PRIFYSGOL BANGOR UNIVERSITY

LOBSTER ESCAPE GAP TRIALS

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INTRODUCTION

The lobster traps currently used in the Isle of Man[1] retain all but the smallest lobsters (*Homarus gammarus*) and brown crabs (*Cancer pagurus*) which enter them. Providing an escape gap by means of a plastic panel with a rectangular hole allows smaller lobsters and crabs to escape. It is important that the size of escape gap used retains as many lobsters of or above the minimum landing size (MLS) as possible while allowing undersized individuals to escape.

In a review of the use of escape gaps in Newfoundland, Canada, Templeman (1958) notes that the advantages of increasing lath spacing, by allowing juvenile American lobsters, *Homarus americanus*, to escape, were recorded as early as 1890 and a minimum lath spacing of 1 ¾ inches was required under law from 1893 in Newfoundland. Although fishers are required to return undersized lobsters to the sea, in the Isle of Man and elsewhere, Brown (1979) suggested discarded lobsters would be more likely to return to known refuges when allowed to escape on the seabed rather than being discarded after traps are hauled. In addition, the modern design of lobster traps which are constructed in steel and are not raised above the seabed by wooden laths, as in traditional designs, can be particularly damaging to trapped lobsters in bad weather due to movement of the traps (pers. comm., D. Quillin).

Several studies have examined the effectiveness of escape gaps in lobster and crab traps in allowing smaller individuals to escape (Brown, 1978, 1979, 1982; Conan, 1987; Maynard *et al*., 1987; Clark, 2007). Brown (1978, 1979) conducted trials of rectangular gaps measuring 42 x 100 mm fitted to lobster traps and assessed catches based on a MLS of 80 mm carapace length finding that escape gaps increased the numbers of lobsters ≥80 mm caught while resulting in fewer lobsters <80 mm being retained. More recently, Clark (2007) trialled escape gaps measuring 80 x 45 mm. The mean size of lobsters caught in traps with escape gaps was 81.9 ±1.1 mm compared to 77.8 ±0.14 mm in traps without escape gaps. The aim of this study was to verify if escape gaps of 80 x 45 mm and 84 x 46 mm, which are currently mass-produced by GT Products, would retain lobsters of ≥87 mm while allowing smaller individuals to escape.

METHODS

Three sets of traps were deployed, one in Ramsey Bay, one at Port St. Mary, and one at Dalby. At Ramsey and Port St. Mary, three strings of c. ten traps were set, one set with no gaps (N), one set with gaps of 80 x 45 mm (small, S) and one set with 84 x 46 mm (large, L) gaps. At Dalby, ten traps with each escape gap size were set individually rather than in strings. Traps with and without gaps were not used within the same string to prevent lobsters entering and leaving traps with gaps and then entering traps with no gaps. Traps in Ramsey were deployed on six different days, on four different days in Port St. Mary, and on eight days at Dalby. Soak times varied from 1 to 6 days for all but one trial where traps

[1] It should be noted that several fishermen have voluntarily installed 80 x 45 mm escape gaps in lobster traps.

were left for 12 days due to bad weather. However, soak time was consistent within each trial. The carapace length (CL) of all lobsters was measured to the nearest millimetre from behind the eye to the base of the carapace. The study was conducted during October and November 2008.

RESULTS

A total of 125 traps with no gaps (N) , 116 traps with small (S) and 129 traps with large gaps (L) were hauled and catch compositions analysed (Table 1). The mean CL ±1 S.D. of lobsters at Port St. Mary was (gap type in brackets) 77.4 ±12.2 mm (N), 83.5 ±9.4 mm (S), and 84.4 ±12.7 mm (L); at Ramsey, the values were 77.8 ±11.6 mm (N), 90.9 ±4.8 mm (S) and 93.4 ±5.6 mm (L). The mean CL of lobsters caught at Dalby was 88.9 ±12.2 mm (N), 85.9 ±8.7 mm (S) and 92.4 ±10.7 mm (Figure 1).

The mean number ±1 S.E. of lobsters caught at Port St. Mary (Figure 2a) was 2.5 ±0.2 (N), 1.4 ±0.2 (S), and 1.2 ±0.2 (L); and at Ramsey (Figure 2b), 3.1 ±0.1 (N), 1.6 ±0.1 (S), and 1.2 ±0.1 (L). At Port St. Mary the percentage of the catch composed of lobsters ≥87 mm was 24.9 %(N), 45.9 %(S) and 52.4 %(L); at Ramsey values were 30.8 % (N), 89.1 %(S) and 92.4 %(L). The mean number ±1 S.E. of lobsters caught at Dalby (Figure 2c) was 1.4 ±0.2 (N), 2.2 ±0.1 (S) and 1.6±0.2 (L). The percentage of the catch at Dalby consisting of lobsters ≥87 mm was 74.2 %(N) 40.4 %(S) 80.9 %(L).

