# Known and Potential Causes of Death from Stranded Killer Whales

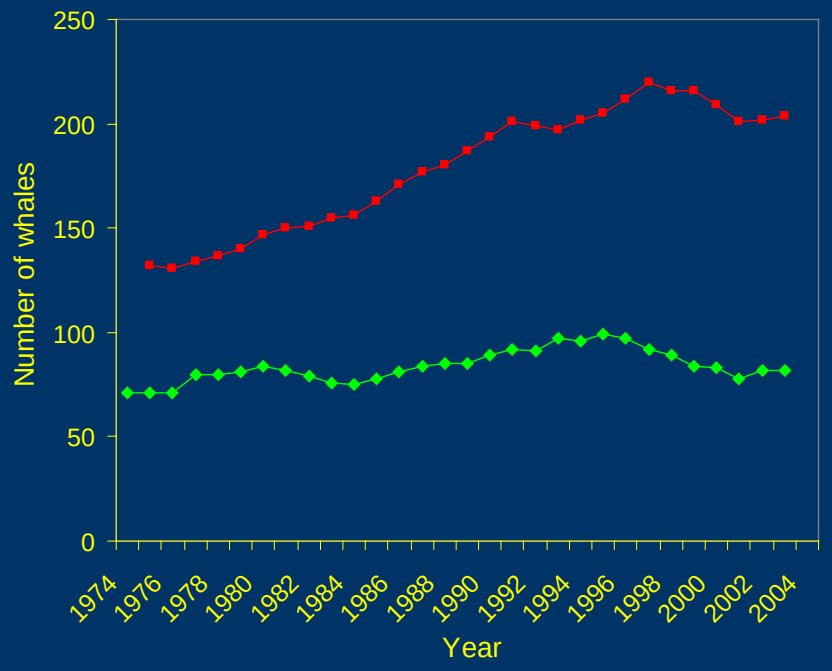
Stephen Raverty[1], Brad Hanson[2], Stephanie Venn-Watson[3], John Ford[4], and Joe Gaydos[5]

[1]Animal Health Centre, BC MAL, Abbotsford, BC
[2]National Oceanic and Atmospheric Administration, Seattle, WA
[3]National Marine Mammal Foundation, San Diego, CA
[4] Department of Fisheries and Oceans, Nanaimo, BC
[5]SeaDoc Society, Orcas Island, Eastsound, WA

# Killer Whale Stranding Survey

- Between 1996 and 2002, there was a significant decline in the number of southern resident killer whales from 102-78

- To put this loss in perspective globally and identify potential contributors to morbidity or mortality, stranding records and case reports were solicited from a variety of sources.



# Demographic Data on Stranded Killer Whales Worldwide, Years 1944-2011

| Demographic | Number (% of reported) | Total Reported |
|---|---|---|
| **Sex** | | 152 |
| Female | 69 (45.4) | |
| Male | 83 (54.6) | |
| **Age Category** | | 163 |
| Sub-adult | 70 (42.9) | |
| Adult | 93 (57.1) | |
| **Median Length** | 549 cm (range 154-1000) | 94 |
| **Region** | | 268 |
| Alaska | 81 (30.2) | |
| British Columbia | 79 (29.5) | |
| California | 9 (3.4) | |
| Hawaii | 3 (1.1) | |
| Japan | 44 (16.8) | |
| Mexico | 14 (5.2) | |
| Oregon | 10 (3.7) | |
| Russia | 13 (4.9) | |
| Washington | 14 (5.2) | |

- No significant differences present between age classes ($P$=0.13) or sexes ($P$=0.26)

# Killer Whale Necropsy Data

- To identify disease processes of concern, an investigation was initiated into the reported causes of death of killer whales
  - Armed Forces Institute of Pathology (Dr M Fleetwood)
  - Published accounts
  - In-house case records

# Killer Whale Necropsy Data

- Extent of post mortem examination of stranded killer whales was ranked
  - **No rating-** little or no diagnostic evaluation
  - **Intermediate-** gross exam and collection of samples
  - **Comprehensive-** gross exam, histopathology and ancillary diagnostics

