

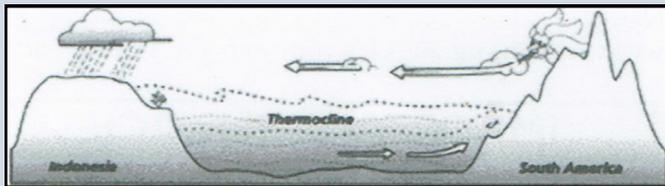
El Nino and the Leeuwin Current

Did you know there's a connection between anchovies in Peru and the success of the crayfish season in Western Australia? It's all to do with a phenomenon known as El Nino, water circulation in the Pacific Ocean and the Leeuwin Current.

The effects of El Nino reach right around the globe. When we have droughts, large areas of Indonesia, India and Southern Africa also experience dry conditions, Peru gets floods; and parts of North America have high temperatures.

In the eastern Pacific in a "normal" year (dubbed La Nina), colder, nutrient-rich water from the deep ocean rises to the surface (upwelling) due to offshore winds. This promotes blooms of plankton (microscope plants and animals), which in turn are eaten by anchovies, a major fishery and important part of the economy of this region.

The southeast trade winds then blow the cool water from the eastern Pacific westward and as it makes its way towards the Indonesian Archipelago it is warmed by up to 80 C by the tropical sun. This is an important process for feeding moisture over Australia as air over warm water rises, taking moisture with it, giving rise to towering cumulo-nimbus clouds that bring summer rain.



Normally, strong trade winds blow from the east along the equator, pushing warm water into the Pacific Ocean. The thermocline later of water is the area of transition between the warmer surface waters and the colder water of the bottom.

On occasion, the eastern Pacific warms up due to local symptoms of a global weather change. The end result is rising air over the eastern Pacific and a weakening or reversal of the airflow across Pacific as it pulls air from the west. This prevents the upwelling from occurring and removes the moisture feed for Indonesia and Northern Australia. When this reversal occurs, the Peruvian fishery collapses, and it is called an El Nino. (A shortening of Spanish for Christmas Child as the warm currents appear around Christmas)



An El Nino condition results from weakened trade winds in the western Pacific Ocean near Indonesia, allowing piled-up warm water to flow toward South America.

An El Nino is a process that has the capacity to severely disrupt global weather patterns producing potentially severe symptoms for us including fires and droughts and effecting fishing for years at a time. We measure onset with the Southern Oscillation Index (SOI), a seesawing effect of air pressures at Darwin and Tahiti.

It is because of this fluctuation of atmospheric pressure that it has been given the name El Nino Southern Oscillation (ENSO).

The Leeuwin Current

In each of the southern hemisphere oceans, there is an anti-clockwise water circulation (or gyre), driven by the southern easterly trade winds near the equator and strong persistent westerlies in the "roaring forties" of the Southern Ocean. The situation off Western Australia is quite different, with warm, clear, low salinity and nutrient poor water of tropical origin flowing southwards along our coast. This eliminates the large-scale upwelling and highly productive waters that exist on other continental west coasts.

A century ago during a study of marine life of the Abrolhos Islands (29°S), a naturalist, William Saville-Kent, suspected that there was probably a warm southward-flowing current off Western Australia and not the expected cool northward current as those near South Africa and South America. He based his view on observations of warm waters and tropical marine flora and fauna around the Abrolhos Islands. Subsequent reports by fishers and scientist noted the presence of southerly currents. It was only with the advent of satellite technology in the 1970's that the existence of the southward current was finally confirmed.

This current has been named the Leeuwin Current, after the Dutch vessel (Leeuwin meaning Lioness) that explored our southwest coast in 1622. The reason for the southward flow is the relatively high sea level gradient between the tropics and the Southern Ocean. These differences in sea level (0.5 metres) is caused by the build up and flow of warm Pacific Ocean water westwards through the Indonesian Archipelago into the Indian Ocean. During an El Nino period, when the trade winds of the Pacific Ocean reverse, the build up of water in Indonesia is reduced resulting in a weaker Leeuwin Current therefore effecting the ocean processes along Western Australian coast.

The Leeuwin Current literally flows downhill from northwest Cape along the Western Australia coast, before turning eastwards at Cape Leeuwin and continuing into the Great Australian Bight where its influence can extend east to Tasmania.

The Leeuwin Current is also responsible for the existence of coral reefs as far south as 29°S and the presence of tropical species at Rottnest Island and along the south coast. It rarely flows around the eastern side of Rottnest, but it frequently bathes the western and southwestern sides, influencing the flora and fauna there. Sea temperatures in those regions in winter are several degrees higher than against the mainland coast even though the mainland coast is 4°C warmer than comparable continental west coasts.

The relatively large production of invertebrate species (such as rock lobster and prawns) compared to finfish in Western Australia is in sharp contrast to other regions of the world where finfish production is usually dominant. This is primarily due to the waters of the Leeuwin Current, which do not favour the production of large quantities of finfish.