



# Scientific Survey of Adult Fish Stocks in Lough Ree

2016





# **A Report on a Scientific Survey of Adult Fish Stocks in Lough Ree**

## **Inland Fisheries Ireland**

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## Preface

This report was written and researched by Professor Martin O'Grady and Karen Delanty PhD, with assistance from many of our colleagues in the Research Section.

The L. Ree survey was very much a team exercise with staff contributing in so many different ways to ensuring the success of the project. A complete list of all the personnel involved is provided in the acknowledgements. A review of the methodology section will indicate to the reader why so many personnel with varying expertise were required to complete this operation safely, successfully and without impacting on the ecology of the lake.

This report outlines the findings of the L. Ree fish stock assessment (2014) in relation to all fish species recorded though paying particular attention to the brown trout population.

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## Lough Ree Fish Stock Survey Summary Findings

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- Almost 52% of all fish recorded during the L. Ree fish stock survey were roach, 20.7% were roach/bream hybrids, 15.9% were perch with significantly smaller numbers of bream, pike, trout, rudd and pollan making up the balance
- The 2014 L. Ree adult fish stock assessment indicates the presence of a healthy brown trout population in this fishery at the time of the survey
- Brown trout are widely distributed throughout the lake
- The CPUE value calculated for the pike stock of 1.41 can be regarded as high when one sees that the population is a large, balanced and uncropped stock.
- The distribution pattern of pike from L. Ree, as recorded from the Spring sampling programme 2014 shows that pike are widespread throughout the lake
- A perch CPUE value of 6.44 was calculated for L. Ree in 2014. This can be regarded as reflecting the presence of a large stock of perch by Irish standards
- The perch samples recorded during the L. Ree 2014 survey indicate the species was widely distributed throughout the lake
- The roach CPUE value calculated for L. Ree in 2014 was 21.04. This is a relatively high figure when compared to CPUE values calculated for other lakes in recent years. This value suggests that L. Ree may still be regarded as a culturally eutrophic lake – roach thrive in culturally eutrophic conditions.
- A comparison of CPUE values for bream from a number of other Spring sampled Irish lakes suggests the L. Ree CPUE value is high
- The distribution pattern of the L. Ree bream show the species are not widespread and appear to have a preference for the mid section of the lake
- A total of 103 rudd were recorded during the L. Ree 2014 survey. The CPUE value for rudd in L. Ree 2014 was 0.52.
- The rudd population of L. Ree showed a very restricted distribution pattern
- Hybrids recorded in L. Ree during the 2014 survey were dominated by roach x bream hybrids



- A roach x bream CPUE value of 8.39 was recorded for L. Ree, 2014. This is an exceptionally high value.
- Roach x Bream hybrids have a fairly widespread distribution throughout the lake.
- A relatively small number of pollan were captured in the course of the 2014 L. Ree survey
- The distribution pattern of the pollan recorded as part of the L. Ree Spring 2014 survey clearly shows the restricted distribution of this species. Pollan were located within the deeper areas of the lake,
- Currently L. Ree can be regarded as one of Ireland's premier "mixed fisheries". Mixed, in this instance, is a reference to three different fish stocks – cyprinid stocks and both the pike and trout populations. The status of all of these populations is such that, presently, each of them can provide quality angling on a seasonal basis.



## **1. Introduction**

The Board of IFI decided that a fish stock assessment of the lake should be undertaken, in 2014, to establish the status quo of all adult fish stocks with particular reference to the brown trout population. Extensive survey data for other trout lakes in Ireland over the last 35 years is available which would help to put the findings of the L. Ree 2014 survey into perspective. It was intended that this survey would both allow one to review the current status of all fish stocks and to reflect on the relevance of current fishery management practice on the fishery and the necessity, if any, to change future management protocols in this area.

### **1.1 Survey Rationale**

There are a number of reasons why an adult fish stock survey of Lough Ree was considered appropriate in 2014.

#### **1.1.1 The status of adult fish stocks.**

A detailed and comprehensive adult fish stock survey had never been carried out on L. Ree prior to 2014. This meant that management could not evaluate the status of fish stocks in this water relative to other Irish lakes.

#### **1.1.2 Changes in the historical angling pattern.**

Historically Lough Ree was always regarded as a quality “mixed fishery”. Thirty years ago the seasonal angling patterns were as follows;-

- In springtime anglers “trolled” for either pike or trout.
- In the May/early June period people “dapped the mayfly” and a few anglers fished dry mayflies.
- From early summer onwards quality coarse angling for roach and roach/bream hybrids (since the 1970’s) took place in selected parts of the lake. Prior to, and following the introduction of roach, selected areas of the lake provided, and continue to provide, quality bream and tench angling.
- Quality pike angling was available generally over the winter months.



The historical angling patterns, described above, continue to the present day. However, one significant change in the pattern described above has been evident for the last decade – L. Ree now provides quality wet fly angling for trout throughout the spring and autumn periods in addition to the traditional mayfly angling. While the level of trout angling effort has not been quantified it is clear from IFI staff observations that trout anglers from different parts of Ireland are now regular visitors to the lake through the spring/summer /autumn period. This change in angling patterns is likely to reflect ecological changes in the fishery in recent times and is one of the reasons why this survey was appropriate in 2014.

### **1.1.3 Excessive cropping of Pike stocks.**

There had been some concern that the fishery regulations in relation to pike angling were not being fully observed and some anglers were catching and killing significant numbers of small pike. Observations by IFI staff in the field, in recent times, did not support this view. A survey of fish stocks within the lake would help to clarify this situation.

### **1.1.4 Impacts of the licensed commercial trout fishery on the trout population.**

There is a limited commercial licensed fishery for brown trout on Lough Ree. It was hoped that any significant impact of this fishery on the overall trout population would be evident from the survey results.

### **1.1.5 Invasive species.**

In 2013 the “Asian Clam” (*Corbicula fluminea*) was recorded upstream of Lough Ree at two locations – the Shannon River at Carrick-on-Shannon and further downstream at Lanesboro (Hayden and Caffrey, 2013 and Minchin, 2014). This survey of L. Ree provided IFI with an opportunity to review the status of the clam population in the lake itself. A one minute dredge sample was taken on the lake bed at each of the 200 netting sites. These samples were examined to establish the presence or absence of both Asian Clams and Zebra Mussels (*Dreissena polymorpha*); zebra mussel having been introduced into the Shannon – Erne system circa 1992 / 1993 (McCarthy and Fitzgerald, 1997) (Plate 1.1).

Roach are a relatively new invasive fish species which first colonised the Shannon system in the 1970’s (Fitzmaurice, 1981). The authors have noted a very significant decline in the standing crop of roach in a number of lakes in the Shannon Catchment (Loughs Derravaragh, Ennell and Sheelin) since

the establishment of zebra mussel populations in the 1990's. This survey of L. Ree would afford one the opportunity to assess the status of roach stocks in this water relative to some of the other lakes in the Shannon system.



Plate 1.1. Zebra Mussel (upper photo) and Asian Cam (lower photo).

#### **1.1.6. Mid Shannon Brown Trout Genetics Study**

Currently genetic analysis of the trout stocks, throughout the entire “middle Shannon”, are in progress. This study includes an analysis of stocks from all rivers and streams from Carrick-on-Shannon south to, and including, the Suck System. These data will include an examination of adult trout from Loughs’ Ree, Derravaragh and Owel and should help delineate the natal stream origin of individual adult trout in all of these lakes. In this current L. Ree survey a GPS reference point is available for all trout captured in the survey. This will allow one to look at the relative distribution of trout from varying origins – a similar study in relation to adult trout stocks in L. Corrib illustrated a stratified distribution of trout of varying origins in the lake (Prodohl *et al*, 2013). A genetic study of trout stocks in the “lower Shannon” has been completed recently by Professor Prodohl and his team



from Queens University Belfast (*in press*). The same personnel are carrying out the “mid Shannon” study. A cross referencing of the “lower Shannon” database with the “mid- Shannon” study, when complete, will prove invaluable in terms of understanding the dynamics of trout stocks throughout most of the Shannon system. The completion of a fish stock survey on L. Ree in 2014 provides a critical data set for the genetic study. The “mid Shannon” genetic study will not be completed for some time. Consequently these data, when available, will be the subject of a separate report.

#### **1.1.7. Background Topographical and Ecological Information**

Lough Ree is the third largest lake in the Republic of Ireland, after Lough Corrib and Lough Derg. It is the middle of the three large Shannon lakes; Loughs Allen, Ree and Derg. The lake is 26km long and 11km at its widest point, has an area of 10,500 ha, a mean depth of 6.2m, a maximum depth of 36m. Much of the northern end of the lake is relatively shallow, with only one deep basin reaching a maximum depth of 31m. The southern end of the lake has several deep basins, with depths exceeding 35m. The lake is categorised as typology class 12 (as designated by the EPA for the purposes of the Water Framework Directive), i.e. deep (>4m), greater than 50ha and high alkalinity (>100mg/l CaCO<sub>3</sub>)(Kelly *et al.*, 2013).

Lough Ree is situated in an ice deepened depression formed on Carboniferous limestone (Charlesworth, 1963). It has a highly irregular shoreline and hence has many sheltered bays. Glacial drift has resulted in the formation of many islands in the lake (NPWS, 2001). The main inflowing rivers are the Shannon, Inny and Hind, and the main outflowing river is the Shannon (NPWS, 2011). Water levels in the lake are regulated by the Electricity Supply Board (ESB) and Waterways Ireland. The water level into Lough Ree and discharges from the lake are controlled by a navigational weir and sluice gates at Athlone. The sluices at Athlone weir are operated by Waterways Ireland on daily instruction from the ESB and at high flows the sluice gates are closed to hold water upstream of Lough Ree to minimize flooding along the Lower Shannon (RPS, 2008).

Lough Ree has been designated as a Special Area of Conservation (SAC) and a Special Protection Area (SPA). It has been selected as a SAC/SPA due to the presence of Annex I habitat types, bird species listed on Annex I of the Birds Directive (Council Directive 79/409/EEC) and the otter listed on Annex II of the EU Habitats Directive (Council Directive 92/43/EEC) (NPWS, 2011). The lake is also home to the endangered fish species, pollan (*Coregonus autumnalis*) listed on Annex V of the EU Habitats Directive. Pollan are classified as ‘Endangered’ in the Irish Red Data Book (King *et al.*, 2011)



and the IUCN Red List of Threatened Species (Freyhof and Kottelat 2008). This species is endemic to Ireland and is found in five lakes throughout the country: Lough Neagh, Lower Lough Erne, Lough Allen, Lough Ree and Lough Derg (Harrison *et al.* 2010).

Using the WFD FIL2 classification tool, Lough Ree has been assigned an ecological status of Poor for both 2010 and 2013 based on the fish populations present (Kelly *et al.*, 2013). In the 2010 to 2012 surveillance monitoring reporting period, the EPA assigned Lough Ree an overall draft ecological status of Moderate, based on all monitored physico-chemical and biological elements, including fish (<http://gis.epa.ie/Envision>).



## 2. Sampling Methodology

The L. Ree fish stock survey commenced on February 24<sup>th</sup> and concluded on March 12<sup>th</sup>, 2014. The survey sampling involved the use of gill nets following a standard technique designed to monitor fish stocks in managed Irish trout lake fisheries. The survey nets used have been standardised since this type of survey commenced (O’Grady, 1981 and 1983). Each gang of nets contains equal lengths of panel every ½ inch mesh size from 2 inches to 5 inches inclusively (stretched mesh measurements). The total length of a survey net is 210m. The individual panels, within each survey net, are arranged randomly.

The survey nets in question are capable of catching all trout  $\geq 19.8\text{cm}$  in length in proportion to their presence (O’Grady, 1981 and 1983). Experience has shown that these nets can capture samples of all perch  $\geq 14\text{cm}$ , roach  $\geq 16\text{cm}$ , roach x bream hybrids  $\geq 12\text{cm}$  and bream  $\geq 12\text{cm}$ . The smallest mesh panel in these survey nets (2”) is physically capable of capturing small pike ( $\geq 25\text{cm}$ ). However, pike  $\leq 35\text{cm}$  are rarely captured in such surveys. This is most likely due to the fact that the smaller pike ( $\leq 35\text{cm}$ ) live down in the “body” of the caraphyte beds, below the level at which the gill nets are fishing.

The number of fish, of any fish species, captured for a particular netting effort (catch per unit effort or CPUE) reflects the relative density of this fish present in the lake. CPUE values for each fish species is calculated by dividing the total number of that fish species caught by the total number of nets set. This type of fish stock assessment has been employed on numerous lake surveys nationally providing an extensive database of CPUE values for many fish species across a wide range of lake types. The availability of such data will benefit this report allowing direct comparisons to be made with similar type lake fisheries surveyed in springtime and provide useful comment on the current fish stock status of L. Ree.

A total of 200 sampling locations were surveyed (Figure 2.1). These locations were chosen as follows; - the lake was divided into a numbered grid system of squares each 250m x 250m and then using a random number generator 200 locations were selected. The number of sites sampled was based on lake area i.e.-an intensity of netting effort similar to that carried out on other lakes surveyed in springtime, like Corrib and Sheelin, were chosen. Garmin GPS units pre-loaded with the netting site co-ordinates were used to locate the sampling sites.

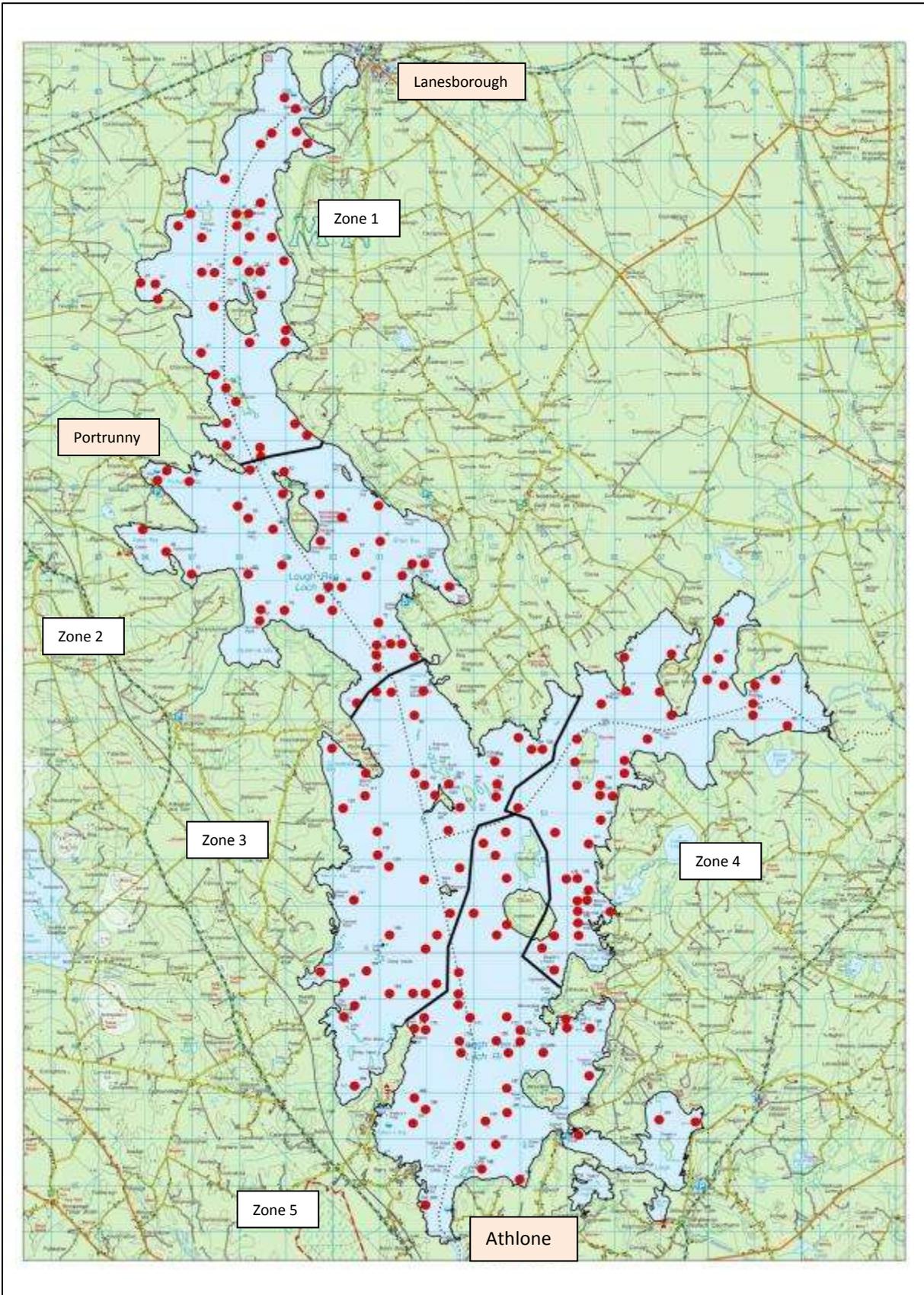


Figure 2.1. Lough Ree gill netting sampling locations.



A one minute dredge sample was also collected at each of the 200 netting sites to determine the presence/absence and relative density of *Corbicula* (Asian Clam) throughout the lake – *Corbicula* had been previously recorded upstream of L. Ree in the river Shannon at Carrick-on-Shannon in 2010 (Hayden & Caffrey, 2013). Since this survey of L. Ree was completed in March 2014 a substantial *Corbicula* population has been identified in the hot water stretch of the Shannon in Lanesboro, immediately upstream of L. Ree in the autumn of 2014 (IFI, 2014).

A total of 5 boats with a 3 man crew on board were required to undertake the survey. The lake was divided into 5 sampling zones (Figure 2.1) each with a total of 40 netting locations, and each crew were allocated a sampling zone for the entire survey period. Boat crews were based all around the lake using five different launch/landing points.

All sets of survey nets were fished over-night; in general nets were set at each site in the morning and lifted the following morning. All trout caught in the survey nets which were alive and in good condition with a good chance of survival were released. All live pike 70 cm and greater in length (and in good condition) were released back into lake, while all live cyprinids 25cm and greater in length (and in good condition) were also released back into lake. All fish of all species released were measured prior to release and their capture location noted.

The lengths of all trout and pike released along with a scale sample from each individual fish and their capture location were recorded on individual scale envelopes. The larger pike released ( $\geq 70$ cms.) were floy tagged (Plate 2.1). It was hoped that the proportion of fin clipped pike caught by anglers in pike angling competitions planned in the weeks following the survey might allow one to generate a pike standing crop estimate.

All fish, of all species, which were retained, were placed in labelled bags for laboratory analysis.

This involved the following;

- Initial processing of the catch was carried out at the IFI base at Portrunny. This involved weighing and measuring individual fish captured, some dietary analysis and retaining fish scale samples for age analysis.
- The stomach contents of all trout and many pike and perch were noted
- Two sets of scale samples were retained for all trout sampled - this was to allow both the growth/ageing analysis and a genetic analysis to proceed in tandem.



- Subsequent analysis of survey data continued thereafter at IFI HQ (Citywest).



Plate 2.1. Floy tagged pike.