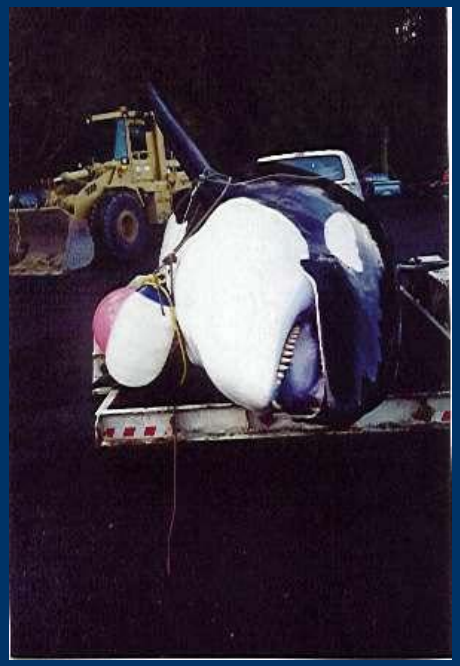
# Evaluation of Post Mortem Reports

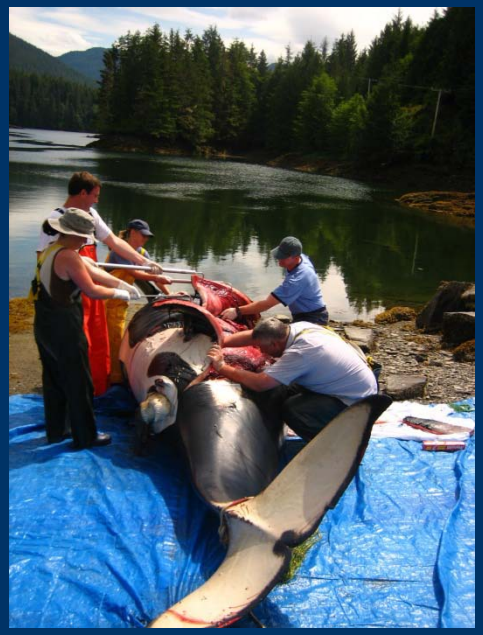
| | Time Interval | |
|---|---|---|
| **Extent of Post Mortem Examination** | 1944-1999 | 2000-2008 |
| No or cursory exam* | 82% (176/213) | 25% (4/16) |
| Intermediate | 16% (36/213) | 20% (3/16) |
| Comprehensive | 1% (4/213) | 55% (9/16) |

* Decomposition, limited site access, personal safety considerations, sample availability

# Summary of Post Mortem Findings

- Between 2000 and 2008, 16 stranded killer whales examined:
  - Age:
    - 9 adults
    - 2 subadult
    - 1 juvenile
    - 4 neonates



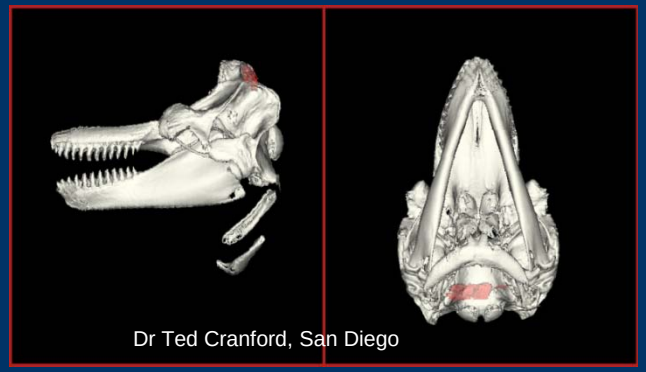


  - Gender
    - 8 females
    - 4 males
    - 4 animals unrecorded

# Summary of Post Mortem Findings

In the Adult cohort:

- 1 animal with only stomach contents assessed
- 1 whale with cerebral abscess, *Brucella* spp like isolate from viscera
- 3 cases, undetermined cause of death
- 2 Hawaiian animals with necrotising adrenal adenitis and cholangiohepatitis
- 1 multicentric uterine leiomyomas with *Brucella* spp isolated
- Presumptive boat strike
- Lodged in ice



# Summary of Post Mortem Findings

- In the Subadult cohort:
  - 1 animal with *Edwardsiella tarda* septicemia
  - 1 animal, vessel strike, L98

- In the Juvenile cohort:
  - 1 animals with *Edwardsiella tarda* septicemia, secondary to ingestion of a halibut fish hook

# Summary of Post Mortem Findings

- In the Neonatal cohort:
  - 1 animal with *Salmonella* Newport septicemia
  - 1 animal with presumptive hypoglycemia and hypothermia
  - 2 neonates autolyzed

# Pathology: Future Considerations

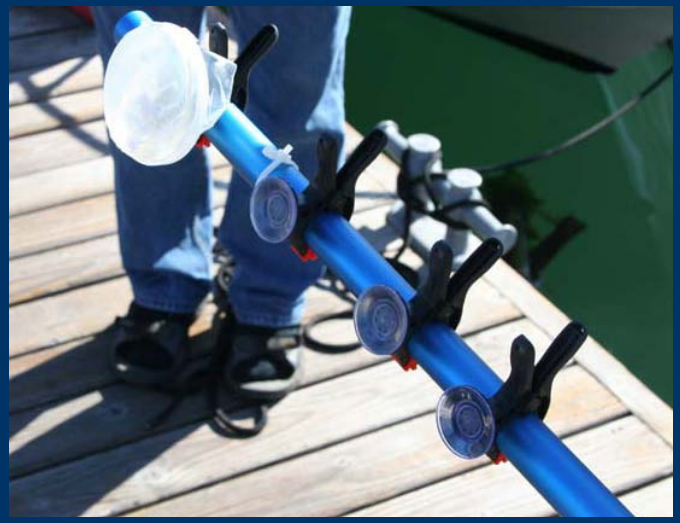
- Infectious and parasitic disease was the most common known diagnostic category associated with abnormal tissues (28/46 killer whales)

- Of these animals, the most common etiologies:
    - Bacteria (57.1%)
    - Parasites (35.7%)
    - Fungi (32.1%)
    - Viruses, little known

# Exhaled Blowhole Air Culture Study

- Infectious pneumonia
  - Most commonly reported cause of mortality in killer whales
  - 23 (50%) killer whales with tissue abnormalities had lung-associated pathology
    - Of these animals, 60.9% had lesions primarily associated with mortality

