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The effects of pot immersion time on catches of lobsters *Homarus gammarus* (L) in the Welsh coast fishery

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THE EFFECTS OF POT IMMERSION TIME ON CATCHES OF LOBSTERS *HOMARUS GAMMARUS* (L.) IN THE WELSH COAST FISHERY

by

D. B. Bennett and S. R. J. Lovewell

Summary

Daily records of lobster catch and effort data, taken from fishermen's log-books in the pot fishery off the Welsh coast, were examined to determine the effects of pot immersion time on catch-per-unit-effort (cpue); here defined as the weight of lobsters caught per 100 traps lifted.

Seasonal changes in cpue occur; lobsters being caught most easily in July or August. The annual cpue was constant for immersion periods up to five days. Monthly cpue relative to immersion time fluctuated considerably, the data being rather limited.

Maximum productivity is obtained from daily lifting of the pots. Intraspecific competition, the effects of adverse weather conditions on catchability, the relatively low abundance, bait effectiveness, and the ability to escape from the traps may vary with immersion time and so affect cpue.

In the Cardigan Bay fishery only 2% of the annual potting effort had an immersion time of more than five days and the cpue for pots immersed for up to five days was constant. For purposes of population modelling in this particular fishery the effect of pot immersion time on lobster catches may be disregarded.

Introduction

When studying the population dynamics of crab, *Cancer pagurus* L. and lobster *Homarus gammarus* (L.) stocks Bennett (1974) has drawn attention to the need to consider the relationship between pot immersion time and catch. That study, which was based on data obtained from the Devon crab fishery where lobsters are only an incidental catch, showed that lobster catches decreased after the first day's immersion.

In the present study the effects of pot immersion time on lobster catches were examined using data collected from the fishery in the Cardigan Bay area of the Welsh coast. This is an important lobster fishery, accounting for 16% of the total catch of lobsters from England and Wales in 1974. A small but representative sample of the Cardigan Bay fishermen was selected and asked to record in log-books daily details of the weight of lobsters caught, together with the areas fished, the number of pots lifted and the time between successive lifts.

The completed log-books from three boats which fished during 1973 and 1974 have been analysed with particular reference to the effect of immersion time on cpue. (Note: as defined and used here, cpue does not include a time component such as is incorporated in a cpue elsewhere eg, catch per 100 hours fishing of trawlers).

Seasonal pattern of catch-per-unit-effort

This analysis considers only the marketable catch; lobsters which were below the minimum legal size of 9 inches (229 mm) total length were rejected at sea and not recorded. Analysis of the log-books showed a considerable variation in the seasonal pattern of cpue of lobsters. Fishing does not usually take place in the Cardigan Bay area during the winter because of adverse weather conditions

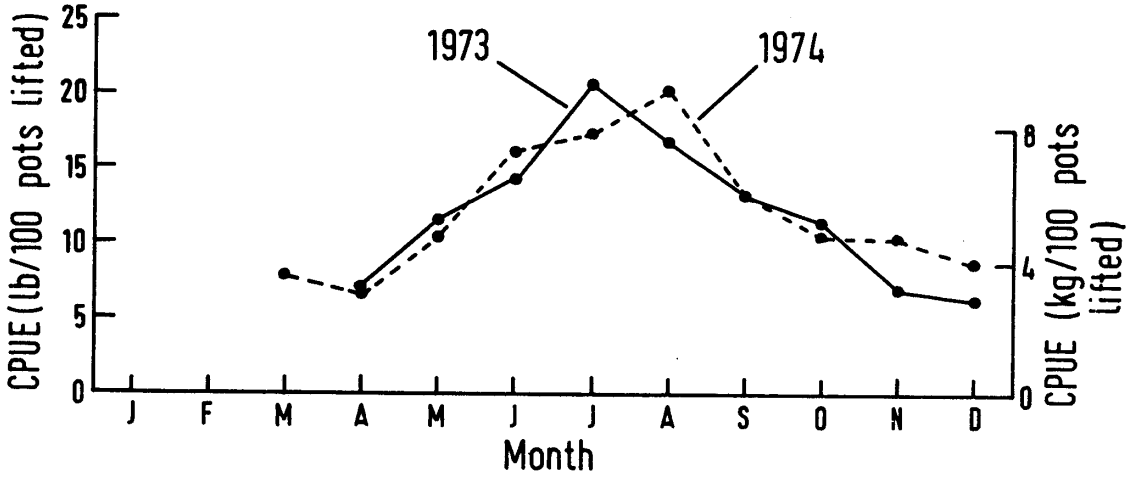

Figure 1. Monthly lobster catch-per-unit-effort for 1973 and 1974.

and very low catch rates. In 1973/74 the fishing seasons began in April and March respectively with a cpue of about 3kg/100 pots lifted (Figure 1). Peak catches were obtained in July and August when the cpue reached a monthly maximum of just over 9 kg/100 pots lifted. Catch rates then declined until December when the fishery ceased, with the cpue at a similar level to that at the beginning of the season. These fluctuations in cpue are probably the result of changes in catchability of lobsters due to temperature dependent factors, particularly feeding activity.

