MARINE MAMMAL MORTALITY INVESTIGATION GROSS REPORT

STRANDING CASE NUMBER: PSU 12-02-11 Oo (identified as SRKW L112)
DATE FOUND: February 11, 2012
DATE OF REPORT: March 19, 2012

LOCATION FROM WHICH CARCASS WAS RECOVERED N. of Cranberry Beach Approach (WA Coast)

(46.40939/-124.06134)

SPECIES (NO.) Killer whale (1) **SEX** Female **AGE** 3 years **WEIGHT** N/A

STRANDING HISTORY and GROSS FINDINGS (D. Duffield, D. Lambourn, J. Huggins and others)

This female juvenile killer whale, later identified as southern resident killer whale L112, was found on morning of February 11, 2012 dead in the beach lying on its right sided, it remained on its right side as it was winched on a flat bed truck and moved to a secure location. It was necropsied by Debbie Duffield (PSU), Dyanna Lambourn (WDFW), Jessie Huggins (CRC) and a supporting team the following day. Gross examination revealed a moderately distended carcass that measured 375 cm straight from the tip of the nose to the deepest notch in the tail fluke. Scavenging was minimal on left side of body (superficial mostly from birds). It was in fresh-moderate postmortem condition and the skin just barely starting to slough. Estimated time dead was 2-4 days. It was in good body condition based on 3.4 cm blubber thickness and fat noted on heart. Bruising was seen around the head and chest (visible through the skin). Left side head bruising extended ~2 inches above eye to tooth # 6 on lower jaw and distending back ~8 inches toward the shoulder. A couple other smaller areas of hemorrhage were observed mid patch and in front of the pectoral fin insertion (Image 1). Right side head bruising was noted ~2 inches above eye tooth #4 on right lower jaw and extends back past the insertion of right pectoral fin and across ventral lower jaw almost all the way to inside of the left lower mandible (Image 2 and 3). The eyes were intact but appeared to be slightly bulging. Two small linear scars were present on the dorsal right, one just behind dorsal fin, the other at same level as anus; both appear healed. Swelling was present at genital slit and the anterior blowhole was raised and swollen. The tongue was markedly swollen, darkened and edematous, and a portion of the right side appeared deflated.

The entire head was excised and retained intact for CT scanning at a later date. When cut, copious dark red serous fluid (~2 liters) and chunks of brain poured from the foramen magnum (Image 4). Spinal cord and epidural rete taken at and between C1 and base of skull; tissues were dark red with red serous fluid surrounding (Image 5). No broken bones were seen on gross necropsy and the bones will be cleaned and examined in detail for fractures. The blubber was dark red on the head, chest and around both scapulae, and down right lateral side to just forward of the dorsal fin. Blubber appeared normal along the back and left ventral side where measurements are normally taken (Image 6). Chest cavity (mostly right side) had ~3 liters of clear red serous fluid. Blood was absent in most examined arteries and veins. Marked hemorrhage and edema was seen in muscle and subcutaneous tissue in same area noted with abnormal blubber. Crepitus was palpated between blubber and muscle on the left flank. Air bubbles were present in various tissues that could have been due to decomposition or other factors. Crepitus and air bubbles also were palpable and visible along the dorsal left abdominal

cavity. All organs were intact with exception of the kidneys (which were severely autolyzed) and the pancreas. With respect to the heart: air bubbles were detected coronary veins/vessels, and red serous edema was obvious on the external layer. The tissue on the inside of the heart was green and no significant amount of blood was noted. (Image 7 and 8) Lungs were both dark and congested. Pleural lining on both lungs had red serous edema, markedly more pronounced in upper lobes and more on right than left (Image 9). Stomachs were mostly empty with 4 fish lenses, and ~30 non-embedded nematodes were found within the balled up sloughed forestomach lining. The forestomach contained 17cc of brown mucous fluid; other stomachs contained ~35cc pinkish salmon colored fluid. Intestines were air-filled with air bubbles tracking throughout mesenteries. They were mostly empty with a small amount of feces in colon (Image 10).

CT FINDINGS (Tori McKlveen DVM, MS, Diplomate, American College of Veterinary Radiology)
Date: 2/23/2012 Head only, frozen.
This patient is positioned with the left side down and the right side up.
On the scan window overlay, A= Left and P=Right.

