

Hauraki Gulf Marine Toxin Response

Updated 22 October 2009

Earlier this year there were 15 incidences involving dogs falling ill with unusual symptoms and five of these dogs died. An investigation into the issue has found sea slugs contained tetrodotoxin (TTX), and that this toxin was present in two of the dogs that died. TTX is a toxin to be avoided.

Below you will find the answers to some questions related to the technical report and wider investigations.

What organisms are affected by the toxin?
Testing confirms a toxin present in the stomach of one of the dogs from Narrowneck Beach, Auckland. The toxin was also identified from a composite sample of three single grey side-gilled sea slugs (<i>Pleurobranchaea maculata</i>), from Narrowneck Beach, and in a single sea slug from Cheltenham Beach.
When did the problem become apparent?
Over 300 calls were made to the Ministry of Agriculture and Forestry (MAF) free phone between July and August 2009. The calls reported incidences of penguins, pilchards and dolphins deaths. Calls related to dog illnesses or deaths totaled 41. Review by MAF National Centre for Disease Investigation has resulted in 14 cases warranting further investigation.
What are the common symptoms displayed by the dogs?
The common symptoms in the dogs included vomiting, wobbliness, slowness of the heart rate, and lethargy. The variable symptoms include excess saliva production, diarrhoea, involuntary contractions or twitching of the muscles, seizures, respiratory failure, abnormal heart beat and death. The onset of clinical signs must be within 48 hours of being at a beach.
What are these sea slugs, are they native and where are they found?
Adult grey side-gilled sea slugs reach up to 100mm in length. They are a soft sea slug with no shell. The body is smooth to touch but covered with minute puckers and folds. Colour is pale grey, densely patterned with short, brownish-black lines. The feathery gill is partly hidden under the right side and extends further when the animal gets stressed. The slug is not common in Auckland but its population can vary widely depending on favourable breeding conditions and diet. They live in all habitats from inter-tidally in harbours and to depths of 250m off open rocky coasts. They are fast, active hunters eating sea anemones, marine worms and molluscs.



Source:
Cawthron Institute

What else has been tested for toxins?

Organic and inorganic samples collected from North Shore and Eastern Suburb beaches have been analysed. These included jelly fish, seaweed, pilchards, algal mats, mussels, pipis, seawater, sediment/sand, sponges, limpets, and other sea slug species. All were negative for known toxins.

What has affected the sea slugs?

Cawthron Institute has identified a high concentration of tetrodotoxin (TTX) in the sea slug and lesser amounts in the dog stomach. This is an unusual finding as it has not been previously described in New Zealand.

What is tetrodotoxin (TTX) and where is it found?

- TTX is a sodium channel blocking neurotoxin
- TTX is wide-spread in marine organisms including puffer fish, crabs, newts, ribbon worms and blue ringed octopus.
- Bacteria are known producers of TTX; most often bacteria of the genus *Vibrio*.
- Bacteria producing TTX may remain in organisms in a symbiotic relationship.
- Symbiotic bacteria have been found in other sea slugs; although the link with TTX is not certain.
- The source of the toxin found in the sea slug may lie in the shallow sub-tidal sediments and crustose turf/benthic algal communities.
- Overseas, consumers of bacteria, like nematodes, copepods and arrow worms are known to have extremely high levels of TTX.
- High concentrations of TTX further up the food-chain may be due to bio-accumulation of the toxin.
- TTX accumulation in animals may be used for defence or offence purposes.
- The spatial and temporal extent of high concentrations of TTX in organisms is largely unknown but has been reported as highly variable.
- Consumption of organisms containing TTX is known to kill cats, dogs and humans.
- The relationship of TTX with a New Zealand marine bacterium has not been previously described and further investigations are required.

Are the levels of TTX found in the sea slugs harmful?

<p>The levels of TTX found in samples of sea slug from Narrowneck and Cheltenham beaches had an average value of 385 mg/kg. The oral toxicity of TTX in dogs is not known, however the minimum lethal dose in humans is 1 to 2mg. Therefore, based on the average value reported to date it is possible that eating 2g of sea slug could be fatal to humans. However, a great deal of further investigation is required to determine this conclusively.</p>
<p>Are other toxins involved?</p> <p>We tested a wide range of the 'usual suspects' of toxins normally associated with shellfish poisoning and blue-green algal blooms and none were found.</p> <p>In addition the New Zealand Food Safety Authority's routine sampling of commercial shellfish and toxin producing phytoplankton in the Hauraki Gulf has revealed no known biotoxins that might cause food safety issues for consumers</p>
<p>Does the presence of TTX explain the clinical symptoms displayed by the all the sick dogs?</p> <p>As at September 2009, MAF Biosecurity NZ considered 40 possible cases during their investigation. It is the expert opinion of their veterinary staff that TTX poisoning could explain the common symptoms exhibited by 13 dogs. MAF can not confirm this definitely as the three other dogs that died had been disposed of before the investigation was officially commissioned. Similarly, blood and urine samples from the 10 dogs that recovered were not available due to the time period that had elapsed and limitations in the detection limits of the clinical tests.</p>
<p>Are you still using reports of dog illness to guide the investigation?</p> <p>The screening of reports of sick animals - on the beach and everywhere else in New Zealand is the ongoing function of the MAF Biosecurity NZ's Investigation and Diagnostic Centre. They routinely notify the appropriate Medical Officer of Health if there is a risk of disease or poisoning. Reports are assessed and where there is a cluster or pattern that emerges and investigation is initiated.</p>
<p>Is the sea slug naturally toxic?</p> <p>This is the first account of TTX in this species of sea slug. Dr Richard Wilan, Curator of Mollusks at the Northern Territories Museum in Darwin, Australia advised that such a situation has not been previously described in this species.</p> <p>We don't know though whether this is something that has been recently acquired or whether it has always existed, but scientists have never undertaken the specific tests necessary until now.</p>
<p>Were sea slugs found beyond Narrowneck Beach?</p> <p>The initial survey of Auckland North Shore and Eastern beaches on 12 August 2009 located around 120 to 150 at Narrowneck Beach and a single specimen at Cheltenham Beach. Repeated surveys since that time has consistently discovered seas slugs at Narrowneck and Cheltenham beaches but at much lower numbers. We have yet to find sea slugs beyond these beaches but do not consider this proves they are not present elsewhere as we do know that the population of seas slugs is typically low in the marine environment but can fluctuate locally when favourable conditions allow.</p>
<p>Do sea slugs wash up normally?</p> <p>Yes, it is not unusual to see sea slugs washed up on the beach and is not normally a cause for concern. We are aware of previous events where sea slugs have washed up onto beaches, the timing of which appears to rely on prevailing weather conditions.</p>
<p>Are the sea slugs hazardous?</p> <p>It is best to be cautious and avoid contact with sea slugs. Results from further tests of sea slugs found at Narrowneck and Cheltenham beaches and held in aquaria at Cawthron Institute has found that TTX remains in high levels throughout the animal's tissue, gut and reproductive organisms. Some sea slugs undergoing tests at Cawthron Institute spawned and the egg masses produced also contained TTX.</p>