The relationship between cpue and immersion time is shown in Figures 2 and 3. For periods of immersion of up to five days the annual cpue of lobsters during 1973 and 1974 was constant; regression analysis of both 1973 and 1974 data showed insignificant ($P > 0.4$) negative slopes. After five days immersion the relationship fluctuated due to insufficient data. In order to determine whether there was a seasonal change in this relationship the data were analysed on a monthly basis. This analysis has been confined to immersion periods of not more than five days

Table 1. The total annual number of pots hauled at different immersion times in 1973 and 1974.

Immersion Time (Days)	1973		1974	
	Pots Hauled	% of Total	Pots Hauled	% of Total
1	50615	73	36168	66
2	10390	15	10525	19
3	5155	8	4843	9
4	710	1	1045	2
5	900	1	1055	2
6	105	)	655	)
7	185	)	295	)
8	365	)2	170	)2
		)		)
>8	695	)	195	)
Total	69120		54951	

Pot immersion time and catch-per-unit-effort

In this Cardigan Bay fishery in 1973 and 1974 any departure from daily hauling of the pots was usually due to bad weather. About 70% of the annual number of pots hauled had been immersed for one day (Table 1). Only 2% of the annual effort had an immersion time of more than five days.

because the data for longer periods were limited and variable. In contrast to the annual relationship the monthly relationship between cpue and up to five days immersion fluctuated considerably (Figure 3). These data were also rather limited and variable, even after omitting immersion periods of more than five days. For example, the high cpue after four days immersion in November 1974 (Figure 3) is based upon a single day's catch of 13.6kg of lobsters from 100 pots ie 0.4% of the annual catch and 0.2% of the annual effort. Thus the data were inadequate to draw valid conclusions on seasonal changes.

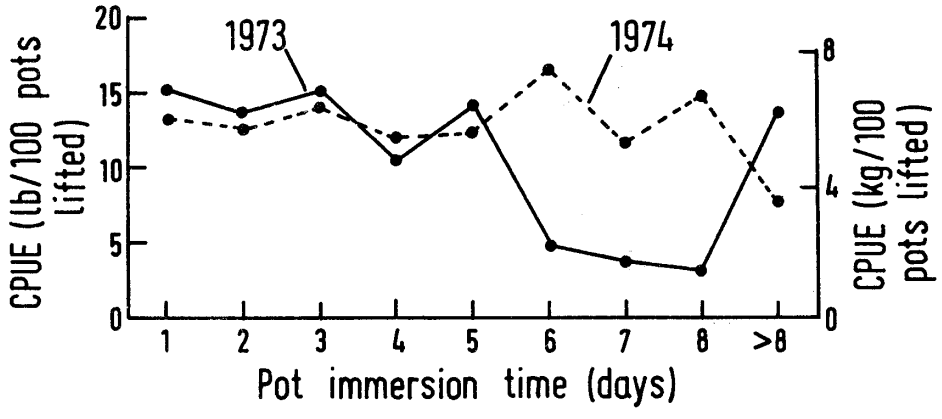

Figure 2. The relationship between annual lobster catch-per-unit-effort and immersion time for 1973 and 1974.

