CLIMATE CHANGE

THE IMPACT ON SE AUSTRALIAN

ATLANTIC SALMON AQUACULTURE

Australia's south east is a climate change 'hotspot', with marine waters warming at more than three times the global average.

The changes will affect Australia's fisheries and aquaculture sectors in different ways.

The East Australian Current (EAC) will push several species further south, potentially improving offshore fishing opportunities for pelagic species. But the climate shift threatens species including Atlantic salmon, creating significant challenges for sustainable aquaculture.

State and Commonwealth agencies are working together to ensure commercial, indigenous, recreational fishers and aquaculture industries understand the biophysical, social and economic implications of climate change.

Through the El Nemo South East Australia Program (SEAP), the agencies are helping fisheries and aquaculture sectors in South Australia, Victoria, New South Wales and Tasmania to manage risks and adapt to change.

State Government Victoria

DEPARTMENT OF PRIMARY INDUSTRIES | fisheries

EL NEMO SOUTH EAST AUSTRALIA PROGRAM **FACT SHEET**

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What is climate change?

Natural climate variability operates on a range of short-term time scales (seasonal, annual, decadal), while climate change refers to movements in climate averages over decades or longer which differ from historical environmental conditions.

Scientists from the CSIRO, Bureau of Meteorology, and other institutions around the world caution that human-induced global warming, caused by industrialisation, burning fossil fuels, land clearing and loss of wetlands, is triggering changes in the ocean and atmosphere that are impacting on marine ecosystems.

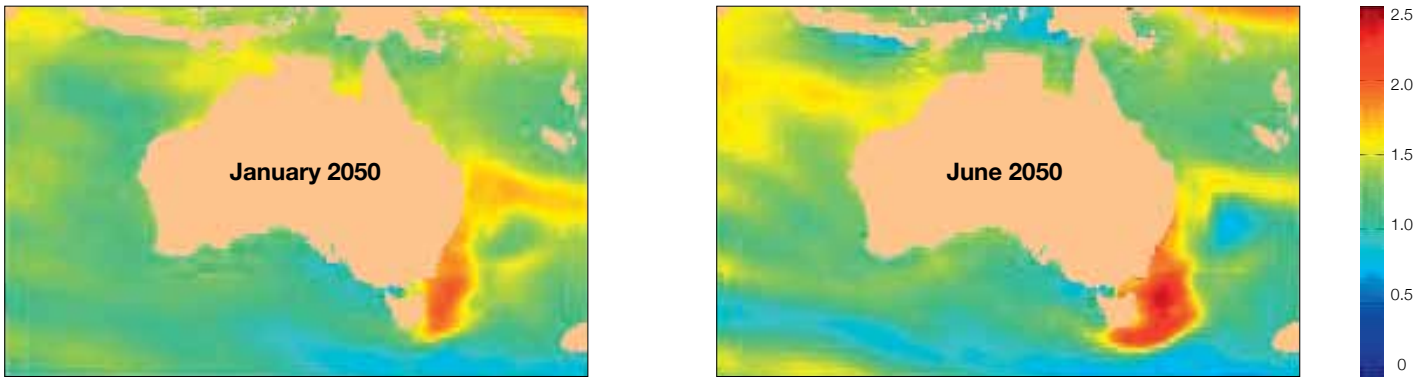
Climate change and the marine environment

Oceans are the earth's main buffer to climate change, absorbing up to 80 per cent of the heat and 50 per cent of the carbon emitted from the atmosphere. Changes in temperature, environmental flows, ocean pH, sea level, and wind regimes impact on fish productivity and species distribution, with flow-on effects to the communities and fisheries they support.

SE a global climate change 'hotspot'

Ocean warming has been observed around the world, with an average global increase of 0.6 degrees celsius. However the rate of warming in south east Australia is 2.3 degrees higher, with coastal waters warming at more than three times the global average.

