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An Anatomical and Pathological Examination of the First Recorded Stranding of a Fraser's Dolphin (*Lagenodelphis hosei*) in the Northwestern Gulf of Mexico

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Reports on Fraser's dolphin (*Lagenodelphis hosei*) strandings in the Gulf of Mexico are uncommon. The only recorded strandings from the Gulf of Mexico, both of which occurred in Florida, consist of one mass stranding and a single stranding. This report represents the first record of a Fraser's dolphin stranding, dead or alive, in the northwestern Gulf of Mexico. Results presented here provide the first available data on blood hematology and chemistry values, detailed anatomy of internal organs and structures, thoracic and abdominal organ weights, blubber thickness, external morphometrics, and pathological findings for this species in the western Gulf of Mexico.

Although groups of Fraser's dolphins [*Lagenodelphis hosei* (Fraser, 1956)] have been observed during marine mammal surveys of the Gulf of Mexico, they are considered uncommon there (Leatherwood et al., 1993; Waring et al., 1997; Würsig et al., 2000). Stranding reports for this species are few. Würsig et al. (2000) reported the population within the Gulf of Mexico to be as many as 1,000 animals. Although relatively rare, sightings of this species have occurred around the world mainly in deep, subtropical waters (Jefferson et al., 1993).

The first record of this species in the Gulf of Mexico came from the skull and skeletal remains of 17 animals found on beaches in the Marquesas Keys, Monroe County, FL, from Nov. 1981 to June 1982 (Hersh and Odell, 1986). Only one additional stranding has been published for the Gulf of Mexico. A single animal was stranded alive on the west coast of Florida on 23 Feb. 1993 but died during transport to a rehabilitation facility, where measurements and necropsy were completed (Leatherwood et al., 1993). This report represents the first record of a live Fraser's dolphin stranding in the western Gulf of Mexico and the first data on blood chemistry and hematology values. Detailed anatomical and pathological findings for this animal are also presented. Because this is the first animal of this species examined by the Texas Marine Mammal Stranding Network (TMMSN), comparisons are made with the bottlenose dolphin (*Tursiops truncatus*), which commonly strands in Texas, as a familiar reference standard.

Live Stranding Treatment

On 22 March 1994 (0810 hr), the TMMSN responded to a report of a live-stranded dolphin on Padre Island, TX (27°26'N 97°17'W), approximately 10 km to the south of the Padre Island national seashore. During the initial stranding event, the dolphin was pushed back into the water twice by beachgoers, but each time it subsequently restranded. Personnel from the TMMSN's Dolphin Rescue Team arrived at the stranding site, assessed the animal's condition, provided necessary immediate care, and transported it to the Texas State Aquarium (TSA) in Corpus Christi for treatment. At the TSA the animal was given a thorough examination and assigned TMMSN field number CC127. The animal was positively identified as a Fraser's dolphin by color pattern, external morphology, and dentition, as described by Jefferson et al. (1993) (Fig. 1). The dolphin was an immature female, measuring 235.0 cm in total length and weighing 124.7 kg.

Blood samples were collected within 3 hr of stranding on the beach, and each day thereafter, and immediately taken to a local hospital for analysis (Table 1). Chemistry and hematology values were within the reference ranges for *T. truncatus* and suggested tissue injury. A second set of samples, three fecal and three blood, were shipped to the Texas Veterinary Medical Diagnostic Laboratory for additional analyses. No viruses were isolated, and no parasite ova were identified. In addition, the canine distemper virus serological test was performed to identify exposure to morbillivirus and was found to be negative. Respiratory and fecal cultures were also analyzed at a local hospital and both revealed three bacteria, *Staphylococcus aureus, Acinetobacter lwoffi,* and an unidentified *Vibrio* sp.

