

Catch, discard and bycatch rates in the Western Gulf of Carpentaria Mud Crab Fishery: summary for 2017 and 2018

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Abstract

Catch, discard and bycatch rates in wire mesh mud crab pots set in two regions of the Western Gulf of Carpentaria are summarised for 47 fishery observer trips undertaken aboard commercial crab fishing vessels in the months of April and May in 2017 and 2018. Catch rates of the Giant Mud Crab (*Scylla serrata*) in both regions and both years were relatively high (i.e. 0.74–1.02 kg/pot-lift), as were discard rates (i.e. 59–69% of individual Mud Crabs captured). Between 33% and 57% of all discarded crabs had attained the minimum legal size, but were released on the basis that they were ‘commercially unsuitable’, having a soft shell, low vigour and low meat content. A total of 88 individuals from 12 different taxa were recorded as bycatch from 4337 pot-lifts. Catfishes (*Arius* spp.) were by far the most numerous bycatch, accounting for 64% of all individuals. There were no interactions between mud crab pots and threatened, endangered or protected species during any observer trips. The low incidence of bycatch in wire mesh mud crab pots is consistent with previous observations on the use of this type of gear both locally and interstate.

Introduction

Commercial mud crab fishery licensees in the Northern Territory, Australia, use baited wire mesh pots (approximately 60 x 70 x 20 cm; L x W x H) to capture mud crabs (*Scylla* spp.) in mangrove and mud-flat habitats. One of the primary indicators of the success of crabbing operations (and mud crab abundance) is catch rate, typically expressed as the quantity of crabs retained (in kg) per unit of fishing effort (as pot-lifts).

Controls on the commercial harvest of mud crabs in the Northern Territory include a Minimum Legal Size (MLS) for each sex (i.e. 140 mm carapace width [CW] for males and 150 mm CW for females) and a prohibition on the take of recently moulted “Commercially Unsuitable Crabs” that exceed the MLS, but have a soft shell, low vigour and low meat content; the latter being an industry initiative to reduce transport mortality and increase the market price. These regulations often mean that a large proportion of the mud crab catch (i.e. >70%; Ward *et al.* 2008) has to be returned to the water, with such individuals referred to here as ‘discards’. The discard rate can vary in both space

and time, depending on the size structure of the local population and the timing of moulting events.

The bait used in mud crab pots also attracts a range of scavengers and predators to the gear, some of which get trapped and become 'bycatch'. There are relatively few accounts of bycatch in Australian mud crab fisheries, but those that are available (e.g. Butcher *et al.* 2012; Grubert & Lee 2013) suggest that bycatch in rigid wire mesh pots is considerably lower than that in collapsible trawl mesh pots, primarily because of the smaller mesh used in the latter gear type.

Management of the Northern Territory Mud Crab Fishery underwent significant reform in 2017, with two discrete regional management units implemented – the Arafura-West Mud Crab Fishery, which encompasses the Northern Territory coastline anti-clockwise from Cape Grey (13°0' S, 136°39' E), and the Western Gulf of Carpentaria Mud Crab Fishery which constitutes the remainder of the Northern Territory coast to the Queensland border (Figure 1).

The performance of these management units is assessed each year through an analysis of catch rates over the indicator months of April and May, derived from compulsory fishery logbooks. The catch rate during this period is considered a reliable indicator of that for the remainder of the year. One of three seasonal closures (beginning in October) may then be imposed if the April–May catch rate is particularly low. A fishery

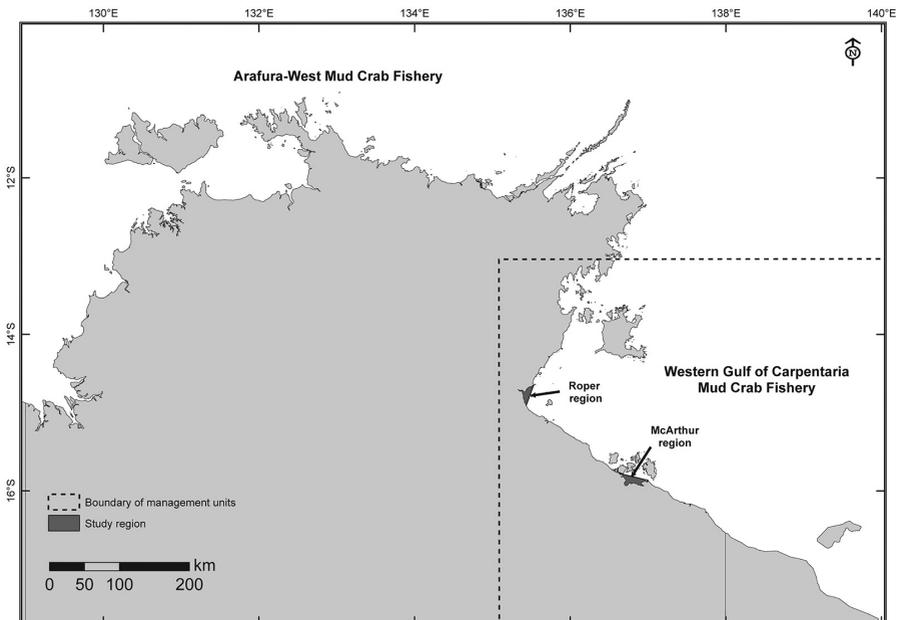


Figure 1. Extent of mud crab fishery management units and study regions.

observer program targeting the same months is also undertaken to validate reported data and collect information on discard rates and bycatch composition, which is not typically reported by licensees.

