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# Historical Perspectives

## William Eugene Evans

(born October 11, 1930, in Elkhart, Indiana)

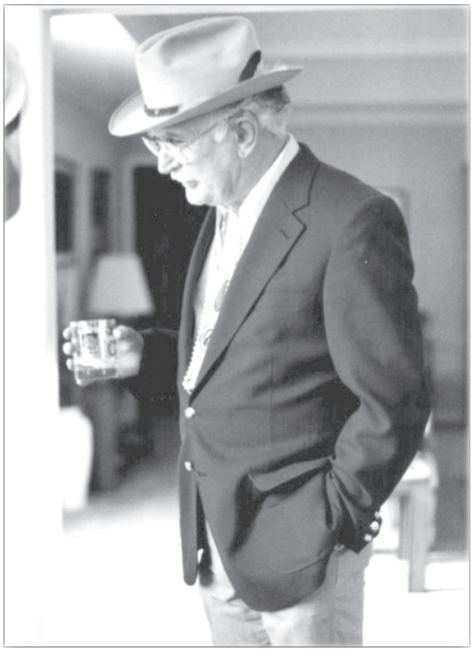
Dr. William Eugene Evans is a world-renowned marine mammal acoustician and ecologist with special interest in marine mammal management and conservation biology.

Bill graduated from Bowling Green State University (B.S.) in 1953 and received his M.S. from Ohio State University the following year. He served in the U.S. Army from 1954 to 1956. In 1956, he began work in the aerospace industry related to the impact of noise on humans and animals.

In the 1960s, Evans was one of the first scientists who made up the cadre of the U.S. Navy's Marine Mammal Program at a naval base in southern California. During his 10 years with the program, his primary area of research was marine mammal communication echolocation and population ecology, which resulted in the design of a special research platform for recording and observing dolphins under water called "Sea See," as well as the radio telemetric study of several species.

Bill was an Advanced Study Fellow and Visiting Scientist for the National Marine Fisheries Service from 1972 to 1974 and Head of the Bioanalysis Group at the Naval Undersea Center from 1974 to 1976. After completing his Ph.D. at the University of California at Los Angeles in 1975, Bill resigned from the Navy and took on administrative duties as the Executive Director of the Hubbs-Sea World Research Institute in San Diego, California, where he created a world-class research facility and staff which remain prominent in the studies of marine species.

In 1984, he was appointed Chairman of the U.S. Marine Mammal Commission (MMC) with oversight responsibilities of the Marine Mammal Protection Act. In 1986, he moved to Washington, DC, to pursue a career with the Federal Service as the Associate Administrator of the National Oceanic and Atmospheric Administration (NOAA) Fisheries. In 1987, he was appointed by President Reagan with Senate confirmation as the Under Secretary of Commerce for the NOAA and the U.S. Commissioner for the International Whaling Commission (IWC). Throughout his years with these organizations, Bill participated in negotiating several environmental and fisheries agreements with Norway, Iceland, Japan, Poland, Korea, the People's Republic of China, and the former Soviet Union. In the late 1980s, he headed a delegation to Murmansk, USSR, for fisheries discussions. This was the first U.S. presence in Murmansk since the end of World War II.



Bill retired from Federal Service in 1989 and left Washington, DC, to become the Dean of the Texas Maritime College, later known as the Texas Maritime Academy, in Galveston, where he conceived a new course entitled Environmental and Resource Management, Policy and Politics. He retired from Texas A & M in 1999 and is currently an adjunct professor at the University of Notre Dame and Managing Editor of *The American Midland Naturalist*.

He and his wife of 56 years, Phyllis, reside in South Bend, Indiana, during the summer and in Galveston, Texas, during the winter, with intermittent visits to their sons, John and Timothy, and grandchildren, Courtney, Kendell, and Kelsey, and Andreya and William.

# A Short History of the Navy's Marine Mammal Program

William Eugene Evans

There are several versions of the history of the U.S. Navy Marine Mammal Program. Most of these give accurate chronologies, but few, if any, address the question of why would the Navy be interested in marine mammals? I think this is a very important question, and it takes someone who had a view from the inside to try to answer that question.

It is important to note that in the first 10 years of marine mammal studies in the U.S., a significant part of the funding for a wide array of research efforts were provided by the U.S. Navy. With the passage of the Marine Mammal Protection Act (MMPA) in 1972, other federal agencies that also funded marine mammal studies came to the forefront: National Marine Fisheries Service (NMFS), U.S. Fish & Wildlife Service (USFWS), and Minerals Management Service (MMS). Government policies regarding human activities with marine mammals were divided between NMFS and USFWS. NMFS was involved primarily with pinnipeds and cetaceans, while USFWS focused on polar bears, walrus, manatees, and sea otters. Although MMS had no jurisdiction over marine mammals, this agency certainly was concerned about the ways that marine mammals could affect the activities of U.S. citizens in regards to oil/gas development and transport on public lands and waters.

The "official" start of the U.S. Navy Marine Mammal Program was in 1960 at the Naval Missile Test Center in Pt. Mugu, California, but that was not really the actual beginning of Navy activities related to marine mammals. Having been involved with the program from 1963 when I was researching sonar at Lockhead, I provide some background here. My view is a bit different than others who had the pleasure of participating in the program. The following is as I remember the events.

I was hired as a researcher in 1964 and started work at the Pt. Mugu, California, facility. Although I left the program in 1976, I always kept my eye on the Navy's marine mammal activities. In 1983, as the Chair of the Marine Mammal Commission, I had oversight of the marine mammal research programs, including the Navy's program, so I also had a view from the outside. These "insider" and "outsider" views have given me a different perspective on the Navy and its contributions to the understanding of marine mammals.

Marine Studios, an aquarium and dolphinarium in St. Augustine, Florida, opened in the late 1930s.

**The U.S. Navy Marine Mammal Program lists the following significant projects from around 1960:**

- Red Letter Year for the U.S. Navy
- Marine Mammal Program Initiated
- First Experiments with Communications in Space
- January 23: Trieste to Bottom of the Ocean
- April 4: First Live Polaris Firing

(See *www.spawar.navy.mil/sandiego/technology/mammals*.)