## 2.1. Biosecurity & Safety Measures

Invasive species are an ever present threat in our aquatic and riparian systems and it is imperative that none of our field operations exacerbate the risks to the environment and to the economy that are posed by these species. Fish parasites, pathogens and diseases also represent a significant threat to the health status of our watercourses. The introduction or transfer of such pathogens or diseases has the potential to wipe out large populations of fish in affected waters or catchments. Vigilance is required if we are to stop the spread of invasive species and fish diseases, and it is imperative that we in IFI lead by example in the on-going struggle against these significant threats to our fishery watercourses. IFI has a bio-security policy (IFI, 2010) which was fully implemented as part of the survey.

The safety measures and protocols identified and listed in the IFI Employee Safety Handbook (IFI, 2012) were fully employed at all times during the survey. In addition to those discussed in the safety manual a number of other safety measures were adopted during the course of the survey operations (IFI, 2014). The procedures implemented ensured the safety of all staff involved and for the survey to run smoothly, without incident.



### 3. Results

The 2014 fish stock assessment of L. Ree is the first one of this type to be carried out on the lake. While Lough Ree has been the subject of two WFD surveys previously (Kelly *et al.*, 2010 & 2013), these surveys were not as intensive or as extensive as the 2014 IFI research survey. The data collected is presented in this section.

A total of 8067 fish of all species were encountered in the L. Ree survey from a total of 199 sampling locations (one sampling site had to be disregarded). Eight fish species were recorded in the survey nets, and in order of abundance were; roach (*Rutilus rutilus* L.), roach x bream hybrids, perch (*Perca fluviatilis* L.), bream (*Abramis brahma* L.), pike (*Esox lucius* L.), brown trout (*Salmo trutta* L.), pollan (*Coregonus autumnalis*), rudd (*Scardinius erythrophthalmus*) and tench (*Tinca tinca* L.). A small number of other hybrids were also recorded.

Table 3.1. Summary Data in relation to fish captured in the L. Ree gill netting survey Spring 2014, with C.P.U.E. values for each species.

	Trout	Pike	Roach	Perch	Roach x Bream Hybrids	Rudd	Bream	Pollan	Tench
Total caught	223	280	4186	1282	1670	103	293	30	1
CPUE	1.12	1.41	21.04	6.44	8.39	0.52	1.47	0.15	

Of the total of 8067 fishes captured in the 199 survey nets (Table 3.1) almost 52% were roach, 20.7% were roach/bream hybrids, 15.9% were perch with significantly smaller numbers of trout, pike, bream and rudd making up the balance. As mentioned in the sampling methods (Section 2.) captured fish were returned to the lake when and where possible, this policy resulted in the following returns, 61% of trout, 52% of pike and approximately 40% of roach.



### 3.1 Observations on the status of stocks in relation to individual species.

#### 3.1.1. Brown Trout.

The 2014 L. Ree adult fish stock assessment indicates the presence of a healthy brown trout population in this fishery at the time of the survey. A total of 223 trout were recorded during the course of the survey.

##### 3.1.1.1. Brown Trout Stock Density (CPUE value).

The relative density (CPUE value) of trout in L. Ree in 2014 can be put in a national perspective by comparing CPUE values recorded for this fishery with values for other Irish lakes surveyed in the springtime of any particular year (Figure 3. 1).

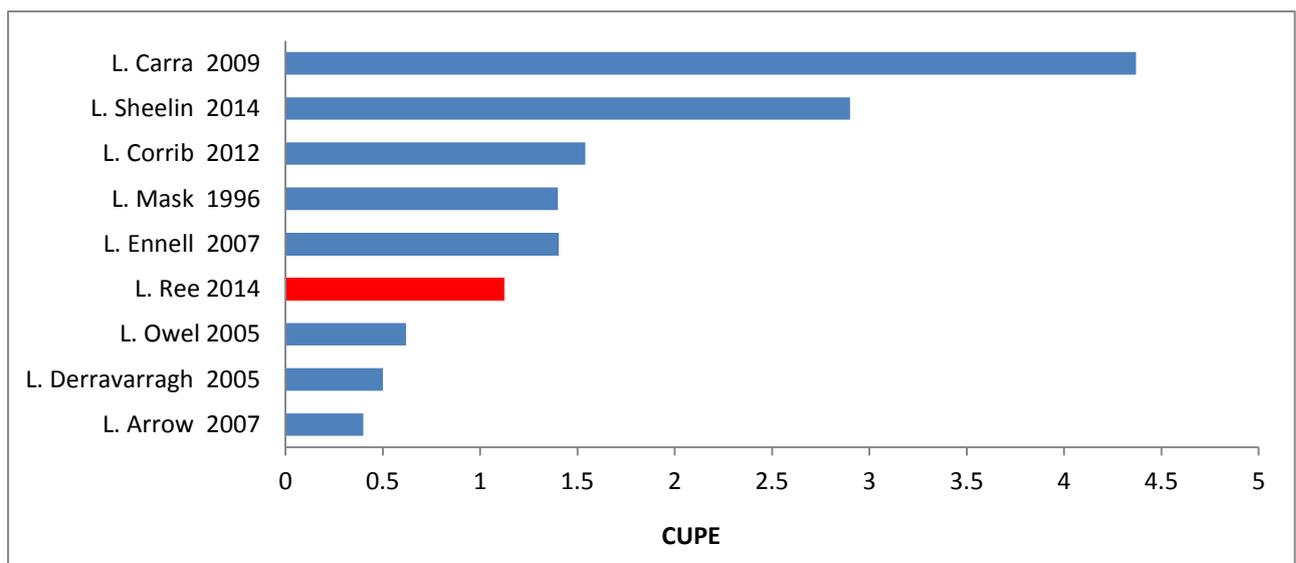


Figure 3.1. CPUE values for wild brown trout recorded in a range of Irish lakes over time.

These data indicate that the adult brown trout population in L. Ree in 2014 is moderate, in numerical terms. In two of the waters listed in Figure 3.1, Derravaragh and Ennell, pike control has not been practised for some time (IFI, 2014a & b) because there is an “ecological bottle neck” on both waters which naturally limits pike production (a limited area of Caraphyte beds). Given the excellent stock of pike in L. Ree presently (see Section 3.1.2) the density of trout present can be regarded as good



and clearly reflects a high level of recruitment to the lake from many of its tributary sub-catchments. Most importantly the angling catches of trout on L. Ree, in recent years, illustrate that a trout CPUE value of 1.12 is adequate in this fishery to provide quality angling in selected areas of the lake.

### 3.1.1.2. Brown Trout Population Structure.

The trout length frequency distribution for L. Ree in the 2014 survey is illustrated in Figure 3.2.

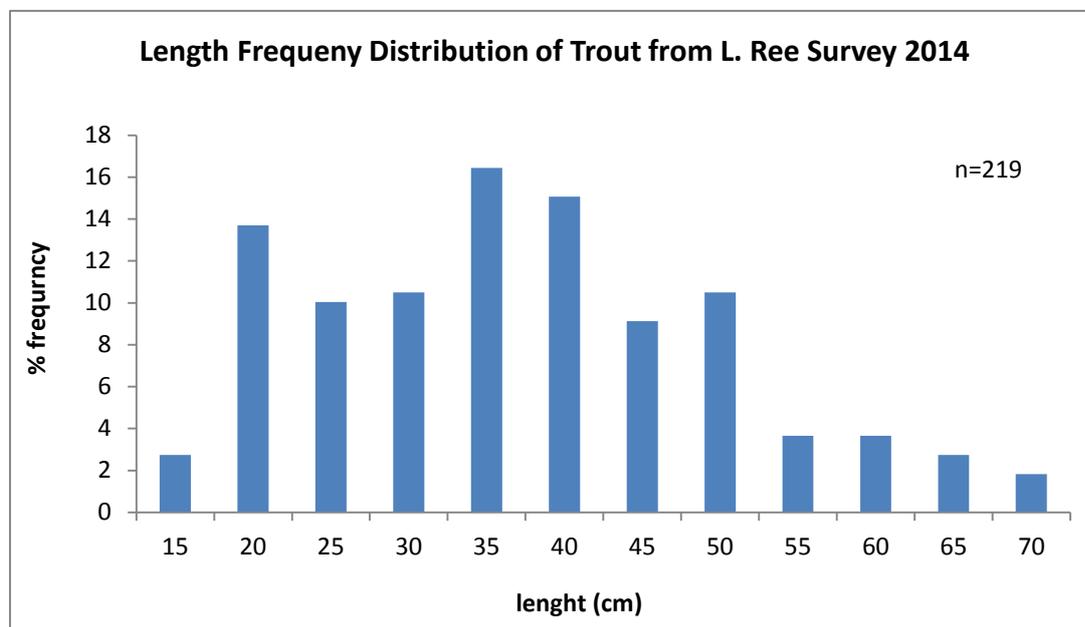


Figure 3.2. The percentage length frequency distribution of the brown trout sample in the 2014 survey of L. Ree.

The percentage length frequency distribution of trout in the sample helps to highlight a number of points in relation to this particular stock;-

- There would appear to have been very steady recruitment of juvenile trout to the lake at a high level over the last six years.
- The very uniform distribution of trout, particularly in the size range from 30cm to 50 cm, suggests cropping rates of trout by a combination of anglers and the commercial netting fishery are not seriously impacting on the size of the stock – if they were one would expect



to see a significant decline in the representation of trout  $\geq 40\text{cm}$  in the population – this comment assumes that recruitment to the adult trout stock over the last 6 years has been relatively constant.

The high proportion of larger older fish ( $> 50\text{cm}$ ) in the trout stock is unusual when compared to trout stocks in other Irish lakes (Figure 3.3a, b and c). A comparison of the percentage length frequency distribution of the trout samples from the L. Ree (22%) and L. Sheelin (15%) surveys in 2014 illustrate the presence of a slightly larger component of bigger fish in the L. Ree population (Figures 3.3a and b). A similar difference is evident when one compares the proportionality of trout in the L. Ree and L. Corrib 2012 (18%) survey sample for trout in the 50 to 70cm length range (Figures 3.3a and c).

The presence of a small stock of very large trout ( $\geq 70\text{cm}$ ) in the Corrib sample (2.3%) and the absence of such a component in the Ree and Sheelin samples relates to the fact that there is a ferox trout sub-population in the Corrib, a type of trout which is not present in Sheelin or possibly in Ree. A genetic study of the trout stock in L. Sheelin suggests that there is no ferox trout population in this lake (Prodohl *et al.*, 2014). One will have to await the findings of the mid-Shannon genetic study before confirming the presence or absence of a ferox trout stock in this water. However, to date, there are no historical records of such a stock in L. Ree. None of the trout captured in the L. Ree 2014 survey exhibited the typical morphometric characteristics of ferox fish.

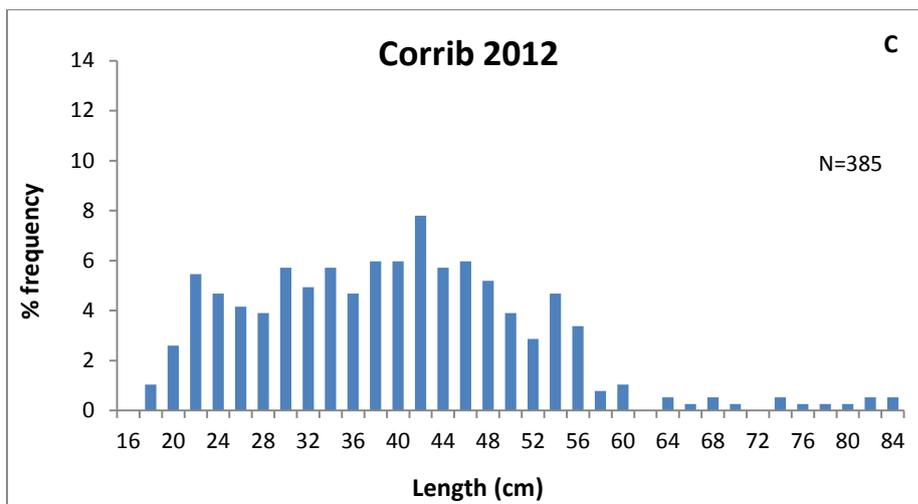
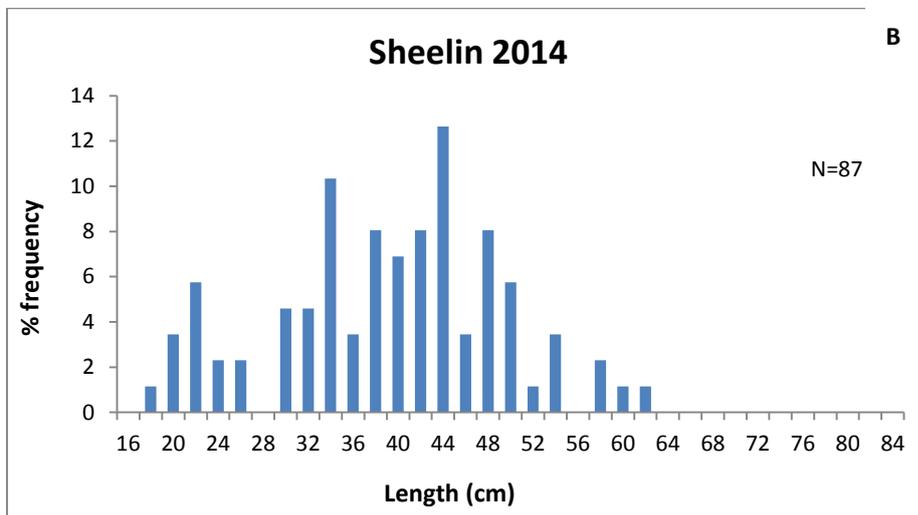
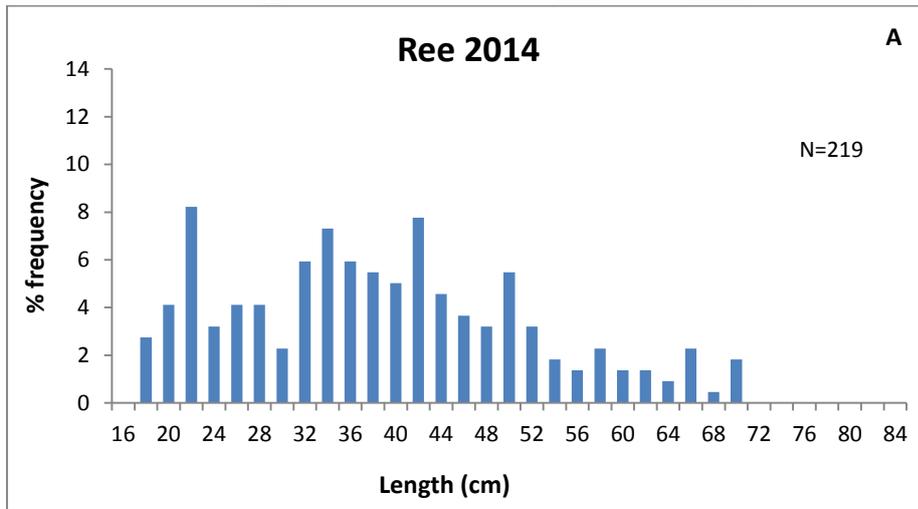


Figure 3.3. Brown trout length frequency distribution from Loughs' Ree (A), Sheelin (B) and Corrib (C).



The trout age structure presented for L. Ree (Figure 3.4) indicates a relatively healthy and stable population with some fish living to 9 years of age. Fish under 15cm (2 years of age) are not capable of being captured by the survey nets used during the survey (see Section 2).

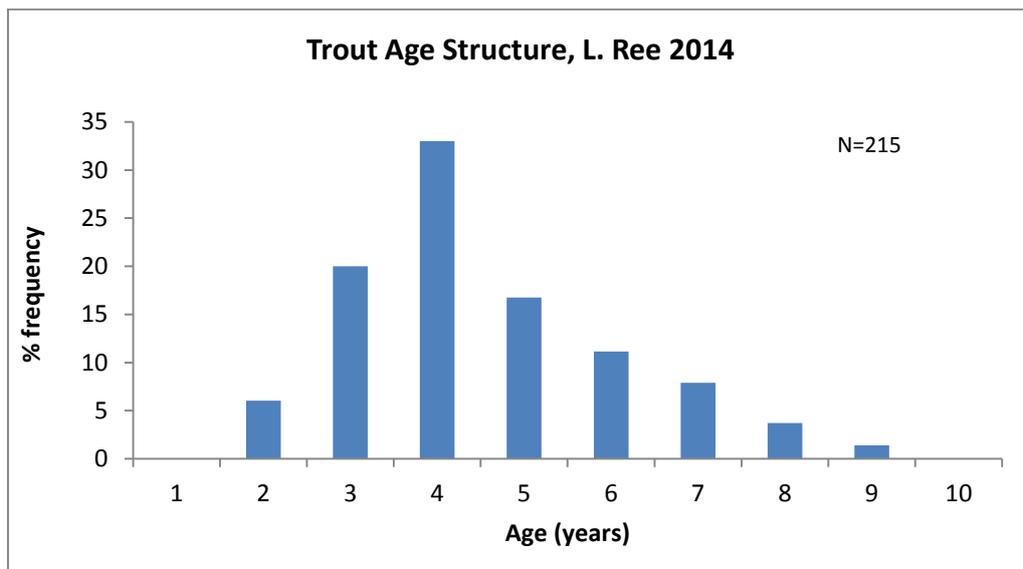


Figure 3.4. Brown trout age structure for L. Ree, 2014

### 3.1.1.3. Brown Trout Growth Patterns and Longevity.

Scale analysis of the L. Ree trout sample from the 2014 survey indicates that the trout in this water have a relatively fast growth pattern on average very similar to that observed in previous surveys of other Irish limestone lakes (Figure 3.5).

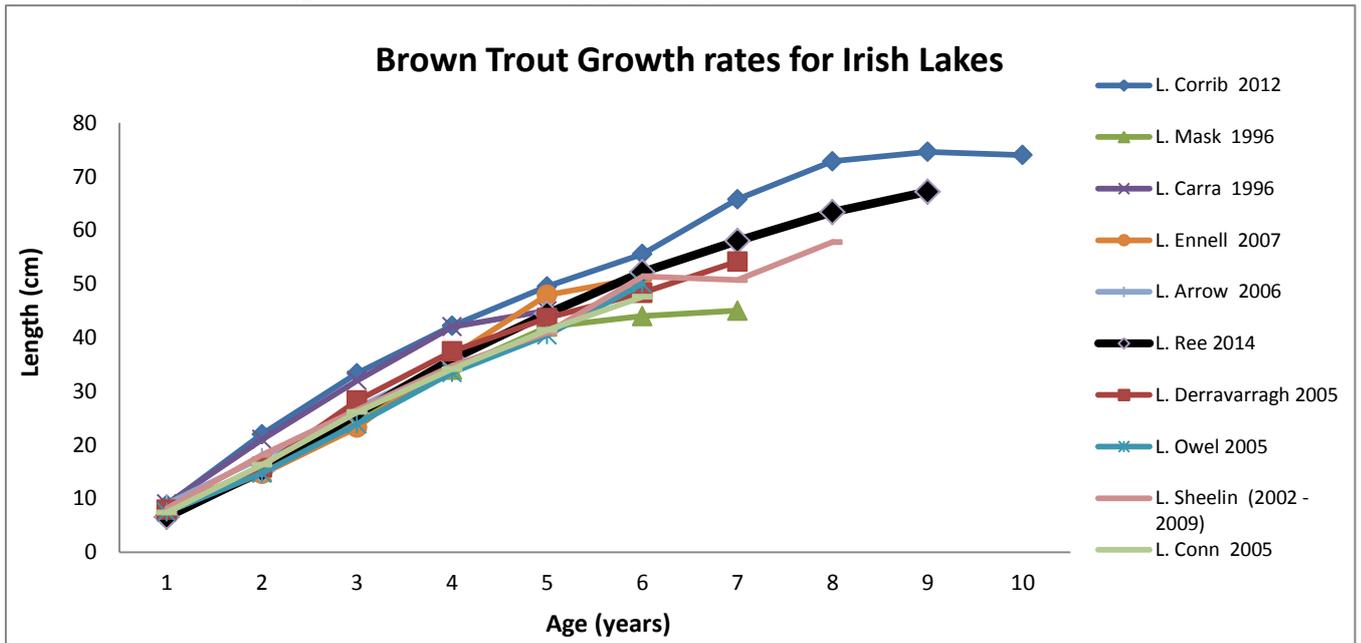


Figure 3.5. Growth patterns for trout samples from a range of Irish lakes.