Although some observer trips have been undertaken in the Arafura-West Mud Crab Fishery, the primary focus to date has been the Western Gulf of Carpentaria Mud Crab Fishery, as this fishery has produced around 70% of the total commercial mud crab catch in the NT over the last two decades (Northern Territory Government 2018). This being the case, the information provided here is confined to observations of the catch, discard and bycatch rates in only the Western Gulf of Carpentaria Mud Crab Fishery.

Materials and Methods

Fishery observers recorded catch, discard and bycatch information during fishing operations by several commercial mud fishery licensees across the months of April and May 2017 and 2018. Observations centred on two fishing regions within the Western Gulf of Carpentaria Mud Crab Fishery – the ‘Roper region’ extending from Warrakunta Point (14°39’ S, 135°32’ E) in the north to the Towns River in the south (14°55’ S, 135°26’ E), and the ‘McArthur region’ extending from Carrington Channel (15°46’ S, 136°36’ E) in the west to Pelican Spit in the east (15°52’ S, 137°0’ E) (Figure 1).

Observers typically joined well established licensees with at least 10 years’ experience in the industry. The number and timing of observer trips was dictated by staff availability and the willingness of licensees to allow them on board. Given these logistic constraints, no attempt was made to concentrate on a particular stage of the lunar cycle.

In most cases, only one observer trip was conducted per day, generally on the larger of the two daily high tides. However, there were a few instances where licensees checked their pots twice a day and were joined by observers on both occasions. These events were treated as two separate observer trips. Trips usually lasted 3–6 hours depending on the number of pots checked (which typically ranged from 60–120) and their proximity to the licensee’s camp.

Results

Observers witnessed in excess of 800 pot-lifts (by two to five different licensees) in each region and both years of the study (Table 1). The mud crab catch consisted entirely of the Giant Mud Crab (*Scylla serrata*), the only species of *Scylla* present in the region. Regional catch rates were relatively high (i.e. 0.74–1.02 kg/pot-lift), as were discard rates (i.e. 59–69% of individuals captured). Overall catch rates (for both regions combined) were 0.91 kg/pot-lift in 2017 and 0.78 kg/pot-lift in 2018.

Most discarded crabs (i.e. >60%) were males, with the ratio of under-sized male to soft-shelled male crabs being broadly similar in several cases (Table 2). The proportion of under-sized female crabs was always higher than that of soft-shelled female crabs, with the greatest difference between these categories observed in the Roper region.

Table 1. Mud crab catch, volumetric catch rate and numeric discard fraction for observer trips undertaken in each region and year.

Location	Year	Observer trips	Licensee count	Retained catch (kg)	Effort (pot-lifts)	Catch rate (kg/pot-lift)	Total catch (number)	Discard fraction
McArthur region	2017	10	4	926.64	885	1.05	3489	68%
	2018	13	5	832.12	1131	0.74	3534	69%
Roper region	2017	11	2	1014.42	1254	0.81	2234	63%
	2018	13	3	889.67	1067	0.83	2782	59%

Table 2. Proportion of mud crabs in each discard category (relative to total discards) by region and year.

Location	Year	Under-sized		Soft-shelled	
		Male	Female	Male	Female
McArthur region	2017	29%	14%	49%	8%
	2018	30%	26%	34%	10%
Roper region	2017	37%	22%	37%	4%
	2018	46%	22%	27%	5%

A total of 88 individuals from 12 different taxa were recorded as bycatch from all observed pot-lifts ($n = 4337$). Fewer bycatch taxa were encountered in the McArthur region (Table 3) than the Roper region (Table 4). Catfishes (*Arius* spp.) were the most common bycatch in both regions and years. Of the other bycatch taxa observed, fewer than 10 examples of each were recorded from a given region during the study period.

No interactions between wire mesh crab pots and threatened, endangered or protected species (e.g. crocodiles, sawfish or turtles) were detected during any of the observer trips.

Discussion

The overall observed catch rates (for both regions combined) in 2017 and 2018 were 0.91 kg/pot-lift and 0.78 kg/pot-lift, respectively. These values were 21% above the reported catch rate for the Western Gulf of Carpentaria Mud Crab Fishery in both years (i.e. 0.75 kg/pot-lift and 0.65 kg/pot-lift, respectively; Northern Territory Government, unpublished data). This was not unexpected given that observations focused on the activities of more experienced (and efficient) licensees.