Initial treatment of the dolphin consisted of two intramuscular injections, one 10 ml Solu-

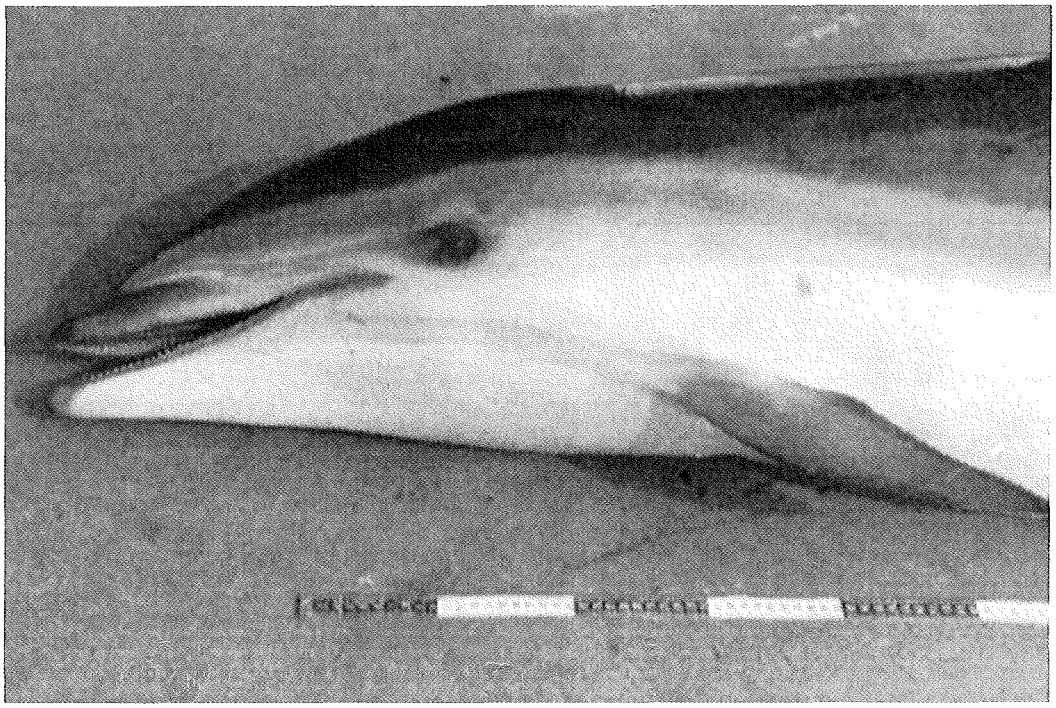

Fig. 1. Fraser's dolphin (*Lagenodelphis hosei*) on 22 March 1994. This animal stranded approximately six miles south of Padre Island National Seashore on Padre Island, TX (27°26'N 97°17'W).

Delta Cortef to help reduce the effects of stranding/stress and 12 ml Amikacin Sulfate to combat potential infection. These injections were followed by administration of 2 liters of lactated ringers (LRS), by stomach feeding tube, to help offset dehydration. Subsequently, 1 liter of LRS and a gruel mixture composed of herring and additional LRS were given to the animal every 6–8 hr. Amikacin Sulfate was continued daily until the animal died 4 d later at 0830 hr on 26 March 1994.

The dolphin was never able to swim, listed to the right, required continuous support from TMMSN volunteers, and showed little spontaneous activity. A complete systematic external examination and necropsy were performed approximately 6 hr after death, after the carcass was transferred on ice to the TMMSN Necropsy Laboratory in Galveston, TX.

Necropsy Procedure

External morphometric measurements (Table 2), including those described by Norris (1961), were taken at 15 specified locations, as were the blubber depth measurements (Table 3). External lesions were noted, and the blubber was removed before opening the body cavity. All organs and tissues were examined grossly and weighed on a Sartorius scale to the nearest 0.1 g (Table 4). Normal tissues and visible gross lesions were collected in 10% buffered formalin. The entire brain was collected in 20% formalin. The samples were embedded in paraffin, sectioned at 5 μm, and stained with a trichrome stain of hematoxylin, phloxine, and saffron before examination with a Nikon microscope.

Morphometrics

The external morphometric measurements were within the ranges previously reported by Perrin et al. (1994) for *L. hosei* (Table 2). The blubber layer of the Fraser's dolphin was thin compared with that of *T. truncatus,* averaging 1.4 cm along the dorsal side, 1.0 cm along the lateral side, and 1.3 cm along the ventral side.