How long are the sea slugs hazardous?
<p>Unfortunately we do not know the answer to this question nor can we make predictions.</p> <p>It is best to remain cautious until future samples are consistently clear of the TTX, or no further poisoning cases are reported. It is unlikely that we will be able to conclusively determine the event has abated due to the inherent limitations in our understanding of the marine environment, its vast area and complex ecosystems.</p>
What should I do if I see a sea slug on the beach?
<p>Avoid it. We strongly suggest you do not touch it and report its presence to the local council for their response.</p>
Is it safe to go to the beach?
<p>The Auckland Regional Public Health Service advise:</p> <ul style="list-style-type: none"> • Children and pets still need to be supervised on Cheltenham and Narrowneck beaches, and parents and owners should be cautious on other Hauraki Gulf beaches. • Adults, children and pets should not eat anything found washed up on any Hauraki Gulf beach. • Parents need to be aware of where their children are swimming or playing and what they are handling. • Sea slugs on any beach must be avoided. • Report any findings of sea slugs to the local council <p>Information on a First Aid Response for Tetrodotoxin (TTX) Poisoning is available on the ARPHS website www.arphs.govt.nz or telephone 09 623 4600</p>
Where does TTX come from?
<p>TTX can be found in common, naturally occurring, marine bacteria. The association between these bacterium and TTX is known from tropical regions, sometimes in a symbiotic or parasitic relationship with higher order animals. The relationship of TTX with a New Zealand marine bacterium has not been previously described and further investigations are required.</p>
What about the penguin deaths? Are they related?
<p>The Department of Conservation commissioned independent toxicology tests on five penguins. Low level traces of brodifacoum were found in the livers of two of the penguins but this has been ruled out as the cause of death.</p> <p>Further test results from the New Zealand Centre for Conservation Medicine (NZCCM) indicate that starvation is the likely cause of death of penguins from the region. This supports earlier findings by NZCCM.</p> <p>Penguin mortalities are not uncommon for this time of year, and have been reported in the Far North, Rodney, Auckland, Coromandel and Bay of Plenty regions.</p>
Pilchards have been dying too haven't they?
<p>Reports of dead pilchards washing up on beaches around Whangaparaoa were received in July, with the last report on 31 July 2009 at Long Bay. A similar mortality event occurred in the same region (and subsequently nationwide) in June 1995, which was attributed to pilchard herpes virus. MAF Biosecurity NZ commissioned specific tests for pilchard herpes virus and results were negative. The cause of death remains unknown. Tests for TTX and brodifacoum undertaken on the pilchards tested were negative.</p>
And the dolphins?
<p>Eight reports of dead common dolphins in the Hauraki Gulf have been received since 9 July 2009. The results of post mortem analysis of six dolphins were not diagnostic and no cause of death could be determined. No signs of starvation in the dolphins were observed and all animals were observed in good condition. There was no evidence of internal bleeding which would be expected if an animal had eaten brodifacoum.</p> <p>The Department of Conservation also tested the livers of some dolphins for TTX, which were negative, and for domoic acid (a toxin associated with algal blooms), also negative.</p> <p>Whilst the cause of death of the dolphins remains unknown we are confident it wasn't due to TTX or</p>

brodifacoum poisoning.
What does this say about the health of the Hauraki Gulf – aren't these incidences all connected?
There is no evidence to suggest that the reported incidences of sick dogs, infected sea slugs, pilchards, penguins and dolphins are related to each other. Nor is there evidence of a wider, greater harm to the health of the Hauraki Gulf.
Does this problem extend beyond the Hauraki Gulf?
We do know that sea slugs are found beyond the Hauraki Gulf. We cannot rule out that these to may be infected with TTX and we advise caution.
Where can I get more information?
We have produced a comprehensive technical report which can be downloaded from ARC's website www.arc.govt.nz or a hardcopy obtained by calling 09 366 2000 or email publications@arc.govt.nz .