South Atlantic Fishery Management Council

Conserving and managing America's fisheries from three to 200 miles off the coasts of North Carolina, South Carolina, Georgia and Florida.

Web User Guide for EcoSpecies Life Histories

Developed by the Florida Fish and Wildlife Conservation Commission

Fish and Wildlife Research Institute

Web User Guide for EcoSpecies Life Histories

REVISION: 2017.03.14

Contents

Introduction to EcoSpecies Web Site

The intended audience for this site includes: Fishermen, Scientists, Fisheries Managers, Coastal Zone Managers, Consultants, Public Outreach, and Media.

Major components of data this system provides include the following: Taxonomy, Geographic Range, Predator/Prey, Reproduction, Age & Growth, Fishery, Enhancement, Assessment & Management, Ecology & Essential Fish Habitat, Threats, and Stock Identification. Citations and references are available for each database entry.

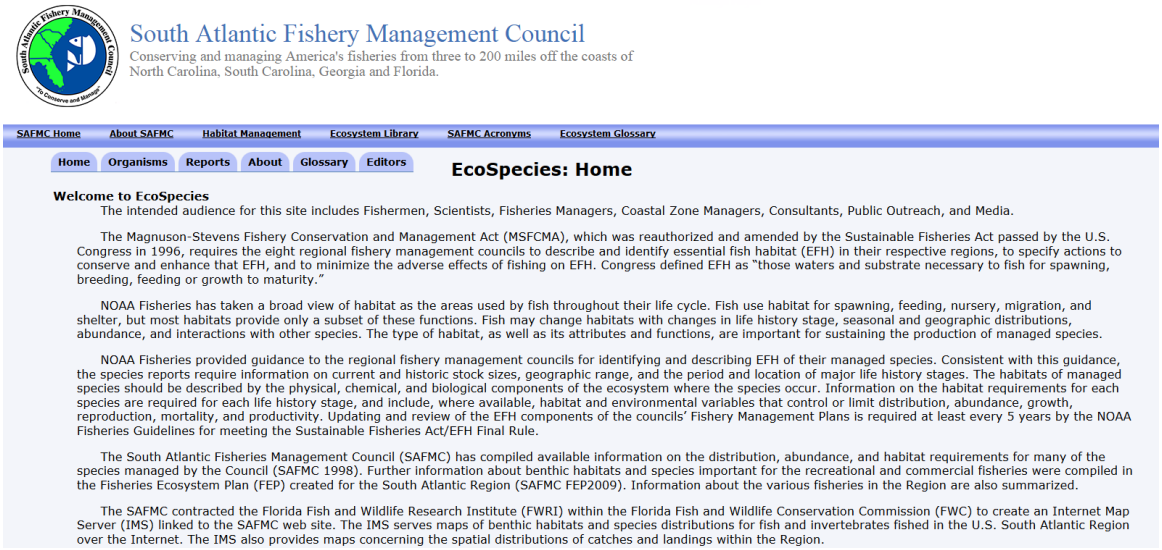
The purpose of this site is to provide the species life history (SLH) information to flexibly fill the needs of different users. The system is designed to allow the input of updated SLH profiles as they become available. Output can be in the following formats: Rich Text Format (RTF) or Web-based (HTML).

EcoSpecies: Login Page

You must be assigned a User name and (default) Password by the system administrator. After the first login, you may change your password.

EcoSpecies: Home

This area provides information regarding the intended audience, and major components of the site. A historical overview of the system's design and purpose is included.



EcoSpecies: Organisms

This area provides a 'lookup' resource by organism / taxonomic classification, or common name. Clicking the common name will take you directly to the appropriate report. Columns can be sorted, as well as searched by common name or taxonomic classification.

Common Name	Phylum	Class	Order	Family	Genus	Species	Id
Almaco Jack	Chordata	Actinopterygii	Perciformes	Carangidae	Seriola	rivoliana	168691
American Oyster	Mollusca	Bivalvia	Ostreoida	Ostreidae	Crassostrea	virginica	79872
Atlantic Croaker	Chordata	Osteichthyes	Perciformes	Sciaenidae	Micropogonias	undulatus	169283
Atlantic Cutlassfish	Chordata	Osteichthyes	Perciformes	Trichiuridae	Trichiurus	lepturus	172385
Atlantic Menhaden	Chordata	Osteichthyes	Clupeiformes	Clupeidae	Brevoortia	tyrannus	161732
Atlantic Spadefish	Chordata	Osteichthyes	Perciformes	Ephippidae	Chaetodipterus	faber	169539
Atlantic Thread Herring	Chordata	Osteichthyes	Clupeiformes	Clupeidae	Opisthonema	oglinum	161748
Banded Rudderfish	Chordata	Actinopterygii	Perciformes	Carangidae	Seriola	zonanta	11112
Bank Sea Bass	Chordata	Actinopterygii	Perciformes	Seranidae	Centropristis	ocyurus	167690
Bar Jack	Chordata	Actinopterygii	Perciformes	Carangidae	Curanx	ruber	168615
Bay Anchovy	Chordata	Steichthyes	Lupeiformes	Engraulidae	Anchoa	mitchilli	161839
Bay Scallop	Mollusca	Bivalvia	Ostreoida	Pectinidae	Argopecten	irradians	79737
Bay Squid	Mullusca	Cephalopoda	Teuthida	Loliginidae	Lolliguncula	brevis	82379

