

Adelaide Dolphin Sanctuary Investigation Interim Report



Accurate at 29 October 2021

Introduction

The Minister for Environment and Water David Speirs launched an investigation on 24 August 2021, into the potential causes of recent dolphin deaths and disappearances in the Adelaide Dolphin Sanctuary.

The investigation, aims to identify the causes for what could be affecting the health of dolphins and ecosystems within the Port River and Barker Inlet. The investigation is expected to take several months to complete due to the complexity in understanding the ways the dolphins' health could be affected and systematically exploring each one.

The investigation is coordinated by DEW in conjunction with a range of expert partners including:

- South Australian Museum
- Flinders University
- Adelaide University
- Whale and Dolphin Conservation
- Australian Marine Wildlife Research & Rescue Organisation (AMWRRO)
- Flinders Ports
- Port Adelaide Enfield Council
- Environment Protection Authority (EPA)
- Primary industries and Regions, SA (PIRSA) - Fisheries
- PIRSA-South Australian Research & Development Institute (SARDI)
- SA Water
- Commonwealth Scientific and Industrial Research Organisation (CSIRO)
- Zoos SA

The initial focus of the investigation is to evaluate historical information from post mortem studies of previous deaths to inform the understanding of historical mortalities and identify common pathways. This will be combined with detailed examination of recent mortalities to explore similarities and differences between deaths and any patterns.

Alongside of this, the experts' joint understanding of the ecology of the Barker Inlet/Port River and the ways that the ADS dolphins interact with this will be described to identify other potential pathways that may affect their health.

Where necessary, the investigation will commission studies to fill knowledge gaps and methodically and thoroughly explore the potential pathways.

This report sets out what has been achieved to date and highlights research and other initiatives currently being undertaken or planned as part of the investigation. Key elements include:

- Dolphin testing and post mortem investigations
- Port River and Barker Inlet Ecology – conceptual model
- Literature review
- Other research and initiatives underway to aid the investigation
- Future changes to management of the ADS

Dolphin testing and post-mortem investigations

On Wednesday 13 October, the Department for Environment and Water met with a sub-group of the investigation team including representatives from Flinders and Adelaide Universities, SA Museum and local dolphin researchers. The sub-group recommended directions for studies and further testing. The sub-group supported the collation and summary of historical health data from the ADS dolphins by the SA Museum, to provide context for current observations of deaths in the Sanctuary.

The purpose of a post mortem examination or autopsy is typically to determine the cause of death, or extent of disease. It is critical in understanding the causes of death to inform potential ways future deaths may be prevented.

Initial testing of the three recent dolphin deaths ('Tallula', the 'Semaphore dolphin' and 'Hunter') has indicated the dolphins were suffering from infections and diseases that affected their health of varying degrees of severity. The three dolphins all exhibited different infections/diseases.

Tallula

'Tallula' was a 12 year old male dolphin that resided within the ADS. Tallula's body was found on 21 August near Garden Island. The post-mortem examination conducted on 25 August found that the body condition of Tallula was very emaciated. One large fishing hook was discovered within the stomach (no signs of obstruction or infection were present). A chronic (long term) condition for this animal was possible because adrenal enlargement observed.

Testing for a range of diseases known to be present in marine mammals was undertaken. While these tests indicated that Tallula was negative for cetacean morbillivirus (a measles like virus affecting cetaceans), the results indicated the presence of a disease called toxoplasmosis (a parasite caused by *Toxoplasma gondii*, a protozoan parasite derived from cat faeces). However levels of antibodies detected were not high enough to indicate an active toxoplasmosis at the time of death.

The presence of a large fishing hook highlights the need for DEW's continued work with PIRSA-Fisheries on responsible fishing in the ADS.

Semaphore Dolphin

The Semaphore dolphin was an adult sized female dolphin whose body was found at Semaphore beach on 19 July in a severely emaciated state. The dolphin did not have any identifying characteristics and it is not known if it was an ADS resident.

Being found adjacent to the ADS and in very poor body condition similar to other ill ADS dolphins, it was important that a post mortem examination was undertaken on 17 August to determine if there were any link between this animal and recent ADS deaths.

