Fishnote

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Freshwater Fish Kills in the Top End

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Territorians are often astounded by the number of dead fish that appear in billabongs and wetlands, especially during the build-up and wet season of most years. Such fish kills are nearly always natural events, and are usually related to a low amount of oxygen in the water. Fish kills are a common occurrence in Top End freshwater systems and in the tropics generally.

HISTORY

On average, more than five fish kills are reported to the department each year (Figure 1). The average number of fish reported dead during each fish kill exceeds 500. However, it is often difficult to accurately estimate numbers and species of dead fish. More dead barramundi have been reported than any other species (Table 1), although they are more likely to be identified and reported than most other fish species, due to their iconic status amongst recreational anglers.

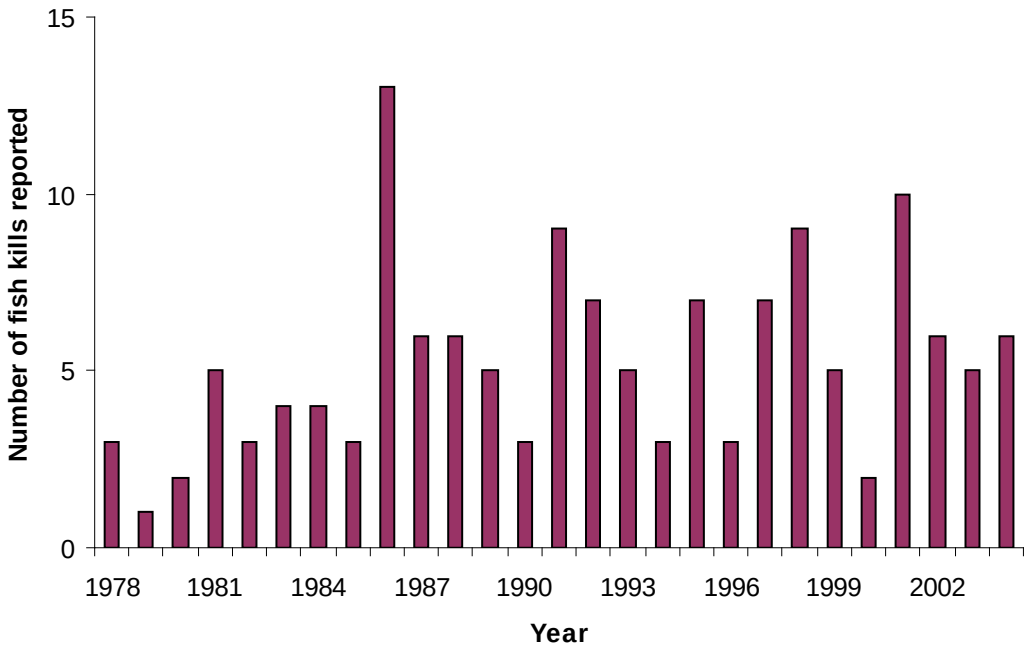

Figure 1. Numbers of fish kills reported to the department each year, from 1978 to 2005

