Red Tide 1C

Red tides are a natural and seasonal phenomena which occur widely off the coast of Namibia and South Africa as a result of nutrient enrichment from intense upwelling. Most red tides represent useful contributions to plankton production, but some produce harmful results. Harmful Algal Blooms (HABs) are the type we read or hear about most frequently in the media.

In recent years, HABs have caused increasing concern around the world because they frequently result in large scale fish mortalities, or shellfish poisoning which can adversely affect fish farming enterprises, coastal tourism and fisheries. Globally there is a belief among many experts that the scale and complexity of HABs is increasing. Some believe that this may be due to an escalation in nutrient enrichment from the land due to agriculture and sewerage effluent, or the result of climate change. Other experts attribute the apparent increase in HABs to heightened awareness and improved surveillance of the phenomenon.

In South Africa red tides and HABs occur most frequently along the west coast in late summer and early autumn, when prevailing winds blow surface water offshore, causing cold, nutrient-rich water to rise up from the deeper reaches of the ocean to take its place. This process is called upwelling.

Red tide organisms

Phytoplankton are microscopic, single-celled organisms that float in the sea. They are able to photosynthesise and form the basis of food chains in the oceans. There are three types of red tide organisms: dinoflagellates, diatoms and ciliates.

Dinoflagellates usually lie dormant on the seabed until they are lifted to the surface during upwelling where the ideal conditions of temperature and light trigger their germination. The dinoflagellates begin to grow and divide until there is a rapid increase in their numbers, sometimes to millions of cells per litre of water. This is known as a phytoplankton bloom. The concentration of the bloom by winds and currents leads to the formation of a red tide, which may colour the water red, orange, yellow, brown or even purple. (Water discolouration varies with the species of phytoplankton, its pigments, size and concentration and the time of day and angle of the sun.)

It is important to note that red tides are not the result of a sudden population explosion of phytoplankton, but rather the concentration of phytoplankton following normal population increases. If calm weather follows a bloom the plankton may become trapped in a bay, use up all the nutrients and die.

Mass mortalities of marine life

Certain types of red tide kill shellfish and cause huge mortalities of abalone, white mussels and black mussels. Other HABs do not harm the mussels but are stored and concentrated in their bodies so that they become poisonous if eaten by humans. Mussels remain contaminated for about four months. Most of the mass mortalities of fish and rock lobster, however, are due to oxygen depletion, either because their gills become clogged or because the oxygen in sea water is used up when the red tide dies and rots. During the decay process aerobic bacteria soon deplete the oxygen in the water and are replaced by anaerobic bacteria. Anaerobes obtain their energy by converting sulphur into toxic hydrogen sulphide gas. This gas smells of rotten eggs, turns the water black and poisons the remaining organisms. A "black tide" event in St Helena Bay killed 95% of all marine life.

Rock lobsters are particularly susceptible to oxygen depletion because they are unable to swim to the surface of the water where oxygen levels are higher. Their only refuge is in the surf zone, where wave action generates oxygen-rich water, but where they are easily left stranded when the tide retreats.

In 1997 the largest ever stranding of rock lobster on the South African west coast followed the decay of a massive bloom of the dinoflagellate, *Ceratium furca*, at Elands Bay. The total loss was estimated to be 2000t and concerns were raised about the future of the commercial rock lobster fishery in this area. Of particular concern was the fact that almost all of the stranded animals were under the legal size. Strandings of rock lobster, as a consequence of low oxygen events, are common on the west coast and are most frequent in the vicinity of Elands Bay, one of the richer rock lobster grounds.

Mass stranding of rock lobsters at Elands Bay

Shellfish poisoning of humans

Toxins produced by certain dinoflagellates are among the strongest poisons known to human beings. Shellfish such as mussels, clams and oysters are particularly vulnerable to red tides because they feed by filtering particles, including phytoplankton, from the water. Toxic phytoplankton accumulate in the digestive systems of these filter-feeders and, although they do not harm the shellfish, they can cause illness or even death to birds, marine mammals and humans who consume contaminated shellfish. There are four distinct types of shellfish poisoning.

Paralytic Shellfish Poisoning (PSP) In South Africa, PSP is associated with the dinoflagellate, *Alexandrium catenella*, which produces toxins that disrupt normal nerve functions. The resulting symptoms usually appear between one and five hours after eating contaminated seafood; they include tingling and numbness of the mouth, lips and fingers, accompanied by general muscular weakness and lack of coordination. Death may result from respiratory paralysis.

Paralytic shellfish poisoning is the most dangerous type of shellfish poisoning to occur in South Africa. Red tide warnings should be taken extremely seriously. Even a single mussel contaminated with the PSP toxin can result in death. Cooking only slightly lessens the toxicity of affected shellfish.

Diarrhetic Shellfish Poisoning (DSP) The dominant symptoms of DSP include diarrhoea, nausea, vomiting and abdominal pain. Because these symptoms are often confused with those of gastroenteritis, it is likely that Diarrhetic shellfish poisoning has gone unreported on many occasions.

Neurotoxic Shellfish Poisoning (NSP) In 1989 30 tons perlemoen were poisoned by the dinoflagellate *Gymnodinium nanasafeinse* and could not grip the rocks. The noxious effects of NSP may be carried by seaspray. During the 1995/96 December holiday season, visitors to False Bay, outside Cape Town, reported symptoms such as stinging eyes, difficulty in breathing, coughing and sneezing after they had come into contact with contaminated seaspray.

Amnesic Shellfish Poisioning (ASP) To date ASP has not been observed in South Africa although the species responsible for ASP is thought to occur in here. The symptoms are abdominal cramps, disorientation and memory loss.

Before eating shellfish contact the Redtide Hotline at (021) 402 3368. A recorded message will tell you whether it is safe to collect and eat shellfish.

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RED TIDE SPECIES

Dinoflagellates have two whip-like flagellae that propel them through the water.

The decay of *Ceratium furca* caused a massive stranding of rock lobsters

Gonyaulax polygramma can cause death when large blooms die off

A chain of cells of *Alexandrium catenella*, the most dangerous paralytic red tide organism, which is stored in mussels making them poisonous

Gymnodinium species are responsible for neurotoxic poisoning.

Ciliates swim using fine hairs (cilia).

Mesodinium rubrum is a common photosynthetic ciliate responsible for non-toxic red tides. Its die off can cause low oxygen events when large numbers of fish and shell fish die.

Dinophysis acuminata, one of four species that cause diarrhoea.

Diatoms

Pseudonitzschia pungens causes memory loss.

FURTHER INFORMATION: • Pitcher, G. 1998. *Harmful Algal Blooms of the Benguela Current*. Sea Fisheries S. Africa, Dept Environmental Affairs • Van der Vyver, I and Pitcher, G. 1993. *Red Tide and Shellfish Poisoning*. Sea Fisheries S. Africa, Dept Environmental Affairs

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