F_{30\%}$ and spawning stock (egg production) to $SS_{30\%}$. Bottom graphic depicts estimated age-1 recruits.

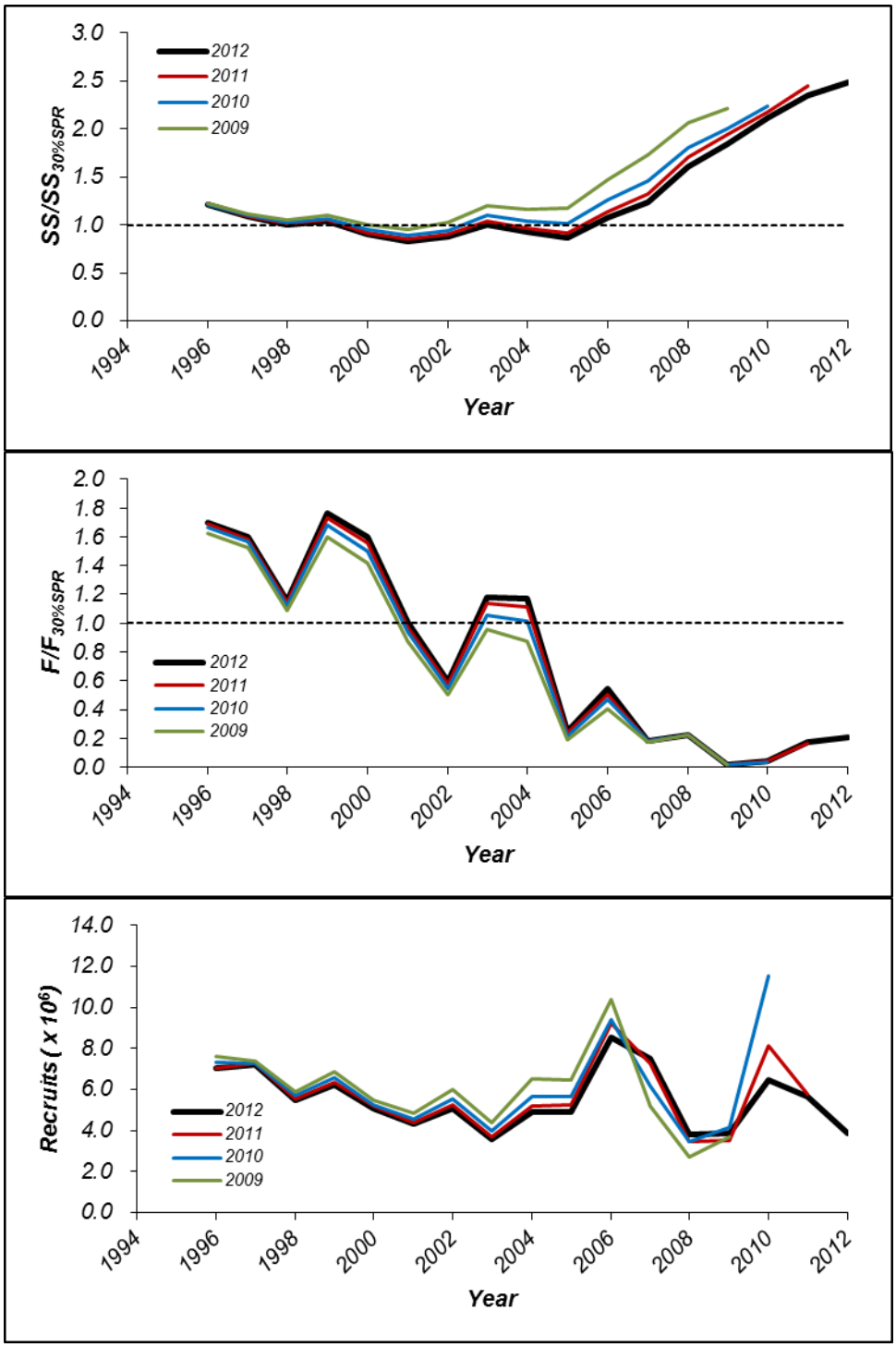


Figure 16: ASAP base model run vs. VPA model run (Blanchet 2013). Top graphic depicts estimated age-1 recruits. Bottom graphics depict annual spawning stock size and average fishing mortality. Fishing mortality is averaged by weighting by the estimated population numbers at age from each model.

