SEDAR

SouthEast Data, Assessment, and Review

SEDAR 9
Stock Assessment Report 2

Gulf of Mexico
Greater Amberjack

SECTION 2. Data Workshop

Results of the SEDAR 9 Data Workshop
June 20-24 2005
New Orleans, LA

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1. Introduction

1.1 Workshop Time and Place

The SEDAR 9 Data Workshop was held June 20 – 24, 2006, at the Hotel Monteleone in New Orleans, LA.

1.2 Terms of Reference

1. Characterize stock structure and develop a unit stock definition.
2. Tabulate available life history information (e.g., age, growth, natural mortality, reproductive characteristics). Provide models to describe growth, maturation, and fecundity by age, sex, or length as appropriate; recommend life history parameters (or ranges of parameters) for use in population modeling; evaluate the adequacy of life-history information for conducting stock assessments.
3. Provide indices of population abundance. Consider fishery dependent and independent data sources; develop index values for appropriate strata (e.g., age, size, area, and fishery); provide measures of precision; conduct analyses evaluating the degree to which available indices adequately represent fishery and population conditions. Document all programs used to develop indices, addressing program objectives, methods, coverage, sampling intensity, and other relevant characteristics.
4. Characterize commercial and recreational catches, including both landings and discard removals, in weight and numbers. Evaluate the adequacy of available data for accurately characterizing harvest and discard by species and fishery sector. Provide length and age distributions if feasible.
5. Evaluate the adequacy of available data for estimating the impacts of current management actions.
6. Recommend assessment methods and models that are appropriate given the quality and scope of the data sets reviewed and management requirements.
7. Provide recommendations for future research in areas such as sampling, fishery monitoring, and stock assessment. Include specific guidance on sampling intensity and coverage where possible.
8. Prepare complete documentation of workshop actions and decisions (Section II. of the SEDAR assessment report).

1.3 Participants

Workshop Participants:

Robert Allman..NMFS/SEFSC Panama City, FL
Luiz Barbieri ....FWC St. Petersburg, FL
Craig Brown..NMFS/SEFSC Miami, FL
Shannon Calay ....NMFS/SEFSC Miami, FL
Alan Collins ....NMFS/SEFSC Panama City, FL
Marianne Cufone ....Environment Matters
Guy Davenport..NMFS/SEFSC Miami, FL
Guillermo Diaz..NMFS/SEFSC Miami, FL
Bob Dixon..NMFS/SEFSC Beaufort, NC
Dave Donaldson..GSFMC
Chris Dorsett ....Nature Conservancy
Chris Gledhill..NMFS/SEFSC Pensacola FL
Terry Henwood ....NMFS/SEFSC, Pascagoula MS
David Hamisko ....NOAA Fisheries Pensacola, FL
Walter Ingram ....NMFS/SEFSC Pascagoula MS
Joanne Lyczkowski-Shultz ....NMFS.SEFSC Pascagoula, MS
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Debra Murie ....University of Florida
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Dennis O'Hearn ....GMFMC Advisory Panel
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Steven Saul..RSMAS/University of Miami
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Tom Turke ....GMFMC Advisory Panel
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1.4 Document List

Document #	Title	Authors
Documents Prepared for the SEDR 9 Data Workshop		
SEDAR9-DW1	History of vermillion snapper, greater amberjack, and gray triggerfish management in Federal waters of the US Gulf of Mexico, 1984-2005	Hood, P
SEDAR9-DW2	Vermillion Snapper Otolith Aging: 2001-2004 Data Summary	Allman, R J., J. A. Tunnell. B. K. Barnett
SEDAR9-DW3	Reproduction of vermillion snapper from the Northern and Eastern Gulf of Mexico, 1991-2002.	Collins, L. A., R. J. Allman, and H. M Lyon
SEDAR9-DW4	Standardized catch rate indices for vermilion snapper landed by the US recreational fishery in the Gulf of Mexico, 1986-2004	Cass-Calay, S. L.
SEDAR9-DW5	Standardized catch rate indices for vermilion snapper landed by the US commercial handline fishery in the Gulf of Mexico, 1990-2004	Kevin J. McCarthy and Shannon L. Cass-Calay
SEDAR9-DW6	Standardized catch rates of vermilion snapper from the US headboat fishery in the Gulf of Mexico, 1986-2004	Craig A. Brown
SEDAR9-DW7	Estimated Gulf of Mexico greater amberjack recreational landings (MRFSS, Headboat, TXPW) for 1981-2004	Guillermo Diaz
SEDAR9-DW8	Size frequency distribution of greater amberjack from dockside sampling of recreational landings in the Gulf of Mexico 1986-2003	Guillermo Diaz
SEDAR9-DW9	Size frequency distribution of greater amberjack from dockside sampling of commercial landings in the Gulf of Mexico 1986-2003	Guillermo Diaz
SEDAR9-DW10	Standardized catch rates of gulf of Mexico greater amberjack for the commercial longline and handline fishery 1990-2004	Guillermo Diaz
SEDAR9-DW11	Length Frequency Analysis and Calculated Catch at Age Estimations for Commercially Landed Gray Triggerfish (*Balistes capriscus*) From the Gulf of Mexico	Steven Saul
SEDAR9-DW12	Estimated Gray Triggerfish (*Balistes capriscus*) Landings From the Gulf of Mexico Headboat Fishery	Steven Saul
SEDAR9-DW13	Estimated Gray Triggerfish (*Balistes capriscus*) Commercial Landings and Price Information for the Gulf of Mexico Fishery	Steven Saul
SEDAR9-DW14	Estimated Gray Triggerfish (*Balistes capriscus*) Recreational Landings for the State of Texas	Steven Saul
SEDAR9-DW15	Estimated Gray Triggerfish (*Balistes capriscus*) Landings From the Marine Recreational Fishery Statistics Survey (MRFSS) In the Gulf of Mexico	Steven Saul and Patty Phares
SEDAR9-DW16	Length Frequency Analysis for the Gray Triggerfish (*Balistes capriscus*) Recreational Fishery In the Gulf of Mexico	Steven Saul
SEDAR9-DW17	Estimates of Vermilion Snapper, Greater Amberjack, and Gray Triggerfish Discards by Vessels with Federal Permits in the Gulf of Mexico	Kevin J. McCarthy
SEDAR9-DW18	Size Composition Data from the SEAMAP Trawl Surveys	Scott Nichols

SEDAR9-DW19	Species Composition of the various amberjack species in the Gulf of Mexico	Ching-Ping Chih
SEDAR9-DW20	Standardized Catch rates of Gulf of Mexico greater amberjack catch rates for the recreational fishery (MRFSS, Headboat) 1981-2004	Guillermo Diaz
SEDAR9-DW21	SEAMAP Reef Fish Survey of Offshore Banks: Yearly indices of Abundance for Vermilion Snapper, Greater Amberjack, and Gray Triggerfish	Gledhill, et. al.
SEDAR9-DW22	Data Summary of Gray Triggerfish (*Balistes capriscus),*Vermilion Snapper (*Rhomboplites aurorubens)*, and Greater Amberjack (*Seriola dumerili)* Collected During Small Pelagic Trawl Surveys, 1988 – 1996	G. Walter Ingram, Jr.
SEDAR9-DW23	Abundance Indices of Gray Triggerfish and Vermilion Snapper Collected in Summer and Fall SEAMAP Groundfish Surveys (1987 – 2004)	G. Walter Ingram, Jr.
SEDAR9-DW24	Review of the Early Life History of Vermilion Snapper, *Rhomboplites auroubens,* With a Summary of Data from SEAMAP plankton surveys in the Gulf of Mexico: 1982 – 2002	Lyczkowski-Shultz, J. and Hanisko, D.
SEDAR9-DW25	Review of the early life history of gray triggerfish, *Balistes capriscus,* with a summary of data from SEAMAP plankton surveys in the Gulf of Mexico: 1982, 1984 – 2002	Lyczkowski-Shultz, J., Hanisko, D. and Zapfe, G.
SEDAR9-DW26	Shrimp Fleet Bycatch Estimates for the SEDAR9 Species	Scott Nichols
SEDAR9-DW27	SEAMAP Trawl Indexes for the SEDAR9 Species	Scott Nichols
SEDAR9-DW-28	Standardized Abundance Indices for Gulf of Mexico Gray Triggerfish (*Balistes capriscus)* based on catch rates as measured by the Marine Recreational Fisheries Statistics Survey (MRFSS)	Josh Sladek Nowlis
SEDAR9-DW-29	Standardized Abundance Indices for Gulf of Mexico Gray Triggerfish (*Balistes capriscus)* based on catch rates as measured by the NMFS Southeast Zone Headboat Survey	Josh Sladek Nowlis
SEDAR9-DW-30	Standardized Abundance Indices for Gulf of Mexico Gray Triggerfish (*Balistes capriscus)* based on catch rates as measured from commercial logbook entries with handline gear	Josh Sladek Nowlis
SEDAR9-DW-31	Estimated Gulf of Mexico vermillion snapper recreational landings (MRFSS, headboat, TPWD) for 1981-2004	Shannon & Guillermo

2. LIFE HISTORY

2.1 Stock Definition

Two management groups (Atlantic and Gulf of Mexico) are currently used by the SAFMC and GMFMC. The geographic boundary of these management units occurs from approximately the Dry Tortugas through the Florida Keys and to the mainland of Florida.

2.1.1 Genetic Differentiation

Analysis of mtDNA haplotypes in greater amberjack indicated spatial homogeneity across the northern Gulf of Mexico (Florida Middle Grounds to Port Aransas, Texas), suggestive of continuous gene flow within the region (Gold and Richardson 1998). Genetic results indicated there may be a split between western Atlantic (includes Florida Keys) and Gulf populations, albeit evidence for two populations was weak. Assuming heterogeneity exists between western Atlantic and Gulf populations, the hypothesized break probably occurs along the southwest coast of Florida (J. Gold, pers. comm.).

2.1.2 Tagging

Tag and recapture data of greater amberjack indicate that there is little exchange (1.3%) between the Atlantic and Gulf of Mexico (McClellan and Cummings 1997). Recaptures observed by McClellan and Cummings (1997) averaged 1.9 years (maximum: 14 years), and the majority of recaptured greater amberjack were within 25 nm of the release site (48% showed no net movement). Moreover, 72.9% and 92.7% of Atlantic and Gulf fish, respectively, were recaptured within 100 nm of the release site. Burch (1979) reported on nearly two decades of tagging work conducted by the Cooperative Gamefish Tagging Program. Based on 510 recaptures, greater amberjack migrated northward along the Florida east coast from June through November and southward from December to May.

2.1.3 Otolith Chemistry

Otolith chemistry studies are not available for greater amberjack in the Gulf of Mexico.

2.2 Habitat Requirements

Throughout the Gulf of Mexico juvenile greater amberjack are commonly collected in association with pelagic *Sargassum* mats (Bortone et al. 1977). YOY greater amberjack (< 200 mm SL) are most common during May-June in offshore waters of the Gulf (Wells and Rooker 2004a). The sizes of individuals associated with *Sargassum* range from approximately 3-20 mm SL (age range: 40-150 d) (Wells and Rooker 2004b). Individuals larger than 30 mm TL are common in NOAA small pelagic trawl surveys (SEDAR9-DW-22), as well as the headboat fishery (Manooch and Potts 1997a), suggesting a shift in habitat (pelagic to demersal) occurs at 5-6 months of age. After shifting to demersal habitats, sub-adults and adults congregate around reefs, rock outcrops, and wrecks. Since greater amberjack are only seasonally abundant in certain parts of their range, they likely utilize a variety of habitats and/or areas each year.

2.3 Age

2.3.1 Ageing

Greater amberjack are considered to be relatively difficult to age and several authors have expressed concern over age determination from scales, otoliths, and spines. Burch (1979) used scales to age greater amberjack from the Florida Keys and obtained a maximum age of 10 years. Manooch and Potts (1997a) aged greater amberjack from the headboat catch from Texas and northwest Florida/Alabama and aged amberjack up to 15 years using sectioned sagittal otoliths. Manooch and Potts (1997b) have aged greater amberjack from the southeastern U.S. headboats and commercial handline vessels up to 17 years. They reported that 71% of the otoliths were readable, with measurements possible on 48% of the samples. Thompson et al. (1999) were able to age amberjack off Louisiana to 15 years of age using sectioned otoliths and reported reasonable consistency in annulus interpretation between readers; estimates for coefficient of variation and index of precision were 0.15 and 0.11, respectively. Recently, Harris et al. (2004) aged greater amberjack collected from the southeast Atlantic using sectioned otoliths and obtained a maximum age of 13 years. These authors also indicated that 85.4% (1,996 out of 2,335) of otoliths collected in the southeastern Atlantic were readable, with relatively good agreement; 42.4% agreement for amberjack aged 0-13 years and agreement increased to 85.4% for ages differing by one year or less.

2.3.2 Validation

To date, information on the timing of annulus formation in greater amberjack differs slightly among aging studies. In Louisiana, Thompson et al. (1999) were unable to use marginal-increment analysis to determine the timing of annulus formation. Instead, they looked at tagged and recaptured greater amberjack that had been injected with oxytetracycline and their results supported age estimates from otoliths. Moreover, they determined that annuli must have been deposited sometime between November and March in 2- and 3-year old fish. Similarly, Schirripa and Burns (1997) used release-recapture observations to validate age and growth estimates from previous studies. Growth curves for recapture data are similar to findings from Burch (1979) and Beasley (1993), supporting the premise that observed growth increments in scales and otoliths represent annuli. Manooch and Potts (1997a) used marginal-increment analysis and determined that the annulus in greater amberjack collected from headboats throughout the Gulf was laid down between March and May for fish 0-15 years of age, with the majority of the 340 amberjack sampled ≤7 years. Similarly, Manooch and Potts (1997b) aging greater amberjack in the southeastern Atlantic reported annulus deposition primarily in April, with the majority of fish ≤12 years of age. Burch (1979), collecting greater amberjack from South Florida, noted that the marginal-increment was at a minimum between February and April. Overall, it would appear that annuli in either otoliths or scales of greater amberjack in the Gulf of Mexico are deposited once per year primarily during March-May.

2.4 Growth

Age of YOY Gulf greater amberjack associated with *Sargassum* in the Gulf of Mexico were approximately 40-150 days post-hatch (35-210 mm SL), and growth ranged from 1.65-2.00 mm/d (Wells and Rooker 2004a). Inter-annual differences in growth were present and late-season cohorts experienced the most rapid growth. In the most recent stock assessment for sub-adult and adult Gulf of Mexico greater amberjack (Turner et al. 2000, using data up to and including 1998), catch-at-length data were converted to catch-at-age data using the growth curve derived by Thompson et al. (1999). Although this growth curve represents greater amberjack caught in various fisheries and gears, only fish from Louisiana were sampled (Thompson et al. 1999). This growth model was preferred by the NMFS stock assessment analysts compared to an alternate growth model by Manooch and Potts (1997a) because the latter study only sampled fish from headboats in the Gulf of Mexico (Cummings and McClellan 2000). There are no new aging data available for sub-adult and adult greater amberjack in the Gulf since Thompson et al. (1999).

