

Crab and lobster deaths along the North East coast – briefing document

February 2022

Summary of what has happened

- Dead and dying crabs and lobsters were washed ashore along parts of the North East coast between October and December 2021. The first reports were received by the Environment Agency (EA) in October, with reports of impacted crabs out to around 4/5 nautical miles.
- Crabs and lobsters were the only species that appear to have been affected by the incident. Dying crabs and lobsters displayed characteristic ‘twitching’ and lethargic behaviour.
- Defra took on overall responsibility for the Investigation from the EA, coordinating a multi-agency response, involving the EA, Cefas, NEIFCA, MMO, FSA and the UK Health Security Agency (UKHSA) to investigate what could have caused the event.
- A range of testing was undertaken after the incident had occurred, looking at potential causes including chemical contamination, phytoplankton blooms and disease. Activities in the area, such as discharges and dredge activity, were also considered but no link has been established.
- No conclusive explanation for the incident has been found, but more details of testing and modelling undertaken are set out in the document below. A harmful algal bloom may have caused the incident, with lines of evidence pointing to this.
- There is currently no evidence of a food safety risk from healthy fish and crustacea, including crabs and lobsters, caught off the North East coast.
- Businesses should continue to ensure that food placed on the market is safe to eat and meets the relevant requirements in relation to food safety and hygiene.

