



Alaska Veterinary Pathology Services (AVPS)

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SPECIES: Beluga whale (*Delphinapterus leucas*)

SEX: Male **AGE:** 1-2 years

ANIMAL ID/NAME: **DL1201**

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PERMIT INFO. 932-1905-00/MA-009526 **PERMIT HOLDER:** MMHSRP

CASE NUMBER: V12-046

SAMPLE DATE: 5/9/2012

TRIM DATE: 8/7/2012

DATE FINAL: 9/28/12; Adden – 10/15/12

PATHOLOGIST: Kathy Burek

NUMBER OF BLOCKS: 42

PENDING:

SPECIMEN: multiple tissues

PRESERVATION: 10% NBF

GROSS FINDINGS:

1. COD is OPEN;
2. Mild enteritis, Parasitism
3. Moderate pulmonary, Parasitism
4. mild renal, Parasitism
5. mild blubber, parasitism
6. Testes immature
7. Moderate multifocal healed traumatic lesions on skin

HISTOPATHOLOGIC DIAGNOSES:

1.) SYSTEMIC:

- 2.) Generalized organ congestion, marked (suggestive of terminal cardiovascular collapse / shock)

3.) RESPIRATORY:

- a. Bronchopneumonia, eosinophilic and histiocytic, chronic mild to severe with intralesional nematodes (*Metastrongylinae* species, most likely *Halocercus sp.*).
- b. mild, lymphoplasmacytic tracheitis.
- c. Terminal aspiration of stomach content

- d. Pulmonary edema, moderate.
- e. Arteriopathy with vacuolation and degeneration of the media, RCd2
- f. eosinophilic arteritis, chronic, severe, RCd3
- g. focal suppurative bronchopneumonia, LCd2

4.) GASTROINTESTINAL

- a. Pharyngitis and sialoadenitis, lymphoplasmacytic with multifocal basal cell hyperplasia, intracytoplasmic edema and intracytoplasmic inclusion bodies.
- b. Stomatitis, lymphocytic, superficial, very mild
- c. Gastritis, multifocal random, lymphocytic with ballooning degeneration and intracytoplasmic inclusion bodies.
- d. Parasite migration tracts, wall of the colon
- e. Mural colitis, eosinophilic and granulomatous, multifocal
- f. Arteritis, eosinophilic and granulomatous, wall of the colon.

5.) INTEGUMENT:

- a. Possible viral lesion (lesion 1) characterized by ballooning degeneration and possible intracytoplasmic inclusion bodies, left flank
- b. Lesion 2 and 3– Chronic proliferative lymphoplasmacytic and neutrophilic dermatitis with compact parakeratotic hyperkeratosis – possible area of focal molt?.

6.) CARDIOVASCULAR:

- a. Cardiomyopathy with myofiber variation and fibrosis
- b. Arteritis, eosinophilic chronic focally severe, lung and colon.
- c. Vacuolar change in the media of arteries, multifocal, marked, lung, GI tract, skin lesions

7.) LYMPHOID:

- a. reactive lymph node, mesenteric
- b. drainage reaction, eosinophilic and histiocytic, mesenteric
- c. Massive splenic congestion;
- d. mild splenic extramedullary hematopoiesis.

8.) HEPATOBILIARY:

- a. Massive centrilobular congestion / hemorrhage with dissociation of the hepatocytes.
- b. Moderate portal lymphocytic and eosinophilic hepatitis.

SUMMARY DIAGNOSIS:

This young beluga has a surprisingly severe case of bronchopneumonia associated with a moderately heavy load of nematodes consistent with the Metastrongylinina family. There was also evidence of trans-arterial migration of parasites both in the wall of the colon and within the lung suggesting a mode of movement through the body for these parasites. . The massive generalized congestion was most likely due to the terminal event. With the pulmonary edema, and the history, this was most likely due to drowning. With the severity of the bronchopneumonia and poor body condition, it would make some sense that the animal could have either died of this, or been compromised enough to be more

susceptible to drowning in the net. The skin lesion 1 was most suggestive of a partially healed viral lesion, with pox virus as the most likely virus. Skin lesion 2 was most likely a repairing traumatic wound. Lesion three was not adequately represented in the section to evaluate.

RECOMMENDATIONS:

- Attempt collection and identification of adult parasites from archived lung
- IHC for Morbillivirus from lung(?)
- Molecular work up at Abbotsford as suggested in the necropsy protocol
- Archive at Univ of the North
- POPs (blubber) and PAHs (liver) at NWFSC
- Heavy metals at ?
- HABS on feces, stomach content, urine, pericardial fluid at NWFSC
- Genetics at SWFSC and Greg Cory-Crowe
- REQUEST recuts of 29 (no epithelium), 33 (no lesion) and 34 (no lesion).
- Trichrome on 32 and 12.

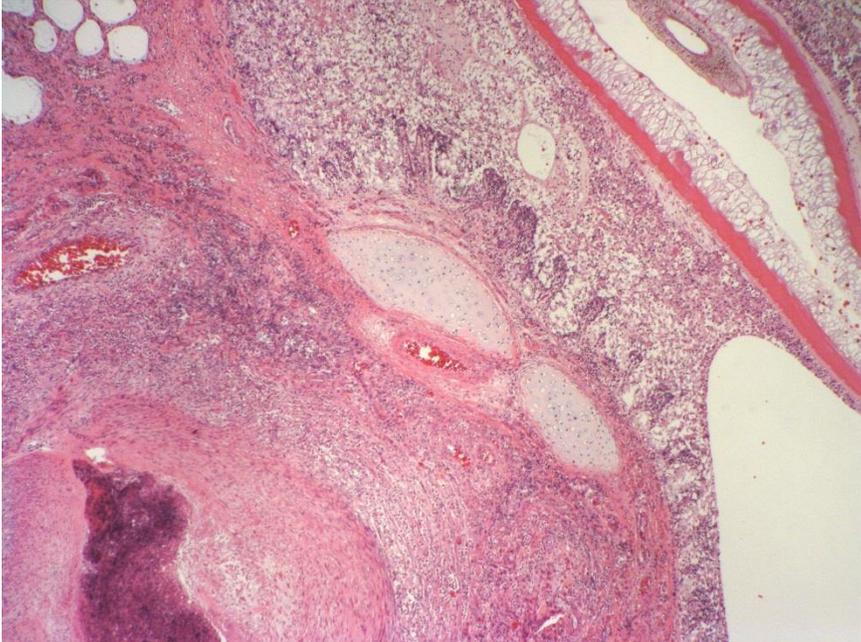
BRIEF HISTORY: This Male, 1-2 years Beluga whale from Kenai River (Lat ; Long) was biopsies / necropsied on 5/9/2012. It was not previously frozen. Post mortem state was mild.