Theoretical von Bertalanffy growth curves for all greater amberjack studies from the southeastern Atlantic and Gulf of Mexico are given in Fig. 1 and Table 1. All von Bertalanffy growth curves shown were fit to back-calculated length at age except for Thompson et al. (1999), which used a 1 April birth date (which also corresponds to annulus deposition) to assign relative ages, and Harris et al. (2004), which used observed ages that are uncorrected for time of annulus deposition (i.e., they report age 0 fish as actually being 9-12 months old).

Greater amberjack may differ in size depending on sex but whether this is related to a difference in growth rates or a difference in maximum size is debatable. Thompson et al. (1999) showed no difference in growth models between males and females; however, maximum size was related to sex. Maximum size of females off Louisiana was 1441 mm FL and females accounted for 72% of fish greater than 1000 mm FL; male maximum size was 1327 mm FL. Although females were more common in Thompson et al.'s study, the sex ratio was variable by time of year and collection source. Burch (1979) reported that females grow larger than males (L_∞ = 159.7 versus 146.3 cm, respectively) using scales. Harris et al. (2004) also observed that females were larger at ages 3-9 and 11 compared to males in the southeastern U.S.

2.5 Conversion Factors

The updated TIP data and data from GulfFin can be used to estimate various conversions between different body measures of greater amberjack. Various estimated conversion are shown in the Figures 2-5 and with the associated equations describing the trends in the data given in Table 2.

2.6 Reproduction

2.6.1 Spawning

In the NW Gulf, hatch-dates of greater amberjack are protracted (Jan to May), and the majority of individuals associated with pelagic *Sargassum* were derived from spawning events in March and April (Wells and Rooker 2004b). Beasley (1993) estimated that spawning for greater amberjack in the northern Gulf of Mexico (off Louisiana) peaked in April to June, based on an increasing gonadosomatic index until June. This is similar to Burch's (1979) earlier study in South Florida, which also indicated that the maximum gonad development occurred in the spring months. Thompson et al. (1991) indicated that peak spawning of greater amberjack off Louisiana occurred in May and June, while more recent work by Harris et al. (2004) in the Florida Keys reported that the spawning season was from mid-March to mid-May. Some greater amberjack off the west coast of Florida (St. Petersburg area) may spawn as late as November (unpublished data, n=11; Alan Collins, NMFS Panama City, FL).

2.6.2 Sexual Maturity

Age and size at sexual maturity for greater amberjack in the Gulf of Mexico is not known well. Cummings and McClellan (2000) noted that maturation information reported by Burch

(1979) may not be applicable to greater amberjack in the Gulf, and suggested that maturation may have changed in the intervening decades (Burch sampled from 1977-78). Thompson et al. (1991) and unpublished data received from Thompson (pers. comm., previous stock assessment) provides the most current data available for greater amberjack in the Gulf of Mexico. Based on histological sections, Thompson estimated that female greater amberjack were all mature by age 4, 50% were mature by age 3, and 0% were mature at age 2; however, Thompson's study was not definitive because a large number of ovaries were not staged. Sexual maturity for greater amberjack in the southeastern U.S. has recently been estimated in detail by Harris et al. (2004) and it is recommended that their analysis be considered following correction of the age estimates from observed ages to ages at annulus formation.

2.6.3 Fecundity

Fecundity-at-size or fecundity-at-age data are currently lacking for greater amberjack in the Gulf of Mexico and weight at age has been used a proxy for fecundity (Cummings and McClellan 2000). Fecundity has been recently estimated for greater amberjack spawning offshore of the Florida Keys (Harris et al. 2004). Spawning frequency was estimated as approximately every 5 days over a spawning season of ~60 days (12 March through 10 May), based on histology of oocytes that either showed a migratory nucleus or hydration, as well as the occurrence of post-ovulatory follicles. A significant relationship existed between batch fecundity (BF) as a function of FL with BF=8.192*FL-6,394,879 (adjusted-r^2=0.54, n=28) and BF as a function of age (BF=458.601*Age+254,065; adjusted-r^2=0.36, n=21) (Harris et al. 2004). Since spawning females in the Harris et al. (2004) study were only sampled during March-May, which is also when the annulus in the otolith is deposited, ages for these specific females would be their ages at annulus formation, and hence the BF versus Age regression would reflect an accurate age of the fish.

Based on the lack of fecundity data for greater amberjack in the Gulf, a comparative analysis based on using female weight as a proxy for fecundity (previous assessment) versus fecundity estimates from Harris et al. (2004) may be warranted.

2.7 Stock-Recruitment Relationship

A Beverton-Holt stock recruitment relationship was examined in the most recent stock assessment of greater amberjack (RFSAP 2000) and the model did not produce a reasonable fit to the observed data because of the nearly linear relationship between estimated stock biomass and recruitment. As a result, estimates of stock biomass at MSY were overly large. Therefore, two alternative stock recruitment relationships were used by the RFSAP: 1) the hockey-stick (piece-wise linear) (Barrowman and Meyers 2000); and 2) historical mean recruitment (Turner et al. 2000). The RFSAP noted that the hockey-stick functionally resembled a Beverton-Holt curve and focused on the results using the hockey-stick relationship because of the relationship between recruitment and stock.

2.7.1 Relative Productivity and Resilience:

The classification scheme developed at the FAO SECOND TECHNICAL CONSULTATION ON THE SUITABILITY OF THE CITES CRITERIA FOR LISTING COMMERCIALLY-EXPLOITED AQUATIC SPECIES (Windhoek, Namibia, 22-25 October 2001; FAO 2001) was used to characterize the relative productivity of greater amberjack. This information is provided in Table 3. A productivity rank was assigned to each life-history characteristic (a value of 1 was assigned for low, 2 for medium, and 3 for high productivity characteristics) and ranks were averaged to produce an overall productivity score. This score was then used to prescribe a prior density function on steepness in the stock-recruitment relationship from the periodic life history strategists as summarized by Rose et al. (2001). The dominant portion of the steepness values from these analogous species range from 0.6-0.8 with 90% of the values less than 0.9. As the greater amberjack productivity score from this exercise is somewhat in the medium category, it is recommended that the prior density function on steepness for this species be lognormal with a mode of 0.7 and a CV such that there is no greater than a 10% probability of steepness values greater than 0.9.

2.8 Natural Mortality

2.8.1 YOY

Catch-curve analysis was used to estimate daily instantaneous mortality of YOY greater amberjack from 40-130 days (M = 0.0045); cumulative natural mortality for a 100 d period resulted in a cumulative mortality estimate of 36% (Wells and Rooker 2004b). Since the rate of natural mortality during the first year of life is likely to be lower the second half of the year, an additional value is required to adjust for mortality during the entire first year of life (note: mortality during the larval period will be markedly higher than the YOY estimate of mortality).

2.8.2 Sub-adult/Adult

Greater amberjack in the Gulf live to at least 15 years, based on age samples available (see Manooch and Potts 1997a and Thompson et al. 1999). Based upon this information, the method of Hoenig (1983) results in a value for M of 0.28. As this results from a sample taken from an exploited population, the value could be considered somewhat high. Based upon this information, the DW suggested using a value of M of 0.25 for baseline evaluations, and agreed with the range of M = 0.2 and 0.35 for sensitivity evaluations. These values are consistent with those applied in the previous Gulf greater amberjack assessment (Turner et al. 2000).

Due to the exploited nature of the fishery, previous studies have estimated total instantaneous mortality (Z). Manooch and Potts (1997a) reported Z for greater amberjack recruited to the headboat fishery in the Gulf; estimates were 0.68 and 0.73 for 1988 and 1993, respectively. It should be noted that most of the fish used to estimate Z were collected off Texas, and the authors also stated that their data may overestimate Z because headboat anglers are less experienced and less likely to land large amberjack compared to commercial fishermen. The same authors reported mortality of greater amberjack sampled from headboats and commercial handline vessels from the southeastern US, and estimates of Z ranged from 0.60 to 0.65 depending upon the year (Manooch and Potts 1997b).

2.9 Release Mortality

Release mortality for greater amberjack in the Gulf of Mexico is unreported. A survival study of released undersized reef fishes using observers aboard headboats and commercial handline vessels off Beaufort, NC estimated maximum acute mortality of greater amberjack as 0.09 (0.91 as survival, n=11) for the headboat fishery and 0.08 (0.92 survival, n=12) for the commercial handline fishery (unpublished data, R. Dixon, NMFS, Beaufort, NC). Acute mortality in this case was defined as the proportion of fish directly observed to float at the surface after release and therefore presumed to die. An estimate of 0.1 would therefore appear to be a minimum acute release mortality; however, actual release mortality (i.e., not directly observed as floaters) would most likely be greater. It is therefore recommended that a sensitivity analysis be done using a range of release mortalities between 0.2 and 0.5

2.10 References

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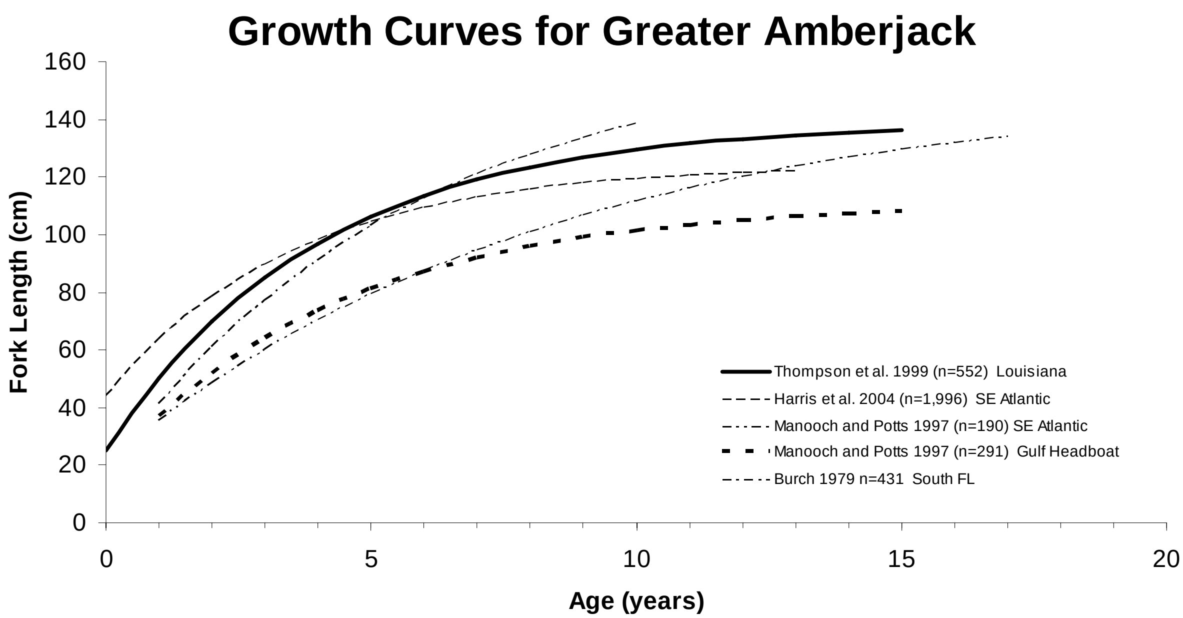


Figure 1. Theoretical von Bertalanffy growth curves for greater amberjack collected in the southeastern Atlantic and Gulf of Mexico. Growth curves were based on back-calculated length at age except for Harris et al. (2004; observed age) and Thompson et al. (1999; age relative to a birth date of 1 April).

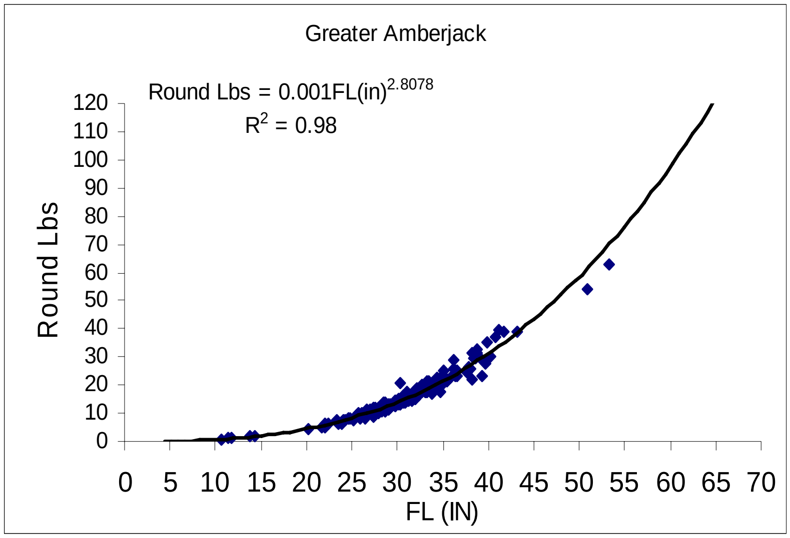


Figure 2. Combined TIP and measures from Manooch and Potts (1997b) describing the relationship between whole weight and fork length in gulf greater amberjack.

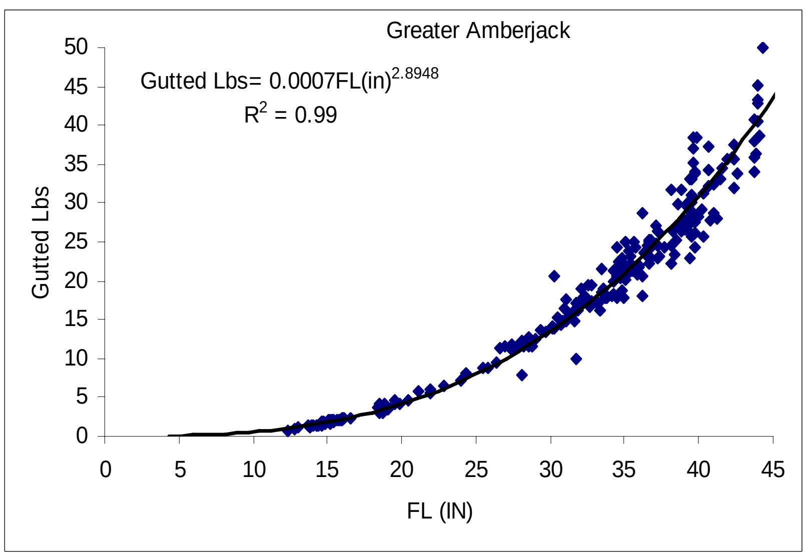


Figure 3. TIP measures describing the relationship between gutted weight and fork length in gulf greater amberjack.

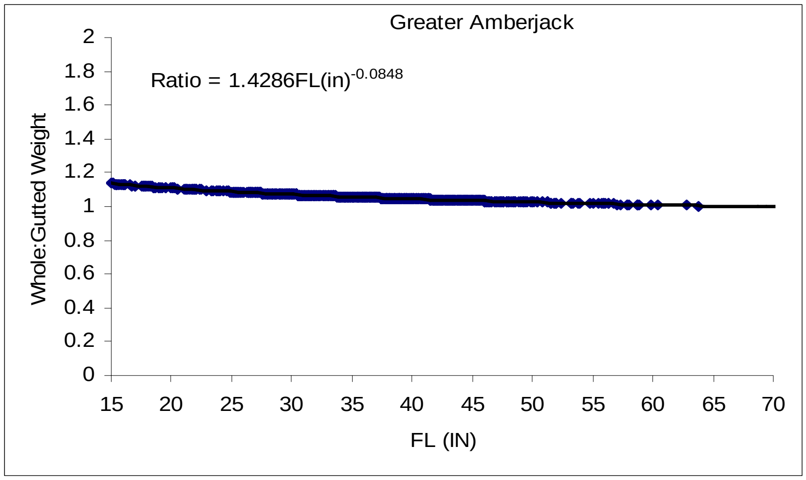


Figure 4. Ratio of whole weight to gutted weight as a function of FL in Gulf of Mexico greater amberjack.

