Jun 21st, 4:00 PM - 4:15 PM

Ocean Connections: Silver Eel (Anguilla anguilla) Production, Spawner Biomass Escapement and Mitigation of Hydropower Eel Mortalities in the River Erne, Ireland

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SILVER EEL (*Anguilla anguilla*) PRODUCTION, SPAWNER BIOMASS ESCAPEMENT AND MITIGATION OF HYDROPOWER EEL MORTALITIES IN THE RIVER ERNE, IRELAND.

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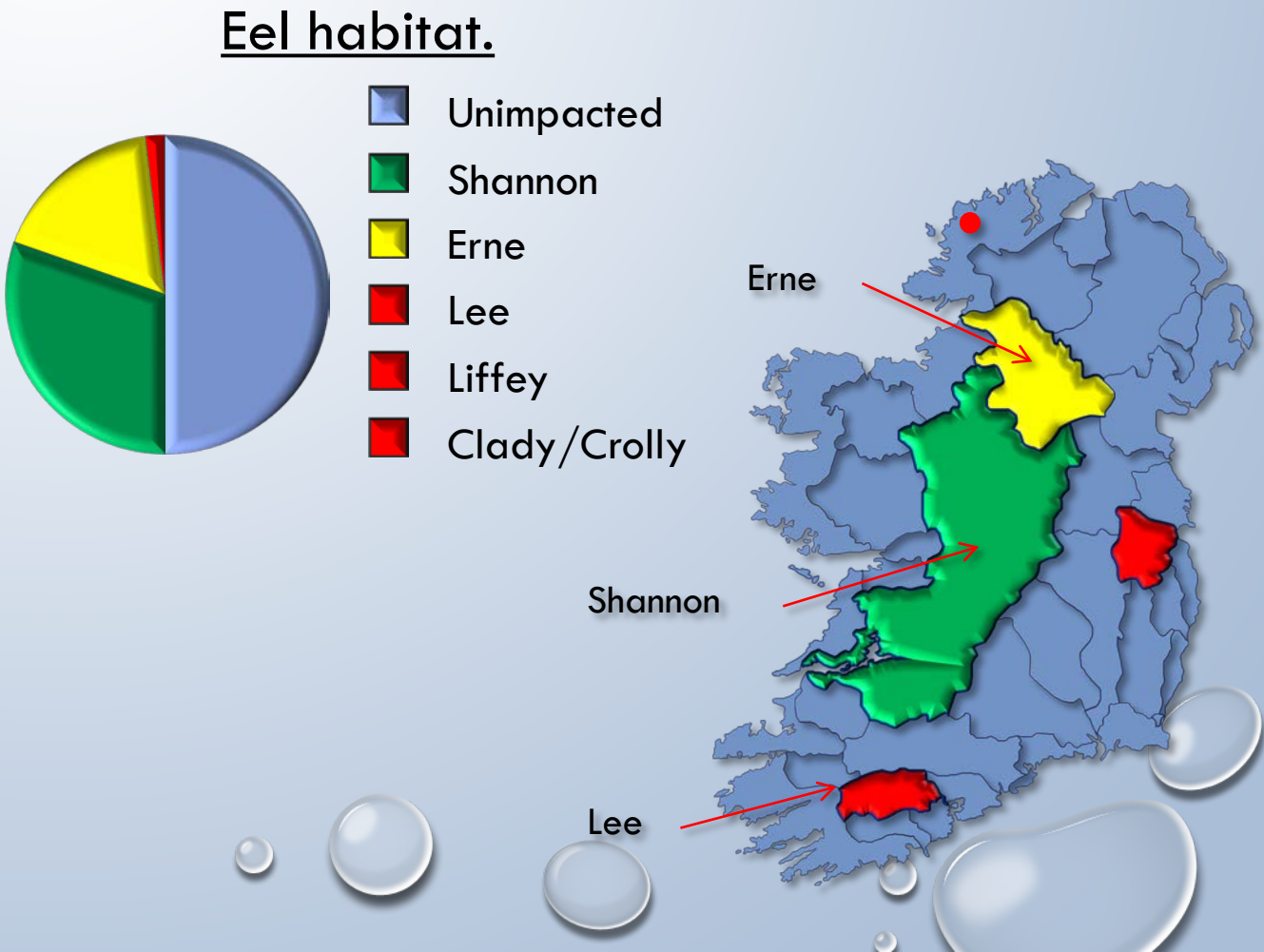
Fish Passage 2016