HISTOPATHOLOGIC FINDINGS: 55 tissues were trimmed into 42 blocks on 8/7/2012 at HCS. The following tissues were examined:

| # | Tissue | Notes |
|---|-----------------|---|
| 1 | RAV | In one area, myofibers are of variable size and separated by fibrosis (Myocardial fibrosis and degenerative myopathy, focal, RV) |
| 2 | RV | WNL |
| 3 | LAV LV | WNL |
| 4 | IVS | There are patches of very small myofibers supported by clear space and some dense collagen. So these myofibers are also have prominence address out of plastic factual and variable nuclear size (anisokaryosis). Whether this is the version of cardiomyopathy or variation within normal is unknown. |
| 5 | Heart Tongue | The section apart has an extensive area of solid row cardio cells. There are several large patches of very small muscle fibers separated by a collagen. (Cardiomyopathy). Their variable numbers of penetrates all the benefits of the germinal papillae.. Please inflammatory cells are primarily lymphocytes and rare neutrophils. (Stomatitis, lymphocytic, superficial, very mild). |
| 6 | RV PA | WNL WNL |
| 7 | Lung | There are several large and coalescing parasitic pyogranulomas along |

| | | |
|----|-------------------|---|
| | Caudal RCD2 | <p>the pleural surface. Some of these contain viable large nematodes. These nematodes have a pseudo coelom, coelomyarian polymyarian musculature, an intestine with a few multinucleate cells with few nuclei, flat lateral cords which divide the muscles into two even halves. These granulomas are space occupying and destructive of the surrounding tissue. The surrounding bronchioles, many are filled with eosinophils and if you sites with the family mucosa. Several these bronchioles also have lymphoid nodules in the drowning tissue. (Bronchopneumonia, eosinophilic and histiocytic, chronic severe with intralesional nematodes.). Many of the medium-sized art arteries are hyper-contracted with marked vacuolation of the media cells with some intracytoplasmic flocculent material within the vacuoles. (Arteriopathy with vacuolation and degeneration of the media.)</p> |
| 8 | Lund Caudal LCR1 | <p>Bronchopneumonia, eosinophilic and histiocytic, chronic severe Pulmonary Bronchospasm and arterial spasm, marked There are also many small mineralized bodies lining the bronchioles, some of which look similar to Splendore-Hoepli bodies. Splendore-Hoepli bodies lining the bronchioles.</p> |
| | Thymus | <p>This was labeled “thymus” but is actually a lymph node, most likely the cranial mediastinal LN. it is reactive and has large numbers of eosinophils in the capsule, sinuses and sinusoids. There are also aggregates of eosinophils in the paracortex. (lymphadenitis, eosinophilic, marked. Mediastinal LN).</p> |
| 9 | Lung Cranial RCR2 | <p>There are several chronic parasitic pyogranulomas scattered throughout the section surrounded by thick, sometimes mineralized walls composed of hyalinized collagen, mixed inflammatory cells.. Some appear to have initiated within the wall of large arteries in that the wall also contains significant smooth muscle fibers. In addition to these granulomas, there is a more diffuse pulmonary atelectasis as well as intense eosinophilic and histiocytic bronchopneumonia.</p> |
| 10 | Lung Caudal LCD1 | <p>This section alone, there are large regions of extensive fibrosis with bridging and obliteration of different adjacent alveoli. There is also marked arterial spasm and filling of bronchioles with eosinophils, histiocytes, and lymphocytes as well as fewer neutrophils. Lymphoid nodules are common around these inflamed airways. Many airways are lined by the Splendore-Hoepli bodies. (Severe bronchopneumonia) Some airways also contain moderate numbers of rod shaped bacteria without much in the way of neutrophilic reaction. One bronchiole contained fragments of muscle fibers (terminal aspiration).</p> |
| | LN unknown site | <p>Lymph node of unknown origin is reactive with drainage of many it eosinophils and neutrophils.</p> |
| 11 | Hilar LN | <p>Very reactive LN; Eosinophilic drainage reaction and lymphadenitis, marked, chronic</p> |

| | | |
|----|--|---|
| | Lung Cranial RCR3 | See above. Mild Bronchopneumonia, primarily along the pleura |
| 12 | L Adrenal Lung Caudal RCD3 | This was pancreas, not adrenal gland. This section also has a long cross section of a very large nematode parasite as described above. The parasite is present within a bronchiole just subjacent to the pleura. There are some rod shaped bacteria deposited around and adhered to the cuticle of the parasite. A large artery adjacent to the occupied bronchiole is heavily scarred and obstructed by degenerated eosinophils (eosinophilic arteritis, chronic, severe).  2x |

| | | |
|----|--|---|
| | |  <p>4x Chronic severe Bronchopneumonia On trichrome, there is marked distortion of the arterial architecture and replacement of smooth muscle cells with collagen.</p> |
| 13 | Lung Middle LM2 Muscle sterno | Severe chronic bronchopneumonia with fibrosis WNL |
| 14 | Lung Middle RM3 Thyroid | Mild multifocal bronchopneumonia, chronic, eosinophilic Variably sized follicles with deeply eosinophilic colloid and lined by cuboidal cells (WNL) |
| 15 | Epaxial muscle Lung Middle RM2 | WNL See above Mild bronchopneumonia; one area of mineralized degenerated parasite |
| 16 | Lung Caudal LCD3 | Severe eosinophilic bronchopneumonia with some mineralized and degenerated nematodes in some of the bronchioles. |
| 17 | Lung Caudal RCD2 | Moderate eosinophilic bronchopneumonia |
| 18 | Lung | Mild eosinophilic bronchopneumonia |

