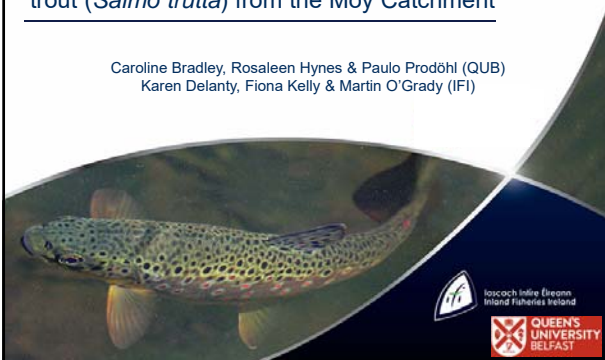


Population structuring and Genetic Stock Identification of sea running and lake-river migratory trout (*Salmo trutta*) from the Moy Catchment

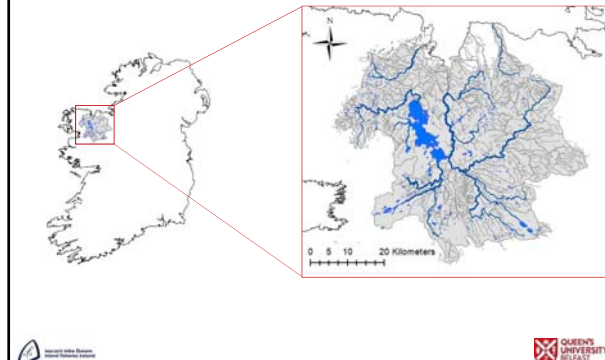
Caroline Bradley, Rosaleen Hynes & Paulo Prodöhl (QUB)
Karen Delanty, Fiona Kelly & Martin O'Grady (IFI)



Coisceach Iníre Éireann
Inland Fisheries Ireland

**QUEEN'S
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BELFAST**

Project background: Moy catchment

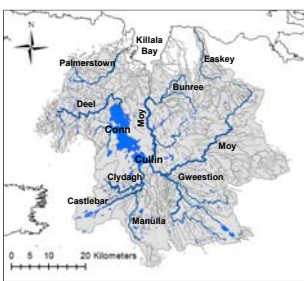


Source: Inland Fisheries Ireland

**QUEEN'S
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Project background: Moy catchment

- Northwest of Ireland (Special Area of Conservation)
- Total river length of Moy catchment: ~228km (Moy: ~101km)
- Drains an area of ~2000km²
- River Moy rises at the foot of the Ox Mountains in Co. Sligo and enters the Atlantic Ocean at Killala Bay
- Other significant rivers
- Comprises two large interconnected lakes
 - Conn (~47km²)
 - Cullin (~ 10.2km²)

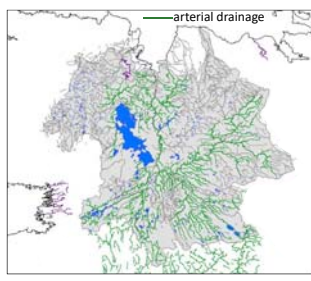


Source: Inland Fisheries Ireland

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Project background: Moy catchment

- Arterial drainage scheme in 1960s to:
 - Alleviate flooding
 - Accelerate run-off
 - Facilitate land reclamation
- Significant lowering in Lough Conn water level
- Possible impact on trout numbers?
 - Limited spawning and nursery ground
- Recent habitat rehabilitation

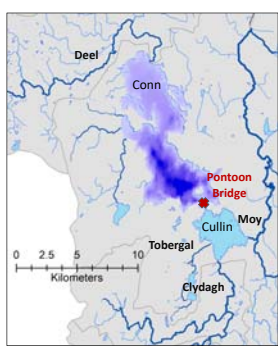


Source: Inland Fisheries Ireland

**QUEEN'S
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Project background: Loughs Conn & Cullin

- Conn fed in the north by the River Deel and other small tributaries
- Lakes are joined through a short channel at Pontoon Bridge
- Cullin receives water from Conn and the Tobergal and Clydagh rivers
- Drains into River Moy from its south-east corner
- Previously regarded as two of Ireland's best wild brown trout angling fisheries for over a century
 - historically large population of relatively small trout (<0.5kg)

