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Information from EU on an Irish Post-Smolt Experimental Research Cruise - May 2007

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Niall Ó Maoiléidigh, Ken Whelan, Paddy Gargan, Robb Bunn and Nigel Bond

Introduction

Scientists believe that a major proportion of the mortality at sea for Atlantic salmon occurs in the early post-smolt migration period. Therefore, knowing the migration routes and timing of migrations will greatly enhance our ability to understand the underlying factors along that route which may significantly affect survival. In order to do this we must be able to find salmon at sea. Great advances in our understanding of these migrations have been made in the last decade or so, particularly by Norwegian, Faroese and UK researchers, and this has also seen the development of new and innovative techniques to capture post-smolts (both for sampling and live capture) or to monitor the presence of post-smolts through camera-rigged open cod ends in experimental pelagic trawls. Slowly, a picture of the likely areas of migration for many stocks is emerging and obtaining more information, particularly which extends knowledge of the range or timing of these early migration routes, is extremely important.

In May 2007, the Marine Institute of Ireland, funded under Irelands' National Development Plan (NDP) and the Atlantic Salmon Trust, organised a short, directed exploratory research cruise using a pelagic trawl net designed by Norwegian scientists for post-smolt fishing and manufactured by Swan Net-Gundry in Donegal. The main objective of the cruise was to test this net prior to a more comprehensive survey which will hopefully take place in 2008 and 2009.

Gear Trials

The scientific party comprising of Dr. N Ó Maoiléidigh, Nigel Bond and Robert Bunn of the Marine Institute and Dr. Paddy Gargan of the Central Fisheries Board, left Killybegs, Co. Donegal, on 8 May 2007 on board the RV Celtic Voyager skippered by Captain Fergus O'Hare. In theory the net was to be fished right at the surface at all times and this was to be achieved by the addition of floats and buoys in specific locations on the net (Figure 1). Over the course of the cruise the optimal operation procedure evolved through a combination of technology (transducers on the nets) and discussions between the scientists and crew after each haul.

The first shooting of the net took place on 8 May at 2000hrs, into and out of Killala Bay, Co. Mayo on the west coast of Ireland, as a trial run, and towed for two and a half hours. Although no salmon smolts were captured, one sea trout smolt and one adult sea trout were taken, along with a small number of very small mackerel. The presence of the sea trout smolts was quite encouraging and it was decided to travel south to the Aran Islands to begin shooting the net in the morning. It had previously been decided not to fish at night as Norwegian experience (Jens C. Holst, *pers comm*.) had shown that it was less likely to capture post-smolts during darkness and the time was better spent steaming to desired locations. Following some modifications, the net was shot at 1430hrs on 9 May, starting north-east of the largest of the Aran Islands, Inishmore, working in towards Galway Bay.

The warps were set on this run to about 50 fathoms initially and the net was observed for some time before lengthening the warps to 75 fathoms. At this length, and towing at about 2.7 knots in short arcs to reduce the effects of ship's propulsion, the floats in the opening of the net were clearly visible breaking the surface of the water and the four large bluffs holding the warps up were also clearly visible. The tow was extended for a total of 5 hours and during this period the weather deteriorated somewhat with increasing swells and wind-speeds gusting to 35mph. When the net was hauled it revealed a mixed bag containing 5 salmon post-smolts, 1 sea trout post-smolt, 2 adult sea trout in amongst about half a basket of large herring, approximately 50 sprats, half a dozen mackerel, 2 lumpfish, 5 pipefish and 1 garfish. Due to the deteriorating weather conditions the Voyager made her way into Galway to overnight. Weather remained poor the following day but the crew managed to shoot the net successfully for three hours that afternoon along a track slightly closer to the Aran Islands. Again, the haul contained a mixed bag but, crucially, comprised 4 salmon post-smolts and 1 adult sea-trout, which were discovered mixed with about 50 sprat and 11 herrings. This track was continued out past the Aran Islands at about 1915hrs. Initially the warps were set to 100 fathoms and towed at 2.8 knots but the net appeared to sink as the floats disappeared and the warps were reduced to 80 fathoms until the floats appeared back on the surface. After 3 hours the net was hauled and although there were no salmon post-smolts, there were 2 adult sea trout mixed in with three-quarters of a basket of sprats, about 20 mackerel and herring and 3 to 4 pipefish. The Celtic Voyager then steamed north back to Killala to attempt another trawl in the bay.