Ecospecies: Reports

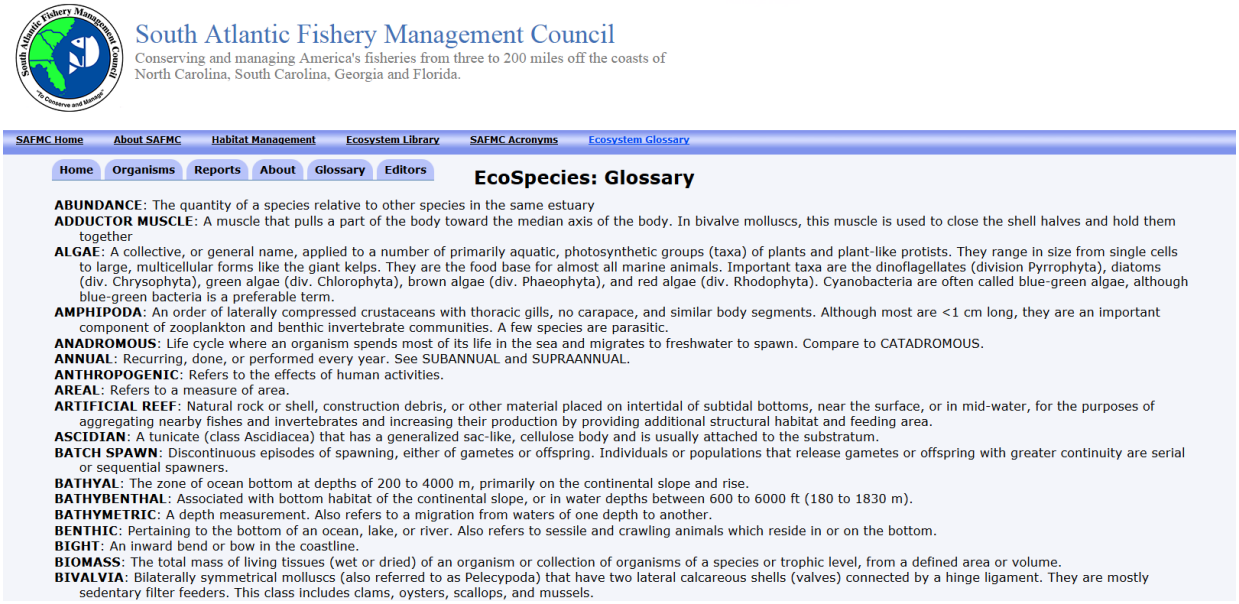
Users may select a species for which to generate an HTML report. The resultant report page also has a link to download a Rich Text Format (RTF) version of the same document.

EcoSpecies: About

This area provides a short history of EcoSpecies, Estuarine Living Marine Resources (ELMR), and Florida Estuarine Living Marine Resources (FLELMR), as well as a link to this User's Manual.

EcoSpecies: Glossary

This page covers some useful vocabulary employed throughout the database of species life history reports.



EcoSpecies: Editors

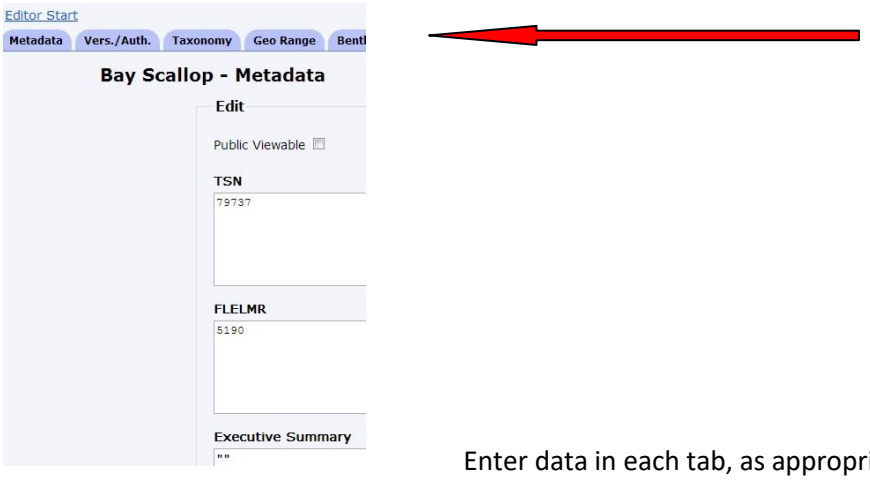
This section allows a user to select a species for editing. Users may also change their password from this tab. The “Manage Citations” selection allows adding or editing citations from the overall list of available citations in the database.

Editing Existing Species

We will use the "Bay Scallop" (*Argopecten irradians*) as an example.

Choose a species from the drop down list…

Select "Edit"

