NAFC Marine Centre

Survival of discarded velvet crabs (*Necora puber*)

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Introduction

Velvet swimming crabs (*Necora puber*) are a valuable species caught around Shetland by vessels in the inshore fleet (Figure 1). This species was traditionally caught as by-catch in brown crab and lobster fisheries and were not targeted in their own right until the 1980s, following a collapse in the Spanish fisheries. As a result all of the velvet crabs landed in Shetland are transported live to the Spanish market by vivier operators. Following a period of steady increase the landings of velvet crabs in Shetland have shown considerable fluctuation since the late 1990's (Figure 2).

Figure 1: A velvet crab (*Necora puber*).

The velvet crab, like all other crustaceans must moult in order to grow. This process involves shedding the hard outer shell, or exoskeleton, and then growing while the new shell is still soft. This is also the time when females will mate. The main moult period in Shetland shows differences between the sexes with males moulting mainly in July and August and females in September and October (Tallack, 2002), although there is considerable local variability (Henderson *et al*., 2005). The time taken from the moult until the exoskeleton is fully hardened was shown to be around 18 days in velvet crabs from Orkney (Hearn, 2001).

In 2005, when this study was carried out, a closed season operated in Shetland during July and August, to protect velvet crab stocks during their vulnerable moulting period. At this time velvet crabs are particularly sensitive to stress caused through handling, exposure to air and wind, and increased temperatures, thus mortality rates may be high from normal fishing capture and holding practices. Whilst the closed season prevents crabs from being landed, stored and sold it does not prevent velvet crabs from being fished, handled and discarded as a by-catch from the lobster, and to a lesser extent the brown crab fisheries.

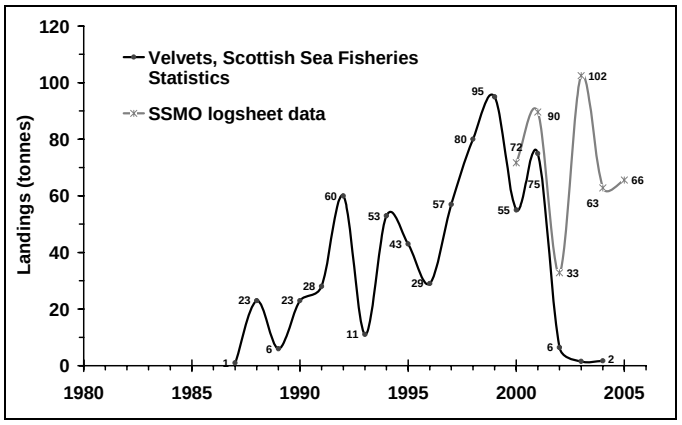

Figure 2: Landings of velvet crab in Shetland, showing data from the Scottish Sea Fisheries Statistics (up to 2004) and data from SSMO logbooks (data up to 2005).

At present there is no information on the effects of such discarding practices on velvet crabs from creels, although previous studies from the *Nephrops* trawl fishery show that mortality rates of discarded harbour crabs can be in the range of 28 - 49% (Bergmann & Moore, 2001). It has also been shown that handling crustaceans captured in creels can increase the risk of limb loss with subsequent energetic costs. Where berried females are handled this is important as it has been shown that egg loss is higher in individuals which have lost a limb (Norman & Jones, 1993).

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Methods

Velvet crabs were caught using normal Scottish creels from the NAFC Marine Centre fishing vessel *Atlantia* LK324 (Figure 3). Two separate fishing trips were made during the 2005 Shetland closed season (July and August) on the 26 July and 31 August. On removal from the creels, velvet crabs were separated into male and female, and hard and soft categories, dependant on the stage of moult they were in (condition of their carapace), and stored in sea water (Figure 4).

Figure 3: Skipper Arthur Johnson hauls a creel onboard.

Only males with a carapace wider than 70mm and females wider than 65mm were included in this mortality experiment, as the majority of the catch from this area in previous fishery trials were of these size classes (Henderson *et al*., 2005). A total of 45 crabs were used in the sea and onshore trials; three replicates of five crabs for each sex (M, F) and shell category (H = Hard, S= Soft) were used where possible (see Table 1). No soft females were caught during July and only seven were caught in Aug/Sept.

For the sea trials single crabs were placed in individual buckie pots, modified 25 litre drums with netted tops, in leaders of five pots. The pot entrances were covered with additional mesh (Figure 5) and then deployed close to the shore in sheltered waters in a depth of 3 - 10m.

For onshore trials crabs were placed individually in mesh crates, the positions of which were chosen at random, and suspended within large tanks of flowing sea water (Figure 5). All crabs were checked three times each week for mortalities, the food remains were removed and fresh food added. The experiments were terminated after two weeks. It was only possible to check the Aug/Sept sea trial crabs once per week due to a shipping diesel oil spill in the area.

Figure 4: Velvet crabs stored in sea water prior to experiments and the sea trial buckie pots.

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Table 1: Details of crabs used in experiments; five crabs from each category were used: MH – male hard, MS – male soft, FH – female hard, FS – female soft, and each category was replicated three times where possible (e.g. MH1 – MH3), # indicates that only 2 crabs used.