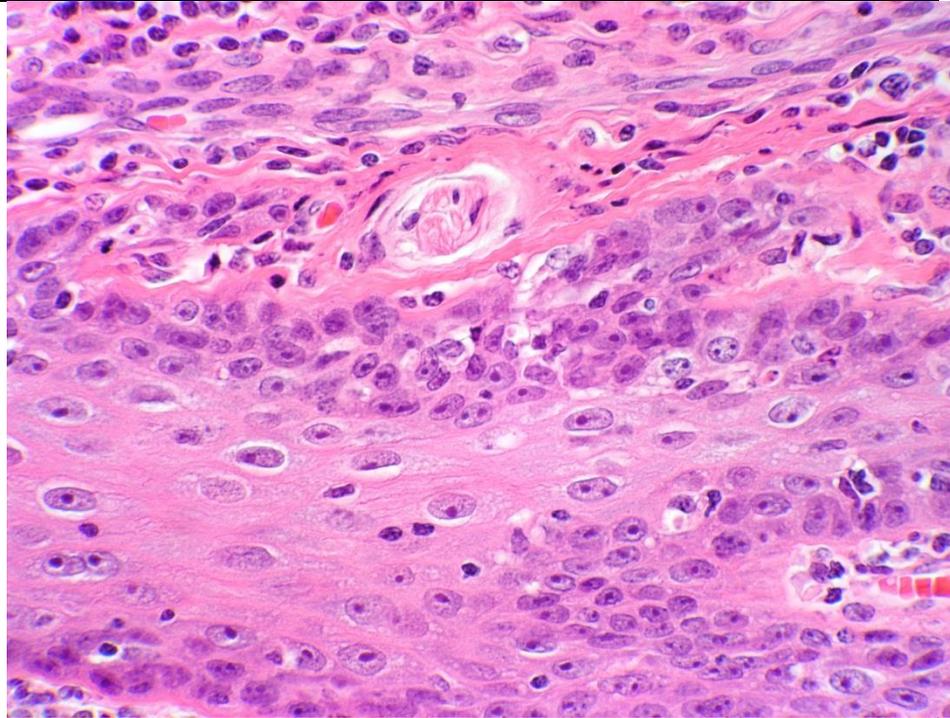
| | | |
|----|-------------------------------------|--|
| | cranial LCR2 | Aspiration of stomach content (muscle and bacte) |
| 19 | Lung cranial RCR1 | Large subpleural mineralized eosinophilic granulomas; Moderate eosinophilic Bronchopneumonia Aspirated stomach content |
| 20 | Lung cranial LCR3 | Moderate eosinophilic Bronchopneumonia There are several degenerated parasites cuffed by multinucleated giant cells and eosinophils in the parenchyma and within bronchi. There is one large artery cuffed by lymphocytes and also containing degenerative inflammatory cells within the wall. |
| 21 | Lung caudal LCD2 | Is several bronchi containing degenerated into nematode Frank fragments turned by very intense inflammation, some mineralization as well as some separate of inflation. Moderate to severe eosinophilic bronchopneumonia with intralesional nematodes and focal suppurative bronchopneumonia |
| 22 | Lung middle LM3 | Most of the lung is minimally affected with normal alveoli and alveolar septa. There are however several smaller bronchioles almost obstructed by degenerated nematodes and associated eosinophilic inflammation. Mild, eosinophilic bronchopneumonia |
| 23 | Lung middle LM1 | Severe bronchopneumonia with intralesional mineralized large parasitic granulomas and obliteration of most of the Airways by inflammation. |
| 24 | Lung middle RM1 Tonsil | Moderate eosinophilic bronchopneumonia Tonsil is not present in this section. There are many mucoid salivary glands and pharyngeal mucosa. At the base of the epithelium, many of the basal cells are piled up and have cleared distended cytoplasm (Possible ballooning degeneration). Some also have distinct amphophilic or lightly basophilic IC inclusion bodies. There is a moderate multifocal subepithelial lymphoplasmacytic infiltrate as well as a moderate lymphoplasmacytic periadnexal infiltrate. Pharyngitis and sialoadenitis, lymphoplasmacytic with multifocal basal cell hyperplasia, intracytoplasmic edema and intracytoplasmic inclusions bodies. |
| 25 | Trachea Spleen Liver | There is a large amount of mixed bacteria on the surface of the epithelium with no direct inflammatory reaction (terminal aspiration). There is a mild, lymphoplasmacytic tracheitis. There is massive splenic congestion; mild splenic extramedullary hematopoiesis. Massive centrolobular congestion / hemorrhage with dissociation of the hepatocytes. Moderate portal lymphocytic and eosinophilic hepatitis. |

| | | |
|----|---|---|
| 26 | Kidney Urinary bladder Pancreas | Massive congestion Only muscular layer was present in the section (no epithelium) WNL; mild autolysis. |
| 27 | Duodenum Mesenteric LN | Appears to be colon, not duodenum, or duodenum with severe villous blunting. Colitis, nodular, lymphoplasmacytic with multifocal parasite migration tracts. There are tracts of eosinophils and macrophages through the wall to the serosa and also into and destroying the wall of an artery (eosinophilic and granulomatous arteritis, colon wall). Reactive LN with eosinophilic and histiocytic drainage reaction, mesenteric LN. |
| 28 | Stomach Diaphragm | This is the squamous section of the stomach. There is a very mild lymphocytic inflammatory pattern subjacent to the epithelium. The basal cells are slightly swollen and piled up with clearing of the cytoplasm. Their focal areas of epithelial necrosis (ulceration). These areas are outlined by increased numbers of neutrophils, eosinophils and macrophages. There are also focal areas of ballooning degeneration of the stratum spinosum layer. In these areas, there are rare distinct eosinophilic inclusion bodies as well as individual necrotic cells. Gastritis, multifocal random, lymphocytic with ballooning degeneration and intracytoplasmic inclusion bodies. WNL |
| 29 | Testes Jejunum | Immature testes there is a focally severe area of eosinophilic and lymphocytic inflammation within the submucosa (parasite migration tract). There is also intense similar inflammation in the lamina propria throughout the section. No parasite cross sections are seen on step sections. Many of the arteries have vacuolation of the smooth muscle fibers of the media. |
| 30 | Pituitary | The pituitary is markedly congested. There are many rosettes and cysts within the pars intermedium. |
| 31 | Orbit (x2) | There's marked cupping and fibrosis of the optic nerve consistent with glaucoma. |
| 32 | Colon / Anus? | Tubular viscus lined by cornified-non-keratinized epithelium. Intense lymphocytic and eosinophilic inflammation subjacent to the epithelium with huge Lymphoid nodules in the Submucosa, often with eversion of the epithelium into the glands. In the muscular layer and submucosa, there are multilobular masses of fibrotic tissue around areas of mineralization. Some have smooth muscle in the wall of the (Probable |