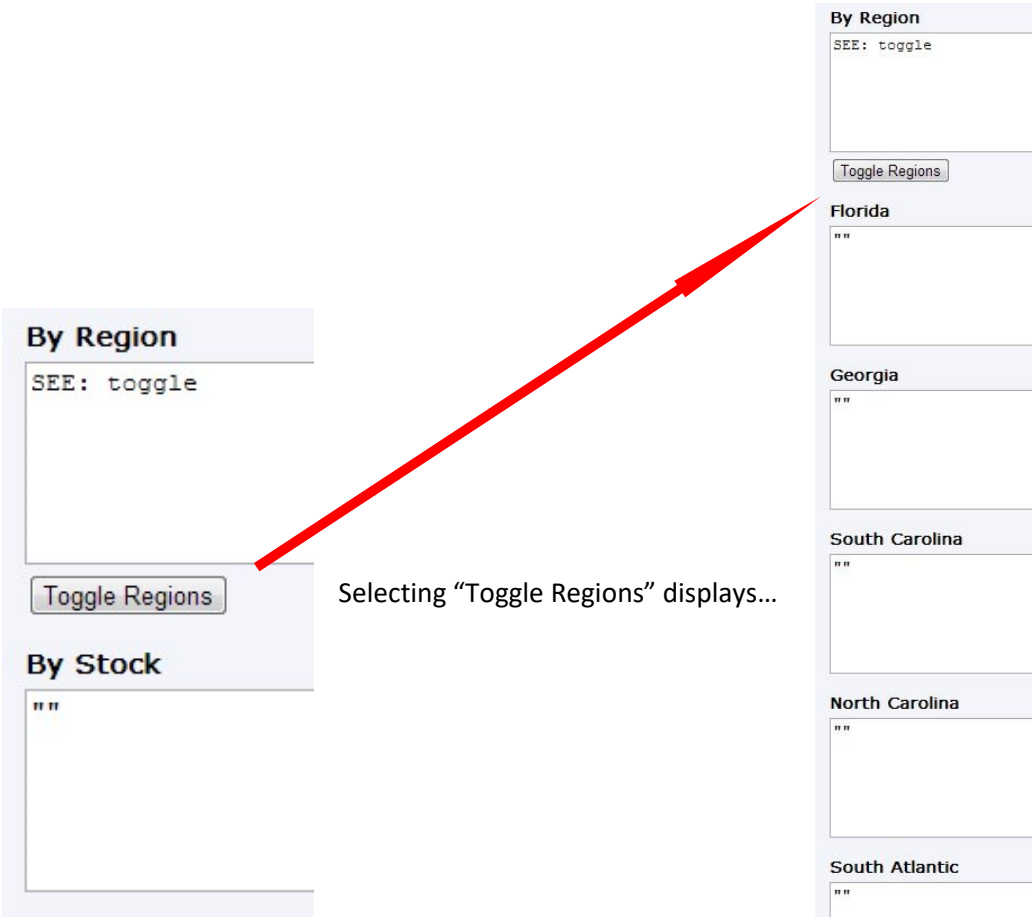


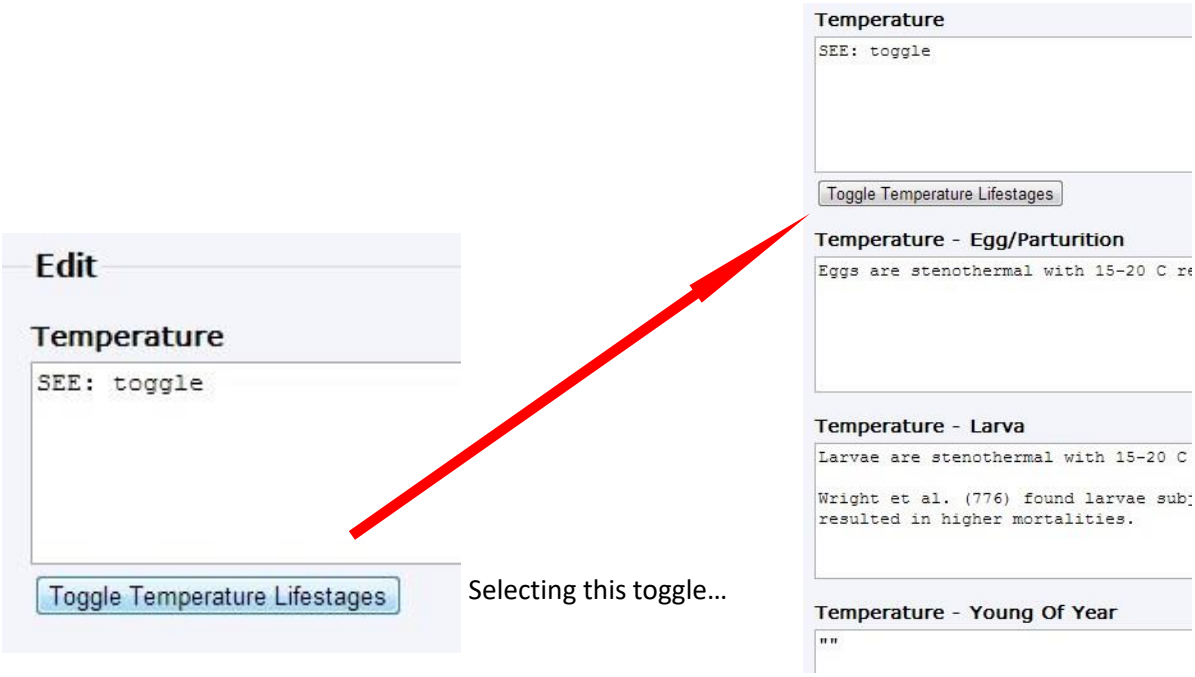
Enter data in each tab, as appropriate

NOTE: All fields must have something in them, ***if only a space***. Currently, we use double quotes to indicate an empty field; but the system will permit a "**Save**" if entering data in other blocks. If you have a data block without anything in it, when you save, you'll receive an error message specific to the empty field.

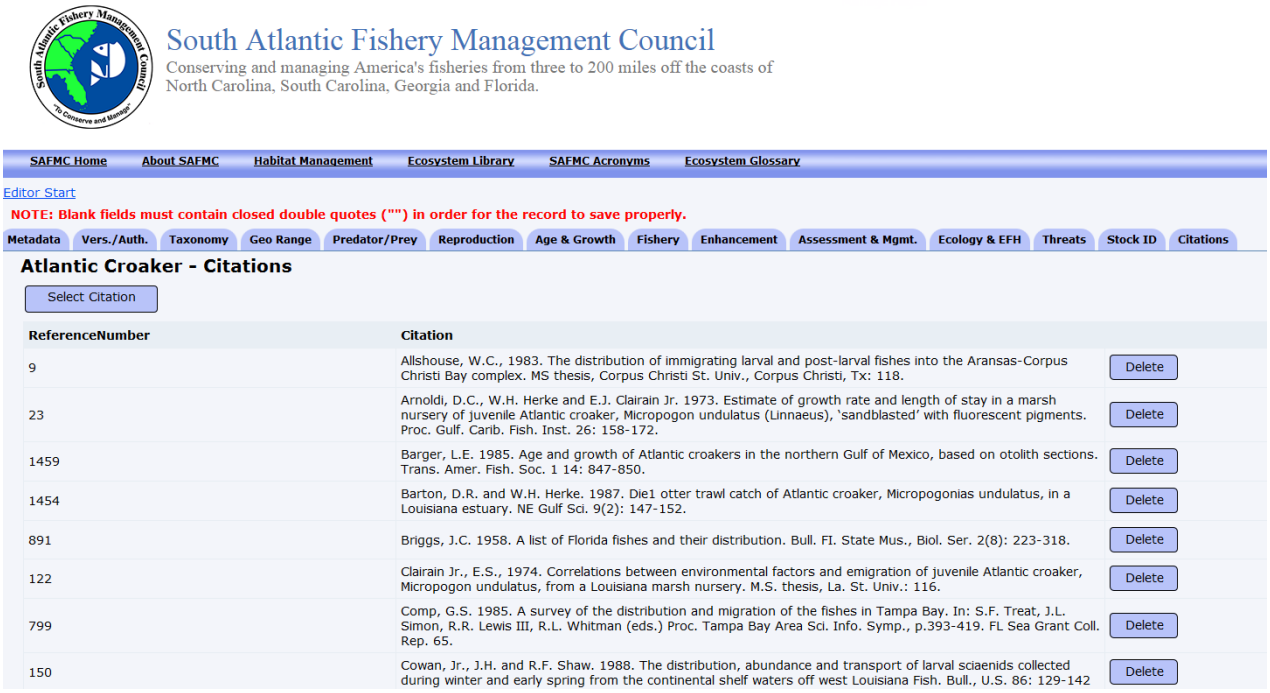
Important: You must save each tab separately. The system is a series of individual tables. Save before leaving the page.

