

Unit II Reef Fish Management

A portion of this information was obtained from material written by Luiz Barbieri.

On the cutting edge...

Researchers at the Florida Fish and Wildlife Conservation Commission's Florida Marine Research Institute are studying the life histories and population dynamics of four economically important snapper species. They hope to use these ecological studies to assess the status of these fish and develop management tools to maintain adequate wild populations. They are using the latest technology to collect data while preserving vital habitat. In the future, these researchers anticipate extending their studies to other areas.

Snapper

Lesson Objectives: Students will be able to do the following:

- Name and describe the two stages of the snapper life cycle
- Discuss the ecological factors that make snapper vulnerable to human impact
- Compare and contrast aging studies utilizing tree rings and otolith rings

Key concepts: pelagic stage, demersal stage, recruitment, marine reserves, otoliths

Snapper Life History and Ecology



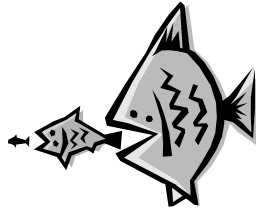
Snappers are economically important reef fish. They generally occur in warm ocean waters ranging from shallow inshore areas to depths of about 550 meters. Sometimes they can be found in **estuaries** or even fresh water. Most snapper **species** have a two-stage life cycle consisting of a **pelagic** or open water phase and a **demersal** or bottom oriented phase. During the pelagic stage, eggs and **larvae** are moved and dispersed by currents. They are subjected to unknown weather conditions and food variability. In addition, larger

organisms eat many of the eggs and larvae. This reduces the number of fish that reach adulthood. This stage lasts from a week to several months depending upon the species.

At this time, the larvae **recruit** or settle to bottom habitats as the demersal stage begins. Once settled, juveniles and adults become associated with a particular reef or structure in a specific area. They are considered "sedentary", because they remain in this area for most of their adult life. In addition many snapper are territorial and have small home ranges. They may also be restricted to specific water

depths. The adults feed on fish and **crustaceans** mainly associated with the bottom.

Snappers have used various **adaptations** to overcome the large loss of larvae during the pelagic stage. Some of the slow-growing, long-lived species reproduce several times during their lives. Others gather in areas during **spawning**. This simultaneous release of larvae gives the fish a better chance for survival against **predators** during their early stages. As these fish mature, large body size can help them escape from predators and become more efficient hunters. Large fish can swim quickly through the water to defend a



territory. They also have a competitive advantage when looking for mates.



Unfortunately these same adaptations allow the snapper to be exploited by humans. Humans

can easily identify reef fish habitat and spawning grounds through modern technology. Fish with longer life histories and slower growth rates are less able to withstand increased fishing pressure. They need longer recovery times than short-lived, faster growing species. Recreational fisheries also target the larger individuals of the population, because they are more exciting to catch. They also provide more food and bring a higher price than smaller fish.

Otoliths as Research Tools

Researchers use state of the art technology to collect various types of data. **Specimens** can be studied live in their underwater habitats through the use of cameras and the latest imaging software. Scientists use this information to learn more about fish behaviors and determine important components of the habitat.

Fish are also collected for study in the laboratory. Fish traps are placed in various parts of the reef to collect specimens of the correct size and number. These traps are monitored for habitat destruction by the use of in water divers and underwater cameras. Samples are also collected

using hook and line or spear. These samples can be used to establish population data.

One of the primary research tools used by fishery biologists is the **otolith**. Otoliths or earstones are small, white bonelike structures that are found in the heads of bony fishes.



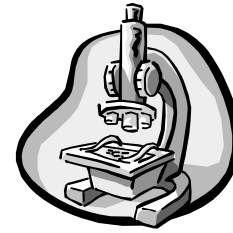
Otolith

These stones, located below the rear portion of the brain, are suspended in the soft inner ear canals. They provide a sense of balance for the fish and also aid in hearing.

Otoliths are actually stones, not bones that begin forming in the fish **embryo**. They are more durable than bone and continue to grow throughout the fish's life. New material is added to the outer surface of the preexisting material causing the otolith to increase in size or grow. Growth rings or **annuli** appear as material is added to the otolith. These rings, similar to tree rings, are used to record the age and growth rate of the fish. Daily growth rings, formed in the first year of life, provide even more detailed information to biologists. In addition, otoliths characterized by distinct shapes, are species specific.