Under the direction of Rob Bunn of the Marine Institute's Fisheries Science Services, transducers were attached to the net the following day in order to establish the optimum warp and towing speed to maintain the net on the surface, while achieving maximum width in the trawl. The net was shot at 1100hrs and various speeds and trawl warp lengths were examined. Optimum operation was estimated at a 2.8 knots and a 70 fathoms warp, giving a maximum net opening of approximately 26m while at the surface. This appeared to confirm the optimal operation for the net as, when hauled, there were 19 salmon post-smolts, 1 sea trout post-smolt and 1 adult sea trout mixed in with about 20 baskets of mackerel, a small number of herring, lumpfish, garfish, pipefish and sand eels, a very successful haul.

Experimental Fishing

With the net now successfully tested and fishing well, and with the prospect of fine weather which was forecast, it was felt that with the remaining days available, some experimental fishing could be embarked on outside the direct influence of large estuaries. The Celtic Voyager duly steamed directly north of Malin Head and west of the Island of Mull that night. Fishing began at 0850hrs and the net was towed for 3 hours. Again, within a mixed catch of about 1 basket of mackerel and some herrings, were 11 salmon post-smolts, with 2 sticklebacks and 3 pipefish. The second shooting and hauling along this track produced 4 salmon post-smolts in a mix of about three-quarters of a basket of mackerel, some herring, sticklebacks, pipefish and lumpfish. The final fishing of the evening was to provide a pleasant surprise as 25 salmon post-smolts were recovered, with only a small number of other species in the same tow, i.e. a quarter of a basket of mackerel and herring, some pipefish, lumpfish and sticklebacks.

As the net was picking up smolts consistently, it was decided to explore further north along the putative migration route indicated by previous experimental trawls which had been carried out by Norwegian and Scottish scientists. Therefore, Celtic Voyager steamed north that night reaching north west of the Isle of Lewis by morning. The net was shot four more

times between the 13 and 14 May, with a total catch of 4 salmon post-smolts amongst what was, by now, the usual small numbers of mackerel, herring, lumpfish and pipefish.

Summary

At the end of the experimental cruise the new net had been tested successfully and used for experimental fishing along the salmon post-smolt migration route. Seventy-two salmon post-smolts were captured from various locations for further analyses (Table 1, Figure 2), including stomach content analyses, lipid content for condition, sex ratios, growth and, crucially, for genetic studies to ascertain the region or even the river of origin of these fish. Information on associated species was also obtained (Table 2) and, simultaneously, data were recorded on position, towing speed, temperature, wave height, wind speed and salinity by the Celtic Voyager, which will help to describe the conditions encountered by post-smolts on their migrations. In this way, another small piece of the salmon migration will be put in place. Clearly, a larger-scale project covering a more extensive area, and including partners from other countries, would provide many more pieces of this still relatively obscure picture. This is now proven to be technically well within our capabilities, with trawls such as the one used in the MI/AST research cruise to capture post-smolts, and new genetic profiling methods to identify region or even river of origin. It is by merging these techniques with the ongoing assessment of the freshwater and marine ecology of salmon from individual river systems, that the distribution and migration picture will become clear and the possible barriers and threats to survival identified.

Acknowledgements

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Table 1 Details of salmon and sea trout captured by the RC Celtic Voyager, May 2007

Date	Start Time	Location Start trawl				Location End trawl				Trawl Time	Salmon Post smolt	Sea trout Post smolt	Sea trout Adult
		North		West		North		West					
08/05/2007	2010									2.5		1	1
09/05/2007	1420	53	12.69	9	45.71	53	10.24	9	26.7	5	5	1	2
10/05/2007	1530	53	8.59	9	27.03	53	11.27	9	42.56	3	4		1
10/05/2007	1915	53	11.27	9	42.56	53	11.75	10	0.83	3			2
11/05/2007	1100	54	20.88	9	19.18	54	20.2	9	14.2	3.5	19	1	2
12/05/2007	850	56	18.95	7	59.66	56	28.96	7	54.15	2.15	11		
12/05/2007	1330	56	28.96	7	54.15	56	38.68	7	52.06	3	4		
12/05/2007	1630	56	38.68	7	52.06	56	46.6	7	38.87	3	25		
13/05/2007	855	58	24.71	8	17.21	58	31.16	8	6.25	3			
13/05/2007	1548	58	32.78	7	59.29	58	37.03	7	59.29	3	3		
14/05/2007	830	58	30.33	7	41.85	58	21.67	7	57.34	4	1		
14/05/2007	1430									4			