At the beginning of World War II, the facility had just started to keep bottlenose dolphins in large saltwater pools. By the end of the war, the facility was reopened, providing the public (including a few scientists) with the opportunity to see and study these very special mammals up close. The dolphin shows at Marine Studios were a big success. Who wouldn't fall for an animal with a built-in smile that could play basketball? Aside from the entertainment value, keeping dolphins in captivity provided some very intriguing answers to many questions about dolphins. How do they swim? How do they produce sounds? Do they really have a sonar system? Are they as intelligent as humans? Could we communicate with dolphins? How do they interact socially? What do they eat? How do they mate? How do they give birth in water? How do they grow? Can they be trained? More observations led to more questions, however.

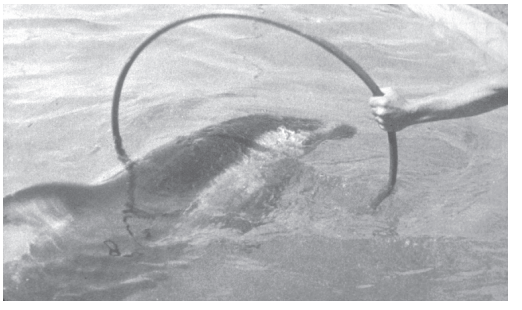
The first reported observations of the incredible swimming abilities of dolphins were recorded by Aristotle. Seafarers have long marveled at the grace and speed of dolphins that frequently joined ships on long voyages, a behavior called bow-riding. Much of the current-day interest and research on dolphins was facilitated by the initial maintenance of dolphins in the controlled environment at Marine Studios (later renamed Marineland). This facility provided an opportunity for the public to view these very special mammals up close and personal. Scientists also started to take advantage of this unique opportunity. New programs included putting hydrophones in the dolphin pools to record underwater sounds and study their swimming behavior.

The efficiency and speed with which a dolphin can move through the water has long been a source of scientific interest. How dolphins accomplish this feat of speed has long puzzled Naval architects. This was even more intriguing to the

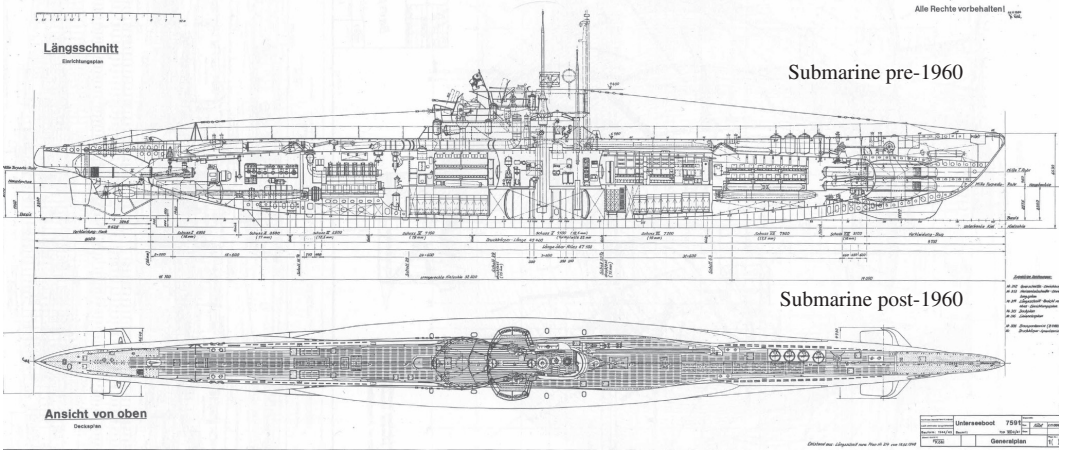
Navy and a new cadre of ship designers working on developing a newer and faster Navy. Much of this interest was further fed by the theories of James Gray, a scientist, who in the 1930s, based on observations of dolphins at sea, thought that the power needed for the dolphins to swim at such speeds exceeded its available power by 10 times, thus, Gray's Paradox (Gray, 1936). Now, with the availability of dolphins for up-close observations and experiments, it was possible to test Gray's hypothesis. This opportunity caught the Navy's attention, especially the Navy personnel whose mission was to make torpedoes and submarines go faster and farther (Kramer, 1960).

The Naval Ordinance Test Facility (NOTS) at China Lake in California had several engineers interested in hydrodynamics as it applied to the design of ships and submarines, and especially torpedoes. So began a series of research projects to measure just how fast a dolphin could swim and determine how a dolphin could achieve high speeds. Enter the Navy's first dolphin, a Pacific white-sided dolphin (*Lagenorhynchus obliqudens)* named "Notty." Most of this early work was done at Marineland of the Pacific in the late 1950s and at test facilities in Southern California (Fish & Rohr, 1999).

During this same period, it was discovered that the Russians (USSR) were conducting experiments very much like those in which we were engaged. In *Review of Dolphin Hydrodynamics* by Fish and Rohr (1999), the number of citations from Russian literature is impressive.



Notty in training (Official U.S. Navy Photo)




### Changes in Submarine Design between World War II and the 1960s

Just as a point of interest, look at the top figure above and note the design of submarines pre-1960—they looked like boats—whereas after 1960 (see photograph on lower right), they look like whales.

(Official U.S. Navy Photo)

At the same time, several scientists became interested in working with dolphins at Marineland to examine how dolphins could use sound to avoid and detect objects: SONAR or SOund NAvigation and Ranging—another Navy interest. During the process of capturing dolphins for Marine Studios, fishermen noted that the dolphins were able to avoid their nets even in very murky water (Schevill & Lawrence, 1953). This discovery resulted in the Office of Naval Research (ONR) funding several basic research projects probing the special acoustic capabilities of this group of mammals (Schevill & Lawrence, 1953; Kohler et al., 1954). Most of my early research papers were funded by ONR (see U.S. Navy Marine Mammal Program, 2008).