The relative abundance of large trout in the L.Ree 2014 sample is, in part, explained by the fast growth pattern of these fish and also by the fact that many of them are relatively long-lived (Figure 3.5).

Considerable variation is evident in the back calculated length at age for L<sub>1</sub>, L<sub>2</sub> and the L<sub>3</sub> range of values (Table 3.2). This is as one would expect for a mixed trout stock in a large lake where fish are recruiting to the lake from a very wide range of channels. This will inevitably lead to some fish migrating to the lake as fry while others may not reach the lake until they are one or two years of age or even older. Both the variation in the productivity of the natal streams and the migratory age of trout going to the lake will influence the size of individual fish at one (L<sub>1</sub>), two (L<sub>2</sub>) and three (L<sub>3</sub>) years of age – the faster growing individuals in any year class are likely to be the individuals who migrated to the lake as fry. This pattern represents the norm in trout stocks in the larger Irish lakes.



Table 3.2. The mean and range of L values for the 2014 L. Ree trout sample.

Backcalculated Length at Age	1	2	3	4	5	6	7	8	9
Mean	6.6	15.2	25.7	36.0	44.5	52.1	58.0	63.4	65.1
Max	10.4	33.7	53.7	59.4	63.7	67.8	71.0	70.5	70.6
Min	3.0	6.6	9.7	18.8	25.1	42.0	49.0	57.6	61.0
N	214	215	202	159	89	53	28	11	3

### 3.1.1.4. Comparative Growth Patterns and Representation in the Population of

#### Male and Female fish.

The growth patterns of both male and female trout in the sample are illustrated in Figure 3.5. Data indicate no significant difference in the growth pattern of the sexes.

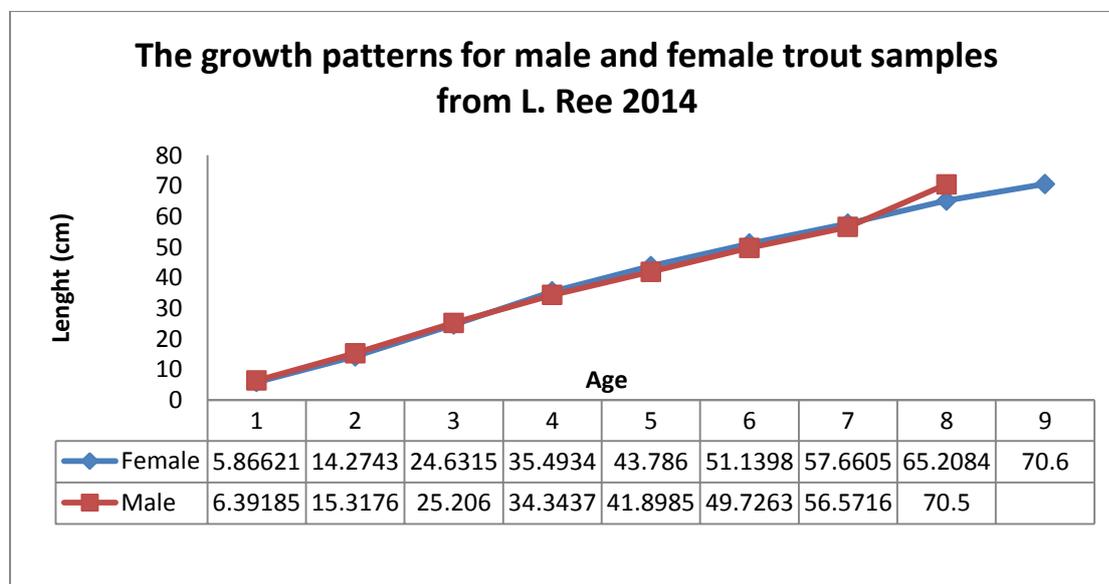


Figure 3.5. Comparison of male and female growth patterns for brown trout, L. Ree 2014.

The trout sex compositions per year class for the L. Ree sample are presented in Figure 3.6. In the younger adult year classes (3, 4 and five year old fish) the ratio fluctuates around a 50/50 ratio which



represents the norm for an Irish lake brown trout stock. Data for the older year classes (6 year old and older) suggest that more females live longer than males. However, the numbers of fish in this part of the overall sample are too small to confirm that this apparent difference is statistically significant.

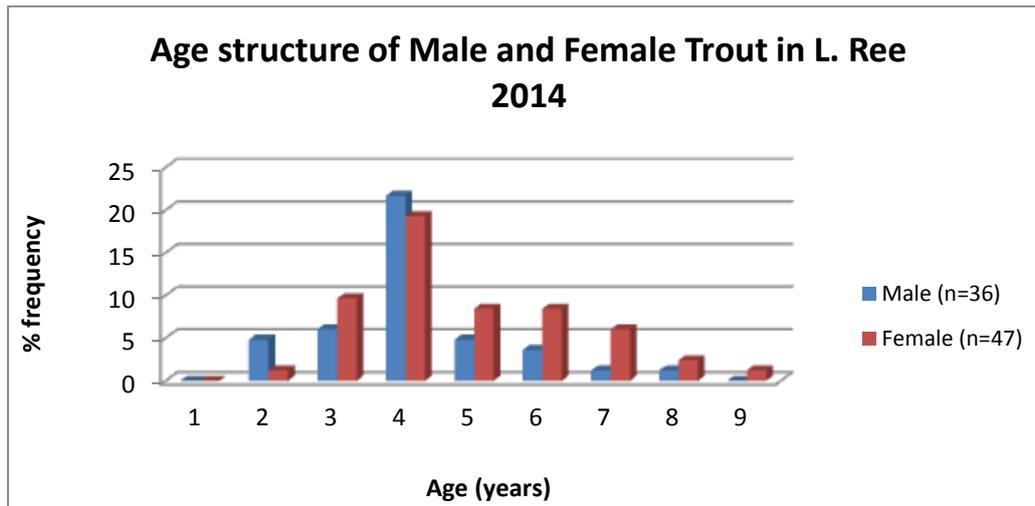


Figure 3.6. Brown trout age structure for male and females, L. Ree 2014.

### 3.1.1.5. Brown Trout Dietary Patterns

A total of 83 trout were examined for dietary content. Of these fish 24 (29%) were found to have empty stomachs. This is not unusual as fish will often regurgitate their stomach contents when caught in a net. The remaining trout (71%) recorded a mostly mixed diet, feeding on a range of items from perch and roach to mayfly, caddis, gammarus and snails (Figure 3.7).

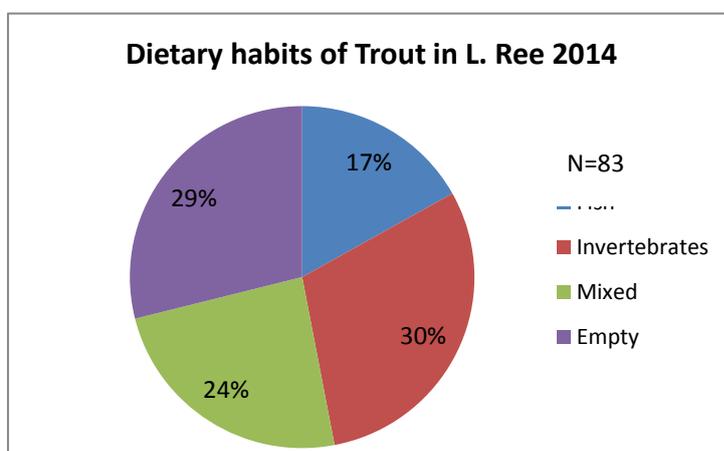


Figure 3.7. Brown trout dietary patterns, L. Ree 2014.



A few features of dietary pattern noted in the L. Ree trout sample are worthy of comment;-

- The significance of mayfly nymphs (*Ephemera danica*) in the trout's diet at this time of year points to the presence of a very large population of these insects in L. Ree at the time of the survey and indicate that there is likely to be a substantial mayfly hatch in May/June, 2015.
- It is not surprising that roach, perch and pike were recorded in trout stomachs from L. Ree given that there are significant numbers of large trout in the stock. These items would normally be a part of the larger trout's diet. In fact an autumn survey series on L. Conn suggests that larger trout in our lakes are piscivorous in nature for lengthy periods of the year, but would not be considered 'ferox' trout. Ferox trout are genetically different and these brown trout feeding on fish for part of the year do so mainly due to the availability of such prey items.

An extensive database on the dietary habits of trout in Irish lakes in springtime is available over the last 50 years. In these waters, during this specific period, adult trout usually feed principally on crustaceans (*Asellus* and *Gammarus*), insects (principally chironomid larvae and pupae) and molluscs (snails) (Kennedy and Fitzmaurice, 1971, O'Grady, 1981).

### **3.1.1.6. Brown Trout Length / Weight Relationship**

The relationship between length and weight of trout are expressed in terms of regression coefficient and Fulton's condition factor (*K*) (Table 3.3). Condition factor is a means of expressing and comparing the plumpness of fish in a quantifiable manner. This is based on the premise that heavier fish for a given length are in better condition (Bagenal and Tesch, 1978). Fulton's condition factor (*K*) was calculated for each fish using the formula;

$$K = W*100/L^3$$

where W = weight of fish(g) and L = length of fish (cm).

Fish in poor condition will have a condition factor of less than unity, while those in good condition will have *K* values greater than unity (Frost and Brown, 1967). As the *K* value for the L. Ree sample is 1.18 these fish can be regarded as being in good condition. This *K* value is very much in line with recent values recorded for the Corrib population (Table 3.3).



Table 3.3. Trout Length: Weight Relationships.

	<b>N</b>	<b>Log (a)</b>	<b>b</b>	<b>R<sup>2</sup></b>	<b>Condition Factor (K)</b>
L. Corrib 2012	128	-4.64	2.88	0.93	1.19
<b>L. Ree 2014</b>	<b>88</b>	<b>-4.64</b>	<b>2.88</b>	<b>0.97</b>	<b>1.18</b>

### 3.1.1.7. The Lake Wide Distribution of Brown Trout

The distribution pattern of trout from L. Ree during the Spring 2014 survey indicates that the trout are widespread throughout the lake (Figure 3.8). The low numbers recorded at each sampling point is a reflection of the solitary nature of trout, they are not a shoaling fish species. Of the 199 sampling locations trout were recorded in 59% of these sites. The highest number of sampling locations where no trout were recorded were west / southwest of Inchmore Island (18 sites) and the north end of the lake (Lanesborough)(16 sites).

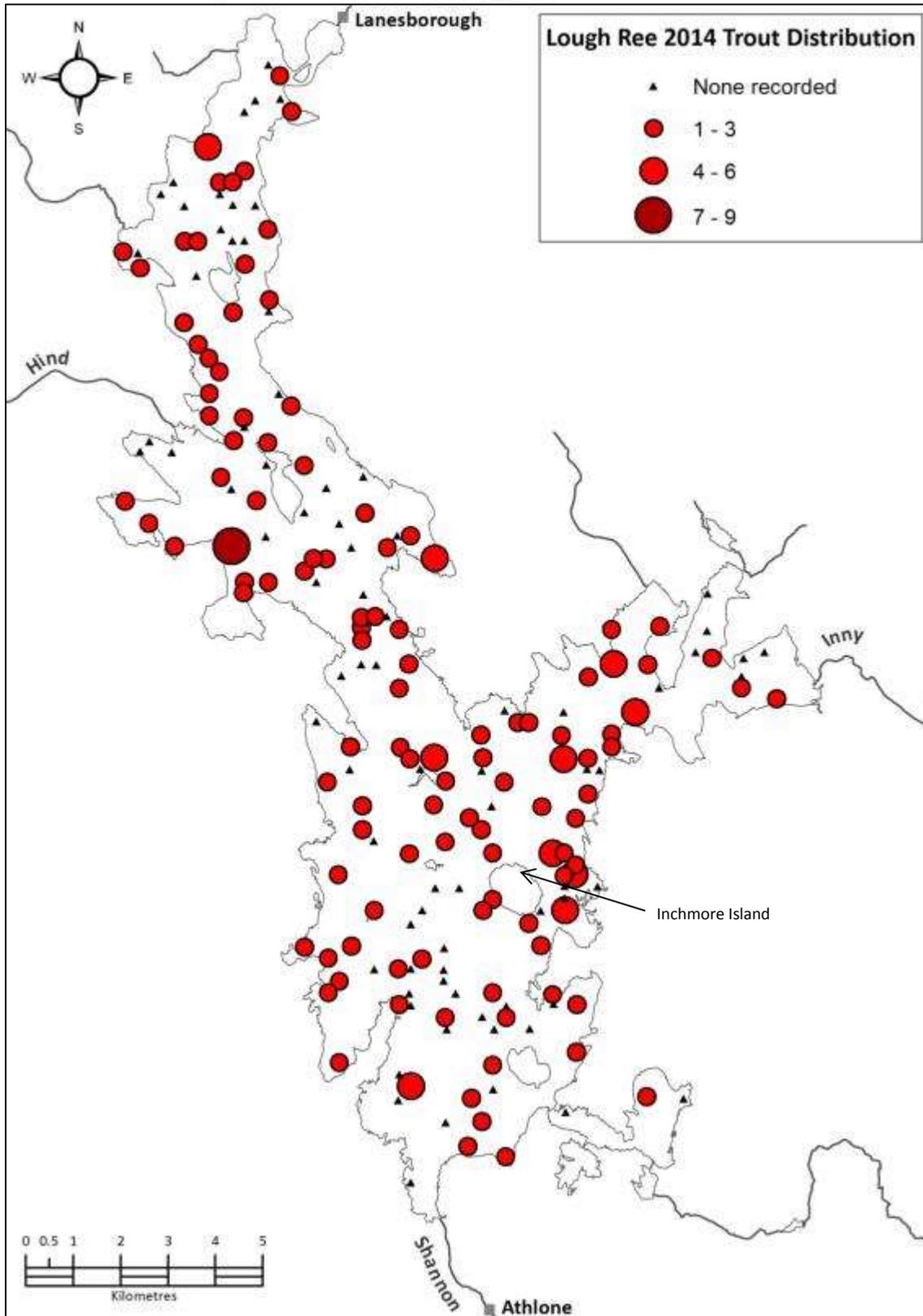


Figure 3.8. Distribution and numbers of brown trout recorded during the L. Ree netting survey, 2014.



### 3.1.2. Pike

Data compiled on the pike population in L. Ree is provided here and put in perspective relative to some of Ireland's managed lake brown trout fisheries. A total of 280 pike were recorded during the course of this fish stock assessment.

#### 3.1.2.1. CPUE Values.

A pike CPUE value of 1.41 was recorded in this survey. This is a relatively high figure when compared to values recorded across a range of lakes in recent years (Figure 3.9). This figure is of little significance until it is viewed within the context of the pike stock structure at that time (Figure 3.10).

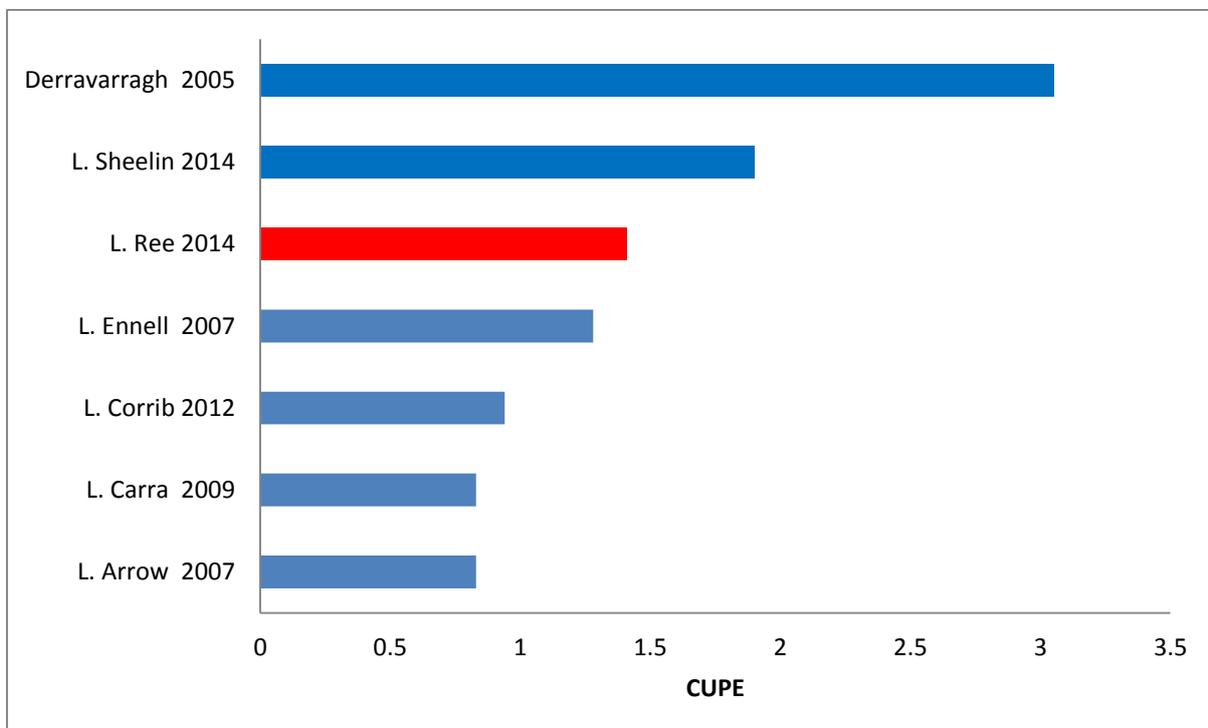


Figure 3.9. Comparison of Pike CPUE values for L. Ree and other Irish lakes, Spring sampled.

#### 3.1.2.2. Pike length frequency distribution

The percentage length frequency pattern for the L. Ree sample is presented in Figure 3.10. A number of points are worth noting:-

- The normal distribution pattern of the sample illustrates that this is an undisturbed stock which is not being cropped heavily.
- The data suggest that recruitment to the population in recent years has been steady with little annual fluctuation. The reader should note that the survey methodology used to



capture this sample cannot capture pike in significant numbers which are smaller than ~35cm.

- The fact that there are very few fish in the sample  $\geq 100\text{cm}$  suggests that this pike population does not contain a significant number of “lake specimen pike” (fish  $\geq 30\text{lbs}$  in weight).

