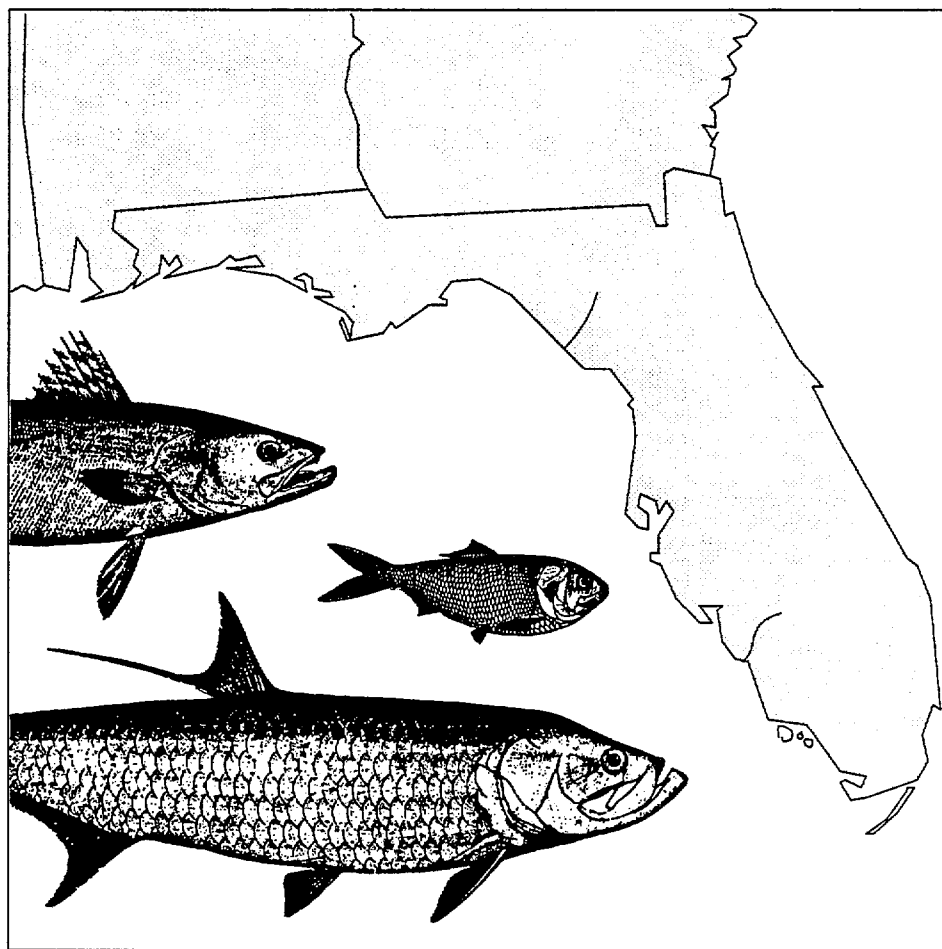


NOAA's Estuarine Living Marine Resources Project

*Distribution and Abundance of
Fishes and Invertebrates in
Eastern Gulf of Mexico Estuaries*



June 1990

*U.S. Department of Commerce
National Oceanic and Atmospheric Administration
National Ocean Service*

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NOAA's Estuarine Living Marine Resources Project

In June 1985, the National Oceanic and Atmospheric Administration (NOAA) began a project to develop a comprehensive information base on the life history, relative abundance and distribution of fishes and invertebrates in estuaries throughout the Nation (Monaco 1986). This project, the Estuarine Living Marine Resources (ELMR) project, is conducted jointly by the Strategic Assessment Branch (SAB) of the Office of Oceanography & Marine Assessment and laboratories of the National Marine Fisheries Service (NMFS). Currently, the Pt. Adams (Hammond), OR; Galveston, TX; Beaufort, NC; and Oxford, MD laboratories are compiling information for the contiguous West Coast, Gulf of Mexico, Southeast, and Northeast regions.

To date, the project has compiled data for 115 species found in 73 estuaries. Four reports have been published: State of Washington (Monaco and Emmett 1988); State of Texas (Monaco et al. 1989); West Coast Volume I: Data Summaries (Monaco et al. 1990); and this volume. Also scheduled for publication in 1990 are the Central Gulf of Mexico (Mississippi Sound, MS through Calcasieu Lake, LA); the Southeast (Albemarle Sound, NC, through Biscayne Bay, FL) and the West Coast *Volume II: Life History Profiles*.

Three salinity zones as defined in Volume 1 of NOAA's *National Estuarine Inventory Data Atlas* (NOAA 1985) provided the spatial framework for organizing information on species distribution and abundance within each estuary. These salinity zones are tidal fresh (0.0 to 0.5 ppt), mixing (0.5 to 25.0 ppt), and seawater (25.0 and greater ppt). The primary data developed for each species for each salinity zone include spatial and temporal distribution and relative abundance by life stage, e. g., adult, spawning or mating, juvenile, larva, and egg. In addition, a detailed estuarine life history profile is developed for each species.

Additional information on this or other projects of the Strategic Assessment Branch is available from:

Strategic Assessment Branch
Office of Oceanography and Marine Assessment
National Oceanic and Atmospheric Administration
6001 Executive Blvd., Rm. 220
Rockville, Maryland 20852
(301) 443-0453

Reports available from NOAA's Estuarine Living Marine Resources project include:

Monaco, M. E., et al. 1989. Distribution and Abundance of Fishes and Invertebrates in Texas Estuaries. ELMR Rpt. No. 3. Strategic Assessment Branch, NOS/NOAA. Rockville, MD. 107 p.

Monaco, M. E., et al. 1990. Distribution and Abundance of Fishes and Invertebrates in West Coast Estuaries, Volume I: Data Summaries. ELMR Rpt. No. 4. Strategic Assessment Branch, NOS/NOAA. Rockville, MD. 240 p.

Bulger, A. J., et al. 1990. A Proposed Estuarine Classification: Analysis of Species Salinity Ranges. ELMR Rpt. No. 5. Strategic Assessment Branch, NOS/NOAA. Rockville, MD. 28 p.

Williams, C. D., et al. 1990. Distribution and Abundance of Fishes and Invertebrates in Eastern Gulf of Mexico Estuaries. ELMR Rpt. No. 6. Strategic Assessment Branch, NOS/NOAA. Rockville, MD. 105 p.

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Abstract: The report presents information on the spatial and temporal distribution, relative abundance, and life history characteristics of 36 fish and invertebrate species in 13 estuaries along the Eastern Gulf of Mexico coast. Its purpose is to disseminate data developed in NOAA's Estuarine Living Marine Resources (ELMR) project.

ELMR is a joint study between NOAA's National Ocean Service and the National Marine Fisheries Service. The study framework, sample data sheets, and species life history profiles presented are illustrative of the nationwide ELMR project.

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Distribution and Abundance of Fishes and Invertebrates in Eastern Gulf of Mexico Estuaries

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Introduction

This report presents information on the spatial and temporal distribution, relative abundance, and life history characteristics of 36 fish and invertebrate species in 13 estuaries along the Eastern Gulf of Mexico coast. Its purpose is to disseminate data developed in NOAA's *Estuarine Living Marine Resources* (ELMR) project (inside front cover). ELMR is a joint study between NOAA's National Ocean Service and the National Marine Fisheries Service. The study framework, sample data sheets, and species life history profiles presented are illustrative of the nationwide ELMR project.

The objective of ELMR is to develop a consistent data base on the distribution and abundance of selected fishes and invertebrates in the Nation's estuaries. The nationwide data base is divided into four regions (Figure 1). The relative abundance and monthly occurrence of life stages are recorded by estuary for three salinity zones (seawater zone, mixing zone, and tidal fresh zone) identified in NOAA's National Estuarine Inventory (NEI) Data Atlas - Volume I (NOAA 1985). When completed, the data base will contain information for approximately 150 fish and invertebrate species found in over 120 U. S. estuaries.

Why Conduct ELMR?

Estuaries are among the most productive natural systems (Odum and Heald 1975, Mann 1982). The physical, chemical, and biological components of estuaries are critical to many living resources (Gunter 1967, Weinstein 1979). They are important nursery areas that provide food, refuge from predation, and valuable habitat for many species (Joseph 1973). Estuarine organisms that support important commercial and recreational fisheries include sciaenids, crabs and shrimp. In spite of the well-documented importance of these areas to fish and invertebrate populations, few consistent and comprehensive data sets exist that allow examination of the relationships of many estuarine species found in or among groups of estuaries. Most information on the distribution and abundance of estuarine-dependent species is for their offshore life stages where major sampling programs have focused, and does not describe estuarine distributions adequately (Darnell et al. 1983, NOAA 1988).

Only a few comprehensive sampling programs, e.g. Texas (McEachron and Green 1984, Hammerschmidt and McEachron 1986) collect organisms with identical methods across groups of estuaries within a region. Because of the variability in sampling strate-

Figure 1. ELMR regions.



gies, much of the existing estuarine fisheries data cannot be compared among estuaries. In addition, existing programs do not focus on how groups of estuaries may be important for regional management of fishery resources. Most existing estuarine data are for a relatively few important commercial and recreational species.

Since life stages of many species use both estuarine and marine habitats, it is necessary to combine information on distribution, temporal utilization, and life history strategies to understand the linkages of estuaries to nearshore/offshore areas. To date, a national, comprehensive, and consistent data base of this type does not exist. Consequently, there is a need to develop a framework that integrates the fragments of information on marine and estuarine species and their associated habitats into a useful, comprehensive, and consistent structure. NOAA's ELMR project was designed to help fulfill this need by developing a uniform, nationwide data base on as many estuarine species as possible. Results will complement other NOAA efforts to develop a national estuarine assessment capability (NOAA 1985) and oceanic fishery sampling programs (e. g. Sherman and Alexander 1985). Compiling this information also helps to identify data gaps and allows an assessment of the content and quality of existing information.

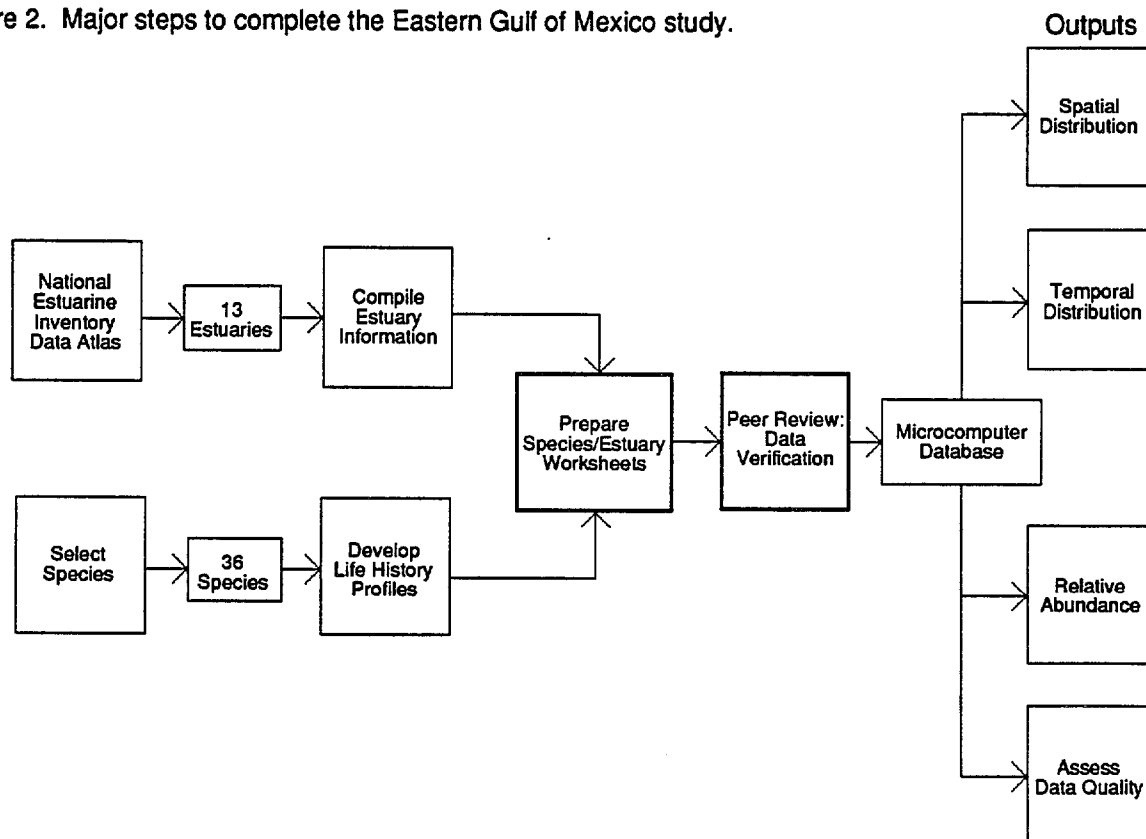
Data Collection and Organization

Figure 2 shows the major steps taken to collect and organize information on the distribution and abundance of fishes and invertebrates in Eastern Gulf of Mexico estuaries.

Selection of estuaries. Estuaries in the Eastern Gulf of Mexico were selected from the *National Estuarine Inventory Data Atlas - Volume I* (NOAA 1985). Although it is not included in the NEI Data Atlas, Florida Bay was included in the ELMR project because of its biological importance. The 13 estuaries chosen for the ELMR Eastern Gulf of Mexico Study are listed in Figure 3.

Data on the spatial and temporal distributions of species were developed and organized based on the tidal fresh [0.0 to 0.5 parts per thousand (ppt)], mixing (0.5 to 25.0 ppt), and seawater (25.0 ppt and greater) zones delineated for each estuary in the NEI. Each salinity zone is present in all 13 estuaries, except the seawater zone is absent from the Caloosahatchee River. A representative map and data table (Mobile Bay) from the NEI Data Atlas is shown in Appendix 3.

Figure 2. Major steps to complete the Eastern Gulf of Mexico study.



Compiling large amounts of data limits the amount of information that can be organized and presented for each species/estuary combination. It would be time and cost prohibitive to map each species by life stage for each estuary (Monaco 1986). Thus, the salinity zone framework allows the available information on estuarine fish and invertebrate distribution to be consistently compiled and organized.

Selection of Species. Four criteria were used to identify the 36 species studied in detail. Data were most available for species that were either commercially or recreationally important. Data were also available for species that are of ecological value or are indicators of environmental stress. A species list was developed and peer reviewed to ensure that the most "important" species were studied (Table 1). The four criteria were:

1) **Commercial value** - determined by review of catch data and value statistics from NMFS, e.g., gulf menhaden (*Brevoortia patronus*) and shrimp (*Penaeus* spp.).

2) **Recreational value** - defined as a species that recreational fishermen specifically try to catch, that may or may not be of commercial importance. Recreational species were determined by consulting regional experts and NMFS reports, e.g., spotted seatrout (*Cynoscion nebulosus*) and red drum (*Sciaenops ocellatus*).

3) **Indicator species of environmental stress** - identified from the literature, discussions with fisheries experts, and from monitoring programs such as NOAA's National Status and Trends Program (NOAA 1984). These species are mollusks or bottom fishes that consume benthic invertebrates or have a strong association with bottom sediments. Their physiological disorders, morphological abnormalities, and bioaccumulation of contaminants such as heavy metals indicate environmental pollution and/or stress, e.g., Atlantic croaker (*Micropogonias undulatus*) and American oyster (*Crassostrea virginica*).

4) **Ecological value** - based on several attributes, including trophic level, relative abundance and importance as a key predator or prey species, e.g., bay anchovy (*Anchoa mitchilli*). Endangered species were also taken into consideration, e.g., Alabama shad (*Alosa alabamae*).

Species Profiles. A concise life history profile for each species was developed to provide an overview of how it utilizes estuaries. The profiles were essential in understanding the distribution of each species. Although many species profiles have been published previously, they often describe estuarine life stages inadequately. Therefore, the profiles developed emphasized estuarine ecology, salinity and temperature ranges, and life history information for estuarine-dependent life stages. A representative species profile for blue crab (*Callinectes sapidus*) is shown in Appendix 4.

Figure 3. ELMR Eastern Gulf of Mexico estuaries.

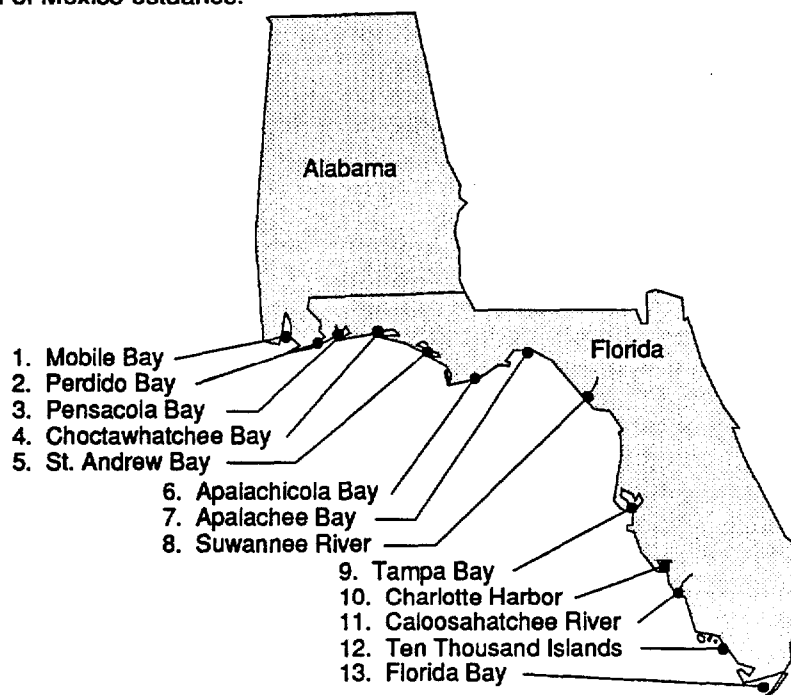


Table 1. Eastern Gulf of Mexico species list

Scientific Name	Common Name
<i>Argopecten irradians</i>	bay scallop
<i>Crassostrea virginica</i>	American oyster
<i>Rangia cuneata</i>	common rangia
<i>Mercenaria</i> species	hard clam
<i>Penaeus aztecus</i>	brown shrimp
<i>Penaeus duorarum</i>	pink shrimp
<i>Penaeus setiferus</i>	white shrimp
<i>Palaemonetes pugio</i>	grass shrimp
<i>Panulirus argus</i>	spiny lobster
<i>Menippe adina</i>	gulf stone crab
<i>Menippe mercenaria</i>	stone crab
<i>Callinectes sapidus</i>	blue crab
<i>Megalops atlanticus</i>	tarpon
<i>Alosa alabamae</i>	Alabama shad
<i>Brevoortia patronus</i>	gulf menhaden
<i>Brevoortia smithi</i>	yellowfin menhaden
<i>Anchoa mitchilli</i>	bay anchovy
<i>Cyprinodon variegatus</i>	sheepshead minnow
<i>Fundulus grandis</i>	gulf killifish
<i>Centropomus undecimalis</i>	snook
<i>Pomatomus saltatrix</i>	bluefish
<i>Caranx crysos</i>	blue runner
<i>Caranx hippos</i>	crevalle jack
<i>Trachinotus carolinus</i>	Florida pompano
<i>Lutjanus griseus</i>	gray snapper
<i>Lagodon rhomboides</i>	pinfish
<i>Cynoscion arenarius</i>	sand seatrout
<i>Cynoscion nebulosus</i>	spotted seatrout
<i>Leiostomus xanthurus</i>	spot
<i>Micropogonias undulatus</i>	Atlantic croaker
<i>Sciaenops ocellatus</i>	red drum
<i>Mugil cephalus</i>	striped mullet
<i>Gobiosoma robustum</i>	code goby
<i>Scomberomorus maculatus</i>	Spanish mackerel
<i>Paralichthys albigutta</i>	gulf flounder
<i>Paralichthys lethostigma</i>	southern flounder

Data Sheets. A data sheet was developed for each species for each estuary to enable quick compilation and simple presentation of the data. Figure 4 shows the data sheet for sand seatrout (*Cynoscion arenarius*) in Mobile Bay. A draft of each data sheet was developed by project staff and reviewed by local experts. Data compiled for each species include: 1) the salinity zone it occupies (seawater, mixing, or tidal fresh); 2) monthly distribution in those zones; and 3) life stage(s) in a particular zone and their relative abundance level. The ELMR data sheets are entered into a microcomputer data base management system.

The relative abundance of a species in an estuary was classified using the following categories:

- **Not present:** species or life history stage not found, questionable data as to identification of species, and/or recent loss of habitat or environmental degradation suggests absence.
- **No information available:** no existing data available, and after expert review it was determined that not even an educated guess would be appropriate.
- **Rare:** species is definitely present but not frequently encountered.
- **Common:** species is frequently encountered but not in large numbers; does not imply a uniform distribution over a specific salinity zone.
- **Abundant:** species is often encountered in substantial numbers relative to other species.
- **Highly abundant:** species is numerically dominant relative to other species.

Adults were defined as sexually mature individuals, juveniles as immature but otherwise similar to adults, and spawning as release of eggs and sperm. A few exceptions existed, such as mating in crabs and spiny lobster.

For well-studied species such as shrimp, it was possible to use quantitative data to estimate abundance levels. For many species, however, reliable quantitative data were limited. Therefore, regional and local experts were consulted to estimate relative abundance based on the above criteria. These data represent relative abundances within a specific estuary. Relative abundance levels across Eastern Gulf of Mexico estuaries could not be determined.

Data Verification. Approximately three years were required to develop the 468 data sheets (Figure 4) and consult with regional and local experts for the 13 estuaries studied. Ninety-five percent of the data sheets were carefully reviewed during consultations or by mail. These important consultations complemented the literature and published data sets compiled by NOAA. Forty-four scientists and managers at 24 institutions were consulted. The names and affiliations of these experts are listed in Appendix 6. Local experts were especially helpful in providing estuary/species-specific information. They also provided additional references and contacts and identified additional species to be included in the ELMR data base.

Results of Study

Data summaries. Information compiled for each species and estuary (468 data sheets) was organized in four data summaries (pp. 17-75). Tables 2 and 3 provide graphic presentations of the spatial and temporal distribution and relative abundance by life stage for each species and estuary. The information shown represents the usual distribution of a species in a particular estuary. Table 4 ranks the relative reliability of the information presented for each species and estuary.

Spatial distribution and relative abundance. Table 2 summarizes the distribution and relative abundance by life stage for each species by salinity zone in each estuary. The highest level of abundance during the year in each estuary is depicted.

Temporal distribution. Table 3 summarizes the temporal distribution of each species by month and life stage for each estuary. This table combines data over the three salinity zones, showing the highest level of abundance for a particular life stage by month.

Presence/absence data. Although each life stage of a species is assigned one of five levels of relative abundance (not present, rare, common, abundant, or highly abundant), Tables 2 and 3 do not distinguish between "rare" and not "present". This was done because management of estuarine fisheries often does not direct efforts towards rare species. To distinguish between "rare" and not "present", Table 5 presents information on the presence/absence of species/life stages by salinity zone. If a life stage of a species had a relative abundance level of rare or greater within an estuary, it was considered present.

Figure 4. Example of a species/estuary data sheet: sand seatrout in Mobile Bay.

Sand seatrout <i>Cynoscion arenarius</i>		Mobile Bay Alabama Investigator: L. R. Settle												
Salinity Zone	Life Stage	Relative Abundance by Month												R
		J	F	M	A	M	J	J	A	S	O	N	D	
Tidal Fresh 0.0 - 0.5 ppt	Adults													2
	Spawning													1
	Juveniles													2
	Larvae													2
	Eggs													1
Mixing 0.5 - 25.0 ppt	Adults													2
	Spawning													2
	Juveniles													2
	Larvae													2
	Eggs													2
Seawater >25.0 ppt	Adults													2
	Spawning													2
	Juveniles													2
	Larvae													2
	Eggs													2

= Not Present

= No Data

= Rare

= Common

= Abundant

= Highly Abundant

Data Reliability (R):

1 = Highly Certain

2 = Moderately Certain

3 = Reasonable Inference

Figure 5. Numbers of species ranked as common or greater in mixing zone, by season and by estuary.

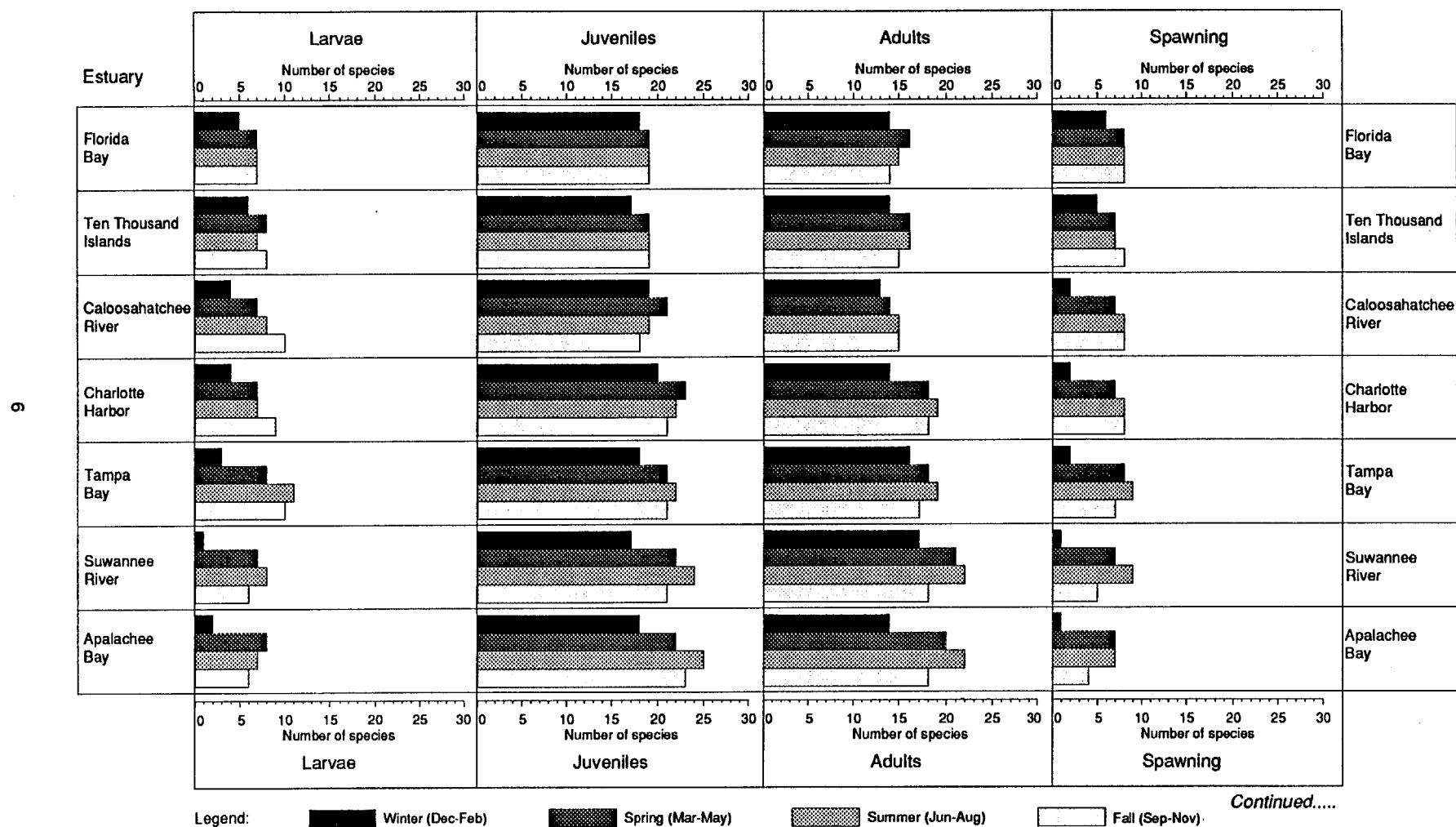


Figure 5 (continued). Numbers of species ranked as common or greater in mixing zone, by season and by estuary.

