Reducing the discarding of small prawns in NSW's commercial and recreational prawn fisheries

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NON-TECHNICAL SUMMARY

2001/031	Reducing the discarding of small prawns in NSW's commercial and recreational fisheries

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OBJECTIVES:

(1) To develop and test a variety of modifications to gears and fishing practices that improve size selectivity and reduce the bycatch and discarding of small school and king prawns from the many methods used to catch them in NSW's commercial and recreational fisheries.

(2) To facilitate the extension of the research results throughout the appropriate sectors.

(3) To recommend and help implement appropriate changes to regulations governing these methods to ensure the widespread use of the results.

NON TECHNICAL SUMMARY:

Outcomes Achieved
The project resulted in recommended changes to the majority of prawn-catching gears used throughout NSW's estuaries that will significantly reduce the fishing mortality of non-targeted sizes of prawns and other species. In particular, an increase in the size of the existing diamond mesh (from 20 to between 25 and 30 mm) was recommended for recreational scoop nets, while square-mesh codends made from between 27- and 29-mm knotless polyamide mesh hung on the bar were recommended for most commercial trawls, seines and stow nets. Regulations on key factors other than mesh size that influence efficiency and selectivity were recommended for all gears.

Few fishing gears catch only the targeted species and their sizes, with many selecting a wide diversity of non-target organisms (termed 'bycatch'), causing problematic interactions with other species, fisheries and user groups. During the past 20 years, most of the concerns about bycatch have been directed towards poor species selection by net-based fishing gears (like otter trawls) and the mortality of charismatic species like turtles and dolphins, as well as juveniles of commercially- and recreationally-important fish. In many cases, these concerns have been mitigated via quite simple modifications to fishing gears and practices designed to minimize the fishing mortality of key non-target species. Another key bycatch issue that has received substantially less attention concerns the capture and discarding of individuals of the targeted species smaller than optimal commercial and/or biological sizes. Poor size selection of fishing gears can have obvious effects on the population of the targeted species and, unlike the discarding of non-target bycatch, is of concern to the fishery in question. In New South Wales (NSW) Australia, the discarding of individuals due to inappropriate size selection is a considerable problem throughout many net-based fisheries, and especially those targeting prawns.

Prawns form the basis of important commercial and recreational fisheries throughout NSW. Catches include 6 species, although school (*Metapenaeus macleayi*), eastern king (*Penaeus*

plebejus), and greasyback prawns (*Metapenaeus bennettae*) account for more than 98% of the total annual commercial (approx. 1000 t) and recreational (approx. 11 million individuals) harvests. These 3 species are targeted throughout estuaries and rivers using 7 types of small-scale fishing gears that include recreational haul, push and scoop nets and commercial otter trawls, seines, stow nets and trap nets.

Like in most Australian fisheries, the 7 prawn-catching gears used in NSW are managed by regulations that include limits on their dimensions, methods, areas of operation and minimum and maximum stretched diamond mesh openings. These legal mesh sizes vary between 40 and 45 mm in the codend (i.e. the bag where the catch is collected) of otter trawls, 30 and 36 mm throughout seines, stow, haul and push nets, 25 and 36 mm throughout trap nets and 20 mm in scoop nets. The use of gears with such small meshes throughout areas that typically have a lot of small fauna has raised considerable concerns and resulted in several quantitative studies of catches. These studies revealed that, at many locations and times most prawn-catching gears, and especially otter trawls, retain small, unwanted prawns (less than between 15 and 17 mm carapace length - CL, or between 2.7 and 3.3 g). Problems associated with the mortality of these individuals and the potentially negative impacts on stocks led to the present study which aimed to determine:

(1) the existing size selectivity (i.e. the proportion of individuals retained for any given size) of the various conventional gears for the key species of prawns; and then, if required

(2) the utility of simple modifications to problematic gears designed to reduce unwanted bycatches of prawns and so improve their size selection.

An underlying assumption of (2) above is that the majority of small prawns escaping through the meshes of fishing gears actually survive the process. However, despite legally-enforced mesh sizes throughout all Australian prawn fisheries, no studies have examined this issue for any of the targeted species. Prior to addressing (1) above, we therefore completed an aquaria-based study that quantified the fate of school prawns after repeated escape from simulated trawls. Like other work done to assess the fate of fish escaping from BRDs, this work demonstrated minimal post-capture damage, stress and mortality (< 11%) and validated an examination of modifications to meshes in prawn-catching gears as a means for reducing the fishing mortality of small prawns.

Where possible, all experiments to assess the size selectivity of the prawn-catching gears were done during normal fishing operations and in those estuaries and rivers characterized by the majority of effort. Each of the experiments involved deploying the gear being tested (termed ‘treatment’) and a fine-meshed ‘control’ gear (either simultaneously or alternatively). The numbers and sizes of prawns (and in some cases non-target bycatch) retained in the treatment and fine-meshed control gear were collected and used to estimate the size selectivity of the treatment gear.

The results from various experiments examining the size selectivity of the 7 conventional gears ((1) above) demonstrated that only trap nets were appropriate in terms of allowing nearly all prawns smaller than optimal commercial sizes to escape. Some small prawns were able to pass through the meshes in recreational haul and push nets and commercial stow nets (rigged with 36-mm diamond-mesh codends), but all other gears were entirely inappropriate and retained large proportions of prawns considerably smaller than optimal sizes, with trawls and some seines demonstrated to be completely non selective (i.e. they retained even the smallest prawns). For these problematic gears, we examined up to 4 modifications designed to increase and regulate the mesh openings in their codends so that small prawns (< 15 mm CL) could escape, but larger, optimal sizes were retained. The modifications involved: (1) reducing the fishing circumference; (2) increasing the size of diamond-shaped mesh; (3) reducing the twine diameter of diamond-shaped mesh; and (4) orientating knotless meshes on the bar, so that they were square shaped.

Experiments examining these modifications for the different gears showed that, irrespective of the size of diamond mesh used, unregulated factors such as the fishing circumference and twine

diameter of codends strongly influence the selectivity of prawn-catching gears. While regulating these factors improved the lateral openings of conventional diamond meshes and allowed at least some small prawns to escape, in many cases catches of optimal-sized prawns were also reduced. Appropriate modifications demonstrated to maximize the escape of small unwanted prawns, but maintain catches of optimal sizes, involved:

(1) increasing the existing diamond-shaped mesh from 20 mm to between 25 and 30 mm in recreational scoop nets; and

(2) orientating between 27- and 29-mm knotless mesh on the bar (i.e. square mesh) in the codends of commercial trawls and most seines and stow nets.

While there was considerable variability in selection among these latter gears and their locations, in most cases, compared to the conventional diamond-mesh codends, the square-mesh designs allowed up to 99% of individual sizes of unwanted school prawns and 91% of total fish bycatch to escape, while maintaining commercial catches.

Because the majority of escaping prawns survive, we conclude that if the key factors demonstrated to influence size and species selectivity (such as fishing circumference and twine diameter) are regulated, using 25- to 30-mm diamond-shaped meshes in scoop nets and 27- to 29-mm square-mesh codends in trawls and most stow nets and seines, respectively will significantly reduce the fishing mortality of non-target individuals. An absence of data on the stock status of the key prawn species, or their important life history parameters, means it is difficult to estimate the magnitude of benefits that the recommended modifications will have on populations, but these should translate to at least some improvement in harvests.

KEYWORDS: bycatch reduction, selectivity, penaeids, trawls, stow nets, seines, trap nets, scoop nets, haul nets, push nets