Economic and Ecological Effects of Pike Management Operations Conducted by Inland Fisheries Ireland and Deficiencies in its Justification

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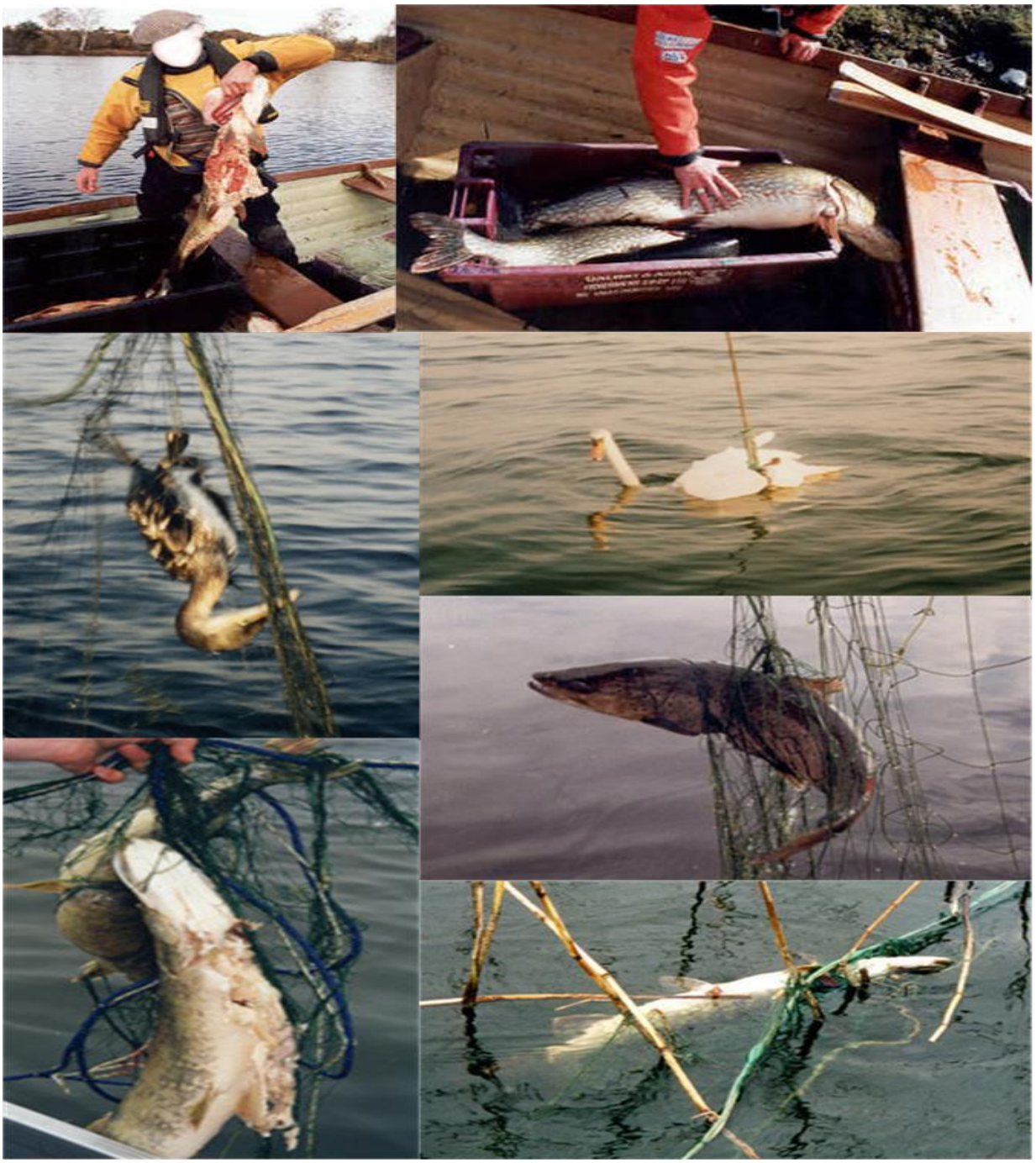

1 REVISION HISTORY

Revision History		
Revision	Author	Notes
1.0	DH & PB	First Issue

Paul Byrne (IPS) & David Hamill (IFPAC) were nominated jointly on behalf of the Irish Pike Society (IPS) and the Irish Federation of Pike Angling Clubs (IFPAC) to prepare this document for submission to Inland Fisheries Ireland. This document represents the views of IFPAC & IPS.

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Chairman
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CONTENTS

2 INTRODUCTION

The purpose of this document is to provide an overview of pike management operations by Inland Fisheries Ireland (IFI). The justifications for these operations will be explored and both old and new science and research related to this subject will be compared.

Current Pike Management Policy will be assessed against the wider National Strategy for Angling Development (NSAD).

The economic effect of pike management operations and the resulting effect on national and rural economies will also be examined.

It would be a failing of this document not to state that there exists, considerable resentment of pike by some sections of the angling community in Ireland. It may be that this resentment is founded upon a poor understanding of the role of pike within a fisheries eco-system; a generational continuance of long-held biases against pike as a competitor to the angler for trout; or simply an individually-held hatred of pike. These are indisputable realities that exist in Ireland in 2016 and would appear to have existed since IFI was formed in 1951 as the Inland Fisheries Trust Incorporated (IFT).

IFT itself was formed "*with the objective of developing brown trout Salmo trutta L. angling in Irish waters*" Fitzmaurice, P. (1983). Since 1951, pike culling has been a significant objective of IFI and its predecessors, through to the present day, where pike are still removed by IFI from approximately 20% by area, of our lake water bodies in Ireland. It is perhaps against this back drop that the relationship between IFI and pike should be considered.

3 INLAND FISHERIES IRELAND'S 'CORNERSTONES' FOR PIKE MANAGEMENT OPERATIONS

Inland Fisheries Ireland (IFI) (formerly Central Fisheries Board (CFB) and Inland Fisheries Trust (IFT)) has engaged in the practice of pike management operations since 1951. The methods of gill-netting and electrofishing are used as tools for pike management. The basis for these operations is to reduce predation by pike on trout, on what are termed "designated wild brown trout fisheries" such as Loughs Arrow, Corrib, Mask, Sheelin, Conn, Cullin and Carra.

There are two cornerstones of justification for pike management operations. The first of these stood until 2013 and was based on anecdotal evidence that pike were not native to Ireland. This was proven to be unfounded when research was undertaken by University College Dublin in collaboration with IFI as part of a PhD study. The following is an excerpt from the related press release by IFI, dated 15th October 2013.

> "NEW STUDY REVEALS PIKE ARE NATIVE TO IRELAND"
>
> "Inland Fisheries Ireland welcomes the publication of an important scientific paper relating to one of Ireland's key angling species – pike. The angling industry is estimated to be worth €750m annually to the Irish economy."
>
> "Pike (*Esox lucius*) is a species that was thought to have been introduced by man in the last few hundred years. Results from this informative research have shown that the colonisation history is more complex, with an indication that they may have colonised naturally some thousands of years ago."
>
> The new findings were further welcomed by Minister Fergus O'Dowd at the Department of the Environment who stated: "I welcome the findings from this important investigation and commend the excellent collaboration between UCD and Inland Fisheries Ireland, who have recently signed a MOU to support this type of ground-breaking research".
>
> Dr. Cathal Gallagher, Head of Research and Development for IFI, stated that "These important results will influence IFI's ongoing management strategy for this species. Dr. Gallagher stated that "Further investigations, using new and developing genomic techniques, will be used to endorse these findings".

Sections 4 and 5 of this document take a closer look at the cornerstone of pike management operations as it relates to the native status of Irish pike.

The second justification was that pike fed preferentially on salmonids and so were a threat on fisheries with large stocks of salmonids such as “designated wild brown trout fisheries”. In 2014 this perspective was shown to be unfounded when again new ‘ground-breaking’ information came to light as part of the previously mentioned PhD study.

Sections 6, 7 and 8 of this document take a closer look at the cornerstone of pike management operations as it relates to the diet of Irish pike.

4 PAST RESEARCH RELATING TO THE ORIGINS OF IRISH PIKE

Prior to 2013, no genetic or scientific research was undertaken by IFT, CFB or IFI in order to establish if pike were a native species to Ireland. The origins of pike were in fact poorly understood, and very possibly, poorly examined.

4.1.1 THE BASIS FOR DESIGNATION OF PIKE AS AN INVASIVE SPECIES PRIOR TO 2013 RESEARCH

The designation of Irish pike as non-native by IFI and its predecessors prior to the 2013 research was based largely on anecdotal evidence. In the abstract below, which was released as part of the 2013 research, it is clear that there existed a lack of evidence to support the 'assumption' that pike were not native to Ireland.

Population Genetics & Management of Pike (*Esox lucius* L.) in Ireland

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Abstract

Throughout the northern hemisphere, northern pike (*Esox lucius* L.) is of particular socio-economic value for recreational and commercial fishing. Within Ireland, pike are considered non-native, although a lack of direct evidence leads this to be a contentious issue among stakeholder groups. Historical management of the species has been based upon this assumption, leading to controversial policies such as intensive removal of pike during predator control operations, aimed at protecting native brown trout (*Salmo trutta* L.).

In Ireland pike occur in most freshwater systems, but until now no attempt has been made to investigate relatedness and connectivity among populations. Here I present the first Ireland-wide population genetic investigation, using microsatellite markers, to illustrate the nature of population connectivity in Irish freshwater systems. This study provides evidence of strong sub-structure, which lay the foundation for a reappraisal of current approaches to the management of this species in Ireland.

Keywords: Population genetics, management, pike, *Esox lucius*, microsatellites.

Excerpt from "Genetic Structure of Pike and their History in Ireland" (IFI/2013/1-4148) Pedreschi *et al.* (2014)

The 'assumption' that pike were not native to Ireland has been as mentioned earlier, a cornerstone for over 60 years of pike culling and removal. Section 4 will hopefully give the reader a greater understanding of the basis for this 'assumption' and some of the pitfalls of accepting this assumption without question.

This assumption was extensively researched by Frank Barbe and Shane Garret in 2000. Their findings were published in the 'Angling in Ireland' magazine over a four-month period during that year. Those findings are now considered in this document.

4.1.1.1 THE USE OF LANGUAGE AS A BASIS FOR THE CLASSIFICATION OF IRISH PIKE ORIGINS

One of the primary arguments used by IFI and its predecessors to designate pike as non-native were references derived from the Irish language. The term “gaill iasc” and “liús” have been used in reference to pike with “liús” being “*much older*” according to research carried out by Barbe, F. & Garrett, S. (2000).

Barbe, F. & Garrett, S. (2000) found dictionary references to “gaill iasc” and “liús” but concluded that “*gaill iasc*” is likely a literary coinage, a creation from the 17th or 18th century. They found it impossible to pinpoint exactly when “liús” was first used although they concluded that it appeared that “liús” dates from somewhere between the 13th and the 15th century, indicating that pike were long established in Ireland prior to this period. Furthermore, they found that the word “*gaill*” has multiple meanings ("*foreigners-" or "Gaul" or "Norseman*") whereas “liús” they concluded is much more definitive.

Barbe, F. & Garrett, S. (2000) discussed a secondary argument relating to language and questioned why there appears to be no old Irish name for pike. However, they commented that this cannot be fully proven, as it is possible that it did exist prior to the 13th century but no reference or record has been found. They concluded by stating that there are many native Irish species that do not have old Irish names or for which old Irish names have not yet been discovered. Some examples suggested were “*mackerel*”, “*cod*” and the “*common partridge*”.

4.1.1.2 THE USE OF ANECDOTAL HISTORICAL EVIDENCE AS A BASIS FOR THE CLASSIFICATION OF IRISH PIKE ORIGINS

Another primary argument used by IFI and its predecessors to designate pike as non-native were references derived from the work of AEJ Went who wrote “The Pike in Ireland” in 1957 and which was published in The Irish Naturalists Journal. Went was a noted historian who wrote several articles about Irish fish. In his publication he came to the conclusion that "…*it would certainly appear that it (the pike that is) is not a native fish.*" To come to this conclusion Went sums up a number of references which are now discussed.

Went initially references the language reference to pike of “gaill iasc”. Section 4.1.1.1 details the potential flaw behind this reference and the likely erroneous nature of using language as a basis for the pike’s native/ non-native status. Barbe, F. & Garrett, S. (2000) commented that ***“It is of extreme importance to note that Went did not investigate the Irish word Liús”***. They further commented that “*the word Liús appeared several times in articles published in The Irish Naturalists' Journal written by other contributors*” and posed the question of why the word “liús” was not investigated when AEJ Went “*had articles himself in some of these Journals*” and as such would have been expected to have been aware of the “liús” reference. This question remains unanswered.

Barbe, F. & Garrett, S. (2000) commented that one of Wents' primary references was the work of Giraldus Cambrensis, "*a Welsh archdeacon who visited Ireland on two occasions at the end of the twelfth century*". Cambrensis wrote the "*Topography of Ireland*". Barbe, F. & Garrett, S. (2000) comment that Went (1957) quotes Cambrensis in his article as follows:

…"The rivers and the lakes are rich in fish peculiar to themselves, and especially in fish of three kinds, namely, salmon, trout and mud-eels. … But some fine fish are wanting. I mean pike, perch, roach, gardon and gudgeon. Minnow, loach, bullheads, verones, and nearly all that do not have their seminal origin in tidal rivers are absent also."

Barbe, F. & Garrett, S. (2000) comment that there is an original translation of Cambrensis' writing and that the correct translation is as follows, indicating that some references are omitted from Went's translation:

"The rivers and the lakes are rich in fish peculiar to themselves, and especially in fish of three kinds, namely, salmon, trout, and mud-eels. But some fine fish, found in other regions, and some magnificent fresh-water fish are wanting. I mean pike, perch, roach, gardon and gudgeon. Minnow, loach, bullheads, verones, and nearly all that do not have their seminal origin in tidal rivers are absent also."

The above translation would appear to illustrate that pike and other species were present in the regions visited by Cambrensis in the 12th century, but the facts are unclear.

Barbe, F. & Garrett, S. (2000) further suggest that some academics have their doubts about the value of Cambrensis' work and they therefore appear to be "wary of giving it more credit than it deserves" and cite a number of examples for this opinion in their research work.

Further references in Wents article mention a thriving and established trade in exported pike from Ireland. However Barbe, F. & Garrett, S. (2000) again find the reference to be incomplete.
"…we find in A.K. Longfield's 'Anglo-Irish trade' in the 16th century that pike were exported in the early part of that century to some of the smaller towns in the south of England. We do not know, of course, the origin of these fish."

They submit a direct quote from A.K. Longfield's 'Anglo-Irish trade, as follows:
"At the end of the fifteenth century and beginning of the sixteenth, however, they (this is the pike) appear as coming regularly from Youghal, Dungarvan, Cork and Kinsale to the Cornish ports…"

Barbe, F. & Garrett, S. (2000) make three important observations here. Firstly, why did Went question the origin of Irish pike that were exported to England when it is clearly stated in the book referenced that they came from several named Irish towns?

Secondly, they comment that Longfield mentions the export of pike to England from Ireland at the end of the fifteenth century. Further in the same book there is a detailed reference of export of pike from Ireland to England in 1492, so they ask why Went ignores these pre-sixteenth century references to pike.

Thirdly, they conclude that if there was a thriving trade of pike in Ireland at the end of the fifteenth century then they were widespread by this time and could not have been a recent introduction as intimated by Went and others since.

In respect of Wents own background, they state that Arthur E.J. Went worked for the Fisheries Branch of the Department of Agriculture and was a founding trustee of the Salmon Research Trust. They comment that Went was regarded as a very dedicated game angler who had no great regard for the fish species called pike.

In consideration of the above, one must ask if potentially, a serious conflict of interest existed.

4.1.2 SECTION SUMMARY CONCLUSION: PAST RESEARCH RELATING TO THE ORIGINS OF IRISH PIKE

The analysis of the information presented in Section 4.1.1 and its subsections show that prior to 2013 the basis for the designation of Irish Pike as non-native was anecdotal, inaccurate and unscientific. The erroneous classification of Irish pike as non-native lasted for over six decades.

Of particular concern is that the leading fisheries scientists of IFI and its predecessors have apparently accepted this erroneous classification without question. Indeed, the extensive research carried out by Barbe and Garret in 2000 has to our knowledge, never been disputed by IFI or its predecessors, over the past 16 years, yet the pike remains officially 'non-native' to Ireland.

It is the conclusion of this section that the 'non-native' status of Irish pike based upon past unscientific research is erroneous but also potentially disingenuous.

5 CURRENT RESEARCH RELATING TO THE ORIGINS OF IRISH PIKE

5.1.1 THE ORIGINS OF IRISH PIKE

In 2012, Debbi Pedreschi of University College Dublin (UCD) supported by Professor Stefano Mariani (UCD), undertook a PhD on the population ecology, dietary and trophic status and morphometrics of the freshwater fish pike (Esox Lucius) in Ireland. This ground-breaking research was undertaken by UCD in collaboration with IFI and was supported by the Irish Federation of Pike Angling Clubs. As stated earlier, it was the common belief that pike were introduced to Ireland approximately 400 years ago from England, so the importance of an actual scientific study to examine these beliefs was long overdue. The report on the origins of pike aspect of this study was released in 2013 and was called the **"Genetic Structure of Pike and their History in Ireland"**. This aspect of the study indicated that pike colonised Ireland naturally about 8000 years ago in a similar way to other native species such as trout. The study also paid particular caution to current pike management operations and strategies as a strain of the species was discovered through DNA analysis and found to be unique to Ireland. The study commented that aspects of the management of pike in Ireland were "potentially compromising the integrity of genetic stocks".

The 2013 study was the first of its kind undertaken by IFT, CFB or IFI into the pike species, and used microsatellite DNA studies of pike from Ireland, Great Britain and the European continent to establish the lineage of Irish pike. The results were ground-breaking but of little surprise to the pike-angling public, who had for many years questioned the validity of the previous research discussed in Section 4. The press release issued by IFI on 15th October 2013 stating that "New Study Reveals that Pike are Native to Ireland" signalled that Irish pike may finally enjoy the recognition that the species was denied for many decades.

5.1.2 RECENT CHALLENGES TO THE CLASSIFICATION OF IRISH PIKE AS A NATIVE SPECIES

The robustness and depth of research undertaken by Debbi Pedreschi and Prof. Stefano Mariani was illustrated in 2014 when the findings of their report **"Genetic Structure of Pike and their History in Ireland"** were challenged by Dennis Ensing in an article titled **"Pike (*Esox lucius*) could have been an exclusive human introduction to Ireland after all: a comment on Pedreschi *et al.* (2014), Journal of Biogeography".** Dennis Ensing works at the Agri-Food and Biosciences Institute (AFBI) in Belfast, Northern Ireland, which advises DCAL on freshwater fish management policies.

Ensing argued that there was a possible human introduction much earlier than previously hypothesised by Pedreschi *et al.* (2014) Ensing argued that a human introduction occurred as far back as 4000 years ago by Neolithic or Bronze Age humans and that this was a basis for questioning any designation of Irish Pike as native.

In 2015 Pedreschi and Mariani responded in an article titled **"Towards a balanced view of pike in Ireland: a reply to Ensing, Journal of Biogeography"** and effectively removed any doubt in relation to the validity of the study first released in 2014.

Furthermore, the opinions expressed by Ensing in his paper were considered by Pedreschi and Mariani (2015) to be *"too speculative and unsupported by data"*.

> Ensing (2015), in his response to the aforementioned paper, argues against these conclusions, suggesting that Neolithic or Bronze Age humans may have introduced pike into Ireland *c.* 4000 years ago. Here, we outline our contention that this does not fit with the available scientific and historical evidence. We argue that the presentation of opinion in the comment by Ensing (2015) is too speculative and unsupported by data, and represents a hypothesis that will always remain difficult to test.
>
> **Excerpt from "Towards a balanced view of pike in Ireland: a reply to Ensing, Journal of Biogeography" Pedreschi (2015)**

The response of Pedreschi and Mariani (2015) to Ensing also highlighted how Ensing's article focused on pike as the sole threat to wild brown trout stocks and how Ensing failed to mention the many threats to wild brown trout stocks, tending rather to focus on pike.
Of particular interest is that the response of Pedreschi and Mariani (2015) to Ensing raised the issue of Irish freshwater fauna studies being somewhat neglected and how long-held assumptions can hinder the way for fresh knowledge.

In framing the issues relating to pike management, Ensing (2015) fails to mention the many other threats to brown trout (*Salmo trutta*) populations, such as the imbalance caused by introduced and invasive species (e.g. roach, *Rutilus rutilus*; Stokes *et al.*, 2004; King *et al.*, 2011; *Lagarosiphon major*; King *et al.*, 2011), habitat destruction (e.g. large-scale arterial drainage in Ireland; Inland Fisheries Trust, 1952–1980; Massa-Gallucci *et al.*, 2010; King *et al.*, 2011), eutrophication (McGarrigle, 2005), sea lice (Stokes *et al.*, 2004; King *et al.*, 2011) etc., and instead focuses only on pike. While we acknowledge that pike can indeed have an impact on trout numbers (O'Grady & Delanty, 2008), they are by no means the sole reason for their decline.

Historically, the freshwater fauna of Ireland has been somewhat neglected by those conducting genetic investigations and phylogeographical analyses, with long-held assumptions hindering the way for fresh knowledge. Recent studies (Coscia *et al.*, 2013; Pedreschi *et al.*, 2014) are lifting the veil and beginning to reveal a more complex phylogeographical history than previously envisioned. These recent developments have stimulated renewed interest and discussion in the field and encouraged the development of new studies and hypotheses. Many ubiquitous freshwater species in Ireland remain to be investigated (gudgeon, *Gobio gobio*; stoneloach, *Barbatula barbatula*; minnow, *Phoxinus phoxinus*; perch, *Perca fluviatilis*).

Excerpt from "Towards a balanced view of pike in Ireland: a reply to Ensing, Journal of Biogeography" Pedreschi (2015)

It is worth noting that Pedreschi and Mariani (2015) acknowledged senior scientific staff of Inland Fisheries Ireland for their assistance in compiling the response to Ensing. Therefore, it could be presumed that Inland Fisheries Ireland would support the response of Pedreschi and Mariani to Ensing (2014).

5.1.3 CLASSIFICATION IMPLICATIONS WITH SPECIFIC REFERENCE TO THE EU WATER FRAMEWORK DIRECTIVE

Kelly et al. (2014) summarised that the Water Framework Directive (WFD) (2000/60/EC) came into force in 2000 and was subsequently transposed into Irish law in 2003 (S.I. No. 722 of 2003), with the principal aim of preserving those water bodies where the ecological status is currently 'High' or 'Good', and restoring those water bodies that are currently impaired, to achieve at least 'Good' ecological status in all water bodies by 2015 or by designated extended deadlines. Furthermore, it was stated that a key step in this process is that each Member State must assess the current ecological status of surface water bodies (rivers, lakes and transitional waters) by monitoring a range of physical, chemical and biological quality elements including phytoplankton, macrophytes, phytobenthos, benthic invertebrates and fish.

Inland Fisheries Ireland has been assigned the responsibility by the Environmental Protection Agency (EPA) of delivering the fish monitoring requirements of the WFD in Ireland. The Agri-Food and Biosciences Institute (AFBI) in Belfast has primarily represented Northern Ireland in this regard.

A key aspect of the fish monitoring requirement has been the joint development by IFI & AFBI of an ecological classification tool i.e. 'Fish in Lakes 2' (FIL2). Similar work was carried out for rivers. The 'Fish in Lakes' ecological classification tool was developed during the North-South Shared Aquatic Resource (NS Share) Project in 2008. (Kelly *et al*, 2012b) further developed the classification tool using "*additional data to make it fully WFD compliant*".

It is at this point that it must be made clear that the WFD 'Fish in Lakes' classification tool classifies all freshwater fish species according to their native status. The native status of pike is based upon the notes on pike contained in Went (1949) and takes account of Went (1950), both of which pre-date the scientific research undertaken by Pedreschi *et al*. (2014) using micro-satellite DNA.

It is interesting that Went (1950) states that the rudd (Scardinius erythrophthalmus) ***"is a native species"***, *yet* (Kelly *et al*, 2012b) have re-designated the rudd as ***"non-native"***. The inference here is that the application of Went (1950) as a basis for the establishment of the native status of Irish freshwater species would appear to be contradictory when considered in the context of the WFD, which favours instead only fish tolerant of marine conditions. Regarding pike in Ireland, Minchin (2007) in his compilation of alien and cryptogenic aquatic species in Ireland was unconvinced of the evidence suggesting pike to be alien and instead cited pike and indeed rudd as cryptogenic species.