About the same time, a group of neurophysiologists from several universities became interested in the very large and complex dolphin brain. The group, which was referred to as the Johns Hopkins Group, which included Dr. John Lilly, started a series of experiments using bottlenose dolphins at Marine Studios in St. Augustine. They tried anesthetizing the dolphins, but this resulted in the deaths of a number of animals. Unfortunately, the respiratory system and cycle of the dolphin is unlike that of most other mammals—they are apneustic breathers (breath-holders). The group gave up their research, all except Dr. John Lilly. He returned to his laboratory in California and developed a method of getting electrodes into the dolphin's brain without anesthesia by penetrating the skull with a stainless steel tube used as a guide for an electrode. The result of his research was presented at the 1960 San Francisco meeting of the American Psychiatric Association. His presentation made the news with a bang. The results are best described by F. G. Wood (1973) in his book, *Marine Mammals and Man: The Navy's Porpoises and Sea Lions*:

> In 1960, Dr. Lilly delivered a paper based on his 1954-1956 research entitled *Some Considerations Regarding the Basic Mechanisms of Positive and Negative Types of Motivations* at a meeting of the American Psychiatric Association in San Francisco (Lilly, 1958, 1961). In his San Francisco talk, Dr. Lilly told of his experiences in electrically stimulating "negative" and "positive" zones of the dolphin brain. Accounts of his talk appeared in several newspapers, including the *Los Angeles Times* and *San Francisco Examiner*, under the following headlines:
>
> "A Scientist Has Shaggy Dolphin Tale"
>
> "A Good Dolphin Is Kind, Loyal, Brave—Psychiatrist Wants to Make Dolphins Talk"
>
> "Shock-Happy Dolphin Laughs with Scientist's Wife . . . Then Dies"

These headlines resulted from the talk discussed above, the one on the basic mechanisms of positive and negative stimulation. Why did this paper trigger the remarkable publicity that followed? Well, John Lilly, a human psychiatrist, had a tendency to go beyond his research results and speculate. According to Wood (1973), more often than not, it seems, the public was more interested in speculations than actual results (or lack thereof).

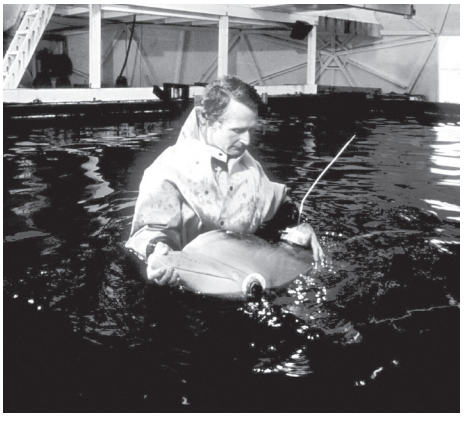
Lilly (1961) went on to expand on this concept. The vocalizations of this animal were the start of Dr. Lilly's belief that it should be possible to establish communications with dolphins and even teach them to speak English. He expressed his views this way:

> Eventually it may be possible for humans to speak with another species. I have come to this conclusion after careful consideration of evidence gained through my research experiments with dolphins. If new scientific developments are to be made in this direction, however, certain changes in our basic orientation and philosophy will be necessary. We must strip ourselves, as far as possible, of our preconceptions about the relative place of *Homo sapiens* in the scheme of nature.

Dr. John C. Lilly and F. G. Wood at Marine Studios, St. Augustine, Florida (Photo from F. G. Wood Archive)

Dr. Bill McLean, with the Naval Ordinance Test Station at China Lake, California, was very interested in Lilly's work and was partially instrumental in his supporting the start of a formal U.S. Navy Marine Mammal Laboratory in 1960. Dr. McLean was an innovative engineer and, in my opinion, is really the Father of the U.S. Navy Marine Mammal Program, which is alive and well today. I think he was instrumental in convincing the various funding branches of the Navy about the importance of this project. The result was the go ahead to start a Marine Mammal Facility at the Naval Missile Test Range at Pt. Mugu, California. These comments are not meant to downplay the rather significant impact that Dr. Lilly had on the research on dolphins, however.

Aerial view of the U.S. Navy Marine Mammal Facility at Pt. Mugu, California; note floating pen complex that housed dolphins. (Official U.S. Navy Photo)



Author trains a bottlenose dolphin for a sonar study at Pt. Mugu (Official U.S. Navy Photo)

While at Lockheed, I obtained a young California sea lion named "Roxie" from Marineland of the Pacific for some evaluation of whether or not they used sonar when blindfolded to retrieve a ring (Evans & Haugen, 1963). When I left Lockheed in 1963, the Navy no longer wanted Roxie and euthanasia was suggested. This was not an acceptable solution to me. We were raising, breeding, and showing Irish setters at home and had fairly large dog runs, with a bathroom and shower in the building next to the runs. I put Roxie in a dog crate and took her to my home in Chatsworth, California. I then put her in a run adjacent to some of my Irish setters. She was not made welcome by any of them except my main stud dog, who didn't care what kind of animal he was with as long as it was female. So that Roxie could get wet when necessary, I rigged the nearby shower with a pull lever with a ring. She could pull it to turn on the water. Unfortunately, this ran up the water bill since she would stick her head in the ring, turn on the water, and fall asleep. This was not very satisfactory.

Fortunately, we had a very famous showman and animal trainer living in Chatsworth not far from us. J. King Ross had a troop of trained poodles and seasonally went on the road with his dog and sea lion acts—the famous Poodelaires. J. King was quite a character and told stories of how he would be able to turn his trained sea lions loose to work in the open ocean, Great Lakes, or whatever body of water was available. He offered to keep Roxie for me as long as he could use her from time to time in his shows. He had a great facility with ponds and four or five sea lions. So, three weeks after she arrived in Chatsworth in October 1963, Roxie went to her new home until I had a better place for her. My dogs were delighted to get rid of their strange

Retrieving a ring at depths plus 50 m open ocean off Anacapa Island; this was one of several test dives to measure Roxie's maximum depth capability. (Official U.S. Navy Photo)

Author trains Navy sea lion (Official U.S. Navy Photo)

kennel mate! J. King was the first "circus personality" that I encountered. He was a showman, and you could tell that from your first encounter. I am not sure if he was ever different from when on stage or in the main ring at a circus.

In 1964, I was brought aboard for a summer internship at the Navy's Pt. Mugu Marine Bioscience Facility. As a Ph.D. student with two sons and a wife, I badly needed the money as well as the opportunity to use their facilities to continue my dolphin and pinniped research. At Pt. Mugu, I had a place for Roxie (Wood, 1973). The Navy did not know that they hired two for one and that I brought my own sea lion. At the marine mammal research facility, Roxie got a new home, even better than J. King Ross's, with real seawater, a better diet, and an excellent healthcare plan.