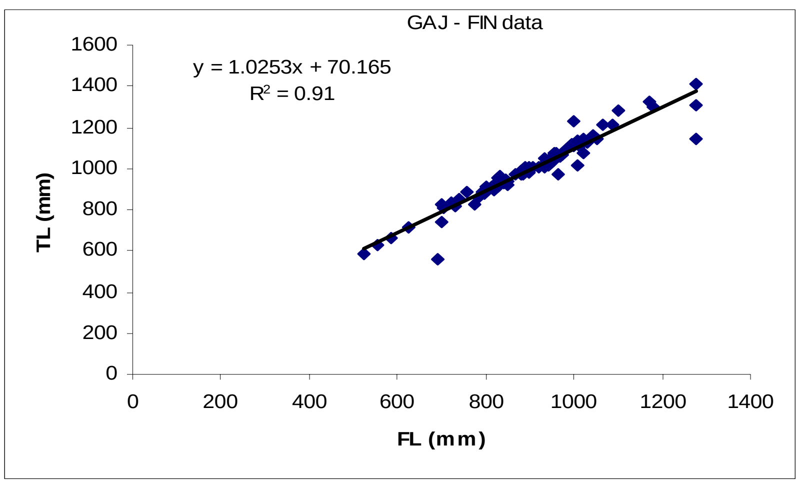


Figure 5. TL as a function of FL for Gulf of Mexico greater amberjack collected through GulfFIN..

Table 1. Theoretical von Bertalanffy growth parameters for greater amberjack. Growth curves were based on back-calculated length at age except for Harris et al. (2004; observed age) and Thompson et al. (1999; age relative to a birth date of 1 April).

Model	Area	L_{inf} (cm)	k	t_0	n
Burch (1979)	South FL	164.3	0.174	-0.653	431
Manooch and Potts (1997a)	SE Atlantic	151.4	0.119	-1.23	190
Manooch and Potts (1997b)	Gulf of Mexico	110.9	0.227	-0.791	291
Thompson et al. (1999, includes Beasley 1993)	Louisiana	138.9	0.25	-0.79	552
Harris et al. (2004)	SE Atlantic	124.15	0.28	-1.56	1,996

Table 2. Conversions of various weights and lengths for Gulf of Mexico greater amberjack. The ratio of whole weight to gutted weight was derived using regressions for round and gutted weights as a function of FL.

Conversion	Source	Model	r^2	n
Round Weight (lbs) vs. FL (in)	TIP	$Y = 0.001X^{2.8078}$	0.98	
Gutted Weight (lbs) vs. FL (in)	TIP	$Y = 0.0007X^{2.8948}$	0.99	
Whole Weight: Gutted Weight Ratio vs. FL (in)	Derived	$Y = 1.4286X^{-0.0848}$		
TL (mm) vs FL (mm)	FIN	$Y = 1.0253X + 70.165$	0.91	

Table 3. Proposed guideline indices of productivity for exploited fish species with specifics for Gulf of Mexico greater amberjack.

Parameter	Productivity			**Species**
	Low	Medium	High	**Greater Amberjack**
M	<0.2	0.2 - 0.5	>0.5	0.2, **0.25**, 0.35
K	<0.15	0.15 - 0.33	> 0.33	**0.25**
t_{mat} (years)	> 8	3.3 - 8	< 3.3	**3**
t_{max} (years)	>25	14 - 25	<14	**15**
Examples	orange roughy, many sharks	cod, hake	sardine, anchovy	**Amberjack Productivity Score = 2.25 (Medium)**

3. Commercial Fishery Statistics

3.1 Commercial Landings Collection and Statistics

3.1.1 Commercial Landings Data Collection

Commercial fishery statistics include information on landings of seafood products, fishing effort, and biological characteristics of the catch. A variety of sources of information are used to obtain these statistics.

The quantity (usually weight) and value of seafood products sold to licensed seafood dealers has been collected through various state and federal programs overtime. Landings statistics are currently collected by state fisheries agencies in Alabama, Florida, and Louisiana on each fishing trip (trip ticket programs). In Mississippi and Texas, monthly dealer reports of landings are either sent in by the dealer or collected by state and federal port agents. Prior to the implementation of trip ticket programs, landings were collected from seafood dealers each month by NMFS and state agents. Trip ticket programs generally provide information on the gear used and the fishing area. For the historical landings obtained from dealers each month, fishing gear and area were assigned by the agents on an annual basis.

At the National Marine Fisheries Service (NMFS) Southeast Fisheries Science Center (SEFSC), commercial landings statistics from North Carolina through Texas from 1962 to present are maintained in a data base referred to as the Accumulated Landings System (ALS). Statistics on all seafood products except shrimp are maintained the ALS. Landings statistics prior to 1962 are maintained at NMFS Headquarters in Silver Spring, MD.

3.1.2 History and overview of landings data collection

Florida

Prior to 1986, commercial landings statistics were collected by a combination of monthly mail submissions and port agent visits. These procedures provided quantity and value, but did not provide information on gear, area or distance from shore. Because of the large number of dealers, port agents were not able to provide the gear, area and distance information for monthly data. Gear, area and distance from shore, however, are provided for annual summaries of the quantity and value and known as the Florida Annual Canvas data.

Mandatory reporting by all seafood dealers was implemented by the State of Florida in 1986. The state requires that a report (ticket) be completed and submitted to the state for every trip from which seafood was sold. Dealers are required to report the type of gear as well as the quantity (pounds) purchased for each species. Information on the area of catch can also be provided on the tickets for individual trips. As of 1986 the ALS system relies solely on the Florida trip ticket data to create the ALS landings data for all species other than shrimp.

Alabama

Data collection in Alabama prior to 2000 was voluntary and conducted by state and federal port agents through monthly dealer and dock visits. Total landings summaries in weight (pounds) and value for species and market category were recorded. Port agents provided information on gear and fishing area from their knowledge of the fisheries and interaction with fishermen and dealers. As of mid- 2000 the State of Alabama required fishermen and dealers to report all commercial landings data through a trip ticket system. As of 2001 the ALS system relies solely on the Alabama trip ticket data to create the ALS landings data for Alabama.

Mississippi

Data collection in Mississippi is voluntary and conducted by state and federal port agents that visit dealers and docks monthly. Summaries of total landings (pounds) and value for species and market category are recorded. Port agents provide information on gear and fishing area from their knowledge of the fisheries and interaction with fishermen and dealers.

Louisiana

Prior to 1993, commercial landings statistics were collected in Louisiana by federal port agents following the traditional procedures established by the NMFS. Monthly summaries of the quantity and value were collected from each dealer in the state. Information on gear, area and distance from shore were added by individual port agents.

Beginning in January 1993, the Louisiana Department of Wildlife and Fisheries began enforcing mandatory reporting requirements. Dealers are licensed by the state and are required to submit monthly summaries of purchases of individual species and market categories. With the implementation of the state statute, federal port agents did not participate in the collection of commercial fishery statistics.

Information on gear, area, and distance from shore has not been added to the landings statistics for 1992-1999. In 1998 the State of Louisiana required fishermen and dealers to report all commercial landings data through a trip ticket system. This data contains detailed landings information by trip including gear, area of capture and vessel information. As of 2000 the ALS system relies solely on the Louisiana trip ticket data to create the ALS landings data for Louisiana.

Texas

Texas has mandatory reporting requirements for state licensed dealers Dealer's are required to submit monthly summaries of the quantities (pounds) and value of the purchases that were made for individual species or market categories. Information on gear, area and distance from shore are added to the state data by SEFSC personnel.

3.1.3 Inter-state Transport

Often seafood products are landed in one state and transported by the purchasing dealer to another state; such landings may be recorded both in the state of landing and where the purchasing dealer is located. State and SEFSC personnel track these landings to assure that double counting does not occur and assign them to the state of landing.

3.2 Commercial Landings Data Base Organization and Data Handling

The data are organized into three primary components: historical annual data (1962-1976), monthly data (1977-present) and Florida annual data (1976-1996). The monthly 1977-present data for Florida does not have gear or fishing area for the period 1977-1996, while the annual Florida data (1976-1996) has gear and fishing area information which was provided by port agents based on their knowledge of the fisheries.

3.2.1 Accumulated Landings System (ALS)

1962-1976 Annual Landings by Year, State, County, Area, Gear, and Species for Florida West Coast through Texas.

1977-present Monthly Landings by Year, Month, State, County, Area, Gear, and Species for Florida West Coast through Texas. Data reported from some states do not have information on the area and gear of capture particularly during the 1990s.

Historically, the state and county recorded in the ALS indicates where the marine resource was landed. However, in recent years (with the advent of trip tickets as the source of the landings data) in some states, the state and county reflect the location of the main office of the purchasing dealer.

Fishing takes place in many different regions, including United States waters of the Gulf of Mexico and South Atlantic as well as in foreign waters. For the years 1976-present the area codes assigned to those regions are:

1.- South Atlantic catch in the ALS is considered all area codes 0010, 0019, and 7xxx and higher.

2.- Foreign Waters are area codes 022x- 060x and 186x.

3.- In order to define the area of capture for Florida West coast for years 1976-1996 previous assessments use the Florida Annual Canvass data set.

(Note: The State of Florida implemented their trip ticket program in 1985 with more complete reporting starting in 1986. This data set was to contain area of capture information, but due to the nature of a public reporting, some fields on the ticket (such as area) may not have been reported consistently or completely in the early implementation years.)

3.2.2 Florida Annual Canvas Landings

Florida Annual Canvass 1976-1996 considerations:

1976-1996 Florida Annual Canvass for area and gear estimates by county which are not in the Monthly Landings for Florida West Coast.

Florida Annual Data files from 1976 – 1996 represent annual landings by county based on dealer reports which are broken out on a percentage estimate by species, gear, area of capture, and distance from shore. These estimates are submitted by Port agents assigned responsibility for the particular county and from interviews and discussions with dealers and fishermen collected through out the year. The estimates are processed against the annual landings totals by county on a percentage basis to create the estimated proportions of catch by the gear, area and distance from shore.(The sum of percentages for a given Year, State, County, Species combination will equal 100.)

1976-1985 data are ‘as landed’ weight; amberjack and vermilion snapper were normally landed gutted and gray triggerfish landed whole. Gutted weight to whole weight conversion factors are 1.04 for amberjack and 1.11 for vermilion. All Area codes 0010, 0019, and 7xxx and higher are considered South Atlantic catch

State 00 and Grid 0000 in the data set are ‘marine product landed elsewhere’ and trucked into the State of Florida and are considered duplicated elsewhere because they are theoretically reported back to the state of landing and are not included in the Florida totals.

State 12 is in the data set which represent Florida interior counties which were landed on Florida East Coast and not included in the Gulf catches.

Coding considerations on greater amberjack ('1812') vs. Amberjacks ('0030'): 1. Florida - Data were edited according to FL species code on 10/8/1996 to make FL species code 103 (Greater Amberjack) = NMFS Species Code 1812 (Greater Amberjack). These edits went as far back as I could reference the 103 code in the computer data which was to 1992.

1. Florida - Florida trip ticket data distinguishes greater amberjack (Florida species code 103) starting in 1992. Prior to that all amberjack were considered 'unclassified amberjack' (NMFS species code 0030)
2. Florida - The State of Florida also submits greater amberjack data converted from 'cores' as code 471. These were left as code 0030 to differentiate them from the gutted greater amberjack.
3. Texas - The species code cross-reference table for Texas was updated in early April of 2001. All data loaded (re-loaded) after that was referenced to the '1812' code instead of the '0030' code previously used. 1994 and forward were updated
4. Louisiana - From 2000 on the data are from the State of Louisiana Trip Ticket System and the codes are specifically referenced.

Assignment of gear and area of capture 1990-present

Gear and fishing area designations in the landings data base are provided by various sources including port agents (annual and/or monthly landing reports), dealers (some trip ticket reports) and permit applications (some trip ticket reports, used only for gear). Not all states required reporting of area and gear when trip ticket programs were initiated. A logbook system was implemented in 1990 that requires fishermen to record gear and area as well as catch and effort. The working group recommended that landings for 1990 onward be classified by gear and area using year- and state-specific information from logbooks.

3.3 Commercial Landings

3.3.1 Commercial landings by State

Commercial landings in pounds by state and year are shown in Table 3.1. Since greater amberjack could be landed in several categories, landings are shown as reported for “greater amberjack”, “unclassified amberjack” and as “all jacks” combined.

3.3.2 Commercial Landings Species Composition

Species composition is a concern with amberjack. Greater amberjack landings could be recorded under the general code for amberjack (0030) as well as the specific code for greater amberjack (1812). Furthermore, It is believed of several species, including greater amberjack (Seriola dumerili), lesser amberjack (Seriola fasciata), almaco jack (Seriola rivoliana), and banded rudder fish (Seriola zonata), are reported as “unclassified amberjack” (0030).

Document SEDAR9-DW-19 presented three methods of calculating the species composition of unclassified amberjack:

Method 1 -the average percentage of landings by each Gulf state of the four species from recent years was used to estimate the percent of landings in the 0030 category that were greater amberjack.

Method 2 -the percentages were derived from the data recorded in the TIP interview program.

Method 3 -the TIP interview program records species composition by the data collectors which compares the landings recorded by the dealer.

There are potential problems with each method such as species identification errors by dealers (Method 1) non-random samples or selective sampling (Method 2), the limited number of samples (Method 3). Of the three methods, Method 1 was considered by the committee as being the most reliable estimate given the information presented in SEDAR9-DW-19. The Method 1 percentages by state were to be used for all unclassified amberjack (species code 0030) as well as all jacks combined to give estimates of the actual catch of greater amberjack. An additional consideration was for the Texas landings which were reported as 100% unclassified amberjack (0030) until 1992 and then as 100% greater amberjack (1812) from 1993 to present; the committee considered it likely that those landings were a mixture of jacks species. To calculate the amount of Texas landings which might have been greater amberjack the committee decided to assume the Louisiana percentages of greater amberjack in the catch of unclassified jacks. The break down by state for greater amberjack are as follows:

Florida ------ x 89.98%

Alabama----- x 82.76%

Mississippi--- x 78.40%

Louisiana---- x 82.63%

Texas---------- x 82.63%(Reference Louisiana)

3.3.3 Commercial Landings for Assessment by State

Commercial landings by state are shown in Table 3.2 and Figure 3.1.

The largest quantities of greater amberjack have been landed in Florida followed by Louisiana. The other states have accounted for comparably smaller quantities.