IRELAND'S EEL MANAGEMENT PLAN

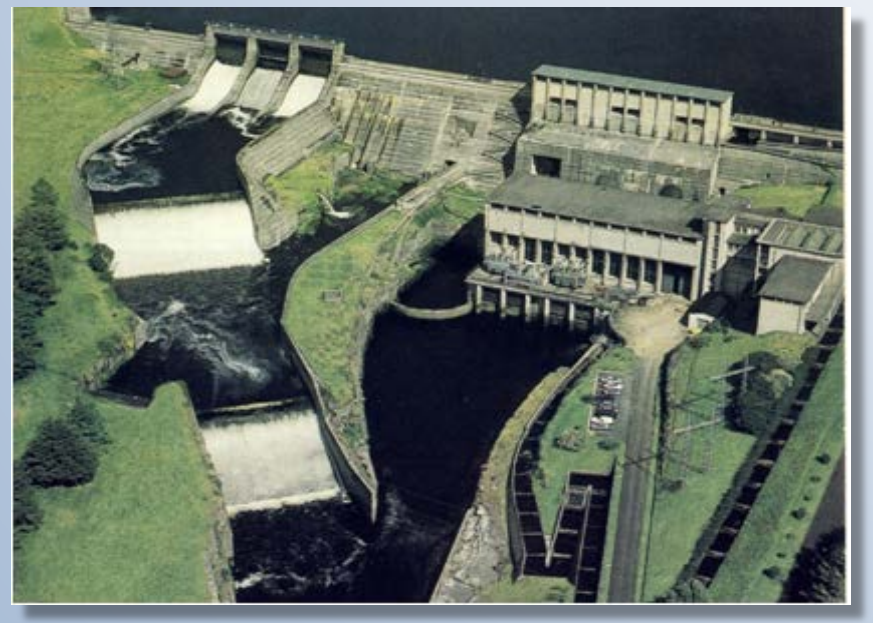
- **EU EEL STOCK RECOVERY PLAN (2007) REQUIRES MEMBER STATES TO IMPLEMENT EEL MANAGEMENT PLANS (EMP) THAT RESTORE SPAWNER ESCAPEMENT TO 40% OF PRISTINE LEVELS.**

- **IRELAND HAS NATIONAL AND RIVER BASIN DISTRICT EMPS SINCE 2009WHICH REQUIRE:**
  - FACILITATION OF JUVENILE RECRUITMENT
  - CLOSURE OF EEL FISHERIES
  - MITIGATION OF HYDROPOWER
  - BIOSECURITY RESTRICTIONS ON ELVER STOCKING
  - PROTECTION OF EEL HABITATS