Some screen fields have ‘toggles’ associated with them, like “Regions” and “Lifestages.”





The Citations tab provides a list of citations associated with the specific SLH, as well as “Reference Number” and a “Delete” option.



To associate a new citation to the species being edited, click “Select Citation”. On the next screen, you can search for and select the appropriate citation, if one currently exists in the system. There is also a button on this screen to “Create New” if necessary.

Creating EcoSpecies Species Life History (SLH) Profiles

Introduction to SLH Profiles

The South Atlantic Fisheries Management Council (SAFMC) provided funding for the first year of the EcoSpecies project (2011-2012). Work during the first year migrated the Species Life Histories (SLHs) from Florida Estuarine Living Marine Resources (FLELMR) into a MS SQL Server database and created a basic web page to allow public access to the FLELMR data. A SLH formal outline was developed to create a standard format for SLHs. A process to import text documents into the database was developed to pre-populate the database with existing information.

Updates to existing SLHs should be based on the report created by the EcoSpecies web application with the options selected for a complete report; including all headings and subheadings. This will provide the formal outline along with any pre-populated information.

Format Needed For Parsing the Information

The parsing program can read only plain ASCII text, so all symbols and formatting will be lost prior to formatting the report. Symbols need to be replaced with the name of the symbol (degrees = °, mu = µ, omega = ω, etc.)

Exponents need to be rendered by using the caret character and parentheses as appropriate. Press shift+6 to get the caret character. For example, a formula might be expressed as: y^2 = 1.24 * x^(-2*z).

Content stored under subheadings (such as each of the life stage fields) can be viewed by clicking the “Toggle” button. The best practice will be to write ‘SEE TOGGLE…’ in the main section when content is to be parsed. This can be the only content in the main heading or it can be pasted at the end of the content as appropriate.

Levels of Outline

1. **HEADER**
   - 1.1 **Source Documentation**
   - 1.2 **FLELMR Code**
   - 1.3 **TSN**
   - 1.4 **Report Generated**
   - 1.5 **Last Updated**
   - 1.6 **Executive Summary**
   - 1.7 **Acknowledgements**
   - 1.8 **Note**

2 **TAXONOMY**
   - 2.1 **Section Summary**
   - 2.2 **Common Name**
   - 2.3 **Scientific Name**
   - 2.4 **Classification**
     - 2.4.1 **Phylum**
     - 2.4.2 **Class**
     - 2.4.3 **Order**
     - 2.4.4 **Family**
   - 2.5
   - 2.6 **Subspecific Names**
   - 2.7 **Synonyms**
   - 2.8 **Other Common Names**
   - 2.9 **Taxonomic Characteristics** (by life stage)
   - 2.10 **Similar Species**
   - 2.11 **Evolutionary Relationships**
   - 2.12 **Stock Structure/Dynamics**
   - 2.13 **Note**

Best Practices for SLH Content Documentation

Here are generic definition for the fields within the report.

LIFE STAGE DEFINITIONS

Egg/Parturition - The life stages Egg and Parturition were merged to become one life stage designation since both pertain to the release of reproductive products by adult fish or invertebrates. This tends to standardize the life stages across species. Eggs are gelatinous, usually spherical, multicellular reproductive propagules released from fish or invertebrates at the time of spawning. Parturition describes the ecological conditions wherein certain types of fish release live young.

Larva - The life stage that usually occurs after hatching of the egg. Larval fishes generally have finfolds, and/or other morphological, and pigmentary characteristics different from juvenile or adult life stages, that usually have been described in the literature. Larval invertebrates that are morphologically distinctive from adults generally also have been described in the literature. In the marine environment, the majority (with some exceptions) of larval fishes and invertebrates are planktonic.

Young-of-Year -This life stage is defined as fish or invertebrates in their first year of life. It is generally followed by juvenile and adult life stages. It may not exist in short-lived species which become sexually mature in their first year of life (e.g., there is only egg, juvenile and adult life stages for that organism).

Juvenile-Juveniles are less easy to define, but may have pigment differences from the Adult life stage, and are usually not sexually mature. Juvenile is defined herein as being younger fish or invertebrates with adult morphology, with less than 50% being sexually mature below a given age or size (length). It is recognized that life stages may be defined in different ways. The term juvenile may be based on taxonomic characters of

individual fish or invertebrate animals. We still need the information concerning the life stage, irrespective of how the term is defined in the literature being summarized. Hence, best practice is to state how the term is being used in the Species Life History (SLH) outline and give the length range used in the literature being summarized. State whether the lengths mentioned are Standard Length (SL), Fork Length (FL), or Total Length (TL). You also need to clearly state whether the length units are metric (e.g., centimeters) or British units (e.g., inches).

Adult-Adult herein refers to individuals of the species where 50% or more are sexually mature at a given age. Adult is the age (or less preferably the length) at which 50% or more of the females of the population are sexually mature. Females were chosen for the definition since it is more difficult to visually determine maturity in males. Additionally, males may mature sooner. This definition ties in with the definition of Spawning Potential Ratio (SPR) used in fisheries management. The comments concerning the various definitions for life stages (e.g., juvenile life stage) and the need to summarize length ranges apply to all life stages in this SLH outline.

VERSIONS/AUTHORS

Describe the history of the work done by staff and institutions involved in the development of the SLH. Each person working on the profile should give their first initial and family name, their place of employment (e.g., Mote Marine Laboratory, FWRI), and the date of the last update of the SLH profile (e.g., 7/10/01). The date of previous work by the same person is replaced with each update. This allows the date to be entered after each update. Hence, the SLH profile has a means of tracking who worked on creating the information being added to the EcoSpecies database. The format for Updates is strict and must be of the form: date followed by a period (.) Authors separated by a vertical line. The last author should be followed by a semi-colon (;) and the affiliation.

TAXONOMY

Summarizes information concerning the naming and classification of species.

Scientific Name: The most recent scientific name accepted by the American Fisheries Society (AFS). The Genus and Species fish names given in the *AFS Guide to Common and Scientific Names #20*. (Invertebrate names would come from the *AFS Guide To Invertebrates*).
Sub specific Names: The most recent subspecies that occur in waters off NC, SC, GA or FL.
Synonyms: Scientific genus and species names. These may be previously used names or names being used that are not accepted by AFS. Where no synonyms are known to exist, that should be stated in the profile.
Common Name: The common name given in the AFS publication #20.