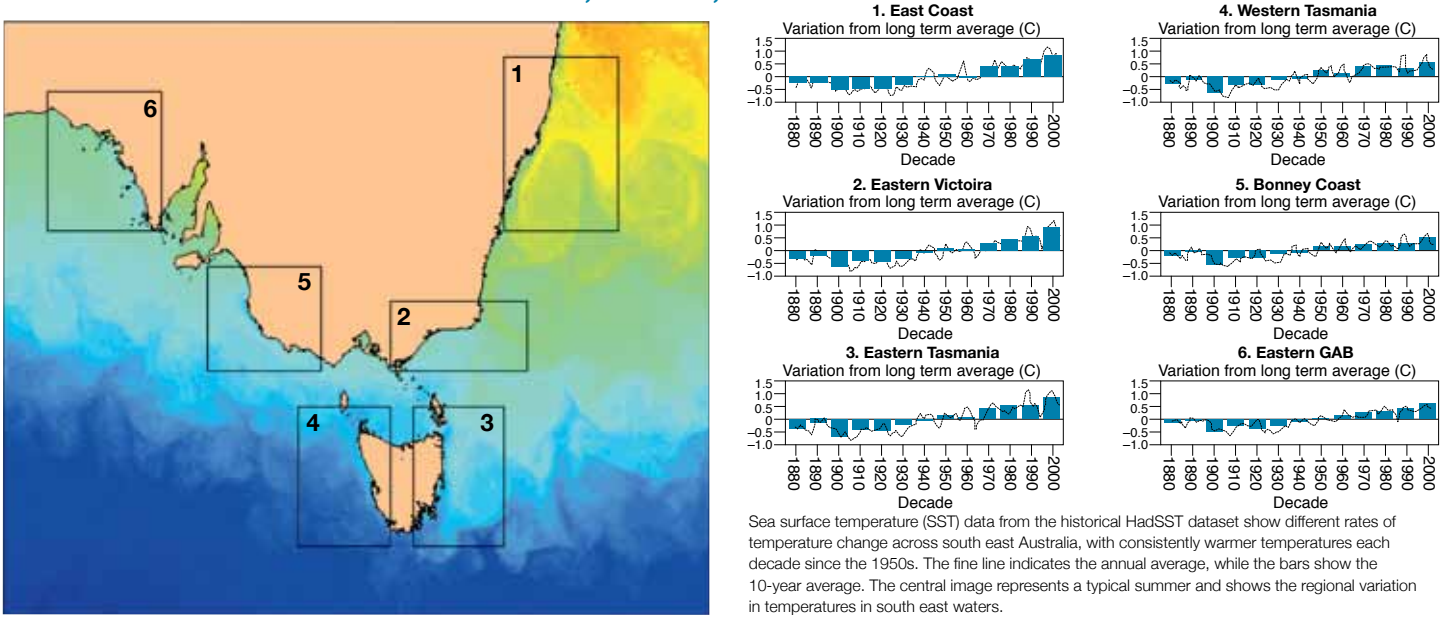
FIGURE 1 Projected increase in sea surface temperatures (2050)



Projected increase in summer and winter sea surface temperature based on a high, but likely, greenhouse gas scenario and medium climate sensitivity. (Simulations from nine climate models were used to project the temperature average).

SOURCE: ALISTAIR HOBDAY, CSIRO

FIGURE 2 Historical change in sea surface temperatures south east Australia, Jan 1, 2010



Sea surface temperature (SST) data from the historical HadSST dataset show different rates of temperature change across south east Australia, with consistently warmer temperatures each decade since the 1950s. The fine line indicates the annual average, while the bars show the 10-year average. The central image represents a typical summer and shows the regional variation in temperatures in south east waters.

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Biophysical changes projected

Rapid warming in south east Australia is synonymous with increased ocean temperature, salinity, sea levels and currents; decreased pH and rainfall; and more frequent extreme weather events.

Ocean temperatures

Ocean temperatures in the south east have warmed by 1.4 degrees since the mid 1940s and are likely to rise another degree by 2030 and a further 2.5 degrees by 2100 (See figures 1 and 2 for projected and historical changes).

Ocean acidification

When carbon dioxide dissolves in the ocean, it directly impacts on fish and invertebrates, and changes the ocean chemistry. A 30 per cent increase in hydrogen ion (acid) concentration in south east Australian marine waters since 1750 has lowered pH (ocean acidification), possibly affecting marine animals that use calcium carbonate to form protective shells.

Ocean currents

The East Australian Current (EAC), which moves warm water counter-clockwise down the east coast, has strengthened by 20 per cent over the past 50 years and is likely to strengthen another 20 per cent by 2100. Stronger, more consistent flows of warm currents along the eastern continental shelf will extend distribution of several warm water sub-tropical species south into parts of Victoria and Tasmania.

