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FRV *Scotia*

Cruise 0797S Part II

REPORT

1 June - 10 June 1996

Loading: Aberdeen (20 - 21 May 1996)
Unloading: Aberdeen

Fishing Gear: PT153 with live fish cod-end, PT160, 1.6 m Methot net

Personnel

R G J Shelton	SPSO
W R Turrell	PSO
G Slesser	HSO
A Macdonald	HPTO
J MacLean	SSO
A F Walker	SSO
I S McLaren	SO
N Nichol	Visitor
H Chambers	Visitor
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Objectives

1. To obtain further information on the life of post-smolts at sea by intensive fishing at the shelf edge and within the slope current, and with special reference to diel movements.
2. To test experimental net designs for catching live post-smolts in good condition.
3. To investigate post-smolt migration pathways in the North Sea using known hydrographic features of the area.
4. To perform further post-smolt prey observations using stomach contents analysis and plankton sampling.
5. Perform *ad hoc* CTD surveys in order to describe the environment within which post-smolts are found.
6. To recover any remaining drifters deployed during 0797S Part I.
7. To obtain any caesium samples remaining after Part I.

Out-turn days per project: 10 days, KAB2

Narrative

Scotia departed from Aberdeen at 1000, 1 June 1997 and proceeded to Start Point (Sanday, Orkney) where, at 2139, the PT160 was shot at the surface in a bottom depth of 68 m. The haul was abandoned after severe damage to the net. *Scotia* then proceeded eastward along the JONSIS line and, at 2351, commenced a series of three oblique hauls with the Mini Methot (MM) net to complete the *Nephrops* larval survey begun during Part 1. The last MM station was completed at 0618 on 2 June 1997 and *Scotia* proceeded north to Lerwick where she docked at 1330.

Scotia left Lerwick at 1600 on 2 June 1997 and proceeded to the south eastern end of the Wyville - Thomson Ridge where 2 hour surface hauls with the PT160 net began at 0714 on 3 June 1997. Post smolts were caught in all four daylight hauls with small by-catches consisting primarily of 1-group mackerel and both adult (externally-tagged and released) and juvenile lumpsuckers. By contrast, a tow during the hours of semi-darkness (shot at 2235 and landed at 0035 on 4 June 1997) caught no post smolt but 20 measured baskets of mackerel, 1.5 baskets of herring, two lumpsuckers and a single large squid. This result was consistent both with the echo sounder record and with the results achieved in 1996 at around the same time and place.

Short surface MM net hauls were undertaken on the completion of each trawl tow.

At 0605 on 4 June 1997, the modified PT153 net was rigged and towed for two hours. Post-smolts, 1 group mackerel and juvenile lumpsuckers were caught but all the post-smolts were badly scaled and could not be used for behavioural observations. A combination of turbulence and constriction of the tunnel joining the separator to the live fish cod-end were thought to be contributory factors. The tunnel was loosened and the net shot at 1005 and towed for one hour only. Although a large number (77) of post-smolts was caught, their overall condition was poor. A subsequent haul for 30 minutes produced no post-smolts. However, a further one hour haul, following the insertion of a ring frame to hold the tunnel open, produced 22 post-smolts in "strong alive" but badly scaled condition. Video observations in a deck tank revealed no evidence of shoaling behaviour but, after some five minutes, the fish spent most of their time at the shaded end of the tank.

Trawling at the Wyville-Thomson Ridge ended at 1405 on 4 June 1997 and *Scotia* set course for surface (drogue at 30 m) drifter positions at he eastern end of the Fair Isle Channel.

