

## Movements of lesser sandeels (*Ammodytes marinus* Raitt) tagged in the northwestern North Sea

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Numbers of the lesser sandeel (*Ammodytes marinus* Raitt 1934) were tagged and released at sites outwith the normal sandeel fishing grounds in the northwestern North Sea. The location of tag recoveries indicates that *A. marinus* is capable of travelling distances of at least 64 km.

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### Introduction

The movements of sandeels have been little studied. Underwater observations made by Kuhlmann and Karst (1967) on shoals of *Ammodytes lancea* in the Western Baltic showed a daily movement between shallow and deep water. The distance travelled each way was 1 km, the fish moving from shallow to deep water soon after sun-rise.

Over the period 1982–1986, Kunzlik *et al.* (1986) showed that *Ammodytes marinus* could be successfully tagged using small internal steel tags. In the course of this tagging work, designed to determine fishing mortality rates on *A. marinus*, several batches of tagged fish were released at positions distant from the sandeel fishing grounds. Recoveries of tagged fish from these release positions are given in this paper.

### Methods and materials

In May–June 1982, 1984, and 1986 numbers of live *A. marinus* were caught using a small mesh sandeel trawl in inshore waters at Shetland and Orkney. To ensure that only specimens in good condition were tagged, trawl hauls were limited to 5–10 min duration and live sandeels were held in tanks for approximately 2 h before and 2 h after tagging. The capture and release positions, together with the location of commercially exploited sandeel fishing grounds, are shown in Figure 1. Those sandeels released to the west of Foula (release positions 1–5) were captured at Fair Isle or Foula, whilst those released east of Shetland (position 6) were captured at Mousa. At Orkney and Smith Bank (positions 7 and 8) the fish were released at their position of capture (see Table 1).

The tags used were of stainless steel (0.5 ×

3.0 × 0.7 mm) and were inserted directly into the abdominal cavity. All tagged fish were aged one year or older and measured over 100 mm in length. Tags were recovered from magnets located on the processing lines in the fish reduction factory at Bressay, Shetland. Fish landed fresh for freezing were not examined for tags and, consequently, the number of tags recovered is likely to have been lower than the total number of tagged fish recaptured.

As the tags used were encoded in batches of 100 it was not possible to relate recovered tags to individual fish. Also, as catches from several vessels having fished different grounds were combined before processing, it was not possible to relate recovered tags to specific vessels or fishing grounds. The minimum distance moved was therefore determined as being a straight line between the release position and the nearest known sandeel fishing ground.

### Results

All tag recoveries from these experimental releases were made within three years of release, but none were recovered in the year of release itself. For all tag releases combined, a total of 37 tags were recovered. Recoveries were made over April to August but the majority were made over May to June:

Month	Apr	May	Jun	Jul	Aug	Total
No. tags recovered	2	16	12	4	3	37

The capture and release positions, the numbers of tags released and recovered, and the minimum distances between release positions and the nearest commercial sandeel fishing ground are given in Table 1.

For sandeels captured, tagged, and released on the inshore sandeel grounds at Shetland tag recoveries

were also made generally within three years of release. These recoveries differed from those from fish released offshore in that a proportion of the tags were recovered during the year of release. The number of tags recovered during the release year and the two subsequent years for the three sandeel grounds nearest to the experimental offshore release positions, i.e. Fair Isle, Mousa, and Foula (see Fig. 1), are given in Table 2. The small number of recoveries from releases at Foula is due, at least in part, to catches from this ground having been landed for freezing and not monitored for tags.

## Discussion

Over the period 1982–1988 close liaison was maintained with sandeel fishermen at Shetland, their controlling organizations, and the fish reduction factory at which tags were recovered. During this time it was ascertained that:

- (1) no sandeel vessels fished within 27 km of any of the release positions, those grounds fished for sandeel were located within 8 km of the Shetland coast;
- (2) the fish reduction factory processed no whitefish offal, thereby removing the possibility of tags having been present in the stomachs of whitefish predators;
- (3) although the reduction factory processed quantities of herring and mackerel, both of which are predators on *A. marinus* (Hopkins, 1988; Anon, 1987), the time at which these species were processed was outwith the periods when the majority of the *A. marinus* tags were recovered, i.e. May–June.