There is extensive gas accumulation in the soft tissues and fat.

There is loss of brain matter. The right side of the calvarium is almost completely devoid of brain tissue- the majority of the right side of the brain is missing. Some brain tissue is noted on the left side.

On the sequences with the head positioned as straight as possible, no asymmetry to the large included bones of the skull is noted. No large displaced fractures are seen. The brain case/calvarium and large bones of the skull such as the parietal bone do not appear to be crushed or broken. There are a few small, smoothly marginated bones at the level of the osseous bulla (separate from the bulla), mostly dorsal to the bulla. Some of these are quite small. These are probably part of normal anatomy as they are bilateral. However, there does appear to be displacement of some of these very small bones on the right side. See image 11. This is interpreted with caution because in this area, especially on the right side, there is loss of normal soft tissue structures (brain, fat etc.) that would normally hold these bones in place. On the right side (see image 11) two or three of the small bones are displaced into the calvarium and the similar bone (s) on the left are outside the calvarium, closer to the bulla. Also, there is heterogenous/irregular tissue surrounding and dorsal to both bulla and the other small bony structures dorsal to the bulla are not aligned. I compared these images to the 3 day old Orca scan from last fall and there is what appears to be a normal void of bone tissue dorsal to the bulla so the bilateral, symmetrical space in the bone there seemed consistent with the other whale anatomy I've seen.

There is mixed accumulation of soft tissue, fluid and gas in the sinuses rostral to the brain, with the left side having more soft-tissue or fluid-attenuating material than the right.

There is soft-tissue or fluid-attenuating material in the majority of the left osseous bulla. There is soft-tissue or fluid-attenuating material and air in the rostral aspect of the right osseous bulla with air in the mid to caudal right osseous bulla. The right bulla has more air in it than the left. The left is almost completely filled with fluid or tissue. Considerations for this fluids/soft tissue attenuating material are blood, infectious or inflammatory debris, polyp like material-chronic inflammation or parasites (See image 12).

CT summary:
-Extensive gas accumulation in the soft tissues and fat could be secondary to trauma, post-mortem change, and disarticulation (or all the above).
-No large skull fractures seen.

-Displacement of some of the small bones dorsal to the bulla on the right into the calvarium. Additional small bones dorsal to the bulla on both sides that not in alignment with each other. Possibilities include secondary to trauma or post-mortem as surrounding supportive tissues are gone.
-Fluid or soft tissue in sinuses.
-Fluid or soft tissue in both osseous bulla (middle ears) worse on the left. Possibilities include: blood, infectious or inflammatory debris, polyp like material and chronic inflammation or parasites (including worms).

HEAD DISSECTION (March 6 & 7, 2012; D. Lambourn & J. Gaydos)

The entire head, severed between C1 and the foramen magnum was preserved frozen for CT scan and thawed in air for 48 hours prior to dissection on March 6. The head was partially frozen at time of dissection. The tongue is dark gray to black, swollen and edematous. There are 12 teeth erupted from the right and left mandible as well as from the right and left maxillae. On the left mandible, the 10th tooth caudal is angled more medially than the other teeth; it appears to have erupted in this direction as the tooth is firmly held by the periosteal ligament and there is no associated bruising or signs of trauma. Dissection reveals bruising in the subcutaneous tissue over the left and right eyes, with that over the left eye being more significant. On cut surface the melon has an almost clear appearance at its ventro-medial aspect, but the tissue surrounding that (dorsally and laterally) is diffusely pink to red, especially from the area just in front of the blowhole and lateral diverticulae or multiple sacs associated with the blowhole extending cranially to about 27cm towards the beak (Image 13). The pink to red color is darker on the right side than it is on the left. The rostral muscles adjacent to the melon on the right side just above the maxillae is dark red with apparent hemorrhage as is the connective tissue on the right side at the junction of the blowhole's rostral vestibular sac and the melon. Approximately 5-10cc of serosanguinous fluid is present frozen in the left side of the paired nares within the blowhole. The right side is clear.

Ventrally, a triangular section of tissue just medial to the right mandible and below the tongue measuring approximately 7cm at its base with a 16cm height is dark brown and green and aerated (Image 14). A smaller area on the medial to the left mandible (~3cm long) is noted as well. Similar colored tracks extend caudally in towards the ramus of the mandible and pharyngeal area. The mandibular or pan-bone fat of the left mandible is dark red (Image 15). The fat in the right mandible appears more autolyzed and darker. Removal of the mandibles and the hyoid reveals an air-filled sponge-like brown material just rostral to the tympanic bulla on the right side. Less of this material is present on the left side.

