

Session B8: Seas, Rivers and Lochs.

Session Chair, Professor Roxane Andersen

Room: 961/962

Presentation 1 - Integrating Biotelemetry and Genetics to inform Conservation and Management of Atlantic salmon	
Sunny Bradbury, Rivers and Lochs Institute, Inverness College UHI, and, Environmental Research Institute, North Highland College UHI	
Abstract	<p>The migrations of Atlantic salmon are remarkable in nature but no less so in their diversity. It is this continuum of migratory strategies at the intra-species level which is fascinating and warrants further study. Without doubt, the successful study of migration relies on an understanding of both the behaviour (motivation) and the physiology (capability) of the fish. For this reason we implement an interdisciplinary approach with the hope of advancing the science of fish migration biology. The field of biotelemetry has yielded countless insights into the migratory behaviour of fish in natural systems. It is however, somewhat limited with regard to answering many fundamental questions associated with the ultimate controls of migration. For instance; to what extent does local adaptation occur within river systems? Are population specific patterns of migration a product of genetic differentiation or behavioural plasticity? And, are populations who employ one migratory strategy capable of switching to another if environmental conditions change? In an attempt to answer some of these questions, we plan to complement real time PIT telemetry data with high throughput sequencing of genetic material from a selection of salmon populations in northern Scotland. Through the development of a high resolution suite of 101 microsatellite markers we hope to identify sub-catchment levels of population genetic structuring, and relate them to potential differences in migration timing.</p>
Presentation 2 - A new escape panel concept to reduce cod bycatch in the Scottish mixed demersal fishery	
Shaun Fraser, NAFC Marine Centre UHI	
Abstract	<p>The species selectivity of demersal fishing gear used in Scottish mixed whitefish fisheries needs to be improved for vessels with limited cod (<i>Gadus morhua</i>) quota which are encountering increasing abundances of cod in some areas of the North Sea, particularly around Shetland. Based on the known behavioural characteristics of cod within a demersal trawl, a new escape panel concept was designed and tested using an alternate haul methodology aboard the NAFC Marine Centre's 12 m fishing vessel MFV <i>Atlantia II</i>. A modified net was made by incorporating an upwardly inclined panel connected to a horizontal middle panel that extends back over and beyond a large mesh escape panel in the lower side of the net extension. The results of 22 paired comparative hauls are presented which demonstrated the relative selectivity of the modified net by reference to a control net. Catch rate data showed a significant reduction in cod in the modified net by an estimated 81% ($p < 0.001$). Importantly, no significant differences in the catches of other main target species were recorded</p>

	<p>between the two nets. The results indicated that the escape probability of cod increased for larger fish, whereas no significant length effects were found for haddock (<i>Melanogrammus aeglefinus</i>) or plaice (<i>Pleuronectes platessa</i>). Further research and development is recommended to evaluate the escape panel concept in commercial conditions and to optimise this promising method for vessels in the local mixed demersal fishery.</p>
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Presentation 3 - Freshwater Mussel Hunting

Sam Jones, Rivers and Lochs Institute, Inverness College

<p>Abstract</p>	<p><i>Margaritifera margaritifera</i>, the freshwater pearl mussel, is a highly endangered long-lived bivalve and Scotland is home to a significant proportion of its declining European population. Unfortunately, even in the Highlands it is still seriously under threat from illegal fishing, pollution and eutrophication, river engineering, and declining host fish stocks (its reproductive lifecycle is closely linked to salmonid fish). Some estimates suggest that if nothing is done the Scottish population could be extinct within 50 years.</p> <p>Unfortunately, pearl mussels are incredibly difficult to survey and enumerate. They appear as dull dark grey shapes on the bottom of rivers, are mostly buried in the sediment, and are very difficult to spot. A large effort is thus needed to exhaustively survey numbers in a catchment, and there is still a high chance of missing many buried or hidden mussels, particularly of the younger, smaller year classes.</p> <p>In collaboration with SNH and pearl mussel researchers across Europe, my project aims to develop an environmental DNA (eDNA) survey methodology as an alternative for <i>Margaritifera</i> surveying. Environmental DNA techniques involve surveying for an organism using the DNA traces it leaves in the environment, in this case by extracting DNA from samples of river water. If successfully developed, this surveying approach will be applied across the Highlands, providing a more sensitive and less time-consuming solution to monitoring pearl mussel populations.</p>
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Presentation 4 - Environmental DNA for aquatic biodiversity monitoring

Lucio Marcello and Mark Coulson, Rivers and Lochs Institute, Inverness College UHI

<p>Abstract</p>	<p>Estimating biodiversity is critical to monitoring the ecological status of different environments, and how human activities can impact on these. This is particularly true of aquatic ecosystems, which are subject to a variety of pressures, including agriculture, water abstraction and aquaculture. The field of environmental DNA (eDNA) research is based on the ability to extract DNA from different environmental sources such as air, soil or water. This DNA can then be interrogated to identify either key organisms of interest such as endangered or invasive species or can assess the broader biodiversity among particular locations or habitats. eDNA has the potential to complement and in some cases replace more time-consuming and expensive traditional sampling methods,</p>
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providing unprecedented information for taxa that are normally difficult to otherwise detect.

The BioMag laboratory at the Rivers and Lochs Institute is set up as a state of the art eDNA facility, which is now fully operational. A range of projects using eDNA sampling and high-throughput DNA sequencing are currently underway and include:

- measuring the impact of barriers such as hydro dams on fish, macro-invertebrates and diatoms communities
- environmental impact assessment of fish farms on marine benthic communities
- Identification and mapping distribution of endangered freshwater pearl mussels
- development of an eDNA assay for the detection of invasive American signal crayfish