How Old Is That Fish ?

by Dave Ramczyk and Tim Morefield

Each year California anglers catch millions of game fish. Few of these anglers realize that each of their fish has its life history recorded on its bones and scales.

As an example, recently an angler sent a letter to the Department of Fish and Game stating that he had hooked a large fish which he fought for about a half hour before he lost it. To his surprise, when he reeled in, he found a plastic fish tag knotted to the end of his line. In response to the angler's inquiry resulting from this unexpected turn of events we were able to tell him that the fish was a striped bass and that it was 17 years old when he hooked it. When the fish was tagged several years earlier a sample of its scales was also collected. Its age was known because of the ability of biologists to interpret life history information from fish scales.

Many anglers who successfully land a nice fish are similarly curious about the fish's age and life history. These questions are also of interest to biologists in the department and studies have been underway for many years to determine accurate answers.

Professional fisheries personnel have found that much can be learned about the life history of fish by examining either their bones or scales. The bony structures most frequently used for age and growth studies are *otoliths* (ear stones), *opercula* (gill covers), fin spines, and spinal vertebrae (Figure 1). Under a microscope most of these bony structures show distinct growth marks much like the growth rings seen on a cross section of a tree trunk.

Scales, however, have many closely spaced growth rings called *circuli* and also yearly marks called *annuli*. The spacing of the *circuli* is determined by the fish's growth rate; wide *circuli* spacing is associated with rapid growth. When growth slows down, the *circuli* are compacted to form an *annulus*.

Scales are often the most suitable structures for age determinations because they are easy to collect, they usually are easy to interpret, and most importantly, scale removal does not kill or severely maim the fish. Unfortunately, some California fish show no definite *annuli* on their scales and others, like catfish, have no scales at all. Therefore, the only alternative for age and growth studies on these fish is to use a bony structure which shows yearly marks.

In most California fish, *annuli* are formed on the scales and bones during the winter when growth is reduced. The age of a fish is determined by simply counting the number of *annuli*. Fish caught in the spring are an exception to this since the *annulus* at the edge of the scale or bone is not yet visible. In this case the scale or bone edge is counted as an additional *annulus*.

Variations in the distance between *annuli* demonstrate yearly differences in the growth rate of the fish. For instance, the distance between *annuli* decreases as the fish gets older, showing that the fish grows less in length with each successive year of life. Other temporary variations in growth result from injury, disease, sexual maturation, or changes in food supply or water temperature. Unfortunately, these periods of slow growth sometimes are visible on the bones and scales at times of the year which are different from the time when the *annulus* is normally produced. This causes a "check" or "false *annulus*" which may interfere with an accurate interpretation of the fish's age.

Presently the Department of Fish and Game's Bay-Delta Fishery Project is involved in continuing studies of three popular Sacramento-San Joaquin Estuary sport fish: striped bass, white sturgeon, and white catfish. One aspect of these studies involves estimation of age composition and growth rate.

The striped bass study has been going on for over 20 years. In that time more than 200,000 scale samples have been analyzed from bass ranging in age from 2 to 22 years. Striped bass *annuli* usually are readily apparent, as can be seen in the accompanying picture of a scale from a 4-year-old fish. Scales are now used exclusively in aging striped bass because the fish can be released unharmed after a scale sample is removed. In the past, *otoliths* (ear stones) were used to verify ages derived from bass scales.

Aging sturgeon and catfish is a more complicated procedure since they have no scales. Sturgeon age is determined from thin slices taken from the first bone-like ray of one of the pectoral fins. The ray is removed from the fish and dried; several thin cross-sectional slices of this bone are then mounted on a slide and examined under a microscope.

