FISHERIES RESEARCH

FISH MONITORING EFFORTS

Read about contributions Cornell Cooperative Extension (CCE) Suffolk County Marine Program has made to fisheries research over the past years.

Maintaining healthy populations of fish is environmentally and economically important to Long Island. Local fish are part of nearly every food chain, serving as either prey or predators, and help keep the ecosystem in balance. Commercial fisheries also rely on healthy stocks of fish to have adequate catch to make a profit and recreational fishing helps connect people to the environment, as well as, stimulates the economy through licenses and charters.

Research
↓
Mathematical models
↓
Management decisions

The goal of fisheries management is to have fishing at a sustainable rate, or a rate where a population will not collapse. **Stock assessments** help inform managers which tell the demographics of a population and include data about **catch**, **abundance**, and **biology** of a species. This information is used in mathematical models to evaluate the current state of a fishery and to make predictions about future stocks, which is used to create fishing regulations for that species. CCE has been involved in several projects that generate accurate data for stock assessments of local fish species.

STOCK ASSESSMENT EXAMPLE *If a recent stock assessment indicates that a fish population has decreased compared to previous assessments, managers may reduce the bag limit, or number of fish a fisherman can take.*

MATHEMATICAL MODELS IN FISHERIES Modeling fish populations is essential for making predictions and decisions in fisheries management. Mathematical models show the relationship between a species of fish and numerous factors that influence their population. Early models were limited by computing power, whereas today, with our nearly infinite computing power, we are limited by scientific data to enter into models. A model is only as good as the data it uses. Thus, creating accurate and complete datasets is necessary for making informed decisions in fisheries management.

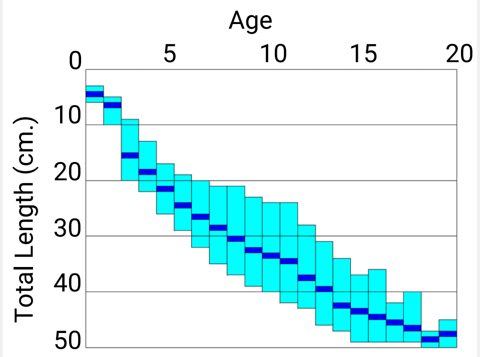
BIOLOGICAL SAMPLING PROGRAM

CCE's Biological Sampling Program worked to gain raw data to provide a foundation for fisheries stock assessments about various species of marine fish. Biological data was collected in the field to better understand ages of fish and size distributions.

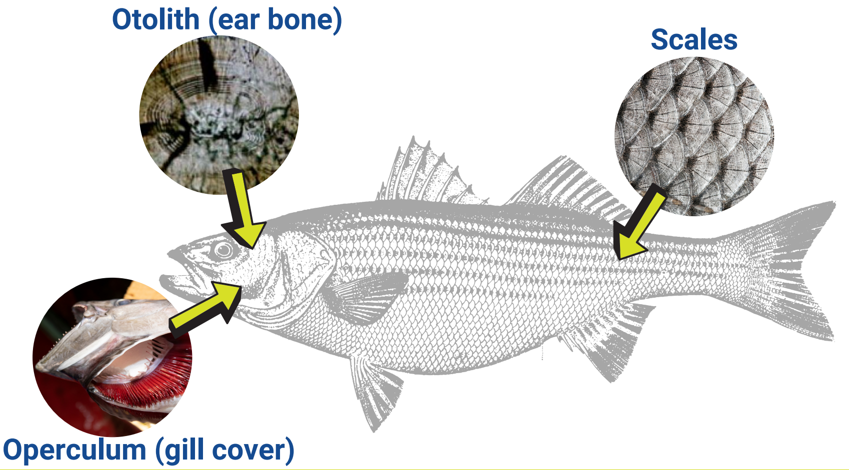
Age was determined by extracting "hard parts" of a fish, like the **scales**, **otoliths** (ear bone), and **operculum** (gill cover). These parts of a fish grow throughout their life and add visible growth rings onto the core of these structures. Much like counting the rings on a tree stump or a clam shell, one can count the rings on these "hard parts" and determine the age of a fish. Each ring usually represents one year. Fish species are aged using different methods. Scale aging is used for flounder, fluke, scup, black sea bass, bluefish, and striped bass. Otolith aging is used for tilefish, weakfish, and winter flounder. Operculum aging is used for blackfish or tautog. Samples were extracted and sent to the North East Fisheries Science Center in Woods Hole, Massachusetts, or to the New York State Department of Environmental Conservation to be aged.