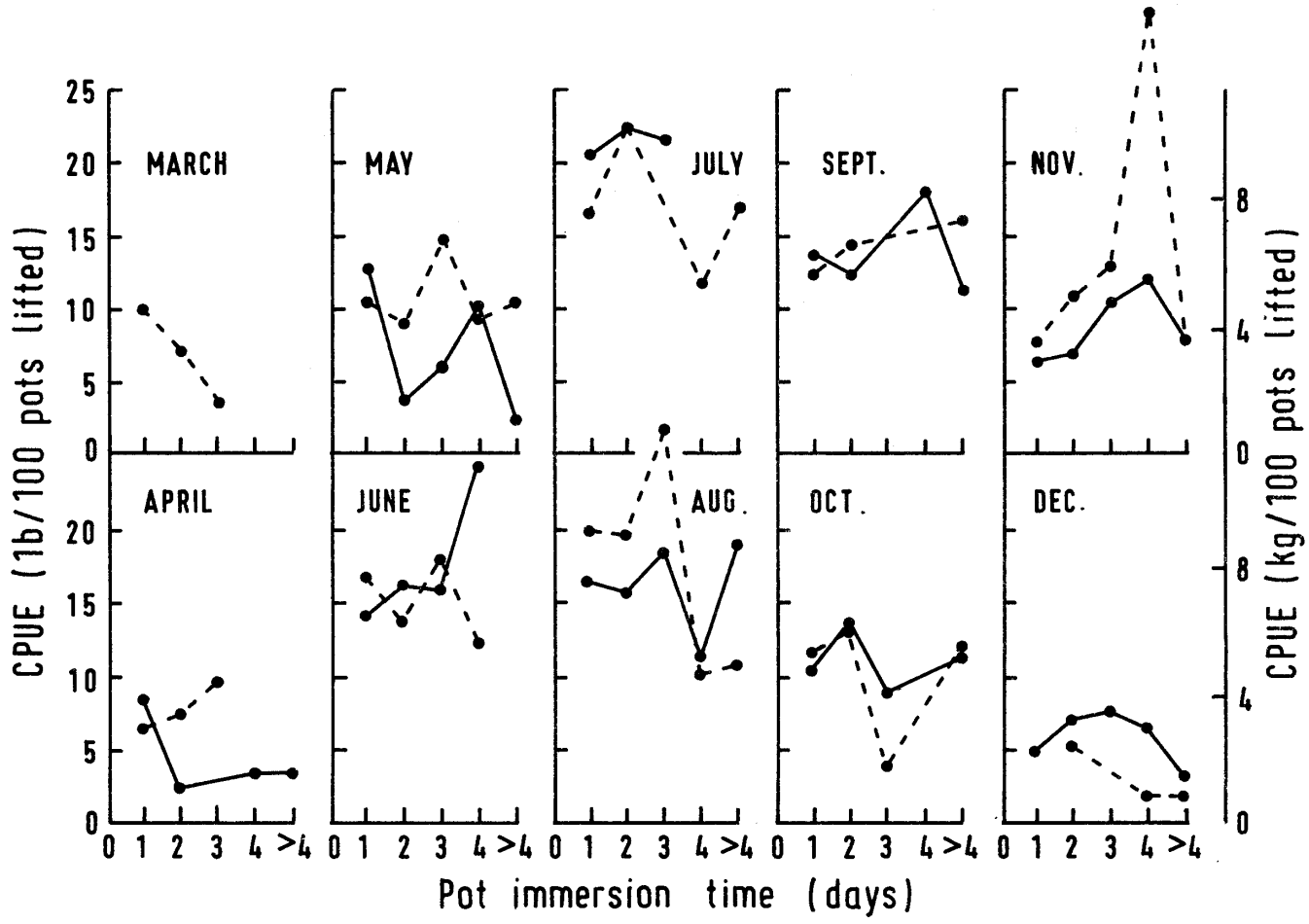

Figure 3. The relationship between monthly lobster catch-per-unit-effort and immersion time for 1973 (continuous lines) and 1974 (broken lines).

Discussion

On an annual basis the cpue was independent of immersion time, for periods up to five days. If pots are hauled within five days of being set the weight of lobsters caught is likely to be, on average, similar to that after one day's immersion. For maximum productivity daily lifting of the pots is desirable. This is usually the lobster fishermen's aim and is only thwarted by adverse weather conditions or mechanical or human failure.

The catch of a baited trap is the result of a series of interactions between the animals attracted to the bait, the environment and the trap (Bennett, 1974). The Cardigan Bay fishery is essentially a lobster fishery with incidental catches of crabs, in contrast to the Devon crab fishery. In the Cardigan Bay fishery the abundance of crabs as indicated by cpue is low (maximum monthly 33 kg/100 pots lifted) compared with Devon (296 kg/100 pots lifted). It therefore seems likely that interspecific competition in Cardigan Bay will be less than in Devon.

In Cardigan Bay intraspecific competition between lobsters will be greater than in Devon as their abundance is greater (9.3 kg/100 pots in Cardigan Bay; 1.4 kg/100 pots in Devon). Preliminary diving observations off Norfolk in 1975 suggested that intraspecific competition between a lobster already in a pot and another approaching the same pot could occur. An examination of the contents of pots off the Welsh coast indicated that of the pots containing lobsters only 2% contained more than one lobster. However, it seems that lobsters are unlikely to be so abundant that intraspecific competition significantly limits the catch, for even when the maximum cpue occurred in July or August only 15% of the pots were occupied. With such relatively low total catches of crabs and lobsters in the pots in Cardigan Bay, gear saturation, as found with female crabs in the autumn off Devon, is unlikely to occur.

The failure of pots to catch more lobsters during extended immersion may be related to the fact that periods of immersion longer than one day are usually the result of adverse weather conditions. The catchability of lobsters may be affected by short-term changes in weather conditions which affect water movements, so that they may remain in their "homes" during stormy conditions and only venture out to feed after the storm. Thus during a stormy period the pots may be effectively fishing only for a short period, and not for the whole of the time between successive hauls.

Irrespective of weather conditions, the abundance of lobsters may be so low that the area of the sea bed influenced by the attractant bait is fished out during the

first day or two of an extended immersion period. In addition, with an extended immersion period the attractant chemical fraction of the bait may leach out and the bait become less effective, resulting in a reduced catch rate. The pots used in the Welsh fishery have a similar basic design to those in Devon. They are made of wire mesh in a cuboid or cylindrical shape with a funnel in the top without any form of trap door or special escape inhibiting mechanism. The swimming ability and manoeuvrability of the lobster may allow fairly easy escape from this type of pot and this could also account for the cpue not increasing with extended periods of immersion.

In the Cardigan Bay fishery, 70% of the pots were immersed for only one day, and only 2% for more than five days. The annual cpue for periods of immersion up to five days was almost constant, so the effects of immersion time on cpue are negligible. Thus when studying the population dynamics of this fishery the errors involved in disregarding immersion time are probably significantly less than those errors obtained when estimating other essential parameters.

References

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