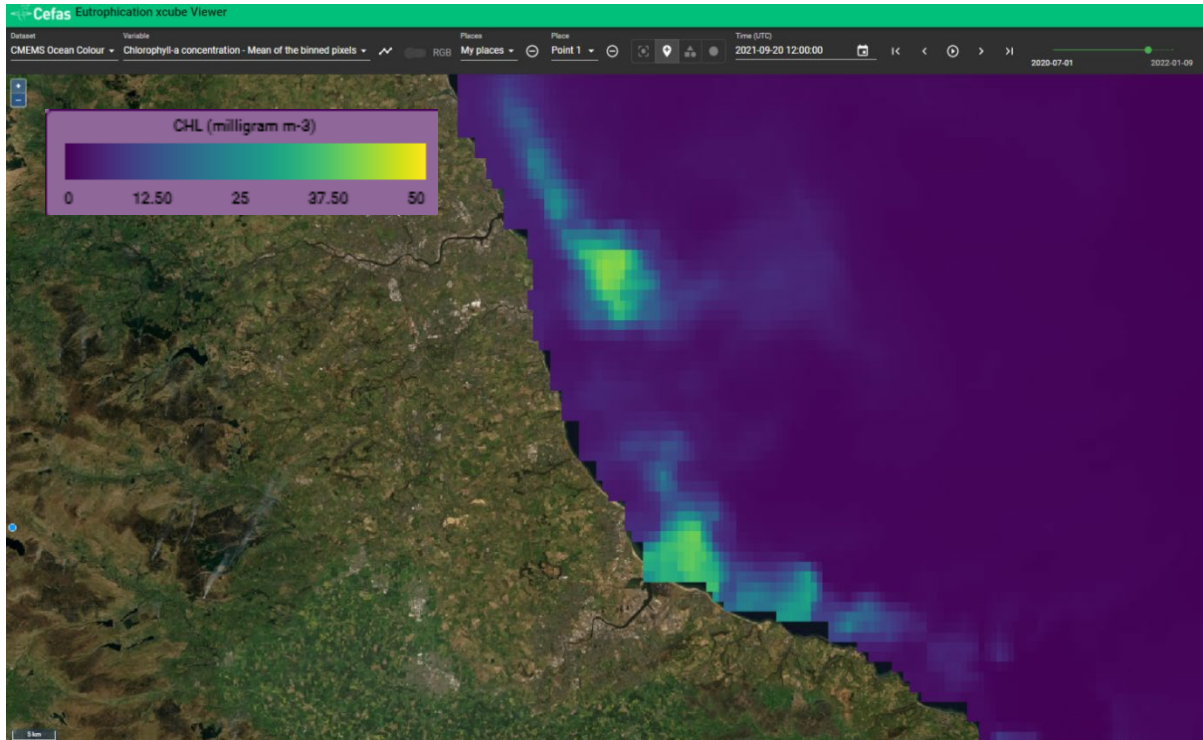
Latest updates – February 2022

- **Cyanide:** Sediment and water samples collected by the EA from the impacted area around Teesside in early October have now been screened for free cyanide. Results from these samples were below the detection limit of the test.
- **Pyridine:** The chemical pyridine was identified in the crab tissue from impacted areas. Further investigations by the EA established that pyridine was not present in water and surface sediment samples collected off the Tees, but was also detected at low to high levels in crab from non-impacted areas. As such, the presence of pyridine in crab is likely to be linked to biological processes (and not necessarily from the environment). More detail can be found in the section on pyridine below.
- **Dredging:** Cefas completed an indicative 2D tracking model of the potential sediment plume from the dredge disposal site. The model indicates that the plume extents are relatively confined along the tidal excursion at the disposal site and do not have the same geographic extent that would be consistent with the known mortalities.
- **Recent survey activity:** The EA’s survey vessel, the Humber Guardian, undertook further testing (benthic invertebrate samples and epifaunal trawls) in the Tees bay area on 18 and 19 Jan. Onboard assessment of the samples showed no obvious impact on animals present in the area. In the epifaunal trawls, healthy swimming crabs (*Liocarcinus holsatus*) were present at 3-4 of the sites.
 - At depth phytoplankton samples were also taken and have been sent to Cefas for analysis.

- The EA also commissioned preliminary rocky shore intertidal surveys, by Aquatic Environments, to coincide with low spring tides on 20 and 21 January.
- Having visited six shores it appears that there has been a significant impact on the 'true crab' intertidal populations. No shore crabs or swimming crabs were recorded within the known zone of the event, whilst healthy populations were seen outside the area. Shore hermit crabs and possibly squat lobsters appear to have been less affected by the event, as their populations appear to be recovering and they were found (sometimes in good numbers) on the shores in the south of the area.
- From the limited observations made on these single post-event visits, it appears that the rest of the 'rocky shore' ecosystem has survived intact. For example the limpet, barnacle, periwinkle and dogwhelk populations, all keystone species, seem to have been relatively unaffected by the event, as healthy populations were recorded on all of the shores.
- **Algal bloom:** Satellite data from two online platforms ([Eutro Viewer \(cefas.co.uk\)](https://www.cefas.co.uk) & [s-3 EUROHAB](#)) show that an algal bloom occurred along the coastal area in question from 20 to 26 September (as shown in Figure 1) at high values, but persisting until 1 October, a week prior to the onset of the mortality event.
 - The bloom has unusually high values of chlorophyll (>40 mg/l) for the time of year, and sea temperatures were higher than normal (>15 °C until 26 September).
 - These conditions are conducive to the formation of a particular species of large biomass Harmful Algal Bloom (HAB) called *Karenia mikimotoi*. It has previously been implicated in lobster mortalities in the USA, by causing a crash in near bed dissolved oxygen.
 - Medium/high values of *Karenia mikimotoi* were detected in samples off the Beadnell Bay in early September. Low numbers were found in water samples at depth collected around Teesside in November.
 - Estimates of the effect such a bloom could have on reducing oxygen levels (as the microbial breakdown of dead bloom consumes oxygen) indicate that they could be locally significant and cause mortality directly under the bloom areas – but that effects would not persist beyond the storm that occurred on 6 October. This storm would then bring crabs or lobster that have died inshore, but the bloom would not be expected to last beyond this time.
 - Initially, samples of frozen dead crab and lobster were screened for two classes of marine algae-produced neurotoxins (ASP and PSP) which are known to have impacts on animal health within the marine food web. There was no evidence for these marine neurotoxins (domoic acid and saxitoxins) being present in the samples received at levels which would cause a concern.
 - Further samples of frozen dead crab and lobster from the early washup (8 October) were sent to the Cefas laboratory to be screened for additional algal toxins in light of the new information on the presence of the *Karenia* algal blooms. Additional analysis of the material (collected on 8 October, of dead crab and lobster from beaches) was conducted for toxins in the crab tissue (hepatopancreas / brown meat). Samples were subjected to methanolic extraction to assess the potential presence of brevetoxins – natural lipophilic toxins which have been reported in other countries as produced by various *Karenia* species of phytoplankton. Whilst brevetoxins were not detected, other