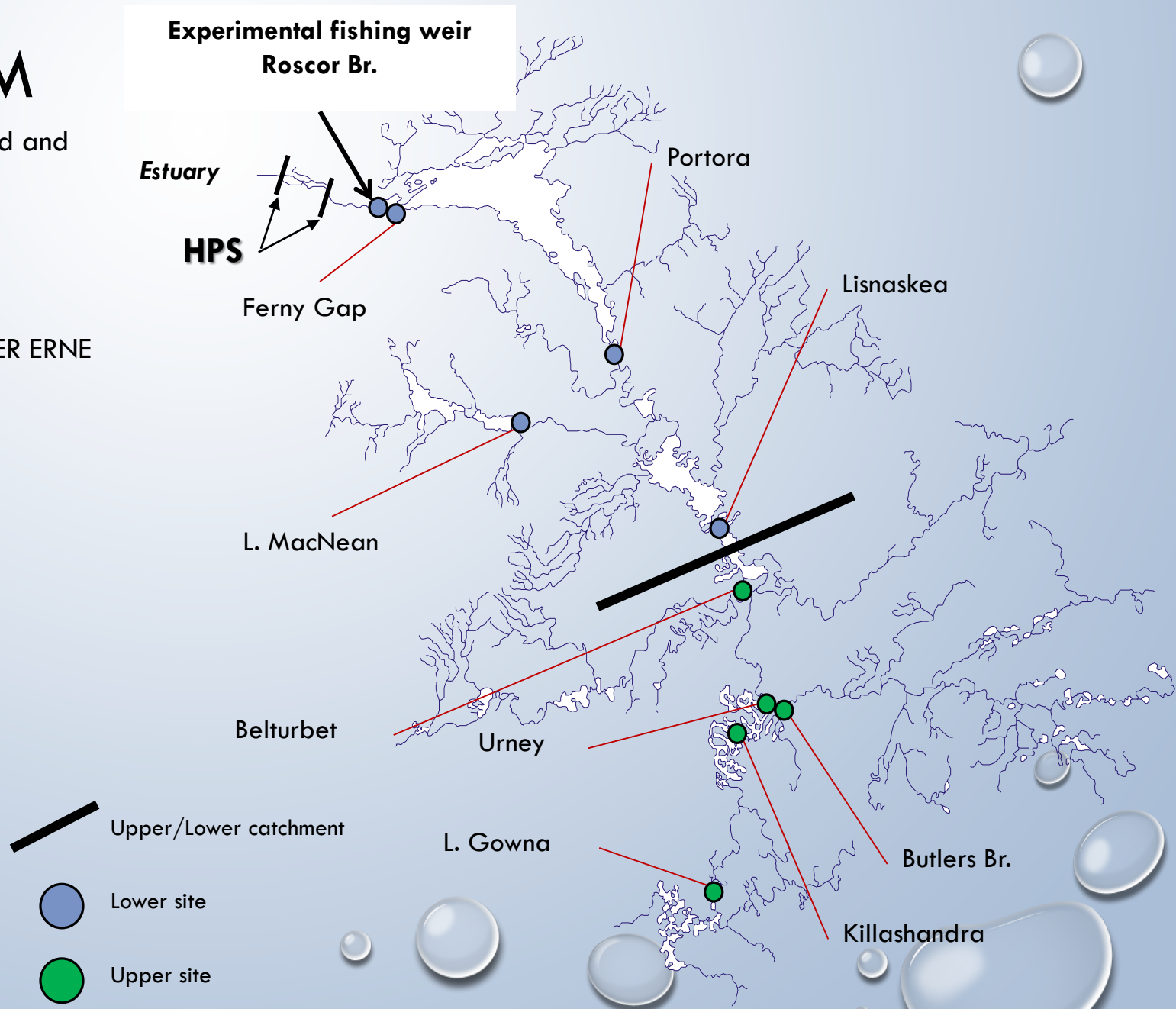


RIVER ERNE SYSTEM

- **TRANS-BOUNDARY** RIVER SYSTEM (Republic of Ireland and Northern Ireland)
- CATCHMENT AREA: **4,375**KM^2
- MEAN ANNUAL DISCHARGE: **94**M^3S^{-1}
- TWO HYDROPOWER STATIONS (HPS) IN LOWER RIVER ERNE

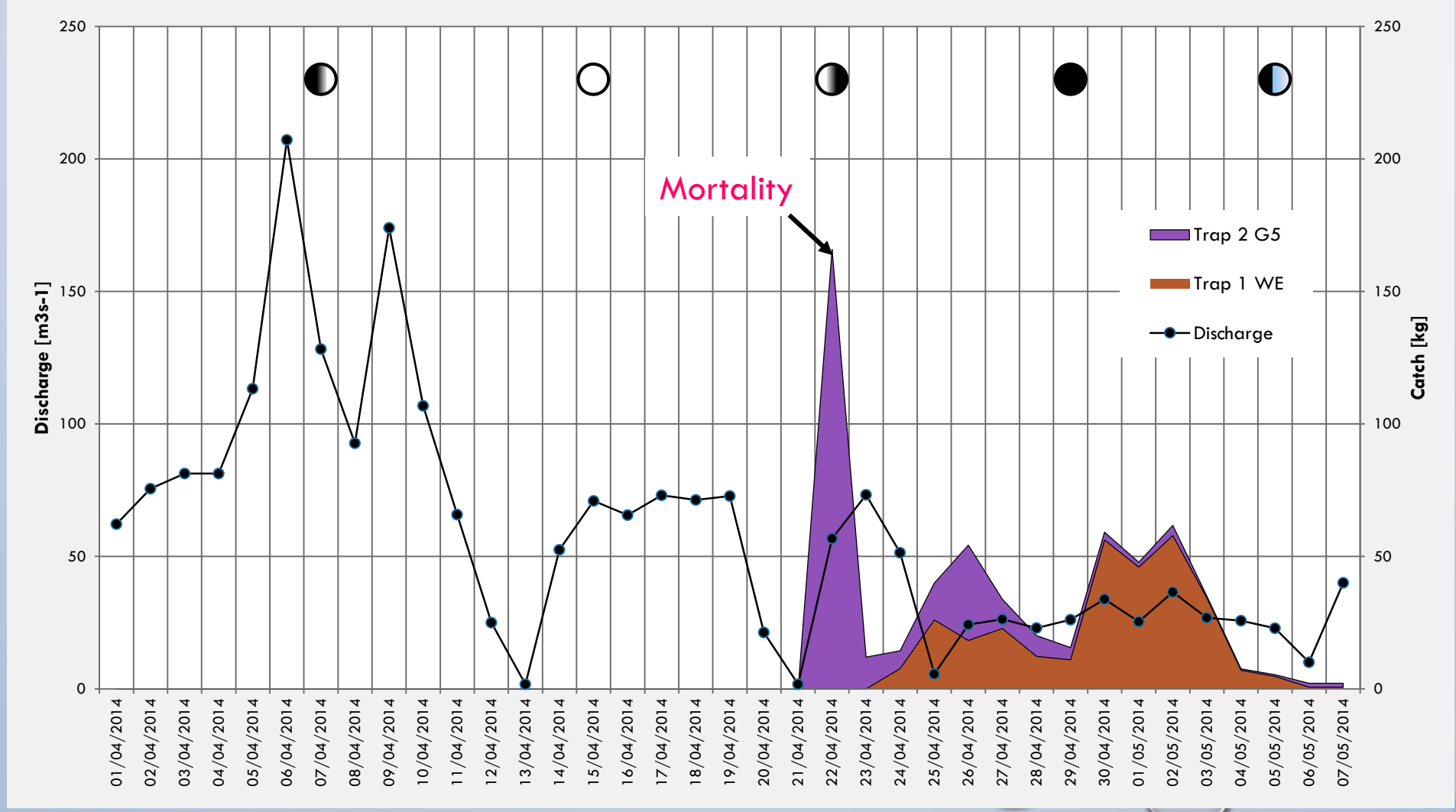


Cathaleen's Fall HPS



Environmental conditions and upstream elver migration (trap catches) April /May 2014