Kelly et. al (2014), in their WFD Summary Report for 2013, commented on the research of Pedreschi *et al*. (2014) by stating that **"*recent research suggests that pike may have colonised Irish waters naturally, without the intervention of man and therefore be mislabelled as a non-native species (Pedreschi et al., 2013); however, further evidence may be needed to verify this"***. It would be presumed that the **"further evidence"** that **"may"** be needed, would be sought, yet Kelly et al. (2015) in their WFD Summary Report for 2014 maintain the status of pike as non-native, having removed previous comments relating to Pedreschi *et al*. (2014). To our knowledge IFI have not sought **"*further evidence*"**, which would lead to concern that the WFD 'Fish in Lakes' classification tool will not be re-examined.

It is clear that to re-classify pike under the WFD as a 'native species', while supported scientifically through the research of Pedreschi *et al*. (2014), is not without complication for the 'Fish in Lakes' classification tool. It may be argued that at present, it necessitates a divergence between the Republic of Ireland and Northern Ireland via the respective representative bodies of IFI and the AFBI, to possibly accommodate two separate classification tools. This matter would be greatly simplified if the AFBI were to endorse the findings of Pedreschi *et al*. (2014). The response of Ensing (2014) to Pedreschi *et al*. (2014) would suggest that the AFBI may not be open to a re-classification of pike. In response to Ensing (2015), however, Pedreschi and Mariani (2015), see section 5.1.2, provided a balanced view of pike, that one would hope would alleviate any concerns that the AFBI might have. As such, there would appear to be no valid reason for IFI to discount the latest and only scientific research available for the re-classification of pike as a native species in the context of the WFD.

5.1.4 SECTION SUMMARY CONCLUSION: CURRENT RESEARCH RELATING TO THE ORIGINS OF IRISH PIKE

The fact remains that the scientific research of Pedreschi *et al*. (2014) represents the single most important and only piece of scientific research produced on the native status of Ireland's pike since the formation of IFI as IFT in 1951. The depth, robustness and scientific validity of this research has been illustrated by facing and easily discounting challenges posed to it generated by peers and others.

In relation to the EU Water Framework Directive, it is feasible to contest that the failure of IFI to embrace the new scientific research of Pedreschi *et al*. (2014), with or without further corroborating scientific evidence, places at risk, Ireland's successful achievement of at least 'Good' ecological status for all fisheries in Ireland. Furthermore, it would appear to contradict the statement referred to earlier and issued on 15th October 2013 by Dr. Cathal Gallagher, Head of Research and Development for Inland Fisheries Ireland, that "further investigations, using new and developing genomic techniques will be used to endorse these findings". The use of the specific term "endorse" suggests support of the previous findings, not contention.

IFI have expended resources, at a cost to the Irish tax payer, in undertaking research into Irish pike origins through the period 2010 to 2013. The findings of the resulting report **"Genetic Structure of Pike and their History in Ireland"** Pedreschi *et al*. (2014) have yet to be considered in formulation of pike management policy and hence the resources used in this study have yet to deliver any meaningful return to the Irish tax payer.

6 PAST RESEARCH RELATED TO THE DIET OF IRISH PIKE

The release of the report **"The Diet of Pike in Irish Watercourses"** in 2014 by Debbi Pedreschi as part of a PhD, and Pedreschi *et al*. (2015) following peer review, is arguably the single most important and only scientifically-based study into the diet of pike in Irish waters. Subsequent to this study, the investigations into the diet of pike in Irish waters was conducted only by Inland Fisheries Ireland and its predecessors and relied upon snap shot stomach content analysis using a potentially flawed methodology i.e. gill-netting. This is not a term used lightly and will be discussed later in Section 6.

Pedreschi *et al.* (2014b) used a combination of Stable Isotope Analysis (SIA) and Stomach Content Analysis (SCA) to provide a more reliable projection of the diet of pike in Irish watercourses. Of particular interest was that Pedreschi et al. was very cognisant of how complicated the diet of pike in Irish waters can be.

Pedreschi *et al.* (2014b) stated that "*sampling using a dedicated plan rather than opportunistic sampling would also facilitate a wider range of analyses and hypothesis testing, including, for example, comparisons between seasonal variations in diet*". The significance of this particular comment is that to date, the data presented by Inland Fisheries Ireland gained over many decades does not reflect seasonal variation, and has allowed assumptions rather than scientific fact to drive management policy. Proof of the paucity of seasonal sampling has been acknowledged through freedom of information requests to IFI and therefore represents a considerable failing of past research into the diet of Irish pike.

It is important to note that past research continues to be used as the basis for and justification of pike management operations in Ireland by Inland Fisheries Ireland. Some of these apparent justifications will be further discussed in this section.

6.1 THE ECOLOGY, BIOLOGY AND MANAGEMENT OF PIKE IN IRISH WATERS WITH PARTICULAR REFERENCE TO WILD BROWN TROUT LAKE FISHERIES

The current position paper supporting pike management in Ireland is **"The Ecology, Biology and Management of Pike in Irish Waters with Particular Reference to Wild Brown Trout Lake Fisheries"** ref: O'Grady & Delanty (2008). The paper refers to several reports and scientific data to support a programme of continued pike removal from a number of significant fisheries in Ireland known to produce quality trout and pike angling. It is the content of O'Grady & Delanty (2008) that forms the basis for the pike diet examination undertaken in this document as it is felt that there are significant fundamental inaccuracies presented in O'Grady & Delanty (2008) with regard to the impact of pike on trout stocks.

The pie charts shown below in the excerpt from O'Grady & Delanty (2008) show a sample of food items found in pike stomachs in Lough Sheelin over a period of 29 years from 1978 to 2006. This information is the subject of further in depth examination in section 6.2.4 following a freedom of information request to Inland Fisheries Ireland, as this document contests that the information made available for this period exhibits worrying inaccuracies and anomalies that question the reliability of the information presented by IFI to support pike management.

A further excerpt from the presentation made to the Pike Policy Group in 2011 as part of the previous pike review is also included in this section. With regard to both of the excerpts in this section, it can be seen with specific reference to the dietary items in pike >60cm that wild trout constitute 16% of an adult pikes diet. However roach and roach fry have been separated, even though they are the same species. Perch have also been separated into fry and adult fish. It could be assumed that in order to maintain any sort of consistency then trout should also be separated by way of mature and immature fish to give the reader a more accurate picture of the dietary items found. As roach and perch are more numerous, e.g. see excerpt section 6.1 i.e. Table 1 of O'Grady & Delanty (2008) with regard to roach, it appears logical that pike will feed more readily on the more available species. For instance, the total consumption for roach and perch is 47%, nearly three times that of trout. This suggests that trout are not the main food source of pike in Lough Sheelin and while ratios may not reflect the apparent availability of each species to pike as a food source, O'Grady & Delanty (2008) do not explain this anomaly, but instead accept an apparently biased hypothesis that pike prefer trout as a food source. This document attempts to redress this imbalance in current thinking by offering unbiased alternative discussion based upon IFI's own information.

Figure 4a

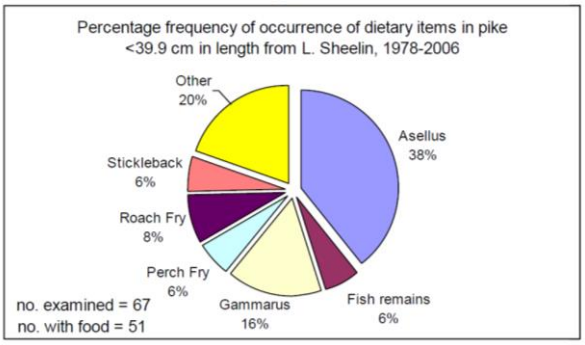


Figure 4b

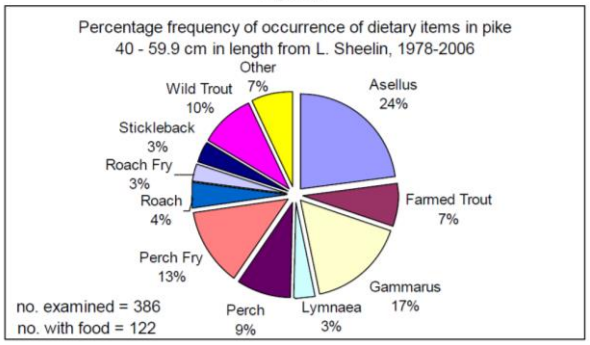
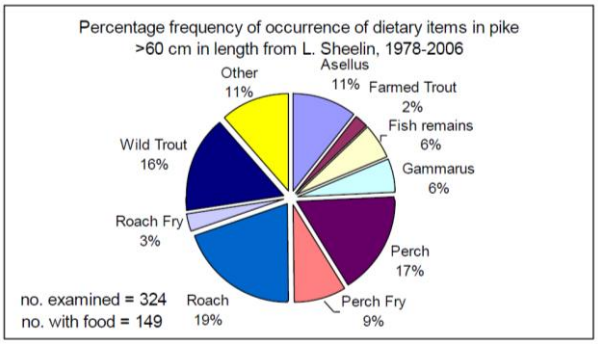
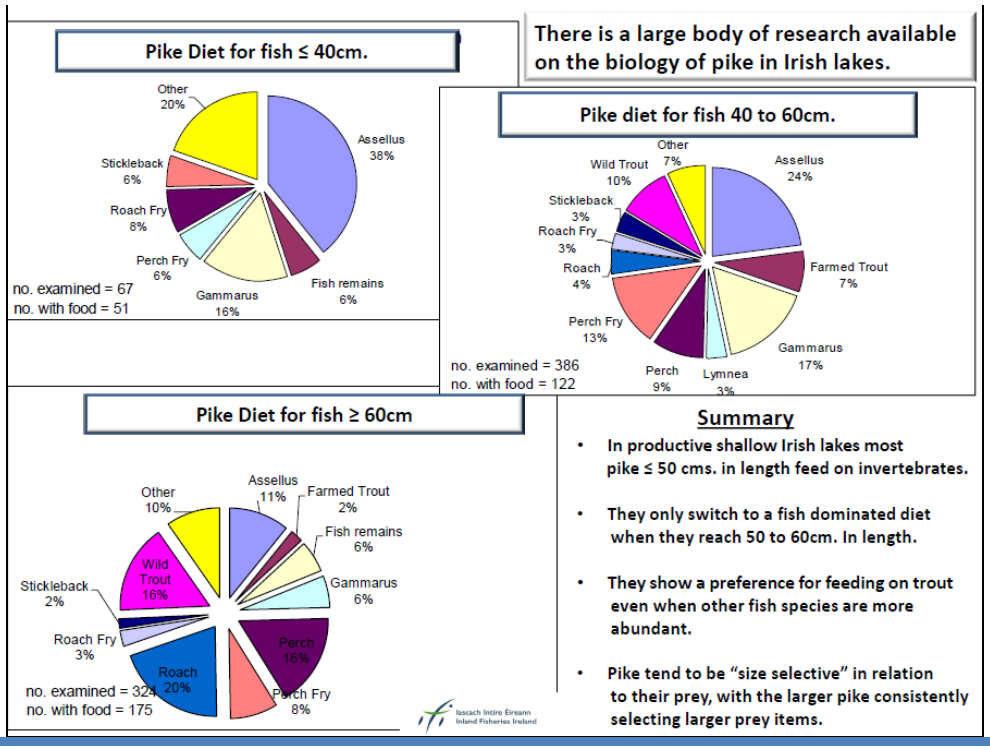


Figure 5a



Excerpt - Figures 4a, 4b and 5a from "The Ecology, Biology and Management of Pike in Irish Waters with Particular Reference to Wild Brown Trout Lake Fisheries" O Grady & Delanty (2008)



Excerpt from "The Necessity for Controlling Pike Stocks in Some Quality Irish Wild Brown Trout Managed Lake Fisheries" -

A presentation to the Pike Policy Group, November 2011

6.1 THE ECOLOGY, BIOLOGY AND MANAGEMENT OF PIKE IN IRISH WATERS WITH PARTICULAR REFERENCE TO WILD BROWN TROUT LAKE FISHERIES CONTD.

Pike dietary studies undertaken prior to the Pedreschi *et al*. (2014b) pike diet research show that in many cases the conclusions of those previous studies are contrary to the data that is supposed to support them. In the table below i.e. excerpt Table 1 of O'Grady & Delanty (2008), it can be seen that as roach populations increased they featured up to seven times more than trout in the diets of the surveyed pike. This appears to contradict the concluding remarks that stated the continuation of predator control was imperative as an increase in pike numbers along with their apparent preference for trout would see trout stocks severely affected.

In contrast to the previous pike studies, the report entitled **"The Diet of Pike in Irish Watercourses"** Pedreschi *et al*. (2014) stated that the research data had shown "***the marked opportunistic nature of individuals that appear to be utilising resources in proportion to their availability in the surrounding environment***". The inference here would appear to be that one must at least be considerate of the opportunistic nature of pike before drawing conclusions to support a theory that pike prey preferentially on any species, including trout.

Table 1. Total numbers of fish captured in survey nets and total number of trout and roach in pike stomachs, from the March gill netting surveys of L. Sheelin, 1980 – 2007

Table 1.	Survey date	1980	1981	1983	1986	2000	2001	2002	2003	2004	2005	2006	2007
	Fish species												
Total No.of fish captured in survey nets	Wild Trout	162	220	90	67	4	4	11	10	7	22	28	4
	Roach	3	18	97	2361	735	611	824	1492	485	47	28	44

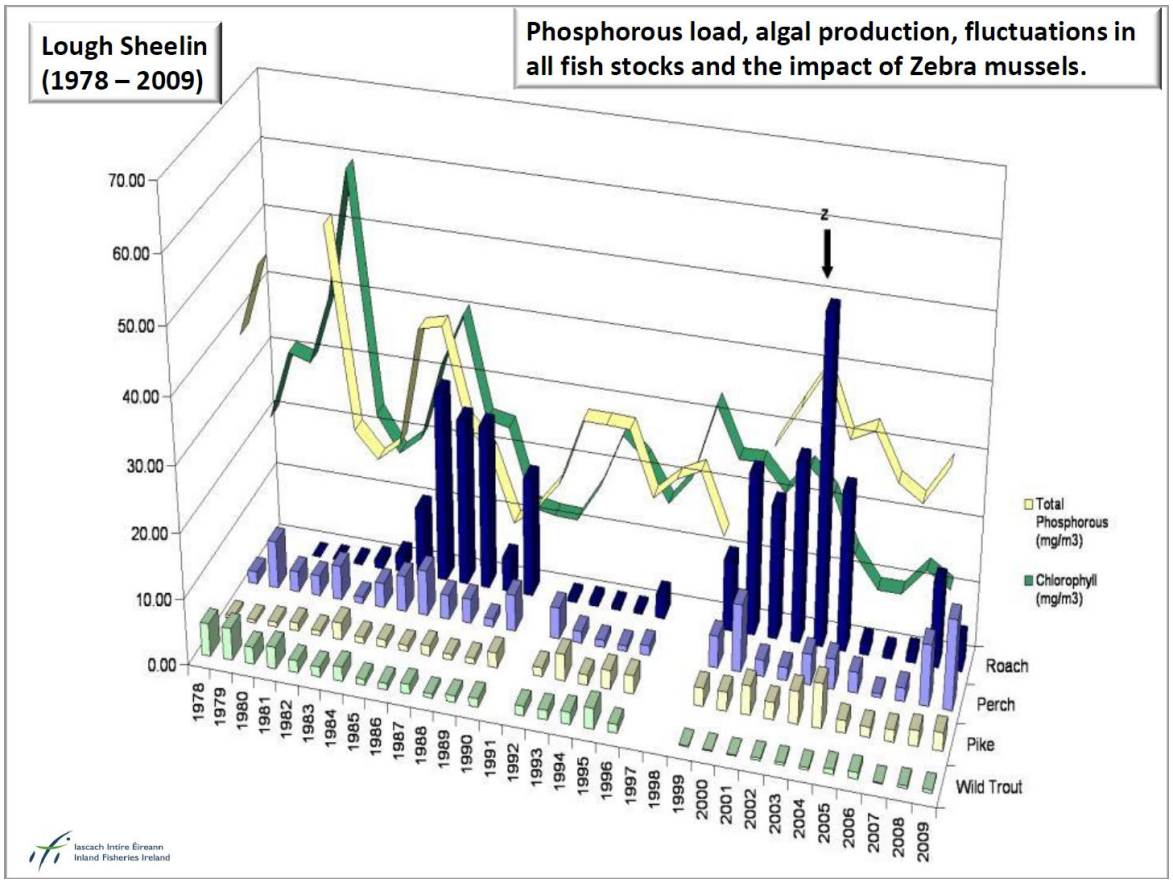
	Survey date	1980	1981	1983	1986	2000	2001	2002	2003	2004	2005	2006	2007
	Fish species												
Total No.of fish in pike stomachs	Wild Trout	6	25	5	4	2	2	2	1	0	2	1	1
	Roach	0	0	2	9	11	14	7	5	7	4	5	6

Excerpt from "The Ecology, Biology and Management of Pike in Irish Waters with Particular Reference to Wild Brown Trout Lake Fisheries" O'Grady & Delanty (2008)

Further evidence of the dependency of a pike population on fish other than trout is illustrated in the following bar graph that was presented to the pike policy review group in 2011. It can be seen that as perch and roach population densities increase and decrease, pike population density follows, yet trout density has remained constant through the same cycles. If pike fed preferentially on trout then the variance in population density with respect to species other than trout should not be so pronounced and should track trout population density rather than roach, perch or others.

Another interesting observation is that it appears that, during periods of high densities of roach in particular trout densities show a marked depression. This would appear to indicate that the population dynamics of all species, and indeed the environmental drivers that naturally dictate species reproduction and survival, are inextricably linked, and as such are critical for inclusion within the context of 'population modelling'.

It is quite clear that the bio-manipulation of pike stocks as part of a pike management policy could have deeper unintended consequences for all species, and in fact be counterproductive when one considers population fluctuations in response to environmental, habitat and other changes within eco-systems.



Excerpt from "The Necessity for Controlling Pike Stocks in Some Quality Irish Wild Brown Trout Managed Lake Fisheries" O'Grady et. al. (2011)

Another misconception that has featured highly in pre-Pedreschi *et al*. (2014) studies is that pike do not feed on pelagic (i.e. suspended over deep water) prey or prey positioned in benthic (bottom) zones. This argument was used to reinforce the assumption of a pikes preference for trout even in waters that contain an abundance of cyprinids, perch and other prey species. The studies centred on the conclusion that pelagic or benthic "positioned" prey were unavailable as food for pike for large portions of the year as pike hunted primarily in shallow-water zones, preferring a hunting habitat of charophyte beds.

In fact, large prey shoals will for long periods of the year lie in, or suspend over very deep water. Pike anglers' experiences over many years and in many fisheries in Ireland and Europe contradict the above assumptions that pike do not feed pelagically. In fact, pike will readily feed in pelagic and benthic zones, necessitating the need for tackle manufacturers to develop specialised equipment required to target those pelagically-feeding pike. As a consequence, numbers of large specimens are caught using pelagic / bottom-fishing techniques. Angling records show that the highest numbers of larger pike are caught in deeper areas year on year through a varied range of fisheries.

6.2 DEFICIENCIES IN SAMPLING, CALCULATION AND DATA GATHERING METHODOLOGY RELATING TO THE STUDY OF PIKE DIET IN IRELAND PRE 2012

The most recent IFI position document used to support pike management is O'Grady & Delanty (2008). The following Sections will detail a number of deficiencies in data gathering, research and supporting evidence contained in that position document, which continues to be used to support pike management in Ireland.

6.2.1 PEER REVIEW

Prior to the release of the ground breaking research i.e. the **"Genetic Structure of Pike and their History in Ireland"** Pedreschi *et al*. (2014) and the **"The Diet of Pike in Irish Watercourses"** Pedreschi *et al*. (2014), both of which are internationally peer-reviewed, there was a dearth of peer reviewed scientific studies in Ireland. It remains a considerable concern that many of the reports produced by or in collaboration with IFT, CFB and IFI relating to Irish pike origins, diet and pike management policy were not internationally peer-reviewed scientific research studies, but were in-house studies and position documents reflecting the opinion of the authors. In contrast to the vast wealth of international knowledge available, Ireland has continued to base policies upon such studies, which is an unacceptable position in the present day. Examples of the wealth of international research information that has been available can be found in the **"Synopsis of Biological Data on the Northern Pike: Esox Lucius" Food and Agricultural Organisation of the United Nations (1988) and Pike, biology and exploitation by Craig, J.F. (1996)**.

6.2.2 STABLE ISOTOPE ANALYSIS AND STOMACH CONTENT ANALYSIS

Pre Pedreschi *et al*. (2014b), Stable Isotope Analysis (SIA) was not used in the study of pike diet in Ireland. As described in Section 7.1.1, SIA provides a much more accurate representation of what a pike consumes over a longer period of time, thus eliminating the deficiencies in stomach content analysis (SCA).

Pre 2014 Stomach Content Analysis (SCA) was the only method used to establish what a pike consumes. As described in Section 7.1.1 SCA is not a suitable method to ascertain what a pike feeds on over a long period of time. SCA provides just a snap-shot in time of what a pike has recently consumed and is currently digesting.

The following Sections illustrate some historical examples of the failings of SCA over time and the erroneous conclusions drawn from past research. References are also made to the variance by different scientific staff and excessive and arguably unsupported overestimates of pike food consumption.

6.2.2.1 HEALY (1956):

O'Grady & Delanty (2008), Section 2.8, refer to the findings of Healy (1956) as supporting evidence for the dominance of trout in the diet of pike in Lough Glore during studies undertaken between 1951 and 1954, ***"despite the presence of a large perch stock"***.

The size of the perch stock at that time should be put into perspective. Healy (1956) states not that there is a large perch stock, but that there ***"should be an adequate supply of perch"***. Healy (1955) also states that in 1951 an estimation of the adult perch stock in Lough Glore was 13,400 fish, 53% of which was removed during 'the scheme for the reduction of coarse fishes' by the end of 1953. Total perch removal from Lough Glore (1950-1954) was 11,504 adults, 407 yearlings, 1,817 perch fry and **"innumerable"** perch eggs.

This perch removal should be viewed against a backdrop of existing and supplemented trout stocks during the same period. Healy (1955), states that when coarse fish removal operations commenced on Lough Glore, ***"large numbers of big trout were netted"***. Healy (1955) also states that during the same operations period that ***"the main spawning stream at Lough Glore has been stocked with 250,000 fry from Lough Owel"***.

The inference here is that, as Lough Glore already contained large numbers of big trout prior to pike management operations, it is only reasonable that a bio-manipulation of fish stocks by removing perch and by adding trout fry that may migrate into Lough Glore, would logically lead to an outcome where trout predation would be inevitable.

The bio-manipulation of fish stocks in Lough Glore, between the years 1951 and 1955 has not been commented on in O'Grady & Delanty (2008).

6.2.2.2 TONER (1959):

O'Grady & Delanty (2008), Section 2.8, refer also to the findings of Toner (1959). Toner states in his research into the food of pike in Lough Corrib, that ***"1,170 pike weighing nearly 5.5 ton, were calculated to have eaten over 46 ton of trout and 11 ton of coarse fish in one year"*** (1954). An alternative analysis of Toner's (1959) findings follows:

1. ***The Maintenance Ratio:***

Pike in Your Waters (2003) noted that the dietary requirements of pike are considered predictable and have been studied by several authors (e.g. Kipling & Frost 1970). It was stated in general terms that a diet comprising between 13oz-1lb of prey fish per pound of pike per annum is needed to merely keep the pike alive (the 'maintenance ration'). Pike in Your Waters (2003) noted that Johnson (1966) listed an average figure equivalent to 1.4lb/lb/year, with a range of 1.3-1.8, whereas Mann (1982) reported an annual value of 0.8/g/g. Fitzmaurice (1983) suggests a significantly higher 'maintenance ration' for pike of "less than 5:1", however Fitzmaurice does not cite any author nor provide any clear evidence in the paper for this conclusion.