Frozen serosanguinous fluid suspected to be blood is evident in the cranial esophagus / pharyngeal region as well as at the junction of the larynx / narial passage. The left-side pharyngeal muscles are red and appear hemorrhagic.

Dissection of the tympanic bulla reveals that the right bulla is less adherent to the skull or at least significantly looser leaving easier visualization of what we presume is the fibro-venous plexus than is the left (Images 16 and 17). Post-dissection of the tympanic bulla, 1 small (1-2cm) nematode and approximately 12 slightly longer (2-4cm) worms that are more flat, are present in the area of the skull that was adjacent to the tympanic bulla, including peribullar sinus, fibro-venous plexus and surrounding peri-bulla soft tissue of both bulla. Concomitant with the parasites is a brown, sponge like material that appears to extend into the bulla. Approximately 6cc of red serous fluid is present in both peribullar sinuses. Two small bony fragments dorsal to the right and left bulla are present. On the left side they measure approximately 2.5cm x 2cm and 1.5cm x 1.5 cm and they appear to not be displaced but are easily removed. On the right side they measure 4cm x 2cm and 1.5 cm x 1.5 cm and are

displaced into the calvarium The edges of all four pieces are irregular and well rounded and don't appear to be freshly fractured (Image 18).

Removal of a large triangular section of the occipital bone revealed slightly frozen brain material on the left side cerebrum encapsulated by meninges and a brain free meninges that was adherent to the calvarium in 3-4 places. Cerebellum was mostly gone and portion were leaking into the left bulla area. Roughly 20cc of dark red to brown frozen serosanguinous fluid is visible between the dura and the calvarium (Image 19). This fluid was consistent with the fluid that was noted during the initial necropsy. The sutures on the right side calvarium appear to be looser then on left and red serous fluid is leaking around suture area.

Gross dissection of the head was conducted and this report was written and approved of by:

Dyanna Lambourn, Washington Department of Fish and Wildlife
Joseph K. Gaydos, SeaDoc Society / UC Davis Wildlife Health Center / San Juan County MM Stranding Network
Debbie Duffield, Portland State University
Jessie Huggins, Cascadia Research
Tori McKlveen, VCA Veterinary Specialty Center of Seattle

Executive Case Summary

This Animal was in good body condition and fresh-moderate post-mortem condition. Significant soft tissue trauma was present in the head, chest and down the right lateral side of the body as evidenced by marked hemorrhage and edema present in the skin, blubber, subcutaneous tissues and muscles (described above), as well as in lung and heart. Marked red serous fluid was present in the calvarium (~ 2 L) and the brain poured out of foraman magnum in chunks. Red serous fluid (~ 3 L) also was present in the thoracic cavity, mostly on the right side. Blood was absent in arteries and veins examined and air bubbles were closely associated with vessels. No broken bones were noted on the initial necropsy, CT scan or head dissection or during further flensing of the carcass except for the noted two small bony fragments displaced dorsal to the right and left bulla (seen on CT and head dissection).

