PROTANDROUS SEX CHANGE IN THE TROPICAL SPARID *ACANTHOPAGRUS BERDA* AND THE IMPLICATIONS OF GEOGRAPHICAL VARIABILITY.

Thesis submitted by Andrew James TOBIN BSc (*UQ*) in May 1998

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A. J. Tobin
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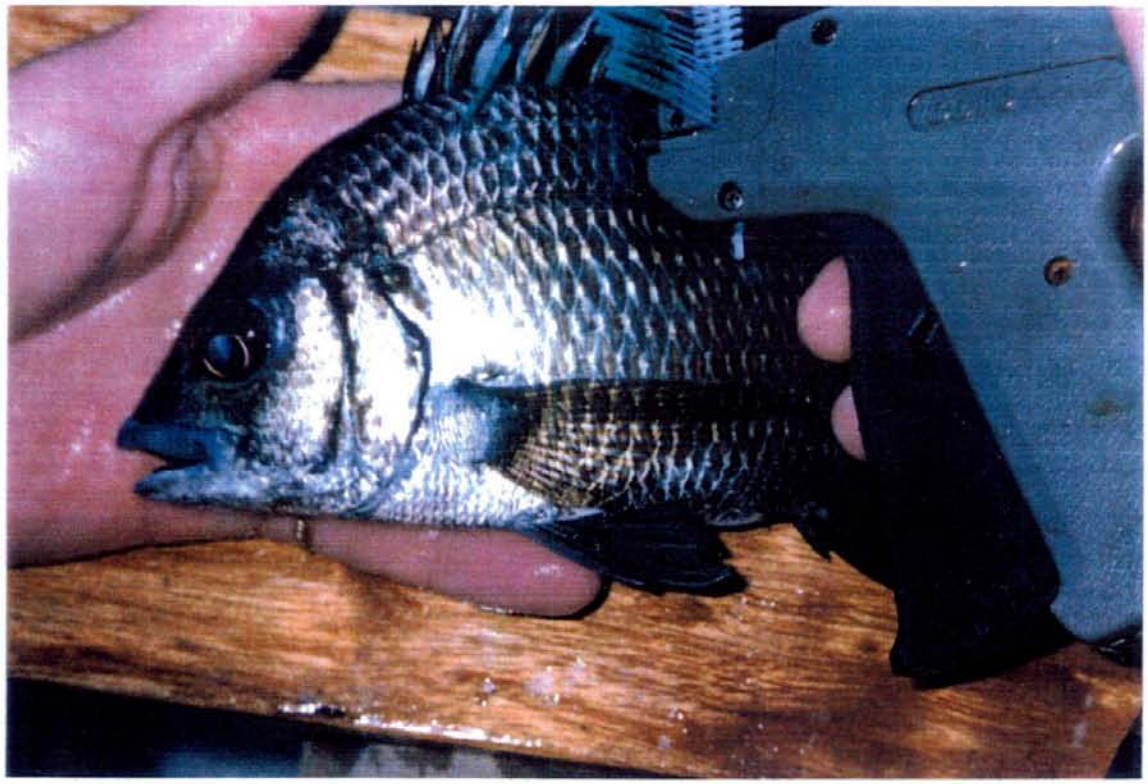

FRONTISPIECE. Tagging an *Acanthopagrus berda* as part of a tag-release study detailed in this dissertation.

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ABSTRACT

This study investigated the sex change of the tropical sparid, *Acanthopagrus herda*. A hierarchical approach incorporating multiple diagnostics was applied. Fish were collected from seven tropical estuaries (Blacksoil, Cocoa, Alligator, Cattle, Mendel and Meunga Creeks as well as Deluge Inlet) in North Queensland, Australia. Both length- and age-frequency distributions showed strong bimodality indicative of protandrous sex change. The smaller length-classes and younger age-classes (years) of all samples were dominated by male fish. Female fish dominated larger length-classes and older age-classes. Adult sex ratios for five of the seven estuaries were largely male biased, presenting further evidence that protandrous sex change may occur in *A. herda*.

The gonad structure of *A. herda* was investigated both macroscopically and microscopically through the complete annual reproductive cycle. In all gonads examined, the characteristic sparid ovotestis structure was observed. During the spawning period (June to September), male and female ovotestes were strongly dimorphic in structure. Ovotestis structures that may represent a transitional stage in a protandrous sex change process were observed during the three month post-spawning period (October to December). The location of sectioning position was found to influence the interpretation of sexual function of some gonad types. Sections need to be taken along the length of the gonad before sexuality can be determined conclusively.

Definitive evidence of protandrous sex change was provided by an in-field tag-release experiment conducted in two estuaries. Fish were sexed in the field by a validated and non-intrusive technique before being tagged and released. The subsequent recapture of fish allowed the sexuality of individual fish to be monitored through time. Protandrous sex change was detected in 3 (6.1%) and 4 (7.8%) fish from Blacksoil Creek and Deluge Inlet respectively. Each of these fish were sexed as male at initial capture, and possessed functional female ovotestes at the time of recapture. Further evidence of protandrous sex

change was provided by aquarium experiments in which a total of ten *A. berda* underwent protandrous sex change.

There was considerable geographical variation in the growth of *A. berda* among locations. The growth of *A. berda* in Deluge Inlet and Mendel Creek was considerably slower than the other 3 estuaries sampled (Blacksoil, Cocoa and Cattle Creeks). The comparison of male and female growth for each estuary suggested in most cases, differences between male and female growth were negligible.

The rate at which protandrous sex change occurs was modelled for each estuary. The rate of sex change for Cocoa and Cattle Creeks was modelled by logistic regression. For Blacksoil Creek, Mendel Creek and Deluge Inlet modelling required a combination of the logistic and linear regression models. Following the geographical variation detected in the age and growth of *A. berda*, the modelled rates of sex change also showed considerable variation between estuaries. While sex change was modelled to occur across 5 age-classes for Cocoa Creek, sex change in all other estuaries was modelled to occur across at least 8 age-classes.

Further research into the apparent plasticity of the protandrous sex change of *A. berda* is required. The estuaries sampled in this study represent a very small area of the geographical range of *A. berda* in Australian waters. Furthermore, the extensive international range of *A. berda* may also be characterised by more extensive variability in the protandrous sex change of *A. berda* than detected by this study.

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DECLARATION

I declare that this thesis is my own work and has not been submitted in any other form for another degree or diploma at any university or other institution of tertiary education. Information derived from the published or unpublished work of others has been acknowledged in the text and a list of references is given.

A. J. Tobin

11 May, 1998.