


Population structure and genetic stock identification of brown trout (*Salmo trutta*) from Lough Derg (Shannon system)

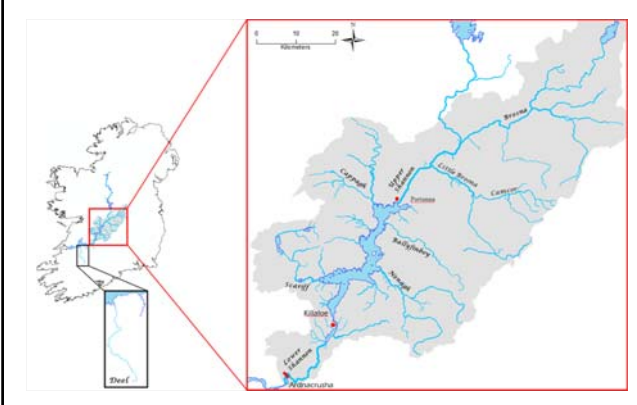
Jamie Magee, Caroline Bradley, Rosaleen Hynes & Paulo Prodöhl (QUB)
Karen Delanty, Fiona Kelly & Martin O'Grady (IFI)



Isaacach Inire Éireann
Inland Fisheries Ireland



QUEEN'S UNIVERSITY BELFAST

Lough Derg



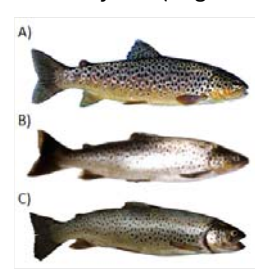
Lough Derg

- 3rd largest lake in Ireland
- Long, narrow profile
- High levels of alkalinity (> 100 mg/l)
- Average depths of 7.6 m (6 - 36 m)
- The lake is fed by six major river catchments: Scariff, Cappagh, Brosna, Little Brosna/Camcor, Ballyfinboy, & Nenagh
- In addition to 60 smaller inflowing rivers and streams

Lough Derg


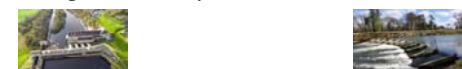
- Several distinct brown trout types have been described as occurring in Lough Derg
- (A) gillaroo trout; (B) "craoneen" (Camcor River); (C) "common lake trout" – *ferox* (large long-lived fish)



Lough Derg: threats

Over the past century

- Urban growth and associated discharges, farming activities and agricultural run-off, introduction of alien species, dredging, water abstraction, arterial drainage schemes
- Barriers (weirs, culverts, and sluices), operation of hydroelectric power stations, among other factors
- All contributed to the alteration of the natural lake/river environment and the loss and/or fragmentation of suitable spawning and nursery areas for brown trout in system

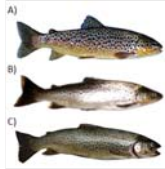



Lough Derg: status

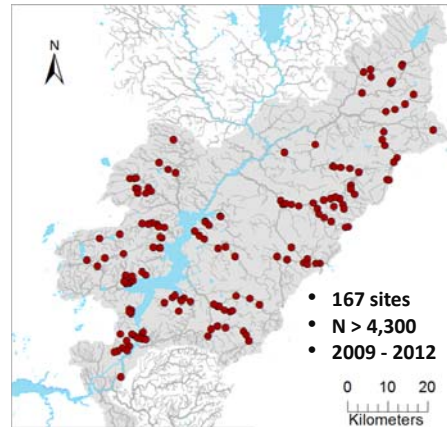
- Limited information is available on the status of Lough Derg brown trout population structuring
- This knowledge is essential for the proper management and conservation (i.e. what and where?)
- Complex nature of the system (i.e. complex river networks linked by the lake)
- Lough Derg is an important case study for investigating alternative migratory life strategies in the freshwater environment
- Assessing both the impact and resilience of brown trout populations in the face of ever changing environments.