Other Common Names: Common names used regionally or derived from other languages.
Classification: Names pertaining to Phylum, Class, Order, and Family.
Taxonomic Characteristics: Distinguishing features such as color, striping patterns, or other observed physical traits.
Similar Species: Common and scientific names of similar species in the same family. This subsection could also mention species similar in appearance, but not closely related (e.g. members of different families, such as members of the family Gerridae that look similar to Centropomidae).
Evolutionary Relationships: Publications that infer evolutionary relationships between species, genera, and/or higher levels of classification should be summarized. This could be studies that infer Phylogeny using traditional taxonomy (e.g., comparative morphology or meristics), cladistic methods, numerical taxonomy, biochemistry and/or parasitology (host-parasite relationships) etc.

GEOGRAPHIC RANGE

Summarizes information concerning geographic distribution of the species, subspecies, or species stocks.

By Region: Pertains to the geographic range of the species with in a state.
By Stock: This subheading pertains to studies that have defined the existence of genetically or morphologically distinct subpopulations or stocks of a species that can be geographically defined. The means by which the stock discrimination was determined, such as biochemical methods (mitochondrial or nuclear DNA, isozymes), tagging, or parasites can be mentioned as well as the geographic distribution of each stock defined within a species.
By Estuary: The estuaries where the species has been found and associated bibliographic citations should be given. It is preferable to cite as many papers as possible indicating the species presence by estuary.
Spatial Strategy: Defines whether the species is resident or migrant inhabitant of estuarine, marine, coastal or oceanic environments. Discuss the species home range if known. May be distinguished by life stage.
Areal Zone: Describe the range throughout the lifecycle for the species both geographically and relative to inshore/offshore.
Bathyl Zone: Depth of the bottom over which a species is generally observed or occurs (not depth the species occupies in the water column, rather does it prefer shallow coastal or deep offshore areas).
Vertical Zone: Where in the water column does the species occur (list by life stage as appropriate).

Mobility/Migration: The movements and migratory behavior of a species/life stage between or within habitats (e.g. stationary, low mobility, high mobility, territorial, unknown).

PREDATOR/PREY

Food Habits: A general overview of what the species eats over its life.
Trophic Mode: Trophic manner of feeding (e.g., detritivore, herbivore, carnivore, omnivore, planktivore, filter-feeder).
Feeding: Where it feeds in the water column (e.g. bottom, midwater, surface). List by life stage as appropriate.
Food Items: The types of organisms or materials eaten (e.g., detritus, phytoplankton, zooplankton, epifauna). List by life stage as appropriate
Known Predator: A list of known predators that eat this species. List by life stage as appropriate

REPRODUCTION

This SLH section summarizes, in plain language, the various topics tied to the reproductive behavior, timing, location of spawning, and fecundity of the species.

Reproduction: A general overview description of reproduction characteristics and behaviors for this species.
Gender: State if sexes are separate, dioecious, sequential hermaphrodite; simultaneous hermaphrodite; asexual, etc.
Mode: Summarize whether the species is oviparous, ovoviviparous, or viviparous in its mode of reproduction. Refer to the glossary for definition of terms as needed.
Spawning Habitat: This section describes where spawning occurs (e.g. riverine, estuarine, marine, unknown).
Fertilization: Describes whether fertilization is external, internal, or unknown. Additional information such as hermaphroditic (two sexes in one individual), protandric (sex reversal), viviparous (giving birth to live young rather than laying eggs), should also be described. Additional categories to cover these possibilities will be added to the REPRODUCTION Table.
Spawning Strategy: Refers to the mode and manner of spawning, reproductive behavior (monogamous, polygamous), method of spawning (broadcast or batch spawner), and the timing of spawning (iteroparous, semelparous). Additional information such as whether it is hermaphroditic (two sexes in one individual), protandric (sex reversal), viviparous (giving birth to live young rather than laying eggs) should also be described.
Reproductive Periodicity: This part of the SLH summarizes the literature pertaining to the months across which spawning occurs. This subsection can also summarize whether reproduction occurs more than once per year. Information on the time of day,

associations with solar or lunar cycles can also be described. State the spawning period(s) by geographic localities (e.g., different states). State whether spawning is unimodal or multimodal (e.g., spring and fall). State the months over which spawning is known to occur.

Parental Care: Refers to whether or not the parent fish guard the eggs, larvae, or fry.

Seasonal Energetics: Summarize literature that describe changes in lipid content, changes in caloric content of the ovaries and/or testes etc during various times preceding, during, and following the spawning period.

Maturation/Reproductive Strategy: This section summarizes the age (or length) at which 50% or more of the population becomes sexually mature. The SLH should summarize fecundity relationships (regressions of age or length versus fecundity) from the literature where these exist.

Comment- These data may be taken from gonadosomatic index (GSI) plots or from sigmoid curves fitted to the percent maturation at age data to define the age when 50% or more of the female population are sexually mature. Tabular data should include changes in the GSI by month. Graphs presenting this information would be useful.

Fecundity: The number of eggs or young produced by an individual. Fecundity varies widely among various fish species.

Mating/Spawning: Describe the geographic and temporal extents, including any habitat, for where mating/spawning occurs.

Sex Ratio: Discuss whether the sex ratio is 1:1 or not, and whether the sex ratio changes with size or age of the species (e.g., groupers, snook).

AGE & GROWTH

This heading encompasses growth data and parameters useful for stock assessment and fisheries management in the south Atlantic. Where possible, the growth data summarized should pertain to south Atlantic fish or macroinvertebrate species. The key information should be summarized into the textual SLH outline from stock assessment documents and other literature.

Age & Growth: A general overview description of the age and growth issues relative to this species.

Length Range (by life stage): This section summarizes the length range taken from the literature or from FWRI's Fisheries Independent Monitoring (FIM) database that defines the range of lengths of a given life stage. The lengths taken from the literature may be in Total Length (TL), Fork Length (FL) or Standard Length (SL) either in the metric system (mm) or British system (inches). All measurements given should be metric.