The post mortem examination found that this dolphin had a large abscess on the external stomach wall. Associated peritonitis was observed with a swollen spleen and lymph nodes in the abdomen. The adrenal glands were also swollen. This is indicative of a possible chronic condition affecting this animal prior to death. There was also blunt force trauma observed in a few small areas along the left side of the head and along the vertebrae. Severe parasite infection was found in and around the ear area.

Further tests revealed that the Semaphore dolphin was seropositive for toxoplasmosis. The high levels observed indicate an active infection at the time of death and may indicate the cause of the encephalitis observed in the brain of this dolphin.

Doc

'Doc' was an 8 year old male dolphin that resided within the ADS. In late 2020, this animal was observed in an emaciated condition, the cause of which was unknown. Rangers and community members observed an improved condition with Doc successfully feeding and socialising with other dolphins. Doc appeared to gain some weight – although body condition still remained emaciated. Two skin lesions developed, one on the dorsal fin and the other behind the fin.

On 19 June 2021, Doc was seen with an entanglement consisting of a single fishing hook embedded in the right side of the jaw and a trailing line. Another smaller hook was embedded in the upper side of the tail, with a short trailing line. On 25 June 2021, a disentanglement team including NPWS staff, SAPOL Water Police, PIRSA Fisheries Officers, two commercial net fishermen, Zoos SA, Whale and Dolphin Conservation volunteers (WDC) and ADS Action Group Volunteers successfully captured Doc and removed the entanglements. While Doc was captured for disentanglement there was an opportunity to take some further health tests. Skin swabs, breath sample and a small skin biopsy and blood sample were taken.

The results of these samples have revealed that Doc had been exposed to Brucella. Brucella is a zoonotic bacterium that can result in dolphin abortions, male infertility, neurobrucellosis, cardiopathies, bone and

skin lesions, and death. The levels observed in Doc, show that he had been historically exposed to Brucella but that the levels did not indicate an active infection.

While Brucella is known to occur in marine mammals, this is the first detection of exposure to Brucella in a South Australian dolphin. The detection of Brucella in an ADS dolphin is significant. Broader surveillance of dolphins will be required to know whether this could be impacting the health of dolphins, particularly whether or not is contributing to calf mortality within the Sanctuary.

Unfortunately, following the disentanglement of Doc, he has only been resighted once following the disentanglement. Doc was usually seen on a very regular basis so it unusual for him not to have been observed in the Sanctuary since 27 June. At the time of his disentanglement he was noted to be in poor body condition but that the entanglement itself was superficial.

Twinkle

In late June 2021, the resident adult male dolphin known as 'Twinkle' was observed to be losing weight and approaching boats, indicating it had learned to beg for food. Photos from around 4 July showed the dolphin in an emaciated condition and on 7 July it was observed at Garden Island swimming in circles and listing to one side. Anticipating that the dolphin may strand in a public location, DEW approached vets seeking possible assistance with euthanasia. The dolphin was not seen again after 7 July and is presumed dead. Rangers were unable to locate the body.

The cause of death of 'Twinkle' in July (who's body has never been found), remains unknown. Given the similar symptoms to the dolphins recovered for testing, the cause of death is possibly linked.

Hunter

'Hunter' was a 6 year old dolphin born with a jaw deformity (missing much of the upper jaw). It was initially unknown whether he would be able to feed on his own to survive but he learned to adapt to the jaw deformity. On 1 October 2021, rangers observed Hunter at close quarters and reported he appeared in good health. Over the following three weeks, his behaviour was observed to change demonstrating symptoms similar to previous ill ADS dolphins; appearing very lethargic and emaciated.

An independent vet assessment of Hunter was undertaken at Garden Island Boat Ramp on 20 October. The assessment was that the dolphin was in a very poor state of health and would not survive. Taking into account the welfare of the dolphin, and

following veterinary advice a decision was made to euthanise the dolphin to prevent further suffering.

On the morning of 22 October, Hunter was netted, assessed and subsequently euthanised. The body was recovered and tests immediately undertaken on site by researchers from Flinders and Adelaide Universities (including skin swabs, breath and blood tests).

A post mortem examination was then immediately performed at Adelaide University's Roseworthy veterinary facility in conjunction with researchers from Flinders University and SA Museum.

