

# **APPENDIX A**

## **NAVY MARINE MAMMAL PROGRAM SSC SAN DIEGO**

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**LIST OF ACRONYMS AND ABBREVIATIONS**

AAALAC	Association for Assessment and Accreditation of Laboratory Animal Care International
APHIS	Animal and Plant Health Inspection Services
ASC	Animal Safety Committee
AWA	Animal Welfare Act
BWG	Biotech Working Group
CFR	Code of Federal Regulations
COTS	Commercial off-the-shelf
MHD	Minimum horizontal distance
MMP	Marine Mammal Program
MMPA	Marine Mammal Protection Act
MMS	Marine Mammal System(s)
NATO	North Atlantic Treaty Organization
NMFS	National Marine Fisheries Service
SECNAVINST	Secretary of the Navy Instruction
SISS	Swimmer Interdiction Security System
SOP	Standard operating procedures
SSC San Diego	Space and Naval Warfare Systems Center, San Diego, CA
U.S.	United States
USDA	United States Department of Agriculture

## 1. HISTORICAL OVERVIEW

The United States (U.S.) Navy's Marine Mammal Program (MMP) began when the Navy acquired a Pacific white-sided dolphin (*Lagenorhynchus obliquidens*) for hydrodynamic studies in 1959. Navy scientists designing torpedoes were aware of the hydrodynamic efficiency of dolphins and were interested in determining whether dolphins did, in fact, have special characteristics that might be applied to the design of underwater ordnance. However, further work with this dolphin indicated that the unique physiological or hydrodynamic capabilities it possessed were limited in applicability to the Navy's hardware systems being developed at that time. Nevertheless, Navy scientists were impressed by the animal's other sensory and physiological capabilities as well as its apparent trainability, and they continued to support studies on how dolphins might be used to perform useful tasks.

In 1963, the Navy began a dolphin research program at Point Mugu, California, to support the studies initiated in the 1950s. Primary interests were in the study of marine mammals' developed senses and capabilities (such as sonar and deep-diving physiology). A major accomplishment was the demonstration showing that trained dolphins and sea lions could reliably work untethered in the open sea. In 1965, a Navy dolphin named Tuffy participated in the Sealab II project off La Jolla, California, carrying tools and messages between the water surface and aquanauts operating 200 feet below on the ocean floor.

In 1967, the Point Mugu facility and its personnel were placed under a newly formed organization, which has since undergone a number of name changes: Naval Undersea Warfare Center; Naval Undersea Research and Development Center; Naval Undersea Center; Naval Ocean Systems Center; Naval Command, Control and Ocean Surveillance Center Research, Development, Test and Evaluation Center; and, finally, the Space and Naval Warfare Systems Center San Diego (SSC San Diego). In 1968, the facility was moved to Point Loma in San Diego, California. Shortly after personnel moved to San Diego, a marine mammal laboratory was established at the Marine Corps Air Station on Kaneohe Bay, Hawaii. Some of the personnel and animals at Point Mugu transferred to the Hawaii laboratory, but over time the complete operation at Point Mugu moved to the new facility at Point Loma, San Diego.

In San Diego, the research and development program that was initiated at Point Mugu continued. This included further studies of marine mammal capabilities; development of improved techniques for diagnosis and treatment of marine mammal health problems; neuro-physiological studies; use of behavioral and other non-invasive techniques to gain a better understanding of how the dolphin brain functions; development of instrumentation for determining, by brain wave activity, the hearing range of cetaceans; and investigations of how dolphins vocalize. These studies were conducted with 10 species of odontocete cetaceans (toothed whales) and 6 species of pinnipeds (seals and sea lions), as well as several species of sharks and marine birds. Presently, only California sea lions (*Zalophus californianus*) and bottlenose dolphins (*Tursiops truncatus*) reside at SSC San Diego.

Marine mammal work at the Hawaii laboratory consisted of behavioral studies, reproductive physiology, further research on dolphin echolocation, and investigation of marine mammal potential for performing useful tasks more efficiently, safely, and cost-effectively than using human divers or deep submersibles. Four of the five current Navy operational marine mammal systems were developed in Hawaii, including a dolphin-based swimmer defense system. In

1993, as a result of the U.S. Military Base Closure and Realignment Commission action, the Hawaii laboratory was closed, and the animals, personnel, and selected facilities were moved to San Diego. The consolidation of military support activities was paralleled by a reduction and consolidation of the program at San Diego during the same period. Currently, the MMP focuses on the use of marine mammals (dolphins and sea lions) for protecting ports and Navy assets from swimmer attack, locating and assisting in the recovery of expensive exercise and training targets, and locating potentially dangerous sea mines. Research into animal care, health, physiology, behavior, and management of these marine mammals is also conducted.