3.3.4 Commercial Landings for Assessment by Gear and Area

Table 3.3 and Figure 3.2 show commercial landings by gear and region. For landings from 1990-2004 gear and statistical area were assigned from log books by year and state. The eastern and western regions were separated at approximately the Mississippi River with east including statistical areas 1-12 and the west including areas 13-21. Longline included vertical longline and handline included all other gears.

3.4 Bycatch

3.4.1 Commercial Finfish Fishery Discards

Estimates of greater amberjack, vermilion snapper, and gray triggerfish commercial discards were presented in SEDAR9-DW-17. A 20% sample of the vessels with a Gulf of Mexico reef fish, king mackerel, Spanish mackerel or shark permit were selected to report discards. Data were available for the period August, 2001 through December, 2004. There were more than 800 trips on which greater amberjack were reported, about 300 with vermilion snapper and only about 50 with gray triggerfish. For greater amberjack and vermilion snapper generalized linear model (GLM) analyses were used to determine those variables with significant effects on the proportion of trips reporting discards of the species of interest and on the catch rates (in number of fish) of trips reporting discards; there were not sufficient data to conduct these analyses for gray triggerfish. Multiple factors were found to influence discard rates by species, but sampling period (August-December and January-July each year) and the number of hooks fished per line were consistently identified as the most important factors influencing discard rates. For the greater amberjack analyses the greater amberjack season (open/closed) was considered as a factor, however the models did not identify amberjack season as a significant factor.

The estimated number of discards was calculated by multiplying the number of trips in a stratum by the average catch rate in the stratum with the strata defined by the results of the general linear models and by the amount of available data (a minimum of 30 observations per stratum). Estimates were made only for the handline fishery (included electric reel and hydraulic 'bandit rig' gear) due to small sample sizes of discards reported from other gears. Discard estimates for both greater amberjack and gray triggerfish were made for each of the seven sampling periods (each about a half year) and for species specific levels of hooks per handline. There were very few observations of gray triggerfish discards so estimates were made only for each sampling period. Additionally estimates were made calculated for years before the discard program was initiated. These were made using the 2001-2004 average discard rates for each stratum (half year and hooks per line for greater amberjack and vermilion snapper, half year for gray triggerfish). These pre-July 2001 estimates were made only for periods when the size limit was the same as the size limit in 2001-2004.

Estimated discards are summarized in Table 3.4. Estimates of greater amberjack were made starting in 1993, the first year that all vessels in the Gulf of Mexico reef fish logbook program were required to provide logbook reports. The time series for vermilion snapper and gray triggerfish were truncated at the point when size limit changes occurred in the regulation in each species (September 14, 1997 for vermilion snapper; November 24, 1999 for gray triggerfish); therefore estimates for vermilion were made for part of 1997 and 1998-2004 and for gray triggerfish for 2000-2004. The committee reviewed the discard estimates of vermilion snapper in detail because of the magnitude of the estimates for 2002 (SEDAR9-DW-17). That review found no obvious difference in the frequency of trips reporting high numbers of discards during 2002 and showed patterns of frequency distributions which were similar to adjacent sampling periods throughout the years covered by the survey. Similarly, patterns of the number of estimated greater amberjack discards per trip did not appear to greatly differ among sampling periods (Figures 3.3 and 3.4).

The committee reviewed existing data which might be useful in estimating the average weight of discards. The committee suggested that the average size of discards might be estimated from information on the composition before and after minimum sized restrictions were imposed. A review of the gray triggerfish data before and after 2000 indicated no differences in the size composition with very few fish below the minimum size; therefore the committee suggested that the weight associated with the minimum size might be used.

3.4.2 Shrimp Fishery Bycatch

The Bayesian techniques used to estimate shrimp fleet bycatch for red snapper during SEDAR7 (SEDAR7-DW-3 and -54) were applied to vermilion snapper, gray triggerfish, and greater amberjack in SEDAR9-DW-26. Results for all three species do not appear to be as reliable as the results for red snapper, probably in large part due to their lower abundances, but also due to reasons unique for each species. Greater amberjack were not on the list for work-up under the evaluation protocol observer trips. Their abundance in trawls is so low that reliable annual estimates may not have been possible even if they had been included. It was not possible to obtain an estimate for bycatch with BRDs for triggerfish and amberjack with the Bayesian model. Because of doubts about the reliability of the annual estimates for these species from the SEDAR7 model, a delta distribution-based version of the Bayesian approach was introduced, and a fully mixed effects model ("Model 3") considered but not ultimately not used for red snapper was resurrected. There is some evidence that the delta implementation may be underestimating bycatch, and the frequencies of occurrence of for vermilion and greater amberjack are so low that one has to be suspicious about results of the CPUE portion of the delta distribution analysis. Model 3 central tendencies tended to be intermediate between the SEDAR7 and delta results, but the uncertainty estimates were enormous. Table 3.5 provides some summary statistics of the performances of the models when applied to the SEDAR9 species, and compare them with the more successful situation for red snapper. In view of the unrealistic results that cropped up for all three SEDAR9 species, the DW recommends setting aside the estimates of inter-annual variation in favor of estimating an overall average, and then constructing wide uncertainty intervals to incorporate estimation error within models, variation among model choices, and inter-annual variation. Working at a resolution below an annual time step is not recommended. The simplest statistic from SEDAR9-DW-26 (average CPUE in all observer trips times an approximate recent effort level) is recommended as the estimate of central tendency. It was not possible to partition the bycatch estimates by age as per SEDAR7-AW-20, as only a handful of fish for these 3 species have been measured across all the observer studies.

There are a number of options to be considered for providing estimates of central tendency and variation. These options will be developed, along with further exploration of why the SEDAR7 model performed as poorly as it did for these less abundant species. Results will be reported in a paper for the Assessment Workshop.

3.5 Size composition

The working group reviewed SEDAR9-DW-09 which reported on the numbers of samples available by year and state and by year and gear. The committee was concerned about the low numbers of greater amberjack measured in all years (Table3.6) and that samples were primarily limited to one state before 1990 (Louisiana) and after 1997 (Florida). Comparison of the size distributions from the two states from 1990-1997 indicated few differences (Figure 3.5), suggesting that it might be reasonable to use samples from one state as indicators of the size from other states. SEDAR9-DW-09 showed that longlines tended to catch larger fish than handlines; therefore the committee recommended that gears be treated separately in developing catch at size even though the numbers of fish measured from the longline fishery was quite low.

Table 3.1 Commercial landings (pounds whole weight) of greater amberjack, unclassified amberjack and unclassified jacks from all waters (Gulf, Atlantic and Caribbean).

	unclassified amberjack							unclassified jacks							greater amberjack							
	TX	LA	MS	AL	wF	eF	subtotal	TX	LA	MS	AL	wF	eF	subtotal	TX	LA	MS	AL	wF	eF	subtotal	total
1963					14,664	6,032	20,696															20,696
1964					10,192	7,696	17,888															17,888
1965					8,632	8,736	17,368															17,368
1966					9,464	21,736	31,200															31,200
1967					34,944	23,192	58,136															58,136
1968					14,144	26,624	40,768															40,768
1969					83,512	15,808	99,320															99,320
1970					20,592	40,248	60,840															60,840
1971					46,592	22,776	69,368															69,368
1972					46,280	11,856	58,136															58,136
1973					40,040	38,064	78,104															78,104
1974					59,800	36,504	96,304															96,304
1975					94,536	56,056	150,592															150,592
1976					99,424	68,744	168,168															168,168
1977					135,901	66,330	202,231															202,231
1978					172,931	39,063	211,995															211,995
1979					194,208	32,973	227,181															227,181
1980					211,947	33,178	245,125															245,125
1981					276,399	36,717	313,116															313,116
1982			4,950		339,660	44,859	389,469															389,469
1983		452	500	2,909	374,541	38,869	417,271															417,271
1984	13,901	364	9,336	19,279	650,644	90,077	783,601															783,601
1985	48,237	96,206	36,758	42,733	693,793	95,482	1,013,209															1,013,209
1986	119,796	314,057	67,403	61,949	881,014	239,367	1,683,586															1,683,586
1987	105,428	380,847	47,508	30,668	1,621,151	855,569	3,041,171															3,041,171
1988	181,677	710,752	40,598	35,951	1,889,651	637,844	3,496,473															3,496,473
1989	139,279	606,955	53,120	28,849	1,778,801	706,259	3,313,263															3,313,263
1990	72,511	315,395	22,535	15,206	1,648,478	690,235	2,764,360															2,764,360
1991	28,472	196,923	20,204	2,194	1,757,338	811,013	2,816,144															2,816,144
1992	170,026	406,802	16,909	21,432	128,082	407	743,658												1,799,601	976,326	2,775,927	3,519,585
1993	184,175	486,153	1,378	7,657	401,164	0	1,080,527										14,949		1,269,895	776,302	2,061,146	3,141,673
1994		351,935	275	5,824	365,340	1,487	724,861								102,696		5,987		1,061,659	965,624	2,135,966	2,860,827
1995		302,778	2,157	2,704	520,912	1,741	830,292					52,474	79,764	132,238	152,232		4,100		852,258	761,109	1,769,699	2,732,229
1996		310,219	2,467	11,922	302,689	7,947	635,244					55,274	100,783	156,057	159,773		24,379		898,508	657,099	1,739,759	2,531,060
1997		262,423	546	3,274	116,083	11,275	393,601					98,426	73,614	172,040	191,933		30,878		863,384	552,975	1,639,170	2,204,811
1998		122,237	894	1,932	4,631	4,401	134,095					98,022	61,906	159,928	139,511		8,606		774,110	519,641	1,441,868	1,735,891
1999		188,420	1,286	3,227	405	1,842	195,180					96,553	36,166	132,719	83,503		5,888		794,040	321,526	1,204,957	1,532,856
2000			606	7,668	4,441	76	12,791					103,271	19,106	122,377	111,526	205,796	8,517		742,835	362,189	1,430,863	1,566,031
2001			447	8,680	4,057	0	13,184					56,583	18,988	75,571	56,878	217,314	4,689	827	731,395	231,775	1,242,878	1,331,633
2002			3,242	2,067	1,379	0	6,688					35,661	24,854	60,515	70,671	260,872	2,972	3,245	736,399	260,575	1,334,734	1,401,937
2003			1,625	7,601	63	0	9,289					41,133	10,754	51,887	74,146	320,082	2,428	6,939	789,299	225,646	1,418,540	1,479,716
2004			1,902	3,503	7,234	0	12,639				8,659	40,310	7,123	56,092	38,122	406,521	1,991	3,634	957,673	210,098	1,618,039	1,686,770

Table 3.2. Commercial landings (pounds whole weight) considered to be greater amberjack for assessment (after adjustment for the fractions of amberjack unclassified and jack combined which were considered to be greater amberjack) from Gulf of Mexico waters.

year	TX	LA	MS	AL	wF	eF	total
1963					8,516		8,516
1964					6,363		6,363
1965					5,240		5,240
1966					7,393	187	7,580
1967					29,197		29,197
1968					11,510	1,404	12,914
1969					72,898		72,898
1970					13,663		13,663
1971					38,461		38,461
1972					41,643		41,643
1973					28,261		28,261
1974					41,736		41,736
1975					78,139		78,139
1976					86,467		86,467
1977					119,870		119,870
1978					150,672		150,672
1979					151,462		151,462
1980					178,386		178,386
1981					235,116		235,116
1982			3,881		219,629		223,509
1983		373	392	2,407	275,631		278,804
1984	11,486	301	7,319	15,955	490,721		525,783
1985	39,858	79,495	28,818	35,366	569,899		753,437
1986	98,987	259,505	52,844	51,269	637,501		1,100,107
1987	87,115	314,694	36,294	25,381	1,074,068		1,537,551
1988	150,120	587,294	31,721	29,753	1,232,092		2,030,980
1989	115,086	501,527	41,646	23,875	1,249,116	770	1,932,021
1990	59,626	260,611	17,667	12,584	859,484	72	1,210,045
1991	23,526	162,717	15,840	1,816	1,171,280		1,375,180
1992	139,850	336,140	13,257	17,737	484,058	113	991,156
1993	151,129	401,708	16,029	6,337	994,182	225	1,569,611
1994	102,117	290,804	6,203	4,820	866,009		1,269,952
1995	151,466	250,185	5,791	2,238	848,882	498	1,259,060
1996	156,859	256,141	26,313	9,867	815,723	1,929	1,266,832
1997	189,993	216,840	31,306	2,710	672,204	1,703	1,114,756
1998	139,371	100,956	9,307	1,599	446,050	1,398	698,681
1999	83,429	155,691	6,896	2,671	525,784	718	775,190
2000	111,114	205,796	8,992	6,346	588,980	567	921,795
2001	56,878	217,314	5,039	8,011	443,431	2,162	732,835
2002	68,807	260,872	5,514	4,956	446,319	3,936	790,403
2003	63,311	320,082	3,702	13,230	598,472	355	999,152
2004	32,982	406,521	3,482	13,699	491,080	7,023	954,787

Table 3.3 Commercial landings of greater amberjack by gear and region in pounds whole weight.

	handline+		longline		
	west US Gulf	east US Gulf	west US Gulf	east US Gulf	total
1963	2,714	5,802			8,516
1964	2,339	4,024			6,363
1965	2,059	3,182			5,240
1966	1,872	5,708			7,580
1967	10,294	18,903			29,197
1968	2,807	10,107			12,914
1969	31,349	41,549			72,898
1970	6,457	7,206			13,663
1971	12,914	25,547			38,461
1972	3,088	38,555			41,643
1973	3,650	24,611			28,261
1974	8,516	33,221			41,736
1975	21,991	56,148			78,139
1976	21,055	65,412			86,467
1977	23,479	96,391			119,870
1978	30,119	120,553			150,672
1979	52,352	96,396	2,714		151,462
1980	54,656	118,977	2,980	1,774	178,386
1981	65,322	147,344	9,054	13,396	235,116
1982	65,994	118,410	10,172	28,934	223,509
1983	72,960	160,272	16,628	28,943	278,804
1984	80,224	384,942	9,739	50,877	525,783
1985	218,757	426,450	41,357	66,873	753,437
1986	371,853	531,692	93,406	103,156	1,100,107
1987	414,997	873,098	83,066	166,390	1,537,551
1988	759,887	949,540	134,729	186,824	2,030,980
1989	668,829	967,284	103,871	192,037	1,932,021
1990	352,719	732,731	15,840	108,755	1,210,045
1991	186,117	1,183,016	4,536	1,511	1,375,180
1992	466,553	474,278	27,208	23,116	991,156
1993	584,267	905,340	29,276	50,727	1,569,611
1994	393,146	808,119	18,980	49,708	1,269,952
1995	384,616	792,594	34,264	47,586	1,259,060
1996	462,020	748,010	19,229	37,572	1,266,832
1997	439,472	615,874	12,688	46,722	1,114,756
1998	269,653	374,174	7,784	47,070	698,681
1999	242,238	472,515	16,741	43,695	775,190
2000	334,603	516,700	14,052	56,440	921,795
2001	287,774	397,807	9,282	37,971	732,835
2002	322,003	390,629	12,020	65,752	790,403
2003	391,248	482,389	15,887	109,628	999,152
2004	427,481	444,864	12,528	69,913	954,787

Table 3.4 Annual estimates of greater amberjack total discards in numbers of fish for the Gulf of Mexico handline fishery

Year	Estimate number of discards
1993	216,602
1994	232,352
1995	220,913
1996	204,475
1997	210,330
1998	219,424
1999	232,554
2000	237,460
2001	197,579
2002	139,632
2003	283,624
2004	234,794

Table 3.5. Summary of levels and ranges for shrimp fleet bycatch estimates for the SEDAR9 species from SEDAR9-DW-26, compared with similar analyses for red snapper, and some supporting statistics.

