

Sea Otter Symposium

ABSTRACTS



National Fish and
Wildlife Foundation



Abstracts of papers presented at the
SEA OTTER SYMPOSIUM following the
T/V Exxon Valdez Oil Spill.

Anchorage, Alaska, April 17-19, 1990

Boundaries of the Symposium

Walter O. Stieglitz, Regional Director (U.S. Fish and Wildlife Service, 1011 E. Tudor Rd., Anchorage, Alaska 99503).

"Evaluation of response activities and data related to sea otters is the subject of this symposium. Damage assessment activities and data will be addressed in other forums as the process evolves.

The damage assessment process consists of a series of studies and analyses that are intended to determine injuries and culminate in the compensation for and restoration of the damages to the trustee resources. Because these studies are still underway and because of the possibility of litigation, presentation of certain data and information at this Symposium is premature and inappropriate. The Symposium Steering Committee and the authors and editors of the papers to be presented have each had to grapple with distinguishing between what is "response" and what is "damage assessment." So that all participants and readers of the Proceedings have the same understanding, let me state here the guidance I have given on this point.

Response, in case of sea otters and their habitat, includes all the rescue efforts (which in turn includes surveys to locate and assess otters in stress, capture, transport, veterinary treatment, rehabilitation, and release), certain procedures necessary to prepare animals for release (blood drawing, re-tagging, and radio implant surgery), recovery of dead otters, gross necropsy of dead otters, collections of tissues and data, analysis of tissues and data to assist in treatment of otters, and observations of distribution and condition of oil as it affected the behavior, distribution, and reproduction of sea otters. In short, any activity whose purpose is to minimize adverse effects on the trust resources is considered response.

Damage assessment, includes such question-stimulating topics as, comparison of before and after-spill sea otter census data, extrapolation of histopathic and toxicologic data to sea otters not captured, radio-tracking data from released otters beyond August 15, 1989 used to effect the release strategy, as well as the studies outlined in the State/Federal Natural Resource Damage Assessment Plan for the Exxon Valdez Oil Spill, August 1989, Public Review Draft. The presentation of information gathered after August 15, 1989, is an exception allowed by permission of the Justice Department."

Excerpt from Welcome Address by Walter O. Stieglitz, Regional Director, U.S. Fish and Wildlife Service

MOVEMENT OF SPILLED OIL FROM THE T/V EXXON VALDEZ

Galt, J.A., and D.L. Payton (National Oceanic and Atmospheric Administration, Hazardous Materials Response Branch, 7600 Sand Point Way, Seattle, Washington 98115).

The task of tracking and estimating the movement of oil spilled from the T/V Exxon Valdez resulted in considerable effort being expended by industry, Federal and State organizations. This task led to hundreds of overflight reports, hours of remote sensing data, a greatly expanded weather observation network, satellite tracked current drifters and significant computer analysis or modeling techniques - all providing fragments of information. Modeling techniques, combined with observational data, have been used to hindcast the movement of the spilled oil. Preliminary results indicate that by the end of the second week of the spill, approximately 30% of the spilled oil may have been lost to weathering processes, 40% beached within Prince William Sound, 25% exited Prince William Sound, and about 5% remained floating within the Sound. Of the oil leaving the Price William Sound system, it is estimated that 10% made it beyond Gore Point, and only about 2% got as far as Shelikof Strait.

DISTRIBUTION AND RELATIVE ABUNDANCE OF SEA OTTERS IN SOUTHCENTRAL AND SOUTHWESTERN ALASKA PRIOR TO OR AT THE TIME OF THE T/V EXXON VALDEZ OIL SPILL

DeGange, Anthony R., Daniel H. Monson, Christopher M. Robbins, David C. Douglas (U.S. Fish and Wildlife Service, Alaska Fish and Wildlife Research Center, 1011 E. Tudor Rd., Anchorage, Alaska 99503), and David B. Irons (U.S. Fish and Wildlife Service, Migratory Bird Management, 1011 E. Tudor Rd., Anchorage, Alaska 99503).

Surveys of sea otters conducted prior to, immediately following, or at the time of impact of the T/V Exxon Valdez oil spill were used to guide otter capture efforts and to assess the immediate effects of the spill. Shoreline counts of sea otters by boat in Prince William Sound in 1984 suggest that a minimum of 4,500 sea otters inhabited nearshore waters of Prince William Sound. Areas of highest density within the western portion of the Sound included the Bainbridge Island area, Montague Island, Green Island, and Port Wells. Approximately 1,330 sea otters were counted from helicopters along the Kenai Peninsula. Highest densities of sea otters were found along the western end of the Kenai Peninsula. At Kodiak Island, approximately 3,500 sea otters were counted in coastal surveys from helicopters. Highest densities of sea otters were found in Perenosa Bay in northern Afognak Island and in waters between Afognak, Kodiak, and Raspberry islands. Along the Alaska Peninsula, approximately 6,500 sea otters were counted between Kamishak Bay and Unimak Pass. Areas of concentration included the Izembek Lagoon area, False Pass, the Pavlof Islands, Hallo Bay and Kijulik Bay. Line transect surveys conducted offshore of the coastal strips indicate, that at the time of the surveys, relatively high offshore densities of sea otters existed at Kodiak Island and along the Alaska Peninsula but not on the Kenai Peninsula.

FISH AND WILDLIFE SERVICE'S ROLE IN THE SEA OTTER RESCUE

Bayha, Keith (U.S. Fish and Wildlife Service, 1011 E. Tudor Rd., Anchorage, Alaska 99503).

The Fish and Wildlife Service is responsible for sea otter management and, as trustee for the T/V Exxon Valdez Oil Spill, was responsible for oversight of the sea otter rescue effort. The Service's goals for the effort were to: 1) provide assistance as requested to Exxon and its contractors, 2) ensure that those engaged in sea otter capture were covered by appropriate permits, 3) monitor efforts of Exxon and its contractors to ensure they were commensurate with the threat to sea otter populations, and 4) balance the public's demand for maximum effort to rescue sea otters with the ecological and practical realities.

The decision to launch a rescue effort was not automatic. There were internal discussions where the pros and cons were expressed. It was recognized from the outset that from an ecological viewpoint the several hundred otters that might be salvaged would be insignificant. But because sea otters stimulate such strong emotional reactions in most people, public demand for animal rescue was high. Available data on the sea otters' ability to cope with oil contamination was scant. Therefore, it was decided to proceed and document the effort. This symposium and the proceeding that will follow represent the culmination of that decision.

THE STATE OF ALASKA'S ROLE IN MITIGATING IMPACTS OF THE T/V EXXON VALDEZ OIL SPILL ON SEA OTTERS

Lowry, Lloyd F. (Alaska Department of Fish and Game, 1300 College Rd., Fairbanks, Alaska 99701).

Sea otters, like other marine mammals but unlike other resident species of wildlife, are managed by federal agencies not by the State of Alaska. Much of the habitat essential to the population is State-owned tidal and submerged lands. It was this near-shore habitat in Prince William Sound and adjacent parts of the Gulf of Alaska that was most severely impacted by the T/V Exxon Valdez oil spill. Three state resource agencies were involved in response to the spill, the Departments of Environmental Conservation, Natural Resources, and Fish and Game. ADF&G had a particular interest in sea otters since their charge is the conservation and management of fish and wildlife and their habitats. The Habitat Division of ADF&G evaluated importance of habitats and impacts of the spill on them, and made recommendations for mitigating measures and cleanup priorities and techniques. The Wildlife Conservation Division conducted on-site evaluation of the distribution of oil and impacts on marine wildlife during the spill, and made recommendations for mitigation and cleanup. ADF&G staff were not directly involved in the design or operations of sea otter capture and rehabilitation efforts, but were consulted during the development of the release strategy. Particular concerns of ADF&G in regard to release of rehabilitated otters were: 1) the need to ensure that released otters did not introduce disease into the wild population; 2) selection of appropriate areas for release; and 3) the need to adequately monitor the fate of released animals.