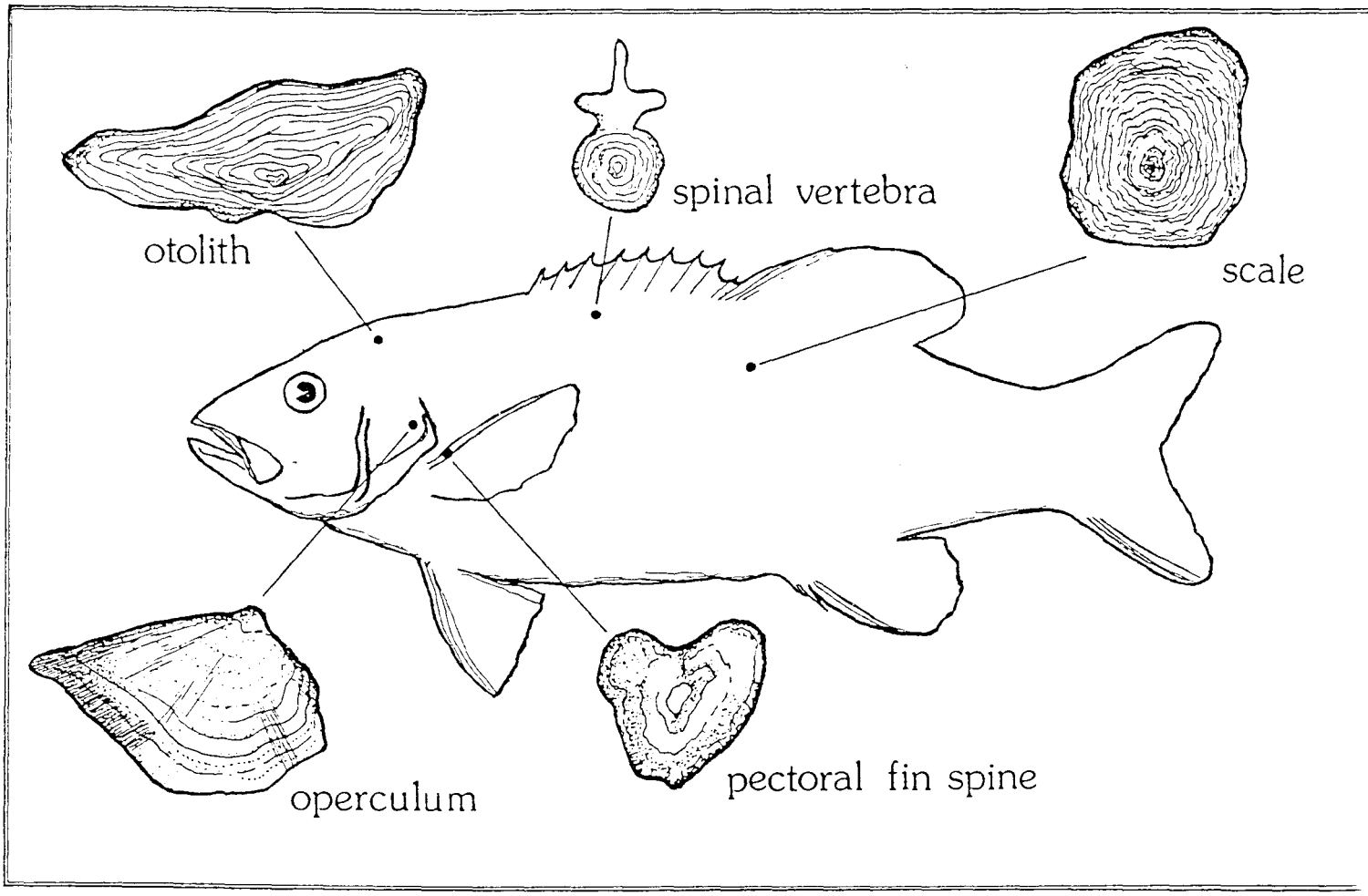

FIGURE 1. Some of the structures used to determine age of fish. Figure drawn by Alexandra Connor.

Most sturgeon fin ray sections are more difficult to interpret than the section (shown in the accompanying photo) from a 21-year-old fish. One of the problems with sturgeon aging is that they live so long. There are stories of fish over 100 years old, although the oldest white sturgeon Department of Fish and Game biologists have examined was about 40 years old and weighed 405 pounds. In these older fish the *annuli* are very close together and hard to count.

The Bay-Delta Fishery Project is currently using spinal vertebrae to age white catfish. It has been determined that the vertebrae possess clearly visible *annuli* and that the center of the vertebrae provides a constant reference point for "back calculating." Basically, "back calculating" is a method of determining the fish's length at an earlier age by measuring the distance from the edge of the vertebra to any *annulus* and by knowing the present length of the fish.