2. ***The Food Conversion Ratio:***

Pike in Your Waters (2003) noted that conversion from prey flesh to pike flesh can also be predicted, and suggested the ratio between weight gain and total food consumed during normal growth is often between 1:5 and 1:10. It was further noted that Popova (1978) listed a figure of 1:8.8 and Mann (1982) calculated a ratio of 1:6.6. Fitzmaurice (1983) noted that Johnson (1966a) under experimental conditions obtained a gross conversion factor of 3.4:1 for immature pike. It was further noted that on the basis of including gonadal production for mature pike Johnson (1966b) assumed a figure 84% for both sexes yielding a 'gross conversion' for mature pike of 6.27:1. It is worth commenting at this point that O'Grady *et Al.*, (1996) used Johnson's (1966) gross conversion factor, corrected for gonadal production (i.e. 6.27:1) in order to calculate the weight of fodder fish consumed by an estimated pike population in Lough Corrib in 1995.

3. ***Alternative Analysis of Toner (1959) Total Pike Food Consumption:***

To analyse the projected food consumption of the 1,170 Lough Corrib pike discussed by (Toner 1959), a similar growth rate to that found in O'Grady *et al.*, (1996) has been assumed, as in both cases the pike stocks are considered to represent an undisturbed pike population. An approximate average weight of 4.776kg for each of the 1170 pike is calculated by converting "5.5 tons" (UK, Long) to kilograms. Using both the regression calculation for length / weight relationship (O'Grady *et al.*, 1996, Page 11) and interpolating the growth pattern graph (O'Grady *et al.*, 1996, Page 61, Fig. 26a) for pike in Lough Corrib in 1996, it is determined that each pike of average weight 4,776 grams would each have a total length of 78.3cm. Using the same method, is it possible to back-calculate the average weight and length for the same pike, at an age one year earlier. This yields an average weight of 3,377 grams and a length of 70.8cm or an average weight increase for each pike of 1390 grams (1.39kg) for the year.

4. Calculation:

Using Johnson's (1966) 'Maintenance' and 'Food Conversion' ratios of 1.4lb/lb/year and 6.27:1, respectively, the following total calculations for one year's food eaten to effect a weight gain of 1.39kg per fish for the entire 1,170 pike are made:

(1170 x 1.39 x 6.27) + (1170 x 4.776 x 1.4) = 18,020kg

Converting 18,020kg to tons (UK, Long) = 17.7 ton

5. Conclusion:

The calculations above conclude that the 1,170 pike referred to by Toner (1959) would probably have eaten only 17.7 tons of food. This figure represents a significantly lower food intake, i.e. 31% of Toner's (1959) estimation. The analysis of Toner's (1959) data in the manner performed may have its limitations; however, it is significant, as it nevertheless serves to show the extent of overestimation that appears to exist in Toner's work.

It is noteworthy with respect to Toner's (1959) estimations that it is stated in O'Grady (1995), that ***"the food of pike in Irish waters, apart from Healy's (1956) and Toner's (1959) pioneering work was examined in great detail"***. It would seem that the continued use of this work as corroborating evidence for Inland Fisheries Ireland's pike management policy serves to mislead with respect to the dietary habits of pike. It should be further noted that Healy (1956) refers to an Inland Fisheries Trust report of 1954 stating that 80% (i.e. 936) of the 1,170 pike examined from Lough Corrib for the period March to June 1954 had empty stomachs.

One further comment on Toner's (1959) estimate of pike food consumption is that it represents an average yearly intake exceeding 1000% of the weight of the pike examined. In contrast, Rudzianskiene G. (2001) examined the diet of 257 pike in the Curonian Lagoon, Lithuania, and calculated that the average yearly ration of pike made 243-266% of its total body weight. The current calculation of 31% of Toner's estimate may therefore be high.

6.2.2.3 O'GRADY ET AL. (1996):

O'Grady *et al.* (1996) estimated that the Lough Corrib pike population in 1995 alone ate over 255,000 trout weighing over 118 tonnes. This study was used to support a broader funding application as part of the 'Tourism Angling Measure' (TAM) at that time, part of which was to include the removal of pike from Lough Corrib.

The estimated calculation of trout eaten relied upon a number of assumptions, including the following:

- that the population of pike in Lough Corrib in 1995 was calculable by applying an estimate for the pike population on Lough Sheelin based on CPUE's and lake surface area, and applying this estimate to the CPUE's and lake surface area of Lough Corrib;
- that the diet of pike in Lough Corrib during 1995, did not change seasonally;
- that the biomass of trout to roach (i.e. 80% - 20%) found in pike stomachs in the 1996 Lough Corrib stock survey, was constant for the entire year, 1995;

The calculation of the pike population on Lough Corrib for the year 1995 in the manner performed above, without using supportive mark-recapture techniques to verify the calculation, continues to be a questionable foundation for the estimated 118 tonnes of trout eaten in 1995.

O'Grady *et al.* (1996) calculated the predation of pike on trout in Lough Corrib for 1995 by assuming that pike diet during 1995 did not change seasonally. Section 8 discusses possible factors influencing seasonal feeding and its lack of consideration in scientific reports.

Of note however, is that O'Grady *et al.* (1996) did recommend a study into the seasonal diet of pike on Lough Corrib, presumably to ascertain the accuracy of the original assumption. It is discussed in section 9.4.1.3 that the recommended study was not undertaken by the Central Fisheries Board, nor was it undertaken subsequently by Inland Fisheries Ireland.

The attached excerpt dated 1988, indicates just how seasonally diverse the diet of pike can be expected to be. This information would have been available to the Central Fisheries Board in 1996.

Frost (1954) and Lawler (1965) found that seasonal changes in the diet of the pike appeared to be related to the availability of the fish food. Different species composition in different waters results in diverging pike diets. Lawler (1965) reports that the most important food types eaten in each of several periods during the year in Haming Lake are: May and June - trout-perch (Percopsis omiscomaycus); July - spottail shiner (Notropsis hudsonius); August to September - yellow perch (Perca flavescens); October to March - sticklebacks (Pungitius pungitius and Eucalia inconstans). In Windermere (Frost, 1954), perch (Perca fluviatilis) occur in the pike diet at all times, but predominate from May to October. Char (Salvelinus willughbii) are eaten only in November and December, brown trout (Salmo trutta) to a greater extent from October to February. Sticklebacks (Gasterosteus aculeatus) and minnows (Phoxinus phoxinus) are taken in spring and summer. Such seasonal variations are associated with the changes in habits of the food species.

Excerpt from "Synopsis of Biological Data on the Northern Pike:Esox Lucius" Food and Agricultural Organisation of the United Nations (1988)

Finally, it should be noted that 461 pike were captured during the Spring stock survey on Lough Corrib in 1996. Of the 461 pike captured, 43 pike (i.e. 9%) were recorded as containing trout (FOI/104/07/C). It is the biomass hypothesis that feeds into the considerable tonnage estimate for trout eaten compared to other species. Pedreschi (2014) commented as follows on stomach data regarding trout in pike stomachs in 2011, ***"Trout were encountered in five sites (9 stomachs), and were only important in Lough Sheelin in 2011 (17% IRI), where despite a low occurrence rate of only 7%, their weight contribution to the diet was 48%. This was primarily due to two large relatively undigested trout, highlighting the bias when using only stomach contents"***. It is not the intention here to take the findings of Pedreschi (2014) out of context, however, it is clear that Pedreschi (2014) was aware that biases are possible when using data obtained from stomach content analysis. Regarding the general estimate of 118 tonnes of trout eaten in 1995, a full review of this figure was requested from Inland Fisheries Ireland scientific staff in a high level-meeting with the Irish Federation of Pike Angling Clubs in April 2009. A further request was made by the Irish Pike Society in April 2016 in relation to same.

To date, a full analysis of the methodology and assumptions used to support this tonnage is still awaited from Inland Fisheries Ireland.

6.2.3 TIMING OF SAMPLING

The method of Stomach Content Analysis (SCA) was the primary method (pre Pedreschi *et al*. (2014)) used to establish what a pike had consumed. As SCA provides only a snap-shot in time of pike consumption, the timing of sampling becomes critical, hence the actual sample timing of pre-2014 pike diet results in severe flaws with respect to previous IFI research.

Pre-2014 SCA was in most cases undertaken on pike caught in gill-nets or by electrofishing during annual pike management operations that occur when pike are spawning on "designated wild brown trout fisheries". Pike spawn in shallow bays that predominantly have small rivers or feeder streams entering them, and hence migrate from deep water to these habitats in numbers from late December. Whilst in deep water, pike are feeding predominantly on pelagic or benthic positioned species such as roach, perch, bream and hybrids. Prior to spawning, pike feed more often in order to build condition in preparation for the rigours of spawning. As pike begin spawning as early as late January, the increased food intake usually occurs between October and January.

Trout spawn in many of the small rivers and feeder streams that flow into pike spawning bays. The migration of trout to their spawning rivers and streams usually occurs around November. When spawning is complete, trout migrate back to the lake and re-enter the shallow bays. According to IFI studies, the now spawned trout can stay in the vicinity for quite some time after spawning before dispersing later back into the main body of the lake - O'Grady & Delanty (2012).

> 2. Most trout migrating to the lake appear to stay in areas near the outfall of their natal river in springtime.

Excerpt from "A Survey of Adult Fish Stocks in Lough Corrib" O Grady et al. (2012)

There is now a period where numbers of pike that are feeding prior to spawning and numbers of fatigued post-spawn trout are in close proximity for a short period of time. At this time, trout - amongst other species - are consumed in small numbers by pike. However, as pike are gillnetted or electrofished very shortly after this time, it is reasonable to assume that SCA only will show that most specimens sampled with food in their stomachs will contain some trout.

At this time of year there is a large timeframe between when a pike consumes a food item and when that item is evacuated (digested) out of the stomach. Water temperatures at this time of year are typically between 2 deg.C and 6 deg.C. Pike metabolism is, like many fish species, determined by their surrounding water temperature, and therefore gastric evacuation can take weeks at this time of year. According to research by Diana (1979a) contained within the **"Synopsis of Biological Data on the Northern Pike: Esox Lucius" - Food and Agricultural Organisation of the United Nations (1988),** the time between meals for pike in January is between days. If a pike consumes a trout in this period, Diana's data highlights how infrequent this occurrence is in this period, and also how wide the window of opportunity is in relation to finding a trout in a gillnetted pike.

Subsequently, the timing of most previous SCA analysis undertaken leads to error, as trout will appear significantly more often in pike diet at this time of year than any other. The assumption that this dietary pattern is constant throughout each year further compounds the errors in past analysis of Irish pike diet.

Daily ration of northern pike for various time-periods sampled during 1976-78 in Lac Sainte Anne (Diana, 1979a)

Time period	Sex	Meal size (kcal/kg)	Time between meals (days)	Daily ration ($kcal/kg\ day^{-1}$)
May	Male	30.4	3.1	9.6
	Female	32.4	2.3	14.0
June	Male	35.0	1.9	18.1
	Female	66.5	2.2	30.9
July	Male	36.5	2.1	11.5
	Female	54.1	2.8	19.2
August	Male	23.1	3.8	6.0
	Female	25.4	2.6	9.8
September	Male	22.5	3.5	6.4
	Female	31.4	4.2	7.5
October	Male	17.4	2.2	7.9
	Female	16.5	1.9	8.6
January	Male	9.8	34.0	0.3
	Female	22.0	23.0	1.0
March	Male	10.9	22.0	0.5
	Female	21.6	26.0	0.8
April	Male	14.8	59.0	0.3
	Female	14.8	59.0	0.3
Winter	Male	10.6	25.0	0.4
	Female	21.8	25.0	0.9
Summer	Male	30.8	2.8	11.4
	Female	47.0	2.7	17.4

Excerpt from "Synopsis of Biological Data on the Northern Pike: Esox Lucius" - Food and Agricultural Organisation of the United Nations (1988)

To date there has been no intensive study into the seasonal variation of pike diet in Irish fisheries. This has arguably resulted in pike management policy being formulated on the basis of SCA conducted at a time that favours the detection of trout in a pike's diet. The most recent research on the diet of Irish pike by Pedreschi *et al.* (2014) recognises and highlights this failing by stating:

"Research should continue to investigate stomach contents on a longer-term sampling plan to see if they better reflect SIA values, and to build stronger estimates of individual specialisation and diet overlap. Sampling using a dedicated plan rather than opportunistic sampling would also facilitate a wider range of analyses and hypothesis testing, including, for example, comparisons between seasonal variations in diet."

6.2.4 SAMPLING ANOMALIES WITH PARTICULAR REFERENCE TO LOUGH SHEELIN (1978 TO 2006)

Using the Freedom of Information legislation in 2008, a 31-year period of raw data from the Lough Sheelin annual stock surveys, which are conducted in March each year, was requested. A 29-year window from 1978 to 2006 is examined in this section, as this particular timeframe is referenced in several documents produced by Inland Fisheries Ireland (See Section 6.1).

The Central Fisheries Board, now Inland Fisheries Ireland, received €500 from the Irish Federation of Pike Angling Clubs for the Freedom of Information request (Ref: FOI/145/08/C). The information provided appeared to be missing significant portions of data, therefore an appeal was forwarded to the Central Fisheries Board in respect of this. The response to the appeal confirmed that "a full review of the information provided" had taken place and "that no additional information is available". It is on the basis of the confirmation that there is no outstanding information, that the review of FOI/145/08/C is conducted in this section as follows.

Pike diet over the 29-year timeframe 1978 to 2006 is examined for:

- Pike >60cm in length;
- Pike from 40cm to 59.9cm and
- Pike <40cm in length.

The above size parameters are chosen and examined here to allow the reader to consider the validity - or otherwise - of the bedrock of research on pike diet used by Inland Fisheries Ireland, to support pike management.

FOI/145/08/C shows that during the 29-year timeframe 2315 pike were captured during the annual Spring surveys. 1716 (i.e. 74%) are recorded on the received data sheets, therefore the remaining 599 pike are, for reasons unknown, excluded from the data sheets. Of the 74% of pike recorded, 22% had food in their stomachs. Of the 22% recorded as having food in their stomachs, 12% were found to contain wild trout, therefore 88% of those stomachs containing food contained something other than wild trout. The basic fact is that percentages alone only tell part of the story. For example, it is a fact that the FOI response indicates that only 46 pike captured in 29 years during the Lough Sheelin Spring surveys are recorded as having eaten wild trout. As stated, this data is the bedrock for pike management in Ireland.

It is considered that the data available for Lough Sheelin between 1978 and 2006 represents the largest collated data base of all Irish fisheries. However, FOI/145/08/C illuminates many failings in that data as a longitudinal study. The examination of FOI/145/08/C, which is presented in the following tables and pie charts, represents the actual raw data base from which Inland Fisheries Ireland draws conclusion with regard to the dietary habits of Irish pike living in fisheries along with wild trout. The data base is based upon a 'snap-shot' look into pike feeding habits at a particular time of year.

The research is conducted with gill-nets, which are known to induce regurgitation of food by fish captured in the nets. There is little evidence to suggest that the research considers external factors such as seasonal spatial distribution of species. Furthermore, the research is not backed up by a corroborating scientific methodology; e.g. Stable Isotope Analysis. To our knowledge, the conclusions stemming from this data base have never been internationally peer reviewed.

It is incumbent on the scientific information that continues to support a pike management strategy in Ireland, costing the Irish Exchequer millions of euros to sustain, to be clear, concise and infallible. The following overview seeks to examine that scientific information.

6.2.4.1 DATA REVIEW FOR PIKE > 60CM IN LENGTH (1978-2006):

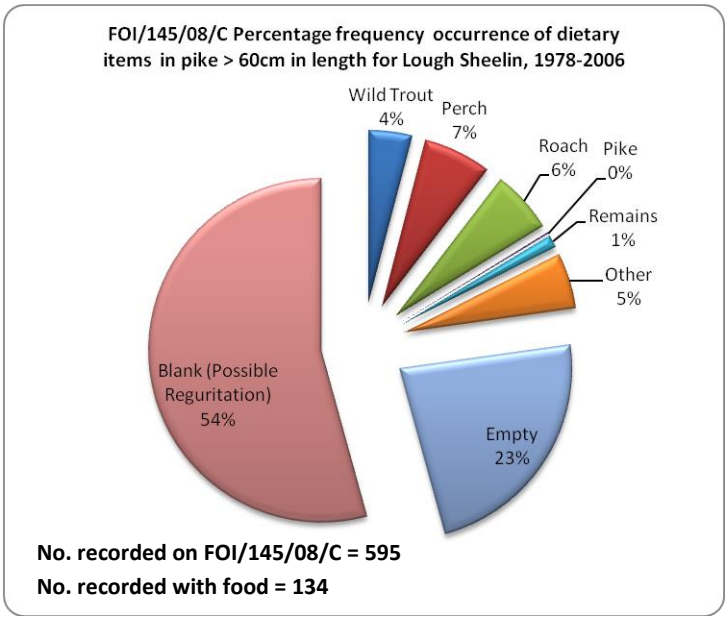
FREEDOM OF INFORMATION REQUEST FOI/145/08/C - STOMACH SAMPLING DATA FOR PIKE >60CM IN LENGTH (1978-2006)											
			No. of Pike Stomachs Containing a Particular Food Sample								
Year	Annual Spring Survey Y/N	No. of Pike Recorded on Data Sheets	Wild Trout	Farmed Trout	Perch	Roach	Pike	Remains	Other	Empty	Blank (No Data)
1978	Y	0	No pike of over 60cm								
1979	Y	7	1	2					1		3
1980	Y	16	3	1					1		11
1981	Y	32	9		2		1			1	20
1982	Y		No data provided for any species with the exception of trout								
1983	Y	49	3		11	2			6	15	12
1984	Y	12	Pike sizes only - No pike stomach sampling data available								12
1985	Y		No data provided for any species								
1986	Y	19	1		3	4				12	0
1987	Y		No data provided for any species								
1988	Y		No data provided for any species								
1989	Y	9	Pike sizes only - No pike stomach sampling data available								9
1990	Y	9	Pike sizes only - No pike stomach sampling data available								9
1991	N		No annual survey								
1992	Y	17	Pike sizes only - No pike stomach sampling data available								17
1993	Y	19	Pike sizes only - No pike stomach sampling data available								19
1994	Y	17	Pike sizes only - No pike stomach sampling data available								17
1995	Y	10	Pike sizes only - No pike stomach sampling data available								10
1996	Y	27	Pike sizes only - No pike stomach sampling data available								27
1997	N		No annual survey								
1998	N		No annual survey								
1999	Y	37	Pike sizes only - No pike stomach sampling data available								37
2000	Y	46	2		7	7		6	11	12	1
2001	Y	60	1		7	6			3	32	11
2002	Y	39	3		1	6			2	10	17
2003	Y	79	1			3		1	2	20	52
2004	Y	31				4			2	23	2
2005	Y	33	Pike sizes only - No pike stomach sampling data available								33
2006	Y	27			7	3				12	5
TOTAL		**595**	**24**	**3**	**38**	**35**	**1**	**7**	**28**	**137**	**324**

Note: Two stomachs are recorded twice - i.e. one containing perch and trout; one containing perch and roach. On an appeal of FOI/145/08/C, the considerable blank columns on the stomach content data sheets was queried, to which a response was received from the Central Fisheries Board (now Inland Fisheries Ireland), to advise upon capture, that ***"pike often evacuate their stomachs"*** and that ***"blank columns reflect empty stomachs".***

COMMENT ON FOI/145/08/C STOMACH CONTENT DATA FOR PIKE >60CMS:

- Inland Fisheries Ireland refers to a sampling period 1978 to 2006. In fact, FOI/145/08/C shows that stomach content data is available for only 11 of those 29 years, i.e. 1979, 1980, 1981, 1983, 1986, 2000, 2001, 2002, 2003, 2004, 2006 (i.e. totalling 405 pike over 60 cm in length).
- There are a further 190 pike >60cm recorded for the years 1984, 1989, 1990, 1992, 1993, 1994, 1995, 1996, 1999, 2005; however stomach sampling data is not provided for these 190 pike, which presumably, if available, would have been made available under FOI/145/08/C.
- No sampling data for any pike was provided for the years 1982, 1985, 1987, 1988, although it is known that a total of 325 pike were captured during the Spring surveys carried out in those years - ref: FOI/145/08/C.
- Spring surveys were not carried out at all in 1991, 1997 and 1998.
- No pike >60cm in length was sampled in 1978; however, only 24 are recorded in all size parameters, of a total of 32 pike captured in the Spring survey - ref: FOI/145/08/C - therefore 25% are unaccounted for.

STATISTICS FOR FOI/145/08/C STOMACH CONTENT DATA FOR PIKE >60CMS:



FACT: Between 1978 and 2006, FOI indicates that only 24 pike stomachs examined in the Spring surveys contained a wild trout!

AMBIGUITY BETWEEN FOI/145/08/C AND INLAND FISHERIES IRELANDS' SCIENTIFIC DATA REPORTS:

- O'Grady & Delanty (2008) – *See Section 6.1* & O'Grady *et al.* (2008) both show that, for pike >60cm captured in the Spring surveys over 29 years, 324 pike were examined, of which 149 contained food. In contrast, FOI/145/08/C shows that in fact, of the 595 pike recorded on the FOI data sheets, only 134 are recorded as containing food. Therefore, the aforementioned documents both include an extra 15 stomachs that are unaccounted for under FOI/145/08/C. To put this into perspective, if one considers that only 24 stomachs in 29 years contained a wild trout, then 15 stomachs unaccounted for is a credible concern.

- Further to the above, a presentation made to the Pike Policy review group in November 2011 was entitled "The Necessity for Controlling Pike Stocks in Some Quality Irish Wild Brown Trout Managed Lake Fisheries". The presentation showed that for pike >60cm captured in the Spring surveys over 29 years, 324 pike were examined, of which 175 contained food - *See excerpt in Section 6.1*. Having discussed in the previous point that FOI/145/08/C proves that only 134 pike stomachs contained food, in this instance it is stated that 175 stomachs contained food, in contrast to the 149 stomachs stated in O'Grady & Delanty (2008) & O'Grady *et al.* (2008). The apparent further inaccuracy contained in the scientific information produced by Inland Fisheries Ireland raises increasing concern as to the general credibility of the information.