## **2. MMP USE OF DOLPHINS AND SEA LIONS**

The marine mammals within the MMP provide unique capabilities for Navy undersea missions, particularly in finding and locating intruders and mines, which are capabilities that cannot be matched by existing technology. Although recent efforts in modernizing and upgrading the Navy's capability in detecting underwater mines and human intruders have been significant, there remain technological challenges associated with the detection, location, marking, and neutralization of underwater objects in harbors, rivers, and complex nearshore environments. To address these challenges, and until technological advances provide for use of underwater detection hardware in these types of environments, Navy marine mammals continue to perform required operational missions as assigned by the Chief of Naval Operations. All MMS underwent independent testing and evaluation when developed at SSC San Diego. The tests were administered by the Commander, Operational Test and Evaluation Force or assigned Independent Test and Evaluation Agents. To date, marine mammals have consistently outperformed other technology-based systems (such as remotely operated vehicles), demonstrating a high probability of completing their tasks while being efficient, reliable, and cost-effective.

Under the MMP at SSC San Diego, research and development continues in exploring the capabilities of marine mammals to conduct Navy tasks. During the 1970s and 1980s, the major components of the MMP were developed under the Advanced Marine Biological Systems Program. This program maintained the care, health, and management of the animals; pursued research that supported marine mammals in the Navy; and initiated the Navy's current operational Marine Mammal Systems (MMS) component. An MMS refers to a collection of personnel, equipment, operational processes, logistics procedures, and documentation that come together to perform a specific operation for the Navy's undersea mission. The key components of the MMP MMS are the mammals and their human teammates. (MMS is used in this document as both a singular and plural acronym.)

The MMP developed five unique MMS referred to as MK 4 to MK 8. The MMS fulfill requirements where Navy hardware is determined to be inadequate or human capability is an issue. The following five MMS are currently in operation.

- MK 4 is a dolphin searching system that detects and marks locations of deep water mines moored off the ocean floor.
- MK 5 is a sea lion mine recovery system that locates pingered training mines for retrieval. The sea lions can dive to mines placed at depths over 500 feet and then attach a grabber device for recovery by a vessel on the surface.

- MK 6 is a dolphin and sea lion swimmer and diver detection system that can detect and mark the location of an intruder in areas such as harbors, ship channels, and anchorages.
- MK 7 is a dolphin mine searching system that detects and marks the location of mines placed on the ocean bottom and buried under the sea floor.
- MK 8 is a dolphin system where dolphins are trained to swiftly identify safe corridors for the initial landing of troops ashore. MK 8 operates in very shallow water (10 to 40 feet sea level).

The typical MMS operation is for dolphins, sea lions, and the necessary equipment to be transported by small boat to an area where the animals are to search for an object/intruder. The animal enters the water as directed by the trainer and follows the boat while searching the area using its detection senses (either vision and hearing for sea lions or sonar and hearing for dolphins). If a target is identified, the animal returns to the boat, alerts the trainer, and is then given instruction by the trainer as to how to proceed (e.g., whether to mark or attach to the object). Usually, the animal is given marking hardware to facilitate retrieval and examination of the target by other security personnel. The MMP marine mammals are generally trained for a particular operational capability; however, animals may be cross-trained to better serve the program.

Dolphins were selected for the MMS because of their exceptional biological sonar that is unmatched by hardware sonar in detecting objects in the water column and on the ocean bottom in shallow water. Sea lions were selected because of their sensitive underwater directional hearing and low light level vision. In addition, dolphins and sea lions dive more quickly and easily than humans. They are capable of diving more than 1,000 feet in a matter of minutes. The primary advantage that dolphins and sea lions have over human divers is their ability to make repeated dives quickly without the threat of decompression sickness.

The MMS accomplish tasks that could not readily be accomplished by human divers. It takes several years for the bottlenose dolphins and California sea lions in the MMP to certify for a specific MMS. The animals are trained at SSC San Diego for operations elsewhere in the U.S. or around the world when needed.

The MMS have been successfully deployed by ship, aircraft, helicopter, and land vehicles to regional conflicts or staging areas around the world. In addition to participating in exercises and deployments worldwide, the current use of marine mammals at the Naval Submarine Base Kings Bay, Georgia, has demonstrated that the MMS is the most capable option for successfully interdicting appropriate targets.

SSC San Diego provides engineering, equipment, maintenance, veterinary care, marine mammals, and training for military personnel. The military and civilian personnel are trained as marine mammal handlers under the supervision of experienced civilian trainers. A senior civilian technical representative is assigned to each MMS to support the training of personnel and marine mammals.

### 3. MMP LOCATIONS

The MMP is headquartered at SSC San Diego. Most research, development, operations, maintenance, and daily marine mammal care and training occur in and around San Diego Bay and in the adjacent nearshore waters. Marine mammals are then deployed from SSC San Diego when needed elsewhere in the United States and around the world.

Training and operation of the MMS have occurred throughout the world. Training exercises have included waters in the vicinity of Asia, Australia, Canada, and Europe, and along the coast of the United States, including Alaska and Hawaii. Notable training exercises (full-scale rehearsal of military maneuvers) where the MMP participated include the following cold weather locations:

- Maritime Coordinated Operational Training—North Atlantic Treaty Organization (NATO) amphibious exercise off the coast of Newfoundland in 1998;
- Blue Game—NATO exercise in Europe (North Sea, Skagerrak, Kattegat, and Western Baltic area) during 2000, 2001, 2002, and 2004; and
- Northern Edge—Alaska training exercise during 2000 and 2001.

