Appendix A

Exhibit 1

Review Article by Michael Moore et. al.

Review Article

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REHABILITATION AND RELEASE OF MARINE MAMMALS IN THE UNITED STATES: RISKS AND BENEFITS

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ABSTRACT

Rehabilitation of stranded marine mammals elicits polarized attitudes: initially done alongside display collections, but release of rehabilitated animals has become more common. Justifications include animal welfare, management of beach use conflict, research, conservation, and public education. Rehabilitation cost and risks have been identified that vary in degree supported by data rather than perception. These include conflict with fisheries for resources, ignorance of recipient population ecology, poor understanding of long-term survival, support of the genetically not-so-fit, introduction of novel or antibiotic-resistant pathogens, harm to human health, and cost. Thus facilities must balance their welfare appeal against public education, habitat restoration, human impact reduction, and other conservation activities. Benefits to rehabilitating marine mammals are the opportunity to support the welfare of disabled animals and to publish good science and so advance our understanding of wild populations. In specific cases, the status of a population may make conservation the main reason for rehabilitation. These three reasons for rehabilitation lead to contrasting, and sometimes conflicting, management needs. We therefore outline a decision tree for rehabilitation managers using criteria for each management decision, based on welfare, logistics, conservation, research, and funding to define limits on the number of animals released to the wild.

Key words: rehabilitation, release, conservation, education, animal welfare.

SCOPE

The purpose of this review is to describe the recent history of and legal basis for the rehabilitation of marine mammals in the United States. We make no attempt to focus on other regions of the world. The reasons for and against, and uncertainties associated with, undertaking rehabilitation are discussed in the context of individual animal welfare, fundamental science, conservation biology, and ecosystem management agendas. A strategy for when rehabilitation with or without release should be attempted is then proposed, given these concerns. This review is less about science than it is values, ethics, and risks, given what we do and do not know.

BACKGROUND

Marine mammals are poorly known, charismatic species that command considerable scientific inquiry and public attention. When these animals are found on land, they generate responses varying from concern over their welfare to interest in the potential environmental factors causing them to come ashore, in addition to attention from hunters where legal. These responses, motivated by a variety of animal welfare, conservation, research, and cultural goals, have resulted in coordinated efforts at times to collect and in some cases to attempt to rehabilitate stranded animals. Gradually, conservation with concomitant needs for better understanding of threatened and endangered species has emerged as an alternate to purely animal welfare agendas as an aim of stranding response. The high public profile, monetary expense, and labor efforts involved in rehabilitation programs with unclear aims have exposed them to criticism from the research and conservation communities. Thus, although extant programs evolved from a welfare origin, they now raise conservation concerns, and there needs to be a review of the relative merits and values of these endpoints. Marine mammal rehabilitation is an effort that currently lacks a coherent central set

of core values, ethics, or goals. As a result, the effort is ill defined (except on the most local level) and, in many cases, self-contradictory. After more than a quarter of a century, the effort remains inconsistent, poorly supported, and fractious. Efforts to correct this will require either internal change by stranding organizations or changes by external regulation.

Legal and Historical Perspective

Workshops to improve coordination were held in 1977 (Geraci and St. Aubin 1979, St Aubin *et al.* 1996), 1987 (Reynolds and Odell 1991), and 1991 (St Aubin *et al*. 1996). The program was reviewed by the National Marine Fisheries Service (NMFS) in 1990 (Wilkinson 1991). In 1992, an amendment to the Marine Mammal Protection Act (MMPA) established centralized coordination of marine mammal stranding response efforts in the United States, with a national stranding coordinator to standardize regional network operations and define national stranding response policy. More recent steps are summarized in the interim release guidelines (Whaley and Borkowski 2006). These guidelines give detailed protocols for release decisions, but do not attempt to address the philosophy or ethics of such actions.

Today a series of independent organizations around the United States responds to stranding events and/or undertakes rehabilitation of cases that are not immediately translocated and released or euthanized. Stranding response groups include federal and state agencies, museums, research laboratories, academic institutions, public display facilities, as well as dedicated rehabilitation centers. Most do not undertake rehabilitation.

The rescue of marine mammals is covered in U. S. law by two provisions of the MMPA. Section 109 (h) allows for the "taking" of marine mammals for "A) the protection or welfare of the mammal, B) the protection of public health or welfare or C) the non-lethal removal of nuisance animals." In 1992, the MMPA was amended to include Title IV (The Marine Mammal Health and Stranding Response Act), which requires NMFS to collect and disseminate information about the health of marine mammals and health trends of marine mammal populations through the collection of stranding data. The legal framework for stranding response then identifies three different goals of stranding efforts—welfare of individual animals, protection of human health or welfare, and the collection of scientific information that may be used for management and conservation—without clearly identifying a priority or decision tree to address conflicting goals.

In the 1970s, release of rehabilitated stranded marine mammals was not considered a serious issue. Most animals either did not survive or were placed in permanent collections in zoos or aquaria. The numbers of animals recovered, facilities available to treat them, and numbers of animals that survived were all small. As knowledge of marine mammal medicine and husbandry improved, the rehabilitation concept grew, and the capacity of aquaria and other display facilities to absorb rehabilitated animals effectively shrank proportionally. Stranded animals increasingly took the place of captured animals for public display facilities. Less space, however, became available for permanent care. The emergence of infectious disease as a factor in strandings (Goldstein *et al.* 2004) further reduced permanent holding capacity by discouraging public displays from holding stranded animals. Release became more of a consideration and the *de facto* goal of an increasing number of "rehabilitation for release" programs.

"Rehabilitation" itself may be defined in two slightly different ways, either as an attempt to return an animal to full health or to return it to a reasonably functional

condition. Although one view is likely overly idealistic and one is overly pragmatic, the difference is more than purely semantic. The efforts and ethics involved in the former are more far reaching than those aimed at returning an animal to some degree of function or health. The vagueness of even this most basic concept simply adds to the conflicting values and options within which stranding organizations work.

The 1991 workshop (St. Aubin *et al*. 1996) undertook a systematic review of marine mammal rehabilitation in general, and release issues in particular. There was general agreement that the health of wild populations should be of greater concern than the welfare of an individual animal. This would seem to tip the balance in favor of conservation when it and welfare concerns collide. Issues of highest concern were risks of introduction of disease into wild populations and the potential genetic consequences of releasing rehabilitated animals (Wilkinson and Worthy 1999). The reader should refer to the St. Aubin report and the Wilkinson review for important historical and technical background. In this review, we consider current best practices. A complete literature review as well as an alternative view of rehabilitation programs has been published recently from a Canadian perspective (Measures 2004).

The first two eras in the evolution of marine mammal rehabilitation could be classified as (1) beach management and (2) advancing veterinary care. The former is perhaps best represented in the publication of a field guide for responding to strandings (Geraci and Lounsbury 1993), and the latter is reflected in a recent benchmark textbook (Dierauf and Gulland 2001) and a more comprehensive stranding guide (Geraci and Lounsbury 2005). It is reasonable to suggest that with the advent of reliable and increasingly small and affordable satellite-linked transmitters, GIS software, and the ability to transmit vast amounts of data via the Internet, the current era, building on the prior two, should be based on animal welfare and conservation, and focused on research and validation of rehabilitation techniques by postrelease tracking. The costs of clinical testing and veterinary care were once considered prohibitive and largely an exercise in "treating a dying animal." Such tests are now considered essential tools for collecting useful scientific information on disease epidemiology and pathogenesis, and a necessary part of even minimal treatment programs. Future programs may rely as much on tools to assess the results of rehabilitation and its effect on wild populations as previous programs used clinical analysis and veterinary care to better understand the treatment of individuals. Such programs that focus on selected animals through multidisciplinary studies can yield new knowledge useful in the welfare of individuals and the conservation of wild populations.

Table 1 summarizes the current level of effort being invested in marine mammal rehabilitation and release in the various coastal regions of the United States. Growing populations of pinnipeds are the primary targets, with most activity in the Southwest, followed by the Northeast and Northwest regions. Cetacean rehabilitation and release is far less common nationally.

Marine mammal rehabilitation raises a suite of philosophical questions about ethics and human values, the answers to which depend on a range of perspectives (Lavigne *et al.* 1999). The animal welfare advocate, conservationist, research scientist, hunter, or commercial fisherman see marine mammals from many perspectives: as sentient beings, as important components of their natural ecosystems, as scientific resources, as quarry and food, or as detractors to profit margins. Such concerns may be, but are not necessarily, mutually exclusive. Attitudes toward marine mammals and wildlife in general have changed dramatically since the establishment of stranding networks and vary according to region and other demographic variables (income, age, education level, sex, race). Most support and detraction for rehabilitation programs is of a local nature, thus the agenda and expectations vary regionally, with the

Table 1. Mean total per year of live and dead strandings and admitted and released rehabilitation cases.[a]

	NE	SE	SW	NW	HI	Total U.S.
Pinnipeds						
Live stranding	338	5	1,294	111	3	1,751
Dead stranding	278	4	921	110	1	1,314
Admitted for rehab	172	2	1,164	75	0	1,413
Released after rehab	63	2	630	46	0	741
Cetaceans						0
Live stranding	56	94	20	3	7	180
Dead stranding	261	625	122	33	7	1,048
Admitted for rehab	5	7	7	2	2	23
Released after rehab	1	3	0	0	0	4

[a]Years 1995–2004 except NW 1995–2002. Data unavailable from Alaska. NOAA data sources by personal communication March and April 2006: NE: Mendy Garron, 1 Blackburn Drive, Gloucester, MA 01930; SE: Blair Mase 75 Virginia Beach Dr Miami, FL 33149; SW: Joe Cordaro, 501 West Ocean Blvd., Suite 4200 Long Beach, CA 90802; NW: Brent Norberg, 7600 Sand Point Way, NE, BIN C15700, Bldg. 1 Seattle, WA 98115; HI: David Schofield, NOAA Pacific Islands Regional Office, 1601 Kapiolani Blvd, Suite 1110, Honolulu, HI 96814.

different economic and employment climates driving different attitudes, as well as with the species of marine mammal being rehabilitated. Stranding organizations are often directly dependent on local funding and support for their work. As a result, local public attitudes toward wildlife in general, and specifically marine mammals, strongly influence the missions of stranding organizations. As rehabilitation programs evolve to include conservation and research and/or education in their missions, there needs to be a clear understanding of how to combine different perspectives to avoid misconstruction, misrepresentation, or conflict among staff, funders, and the general public, and to make the most effective use of very limited resources. Ideally, organizations will maintain core values while applying locally appropriate attitudes and ethics—within the structure of legal rules and guidelines.

Reasons for Rehabilitating Marine Mammals

Rehabilitation facilities around the United States publicly refer to one or more of the following reasons to justify their actions. Such reasons include:

1. Humane care of animals, especially intervention in cases impacted by human activities
2. Mitigation of human/animal beach use conflict
3. Research, both applied to rehabilitation and care of collection animals and other more fundamental disciplines
4. Conservation of endangered species
5. Postrelease tracking to elucidate poorly understood wild population ranges, as well as to monitor postrelease survival and behavior
6. Education of the public about marine ecosystem health and marine mammal conservation

Humane care—Welfare of the individual animal forms the base of veterinary medicine and is the driving force for marine mammal rehabilitation. Removal of netting that is cutting into a pinniped's neck provides immediate relief for the

(a)

(b)

Figure 1. (a) Rehabilitation of animals entangled in fishing gear is perhaps one of the most obvious justifiable targets for rehabilitation efforts. (b) Where populations such as these California sea lions verge on the pestilential, the value in routine rehabilitation efforts can be brought into greater question.

animal and gratification for the rehabilitator (Fig. 1a). However, decisions on the beach can be far more complex. Faced with a distressed marine mammal, it may be necessary to prognosticate the relative pain and suffering of long, drawn-out rehabilitation treatment and potential retention in captivity for the remainder of its life, compared to euthanasia. Furthermore, limited availability of holding facilities necessitates euthanasia on a sliding gradient of criteria as the caseload varies. Such acts can induce a negative public image and result in loss of support. However, in a world where resources are limited, and decisions to not euthanize an animal can lead to significant further chronic suffering in the wild or captivity, with inevitable ultimate demise, the well-informed and carefully measured application of euthanasia should not be overlooked. The Greek etymological root of *euthanasia* is "a good death." It is incumbent upon rehabilitation organizations and governmental agencies to educate the public that rehabilitation is not necessarily in the best interests of the individual, and suffering may best be alleviated through euthanasia. For example, 18% of stranded adult California sea lions (*Zalophus californianus*) examined postmortem in California had disseminated cancer (Gulland *et al.* 1996). Because this disease is painful and progressively debilitating, due to vertebral and spinal cord erosion by tumors, early diagnosis and euthanasia is considered the most humane treatment for these animals by those authors, and rehabilitation resources have been directed at early diagnosis rather than treatment.

Furthermore, welfare of stranded animals must be carefully evaluated to prevent anthropomorphizing and not acting in the best interests of an individual animal's welfare. For example, euthanasia may be a more humane option for a beached large whale than prolonged attempts at rehabilitation. Similarly it is the policy on Cape Cod, Massachusetts, to euthanize single stranded cetaceans, other than phocoenids, irrespective of condition, as they have shown a very poor survival rate when beach released, or in rehabilitation.

Beach conflict—Different areas of the U.S. coast vary in their relative densities of humans and pinnipeds on beaches that at least in part drive regional management styles and constraints for stranded marine mammals. The distribution of stranding responders in the continental U.S. west coast ranges from multiple facilities and agencies serving single counties in California, to three entities serving the entire state of Oregon. Differing attitudes are driven by the intensity of the haul-out space conflict between humans and pinnipeds. Where such conflicts are most intense, such as in parts of California and New York, the humans that are displacing pinnipeds may be the engine driving local rehabilitation efforts. In contrast, Oregon, with a largely undeveloped coastline, does not rehabilitate pinnipeds that come from stocks that are not endangered, threatened, or depleted.[1] In Alaska, conflicts arise owing to vast differences in cultural attitudes to marine mammals among residents. In an extreme example, a seal harvested in late pregnancy was eaten by one group of people, whereas its pup, born by cesarian section, was rehabilitated by another.[2]

Conservation/enhancement of endangered species—The NMFS ran a translocation and rehabilitation program for Hawaiian monk seals (*Monachus schauinslandi*) in the 1980s on Kure Atoll to enhance juvenile survival of this declining endangered species. The rehabilitated seals may be some of the few surviving females from that decade

[1]Personal communication from Tammy McGuire, Oregon Stranding Network Coordinator, P. O. Box 17, Yachats, OR 97498, 10 December 2004.

[2]Personal communication from Pamela Tuomi, Alaska Sealife Center, P. O. Box 1329, Seward, AK 99664, 3 February 2006.

alive in the 21st century. Thus, rehabilitation of a few individuals of a critically endangered species can be important to the maintenance of reproductive females. The monk seal story, however, also illustrates the risks and limitations of rehabilitation and enhancement programs. Similar translocations of monk seal pups to Midway Atoll in 1992–1993 resulted in the disappearance or death of most pups. In 1995, twelve pups captured for transfer to Midway Atoll developed eye problems during rehabilitation, resulting in blindness in most pups. Concerns about the risk to the wild population (Aguirre *et al.* 1999) prevented release, and the seals are now held in permanent care facilities. The program was suspended in 1998 when blood samples from wild-caught seals appeared to indicate antibodies to morbillivirus in one island subpopulation, although subsequent testing showed the virus not to be present. The survival rates of wild pups have not been good in recent years, and the captive care program without translocation was started again in 2006 on Midway Atoll (http://www.pifsc.noaa.gov/psd/captivecareproject.php). The program's efforts have been reviewed by Lavigne *et al*. (1999) and in Marine Mammal Commission annual reports.

Although release of rehabilitated animals is often presented as a means of enhancing depleted populations, in fact many conservation concerns are inversely density dependent. If the number of released animals becomes large relative to a smaller wild population, disease and genetic impacts from released animals could potentially be greater. Thus, both potential value and potential risk increase when releasing individuals into small wild populations. The majority of pinnipeds rehabilitated in the United States today, however, are from species or stocks that are from numerically healthy populations (*e.g.*, 180,000 California sea lions [Fig. 1b], 100,000 harbor seals [*Phoca vitulina*] in the Gulf of Maine [Waring *et al.* 2004]), so that the numerical conservation value to the population of rehabilitating a single animal is nonexistent.

The conservation value of rehabilitation as an outreach and education tool is discussed later.

Research—It is important to realize that many questions facing marine mammal science cannot be addressed in the rehabilitation context. However, advances by the study of animals in rehabilitation include the following disciplines, with examples from each: infectious disease (Duignan *et al.* 1995, Gulland *et al.* 1997, King *et al.* 1998, Thornton *et al.* 1998, Lipscomb *et al.* 2001, Haulena *et al.* 2002, Maratea *et al.* 2003, Haulena *et al.* 2006), medicine (Gulland *et al.* 2000, Fauquier *et al.* 2003, Lander *et al.* 2003), pathology (Ridgway and Carder 2001, Fauquier *et al.* 2003), parasitology (Ferti and Landry 1999, Poynton *et al.* 2001), management (Dierauf 1984), human interaction (Howorth 1994, Goldstein *et al.* 1999), immunology (King *et al.* 2001), and zoonoses (Colagross-Schouten *et al.* 2002). Increased information on these topics enhances our understanding of marine mammal health. Although most studies are based on common species, much information also applies to the management of threatened and endangered species.

There has been a steep increase in the number of published scientific papers on marine mammals since the early 1970s (Lavigne *et al*. 1999). These authors also noted an increase in professional societies and laboratories dedicated to marine mammal science. They conclude that the increase in publication seems to far exceed what would be expected simply from the trends in the number of scientists, projects, and particularly funding. When corrected (to 1978 dollars), U.S. funding for marine mammal research has remained nearly flat both in absolute terms and as a fraction of total research dollars. In contrast, public funding of some (but not all) nonprofit rehabilitation organizations with active research and education

programs has increased dramatically (see annual reports for The Marine Mammal Center [http://www.tmmc.org/about_us/financials.asp]), suggesting that rehabilitation activity can be used to increase funding and, in some cases, rehabilitation can be used to attract public interest in marine mammal research, as long as the research activities appeal to public opinion.

