POTENTIAL FOR MANAGEMENT

OF THE

PEEL-HARVEY ESTUARY

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PEEL-HARVEY ESTUARY

Fish and the Fishery

Ian Potter*
Rod Lenanton†
Neil Loneragan*
Pippa Chrystal†
Rob Manning*

*School of Environmental and Life Sciences
Murdoch University, Murdoch 6150

†Department of Fisheries and Wildlife
Western Australian Marine Research Laboratories
PO Box 20, North Beach 6020
Introduction

The initial work on the fish fauna and the blue manna crab in the Peel-Harvey estuarine system, which commenced in April 1979, was aimed at elucidating the patterns of distribution, abundance and growth of the different species (Potter et al., 1983a; in press). At the same time, the data on the commercial fish catches for the last 40 years were subjected to detailed analysis to ascertain whether any changes in catch during the 1970s could be related to the increased growth of macroalgae (Lenanton et al., in press). More recent work has focussed on determining whether Nodularia has an effect on the fish fauna either through inducing changes in behaviour or by causing mortality (Potter et al., 1983b).

The Fish Fauna

Beach seines, gill nets and otter trawls were used during 1979-81 to sample extensively the fish fauna of the Peel-Harvey estuarine system. Approximately 145,000 individuals were caught, representing 29 families and 55 species. The Clupeidae, Teraponidae, Mugilidae, Apogonidae, Atherinidae and Gerreidae were the dominant families, each contributing more than 8% to the total catch (total 86.2%). Seasonal catch data and length-frequency distributions were used to help clarify the way in which the estuary was utilised by fish. Nine of the fifteen most abundant fish species were marine species which entered the estuary for variable periods, while the other six were represented by populations in which the individuals were capable of passing through the whole of their life cycle within the estuary. In order of abundance, the nine marine species were the sandy sprat or whitebait (Hyperlophus vittatus), six-lined trumpeter (Pelates sexlineatus), yellow-eye mullet (Aldrichetta forsteri), sea mullet (Mugil cephalus), common blowfish (Torquigener pleurogramma), long-finned goby (Favonigobius lateralis),
Ogilby's hardyhead (*Pranesus ogilbyi*), devil fish (*Gymnapistes marmoratus*) and western sand whiting (*Sillago schomburgkii*), while the six species with estuarine populations were the gobbleguts (*Apogon rueppellii*), elongate hardyhead (*Atherinosoma elongata*), Wallace's hardyhead (*Atherinosoma wallacei*), cobbler (*Cnidoglanis macrocephalus*), Perth herring (*Nematalosa vlaminghi*) and yellow-tailed trumpeter (*Amniataba caudavittatus*). The extent and seasonality of the distribution of the species within the estuary and associated river systems varied considerably. Our data also showed that marine species were represented predominantly by individuals in their first or second year of life and that in general fish tended to move further away from the shallow banks near the shore with increasing age and size. Comparisons of the fish fauna of the Peel-Harvey were made with those of Cockburn Sound and the estuary of the Swan-Avon in Western Australia and with Botany Bay in eastern Australia. These comparisons showed that the incidence of large piscivorous fish was lowest in the Peel-Harvey system.

The blue manna crab

Various aspects of the biology of the blue manna crab, *Portunus pelagicus*, were investigated using samples collected regularly by beach seine, gill net and otter trawl. Whereas crabs were widely dispersed throughout Peel Inlet, Harvey Estuary and the saline regions of tributary rivers during the summer and autumn; they were found mainly near the estuary mouth in the winter and spring. Since our data suggest that *P. pelagicus* prefers salinities of 30-40%, the above changes in distribution are apparently related to the marked seasonal variation in salinity which results from the very seasonal pattern of rainfall. The number of ovigerous crabs in the estuary were greatest in January and February. The mean carapace length

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and number of eggs of ovigerous females were 110 mm (range 85-157 mm) and 509,433 (range 270,183 - 847,980) respectively. P. pelagicus started to reach the minimum legal size for capture (carapace width 127 mm) in the summer when they were approximately one year old and left the system in large numbers in the following winter when they were 15-20 months old. These features explain why the fishery for P. pelagicus is highly seasonal, with the vast majority of crabs being taken between January and May. As crabs approached the end of their first year of life, the ratio of females began to exceed that of males, apparently as a result of the movement of males out of the system and the legislation against the capture of ovigerous females.

