



**The Current Status of Fish Stocks in Lough Sheelin (March, 2000)
and
A Review of Fluctuations in Fish Populations in this Water
over a 22 Year Period
and
Management Recommendations for its Maintenance as a
Trout Fishery in the Long-term**

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1. INTRODUCTION

A fish stock census was carried out on Lough Sheelin in March, 2000. This was the 19th annual survey of its kind since 1978 – no survey data is available for just three individual years within this period (1991, 1997 and 1998). The procedure involves selecting and netting randomly chosen sites on the lake with gangs of special survey nets which are capable of catching trout (≥ 19.8 cm) in proportion to their presence in the stock. This sampling gear can also catch a cross-section of all other fish species present. All of these annual surveys have been carried out at the same time of year (springtime) to ensure that the results of the surveys are comparable. The distribution of the sampling sites in the 2000 survey are illustrated (Fig. 1).

This document outlines the current status of fish stocks and reviews the fluctuations in the populations of some fishes since 1978. The possible influence of various factors on the level of trout stocks in the fishery are reviewed. The implementation of an applied R & D programme is recommended to assist with the restoration of Lough Sheelin as one of only twelve lakes in Western Europe capable of supporting substantial stocks of large wild brown trout. It is stressed that the findings of the proposed R & D programme on Lough Sheelin would have significant longterm implications for the management of all of Ireland's lake trout fisheries.

This document should be read in conjunction with reports, which review the cultural eutrophication status of this water, past and present (see T. Champ's reports).

2. RESULTS FOR THE 2000 SURVEY

The March 2000 survey indicates the presence of:

- (a) A poor adult trout population
- (b) Substantial stocks of roach and perch
- (c) A significant pike population dominated by younger adult year-classes.

3. A REVIEW OF THE ANNUAL SURVEY DATABASE (1978 – 2000)

The fluctuations in fish stocks over this period are reviewed here in relation to trout, roach, perch and pike populations.

3.1. Trout Populations

Considerable fluctuations have been recorded in the levels of the trout stock in Lough Sheelin from 1978 to date (Fig. 2). The relative density of the trout population in any annual survey is calculated by dividing the total number of individual trout captured in the survey by the number of sites sampled. Values calculated thus are called Catch per Unit of Effort Values (C.P.U.E.).

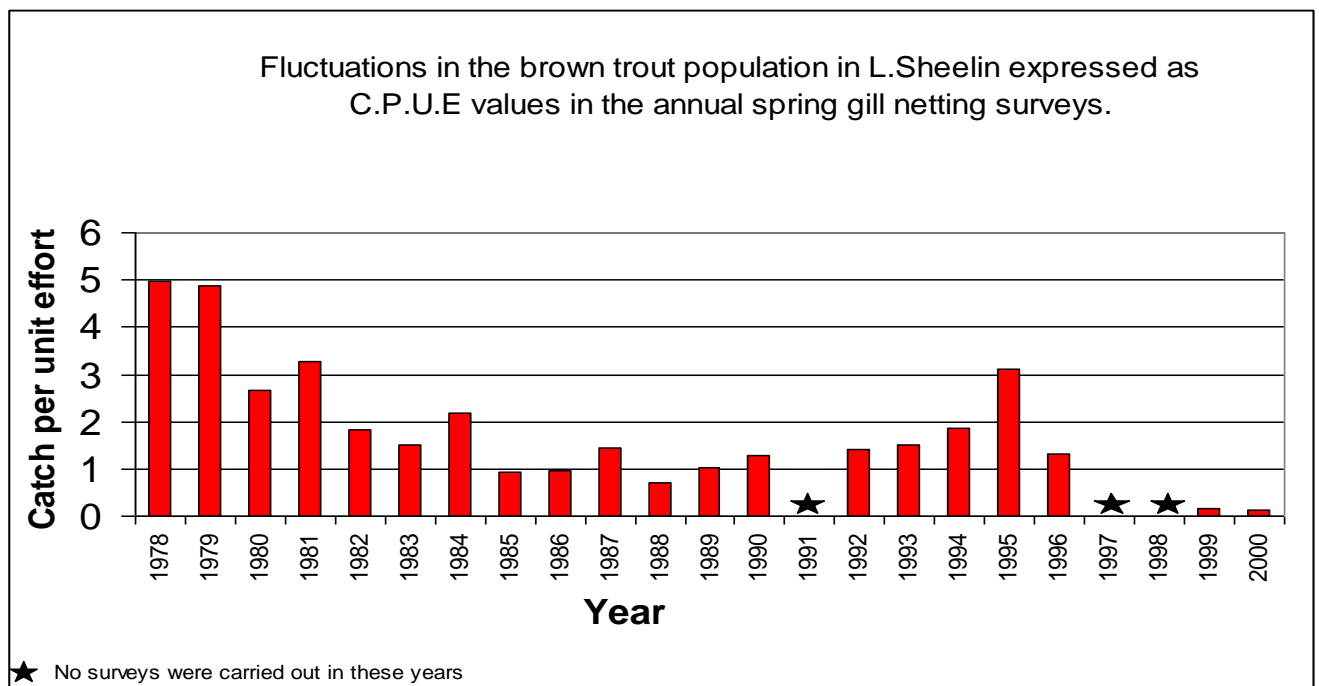


Fig.2. Trout CPUE values from 1978 to 2000.

