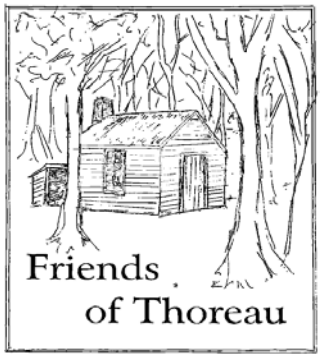

The California Sea Otter Recovery Plan

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> "There is something about sea otters that captures our hearts. Maybe it´s the way a mother otter cuddles her sleeping pup, or the way a pup cries when it´s left alone on surface while its mother dives for food. Whatever it is, these engaging animals give people an emotional connection to the health of the ocean environment." (Foreword of Julie Packard, Executive Director of the Monterey Bay Aquarium, in Elin Kelsey´s *Saving Sea Otters*, edited by the Monterey Bay Aquarium).

Introduction

Sea otters are cute and playful and their pups are some of the fluffiest and more adorable creatures among the animal world. But the important thing is that sea otters are a keystone species, which means that the ecosystem itself which sea otters share with other species depends on sea otters for their survival. Sea otters are also an

important indicator species of the health of their ecosystem since their organisms are highly sensible to contaminants, pollution, and other human activities.

Public opinion and the psychological mood of people are very important factors in the elaboration and implementation of wildlife recovery plans in the US. Humans, in general, feel the need to redress the environmental damage produced by human activities. In this case, the sea otter has an strong emotional link to the people of the Monterey area, CA, where the case study has been conducted. They consider sea otters as part of their landscape, so its symbolic image is not only something that NGOs devoted to sea otters (The Otter Project; or Friends of the Sea Otter…) and prestigious institutions (the Monterey Bay Aquarium, the Marine Mammal Center…) care about, but an important piece in the tertiary economy (research, tourism, commerce…) around which the Bay area, and in particular, the city of Monterey, the epicenter of the sea otter studies in California, carry along their daily business.

Yet, the survival of the California sea otter is threatened mainly due to human activities and other natural dangers. That is why a recovery plan, that would allow for the southern sea otters to reach a number of individuals sufficient to ensure the survival of the species, needed to be designed and implemented. Once more, like with other endangered species as the black-footed ferret, the red wolf or the California condor, the US leads the way in the implementation of recovery plans for the conservation of biodiversity. This tradition is due to several reasons: first, the US has a relatively low human population; second, the US has a large population sensitive to environmental issues; third, it has many good well trained and motivated professionals; fourth, there are a large number of agencies and academic institutions cooperating; fifth, it has relatively strong and effective domestic environmental laws; and finally, and very important, ownership of wildlife is undisputedly state or federal.

Summing up, a recovery plan for the Southern Sea Otter is important for public opinion since it is an emblematic and charismatic species, very significant as an economic and touristic source for the area (in part because sea otters can be seen from the shore). They are a keystone and sentinel (bioindicator) species in marine ecosystems, being considered “the keepers of the kelp forest”.

The shift from aboriginal hunting of sea otters to commercial hunting for pelts after the 1700s drove them almost to extinction by the beginning of the 1900s. From an estimated number of 30.000 in the Pacific coast of North America (16,000 in California), the numbers descended to around 1500 (50 in Big Sur, California). The California, or Southern, sea otter was listed as "threatened" species under the Endangered Species Act in January 14, l977. There was then an estimated population of 1,789 individuals. The Recovery Plan of 1982 stopped the decline of populations that lasted until 1984 (1,372 individuals) and established a trend that allowed for the increase of populations towards the targeted delisting number (2,650). This number was never reached since few years latter, and specially after 1995 when populations started to decline again, it was clear that something was wrong. The main threat (a catastrophic oil spill) had not disappeared and sea otters kept dying (with no definitive conclusions about the cause of their deaths.) The approval of a Revised Recovery Plan, envisioned in 1989, became urgent.

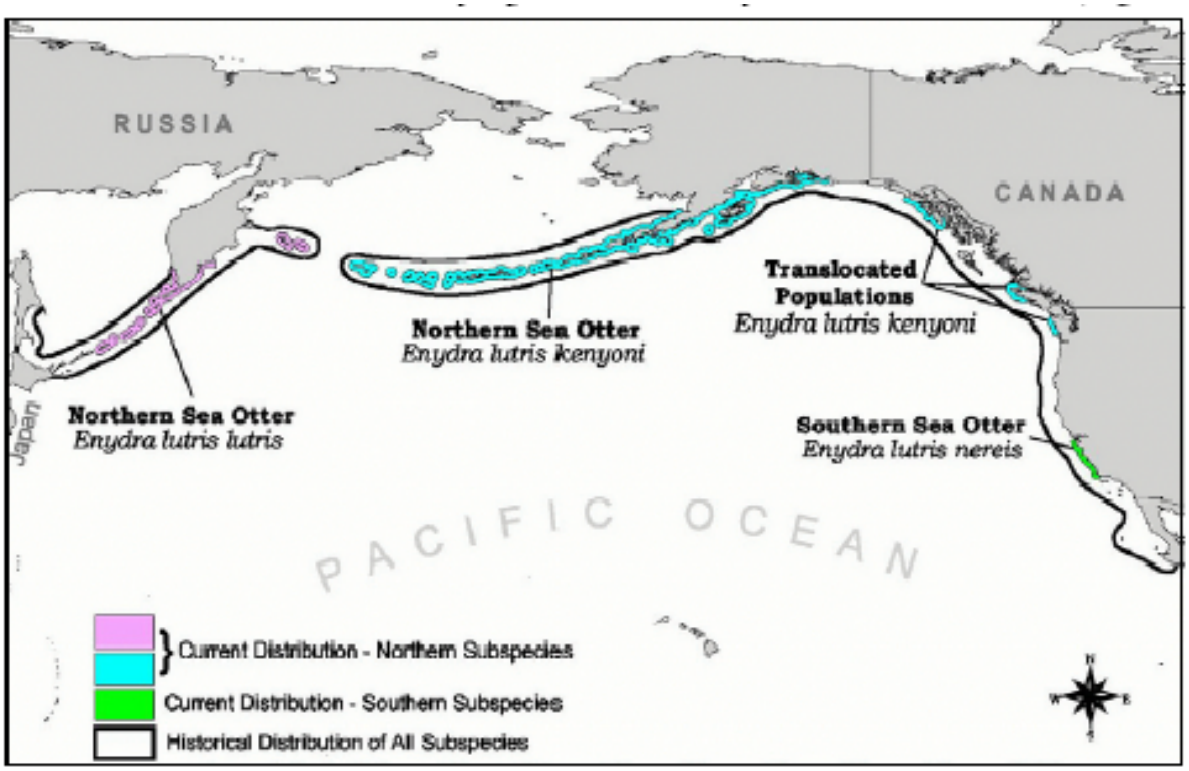
Throughout the essay we are going to analyze the scientific, socio-economic, political, and cultural aspects of the ecological problem regarding sea otters and their influence in the planning process.

Courtesy of Mike Murray & Ree Brennin from the Monterey Bay Aquarium

Sea otters are one of the four groups of marine mammals. The other three groups include pinnipeds (seals, sea lions, and walruses), sirenians (manatees and dugongs), and cetaceans (whales, porpoises, and dolphins). Together with weasels, ferrets, minks, skunks, and badgers, otters, including sea otters, constitute the mustelid family. Its members are the most diverse group of the order of carnivore mammals. They are characterised by the loss of the caranassial notch (on upper premolar- *pm4*), invariable loss of upper molar (*m4*) and the enlargement of the anal sac. They differ from the members of the family of felines by the absence of retractile claws and from those of the family of canids by having a well developed first digit on the forefoot, well developed anal glands and by not having a deep chested body. In mustelids, the total length (head, body and tail) varies from 110 to 2100 mm and body weight varies from 70 gm in the case of least weasels to 37 kg in the case of sea otters. The mustelids are highly adaptive, terrestrial, arboreal or aquatic in nature and primarily flesh eaters. The family is subdivided into four subfamilies, *Lutrinae* (otters), *Melinae, Memphitinae* and *Mustelinae*.

Sea otters are believed to have been former land mammals who got into the water to escape from predators. Sea otters developed a waterproof coat - the densest of all mammals (100,000 follicles per square cm) for air trapping, which what isolates them from cold water temperatures- , webbed hindfeet (flippers), and larger lung capacity. They do not have to drink fresh water; they drink sea water and use metabolic water. They are adapted to live only at the sea (90% or their lifetime) although they like to come ashore once in a while, preferring rocky shores with kelp forest to sandy shores.

There are two subspecies of sea otters based on different genetic components: the Asian (*Enhydra lutris gracilis*), and the Alaskan (*Enhydra lutris kenyoni*) although some marine biologists consider the Southern or California sea otter (*Enhydra lutris nereis*) a third subspecies.



Courtesy of The Otter Project

Sea otters' length is about 1.30 meters and their weight around 33 kgs for males and 23 kgs. for females who give birth to a single pup every year after a 6-8 months period of gestation. Twins occur in 2% of births but only one pup can be raised successfully. Females reach maturity when they are three years old, but their weaning success during the first year is very low. Males reach maturity around their fifth year although it varies depending on their status in their social context. Males will mate with females who wander into their territory or, if none are available, will go seeking for females in estrus. Females are only receptive for 3 days. The lifespan of sea otters is between 15 and 20 years (females live longer).

They are carnivores who use tools, usually stones, to break their preys which they bring to eat to the surface (some sea otters carry the stones in their dives, possibly as additional help to make diving easier) where they also undergo most of their activities (mating, grooming...).

Courtesy of Mike Murray & Ree Brennin from the Monterey Bay Aquarium

They feed on sea urchins, abalone, crabs, mussels, clams, snails and about 40 other marine species but, to be more efficient, different individuals specialize in just one type of food, this way they save time and energy, and allow for the resources to be shared. This specialization is transmitted from mothers to pups. Although they have the thickest fur of all marine mammals (they have this fur because they lack the blubber cover) they need to eat everyday 1/3 of their body weight to keep their temperature given that they live in gelid waters and have a high metabolism. Sea otters spend also a lot of time in grooming and rubbing their fur to keep it healthy and warm. This is a basic task to keep the insulation of their fur (by trapping tiny air bubbles), and therefore, to keep their body temperature. Their fur color is composed by shades of brown and it becomes lighter when aging because of the loss of pigmentation.