If it is correct to assume that tagged sandeels were recaptured from known sandeel fishing grounds, the results clearly show that the sandeels had moved appreciable distances. The minimum distances moved between release positions and nearest known sandeel grounds were 27–64 km. No tags were recovered from fish released at greater distances. The recovery of four tags from fish captured and released to the east of Orkney suggested a movement away from the original capture position. The recovery of tags from fish released west of Foula and east of Shetland but captured elsewhere (i.e. fish transported to these release positions) suggested a movement away from the release positions.

The majority of tags were recovered during May–June in the first and second years following tagging. This, taken in conjunction with the lack of tag recoveries in the year of release, could mean that a movement onto the fishing grounds occurred during the 6–12 months following tagging. This ability of sandeels to move distances up to 64 km may explain, at least in part, the apparently inexhaustible supply of *A. marinus* found on certain fishing grounds throughout the summer months.

Table 1. Capture and release positions of tagged sandeels, the numbers of tags released and recovered, the distance transported to release position, and the distance from the release position to the nearest known sandeel fishing ground (km). Release position numbers correspond to numbers in Figure 1.

Release position number	Year of release	Position of capture A	Position of release B	Nearest position of recapture C	Number of tags recovered and released (-)	Distance transported to release position (km) A-B	Minimum distance to nearest sandeel ground (km) B-C
1	1984	Fair Isle	NW Foula	Foula	1 (495)	97	32
2	1984	Foula	W Foula	Foula	5 (499)	27	27
4	1986	Foula	SW Foula	Foula	1 (600)	27	27
3	1984	Foula	SW Foula	Foula	1 (998)	32	32
5	1984	Foula	E Papa Bank	Foula	0 (999)	72	72
6	1986	Mousa	E Mousa	Mousa	25 (1000)	32	32
7	1982	E Orkney	E Orkney	Fair Isle	4 (996)	0	64
8	1982	Smith Bank	Smith Bank	Fair Isle	0 (1022)	0	169

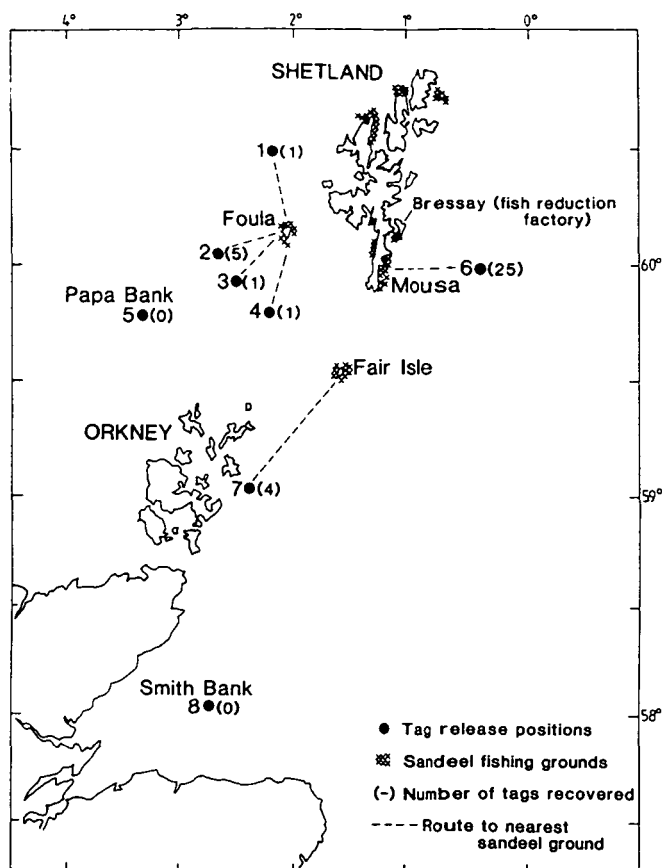


Figure 1. Location of sandeel fishing grounds, tag release positions, and the numbers of tags recovered.

Table 2. Numbers of tags recovered from sandeels caught, tagged, and released on inshore sandeel fishing grounds during 1982–1986.

Fishing ground	Number of tags released	Number of recoveries in:	
		year of release	years 1 + 2 after release
Fair Isle	5066	478	112
Mousa	3984	860	134
Foula	2584	84	12

## Summary

Tagging experiments have shown that *A. marinus* is capable of moving distances of 27–64 km over a period of 1–3 years following release. Precise recapture positions could not be identified, but the tags recovered suggested a movement from more distant areas onto those fishing grounds customarily fished for sandeel. The data did not allow for identification of movements between seasons or between sandeel fishing grounds. The absence of an offshore fishery has prevented identification of any movement offshore and away from the sandeel grounds.

## References

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