C.P.U.E. values for trout in annual surveys have ranged widely between 4.97 and 0.13. Relatively high C.P.U.E. values were noted from 1978 to 1984 and again in the mid nineties (1994 and 1995). In the intervening years, 1985 to 1993, and again from 1996 to date poor C.P.U.E. values were noted – the poorest C.P.U.E. (0.13) was recorded in 2000 (Fig. 2). It should be noted that despite the very low C.P.U.E. value recorded in 2000, a monitoring of juvenile trout stocks in the stream sub-catchments indicates that the current limited adult trout population is still adequate to generate a substantial juvenile stock in the streams.

C.P.U.E. values for lake trout populations in Lough Sheelin can be put in perspective by way of comparison with some of Ireland's other fisheries. Recently recorded C.P.U.E. values for Lough Ennell (2.6 in 1999), Lough Corrib (1.9 in 1996) and Lough Carra (4.0 in 1996) indicate that, currently, the adult trout stock density in Lough Sheelin is quite poor comparatively speaking and may not be adequate in the immediate future, to provide quality angling.

The wide fluctuations in trout C.P.U.E. values annually since 1978 are paralleled by the records of numbers of trout released during pike gill netting operations. In 1980 and 1998 staff effort in the pike gill netting programme were similar. Trout numbers released from pike gill nets in 1980 were almost 10 times greater (2,091 fish) than the number released in 1998 (273 fish). This is further clear evidence of the decline in adult trout stock levels in the lake.

The C.P.U.E. value for 1999 (0.17) and this year (0.13) are the lowest on record since the survey series began in 1978. C.P.U.E. values for both years (1999 and 2000) are indicating a serious decline in brown trout populations in Lough Sheelin for 5 successive adult year classes. Clearly the young trout migrating from the stream catchments to the lake are failing to survive to adulthood in significant numbers.

3.2. Roach Stocks

Roach are not an indigenous species in Irish waters. They were introduced, probably by pike anglers using roach as live bait, to Lough Sheelin in the early 1970's. No roach were caught in the initial fish stock surveys on Lough Sheelin (1978 and 1979). A few roach were captured in the surveys from 1980 onwards to 1984. Thereafter (1985 to 1990) there was an exponential expansion in the roach population. Roach stocks had collapsed by 1992 and numbers of this fish remained at a low level in Lough Sheelin up to 1996. The 2000 survey shows the continued growth in roach numbers since the 1999 survey, to almost '87/'88 levels (Fig. 3).

The length/frequency distribution (Fig.4) for roach shows the absence of younger year classes within the population indicating the lack of recruitment to the lake of 2+/3+ year old fish.

The extreme fluctuations, evident in the roach stock in Lough Sheelin, is not unusual in a western European context. Researchers studying this phenomenon have concluded that the success of individual year-classes of roach is temperature dependant, particularly in countries like Ireland, which is in the northern part of the geographical range of this species – i.e. roach year-classes born in hot summers thrive and *vice versa*.

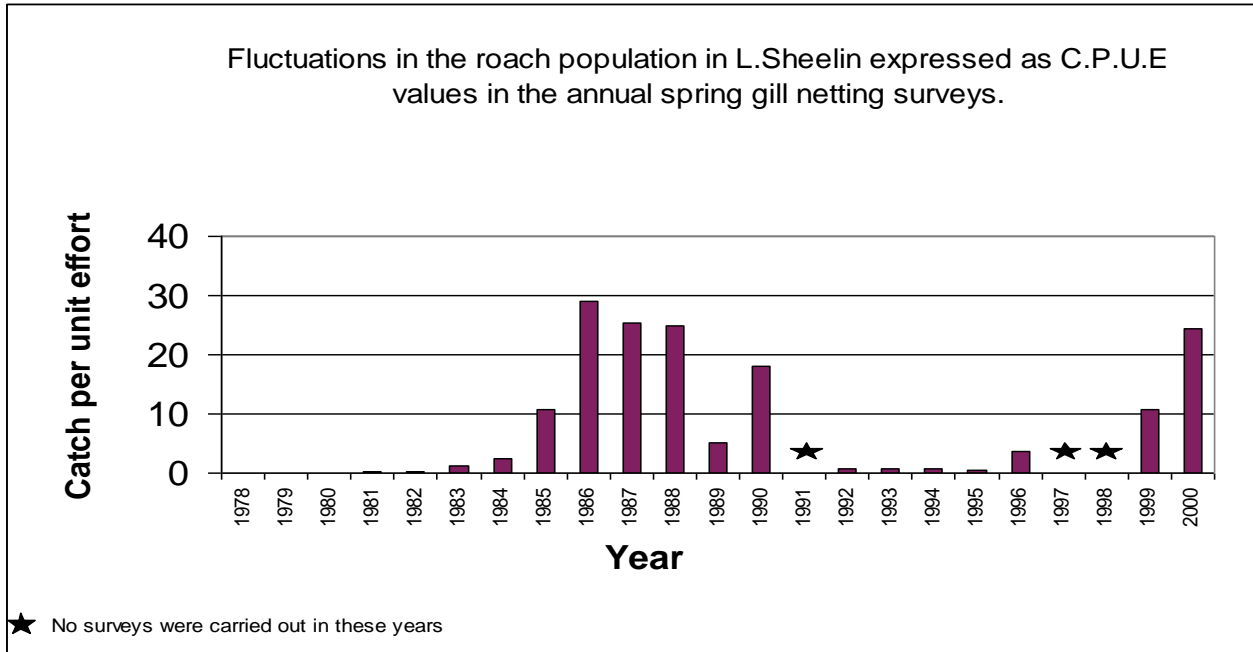


Fig.3. Roach CPUE values from 1978 to 2000.

