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Inland Fisheries Ireland

# National Eel Monitoring Programme, 2012-2014

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# Reasons for Programme

- Fulfill monitoring objectives as outlined in National Management Plan
  - Monitoring of recruitment (glass eel / elvers)
  - Monitoring of yellow eel
  - Monitoring of silver eel
- Create a benchmark to evaluate future changes to the eel stock over time and
- allow the outcome of the management actions to be evaluated



# Monitoring Objectives

In 2009 the eel monitoring programme was initiated to carry out the monitoring Objectives in the National Management Plan.

## 2. Estimate silver Eel Escapement (with ESB, NUIG, M.I)

- Barrow, Burrishoole, Erne, Fane, Shannon systems

### 2.1 Estimate silver eel escapement indirectly using yellow eels

- Intensive fyke netting surveys: 13 surveys of 5 lakes, 5 surveys of 2 transitional waters
- 2 catchment wide semi quantitative electrofishing surveys

## 3. Monitor the impact of fishery closure on yellow eel stock structure

- CPUE, Age and growth studies (n = 2,057)

## 4. Inter-Calibration with Water Framework Sampling

- 2011 – 2013: 77 lakes, 198 river sites, 15 transitional waters



# Monitoring Objectives

## 5. Compare current and historic brown eel stocks

- Fisheries Research Centre fyke net surveys 1960's to 1990's.
  - Lough Conn, Derg, Ree, Oughter, Upper Lough Erne, Upper and Lower L. Corrib and Barrow,

## 6. Establish baseline data to track changes in eel stock over time

- Elver monitoring programme
- Intensive Fyke Net surveys & Catchment Wide E/fishing Surveys
- WFD programme

## 7. Evaluate impedance of upstream colonisation: migration and water quality effects.

## 8. Determine parasite prevalence and eel quality

- Distribution, prevalence & intensity of *Anguillicola crassus*, (swimbladder parasite)
- Swimbladder Health Indices – assess damage



# Recruitment



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# Recruitment

- Biological monitoring of traps
  - aimed at giving an indication of the recruitment into a river
  - Located around the country
  - Natural annual fluctuations due to environmental conditions
  - Long-term data series to capture general trend
  - Aim: to observe and record change in recruitment as a result of the management measures implemented





# Elver Ramp Traps



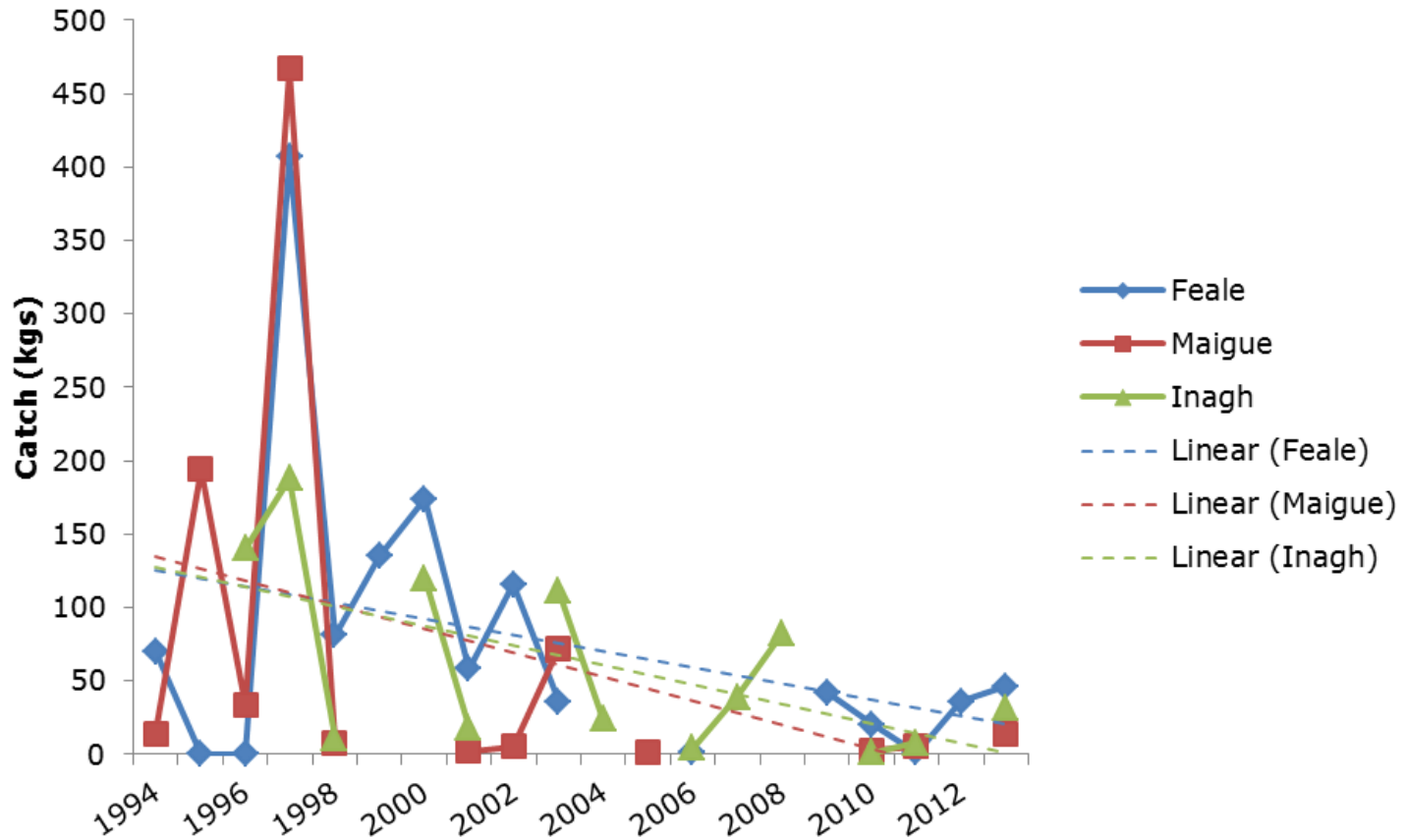
**National Elver Monitoring traps: Top left to right; Ballysadare, Inagh and Liffey.  
Bottom left to right: Feale, Corrib and Maigue**



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# Long-Term Recruitment Trend