Residuals of numbers of lobsters ≥87 mm data approximated normality and variances were not significantly different (Levene's Test = 1.25, p = 0.269). A crossed GLM ANOVA revealed that there was no significant effect of the escape gaps on the number of lobsters ≥87 mm caught ($F_{2,361}$ = 0.15, p = 0.860), but there was a significant difference between areas ($F_{2,361}$ = 10.63, p <0.001) with more caught in Ramsey Bay. The interaction term was not significant ($F_{4,361}$ = 1.60, p = 0.175). The mean CL of lobsters was significantly different (ANOVA, $F_{2,682}$ = 83.73, p<0.001) in traps with and without gaps overall. Tukey's pairwise comparisons revealed that the mean CL of lobster caught was significantly lower in traps without gaps than in those with either a small (T = 9.406, p<0.001) or large gap (T = -11.6, p<0.001), and that the mean CL of lobsters caught in traps with a small gap was significantly smaller than in traps with a large gap (T = -2.53, p = 0.031).

Table 1. Data summary of catches at Port St. Mary (PSM), Ramsey (RAM) and Dalby (DAL) in October and November 2008. CPUE: Catch Per Unit Effort. CL: Carapace Length.

Location	Gap	Traps hauled	Total catch	Mean CL	SD	Mean CPUE (All Lobsters)	SE	Mean CPUE (Lobsters ≥87 mm)	SE
PSM	large	34	42	84.4	12.7	1.2	0.2	0.7	0.1
PSM	small	26	35	83.5	9.4	1.4	0.2	0.6	0.1
PSM	none	47	117	77.4	12.2	2.5	0.2	0.6	0.1
RAM	large	58	69	93.4	5.4	1.2	0.1	1.1	0.1
RAM	small	59	92	90.9	4.8	1.6	0.1	1.4	0.1
RAM	none	58	185	77.8	11.6	3.1	0.1	1.0	0.1
DAL	large	36	57	92.4	10.7	1.4	0.1	1.2	0.1
DAL	small	32	73	85.9	8.7	2.2	0.2	0.9	0.1
DAL	none	20	38	88.9	12.2	1.6	0.1	1.2	0.1

No lobsters >105 mm CL were caught in traps without escape gaps, but lobsters up to 110 mm CL were caught in traps with small escape gaps, and up to 120 mm CL in traps with large escape gaps (Figure 3). Fewer lobsters <105 mm CL were caught in traps with escape gaps; however, this was counteracted by the larger lobsters caught. It is estimated that of the lobsters escaping through 80 x 45 mm gaps, 92% had a carapace length of <90 mm, and that of the lobsters escaping through the 84 x 46 mm gaps, 87% had a carapace length of <90 mm. The estimated modal size class of lobsters escaping through the small gaps was 80 – 85 mm (Figure 4a), while the estimated modal size class of lobsters escaping through the large gaps was 85 – 90 mm (Figure 4b).

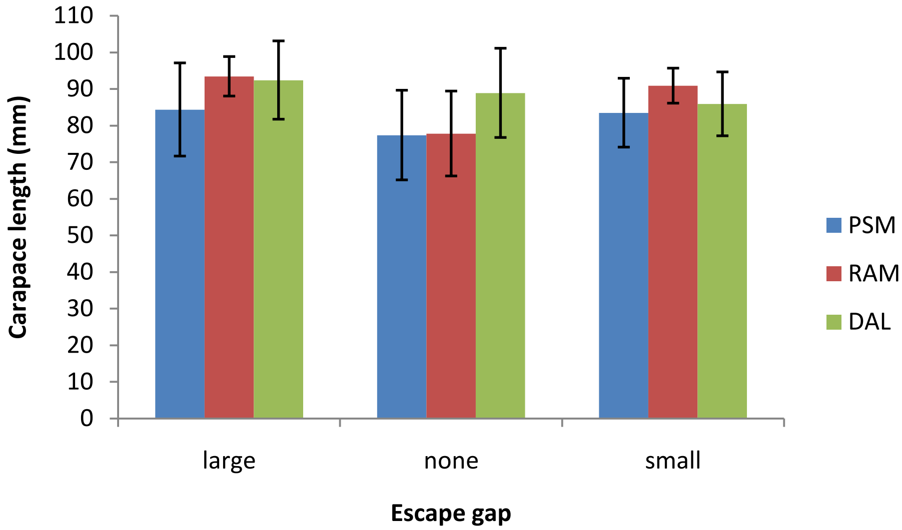

Figure 1. Mean carapace length (±1 S.D.) of lobsters caught in traps with no escape gaps, small escape gaps or large escape gaps at Port St. Mary (PSM), Dalby (DAL), and in Ramsey Bay (RAM).