6.2.4.2 DATA REVIEW FOR PIKE 40CM TO 59.9CM IN LENGTH (1978-2006)

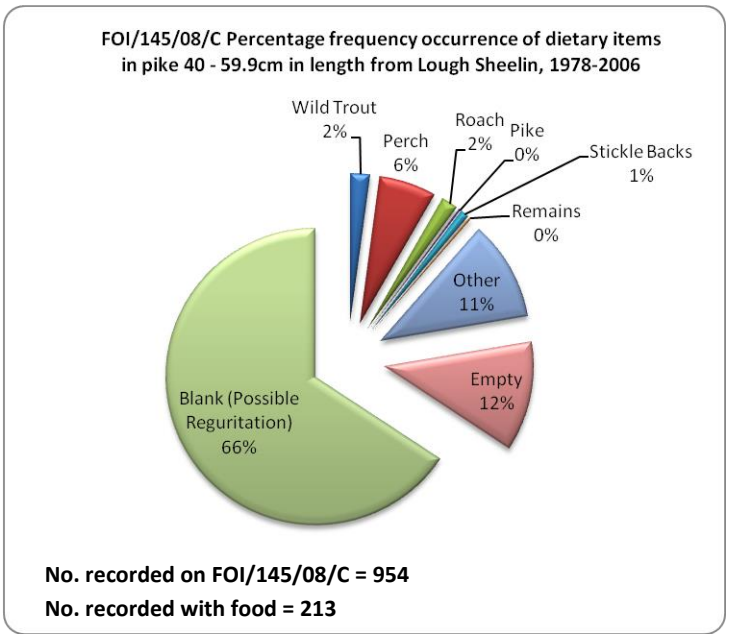
FREEDOM OF INFORMATION REQUEST FOI/145/08/C - STOMACH SAMPLING DATA FOR PIKE 40CM TO 59.9CM (1978-2006)												
Year	Annual Spring Survey Y/N	No. of Pike Recorded on Data Sheets	No. of Pike Stomachs Containing a Particular Food Sample									
			Wild Trout	Farmed Trout	Perch	Roach	Pike	S/Backs	Remains	Other	Empty	Blank (No Data)
1978	Y	20	2	4				4	1	3	6	0
1979	Y	25	1	16	1			2				5
1980	Y	45	3		1			1		10		30
1981	Y	64	11		4		1		1	3		44
1982	Y		No data provided for any species with the exception of trout									
1983	Y	144	2		35	1		1		20	28	57
1984	Y	60	Pike sizes only - No pike stomach sampling data available									60
1985	Y		No data provided for any species									
1986	Y	44	1		8	4				8	22	1
1987	Y		No data provided for any species									
1988	Y		No data provided for any species									
1989	Y	15	Pike sizes only - No pike stomach sampling data available									15
1990	Y	27	Pike sizes only - No pike stomach sampling data available									27
1991	N		No annual survey									
1992	Y	25	Pike sizes only - No pike stomach sampling data available									25
1993	Y	40	Pike sizes only - No pike stomach sampling data available									40
1994	Y	27	Pike sizes only - No pike stomach sampling data available									27
1995	Y	92	Pike sizes only - No pike stomach sampling data available									92
1996	Y	81	Pike sizes only - No pike stomach sampling data available									81
1997	N		No annual survey									
1998	N		No annual survey									
1999	Y	45	Pike sizes only - No pike stomach sampling data available									45
2000	Y	34			1	4				14	14	1
2001	Y	70			3	4		1		14	17	31
2002	Y	35			1	1				2	11	20
2003	Y	19				1	1			3	8	6
2004	Y	10				1				4	3	2
2005	Y	16	Pike sizes only - No pike stomach sampling data available									16
2006	Y	16			5	1				3	5	2
TOTAL		**954**	**20**	**20**	**59**	**17**	**2**	**9**	**2**	**84**	**114**	**627**

Note: Two stomachs recorded as roach contained unidentified cyprinid fry. Stomachs recorded as 'other' contained invertebrates, snails; some stocked farmed trout - i.e. over two years only, 1978/79, frogs, etc. On an appeal of FOI/145/08/C, the considerable blank columns on the stomach content data sheets was queried, for which a response was received from the Central Fisheries Board (now Inland Fisheries Ireland), to advise that upon capture, ***"pike often evacuate their stomachs"*** and that ***"blank columns reflect empty stomachs".***

COMMENT ON FOI/145/08/C STOMACH CONTENT DATA FOR PIKE 40CM TO 59.9CMS:

- Inland Fisheries Ireland refers to a sampling period 1978 to 2006. In fact, FOI/145/08/C shows that stomach content data is available for only 12 of the 29 years, i.e. 1978, 1979, 1980, 1981, 1983, 1986, 2000, 2001, 2002, 2003, 2004, 2006 (totalling 526 pike of between 40cm to 59.9cm in length).
- There are a further 428 pike of between 40cm to 59.9cm recorded for the years 1984, 1989, 1990, 1992, 1993, 1994, 1995, 1996, 1999, 2005; however, stomach sampling data is not provided for these 428 pike, which presumably, if available, would have been made available under FOI/145/08/C.
- No sampling data for any pike was provided for the years 1982, 1985, 1987, 1988, although it is known that a total of 325 pike were captured during the Spring surveys carried out in those years - ref: FOI/145/08/C.
- Spring surveys were not carried out at all in 1991, 1997 and 1998.

STATISTICS FOR FOI/145/08/C STOMACH CONTENT DATA FOR PIKE 40CM TO 59.9CMS:



FACT: Between 1978 and 2006, FOI indicates that only 20 pike stomachs examined in the Spring surveys contained a wild trout!

AMBIGUITY BETWEEN FOI/145/08/C AND INLAND FISHERIES IRELANDS' SCIENTIFIC DATA REPORTS:

- Inland Fisheries Ireland (2011) - See excerpt Section 6.1, O'Grady & Delanty (2008) and O'Grady *et al.* (2008) show that for pike from 40cm to 59.9cms captured in the Spring surveys over 29 years, 386 pike were examined, of which 122 contained food. FOI/145/08/C shows that 954 pike are recorded on the data sheets, of which 213 are recorded as containing food. This anomaly represents the significant difficulty one is presented with when trying to examine and analyse pike dietary data provided by Inland Fisheries Ireland.

  As mentioned previously in this section, only 74% of the pike captured in the 29 years during the Spring surveys are actually recorded in the FOI/145/08/C data sheets. Therefore, it is the contention of this document that the pie chart above represents the most accurate overview of the research data base for pike from 40cm to 59.9cms.

6.2.4.3 DATA REVIEW FOR PIKE <40CM IN LENGTH (1978-2006)

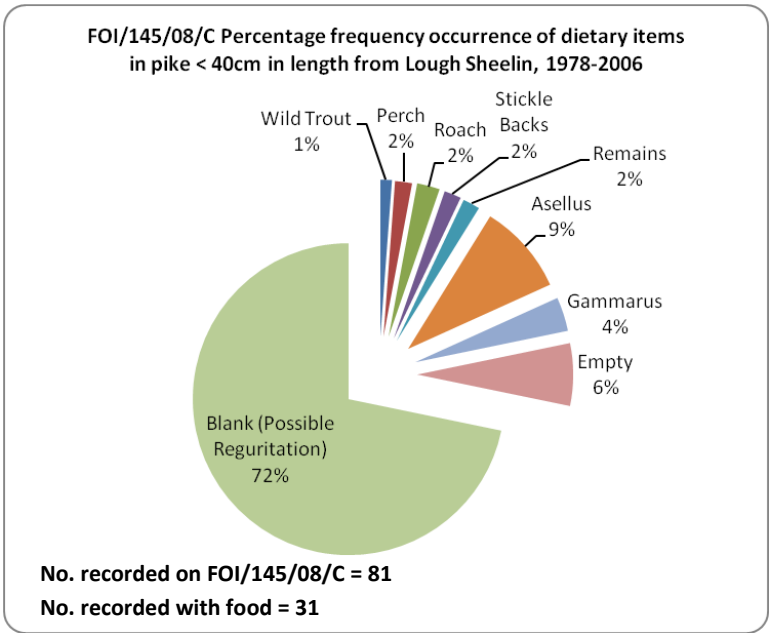
FREEDOM OF INFORMATION REQUEST FOI/145/08/C - STOMACH SAMPLING DATA FOR PIKE <40CM IN LENGTH (1978-2006)												
Year	Annual Spring Survey Y/N	No. of Pike Recorded on Data Sheets	No. of Pike Stomachs Containing a Particular Food Sample									
			Wild Trout	Farmed Trout	Perch	Roach	S/Backs	Remains	Asellus	Gammarus	Empty	Blank (No Data)
1978	Y	4			1		3					
1979	Y	1										1
1980	Y	7							2	1		5
1981	Y	5							1	1		4
1982	Y		No data provided for any species with the exception of trout									
1983	Y	13			1				1	1	3	7
1984	Y	1	Pike sizes only - No pike stomach sampling data available									1
1985	Y		No data provided for any species									
1986	Y	14	2			1		1	4		4	2
1987	Y		No data provided for any species									
1988	Y		No data provided for any species									
1989	Y	0	Pike sizes only - No pike stomach sampling data available									0
1990	Y	12	Pike sizes only - No pike stomach sampling data available									12
1991	N		No annual survey									
1992	Y	10	Pike sizes only - No pike stomach sampling data available									10
1993	Y	11	Pike sizes only - No pike stomach sampling data available									11
1994	Y	15	Pike sizes only - No pike stomach sampling data available									15
1995	Y	13	Pike sizes only - No pike stomach sampling data available									13
1996	Y	14	Pike sizes only - No pike stomach sampling data available									14
1997	N		No annual survey									
1998	N		No annual survey									
1999	Y	4	Pike sizes only - No pike stomach sampling data available									4
2000	Y	5						1	3		1	
2001	Y	3							1	2		1
2002	Y	4							1			3
2003	Y	19				1			3	1	2	12
2004	Y	5				2		1			1	1
2005	Y	6	Pike sizes only - No pike stomach sampling data available									6
2006	Y	1			1							
TOTAL		**167**	**2**	**0**	**3**	**4**	**3**	**3**	**16**	**6**	**11**	**122**

Note: Three stomachs are recorded twice i.e. each contained both Asellus and Gammarus. On an appeal of FOI/145/08/C, the considerable blank columns on the stomach content data sheets was queried, for which a response was received from the Central Fisheries Board (now Inland Fisheries Ireland), to advise that upon capture, ***"pike often evacuate their stomachs"*** and that ***"blank columns reflect empty stomachs".***

COMMENT ON FOI/145/08/C STOMACH CONTENT DATA FOR PIKE < 40CM:

- Inland Fisheries Ireland refers to a sampling period 1978 to 2006. In fact, stomach content data was provided for only 12 of the 29 years, i.e. 1978, 1979, 1980, 1981, 1983, 1986, 2000, 2001, 2002, 2003, 2004, 2006 (totalling 81 pike <40cm in length).
- There are a further 86 pike <40cm recorded for the years 1984, 1989, 1990, 1992, 1993, 1994, 1995, 1996, 1999, 2005; however, stomach sampling data is not provided for these 86 pike, which presumably, if available, would have been made available under FOI/145/08/C.
- No sampling data for any pike was provided for the years 1982, 1985, 1987, 1988 although it is known that a total of 325 pike were captured during the Spring surveys carried out in those years - ref: FOI/145/08/C.
- Spring surveys were not carried out at all in 1991, 1997 and 1998.

STATISTICS FOR FOI/145/08/C STOMACH CONTENT DATA FOR PIKE < 40CMS:



FACT: Between 1978 and 2006, FOI indicates that only 2 pike stomachs examined in the Spring surveys contained a wild trout!

AMBIGUITY BETWEEN FOI/145/08/C AND INLAND FISHERIES IRELANDS' SCIENTIFIC DATA REPORTS:

- Inland Fisheries Ireland (2011) - See excerpt Section 6.1, O'Grady & Delanty (2008) and O'Grady *et al.* (2008) show that for pike from < 40cm captured in the Spring surveys over 29 years, 67 pike were examined, of which 51 contained food. FOI/145/08/C shows that 81 pike are recorded on the data sheets, of which 31 are recorded as containing food. This shows that each of the respective data reports refer to an additional 20 pike as containing food on top of those recorded on the FOI/145/08/C data sheets. This again questions the credibility of the research data presented.

  As mentioned previously in this section, only 74% of the pike captured in the 29 years during the Spring surveys are actually recorded in the FOI/145/08/C data sheets. Therefore, it is the contention of this document that the pie chart above represents the most accurate overview of the research data-base for pike from 40cm to 59.9cms.

6.2.5 THE FAILURE OF GILL-NETS AS A SAMPLING TOOL FOR PIKE DIETARY ANALYSIS

The analysis of pike diet relies on the capture of numbers of specimens, which has been achieved primarily by gill-netting during Pike Management Operations. There are many inherent flaws with this method of capture with respect to Pike dietary analysis.

As mentioned in section 6.2.4, only 22% of pike recorded in FOI/145/08/C data sheets contained food. For those remaining, 15% are recorded as empty and 63% are left blank. As stated, an appeal to FOI/145/08/C was initiated under Freedom of Information to Inland Fisheries Ireland (then Central Fisheries Board), to request clarification as to why stomach content columns were left blank. The response received stated that ***"upon capture in a net, or by rod, pike often evacuate their stomachs"*** and that ***"blank columns reflect empty stomachs".*** The issues of 'empty stomachs' and the 'regurgitation of food' will be discussed in the following sections.

6.2.5.1 EMPTY STOMACHS

The 1978 to 2006 stock sampling took place in Spring, primarily, it appears, to coincide with the pike spawning period. Craig (1996) commented on the migration of pike to their spawning grounds, stating that some river pike travelled 15km to reach their spawning grounds. A spawning migration of pike would likely lead to them being susceptible to capture in survey nets. This spawning period, itself, has been linked to a spawning fast in pike. As such, it may be reasonable to suggest that feeding opportunism rather than selectivity is more likely.

Spring sampling can, by its very nature, allow increased capture of pike than can, for instance, summer sampling conducted under the Water Framework Directive, simply because of the previously mentioned migration. As such, Spring sampling may provide sufficient numbers of pike required to allow an examination of growth rates of individual pike and length frequency studies. Dietary studies are a different and more complicated matter.

Many authors - e.g. Dominguez & Pena (2000), King & Kirrane (1994), O'Grady & Delanty (2003) - link the spawning period to a large percentage of empty stomachs. Dominguez & Pena (2000) found up to 84% empty stomachs in February over six years from 1982 to 1987 in the Esla Basin. O'Grady & Delanty (2003) found 64% empty stomachs in Lough Arrow in 2002. However, empty pike stomachs in Ireland are disregarded in the analysis of pike diet, yet they clearly can represent a considerable unknown quantity. This unknown quantity allows assumptions to be made, based primarily on a small number of stomachs containing food (See Section 6.2.4). The assumption is then applied to the entire pike stock.

As discussed in Section 6.2.2.2, 80% of the Lough Corrib pike stomachs referred in Toner (1959) were empty, yet a projected pike diet for a whole year of over 1000% for 100% of the pike captured, was used as a basis to support the removal of pike. Furthermore, the data flowing from this projection continues to be used by Inland Fisheries Ireland today. The inference here is that the lack of available scientific data stemming naturally from empty stomachs during Spring, while uninformative, should not be disregarded or presumed.

6.2.5.2 REGURGITATION OF FOOD

In contrast to empty stomachs, the regurgitation of food by pike may be relevant in all dietary sampling, particularly when gill-nets are used, irrespective of the season. It is important to note that the dominant sampling method used in the 29-year sampling period on Lough Sheelin during 1978-2006 discussed in section 6.2.4 was gill-netting.

Treasurer (1988), Dominguez & Pena (2000) and Healy (1956) linked regurgitation of food from pike stomachs with being captured using gill-nets. Alternative techniques were promoted by Dominguez & Pena (2000) such as electro-fishing and traps to study the diet of 4,362 pike in Northwest Spain, so as to reduce regurgitation. Treasurer (1988) linked high levels of regurgitation to gill-nets being set overnight and to water temperature, with up to 84% regurgitation found in pike during Summer sampling. It was further suggested that gill-netting is an unsatisfactory capture method, leading to a false estimate of empty stomachs. Treasurer (1988) also suggested that failure to critically appraise regurgitation may mislead, in respect of the predation on prey species.

Regarding the Spring surveys on Lough Sheelin, gill nets are set overnight, and the likelihood of regurgitation is therefore scientifically supported. Although there appears to be no evidence to suggest that Inland Fisheries Ireland has in the past considered the bias of using gill-nets and the resultant regurgitation in the examination of the results, there does now appear to be some acknowledgement that gill-nets do lead to biases. Delanty *et al.* (2016) state in relation to a fish stock survey of Lough Ree carried out in 2014, ***"that many of the pike examined had no food in their stomachs"***. It was stated that ***"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".***

In contrast to Inland Fisheries Ireland's theory that pike feed selectively on trout, Pedreschi (2014) has provided ground-breaking scientific evidence that pike are 'opportunist feeders'. This evidence is based principally upon a scientific technique known as 'Stable Isotope Analysis' (SIA). Paradis *et al.* (2008) discuss the merits of combining Stable Isotope Analysis and 'snap-shot' data in their research. To date, and since 1978, Inland Fisheries Ireland has relied solely on 'snap shot' stomach sampling by capturing fish principally in gill-nets.

The inference here is that the current body of research data into the diet of Irish pike, which has been collected over many decades, has relied principally upon gill-nets to provide that research data - a technique which is clearly inherently flawed.

6.2.6 SECTION SUMMARY CONCLUSION: PAST RESEARCH RELATED TO THE DIET OF IRISH PIKE

It is clear that the study of Irish pike diet prior to the modern research of Pedreschi *et al*. (2014) was inherently flawed due to a number of factors. The investigation and analysis undertaken in section 6 suggests that the scientific research currently supporting pike management in Ireland is based largely upon inaccurate data collation and representation, flawed sampling techniques, and arguably exaggerated conclusions supporting a theory that pike have a preference for feeding on trout.

In Section 6.1 the current Inland Fisheries Ireland position paper is discussed i.e. **"The Ecology, Biology and Management of Pike in Irish Waters with Particular Reference to Wild Brown Trout Lake Fisheries"** O'Grady & Delanty (2008). It is the contention of this document that this position paper inaccurately assumes that pike do not feed pelagically and that they will target trout over any other species, even when other species are significantly more available and accessible to pike as food.

With regard to the study of the diet of pike on Lough Sheelin (1978 – 2006), there is an unquestionable anomaly with regard to how this information is presented in a number of different papers produced by Inland Fisheries Ireland and its predecessors and the actual factual data obtained for that period using Freedom of Information legislation. There is no correlation between the data, and the credibility of the data is therefore open to question.

Of considerable concern is that the **"The Ecology, Biology and Management of Pike in Irish Waters with Particular Reference to Wild Brown Trout Lake Fisheries"** O'Grady & Delanty. (2008), is not an internationally peer-reviewed paper, as appears to be the case with many pike-related position papers and pike dietary studies undertaken by Inland Fisheries Ireland and its predecessors IFI prior to Pedreschi *et al*. (2014).

Regarding O'Grady *et al.* (1996), the resulting estimates of the predation of pike upon trout continue to be presented by Inland Fisheries Ireland as justification for removing pike, yet this estimate relies upon unsubstantiated assumptions. Furthermore, this paper again is an internal report, and the methodology, assumptions relied upon, and calculations have not been subjected to international peer review. It is notable that Inland Fisheries Ireland have not responded to requests for clarification regarding this paper.

Stomach Content Analysis is recognised as having limited applicability in relation to establishing dietary habits, as it can only provide a snap-shot in time of what has been consumed, providing the stomach contents have not already been digested, or ejected. The susceptibility of weakened or dead post-spawning trout to opportunistic pike predation during the Spring sampling periods remains a distinct possibility that has not been studied by IFI. In addition, the absence of a study undertaken by IFI and its predecessors into seasonal variations in pike diet as recommended in O'Grady *et al.* (1996) represents a significant failing with regard to advancing knowledge regarding Irish pike.

Considering all of the above, there appears to be considerable evidence to suggest that the validity and accuracy of the past research into the diet of pike is open to question, and as such is difficult to describe as acceptable. Furthermore, the use of past research data as a foundation for future scientific studies will likely have a negative impact on the reliability of those studies.

7 CURRENT RESEARCH RELATED TO THE DIET OF IRISH PIKE

A cornerstone of justification for pike management operations is that pike predominantly target and predate on salmonids, even where other prey species are available and more abundant. Recent research has shown this to be unfounded and revealed a number of flaws in the methodology and findings of over six decades of research undertaken by IFT, CFB and IFI relating to the diet of Irish pike.

7.1.1 THE DIET OF PIKE IN IRISH WATERCOURSES

In 2014, a PhD study was undertaken by University College Dublin in collaboration with IFI in order to accurately analyse the diet of pike. The report **"The Diet of Pike in Irish Watercourses"** - Pedreschi *et al*. (2014) highlighted many new characteristics related to pike diet, feeding habits and preferences. As the table below illustrates, the dominance of one prey species over another in a pike's diet is solely dependent on its availability. Therefore, if roach are the most numerous prey species, they will feature as the most targeted prey fish. Similarly if trout are the most numerous prey species, they will feature as the most targeted prey fish. The report goes further in dispelling the bias towards trout as a prey item by stating that pike are mainly opportunistic feeders. As roach and perch numbers are typically higher than trout numbers by a significant multiple, then opportunities to consume these species will arise far more often, as illustrated by the following table.

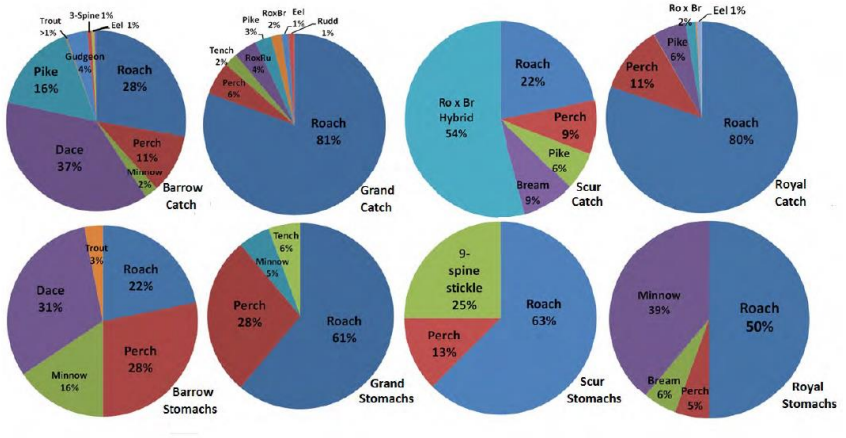


Figure 7. Prey species percent relative abundance from catch data (upper) and pike diet stomach content data (lower). Overall diet proportions follow the general trends found in the environment. Exceptions occur in relation to species such as sticklebacks and minnow that are generally under sampled due to their small size. Differences occur in Lough Scur in relation to Bream and Roach x Bream Hybrids, likely related to differences in morphology (see Discussion).

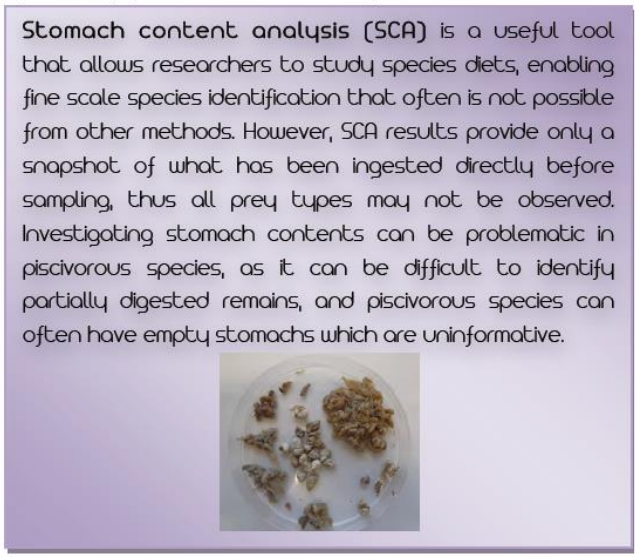
Excerpt from "The Diet of Pike in Irish Watercourses" - Pedreschi *et al*. (2014)

The report paid caution to current pike management policy and operations in light of this new research.

"Managers need data on feeding habits, interactions and competition in order to gain a better insight into community dynamics and manage waterways as ecosystems rather than separate components. This study for the first time provides this information across lake, river and canal habitats, representing a cross-section freshwater ecosystem diversity, and inputting directly into the better conservation and management of this economically and ecologically important species."

7.1.1 THE DIET OF PIKE IN IRISH WATERCOURSES CONTD.

There were two sampling methods used in this study. The first was stomach contents analysis of captured pike. This was a method also used in previous studies. However, as discussed previously, "**stomach contents analysis" (SCA)** gives only a snap-shot in time of what each pike has last consumed, and hence is not reliable in establishing the seasonal variation of what each pike consumes.



Excerpt from "The Diet of Pike in Irish Watercourses" - Pedreschi *et al.* (2014)

The second method employed in this study is known as **"stable isotope analysis" (SIA)**. This method helps to provide a much more expansive and accurate representation of a pike's diet over its lifespan, and hence can go some way to formulating seasonal dietary variation. This study was the first time that SIA was employed in order to study the diet of Irish pike. No previous studies on the subject had used this method, with just SCA and the previously discussed inherent inaccuracies being used to inform and indeed shape pike management policy.

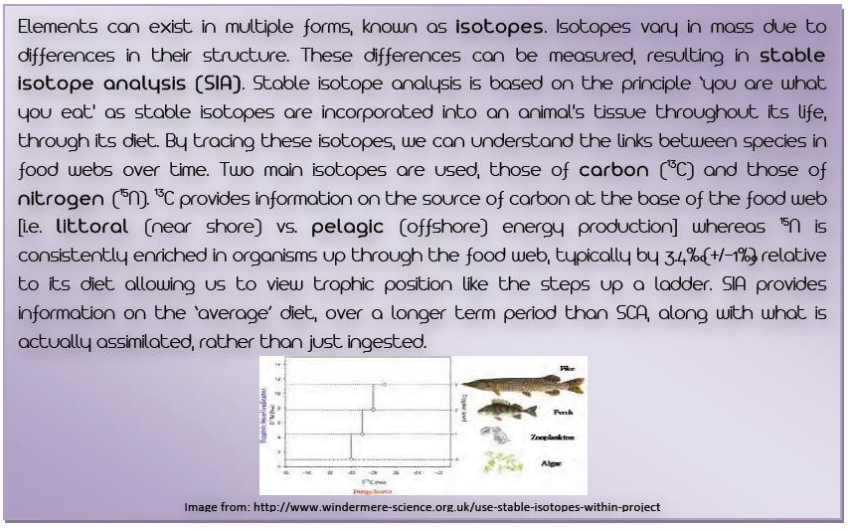


Image from: http://www.windermere-science.org.uk/use-stable-isotopes-within-project

Excerpt from "The Diet of Pike in Irish Watercourses" - Pedreschi *et al.* (2014)

7.1.1 THE DIET OF PIKE IN IRISH WATERCOURSES CONTD.

There were a number of important findings and conclusions resulting from the report **"The Diet of Pike in Irish Watercourses"** - Pedreschi *et al*. (2014), many of which revealed to the reader severe deficiencies and inaccuracies in decades of previous research undertaken by IFI, CFB and IFT. Note that pre-2014 diet research continues to be used to shape pike management policy in Ireland. Some of the most notable findings with respect to the relationship between pike and trout are shown as follows:

Diet and Trophic Variation

As expected, pike do engage in piscivory, with roach and perch being by far the most important prey species across all sites, and within each site, with the exception of Lough Sheelin in 2011 and the River Deel in 2012, where trout and pike respectively, constituted the largest fish proportion of the diet. Contrary to the expected (Kennedy 1969; O'Grady & Delanty 2008), trout made up a small proportion of the overall diet, with predation levels being similar to pike cannibalism levels. This likely reflects the relatively low numbers of trout captured in the sites sampled.