Scientists must "read" the growth rings to obtain information. The easiest way for researchers to read an otolith is to take a slice or cross section out of the otolith using a special saw. In this case, an isomet saw with a diamond blade, is used to slice the otolith. This low speed saw cuts and polishes the otolith simultaneously, so slices can be read

immediately. Scientists can create accurate life history maps from the location, size, and composition of the otolith's rings.



Current Snapper Study



Researchers in Florida are currently studying four snapper species. These include the gray snapper (*Lutjanus griesus*), also known as the mangrove snapper; the yellowtail snapper (*Ocyurus chrysurus*), a tropical reef fish with a deeply forked tail; the mutton snapper (*Lutjanus analis*), considered a medium sized species; and the lane snapper (*Lutjanus synagris*). These targeted species are being collected in southeastern Florida and the Florida Keys. They were chosen for this study because of their local economic importance and easy accessibility.

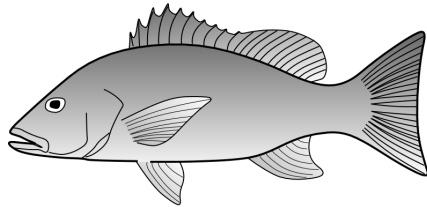
Scientists are trying to generate life history information and population

dynamics data from this research. When studying life history, researchers are also looking for information about the types of **habitats** that the fish occupy during various phases in their life cycles. They are trying to determine spawning grounds and areas within the reefs that the fish inhabit. Population studies focus on age, growth, and reproduction. This information includes the composition of the population such as ratios of males to females or numbers of reproductive females present within a given population. Population studies are also concerned with determining the life span and age of maturation of members of the species.

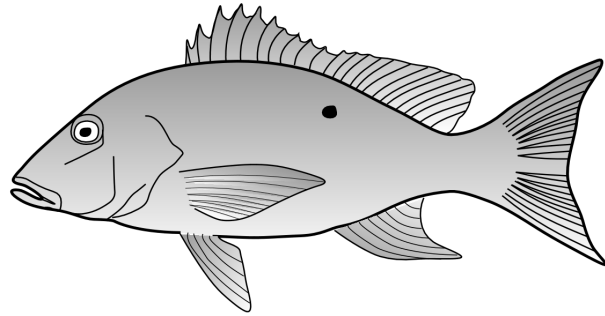


These researchers hope to use the results of this study to develop regulations and other management techniques. For instance, regulations supported by research could include bag and size limits and fishing seasons that promote population

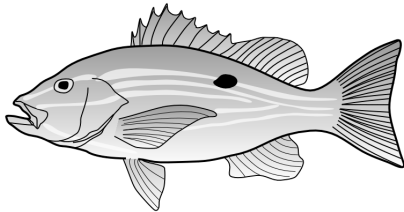
stability. Marine reserves are another management tool being considered. Marine reserves are water areas set aside for fish conservation and habitat preservation. They are similar to state parks and preserves that are set aside to protect land areas



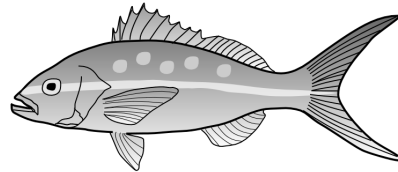
Gray Snapper



Mutton Snapper



Lane Snapper



Yellowtail Snapper

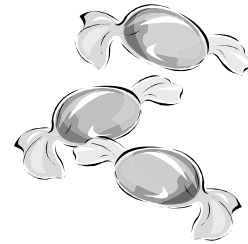
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Activity: Dichotomous Key

Sometimes scientists need to categorize or classify organisms. They can determine how closely related organisms are by the number of characteristics they have in common. Closely related organisms share many characteristics. One tool that scientists use to determine close relationships is a dichotomous key. A dichotomous key is used to compare and contrast one characteristic at a time. As scientists move through the key, organisms become more difficult to distinguish until they end up in closely related groups called species. Species are groups of organisms so closely related that they can interbreed.