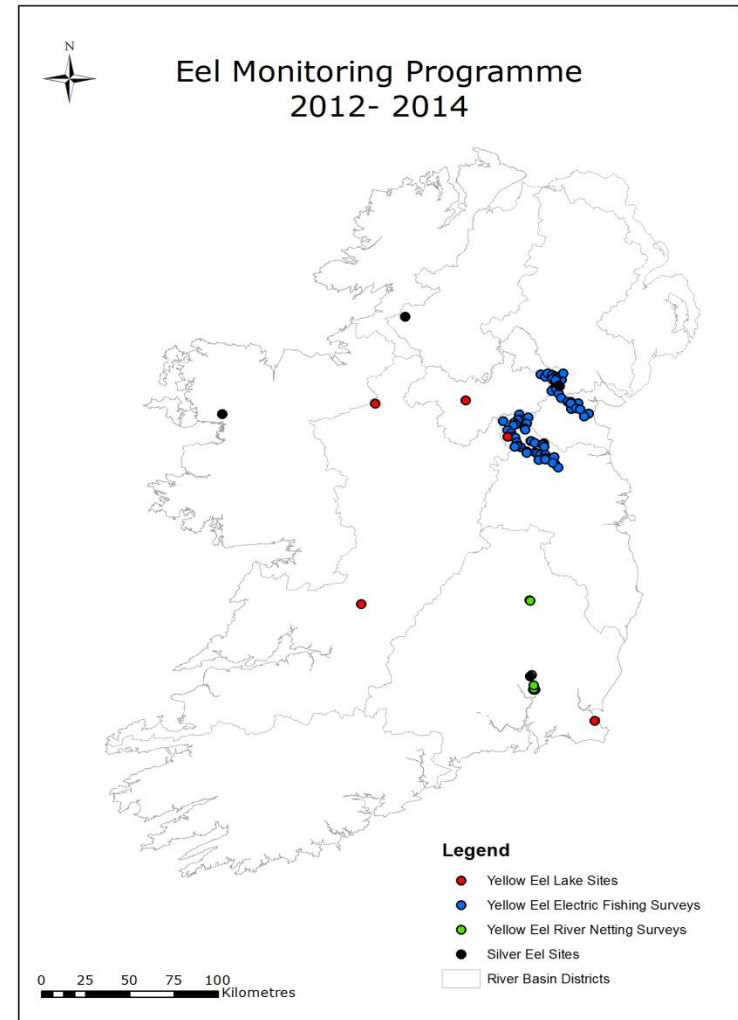
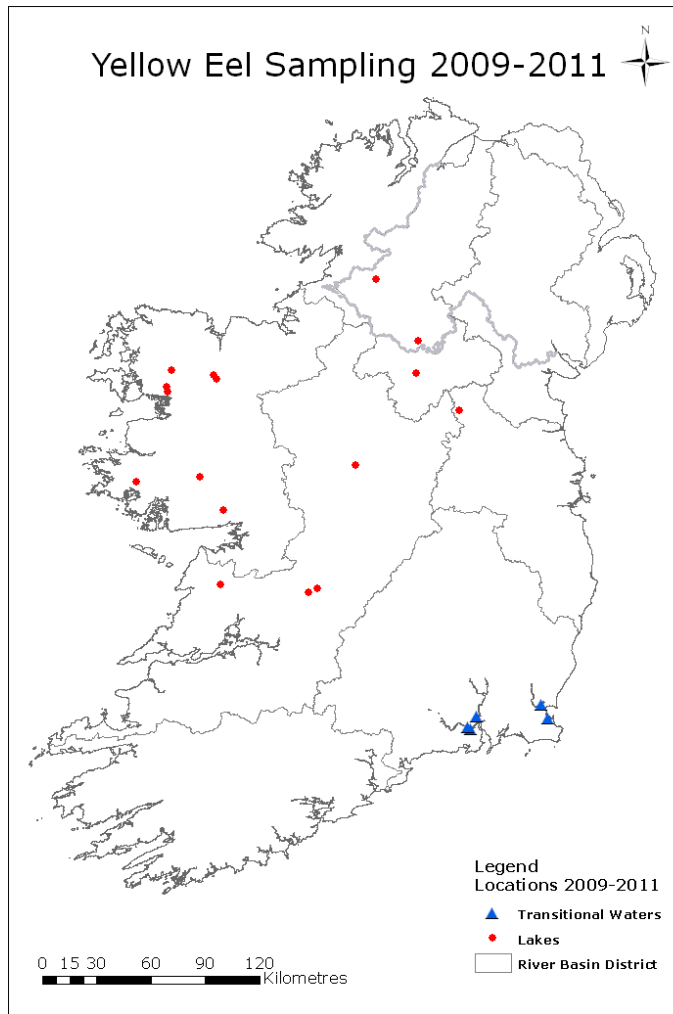
## 1994 - 2014



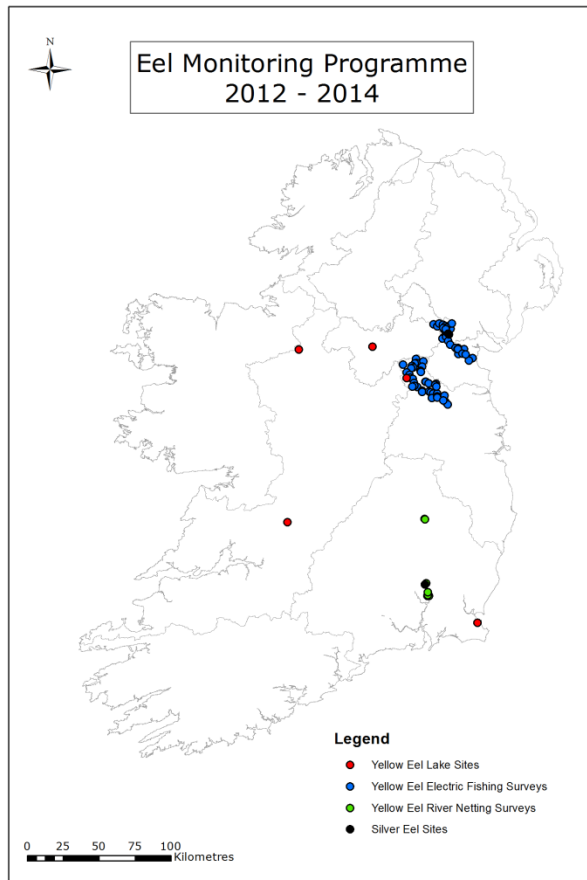


# Yellow Eel Surveys

2009-2011 & 2012-2014



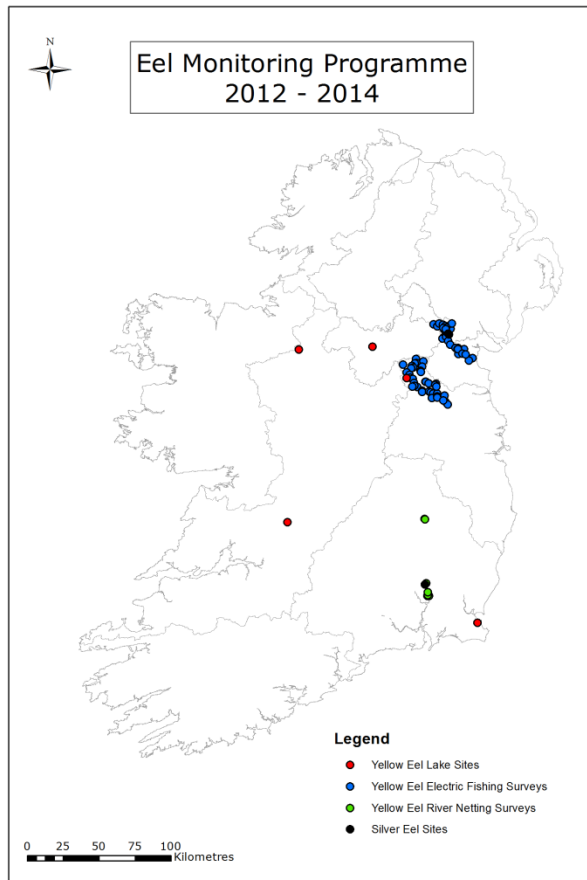
# Yellow Eel Intensive Surveys 2012 - 2014