*It is generally acknowledged in the scientific literature that pike prey primarily upon fish once a length of **>10cm** has been attained (Frost 1954; Mittelback & Persson 1998; Beaudoin et al. 1999). In Ireland however, Healy (1956) stated that pike have a preference for fish when **>55cm** length, and noted that in two of the three lakes she examined, pike ate more trout than perch. This may have been due to the greater natural defences of perch (i.e. tough skin and hard spiny fin rays). More recently, O'Grady & Delanty (2008) have also highlighted the piscivorous habits of pike **>60cm**, which is further supported here, and described a preference of pike for eating trout in Lough Sheelin. As a 60cm fish in Ireland is estimated to be 5-6 years old (O'Grady and Delanty 2008), and as relatively few fish have been found to live beyond 6 years in Irish waters (Healy 1956; O'Grady & Delanty 2008), the impact of pike on brown trout may not be as drastic as previously feared, as it seems few individuals reach an age / size suitable for predating primarily on trout. The present study suggests that since the invasion of roach throughout Irish waterways, particularly since the 1970s (IFT Reports; King et al. 2011), a certain amount of predation pressure on trout in may have been alleviated. However, continued monitoring is essential for management purposes, as pike may predate more heavily on trout if roach stocks collapse, which can happen with the introduction of invasive mussels and clams.*

Excerpt from "The Diet of Pike in Irish Watercourses" - Pedreschi *et al*. (2014)

Specialisation

The degree of dietary specialisation within a species will vary according to a range of factors such as abundance, size and behaviour of prey, along with preference and phenotype of the predator (Gurtin 1996). Within this study δ15N values often ranged across nearly a full trophic level within each population, indicating a that a wide prey base is used.

Specialisation and niche overlap values were low, further reflecting that individuals often ate different things from one another. Overall the data indicates a generalist population, and the marked opportunistic nature of individuals that appear to be utilising resources in proportion to their availability in the surrounding environment. The only site that did not present a strong correlation was Lough Scur, probably due to the high proportion of roach x bream hybrids present, which do not seem to be utilised as a food source by pike. This is likely due to the fact that roach x bream hybrids often have a deeper and more flattened body in comparison to roach (Nilsson & Brönmark 2000). Despite their predatory capabilities, pike are generally cautious in the type of prey they pursue, usually selecting the least risky option rather than the most profitable prey (Hart & Hamrin 1988; Nilsson & Brönmark 1999, 2000). Handling time is very important to them as the risk of cannibalism can be high and as such pike tend to choose prey that are the easiest to manipulate and swallow, such as those with a more fusiform shape (e.g. roach instead of bream or hybrids) (Wahl & Stein 1988; Abrahams & Kattenfeld 1997; Robinson and Wilson 1998; Nilsson & Brönmark 1999).

Excerpt from "The Diet of Pike in Irish Watercourses" - Pedreschi *et al*. (2014)

Conclusions

An opportunistic feeding strategy is particularly advantageous in prey-limited temperate lakes (Chapman & Mackay 1990; Beaudoin et al. 1999; Domínguez & Pena 2000; Venturelli & Tonn 2005; 2006; Paradis et al. 2008). The present study has confirmed previous findings that pike are highly plastic in what they can utilise as a food source. This is important, as when conditions are limited in some way, they can ensure their survival through dietary flexibility (Frost 1954; Inskip 1982; Chapman et al. 1989). This flexibility is likely to have been a major factor in enabling them to adapt to a wide range of environments globally, and also enables them to adapt to perturbations through prey switching as certain species become more or less available throughout the year, or as species introductions occur (Frost 1954; Adams 1991; King et al. 2011); an extremely important attribute during these times of changing climate.

Overall it appears that, as a thoroughly efficient predator capable of dispatching any prey within its gape width, pike are inherently opportunistic, selecting only for more fusiform prey to minimise their own exposure risks when predating upon fish (Wahl & Stein 1988; Nilsson & Brönmark 1999; Domínguez & Pena 2000). This study has highlighted an unusual phenomenon in the delay of the ontogenetic dietary switch, widely reported to occur at lengths of 10-12cm (Frost 1954; Raat 1988 and references therein; Mittelback & Persson 1998). Within Ireland, stomach content data indicate that fish are more important in the diet from 40cm, and the primary food item after 60cm, however this is not clearly reflected in stable isotope values, instead a general increase in isotopic values is seen throughout life. It seems likely that as a consequence of the somewhat depaupaurate freshwater fish biodiversity, coupled with large numbers of invertebrate prey, Irish pike continue to prey on invertebrates (predominantly Asellus and Gammarus) throughout their lifetime.

This study has provided important baseline SIA information for this species in Ireland, and updated SCA data. Combined, these findings are particularly relevant in relation to the ongoing management activities, and the data from this study will contribute to policy management and plans. This research also serves to highlight the change in diet of a top predator with the introduction of an invasive species, in this case roach.

Research should continue to investigate stomach contents on a longer term sampling plan to see if they better reflect SIA values, and to build stronger estimates of individual specialisation and diet overlap. Sampling using a dedicated plan rather than opportunistic sampling would also facilitate a wider range of analyses and hypothesis testing, including for example, comparisons between seasonal variations in diet.

Managers need data on feeding habits, interactions and competition in order to gain a better insight into community dynamics and manage waterways as ecosystems rather than separate components. This study for the first time provides this information across lake, river and canal habitats, representing a cross-section freshwater ecosystem diversity, and inputting directly into the better conservation and management of this economically and ecologically important species.

Excerpt from "The Diet of Pike in Irish Watercourses" - Pedreschi *et al*. (2014)

7.1.2 INLAND FISHERIES IRELAND PIKE RESEARCH PROGRAMME 2016

It would be remiss of this document not to acknowledge the announcement by Inland Fisheries Ireland on 9th September 2016 that a new pike research programme has commenced.

IFI have stated that the research programme will "*combine archived IFI data on pike ecology with empirical research on pike feeding and on the feasibility of transferring pike between Irish waters*".

IFI also stated that a "*cutting-edge mathematical model of pike-trout interactions" is to be developed. It has been stated that "this model will take account of existing knowledge relating to the focal species, including population dynamics, life-history strategies, feeding ecology, behaviour and physiology*". It is suggested that the model "*will be designed to simulate the populations of pike and trout in a lake specified by available input data and will be validated using available survey-based time series data from Irish lakes*".

Furthermore, IFI state that "*this research will be supported by additional field work looking at the seasonal variation in the diet of pike*" and that "*Genetics samples of pike will be taken from all waters where pike are recorded during routine IFI surveys on lakes and rivers (on-going), for future analysis*".

Irish pike angling is clearly indebted to the work of Pedreschi *et.al.* (2013) and Pedreschi *et.al.* (2014b) for not only providing the only internationally peer-reviewed scientific research into the origins and dietary habits of Irish pike, but for providing a platform whereby scientific research into Irish pike will finally move into the 21st century.

Whilst it is recognised that IFI research now underway will potentially be very enlightening, it will nevertheless be necessary to cautiously welcome the research, particularly in consideration of conclusions drawn in section 6 in relation to past research. It is notable that "archived IFI data" will be used in the new research. This in itself raises justifiable questions and concerns. Further questions required of this research relate to the 'synergistic' effect on "pike-trout interactions", if one is to provide a reliable mathematical model that considers any fishery holistically, rather than concentrate specifically on just two "focal species".

In the interest of gaining a greater fundamental understanding of the research project currently being undertaken, the Irish Federation of Pike Angling Clubs presented a number of questions directly to IFI. These questions included the following:

1. How long will the project take from start to completion?
2. What are the terms of reference for the project?
3. Is there any independent input into the project methodology and analysis and if so, by whom?
4. How is the project being funded, and what is the estimated cost of the project?
5. Please provide advice on the **"mathematical model"** type that is proposed for this project.
6. Please provide a list of the specific **"archived IFI data on pike ecology"** which this project will be relying upon.
7. Please provide a list of the specific **"empirical research on pike feeding"** which this project will be relying upon.
8. Please explain what presumptions are considered by examining **"the feasibility of transferring pike between Irish waters"**
9. Please forward a precise list of all of the fisheries for which the **"seasonal variation in the diet of pike"** is being examined in this project.
10. On a fishery by fishery basis, please advise on the stomach examination methodology and capture process being used to assess the **"seasonal variation in the diet of pike"**.
11. In terms of **"genetics samples"**, please provide a precise list of the fisheries that this type of sampling applies to in this project.
12. On a fishery by fishery basis please explain the precise scientific analysis that will be applied to the **"genetic samples"** taken; e.g. stable isotope analysis; microsatellite markers, etc.
13. When do you expect to produce preliminary and final reports on the **"seasonal variation in the diet of pike"**?
14. When do you expect to produce preliminary and final reports on the **"genetic sampling"** results?
15. Can you please explain why the project is focusing on **"pike-trout interactions",** solely rather than, for instance, the synergistic effects on trout populations within different fisheries?

As of November 2016, a response to the above questions is awaited from IFI; therefore it is not possible to discuss this research project further at this time.

7.1.3 SECTION SUMMARY CONCLUSION: CURRENT RESEARCH RELATED TO THE DIET OF IRISH PIKE

Pedreschi *et al.* (2014b) presents the most current research into the diet of Irish pike. Using a combination of SIA and SCA, it is without question the most scientifically superior analysis of pike diet undertaken since research began over 60 years ago, and has presented the diet of pike in a balanced and fair manner. However, research discussed in section 6 of this document continues to be used as justification for, and the formulation of, pike management policy in Ireland.

Current research has now shown that pike are opportunistic feeders, and will feed on prey that is most numerous and hence available to them. The previously-held idea that pike specifically target trout as a preferred food item is in effect questioned.

The location of numbers of large pike in pelagic and benthic zones across a variety of water environments highlights the preference of pike to feed on cyprinids and perch that shoal in vast numbers and are hence more available as a food item. Where pike are present and hunting in shallow water zones such as charophyte beds, the most available food source will be consumed.

Previous research assumes that trout will constitute the bulk of prey consumed by pike in these areas. However, as perch and cyprinids occupy these areas in far greater numbers from May to October, they become the most available food source. These conclusions are recent in the Irish context, but it is of particular concern that IFT, CFB and IFI did not recognise, and in effect ignored, such conclusions already drawn by Frost as far back as 1954.

Frost (1954) and Lawler (1965) found that seasonal changes in the diet of the pike appeared to be related to the availability of the fish food. Different species composition in different waters results in diverging pike diets. Lawler (1965) reports that the most important food types eaten in each of several periods during the year in Haming Lake are: May and June - trout-perch (Percopsis omiscomaycus); July - spottail shiner (Notropsis hudsonius); August to September - yellow perch (Perca flavescens); October to March - sticklebacks (Pungitius pungitius and Eucalia inconstans). In Windermere (Frost, 1954), perch (Perca fluviatilis) occur in the pike diet at all times, but predominate from May to October. Char (Salvelinus willughbii) are eaten only in November and December, brown trout (Salmo trutta) to a greater extent from October to February. Sticklebacks (Gasterosteus aculeatus) and minnows (Phoxinus phoxinus) are taken in spring and summer. Such seasonal variations are associated with the changes in habits of the food species.

Excerpt from "Synopsis of Biological Data on the Northern Pike:Esox Lucius" Food and Agricultural Organisation of the United Nations (1988)

Over the past two decades, there has been significant colonisation by cyprinids and vast increases in perch populations on a number of "designated wild brown trout fisheries". The data and evidence presented throughout a number of fishery survey reports (see Section 9.4) illustrates that such newly-established and/or increased populations of cyprinids and perch have a negative effect on brown trout. This effect is amplified as cyprinid and perch populations are subject to severely reduced predation upon them as a result of pike management operations.

One objective of the current research project being undertaken by IFI is to produce a "*cutting-edge mathematical model of pike-trout interactions". If one considers that the population dynamics of all species within a fishery are inextricably linked to each other and to their environment, then one must consider that habitat loss, pollution, over-harvesting, climate change, arterial drainage schemes, over-grazing, bio-manipulation, etc., are critical contributors to the creation of a balanced and considered population model. At this time, further information is awaited.*

IFI have expended resources, at a cost to the Irish tax payer, in undertaking research into pike diet leading to the findings of the resulting report **"The Diet of Pike in Irish Watercourses"** - Pedreschi *et al*. (2014). However, these findings have yet to be considered in the formulation of pike management policy, and hence the resources used in this study have yet to deliver any meaningful return to the Irish tax payer.

8 THE EFFECT ON PIKE DIET OF SPATIAL DISTRIBUTION OF FISH SPECIES

Inland Fisheries Ireland's theory of trout selectivity in the diet of pike appears to assume that all fish species are available in the ratio of their respective biomass to each pike equally at all times of a pike's natural migration through a fishery, and in particular during the pike spawning period in Spring, and as such, pike make a selective choice of food. However, Pedreschi *et al.* (2014b) found pike to be opportunistic feeders. Therefore, how does this finding apply to instances of trout found in pike stomachs?

Gargan & O'Grady (1992) studied the feeding relationships of trout, perch and roach in Lough Sheelin from 1982 to 1984. Perch were recorded feeding in charophyte areas in Spring 1982, but also underwent spawning migrations to shallow water, winter migrations, and were found to be feeding pelagically at times. King & Kirrane (1994) found that survey nets set on Lough Arrow in Spring 1994 caught perch in moderate/large numbers in deep water, with few perch in shallow water, and recorded that ***"this type of spatial distribution represents the norm for a perch stock in an Irish lake at this time of year"***. Gargan & O'Grady (1992) suggested that roach in Lough Sheelin underwent a diel feeding migration but that they were much more restricted in their lake movements in Lough Sheelin. The spatial separation of the roach population was also suggested to reduce competition of roach for food, with both trout and perch.

The potential for seasonal spatial separation between pike and roach during Spring, and the apparent lack of roach found in pike stomachs during the Lough Sheelin Spring surveys 1978-2006 is not easily linked, nor is it discussed in the available scientific reports produced by Inland Fisheries Ireland. However, O'Grady (2006), in a review of Lough Sheelin fish stocks 2000-2006, stated that a reduction in the pike population at that time was of no surprise ***"given the fact that their major food source (roach) is no longer available"***. This comment suggests that pike must feed heavily on roach at some time during the year if a pike population is to be maintained; however, the clear evidence for this has not filtered into current scientific dietary reports. The inference here is that Inland Fisheries Ireland must be at least aware that seasonal influences on pike dietary habits take place, and that these influences detract from any presumed trout predation. It may be likely that such seasonal shifts in pike dietary habits may have some bearing on conclusions stemming from, for instance, the 118 tonnes; sometimes misquoted as 116 or 117 tonnes of trout suggested to have been eaten in Lough Corrib in 1995.

An interesting observation with regard to the 1983 Spring survey on Lough Sheelin is the number of pike stomachs containing perch. This is interesting if one looks at the tables in Sections 6.2.4.1 & 6.2.4.2. It can be seen that pike captured with perch in their stomachs exceeded those with trout by a ratio of 9:1. The ratio of perch to wild trout captured in the Spring survey during 1983 was approximately 1:1. It is recognised that the survey nets do not capture all sizes of fish. Furthermore, it is not intended that confidence is placed in the Spring surveys as representing the entire facts with regard to pike dietary habits. Nevertheless, this example is interesting in that Gargan & O'Grady (1992) commented on the close similarity in diet between trout and perch; therefore it could be argued that such heavy predation on perch, far in excess of their apparent availability in the stock, can only be of benefit to wild trout.

Craig (1996) commented that the ***"consumption of prey by pike is not seasonally constant, but varies on a monthly or possibly on a more frequent basis due to predator opportunities, prey abundances and vulnerabilities and physical conditions".***

The inference here is that the bio-manipulation of fish stocks in Irish fisheries, based upon a theory that pike select trout as a dietary item, may have more complicated factors at play and more consequences than Inland Fisheries Irelands research has shown to date.

9 THE EFFECT OF PIKE MANAGEMENT POLICY ON WILD BROWN STOCKS

The purpose of pike management operations previously executed by IFT, CFB and now IFI is to improve the wild brown trout stock on so-called "designated wild brown trout fisheries". The following sections will illustrate that pike management operations, amongst other factors, have resulted in the opposite effect.

9.1 DAMAGE TO THE MIGRATORY SPAWNING STOCK

As previously described in Section 6.2.3 (Timing of Sampling) trout spawn in many of the small rivers and feeder streams that flow into pike spawning bays. The migration of trout to their spawning rivers and streams usually occurs around November. When spawning is complete, trout migrate back to the lake and re-enter the shallow bays. According to IFI studies, the now spawned trout can stay in the vicinity for quite some time after spawning, before dispersing later back into the main body of the lake - O Grady *et al*. (2012).

Trout spawn in their natal rivers, and hence migrate to the same river year after year, often travelling great distances. The execution of pike management operations results in many mortalities with respect to both pike and trout. This is especially concerning, as the trout returning from their spawning rivers constitute the native migratory spawning stock of that river, and a reduction in their number vastly reduces the trout recruitment potential of their natal river year on year. The effect is further reinforced by the fact that the numbers of trout captured in and around their spawning rivers are decreasing, when in fact they should be increasing due to the removal of pike year on year illustrating that the basic objective of pike management operations does not work, and has a severely negative effect on trout migratory spawning stocks. This may be one of the contributory factors for the reduction in brown trout CPUE noted on a number of "designated wild brown trout fisheries" and described in detail in Section 9.4.

Dáil Éireann - Volume 319 - 15 April, 1980
Written Answers. - Lough Corrib (Galway) Fishing.

337. **Mr. Molloy** asked the Minister for Fisheries and Forestry the number of trout per year caught by the Inland Fisheries Trust on Lough Corrib, County Galway, from 1960 to date.

Minister for Fisheries and Forestry (Mr. Power): The Inland Fisheries Trust remove predators on trout from Lough Corrib in order to improve the lake as a trout fishery. Some trout are unavoidably caught in the nets set for the predators. Trout that survive these operations are returned to the lake. The number taken by the trust each year since 1968, when records were first kept, is as follows:

[1155]Year	No. of trout released from nets and returned to lake	No. of trout found dead in nets
1968	1,905	1,130
1969	1,435	1,022
1970	1,224	943
1971	1,025	574
1972	959	552
1973	689	448
1974	775	534
1975	914	589
1976	924	724
1977	674	498
1978	573	358
1979	288	255

11385 7627

338. **Mr. Molloy** asked the Minister for Fisheries and Forestry if the Inland Fisheries Trust have sprayed any of the waters of Lough Corrib, County Galway with rotenone and, if so, why.

Excerpt from Dail records using IFT data showing a 78% decrease in captured trout over 11 years

9.2 INCREASE IN NUMBERS OF JUVENILE PIKE

A vast amount of international research has illustrated that removal of pike (an apex predator) from a fishery is an ineffective form of fishery management. In Ireland, removal of pike is undertaken in order to improve the conditions for survival of wild brown trout. The result of pike management operations as witnessed on the target fisheries and indicated by previous international research (**"Pike in Your Waters"** Broughton, Rickards, Fickling *et al*. (1992)) is that undesirable changes to fish population structures occur. As pike are cannibalistic, they regulate their own numbers. Removal of large numbers of older year classes means no regulation of juvenile pike. Juvenile pike feed as voraciously as any other fish species in their juvenile stage. However, at this time in their lifecycle their main food source is similar to other fish species, including trout, therefore increasing the competition for food between species. As juvenile pike reach a length of approximately 45cm, they become increasingly piscivorous. A proliferation of juvenile pike means a higher number of prey fish species are consumed at a juvenile stage. Studies have shown that pike management operations do not alter the actual pike biomass of a fishery. What they have shown is that numbers of pike increase greatly but specimens reduce in size.

The table below shows data gathered for Lough Corrib by the Inland Fisheries Trust (IFT) for the years 1961 and 1979. It is clear to see that due to pike management operations the pike population has more than doubled, while the total weight of pike or biomass was almost static. Incidentally, trout numbers decreased significantly, highlighting the ineffectiveness of pike management operations as a tool used to improve native wild brown trout stocks. The data clearly supports the substantial international science and research advising against pike management operations and detailing the adverse effects.

Gillnet Captures			
Year	No. of pike Captured	Weight of pike Captured (Tonnes)	No. of trout Captured
1961*	5000	6	3035
1979	13000	6.3	543

***trout data begins at 1968**

9.2 INCREASE IN NUMBERS OF JUVENILE PIKE CONTD.

For more than 50 years the longest and most comprehensive study of pike ecology and behaviour was conducted at Lake Windermere. Various regimes of intensive pike controls have been run and ceased over this period to monitor the effect this has on a fishery and validate related science and research. Below is an excerpt from Frost & Kipling relating to their extended research and aligning directly with modern fisheries science. It is worth noting how accurately these findings are continuously reflected in IFI fishery surveys and the cycle of predator removal following undesirable population explosions of juvenile pike and competitor species to wild brown trout.

After the initial perch population reduction, it was feared that the Windermere pike would consume more trout and that this would be unpopular with sport fishermen. It was therefore decided to reduce the pike population. After various trials gill nets, first of flax and now terylene, of 64 mm bar, were found to catch pike with a minimum of labour, and allow salmonids of up to 3 lbs (1.36 kg) to escape. Gill nets of this mesh have been used each winter from October to February, from 1944–45 to the present, and they catch pike of about 55 cm and over. Because the females grow faster than the males, the nets catch males of 4 years and older, and females of 3 years and older. From 1944 to 1979–80 12 918 pike weighing 37.7 tonnes have been removed from Windermere. Each fish is measured, weighed, sexed and aged and the stomach contents analysed. After the winter gill netting to remove pike, nets continue to be set to tag pike. From 1949 to 1980 4659 pike have been tagged. A high proportion (up to 80% of some batches) are recaught. The pike data have been worked up and published by Frost (1946, 1954), Frost & Kipling (1967), Kipling & Frost (1970) and Le Cren *et al.* (1972). From the data the population numbers and biomass have been calculated. These are illustrated in Fig. 2. The points to note in this figure are: 1) after an initial reduction the number of pike in Windermere has only fallen below the pre-netting level in 1956; 2) the biomass has only exceeded the pre-netting level in one year, 1962. This suggests that the netting has led to Windermere containing more but smaller pike. This is also shown in Table 1; in the later years there are relatively more younger pike in the catches than in the first year of gill netting. Table 2 indicates that the pike are growing faster, although the differences are not large.

Excerpt from "Synopsis of Biological Data on the Northern Pike: Esox Lucius" Food and Agricultural Organisation of the United Nations (1988)

9.3 REDUCED PREDATION ON SPECIES COMPETING WITH NATIVE WILD BROWN TROUT

As previously described, fisheries where pike management operations are executed experience reduced numbers of both adult pike and trout. Pike and trout are both predators, and so play an important role in maintaining and controlling other fish populations as well as their own. While adult pike are the primary regulator of numbers of juvenile pike, trout will also readily predate on pike, and contribute to controlling the numbers of juvenile pike present. Both pike and trout will predate on species such as roach and perch (O'Grady et al. 2001); however, the effect of this predation is significantly reduced where pike management operations are executed.

Other fish populations (roach, perch, hybrids, bream) can thrive in the absence of predation by adult pike and trout. Spiralling roach and perch populations are recognised by many as one of the biggest threats to wild brown trout populations, as these species compete directly with trout for the same food sources throughout or at certain periods of their life-cycle (O'Grady et al. 2001). In addition, perch can also predate directly on trout. Roach and perch populations can increase dramatically in the absence of a suitably balanced and naturally-controlled predator stock.