PRESS INTEREST IN THE SEA OTTERS AFFECTED BY THE T/V EXXON VALDEZ OIL SPILL: A STAR IS BORN

Batten, Bruce T. (U.S. Fish and Wildlife Service, 1011 E. Tudor Rd., Anchorage, Alaska 99503).

For the federal agency with responsibility for management and welfare of the sea otter, as well as for scientists and volunteers devoted to studying and caring for it, the T/V Exxon Valdez oil spill transformed a biological species that was relatively unknown by the general public into a media icon. The anthropomorphic character of the sea otter helped it become a powerful symbol of the oil spill that was one of the world's top news stories of the year and one of the top environmental stories of the decade. The nature and extent of the press attention generated by the sea otters often led to strong public reactions to sea otter-related activities and decisions. Responding to and anticipation of those reactions posed substantial challenges which impacted the sea otter response in many ways. Scientists and managers who may be involved in future sea otter research and management activities should be prepared to recognize the sea otter's very strong, new identity. That identity can be expected to generate a much higher level of public scrutiny of sea otter activities than in the pre-spill days, and future sea otter activity planning should include adequate public information resources to respond to that scrutiny.

OVERALL CAPTURE STRATEGY

Bayha, Keith (U.S. Fish and Wildlife Service, 1011 E. Tudor Rd., Anchorage, Alaska 99503) and Ken Hill (Prince William Sound Veterinary Clinic, Cordova, Alaska).

The sea otter capture effort began in Prince William Sound March 30th with two Exxon-chartered fishing vessels staffed with personnel experienced in capture and handling of sea otters (one of whom was a veterinarian) and intermittent access to an Exxon-chartered helicopter. The Service responded to Sea World's request for assistance by fielding two more vessels April 1st staffed with sea otter biologists from California, a local veterinarian and a second helicopter based out of Seward. This effort expanded as the oil left the Sound to a peak effort of 14 capture crews and air support out of Valdez, Seward, Homer, and Kodiak. Initial instructions included a prioritized list of objectives, including pre-emptive capture of otters in imminent danger of being oiled. Pre-emptive capture was quickly abandoned because of the risk of chasing clean otters into oiled waters. The primary objective of capturing only oiled otters or otters in stress continued. Methods evolved from a simple dip-net operation to more difficult judgement calls involving lightly-oiled otters and tangle nets. The "when" to stop the capture became a delicate balancing act involving public pressure to continue, documentation of no otters in stress, diminishing returns, Exxon pressure to reduce costs, and lack of a definitive tool for detection of oil on otter pelage. As time wore on and our California talent was in shorter supply, it became evident that a capture protocol and a training program for Alaska laymen was needed. An agreement was signed with the Indigenous Conservators of the Environment (ICE), a newly established Alaska Native organization, to supply volunteers experienced with boats and nets while the Service arranged for on-the-job training in capture and rehabilitation. Other problems encountered and solutions adopted are discussed.

A SUMMARY AND EVALUATION OF SEA OTTER REHABILITATION OPERATIONS IN RESPONSE TO T/V EXXON VALDEZ OIL SPILL, PRINCE WILLIAM SOUND, ALASKA, 1989

Bodkin, James L. (U.S. Fish and Wildlife Service, P.O. Box 287, Galena, Alaska 99741) and **Fred Weltz** (P.O. Box 982, Cordova, Alaska 99574).

Following the T/V Exxon Valdez oil spill into Prince William Sound, the U.S. Fish and Wildlife Service and Exxon Corporation began an effort to rescue sea otters. The primary objective of this operation was to capture live, oiled otters for cleaning and rehabilitation. Between 30 March and 22 April, 139 live otters were captured for transport to rehabilitation facilities in Valdez, Alaska. Ninety of these were captured around Knight, Green and Evans Islands in the western Sound. The primary capture method consisted of dip-netting otters out of the water and off of beaches. Declining capture rates led to the use of set tangle-nets. While capture rates declined over time, survivorship of captured otters increased as the interval from spill date to capture date increased. The relative degree of oiling observed for each otter captured declined over time. The evidence suggests the greatest threat to sea otters in Prince William Sound occurred within the first three weeks of the spill. Following an oil spill in sea otter habitat, response efforts should be initiated as soon as possible. Pre-emptive capture and relocation of sea otters in Prince William Sound may have increased the number of otters that survived this event.

SEA OTTER CAPTURE ALONG THE KENAI PENINSULA, ALASKA

Britton, Ron L. (U.S. Fish and Wildlife Service, 2140 Eastman Ave., #100, Ventura, California 93003) and **Jeff Foster**.

The major emphasis of the sea otter rescue efforts along the Kenai Peninsula was from Port Chatham to Nuka Bay. Professional and volunteer personnel worked on two to five contract fishing vessels conducting surveys and capturing sea otters using dip-netting and entangle netting methods. Training of both professional and volunteer replacement personnel was conducted on the job. Dip-netting techniques were abandoned after a few weeks due to the healthy vigor of the otters and entangling nets became the primary capture method. Provisions for capture vessels, capture supplies and equipment repairs were provided haphazardly without an apparent schedule by a "chain of command", which made the acquisition process difficult. On several occasions this compromised the safety of the inflatable capture boats and the outboard engines employed. Capture efforts were also affected by field management decisions being delivered from the cleaning and rehabilitation facilities without adequate field input to determine the level of capture effort possible. Inadequate radio communications between the field and the base, erroneous reports and updates on oil spill location, the absence of adequate sea otter capture criteria, and the long periods of unpredictably bad weather resulted in the capture of fewer sea otters than was possible when they could have benefitted the most.

SEA OTTER SURVEY AND CAPTURE EFFORT, KODIAK ISLAND ARCHIPELAGO AND ALASKA PENINSULA

Hander, Raymond F. (Kodiak National Wildlife Refuge, 1390 Buskin River Rd., Kodiak, Alaska 99615).

From April 17 through August 4, 1989, post-oil impact surveys for sea otters (Enhydra lutris) were conducted in the coastal waters of the Kodiak Island Archipelago and Alaska Peninsula. Objectives were to locate and capture distressed sea otters, collect data on relative abundance and distribution, and collect dead otters. There were 18 trained otter handling personnel working out of four chartered vessels and village skiff crews in Ouzinkie and Larsen Bay on Kodiak Island involved in the survey/capture effort. Systematic coastline surveys were conducted along the Alaska Peninsula from Cape Douglas to Puale Bay, around Afognak and Shuyak Islands, and along the west side of Kodiak Island. Field observations from boat and village skiff crews were reported to Kodiak National Wildlife Refuge. The primary capture method was dip-netting from inflatable and hard bottom skiffs. Twenty-eight otters were captured of which 22 were transferred to the Kodiak Temporary Care Facility and then to the Seward Otter Rehabilitation Center. One hundred ninety-five dead otters were recovered. Sea otters observed in or near areas of oil took no actions to avoid oil. During the initially critical three to four weeks of the capture effort, inadequate capture and handling materials, training, food provisions and poor radio communications were a problem. Feedback information from otter rehabilitation centers for possible immediate and future capture efforts were lacking. Recommendations are given to initiate a well organized contingency plan to expedite the initial effort when the need is most critical.