Postrelease tracking—Many rehabilitated animals that have been tracked have shown unexpected movements, and whether this is a result of the pathophysiological abnormality that caused them to strand or normal for the individual within a population range cannot be determined yet. Recent studies have shown, however, that behavior of wild-caught juvenile Steller sea lions held for up to several months in captivity did not differ significantly from free ranging counterparts following release (Mellish *et al.* 2006). Tracking has also shown that Steller sea lions survive postrehabilitation and that their dive behaviors are similar to wild pups of the same age despite rehabilitation in shallow tanks (Lander and Gulland 2003). Two rehabilitated bottlenose dolphins (*Tursiops truncatus*) of the little-studied intermediate and offshore forms were tracked for 43 and 47 d, respectively (Wells *et al.* 1999*b*), revealing possible new information about ranges for these forms of the species, although it cannot be stated with any certainty that the dolphins' movements were representative of animals that did not strand and undergo rehabilitation. Similarly, tracking and subsequent resighting of rehabilitated rough-toothed dolphins (*Steno bredanensis*) over a period of 5 mo demonstrated the success of rehabilitation efforts as well as the location of a previously undescribed stock of rough-toothed dolphins (Wells *et al.* 1999*a*).

Two rehabilitated pilot whales (*Globicephala melas*) survived at least 4 mo postrelease (Nawojchik *et al.* 2003). Thus, there are significant successes and research advances that have been published both for cetaceans and pinnipeds. However for most species, there is no way to control for survival studies of releases, given the lack of a suitable control population, thus making it hard to validate rehabilitation techniques and procedures.

Education and outreach—Marine mammals in rehabilitation may be used as centerpieces for education and outreach programs highlighting conservation needs. A live animal in rehabilitation due to a health problem arising from habitat degradation can be used for effective outreach programs about habitat conservation. Thus, an entangled animal in rehabilitation may do more for conservation through its role in an outreach program than it does through a numerical contribution to the population after release. Present regulations, however, prohibit the display of animals undergoing rehabilitation, further dampening the participation of public display institutions in rehabilitation. Educational programs must be carefully constructed and managed unless animals have been designated as nonreleasable and are in permanent care.

Reasons against rehabilitation of marine mammals—Risks associated with rehabilitating marine mammals can be considered in three categories: issues presently supported by scientific data (see 3, 4 below); issues with a theoretical basis but no data to support them as yet (see 1, 5, 6 below); and "perceived" issues that current data do not support (see 2 below). These risks include:

1. Conflict with other stakeholders: Populations showing a significant growth in numbers that may be perceived a competitor with local fisheries
2. Artificial support of the genetically not-so-fit by releasing rehabilitated animals that otherwise would have died on the beach through natural selection processes
3. Introduction of pathogens acquired or modified during rehabilitation to a naïve wild population

4. Transmission of zoonotic infections to humans interacting with animals being rehabilitated
5. Expense: costs to rehabilitate individuals may not have the same benefit as other population-wide conservation measures
6. Conflict with conservation goals for other more threatened or endangered species

Management conflicts—Many marine mammal populations, especially pinniped, are growing: the Northwest Atlantic harbor, harp (*Pagophilus groenlandicus*, hooded (*Cystophora christata*), and gray (*Halichoerus grypus)* seals and California sea lions on the west coast are good examples. As a local population grows in size in proportion to the capacity of regional rehabilitation facilities, the proportion of animals that can be managed humanely out of habitat shrinks. This question also blends into issues of broader management concern, as a growing pinniped population becomes a perceived or real threat to the sustainability of fisheries. At some point, there will be an increasingly vocal demand from the fishing industry for resumption of culls. This is a reality today with regard to the California sea lion.

Some species cross not only local but also international borders and demographics. In these cases, attitudes and values may be starkly contrasting. Such juxtaposition is evident where four flipper-tagged harp seals were rescued, treated, and released in New York waters, and returned to their home range in Canada only to be harvested in local hunts.[3]

Genetics—There is a concern that rehabilitation of genetically "less fit" animals may interfere with natural selection and alter host–parasite population dynamics. The limited studies to date have pointed to a lower survival and increased susceptibility to disease of animals with higher degrees of inbreeding in sea lions (Acevedo-Whitehouse *et al.* 2003), striped dolphins (Valsecchi *et al.* 2004), and gray seals (Bean *et al.* 2004). There are abundant empirical data from terrestrial species indicating that the coevolution of host and parasite tends to modify pathogenicity of the parasite and increase the resistance of the host (Toft and Karter 1990). By artificially enhancing survival of an infected host to reproductive age by removing parasites, rehabilitation could interfere with host–parasite coevolution. One potential outcome is to reduce the adaptive pressure keeping more virulent forms of parasites and disease in check and allowing more damaging forms of disease to develop (Ewald 1996).

Early on in the marine mammal rehabilitation era, the number of rehabilitated animals was so small that population-level genetic effects seemed to be remote. The size of the wild population in relation to the released population was sufficient to allay most fears about serious effects to wild populations, and this was a *de facto* assumption of the day. This view does not account for potential effects from localized release of animals or the increase in the number of animals released, and as rehabilitation programs become more successful, this premise may no longer hold true.

Introduction of pathogens—A released rehabilitated animal could introduce a novel or modified pathogen that it acquired in rehabilitation into the marine environment, and potential effects on a naïve wild population could be devastating. Pathogens could be acquired from terrestrial hosts, such as canine distemper, leptospirosis (Stamper *et al.* 1998), or influenza, or be enzootic marine mammal pathogens altered by the rehabilitation process. This can occur as an unwanted side effect of treatment. Pathogens can be modified by contact with new hosts, or modified by

[3]Personal communication from Robert DiGiovanni, 6 Wakefield Road, Hampton Bays, NY 11946, 1 May 2005.

treatment (antibiotic resistance) or changes in selective pressure. An ecological perspective (Ewald 1996) proposes that pathogens adapt to changes in their environment by altering their pathogenicity. In humans it has been proposed that less virulent forms of cholera out-compete more damaging forms when spread of the disease is made more difficult (through sanitation), resulting eventually in a less severe form of the illness in hosts. By contrast, incomplete treatment with antibiotics and crowding can favor more virulent strains (that replicate, spread, and cause disease more quickly with less adaptive pressure to spare their hosts). A recent study documented an increase in antibiotic-resistant *Escherichia coli* in elephant seals (*Mirounga angustirostris*) through the rehabilitation process (Stoddard *et al.* in press). The high-density housing inherent in captive husbandry also elevates the risk of disease transmission from other hosts, such as humans and domestic animals. With increasing pressure to treat more animals more quickly, rehabilitation centers, if viewed ecologically, would be just the environment to alter pathogens in a way that could promote virulence. Although this result is not a given, it should be one of the warnings that the effects of a rehabilitated animal on a wild population are not necessarily a statistical moot point. This latter concern is perhaps most starkly voiced in a recent Canadian review of the subject (Measures 2004): "Concerns about Canadian marine mammals at risk such as the killer whale, St. Lawrence beluga, blue whale, harbor porpoise etc. threatened by diseases potentially carried by straddling stocks of marine mammals rehabilitated in the U. S. should be formally conveyed to the U.S. Government."

Health risk to humans—Morbillivirus, influenza, caliciviruses, leptospirosis, seal finger, and other zoonotic risks have been previously reviewed (St. Aubin *et al*. 1996) and are all diseases of concern with rehabilitation operations in regard to humans. Brucellosis has more recently emerged as a further concern (Maratea *et al*. 2003). Protection of people is inadequate, as many of these infections are asymptomatic in marine mammals yet can cause severe and occasionally fatal disease in humans. Our understanding of the carrier status of individuals is only as good as our capacity and effort expended to investigate the status of specific pathogens in a particular individual. Thus, one must assume that there will be zoonotic pathogens present that remain undetected in healthy marine mammals.

Expense—Costs associated with rehabilitation of individual animals far exceed those associated with sampling dead or euthanized stranded marine mammals. In one example, a cetacean rehabilitation facility in the southeastern United States treated 25 nonendangered dolphins or small whales over a recent 5-yr period. Of these, 9 dolphins were released, 13 animals died or were euthanized, and 3 dolphins were considered nonreleasable and placed into public display. The average cost of hospital operations leading to the release of each dolphin was more than $157,000 (not including extensive volunteer service or facility construction costs). Dividing the hospital operating costs for the 5 yr by the number of days of treatment of the nine released dolphins yields a cost of more than $1,225 per animal-day, over an average of 130 d of care for each individual. A recent review of U.S. west coast odontocete rehabilitation has shown "that the success of rehabilitating and releasing stranded odontocetes in California is minimal, and the stress of stranding and rehabilitation in addition to pre-existing disease can result in morbidity and mortality" (Zagzebski *et al.* 2006). In another example, a pinniped rehabilitation facility on the U.S. west coast over a recent 5-yr period treated an average of 632 individuals each year, at an average cost of $2,500 each. These latter pinniped costs per animal are lower compared to the cetacean example owing to a very large case load, small space, and

water allowance to yearling animals, and a short survival time of some due to the facility's euthanasia policy. An extreme expense was the rehabilitation of a young gray whale "JJ" by Sea World Inc (Andrews *et al.* 2001). There is a question as to whether funds for rehabilitation of live animals would be better spent for other purposes (funding research, education, or conservation). The answer is complex and likely to depend on local attitudes and values toward animals, science, and conservation. It is likely that in some cases, funds for rehabilitation would not be available for other pursuits, but in other cases, the funds for rehabilitation are drawn from budgets that would otherwise support research.

It is important to recognize that the general public tends to support welfare agendas more readily than less tangible scientific or even conservation agendas, whereas the latter tend to be supported by private and governmental agencies. It should also be recognized that the opinion and agenda of funding agencies and the general public can evolve with careful education about the costs and benefits of different management strategies. Recently, the Monterey Bay Aquarium adopted a policy to euthanize stranded sea otter (*Enhydra lutris*) pups that could not be placed into a surrogate hand-rearing program. On the basis of their experience of 20 yr rehabilitating sea otter pups, this organization determined that the rehabilitation of preweaned pups without a surrogate female was unlikely to be successful and decided to use limited funds on other aspects of sea otter conservation rather than rehabilitation. This decision has been very controversial and illustrates the conflict between an agenda that encompasses the sum of economic, practical, and survival expectancies *vs.* one that is driven more by the overarching value of the welfare of an individual animal without looking at the broader contexts. It also highlights the public outreach dilemma for an organization encouraging coastal conservation while "killing" a charismatic keystone species from the same ecosystem.

Conflict with other conservation goals—On both coasts, pinniped (sea lion on the west coast and harbor seal on the east) populations are growing at roughly 10% annually. They are routinely rehabilitated under agreements from NOAA Fisheries, an agency also charged with conserving endangered salmon stocks that are preyed on by sea lions and seals.

Uncertainties Involved with Marine Mammal Rehabilitation

1. Lack of information about how best to release an animal
2. Ignorance about the reproductive potential of released animals
3. Risk of abnormal behavior in the wild resulting from human interactions during captivity
4. Capacity to forage successfully once released
5. Ignorance about long-term survival

Release uncertainties—Common operational dilemmas exist, such as, "Is it better to transport an animal for release a long distance (into a "more suitable range") or to release an animal near its stranding site?" This decision (and even the general guideline to release an animal into "home range") is challenging in those cases where such background information is not available for the release candidate. This puts rehabilitators in the position of taking an action, and the managers in the position of creating release guidelines (NOAA 1997) that cannot be demonstrated to be in the animal's best interest.

Reproductive success—The ability of released rehabilitated marine mammals to reproduce successfully is largely unknown.

Human interactions—The interaction of animals being rehabilitated with humans during rehabilitation can lead to interactions in the wild that result in released animals becoming "nuisance" animals, in some cases begging from humans. This has occurred with California sea lions, sea otters, and bottlenose dolphins. It is hard to predict such cases prior to release.

Inability to forage—The ability of rehabilitated animals to forage independently cannot be accurately predicted prior to release. Because of vast differences between captive and wild environments, it is difficult to simulate and assess foraging capability during treatment. Although animals can (and often are required) to be exposed to live prey items, the relevance of such tests has not been rigorously evaluated. If an animal cannot forage in the wild, a slow death due to malnutrition and its complications can be viewed as subjecting a released animal to pain and suffering, thus questioning the animal welfare tenet of undertaking rehabilitation.

Inadequate assessment of long-term survival—There is a paucity of unbiased information, exacerbated by an understandable willingness to publish successes and move on from the failures and a difficulty in publishing null results in the peer-reviewed literature. Data are theoretically available but relatively rarely published from satellite tag tracks, visible tag returns, photo-identification, and restranding events. The last feature should be available from "Level A" data submitted to NMFS regional stranding coordinators but has not thus far been systematically summarized in an available format and fails to account for mortalities that occur at sea. Disseminating data should be considered a part of "good animal care." Furthermore, rehabilitation of oiled birds and marine mammals after oil spills has also had limited success (Brody *et al.* 1996, Estes 1998, Jessup 1998).

Conclusion

A decision on whether rehabilitation of marine mammals is justified in the United States currently depends on personal/institutional philosophy. A conservationist might argue that the potential negative impacts (discussed earlier) of released rehabilitated animals on the recipient population might sway the balance to favor judicious use of euthanasia, beach release of "appropriate" (not a risk to the wild, and likely to survive) mass stranded animals, and sustenance of captive colonies with selected rehabilitated candidates as appropriate. Captive colonies and data acquired in stranding response may educate government agencies and the voting public about the need for habitat conservation. They also may encourage commercial and recreational marine practices that minimize human impacts that induce morbidity and mortality of marine mammals.

An animal welfare advocate might argue that the intrinsic worth of well-being to an individual marine mammal in itself justifies whatever efforts can be afforded to apply, irrespective of species status, final result, or cause of stranding. However, fiscal reality would perhaps suggest that such investment should be made by the interested private sector, rather than by taxpayers through governmental support. Taking this one step further, it would be reasonable to ask, for example, whether the $157,000 spent to rehabilitate a single dolphin that stranded as a result of natural selection might have been better applied to improving the welfare of thousands of con-specifics through increased public education, law enforcement, or research activities.

A scientist might see management of live and dead beached marine mammals as an opportunity for the curious to further our knowledge and apply such understanding to matters of conservation.

The above arguments are not necessarily mutually exclusive, but they do result in different priorities being established in the mind of each individual involved in the practice of marine mammal rescue and rehabilitation. The challenge is to find the common ground and the greater good. Finding this common ground will also require educating members of the public, who expect every live stranded animal to be properly cared for, about the relative costs and benefits of each option described earlier. In particular, the value of euthanasia at the right time should be understood.

With increasing research and a maturing of stranding programs comes a need to better manage data generated by these programs. An important current evolution in expectation from funders is the ethical position that the sharing of data constitutes good animal use. Open access to data, as outlined in an abstract by Ian Boyd to be found on-line (Littnan and Ragen 2003), should be a prerequisite of future federal funding of marine mammal stranding response and be at a defined level of data sharing above the current basic data requirement in the United States. There are models for such data consortia, and the appropriate management of intellectual property, such as the multiinstitutional databases maintained by the Right Whale Consortium (www.rightwhaleweb.org) that are overseen by members of the peer group within which the data are being generated and shared. In this way, issues of authorship and duplication of effort are managed proactively.

Rehabilitation effort can be based on a scale of degree of animal suffering, likelihood of success, conservation value, likely destination for the animal (*e.g.,* Will space be available to assimilate a nonreleasable dependent dolphin calf into a collection if it is decided to rehabilitate it?), and scientific/educational value. This should follow a system that is used by Institutional Animal Care and Use Committees, among others, to determine ethical treatment of experimental animals. Stranding networks should adopt similar guidelines for evaluating those four criteria, following experimental community techniques. In particular the three tenets of reduce, refine, and replace (the three *R*s) can be interpreted in the marine mammal context by reducing the number of animals managed but with refined (improved) protocols that maximize welfare, research, and conservation goals. Replace in this context would mean examination of dead or rehabilitating animals in the place of work with live, healthy captive animals where possible. Rehabilitation centers should also establish Animal Care and Use Committees where currently absent.

Were rehabilitation only extended to threatened and endangered species, only sea otters, monk seals, sirenians, Steller's sea lions, Guadalupe fur seals, and (in theory) various large whale species would be rehabilitated in the United States. The above concerns would not be reduced (and in fact would be magnified) in a small population. Restoration programs, trying to rebuild stocks of animals using captive stocks (probably a best case scenario) have had mixed success (Griffith *et al.* 1989). Among the most popular attempts have been those involving California condors, Arabian oryxes, red wolves, peregrine falcons, golden lion tamarins, and black-footed ferrets.

Stranding response has been organized and regulated by law in the United States for over a quarter of a century, and many of the organizations that participate have been active in the field for a decade or more. These organizations and the networks that have grown up (formal and informal) represent an institutionalization of those efforts. As the above discussion demonstrates, however, they have done this without

a central set of goals, values, or ethics. As such, they work within a field that must accommodate self-contradictory practices, methods, and purposes. Is it acceptable to rehabilitate marine mammals but unacceptable to either retain them in captivity or release them to the wild? Or is it only acceptable to rehabilitate marine mammals if they are released to the wild? Faced with such basic and inescapable self-contradictions, what direction is there for marine mammal rescue, rehabilitation, and release?

There are three basic possibilities: stop, do nothing, or progress. Stopping marine mammal rehabilitation and release has been the option chosen by many public display organizations once the risk of contagious disease to captive populations was clearly realized. Although some organizations invested in separate treatment facilities for stranded animals, few could justify the more than doubling the efforts and simply stepped away from rehabilitation efforts. Stopping release of rehabilitated animals would also be the most conservative option for protecting wild populations and has been proposed (Measures 2004) as a policy. This option, however, is at odds with values for stranded marine mammals in many parts of the United States and requires that they be left on the beach or euthanized. The former would only be viable in extremely isolated regions, where stranding response is also likely to be least active. Thus, in this scenario a careful, considered policy that regards euthanasia as a desirable endpoint in certain situations is a policy that has proven to be viable in some regions, as long as care is given to educate those present on the beach, and the public at large, as to the benefit of such an approach and the risks of other strategies.

The option to do nothing about the current state of the art best describes the present situation, a situation that is described (Lynn 1999) as a "values gridlock" where progress is impeded by an inability to resolve conflicting values.