Sea otters prefer to live along rocky shores in areas of dense kelp forests to which they usually tie themselves around when they sleep. They like swimming in their backs ("sculling.") They can dive a maximum of 100 meters but they usually forage at 20 meters. Since they have large lungs, they can hold their breath around five minutes. When mothers dive for foraging, pups remain on the surface waiting for them and it is now when they usually squeal calling their mothers. This is a dangerous moment for them because it is when they can be taken as a prey by bald eagles or when they can be taken as hostages by male adults who will only give them back to their mothers in

exchange for the food that the mothers might have retrieved to the surface. Sea otters spend about 30% of their time (large portions of the night included) in foraging but in areas at the edge of their carrying capacity they can spend 50% of the time in this activity. The Southern sea otter is far of reaching its habitat carrying capacity since this has been estimated in 2001 to be around 16,000 individuals.

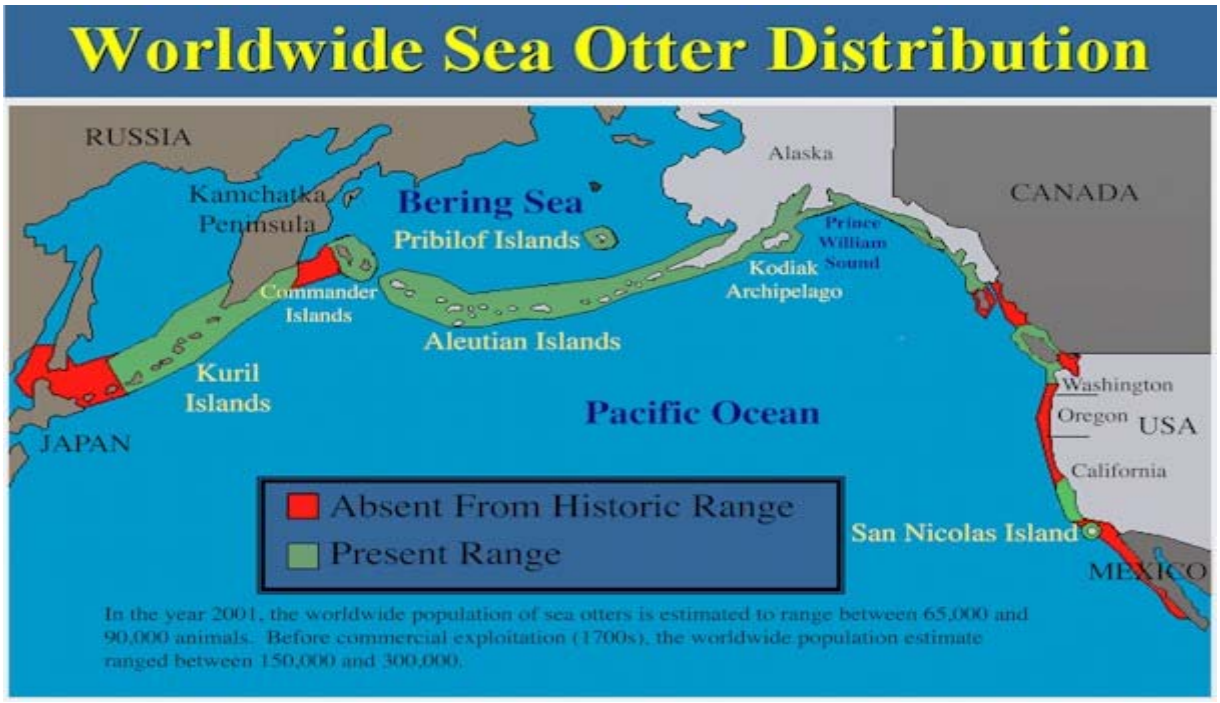
Regarding social life, fathers do not share the caring and teaching of the pups. This is a task left only to mothers. Mothers teach all surviving skills to the pups. At three months pups can dive independently, and at six months, they begin to forage by themselves. Sea otters can live congregated in "rafts" formed either by groups of mothers and pups, by juvenile males, or by adult males, and they display territoriality in their behavior. The expansion to new territories is usually done by groups of subadults.

Courtesy of Mike Murray & Ree Brennin from the Monterey Bay Aquarium

Regarding their management, the following behavioral aspects are the ones to be considered: dispersal of young animals (mainly due to storms), habitat selection, courtship, territorial defense, daily activities, response to predators (mainly sharks), response to presence of humans, and migration (not applicable in this case, where expansion –rather than migration- to the south is one of the main issues).

Population evolution and range.

Sea otters range has historically expanded through the Pacific Ocean, from offcoast California (even Baja California) to Washington, Canada , Alaska, and Russia (even to Hokkaido in Northern Japan). Sea otters were discovered by the Russian explorer Vitus Bering. After his expedition, the Russians claimed the Alaska Territory and hunted for pelts with the native Aleuts. Between 1740 and 1840 when American and English added to the hunting, the species was overhunted and almost driven to extinction around 1900, remaining only between 1000 and 2000 individuals. At last, in l9l1, sea otters got protection under the International Fur Seal Treaty which enabled their slow recovery.



Regarding the southern sea otter, its actual range is a band of around 500 Km (380 Km in 1995), from Half Moon Bay to Point Conception, with a population of around 2150 individuals in 2002. **Maps courtesy of Defenders of Wildlife and Friends of the Sea Otter**

The California sea otter is a group formed out of descendants of an isolated group of around 50 that was discovered in 1915 in the Big Sur coastline, when the area was still remote. The discovery was kept in secret until 1938, when the new highway from Monterey to San Simeon was open to the public. From this date on California sea otters population started to grow gradually, with a critical period of decline during the 70s, a slow recovery during the second half of the 80s, when the Recovery Plan of 1982 was approved and legislation to move fishing nets farther (to avoid entanglement) was passed, and, again, a decline since 1995 due to several tentative causes.

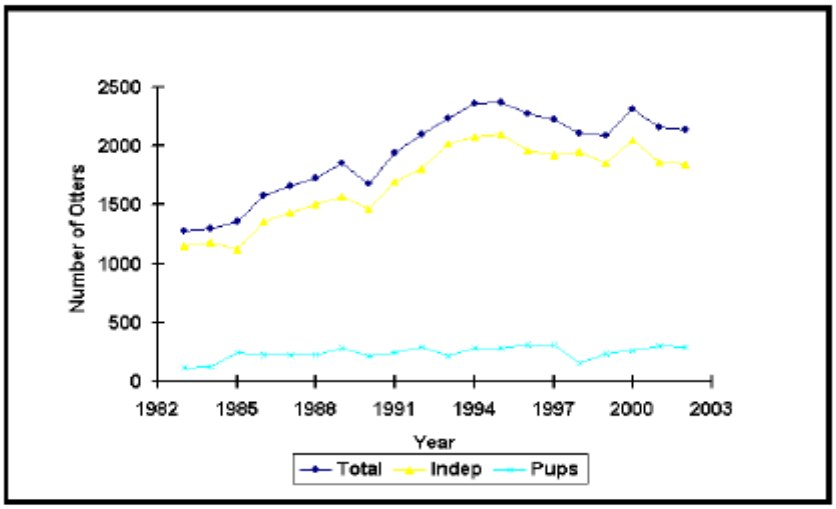


Figure 3. Total number of sea otters counted from 1982 through 2002 during spring surveys. Source: U.S. Geological Survey (2002) http://www.werc.usgs.gov

Dr. Jim Estes, an international expert on sea otters and research biologist at the Western Ecological Research Center of the U.S. Geological Survey in Santa Cruz, CA., estimates that the main causes are contamination of the area (PCBs, DDT…); infectious disease (peritonitis, toxoplasmosis, valley fever); loss of habitat; entanglement or entrapment in fishing gear; discharging waters of cruisers; starvation; natural predators (great white shark) and oil spills. However, as Dr. Jim Estes also puts it, "this continuing pattern of decline is of grave concern, especially given our lack of understanding of the cause." Which means that, although there is a lot of research from different institutions going on, there seems not to be a single definitive cause for the declining of this species. We will return to the causes of deaths in the Scholars Debate section.

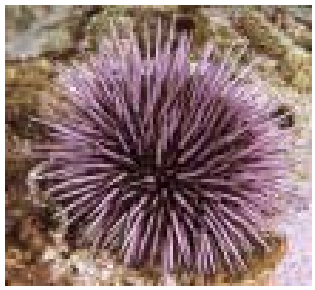
Sea otters as sentinel and keystone species in marine ecosystems. Their influence in the area´s economy.

Sea otters are a **sentinel species** whose health tells us a lot about the status quo of the Ocean, mainly about the amount of contaminants. These contaminants concentrate in their tissues (biomagnification) because they lack the enzyme system to metabolize them. They have very complex organisms which make them very susceptible to environmental alterations and changes which can be detected before they become irreversible. That is why they are considered one of the best bioindicators of marine ecosystems telling much about oil pollution, infectious diseases and other contaminants in water, three of the major threats for sea otters. Oil makes them loose their fur isolation. They cannot keep warm and die of hypothermia. On the other hand, inhaling it affects their immune system in the long run. That is the reason why oil spill impact mitigation schemes are such an important component of the Recovery Plans.

Sea otters role in marine ecosystems makes them also a **keystone species**. They affect the ecological system where they live in, being completely necessary for its biodiversity and productivity, therefore, making it more stable. They are essential for the survival of the other species. We have seen above that they prefer kelp forests to live in; kelp forests, which have a high economic value (kelp canopies are used as thickeners and emulsifying agents in food and pharmaceutical products in yoghourts, paints, surgical thread, ice cream…), provide additional environmental benefits, and are an important factor in the prevention of shoreline erosion. But, the most relevant thing, as the Executive Director of "The Otter Project", Steve Shimek, puts it is that "thousands of species depend upon kelp forests. California kelp forests are the most diverse ecosystem of the temperate latitudes on earth and have some of the highest primary productivity rates of any naturally occurring ecosystem on earth." Kelp forests are the Ocean´s rainforest.