Lough Derg: study aims

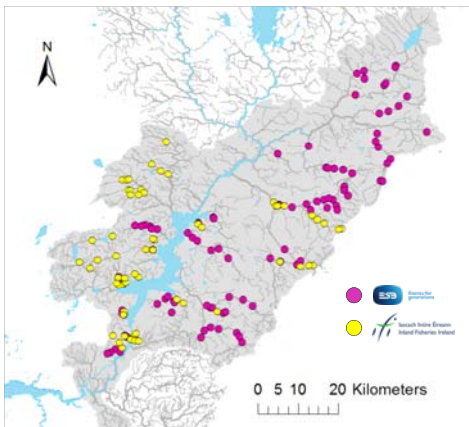
- To describe patterns of population structuring of the lake-river brown trout populations inhabiting the main catchment rivers and tributaries draining in and out of Lough Derg
- To construct a population baseline data set that can be used to estimate the relative contribution of each individual tributary/river to the lake mixed brown trout stock



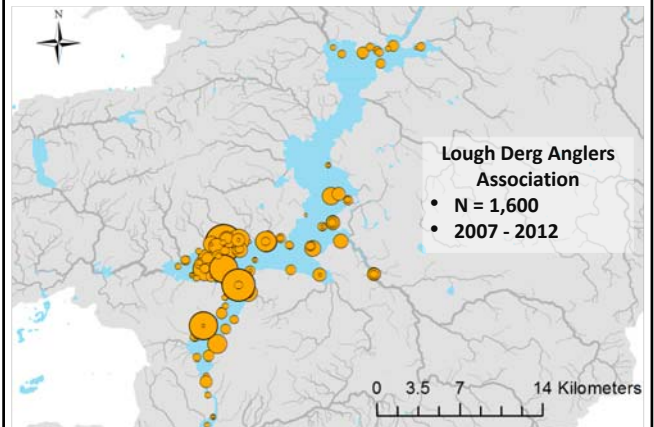
Sampling – baseline rivers



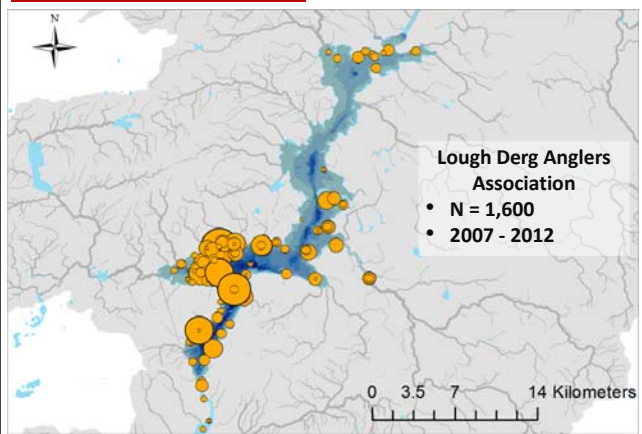
Sampling – baseline rivers



Sampling – mixed lake stock

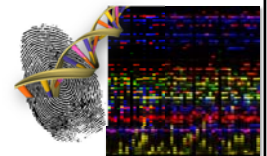


Sampling – mixed lake stock

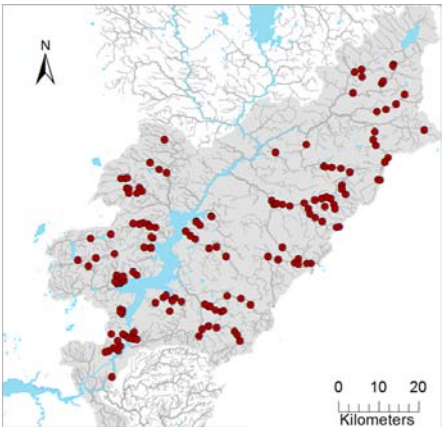


Methodological approach

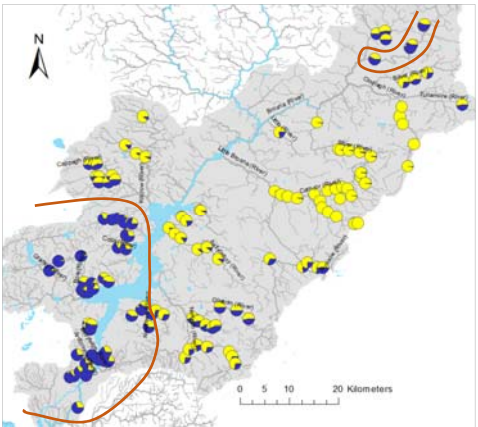
- Microsatellite DNA profiling/Genetic tagging
- A forensic based technique that allows for the unequivocal identification of individual to families
- No two individuals within outcrossing populations share the same microsatellite DNA profile
- Individual "DNA fingerprinting"
- Very useful tool for examining population genetic structuring



