

WAMSI 4.2.3

Climate change effects on fisheries: implications for management

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Fish for the future

Overview

- 1. Overall environmental trends**
- 2. Environmental effect on fisheries (recruitment, size at maturity, etc)**
- 3. Historic trend of environmental variables (space-time)**
- 4. Implications**
 - **Stock assessment**
 - **management**
- 5. Future climate trends**
- 6. Future climate change effects on fisheries**

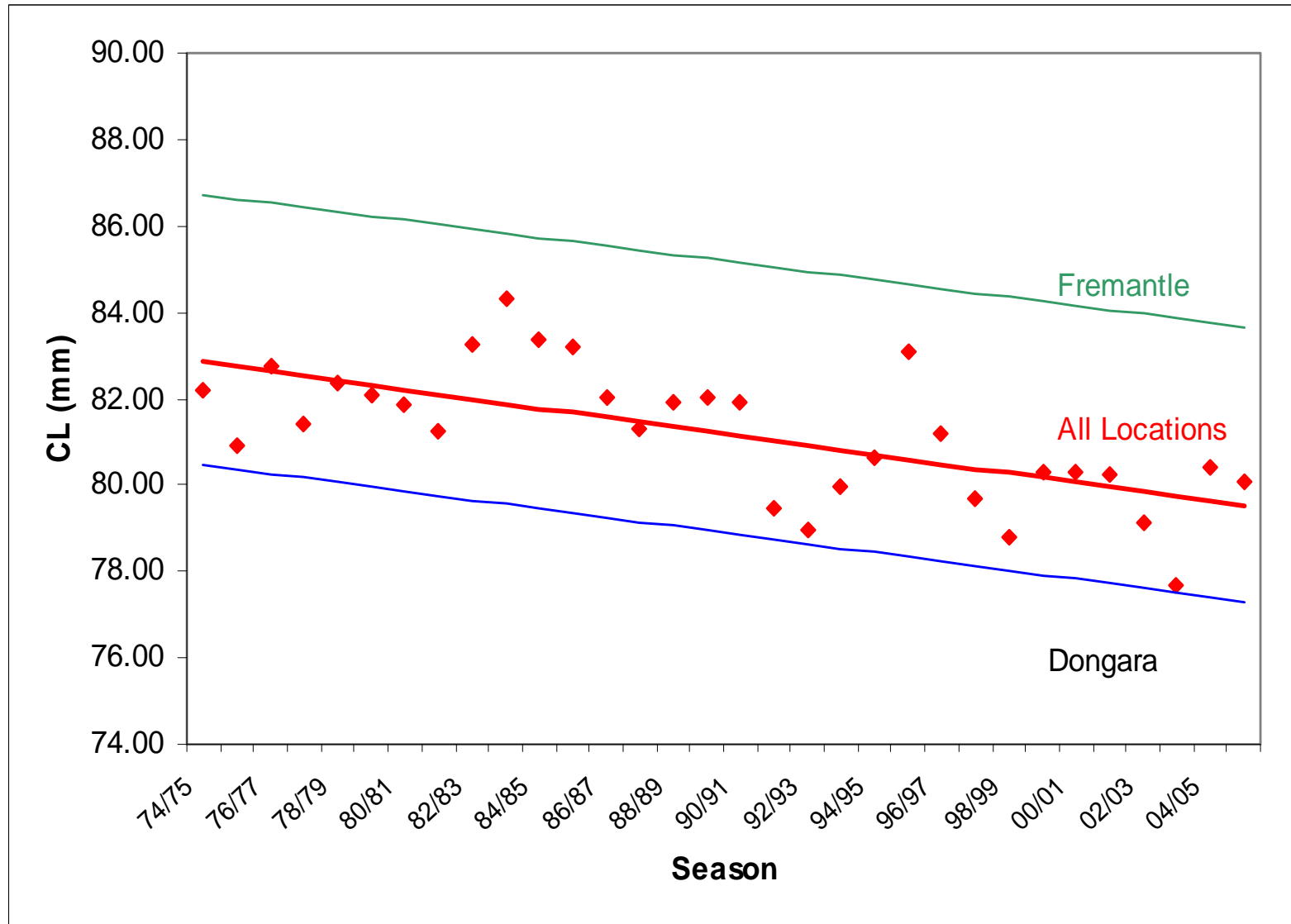
Key environmental trends

- (a) increasing frequency of ENSO events;
- (b) more years with weaker Leeuwin Currents?
- (c) increase in water temperature off lower west coast (autumn-winter)
- (d) increase in salinity with large inter-annual fluctuations
- (e) changing frequency & location of storms (westerly winds, rainfall) lower west coast
- (f) change in frequency of cyclones (& summer rainfall) affecting north-west of WA

