What's for Dinner, or who eats whom in the Gulf of Mexico?

Teacher's Guide

Audience: High school biology or aquatic science students

Duration: One class period, or more with extensions

STEM Process Skills: interpreting, comparing, and contrasting data

Learning Objectives/Goals: Students will be able to search authentic dietary data for local fish species, construct a food web for one or more species, and contrast data by location of the species.

TEKS: *Biology science concept 12B,* flow of matter and energy through tropic levels

Aquatic Science concept 11, interdependence and interactions in aquatic environments

Ocean Literacy Principles: 5D & 6B

Required Knowledge/Vocabulary: Food webs, predator, and prey; scientific naming, marine taxa, local fish and marine animal knowledge may also be helpful

Set Up/Break Down: Set up a GoMexSI website account at http://gomexsi.tamucc.edu/. Gain access for student computers and make sure to clear firewall hurdles and practice queries beforehand.

Description: "What's For Dinner?" challenges students to diagram food webs from authentic dietary data collected by scientists at the Gulf of Mexico Species Interaction (GoMexSI) program. Yes, they really looked inside fish guts!

Materials: Computers and internet connection to the GoMexSI website at http://gomexsi.tamucc.edu; paper or poster board, pencils, pens, or markers; Gulf of Mexico charts and Gulf of Mexico fish guides helpful but not required

Procedure: Once on the GoMexSI website, have students conduct a Taxonomic Query for a predator species of interest to them, or provide a list of animals relevant to your location.

If using a common name, a list of scientific names will appear. Select the first name on the list, then click "All Interaction Types" to find the five most common predators and prey of that species.

These data can then be used to construct a simple diet matrix, or diagram of the food web, which can be checked by conducting the same query in Exploration Mode.

For interesting discussions, try queries for the tiger shark, green and loggerhead sea turtles, blue crab, or bottlenose dolphin. Note that a single click on any species name retrieved in the query will pull up a menu of additional resources.

Extensions: Time allowing, students may conduct sequential queries for the predators and prey of their selected species to expand the diet matrix or food web diagram with additional detail.

Or, after selecting a species of interest, have individual students or small groups select three different bays (e.g. from the northern, central, and southern parts of Texas), then conduct Spatial Queries for each bay by manipulating the yellow box to include just one bay at a time. This is easier to do when in full screen.

Once a single bay is highlighted in yellow, exit full screen to enter a common or species name in the box provided. Again, if using a common name, a list of scientific names will appear. Select the first name on the list. Have students list and compare the top five diet items for their species from each of the bays. This should lead to a lively discussion of possible reasons for differences in diet.

Students may also conduct queries and diagram food webs for fishes, shrimp, crabs, or endangered species protected by law, or for different classes (birds, mammals or reptiles).

Texas State Aquarium: www.texasstateaquarium.org, GoMexSI http://gomexsi.tamucc.edu/

Fish diets, gut contents, food webs, and GoMexSI
By Dr. James Simons

What fishes eat has been of interest to humans, at least as long as they have been attaching bait to the end of a hook. So how do they know what the fish is eating? Well, through observation of the fish, and by examining what is in their stomachs and intestines (gut contents), we now have a large knowledge of the diets of fishes. I know of a local fishing guide who makes it a practice to examine the stomachs of many of the fishes that he catches. Scientists and fishery managers are also interested in the diets of fishes. Many studies on the diets of fishes have been published in the scientific literature, and many of these data are used by fisheries modelers to inform fishery managers about the effects of different actions on fish populations.

Gut content analysis is performed by graduate students, technicians, government scientists, and others to help us to understand what the fishes are eating and how they fit into the overall ecosystem food web. The fish are collected in numerous ways – rod and reel, gill netting, trawling, electrofishing, and many others. As soon as possible after being caught, the fish are preserved in some manner – either put on ice, frozen, or preserved in formalin. The fish are identified to species either in the field or back at the lab. The gut content analysis process begins with the scientist removing the stomach (and intestines sometimes) from the fish.

Then she will use a scalpel or scissors to carefully open the stomach to reveal the contents. The scientist will then sort the items into groups of common items – i.e. fishes, crustaceans, worms, crabs, amphipods, etc. Care is taken to identify all items to the lowest possible taxon, and all of this information is carefully recorded on datasheets. For items the scientist cannot identify, she seeks an expert on that taxa for further help. Recently, we and other scientists have begun using DNA to identify tissues that are too degraded to identify otherwise. Finally, after months, and sometimes years of work, all of the data are assembled into a database and the interrelationships among the fishes can be pictured as a food web. These data can then be assembled with other datasets to construct larger food webs as is now possible with data from the GoMexSI database.

The Gulf of Mexico Species Interaction Database is endeavoring to locate, obtain, and extract diet data from published and unpublished sources for fishes of the Gulf of Mexico and enter these data in the GoMexSI database. These data come from a wide variety of reference material including theses and dissertations, peer review literature, government reports, conference proceedings and others. These data, which are collected as described above, are then entered into the GoMexSI database, where they can be searched and downloaded from the webpage. To date we have had teachers and students, fishing industry reps, and fishery scientists using the data, and probably others that we do now know of.

What's for Dinner, or who eats whom in the Gulf of Mexico?

Student Guide

After reading, "Fish diets, gut contents, food webs, and GoMexSI," by Dr. James Simons, head to the GoMexSI website at http://gomexsi.tamucc.org and conduct a Taxonomic Query for a Gulf of Mexico predator of interest to you. Your teacher may share some ideas, or try a fish you like to catch or eat, like red snapper, red or black drum, or mahi-mahi.

If entering a common name, a list of scientific names will appear. Select the first name on the list, then click, "All Interaction Types," to find the five most common predators and prey for your species. Use these data to construct a simple diet matrix or diagram of the food web in the space below. Then, use the Exploration Mode to check your work. NOTE: A single click on any species name retrieved through any query will pull up a menu of additional resources to investigate.

Got more time?

Try expanding the diet matrix or food web diagram by adding detail with sequential queries for your species' predators and prey. Diagram these on the back of this paper.

Or, get a closer look at your species by selecting three different bays (e.g. from the northern, central, and southern parts of Texas), then conduct Spatial Queries for each bay by manipulating the yellow box to include just one bay at a time. This is easier to do when in full screen, and faster if working with a couple of friends.

Once a single bay is highlighted in yellow, exit full screen to enter a common or species name in the box provided. Again, fi using a common name, a list of scientific names will appear. Select the first name on the list, then make a chart and compare the top five diet items for your species from each of the bays.

Really wild stuff: Most GoMexSI queries are pretty interesting, but past users recommend the tiger shark, green and loggerhead sea turtles, blue crab, or bottlenose dolphin. You might also try queries for fishes, shrimp, crabs, or endangered species protected by law, or even different classes (birds, mammals, or reptiles).