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## Appendix D. CT scan results

HARVARD MEDICAL SCHOOL  
DEPARTMENT OF OTOTOLOGY AND LARYNGOLOGY  
HEAD AND NECK IMAGING SERVICE  
MASSACHUSETTS EYE AND EAR INFIRMARY  
BOSTON, MASSACHUSETTS 02114



CT Imaging Report to NOAA Fisheries, NW Office, Seattle, Washington

Submitted to: Dr. Brent Norberg

Provided by: D.R. Ketten, Ph.D., Dir., Head and Neck Imaging Service, MEEI; Senior Scientist, WHOI

### NOTE:

This report is based on images provided by Center for Diagnostic Imaging (CDI), Mountlake Terrace, Washington, the scan facility contracted by NOAA Fisheries for imaging these cases, and for one case, by and auxiliary center, First Imaging Diagnostics (FID). Additional, multi-plane reformats, magnifications of basic scans, and 3D reconstructions were obtained through post-scan processing of the original image files on the Volume Zoom scanner at WHOI Ocean Imaging Center (WHOI OIC) in conjunction with the MEEI Head and Neck Imaging Service and the Harvard Medical School Dept. of Otology and Laryngology (MEEI/HMS).

The original image files produced by CDI and FID used conventional human bone and soft tissue protocols and windowing that provide good general images but are sub-optimal for some specialized odontocete cranial structures or for detection of inner ear abnormalities in marine mammals because of extreme tissue densities and differences in contiguous tissue suites. Consequently, reformats were performed in all cases in order to provide image sets that are consistent with both human UHR temporal bone and cranial exams as well as with preferential imaging protocols established by the WHOI facility to maximize the information that could be obtained from this scan series. Each series or set of scans consists of 30 to 70 images. Consequently for each animal, between 200 and 1000 images were reviewed.

Observations provided in the following report focus on cranial anatomy as the area of expertise for this service. Additional analyses are reported for post-cranial regions and organs in some cases but should not be considered to be a comprehensive analysis for those body regions. All observations are necessarily limited based on the original protocols employed as image files cannot be optimized retrospectively for any tissue. Scan numbers in this report refer to image position numbers in the original series for ease of reference in all cases.

Copies of images and the reports of results provided here may be distributed only with permission of this office. All data and images from the WHOI/HMS facility are to be treated with a level of confidentiality strictly consistent with the HIPAA guidelines.

These scans and related reports are confidential and should be retained by the requesting agency. Data and findings included in this report are confidential, proprietary and produced only for release to the requesting agency and participants of the official necropsy team. WHOI OIC reformatted images and reconstructions are

copyrighted and carry all conventional restrictions for use. Do not distribute this report or related images to third parties without first contacting this office for releases.

Raw scan data were retained by the original scan facility; images were distributed on CD formatted for auto-display. Reformatted high-resolution images produced by WHOI OIC were archived on CD and MO disks and are available in DICOM, tiff, or jpg formats. If additional images or projections are required for this case, please contact Dr. Ketten at the WHOI address listed at the end of the report.

re: P-pho79-03NWR05001

Species *Phocoena phocoena*

Imaging Analysis Requested by: B. Norberg, NOAA Fisheries

Scan date: 20 July 2003; reformats obtained August-November 2003

WHOI Scan technician(s): J. Arruda

Scan Analyses: D.R. Ketten

Report Dictation Date: Preliminary 23 July 2003; final 15 November 2003

#### Scan Parameters

Primary scans were obtained by Center for Diagnostic Imaging and formatted as a series of transaxial head and body images in both soft and bone windows using a spiral scan protocol. All primary scans were obtained with the body placed prone, rostrum first.

Nine primary image sets were provided by CDI. CDI primary scans were imaged with variable image slice thicknesses of 1-8 mm in bone and soft tissue protocols. The majority of scans were obtained at 120 kV/250 MA. At WHOI OIC, 10 reformatted sets were produced, comprising soft tissue and bony windows of the head and body with expanded views of the brain and ear in transaxial, sagittal and coronal planes to obtain detail from each ear region. Three-dimensional reconstructions were also produced of some head structures.

#### History

No details on the history of this animal were available at the time scans were reviewed.

#### General Observations

Cranial, thoracic, and abdominal images are provided. Bright signals that appear on the surface of the animal are likely to be sand or other similar material

#### Cranial Soft Tissues

All soft tissues of the head are in relatively poor condition with some separation of tissue layers and multiple air pockets ranging from minor to multiple cm. spaces consistent with dissection by gaseous decomposition of the tissues post-mortem.

Extensive external ridging on the transaxial images suggests there are superficial scrapes consistent with abrasions on the beach or scavenger damage.

The fatty layers on the right side of the head are noticeably degenerated.

The soft-walled nasal passages are poorly defined and collapsed.

Sinuses are normal with good pneumatization.

The melon has a relatively uniform attenuation, suggesting moderate decomposition although it retains a fundamentally fatty attenuation signature. There is one region of slightly increased attenuation near the core that is consistent with a small contusion but the degenerative quality of all tissues makes a definitive statement from attenuation impossible for this case.

#### Intracranial/Brain

All skull features are normal.

The brain is intact. There are extensive regions of extravasated blood in the skull base and basioccipital regions with minor poolings in the temporal areas. This conclusion is based on

HU readings of 27 to 40 and on the fluid, pooled appearance of the deposits. By contrast, fresh clotted blood would have a reading >60. There is no evidence of well demarcated hemorrhage or contusion within any brain region. Meningeal suspensory fibers and vessel tracks are intact and visible traversing the subarachnoid spaces.

There is little differentiation of the cortical layers in the soft tissue scans, suggesting moderate to severe autolysis.

The ventricles are poorly defined and likely reduced by freezing.

### **Eyes**

Both eyes are present. The left globe is collapsed. The lens is displaced ventrally in both eyes (IP 484.5-500.5). There is little differentiation of the external and internal regions of the globe bilaterally indicating that both eyes are compromised with the left in poorer condition than the right.

### **Ears**

#### **Peribullar region**

There is an extensive soft tissue mass in the left medial peribullar space that has irregular but well defined margins and attenuation values consistent with peribullar parasites. The retrobullar spaces have minor clotting bilaterally but are otherwise normal bilaterally with good pneumatization.

#### **Internal Auditory Canal (IAC)/Acousto-Vestibular/Facial Nerve**

The internal auditory canals are well defined. There is no evidence of blood or other abnormal material within either IAC. VIIIth and VIIth nerves are intact bilaterally and well defined.

#### **Middle Ear**

The middle ear cavities are normal with distinct middle ear air spaces bilaterally and a well-defined corpus cavernosum. All ossicles are intact and normally configured bilaterally. The round window is normal bilaterally. There is a small moderate density mass at the right round window consistent with a minor clot.

#### **Inner Ear**

The canals are symmetrical and normal in appearance. There is no evidence in these scans of abnormal intracochlear blood or other cochlear compromise, however, submillimeter images are required to confirm this observation.