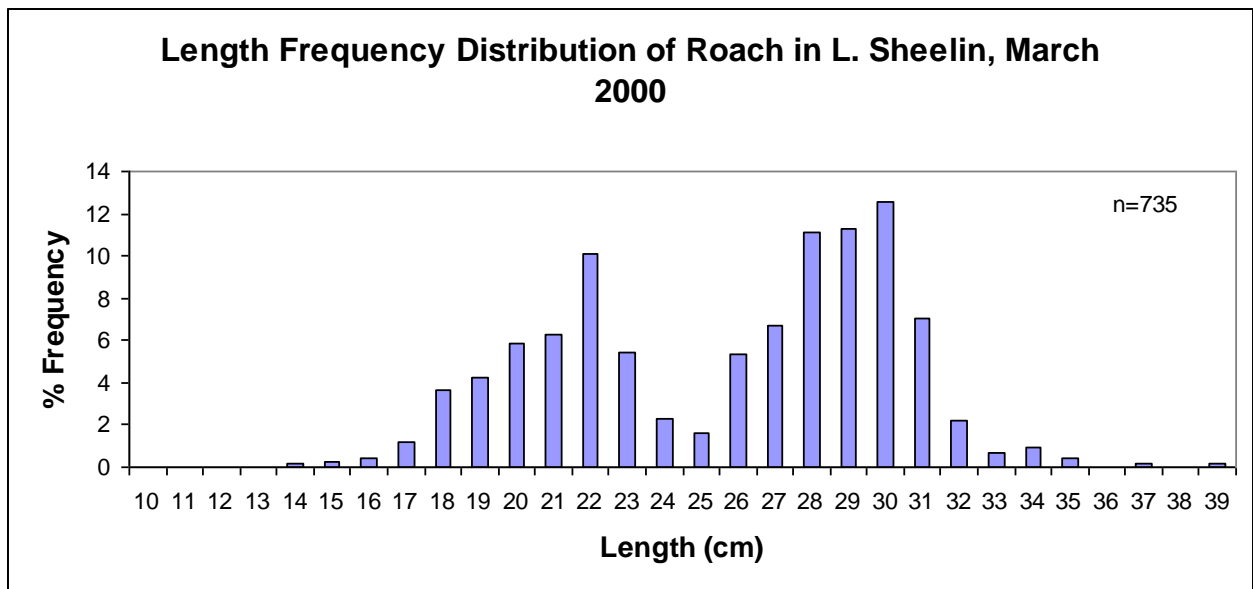


Fig.4. Length/Frequency Distribution of Roach, March 2000.

Over the period 1978 to date there have been wide fluctuations in levels of cultural eutrophication in Lough Sheelin (see T. Champ's reports). A substantial improvement in water quality (reduced phytoplankton levels) was evident in Lough Sheelin in the early 1990's, when roach stocks collapsed. It is not known whether or not there is a causal link between these two events.

Lough Ennell is ecologically similar, in many respects, to Lough Sheelin. Small numbers of roach have been recorded in Lough Ennell since the late 1970's. However the species has never prospered in Lough Ennell, unlike Lough Sheelin or indeed Lough Derravaragh (Lough Derravaragh is situated downstream of Lough Sheelin and is connected to Lough Sheelin by the River Inny). Lough Ennell, unlike Loughs Sheelin and Derravaragh, has not suffered from major cultural eutrophication problems in the 1980's and 1990's. Perhaps there is a link between the eutrophic status of a water and its suitability to sustain a large roach stock. Again while this is a possibility it is not a proven fact in Irish waters.

Lough Derravaragh was also managed as a trout fishery up to the late 1970's. At that time roach stocks became so prolific that pike control with gill nets became an impossible task – nets set to capture pike were quickly “saturated” with roach, and thus were ineffective in controlling pike. Following the cessation of pike control on Lough Derravaragh there was no apparent decline in roach numbers despite an obviously expanding pike population. This suggests that the ongoing control of pike stocks on Lough Sheelin has had no significant impact on the roach population-annual dietary examinations of juvenile and young adult pike indicates that, throughout the survey period on Lough Sheelin, these fish (young pike) have been feeding principally on macroinvertebrates.

There is a clear and statistically negative correlation ($r = - 0.57$) between trout and roach C.P.U.E. values, recorded in Lough Sheelin from 1978 to date – i.e. over the period 1985 to 1990 there was a major increase in roach numbers and a marked decline in the trout population (Fig. 5). Again, in 2000, the lowest recorded trout C.P.U.E. value has been noted in the presence of a substantial roach stock (see Figs. 2 and 3). Great care needs to be taken in interpreting these data – i.e. correlation does not necessarily reflect causation (see Section 5(iii)).