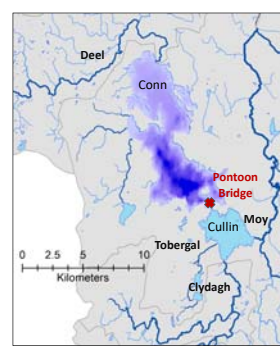


Source: Inland Fisheries Ireland

**QUEEN'S
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Project background: Loughs Conn & Cullin

- Population decline (1990s)
- Conn
 - Increased average adult sizes (increased growth rate)
 - Arterial Drainage Scheme - increased young production in rivers but reduced survival in the lake
 - Eutrophication (charr extinction)
 - Reduction in food for young trout
- Cullin: Drastic decline in numbers
 - Castlebar River: important spawning and nursery area?
 - Problems with fish kills (late 90s-2001), pollution and poor water quality

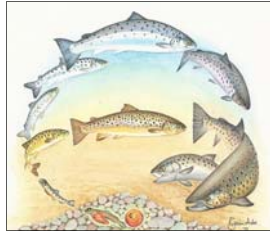


Source: Inland Fisheries Ireland

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Life history strategies

- Many brown trout display facultative anadromy
 - Sea trout
 - River-residents
 - River-estuary migratory
 - River-lake migratory
 - Within-river migratory
 - Lake-resident
- Quantitative trait controlled by
 - Multiple genes
 - Environmental factors
 - Parental influence
- Cost/benefit of anadromy versus residence
- Moy catchment - unique
 - Examine life history strategies

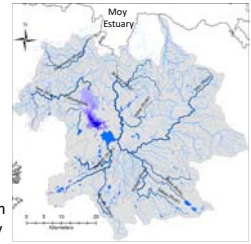


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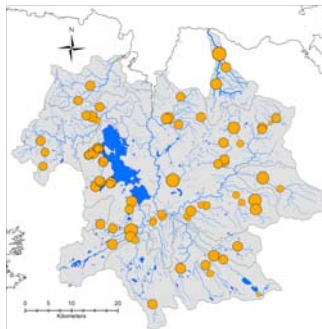
Key aims & questions

- Investigate population structure – are there discrete genetic stocks within the Moy catchment?
- Understand their importance to the fishery (adult mixed stock) – estimate the contribution of the various sub-catchments and associated populations to Conn/Cullin adult brown trout stock as well as to the sea trout sample from the Moy estuary
- To investigate the presence of sea trout from the Moy estuary that are not related to Moy catchment populations
- Assess recent influence of hatchery trout on present day stocks
- Investigate whether there is any evidence of hatchery fish in the Castlebar River or Conn/Cullin stocks



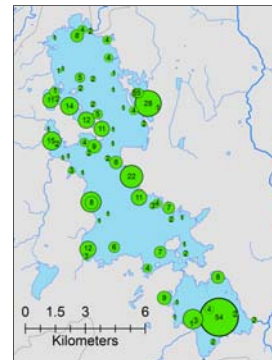
Baseline river sampling

- Extensive non-destructive sampling (fish scales) from 78 individual sites representing 30 tributary rivers
- N = 1660
 - Juveniles (0+/1+) = 1211
 - Adults = 449
- N = 1470 (88%) used for analysis
 - Losses due to contamination, poor quality material, salmon
- Some sites had poor juvenile representation
 - Local adults used to increase sample size



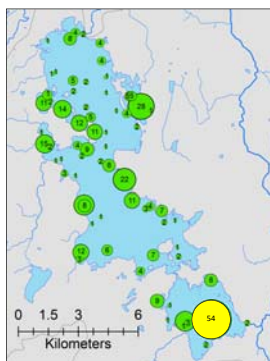
Adult sampling (lakes and Moy estuary)