The initial findings from Hunter's post mortem examination are that there were multiple infections adversely impacting him, which were connected to his recent and significant weight loss. Hunter had a severe bacterial infection of the middle and inner left ear, which appeared to extend to the surrounding tissues. Cultures and microscopic examination of the ear tissue will be undertaken, however expert advice is that these changes would have permanently affected his ability to hunt and forage.

Hunter presented multiple skin abscesses over his body, known to be associated with disease causing (pathogenic) bacteria leading to infection (sepsis) and death in marine mammals. Skin cultures are underway to identify the bacteria responsible. Internally, aside from several parts of local species of prawn', Hunter appeared not to have eaten recently, and had a haemorrhagic gastritis and enteropathy (bleeding in the stomach and intestine), which would have also contributed to his weight loss. Based on the post mortem examination, it confirms that Hunter's prognosis was serious and it was unlikely that he would have survived much longer.

The underlying cause of these infections is under investigation over the next few weeks and months, with extensive testing to detect a range of bacterial, parasitic and viral diseases underway. Metagenomic analyses on samples collected from Hunter and water will also be performed by Flinders University in collaboration with Adelaide University to provide extensive microbial resolution and increased accuracy for the identification of potential pathogens involved. Further toxicology tests will also be sought to understand the presence and levels of toxins in this dolphin and whether they have contributed to his deteriorating health.

Further toxicological investigations

Investigations are continuing to understand whether the initial ADS dolphin post mortem examination findings indicate that toxicants are present. Toxicants may be present but unrelated to the health conditions recently observed in ADS dolphins, may

be contributing to the poor health of the dolphins as has been observed elsewhere interstate and overseas. Determining the impact of toxicants is complicated by the small number of samples tested to date, the presence of similarly acting compounds and uncertainty regarding species-specific levels of exposure which makes assessment of the effects of these contaminants at a population level challenging.

It was recommended by expert researchers that additional, detailed toxicology tests for Tallula, the Semaphore dolphin and Hunter now be undertaken. The additional testing is intended to provide further detail about the health of these animals and the environment in which they are living and test the potential role of these toxicants on immunosuppression. The immune system is a vital defence for the dolphins.

The Department has commissioned these tests through the Adelaide University and Museum team in collaboration with the EPA, sending the necessary samples to specialty laboratories interstate where previous tests on ADS dolphin samples have been sent (to ensure consistency). Due to COVID-19 restrictions and interruptions to business-as-usual, DEW cannot at this stage place a timeframe on when the results will be available.

The SA Museum team and Adelaide University will continue to finalise the expert collation of the post mortem examination reports including pathology, toxicology and life history as they become available for inclusion in future reports.

Once all toxicology tests have been completed, the SA Museum will work with DEW, Flinders University and the Adelaide University to analyse the findings and a report will be publicly available.

Summary of historical ADS post mortem investigations

The marine mammal collection at SA Museum is the largest and most comprehensive in Australia. In the study of dolphin carcasses the Museum's scientists have been investigating their biology, diseases and causes of death over many years in the ADS. The Museum's research has found that level of toxic contaminants in dolphins from some areas of SA are unacceptably high. Specialist research by the SA Museum together with Adelaide University and CSIRO will be undertaken to review the pathology findings of ADS dolphins, their age at their time of death and the emaciation indices over the past 20 years. This will provide critical background information to be able to identify any trends over a long period of collected data. Historic analysis of dolphins is also able to be undertaken accessing the bank of organ and frozen tissues collected by the Museum which goes back over 30 years.

Fleurieu Dolphin Deaths

There have been two recent dolphin deaths along the Fleurieu coastline. A dead common dolphin was reported at Seaford on 15 Oct and on 17 October a dead bottlenose dolphin was reported at Aldinga. The body of the common dolphin was collected by rangers and taken to SA Museum for further examination.

While the death of any animal is of concern, each year there are a number of reports of dead common and bottlenose dolphins along the metro and Fleurieu coastline, attributed to natural causes. The SA Museum on behalf of DEW records annual cetacean strandings and entanglements which are reported to the International Whaling Commission Scientific Committee. Each year there is an average of around 18 dolphin deaths reported in the Gulf St Vincent bioregion. A maximum of 8 deaths were recorded in 2020 along the Fleurieu coastline. These numbers do not represent total deaths in these populations, the numbers only reflect the bodies that are washed ashore.