### **Post-cranial Features**

Superficially, there are ridges on the ventral and lateral left surfaces suggestive of epidermal abrasions. Fatty tissues throughout the body are particularly poorly preserved.

Thoracic scans show both lungs are partially consolidated with the right lung more compromised than the left. Relatively rapid consolidation is consistent with post-mortem response in marine mammals. However, there are clear abnormalities suggestive of pneumonia and possibly an infectious congestive processes consistent with a premortem pathologic lung condition. It is recommended that lung tissues be examined histologically to determine the exact source of increased densities in this case.

Abnormal features include positive air bronchiogram signs that are consistent with segmental pneumonia in the superior and lateral lobes of the right lung. Exudate is visible in the right pleural space. There are extensive regions of consolidation paralleling the right bronchi and bronchioles. The right bronchial mucosa is thickened. This is particularly evident at the first division of the bronchi.

There are relatively few small, discrete, high density inclusions in both lungs. These are most evident in the right middle lobe (35-50) and are consistent with calcified, parasitic and cystic formations.

The abdominal scans show extensive air throughout the gut. There are multiple regions of disorganized tissue margins, suggesting that there is diffuse parenchymal degeneration in most organs.

### **Summary**

The scans suggest the animal is an adult in a moderate to poor state of preservation. Abnormal lung scans suggestive of pneumonia that is particularly evident in the right lung. Abdominal scans show a patent but unoccupied GI-tract and poor organ preservation. Cranial scans suggest broad post-mortem degenerative changes with poor preservation of most structures. The intracranial spaces have moderate to extensive areas of extravasated blood, consistent with post-mortem seepage and migration. There are no well-defined regions of hemorrhage, but the poor tissue quality makes any conclusion about pre-post mortem deposition difficult. The ears are essentially normal bilaterally. There is a small area in the mid-melon region that appears to be contused; the mandibular structures are largely autolyzed and poorly defined on the scans. Head musculature is intact but poorly preserved.

#### **Cause of Death**

Indeterminate: Cause of death cannot be determined from the scan-based information available to date.

#### **Additional Comments**

No additional comments or recommendations.

#### **Subject ID**

re: P-pho79-03NWR05003

Species *Phocoena phocoena*

Imaging Analysis Requested by: B. Norberg, NOAA Fisheries

Scan date: 20-23 July 2003 with reformats obtained August-November 2003

WHOI Scan technician(s): J. Arruda

Scan Analyses: D.R. Ketten

Report Dictation Date: 15 September, 2003

#### **Scan Parameters**

Primary scans were obtained by CDI and formatted as a series of transaxial head images in both soft and bone windows using a spiral scan protocol. All scans were obtained with head prone, rostrum first.

Raw attenuation data were retained by CDI. Image sets were transferred to NOAA Fisheries for analysis by copying onto CD with a WinPacs system. These image files were subsequently reformatted as needed into additional views at the WHOI OIC.

Two scout and four primary image sets plus magnified reformats were produced by CDI and WHOI, comprising soft tissue and bony windows of the head with variable spacings of 1-5 mm and expanded views of the brain and ear in transaxial, sagittal and coronal planes to obtain detail from each ear region. Three-dimensional reconstructions were also produced of some head structures.

#### **History**

No details on the history of this animal were available at the time scans were reviewed.

#### **General Observations**

Cranial images only are available. The head was decapitated at the occiput and is heavily flensed. It was scanned within wrappings. There is extensive dense material (HU 1000-1500) coating the head and filling the nares, suggesting that this animal was injected with contrast material or may have been soaked in some dense, high contrast fluid.

#### **Cranial Soft Tissues**

The majority of soft tissue was removed on the right and dorsal surfaces of the head from the posterior margin of the head forward to the level of the juncture of the nasal and premaxillary bones. All dermis, fats, and musculature are removed from this and the sublingual areas.

The right mandible is abraded, probably as a result of the flensing procedure. All remaining soft tissues of the head are in poor condition. The remaining left mandibular fats, like the

brain, show extensive areas of fissures and granular, crystalline regions that are indicative of freeze-thaw cycles that compromised the tissues. There are also extensive air pockets in the fatty tissues bilaterally. These are most pronounced in the right inner mandibular fats. As noted above, the narial passages are filled with high contrast material and cannot be assessed.

Sinuses are partially occluded with poor pneumatization. The left sinus has moderately dense material coating the medial wall.

#### **Intracranial/Brain**

The skull is intact except for the right parietal region which is disrupted and from which a section has been displaced penetrating the brain on the right. The shard is a 13.8X6.6X8 mm wedge of bone penetrating the right parietal and temporal lobes and lodged near the right lateral ventricle. The lack of tissue density changes in the area suggests this is a post mortem trauma.

The brain is intact but has a uniform, granular appearance that suggests it has extensive freezing artifact and has been subjected to several freeze-thaw cycles. Lobe structures are poorly defined. There is little differentiation of the cortical layers in the soft tissue scans, suggesting moderate to severe autolysis. The ventricles are poorly defined and likely reduced by freezing. Because of extensive degeneration, no useful assessment can be made of the premortem condition of the brain.

#### **Eyes**

The right eye is missing. The left is collapsed and there are extensive retro-ocular air pockets.

#### **Ears**

##### **Peribullar region**

The peribullar spaces are aerated and generally normal bilaterally for an animal in this poor preservation state.

##### **Internal Auditory Canal (IAC)/Acousto-Vestibular/Facial Nerve**

The internal auditory canals are normal. The VIIIth and VIIth nerves are intact bilaterally and well defined. Both appear smaller than average and are likely partially degenerated.

##### **Middle Ear**

The middle ear cavities have aerated middle ear air spaces bilaterally. The corpus cavernosum is present but retracted bilaterally. All ossicles are intact and normally configured bilaterally. The round window and oval windows are intact

##### **Inner Ear**

The canals are symmetrical and normal in appearance. There is no evidence in these scans of abnormal intracochlear blood or other cochlear compromise; however, the poor state of preservation makes conclusions about the health of these ears impossible.

#### **Post-cranial Features**

No post-cranial scans were provided.

#### **Summary**

The scans of this head suggest the animal was an adult in a poor state of preservation. The head is largely denuded with most of the soft tissues missing on the right. The residual tissues, particularly the fats and brain have granular, crystalline characters that are indicative of freeze-thaw changes compromising tissue quality. The right side of the skull is compromised and a portion of the parietal bone penetrates the brain.

There are broad post-mortem degenerative changes with poor preservation of most structures. The ears are essentially normal bilaterally. There are extensive areas on the surface of the head and in the narial passages that are consistent with high density sedimentary deposition or contrast agent injection.

**Cause of Death**

Indeterminate: Cause of death cannot be determined from the scan-based information available to date.

