
UKILN Conference
Lakes – protecting, enhancing and restoring.
Westport
16th and 17th October 2019
Hotel Westport Leisure, Spa & Conference Hotel
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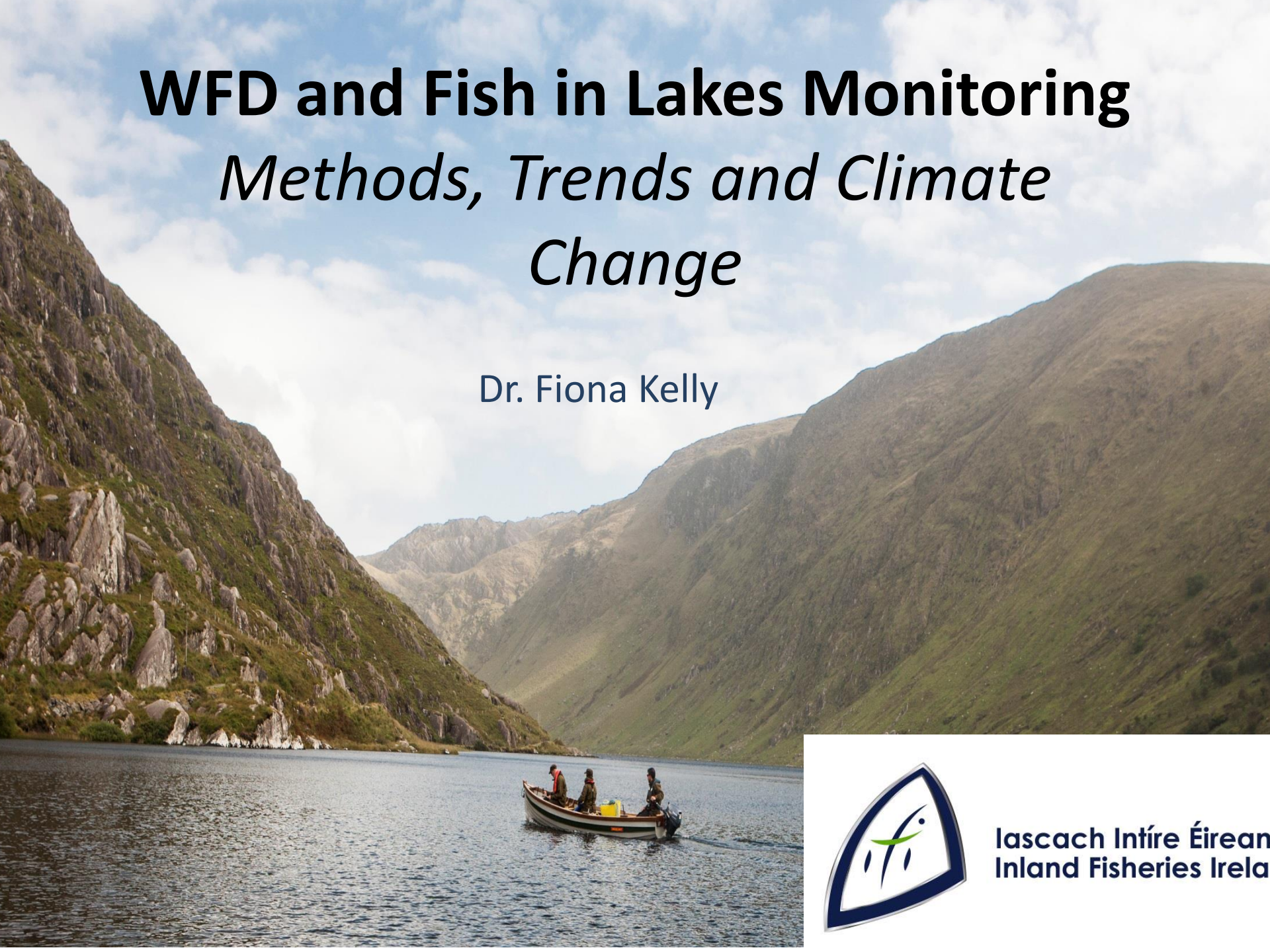
Environmental Protection Agency

WFD and Fish in Lakes Monitoring

Methods, Trends and Climate Change

Dr. Fiona Kelly



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Objectives

- WFD fish in lakes monitoring methods
- Methods update
- Trends in status – causes of failures
- Climate change and fish
- Brief – LARC Project

WFD Fish in Lakes Monitoring

WHO?
Inland Fisheries Ireland (IFI) is responsible for monitoring fish in lakes for WFD purposes.

WHAT?
Species composition
Species abundance
Age structure

WHERE?
SM lakes only
But we are monitoring other lakes also (OM and non-WFD)

WHEN?
3-Year cycle

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WFD Fish in Lakes Monitoring: Methods

Multi-method

Combination of CEN standard monofilament survey gill nets, fyke nets and large mesh, braided survey gill nets (method developed during the NS Share project)

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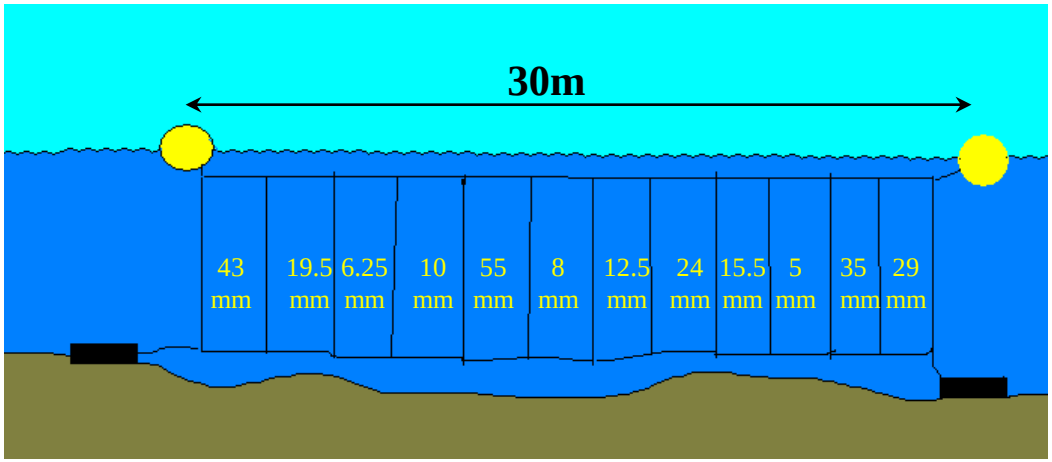
WFD Fish in Lakes Monitoring: Methods contd

- Nets set randomly in each depth zone
- Nets are set at random directions to the shore
- Benthic fish and pelagic fish sampled
- Nets set for 12-18hrs
- Method specifies netting effort required at each depth zone (4 to 64 gill nets)
- Sampling between June and early October
- Length, weight, scales, secchi, DO/temp profiles,
- Diet, sex, ageing of otoliths and opercular bones in lab



CEN Survey gill net - incremental mesh progression
5 - 55 mm half mesh, 12 panels, randomised sequence
"Norden"net, commercially available