Images

Image1. Left side head to pectoral fin

Image 2. Right side head to dorsal fin

Image3. Ventral head and chest from inside skull

Image 4. Brain and dark red serous fluild

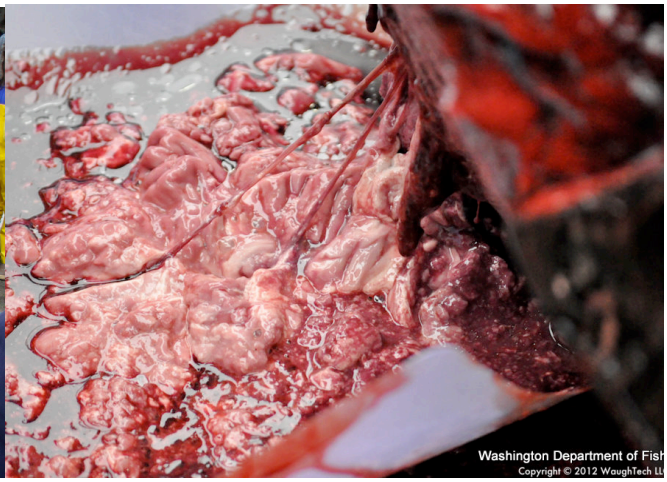


Image 5. Cervical vertebrae 1 and epidural rete muscle and blubber

Image 6. Left side behind head-

Image 7. Heart external

Image 8. Heart left ventricle

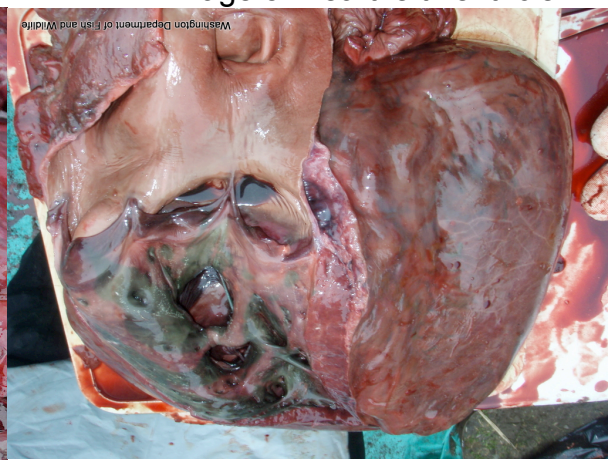


Image 9. Right lung

Image10. Intestines, mesentery

Image 11. Small bones displaced into calvarium on the right side. The side with the missing brain matter.

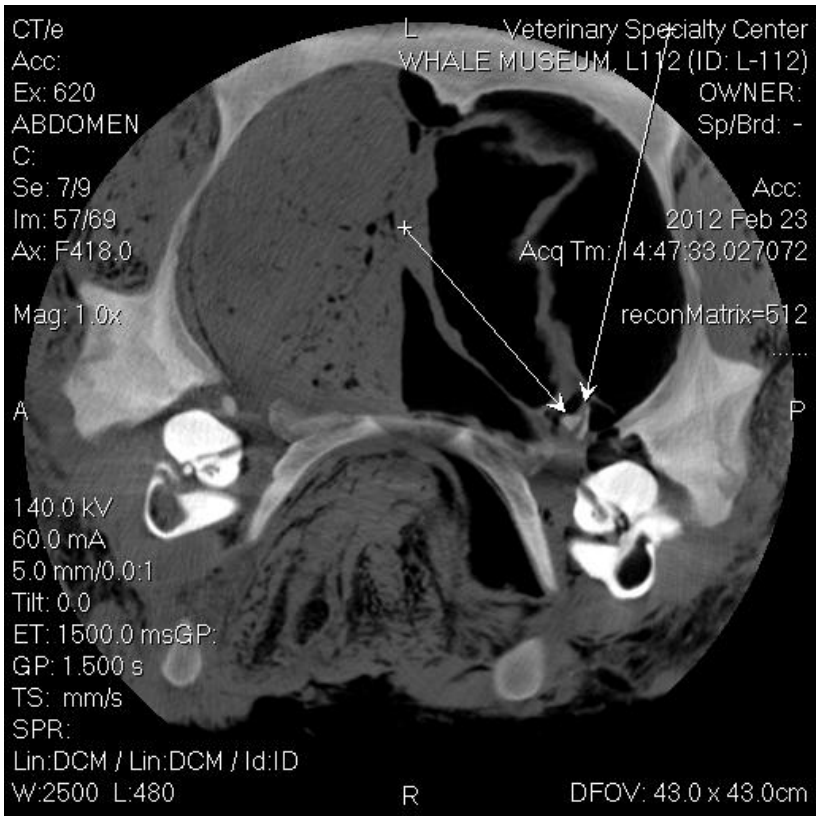
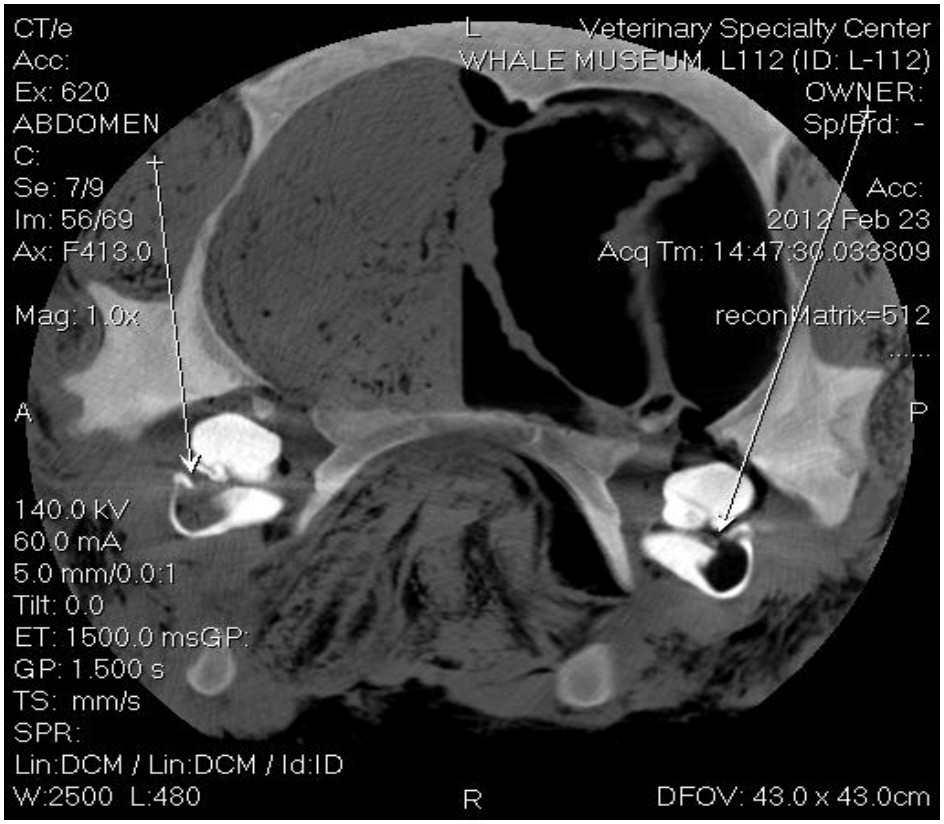