TRANSPORTATION OF SEA OTTERS TO REHABILITATION CENTERS

Cramer, Dean W. (U.S. Fish and Wildlife Service, Fish and Wildlife Research Center, Anchorage, Alaska 99503).

The rehabilitation effort of sea otters oiled during the T/V Exxon Valdez oil spill required transportation of captured otters from remote locations into rehabilitation centers. Avoiding additional stress to the otters was a primary concern. Three hundred and sixty-four live otters were brought in to centers and three hundred were transferred between centers. Logistics, weather, terrain, and communications all combined to present many different problems. Methods and procedures had to be devised and modified to fit varying situations. Bell 206 and Bell 212 helicopters provided most of the transportation since they were already on lease and available. Airplanes and boats were also used to transport otters. Fiberglass airline flight kennels served as cages. Radio communication between the capture boats, the transportation vehicles, and the rehabilitation centers was the biggest problem. The discussion of methods tried and recommendations will be useful in the event of another oil spill requiring a sea otter rescue effort.

A FIELD TEST FOR QUANTIFYING CRUDE OIL CONTAMINATION OF THE FUR OF SEA OTTERS

Hill, Ken (Prince William Sound Veterinary Clinic, Cordova, Alaska) and Pamela A. Tuomi (College Village Animal Clinic, 2036 Northern Lights Blvd., Anchorage, Alaska 99517).

The need to have a field test which could determine whether a sea otter's fur had been oiled, became evident subsequent to the T/V Exxon Valdez oil spill of March, 1989. A short history describes the test and traces the evolution of a study of the test conducted under conditions at the Seward Otter Rehabilitation Center. Whether the need for such a test still exists is discussed given another oil spill in sea otter habitat. Possible scenarios for determining disposition of sea otters oiled to varying degrees are discussed.

ANALYSIS OF SEA OTTER (EHYDRA LUTRIS) FUR FOR CRUDE OIL CONTAMINATION

Perrollaz, D.C. and Jeffery Rash
(Marine Animal Resource Center, 2201 34th West, Seattle, Washington 98199).

Following the release of oil into the surrounding ecosystem, a major effort was launched to capture the contaminated sea otter population of Price William Sound. Techniques were then sought as a method for oil detection in sea otter fur.

Thin layer chromatography, TLC, is a relatively simple and inexpensive analytical technique that is very useful both in the laboratory and in the field. TLC's greatest asset in the field is its accuracy and quick turn-around time. With control animals as a comparison, differences were determined between squalene (natural polar oils) and the less polar Prudhoe Bay crude petroleum products. Crude oil exhibits very characteristic bands and can be easily standardized to determine oil concentrations in the otter's coat. This presentation will demonstrate how TLC can be used to determine the more toxic biodegradation products that can affect the sea otter coat from contamination of Prudhoe Bay crude oil.

DISTRIBUTION, AGE, AND SEX COMPOSITION OF SEA OTTER CARCASSES RECOVERED DURING THE RESPONSE TO THE EXXON VALDEZ OIL SPILL

DeGange, Anthony R. (U.S. Fish and Wildlife Service, Alaska Fish and Wildlife Research Center, 1011 E. Tudor Rd., Anchorage, Alaska 99503) and Calvin J. Lensink (National Wildlife Refuge Association, 13641 Jarvi Drive, Anchorage, Alaska 99515).

During the response to the T/V Exxon Valdez oil spill, nearly 900 sea otter (Enhydra lutris) carcasses were recovered in or adjacent to coastal areas affected by the oil. An estimated 80% of those carcasses represent oil spill-related mortalities. Timing of recovery of carcasses indicates that most oil spill-induced mortality occurred early in the response period. In fact, by 19 May about 70% of the carcasses had been found. The majority of the carcasses (56%) were from Prince William Sound suggesting that mortality was more acute there than in other geographic areas. Examination of the recovered carcasses indicated that more adult female sea otters were killed in Prince William Sound and along the Kenai Peninsula by the oil than other sex and age cohorts, reflecting their greater abundance in those regions. Nearly 65% of the adult females in those areas were pregnant or lactating. Pups made up a higher proportion of the carcass collections in the western portion of the spill zone reflecting the advanced pupping chronology at the time the search effort reached the Alaska Peninsula and the Kodiak Archipelago.

CAPTURE OF LIGHTLY OILED SEA OTTERS FOR REHABILITATION: A REVIEW OF DECISIONS AND ISSUES

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Oil spilled from the T/V Exxon Valdez spread along the coast of the Kenai Peninsula during April and May, 1989. Sea otter capture teams concentrated their efforts in Tonsina Bay, Rocky Bay, and Windy Bay because of high densities of sea otters and heavy oil accumulation. Many of the sea otters encountered by capture teams were lightly oiled, relatively active, and difficult to capture with dip nets. As a consequence, tangle nets were used to capture lightly oiled animals. Use of tangle nets resulted in capture of some unoiled animals, and may have forced some previously unoiled animals into contact with floating oil.

The effect of light oiling on sea otters is an important, contentious issue. One view is that lightly oiled otters should not have been captured. This view is based on the premise that risks to sea otters associated with light oiling are less than risks associated with capture, transport, treatment, and holding. The alternative view is that the decision to capture lightly oiled animals was correct, and that risks associated with capture and rehabilitation are less than risks of reduced survival and various sublethal consequences of light oiling.

There are no existing data sufficient to understand the effects of light oiling on sea otters. In the absence of such data, I argue that: a) the decision to capture lightly oiled sea otters was proper, conservative, humane, and of value with regard to management of future oil spills; and b) there is a compelling need for definitive research on the effects of light oiling on sea otters, in order to improve management of future rehabilitation programs following oil spills.

THE IMPETUS FOR CAPTURING, CLEANING, AND REHABILITATING OILED OR POTENTIALLY OILED SEA OTTERS RESULTING FROM THE T/V EXXON VALDEZ OIL SPILL

Ames, Jack (California Department of Fish and Game, 2201 Garden Rd., Monterey, California 93940).

The T/V Exxon Valdez grounding was the first major oil spill event which affected large numbers of sea otters. The spill response was, therefore, original and predictably quite confused, particularly initially. New information and situations were leading to new methodologies from day to day. For a variety of reasons, many sea otters were captured, held, transported and cleaned when they might have been better off left alone. Prior research had suggested that lightly oiled (but observably oiled) sea otters could survive on their own. This information was unknown to or forgotten by some decisions makers, or pre-empted for unknown reasons. In fact, at one point, capture teams were told to consider euthanizing heavily oiled otter (these were otters that were hard to dip-net and quite vigorous when first captured) and only send lightly oiled otters (which included many non-oiled otters) to the cleaning centers. In my view, sea otter captures continued for 2 to 3 months beyond when they were useful. It is likely that some otters died and that several mother-pup bonds were broken (thereby creating several dependant orphans), only because the animals were "rescued". Possible reasons include: 1) very poor communications, at all levels, but particularly between capture boats and cleaning centers, 2) some capture crews having very little background with sea otters, 3) no one wildlife agency person was "in charge", 4) favorable press that the rescue effort received and 5) high wages paid by Exxon.