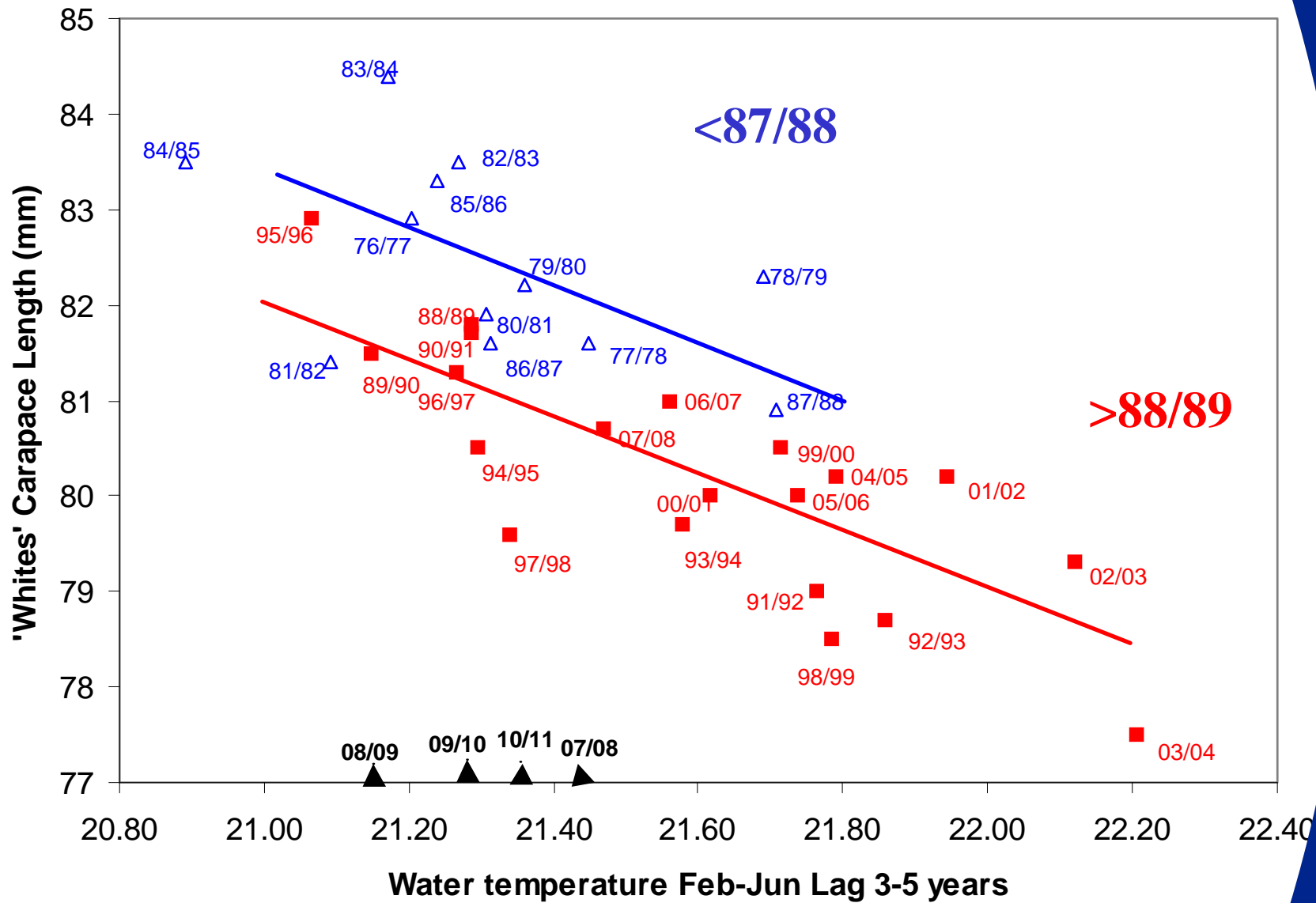
Western Rock Lobster (*Panulirus cygnus*)