- Lake adult trout sampling carried out by IFI and anglers over a 3 year period: 2011-2013 (87% with GPS information)
 - Lough Conn: N = 334
 - Lough Cullin: N = 116
- Adult sea trout sample from Moy estuary (N = 90)
- Hatchery reared fish of Roscrea and Leven origins (N = 205)
- All samples genetically analysed with a panel of 19 microsatellite markers



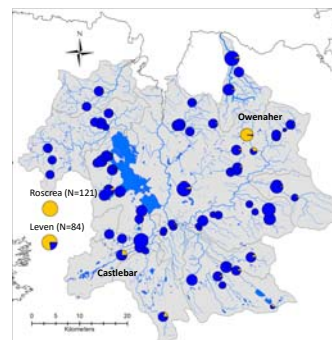
Adult sampling (lakes and Moy estuary)

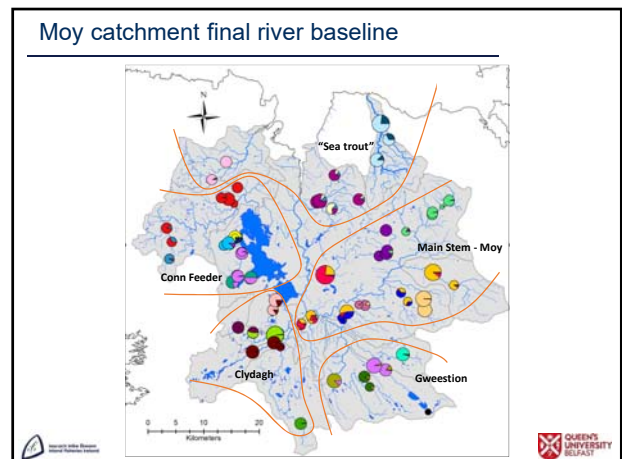
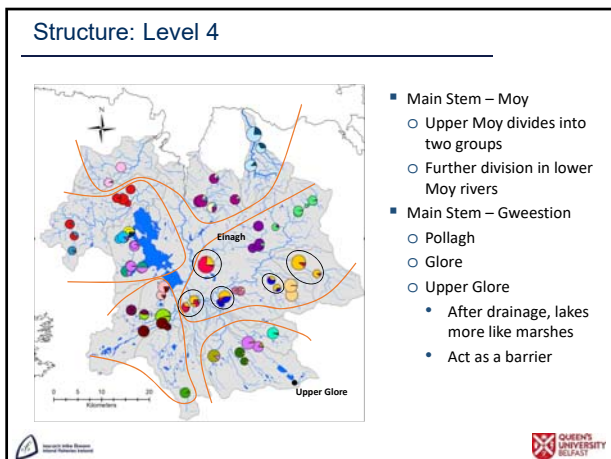
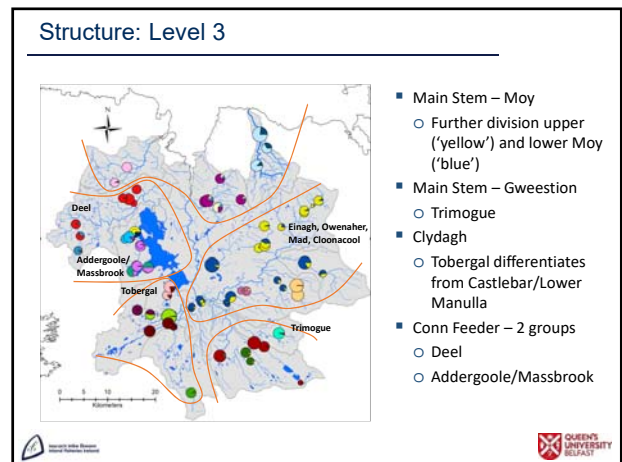
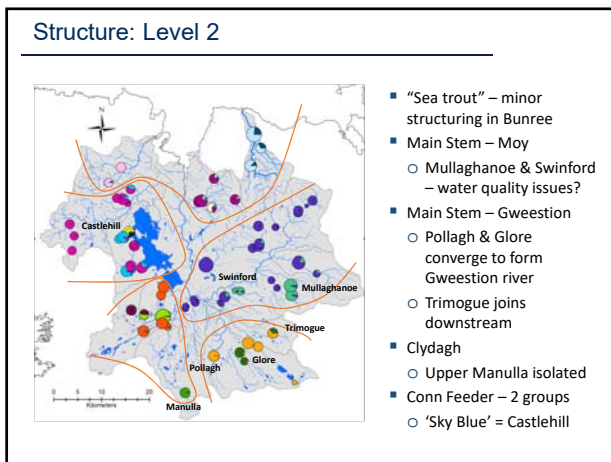
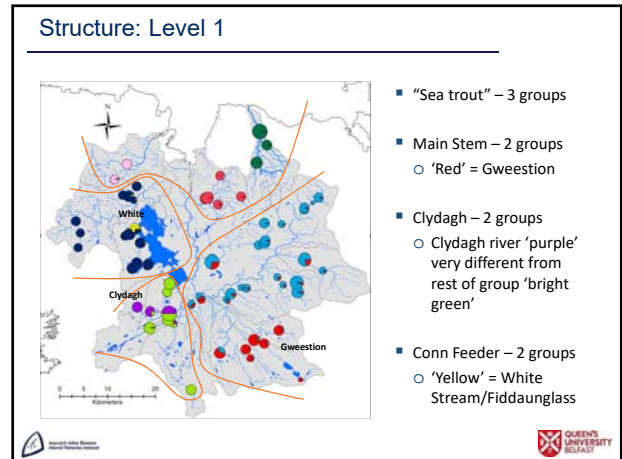
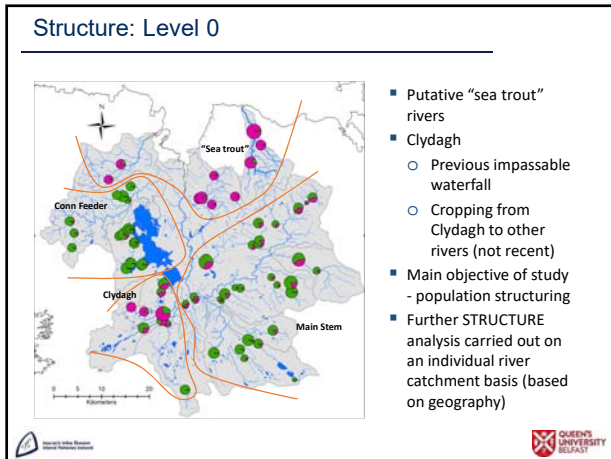
- 54 samples from Lough Cullin → missing GPS data
- Limited use for some of the analysis