This leaves the most acceptable option, to progress. To do this, we believe it is necessary to clearly identify those components that make up a well-rounded organizational structure. Progress will require adopting, supporting, and strengthening each component. In this way, stranding organizations will share common values and objectives. We suggest three components: science, ethics, and legal regulation. We suggest science as a core value and defining characteristic for stranding programs. Science is not value neutral and should be done within a context of appropriate ethics. Ethics would make up the second component of the organizational model. Although ethics will be more varied from organization to organization and from location to location, there may be some common ground. In addition to the three *R*s mentioned earlier, Lynn (2004) has outlined some useful principles that may serve as a starting point. In the field of animal experimentation, ethicists use the concept of the "Burden of Justification." In the case of experiments that may cause animal suffering or produce an ecological risk, the burden to justify those activities lies with the experimenter. This would change the relationship with NMFS concerning release of rehabilitated animals where facilities are required to release animals unless legally instructed to retain them—essentially the reverse principle.

"Harm Benefit Ratios"—Rehabilitation efforts should be evaluated on whether the likely benefits to science, nature, or knowledge outweigh the potential harm to individuals or populations. Although this concept is outlined in the language of the MMPA and it is a part of new NMFS guidelines (Whaley and Borkowski 2006), it remains a difficult task and one that should be more readily identified and supported. In other fields of animal use, the concept of "Endpoints" is used to identify at what point an activity should cease because the cost or risk to subjects is too great to continue. Organizations should develop, identify, and be responsible for establishing those points within their operations. Although well intended, organizations are

continually tempted to undertake actions that they may not have the capability to complete. For example, beginning the rehabilitation of a cetacean without necessary support because it is thought that if the process is started they will "find a way." In other fields, this would not be considered professional, or reasonable, and is at best, although a common practice, ethically questionable.

The final component of a program model would be sufficient legal framework to shape and guide programs without restricting them. Presently, guidelines are being proposed by NMFS to improve release evaluations and set standards for rehabilitation facilities. Both are significant and needed steps. If, however, these guidelines do not have the desired effect, of raising standards and reducing concerns about release risks, a second option might be to regulate the number of animals (of each species) released by a facility. This number would be based on both population dynamics of the host population and the capabilities of the organization—those with higher standards and better records of scientific contribution allowed the greater portion. In this way, the regulating organization would be able to directly regulate the return of animals to the wild. This final option would likely produce a drastic change to rehabilitation procedures, but organizations are unwilling or unable to change, there may be little alternative.

We therefore suggest that managers, in consultation with experts from the veterinary, conservation, welfare, and population biology fields, develop guidelines for when to intervene with stranded marine mammals, and how to manage those in rehabilitation, so as to balance the arguments made earlier (*e.g.,* as shown in Fig. 2).

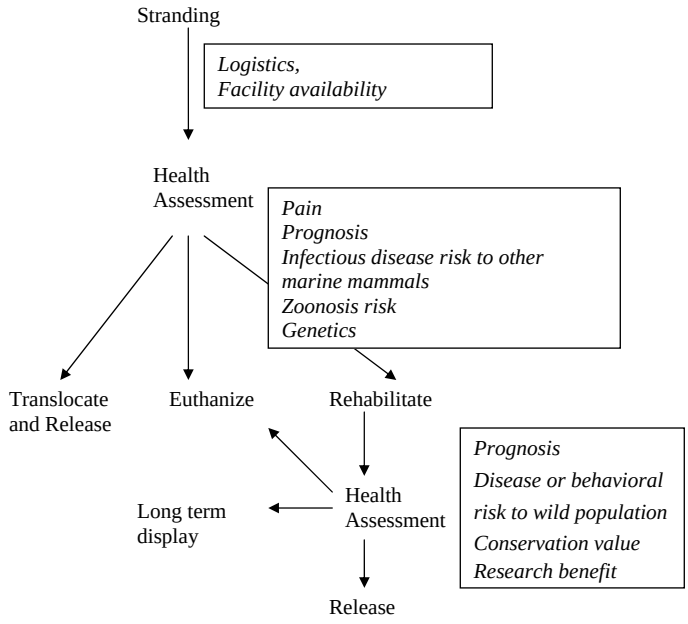

Figure 2. Schematic decision tree for the management of live stranded marine mammals. At each health assessment stage, the relative conflicts of cost, chronic pain, prognosis, zoonosis, and genetic and microbiological impacts *vs.* risks to the conservation of recipient population *vs.* the advancement of science must be carefully balanced.

Currently, these decisions are made on a case-by-case basis by the responder, often under the close scrutiny of the public. Strong federal guidelines based on a review of current understanding of rehabilitation costs and benefits, as discussed in this review, would remove some of the burden of inherently unpopular decisions from the responder and transfer it to the government management agencies responsible for protection and conservation of these animals and their environment. Such management should aim to maximize animal welfare and the growth of understanding of marine mammal health and other disciplines, make the most effective use of limited funds to benefit the greatest number of marine mammals, and above all minimize the risk to the wild populations.

We recommend a decision tree be adopted by rehabilitation managers and clear criteria developed for making each animal management decision, based on animal welfare, logistics, conservation value, research possibilities, and funding (Fig. 2).

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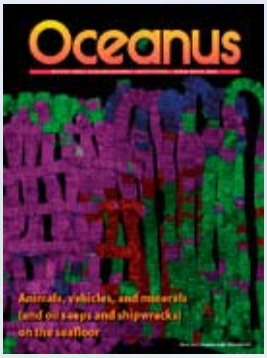
Appendix A

Exhibit 2

Oceanus Article on Michael Moore

«Woods Hole Oceanographic Institution
Oceanus The Magazine that Explores the Oceans in Depth



Stranded Marine Mammals Stir Tough Decisions

Experts propose guidelines for when to rehabilitate, release, and euthanize

A seal, sick or injured, is found stranded on a beach. What should be done?

That depends on whom you ask.

An animal welfare advocate would urge efforts to help the disabled animal. A scientist might want to rehabilitate it with another reason also in mind: to release and track it, and learn about wildlife populations. Veterinarians might welcome the rare opportunity to discover more about wildlife diseases and physiology —though they would also be wary of exposure to diseases that could be transmitted to humans.

The range of perspectives doesn't end there. California or East Coast fishermen might not shed a tear about losing one out of a proliferating population of seals that they perceive to be eating into diminished fish stocks, and fishermen's profits. But if the seal were an endangered species, saving each one would be critical from a conservationist's point of view. Unless, of course, releasing it back into the wild could further endanger the species, by introducing a novel pathogen acquired in a rehabilitation facility. The same seal, endangered or not, would be considered fair game by another endangered population, subsistence hunters, if it were found on a beach in Canada or Alaska.

And then there's the cost-factor debate: Should limited marine mammal protection funds be spent to rehabilitate animals, or to increase public education, law enforcement, or research activities?

Six marine mammal specialists have now called for an innovative method to help balance and sort out conflicting priorities involved in strandings and forge compromises among competing interests. In a review and

Enlarge Image

Seals entangled in fishing lines and gear may strand on beaches where they are noticed by people. Local stranding networks around the country send workers to evaluate the animals' condition and make difficult decisions about how to care for them. Here, a worker wraps and prepares to examine a badly entangled seal. (Photo courtesy of Cape Cod Stranding Network)

Enlarge Image

Seals frequently congregate and rest on Billingsgate Shoal, Cape Cod, Mass. (Photo by Jim Canavan, Woods Hole Oceanographic Institution)

Enlarge Image

position paper published in the October 2007 issue of the journal *Marine Mammal Science*, they outline a decision tree—a systematic framework to assess the risks, benefits, costs, and probabilities that branch out from various choices to euthanize, rehabilitate, and release stranded animals.

Joining together to make the proposal were a range of experts spanning research, conservation, veterinary medicine, public education, rehabilitation facilities, and regional stranding networks: Michael Moore (Woods Hole Oceanographic Institution), Greg Early (Mote Marine Laboratory), Kathleen Touhey (Cape Cod Stranding Network), Susan Barco (Virginia Aquarium), Frances Gulland (The Marine Mammal Center, Sausalito), and Randall Wells (Chicago Zoological Society and Mote Marine Laboratory).

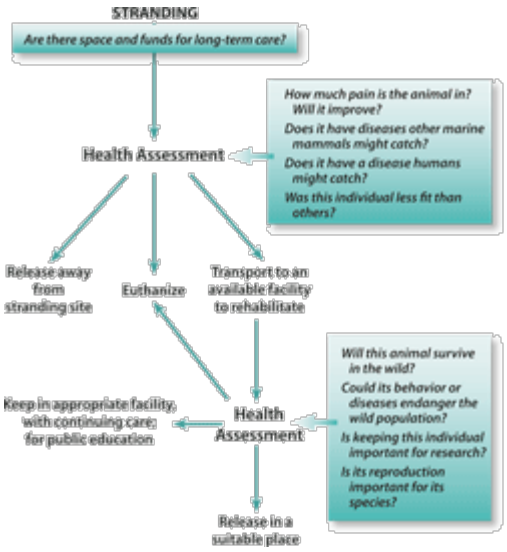
“Rehabilitation of stranded marine mammals elicits polarized attitudes,” the authors wrote. “The challenge is to find the common ground and the greater good.”

When success creates problems

Decades ago, few stranded animals could be saved, and those that could were generally placed in zoos and aquariums and displayed for public education. Over the last 25 years, though, veterinarians and curators learned more about marine mammal physiology and medicine, making it possible to keep more stranded animals alive. Eventually there were more stranded animals than there was display space to permanently house them.

“The issue is complex, but the math is simple,” said co-author Early of the Mote Marine Laboratory. “One either releases animals, or stops admitting them.”

WHOI biologist and marine mammal specialist Michael Moore was lead author of a recent article proposing a new method for making decisions about stranded marine mammals. (Photo by Jim Canavan, Woods Hole Oceanographic Institution)



Enlarge Image

Michael Moore and co-authors have called for clear guidelines for marine mammal rehabilitation and release and have proposed a decision tree similar to this, with specific criteria for choices that stranding responders must make. (Tree courtesy of Michael Moore, redrawn by E. Paul Oberlander and Jeannine Pires, Woods Hole Oceanographic Institution)

Related Links

» Michael Moore

» NOAA Fisheries Marine Mammal Health and Stranding Response Program

» Cape Cod Stranding Network

» Rehabilitation and Release of Marine Mammals in the United States: Risks and Benefits

Independent organizations that respond to strandings proliferated and now total more than 400 in the United States. When notified about stranded animals on public beaches, organizations must respond; doing nothing is usually not an option, from the perspective of animal or human welfare. They are faced with making choices about the animals on the spot, in situations that prompt strong public reactions.

Though governed by federal regulations under the Marine Mammal Protection Act, the stranding response groups mostly depend on local funding. As a consequence, they reflect local priorities, are not well-coordinated, and sometimes contradict each other’s goals.

For example, saving a stranded dolphin can be gratifying to human responders, Moore and colleagues said, but the situation is more complex. Responders must also take into account whether nearby rehabilitation facilities exist; whether the animal could, or should, ever be released to the wild; whether the animal would suffer during treatment, and whether resources are available for a lifetime of ongoing care.

It has cost as much as $175,000 to rehabilitate a single dolphin, and between $400 and $50,000 to rehabilitate a seal, sea lion, or walrus, according to estimates cited by the researchers. Emotion-charged decisions to rehabilitate can lead organizations to begin to care for animals they have no assurance of funds to support or treat; Moore and colleagues suggest this is inappropriate. Even more difficult is weighing the relative benefits of spending limited funds on rehabilitating individuals, or on education, conservation, or research efforts.

Conflicts and contradictions

Making rehabilitate-or-release decisions more difficult is that some risks (transmitting pathogens to wild populations, for example) are supported by scientific data; some (seals competing with fishermen) are theoretical but unproven; and some—interfering with natural selection by releasing less-fit animals to reproduce, for example—are "perceived' risks unsupported by current data.

Further complicating the situation are the federal guidelines themselves. The federal agency charged with managing marine mammals—the National Marine Fisheries Service (NMFS, part of NOAA, the National Oceanic and Atmospheric Administration)—authorizes just three reasons for responding to marine mammal strandings: protecting animal welfare, protecting public health, and collecting scientific information to advance conservation of wild populations. But these justifications can compete: For example, NMFS is charged with protecting seals and sea lions, as well as preserving endangered salmon stocks that the marine mammals prey on. NMFS guidelines don't identify, or provide a way to decide, priorities.

Even the term "rehabilitation" is problematic, because many existing rehabilitation organizations do not agree on what it means, and federal regulations don't make the meaning clear, Moore and colleagues said. It can be interpreted as returning an animal to full health (which may not be possible, if the animal has other health problems), or returning it to basic functioning (which may not be wise, if the animal might suffer a slow death from a pre-existing condition). "The vagueness of even this most basic concept," the authors wrote, "adds to the conflicting values and options within which the stranding organizations work."

As a result, the authors wrote, "marine mammal rehabilitation is an effort that currently lacks a coherent central set of core values, ethics, or goals. After more than a quarter-century, the effort remains inconsistent, poorly supported, and fractious."

A method to make decisions

Hence the call for a decision tree—a cascading series of assessments and choices designed to "identify at what point an activity should cease because the cost or risk to subjects is too great to continue." Moore and colleagues called on federal managers to consult with veterinary, conservation, animal welfare, and other experts to develop clear ethical, scientific, and legal criteria for each decision branchpoint on the tree.

The tree would provide consistent guidelines for decisions and "remove the burden of inherently unpopular decisions from the responder and transfer it to government management agencies," they said. "Rehabilitation efforts should be evaluated on whether the likely benefits to science, nature, or knowledge outweigh the potential harm to individuals or populations."

"The issue of what's appropriate to do with mammals is hugely difficult," Moore said. "We have to take a hard look at the situation in the context of the real political pressures we're all under."

—*Kate Madin*

The WHOI Ocean Life Institute provided funding for Moore's work.

Posted: December 20, 2007

[top]

Appendix B

Photos of Sea Lions

APPENDIX B – PHOTOS OF SEA LIONS IN HUMAN COMMUNITIES

California sea lions hauled out on San Francisco's Pier 39, tourist attraction.

California sea lions resting on docks of harbor.

California sea lions resting abundantly on beach near harbor.

California sea lion sun bathing on Highway Patrol car.

Angry sea lion makes a home on someone's boat.


San Carlos Police Department

Police officers trying to trap juvenile sea lion for his own as well as public safety reasons.

Sea lion on Highway Patrol car – very far from his natural environment.

Angry sea lions in marina, dangerously close to humans.

California sea lion on boat pier, blocking path of boaters.


Sea lion dangerously close to human communities, sitting on porch of someone’s house.

Appendix C

NOAA Fisheries 2007 Sea Lion

Stock Assessment Report

Revised 10/30/2007

CALIFORNIA SEA LION (*Zalophus californianus californianus*): U.S. Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

The California sea lion *Zalophus californianus* includes three subspecies: *Z. c. wollebaeki* (on the Galapagos Islands), *Z. c. japonicus* (in Japan, but now thought to be extinct), and *Z. c. californianus* (found from southern Mexico to southwestern Canada; herein referred to as the California sea lion). The breeding areas of the California sea lion are on islands located in southern California, western Baja California, and the Gulf of California (Figure 1). These three geographic regions are used to separate this subspecies into three stocks: (1) the United States stock begins at the U.S./Mexico border and extends northward into Canada; (2) the Western Baja California stock extends from the U.S./Mexico border to the southern tip of the Baja California Peninsula; and (3) the Gulf of California stock which includes the Gulf of California from the southern tip of the Baja California peninsula and across to the mainland and extends to southern Mexico (Lowry et al. 1992). Some movement has been documented between these geographic stocks, but rookeries in the United States are widely separated from the major rookeries of western Baja California, Mexico. Males from western Baja California rookeries may spend most of the year in the United States. Genetic differences have been found between the U.S. stock and the Gulf of California stock (Maldonado et al. 1995). There are no international agreements for joint management of California sea lions between the U.S., Mexico, and Canada.

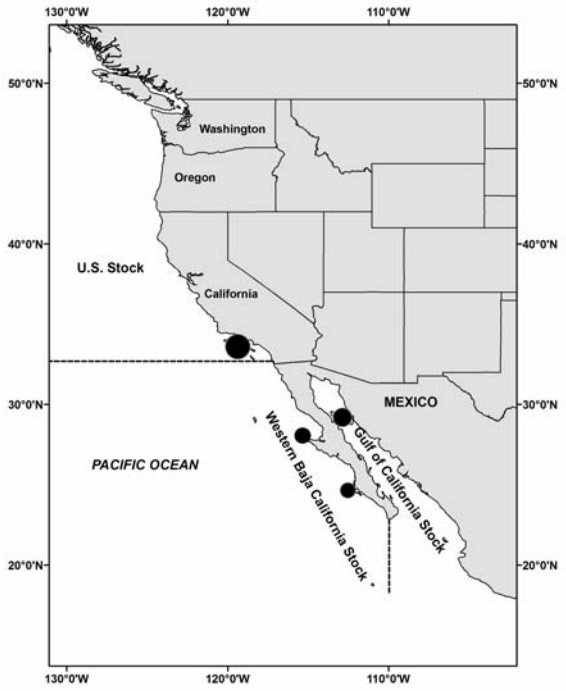


Figure 1. Geographic range of California sea lions showing stock boundaries and locations of major rookeries. The U.S. stock ranges north into Canadian waters.

POPULATION SIZE

The entire population cannot be counted because all age and sex classes are never ashore at the same time. In lieu of counting all sea lions, pups are counted during the breeding season (because this is the only age class that is ashore in its entirety), and the number of births is estimated from the pup count. The size of the population is then estimated from the number of births and the proportion of pups in the population.

Censuses are conducted in July after all pups have been born. To estimate the number of pups born, the pup count in 2005 (48,277) was adjusted for an estimated 15% pre-census mortality (Boveng 1988; Lowry et al. 1992), giving an estimated 55,519 live births in the population. The fraction of newborn pups in the population (23.3%) was estimated from a life table derived for the northern fur seal (*Callorhinus ursinus*) (Boveng 1988, Lowry et al. 1992) which was modified to account for the growth rate of this California sea lion population (5.6% yr^{-1}, see below). Multiplying the number of pups born by the inverse of this fraction (4.28) results in a population estimate of 238,000.