**Additional Comments**

No additional comments or recommendations.

re: P-pho79-03NWR05006

*Phocoena phocoena*

WHOI Case Number:

Imaging Analysis Requested by: B. Norberg, NOAA Fisheries

Scan date: 20-23 July 2003 with reformats obtained August-November 2003

WHOI Scan technician(s): J. Arruda

Scan Analyses: D.R. Ketten

Report Dictation Date: 15 September, 2003

**Scan Parameters**

Primary scans were obtained by Center for Diagnostic Imaging and formatted as a series of transaxial head and body images in both soft and bone windows using a spiral scan protocol. All primary scans were obtained in with the body placed prone, rostrum first.

Seven primary and two scout image sets were provided by CDI. CDI scans were imaged with variable image slice thicknesses of 1-8 mm in bone and soft tissue protocols. The majority of scans were obtained at 120 kV/250 MA. At WHOI OIC, 10 reformatted sets were produced, comprising soft tissue and bony windows of the head and body with expanded views of the brain and ear in transaxial, sagittal and coronal planes to obtain detail from each ear region. Three-dimensional reconstructions were also produced of some head structures.

**History**

No details on the history of this animal were available at the time scans were reviewed.

**General Observations**

Scans are provided for an intact animal. Cranial, thoracic, and abdominal images are provided. There are extensive regions over the entire animal of bright signals with irregular shapes that suggest it is heavily coated in sand or other similar substrate material.

**Cranial Soft Tissues**

All soft tissues are in relatively poor condition but the majority of tissue suites are intact. The head has extensive superficial and internal deposits of gravel, sediment, or sand. There are extensive patches of irregular surface ridging consistent with superficial abrasions, particularly along the left consistent with abrasions on the beach or scavenger damage.

The nares are filled with high density objects, likely gravel and debris, in the upper regions. The blubber appears to be in average to poor condition with mottled areas of variable densities, consistent with postmortem degeneration.

The right mandibular fats are well-defined considering the other head tissues. The left lateral fats show mid-low density regions consistent with diffuse or mild contusions or extravasated blood. These areas underlie the abraded areas

**Intracranial/Brain**

All skull features are normal.

The brain is intact but tissue layers are not well-defined. There are extensive regions of extravasated blood in the subarachnoid and subdural regions but the divisions are poorly defined and therefore precise distributions cannot be given. There is little differentiation of



the cortical grey vs. white matter layers in the soft tissue scans, suggesting moderate to severe autolysis.

#### **Eyes**

Both eyes are present. The left globe is collapsed and the lens is missing. The lens is displaced ventrally in the right eye.

#### **Ears**

##### **Right ear**

There is an extensive soft tissue mass in the right dorsal retrobullar space that has irregular attenuation values of 50-60, consistent with an organized clot. The suspensory ligaments are intact.

The internal auditory canal is well defined. There is no evidence of blood or other abnormal material within the IAC. VIIIth and VIIth nerves are intact and well defined. .

The middle ear cavity is normal with distinct middle ear air spaces and a well-defined corpus cavernosum. All ossicles are intact and normally configured (see IP 168-175). The round window is normal. There is a small moderate density reading intracochlear at the right round window consistent with a minor blood deposit. .

##### **Left Ear**

The left peri and retrobullar spaces are well aerated and normal in appearance. There is no evidence of extensive parasitism or other compromised regions. The left tympanic bone has a moderately low density for this species and is possibly partially demineralized.

The internal auditory canal is well defined. There is no evidence of blood or other abnormal material within the IAC. VIIIth and VIIth nerves are intact and well defined. .

The middle ear cavity is normal with distinct middle ear air spaces and a well-defined corpus cavernosum. All ossicles are intact and normally configured (see IP 168-175). The round and oval windows are normal.

#### **Post-cranial Features**

Superficially, there are extensive abrasions across most of the body, with large deposits of sediment, including invasion of the rectum. The ventral surface has extensive cuts as does the left side of the body.

Thoracic scans show both lungs are consolidated with the right lateral lung more compromised than the left.

There are substantial numbers (50-100) of small,, high density inclusions in both lungs. These are most evident in the anterior or apical lobe and are consistent with calcified, parasitic and cystic nodules. The right bronchus and trachea have distinct deposits of foamy material that is likely to represent sero-sanguinous material.

The abdominal scans show extensive air throughout the intestine. The colon is poorly preserved. The liver is degraded.

#### **Summary**

The scans suggest the animal is an adult in a moderate to poor state of preservation. Thoracic scans show the right lung with moderate to extensive areas of consolidation. Both lungs have high density nodules suggestive of parasitic or other chronic infections. The right lung is more compromised than the left, with fluid and foamy deposits in the airways. Abdominal scans show a patent but unoccupied GI-tract and poor organ preservation.

Cranial scans suggest broad post-mortem degenerative changes with poor preservation of most structures. The intracranial spaces have moderate to extensive areas of extravasated blood, consistent with post-mortem seepage and migration. There are no well-defined regions of hemorrhage, but the poor tissue quality makes any conclusion about pre-post mortem deposition difficult. The ears are essentially normal bilaterally but poorly preserved.

#### **Cause of Death**

Indeterminate: Cause of death cannot be determined from the scan-based information available to date.

**Additional Comments**

No additional comments or recommendations.

**Subject ID**

re: P-pho79-03NWR05007

Species *Phocoena phocoena*

Imaging Analysis Requested by: B. Norberg, NOAA Fisheries

Scan date: 20-23 July 2003 with reformats obtained August-November 2003

WHOI Scan technician(s): J. Arruda

Scan Analyses: D.R. Ketten

Report Dictation Date: 17 September, 2003

**Scan Parameters**

Primary scans were obtained by Center for Diagnostic Imaging and formatted as a series of transaxial head and body images in both soft and bone windows using a spiral scan protocol. All primary scans were obtained in with the body placed prone, rostrum first. Nine primary and two scout image sets were provided by CDI. CDI primary scans were imaged with variable image slice thicknesses of 1-8 mm in bone and soft tissue protocols. The majority of scans were obtained at 120 kV/260 MA. At WHOI OIC, 10 reformatted sets were produced, comprising soft tissue and bony windows of the head and body with expanded views of the brain and ear in transaxial, sagittal and coronal planes to obtain detail from each ear region. Three-dimensional reconstructions were also produced of some head structures.

**History**

No details on the history of this animal were available at the time scans were reviewed.

**General Observations**

Cranial, thoracic and abdominal images were provided.

**Cranial Soft Tissues**

All tissues are in moderate to poor condition with the notation that some blubber areas show evidence of very poor condition with separation of tissue layers and extensive air inclusions that are particularly evident at the blubber and muscular interface. This suggests dissection by gaseous decomposition of the tissues

The nares and oral cavity are filled with high density material that is likely to be sand or sediment. The throat region has intramuscular inclusions that are less dense which may be either partially calcified parasitic cysts or lower density sediments that migrated into the subcutaneous areas post mortem.

Both sinus areas are partially opacified with the right being more compromised than the left and containing some relatively high density material.

**Intracranial/Brain**

All skull features are normal.