The fishery

Comparisons were made between the catch statistics for the commercial gill and haul net fisheries of the Peel-Harvey system and that of the large neighbouring Swan-Avon estuary. The results indicate that during the 1970s the abundance of fish in the Peel-Harvey system rose as a result of the effects of nutrient enrichment, which included a massive increase in macroalgae (Cladophora sp. and Chaetomorpha spp.). In terms of mean monthly catch per boat per annum, which is shown to be a good reflection of the annual catch per unit effort, the total fishery increased by 1.8 times from 738 kg in the ten years prior to 1969 to 1,327 kg between 1970 and 1979. The comparable values for the three most important commercial species, i.e. the yellow-eye mullet (Aldrichetta fosteri), sea mullet (Mugil cephalus) and cobbler (Cnidoglanis macrocephalus), increased by 1.9, 2.1 and 3.3 times respectively. This contrasts with the situation in the nearby large Swan-Avon estuary which has not seen prolific macroalgal growth but whose fishery uses the same techniques and is exposed to similar market demands. Thus, in the Swan-Avon the mean monthly catch
per boat for the total fishery increased in the 1970s by only 1.2 times and no significant change occurred in this parameter for the important sea mullet and cobbler. Length-frequency data showed that all three species grew rapidly in the Peel-Harvey estuary, with the result that most individuals had reached the minimum legal length for capture within two years. In the case of the sea mullet, this length was sometimes achieved by the end of the first year of life. Since growth rates of the main fish species in the Peel-Harvey were similar to those in the Swan-Avon, the increase in weight of fish caught is probably attributable to a rise in fish abundance rather than a faster growth rate. While the rise in abundance may reflect a greater food availability, it could also represent a decline in predation from the large, local, piscivorous bird populations as a result of the development of extensive macrophyte cover.

Effects of Nodularia

Our data indicate that dense blooms of the blue-green alga Nodularia spumigena affect fish and crab populations in the Peel-Harvey system. For example, the numbers of fish were generally very low at sites in which chlorophyll a level, an excellent indicator of Nodularia density during the late spring and summer, was above 100 μl l⁻¹. Moreover, commercial fishermen have recorded greatly reduced catches in Nodularia-affected areas and dead fish and crabs were found in regions where Nodularia was very dense. While the effects of this blue-green alga apparently led to death in the case of some bottom-living species in the most affected parts of the system, more active species moved into regions where Nodularia was virtually absent.

Current work is examining the relationship between Nodularia blooms and the commercial catch. This study involves an analysis of the fishermen's commercial log books which have been designed to distinguish catches taken
in different parts of the system. It also involves the chartering of two fishermen to determine the areas in which commercial sized cobbler and yellow-eye and sea mullet are found in the Peel Inlet and Harvey Estuary during Nodularia blooms.

Conclusions

For the following reasons, the introduction of a cut between the Harvey Estuary and the sea, without the construction of a plug between the Peel Inlet and Harvey Estuary, is likely to have beneficial effects for the fishery.

1. It adds an additional entry point to the Peel-Harvey system for the juvenile stages of marine teleosts and crustaceans which form the basis of the commercial and recreational fisheries.

2. The reduction in Nodularia in the Harvey Estuary will remove what appears to be the major reason for the decline in crab numbers and fish catches in this part of the Peel-Harvey system during those periods when the cyanobacterium reaches high levels.

3. The reduced period of very low salinities in the Harvey Estuary will mean that large crabs will remain longer in this part of the Peel-Harvey system.

In contrast to the above beneficial effects, a reduction in macroalgae in Peel Inlet as a result of reduced phosphorus input may lead to a slight reduction in fish catches. However, it is relevant to note that a very viable commercial fishery operated in the Peel-Harvey prior to the massive outbreak in macroalgal growth.

It should be noted that if management plans call for continual dredging of the current Entrance Channel, this will almost certainly reduce the numbers of fish and crabs migrating into Peel Inlet.
References