The measurements of each life stage of a species should be converted to Total Length (TL) in millimeters. **Length Conversions:** Regression equations that allow conversion between metric units (TL, FL, and SL) should be summarized in the SLH. Conversion

coefficients (slope and intercept of straight-line regressions) should be provided and used to convert FL to TL or SL to TL for entry of mean total length at age.

Weight-Length Conversions: This section summarizes weight-length relationships preferably those done in the metric system. The weight-length relationships for the combined life stages Juvenile and Adult should be summarized in the SLH. It is important to present the range of lengths over which the weight-length regression was conducted. The correlation coefficient *r* or the coefficient of determination *r-squared* should also be presented. Weight-length regressions by sex should be presented where the sexes differ significantly from one another. All weights used to calculate these relationships pertain to wet weight. Sometimes weight-length regressions are calculated from frozen or chemically preserved (e.g., formalin or alcohol) specimens. These coefficients should only be summarized, if the author has determined the weight loss from preservation prior to calculating the regressions.

Weight Conversions: Summarize any conversion factors between wet-weight and dry-weight presented in the literature. Bioenergetic studies often dry fish specimens in an oven to determine caloric content.

Length at Age: Literature that summarizes the growth in length of a marine fishery species should be cited and key findings discussed. Growth parameters by sex should be summarized in the textual SLH outline where these are significantly different. Otherwise only the growth parameters for the sexes combined are needed. Mean TL at age for the sexes combined should be included.

Length at Age - Male: In this description, include the method/criteria of measurement as well as data and methodology. For example: Total Length (TL) vs Fork Length (FL).

Length at Age - Female: In this description, include the method/criteria of measurement as well as data and methodology. For example: Total Length (TL) vs Fork Length (FL).

Length at Age - Combined: In this description, include the method/criteria of measurement as well as data and methodology. For example: Total Length (TL) vs Fork Length (FL).

Longevity: Stock assessment models generally need information concerning the maximum age of adults (to calculate natural mortality M) of a species and the mean duration of each life stage for use in growth equations (von Bertalanffy, Gompterz). Provide the mean duration of the egg (hours), larvae (days), juvenile (years), and adult (years) life stages.

Aging Structures/Methods: Describe the bony structures used for age determination (e.g., scales, otoliths, spines, vertebrae) and the methods used to prepare the samples (e.g., diamond saw, resins etc.).

Growth Equations: The Von Bertalanffy growth parameters which should to be summarized include the Brody growth coefficient (K), total length to infinity (L_{oo}) in millimeters, and time at hatching (t_o) (days or fraction of a year).

Development: This section should give the morphometric, meristic, and pigmentary characteristics that distinguish the various life stages defined above, and that

distinguish the species from other similar species. Drawings or images depicting the various life stages should be included in the SLH document.

FISHERY

Value & Status: Value in this section refers primarily to the benefits accrued from the exploitation of the species in the south Atlantic. Status in this section pertains to whether the species "stock" is managed or not, and whether it is natural or introduced.

Combined Fisheries: Summarize data where all types of fisheries data were combined.

Commercial: Information on commercial fishery harvest of species of concern should be summarized using tables and graphs, including landings (in pounds), the total dollar value of the resource statewide and/or by county. Where available, maps depicting landings by county should be included.

Recreational: Information on recreational fishery harvest of the species of concern should be summarized using tables and graphs, including landings (in pounds), the total dollar value of the resource statewide and/or by county. Where available, maps depicting landings by county should be included.

Ecological Role: This refers to the role a species plays in marine/estuarine ecosystems. Summarize studies in the SLH that document the species as being either a top predator, forage fish (prey), scavenger (detritivore) or herbivore, symbiotic with other species, a filter-feeder (e.g., oysters, clams), or keystone species (an essential link in the food chain or component of the fish community).

Species Stress: This subsection should rank whether the species is under stress from fishing, pollution, or natural perturbations. Discuss whether the species is considered as being sensitive or insensitive to pollution, red tides, municipal or industrial waste etc. The literature documenting the response of the species to anthropogenic factors should be summarized and cited.

Status: General comment on status of the species overall. Two toggles: stock and management.

Stock Status: This toggle summarizes information pertaining to whether the landings are going up or down in relation to previous years. Pertinent information from stock assessments should be summarized. Information concerning whether populations are increasing, stable, decreasing, or unknown should be discussed. Inter-annual trends should be discussed from a graph, where this information is available.
Indicate the general trends.

Management Status: Using state or federal documentation list whether the species is of concern for fisheries management or for the protection of threatened and/or endangered species. Information from other states or other countries is not required; except perhaps where this has a bearing on the management of the species in the South Atlantic.

Social Value: Discuss whether the species is important to the recreational and/or commercial fishery, or important as a biological indicator of pollution or ecosystem health (like the canary in a coal mine).
Environmental Indicator: Provide a descriptive broad measure of ecosystem health based on the observed species health. Also include any details about the species role as an environmental indicator.

STOCK ENHANCEMENT

Stock Enhancement: A general overview covering any stock enhancement in place for this species.
Stock Enhancement – Council Policy: Provide a link with a date indicating the Council's standing policies relevant to this species.
Stock Enhancement – Other Policies: List any known policies outside of the Council for this species; for example, state, municipal, federal, or other policies.
Captive Breeding: Summarize research pertaining to induced breeding including environmental manipulations (temperature, photoperiod) and hormonal manipulations causing sexual maturation etc.
Rearing: Environmental requirements for maintenance of eggs and larvae (e.g. temperature, photoperiod), rearing tank design, filtration requirements etc.
Diet: Studies of the culture of food organisms or artificial diets that satisfy the nutritional requirements of the young under hatchery conditions should be described.
Stocking: Studies that have assessed the success or failure of stocking young fish into estuaries is especially important. Survival rates over time should be summarized, where these are available.
Disease Control: Parasites or pathogens that cause mortalities under hatchery condition, as well as chemical and other prophylactic (e.g. freshwater dips) treatments should be described.
Aquaculture: List present and past activities and/or research related to aquaculture for this species. Include any locations where aquaculture occurs (ponds/pens/offshore/inland) and the level of success for each setting.
Aquaculture – Council Policy: Provide a link with a date indicating the Council's standing policies relevant to this species.
Aquaculture – Other Policies: List any known policies outside of the Council for this species; for example: state permitting, municipal, federal, or other policies.

ASSESSMENT & MANAGEMENT

This section summarizes key population parameters from stock assessment documents of the species conducted by state or federal agencies. Key parameters obtained from the literature should be summarized in the SLH profile.