	Vermilion Snapper	Gray Triggerfish	Greater Amberjack	Red Snapper
average CPUE x approx effort	7.7M	3.8M	1.9k	27.6M
SEDAR7 model results				
median of annual medians	36M	8.3M	140k	26.3M
range of annual medians	530x	130x	88x	15x
range of annual 95% ci ranges	18x-1200x	4.9x-67x	18x-100x	1.7x-29x
Delta model results				
median of annuals	1.6M	2.2m	24k	13M
range of annual medians	160x	140x	78x	6x
range of annual 95% ci ranges	2.5x-700x	3.9x-360x	53x-1100x	1.4x-6.7x
Model 3 results				
median of annuals	3.8M	1.7M	73k	14M
range of annual medians	93x	160x	70x	19x
range of annual 95% ci ranges	23000x-38000x	810x-1300x	660x-1200x	190x-270x
frequency of occurrence in C	4%	9%	0.07%	43%
frequency of occurrence in R	2%	8%	0.50%	30%
frequency of occurrence in B	5%	0	0	55%
number of stations				
C	8460	2863	2866	9943
R	26487	26983	26487	26486
B	4920	402	402	8130

C refers to observer data for commercial shrimp tows without BRDs
B refers to observer data for commercial shrimp tows with BRDs
R refers to research vessel (Oregon II) tows

Table 3.6. Number of greater amberjack sampled from commercial landings by state and year.

Year	TX	LA	MS	AL	FL	Total
1984		146				146
1985		260				260
1986		124				124
1987		37				37
1988		52			1	66
1989		196			14	210
1990	13	259			355	627
1991		225			234	459
1992	104	488			347	939
1993	59	223	23		447	752
1994	17	326	6		653	1,002
1995	22	247			472	741
1996	37	185			321	543
1997	9	130			455	594
1998	1	1	2		602	606
1999	3	6	14		813	836
2000			1		822	823
2001		4			441	445
2002		24	3		763	790
2003		19	1	62	497	579
2004	1	21		8	288	318
Total	266	2,973	50	70	7,538	10,897

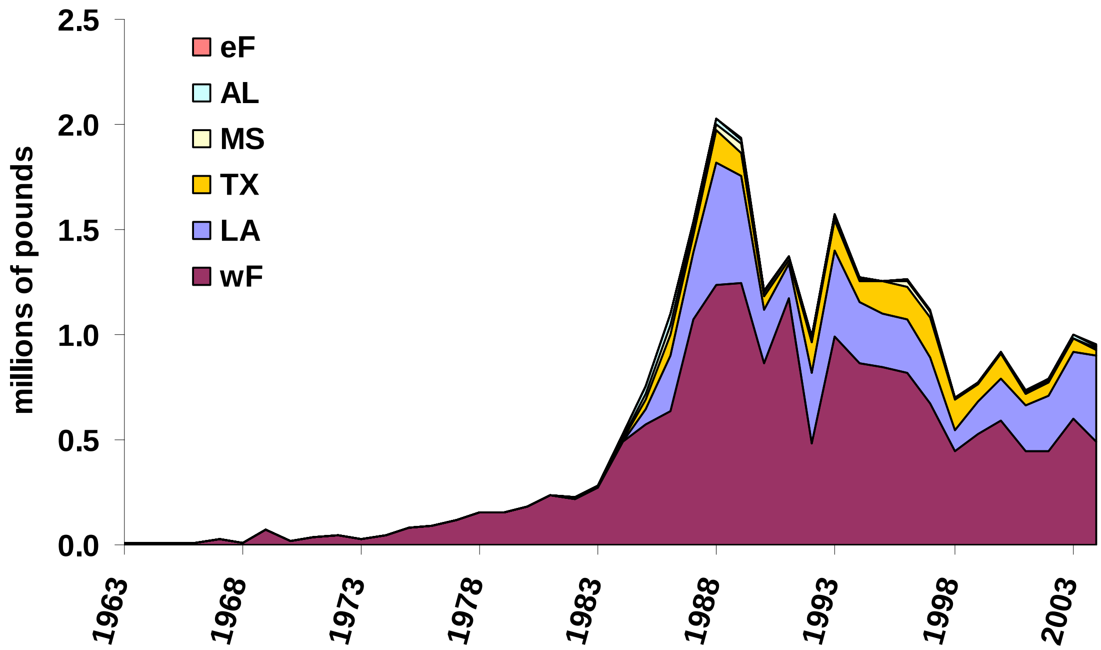


Figure 3.1. Commercial landings of greater amberjack by state from 1962-2004.

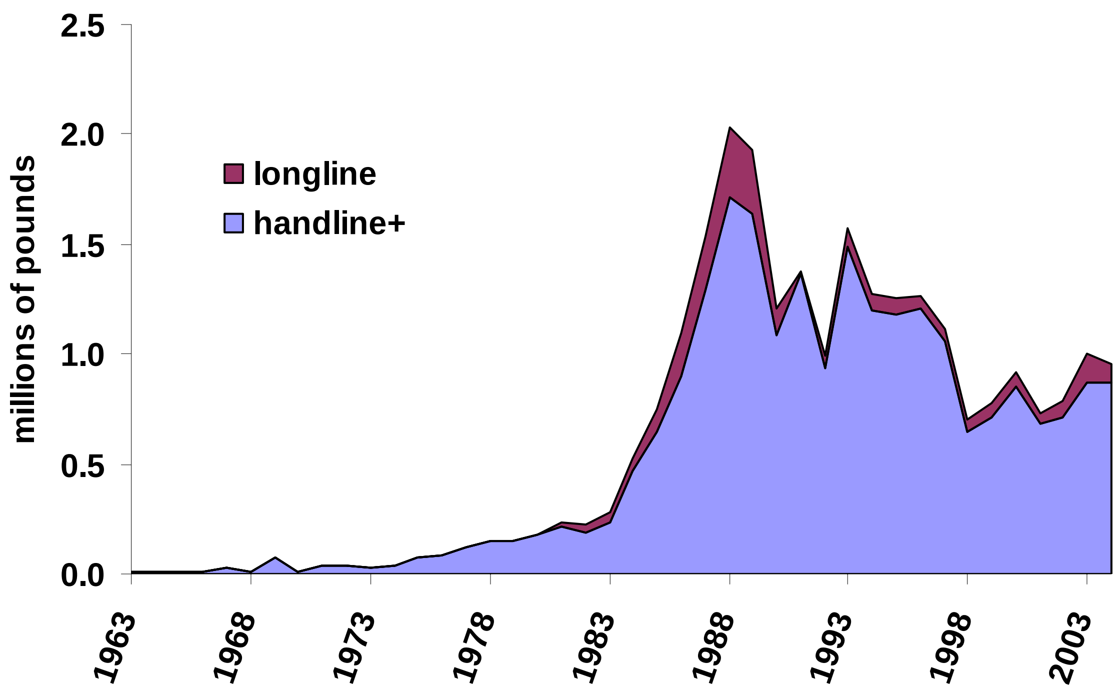


Figure 3.2. Commercial landings of greater amberjack by gear

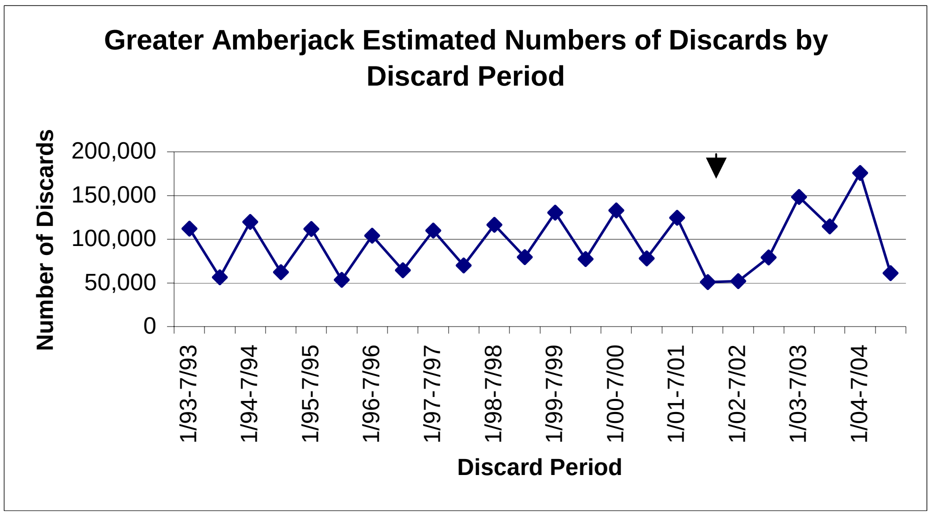


Figure 3.3. Estimated numbers of greater amberjack discards by discard period. Arrow indicates the beginning of the discard reporting program.

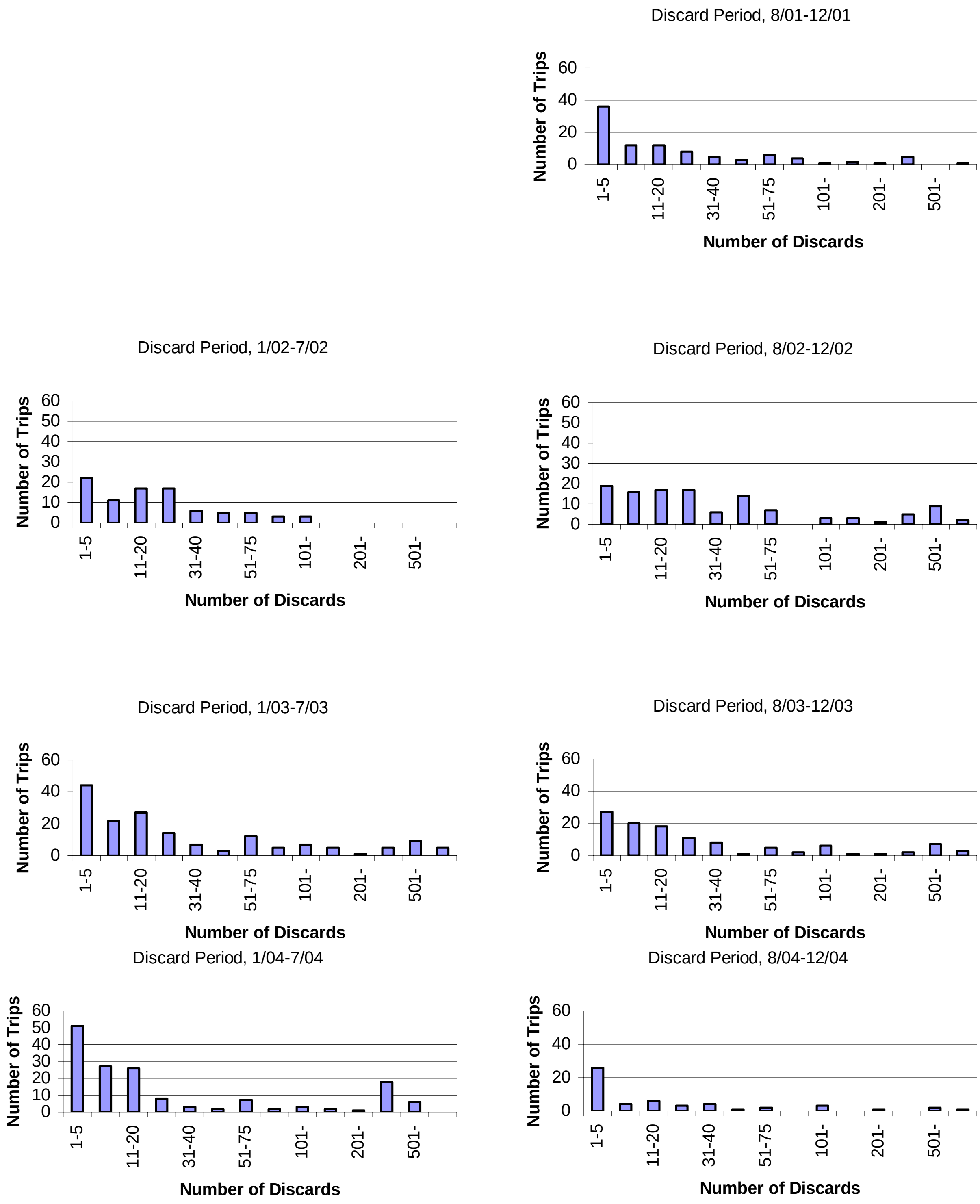
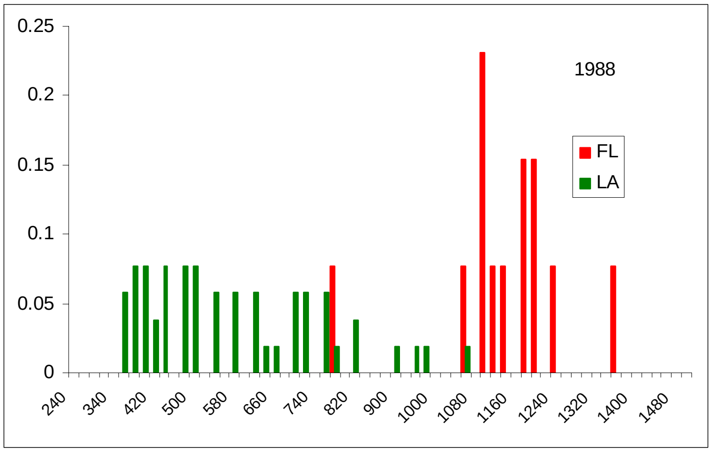
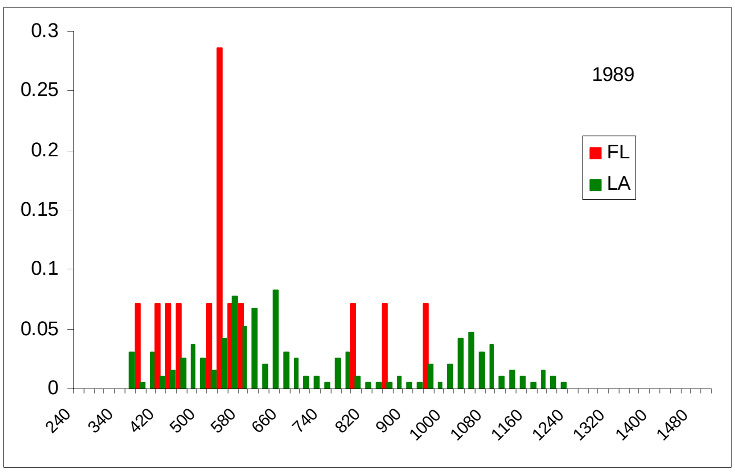
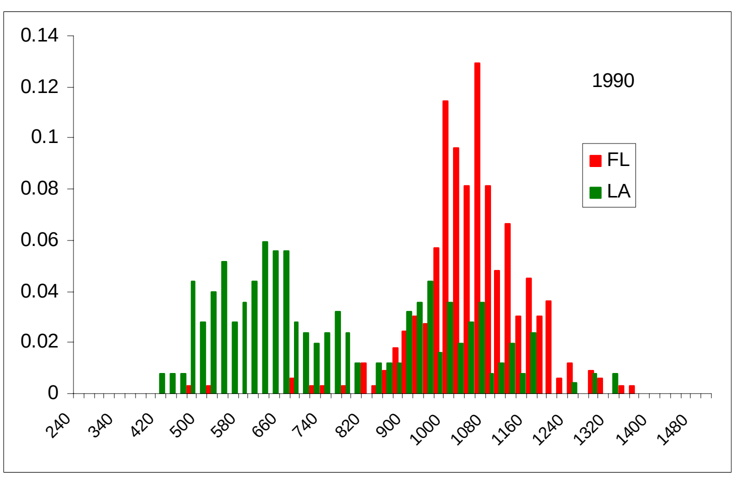