My task for the summer was to train Roxie to retrieve rings similar to those in the echolocation study but fixed with an acoustic pinger. This procedure was adapted to train her to retrieve submerged objects and give her a target that could be lowered progressively deeper. Fortunately, a very experienced sea lion trainer, Wally Ross, was at Pt. Mugu working with Dr. Sam Ridgway's research dolphin, "Tuffy." Although Wally was very busy with Tuffy, deep in his heart he was a sea lion trainer extraordinaire. Sea lions were his first love, and he considered it a great opportunity to work with them again. Wally and J. King Ross convinced me that researchers could work with sea lions in the open ocean. Wally helped me get Roxie ready for open-ocean work. He had trained many animals, including dolphins, dogs, pigs, elephants, sheep, and the list goes on. His first love was the circus, and he had a thousand stories, some of them not for mixed company. Wally was selected as the head trainer for the original Dr. Doolittle movie, including training some very fine sheep dogs as well as the sheep. Wally became a close friend, and still is one, even though I haven't seen him in years. I still can't see a movie where animals are doing incredible things without thinking of Wally. His favorite animals were elephants, although, of course, he had a long list of favorites. One of his favorite stories was about his elephant act where he had the elephant sit on him, then pick him up in her mouth and carry him out of the circus ring.

With Wally's help, we took Roxie through several steps to transition her into the ocean—first in a dive tank, then in the lagoon. We didn't use any of the dolphin pens since Roxie did not like being harassed by dolphins. The goal was to start training Roxie to retrieve rings at increasing depths. We used pretty much the same protocol that Wally used in training Tuffy for his open-ocean work (see Ridgway, 1987). Transporting Roxie to the test site was considerably easier than transporting Tuffy. Sea lions are amphibious and walk quite well, so it is easy to train them to enter a crate. Dolphins, on the other hand, must be hauled into a stretcher and be lifted into a boat for transport.

The sea trials were conducted near Anacapa Island, some 15 miles west of Pt. Mugu. Here, the water was clear, and we were able to photograph Roxie's behavior. One of the underwater photographers from the Naval Missile Center followed her with his camera as she approached the ring at 40 m, stuck her head through the ring, and headed to the surface—not directly but along several oblique spiraling excursions. Dr. Ridgway speculated this might be to avoid the bends by allowing time for his system to adapt to the greater depths. After so many minutes at depths greater than 20 m, humans must spend time at decompression stops to avoid the bends. However, Roxie would return from depths greater than 65 m along a straight path. As it turns out, California sea lions are adapted to deep diving, but are metabolically limited in the amount of time they can spend at great depths.

When the Photo Department was assembling the underwater movie footage for my final report in 1965, they called and asked about a title. We thought about it and said, "Just call it *Project Roxie*." It wasn't until later, when I was presenting the film to VIPs from the Pentagon and the project was introduced by a Navy commander that I discovered that her name was an acronym for Retrieval of EXperimental Immersed Elements (Wood, 1973). The U.S. Government has an acronym for everything! I believe that the success of Roxie and Tuffy working free in the ocean was one of the things that got the Navy interested in using sea lions and dolphins in Navy operations.

Author works in a "state-of-the-art" Marine Mammal Acoustics Laboratory in the 1960s (Photo from W. E. Evans)

In 1967, all the personnel manning the Navy Marine Mammal Facility were placed under the newly formed Naval Undersea Warfare Center (NUWC), later renamed the Naval Undersea Center (NUC), then renamed Naval Ocean Systems Center (NOSC), and then referred to as Space and Warfare Systems (SpaWARS). It is currently named the Space and Naval Warfare Systems Center (SSC) Pacific and is still headquartered in San Diego. Indeed, every time I went on any kind of field excursion for the Navy, it seemed the laboratory was renamed during my absence!!

The NUWC was formed from portions of other Navy laboratories and was a wide-ranging organization with laboratories or facilities in Pasadena, Long Beach, and San Clemente Island in California; Lake Pend Oreille in Idaho; and Cape Prince of Wales in Alaska.

With the advent of the Vietnam War, interest grew in the possible application of marine mammals to assist in a number of Naval operations. The result was the development of the Navy's Laboratory in Hawaii (NUWC), which included moving personnel, part of an ocean engineering group, and animals to be closer to Fleet Operations and also to be more remote from the public. The staff of the program grew over time and now includes several individuals who are well-known in the marine mammal sciences community.

As a result, many of us had to make a decision to ether move to Hawaii or San Diego. My family and I spent the summer of 1967 in Hawaii, and it was a great experience. It gave me an opportunity to work with several species not available on the mainland. It also provided an opportunity to work with one of my mentors, Dr. Ken Norris, and meet some fascinating personalities, like Gregory Bateson (that meeting was not appreciated by my youngest son who was bitten on the arm by one of Bateson's gibbons). I also had the opportunity to watch dolphins under water from Ken Norris' "Sea-sick Machine." Unfortunately, Dr. Norris forgot to inform me that he lost his breakfast just before my turn in the observation chamber. As unpleasant as that was, it presented an opportunity to observe dolphins under water where they spend over 90% of their time. This experience changed my whole approach and appreciation of dolphins.

At that time, research in the Navy was mostly aimed at investigating projects that might be useful in improving Fleet performance. The Navy funding process proceeded from basic research to development, including testing and evaluation, and eventually, if successful, to deployment with the Fleet. It became obvious that with the demonstration of the ability to train California sea lions and bottlenose dolphins to travel onboard a ship or small boat, swim in open water under the control of a trainer, and return to that trainer, there were many useful applications for both species in Naval Operations (Evans & Harmon, 1968). This was especially true for the operation in Vietnam.

My family could take only so much of "paradise" (one person's paradise is another's island fever), and it was decided that we would move to San Diego instead. Phyllis, my two sons, and I moved all our 4-H projects south from Chatsworth, California, to San Diego County, to a small ranch of about seven acres on the side of a small mountain close to Escondido, California, and about 25 miles from San Diego. It overlooked a small lake, Lake Hodges. The move looked like something out of *The Grapes of Wrath*. In our small Datsun pickup truck (now called Nissan), we headed south with two young boys, two goats, chickens, two Irish Setters, two Chihuahuas, a mess of rabbits, and other associated 4-H projects. After about a year on the mountain, we added many more goats and four horses. I guess it's no surprise that both my sons developed careers related to animal husbandry—one became a veterinarian and the other a high school agriculture science teacher.