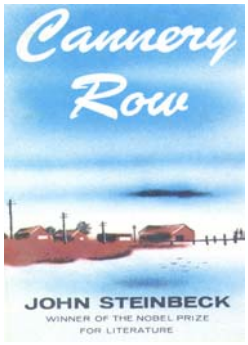
Sea otters consume animals that feed on kelp, like sea urchins and abalone which can end up with kelp forests turning them into urchin barrens, which have very low diversity and productivity. Therefore, sea otters contribute to kelp production. Wherever there are sea otters, kelp forests expand. But, as we will see later, here is where precisely lies one of the biggest controversies for the definition of a final recovery plan. Fisheries and shellfish industries claim that sea otters end up with abalone and sea urchins of the area. Overharvest, sea otters disease and other factors have pushed populations so low, that California, beginning in 1993, banned the taking of four species of abalone.

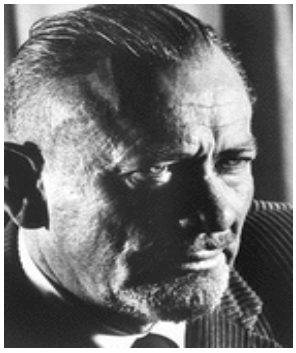
Abalone



Sea urchins

But sea otters are not only important in ecological terms. They are also essential as symbols of economic health for the area. Although the Monterey Bay area was historically based on its fisheries (it was called "The Sardine Capital of the World," processing nearly a quarter million tons of sardines, a season in its peak during World War II years, so well portraited in John Steinbeck's 1945 *Cannery Row*), the sudden collapse of the sardine industry into less than 1,000 tons per season in the mid 1950's was the beginning of a shift toward a tertiary economy in which tourism is today the base of the economy (and a stable source of income for the municipality of Monterey through the Hotel Room tax).





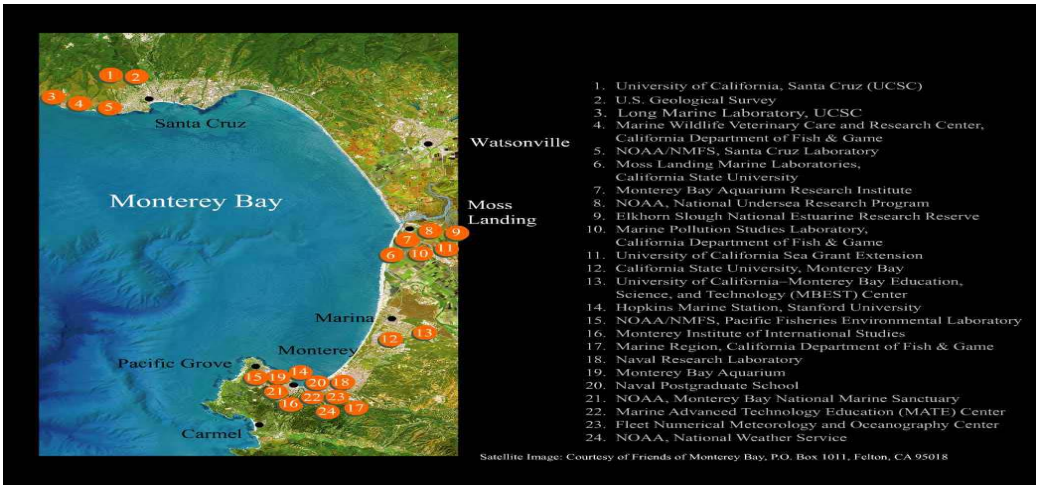
Today a smaller commercial fishing fleet and industry continues to operate. Due to its strategic location, Monterey has historically been a key military outpost, a legacy of military tradition that still stands. Monterey's historic character, natural beauty, and unique attractions have enabled this city to become a quality residential community and one of the premier tourist destinations in the United States.

Certainly the fact that it can also borrow from its heritage (Monterey was the capital of the Northern California province in Spanish and Mexican times; it also hosted California's first constitutional convention in the city's historic Colton Hall, where in October 13, 1849, the State Constitution was signed) and its proximity to Carmel and to Point Lobos State Reserve (one of the most beautiful coast sceneries of the world, host also to resident populations of sea otters) contribute to this economy.

The coincidental range of the sea otter with that of the Monterey Bay National Marine Sanctuary (the "Serengeti of the Sea"), with its importance as a biodiverse and

geologically unique ecosystem, draws also marine high tech businesses and research institutions in the area, around what has been called “the Monterey Bay Crescent Ocean Research Consortium”, established in 1998, a unique concentration of education and research institutions. The world-class famous Monterey Bay Aquarium, whose role in the research and rehabilitation program for sea otters is an essential piece of the strategy for the public awareness and full recovery of the species –see the Guiding Students Discussion section- is both a motor of this new economy as well as its beneficiary.

The Monterey Bay Aquarium



Institutions of the Monterey Bay Crescent

The 1982 Recovery Plan and the Actions Taking Thereafter

In January 14th 1977 the southern sea otter was listed as a "threatened" species under the 1973 Endangered Species Act (ESA) and as a "depleted" species under the Marine Mammal Protection Act (MMPA), which obliges to the recovery of populations to their optimum sustainable level (4,500 vs 2,650 individuals are the respective targets for the MMPA and the ESA).

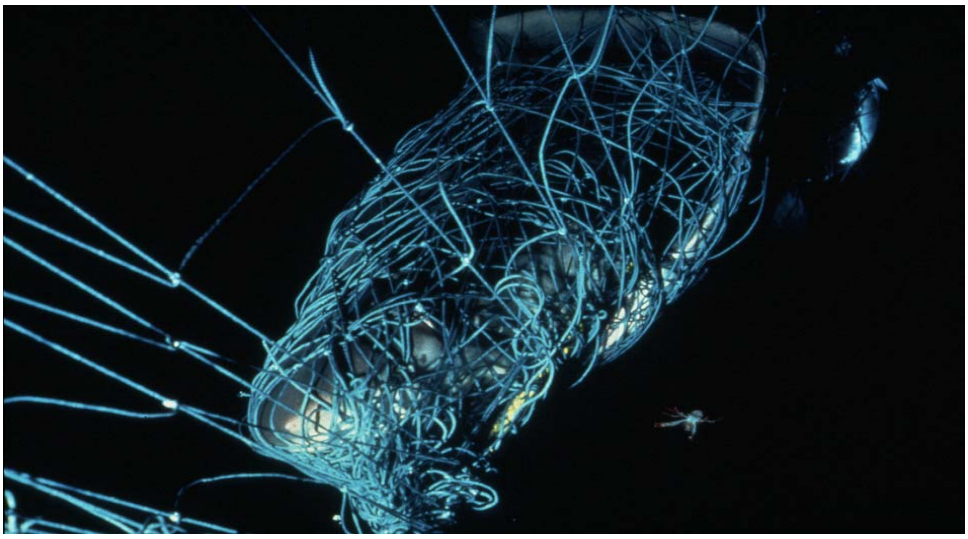
The main reasons for its listing under the ESA were the recognition that the historical population was 10 times larger; the fact that its geographical distribution was very limited; and the fact that the remaining population could disappear in the event of a single oil spill.

The 1982 Recovery Plan focused on research but also identified several mortality causes (such as incidental taking by fisheries); insisted in the need to prepare a risk management plan in the event of an oil spill; and called for the establishment of at least one more breeding colony that would be geographically separated in a place where an eventual oil spill would not reach it.

Sea otters impacted by oil (Courtesy of Mike Murray & Ree Brennin from the MBA)

Regarding the first issue, during the 80s and 90s the California legislature and Department of Fish and Game, which manages the nearshore fisheries, implemented the

appropriate policies to minimize the effects of the interaction between sea otters and fishermen. In 1985, Bill 2563 made illegal the use of gill and trammel nets (with stretched mesh greater than 8.9 cm) from Waddell Creek in Santa Cruz County to Point Sal in Santa Barbara County, in waters 55 meters deep or less. This measure was latter both exempted (from Point San Luis to Point Sal if the record of no incidental takings remained clear) and enlarged in April 2002. In this date nets were prohibited from Point Reyes to Point Aguiello in 110 meters depth or less, by the Director of the Department (a superior court judge in San Luis Obispo Country upheld in July 17, 2003, the regulations, challenged by the fishermen). In the 1990s, due to the development of pot traps shallow water fisheries, the Department required 13 cm rings to be placed in live fish traps to prevent incidental trapping and drowning after experiments undergone at the Monterey Bay Aquarium proved that sea otters could not enter the pot traps with such size restrictions. During the first year they were given for free to the fishermen.



Courtesy of Mike Murray & Ree Brennin from the MBA

Regarding the oil spill impact prevention plan, especially after following the impact of the Exxon Valdez accident of 1989, oil spill response facilities were established even though it was clear that they would work only in the event of a small oil spill. The California Department of Game and Fish Office of Spill Prevention Response (OSPR) developed contingency plans, established methods to assess injuries, identified

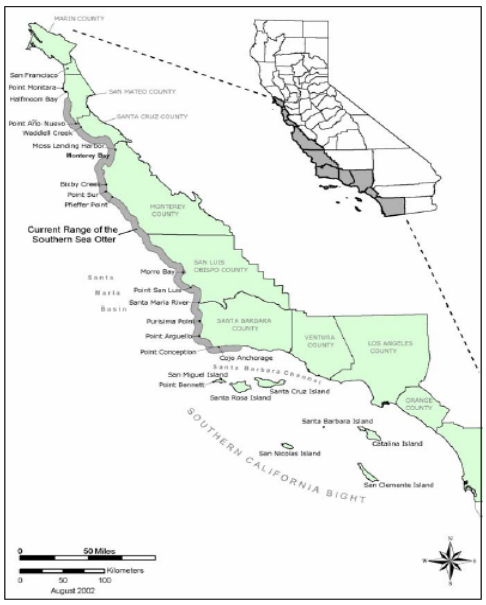
rehabilitation centers, and developed protocols for the treatment of oiled sea otters as well as restoration plans. It started by funding the Oiled Wildlife Care Network (OWCN) which has trained professionals, volunteers, paid staff and veterinaries. There are 24 permanent facilities on alert, five of which have extensive capacity.