Biological changes projected

Fish distribution and abundance

Warming waters in south east Australia are triggering biological responses including a shift in pelagic species distribution, abundance and productivity. Due to drought, estuarine areas in the south east are predicted to become more saline with less freshwater inflows to flush the rivers. Species such as black bream depend on freshwater inflows for successful spawning and prolonged drought is likely to adversely impact recruitment. Species with low tolerance to warmer water temperatures could decline, and long-lived species unable to adjust quickly to changing conditions may also be affected. South east Australia's valuable Atlantic salmon aquaculture operations similarly face challenges from exposure to warming waters, increased rainfall events and a higher disease risk.

Life-cycle timing

As ocean temperatures continue to warm, the timing of life-cycle events such as spawning or moulting is changing in some species. Events are now occurring at different times throughout the year.

Growth rates

In southern locations, warming water temperatures may increase growth rates of fish and other species, depending on temperature sensitivity. However, some species may experience a growth decline if waters warm beyond their physiological limits.

What is climate change adaptation?

Adaptation aims to moderate or cope with the effects of climate change by reducing vulnerability of fish stocks and habitats. Options may include:

- selective breeding (aquaculture) to increase tolerance to warmer waters
- managing environmental flows to optimise spawning conditions for estuarine fish during drought
- adjusting size limits if 'size at maturity' varies due to changing growth rates.

Understanding the physical and biological effects of climate change, particularly changes in fish distribution and productivity, is a prerequisite to adaptation and should be acknowledged in risk management strategies.

Addressing the potential impacts of climate change on commercial and recreational fishing could involve:

- developing new resource-sharing arrangements between different jurisdictions and users
- setting catch limits under harvest strategies (and prioritising strategy implementation)
- incorporating climate change projections into stock assessment modelling.

Adaptation can also include providing new 'niche' opportunities for the commercial, recreational and charter sectors. Greater numbers of tropical and sub-tropical species including blue marlin, mahi mahi, yellowfin tuna and cobia will extend their traditional range and cross jurisdictions into Victoria and Tasmania, while Spanish mackerel and wahoo will extend across the border into southern New South Wales. Flexibility will be important, as fishers may have to relocate their operations or alter fishing activities to take advantage of changes in species distribution.

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ATLANTIC SALMON – IMPACTS OF CLIMATE CHANGE

Atlantic salmon (*Salmo salar*) supports a highly valuable ocean-based aquaculture fishery in Tasmania, with an annual gross value of production estimated at $350 million.

A risk assessment commissioned by SEAP determined that climate change would impact on Atlantic salmon in the following ways:

- increased water temperatures could see the thermal limit exceeded in parts of Tasmania, adversely impacting production
- warming waters could also cause stress and increase the risk of disease
- freshwater availability, extreme storm events and more jellyfish blooms could have implications for the industry.

Adaptation by the industry is focused on selective breeding and new husbandry techniques.

What can you do?

Commercial, indigenous, recreational and charter fishers are in a position to observe early changes in the marine ecosystems.

By reporting these changes, or taking a photograph of a species you do not recognise, you will ensure scientists and fisheries managers have access to the latest information.

You can also help to monitor changes through the use of routine commercial fishing logbooks, angler diary programs, or community-based tools including the Range Extension Database Mapping Program – Redmap (www.redmap.org.au).

redmap SPOT. LOG. MAP.

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EL NEMO SOUTH EAST AUSTRALIA PROGRAM (SEAP)

Launched in 2009, SEAP represents a four-year partnership between Australia's State and Commonwealth fisheries management and research agencies. Coordinated by the Victorian Department of Primary Industries, key partners include the Fisheries Research and Development Corporation, the CSIRO, the University of Tasmania and the South Australian Research and Development Institute. SEAP is co-funded through the Australian Government's Climate Change Research Program – a key component of Australia's Farming Future. The collaborative partnership sets a new benchmark for Australia's fisheries and aquaculture sectors, and responds to the need for a coordinated, outcome-focused approach to climate change adaptation and management in State and Commonwealth marine waters from the South Australia/Western Australia border to the New South Wales/Queensland border. SEAP is one of three programs across Australia underpinning the National Climate Change Action Plan for Fisheries and Aquaculture.

FURTHER INFORMATION

For more information contact Fisheries Victoria on 136 186 or visit www.dpi.vic.gov.au/fishing

Fisheries Victoria is seeking positive and practical stories about climate change action. Contact us on 136 186 if you have a story to share.

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