## Eel Specific Intensive Standardised Fyke Net Surveys



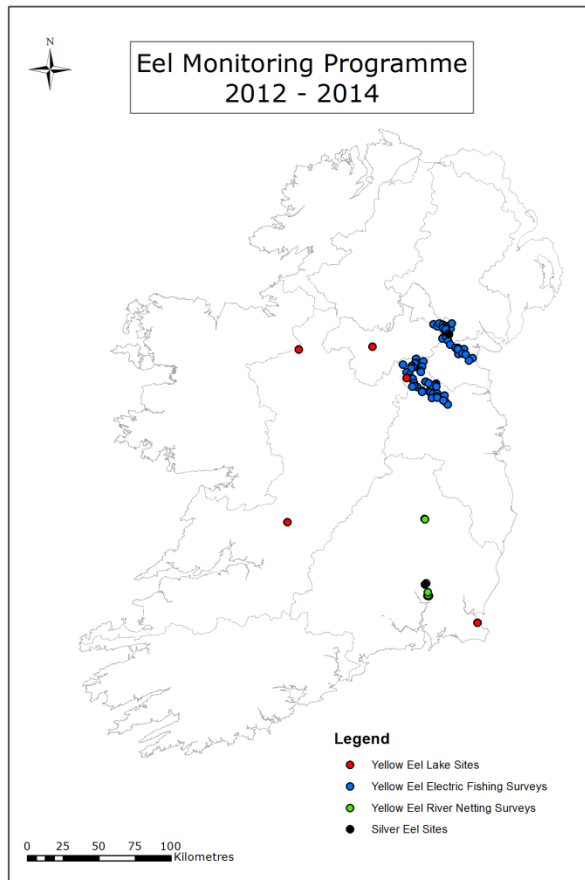
# Yellow Eel Intensive Surveys 2012 - 2014



## Eel Specific Electric Fishing Surveys



# Yellow Eel Intensive Surveys 2012 - 2014



- **Fyke Net Surveys**
  - 4,851 yellow eels & 1,783 net nights
- **Catchment wide Electric Fishing Surveys**

## Data recorded

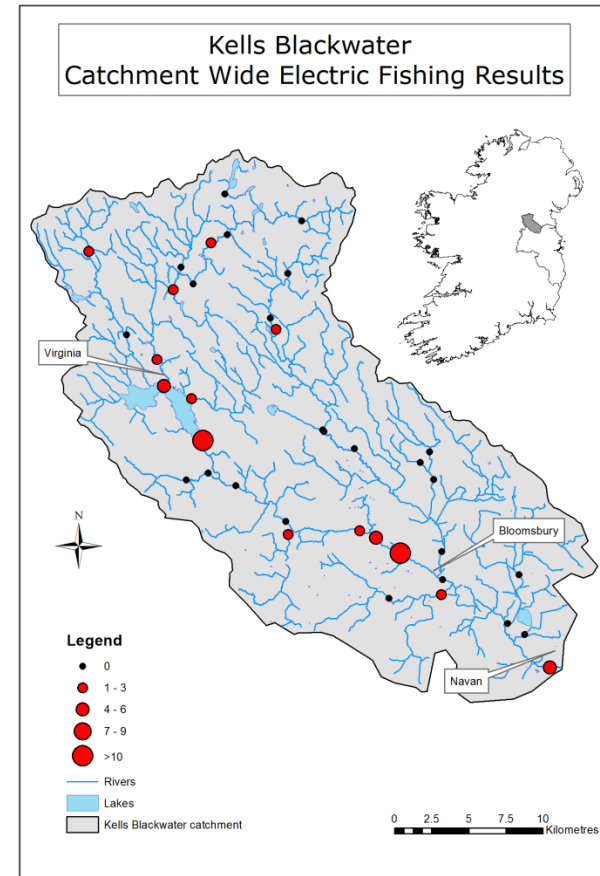
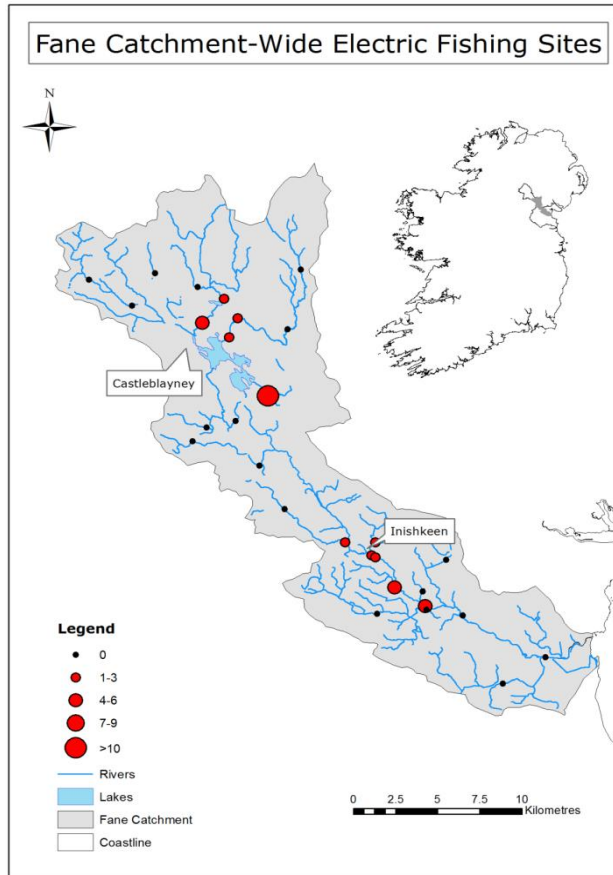
- CPUE/Density
- Length Frequency
- Stock structure
- Sex ratios
- Growth, age
- Parasite prevalence
- Swimbladder health

Monitoring Objectives



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# Catchment Wide Electric Fishing





# Catchment Wide Electric Fishing

- 2 \* Catchments with healthy eel populations within the Lake
  - Lough Muckno and Lough Ramor
- Eels were absent at
  - 60% of river sites in Kells Blackwater catchment
  - 62% of river sites in Fane catchment
  - Eels using the main channel on the way to lake and are not in the tributaries.
- Highlights the importance of Lake Habitat
- Fane eels have poor growth rates for first few years then a burst of growth as eels reach the lake
- Assume eels are everywhere but not the case!
- Repeat in Riverine catchment with no lake



