

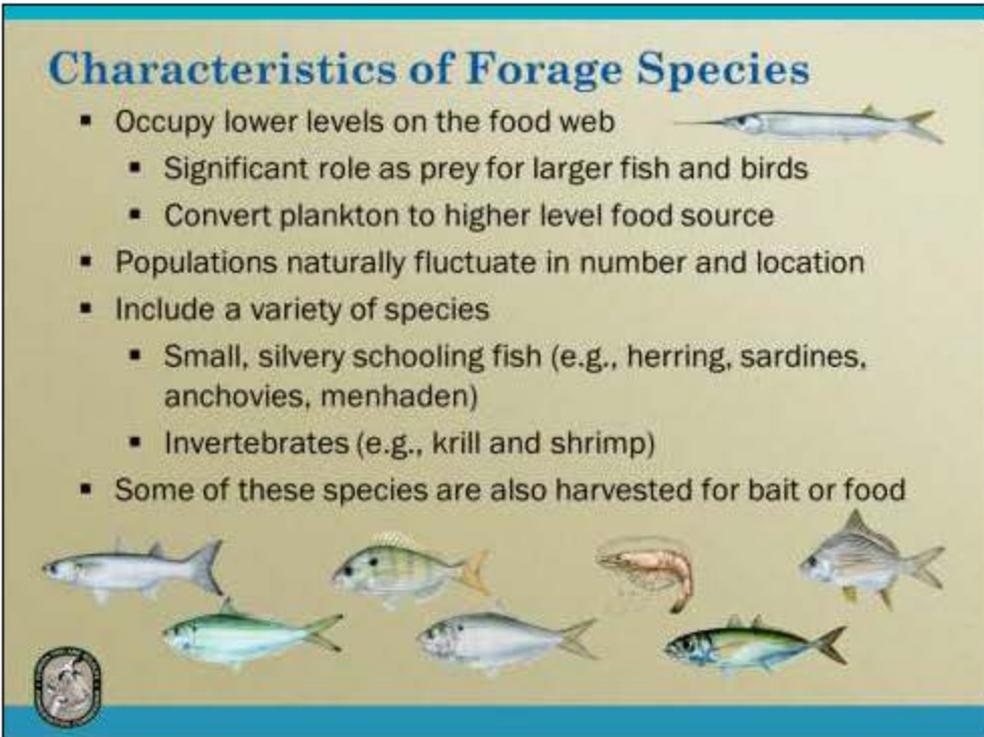
This presentation is a review and discussion of forage fish monitoring and management in Florida. The presentation will review ongoing Florida Fish and Wildlife Research Institute (FWRI) monitoring and modeling programs, population status and trends, and general and species-specific regulations relating to forage fish.

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Characteristics of Forage Species

- Occupy lower levels on the food web
 - Significant role as prey for larger fish and birds
 - Convert plankton to higher level food source
- Populations naturally fluctuate in number and location
- Include a variety of species
 - Small, silvery schooling fish (e.g., herring, sardines, anchovies, menhaden)
 - Invertebrates (e.g., krill and shrimp)
- Some of these species are also harvested for bait or food



Food webs illustrate the interconnections between different trophic levels and represent the transfer of energy from one level to another. The lowest levels on the food web are occupied by species that make their own food, such as plants or plankton. In marine food webs, these organisms are consumed by forage species that are in turn consumed by higher level predators. Thus, forage species play a significant role in converting organisms at the lowest levels of the food web into food sources for higher levels of the web, including larger fish, sea and shore birds, and marine mammals.

Populations of forage species naturally fluctuate, both in their numbers and location, in response to environmental conditions. Ocean currents, temperature, and salinity are factors that can influence and shift the population dynamics of these lower level species.

Forage species are commonly thought to be small, schooling fish like herring, sardines, anchovies, or menhaden, but also include invertebrates like krill and shrimp. All are food sources for higher level predators, with some of them also harvested by humans for bait or food.

Overview

Forage species targeted commercially and recreationally for bait are:

- Monitored extensively as baitfish by FWRI's fisheries independent monitoring program
 - Ongoing for over 20 years
 - Trawl and seine surveys
 - Monitoring data used in ecosystem modeling
- Monitored at the federal level through SEAMAP
- Subject to general and species specific regulations



Forage species that are targeted by commercial and recreational fisheries for use as bait are considered “baitfish” and have been monitored extensively by FWRI for over twenty years under their fisheries independent monitoring (FIM) program. This comprehensive program includes offshore and inshore trawling and seining surveys to assess abundance and distribution of Florida’s marine species. Monitoring of the commercial harvest also occurs through FWRI’s fishery dependent monitoring (FDM) program, which captures fish landings via the trip ticket program. The information gained from these programs is then used to evaluate populations and is incorporated into ecosystem models.