The MMP marine mammals performed well and were effective while participating in these exercises.

Military operations where the MMP participated include the following:

- Dolphins were used in Vietnam from 1970 to 1971 to protect harbor installations and ships against unauthorized human swimmers (Viet Cong) attempting to detonate Army munitions at Cam Ranh Bay. They were then deployed to Guam until 1972.
- Dolphins were used in the Persian Gulf (Bahrain) from 1986 to 1987 during the Iran-Iraq War to perform as sentries and protect the USS LaSalle.
- Dolphins patrolled San Diego Bay in 1996 when the Republican National Convention was held in San Diego.
- Operation Noble Eagle employed dolphins to perform security missions on U.S. military installations and at other potential terrorist targets from 2001 to 2003.
- For Operations Enduring Freedom and Iraqi Freedom, MMP military and civilian personnel, dolphins, and sea lions traveled and worked in the Northern Arabian Gulf including Iraq, Kuwait, and Bahrain beginning in 2003. In particular, the MK 6 MMS provided security for U.S. and coalition ships berthed at the Mina Salman pier in Bahrain until September 2005. During this time, the dolphins and sea lions were available for work assignments continuously every day for more than 2.5 years.
- A swimmer interdiction security system (SISS) utilizing MMP marine mammals was implemented at Naval Submarine Base Kings Bay, Georgia, in early 2005 and is currently in continuous operation at that facility.

#### **4. MMP FACILITIES**

MMP facilities at SSC San Diego include a veterinary clinic, fish houses and freezers, storage facilities, above-ground holding pools (20 feet in diameter and 20 feet by 40 feet) for deployment training, staff offices, laboratory and testing equipment, boats and piers, and marine enclosures.

The dolphin enclosures at SSC San Diego were constructed as open-air enclosures without above-water nets or fences. The enclosures have above-water decking and underwater netting separating the individual enclosures, which are each 30 by 30 feet square. The floating portion of the enclosures was constructed from commercial off-the-shelf (COTS) decking material and floats. Some enclosures were constructed from EZ-Dock, a COTS interlocking dock system. The underwater portion of the dolphin enclosures was constructed with stretch, box-shaped nets with 1.5- to 6-inch size openings that attach to the floating walkways. The mesh netting includes underwater gates that allow for dolphins to move between enclosures and socially interact.

The sea lion enclosures at SSC San Diego are closed both above and below water. Each enclosure has outside dimensions of 30 by 30 feet square with above-water fencing 6 feet high surrounding the outer enclosure perimeter. Deck space is available above-water for sea lion haul-outs. The underwater netted enclosures are constructed in the same way as the dolphin enclosures. Half of the open-water enclosure is designed as a common area with water access. The other half of the enclosure is designed as an area to separate the sea lions for health inspections and preparation for open-water excursions.

MMP enclosures for dolphins and sea lions exceed requirements for minimum size and depth as specified by the Animal Welfare Act (AWA) (9 Code of Federal Regulations [CFR] 3.104). For housing up to two bottlenose dolphins, the regulations specify enclosure minimum depth (6 feet), minimum horizontal distance (MHD) (24 feet), and minimum surface area (117.75 square feet). The MMP houses dolphins in socially compatible groups and assembles interconnected groups of enclosures such that one enclosure is available for each dolphin in the group. Each MMP dolphin enclosure has a minimum depth of 8 feet, MHD of 24 feet, and a surface area of at least 576 square feet. Incorporating additional requirements for minimum volume when housing more than two animals, each MMP dolphin enclosure meets the requirements to house up to four bottlenose dolphins. The result is that a group of MMP dolphins typically share a group of interconnected enclosures that, in total, are four times larger than the minimum federal standard.

Enclosures housing California sea lions must incorporate both a water or pool area and a dry resting area. For housing up to four California sea lions, the regulations specify enclosure minimum water depth (3.65 feet), MHD of water area (10.95 feet), minimum water surface area (213.16 square feet), and minimum dry resting area (213.16 square feet). The MMP houses sea lions in socially compatible groups of four animals. Each MMP sea lion enclosure has a minimum depth (6 feet), MHD (11.69 feet), minimum water surface area (278.57 square feet), and dry resting area (440.54 square feet). Incorporating additional requirements for minimum volume when housing more than four sea lions, each MMP sea lion enclosure meets the federal standard to house up to six animals.