The effect of an increased perch and cyprinid population (due to lack of predation as a result of pike management operations) on the food web shared by these species and brown trout is clearly referenced in the 2012 Lough Corrib survey report. The 2012 report states:

"The recovery in the perch population in 2012, compared to 1996, in addition to the increase in roach x bream hybrid and bream numbers and the maintenance of a moderate roach and trout stocks in 2012 means that the standing crop or biomass of fishes feeding on plankton and macro-invertebrates was substantially higher in 2012 compared to 1996."

The fecundity (rate of reproduction) of trout, perch and roach illustrates how quickly trout can be outnumbered by other species. Lack of predation on these species by both trout and pike is compounded, as large numbers of trout and pike are removed during pike management operations.

Species	Fecundity (eggs/kg of body weight)
Trout	900
Perch	45000
Roach	25000 – 1,000,000

9.3.1 ADDITIONAL LOADINGS ON THE FOOD WEB OF TROUT DUE TO PIKE MANAGEMENT OPERATIONS

The following data is shown in order to illustrate the extra loading placed on the food web supporting a trout population in a "designated wild brown trout fishery" where pike management operations are undertaken. In this case, Lough Corrib is used as an example. Prior to assessing this estimate, there are some important points to consider that have been discussed previously in Section 6.2.2.3, the contents of which are shown below for reference.

6.2.2.3·O'·GRADY·ET·AL.·(1996):¶

O'· Grady· *et· al.*· (1996)· estimated· that· the· Lough· Corrib· pike· population· in· 1995· alone,· ate· over· 255,000· trout· weighing· over· 118· tonne.· This· study· was· used· to· support· a· broader· funding· application· as· part· of· the· 'Tourism· Angling·Measure'·(TAM),·at·that·time,·part·of·which·was·to·include·the·removal·of·pike·from·Lough·Corrib.¶

The·estimated·calculation·of·trout·eaten·relied·upon·a·number·of·assumptions,·including·the·following;·¶

¶

- → that· the· population· of· pike· in· Lough· Corrib· in· 1995· was· calculable· by· applying· an· estimate· for· the· pike· population· on· Lough· Sheelin· based· on· · CPUE's· and· lake· surface· area,· and· applying· this· estimate· to· the· CPUE's·and·lake·surface·area·of·Lough·Corrib;·¶
- → that·the·diet·of·pike·in·Lough·Corrib·during·1995,·did·not·change·seasonally;¶
- → ·that·the·biomass·of·trout·to·roach·(i.e.·80%·-·20%)·found·in·pike·stomachs·in·the·1996·Lough·Corrib·stock· survey,·was·constant·for·the·entire·year,·1995;·¶

¶

The·calculation·of·the·pike·population·on·Lough·Corrib·for·the·year·1995·in·the·manner·performed·above,·without· using·supportive·mark-recapture·techniques·to·verify·the·calculation·continues·to·be·a·questionable·foundation·for· the·estimated·118·tonne·of·trout·eaten·in·1995.¶

O'·Grady·*et·al.*·(1996)·calculated·the·predation·of·pike·on· trout·in·Lough·Corrib·for·1995·by·assuming·that·pike·diet· during·1995·did·not·change·seasonally.·Section·8·discusses· possible·factors·influencing·seasonal·feeding·and·its·lack·of· consideration·in·scientific·reports.·¶

Of·note·however,·is·that·O'·Grady·*et·al.*·(1996)·did· recommend·a·study·into·the·seasonal·diet·of·pike·on·Lough· Corrib,·presumably·to·ascertain·the·accuracy·of·the·original· assumption.·It·is·discussed·in·section·9.4.1.3·that·the· recommended·study·was·not·undertaken·by·the·Central· Fisheries·Board,·nor·was·it·undertaken·subsequently·by· Inland·Fisheries·Ireland.·¤

¶

The·attached·excerpt·dated·1988,·indicates·just·how· seasonally·diverse·the·diet·of·pike·can·be·expected·to·be.· This·information·would·have·been·available·to·the·Central· Fisheries·Board·in·1996.·¤

Frost (1954) and Lawler (1965) found that seasonal changes in the diet of the pike appeared to be related to the availability of the fish food. Different species composition in different waters results in diverging pike diets. Lawler (1965) reports that the most important food types eaten in each of several periods during the year in Haming Lake are: May and June - trout-perch (Percopsis omiscomaycus); July - spottail shiner (Notropsis hudsonius); August to September - yellow perch (Perca flavescens); October to March - sticklebacks (Pungitius pungitius and Eucalia inconstans). In Windermere (Frost, 1954), perch (Perca fluviatilis) occur in the pike diet at all times, but predominate from May to October. Char (Salvelinus willughbii) are eaten only in November and December, brown trout (Salmo trutta) to a greater extent from October to February. Sticklebacks (Gasterosteus aculeatus) and minnows (Phoxinus phoxinus) are taken in spring and summer. Such seasonal variations are associated with the changes in habits of the food species. ¶

Excerpt·from·"Synopsis·of·Biological·Data·on·the·Northern· Pike·Esox·Lucius"·Food·and·Agricultural·Organisation·of· the·United·Nations·(1988)¤

¶

Finally,·it·should·be·noted·that·461·pike·were·captured·during·the·spring·stock·survey·on·Lough·Corrib·in·1996.·Of· the·461·pike·captured,·43·pike·(i.e.·9%)·were·recorded·as·containing·trout·(FOI/104/07/C).·It·is·the·biomass· hypothesis·that·feeds·into·the·considerable·tonnage·estimate·for·trout·eaten·compared·to·other·species.·Pedreschi· (2014)·commented·as·follows·on·stomach·data·regarding·trout·in·pike·stomachs·in·2011,·***"Trout·were·encountered· in·five·sites·(9·stomachs),·and·were·only·important·in·Lough·Sheelin·in·2011·(17%·IRI),·where·despite·a·low· occurrence·rate·of·only·7%,·their·weight·contribution·to·the·diet·was·48%.·This·was·primarily·due·to·two·large· relatively·undigested·trout,·highlighting·the·bias·when·using·only·stomach·contents"***.·It·is·not·the·intention·here·to· take·the·findings·of·Pedreschi·(2014)·out·of·context·however·it·is·clear·that·Pedreschi·(2014)·was·aware·that·biases· are·possible·when·using·data·obtained·from·stomach·content·analysis.·Regarding·the·general·estimate·of·118·tonne· of·trout·eaten·in·1995,·a·full·review·of·this·figure·was·requested·from·Inland·Fisheries·Ireland·scientific·staff·in·a·high· level·meeting·with·the·Irish·Federation·of·Pike·Angling·Clubs·in·April·2009.·A·further·request·was·made·by·the·Irish· Pike·Society·in·April·2016·in·relation·to·same.·¶

The data and calculations in the following table are the "best minimum estimate" that could be calculated in the absence of mathematical methodology and data from IFI. While potentially incorrect (due to lack of information from IFI), the data and calculations highlight the significant additional loading and level of competition for food when numbers of both predatory pike and trout are eliminated from a fishery through pike management operations.

9.3.1 ADDITIONAL LOADINGS ON THE FOOD WEB OF TROUT DUE TO PIKE MANAGEMENT OPERATIONS CONTD.

Total Trout Stock (kgs)	Avg Size (kgs)
232000	1

Cumulative Total of Pike Removed over 9 Years					
	Year	Consumption Ratio	Captured (kg)	Total Consumption Adult (kg)	Total Consumption Juvenile (kg)
Adult (Gillnets)	2004	4	2104	8417	
Juvenile (Electro)		7	426		2981
Adult (Gillnets)	2005	4	2104	8417	
Juvenile (Electro)		7	426		2981
Adult (Gillnets)	2006	4	1620	6481	
Juvenile (Electro)		7	323		2264
Adult (Gillnets)	2007	4	1849	7395	
Juvenile (Electro)		7	230		1607
Adult (Gillnets)	2008	4	1753	7012	
Juvenile (Electro)		7	285		1995
Adult (Gillnets)	2009	4	2026	8104	
Juvenile (Electro)		7	137		959
Adult (Gillnets)	2010	4	1731	6924	
Juvenile (Electro)		7	364		2548
Adult (Gillnets)	2011	4	1904	7616	
Juvenile (Electro)		7	152		1064
Adult (Gillnets)	2012	4	1103	4412	
Juvenile (Electro)		7	241		1687
Total after 9 years				64778	18086
Trout (contribution to removed pike stock diet, 16% adult, 10% juvenile)				10364	1809

Note: Data unavailable for year 2004 hence 2005 data replicated

Additional Loading on trout food web by roach and perch due to pike removal		
Roach (23% and 7%)(kg)	14899	1266
Perch (24% and 21%)(kg)	15547	3798
Total(kg)		35510

9.4 REDUCTION IN NUMBERS OF WILD BROWN TROUT ON DESIGNATED WILD BROWN TROUT FISHERIES

The following sections will illustrate how wild brown trout stocks have diminished on designated brown trout fisheries due to various issues, and with particular reference to pike management operations. Additional factors such as pollution, habitat destruction, and poaching will also be discussed where relevant. Species density is measured by calculating the Catch Per Unit Effort (CPUE). CPUE is a widely used method for establishing species density in a fishery, and is calculated by dividing the total number of individuals captured for a particular species by the total number of nets set during a fishery survey.

Accurate data generated through intensive fishery surveys (undertaken by IFT, CFB and IFI) will be used in the following sections. Such data is available for Loughs Corrib, Carra, Conn, Cullin and Sheelin.

Data generated through less intensive fishery surveys for the purposes of the Water Framework Directive will be shown and referenced only where applicable. Such data is available for Loughs Arrow, Mask and Owel. The conclusions and trends for these fisheries are similar to those drawn for the fisheries with more detailed and extensive data sets.

9.4.1 LOUGH CORRIB

There have been two intensive fishery surveys conducted on Lough Corrib. The CPUE (Catch Per Unit Effort) values of both surveys are shown in the following table.

	Year	Trout	Pike	Perch	Roach	Bream	Rudd	Hybrid	Tench	Salmon	Eel
Lough Corrib	2012	1.54	0.94	2.8	5.75	0.13	0	2.52	N/A	0.02	N/A
	1996	1.95	1.84	0.08	4.96	0	0.02	0.25	N/A	0.02	N/A

While the comparisons between the two surveys must take into account slight variations in survey methodology, the 2012 Lough Corrib report attempted to fill in such gaps by back-calculating the 1996 CPUE values in order to bring them into line with the 2012 survey methodology.

This data set is particularly relevant in highlighting the effect of pike management operations on a fishery, as the 1996 survey was conducted at the end of a 10+ year moratorium on pike management operations. In 1997 pike management operations resumed on Lough Corrib.

A first look at the 2012 Lough Corrib report shows that 16 years of intensive pike management operations have had no beneficial effect on the overall wild brown trout population. The CPUE value for pike has decreased significantly by 48.9%. The CPUE value for brown trout has decreased by over 21%. The objective of pike management operations is to reduce predation by pike on trout and hence observe an increase in the trout stock; however, in the case of Lough Corrib trout population density has effectively reduced by almost a quarter since 1996 - even with an almost halving of pike population density in the same period.

The reduced number of pike due to pike management operations has, over the 16-year period, led to a large increase in the numbers of perch, roach and hybrids. As previously described in Section 9.3, these species compete directly with brown trout for food, and, in the case of perch, predate heavily on trout fry and smaller trout as well as their food sources.

The CPUE values for perch increased by 3,400%, roach increased by 15.9%, and hybrids increased by 908%. The increases for perch and hybrids are particularly significant. The 2012 report states:

"The 1996 survey data suggests that at that time roach dominated upper L. Corrib followed by trout, while numbers of pike and then roach were greater in the lower lake. The 2012 survey data follows a different trend with roach along with perch and roach x bream hybrids completely dominating the upper lake. Lower Corrib showed signs that the levels of trout, pike, roach and even perch were similar."

A significant observation relating to perch numbers pre-1986 is made within the survey report. It is interesting to note that pike management operations were active prior to 1986, and perch stocks were reported to be very high at this time possibly due to the reduced number of pike and trout. When pike management operations ceased after 1986, perch numbers dropped considerably as recorded in the 1996 survey; disease was cited as a factor at this time. The resumption of pike management operations in 1997, and recovery from disease, has resulted in a 3400% increase in perch numbers, due in part to severely reduced predation by pike. Perch predate heavily on juvenile trout and compete directly for the same food sources. The 2012 report states:

"A major recovery in perch stocks has taken place with the catch increasing from 21 individuals in the 1996 survey to 699 fish in 2012. Prior to 1986 L. Corrib was known to have large stocks of perch."

Some of the summary findings discussed in the 2012 Lough Corrib report correlate with subjects already discussed in this document.

For example, the 2012 report states:

"Most trout migrating to the lake appear to stay in the areas near the outfall of their natal river in springtime"

This would correlate with the errors in data related to pike diet due to the timing of pike stomach sampling analysis discussed in Section 6.2.3. This also correlates with the risks to the migratory spawning stock of particular trout spawning streams where pike management operations are undertaken, as discussed in Section 9.3.

Significant environmental impacts have occurred on some of the important trout nursery streams. In particular, very poor trout recruitment from the Cross and Black rivers has had a significant impact.

If an improvement in brown trout angling on Lough Corrib is to be realized, a more holistic approach must be taken in assessment of the relationship between trout densities, other fish species, eutrophication, stream habitat degradation, and cropping of trout by anglers. The data and issues discussed have illustrated that trout stocks do not benefit from pike management operations, which have the potential to be highly counterproductive in protecting a balanced and healthy environment in which brown trout can thrive.

Prior to the establishment of the IFT in 1951, and hence any form of state-coordinated predator management on Lough Corrib, the lake boasted the finest trout and pike fishing in Europe. Since the initiation of predator management by IFT, the quality of trout and pike angling has suffered, with the exception of periods of moratorium as recorded between 1986 and 1996. One of the concluding remarks made by Dr. Martin O Grady in the 1996 Lough Corrib report states:

"The size and stock structure of the trout population, as measured in the 1996 survey, represents the ideal in fishery management terms - substantial numbers of young adult fish (< 40cm) many of whom will be large enough to be cropped by anglers in the 1996 and 1997 angling seasons. The numbers of older larger fish (>40cms) will ensure a good spawning population in the following year. The angling catches in both 1996 and 1997 were considered to be good."

9.4.1.1 NOTE ON IMPROVEMENT IN BROWN TROUT POPULATION DENSITY FOR LOWER LOUGH CORRIB OBSERVED IN THE LOUGH CORRIB 2012 SURVEY REPORT

The 2012 Lough Corrib survey report noted an improvement in the CPUE value of brown trout stocks in an area defined as the lower lake. The improvement has been heralded as a success of pike management operations; however, there are some additional factors to consider here.

The area defined as Lower Lough Corrib is shown in the following diagram as Area 5. It is clear that the area defined as the lower lake is quite small in comparison to the lake as a whole. For example, Areas 2 and 3 alone could accommodate three to four times the surface area of Lower Lough Corrib. In this context, the area where improvement has been noted is small when considering the lake as a whole. As previously noted (Section 9.4.1), the overall CPUE value for brown trout on Lough Corrib has decreased by 21%.

It is also important to consider the proximity of Lower Lough Corrib to two of the most important trout spawning streams for the entire catchment. The Abbert and Grange rivers both flow into the Clare river, which empties into the lower section of Lower Lough Corrib. The Abbert and Grange rivers account for 44% of the total trout recruitment for the entire lake. Trout that originate from these catchments predominantly stay in the lower lake, due to the richness of the aquatic environment there. The numbers of trout in the lower lake are further supplemented by trout from the other major contributory catchments, namely the Bealnabrack, Cornamona and Oughterard rivers, as these trout migrate south due to the lack of productive aquatic conditions in the vicinity of their natal catchments O'Grady et al. (2012). It is therefore feasible to assume that any minor improvement in the ability of these catchments to produce trout (in particular the Abbert and Grange rivers) will have a positive effect on the trout population of Lower Lough Corrib.

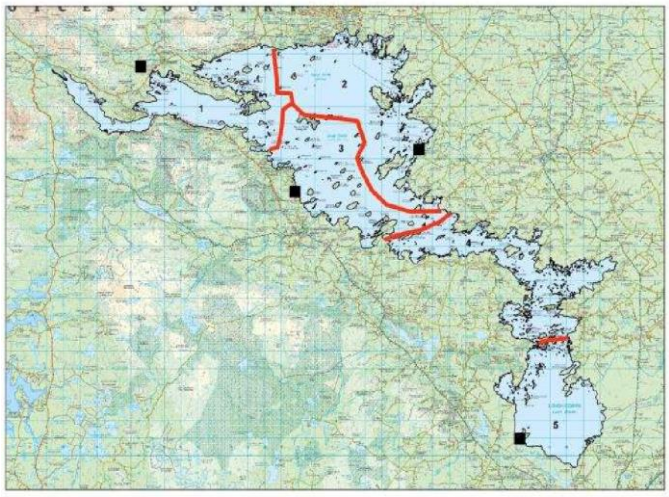


Figure 2.2. L. Corrib sampling zones (1 to 5) and IFI lake stores/offices.

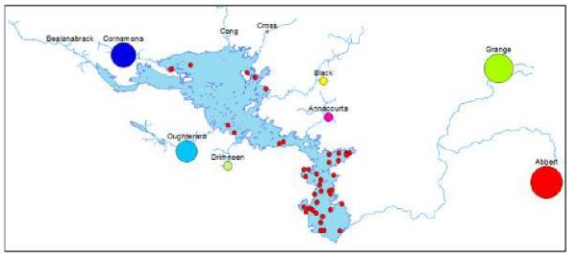


Figure 4 a. The distribution of trout of Abbert origin in the 2012 lake survey sample.

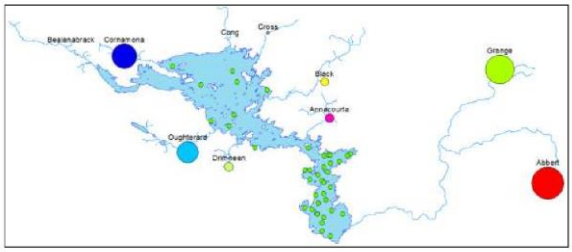


Figure 4 b. The distribution of trout of Grange origin in the 2012 lake survey sample.

Excerpt from "A Survey of Adult Fish Stocks in Lough Corrib" - O'Grady et al. (2012)

9.4.1.2 NOTE ON LOUGH CORRIB PIKE DIET

During the Lough Corrib 2012 survey pike stomach contents were examined in order to establish dietary patterns. Section 7 of this document illustrates the inherent flaws and inaccuracies that can occur by solely using SCA (Stomach Contents Analysis) as a method to establish dietary patterns. However, the data gathered will be discussed briefly here. The following pie chart shows the dietary patterns of pike in Lough Corrib.

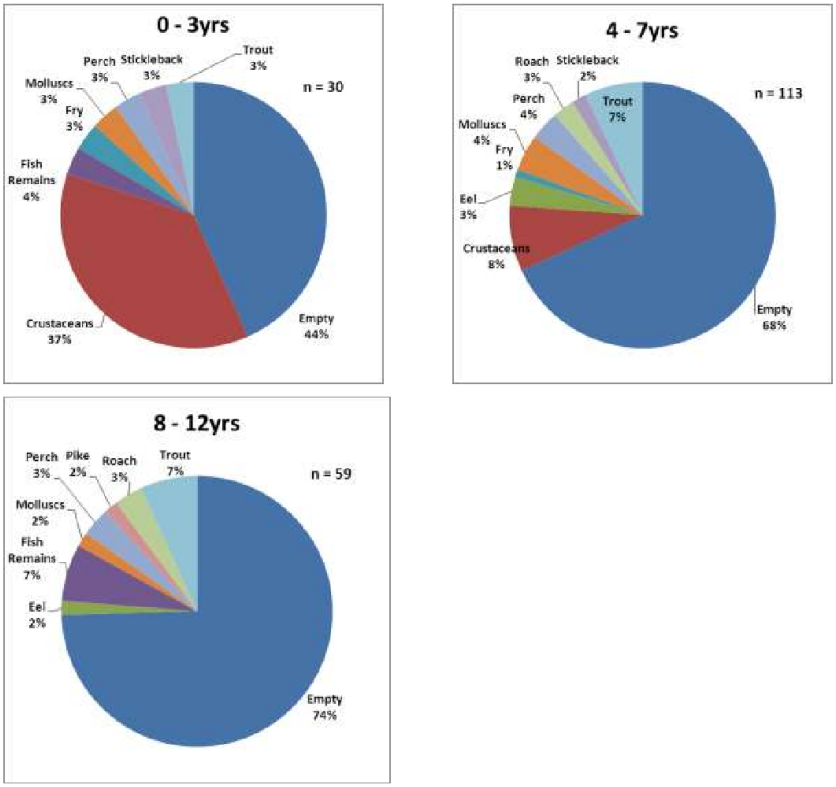


Figure 3.17. The dietary patterns for young (0+ - 3yrs), young adult (4 – 7yrs) and older adult pike in the 2012 Corrib survey.

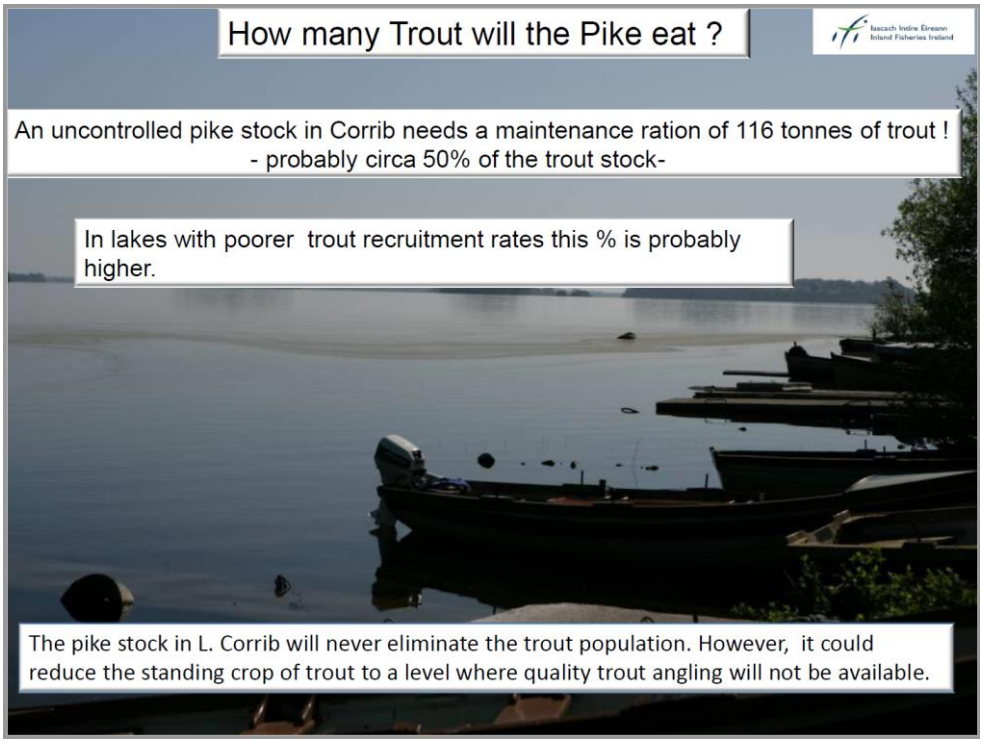
Excerpt from "A Survey of Adult Fish Stocks in Lough Corrib" – O'Grady et al. (2012)

Section 6.1 of this document refers to the misconception throughout IFI Fishery Surveys and pike studies that pike do not hunt pelagically or in benthic zones. This is incorrectly referenced in the Lough Corrib survey report. Pike will readily feed in shallow weedy areas, but the assumption that trout will be the most numerous and hence available food item is incorrect as both perch and cyprinids will occupy these areas in higher numbers at certain times throughout the year (see Section 8: The Effect on Pike Diet of Spatial Distribution of Fish Species). The 2012 report states:

"The bias of the larger pike in preferentially selecting trout as a dietary item is probably a reflection of the distribution of the different prey fishes and the hunting practices of pike - most trout ≥ 30cm will be feeding in shallow weedy areas, the pikes preferred hunting area. In contrast many roach and perch may be feeding either pelagically or in benthic areas with a muddy/sandy bed, zones which are not the favoured hunting areas of pike."