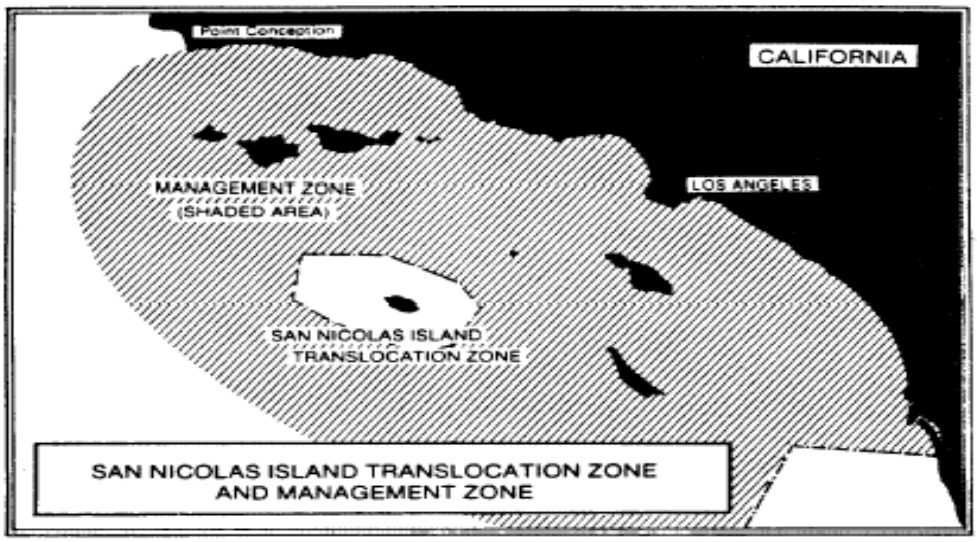
Traffic management was also targeted by the Monterey Bay National Marine Sanctuary, the US Coast Guard and the International Maritime Organization, leading to recommendations on 1) the distance from shore navigation, which depends on the type of vessel (e.g. 93 Km -50 nautical miles- for oil tankers); 2) recommended tracks for commercial vessels carrying hazardous materials; and 3) two traffic separation lanes for the approach to major ports.

Regarding the issue of translocation, a experimental population of sea otters was established in the island of San Nicolas under the so-called Translocation Plan, approved on November 7, 1986 by Public Law 99-625 passed by the Federal Congress. The Plan distinguished between a "translocation zone," where the sea otters were placed, and a "management zone," in reality an otter-free zone devised for the containment of the translocated populations. The first decision implementing the Plan was issued by the US Fish and Wildlife Service on August 11th, 1987, leading to the translocation of 140 sea otters (of the 250 originally planned.) Between that date and July 1990, 50% disappeared, and of the remaining 70, only 13 remained in the island; 3 died within days of release, 36 returned to their parent grounds, and 18 were found in the management zone, 11 of which were captured and relocated. Notwithstanding their birth rates (73 recorded) the population was of 27 individuals in 2002.

Removal (always non-lethal) was questioned in 1990 when a colony found in San Miguel Island was thought to be residents, and was discontinued since 1993. The finding of a group of around 100 in Cojo Anchorage, just south and east of the northern limit of the management zone, triggered a debate about whether they should be removed or not. Since they were predicted to be non resident populations, but rather populations moving in and out of the management zone, the US Fish and Wildlife Service decided to leave them, which non successfully prompted litigation by fishermen. In any case, it was clear by the late 1990s that the original intention of the Translocation Plan (having an isolated viable population non reachable by a hypothetical oil spill) would not be met

(in addition to the fact that many of them decided to come back to areas as far as 30 Km. from where they had been removed). Since the translocation plan had been originally approved after an environmental impact statement (EIS) done in 1978, a supplemental EIS started to be prepared in June 17, 2000, when new significant effects were not adequately analyzed in the previous EIS. In January 22, 2001, pending the preparation of the supplemental EIS, the US Fish and Wildlife Service took the decision that no otter would be captured in the management zone





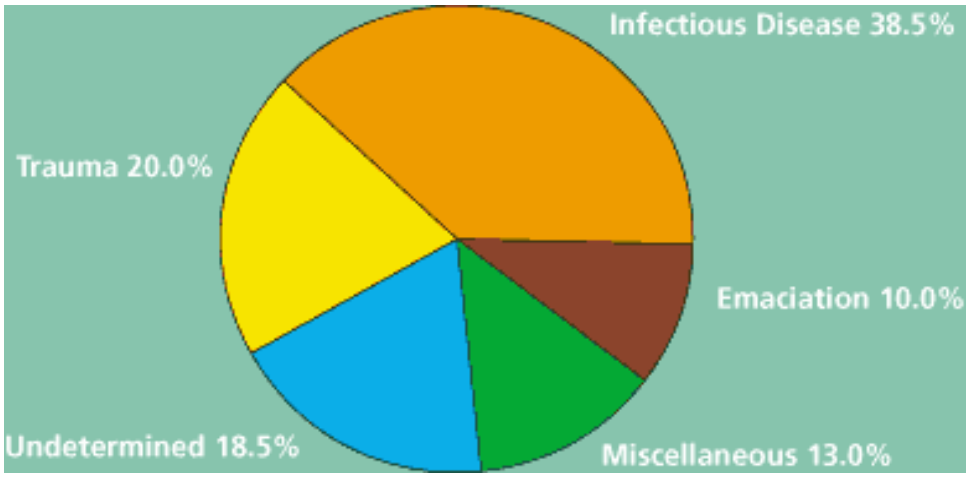
The situation between the 1982 Recovery Plan. The Final Revised Recovery Plan of 2003.

The gap between planning and real life takes usually some time to be identified.

Notwithstanding the accomplishments achieved under the 1982 Recovery Plan, including the research on population dynamics, causes of mortality, biology and behavior at the northern range, or immune system and genetic differential, it was clear even by the late 1980s that the trends in abundance were not reaching the target; that the translocation program needed to be revisited; and that new oil spill threats were developing.

The Recovery Team appointed by the US Fish and Wildlife Service elaborated three consecutive drafts of a Revised Plan (in 1991, 1996 and 2000). The delay in reacting to public comments and on the final decision started to look dramatic. Only on February 24, 2003 the Final Revised Recovery Plan (FRRP) was approved by the manager of Region 1 of the US Fish and Wildlife Service.

To the stakeholders, the reasons for the length of the process are several and of different depth. Some of these stakeholders found the delay unjustifiable and called for political action during the early 2000s. (The Scholars' Debate section will deal with this issue). The populations, while steadily growing until 1995, stabilized around 2,100-2,200 individuals, far from the 2,650 delisting target, and continued its decline until 1999 to 2,090 individuals. Later, the numbers started to pick up again and stabilized, 2317 in 2000; 2161 in 2001; and 2139 in 2002. Mortality rates (vs. reproduction, which seems normal, and emigration, which does not take place) were related to one or more factors: 1) infectious diseases due to either increased immune deficiencies or related to parasites or pathogens exposure (in particular, to newly introduced microorganisms); 2) unreported or unidentified incidental deaths by commercial fisheries; or 3) food resources' limitations. Shark attacks and starvation were also causes although it is unclear whether they were independent causes of death or due to the weakness of sea otters caused by the other threats.



Courtesy of The Otter Project

So the main threats identified by the FRRP are habitat degradation (the risk of oils spills and the continuous presence of contaminants) and human taking (sporadic shooting, entanglement in fishing gear, and harassment).

The FRRP is crystal clear about the fact that, notwithstanding all the efforts undergone by California, the aggregate risk of having a single oil spill wipe out the entire population remains a very clear possibility (there is not even a worst case scenario). The fact that the licenses for exploitation of oil and natural gas increased since 1977 also adds to the risk although the FRRP reaches the conclusion that the current trend of decommissioning of the platforms and structures and the retirement of aged onshore facilities minimizes that risk.

It is also clear that there is not enough evidence about the current impact of the increase of the live trap fisheries and set nets (there has been no comparison for a hypothetical cause-effect relationship between locations and seasons where carcasses have been recovered and those of gillnets).

Based on such a diagnosis the FRRP establishes the following objectives and actions:

The main objective is to delist the species as “threatened” under the USFWS when populations remain for three years at an average level exceeding 3,090 individuals, but to keep it as a “depleted” species under the Marine mammal Protection Act until it reaches the optimal sustainable level, which is equivalent to 50% to 80% of the current

carrying capacity of the range, that is to say 8,400 individuals for the entire California coast. A decrease in the numbers that would mean a three year average of individuals between 1,850 and 3,090 would leave the species as "threatened", while an average below 1,85o should trigger its classification as "endangered".

The actions, carefully listed, will consist in **monitoring** (abundance, distribution, available habitat, peripheral areas used for different activities by the sea otters…); **evaluation of the causes of mortality** by keeping on with the coordination of data from strandings and necropsies; **protection of the populations** against the listed threats; development of an **additional contingency plan against the effects of an oil spill** (the farther rerouting of traffic to achieve the ideal of les that 1% probability of having the populations affected by an oil spill is rejected due to logistical problems and lack of consensus among the authoritative actors**); evaluation of the translocation plan** through the continuation of the EIS (although the FRRP flags out the almost inevitable solution: disappearance of the management zone so that the sea otters are allowed to stay south of Point Conception –passive versus active recovery-: "it is in the best interest of recovery …to declare experimental translocation to San Nicolas a failure and to discontinue the maintenance of the otter-free zone in southern California"; the current population of 27-29 sea otters in san Nicolas should be allowed to stay rather than recapturing to return them to the mainland); and **farther research** on mortality, interaction with fisheries, and recovery objectives.

The estimated costs are 10,219,700 $ over 20 years (plus additional expenses to be determined) and the recovery for ESA delisting is expected to take place in 10 years.

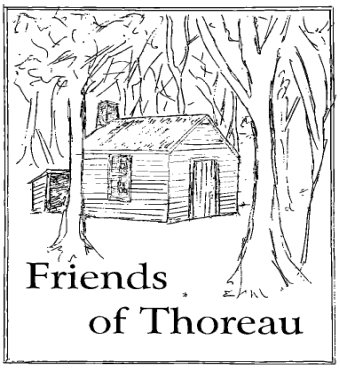
What now?

More bad news: just after the FRRP was approved, massive strandings took place in April and May 2003 the cause(s) of which will probably soon determined once the results of the careful analysis of the necropsies are released.

The good news: “But then, the spring count was completed and there were more otters counted than EVER before, just over 2500. So, it is still very confusing. Counting conditions were near perfect (very flat, very clear, very unusual for the open ocean) so most of us think the count was more complete than ever before -- but we don't know how that relates to other counts!” (Steve Shimek, Executive Director of the Sea Otter Poject)

The EIS for the Translocation program has not been released as of November 2003, but a new bill authorizing $5 million per year for 5 years for research and recovery may be introduced by Congressman Sam Farr. This bill may also direct the US Fish and Wildlife Service to create a broader based Recovery Team with more representation of stakeholders, ……..so, the saga continues. Recovery of a species is always an on-going long term (hopefully not everlasting) story.