A CONCISE HISTORY OF THE SEA OTTER REHABILITATION CENTERS

Davis, Randall W. (Physiological Research Laboratory, A-004, University of California, San Diego, CA 92038) and **James Styers** (Wildlife Rapid Response Team, Inc., Longbranch, Washington).

The first sea otter rehabilitation center was opened in the Prince William Sound Community College on March 27. Oiled otters began arriving on March 30 at an average rate of 10 per day until April 9, after which the new arrivals averaged only 1-2 per day. To accommodate the large number of oiled otters, the rehabilitation center was moved into the gymnasium of the Growden-Harrison Complex on April 2. As otters were rehabilitated, they were placed in floating pens in the small boat harbor. When space in the harbor was needed for fishing vessels, the otters were moved to salmon raceways or a large, floating salmon pens at the Solomon Gulch Hatchery located near Valdez. By April 1, the southern edge of the oil spill had moved out to Prince William Sound and threatened the coast of the Kenai Peninsula. A second rehabilitation center that could clean and care for oiled otters was opened in Seward on May 5 and fully operational by May 25. A third facility designed to hold rehabilitated otters from Seward was opened in Little Jakobof Cove near Homer on May 17. On May 15, the first of seven rehabilitated sea otters were released in Simpson Bay, Prince William Sound. The release plan for the remaining otters was completed in early July. Of the 357 otters treated at the three rehabilitation centers, 195 (55%) were released in eastern Prince William Sound and along the Kenai Peninsula during July and August. Forty-five of the otters released in Prince William Sound had radio transmitters implanted in their abdomen. The remaining 28 otters were permanently placed in seaquariums because of chronic health problems or because they were too young to be released. All three facilities were closed by September 13.

VALDEZ SEA OTTER REHABILITATION CENTER: FACILITIES AND TRAINING

Davis, Randall W. (Physiological Research Laboratory, A-004, University of California, San Diego, CA 92038) and Terrie M. Williams (Naval Oceans Systems Center, P.O. Box 997, Kailua, HI 96734).

The first sea otter rehabilitation center in Valdez was located in the Copper Basin Hall at the Prince William Sound Community College. Approximately 3,000 ft² were available for cleaning and holding sea otters. This facility was used to treat otters until April 6. The new rehabilitation center, which was built at the Growden-Harrison Complex, provided 6,200 ft² of indoor space and an equivalent amount of outdoor space. Sixty holding pens were built in the gymnasium as a part of the critical care facility. Three ATCO trailers, which were placed next to the gymnasium, provided space for administration, a veterinary clinic, a clinical laboratory, sea otter washing facilities, staff dining area, sea otter food preparation and a staff office. The yard northeast of the gymnasium was used for outdoor holding pens and a sea water reservoir. Some of the pens were plumbed for seawater from two plastic reservoirs (1000 gallons each) that were filled by a tanker truck. Rehabilitated otters were held in the floating pens or salmon raceways at the Solomon Gulch Hatchery. The large, octagonal salmon pen located in Port Valdez Bay was well suited for long-term holding because it enabled rehabilitated otters to regain muscle condition by swimming and diving. In addition to the otter rehabilitation center, we built a facility adjacent to the Copper Basin Hall for rehabilitating oiled harbor seal pups. The pens were similar to those used for sea otters. Of the three sea otter rehabilitation centers, Valdez had the highest number of paid staff (i.e. 159) and did not use volunteers after early April. The ratio of personnel to otters reached a peak of 3.5 in April (the period of heaviest oiling and the most severe toxic reactions) and showed a steady decline to about 0.6 through July and early August (the period in which most of the otters were rehabilitated and awaiting release).

SEWARD SEA OTTER REHABILITATION CENTER: FACILITIES AND TRAINING

Styers, James (Wildlife Rapid Response Team, Inc., Longbranch, Washington), and Thomas McCloskey

The decision to open another otter rehabilitation center, became apparent in the first days of April. The oil began to move toward the Kenai Peninsula, Kodiak Island, and the Alaska Peninsula. Home to thousands more sea otters, this additional, much larger area presented an insurmountable logistical and communications problems to otter rescue efforts that, at the time, were centered in Valdez, Alaska. To address this situation, Exxon and the U.S. Fish and Wildlife Service decided to open a second otter rehabilitation center in Seward, Alaska. Several communities put in a bid for this center, but Seward was picked as the most logical, based on several factors. Housing, location, accessibility, driving distance to Anchorage, etc.

This paper describes how the Seward Otter Rehabilitation Center (SORC), was organized and managed. It begins with a description of the overall approach that was applied at the center. It covers how the center was organized, designed, and constructed.

The T/V Exxon Valdez incident was the first to affect sea otters. As a result, those responding to the incident had to start from scratch in their efforts to organize and carry out response operations. At Seward, we benefited by the lessons learned at Valdez, and it is our fervent hope that any future response effort directed at sea otters will learn from our operation in Seward.

JAKOLOF PRE-RELEASE FACILITY: FACILITIES AND TRAINING

Redman, Linda and Nancy Hillstrand.

See page 18 for abstract.

RECORD KEEPING FOR AN OTTER REHABILITATION CENTER

Loshbaugh, Shana F.

Record keeping was not a priority during planning and emergency phases of the sea otter rescue. Once initiated, records provided summaries for administrators, aid for clinicians, feedback for staff, and information for the press and oversight agencies. Since the release of the otters, the information collected at the otter rehabilitation centers remains useful for assessing response effectiveness, planning for future disasters, providing data for researchers, recording history, and documenting for litigation. At otter rehabilitation centers, the types of records fell roughly into the following categories: otter demographics, clinical, husbandry/behavioral, and pathological. To set up effective record keeping in the future, the administration must set priorities for which data to collect. Standard office supplies and equipment, including a large-capacity photocopier and secure file cabinets, meet supply needs. Records personnel need aptitude for detail, skills in office procedures, basic understanding of life sciences or medicine, continuity, and authority to do their job.

The human element is crucial for successful records. Cooperation from all supervisors and adequate briefing of staff is required. Set aside an undisturbed location for records, find and keep competent personnel, and establish a data manager to oversee records and computerization. Animal identification was a major problem at otter rehabilitation centers. Use more legible tags and consistent tagging procedures, provide binoculars for observations of groups, describe all animals in detail when admitted, establish a consistent numbering scheme and use it for all animals, label dead otters clearly, and use implanted transponder chips as a backup for tracing animals. Have master forms ready beforehand, use white paper and black, waterproof pens on forms, double check animal numbers against other identification frequently, and utilize computers to maximize effectiveness.

The data set is variable in quality but it is valuable. Protocols explain some methods but are often lacking or undated. Different measuring devices, calculation methods, or circumstances compromised accuracy. Organization of the data set remains incomplete and should be addressed to maximize the learning value of our sea otter rescue project.

AN ANIMAL REHABILITATION CENTER DATABASE

Swarthout, David J.

A database was designed and created to record the demographical, behavioral, nutritional, medical and laboratory test data for injured sea otters cared for at the Seward Otter Rehabilitation Center during the aftermath of the T/V Exxon Valdez tragedy. This paper will describe the chief components of the database and the grounds for their inclusion. While recording this data for posterity, future research, and even potential litigation is important in its own right, compiling all important data in a well designed database makes it readily available for custom report generation during the crisis. Such reports proved indispensable for keeping the medical and husbandry staff informed about the animals' condition on a day-to-day basis. Several of these ad hoc reports developed during the existence of the otter rehabilitation center are discussed.

