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## PARASITES AND ASSOCIATED PATHOLOGY OBSERVED IN CETACEANS STRANDED ALONG THE OREGON COAST <sup>□</sup>

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**Abstract:** Ten stranded cetaceans, representing five species, from the Oregon Coast were examined between 1973-1977. Fourteen genera of parasites, together with the pathogenesis and pathology associated with the presence of some of these parasites are reported.

### INTRODUCTION

Parasitic disease as a factor in cetacean stranding behavior is an area of current speculation. Reports of parasites recovered from cetaceans stranded along the California Coast have implicated various helminths.<sup>6,8,9,10</sup> However, to the authors knowledge, no reports exist on parasitism from a collective group of stranded cetaceans from the U.S. Pacific Northwest. This study covers the parasites and the associated pathology found in five species of cetaceans (*Phocoena phocoena*, *Stenella coeruleoalba*, *Grampus griseus*, *Delphinus delphis* and *Eschrichtius robustus*) found stranded along the Oregon coast between 1973-1977.

### MATERIALS AND METHODS

All animals examined were recovered from the beach either dead or moribund and transported to the Oregon State University Veterinary Diagnostic Laboratory, Corvallis, Oregon for necropsy. When size or other reasons prohibited transportation of the entire carcass, a necropsy was performed on the beach and the organs transported to the laboratory for more thorough examination. Special efforts were made to collect and examine parasites from the head, lungs, liver,

stomach and intestinal tract. The head sinuses were flushed, the bronchial tree was opened, the lung tissue was minced and then soaked in warm 4% formalin in physiological saline to recover lungworms. In most cases the entire small intestine and colon were opened, examined and the contents washed through various sizes of sieves to recover parasites.

At necropsy, appropriate tissues were fixed in 10% buffered formalin, embedded in paraffin, sectioned at 6  $\mu$ m, stained with hematoxylin and eosin (H&E) and examined under light microscopy for lesions. Cestodes, trematodes and acanthocephalans were stained with Semichon's carmine or H&E, dehydrated in ethanol, cleared in xylene and mounted in Permount.

Nematodes were cleared in lactophenol for temporary mounts and identification. Permanent mounts were prepared in glycerin and glycerin jelly.

### RESULTS AND DISCUSSION

Parasites recovered from 10 stranded cetaceans are listed in Table 1. Additional comments on importance of occurrence and associated pathology are discussed by host species.

<sup>□</sup> Supported in part by Oregon State University Graduate School (1973-1975), Research Council (1975-1976) and National Marine Fisheries Service (1976-1977).

TABLE 1. Parasites from stranded cetaceans

Host	No. Examined	Parasite	U.S.N.M. <sup>2</sup> No.	Organ infected	No. infected	Percent infected
<i>Phocoena phocoena</i>	4	<i>Hadwenius mironovi</i>	74672	stomach, duodenum	1	25.0
		<i>H. nipponicus</i>	74673	stomach, duodenum	2	50.0
		<i>Campula oblonga</i>	74674	bile/pancreatic duct	4	100.0
		<i>Halocercus invaginatus</i>	74682	lung	3	75.0
		<i>Pharurus convolutus</i>	74688	lung	2	50.0
		<i>Stenurus minor</i>	74684	air sinus	3	75.0
		<i>Anisakis simplex</i>	74678	stomach	2	50.0
		<i>Crassicauda</i> sp.	74686	blubber, mammary	3	75.0
<i>Stenella coeruleoalba</i>	2	<i>Bolbosoma</i> sp.	74685	intestine	1	25.0
		<i>Phyllobothrium delphini</i>	74663	blubber	2	100.0
		<i>Monorygma grimaldii</i>	74667	mesentery	2	100.0
		<i>Tetrabothrius forsteri</i>	74666	duodenum	1	50.0
		<i>Strobilocephalus triangularis</i>	74662	colon	1	50.0
		<i>Sarcocystis</i>		muscle	1	50.0
<i>Delphinus delphis</i>	1	<i>Phyllobothrium delphini</i>		blubber	1	100.0
		<i>Monorygma grimaldii</i>		mesentery	1	100.0
<i>Grampus griseus</i>	1	<i>Monorygma grimaldii</i>		mesentery	1	100.0
		<i>Monorygma grimaldii</i>		mesentery	1	100.0
		<i>Crassicauda grampicola</i>	74687	air sinus	1	100.0
<i>Eschrichtius robustus</i>	2	<i>Penella</i> sp.	74668	skin	1	100.0
		<i>Cyarnus ceti</i>	74669	skin	2	100.0