Minimum Population Estimate

The minimum population size was determined from counts of all age and sex classes that were ashore at all the major rookeries and haulout sites during the 2005 breeding season. The minimum population size of the U.S. stock is 141,842 (NMFS unpubl. data). It includes all California sea lions counted during the July 2005 census at the Channel Islands in southern California and at haulout sites located between Point Conception and the Oregon/California border. An additional unknown number of California sea lions are at sea or hauled out at locations that were not censused.

Current Population Trend

Records of pup counts from 1975 to 2005 (Figure 2) were compiled from the literature, NMFS reports, unpublished NMFS data, and Lowry 1999 (the literature up to 2000 is listed in Lowry and Maravilla 2005). Pup counts from 1975 through 2005 were examined for four rookeries in southern California and for haulouts in central and northern California. The number of pups at rookeries not counted were estimated using multiple regressions derived from counts of two neighboring rookeries using data from 1975-2000 (Lowry and Maravilla 2005) : (1) 1980 at Santa Barbara Is.; (2) 1978-1980 at San Clemente Is.; and (3) 1978 and 1979 at San Nicolas Is. The mean was used when more than one count was available for a given rookery. Four major declines in the number of pups counted occurred during El Niño events in 1983-1984, 1992-93, 1998, and 2003 (Figure 2). A regression of the natural logarithm of the pup counts against year indicates that the counts of pups increased at an annual rate of 5.6% between 1975 and 2005 when pup counts for El Niño years (1983, 1984, 1992, 1993, 1998, and 2003) were removed from the 1975-2005 time series.

The 1975-2005 time series of pup counts shows the effect of four El Niño events on the sea lion population. Pup production decreased by 35 percent in 1983, 27 percent in 1992, and 64 percent in 1998. After the 1992-93 and 1997-98 El Niños, pup production rebounded by 52 percent and 185 percent, respectively, but there was no rebound after the 1983-84 El Niño (Figure 2). Unlike the 1992-93 and 1997-98 El Niños, the 1983-1984 El Niño affected adult female survivorship (DeLong et al 1991) which prevented the rebound in pup production because there were fewer adult females available in the population to produce pups (it took five years for pup production to return to the 1982 level). Other characteristics of El Niños are higher pup and juvenile mortality rates (DeLong et al 1991, NMFS unpubl. data) which affect future recruitment into the adult population for the affected cohorts. The 2002 and 2003 decline can be attributed to (1) reduced number of reproductive adult females being incorporated into the population as a result of the 1992-93 and 1997-98 El Niños, (2) domoic acid poisoning (Scholin et al. 2000, Lefebvre et al. 2000), (3) lower survivorship of pups due to hookworm infestations (Lyons et al. 2001), and (4) the 2003 El Niño

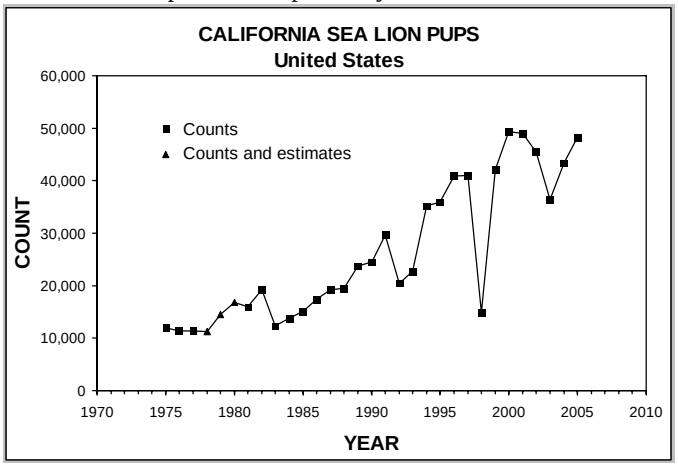


Figure 2. U.S. pup count index for California sea lions (1975-2005).

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

A generalized logistic growth model indicated that the maximum population growth rate (R_{max}) was 6.52 percent when pup counts from El Niño years (1983, 1984, 1992, 1993, 1998, and 2003) were removed (Figure 3).

POTENTIAL BIOLOGICAL REMOVAL

The potential biological removal (PBR) level for this stock is calculated as the minimum population size (141,842) times one half the default maximum net growth rate for pinnipeds (½ of 12%) times a recovery factor of 1.0 (for a stock of unknown status that is growing, Wade and Angliss 1997); resulting in a PBR of 8,511 sea lions per year.

ANNUAL HUMAN-CAUSED MORTALITY

Historical Depletion

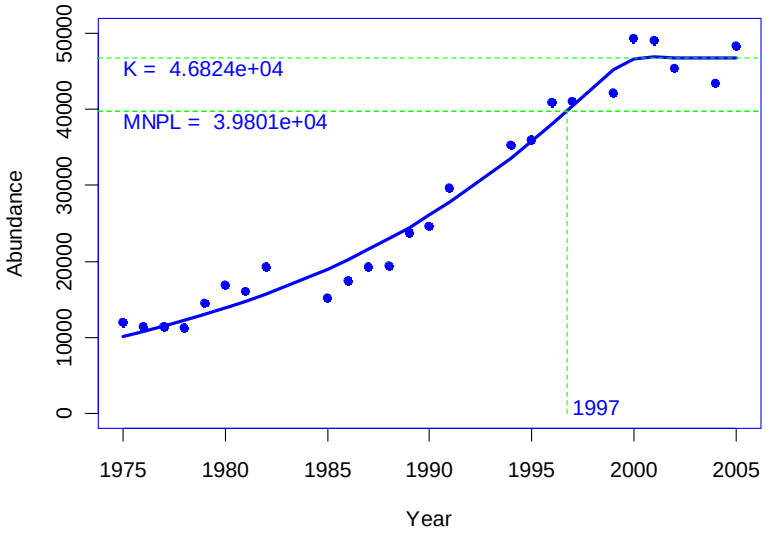
Historic exploitation of California sea lions include harvest for food by native Californians in the Channel Islands 4,000-5,000 years ago (Stewart et al. 1993) and for oil and hides in the mid-1800s (Scammon 1874). More recent exploitation of sea lions for pet food, target practice, bounty, trimmings, hides, reduction of fishery depredation, and sport are reviewed in Helling (1984), Cass (1985), Seagers et al. (1985), and Howorth (1993). Lowry et al. (1992) stated that there were few historical records to document the effects of such exploitation on sea lion abundance.

Fisheries Information

California sea lions are killed incidentally in set and drift gillnet fisheries (Hanan et al. 1993; Barlow et al. 1994; Julian 1997; Julian and Beeson, 1998, Cameron and Forney 1999; Carretta et al. 2005a; Table 1). Detailed information on these fisheries is provided in Appendix 1. Mortality estimates for the California the set and drift gillnet fisheries are included in Table 1 for the five most recent years of monitoring, 2000-2004 (Carretta and Chivers 2004, Carretta et al. 2005a, 2005b). A controlled experiment during 1996-97 demonstrated that the use of acoustic warning devices (pingers) reduced sea lion entanglement rates considerably within the drift gillnet fishery (Barlow and Cameron 2003). However, entanglement rates increased again during the 1997 El Niño and continued during 1998. The reasons for the increase in entanglement rates are unknown. However, it has been suggested that sea lions may have foraged further offshore in response to limited food supplies near rookeries, which would provide opportunity for increased interactions with the drift gillnet fishery. Because of interannual variability in entanglement rates, additional years of data will be required to fully evaluate the effectiveness of pingers for reducing mortality of this particular species. Mortality estimates from the drift gillnet fishery are based on 2000-2004 observer data (~20% observer coverage). In past years, the largest source of sea lion mortality has been in the California halibut and angel shark set gillnet fishery, which currently operates south of Point Arguello, California and has not been observed throughout its range since 1994. Limited observer coverage occurred in Monterey Bay in 2000 and 2001, but represented less than 5% of the total fishing effort. Given the lack of recent observer data, it is not possible to estimate sea lion mortality for this fishery. Evidence from fisher self-reports (Table 1) indicates that mortality of sea lions still occurs in this fishery, but it is not possible to extrapolate these self reports to overall mortality because these self reports have been shown to be grossly underreported. Logbook and observer data, and fisher reports, indicate that mortality of California sea lions occurs, or has occurred in the past in the following fisheries: (1) California, Oregon, and Washington salmon troll fisheries; (2) Oregon and Washington non-salmon troll fisheries; (3) California herring purse seine fishery; (4) California anchovy, mackerel, and tuna purse seine fishery; (5) California squid purse seine fishery, (6) Washington, Oregon, California and British Columbia, Canada salmon net pen fishery, (7) Washington, Oregon, California groundfish trawl fishery, (8) Washington, Oregon and California commercial passenger fishing vessel fishery (NMFS 1995, M. Perez pers. comm, and P. Olesiuk pers. comm.) (9) the California small mesh drift gillnet fishery, and (10) the California purse seine fishery for anchovy, mackerel, and tuna. The OR Columbia River gillnet fishery has been reduced to such levels that California sea lion mortality, if any, is negligible (J. Scordino, per. comm.). Stranding data from California, Oregon, and Washington during 2000-2004 shows that an additional 66 sea lions died from unknown entangling net fisheries (Table 1). Animals are typically found on the beach or sometimes at sea with portions of gillnet wrapped around the carcass. This represents a minimum number of animals killed, as many entanglements are likely unreported or undetected.

Drift gillnet fisheries for swordfish and sharks exist along the entire Pacific coast of Baja California, Mexico and may take animals from the same population. Quantitative data are available only for the Mexican swordfish drift gillnet fishery, which uses vessels, gear, and operational procedures similar to those in the U.S. drift gillnet fishery, although nets may be up to 4.5 km long (Holts and Sosa-Nishizaki 1998). The fleet increased from two vessels in 1986 to 31 vessels in 1993 (Holts and Sosa-Nishizaki 1998). The total number of sets in this fishery in 1992 can be estimated from data provided by these authors to be approximately 2700, with an observed rate of marine mammal bycatch of 0.13 animals per set (10 marine mammals in 77 observed sets; Sosa-Nishizaki et al. 1993). This overall mortality rate is similar to that observed in California driftnet fisheries during 1990-95 (0.14 marine

Figure 3. Generalized logistic growth of California sea lion pup counts obtained during 1975-2005 (excluding El Niño years) indicating when Maximun Net Productivity Level (MNPL) was reached and that the population has reached carrying capacity (K).



mammals per set; Julian and Beeson, 1998), but species-specific information is not available for the Mexican fisheries. Previous efforts to convert the Mexican swordfish driftnet fishery to a longline fishery have resulted in a mixed fishery, with 20 vessels alternately using longlines or driftnets, 23 using driftnets only, 22 using longlines only, and seven with unknown gear type (Berdegué 2002).

Table 1. Summary of available information on the mortality and serious injury of California sea lions in commercial fisheries that might take this species (Carretta 2001; 2002, Carretta et al. 2005a, 2005b, Perez 2003, Perez 2003; Appendix 1). Mean annual takes are based on 2000-2004 data unless noted otherwise. In past years, the set gillnet fishery for halibut and angel shark has been responsible for the majority of fishery-related mortalities. However, this fishery has not been observed recently and thus, current estimates of mortality are unknown. Because current mortality estimates are lacking for this fishery, overall mean annual takes reported in Table 1 are negatively biased by an unknown amount.

Fishery Name	Year(s)	Data Type	Percent Observer Coverage	Observed Mortality	Estimated Mortality (CV in parentheses)	Mean Annual Takes (CV in parentheses)
CA/OR thresher shark/swordfish large mesh drift gillnet fishery	2000 2001 2002 2003 2004	observer	22.9% 20.4% 22.1% 20.2% 20.6%	13 2 18 4 6	50 (0.43) 10 (0.67) 81 (0.25) 20 (0.50) 29 (0.44)	38 (0.18)
CA angel shark/halibut and other species large mesh (>3.5 in) set gillnet fishery	2001 2002 2003 2004 2005	No fishery-wide observer program since 1994	0% 0% 0% 0% 0%	n/a n/a n/a n/a n/a	n/a n/a n/a n/a n/a	n/a
	2000-2004	MMAP self reports	-	57	n/a	≥11.4
CA small-mesh drift gillnet fishery for white seabass, yellowtail, barracuda, and tuna	2003[1] 2004[1]	observer	11%[1] 11%[1]	2 1	18 (0.71) 9 (0.94)	13.5 (0.57)
CA anchovy, mackerel, and tuna purse seine fishery	2004[2]	observer	n/a	1	≥ 1 (n/a)	≥ 1 (n/a)
WA, OR, CA domestic groundfish trawl fishery (At-sea processing Pacific whiting fishery only)	2000 2001 2002 2003 2004	observer	80.6% 96.2% 100% 100% 100%	0 0 1 2 2	0 0 1 2 2	1.2 (0)
WA, OR, CA domestic groundfish trawl fishery (bottom trawl)	2000 2001 2002 2003 2004	observer	n/a	n/a 8 6 24 6	n/a	≥11
WA, OR salmon net pen fishery	2000 2001 2002 2003 2004	n/a	n/a	n/a	n/a	n/a
Canada: BC salmon pen fishery	2000 2001 2002 2003 2004	MMAP	n/a	225 88 19 14 6	225 88 19 14 6	≥70

Fishery Name	Year(s)	Data Type	Percent Observer Coverage	Observed Mortality	Estimated Mortality (CV in parentheses)	Mean Annual Takes (CV in parentheses)
Unknown entangling net fishery	2000-2004	stranding	n/a	66	n/a	13 (n/a)
Minimum total annual takes						≥159 (n/a)

[1] A pilot observer program existed for two years in the small mesh drift gillnet fishery, where observer coverage ranged between 11-17%, based on logbook effort data and 22 observed sets in 2003 and 2004, respectively.

Other Mortality

California sea lions injured by entanglement in gillnet and other man-made debris have been observed at rookeries and haulouts (Stewart and Yochem 1987, Oliver 1991). The proportion of those entangled ranged from 0.08% to 0.35% of those hauled out, with the majority (52%) entangled in monofilament gillnet. Data from a marine mammal rehabilitation center showed that 87% of 87 rescued California sea lions were entangled in 4-4.5 inch square-mesh monofilament gillnet (Howorth 1994). Of California sea lions entangled in gillnets, 0.8% in set gillnets and 5.4% in drift gillnets were observed to be released alive from the net by fishers during 1991-1995 (Julian and Beeson 1998). Clearly, some are escaping from gillnets; however, the rate of escape from gillnets, as well as the mortality rate of these injured animals, is unknown.

Live strandings and dead beach-cast California sea lions are regularly observed with gunshot wounds in California (Lowry and Folk 1987, Deiter 1991, Barocchi et al. 1993, Goldstein et al. 1999, NMFS unpublished stranding data). A summary of records for 2000-2004 from the California Marine Mammal Stranding Network (CMMSN) and the Oregon and Washington stranding databases shows the following non-fishery related mortalities: boat collisions (17 mortalities), entrainment in power plants (106 mortalities), shootings (237 mortalities), marine debris (three mortalities), and unknown sources (seven mortalities). Stranding records are a gross under-estimate of injury and mortality because many animals and carcasses are never recorded. There are currently no estimates of the total number of California sea lions being killed or injured by guns, boat collisions, entrainment in power plants, marine debris, or gaffs, but the minimum number from 2000-2004 was 370. The average annual non-fishery related mortality of sea lions from 2000-2004 is a minimum of the 370 mortalities listed above, divided by 5 years = 74 sea lions annually.

Several Pacific Northwest treaty Indian tribes have promulgated tribal regulations allowing tribal members to exercise treaty rights for subsistence harvest of sea lions. Current estimates of annual take are zero to two animals per year.

Sea lion mortalities in 1998 along the central California coast have recently been linked to the algal-produced neurotoxin domoic acid (Scholin et al. 2000). Future mortalities may be expected to occur, due to the periodic nature of such harmful algal blooms.

STATUS OF STOCK

A generalized logistic growth model of pup counts obtained during 1975-2005 (excluding El Niño years) indicated that the population reached its Maximum Net Productivity Level (MNPL) of 39,800 pups in 1997 and has reached carrying capacity (K) at 46,800 pups per year ($z = 19.09$, $R_{max} = 0.0652$, $n_0 = 10{,}100$, SE = 1,055) (Figure 3). This determination should be taken with caution until more years of data have been collected to verify whether the flattening of the generalized logistic curve persists in future years. California sea lions in the U.S. are not listed as "endangered" or "threatened" under the Endangered Species Act or as "depleted" under the MMPA. Even though current total human-caused mortality is unknown (due a lack of observer coverage in the California set gillnet fishery that historically has been the largest source of human-caused mortalities), California sea lions are not considered a "strategic" stock under the MMPA because (based on historical takes in the set gillnet fishery and current levels of fishing effort) total human-caused mortality is still likely to be less than the PBR (8,511). The total fishery mortality and serious injury rate for this stock likely remains above 10% of the calculated PBR and, therefore, cannot be considered to be insignificant and approaching a zero mortality and serious injury rate.

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Appendix D

Sealine - TMMC Volunteer Newsletter

The Marine Mammal Center

sealine

THE VOLUNTEER NEWSLETTER OF THE MARINE MAMMAL CENTER

SPRING 2009

FROM THE DESK OF THE EXECUTIVE DIRECTOR...

As Executive Director, I often find myself bridging one part of the Center community with another. Thus it was at the recent annual meeting of our Board of Directors. There, I let the directors know what we all had achieved this past year and I gave them my perception as to where we stand now.

As you can imagine, distilling the story of 2008 into a short presentation is no mean feat. I highlighted the 813 patients we treated, the just over 40,000 students we reached, the 22 scientific publications we authored and the amazing 74,736 hours you all contributed. Wow. I called out some of the extraordinary events of the year—the necropsy of the sperm whale and the 450 pounds of netting it had ingested, the rescue of Arctic, the harbor porpoise mortality event, and the leptospirosis and harbor seal research we led. I talked about our new facility and all the positive impressions I've heard from so many of you. And, I spoke about the elephant in the room: the economy and the tough decisions the Center made and continues to make to address its impact on us.