Point Lobos, south of Carmel, frequently visited by sea otters (and by poets)



The California Sea Otter Recovery Plan

ANA RECARTE
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Scholars Debate

Marine mammals protection is based on two different legislative actions which reflect different policy options: the Marine Mammal Protection Act of 1972 (MMPA) and the Endangered Species Act of 1973 (ESA).

In passing the MMPA in 1972, Congress found that 1) certain species and population stocks of marine mammals are, or may be, in danger of extinction or **depletion** as a result of man's activities; 2) such species and population stocks should not be permitted to diminish beyond the point at which their cease would mean a significant breakup in the functioning of the ecosystem they live in; consistently with this major objective, **they should not be permitted to diminish below their optimum sustainable population level**; 3) measures should be taken immediately to replenish any species or population stock which has diminished below its optimum sustainable level; 4) there is inadequate knowledge of the ecology and population dynamics of such marine mammals and of the factors which bear upon their ability to reproduce themselves

successfully; and 5) marine mammals have proven to be resources of international significance, with aesthetic, recreational, and economic value.

The MMPA term "depletion" or "depleted" means 1) any case in which either the Secretary of the Interior for sea otters (NOAA for cetaceans and pinnipeds), after consultation with the Marine Mammal Commission and the Committee of Scientific Advisors on Marine Mammals, or a State to which the authority for the conservation and management of a specific species or population stock has been legally transferred, determines that a species or population stock is below its optimum sustainable population; or 2) a species or population stock listed as endangered or threatened under the Endangered Species Act of 1973. As we see, every species listed under the ESA is considered “depleted” however, there can be species which are “depleted” although they are considered neither “endangered” nor “threatened” under the ESA.

The term MMPA "optimum sustainable population" means, with respect to any population stock, the number of animals which will result in the maximum productivity of the population or the species, keeping in mind the carrying capacity of the habitat and the health of the ecosystem of which they form a constituent element.

The ESA provides for the conservation of species which are prone to endangerment or extinction throughout all or a significant portion of their range and the conservation of the ecosystems they depend on. An individual, or organization, may raise a petition to have a species listed under the Act as “endangered” or “threatened” which would qualify this species for increased protective measures (the National Marine Fisheries Service –NMFS, within the National Oceanic and Atmospheric Administration of the Department of Commerce –NOAA-, or the U.S. Fish and Wildlife Service –FWS, within the Department of the Interior- can also initiate a status review of a species without a petition for listing). Generally speaking, the FWS coordinates ESA activities for terrestrial and freshwater species, while the NMFS is responsible for marine and anadromous species.

A species must be listed if it is “threatened” or “endangered” due to any of the following five factors: 1) present or threatened destruction, modification, or curtailment of its habitat or range; 2) overharvesting for commercial, recreational, scientific, or

educational purposes; 3) disease or predation; 4) inadequacy of existing regulatory mechanisms; and 5) other natural or manmade factors affecting its existence. "Endangered" means that a species is in danger of extinction throughout all or a significant portion of its range. "Threatened" means a species is likely to become endangered within a foreseeable future. All species of plants and animals, except pest insects, are eligible for listing as endangered or threatened. The Secretary of Commerce, or of the Interior, shall develop and implement "recovery plans" for the conservation and survival of "endangered" and "threatened" listed species, unless he/she finds that such plan will not promote the conservation of those species. Usually developed by federal and state agency biologists and outside contractors, or by teams of other experts, recovery plans are general prescriptions for bringing a listed species out of peril. It is up to these plans to determine the objective, measurable criteria which, when met, would result in a determination that the species be removed from the list.

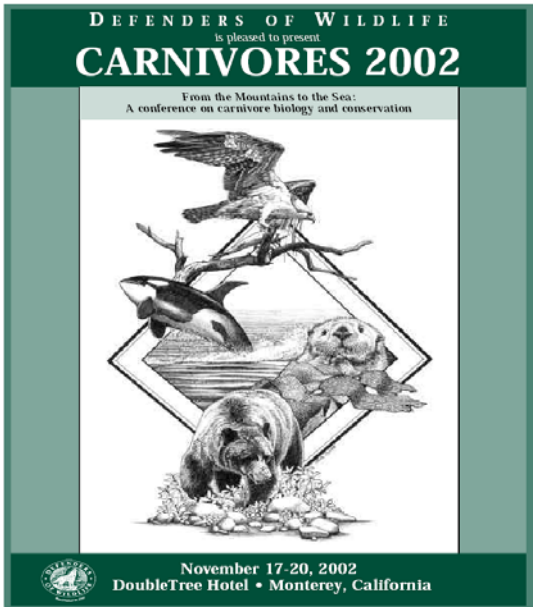
Does this mean that the criteria of both statutes (the ESA and the MMPA) are different? What is at the core of the distinction between a "depleted" and a "threatened" species?

Section 4 of the ESA requires the designation of critical habitat essential to the conservation of a listed species. The designation should include enough area for the species to expand its range and recover to a healthy population level. Why doesn't the FRRP designate critical habitat for the sea otter?

Re-establishing a "threatened" or "endangered" species in areas of its former range is often necessary for its recovery. However, residents and businesses frequently oppose such reintroductions because they fear the presence of the species will also bring severe restrictions on the use of private and public land in the area. To overcome this serious obstacle the ESA, in Section 10(j) –introduced in 1982- , used the concept of **experimental populations**: a geographically-described group of reintroduced plants or animals that is isolated from other existing populations of the species. Members of the experimental populations can be labeled "essential", which implies that the loss of the reintroduced population would be likely to appreciably reduce the likelihood of the survival of the species in the wild. These populations are treated as threatened species (with special rules). But the experimental population can also be labeled as "nonessential" to the survival of the species, in which case it is not given the full

protection otherwise provided by the ESA, being treated as a species proposed for listing thus providing for greater management flexibility and reduction of local opposition. The Sea Otter Translocation Plan, created both the "translocation zone" and the "management zone". The second is an otter-free zone. Does that mean that the sea otters in these areas are experimental populations? Are they "essential" or "non-essential" experimental populations? Isn't Public Law 99-625 really creating an *ad hoc* category for the sea otters of those zones?

Among other things, the FRRP took so much time to be developed because there was scientific uncertainty about population dynamics and about the causes of mortality. Issues that are still being researched were exposed to the general public in a section of the Defenders of Wildlife Carnivores 2002 Conference that took place in Monterey in November 2002. They include questions related to sea otter population studies, sea otter threats, sea otter behavior and physiology, and sea otter diseases (see annex 1 in the Section on Works Cited and Additional)



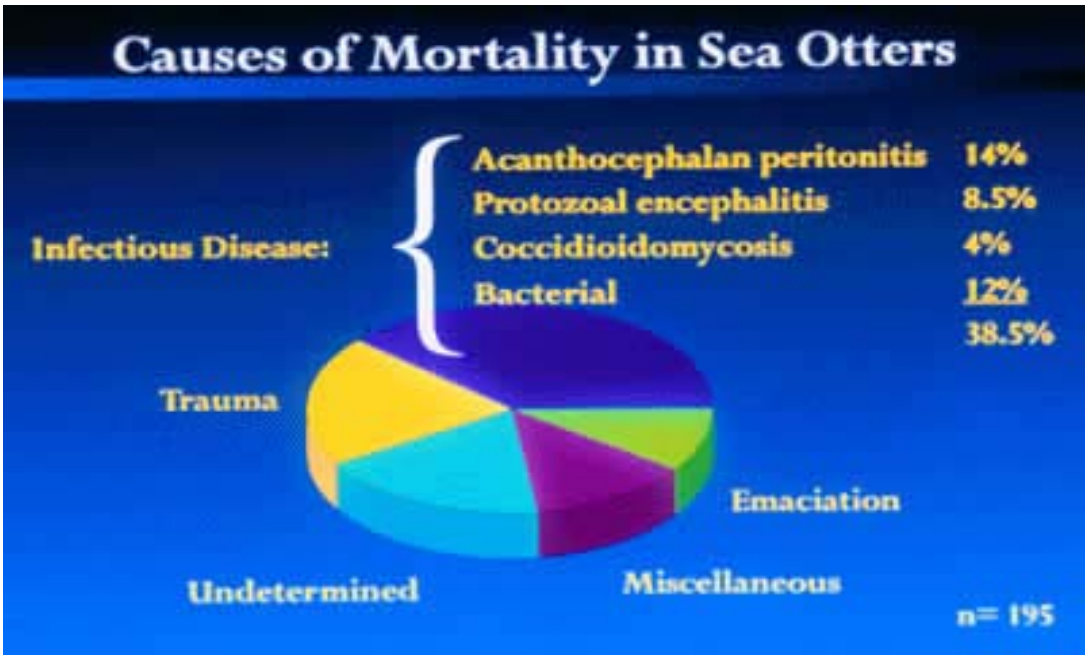
Courtesy of Defenders of Wildlife

The FRRP itself mentions additional research done during the 1982-2003 impasse (see annex 2 in the Section on Works Cited and Additional) as well as the literature cited in the text of the Plan itself (in Annex 3 in the Section on Works Cited and Additional).

But what is happening with all the research going on? It is obvious that the impression in the air is that nothing can be done because there is still too much uncertainty about the causes of mortality and, thereby, about which are the best options for action. As the approach to the conflict of interest game materials prepared by Defenders of Wildlife puts it "*as researchers, one of our jobs is to assess the status of the California sea otter population. This population declined by nine percent from 1995 to the present. This concerns us because sea otters are indicators of the health of the ecosystem, when they are in trouble it means the entire ecosystem is suffering. The causes for the sea otter declines since 1995 aren't entirely understood, but some of the apparent impacts are from entrapment in fisheries gear, habitat loss and degradation, and disease. In order to get a better assessment of the status of the California sea otter population declines,* ***critical*** *research funding is needed. In addition, we now believe that allowing for natural range expansion of this population is the key to their recovery*".

Does "critical" mean that no Plan should be approved until the results of all these research projects are agreed upon by the scientific community?