The first surface drifter was recovered at 1700 on 4 June 1997 and the second at 0800 on 5 June 1997. *Scotia* then steamed to a position just east of the 200 m contour on the western slope of the Norwegian Trench where the PT153 net was shot at 60°.00'N at 1750. Temporary trawl winch and net drum failures prolonged the two hour tow by a further one hour and 55 minutes. Sixteen and a half baskets of mackerel and 4.5 of herring dominated the catch. Thirty eight lumpsuckers were caught and the "strong alive" adults were tagged and released. Four post-smolts were found in the main cod end but, from their crushed condition, it was apparent that they were left over from the final haul at the Wyville-Thomson Ridge. This interpretation is consistent with the discovery of a fifth "strong alive" post-smolt in the live fish cod end. This fish was found during the long steam from the Wyville-Thomson Ridge. It was in exceptional condition with some 80% of its scales still in place and lived for some hours in the deck tank. On completion of the haul, the mini-Methot net was towed obliquely to a depth of 118 m to obtain material (principally large euphausiids) for photography.

CTD observations were made during the hours of darkness and trawling was resumed at the same site at 0600 on 6 June 1997. Two two hour hauls were undertaken W-E and E-W along 60° N but no post smolt was obtained. Adult mackerel dominated the first haul and 1 group mackerel the second. All adult "strong alive" lumpsuckers were tagged and released.

Three hauls along the 60° N line on the western slope of the Norwegian Trench produced no post-smolt salmon. Adult mackerel and small numbers of herring, lumpsuckers and garfish dominated the first two hauls and 1 group mackerel the third.

Scotia then steamed north to 60°50'N, 2°56' E where, at 1820, the PT153 was fished for two hours. Two small post-smolts were obtained with a by catch of mackerel, herring, lumpsuckers and garfish plus a single saithe. Fishing operations on 6 June 1997 were completed by two surface trawls with the mini-Methot net.

Four CTD stations were worked during the night in a line approximately perpendicular to four trawl tows planned for 7 June 1997. However, deteriorating weather restricted subsequent fishing to two 2 hour hauls neither of which produced post-smolt salmon.

Scotia then steamed north of 61° where fishing was resumed at 0355 on 8 June 1997 on the western side of the Norwegian Trench. Three 2 hour tows with the PT153 net yielded 11 post-smolts and a male grilse in the first haul, a second male grilse in the second but no *Salmo salar* in the third. It was clear from the thermosalinograph record that the edge of an eddy had been crossed. This haul was characterised by a large by catch (335) of lumpsuckers. The final haul was some five miles to the east and was entirely in the Norwegian coastal current. Here the lumpsucker catch was even larger (1162 juveniles and 23 adults).

Where conditions permitted, each haul at the Norwegian Trench was followed by a surface Methot trawl. Interpretation was impeded by large quantities of *Phaeocystis*-like debris.

Scotia left the area at 1310 on 8 June 1997 to make for surface drifter positions east of Rattray Head.

Results

Objective 1

230 post-smolt salmon were caught at the south east end of the Wyville-Thomson Ridge in a total of nine hauls made in this area. Catches varied from zero (in two hauls) to 77 post-smolts. There was no clear relationship

between catch rate and time of day during the daylight hauls but no smolt was caught during the short period of darkness. Inspection of the echo sounder record revealed a substantial movement of pelagic fish into the upper layers at this time and this was reflected in large numbers of adult mackerel and herring in the catch. The principal by catch species during daylight was 1 group mackerel with smaller numbers of lumpsuckers, adult herring and garfish.

Five categories of post-smolt were identified:

- intact fish of wild appearance (n=192)
- fish with minor fin and operculum distortions suggesting possible hatchery origin (10)
- fish with adipose fin clips (6)
- fish with adipose fin clips carrying microtags (18)
- fish not designated as being of wild or hatchery origin due to poor condition (4)

Each fish was measured (fork length in mm), weighed (whole and gutted in g) and sexed and the following samples were taken, scales, muscle tissue (for DNA analysis), gut (for contents analysis). Where present, sea lice samples were also taken. In addition, the degree of eye opacity was also recorded and any other distinguishing features noted. Preliminary results suggest that all the WTR fish were following the same growth trajectory but that the fish deemed to be of hatchery origin occupied the upper part of the length/weight ranges.