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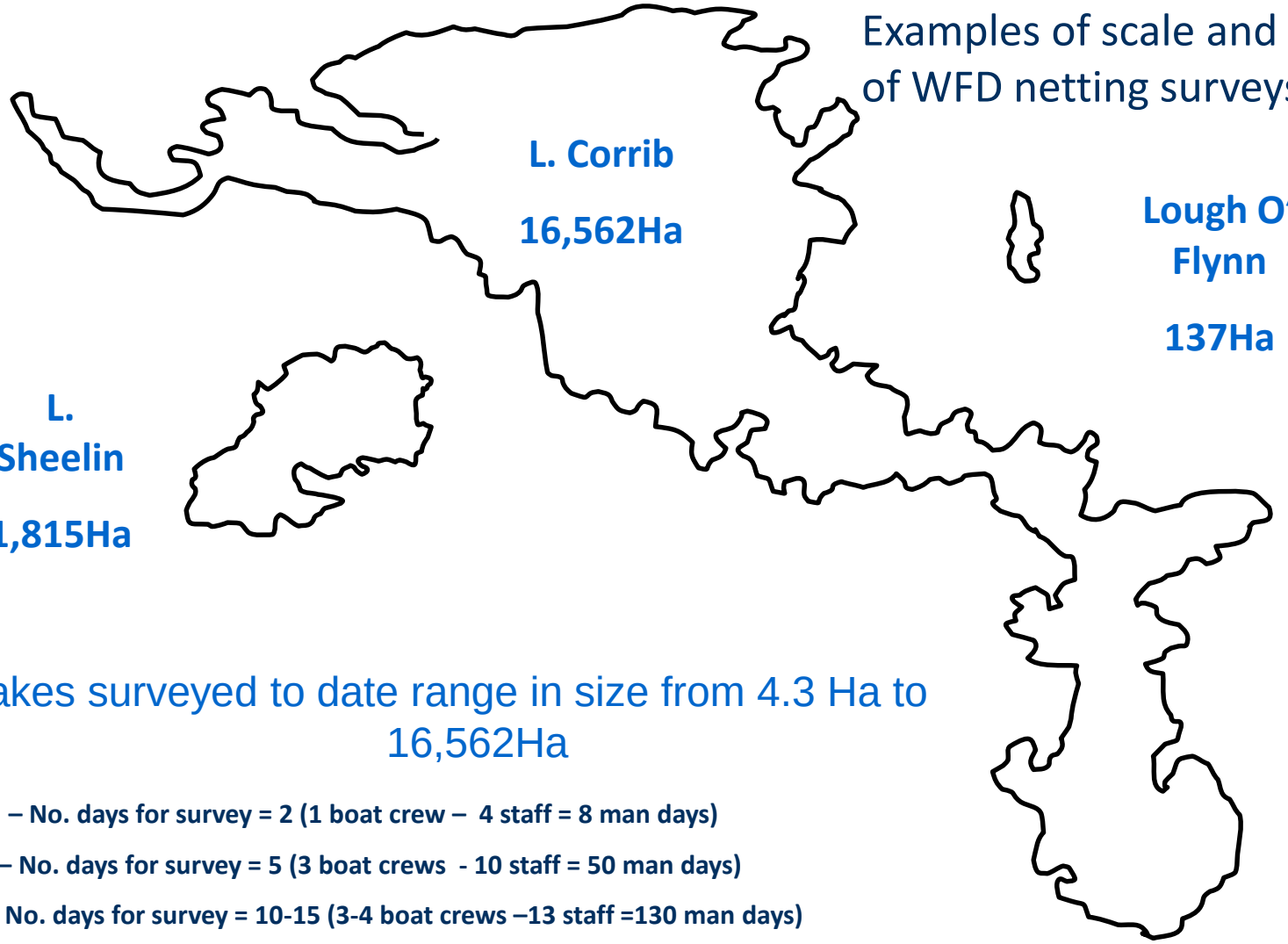
WFD Fish in Lakes Monitoring: Scale



Lakes surveyed to date range in size from 4.3 Ha to 16,562Ha

L. O' Flynn – No. days for survey = 2 (1 boat crew – 4 staff = 8 man days)

L. Sheelin – No. days for survey = 5 (3 boat crews - 10 staff = 50 man days)

L. Corrib – No. days for survey = 10-15 (3-4 boat crews –13 staff =130 man days)

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WFD Fish in Lakes Monitoring: Method Intercalibration

Problem: Netting on lakes is resource intensive. In some years different IFI projects surveyed the same lakes using methodologies specific to their own needs.

Aim of method intercalibration: Rationalise IFI sampling methods - data are comparable across research and monitoring programmes (more cost effective/maximise resources). Added value from surveys.

Int

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SOLUTION:

- **Replace single panel large mesh braided nets with 4PBB large mesh survey gill nets in all large brown trout and coarse fish lakes.**
- **Number increased**
- **No impact on fish status for WFD assessments as we can still calculate status using the old method.**
- **Lake sampling = Summer**

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WFD Fish Monitoring – Indicator/Endangered Fish Species

Three endangered fish species in Irish lakes:

- Pollan (*Coregonus autumnalis pollan*) (Annex IV)
- Arctic char (*Salvelinus alpinus*) (Red Data Book)
- Killarney shad (*Alosa killarnensis*) (Annex II & V)

Considered vulnerable to extinction
Indicator species

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PhD. Thesis

Endangered fish species in Irish lakes: The development of novel sampling protocols for ecological and conservation status assessment

- **Aim**: to develop a standard sampling methodology that satisfies WFD and HD Directives for assignment of ecological and conservation status – 3 species
  Pelagic gillnetting and hydroacoustic protocols tested

Conclusions

- Pelagic gillnetting protocol dependent on lake size and fish community
- Pelagic nets inappropriate for small Arctic char lakes due to high increase in % mortality (39 – 46%) with little additional information
- Pelagic gillnetting protocol is needed to reliably detect pollan and 0+ Killarney shad
- Hydroacoustics and pelagic gillnetting can effectively sample pollan.

Morrissey-McCaffrey, E., Rocks, K., Kelly, F.L. and Kelly-Quinn, M. (2018) Effects of differing ground-truth data, transect design and statistical analysis on the repeatability of hydroacoustic assessments of *pollan Coregonus autumnalis pollan. Fisheries Management and Ecology,* **25 (4)**, 304-318.

Fish in Lakes Classification Tool 2 (FIL2) for Eco Region 17

- **FIL2 is a multimetric index combined with predictive modelling.**
- **13 fish Metrics are scored and combined into a single value, which corresponds to a water quality class with an indication of confidence.**
- **Four lake typologies are used**
- **TP and Chlorophyll = stressor/pressure gradient.**

Boundary	EQR
High	0.76 – 1.0
Good	0.51 – 0.76
Moderate	0.32 – 0.51
Poor/bad	0 – 0.32

Expert opinion helps to sense-check the outputs and explain anomalies (invasive species, fish kills, etc.)

Kelly *et al*., (2012) Development and application of an ecological classification tool for fish in lakes in Ireland. *Ecological Indicators* **(18)** 608-619

WFD Fish Monitoring – Progress to Date – 2007-2019

Fish in lakes – **surveillance monitoring only,** 76 lakes,
IFI survey other lakes also (OM and non-WFD).

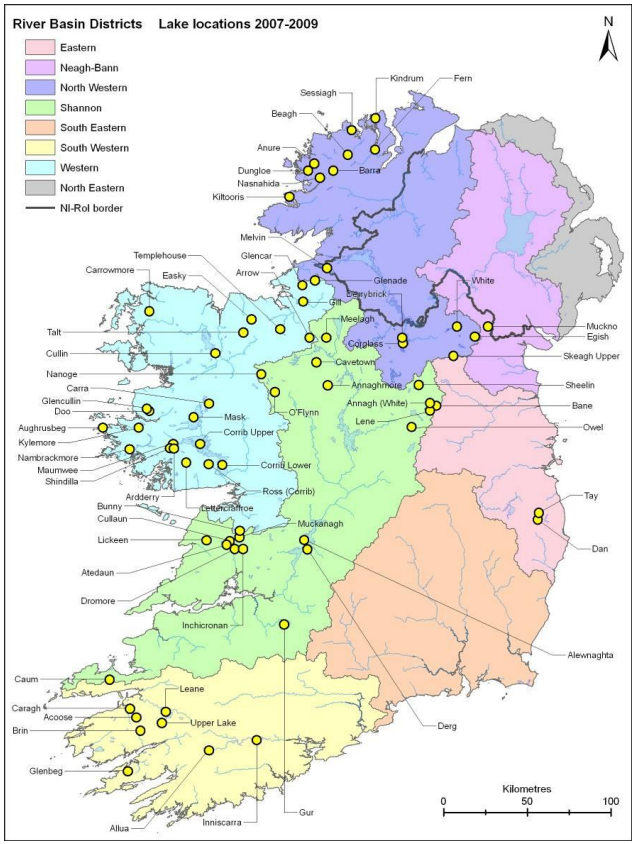
- **2007 to 2009:** 68 SM + 2 OM lakes
- **2010 to 2012:** 77 SM + 3 OM lakes
- **2013-2015:** 68 SM + 5 OM lakes
- **2016-2018:** 44 SM + 23 OM/other lakes
- **2019-2021**: 6SM + 12 OM/other lakes to date

263 SM surveys + 45 OM/other surveys to date

TOTAL: 301 surveys have been assigned fish status

Most SM lakes = 3-5 surveys to date

Requirement to survey every 3 years, but in 2014 we began to push some lakes out to 6 years.