115kg mortality 22/4/2014



Review of Erne elver mortality by the Standing Scientific Committee on Eel (SSCE)

SSCE CONCLUDED THAT 2014 ERNE ELVER LOSSES = 12,955Kg SILVER EEL

Limitations of this methodology for River Erne :

- (1) Parameters derived for modelling eel populations in continental Europe;
- (2) Mitigation involved immediate increase in spawner biomass escapement, though lost elvers would have taken c 19 years to reach silver female stage;
- (3) Increased silver eel captures in winter prior to mortality event were not fully credited in calculations.

Calculation of Silver Eel Equivalent (ICES Model)

The ICES Silver Eel Equivalent (SEE) method works on the basis of the following:

- 80% mortality occurs at settlement, typically between pigment stages VIAII and VIAIII.
- An instantaneous lifetime mortality of 0.14 yr-1 (Dekker, 2000)
- 50:50 sex ratio with males maturing at 11 years and 114g mean weight and females maturing at 19 years and 679.5g mean weight

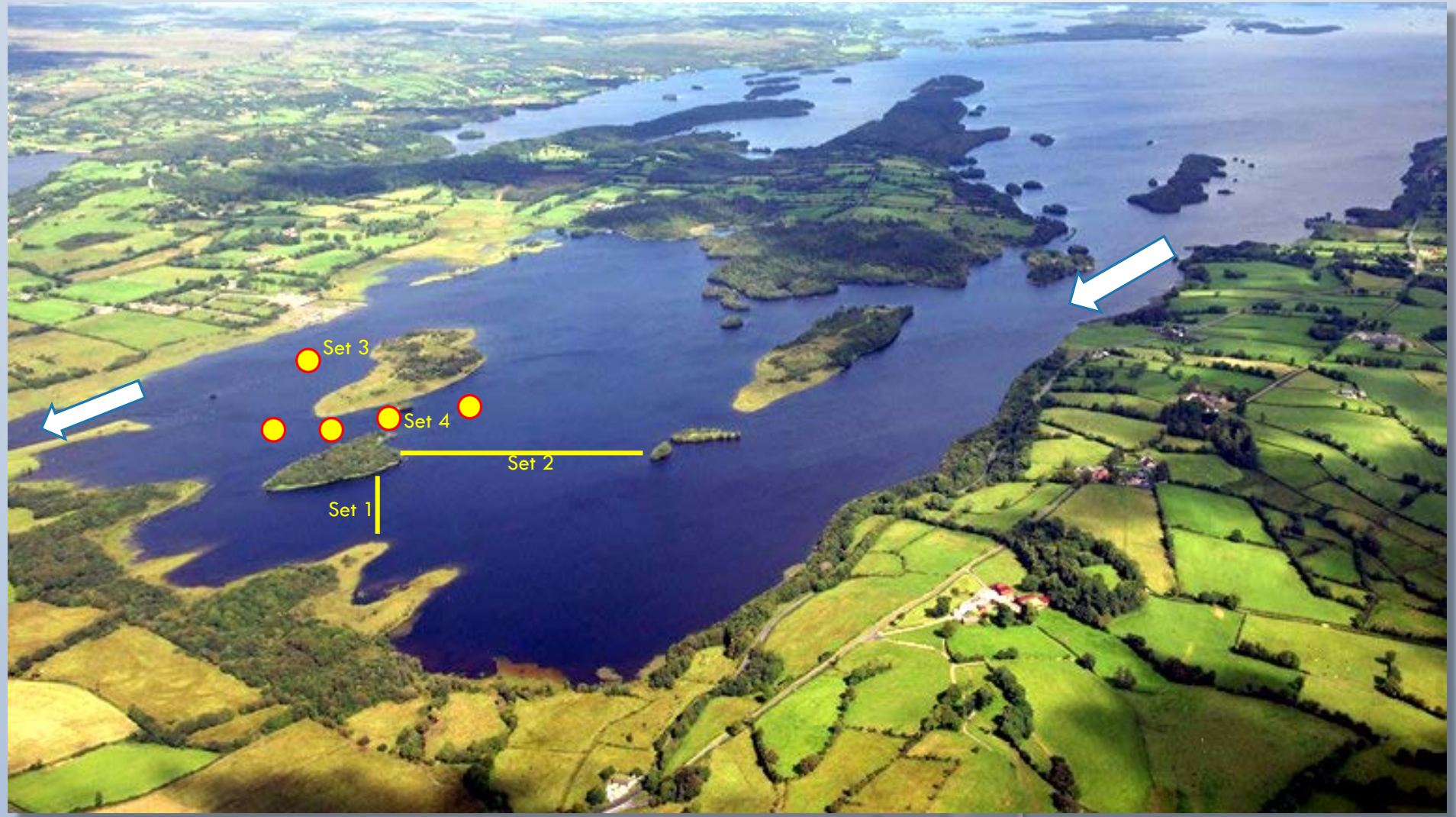