Implications for the ADS investigation

In considering the post mortem of the emaciated dolphins (Semaphore dolphin, Tallula and Hunter) there has not been a definitive cause for the emaciation or common links between these deaths beyond possible suppression of their immune systems allowing them to become affected by the diseases and infections observed.

The reasons for this are unclear at this time, however testing for environmental toxicants (including biotoxins) and factors that may contribute to immunosuppression is underway, involving experts in water quality, toxicology, pathology and marine ecosystems

The presence of toxicants including PFAS (per- and polyfluoroalkyl substances), heavy metals and other persistent pollutants are expected in a species such as dolphins that live in a large urban centre like Adelaide and because they are long lived predators. The extent to which these could be impacting the health of the dolphins is being explored through these studies.

Port River and Barker Inlet Ecology - Conceptual Model

To help DEW and other authorities better understand the functions and current threats to the sanctuary's ecosystem, an expert workshop was held on 17 September 2021 with representatives from:

- Department for Environment and Water
- Environment Protection Authority
- SA Museum
- Adelaide University
- Flinders Ports
- Flinders University
- Australian Marine Wildlife Research and Rescue Organisation
- Primary Industries and Regions SA (PIRSA)- Fisheries
- Whale and Dolphin Conservation

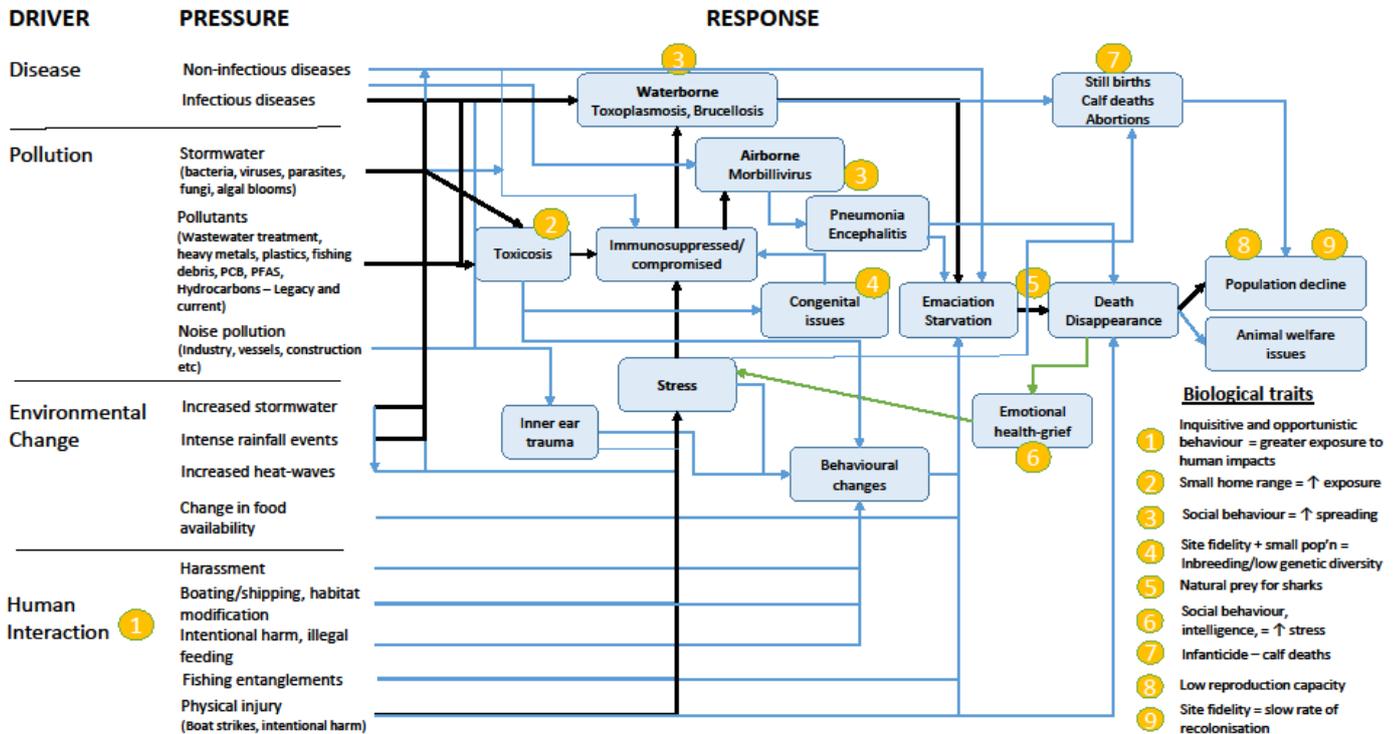
Workshop participants reviewed historical data, identified trends and patterns in factors corresponding to dolphin deaths and developed a common understanding on how the ecosystems within the sanctuary work, what pressures affect them and how dolphins interact with these.