The CPUE value calculated for the pike stock of 1.41 can be regarded as high when one sees that the population is a large, balanced and uncropped stock.

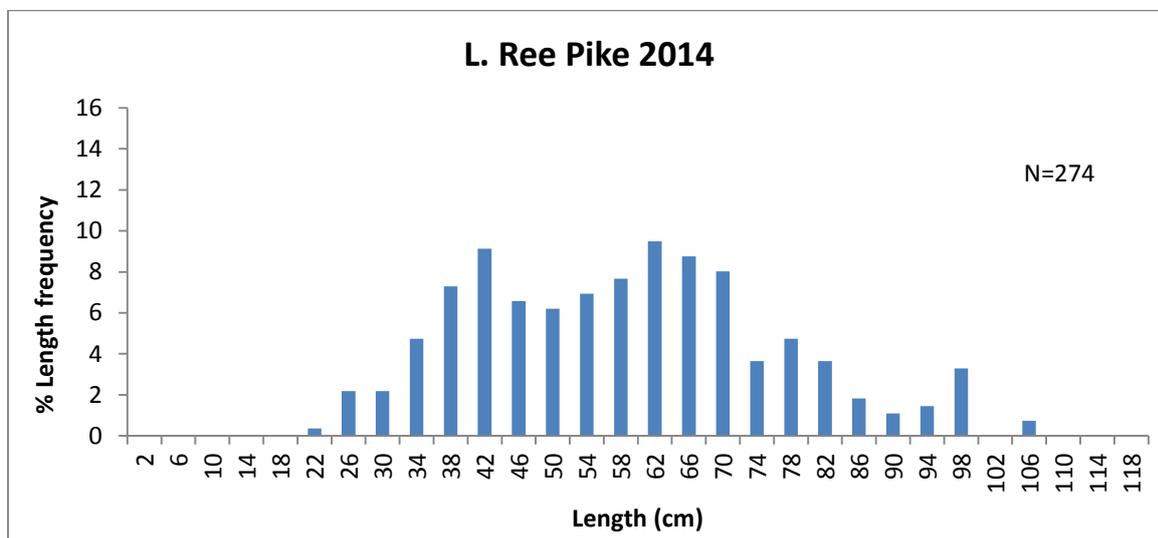


Figure 3.10. Length frequency distribution for pike, L. Ree 2014.

### 3.1.2.3. Age Structure

An examination of the age structure indicates some variation in the strength of individual year classes (Figure 3.11). The younger year classes (2,3 and 4 year old fish) are all strongly represented in the sample indicating that there are likely to be significant adult stocks of pike in the lake over the next three years. The decline in the representation of 10 and 11 year-old fish in the sample is not surprising – few pike in Irish loughs live beyond 10 years of age.

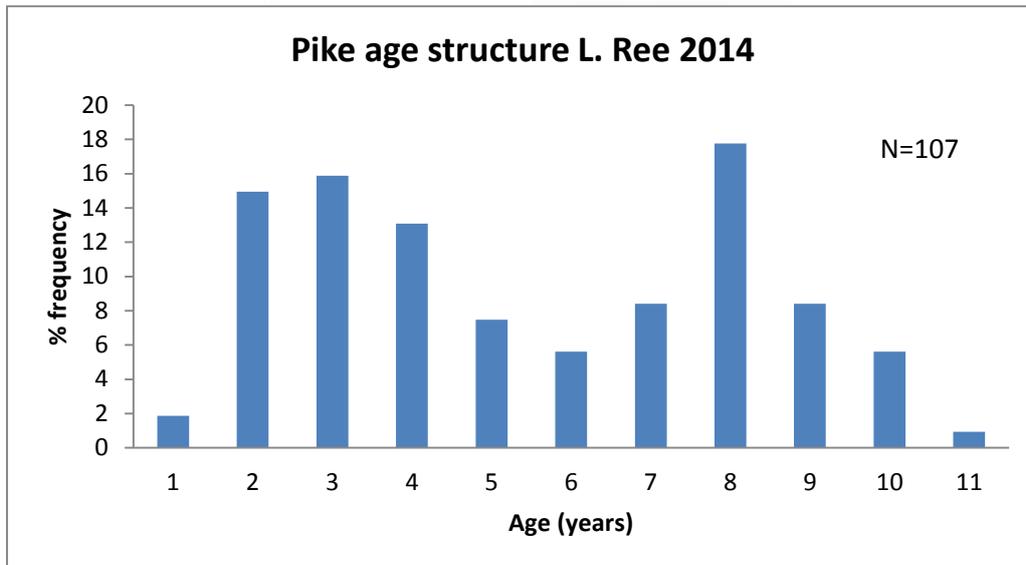


Figure 3.11. Pike age structure, L. Ree 2014.

The representation of male and female pike in individual year classes in the L. Ree sample are illustrated (Figure 3.12). These results are typical for an Irish lake pike stock with few males exceeding four years of age and all the bigger, older fish in the population being females.

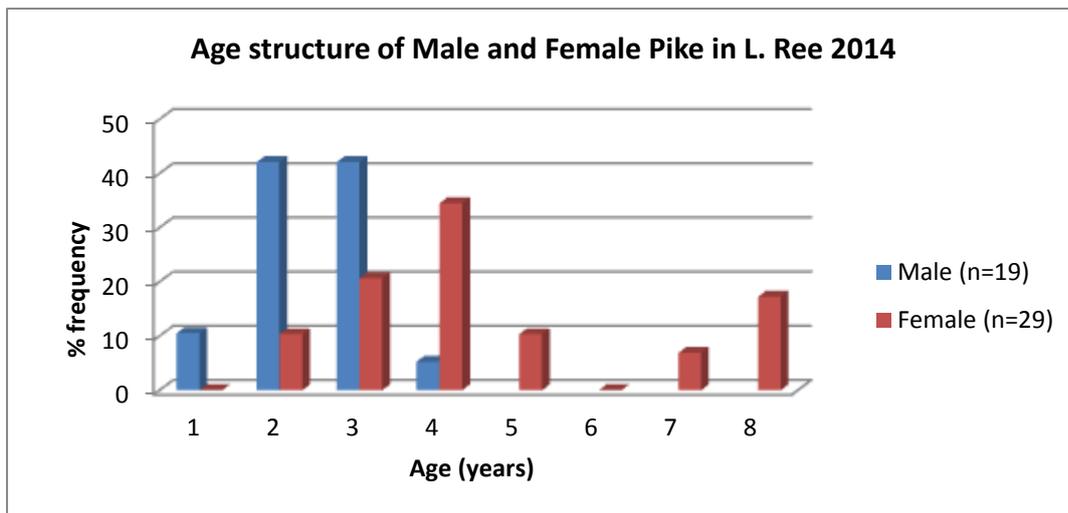


Figure 3.12. Comparison of male and female pike age structure, L. Ree 2014.



### 3.1.2.4. Growth Patterns.

The growth pattern of pike in the L. Ree 2014 sample are illustrated in Figure X and compared with data from a range of other Irish lakes. These data indicate that L. Ree pike are fast growing and long lived fish, similar to the stocks in other Irish limestone lakes (Figure 3.13).

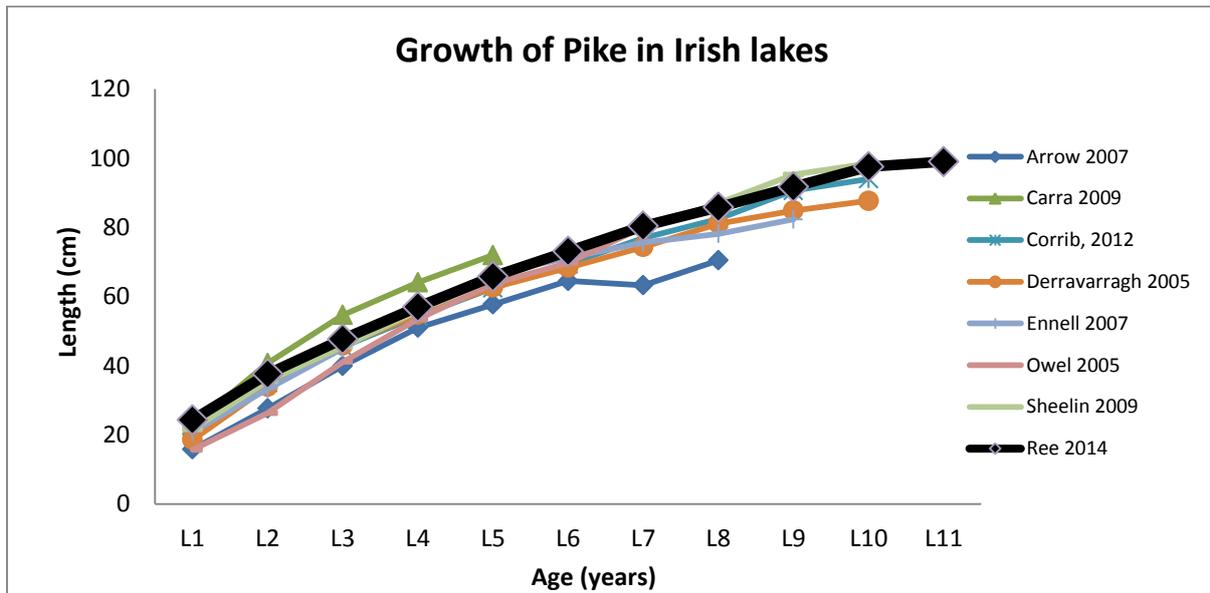


Figure 3.13. Growth of pike in Irish lakes.

### 3.1.2.5. Dietary observations.

Data in relation to the dietary habits of pike examined in the 2014 survey sample are provided (Figure 3.14). A total of 109 fish were examined.

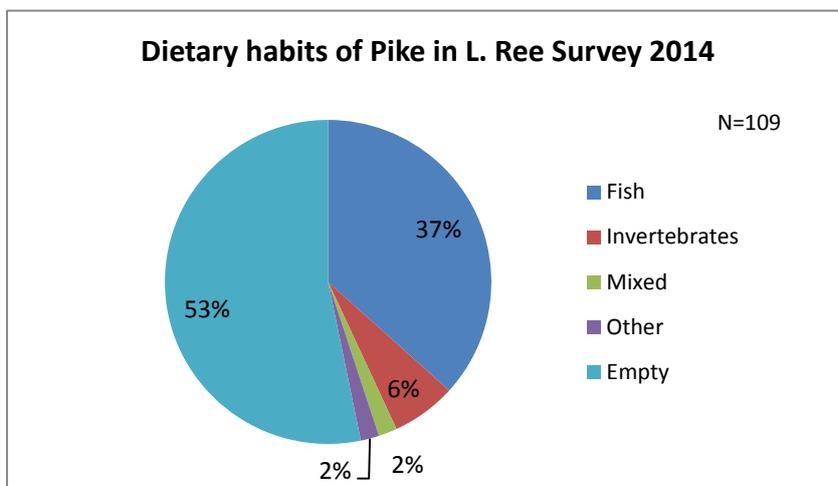


Figure 3.14. Pike dietary patterns.



Many of the pike examined had no food in their stomachs (Figure 3.14). This is a common feature of pike caught in gill nets. Many of these fish tend to regurgitate their stomach contents when caught in a net. Of those with food items present in their stomachs fish remains (either perch or roach) dominated. The range of invertebrates consumed consisted of asellus mainly and to a lesser extent mayfly nymphs.

### 3.1.2.6. Length Weight Relationships - Condition Factor

As with the trout, the relationship between length and weight of pike was calculated and fish condition factor also determined. This data is presented below along with the values generated for L. Corrib 2012 (Table 3.4). Data indicate that both of these pike samples have a reasonable condition factor and very similar length/weight relationships.

Table 3.4. Length/Weight Relationships and Condition factor for pike samples from L. Ree In 2014 and L. Corrib in 2012.

	<b>N</b>	<b>Log (a)</b>	<b>b</b>	<b>R<sup>2</sup></b>	<b>Condition Factor (K)</b>
L. Corrib 2012	204	-5.77	3.25	0.94	0.90
<b>L. Ree 2014</b>	<b>108</b>	<b>-5.31</b>	<b>3.09</b>	<b>0.95</b>	<b>0.86</b>

Fish in poor condition will have a condition factor of less than unity, while those in good condition will have *K* values greater than unity (Frost and Brown, 1967). As the *K* value for the L. Ree sample is 0.86 these fish can be regarded as being in reasonable condition.

### 3.1.2.8. Lake wide distribution of Pike

The distribution pattern of pike from L. Ree, as recorded from the Spring sampling programme 2014 shows that pike are widespread throughout the lake (Figure 3.16). A total of 121 sampling sites recorded pike (61%). Numbers of pike recorded in any one net ranged from 0 to 15. High densities of pike were recorded within the River Inny Bay area and just off Inchturk Island perhaps reflecting movement of pike into spawning areas (Figure 3.16).

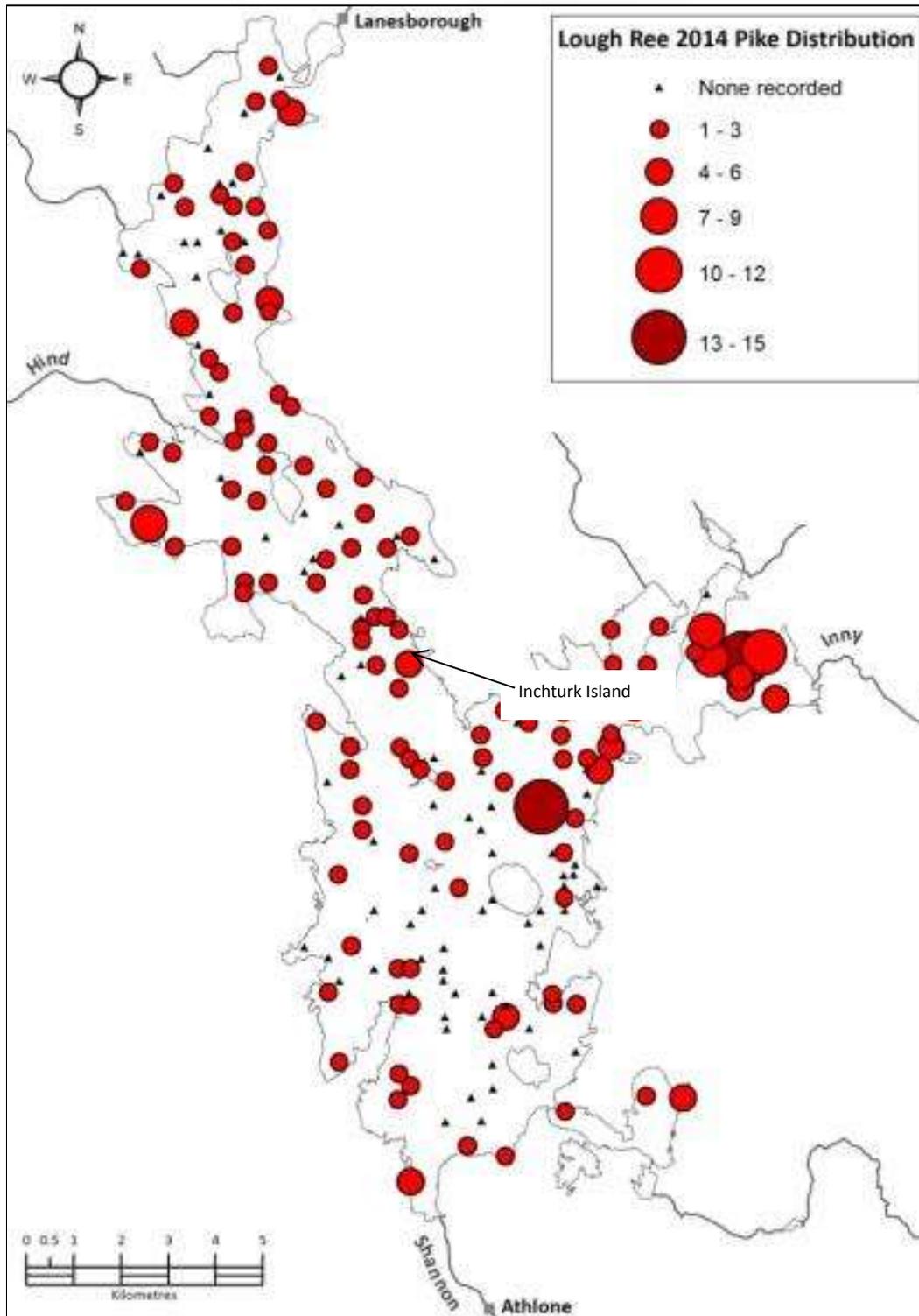


Figure 3.16. The distribution of the pike sample in the 2014 survey of L. Ree.



### 3.1.3 The Perch Stock

The data compiled on the perch stock in L. Ree in 2014 is provided here and compared to survey information available for this species in other waters. A total of 1282 perch were recorded during the course of this fish stock assessment.

#### 3.1.3.1. CPUE value and comparative data

A perch CPUE value of 6.44 was calculated for L. Ree in 2014. This can be regarded as reflecting the presence of a large stock of perch by Irish standards. Data are presented in Figure 3.17 to illustrate the range of perch CPUE values recorded in many loughs over a period of years and to illustrate the wide fluctuations that can occur in perch populations even within lakes.

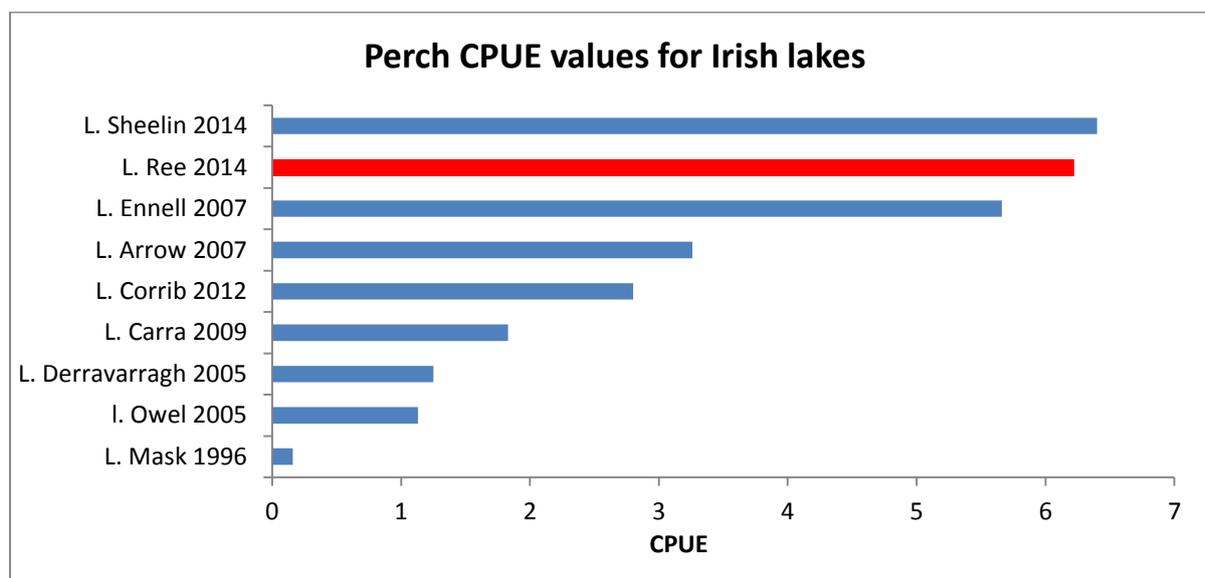


Figure 3.17. Comparison of Perch CPUE values for selected Irish lakes.