<sup>2</sup>United States National Museum Parasite Reference Collection, Beltsville, Md.

**Harbor Porpoise (*Phocoena phocoena*)**

**Trematoda:** *Hadwenius mironovi* has been reported previously only from the Beluga whale (*Delphinapterus leucas*). A mixed infection of *H. mironovi* and *Hadwenius nipponicus* caused a mild irritation characterized by hyperemia and hemorrhage in the pyloric stomach and the anterior duodenum. Both species were found embedded deeply in the mucosa of both organs (Figure 1). *Hadwenius nipponicus* has been reported previously from *P. phocoena* off the Washington coast.<sup>1</sup> *Campula oblonga* was found in the bile and pancreatic ducts of the four (2 adult and 2 subadult) *P. phocoena* examined. A severe chronic cholangitis was noted. Also, eggs were responsible for a severe chronic hepatitis when free within the hepatic parenchyma. Fibrosis and chronic inflammation were evident in the pancreatic ducts. Focal areas of both acute and chronic pancreatitis were observed in response to this trematode and its eggs. *Campula oblonga* has been

reported previously from *P. phocoena* and *Phocoenoides dalli* in Washington and California, respectively.<sup>1,4,6</sup>

**Nematoda:** Parasitic pneumonia was diagnosed as the primary cause of death in the two subadult *P. phocoena* examined. In the first animal, massive numbers of *Pharurus convolutus* and *Stenurus minor* were recovered from the bronchi (Figure 2). Histologic examination revealed little or no inflammatory response associated with adult worms, but larvae initiated a subacute purulent focal pneumonia when present in alveoli. Edema also was a prominent histologic finding.

In the second subadult *P. phocoena*, large numbers of small nodular lesions containing *Halocercus invaginatus* were observed throughout the lung parenchyma. Histologically, fibrinous interstitial pneumonia with focal abscesses and calcifying parasites were observed (Figure 3).

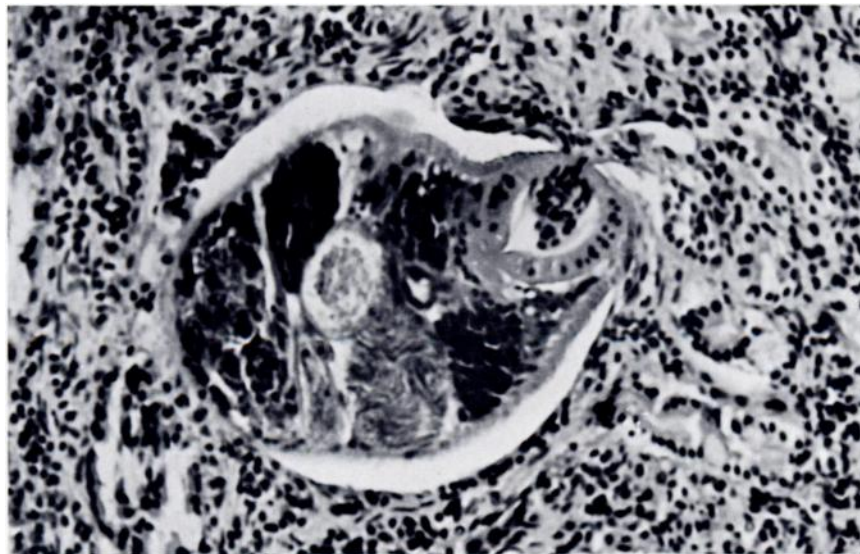


FIGURE 1. *Hadwenius nipponicus* embedded in duodenal mucosa of *Phocoena phocoena*. (Approx.  $\times 300$ )