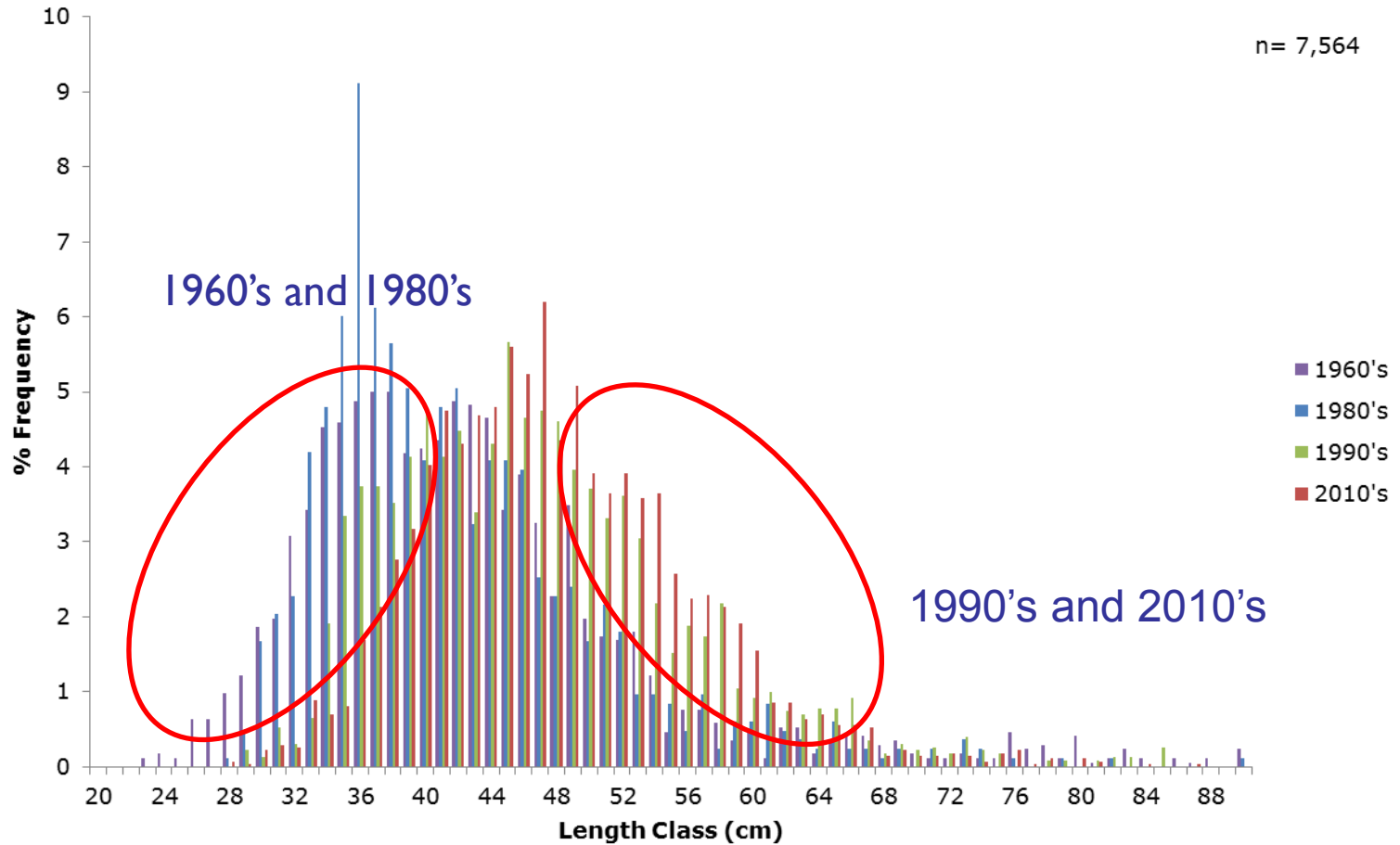
# Fyke Net Surveys: 2009 - 2011 & 2012 - 2014

Water Body	2009	2010	2011	2012	2013	2014
Burrishoole	√	√	√			
Lower L. Derg	√		√*	√*	√*	
Upper L. Derg		√				
Upper Corrib		√				
Lower Corrib	√					
L. Cullen	√					
L. Conn	√					
Upper L. Erne		√				
L. Ree (Upr.&Lwr.)		√				
L. Oughter			√	√		
L. Ramor			√			√
L. Inchiquin			√			
L. Ballynahinch			√			
L. Muckno				√	√	√
L. Key					√	
Waterford Estuary	√		√			
Slaney Estuary		√				
South Sloblands		√				√
River Barrow				√	√	√

\* Meelick Bay on Lower L. Derg sampled in 2012, 2013 & 2014.

# Yellow Eel Stock Structure: - Lakes

Absence of small eels in lakes compared with 1960's and 1980's

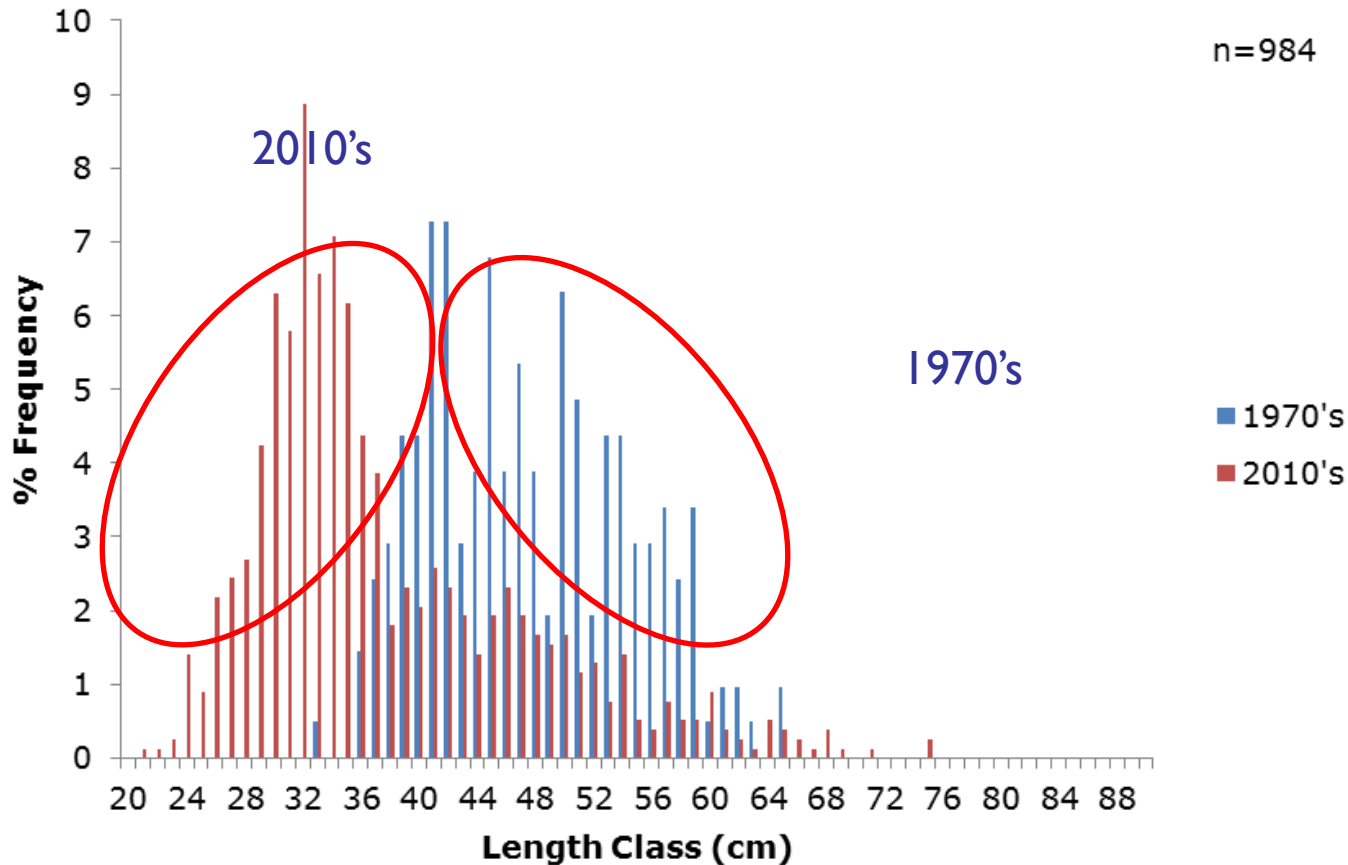


# Yellow Eel Stock Structure: Transitional Waters

Small eels are present in the Transitional Waters in Southeast



Likely Response to recruitment & closure of fishery



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# Changes to Stock Structure

- Preliminary data;
- Future work will include focus on Index catchments in each EMU examining all life stages and water bodies to investigate the distribution of eels within a catchment and determine if there is a reduced distribution/spread of eels occurring.



