The 2009 unusual mortality event for bottlenose dolphins: findings and significance

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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
## Cases

<table>
<thead>
<tr>
<th>DATE</th>
<th>SIGNALMENT</th>
<th>COMMENT</th>
</tr>
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<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>
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<tr>
<td>21 June</td>
<td>Female, adult</td>
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<tr>
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<tr>
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<td>25 Oct</td>
<td>Female, adult</td>
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June 8: Male juvenile

Most significant findings:

– Fungal meningoencephalitis with intrallesional 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
September 17: adult female

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
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

1º pathogen (morbillivirus, pox, others)

Human-induced injury

Immune function

Opportunistic infection

Death

Possible causes of immunosuppression

multifactorial aetiology likely
What was different about 2009?

1° pathogen (morbillivirus, pox, others)

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Cetacean morbillivirus

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

Secondary infections (pneumonia, encephalitis, parasites)
Cetacean morbillivirus

- 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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Significance of morbillivirus for WA

• First confirmed cases in WA
• Second confirmed cases in Australia
• First confirmed cases in the Indian Ocean
• Highly pathogenic
Knowledge gaps

• How did the virus get here?
• What is the long term significance?
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 Future

- Morbillivirus could enter the Swan Canning river population again
- Populations of odontocetes (toothed whales/dolphins) elsewhere in WA are also susceptible
There are three important epidemiological concepts of disease:
1. Disease never occurs randomly
2. All diseases are multifactorial
3. Disease is an interaction between three main factors: host, agent and environment
Concluding remarks

The 2009 mortalities are best explained as the outcome of multiple contributing factors.
Acknowledgements

We thank:

• 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