The brain is intact with moderate preservation. The soft tissue images show distinctive arborification of the sublayers within the cerebral hemispheres. The insulae are not well defined but they are detectable as are most of the grey and white matter interfaces.

The ventricles are reduced or collapsed but are consistent with normal post-mortem appearance in this species. The cerebellum and mid-brain are intact with normal appearance. There is a complexly shaped, mid to low density structure in the subtemporal region (IP -216 to -220) with HU values ranging -17 to 44. These readings are consistent with pooled extravasated blood but are somewhat lower than an organized clot.

**Eyes**

The left globe is enucleated and the ocular cavity is filled with fluid and clotting. The right eye is present but has intra-globular air.

#### **Ears**

##### **Peribullar region**

The peribullar areas are clear and well aerated bilaterally with well-defined suspensory ligaments. Scan IP -226.949 shows a diffuse mid-density region with HU values of 54-84, consistent with a minor clot or contused muscle and fats.

##### **Internal Auditory Canal (IAC)/Acousto-Vestibular/Facial Nerve**

There is no indication of blood or other abnormal material within either IAC. VIIIth and VIIth nerves are intact bilaterally but poorly defined in some sections suggesting there is tissue degeneration.

##### **Middle Ear**

The middle ear cavities are normal with distinct middle ear air spaces bilaterally and a well-defined corpus cavernosum. All ossicles are intact and normally configured bilaterally. The round window is normal bilaterally.

##### **Inner Ear**

The canals are symmetrical and normal in appearance. The internal auditory canals are well defined. There are minor mid attenuation deposits in the inner ears bilaterally that suggest intracochlear blood in part of the canals (IP -254.449 and -216.949), however, only 1.2 mm scans are available and submillimeter images are required to confirm this observation.

#### **Post-cranial Features**

Fatty tissues throughout the body are particularly poorly preserved. The blubber at the thoracic level particularly shows extensive fissuring suggestive of post-mortem autolytic breakdown of the tissues. These effects are more profound and extensive on the left than right sides.

Thoracic scans show both lungs are partially consolidated with the right lung considerably more extensively affected than the left and with the apices and middle lobes bilaterally having the greatest areas of apparent congestion. Both lungs also have multiple high density nodules or calcified cysts.

The abdominal scans show extensive air throughout the intestine. The colon is normal in appearance and contains compacted feces.

#### **Summary**

The scans suggest the animal is an adult in a moderate to poor state of preservation. Abnormal lung scans are not definitive for premortem disease; histologic evaluation may be useful. Abdominal scans show a patent but largely unoccupied GI-tract although some waste products are evident in the most posterior segments..

Cranial scans suggest moderate post-mortem degenerative changes. The brain and intracranial spaces are normal with one relatively defined area of possible extravasated blood in the basioccipital and subtemporal areas. The ears are normal bilaterally with some intracochlear regions of increased density that may represent intracochlear blood. The peribullar and middle ear spaces are normal. The cranial sinuses are abnormal with distention of the mucosa and some foreign material.

#### **Cause of Death**

Indeterminate: Cause of death cannot be determined from the scan-based information available to date.

#### **Additional Comments**

No additional comments or recommendations.

#### **Subject ID**

re: P-pho79-03NWR05008

**Species** *Phocoena phocoena*

**Imaging Analysis Requested by:** B. Norberg, NOAA Fisheries

**Scan date:** 20-23 July 2003 with reformats obtained August-November 2003

**WHOI Scan technician(s):** J. Arruda

**Scan Analyses:** D.R. Ketten

**Report Dictation Date:** 17 September, 2003

#### **Scan Parameters**

Primary scans were obtained by Center for Diagnostic Imaging and formatted as a series of transaxial head images in both soft and bone windows using a spiral scan protocol. All primary scans were obtained in with the body placed prone, rostrum first.

Four primary and two scout image sets were provided by CDI. CDI primary scans were imaged with variable image slice thicknesses of 1-8 mm in bone and soft tissue protocols. The majority of scans were obtained at 120 kV/260 MA. At WHOI OIC, 10 reformatted sets were produced, comprising soft tissue and bony windows of the head with expanded views of the brain and ear in transaxial, sagittal and coronal planes to obtain detail from each ear region. Three-dimensional reconstructions were also produced of some head structures.

#### **History**

No details on the history of this animal were available at the time scans were reviewed.

#### **General Observations**

Cranial images only were provided. The head was decapitated at the level of the occipital bone and is partially flensed in the posterior areas. There are multiple and diffuse areas of mid-range readings suggesting pockets of degenerated tissues, and air pockets are common at the fat and muscle interfaces. Large deposits of high density material are evident in the airways and esophagus.

#### **Cranial Soft Tissues**

All soft tissues of the head are present with the exception of the most posterior sections. There is some increased mass effect anterior to the frontals consistent with high density, mixed material filling the nares and particularly the left sacs (HU ~1300). There is a granular appearance to virtually all tissues as well as multiple areas of poor preservation. The melon is unremarkable.

The nares and oral cavity are filled with high density material that is likely to be sand or sediment.

#### **Intracranial/Brain**

All skull features are normal.

The brain is intact but is otherwise unremarkable. The relatively uniform appearance suggest that it is poorly preserved.

#### **Eyes**

The left eye is intact but has an air pocket within the globe located in the superior posterior quadrant. The right eye is present with the lens displaced ventrally.

#### **Ears**

##### **Peribullar region**

The peribullar areas are generally clear and well aerated bilaterally with well-defined suspensory ligaments. There is a substantial, well-defined mass of tissue medial to the left tympano-periotic bone (IP-262.5) and a similar but smaller mass on the right (IP -227.5). HU values (ranges of -4.67 to -10) are most consistent with bundled parasites

##### **Internal Auditory Canal (IAC)/Acousto-Vestibular/Facial Nerve**

The IAC. VIIIth and VIIth nerves, and retrobullar areas are normal and unremarkable bilaterally. (See IP -229 to -235).

##### **Middle Ear**

The middle ear cavities are normal bilaterally with clearly delineated middle ear air spaces and a well-defined corpus cavernosum. All ossicles are intact and normally configured bilaterally. The round and oval windows are normal bilaterally.

#### **Inner Ear**

The canals are symmetrical and normal in appearance. The intracochlear attenuations are consistent with normal cochlear fluids.

#### **Post-cranial Features**

No postcranial scans were provided.

#### **Summary**

The scans suggest the animal is an adult in a poor state of preservation. Foreign material is evident on the surface and within the airways and esophagus. The brain, melon, skull, and ears are basically normal for an animal in this state of preservation.

#### **Cause of Death**

Indeterminate: Cause of death cannot be determined from the scan-based information available to date.

#### **Additional Comments**

No additional comments or recommendations.