Objectives: Students will be able to do the following:

1. Classify objects using a dichotomous key.
2. Apply what they learned to develop a classification key.



Materials:

- Bag of Hershey's miniature chocolate bars (including milk chocolate bars, dark chocolate bars, Mr. Goodbars, and Krackle bars)
- Small bag of Kiddie Party Mix (including miniature tootsie rolls, taffy, bubble gum, sour balls, laffy taffy, and smarties)
- Copies of Dichotomous keys
- Pencil

Procedure:

1. Discuss dichotomous keys with students. Be sure to tell students that dichotomous means two pronged and explain how scientists use these keys.
2. Discuss how they will use the keys today to classify sweet treats.
3. Give each student or group of students a copy of the dichotomous key sheet.
4. Give each student or group of students one of each of the following: Hershey miniature milk chocolate bar, Hershey miniature dark chocolate bar, miniature Mr. Goodbar, miniature Krackle bar, miniature tootsie roll, package of sweet tarts, bubble gum, taffy, laffy taffy, and sour ball.
5. Have students use their dichotomous keys to classify their treats.
6. Discuss what was learned from the classification process. Include questions such as the following:
 - Which treats were more closely related?
 - How do you know?
 - How could you construct your own dichotomous key?
 - What kinds of things could you classify?
7. Have students try to make their own dichotomous keys using other objects such as buttons. Did they have all the information they needed in order to be successful?
8. Brainstorm to come up with some simple guidelines for developing dichotomous keys. (These guidelines would include having objects that could

be divided into two groups based on one characteristic and that the groups could continually be divided based on one characteristic. Students should also be able to infer that there could be more than one way to divide groups and that their key will only work for the objects that are included in their first grouping.)

9. Have students compare and contrast their findings to those of a real scientist. If they were real scientists, what would they do differently?

Possible Extensions:

1. Have students make their own dichotomous keys using other objects. See if other students can successfully use them.
2. Have students try to classify very similar items such as jellybeans. What kinds of characteristics do they have to look for when classifying similar items? Students should understand that now they may have to make specific measurements or look for small distinguishing characteristics such as odd shapes or dimpled surfaces in order to classify their objects. Relate this to real world studies.

Sweet Treat Classification

For each item, begin with No. 1 and follow the directions at the end of the line. Put the name of each treat in the correct blank.

- 1a. Treat contains chocolatego to 2
1b. Treat does not contain chocolatego to 6

- 2a. Treat is a candy bargo to 3
2b. Treat is not a candy bar

- 3a. Treat is milk chocolatego to 4
3b. Treat is not milk chocolate

- 4a. Treat is entirely milk chocolate.....
4b. Treat is not entirely milk chocolatego to 5

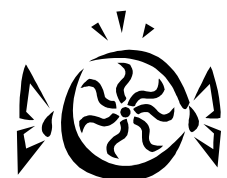
- 5a. Treat contains rice.....
5b. Treat does not contain rice.....

- 6a. Treat package contains more than one piece
6b. Treat package does not contain more than one piecego to 7

- 7a. Treat is candy.....go to 8
7b. Treat is not candy.....

- 8a. Treat is chewygo to 9
8b. Treat is not chewy

- 9a. Treat is rectangular
9b. Treat is not rectangular



Sweet Treat Answer Key

- 2b. Tootsie roll
- 3b. Hershey's special dark chocolate candy bar
- 4a. Hershey's milk chocolate candy bar
- 5a. Krackel candy bar
- 5b. Mr. Goodbar candy bar
- 6a. Smarties
- 7b. Bubble gum
- 8b. Sour ball
- 9a. Laffy taffy
- 9b. Taffy

Student Information: Sport Fish Restoration Programs



In the early 1900's, fish and wildlife were abundant.

Wildlife managers wanted future

generations to be able to enjoy these animals. They promoted **conservation** efforts to help maintain wild populations and preserve natural **habitats**. Through the years cooperative efforts with state agencies have been successful. Today the Federal Aid in Sport Fish Restoration Program managed by the U.S. Fish and Wildlife Service provides support for many conservation plans.

Through this plan, every state receives monies to develop programs that target their areas of interest and need. Monies can be used for scientific research that will help wildlife managers make good decisions. Other monies are used to develop brochures and videos and support fishing clinics for interested citizens. Additional revenue can be used

to build more boating piers, so that all people have access to the water.

This program has been very successful, because the users pay for the improvements. Taxes paid on items that display the Sport Fish Restoration logo go into a fund for fishing projects. The funds are then given to each state to develop their programs. The individual states decide which programs to fund. For instance, Louisiana is using some of its monies to restore wetlands. Oklahoma is producing genetically engineered largemouth bass while Alaska is trying to save its salmon population. The Lake Havasu project in Arizona is targeting warm water fisheries for improvement.

The Sport Fish Restoration Program is just one example of how all of us working together can help preserve and restore our natural resources. If you would like to learn more about programs in your area log on to www.restorewildlife.org