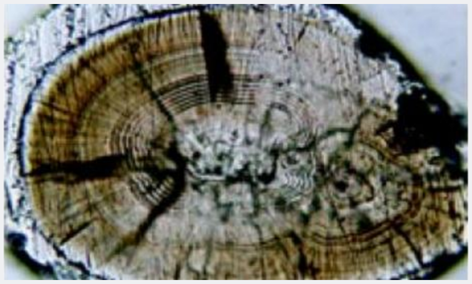
Age data was linked to the measured total length of each fish to create **growth curves,** or age-length curves. Growth curves allow fishermen or scientists to estimate the age of their catch from length.

Growth Curve for Striped Bass (*Morone saxatilis*)



FISH "HARD PART" ANATOMY





Age can be determined by counting the rings of otoliths, like this one above. Otoliths are small bones near the fish's brain. They are extracted by scientists through the gills or by cutting into the skull.

FLUKE SEX RATIO STUDY

CCE worked in junction with the Partnership for Mid-Atlantic Fisheries Science (PMAFS) to support stock assessments of summer flounder (*Paralichthys dentatus*), fluke, on the Atlantic coast. Fluke are important for commercial and recreational fisheries on Long Island and along the northeast coast of the United States. Stock assessments are in need of more detailed data on the sex ratios of current fluke stocks. It appears that fisheries target faster growing females and slower growing males, which could have implications on the population.

Summer Flounder (*Paralichthys dentatus)*
Common name: Fluke
Status: Least Concern

Fluke are benthic fish that inhabit the sea floor. Adults have flat bodies and eyes have shifted to the left side of their body. They are shades of brown and grey and are able to change color to better camouflage on the sea floor. They live for 12-14 and are opportunistic feeders that eat crustaceans and fish. Bottom trawls can harm fish and affect populations.

fishwatch.gov

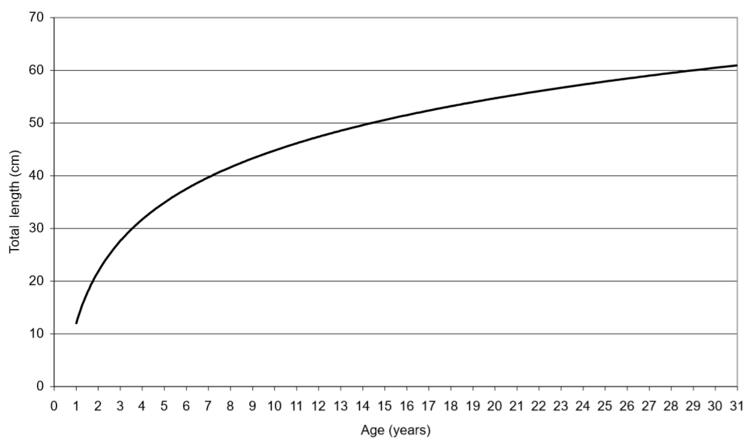
Sex specific data is particularly important for fluke because male and females exhibit different traits and abundance throughout their life. Females generally grow faster and mature when they are at greater lengths than males. Females to male sex ratios are also skewed towards males at young age but then this switches to more females as they grow older. Fisheries management should consider the effects of size selective fishing in fluke populations. Minimum retention size limits, or the minimum length a fish can be to take them, could cause more of the faster growing females to be fished and removed from the population which would have negative impacts on future populations. This novel collection of data for the fluke species enables managers to make more informed decisions to be made and have more sustainable stocks of fish in the years to come.