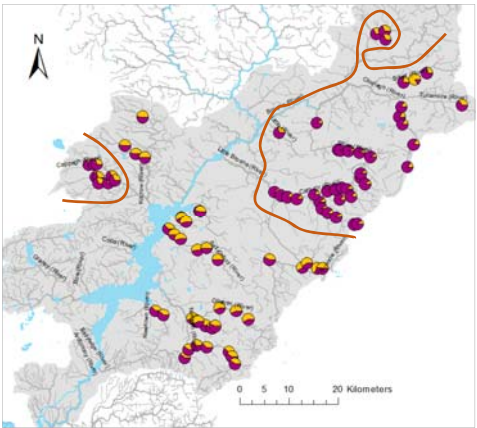
Hierarchical Structure Analysis



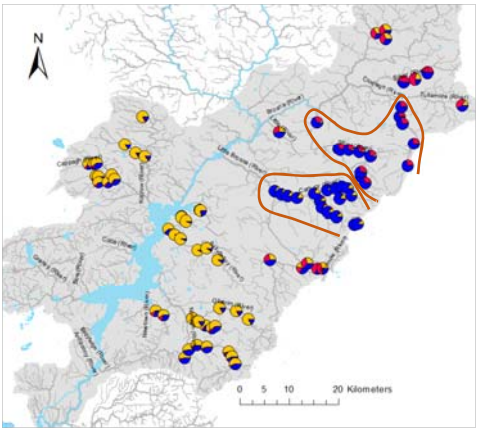
Structure – 1st level hierarchy



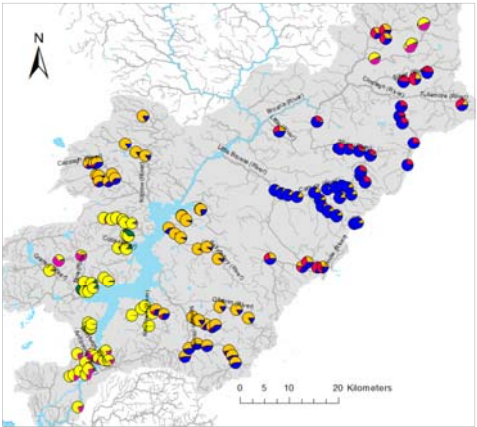
Structure – 2nd level hierarchy



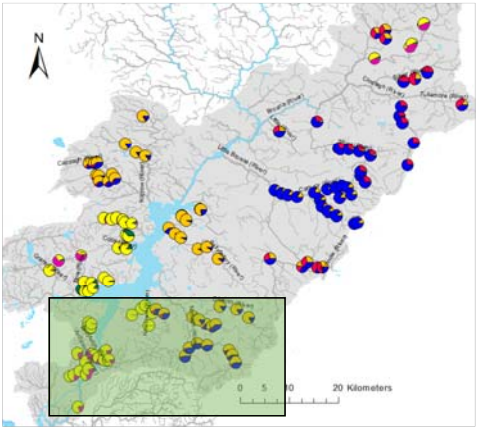
Structure – 3rd level hierarchy



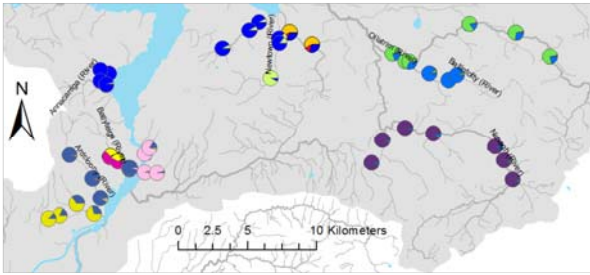
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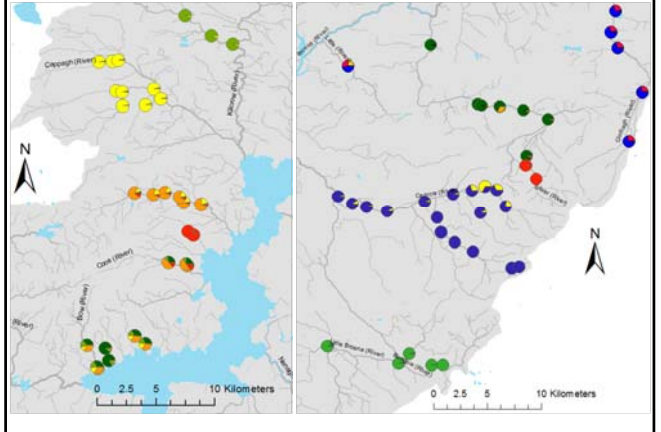
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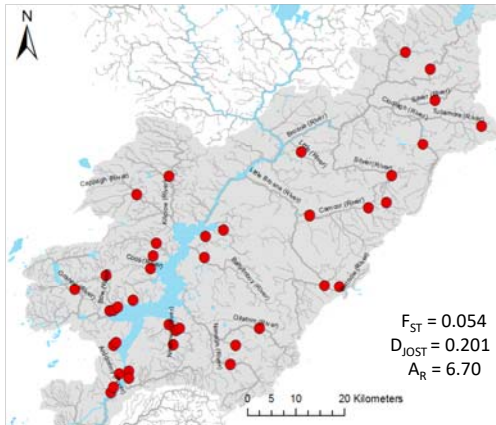
Structure – 4th level hierarchy