| | | |
|----|--------|--|
| | | <p>arteries) suggesting parasite migration through the vessels? Request a trichrome.</p> <p>On trichrome, there are circumferential smooth muscle fibers in the walls of these structures indicating these were damaged arteries, most likely parasite migration tracts.</p> |
| 33 | Skin3 | <p>NSF – request step section. moderately pigmented epithelium. Focally intense lymphocytic superficial dermatitis. In the dermis subjacent to the epithelium and in the dermal cords, there are lymphocytes and some macrophages, many containing cellular debris. The epithelium appears to be WNL – lesion probably not in section. (GROSS - fluke / tail - Lesion 3: Along the left side of the peduncle, just anterior to the flukes, a cluster of 4 pale splotchy areas with firm centers, a few of these are scattered across the body but these are the most prominent.)</p> <p>Step section: See above. No further new information. There is a thick layer of compact parakeratotic stratum corneum on the surface (possible molt)? Lesion 3: Chronic proliferative lymphoplasmacytic and neutrophilic dermatitis with possible molt</p> |
| 34 | Skin 2 | <p>NSF – request step section. The basal cells are very piled up and the epithelial dermal junction very irregular. Rete pegs and dermal papillae are also irregular and anastomosing. There is very mild, focal lymphocytic and neutrophilic inflammation in the tips of the dermal papillae. The deep dermal and SQ arteries have marked vacuolar change in the media cells and some degeneration eosinophilic material within the vacuoles. (GROSS – fluke / tail - Lesion 2: A prominent, healed scar ~5cm in diameter was noted along the right junction of the flukes and the peduncle. The scar does not extend deeply and no abnormal tissue is noted underneath.). Lesion 2 – Chronic proliferative lymphoplasmacytic and neutrophilic dermatitis with possible molt</p> |
| 35 | Skin 1 | <p>There is a central erosive lesion which also has some components of proliferation. The cells within this area are swollen and distended with clear cytoplasm (ballooning degeneration). Underlying this lesion, the superficial dermis is intensely inflamed by lymphocytes and plasma cells. The cells within the stratum basale are piled up with increased mitotic figures and scattered areas of individual cell necrosis. Possible small eosinophilic intracytoplasmic inclusion bodies were present within epithelial cells on the periphery of this lesion (trichohyalin granules? Inclusions). This could be a regenerative lesion following trauma or a viral lesion (this seems most likely – poxviral).</p> |

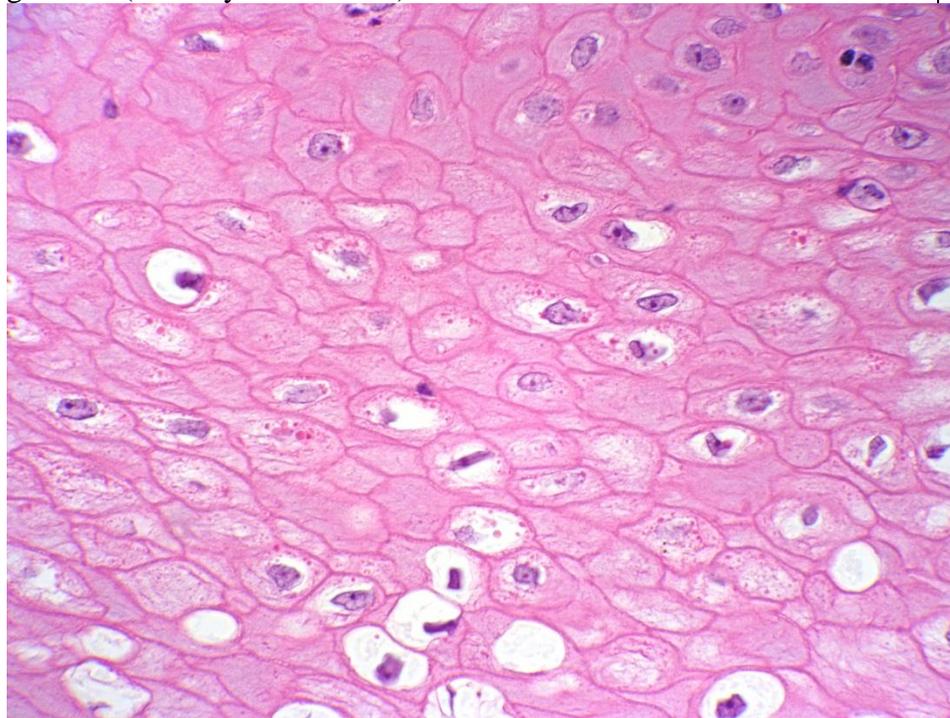


2X

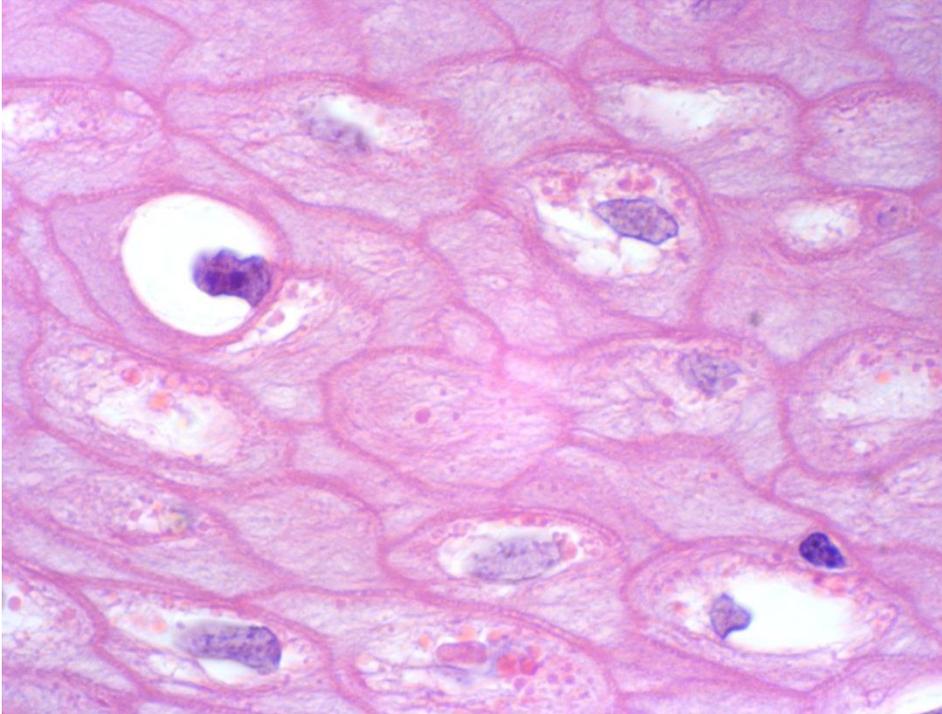


40 X

Some of the ballooned cells also have multiple brightly eosinophilic granules (trichohyalin? Viral?)