lipophilic toxins were detected and quantified, specifically the diarrhetic shellfish toxins okadaic acid and dinophysis toxin 2. The significance of these findings in the context of the mortality event is not yet fully understood.

Figure 1- Image of algal bloom in impacted area and to the north on 20 September 2021



Next steps

- The various agencies will continue to collaborate and bring together the evidence that has been collected during the investigation.
- Government scientists will continue to study the long-term effects of the incident and the agencies will work with local fishers to address any concerns they may have.
- Stakeholders will receive future updates where relevant, via meetings and stakeholder/media briefings.
- The public and industry can report any dead or dying crabs and lobsters, or any other incidents of concern via the contact details below.
 - The public can contact the Environment Agency helpline on 0800 80 70 60
 - Industry should contact NE IFCA on:
 - 01482 393 515 or
 - ne-ifca@eastriding.gov.uk

What are the results of the investigation so far?

Pyridine

- As per the update at the top of this document, pyridine was identified in the crab tissue from impacted areas using a novel screening technique. The method provides a starting point only and was employed to screen for any indication of a contaminant that could provide a lead for further investigation.
- The EA used an adapted accredited water screening methodology developed for the identification of substances including Pyridine. In response to the seriousness of this incident the method was adapted for the screening of biota (flora and fauna) and sediment to provide as much information as possible about any potential chemical pollution. It has to be recognised that the outputs are indicative as this is not a fully established/tested analytical method.
- Concentrations are regarded as 'low', 'medium' and 'high' relative values (across the samples) for interpretation purposes. The indicatively high concentrations in the first impacted crab samples immediately initiated several lines of investigation by the Environment Agency:
 - **Line of investigation 1:** It was assumed that pyridine was the cause and a potential source of the contaminant was sought. This included taking a formal water discharge sample (9/11/2021). No pyridine was found present. No source could be identified. (Note: As the impacted area and length of time of the Incident increased, with no dilution mitigation, a contaminant source became increasing improbable)
 - **Line of investigation 2:** Literature searches for information including the ecotoxicology and background levels of, and impact of, pyridine in crabs and lobsters, were carried out.
 - **Line of investigation 3:** Comparison crabs from outside the known impacted area were sourced to provide an indication of the 'background' levels of pyridine in crab tissues. Comparison crabs were obtained from St. Mary's Lighthouse, North Shields, Norfolk Wash (Eastern IFCA), Cornwall, and analysed using the same indicative screening technique. Levels found ranged from low to medium.
 - **Line of investigation 4:** Pyridine was analysed for in other materials in the area – water, sediment and blue mussels. Pyridine was detected at low levels by the screening method in blue mussels but not in the sediment samples. Pyridine was not detected in the water samples (note: the water screening methodology is an established and accredited lab method). Pyridine is readily soluble in water, and considered to be "mobile" in soil/sediments.
 - **Line of investigation 5:** A laboratory pyridine standard was obtained to validate that the screening technique was identifying pyridine. It has been confirmed that the substance detected was indeed pyridine but the 'concentrations' remain indicative only. A fully validated analytical method would need to be developed to obtain accurate concentration measurements.
- Some literature, and the presence of pyridine in the comparison crabs, may suggest that pyridine is linked to biological processes in the crab tissue, rather than being the cause of the mortalities. Further research into pyridine in crabs (and development in testing methods) is needed to confirm whether biological processes are of significance.