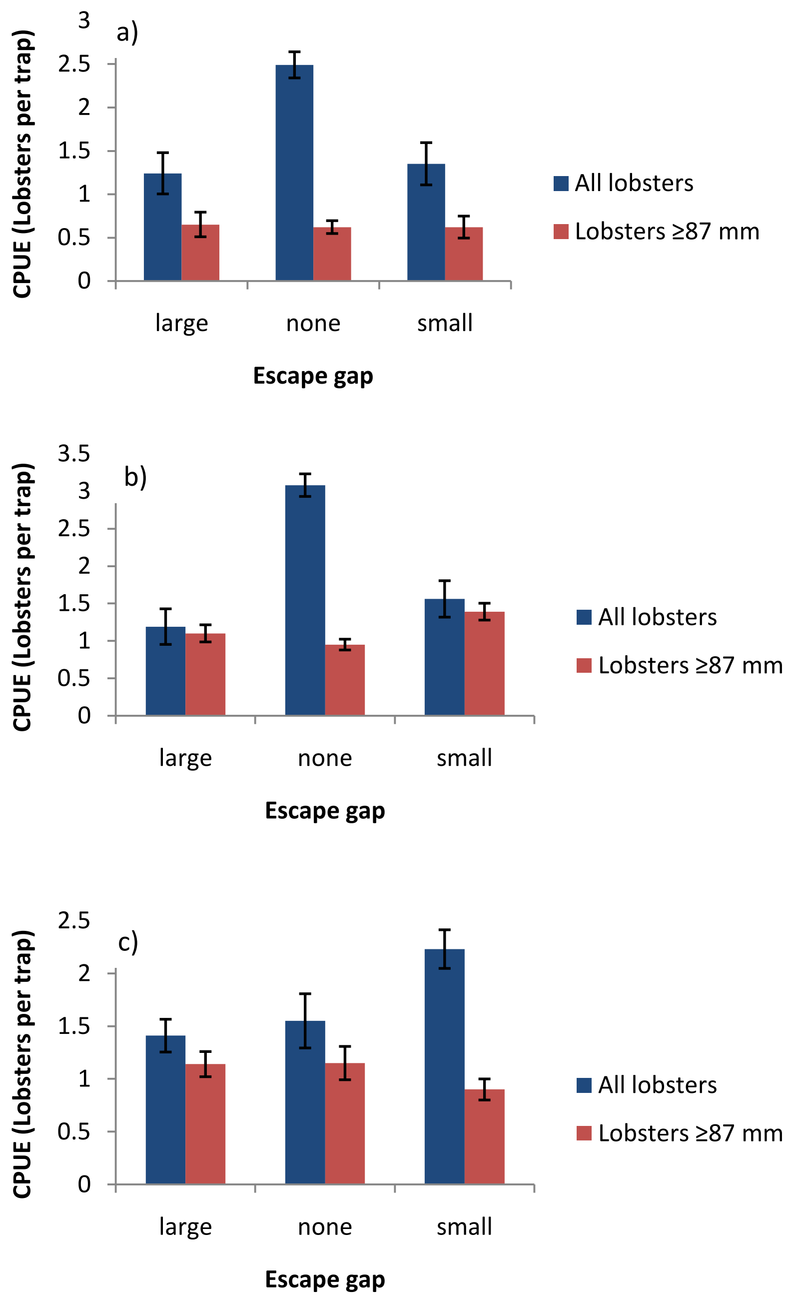

Figure 2. Mean total number of lobsters (±1 S.E.) and number of lobsters ≥87 mm carapace length (±1 S.E.) caught in traps with no escape gaps, small escape gaps or large escape gaps in a) Port St. Mary (PSM), b) Ramsey Bay (RAM) and c) Dalby (DAL).

