

Ornith

fish.





fish,

old fish, new fish



BY CHUCK COLGAN

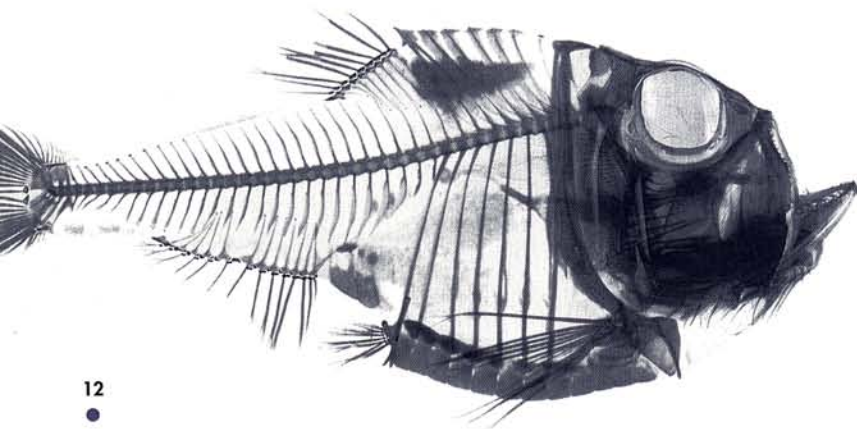
Preserved specimens of a hammerhead shark and scorpionfish (previous pages). The fish collection is comprised of millions of specimens (above). The opportunity to dissect specimens is part of what makes the fish collection a living library (left). A cleared-and-stained hatchefish (below). This technique allows for a better study of bony and cartilaginous structures. Richard Rosenblatt and H. J. Walker measure and record data from a young whale shark (facing page).

To the uninitiated, the scene is reminiscent of an enormous canning cellar—row upon row of wooden shelves lined with thousands of bottles and jars—but preserved inside these containers are fish that serve as an invaluable archive for marine biologists.

At the Scripps Institution of Oceanography Marine Vertebrates Collection, called simply the fish collection, almost two million creatures, some dating back to the 1890s, are preserved in alcohol for scientific studies. The collection has grown from the catches of hundreds of marine researchers who have returned to Scripps with specimens taken during expeditions throughout the world's oceans.

From lowly hagfish to great white sharks, the collection is a historical record of fish evolution, which is revealed by analyzing a specimen's external anatomy and its innards. The collection contains 4,500 different species representing about one-fifth of all known fishes, according to Richard Rosenblatt, professor of marine biology and the collection's curator for nearly forty years.

"It's the raw material for a multitude of marine life studies, not only systematic, but ecological as well," Rosenblatt explained. "It would be impractical and prohibitively expensive for every-







one interested in fishes to go out and capture his or her own specimens, not to mention the impossibility of collecting a fish that lived decades ago.”

Although not the biggest fish collection, the Scripps collection excels in specialized areas. It contains one of the largest holdings of deep-sea fishes (from below 1,000 feet) and the most extensive inventory of eastern Pacific shorefishes from the continental shelf areas of North and South America. The collection also houses selected specimens from other areas of the world’s oceans that are used for comparative studies. And it keeps on growing.

The fish collection began in earnest in 1944, when Carl Hubbs came to Scripps from the University of Michigan where he had built the premier North American freshwater fish collection. He took over a small collection with specimens dating from the nineteenth century, which had been maintained by Percy Barnhart, the aquarium’s curator. In those days, much of the collection was displayed in jars in the public museum. In the 1950s Hubbs convinced then director Roger Revelle that the materials were valuable and needed proper care.

Revelle set up three curator positions for the collections of geological samples, invertebrates, and fishes. Rosenblatt, then finishing his doctoral work in zoology at UC Los Angeles, was chosen for the latter in 1958. A new wing of Ritter Hall was being planned, and a room was built especially to house the fish collection. Rosenblatt recalls, “When I first came down, the fishes were in the basement of the old aquarium. . . . Some of the bottles didn’t have labels, and some of them had to be tossed. I remember one of the custodians saying, ‘You’re doing a great job here, Doc. How long will it take you to get all of this stuff thrown out?’”