Using information from this workshop, a conceptual model of the Port River and Barker Inlet ecosystem has been developed to inform the investigation further. Conceptual models are useful for visualising complex processes. They are effective at highlighting contributing issues and mapping out their interactions.

The conceptual model takes into consideration the biological traits of bottlenose dolphins residing in and using the ADS and whether some of their biological traits make them more susceptible to impacts from some key pressures.

As we learn more this model will continue to be modified to reflect the outcomes of the investigation. The flowchart (Figure 1) highlights drivers, pressures and expected responses within the Adelaide Dolphin Sanctuary's Port River and Barker Inlet environs.

Blue lines show linkages between pressures and responses with black lines highlighting the most acute issues. Green arrows indicate a feedback loop. Many of these responses are exacerbated by biological traits, these are numbered next to the relevant response and described in text.



Conceptual flowchart (Figure 1)

Literature Review

A **literature review** will be undertaken by South Australia's Research and Development Institute focusing on the Port River and Barker Inlet ecology, coastal and ADS dolphin ecology and key findings from studies that have been undertaken on the ADS dolphins. This review will provide useful background and summarise critical relevant research that has occurred within the ADS over time.

This review of worldwide published scientific information is to ensure that the broader investigation is focused on the right issues and is efficient in its scope and direction. It will also ensure we are not missing any other potential key aspects from other work around the world.

Finally, the literature review will provide relevant scientific information as background to the description of the ecology of the Barker Inlet/Port River, issues highlighted in the conceptual model or possible pathways the dolphin's health is being negatively affected.

Implications for the ADS investigation

The implications of the literature review and the conceptual models provides additional information to inform the investigations team with respect to further lines of investigation for how the toxicants under investigation have entered the ADS dolphins along with other pressures that are affecting their health as the basis for additional studies. Other research & initiatives underway to aid the investigation

There are many avenues of enquiry to explore the potential pathways that the ADS dolphin's health is being negatively affected. Research by partners in the investigation team is underway whilst the investigation is commissioning studies to fill knowledge gaps and methodically and thoroughly explore the potential pathways. Some of these studies will continue over the next several years.

Knowing the historical and current population trends for the ADS is critical to understanding and detecting any changes over time by identifying common issues, patterns and potential pathways the health of ADS dolphins have been affected in the past.

Work will be undertaken by DEW to estimate the total abundance of dolphins within the Adelaide Dolphin Sanctuary over the period of November 2016 to August 2021 together with a study by Flinders University and Dr Mike Bossley over a longer term (1989-2020) using complementary yet separate techniques and datasets.

This will provide an understanding of the abundance of the entire ADS population (not just the inner Port resident dolphins) and whether there have been any recent changes in sighting numbers.

The analysis of the longer-term dataset will give an idea of trends in numbers over time over a more restricted spatial area, whereas the analysis of the shorter term dataset will provide an idea of recent and current abundance over the entire dolphin sanctuary.

Tissues held by the Museum will also be used by Flinders University to investigate genetic diversity and inbreeding levels of ADS dolphins over time, and their potential genetic differentiation to dolphins from adjacent waters.

Changes to future management

As more information and research from the investigation becomes available this will inform future directions for the management of the ADS.

At present DEW and the investigation team are focused on the collation of data, summarising what we know and gaining as much knowledge as we can about dolphin health.

While the usual approach of the Department is not to intervene with wild animals, consideration to intervention on live dolphins could become critical to understanding health factors affecting resident dolphins within the population. Decisions on whether to undertake this would be considered on a case by case basis based on expert advice.