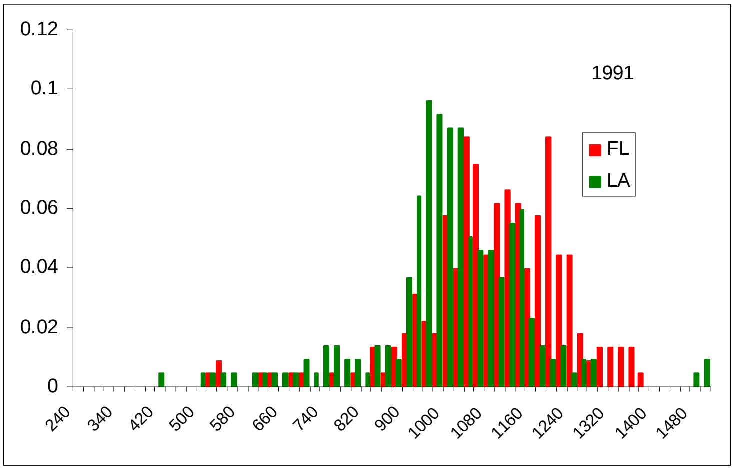
Figure 3.4 . Frequency of greater amberjack trips that reported discards by number of fish discarded and discard period.

Figure 3.5. Relative size frequency of greater amberjack from TIP samples by state from 1988-1998









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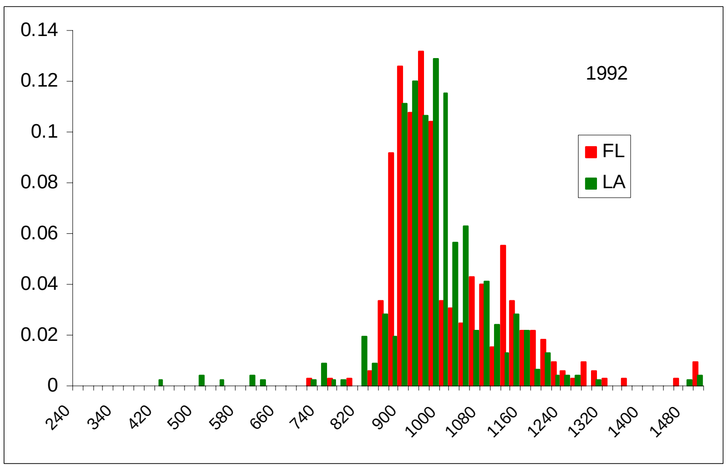

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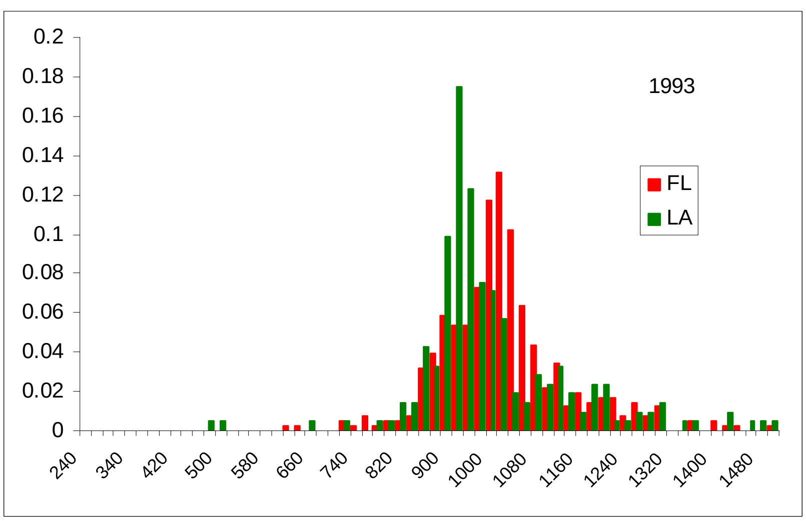

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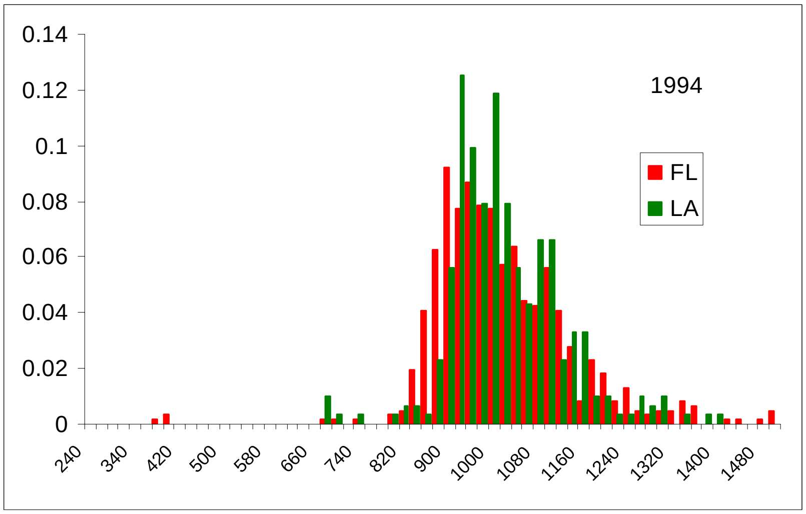
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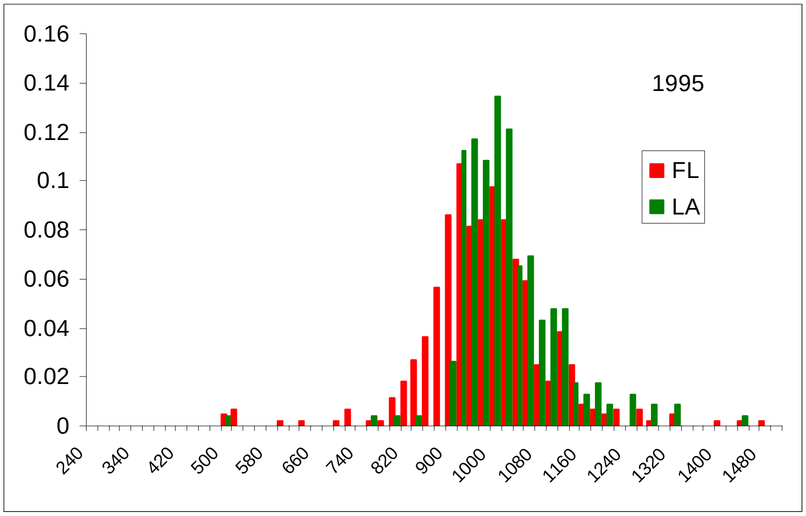
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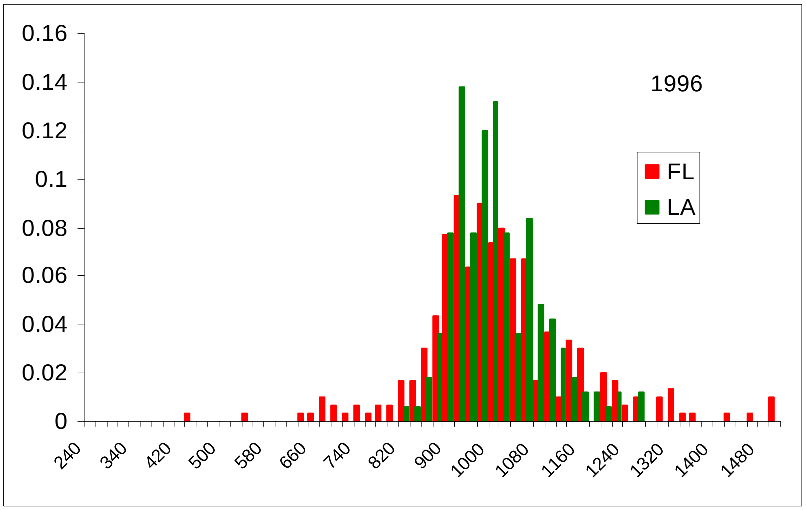
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4. Recreational Fishery Statistics

The recreational fishery statistics for greater amberjack are collected by three separate surveys: Marine Recreational Fishing Statistical Survey (MRFSS), Texas Parks and Wildlife Department (TPW) and the NMFS Headboat Survey (HB). MRFSS has captured statistics on shore based, charter boat and private/rental boat fishing and provided estimated catch for each one of these modes since 1981 from Florida through Louisiana. MRFSS included headboats in the survey from 1981-1985 and provided estimated catches for the combined mode headboat-charterboat for that period. The HB survey began in 1986 extending from the west coast of Florida through Texas. TPW has collected recreational fishing statistics from 1981-1985, and for all fishing modes except headboats in the state of Texas since 1986.

4.1 SIZE SAMPLES

MRFSS Sampling Adequacy

Document SEDAR9-DW-08 provided a summary of the number of length samples available from each survey/mode. The group had a major concern with the number of fish intercepted to obtain length samples because they are generally too low to characterize the recreational fishery (see document SEDAR9-DW-08). Many of the years have less than 100 length samples in a year across fishing modes (Table 1). MRFSS Sampling intensity by mode and across years ranged from 0.01% to 4.78%. Charter and private boat modes combined had lower sample sizes than headboat. Because charter boats catch a different size range of fish compared to the private boat fishing mode, length samples from the headboat fishery can not be used to characterize the catches of the private and charterboat modes.

Recommendation: the group did not feel that the number of length samples should be combined across modes or years to fill missing cells, because any change in population and size selectivity of the different fishing modes would be masked. In addition, the low number of length samples might not be enough to characterize the landings from some modes during certain years. Thus, we suggest not using a model that requires catch-at-age matrixes (e.g., VPA) because of the high degree of uncertainty associated with estimation of catch-at-length using low numbers of size samples.

Headboat length sample adequacy (Tables 2a and b)?

DW recommendation: Generally in most areas, as defined by the HB, there is adequate number of samples to characterize the headboat fishery, except in southwest and central Florida. The group felt that those samples could be combined with the NW FL and AL samples by year to increase the sample size (Tables 5a-b).

4.2 LANDINGS

4.2.1 MRFSS and TPW

Estimated greater amberjack landings by MRFSS and TPW are shown in Tables 3 and 4, respectively. The Recreational Statistics working group expressed concern over the accuracy of the MRFSS data for the reef fish species. The group agrees that the recreational fishery landings for these species contribute a large proportion of the overall landings. The group's concern centers on the low number of intercepted fish that is used in conjunction with the fishing effort estimates from the phone survey to estimate total catch (e.g., small anomalies in the data can be expanded to large anomalies). Another concern is over species identification by contract port agents in the early years of the MRFSS and by fisherman for the B1 and B2 catches. For the majority of recreational anglers, species identification for the jack family (Carangidae) is very difficult.

Estimated landings of greater amberjack in numbers of fish from the shore-based mode ranged from 0 to 126,747 (SEDAR-DW-07). These greater amberjack estimated landings were based on only 40 intercepts (only 17 measured) within a 24 year period. During the plenary meeting it was discussed and agreed that greater amberjack is very unlikely to be caught from shore. Thus, shore-based catches are most likely to be other jack species, not greater amberjack.

DW recommendation: The MRFSS data is the best available data and cannot be ignored. The estimated landings have CVs associated with them that will capture the level of uncertainty and might be incorporated into the assessment model (Tables 2a-b).

Omit shore based landings, because it was felt that the fishing mode or the species may have been misidentified and the chance of a greater amberjack being caught from the shore is highly unlikely. If the fishing mode was misidentified the expansion factor for fishing effort from shore mode would greatly inflate any landings of greater amberjack classified as shore mode.

Research recommendation: review this problem and collect more information (hasn't been done for this assessment, needs to be for future)

Unidentified Jack Landings

There is a large amount of MRFSS estimated landings of unidentified jack (Carangidae and *Seriola*), especially in the earliest years. Because some of these landings are comparable to greater amberjack landings, it is necessary to estimate what proportion of the unidentified landings are actually greater amberjack.

DW recommendation: Determine the total landings of identified jack species by year, region and mode. Then apply the proportion of the jack species that are greater amberjack to the unidentified jacks by year, region and mode. The two regions considered will be east and west of the Mississippi River. Information from professional fishermen indicates banded rudderfish occur in the eastern part of the Gulf and lesser amberjack occur in the western portion, but the two rarely overlap. Thus, species composition from the two regions would be different. The data were not available at the SEDAR9 Data Workshop to complete this analysis. The data will be presented at the SEDAR9 Assessment Workshop.

Missing Data

The MRFSS and TPW data set have missing information for landings in some years, waves, or states that need to be filled with some estimate.

DW recommendation: Staff of NMFS SEFSC are presently working to fill in the missing landings information. The missing landings are most commonly from the first wave in 1981 and Texas for all years. Although the group was not able to review the methodology at the time of the data workshop (see attached document from Patty Phares, NMFS, SEFSC, Miami Laboratory) it decided to accept it because it was already used and reviewed during the 2004 red snapper assessment.

4.3 HEADBOAT

Table 5 shows estimated greater amberjack landings by the NMFS Headboat Survey.

Discards

Unlike MRFSS (Table 6), the Headboat survey does not provide estimates of released fish. Because a proportion of the released fish is expected to die, estimated number of releases are necessary for the estimation of fishing mortality rates.

DW recommendation: Estimate the ratio of releases (B2) to the total catch (A+B1+B2) from MRFSS charter boat mode only (Table 6) and use it to estimate headboat releases. The group felt that charterboat and headboat fishing are most similar and the rate of released fish would be most alike. Private boat fishing would not be the same as the "for-hire" sector. Table 6 includes MRFSS estimated number of live releases (B2) by year and mode.

Dry Tortugas and Keys

Headboat landings from the Florida Keys and Atlantic based trips to the Dry Tortugas (areas 12 and 17):

DW recommendation: The landings from areas 12 and 17 should not be included in the Gulf of Mexico analysis. The group felt that better than 99% of the trips in area 12 and area 17 are in South Atlantic jurisdiction waters. Table 4 includes estimated landings from the HB.

4.4 Recreational landings estimates for TX, 1981-1985

Summary prepared June 21, 2005, Patty Phares

4.4.1 Available estimates for gray triggerfish, greater amberjack and vermilion snapper in TX

TPWD Management Data Series 204

Private and charterboat only (no headboat).