I went to San Diego to join Dr. Sam Ridgway, a major contributor to marine mammal research, and other major players in the U.S. Navy Marine Mammal Program at the Navy facility. Although we did not have animal-holding facilities until 1971, I visited Sea World San Diego and cut a deal with their Director of Animal Care to conduct research on their dolphins. Shortly afterward, an Atlantic bottlenose dolphin arrived, one with which I had worked at Pt. Mugu. Her name was "Scylla."

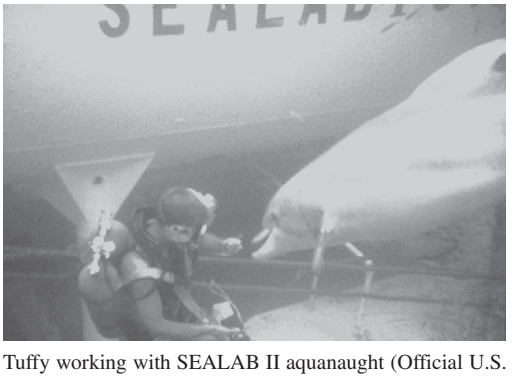
My first project was to train Scylla to echolocate while wearing an array of attached hydrophones. We were fortunate to have a good working relationship with the engineers at the University of Texas Applied Acoustics Laboratory to help build

San Diego home of the U.S. Navy Marine Mammal Program (Official U.S. Navy Photo)

the hydrophone and attachment method. While this entire Navy activity was going on, there were significant changes in public attitudes toward wildlife and especially toward marine mammals. For a detailed review of the U.S. Navy Marine Mammal Program from its beginnings through 1973, see *Marine Mammals and Man*: *The Navy's Porpoises and Sea Lions* by F. G. Wood (1973).

In 1965, the Marine Mammal Program began its first military project: SEALAB II. Working in the waters off La Jolla, California, Tuffy, the bottlenose dolphin we worked with earlier, completed the first successful open-ocean military exercise. He repeatedly dove 65 m to the SEALAB II installation, carrying mail and tools to Navy personnel. He was also trained to guide lost divers to safety.

Author and William Perrin collecting data on dolphin by-catch (*Life Magazine* Photo)



Tuffy working with SEALAB II aquanaught (Official U.S. Navy Photo)

During the 1970s, the Navy Laboratory personnel were very much involved in assisting the NMFS in their research project on the by-catch of dolphins in the tuna purse seine fishery in the Eastern Tropical Pacific. That work included several Navy personnel participating as observers onboard U.S. tuna boats.

In 2005, Dr. Bill Perrin of the NMFS La Jolla, California, laboratory, organized a reunion of all the tuna boat observers from the start of the program, which was held at the Society for Marine Mammalogy conference.* All the participants wore numbered name tags. Dr. Perrin was number 1, I think Steve Leatherwood was number 4 or 5, and I was number 11 or 12. As I stood in line for refreshments, a young man standing next to me looked at my badge and said "You must be older than dirt." He was a bit over his limit of refreshment. I checked on his badge—he was a four-digit number.

In addition to that project, the Navy also provided the logistical support to NMFS and USFWS in returning "GiGi," the orphaned gray whale, back to the wild. She was found on the beach and was one of the first baleen whales to be held in captivity. Even today, much of what is known about this species was learned during her brief holding at Sea World in San Diego (see Evans, 1974; Coerr & Evans, 1980).

BBC NEWS WORLD EDITION

Last Updated: Thursday, 27 March, 2003, 15:22 GMT

**Dolphins clear mines the natural way**

By Alex Kirby
BBC News Online environment correspondent

**Dolphins have been pressed into service in the coalition war effort in the Gulf.**

Two animals trained by the US Navy are helping to clear mines from the waters around the southern Iraqi port of Umm Qasr.

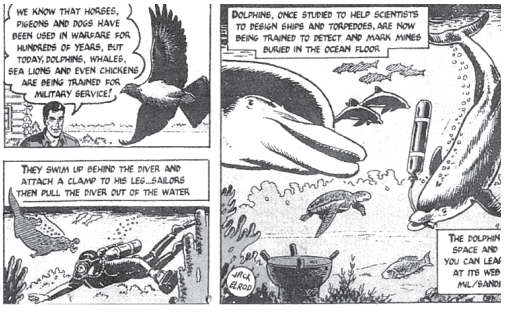
The coalition says the dolphins will help to make the port safe for aid cargoes and for other vessels.

The Navy says they are well cared for, and face little danger.

**"The dolphins are basically like underwater sniffer dogs"**

Major Andy Hopkinson

*Dr. Perrin will contribute an article to the Historical Perspectives section of *Aquatic Mammals* in the next few issues.





## FROM SEA WORLD TO ACTIVE DUTY

The Navy has plenty of high-tech gear poised to defend its fleet of carriers, cruisers and destroyers deployed in the Persian Gulf for possible war with Iraq. But the service has also quietly dispatched a low-tech team of military helpers: California sea lions.

The mammals have been flown from their home base in San Diego to Bahrain to see whether they can help protect U.S. ships against Iraqi frogmen and mines. Living in pens on land next to the Persian Gulf, the sea lions, which average around 350 lbs. each, will hop aboard boats and dive into the water near the ships they are protecting. Their keen eyes and hearing allow them to detect intruders or mines far better than their human counterparts. A sea lion can swim up to 25 m.p.h. for short bursts, enabling it to nab an underwater foe by snaring it in a clamp placed in its mouth. The sea lion then hands its prey, whether a submerged mine or a swimmer, over to human handlers.

In keeping with Defense Secretary Donald Rumsfeld's tight-lipped policy on revealing the number of U.S. troops near Iraq, the Navy won't disclose just how many of its 20 or so sea lions have been sent to the gulf. But unlike the human troops, who are all volunteers, the sea lions were drafted.