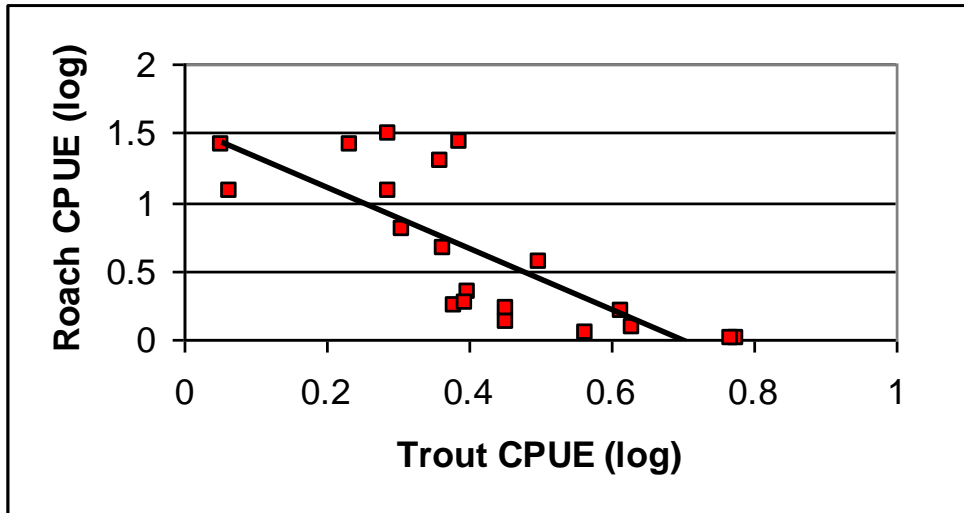


Fig.5. The relationship between trout and roach CPUE's over the survey period (1978-2000).

3.3. Pike Populations

Pike stocks in Lough Sheelin have been subject to significant control since the mid 1960's. Gill netting programmes during the pike spawning season have been the primary control method for adult pike. From the 1960's to the early 1970's substantial numbers of juvenile (0+ and 1+ year-old fish) were also removed using wire traps and rotenone. The control of juvenile stocks have ceased since the early 1970's primarily for budgetary reasons.

There have been substantial fluctuations in the size of pike stocks in Lough Sheelin over the monitoring period (1978 to 2000) (Fig. 6). The lowest C.P.U.E. values for pike were recorded in 1978 and 1979 (0.49 in both years). The highest values were noted in recent years (1993, 1995, 1996, 1999 and 2000) when C.P.U.E. values of 4.1, 2.9, 2.7, 2.8 and 2.8 were recorded respectively. The higher values in recent years are probably in part a reflection of the Shannon Regional Fisheries Boards inability (for financial reasons) to control juvenile pike stocks – this imbalance will be rectified in future years (see Section 6).

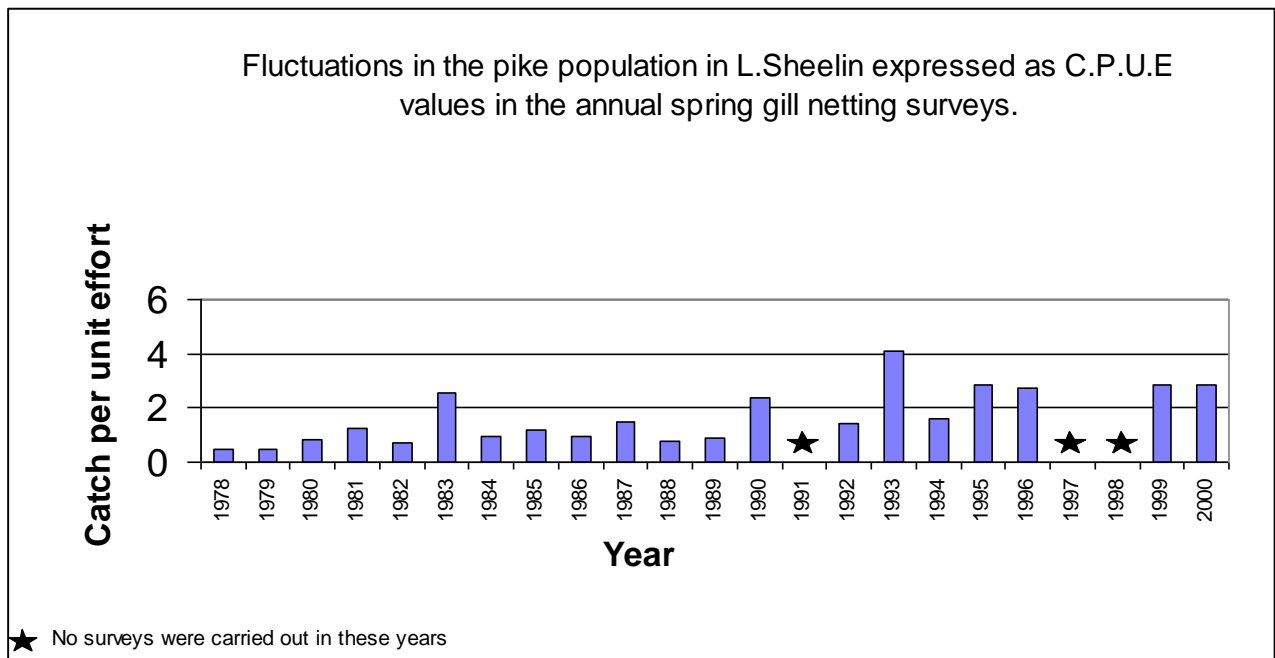


Fig. 6. Pike CPUE values from 1978 to 2000.