The 1950s and 1960s were the golden days of oceanography when ships made numerous expeditions

throughout the world, so deep-sea fish came pouring in. Even on trips undertaken for other purposes, shipboard technicians knew to freeze for Rosenblatt any fish dragged up inadvertently by geologists’ dredges. In the meantime, Rosenblatt started working and collecting in the Gulf of California. He recalls one Baja trip that brought back four 50 gallon drums and 100 five-gallon cans of fish. The collection grew quickly.

These days Rosenblatt has to be more selective about accepting new specimens because space in the collection is limited and many species are already well represented. Still, occasionally there are opportunities to collect needed fish, such as an expedition in 1994 taken by his assistant of 14 years, museum scientist Harold (H. J.) Walker. He went to the Gulf of Alaska on a National Marine Fisheries Service ship and filled up a drum of fish to round out the general collection of fishes from that region.

Soon after capture, specimens are submerged in formaldehyde to prevent deterioration. Formaldehyde is the best fixative, but unpleasant to work with and not a good long-term preservative, so the samples are not stored in it. Instead, they are washed and transferred to isopropyl (rubbing) alcohol.

All of the animals from the same capture are kept together until they arrive at the fish collection. There they are sorted and the plankton and seafloor invertebrates are sent to the two marine invertebrate collections at Scripps. The fish are further separated into species, identified (through visual examination or by meticulous comparative research), put in jars, labeled, and placed on the shelves. The process can take from a few minutes to weeks of work, and sometimes yields a paper describing a new species. Hundreds of scientific papers have resulted from studies of the collection.

Research on the specimens usually entails describing and comparing



Carl Hubbs, who convinced then director Roger Revelle of the importance of a fish collection at Scripps (above). A very small flying fish is examined microscopically (left). Two cleared-and-stained juvenile sturgeon (below). Richard Rosenblatt, ca. 1968, studies a deep-sea rattail fish (facing page).