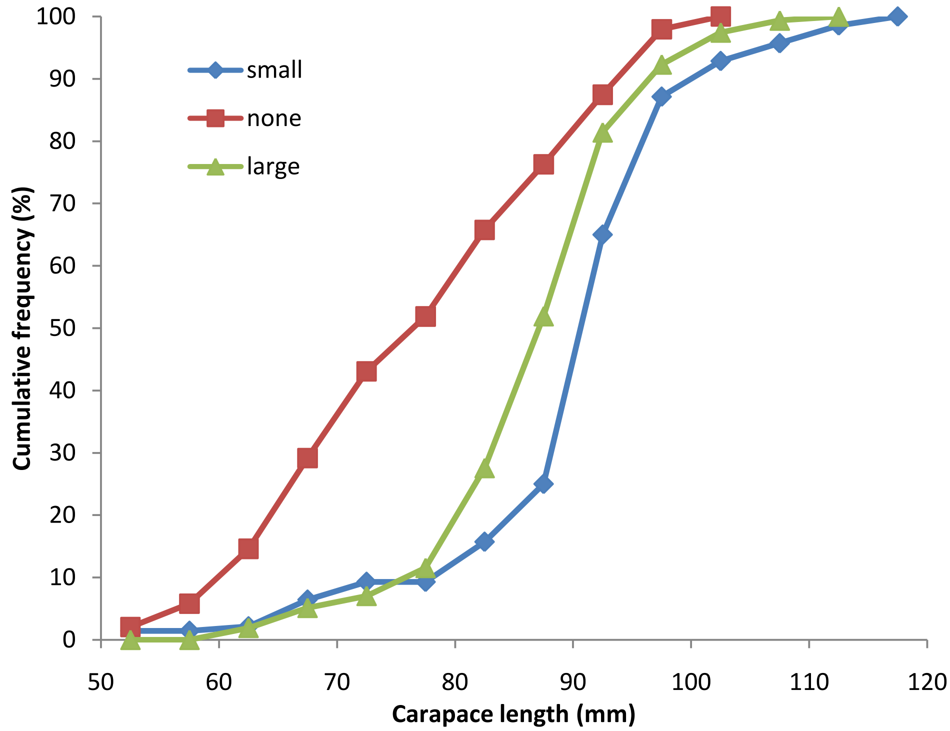

Figure 3. Cumulative size-frequency distribution of lobsters caught in traps with small, large or no escape gaps.