Dentition counts included 32 teeth and 4 missing in the upper left arcade, 37 teeth and 3 missing in the upper right arcade, and 36 teeth with no empty sockets in each of the lower arcades. Growth Layer Group analysis (Hohn et al., 1989) of extracted teeth revealed that the animal was 8 yr of age.

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TABLE 1. Blood hematology and chemistry values taken during captive care.[a]

	22 March	23 March	24 March	25 March	26 March
Blood urea nitrogen (mg/dl)	58	55	48	50	65
Creatinine (mg/dl)	2.7	2.1	1.9	2.2	2.6
Sodium (mEq/liter)	157	155	153	154	158
Potassium (mEq/liter)	3.1	4.2	5.1	4.2	7.4
Chloride (mMl/liter)	111	114	115	110	110
CO_2 (mMl/liter)	30	37	30	39	26
Calcium (mg/dl)	9.2	9.3	9.4	8.1	2.1
Phosphorous (mg/dl)	0.9	4.3	3.8	5.7	7.4
Glucose (mg/dl)	165	161	137	154	64
Uric acid (mg/dl)	3.9	2.4	4.6	1.6	10.1
Total bilirubin (mg/dl)	2.6	1.9	2.0	1.3	2.7
Cholesterol (mg/dl)	183	176	152	156	125
Total protein (g/dl)	6.6	6.4	6.6	6.3	6.2
Albumin (g/dl)	3.1	3.1	2.8	3.1	2.5
Alkaline phosphatase (U/liter)	81	74	63	44	68
Creatine phosphokinase (U/liter)	3,670	593	774	846	No data
AST (U/liter)	506	898	984	1,259	No data
ALT (U/liter)	65	113	118	140	195
LDH (U/liter)	1,180	5,450	2,251	2,910	No data
White blood cells ($\times 10^3$)	6,700	8,500	11,500	6,000	7,900
Red blood cells ($\times 10^6$)	4.72	2.89	4.71	4.68	4.91
Hemoglobin (g/dl)	20.4	12.1	20.4	20.3	21.4
Hematocrit (%)	56.4	34.9	56.2	56.3	59.8
Platelets ($\times 10^3$)	140	116	77	127	85
Segs (%)	84	73	90	79	83
Bands (%)	0	8	0	1	0
Lymphocytes (%)	16	16	0	16	6
Monos (%)	0	2	0	1	9
Eosinophils (%)	0	5	8	3	1
MCV (FL)	119.4	120.8	117.4	120.2	121.7
MCH (pg)	43.2	41.9	43.3	43.4	43.6
MCHC (g/dl)	36.2	34.7	36.3	36.1	35.8
RDW (%)	13.0	13.4	13.4	13.2	13.1

[a] Abbreviations: AST, aspartate aminotransferase; ALT, alanine aminotransferase; LDH, lactate dehydrogenase; MCV, mean corpuscular volume; MCH, mean corpuscular hemoglobin; MCHC, mean corpuscular hemoglobin concentration; RDW, red cell distribution width.

ANATOMY

The heart was remarkably different from that of *T. truncatus* in that the apex was nearly bifid. In *T. truncatus* the apex tapers to a point. Unlike *T. truncatus,* the kidneys and adrenal glands were located more to the lateral than to the dorsal side in the abdominal cavity. The adrenal glands were flatter than those of *T. truncatus.*

The diaphragmatic lymph nodes were connected to the lungs by fibrous tissues and lymphatic channels in the manner described for these nodes found in *T. truncatus* (Cowan and Smith, 1999). In this animal they formed a horseshoe mass around the diaphragmatic hilus, and the pericardial sac overlaid them. Marginal lymph nodes were present at the junction of the anterior and diaphragmatic edges of the lungs. More lymph nodes were found above the aortic arch. Two masses of lymph nodes, 6–8 nodes each, were present along the lateral walls of the pelvis, at the level of the intestinal muco-squamous junction (pelvic lymph nodes). There were eight cervical lymph nodes in the posterior triangle defined by the mastohumeral muscle and two in the anterior triangle.

