


Population structure and genetic stock identification of brown trout (*S. trutta*) inhabiting three urban rivers in the Dublin area

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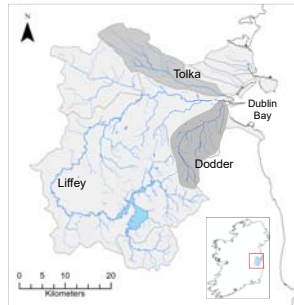


Koscach Inilire Éireann
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Project background

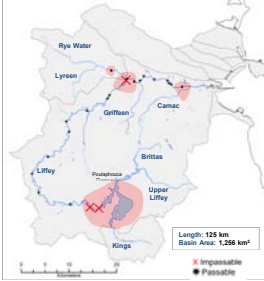
- Three main Dublin Bay Rivers; Liffey, Dodder & Tolka



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Liffey (largest of the three rivers)

- Poulaphouca Reservoir established 1940's (Golden Falls -Impassable waterfall)
- Leixlip Dam – fish pass – potential partial/complete barrier
- Mid-Rye Water – Man-made dam constructed 150 – 200 yrs ago – Made passable to salmonids 2012
- Islandbridge weir – partial barrier on Lower Liffey main channel
- Pollution** – Lower reaches heavily polluted 1960's – 1980's
 - Griffen & Camac – trout virtually extinct
 - Water quality significantly improved
- Stocking** – Liffey catchment stocked with Roscrea hatchery trout since 1970's – 2012 – No longer stocked




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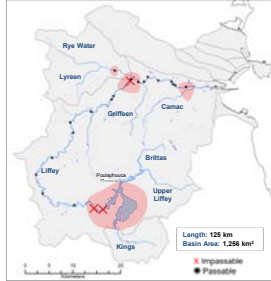
Liffey (largest of the three rivers)



Leixlip Barrier



Poulaphouca

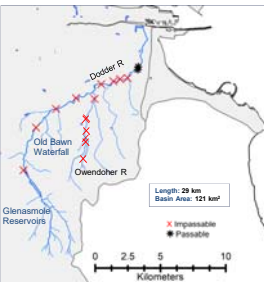


Length: 125 km
Basin Area: 1,256 km²

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Dodder (third largest rivers)


- Owendocher – major tributary
- Series of impassable weirs built 1700 to mid 1800's
- "Old Bawn" most upstream weir – natural impassable waterfall – upstream migratory cut-off
- Glensmole Reservoirs completed 1886 –
- Flood relief and drinking water supply
- Pollution** – Numerous fish Kills – 1970's – 1990's due to poor water quality
 - Post 1990's water quality improved - currently regarded as "good" in both rivers
 - Occasional fish kill incidents
- Stocking** – Annually stocked since 1970's; currently only Adults (March)




Length: 29 km
Basin Area: 121 km²

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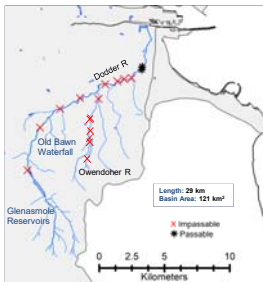
Dodder (third largest rivers)



Old Bawn Bridge



Oldest Manmade Barrier (~1700) at Firhouse

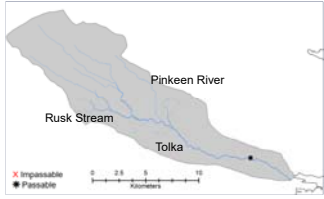


Length: 29 km
Basin Area: 121 km²

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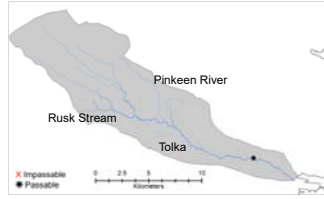
Tolka (2nd largest river in terms of length)

- Large number of weirs in lower to mid reaches - dating back to the 1800's. Many were passable or partially passable in low flows. Pollution has been a consistent problem
- 2008 – small brown trout stock (Electrofishing survey)
- 2008/2009 - Impassable weirs in lower reaches removed/modified
- Following weir removal & improved water quality – sea trout returned
- First sea trout caught in upper reaches in 150 yrs
- Pollution** – still poor to moderate. Fish kills still occurring
- Stocking** – heavily stocked with Roscrea trout since 1970's; currently only adults (March)