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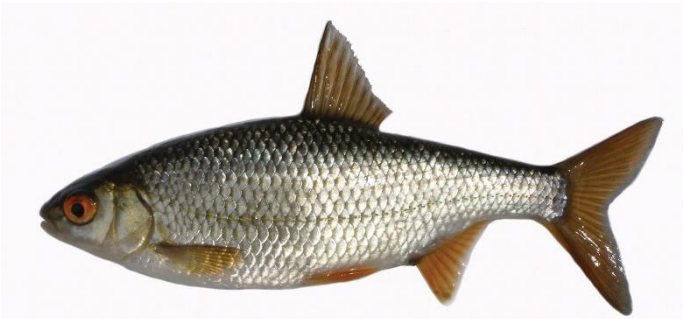
WFD Fish Monitoring – Progress to Date 2007-2019 contd.



128,945 Individual fish

17 species recorded, plus 3 hybrids

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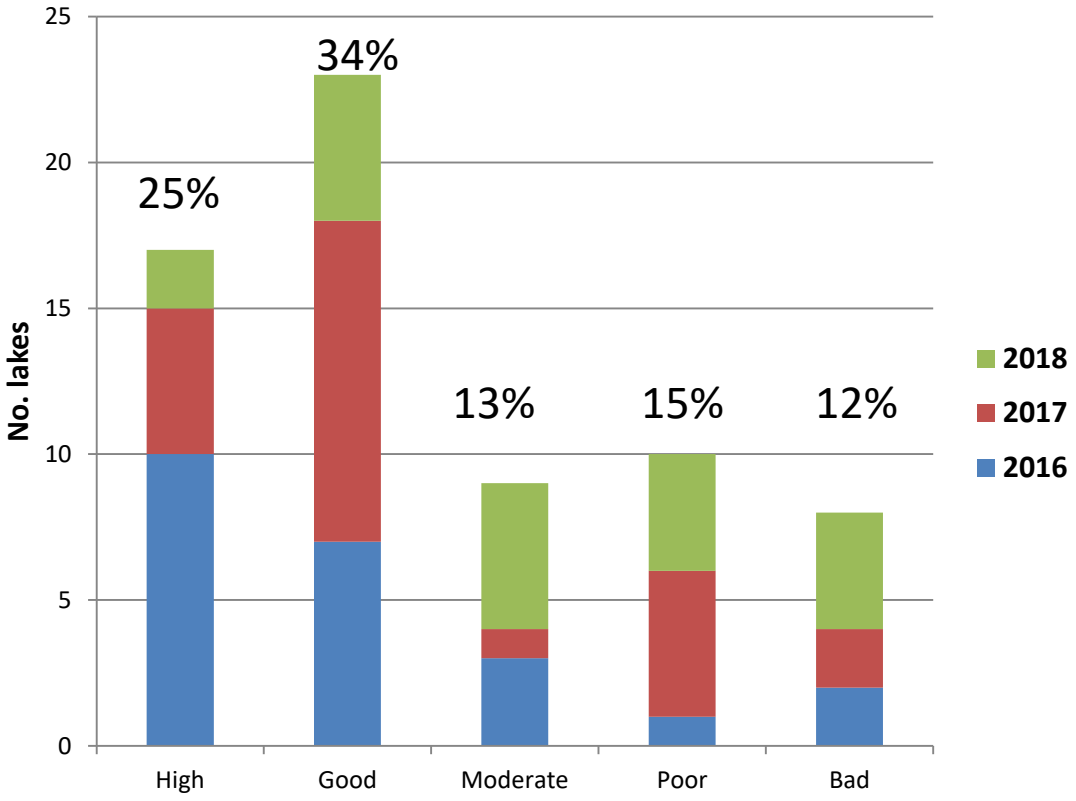
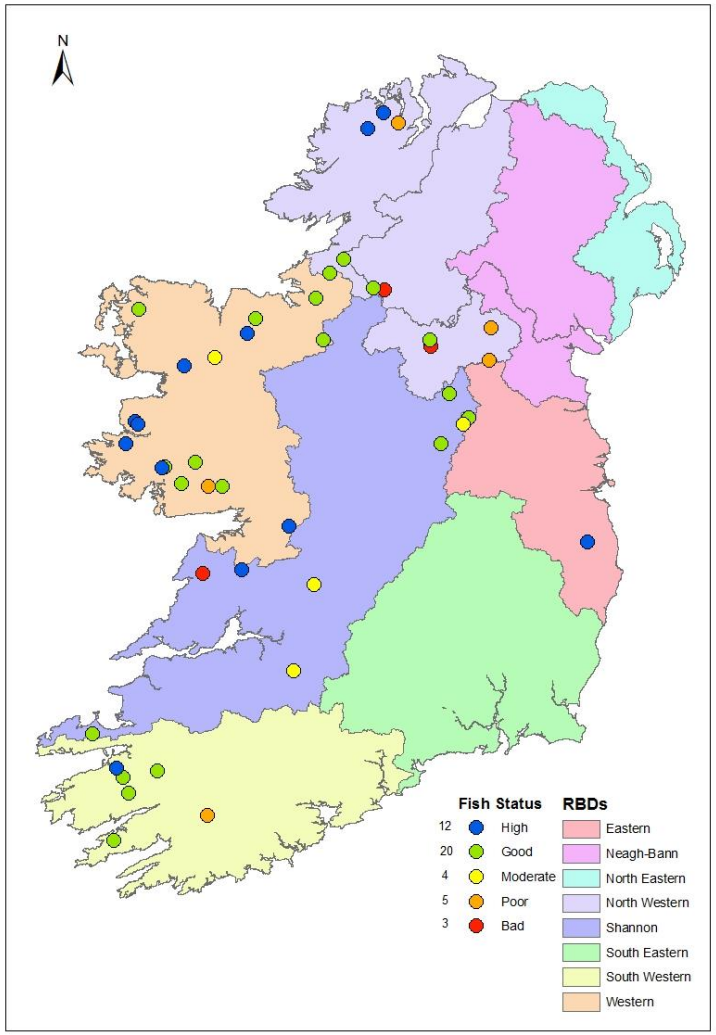
Eel most common species

WFD Fish Monitoring – Trends in fish status

2016-2018: 66 lakes (44 SM + 19 OM lakes + 3 others)