The liver was relatively small compared with that of *T. truncatus,* approximately the same size as one lung. The vessels in the center of the liver lobes were very large, the right measured about 8 cm and the left about 5 cm. The spleen was unusual in that it was deeply creased by three parallel linear grooves on the convex surface. In the hilus there were two accessory spleens, one 4 mm in diameter and another 1 cm in diameter.

TABLE 2. External morphometric measurements.

Measurements	Length (cm)
From tip of rostrum to	
Center of eye	34.0
Apex of melon	5.5
External auditory meatus	39.4
Center of blowhole	35.5
Anterior insertion of flipper	47.0
Axilla	56.0
Dorsal fin leading edge	106.0
Tip of dorsal fin	124.5
Center of umbilicus	107.0
Genital slit	158.0
Anus	166.0
Other measurements	
Projection of lower jaw	0.5
Length of gape	28.5
Center of eye to ear	6.2
Center of eye to angle of mouth	6.1
Fluke width	51.0
Fluke length	15.0
Depth of fluke notch	2.5
Flipper length (anterior)	30.0
Flipper length (posterior)	20.5
Flipper width (maximum)	9.0
Dorsal fin base	28.0
Dorsal fin height	14.5
Genital slit	14.0
Anal slit	2.0
Right mammary slit	2.1
Left mammary slit	2.3
Girth measurements	
Auditory meatus	90.0
Axilla	102.0
Dorsal fin leading edge	109.5
Dorsal fin trailing edge	98.5
Anus	64.0

TABLE 3. Blubber depths.

Blubber depths	Depth (cm)
Auditory meatus dorsal	1.5
Auditory meatus lateral	1.6
Auditory meatus ventral	1.8
Axilla dorsal	1.4
Axilla lateral	1.2
Axilla ventral	1.1
Dorsal fin leading edge dorsal	1.5
Dorsal fin leading edge lateral	0.8
Dorsal fin leading edge ventral	1.2
Dorsal fin trailing edge dorsal	1.5
Dorsal fin trailing edge lateral	0.8
Dorsal fin trailing edge ventral	1.1
Anus dorsal	1.1
Anus lateral	0.7
Anus ventral	1.2

The intestinal tract arrangement was similar to that of *T. truncatus*, as described by Cowan and Smith (1999). The most distal segment was not attached to the common mesentery, which is supplied by the mesenteric artery and vein, but was rather suspended from the dorsal body wall by a long straight mesentery. The long mesentery extended to the level of the splenic flexure before joining the remainder of the gut at the common mesentery. This straight segment measured 65.0 cm from the anal aperture to the flexure. The glandular segment of the gut, immediately adjacent to the squamous canal, was cross-wrinkled for 2.0 cm followed by a pigskin texture for 4.5 cm and abrupt, longitudinal folds at about the 12- to 13-cm level. The anal canal measured 5.7 cm, with two aggregations of apparent crypt openings in the canal. The uterus showed no noticeable differences from that of *T. truncatus*. Both the ovaries were small, and neither showed any corpora, indicating that the animal was immature. The female *L. hosei* is reported to attain sexual maturity between 5 and 8 yr of age and when 210–230 cm in length (Ross, 1984; van Bree et al., 1986; Amando et al., 1996). CC127 may represent the outer limit of sexual immaturity, or was possibly infertile, because she was 235 cm long and 8 yr of age.

The oral cavity was inspected by removing the lower jaw and the adjacent tissues. The mucosa over the hard palate was relatively flat and smooth, whereas the mucosa over the soft palate and further back was edematous and rugose. The tonsils appeared to be larger and more diffuse, with larger openings than those of *T. truncatus*. There were many pits in the palatal mucosa, which suggested gland orifices. The goosebeak (larynx) was firmly in place in

TABLE 4. Thoracic and abdominal organ weights.

Organ	Measured weight (g)
Lung (left)	2,166
Lung (right)	2,248
Heart	825
Pancreas	214
Adrenal (left)	9.4
Adrenal (right)	10.6
Kidney (left)	383
Kidney (right)	445
Brain	1,103
Pituitary	1.4
Thyroid	34.2
Spleen	115

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the blowhole, and a stiff cartilaginous plate was present in both lateral pharyngeal walls at the level of the goosebeak.