Certainly, the ratio of the causes of mortality makes it worth the effort of trying to figure out which of the infectious diseases is more important, or whether it is the immune system depression or general weakness what contributes to all the diseases (and even to the shark attacks ratio of success). Several diseases have being identified and are currently researched, such as **acanthocephalan peritonitis** (caused when larval acanthocephalan parasites that reside in the intestine migrate through the intestinal wall allowing bacteria to infect the abdominal cavity), **protozoal encephalitis** (caused by *Toxoplasma gondii*, maybe from cat feces, as discussed in the Section on Guiding Students' Discussion), **coccidioidomycosis** (a systemic infection caused by a fungus, *Coccidioides immitis*, by inhalation of airborne arthrospores, pretty much similar to how humans get hay fever in dry agricultural conditions such as those existing in the San Joaquin Valley, which is really strange and so far unseen in the marine environment), and **other bacterial infections** (manifested primarily as pneumonia, heart valve infection, abscess or septicemia).



Courtesy of USGS (National Wildlife Health Center)

Even NGOs sponsor research. For example, independently of the research sponsored until that moment, in an attempt to identify the real critical research issues that were still non being targeted, The Sea Otter Project organized a Workshop to Develop a Research Plan on Chemical Contaminants and Health Status of Southern Sea Otters in January 30 – February 1, 2002.

Courtesy of The Otter Project

But, should recovery plans be partially science-informed or entirely science-based? What are the limits to science when action is needed?

The delay in the approval of the Recovery Plan may not be entirely related to this fact. As Greg Sanders, from the US FWS Ventura Office, stated (personal interview), "although uncertainty about where the problem is (food, disease, fisheries interaction?...) contributed to the delay, there were also additional reasons: the 2000 Draft was based in a sharp decline of populations, a fact that was not so clear immediately afterwards; things seemed to be moving in the right direction even without a revised plan (especially after the 2001 waiver of capturing in the management zone); the decline of the fisheries South of Point Conception could also make things easier; and , of course, the Agency is overwhelmed by workload on many other species, and habitat conservation plans, and its priorities are distorted through litigation (judicial orders and decrees need to be complied with first) and legal mandates to produce plans and results".

Are all these valued reasons for a 14 year process of revision of an outdated Plan?

As we have seen, the FRRP requires the actions of multiple public agency actors: the US Fish and Wildlife Service (US FWS), the US Geological Survey, the National Oceanic and Atmospheric administration (NOAA), the National Marine Fisheries Service (NFWS), the University of California (UC), the California Fisheries, the California Game & Fish, US Congress…aren't there too many public actors? Aren't recovery programs an excessively bureaucracy-burdened process? What is the role, for example, of the US Geological Survey? Or, to the contrary, is it the best –maybe the only- way to proceed? What would be the problems that a more simplified single-agency process would face? Why took it so long to have a common data base of the results of the necropsies notwithstanding the public nature of the agencies involved? Don't Federal (and State) agencies have to compete for the same money in the US budget?

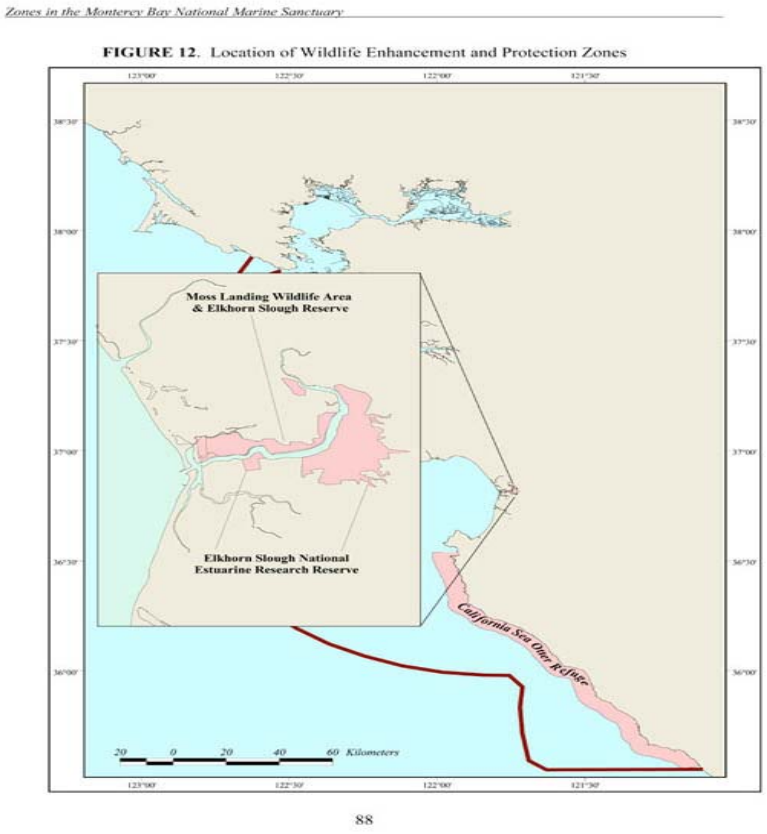
Is this complexity a special feature of marine species or habitats? What is the difference between the planning of marine vs. terrestrial habitats?

One of the agencies, the Monterey Bay National Marine Sanctuary, established in 1992, and also part of NOAA, and which covers a great portion of the range, prefers to "leave" the planning of the sea otter recovery to other agencies (Chris Dourras, personal conversation, November 2002). Shouldn't it be the main actor since it "controls" the range habitat? Or is it wiser to focus on issues regarding the Sanctuary which need attention and about which nobody is doing any planning? Can Marine Protected Areas (MPAs) pretend the "exclusivity" in resource management and authority that terrestrial Special Protected Areas (SPAs), such as National Parks, usually claim? Aren't MPAs essentially different in management than terrestrial SPAs?

NATIONAL MARINE SANCTUARIES

Map & logo courtsey of the Monterey Bay National Marine Sanctuary Foundation

Within the Sanctuary, the state of California has, since 1959, under the responsibility of the Fish and Game Commission of the California Department of Fish and Game, a Sea Otter Game Refuge which expands, in the north, from the Carmel River to the Santa Rosa Creek in San Luis Obispo County, in the south, with its Sea Otter Education Center, located just east of Carmel. What is the function of this Refuge? Does it add anything to the overlapping and larger Sanctuary? Can both types of MPA, the Refuge and the Sanctuary coexist? Or, why not?



Range of the California Sea Otter Refuge (Courtesy of California Fish & Game)

As we have seen, there are multiple stakeholders such as fishermen, scuba divers, tourism industry, oil drilling companies, maybe even farmers (if pollution is traced to pesticides or if any of the diseases [such as coccidioidomycosis, previously described] can be traced to agricultural practices). Some tentative research also points to some effects (probably due to heating) of the two huge power plants in Moss Landing and Morro Bay (Duke energy). Are the PCBs related to the intense military use of the Bay Area? (Fort Ord, the largest military base during the Vietnam War has just been closed). The navigation industry has also been involved in the Plan, making concessions that go beyond limits supposedly unsurpassable (the less than 1% fatal oil spill risk)

The NGOs, why well intentioned, might also have different agendas. Certainly Rehabilitation centers such as the Sausalito headquartered Marine Mammal Center

Monterey Bay Operations in Moss Landing and, in particular, the Monterey Bay Aquarium dedicate efforts well beyond that particular role. The Recovery Plan of the Southern Sea Otter has been supported and even pushed by civil society to an extent perhaps previously unknown in the US. Defenders of Wildlife, and the Animal Protection Institute have specific programs. There are also totally focused NGOs, such as Friends of the Sea Otter, which has more than 4,000 members world-wide and which is dedicated to public awareness, advocacy, education, and science sponsoring and divulgation; a second one, The Sea Otter Project, whose mission is to promote the rapid recovery of the California sea otter, as an indicator of near shore Ocean health, by facilitating research and communicating research results to the general public and policy makers, is also thoroughly engaged in policy making participatory processes.

Could it be that the US FWS was aware of the controversial nature of the species, being the delay in the approval of the FRRP based on the need to accommodate and acknowledge everybody's position? Or was that an excuse for action, being the delay due more to the almost exclusive "scientific" background of the Working Team?

Finally, the Recovery Plan showed how international cooperation, when needed, paid off. The traditional freedoms of the sea (freedom of navigation; freedom of overflight; freedom to lay submarine cables and pipelines; freedom to construct installations and artificial islands; freedom to fish; and freedom to conduct scientific research…) are certainly more restricted in the territorial sea and inland waters, but they still imply a daunting task of coordination. The targeting of the International Maritime Organization as one of the key players for the effective rerouting of traffic is a clear example of success in international cooperation.

Another example is the Convention on International trade of Endangered Species (CITES). The California sea otter is listed in appendix 1, thus requiring special export and import permits (both the individuals and any part of them). The other subspecies are in appendix 2 (only requiring export permit).

Can these examples be considered significant to the assertion that the US biodiversity conservation policies are multilateral?

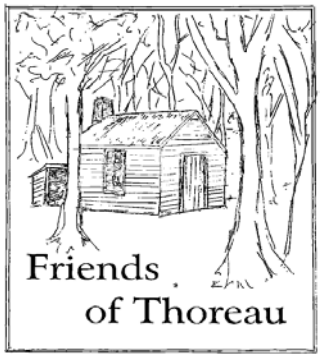
The range of the species (is the Southern sea otter really a subspecies?) will eventually have to be, at least, all its historical range in the eastern pacific coast (which included Baja California in Mexico). The populations translocated in Canada are facing, 20 years later than California, the same problems, in particular those of interaction with fisheries.

Through the MSCCC, Marine Species of Common Conservation Concern Initiative (North American Agenda for Conservation of Biodiversity Action: 2003–2005), governments, NGOs, marine conservation scientists, and the private sector of Mexico, Canada, and the US are working together, within the context of the North American Commission for Environmental Cooperation of the side treaty to NAFTA (North American Free Trade Agreement), to develop a long-term cooperative agenda to help conserve migratory and transboundary marine species at risk. Specifically, the selected MSCCC projects will: 1) develop a North American cooperative agenda and subsequent MSCCC action plans that include bi- and tri national cross-cutting initiatives and that recognize ecological, economic, social and cultural issues; 2) foster improved decision-making, facilitate scientific information exchange, help influence policy and increase public awareness, as they relate to the conservation of MSCCC; 3) build regional, national and international capacity to conserve MSCCC by sharing lessons learned, new technologies and management strategies, and by increasing access to relevant information; and 4) monitor and assess the status and threats to MSCCC.

Should the sea otter be part of the plan MSCCC Initiative? Could the “transboundary” and “migratory” requirement, which is not so clear for sea otters, foreclose such a cooperative potential?