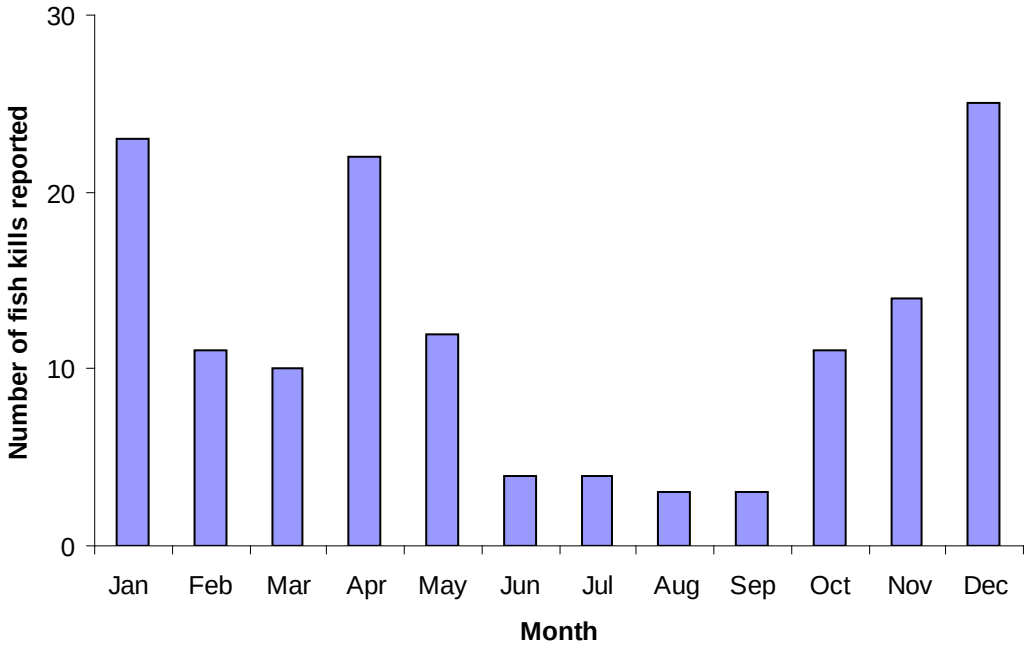

Figure 2. Cumulative monthly number of fish kills reported to the department over 29 years, from 1978 to 2005

Table 1. Numbers of fish reported dead between 1978 and 2005

Fish species	Numbers
Barramundi	11 453
Catfish (eel and fork tailed combined)	3058
Anchovies	2092
Mullet	1221
Sardines	1000
Grunters	776
Bony Bream	664
Other fish	54 861

WHY DO FISH KILLS OCCUR IN THE WET SEASON?

Fish kills are most common during the build-up and wet season (Figure 2).

During the wet season most freshwater fish spread out over the wetlands, inhabiting areas that were dry only days earlier. During March to April, as the rains decrease and the water slowly drains out to sea, fish slowly move into the deeper permanent channels, greatly increasing demand for oxygen and food sources, especially in the smaller creeks. This demand increases again around October and November when the temperature starts to rise, making fish more active. Higher temperatures also increase the activity of microbes such as algae and bacteria, which can use up dissolved oxygen in the water. Evaporation and leaching during the dry season turn the once deep channels into shallow, warm bodies of water. The combination of large concentrations of fish in relatively shallow, warm billabongs is a recipe for disaster.

WHAT CAUSES FISH KILLS?

Most fish kills in Top End fresh waters are caused by low levels of dissolved oxygen, resulting in fish suffocating. This happens when a rise in water temperature at the start of the build-up to the wet season causes a decline in the amount of dissolved oxygen that can be held in the water.

Low levels of oxygen also result when oxygen is rapidly removed from water bodies by either large inflows of water with low levels of oxygen and large amounts of organic matter, or when surface and bottom layers of water mix. Fish kills are also caused by rain water washing organic matter from floodplains into the main water channels. Other contributing factors include shrinking water bodies, bacteria and other organisms, which use up oxygen in the water.

Inflow of Water with Low Levels of Oxygen

This is the most common cause of fish kills. Water flowing into the billabongs from the floodplains can be very low in oxygen and contain high amounts of organic matter. When such water enters the main channel, the concentration of oxygen in it falls, leading to fish deaths. Bacteria use up dissolved oxygen in the water when they break down organic matter, which can cause dissolved oxygen levels to drop to very low, fatal levels. Sometimes the inflowing water can simply replace the water in the channel, thereby replacing oxygenated water with low oxygen water.

Mixing of Water Layers

Water in billabongs and slow moving creeks and rivers can become layered in the dry season. A relatively thin surface layer of water with large amounts of oxygen often sits on top of a thicker bottom layer that contains very little oxygen (Figure 3). These layers can be mixed by strong winds or a sudden rush of water entering the system with the first rains. When the different water layers mix, the whole water column can end up with very low levels of oxygen.