The skull contained a definite cup or sella for the pituitary, with a sharp bladelike ridge in front, 3.0-mm maximum height, and a lower, more obtuse ridge at the posterior margin. The tentorium was partly ossified, more extensively on the left than on the right, but it posed no problem in the removal of the brain.

Pathology

Extensive hemorrhaging into the blubber layer was noted over most of the left side, from the head to the leading edge of the dorsal fin and from the dorsal midline to the ventral surface. A subcutaneous fat pad covered the entire dorsal surface, extending 4.0 cm in front of the blowhole to approximately halfway between the blowhole and the leading edge of the dorsal fin. This pad was translucent and near jellylike, which we interpreted as serous atrophy. Many encysted parasites (*Phyllobothrium* sp.), approximately 4 mm in diameter, were present in the blubber and were distributed in a circumferential zone at the level of the vent. Bones et al. (1998) and Mignucci-Giannoni et al. (1999) also reported finding these encysted parasites in *L. hosei*.

The atlanto-occipital joint outlines were irregular and asymmetrical, with a patch at one margin suggesting erosion, but no histological evidence of inflammation was found. One humeroscapular joint was greatly eroded on both sides; however, there was no fusion of the joint. The fossa was deep, without cartilage, and the humeral head projected only cancellous bone without cartilage lining. Culture of the joint revealed *Vibrio alginolyticus*.

The great flow of blood from the superficial veins, which did not clot, was striking. Later, aspiration of blood from the heart provided a large volume with little effort, suggesting disseminated intravascular coagulation from sepsis. Aerobic and anaerobic blood cultures grew β hemolytic *Streptococcus* sp. and *V. alginolyticus*.

The myocardium was slightly mottled, and the papillary muscle of the right ventricle was yellow, suggesting necrosis. Coronary vessel surfaces, heart valves, chorda, endocardium, and aorta were all normal. Both lungs were smooth and dense, giving the impression that both were completely collapsed and airless. The tracheae of both lungs contained bloody fluid, and the mucosa of both the tracheae and the bronchi were intact.

There was a generalized lymphadenopathy, with most of the lymph nodes appearing large and edematous. These included the hilar lymph nodes, lung lymph masses, diaphragmatic lymph nodes, mesenteric lymph nodes, and cervical lymph nodes. The mesenteric lymph nodes were rounded and appeared very reactive and swollen but were relatively small compared with those of *T. truncatus*.

The brain showed no abnormalities, except for irregular subarachnoid patches and possibly small hematomas on the undersurfaces of the cerebellum. Both kidneys were symmetric and grossly normal, except for pale papillae throughout. Liver texture was friable, and the color was typical dark purple-brown. The biliary tract was normal, and no parasites were identified in the liver or bile ducts. Splenic texture was neither firm nor soft, and the capsule was gray with small petechial spots as observed in other cetacean species. The pancreas and urinary bladder were not remarkable, with the latter being contracted and empty. At least a dozen 1- to 2-cm diameter worm cysts (*Phyllobothrium* sp.) were present under the peritoneum in the lateral abdominal walls near the pelvic lymph nodes. The genital tract was not remarkable. The goosebeak had only mild congestion, with no abrasions, ulcerations, or suggestion of ulceration or fungal growth.

Conclusions

The first detailed anatomical description of the thoracic and abdominal organs, organ weights, blood values (hematology and chemistry), and pathologies of *L. hosei* are presented. CC127 had few abnormalities noted during gross examination, with the exception of an infectious arthritis, a striking failure for the blood to clot, and a general enlargement of the lymph nodes. These three findings together suggest infection with disseminated intravascular coagulation. Indeed, the growth of bacteria in tissues after the death of the animal was evident upon study of the histology slides. There were extensive degenerative changes in the myocardium that evolved over several days. These changes were probably related to the stress of stranding and handling (Turnbull and Cowan, 1998). The humeroscapular joint was greatly eroded and septic with destructive arthritis. The cause of stranding and death was attributed to joint disease and sepsis because there was no evidence of immune system failure, net marks, or other signs of human or fisheries interactions.

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