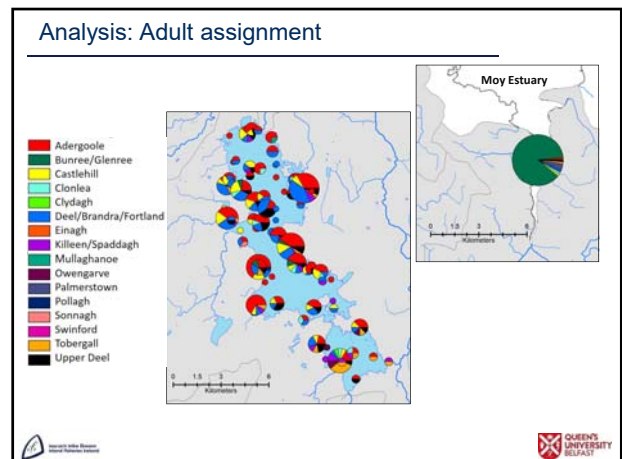
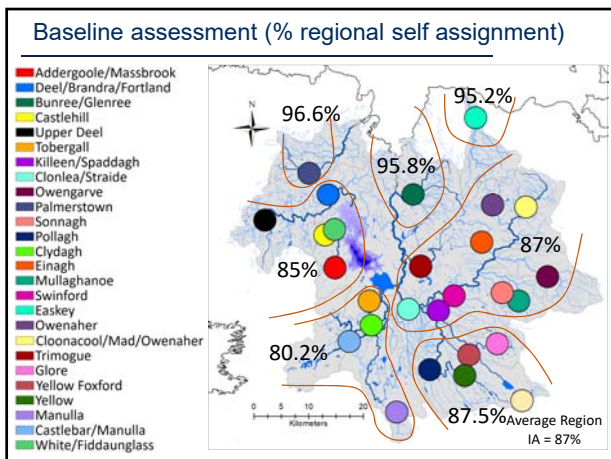
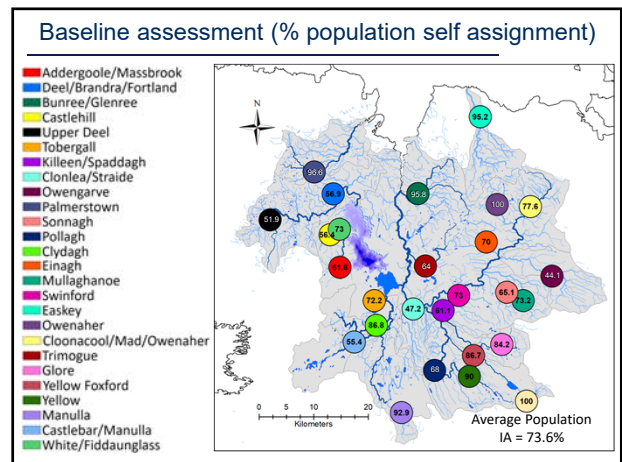
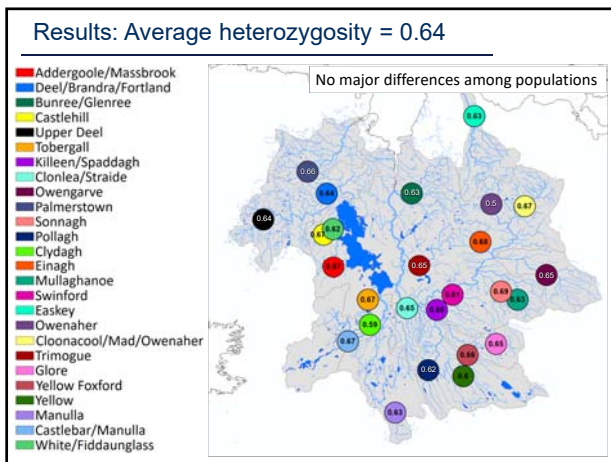
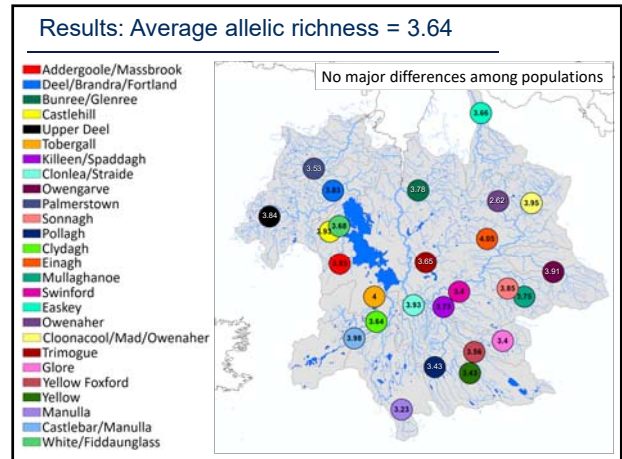
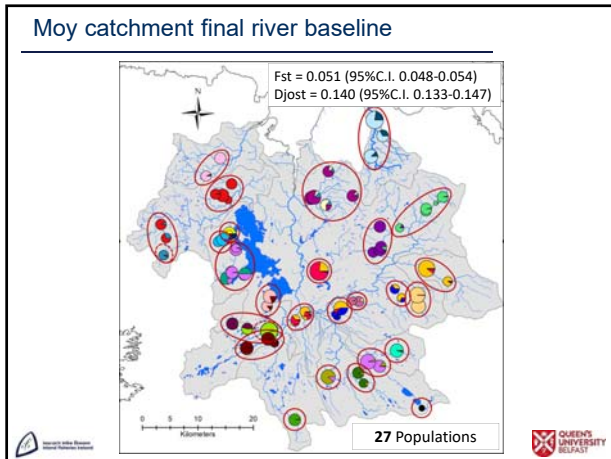