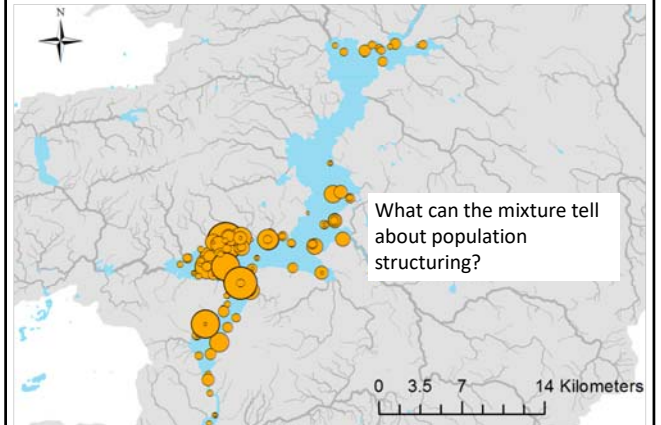
Structure – 4th level hierarchy



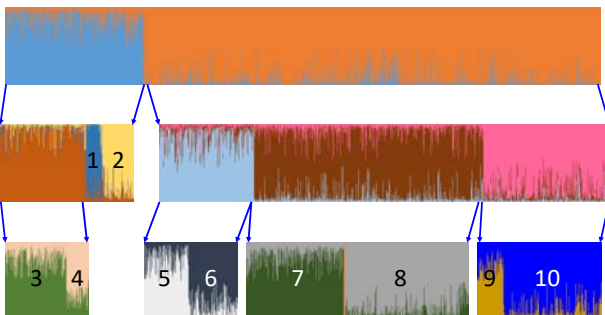
Structure – 40 populations



Mixed lake stock - Hierarchical Structure Analysis

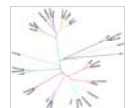


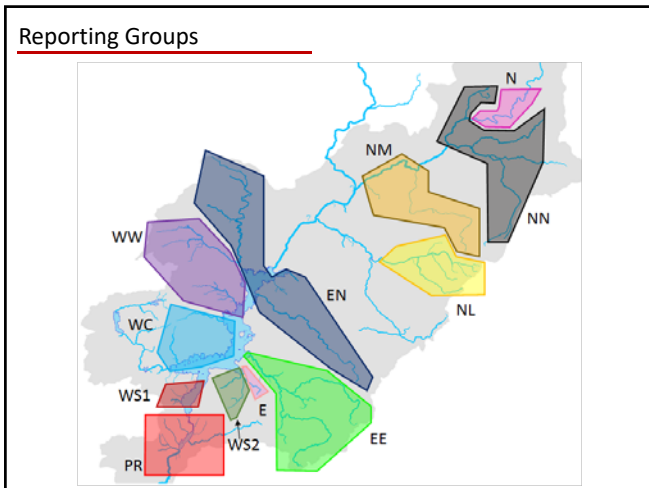
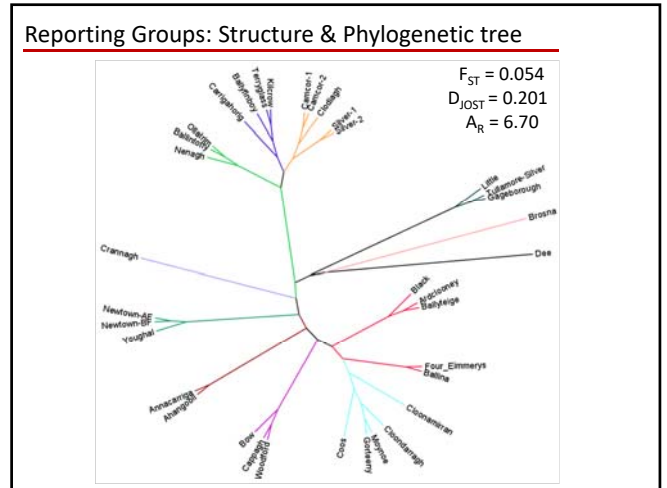
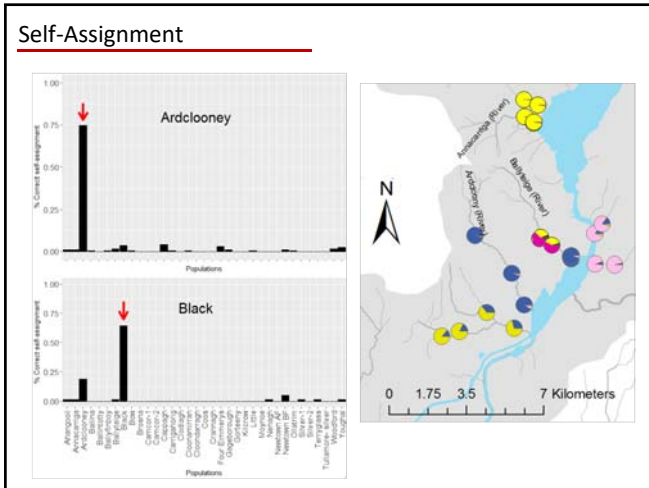
Lake mixed trout stock – how many populations?



Lough Derg – Population structuring

- High level of population genetic substructuring