## 5. ANIMAL MANAGEMENT PROGRAM

The MMP reviews, monitors, and adjusts the program based on best available science and program expectations and performance. The management concept for the MMP was developed to meet the Navy's internal policy guidelines requiring that Navy marine mammals be provided the highest quality of humane care and treatment. The MMP manages through committee policy direction; review of ongoing operations, research, and best available science when implementing this direction; and adjusting MMP practices when necessary to ensure that the MMP marine mammals receive the highest quality health and humane care and treatment according to the most recently available information. The MMP is continuously reviewed by several MMP committees and work groups. These committees and their functions include:

- *Institutional Animal Care and Use Committee.* The MMP is accredited by the Association for Assessment and Accreditation of Laboratory Animal Care International and adheres to the national standards of the United States Public Health Service Policy on the Humane Care and Use of Laboratory Animals and the Animal Welfare Act. As required by the Department of Defense, the MMP's animal care and use program is routinely reviewed by an Institutional Animal Care and Use Committee and the Department of Defense Bureau of Medicine.
- *Biological Technician (BioTech) Working Group.* The purpose of the Biotech Working Group (BWG) is to continuously assess training methodologies, facilities design, and husbandry procedures; to optimize the use of the animal program resources to support mission accomplishment; and to insure the animals receive the highest quality care. The Biotech Working Group is comprised of civil servant biological technicians who are assigned direct oversight for the operation of the Navy's marine mammal population. The BWG meets on a bi-weekly basis with attending veterinarians, contract supervisory staff and In Service Engineering Agent representatives. The BWG makes policy recommendations to the Division Head for the MMP with respect to animal training procedures and husbandry of marine mammals. The BWG reviews and makes recommendations on future animal facilities and hardware designs for use with Navy marine mammals.
- *Animal Safety Committee.* The purpose of the Animal Safety Committee (ASC) is to review animal safety issues and in particular, changes to hardware, methodologies and applications of training employed with the military assigned working animals. Committee emphasis is to insure that the safest hardware and equipment designs and methodologies practical are being employed. New hardware applications are reviewed prior to implementation. Existing hardware to be utilized in new areas or greatly expanded in application, such as transfer from use at SSC San Diego to Fleet systems are also reviewed. The ASC includes personnel with experience from animal training, veterinary service, military systems technical representatives, MMS hardware engineering and marine mammal research.
- *Safety Working Group.* The MMP has a personnel safety committee consisting of key personnel involved in MMP operations. The committee meets as required to review all personnel safety procedures, equipment use, training certifications, and other pertinent areas and to recommend updates/changes.

## **6. DOLPHIN AND SEA LION FOOD**

Frozen fish obtained from outside vendors are used to feed the MMP marine mammals. Examples of fish species fed to the mammals include capelin, herring, mackerel, and squid. The fish are initially stored in a large freezer room and are individually inspected, thawed, and cleaned in a fish house (sanitary kitchen) prior to feeding the dolphins and sea lions. The fish house is cleaned following each daily fish inspection, thawing, and fish cleaning. The MMP quality assurance program is equivalent to that required for restaurant-quality fish, including onsite inspections conducted at vendors' facilities by qualified personnel (e.g., Army Veterinary Corps inspectors) as fish are caught, frozen, and shipped. Fish are tested for histamine levels as an indicator of bacterial activity. Analyses are also conducted on the fish for caloric, fat, and protein content, which is needed to calculate daily intake for individual marine mammals. The fish houses are inspected monthly by an Army Veterinary Corps inspector and semi-annual inspections are conducted by an Institutional Animal Care and Use Committee. Per requirements set forth by the Secretary of the Navy Instruction (SECNAVINST) 3900.38C, the amount of fish fed to each animal is recorded daily by animal trainers. The dolphins and sea lions are also provided nutritional supplements.

## **7. DOLPHIN AND SEA LION TRAINING AT MMP**

Operant conditioning is the training technique the MMP uses to train dolphins and sea lions, whereby the consequences of a behavior affect the frequency of that behavior happening again. The MMP uses successive approximation and positive reinforcement as the standard method to establish system behaviors. Successive approximation refers to a behavior-shaping progression in which behavior comes closer and closer to a preset goal, and the marine mammals are rewarded for advances toward the goal. To maintain the desired behavior once it is established, an intermittent reinforcer (such as food) is used to ensure long-term responses. Positive reinforcement for the MMP is not limited to food. Tactile reinforcement and praise are used to reinforce the animals for correct behaviors. A behavior is broken down into small steps and trained one step at a time until the total goal behavior is complete. The key is to teach the animals without causing frustration. Positive relationships are developed between trainers and the MMP marine mammals.

Marine mammal training at the MMP affects the dolphins' and sea lions' natural behavior. The longer an animal has been in the care of humans, the more the animal relies on humans for food, sustenance, and protection. However, MMP marine mammals retain their ability to forage and evade danger when in the open-water environment because they are continuously exposed to the open-water environment during training and on exercises and deployments. MMP dolphins and sea lions are released to the open water on an almost daily basis and typically stay close to the boat and trainer. One of the most difficult steps in open-water training is building an animal's confidence to leave the home enclosures and enter open-water conditions. The MMP enclosures provide the animal's social bonds with other animals and security from the outside environment. The animals are not tasked in open water outside their enclosures until they have displayed precise responses to basic behaviors within enclosures. Once released to open water, trainers continuously evaluate an animal's responses to cues when working in these conditions. Also, the animals are outfitted with tracking equipment to aide a quick recovery should they become separated from the work boat (e.g., rough seas).