One of the directors had asked me in advance what the theme of the meeting was. A theme can be a course setter, or it can be a description of the course we're currently on. In this case, I believe we have both. There's a palpable energy at the Center that propels us forward. As I speak to others in the community I find that there's something we have here that sets us apart. Two words, for me, embody a theme for the Center this spring: passion and resolve.

The theme strikes me as a powerful way to describe all of us in our various roles at the Center. We are a group of people who believe strongly—passionately—in the purpose of our work. We feel passionate about each animal we treat and passionate about the higher purpose of our work as well: the science we advance, the children and adults whom we teach and inspire. This passion fuels us, sustains us, and allows us to find optimism in a world that is sorely lacking in that commodity.

I pair passion and resolve because I think that one builds off of the other. Many have been the discussions I've had at the Center where we considered options for how we would move forward. Time and again we've opted for action and resolve, and even boldness, as we've considered what choices are ultimately best for our patients, for ourselves, and for our organization. We've pushed ourselves to smartly, and with due consideration, drive forward—resolutely.

I visited MBO a couple of weeks ago on the Monday following the rescue of Fanbelt, an animal sadly, but aptly, named for the strap that deeply cut into his shoulders. That day, I met a woman on her first day, another returning on break from college, and several long-standing volunteers. I saw them as they started their day and again ten hours later with a couple of hours work yet ahead of them. In that assemblage of Monday MBO volunteers I saw the faces of the Center—the personification of a theme.

I draw inspiration from all of you, and I thank you for everything you do to make the Center the truly exceptional organization that it is.

Executive Director

News from Stranding

BY **ERIN BRODIE,** STRANDING COORDINATOR

AS MOST OF YOU KNOW, the Stranding Department offers an internship program for individuals looking to gain some experience with marine mammals. This program began in the spring of 2004 and we have had the pleasure of working with 18 individuals since that time. The interns are here for a minimum of three months, working five days a week doing a combination of stranding, research, lab work and animal care. They all bring something unique to the Center and we are so grateful for all the work that they do. This spring we have two wonderful ladies joining us for our internship program, Sarah Ashworth and Callie Wilder.

Sarah comes to us as a graduate of the University of Washington in Seattle. She has spent the past two years working as a marine mammal observer, data manager and surveyor with the Hawaiian Longline Fisheries and with LGL Limited – Alaska looking for animals in the Bering and Chukchi Seas. Sarah is excited to donate her time to an organization that is committed to preservation of the marine environment and get some hands-on experience with pinnipeds.

Callie comes to us as a graduate of Hawaii Pacific University. She has spent the past three years as a conservation advocate at the Jatun Sacha Biological Reserve in the Galapagos Islands and various fisheries jobs in Texas, Hawaii and Oregon. Most recently she has completed some contract work with LGL Limited –Alaska in the Bering and Chukchi Seas where she worked with Sarah Ashworth, our other Stranding Intern. Callie is excited to be here as she really enjoys the excitement of an ever changing hands-on work environment that keeps her outdoors.

Please welcome the two newest members of Stranding if you see them around.

• • •

The Stranding Department recently attended the NOAA Fisheries Southwest Regional Stranding Meeting, March 16-18 in Santa Barbara. What an event! Three days filled with scientific presentations and updates on items such as sea turtles, entangled whales, research findings and 2008 "year in reviews" from other network participants. This annual meeting is a great place to gather all the live and dead animal responders in the state of California to swap stories and improve collaborations to achieve best practices in our common goal of responding to marine mammals.

• • •

The Stranding Department has been insanely busy with the recent influx of elephant seals and harbor seals in the past six weeks. It is safe to say that the season has definitely arrived! Since March 1st, we have admitted 120 animals into the hospital, often bringing in 10 animals in a day. We would just like to say THANK YOU to all of the Stranding volunteers who have spent countless hours on the beaches, tirelessly working to bring animals in at all hours of the day. We appreciate everything you do. And to the animal care crews, THANK YOU for caring for all the patients we have brought in.

In summary….THANK YOU!

• • •

Support The Marine Mammal Center

We wanted to call your attention to a page on our web site that lists upcoming events by local businesses that will support The Marine Mammal Center — http://www.marinemammalcenter.org/learning/comm/pubeducation_campaigns/fundraisingcampaign.asp .

Please check this page regularly as we are actively working with businesses along our rescue range to support the Center. Our SLO staff member Lisa Harper Henderson has secured a business partner in SLO for an event in July, and we'll have that information on this web page soon.

Monthly Stats

ADMITS *through 3/31/09*
(includes carcasses and DOAs)

	Oct	Nov	Dec	Jan	Feb	Mar	TOTAL
ES	1	2	1	0	4	56	**64**
HS	1	0	1	1	5	26	**34**
CSL	60	29	17	19	22	15	**162**
SSL	0	0	0	0	0	0	**0**
GFS	0	0	0	0	0	1	**1**
NFS	11	5	0	0	0	1	**17**
ST	1	1	0	0	0	0	**2**
SO	2	0	0	0	0	1	**3**
C	2	1	0	0	0	0	**3**
TOTAL	**78**	**38**	**19**	**20**	**31**	**100**	**286**

RELEASES *through 3/31/09*
(includes relocations and transfers)

	Oct	Nov	Dec	Jan	Feb	Mar	TOTAL
ES	1	0	1	0	0	2	**4**
HS	0	0	0	0	0	0	**0**
CSL	27	18	5	3	8	5	**66**
SSL	0	0	0	0	0	0	**0**
GFS	0	0	0	0	0	0	**0**
NFS	0	0	9	0	0	0	**9**
ST	0	1	0	0	0	0	**1**
SO	2	0	0	0	3	0	**5**
C	0	1	0	0	0	0	**1**
TOTAL	**30**	**20**	**15**	**3**	**11**	**7**	**86**

NECROPSIES *through 3/31/09*
(includes euthanasia, DOA,
died in treatment,and carcasses)

	Oct	Nov	Dec	Jan	Feb	Mar	TOTAL
ES	0	2	0	0	1	8	**11**
HS	1	0	1	1	3	3	**9**
CSL	42	19	14	11	12	8	**106**
SSL	0	0	0	0	0	0	**0**
GFS	0	0	0	0	0	0	**0**
NFS	3	4	0	0	0	1	**8**
ST	0	0	0	0	0	0	**0**
SO	1	0	0	0	0	0	**1**
C	2	0	0	0	0	0	**2**
TOTAL	**49**	**25**	**15**	**12**	**16**	**20**	**137**

The Marine Mammal Center

sealine

THE VOLUNTEER NEWSLETTER OF THE MARINE MAMMAL CENTER

FALL 2008

FROM THE DESK OF THE EXECUTIVE DIRECTOR...

2009 holds a great deal in store for The Marine Mammal Center—a new facility, the blending of staff and volunteers, and an improved experience for the visiting public. We're in for a shift in operations, work flow, and work dynamics that will impact us here in the Headlands, and all the way up to Anchor Bay and down to SLO. Whether you signed on for it or not, you're heading into what the corporate types call *cultural change*.

When I started in June, I spoke with many of you to learn why you volunteer, what keeps you here, and what priorities you see for us as we move ahead. I did this with the upcoming change in mind. Through these conversations, I learned a great deal about the Center and was able to align your observations with my own instincts and initial impressions. I had similar discussions with staff, and comments from them echoed your own. There was a clear call for two priorities: better communication and better integration. Interestingly, something else significant emerged as well.

To a person, volunteers I spoke with applauded the professional staff and to a person, staff with whom I spoke applauded the volunteers. Fantastic stories of individuals and working relationships, dedication and cooperation made their way into my conversations. A synergistic "mutual appreciation society" became clear right out of the gates. I don't want to suggest that I didn't hear constructive comments about ways to improve the Center, but all of those were heard in the context of a community that has a basic foundation of mutual support and respect—a great platform for the change and growth ahead of us.

Many times change is thrust upon us. The change here at the Center is something we've seen on the horizon for some time. It's something we can control and shape, something we can make a positive force in defining who we are as a community, how we work together, and how we present ourselves to others. It's an opportunity to hold up our mission and consider how we might become an even better and stronger organization.

Change can be immense or it can be small. Ours will likely be somewhere in between. I wouldn't expect abrupt 180 degree turns, or dramatic, sweeping changes in who we are as an organization. But the mere fact that we will be occupying a new space and rubbing elbows more will prompt both subtle changes and distinct ones. You all know well that sometimes it's the little changes that have the largest impact.

I finish this article with an appeal. As ideas come to you—especially those of you at the far northern and southern ends of our Center community—as to how to manage our change, improve communication, and better integrate our operations, please let me know. Send me an email, call me, or stop by. I want to hear from you.

2009 is going to be a banner year for the Center and with all that we have ahead of us we're going to need to draw on one another's passion, enthusiasm and energy like never before. I want you all to be a part of shaping our future together—it's essential. We're going to have quite a bit to celebrate in the coming months, and your pride in the Center, I hope, will only grow.

Through it all, please always know how much I appreciate all that you do.

Executive Director

Pieter Arend Folkens © 2000

News from Stranding

COMING TO THE RESCUE

BY **SHARRON JACKMAN,** VOLUNTEER AT SAN LUIS OBISPO

WHAT'S IT LIKE TO BE A MARINE MAMMAL CENTER VOLUNTEER ON THE CENTRAL COAST OF CALIFORNIA?

Our job is somewhat different than volunteers at the other sites because of the long distance to Sausalito. Our animals need to be stabilized if at all possible, due to the long van/truck ride they have to endure to get to the hospital in Sausalito.

This often entails keeping them in Morro Bay overnight to allow them to calm down from the stress of the rescue, and giving them fluids and nutrition to help them survive their journey. In the case of a critically ill or injured animal, it means getting into the Center's van and hitting the road immediately to drive our patient to King City, Moss Landing, Monterey, and in some cases, all the way to Sausalito — a 4½ hour drive each way.

Reflecting back on the 12 years that I have been a volunteer here, it is amazing to see how far we have come, from the days when volunteers transported animals in personal vehicles and treated animals in a volunteer's garage, to today's beautiful and functional triage facility. When I retire from the Center at the end of this year, I will take so many experiences, memories, and friendships with me. Working shoulder to shoulder during Domoic Acid outbreaks, climbing down cliffs to get to an injured animal, walking on unstable docks and rock jetties and carrying animals over a mile to get them to the hospital are memories that I will never forget. I would like to thank all of the volunteers I have worked with here, at MBO, and in Sausalito for giving me the opportunity to care for these magnificent animals. I wish you all well in the new facility, and know that the Center volunteers will go on to do even bigger and better things in the future.

Photo by Tim Lytsell

Monthly Stats

ADMITS *through 9/30/08*
(includes carcasses and DOAs)

	June	July	Aug	Sept	TOTAL
ES	5	1	2	0	8
HS	13	4	2	0	19
CSL	80	58	78	67	283
SSL	1	0	0	0	1
GFS	1	1	0	0	2
NFS	0	0	0	0	0
ST	0	0	1	1	2
SO	3	1	1	1	6
C	12	12	11	5	40
TOTAL	115	77	95	74	361

RELEASES *through 9/30/08*
(includes relocations and transfers)

	June	July	Aug	Sept	TOTAL
ES	19	6	1	1	27
HS	16	9	2	1	28
CSL	40	21	26	19	106
SSL	0	0	0	0	0
GFS	0	0	0	0	0
NFS	0	0	0	0	0
ST	0	0	0	0	0
SO	3	1	1	0	5
C	0	1	0	0	1
TOTAL	78	38	30	21	167

NECROPSIES *through 9/30/08*
(includes euthanasia, DOA, died in treatment,and carcasses)

	June	July	Aug	Sept	TOTAL
ES	2	2	1	0	5
HS	6	5	1	0	12
CSL	47	36	46	50	179
SSL	0	0	0	0	0
GFS	1	1	0	0	2
NFS	0	0	0	0	0
ST	0	0	0	0	0
SO	0	0	0	1	1
C	8	4	5	5	22
TOTAL	64	48	53	56	221

Appendix E

NOAA Fisheries Stranding Newsletter

California Marine Mammal Stranding Network Newsletter

Volume 1, Issue 2 July 2009

This Newsletter is a product of the Marine Mammal Stranding Program at the NMFS Southwest Regional Office in Long Beach, CA. Questions, comments or requests for information can be sent to: Sarah.Wilkin@noaa.gov

2009 Regional Stranding Meeting a Success

Participants at the 2009 California Marine Mammal Stranding Meeting, hosted by the Santa Barbara Museum of Natural History, pose in front of the articulated blue whale skeleton in front of the museum.

The 2009 California Marine Mammal Stranding Meeting was held at the Santa Barbara Museum of Natural History March 16-18. The meeting was very successful with over 80 people in attendance throughout the three days representing regional stranding responders, the U.S. Navy and several offices of NOAA. Monday provided a comprehensive view of the accomplishments produced recently by the California network made possible with Prescott funding. It was very encouraging to see how the Prescott grant program has enhanced our network and how it will continue to improve our responses into the future.

Another exciting development that was presented is the new UC Davis Marine Ecosystem Health Diagnostic and Surveillance Laboratory. Tuesday morning Dr. Tracey Goldstein and Dr. Jonna Mazet presented the capabilities and goals for the lab and how stranding network participants can benefit from this new relation. We are very fortunate to have this new lab contracted by NOAA. Tuesday afternoon saw us in break-out sessions developing network priorities and assessing our strengths and weaknesses as part of a program review. We developed an optimistic view of what the ideal situation would be for the future of the CA stranding network.

Wednesday morning was filled with a case study on a stranded leatherback sea turtle with some very interesting findings during the necropsy. Ed Lyman and the large whale disentanglement team closed out the meeting with some interesting discussions on how to best equip and train the California disentanglement network. Hopefully we are not faced with an entangled whale but equipment and trained responders are in place to proceed if one occurs.

By Michelle Berman, SBMNH

Inside this issue:

Mass Stranding of Northern Right Whale Dolphins

Michelle Berman, (SBMNH) examines a stranded Lissodelphis on Santa Rosa Island. Photo by Sarah Wilkin

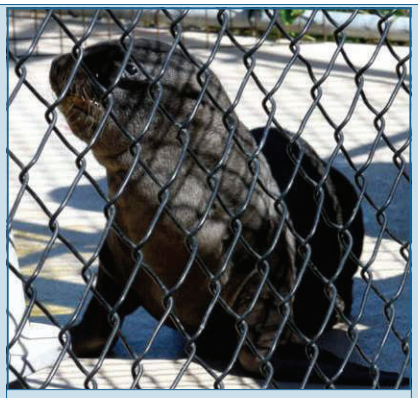
On May 21, 2009 a mass stranding of 5 northern right whale dolphins (*Lissodelphis borealis*) was reported to the stranding network at Bechers Bay, Santa Rosa Island, Channel Islands (approximately 30 miles off the coast of Santa Barbara). This species is not frequently stranded: from 1988-2007 only 34 *Lissodelphis* stranded in California, and no mass strandings have been reported. The dolphins were first observed early in the morning in the surf zone; at least 2 of the animals stranded alive. Attempts by National Park Service personnel to push them back out were unsuccessful. The animals were documented with photo and video. Due to the time of day of the receipt of the report, no response was possible on the 21st, but early the next morning a response team consisting of personnel from the Santa Barbara Museum of Natural History, National Park Service, and the SWR were transported to Santa Rosa Island courtesy of an Island Packers vessel. Four animals, all dead, were located by the response team, three floating in the kelp beds and one on the beach above the tide line. All four were males, with two adults (~3 meters long) and two subadults (~2.2 m). The animal on the beach was necropsied in the field due to its decomposition state, with the head saved for further analysis. The other three were brought back to the mainland on the stern of the Island Packers ferry (thank you!). An expert examination and necropsy team was assembled with personnel from The Marine Mammal Center, Channel Islands Marine Wildlife Institute, Santa Barbara Museum of Natural History, and NMFS. The three intact animals and the head of the fourth were taken to a local radiology

(Continued on page 3)

Liz Wheeler and Frances Gulland (TMMC) and Krista Fahy (SBMNH) position one of the dolphins for a CT scan. Photo by Sarah Wilkin

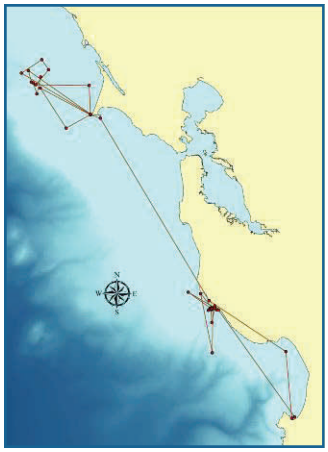
Case Files: "Arctic" from The Marine Mammal Center

On 6/30/2008 TMMC admitted "Arctic," a newborn 18.5 kg Steller sea lion (*Eumatopias jubatus*) pup from Año Nuevo Island to The Marine Mammal Center in Sausalito. Because Steller sea lions have such a long period of dependency in the wild (1 to 2 years), we tried to minimize Arctic's exposure to humans during her stay, monitoring her by video and initially feeding her from a bottle attached to her pen wall.



Arctic, a female Steller sea lion at admission in June 2008 (above) weighing 18.5 kg, and at an impressive 91 kg upon release in April 2009 (below). Photos TMMC

At release, we dye marked her for easy identification from a distance and outfitted her with a Splash tag from Wildlife Computers that records and transmits location information as well as summary data on dive depth and duration. She weighed 91.0 kg when she returned to Año Nuevo Island on 4/20/2009. After release, Arctic stayed around Ano Nuevo for about four weeks. On 5/15/2009, she was visually resighted by UCSC biologist Pat Morris. Pat observed Arctic resting in an area of the island where she normally sees wild Steller sea lions and reported that Arctic was in good body condition. Next, Arctic took a three day trip to Monterey Bay, and then travelled north to Point Reyes National Seashore. She's been taking trips in and around the Point Reyes area since 5/22/09 and we hope she will continue to thrive and one day help contribute to an increase in Steller population numbers. *By Denise Greig, TMMC*



Arctic's movements following her release on 4/20/09. She was released at her stranding site on Año Nuevo Island and has traveled down to Monterey Bay and north to Point Reyes.
Map courtesy TMMC

Mass Stranding of Northern Right Whale Dolphins (cont.)