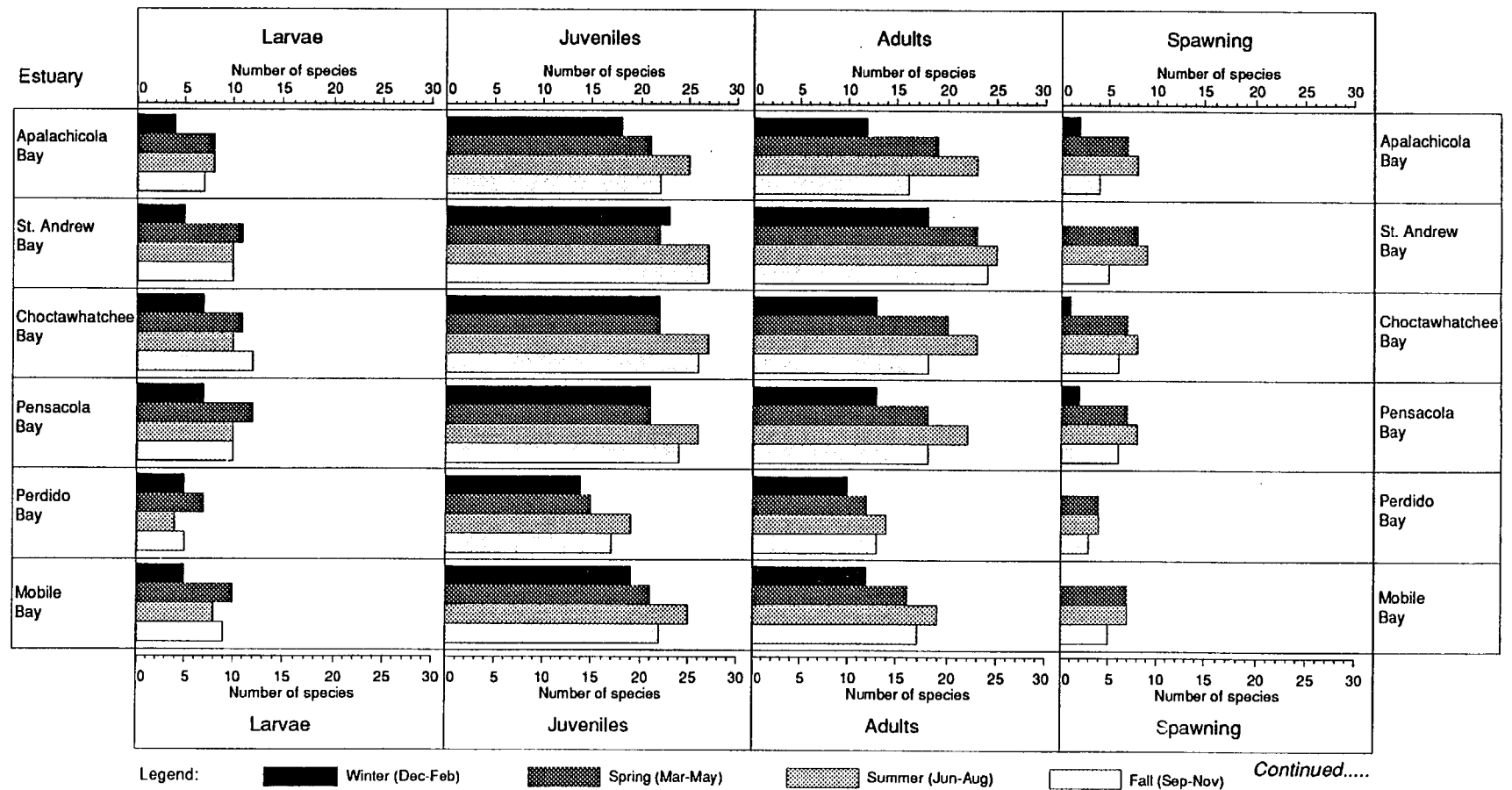


Figure 5 (continued). Numbers of species ranked as common or greater in seawater zone, by season and by estuary.

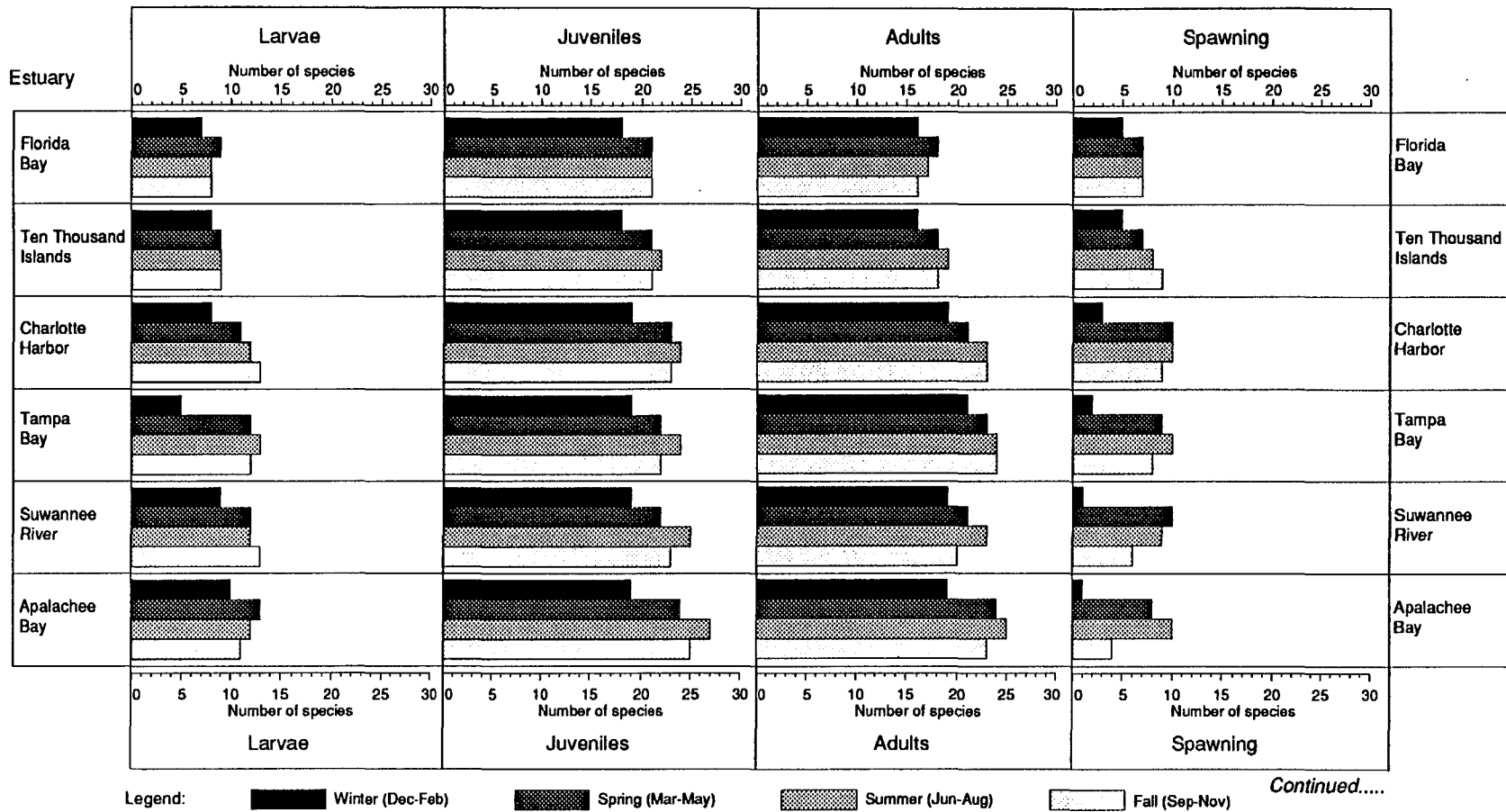


Figure 5 (continued). Numbers of species ranked as common or greater in seawater zone, by season and by estuary.

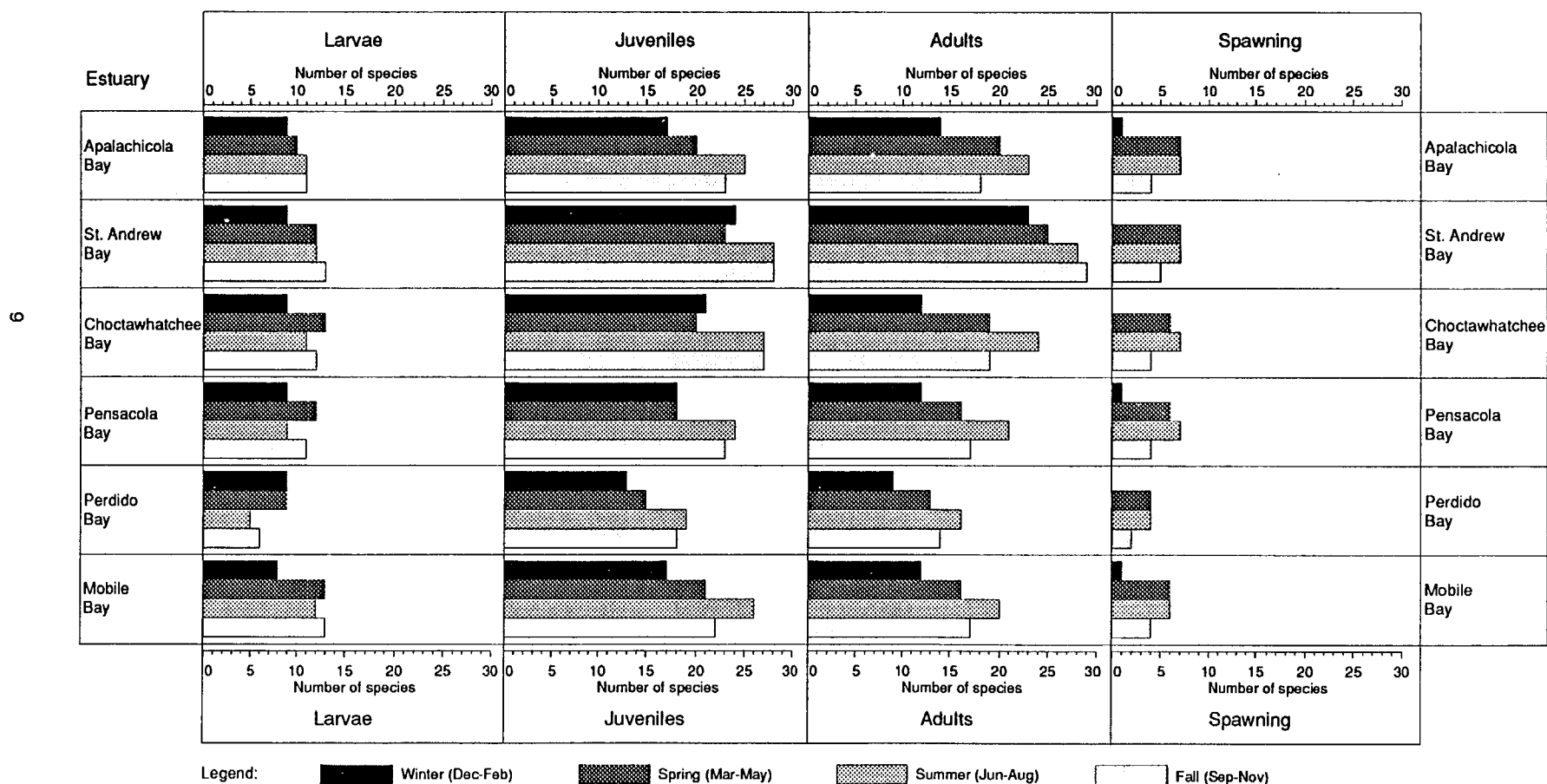
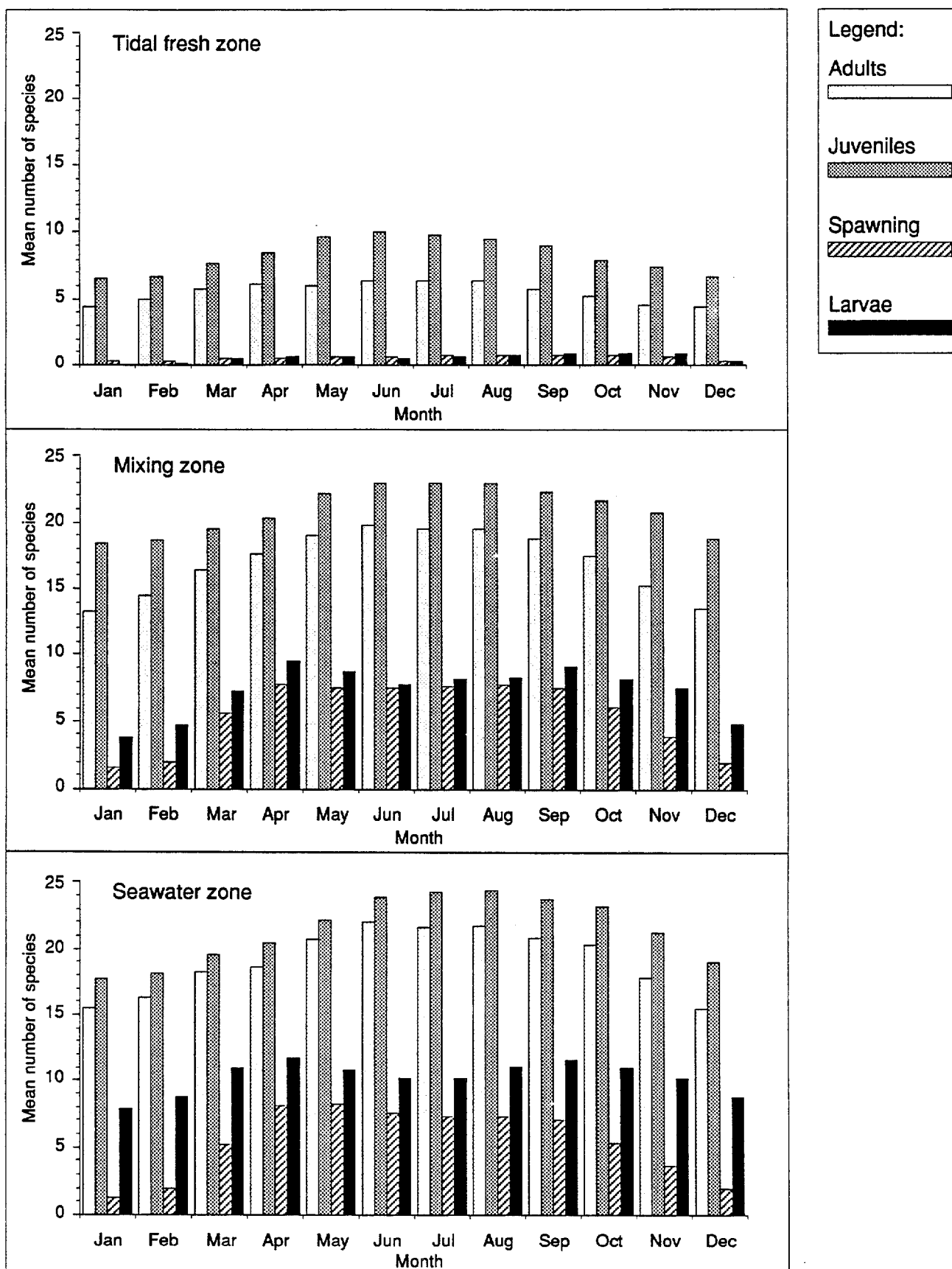


Figure 6. Mean number of species (averaged across estuaries) with relative abundance of common or greater, by salinity zone, life stage, and month.

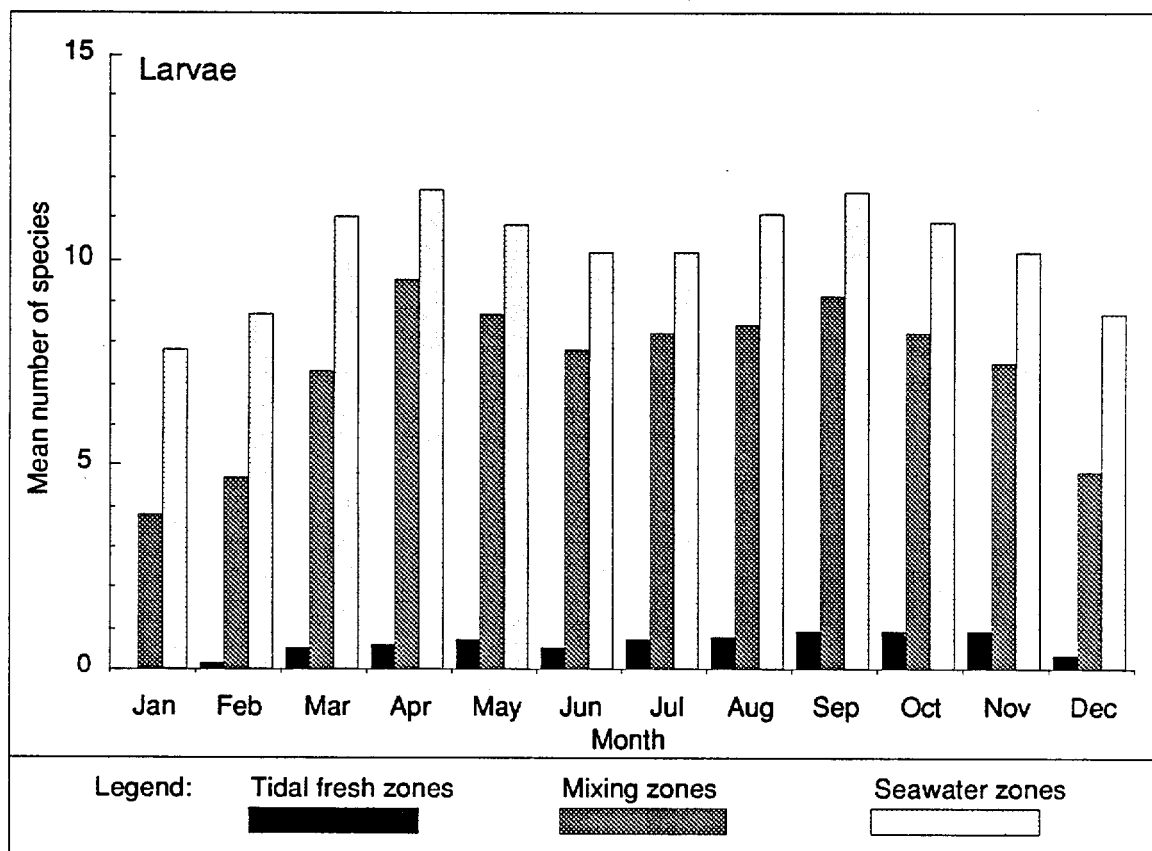


Seasonal Comparisons. To examine general seasonal abundance patterns, the number of species ranked as "common" or greater were counted for each life stage by month and by salinity zone for winter (Dec-Feb), spring (Mar-May), summer (Jun-Aug), and fall (Sep-Nov) (Figures 5, 6, and 7). In Figure 5, the number of species was averaged across months and within seasons, allowing a comparison of estuaries. In Figure 6, the number of species was averaged across estuaries and plotted by month. Although not a statistical analysis of abundances, these summaries do provide insights into the seasonal distribution of selected species in these estuaries:

- Fewer species utilize Eastern Gulf of Mexico estuaries in the winter than in any other season. Estuarine utilization by all life stages is highest in the spring and summer (Figures 5 and 6).
- The number of species varies least from season to season in the southern Florida estuaries, i.e. Florida Bay to Tampa Bay (Figure 5).

- The number of larval species displays a bimodal temporal distribution with peaks in April and September (Figure 7).
- In any given month, more juvenile species utilize these estuaries than any other life stage (Figures 5 and 6).
- Many estuarine-dependent species spawn in marine waters. Thus, of the five life stages, the fewest species were present as eggs and for spawning (Figure 5 and 6). The scarcity of these two life stages may also be a result of limited studies on spawning and ichthyoplankton in estuaries.
- The number of species is lowest in Perdido Bay (Figure 5, see discussion on page 14).
- The number of species appears to be lowest in the tidal fresh zone (Figure 6). However, this may be because the selected ELMR species are primarily estuarine, not freshwater. Also, few studies exist for a large number of estuaries and species in tidal fresh waters, so any true patterns are difficult to define.

Figure 7. Mean number of species as larvae (averaged across estuaries), by month and salinity zone.



Biogeography. A transition of species' presence/absence between northern and southern Florida has been documented (Roessler 1970, Gilmore 1977) and is probably the result of a climatological transition between a temperate and a subtropical environment. The faunal transition zone is considered to extend east/west across central Florida, corresponding with the Indian River Lagoon and Tampa Bay estuaries. Several species in the ELMR Eastern Gulf of Mexico data base display geographical heterogeneity and seem to support the observed central Florida transition zone. Of the stone crabs (*Menippe* species), *M. mercenaria* is the prevalent species from Florida Bay north through Tampa Bay. A zone of hybridization occurs between Suwannee River and Apalachicola Bay, and *M. adina* is dominant west of Apalachicola Bay (Bert, T., 1987, Florida DNR, personal communication). The spiny lobster (*Panulirus argus*) is rare in estuaries north of Tampa Bay while white shrimp (*Penaeus setiferus*) is present only from the Suwannee River estuary north and westward.

A number of fishes have distributional patterns similar to the invertebrates. Alabama shad (*Alosa alobamae*) is only present from Suwannee River through Mobile Bay, while snook (*Centropomus undecimalis*) is absent from Suwannee River westward. Yellowfin menhaden (*Brevoortia smithi*) occur primarily from Florida Bay north to Tampa Bay, whereas gulf menhaden (*B. patronus*) occur primarily from Tampa Bay north and westward. Southern flounder (*Paralichthys lethostigma*), while rare in southern Florida estuaries, is common from Suwannee River to Mobile Bay.

Data Content and Quality

An important aspect of this study, especially since it was based primarily on published and unpublished literature and consultations, was to determine the quality of data used. A deliberate effort was made to assess the overall reliability of the data base so that the information could be used appropriately. Depending on questions to be addressed, some data may not be suitable to use. Estimates of the reliability of the distribution and abundance information organized by species, life stage, and estuary are presented in Table 4. The following criteria were used to assess data reliability:

Highly certain: Considerable sampling data available. Distribution, ecology, and preferred habitats well-documented within an estuary.

Moderately certain: Some sampling data available for an estuary. Distribution, preferred habitat, and ecology well-documented in similar estuaries.

Reasonable inference: Little or no sampling data available. Information on species distributions, ecology, and preferred habitats documented in similar estuaries.

The quality and quantity of available data vary by species and by estuary. For example, a large amount of information is available on shrimp because they are economically valuable. In general, the lowest quality of data and the least amount available are for spawning, egg, and larval stages. Except for a few species (e.g., brown shrimp), very little research has focused on habitat preferences and environmental tolerances. This is particularly true for the smaller forage and/or non-commercial fishes and invertebrates. Gear selectivity, inability to correctly identify larval stages and difficulty in sampling various habitats limit the reliability of this information. In addition, regional life history data are lacking on some commercially important sciaenid and pelagic species.

Data reliability was also based on experimental design and whether the studies were relatively recent. For example, several recent studies on Florida Bay fish communities, ichthyoplankton populations, and habitat assemblages provide extensive, up to date information (Powell et al. 1987, Thayer et al. 1987, Thayer and Chester 1989). In the case of limited studies, information was inferred.

Since the amount and quality of available information vary by species, by life stage, by estuary, and even within an estuary, considerable scientific judgment is required to derive or infer spatial and temporal distributions from existing data and literature. Unfortunately, even the most informed judgment is far from perfect due to the complexity of estuarine systems. Consequently, information on the level of certainty associated with each data element must be presented (Table 4). Appendices 3, 4, and 5 provide a complete summary of the references and personal communications used so that readers can track and obtain additional information efficiently.

Variability in Space and Time. Species data were organized according to the salinity zone boundaries identified for each estuary in the *NEI Data Atlas - Volume 1* (NOAA 1985). However, these salinity zones are highly variable due to interacting factors that affect salinity, such as variations in freshwater inflow, wind, and tides. It was assumed that if the area of a particular salinity zone increases or decreases, the distribution of a mobile species in that

zone will correspondingly shift. For example, if increased freshwater inflow shifts the tidal fresh zone further down the estuary, the distribution of a species confined to that zone increases accordingly. For euryhaline species, a distributional shift may or may not occur. The placement of species in a salinity zone was ultimately determined by where they have been observed or captured.

Species temporal distributions are often dependent on annual climatic conditions and water currents. Monthly distribution patterns were based on the consistent presence of a life stage within a particular month. If a species is present in an estuary only in unusual years (e.g., as a result of drought), it was not considered present. However, if a species is typically found, even during a restricted time period, it was considered present. Greater temporal resolution, such as on a biweekly rather than on a monthly basis, was not possible.

Abundance Data. Except for a few important commercial and recreational species, little or no quantitative information was available to determine the relative abundance of species across estuaries. Therefore, relative abundance estimates were made compared to other species within a specific estuary. For well-studied species, such as juvenile sciaenids or penaeids, quantitative data were used to estimate the level of abundance within an estuary. However, in most cases the level of abundance assigned to a species was determined by asking regional and local biologists for expert opinions based on their knowledge of individual species within an estuary. This effort complemented quantitative studies, and greatly increased reliability of abundance information.

The quality of relative abundance information varied between estuaries as well as species. As a result, temporal resolution was greater in well-studied estuaries, e.g. blue crab in Mobile Bay. Nevertheless, the relative abundance data shown in the data summaries are the best that could be synthesized from agency reports, academic studies, and expert reviews.

Life History Notes. Because of the complex life histories of some species, the following comments are provided below to clarify and supplement information presented in the data summary tables. Also, a brief discussion of data for Perdido Bay is presented due to generally poor water quality and its effect on biota.

Invertebrates. Sessile invertebrates, such as clams and oysters, usually have a patchy rather than a general distribution. Therefore, areal distribution of

these organisms may be overestimated, but the salinity zones of colonization are identified. Specific areas may contain acceptable salinity regimes, but suitable bottom habitat for colonization may not exist. Specific habitat requirements and life history characteristics of a number of invertebrate species are provided below:

- *Bay scallop:* Usually associated with seagrass beds.
- *Rangia:* All life stages occur in salinities below 25 ppt.
- *Hard clam:* Most life stages occur in salinities above 20 ppt.
- *Penaeid shrimp:* Postlarvae and juveniles are the critical life stages utilizing estuaries. Most adults move to nearshore spawning grounds, where spawning, egg development, and most larval development occur.
- *Grass shrimp:* Fertilized eggs are held on the female's pleopods until hatching.
- *Gulf stone crab:* Usually found in salinities greater than 20 ppt. Males are typically located in nearshore waters, but migrate into estuaries for mating.
- *Blue crab:* Mating usually takes place in low salinities of the tidal fresh to upper region of the mixing zone. After mating, females move to the seawater zone, while males often remain in the upper reaches of the estuary. The females brood the eggs (sponge females), and larvae are released in higher salinities. Development through the late zoeal stages occurs offshore. Megalopae are recruited back into the estuary and disperse throughout the salinity zones. As they approach maturity, blue crabs seek lower salinities. There appears to be a primary spawning ground located in the Apalachicola Bay region that serves as a source area for the entire Florida peninsular Gulf coast blue crab fishery. A hypothesis for redistribution of larvae to southwestern Florida includes transport through circulation patterns associated with the Loop current and the Apalachicola River (Oesterling and Adams 1982).

Fishes - Aggregating species by salinity zone uses a single fundamental habitat parameter. However, a combination of habitat characteristics, such as bottom type, water temperature, and bathymetry, would more accurately indicate species spatial and tempo-

ral distributions. Specific habitat requirements and life history characteristics of a number of fishes are presented here:

- *Tarpon*: Spawning and eggs occur offshore. Juveniles and larvae use the estuaries as a nursery ground, and are often found in low salinity waters.
- *Alabama shad*: Included in the ELMR study because it is an endangered species.
- *Menhaden*: Spawning occurs from the coastline to six miles offshore. Gulf and yellowfin menhaden may hybridize where their ranges overlap.
- *Crevalle jack and blue runner*: The juvenile and adult stages are found in estuaries, but all other life stages are in offshore waters.
- *Florida pompano*: Typically found in nearshore surf and inlet waters, but juveniles and adults sometimes enter the bays. Spawning, eggs and larvae are distributed offshore.
- *Gray snapper*: Larvae and juveniles are typically associated with vegetation in estuaries, particularly seagrass beds and mangroves. Spawning and eggs usually occur offshore.
- *Pinfish*: Juveniles and adults are the predominant life stage within estuaries. Spawning and eggs occur offshore. Larvae are transported into estuaries, but may attain juvenile size before they enter.
- *Sciaenids*: Almost all of the sciaenids move to nearshore or offshore waters for spawning, although some species may spawn in passes. Larvae are transported into estuaries, but may attain juvenile size before they enter. Since some of these species have rather long life spans, several years may be spent in the estuaries as juveniles. Juveniles develop in estuarine habitats, then migrate out as subadults or adults.
- *Striped mullet*: Adults and juveniles are the predominant life stages found in estuaries. They spawn offshore, and larvae move inshore and into estuaries.
- *Code goby*: Usually associated with seagrasses and higher salinities.
- *Spanish mackerel*: Adults and juveniles occur in estuaries. Although not reported, some larvae probably enter estuaries.

- *Flounders*: Spawning, eggs and larvae are distributed in nearshore waters. Juveniles and larvae migrate into bays for growth and development. Gulf flounder typically remain in the higher salinities of the seawater and lower mixing zones, but southern flounder are more generally distributed.

Perdido Bay Estuary. Perdido Bay is part of a complex waterway system connected to Pensacola Bay by the Intracoastal Waterway. It has a significant dissolved oxygen constraint, especially near the bottom during the summer. Industrial effluent and nutrient-poor, acidic blackwater tributaries combine to make Perdido Bay an area of low productivity. Some species (e.g., pinfish) are still found in the upper water column, but bottom dwellers are rare (Flemer, D., 1988, U.S. EPA, personal communication). Macroinvertebrates are generally absent from areas of suspended and settled organic sediments with high oxygen demand. Degraded bottom conditions are indicative of cumulative effects of long-term waste input (Suttkus and Gunning 1986).

Use of ELMR Data

Classifying and Comparing Estuaries. Although the qualitative nature of the distribution data precludes statistical comparisons of species abundances among estuaries, comparisons can be made using data on the presence/absence of species in salinity zones. This information, combined with the spatial and temporal distribution data, is the strength of the data base. Estuaries can be loosely categorized by their physical and chemical characteristics and their associated species assemblages. The relative importance of individual estuaries to specific species may also be determined.

The species found in an estuary are sensitive indicators of both the mean and extreme environmental conditions within that estuary. Estuaries can be classified by the number of species present and by whether the fauna are primarily marine, estuarine, or freshwater. Species assemblages may correlate with physical characteristics, such as bottom substrate, vegetation, and areal and temporal characteristics of salinity zones. The information on species presence/absence or other attributes can be used to determine the faunal similarities and differences among estuaries.

A comparison of estuaries and associated species can identify differing factors among those estuaries that might account for shifts in species distribution and relative abundance, helping to define ecological variables controlling species distributions. For ex-

ample, a species may show differing salinity tolerances among estuaries, suggesting that some other factor, such as temperature, competition, or predation may be regulating its distribution.