- Populations are structured in well-defined hierarchical regional groupings, represented both at broad and micro geographical scales
- This pattern most likely reflect both natural historical colonisation patterns and recent contemporary history
- Despite the fact that the system has been severely impacted by anthropogenically mediated factors, so far populations seem to be able to cope
- Potential good baseline for GSI

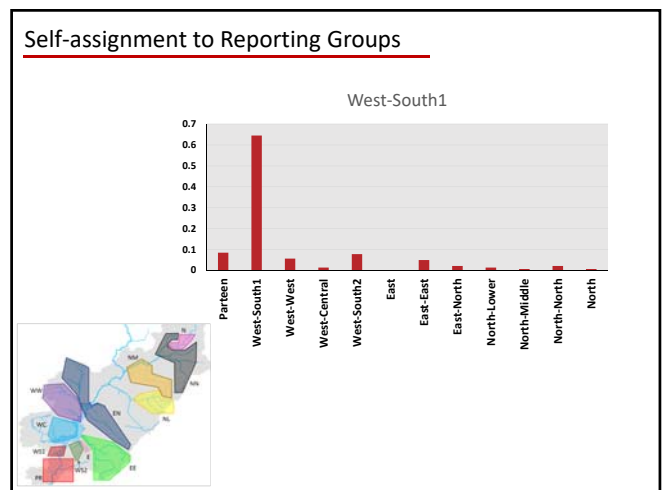
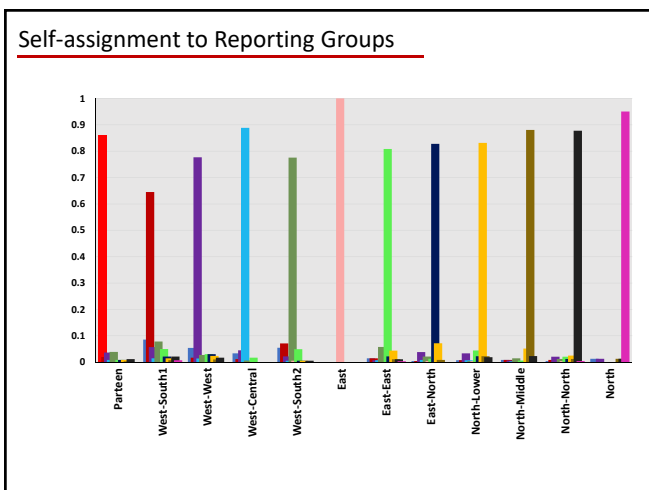