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Tolka (2nd largest river in terms of length)





Stepping out the impassable weir u/s of Finglas Road Bridge

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Key Aims & Questions

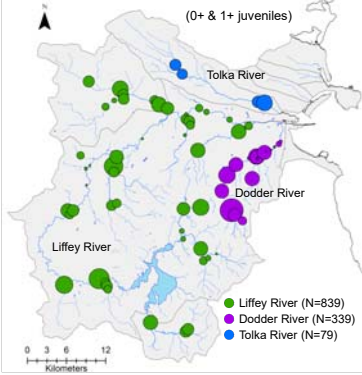
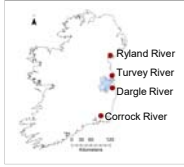
- Describe population genetic structure (i.e. potential existence of discrete genetic stocks in each catchment)
- Investigate the impact of barriers (natural and manmade) to fish migration and influence on present day stock structure
- Considering the serious pollution in the lower Liffey, Dodder & Tolka, is there evidence for recolonisation from neighbouring sea trout rivers?
- Assess recent influence of hatchery trout on present day stocks
- Gain an understanding of the contribution of the identified populations to the adult stock



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Sampling (Baseline river sampling: 2012-2015)


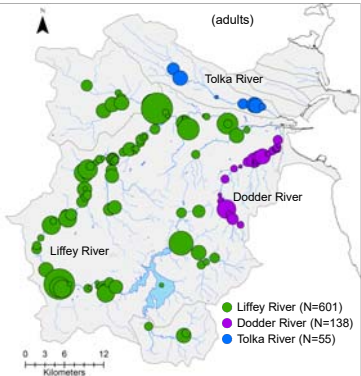
- Additional Genotypic Data
- Sea Trout (CSTP):
 - Corrook River (N = 47)
 - Dargle River (N = 47)
 - Ryland River (N = 47)
 - Turvey River (N = 42)
- Hatchery:
 - Roscrea (N = 123)
 - Leven (N = 86)

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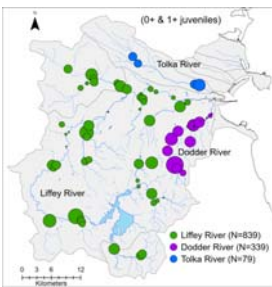
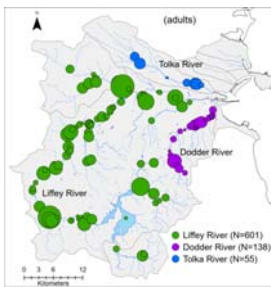
Sampling (Adult sampling: 2012-2015)

- 794 adults
- Scales (mostly angling)

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Contrasting distribution (juveniles vs. adults)

1257 juveniles discontinuous distribution → spawning and feeding habitats

794 adults → mostly continuous distribution

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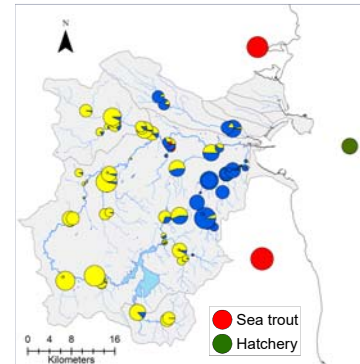
Genetic analysis

- DNA Extraction from scales
- Screened for 20 microsatellite loci
- Levels of population genetic structuring within the baseline data were investigated using the Hierarchical STRUCTURE Analysis – as previously described



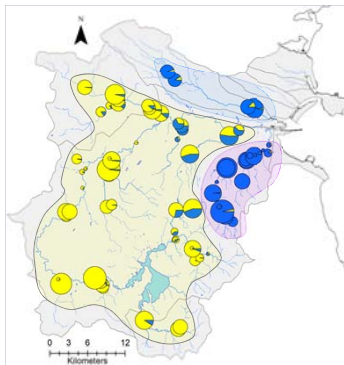
Level 0 – STRUCTURE (Hatchery and Sea trout)

- No contemporary hatchery genetic impact
- Minimal evidence for outside gene flow