Population: This section should include information about long-term trends in abundance by management unit.

Stock Assessments: Describe stock assessments in general. Describe the region and time period of the named stock assessment.
Total Mortality: Studies that have estimated total mortality (Z) should be summarized, including a brief description of the methods used to estimate the parameter. List the estimated Z values.
Annual Mortality: Studies that have estimated annual mortality (A) should be summarized including a brief description of the methods. List estimated A values for the population/stock.
Natural Mortality: Studies that have estimated natural mortality (M) should be summarized. List the M values used and state whether they were assumed or calculated from other population parameters (e.g., maximum age). Provide brief descriptions of the methods used to estimate M along with citations [e.g., M was calculated using the method described by Pauly (1978)].
Fishing Mortality: Studies that have estimated fishing mortality (F) across exploited age groups should be summarized, including a brief description of the methods used to estimate the parameter [e.g., Fs across ages 2-6 were estimated from virtual population analyses (VPA) and/or Fs were estimated from catch curves across ages 2-6].
Annual Cohort Success: List years with exceptionally large year classes or recruitment failure etc. Discuss recruitment patterns where these are known.
Recruitment Indices: Document identification of existing indices, for example: eggs, larvae, juveniles, etc.
Biomass Criteria: Describe the data gathering processes such as whole weight, gutted weight, population biomass, or spawning biomass.
Temporal Abundance: Summarizes literature and/or stock assessment documents that present trends in catch-per-unit-effort (CPUEs) by month. The text in the SLH should summarize categorized abundances by month and salinity zones for different life stages. Summarizes literature and/or stock assessment documents that present trends in CPUEs between years, for populations of each species in for which information exists. If mean CPUEs are available for various gear types, include them.
Abundance by Sex: List the sex ratio for this species.
Spatial Abundance: Summarize the stock assessment findings for the species by state region or area (e.g., present estimated population numbers and/or biomass derived from Virtual Population Analysis (VPA), production models etc.
Populations Abundance: Literature which describes trends in population abundance between years should be summarized from stock assessments, Fisheries Independent Monitoring reports and/or the primary scientific literature. The methods or models used to derive the estimates should be mentioned along with the citation.
Biological Benchmarks: Discuss indices used to assess population status such as Spawning Potential Ratio (SPR), Fmsy, Fmax, and F0.1 (indices used as a benchmark in stock assessments).

Annual Catch Limit: Provide the Council determined annual catch limits taken from Magnuson Stevens Act.
Management Regulations: Information pertaining to bag limits, size (slot) limits, closed areas or closed seasons when fishing is not allowed for either the recreational or commercial fisheries should be summarized. Other information may pertain to the Allowable Biological Catch (ABC), or spawning potential ratio (SPR) for the species established by management councils responsible for the Territorial Sea (TTS) or the Exclusive Economic Zone (EEZ). Some of the councils making recommendations and setting regulations include the Florida Fish and Wildlife Conservation Commission (FWC), the Gulf of Mexico Fisheries Management Council (GMFMC), the South East Atlantic Fisheries Management Council (SEAFMC), the Gulf States Marine Fish Commission (GSMFC) and the Atlantic States Marine Fish Commission (ASMFC). State whether or not there are management regulations in place.
This subsection should also discuss how the fishery has changed with regulation and whether or not there is a high percentage of illegal harvest of the species being managed. Regulations should be presented both at the Federal and at the state level for FL, GA, NC, and SC.
Assessment History: Provide a list of completed stock assessments including terminal year of data and year completed – include links to SEDAR and Commission websites.
Management History: Provide a list of completed stock assessments including terminal year of data and year completed – include links to SEDAR and Commission websites.

ECOLOGY & ESSENTIAL FISH HABITAT

This section describes the physical habitat associated with the bottom. The terms habitat and environment have similar meanings and are often used interchangeably. Herein, we use benthic habitat to refer to physical environments generally associated with the bottom. Examples are seagrass habitat, oyster reef habitat, sediment types, vegetation types, depth ranges etc.

This section summarizes information concerning the relationships between a species life stage and other life stages of the same species, and with other species. Many of the problems of concern to managers relate to anthropogenic or climatic stresses on the ecosystem. The species must be viewed in relation to its role within the ecosystem. This information is becoming of greater concern as we shift to ecosystem management.

This summarizes physical/chemical occurrence information of estuarine/marine fish or macro-invertebrate species by life stages. The SLH summarizes information from the literature pertaining to the ranges for different environmental gradients across which a species is present. The environmental gradients include temperature, salinity, dissolved oxygen, turbidity, floating habitat, pH, light, and currents/tides. The environmental ranges across which a particular species life stage is found based on field sampling

should be summarized from either primary or grey literature. Bibliographic citation numbers should accompany the information in the SLH. Behavioral or physiological information concerning whether or not a life stage "prefers", "avoids", or is "physiologically adapted" to certain environmental ranges can also be summarized and cited from laboratory and/or field studies. The physiological/behavioral citations should be distinguished in the SLH from the presence of a particular life stage determined from field sampling. The species may occur in areas which are not optimal because of ecological factors such as food availability, or the availability of shelter that helps it avoid predation.

Essential Fish Habitat: As defined on by NOAA: "Essential Fish Habitat includes all types of aquatic habitat, such as:

- wetlands
- coral reefs
- seagrasses
- rivers

where fish spawn, breed, feed, or grow to maturity. These habitats are "essential" because, without these prime locations, fish would not be able to survive."
Ecological Interactions: Describe the broader ecological interactions for the species beyond predator/prey interactions; describe all interactions not listed elsewhere.
Competition: Describe whether intraspecific or interspecific competition exists or is suspected. Name potential competing species.
Parasites/Diseases: Describe the types of parasites that have been found or diseases that have been diagnosed (bacterial, viral, parasitic) on the host species. Of special interest are situations that lead to mass mortalities such as fish kills etc. An example might be the virus that caused widespread mortalities of hardhead catfish off the west coast of Florida during 1995.
Perturbations: Short-term events such as freezes, or red tide outbreaks that have impacted fisheries populations by causing fish kills or other negative impacts should be described.
Climate: Abnormal climatic events or deviations from normal conditions that negatively impact marine communities should be described. Examples are hurricanes, tornadoes, El Ninos, flooding, droughts, and greenhouse warming (e.g. effects on coral reefs) should be described.
Schooling: List whether or not the species exhibits schooling behavior.
Symbiotic: List whether the species exhibits symbiotic behavior (e.g., mutualism, commenselism, parasitism etc.).
Benthic Habitat: Provide a general summary of the associations with the flora and fauna on the seafloor or in bottom sediments.
Substrate: This can be soft bottom, live/hard bottom or intertidal bottom. Soft Bottom refers to various fine-grained sand, silt, or mud bottom types in which fish may hide and may include vegetation. Live/Hard Bottom includes Rocky or limestone-based