Thirteen post-smolts and 2, 1SW adult salmon were caught in three of nine hauls over the western slope of the Norwegian Trench. Adult mackerel and juvenile and adult lumpsuckers formed the principal by catch in the successful hauls and were the main catch in the others.

None of the Norwegian Trench post-smolts appeared to be of hatchery origin and they were, on average, markedly smaller than those caught at the WTR. The smallest post-smolt was very heavily infested with the early stages of *Lepeophtheirus salmonis*.

Both of the 1SW fish were male and both were in the early stages of maturation. The stomachs of both contained food items, one including terrestrial food organisms (an hemipteran and a dipteran.

Objective 2

The PT153 net had been modified by the fitting of a separator grid based upon a Marine Laboratory design. The grid itself comprised 10 mm aluminium angled vertical bars spaced at 20 mm intervals. Selected fish passed through a connecting tunnel of knotless netting attached to the upper surface of the net funnel and confected to a live fish cod end trawl. The larger fish passed below the selection grid into the main cod end.

The rig was found to be successful in achieving good separation between smolt-sized and larger fish. Adult herring were treated by the separator as "small fish" and this caused problems when large concentrations were encountered.

The condition of the post-smolts caught in the modified PT 153 net was generally better than that obtained in unmodified PT153 and PT160 nets in 1996. As a result, better scale samples were obtained and it was also possible to record external parasites in a credible way.

On a number of occasions it was possible to obtain "strong alive" smolts for behavioural observations. As indicated in the narrative, these fish did not exhibit shoaling behaviour in the deck tank but did react to light by selecting the shaded side.

On one occasion, a single 80% scaled post-smolt was found in "strong alive" condition in the live fish cod end tank some 24 h after capture. This fish lived a further two hours in the deck tank.

Objective 3

Following on from work conducted during part I of the cruise, two further potential North Sea "gateways" were trawled in an attempt to locate migrating post-smolts. Hauls 220-222 were performed at the western edge of the Norwegian Trench, at 60°N, in order to investigate the southerly flowing current of Atlantic water in this area. A further set of three hauls (223-225) were performed again along the western edge of the Trench, but further north. These hauls failed to locate any post-smolts, apart from haul 223 where 2 post-smolts were obtained. Although the location of this haul was at the western edge of the Trench, the thermosalinograph indicated that the haul was conducted in purely coastal water, extending out from the Norwegian coast. The hypothesis that the post-smolts

were moving north within the coastal water adjacent to the Norwegian coast was further tested during hauls 226-228, but again no smolts were obtained. The "gateway" hypothesis suggesting key sites within the North Sea where post-smolts may be concentrated is therefore unproven. Further work is required in order to determine the location and behaviour of migrating smolts in the North Sea

Objective 4

There was an indication that post-smolts caught at dawn had fewer stomach contents compared with those taken later in the day. This is in accord with the idea that, in the hours of darkness, post-smolts migrate downwards from the surface of the water while other shoaling pelagic species (herring and mackerel) move nearer the surface.

Preliminary analyses of gut contents showed considerable variety in the prey items, which included, *Ammodytes* sp., *Onos mustela*, gadoid larvae, euphausiids, copeopods, amphipods, brachyuran larvae, nematodes and trematodes. This result is consistent with those achieved during the 1996 observations at the WTR but is in marked contrast to the Norwegian results in this area in 1995. In that year, all of the fish caught contained blue whiting larvae only. It is now apparent that the 1995 blue whiting year class is an especially strong one. Taken together these results, and the presence of terrestrial insect remains in one of the 1SW salmon, support the idea that Atlantic salmon feed opportunistically near and at the surface of the sea.

Objectives 5

A total of five drifters were successfully recovered during the cruise. On from Shetland where it had been returned by a fisherman.

Objective 6

The Fair Isle caesium sample was taken.

R G J Shelton
20 June 1997

Seen in draft: J Nichols, Master