Other chemical pollution and sewage

- The EA do not consider chemical pollution and sewage as likely causes, and EA analysis of water quality detected nothing of concern that could cause this impact.
- They have tested using both traditional and innovative screening methods to analyse samples of water, sediment and crab looking for traces of contamination. They screened for over 1,000 potential chemical contaminants and found no anomalies or levels of contaminants that could lead to an event of this scale.
- Environment Officers also reviewed environmental permits and scrutinised industrial sites in the Teesside area and found no evidence of abnormal discharges that could lead to altered water quality.
- Cefas has also tested for signs of heavy metals in the crab tissue. They have found no clear indications of heavy metals being present in the samples received at levels which would cause concern.
- Sediment and water samples collected by the EA from the impacted area around Teesside in early October have now been screened for free cyanide. Results from these samples were below the detection limit of the test.
- The screening technique used provides a starting point only and was employed to screen for any indication of a contaminant that could provide a lead for further investigation.

Licensed activity (including dredging)

- MMO has reviewed activity that has an MMO marine licence (or deemed licence) and is not aware of any licensed activity that has taken place in the vicinity that would result in mass crustacean mortality.
- Licensed disposal of dredged sediment to designated disposal grounds is not likely to be the cause. All dredged material licensed for deposit at sea undergoes rigorous regulatory testing, in line with international guidance, to ensure that deposit of such material will not cause harm to marine life.
- Disposal of dredged material at sea can only be undertaken following significant testing of sediment samples for a suite of contaminants to ensure the material to be deposited meets these international guidelines.
- Material from ongoing (year-round) dredging operations is deposited in the designated Inner and Outer Tees disposal grounds off Teesmouth and there is no evidence to suggest that these deposits did not meet the required standards.
- The contaminants screened by the EA included those that dredging material is tested for, before sediment is licensed to be deposited at sea.
- Cefas completed an indicative 2D tracking model of the potential sediment plume from the dredge disposal site. The model indicates that the plume extents are relatively confined along the tidal excursion at the disposal site and do not have the same geographic extent that would be consistent with the known mortalities.

Disease and toxins

- Cefas have analysed crab samples for signs of infectious disease and naturally occurring marine harmful algal toxins.
- It has found no clear indications of marine neurotoxins (domoic acid and saxitoxins) being present in the samples received at levels which would cause concern.
- There is also no evidence from the samples that there is an infectious disease agent responsible for the mortalities observed and Cefas therefore do not believe that an aquatic animal disease is the likely cause of this event.

Health and safety

- There is currently no evidence of a food safety risk from healthy fish and crustacea, including crabs and lobsters, caught off the North East coast.
- Businesses should continue to ensure that food placed on the market is safe to eat and meets the relevant requirements in relation to food safety and hygiene.
- Members of the public fishing in the affected area should not handle or consume unhealthy fish or crustacea found dead or dying, including crabs and lobsters.

Questions

Is this an ongoing issue? Should levels of catch, more instances of dead or dying shellfish, and other issues continue to be reported and how?

- Anecdotal evidence suggests that dead and dying crabs and lobsters are no longer being found in significant numbers, but local industry and the public should continue to report any instances. This will help us get a better picture of what is still happening.
 - The public can report via the EA phone line
 - Local industry can do this through the NEIFCA office

Has dredging been ruled out as the cause? What testing has been done to reach this conclusion?

- Dredging has been ruled out as a likely cause. Samples of dredge material must meet the highest international standards protecting marine life before it is permitted to be disposed of at sea. If samples analysed for contaminants do not meet the standards, the disposal to sea of that material will not be licensed.
- Nothing in the testing of sediment prior to disposal or evidence from EA sampling suggests a chemical contaminant is a cause. Testing of sediment at the Inner Tees disposal site has already taken place in April 2021 and there was no evidence of significantly elevated contaminants in sediment at locations around and within the disposal site.
- Sediment that is proposed to be dredged in the Tees Estuary is tested and sampled across the footprint of the area to be dredged at least every three years prior to disposal.
- Cefas completed an indicative 2D tracking model of the potential sediment plume from the dredge disposal site. The model indicates that the plume extents are relatively confined along the tidal excursion at the disposal site and do not have the same geographic extent that would be consistent with the known mortalities.

