THE ECOLOGY AND BIOLOGY OF WOBBEGONG SHARKS (GENUS *ORECTOLOBUS*) IN RELATION TO THE COMMERCIAL FISHERY IN NEW SOUTH WALES, AUSTRALIA

Orectolobus maculatus

BY

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Summary

In New South Wales (NSW), Australia, wobbegong sharks (Orectolobidae) have been commercially targeted by the Ocean Trap and Line Fishery since 1991. A catch decrease of *ca.* 50% in a decade lead to concern over the sustainability of the fishery and to wobbegongs being listed as Vulnerable in NSW under the World Conservation Union (IUCN) Red List assessment. The aim of this research was to investigate wobbegong biology and ecology in relation to its fishery to provide essential data and information for sustainable management of the wobbegong fishery. Biological data was obtained from 904 wobbegongs collected from commercial fishing boats, using setlines and lobster pots and by scuba diving.

Previously, two species of wobbegongs were known to occur in NSW: the spotted wobbegong (*Orectolobus maculatus*) and the ornate wobbegong (*O. ornatus*). This study discovered a new species (*O. halei*) described as a subspecies by Whitley (1940), but which had been synonymised with *O. ornatus* due to a lack of taxonomic investigation. An identification key was developed that will allow fishers to correctly identify wobbegongs to species level and to report catch accordingly. Correct species identification allows for the implementation of species-specific management regulations, previously not possible.

A diver survey indicated that wobbegongs are more abundant in northern NSW and that size segregation might occur as the absence of neonates and small juveniles suggest that they may be elsewhere, possibly located in nursery areas.

Passive acoustic tracking of *O. halei* suggested that at least some wobbegongs have long-term residency. Diel patterns were also observed with sharks more frequently recorded during daylight hours than at night. The long-term residency pattern found in this preliminary study suggests that temporal closures or marine protected areas may be effective tools for the management and conservation of local populations.

Morphometric relationships between partial and total lengths; and carcass and total mass were developed to correct for the common commercial fishing practice of landing trunks only. The length-frequency of wobbegongs collected during this study also shows that neonates and small juveniles were absent from the catches.

Dietary examination indicated that wobbegongs fed primarily on bony fishes, but also consumed cephalopods and chondrichthyans. Wobbegongs were frequently gut-hooked (80–90% of the catch), potentially leading to high post-release mortality rates. Diet did not vary between the sexes, but interspecific differences were evident and were related to the total length of the shark. The high trophic level of wobbegongs means that their removal from the ecosystem may have impacts at lower trophic levels.

Reproductive parameters of wobbegong were investigated to provide a biological basis for the management of a commercial fishery targeting wobbegongs. L_{50} for male and female maturity was *ca.* 800 mm, 1250 mm, and 1750 mm TL for *O. ornatus*, *O. maculatus* and *O. halei*, respectively. These species of wobbegong had synchronous, triennial reproductive cycles. During the first year, follicles remained small, and then grew rapidly during the second year prior to ovulation during November. Gestation lasted *ca.* 10–11 months and parturition occurred during

October–November. Mean litter sizes were *ca.* 9 and 21 for *O. ornatus* and *O. maculatus*, respectively, and increased with female total length in *O. ornatus*. No pregnant *O. halei* were sampled. Pregnant *O. ornatus* and *O. maculatus* were frequently caught in northern NSW and no pregnant wobbegongs, or females with large, yolky follicles were captured south of Sydney. Differences in the reproductive stages of wobbegongs caught in northern and central NSW suggested geographically dependent reproductive behaviour.

Age and growth information was also investigated. Periodicity of growth band deposition could not be determined using marginal increment ratio, edge analysis, and growth rate and chemical marking of captive sharks. Counts of growth bands using whole vertebrae consistently underestimated age compared to thin sections. Growth parameters were obtained and compared using four different models, and counts from whole vertebrae and thin sections, and a combination of observed and back-calculated lengths-at-age. Growth parameters could not conclusively be determined because validation of growth bands and vertebral preparation was not possible.

Declaration

I hereby declare that this work is my own, except where otherwise acknowledged. It has not been submitted in any form for another degree or diploma at any university or other institution. All work conducted for this dissertatin was conducted under the Macquarie University Animal Research Authority 2003/011 and the NSW DPI Research Permit P03/0057.

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CHARLIE HUVENEERS

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Dedication

To mum… for the education given and enabling me to be where I am now.