

from Early Dorset (c. 500 B.C.) to the arrival of the Late Dorset (c. A.D. 800)—the High Arctic was abandoned by humans. In this connection, I must correct a minor error in Chapter 6 on the Pre-Dorset/Early Dorset cultures. Dorset I in West Greenland is dated to the period c. 500 B.C. to c. A.D. 300. Thus, West Greenland was not abandoned a few centuries after 700 B.C. because of climatic changes, as stated on page 80.

The next three chapters are devoted to the Thule culture. Excellently preserved houses and finds analyzed by Karen McCullough document that these Neo-Eskimo whale hunters migrated directly to Ellesmere Island and North Greenland from Western Alaska around A.D. 1200. A peak in Schledermann's book is reached when he presents and interprets the finds of Norse objects found in Thule culture context. The first contacts between peoples of the Old World and the Inuit were made here in the remote North.

With the chapter "Land of the Bears," we enter the transition to history. At Cape Faraday, Schledermann and his crew traced the sites which belonged to the last Inughuit migrants into Greenland in the 1860s—the small group of Baffinlanders led by the great hunter Qitdlarssuaq. Finally, the chapter on the dramatic history of exploration and geopolitics of the Ellesmere/Thule region casts light on the importance of this seemingly remote and deserted area.

In the last chapter, a kind of postscript, the author returns to more general ecological lessons from the past. The vulnerable ecosystem and the discontinuities of human presence in the area trigger considerable worry about the future of mankind: "Unless we collectively wake up to reality and take evasive action, a lot more than the High Arctic will have to be abandoned" (p. 196).

It is truly an eyeopening experience to read *Voices in Stone*. The reader's concept of marginality—of what is centre and what is periphery—is challenged by Schledermann's fascinating and skillfully written book. He succeeds in his main objectives: to demonstrate the importance of Arctic archaeology, to contribute to awareness of vulnerable ecosystems, and, basically, to tell a brilliant story.

The author's starting point in systems theory and the "ecological approach to archaeology" founded in the late 1960s and 1970s dominates the explanations and interpretations throughout the book. This very consequent, sometimes rigid, approach provides a clear basis for Schledermann's version of the history. However, this has left very little room for important discussions on the concept of culture. I would have welcomed a discussion on, for example, the problems of Schledermann's direct correlation between an archaeologically defined "culture"—a combination of material elements—and a people or ethnic group. If this correlation is not as simple as presented, which I suspect, several alternative and equally valid versions of the history of the study area could be told. I miss as well some more thorough consideration of culture interactions and concepts like "fusion" of three different cultures, and culture elements that "trickle southwards" (p. 80).

These critical remarks in no way overshadow the fact that Schledermann's book is a most important and original

contribution to Arctic literature. Furthermore, the quality of the layout, the cover design, and the black-and-white photographs and colour plates is remarkably high. Brenda Carter's drawings of migratory birds are beautiful. The many notes, the references, and the index make the book a very useful tool for students and professionals.

I warmly recommend Peter Schledermann's book to everyone—lay and learned—who wishes to travel into the fascinating world of Arctic prehistory.

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EMERGENCY CARE AND REHABILITATION OF OILED SEA OTTERS: A GUIDE FOR OIL SPILLS INVOLVING FUR-BEARING MARINE MAMMALS. Edited by TERRIE M. WILLIAMS and RANDALL W. DAVIS. Fairbanks: University of Alaska Press, 1995. 279 p., b&w and colour illus., glossary, appendices, index. Hardbound, US\$45.95; Softbound, US\$29.95.

The sea otter, *Enhydra lutris*, a social marine mustelid found around the Northern Pacific rim, once ranged from northern Japan, through Russia and the Alaska Peninsula, along the west coast of North America to Baja California. Apart from Russia, Alaska, and a few transplanted populations in California, Oregon, and British Columbia, the sea otter is now extirpated from its Asian and southern North American range. This is the result of intensive hunting from the 16th to the early 20th century, a period when sea otter fur was at times literally worth its weight in gold. Sea otters have high metabolic rates and may eat 30% of body weight daily in protein-rich invertebrate prey. These animals lack insulating blubber, they rely on regular grooming of dense pelage with an outer guard hair coat to exclude water, and an inner dense layer of underfur serves to trap air and maintain body heat in water as cold as -1°C. Events like storms that cause the cessation of grooming behaviour and physical or chemical damage to pelage may cause hypothermia and subsequently drowning. By consuming macroalgae-eating invertebrates, such as sea urchins and abalone, sea otters play an important role in the preservation and health of the *Macrocystis* and *Nereocystis* kelp stands, which are the nursery of much larval and juvenile

fish and invertebrate life of near-shore northern Pacific coast ecosystems.