The pike stock structure in Lough Sheelin in 1979, 1993, 1999 and 2000 are presented (Fig. 7.a-d). These data were compiled from the fish sample captured in each of respective annual surveys. The stock structure of an “undisturbed” pike population is also included (Fig. 7.e) for comparative purposes. These data are from Lough Corrib in 1996 at which time gill netting had ceased for a period of years and pike angling catches on the lake were negligible relative to the stock size. An examination of the Lough Sheelin pike length frequency data from the 1979, 1993, 1999 and 2000 surveys indicates that the predator control programme is effective at removing the piscivorous portion of the pike population. However an increasing proportion of adult pike in the latter year (2000) suggests that a higher level of netting control is desirable, i.e., stock structures in 2000 on Lough Sheelin more closely resembles the 1996 Corrib data than the '79 or '93 Sheelin data. There has been a continuous high level of recruitment of juvenile pike to the young adult stage in Lough Sheelin in recent years.

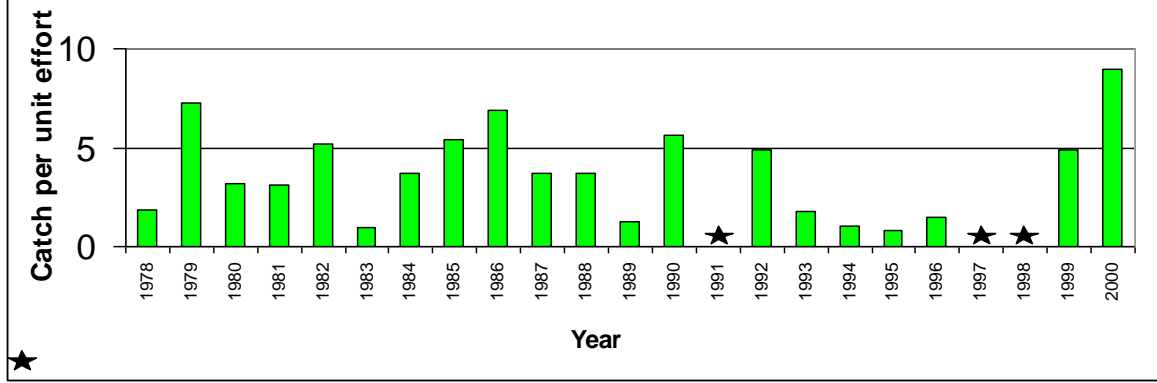
Detailed examination of the stomachs of all 85 pike captured in the 2000 survey indicated that the vast majority of pike ≤ 50 cm in length were feeding on invertebrates (mostly shrimps and waterlouse) despite the relative abundance of small roach in the fishery presently. This feeding pattern for small (≤ 50 cm) pike has been a consistent feature of the Lough Sheelin pike population throughout the monitoring period (1978 to date).

The larger pike (> 50 cm) captured in the 2000 survey had been feeding on trout, roach and perch. A total of 4 trout, 735 roach and 311 perch were captured in the survey nets in 2000. Despite the obvious abundance of roach and perch in the fishery presently, compared to trout, it is noteworthy that 2 trout were found in the stomachs of the 68 adult (> 50 cm) pike captured in the survey. This is not surprising. A substantial data base from many Irish loughs over 25 years has shown repeatedly that pike will consistently target trout as a fodder species irrespective of the abundance of other fishes in a lough. The most extreme example of this phenomenon was noted in Lough Derravaragh in the early 1980's when, in the course of a netting survey, a greater number of trout were found in the stomachs of pike caught in the survey nets than were actually captured in the nets themselves. At that time there were very large populations of roach and roach/bream hybrids in Lough Derravaragh.

3.4. Perch Populations

Perch stocks, as measured in the annual surveys, have fluctuated significantly from 1978 to date (Table 1). Unlike the roach and trout stocks there is no positive or negative correlation between fluctuating roach and perch numbers. A similar pattern in the length/frequency distribution of the perch, as with the roach, is evident (Fig.9). The graph shows the lack of younger year classes indicating poor recruitment in recent years.

Fluctuations in the perch population in L. Sheelin expressed as C.P.U.E values in the annual spring gill netting surveys.



Length Frequency Distribution of Perch in L. Sheelin, March 2000

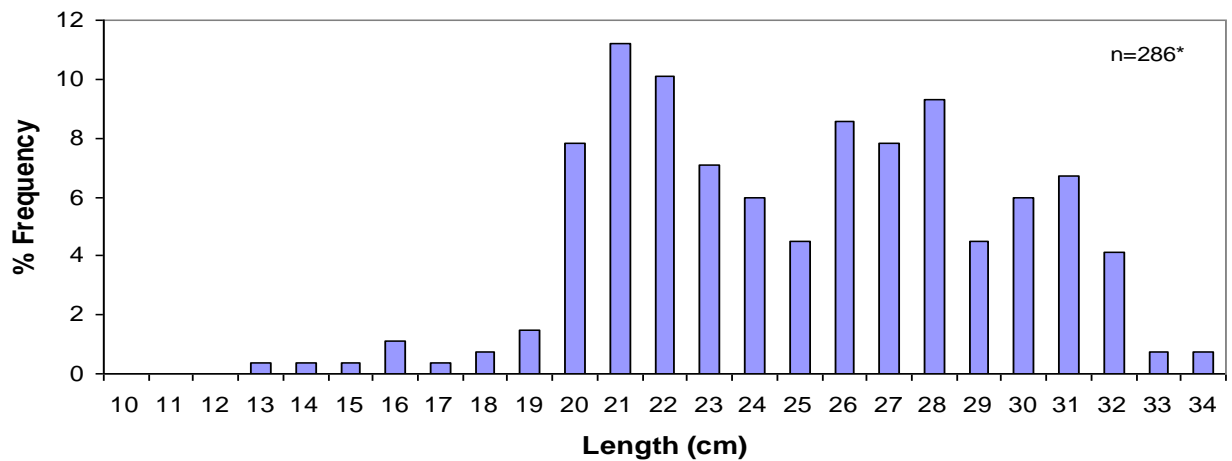


TABLE 1. List of CPUE values for trout, pike, perch and roach in all surveys from 1978 to 1999 (no surveys were carried out in 1991, 1997 and 1998).