CLINICAL EVALUATION AND CLEANING OF SEA OTTERS IMPACTED BY THE OIL SPILL

Williams, Terrie M. (University of California, San Diego), Judy McBain (San Diego, California), and Riley Wilson (Arctic Animal Hospital, Anchorage, Alaska), and Randall Davis (University of California, San Diego).

Following the T/V Exxon Valdez oil spill, medical condition and degree of oiling were evaluated in 351 sea otters on arrival at rehabilitation centers. Criteria used to determine condition included behavior, respiratory rate, body temperature, and appetite. We assessed exposure to petroleum hydrocarbons by determining the percentage covered and penetration of oil on the otter's pelage, and by measuring total petroleum hydrocarbon concentration in blood samples. Both medical condition and degree of oiling were dependent on when otters encountered the spill. Heavily oiled animals arriving within 10 days of the spill showed the greatest number of critical disorders. At the Valdez Sea Otter Rehabilitation Center, approximately 50% of the otters were heavily or moderately oiled. Hypothermia, hypoglycemia, and emphysema were diagnosed in many of these animals. In comparison, two heavily and 20 moderately oiled sea otters were received at the Seward facility; the remainder were lightly oiled or unoiled. Less than 2% of these otters displayed symptoms of hypothermia, hypoglycemia, or emphysema on arrival at the center.

Depending on the medical evaluation, sea otters were washed within 2 to 24 hours of arriving at the Rehabilitation Centers. As reported in previous studies, a 1:16 solution of dish-washing detergent and fresh water was effective in removing crude oil from the fur. Duration of recovery for the otters was contingent on physical and physiological factors that permitted grooming activity. Ongoing research indicates that the replacement of natural oils in washed fur may speed coat recovery in washed sea otters.

COAT GRADATION AND CONDITIONING OF SEA OTTERS (ENHYDRA LUTRIS) AT THE SEWARD OTTER REHABILITATION CENTER

Rash, J.A. (Marine Animal Resource Center, 2201 34th Avenue West, Seattle, Washington 98199), C.R. McCormick, R. Alexander, S.J. Nichol, and D.C. Perrollaz.

The Seward Otter Rehabilitation Center received over 150 sea otters (Enhydra lutris) during the period from May 1989 through September 1989. During the rehabilitation period, the sea otter proceeded through a series of pool systems. This system provided an environment for the otter to stimulate its natural oils and recondition its coat before returning to its natural habitat. Using methods developed by Dr. T.A. Gornall, and Jeffrey A. Rash, from several overseas transports of otters, criteria were developed to "grade" coat conditions at the center and provide valuable behavioral information in relation to coat condition. It was found that with a study of grooming behavior, amount of time spent in the water, and a chemical analysis of hair samples, we could correlate the "grade" of the coat to the degree of oiling of the otter's coat by the Prudhoe Bay crude. This study will also show the relationship between medical condition and coat condition of the sea otter at specific times during the rehabilitation process at the Seward Otter Rehabilitation Center.

HUSBANDRY - VALDEZ REHABILITATION CENTER

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Large numbers of sea otters (Enhydra lutris) were contaminated with crude oil following the March 24, 1989 oil spill from the T/V Exxon Valdez. One hundred and fifty-six (156) sea otters were housed and treated at the Valdez Otter Rehabilitation Center between March 30 and August 16, 1989. This was the first effort to treat and rehabilitate large numbers of wild oil-contaminated sea otters. The evolution of the center from critical care to long term holding resulted in many innovations and improvements over time. This paper will discuss short and long term care of otters debilitated by oil contamination including: (1) attempts to provide an environment where otters could maintain body temperature and restore coat condition, (2) dealing with natural and capture related stresses, (3) nutritional support, (4) maintaining sanitary and disease-free facilities, and (5) training of personnel in veterinary and husbandry procedures.

HUSBANDRY - SEWARD REHABILITATION CENTER

Otten, Jill (Point Defiance Zoo, 5400 N. Pearl St., Tacoma, Washington 98407).

In the establishment of the Seward Otter Rehabilitation Center, using techniques learned at the Valdez Center and elsewhere in the field, we attempted to design a system where the otters were provided with everything they would need for the quickest possible rehabilitation, movement to a pre-release facility and back to the wild. Our goal in husbandry was to minimize our contact and impact on these oiled otters as much as possible. As the husbandry staff worked with the S.O.R.C. system, we were able to define more clearly what worked and what did not in regard to staffing requirements, feeding (amount, variety, method, etc), housing (for example - ways to eliminate abrasions, social stress, how to facilitate movement through coat conditioning, etc), how to minimize many types of stress-induced problems, needs of special care groups, and improved general husbandry procedures (which were continually being revised as we learned more). We hope that what we have learned will help in setting parameters for future sea otter care in a rehabilitation setting.

OTTER PUP NURSERY

Styers, Dale (Wildlife Rapid Response Team, Inc., Longbranch, Washington), and Carolyn McCormick (Eagle River, Alaska).

The Seward Otter Rehabilitation Center received 21 sea otter pups that were either born at the center, abandoned by their mothers taken from their mothers for health reasons, or found orphaned in the Kenai or Kodiak area. A nursery was set up to handle these pups. Not much was previously known about raising sea otter pups. All known knowledge was implemented, but several new techniques emerged; from formula and medical treatments, to water and play time. This paper will discuss all aspects of the "Pup" nursery from medical problems and design to the eventual shipment of 13 surviving pups to their final destinations aquaria in the lower 48.

BEHAVIORAL OBSERVATIONS OF REHABILITATING SEA OTTERS IN PRE-RELEASE PENS

Michaelson, Nancy E.

This paper summarizes techniques and charts used and behavioral observations made of sea otters rehabilitating in pre-release holding pens in the Valdez and Seward Otter Rehabilitation Centers, Alaska, after the T/V Exxon Valdez oil spill. Correct and informative observations by handlers and notations of the same carefully reviewed by the husbandry and veterinary staff of the behavior are requisite to ensure successful rehabilitation or early detection of health problems in the otters. Sleeping, eating, grooming, and hauling-out patterns along with shivering, net-hanging, repetitive diving or porpoising, lethargy, aggression, vocalization, social interactions and individual activity levels were affected by the factors of age, stress, health, boredom, sex, personality of individual, or captivity.

Documented information about these behaviors or factors affecting them was not general knowledge among the husbandry staff on location daily. This provided the staff with a job intriguing and educational in nature, albeit a bit confusing at times due to differences in conjecture by varied staff members. In the event of any future oiled sea otter rehabilitation effort, more background knowledge in these areas is needed to improve the ability of the husbandry staff to identify which behavior patterns indicate possible health problems or the return to health and normal behavior, thereby alerting care givers to any need of immediate veterinary care or providing a sound basis for release recommendations, respectively.

FOOD PROCUREMENT AND FEEDING OF SEA OTTERS DURING THE T/V EXXON VALDEZ OIL SPILL

Ferrante, Peter (Monterey Bay Aquarium, 886 Cannery Row, Monterey, California 93940-1085), Paul Wunnicke, and John Watts.