Table 2 Details of other species captured by the RC Celtic Voyager, May 2007

Date	Start Time	Mackerel Basket	Herring Basket	Sprat	Pipefish	Lumpfish	Garfish	Sandeel	Anchovy	Stickleback	Turbot
08/05/2007	2010	3									
09/05/2007	1420	0.1	0.5	0.1	5	2	1				
10/05/2007	1530		0.1	0.1							
10/05/2007	1915	0.2	0.2	0.75	4				1		
11/05/2007	1100	20	0.2		7	1	1	7			
12/05/2007	850	1	0.3		3					2	
12/05/2007	1330	0.75	0.2		3	2				12	1
12/05/2007	1630	0.1	0.15		5	6				6	
13/05/2007	855		0.01		1	1					
13/05/2007	1548	1.5	0.5			3				1	
14/05/2007	830	0.05	0.05		3	1					
14/05/2007	1430				2	6					

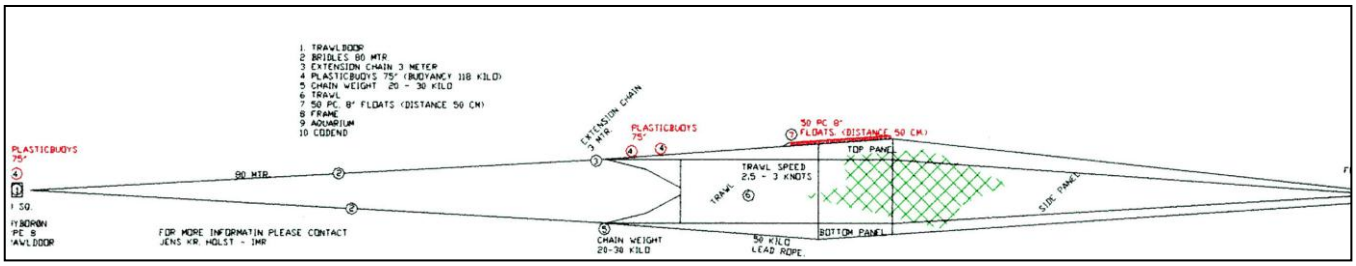

Figure 1 Net side view schematic. Cod end (8m) not shown.

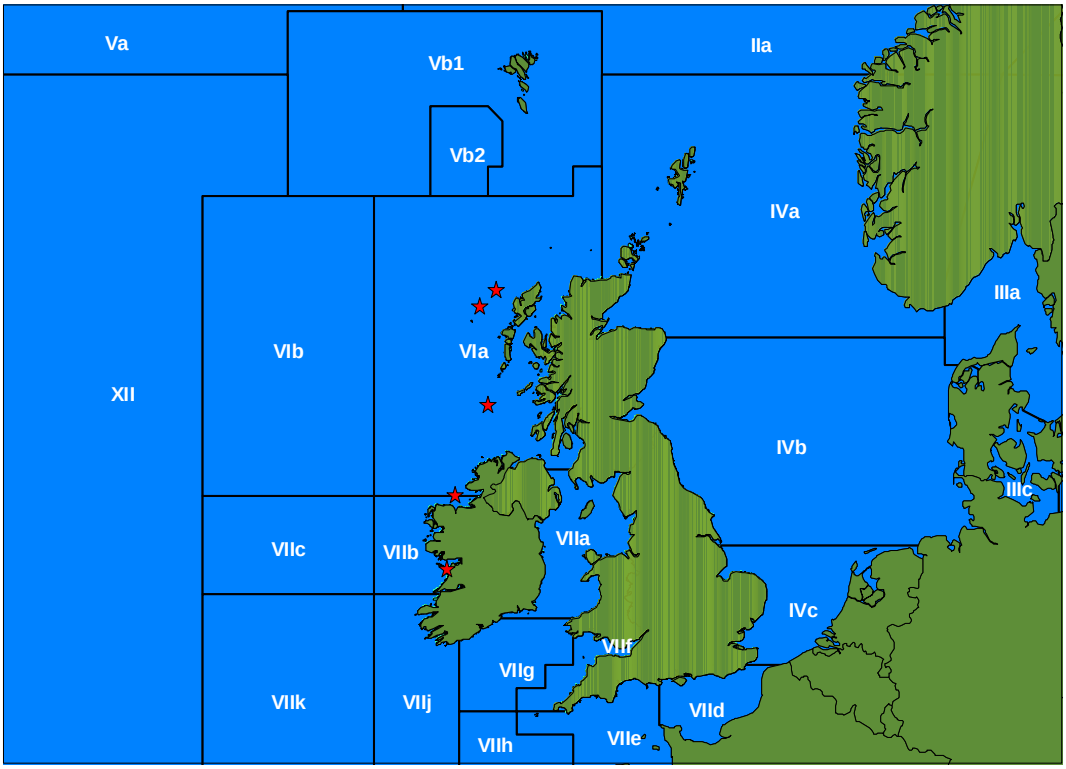

Figure 2 Locations (stars) where experimental fishing for salmon post-smolts took place, May 2007