Year	Trout	Pike	Perch	Roach
1978	5.0	0.5	1.9	0.0
1979	4.9	0.5	7.2	0.0
1980	2.7	0.8	3.2	0.1
1981	3.3	1.3	3.1	0.2
1982	1.8	0.7	5.2	0.3
1983	1.5	2.6	1.0	1.2
1984	2.2	1.0	3.7	2.5
1985	0.9	1.2	5.4	10.6
1986	1.0	1.0	6.9	29.1
1987	1.4	1.5	3.7	25.4
1988	0.7	0.8	3.7	25.0
1989	1.0	0.9	1.2	5.1
1990	1.3	2.4	5.6	18.1
+ 1991				
1992	1.4	1.4	4.9	0.7
1993	1.5	4.1	1.8	0.8
1994	1.9	1.6	1.0	0.6
1995	3.1	2.9	0.8	0.6
1996	1.3	2.8	1.5	3.6
+ 1997				
+ 1998				
1999	0.2	2.8	4.9	10.8
2000	0.13	2.8	10.37	24.5

+ - No survey carried out in this particular year.

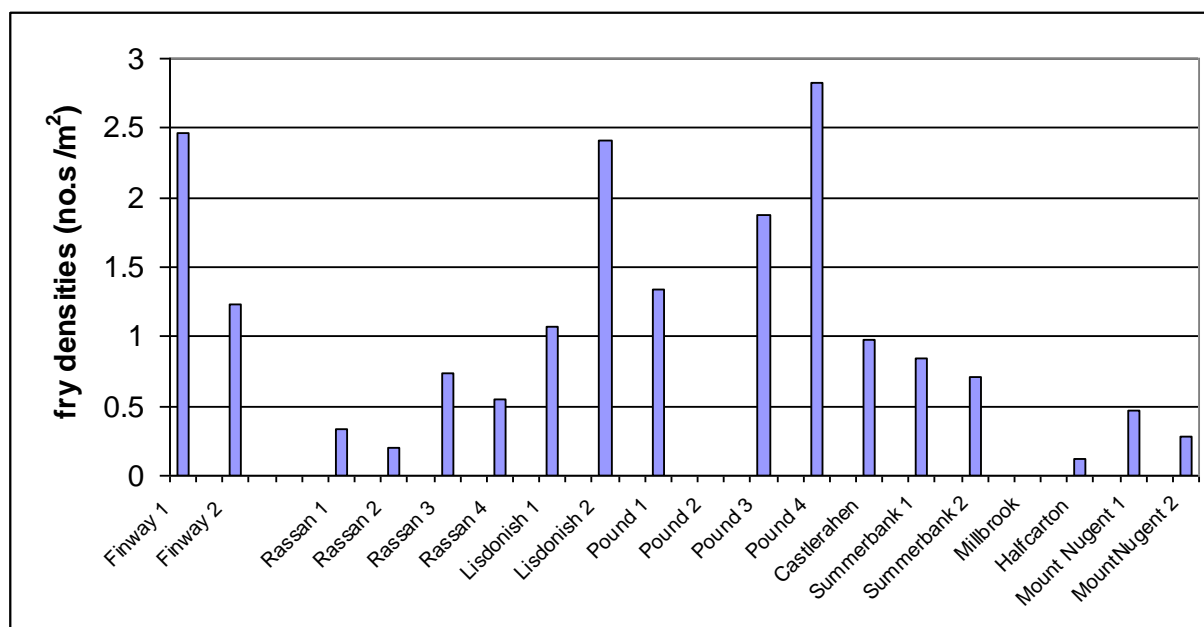
4. THE STATUS OF JUVENILE TROUT STOCKS IN THE LOUGH SHEELIN STREAM SUB-CATCHMENTS

A long-term monitoring programme of juvenile trout stocks at specific sites in this catchment has been in train for the last 15 years. Recently (1998/99) a more intensive evaluation of juvenile trout stocks have been undertaken as part of the TAM funded stream enhancement programme. A review of the polluted status of specific stream locations, on the basis of their macroinvertebrate populations, was also completed in 1998.

In summary, these data indicate the presence of moderate stocks (principally 0+ year-old trout) in most streams up to and including 1998 (Fig.10). This means that despite the substantial decline in adult trout stocks in the lake presently, there would still appear to be an adequate level of stock to fully spawn the catchment - ie circa 1000 adult lake trout would be adequate to fully spawn the 30km of productive stream catchment to L. Sheelin . However, a standing crop of ≥ 50000 adult trout in the lake would be necessary to provide reasonable angling catches.

Monitoring evidence from other T.A.M. stream development projects suggests that a 3 to 4 fold increase in the recruitment rates to juvenile trout to Lough Sheelin can be expected following the completion of the stream development programme.

