

WAMSI NODE 4 MILESTONE PROGRESS REPORT (MPR)

Project Details

Project No. and Title	4.2 Assessment of marine communities and the impact of anthropogenic influences.
Node Leader	Rick Fletcher
Project Leader	Jessica Meeuwig / E. Harvey
SubProject No. and Title	4.2.3 Fisheries dependent data and climate
Project Start Date	1/1/08
Project End Date	30/6/11
Due Date for this Milestone	30/6/08
Milestone Description	Relevant climate-related data sets compiled. Relevant fisheries data sets compiled. Statistical analyses of fisheries dependent data as related to climate completed. Draft report completed. Final report completed.

1. Executive Summary

Alan Pearce has been employed on a part-time basis and he is compiling a number of oceanographic and meteorological data sets from both historical and current data sources, within and external to the Department of Fisheries. These data sets are being used to understand the effects of the environment on fisheries. Three papers relevant to this project have been prepared and their abstracts are listed below:

Caputi, N., Melville-Smith, R., de Lestang, S., Feng, M., Pearce, A. (in prep.). The effect of climate change on the western rock lobster fishery.

Environmental factors have been previously shown to have a significant effect on the western rock lobster fishery of Western Australia. The south-flowing Leeuwin Current and the strength of westerly winds in late winter/spring have been shown to significantly affect the level of puerulus settlement. The strength of the Leeuwin Current is influenced by the ENSO cycle; the current is stronger during La Niña events and weaker during El Niño events. Climate change may be causing an increasing trend in water temperature that may be seasonally variable, a weakening of the westerly winds in winter, an increase in the frequency of El Niño events, and an increase in the sea level. This paper shows that increasing water temperatures over the last 30-35 years may have resulted in a decrease in size at maturity, decrease in the size of migrating lobsters from shallow to deep water, an increase in the abundance of undersize and legal size lobsters in deep water relative to shallow water and a subsequent shift in catch to deep water. The size of the migrating lobsters is significantly related to the water temperature about the time of puerulus settlement (4 years previously). The impact of climate change on the level and spatial distribution of puerulus settlement, catchability of lobsters in traps, numbers of mature females moulting from setose to non-setose, growth rates, timing of moults and hence the timing of the peak catch rates, are also assessed. Climate change model projections are that the warming trend is likely to continue even after the greenhouse gas concentrations in the atmosphere are stabilized so that these biological trends may continue. Some of these changes

(such as the increasing frequency of El Niño events) may have negative implications on the western rock lobster fishery but some such as increasing water temperature may have some positive influence. These changes would need to be taken into account in stock assessment models which generally have a stationarity assumption of parameters.

Caputi, N., de Lestang, S., Feng, M., Pearce, A. (in prep.). Seasonal variation in the long-term warming trend in water temperature off the Western Australian coast.

Previous studies have demonstrated that one area of greatest increase in surface sea temperatures (SST) (0.02oC per year) in the Indian Ocean over the last 50 years occurs off the lower west coast of Australia; an area dominated by the Leeuwin Current. Climate models indicate that increases of 1.5oC are expected over the next century. This paper examines water temperature trends at a number of coastal sites since the early 1970s: two rock lobster puerulus monitoring sites in shallow water (<5m); four sites from a monitoring program onboard rock lobster vessels that provide bottom water temperature (<36 m); an environmental monitoring site at Rottnest (0-50m depth). Two global SST datasets are also examined. These data show that there was a strong seasonal variation in the historic increases in temperature with most of the increases (0.02-0.035oC per year) only focused on 4-6 months over the austral autumn-winter with little no increase (<0.01oC per year) apparent in the austral spring-summer period. These increases are also apparent after taking into account the interannual variation in the strength of the Leeuwin Current. The warming results in a change to the seasonal temperature cycle over the decades with a delay in the peak in the temperature cycle during autumn between the 1950s and 2000s of about 10-20 days. A delay in the timing of the minimum temperature is also apparent at Rottnest from August-September to October. This seasonal variation in water temperature increases and its effect on the annual temperature cycle should be examined in the climate models and assessed in the future projections of how increases will be manifest.

Lenanton, R, N. Caputi, and M. Kangas (in prep). The influence of the Leeuwin Current on economically important fish and invertebrates off temperate Western Australia.

Earlier reviews have identified that the strength of the Leeuwin Current is a key factor associated with changing abundance of a number of key invertebrate and scalefish species harvested by on-shelf commercial fisheries off the Western Australian coast. The current review of these relationships has revealed that the addition of more recent data has strengthened the relationship for rock lobster, the only species whose larvae are primarily distributed in the area of the influence of the Leeuwin Current and its offshore eddies. For other invertebrate species, such as scallops and Shark Bay prawns, the addition of new data has weakened the relationships. For prawns, although the underlying trend remains positive, the additional data strongly suggests that the overall production from the fishery has declined.

For a number of the scalefish species, the lack of ongoing records of comparable abundance data, primarily as a consequence of changes in the distribution of fishing, relative to the distribution of the stocks, has precluded ongoing exploration of earlier relationships. However preliminary data for some hitherto unreported relationships for other coastal scalefish species suggest that while the Leeuwin Current strength per se is implicated, other physical variables that are likely to be influenced by the Leeuwin Current may also be important. To help unravel these relationships, the underlying mechanism of the influence of the current, particularly the role of salinity and temperature of shelf waters, and factors controlling the availability of nutrients to on-shelf primary production need to be better understood.