# Exhale Blowhole Air Culture Study



# Microbial Diversity

- Total of 56 microbial genera
  - 37 bacterial
  - 19 fungal

- Bacteria

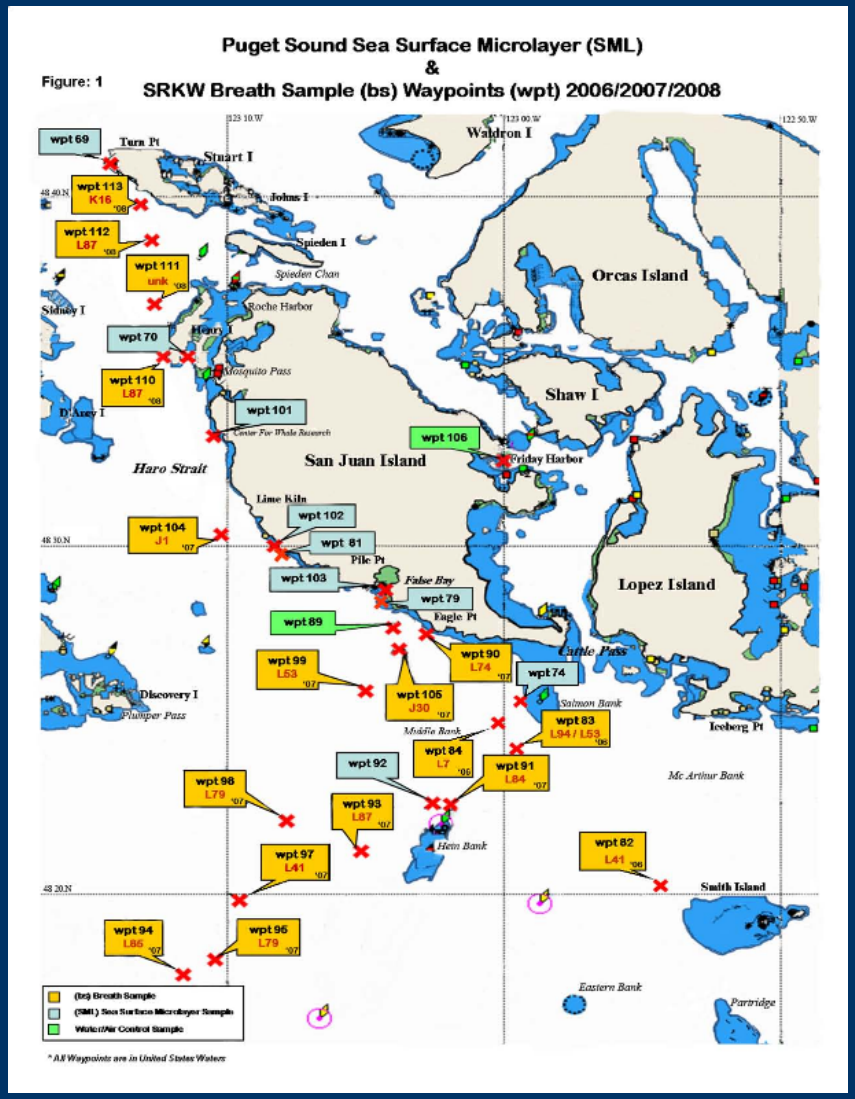
| | | |
|---|---|---|
| Acinetobacter | Gelidibacter | Pseudomonas |
| Aeromonas | Halomonas | Psychrobacter |
| Alteromonas | Leewenhoekiella | Rahnella |
| Arthropbacter | Listonella | Rheinheimera |
| Bacillacae | Gamma proteobacterium | Rothia |
| Bacillus | Kocuria | Salmonella |
| Burkholderia | Macrococcus | Shewanella |
| Clostridium | Marinomonas | Sporosarcina |
| Cobetia | Microbacterium | Staphylococcus |
| Curtobacterium | Moritella | Stenotrophomonas |
| Enterobacter | Photobacterium | Alpha Streptococcus |
| Exiguobacterium | Pseudoalteromonas | Streptomyces |
| | | Vibrio |

- Fungi

| | |
|---|---|
| Alternaria | Hormodendrum |
| Aureobasidium | Hypocrea |
| Aspergillus | Mucor |
| Botrytis | Penicillium |
| Candida | Phialophora |
| Cladosporidium | Phoma |
| Doratomyces | Rhodotorula |
| Epicoccum | Tametes |
| Fusarium | Trichoderma |
| | Verticillium |