40x

| | | |
|----|----------------------|--|
| | |  <p>100x – viral or trichohyalin granules? (GROSS - Lesion 1: left flank - Multiple (7) white punctuate scars just below dorsal ridge, 0.1-1 cm)</p> |
| 36 | R Frontal | NSF |
| 37 | R? Ant Hypo | The section of markedly congested. Several of the arteries are packed full of eosinophils with some disruption of the wall of the artery. There are a few aggregates of brightly eosinophilic globular bodies consistent with spheroids. |
| 38 | R post hypo w/ gyrus | this section is markedly congested. There appears to be an increase in cellularity in the stroma and also within the vessel walls. The change in the vessel walls is primarily vacuolation of the media. (Postmortem artifact?). The gyrus is not present in the section. The cellularity appears to be a combination of age of the animal and postmortem artifacts. |
| 39 | L Ant Hypo | There is a ring hemorrhage in this section. Is a moderate amount of dark neuron artifact. |
| 40 | L Post Hypo w/ gyrus | There is no gyrus in this section. |
| 41 | Cerebellum Ls | NSF |
| 42 | Cerebellum Xs | |

**ANCILLARY DIAGNOSES:
VIROLOGY:**

| Lab short name | Sample tested | Sub type of test | Lab_RPT_No | Agents | Pos/Neg | Comment |
|-------------------------|--|------------------|------------|---|--|--|
| Carlos Romero - UF | BH Bacte Swab | PCR | | Herpesvirus | POS | GEN BANK DNAPol KJ191536-KJ191540 |
| | BH viral Swab | Culture | | Herpesvirus | POS | |
| O. Nielsen | Fecal swab, Lesion SK1 and SK3, Spleen | Culture | | Open | NEG | |
| Athens - U of G G | LN Hilar | PCR | A15-00096 | Herpesvirus Influenza - A Morbillivirus | NEG | |
| | Lung w/ Bronchus | | | | | |
| | Skin lesion SK1 | | A15-00096 | Herpesvirus | POS | WAS IT SKIN OR LUNG THAT WAS POSITIVE? |
| | | | | Poxvirus | NEG | |
| | | | | Vesivirus (Calicivirus) | NEG | |
| Lesions Skin SK1 / SK3? | Culture | A14-17518 | Open | NEG | two samples, no virus detected after 21 days of incubation | |
| | PCR | A14-17518 | | | Both SK1 and SK3 | |

BACTERIOLOGY:

| Lab short name | Sample tested | Sub type of test | Lab_RPT_No | Agents | Pos/Neg |
|----------------|--------------------|------------------|------------|--|---------|
| Athens – UGA | Lung with Bronchus | PCR | A15-00096 | Erysipelothrix spp | NEG |
| | | PCR | A15-00096 | Mycoplasma sp. | POS |
| | | | A15-00096 | Plesiomonas shigelloides, Kingella oralis and Clostridium perfringes | POS |
| | Spleen | | A15-00096 | Open | NEG |
| Providence | Fecal Cary | Fecal | | Aeromonas sp. | POS |

| Lab short name | Sample tested | Sub type of test | Lab_RPT_No | Agents | Pos/Neg |
|----------------|---------------|------------------|------------|---|---------|
| | Blair swab | Pathogens | | Campylobacter sp., E coli 0157, Salmonella sp. Shigella sp. | NEG |

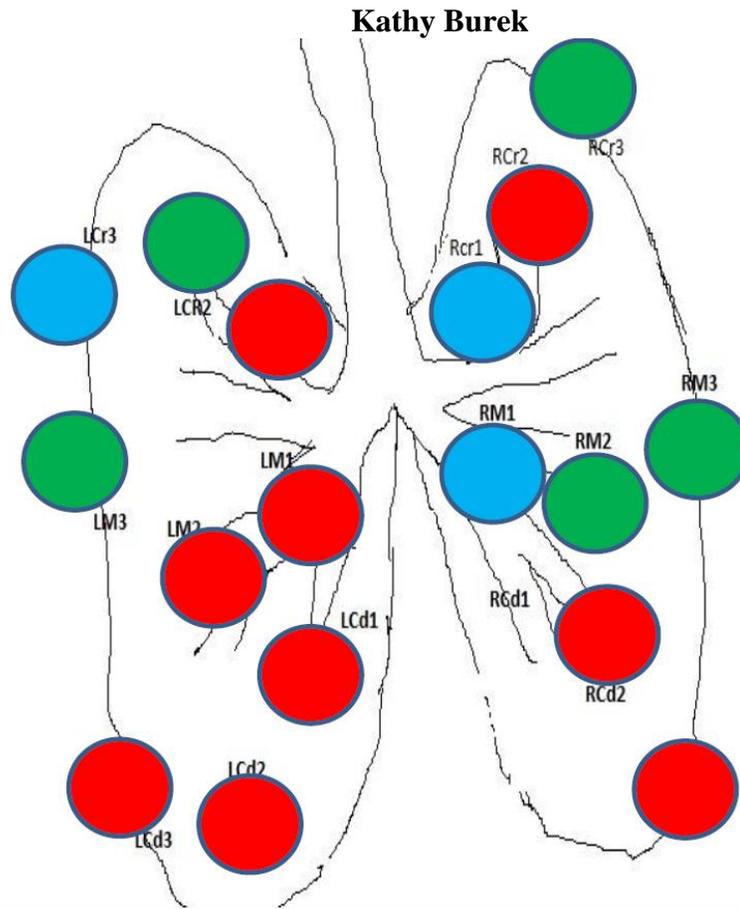
TOXICOLOGY – HABS –NWFSC HABS Laboratory (E. Frame)

| Sample tested | Sub type of test | Agents | Pos/Neg | measured result | Comment |
|--|------------------------------|-------------|---------|-----------------|---------------------------|
| Feces | Biosense ELISA (domoic acid) | domoic acid | bdl | bdl | dl = 4 ng/g |
| Pericardial Fluid and Urine | | | | | dl = 0.4 ng/g |
| Stomach Contents | | | | | dl = 2.0 ng/g dl = 1 ng/g |
| Feces | ELISA Abraxis (saxitoxin) | Saxitoxin | Pos | 3.6 ng/g | dl = 3.0 ng/g |
| Pericardial Fluid, Stomach Contents, Urine | | | bdl | | |

COMMENT:

This young beluga has a surprisingly severe case of bronchopneumonia associated with a moderately heavy load of nematodes consistent with the Metastrongyline family. Most cetacean lungworms are in the Metastrongyloidea and in the Pseudaliidae family. Lungworms previously reported in belugas are *Pharurus pallasii*, *Stenurus arctomarinus*, *Skryabinalius guevarai*, and *Halocercus delphini* and *H. monoceris* (Measures 2001). The lungworm and pathology reported previously that causes this sort of very intense inflammatory reaction in the lung is *Halocercus monoceris* (Measures et al. 1995, Measures 2001, Martineau D et al. 2003). , The only lung worms IDed in this population has been *Stenurus arctomarinus*. We should try and get an adult for identification from the frozen sections of lung. There was also evidence of trans-arterial migration of parasites both in the wall of the colon and within the lung suggesting a mode of movement through the body for these parasites. The figure below outlines the intensity of infection in the lungs.