Sea trials

July/Aug 05			Aug/Sept 05			
MH1	MS1	FH1	MH1	MS1	FH1	FS1
MH2	MS2	FH2	MH2	MS2	FH2	
MH3	MS3	FH3	MH3	MS3	FH3	

Onshore trials

July/Aug 05			Aug/Sept 05		
MH1	MS1	FH1	MH1	FH1	FS1#
MH2	MS2	FH2	MH2	FH2	
MH3	MS3	FH3	MH3		

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Figure 5: Buckie pot used in sea trials and crates used in onshore trials

Results

July/August

No crab mortalities were recorded from the 45 crabs observed during July in the sea trials. Of the crabs used in the sea trials only one third were soft animals and these were all male. One of the hard females used in the sea trials laid a brood of eggs during the period of observation.

From the onshore trial, also with 45 individuals, only one mortality was recorded, and it occurred at the end of the first week of observations. This was a hard-shelled male.

There were a number of escapees from the buckie pots used in the sea trials (Figure 6). Male crabs were much more adept than females at escaping through the mesh at the top of the pots. Only 3 crabs escaped from the onshore mesh crates and were replaced in the crates when discovered. In contrast to the sea trials these escapees were all female.

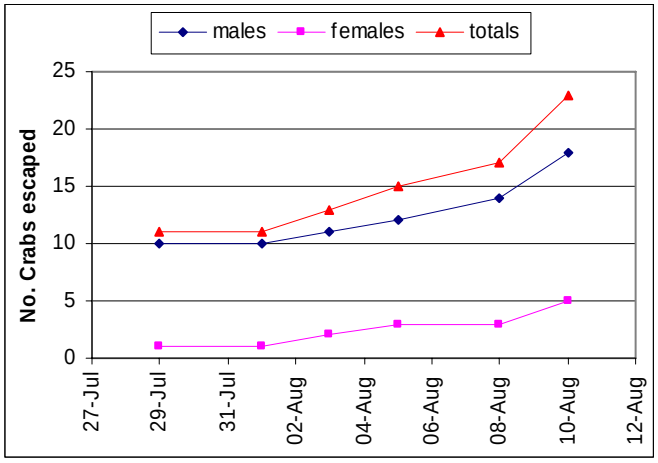

Figure 6: The cumulative number and sex of velvet crabs escaping from the buckie pots used in the sea trials carried out in July/August 2005.

August/September

A total of seven soft females were caught during August, five were used in the sea trials and two were used in onshore trials, all of which survived and hardened. Escapees were reduced to one crab in this trial, as extra cable ties were used to hold the mesh in place over the buckie pot entrances.

Two crabs were found dead during the August/September sea trials, one soft male and one hard female. One hard female was found dead in the onshore trials, occurring towards the end of the first week.

Discussion

Relatively low numbers of female soft crabs were caught in creels during the course of this study. This is likely to be related to the breeding behaviour of the velvet crab. Once the female has moulted and is soft she is also ready to mate and will be guarded by her male partner while her shell hardens. In this way the male aims to assure his paternity of her eggs. During this mate guarding period the females are less likely to be feeding and away from their partner and are therefore not as susceptible to being caught in creels.

Only four crabs (2.4% from a total of 167) died during the discard experiments, two (2.1%) in the sea trials and two (2.8%) in the onshore trials. These results indicated that, in general, velvet crabs discarded from creels during the 2005 Shetland closed season (July and August) did survive. Whilst survival was good during these preliminary discard experiments, a few points must be taken into consideration, which are outlined below.

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This experiment provided ideal conditions after "discarding" crabs, in that each crab had its own individual shelter and food, and was undamaged. In normal conditions discarded crabs may be damaged, predators are present, and the repeated discarding of undersized crabs may occur, all of which may result in higher mortality in the fishery.

The survival of discarded undersized crabs or the effect of repeated discarding on undersized crabs was not investigated in this experiment and this could be a future area for research. This is particularly relevant as, in certain areas of Shetland; more than 50% of the catch can be undersized individuals. However, it is not known if repeated discarding of the same crabs does actually happen.

Occasionally crabs are damaged during fishing operations (Tallack, 2002; Henderson *et al*., 2005) and it is possible that the survival rates of discarded damaged crabs (e.g. limbs missing) or berried crabs are not as low as those seen in this experiment. Investigations into this area would also be of interest to the fishery.

Very few extremely soft crabs were found (i.e. in paper-soft shell condition) during this experiment and crabs in this state may show higher mortalities. However, the percentage of crabs in this very soft stage that actually enter creels is also small and so this is not of major concern for the fishery.

The crabs used in the sea trial were good at escaping from the buckie pots despite the extra mesh used to block the entrance hole. Extra fastenings were used for the Aug/Sept trial to address this problem. More male crabs escaped than female crabs which may reflect their more aggressive nature. It was assumed that all the escapees survived, as they were fit enough to escape.

Conclusion

Based on the low mortality rates of velvet swimming crabs observed in the above experiment, mortality of the velvet crab by-catch in the lobster and brown crab fisheries is unlikely to have a detrimental effect on the velvet crab stock. However, fishermen should be advised to minimise handling and exposure to air during discarding as both rough handling and excessive exposure to air will increase discard mortality.

Acknowledgements

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