
Presentation

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An unusually severe presentation of dolphin poxvirus in bottlenose dolphins (Tursiops aduncus) within the Swan-Canning Estuary
First report of fatal cetacean morbillivirus infection in WA and an accompanying unusually severe presentation of dolphin poxvirus infection

Nahiid Stephens, Carly Holyoake, Hugh Finn & Lars Bejder
Unusual mortality event
2009

• 6 bottlenose dolphin deaths within 5 months in the Swan Canning estuary

• Represent a marked ↑ in dolphin mortalities based on previous stranding data
Dolphins in the estuary

• 2001-2003: 20-25 bottlenose dolphins were consistently found in the estuary

Mortalities:

<table>
<thead>
<tr>
<th>DATE</th>
<th>SIGNALMENT</th>
<th>COMMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 June</td>
<td>Male, calf</td>
<td>Too decomposed</td>
</tr>
<tr>
<td>8 June</td>
<td>Male, juvenile</td>
<td></td>
</tr>
<tr>
<td>21 June</td>
<td>Female, adult</td>
<td></td>
</tr>
<tr>
<td>17 Sept</td>
<td>Female, adult</td>
<td></td>
</tr>
<tr>
<td>9 Oct</td>
<td>Male, adult</td>
<td>Too decomposed</td>
</tr>
<tr>
<td>25 Oct</td>
<td>Female, adult</td>
<td></td>
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</table>
June 8: Male juvenile

Most significant findings:

– Fungal meningoencephalitis with intralesional fungal organisms consistent with *Aspergillus* spp. (fungal infection of the brain)

– Lymphoid depletion noted histologically (reduction in immune cells in lymph nodes & spleen)
Aspergillus

- Ubiquitous in the environment
- Usually exposure does not result in infection as the immune system is able to ward off infection in healthy animals
- Infection with *Aspergillus* suggests that the immune system of this dolphin was compromised
June 21: Female adult

Most significant findings:
- severe chronic fishing line entanglement of the right fluke
- Lung fungal & bacterial infection
- Kidney bacterial infection
- Lymphoid depletion noted histologically
- Septicaemia likely
Most significant findings:

- Numerous, extensive ulcerative skin lesions with intralesional opportunistic bacterial & fungal organisms
- Intracytoplasmic viral inclusion bodies detected in keratinocytes, indicative of poxvirus infection
Poxvirus inclusion bodies
October 25: female, adult

Most significant findings:

- Numerous, extensive ulcerative skin lesions with intralesional opportunistic bacterial & fungal organisms
- Intracytoplasmic viral inclusion bodies in keratinocytes (poxvirus infection)
- Acute (recent) human induced injury – fish-hook lodged in oesophagus, minor entanglement with minimal tissue laceration of the right pectoral fin
Poxvirus/Tattoo Skin Disease

- Poxvirus infection - most often reported in juveniles (adults tend to develop protective immunity following infection as a juvenile)
- Considered to be only weakly pathogenic. Infection usually self-limiting
- Does not usually result in large deeply ulcerative lesions
- Usually not associated with death
General post-mortem findings

- Secondary infections (bacteria &/or fungi)
- Lymphoid depletion (reduction in immune cells in lymph nodes & spleen)
- Severe skin lesions in 2 dolphins

= Clinical findings suggestive of compromised immune function → underlying cause?????
Possible causes of impaired immune function

- Stressors
- Contaminants
- Environmental factors (salinity, pH, O₂, temperature)
- Disturbance
- Noise
- Food availability
- Low genetic diversity

1° pathogen (morbillivirus, pox, others)

- Human-induced injury

↓ Immune function

- Opportunistic infection

→ Death

Possible causes of immunosuppression

*multifactorial aetiology likely*
What was different about 2009?

Stressors

Contaminants

Environmental factors (salinity, pH, O$_2$, temperature)

Disturbance

Noise

Food availability

Low genetic diversity

1$^{\circ}$ pathogen (morbillivirus, pox, others)

Human-induced injury

↓ Immune function

Opportunistic infection

Death

Possible causes of immunosuppression

*multifactorial aetiology likely*
Cetacean morbillivirus

- Most pathogenic virus known to cetaceans
- Causes severe lymphoid depletion

Secondary infections (pneumonia, encephalitis, parasites)
Cetacean morbilliviruses

- Implicated in mass mortalities in US & Europe
- Little surveillance for disease in Australian cetaceans
- 1st confirmed case in Australia in a dolphin calf from QLD in 2010
Morbillivirus testing

- Immunohistochemistry (IHC) for the detection of morbillivirus antigen

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<td>Not tested</td>
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Significance of morbillivirus for WA

• First time in WA
• Second in Australia
• First Indian Ocean
• Highly pathogenic
Transmission of morbillivirus

- Virus needs a very large population to persist
- Herd immunity not maintained in small dolphin communities
- No carrier or latent state
- Infected dolphins that survive remain immune
- Pilot whales thought to be reservoir hosts
The 2009 mortalities are best explained as the outcome of multiple contributing factors.

- **Stressors**
  - Contaminants
  - Environmental factors (salinity, pH, O₂, temperature)
  - Disturbance
  - Noise
  - Food availability
  - Low genetic diversity

- **1° pathogen** (morbillivirus, pox, others)

- **Human-induced injury**

- **Opportunistic infection**

- **Death**

**Possible causes of immunosuppression**

*multifactorial aetiology likely*
Acknowledgements

• Swan River Trust for providing funding which enabled this project

• Swan River Trust and Department of Environment and Conservation personnel responsible for the retrieval of the dolphin carcasses
Questions?