59% Good or High

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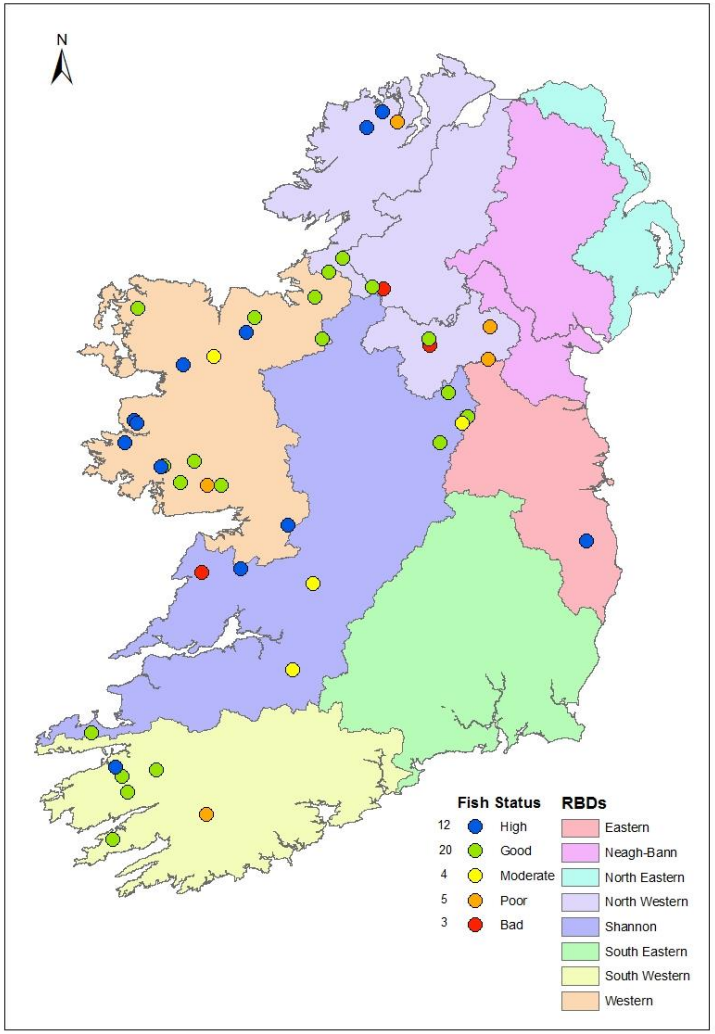
WFD Fish Monitoring - Trends in fish status contd

Status class trend

- 53 (62%) = no recent change (many stable)

- 18 (21%) = improved
  - 13 = 1 class change
  - 5 = 2 class change

- 15 (17%) deteriorated
  - 13 = 1 class
  - 1= 2 classes
  - 1= 3 classes



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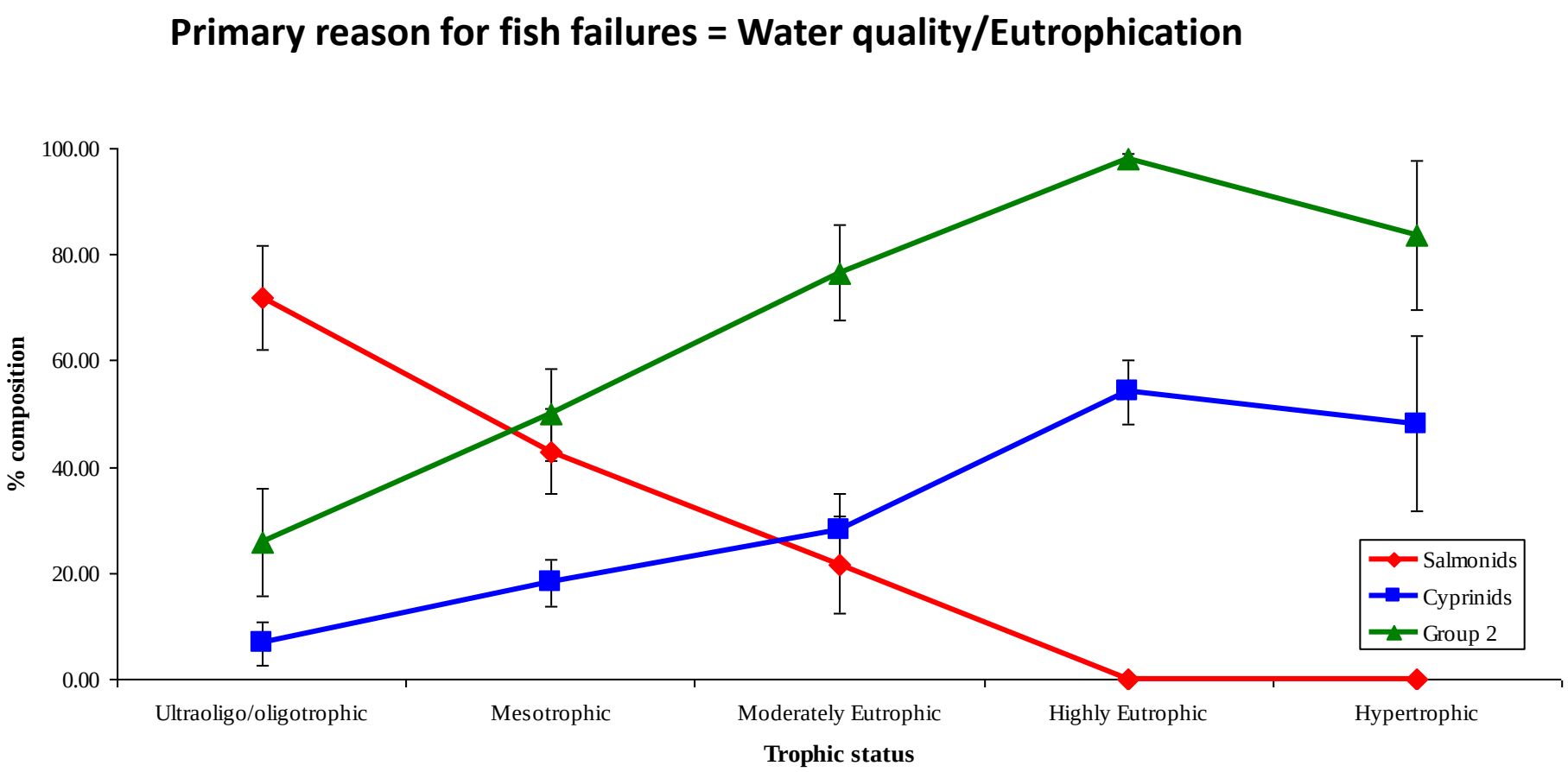
WFD Fish Monitoring – Reason for Failures



There is a change in the structure of the fish community in lakes in relation to a decrease in water quality

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WFD Fish Monitoring – Reason for Failures contd.

Pressure: ***Fish Translocations or "Who put what where when effect" (unauthorised stocking)***

Roach: Confined to Munster Blackwater 'till 1960's Widely distributed throughout Ireland since 1970 – classified as invasive. Not present in all waterbodies.

Perch: Present in some waters since Norman times. Not present in all waterbodies

Pike: Present in some waters since Norman times. A second cohort may have arrived earlier. Not present in all waterbodies.

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Case study – Ardderry and Shindilla Loughs

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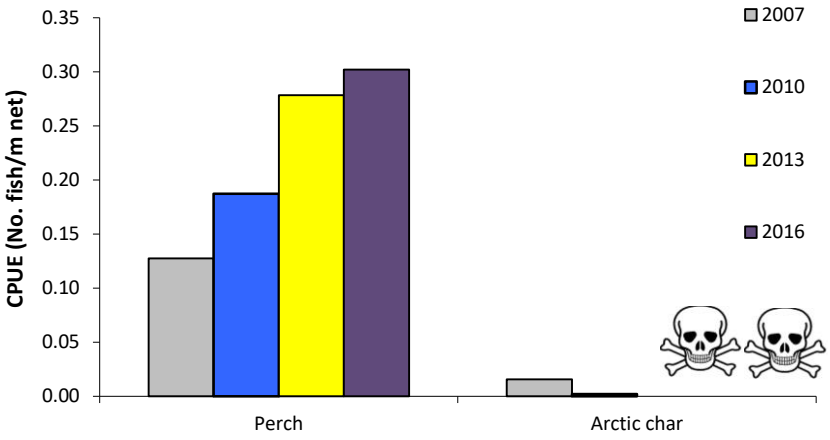
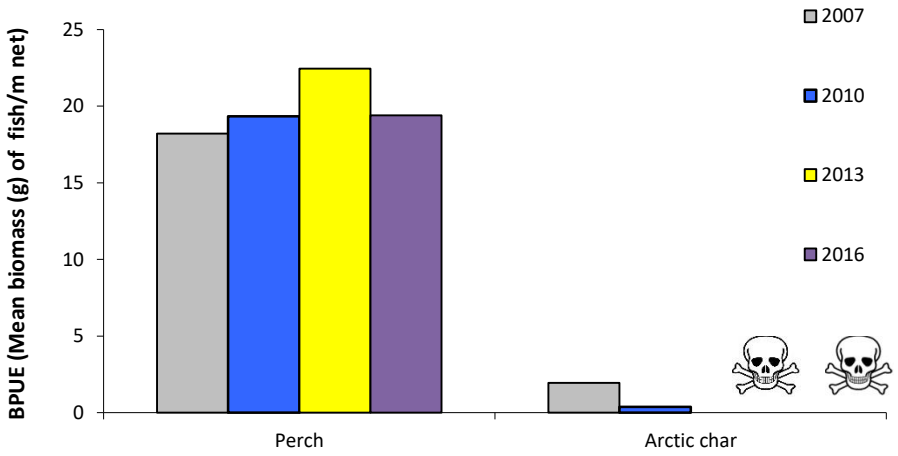
Case study – Ardderry and Shindilla Loughs contd.