In March 1989, the oil tanker *Exxon Valdes* ran aground on Bligh Reef in Prince William Sound, Alaska, releasing 11 million gallons of Prudhoe Bay crude oil into the Sound over several days of sunny, calm weather. Ultimately thousands of kilometres of coastline and hundreds of thousands of birds, mammals, fish and invertebrates were affected by the *Exxon Valdes* Oil Spill (EVOS). In the largest marine mammal rehabilitation operation ever attempted, scientists, veterinarians, wildlife officials, and a range of ancillary and support personnel launched an effort to capture and treat oiled sea otters that ultimately cost approximately US\$88 000 per animal, resulting in the release of 197 animals (Anon., 1990).

At the time of the spill, communication and free exchange of information between government and regulatory personnel (involved in building a prosecution case based in part on pathological examination of oiled sea otters), and the clinical and rehabilitation personnel (employed primarily by the oil spill response organization contracted by Exxon) were impaired by the shadow of the impending legal case, obliging the principals to guard information carefully. Unfortunately, this cut off dialogue concerning the problems facing oiled animals and undermined their clinical management during rehabilitation. Hopeful that, with the major legal settlement in the EVOS resolved, this volume would help to address some of the issues resulting from earlier secrecy, this reviewer read with interest.

This volume provides a primer to wildlife rehabilitators and catastrophe responders covering the principal areas of concern in rehabilitating marine mammals in oil spills, with 250 of 279 pages devoted to the sea otter. The book is divided into three major sections: Care and Handling of Oiled Sea Otters, Logistical Considerations for Large Oil Spills, and Other Marine Mammals. A laudable goal in producing this volume was to provide a distillation of the difficult empirical lessons in treating oiled sea otters, rather than dispersing this information by publishing the results of various studies in piecemeal fashion in scientific and veterinary journals.

In the first chapter, Williams et al. describe some toxic effects of oil on sea otters, emphasizing gross and histopathologic findings. There is cursory discussion of toxicologic examination of blood and tissue for hydrocarbon residues, unaccompanied by an explanatory preamble on the basic science of petroleum hydrocarbon toxicity at the molecular or cellular level. Rather, the focus of discussion is the pathologic effects on organ systems, with description of patterns of mortality in the spill. The information presented comes from animals that died in rehabilitation centers, but unfortunately there is little consideration of animals that died acutely in the wild during the early phase of the spill or the differences in clinical and pathological syndromes seen in acute versus chronic oil toxicity in this species. At times this results in dubious statements, such as "Pneumonia induced by the aspiration of oil, a characteristic respiratory lesion of petrochemical poisonings (Hatch 1988), was not apparent in oiled sea otters during the EVOS" (p. 15). This statement

appears to be based on pathology in a limited number of animals dying in rehabilitation centers.

This chapter contains excellent gross specimen photographs and photomicrographs of oil-related pathology in sea otters, but the graphs and charts can be frustrating: for instance, a graph may present data on the number of otters dying in rehabilitation centers during each of 20 weeks following the spill, but the total number cannot be found in either the caption or the accompanying text. Text and figures are not always integrated: an example is the bar graphs that list tissue congestion in moderately and heavily oiled otters by organ affected, but the total number of animals in any given group is unclear, as is the significance of this finding. The utility of this information and interpretation of the results are lacking in the accompanying text. The overall review of a range of oil-related pathology in this species, the main thrust of this chapter, is valuable, but the authors could have enhanced it by presenting data in tabular form, with statistical analysis, rather than raw data.

The following nine chapters in the first section deal in considerable detail with the otter rehabilitation process from capture to release. Capture methods are described by Benz and Britton, with emphasis on pre-planning, safety, logistics, and the need for experienced personnel. There is some discussion of the problems seen in sea otters during and after capture, such as hyperthermia. However, the important topic of capture myopathy, seen in all major wild animal capture operations and previously documented in sea otters (Williams and VanBlaricom, 1989), is not discussed—nor is mitigation of this problem directly addressed in this chapter—although both are crucial in successful capture operations. Similarly, the inevitable problem of capture-associated mortality is shunned, and no data concerning this problem during the EVOS are presented.

Chapter 3 deals briefly and adequately with physical and chemical restraint, while Chapter 4 deals with initial evaluation and treatment of common clinical syndromes associated with oil exposure. Figures presented in this chapter on degree of oiling and blood hydrocarbon levels would more logically belong in Chapter 1, evidence of a need for editorial input. Veterinary bloopers in this chapter include advising the treatment of oil-induced bullous and subcutaneous emphysema with sedatives, when in fact the supportive treatment of choice would be administration of 100% oxygen. Another example of treatment that is expedient, but not wholly justifiable from a veterinary viewpoint, is the blanket prophylactic use of a corticosteroid, Dexamethasone, at immunosuppressive dosages, in animals already suffering from immune-depressing clinical conditions related to crude oil exposure.