Linkages to Marine Ecosystems. Estuaries are home to many aquatic species year-round, however, a large number of species only use estuaries for specific parts of their life histories and spend the rest offshore. Most of these latter species fall into four general categories: 1) diadromous species, which use estuaries as migration corridors and, in some instances, nursery areas; 2) species that use estuaries for spawning, often at specific salinities; 3) species that spawn in marine waters near the mouths of estuaries and depend on tidal- and wind-driven currents to carry eggs, larvae, or early juveniles into estuarine nursery areas; and 4) species that enter estuaries during certain times of year to feed on abundant prey. The importance of an estuary can be assessed by the intensity with which species use estuarine habitats. Importance can be estimated both by the number of species present as well as the density of specific life stages in estuaries relative to offshore habitats. These data may assist in identifying adverse effects of estuarine degradation on offshore populations.

The presence or absence of members of a set of pre-selected species or species with specific life history strategies can be used to rank the importance of an estuary to these species on a regional basis. For example, if the species group is defined as anadromous fishes that are commercially important offshore, the strength of the offshore-estuarine linkage for each estuary can be established. This can be used to identify estuaries needing special attention or management. Data sets developed or under development in SAB's *Living Marine Resources Program* and other NOAA programs will enable regional assessments with consistent species information from the head-of-tide in estuaries to the continental shelf. Integration of biological and physical data will significantly improve our ability to identify and define the biological linkages and physical interchanges between estuarine and shelf habitats.

Concluding Comments

This report is part of an effort to "capture" the Nation's data on fishes and invertebrates in estuaries (see inside front cover). This research is one step in developing an information base to bridge the gap between site-specific estuarine problems and formulating regional management strategies. Filling this gap is more important than ever, as it becomes clear that cumulative effects of small changes in many

estuaries may have a total systemic effect throughout the Nation's estuaries and coastal ocean. Compiling and organizing fragments of estuarine information is a difficult task, but is necessary to effectively manage the nation's estuaries. Although the knowledge available to conserve and protect estuaries continues to be limited, the ELMR data base will allow comparisons among species, groups of species, specific life stages and times of year within an estuary, or by geographic regions. When combined with other data sets, the ELMR data base will enable development and testing of ecological hypotheses and identify gaps in our knowledge of estuarine fishes and invertebrates.

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Data Summary Tables

Table 2. Spatial distribution and relative abundance

Table 3. Temporal distribution

Table 4. Data reliability

In each data summary table, species are listed in phylogenetic order, as in Table 1. Estuaries are listed in a southeast to northwest order, from Florida Bay, FL, to Mobile Bay, AL. At the beginning of each data summary is an index table showing the page location of each species and estuary within the data summary.

Table 2. Spatial distribution and relative abundance

Index to Table 2: Page location of spatial distribution table for each species and estuary.

Common and Scientific Name	Estuary	
	Florida Bay Ten Thousand Islands Caloosahatchee River Charlotte Harbor Tampa Bay Suwannee River Apalachee Bay	Apalachicola Bay St. Andrew Bay Choctawhatchee Bay Pensacola Bay Perdido Bay Mobile Bay
Bay scallop (<i>Argopecten irradians</i>) American oyster (<i>Crassostrea virginica</i>) Common rangia (<i>Rangia cuneata</i>) Hard clam (<i>Mercenaria</i> species) Brown shrimp (<i>Penaeus aztecus</i>) Pink shrimp (<i>Penaeus duorarum</i>)	p. 19	p. 20
White shrimp (<i>Penaeus setiferus</i>) Grass shrimp (<i>Palaemonetes pugio</i>) Spiny lobster (<i>Panulirus argus</i>) Gulf stone crab (<i>Menippe adina</i>) Stone crab (<i>Menippe mercenaria</i>) Blue crab (<i>Callinectes sapidus</i>)	p. 21	p. 22
Tarpon (<i>Megalops atlanticus</i>) Alabama shad (<i>Alosa alabamae</i>) Gulf menhaden (<i>Brevoortia patronus</i>) Yellowfin menhaden (<i>Brevoortia smithi</i>) Bay anchovy (<i>Anchoa mitchilli</i>) Sheepshead minnow (<i>Cyprinodon variegatus</i>)	p. 23	p. 24
Gulf killifish (<i>Fundulus grandis</i>) Snook (<i>Centropomus undecimalis</i>) Bluefish (<i>Pomatomus saltatrix</i>) Blue runner (<i>Caranx crysos</i>) Creville jack (<i>Caranx hippos</i>) Florida pompano (<i>Trachinotus carolinus</i>)	p. 25	p. 26
Gray snapper (<i>Lutjanus griseus</i>) Pinfish (<i>Lagodon rhomboides</i>) Sand seatrout (<i>Cynoscion arenarius</i>) Spotted seatrout (<i>Cynoscion nebulosus</i>) Spot (<i>Leiostomus xanthurus</i>) Atlantic croaker (<i>Micropogonias undulatus</i>)	p. 27	p. 28
Red drum (<i>Sciaenops ocellatus</i>) Striped mullet (<i>Mugil cephalus</i>) Code goby (<i>Gobiosoma robustum</i>) Spanish mackerel (<i>Scomberomorus maculatus</i>) Gulf flounder (<i>Paralichthys albigutta</i>) Southern flounder (<i>Paralichthys lethostigma</i>)	p. 29	p. 30

Table 2. Spatial distribution and relative abundance

		Eastern Gulf of Mexico Estuaries																							
		Florida Bay			Ten Thousand Islands			Caloosa-hatchee River			Charlotte Harbor			Tampa Bay			Suwannee River			Apalachee Bay					
Species/Life Stage		T	M	S	T	M	S	T	M	*	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S
Bay scallop	A									○															○
	S									○															○
<i>Argopecten irradians</i>	J									○															○
	L									○															○
	E									○															○
American oyster	A					○	○		●			○	○		○	○		●	●		●	●		●	●
	S					○	○		○			○	○		○	○		●	●		●	●		●	●
<i>Crassostrea virginica</i>	J					○	○		○			○	○		○	○		●	●		●	●		●	●
	L					○	○		○			○	○		○	○		●	●		●	●		●	●
	E					○	○		○			○	○		○	○		●	●		●	●		●	●
Common rangia	A							●	●		●	●		●	●		○	●		○	○				
	S							●	●		●	●		●	●			●			○				
<i>Rangia cuneata</i>	J							●	●		●	●		●	●		○	●		○	○				
	L							●	●		●	●		●	●			●		○	○				
	E							●	●		●	●		●	●			●		○	○				
Hard clam	A												○			○				○					○
	S												○			○				○					○
<i>Mercenaria species</i>	J												○			○				○					○
	L												○			○				○					○
	E												○			○				○					○
Brown shrimp	A																								
	S																								
<i>Penaeus aztecus</i>	J																								
	L																								
	E																								
Pink shrimp	A																								
	S		●	●		●	●		●			●	●		●	●		●	●		●	●		●	●
<i>Penaeus duorarum</i>	J																								
	L																								
	E																								
		T	M	S	T	M	S	T	M	*	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S
		Florida Bay			Ten Thousand Islands			Caloosa-hatchee River			Charlotte Harbor			Tampa Bay			Suwannee River			Apalachee Bay					
		Eastern Gulf of Mexico Estuaries																							

Relative Abundance

- Highly Abundant
- Abundant
- Common
- Blank Rare, No Data Available, or Not Present

Salinity Zone

- T - Tidal Fresh
- M - Mixing
- S - Seawater
- * - Seawater zone not present.

Life Stage

- A - Adults
- S - Spawning adults
- J - Juveniles
- L - Larvae
- E - Eggs

Table 2 (continued). Spatial distribution and relative abundance

		Eastern Gulf of Mexico Estuaries																	
		Apala- chicola Bay			St. Andrew Bay			Choctaw- hatchee Bay			Pensacola Bay			Perdido Bay			Mobile Bay		
Species/Life Stage		T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S
Bay scallop	A					○	○					○	○						
	S					○	○												
<i>Argopecten</i>	J					○	○					○							
<i>irradians</i>	L					○	○												
	E					○	○												
American oyster	A		●	●		○			○			○						○	○
	S		●	●		○			○			○						○	○
<i>Crassostrea</i>	J		●	●		○			○			○						○	○
<i>virginica</i>	L		●	●		○			○			○						○	○
	E		●	●		○			○			○						○	○
Common rangia	A	○	●		○	○			○		○	○		○	●		●	●	
	S		●			○			○			○			●		●	●	
<i>Rangia</i>	J	○	●		○	○			○		○	○		○	●		●	●	
<i>cuneata</i>	L	○	●			○			○		○	○			●		●	●	
	E		●			○			○			○			●		●	●	
Hard clam	A						○			○					○	○			
	S						○			○									
<i>Mercenaria</i>	J						○			○									
<i>species</i>	L						○			○									
	E						○			○									
Brown shrimp	A		●	●		●	●		●	●		●	●					●	●
	S		●	●		●	●		●	●		●	●					●	●
<i>Penaeus</i>	J	●	●	●		●	●	●	●	●	●	●	●				●	●	●
<i>aztecus</i>	L		●	●		●	●		●	●		●	●					●	●
	E		●	●		●	●		●	●		●	●					●	●
Pink shrimp	A					●	●												
	S																		
<i>Penaeus</i>	J		●	●		●	●		●	●		○	○		○	○		○	○
<i>duorarum</i>	L			○															
	E																		
		T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S
		Apala- chicola Bay			St. Andrew Bay			Choctaw- hatchee Bay			Pensacola Bay			Perdido Bay			Mobile Bay		
		Eastern Gulf of Mexico Estuaries																	

Relative Abundance

- Highly Abundant
- Abundant
- Common
- Blank Rare, No Data Available, or Not Present

Salinity Zone

- T - Tidal Fresh
- M - Mixing
- S - Seawater

Life Stage

- A - Adults
- S - Spawning adults
- J - Juveniles
- L - Larvae
- E - Eggs

Table 2 (continued). Spatial distribution and relative abundance

		Eastern Gulf of Mexico Estuaries																							
		Florida Bay			Ten Thousand Islands			Caloosa-hatchee River			Charlotte Harbor			Tampa Bay			Suwannee River			Apalachee Bay					
Species/Life Stage		T	M	S	T	M	S	T	M	*	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S
White shrimp	A																								●
<i>Penaeus setiferus</i>	S																								
	J																						○	●	●
	L																								
	E																								
Grass shrimp	A		●	●		○	○	○	●			●	●		●	●		●	●		●	●		●	●
<i>Palaemonetes pugio</i>	S		●	●		○	○		●			●	●		●	●		●	●		●	●		●	●
	J		●	●		○	○		●			●	●		●	●		●	●		●	●		●	●
	L		●	●		○	○		●			●	●		●	●		●	●		●	●		●	●
	E		●	●		○	○		●			●	●		●	●		●	●		●	●		●	●
Spiny lobster	A																								
<i>Panulirus argus</i>	M																								
	J			○																					
	L																								
	S																								
Blue crab	A	○	●	●		●	●		●			●	○		●	○	○	●	●	○	●	●	○	●	●
<i>Callinectes sapidus</i>	M	○	●			●			●			●			●		○	●		○	●		○	●	
	J	○	●	○		●	○	●	●			●			●		○	●	○	○	●		○	●	○
	L			○			○						○			○			○				○	●	○
	S			○			○					○	○		○	○			○			○	○	○	○
Gulf stone crab	A																								
<i>Menippe adina</i>	M																						○		
	J																						○		
	L																						○		
	S																						○		
Stone crab	A			○		○	○					○	○			○			○						○
<i>Menippe mercenaria</i>	M			○		○	○					○	○			○			○						○
	J											○	○			○			○						○
	L											○	○			○			○						○
	S			○		○	○					○	○			○			○						○
		T	M	S	T	M	S	T	M	*	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S
		Florida Bay			Ten Thousand Islands			Caloosa-hatchee River			Charlotte Harbor			Tampa Bay			Suwannee River			Apalachee Bay					
		Eastern Gulf of Mexico Estuaries																							

Relative Abundance

- Highly Abundant
- Abundant
- Common
- Blank Rare, No Data Available, or Not Present

Salinity Zone

- T - Tidal Fresh
- M - Mixing
- S - Seawater
- * - Seawater zone not present.

Life Stage

- A - Adults
- S - Spawning adults
- J - Juveniles
- L - Larvae
- E - Eggs
- M - Mating

Table 2 (continued). Spatial distribution and relative abundance

		Eastern Gulf of Mexico Estuaries																	
		Apala-chicola Bay			St. Andrew Bay			Choctaw-hatchee Bay			Pensacola Bay			Perdido Bay			Mobile Bay		
Species/Life Stage		T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S
White shrimp	A			●		○	○		○	○		○	○			○		○	○
<i>Penaeus setiferus</i>	S																		
	J	○	●	●		○	○		●	●		●	○		○	○	●	●	●
	L																		
	E																		
Grass shrimp	A		●	●		●	●		●	●		●	●					●	●
<i>Palaemonetes pugio</i>	S		●	●		●	●		●	●		●	●					●	●
	J		●	●		●	●		●	●		●	●					●	●
	L		●	●		●	●		●	●		●	●					●	●
	E		●	●		●	●		●	●		●	●					●	●
Spiny lobster	A						○												
<i>Panulirus argus</i>	M																		
	J																		
	L																		
	S																		
Blue crab	A	○	●	●	○	●	●		●	○		●	○		○	○		●	●
<i>Callinectes sapidus</i>	M	○	●	●	○	●	●		●	○		●	○		○	○		●	●
	J	○	●	○	○	●	●		●	○		●	○	○	○	○	○	●	●
	L		○	○		○	○			○			○		○	○			●
	S		○	○											○	○			
Gulf stone crab	A		○	○															
<i>Menippe adina</i>	M		○	○															
	J		○	○															
	L		○	○															
	S		○	○															
Stone crab	A																		
<i>Menippe mercenaria</i>	M																		
	J																		
	L																		
	S																		
		T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S
		Apala-chicola Bay			St. Andrew Bay			Choctaw-hatchee Bay			Pensacola Bay			Perdido Bay			Mobile Bay		
		Eastern Gulf of Mexico Estuaries																	

Relative Abundance

- Highly Abundant
- Abundant
- Common
- Blank Rare, No Data Available, or Not Present

Salinity Zone

- T - Tidal Fresh
- M - Mixing
- S - Seawater

Life Stage

- A - Adults
- S - Spawning adults
- J - Juveniles
- L - Larvae
- E - Eggs
- M - Mating

Table 2 (continued). Spatial distribution and relative abundance

		Eastern Gulf of Mexico Estuaries																								
		Florida Bay			Ten Thousand Islands			Caloosa-hatchee River			Charlotte Harbor			Tampa Bay			Suwannee River			Apalachee Bay						
Species/Life Stage		T	M	S	T	M	S	T	M	*	T	M	S	T	M	S	T	M	S	T	M	S				
Tarpon <i>Megalops atlanticus</i>		A S J L E	○	○	○	○	○	○	●	●		○	●	●		○	○			○	○		○			
Alabama shad <i>Alosa alabamiae</i>		A S J L E																	○	○	○					
Gulf menhaden <i>Brevoortia patronus</i>		A S J L E													●	●						●	●			
Yellowfin menhaden <i>Brevoortia smithi</i>		A S J L E	○	●	●		●	●	○	○		○	○	○	○	○	○									
Bay anchovy <i>Anchoa mitchilli</i>		A S J L E	●	●	●	○	●	●	●	●		●	●	●	●	●	●	○	●	●	○	●	●			
Sheepshead minnow <i>Cyprinodon variegatus</i>		A S J L E	●	○	○	○	○	○	○	○		○	○	○	○	●	○	○	●	○	○	●	○			
			T	M	S	T	M	S	T	M	*	T	M	S	T	M	S	T	M	S	T	M	S			
			Florida Bay			Ten Thousand Islands			Caloosa-hatchee River			Charlotte Harbor			Tampa Bay			Suwannee River			Apalachee Bay					
			Eastern Gulf of Mexico Estuaries																							

Relative Abundance

● Highly Abundant
 ⊙ Abundant
 ○ Common
 Blank Rare, No Data Available,
 or Not Present

Salinity Zone

T - Tidal Fresh
M - Mixing
S - Seawater
* - Seawater zone not present.

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs

Table 2 (continued). Spatial distribution and relative abundance

		Eastern Gulf of Mexico Estuaries																	
		Apala-chicola Bay			St. Andrew Bay			Choctaw-hatchee Bay			Pensacola Bay			Perdido Bay			Mobile Bay		
Species/Life Stage		T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S
Tarpon	A	○	○	○		○	○	○	○	○		○	○					○	○
<i>Megalops atlanticus</i>	S																		
	J	○	○	○				○	○	○		○	○					○	○
	L			○			○			○		○	○						○
	E																		
Alabama shad	A	○	○	○	○	○	○	○	○	○									
<i>Alosa alabamae</i>	S	○	○	○	○	○	○	○	○	○									
	J	○	○	○	○	○	○	○	○	○									
	L	○																	
	E	○																	
Gulf menhaden	A		●	●		●	●		●	●		●	●		○	○		●	●
<i>Brevoortia patronus</i>	S		○	○		○	○		○	○		○	○		○	○	○	○	○
	J	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	L		○	○		○	○		○	○		○	○		○	○		○	○
	E			○		○	○		○	○		○	○		○	○		○	○
Yellowfin menhaden	A																		
<i>Brevoortia smithi</i>	S																		
	J																		
	L																		
	E																		
Bay anchovy	A	○	●	●	○	●	●	○	●	●	○	●	●	○	○	○	○	●	●
<i>Anchoa mitchilli</i>	S		●	●		●	●		●	●		●	●		○	○	○	●	●
	J	○	●	●	○	●	●	○	●	●	○	●	●	○	○	○	○	●	●
	L		●	●		●	●		●	●		●	●		○	○		●	●
	E		●	●		●	●		●	●		○	○		○	○		●	●
Sheepshead minnow	A	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
<i>Cyprinodon variegatus</i>	S		○	○		○	○		○	○		○	○		○	○		○	○
	J	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	L		○	○		○	○		○	○		○	○		○	○		○	○
	E		○	○		○	○		○	○		○	○		○	○		○	○
		T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S
		Apala-chicola Bay			St. Andrew Bay			Choctaw-hatchee Bay			Pensacola Bay			Perdido Bay			Mobile Bay		
		Eastern Gulf of Mexico Estuaries																	

Relative Abundance

- Highly Abundant
 ○ Abundant
 ○ Common
 Blank Rare, No Data Available, or Not Present

Salinity Zone

- T - Tidal Fresh
 M - Mixing
 S - Seawater

Life Stage

- A - Adults
 S - Spawning adults
 J - Juveniles
 L - Larvae
 E - Eggs

Table 2 (continued). Spatial distribution and relative abundance

		Eastern Gulf of Mexico Estuaries																										
		Florida Bay			Ten Thousand Islands			Caloosa-hatchee River			Charlotte Harbor			Tampa Bay			Suwannee River			Apalachee Bay								
Species/Life Stage		T	M	S	T	M	S	T	M	*	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S			
Gulf killifish	A	○	○	○	○	○	○	○	○		●	●	●		○	○			●	○		●	○		○			
<i>Fundulus grandis</i>	S	○	○	○	○	●	○	○	○		●	●	●		○	○			●	○		●	○		○			
	J	○	○	○	○	●	○	○	○		●	●	●		○	○			●	○		●	○		○			
	L	○	○	○	○	●	○	○	○		●	●	●		○	○			●	○		●	○		○			
	E	○	○	○	○	●	○	○	○		●	●	●		○	○			●	○		●	○		○			
Snook	A		○	○	○	●	●	○	○		○	●	●	○	○	○	○	○	○	○	○	○	○	○	○			
<i>Centropomus undecimalis</i>	S					○						○	○			○												
	J	○	○	○	○	○	○	○	○		○	○	○	○	○	○			○	○								
	L				○	○	○	○	○		○		○		○	○			○	○								
	E					○	○	○	○				○		○	○			○	○								
Bluefish	A		○	○		○	○						○			○		○	○		○	○		○	○			
<i>Pomatomus saltatrix</i>	S																											
	J											○	○					○	○		○	○		○	○			
	L																											
	E																											
Bluerunner	A						○						○			○			○					○				
<i>Caranx crysos</i>	S																											
	J						○						○			○			○					○				
	L																											
	E																											
Creville jack	A		●	●		○	○		○			●	●			●		○	○			○	○		○			
<i>Caranx hippos</i>	S		○	○		○	○		○			○	○		○	○		○	○		○	○		○	○			
	J		○	○		○	○		○			○	○		○	○		○	○		○	○		○	○			
	L																											
	E																											
Florida pompano	A			●			○						●			○								○				
<i>Trachinotus carolinus</i>	S			○			○						○			○								○				
	J																											
	L																											
	E																											
		T	M	S	T	M	S	T	M	*	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S			
		Florida Bay			Ten Thousand Islands			Caloosa-hatchee River			Charlotte Harbor			Tampa Bay			Suwannee River			Apalachee Bay								
		Eastern Gulf of Mexico Estuaries																										

Relative Abundance

- Highly Abundant
- Abundant
- Common
- Blank Rare, No Data Available, or Not Present

Salinity Zone

- T - Tidal Fresh
- M - Mixing
- S - Seawater
- * - Seawater zone not present.

Life Stage

- A - Adults
- S - Spawning adults
- J - Juveniles
- L - Larvae
- E - Eggs

Table 2 (continued). Spatial distribution and relative abundance

		Eastern Gulf of Mexico Estuaries																	
		Apalachicola Bay			St. Andrew Bay			Choctaw-hatchee Bay			Pensacola Bay			Perdido Bay			Mobile Bay		
Species/Life Stage		T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S
Gulf killifish	A	○	○	○	○	○	○	○	○	○	○	○	○				○	●	○
	S		○	○		○	○		○	○		○	○					●	○
<i>Fundulus grandis</i>	J	○	○	○		○	○	○	○	○	○	○	○				○	●	○
	L		○	○		○	○		○	○		○	○					●	○
	E		○	○		○	○		○	○		○	○					●	○
Snook	A	○	○	○															
	S																		
<i>Centropomus undecimalis</i>	J																		
	L																		
	E																		
Bluefish	A		○	○		●	●		●	●		○	○		○	○		○	○
	S																		
<i>Pomatomus saltatrix</i>	J		○	○		○	○		○	○		○	○		○	○		○	○
	L																		
	E																		
Bluerunner	A			○			●			○			○			○			○
	S																		
<i>Caranx crysos</i>	J			○			○			○			○			○			○
	L																		
	E																		
Crevalle jack	A		○	○		○	○		○	○		○	○			○			○
	S																		
<i>Caranx hippos</i>	J		○	○		○	○		○	○		○	○		○	○		○	○
	L																		
	E																		
Florida pompano	A						○			○									○
	S																		
<i>Trachinotus carolinus</i>	J						○						○		○	○			○
	L																		
	E																		
		T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S
		Apalachicola Bay			St. Andrew Bay			Choctaw-hatchee Bay			Pensacola Bay			Perdido Bay			Mobile Bay		
		Eastern Gulf of Mexico Estuaries																	

Relative Abundance

- Highly Abundant
- Abundant
- Common
- Blank Rare, No Data Available, or Not Present

Salinity Zone

- T - Tidal Fresh
- M - Mixing
- S - Seawater

Life Stage

- A - Adults
- S - Spawning adults
- J - Juveniles
- L - Larvae
- E - Eggs

Table 2 (continued). Spatial distribution and relative abundance

Species/Life Stage		Eastern Gulf of Mexico Estuaries																							
		Florida Bay			Ten Thousand Islands			Caloosa-hatchee River			Charlotte Harbor			Tampa Bay			Suwannee River			Apalachee Bay					
		T	M	S	T	M	S	T	M	*	T	M	S	T	M	S	T	M	S	T	M	S			
Gray snapper	A											○					○	○			○	○			
<i>Lutjanus griseus</i>	S											○					○	○			○	○			
	J	●	●		○	○	○					○					○	○			○	○			
	L																								
	E																								
Pinfish	A		●	●		●	●		○			●	●		●	●		●	●		●	●			
<i>Lagodon rhomboides</i>	S		●	●		●	●		○			●	●		●	●		●	●		○	●			
	J	○	○		○	○	○	○	●			○	●			○			○		○	○			
	L					○	○																		
	E																								
Sand seatrout	A					○	○				○	○	●		○	○		○	○		○	○			
<i>Cynoscion arenarius</i>	S											○	○	●		○	○		○	○		○			
	J					○	○	○	●		○	○	○	○	○	○	○	○	○	○	○	○			
	L																								
	E																								
Spotted seatrout	A		○	○		○	○		○			○	○		○	○		○	○		○	○			
<i>Cynoscion nebulosus</i>	S	○	○	○		○	○		○			○	○		○	○		○	○		○	○			
	J	○	○	○		○	○		○			○	○		○	○		○	○		○	○			
	L	○	○	○		○	○		○			○	○		○	○		○	○		○	○			
	E	○	○	○		○	○		○			○	○		○	○		○	○		○	○			
Spot	A														○	○		○	○		○	○			
<i>Leiostomus xanthurus</i>	S														○	○		○	○		○	○			
	J			○		○	○	○	○		○	○	○	○	○	○	○	○	○	○	○	○			
	L																								
	E																								
Atlantic croaker	A																○	○	○		○	○			
<i>Micropogonias undulatus</i>	S																○	○	○		○	○			
	J																								
	L																								
	E																								
		T	M	S	T	M	S	T	M	*	T	M	S	T	M	S	T	M	S	T	M	S			
		Florida Bay			Ten Thousand Islands			Caloosa-hatchee River			Charlotte Harbor			Tampa Bay			Suwannee River			Apalachee Bay					
		Eastern Gulf of Mexico Estuaries																							

Relative Abundance

- Highly Abundant
- Abundant
- Common
- Blank Rare, No Data Available, or Not Present

Salinity Zone

- T - Tidal Fresh
- M - Mixing
- S - Seawater
- * - Seawater zone not present.

Life Stage

- A - Adults
- S - Spawning adults
- J - Juveniles
- L - Larvae
- E - Eggs

Table 2 (continued). Spatial distribution and relative abundance

		Eastern Gulf of Mexico Estuaries																		
		Apala-chicola Bay			St. Andrew Bay			Choctaw-hatchee Bay			Pensacola Bay			Perdido Bay			Mobile Bay			
Species/Life Stage		T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	
Gray snapper	A						○		○	○		●	○							
<i>Lutjanus griseus</i>	S								○	○	○		○	○		○	○		○	○
	J																			
	L																			
	E																			
Pinfish	A		●	●		●	●		○	○	●	●	●		○	○		●	●	
<i>Lagodon rhomboides</i>	S								○	○	○	●	●		○	○		○	○	
	J	○	●	●		●	●	○	●	●		●	●		○	○		●	●	
	L			○		○	○			●	●		○	○				○	○	
	E																			
Sand seatrout	A		●	●		○	○	○	●	●		○	○		○	○	○	●	●	
<i>Cynoscion arenarius</i>	S					○	○		○	○		○	○		○	○		○	○	
	J		●	●	○	○	○	○	○	○	○	○	○		○	○	○	○	○	
	L			○		○	○		○	○	○	○	○		○	○		○	○	
	E					○	○		○	○	○	○	○		○	○		○	○	
Spotted seatrout	A		○	○		○	○		○	○		○	○		○	○		○	○	
<i>Cynoscion nebulosus</i>	S		○	○																
	J		○	○		○	○		○	○		○	○		○	○		○	○	
	L		○	○		○	○		○	○		○	○		○	○		○	○	
	E		○	○		○	○													
Spot	A		○	○		○	○		○	○										
<i>Leiostomus xanthurus</i>	S								○	○										
	J	○	○	○	○	○	○		●	●		●	●		○	○		●	●	
	L			○		○	○		○	○		○	○		○	○		○	○	
	E																			
Atlantic croaker	A		○	○		○	○		○	○		○	○		○	○		○	○	
<i>Micropogonias undulatus</i>	S								○	○	○	○	○		○	○		○	○	
	J	○	●	●		○	○	○	○	○	○	○	○	○	○	○	○	○	○	
	L		○	○		○	○		○	○		○	○		○	○		○	○	
	E																			
		T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	
		Apala-chicola Bay			St. Andrew Bay			Choctaw-hatchee Bay			Pensacola Bay			Perdido Bay			Mobile Bay			
		Eastern Gulf of Mexico Estuaries																		

Relative Abundance

- Highly Abundant
- Abundant
- Common
- Blank Rare, No Data Available, or Not Present

Salinity Zone

- T - Tidal Fresh
- M - Mixing
- S - Seawater

Life Stage

- A - Adults
- S - Spawning adults
- J - Juveniles
- L - Larvae
- E - Eggs

Table 2 (continued). Spatial distribution and relative abundance

		Eastern Gulf of Mexico Estuaries																							
		Florida Bay			Ten Thousand Islands			Caloosa-hatchee River			Charlotte Harbor			Tampa Bay			Suwannee River			Apalachee Bay					
Species/Life Stage		T	M	S	T	M	S	T	M	*	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S
Red drum <i>Sciaenops ocellatus</i>	A												○		○	○		○	○			○	○		
	S																								
	J		○	○				○	○		○	○	○	○	●	●		○	○			○	○		
	L								○				○											○	○
	E																								
Striped mullet <i>Mugil cephalus</i>	A		○	○		○	○	○	○		○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	S																								
	J	○	●	○	○	●	○	●	●		●	●	●	●	●	●	○	○	○	○	●	●	●	●	○
	L																								
	E																								
Code goby <i>Gobiosoma robustum</i>	A		●	○		●	●		○			○	●		○	○		○	○			○	○		○
	S		●	○		●	○		○			○	●		○	○		○	○			○	○		○
	J		●	●		●	○		○			○	●		○	○		○	○			○	○		○
	L		●	○		●	○		○			○	●		○	○		○	○			○	○		○
	E		●	○		●	○		○			○	●		○	○		○	○			○	○		○
Spanish mackerel <i>Scomberomorus maculatus</i>	A		○	○		○	○						○			○									
	S																								
	J		○	○		○	○					○	○							○					
	L																								
	E																								
Gulf flounder <i>Paralichthys albigutta</i>	A		○	○		○	○					○	○		○	○		○	○			○	○		○
	S																								
	J		○	○		○	○					○	○		○	○		○	○			○	○		○
	L		○	○									○											○	○
	E																								
Southern flounder <i>Paralichthys lethostigma</i>	A																○	○	○	○	○	○		○	○
	S																								
	J																								
	L																								
	E																								
		T	M	S	T	M	S	T	M	*	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S
		Florida Bay			Ten Thousand Islands			Caloosa-hatchee River			Charlotte Harbor			Tampa Bay			Suwannee River			Apalachee Bay					
		Eastern Gulf of Mexico Estuaries																							

Relative Abundance

- Highly Abundant
- ◎ Abundant
- Common
- Blank Rare, No Data Available, or Not Present

Salinity Zone

- T - Tidal Fresh
- M - Mixing
- S - Seawater
- * - Seawater zone not present.