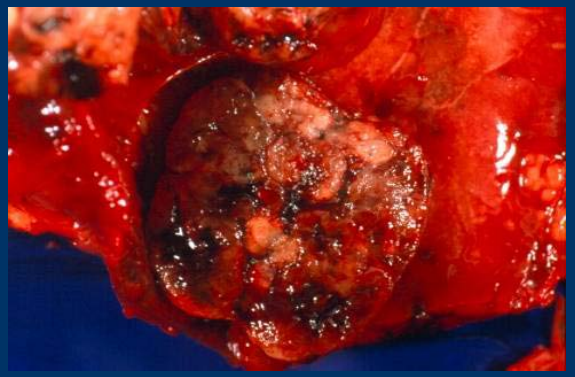
# Conclusions

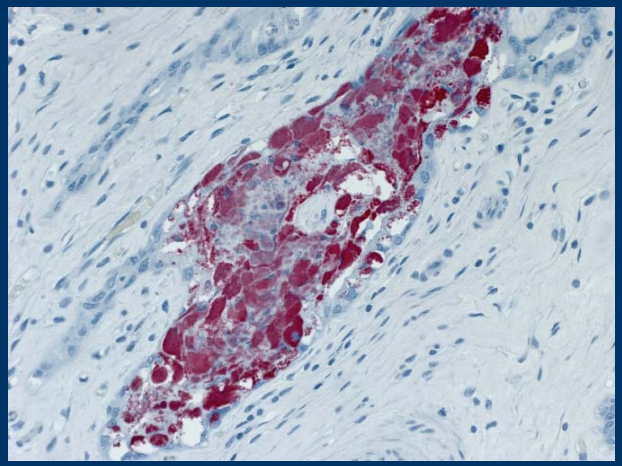
- Pathogenic bacteria recovered from blowhole and SML
- Microbial population distinct between blowhole and SML
- Antimicrobial resistance identified in isolates

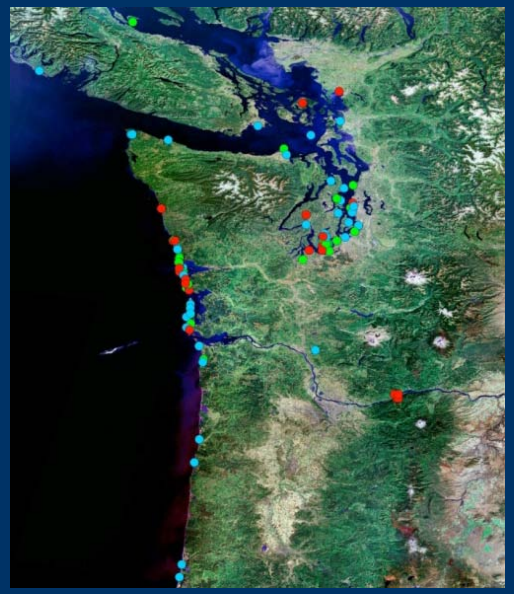


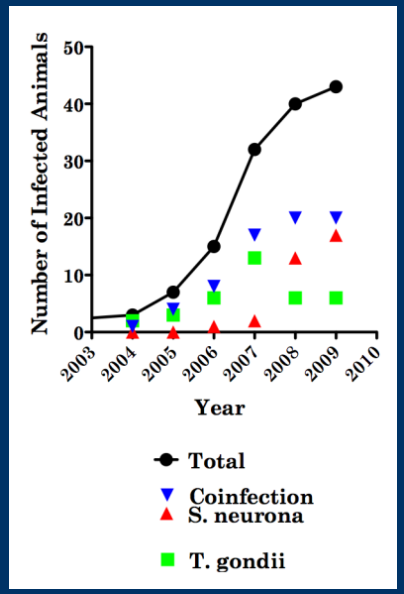
# Pathology: Future Considerations

- Pathogens of Concern
  - *Cryptococcus gatti*
  - *Coxiella burnetti*
  - *Toxoplasma gondii*
  - *Sarcocystis neurona*
  - *Bartonella* spp
  - Gamma retroviruses










•PCR for ITS1, NTS2, B1, and ITSI500 loci identified atypical and type I *T gondii* (Dr M Grigg, NIH)

# Killer Whale Population Status

- **No single cause for decline has been identified**

- **Proposed threats:**
  - **Prey limitation**
  - **Environmental contaminants**
  - **Boat  vessel traffic**
  - **Disease**

•COSEWIC 2008, NMFS 2008, US Federal Register 2005, Gaydos *et al.* 2004, Krahn *et al.* 2004, Wiles et al. 2004, Baird 2001, Ross *et al.* 2000, Van Bressem *et al.* 1991

•Photo: D. Schofield

# Acknowledgements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