Will the disposal of dredged sediment be stopped?

- No. The MMO uses the best available evidence to inform its decision making. There is no evidence to suggest that the disposal of dredged sediment responsible for the crab and lobster mortality – this has been tested in accordance with international (OSPAR – Oslo/Paris convention (for the Protection of the Marine Environment of the North-East Atlantic)) obligations.

Has cyanide in the sediment/water been tested for?

- Sediment and water samples collected by the EA from the impacted area around Teesside in early October have now been screened for free cyanide. Results from these samples were below the detection limit of the test.

Is it only crabs and lobsters affected? What about other species?

- The incident only appears to have affected crabs and lobsters. Reports of other animals, including octopus, limpets and shrimp found dead in the area appear to be

unconnected and are more likely to be a result of storms and bad weather in the area.

- Please continue to report instances of dead or dying animals through the helpline or NEIFCA representative so we can investigate.

Are there links to seabird deaths reported earlier in the year?

- The seabird death incidents were during late August and September and cases have significantly reduced since then. Investigative work to understand the cause is ongoing.

What about dogs which have been reported as falling ill recently?

- Defra and the Animal and Plant Health Agency are aware of these reports and are liaising with veterinary organisations, academia and animal charities. At present no specific cause has been identified by the private vets involved in treating dogs affected.
- If a pet shows clinical signs, then the owner should seek veterinary care from their own private veterinary practice

And seals?

- There is no evidence linking reports of dead seals to the investigation on crab and lobster deaths in the North East.
- If a member of the public observes a seal they deem in danger or distress, they should contact an appropriate helpline for advice and assistance (e.g. the RSPCA hotline in England and Wales; SSPCA hotline in Scotland; and USPCA in Northern Ireland, or the British Divers Marine Life Rescue on 01825 765546).
- The APHA Disease of Wildlife Scheme in conjunction with a network of collaborators from across GB undertake surveillance for new and emerging diseases in seals, however, large die-offs can occur for many reasons, including storm surges, food shortages, trauma, predation or disease outbreaks.
- The APHA Wildlife Expert group has commented that they have carried out post mortems on seal samples, taken from a range of sites in Great Britain, over the last year and not seen any evidence of an emerging disease.
- We will continue to engage with wildlife experts and remind the public not to approach dead or sick seals.

How are you measuring the impact on shellfish stocks in the area?

- We are continuing to work with fishers in the areas. Any information provided – especially in comparison to previous years' catch – will help us get a better picture of the impact on stocks. Please report this via your NE IFCA representative.

Are you sure that crabs and lobsters are safe to eat and sell? What about eating species which feed on crab/lobster?

- There is currently no evidence of food safety risk from fishery products caught off the North East coast, but is unsafe to eat any dead or dying animals, including crabs or lobsters, that are found.
- Businesses should continue to ensure that food placed on the market is safe and meets the relevant legislative requirements in relation to food safety and hygiene.

How are you sure that disease is not the cause?

- Cefas has taken further samples from the area recently, to investigate whether an aquatic animal disease is the cause of this incident. There is no evidence in the samples analysed that there is an infectious disease agent responsible for the mortalities.

What about compensation/support for the industry?

- The priority of the government is to investigate and understand the cause of the issue. At this stage, while investigations into the cause are ongoing, we are not considering financial support.

What about the possibility of natural causes?

- Mass crustacean mortality events can occur from natural causes. For example, a mortality event was evident off the Kent coast in Dec 2011 that was linked to unseasonal low temperatures.
- As referenced above, a harmful algal bloom may have caused the incident, with lines of evidence pointing to this.