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CAUSES OF DEATH IN MARINE MAMMALS STRANDED ALONG THE OREGON COAST [1][2]

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Abstract: Sixty-eight marine mammals stranded on the Oregon beaches were examined at necropsy. Gunshot was the primary cause of death in 30% of the pinnipeds examined. Bacterial infections (27%) and parasitism (27%) were also of major importance in the death and debilitation of Oregon marine mammals. Traumatic death or debilitation other than gunshot was observed in 11 animals (16%). Predation, starvation due to neonatal abandonment, viral encephalitis (presumptive diagnosis), dystocia and neoplasia were diagnosed as primary or contributory causes of stranding.

INTRODUCTION

Marine mammals commonly strand or are washed ashore along ocean beaches. Post mortem examination of these animals may provide information on natural and human related causes of death. This information has application to the maintenance of health in captive marine mammals. The health status of wild populations affected by natural epizootics or environmental contaminants may be monitored by such examinations.[3,4,6,13] Investigations of natural disease in marine mammals, the highest level in the marine food chain, also may identify problems important to domestic animals and human health.[7,9,14]

Studies of a series of stranded marine mammals from California beaches are reported in the literature.[12,17,18] Reports of individual strandings or small groups of stranded animals also have been widely published.[2,5,7,8,10,11,15] This report documents causes of death and contributory pathology in 10 species of stranded marine mammals found on beaches along the Oregon coast from January, 1973 to March, 1978.

MATERIALS AND METHODS

Stranded animals were reported by officers of the Oregon State Police, Game Division, biologists of the Oregon Department of Fisheries and Wildlife, scientists at the Oregon State University Marine Science Center and coastal residents. Only animals that were reasonably fresh, as determined from questioning the individual reporting the animal, were investigated. Gross necropsies were performed on the beach unless size and accessibility to the carcass by truck permitted removal and transport to the Veterinary Diagnostic Laboratory, School of Veterinary Medicine, Oregon State University, Corvallis, Oregon, for necropsy. When appropriate, lesions and tissues were cultured for bacteria and

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tissues fixed in 10% formalin for microscopic examination. Parasites were collected, preserved in 5% formalin and identified. Parasites identified along with descriptions of pathology attributable to them are reported separately.[1,16] Radiographs or cleaned skeletal preparations were made to demonstrate lesions of the skeletal system. Virus isolation was not attempted because of autolysis in most carcasses and the lack of suitable technical facilities in the diagnostic laboratory.

Fixed tissues were embedded in paraffin, sectioned at 6 μm, stained with hematoxylin and eosin and examined by light microscopsy. When appropriate, special staining procedures were used to demonstrate specific etiologic agents or processes. Pathologists at the Armed Forces Institute of Pathology, Washington, D.C. reviewed slides and confirmed the diagnosis on several cases.

RESULTS AND DISCUSSION

From January, 1973 to April, 1978, 68 marine mammals representing five species of pinnipeds and five species of cetaceans were examined. Primary and contributory causes of death are summarized by species in Table 1. Primary and contributory causes of death were differentiated by type, duration, and severity of pathologic changes observed at necropsy. Multiple contributory causes were listed in some cases. The primary cause of death was undetermined in nine cases, primarily because of decomposition of the carcass which prevented more thorough examination. Euthanasia is listed as a primary cause of death in animals which were dispatched by state police officers for public safety reasons. Lesions or conditions leading to the animal's stranding are recorded as contributory. The categories of causes of death are necessarily broad to facilitate data presentation. Many incidental lesions were observed and recorded but are not listed in this report.

Gunshot

Despite legal protection under the Marine Mammal Protection Act 1972, gunshot was the most common cause of death in pinnipeds. Ten of 23 harbor seals *(Phoca vitulina)*, two of 12 Steller's sea lions *(Eumetopias jubata)*, five of ten California sea lions *(Zalophus californianus)* and two of eight northern elephant seals *(Mirounga angustirostris)* had been shot. Seal and sea lion predation on salmon is considered by fishermen to be a major factor affecting salmon stocks along the Oregon coast. Harbor seals and California sea lions frequent bays and river mouths and therefore are more apt to be shot than other species. All harbor seals examined that had a primary diagnosis of gunshot were found near the mouth of a river. Gunshot is also a significant cause of death of pinnipeds examined from Washington[a] and California beaches.[17]

Traumatic

This category includes accidental traumatic deaths other than gunshot. Traumatic injury such as obtained in falls, intraspecific fighting and boat collisions may be relatively common. For example, a fractured lumbar vertebrae resulted in posterior paralysis in a California sea lion, and a fractured tail vertebrae resulted in death, probably by drowning, of a grey whale *(Eschrichtius robustus)*. The fractured tail may have resulted from a boat collision. Fatal wounds in the abdomen of a second grey whale definitely were caused by a boat propeller.