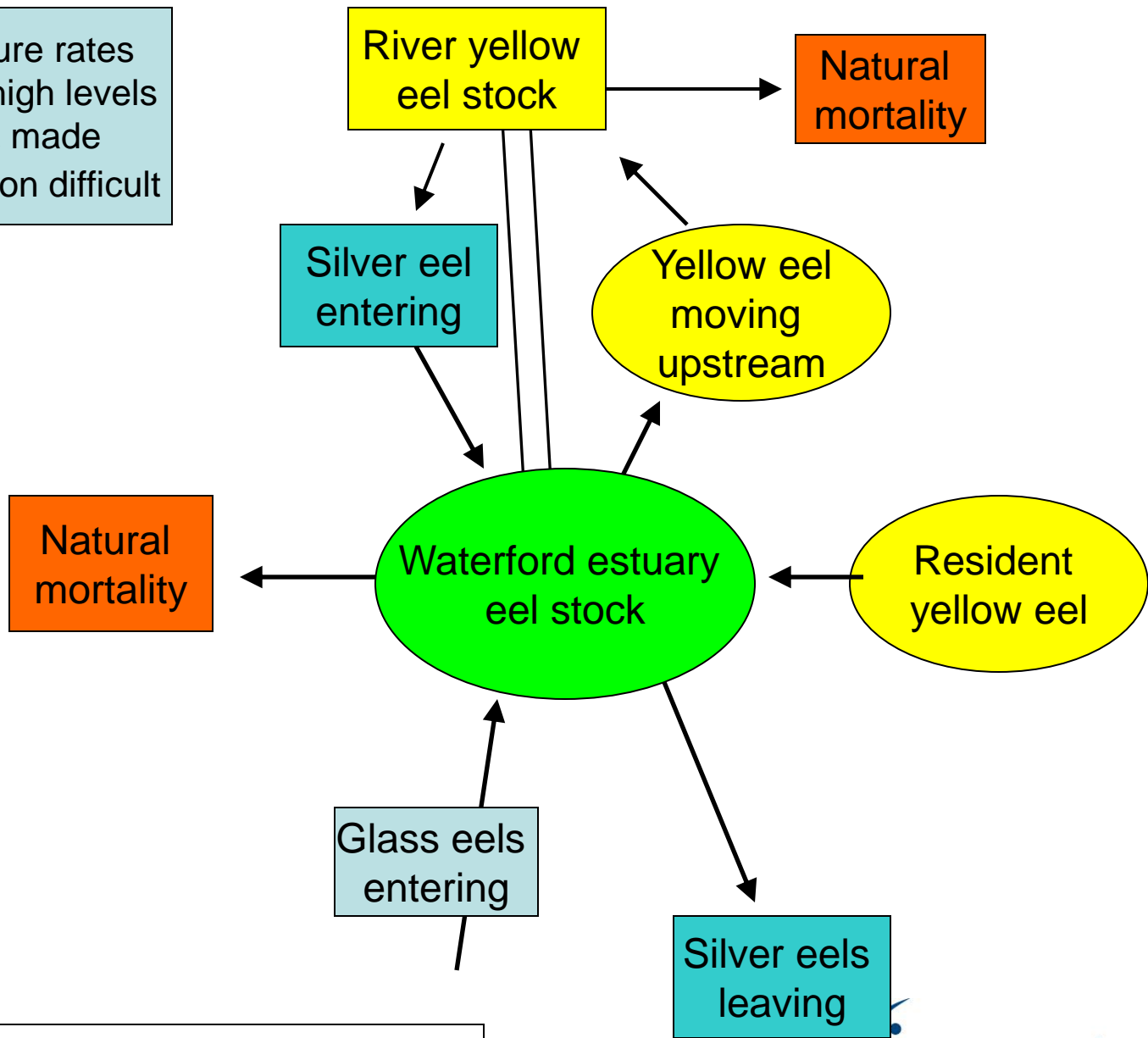


# Transitional Waters 2009-2012

- The transitional waters contained significantly smaller eels than the lakes.
- Highest CPUE values were recorded in the Barrow estuary.
- Low mark-recapture rates indicated probable high levels of movement within these waters and made population estimation difficult.
- Due to the difficulties in obtaining density estimates for eels in large water bodies and the migratory habits of eels moving upstream into the rivers and/or leaving the transitional water as silver eel,
  - it is still not possible to estimate silver eel production and escapement for transitional waters
- Historic eel biomass estimates are not available for the Waterford estuary to assess achievement of the eel escapement target
- The use of telemetry studies will give a clearer indication of the movement habits of eels in estuaries and improve population density estimates



Low mark recapture rates indicate probable high levels of movement & made population estimation difficult

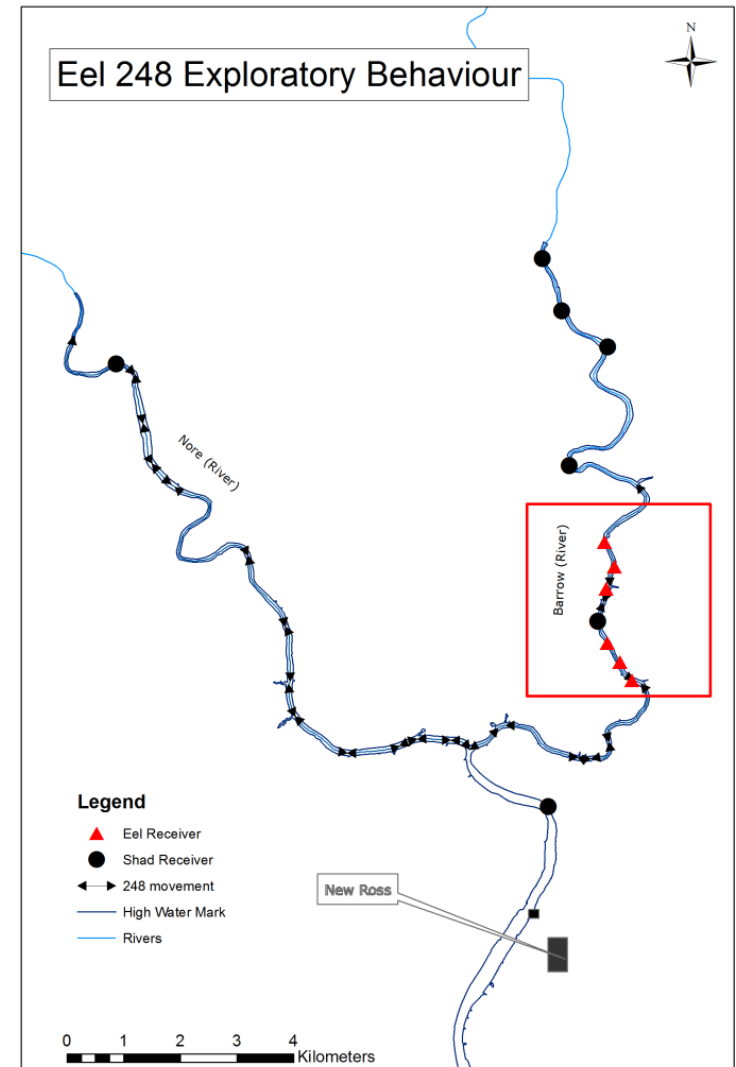


Currently can not provide quantitative eel stock advice for estuaries



# Barrow Acoustic Survey - 2013 - 2014

- Majority of eels remained in the study site for duration of survey (red box on map)
- Site fidelity with foraging and outer exploratory behaviour
- Eel 248 undertook extensive exploratory behaviour ~ 17kms round trip to R. Nore and back
- Evidence of Home range 2-3kl



