

LONG-TERM MOVEMENT PATTERNS OF COASTAL COD (*GADUS MORHUA*)

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ABSTRACT

Movement patterns were studied by means of hydroacoustic telemetry along the Norwegian Skagerrak coast. Ultrasonic transmitters were surgically implanted in 10 coastal cod, and released in the same area as they were caught. Their swimming behavior was continuously recorded for 45 days by means of a stationary positioning system. For another 128 days after the initial 45 days, they were tracked using a handheld hydrophone. During the study period three fish left the area after 40-50 days, three moved 2-6 km away from the releasing site, and the remaining four stayed within the area (<2 km from releasing point.) This may indicate a low rate of ranging for cod in this area, and a high degree of fidelity to their area of residency.

INTRODUCTION

Several experiments have been done to study the movement patterns and stock structure of cod on the southern Skagerrak coast of Norway. A series of capture-mark-recapture studies were done to gain information on the long-term migration of cod (Danielssen 1969, Danielssen and Gjøsæter 1994). There have also been done some genetic studies to investigate stock structure on cod along the coast. These studies indicate that the coastal cod in this area belong to local non-migratory stocks with relatively low rate of ranging. Hydroacoustic telemetry is a new way of tracking fish and can give new insight on the minutely movement of fish. This technique may be a valuable addition to the other studies and provide new information on the movement patterns and migration on the coastal cod.

MATERIAL AND METHOD

The study was conducted on the southern coast of Norway during the spring 2001. Several cods were captured at different times in the strait of Tromøysund. Ultrasonic transmitters were surgically implanted in the abdominal cavity of a total of 10 fish. The cods were then released in close vicinity of the area they were caught (Release site of the first 5 is marked R on the top map). Later three more fish were tagged, and transferred to the outside of the island of Hisøya, 7.5 km away from where they were caught. This was to see if any traces of homing movement were present.

During the first 45 days of the study (08/2-01-25/3-01) a stationary positioning system was set up in the experiment area. This system consisted of three buoys arranged in a triangle (marked A, B and C in both maps). These buoys monitored the movement of the fish by scanning one out of ten preset frequencies every 20 sec. The movement was logged to a computer and displayed in real-time (as shown in figure 1 and 2).

For 128 days after the initial 45 days, the fish was located using a handheld hydrophone. This gave positional fixes from every 2-3 days to every 2-3 week later in the period. The fish was also occasionally tracked using the handheld receiver during the period where the positioning system was present.

RESULTS AND DISCUSSION

During the first 39 days using the positional system all of the fish stayed within the reach of the buoys, although some moved into areas along the seashore where they were out of range. These were tracked with the handheld hydrophone to ensure that they were still present in the local area (< 2 km away from the release point). In the period 40-50 days after release, three fish escaped out of range of both tracking systems (>10 km). In the same period, three fish moved 2-7 km from the release point, and settled there. The rest stayed within 2 km from the release point. During this period one fish was declared dead, and removed from the data. About 100 days after release fishing tourists captured two fish. Two others were declared dead by 17/7-01. The last two of the original ten released, is by 31/7-01 still alive in the strait.

Of the three released away from the catching area, one was caught halfway between the release point and the original catching area. One escaped out of range (> 3 km), while the last is still alive 1.2 km away from the release site.