Annual landings estimates, with a year defined as May 15 - May 14, for 1983/84 through 1997/98.

(Estimates for 1998-99 and later years have not been received yet.)

These annual estimates are what TPWD uses and are based on the same survey data they use to compute the TPWD wave estimates sent to us. If landings by wave are not needed, these annual estimates may be best, at least until the wave estimates for 1983-1997 are replaced (see notes below).

Notes:

(1) The annual estimates were recomputed in the mid-1990s using a revision to the "pressure files", thus eliminating some extreme estimates. The wave estimates for the 1980s and early 1990s have not yet been recomputed to use the revised pressure files and still contain outliers which may disappear when the wave estimates are recomputed.

(2) The annual estimates are based on 2 fishing seasons (high use and low use)

and may be more precise than the sum of the 6 wave estimates.

(3) The annual estimates incorporate data entry corrections not yet made to the wave estimates.

(4) TPWD makes species-specific estimates for selected "target species". The rest of the species are combined in to "other". A "substitute" estimate can be derived for the species in "other" based on the counts of species observed, but these may not be very reliable estimates.

The annual estimates have species-specific estimates for each of these 3 species in gulf areas (not bays) in all years.

Before 1994, the wave estimates have species-specific estimates for vermilion snapper in gulf areas but not for gray triggerfish and vermilion snapper.

TPWD Management Data Series 29 and 58

gulf headboats, through May 1983.

(#29) Annual landings estimates (use gulf headboats):

Sept 1978 - Aug 1979, Sept 1980 -- Aug 1981, Sept 1981 -- Aug 1982

(#58) Landings estimates for a partial year (use gulf headboats):

Sept 1 1982 -- May 14 1983

Notes:

(1) These estimates were published in 1984 and may not incorporate needed revisions as do those in MDS 204 (no confirmation from TPWD on this yet).

(2) The Sept-Aug years are not comparable to either the May 15-May 14 years or to calendar years.

(3) According to the MDS, not all headboat in the survey areas were found and contacted (apparently a census was attempted) and possibly not all regions were covered (survey areas listed do not include the current "major areas" of gulf waters off Sabine Lake, Matagorda, San Antonio). **The MDS 29 states "Harvest estimates in this study should be considered minimum estimates...".**

TPWD wave estimates (estimates made for NMFS)

Summed to be comparable to TPWD annual estimates in A (May 1 - April 30, 1983/84 -- 2002/03).

Private and charter boats all years, headboats only in May 1983 - Aug 1984.

TPWD wave estimate (estimates made for NMFS)

Summed into annual estimates (Jan-Dec) as would be used in assessments.

Private and charter boats (wave 3-6 only in 1983), headboats only in May 1983 - Aug 1984.

MRFSS 1981- 1985

1981 waves 2, 3, 5, 6 (waves 1 and 4 are missing). All modes, charterboat and headboat combined.

1982-1984 waves 1-3, 5-6 (wave 4 is missing). Only shore mode.

1985 waves 1-2, 5-6 (wave 4 is missing). All modes, charterboat and headboat combined.

NMFS HEADBOAT SURVEY

1986-1989

Use these estimates to evaluate magnitude and trends in pre-1986 headboat landings in TX.

Before 1997, TX landings were combined for Jan-May and for Sept-Dec.

Area (TTS, EEZ is not known), but all can be assigned to EEZ (area=4) for this purpose. These are gulf headboats (not in the bays).

4.4.2 Summary of "holes"

If both MRFSS and TPWD wave estimates are used:

* charter and headboat are combined in MRFSS (are bay headboats included in MRFSS?)

x = "hole" (no survey or MRFSS estimate lost)

		Shore	Private	Charter	Headboat (gulf)	Headboat (bay)
1981	wave 1	x	x	x	x	x
	wave 2	MR	MR	MR*	MR*	with gulf?
	wave 3	MR	MR	MR*	MR*	with gulf?
	wave 4	x	x	x	x	x
	wave 5	MR	MR	MR*	MR*	with gulf?
	wave 6	MR	MR	MR*	MR*	with gulf?
1982	wave 1	MR	x	x	x	x
	wave 2	MR	x	x	x	x
	wave 3	MR	x	x	x	x
	wave 4	x	x	x	x	x
	wave 5	MR	x	x	x	x
	wave 6	MR	x	x	x	x
1983	wave 1	MR	x	x	x	x
	wave 2	MR	x	x	x	x
	wave 3	MR	TX	TX	TX	TX
	wave 4	X	TX	TX	TX	TX
	wave 5	MR	TX	TX	TX	TX
	wave 6	MR	TX	TX	TX	TX
1984	wave 1	MR	TX	TX	TX	TX
	wave 2	MR	TX	TX	TX	TX
	wave 3	MR	TX	TX	TX	TX
	wave 4	X	TX	TX	TX	TX
	wave 5	MR	TX	TX	x	TX
	wave 6	MR	TX	TX	x	TX
1985	wave 1	MR	TX/MR	TX/MR*	x/MR*	TX/MR*
	wave 2	MR	TX/MR	TX/MR*	x/MR*	TX/MR*
	wave 3	MR	TX/MR	TX/MR*	x/MR*	TX/MR*
	wave 4	x	TX/x	TX/x	x/x	TX/x
	wave 5	MR	TX/MR	TX/MR*	x/MR*	TX/MR*
	wave 6	MR	TX/MR	TX/MR*	x/MR*	TX/MR*

4.4.3 DISCUSSION

Comparing data sources in Tables 1 and 2, there is not appearance of comparability among data sources. For instance, in Table 1(a) for gray triggerfish, the TPWD Management Data Series estimates (based on May15-May14 year) and TPWD wave estimates made for NMFS are very different in many years. For MRFSS, there are almost no gray triggerfish estimates, but the leatherjacket family (Table 1(d) bears slight resemblance to the estimates from other sources.

This is true for private and charter (including MRFSS charter + headboat) for all three species (gray triggerfish, greater amberjack, vermilion snapper).

For headboats (without charterboats) compared between TPWD and the NMFS Headboat Survey, the comparisons cannot be made in the same year, but the general magnitude of TPWD estimates before 1985 is not like that of Headboat Survey estimates in 1986+ except for vermilion snapper.

Comparisons are destined to be faulty because of the abundance of "holes" and the different time periods for estimates (not the same 12-month period), different grouping of modes (charterboat and headboat alone vs. separate), and poor quality of some of the estimates. The TPWD wave estimates for these years do not have the benefit of revisions slated to be done, and the sampling levels are especially low for charterboats. The MRFSS estimates before 1986 also are considered less reliable – the charterboat component uses the "old" method for charterboats, and there are weaknesses in the estimates for all modes (early years of survey, less thorough editing of data when all estimates were revised in early 1990s, some procedural or methodological differences?).

In short, it's too messy to try to consolidate the different estimates and fill in the holes. Suggestions:

(1) Use MDS private and charterboat estimates for 1983-1997 (and use then as though they are calendar year estimates)

(2) Use TPWD wave estimates for 1998+ (these use the calculation procedures that will be applied to the earlier years when time allows for TPWD to do replace the old estimates).

(3) Use the average of the Headboat Survey for 1986-1989 for all years 1981-1985 (perhaps modified by Bob Dixon and TPWD if they believe the fleet was smaller or different).

If this is unsatisfactory, anyone's procedure may be just as good. But there will never be more data, just re-hashing of the same data presented here.

Table 1: Number of greater amberjack measured (sampled) and percentage of the estimated landings sampled (%) by MRFSS by state and year, fishing modes combined.

	FL		AL		MS		LA		
Year	Sampled	%	Sampled	%	Sampled	%	Sampled	%	Total
1986	159	0.05	15	0.20			56	1.12	230
1987	554	0.13	129	0.43			100	0.35	783
1988	120	0.06	78	0.31			3	0.12	201
1989	37	0.01	66	0.13			19	0.14	122
1990	6	0.01	26	0.12					32
1991	85	0.04	84	0.76	3	0.96	63	0.25	235
1992	166	0.11	423	0.96			73	0.69	662
1993	55	0.07	44	0.07			10	0.28	109
1994	12	0.02	47	0.14	1	0.95	7	0.22	67
1995	11	0.07	7	0.04	1	0.12	4	0.05	23
1996	15	0.04	16	0.05			14	0.11	45
1997	54	0.15	28	0.32	1	0.18	8	0.17	91
1998	129	1.62	25	0.75			15	0.11	169
1999	428	4.78	89	0.80			10	0.41	527
2000	561	1.33	145	1.49			11	0.17	717
2001	307	0.92	107	0.46			22	0.21	436
2002	732	0.93	153	0.64			84	0.66	969
2003	697	0.84	273	0.54			98	0.80	1,068
2004	463	0.73	90	0.42			85	0.46	638
Total	4,591	0.20	1,845	0.38	6	0.23	682	0.35	7,124

Table 2a. Number of greater amberjack sampled from Headboat landings by year and area.

Year	SW-C FL	NW FL, AL	LA	TX	Total
1986	283	69		200	552
1987	198	66		253	517
1988	69	86	15	184	354
1989	227	669	87	275	1,258
1990	93	33		105	231
1991	7	59	50	67	183
1992	18	55	218	94	385
1993	6	38	92	103	239
1994	12	72	24	138	246
1995	3	43	74	144	264
1996		33	72	45	150
1997		29	59	18	106
1998		28	67	27	122
1999		15	96	5	116
2000		71	27	3	101
2001	7	44	117	13	181
2002	2	22	104	14	142
2003	39	53	117	69	278
2004	4	17	0	44	65
Total	968	1,485	1,219	1,757	5,425

Table 2b: Percentage of the landings sampled by area and year by the Headboat survey.

Year	SW-C FL	NW FL, AL	LA	TX	Total
1986	0.51	0.33		2.11	0.64
1987	0.87	0.32		2.76	0.98
1988	0.44	1.78	1.20	2.32	1.19
1989	1.33	2.60	40.28	2.88	2.40
1990	0.45	5.31		3.88	0.95
1991	0.14	3.96	4.56	2.76	1.86
1992	0.21	3.61	5.54	1.59	1.95
1993	0.11	4.99	3.08	2.20	1.70
1994	0.20	7.27	1.41	3.04	1.88
1995	0.14	7.18	5.08	3.21	3.04
1996		3.19	1.87	1.31	1.43
1997		4.20	6.24	0.61	1.41
1998		5.96	10.11	1.42	2.39
1999		1.57	9.70	0.57	2.19
2000		4.48	18.37	0.18	1.68
2001	0.44	5.46	5.46	0.88	3.01
2002	0.06	1.61	4.80	0.38	1.33
2003	1.23	2.96	4.33	1.60	2.32
Total	0.54	1.71	4.41	2.16	1.45

Table 3: Estimated greater amberjack landings (A+B1) and associated coefficient of variation (CV) for shore, charterboat , private boat and the combined charterboat-headboat mode.

	Shore		Charterboat		Private boat		Charterboat + headboat		
Year	Landings	CV	Landings	CV	Landings	CV	Landings	CV	Total
1981					97,795	0.32	13,773	0.54	111,569
1982	12,307	0.87			149,066	0.35	479,900	0.78	641,274
1983					47,390	0.33	191,678	0.47	239,068
1984	7,073	0.71			4,477	1.00	89,008	0.56	100,558
1985					37,579	0.52	156,220	0.47	193,799
1986			254,003	0.24	97,892	0.26			351,895
1987	4,351	0.73	293,391	0.28	192,545	0.20			490,286
1988	25,078	0.49	140,579	0.31	79,549	0.20			245,206
1989	126,747	0.48	158,556	0.31	193,263	0.22			478,566
1990	1,278	0.47	23,735	0.53	38,616	0.44			63,629
1991	8,152	1.00	227,427	0.33	11,812	0.33			247,390
1992	53,487	1.00	123,756	0.20	33,649	0.17			210,891
1993	3,703	0.60	104,232	0.45	33,809	0.22			141,744
1994			83,733	0.25	19,025	0.26			102,758
1995			17,160	0.33	24,178	0.49			41,338
1996			49,111	0.42	32,243	0.25			81,353
1997			35,807	0.33	13,264	0.33			49,072
1998	13,149	0.99	19,139	0.09	8,828	0.28			41,115
1999	455	1.00	28,925	0.90	18,364	0.24			46,745
2000	3,796	0.58	36,853	0.80	17,785	0.25			58,434
2001			29,060	0.11	38,063	0.19			67,123
2002			73,973	0.06	41,143	0.17			115,115
2003			64,387	0.06	81,071	0.15			145,457
2004			54,211	0.06	48,540 0.18	0.18			102,751
Total	259,575		1,817,038		1,359,945		930,580		4,367,138

Table 4: Estimated landings by TPW by mode and year.

Year	Headboat	Charter Boat	Private Boat	Total
1983	64,449		2,397	66,846
1984	38,510		8,139	46,649
1985		372	3,157	3,529
1986		485	5,929	6,414
1987			4,434	4,432
1988		203	1,547	1,750
1989		813	1,169	1,982
1990			835	835
1991			1,816	1,816
1992			4,851	4,851
1993		16,858	344	17,202
1994			239	239
1995		76	337	413
1996		268	517	785
1997		472	969	1,441
1998		48	403	451
1999		55	277	332
2000		78	503	581
2001		450	753	1,203
2002		1,886	1,731	3,617
2003		1,603	1,264	2,867
Total	102,959	23,667	41,611	168,237

Table 5: Estimated greater amberjack landings (in numbers) by the Headboat fishery.

Year	FL	FL-AL	LA	TX	Total
1986	55,040	20,760	739	9,485	86,024
1987	22,688	20,623	402	9,179	52,892
1988	15,628	4,845	1,251	7,936	29,660
1989	17,052	25,693	216	9,560	52,521
1990	20,689	621	245	2,705	24,260
1991	4,836	1,489	1,097	2,430	9,852
1992	8,388	1,525	3,932	5,902	19,747
1993	5,614	761	2,989	4,689	14,053
1994	5,886	990	1,697	4,543	13,116
1995	2,129	599	1,456	4,486	8,670
1996	2,191	1,035	3,841	3,444	10,511
1997	2,960	691	945	2,942	7,538
1998	2,079	470	663	1,898	5,110
1999	2,462	954	990	880	5,286
2000	2,616	1,584	147	1,653	6,000
2001	1,579	806	2,142	1,482	6,009
2002	3,494	1,370	2,167	3,658	10,689
2003	3,178	1,790	2,699	4,309	11,976
Total	178,509	86,606	27,618	81,181	373,914

Table 6: Estimated greater amberjack discards (B2) and associated coefficient of variation (CV) for shore, charter boat, private boat and the combined charterboat-headboat mode.