The MMP dolphins and sea lions are congregated into compatible social groups, as the animals have the opportunity to move about within the enclosures at the end of daily training. Both male and female dolphins reside in the MMP. The MMP also has a dolphin breeding program to produce replacements for aging MMP dolphins. Sea lions are procured from public display and other marine animal facilities, are all male, and are neutered or not sexually viable.

## **8. DOLPHIN AND SEA LION VETERINARY CARE**

Per SECNAVINST 3900.41E, the MMP is tasked to ensure that “all Navy marine mammals receive the highest quality of humane care and maintenance in accordance with all applicable laws and regulations.” Veterinary care, including emergency response, is available 24 hours a day, 7 days a week (including holidays) at all locations housing MMP marine mammals. Abnormal observations noted by an animal’s trainer regarding the health or behavior of an animal are reported to the attending or on-call veterinarian. Veterinary care plans include administration of supportive care or medications, diagnostic tests, enhanced observations of animal behavior and appetite, and/or changes in environment or social structure.

Direct veterinary care of marine mammals within the MMP is provided by a team of Navy and civilian veterinarians, Army Veterinary Corps officers, and enlisted veterinary technicians; and all are supported by animal trainers. The veterinary care program is currently overseen by the Head of the Scientific and Veterinary Support Branch and the Senior Scientist for Animal Care. A total of ten veterinarians serve the MMP animal population, including eight clinical veterinarians, a veterinary epidemiologist, and a senior scientist. At least one veterinarian and/or one veterinary technician accompany animals during all deployments outside SSC San Diego. For long-term deployment of animals, at least one veterinarian and veterinary technician are assigned to that location for the duration of the deployment. For deployments, all animals receive pre- and post-transport health examinations conducted by veterinarians.

The MMP preventative medicine program includes daily supplements, monthly or quarterly antiparasitics, and vigilant monitoring of animal health through routine examinations by veterinarians and daily assessments by trainers. The MMP marine mammals receive complete comprehensive physical examinations semiannually or annually unless otherwise directed by the attending veterinarian (e.g., during late-term pregnancy or early lactation). The physical may include an assessment of the animal’s vital signs (temperature, blood pressure, pulse, and respiratory rate), length, weight, and general physical appearance (eyes, abdomen, genitalia, musculoskeletal system, head and neck, skin, and extremities). Diagnostic testing may also occur including tissue sampling on feces, urine, and blood. An in-house clinical laboratory is used to process, archive, and ship animal samples to reference laboratories. Mobile clinical laboratories are used during animal deployments.

Diagnostic tests can include complete blood counts, serum chemistries, bacterial and fungal cultures, fecal examinations, antibody enzyme-linked immunosorbent assays validated specifically for bottlenose dolphins or California sea lions, and testing for marine toxins.

## 9. ENVIRONMENTAL HEALTH AND DISEASE POTENTIAL FOR MMP MARINE MAMMALS

To assess the aquatic environment where marine mammals are housed in San Diego Bay, the Navy employs the same water quality tests and diagnostics required by San Diego County and California State Health departments for recreational water deemed fit for human use. Routine water quality tests of animal enclosures include temperature, salinity, and weekly coliform counts. If coliform counts exceed the county threshold, a veterinarian is notified, samples are retested and, if necessary, mitigation strategies are implemented (e.g., movement of marine mammals to other locations), and the water is retested until levels return to normal.

Routine reports by local and state agencies regarding water contamination events, including sewage spills, oil spills, and harmful algal blooms, are provided to MMP management and the veterinary staff. Animal health concerns associated with water quality are addressed by the attending veterinarian and Senior Scientist for Animal Care. Specific and routine responses to water contamination events have been developed by the MMP to ensure immediate responsive actions particularly related to emergencies, adverse weather conditions, or other catastrophic events. To date, the MMP has had no reports of animal illness associated with harmful algal blooms. This includes the algal blooms occurring in 2007, as well as toxic blooms in 2002 and 2003. Wild sea lions that appear to be affected by these toxic blooms have been observed in San Diego Bay (Associated Press 2007) and within the vicinity of the MMP. It is believed that the Navy's animals are not affected by toxic blooms in southern California because their food is procured from vendors supplying fish from outside California and areas with toxic blooms. Navy marine mammal samples were routinely tested for marine toxins during 2004.

Communicable diseases, including bacterial and viral infections, have been reported among wild marine mammals, particularly several types of virus of the genus *Morbillivirus*. These include dolphin morbillivirus, which killed several thousand striped dolphins (*Stenella coeruleoalba*) in the Mediterranean Sea during the early 1990s (Aguilar and Borrell 1994) and unknown numbers of bottlenose dolphins in the western Atlantic during the late 1980s and Gulf of Mexico in the mid-1990s (review in Kennedy 1999); phocine distemper virus, which produced large die-offs of harbor seals and gray seals in Europe in the late 1980s and 2002 (review in Kennedy 1999; Jensen et al. 2002; Wohlsein et al. 2007); and canine distemper virus, which caused mass mortalities among Baikal seals (*Phoca sibirica*) in the late 1980s and Caspian seals (*P. caspica*) in 2000 (review in Kennedy 1999; Kennedy et al. 2000). Morbillivirus may have been the causative agent in an epidemic which killed approximately 50 percent of the largest colony of endangered Mediterranean monk seals along the Mauritanian coast of Africa in 1997 (Di Guardo et al. 2005).