Standardized Migrating 'Whites' Mean Carapace Length



'Whites' carapace length and Water temperature



Caputi et al. in press

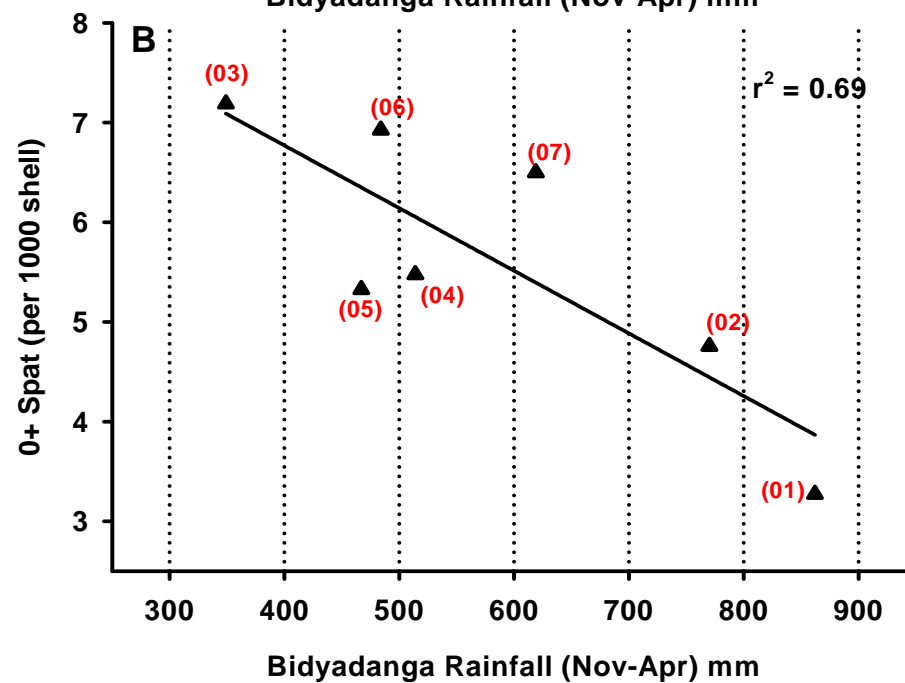
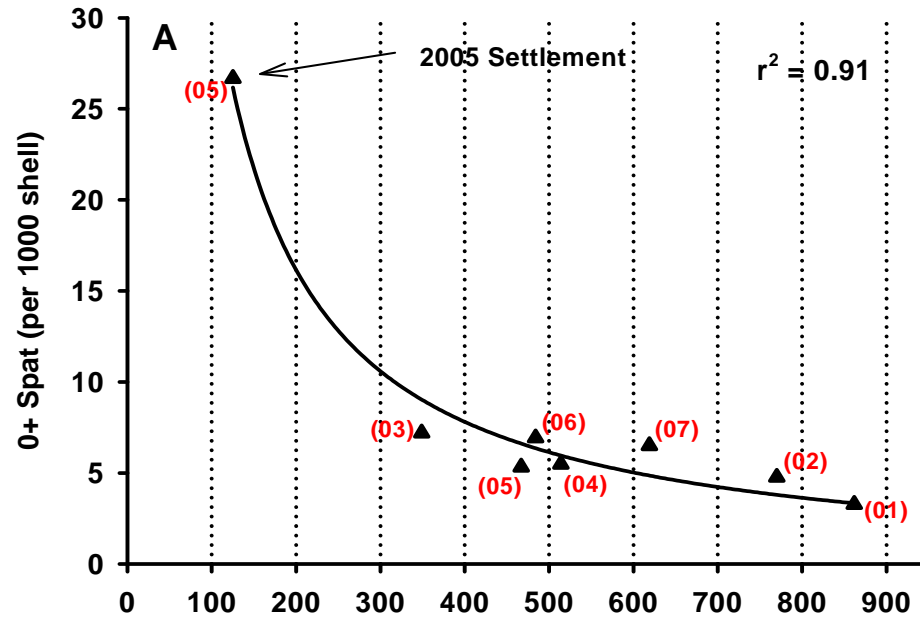
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Pearl oyster – piggyback spat (0+ and 1+)