9.4.1.3 INFORMATION DEFICIT FOR LOUGH CORRIB DIETARY ANALYSIS

Of immense importance is that scientific studies and the results presented to the public are founded upon fact and that they are balanced. The slide below presented to the pike policy review group in 2011 continues to be an influential aid to the anti-pike lobby, as well as damaging to the pike itself, as it portrays an unsubstantiated dietary impact of pike upon the trout stock in Lough Corrib (see section 6.2.2.3). The slide is discussed further below, as is the failure to create an appropriate balance in what is a contentious issue that regrettably has allowed disagreement to fester between pike and trout anglers in Ireland over many years, and which Inland Fisheries Ireland have allowed to continue.



Excerpt from "The Necessity for Controlling Pike Stocks in Some Quality Irish Wild Brown Trout Managed Lake Fisheries"
A presentation to the Pike Policy Group, November 2011

Section 6.2.2.3 refers to the estimation of O'Grady *et al*. (1996) that the Lough Corrib pike population in 1995 alone ate over 255,000 trout weighing over 118 tonnes, (not 116 tonnes). As discussed, this estimate was calculated using a biomass theory, hypothesising that the ratio of total trout weight taken from the stomachs of 43 of 461 pike captured, compared to total roach weight, could be applied to the entire year 1995.

O'Grady *et al.* (1996) in 'Section 6' of their report, made a number of management recommendations with regard to Lough Corrib. Some of the recommendations were administrative in nature, in respect of the "Tourism Angling Measure 1994-99" (TAM), under which pike removal was to receive EU funding in response to the respective 1996 report. More importantly, some of the recommendations laudably sought to scientifically research a number of the assumptions (See Section 6.2.2.3) made in O'Grady et al. (1996), which led to the estimation of 118 tonnes of trout eaten.

A Freedom of Information request (i.e. FOI/103/07/W – See below) was made by the Irish Federation of Pike Angling Clubs in 2007. The request sought all relevant records referenced in 'Section 6' of O'Grady *et al.* (1996). The records would include pike stock density reports over a five-year recommended period, a stock survey recommended for 1999 considered necessary to review the effectiveness of the strategy, and, most importantly, a dietary analysis of pike for Summer and Autumn in order to assess, presumably, the validity of assuming that trout made up 80% of the diet of pike in 1995 in the calculation of 118 tonnes.

EXTRACT FROM REQUEST - FOI/103/07/W

With regard to the report produced by the Central Fisheries Board under the EU funded 'Tourism Angling Measure 1994-1999', titled:

'Fish Stock Survey Report for Loughs Corrib, Mask and Carra and Future Management Options for this Fishery Resource' of 3rd July 1996,

and in the interest of understanding the review and conclusions reached on completion of the 'Western Lakes Project' as explicitly recommended under Section 6 within the report and also in the interest of understanding the scientific basis for the current stock management policy on Loughs Corrib, Mask and Carra following completion of the TAM project, the following information is requested:

1. With regard to '6.1 Recommendations (key elements)', please provide a copy of the pike stock density reports for Loughs Corrib, Mask and Carra for each of the intervals for the stated five year period.
2. With regard to '6.5 Recommendations (key elements)', please provide a copy of the "Fish stock survey exercise and results undertaken in "1999 on Loughs Corrib and Mask as part of a review of the effectiveness of the management strategy".
3. With regard to '6.7 Recommendations (key elements)', please provide a copy of the dietery analysis of pike sampled in mid-summer and autumn.
4. Please provide a copy of the status report regarding the 'Western Lakes Project' sent to the EU 'Tourism Angling Measure' funders on completion of the 1994-1999 monitoring and development program.
5. Please provide a copy of all stock analysis and respective reports for all species, undertaken on Loughs Corrib and Mask, since the completion of the 'Western Lakes Project' in 1999 to the present date.

EXTRACT FROM RESPONSE - FOI/103/07/W

The *FOI Act 1997 & 2003* provides for making such records exempt under its exemption provisions. In this case, and in relation to the records you request, the exemption under Section 10 – Refusal on administrative grounds to grant requests under *Section 7.*

"Section 10 – Refusal on administrative grounds to grant requests under *Section 7.*

10.(1) A head to whom a request under section 7 is made may refuse to grant the request if

(a) *The record concerned does not exist or cannot be found after all reasonable steps to ascertain its whereabouts have been taken."*

The response to the Freedom of Information request (i.e. FOI/103/07/W) is significant, as it proves that the scientific research recommended by O'Grady *et al.* (1996) was not undertaken. Furthermore, the authors of O' Grady *et al.* (1996) were the chief scientific staff with Inland Fisheries Ireland (then Central Fisheries Board) at that time, and presumably would have been aware of any impediments, financial or otherwise, that would have prevented the execution of the necessary corroborating scientific research on Lough Corrib.

The scientific research deficit that currently exists with regard to Lough Corrib, notwithstanding some unscientifically conducted pike stomach sampling from time to time, allows the continued uncorroborated or internationally peer-reviewed use of the statement that "*An uncontrolled pike stock in Corrib needs a maintenance ration of 116 tonnes of trout*!".

The inference here is that the current scientific research is simply incomplete, uninformative, and is not based upon robust scientific validation.

9.4.2 LOUGHS CONN & CULLIN

There have been a number of intensive fishery surveys conducted on Lough Conn since 1978. The CPUE (Catch Per Unit Effort) values of these surveys are shown in the following table.

	Year	Trout	Pike	Perch	Roach	Bream	Rudd	Hybrid	Tench	Salmon	Eel
	2005	2.1	1.7	12.1	64.1	N/A	3.3	N/A	N/A	N/A	N/A
	2001	2.5	2.1	23.9	24.4	N/A	16.33	N/A	N/A	0.17	N/A
	1998	1.15	0.7	9.48	0	N/A	0.4	N/A	N/A	0.1	N/A
	1994	4.3	1.8	15.67	0	N/A	0.08	N/A	N/A	0.2	N/A
	1990	6.4	1.18	17.88	0	N/A	0	N/A	N/A	0.2	N/A
	1984	6.84	0.35	3.89	0	N/A	0	N/A	N/A	N/A	N/A
Lough Conn	1978	5.56	0.21	N/A	0	N/A	0	N/A	N/A	N/A	N/A

	Year	Trout	Pike	Perch	Roach	Bream	Rudd	Hybrid	Tench	Salmon	Eel
	2001	1.5	2.9	13.7	91.2	N/A	23.8	N/A	N/A	N/A	N/A
	1998	0.9	1.5	9.1	0.2	N/A	31.4	N/A	N/A	N/A	N/A
Lough Cullin	1994	11.9	5	6.9	0	N/A	4.6	N/A	N/A	N/A	N/A

Loughs Conn and Cullin, like Lough Corrib, have undergone intensive periods of pike management operations over a number of decades. Despite the execution of these operations, the data illustrates a steady decline in trout densities on Lough Conn, with short periods of minor improvement as a result of other factors.

The trend for Lough Conn is similar to other designated wild brown trout fisheries in Ireland. As densities of competitor species (perch/ cyprinids) rise exponentially, trout densities lower. Eutrophication plays a part in reducing the suitability of the lake for high numbers of trout, while cyprinids can thrive in such environments.

The reduced numbers of pike due to pike management operations has been a major contributory factor to a large increase in the numbers of perch, roach and rudd. As previously described in Section 9.3, these species compete directly with brown trout for food, and in the case of perch predate heavily on trout fry and smaller trout. The 2001 survey report (O'Grady, 2001) states:

"There may be competition for food between cyprinids and trout either at the zooplankton and/or macroinvertebrate levels."

A thriving cyprinid population can also have a significant indirect effect on the trout angling on the lake by altering the behaviour of the trout population thus compounding the conclusion that there is no longer quality trout angling available. The 2001 report (O'Grady, 2001) states:

"The presence of large numbers of young cyprinids will provide a food supply for trout ≥ 30 cms in length all year round. Should a significant proportion of the trout population become largely piscivorous then they will be less available (harder to catch) using traditional fly fishing methods. This trend is already evident – 12.2% of the large trout captured in the 2001 L. Conn and Cullin surveys had been feeding on cyprinid fry."

A significant observation relating to pike numbers can be seen in the Lough Conn data, as it is typical of trends recorded in other "designated wild brown trout fisheries". As the densities of perch and cyprinids increase, the pike density also increases, despite the significant drop in trout density. This correlates with the subjects discussed in Section 7, and clearly shows that pike will not specifically target trout, even in the presence of larger numbers of other species.

Significant environmental impacts have occurred on some of the important trout nursery streams of Loughs Conn and Cullin. An extensive sub-catchment enhancement programme was undertaken from 1996 to 1998, which greatly improved the numbers of trout within these rivers and is responsible for the improvement in trout densities in 2001.

"Over the period 1996 to 1998 very extensive fishery enhancement programmes were carried out on all of L. Conn's sub-catchments. A monitoring of the effectiveness of these programmes has shown that the capacity of these rivers and streams to produce trout were significantly increased by these exercises – i.e. recruitment of young trout to the L. Conn population has greatly increased from 1998 to date (2001)."

However, the environmental problems facing the lake itself negated the full potential of these improvements. Predation by pike was not cited as a reason for the decline in trout density due to the "effectiveness" of pike management operations; however, the many negative effects due to such operations were not mentioned in the report.

"One can conclude therefore that the numerical decline in trout numbers in Lough Conn in 2001 is due to a failure of young trout, despite their increasing numbers in L. Conns sub-catchments, to survive in the lake itself. Similarly the increased growth rate of trout can be linked to changes in the lake."

The fish stock survey data indicates that the N.W.R.F.B. pike management programme has been and, still is (2001), successful. The paucity of trout in the lake cannot therefore, in this instance, be linked to increased predation rates by pike.

Young trout in Irish loughs tend to be largely pelagic for at least a year after migrating to the lough feeding principally on zooplankton. It seems most likely therefore that the cultural eutrophication problems in L. Conn have depressed the production of key food items required by young trout thereby limiting their survival."

If an improvement in brown trout angling on Loughs Conn and Cullin is to be realized, a more holistic approach must be taken in assessment of the relationship between trout densities, other fish species, eutrophication, stream habitat degradation, and cropping of trout by anglers. The data and issues discussed have illustrated that trout stocks do not benefit from pike management operations, which have the potential to be highly counterproductive in protecting a balanced and healthy environment in which brown trout can thrive.

9.4.3 LOUGH CARRA: AN EXAMPLE IN IMPROVING BROWN TROUT STOCKS BY ADDRESSING THE REAL ISSUES

There have been a number of intensive fishery surveys conducted on Lough Carra since 1978. The CPUE (Catch Per Unit Effort) values of these surveys are shown in the following table.

	Year	Trout	Pike	Perch	Roach	Bream	Rudd	Hybrid	Tench	Salmon	Eel
	2009	4.4	0.8	1.8	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	2001	6.1	0.7	0.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	1996	4.4	0.8	1.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	1986	2.1	0.9	0.3	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	1981	3.6	0.1	1.4	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	1980	2.7	0.1	0.6	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	1979	1.9	0.2	0.9	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Lough Carra	1978	0.8	0.1	0.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Lough Carra is a good example of how brown trout stocks can be improved by addressing the significant and more important issues facing a "designated wild brown trout fishery". Such issues include eutrophication, nursery stream habitat destruction and intensive cropping by anglers.

The data illustrates two periods of stable pike densities on Lough Carra between 1978 to 1981 and again from 1986 to 2009. Perch densities, unlike previously discussed fisheries, have remained low and hence have had no significant impact on trout density.

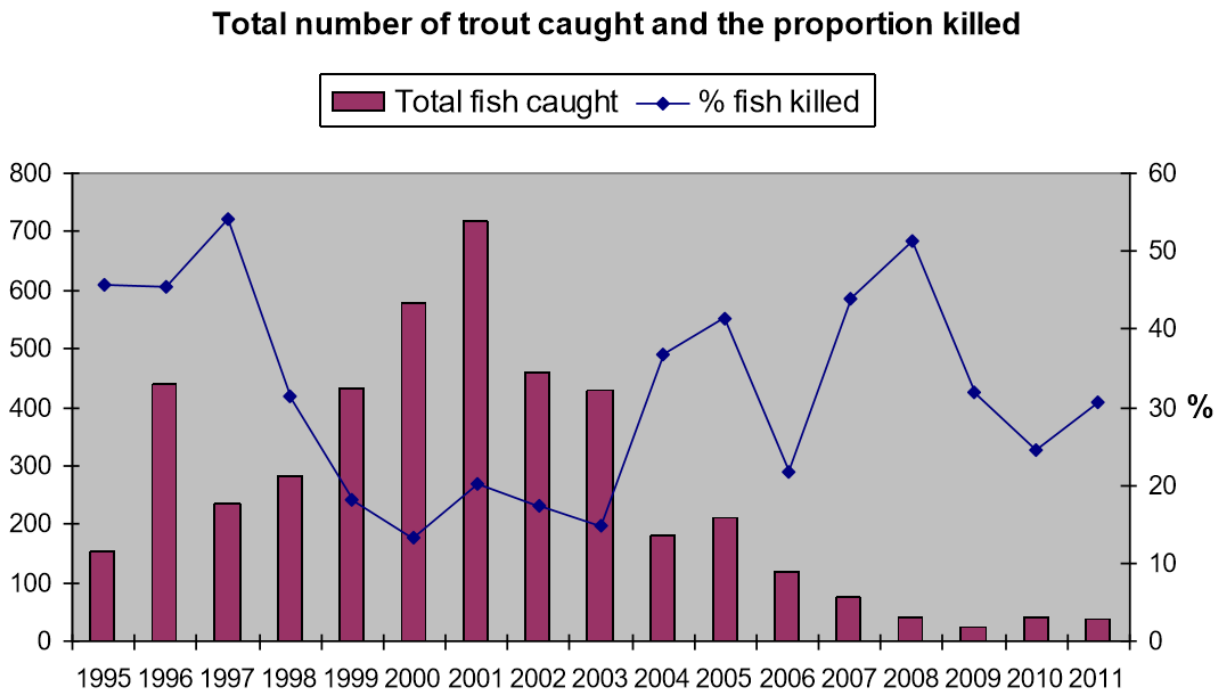
From 1978 to 1981, there was a steady increase in trout density on the lake. The 1986 survey records a significant drop in trout density due to sub-catchment degradation through an arterial drainage scheme. Most "designated wild brown trout fisheries" have at some point been affected by sub-catchment degradation. It is interesting to note that the Western Regional Fishery Board cite this as a reason for trout density decline, but also mention the effect of a higher pike density in the lake on the trout stock. However, from 1986 to 1996 trout density increased to higher levels than any period pre-1986, even though pike densities remained stable at the higher 1986 levels, which would not correlate with findings in the report. The survey report states:

"Lough Carra's stream sub-catchments were subject to an arterial drainage scheme carried out over the period 1981-1985. This probably accounts at least in part, for the decline in the standing crop of trout in the 1986 survey. The decline in numbers at this point in time (1986) may have also been due in part to a decline in controlling pike stocks – pike netting efforts were reduced by 50% from 1985 onwards and ceased completely in 1988. A pike control program was reintroduced in 1992 at a "pre-1985" intensity and has continued to date (O'Grady et al. 1996)."

Again, in the period from 1996 to 2001 trout density increased significantly. This increase was not due to increased levels of pike management, as pike density remained stable. Two factors were responsible for this increase: the first was an extensive sub-catchment restoration programme conducted between 1998 and 2001. The survey report states:

"From 1998 to 2001 a major post-drainage stream enhancement program was carried out on all of the sub catchments to the lake of the Western Regional Fisheries Board."

The second major factor that contributed to the significant increase in trout density between 1996 and 2001 was a vast increase in the amount of trout being caught and released by trout anglers. The table below illustrates clearly the effect on trout numbers, during periods of both low and high catch and release rates. Post-2003, the numbers of trout killed by trout anglers returned to "normal" levels, and contributed to the drop in CPUE value from 6.1 to 4.4 between 2001 and 2009. This data is further validated by assessment of the numbers of trout caught in gill-nets over the same period during annual pike management operations.



Excerpt from "Lough Carra Angling Records" - Chris Huxley (2011)

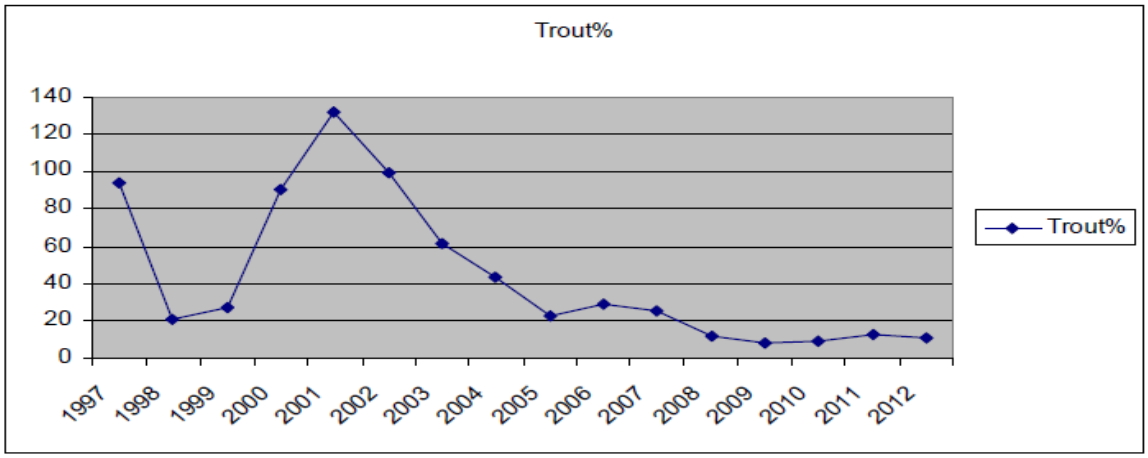


Figure 2. The changes in trout numbers caught during pike culls, shown as a percentage of the number of pike caught.

Excerpt from "Lough Carra Angling Records" - Chris Huxley (2011)

The Lough Carra data clearly illustrates how an erroneous emphasis on pike management operations results in the partial masking of much more significant factors that affect brown trout densities in "designated wild brown trout fisheries". Two major factors when addressed resulted in vast improvement in trout density between 1996 and 2009 even though pike densities were higher than in any other period.

It is interesting to note than in the summary conclusions of the 2009 Lough Carra Survey report the Western Regional Fisheries Board vindicated itself and its management strategy of Lough Carra as a result of the excellent brown trout densities that were recorded. It can be assumed that a large part of the self-vindicated management strategy related to pike management operations. Little emphasis was awarded to the two major factors (sub-catchment enhancement and extensive catch and release of brown trout) that contributed to the rise in trout densities, nor the significance of their overall effect on a fishery compared to the lesser effect of a stable native pike population.

"The large trout stock and limited pike densities recorded in Lough Carra in both the 2001 and the 2009 surveys vindicates the Western Regional Fisheries Boards (WRFB) management strategy in relation to this resource. The successful maintenance of Lough Carra, into the future, as a quality wild brown trout fishery necessitates a continuation of the WRFB's current management strategy."

9.4.4 SECTION SUMMARY CONCLUSION: THE EFFECT OF PIKE MANAGEMENT POLICY ON WILD BROWN STOCKS

The philosophy behind pike management operations on "designated wild brown trout fisheries" is that removal of an apex predator (pike) from the fishery should reduce predation by pike on brown trout and hence improve the trout angling potential of the fishery. However, as detailed in Section 9.4, the execution of pike management operations over extended periods of time has not had the desired effect and has in fact been one of many contributory factors in the decline of brown trout stocks on such fisheries. Pike management operations take the focus of anglers off the real issues affecting brown trout stocks, and presents stakeholders with the easiest opportunity to show that something is being done to conserve the species. Issues that are far more difficult to combat and control but have a far more significant impact on brown trout stocks are given less focus. For Inland Fisheries Ireland, the management of pike populations is in effect far easier to execute and manage as opposed to dealing with stream degradation and enhancement, habitat restoration, eutrophication, drainage schemes, flood relief schemes and many other high-impact issues affecting brown trout populations and recruitment.

Arterial drainage schemes have decimated sub-catchments of many brown trout fisheries. Outside of the Shannon and Lee hydroelectric schemes, the Corrib-Clare arterial drainage scheme conducted through the 1950s and 60s is cited as having the most significant ecological impact on Ireland's natural river heritage. The scheme decimated the trout and salmon recruitment potential of this catchment, which includes the Abbert and Grange rivers, which currently account for 44% of trout recruitment to Lough Corrib. However, there remains an expectation that trout angling on Lough Corrib should be as it was pre-1950, and that the issue is primarily pike and not destruction of trout nursery streams. Works have been undertaken over a number of years that have led to parts of the catchment being restored, but significant current and future challenges remain, such as widening the Clare river to facilitate the Claregalway flood relief scheme. Schemes such as this undertaken in the past have had a far more significant impact on brown trout stocks than an unmanaged and naturally-balanced pike stock could ever have, as was the case prior to 1951.

Intensive cropping of trout by anglers, and in particular during catch and kill trout competitions, has a severely detrimental effect on trout populations. The case for catch and release and the resulting higher trout densities is clearly illustrated in Section 9.4.3 in the Lough Carra data. This is validated by the numbers of trout caught in gill-nets during pike management operations, as can be seen in the table below showing higher numbers of trout during the period of high catch and release rates from 1998 to 2003.

Compounding the apparent poor angling returns for brown trout are the changing feeding habits of trout on some "designated wild brown trout fisheries". The appearance of invasive species such as zebra mussels and roach have contributed to changing feeding habits of brown trout, thus making them less available to anglers, a trend reflected in the Lough Conn data.

The main issues negatively affecting brown trout populations have been discussed in this section. Over six decades of pike management operations have resulted in poorer brown trout densities, a fact highlighted by trout densities and catch returns during periods of moratorium on predator management. In the light of this information and the weight of awareness and knowledge of far more impactful issues previously discussed, pike management operations continue on "designated wild brown trout fisheries".

10 THE DESTRUCTION OF SALMONID SPAWNING HABITAT ON LOUGH CORRIB'S CROSS RIVER

The Cross and Black rivers were once two of the primary trout spawning rivers for the north-eastern part of Lough Corrib. As detailed in section 9.4.1, the contribution to the Lough Corrib trout population of both these rivers has vastly reduced, "***The poor contribution of the Cross and Black rivers (a combined figure of 8%) may be responsible for the decline in trout numbers in the north-eastern part of the lake noted since the 1996 survey"*** **O'Grady (2012**).

The eastern side of Lough Corrib comprises mainly agricultural land, which is used predominantly to farm cattle. It could be assumed that nutrient enrichment and poor water quality would be responsible for the degradation of fish and invertebrate populations on the river; however, the river exhibits excellent water quality characteristics. Excessive macrophyte growth along the river, particularly towards the mouth, would suggest that there are input influences from nitrates and phosphates at work.

Macroinvertebrate samples show that despite the clarity and cleanliness of the water many expected macroinvertebrate groups are not present, namely *Tricoptera*, *Ephemeroptera* and *Plecoptera* spp. Specimens from each group occur at sites closer to the lake outflow; however, locations in the upper river are all but devoid of specimens.

The upper Cross River, where one would expect to find spawning trout at the appropriate times, has been subjected to heavy modification to a point where it is canalised for a lot of sections. The straightening and extensive dredging that occurred on this waterway to aid with agricultural land drainage has so dramatically altered the habitat that the expected macroinvertebrate communities have been damaged. A lot of pool, riffle and glide habitats have been removed from the upper river, resulting in a substrate that can only support a limited range of said invertebrates.

The habitat that some of these invertebrates need to survive is exactly the same as the habitat trout need for spawning. Extensive removal of gravel from the river through the dredging for drainage has ensured that there are not sufficient spawning beds for adequate trout recruitment; hence the north-east Corrib trout declines. Trout can only spawn where there is suitable habitat for them to spawn.

Noting the data and examples shown in section 9.4, it can be assumed that the modification of numbers of sub-catchments surrounding "designated wild brown trout fisheries" has led to the same situation as that of the Cross river and hence has been of the highest significance with respect to declining trout populations.