The T/V Exxon Valdez hit Bligh Reef on March 24, 1989 spilling 11 million gallons of crude oil. 359 sea otters were captured and taken to three Otter Rehabilitation centers for treatment for various medical problems during the spring and summer of 1989. These sea otters were severely stressed by the oil and by removing them from their natural environment. The nutrition of the otters is an important factor in their recovery. This paper will discuss: food procurement from distributors, types of food, expense, and transportation to the recovery centers, the storage of the food in freezers, refrigerators and shaved ice, the pros and cons of thawing the frozen food in refrigerators versus water and the tools and equipment used in the operation. The facilities in Valdez and Seward will be compared with the optimum. A sea otter in captivity due to its high metabolic rate consumes approximately 15% of its body weight per day. As the exact nutrient requirement of the sea otter is not known, a variety of food was offered including shell fish (clams, crabs, shrimp), squid, and fish fillets. A pup is a special case and the food preparation is more labor intensive. The amounts, frequency, cost, and waste of feeding will be discussed. The facilities were staffed on a 24 hour basis and requirements and duties concerning food preparation and handling will be covered.

POST CAPTURE SUPPORTIVE CARE OF CRUDE OIL CONTAMINATED SEA OTTERS, ENHYDRA LUTRIS

Thomas, Jon F. (Chester Valley Veterinary Hospital, 1571 Muldoon Rd., Anchorage, Alaska 99504).

Experience aboard otter capture boats shortly after the Exxon Valdez oil spill produced clinical data and observations on oiled otters. Symptoms observed in newly captured otters included shivering, weakness, coma, blindness, loose stools, and diarrhea. Subtle behavioral characteristics in pre-captured oiled otters were head and neck and shaking, and intense grooming. Captured otters were often unable to maintain body temperature in kennels on deck. Precautions were necessary to prevent hypothermia. There was a low rate of survival in otters captured in areas where relatively unweathered oil was present. Prophylactic medical treatment including antibiotic, vitamin E, selenium and corticosteroids may be indicated in captured oiled otters.

CLINICAL TREATMENT (Presented in four parts)

Initial Treatment - Riley Wilson

Clinical Treatment - Carolyn McCormick

Gastro-Intestinal and Respiratory Problems - Thomas D. Williams

Pregnancy and Musculo-Skeletal Problems - Pamela A. Tuomi

Sea otters were presented in various degrees of oiling and general body condition. This ranged from emaciated, comatose, severely oiled otters to ones that were in excellent body condition and questionable degree of oiling. Treatment during the washing process followed a standard protocol. While the otters were being washed under sedation they received fluids, steroids, antibiotics, Vitamin E/selenium, and blood drawn for diagnostics. Immediately following the washing process, several problems were encountered that required immediate attention. These were hypothermia/hyperthermia, seizures, and shock. Throughout the rehabilitation program a multitude of medical problems were treated. These include skin associated problems, gastro-intestinal disorders, respiratory disorders, ophthalmic conditions, pregnancy related problems and several miscellaneous disorders. Treatment regimes and level of success for each problem are discussed.

VETERINARY TECHNICIANS' PERSPECTIVES

Kelly, Laura L. (Northern Lights Animal Clinic, Anchorage, Alaska), **Anne M.Green** (Seward, Alaska), and **Bonnie W. Miller**.

The following article is a report from the veterinary technician staff involved in the rescue, rehabilitation and release of sea otters incapacitated by the T/V Exxon Valdez oil spill. The accuracy of clinical pathology was improved by the technicians' knowledge of record keeping, archiving, and the processing of blood samples to send to various laboratories, and by proper performance of specific in-house tests. Critical to a smooth operation, the recovery of, and the overall health of the sea otters was a sufficient inventory of medical supplies. The veterinary technicians were responsible for ordering, stocking, and organizing these needed supplies. The technician staff also had input on decisions regarding structural layout of the facilities as well as protocols for washing procedures, treatments, controlled drug logs, and harbor or pre-release preparation. Through their assistance to the veterinarian in the admittance, washing and the recovery of the oiled sea otters, the veterinarian technicians proved essential to the Otter Rehabilitation Centers in Valdez, Seward, and Homer, Alaska.

CHEMICAL RESTRAINT AND ANESTHESIA OF SEA OTTERS AFFECTED BY THE OIL SPILL IN PRINCE WILLIAM SOUND, ALASKA

D.C. Sawyer (Michigan State University, E. Lansing, Michigan), and **T.D. Williams** (Monterey Bay Aquarium, Monterey, California).

Most of the otters affected by the oil spill in Prince William Sound and brought to the rehabilitation centers in Valdez and Seward, Alaska for cleaning and rehabilitation, required chemical restraint for the 2 hour cleaning process. Various combinations of opioid agonists, a dissociative agent, and tranquilizers were used and a small number of otters were anesthetized with isoflurane. In varying numbers, otters were given combinations which included butorphanol/diazepam, meperidine/diazepam, fentanyl/azaperone/diazepam, fentanyl/acetylpromazine/diazepam, oxymorphone/acetylpromazine/diazepam, and tiletamine/zolazepam (Telazol). Problems in handling and administering the drugs, induction time, duration of effect, variables monitored during anesthesia, recovery time, complications, morbidity, and mortality will be discussed. Advantage, disadvantages, and acceptability of each group will be presented not only in the effectiveness of chemical restraint provided for the cleaning and therapeutic procedures but also in regards to the potential risk and abuse potential to personnel working at the Centers. The most effective combination was fentanyl (0.1 mg/kg) combined with either phenothiazine tranquilizer and diazepam (0.22 mg/kg) given intra-muscular.

BLOOD COLLECTION AND ANALYSIS DURING THE OIL SPILL

Williams, Thomas D. (Monterey Bay Aquarium, Monterey, California), and **Riley Wilson** (Arctic Animal Hospital, Anchorage, Alaska).

Large numbers of sea otters were contaminated with crude oil following the March 24, 1989 oil spill from the T/V Exxon Valdez. 359 sea otters were captured and taken to three Otter Rehabilitation Centers for treatment for various medical problems and rehabilitation during the spring and summer of 1989.

Hematology and biochemical profiling was a major diagnostic aid providing valuable information regarding the health status of the sea otters. Blood was routinely drawn at admission to help establish the overall health of the otter, during treatment to monitor the animal's progress, pre-surgery in order to select healthy animals for surgical implantation of the transmitters and pre-release to insure the otter was disease-free before releasing into the wild population. Blood was drawn from the femoral vein (proximal or distal) or if the animal was under anesthetic, from the jugular vein. Samples were taken for hematology, blood chemistry and for hydro-carbon toxicity. Hematology and blood chemistry results were compared to normals established on California sea otters involved in the U.S. Fish and Wildlife Service (California) translocation program and others under the care of the Monterey Bay Aquarium. Significant disease problems were identified including treatment protocols were based upon those results.

IDENTIFICATION OF A HERPES-LIKE VIRUS IN SEA OTTERS DURING REHABILITATION EFFORTS FOLLOWING THE T/V EXXON VALDEZ OIL SPILL

Harris, R.K.¹, R.B. Moeller¹, T.P. Lipscomb¹, R.J. Haebler², P.A. Tuomi³, C.R. McCormick⁴, A.R. DeGange⁵, D. Mulcahy⁵, T.D. Williams⁶, and J.M. Pletcher¹

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On 15 July 1989, during radio-telemetry device implantation surgery on sea otters maintained at the Seward Otter Rehabilitation Center (SORC), surgical team members noted ulcers in the oral cavity of each of five animals examined. Ultimately, oral lesions were identified in 25 of 27 otters examined at the SORC. Histologic evaluation of the lesions revealed focal areas of mucosal epithelial necrosis with associated intranuclear viral inclusion bodies. A herpes-like virus was subsequently identified ultrastructurally. The concern of releasing a virus of unknown origin and virulence into a naive wild otter population prompted management decisions restricting the movement of otters and jeopardizing the scheduled release of the otters on 27 July 1989. A team of veterinarians and otter capture personnel captured and examined twelve free-living adult otters living in waters off the coast of the southern Kenai Peninsula. Viral induced oral lesions were identified in a number of these animals establishing that the virus was indigenous to sea otters living in Alaskan waters; the decision was made to release rehabilitated otters back into the wild.