Morbillivirus infections may occur in marine mammals without overt clinical signs of disease or causing death, and no marine or terrestrial reservoirs have been identified since the epidemics in the 1980s and 1990s (Wohlsein et al. 2007). A recent test of eleven individuals from four different odontocete species sampled in the northeast Pacific, along the coast of British Columbia, found that none had dolphin morbillivirus antibodies (Van Bresse et al. 2001). Antibodies to dolphin morbillivirus have been detected in common dolphins (*Delphinus delphis*) from southern California (Reidarson et al. 1998), placing the virus inside the range of the MMP marine mammals. To date, MMP animal populations remain immunologically naïve (unexposed) to known marine morbilliviruses.

Because of the species-jumping history of morbilliviruses, there is a possibility that these forms could infect MMP marine mammals. To date, the MMP marine mammals have not demonstrated population exposure to morbilliviruses. Aside from morbilliviruses, there are limited tests available for disease known to be communicable to bottlenose dolphins and sea lions. The Navy has quarantine facilities at all MMP deployed locations for those animals that could be found to harbor a communicable disease of population health concern.

There are no reported incidents in which the presence of MMP marine mammals has led to disease introduction from an MMP animal to the wild marine mammal population. Although the MMP marine mammals socialize with other marine mammals within the MMP, they are not encouraged to socialize with wild marine mammals. While training and working outside of their enclosures, the trainers attempt to avoid areas where other wild marine mammals are observed. However, this is not always possible because some marine mammals may be underwater and not observable by the trainers when the MMS boat initially enters an area. Thus, a Navy marine mammal may encounter a wild marine mammal while training or working. When this has occurred in the past, trainers have rarely observed interactions between the animals. Although the animals were aware of each other, they were observed by the trainers to avoid contact.

MMP strategies to prevent disease transmission among Navy and wild marine mammals are based upon discussions with local and state wildlife agencies; review of marine mammal diseases documented in the area of interest; and a population risk assessment involving the likelihood of novel introduction of a disease to an unexposed and susceptible population, documented mortality rates, and potentially negative impacts on reproduction. The risk assessment approach used by the MMP is based upon the U.S. Department of Agriculture's (USDA) generic non-indigenous risk assessment process and has been used for other species to assess the risk of introducing new diseases to various locations (Orr et al. 1993). If a communicable disease present in the area has been identified as a potentially high risk to either the MMP or wild marine mammals, a plan is implemented by the attending veterinarian, in concert with local and state wildlife agencies, to prevent disease transmission between the two populations. In addition to routine, transport-associated physical examinations, veterinarians also implement pre- and post-transport quarantine periods as required to monitor animals for illness and to conduct diagnostic tests for previous exposure, active shedding, and/or active infection. Due to the relatively high risk potential of morbillivirus infections compared to other marine mammal communicable diseases, paired morbillivirus antibody tests and viral cultures are always conducted before deployments outside southern California. These animals are also tested upon their return to check that they were not infected during deployment.

The Navy follows strict guidelines to avoid transfer of diseases between humans and marine mammals. These guidelines follow recommendations from Geraci and Ridgway (1991) and the Association for Assessment and Accreditation of Laboratory Animal Care International (AAALAC) guidelines. Safety measures can include wearing gloves and other protective gear when handling animals; avoiding contact with animals when trainers are ill or immunocompromised; using additional safety equipment when risks of acquiring an infection are high; use of necropsy, husbandry, and laboratory procedures that minimize the risk of cuts and injuries; and washing hands thoroughly after contact with animals and specimens. Most injuries reported by marine mammal workers are cuts and scrapes followed in frequency by bites (Mazet

et al. 2004). There have been no incidences of disease transfer between humans and MMP animals.

The MMP marine mammals have high survival rates. While the average life expectancy for wild bottlenose dolphins is 25 years (as calculated by van der Toorn 1997 from data in Wells and Scott 1990), the MMP has numerous dolphins aged 40 to 50 years. For bottlenose dolphins, life expectancy was not shown to be significantly different between wild and captive dolphins (Small and DeMaster 1995; DeMaster and Drevenak 1988). However, recent data have shown that dolphin life expectancy in captivity has been increasing, presumably from increased knowledge of raising dolphins in captivity (Woodley et al. 1997). Wild male sea lions have considerably lower maximum longevity (17 years) but this is primarily due to mortality inflicted among competing breeding males. More than a third of the Navy's sea lions are more than 20 years old.