Ardderry Lough – perch ↑ Arctic char ↓ to extinction?





Status=GOOD 2007 (0.657), 2010 (0.724), 2013 (0.575), 2016 (0.628), 2019 (?)

BUT – type specific indicator species missing

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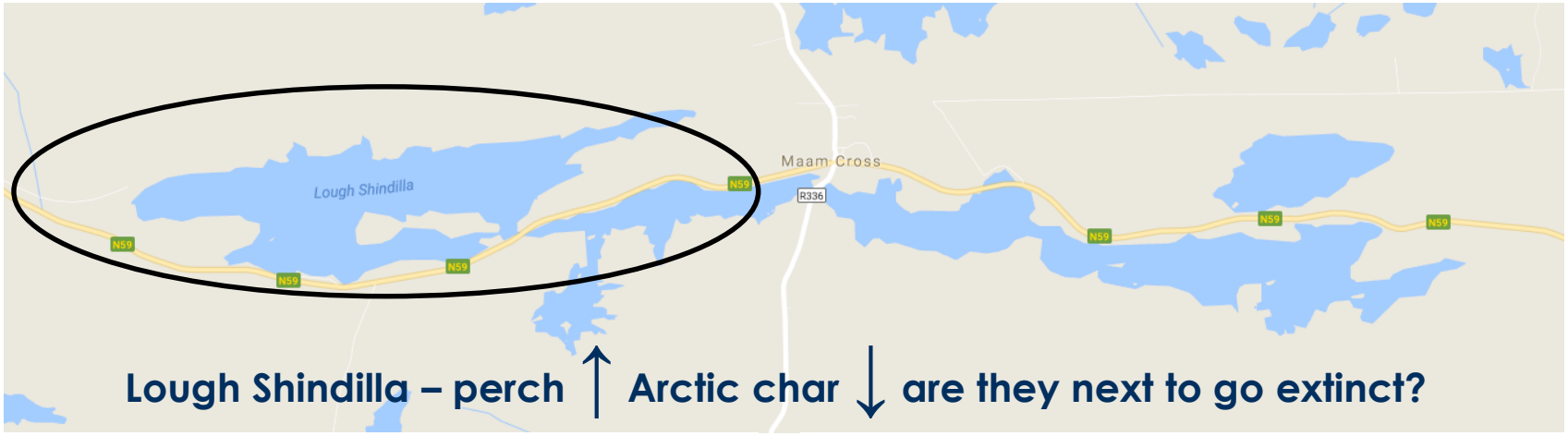
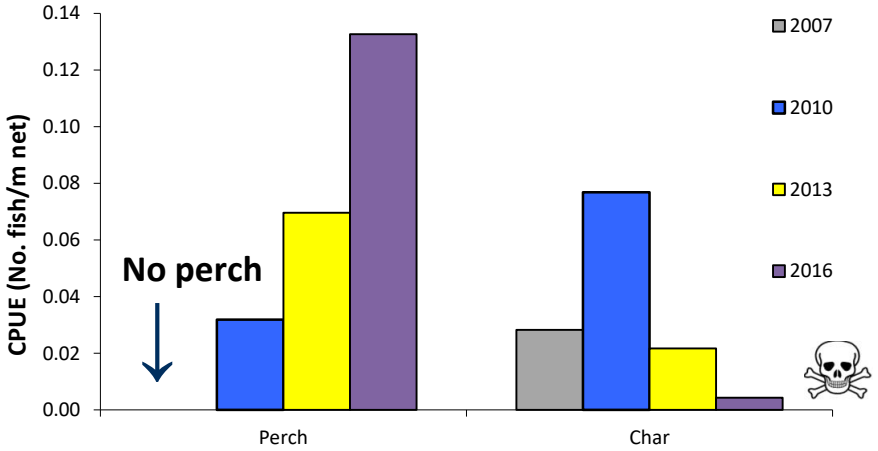
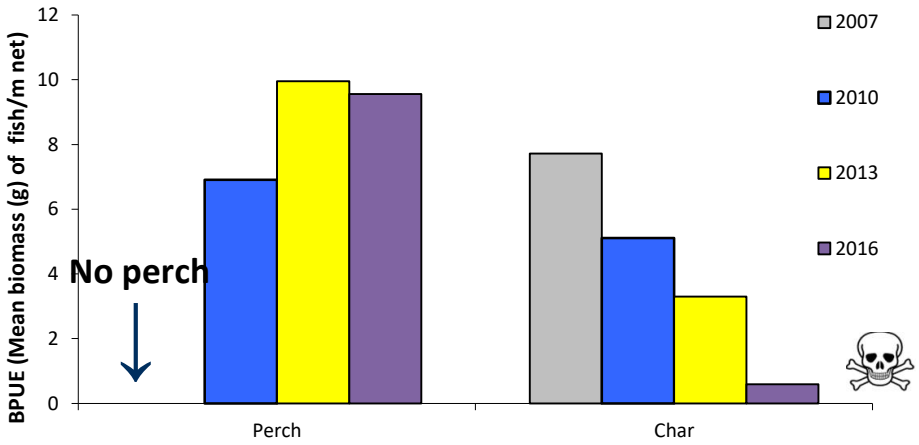
Case study – Ardderry Lough and Lough Shindilla







Status = High 2007 (0.803), 2010 (0.818), 2013 (0.838), 2016 (0.848), 2019 (?)