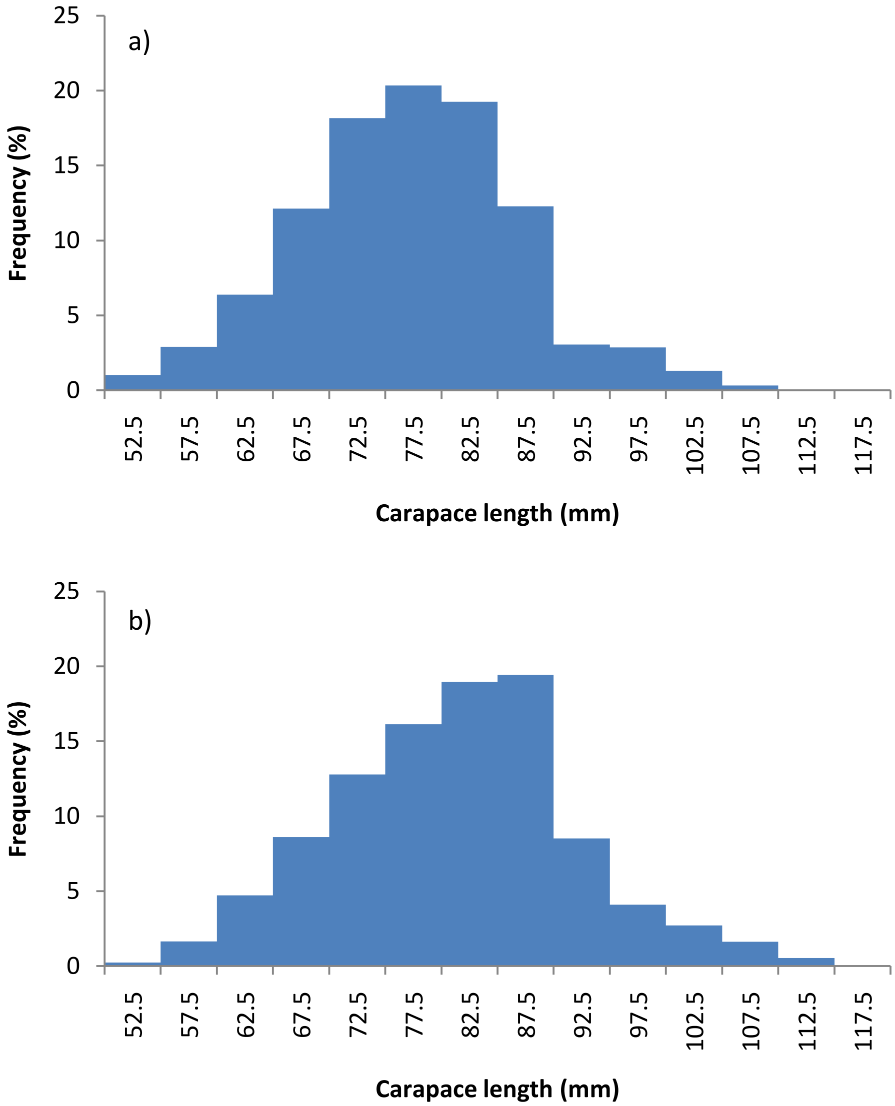

Figure 4. Estimated size frequency distributions of lobsters escaping from traps with a) large gaps and b) small gaps.

DISCUSSION

Brown (1982) concluded that the optimal size of lobster escape gap was 1 mm below the size of the minimum carapace or abdomen dimension which corresponds to the required carapace length. Thus, a lobster with a carapace length of 87 mm would be expected to have a carapace width of 47.7 mm for males or 47.8 mm for females; ideal escape gap sizes would therefore be 83 mm x 47mm to allow most undersized males to escape. The size of escape gap adopted by Sussex Sea Fisheries Committee is 80 x 45 mm and therefore below the optimal size suggested by Brown (1982). However, given the natural variability in lobster sizes, adopting a slightly smaller gap size would prevent the loss of individuals ≥87 mm. Based on the results of Brown (1982), an 80 x 45 mm gap could be expected to allow most lobsters of 83 mm carapace length to escape, while a larger gap, of 84 x 46 mm, would allow lobsters of 84 m carapace width to escape. In the current study, the estimated modal size of lobsters escaping through 80 x 45 mm gaps was 81 mm, and 83 mm from 84 x 46 m gaps. Conan (1987) emphasised that it is not possible to have an exact retention size. Escape gaps could be varied in size by a few millimetres depending on whether it was more desirable to allow all undersized individuals to escape or to retain all individuals of ≥87 mm. For a minimum landing size of 87 mm the 80 x 45 mm escape gaps provide an acceptable intermediate that will not, overall, result in losses of commercially viable lobsters.

Lacing escape panels into traps through the escape gap should be avoided as this will result in smaller lobsters being retained. It is important that lobsters continue to be measured to ensure only lobsters of ≥87 mm are landed as undersized lobsters will continue to be retained in traps with escape gaps. Only females of <80 mm would be expected to escape through the 80 x 45 mm gap due to their greater abdominal width. Other lobsters may not have time to escape or the gap may become blocked. Therefore, it is important that the introduction of escape panels is not viewed as an alternative to measuring lobsters. As the introduction of escape gaps may improve the efficiency of traps, lobster landings may increase due to greater CPUE. Thus, it will be important to monitor landings over coming years. Any apparent increase in the efficiency of traps could be counteracted by a reduction in the number of pot licences or other effort restrictions. The compulsory use of escape gaps in traps used for hobby fishing may be beneficial for lobster populations as these traps are more likely to be abandoned or hauled only irregularly. As such, there may be a case for the compulsory use of larger escape gaps in hobby pots.

CEFAS (2005) summarized the relative benefits in terms of egg production per recruit in response to various management measures. A ban on the landing of berried females, effort reduction and an increase in the MLS would produce the greatest increases in eggs per recruit. Of these measures, only an increase in MLS would result in a greater yield per recruit. Therefore, in addition to the current ban on landing berried females an increase in the minimum landing size would be the most effective means of ensuring recruitment to the fishery.

CONCLUSIONS AND RECOMMENDATIONS

- Fitting escape gaps to lobster traps is an effective means of allowing undersized lobsters to escape.

- It is estimated that 83% of lobsters escaping through 80 x 45 mm gaps had a carapace length of <90 mm.

- The mean carapace length of lobsters caught in traps without escape gaps was lower than in traps with escape gaps.

- CPUE of lobsters of ≥87 mm was not significantly different between traps with and without escape gaps.

The fitting of 80 x 45 mm rectangular escape gaps to lobster traps would allow many lobsters <87 mm to escape with minimal loss of lobsters ≥87 mm CL. Both this study and previous studies indicate that fitting escape gaps may improve the efficiency of traps at catching larger lobsters, in addition to reducing the time required to sort catches. Therefore, it is important that landings and the catch composition of lobsters are monitored if the effects of introducing escape gaps are to be fully understood. Escape gaps of 80 x 45 mm will retain some undersized male lobsters and many undersized female lobsters, particularly those which are egg-bearing. It is thus essential that lobsters continue to be measured before they are landed.

ACKNOWLEDGMENTS

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