# Eel Stock Assessment in Estuaries

- Waterford estuary survey has provided preliminary data on eel distribution and home range movement. Confirming a considerable resident standing stock.
- This will support future stock assessments and the development of a methodology for the assessment of silver eel output in estuaries
- Investigate the possibility, with partners across the EU, of novel stock assessment methods to improve quantifying stock density in estuaries,
- Continue to include WFD transitional water eel monitoring
- This work will support the development of an international standard method for eel stock assessment in tidal waters



# Swimbladder Parasite - *Anguillicola crassus*





# Swimbladder Parasite - *Anguillicola crassus*



Eel code CONN/YE/09/087 sampled on Lough Conn (Summer 2009). Female yellow eel, presenting with 34 adult parasites.

- Nematode worm, originates from Asia (1974)
- First recorded in Ireland in Waterford Estuary in 1997 (McCarthy *et al.*, 1999)
- later recorded on Lough Erne in 1998 (Evans & Matthews, 1999)
- Prolific spread across Ireland
- Currently occupies 74% of the wetted area in the Republic of Ireland (Becerra-Jurado *et al.*, 2014)
- High rates of infection and severe swimbladder damage
- may represent a potential hindering effect to stock recovery (Palstra *et al.*, 20007; SSCE, 2012).



# Swimbladder Health Indices

## Swimbladder Degenerative Index (SDI)

*Lefebvre et al., 2002*

- **Qualitative index**
- **Scores swimbladders from 0-6**
- **Three parameters**
  - **Transparent / Opaque**
  - **Pigmentation / Exudate**
  - **Thickness of swimbladder wall (Molnár et al., 1994)**

**No severe damage noted in the swimbladders of Irish eels using either of these indices**

## Length Ratio Index (LRI)

*Palstra et al., 2007*

- **Quantitative index**
- **Shortening due to multiple infections**
- **Length of swimbladder divided by total body length of eel**  
(assuming isometric growth relationship between swimbladder length and total body length)
- **Scores from 0.00 to 0.20**

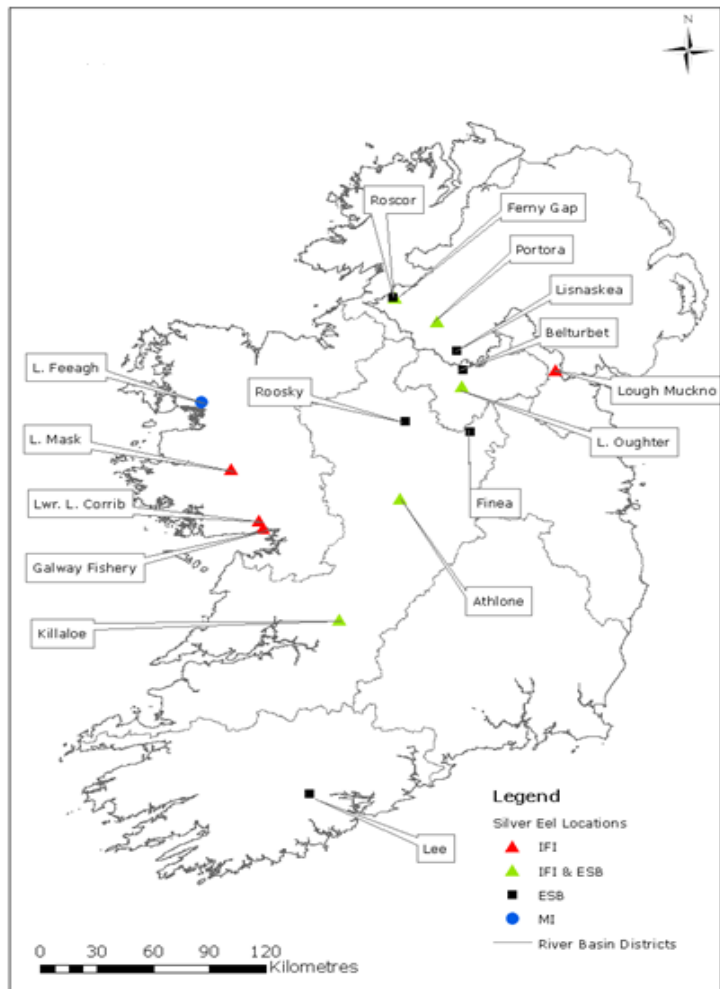


# Lack of Severe Swimbladder Damage

**The fact that no severe swimbladder damage has been recorded, may suggest that eels leaving Ireland, could contribute to the spawning stock to a greater degree than those leaving mainland Europe, as they may be more likely to successfully complete the long migration to their spawning grounds.**



# Silver Eel Escapement



Shannon	2009 - 2014
Erne	2010 - 2014
Burrishoole	2009 - 2014
Corrib	2009
Fane	2011 - 2014
Barrow	2014 - pilot year