These age and growth studies provide extremely important indicators for the Department of Fish and Game. From these studies, environmental conditions favorable for fish can be determined. This enables the department to better manage the fisheries, improve fish cultural practices, estimate abundance and harvest of individual year classes, and forecast future fishing prospects.

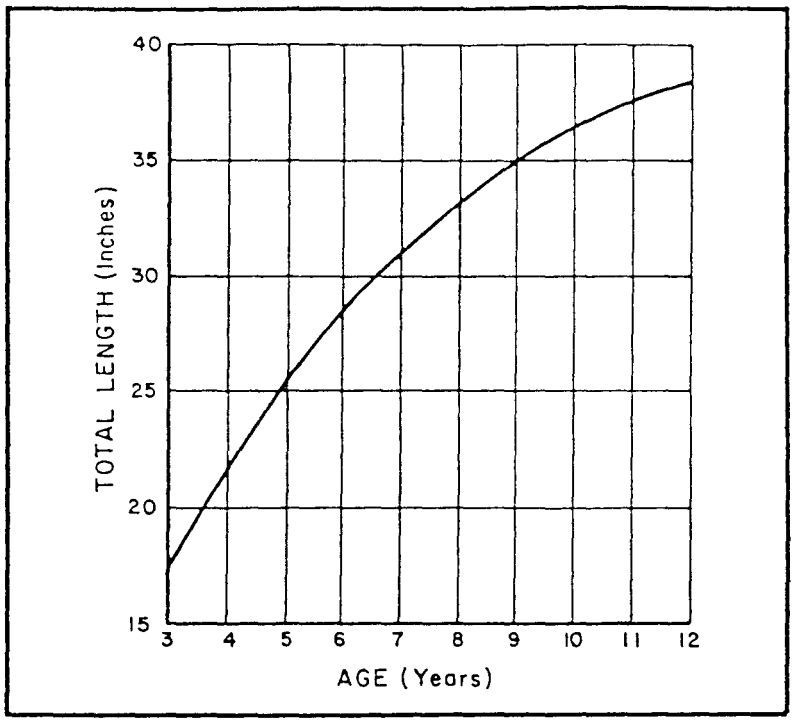

FIGURE 2. Age-length relationships for striped bass in the Sacramento-San Joaquin Estuary.

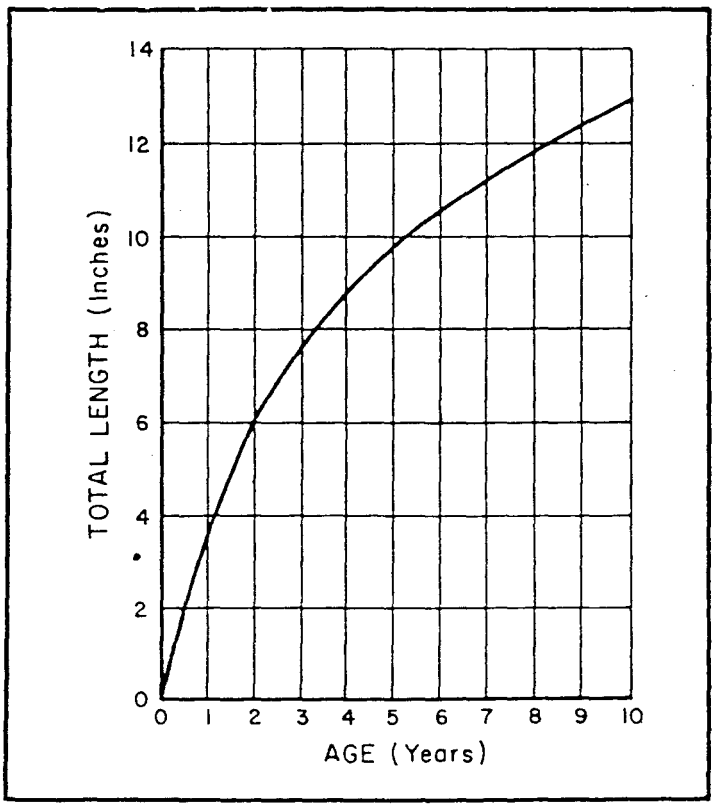

FIGURE 4. Age-length relationships for white catfish in the Sacramento-San Joaquin Estuary.