## **10. DOLPHIN AND SEA LION TRANSPORT**

When it is necessary to transport the MMP dolphins and sea lions for deployment outside of San Diego Bay, they are trucked, placed aboard ships, and/or flown in cargo aircraft equipped for the transport of animal transport containers. Dolphins at SSC San Diego have been transported outside of their facility for over 35 years. Marine mammal transportation procedures exceed relevant regulatory and accreditation guidelines including 9 CFR Chapter 1, USDA Regulation Subpart E, Specification for the Humane Handling, Care, Treatment, and Transportation of Marine Mammals. All transports are planned in advance to ensure that the necessary equipment and personnel are available for the transport, as well as at the location of deployment. Transport staff include a transport coordinator and planner, trainer, safety officer, veterinarian, and other support staff. The MMP staff are also responsible for providing guidance regarding liaison with outside agencies with respect to marine mammal transport, care, and maintenance when animals are transported outside of San Diego Bay.

For any transport over 2 hours in duration, the attending veterinarian will accompany the animals. The veterinarian works cooperatively with the transport coordinator and safety officer to ensure that the animal's comfort and health are maintained during the transport. Pre-transport briefings are held in advance of the transport to address logistics and assign responsibilities. One of the responsibilities of the transport coordinator is to ensure that an adequate number of trained personnel are available to monitor and/or attend to the dolphins and sea lions during transport at all times. At the pre-transport briefing, all involved parties receive guidelines and procedures along with specifics particular to the transport. A final transport briefing is held at least one day prior to the transport to ensure that requirements necessary for personnel and animal safety have been met. As previously described under Section 7, Dolphin and Sea Lion Care, if any animal is to be transported for more than 2 hours, a veterinarian assesses its health prior to transport. At least 48 hours is allowed for laboratory results, thus requiring the health assessment to occur no less than 2 days and no more than 10 days before the transport. During the week prior to the transport, equipment needed for the transfer and deployment is cleaned and assembled to ensure all parts are available and functioning properly.

For land transports, flatbed or enclosed trucks are normally used in transporting the MMP marine mammals. In addition, at least one safety vehicle accompanies the transport truck(s). Specific procedures have been developed for use of the dolphin and sea lion transporters to ensure the safety and comfort of the animals. The animals are kept wet, cool, and shaded at all times.

Animals are cleaned and their waste removed as needed during transport. Procedures are followed to ensure that additional clean water is available for use and exchange when needed. Animal respiration rates, ambient temperature readings, and animal activity levels are monitored throughout the transport. Each animal's trainer is required to be near the transport carrier at all times to ensure that he/she is aware of the animal's safety and comfort during movement. The driver is required to take slower speeds and avoid rough areas that might lead to bumps and vibrations. The trainer has direct contact with the driver via radio to immediately inform the driver of any animal behavior that may indicate discomfort or if there are changes in the animal's position that may need more secure cushioning. A refrigerated food supply is also provided with transport.

Each transport animal is under constant surveillance. The attending veterinarian is notified immediately if rapid respiration rates or any other health concerns are observed. After arrival at the deployment site, the attending veterinarian assesses the animal's health. At the new site, a 24-hour watch is conducted to monitor the transported animal. A post-transport review is conducted by the transport coordinator or attending veterinarian after each transport.

Air transport of the MMP marine mammals is similar to that described for land transport. Generally, the air transports are planned with at least a 30-day advance notice. Cabin pressure and ambient temperatures are controlled and recorded throughout flight to ensure appropriate conditions. Animals are continuously monitored for body temperature variations. Shallow angled ascent and descent of the aircraft are necessary to prevent water from spilling out of the animal's transport carrier and to ensure that the animals are entirely moist and/or wet at all times. Flight operations personnel are informed of required cabin pressures, temperatures, and flight take-off and landing angles well in advance of the transport to ensure that the plane and pilot can meet these conditions continuously during the transport. Transport from the plane to the operations site follows the truck procedures described above.

Ship transport also occurs with similar procedures as described above for truck and air transport. On ships, however, dolphins are housed in specially designed pools. Water depth is monitored continuously and water quality is tested on a daily basis. If animals are housed on ships during deployment, they are given regular exercise in open water, and compatibility between animals is required prior to placing MMP marine mammals together in a pool. At the transport location, all required equipment and facilities are in place prior to the transport. Pools are cleaned when animals are employed for open-water exercises. Pool watches are required at all times (24 hours) to monitor animal safety and security. All watch personnel must be trained by SSC San Diego staff on pool operation and emergency procedures. The watch personnel may not conduct any other activity when watching the dolphins. Specific pool conditions must be written in a log throughout pool watches, including animal pool conditions such as water flow, depth, and quality.

## **11. MINIMIZING OPEN-WATER RISKS**

MMP marine mammals working under care of their trainers are released into the open ocean on an almost daily basis. The animals are not tasked in open water outside their enclosures until they have displayed precise responses to basic behaviors within their enclosures. Once released to open water, trainers continuously evaluate an animal's responses to cues when working in these conditions; however, MMP marine mammals have occasionally become separated from

their workboats. This can happen for a variety of reasons, including inclement weather or mechanical problems with the boat. When an MMP marine mammal becomes separated from its workboat, trainers recall the animal with an acoustic recall pinger. The pinger is a low-power, sound generator that is lowered by hand into the water from the side of a boat. The pinger is omni-directional, and the sound is transmitted into the water. This pinger is a commercial device that has been used for many years by the MMP. The marine mammals are trained to respond to the sound from the pinger as an emergency recall.

