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LARGE SCALE RELEASE EXPERIMENT OF JUVENILE LOBSTERS, *Homarus gammarus*, IN NORWAY

by

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ABSTRACT

A large scale spring release of juvenile lobsters, *Homarus gammarus*, was conducted at Kvitsøy, southwestern Norway in March 1990. The lobsters, 14,700 one and a halve year old and 8,700 six months old, were tagged internally with coded microtags at the hatchery. The lobsters were transported by road and air to the release site and acclimated to sea water of 6 °C, 15 to 60 minutes prior to release. The lobsters were released from small boats in shallow water, with about one lobster per m^2 shoreline. Under water video takings showed that the lobsters were alert, but very calm after release. They moved into shelter within the first hour. No inter-specific aggression or predator fish were observed.

INTRODUCTION

The lobster populations on the Norwegian coast have declined rapidly the last 40 years. From catches ranging from 300 to 1000 tonnes $year^{-1}$ in 1930-50, the yearly catches are now less than 30 tonnes. To meet the marked demand, intensive production of lobsters has been tried. This has, however, not proved to be commercially viable.

In several countries, releases of reared stage VII or older lobster juveniles have been started. Lobster juveniles probably have better survival possibilities than the planktonic larvae, and the results from enhancement projects with marked lobsters in Great Britain confirm that released lobsters do survive and grow in the sea (Bannister & Howard 1989, Burton 1990). Since 1979 the previously commercial lobster hatchery at Kyrksæterøra, Norway (Fig. 1), released one year old lobster juveniles for several years. The animals were not marked and any beneficial results of the releases are therefore difficult to document. However, catches of lobsters with two scissor claws, typically for reared individuals, indicate that the reared lobsters do survive. The lobster hatchery is now handed over to the Institute of Marine Research, which will continue the enhancement experiments.

A release of branded lobster juveniles at Austevoll (Fig. 1) in August 1988, Norway, showed that the losses due to predatory fishes were unacceptably high (Meeren 1990). More than 10% of the lobsters were eaten within the first 30 min after release, and lobsters were found in the stomach of fishes also in the following days. This release was followed up by laboratory research, concentrated on how the lobsters were affected by transport and release in unknown environments (Meeren 1990). The studies revealed that lobsters experienced heavy stress from pressure and cooling in the transportation boxes, leading to uncontrolled swimming or apathy immediately after release, making the lobsters vulnerable to predators. When given the possibility to acclimate between transportation and release, they showed an alert and calm behaviour. With fishes present and at low sea temperature, acclimated lobster juveniles showed little conspecific aggression and alert movement patterns after the release. Increased aggression was observed in warmer water and in reduced light.

This information was used by the Institute of Marine Research, Division of Aquaculture when starting a large scale lobster release programme. This paper describes the first releases of tagged lobsters after a partly revised release method at Kvitsøy, southwestern Norway.

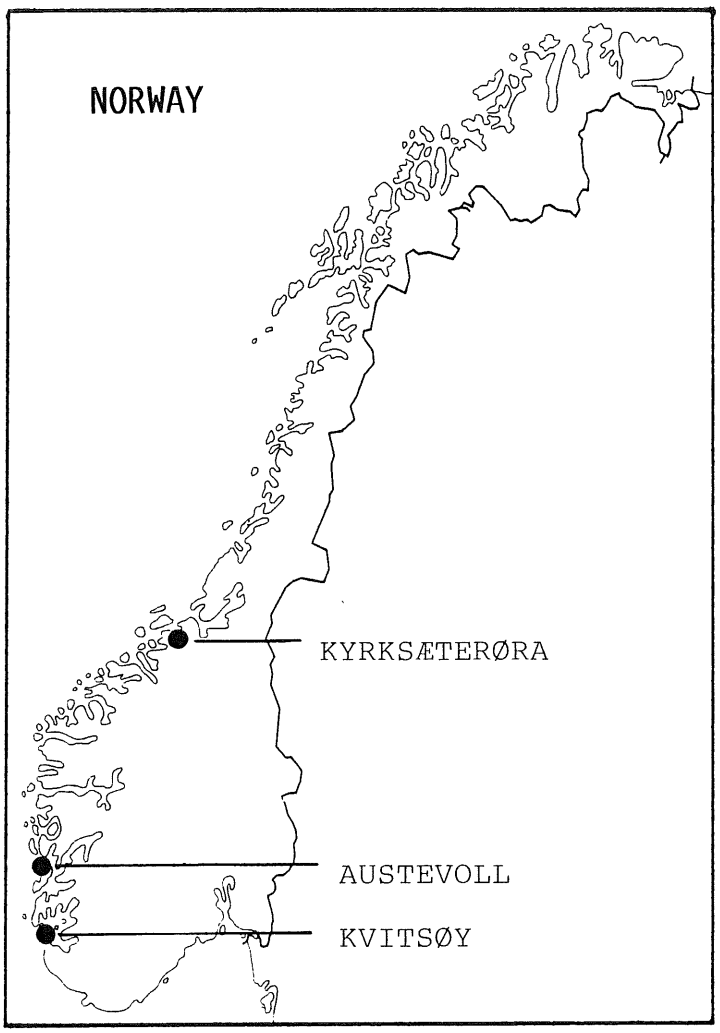

Figure 1. Map showing the location of the lobster hatchery at Kyrksæterøra, Austevoll the release area of juvenile lobster in 1988, and Kvitsøy the release area of juvenile lobster in 1990.