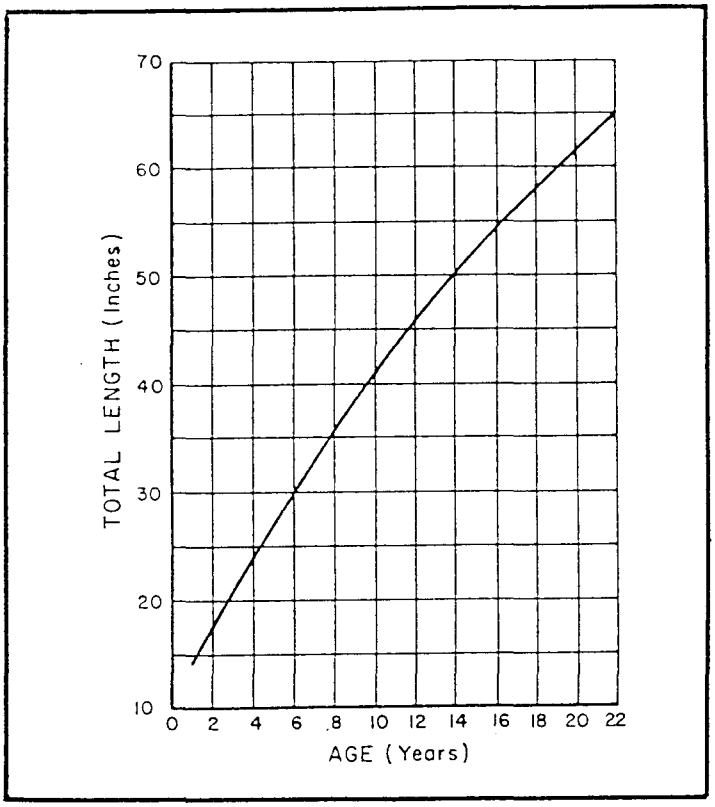

FIGURE 3. Age-length relationships for white sturgeon in the Sacramento-San Joaquin Estuary.

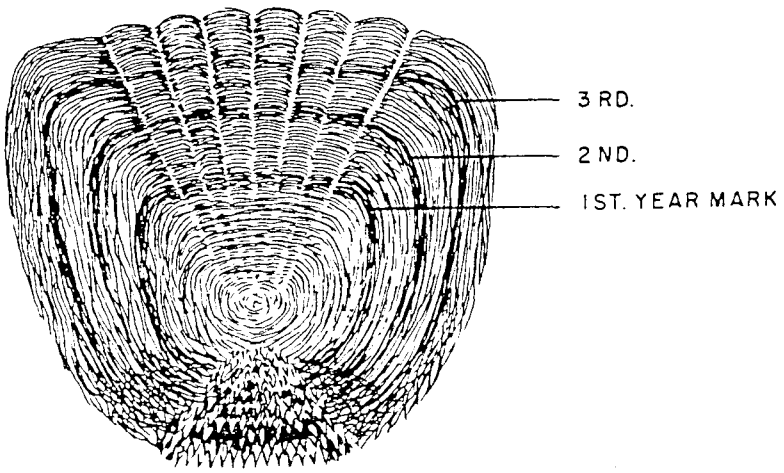

Diagram of a scale from a 16-inch largemouth bass 3½ years old, greatly enlarged. Each dark band represents the end of one year of growth.

After studying the picture of the striped bass scale, you may want to try your hand at aging fish. First, select a scale from your fish near the site shown in the diagram and gently wipe any slime or skin off the scale with a tissue. Hold the scale between your fingers and adjust its position until you are holding it the same way as pictured. Now look at the scale with any type of hand magnifier. With a little luck you will be able to see the *annuli* and get an idea of the fish's age. If the central part of the scale looks strangely formless it is probably one that the fish regenerated to replace one that was lost earlier in life, so throw it away and take another one. This method may be applied to most fish that have scales.