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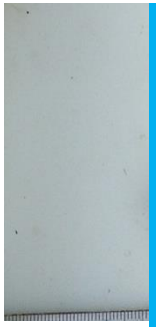
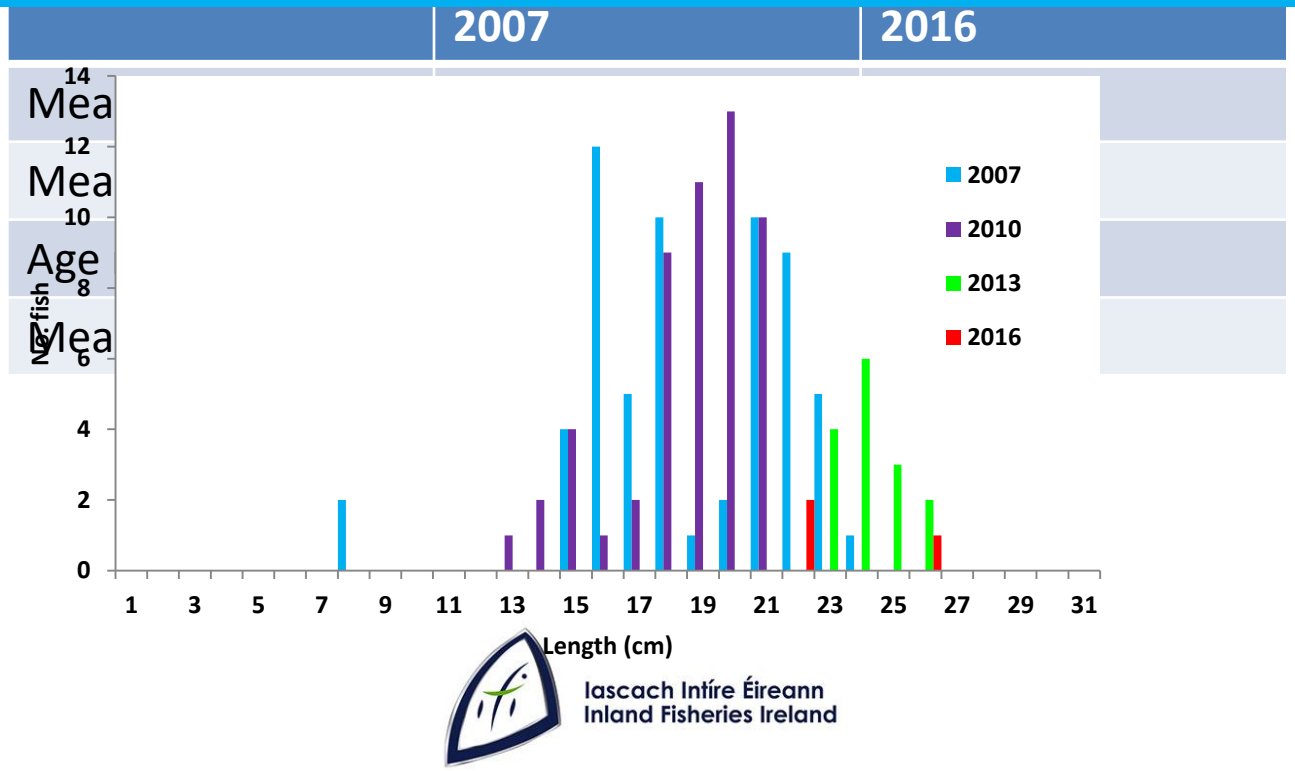
Char – Lough Shindilla 2007 Vs 2016 contd.



2019 – No Arctic char captured!!!!!!!!!!

Extinct or the population is so small that it is not detectable using netting techniques

What effect will this have on lake status?



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Arctic char coexistence

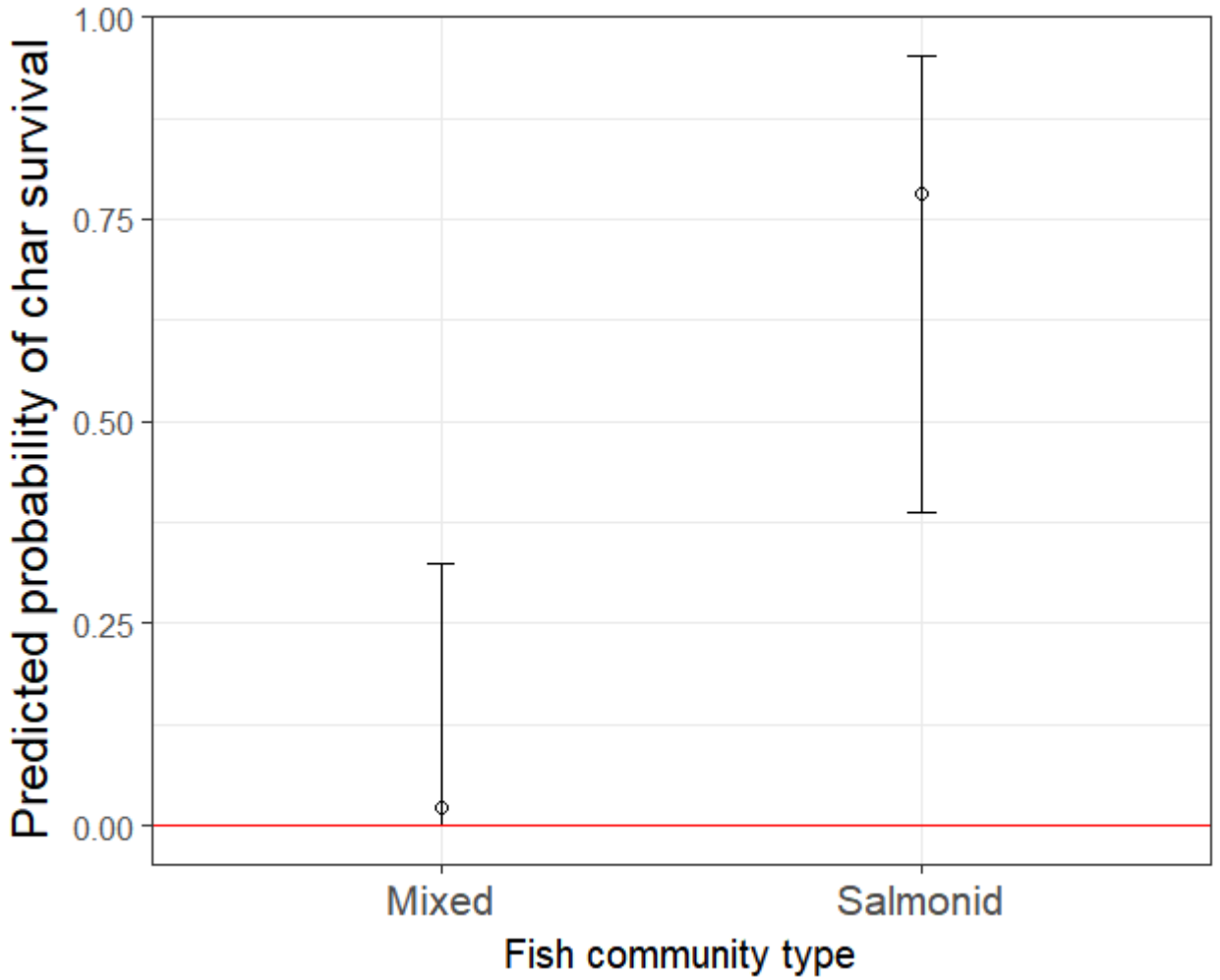
Best fitting model included community type ($P<0.01$) and maximum depth ($P>0.1$)

Lake fish community (salmonid or mixed)

75% probability of char survival in salmonid lakes (Max D>40m)

Char are more vulnerable to extinction in shallower lakes with mixed fish communities

13 lakes at risk from colonisation (10=4 (high and imminent risk)

