NCCARF
National
Climate Change Adaptation
Research Facility
Adaptation Research Network
MARINE BIODIVERSITY AND RESOURCES

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information sheet 6

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Edited by Neil Holbrook. Published in April 2011

Climate Change, the Marine Environment and Fisheries Adaptation: Victoria

Bass Strait is an area of shallow continental shelf waters located between Victoria and Tasmania connecting the south-east Indian Ocean with the Tasman Sea. Bass Strait is a convergence zone for temperate oceanic currents. The poleward flowing Eastern Australian Current (EAC) along Australia's eastern seaboard and Leeuwin Current along Australia's western and southern seaboards both transport warm, low nutrient ocean waters into the eastern and western regions of Victoria's marine environment. Seasonal upwelling is also an important feature of Victoria's western, and to a lesser extent eastern, coastal regions, introducing nutrient rich waters that stimulate productivity.

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Computer model simulations predict that the Tasman Sea to the southeast of Australia is expected to experience the greatest level of warming in the Australian region[1]. The warming expected in the Tasman Sea is associated with systematic changes in the surface currents on the east coast of Australia, including a strengthening of the EAC and increased southward flow as far south as Tasmania. Ocean temperatures at Maria Island off the east coast of Tasmania have warmed at a rate of 2.28°C per century over the past 60 years[2] (more than three times the global average). Projections for changes to the Leeuwin current and upwelling along the eastern and western Victorian coastlines are less certain, but any changes are likely to influence the distribution and abundance of marine organisms[3].

Ecologically, Victoria's marine environment shares many similar fishery resources and habitats with the neighbouring states of Tasmania, South Australia and New South Wales. Some of the observed ecological changes linked to possible climate change drivers in these states are also consistent with observations from Victoria's marine waters, including expansion of sea urchin *Centrostephanus rodgersii* 'barrens' along the eastern coast and reduced southern rock lobster recruitment and catches across the State.

Climate change is also predicted to change rainfall patterns across south-eastern Australia[4]. For example, in Melbourne between 1990 and 2030 it has been projected that across all four seasons of the year, mean rainfall would decrease by 1–7 %; this would be most pronounced in the 10th percentile of the rainfall range (9–16 % reduction). However, high rainfall events during summer and autumn are expected to increase (by 9 and 6 % respectively). These predicted changes, in association with increased solar radiation and evaporation, are expected to lead to a significant reduction in freshwater flows across the State. The ecological responses to these changes in flow patterns are uncertain, but these projections are likely to result in less available water to maintain base flow in rivers and streams that discharge into estuarine waters, while more frequent high intensity rainfall events would be expected to introduce 'high energy' catchment discharges into estuarine and coastal embayments.

Black Bream

Many organisms inhabiting estuaries are capable of tolerating a wide range of physical and chemical conditions than can occur in these highly-variable environments. However, it has been shown that black bream *Acanthopagrus butcheri* rely on specific estuarine conditions to facilitate spawning and the survival of the larval life stage[5]. Analysis of year-class strength of black bream based on age structure and pre-recruit surveys with physico-chemical data collected over

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25 years has demonstrated that year-class strength is strongly related to the amount of salinity stratification in Gippsland Lakes and freshwater flow into the Lakes[6]. Salinity stratification tends to increase with increasing freshwater flows but may decline at very high flows. Black bream recruitment showed a linear relationship with stratification and a dome shaped relationship with freshwater flow (i.e. recruitment was highest at intermediate flows)[6]. Introducing intermediate flows more strategically will reduce black bream vulnerability to climate change and facilitate adaptation. The relationship between successful recruitment of black bream and freshwater flow in other Victorian estuaries is currently unknown. A project focusing on a range of estuaries along Victoria's coastline is currently underway. This project will further examine the reliance of black bream on environmental flows in different types of estuaries. A key outcome will be to provide practical management advice to a range of stakeholders for enhancing successful black bream recruitment in a changing climate.

King George whiting

In Victoria, King George whiting spawn offshore and larvae are transported hundreds of kilometres by currents to juvenile nursery areas in bays and inlets where most of the fishing occurs. Prediction of the future trends in King George whiting under climate change projections depend to some extent on the mechanisms underlying the increase in sea surface temperature (SST) that has been occurring off western Victorian marine waters for at least 50 years[4]. If the main mechanism is to promote larval growth and therefore survival, then increasing SST should lead to a positive trend in recruitment and population size in bays and inlets. If, however, SST is an indicator of favourable currents that transport larvae to nursery areas such as Port Phillip Bay, then the possible weakening of the Leeuwin current under climate change may lead to a decreasing trend in recruitment and population size. The presence of adequate seagrass cover is also a significant influence on the King George whiting population as indicated by historical trends in Western Port[5]. Climate change is expected to have a negative effect on seagrass through decreasing light (resulting from greater water depth, turbidity, and storm intensity), and increased storm intensity and water temperature. Shallow seagrass beds are expected to be most affected, and a pilot study using underwater stereo video showed that juvenile whiting were strongly associated with shallow beds[5]. Further understanding of expected SST change, Leeuwin current weakening, and critical habitat needs of King George whiting, will enhance our ability to provide advice for supporting management measures that facilitate adaptation by DPI and other national resource management agencies for this important fish species in Victoria.

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References

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About the Marine Adaptation Network

The Adaptation Research Network for Marine Biodiversity and Resources (aka. the Marine Adaptation Network) is hosted by the University of Tasmania and convened by Assoc Prof Neil Holbrook. The Network is supported by 14 partner institutions nation-wide. It comprises a holistic framework of interconnecting marine themes that cross-cuts climate change risk, marine biodiversity and resources, socio-economics and policy. This interdisciplinary network aims to build adaptive capacity and adaptive response strategies for the effective management of marine biodiversity and living marine resources under climate change. For more information on the Marine Adaptation Network, or to subscribe to become a member of the Network, please visit <www.nccarf.edu.au/marine/>

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