



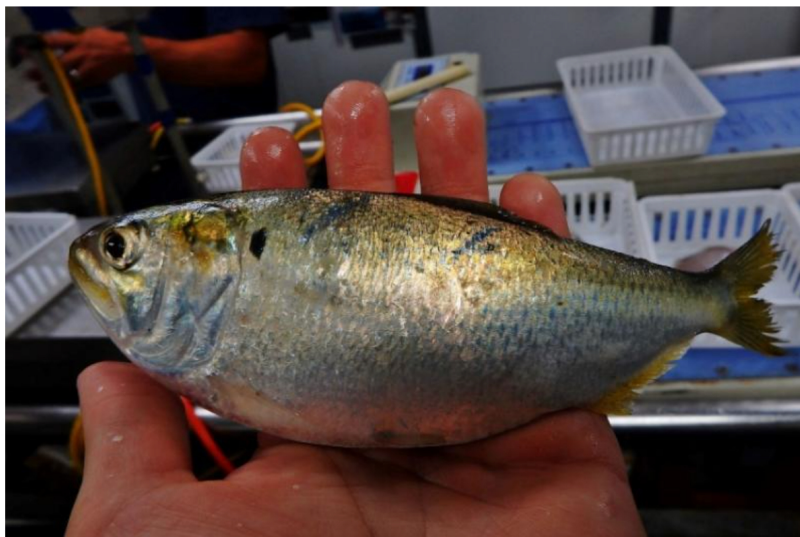
NEWS

A Pathway Toward Ecosystem-Based Management for Gulf Menhaden

February 28, 2023

NOAA Fisheries and partners developed and calibrated an ecosystem model of the Gulf of Mexico that revealed key trade-offs between Gulf menhaden and their predators, which could assist in managing the stock.

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Collecting data on Gulf menhaden helps scientists understand how we can better protect this important fish stock. Credit: NOAA Fisheries

A [new study](#) by NOAA's Southeast Fisheries Science Center and various partners created an ecosystem model of the Gulf of Mexico. We will use it to evaluate how changes in menhaden fishing pressure may affect the entire ecosystem. Gulf menhaden have the largest fishery yield in the Gulf of Mexico and support the second largest fishery by weight in the United States. Their presence in the Gulf is crucial. Fisheries management is becoming increasingly aware of this species' importance, particularly after the successful implementation of an [ecosystem approach for Atlantic menhaden](#) [↗](#). There is also growing interest in management of the stock given the commercial fishing fleet's [Marine Stewardship Council certification](#) [↗](#) and increasing interest from stakeholders across the Gulf states.

How can a fish so small have such a large effect on the ecosystem?

Marine ecosystems have to maintain a fragile balancing act. If a population declines at an unsustainable rate it can impose a threat on the entire system. This can result in a trophic cascade, a change in the food web that can have strong effects on others in that ecosystem. Our team used an ecosystem modeling approach to evaluate factors that are causing changes in the Gulf of Mexico, focused on Gulf

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menhaden and their predators. This model revealed that a decrease in menhaden in the Gulf reduces the available forage, negatively affecting its predators. It shows that while the fishery was historically fished at a higher level than optimal from an ecosystem perspective, recent catches support predator foraging requirements.

Five Key Takeaways from the Results

1. Gulf menhaden support an array of predatory species
2. The model estimated key mortality approximations for Gulf menhaden and their predators, which is crucial information for stock assessment and management
3. Catch of Gulf menhaden affects the abundance of their direct predators and species that are caught as bycatch
4. Based on tradeoff relationships, the model predicted sustainable harvesting levels of Gulf menhaden for their predator populations
5. Current catch levels of Gulf menhaden support predator foraging needs



The modeling system created to assess reference points for the Gulf Menhaden will be important to maintaining the ecosystem. Credit: NOAA Fisheries

Menhaden and Their Predators

Menhaden play a central role in the coastal ecosystem of the Northern Gulf of Mexico. They are most abundant near the Mississippi River estuary, where nutrients and plankton production are high. These tiny fish are a tasty snack for at least 32 different predators including marine mammals, sea birds, sea turtles, sharks, and finfish such as mackerel, sea trout, and drum. Menhaden are filter feeders meaning they consume algae, particulate matter, and small invertebrates from the water. They transfer energy from primary producers (such as algae and phytoplankton) to upper trophic levels. They provide predators with nutrients, vitamins and oil, making them a high-quality forage fish.

This nutritional importance is critical in [evaluating tradeoffs between harvest of menhaden and their predators](#). [↗](#) If the Gulf menhaden fishery is held at a sustainable harvest it may have substantial positive effects on both the population and their main predators. Overharvest, in turn, may cause a decline in predator abundances within the ecosystem.



Gulf menhaden populations are spread throughout the Northern Gulf of Mexico and play a central role in this ecosystem. Credit: NOAA Fisheries/ Brandi Noble

Ecopath with Ecosim Modeling System

The modeling tool that was used for this study is [Ecopath with Ecosim](#). [↗](#) It combines information on species vital rates, food web interactions, and fisheries to address marine resource and ecosystem challenges. It is a dynamic

model representing the different aspects and levels of a food web and fisheries. It also shows how different resources in an ecosystem interact with one another.

In this study, the model was first used to make sure its predictions were reasonable. Then, the model was used to identify key predators of Gulf menhaden, which assisted in estimating natural and predation mortality. Also, the model explores the impacts of the menhaden fishery on the ecosystem. The model's reference points for the relative health of the menhaden population could be used in the future to support predator forage needs. Along with evaluating trade offs, this study represents a major step towards [ecosystem-based fisheries management](#) in the Gulf of Mexico.

Our Partners

As part of a NOAA RESTORE Science Program project, the Southeast Fisheries Science Center worked closely on this study and model development with partners from:

- [University of Miami Rosenstiel School of Earth, Marine and Atmospheric Science](#) 
- [Cooperative Institute for Marine and Atmospheric Studies](#) 
- [University of Florida](#) 
- [George Mason University](#) 
- [University of Southern Mississippi](#) 
- [NOAA's Southeast Regional Office](#)

The modeling team also incorporated feedback from stakeholders, particularly the [Gulf States Marine Fisheries Commission's Gulf Menhaden Advisory Committee](#) .

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