Life Stage

- A - Adults
- S - Spawning adults
- J - Juveniles
- L - Larvae
- E - Eggs

Table 2 (continued). Spatial distribution and relative abundance

		Eastern Gulf of Mexico Estuaries																	
		Apala-chicola Bay			St. Andrew Bay			Choctaw-hatchee Bay			Pensacola Bay			Perdido Bay			Mobile Bay		
Species/Life Stage		T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S
Red drum	A		○	○		○	●		○	○		○	○					○	
<i>Sciaenops ocellatus</i>	S																		
	J		○	○		○	○		○	○		○	○		○			○	○
	L			○			○			○			○						○
	E																		
Striped mullet	A	●	●	●	○	●	●	○	●	●	●	●	●		○	○	●	●	●
<i>Mugil cephalus</i>	S																		
	J	●	●	●	○	●	●	○	●	●	●	●	●		○	○	●	●	●
	L			○		○	○		○	○		○	○		○	○	○	○	○
	E																		
Code goby	A		○	○		●	●		○	○		○	○						
<i>Gobiosoma robustum</i>	S																		
	J		○	○		●	●		○	○		○	○						
	L		○	○		●	●		○	○		○	○						
	E		○	○		●	●		○	○		○	○						
Spanish mackerel	A						●		○	○		○	○		○	●		○	○
<i>Scomberomorus maculatus</i>	S																		
	J						●		○	○		○	○			○		○	○
	L								○	○		○	○					○	○
	E																		
Gulf flounder	A			○		○	●		○	○		○	○			○			
<i>Paralichthys albigutta</i>	S																		
	J			○		○	●		○	○		○	○		○	○			○
	L			○			○			○			○			○			○
	E			○			○			○			○			○			○
Southern flounder	A	○	○	○	○	○	○		○	○	○	○	○		○	○	○	○	○
<i>Paralichthys lethostigma</i>	S																		
	J	○	○		○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	L		○	○		○	○		○	○		○	○		○	○		○	○
	E		○	○		○	○		○	○		○	○		○	○		○	○
		T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S
		Apala-chicola Bay			St. Andrew Bay			Choctaw-hatchee Bay			Pensacola Bay			Perdido Bay			Mobile Bay		
		Eastern Gulf of Mexico Estuaries																	

Relative Abundance

- Highly Abundant
- Abundant
- Common
- Blank Rare, No Data Available, or Not Present

Salinity Zone

- T - Tidal Fresh
- M - Mixing
- S - Seawater

Life Stage

- A - Adults
- S - Spawning adults
- J - Juveniles
- L - Larvae
- E - Eggs

Table 3. Temporal distribution

Index to Table 3: Page location of temporal distribution table for each species and estuary.

Common and Scientific Name	Estuary				
	Florida Bay	Ten Thousand Islands	Caloosahatchee River	Charlotte Harbor	Tampa Bay
Bay scallop (<i>Argopecten irradians</i>)					
American oyster (<i>Crassostrea virginica</i>)					
Common rangia (<i>Rangia cuneata</i>)	p. 32	p. 33	p. 34	p. 35	
Hard clam (<i>Mercenaria</i> species)					
Brown shrimp (<i>Penaeus aztecus</i>)					
Pink shrimp (<i>Penaeus duorarum</i>)					
White shrimp (<i>Penaeus setiferus</i>)					
Grass shrimp (<i>Palaemonetes pugio</i>)					
Spiny lobster (<i>Panulirus argus</i>)					
Gulf stone crab (<i>Menippe adina</i>)	p. 36	p. 37	p. 38	p. 39	
Stone crab (<i>Menippe mercenaria</i>)					
Blue crab (<i>Callinectes sapidus</i>)					
Tarpon (<i>Megalops atlanticus</i>)					
Alabama shad (<i>Alosa alabamae</i>)					
Gulf menhaden (<i>Brevoortia patronus</i>)	p. 40	p. 41	p. 42	p. 43	
Yellowfin menhaden (<i>Brevoortia smithi</i>)					
Bay anchovy (<i>Anchoa mitchilli</i>)					
Sheepshead minnow (<i>Cyprinodon variegatus</i>)					
Gulf killifish (<i>Fundulus grandis</i>)					
Snook (<i>Centropomus undecimalis</i>)					
Bluefish (<i>Pomatomus saltatrix</i>)	p. 44	p. 45	p. 46	p. 47	
Blue runner (<i>Caranx crysos</i>)					
Crevalle jack (<i>Caranx hippos</i>)					
Florida pompano (<i>Trachinotus carolinus</i>)					
Gray snapper (<i>Lutjanus griseus</i>)					
Pinfish (<i>Lagodon rhomboides</i>)					
Sand seatrout (<i>Cynoscion arenarius</i>)	p. 48	p. 49	p. 50	p. 51	
Spotted seatrout (<i>Cynoscion nebulosus</i>)					
Spot (<i>Leiostomus xanthurus</i>)					
Atlantic croaker (<i>Micropogonias undulatus</i>)					
Red drum (<i>Sciaenops ocellatus</i>)					
Striped mullet (<i>Mugil cephalus</i>)					
Code goby (<i>Gobiosoma robustum</i>)	p. 52	p. 53	p. 54	p. 55	
Spanish mackerel (<i>Scomberomorus maculatus</i>)					
Gulf flounder (<i>Paralichthys albigutta</i>)					
Southern flounder (<i>Paralichthys lethostigma</i>)					

Table 3. Temporal distribution

		Eastern Gulf of Mexico Estuaries											
		Florida Bay				Ten Thousand Islands				Caloosahatchee River			
Month		J	F	M	A	M	J	J	A	S	O	N	D
Species / Life Stage													
Bay scallop <i>Argopecten irradians</i>	A												
	S												
	J												
	L												
	E												
American oyster <i>Crassostrea virginica</i>	A												
	S												
	J												
	L												
	E												
Common rangia <i>Rangia cuneata</i>	A												
	S												
	J												
	L												
	E												
Hard clam <i>Mercenaria species</i>	A												
	S												
	J												
	L												
	E												
Brown shrimp <i>Penaeus aztecus</i>	A												
	S												
	J												
	L												
	E												
Pink shrimp <i>Penaeus duorarum</i>	A												
	S												
	J												
	L												
	E												
		J	F	M	A	M	J	J	A	S	O	N	D
		Florida Bay				Ten Thousand Islands				Caloosahatchee River			
		Eastern Gulf of Mexico Estuaries											

Relative Abundance

	Highly Abundant
	Abundant
	Common
Blank	Rare, No Data Available, or Not Present

Life Stage

A	Adults
S	Spawning adults
J	Juveniles
L	Larvae
E	Eggs

Table 3 (continued). Temporal distribution

		Eastern Gulf of Mexico Estuaries											
		Charlotte Harbor				Tampa Bay				Suwannee River			
Month		J	F	M	A	M	J	J	A	S	O	N	D
Species / Life Stage													
Bay scallop	A												
	S												
<i>Argopecten</i>	J												
<i>irradians</i>	L												
	E												
American oyster	A												
	S												
<i>Crassostrea</i>	J												
<i>virginica</i>	L												
	E												
Common rangia	A												
	S												
<i>Rangia</i>	J												
<i>cuneata</i>	L												
	E												
Hard clam	A												
	S												
<i>Mercenaria</i>	J												
<i>species</i>	L												
	E												
Brown shrimp	A												
	S												
<i>Penaeus</i>	J												
<i>aztecus</i>	L												
	E												
Pink shrimp	A												
	S												
<i>Penaeus</i>	J												
<i>duorarum</i>	L												
	E												
		J	F	M	A	M	J	J	A	S	O	N	D
		Charlotte Harbor				Tampa Bay				Suwannee River			
		Eastern Gulf of Mexico Estuaries											

Relative Abundance

 Highly Abundant

 Abundant

 Common
Blank Rare, No Data Available,
or Not Present

Life Stage

A - Adults

S - Spawning adults

J - Juveniles

L - Larvae

E - Eggs

Table 3 (continued). Temporal distribution

		Eastern Gulf of Mexico Estuaries																																			
		Apalachee Bay												Apalachicola Bay												St. Andrew Bay											
Month		J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
Species/Life Stage																																					
Bay scallop	A																																				
	S																																				
	J																																				
	L																																				
	E																																				
American oyster	A																																				
	S																																				
	J																																				
	L																																				
	E																																				
Common rangia	A																																				
	S																																				
	J																																				
	L																																				
	E																																				
Hard clam	A																																				
	S																																				
	J																																				
	L																																				
	E																																				
Brown shrimp	A																																				
	S																																				
	J																																				
	L																																				
	E																																				
Pink shrimp	A																																				
	S																																				
	J																																				
	L																																				
	E																																				
		J	F	M	A	M	J <th>J</th> <th>A</th> <th>S</th> <th>O</th> <th>N</th> <th>D</th> <th>J</th>	J	A	S	O	N	D	J	F	M	A	M	J <th>J</th> <th>A</th> <th>S</th> <th>O</th> <th>N</th> <th>D</th> <th>J</th>	J	A	S	O	N	D	J	F	M	A	M	J <th>J</th> <th>A</th> <th>S</th> <th>O</th> <th>N</th> <th>D</th>	J	A	S	O	N	D
		Apalachee Bay												Apalachicola Bay												St. Andrew Bay											
		Eastern Gulf of Mexico Estuaries																																			

Relative Abundance

-  Highly Abundant
-  Abundant
-  Common

Blank Rare, No Data Available, or Not Present

Life Stage

- A - Adults
- S - Spawning adults
- J - Juveniles
- L - Larvae
- E - Eggs

Table 3 (continued). Temporal distribution

		Eastern Gulf of Mexico Estuaries																											
		Choctawhatchee Bay				Pensacola Bay				Perdido Bay				Mobile Bay															
Month		J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D				
Species/Life Stage																													
Bay scallop <i>Argopecten irradians</i>	A																												
	S																												
	J																												
	L																												
	E																												
American oyster <i>Crassostrea virginica</i>	A																												
	S																												
	J																												
	L																												
	E																												
Common rangia <i>Rangia cuneata</i>	A																												
	S																												
	J																												
	L																												
	E																												
Hard clam <i>Mercenaria species</i>	A																												
	S																												
	J																												
	L																												
	E																												
Brown shrimp <i>Penaeus aztecus</i>	A																												
	S																												
	J																												
	L																												
	E																												
Pink shrimp <i>Penaeus duorarum</i>	A																												
	S																												
	J																												
	L																												
	E																												
		J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D				
		Choctawhatchee Bay				Pensacola Bay				Perdido Bay				Mobile Bay															
		Eastern Gulf of Mexico Estuaries																											

Relative Abundance

	Highly Abundant
	Abundant
	Common

Blank Rare, No Data Available,
or Not Present

Life Stage

A	- Adults
S	- Spawning adults
J	- Juveniles
L	- Larvae
E	- Eggs

Table 3 (continued). Temporal distribution

		Eastern Gulf of Mexico Estuaries																																			
		Florida Bay												Ten Thousand Islands												Caloosahatchee River											
Month		J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
Species/Life Stage																																					
White shrimp	A																																				
	S																																				
	<i>Penaeus</i>																																				
	<i>setiferus</i>																																				
		J																																			
Grass shrimp	A																																				
	S																																				
	<i>Palaemonetes</i>																																				
	<i>pugio</i>																																				
		J																																			
Spiny lobster	A																																				
	M																																				
	<i>Panulirus</i>																																				
	<i>argus</i>																																				
		J																																			
Blue crab	A																																				
	M																																				
	<i>Callinectes</i>																																				
	<i>sapidus</i>																																				
		J																																			
Gulf stone crab	A																																				
	M																																				
	<i>Menippe</i>																																				
	<i>adina</i>																																				
		J																																			
Stone crab	A																																				
	M																																				
	<i>Menippe</i>																																				
	<i>mercenaria</i>																																				
		J																																			
		J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
		Florida Bay												Ten Thousand Islands												Caloosahatchee River											
		Eastern Gulf of Mexico Estuaries																																			

Relative Abundance

	Highly Abundant
	Abundant
	Common
Blank	Rare, No Data Available, or Not Present

Life Stage

A	- Adults
S	- Spawning adults
J	- Juveniles
L	- Larvae
E	- Eggs
M	- Mating

Table 3 (continued). Temporal distribution

		Eastern Gulf of Mexico Estuaries											
		Charlotte Harbor				Tampa Bay				Suwannee River			
Month		J	F	M	A	M	J	J	A	S	O	N	D
Species/Life Stage													
White shrimp	A												
	S												
<i>Penaeus</i>	J												
<i>setiferus</i>	L												
	E												
Grass shrimp	A												
	S												
<i>Palaemonetes</i>	J												
<i>pugio</i>	L												
	E												
Spiny lobster	A												
	M												
<i>Panulirus</i>	J												
<i>argus</i>	L												
	S												
Blue crab	A												
	M												
<i>Callinectes</i>	J												
<i>sapidus</i>	L												
	S												
Gulf stone crab	A												
	M												
<i>Menippe</i>	J												
<i>adina</i>	L												
	S												
Stone crab	A												
	M												
<i>Menippe</i>	J												
<i>mercenaria</i>	L												
	S												
		J	F	M	A	M	J	J	A	S	O	N	D
		Charlotte Harbor				Tampa Bay				Suwannee River			
		Eastern Gulf of Mexico Estuaries											

Relative Abundance

	Highly Abundant
	Abundant
	Common
Blank	Rare, No Data Available, or Not Present

Life Stage

A	Adults
S	Spawning adults
J	Juveniles
L	Larvae
E	Eggs
M	Mating

Table 3 (continued). Temporal distribution

		Eastern Gulf of Mexico Estuaries											
		Apalachee Bay				Apalachicola Bay				St. Andrew Bay			
Month		J	F	M	A	M	J	J	A	S	O	N	D
Species/Life Stage													
White shrimp <i>Penaeus setiferus</i>	A												
	S												
	J												
	L												
	E												
Grass shrimp <i>Palaemonetes pugio</i>	A												
	S												
	J												
	L												
	E												
Spiny lobster <i>Panulirus argus</i>	A												
	M												
	J												
	L												
	S												
Blue crab <i>Callinectes sapidus</i>	A												
	M												
	J												
	L												
	S												
Gulf stone crab <i>Menippe adina</i>	A												
	M												
	J												
	L												
	S												
Stone crab <i>Menippe mercenaria</i>	A												
	M												
	J												
	L												
	S												
		J	F	M	A	M	J	J	A	S	O	N	D
		Apalachee Bay				Apalachicola Bay				St. Andrew Bay			
		Eastern Gulf of Mexico Estuaries											

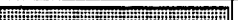
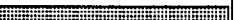
Relative Abundance

■	Highly Abundant
▨	Abundant
□	Common
Blank	Rare, No Data Available, or Not Present

Life Stage

A	Adults
S	Spawning adults
J	Juveniles
L	Larvae
E	Eggs
M	Mating

Table 3 (continued). Temporal distribution

		Eastern Gulf of Mexico Estuaries																								
		Choctawhatchee Bay					Pensacola Bay					Perdido Bay					Mobile Bay									
Month		J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	
Species/Life Stage																										
White shrimp <i>Penaeus setiferus</i>	A																									
	S																									
	J																									
	L																									
	E																									
Grass shrimp <i>Palaemonetes pugio</i>	A																									
	S																									
	J																									
	L																									
	E																									
Spiny lobster <i>Panulirus argus</i>	A																									
	M																									
	J																									
	L																									
	S																									
Blue crab <i>Callinectes sapidus</i>	A																									
	M																									
	J																									
	L																									
	S																									
Gulf stone crab <i>Menippe adina</i>	A																									
	M																									
	J																									
	L																									
	S																									
Stone crab <i>Menippe mercenaria</i>	A																									
	M																									
	J																									
	L																									
	S																									
		J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	
		Choctawhatchee Bay					Pensacola Bay					Perdido Bay					Mobile Bay									
		Eastern Gulf of Mexico Estuaries																								

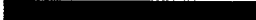
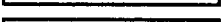
Relative Abundance

 Highly Abundant
 Abundant
 Common
Blank Rare, No Data Available, or Not Present

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs
M - Mating

Table 3 (continued). Temporal distribution

		Eastern Gulf of Mexico Estuaries																																			
		Florida Bay												Ten Thousand Islands						Caloosahatchee River																	
Month		J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
Species/Life Stage																																					
Tarpon <i>Megalops atlanticus</i>	A																																				
	S																																				
	J																																				
	L																																				
	E																																				
Alabama shad <i>Alosa alabamae</i>	A																																				
	S																																				
	J																																				
	L																																				
	E																																				
Gulf menhaden <i>Brevoortia patronus</i>	A																																				
	S																																				
	J																																				
	L																																				
	E																																				
Yellowfin menhaden <i>Brevoortia smithi</i>	A																																				
	S																																				
	J																																				
	L																																				
	E																																				
Bay anchovy <i>Anchoa mitchilli</i>	A																																				
	S																																				
	J																																				
	L																																				
	E																																				
Sheepshead minnow <i>Cyprinodon variegatus</i>	A																																				
	S																																				
	J																																				
	L																																				
	E																																				
		J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
		Florida Bay												Ten Thousand Islands						Caloosahatchee River																	
		Eastern Gulf of Mexico Estuaries																																			

Relative Abundance

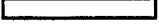
-  Highly Abundant
-  Abundant
-  Common

Blank Rare, No Data Available,
or Not Present

Life Stage

- A - Adults
- S - Spawning adults
- J - Juveniles
- L - Larvae
- E - Eggs

Table 3 (continued). Temporal distribution

		Eastern Gulf of Mexico Estuaries																																															
		Charlotte Harbor												Tampa Bay												Suwannee River																							
Month		J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D												
Species/Life Stage																																																	
Tarpon <i>Megalops atlanticus</i>	A																																																
	S																																																
	J																																																
	L																																																
	E																																																
Alabama shad <i>Alosa alabamae</i>	A																																																
	S																																																
	J																																																
	L																																																
	E																																																
Gulf menhaden <i>Brevoortia patronus</i>	A																																																
	S																																																
	J																																																
	L																																																
	E																																																
Yellowfin menhaden <i>Brevoortia smithi</i>	A																																																
	S																																																
	J																																																
	L																																																
	E																																																
Bay anchovy <i>Anchoa mitchilli</i>	A																																																
	S																																																
	J																																																
	L																																																
	E																																																
Sheepshead minnow <i>Cyprinodon variegatus</i>	A																																																
	S																																																
	J																																																
	L																																																
	E																																																
		J	F	M	A	M	J <td>J</td> <td>A</td> <td>S</td> <td>O</td> <td>N</td> <td>D</td> <td>J</td> <td>F</td> <td>M</td> <td>A</td> <td>M</td> <td>J</td> <td>J</td> <td>A</td> <td>S</td> <td>O</td> <td>N</td> <td>D</td> <td>J</td> <td>F</td> <td>M</td> <td>A</td> <td>M</td> <td>J</td> <td>J</td> <td>A</td> <td>S</td> <td>O</td> <td>N</td> <td>D</td>	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D												
		Charlotte Harbor												Tampa Bay												Suwannee River																							
		Eastern Gulf of Mexico Estuaries																																															

Relative Abundance

[Solid Black]	Highly Abundant
[Cross-hatched]	Abundant
[White]	Common
[Blank]	Rare, No Data Available, or Not Present

Life Stage

A	Adults
S	Spawning adults
J	Juveniles
L	Larvae
E	Eggs

Table 3 (continued). Temporal distribution

		Eastern Gulf of Mexico Estuaries											
		Apalachee Bay				Apalachicola Bay				St. Andrew Bay			
Month		J	F	M	A	M	J	J	A	S	O	N	D
Species/Life Stage													
Tarpon <i>Megalops atlanticus</i>	A												
	S												
	J												
	L												
	E												
Alabama shad <i>Alosa alabamae</i>	A												
	S												
	J												
	L												
	E												
Gulf menhaden <i>Brevoortia patronus</i>	A												
	S												
	J												
	L												
	E												
Yellowfin menhaden <i>Brevoortia smithi</i>	A												
	S												
	J												
	L												
	E												
Bay anchovy <i>Anchoa mitchilli</i>	A												
	S												
	J												
	L												
	E												
Sheepshead minnow <i>Cyprinodon variegatus</i>	A												
	S												
	J												
	L												
	E												
		J	F	M	A	M	J	J	A	S	O	N	D
		Apalachee Bay				Apalachicola Bay				St. Andrew Bay			
		Eastern Gulf of Mexico Estuaries											

Relative Abundance

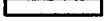
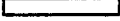
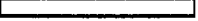
-  Highly Abundant
 Abundant
 Common

Blank Rare, No Data Available,
or Not Present

Life Stage

- A - Adults
 S - Spawning adults
 J - Juveniles
 L - Larvae
 E - Eggs

Table 3 (continued). Temporal distribution

		Eastern Gulf of Mexico Estuaries																							
		Choctawhatchee Bay					Pensacola Bay					Perdido Bay					Mobile Bay								
Month		J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
Species/Life Stage																									
Tarpon	A																								
	S																								
	J																								
	L																								
	E																								
Alabama shad	A																								
	S																								
	J																								
	L																								
	E																								
Gulf menhaden	A																								
	S																								
	J																								
	L																								
	E																								
Yellowfin menhaden	A																								
	S																								
	J																								
	L																								
	E																								
Bay anchovy	A																								
	S																								
	J																								
	L																								
	E																								
Sheepshead minnow	A																								
	S																								
	J																								
	L																								
	E																								
		J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
		Choctawhatchee Bay					Pensacola Bay					Perdido Bay					Mobile Bay								
		Eastern Gulf of Mexico Estuaries																							

Relative Abundance

 Highly Abundant
 Abundant
 Common
Blank Rare, No Data Available, or Not Present

Life Stage

A - Adults
S - Spawning adults
J - Juveniles
L - Larvae
E - Eggs

Table 3 (continued). Temporal distribution

		Eastern Gulf of Mexico Estuaries											
		Florida Bay				Ten Thousand Islands				Caloosahatchee River			
Month		J	F	M	A	M	J	J	A	S	O	N	D
Species/Life Stage													
Gulf killifish <i>Fundulus grandis</i>	A												
	S												
	J												
	L												
	E												
Snook <i>Centropomus undecimalis</i>	A												
	S												
	J												
	L												
	E												
Bluefish <i>Pomatomus saltatrix</i>	A												
	S												
	J												
	L												
	E												
Bluerunner <i>Caranx crysos</i>	A												
	S												
	J												
	L												
	E												
Creville jack <i>Caranx hippos</i>	A												
	S												
	J												
	L												
	E												
Florida pompano <i>Trachinotus carolinus</i>	A												
	S												
	J												
	L												
	E												
		J	F	M	A	M	J	J	A	S	O	N	D
		Florida Bay				Ten Thousand Islands				Caloosahatchee River			
		Eastern Gulf of Mexico Estuaries											

Relative Abundance

 Highly Abundant

 Abundant

 Common

 Blank Rare, No Data Available,
or Not Present

Life Stage

A - Adults

S - Spawning adults

J - Juveniles

L - Larvae

E - Eggs

Table 3 (continued). Temporal distribution

		Eastern Gulf of Mexico Estuaries																																			
		Charlotte Harbor												Tampa Bay												Suwannee River											
Month		J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
Species/Life Stage																																					
Gulf killifish <i>Fundulus grandis</i>	A																																				
	S																																				
	J																																				
	L																																				
	E																																				
Snook <i>Centropomus undecimalis</i>	A																																				
	S																																				
	J																																				
	L																																				
	E																																				
Bluefish <i>Pomatomus saltatrix</i>	A																																				
	S																																				
	J																																				
	L																																				
	E																																				
Bluerunner <i>Caranx crysos</i>	A																																				
	S																																				
	J																																				
	L																																				
	E																																				
Crevalle jack <i>Caranx hippos</i>	A																																				
	S																																				
	J																																				
	L																																				
	E																																				
Florida pompano <i>Trachinotus carolinus</i>	A																																				
	S																																				
	J																																				
	L																																				
	E																																				
		J	F	M	A	M	J <td>J</td> <td>A</td> <td>S</td> <td>O</td> <td>N</td> <td>D</td> <td>J</td> <td>F</td> <td>M</td> <td>A</td> <td>M</td> <td>J</td> <td>J</td> <td>A</td> <td>S</td> <td>O</td> <td>N</td> <td>D</td> <td>J</td> <td>F</td> <td>M</td> <td>A</td> <td>M</td> <td>J</td> <td>J</td> <td>A</td> <td>S</td> <td>O</td> <td>N</td> <td>D</td>	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
		Charlotte Harbor												Tampa Bay												Suwannee River											
		Eastern Gulf of Mexico Estuaries																																			

Relative Abundance

[Solid Black] Highly Abundant

[Dotted] Abundant

[White] Common

Blank Rare, No Data Available,
or Not Present

Life Stage

A - Adults

S - Spawning adults

J - Juveniles

L - Larvae

E - Eggs

Table 3 (continued). Temporal distribution

		Eastern Gulf of Mexico Estuaries											
		Apalachee Bay				Apalachicola Bay				St. Andrew Bay			
Month		J	F	M	A	M	J	J	A	S	O	N	D
Species/Life Stage													
Gulf killifish <i>Fundulus grandis</i>	A												
	S												
	J												
	L												
	E												
Snook <i>Centropomus undecimalis</i>	A												
	S												
	J												
	L												
	E												
Bluefish <i>Pomatomus saltatrix</i>	A												
	S												
	J												
	L												
	E												
Bluerunner <i>Caranx crysos</i>	A												
	S												
	J												
	L												
	E												
Creville jack <i>Caranx hippos</i>	A												
	S												
	J												
	L												
	E												
Florida pompano <i>Trachinotus carolinus</i>	A												
	S												
	J												
	L												
	E												
		J	F	M	A	M	J	J	A	S	O	N	D
		Apalachee Bay				Apalachicola Bay				St. Andrew Bay			
		Eastern Gulf of Mexico Estuaries											

Relative Abundance

[Solid Black] Highly Abundant

[Cross-hatched] Abundant

[White] Common

Blank Rare, No Data Available, or Not Present

Life Stage

A - Adults

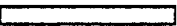
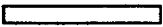
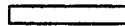
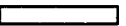
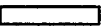
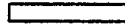
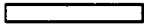
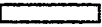
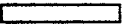
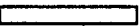
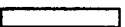
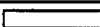
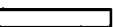
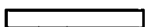
S - Spawning adults

J - Juveniles

L - Larvae

E - Eggs

Table 3 (continued). Temporal distribution

		Eastern Gulf of Mexico Estuaries																							
		Choctawhatchee Bay					Pensacola Bay					Perdido Bay					Mobile Bay								
Month		J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
Species/Life Stage																									
Gulf killifish <i>Fundulus grandis</i>	A																								
	S																								
	J																								
	L																								
	E																								
Snook <i>Centropomus undecimalis</i>	A																								
	S																								
	J																								
	L																								
	E																								
Bluefish <i>Pomatomus saltatrix</i>	A																								
	S																								
	J																								
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	E																								
Bluerunner <i>Caranx crysos</i>	A																								
	S																								
	J																								
	L																								
	E																								
Crevalle jack <i>Caranx hippos</i>	A																								
	S																								
	J																								
	L																								
	E																								
Florida pompano <i>Trachinotus carolinus</i>	A																								
	S																								
	J																								
	L																								
	E																								
		J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
		Choctawhatchee Bay					Pensacola Bay					Perdido Bay					Mobile Bay								
		Eastern Gulf of Mexico Estuaries																							

Relative Abundance

	Highly Abundant
	Abundant
	Common
Blank	Rare, No Data Available, or Not Present

Life Stage

A	Adults
S	Spawning adults
J	Juveniles
L	Larvae
E	Eggs

Table 3 (continued). Temporal distribution

		Eastern Gulf of Mexico Estuaries											
		Florida Bay				Ten Thousand Islands				Caloosahatchee River			
Month		J	F	M	A	M	J	J	A	S	O	N	D
Species/Life Stage													
Gray snapper <i>Lutjanus griseus</i>	A												
	S												
	J												
	L												
	E												
Pinfish <i>Lagodon rhomboides</i>	A												
	S												
	J												
	L												
	E												
Sand seatrout <i>Cynoscion arenarius</i>	A												
	S												
	J												
	L												
	E												
Spotted seatrout <i>Cynoscion nebulosus</i>	A												
	S												
	J												
	L												
	E												
Spot <i>Leiostomus xanthurus</i>	A												
	S												
	J												
	L												
	E												
Atlantic croaker <i>Micropogonias undulatus</i>	A												
	S												
	J												
	L												
	E												
		J	F	M	A	M	J	J	A	S	O	N	D
		Florida Bay				Ten Thousand Islands				Caloosahatchee River			
		Eastern Gulf of Mexico Estuaries											