Fig.10. Trout fry densities in the Lough Sheelin streams in 1998.



The completion of the T.A.M stream development programme could also have a very significant bearing on the survival rate of juvenile trout after they migrate to the lough. Post T.A.M (based on preliminary stream survey data), it is reasonable to assume that a very substantial increase in numbers of 1+ and to a lesser extent 2+ year old trout will migrate from their natal streams to the lough. The significance of this change in the life history pattern of Lough Sheelin trout is two fold,

i-Research has shown that a far greater proportion of 1+ and 2+ year old trout migrating to Irish lakes survive than do 0+ year old fish.

ii-In circumstances when then the zooplankton crop in the lake is very limited, either because of competition from roach or due to the dominance of blue green algae in the phytoplankton, these older trout (1+ and 2+ year olds) on migration to the lake can feed on a range of macroinvertebrates, thereby hopefully limiting the effects of temporary zooplankton shortages on their survival.

A review of the pollution status of the streams in 1998, indicated either clean, and/or moderately polluted conditions of a level which were not likely to depress the trout carrying capacity of the streams.

However, it must be stated that, until the cultural eutrophication problems are resolved and ecological stability restored to the lake the optimum survival of juvenile trout migrating to the lake is unlikely to be realised.

4.1. Redd Counts

Redd count data is available for selected stream reaches in the Lough Sheelin catchment annually since 1988/89 (Table 2). The figures for 89/90 and 90/91 were incomplete because of flood levels. Unfortunately no figures are available for 1998/99 and 1999/2000 because of the persistent floods throughout the winter/spring periods. Though both the authors and the Lough Sheelin staff have observed some level of spawning during these periods in parts of the Mountnugent and upper Inny catchments. These data suggest that the demise of the adult trout stock took place over the 1998/99 period and has continued into the 1999/2000 period. This suggests that the problems faced by the trout stock are in the lake itself, not in the stream catchments.

Great care needs to be taken when interpreting redd count data. In years when streams are heavily spawned, there will be many multiple redds, -ie., one large redd could be the product of one or many pairs of fish. This means that any annual redd count is no more than a qualitative evaluation of spawning effort. A redd count is of particular value when there is a complete collapse in the trout stock as was observed in Lough Ennell in the 1970's. At that time the redd count in the Lough Ennell streams virtually fell to zero. The indications from the Lough Sheelin redd count data, up to and including 1997/1998 are that no such complete collapse in the stock has occurred.

TABLE 2. Redd counts in the Lough Sheelin stream catchment (1988/89 – 1999/2000)

Year	Redd Count
1988/99	1573
1989/90	+
1990/91	+
1991/92	1457
1992/93	1850
1993/94	800
1994/95	1300
1995/96	3106
1996/97	3333
1997/98	2718
1998/99	+
1999/00	+

+ Complete count unavailable due to persistent flooding.

5. SUMMARY AND CONCLUSIONS

There has been a marked decline in the level of adult trout stocks in Lough Sheelin since 1999 compared to all previous years back to 1978. Available monitoring data is inadequate to pin-point the reason, or combination of reasons, for this decline. Factors which may have contributed to this phenomenon include the following:

i – Recruitment of Juvenile Trout

In the last dry summer (1995) substantial stocks of juvenile trout were evident in the streams in the late summer period. However, this drought continued into late October and could possibly have caused above average mortalities in stocks of 0+ and 1+ year old fish in the streams prior to their migration to the lake. This might explain why two current adult trout year-classes (5+ and 6+ year old) in the lake are poorly represented.

Although this theory might explain low numbers in the aforementioned age classes, it is not applicable to the overall adult trout stock in the lake. If this drought were the causative factor, then one would expect both significant numbers of 4+ and 7+ year-old fish to be resident in the lake presently – this is not the case. In addition, a recent (1999) survey of the Lough Ennell (a nearby water) trout stocks indicates moderate recruitment and subsequent survival to adulthood of juvenile trout which recruited to this lake from its stream catchment in 1995.

ii – Predation by Pike

The adult pike population in Lough Sheelin has been subject to a very considerable level of control over the last four years. The length frequency structure of the survey pike sample in 2000, indicates that overall control levels are still inadequate. This is due in large part to the continuous high recruitment rate of juvenile pike annually into the adult stock. This is a reflection of the absence of any control programme for juvenile pike in recent years. The current adult pike stock level in Lough Sheelin is capable of significantly impacting on trout stocks because of their marked preference for trout as prey items (see Section 3.3).

A review of the historical catch data in surveys for pike from 1978 to 2000 indicates certain definite trends. The smallest pike numbers were recorded in the 1978 and 1979 surveys. Thereafter C.P.U.E. values for pike fluctuated widely with the highest values being recorded in the late 1990's. This may relate to two factors:

- A. The fact that no control of juvenile pike has been in place for many years.
- B. Fluctuations in the level of netting effort annually for larger pike

There is no correlation, over this 22 year study period, between pike stocks and roach populations – i.e. when pike control was very limited in the early to mid 1990's roach numbers did not increase. In fact they declined markedly (see also Section 3.2).

iii – Fluctuating Roach, Perch and Trout Stocks

Following the first records of roach in the stock survey series in 1980, there have been very marked fluctuations in stock levels (see Section 3.2). There is also a clear correlation between roach and trout stocks, with adult trout numbers declining markedly during periods when roach were most abundant. No such correlation exists between roach and perch numbers.