In addition to FWRI programs, population monitoring is ongoing at the federal level throughout Florida waters in both the Gulf and Atlantic under the Southeast Area Monitoring and Assessment Program (SEAMAP).

Effective regulations are in place to conserve forage species, both by limiting the types of gear that can be used in Florida waters and by managing harvest through regulations tailored to address the individual needs of particular species.

Species Monitoring – Trawl Surveys

- Annual survey in the spring
- Trawls conducted off west coast of Florida
- Monitor relative abundance and size of key species
- Allows evaluation of:
 - Relationship between key species and the environment
 - Fish community structure



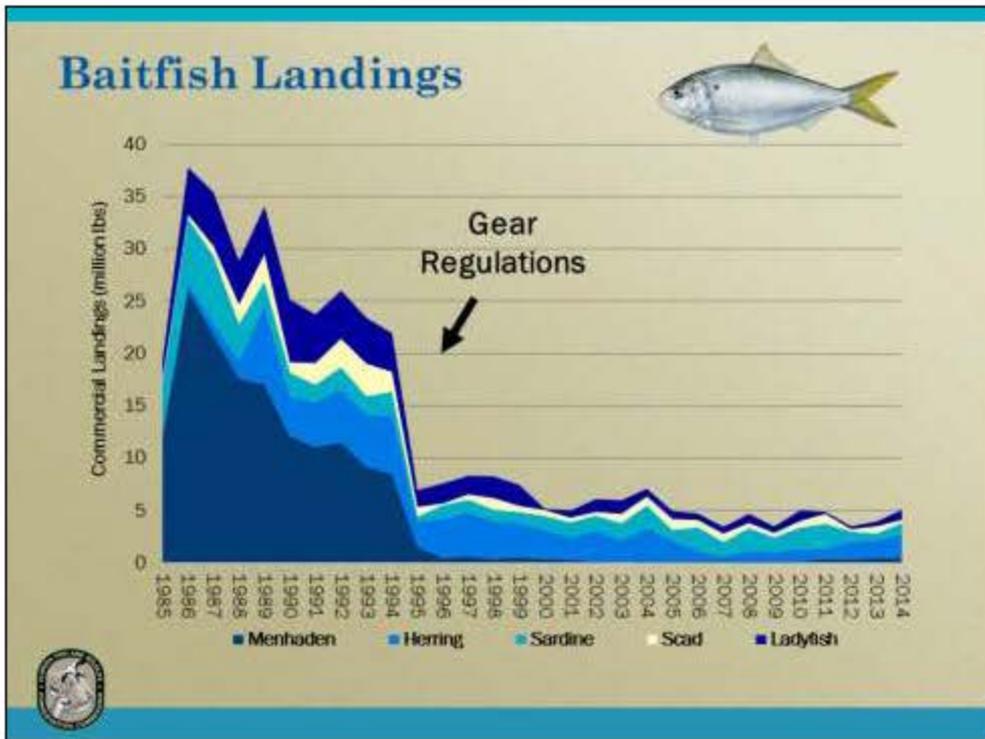
FWRI's robust FIM program has conducted annual spring surveys since 1994 to evaluate baitfish populations. These trawl surveys are conducted off central and southwest Florida, as shown on the map, at the opening of the baitfish fishery season in the Tampa Bay region and are used to monitor the relative abundance and size of key species. With this information, FWRI is able to monitor changes in size compositions of baitfish and other marine species, to evaluate the relationships between these species and environmental factors, and to determine the community structure of fish populations.

Species Monitoring – Estuaries

- Long-term, statewide program
- Year-round surveys
- Seines and inshore trawls
- Monitor relative abundance of a variety of species



Another component of the FIM program involves statewide monitoring of the fish populations that occur in estuaries. Seines and inshore trawls are used to collect and record relative species abundance and size. This long-term monitoring occurs statewide and is particularly important in evaluating the status of stocks because it allows FWRI to monitor populations of multiple juvenile marine species that use these areas as nursery habitat. The basic fisheries information gathered from these locations provides crucial input for computer models used in stock assessments.