hooked on fish

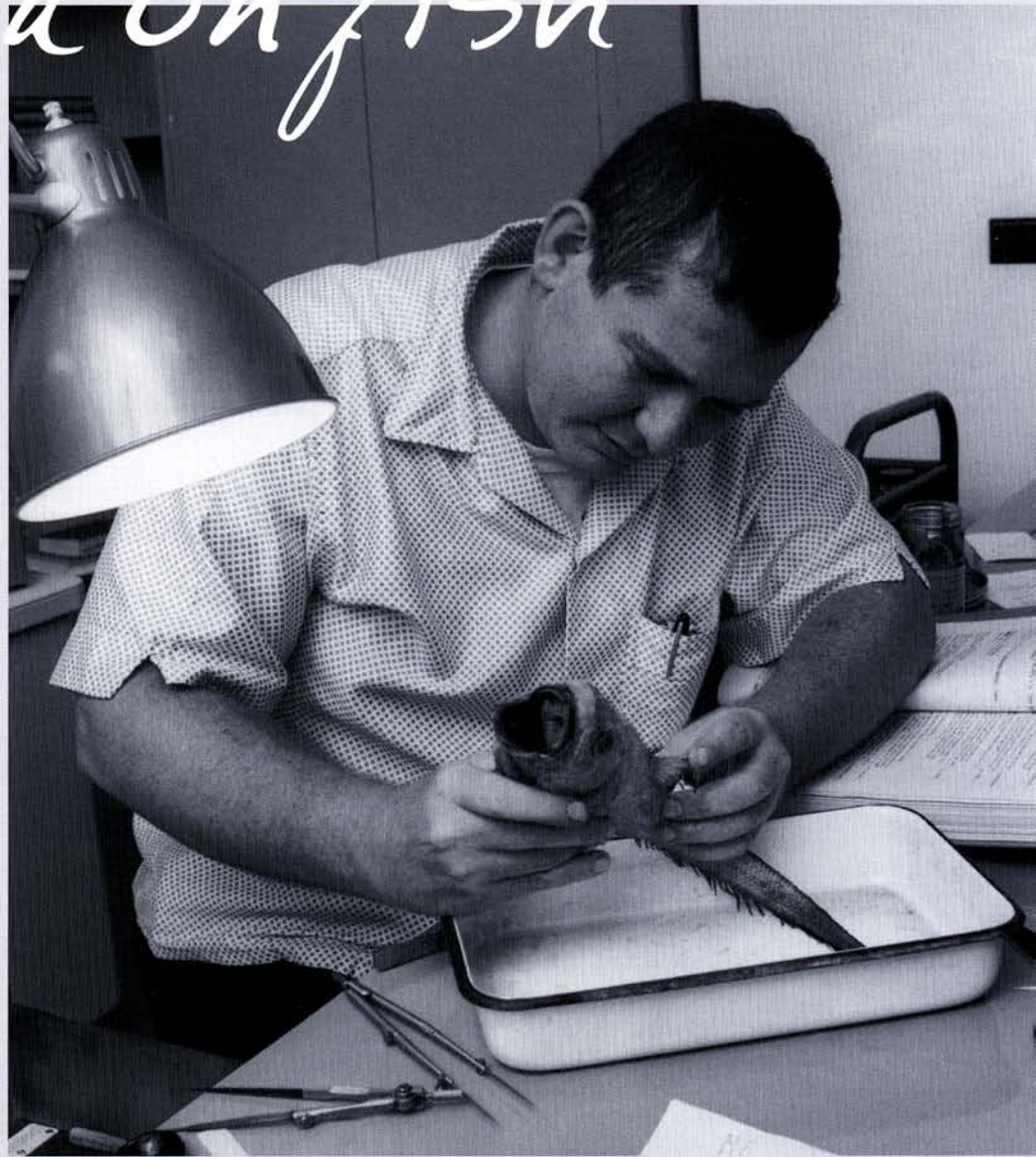
As a ten-year-old, Richard Rosenblatt peered through the glass of his elementary school aquarium and discovered a watery world that has fascinated him ever since.

He recalls one day the guppies in the tank had babies, and the teacher didn't know what to do, but remembered that there was a sixth grader who knew a lot about fish. "They got me out of class, and I gave them directions on how to separate the young from the adults—it was pretty heady stuff for a kid. I think I realized at that time the way to fame, fortune, and success was fish," he says, immediately followed by a hearty, trademark Rosenblatt guffaw.

As he continued through high school, Rosenblatt knew that the study of fish would be his career. His only worry about the decision, he recalls, was that he feared everything would be known about fish by the time he got to graduate school. "I now know enough about fish to realize that we will never know everything about the oceans and their inhabitants," he says.

Rosenblatt came to Scripps in 1958 to be the first full-time curator of the Marine Vertebrates Collection on what he considered a temporary basis, and ended up staying for nearly 40 years. He was appointed full professor of marine biology in 1972 and has served as chairman of the Marine Biology Research Division and the graduate department (twice). In the process he became one of the nation's leading figures in ichthyology.

"For what I am interested in, there isn't any other place in the world like Scripps because it's a university—



with a major fish collection and a stimulating environment of research and teaching," Rosenblatt said. "Most people who do what I do are in the basements of museums."

Rosenblatt's research focuses on the taxonomy, evolution, and geographic distribution of fishes in the eastern Pacific, especially Panama and the Gulf of California. He finds fish absolutely fascinating creatures, in part, he says, because they live in a completely different world from ours, "so you really

have to stretch your imagination to think about them."

Rosenblatt considers his relationships with students among the greatest benefits of being at Scripps because "in the process of teaching, you learn from them, and they become good friends as well." This past May, many of his former students gathered at Scripps to take part in an all-day symposium on fish ecology, behavior, and physiology, as part of a celebration of his 65th birthday. 🌐



physical characteristics, such as coloration, shape, size, and things you can count (like rays and spines in the fins). But studies may include dissection to examine internal organs or to determine gut contents. Structural analysis is enhanced by a technique called “clearing and staining,” in which the specimen is rendered transparent through the use of an enzyme that digests away all but a portion of the skin, the bones, and the cartilage. More recently, researchers are using

molecular techniques and DNA sequencing for distinguishing species and determining relationships.