Internal bleeding from a ruptured uterine artery in a pregnant harbor seal and a ruptured liver and spleen in a California sea lion may have resulted from falls. Pinnipeds frequently jump,

[a] Gornall, T.A. Personal Communication 1977. Elliott Bay Animal Hospital, Seattle, Washington 98183.

TABLE 1. Primary and contributory causes of death in 68 marine mammals stranded along the Oregon coast from January, 1973 through April, 1978.

	Harbor Seal		Northern Elephant Seal		California Sea Lion		Steller's Sea Lion		Harbor Porpoise		Striped Dolphin		Common Dolphin		Pacific White Sided Dolphin		Risso's Dolphin		Grey Whale		Total	
Causes of Death	P	C	P	C	P	C	P	C	P	C	P	C	P	C	P	C	P	C	P	C	P	C
Gunshot	9	1	2	-	3	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-	16	3
Traumatic	1	1	1	-	1	1	1	2	-	-	-	1	-	-	-	-	-	-	2	-	6	5
Predator	1	-	-	-	-	-	1	1	-	-	-	-	-	-	1	-	-	-	-	1	3	2
Reproductive**	-	3	-	-	-	-	-	-	4	-	-	-	-	-	-	-	-	-	-	-	4	3
Neoplastic	-	1	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
Parasitic	-	3	1	4	-	1	4	-	3	-	-	1	-	-	-	-	1	-	-		9	9
Bacterial	5	-	-	3	3	-	2	2	-	1	-	-	-	-	-	-	-	1	1	-	11	7
Other Misc.	1	5	-	-	-	-	1	1	-	-	-	-	1	-	-	1	-	-	-	-	3	7
Euthanasia	2	-	3	-	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	7	-
Undetermined	4	-	1	-	2	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	9	-

P = Primary cause of death.
C = Contributory cause of death.
** = including abandonment and starvation of neonates.

fall, or are pushed from rocks. Injuries might easily occur due to this behavior.

The bony head and the dorsal and opercular spines of a Pacific Ocean perch *(Sebastes alutus)* prevented a subadult northern elephant seal from dislodging the fish from it oral pharynx. The animal presumably died of asphyxiation. Choking on fish by marine mammals has been reported previously and appears to be a common form of natural mortality.[8]

Predation

Evidence of attacks by sharks or killer whales *(Orcinus orca)* was observed in five animals. In all cases of shark attack, debilitating conditions such as bullus emphysema in the lung of a white-sided dolphin *(Lagenorhynchus obliquidens)*, nephritis in a Steller's sea lion and propeller wounds in a grey whale were observed. The exception was a recently post partum harbor seal apparently guarding a newborn pup on the beach. The single bite wound from a large shark, which totally eviscerated the seal, was 61 cm across. Predation probably accounts for greater mortality of debilitated animals than is indicated by this study because recovery of the remains of animals killed by large predators is less likely than those dead of other causes. An apparently healthy adult female Steller sea lion was the only animal showing evidence of killer whale attack.

Reproductive Failure and Neonatal Deaths

Two cases of dystocia were encountered in harbor porpoises *(Phocoena phocoena)*. One was due to an abnormal fibrous band in the dorsum of the vagina and one to fetal malposition. Two newborn harbor porpoises were found dead. In both cases the lungs were partially inflated but there was no indication of the animals having nursed. The animals were presumed to have been born weak and/or separated from their dams and subsequently died of starvation.

Harbor seal pups frequently are found "abandoned" along the beaches and are taken home by well meaning persons. Inhalation pneumonia and bacterial pneumonia, hypoglycemia and dehydration were diagnosed as causes of death. These conditions can be traced to improper care by persons salvaging "abandoned" animals. Several of those examined had a functionally patent ductus arteriosis. The contributory role of a patent ductus arteriosis to abandonment of baby harbor seals is not known.

Neoplasia

Neoplasia was contributory in the deaths of two animals. Lymphosarcoma was considered to be the cause of debilitation and stranding of a young harbor seal which was euthanized. A necrotic endrocrine adenocarcinoma with subsequent peritonitis was considered as the cause of death of a California sea lion.