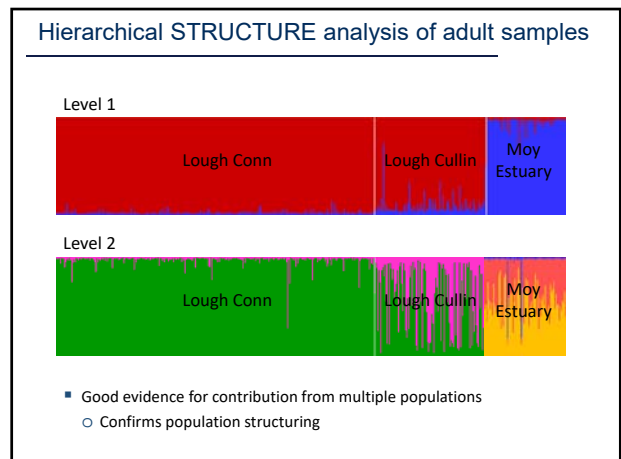
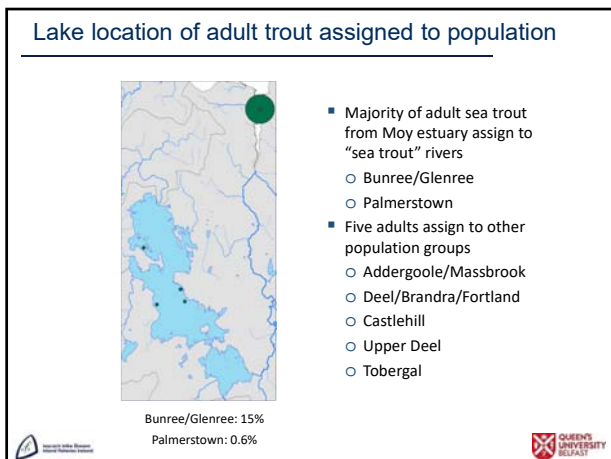
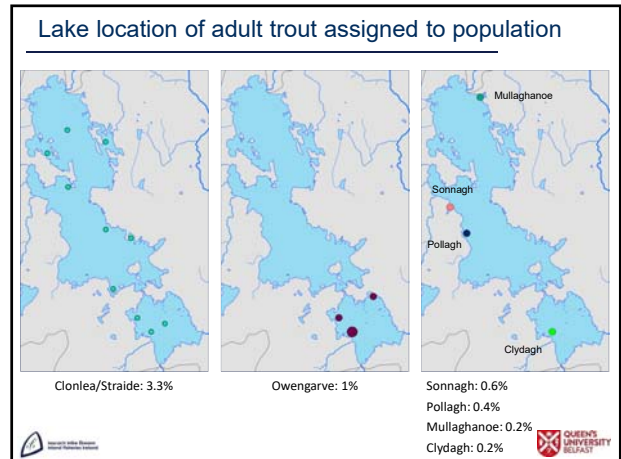
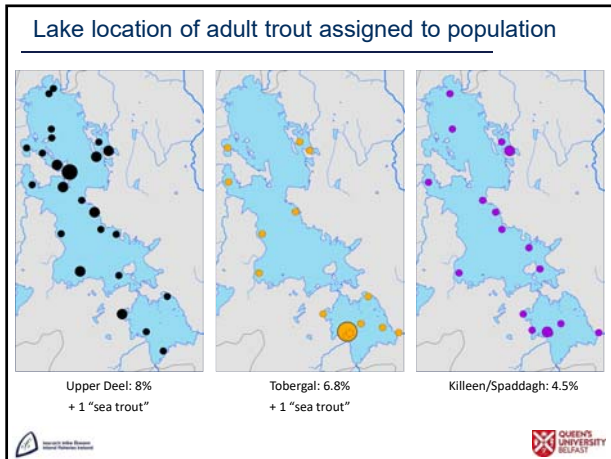
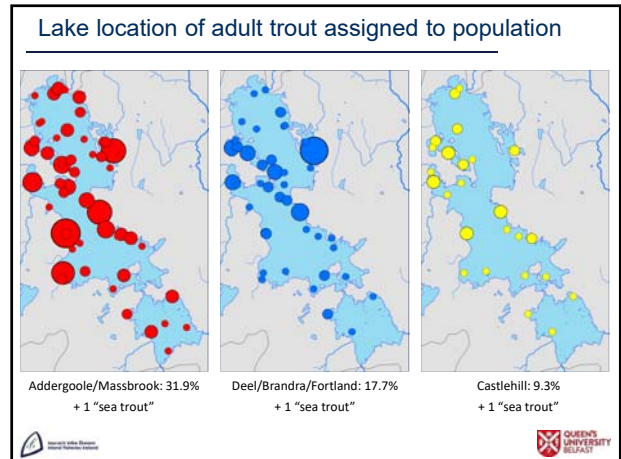
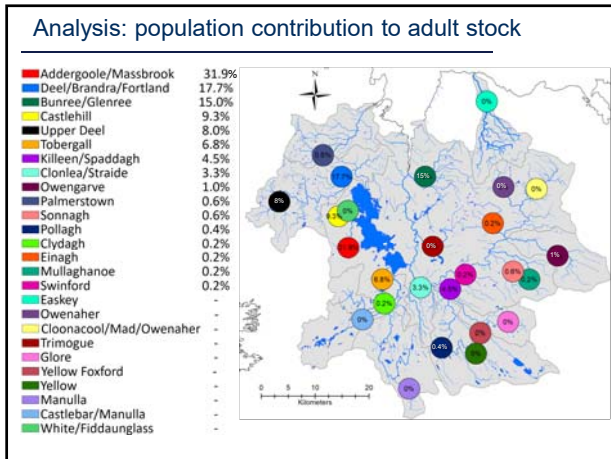
Structure: presence of Roscrea hatchery fish