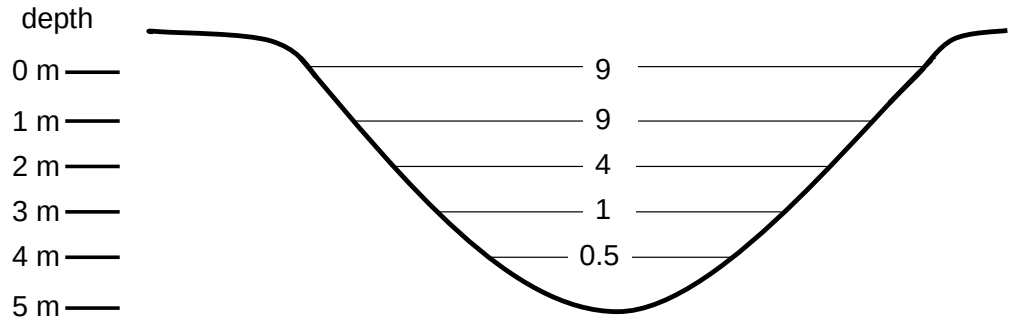

Figure 3. Dissolved oxygen (mg/L) at Corroboree Billabong (Mary River) on 9 December 1997

Figure 3 shows a thin layer of water with high levels of oxygen (9 mg/L) on top of deeper water with little oxygen (0.5 mg/L).

Naturally Occurring Toxins

Another less common cause of fish kills are naturally occurring toxins. Toxins can come from a number of sources including soil, plants and fish themselves.

Many wetlands have sulphate soils and so run-off from wetlands can sometimes be quite acidic. Acidic water can cause naturally-occurring aluminium to interfere with fish gill membranes, preventing them from absorbing oxygen.

Some common wetland plants release toxic compounds when they decompose. Such compounds are generally found in such low concentrations that they are very unlikely to cause a large fish kill.

Fish release waste products such as ammonia, which can build-up to toxic levels, especially when a lot of fish are in a small water body, as may occur when isolated billabongs shrink over the dry season. Except in extreme cases, this is usually not a problem in natural situations.

THE MARY RIVER

Salt water has spread inland within the Mary River floodplains over the last 50 years. This has killed large areas of paperbark swamp and highly productive floodplain grass habitats. There are many theories on the cause of this intrusion, from rises in the sea level to erosion caused by feral buffaloes. Whatever the cause, the end result is the same: a large loss of freshwater habitat for juvenile fish, including barramundi.

To prevent salt water from entering freshwater habitats, earth walls (barrages) have been built across some of the smaller creeks. Spillways have been built to allow fish to move upstream and downstream during the wet season. This helps ensure that fish do not become stranded as a result of the barrage. The major effect of the barrages is therefore to protect freshwater habitats.

A barrage with a spillway was built at Shady Camp in 1988 to prevent salt water from encroaching further up the main channel of the Mary River. A permanent freshwater billabong has now been re-established above the barrage and during the wet season a large amount of fresh water flows over the spillway to the ocean. Fish kills have been noted in this area both before and after construction (Figure 1), suggesting that the barrage does not cause fish kills.

Barramundi populations in the Mary River system have been monitored regularly since 1989. Barramundi deaths due to fish kills in Corroboree Billabong have very little impact on total numbers of barramundi in the billabong.

WHAT CAN YOU DO?

Most fish kills are reported by recreational fishermen and tourists. If you notice any fish kills, it would be appreciated if you would notify one of the departments listed below as soon as possible. This will enable a quick response and investigation into the cause of the kill. A fish kill investigation manual is available on the internet at http://www.nt.gov.au/d/Content/File/p/Fish_Rep/FR70.pdf and details the sort of information that is most useful in determining the most likely cause of an observed fish kill.

CONTACTS

Northern Territory Government - Fisheries
Phone: (08) 8999 2144
Fax: (08) 8999 2065

POLLUTION ASSISTANCE LINE

24hrs free call
Phone: 1800 064 567

ACKNOWLEDGMENTS

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FURTHER INFORMATION

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