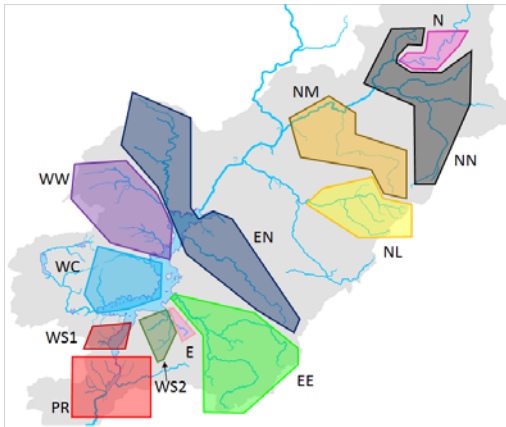
Reporting Groups

Parteen	West-West1	West-South1	West-South2	West-Central
Ardclooney	Bow	Ahangooli	Newtown AF	Cloanamirran
Ballina	Cappagh	Annacarriga	Newtown BF	Cloondarragh
Ballyteige	Woodford		Youghal	Gorteeny
Four Eimмерыs				Moynoe

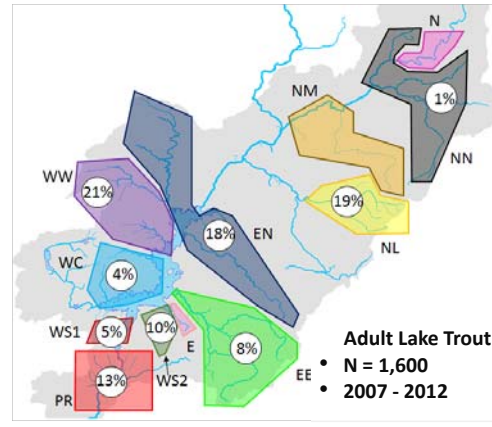
East-East	East-North	North	North-Middle	North-North
Ballintotty	Ballyfinboy	Brosna	Silver-1	Clodiagh
Nenagh	Carrighorrig	North Total	Silver-2	Gageborough
Ollatrim	Kilcrow	North-Lower		Little
	Terryglass	Camcor-1		Tullamore-Silver
		Camcor-2		



Reporting Groups: Lake trout



Reporting Groups: Lake trout



Reporting Groups: summary contribution

Parteen	West-West	West-South1	West-South2	West-Central
Ardclooney	Bow	Ahangooil	Newtown AF	Cloonamirran
Ballina	Cappagh	Annacarriga	Newtown BF	Cloondarragh
Ballyteige	Woodford		Youghal	Coos
Black			Gorteeny	Moynoe
Four Eimmerys				
13.1%	21.2%	4.7%	10.2%	4.0%

East-East	East-North	North	North-Lower	North-Middle
Ballintotty	Ballyfinboy	Brosna	Camcor-1	Silver-1
Nenagh	Carrigahorig	North Total	Camcor-2	Silver-2
Ollatrim	Kilcrow			
	Terryglass			
8.1%	18.4%	0.2%	18.5%	0.2%