(Continued from page 2)

center where their heads were CT-scanned, following the expanded necropsy protocol for strandings during Naval activities. The scanning was straightforward, once the team maneuvered the 2.2 - 3 meter animals around several corners! Thorough necropsies were conducted on all of the animals the following day. All four animals had parasites in the nasal sinuses, and all four had mostly empty GI tracts. In the biggest animal, there was a brain lesion that was most likely due to a parasite. Additionally, one of the animals had extensive bruising and subcutaneous hemorrhage, consistent with being in the surf zone for an extended time period. A complete suite of tissues was collected for histology and other diagnostic tests; these results are still pending.

Aerial support during the event was provided by NMFS-Southwest Fisheries Science Center and Channel Islands National Marine Sanctuary—no additional stranded or milling animals were detected.

Thanks to all who helped out with this complex and rare stranding event!

The Marine Mammal Center Opens Rebuilt Facility

The newly rebuilt TMMC headquarters in the Marin Headlands. Photo TMMC

June 15, 2009 represented a huge milestone for The Marine Mammal Center in the Marin Headlands, as the public reopening was celebrated. The $32 million renovation began in Fall 2005 and has finally reached its culmination. The new building was built with a great deal of attention to "green" technology in its use of recycled building materials, approach to conserving energy, and the way it maintains harmony between the existing natural landscape while meeting the needs of the marine mammal patients. The shade structures over each pen are made up of 5 solar modules that provide protection from the elements and also reduce energy consumption by about 10%. A modernized water treatment plant also allows for approximately 80% of the backwashed water to be reclaimed.

In addition to being a great space for the animals, significant improvements were also made for our human colleagues, moving them out of shipping containers and into actual buildings! The new onsite lab will greatly assist the animal care staff in diagnosis, treatment and husbandry. An expanded classroom and transparent walls into many of the buildings will greatly enhance the education and outreach potential as well. Congratulations to TMMC on your new space, and hopefully we will all get a chance to visit the Center soon.

Upcoming Meetings and Trainings:

"Management of Animal Carcasses, Tissue and Related Byproducts"

July 21-23, 2009 at Gladys Valley Hall—University of California, Davis

A three-day workshop discussing of emergency response, composting, burial, and rendering! To register or find out more: **http://www.extension.umaine.edu/byproductssymposium09/default.htm**

24-hour HAZWOPER Training

August 12-14, 2009 at LA Oiled Bird Care, San Pedro, CA

For more information or to register contact Nils Warnock at: ndwarnock@ucdavis.edu or (530) 752-5797

National Marine Mammal Stranding Network Conference

April 5-9, 2010 at the National Conservation Training Center, Shepherdstown, WV

Planning is underway—for more information contact steering committee members Shelbi Stoudt, Jim Dines, or Sarah Wilkin

Photo courtesy Monica Hiner

Welcome Monica Hiner to the CA Stranding Network!

Welcome to the new Director of the Northcoast Marine Mammal Center, Monica Hiner. Monica got her Bachelor's degree in Environmental Field Biology at Lewis-Clark State College, and a Master's in Fishery Resources at the University of Idaho where her thesis work and studies focused on disease. Her most recent position was with the Yurok Tribe in Klamath, CA, where she was a Fisheries Biologist working on fish disease projects, including taking a lead role in investigating the 2002 Klamath River fish kill. A northern CA native, Monica previously volunteered at NMMC between 2000-2002 and is excited to be back. Welcome Monica!

New Animal Enclosures at Fort Mac

On April 7th the Marine Mammal Care Center at Fort Macarthur unveiled the opening of new patient housing space at the facility: three isolation enclosures and two critical care enclosures. While enhancements have been made to staffing, lab facilities and other upgrades, this project marks the first time in over twelve years that the Care Center has been able to add to the actual patient housing space. The enclosures are intended to create space for up to 20 additional animals, allow for better quarantine practices, and improve staff and volunteer safety by reducing per-enclosure density. Design innovations include: improved drainage; temporary divider walls which can be put in place to minimize the potential for cross-contamination; and the use of sustainable materials such as recycled plastic lumber for use in enclosure fixtures.

photos courtesy MMCC/FM

The Care Center also unveiled the new donor block program: blocks on the enclosures are available for engraving with a name or message (for more info call 310-548-5677).

All of us at the Marine Mammal Care Center would like to express our thanks to the community, our funding organization MAR^{3}INE, and the John H. Prescott program for making these additions possible. Please visit when you can!

By David Bard, MMCC/FM

High numbers of stranded California sea lions

California sea lions have been stranding at a very high rate in central and southern California so far in 2009, especially since May; many facilities have already admitted more animals than in all of 2008 (see table). Most are yearlings, following last year's record number of 59,000 pups. The animals are coming in emaciated and weak, but we don't fully understand what is happening with the abundance and distribution of the prey of these sea lions. Scientists at the National Weather Service's Climate Prediction Center are also forecasting favorable oceanographic conditions for the development of an El Niño during this summer, although we would expect to see impacts to the marine mammal community from that event next year (2010). For now there's no good explanation—just lots of sea lions.

Facility	May-June	2009 Total	% of 2008 total
The Marine Mammal Center	328	401	260%
Santa Barbara MMC		226	
Channel Islands MWI (Ventura)	26	26	116%
MMCC at Fort MacArthur (LA)	110	185	87%
Pacific MMC (Orange Co.)	60	144	106%
2009 CSL TOTAL TO DATE: 982			

Notable Strandings—April 2009

Photo by Moss Landing Marine Laboratories

Killer Whale—Carmel

This 3-meter female killer whale was first reported on April 4, 2009 to Moss Landing Marine Laboratories. Initial exam confirmed sex and species, and allowed the collection of a skin sample. Killer whales are a high priority species for NMFS to examine (particularly given the severely endangered status of Southern residents). MLML responders took advantage of a break in heavy seas to conduct a multi-phase recovery effort which included towing the animal behind three different platforms, allowing for a full necropsy and essential sample collection. Thanks for your dedication in examining this relatively rare specimen!

Fin Whale—Los Angeles

On April 10, 2009, the Port of Los Angeles reported that a large whale had been brought in that morning on the bow of a container ship. The LA County Museum of Natural History led the response with assistance from NMFS-SWR. The Port was extremely helpful during the examination by utilizing their heavy equipment and skilled operators to pull the animal, a very fresh 62-foot adult male fin whale, on to land so that we could conduct a partial necropsy. The strike site was examined and multiple bone fragments were observed. Many thanks to the Port and the response team!

Photo by Sarah Wilkin, NMFS

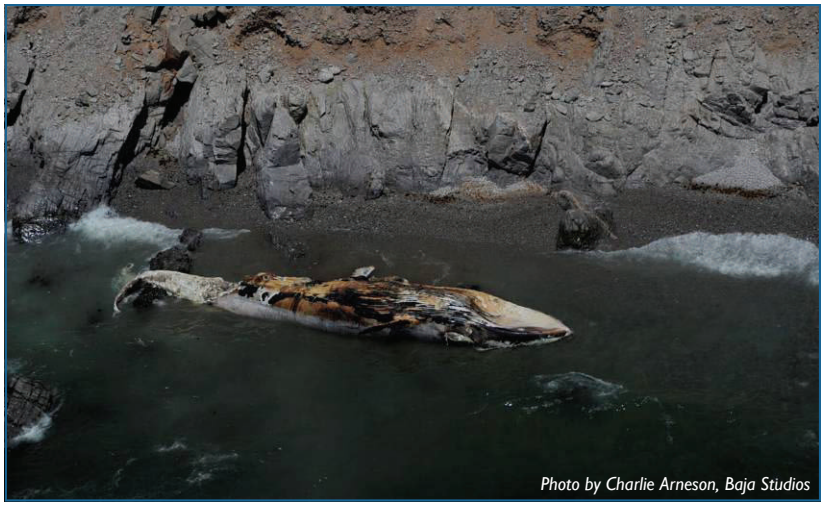


Photo by Charlie Arneson, Baja Studios

Large Whales—Baja, Mexico

The last week of April 2009 a helicopter pilot flying over remote beaches along the Sonoran (mainland) coast in the Gulf of California observed multiple carcasses of decomposed large whales. Additional animals were reported along the Baja Peninsula, totaling over 25 animals. A team from Mexico investigated the animals in northern Baja, counting a total of 13 carcasses; three animals were identified as Bryde's whales. Samples were taken from the rest to determine sex and species; the animals were too decomposed for any disease sampling. The cause of this mortality is unknown, although there were no concurrent reports of algae blooms, fish kills or dead birds, which would indicate that a Harmful Algal Bloom likely to be the cause.

Recent Publications—Marine Mammal Health and Stranding

Bearzi, M. et al. 2009. Skin lesions and physical deformities of coastal and offshore common bottlenose dolphins (*Tursiops truncatus*) in Santa Monica Bay and adjacent areas, California. Ambio. 38(2):66-71.

Colegrove, K.M. et al. 2009. Pathological features of amyloidosis in stranded California sea lions (*Zalophus californianus*). Journal of Comparative Pathology. 140: 105-112.

Dau, B.K. 2009. Fishing gear-related injury in California marine wildlife. Journal of Wildlife Diseases. 45(2): 355-362.

Dennison, S.E. et al. 2009. Normal thoracic radiographic anatomy of immature California sea lions (*Zalophus californianus*) and immature northern elephant seals (*Mirounga angustirostris*). Aquatic Mammals. 35(1):36-42.

Fire S.E. et al. 2009. Domoic acid exposure in pygmy and dwarf sperm whales (*Kogia* spp.) from Southeastern and Mid-Atlantic U.S. Waters. Harmful Algae. 8:658-664.

Goldstein, T. et al. 2009. The role of domoic acid in abortion and premature parturition of California sea lions (*Zalophus californianus*) on San Miguel Island, California. Journal of Wildlife Diseases. 45(1):91-108.

Green, J.A., et al. 2009. Trial implantation of heart rate data loggers in pinnipeds. Journal of Wildlife Management. 73: 115-121.

Moore, M.J. et al. 2009. Gas bubbles in seals, dolphins and porpoises entangled and drowned at depth in gillnets. Veterinary Pathology. 46:536-547.

Ng, T. et al. 2009. Novel anellovirus discovered from a mortality event of captive California sea lions. Journal of General Virology. 90:1256-1261.

Philippa, J.D.W. et al. 2009. Neurological signs in juvenile harbour seals (*Phoca vitulina*) with fatal phocine distemper. Veterinary Record. 164(11): 327-331.

St. Leger, J.A. et al. 2009. Comparative pathology of nocardiosis in marine mammals. Veterinary Pathology. 46(2):299-308.

Stoddard, R.A., et al. 2009. The effects of rehabilitation of northern elephant seals (*Mirounga angustirostris*) on antimicrobial resistance of commensal *Escherichia coli*. Veterinary Microbiology. 133: 264-271.

Torres de la Riva, G. et al. 2009. Association of an unusual marine mammal mortality event with Pseudo-nitzschia spp. blooms along the southern California coastline. Journal of Wildlife Diseases. 45(1): 109-121.

Zabka, T.S. et al. 2009. Characterization of a degenerative cardiomyopathy associated with domoic acid toxicity in California sea lions (*Zalophus californianus*). Veterinary Pathology. 46:105-119.

Zuerner, R.L and D.P. Alt. 2009. Variable nucleotide tandem-repeat analysis revealing a unique group of *Leptospira interrogans* serovar Pomona isolates associated with California sea lions. Journal of Clinical Microbiology. 47(4):1202-1205.

Zuerner, R.L. et al. 2009. Geographical dissemination of *Leptospira interrogans* serovar Pomona during seasonal migration of California sea lions. Veterinary Microbiology. 137(2009):105-110.

Like the Newsletter? Help make it better!

Submit your photos, stories, observations, notes, and recent publications for inclusion in our next issue, ETA Nov 2009!
E-mail them to Sarah at: sarah.wilkin@noaa.gov

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Southwest Regional Office
Marine Mammal Stranding and Disentanglement Program
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Appendix F

News Article about Sea Lions' Attacks

Thursday, November 30, 2006 - Page updated at 12:00 AM

E-mail article | Print view

San Francisco sea lions are on the attack

By MARCUS WOHLSEN
The Associated Press

SAN FRANCISCO — Tourists flock to Fisherman's Wharf for the seafood and the stunning views of San Francisco Bay, but for many visitors, the real stars are the dozens of playful, whiskered sea lions that lounge by the water's edge, gulping down fish.

Related
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- Sign up for our Travel newsletter

Now a series of sea-lion attacks on people in recent months has led experts to warn that the animals are not as cute and cuddly as they appear.

"People should understand these animals are out there not to attack people or humans. But they're out there to survive for themselves," said Jim Oswald, a spokesman for the Marine Mammal Center across the Golden Gate Bridge from San Francisco.

In the most frightening of the recent episodes, a rogue sea lion bit 14 swimmers this month and chased 10 more out of the water at San Francisco's Aquatic Park, a sheltered lagoon near the bay. At least one victim suffered puncture wounds.

Some scientists speculate that the animals' aggressive behavior is being caused by eating fish contaminated by toxic algae, or by a shortage of food off the coast. But wildlife experts say even healthy sea lions are best left alone.

In Southern California in June, a sea lion charged several people on Manhattan Beach and bit a man before waddling into the water and swimming away. In Berkeley, a woman was hospitalized last spring after a sea lion took a chunk out of her leg.

Sea lions, which can reach 1,000 pounds, typically bite only if they feel threatened or cornered. And they are more likely to flee than fight if they can escape. Researchers have described the most recent attacks, in which some swimmers were chased through open water, as abnormal behavior.

Still, with a population numbering about 200,000 and growing, these playful, social creatures are increasingly likely to cross paths with humans.

Sea lions accustomed to the easy pickings of seafood scraps in popular fishing areas can become aggressive toward people if they fear their food is about to be taken away, Oswald said.

The Berkeley attack, for example, was at a marina where fishermen dock their boats and feed fish scraps to sea lions. After they ran out of scraps, the sea lion turned aggressive and bit a crew member.

At the same time, a drop in fish stocks off the Southern California coast due to El Nino-like conditions could be driving more hungry sea lions than usual to San Francisco Bay, said Lynn Cullivan, a spokesman for San Francisco Maritime National Historical Park.

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Humans could also be contributing to aggression in sea lions in another way: Toxic algae blooms fed by agricultural runoff and other pollution can lead to the poisoning of marine mammals by a chemical called domoic acid, which can cause brain damage. The Marine Mammal Center treated more than 200 sea lions for domoic acid poisoning last year.

Veterinarians at the center believe the brain damage caused by the poison could have led to the marauding animal's erratic behavior in Aquatic Park, Oswald said, though they cannot be sure without actually examining the sea lion.

So far park rangers have not been able to track the attacker down. Nevertheless, the lagoon where the attacks occurred has been reopened to swimmers, though with new signs warning people to stay away from sea lions.

Appendix G

AMMPA Press Release

FOR IMMEDIATE RELEASE
March 10, 2005

MEDIA CONTACT:
Emily Mason, PCI
312-558-1770, ext. 136
emason@pcipr.com

The Dolphin is America's Sweetheart!

NEW POLL REVEALS AMERICA'S FAVORITE AQUARIUM ANIMAL

ALEXANDRIA, Va. – Dolphins are America's darlings. According to the results of a new public opinion poll announced today, a full 40 percent of U.S. adults named dolphins as their favorite aquarium animal.

DOLPHINS ARE A GIRL'S BEST FRIEND!

The new poll released by the Alliance of Marine Mammal Parks and Aquariums finds that higher percentages of women than men choose dolphins as their favorite aquarium animal exhibit, while higher percentages of men than women choose sharks:

Dolphins

Women - 46 percent
Men – 34 percent

Sharks

Men– 17 percent
Women – 8 percent

Sampling error for the overall results: +/- 3 percentage points

Dolphins are especially popular among women, while men showed a preference for sharks. Forty-six percent of women surveyed listed dolphins as their favorite aquarium animal, while only 34 percent of men did the same. Overall, sharks came in a distant second with 13 percent of the total vote. But 17 percent of men said sharks were their favorite, while only 8 percent of women said sharks rule.

The poll, released by the Alliance of Marine Mammal Parks and Aquariums and conducted by Harris Interactive®, also showed that 91 percent of respondents agree that interacting with dolphins offers people a deeper understanding and appreciation of them.

"Our visitors tell us that they see and learn about dolphins by visiting marine life parks, aquariums and zoos," said Marilee Menard, executive director of the Alliance of Marine Mammal Parks and Aquariums, a 45-member international professional association. "We have always believed that seeing marine mammals in person helps increase people's understanding and appreciation of them. This new research demonstrates that this is more than a belief – it's a fact."

Following are some additional findings from the new research:

- more -

- 97 percent of respondents agree that marine life parks, aquariums and zoos play an important role in educating the public about marine mammals they might not otherwise have the chance to see.

- 96 percent agree that marine life parks, aquariums and zoos provide people with valuable information about the importance of oceans, waters and the animals that live there.

- 93 percent agree that visiting a marine life park, aquarium or zoo can inspire conservation action that can help marine mammals and their natural environment.

- 93 percent agree that people are more likely to be concerned about animals if they learn about them at marine life parks, aquariums and zoos.

- If looking for educational information about marine mammals, 75 percent would either visit a marine life park, aquarium or zoo or go to their Web sites.

Menard said, "The ultimate goal at responsible parks and aquariums is to provide an educational and enjoyable experience for families while increasing their understanding and appreciation of these magnificent animals and the need to protect them in the wild. We feel extremely gratified to know that we are achieving this goal."

Wondering how other aquarium animal exhibits rate? Here are the top five favorites among U.S. adults, chosen from a group of eight:

Dolphins	40%
Sharks	13%
Tropical fish	11%
Killer whales	8%
Sea turtles	7%

Methodology
Harris Interactive® conducted the study online on behalf of the Alliance of Marine Mammal Parks and Aquariums between September 16 and 21, 2004 among a nationally representative

sample of 1,102 U.S. adults aged 18 and over, of whom 319 were aged 18-34. The data were weighted to be representative of the total U.S. adult population on the basis of region, age within gender, education, household income, race/ethnicity and propensity to be online.

In theory, with samples of this size, one could say with 95 percent certainty that the results for the overall sample have a sampling error of plus or minus 3 percentage points. Sampling error for the men's sample results is plus or minus 4 percentage points and for the women's sample results is plus or minus 5 percentage points. This online sample is not a probability sample.