Each animal is also outfitted with radio and satellite transmitters that can be used to locate an animal when it is out of range of the acoustic pinger recall. Program personnel are well trained in the use of these tracking devices and can quickly ascertain a marine mammal's location. When the MMP marine mammal is located, the trainers travel to the animal and then use pingers and positive reinforcement behaviors to retrieve the marine mammal.

Whenever an animal does not return to its workboat or respond to a pinger, the trainer immediately contacts the MMP to report a missing animal. Information on the location of the boat and most recent location of the animal is reported. This would occur if an animal does not respond within 5 minutes. If neither a pinger nor a transmitter can locate the marine mammal, the first location physically searched is the MMP home enclosure. This is the most likely location where animals are found. If the animal is not found at the MMP enclosures, satellite telemetry system tracking for the animal commences. Additional MMP staff become involved in the search, and telemetry is used to find the animal. Harbor police and the U.S. Coast Guard may be notified, along with the Navy public affairs officer for SSC San Diego and/or the cognizant Navy commanding officer.

To ensure that any equipment placed on an animal does not injure it; all equipment has been approved by the MMP Animal Safety Committee and is attached with breakaway materials (dissolvable links, suction cups, and adhesive and/or magnetic rubber band connectors). Animals wearing equipment are closely monitored at all times and are never left unattended. The animals wear the equipment only when working with trainers, and not when they are within their enclosures. If the animals behave abnormally when the equipment is placed on them, an indication of a potential equipment malfunction or incorrect placement, the equipment is immediately removed.

## **12. REGULATORY OVERVIEW AND COMPLIANCE**

The MMP complies with all laws and regulations applicable to the use of animals in government defense programs, and to marine mammals specifically, as described below.

SECNAVINST 3900.41E, Acquisition, Transport, Care and Maintenance of Marine Mammals, prescribes the policies and procedures governing the care and maintenance of Navy marine mammals. The policy states that Navy marine mammals will be provided the highest quality of humane care and treatment and will be maintained in accordance with federal law and regulations. The MMP at SSC San Diego is designated the lead laboratory for all Navy-sponsored programs for marine mammals, responsible for ensuring the Navy adheres to the provisions of the instruction, while serving as the principal liaison with other federal, state, and international agencies. The MMP has designated a Senior Scientist for Animal Care who directs

and supervises a program of animal husbandry and veterinary care for all mammals within Navy responsibility.

As directed by Department of Defense Directive 3216.1, the MMP is also accredited by AAALAC, a private nonprofit organization that promotes the humane treatment of animals in science through a voluntary accreditation program. AAALAC evaluates organizations using animals in research, teaching, or testing and accredits those organizations that exhibit excellence in animal care. Accreditation implies quality, scientific validity, accountability, and commitment to humane animal care. The accreditation process begins with a comprehensive internal audit conducted by the institution applying for accreditation. Members of the AAALAC International Council on Accreditation, which include animal care and use professionals and researchers, then review the institution's internal reports and conduct their own comprehensive assessment. Institutions are reevaluated every 3 years to maintain their accredited status.

The AWA is the law establishing minimum care, maintenance, and operating standards for captive animals, including marine mammals. Regulations enforcing the AWA are administered by the USDA, Animal and Plant Health Inspection Service (APHIS). These regulations specify facility licensing, permitting, animal registration, and inventory and medical records requirements; and the establishment and operation of an Institutional Animal Care and Utilization Committee at institutions holding marine mammals. Veterinary care requirements for facilities, personnel, equipment, drugs, and pathology and necropsy procedures are established. Operations and transport standards are delineated for animal enclosure construction, materials, dimensions, maintenance, and sanitization; food preparation and handling; animal feeding, observation, and training; water quality; security; and personnel qualification and instruction. The MMP maintains a program of animal care that meets or exceeds APHIS regulations but, as a U.S. government organization, does not require a license from APHIS and is not subject to inspections. However, APHIS personnel with nationwide inspection responsibility have regularly visited the MMP facilities, and MMP staff annually submits the APHIS form associated with annual inspections.

The Marine Mammal Protection Act (MMPA) of 1972, as amended, establishes a national policy designated to protect and conserve wild marine mammals and their habitats. This policy is established so as to not diminish such species or population stocks beyond the point at which they cease to be a significant functioning element in the ecosystem, nor to diminish such species below their optimum sustainable population. The Department of Commerce, National Oceanographic and Atmospheric Administration, National Marine Fisheries Service (NMFS) is responsible for reviewing federal actions for compliance with the MMPA. In addition, NMFS is tasked with maintaining an inventory of all marine mammals in U.S. facilities. MMP staff regularly submit inventory reports and updates to NMFS, specifically the Office of Protected Resources, so that the Navy's animals can be included in the inventory, and they notify the agency prior to acquiring animals from or transferring marine mammals to other facilities.

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