Relative Abundance

Highly Abundant

Abundant

Common

Blank Rare, No Data Available,
or Not Present

Life Stage

A - Adults

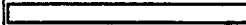
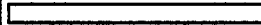
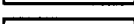
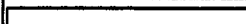
S - Spawning adults

J - Juveniles

L - Larvae

E - Eggs

Table 3 (continued). Temporal distribution

		Eastern Gulf of Mexico Estuaries																																			
		Charlotte Harbor				Tampa Bay				Suwannee River																											
Month		J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D												
Species/Life Stage																																					
Gray snapper <i>Lutjanus griseus</i>	A																																				
	S																																				
	J																																				
	L																																				
	E																																				
Pinfish <i>Lagodon rhomboides</i>	A																																				
	S																																				
	J																																				
	L																																				
	E																																				
Sand seatrout <i>Cynoscion arenarius</i>	A																																				
	S																																				
	J																																				
	L																																				
	E																																				
Spotted seatrout <i>Cynoscion nebulosus</i>	A																																				
	S																																				
	J																																				
	L																																				
	E																																				
Spot <i>Leiostomus xanthurus</i>	A																																				
	S																																				
	J																																				
	L																																				
	E																																				
Atlantic croaker <i>Micropogonias undulatus</i>	A																																				
	S																																				
	J																																				
	L																																				
	E																																				
		J <th>F</th> <th>M</th> <th>A</th> <th>M</th> <th>J</th> <th>J</th> <th>A</th> <th>S</th> <th>O</th> <th>N</th> <th>D</th> <th>J</th> <th>F</th> <th>M</th> <th>A</th> <th>M</th> <th>J</th> <th>J</th> <th>A</th> <th>S</th> <th>O</th> <th>N</th> <th>D</th>	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D												
		Charlotte Harbor				Tampa Bay				Suwannee River																											
		Eastern Gulf of Mexico Estuaries																																			

Relative Abundance

	Highly Abundant
	Abundant
	Common
Blank	Rare, No Data Available, or Not Present

Life Stage

A	Adults
S	Spawning adults
J	Juveniles
L	Larvae
E	Eggs

Table 3 (continued). Temporal distribution

		Eastern Gulf of Mexico Estuaries																							
		Apalachee Bay				Apalachicola Bay				St. Andrew Bay															
Month		J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
Species/Life Stage																									
Gray snapper <i>Lutjanus griseus</i>	A																								
	S																								
	J																								
	L																								
	E																								
Pinfish <i>Lagodon rhomboides</i>	A																								
	S																								
	J																								
	L																								
	E																								
Sand seatrout <i>Cynoscion arenarius</i>	A																								
	S																								
	J																								
	L																								
	E																								
Spotted seatrout <i>Cynoscion nebulosus</i>	A																								
	S																								
	J																								
	L																								
	E																								
Spot <i>Leiostomus xanthurus</i>	A																								
	S																								
	J																								
	L																								
	E																								
Atlantic croaker <i>Micropogonias undulatus</i>	A																								
	S																								
	J																								
	L																								
	E																								
		J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
		Apalachee Bay				Apalachicola Bay				St. Andrew Bay															
		Eastern Gulf of Mexico Estuaries																							

Relative Abundance

	Highly Abundant
	Abundant
	Common

Blank Rare, No Data Available,
or Not Present

Life Stage

A	- Adults
S	- Spawning adults
J	- Juveniles
L	- Larvae
E	- Eggs

Table 3 (continued). Temporal distribution

		Eastern Gulf of Mexico Estuaries																							
		Choctawhatchee Bay					Pensacola Bay					Perdido Bay					Mobile Bay								
Month		J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
Species/Life Stage																									
Gray snapper <i>Lutjanus griseus</i>	A																								
	S																								
	J	■																							
	L																								
	E																								
Pinfish <i>Lagodon rhomboides</i>	A																								
	S																								
	J																								
	L																								
	E																								
Sand seatrout <i>Cynoscion arenarius</i>	A																								
	S																								
	J																								
	L																								
	E																								
Spotted seatrout <i>Cynoscion nebulosus</i>	A																								
	S																								
	J																								
	L																								
	E																								
Spot <i>Leiostomus xanthurus</i>	A																								
	S																								
	J																								
	L																								
	E																								
Atlantic croaker <i>Micropogonias undulatus</i>	A																								
	S																								
	J																								
	L																								
	E																								
		J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
		Choctawhatchee Bay					Pensacola Bay					Perdido Bay					Mobile Bay								
		Eastern Gulf of Mexico Estuaries																							

Relative Abundance

 Highly Abundant

 Abundant

 Common

 Blank Rare, No Data Available,
or Not Present

Life Stage

A - Adults

S - Spawning adults

J - Juveniles

L - Larvae

E - Eggs

Table 3 (continued). Temporal distribution

		Eastern Gulf of Mexico Estuaries											
		Florida Bay				Ten Thousand Islands				Caloosahatchee River			
Month		J	F	M	A	M	J	J	A	S	O	N	D
Species/Life Stage													
Red drum	A												
	S												
<i>Sciaenops ocellatus</i>	J												
	L												
	E												
Striped mullet	A												
	S												
<i>Mugil cephalus</i>	J												
	L												
	E												
Code goby	A												
	S												
<i>Gobiosoma robustum</i>	J												
	L												
	E												
Spanish mackerel	A												
	S												
<i>Scomberomorus maculatus</i>	J												
	L												
	E												
Gulf flounder	A												
	S												
<i>Paralichthys albigutta</i>	J												
	L												
	E												
Southern flounder	A												
	S												
<i>Paralichthys lethostigma</i>	J												
	L												
	E												
		J	F	M	A	M	J	J	A	S	O	N	D
		Florida Bay				Ten Thousand Islands				Caloosahatchee River			
		Eastern Gulf of Mexico Estuaries											

Relative Abundance

	Highly Abundant
	Abundant
	Common

Blank Rare, No Data Available,
or Not Present

Life Stage

A	Adults
S	Spawning adults
J	Juveniles
L	Larvae
E	Eggs

Table 3 (continued). Temporal distribution

		Eastern Gulf of Mexico Estuaries																																			
		Charlotte Harbor												Tampa Bay												Suwannee River											
Month		J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
Species/Life Stage																																					
Red drum <i>Sciaenops ocellatus</i>	A																																				
	S																																				
	J																																				
	L																																				
	E																																				
Striped mullet <i>Mugil cephalus</i>	A																																				
	S																																				
	J																																				
	L																																				
	E																																				
Code goby <i>Gobiosoma robustum</i>	A																																				
	S																																				
	J																																				
	L																																				
	E																																				
Spanish mackerel <i>Scomberomorus maculatus</i>	A																																				
	S																																				
	J																																				
	L																																				
	E																																				
Gulf flounder <i>Paralichthys albigutta</i>	A																																				
	S																																				
	J																																				
	L																																				
	E																																				
Southern flounder <i>Paralichthys lethostigma</i>	A																																				
	S																																				
	J																																				
	L																																				
	E																																				
		J	F	M	A	M	J <th>J</th> <th>A</th> <th>S</th> <th>O</th> <th>N</th> <th>D</th> <th>J</th> <th>F</th> <th>M</th> <th>A</th> <th>M</th> <th>J</th> <th>J</th> <th>A</th> <th>S</th> <th>O</th> <th>N</th> <th>D</th> <th>J</th> <th>F</th> <th>M</th> <th>A</th> <th>M</th> <th>J</th> <th>J</th> <th>A</th> <th>S</th> <th>O</th> <th>N</th> <th>D</th>	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
		Charlotte Harbor												Tampa Bay												Suwannee River											
		Eastern Gulf of Mexico Estuaries																																			

Relative Abundance

 Highly Abundant

 Abundant

 Common

Blank Rare, No Data Available, or Not Present

Life Stage

A - Adults

S - Spawning adults

J - Juveniles

L - Larvae

E - Eggs

Table 3 (continued). Temporal distribution

		Eastern Gulf of Mexico Estuaries											
		Apalachee Bay				Apalachicola Bay				St. Andrew Bay			
Month		J	F	M	A	M	J	J	A	S	O	N	D
Species/Life Stage													
Red drum <i>Sciaenops ocellatus</i>	A												
	S												
	J												
	L												
	E												
Striped mullet <i>Mugil cephalus</i>	A												
	S												
	J												
	L												
	E												
Code goby <i>Gobiosoma robustum</i>	A												
	S												
	J												
	L												
	E												
Spanish mackerel <i>Scomberomorus maculatus</i>	A												
	S												
	J												
	L												
	E												
Gulf flounder <i>Paralichthys albigutta</i>	A												
	S												
	J												
	L												
	E												
Southern flounder <i>Paralichthys lethostigma</i>	A												
	S												
	J												
	L												
	E												
		J	F	M	A	M	J	J	A	S	O	N	D
		Apalachee Bay				Apalachicola Bay				St. Andrew Bay			
		Eastern Gulf of Mexico Estuaries											

Relative Abundance

 Highly Abundant

 Abundant

 Common

 Blank Rare, No Data Available,
or Not Present

Life Stage

A - Adults

S - Spawning adults

J - Juveniles

L - Larvae

E - Eggs

Table 3 (continued). Temporal distribution

		Eastern Gulf of Mexico Estuaries																																															
		Choctawhatchee Bay												Pensacola Bay												Perdido Bay												Mobile Bay											
Month		J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D												
Species/Life Stage																																																	
Red drum	A																																																
	S																																																
	J																																																
	L																																																
<i>Sciaenops ocellatus</i>	E																																																
	A																																																
	S																																																
	J																																																
Striped mullet	L																																																
	E																																																
	A																																																
	S																																																
<i>Mugil cephalus</i>	J																																																
	L																																																
	E																																																
	A																																																
Code goby	S																																																
	J																																																
	L																																																
	E																																																
Spanish mackerel	A																																																
	S																																																
	J																																																
	L																																																
<i>Scomberomorus maculatus</i>	E																																																
	A																																																
	S																																																
	J																																																
Gulf flounder	L																																																
	E																																																
	A																																																
	S																																																
<i>Paralichthys albigutta</i>	J																																																
	L																																																
	E																																																
	A																																																
Southern flounder	S																																																
	J																																																
	L																																																
	E																																																
		J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D												
		Choctawhatchee Bay												Pensacola Bay												Perdido Bay												Mobile Bay											
		Eastern Gulf of Mexico Estuaries																																															

Relative Abundance

 Highly Abundant

 Abundant

 Common

 Blank Rare, No Data Available,
or Not Present

Life Stage

A - Adults

S - Spawning adults

J - Juveniles

L - Larvae

E - Eggs

Table 4. Data reliability

Index to Table 4: Page location of data reliability table for each species and estuary.

Common and Scientific Name	Estuary									
	Florida Bay	Ten Thousand Islands	Caloosahatchee River	Charlotte Harbor	Tampa Bay	Suwannee River	Apalachee Bay	Apalachicola Bay	St. Andrew Bay	Choctawhatchee Bay
Bay scallop (<i>Argopecten irradians</i>)										
American oyster (<i>Crassostrea virginica</i>)										
Common rangia (<i>Rangia cuneata</i>)										
Hard clam (<i>Mercenaria</i> species)										
Brown shrimp (<i>Penaeus aztecus</i>)										
Pink shrimp (<i>Penaeus duorarum</i>)										
White shrimp (<i>Penaeus setiferus</i>)										
Grass shrimp (<i>Palaemonetes pugio</i>)										
Spiny lobster (<i>Panulirus argus</i>)										
Gulf stone crab (<i>Menippe adina</i>)										
Stone crab (<i>Menippe mercenaria</i>)										
Blue crab (<i>Callinectes sapidus</i>)										
Tarpon (<i>Megalops atlanticus</i>)										
Alabama shad (<i>Alosa alabamae</i>)										
Gulf menhaden (<i>Brevoortia patronus</i>)										
Yellowfin menhaden (<i>Brevoortia smithi</i>)										
Bay anchovy (<i>Anchoa mitchilli</i>)										
Sheepshead minnow (<i>Cyprinodon variegatus</i>)										
Gulf killifish (<i>Fundulus grandis</i>)										
Snook (<i>Centropomus undecimalis</i>)										
Bluefish (<i>Pomatomus saltatrix</i>)										
Blue runner (<i>Caranx crysos</i>)										
Creville jack (<i>Caranx hippos</i>)										
Florida pompano (<i>Trachinotus carolinus</i>)										
Gray snapper (<i>Lutjanus griseus</i>)										
Pinfish (<i>Lagodon rhomboides</i>)										
Sand seatrout (<i>Cynoscion arenarius</i>)										
Spotted seatrout (<i>Cynoscion nebulosus</i>)										
Spot (<i>Leiostomus xanthurus</i>)										
Atlantic croaker (<i>Micropogonias undulatus</i>)										
Red drum (<i>Sciaenops ocellatus</i>)										
Striped mullet (<i>Mugil cephalus</i>)										
Code goby (<i>Gobiosoma robustum</i>)										
Spanish mackerel (<i>Scomberomorus maculatus</i>)										
Gulf flounder (<i>Paralichthys albigutta</i>)										
Southern flounder (<i>Paralichthys lethostigma</i>)										

Table 4. Data reliability

		Eastern Gulf of Mexico Estuaries						
		Florida Bay	Ten Thousand Islands	Caloosa-hatchee River	Charlotte Harbor	Tampa Bay	Suwannee River	Apalachee Bay
Species/Life Stage								
Bay scallop <i>Argopecten irradians</i>	A	■	▣	▣	□	▣	■	▣
	S	■	▣	▣	□	▣	■	▣
	J	■	▣	▣	□	▣	■	▣
	L	■	▣	▣	□	▣	■	▣
	E	■	▣	▣	□	▣	■	▣
American oyster <i>Crassostrea virginica</i>	A	■	■	■	■	■	▣	▣
	S	■	▣	□	▣	▣	▣	▣
	J	■	▣	■	■	■	▣	▣
	L	■	▣	□	▣	▣	▣	▣
	E	■	▣	□	▣	▣	▣	▣
Common rangia <i>Rangia cuneata</i>	A	■	■	▣	▣	▣	▣	▣
	S	■	■	▣	▣	▣	▣	▣
	J	■	■	▣	▣	▣	▣	▣
	L	■	■	▣	▣	▣	▣	▣
	E	■	■	▣	▣	▣	▣	▣
Hard clam <i>Mercenaria species</i>	A	■	■	■	▣	▣	■	□
	S	■	■	■	□	▣	▣	□
	J	■	■	■	▣	▣	■	□
	L	■	■	■	□	▣	▣	□
	E	■	■	■	□	▣	▣	□
Brown shrimp <i>Penaeus aztecus</i>	A	▣	▣	□	▣	□	■	■
	S	□	■	■	■	■	■	■
	J	▣	▣	□	▣	□	■	■
	L	□	▣	▣	▣	□	■	■
	E	□	■	■	■	■	■	■
Pink shrimp <i>Penaeus duorarum</i>	A	■	■	■	■	■	▣	▣
	S	■	■	■	■	■	■	■
	J	■	■	□	▣	■	▣	■
	L	■	■	■	■	■	▣	▣
	E	■	■	■	■	■	■	■
		Florida Bay	Ten Thousand Islands	Caloosa-hatchee River	Charlotte Harbor	Tampa Bay	Suwannee River	Apalachee Bay
Eastern Gulf of Mexico Estuaries								

Reliability

- Highly Certain
 ▣ Moderately Certain
 □ Reasonable Inference

Life Stage

- A - Adults
 S - Spawning adults
 J - Juveniles
 L - Larvae
 E - Eggs

Table 4 (continued). Data reliability

Species/Life Stage		Eastern Gulf of Mexico Estuaries					
		Apalachi- cola Bay	St. Andrew Bay	Chocta- watchee Bay	Pensacola Bay	Perdido Bay	Mobile Bay
Bay scallop <i>Argopecten irradians</i>	A	■	■	■	■	■	■
	S	■	■	■	■	■	■
	J	■	■	■	■	■	■
	L	■	■	■	■	■	■
	E	■	■	■	■	■	■
American oyster <i>Crassostrea virginica</i>	A	■	■	■	■	■	■
	S	■	■	■	■	■	■
	J	■	■	■	■	■	■
	L	■	■	■	■	■	■
	E	■	■	■	■	■	■
Common rangia <i>Rangia cuneata</i>	A	■	■	■	■	■	■
	S	■	■	■	■	■	■
	J	■	■	■	■	■	■
	L	■	■	■	■	■	■
	E	■	■	■	■	■	■
Hard clam <i>Mercenaria species</i>	A	■	■	■	■	■	■
	S	■	■	■	■	■	■
	J	■	■	■	■	■	■
	L	■	■	■	■	■	■
	E	■	■	■	■	■	■
Brown shrimp <i>Penaeus aztecus</i>	A	■	■	■	■	■	■
	S	■	■	■	■	■	■
	J	■	■	■	■	■	■
	L	■	■	■	■	■	■
	E	■	■	■	■	■	■
Pink shrimp <i>Penaeus duorarum</i>	A	■	■	■	■	■	■
	S	■	■	■	■	■	■
	J	■	■	■	■	■	■
	L	■	■	■	■	■	■
	E	■	■	■	■	■	■
		Apalachi- cola Bay	St. Andrew Bay	Chocta- watchee Bay	Pensacola Bay	Perdido Bay	Mobile Bay
Eastern Gulf of Mexico Estuaries							

Reliability

- Highly Certain
 ■ Moderately Certain
 □ Reasonable Inference

Life Stage

- A - Adults
 S - Spawning adults
 J - Juveniles
 L - Larvae
 E - Eggs

Table 4 (continued). Data reliability

		Eastern Gulf of Mexico Estuaries						
		Florida Bay	Ten Thousand Islands	Caloosa-hatchee River	Charlotte Harbor	Tampa Bay	Suwannee River	Apalachee Bay
Species/Life Stage								
White shrimp <i>Penaeus setiferus</i>	A	■	■	■	■	■	■	■
	S	■	■	■	■	■	■	■
	J	■	■	■	■	■	■	■
	L	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■
Grass shrimp <i>Palaemonetes pugio</i>	A	■	■	■	■	■	□	■
	S	■	■	■	■	■	□	■
	J	■	■	■	■	■	□	■
	L	■	■	■	■	■	□	■
	E	■	■	■	■	■	□	■
Spiny lobster <i>Panulirus argus</i>	A	■	■	■	■	■	■	■
	M	■	■	■	■	■	■	■
	J	■	■	■	■	■	■	■
	L	■	■	■	■	■	■	■
	S	■	■	■	■	■	■	■
Blue crab <i>Callinectes sapidus</i>	A	■	■	■	■	■	□	■
	M	■	■	■	■	■	■	■
	J	■	■	□	■	■	■	■
	L	□	□	■	□	□	□	□
	S	■	■	■	■	■	■	□
Gulf stone crab <i>Menippe adina</i>	A	■	■	■	■	■	□	□
	M	■	■	■	■	■	□	□
	J	■	■	■	■	■	□	□
	L	■	■	■	■	■	□	□
	S	■	■	■	■	■	□	□
Stone crab <i>Menippe mercenaria</i>	A	■	■	■	□	■	■	□
	M	■	■	■	□	■	■	□
	J	■	■	■	□	■	■	□
	L	■	■	■	□	■	■	□
	S	■	■	■	□	■	■	□
		Florida Bay	Ten Thousand Islands	Caloosa-hatchee River	Charlotte Harbor	Tampa Bay	Suwannee River	Apalachee Bay
Eastern Gulf of Mexico Estuaries								

Reliability

- Highly Certain
 ■ Moderately Certain
 □ Reasonable Inference

Life Stage

- A - Adults
 S - Spawning adults
 J - Juveniles
 L - Larvae
 E - Eggs
 M - Mating

Table 4 (continued). Data reliability

		Eastern Gulf of Mexico Estuaries					
		Apalachi- cola Bay	St. Andrew Bay	Chocta- whatchee Bay	Pensacola Bay	Perdido Bay	Mobile Bay
Species/Life Stage							
White shrimp <i>Penaeus setiferus</i>	A	■	■	■	■	■	■
	S	■	■	■	■	■	■
	J	■	■	■	■	■	■
	L	■	■	■	■	■	■
	E	■	■	■	■	■	■
Grass shrimp <i>Palaemonetes pugio</i>	A	□	■	■	■	■	■
	S	□	■	■	■	■	■
	J	■	■	■	■	■	■
	L	□	■	■	■	■	■
	E	□	■	■	■	■	■
Spiny lobster <i>Panulirus argus</i>	A	■	■	■	■	■	■
	M	■	■	■	■	■	■
	J	■	■	■	■	■	□
	L	■	■	■	■	■	■
	S	■	■	■	■	■	■
Blue crab <i>Callinectes sapidus</i>	A	■	■	■	■	■	■
	M	■	■	■	■	■	■
	J	■	■	■	■	■	■
	L	□	■	□	□	□	□
	S	■	■	■	■	■	■
Gulf stone crab <i>Menippe adina</i>	A	□	□	□	□	□	□
	M	□	□	□	□	□	□
	J	□	□	□	□	□	□
	L	□	□	□	□	□	□
	S	□	□	□	□	□	□
Stone crab <i>Menippe mercenaria</i>	A	□	■	■	■	■	■
	M	□	■	■	■	■	■
	J	□	■	■	■	■	■
	L	□	■	■	■	■	■
	S	□	■	■	■	■	■
		Apalachi- cola Bay	St. Andrew Bay	Chocta- whatchee Bay	Pensacola Bay	Perdido Bay	Mobile Bay
Eastern Gulf of Mexico Estuaries							

Reliability

- Highly Certain
 ■ Moderately Certain
 □ Reasonable Inference

Life Stage

- A - Adults
 S - Spawning adults
 J - Juveniles
 L - Larvae
 E - Eggs
 M - Mating

Table 4 (continued). Data reliability

		Eastern Gulf of Mexico Estuaries						
		Florida Bay	Ten Thousand Islands	Caloosa-hatchee River	Charlotte Harbor	Tampa Bay	Suwannee River	Apalachee Bay
Species/Life Stage								
Tarpon <i>Megalops atlanticus</i>	A	■	■	■	■	■	■	□
	S	■	■	■	■	■	■	■
	J	■	■	■	■	■	■	□
	L	□	□	■	□	■	■	□
	E	■	■	■	■	■	■	■
Alabama shad <i>Alosa alabamae</i>	A	■	■	■	■	■	■	■
	S	■	■	■	■	■	■	■
	J	■	■	■	■	■	■	■
	L	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■
Gulf menhaden <i>Brevoortia patronus</i>	A	■	■	■	□	■	□	■
	S	■	■	■	■	■	□	■
	J	■	■	□	□	■	□	■
	L	■	■	■	□	■	□	■
	E	■	■	■	■	■	□	■
Yellowfin menhaden <i>Brevoortia smithi</i>	A	□	□	■	■	■	□	■
	S	□	■	■	■	■	□	■
	J	□	■	■	■	■	□	■
	L	□	■	■	□	■	□	■
	E	□	■	■	■	■	□	■
Bay anchovy <i>Anchoa mitchilli</i>	A	■	□	■	■	■	□	■
	S	■	■	■	■	■	□	■
	J	■	□	■	■	■	□	■
	L	■	■	■	■	■	□	■
	E	■	■	■	■	■	□	■
Sheepshead minnow <i>Cyprinodon variegatus</i>	A	■	■	■	■	■	□	■
	S	■	■	■	■	■	□	■
	J	■	■	■	■	■	□	■
	L	■	■	■	■	■	□	■
	E	■	■	■	■	■	□	■
		Florida Bay	Ten Thousand Islands	Caloosa-hatchee River	Charlotte Harbor	Tampa Bay	Suwannee River	Apalachee Bay
Eastern Gulf of Mexico Estuaries								

Reliability

- Highly Certain
- Moderately Certain
- Reasonable Inference

Life Stage

- A - Adults
- S - Spawning adults
- J - Juveniles
- L - Larvae
- E - Eggs

Table 4 (continued). Data reliability

		Eastern Gulf of Mexico Estuaries					
		Apala- chicola Bay	St. Andrew Bay	Choctaw- hatchee Bay	Pensacola Bay	Perdido Bay	Mobile Bay
Species/Life Stage							
Tarpon <i>Megalops atlanticus</i>	A	■	■	□	□	■	■
	S	■	■	■	■	■	■
	J	■	■	□	□	■	■
	L	■	■	□	□	■	■
	E	■	■	■	□	■	■
Alabama shad <i>Alosa alabamae</i>	A	■	■	■	■	■	■
	S	■	■	■	■	■	■
	J	■	■	■	■	■	■
	L	■	■	■	■	■	■
	E	■	■	■	■	■	■
Gulf menhaden <i>Brevoortia patronus</i>	A	■	■	■	■	■	■
	S	■	■	■	■	■	■
	J	□	■	■	■	■	■
	L	■	■	■	■	■	■
	E	■	■	■	■	■	□
Yellowfin menhaden <i>Brevoortia smithi</i>	A	■	■	■	■	■	■
	S	■	■	■	■	■	■
	J	■	■	■	■	■	■
	L	■	■	■	■	■	■
	E	■	■	■	■	■	■
Bay anchovy <i>Anchoa mitchilli</i>	A	□	■	■	■	□	■
	S	■	■	■	■	□	■
	J	□	■	■	■	□	■
	L	■	■	■	■	□	■
	E	■	■	■	■	□	■
Sheepshead minnow <i>Cyprinodon variegatus</i>	A	□	■	■	■	■	■
	S	□	■	□	■	■	■
	J	□	■	□	■	■	■
	L	□	■	□	■	■	■
	E	□	■	□	■	■	■
		Apala- chicola Bay	St. Andrew Bay	Choctaw- hatchee Bay	Pensacola Bay	Perdido Bay	Mobile Bay
Eastern Gulf of Mexico Estuaries							

Reliability

- Highly Certain
 ■ Moderately Certain
 □ Reasonable Inference

Life Stage

- A - Adults
 S - Spawning adults
 J - Juveniles
 L - Larvae
 E - Eggs

Table 4 (continued). Data reliability

Species/Life Stage		Eastern Gulf of Mexico Estuaries						
		Florida Bay	Ten Thousand Islands	Caloosa-hatchee River	Charlotte Harbor	Tampa Bay	Suwannee River	Apalachee Bay
Gulf killifish	A	■	□	■	■	■	□	■
	S	□	□	■	■	■	□	■
<i>Fundulus grandis</i>	J	■	□	■	■	■	□	■
	L	□	□	■	■	■	□	■
	E	□	□	■	■	■	□	■
Snook	A	■	□	□	■	■	■	■
	S	■	■	□	■	■	□	■
<i>Centropomus undecimalis</i>	J	■	■	□	■	■	□	■
	L	■	□	□	□	■	□	■
	E	■	■	□	□	■	□	■
Bluefish	A	■	■	■	■	■	■	□
	S	■	■	■	■	■	■	■
<i>Pomatomus saltatrix</i>	J	■	■	■	■	□	■	□
	L	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■
Bluerunner	A	■	□	□	■	□	■	■
	S	■	■	□	■	■	□	■
<i>Caranx crysos</i>	J	■	□	□	■	□	□	■
	L	■	■	□	■	□	□	■
	E	■	■	□	■	■	□	■
Crevalle jack	A	■	□	□	■	■	□	■
	S	■	■	□	■	■	■	■
<i>Caranx hippos</i>	J	■	□	□	■	■	□	■
	L	■	■	□	■	■	□	■
	E	■	■	□	■	■	□	■
Florida pompano	A	■	■	■	■	■	■	■
	S	■	■	■	■	■	■	■
<i>Trachinotus carolinus</i>	J	■	■	■	■	□	■	■
	L	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■
		Florida Bay	Ten Thousand Islands	Caloosa-hatchee River	Charlotte Harbor	Tampa Bay	Suwannee River	Apalachee Bay
Eastern Gulf of Mexico Estuaries								

Reliability

- Highly Certain
 ■ Moderately Certain
 □ Reasonable Inference

Life Stage

- A - Adults
 S - Spawning adults
 J - Juveniles
 L - Larvae
 E - Eggs

Table 4 (continued). Data reliability

		Eastern Gulf of Mexico Estuaries					
		Apala- chicola Bay	St. Andrew Bay	Choctaw- hatchee Bay	Pensacola Bay	Perdido Bay	Mobile Bay
Species/Life Stage							
Gulf killifish <i>Fundulus grandis</i>	A	☐	☒	☐	☒	☐	☒
	S	☐	☒	☐	☒	☐	☒
	J	☐	☒	☐	☒	☐	☒
	L	☐	☒	☐	☒	☐	☒
	E	☐	☒	☐	☒	☐	☒
Snook <i>Centropomus undecimalis</i>	A	☒	☒	☒	☒	☒	☒
	S	☐	☒	☒	☒	☒	☒
	J	☐	☒	☒	☒	☒	☒
	L	☐	☒	☒	☒	☒	☒
	E	☐	☒	☒	☒	☒	☒
Bluefish <i>Pomatomus saltatrix</i>	A	☐	☒	☒	☒	☒	☒
	S	☐	☒	☒	☒	☒	☒
	J	☐	☒	☒	☒	☒	☒
	L	☐	☒	☒	☒	☒	☒
	E	☐	☒	☒	☒	☒	☒
Bluerunner <i>Caranx crysos</i>	A	☐	☒	☒	☒	☒	☒
	S	☐	☒	☒	☒	☒	☒
	J	☐	☒	☒	☒	☒	☒
	L	☐	☒	☒	☒	☒	☒
	E	☐	☒	☒	☒	☒	☒
Creville jack <i>Caranx hippos</i>	A	☐	☒	☐	☒	☒	☒
	S	☐	☒	☒	☒	☒	☒
	J	☐	☒	☐	☒	☒	☒
	L	☐	☒	☒	☒	☒	☒
	E	☐	☒	☒	☒	☒	☒
Florida pompano <i>Trachinotus carolinus</i>	A	☒	☒	☒	☒	☒	☒
	S	☒	☒	☒	☒	☒	☒
	J	☒	☒	☒	☒	☒	☒
	L	☒	☒	☒	☒	☒	☒
	E	☒	☒	☒	☒	☒	☒
		Apala- chicola Bay	St. Andrew Bay	Choctaw- hatchee Bay	Pensacola Bay	Perdido Bay	Mobile Bay
Eastern Gulf of Mexico Estuaries							