# Mark & Recapture – Fane & Barrow

Passive Integrated Transponder

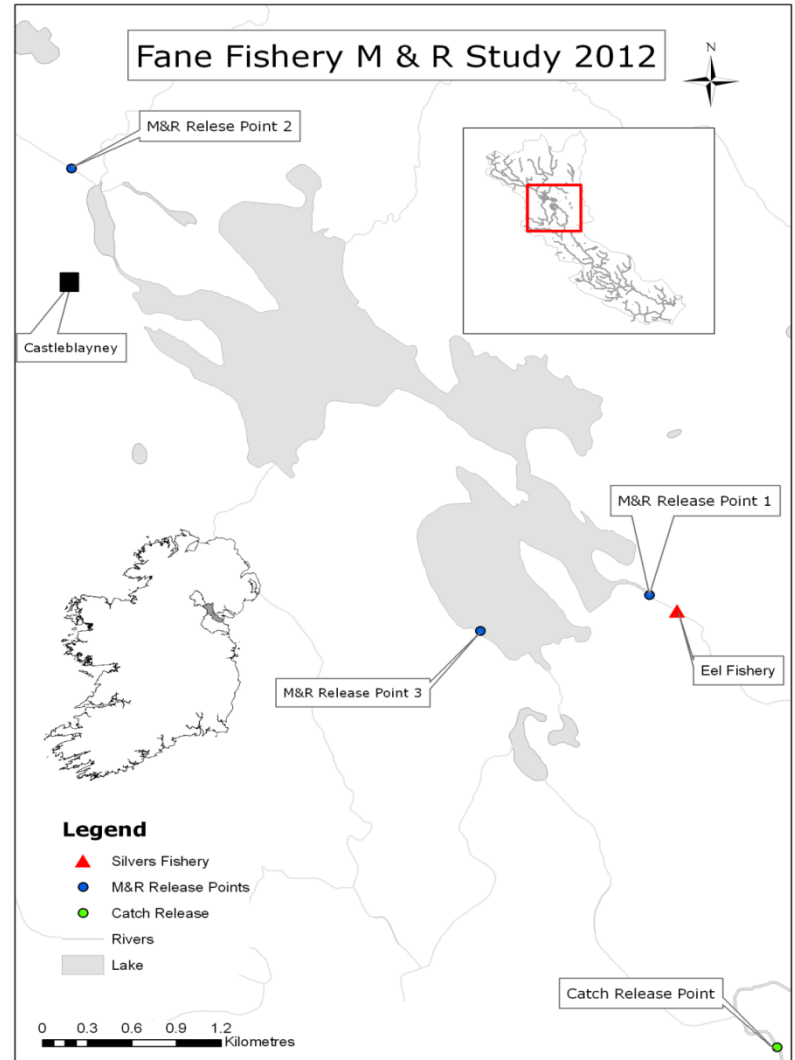




# Silver Eels: Fane



Coghill net being lifted at Fane Silver Eel Site on Clarebane River.



# Fane

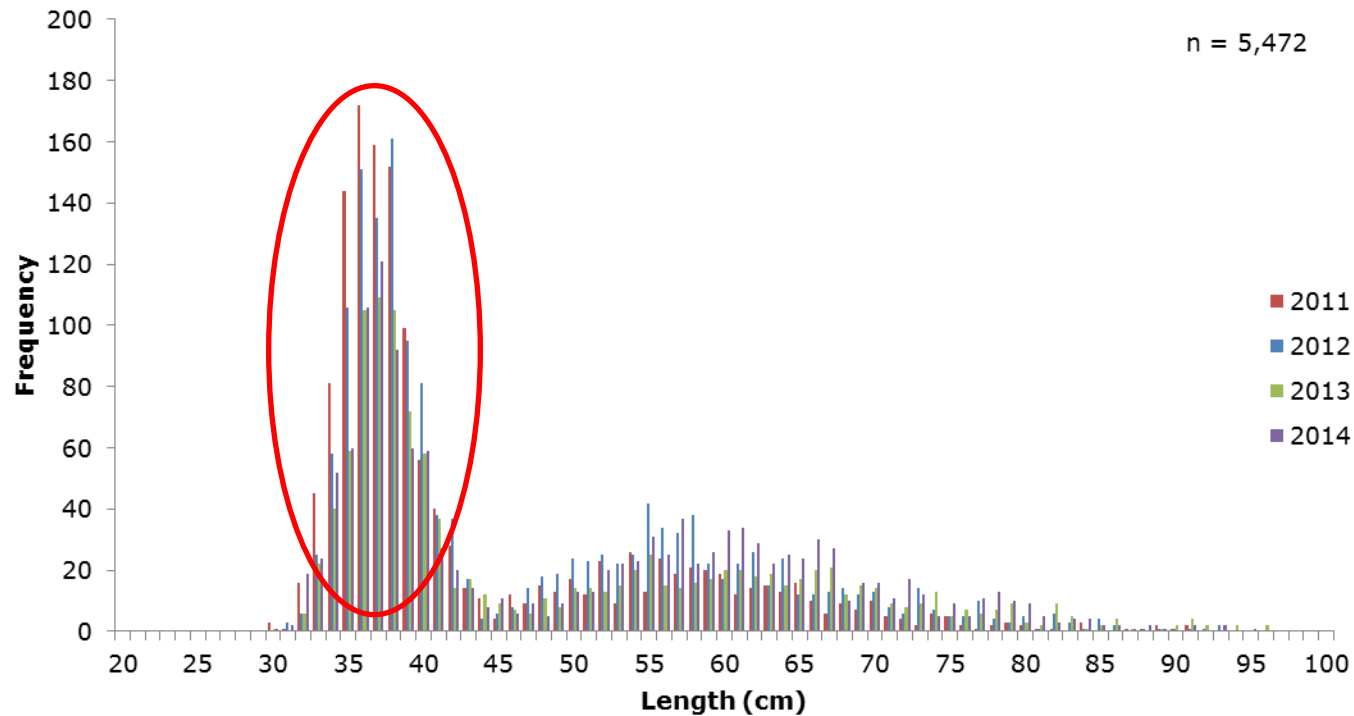
Table 3-6: Mark Recapture preliminary results 2011 – 2014.

Location	Year	Tagged	Recaptured within Yr	within Yr MR %	Total Recapture	Overall MR %
u/s fishery	2012	470	34	8%	92	20%
River	2011	173	47	29%	57	33%
River	2012	286	26	10%	52	18%
Lake	2011	160	23	15%	34	21%
Lake	2012	119	8	8%	28	24%
Mouth River	2013	303	61	22%	91	30%
Mouth River	2014	272	80	29%		
Average MR % all locations				18%		24%
Average MR% Mouth River				26%		30%