FIGURE 2. Heavy mixed infection of *Pharus convolutus* and *Stenurus minor* from bronchi of subadult *Phocoena phocoena*.



FIGURE 3. Section of lung nodule from *Phocoena phocoena* containing *Halocercus invaginatus*. (Approx.  $\times 38$ )



FIGURE 4. Blubber lesion from *Phocoena phocoena* with coiled *Crassicauda* sp. released.

In addition to the lungs, *S. minor* was found tightly packed in tympanic bullae and pterygoid sinuses of three porpoises. Despite the large numbers of nematodes, no inflammation of mucosal tissue or penetration of the brain was found.

Two adult, pregnant, *P. phocoena* were infected heavily with *Crassicauda* sp., and a single *Crassicauda* sp. was recovered from one subadult. These worms occurred in blubber at the muscle-blubber interface, in the mammary glands, and in the urogenital regions. In blubber they characteristically are found tightly coiled in the center of large crater-like lesions surrounded by a sheath of partially saponified and calcified fat (Figure 4). Adult worms and eggs were observed in the mammary ducts of both pregnant animals (Figures 5, 6). A suppurative mastitis was present in one of the two.

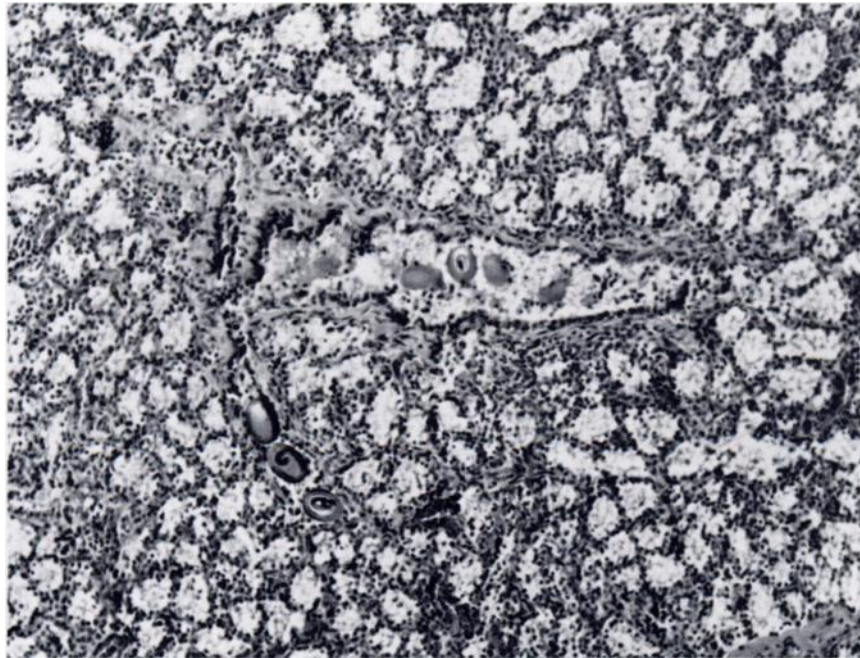


FIGURE 5. *Crassicauda* sp. eggs in ducts of mammary gland of *Phocoena phocoena*. (×100)