About the Alliance of Marine Mammal Parks and Aquariums
The Alliance of Marine Mammal Parks and Aquariums (www.ammpa.org) is an international association of marine life parks, aquariums, zoos, research facilities, and professional organizations dedicated to the highest standards of care for marine mammals and to their conservation in the wild through public education, scientific study, and wildlife presentations.

About Harris Interactive®
Harris Interactive Inc. (www.harrisinteractive.com), the 15th largest and fastest-growing market research firm in the world, is a Rochester, N.Y.-based global research company that blends premier strategic consulting with innovative and efficient methods of investigation, analysis and application. Known for *The Harris Poll®* and for pioneering Internet-based research methods, Harris Interactive conducts proprietary and public research to help its clients achieve clear, material and enduring results.

Harris Interactive combines its intellectual capital, databases and technology to advance market leadership through U.S. offices and wholly owned subsidiaries: London-based HI Europe (www.hieurope.com), Paris-based Novatris (www.novatris.com), Tokyo-based Harris Interactive Japan, through newly acquired WirthlinWorldwide, a Reston, Virginia-based research and consultancy firm ranked 25th largest in the world, and through an independent global network of affiliate market research companies. EOE M/F/D/V

# # #

Appendix H

Exhibit 1

IMMS Brochure about Facility

The Institute for Marine Mammal Studies (IMMS) is a non-profit organization established in 1984 for the purposes of public education, conservation and research of marine mammals in the wild and under human care. The Center for Marine Education and Research provides a place for IMMS to fulfill its mission and share its work with the public.

FIELD TRIP INFORMATION

ADMISSION:

$2 per student
Chaperones are free
(1 per 10 students)

HOURS:

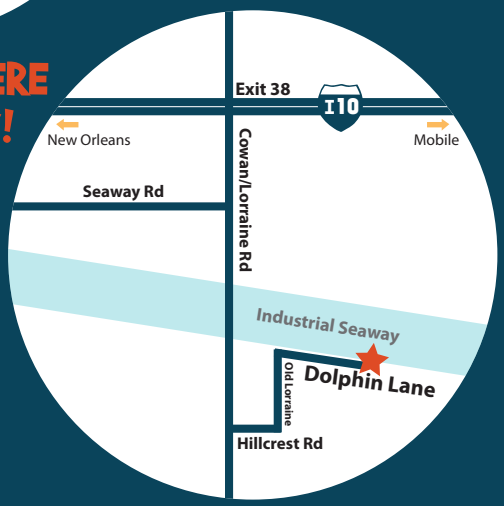
Monday - Friday
9am - 4pm

Reservations are required.
Please call 228.896.9182
or email us at
contactus@imms.org

Parking is FREE and
bus parking is available.

Contact us for weekend hours, special events and memberships.

GETTING HERE IS EASY!



INSTITUTE FOR MARINE MAMMAL STUDIES
Gulfport, Mississippi

www.IMMS.org

ENCOUNTER

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CENTER FOR MARINE EDUCATION AND RESEARCH

EXPLORE

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www.IMMS.org

IMMERSE YOURSELF IN THE WONDERS OF THE SEA!

At South Mississippi's premier marine education and conservation center, visitors of all ages will be engaged in a fun, hands-on learning experience that will help them understand and appreciate the species that make our Gulf Coast waters unique.

MUSEUM

Explore 2,000 square feet of interactive exhibits and life-size replicas of sea creatures. Sift through the sand for a shark tooth and identify the species. Admire the marine inspired local art.

DISCOVERY ROOM

Encounter the touch pool. Hold a horseshoe crab and get close with stingrays, sea stars and other marine animals. Observe saltwater and freshwater aquariums and analyze artifacts.

AUDITORIUM

Experience an underwater adventure on the big screen. Films shown daily in our 180-seat auditorium.

The perfect place for a special presentation or teacher activity!

Appendix H

Exhibit 2

IMMS Stranding Brochure

IMMS will respond to any of the following:

- A dead or alive dolphin or whale
- A live turtle
- A live otter
- A dead or alive manatee

For the following animals, IMMS can relay your information to the appropriate authorities:

- Sick or injured sea bird
- Dead stranded turtle

Stranding Hotline

DOLPHIN RESCUE

1 (888) SOS - DOLPHIN

(1-888-767-3657)

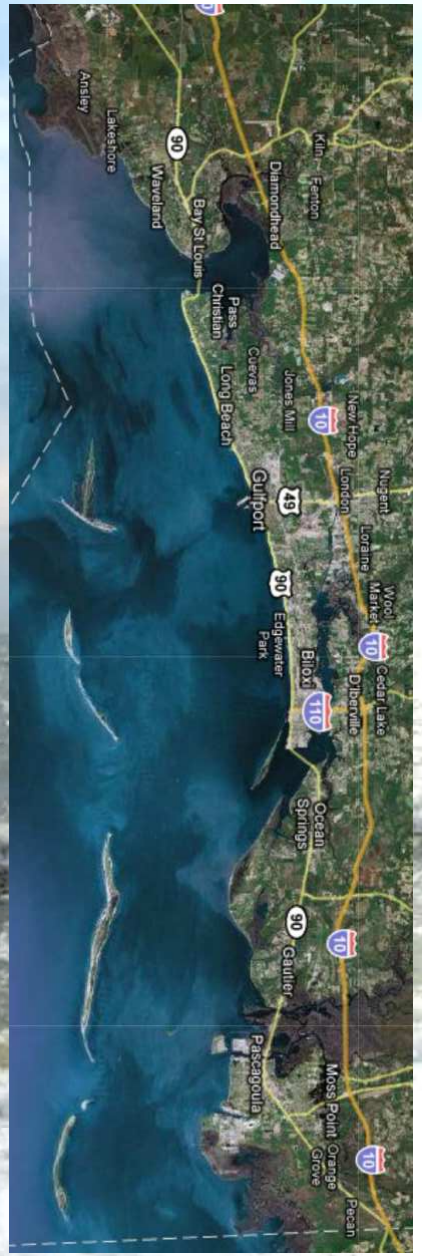
www.IMMS.org

INSTITUTE FOR MARINE MAMMAL STUDIES

Marine Mammal Stranding Survey and Response Guide

Gulfport, Mississippi

IMMS Stranding Survey Area



Hancock County Beaches

Harrison County Beaches

Jackson County Beaches

Shorelines of MS Barrier Islands

Contact IMMS for an area to survey:

(228) 896-9182, contactus@imms.org

Who is IMMS?

The Institute for Marine Mammal Studies (IMMS), located in Gulfport, MS, is a non-profit organization dedicated to public education, conservation and research of marine mammals in the wild and under human care.

What is a stranding?

A stranded animal is one that is unable to return to their natural habitat (stuck on a beach, trapped at low tide, entangled in fishing gear, sick, injured, or dead).

The IMMS rescue team prepares to relocate this young stranded dolphin.

A sea turtle that was rescued after having a fish hook embedded in her mouth.

What is a stranding survey?

IMMS regularly conducts walking surveys of Mississippi shorelines. Harrison, Hancock, and Jackson County beaches are divided into 1-2 mile survey areas. Designated areas are surveyed by volunteers, who then report their findings to IMMS staff upon completion.

Why does IMMS conduct stranding surveys?

- All marine mammals are federally protected. All stranded marine mammals must be reported to the National Marine Fisheries Service.
- With every stranded animal found and reported, IMMS can gain valuable information about the species and any problems it may be incurring.

Where do I look for stranded animals on the beach?

- On the shoreline
- Up in the soft sand where an onlooker may have pulled the animal on shore
- In the shallow water (at least 100 yards out)

IMMS staff responding to a pygmy killer whale stranding in April 2008.

What to look for?

- A stranded dolphin alive OR dead
- Dolphins range in size from 2-10 ft. in length, and small animals are often missed.
- Dolphin carcasses with any degree of decomposition.
- Partial carcasses (Please call the stranding hotline below to obtain assistance with identification)

If you only find a skull, it can still be reported, as long as it can be positively identified as a dolphin.

What to do if you find a stranded animal?

Call the IMMS stranding hotline number **IMMEDIATELY**:

1(888)SOS-DOLPHIN

(1-888-767-3657)

- **DO NOT PUSH THE ANIMAL BACK OUT TO SEA!** (the animal stranded for a reason and more than likely needs medical attention)
- Make sure the blowhole on top of the head (which is used for breathing) is clear of any obstruction. Do not allow water to enter its blowhole at any time.
- Keep onlookers, children, and pets away
- Be extremely careful around the head and tail. Dolphins are very powerful animals even when their health is compromised.
- Sick animals can carry diseases so please do not handle them without proper instruction.

What does IMMS do with stranded dolphins?

If Alive: IMMS' Dolphin Rescue Team will take the appropriate measures depending on the animal's condition. The ultimate goal is always to release the animal back into the wild if possible.

If Dead: IMMS will collect various tissue samples for analysis and look for signs of injury, pollution, disease, infection, and parasites. Signs of human interaction are also investigated if present.

IMMS staff examining a newborn dolphin stranding.

Why is studying dolphins important?

There are about 75,000 bottlenose dolphins in the Gulf of Mexico. Approximately 2,000 of them reside in the Mississippi Sound. Dolphins, like humans, are at the top of the food chain, which makes them biological indicators of their environment. Because humans and dolphins share habitat and food supply, changes in the ecosystem that impact dolphins also affect humans.

IMMS's dolphin rescue team carries a 600 lb offshore bottlenose dolphin that was stranded in shallow water.

How can I help with stranding surveys?

If you would like to help IMMS with stranding surveys, please call (228) 896-9182 or email contactus@imms.org.

Appendix I

IMMS Key Personnel

APPENDIX I

Qualifications of Key Personnel

Dr. Moby Solangi – *Executive Director & Founder of IMMS (Principal Investigator)* – Ph.D. in Marine Biology and over 27 years of experience in all aspects of the marine mammal industry including stranding response and rehabilitation, capture and restraint, husbandry, research, water quality, public display, training, transport, diagnostic sampling, necropsy, public and media relations. Serves as adjunct faculty at University of Southern Mississippi, Mississippi State University, Jackson State University, Louisiana State University and Oklahoma State University and has served on committees of many graduate students.

Dr. Delphine Vanderpool – *Assistant Director of Research (Co-investigator)* – M.D. (doctorate in medicine) and over 15 years of experience in marine mammal handling, behavior, and husbandry; and over 6 years of experience in research management, stranding response and rehabilitation, transport, necropsy, tissue collection, public relations.

Dr. Connie Chevis – *Attending Veterinarian (Co-investigator)* – D.V.M. (doctorate in veterinary medicine) and more than 12 years of experience in marine mammal medicine, nutrition, diagnostic sampling, husbandry, transport, and necropsy; also over 6 years of experience in research and teaching.

Mr. Tim Hoffland – *Stranding Coordinator / Director of Animal Care* – B.S. in biology and over 18 years of experience in the marine mammal science including training, behavior, handling, capture and restraint, transport, husbandry, diagnostic specimen collection, nutrition, water quality, necropsy, and research data collection.

Dr. Sharon Walker – *Director of Education and Outreach* – Ph.D. in Science Education and over 30 years of experience in the same; former director of the University of Southern Mississippi's Marine Education Center for over 25 years.

Ms. Shea Eaves – *Research Assistant / Educational Coordinator* – B.S. in biology and over 8 years of experience in marine mammal training, behavior, husbandry, transport, capture and restraint, handling, nutrition, diagnostic specimen collection, water quality; also over two years experience in stranding response and rehabilitation and research data collection.

Ms. Emma Jarvis – *Research Assistant / Volunteer Supervisor* – B.S. in psychology and biology and over 6 years of experience in marine mammal training, behavior, husbandry, handling, and transport; also experienced in stranding response and rehabilitation, and research data collection.

Ms. Shannon Huyser - *Research Assistant / Educational Coordinator* – over 12 years of experience in marine mammal training, behavior, husbandry, transport, capture and restraint, handling, nutrition, diagnostic specimen collection and water quality; also 3 years of experience in stranding response and rehabilitation.

Ms. Becky Winstead – *Research Assistant* – B.S. in psychology and 3 years of experience in stranding response and rehabilitation, specimen collection, and research data collection; additionally, has a year and a half of experience in marine mammal training, behavior, husbandry, handling, nutrition, transport, and diagnostic specimen collection.

Ms. Kelly Folkedahl – *Research Assistant / Educational Coordinator* – B.S. degree in biology with a minor in psychology as well as a certificate from the Exotic Animal Training and Management Program at Moorpark College in Moorpark, CA; experience in sea lion and bird training as well as field research and data analysis.

Ms. Megan Broadway – *Research Assistant* – B.S. in marine science and collegiate plus two years work experience in behavioral and ecological research data collection including photo ID, habitat delineation, population dynamics, passive listening, and behavioral observations; and two years experience in stranding response.

Dr. Tami Wells – *Marine Ecologist* – Ph.D. (candidate for May 2010 graduation) in Marine Science with over 10 years of experience in marine ecology, coastal sciences, coastal restoration, and remote sensing with marine mammal mitigation applications.

Dr. Rick Kastner – *Senior Biologist* – Ph.D. – has over 30 years of experience in fishery biology and research.

Appendix J

Photo Exhibits

Center for Marine Education and Research— Aerial
Exhibit 1

Center for Marine Education and Research— Site Plan
Exhibit 1

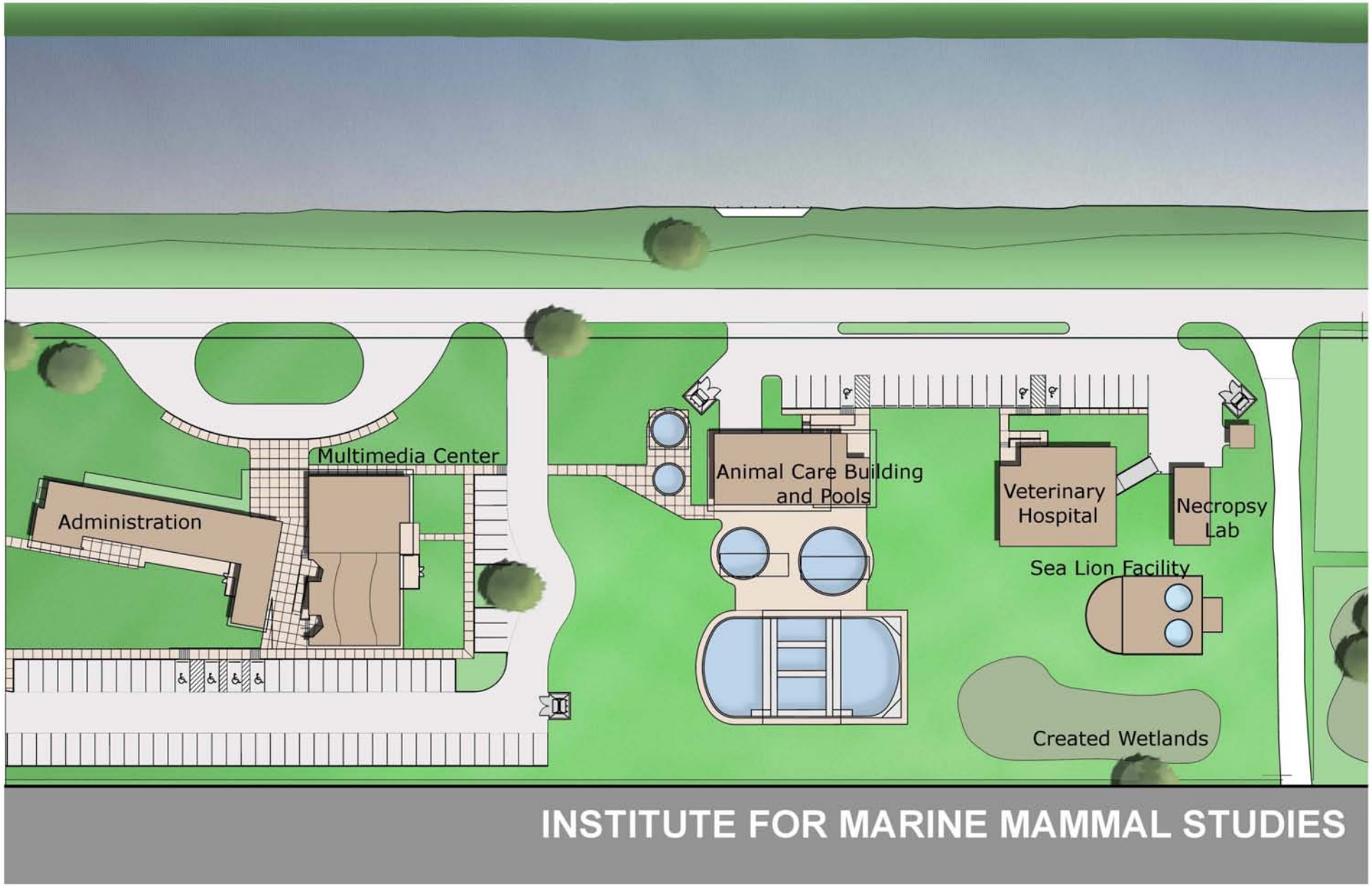


Exhibit 2

Multimedia Center

Multimedia Center.

Breezeway and multimedia center.