#### 3.1.3.2. Population Structure

The stock structure of the perch sample from the L. Ree survey is provided in Figure 3.18. These data illustrate a number of points about the current L. Ree perch population;-

- Currently there is a succession of strong year classes in this perch stock with possibly significant numbers of 2 to 6 year-old fish – this comment is based on the authors' evaluation of perch age/length data from numerous Irish lakes. It was not possible to age the sample caught in the L.Ree survey.



- A few very large perch ( $\leq 35.0\text{cm}$ .) were captured in the L. Ree survey. Historical data available on age/length relationship for this species in Ireland indicates these very big fish might be up to 13 years of age.

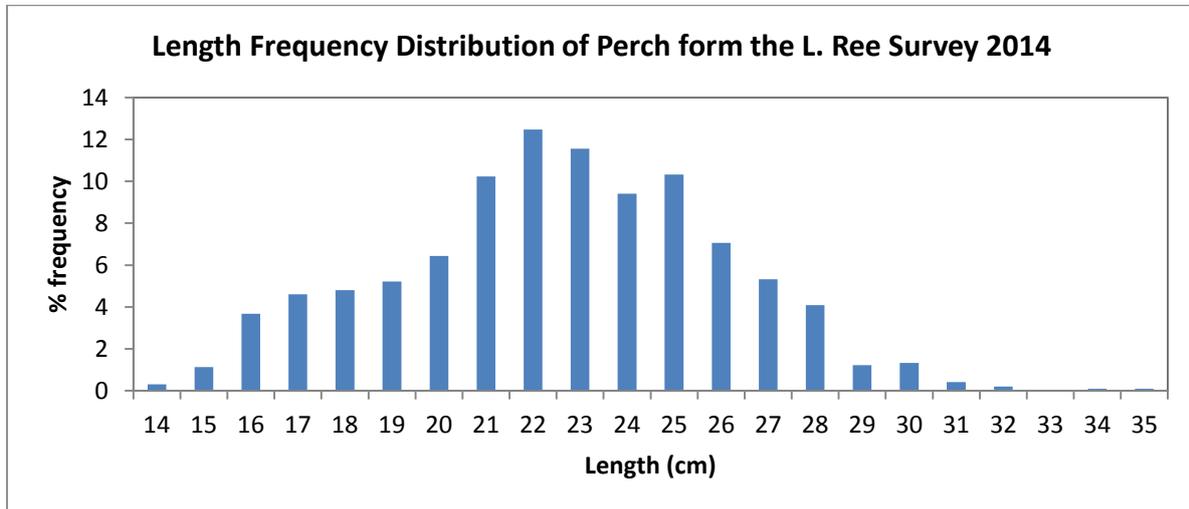


Figure 3.18. Length frequency distribution for perch, L. Ree 2014.

### 3.1.3.3. Sex Ratio in the Perch Stock

The sex ratio in the L Ree perch sample illustrates a slight dominance of males in the population (Figure 3.19). In the authors' experience this is unusual. Previous observations in relation to the sex ratio in Irish perch stocks have found a dominance of females in perch populations. As outlined in the methods section fish greater than 25cm were released, when alive and in good condition. This protocol may have biased the male to female ratio as in the majority of cases larger older perch tend to be female.

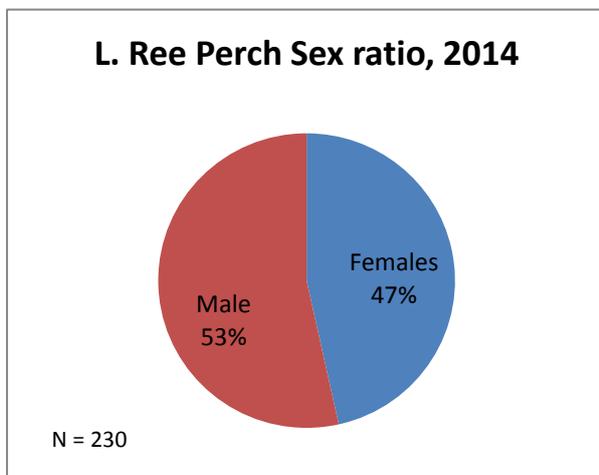


Figure 3.19. Perch sex ration, L. Ree 2014.



### 3.1.3.4. Length Weight Relationship & Condition Factor

The relationship between length and weight of perch was calculated along with fish condition factor for L. Ree (2014) and compared with the L. Corrib (2012) results (Table 3.5). The statistics for both populations are very similar and are indicative of well-conditioned fish in both populations.

Table 3.5. Perch Length / weight relationship & Condition Factor for L. Ree and comparable data for L. Corrib stock in 2012.

Values	N	Log (a)	b	R <sup>2</sup>	Condition Factor (K)
L. Ree 2014	21	-4.79	3.07	0.87	1.52
L. Corrib 2012	191	-5.57	3.31	0.86	1.56



### 3.1.3.5. Perch Distribution Patterns

The perch samples recorded during the L. Ree 2014 survey indicate the species was widely distributed throughout the lake (Figure 3.20). A total of 172 sampling sites recorded perch. Of these sites the highest densities were noted in an area of the lake between Clawinch Island (just north of Portrunny Bay) and Inchmore Island.

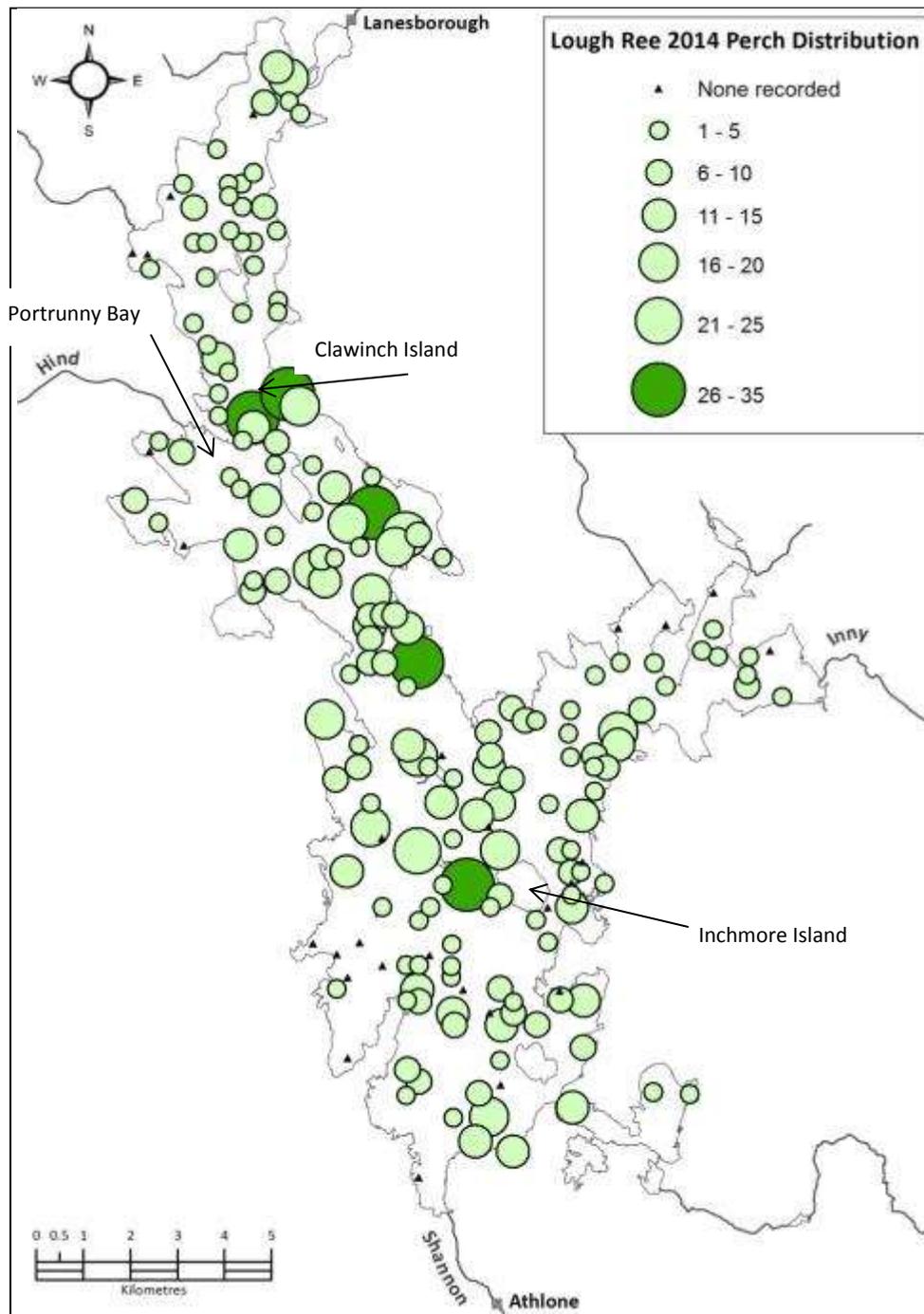


Figure 3.20. The distribution of the perch sample from the 2014 survey of L. Ree.



### 3.1.4. Roach Stocks

Data in relation to the L. Ree roach population are provided here and compared with the available database on roach in other Irish lakes. A total of 4186 roach were recorded during the course of this fish stock assessment.

#### 3.1.4.1. CPUE Values

The roach CPUE value calculated for L. Ree in 2014 was 21.04. This is a high figure when compared to CPUE values calculated for other lakes in recent years (Figure 3.21). This value suggests that L. Ree may still be regarded as a culturally eutrophic lake – roach thrive in culturally eutrophic conditions.

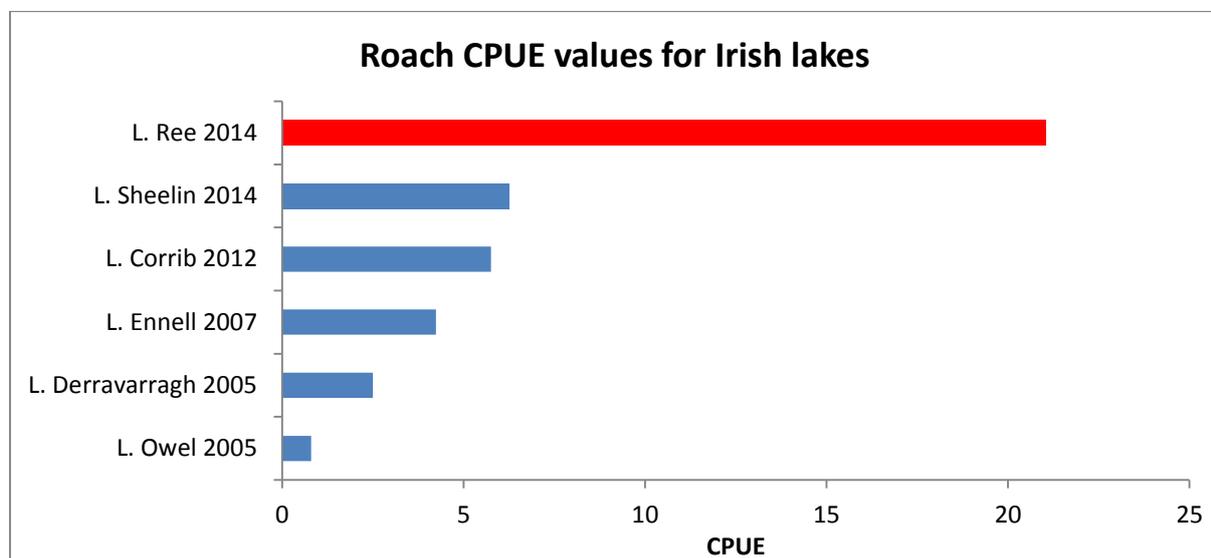


Figure 3.21. Comparison of Roach CPUE values from a number of Spring Sampled Irish lakes.

There is no historical data available in relation to the fluctuations which might have taken place in relation to the roach stock in L. Ree since this invasive fish entered the Shannon Catchment at some point in the 1970's (Fitzmaurice 1981). A long term data set in relation to annual fluctuations in fish stocks in L. Sheelin suggests that the L. Ree roach population may have been significantly larger in the past, prior to the establishment of a zebra mussel population (Figure 3.22). In Loughs Sheelin and Derravaragh, prior to the introduction of zebra mussels in the early 00's, roach CPUE values of up to 49.7 and 112.4 respectively were recorded on these two waters, far in excess of the current L. Ree figure. Given the ecological similarities of these three lakes it is likely that the roach stock has declined somewhat on L. Ree in recent years.

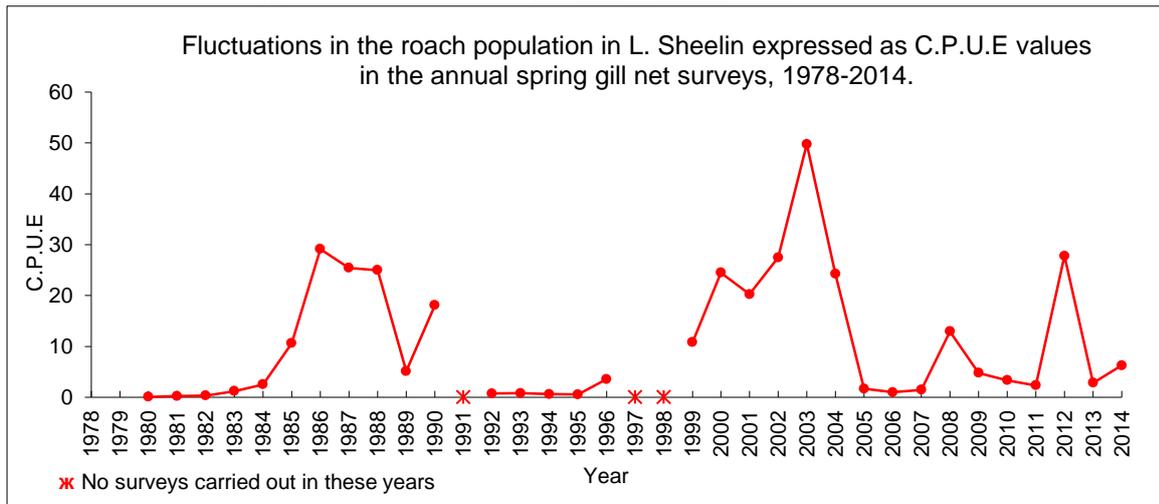


Figure 3.22. Roach CPUE values from L. Sheelin 1978 to 2014.

### 3.1.4.2 Population Structure

The percentage length frequency distribution of the L. Ree roach sample is illustrated in Figure 3.23. These data would indicate a relatively uniform recruitment rate to this population over the last 6 to 7 years. Though there does appear to be a significant number of fish in the bigger length range present in the population (>27cm), approximately 37%.

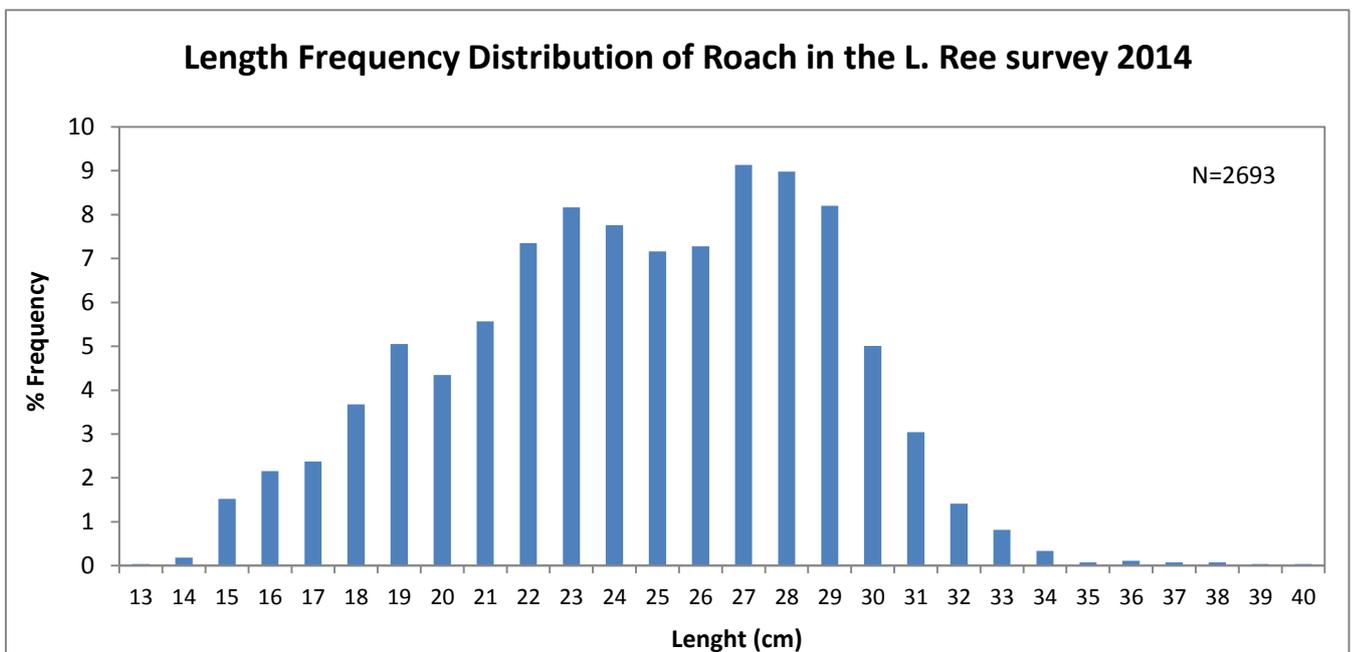


Figure 3.23. Roach length frequency distribution, L. Ree 2014



However, the roach population age structure would suggest that a small number of years classes are under-represented (namely the 6 and 7 year old ages classes) and that the population is dominated more so by the older age classes of 7 years and older, approximately 70% (Figure 3.24). This however may also be a reflection of when the survey was conducted (Spring), a time when roach may be exhibiting seasonal migration / aggregations.

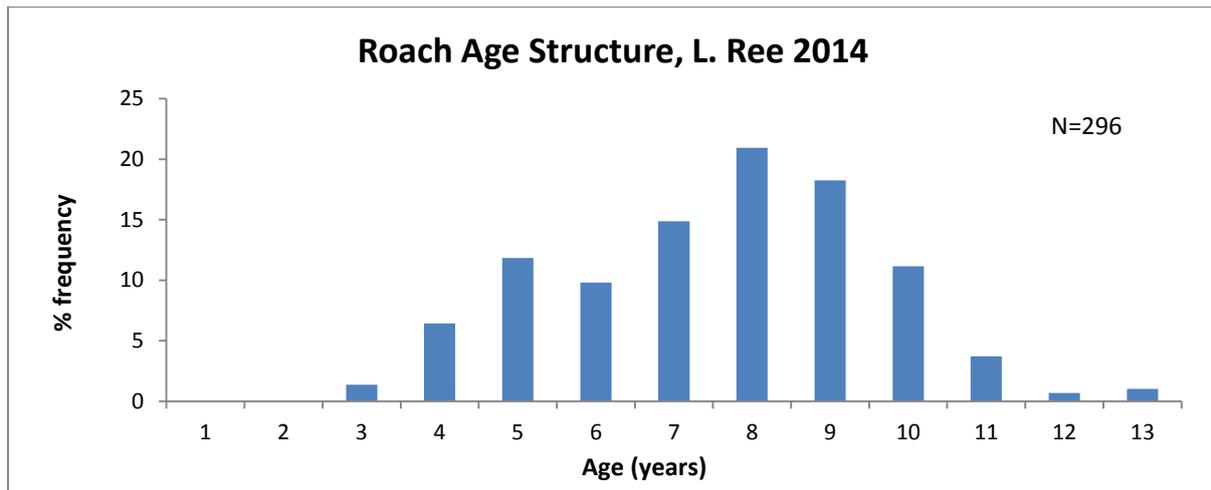


Figure 3.24. Roach age structure, L. Ree 2014.