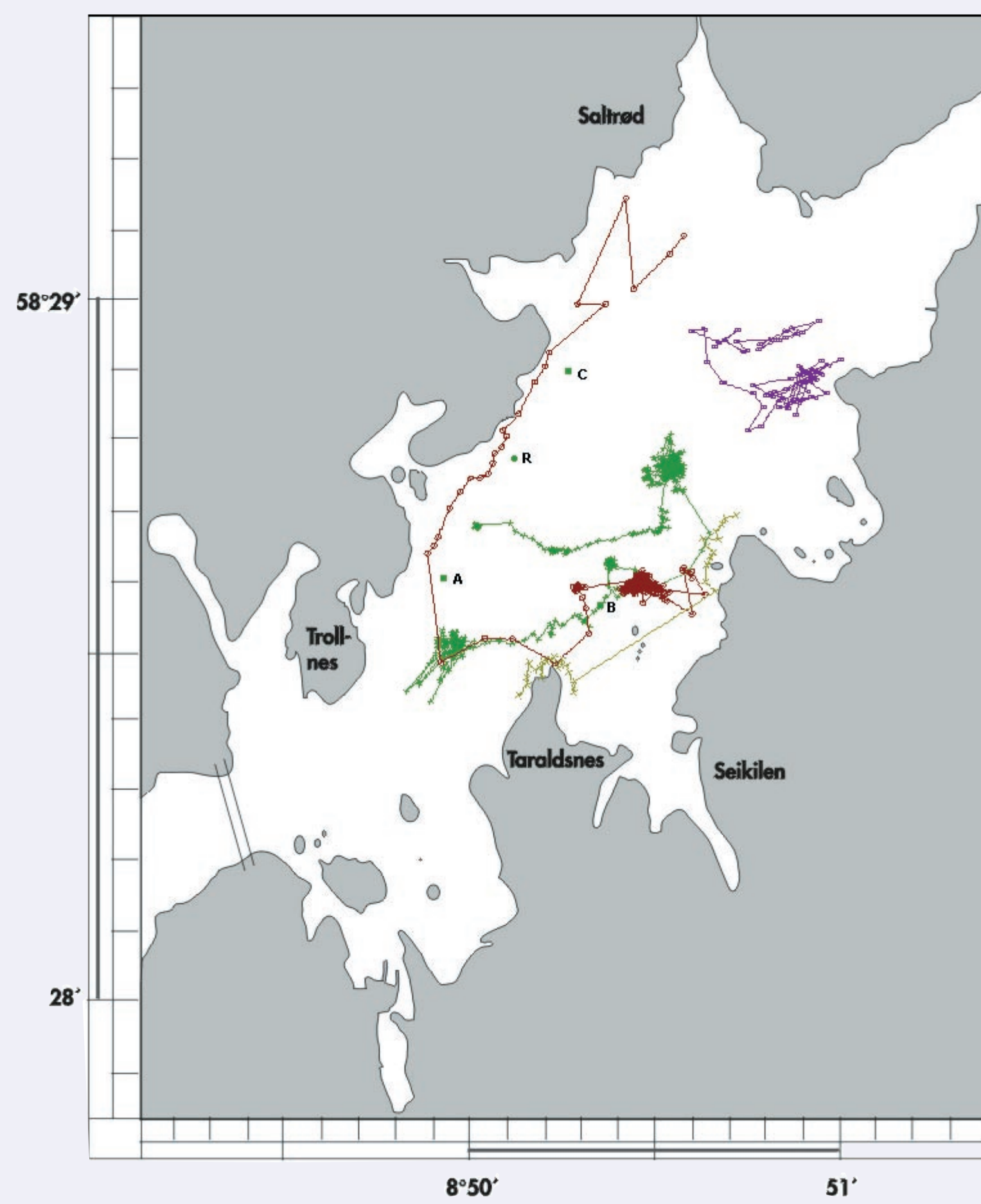


Fig 1.: This figure describes the movement of five fish from a few hours after their release on 08/2-01 to 12/2-01. Buoys are marked A, B and C. The release point is marked R.