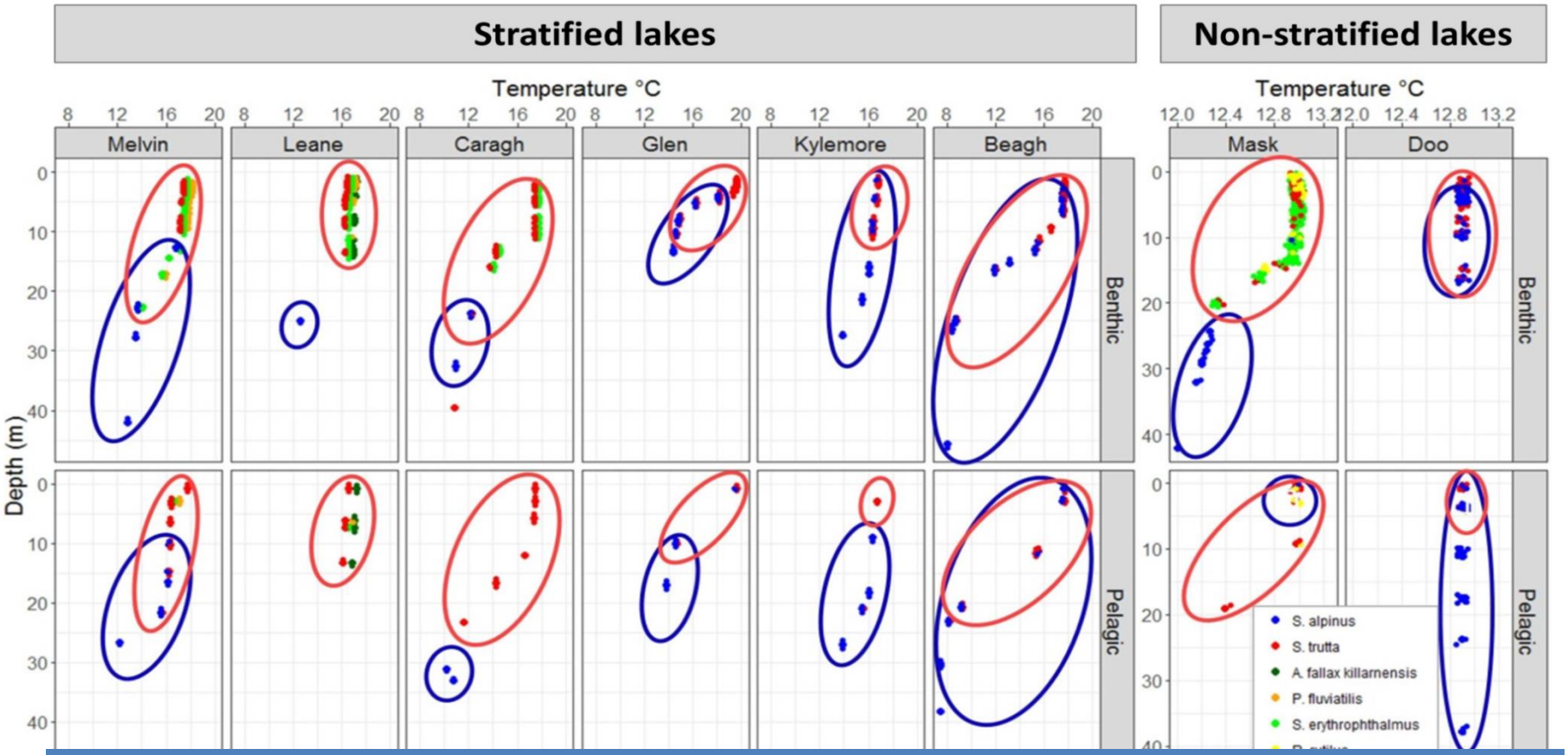


Connor, L., Shephard, S., Rocks, K., Kelly, Fiona (2019) Potential climate change impacts on Arctic char *Salvelinus alpinus* L. in Ireland. Fisheries Management and Ecology,

Arctic char vs non-natives

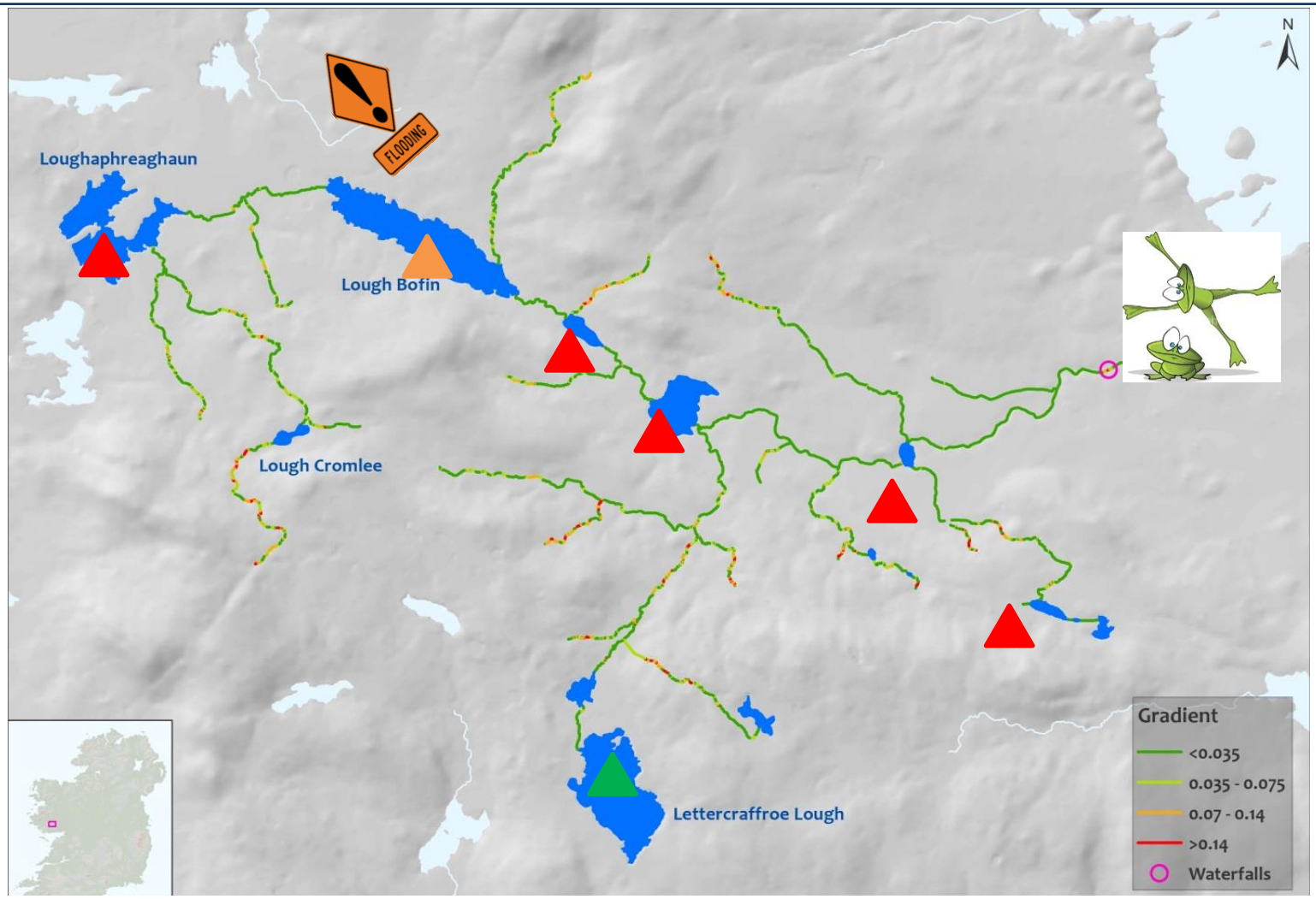
Non-native species and warming temperatures have significant negative effects on Arctic char in Irish lakes

Arctic char use all available thermal habitat and demonstrate random co-occurrence with brown trout in native dominated lakes. But thermal habitat use is narrower and they demonstrate negative co-occurrence with all species in non-native dominated lakes



McCaffrey, E.M., Shephard, S., Kelly, F.L., Kelly-Quinn, M. (2019) Non-native species and lake warming negatively affect Arctic char *Salvelinus alpinus* abundance; deep thermal refugia facilitate co-existence. *Journal of Fish Biology*, **94 (1)**, 5-16.