Chapter 5 considers diagnosis and treatment of common clinical disorders of oiled sea otters, including a useful discussion of the common renal, hepatic, and hematological problems and excellent summary tables of syndromes, symptoms, and treatments. Chapter 6 deals briefly with cleaning and restoring the fur of oiled otters, which is particularly crucial because of their dependence on an intact coat for

waterproofing and thermoregulation purposes. It describes some interesting putative measures, such as a squalene-based coat conditioner to restore waterproofing capacity to the fur, but does not characterize the clinical efficacy of these measures.

Chapter 7 deals with husbandry and nutrition, describing in detail housing conditions and dietary considerations. The authors have, perhaps inadvertently, omitted important lessons of the EVOS experience: the need, for instance, to cover the pens of mature sea otters, who learned, with time, to scale and escape from some enclosures. The presence of climbing ability in captive sea otters was a new addition to the understanding of this animal's behavioural repertoire. Some attention was paid to sea water quality suitable for holding sea otters, including recommendations as to acceptable levels of bacteria. Because some otter rescue facilities during the EVOS had to draw seawater from polluted harbour areas, realistic mitigation methods for improving incoming seawater quality should be included in a primer of this type. Another omitted item was the failure to consider social and behavioural requirements of wild animals in designing and managing facilities constructed for otter rehabilitation. The need for quiet, separation from humans, and a low-stress environment could have received more attention. Captivity stress issues were a major problem in sea otters, considered a stress-prone species, during EVOS, and a discussion of methods of mitigating these through better architecture and husbandry management in the future was certainly warranted.

Chapter 8 considers in some detail the care of pregnant female sea otters with their pups, while Chapter 9 considers the care of pups alone, with good descriptions of common conditions, special nutritional needs, and general biology. Chapter 10 describes release strategies for sea otters following rehabilitation, although nowhere in this chapter is the number of animals released following EVOS, or their long-term fate, discussed.

The second section of the book details the logistical aspects of operating a large-scale rehabilitation operation, from the triage process in Chapter 11, to the physical plant requirements, including the number of personnel of every sort required to operate rehabilitation facilities, together with their duties. Chapter 14 considers occupational health and safety; however, much basic information germane to any wildlife rehabilitation operation (such as the universal need for tetanus immunization) has been omitted. The final chapter considers oil contamination and rehabilitation in other marine mammals such as fur seals and polar bears, with emphasis on past spills and experimental studies. The appendices include a number of useful forms and tables, such as tables of clinical blood values for various marine mammal species and standard forms for veterinary examination, pathology, and husbandry, equipment lists, and even floor plans for the construction of facilities.

In the book as a whole, some issues were ignored or not addressed, and there was a lack of critical review and reflection on the outcomes of approaches taken during the EVOS sea otter rehabilitation operation, which is the essential starting point for recommending future conduct and practice.

Specifically where this volume could have been improved, apart from details mentioned above, was in the addition of an introduction and overview of sea otter biology and captive husbandry and biology. Many problems during the EVOS, for instance gastric disturbances in sea otters due to a lack of hard shell and exoskeletal material in diets, later corrected, could have been avoided through a more comprehensive understanding of sea otter biology and scientific literature by personnel involved in the rehabilitation operation. This type of basic information would enhance a primer greatly.

Similarly, an important consideration in oil spill response is the removal, translocation or displacement of animals from areas at risk for oil exposure prior to oil impact; however, this topic received little consideration. What was particularly worthwhile about this book was its broad scope and accessible layout, with brief sidebar summaries of contents in bold italics. A large amount of useful information is gathered here in one volume, and if you were required to render assistance in an oil spill involving sea otters and could take only one volume, this would undoubtedly be the one to bring. This book is recommended for biologists and biology students, wildlife managers and rehabilitators, veterinarians, regulatory personnel, and oil transport and spill professionals, both as a primer for information during response and as a reference source.

In producing this useful volume, the editors and authors have achieved their prime objective of sharing the knowledge gained during sea otter rehabilitation in the EVOS. As the art and science of wildlife rehabilitation become more accepted in the community of wildlife managers, this book will find a place near Karl W. Kenyon's classic of sea otter biology, "The Sea Otter in the Eastern Pacific Ocean." Let us hope, however, that the opportunity does not arise again to use the hard-won lessons in this book.

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