The massive generalized congestion was most likely due to the terminal event. With the pulmonary edema, and the history, this was most likely due to drowning. With the severity of the bronchopneumonia and poor body condition, it would make some sense that the animal could have either died of this, or been compromised enough to be more susceptible to drowning in the net. The skin lesion 1 was most suggestive of a partially healed viral lesion, with pox or papilloma virus as the most likely virus. Skin lesion 2 was most likely a repairing traumatic wound. Lesion three was not adequately represented in the section to evaluate.



RED is Severe; Blue is Moderate; Green is Mild

Distribution of the severity of the lungworm associated bronchopneumonia.

Martineau D, Mikaelian I, Lapointe J-M, Labelle P, Higgins R (2003) Pathology of cetaceans. A case study: Beluga from the St. Lawrence estuary. In: Vos JG, Bossart, G.D., Fournier, M., O'Shea, T.J. (ed) Toxicology of marine mammals. Taylor and Francis Group, London and New York

Measures L (2001) Lung Worms in Marine Mammals. In: Samuel WM, Pybys MJ, Kocan AA (eds) Infectious and Parasitic Diseases of Wild Mammals. Iowa State University Press, Ames Iowa

Measures LN, Beland P, D M, De Guise S (1995) Helminths of an endangered population of belugas, *Delphinapterus leucas*, in the St. Lawrence estuary, Canada. Canadian Journal of Zoology 73:1402-1409

SPECIMEN DISPOSITION:

| Sample ID | Specific Sample | Container Type | Sample Location | Freezer | Purpose | Type of analysis | Analysis detail | Date shipped out for analysis | Shipped to |
|---------------|-----------------|----------------|-----------------|-------------|------------|------------------|-----------------|-------------------------------|---------------------|
| Adrenal Gland | | Whirl-pak | UAA | UAA - 80 #1 | DZ ARCHIVE | | | | CANADA - O. NIELSEN |

| Sample ID | Specific Sample | Container Type | Sample Location | Freezer | Purpose | Type of analysis | Analysis detail | Date shipped out for analysis | Shipped to |
|------------------|--|----------------|-----------------|-------------|------------|---------------------------|-----------------|-------------------------------|----------------------|
| Aqueous humor | | Cryovial 2 ml | UAA | UAA - 80 #1 | DZ ARCHIVE | Clin chemistries | | | Cornell University |
| BH dry Swab | | Cryovial 2 ml | UAA | UAA - 80 #1 | DZ ARCHIVE | | | | |
| BH dry Swab | | Cryovial 2 ml | UAA | UAA - 80 #1 | DZ ARCHIVE | Herpes, morbillivirus PCR | | 12/18/2013 | Carlos Romero - UF |
| BH RNAlater Swab | | Cryovial 2 ml | | | DZ ARCHIVE | morbillivirus | | 8/19/2013 | CANADA - S. RAVERTY |
| BH RNAlater Swab | | Cryovial 2 ml | UAA | UAA - 80 #1 | DZ ARCHIVE | | | 10/16/2013 | MIT - Runstadler lab |
| BH viral Swab | | Cryovial 2 ml | UAA | UAA - 80 #1 | DZ ARCHIVE | | | | |
| BH viral Swab | | Cryovial 2 ml | SHIPPED | UAA - 80 #1 | DZ ARCHIVE | viral culture | | 8/19/2013 | CANADA - O. NIELSEN |
| Blocks | 27 (duo), 29 (jej), 30 (colon), 34 (skin), 28 (stom) | | | | | | | | |
| Blubber | VAX | Foil / Teflon | UAA | UAA - 80 #1 | AMMP | TOX | | | |
| Blubber | DAX | Foil / Teflon | UAA | UAA - 80 #1 | TOX | | | | |
| Blubber | DAX | Whirl-pak | UAA | UAA - 80 #1 | TOX | | | | |
| Blubber | LAX | Whirl-pak | UAA | UAA - 80 #1 | TOX | | | | |
| Blubber | ADR | Whirl-pak | UAA | UAA - 80 #1 | DZ | NK | | | |
| Blubber | LAX | Whirl-pak | UAA | UAA - 80 #1 | TOX | | | | |

| Sample ID | Specific Sample | Container Type | Sample Location | Freezer | Purpose | Type of analysis | Analysis detail | Date shipped out for analysis | Shipped to |
|----------------------|-----------------|----------------|-----------------|-------------|------------|------------------|-----------------|-------------------------------|--------------------|
| Blubber | BDR | Whirlpak | UAA | UAA - 80 #1 | DZ | NK | | | |
| Blubber | DAX | Whirlpak | UAA | UAA - 80 #1 | TOX | | | | |
| Blubber | DDR | Whirlpak | UAA | UAA - 80 #1 | DZ | LC | | | |
| Blubber | LAX | Foil / Teflon | UAA | UAA - 80 #1 | AMMP | TOX | | | |
| Blubber | VAX | Whirlpak | UAA | UAA - 80 #1 | TOX | | | | |
| Blubber | VAX | Whirlpak | UAA | UAA - 80 #1 | TOX | | | | |
| Blubber | BDF | Foil / Teflon | UAA | UAA - 80 #1 | TOX | | | 6/18/2012 | NWFSC - G. YLITALO |
| Blubber | BDF | Foil / Teflon | UAA | UAA - 80 #1 | DZ | Calorimetry | | 3/29/2013 | Leslie Cornick |
| Blubber | DAX | Whirlpak | UAA | UAA - 80 #1 | DZ | Calorimetry | | 3/29/2013 | Leslie Cornick |
| Blubber | LAX | Whirlpak | UAA | UAA - 80 #1 | DZ | Calorimetry | | 3/29/2013 | Leslie Cornick |
| Blubber | VAX | Whirlpak | UAA | UAA - 80 #1 | DZ | Calorimetry | | 3/29/2013 | Leslie Cornick |
| brain dry Swab | R Cerebrum | Cryovial 2 ml | UAA | UAA - 80 #1 | | | | | |
| brain dry Swab | L Cerebrum | Cryovial 2 ml | UAA | UAA - 80 #1 | DZ ARCHIVE | | | | |
| Brain RNA later swab | L Cerebrum | Cryovial 2 ml | UAA | UAA - 80 #1 | DZ ARCHIVE | | | | |
| Brain RNA later swab | R Cerebrum | Cryovial 2 ml | UAA | UAA - 80 #1 | DZ ARCHIVE | | | | |
| Brain viral Swab | L Cerebrum | Cryovial 2 ml | UAA | UAA - 80 #1 | DZ ARCHIVE | | | | |
| Brain viral Swab | R Cerebrum | Cryovial 2 ml | UAA | UAA - 80 #1 | DZ ARCHIVE | | | | |