MATERIALS AND METHODS

Two groups of lobster juveniles (hatched in 1988 and 1989) were produced from wild caught broodstock at the Kyrksæterøra hatchery, mid Norway (Fig. 1) after methods described by Grimsen *et al.* (1987). The lobsters were fed frozen *Artemia salina* from hatching to time of release.

The lobsters were tagged with 1 mm binary coded microtags with a Northwest Marine Technology Tagging Unit, "Mark IV", according to the method described by Wickins *et al.* (1986). The tagging was done within five weeks from January to March 1990. The

quality control device (QCD) available was of an older model and did not function together with the new tagging machine. A tubular field detector was used instead and a sample were dissected for control of the placement of the tag. Only lobsters with correctly placed tags were used in this experiment. The tags were placed just posteriorly to the 5th pereiopod, on the left side for the 1988 generation and on the right side for 1989 generation. A sample of 900 lobsters (4%) were dissected for control of tag displacement.

The site chosen for release was Kvitsøy, southwestern Norway (Fig. 1), a small island community, with fishery as traditional occupation and previously an important lobster fishery. The area consists of about 360 small islands and skerries separated by shallow sounds (Fig. 2). The bottom substrate consists of rock, sand, silt and clay in sheltered bays. Large seaweeds as *Laminaria* sp. are common in shallow waters in the area.

On 16 March 1990, the tagged lobsters were transported (by road and air) from the hatchery to Kvitsøy. The lobsters were packed between wet wooden shavings and newspapers in cooled thermal boxes. At arrival, the lobsters were transferred to plastic cases, partly submerged in a seawater basin with flowing seawater. After a period of 15 to 60 min the lobsters were transferred to five small boats in transportation boxes, covered to avoid draught. Each boat was manned with two persons. The lobsters were released close to the shoreline at depths from 0.5 to 5 m by throwing them out one by one by hand, with approximately 1 lobster per m^2 shoreline. The bottom substrate at the release sites varied from sand with boulders and rocky slopes to rocky bottom with cracks and seaweed. A diver with video camera observed some of the lobsters immediately after release.

RESULTS

Tagging

A total of 16,275 lobsters from the 1988 generation were tagged. In this group mortality was 6.7% and tag displacement 21.1%. Of the 9.486 individuals of the 1989 yearclass, tagged later, the mortality was reduced to 4.3% and tag displacement to 13.0%. Number of animals tagged per hour ranged from 100 to 250. The carapace lengths (CL) of the lobsters hatched in 1988 and 1989 were 21.1mm (SD=1.27mm) and 12.1mm (SD=1.18mm), respectively.