11 SECTION 59: THE LEGISLATION RELATED TO PIKE MANAGEMENT OPERATIONS

The legislative mechanism that allows Inland Fisheries Ireland to remove fish from a watercourse is Section 59 of The Inland Fisheries Act 2010. In relation to "designated wild brown trout fisheries" Section 59 is used with respect to pike management operation undertaken by IFI and also to grant what are termed "Section 59 Exemptions". Section 59 Exemptions are granted to mainly trout angling clubs and bodies in order for them to execute pike culls without being in breach of pike bye-law number 809 (2006) which is designed to protect pike over 50cm in length and limit the taking of pike to one individual under 50cm per day. Such culls commonly take the form of angling competitions outside of the normal trout angling season. Culls that take place inside the trout angling season are commonly called "mixed grills" as essentially anything that is caught is killed in. Such competitions/ culls are commonly known as catch and kill events, and through issuance of Section 59 exemptions are essentially endorsed by Inland Fisheries Ireland.

The first statement in Section 59 legislation states **"(1) Subject to this section, for the purpose of improving any fishery (whether or not the fishery is the property of IFI) IFI may do all or any of the following, namely-"**. This statement raises particular concerns, as actions undertaken using Section 59 legislation have the primary objective of improving the target fishery. Section 9 of this document has clearly shown that decades of pike management operations undertaken within the bounds of Section 59 (and its predecessors) have not realised an improvement in trout stocks on "designated wild brown trout fisheries".

Inland Fisheries Act 2010

View by Section | View Full Act | Amendments, Commencement, SIs made under the Act | Open PDF | Print Full Act

Previous Section | Next Section | Print Section

Chapter 3

Fishery Improvement

Powers of IFI in relation to improvement of fisheries.

59.— (1) Subject to this section, for the purpose of improving any fishery (whether or not the fishery is the property of IFI) IFI may do all or any of the following, namely—

(*a*) take fish from a fishery by any means whatsoever,

(*b*) implement any other measure intended to alter or regulate the stock in a fishery of fish of one or more particular species,

(*c*) keep under surveillance and from time to time ascertain by any means the quality of water in a fishery,

(*d*) alter, repair, remove or demolish any fence, hedge, tree or wall,

(*e*) dig, break or otherwise temporarily close, cross, extend, divert or otherwise interfere with or alter any navigable waterway, river, stream or other watercourse, bridge, tunnel, culvert, pipe, drain or other thing, and

(*f*) notwithstanding section 327 of the Principal Act, take materials from any river, stream or other watercourse,

Excerpt from "The Irish Statute Book"

12 THE COST OF PIKE MANAGEMENT OPERATIONS

12.1 COST OF OPERATIONS

Using available data*obtained using the Freedom of Information Act, the cost of pike management operations averages €146,560 per year. The number of pike removed average at 9958 specimens per year.

The objective of pike management operations undertaken using Section 59 on "designated wild brown trout fisheries" is to protect the trout population and improve trout angling returns. Changes in the trout population of these fisheries are measured using CPUE (Catch per unit effort), which is calculated using data from fishery surveys. As shown in Section 9, the CPUE values for trout on "designated wild brown trout fisheries" have been in decline for some time despite continued pike management operations.

Pike management operations are undertaken annually, hence the associated operational costs are incurred annually, in addition to lost tourism angling revenues. Fishery surveys are not undertaken annually (e.g. Lough Corrib, 16 years between surveys), hence there is no way to establish whether the execution of and expenditure on pike management operations have delivered their stated objective. This results in the Irish tax payer funding pike management operations for extended periods of time without transparency or visibility of whether their investment has delivered its intended return.

Currently there is no valid cost benefit analysis to justify pike management operations carried out by Inland Fisheries Ireland.

Recent fishery surveys undertaken by Inland Fisheries Ireland on "designated wild brown trout fisheries" have in general shown declining trout populations, as shown in Section 9.

ANNUAL PIKE REMOVAL COSTS 2005-2009 *(Five Select Fisheries)*

		Wrfb						Nwrfb		Shrfb	
		Lough Corrib		Lough Mask		Lough Carra		Lough Conn/Cullin		Lough Sheelin	
		Electro fishing	Gillnets	Electro fishing	Gillnets	Electro fishing	Gillnets	Electro fishing	Gillnets	Electro fishing	Gillnets
2005	No. Pike	5,277	1,438	1,789	1,336			165	1,119	200	0
	Total Weight lb	939	4,639	759	6,128			434	4,918	800	0
	Total Cost €	5,456.00	17,219.00	10,098.00	26,053.00			482.00	33,804.00	27,800.00	0.00
	Cost per Pike	1.03	11.97	5.64	19.50			2.92	30.03	139.00	0.00
	Cost/lb €	5.81	3.71	13.30	4.25			1.11	6.87	34.75	0.00
2006	No. Pike	7,752	2,182	948	1,219			0	525	310	0
	Total Weight lb	713	3,572	696	3,567			0	2,319	1,085	0
	Total Cost €	10,364.00	30,445.00	6,009.00	22,175.00			0.00	7,386.00	34,000.00	0.00
	Cost per Pike	1.34	13.95	6.34	18.19			0.00	14.06	109.67	0.00
	Cost/lb €	14.54	8.52	8.63	6.22			0.00	3.18	31.34	0.00
2007	No. Pike	1,234	2,243	1,768	953	417	390	11	1,113	0	675
	Total Weight lb	506	4,076	1,459	4,814	284	1,039	46	6,717	0	2,700
	Total Cost €	15,732.00	48,966.00	12,142.00	20,175.00	2,099.00	7,230.00	96.00	22,482.00	12,000.00	44,800.00
	Cost per Pike	12.75	21.83	6.87	21.17	5.03	18.54	8.72	20.20	12,000.00	66.37
	Cost/lb €	31.09	12.01	8.32	4.19	7.39	6.96	2.09	3.35	0.00	16.59
2008	No. Pike	924	2,269	1,347	771	189	697	35	1,503	0	2,400
	Total Weight lb	626	3,864	1,923	4,515	223	1,803	264	12,129	0	9,600
	Total Cost €	9,561.53	24,891.00	13,067.87	21,965.70	1,538.90	11,438.33	1,307.00	23,370.00	0.00	46,800.00
	Cost per Pike	10.35	10.97	9.70	28.49	8.14	16.41	37.34	15.55	0.00	19.50
	Cost/lb €	15.27	6.44	6.80	4.87	6.90	6.34	4.95	1.93	0.00	4.86
2009	No. Pike	180	1424	1443	832			177	1133	0	1403
	Total Weight lb	163.24	4310.78	803.75	3987.25			637	6159	0	4015
	Total Cost €	4042.67	23796.01	10457.66	25608.25			5472	25272	0.00	67200
	Cost per Pike	22.46	16.71	7.25	30.78			30.91	22.3	0.00	47.9
	Cost/lb €	24.77	5.52	13.01	6.42			8.59	4.1	0.00	16.73

Note: (Wrfb - Western Regional Fisheries Board); (Nwrfb - North Western Regional Fisheries Board); (Shrfb - Shannon Regional Fisheries Board)

Total Combined Electrofishing and gillnetting Cost for 2005 = **€120,912** ------ (11,324 pike removed @ (€10.68 per pike) or (€6.49 per lb)
Total Combined Electrofishing and gillnetting Cost for 2006 = **€110,379** ------ (12,936 pike removed @ (€8.53 per pike) or (€9.24 per lb)
Total Combined Electrofishing and gillnetting Cost for 2007 = **€185,722** ------ (8,804 pike removed @ (€21.10 per pike) or (€8.58 per lb)
Total Combined Electrofishing and gillnetting Cost for 2008 = **€153,940** ------ (10,135 pike removed @ (€15.19 per pike) or (€4.40 per lb)
Total Combined Electrofishing and gillnetting Cost for 2009 = **€161,848** ------ (6,592 pike removed @ (€24.55 per pike) or (€8.06 per lb) ---- (Correct to 31st July)

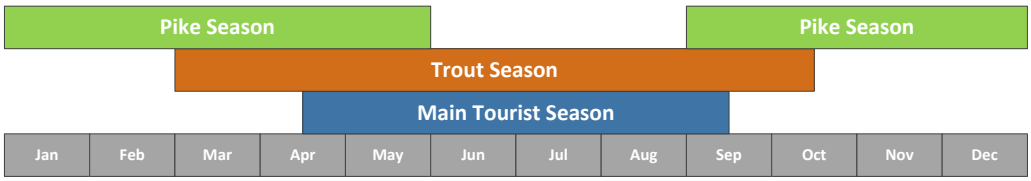
Note: During years 2005 to 2009 Inclusive - 49,791 Pike were removed at a Cost of €732,801or €14.71 per Pike from the specific fisheries tabled.
(By gillnets alone 25,625 Pike were removed at a Cost of €551,076.29 or €21.50 per Pike removed - Average weight of gillnetted Pike was 3lb 11oz)

Note: Pike weights and numbers for Loughs Mask/Carra for 2005, 2006 and 2009 are combined under Lough Mask heading

***More current data has been requested under the Freedom of Information Act for years 2010 to present.**

12.2 ECONOMIC IMPACT TO THE IRISH TAX PAYER

The negative economic impacts of pike management operations are wide and varied, but generally affect areas where alternative opportunities for revenue and employment are limited, such as rural towns and communities. Such areas have typically not felt the effect of the general recovery in the Irish economy in recent years. Pike management operations further limit employment and revenue opportunities in these areas outside of the main tourist season, as thousands of domestic and international pike anglers stay away in protest and on the assumption that their target quarry is very limited.



As opposed to some other fish species, pike do not require management in order to function in a fishery and reach an acceptable size and number to attract anglers. It is true that pike populations fare best when neglected. However, IFI are investing year on year on management that has no beneficial effect to pike or any other species, and in fact vastly reduces the attractiveness of Ireland's pike-angling product. Pike management policy endorses the widely-held idea that Ireland's fishery management policies are in fact anti-pike.

Angling as a whole contributes €836,000,000 to the Irish economy and supports over 11,000 jobs directly. There is a contribution from pike angling of 12.2% or €102,000,000. In terms of placement pike angling is the fourth largest contributor to overall angling revenues with brown trout third, sea angling second and salmon and sea trout angling the largest contributor. However, as detailed in the IFI commissioned report **"The Economic Contribution of Pike Angling in Ireland 2015"** pike angling is vastly underrepresented with significant potential for growth through a more focused management approach for the benefit of pike. In this independent report there is recognition that currently the potential of pike angling revenue is severely limited due to negative pike management policy. IFI states in its own market research (2015) in the National Strategy for Angling Development that: ***"current pike management policies may impact negatively on Ireland's reputation as a prime pike angling destination",*** and additionally, the potential for pike as an asset for angling tourism with a status as ***"the number one sport fish in Germany, France, the Netherlands and Italy"*** and that pike fishing is ***"also quite popular amongst anglers in the UK".*** A positive change in management policy would see pike angling revenue contribution increase greatly as large numbers of anglers return and hence elevate its contributory position. This is supported by data from both domestic and international anglers alike.

13 IFI CONTRAVENTION OF POLICY, MODERN RESEARCH AND COMPARATIVE ANALYSIS

13.1 IFI CONTRAVENTION OF ECONOMIC AND NATIONAL ANGLING RELATED POLICY

Through review of the various policies and intent of Inland Fisheries Ireland, it is apparent that the organisation's actions on the ground do not align. In relation to Fisheries Protection, the public message conveyed by IFI through various media is "*Inland Fisheries Ireland is charged with ensuring the protection and conservation of our fisheries resource, both the fish and their habitats. IFI's area of responsibility covers both inland waterways and out to the twelve mile limit off the coast. The species protected include all freshwater fish, sea bass and certain molluscs*." Inland Fisheries Ireland kills and disposes of more freshwater fish than any other individual or organisation in Ireland.

In 2013, at a cost of €110,000 to the Irish tax payer, IFI commissioned the **"Socio-Economic Survey of Recreational Anglers"**. The report recognised the value of all angling disciplines to the Irish economy, and highlighted recommendations and changes. In the same period, the **"Inland Fisheries Ireland Pike Policy"** document was being reviewed by IFI and various stakeholders through a review committee structure. Mid-way through this process, IFI decided to stand down the Pike Policy Review committee. The **"Inland Fisheries Ireland Pike Policy"** was released in 2014, and did not integrate recommendations made within the Socio-Economic study or the Pike Policy review committee. IFI have stated publicly that their pike Policy was endorsed by the pike angling stakeholder on the review committee, when in fact this is not the case. Further concessions on pike policy were agreed with the pike angling stakeholder earlier in the review process, but not honored by IFI.

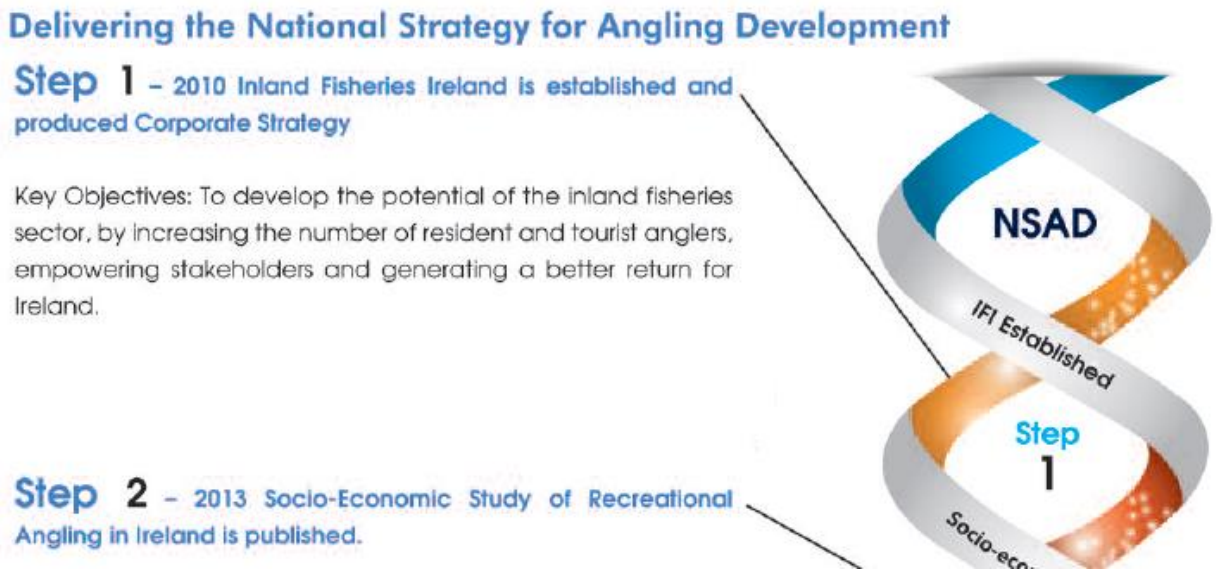
The **"National Strategy for Angling Development"** (NSAD) is the first comprehensive national framework for the development of Ireland's angling resource. The development of this strategy has come at a cost to the Irish tax payer, and its implementation will cost €25,000,000 over a 5-year period. IFI's current pike management operations would appear to be odds with the NSAD on many fronts.

A key strategic objective of the NSAD is to enhance Ireland's international reputation as a key destination in the angling world. Current Pike Management Policy and Operations are a major obstacle to this and are recognised as such across the NSAD main target markets of the UK and mainland Europe. Continued implementation of current pike management policy supports the widely-held opinion that some Irish fishery management policies are archaic, outdated, and at odds with modern research and international best practice, and hence provide no benefit for the target fishery.

13.1 IFI CONTRAVENTION OF POLICY CONTD.

A key action measure in the NSAD is to "Encourage stakeholder engagement and involvement in fisheries development and management". Using the recent Pike Policy review as an example, it is unclear as to how this will be successfully implemented by IFI when stakeholder input is not valued, considered or implemented.

Implementation of the NSAD is proposed to occur in a structured step-by-step approach. The continued practice of Pike Management Operations would appear to directly oppose the intent at the very beginning of this process.



Excerpt from "The National Strategy for Angling Development" (2015)

13.2 IFI CONTRAVENTION OF PIKE MANAGEMENT POLICY & SOP'S

With respect to Pike Management Policy IFI purport to operate within guidelines and standard Operating Procedures. The two most relevant SOPs are **"Inland Fisheries Ireland Standard Operating Procedure (SOP) for Pike Management Operations using Gill-nets"** and **"Inland Fisheries Ireland Standard Operating Procedure (SOP) for Pike Management Operations using Electrofishing Apparatus"**. It has been a long-standing opinion that the SOPs (past and present) have rarely been adhered to. Much evidence from anglers and the general public supports this, and in recent years many IFI staff have been photographed and filmed executing Pike Management Procedures in an improper and barbaric way. The recent IFI review of both SOPs was initiated by damning evidence filmed in March 2015 on Lough Conn and released on social media one year later by a member of the public.

https://www.youtube.com/watch?v=QLLoUmk4CnE
https://www.youtube.com/watch?v=qEzcIXuUnAM

Correct execution of pike management SOPs were intended to facilitate the return of pike over a certain length to their waters, with smaller individuals removed and disposed of. In some cases, pike over a certain length were to be transferred to other "more suitable" waters. Simple measuring devices are mainly absent on management vessels, raising questions as to how a determination is made on length. The video evidence released on social media suggests that loop holes in the IFI SOPs were being used whereby pike that should have been returned were indeed retained in the bottom of boats or barrels with insufficient water for hours at a time. When staff attempted to return the pike, they were already dead, but as an attempt has been made to return them there was no contravention of the SOP - hence no repercussions for IFI or its staff.

The recently updated SOPs do not garner much support. They remain open to contravention by staff, as determinations of fish to be returned are entirely subjective and at the discretion of the senior officer. IFI face many challenges here, as typically senior staff endorsing and undertaking pike management operations are informing field staff with erroneous data on the pike's role within the target fishery. This is a major obstacle to overcome if proper implementation of SOPs is to occur; field staff are unfairly left open to criticism and intense scrutiny by members of the public as they execute ill-informed policies endorsed at more senior levels in IFI.

Irrespective of whether the current SOPs can be followed or not, they have no place in modern fishery management, and by consigning them to the past IFI could solve many public relations issues and reclaim much support from the angling public and their peers internationally.

14 THE PRACTICE OF GILL-NETTING, ELECTROFISHING AND PIKE MANAGEMENT OPERATIONS

14.1 GILLNETTING

Gill-netting involves the use of fine nets to trap and entangle fish and eventually cause death. With respect to the use of gill-netting for IFI pike management operations, the main target species is pike; hence the gill-nets are placed in shallow bays from February to May each year in order to capture egg-laden females and spawn-bound males en route to spawn in reed beds and shallow margins. The method is entirely indiscriminate by nature. Many species of fish are caught in gill-nets and recent evidence suggests that high numbers of brown trout perish in addition to pike, perch, roach, bream and salmon. As gill-nets are typically laid in areas that are “food rich” for water birds and mammals, much additional wildlife risks becoming entangled and dying. Species include ducks, grebes, herons, swans, water hens, otters, mink, and indeed any living creature that potentially comes into contact with the gill-net.

Gill-nets are also a concern for Public Health and Safety, as typically they are poorly marked and cannot be easily seen in the water. Gill-nets have the capacity to entangle swimmers and various other water users with dire consequences. Boat users are also at serious risk, as engines can easily become entangled and hence disabled, therefore stranding the occupants or in bad weather conditions potentially causing a boat to capsize.

14.2 ELECTROFISHING

Electrofishing involves the use of electric current passed through the water column between two electrically conductive rod; fish or animals in the area are stunned as they pass through the electric field. Whilst some fish do survive this process, it is quite often fatal for larger specimens such as pike. Scientific evidence suggests that significant spinal damage occurs in longer fish species such as pike and trout when affected by electrofishing resulting in a high mortality rate later. To avoid this, specific specialised training is required in order to set up the electrical equipment correctly for conditions at the start of the operation and for the duration of the operation.

14.3 INTERNATIONAL BEST PRACTICE

Inland Fisheries Ireland purports to implement pike management operations to the same standards as international best practice. Internationally, the use of gill-netting and electrofishing as methods of species control are deemed necessary, and in most cases only permitted, where the target species is non-native - pike are native to Ireland.

14.4 RETURNING PIKE CAPTURED DURING PIKE MANAGEMENT OPERATIONS

IFI pike management policy calls for the return of pike exceeding a certain length. Evidence suggests that this does not presently occur and has not in the past occurred, in the intended way. Using available data and taking Lough Corrib as an example, the tables shown below illustrate that an average return rate of just 0.39% is executed during pike management operations.

No. of pike Captured			
Year	Electrofishing	Gillnets	Total
2008	924	2269	3193
2009	180	1424	1604
2010	1583	1773	3356
2011	918	786	1704
2012	942	2087	3029

Pike captured annually averaged over 5 years	2577

No. of pike Returned			
Year	Electrofishing	Gillnets	Total
2008	0	10	10
2009	0	20	20
2010	0	8	8
2011	0	9	9
2012	0	3	3

Pike returned annually averaged over 5 years	10

The data shown shows that an average of just 10 pike per year are returned to Lough Corrib during pike management operations. Considering the data set as a whole, between 2008 and 2012 12,886 pike were captured and just 50 returned. Pike that are returned are allegedly Floy-tagged by IFI.

14.3 RETURNING PIKE CAPTURED DURING PIKE MANAGEMENT OPERATIONS CONTD.

On waters where return rates are purported to be higher, such as Lough Mask, a worrying statistic emerges. For more than a decade, it has been recognised that the quality of pike fishing on Lough Mask has collapsed. However, it remains practised by a few local dedicated individuals who do not have to travel long distances or invest in overnight accommodation for resulting poor returns. Allegedly IFI Floy-tag captured specimens that are then released back into Lough Mask. With such vastly reduced and hence localised pike populations, it is reasonable to assume that some of these pike would be recaptured by legitimate means (rod and line) or at a minimum recaptured in subsequent stock surveys or pike management operations. However, there have been no recaptures of Floy-tagged specimens recorded since the tagging regime began on both Loughs Mask and Corrib. This raises many concerns such as:

1) Are pike over a certain length returned at all (as required by IFI SOPs) and if so are they actually tagged?
2) Are pike that are captured tagged and released, but soon after perish due to injuries caused by gill-nets and/or electrofishing?

Studies of pike and pike movement referenced in the **"Synopsis of Biological Data on the Northern Pike (1988)"** show a considerable rate of recapture of tagged pike for years after initial tagging.

Gill netting	No returned or relocated
2010	12
2011	54
2012	14
2013	16*
2014	23

* 32 in first FOI response see above

L Mask - 2010 Gill netting (n = 12)

Date	Length	Weight	Floy Tag No.	Receiving Waters
27/01/2010	94	n/a	2700	Mask
28/01/2010	96	n/a	2699	Mask
29/01/2010	102	n/a	2698	Mask
05/02/2010	104	n/a	4649	Mask
05/02/2010	95	n/a	2687	Mask
16/02/2010	102	n/a	2696	Mask
03/03/2010	98	n/a	4601	Mask
03/03/2010	112	n/a	4602	Mask
04/03/2010	98	n/a	2651	Mask
12/03/2010	94	n/a	4456	Mask
12/03/2010	98	n/a	4457	Mask
24/03/2010	93	n/a	4603	Mask

Number of Lough Mask pike returned or relocated for year 2010

15 SUMMARY

It is clear that pike management operations have a wide range of negative effects on both the angling community and the general public as a whole. The negative economic impact on rural communities will continue until policy changes and a more sustainable and balanced strategy is employed.

Pike management policy is divisive among the various angling groups and disciplines within Ireland. Such conflict is highly counterproductive and undesirable at a time when anglers and state agencies need to work together harmoniously to protect our fisheries and habitats against threat. Poaching, illegal fishing, pollution, habitat restoration, and climate change are just a few of the many challenges facing our fisheries. Anglers as a group are one of the most important guardians of the natural environment; they are the eyes and ears of our waterways, and can only afford them maximum protection when unified.

Evidence supports the view that pike management policy has not had its intended effect on fisheries. This is indicated by a reduction in stocks of wild brown trout, whilst pike populations are severely reduced. This raises the question as to what research has been undertaken to ascertain the root cause of the decline of this important and valuable species in fisheries where pike management is executed annually. More likely causes are degradation of trout spawning habitat in important feeder streams and increases in populations of competitor species (roach, perch) due to decreased predation. Degradation of trout spawning habitat has been a major problem nationally, and there is an ongoing battle against such factors as pollution, encroachment and enrichment. IFI execute habitat restoration and stream enhancement projects in many areas of the country. Local angling clubs contribute significantly in this area also, by funding and executing such works themselves on their local waters. IFI would generate much good-will and support by abandoning pike management operations and the wasteful utilisation of resources to execute it while redirecting those resources to tackle the real problems facing important wild brown trout populations.

The continuation of pike management operations results in the destruction of one of Ireland's natural resources at significant expense to the Irish economy.

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17 IMAGES