MITIGATION MEASURES FOR LOSS OF 115KG OF RIVER ERNE ELVERS

- 8450KGS OF COMMERCIAL SILVER EEL CATCHES TO BE PURCHASED FOR IMMEDIATE RELEASE TO SEA.
- TRAP AND TRANSPORT ON THE ERNE CATCHMENT TO BE INCREASED BY 17,500KGS.
- IN RECOGNITION OF THE QUANTITY (12,000KGS) ABOVE 3-YEAR ROLLING AVERAGE (50%) TARGET TRANSPORTED (POST EVENT) IN 2014 6,500KGS OF THIS TO BE COUNTED AS PART OF ADDITIONAL QUANTITY
- THE AGREED NET ADDITIONAL 11,000KGS TO BE ACHIEVED BY EXCEEDING THE ANNUAL TARGETS (SET BY SSCE) FOR T&T UNTIL SUCH TIME AS THE NET ADDITIONAL QUANTITY (11,000KGS) HAS BEEN EXCEEDED (WITHIN A MAXIMUM PERIOD OF 4 YEARS)
- ESB, HAVING ALREADY UPGRADED EEL TRAPS TO BEST AVAILABLE, WILL KEEP OPERATIONAL MATTERS UNDER REVIEW IN THE LIGHT OF FUTURE DEVELOPMENTS IN TECHNOLOGY.

ROSCOR BRIDGE FISHING SITE

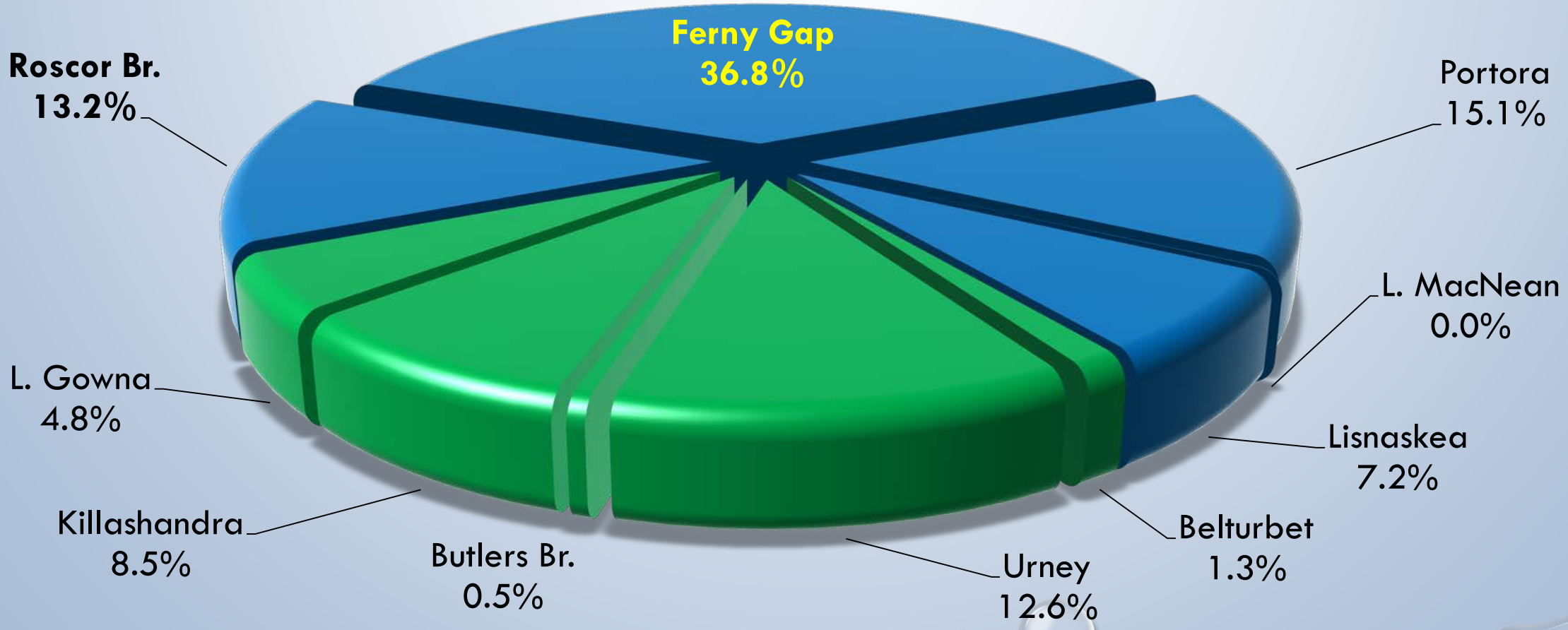
- Lowermost silver eel fishing site on the River Erne
- Three coghill nets attached to the bridge pillars
- Scientific monitoring site
- Annual mark-recapture estimation of biomass silver eel eels migrating downstream