The recent unexplained (probably released by humans) appearance during several weeks in the Spring of 2003 of what seemed a sea otter in the waters of the Tama River, which flows from its source in Mt. Kasatori in Yamanashi Prefecture down to Tokyo Bay, flashed the imagination of Japanese in the search for a mythical animal. As Andrew Horvat, Japan representative of the Asia Foundation, put it in (remarks

delivered on August 28, 2002 in Sapporo, Japan), "*The Media in a Globalized Age – why the Global Village is more village than global*; r*ight now, the Tokyo papers are preoccupied with Tama-chan, a sea otter, which has been sighted resting on concrete blocks after straying into Tokyo's Tama River. Tama-chan is hogging the headlines in Tokyo. In other words, the demand in Tokyo is for sea otters".* Although it is obvious by now that the Tama-Chan was not a sea otter, but a bearded seal (*Erignathus barbatus*), and although it is obvious that while Tokyo is too far away from the historical range of the sea otters, Hokkaido, the Northern island of Japan, had populations of sea otters; why not a broader cooperation scheme with the Russians and Japanese to return to this cute animal the range habitat that humans should not have taken from it since long time ago?



The California Sea Otter Recovery Plan

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Guiding Student Discussion

As we have seen , one of the main reasons to have a Sea Otter Recovery Plan is to maintain its ecosystem (the kelp forest)…but, is it so important to maintain it? Wouldn´t it be better to save the populations of southern sea otters for the sake of the animals themselves? It is biological diversity (or biodiversity) that is at stake? What does biological diversity mean, is it diversity among individuals or among populations of the same species? Is it diversity of species or diversity of ecosystems?

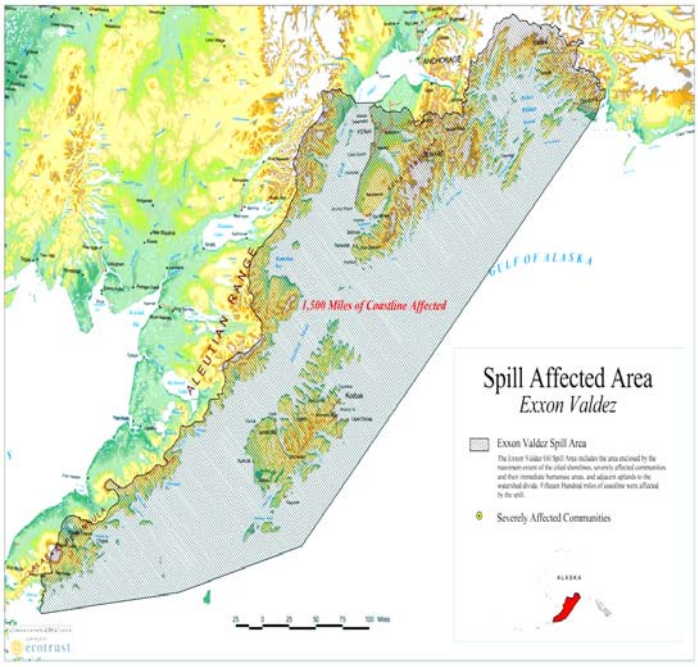
What is the best way to protect a species: To protect the individuals, populations, or to protect their habitat?

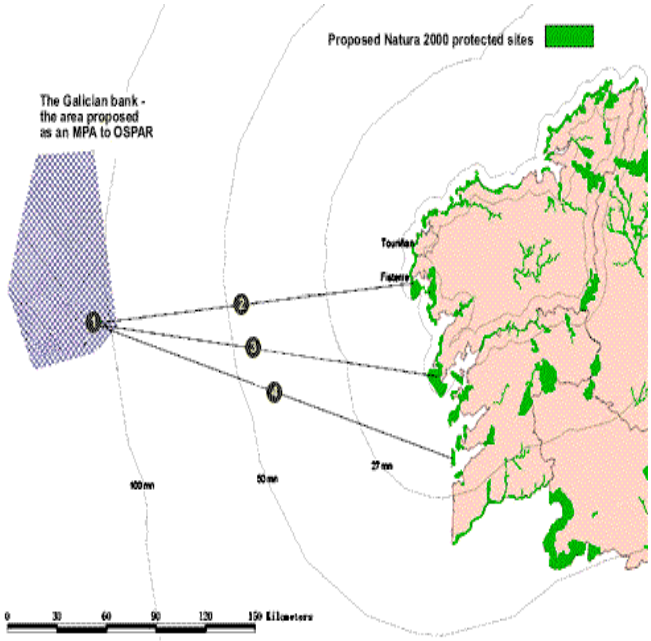
Focus then on the kelp forest. There are several families of kelp, each of which has its own design variation (the oarweeds , family *Laminariaceae*; the Giant kelp and bull kelp, family *Lessoniaceae*; and the feather boa kelp, in the family *Alariaceae*). All of them are members of very valuable ecosystems because their high productivity. Are

there other marine ecosystems with such a rich biodiversity and productivity? Could you identify them?

The traditional idea was that of oceans as a water desert, only eventually interrupted by swarms of fish and their predators, with a few exceptional **hot spots** such as **seagrasses**, **coral reefs** and/or **coastal wetlands**, all of which are, as the kelp forests, mainly coastal ecosystems. This idea has faded away. New discoveries have brought to public attention "new" marine offshore ecosystems such as **thermal vents**, **deep seeps**, **cold coral reefs**, **sponges' aggregates** or **seamounts**. Could you identify each of them? Where are they located in the world map? What are their main characteristics?

The single most important catastrophic threat for the southern sea otter as a population species is the risk of a single oil spill off the California coast that could wipe out the entire population. Can an oil spill affect 500 Km of coast? Compare the extent of the Exxon Valdez oil spill with that of the Prestige in Galicia (North West Spain), and with a projection of the E.V. oil spills in Asia –Sakhalin and Hokkaido in Southern Russia and Northern Japan-. Are they so extensive? Do oil spills affect sea otters in particular ? Why?





Prestige oil spill in the North West of Spain (2003)

The Monterey Bay Aquarium is engaged in a very comprehensive research program to monitor population health and demographics. Among other things, this program is engaged in measuring how much energy sea otters spend in finding food and how they use their sense of smell to find food. They also study how well, or bad, young otters survive in the wild after they are weaned from their mothers. At the same time, as a public aquarium, it provides a special opportunity, through public awareness, to help people learn about the plight of sea otters and to engage visitors in actions that could make a difference for otters. It is also well equipped to become the main center for rescue and rehabilitation of stranded sea otters or those found with severe wounds or disease. It concentrates its rescue work in returning animals to the wild, in particular those who have the greatest potential to contribute to population recovery, especially stranded females of breeding age and others that can help the population recover. The release is usually done in Elkhorn Slough, a wetland north of Monterey which provides a wonderful setting for this function due to its biodiversity. Sometimes the rehabilitated sea otters cannot be reintroduced and need to stay captive. The Monterey Bay Aquarium

has also taken the lead in planning for management of sea otters at aquariums, zoos and research facilities.

Can you imagine in what cases it is almost impossible to reintroduce them to the wild? Do you think that aquariums in general should host marine mammals? Do *ex situ* centers (such as pet-parks, botanical gardens, zoos, aquariums…) contribute to the conservation of biodiversity or, to the contrary, since they foster trade in endangered species, should they rather be severely controlled?

Mae and Rosa at the MBA

Rehabilitated sea otters are reintroduced in a wetland (Elkhorn slough). What is a wetland? What other values do they have? Are wetlands worth being preserved?

A sea otter in Elkhorn Slough

Rehabilitation is not the only cause of non-lethal capturing of sea otters. As you have seen they were captured first to be translocated to San Nicolas Island (3 died the very next day) and several were removed from the management zone (suspended since 1993 and definitively stopped in 2001). Some animal rights institutions (for example the Animal Rights Institute (API), headquartered in Sacramento, the capital of California), launched a campaign against that practice. In May 2000, the Santa Barbara fishermen filed a lawsuit against the U.S. Fish and Wildlife Service that sought to force the relocation of sea otters that migrate south of Point Conception into the "no otter" or management zone. Friends of the Sea Otter had been working with the fishing industry for 6 months to reach a consensus solution to the fishermen/sea otter conflict and was disappointed to learn that a lawsuit had been filed. API joined Friends of the Sea Otter along with ten other environmental and animal advocacy organizations to intervene and oppose the fishermen's lawsuit. Are they right? Shouldn't the fishermen be entitled to the enforcement of the management zone regulations?

Fishermen´s Warf, Monterey

There is also the animal rights issue involved in the sea otter management plan. As it is discussed in the Scholar's Debate section, one of the very probable causes of the high mortality rate is toxoplasmosis that causes encephalitis. It is very probable that this infection due to protozoal parasites that affect the sea otters (*Toxoplasma gondii*) causing their death, has its origin in domestic cats litter reaching the ocean through runoff or waste water, since these protozoans are well known inhabitants of cats' intestines (the typical infectious stage of *T. gondii* is shed in the feces of a species-specific definitive host, the cat). This means that, although the way of transmission of these agents to sea otters is unknown, one of the most important threats for this species

may be due to the increase of urban population on the coast and its correspondent equivalence in the amount of domestic cats. How can this "conflict" between domestic cats and sea otters, if proven, be solved?

Although it does not apply to the California sea otters, Alaska Natives (Indians, Aleuts, and Eskimos) who reside in Alaska and who dwell on the coast of the north Pacific Ocean, or the Arctic Ocean, may harvest sea otters for subsistence purposes or for the creation and sale of native articles of handcraft and clothing if the harvest is not wasteful. A Native must be one-fourth, or more, Alaska Indian, Aleut or Eskimo or be enrolled under the Alaska Native Claims Settlement Act. It is illegal for a person who is not Indian, Aleut, or Eskimo to actively participate in any manner in hunting sea otters. Is this "indigenous clause" justified? (their right to hunt sea otters and other mammals) Should cultural diversity be based on values that do not encroach upon threatened species? Should Aleuts be allowed to sell their "native crafts" made of sea otter fur on Ebay?

Going back to the fisheries, can fishermen and marine mammals cohabitate? Do you think that scientific study of the interactions between the diet of the sea otters and "the diet" of the fishing boats can lead to a possible solution? Is conflict inevitable? A Defenders of Wildlife conflict resolution scenario on wildlife management summarizes the fishermen´s arguments in a very straightforward approach: "*Sea otters eat a lot of shellfish. One hundred sea otters can consume one-half to one million pounds of abalone, sea urchin, crab and lobster per year. California has more than 2,000 sea otters right now, that is over 10 to 20 million pounds of shellfish that sea otters are eating per year! We may know how to regulate commercial fishing but sea otters we do not. They will keep reproducing and depleting this precious food source*". What can you answer to this argument?