—*By Mark Thompson*

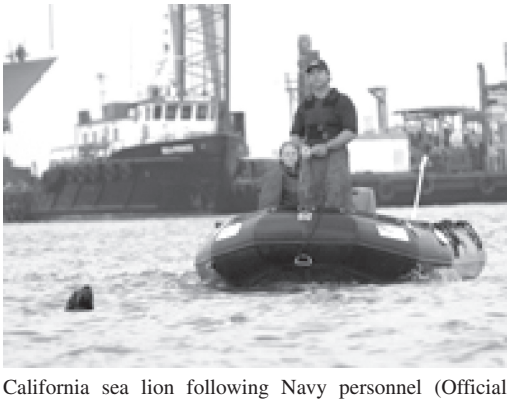
2/17/2003

Navy sea lion retrieving practice mine (Official U.S. Navy Photo)

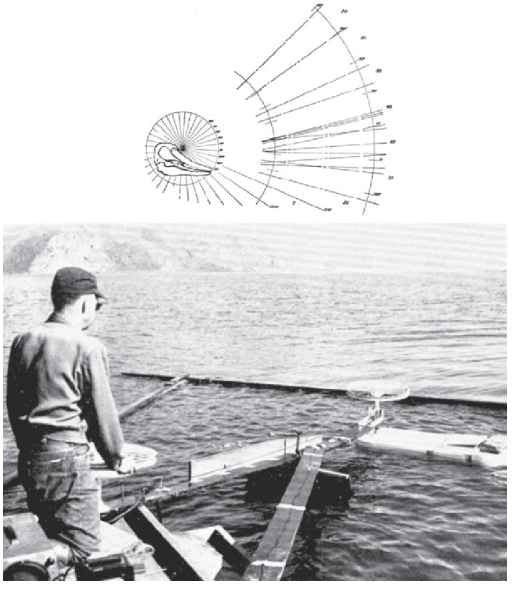
(For entire article, see *http://news.bbc.co.uk/2/hi/science/nature/2891629.stm*.)

During the early part of the Vietnam War, enemy swimmers, stripped down to avoid sonar, were attempting to put explosives on U.S. supply ships. In response to this threat, the Navy sent five dolphins to Cam Ranh Bay to protect the Army ammunition pier there. During this era, rumors circulated about a "swimmer nullification program" through which dolphins were supposedly trained to attack and kill enemy swimmers. This would have been highly ridiculous since capture of live prisoners is definitely more useful for information gathering. The Navy confirmed that such a program never existed. I think the idea of dolphins nullifying swimmers was mostly from the imagination of some reporter. Unfortunately, this type of sensationalizing by the media was not uncommon. The success of the deterrence efforts by the dolphins resulted in an expanded Navy program. The fact, based on satellite information, that the Soviet Union's Navy also had an expanding marine mammal program based in the Black Sea and patterned after ours, added urgency to the program. In light of the discovery of Soviet Union activities, emphasis was put on the development of a dolphin system countermeasure program. The success of

Bottlenose dolphin under command of Navy personnel in San Diego Bay (Official U.S. Navy Photo)



California sea lion following Navy personnel (Official U.S. Navy Photo)



Measuring a dolphin's acoustic beam pattern at Pt. Mugu (see Evans et al., 1964) (Official U.S. Navy Photo)

this program also resulted in deployment to other sensitive areas of operation in 1986 such as the Persian Gulf. It also stimulated the addition of a sea lion system, especially for finding and marking underwater mines. The obvious advantage of a sea lion over a dolphin system was the portability of the sea lion. It was commonplace to see a sea lion riding around the laboratory next to a sailor driving an electric cart. As the emphasis of the program shifted to operational programs, my interest with the program also shifted.

By the 1980s, the U.S. Navy Marine Mammal Program was expanding at an accelerated rate with an also expanding budget. Unfortunately (from a scientist's point of view), this expanding budget was for operational systems rather than basic research. One set of programs that did fair well involved the health care of marine mammals, including disease detection and treatment. The bulk of this research occurred in the late 1970s and 1980s, and it continues as an emphasis today.

Author viewing dolphins under water from *Sea See* (Official U.S. Navy Photo)

In 1974, U.S. President Richard Nixon and the Chairman of the Presidium of the Supreme Soviet of the USSR, Nikolai Podgorny, signed an environmental agreement. The agreement established the USSR-U.S. Cooperative Environmental Research Program. This opened the door for U.S. scientists to communicate openly with Soviet scientists working on marine mammals. During the Cold War Period, San Diego (so we are told now) was off limits to Eastern Block visitors. Since Dr. Sam Ridgway, C. Scott Johnson, and I had been communicating with Soviet colleagues working with marine mammals, we had visits from some of them. During a visit by Alexei Yablokov, we took his party on a cruise on the *RV Sea See*, a semi-submersible designed to observe marine mammals under water. As we passed the submarine base in San Diego, Dr. Yablokov turned to me and asked, "Why are your submarines so small, maybe to protect you from Mexico?" My reply was, "Alexei, they have to be that size and light since they are designed to fly." He smiled, made a note . . . and changed the subject.

As a part of the joint program, Dr. Dale Rice from the NMFS-NOAA and I were selected to participate in a Soviet Research cruise to the Eastern Tropical Pacific. When we had been at sea for a period of approximately 40 days, we made port in Panama. We were boarded by a Panamanian official . . . and were impounded. It seems that the boat had been a whale catcher boat and fishing vessel before being converted to a research vessel. Then, while going over the crew's passports, the officials found two official U.S. passports which convinced them that we were spies planning to infiltrate the United States. A Washington, DC, official explained our mission as part of the joint USSR-U.S. agreement for research, so we were allowed to leave (Evans, 2008). In hindsight, these initial meetings set the stage for scientific exchanges between the U.S. and Russia after the end of the Cold War.

