

# Ocean Warming

In the summer of 2010/11, ocean waters around the mid-west coast of Western Australia rose more than 3°C above average, in what was later termed a 'marine heatwave'.

Following this event, higher than average summer water temperatures persisted for the next two years with record-high water temperatures experienced on the south coast and at Ningaloo in the 2012/13 summer. Temperatures then declined to more average levels before starting to rise again in 2017.

## The Leeuwin Current

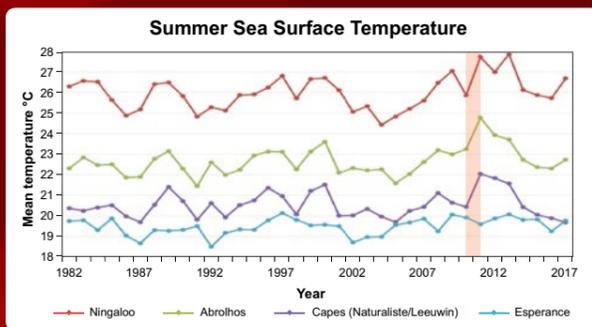
is a warm tropical current that pushes south from Indonesian seas down the west coast and past Cape Leeuwin.

The extreme 'marine heatwave' event is thought to be explained by an unseasonal surge in the southward-flowing Leeuwin Current, which coincided with high atmospheric temperatures (that was associated with an intense La Niña period) and no wind. This resulted in increased heat exchange from the atmosphere to the ocean.

The current typically flows most strongly during May to July, however in more recent years, peak flows have occurred earlier in the year around February to April – resulting in higher than average

water temperatures.

Both large-scale satellite imagery and local temperature loggers are being used to monitor sea surface temperatures as part of a long-term monitoring program. See the figure below highlighting summer sea surface temperatures between Ningaloo and Esperance.



## Effect of ocean warming

The distribution, abundance, survival and growth of most marine plants and animals are affected by water temperature, especially sharp rises or falls. In comparison to the terrestrial environment where species can tolerate relatively large temperature ranges, in the marine environment, which is fairly stable, species are only able to tolerate relatively small changes in water temperature. Significant increases can ultimately cause death, particularly for species that cannot move.

Ocean warming has had a major effect on a variety of marine species along the Western Australian coast.

## Fishery impacts

The marine heatwave caused the closure of the Kalbarri Roe's abalone fishery when over 99% of stock died. The abalone stock in the Perth metropolitan area was also affected by the warmer water temperatures but to a lesser extent. A research trial has been conducted in Kalbarri to relocate stocks of Roe's abalone into the area in an attempt to assist the stock recovery.

The scallop and crab fisheries suffered poor recruitment resulting in the closure of the commercial fisheries. Both crab and scallop stocks have now recovered 4-5 years on from the marine heatwave event.



Seagrass. Photo: Michael Burgess.

### Habitat loss

Large areas of seagrass and kelp forest habitat were devastated. The combined effect of the marine heatwave and severe river flood events, led to the thinning out of Shark Bay's seagrass meadows that are the basis of Shark Bay's food web.



Photo: Department of Environment and Conservation.

### Coral Bleaching

Coral bleaching were reported at many coastal sites around the State extending from Ningaloo Reef to Rottnest Island. For example, sites surveyed at the Abrolhos Islands showed 50-100% coral loss after the marine heatwave.



Asian green mussel. Photo: Helen Cribb, Northern Territory Government.

### Marine pest risk

Changing environmental conditions including warmer waters, increased marine infrastructure, combined with greater vessel numbers place stress on our marine systems increasing the likelihood for incursions and establishment of introduced species along our coast.



Rabbitfish. Photo: Chris Dowling.



Bannerfish. Photo: Anna Micha.

### Species range shifts

Following the marine heatwave, a variety of tropical species have been observed outside their typical range, including reef bannerfish at the Busselton Underwater Observatory, whale sharks off Mandurah and several native tropical crab species in the Swan River.

Rabbitfish have also become established and are now breeding in the Cockburn Sound region.



Roe's abalone. Photo: Dave Murphy.

### Species mortality

A number of different fish and invertebrate species, including pink snapper and rock lobster, died as a result of the sudden rise in sea temperature. Slow moving species, such as abalone, were particularly impacted with extreme levels of mortality.



### Redmap

On the lower west coast and south coast, fishers have been benefiting from the shifting range of some tropical species particularly members of the Emperor family e.g. redthroat emperor, spangled emperor and red emperor. Fishers and divers are encouraged to report unusual captures/sightings to Redmap ([www.redmap.org.au](http://www.redmap.org.au)).



Redthroat emperor. Photo: Courtesy Redmap Australia, [www.redmap.org.au](http://www.redmap.org.au)