	Shore		Charter boat		Private boat		Charterboat + headboat		
Year	Discards	CV	Discards	CV	Discards	CV	Discards	CV	Total
1981	14,952	0.91			5,132	0.60	0		20,084
1982	32,829	0.65			31,165	0.66	19,964	1.49	83,957
1983					64,649	0.83	15,141	1.08	79,790
1984					5,242	1.00	3,500	0.86	8,742
1985					0		0		0
1986			31,273	0.45	68,262	0.32			99,535
1987	5,773	0.81	10,278	0.47	25,549	0.50			41,600
1988			1,404	0.67	31,411	0.38			32,816
1989	75,621	0.50	7,866	0.61	81,690	0.49			165,177
1990	5,174	1.00	23,748	0.48	46,475	0.67			75,397
1991	17,046	1.00	223,034	0.32	29,290	0.40			269,370
1992	140,147	0.78	91,422	0.26	86,205	0.20			317,775
1993	17,808	0.32	109,152	0.21	68,609	0.25			195,570
1994	7,201	0.69	65,235	0.33	44,957	0.36			117,393
1995	4,649	0.61	10,986	0.53	55,997	0.26			71,632
1996	8,873	42.0	42,719	0.72	21,065	0.37			72,657
1997	1,541	1.00	22,723	0.42	21,428	0.26			45,692
1998	2,005	0.71	40,668	0.13	55,715	0.30			98,387
1999	4,033	0.62	44,006	0.09	51,201	0.23			99,240
2000	5,845	0.52	32,922	0.09	86,802	0.19			125,570
2001	20,401	0.89	56,422	0.09	387,050	0.21			463,872
2002	3,477	0.61	81,799	0.07	182,489	0.14			267,764
2003			56,882	0.07	171,092	0.17			227,974
2004	9,577	0.67	30,787	0.08	123,341	0.18			163,705
Total	376,951		983,326		1,744,815		38,605		3,143,697

5. MEASURES OF ABUNDANCE

5.1 Fishery-Dependent Indices

5.1.1 Commercial Fishery Catch Rates

SEDAR9-DW-10 used data from the National Marine Fisheries Service (NMFS) reef fish logbook program to develop greater amberjack abundance indices for the commercial longline and handline fisheries. Because for the period 1990-1992 only 20% of vessels registered in FL were sampled, indexes of abundance were estimated for the period 1993 onwards. Trips were selected for inclusion in the analyses of both fisheries based upon the species composition of the landings (Stephens and MacCall 2004). Trips were retained if this species composition reflected species usually associated with greater amberjack in the landings. This process was intended to select trips with a reasonable probability of catching greater amberjack, based upon some combination of location, timing, technique, habitat, etc.

5.1.2 Commercial Longline

The longline index was estimated from trips recording at least 10 sets per day or 1-day trips. This criteria was used to select only trips that reported total effort for the entire trips, instead of daily effort. The index of abundance selected for the analysis was lbs/100 hooks. The estimated standardized index of abundance showed no trend for 1993-1999 and a clear increasing trend afterwards (Figure 1.1). The Working Group recommended that the index could be considered for use in the assessment, subject to revisions described in section 4.3.

5.1.3 Commercial Handline

The selected unit of effort for the analysis of handline trips was hook-days (number of hooks used per line multiplied by the duration of the trip in days). Separate standardized indexes of abundance were estimated for handline vessels fishing with 1-9 and 10-40 hooks per line because these two groups are believed to target different species and their greater amberjack nominal indexes of abundance are very different (the catch rate of trips using 10-40 hooks per line is much lower). There was concern that a subset of vessels may strongly target greater amberjack, fishing in areas of high local abundance and returning when specific catch levels, perhaps dictated by dealer capacities, were achieved. This practice, if it exists, has the potential to adversely affect any relationship between catch rates and abundance trends. In order to investigate the possible effect of this practice, handline vessels which appear to strongly target greater amberjack in each year were identified (those returning with greater amberjack constituting greater than 80% of their landings on at least 3 trips in that year). For the 1-9 hooks per line trips, this effect on the index of abundance was investigated by estimating the index for all trip and for a subset of trips that excluded those vessels identified as targeting greater amberjack on a yearly basis. The estimated indexes for handline trips with 1-9 hooks per line for all trips and the subset of trips excluding vessels targeting greater amberjack showed the similar results. In general, these indexes showed inter-annual variability but without any discernable trend. The index estimated for trips using 10-40 hooks per line was less variable but it also showed no discernable trend. The Working Group recommended that the index of trips using 1-9 hooks per line and incorporating all vessels could be considered for use in the assessment, subject to revisions described in section 4.3. There appeared to be no need to exclude vessels identified as highly targeting and catch rates were likely too low and variable on trips using 10-40 hooks per line to be reflective of abundance trends.

5.2 Recreational Fishery Catch Rates

SEDAR9-DW-20 used data from the Marine Recreational Fisheries Statistics Survey (MRFSS), including modes private and charterboat only, and the NMFS Beaufort Headboat Survey to develop greater amberjack abundance indices for the recreational rod and reel fisheries. Trips were selected for inclusion in the analyses based upon the species composition of the landings (Stephens and MacCall 2004).

5.2.1 Marine Recreational Fisheries Statistics Survey Catch Rates

MRFSS data include fish landed and observed by the interviewer (A), dead fish not observed by the interviewer (B1; e.g., unavailable, filleted, used for bait, discarded dead at sea) and fish released alive (B2). Since the index was estimated on the total catch (A+B1+B2) instead of on landings, it was not necessary to account for changes in size (or, to a large extent, bag limit) regulations in the estimation of the indexes. The MRFSS standardized index showed very high and variable values in the part time of the series followed by a decline until 1998 when it reached the lowest value of the series. The index increased from 1998 to 2002 to decrease again in 2003-2004. The Working Group recommended that the index could be considered for use in the assessment, subject to revisions described in section 4.3.

5.2.2 Headboat Survey Catch Rates

The index for the headboat recreational fishery was estimated using data from full day trips. The possible effect of regulations on the catch rate was investigated by estimating indexes of abundance for the entire time series 1986-2003 and for the periods before and after the 1 fish bag limit was introduced in early 1996. The results, along with examination of the nominal catch frequencies, indicated that the implementation of the 1 fish bag limit did not have any effect on the standardized indexes. In general, headboat catch rates were very high in 1986 and showed a continuous decline until 1991 and it remained approximately constant until 1996 when a period of recovery started. Year 2003 showed a decline with respect to 2002. The Working Group recommended that the index could be considered for use in the assessment, subject to revisions described in section 4.3.

5.3 Recommendations

5.3.1 Indices to be considered for use in the assessment

As a general recommendation, the indices recommended for use from each fishery are those gulf-wide indices which employed the Stephens and MacCall (2004) approach to subsetting the data.

5.3.2 Data and/or analysis revisions

The protocol outlined by Stephens and MacCall (2004) results in observations which catch only greater amberjack on a trip were excluded from the data set. The analyses which developed the recommended indices departed from this protocol in that those observations were reintroduced into the analysis the data set. For consistency with the protocol and with the analyses for other species, the analyses should be rerun prior to the assessment with those observations excluded. It is expected that this would have minor influence on the trends and would not change the recommendations for these indices.

Data are now available from the Headboat Survey in 2004. These should be incorporated in the headboat analysis prior to the assessment.

The question of whether or not size limit changes may have impacted the indices should be revisited, incorporating information such as size frequency distributions, and included in the paper(s).

5.3.3 References:

Stephens, A. and A. MacCall. 2004. A multispecies approach to subsetting logbook data for purposes of estimating CPUE. Fisheries Research 70 (2004), 299–310.

5.4 Fishery Independent Indices

In preparation for the SEDAR, four fishery independent surveys were analyzed and indices of relative abundance developed. These were the Southeast Area Monitoring and Assessment Program (SEAMAP) shrimp/bottomfish surveys and their predecessors, the SEAMAP ichthyoplankton surveys, the SEAMAP reef fish survey, and the small pelagic trawl survey. The small pelagic data may be useful for extended distributional information, but is not a rigorous time series, and is not considered further here. The ichthyoplankton and reef fish surveys are intended to index spawning stock size. The trawl indexes are intended to index new recruitment.

5.4.1 SEAMAP Ichthyoplankton Surveys:

At this time, no larval abundance index for greater amberjack is available. *Seriola spp*. larvae are taken in both bongo and neuston nets during SEAMAP surveys. There are at least 3,500 specimens initially identified as *Seriola spp*., however these specimens will have to be re-examined to verify identification. This task cannot be accomplished before the stock assessment in August.

5.4.2 SEAMAP Reef Fish Survey:

The SEAMAP reef fish survey employs video cameras to estimate the abundance of fish associated with reefs and banks located on the continental shelf of the Gulf of Mexico. Fish traps are also employed to capture fish for aging. Details of survey design and estimates of abundance for greater amberjack are in the working paper. We recommend the use of design-based estimates of abundance for greater amberjack. There was no advantage to using the model-based estimates because no gaps were present in the survey time series that could be accounted for using a GLM approach. The size of the fish observed during the survey come from two sources, fish captured in traps and fish measured on video tape with lasers. Lasers were first introduced in 1995. However, since both the capture of fish in traps, and the instances where fish are hit by lasers was infrequent, size distributions were not estimated. We report only the average size and size range of fish. Survey indices are in working paper SEDAR9-DW21 (Figure 1.2). No greater amberjack were captured in fish traps so size was determined only with lasers. The size of greater amberjack observed ranged from 265 mm FL to 1563 mm FL. Therefore the video survey observes fish age 0+. The results of a 2004 survey will be added. These will be provided prior to the August stock assessment by Chris Gledhill, NMFS Pascagoula, MS.

5.4.3 SEAMAP Trawl Surveys:

Portions of the procedures used in SEDAR7 to derive trawl survey indexes of abundance for red snapper (those in SEDAR7-DW-1) were applied to greater amberjack, and reported in SEDAR9-DW-27. Greater amberjack are uncommon in the survey data, with abundances too low for the procedures of SEDAR7-DW-2, used to link separate time series into extended fall and summer indexes, to be useful. Therefore, the analyses reported only separate 'base index' values for each time series in the data base. In many years, greater amberjack did not occur at all in the surveys. Except for possibly looking at something like frequencies of occurrence over blocks of years, the survey data will probably not be useful in the amberjack assessment. Size composition data were collected from 1987 on. What size data there are for amberjack look consistent with a single vulnerable year class, with a peak at about 200 mm in the summer, and 300 mm in the fall (SEDAR9-DW-18).

5.5 Summary of Outstanding Items:

The only outstanding item for fishery independent indexes for greater amberjack is an update of the Reef Fish survey – addition of the 2004 point (Gledhill).

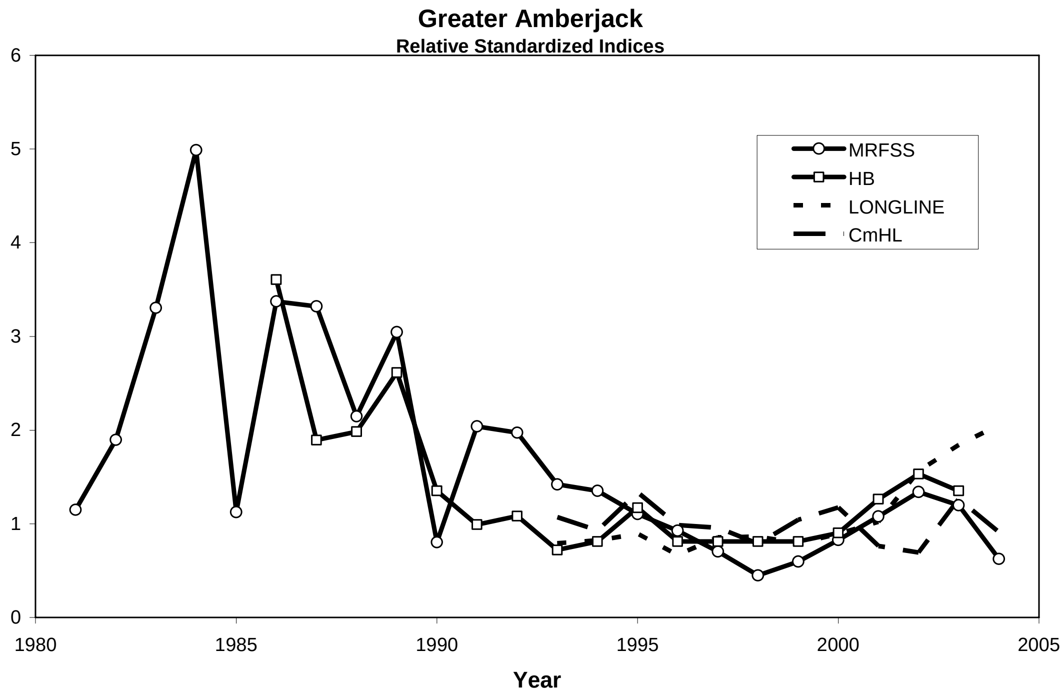

Figure 1.1: Relative standardized indices of Gray Triggerfish from the MRFSS, Headboat (HB), Longline and Commercial Handline (CmHL) fishery dependent surveys.

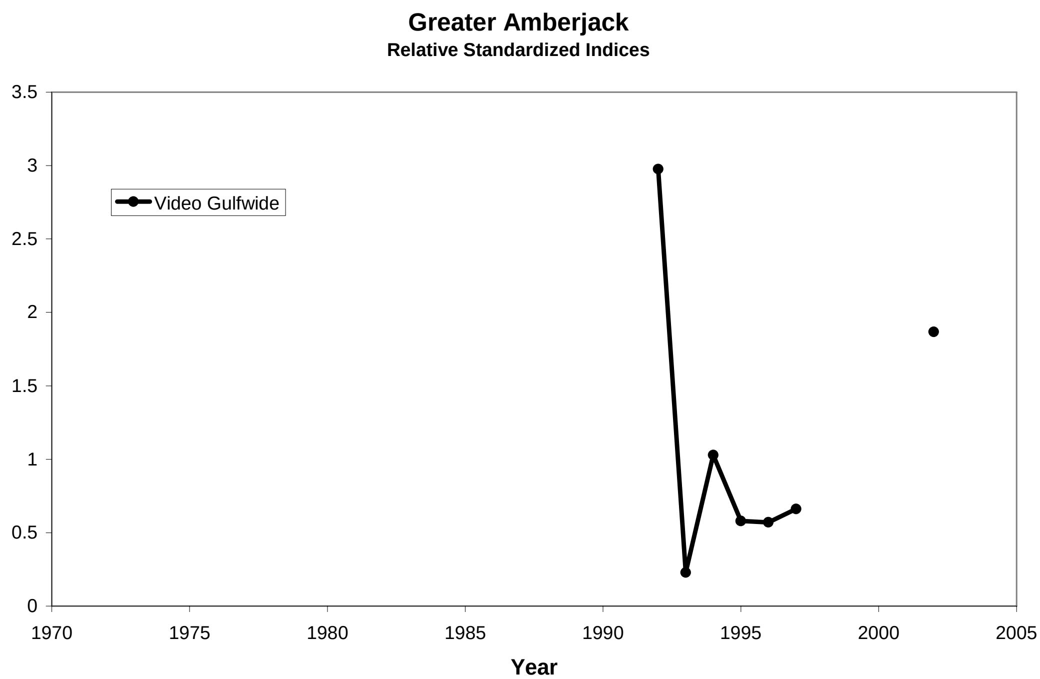

Figure 1.2: Relative standardized indices from the Gulf-wide Reef Fish Video fishery independent survey.