| Sample ID | Specific Sample | Container Type | Sample Location | Freezer | Purpose | Type of analysis | Analysis detail | Date shipped out for analysis | Shipped to |
|------------|-----------------|-----------------|-----------------|-------------|------------|-----------------------|-----------------|-------------------------------|---------------------|
| | m | | | | | | | | |
| Cerebrum | | Whirlpak | | | DZ | morbillivirus | | 8/19/2013 | CANADA - S. RAVERTY |
| Cerebrum | | Foil / Whirlpak | UAA | | PARASIT | Protozoal PCR | | 8/19/2013 | Mike Grigg - CDC |
| Eye | | Whirlpak | UAA | UAA - 80 #1 | DZ ARCHIVE | | | | |
| Fecal swab | dry swab | Cryovial 2 ml | UAA | UAA - 80 #1 | DZ ARCHIVE | | | | |
| Fecal swab | dry swab | Cryovial 2 ml | UAA | UAA - 80 #1 | DZ ARCHIVE | | | | |
| Fecal swab | Viral Media | Cryovial 2 ml | UAA | UAA - 80 #1 | DZ ARCHIVE | | | | |
| Fecal swab | Viral Media | Cryovial 2 ml | SHIPPED | UAA - 80 #1 | VIROLOGY | Virus culture | | 8/19/2013 | CANADA - O. NIELSEN |
| Feces | | Cryovial 2 ml | UAA | UAA - 80 #1 | DZ | TR | | | |
| Feces | | Whirlpak | UAA | UAA - 80 #1 | TOX | HABs | | 6/18/2012 | NWFSC - E. FRAME |
| Feces | | Whirlpak | | | DZ | Bacte Fecal pathogens | | 8/19/2013 | CANADA - S. RAVERTY |
| Heart | | Whirlpak | UAA | UAA - 80 #1 | TOX | Protozoal PCR | | | |
| Heart | | Whirlpak | UAA | | PARASIT | Protozoal PCR | | 8/19/2013 | Mike Grigg - CDC |
| Jejunum | | Whirlpak | UAA | UAA - 80 #1 | DZ ARCHIVE | | | | |
| Jejunum | | Whirlpak | UAA | UAA - 80 #1 | DZ ARCHIVE | | | | |
| Kidney | w/ nodules | Whirlpak | UAA | UAA - 80 #1 | DZ | | | | |
| Kidney | | Foil / Teflon | UAA | UAA - 80 #1 | DZ | | | 6/18/2012 | |
| Kidney | | Whirl- | | | HMs | Heavy | | 8/19/2013 | CANADA - |

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| | | pak | | | | metals and vitamins | | 3 | S. RAVERTY |
| Lesions | SK2 | Cryovial 2 ml | UAA | UAA - 80 #1 | DZ | | | | |
| Lesions | SK2 | Cryovial 2 ml | UAA | UAA - 80 #1 | DZ | Viral culture | | | CANADA - O. NIELSEN |
| Lesions | SK3 | Cryovial 2 ml | UAA | UAA - 80 #1 | DZ | | | | |
| Lesions | SK1 | Cryovial 2 ml | SHIPPE D | UAA - 80 #1 | VIROLOGY | Culture | | 8/19/2013 | CANADA - O. NIELSEN |
| Lesions | SK3 | Cryovial 2 ml | SHIPPE D | UAA - 80 #1 | DZ | Viral culture | | 8/19/2013 | CANADA - O. NIELSEN |
| Lesions | SK1 | Cryovial 2 ml | UAA | UAA - 80 #1 | VIROLOGY | PCR and culture; pox, herpes | | 12/9/2013 | Athens Vet Diagnostic Lab |
| Lesions | SK3 | Cryovial 2 ml | UAA | UAA - 80 #1 | DZ | PCR and culture; pox, herpes | | 12/9/2013 | Athens Vet Diagnostic Lab |
| Lesions | SK1 | Cryovial 2 ml | UAA | UAA - 80 #1 | DZ | Pox, herpes, vesic PCR | | 6/30/2014 | Athens Vet Diagnostic Lab |
| Liver | | Whirlpak | UAA | UAA - 80 #1 | DZ ARCHIVE | | | | |
| Liver | | Cryovial 2 ml | UAA | UAA - 80 #1 | DZ ARCHIVE | | | | |
| Liver | RNALater | Cryovial 2 ml | UAA | UAA - 80 #1 | DZ ARCHIVE | | | | |
| Liver | | Foil / Whirlpak | UAA | UAA - 80 #1 | TOX | POPs | | 6/18/2012 | NWFSC - G. YLITALO |
| Liver | | Whirlpak | | | HMs | Heavy metals and vit A | | 8/19/2013 | CANADA - S. RAVERTY |
| Liver | | Whirl- | UAA | UAA - | PARASIT | Protozoal | | 11/24/20 | MISSING |