Reliability

- ☒ Highly Certain
☒ Moderately Certain
☐ Reasonable Inference

Life Stage

- A - Adults
 S - Spawning adults
 J - Juveniles
 L - Larvae
 E - Eggs

Table 4 (continued). Data reliability

		Eastern Gulf of Mexico Estuaries						
		Florida Bay	Ten Thousand Islands	Caloosa-hatchee River	Charlotte Harbor	Tampa Bay	Suwannee River	Apalachee Bay
Species/Life Stage								
Gray snapper <i>Lutjanus griseus</i>	A	■	■	■	▣	■	▣	▣
	S	■	■	■	■	■	▣	■
	J	▣	▣	□	▣	▣	▣	▣
	L	■	▣	■	■	▣	▣	■
	E	■	■	■	■	■	▣	■
Pinfish <i>Lagodon rhomboides</i>	A	■	▣	▣	▣	■	□	▣
	S	■	■	■	■	■	■	■
	J	■	▣	▣	▣	■	▣	▣
	L	■	▣	■	▣	▣	▣	▣
	E	■	■	■	■	■	■	■
Sand seatrout <i>Cynoscion arenarius</i>	A	■	▣	▣	▣	▣	□	▣
	S	■	■	□	□	▣	▣	■
	J	▣	▣	▣	▣	▣	▣	▣
	L	■	▣	□	□	▣	▣	■
	E	■	■	□	□	▣	■	■
Spotted seatrout <i>Cynoscion nebulosus</i>	A	■	■	■	■	▣	▣	▣
	S	▣	▣	▣	▣	▣	▣	▣
	J	■	■	■	■	▣	□	▣
	L	▣	▣	▣	▣	▣	▣	▣
	E	▣	▣	■	▣	▣	▣	▣
Spot <i>Leiostomus xanthurus</i>	A	■	■	▣	▣	▣	□	▣
	S	■	■	■	■	▣	■	■
	J	▣	▣	▣	▣	▣	▣	▣
	L	■	▣	■	▣	▣	▣	■
	E	■	■	■	■	▣	■	■
Atlantic croaker <i>Micropogonias undulatus</i>	A	■	■	■	■	■	□	▣
	S	■	■	■	■	□	■	■
	J	■	▣	▣	▣	▣	□	▣
	L	■	▣	■	■	■	□	▣
	E	■	■	■	■	■	■	■
		Florida Bay	Ten Thousand Islands	Caloosa-hatchee River	Charlotte Harbor	Tampa Bay	Suwannee River	Apalachee Bay
Eastern Gulf of Mexico Estuaries								

Reliability

- Highly Certain
 ▣ Moderately Certain
 □ Reasonable Inference

Life Stage

- A - Adults
 S - Spawning adults
 J - Juveniles
 L - Larvae
 E - Eggs

Table 4 (continued). Data reliability

		Eastern Gulf of Mexico Estuaries					
		Apala-chicola Bay	St. Andrew Bay	Choctaw-hatchee Bay	Pensacola Bay	Perdido Bay	Mobile Bay
Species/Life Stage							
Gray snapper <i>Lutjanus griseus</i>	A	□	■	■	■	■	■
	S	■	■	■	■	■	■
	J	□	■	■	■	■	■
	L	■	■	■	■	■	■
	E	■	■	■	■	■	■
Pinfish <i>Lagodon rhomboides</i>	A	■	■	■	■	■	□
	S	■	■	■	■	■	■
	J	■	■	■	■	■	■
	L	■	■	■	■	■	■
	E	■	■	■	■	■	■
Sand seatrout <i>Cynoscion arenarius</i>	A	■	■	■	■	■	■
	S	■	■	■	■	■	■
	J	■	■	■	■	■	■
	L	■	■	■	■	■	■
	E	■	■	■	□	■	■
Spotted seatrout <i>Cynoscion nebulosus</i>	A	□	■	■	■	■	■
	S	■	■	■	■	■	■
	J	■	■	□	■	■	■
	L	□	■	■	■	■	■
	E	□	■	■	■	■	■
Spot <i>Leiostomus xanthurus</i>	A	■	■	■	■	■	■
	S	■	■	■	■	■	■
	J	■	■	■	■	■	■
	L	■	■	■	■	■	■
	E	■	■	■	■	■	■
Atlantic croaker <i>Micropogonias undulatus</i>	A	■	■	■	■	□	■
	S	■	■	■	■	□	■
	J	■	■	■	■	□	■
	L	■	■	■	■	□	■
	E	■	□	■	■	■	■
		Apala-chicola Bay	St. Andrew Bay	Choctaw-hatchee Bay	Pensacola Bay	Perdido Bay	Mobile Bay
		Eastern Gulf of Mexico Estuaries					

Reliability

- Highly Certain
- Moderately Certain
- Reasonable Inference

Life Stage

- A - Adults
- S - Spawning adults
- J - Juveniles
- L - Larvae
- E - Eggs

Table 4 (continued). Data reliability

		Eastern Gulf of Mexico Estuaries						
		Florida Bay	Ten Thousand Islands	Caloosa-hatchee River	Charlotte Harbor	Tampa Bay	Suwannee River	Apalachee Bay
Species/Life Stage								
Red drum <i>Sciaenops ocellatus</i>	A	■	■	■	■	■	□	■
	S	■	■	■	■	■	□	■
	J	■	■	■	■	■	□	■
	L	■	■	■	■	■	□	■
	E	■	■	■	■	■	□	■
Striped mullet <i>Mugil cephalus</i>	A	■	■	■	■	■	□	■
	S	■	■	■	■	■	■	■
	J	■	■	■	■	■	□	■
	L	■	■	■	■	■	■	■
	E	■	■	■	■	■	■	■
Code goby <i>Gobiosoma robustum</i>	A	□	■	■	□	■	□	■
	S	■	■	■	□	■	□	■
	J	■	■	■	□	■	□	■
	L	■	■	■	□	□	□	■
	E	■	■	■	□	■	□	■
Spanish mackerel <i>Scomberomorus maculatus</i>	A	■	■	■	□	■	□	■
	S	■	■	■	■	■	■	■
	J	■	■	■	□	■	□	■
	L	■	■	■	■	■	■	■
	E	■	■	■	■	□	■	■
Gulf flounder <i>Paralichthys lethostigma</i>	A	■	■	■	■	■	□	□
	S	■	■	■	■	■	■	■
	J	■	■	■	■	■	□	■
	L	■	■	■	■	■	□	■
	E	■	■	■	■	■	■	■
Southern flounder <i>Paralichthys albigutta</i>	A	□	■	■	□	□	■	■
	S	■	■	■	■	■	■	■
	J	□	■	■	□	□	■	■
	L	■	■	■	□	□	■	■
	E	■	■	■	■	□	■	■
		Florida Bay	Ten Thousand Islands	Caloosa-hatchee River	Charlotte Harbor	Tampa Bay	Suwannee River	Apalachee Bay
Eastern Gulf of Mexico Estuaries								

Reliability

- Highly Certain
 ■ Moderately Certain
 □ Reasonable Inference

Life Stage

- A - Adults
 S - Spawning adults
 J - Juveniles
 L - Larvae
 E - Eggs

Table 4 (continued). Data reliability

Species / Life Stage		Eastern Gulf of Mexico Estuaries					
		Apala- chicola Bay	St. Andrew Bay	Choctaw- hatchee Bay	Pensacola Bay	Perdido Bay	Mobile Bay
Red drum <i>Sciaenops ocellatus</i>	A	■	■	□	■	■	■
	S	■	■	□	■	■	■
	J	■	■	□	■	■	■
	L	■	■	□	■	■	■
	E	■	■	□	■	■	■
Striped mullet <i>Mugil cephalus</i>	A	■	■	■	■	■	■
	S	■	■	■	■	■	■
	J	■	■	■	■	■	■
	L	■	■	■	■	■	■
	E	■	■	■	■	■	■
Code goby <i>Gobiosoma robustum</i>	A	■	■	■	■	■	■
	S	■	■	■	■	■	■
	J	■	■	■	■	■	■
	L	■	■	■	■	■	■
	E	■	■	■	■	■	■
Spanish mackerel <i>Scomberomorus maculatus</i>	A	□	□	■	■	■	■
	S	■	■	■	■	■	■
	J	□	□	■	■	■	■
	L	■	■	■	■	■	■
	E	■	■	■	■	■	■
Gulf flounder <i>Paralichthys lethostigma</i>	A	□	■	■	■	■	■
	S	■	■	■	■	■	■
	J	□	■	■	■	■	■
	L	□	■	■	■	■	■
	E	■	■	■	■	■	■
Southern flounder <i>Paralichthys albigutta</i>	A	□	■	■	■	■	■
	S	■	■	■	■	■	■
	J	□	■	■	■	■	■
	L	■	■	■	■	■	■
	E	■	■	■	■	■	■
		Apala- chicola Bay	St. Andrew Bay	Choctaw- hatchee Bay	Pensacola Bay	Perdido Bay	Mobile Bay
Eastern Gulf of Mexico Estuaries							

Reliability

- Highly Certain
 ■ Moderately Certain
 □ Reasonable Inference

Life Stage

- A - Adults
 S - Spawning adults
 J - Juveniles
 L - Larvae
 E - Eggs

Table 5. Presence/absence of 36 species in Eastern Gulf of Mexico Estuaries*

Index to Table 5: Page location of presence/absence table for each species and estuary.

Common and Scientific Name	Estuary									
	Florida Bay	Ten Thousand Islands	Caloosahatchee River	Charlotte Harbor	Tampa Bay	Suwannee River	Apalachee Bay	Apalachicola Bay	St. Andrew Bay	Chocotawhatchee Bay
Bay scallop (<i>Argopecten irradians</i>) American oyster (<i>Crassostrea virginica</i>) Common rangia (<i>Rangia cuneata</i>) Hard clam (<i>Mercenaria</i> species) Brown shrimp (<i>Penaeus aztecus</i>) Pink shrimp (<i>Penaeus duorarum</i>) White shrimp (<i>Penaeus setiferus</i>) Grass shrimp (<i>Palaemonetes pugio</i>) Spiny lobster (<i>Panulirus argus</i>) Gulf stone crab (<i>Menippe adina</i>) Stone crab (<i>Menippe mercenaria</i>) Blue crab (<i>Callinectes sapidus</i>)	p. 70					p. 71				
Tarpon (<i>Megalops atlanticus</i>) Alabama shad (<i>Alosa alabamae</i>) Gulf menhaden (<i>Brevoortia patronus</i>) Yellowfin menhaden (<i>Brevoortia smithi</i>) Bay anchovy (<i>Anchoa mitchilli</i>) Sheepshead minnow (<i>Cyprinodon variegatus</i>) Gulf killifish (<i>Fundulus grandis</i>) Snook (<i>Centropomus undecimalis</i>) Bluefish (<i>Pomatomus saltatrix</i>) Blue runner (<i>Caranx crysos</i>) Crevalle jack (<i>Caranx hippos</i>) Florida pompano (<i>Trachinotus carolinus</i>)	p. 72					p. 73				
Gray snapper (<i>Lutjanus griseus</i>) Pinfish (<i>Lagodon rhomboides</i>) Sand seatrout (<i>Cynoscion arenarius</i>) Spotted seatrout (<i>Cynoscion nebulosus</i>) Spot (<i>Leiostomus xanthurus</i>) Atlantic croaker (<i>Micropogonias undulatus</i>) Red drum (<i>Sciaenops ocellatus</i>) Striped mullet (<i>Mugil cephalus</i>) Code goby (<i>Gobiosoma robustum</i>) Spanish mackerel (<i>Scomberomorus maculatus</i>) Gulf flounder (<i>Paralichthys albigutta</i>) Southern flounder (<i>Paralichthys lethostigma</i>)	p. 74					p. 75				

*Table 5 was revised in December 1990. This copy differs slightly from earlier printings.

Table 5. Presence/absence of 36 species in Eastern Gulf of Mexico estuaries (revised 12/90).

Species		Florida Bay			Ten Thousand Islands			Caloosa-hatchee River			Charlotte Harbor			Tampa Bay			Suwannee River			Apalachee Bay		
		T	M	S	T	M	S	T	M	*	T	M	S	T	M	S	T	M	S	T	M	S
Bay scallop <i>Argopecten irradians</i>	A S J L E	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓				✓	✓	✓
American oyster <i>Crassostrea virginica</i>	A S J L E				✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Common rangia <i>Rangia cuneata</i>	A S J L E							✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Hard clam <i>Mercenaria species</i>	A S J L E											✓	✓		✓	✓		✓	✓		✓	✓
Brown shrimp <i>Penaeus aztecus</i>	A S J L E		✓	✓		✓	✓				✓	✓	✓									
Pink shrimp <i>Penaeus duorarum</i>	A S J L E		✓	✓		✓	✓		✓		✓	✓		✓	✓		✓	✓		✓	✓	✓
White shrimp <i>Penaeus setiferus</i>	A S J L E																✓	✓		✓	✓	✓
Grass shrimp <i>Palaemonetes pugio</i>	A S J L E	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Spiny lobster <i>Panulirus argus</i>	A M J L S			✓			✓					✓			✓							
Gulf stone crab <i>Menippe adina</i>	A M J L S																✓	✓		✓	✓	✓
Stone crab <i>Menippe mercenaria</i>	A M J L S		✓	✓		✓	✓		✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Blue crab <i>Callinectes sapidus</i>	A M J L S	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
		T	M	S	T	M	S	T	M	*	T	M	S	T	M	S	T	M	S	T	M	S
		Florida Bay			Ten Thousand Islands			Caloosa-hatchee River			Charlotte Harbor			Tampa Bay			Suwannee River			Apalachee Bay		

Legend:

T = Tidal fresh zone
M = Mixing zone
S = Seawater zone
* = Salinity zone is not present

A = Adult
S = Spawning adult
J = Juvenile
L = Larvae
E = Egg
M = Mating

✓ = Species/lifestage is present
Blank = Species/lifestage is not present

Table 5, continued. Presence/absence of 36 species in Eastern Gulf of Mexico estuaries (revised 12/90).

Species		Apalachicola Bay			St. Andrew Bay			Choctaw-hatchee Bay			Pensacola Bay			Perdido Bay			Mobile Bay		
		T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S
Bay scallop <i>Argopecten irradians</i>	A S J L E		✓	✓		✓	✓					✓	✓						
American oyster <i>Crassostrea virginica</i>	A S J L E		✓	✓		✓	✓		✓	✓		✓	✓					✓	✓
Common rangia <i>Rangia cuneata</i>	A S J L E	✓	✓		✓	✓		✓	✓		✓	✓		✓	✓		✓	✓	
Hard clam <i>Mercenaria species</i>	A S J L E						✓			✓					✓	✓		✓	✓
Brown shrimp <i>Penaeus aztecus</i>	A S J L E		✓	✓		✓	✓		✓	✓		✓	✓				✓	✓	✓
Pink shrimp <i>Penaeus duorarum</i>	A S J L E		✓	✓	✓	✓	✓	✓	✓	✓		✓	✓		✓	✓		✓	✓
White shrimp <i>Penaeus setiferus</i>	A S J L E		✓	✓		✓	✓	✓	✓	✓	✓	✓	✓		✓	✓		✓	✓
Grass shrimp <i>Palaemonetes pugio</i>	A S J L E	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓				✓	✓	✓
Spiny lobster <i>Panulirus argus</i>	A M J L S						✓												
Gulf stone crab <i>Menippe adina</i>	A M J L S		✓	✓		✓	✓		✓	✓		✓	✓		✓	✓		✓	✓
Stone crab <i>Menippe mercenaria</i>	A M J L S		✓	✓															
Blue crab <i>Callinectes sapidus</i>	A M J L S	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
		T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S
		Apalachicola Bay			St. Andrew Bay			Choctaw-hatchee Bay			Pensacola Bay			Perdido Bay			Mobile Bay		

Legend:

T = Tidal fresh zone
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A = Adult
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E = Egg
M = Mating

✓ = Species/lifestage is present
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Table 5, continued. Presence/absence of 36 species in Eastern Gulf of Mexico estuaries (revised 12/90).

Species		Florida Bay			Ten Thousand Islands			Caloosa-hatchee River			Charlotte Harbor			Tampa Bay			Suwannee River			Apalachee Bay		
		T	M	S	T	M	S	T	M	*	T	M	S	T	M	S	T	M	S	T	M	S
Tarpon	A	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
<i>Megalops atlanticus</i>	S	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	J							✓	✓				✓									
	L							✓	✓				✓									
	E												✓									
Alabama shad	A																✓	✓	✓			
<i>Alosa alabamae</i>	S																✓	✓	✓			
	J																✓	✓	✓			
	L																✓	✓	✓			
	E																✓	✓	✓			
Gulf menhaden	A										✓	✓		✓	✓		✓	✓	✓	✓	✓	✓
<i>Brevoortia patronus</i>	S			✓			✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	J																					
	L																					
	E																					
Yellowfin menhaden	A										✓	✓		✓	✓					✓	✓	✓
<i>Brevoortia smithi</i>	S	✓	✓	✓		✓	✓	✓	✓		✓	✓	✓	✓	✓	✓				✓	✓	✓
	J		✓	✓		✓	✓	✓	✓		✓	✓	✓	✓	✓	✓				✓	✓	✓
	L		✓	✓		✓	✓	✓	✓		✓	✓	✓	✓	✓	✓				✓	✓	✓
	E																					
Bay anchovy	A	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
<i>Anchoa mitchilli</i>	S	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	J		✓	✓		✓	✓	✓	✓													
	L		✓	✓		✓	✓	✓	✓													
	E		✓	✓		✓	✓	✓	✓													
Sheepshead minnow	A	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
<i>Cyprinodon variegatus</i>	S	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	J	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	L	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	E	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Gulf killifish	A	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
<i>Fundulus grandis</i>	S	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	J	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	L	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	E	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Snook	A		✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
<i>Centropomus undecimalis</i>	S	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓						
	J																					
	L																					
	E																					
Bluefish	A		✓	✓		✓	✓				✓	✓			✓		✓	✓		✓	✓	✓
<i>Pomatomus saltatrix</i>	S		✓	✓		✓	✓				✓	✓			✓		✓	✓		✓	✓	✓
	J																					
	L																					
	E																					
Blue runner	A			✓			✓				✓	✓			✓			✓				✓
<i>Caranx crysos</i>	S			✓			✓				✓	✓			✓			✓				✓
	J																					
	L																					
	E																					
Crevalle jack	A		✓	✓		✓	✓	✓	✓		✓	✓		✓	✓		✓	✓		✓	✓	✓
<i>Caranx hippos</i>	S		✓	✓		✓	✓	✓	✓		✓	✓		✓	✓		✓	✓		✓	✓	✓
	J																					
	L																					
	E																					
Florida pompano	A			✓			✓					✓			✓			✓				✓
<i>Trachinotus carolinus</i>	S			✓			✓					✓			✓			✓				✓
	J																					
	L																					
	E																					
		T	M	S	T	M	S	T	M	*	T	M	S	T	M	S	T	M	S	T	M	S
		Florida Bay			Ten Thousand Islands			Caloosa-hatchee River			Charlotte Harbor			Tampa Bay			Suwannee River			Apalachee Bay		

Legend:

T = Tidal fresh zone
M = Mixing zone
S = Seawater zone
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Table 5, continued. Presence/absence of 36 species in Eastern Gulf of Mexico estuaries (revised 12/90).

Species		Apalachicola Bay			St. Andrew Bay			Choctaw-hatchee Bay			Pensacola Bay			Perdido Bay			Mobile Bay		
		T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S
Tarpon	A	√	√	√		√	√	√	√	√	√	√	√			√		√	√
<i>Megalops atlanticus</i>	S	√	√	√	√	√	√	√	√	√	√	√	√			√		√	√
	J																		
	L																		
	E																		
Alabama shad	A	√	√	√	√	√	√	√	√	√									
<i>Alosa alabamae</i>	S	√	√	√	√	√	√	√	√	√									
	J																		
	L																		
	E																		
Gulf menhaden	A		√	√	√	√	√		√	√	√	√	√	√	√	√	√	√	√
<i>Brevoortia patronus</i>	S	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
	J																		
	L																		
	E																		
Yellowfin menhaden	A																		
<i>Brevoortia smithi</i>	S																		
	J																		
	L																		
	E																		
Bay anchovy	A	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
<i>Anchoa mitchilli</i>	S	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
	J																		
	L																		
	E																		
Sheepshead minnow	A	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
<i>Cyprinodon variegatus</i>	S	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
	J	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
	L	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
	E	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Gulf killifish	A	√	√	√	√	√	√	√	√	√	√	√	√				√	√	√
<i>Fundulus grandis</i>	S	√	√	√	√	√	√	√	√	√	√	√	√				√	√	√
	J	√	√	√	√	√	√	√	√	√	√	√	√				√	√	√
	L	√	√	√	√	√	√	√	√	√	√	√	√				√	√	√
	E	√	√	√	√	√	√	√	√	√	√	√	√				√	√	√
Snook	A	√	√	√															
<i>Centropomus undecimalis</i>	S																		
	J																		
	L																		
	E																		
Bluefish	A		√	√		√	√		√	√		√	√		√	√		√	√
<i>Pomatomus saltatrix</i>	S		√	√		√	√		√	√		√	√		√	√		√	√
	J																		
	L																		
	E																		
Blue runner	A			√			√			√			√			√			√
<i>Caranx crysos</i>	S																		
	J																		
	L																		
	E																		
Crevalle jack	A		√	√		√	√		√	√		√	√			√			√
<i>Caranx hippos</i>	S		√	√		√	√		√	√		√	√	√	√	√		√	√
	J																		
	L																		
	E																		
Florida pompano	A						√			√		√	√					√	√
<i>Trachinotus carolinus</i>	S											√	√		√	√		√	√
	J																	√	√
	L																	√	√
	E																	√	√
		T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S
		Apalachicola Bay			St. Andrew Bay			Choctaw-hatchee Bay			Pensacola Bay			Perdido Bay			Mobile Bay		

Legend:

T = Tidal fresh zone
M = Mixing zone
S = Seawater zone

A = Adult
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L = Larvae
E = Egg

√ = Species/lifestage is present
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Table 5, continued. Presence/absence of 36 species in Eastern Gulf of Mexico estuaries (revised 12/90).

Species		Florida Bay			Ten Thousand Islands			Caloosa-hatchee River			Charlotte Harbor			Tampa Bay			Suwannee River			Apalachee Bay		
		T	M	S	T	M	S	T	M	*	T	M	S	T	M	S	T	M	S	T	M	S
Gray snapper	A												✓				✓	✓	✓	✓	✓	✓
<i>Lutjanus griseus</i>	S		✓	✓	✓	✓	✓		✓		✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓
	J																					
	L																					
	E																					
Pinfish	A	✓	✓	✓		✓	✓	✓	✓		✓	✓	✓		✓	✓	✓	✓	✓		✓	✓
<i>Lagodon rhomboides</i>	S	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓
	J																					
	L																					
	E																					
Sand seatrout	A					✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
<i>Cynoscion arenarius</i>	S					✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	J																					
	L																					
	E																					
Spotted seatrout	A		✓	✓		✓	✓	✓	✓			✓	✓		✓	✓	✓	✓	✓	✓	✓	✓
<i>Cynoscion nebulosus</i>	S		✓	✓		✓	✓	✓	✓			✓	✓		✓	✓	✓	✓	✓	✓	✓	✓
	J		✓	✓		✓	✓	✓	✓			✓	✓		✓	✓	✓	✓	✓	✓	✓	✓
	L		✓	✓		✓	✓	✓	✓			✓	✓		✓	✓	✓	✓	✓	✓	✓	✓
	E		✓	✓		✓	✓	✓	✓			✓	✓		✓	✓	✓	✓	✓	✓	✓	✓
Spot	A							✓	✓			✓	✓		✓	✓	✓	✓	✓	✓	✓	✓
<i>Leiostomus xanthurus</i>	S			✓		✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	J																					
	L																					
	E																					
Atlantic croaker	A																✓	✓	✓		✓	✓
<i>Micropogonias undulatus</i>	S			✓				✓	✓		✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓
	J																					
	L																					
	E																					
Red drum	A		✓	✓		✓	✓	✓	✓			✓	✓	✓	✓	✓		✓	✓	✓	✓	✓
<i>Sciaenops ocellatus</i>	S		✓	✓		✓	✓	✓	✓		✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓
	J																					
	L																					
	E																					
Striped mullet	A		✓	✓		✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
<i>Mugil cephalus</i>	S	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	J																					
	L																					
	E																					
Code goby	A	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓
<i>Gobiosoma robustum</i>	S	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓
	J																					
	L																					
	E																					
Spanish mackerel	A		✓	✓		✓	✓	✓	✓			✓	✓		✓	✓		✓	✓		✓	✓
<i>Scomberomorus maculatus</i>	S		✓	✓	✓	✓	✓	✓	✓			✓	✓		✓	✓		✓	✓		✓	✓
	J																					
	L																					
	E																					
Gulf flounder	A		✓	✓		✓	✓		✓			✓	✓		✓	✓		✓	✓		✓	✓
<i>Paralichthys albigutta</i>	S		✓	✓		✓	✓		✓			✓	✓		✓	✓		✓	✓		✓	✓
	J																					
	L																					
	E																					
Southern flounder	A			✓							✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
<i>Paralichthys lethostigma</i>	S			✓							✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	J																					
	L																					
	E																					
		T	M	S	T	M	S	T	M	*	T	M	S	T	M	S	T	M	S	T	M	S
		Florida Bay			Ten Thousand Islands			Caloosa-hatchee River			Charlotte Harbor			Tampa Bay			Suwannee River			Apalachee Bay		

Legend:

T = Tidal fresh zone

M = Mixing zone

S = Seawater zone

* = Salinity zone is not present

A = Adult

S = Spawning adult

J = Juvenile

L = Larvae

E = Egg

✓ = Species/lifestage is present

Blank = Species/lifestage is not present

Table 5, continued. Presence/absence of 36 species in Eastern Gulf of Mexico estuaries (revised 12/90).

Species		Apalachicola Bay			St. Andrew Bay			Choctaw-hatchee Bay			Pensacola Bay			Perdido Bay			Mobile Bay		
		T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S
Gray snapper <i>Lutjanus griseus</i>	A S J L E		√	√		√	√	√	√	√	√	√	√				√	√	√
			√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Pinfish <i>Lagodon rhomboides</i>	A S J L E		√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
		√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Sand seatrout <i>Cynoscion arenarius</i>	A S J L E		√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
			√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Spotted seatrout <i>Cynoscion nebulosus</i>	A S J L E	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
		√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Spot <i>Leiostomus xanthurus</i>	A S J L E		√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
		√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Atlantic croaker <i>Micropogonias undulatus</i>	A S J L E		√	√		√	√	√		√	√	√		√	√	√		√	√
		√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Red drum <i>Sciaenops ocellatus</i>	A S J L E	√	√	√		√	√	√	√	√	√	√			√	√	√	√	√
		√	√	√	√	√	√	√	√	√	√	√			√	√	√	√	√
Striped mullet <i>Mugil cephalus</i>	A S J L E	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
		√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Code goby <i>Gobiosoma robustum</i>	A S J L E	√	√	√	√	√	√	√	√	√	√	√	√		√	√			
		√	√	√	√	√	√	√	√	√	√	√	√		√	√			
Spanish mackerel <i>Scomberomorus maculatus</i>	A S J L E		√	√		√	√		√	√		√	√		√			√	√
			√	√		√	√		√	√		√	√		√			√	√
Gulf flounder <i>Paralichthys albigutta</i>	A S J L E		√	√		√	√		√	√		√	√		√	√		√	√
			√	√		√	√		√	√		√	√		√	√		√	√
Southern flounder <i>Paralichthys lethostigma</i>	A S J L E	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
		√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
		T	M	S	T	M	S	T	M	S	T	M	S	T	M	S	T	M	S
		Apalachicola Bay			St. Andrew Bay			Choctaw-hatchee Bay			Pensacola Bay			Perdido Bay			Mobile Bay		

Legend:

T = Tidal fresh zone
M = Mixing zone
S = Seawater zone

A = Adult
S = Spawning adult
J = Juvenile
L = Larvae
E = Egg

√ = Species/lifestage is present
Blank = Species/lifestage is not present

Appendices

Appendix 1. Gulf of Mexico ELMR species list

Appendix 2. Gulf of Mexico ELMR estuary list

Appendix 3. National Estuarine Inventory map of Mobile Bay

Appendix 4. Species profile and sample data sheet: blue crab

Appendix 5. Table of references and personal communications

Appendix 6. Personal communications

Appendix 7. References

Appendix 1. Gulf of Mexico ELMR Species List

Scientific Name	Common Name
<i>Argopecten irradians</i>	bay scallop
<i>Crassostrea virginica</i>	American oyster
<i>Rangia cuneata</i>	common rangia
<i>Mercenaria species</i>	hard clam
<i>Lolliguncula brevis</i>	bay squid *
<i>Penaeus aztecus</i>	brown shrimp
<i>Penaeus duorarum</i>	pink shrimp
<i>Penaeus setiferus</i>	white shrimp
<i>Palaemonetes pugio</i>	grass shrimp
<i>Panulirus argus</i>	spiny lobster †
<i>Callinectes sapidus</i>	blue crab
<i>Menippe adina</i>	gulf stone crab
<i>Menippe mercenaria</i>	stone crab †
<i>Carcharhinus leucas</i>	bull shark *
<i>Megalops atlanticus</i>	tarpon
<i>Alosa alabamae</i>	Alabama shad
<i>Brevoortia patronus</i>	gulf menhaden
<i>Brevoortia smithi</i>	yellowfin menhaden †
<i>Dorosoma cepedianum</i>	gizzard shad *
<i>Anchoa mitchilli</i>	bay anchovy
<i>Arius felis</i>	hardhead catfish *
<i>Cyprinodon variegatus</i>	sheepshead minnow
<i>Fundulus grandis</i>	gulf killifish
<i>Menidia species</i>	Atlantic silversides *
<i>Centropomus undecimalis</i>	snook
<i>Pomatomus saltatrix</i>	bluefish
<i>Caranx crysos</i>	blue runner †
<i>Caranx hippos</i>	crevalle jack
<i>Trachinotus carolinus</i>	Florida pompano
<i>Lutjanus griseus</i>	gray snapper
<i>Archosargus probatocephalus</i>	sheepshead *
<i>Lagodon rhomboides</i>	pinfish
<i>Bairdiella chrysoura</i>	silver perch *
<i>Cynoscion arenarius</i>	sand seatrout
<i>Cynoscion nebulosus</i>	speckled seatrout
<i>Leiostomus xanthurus</i>	spot
<i>Micropogonias undulatus</i>	Atlantic croaker
<i>Pogonias cromis</i>	black drum *
<i>Sciaenops ocellatus</i>	red drum
<i>Mugil cephalus</i>	striped mullet
<i>Gobiosoma robustum</i>	code goby
<i>Scomberomorus maculatus</i>	Spanish mackerel
<i>Paralichthys albigutta</i>	gulf flounder
<i>Paralichthys lethostigma</i>	southern flounder

* These eight species are included in the Western Gulf of Mexico data base and Texas ELMR report, but are not included in this report. Data for these species in Eastern Gulf of Mexico estuaries are now being compiled.