North-North
Clodiagh
Gageborough
Little
Tullamore-Silver
0.8%

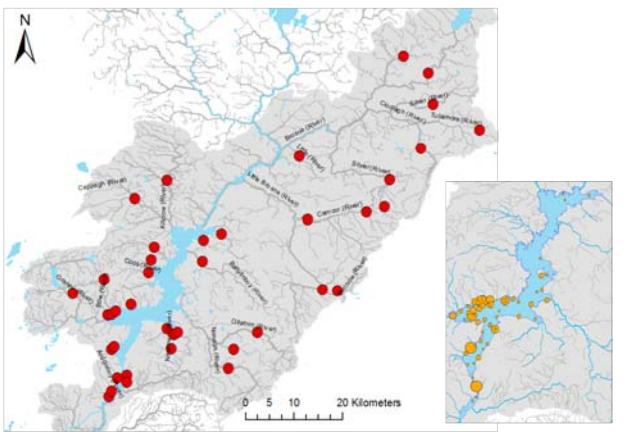
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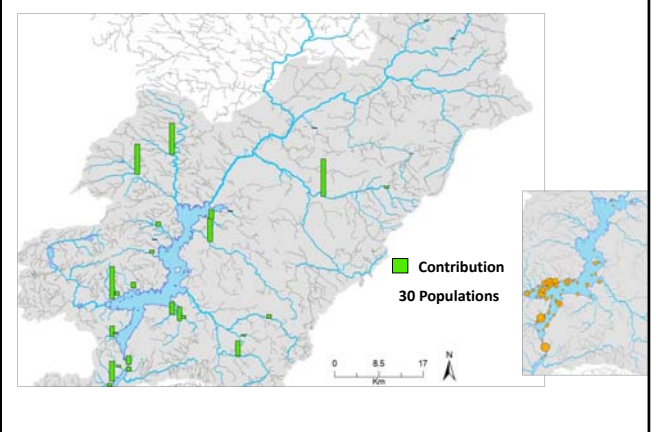
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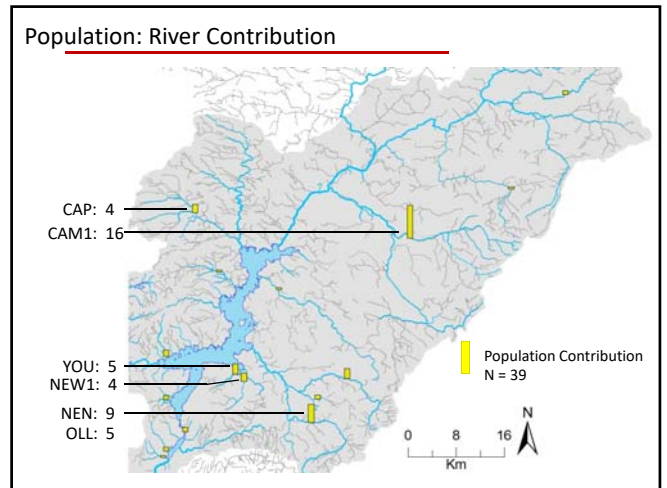
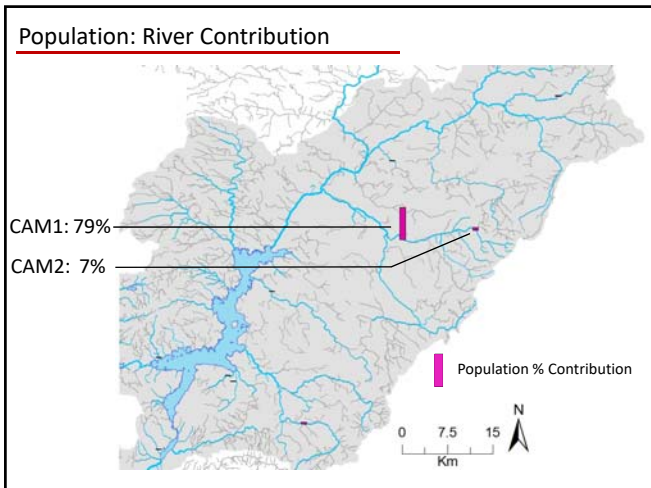
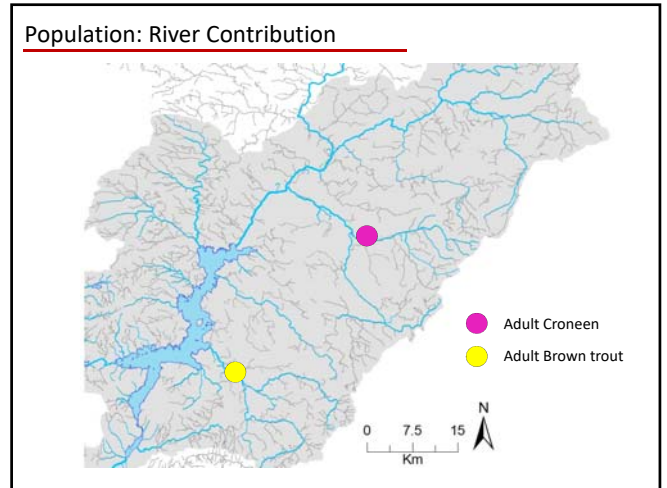
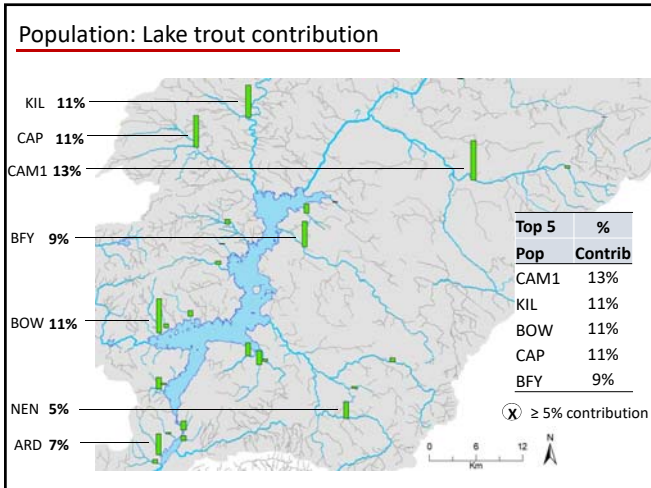
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Population: Lake trout contribution