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| | | pak | | 80 #1 | | PCR | | 13 | |
| LN Hilar | | Whirl-pak | | | DZ ARCHIVE | morbillivirus; other molecular | | 8/19/2013 | CANADA - S. RAVERTY |
| LN Hilar | RNA Later | Cryovial 2 ml | UAA | UAA - 80 #1 | DZ ARCHIVE | morbillivirus; influenza A | | 6/30/2014 | Athens Vet Diagnostic Lab |
| LN Mesenteric | | Whirl-pak | UAA | UAA - 80 #1 | DZ | PCR Panel; fecal pathogens | | | CANADA - S. RAVERTY |
| LN Mesenteric | | Whirl-pak | UAA | UAA - 80 #1 | DZ | | | | |
| LN Mesenteric | | Cryovial 1 ml | UAA | UAA - 80 #1 | DZ ARCHIVE | | | | |
| LN Prescapular | | Whirl-pak | UAA | UAA - 80 #1 | DZ ARCHIVE | | | | |
| LN Prescapular | RNA Later | Cryovial 2 ml | UAA | UAA - 80 #1 | DZ ARCHIVE | | | | |
| Lung - CdD | | Whirl-pak | UAA | UAA - 80 #1 | DZ ARCHIVE | Drfrost and attempt to isolate parasites for ID. | | | |
| Lung CV | | Whirl-pak | | | DZ ARCHIVE | morbillivirus and Aerobic culture; Mollicutes | | 8/19/2013 | CANADA - S. RAVERTY |
| Lung w/ Bronchus | | Whirl-pak | UAA | UAA - 80 #1 | DZ ARCHIVE | Aerobic culture; morbilli, herpes PCR | | 6/30/2014 | Athens Vet Diagnostic Lab |
| Muscle Epaxial | | Whirl-pak | UAA | UAA - 80 #1 | DZ | | | | |
| Muscle Epaxial | | Whirl-pak | UAA | UAA - 80 #1 | TOX | | | | |

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| Muscle Epaxial | | Whirlpak | UAA | | PARASIT | Protozoal PCR | | 8/19/2013 | Mike Grigg - CDC |
| Muscle Sterno | | Whirlpak | UAA | UAA - 80 #1 | DZ ARCHIVE | | | | |
| Muscle Sterno | | Whirlpak | UAA | | PARASIT | Protozoal PCR | | 8/19/2013 | Mike Grigg - CDC |
| OTHER | Found in throat | Tube | UAA | UAA - 80 #1 | DZ ARCHIVE | | | | |
| Pericardial Fluid | | Cryovial 5 ml | UAA | UAA - 80 #1 | HABs | | | | |
| Pericardial Fluid | | Cryovial 2 ml | UAA | UAA - 80 #1 | HABs | | | | |
| Pericardial Fluid | | Cryovial 5 ml | UAA | UAA - 80 #1 | HABs | HABs | | 6/18/2012 | NWFSC - E. FRAME |
| Skin | | Whirlpak | UAA | UAA - 80 #1 | | | | | |
| Skin | | Whirlpak | UAA | UAA - 80 #1 | GENETICS | | | 10/22/2012 | SWFSC |
| Spleen | Viral Media | Cryovial 2 ml | UAA | UAA - 80 #1 | DZ ARCHIVE | | | | |
| Spleen | dry swab | Cryovial 2 ml | UAA | UAA - 80 #1 | DZ ARCHIVE | | | | |
| Spleen | RNA Later | Cryovial 2 ml | UAA | UAA - 80 #1 | DZ ARCHIVE | | | | |
| Spleen | dry swab | Cryovial 2 ml | UAA | UAA - 80 #1 | DZ ARCHIVE | | | | |
| Spleen | RNA Later | Cryovial 2 ml | UAA | UAA - 80 #1 | DZ ARCHIVE | | | | |
| Spleen | Viral Media | Cryovial 2 ml | SHIPPED | UAA - 80 #1 | DZ ARCHIVE | Viral culture | | 8/19/2013 | CANADA - O. NIELSEN |
| Spleen | | Whirlpak | | | DZ ARCHIVE | morbillivirus PCR panel | | 8/19/2013 | CANADA - S. RAVERTY |
| Spleen | | Cryovial 2 ml | UAA | UAA - 80 #1 | DZ | aerobic | | 12/9/2013 | Athens Vet Diagnostic Lab |

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| Stomach | | | UAA | UAA - 80 #1 | PREY ANALYSIS | | | | MISSING |
| Stomach Contents | | Zip-loc | UAA | UAA - 80 #1 | LIFE HX | HABs; Split and send some to LQ | | 6/18/2012 | NWFSC - E. FRAME |
| Testes (ext) | | Whirl-pak | UAA | UAA - 80 #1 | DZ ARCHIVE | | | | DISCARD |
| Thymus | | Whirl-pak | UAA | UAA - 80 #1 | DZ ARCHIVE | | | | |
| Tongue | | Whirl-pak 18 oz | UAA | UAA - 80 #1 | DZ ARCHIVE | | | 5/21/2013 | UAF - Lara Horstmann-Dehn |
| Tonsil | | Whirl-pak 18 oz | UAA | UAA - 80 #1 | DZ ARCHIVE | | | | |
| Tonsil | RNA Later | Cryovial 2 ml | UAA | UAA - 80 #1 | DZ ARCHIVE | | | | |
| Tonsil | Viral Media | Cryovial 2 ml | UAA | UAA - 80 #1 | DZ ARCHIVE | Viral culture | | | CANADA - O. NIELSEN |
| Tonsil | Viral Media | Cryovial 2 ml | UAA | UAA - 80 #1 | DZ ARCHIVE | | | | |
| Tonsil | RNA Later | Cryovial 2 ml | UAA | UAA - 80 #1 | DZ ARCHIVE | | | | |
| Tonsil dry swab | | Cryovial 2 ml | UAA | UAA - 80 #1 | DZ ARCHIVE | | | | |
| Tonsil dry swab | | Cryovial 2 ml | UAA | UAA - 80 #1 | DZ ARCHIVE | | | | |
| Tonsil dry swab | | Cryovial 2 ml | UAA | UAA - 80 #1 | DZ ARCHIVE | | | | |
| Tonsil dry swab | | Cryovial 2 ml | UAA | UAA - 80 #1 | DZ ARCHIVE | | | | |
| Urine | | Cryovial 5 ml | UAA | UAA - 80 #1 | HABs | | | | |
| Urine | | Cryovial 2 ml | UAA | UAA - 80 #1 | HABs | | | | |
| Urine | | Cryovial 5 ml | UAA | UAA - 80 #1 | HABs | HABs | | 6/18/2012 | NWFSC - E. FRAME |

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| Whole Blood | | Cryovial 1 ml | UAA | UAA - 80 #1 | DZ ARCHIVE | aerobic culture | | | Athens Vet Diagnostic Lab |
| Whole Blood | | Cryovial 1 ml | UAA | UAA - 80 #1 | DZ ARCHIVE | | | | |
| Whole Blood | | Cryovial 1 ml | UAA | UAA - 80 #1 | DZ ARCHIVE | | | | |
| Whole Blood | | Cryovial 1 ml | UAA | UAA - 80 #1 | | | | | |