#### **Subject ID**

re: P-pho79-03NWR05011

Species *Phocoena phocoena*

Imaging Analysis Requested by: B. Norberg, NOAA Fisheries

Scan date: 20-23 July 2003 with reformats obtained August-November 2003

WHOI Scan technician(s): J. Arruda

Scan Analyses: D.R. Ketten

Report Dictation Date: 17 September, 2003

#### **Scan Parameters**

Primary scans were obtained by Center for Diagnostic Imaging and formatted as a series of transaxial head and body images in both soft and bone windows using a spiral scan protocol. All primary scans were obtained in with the body placed prone, rostrum first.

Eleven primary and two scout image sets were provided by CDI. CDI primary scans were imaged with variable image slice thicknesses of 1-8 mm in bone and soft tissue protocols. The majority of scans were obtained at 120 kV/260 MA. At WHOI OIC, 10 reformatted sets were produced, comprising soft tissue and bony windows of the head with expanded views of the brain and ear in transaxial, sagittal and coronal planes to obtain detail from each ear region. Three-dimensional reconstructions were also produced of some head structures.

#### **History**

No details on the history of this animal were available at the time scans were reviewed.

#### **General Observations**

The animal is in generally poor condition but most remarkably has extensive trauma evident, particularly on the surface and within the head.

#### **Cranial Soft Tissues**

All soft tissues of the head are present. There are multiple areas of abrasion with the most compromised areas rostral. Large patches of the epidermis are clearly missing. Sand or similar material (HU>800) is present throughout much of the head and is particularly copious in the left superior nasal sac. There are extensive areas of contusion consistent with the cranial traumas described below.

**Intracranial/Brain**

The entire skull is severely compromised by multiple fractures, including longitudinal and comminuted fractures of the skull base, right occipital, left temporal, left parietal, left squamosal, frontal and left mandibular bones, with multiple skull elements displaced. (see IP -199.9 to -184.0 plus attached 3D reconstruction.)

The left mandible has 2 longitudinal fractures, 3 parallel fractures and one laterally displaced chip (see IP -197.4 to -179.9)

The brain is essentially homogenous and likely to be severely compromised as a result of the traumas evident in the fractures noted above..

**Eyes**

Both eyes are present but deflated.

**Ears****Right ear**

The right peribullar areas are generally clear and well aerated with well-defined suspensory ligaments. All middle ear structures appear essentially normal. The inner ear contains blood in the apical and middle turns.

**Left ear**

The left inner ear contains blood in the apical and middle turns. The peribullar space. Contains two notable tissue masses: one is an organized clot; the other is a mass medial to the left tympano-periotic bone with a similar mass within the middle ear cavity. There are multiple, small, dense spheroids within these soft tissue masses that are likely to be calcified parasitic bodies. (IP -109.7 to -188.2). There is also a tympanic bone fracture evident on the left lateral wall (IP -213.2)

**Post-cranial Features**

There is extensive air throughout the gastro-intestinal system. Scans at IP -815.6 to -845.6 show ventral left contusions and possible hemorrhagic areas. The internal organs are partially autolyzed with distinctive granulated appearance notable in the liver that is consistent with cyclic freeze-thaw artifacts.

The lungs are consolidated with patent airways. An ice block is evident in the rt bronchus (IP 1125.6) and trachea (1155.6). The right lung shows slightly more extensive consolidation than the left. There are several dense foci within the trachea that are likely to be sand or parasitic inclusions.

**Summary**

The scans suggest the animal is an adult in a moderate to poor state of preservation. The most significant findings are the extensive fractures compromising the brain case and jaws of this animal. The intracochlear blood and left ear clots are consistent with the fractures and with broad, direct, high impact blunt trauma with most extensive damage to the left jaw and left cranium. The fracture pattern suggests an oblique, slightly dorsal impact. However, determination of direction and point of impact can be better determined by examination and comparison of the fracture field with soft tissue damage patterns of the entire head.

**Cause of Death**

Indeterminate: Cause of death cannot be determined from the scan-based information available to date, however, if correlative evidence is found on dissection that indicates the fractures were pre or peri-mortem they are consistent with a blunt trauma incident that was sufficient to kill the animal virtually immediately.

**Additional Comments**

No additional comments or recommendations.

**Subject ID**

re: P-pho79-03NWR05012

Species *Phocoena phocoena*

Imaging Analysis Requested by: B. Norberg, NOAA Fisheries

Scan date: 20-23 July 2003 with reformats obtained August-November 2003

WHOI Scan technician(s): J. Arruda

Scan Analyses: D.R. Ketten

Report Dictation Date: 19 September, 2003

**Scan Parameters**

Primary scans were obtained by Center for Diagnostic Imaging and formatted as a series of transaxial head and body images in both soft and bone windows using a spiral scan protocol.

All primary scans were obtained in with the body placed prone, rostrum first.

Five primary and two scout image sets were provided by CDI. CDI primary scans were imaged with variable image slice thicknesses of 1-8 mm in bone and soft tissue protocols.

The majority of scans were obtained at 120 kV/260 MA. At WHOI OIC, 10 reformatted sets were produced, comprising soft tissue and bony windows of the head with expanded views of the brain and ear in transaxial, sagittal and coronal planes to obtain detail from each ear region. Three-dimensional reconstructions were also produced of some head structures.

**History**

No details on the history of this animal were available at the time scans were reviewed.

**General Observations**

The animal is in moderate to poor condition. Based on its size, relatively low skull mineralization and incompletely ossified cranial sutures, it is a young juvenile..

**Cranial Soft Tissues**

The head is intact with generally normal soft tissue configurations. The majority of the airways and associated spaces are compromised by fluid and foam deposits. The left sinus is opacified and contains both fluid and foam. The cranial musculature appears normal. The blubber layer is well defined but thin.

**Intracranial/Brain**

The cranium has a relatively low density and the sutures are poorly ossified, consistent with an immature animal. All neural apertures are larger than normal in an adult. The most remarkable feature is a complex mass bilaterally juxtaposed to the subtemporal entry points of the VIIth and VIIIth nerves (IP -213.759). The masses are irregularly shaped with involuted and elevated margins, and the HU values range from 0-40. In combination with the complex shape, these values are most consistent with a mixture of fats and blood and represent either multiple clots or degenerated parasitic bundles. Considering the proximity of the ears and the presence of parasites in the ear regions adjacent to these spaces, the latter is the most likely case.

**Eyes**

The right eye is normal. The left eye is collapsed with an associated, well-organized orbital clot .

**Ears****Right ear**

The right peribullar areas are generally normal with some moderate density masses in the medial peribullar region and middle ear. The peribullar spaces are otherwise well aerated with well-defined suspensory ligaments. All middle ear structures are intact and normal although there are large soft tissue masses suggestive of nematode infestations common to this species. The inner ear is normal with no evidence of blood or other intracochlear abnormalities.

### **Left ear**

The left peribullar areas, like the right, are generally normal with moderate density masses in the medial peribullar region and middle ear. The middle ear structures are intact and normal. The soft tissue masses are more extensive in the left ear. The inner ear is normal with no evidence of blood or other intracochlear abnormalities.