An easier and fairly accurate way to determine the age of a fish you catch is to use an age-length curve. Curves for striped bass (Figure 2), white sturgeon (Figure 3), and white catfish (Figure 4) from the Sacramento-San Joaquin Estuary are provided here for your use. Simply find the total length of your fish on the left hand side of the graph. The approximate age corresponding to that point on the curve is read from the bottom of the graph. As an example, a 25-inch striped bass is about 5 years old. Since growth rates for striped bass and white catfish in other areas of California differ from those in the Sacramento-San Joaquin System, these graphs may give incorrect ages for fish caught in other waters.

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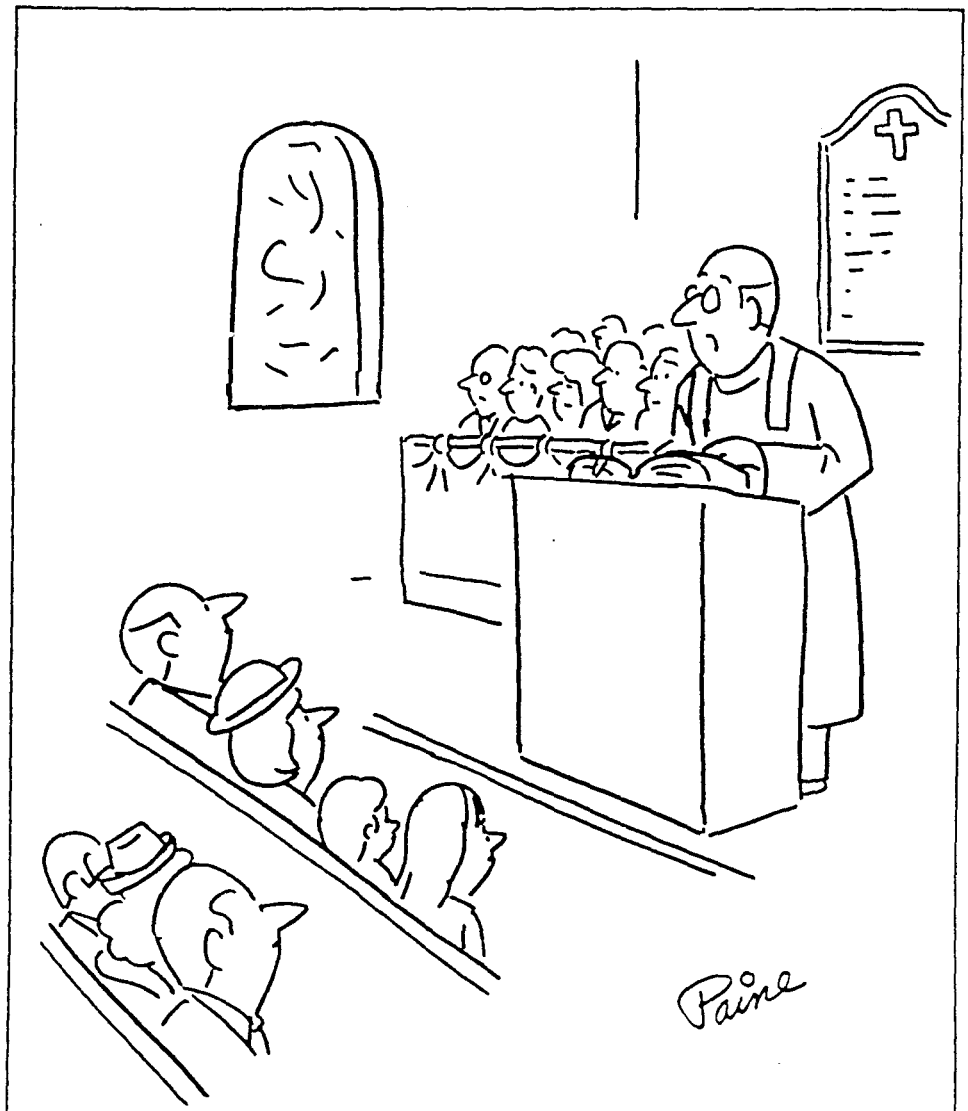

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