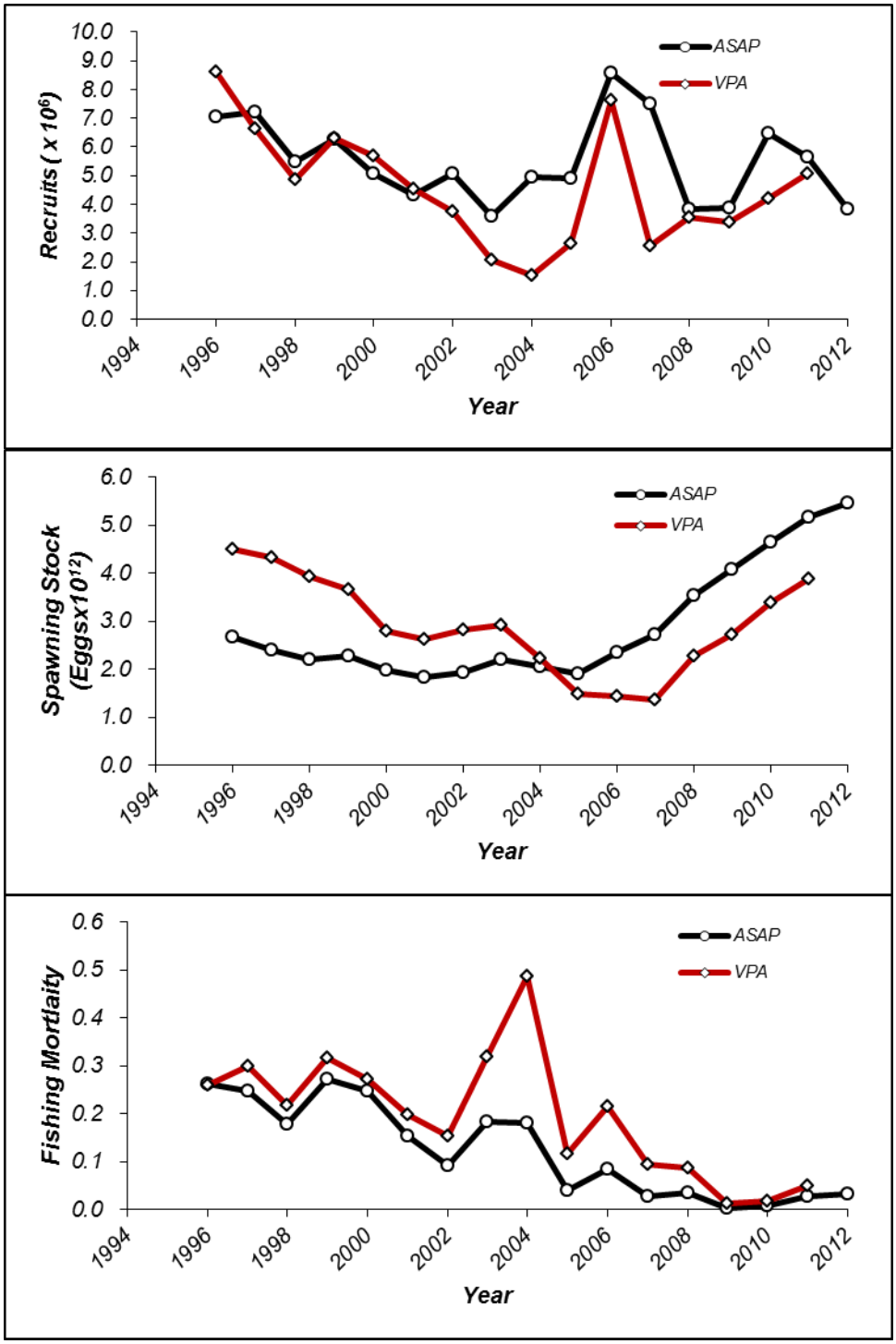


Figure 17: ASAP base model estimated vs VPA model estimated (Blanchet 2013) fishery selectivity's. The VPA estimates are derived from the 2008-2010 F at age estimates.