FWRI's FDM program monitors forage fish that are harvested for commercial sale, including menhaden, herring, sardines, scad, and ladyfish. This graph illustrates commercial landings from state and federal waters off Florida since 1985 and includes the mid-1990s when a suite of gear regulations was enacted for state waters. As a result of these regulations, baitfish harvest levels decreased dramatically and harvest continues only at low levels today due to this proactive limitation of allowable gear.

Ecosystem Modeling

- Ecosystem models evaluate impacts of predator-prey dynamics on fisheries
- FWRI has used these complex models for the last 20 years
- Understanding of species interactions has improved over time as more data is gathered about the ecosystem/food web



Together, the data obtained from the FIM and FDM programs are used in computer programs to generate models of ecosystems and evaluate the impacts of predator and prey dynamics on fisheries. These complex models have been used by FWRI for the last 20 years and are continually tuned for better accuracy as our understanding of species interactions improves over time due to the increasing availability of data relating to ecosystems and food web interactions.

Opportunities for Data Expansion

- Expanding data collection could:
 - Improve knowledge of forage fish distribution and abundance
 - Improve understanding of the impacts of environmental factors on forage fish
- Further development of ecosystem-wide food web studies could:
 - Provide additional baseline data for ecosystem models
 - Improve our ability to evaluate the status of various species relative to management goals



While the current monitoring programs are already extensive and effective, more data can always be useful. Expanding the scope of data collection could improve our knowledge of forage fish distribution and abundance, and improve our understanding of the interactions between environmental factors and forage fish. This information could then be used to further develop and fine tune our ecosystem models by providing additional baseline data and improving our ability to evaluate the status of various species relative to management goals.

Status and Trends of Florida Finfish Species

Over 99% of evaluated finfish species are increasing or stable

Forage fish

- No forage species currently classified as decreasing

Predators

- Stable – includes snook, redfish, cobia, king and Spanish mackerel
- Increasing – swordfish



FWRI prepares an annual Status and Trends Report that evaluates a wide range of marine species. The 2014 report was very positive and indicated that over 99% of the finfish species populations that were evaluated are either increasing or stable. No forage fish species are currently classified as decreasing and the predators that depend on these species for food are also either stable or increasing in number in Florida.

The 2014 Status and Trends Report is available at MyFWC.com/Research and clicking on "Saltwater" and then "Status and Trends."

Global Forage Fish Fisheries

- Increased focus worldwide on harvesting fish lower on food webs
- Account for over 30% of global fish harvest
- Large reduction fisheries for fish oil and fishmeal
- Net-based fisheries
- Largest catches from South America, Northern Europe, and portions of the United States (U.S.)
- Collapses have occurred in anchovy (S. America) and sardine (West Coast, U.S.) fisheries
- Concerns about menhaden (mid-Atlantic, U.S.)



Forage fish are important worldwide fisheries. As increased fishing pressure has resulted in declines of predatory fish at higher levels in the food web, focus has shifted to harvesting lower level species, like forage fish (a phenomenon known as “fishing down the food web”). The harvest of forage fish now accounts for 30-40 percent of the global fish harvest. The majority of these fish are processed and “reduced” to fish oil and fishmeal, which are used as dietary supplements for humans and food for livestock and aquaculture. These fish are also used for direct human consumption and for bait. Forage fish fisheries outside of Florida state waters are typically net based and include the use of large scale entangling nets and purse seines to allow for the greatest catch. The largest catches are concentrated off the coast of South America (targeting Peruvian anchovy), Northern Europe (targeting capelin smelt), and the United States (targeting menhaden). Collapses have occurred in the South American Peruvian anchovy fishery and in the sardine fishery off of the U.S. West Coast. There are also continued concerns about the menhaden fishery operating on the East Coast of the U.S., particularly off the mid-Atlantic states.

Florida Forage Fish Fisheries

- Relatively small fisheries in Florida waters
 - No reduction fisheries
 - Harvest greatly reduced compared to historical rates
- No large nets in nearshore and inshore waters since 1995
 - Limited to 500 square feet
- No entangling nets
- No causes for concern under current management measures



Florida is a different story. Unlike the global fisheries, forage fish fisheries in Florida waters are relatively small. Even with its extensive coastline, landings from state and federal waters off Florida are a small fraction of the total forage fish harvest in the U.S. and worldwide. No reduction fisheries are operational in the state, and the gear limitations that have been in place since the mid 1990's have kept harvest levels low. Only small nets, less than 500 square feet, are allowed in nearshore and inshore waters and entangling or gill nets are prohibited throughout state waters.