Discard rates ranged from 59–69% depending on year and region, and fell within the range of values previously reported for wire mesh crab pots set in the Northern Territory (Ward *et al.* 2008; Grubert & Lee 2013). However, it should be noted that previous studies did not distinguish discards as either under-sized or soft-shelled as was done here (Table 2).

The survival rate of discards is not known, but is assumed to be relatively high, given observations of repetitive recaptures of tagged crabs over the period of a few days

Table 3. Annual bycatch totals and pooled bycatch rate* for mud crab pots set in the McArthur region.

Class	Species	2017	2018	Pooled bycatchrate/1000 pot-lifts
Actinopterygii	Bream (<i>Acanthopagrus</i> spp.)	1	1	1.0
	Catfish (<i>Arius</i> spp.)	2	21	11.4
	Goldspotted Rockcod (<i>Epinephelus coioides</i>)	0	3	1.5
	Conger Eel (family Muraenidae)	1	0	0.5
	Spotted Scat (<i>Scatophagus argus</i>)	0	1	0.5
Chondrichthyes	Milk Shark (<i>Rhizoprionodon acutus</i>)	1	1	1.0
Malacostraca	Blue Swimmer Crab (<i>Portunus</i> spp.)	0	6	3.0

* Pooled bycatch rate calculated as the sum of the annual bycatch totals divided by the sum of annual pot-lifts (i.e. 2016 for the McArthur region) multiplied by 1000.

Table 4. Annual bycatch totals and pooled bycatch rate* for mud crab pots set in the Roper region.

Class	Species	2017	2018	Pooled bycatch rate/1000 pot-lifts
Actinopterygii	Barramundi (<i>Lates calcarifer</i>)	0	1	0.4
	Barred Javelin (<i>Pomadourys kaakan</i>)	1	0	0.4
	Blue Threadfin (<i>Eleutheronema tetradactylum</i>)	2	0	0.9
	Bream (<i>Acanthopagrus</i> spp.)	0	2	0.9
	Catfish (<i>Arius</i> spp.)	19	14	14.2
	Goldspotted Rockcod (<i>Epinephelus coioides</i>)	0	1	0.4
	Mullet (<i>Mugil</i> spp.)	2	0	0.9
	Tripletail (<i>Lobotes surinamensis</i>)	2	0	0.9
Chondrichthyes	Milk Shark (<i>Rhizoprionodon acutus</i>)	5	0	2.2
Malacostraca	Blue Swimmer Crab (<i>Portunus</i> spp.)	1	0	0.4

* Pooled bycatch rate calculated as the sum of the annual bycatch totals divided by the sum of annual pot-lifts (i.e. 2321 for the Roper region) multiplied by 1000.

(Grubert & Lee 2013). The high proportion of discarded male crabs was not surprising because male crabs are known to dominate the catch during the first half of the year (Knuckey 1999).

Soft-shelled male crabs constituted the largest, or second largest, proportion of all discards across the months of April and May in both regions and years. By contrast, soft-shelled female crabs formed the smallest percentage of discards in all cases. This observation is consistent with the reproductive cycle of *Scylla serrata*, where mating activity peaks towards the end of the year (Knuckey 1999). Mating can only take place when the shell of the male crab is hard and that of the female crab is soft. This necessitates that the moult cycles of the sexes are asynchronous (at least four adults), with males generally moulting earlier in the year and females later in the year.

The mandatory use of escape vents in commercial mud crab pots in the Northern Territory (implemented in June 2018) is expected to reduce the discard rate in the fishery by allowing more under-sized crabs to escape from pots. While future fishery observer work during the focal period (i.e. April–May) might detect a reduction in the discard rate, it may not capture the full impact of this legislative change, as observations are restricted to a two-month window. Expansion of the fishery observer program beyond these months is unlikely (because of costs), but a more comprehensive assessment of discard rates could be undertaken by industry voluntarily.

The low incidence of bycatch in wire mesh mud crab pots described here is consistent with previous reports on the use of this gear in both the Northern Territory (Hay *et al.* 2005; Grubert & Lee 2013) and New South Wales (Butcher *et al.* 2012). Of the 12 taxa recorded as bycatch during the current study, three were new records for wire mesh pots in the Northern Territory – the Spotted Scat (*Scatophagus argus*), the Tripletail (*Lobotes surinamensis*) and an undifferentiated species of conger eel (family Muraenidae). The number of taxa recorded as bycatch in the Roper region was greater than that in the McArthur region. However, this is of limited significance because a large proportion of the taxa recorded in both regions were represented by just one individual.

Similar to Hay *et al.* (2005), who observed a total of 10,416 pot-lifts over a two-year period, there were no observations of interactions between wire mesh crab pots and threatened, endangered and protected species during the current study.

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