### **Post-cranial Features**

There is extensive air throughout the gastro-intestinal system. The intestinal loops are well defined on even the lateral scout images, suggesting well preserved intestinal structure. Both lungs are consolidated with the right lung more extensively compromised at all levels compared to the left. The trachea contains mid to low attenuation soft tissue deposit (HU-45.6) with an inconsistent appearance suggesting that it is mixture of foamy, sero-sanguinous material. This material extends from the larynx to the mid trachea.

### **Summary**

The scans suggest the animal is a juvenile in a moderate to poor state of preservation. The most significant findings are intra-tracheal fluid, lung consolidation, and extensive peribullar parasitic masses that extend intracranially. Extravasated pooled blood is associated with the parasitic masses. Intracranial invasion was likely possible because of the exceptionally large aperture for the VIIth and VIIIth nerves and the relatively low density of the cranium. The cranial sutures are also incomplete, which is, again suggestive of a young and possibly poorly nourished animal. All other structures are essentially normal.

### **Cause of Death**

Indeterminate: Cause of death cannot be determined from the scan-based information available. .

### **Additional Comments**

No additional comments or recommendations.

### **Subject ID**

re: P-pho79-03NWR06005

Species *Phocoena phocoena*

Imaging Analysis Requested by: B. Norberg, NOAA Fisheries

Scan date: 20-23 July 2003 with reformats obtained August-November 2003

WHOI Scan technician(s): J. Arruda

Scan Analyses: D.R. Ketten

Report Dictation Date: 19 September, 2003

### **Scan Parameters**

Primary scans were obtained by Center for Diagnostic Imaging and formatted as a series of transaxial head and body images in both soft and bone windows using a spiral scan protocol. All primary scans were obtained in with the body placed prone, rostrum first. Eleven primary and five scout image sets were provided by CDI. CDI primary scans were imaged with variable image slice thicknesses of 1-8 mm in bone and soft tissue protocols. The majority of scans were obtained at 120 kV/260 MA. At WHOI OIC, 10 reformatted sets were produced, comprising soft tissue and bony windows of the head with expanded views of the brain and ear in transaxial, sagittal and coronal planes to obtain detail from each ear region. Three-dimensional reconstructions were also produced of some head structures.

### **History**

No details on the history of this animal were available at the time scans were reviewed.

### **General Observations**



The animal is in moderate to poor condition. It is a rather typical adult animal with one notable feature: there are extensive, filiform, calcified parasites throughout the entire body. .

### **Cranial Soft Tissues**

The head is intact with generally normal soft tissue configurations. On the left side there is a convoluted, calcified nematode track that extends nearly 120 mm (see accompanying 3D image) There are also numerous fibrotic or heavily calcified nodules found in virtually every major tissue suite in the head, including the ventral, sublingual musculature, the right sphenoid sinus, and the musculature proximal to the melon and maxillary bones. There are substantial cystic deposits in the peri-esophageal tissues as well. This is an exceptional parasitic burden, even for this species of odontocete, in which parasites are fairly common. .

### **Intracranial/Brain**

The cranial structures are unremarkable. The brain is intact with moderately defined structure. There is no evidence of hemorrhage or pooled fluids.

### **Eyes**

Both eyes are intact with evidence of periocular clots.

### **Ears**

As with the other head structures, there is evidence of extensive parasitic infiltration of the peribullar and middle ear tissues bilaterally. Both ears have extensive masses in the retrobullar spaces and, somewhat unusually, there are substantial calcified inclusions associated with these masses (see IP -20791; soft tissue HU 17.99; calcified spheroid HU 170-200). The medial wall of the left ear retrobullar space has a distended epithelium that may be evidence of active inflammation. The inner ear anatomies are normal bilaterally.

### **Post-cranial Features**

There are some minor freeze fractures evident in the flippers and flukes and superficial abrasions. .Most organs are intact and generally normal in appearance with the notation that as in the head structures, the most remarkable features post cranially are extensive calcified parasitic tracks affecting most tissues. There are long, convoluted, calcified threads, several mm. in diameter distributed throughout the blubber and musculature of the abdomen. One notable bundle parallels the ventral surface of the penis and plunges into the blubber –muscle interface.

The kidneys are well-defined but have fibrotic masses near the midline. (IP -663.140). Intestines are inflated but intact. There is a relatively dense signal from diffuse material in the stomach.

The lungs have extensive clouding bilaterally that parallels the bronchial tree, but there is not uniform consolidation, suggesting better postmortem lung preservation than in most of the animals examined. The clouding is more apparent and extensive in the left lung (IP-448.14). The right lung (IP -408.14) has an accumulation of foamy exudate and some pooled fluid that extends into the larynx. The right lung also shows evidence of mass lesions in the right lingual and right middle lobe dorsal to the right bronchus. Both the right and left lung have spotty opacified regions throughout. The heart has a moderate density mass associated with the right ventricle.

There

### **Summary**

The scans suggest the animal is an adult in a moderate state of preservation. The most significant findings are extensive calcified parasites present throughout the body. Most major organs appear compromised or are likely to be secondarily stressed by the exceptional parasitic burden of this animal. Further, based on the extent of calcified inclusions, this is a long-standing pathology. There are multiple, extensive, calcified parasitic strands that are primarily found at the blubber and muscle interfaces. The ears are similarly infested with soft and calcified inclusions. The kidneys, gall bladder and heart have minor mass effects but

these may be within normal limits of this species. With the exception of those notations, the principal organs are otherwise essentially normal in appearance on these scans.

**Cause of Death**

Indeterminate: Cause of death cannot be determined from the scan-based information available. .

**Additional Comments**

No additional comments or recommendations.

Respectfully submitted,



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**Appendix E. Phocoenid strandings in British Columbia, Canada (April – May 2003).**

<b>Date of Initial Observation</b>	<b>Location</b>	<b>Case Number</b>	<b>Species</b>	<b>Gender</b>	<b>Comments</b>
4/22/2003	Clover Point	2767	Harbor porpoise	M	head and limbs amputated; NSF
4/29/2003	Willow Beach	2768	Dall's porpoise	M	cryptococcosis
5/1/03	Esquimalt, Vancouver Island, BC	2769	Harbor porpoise	M	fetus, marked meconium aspiration
5/2/03	Seabird Point, Discovery Island, BC	03NWR05032	Harbor porpoise	U	not collected
5/21/03	Bamfield, Vancouver Island, BC	2770	Dall's porpoise	F	cryptococcosis