FERNY GAP FISHING SITE

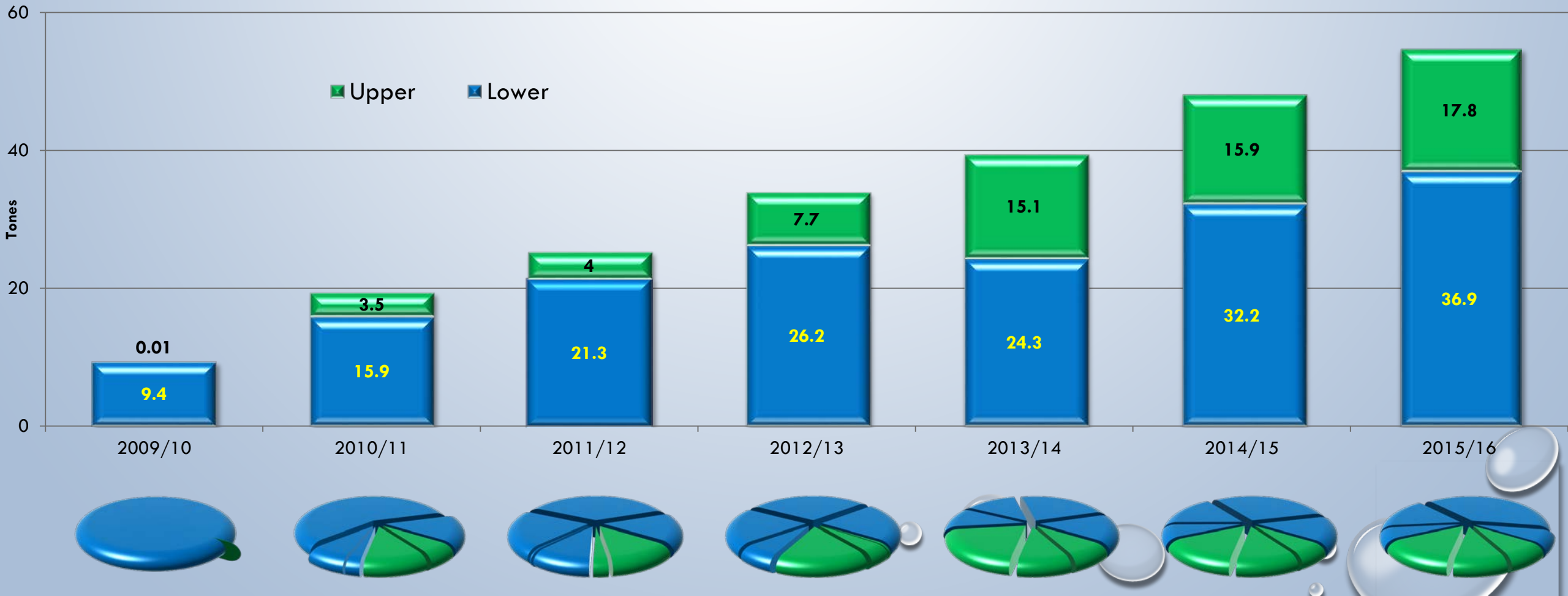


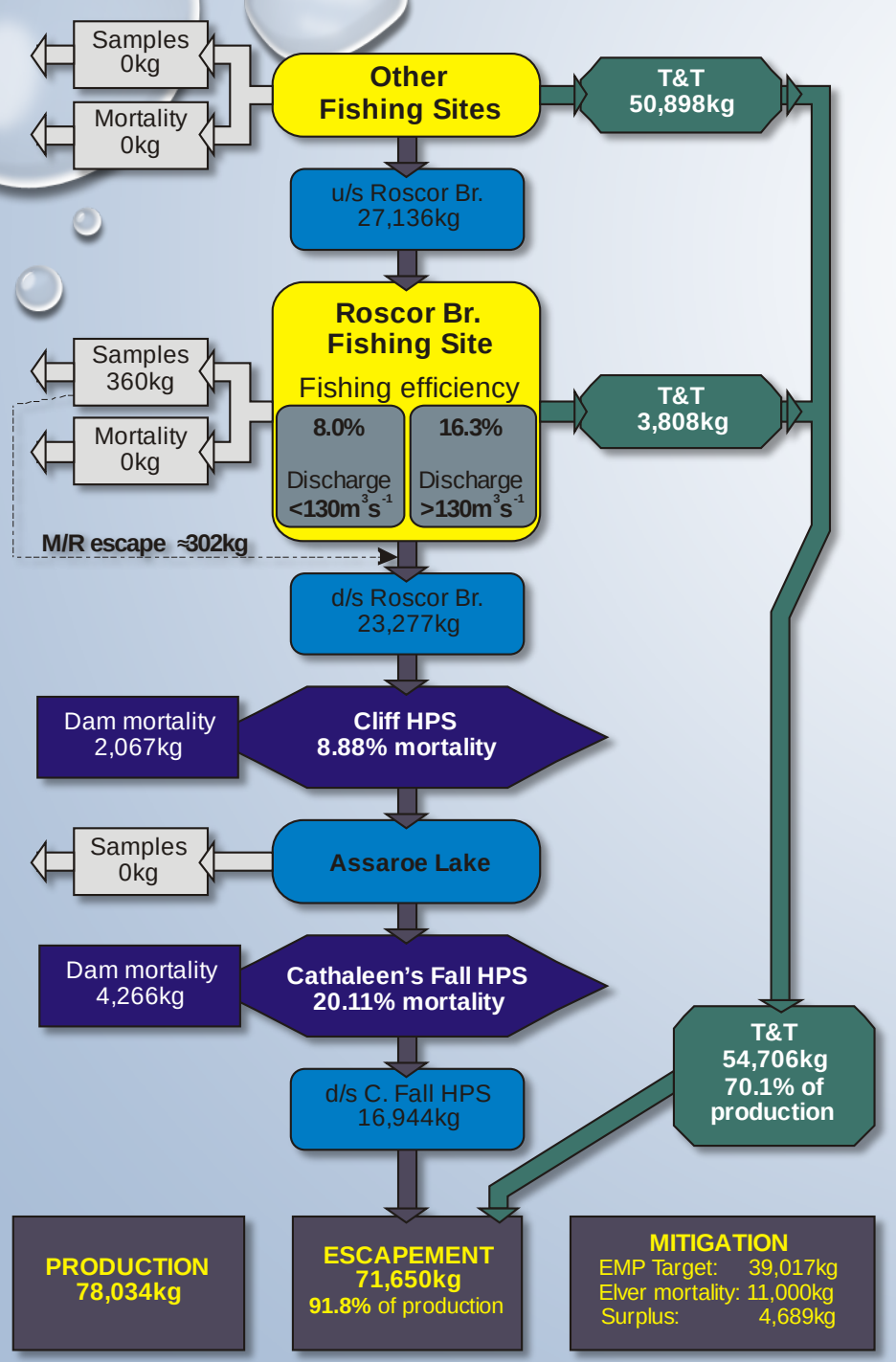
Complex lake outlet fishing site (Lower Lough Erne): 4 sets of nets.

CUMULATIVE CATCH PER ERNE SITE (2009 – 2015 SEASONS)



Development of the River Erne T & T: Upper versus Lower catchment fishing site catches





2015 / 2016 Season

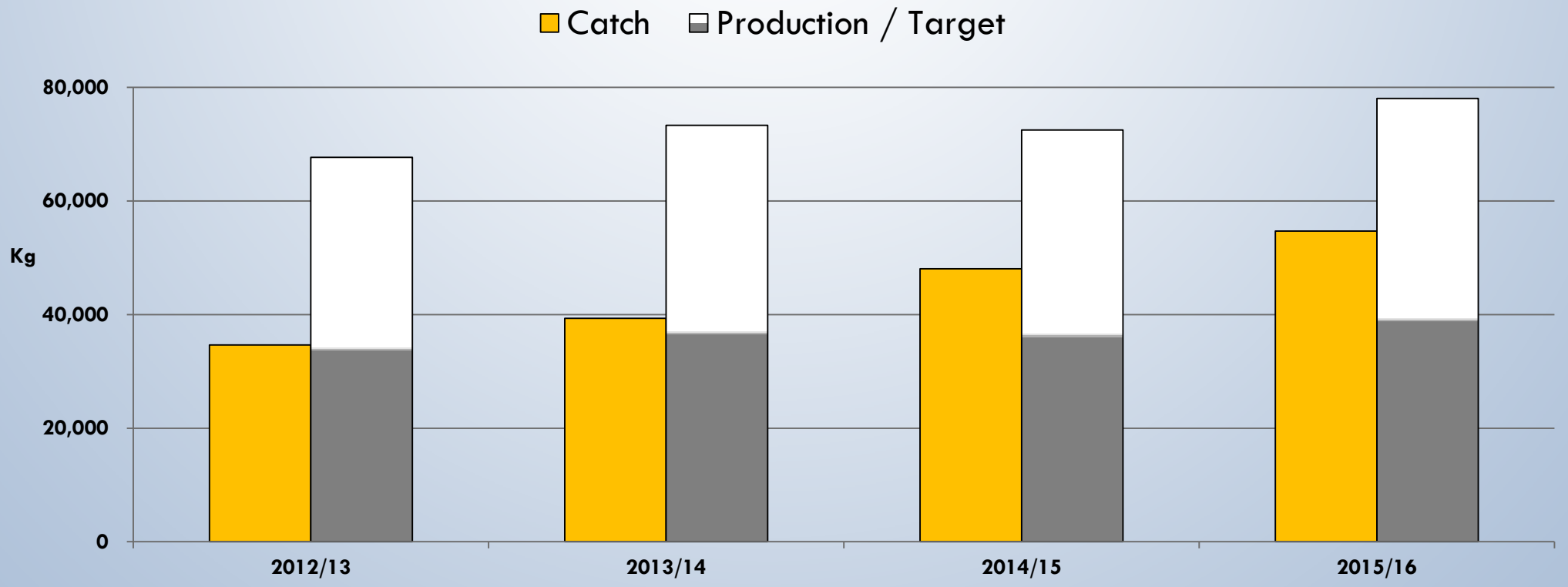
- PRODUCTION = TOTAL T&T + BIOMASS MOVING DS OF ROSCOR BRIDGE (78,034KG)
- T&T = 70.1% OF PRODUCTION
- DAM MORTALITY CALCULATED USING PREVIOUS TELEMETRY DATA FOR VARIOUS FLOW REGIMES (CUMULATIVE DAILY ESTIMATES) = 6333kg (HIGH SPILLAGE/LOW GENERATION)
- SPAWNER BIOMASS ESCAPEMENT = 91.8% of PRODUCTION
- MITIGATION : EMP TARGET (50 % of P) plus extra 11,000 kg plus extra River Bann release, = SUCCESS and 4,689 surplus