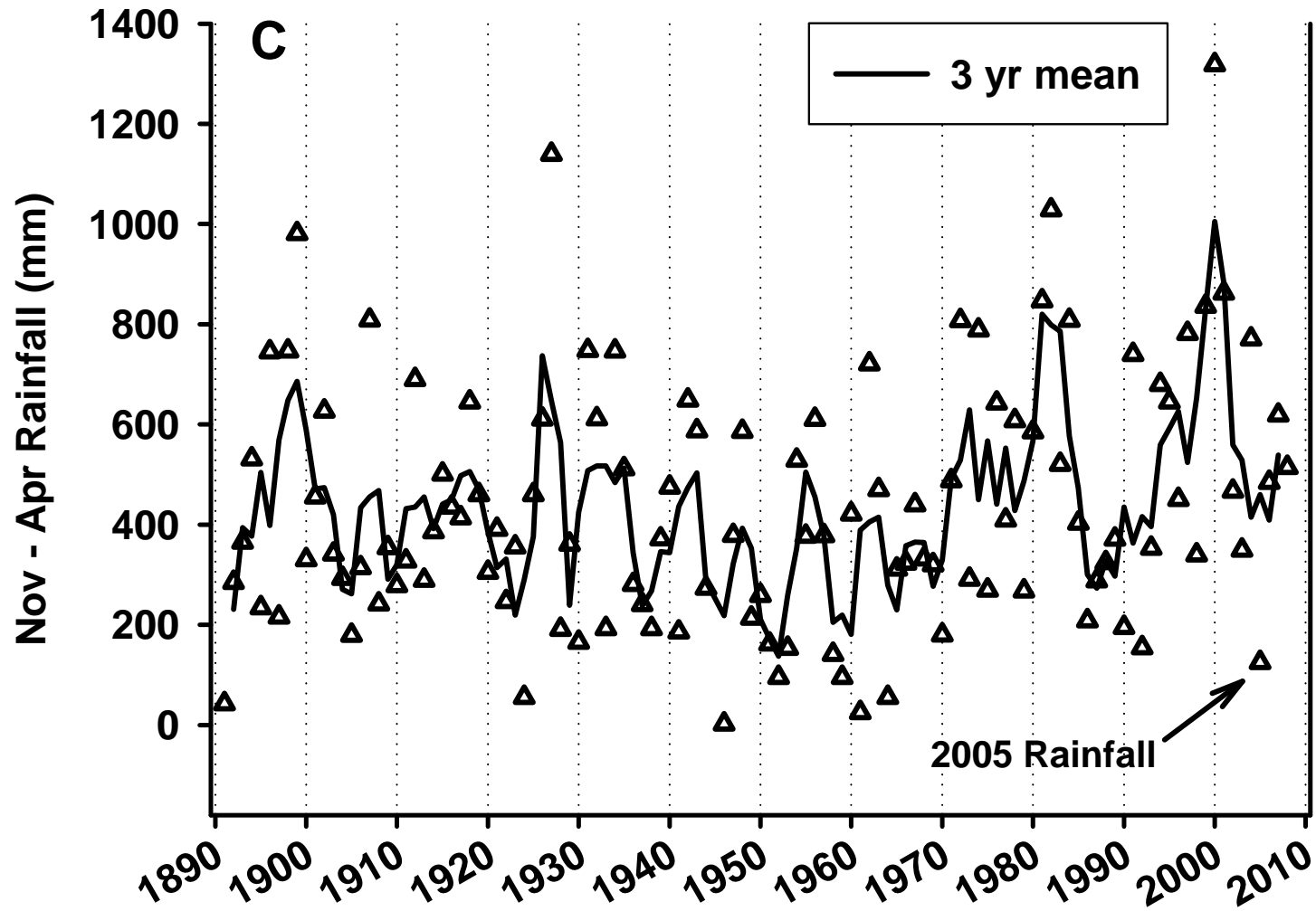
Hart & Joll 2006

Pearl oyster 0+ settlement vs rainfall (Nov to April) at Bidyadanga



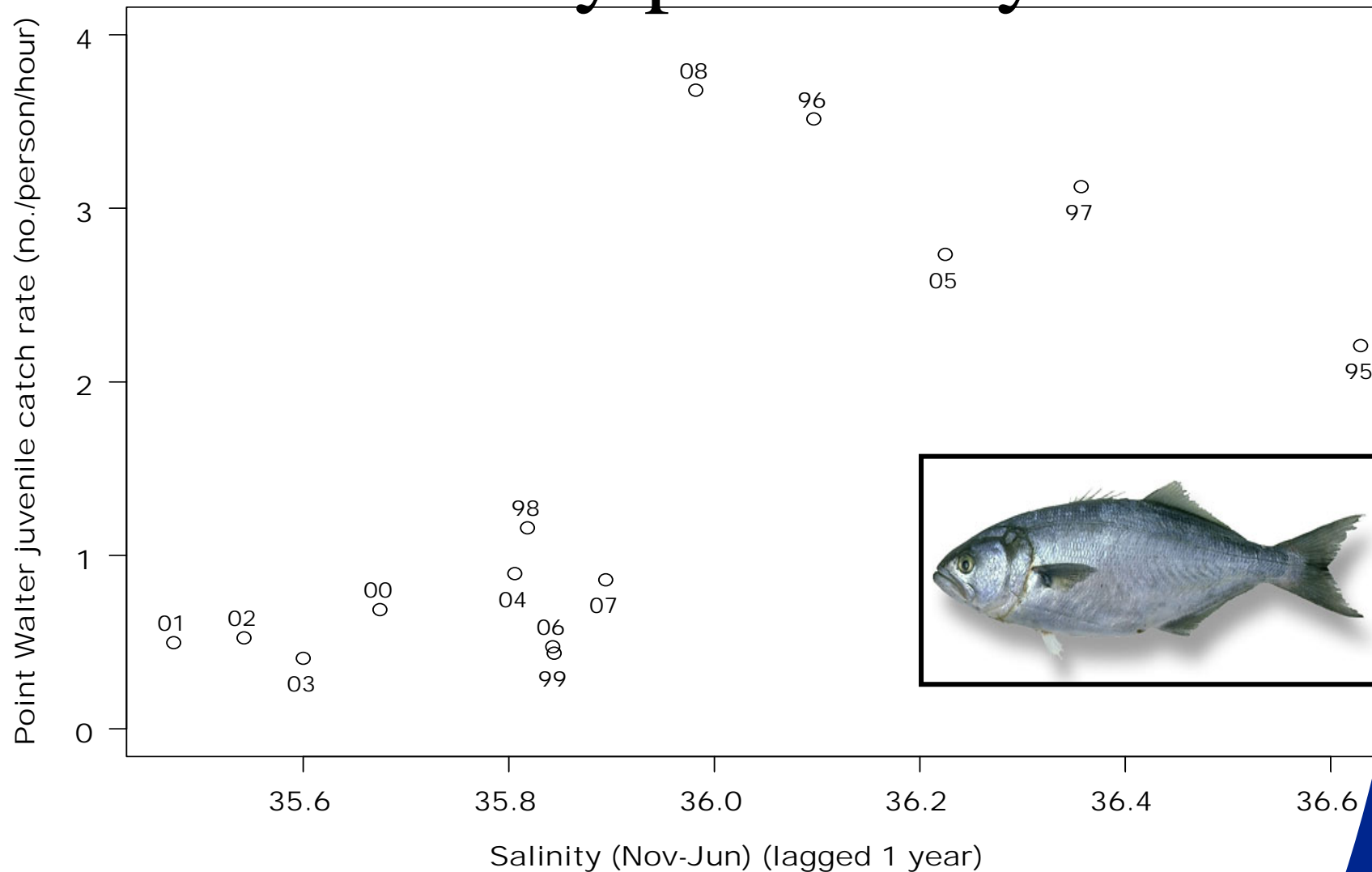
Hart et al. in prep.

Rainfall trends (Nov-April) Bidyadanga



Hart et al. in prep.

Tailor: Recruits 0+ (Feb-Apr) v Salinity previous year



Ayvazian et al.

Implications for stock assessment (Rock lobster case study)

- Biological parameters generally assumed fixed
- Climate change trends of biological parameters
 - Size of migrating (to deepwater) lobsters smaller
 - More lobsters in deep water
 - Size of maturity smaller
 - Change in growth curve
 - Reduced recruitment
- Abundance trends/prediction important

Management implications

- Changes in abundance (+ve or –ve)
 - Adjust fishing effort and/or catch quota
- Changes in biological parameters (eg growth)
 - changes in minimum/maximum size etc?
- Change in spatial distribution of species relative to management boundaries
 - winners and losers?
 - historic shares?

Future Research

- WA marine climate change (WAMSI Node 2)
 - Indian Ocean, Leeuwin Current, coastal site
 - Inner shelf environmental trends
- Indian Ocean Climate Initiative (IOCI)
 - Storm rainfall decline (south-west)
 - Increase in cyclones/rainfall (north-west)
- Effects on fish stocks
 - Climate change trends at space-time scales
 - Long-term monitoring sites for habitat and biodiversity
 - Effect of climate change on fish stocks

Research Findings

- Caputi, N., Pearce, A., Lenanton, R. (in prep.). Fisheries-dependent data and climate. WAMSI. report
- Caputi, N., de Lestang, S., Feng, M., Pearce, A. (2009). Seasonal variation in the long-term warming trend in water temperature off the Western Australian coast. *Marine and Freshwater Research* 60: 129-139
- Caputi, N., Melville-Smith, R., de Lestang, S., Feng, M., Pearce, A. (in press). The effect of climate change on the western rock lobster fishery. *Can. J. Fish. Aquat. Sci.*
- Lenanton, R, N. Caputi, M. Kangas, M. Craine (2009). The influence of the Leeuwin Current on economically important fish and invertebrates off temperate Western Australia. *J. Royal Soc. WA* 92: 111-127