The California Sea Otter Recovery Plan

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Illustration Credits

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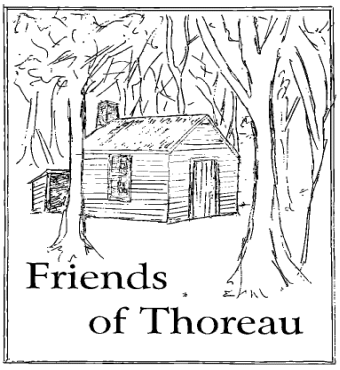
The rest of the pictures were taken by Ana Recarte, from the Friends of Thoreau Program of the Research Institute of North American Studies of the University of Alcalá (Madrid, Spain)

Courtesy of Friends of the Sea Otter



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Links to Online Resources

The Otter Project

http://www.otterproject.org (last visited 10-22nd-02)

Friends of the Sea Otter
http://www.seaotters.org

The Marine Mammal Center
http://www.tmmc.org

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http://seaurchin.org/OtterNews1.html (last visited 09-24th-02

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http://tis.eh.doe.gov/oepa/law_sum/MMPA.HTM (last visited 09-17th-02)

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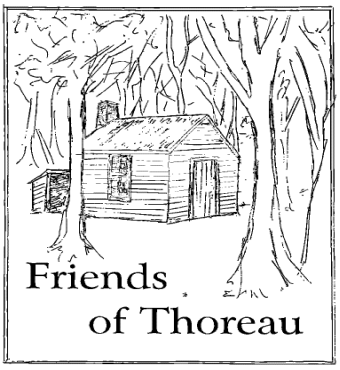
http://www.seaotterresearch.org



The California Sea Otter Recovery Plan

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ANNEX 1

PRESENTATIONS IN THE DEFENDERS OF WILDLIFE CARNIVORES 2002 CONFERENCE

SEA OTTER POPULATION STUDIES

Southern Sea Otter Demography and Population Analyses (M. Tim Tinker and Daniel F. Doak, University of California-Santa Cruz); ***Assessing Population Status Using Activity Budgets: Inter- and Intra-Population Differences in Foraging Effort***(James Bodkin, USGS Alaska Science Center, Michelle L. Staedler, Monterey Bay Aquarium, M. Tim Tinker and James A. Estes, University of California-Santa Cruz); ***Southern Sea Otter Survival: Risks, Rehabilitation and Responsibilities*** (Krista Hanni and Jonna A. K. Mazet, Wildlife Health Center, Frances M.D. Gulland, The Marine Mammal Center, James A. Estes, University of California-Santa Cruz, Michelle Staedler, Monterey Bay Aquarium, David A. Jessup, Marine Wildlife Veterinary Care and Research Center; ***Analysis of Rehabilitation Data from the Sea Otter Research and Conservation Program at the Monterey Bay Aquarium*** (Andrew Johnson, Karl Mayer, Teri Nicholson, Michelle Staedler and Julie Hymer, Monterey BayAquarium); ***Causes of Mortality in California Sea Otters Based on Death Assemblage Analysis*** (James Estes and B. B. Hatfield, USGS Santa Cruz Field Station, Katherine Ralls, Smithsonian National Zoological Park J. A. Ames, California Department of Fish and Game); ***Are Sea Otters Suffering from Inbreeding Depression?*** (Shawn Larson, Seattle Aquarium Ron Jameson, Brenda Ballachey and Dan Monson, USGS, Sam Wasser, Center for Conservation Biology);

SEA OTTER THREATS

A Marine Carnivore, the Southern Sea Otter, as a Sentinel of Pathogen and Chemical Pollution (David Jessup and Melissa Miller, Marine Wildlife Veterinary Care and Research Center,Christine Kreuder, Patricia Conrad and Jonna A. K. Mazet, University of California-Davis); *Recent Causes of Mortality in Southern Sea Otters* (Christine Kreuder, Linda J. Lowenstine, Tim E.Carpenter, Patricia A. Conrad and Jonna A. K. Mazet, University of California-Davis, Melissa A. Miller, David Jessup, Michael D. Harris and Jack A. Ames, Marine Wildlife Veterinary Care and Research Center); ***Sea Otters in Price William Sound, Alaska: Status ofRecovery 12 Years After the Exxon Valdez Oil Spill*** (Brenda Ballachey, James L. Bodkin and Daniel H. Monson, USGS Alaska Science Center Paul W. Snyder, Purdue University); ***Chemical Contaminants and Disease***

in Sea Otters: A Collaborative Approach to Funding and Research (Steve Shimek, The Otter Project)

SEA OTTER BEHAVIOR AND PHYSIOLOGY

Foraging Ecology: Sources of Variation in Dive Behavior, Diet and Foraging Success (M. Tim Tinker and James A. Estes, University of California-Santa Cruz, Michelle Staedler, Monterey Bay Aquarium, James L. Bodkin, USGS Alaska Science Center); ***Application of Individual-Based Movement Models toMovement Patterns of California Sea Otters*** (Alisha H. Kage, M. Tim Tinker and Daniel F. Doak, University of California-Santa Cruz, James A. Estes, USGS Santa Cruz Field Station); ***Nocturnal Foraging Ecology of the Sea Otter in Elkhorn Slough, California*** (Sarah Wilkin, Moss Landing Marine Laboratories); ***Thermoregulation and Diving Energetics of the California Sea Otter: Are They Pushing Their Physiological Limits? Carnivore Crossings for Roads and Highways*** (Bill Ruediger, U.S. Forest Service)

CARNIVORE DISEASES

Emerging Diseases in Marine Ecosystems: ProtozoalEncephalitis in Sea Otters (Melissa Miller, D. A. Jessup, E. Dodd, M. D. Harris and J. Ames, Marine Wildlife Veterinary Care and Research Center, I. A. Gardner, C. Krueder, K. D. Hanni, J. K. Mazet, L. J. Lowenstine, A. Packham and P. A. Conrad, University of California-Davis, D. M. Paradies, Bay Foundation of Morro Bay, K. R. Worcester, Central Coast Regional Water Quality Control Board, P. R. Crosbie, California State University-Fresno, F. M. Gulland, The Marine Mammal Center, J. Estes, USGS Santa Cruz Field Station, R. Jameson, Western Ecological Health Center) .

POSTER PRESENTATIONS

(On display in throughout conference)

Dead Sea Otter Drift and Recovery in Central California (Jack Ames, California Department of Fish and Game, Michelle Staedler, Monterey Bay Aquarium)

Preserving the Peaceable Kingdom: Investigating the Relationships Between Marine Recreation and Sea Otters in the Monterey Bay (Deborah M. Benham, Thea Sinclair and Sarah Collins, University of Nottingham Ashley Dayer, U.S. Fish and Wildlife Service)

ANNEX 2

Excerpt form the Final Revised Recovery Plan

Research. Numerous research projects on sea otters have been initiated or completed since the Southern Sea Otter Recovery Plan was first published in 1982. The major projects concerning southern sea otters are listed below.

Translocation of Southern Sea Otters to San Nicolas Island (U.S. Fish and Wildlife Service). The main research-related purposes of this project were to: i) evaluate and develop techniques for translocating sea otters, ii) evaluate the status of the sea otter population in central California, iii) evaluate the ecological importance of sea otters in nearshore communities, and iv) evaluate and develop methods for containment of sea otter populations. Most studies at San Nicolas Island have been terminated or severely reduced in scope. The colony and the coastal ecosystem are still being monitored.

Determine the status of the southern sea otter population (Minerals Management Service). This study, now complete, had two main purposes: i) to determine the behavior and demography of sea otters in California, and ii) to model the impacts of a possible oil spill on that population. A final report from the study has been published (Siniff and Ralls 1988), as have subsequent papers in peer-reviewed journals (*e.g.*, Ralls and Siniff 1990; Siniff and Ralls 1991; Ralls *et al.* 1989, 1992, 1995, 1996*a*, 1996*b)*.

Population biology and behavior of sea otters at the northern end of their range in California (Monterey Bay Aquarium). The purpose of this study is to obtain long-term records of marked sea otters to obtain basic life history information and longitudinal profiles of the behavior of individuals. This study is ongoing and involves OSPR, University of California at Davis, and the Oiled Wildlife Care network. The reproductive data are summarized in Riedman *et al.* (1994).

Causes of mortality in southern sea otters. The purpose of this study is to determine the cause of death in stranded sea otters. An assessment of records obtained from 1968- 99 was recently completed (Estes *et al.* 2003). Detailed necropsies of fresh carcasses have been conducted since 1992 by veterinary pathologists from the National Wildlife Health enter in Madison, Wisconsin, the California Department of Fish and Game, and the University of California at Davis. The main finding from this effort is that about 40 percent of the deaths result from infectious disease (Thomas and Cole 1996). These efforts are continuing.

Potential effects of oil on sea otters. Mink were used as a model for sea otters in oil exposure trials. Groups of mink were exposed briefly to oil slicks of Bunker C fuel and Alaska North Slope crude, and other groups were exposed via their diet. Results verified that mink are a good model, and that petroleum released into the environment may have both short and longer term consequences (*e.g.*, reduced reproductive success in both the first and second generation).

Immune response system. Reagents and methods to assess the function of the immune system of sea otters have been developed and are currently being tested on live captured

and fresh dead sea otters by veterinary pathologists from the California Department of Fish and Game.

Contaminants in the southern sea otter. Tissue samples were obtained from sea otter carcasses collected in central California, southeast Alaska, and the Aleutian Islands to determine whether contaminant levels were elevated in the southern sea otter. These analyses show that PCB and especially DDT residues occur at elevated levels in the southern sea otter (Estes *et al.* 1997, Bacon *et al.* 1999).

Genetic differential of sea otter populations. Blood and other tissue samples were obtained from sea otters in California, Washington, British Columbia, several regions of Alaska, the Commander Islands, and mainland Russia to determine geographical patterns in the genetic structure of populations. Mitochondrial DNA analysis shows haplotype differentiation among many of these populations, including the southern sea otter (Sanchez 1992, Cronin *et al.* 1996)

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