Parasitism

All marine mammals investigated except for the newborn had parasites or lesions attributable to parasitism. Severe endoparasitism was diagnosed as the primary cause of death in nine animals and contributory in nine others. Verminous pneumonia, often with secondary bacterial bronchopneumonia, was observed in seven young animals including two yearling Steller's sea lions heavily infected with *Parafilaroides decorus*, one yearling northern elephant seal with *Parafilaroides* sp. and another with *Otostrongylus circumlitus* and three subadult harbor porpoises with *Halocercus invaginatus*.

Parasitic sinusitis due to *Crassicauda grampicola* together with secondary bacterial sinusitis, was diagnosed as the primary cause of stranding and death in an adult Risso's dolphin *(Grampus griesus)*. Heavy nematode *(Stenurus minor)* infection in the head sinuses, eustachian tube and tympanic bulla were observed in all five adult or subadult harbor porpoises. However, no path-

ologic changes were associated with the presence of the parasites.

Gastric nematodes were present in almost every animal examined. Granulomatus ulcers associated with pure or mixed populations of *Anisakis* sp., *A. simplex, Contracaecum* sp., *C. osculatum* and *Porrocaecum (Terranova) decipiens* frequently were observed in all species of pinnipeds examined although none were perforating or resulted in peritonitis. Massive hemorrhage from nematode damaged gastric mucosa led to severe anemia and death in only one Steller's sea lion.

Bacterial Infections

Bacterial infections were diagnosed as the primary cause of death in 11 cases and as a secondary debilitating condition in seven others. In some of these, the initiating cause of the infection was obvious, e.g., a colonic ulcer or a bullet wound leading to peritonitis. Many carcasses were too decomposed to culture and obtain significant results. Additionally, animals with chronic debilitating diseases were more susceptible to predation by sharks as demonstrated by several cases listing shark predation as the primary cause of death. Therefore, bacterial infections may be more important as a cause of natural mortality than are indicated by this study.

Pyoderma, abscesses, cellulitis, pneumonia, peritonitis, pyothorax, vegetative endocarditis and septicemia were the bacterial conditions observed. Severe exudative pyodermatitis was observed in four of eight northern elephant seals. *Streptococcus* sp., *Bacillus* sp., *E. coli* and *Acinetobacter* sp. were cultured from the skin lesions and peripheral lymph nodes. Purulent dermatitis and lymphadenitis were associated with bacterial colonies. In one case, ulcers were distributed over the entire body surface. These may have been initiated by a virus and become secondarily infected with bacteria.

A beta hemolytic *Streptococcus* sp., biochemically similar to *S. canis* was isolated from a pyogranulomatus lesion of the laryngeal cartilages and epiglottis of an adult harbor seal. The lesion obstructed the trachea and exudate inhaled from the lesion initiated a bacterial pneumonia.

Bacterial peritonitis was observed in Two Steller's sea lions, two California sea lions and one harbor porpoise. Mixed cultures of *Edwardsiella tarda, Klebsiella* sp., *E. coli, Staphylococcus aureus* and *Moraxella kingii* were isolated from the peritoneal exudates. A perforating colonic ulcer, fishhooks in the stomach and bullet wounds in the sea lions and dystocia in a harbor porpoise were diagnosed as initiating causes of peritonitis. Peritonitis was not associated with perforating gastric ulcers in any of the above cases.

A subadult grey whale died of pyothorax and fibrinous pleuritis-pericarditis. Pyothorax was also diagnosed as the primary cause of death in an adult California sea lion. The initiating cause was a .22 cal. bullet. Vegetative endocarditis with septic thrombosis and infarcation of the myocardium and kidney caused the death of another adult California sea lion. *S. aureus* and *M. kingii* were cultured from the valvular lesions. The origin of the infection was not determined.

Miscellaneous Conditions

This category includes suspected viral and other miscellaneous conditions not readily classified in other categories. In two cases, a viral etiology was suspected based on gross and histopathologic observations. A stranded yearling northern elephant seal had multiple pox-like dermoepidermal lesions distributed over the entire body surface. Although foci of degenerate vacuolated epithelial cells along the dermoepidermal junction were observed, inclusion bodies suggestive of seal pox could not be

demonstrated. Virus isolation procedures were not attempted. This animal was euthanized because of the severe secondary bacterial infection of the skin lesions.

Meningoencephalitis was diagnosed in a common dolphin *(Delphinus delphis)*. The lesions were characterized histologically by a diffuse mononuclear cell infiltration in the subarachnoid space and perivascular cuffing of blood vessels which suggested a viral infection. Virus isolation was not attempted.

Debilitation and emaciation resulting from multiple proliferative and degenerative bone lesions, severe tooth wear, peridontal disease and a poorly-healed fracture of the lower jaw were diagnosed as the cause of death in an adult male harbor seal.

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