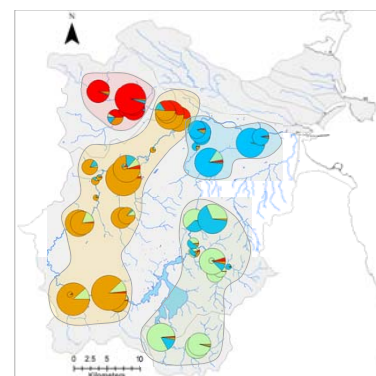
Level 0 – STRUCTURE

- Two major groups
 - 1- Liffey
 - 2- Dodder & Tolka
- Main objective → population structuring
- Further STRUCTURE analysis carried out on individual catchment basis



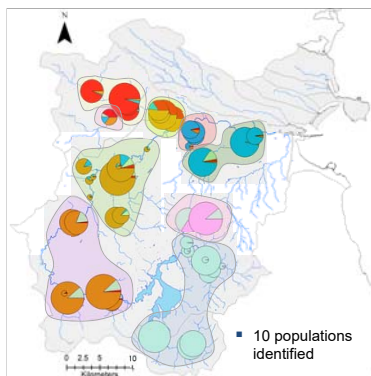
Level 1 – Liffey

- Four major sub-groups
 - 1- Liffey Above dam
 - 2- Liffey Main Stem
 - 3- Rye Water
 - 4- Griffeen & Camac