Case study: Owenriff example



Introductions of pike are likely to have catastrophic effects on Brown trout stocks in small isola[illegible]h and

McLoone, P., Shephard, S. Kelly, F.L. (2019) Coexistence of pike *Esox lucius* and brown trout Salmo trutta in Irish lakes. Journal of Fish Biology,

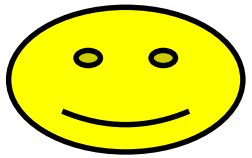
IFI's Climate Change Mitigation Research Programme (CCMRP)

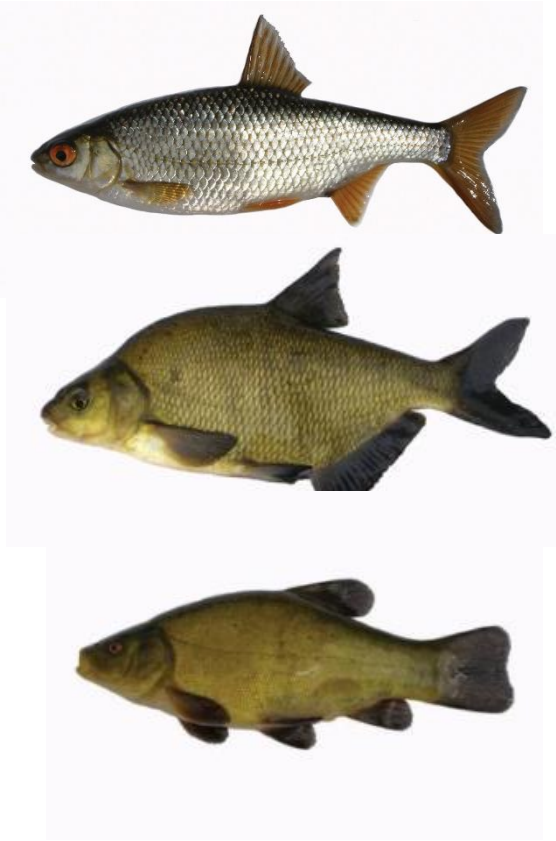
Climate change refers to shifts in ambient temperature regime, and to changes in the frequency and intensity of extreme weather and climate events

Higher temperatures, droughts, floods and sea level rise

-ive

+ive





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IFI's Climate Change Mitigation Research Programme (CCMRP) contd.

CURRENT

Index catchments
5 areas of Ireland to represent continental effect

Lakes and Rivers

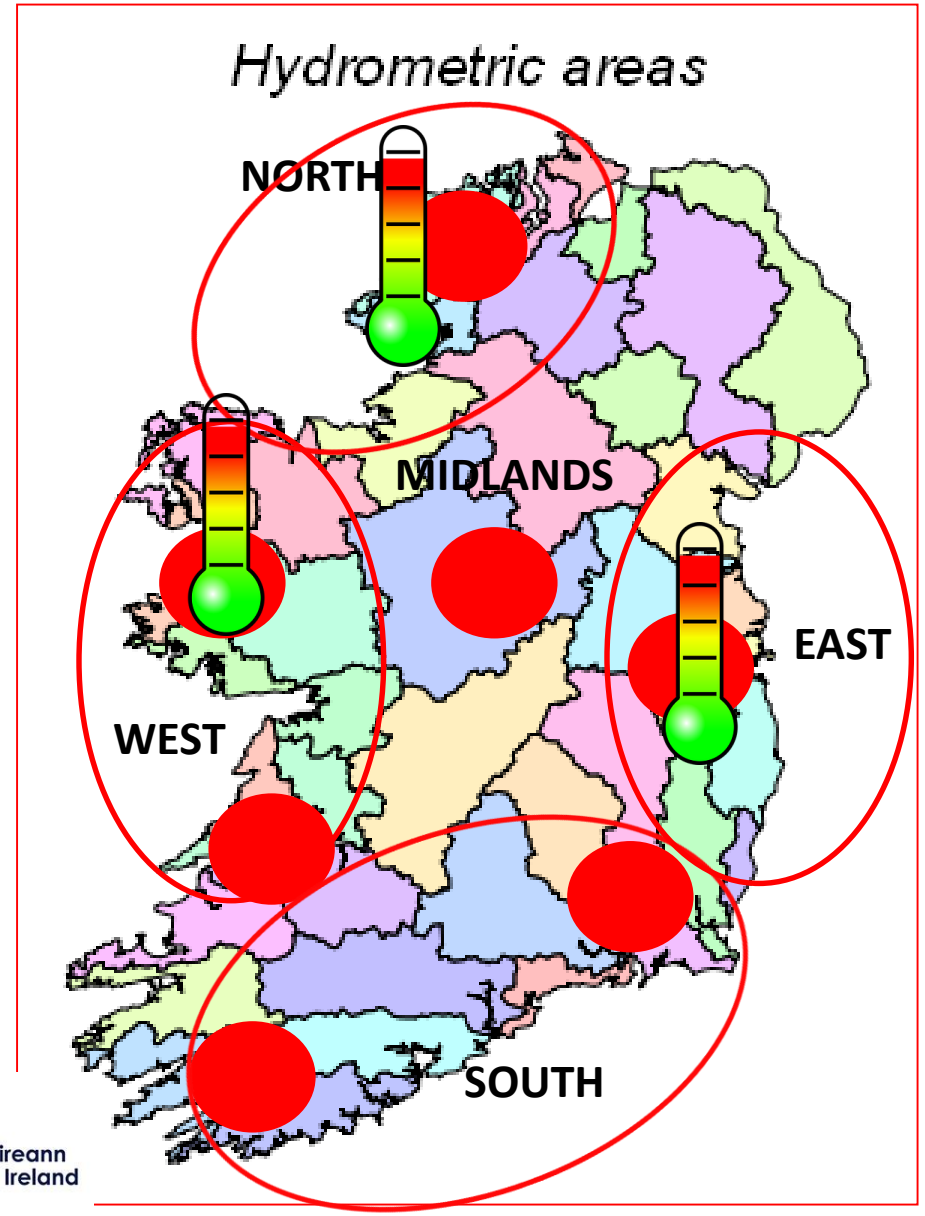
Low tech option (TW loggers every 2m)

Temperature, weather variables and other parameters

Identify high risk areas for fish

Identify priority areas for mitigation measures for fish

Identify mitigation measures



LAKES

CURRENT

Index catchments
5 areas of Ireland to represent continental effect

Lakes and Rivers

Low tech option (TW loggers every 2m)

Temperature, weather variables and other parameters

Identify high risk areas for fish

Identify priority areas for mitigation measures for fish

Identify mitigation measures

FUTURE – 2020 on

Establish an intelligent sensor array in index catchments to provide real-time high frequency data to inform climate change mitigation measures for fish in Ireland.

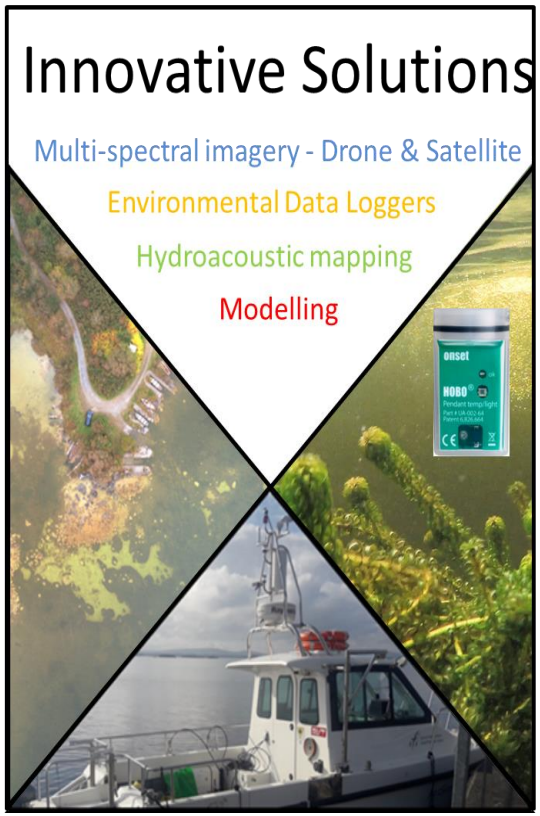
LAgarosiphon **R**esearch on Lough **C**orrib - **LARC**

Aims:

- To establish the current distribution of *Lagarosiphon major* in Lough Corrib
- Trial innovative methods to survey *Lagarosiphon major*,
- Gain a better understanding of the influence of habitat and environmental factors on *Lagarosiphon major*

Progress to date

- Surveys began in October 2018
- 200 sites - environmental factors and mapping its distribution.
- Temperature loggers installed at 36 sites in December 2018 and are recording continually.
- In-depth surveys are being conducted in two bays
- Multispectral imagery



Report due in January 2020

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THANK YOU

ANY QUESTIONS?

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