With the end of the Cold War in the 1990s, military budgets were reduced, including that of the U.S. Navy Marine Mammal Program. The Hawaii Laboratory of NOSC was closed, and many of the personnel returned to San Diego. However, some of the research scientists, primarily Drs. Paul Nachtigall and Whitlow Au, stayed in Hawaii and established a Marine Mammal Research Laboratory at the Hawaii Institute for Marine Biology, part of the University of Hawaii. Nachtigall, Au, and their graduate students remain

**The Russian Saga**

In 1974, U.S. President Richard Nixon and the Chairman of the Presidium of the Supreme Soviet of the USSR, Nikolai Podgorny, signed an environmental agreement. This ended the long absence of our Russian colleagues from discussions of marine mammal protection and conservation. The agreement established the USSR-U.S. Cooperative Environmental Research Program, which opened the door for U.S. scientists to communicate and cooperate openly with Soviet scientists working on marine mammals, primarily because of their shared waters between Vladivostok and the shores of Alaska. Dr. Robert Miller of the National Marine Fisheries Service became the coordinator of this program. The participation in this program was of great interest to me since I had been reviewing the Russian marine mammal literature (both classified and unclassified) as a part of an assignment from the U.S. Navy and other government agencies. My major task was to evaluate the quality of the research and the main areas of focus. The opportunity to be able to meet and work with many of the scientists I had been studying provided an entrance for my many adventures with Russian friends and colleagues for more than 30 years.

My first trip to the Soviet Union was in October of 1974 to attend the International Theriological Congress in Moscow. Dr. Sam Ridgway, who was associated with the U.S. Navy research programs, accompanied me. During the visit, we were ushered around to meet with several Soviet marine mammal researchers, including Alexei Yablokov, Vladimir Sokalov, and Professor A.G. Tomilin. When I was introduced to Professor Tomilin by Alexei Yablokov, after much quizzing to make sure I was who I said I was and not some CIA operative, Professor Tomilin commented that I was much younger than he thought and said, "I am very pleased to meet a living classic." Sam Ridgway will never let me live that down, and for several years he introduced me as a "living classic!" Now that I'm much older, my initial dismay has turned into appreciation of age and the term "classic."

One of the main accomplishments of this first trip was establishing contacts with Soviet scientists working on related marine mammal problems. Several other trips followed through 1986. This cooperative marine mammal program is still alive and well.

One of the most exciting trips was with Dr. Scott Johnson in 1976. After our stay in Moscow, at the lovely Budapest Hotel right out of the Stalin era, Scott and I were given the opportunity to travel to Batumi in Soviet Georgia, which at that time was the location of the only public aquarium in the USSR with trained bottlenose dolphins. On the way to Batumi, we stopped in Kiev to visit scientists at the Neurophysiologic Institute. In the evening, we stayed in one of the major hotels and went to the "Dollar Bar," which catered to western tourists, as few as there were in those days. Sitting at a table across from us were three older women. They overheard us talking and came over to ask if we were Americans. We replied, "Yes." They told us they had just returned from a trip on the Trans-Siberian railroad, which had taken them a month. They were excited to hear someone else speaking English. We learned more about the Trans-Siberian railroad than we ever wanted to know—certainly enough to decide that we never wanted to go there!!

We then went on to Batumi where we were treated very royally. In fact we were guests of honor at the annual May Day Parade and seated in a box to view the parade. It was advertised that we were an official U.S. delegation. We even got bouquets of flowers from pretty little Russian girls with big bows in their hair. It was quite an impressive parade. I still cherish the dried flowers from that May Day Parade. In Batumi, we not only visited the aquarium and talked to the dolphin trainers, but we also visited a tea plantation and a facility that made Georgian cognac. I think we enjoyed the cognac more than the tea. We also participated in a Georgian barbeque.

While visiting the tea fields, I reverted back to my childhood and collected a nice green frog which I kept in a glass jar during the entire trip and the return to the U.S. When we were going through U.S. customs on our return, the customs officer looked in the glass jar at the frog and asked, "Where did the frog come from?"

I answered truthfully, "Georgia."

He said, "Georgia—okay, you can go." I'll never figure out how he thought I got a frog from Georgia while returning from the Soviet Union.

One of the more exciting parts of that program was the opportunity I was given in 1976 to participate as one of the scientists on board the Soviet Research Vessel *Vnuchetelnie*. Dale Rice of the NMFS Laboratory in Seattle, Washington, was the other visiting U.S. scientist. The ship was actually a converted whale catcher from the Vladivostok whaling fleet. The cruise was to study the oceanographic conditions and distribution of cetaceans in the Eastern Tropical Pacific. This included going into several oceanographic

stations as well as tagging cetaceans. The Soviet cetacean expert on board was Alfred Berzin, who was in charge of tagging whales. Berzin, while still active, died a tragic, mysterious death years later after the Soviet Union began to collapse.

After 41 days at sea and the end of my part of the cruise, we headed for Balboa, Panama, for resupplying and putting me ashore to fly back to California. When we sailed into the port at Balboa, we were radioed by the Port Authority and told to stand off and prepare for Panamanian officials to inspect the vessel. The officials from Panama went through all the passports and found it unusual that two of the crew (Dale Rice and I) carried passports from the U.S. government. The ship was escorted into the dock area and surrounded by Panamanian soldiers carrying automatic weapons. We were informed that we were impounded for illegally entering Panamanian waters and could not leave the ship.

Only the captain, his first officer, and the two suspected spies with forged official U.S. passports were allowed to leave with the Panamanian officials. I requested to speak with the U.S. authorities in Panama and was told they were all on vacation. Then I asked for permission to call my Navy sponsor at the Pentagon to clarify that this was a legitimate U.S.-USSR research project. I gave the ranking Panamanian officer in charge the phone number in Washington. He put the call on a speakerphone. The switchboard of Bob Stone in the Navy Research and Development Office answered, and the Panamanian official requested to speak with Mr. Stone. The operator said, "Just a minute; I'll connect you."

Unfortunately, I did not know that Bob Stone was attending a meeting in McLean, Virginia, at the headquarters of the CIA. The operator to whom we were transferred answered the phone, "Central Intelligence Agency." What a help!

We finally got Bob Stone on the phone, and he assured all officials that this was truly a U.S.-sanctioned research cruise. The problem with the ship was that of registry. When the Soviets turned the ship into a research vessel, they did not remove her from the international registry as a fishing vessel. Research vessels frequently are given courtesy of the port; foreign fishing vessels are not.