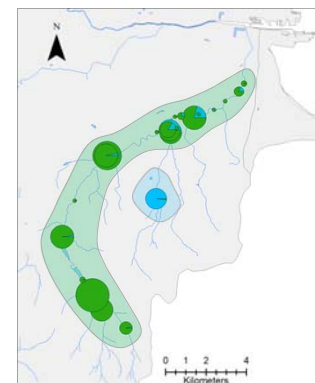
Level 2 – Liffey

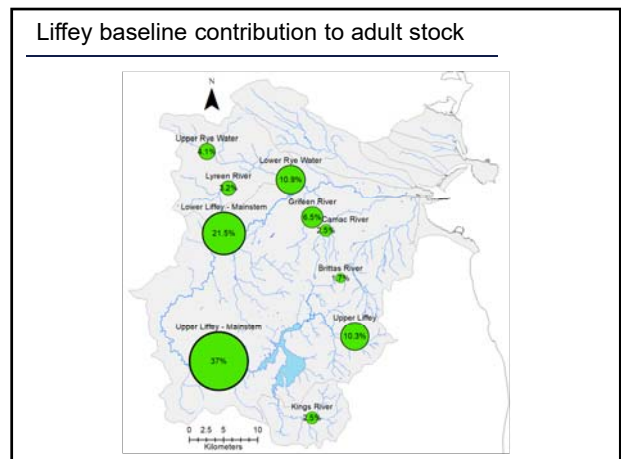
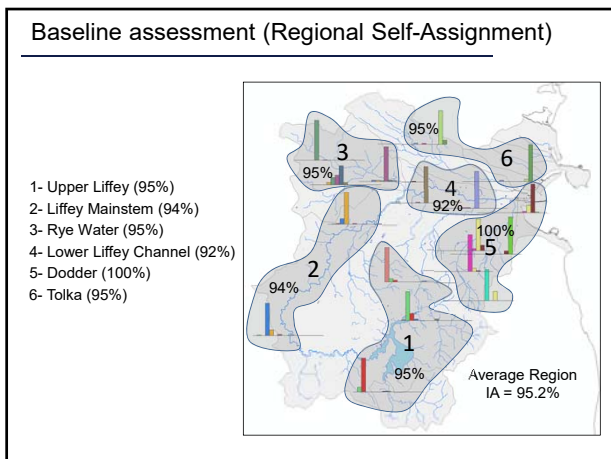
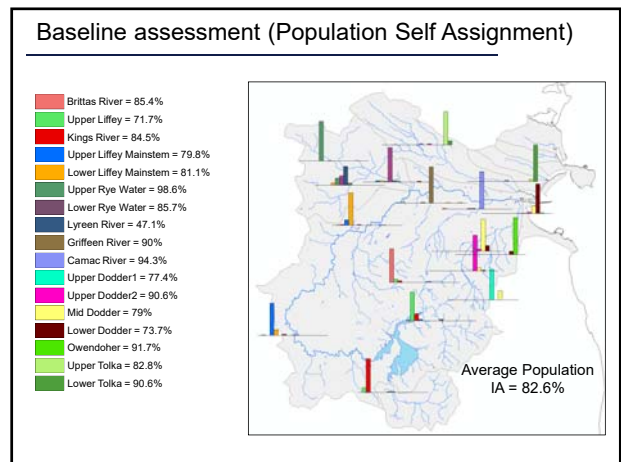
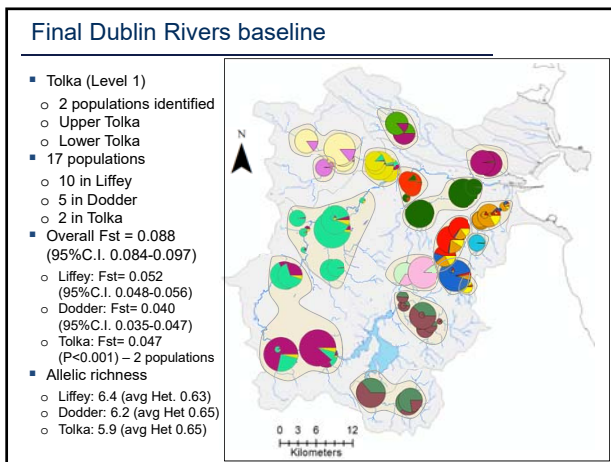
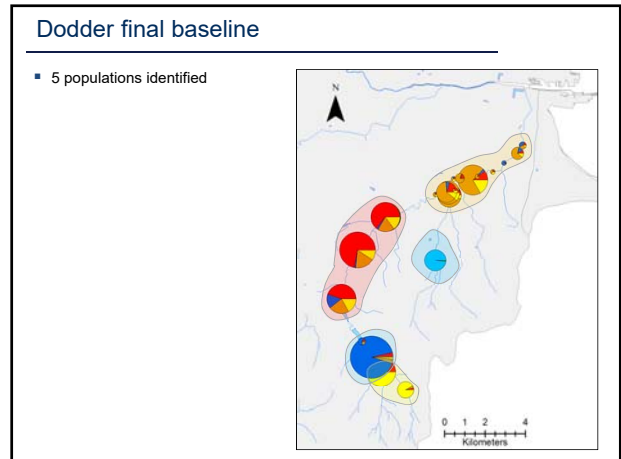
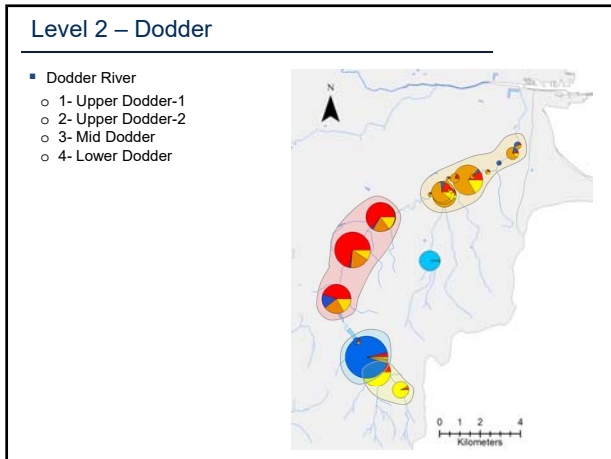
- Liffey Above dam
 - 1- Brittas
 - 2- Upper Liffey & Kings River
- Liffey Mainstem
 - 1- Upper Liffey Mainstem
 - 2- Lower Liffey Mainstem
 - 3- Lower Rye Water
- Griffeen & Camac
 - 1- Griffeen
 - 2- Camac
- Rye Water
 - 1- Upper Rye Water
 - 2- Lyreen River