# Silver Eels: Fane

Dominated by male eels, Burrishoole, Shannon, Erne are female dominated

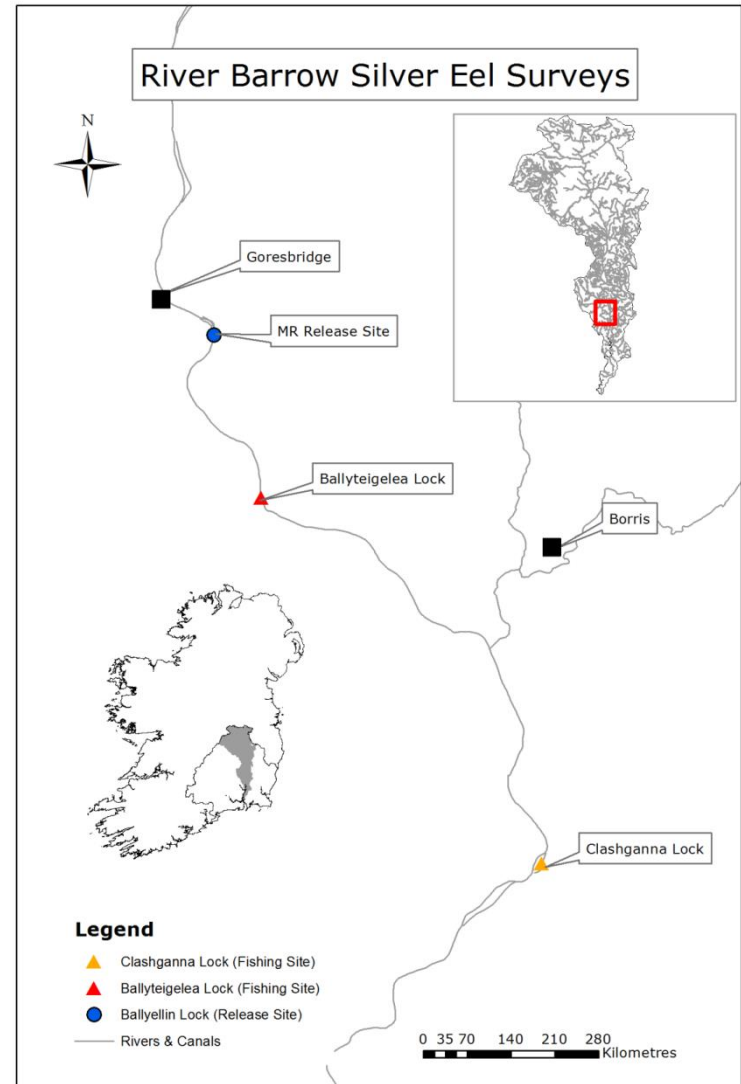




# Silver Eels: Barrow

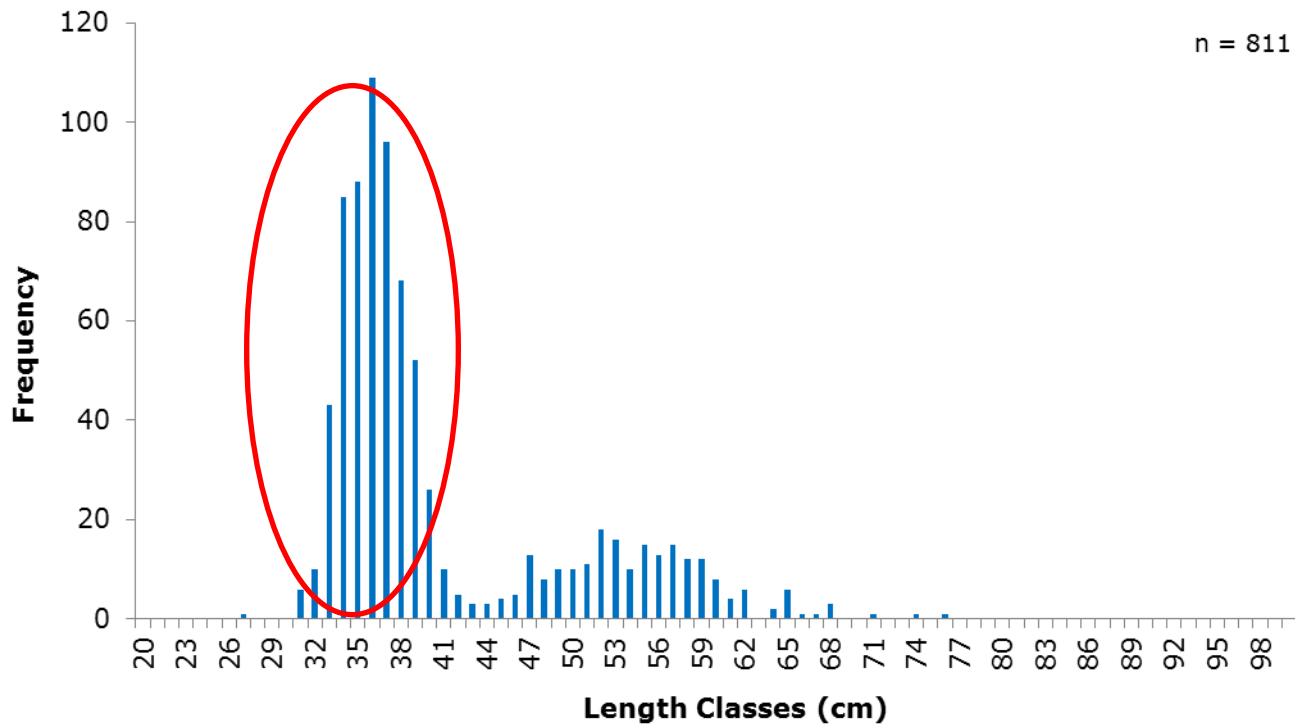


Ballyteige Lock, River Barrow, near Gaignamanagh.

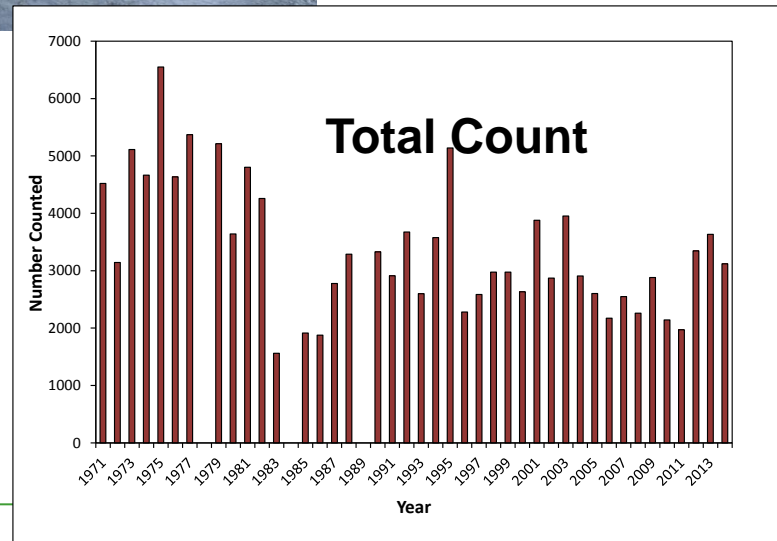
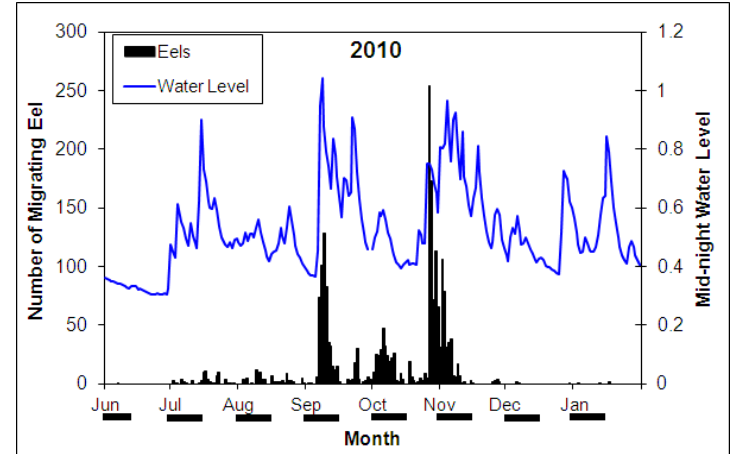


# Silver Eels: Barrow

Dominated by male eels,



# Burrishoole Silver eels



# Overall Stock Structure

- Generally recruitment increased in 2013 & 2014 but remains sign below (20%) historic levels
- Between 2012 and 2014, some stocks exhibited relatively good densities of eel (high CPUE) and normal size structures. However, other areas have seen a considerable decline in numbers and a reduction in the proportion of small eel in the stock.
- Surveys in tidal waters in the south east have indicated relatively good densities of eel and high proportions of small size classes.
- The descriptions of the characteristics of the silver eel production vary considerably between catchments. This is likely to be a reflection of previous recruitment, stocking, and exploitation history.
- There is evidence in some areas of a density dependent shift towards fewer larger eels, indicative of a declining stock – an observation hidden in the biomass data.



# Purpose of Monitoring

- The monitoring programme provides data on cpue, length, ratio of male/female, stock structure, age, escapement etc. from index catchments & from transitional waters, to allow a wider assessment of data from data poor catchments.
- Which allows an eel production assessment models to be run, in conjunction with Shannon & Erne data
- Which allows assessment of River Basin District silver eel production and escapement in relation to the EU target