PATHOLOGICAL EXAMINATION AND COLLECTION OF TOXICOLOGICAL SPECIMENS FROM SEA OTTERS

Haebler, Romona (U.S. Environmental Protection Agency, Environmental Research Laboratory, 27 Tarzwell Drive, Narragansett, Rhode Island 02882).

In an environmental disaster that impacts wildlife such as the oil spill of the T/V Exxon Valdez, it is critical to perform rigorous pathological examinations of carcasses for several purposes: 1) to provide medical information to guide and improve clinical treatment of living animals; 2) to document pathological processes to increase scientific understanding of mechanisms associated with exposure to toxic chemicals; 3) to provide scientific documentation required for legal purposes. Field laboratories were created, stocked and staffed in two locations. Gross necropsies were performed on all otters that died in sea otter rehabilitation centers and on all otters recovered fresh dead from the field. Protocols were established for record keeping, tissue collection, disposition of samples, chain of custody, etc. Written necropsy reports were recorded on a standardized form. Tissue samples were collected for histopathology, chemical residue analysis and other tests as indicated. Information from the pathological examinations and data generated from chemical residue analyses is now being integrated with the clinical record and histopathology to fully characterize the pathological processes that caused death in sea otters following the oil spill of the T/V Exxon Valdez.

DEVELOPMENT OF THE RELEASE STRATEGY PLAN FOR REHABILITATED SEA OTTERS

Rappoport, Ann G., Mary E. Hogan, and Keith Bayha (U.S. Fish and Wildlife Service, 1011 E. Tudor Road, Anchorage, Alaska 99503).

Within 6 days of the 24 March 1989 oil spill from the T/V Exxon Valdez, the first oiled sea otter carcasses were recovered and the first live but sick and oiled otters were captured. As Trustee for the capture, cleaning, holding, and release of otters, the U.S. Fish and Wildlife Service's (Service) objective was to return as many healthy otters to the wild as possible. That objective included releasing otters in good habitats where there would be minimum socio-economic conflicts and where they could be monitored. Pros and cons of releasing otters to areas ranging from where they had been captured, to Southeast Alaska, the North side of the Alaska Peninsula, or Washington state were considered. Long-distance translocation was dropped as an option in consideration of the spill's effects, stresses to which captured animals were exposed, otter homing instincts which would cause them to move long distances from release sites back to their areas of capture, and high losses of animals in previous translocation efforts. After initial establishment of otter rehabilitation centers in Valdez and Seward, the Service pushed for construction of long-term holding facilities for monitoring and stabilizing rehabilitated otters prior to their release. By mid-May, such a facility was under construction in Jakolof Bay across from Homer, Alaska. The Service consulted with veterinarians, other otter experts, Service site representatives, and the State in developing their 10 July 1989 release strategy. The strategy included protocols for determining the health status of otters and the release of near term pregnant otters. Six otters with radios attached to their flippers were released into clean waters in eastern Prince William Sound on 15 May and monitoring of those otters and 21 radio-tagged otters released 27-28 July into clean waters in Prince William Sound provided the basis for further releases. The majority of the releases took place in August and were completed 30 August.

POTENTIAL HAZARDS ASSOCIATED WITH THE RELEASE OF REHABILITATED ANIMALS WITH PARTICULAR EMPHASIS ON SEA OTTERS AND THE T/V EXXON VALDEZ OIL SPILL

Speaker, Terry (College of Veterinary Medicine, Colorado State University, Ft. Collins, Colorado 80523).

When animals are removed from the wild for rehabilitation purposes and released into pre-existing or new habitat, many problems can occur. An area of concern is the transmission of diseases to the free-ranging animals by the released animals. These diseases can be endemic diseases of the rehabilitated animals or be diseases that were acquired during the trapping, handling, and rehabilitation procedures. Numerous sequelae can result from this disease exposure including: 1) death of captured animals, 2) animals develop carrier state that cause diseases in times of low nutrition or stress, 3) adults become carriers and transmit the disease to their offspring, 4) animals become carriers and transmit diseases to other species, 5) and others. Examples of these conditions as they relate to the sea otter release program of the T/V Exxon Valdez oil spill will be discussed. The potential exposure to disease for the rehabilitated sea otters was overwhelming. The release of the rehabilitated sea otters into Prince William Sound and the Kenai Peninsula was probably not a wise decision.

DETERMINATION OF HEALTH STATUS IN REHABILITATED SEA OTTERS PRIOR TO RELEASE

Haebler, Romona (U.S. Environmental Protection Agency, Narragansett, R.I. 02882), Riley Wilson (Arctic Animal Hospital, Anchorage, Alaska), and Carolyn McCormick (15536 Husky St., Eagle River, Alaska 99577).

Following the accident of the T/V Exxon Valdez, sea otters were exposed to oil that caused adverse health effects. Many of these animals were rescued and treated at rehabilitation centers in Valdez and Seward. The goal was to release rehabilitated animals back to their natural environment if it could be determined that the health of these animals was sound enough that they could be expected to survive in the wild. To ensure that minimal risk was associated with their release, sound protocols were established for determination of the health status of each individual animal. Several sources of information were used. First, the medical record provided information concerning the clinical history, medical treatment, and temporal change of clinical signs. Second, physical examination and visual observation of the animal provided information on the physical status of the animal, appearance of the hair coat, appetite, nutritional status, activity level, etc. Third, blood samples were collected and analyzed for hematology and clinical chemistry profiles. This blood analysis provided the "health profile" that allowed determination of how well the internal organs were functioning. Also, animals were examined for pregnancy. All of this information was integrated and weighed by the veterinarians to determine if a given individual animal was ready for release to the natural environment.

PROCEDURES AND RATIONALE FOR MARKING SEA OTTERS CAPTURED AND TREATED DURING THE T/V EXXON VALDEZ OIL SPILL

DeGange, Anthony R. (U.S. Fish and Wildlife Service, 1011 E. Tudor Rd., Anchorage, Alaska 99503), and Thomas D. Williams (Monterey Bay Aquarium, Monterey, California).

Four methods were used for marking sea otters captured and treated during the response to the T/V Exxon Valdez oil spill. Colored and numbered flipper tags were placed on each sea otter that entered the otter treatment centers. These tags allowed individual recognition and permitted the tracking of individuals through the treatment and holding processes. Recovery of tagged carcasses may provide a crude measure of the fate of rehabilitated otters. Seven sea otters were instrumented with radio transmitters attached to flipper tags as part of a pilot release program. The results of that study were inconclusive. Forty-five sea otters were implanted with radio transmitters as part of a study to assess the fate of rehabilitated sea otters. Specific objectives of the study include estimating survival rates and monitoring the reproductive efforts of the sample of rehabilitated sea otters and comparing the results to similar parameters in a control population. Transponder chips were injected in the perianal region of all but 7 of the instrumented sea otters and all were tagged with red flipper tags. The advantages and disadvantages of each type of tag are discussed.