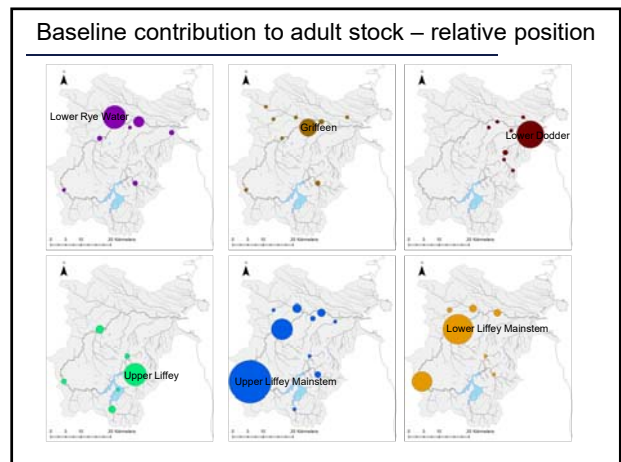
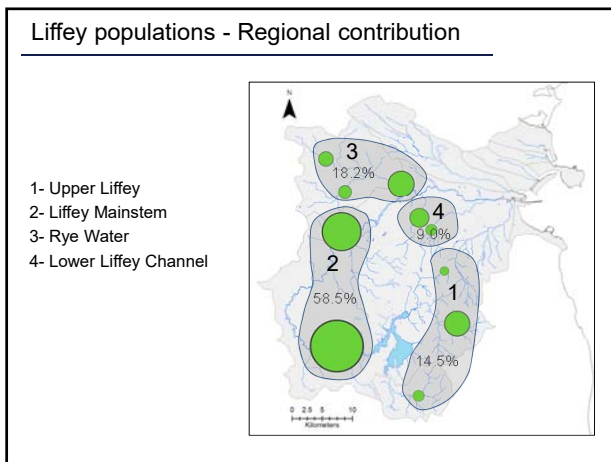
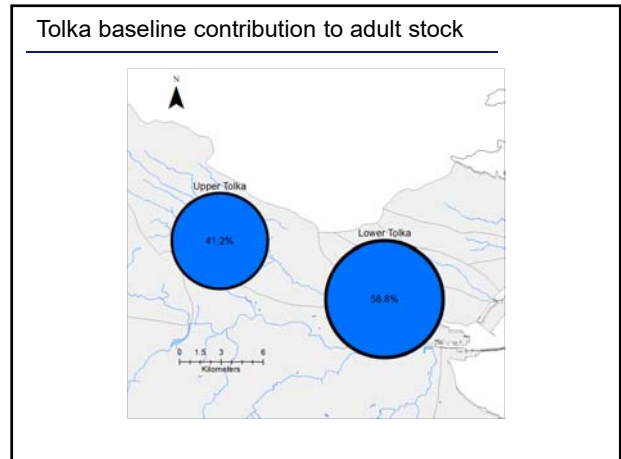
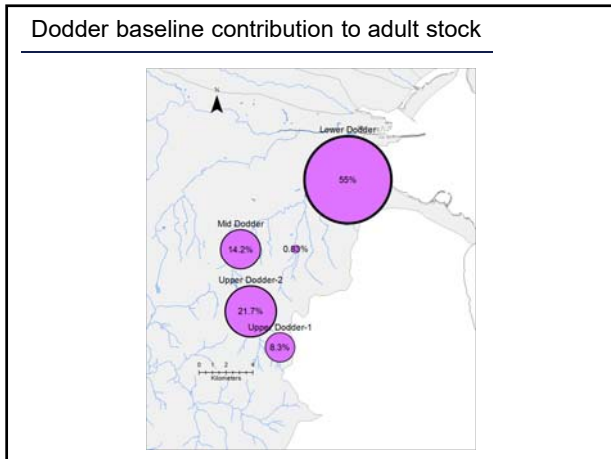


Level 1 – Dodder

- Two sub-groups
 - 1- Owendoher River
 - 2- Dodder River







Summary & Concluding Remarks

- Substantial population structuring within each catchment (i.e. limited gene flow among areas)
- Higher level of genetic differentiation among river catchments (i.e. $F_{st} = 0.088$ vs. $F_{st} = 0.052, 0.040$ and 0.047 for Liffey, Dodder and Tolka respectively) → limited gene flow between river catchments
- No contemporary evidence of hatchery derived fish among adults (surprising given ongoing stocking)
- No evidence of gene flow from neighbouring sea trout populations → trout stock from Tolka River most likely recovered from small populations from the upper reaches of the catchment
- Excluding major obstacles (e.g. dam, etc), no major evidence that man-made barriers are currently preventing fish movement in the Liffey.
- Most populations in the system can be explained by the presence of contemporary and/or historical barriers (e.g. Liffey, Dodder)
- With exceptions, most adult fish seem to concentrate in areas close to their respective river baselines

Acknowledgements

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