This was not the end to one of the most exciting research cruises in which I have participated. Once this port problem was solved, I prepared to return home. My Russian shipmates had a little going-away party, and then I packed my sea bag and departed for the airport. After all the passengers checked in for the flight, the U.S. customs inspectors had all the checked baggage lined up on the tarmac for identification before loading on the plane. Because of concerns about drug smuggling, out came the dogs. One big German shepherd worked his way down the line of bags and stopped at my sea bag and sniffed, again and again. The customs inspectors pulled my bag out of the line and requested I unpack it. I responded, "It's mostly dirty clothes."

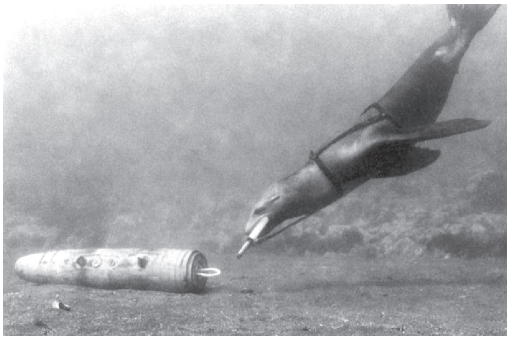
As I unpacked my bag, I unrolled some of my dirty underwear and out came an interesting assortment of cheeses, salami and dried fish and a jar of Beluga caviar. It seems my Russian shipmates had given me several presents to take home. Although it was not drugs, the inspectors immediately confiscated my contraband and sent me on my way. I think I either made one German shepherd or a bunch of customs inspectors very happy.

This was the prelude to more adventures with the crew of the *Vnuchetelnie*. When the ship returned to Long Beach, California, I took several of the officers and scientists to my home in Escondido, California—much to the surprise and questionable delight of my wife. She had prepared a dinner, complete with an expensive prime rib beef roast. Little did we know that the beef was not of interest, just how hot the seasoning could be. These sailors were from a cold country; they liked things really spicy. Out came Tabasco® and the red pepper sauce and anything else that Mexico could provide to clear the sinuses. Wow!! By the time the food was seasoned to their liking, the beef had disappeared into a red sauce of unknown heating quality, followed by a drowning in huge quantities of beer. My sons were fascinated, or overwhelmed—one or the other. The most amusing part was when my wife took a couple of our Russian friends on a shopping tour for women's clothing. She never gave me all the details, but she smiled for a week.

one of the primary research groups studying sensory and acoustic abilities of marine mammals using a small population of bottlenose dolphins and a false killer whale held in a floating-pen complex near the laboratory. The animals are former Navy dolphins and whales that were transferred from the Navy's Kaneohe Bay facility to the University of Hawaii several years after the Kaneohe Bay facility was moved to San Diego.

With this downsizing, all but one of the Navy's animal training centers were closed, leaving 103 bottlenose dolphins remaining in the program.

The decision was made to reduce that number to 70. Most of the marine mammal projects were declassified. Because of the MMPA regulations, this produced a problem—what to do with the surplus dolphins? Most of the marine parks holding bottlenose dolphins had successful breeding programs. When it was announced that the Navy had excess dolphins available for transfer, there were many interested respondents. In one instance, a U.S. Senator tried to get some animals placed in a facility he liked. The Navy transferred about 20 dolphins over a period of months based on marine park requests. With the downsizing, all but one of the Navy's animal training centers were closed. The Navy maintained a set of object-recovery sea lions in Charleston for several years after the downsizing. For many reasons, preparing the retirees for release back to the wild was not acceptable. Foremost, these dolphins likely would follow and approach boats, expecting to be fed.



California sea lion with biteplate attachment for retrieving mines (Official U.S. Navy Photo)

The current emphasis of the remaining program based in San Diego is on maintaining Navy operational marine mammal systems; acquiring through breeding (dolphins); purchasing younger animals (sea lions) to replace veterans; and training them to support the operational systems for mine detection, swimmer defense, and underwater recovery. Good health care is always critical in the maintenance of such programs. With recent concerns about the effects of increasing underwater noise levels, especially from new mid-range and low-frequency active sonar development, the Navy now has an active and innovative research program addressing those issues, which is substantially supported by the U.S. Navy Marine Mammal Program.

Reviewing the scientific contributions by the U.S. Navy to marine mammal science would require wading through over 400 scientific papers on such varied topics as hydrodynamics, sonar, hearing, echolocation, animal communication, radio-tagging, satellite telemetry, population surveys, physiology, anatomy, zoogeography, and behavior, to mention just a few (see U.S. Navy Marine Mammal Program, 2008).

This list does not include advances in satellite telemetry, acoustic recording technology, development of specialized equipment, and procedures like anesthesia for dolphins. Dolphins are used because of their exceptional biological sonar that is unmatched by hardware sonars in detecting objects in the water column and on the ocean bottom. In addition, sea lions are used because of their very sensitive underwater directional hearing and low-light-level vision. Both dolphins and sea lions are trainable and are capable of repetitive deep dives. Also, they can operate at depths and for durations which human divers cannot.

The Military Services have trained bottlenose dolphins and California sea lions into several "Biological Systems," including the following:

- Mark 4 is a dolphin mine-searching system that detects and marks the location of mines moored off the ocean bottom.
- Mark 5 is a sea lion mine-recovery system that locates pingered training mines. Sea lions can operate at depths up to 330 m.
- Mark 6 is a dolphin swimmer/diver-detection system that can detect and mark the location of a human intruder in the water. This system was used in Vietnam in 1970-1971 and in the Persian Gulf in 1987-1988.
- Mark 8 is a dolphin mine-searching system that detects and marks the location of mines on the ocean bottom.

The SSC Pacific facility continues research and also provides support for these operational systems.

Many people have concerns about the military's use of dolphins and sea lions in warfare. This is not a new concern. During my tour with the Navy, I was burned in effigy twice and even received a couple of death threats. Dolphins, whales, seals, and sea lions are very charismatic animals. In addition, many species are threatened or endangered, which adds to the public's concern. Whether or not the Russian Federation or other countries continue military marine mammal programs is unknown. Now, the dolphins from Soviet-era programs are being used to work with handicapped children or in dolphin-assisted therapy programs. Some of the other animals from that program are currently in zoos and aquaria. It is possible that Israel has a marine mammal program to detect aquatic terrorists. All of this aside, the U.S. Navy's programs have not only advanced our knowledge and understanding of marine mammals but have been instrumental in training many of this country's most productive young scientists.

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