- Investigate the presence of Roscrea hatchery-reared fish on the catchment
- Historically few records of stocking on the Moy catchment
 - But, stocking on Castlebar though not recently
- Owenaher
 - No known history of stocking
 - Sample site above impassable waterfall









Summary & Concluding Remarks

- Substantial population substructuring within the Moy catchment (i.e. reduced gene flow among samples from distinct tributary rivers)
- Most populations in the system can be explained by physical landscape of the system (e.g. lakes, barriers)
- No contemporary evidence of hatchery derived fish among adults
- No evidence of sea trout from other areas within Moy estuary stock
- The Bunree/Glenree population is the major contributor for Moy Estuary sea trout stock; the contribution from Moy populations is small
- However, need to check for temporal variation of Moy Estuary stock (current sample is restricted to July 2014/2015). The absence of contribution from Yellow Foxford River is of particular interest, given confirmed sea trout phenotype in the river



Summary & Concluding Remarks

- The inflowing rivers to Lough Conn/Cullin contribute ~74% of the lakes' mixed stock with a noticeable bias (~67%) from the inflowing rivers of Lough Conn
- Considering evidence of good numbers of trout on the rivers showing poor contribution, it's likely these trout remain in their respective rivers
- Low population self-assignment within particular areas, however, indicates higher levels of gene flow among population within catchments. Nevertheless, regional assignment is high
- Need to consider poor sampling from Moy main channel in addition to temporal sampling



Acknowledgements

- To all the many people that made this possible..... many thanks!



Beaufort Award