Image 12. Caudal aspect of the bulla. Fluid or soft tissue in left osseous bulla. Air in the right.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Lin:DCM / Lin:DCM / Id:ID
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Image 13: Pink to red staining of melon tongue

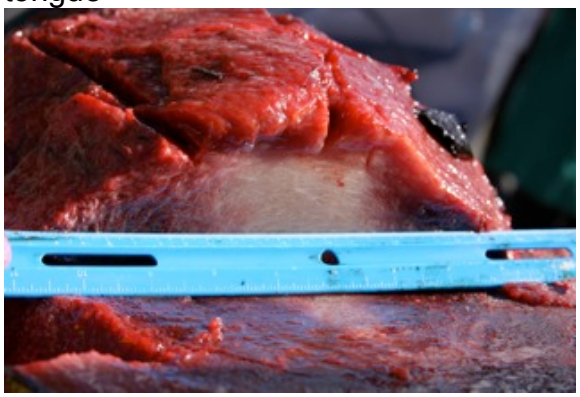

Image 14: Lesions ventral to the

Image 15: Mandibular fat

Image 16: Left bulla in-situ

Image 17: Right bulla in-situ

Image 18: Bulla and associated bone fragments

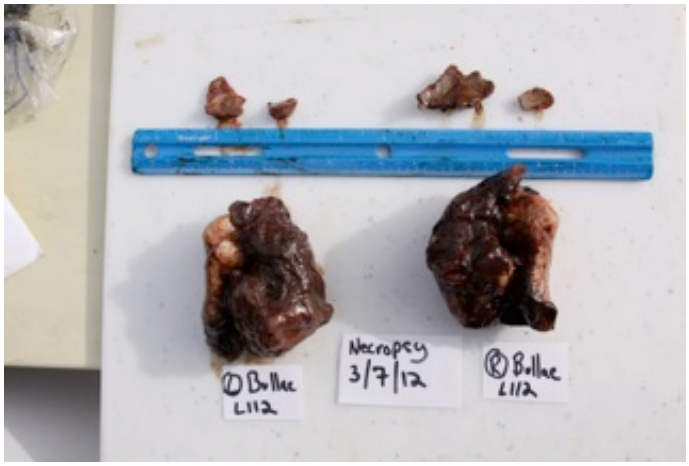

Image 19: Hemorrhage between dura and calvarium