† These four species are included in the Eastern Gulf of Mexico data base and this report, but are not included in the ELMR Texas report. Data for these species in Western Gulf of Mexico estuaries are now being compiled.

Appendix 2. ELMR Gulf of Mexico Estuaries

Estuary	State
<u>Eastern Gulf of Mexico (13 estuaries):</u>	
Florida Bay	Florida
Ten Thousand Islands	Florida
Charlotte Harbor	Florida
Caloosahatchee River	Florida
Tampa Bay	Florida
Suwannee River	Florida
Apalachee Bay	Florida
Apalachicola Bay	Florida
St. Andrew Bay	Florida
Choctawhatchee Bay	Florida
Pensacola Bay	Florida
Perdido Bay	Florida/Alabama
Mobile Bay	Alabama

Central Gulf of Mexico (9 estuaries):

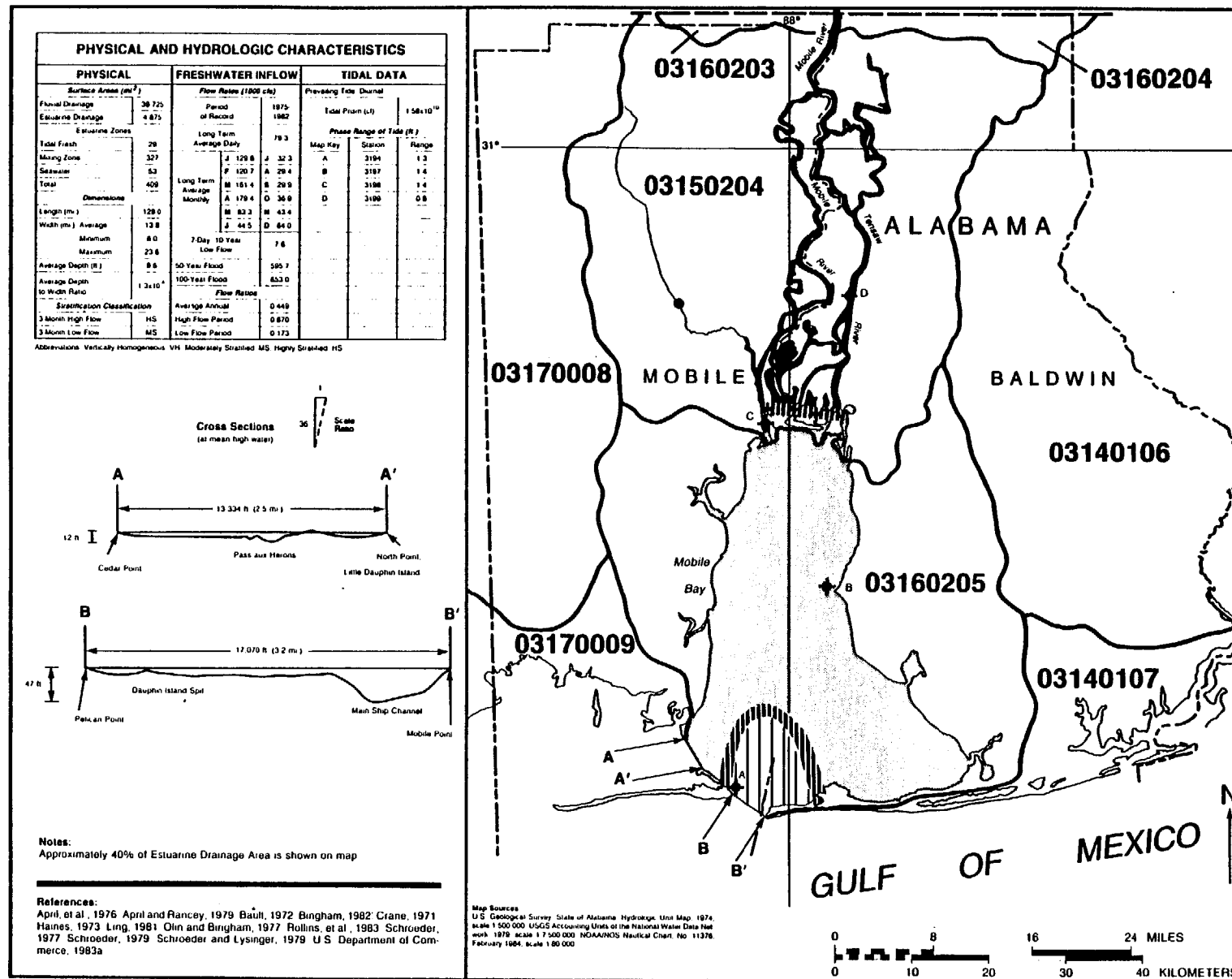
Mississippi Sound	Alabama/Mississippi
Breton/Chandeleur Sounds	Louisiana
Lake Borgne	Louisiana
Lake Pontchartrain	Louisiana
Mississippi River	Louisiana
Barataria Bay	Louisiana
Terrebonne/Timbalier Bays	Louisiana
Atchafalaya and Vermilion Bays	Louisiana
Calcasieu Lake	Louisiana

Western Gulf of Mexico (9 estuaries):

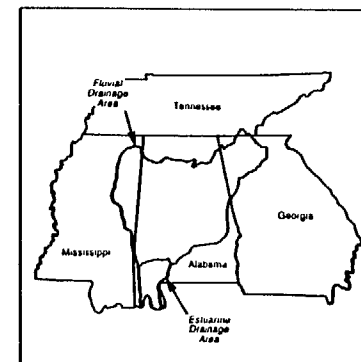
Sabine Lake	Louisiana/Texas
Galveston Bay	Texas
Brazos River	Texas
Matagorda Bay	Texas
San Antonio Bay	Texas
Aransas Bay	Texas
Corpus Christi Bay	Texas
Laguna Madre	Texas
Baffin Bay	Texas

Appendix 3. National Estuarine Inventory map of Mobile Bay

National Estuarine Atlas



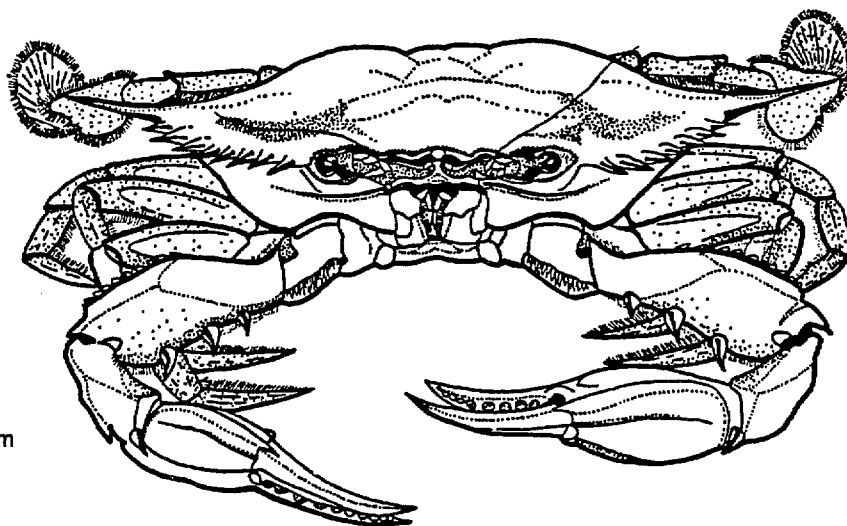
Mobile Bay AL



- Tide Gage
- Flow Gage
- Head of Tide
- Estuarine Drainage Area (EDA)
- Tidal Fresh Zone
- Mixing Zone
- Seawater Zone
- Hydrologic Cataloging Unit Boundary
- County Boundary
- Salinity Zone Boundary - Low Variability
- Salinity Zone Boundary - Moderate Variability
- Salinity Zone Boundary - High Variability

Appendix 4. Blue crab species profile.

Blue crab
Callinectes sapidus
Adult
(from Perry et al. 1984)



Common Name: blue crab
Scientific Name: *Callinectes sapidus*

Other Common Names: common edible crabs, edible blue crabs, jimmies, she crabs, sooks, sallies, spongers, sponge crabs, soft shells, soft shelled crabs, hard crabs.

Classification

Phylum: Arthropoda
Class: Crustacea
Order: Decapoda
Family: Portunidae

Value

Commercial: The commercial value of the blue crab fishery in the eastern Gulf of Mexico is difficult to estimate (Perry et al. 1984). Many blue crab fishermen use unsurveyed market channels, leading to under-reporting of landings. Nearly 78 million pounds of blue crab, valued at \$30.7 million, were reported from the Gulf Region in 1988 (U.S. NMFS 1989). Reported landings for Florida's west coast fishery from 1960-1980 contributed an average of 41% of the Gulf landings, while Alabama landings have fluctuated around an average of 5% of the Gulf landings for the same time period (Perry and McIlwain 1986). Based on landings from 1951-1976, crab pots accounted for 99% of the Florida and Alabama harvest, while trawls accounted for the remaining 1% (Perry et al. 1984). Alabama has a 4-inch minimum carapace width harvest restriction while Florida has a 5-inch restriction (Perry et al. 1984). Landings are believed to be totally consumed by the domestic market. The main commercial outlets for blue crabs are seafood restaurants and retail seafood markets. Approximately 75% of the hard crab landings are sold as processed product,

the other 25% are probably sold live for boiling or steaming (Perry et al. 1984). The blue crab fishery also supports a small soft shell crab industry which meets local demand for fresh soft shell crabs.

Recreational: Blue crabs support a large recreational fishery. They are taken in estuaries and nearshore Gulf waters by dip nets, baited lift nets, baited strings, "fold-up" traps, crab pots, and recreational shrimp trawls. Estimates for recreational landings vary widely, ranging from 4% of the commercial landings in Mississippi in 1971 (Herring and Christmas 1974) to 400% of the commercial landings in Louisiana in 1968 (Lindall and Hall 1970). No reliable estimates are available for Alabama or the west coast of Florida. Smaller crabs are considered to be excellent bait for sport fishes, especially for red drum (*Sciaenops ocellatus*).

Indicator of Environmental Stress: Blue crabs are sensitive to low dissolved oxygen (DO) conditions common to estuaries during the summer (Carpenter and Cargo 1957). Mass mortalities have been reported to be associated with low DO estuarine water masses (May 1973). Survival times of 2 hours (h) at 0 parts per million (ppm) DO, 32° C and 13 parts per thousand (ppt) salinity and 4.3 h at 0 ppm DO, 25° C and 13 ppt salinity have been reported by Lowery and Tate (1986). The occurrence of dead crabs in traps is fairly common during warm water conditions. Fishermen usually remedy the problem by moving their traps into shallower water to avoid any low DO water layers. Mortalities of blue crabs have also been related to extreme cold and sudden drops in water temperature (Couch and Martin 1982, Van Engel 1982). Blue crabs are also extremely sensitive to chemical pollution. Kepone released into the James

River, Virginia from 1950-1975 negatively affected the fishery by lowering landings and juvenile crab abundance (Van Engel 1982). Kepone concentrations of 0.50 and 0.75 parts per billion (ppb) were sublethal to blue crab zoeae, whereas 1.0 ppb lowered the juvenile crab survival rate to 5%, compared with 22% in the control group (Bookout et al. 1980). The 96 h LC50 of kepone to juvenile blue crabs was greater than 210 ppb (Schimmel and Wilson 1977). Mirex has been reported to be toxic to blue crab zoeae at concentrations of 1 and 10 ppb, whereas 0.01 and 0.1 ppb were sublethal (Lowe et al. 1971, Bookout and Costlow 1975). Juvenile blue crabs (27 mm carapace width) died following several days of exposure to DDT concentrations greater than 0.5 ppb (Lowe 1965). Mass mortalities of blue crabs occurred in South Carolina, North Carolina, and Georgia in 1966; pesticides were speculated to have been responsible (Newman and Ward 1973).

Range

Overall: Blue crabs range from Nova Scotia to Northern Argentina, and the coastal waters of Europe, including the Mediterranean (Williams 1974). They are present throughout the entire Gulf of Mexico (NOAA 1985).

Within Study Area: Blue crabs inhabit estuaries and nearshore waters of the Alabama and Florida Gulf coast (NOAA 1985).

Life Mode

Blue crabs spend most of their lives in estuaries and nearshore Gulf waters. Eggs are carried by females (sponge crabs) until hatching. Zoeae are planktonic and megalop larvae are free swimming. Juveniles and adults are demersal (Dudley and Judy 1971, Steele 1982, Millikin and Williams 1984, Perry et al. 1984, Van den Avyle and Fowler 1984, Williams 1984).

Habitat

Type: Zoeae are neritic to oceanic in polyhaline to euhaline waters. Megalopae are oceanic and/or neritic to estuarine in euhaline to mesohaline waters. Juveniles inhabit oligohaline to euhaline subtidal estuarine habitats. Adult males are estuarine and riverine inhabitants of subtidal freshwater to polyhaline habitats. Adult females are subtidal inhabitants of euhaline to mesohaline estuarine waters (Steele 1982, Millikin and Williams 1984, Van den Avyle and Fowler 1984, Williams 1984).

Physical/Chemical Characteristics: Tolerant of extremes, blue crabs have been reported from freshwater to hypersaline lagoons (0 - 50 ppt) and from 3 - 35° C (Van den Avyle and Fowler 1984). Hatching

occurs in high salinity waters around 23 to 30 ppt near river mouths, inlets, and nearshore coastal waters (Millikin and Williams 1984). In laboratory experiments, successful hatching did not occur below 20 ppt (Costlow and Bookout 1959). Zoeal stages are present at 20 ppt or greater, while megalop larvae are found in less saline waters (commonly 2 - 21 ppt) (Costlow and Bookout 1959). The optimal salinity and temperature combination for zoeal and megalopal development was 30 ppt and 25° C (Bookout et al. 1976, Costlow 1967). Juveniles are euryhaline. Adult males are usually found at < 10 ppt and are more tolerant of temperature extremes than are adult females. Adult females generally inhabit the more saline lower reaches of estuaries, except when they migrate to the middle and upper reaches to mate. Blue crabs may burrow and become inactive at 5° C. They are also less tolerant of low salinities at high temperatures, and of high salinities at low temperatures (Millikin and Williams 1984, Van den Avyle and Fowler 1984, Williams 1984).

Migrations and Movements

Migrations within estuarine systems are related to phases of the life cycle, season, and to some extent habitat preference. Larvae hatch and develop in higher salinity waters as they drift with currents. During this planktonic stage movements can be extensive in the open Gulf. Megalopae are recruited back into the estuaries. Juvenile stages of both sexes migrate upstream into lower salinity waters where they feed in shallow waters (Van Engel 1958). Immature females approaching their terminal molt migrate to low salinity waters to seek out mature males for mating (Millikin and Williams 1984). These migrations are especially heavy during the spring. Soon after mating, adult females initiate migrations back to higher salinity waters (Millikin and Williams 1984). Similarly, during cold water months, females migrate into higher salinity areas associated with deeper portions of estuaries, mouths of estuaries, and nearshore Gulf waters. Following mating, adult females also migrate along the Gulf coast of Florida and Alabama in a northerly direction, whereas adult males usually remain in the estuaries and do not migrate appreciably between estuaries (Oesterling 1976).

Reproduction

Mode: Blue crabs are dioecious and reproduce sexually (Williams 1965).

Mating and Spawning: Mating occurs from spring through fall in low salinity waters. Females usually mate once while in the soft shell stage during their pubertal or terminal molt. The females are extremely vulnerable to cannibalism and predation during these

molts. As a result, the recognition of amorous males is fairly important. Females approaching their pubertal or terminal molts initiate mating behavior upon recognition of a mature male via olfactory and visual stimuli (Teytaud 1971). Males recognize the females via a pheromone that triggers male mating behavior (Gleeson 1980). Copulation occurs while the female molts. During the female's molt, the male protects her by grasping her with his first pair of walking legs and "cradle-carries" her in an upright position underneath him. Males transmit their spermatophores by tube-like pleopods into the female's seminal receptacle (Cronin 1947). The sperm are stored in the seminal receptacle until fertilization; inseminated females can retain viable sperm for at least one year. Fertilization is accomplished by passing the eggs from the ovaries to the seminal receptacles before being extruded onto the females' pleopods. Egg extrusion onto the pleopods may be completed within 2 h (Van Engel 1958). Spawning typically occurs within two months after spring and summer matings, but may be postponed until the following spring after fall matings (Millikin and Williams 1984, Perry et al. 1984, Van den Avyle and Fowler 1984).

Reproductive Capacity: Fecundity in blue crabs ranges from 1.75 to 2.00 million eggs per spawning (Millikin and Williams 1984). No data is available concerning fecundity as a function of size or the relative fecundity of successive spawnings (Millikin and Williams 1984, Perry et al. 1984, Van den Avyle and Fowler 1984).

Growth and Development

Eggs: Freshly extruded eggs in the early stages of development are 0.273 x 0.263 mm, and enlarge to 0.320 x 0.278 mm before hatching (Davis 1965). Approximate ages (after extrusion) of blue crab egg masses (sponges) can be estimated according to coloration. Yellow to orange egg masses are from 1 to 7 days old, while brown to black egg masses are from 8 to 15 days old (Bland and Amerson 1974). Hatching occurs in about two weeks at temperatures of 26 - 29° C (Perry et al. 1984, Van den Avyle and Fowler 1984).

Larvae: Blue crab larvae usually develop through seven zoeal stages before metamorphosing into the megalop larval stage (Costlow and Bookout 1959). Larval blue crabs are about 0.25 mm at hatching, and develop by successive molts through 4 - 7 zoeal stages over 30 - 50 days. Laboratory studies indicate that 31 to 43 days are required to complete the zoeal larval stages at 25° C and 26 ppt salinity (Costlow and Bookout 1959). The final zoeal stage is about 1 mm in width. The megalop stage of larval development follows and lasts from 6 - 20 days with the

larvae assuming a more crab-like appearance with each molt (Hopkins 1943, Sandoz and Rogers 1944, Williams 1965, Millikin and Williams 1984, Van den Avyle and Fowler 1984).

Juvenile: "First crabs" are about 2.5 mm at transformation and grow toward maturity through a series of 18 - 20 molts. Age at maturity is related to temperature, with crabs from warmer environments developing sooner (Millikin and Williams 1984, Perry et al. 1984, Van den Avyle and Fowler 1984). Juvenile blue crabs may reach maturity within one year along the Gulf coast (Perry 1975). Salinities from 6 to 30 ppt do not differentially affect growth of juveniles (Millikin and Williams 1984). Generally, as temperature decreases feeding decreases, especially from 34° C to 13° C (Leffler 1972). Tagatz (1968a) observed that growth per molt remained similar regardless of temperature (summer vs. winter) in the St. Johns River, FL, but that intermolt intervals were three to four times longer in the winter. Juvenile blue crabs range in size from 2 mm to 240 mm in carapace width, with considerable overlap with adults in the 100 mm to 240 mm range (Newcombe et al. 1949, Tagatz 1968b).

Adults: Juveniles reach maturity at 1 - 1.5 years. Females have been reported to vary in size at maturity from 51 mm to > 177 mm. Adult females mate following their terminal molt, and growth is discontinued. Males, however, grow throughout their lives, which may be more than three years (Fischler and Walburg 1962, Tagatz 1968b, Millikin and Williams 1984, Perry et al. 1984, Van den Avyle and Fowler 1984). Tagatz (1968a), sampling blue crabs from St. Johns River, FL, reported mean carapace widths and ranges: adult males averaged 147 mm, ranging from 117 mm to 181 mm; adult females averaged 148 mm, ranging from 128 to 182 mm.

Food and Feeding

In general, blue crabs are opportunistic omnivores and scavengers, feeding on a variety of plants and animals including other blue crabs. Food is located by a combination of chemoreception and tactition (Van Engel 1958, Millikin and Williams 1984, Van den Avyle and Fowler 1984). Larval blue crab are believed to feed on phytoplankton and zooplankton (Costlow and Sastry 1966). Zoeae are generally phytoplanktivorous but also consume copepod nauplii and dinoflagellates. Megalopae are more omnivorous, preying upon fish larvae, small shellfish, and aquatic plants. Juvenile and adult blue crabs feed mostly on molluscs, crustaceans, and fish. Juvenile and adult blue crabs have been characterized as opportunistic benthic omnivores whose food habits

are governed by availability of food items (Darnell 1961). Laughlin (1982) evaluated stomach contents of blue crabs from Apalachicola Bay, FL and observed the following: small juveniles (less than 31 mm carapace width) fed mainly on bivalves, plant matter, ostracods, and detritus; intermediate juveniles (31-60 mm) fed mostly on fishes, gastropods, and xanthid crabs; large juveniles and adults (greater than 60 mm) fed on bivalves, fishes, xanthid crabs, and smaller blue crabs. The following is a list of molluscs known to be food items for blue crab: American oyster (*Crassostrea virginica*); hard clams (*Mercenaria mercenaria*); coot clam (*Mulina lateralis*); mussels (*Congeria leucophaeta*, *Mytilopsis leucophaeta*, *Brachidontes exustus*); common rangia (*Rangia cuneata*); marsh periwinkle (*Littorina irrorata*); Atlantic ribbed mussel (*Geukensia demissa*) (Millikin and Williams 1984).

Persons Consulted

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References

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Appendix 5. Table of references and personal communications

Common/Scientific Name	Florida Bay	Ten Thousand Islands	Caloosahatchee River	Charlotte Harbor
Bay scallop <i>Argopecten irradians</i>	6 Fonseca, LaCroix, Tilmant	6	6 Estevez	6 Estevez
American oyster <i>Crassostrea virginica</i>	Tilmant	36, 38, 183, 225, 245 Browder, Thoenke	36, 183 Chamberlain	36, 183 Fraser
Common rangia <i>Rangia cuneata</i>	126 Marelli, Tilmant	30, 126 Browder, Marelli, Tilmant	81, 126 Marelli	81, 126 Estevez, Marelli
Hard clam <i>Mercenaria species</i>	80, 81, 107 Tilmant	30, 81, 285 Browder, Tashiro, Tilmant	81, 126, 138, 150 Chamberlain	81, 126, 138, 150 Fraser
Brown shrimp <i>Penaeus aztecus</i>	183	92, 183, 289	183, 289	183, 289
Pink shrimp <i>Penaeus duorarum</i>	19, 29, 107, 183, 225 Tilmant	19, 29, 38, 59, 178, 183, 225 Browder, Tilmant	93, 183	183 Browder
White shrimp <i>Penaeus setiferus</i>	183 Tilmant	30, 183 Browder, Tilmant	183	183
Grass shrimp <i>Palaemonetes pugio</i>	4, 225, 297 Tilmant	4, 30, 38, 44, 59, 289, 297 Browder, Tilmant	4, 93 Chamberlain	4, 93
Spiny lobster <i>Panulirus argus</i>	107, 155, 183 Hunt, Tilmant	30, 44, 155, 183 Hunt	155 Hunt	155, 183 Fraser, Hunt
Gulf stone crab <i>Menippe adina</i>				
Stone crab <i>Menippe mercenaria</i>	30, 59, 107, 139, 183, 289 Bert	17, 18, 30, 38, 59, 139, 183, 289 Bert, Browder	17, 18, 59, 139, 183 Bert	17, 18, 59, 139, 183 Bert
Blue crab <i>Callinectes sapidus</i>	107, 266, 297 Steele, Tilmant	30, 38, 44, 171, Browder, Steele	171, 276 Chamberlain, Steele	59, 93, 171, 276 Fraser, Steele
Tarpon <i>Megalops atlanticus</i>	116	30, 38, 44, 183		116, 239 Fraser
Alabama shad <i>Alosa alabamae</i>	275 Tilmant	275	275	275
Gulf menhaden <i>Brevoortia patronus</i>	275 Tilmant	30, 44, 275	275	275
Yellowfin menhaden <i>Brevoortia smithii</i>	41, 45, 266, 275 Tilmant	30, 31, 38, 41, 44, 45, 275 Browder	41, 93, 275, 283 Chamberlain	41, 93, 275, 283 Fraser
Bay anchovy <i>Anchoa mitchilli</i>	116, 212, 261, 266, 267 Tilmant	30, 38, 44, 212, 261 Browder	59, 93 Chamberlain, Fraser	59, 64, 93, 283
Sheepshead minnow <i>Cyprinodon variegatus</i>	201, 241, 261, 266 Tilmant	30, 31, 38, 44, 261 Browder	93, 103, 198, 206 Chamberlain, Fraser	93, 202, 283 Fraser
Gulf killifish <i>Fundulus grandis</i>	84, 107, 201, 241, 261, 265 Tilmant	30, 31, 38, 44 Browder	93 Chamberlain	64, 283 Fraser
Snook <i>Centropomus undecimalis</i>	107, 199, 200, 270	38, 73, 226, 270, 271 Browder	93, 154, 280 Chamberlain, Fraser	283 Browder, Fraser
Bluefish <i>Pomatomus saltatrix</i>	95, 153, 224	30, 73, 95, 153, 183	93, 95, 153, 183, 198, 283 Chamberlain	95, 153, 183, 283
Blue runner <i>Caranx crysos</i>	107, 214, 224, 243, 260 Edwards, Tilmant	30, 31, 138, 261 Edwards	283 Chamberlain	283 Fraser
Crevale jack <i>Caranx hippos</i>	107, 214, 224, 243, 260 Edwards	30, 31, 38, 44, 138, 164, 261 Browder	93, 198 Chamberlain	93, 138, 283 Fraser
Florida pompano <i>Trachinotus carolinus</i>	78, 183, 266 Tilmant	30, 44, 183	93, 198, 244, 283 Chamberlain	93, 244, 283 Fraser
Gray snapper <i>Lutjanus griseus</i>	22, 107, 199, 200, 219, 220, 265, 266, 267, 297 Powell, Thayer, Tilmant	22, 38, 44, 87, 218, 261 Browder, Tilmant	93, 283 Chamberlain, Fraser	93, 283 Fraser
Pinfish <i>Lagodon rhomboides</i>	107, 225, 267, 297 Hettler, Powell, Tilmant	30, 38, 44, 45, 176, 225	93, 176, 244, 283 Chamberlain	59, 176, 283
Sand seatrout <i>Cynoscion arenarius</i>	113, 183, 225, 251, 265 Tilmant	30, 31, 38, 44, 230, 251 Browder	93 Chamberlain, Fraser	93, 183, 283 Fraser
Spotted seatrout <i>Cynoscion nebulosus</i>	107, 114, 194, 199, 200, 219, 266, 267, 286	38, 44, 192, 194 Browder	44, 59, 64, 114, 194, 283 Chamberlain, Fraser	44, 59, 64, 114, 194, 283 Fraser
Spot <i>Leiostomus xanthurus</i>	113, 183, 225, 265, 266, 297 Tilmant	30, 31, 38, 44, 113, 261 Browder, Tilmant	93, 283 Chamberlain, Fraser	93, 183, 283 Fraser
Atlantic croaker <i>Micropogonias undulatus</i>	113, 244 Davis	30, 44, 261 Tilmant	93, 283 Chamberlain	283
Red drum <i>Sciaenops ocellatus</i>	107, 183, 199, 200, 241, 295 Tilmant	30, 38, 45 Browder	93, 244 Chamberlain, Fraser	93, 283 Fraser
Striped mullet <i>Mugil cephalus</i>	107, 261, 266 Hettler, Powell, Tilmant	26, 30, 38, 44, 137, 261 Browder, Hettler, Tilmant	26, 93, 183, 269, 283 Chamberlain, Fraser	26, 93, 183, 269, 283 Fraser
Code goby <i>Gobiosoma robustum</i>	107, 225, 261, 266, 297 Tilmant	30, 31, 38, 43, 44, 261 Browder	27, 74, 93, 244, 283 Chamberlain	64, 74, 244, 283 Fraser
Spanish mackerel <i>Scomberomorus maculatus</i>	71, 123	38, 71, 82, 123, 193 Browder	82, 193, 198 Chamberlain	82, 123, 283
Gulf flounder <i>Paralichthys albigutta</i>	214, 266 Powell, Tilmant	31, 38, 44 Browder	93 Chamberlain	283 Fraser
Southern flounder <i>Paralichthys lethostigma</i>	79, 183 Tilmant	30, 31, 38, 79, 183 Browder	93 Chamberlain	283 Fraser

Numbers correspond to references listed in Appendix 7, References, pp. 92-105.