### 3.1.4.3. Roach Growth Patterns

Growth patterns for roach in a range of Irish lakes including the 2014 L. Ree sample are illustrated below in Figure 3.25. The L. Ree roach growth rate appears to be within the middle range of growth patterns observed for a number of other Irish lakes. Though, along with the other Shannon lakes included, the roach in L. Ree are longer lived and bigger than those along the west coast.

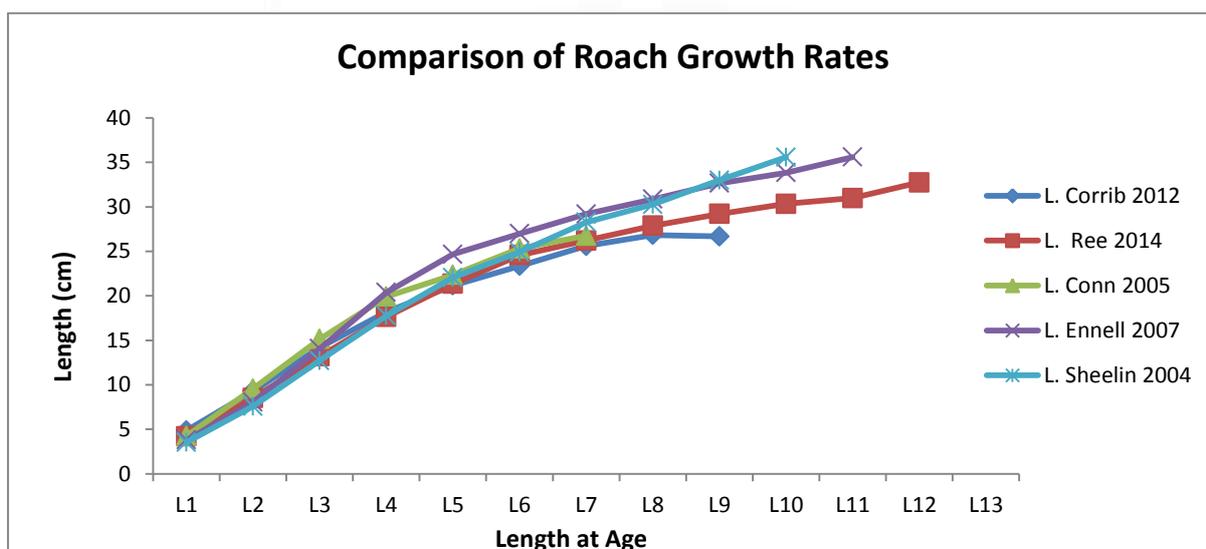


Figure 3.25. Roach growth patterns for the L. Ree stock in 2014 and a range of other Irish lakes.

#### 3.1.4.4. Length Weight Relationship & Condition Factor

The relationship between length and weight of roach was calculated along with fish condition factor for L. Ree (2014) and compared with the L. Corrib (2012) results (Table 3.6). The statistics for both populations are very similar and are indicative of well-conditioned fish in both populations.

Table 3.6. Roach Length / weight relationship & Condition Factor for L. Ree and comparable data for L. Corrib stock in 2012.

	N	Log (a)	b	R <sup>2</sup>	Condition Factor (K)
L. Corrib 2012	327	-5.32	3.25	0.94	1.86
L. Ree 2014	556	-4.8	3.05	0.8	2.08

#### 3.1.4.5 Roach Sex Ratios

Roach, like other cyprinids, perch and pike populations, tend to be dominated by larger, older female fish. The sex ratio in the 2014 roach sample from L. Ree reflect this trend and is very similar to a long term data set on this feature of roach populations in L. Sheelin (Figure 3.26).

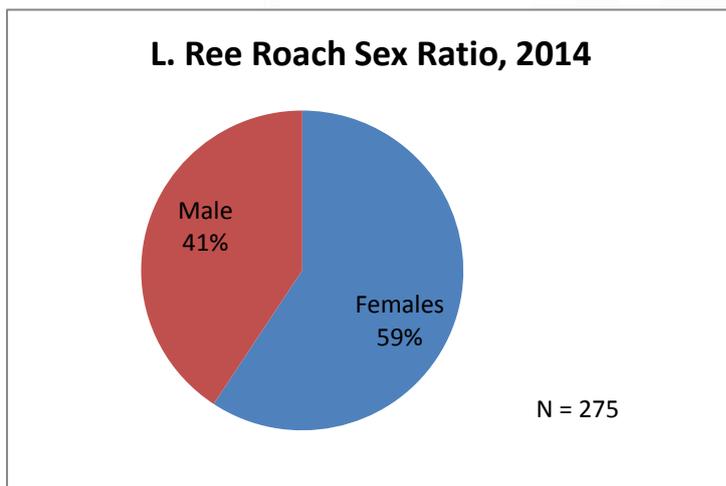


Figure 3.26. The sex ratio of roach examined from L. Ree in 2014

### 3.1.4.6. Roach Distribution Patterns

The distribution of roach within L. Ree, as noted from the Spring 2014 survey, is presented in Figure 3.27. Roach were recorded throughout the lake - being present at 85% (170) of all sites sampled. Greatest densities of this species were found within an area between Elfeet Bay and just north of Inchcleraun Island, indicating possible important over-wintering locations.

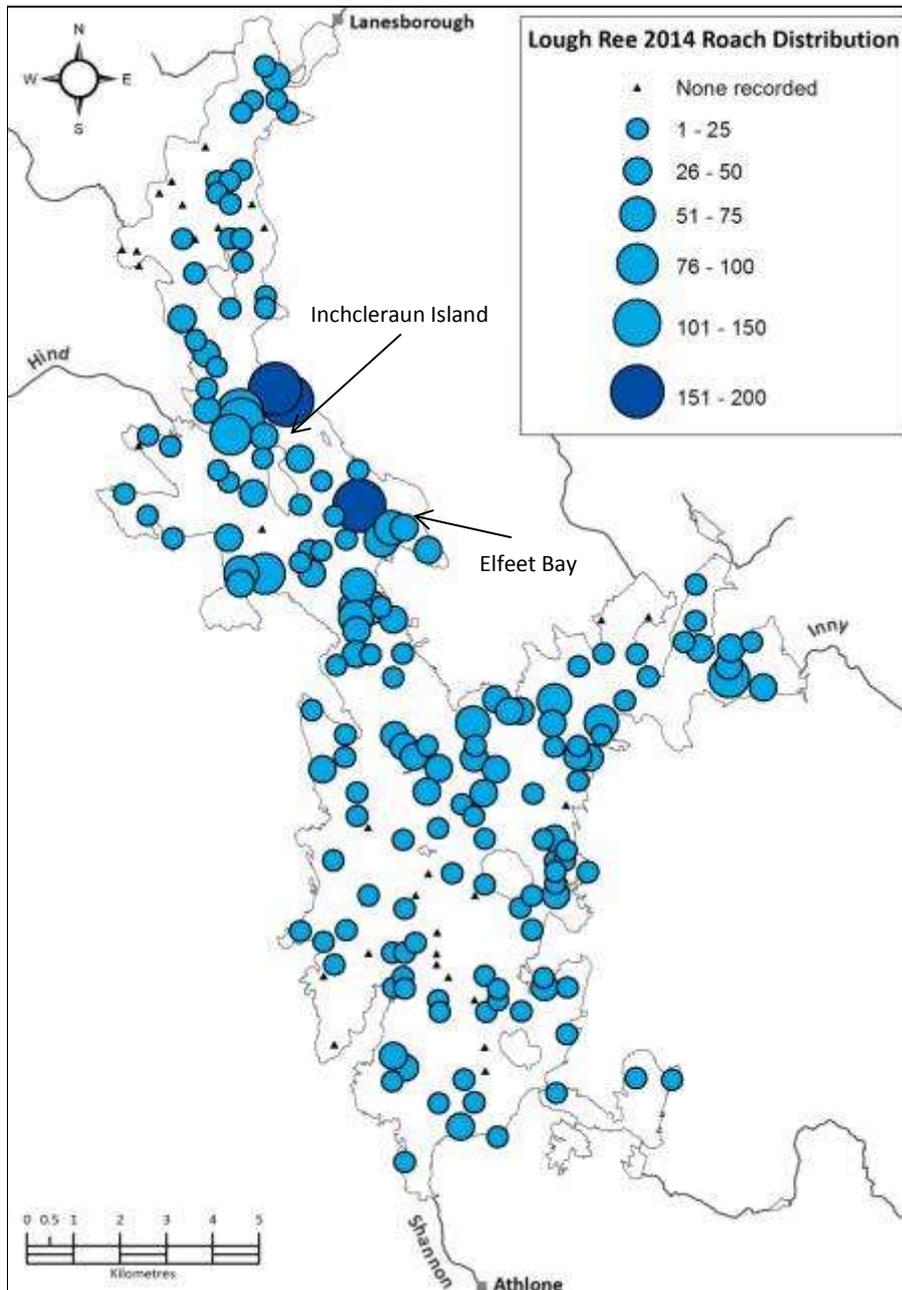


Figure 3.27. The distribution of the roach sample in the 2014 survey of L. Ree.



### 3.1.5. Bream

A total of 293 bream were recorded during the L. Ree survey 2014 representing a CPUE of 1.47.

#### 3.1.5.1. Bream CPUE

A comparison of CPUE values for bream from a number of other Spring sampled Irish lakes suggests the L. Ree CPUE value is high (Figure 3.28). However it should be noted that the movement of many coarse fish species is very much linked to temperature and the colder waters normally experienced during Spring time limits the movement of such fish species like bream.

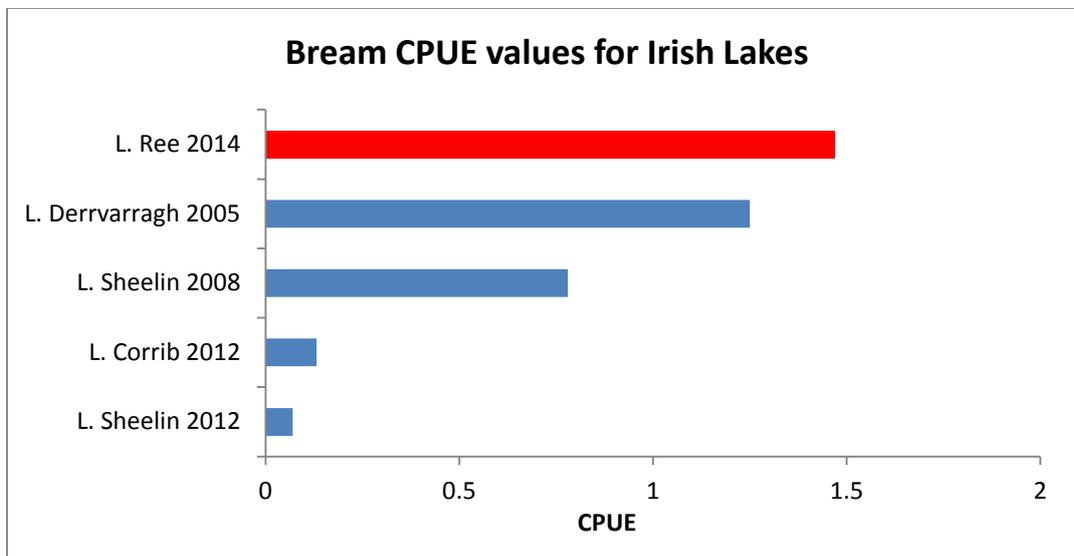


Figure 3.28. Comparison of Bream CPUE values across a number of Irish lakes.

#### 3.1.5.2. Population Structure

The length frequency distribution of the L. Ree bream, as presented below (Figure 3.29) suggests a balanced population is present in the lake. For this type of lake survey it is not unusual that so few fish in the smaller length classes are recorded. Fish recorded ranged in length from 20cm to 48cm.

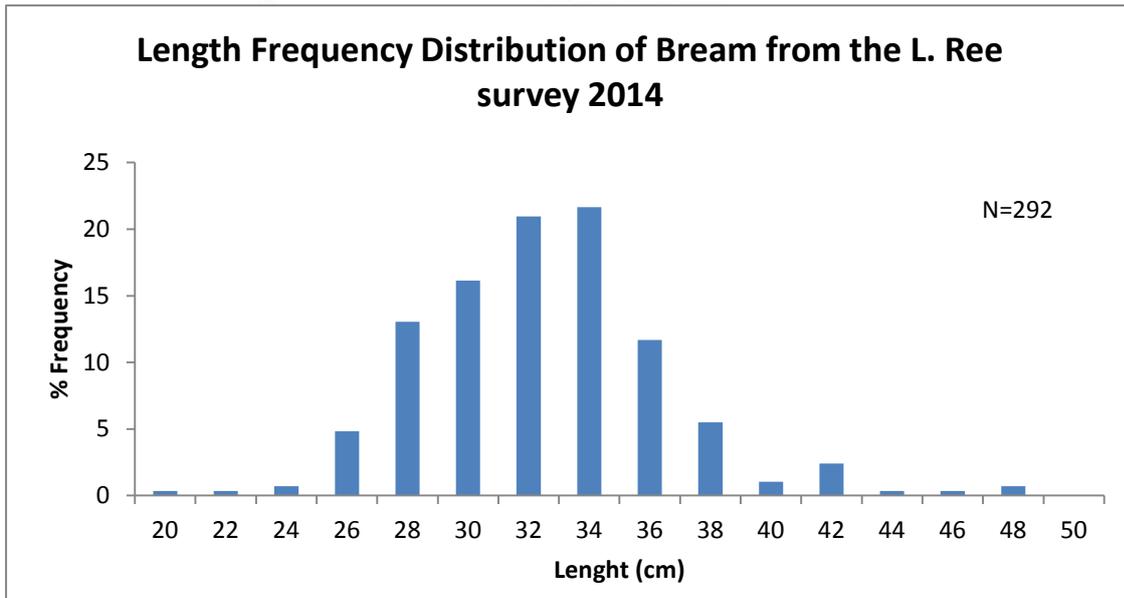


Figure 3.29. Bream length frequency distribution, L. Ree 2015

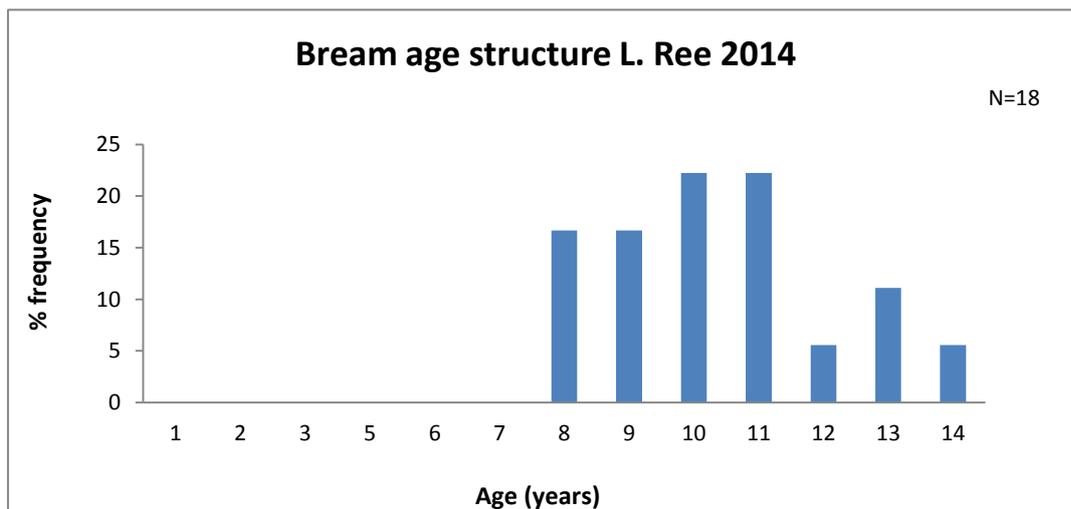


Figure 3.30. Bream age structure.

Only a small number of bream scale samples were collected during the course of the survey due to the large number of samples to be processed and thus the age data presented here is not necessarily an accurate reflection of the true age structure of the bream population present in the lake. Based on the length frequency distribution observed (Figure 3.30) younger fish are present in the lake population. Data from the length frequency and age structure would suggest a relatively stable bream population.



The growth rate of the L. Ree bream is compared with the growth of bream in a number of other Irish lakes (Figure 3.31). The bream of L. Ree would seem to be somewhat slower growing than those observed elsewhere. However this is only marginal.

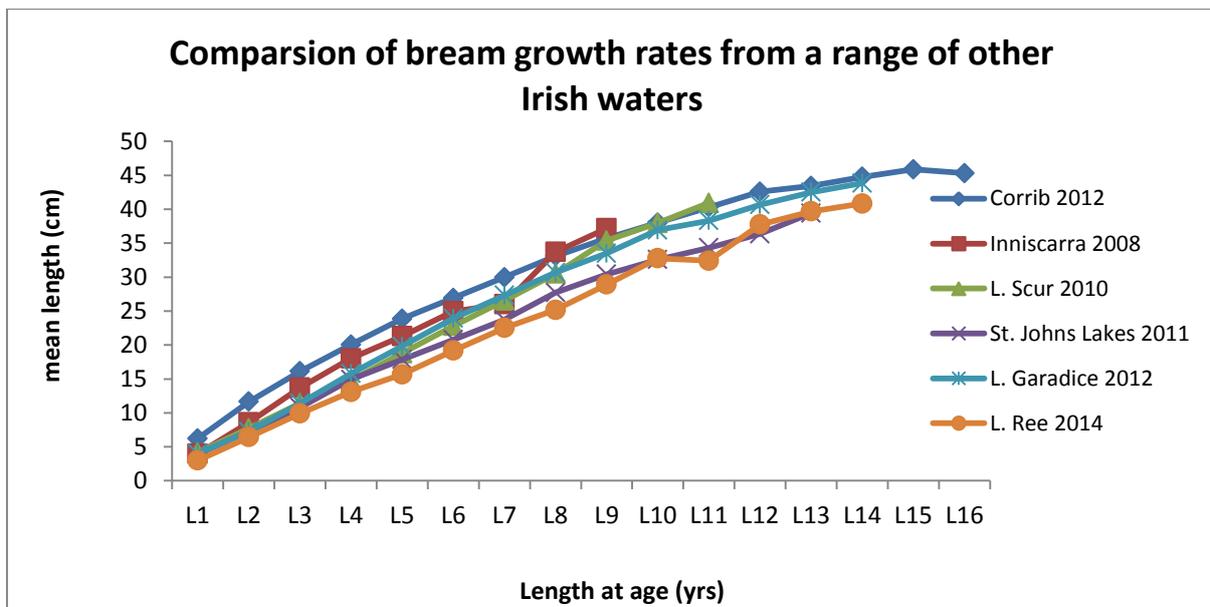


Figure 3.31. Comparison of bream growth rates across a number of Irish lakes.