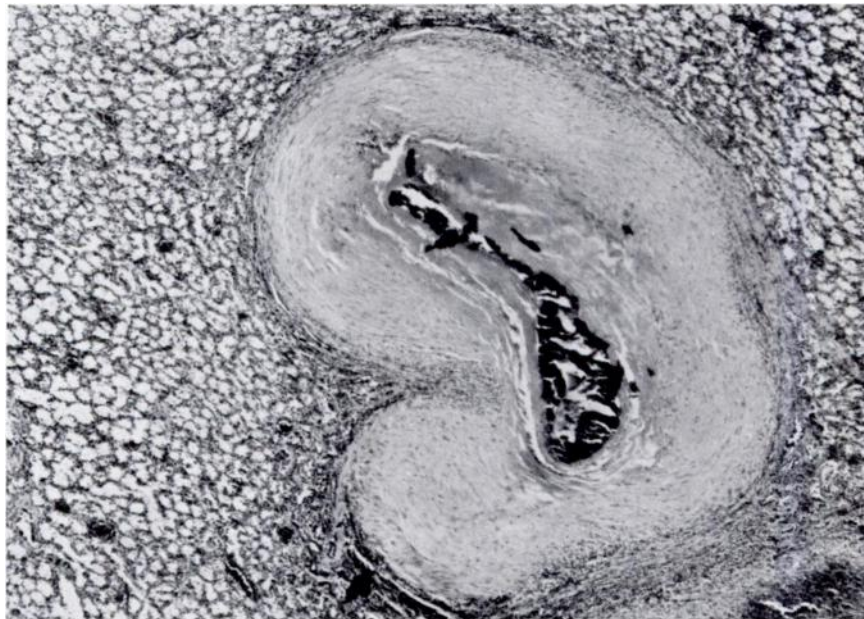


FIGURE 6. Section of encapsulated dead adult *Crassicauda* sp. in mammary gland of *Phocoena phocoena*. ( $\times 12.8$ )

*Anisakis* sp. and *Anisakis simplex* were recovered from the stomach of two of the four harbor porpoises examined. The worms occurred in circumscribed, granulomatous nodules which apparently are characteristic of this infection (Figure 7).<sup>4</sup>

**Striped Dolphin (*Stenella coeruleoalba*)**

**Cestoda:** *Strobilocephalus triangularis* was recovered from the terminal colon of one animal. The encapsulated scolex was deeply embedded in the submucosa, initiating an intense inflammatory response consisting of neutrophils and eosinophils (Figure 8). Massive infections with this species have been reported as a probable cause of mortality in certain age classes of spotted porpoise (*Stenella graffmani*) in the eastern tropical Pacific.<sup>5</sup> This is the first report of this parasite from U.S. Pacific coastal waters.

**Protozoa:** a species of *Sarcocystis* was observed in the skeletal muscle of one striped dolphin. This is the first report of this parasite from this host although it has been reported as an incidental finding from Pilot (*Globicephala melaena*) and Sperm (*Physeter catadon*) whales (Figure 9).<sup>2,7</sup>

**Risso Dolphin (*Grampus griseus*)**

A heavy infection ( $>50$ ) of *Crassicauda grampicola* was observed penetrating the mucosal lining of the right pterygoid sinus. The anterior ends of the parasites were embedded in the mucosa and they lay tightly coiled within the pterygoid bone. The entire sinus was filled with a thick purulent exudate. The mucosal surface was inflamed and necrotic. The left sinus contained only one living parasite and the calcified remains of several others. No exudate or inflammation was present. The cause of stranding and death of this animal was attributed to



FIGURE 7. Nematode (*Anisakis simplex*) induced granuloma in first stomach of *Phocoena phocoena*.