Names correspond to individuals listed in Appendix 6, Personal Communications, pp. 90-91.

Appendix 5, continued. Table of references and personal communications

Common/Scientific Name	Tampa Bay	Suwanee River	Apalachee Bay
Bay scallop <i>Argopecten irradians</i>	6, 136 Estevez, Fonseca		165, 223 Menzel, Subrahmanyam
American oyster <i>Crassostrea virginica</i>	36, 48, 49, 183, 245 Edwards, Estevez, Phillips	99, 132, 245 Lindberg	98, 165, 245 Subrahmanyam
Common Rangia <i>Rangia cuneata</i>	183	126, 202 Gilbert, Marell	126, 165 Subrahmanyam
Hard clam <i>Mercenaria species</i>	81, 238, 244 Edwards	65, 150, 238 Menzel, Nordlie	Menzel, Subrahmanyam
Brown shrimp <i>Penaeus aztecus</i>	63, 137, 173, 202, 259 Comp	50, 91, 92, 132 Sheridan	1, 40, 50, 60, 85, 91, 92, 105, 106 Sheridan, Subrahmanyam
Pink shrimp <i>Penaeus duorarum</i>	183 Comp, Edwards, Estevez	19, 108, 132, 183 Sheridan	109, 165, 183, 249, 289 Sheridan, Subrahmanyam
White shrimp <i>Penaeus setiferus</i>	183	132, 177, 183, 289 Sheridan	140, 141, 146, 177, 183, 289 Sheridan, Subrahmanyam
Grass shrimp <i>Palaemonetes pugio</i>	4, 58, 289 Phillips	4, 100, 289 Sheridan	249, 289 Menzel, Sheridan, Subrahmanyam
Spiny lobster <i>Panulirus argus</i>	287 Hunt, Estevez	183	183 Subrahmanyam
Gulf stone crab <i>Menippe edina</i>		132 Bert, Lindberg	183 Bert, Lindberg, Menzel, Subrahmanyam
Stone crab <i>Menippe mercenaria</i>	136, 139, 287 Bert	132 Bert, Lindberg	183 Bert, Lindberg, Menzel, Subrahmanyam
Blue crab <i>Callinectes sapidus</i>	171, 183, 259, 287, 289 Steele	132, 195, 246, 276 Steele	183, 195, 246, 298 Steele, Subrahmanyam
Tarpon <i>Megaloops atlanticus</i>	202, 244 Edwards	132, 183	117, 118, 165, 183, 190 Subrahmanyam
Alabama shad <i>Alosa alabamae</i>	275	8, 72, 275 Clugston, Gilbert	215, 216 Subrahmanyam
Gulf menhaden <i>Brevoortia patronus</i>	128, 275 Edwards, Mahmoudi, Phillips	41, 57, 127, 275, 277 Ahrenholz	20, 118, 127, 190, 275 Subrahmanyam
Yellowfin menhaden <i>Brevoortia amlmii</i>	41, 244, 259 Mahmoudi, Phillips	275	41, 275 Subrahmanyam
Bay anchovy <i>Anchoa mitchilli</i>	47, 212, 287 Comp, Edwards, Estevez	120, 209, 212	25, 212, 248, 249 Subrahmanyam
Sheepshead minnow <i>Cyprinodon variegatus</i>	47, 95, 202, 209 Comp, Phillips	120, 209	249, 298 Subrahmanyam
Gulf killifish <i>Fundulus grandis</i>	120, 202, 244, 248 Comp, Phillips	120	39, 249, 296 Subrahmanyam
Snook <i>Centropomus undecimalis</i>	123, 154, 183, 244, 280 Edwards	183, 209, 211	51, 117, 165, 183, 211, 293 Subrahmanyam
Bluefish <i>Pomatomus saltatrix</i>	95, 153, 183, 244	69, 132, 183, 209	69, 117, 118, 140, 183, 209 Subrahmanyam
Blue runner <i>Caranx cryos</i>	115, 161, 221, 244, 259 Edwards	15, 16, 83, 98, 115, 209	16, 83, 117, 118, 165 Subrahmanyam
Creville jack <i>Caranx hippos</i>	221, 244, 259 Edwards	15, 52, 90, 115, 187, 209, 278	3, 52, 90, 117, 118, 140, 165, 187, 278 Subrahmanyam
Florida pompano <i>Trachinotus carolinus</i>	68, 244 Phillips		117, 118, 183 Subrahmanyam
Gray snapper <i>Lutjanus griseus</i>	244 Edwards	6, 183	165 Subrahmanyam
Pinfish <i>Lagodon rhomboides</i>	47, 176, 244 Comp, Edwards, Estevez	57, 120, 175, 176, 209	20, 25, 118, 176, 190, 248 Subrahmanyam
Sand seatrout <i>Cynoscion arenarius</i>	244, 259 Comp, Phillips	183, 237 Lindberg	57, 183, 236, 237, 248 Menzel, Subrahmanyam
Spotted seatrout <i>Cynoscion nebulosus</i>	114, 162, 183, 259, 283, 286 Comp, Phillips	132, 166, 188 Lindberg	57, 118, 121, 130, 151, 165, 169, 249, 286 Menzel, Subrahmanyam
Spot <i>Leiostomus xanthurus</i>	47, 137, 202, 244, 259 Comp, Phillips	8, 57, 75, 120, 209	39, 118, 229, 248, 298 Menzel, Subrahmanyam
Atlantic croaker <i>Micropogonias undulatus</i>	129, 137, 244, 259 Phillips	57, 75, 132 Nordlie, Warden	57, 75, 118, 229, 249, 298 Subrahmanyam
Red drum <i>Sciaenops ocellatus</i>	183, 196, 197, 202, 213, 259 Estevez, Phillips	104, 132, 142, 167, 168, 183, 207	104, 142, 167, 168, 182, 183, 207 Subrahmanyam
Striped mullet <i>Mugil cephalus</i>	46, 47, 202, 213, 244, 259 Edwards, Estevez, Phillips	132 Clugston, Nordlie	46, 118, 190 Subrahmanyam
Code goby <i>Gobiosoma robustum</i>	27, 74, 242, 244	120, 209	25, 133, 165 Subrahmanyam
Spanish mackerel <i>Scomberomorus maculatus</i>	82, 123, 193, 259 Comp	57, 70, 82, 118	57, 70, 82 Subrahmanyam
Gulf flounder <i>Paralichthys abigitia</i>	47, 202, 244, 259, 272 Phillips	8, 72, 86, 88, 120, 175, 209	25, 79, 140, 183, 248, 249 Subrahmanyam
Southern flounder <i>Paralichthys lethostigma</i>	47, 202, 208, 209, 244, 259	8, 272 Clugston, Nordlie	25, 140, 248, 249 Subrahmanyam

Numbers correspond to references listed in Appendix 7, References, pp. 92-105.

Names correspond to individuals listed in Appendix 6, Personal Communications, pp. 90-91.

Appendix 5, continued. Table of references and personal communications

Common/Scientific Name	Apalachicola Bay	St. Andrew Bay	Choctawatchee Bay
Bay scallop <i>Argopecten irradians</i>	Menzel	67, 222 Fable, Fonseca, Menzel	21 Barkuloo
American oyster <i>Crassostrea virginica</i>	142, 245 Menzel	76, 93.1, 99, 245, 295.1 Fable, Menzel, Ogren	35, 99, 245 Barkuloo, Menzel
Common rangia <i>Rangia cuneata</i>	126, 142, 205 Menzel	126 Naughton	21 Barkuloo
Hard clam <i>Mercenaria species</i>	Menzel	65, 76, 93.1 Menzel, Naughton	21, 65 Barkuloo, Menzel
Brown shrimp <i>Penaeus aztecus</i>	1, 2, 50, 53, 92, 108, 110, 135, 142, 145, 146, 152, 165, 284 Sheridan	50, 53, 92, 108, 110, 135, 142, 145, 152, 165, 284, 295.1 Fable, Ogren, Sheridan	127 Barkuloo, Sheridan
Pink shrimp <i>Penaeus duorarum</i>	18, 142, 183, 205, 289 Sheridan	32, 222 Ogren, Sheridan	143, 183, 289 Barkuloo, Sheridan
White shrimp <i>Penaeus setiferus</i>	142, 145, 146, 177, 183 Sheridan	32, 295.1 Ogren, Sheridan, Young	143, 183, 289 Barkuloo, Sheridan
Grass shrimp <i>Palaemonetes pugio</i>	4, 100, 142, 144, 205 Sheridan	222, 295.1 Fable, Ogren, Sheridan, Young	143 Barkuloo, Menzel, Sheridan
Spiny lobster <i>Panulirus argus</i>	183	Fable	Barkuloo
Gulf stone crab <i>Menippe adina</i>	139 Bert, Lindberg	17, 89, 139, 289 Bert, Lindberg, Naughton	17, 139, 183 Barkuloo, Bert
Stone crab <i>Menippe mercenaria</i>	139 Bert, Lindberg		
Blue crab <i>Callinectes sapidus</i>	146, 184, 185, 195, 205, 246 Steele	183, 185, 195, 222, 246, 295.1 Naughton, Steele	143 Barkuloo, Steele
Tarpon <i>Megalops atlanticus</i>	2, 165, 183	98, 160, 183, 250, 278 Fable	12, 98, 183 Barkuloo
Alabama shad <i>Alosa alabamae</i>	13, 131, 172, 294 Menzel	160, 203, 204 Finucane	7, 12, 13, 21, 37, 111, 143, 268 Barkuloo
Gulf menhaden <i>Brevoortia patronus</i>	20, 128, 142, 144, 146, 190, 205, 229, 275	3, 160, 186, 203, 204, 273, 278 Finucane	12, 98, 143, 268, 275 Barkuloo
Yellowfin menhaden <i>Brevoortia smithii</i>		Fable	Barkuloo
Bay anchovy <i>Anchoa mitchilli</i>	20, 34, 141, 142, 145, 227, 229	3, 54, 186, 278 Finucane	12, 21, 37, 143, 268 Barkuloo
Sheepshead minnow <i>Cyprinodon variegatus</i>	142, 247	3, 180, 278 Finucane	7, 98 Barkuloo
Gulf killifish <i>Fundulus grandis</i>	56, 140, 142	54, 180, 278 Finucane	7 Barkuloo
Snook <i>Centropomus undecimalis</i>	2, 51, 165, 211, 293	51, 98, 183, 211, 250, 278, 293 Fable	51, 183, 210, 211, 293 Barkuloo
Bluefish <i>Pomatomus saltatrix</i>	2, 69, 141, 142, 144, 146, 165, 170, 183	33, 66, 69, 118, 160, 183, 186, 204, 250, 273, 278 Fable	69, 96, 98, 111, 143, 183, 209 Barkuloo
Blue runner <i>Caranx crysos</i>	2, 16, 83, 96, 98, 144, 165	3, 16, 33, 66, 83, 98, 160, 186, 204, 250, 273, 278 Fable	16, 83, 96, 98, 111 Barkuloo
Creville jack <i>Caranx hippos</i>	2, 52, 90, 141, 142, 144, 146, 187, 278	3, 33, 54, 98, 160, 180, 186, 204, 250, 278 Fable	12, 90, 96, 98, 111, 143 Barkuloo
Florida pompano <i>Trachinotus carolinus</i>	118, 144, 153	3, 98, 160, 204, 250 Finucane	7, 98, 111, 143 Barkuloo
Gray snapper <i>Lutjanus griseus</i>	144, 153	3, 54, 160, 180, 186, 204, 250, 278 Fable	7, 12, 98, 111, 143, 268 Barkuloo
Pinfish <i>Lagodon rhomboides</i>	20, 34, 118, 178	3, 54, 98, 160, 186, 203, 204, 250, 273, 278 Fable	7, 12, 37, 98, 111, 143, 268 Barkuloo, Menzel
Sand seatrout <i>Cynoscion arenarius</i>	57, 142, 145, 146, 227, 229, 236, 237	3, 160, 180, 186, 204, 250, 273, 278 Fable	7, 98, 143, 268 Barkuloo, Menzel
Spotted seatrout <i>Cynoscion nebulosus</i>	20, 112, 114, 121, 130, 166, 174, 188	3, 54, 160, 180, 186, 204, 250, 273, 278 Fable	12, 37, 98, 111, 143, 268 Barkuloo, Menzel
Spot <i>Leiostomus xanthurus</i>	57, 122, 142, 145, 146, 227, 229	3, 98, 160, 180, 186, 204, 250, 273, 278 Fable	7, 12, 37, 98, 143, 268 Barkuloo
Atlantic croaker <i>Micropogonias undulatus</i>	122, 142, 145, 146, 227, 228, 288 Sheridan	3, 160, 180, 186, 203, 204, 250, 273, 278 Fable	7, 12, 37, 98, 143, 268 Barkuloo
Red drum <i>Sciaenops ocellatus</i>	104, 142, 167, 168, 182, 183	54, 250, 278 Fable	7, 12, 98, 111, 143, 189, 194 Barkuloo
Striped mullet <i>Mugil cephalus</i>	13, 46, 118, 183 Menzel	3, 54, 98, 160, 180, 204, 278 Fable	7, 13, 28, 37, 46, 55, 98, 111, 118, 143, 183 Barkuloo
Code goby <i>Gobiosoma robustum</i>	20, 34, 74, 140, 242	180 Fable	98, 143, 268 Barkuloo
Spanish mackerel <i>Scomberomorus maculatus</i>	20, 142	98, 160, 179, 186, 203, 204, 250, 273, 278 Fable	70, 82, 98, 111, 143 Barkuloo
Gulf flounder <i>Paralichthys abigitta</i>	79, 141, 183, 191	3, 98, 160, 180, 186, 204, 250, 273, 278 Naughton	7, 98, 111, 143, 268 Barkuloo
Southern flounder <i>Paralichthys lethostigma</i>	13, 79, 144, 145, 191	3, 204, 250, 278 Naughton	37, 98, 143, 183, 208, 268 Barkuloo

Numbers correspond to references listed in Appendix 7, References, pp. 92-105.

Names correspond to individuals listed in Appendix 6, Personal Communications, pp. 90-91.

Appendix 5, continued. Table of references and personal communications

Common/Scientific Name	Pensacola Bay	Perdido Bay	Mobile Bay
Bay scallop <i>Argopecten irradians</i>	52 Flemer, Kruczynski, Young	Flemer, Heath, Kruczynski, Young	254, 257 Derdeau, Heath, Shipp
American oyster <i>Crassostrea virginica</i>	9, 10, 52 Flemer, Young	156, 157 Flemer, Heath, Mantel, Young	61, 102, 134, 156, 157, 158, 159 Derdeau, Heath, Shipp
Common rangle <i>Rangia cuneata</i>	52, 126 Derdeau, Flemer, Young	124, 125, 126, 256, 296 Kruczynski, Flemer, Heath, Young	119, 126, 254, 256, 279 Derdeau, Heath, Shipp
Hard clam <i>Mercenaria species</i>	52 Flemer, Young	254 Heck, Flemer, Heath, Young	65, 256 Derdeau, Heath, Shipp
Brown shrimp <i>Penaeus aztecus</i>	10, 52, 187, 296 Flemer, Sheridan, Young	40, 101, 102, 147, 254, 257, 258 Flemer, Heath, Sheridan, Young	40, 101, 102, 147, 240, 254, 258 Derdeau, Heath, Sheridan, Shipp
Pink shrimp <i>Penaeus duorarum</i>	9, 10, 187 Flemer, Sheridan, Young	254, 257 Flemer, Heath, Sheridan, Young	14, 42, 254, 257 Derdeau, Heath, Sheridan, Shipp
White shrimp <i>Penaeus setiferus</i>	9, 10, 52, 187, Flemer, Sheridan, Young	254, 257 Flemer, Heath, Sheridan, Young	14, 42, 148, 149, 217 Derdeau, Heath, Sheridan, Shipp
Grass shrimp <i>Palaemonetes pugio</i>	187 Flemer, Sheridan, Young	254, 257 Flemer, Heath, Sheridan, Young	23, 231, 254, 257 Derdeau, Heath, Sheridan, Shipp
Spiny lobster <i>Panulirus argus</i>	183 Flemer, Young	183 Flemer, Heath, Young	Derdeau, Heath, Shipp
Gulf stone crab <i>Menippe adina</i>	183 Bert, Flemer, Young	254 Bert, Flemer, Heath, Young	254 Bert, Derdeau, Heath, Shipp
Stone crab <i>Menippe mercenaria</i>			
Blue crab <i>Callinectes sapidus</i>	9, 10, 187 Flemer, Steele, Young	254, 257 Flemer, Heath, Lane, Steele, Young	14, 102, 231, 246, 264 Derdeau, Heath, Shipp, Steele
Tarpon <i>Megalops atlanticus</i>	183, 262, 263 Bortone, Young	5, 183, 254 Heath, Young	62, 254, 281, 282 Heath, Shipp
Alabama shad <i>Alosa alabamae</i>	5, 10, 13 Bortone, Young	254, 257 Heath, Young	131, 172, 216, 216, 254, 257, 274, 290 Heath, Shipp
Gulf menhaden <i>Brevoortia patronus</i>	9, 10, 187, 263 Bortone, Young	254, 257 Heath, Young	14, 102, 232, 233, 235, 253, 257, 291 Heath, Shipp
Yellowfin menhaden <i>Brevoortia amihill</i>	Bortone, Young	Heath, Young	14, 233, 235, 253, 254, 257, 291 Heath, Shipp
Bay anchovy <i>Anchoa mitchilli</i>	5, 9, 10, 52, 97, 187, 263 Bortone, Young	254, 257 Heath, Young	Heath, Shipp
Sheepshead minnow <i>Cyprinodon variegatus</i>	5, 10, 52, 97, 263 Bortone, Young	254, 257 Heath, Young	232, 253, 257 Heath, Shipp
Gulf killifish <i>Fundulus grandis</i>	5, 10, 52, 97, 263 Bortone, Young	254, 257 Heath, Young	232, 253, 257 Heath, Shipp
Snook <i>Centropomus undecimalis</i>	51, 183, 210, 211, 293 Bortone, Young	5, 183, 210, 211, 293 Heath, Young	Heath, Shipp
Bluefish <i>Pomatomus saltatrix</i>	52, 69, 96, 97, 209 Bortone, Young	69, 183, 209 Heath, Young	14, 69, 71, 254 Heath, Shipp
Blue runner <i>Caranx cryos</i>	16, 52, 83, 96, 97 Bortone, Young	16, 83, 96, 97 Heath, Young	115, 235, 254 Heath, Shipp
Creville jack <i>Caranx hippos</i>	9, 10, 52, 96, 97, 187, 263 Bortone, Young	90, 252, 257 Heath, Young	3, 24, 233, 254, 257 Heath, Shipp
Florida pompano <i>Trachinotus carolinus</i>	52, 97 Bortone, Young	254 Heath, Young	14, 253, 254, 282 Heath, Shipp
Gray snapper <i>Lutjanus griseus</i>	52, 97, 187, 263 Bortone, Young	254 Heath, Young	14, 253, 254 Heath, Shipp
Pinfish <i>Lagodon rhomboides</i>	9, 10, 52, 97, 176, 187, 263 Bortone, Young	252, 254, 257 Heath, Young	14, 24, 232, 253, 254, 257, 274 Heath, Shipp
Sand seatrout <i>Cynoscion arenarius</i>	5, 9, 10, 52, 97, 187, 263 Bortone, Young	252, 254 Heath, Young	14, 24, 102, 232, 233, 234, 235, 253, 254, 257, 274, 282, 291 Heath, Shipp
Spotted seatrout <i>Cynoscion nebulosus</i>	5, 9, 10, 52, 97, 114, 130, 166, 186, 294, 234, 263 Bortone, Young	252, 254, 257 Heath, Young	14, 24, 102, 232, 233, 234, 235, 257, 274, 282, 291 Heath, Shipp
Spot <i>Leiostomus xanthurus</i>	5, 9, 10, 52, 97, 187, 263 Bortone, Young	252, 254, 257 Heath, Young	14, 57, 102, 181, 232, 233, 235, 253, 254, 257, 291 Heath, Shipp
Atlantic croaker <i>Micropogonias undulatus</i>	5, 9, 10, 52, 94, 97, 187, 263 Bortone, Young	252, 254 Heath, Young	57, 102, 142, 181, 233, 234, 235, 253, 254, 255, 257, 282, 288, 291 Heath, Shipp
Red drum <i>Sciaenops ocellatus</i>	10, 52, 97, 187, 194, 263 Bortone, Young	254 Heath, Young	14, 24, 102, 232, 233, 234, 235, 253, 254, 274, 282, 291 Heath, Shipp
Striped mullet <i>Mugil cephalus</i>	5, 9, 10, 13, 46, 183, 187, 263 Bortone, Young	254, 257 Heath, Young	14, 24, 102, 232, 233, 253, 254, 257, 274, 282 Heath, Shipp
Code goby <i>Gobiosoma robustum</i>	5, 10, 52, 97 Bortone, Young	232, 254, 257 Heath, Young	232, 233, 234, 254, 257 Heath, Shipp
Spanish mackerel <i>Scomberomorus maculatus</i>	52, 187, 263 Bortone, Young	254 Heath, Young	14, 24, 102, 233, 253, 254, 282 Heath, Shipp
Gulf flounder <i>Paralichthys aibigutta</i>	52, 79 Bortone, Young	257 Heath, Young	14, 24, 254, 257, 282, 290 Heath, Shipp
Southern flounder <i>Paralichthys lethostigma</i>	5, 11, 10, 52, 263 Bortone, Young	254 Heath, Young	14, 24, 102, 233, 253, 254, 257, 282 Heath, Shipp

Numbers correspond to references listed in Appendix 7, References, pp. 92-105.

Names correspond to individuals listed in Appendix 6, Personal Communications, pp. 90-91.

Appendix 6. Personal communications

Ahrenholz, D.	National Marine Fisheries Service, Beaufort, NC
Barkuloo, J.	U.S. Fish and Wildlife Service, Panama City, FL
Bert, T.	Florida Department of Natural Resources, St. Petersburg, FL
Bortone, S.	University of West Florida, Pensacola, FL
Browder, J.	National Marine Fisheries Service, Miami, FL
Chamberlain, B.	South Florida Water Management District, West Palm Beach, FL
Clugston, J.	U.S. Fish and Wildlife Service, Gainesville, FL
Comp, G.	Sarasota County Government, Sarasota, FL
Dardeau, M.	Marine Environmental Sciences Consortium, Dauphin Island, AL
Davis, D.	Mote Marine Laboratory, Sarasota, FL
Edwards, R.	Mote Marine Laboratory, Sarasota, FL
Estevez, E.	Mote Marine Laboratory, Sarasota, FL
Fable, W.	National Marine Fisheries Service, Panama City, FL
Finucane, J.	National Marine Fisheries Service, Panama City, FL
Flemer, D.	U.S. Environmental Protection Agency, Gulf Breeze, FL
Fonseca, M.	National Marine Fisheries Service, Beaufort, NC
Fraser, T.	Environmental Quality Laboratory, Port Charlotte, FL
Gilbert, C.	University of Florida, Gainesville, FL
Heath, S.	Alabama Dept. of Conservation and Natural Resources, Dauphin Island, AL
Heck, K.	Marine Environmental Sciences Consortium, Dauphin Island, AL
Hettler, W.	National Marine Fisheries Service, Beaufort, NC
Hunt, J.	Florida Department of Natural Resources, Marathon, FL
Kruczynski, W.	U.S. Environmental Protection Agency, Gulf Breeze, FL
LaCroix, M.	National Marine Fisheries Service, Beaufort, NC
Lane, J.	Pensacola Junior College, Pensacola, FL
Lindberg, W.	University of Florida, Gainesville, FL
Mahmoudi, B.	Florida Department of Natural Resources, St. Petersburg, FL
Marelli, D.	Florida Department of Natural Resources, St. Petersburg, FL

Menzel, W. (deceased)	Florida State University, Tallahassee, FL
Naughton, S.	National Marine Fisheries Service, Panama City, FL
Nordlie, F.	University of Florida, Gainesville, FL
Ogren, L.	National Marine Fisheries Service, Panama City, FL
Phillips, D.	Mote Marine Laboratory, Sarasota, FL
Powell, A.	National Marine Fisheries Service, Beaufort, NC
Sheridan, P.	National Marine Fisheries Service, Galveston, TX
Shipp, R.	University of South Alabama, Mobile, AL
Steele, P.	Florida Department of Natural Resources, St. Petersburg, FL
Subrahmanyham, D.	Florida A & M University, Tallahassee, FL
Tashiro, J.	National Marine Fisheries Service, Miami, FL
Thayer, G.	National Marine Fisheries Service, Beaufort, NC
Thoemke, K.	National Estuarine Research Reserve, Fla. Dept. of Natural Resources, Naples, FL
Tilmant, J.	U.S. National Park Service, Homestead, FL
Warlen, S.	National Marine Fisheries Service, Beaufort, NC
Young, B.	Florida Department of Environmental Regulation, Pensacola, FL

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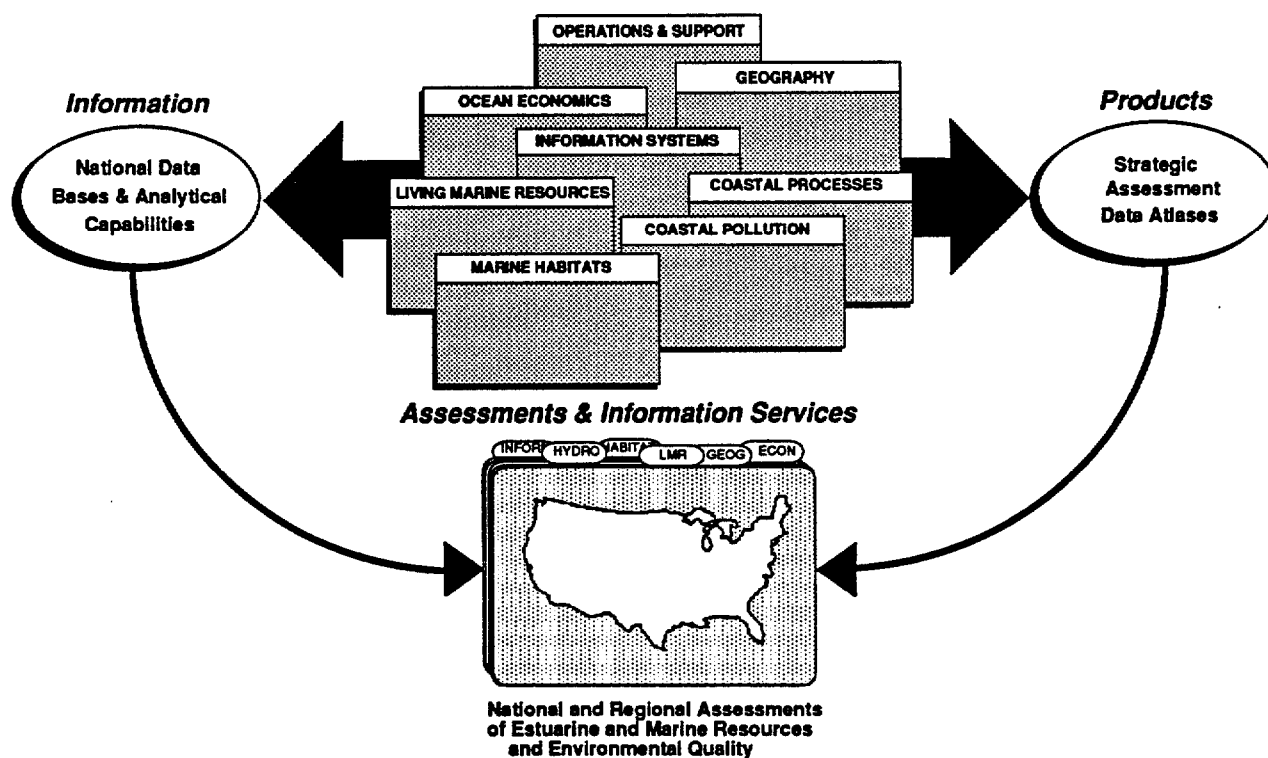
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The major activities of the Strategic Assessment Program are focused on assembling information and providing assessment services required for decisionmaking about the estuarine and marine resources of the USA. The information and assessments that are developed help identify strategies for balanced conservation and use of these resources for maximum benefit to the Nation. Recent projects completed by the Branch include the *Bering, Chukchi, Beaufort Seas Strategic Assessment Data Atlas*, along with two *National Estuarine Inventory Data Atlases* and one pre-publication edition of the *West Coast of North America Data Atlas*. A continuing effort to expand and improve the National Estuarine Inventory (NEI)

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