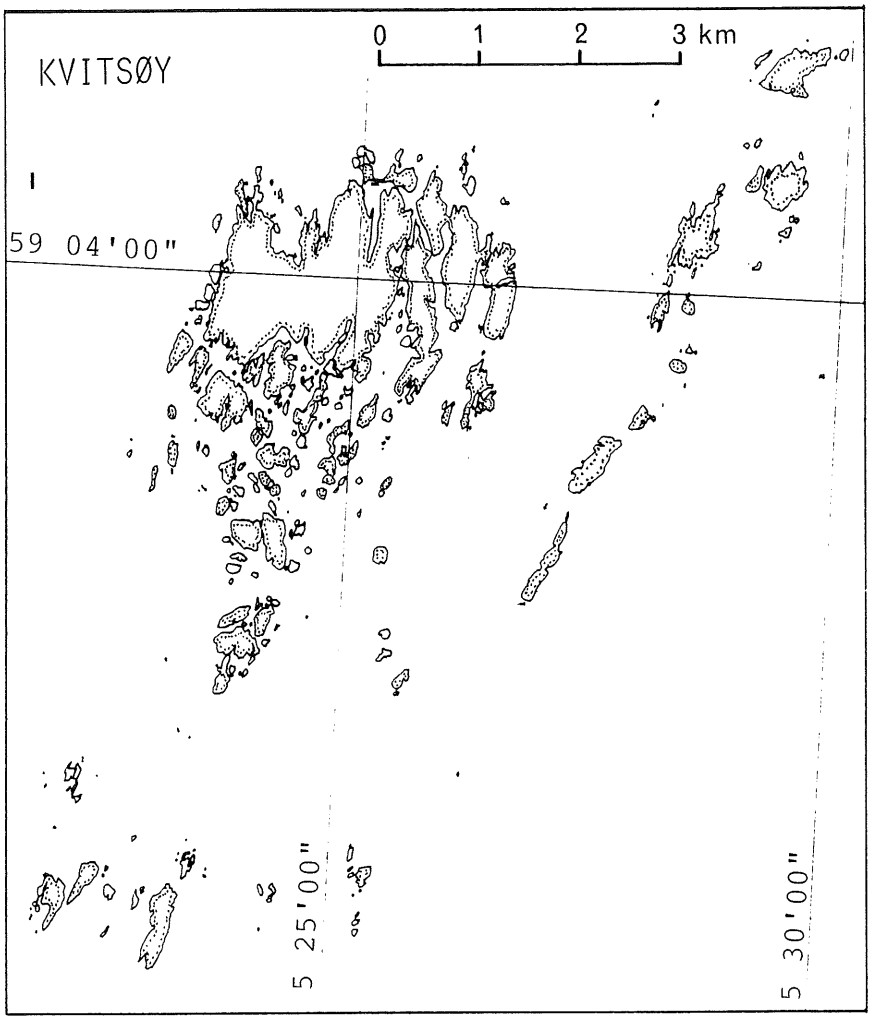

Figure 2. A map of Kvitsøy, the release area of juvenile lobsters in 1990.

Transportation

Packing started at the hatchery at 04.00 a.m. 16 March and included 14,694 lobsters from the 1988 generation and 8,726 from the 1989 generation. The animals were transported in 49 thermal boxes at low temperature (1-5°C). Nine hours after start of packing, the lobsters arrived at Kvitsøy. Mortality during transportation was less than 2%.

Acclimation

At arrival at Kvitsøy the lobsters were unpacked and transferred to perforated plastic cases in a basin with seawater with temperature near 6° C, as the sea temperature. Several lobsters lay floating as long as 10 min before regaining mobility. Rushing up and down in the cases were also common in the first five minutes. The lobsters were kept in the basin for 15-60 min, before transfer to the boats for release.

Release

No released lobsters were observed taken by potential predators as birds or fishes. The released lobsters sank slowly from the surface (20 to 60 sec, dependent on the depth), with all extremities wide spread. They landed on the pereiopods on the bottom or on seaweed, with their chelae spread and telson raised. Most lobsters kept this position for 5-30 min, before slowly moving into shelter like cracks between stones or under seaweed. Before entering the shelter they moved carefully, probing with the chelaes and antennas. No lobsters were observed swimming or moving backwards with tail flapping in the sea, neither was any aggressive behaviour observed. At 04.00 p.m. 16 March all lobsters were released.

DISCUSSION

Tagging

Wickins *et al.* (1986) showed that microtags could be accurately placed and retained in lobsters as small as 9 mm carapace length. The high tagging mortality and tag displacement in this experiment may be attributed to untrained tagging staff, and both the rate of mortality and tag displacement decreased towards the end of the tagging session.

Transportation and acclimation

The transportation method with the lobsters placed dry between cold, wet papers and wooden shavings in isolated thermal boxes is a cheap and rational method. The boxes can be transported by any means and take little space. The survival rate is high, at least for up to 20 hours, if the temperature in the box keeps above 0 °C. The problem with heavy pressure and cooling of the lobsters is solved with a rather short acclimation stay in tempered water before release. This acclimation period must be so short that the lobsters do not get time to be aggressive towards each other. Less than 60 minutes seems to be sufficient.

Release

The release was conducted in early spring to avoid fish predation on the lobster juveniles (Meeren 1990). The wrasses, *Labridae* sp., commonly found during summer,

are absent in the spring (Kristiansen 1987). The low water temperature in shallow waters during winter induce lowered metabolism, and reduced activity. This is the case both for the lobster juveniles (McLeese & Wilder 1958, Cooper & Uzmann 1977) and their predators. Low water temperature does not seem to reduce the ability of the lobster to move around to explore a new environment, but it reduces aggressive behaviour (Hoffmann *et al.* 1975, Meeren 1990). We find it likely that a winter release gives the lobsters enough time to get to know the new habitat before it must seek food. In addition, it is given more time to seek shelter before it reaches the vulnerable molting stage.

The observations on the released lobsters showed that the short acclimation had been sufficient for the lobsters to act in a careful way from the first seconds after release. They all landed on the bottom in an alert position, with no uncontrolled swimming or running. The freezing reaction is known among wild crustaceans as an effective anti-predator behaviour (Stein & Magnusson 1976). They probably reacted on the diver as a threat, and remained frozen longer than they would without being disturbed.

However, the release method still need adjustments. It is not optimal to release the lobsters from the surface. Both water currents (Howard & Nunny 1983) and bird predators make this method unnecessary risky and unreliable.

Further works

This release was the first in a large lobster enhancement experiment. During the next 4 years, the plan is to release more than 50,000 tagged lobster juveniles each year. Local fishermen and the Institute of Marine Research will cooperate in the catching program. Parallel to the release program, it is planned controlled laboratory experiments on the lobster juveniles ability to adjust to a life in the sea. This will give data for selection of the most optimal sites and times for release and also information on how growth of the lobsters are influenced by environmental aspects as fluctuations in sea temperature, space and presence of predators.

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