**Appendix F.** List of harbor porpoise (*Phocoena phocoena*) stranding events in Washington State 1992-2002.

Initial Date	City	State	Field ID Number	Number of Animals	Sex	Length (cm)	Examiner
5/14/1992	La Push	WA	RCF282	1	M	89	National Marine Mammal Lab (NMML)
5/26/1992	Neah Bay	WA	RCF 284	2	M	133	NMML
7/5/1992	Long Beach	WA	HP92-07-05	1	M	75*	Marine Animal Resource Center (MARC)
8/22/1992	La Conner	WA	HP92-08-22	1	M	136	MARC
10/4/1992	Long Beach peninsula	WA	RLH 005	1	M	155	NMML
10/4/1992	Long Beach peninsula	WA	RLH 013	1	M	147	NMML
10/4/1992	Long Beach peninsula	WA	KMM 043	1	M	144	NMML
10/4/1992	Long Beach peninsula	WA	KMM 049	1	M	152	NMML
10/9/1992	Long Beach peninsula	WA	JCC 002	1	M	144	NMML
10/23/1992	Squaxin Island	WA	JCC-004	1	M		Public
1/30/1993	Belfair	WA	HP93-01-30	1	M	181	MARC
2/14/1993	Moclips	WA	MARC93-022	1	U	120*	MARC
4/5/1993	San Juan Island	WA	PJG-126	1	M	153	NMML
5/2/1993	Lopez Island	WA		1	M	130*	Whale Museum
5/21/1993	Port Angeles	WA	SDO-93-010	1	M	133	NMML

\* - estimated length

**Appendix F.** List of harbor porpoise (*Phocoena phocoena*) stranding events in Washington State 1992-2002.

Initial Date	City	State	Field ID Number	Number of Animals	Sex	Length (cm)	Examiner
6/17/1993	Ocean Shores	WA		1	U	120*	Public
8/21/1993	Brown Island	WA	PJG-130	1	U	105*	NMML
9/22/1993	Tacoma	WA	MARC93-279	1	F	94*	MARC
5/2/1994	San Juan Island	WA		1	M	125	Whale Museum
7/25/1994	San Juan Island	WA	SJ078-94	1	F	80	Whale Museum
8/1/1994	San Juan Island	WA	SJ099-94	1	U		Whale Museum
8/3/1994	Lopez Island	WA	SJ100-94	1	F		Whale Museum
4/17/1995	Orcas Island	WA	SJ-002-95	1	M	135	Whale Museum
4/19/1995	Lopez Island	WA	SJ003-95	2	F	178	Whale Museum
8/20/1995	Orcas Island	WA	SJ045-95	1	F	75	Whale Museum
10/24/1995	San Juan Island	WA	SJ066-95	1	F	107.5	Whale Museum
10/29/1995	San Juan Island	WA	SJ067-95	1	U	92.5	Whale Museum
5/11/1997	San Juan Island	WA	SJ017-97	1	U	135*	Whale Museum
9/14/1997	San Juan Island	WA	SJ096-97	1	U	135*	Public
4/8/1998	Anacortes	WA		1	M	127	NMML
4/30/1998	Shaw Is.	WA		1	U	0	Public
7/17/1998	Waldron Island	WA		1	U	50*	U.S. Coast Guard
8/8/1998	San Juan Island	WA	1998-SJ015	1	F	90*	Whale Museum
11/22/1998	San Juan Island	WA		1	F	177.5*	Whale Museum
3/11/1999	Pt. Roberts	WA	MBHPp99001	1	M	44*	Public
5/21/1999	Friday Harbor	WA	1999-SJ005	1	M	152	Whale Museum

\* - estimated length

**Appendix F.** List of harbor porpoise (*Phocoena phocoena*) stranding events in Washington State 1992-2002.

Initial Date	City	State	Field ID Number	Number of Animals	Sex	Length (cm)	Examiner
1/29/2000	San Juan Island	WA	2000SJ001	1	F	140*	Whale Museum
3/17/2000	Ocean Shores	WA	MMP00-10	1	F	176	Washington Department of Fish and Wildlife
3/29/2000	Lopez Island	WA	2000-SJ017	1	U	107.5	Whale Museum
4/14/2000	San Juan Island	WA	2000SJ007	1	U		Public
8/12/2000	Rialto Beach	WA	MBHPp20001	1	M	116	Park Ranger
8/29/2000	Bellingham	WA		1	F	143	NMFS Enforcement
1/7/2001	Port Angeles	WA	Dng-01-002	1	M	155	National Marine Fisheries Service (NMFS)
4/27/2001	Strait of Juan de Fuca	WA	001-01	1	F	132.5	M. Klope
5/2/2001	Lopez Island	WA	2001-SJ002	1	F	142.5	Whale Museum
5/2/2001	Port Townsend	WA		1	U	120*	NMML
5/3/2001	San Juan Island	WA	2001-SJ003	1	F	130	Whale Museum
5/10/2001	San Juan Island	WA	2001-SJ004	1	F	135*	Whale Museum
5/13/2001	Sequim	WA	Dng-01-004	1	F	1010	NMML
5/17/2001	Port Angeles	WA		1	M	135	NMML
5/26/2001	San Juan Island	WA	2001-SJ005	1	U		Whale Museum
7/9/2001	Mountain View	WA		1	U	135*	NMFS Enforcement
7/12/2001	Ocean Shores	WA	CRC - 478	1	M	85	Cascadia Research
7/31/2001	San Juan Island	WA	2001-SJ041	1	F	155	Whale Museum

\* - estimated length

**Appendix F.** List of harbor porpoise (*Phocoena phocoena*) stranding events in Washington State 1992-2002.

Initial Date	City	State	Field ID Number	Number of Animals	Sex	Length (cm)	Examiner
8/16/2001	Port Townsend	WA		1	U	75*	Olympic Coast National Marine Sanctuary (OCNMS)
12/25/2001	Orcas Island	WA	2001-SI059	1	M	117.5	Whale Museum
12/27/2001	Shaw Island	WA	2001-SI060	1	M	132	Whale Museum
1/15/2002	Whidbey Island	WA	001-02	1	U		M. Klope
3/12/2002	Port Angeles	WA		1	M	130	OCNMS
4/27/2002	Samish Island	WA		1	M	128	NMML
5/15/2002	San Juan Island	WA	2002-SI004	1	F	165	Whale Museum
5/30/2002	Lopez Island	WA	2002-SI033	1	M	146	Whale Museum
6/15/2002	Lopez Island	WA	2002-SI006	1	M	162.5	Whale Museum
6/16/2002	Crescent Bay	WA		1	M	132.5	Public
8/6/2002	Shaw Island	WA	2002-SI025	1	U	97.5*	Whale Museum
8/25/2002	Point Roberts	WA	01/03278	1	F	172	S. Raverty