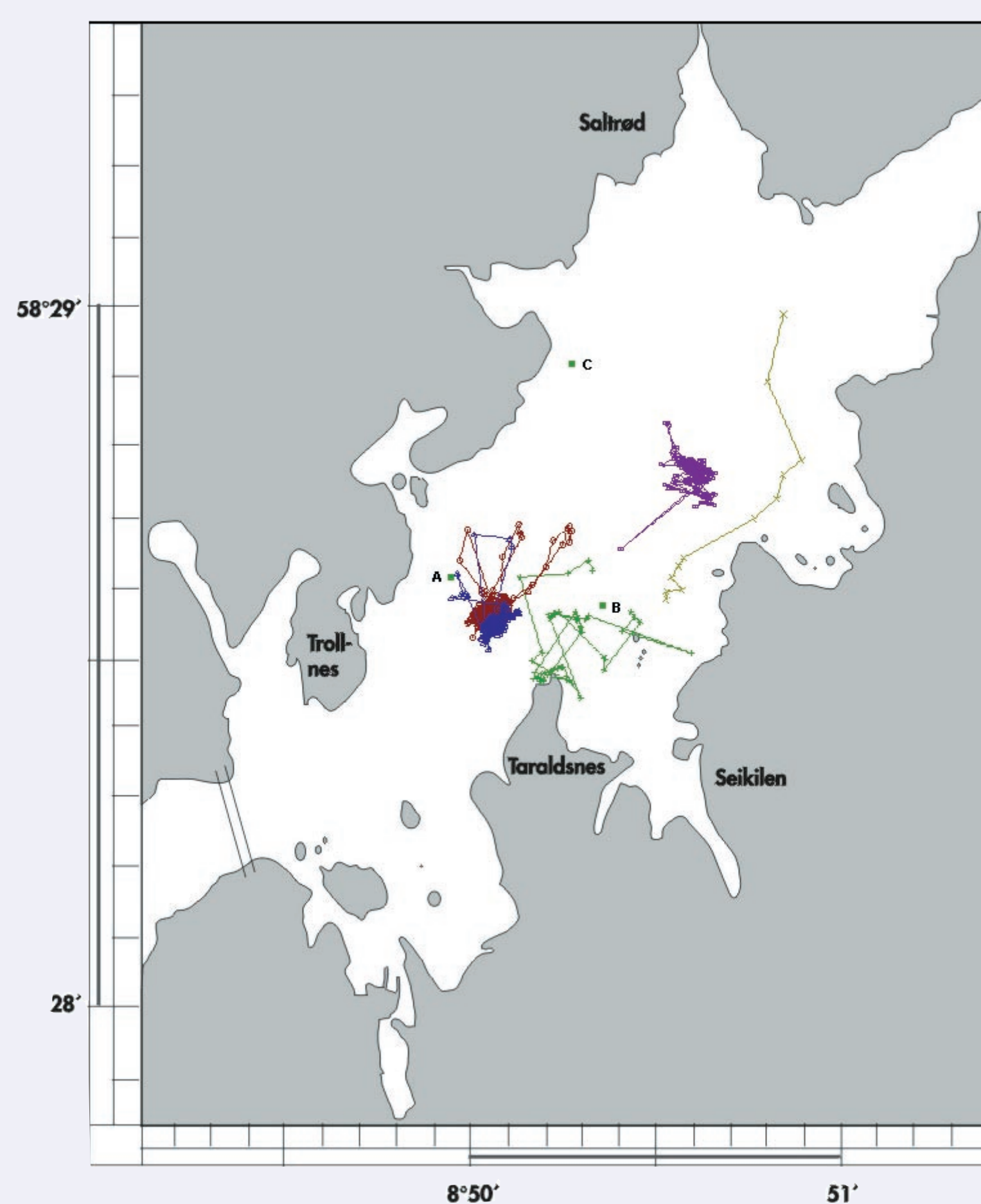


Fig 2.: Shown here are the five same fish in the period 09/3-01 to 20/3-01.

CONCLUSION

All of the fish in this study showed a relatively low rate of ranging. During the period studied with the positioning system they mostly stayed in small areas (radius 50-100 meter) with some sallies outside these areas. Sometimes they would leave to settle in another place on a permanent basis. Others would more often stray around in a wider pattern of movement. Even though the movement was partly different between the different fish most of the activity took place inside the reach of the buoy (app. 1 km outside the center of the triangle). The three fish that moved intermediate distances, did this in large jumps, and stayed permanent on the sites they settled in. The three fish that left the area did also so in short periods of time.

Off the three fishes displaced away from the original catching area, none showed clear homing movement

This result may indicate a low rate of ranging for the cod in this area, and a high degree of site fidelity even though no sign of homing activity was found.

Fish no.	Date of release	Days tracked	Distance from point of release	Comment
1759	12/2-2001	156	2000 meter	Declared dead 17/7-01
1760	12/2-2001	52	-	Escaped out of range
1761	12/2-2001	45	-	Escaped out of range
1762	8/2-2001	160	850 meter	Declared dead 17/7-01
1763	15/5-2001	7	4500 meter	Escaped out of range
1764	8/2-2001	102	970 meter	Caught
1765	8/2-2001	39	-	Escaped out of range
1766	15/5-2001	13	-	Escaped out of range
1768	24/2-2001	159	5300 meter	Alive
1769	8/2-2001	109	7500 meter	Caught
1770	15/5-2001	78	1200 meter	Alive
1771	8/2-2001	174	500 meter	Alive

Tab 1. The distance from release point given for every fish is from when the tracking ended. Out of range means that the fish moved more than 10 km away and out in the open sea which eventually made it impossible to track