### 3.1.5.3. Lake Distribution

The distribution pattern of the L. Ree bream show the species are less widespread than roach and roach bream hybrids and in general have a patchy distribution. They appear to have a preference for the mid section of the lake (Figure 3.32). Areas such as Galey Bay, Inny Bay, the smaller mid lake islands along with the top end of the lake are the primary locations as noted during this survey. Of the sites sampled 30% recorded bream.

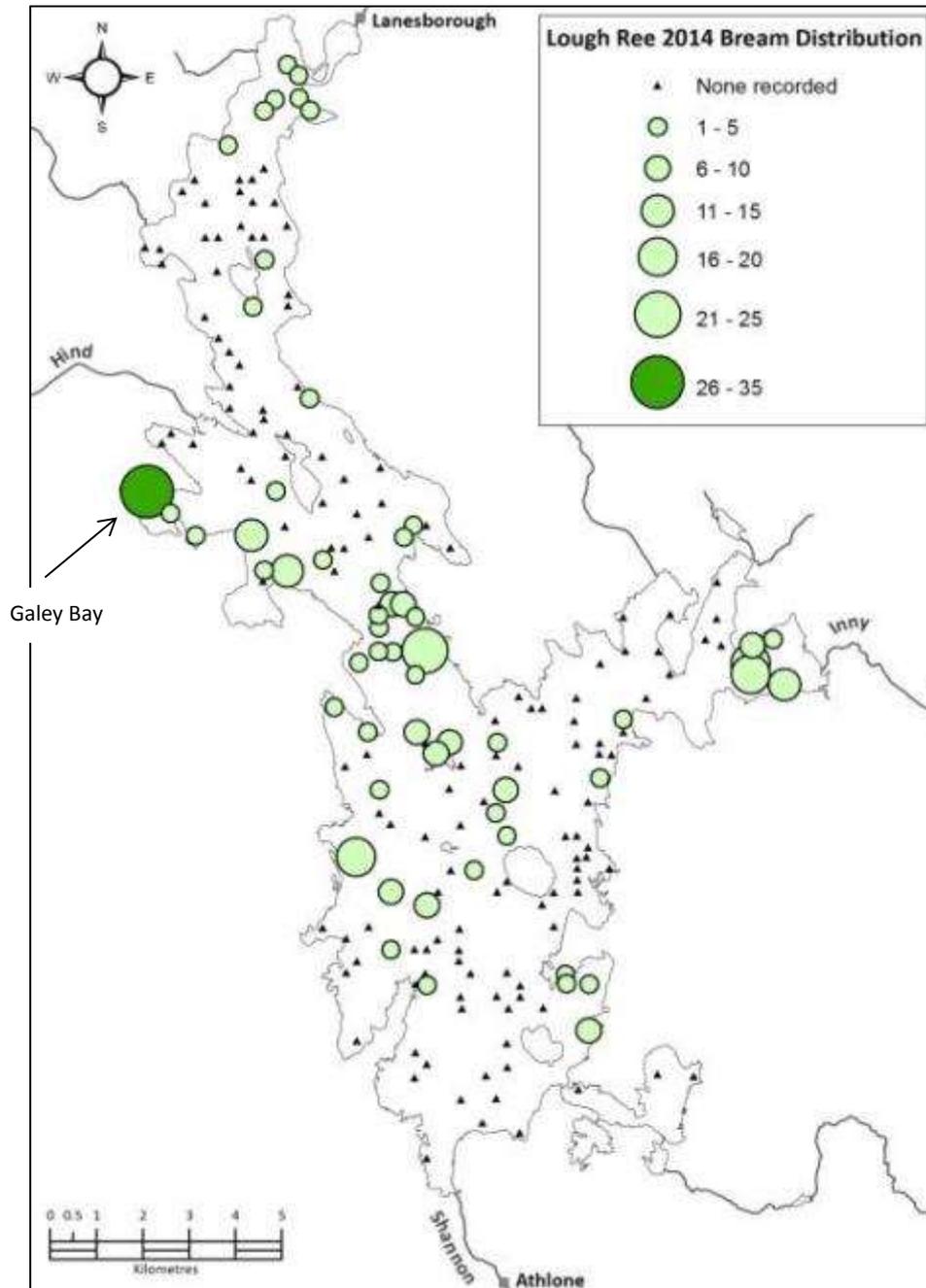


Figure 3.32. Distribution and numbers of bream recorded during the L. Ree netting survey, 2014.



### 3.1.6 Rudd

A total of 103 rudd were recorded during the L. Ree 2014 survey. The CPUE value for rudd was 0.52. This can be classed as a high value for rudd, in the majority of other spring sampled lake surveys numbers of rudd recorded are generally less than 10 in number (Loughs Arrow, Sheelin, Ennell and Derravaragh).

#### 3.1.6.1. Rudd Population structure

Rudd recorded from L. Ree during the course of this survey ranged in length from 20 to 35cm though the majority were in the range 25 to 31cm (91%)(Figure 3.33).

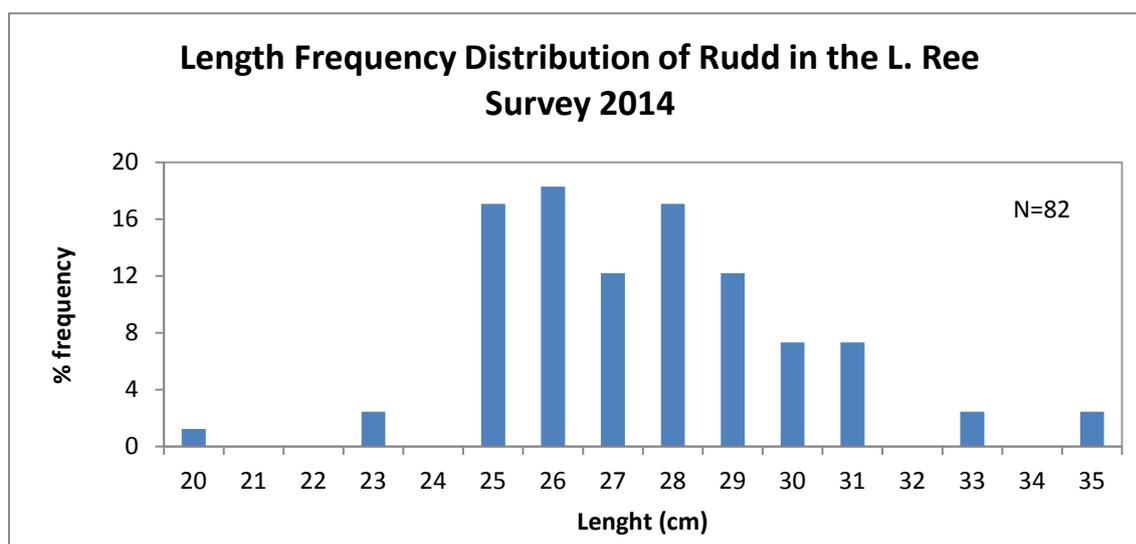


Figure 3.33. Length frequency distribution for rudd, L. Ree 2014.

Few fish in the smaller size classes were caught (<25cm) and this is also observed in the age classes determined from scale reading (Figure 3.34). This may be a reflection on spawning effort and year class survival. It does suggest a somewhat unbalanced population.

(<http://www.fisheriesireland.ie/fish-species/rudd.html>, Winfield, 1986 and Burrough *et al.*, 1979),

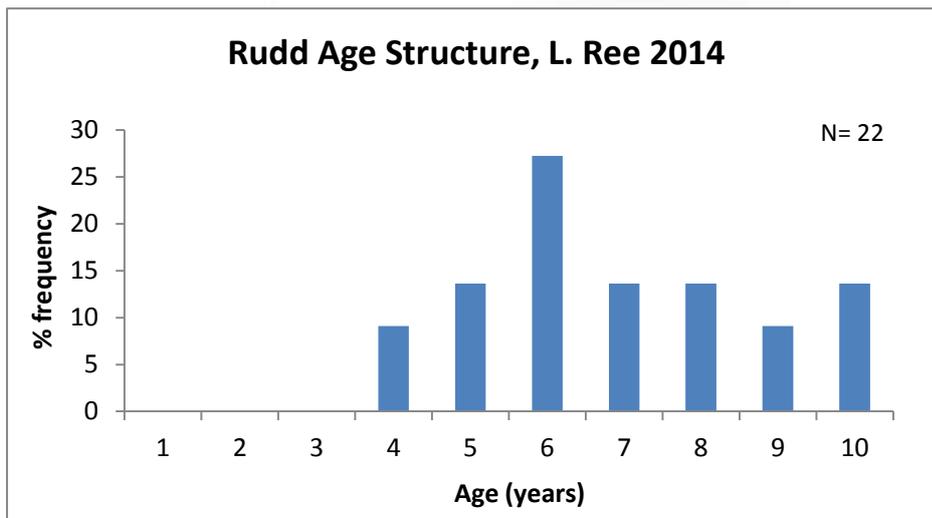


Figure 3.34. Rudd age structure, L. Ree 2014

Only a small number of rudd scale samples were collected during the course of the survey and thus the age data presented here is not necessarily an accurate reflection of the true age structure of the rudd population present in the lake.

### 3.1.6.2. Lake Distribution

The rudd population of L. Ree showed a very restricted distribution pattern (Figure 3.35). They were recorded mainly in an area northwest of Portrunny Bay all around Clawinch Island. A small number were also found near Inny Bay and north of St. Johns Bay.

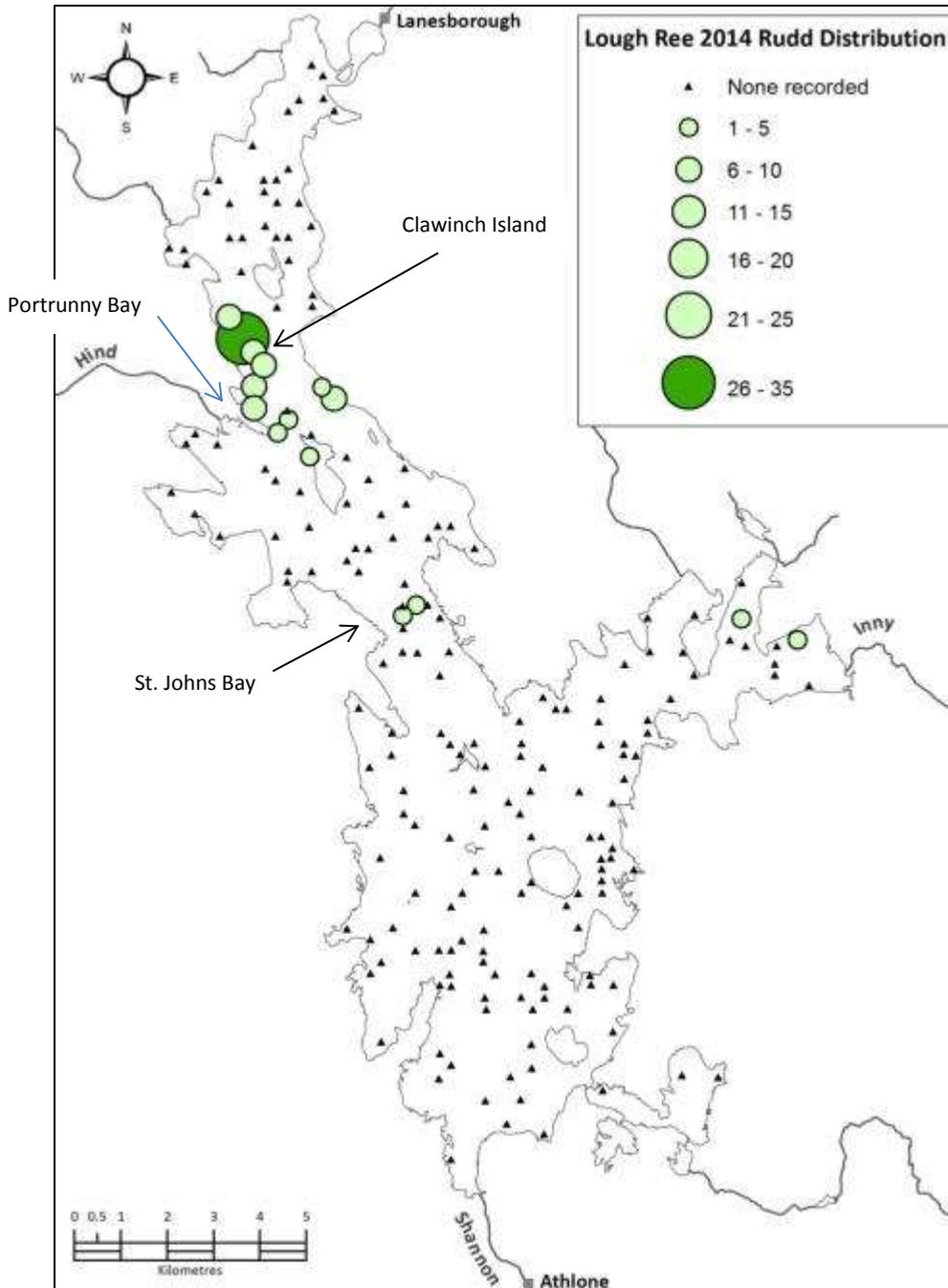


Figure 3.35. Distribution and numbers of rudd recorded during the L. Ree netting survey, 2014.



### 3.1.7 Cyprinid Hybrids

Cyprinid hybrids, like roach x bream, roach x rudd (*Rutilus rutilus* x *Scardinius erythrophthalmus*) or rudd x bream (*Scardinius erythrophthalmus* x *Abramis brama*) are a feature of cyprinid fish stocks in Europe generally. However, the level of cyprinid hybrids in Irish waters, particularly roach x bream, is regarded as being very high by European standards (Hayden *et al.*, 2010).

Hybrids recorded in L. Ree during the 2014 survey were dominated by roach x bream hybrids with much smaller numbers of roach x rudd and rudd x bream hybrids also noted. A roach x bream CPUE value of 8.39 was recorded for L. Ree, 2014. This is an exceptionally high value. By way of comparison during the L. Corrib 2012 survey a CPUE value of 2.52 was recorded. A total of 1670 cyprinid hybrids were recorded during the course of the L. Ree fish stock assessment.

#### 3.1.7.1. Population Structure

The roach x bream population structure indicate that there is a relatively large population of big fish in the 30 to 35cm range (62%) present within the lake (Figure 3.36). However it should be noted that the type of nets used during the course of this survey are not capable of capturing fish below 14cm in length.

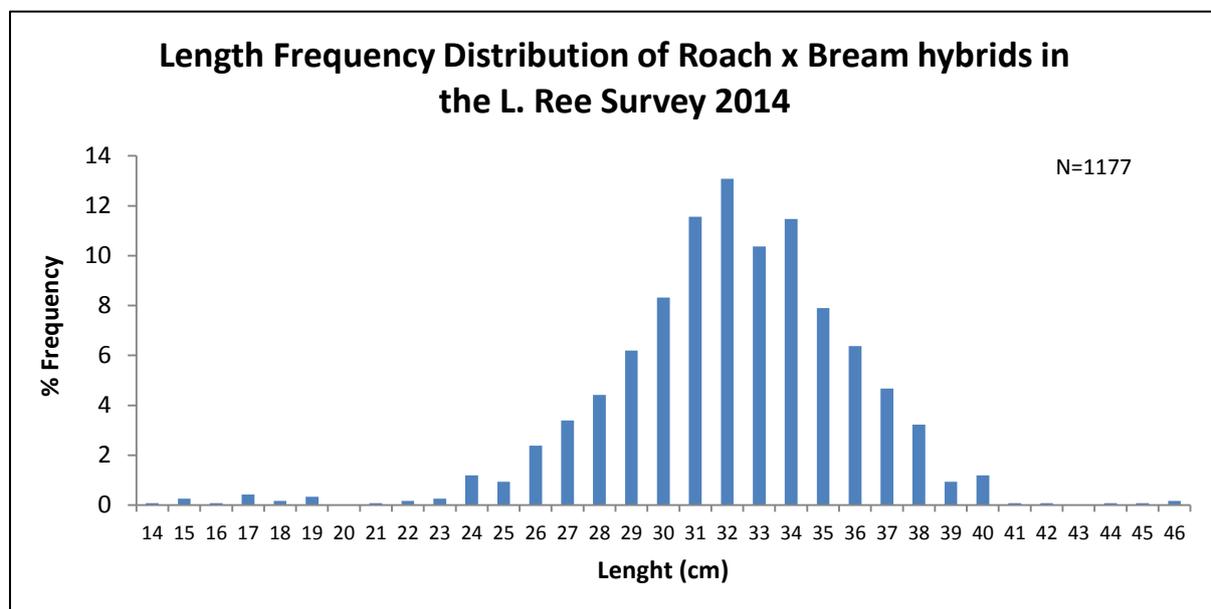


Figure 3.36. Length frequency distribution for roach X bream hybrids, L. Ree 2014.



The age class structure of the roach x bream population shows a dominance of older year classes, mainly the 10 and 11 year old age group (Figure 3.37). Fluctuations in hybrid year classes maybe a reflection of the status of the roach and bream population and lake water temperatures around spawning times.

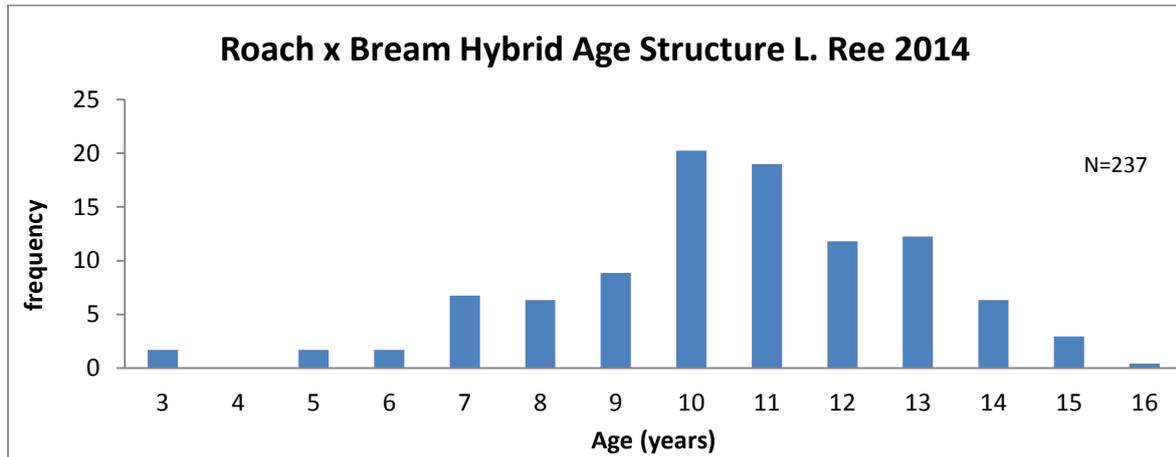


Figure 3.37. Age structure for roach X bream hybrids, L. Ree 2014.