bottoms of geological or biological origin that may be either bare or covered with encrusting organisms. These habitats generally attract different fish species (e.g., grouper) than those that occur over soft bottom (e.g., flatfish). Intertidal Bottom includes areas that lie between the high and low tide marks. This varies from low relief areas with little wave action such as mudflats to high relief areas that may be exposed to strong currents and/or wave action such as rocky shorelines or seawalls.

Submerged Vegetation: The vegetation type where a species is found. This refers to leafy vegetation on the bottom where fish may seek cover from predation. Plants with true roots are termed Submerged Rooted Vegetation (SRV). Macroalgae (such as *Caulerpa)* having runners similar in appearance to roots are more correctly termed Submerged Aquatic Vegetation (SAV). When both types occur together or where the literature or GIS maps don't make any distinction, the term SAV is commonly applied.

Depth Distribution: Depth ranges across which a particular life stage of a species is found. If the literature gives the depths in British units (e.g., feet) it is OK to use those units in the SLH profile.

Habitat Type: (legacy) This is in some of the older SLHs, but should be phased out.

Temperature: The range of temperatures across which each species life stage occurs. While there is a amount of huge literature concerning the physiological tolerances, behavioral preferences, and ecological effects of temperature on estuarine and marine organisms, there is no generally accepted temperature classification scheme. Hence, the water temperature gradient has been rather arbitrarily divided into intervals of 10 degrees centigrade (^{o}C).

Salinity: A number of salinity zone schemes exist in the scientific literature. A good summary is presented in the *Biology of Brackish Water* by Remane and Schlieper (1971). Enter information by life stage if known and if ranges are not NOAA or Venice.

NOAA/NOS: The National Oceanic and Atmospheric Administration (NOAA)/ National Ocean Service (NOS) recognizes the following salinity zones: Tidal Fresh (0.0-0.5 o/oo), Mixing (0.5-25 o/oo), and Seawater (>25 o/oo).

Venice System of Salinity Classification: A system originally adopted at a Symposium on the Classification of Brackish Waters held in 1958. It defines the following salinity ranges: limnetic (0.0-0.5 o/oo), mixohaline 0.5-30 o/oo, euhaline (>30-40 o/oo), and hyperhaline (>40 o/oo). The Venice System further subdivides the mixohaline salinity range into subranges. These correspond to oligohaline (0.5-5 o/oo), mesohaline (>5-18 o/oo), and polyhaline (18-30 o/oo). The terms limnetic, oligohaline, mesohaline, polyhaline, euhaline, and hyperhaline appear in the WATER COLUMN HABITAT Table of the new FLELMR SLH and are defined in the FLELMR Glossary.

Dissolved Oxygen: The range of dissolved oxygen (D.O.) values across which species life stages occur.

Turbidity: The range of turbidities (or possibly secchi disk readings) across which species life stages occur.

Floating Habitat: Certain areas such as the Sargasso Sea and parts of the Gulf of Mexico have floating vegetation or macroalgae (e.g., sargassum) in which various

species of fishes occur. Summarize the species life stages found respectively in wrack, macroalgae, or other floating aquatic vegetation.
pH: If the information is available, summarize the range of pHs across which each life stage of the species occurs.
Light: The range of light conditions or the time of day/night when each life stage of a species is active.
Ammonia: The range of ammonia that can be tolerated. This is an optional heading.
Currents/Tides: Provide information on whether the life stage of a species occurs in moving or static water conditions. Explain how each life stage utilizes currents or tides for movements, migrations and/or feeding.

THREATS

Oil Spills: Literature that describes the toxicity of oil types or oil fractions, or the actual mortalities from an oil spill should be summarized.
Contaminants: Describe organic or heavy metal contaminants that are taken up by the species or life stage, that are a problem from the point of view of human consumption, or interfere with the species ability to complete its life history (e.g. reproduction).
Entrainment/Impingement: Describe instances where kills of fish or invertebrates have occurred from the entrainment or impingement of organisms on water intakes of power plants or other industrial or municipal water users. Of particular interest are solutions that have been found to minimize or eliminate such mortalities. An example might be the design of a water intake system that eliminates the impingement problem. Specific situations where such problems have occurred in estuaries can be mentioned.
Eutrophication: Describe impacts of nutrient inputs from municipal, industrial, and agricultural sources, or from natural sources, that lead to excessive growths of aquatic vegetation, plankton blooms, nuisance algae problems, tainting of fish etc. A variety of ecological impacts suspected or proven should be described. Concerns about effects or potential impacts on fisheries or aquatic communities should be briefly discussed.
Pollutant Toxicity: Describe man-made pollutants that have been shown to have adverse effects on the species. These may be various non-degradable or toxic chemicals released into the estuary from municipal, industrial, or agricultural point or non-point sources.
Other Human Impacts: Provide a general description of human impacts other than those listed above as well as a general vulnerability of the species to human activities.

STOCK IDENTIFICATION

Management Unit: Geographical boundaries of managed populations.
Genetics: Population markers; genetic composition and distribution of a population.
Morphology: Meristic (shape, fin ray count, vertebrae count, etc.) characteristics used to define a stock identification.

Tagging Movement: Movement of individuals within a population based on tagging studies; should include when work and study was conducted, types of tags used, geographical range.
Life History Parameters: What are the life history parameters used to define stock ID; Eg: growth parameters, reproductive parameters and strategies, migration patterns.
Otolith Microchemistry: Methods used to determine chemical composition (ratio of certain elements) to determine stock ID and distribution over time; should include methods used, elements analyzed.

CITATIONS

List the bibliographic citations that have been referred to in the SLH, if these have not been added to the database elsewhere (e.g. in the Citations part of FLELMR database).