Exhibit 2 continued

Multimedia Center Floor Plan

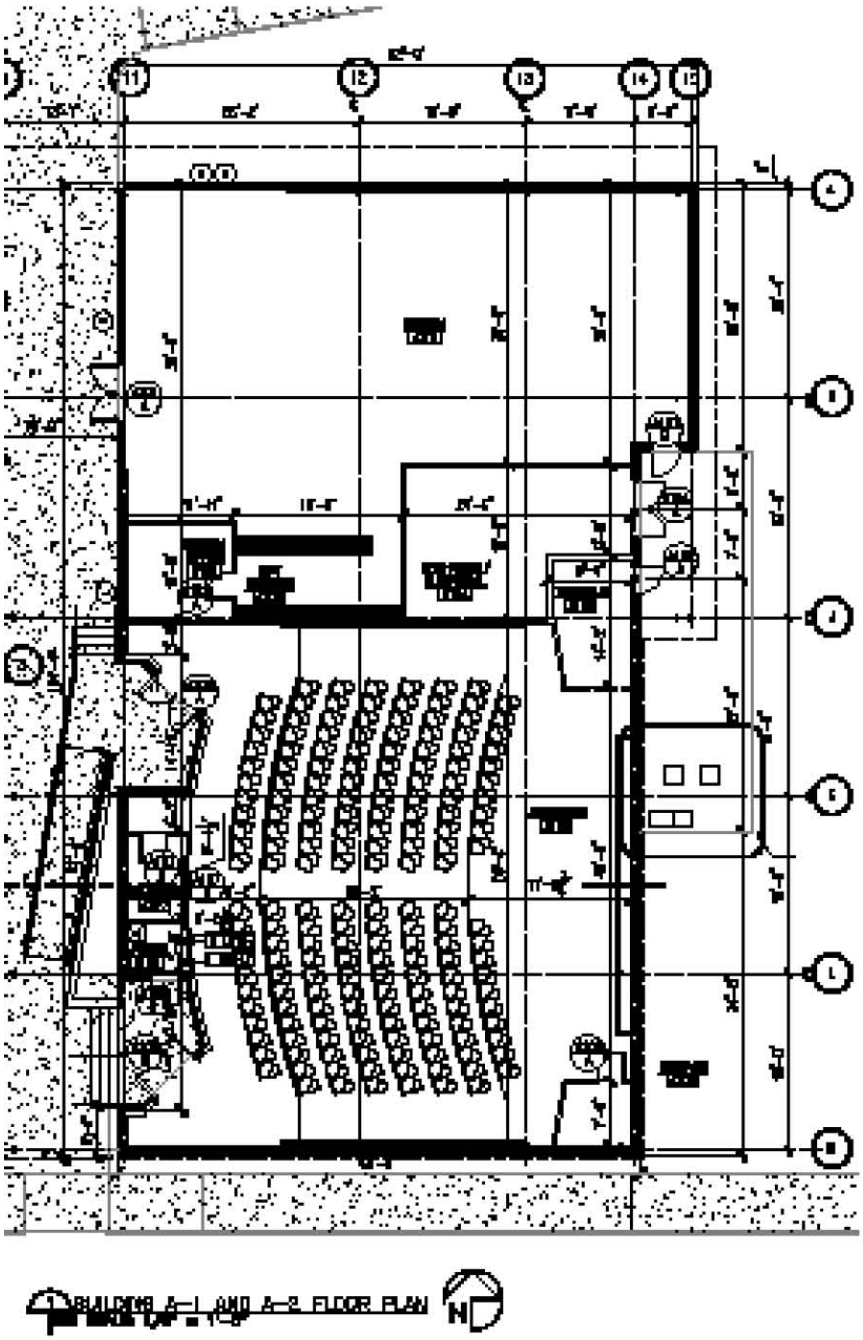


Exhibit 2 continued

Multimedia Center—Museum & Classroom

Interactive museum.

Reception area—museum.

Museum office—adjacent to reception area.

Multimedia classroom.

Multimedia classroom (view from back of room).

Multimedia classroom—speaker's podium and emergency exit hallway at front classroom.

Exhibit 3

Animal Care Facility and Pools

Animal Care building—housing life support area, fish kitchen, locker rooms, showers, staff meeting and records area (front view).

Another front view of Animal Care building.

Close-up view of exterior entrance of fish freezer and ramp.

Marine mammal rehab pools—main, large pool in back, 40-foot pool to left, and 30-foot pool to right of photo. View is from 2nd floor security tower in Animal Care building .

East view of dolphin rehab pools behind Animal Care building; 30-foot diameter pool is in foreground and 40-foot diameter pool is in background (30ft. pool is 8ft. deep and 40ft. pool is 10ft. deep.

Main, large, rectangular, marine mammal rehab pool with holding and medical pens in middle. Pool capacity is 650,000 gallons and dimensions are: 125'L x 60'W x 12'D. Perimeter fence can be seen in background.

Exhibit 3 continued

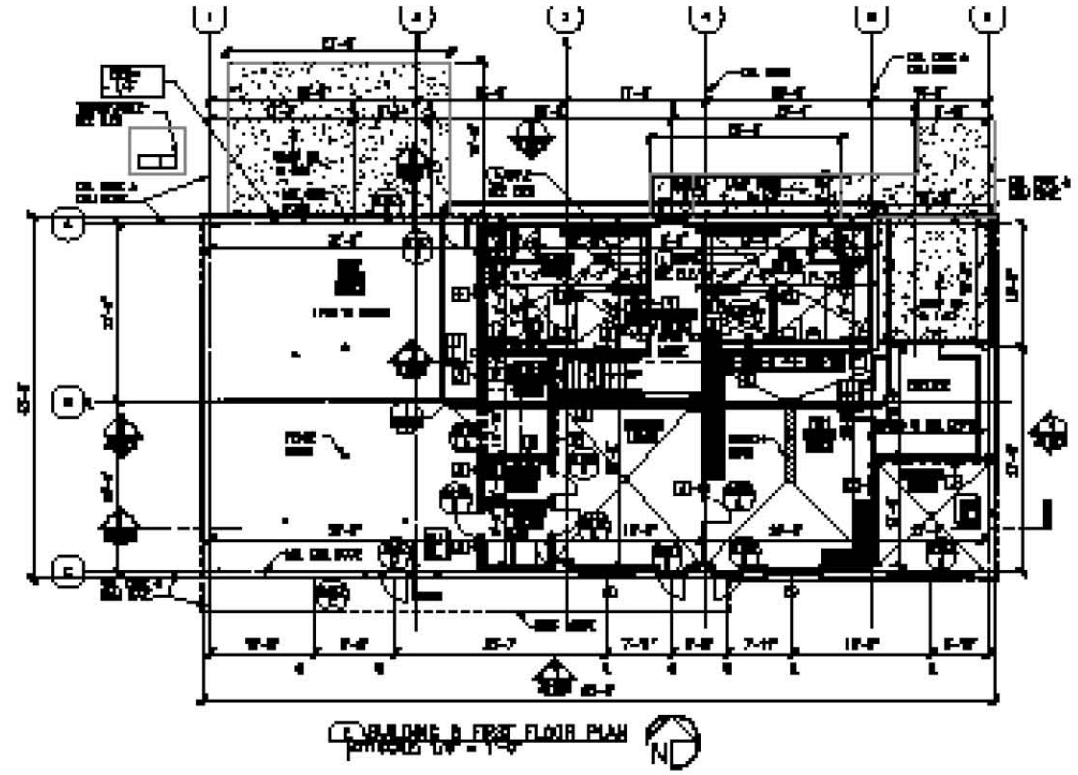
Animal Care Facility and Pools

Two wells constructed for water conservation.

Water treatment and mixing pools for rehab area with wells in background (west of animal care building).

Exhibit 3 continued

Animal Care Building Floor Plan



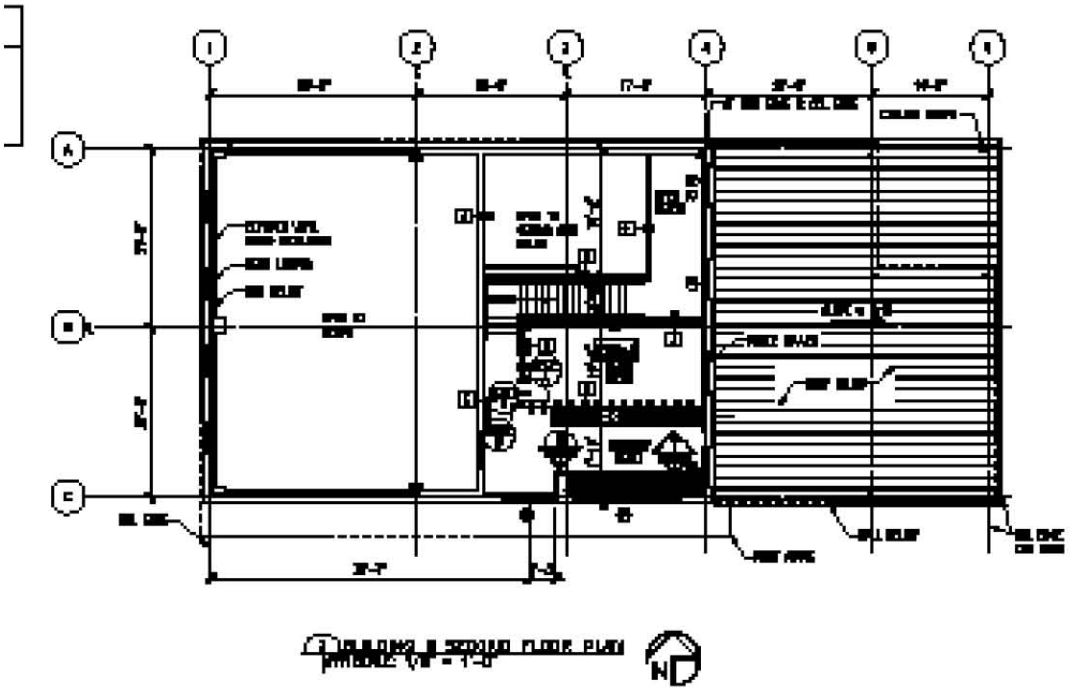


Exhibit 3 continued

Animal Care Facility Interior

Life support systems (pumps and filters) in Animal Care building.

Animal care staff meeting room.

Fish kitchen in Animal Care building—view of sink, counter space, and walk-in freezer.

Another view of the fish kitchen with refrigerator and stainless steal cabinets and counter (view of pools through window).

Interior view of walk-in freezer.

Exhibit 3 continued

Animal Care Facility Interior

Laundry area.

Security room and water quality lab in Animal Care building (2nd floor). The two sets of windows overlook the pools (left) and life support systems (window in back of photo).

Men's locker room. Locker rooms contain changing area, restrooms, and shower.

Interior view of women's locker room.

Shower and toilet facilities.

Changing area and lockers.

Exhibit 4

Veterinary Hospital

Front view (north side) of Veterinary Hospital.

Exterior of Veterinary Hospital, north and west sides of the building.

Receptionist area and lobby.

Exam room.

Small animal treatment room.

Surgical Prep Room.

Exhibit 4 Continued

Veterinary Hospital Floor Plan

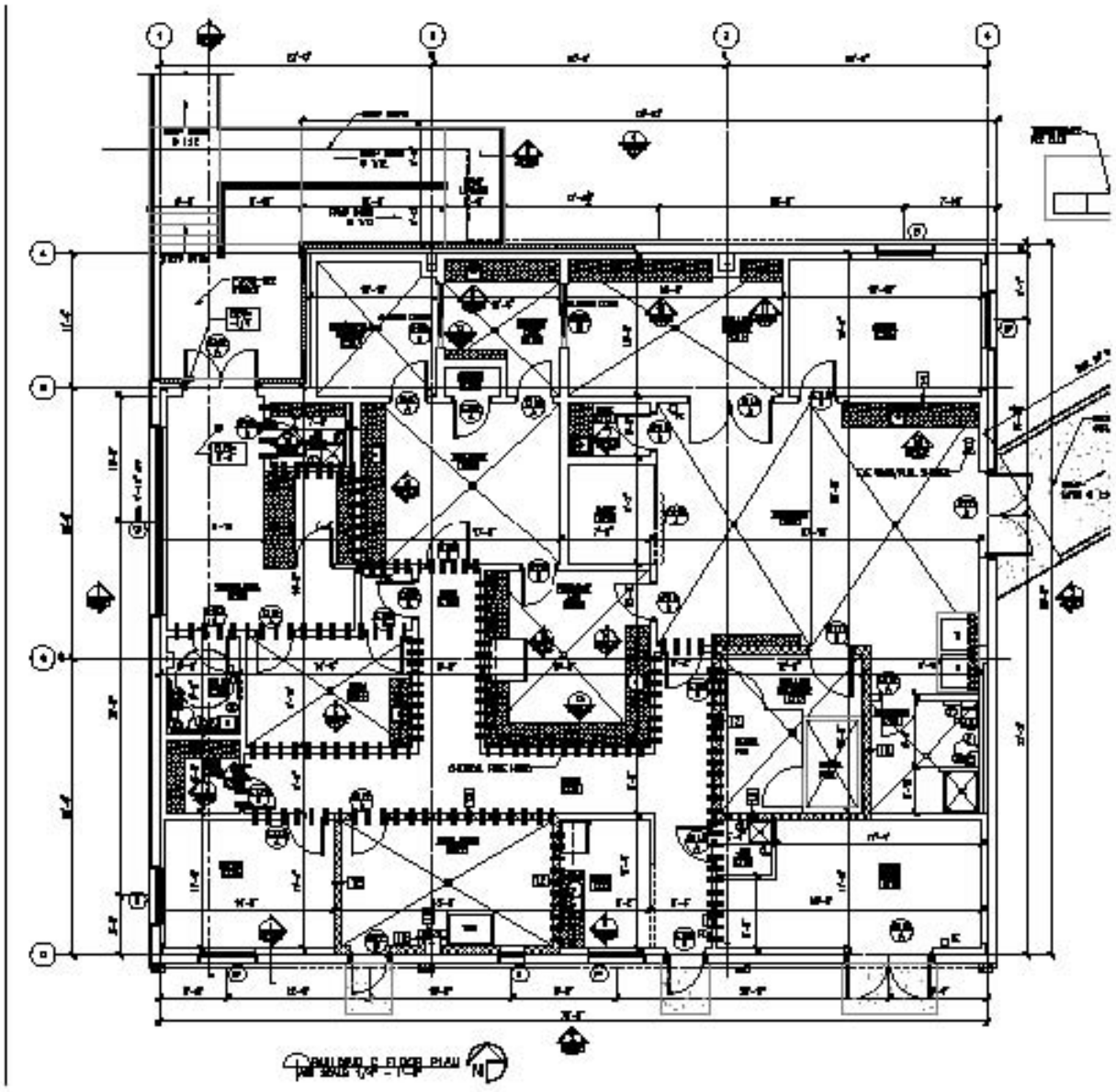


Exhibit 4 continued

Veterinary Hospital Interior

Small animal surgery room.

Large animal (marine mammal) surgery room.

Pharmacy/laboratory in veterinary hospital.

Large animal treatment room.

X-ray area.

Large animal recovery room.

Exhibit 4 continued

Veterinary Hospital Interior

Break area for staff .

Laundry area.

Small animal recovery ward with outdoor access and sink.

Veterinary Hospital hallway.

Veterinarian office.

Secondary office space.

Exhibit 5

Necropsy Building

Exterior of Necropsy Lab.

Inside of Necropsy Lab with freezer and cooler. Both are walk-in types capable of storing a large pilot whale carcass if necessary.

Quarantine Area

Quarantine facility.

Covered pools and water treatment.

34 x 17 x 5 ft. deep pool within green house structure.

50 x 17 x 5 ft. deep pool within green house structure.

Exhibit 5 continued

Necropsy Building Floor Plan

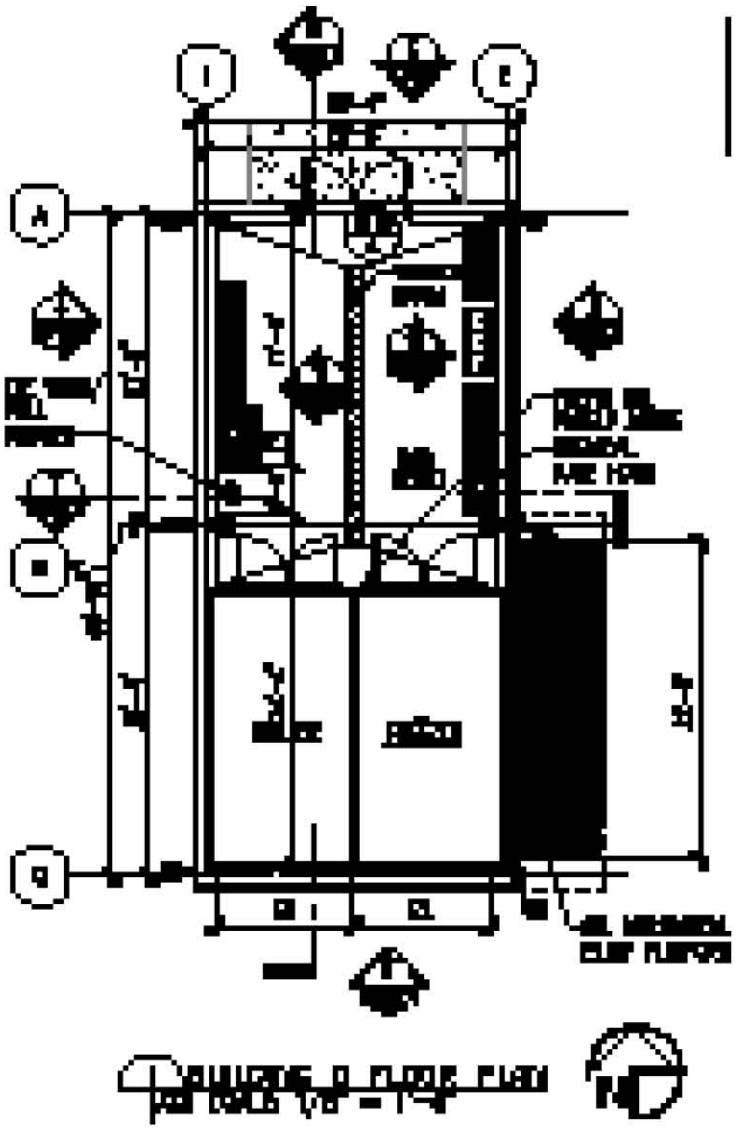


Exhibit 6

Sea Lion Facility

Side view: display stage with bleacher viewing.

Front view: display stage with bleacher viewing.

Interior holding pens.

Interior holding pools.

Dry resting areas.

Appendix K

IMMS' USDA Class C License

USDA

EXPIRATION DATE: DECEMBER 16, 2010

United States Department of Agriculture

Marketing and Regulatory Programs

Animal and Plant Health Inspection Service

Animal Care

This is to certify that

INSTITUTE FOR MARINE MAMMAL STUDIES INC

is a licensed under the CLASS C EXHIBITOR

Animal Welfare Act

(7 U.S.C. 2131 et seq.)

Certificate No. 65-C-0540

Customer No. 322997

Deputy Administrator