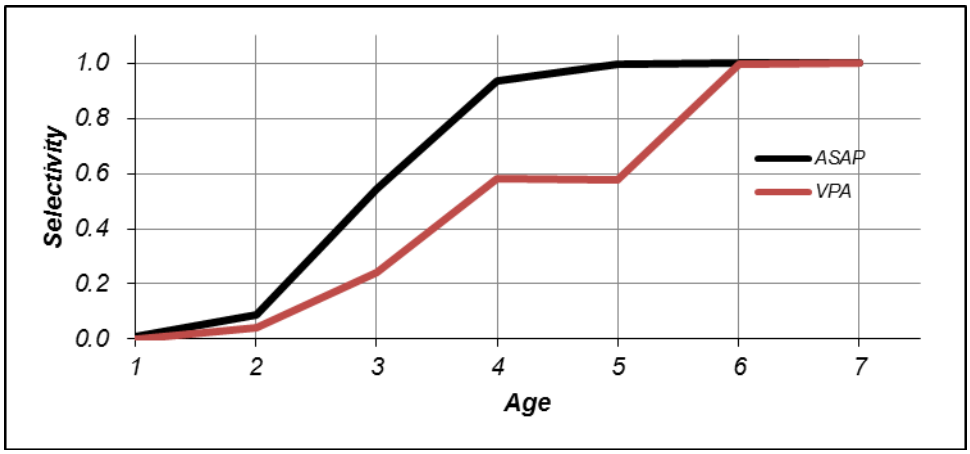
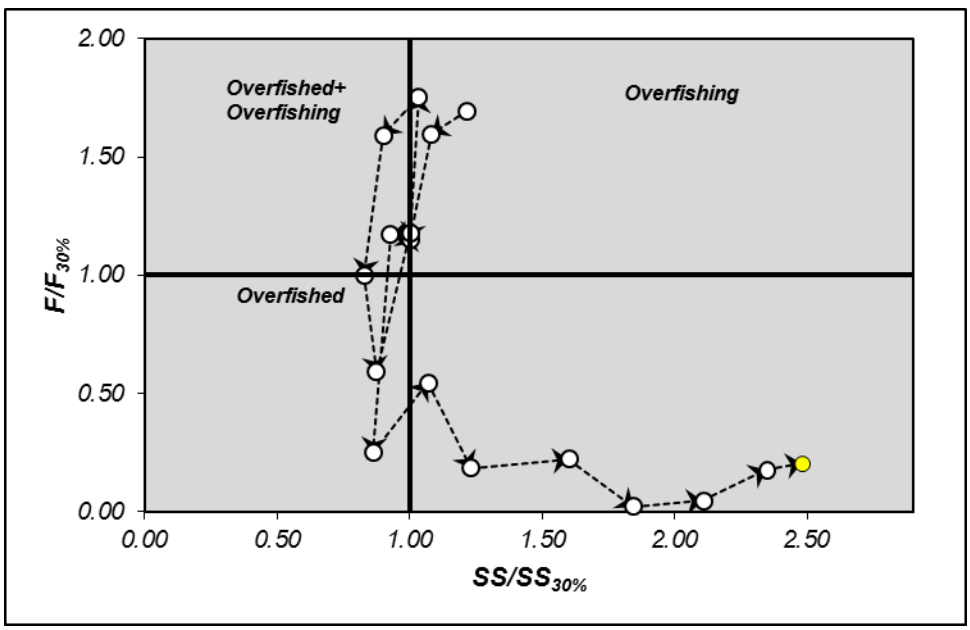


Figure 18: ASAP base model estimated ratios of annual average fishing mortality to $F_{30\%}$ and spawning stock size to $SS_{30\%}$. Arrows and dashed line represent direction of time-series. The yellow circle represents current status (2012).



Chairman Broussard announced the next item**, To Set the June 2014 Meeting Date**
A discussion took place and the meeting is set for June 5, 2014. A motion for approval was made by Commissioner Manuel and seconded by Commissioner Davis. Chairman Broussard called for a vote and the motion passed with no opposition.

Chairman Broussard announced the next item, **To Hear Public Comments,**

First Speaker, John Martone, East Feliciana Parish
Mr. Martone stated he would like for the Commission to consider putting East Feliciana back in Area One and remove from Area Four
Chairman Broussard asked Tommy Tuma to explain: Mr. Tuma stated that deer are managed on Habitat and breeding dates. Doe days are placed on weekends due to concerns over habitat. This was scaled back for a couple of years, but it was not a permanent rule.
Mr. Tuma also stated that WLF was holding several community meetings.
Tommy stated he would meet with Mr. Martone after today's meeting to discuss further.

Second Speaker, Larry Robicheaux stated that people are not following the rules and regulations
Mr. Robicheaux would like the Commission to consider taking small game possession limits to three (3) days.
Colonel Mayne stated that a discussion would take place to assist this request.

There being no further business, Chairman Broussard **Adjourned** the meeting

_____
Billy Broussard, Chairman