Florida Species-Specific Commercial Regulations

- Ballyhoo
 - Limited entry program
 - Trip limits and closed season
 - Gear restrictions: lampara, cast or dip nets, or hook and line only
- Striped mullet
 - Weekend closures statewide
 - Minimum size limit
 - Gear restrictions: cast or seine nets, or hook and line only
 - Bag limits and closures in some regions



In addition to restricting allowable gear, Florida also has extensive regulations for individual forage fish species. The commercial ballyhoo fishery is a limited entry program with fewer than 30 participants, requiring special endorsements for participation. This fishery also operates under trip limits, a closed season, and additional gear restrictions. The commercial striped mullet fishery requires a restricted species endorsement and is subject to weekend harvest closures, minimum size limits, gear restrictions, and additional regional regulations regarding bag limits and closures.

Florida Species-Specific Commercial Regulations - Continued

- Shad and river herring
 - Bag limit
 - Gear restrictions: hook and line only
- Sardines
 - Regional vessel limits and closed areas
- Menhaden
 - Managed in cooperation with ASMFC
 - Annual quotas



Additional bag limit and gear restrictions also exist for shad and river herring, and sardines are regulated under regional vessel limits and closed areas. Menhaden are managed in cooperation with the Atlantic States Marine Fisheries Commission (ASMFC) under annual quotas.

Other Regulations

FWC is conservative when considering allowable gear for baitfish harvest

- Special Activity Licenses required for evaluation of new gear types
 - Gear testing and use closely monitored
 - Any new gear types must be approved by the Commission for large scale use
- Baitfish trawl rule
 - Provided for a pilot program using tarp purse seines
 - Fishery never developed
 - Rule sunset in 1998



FWC also has a mechanism in place to prevent the development of fisheries using new gear types that may have detrimental effects. The Special Activity License (SAL) program provides a conservative mechanism for evaluating any potential new fishing gear not currently authorized for use in Florida. License applicants must provide extensive information about the proposed gear, and the testing and use is closely monitored under the licensing conditions. Ultimately, the use of any new gear types must be approved by FWC for large scale use.

Another example of how Florida closely monitors development of new baitfish fisheries is the regulations that were implemented under the baitfish trawl rule. After extensive, broad gear regulations were enacted in the mid-1990s, the Marine Fisheries Commission (the precursor of FWC) approved a regional, small-scale pilot program to use tarp purse seines for baitfish harvest. While the regulations provided a mechanism for exploring a new baitfish gear, the fishery never actually developed and the regulations (though still found in the Commission's rules in 68B, FAC) sunset in 1998.

Conclusions

- Florida is a leader in forage fish management
 - Managing and monitoring these species for over 20 years
 - Current monitoring programs and regulations are extensive and effective
- Forage fish fisheries are limited in scale in Florida
- Development of new, large-scale fisheries or expansion of existing fisheries is unlikely
- FWC poised for quick response should trends indicate concern



In conclusion, Florida is and has been at the forefront of forage fish management. FWC and FWRI have managed and monitored these species for over 20 years through gear and species-specific regulations in concert with robust and rigorous fisheries independent and dependent monitoring programs. These current programs are considered to be extensive and effective, which is reflected in the current status and trends of these species. Current regulations make the development of new, large-scale fisheries or the expansion of existing fisheries unlikely as their use would require FWC approval. However, if trends for these species change and there are indication of a cause for concern, FWC is poised to respond quickly, before significant issues arise.

Staff Recommendation

Adopt a resolution in support of continuing forage fish monitoring and management in Florida

Proposed resolution would emphasize:

- Importance of forage fish in Florida
 - To marine ecosystems
 - As prey for popular fishery species
 - As bait and food fish
- FWC's commitment to
 - Continue forage fish monitoring
 - Sustainable management of forage fish species



Recently, there has been increased focus on forage fish stocks both globally and nationwide. Concerns about forage fish stock depletions, ineffective management, and the importance of forage fish not only to humans, but to marine ecosystems and their interconnected food webs. As a result, staff recommend FWC consider adopting a resolution specific to forage fish to confirm the importance of these species in Florida as part of healthy marine ecosystems and their economic importance as bait and food fish. In addition, the proposed resolution would reaffirm FWC's commitment to continue to monitor these important basal species and to continue to sustainably manage forage fish into the future.