Fish are placed in the collection as in a “once-living” library. Their containers are filed in phylogenetic order, by their evolutionary history, from most primitive to the more recently evolved.

Most of the collection is listed in a computerized data base that is available on the Scripps home page (<http://sio.ucsd.edu>) on the World


Cynthia Klepadlo, museum scientist, sorts and identifies a midwater sample (left). Midwater larval fishes awaiting identification (below left). A juvenile white marlin, unusual because of the large dorsal fin (below). The famous megamouth shark, caught in waters off Hawaii. This is the first specimen ever seen (facing page).

Wide Web. Researchers can call up a genus or species and search for a listing of holdings and data on each specimen.

Scientists from many countries make pilgrimages to Scripps to study the collection, and a number of loan requests are processed each year. Any qualified researcher at a recognized institution may borrow specimens, and exchanges are often made to increase the scientific value of the collection.

Upon approval, borrowers can sample, dissect, and otherwise manipulate a specimen, with the exception of about 180 holotype specimens. These are the single fish of a species used worldwide as the standard against which all other fish suspected of being that species are compared.

“When a researcher asks to alter a fish for a good reason, we like to say yes, because the purpose of the collection is to provide information,” Rosenblatt said. “We just prefer they do it in a way that doesn’t mean others can’t get information as well.”

Within the next few years, portions of Ritter Hall are slated for demolition, and the fish collection will move into new quarters. With continued care, Rosenblatt expects the specimens to last for several hundred years and be available for many generations of students and researchers. “And that,” he said, “is why we keep them here and don’t throw them out.” 



famous fish stories

Paging through Professor Richard Rosenblatt's biography file in the SIO Communications Office reveals reams of newspaper clips going back to 1958, the year he joined the institution. As an academic scientist, Rosenblatt never sought fame, but a number of the marine animals that he has had contact with have brought him notice in the news media.

A visit to the fish collection by Thomas Manar, the campus information officer, who was looking for stories and asked Rosenblatt what was new, started all of the news attention. "A strange and rare little fish that hops about the ocean floor, rather than swims, has been added to the collection of specimens," wrote Manar in his December 1958 news release describing a deep-water batfish that had been taken in a dredge haul off a Scripps ship in the Gulf of Tehuantepec, Mexico. The resulting newspaper articles appeared around the nation and worldwide.

In the 1960s, the first of many news items was published about rare or unusual fish returned to Scripps from dive trips to the Gulf of California and coastal islands. In addition to the scientific collection, some fish were brought back alive and put on display in the public aquarium-museum. Then aquarium director Donald Wilkie often accompanied the expeditions, and his naturalistic tank displays attracted many visitors.

The most unique fish to come to Scripps was the "four-legged" coelacanth (pronounced see-la-canth), touted as a distant ancestral "cousin" to man, a living fossil with paddle-like fins resembling limbs. Its relatives chose the sea, whereas others evolved into amphibians about 60 million years ago. Thought extinct until 1938, they are occasionally caught off the Comoro Islands in the Indian Ocean near Madagascar.