\* - estimated length

**Appendix G.** Marine mammal stranding events reported in Washington State (April – June 2003).

Initial Date	Species	Number Animals	City	State	Field ID Number	Registration Number	Sex	Length (cm)	Examiner
4/2/2003	HARBOR SEAL	1	Belfair	WA	03-MA-009	03NWR04001	U	N/E	Public
4/8/2003	HARBOR SEAL	1	Bainbridge Island	WA	03-KP-010	03NWR04002	U	122	Public
4/11/2003	HARBOR SEAL	1	Vashon Island	WA	03-KG-012	03NWR04004	U	152	Public
4/14/2003	HARBOR SEAL	1	Kingston	WA	03-KP-011	03NWR04003	U	91	Public
4/14/2003	HARBOR SEAL	1	San Juan Island	WA	2003-SJ004	03NWR04007	U	N/E	Whale Museum
4/16/2003	UNSPECIFIED SEA LION	1	Ocean Park	WA	03-PA-014	03NWR04008	M	198	Public
4/16/2003	HARBOR SEAL	1	San Juan Island	WA	2003-SJ097	03NWR04020	F	168	Whale Museum
4/19/2003	HARBOR PORPOISE	1	South Sand Point	WA	03-CM-015	03NWR04009	U	N/E	National Park Service
4/21/2003	UNSPECIFIED SEA LION	1	County Line Park	WA	03-WA-013	03NWR04006	U	N/E	Public
4/23/2003	CALIFORNIA SEA LION	1	Sucia Island	WA	2003-SJ005	03NWR04010	M	N/E	Whale Museum
4/26/2003	HARBOR SEAL	2	Ocean Shores	WA	03-GH-016	03NWR04011	F	122	Public
5/2/2003	HARBOR PORPOISE	1	Shaw Island	WA	2003-SJ006	03NWR05001	F	136	Whale Museum
5/3/2003	CALIFORNIA SEA LION	1	Whidbey Island	WA	WIC050503SD	03NWR05002	M	236	WSU/Island County Beachwatchers
5/4/2003	HARBOR PORPOISE	1	Sequim	WA	DNG-03-002	03NWR05003	F	200	USFWS
5/4/2003	HARBOR PORPOISE	1	Sequim	WA	DNG-03-003	03NWR05004	U	84	USFWS
5/4/2003	HARBOR PORPOISE	1	San Juan Island	WA	2003-SJ007	03NWR05005	F	126	Whale Museum
5/5/2003	HARBOR PORPOISE	1	San Juan Island	WA	2003-SJ008	03NWR05006	F	152	Whale Museum
5/6/2003	HARBOR PORPOISE	1	Sequim	WA	DNG-03-001	03NWR05007	F	146	USFWS
5/9/2003	HARBOR PORPOISE	1	Port Angeles	WA	OCNMS03Pp01	03NWR05008	M	146	Olympic Coast National Marine Sanctuary
5/11/2003	UNSPECIFIED SEA LION	1	Point No Point	WA	03-KP-017	03NWR05009	U	N/E	Public
5/12/2003	HARBOR PORPOISE	1	Ocean City	WA	03-GH-159	03NWR05034	U	N/E	Cascadia Research Collective
5/12/2003	HARBOR PORPOISE	1	Whidbey Island	WA	03-IS-160	03NWR05033	U	N/E	WSU/Island County Beachwatchers
5/13/2003	HARBOR PORPOISE	1	Whidbey Island	WA	WIC051303SD	03NWR05010	M	160	WSU/Island County Beachwatchers
5/14/2003	DALL'S PORPOISE	1	Fidalgo Island	WA	03-SK-161	03NWR05035	U	N/E	Public/Whale Museum



**Appendix G. Marine mammal stranding events reported in Washington State (April – June 2003).**

5/16/2003	HARBOR PORPOISE	1	Port Angeles	WA	OCNMS03Pp02	03NWR05011	F	141	Olympic Coast National Marine Sanctuary
5/17/2003	HARBOR PORPOISE	1	Whidbey Island	WA	WIE051703SB	03NWR05019	F	137	WSU/Island County Beachwatchers
5/18/2003	CALIFORNIA SEA LION	1	Yellow Island	WA	2003-SJ016	03NWR05043	U	N/E	Whale Museum
5/20/2003	UNSPECIFIED SEA LION	1	Waldron Island	WA	2003-SJ017	03NWR05044	U	N/E	Whale Museum
5/20/2003	HARBOR SEAL	1	Lopez Island	WA	2003-SJ099	03NWR05045	U	N/E	Whale Museum
5/20/2003	HARBOR PORPOISE	1	San Juan Island	WA	2003-SJ009	03NWR05012	M	123	Whale Museum
5/22/2003	HARBOR SEAL	1	Ruby Beach	WA	03-JE-018	03NWR05013	U	N/E	National Park Service
5/25/2003	HARBOR PORPOISE	1	Lopez Island	WA	2003-SJ020	03NWR05046	U	N/E	Whale Museum
5/27/2003	HARBOR SEAL	1	Orcas Island	WA	2003-SJ012	03NWR05042	F	N/E	Whale Museum
5/27/2003	CALIFORNIA SEA LION	1	Whidbey Island	WA	03-IS-019	03NWR03014	U	N/E	Public
5/31/2003	HARBOR SEAL	1	Birch Bay	WA	03-WH-022	03NWR05017	U	112	Public
5/31/2003	NORTHERN ELEPHANT SEAL	1	Forks/Kalaloch	WA	03-JE-021	03NWR05016	U	320	National Park Service
5/31/2003	HARBOR SEAL	1	San Juan Island	WA	2003-SJ018	03NWR05047	M	174	Whale Museum
6/2/2003	HARBOR PORPOISE	1	Long Beach	WA	CRC-490	03NWR06005	M	141	Cascadia Research Collective
6/3/2003	HARBOR SEAL	1	Lopez Island	WA	2003-SJ019	03NWR06031	U	N/E	Whale Museum
6/12/2003	HARBOR SEAL	1	Blaine	WA	03-WH-064	03NWR06014	M	84	Public
6/13/2003	HARBOR SEAL	1	Moclips	WA	03-GH-024	03NWR06002	U	61	Public
6/16/2003	HARBOR SEAL	1	Copalis	WA	03-GH-025	03NWR06003	U	N/E	Public
6/16/2003	UNSPECIFIED TOOTHED WHALE	1	Ocean Shores	WA	03-GH-027	03NWR06004	U	152	Public
6/17/2003	CALIFORNIA SEA LION	1	San Juan Island	WA	2003-SJ021	03NWR06032	M	225	Whale Museum
6/17/2003	HARBOR SEAL	1	Lummi Island	WA	03-WH-072	03NWR06019	M	74	Public
6/21/2003	UNSPECIFIED PORPOISE	1	San Juan Island	WA	2003-SJ022	03NWR06033	U	N/E	Whale Museum
6/21/2003	ODONTOCETE	1	Ocean Shores	WA	03-GH-027	03NWR06004	U	150	Public
6/24/2003	HARBOR SEAL	1	San Juan Island	WA	2003-SJ023	03NWR06034	U	120	Whale Museum
6/24/2003	GRAY WHALE	1	Mt. Vernon	WA	CRC-496	03NWR06029	U	520	Cascadia Research
6/29/2003	HARBOR SEAL	1	Patos Island	WA	2003-SJ024	03NWR06030	M	78	Whale Museum
6/29/2003	UNSPECIFIED SEA LION	1	Lopez Island	WA	2003-SJ025	03NWR06035	U	N/E	Whale Museum
6/30/2003	HARBOR SEAL	1	Lopez Island	WA	2003-SJ026	03NWR06037	U	N/E	Whale Museum