### 3.1.7.2. Growth Patterns

The growth patterns for the L. Ree 2014 roach x bream hybrid sample are presented below (Figure 3.38) along with those for other Irish lakes and reservoirs. The L. Ree hybrid population exhibit a somewhat moderate growth rate.

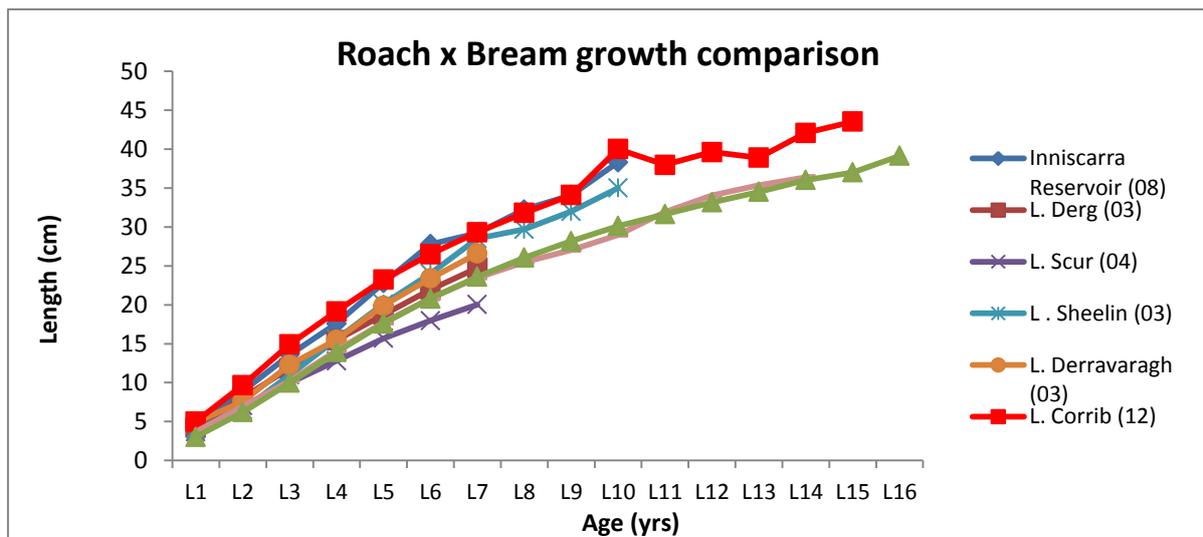


Figure 38: Comparison of growth rates for roach X bream hybrids across a number of other Irish lakes.

### 3.1.7.3. Lake Distribution

Roach x Bream hybrids have a fairly widespread distribution throughout the lake (Figure 3.39). Highest densities were recorded in an area north of Inchcleraun Island.

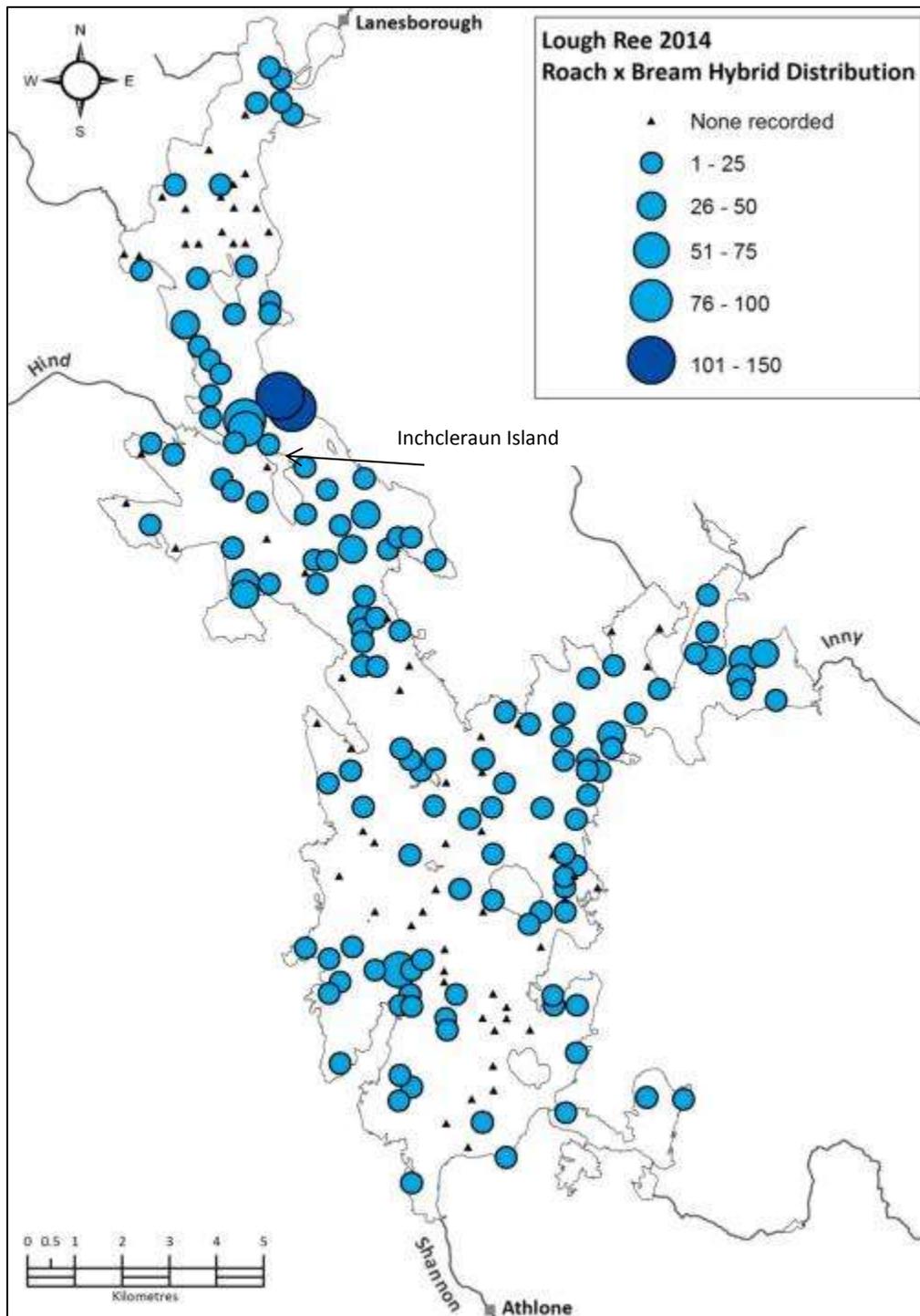


Figure 3.39. Distribution and numbers of roach x bream hybrids recorded during the L. Ree netting survey, 2014.



### 3.1.8. Pollan

A relatively small number of pollan (30 fish) were captured in the course of the 2014 L. Ree survey. All pollan collected were measured, weighed and a scale sample taken.

#### 3.1.8.1. Population Structure

The population structure of the pollan sample from the L. Ree survey is provided below (Figures 3.40 & 3.41). Length frequency data presented show all fish caught were within the 21 to 31cm range (Figure 3.40).

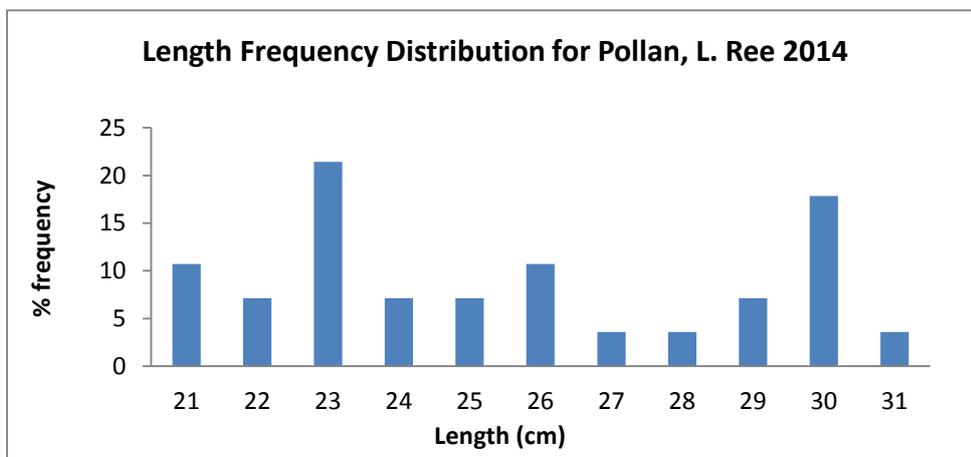


Figure 40. Pollan Length frequency distribution, L. Ree 2014

The age structure of the population sampled show the maximum age reached is 6 years. While the dominant age classes appear to be 3 and 4 years (Figure 3.41).

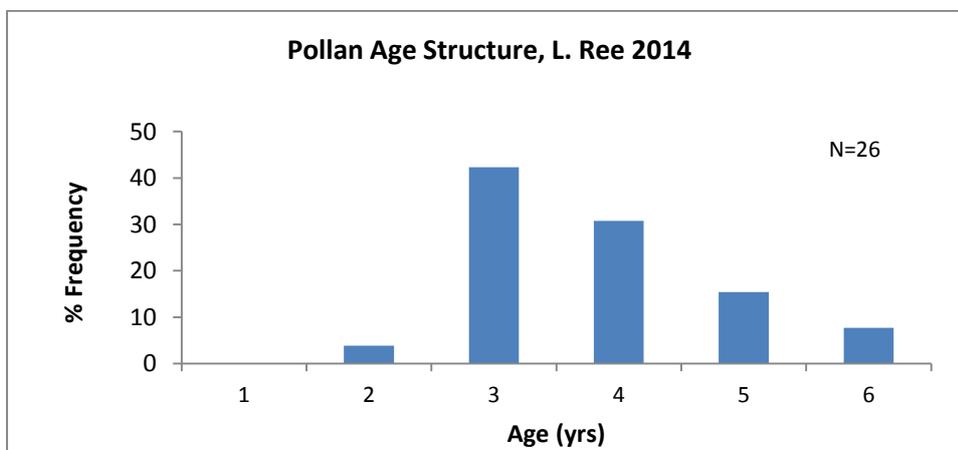


Figure 3.41. Age structure for Pollan, L. Ree 2014.

The pollan samples collected from this survey were used as part of a separate study carried out under the Habitats Directive and further information and data analysis are available in that report (O’Gorman *et al.*, 2015)

### 3.1.8.2. Lake Wide Distribution of Pollan

The distribution pattern of the pollan recorded as part of the L. Ree Spring 2014 survey clearly shows the restricted distribution of this species (Figure 3.42). Pollan were located within the deeper areas of the lake, especially around Inchmore Island and south to Hare Island. All survey nets set were benthic nets and so these fish were found within 2 meters off the bottom of the lake bed. This is not surprising as Pollan tend to inhabit the cooler, deeper waters of large lakes (Rosell 1997; Rosell *et al.*, 2004; Harrison *et al.*, 2010).

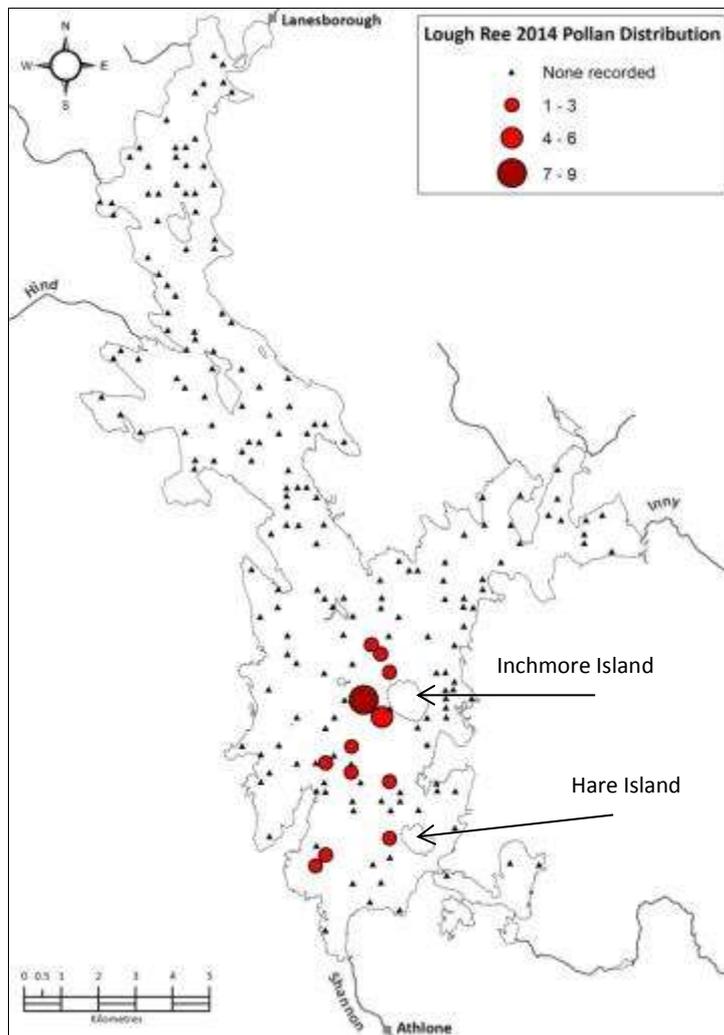


Figure 3.42. Distribution and numbers of pollan recorded during the L. Ree netting survey, 2014.



## 4. Summary

This report is particularly important in fishery management terms for a number of reasons:-

1. Ecological conditions in many Irish lakes have been very unstable since the 1970's because of three major events – the onset of cultural eutrophication in the 1970's and the continuation of this problem to the present day. This was followed by the introduction of a non-indigenous fish species, the roach, a species which we now know thrives in culturally eutrophic conditions. The third major change was the introduction and establishment of large Zebra mussel populations. The impacts of these changes were monitored with annual fish stock surveys on L. Sheelin. However no such database is available for L. Ree which was equally affected by the three aforementioned events –the 2014 fish stock survey was the first of its kind carried out on L. Ree. At least now we have a “marker” in relation to the status of fish stocks in this water at a particular point in time. This is important because further changes in the ecology of L. Ree and other Irish lakes are likely given the level of exotic introductions of plants, invertebrates and fish to Irish waters in recent years. For example recent surveys have established the presence of a substantial Asian clam population in the river Shannon at Lanesborough. While no Asian clams were found at any of the lake sampling points during this survey (2014) there is clearly a possibility that this invertebrate could colonise L. Ree in the next few years. Should it do so it will inevitably change the ecology of the fishery in ways which could significantly alter the balance of fish stocks. At least now (after the 2014 survey) we have established the current status of fish stocks and can monitor change into the future.
2. A comparative review of the fish stock data for the 2014 L. Ree survey relative to other productive Irish lakes has been provided in this report on a species by species basis in Section 3. This allows one to put the overall status of L. Ree as a fishery currently into a national perspective.
3. Currently a comprehensive genetic study of trout stocks in the mid- Shannon Catchment is underway- a comprehensive genetic study of trout has already been completed from the Big Brosna south to and including L. Derg. When completed in 2017 this study will provide important data on the origin of adult trout in L. Ree. This is of significant importance in management terms in that it will illustrate the relative mobility of individual trout stocks in the Shannon. In combination with other data bases (particularly electro-fishing surveys) it will also help define the relative productivity of individual sub-catchments.

The 2014 survey was important in this regard in so far as every trout captured in the survey was scaled and has a GPS location which will allow the geneticists' to establish the distribution of



the various trout populations in the lake. The reader should note that a similar study on L. Corrib in 2012 illustrated that fish of varying river origins had quite different and distinct distributions in this lake (O’Grady and Delanty, 2013).

#### **4.1. L. Ree as a “Mixed Fishery”**

Currently L. Ree can be regarded as one of Ireland’s premier “mixed fisheries”. Mixed, in this instance, is a reference to three different fish stocks – cyprinid stocks and both the pike and trout populations. The status of all of these populations is such that, presently, each of them can provide quality angling on a seasonal basis. Subsequent sections provide greater detail in relation to the status of these individual populations.

##### **4.1.2. Trout Stocks Summary Comment.**

The stock density of trout in Irish lakes can be compared by looking at the CPUE values recorded for trout across a range of lakes surveyed over many years. The trout CPUE value generated for the 2014 L. Ree survey was 1.12. This is a modest figure compared to those recorded for other Irish lakes over many years (see Figure 3.1 Section 3.1.1.1). The most important feature of the current L. Ree trout population is that this level of stock is capable of producing good quality mayfly fishing and some quality wet fly angling both early and late in the season.

The percentage length frequency distribution of the 2014 L. Ree trout sample indicates the presence of a very balanced stock with significant numbers of trout in each 5cm group from 20cm to 50cm in length and a considerable number of larger trout  $\leq 65$ cm in length. A combination of a fast growth rate and the presence of a significant number of larger older trout ( $\geq 60.0$  cm) in the stock makes this population particularly attractive from an angling perspective.

##### **4.1.3. Summary Comment on the L. Ree Pike Population.**

The L. Ree survey (2014) illustrated that there is a substantial and balanced adult pike population in this fishery, sufficient to provide quality angling. The stock structure of the L. Ree pike population in 2014 is remarkably similar to the L. Corrib population when viewed in 1996 - at that point there had been no pike management programme on Corrib for the previous ten years. These data suggest that the stock structure and density of the pike populations in Corrib in 1996 and Ree in 2014 reflect the norm in relation to the population of this species in large Irish limestone lakes in circumstances



where there is no pike management programme and where most anglers adopt a catch and release policy (IFI, 2014a & b).

Specimen lake pike (fish  $\geq$  30lbs. in weight) would seem to be few in number in L. Ree (as noted from this survey), normally a lake pike at, or above, specimen weight would exceed 117cm in length. During the L. Ree survey only one pike caught exceeded 100cm in length, a fish of 105cm. However it should be noted that pike angling returns do indicate that there are sufficient numbers of larger pike ( $>$  100cm) available in the lake, enough to support good angling.

All of the other biological parameters reviewed in relation to the L. Ree pike stock fall within the normal range of values recorded for pike in other Irish waters – growth patterns, dietary habits, lifespan and the sex ratio within the population.

#### **4.1.4. The L. Ree Coarse Fish (Cyprinid) Fishery – Summary Comment.**

The L. Ree 2014 fish stock survey indicated the presence of significant populations of both roach and roach/bream hybrids. Smaller numbers of bream were also captured. The reader should note that bream are much less active than roach and their hybrids in early spring when this survey was carried out. Experience has shown that bream numbers captured in early spring surveys in Irish lakes do not reflect the status of bream populations in these waters. This is also the case in relation to tench stocks. This species is rarely captured in spring gill-netting surveys even in waters which support large populations of this species. Angling catches of bream, particularly in Inny Bay and the lower reaches of the River Inny, in recent years confirm the presence of a substantial bream stock in this lake basin. Selected bays in L. Ree (most notably in the Coosan area) provide quality tench angling in summertime indicating that this species is at least locally abundant in parts of L. Ree (J. Devanny, IFI, *pers com*).

The CPUE values recorded for roach and roach/bream hybrids in the L. Ree 2014 survey are relatively high compared to other lakes in the Shannon in recent years. While this is clearly advantageous to the cyprinid fishery in this watershed and provides increased fodder for the pike stock it probably also reflects the fact that there are on-going significant cultural eutrophication problems in L. Ree. In repeated surveys on Irish lakes for over two decades it is now clearly obvious that large roach stocks are only evident in organically polluted lakes.



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