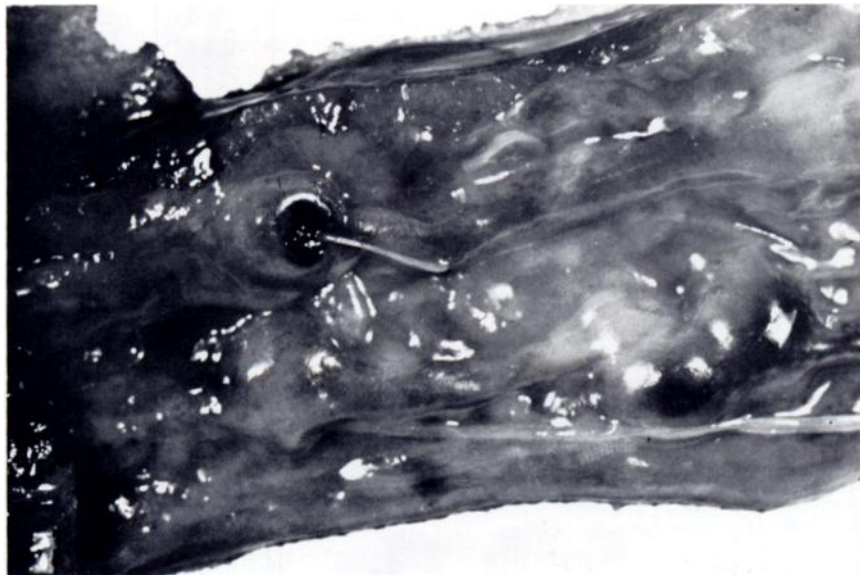


FIGURE 8. *Strobilocephalus triangularis* with necrotic ulcer in colon of *Stenella coeruleoalba*.



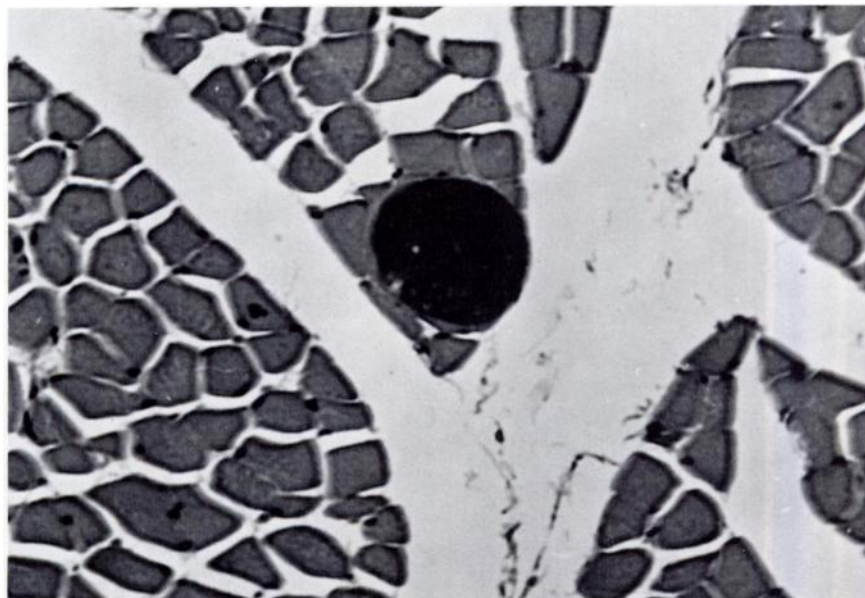


FIGURE 9. Sarcocyst in skeletal muscle of *Stenella coeruleoalba*. (Approx.  $\times 50$ )

unilateral purulent sinusitis initiated by this nematode. Parasites of the genus *Crassicauda* have been reported to be responsible for an extensive erosion of the pterygoid bone in *Stenella graffmani*.<sup>5</sup>

The parasites recovered from *Delphinus delphis* and *Eschrichtius robustus* are considered to be non-pathogenic and are, therefore, only listed in Table 1.

In this study the role of parasites as the contributing factor in stranding was found in 3 of 10 animals; moreover, parasites possibly predisposed two other animals to secondary infection, resulting in their death. These results appear to concur with previous reports that disease should be considered as a major factor in strandings among single-stranded small odontocetes along the West Coast of North America.

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