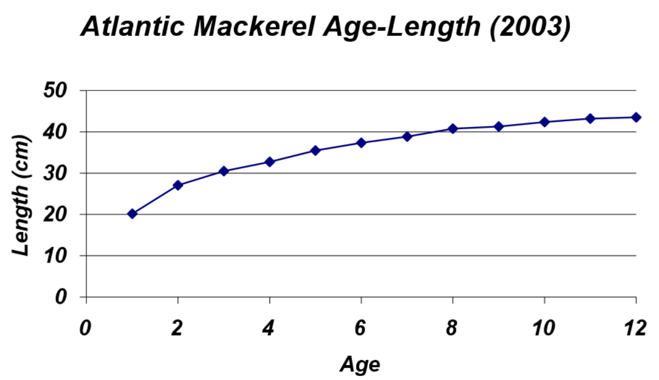
CONSERVATION GEAR TECHNOLOGY

Stock assessments are based on catch, abundance, and biology of a species. Other factors can also affect population size and influence predictions of stock assessments in the future, like bycatch. **Bycatch** is the unwanted catch of a nontarget species. Bycatch is not included in stock assessments but can negatively impact population size and structure. CCE is working cooperatively with fisherman to design gear to reduce bycatch while still allowing them to catch their target species.

CCE FISHERIES - TEST YOUR KNOWLEDGE

Length at age key for tautog (*Tautoga onitis*). Data courtesy of the Atlantic Coastal Cooperative Statistics Program.





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Question 1.

You are on a fishing charter and have to estimate the ages of the fish caught that day. Read the following lengths of each species and estimate their ages from the growth curves/age-length curves provided.

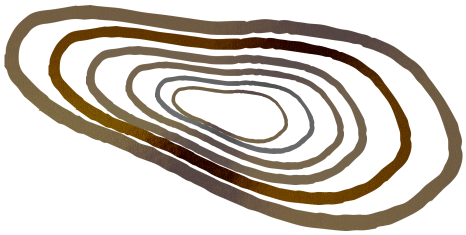
Species	Length (cm)	Estimated Age
Tautog (Blackfish)	21	_____
Tautog (Blackfish)	45	_____
Atlantic Mackerel	32	_____
Tautog (Blackfish)	60	_____
Atlantic Mackerel	21	_____
Atlantic Mackerel	40	_____
Tautog (Blackfish)	36	_____
Atlantic Mackerel	27	_____

CCE FISHERIES - TEST YOUR KNOWLEDGE

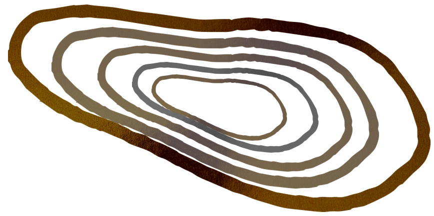
Question 2.

Age each fish by counting the rings on this collection of otoliths, scales, and operculums. Assume 1 ring = 1 year.

<u>OTOLITHS</u>

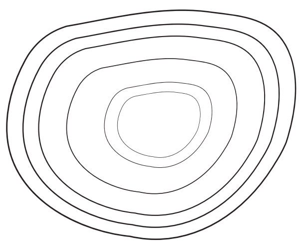


Age: ______

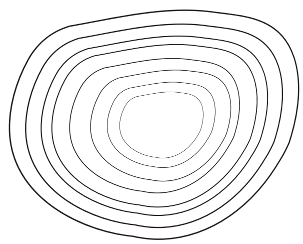


Age: ______

<u>SCALES</u>

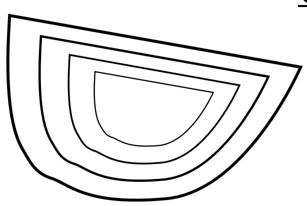


Age: ______



Age: ______

<u>OPERCULUM</u>



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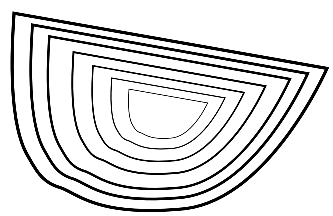

Age: ______

FOR MORE INFORMATION

Biological Sampling Program: http://ccesuffolk.org/marine/fisheries/nys-fisheries-data-collection

Growth curves: http://ccesuffolk.org/marine/fisheries/nys-fisheries-data-collection/growth-curves

Conservation Gear Technology: http://ccesuffolk.org/marine/fisheries/bycatch-reducation-projects