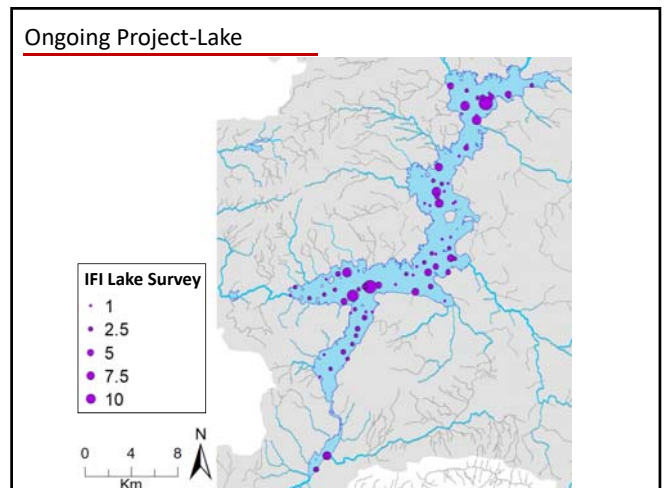


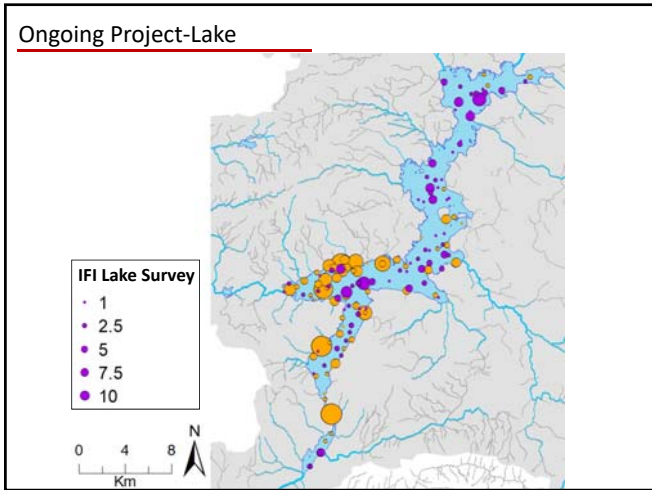
Population: Lake trout contribution





- General Remarks
- No major correlations between wetted area and contribution to lake stock
 - Small river/tributaries also important contributors to lake stock
 - In many cases, there is evidence supporting river residence (migration between spawning and feeding grounds within a river – no river-lake migration)
 - Results suggest that river baseline, while comprehensive, is still incomplete
 - Scariff catchment, Lower Brosna & many other tributaries





Acknowledgements