POST-RELEASE MONITORING OF RADIO-INSTRUMENTED SEA OTTERS IN PRINCE WILLIAM SOUND

Monnett, Charles W. (Prince William Sound Science Center, P.O. Box 705, Cordova, Alaska 99574), Lisa Mignon Rotterman (University of Minnesota, Department of Ecology and Behavioral Biology, 318 Church St. S.E., Minneapolis, Minnesota 55455), Cece Stack (Prince William Sound Science Center), and Daniel Monson (U.S. Fish and Wildlife Service, 1011 E. Tudor Rd., Anchorage, Alaska 99503).

Sea otters (*Enhydra lutris*) that had been captured in areas in, or west of, western Prince William Sound (PWS), treated, and held in captivity at the temporary centers established in response to the T/V Exxon Valdez oil spill, were instrumented with radio transmitters, released into eastern Prince William Sound, and monitored using radio-telemetry in order to gain information about their movements, general viability, and survival. Radio transmitters were attached to the flippers of 7 sea otters that were released in May, 1989 and monitored for periods ranging from a few hours to over 60 days. The relative lethargy of these seven otters, as compared with individuals released later, suggests that their release may have been premature. Forty-five additional sea otters from the centers were implanted with radio-transmitters, released into northeastern PWS and monitored for 8 months. During the first 20 days following the release of the first of these implanted otters ($n = 21$), they were observed to be much more mobile than normal sea otters. Many of them (38.1%) crossed the supertanker navigation lanes that bisect PWS and re-entered the area directly impacted by crude oil. However, all were alive and vigorous at the end of the twenty day period. Information obtained on the movements of all 45 implanted sea otters over the entire 8 month period showed that the otters remained highly mobile. 46.6% crossed into western PWS. A few ($n = 6$) went to waters adjacent to the Kenai Peninsula, one to Controller Bay and several into the Gulf of Alaska. However, by the end of the 8 month period, just over half of the otters that were instrumented and released were known to be alive (23 of 45). Twenty-one individuals were dead or missing. One radio had failed. These mortality and missing rates are much higher than those normally observed for adult sea otters in normal populations. The proportion of dead or missing animals were similar between those that had, at some point after release, made the crossing into the western sound and those that had remained in the east. The death rate increased strikingly in the winter. These data suggest that, despite the tremendous amount of money and energy that was directed toward the treatment and care of these animals, many or all of the sea otters that were released from the centers were not "rehabilitated", that is, not returned to a normal state. We recommend that future policies focus on preventing otters from becoming oiled, rather than attempting to treat them after oiling has occurred. This focus is especially recommended in light of the recognition of the stress and disease risks associated with bringing a wild animal into captivity.

SEA OTTER RELEASE SITE SELECTION AND POST RELEASE ACTIVITIES

Sharpe, Elizabeth (U.S. Fish and Wildlife Service, 1011 E Tudor Rd., Anchorage, Alaska 99503).

Several selecting factors were used to decide on Kenai Peninsula release sites for sea otters affected by the T/V Exxon Valdez oil spill in Prince William Sound. Each site was evaluated according to these factors. The main selecting factors were: 1) areas free of oil contamination with depths up to 20 fathoms, 2) sea otters present (establish whether they were male or female groups), 3) kelp beds or other indicators of food supply, and 4) suitable helicopter landing sites. After selecting release sites, flipper-tagged otters were released and visually monitored for up to two weeks to establish if they remained at the release sites or moved. The first week of monitoring was spent in the release areas to establish if the otters remained. The second week was spent mostly at the main capture sites to determine if the otters returned. All monitoring of flipper-tagged otters proved to be difficult because of the poor visibility of the golden-brown colored tags used.

TRANSFER AND PLACEMENT OF NON-RELEASABLE SEA OTTERS IN AQUARIA OUTSIDE ALASKA

Gruber, Jody and Mary E. Hogan (U.S. Fish and Wildlife Service, 1011 E. Tudor Rd., Anchorage, Alaska 99503).

During the first six months following the T/V Exxon Valdez oil spill, a total of 37 sea otters were transported from Alaska to aquaria in the U.S. and Canada. This included 20 adult sea otters which were shipped from Valdez in April 1989 under emergency permits to aquaria which provided immediate, intensive care. An additional four adults suffering from chronic long-term health problems were sent to Sea World San Diego in August. In September, 13 otter pups which were orphaned or abandoned by their mothers were transferred to Point Defiance Aquarium for intensive care prior to placement in other aquaria.

The Fish and Wildlife Service is reviewing its permitting process following the need to take high numbers of animals from the wild under the emergency conditions generated by the spill. Considerations include developing a network of accredited placement facilities readily available to accept animals under emergency conditions and for potential permanent placement.

PROTECTING SEA OTTERS FROM OIL SPILLS: RECOMMENDATIONS BASED ON THE ALASKA EXPERIENCE

Shane, Susan H. (Friends of the Sea Otter, P.O. Box 221220 Carmel, California 93922).

The 1989 Alaska oil spill provided valuable lessons about how to improve management of sea otters during a spill:

- 1) The U.S. Fish and Wildlife Service (USFWS), the federal agency charged with responsibility for sea otters, must have clear authority and unlimited funds to respond immediately to otters affected or threatened by an oil spill. Decisions affecting otters cannot be left to the spiller.
- 2) Once an oil spill occurs, the USFWS must direct protective booming efforts and pre-emptive captures to prevent sea otters from becoming oiled.
- 3) To adequately treat oiled otters, sea otter rehabilitation and holding facilities must be constructed and operational before an oil spill occurs.
- 4) Trained staff and volunteers, otter-care protocols, and record-keeping procedures must be in place before a spill occurs to insure that otters receive the best care possible.
- 5) Both short and long-term research projects relating to the effects of oil spills on otters and their habitat should be designed in advance of an oil spill and implemented as soon as a spill occurs.

JAKOLOF PRE-RELEASE FACILITY: FACILITIES AND TRAINING

Redman, Linda and Nancy Hillstrand.

The first sea otter temporary care center in Homer was opened at Homer Junior High School's condemned pool building on April 8. The first otter arrived April 25. Approximately 1,000 sq. ft. indoors and 6,000 sq. ft. outdoors was available for otter care and building pens. This facility was used to care for otters until May 20. The pre-release facility was located in a small lagoon with a narrow entrance in the back of Little Jakolof Bay on the south coast of Kachemak Bay. It included 20 (14' x 28') and 6 (14' x 14') floating pens with a 12' deep underwater space surrounded by seine netting. the floating pens bordered a long, solid floating dock. Two of the 8' x 25' dock sections was used for holding and weighing otter food, and one of the sections was used for the husbandry building. This building held a VHF solar-powered radio, supplies, current records and information. An A-frame cabin, approximately 1/2 mile by trail and 3/4 mile by boat from the floats, was used for preparing meals for the crew, VHF communication, laundry, showers and limited housing. Two other houses were available for sleeping along with 87 acres for tent sites. A helicopter pad was located approximately 1,000' from the A-frame building. The food preparation area and office was located at the University of Alaska's N.O.A.A. station at Kasitsna Bay, 15 to 20 minutes away by boat. At the height of operation, the paid staff reached a maximum of 35. The most otters in captivity at any one time was 97. The overall personnel-to-otter ratio was approximately 0.3. Each husbandry person was responsible for 6 to 20 otters. Live shellfish were purchased locally to feed the sea otters. Recycling of some supplies was practiced to minimize costs and pollution.

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