Release of commercial silver eel catches (8540kg) on the River Bann in Northern Ireland

- Two silver eel fishing weirs are still fished commercially on the River Bann
- Lough Neagh Eel Fishermen's Cooperative provided 8540kg for release to the estuary
- These silver eels would otherwise be sold for human consumption in the Netherlands

River Erne T & T Catches

(versus a 50% of Silver Eel Production Target)



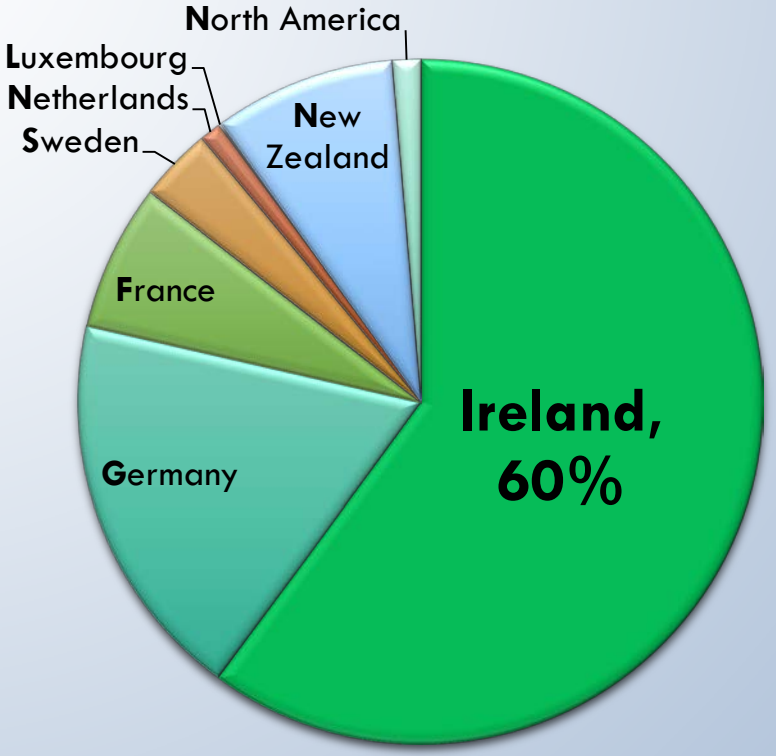
Silver Eel T&T
Summary Statistics (to 2014)

Post EMP T&T (254t)
67% of European total
66% Females

HPS Mortality Reduction

T&T (254t) saved c. 53t

Over 190 billion ($190x10^9$) eggs*



N. B.
Poor eel quality in Europe limits potential contribution to spawner population

* **R. MacNamara** and **T.K. McCarthy 2012.** Size-related variation in fecundity of European eel (*Anguilla anguilla*).
ICES Journal of Marine Science, 69: 1333-1337.

Overview and Conclusions

1. Elver mortalities can be expensive !

2. 115kg River Erne elver mortality : Release of silver eels (8450Kg)from a commercial fishery; increased trap and transport of silver eels (17,500Kg) past the dams; new elver traps and new monitoring systems.

3. Mitigation was successfully completed in one year (Target <4 years).

4. The successful mitigation involved: high costs, unusually favourable weather and increased fishing effort/ efficiency.

5. Biosecurity concerns prevented restoration using imported elvers (>5% of cost).

Thank You For Your Attention