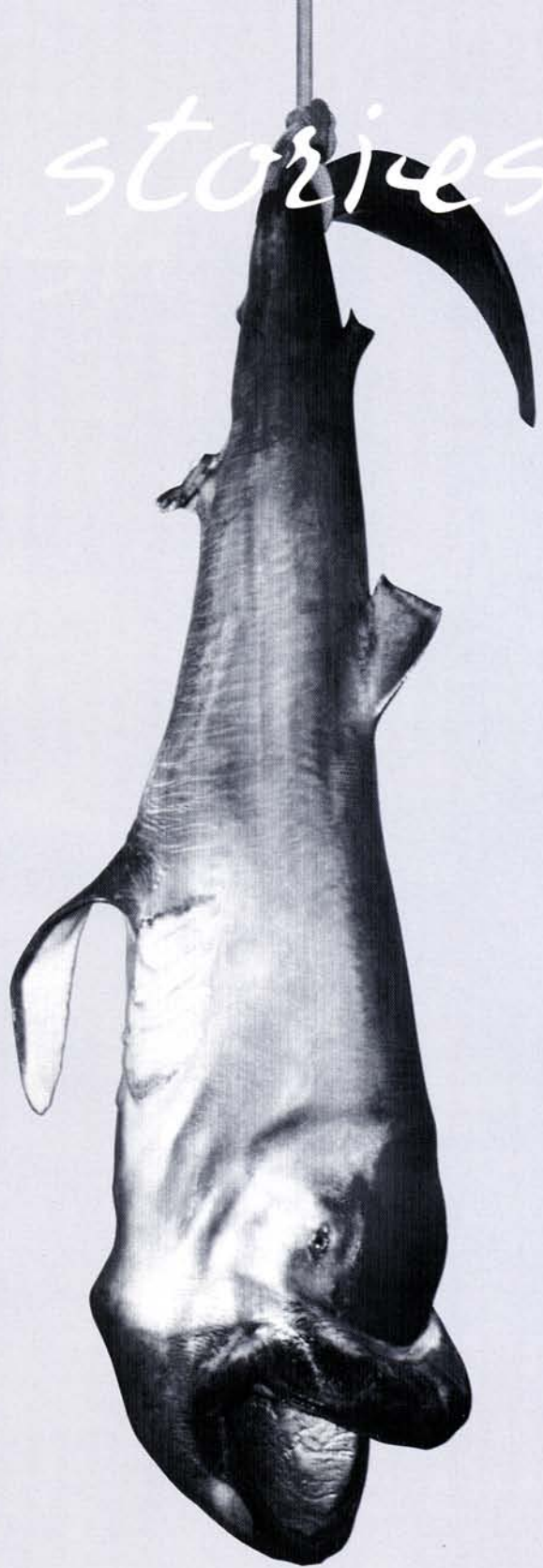
Rosenblatt and Professor John Isaacs attempted to photograph or capture a coelacanth during a 1971 expedition on board research vessel *Melville*. Isaacs lowered his camera system into the deep waters while Rosenblatt and others spent two weeks on all-night forays in a 16-foot whaler setting lines and tending them. Their efforts were unsuccessful.

Later John McCosker, a Scripps graduate and then director of the Steinhart Aquarium, went to the Comoros, and although he didn't catch a live specimen, he got two frozen ones. Out of loyalty to his alma mater he allotted Rosenblatt one. "Rare Fish Thaws Out at Scripps" read the headline on a story describing how the coelacanth was sampled and preserved. It became a popular display in the museum and remained there for decades. It is now back in the fish collection.

In the late 1970s, Rosenblatt worked on flashlight fishes, which have organs filled with bioluminescent bacteria under each eye that glow like headlights. Expeditions were made to the Caribbean and the Gulf of California to observe and collect them. Rosenblatt described two new species and worked out the mechanisms that different flashlight fish use to control light emission.

Sharks have played a significant role in Rosenblatt's public life. First there was an amazing discovery called megamouth, a huge, fat, round-headed shark. When the first one was accidentally taken off Hawaii in 1976, Scripps graduate and Honolulu Aquarium Director Leighton Taylor called Rosenblatt and said, "I figured it would be easier to call you than go to the library. Have you ever heard of something like this?" The reply: "No, there isn't anything like that." Only about a half dozen other specimens have been seen since then.

There was the movie *Jaws* and its sequels that popularized the idea of monstrous, hunger-crazed great white sharks. Rosenblatt gave interviews to



newspapers and radio stations around the country, often explaining that great whites range widely along coastlines worldwide and that attacks on humans are rare, without minimizing the potential threat. "I figure that *Jaws* cost American ichthyology two staff years of work with all the people who spent time answering questions and phone calls," he chuckled. 🌐