A detailed study of roach, perch, trout and pike diets was carried out on Lough Sheelin over a period from 1982 to 1984. The availability of food items was also assessed at that time. This study concluded that there was “a significant correlation in diet between trout and perch, little or no correlation in diet between trout and roach and moderate correlation between perch and roach”. However, the authors of this study were cautious in their interpretation of these results for a number of reasons:-

- A. - The study did not include juvenile roach (≤ 16 cm), perch (≤ 14 cms) and trout (≤ 19.8 cms) all of whom would probably have been feeding on zooplankton.
- B. - The roach population in Lough Sheelin was only starting to expand at that time (see Fig. 3).
- C. - There was an abundance of zooplankton in the Lough at that time.

Other European studies have shown that an abundance of roach can seriously deplete zooplankton populations. It is therefore possible that a combination of circumstances in recent years (cultural eutrophication and expanding roach stocks) may have lead to severe interspecific competition between juvenile roach and trout at the zooplankton stage, to the detriment of trout stocks. No such effect is evident between juvenile roach and perch numbers. Studies in the European literature illustrate an ability of 0+ perch to change their

diet from zooplankton to macroinvertebrates if the need arises. There appears to be no published literature on the capacity of small trout in such circumstances to do the same. European studies on the interspecific competition of fishes for food in lakes have been largely confined to waters supporting mixed stocks of cyprinids and perch. The aforementioned study on Lough Sheelin and one study in Scotland are the only studies on mixed lake populations of trout, cyprinids and perch. The Scottish study was confined to a mixed trout/perch stock and therefore isn't relevant to cyprinid/trout relationships.

It is possible that a combination of factors including cultural eutrophication and fluctuating pike stocks have impacted on the lake trout population. Furthermore it is likely that poor zooplankton crops combined with an expanding roach stock may have depressed the survival of young (0+ and 1+ year-old) trout in Lough Sheelin in the latter half of the 1990's. In the past when roach were most prolific in Lough Sheelin (1984 to 1988) trout stocks were also depressed. However, the reduction in stocks at that time were not as severe as they are presently (Fig. 2 and 3). The difference in the rate to which trout numbers are depressed now (2000) compared to that in the 1984 to 1985 period could simply be related to a significant difference in available zooplankton crops during the two periods. There is no available data on either the species composition or relative abundance of zooplankton crops throughout the fish stock monitoring period (1978-1999), apart from a one study carried out from 1982 to 1984.

The biological status of Lough Sheelin has been extremely unstable, as a consequence of cultural eutrophication, throughout the fish stock monitoring period (1978 to 2000) (see T. Champ's reports). This instability must have impacted on all fish stocks periodically, both directly and indirectly. It is not possible, with available data to fully interpret the impact of this phenomenon on fish stocks. Some European studies suggest that cultural eutrophication trends in lakes will favour cyprinids rather than salmonid and coregonid fishes. Clearly the elimination of cultural eutrophication problems followed by the restoration of the lakes natural ecology is an absolute prerequisite to the recovery of the trout population

Research in Lough Erne in the early 1990's noted a marked decline in Pollan stocks when roach numbers were most prolific.

6. MANAGEMENT RECOMMENDATIONS

The problems facing Lough Sheelin presently are mirrored, albeit to a less serious extent to date, in virtually all of Ireland's wild lake brown trout fisheries.

Roach populations are established in Loughs Ennell and Corrib. In the last decade this species has also been introduced to Lough Leane, Lough Cullen, Lough Conn and Lough Mask. Roach in Lough Mask have access to Lough Carra.

Cultural eutrophication problems are also evident on Loughs Sheelin, Leane, Cullin, Conn and Melvin with minor problems of a similar nature, also evident on Lough Arrow and in a localised area of Lough Ennell periodically.

It is crucial that the cultural eutrophication problem on L. Sheelin be addressed. Unless ways are found to stabilise the lakes ecology its longterm future as a trout fishery must be in doubt.

In parallel with the pollution control programme a combined Central Fisheries Board and Shannon Regional Fisheries Board research and development (R&D) programme should be undertaken on Lough Sheelin to:

1. Pin-point the interspecific and intraspecific feeding relationship of resident fishes of all age groups to determine the level of competition particularly in relation to zooplankton crops. This would help us to understand why the juvenile trout recruitment to the lake in recent years are not surviving in significant numbers.
2. Collect detailed information, using a combination of radio tagging, acoustic, electro-fishing and netting techniques to examine seasonal movement patterns of fishes and help to quantify stocks, as a preface to further controlling roach and pike stocks. For example, currently we do not know the precise spawning areas for roach in Lough Sheelin. Both pike and roach are introduced fish species – ie they are not a natural part of our lakes ecology.
3. Continue the ongoing adult pike gill netting control programme. The availability of

at least four crews, seasonally, for this programme is critical. Supplement the gill netting programme with a lake electro-fishing programme designed to control 0+ and 1+ year old pike numbers. The Sh. R.F.B. have recently purchased such equipment. Trials with this equipment suggests that the use of one such unit on Lough Sheelin would probably be even more effective than a combination of the wire trap and rotenone operations, which proved successful in the past. Clearly the continuing high recruitment rate of young adult pike in the 1990's, points to the absolute necessity of using this technique. This electro-fishing methodology could also prove very useful in terms of assisting effective gill netting operations for adult pike, and perhaps assist in cropping spawning roach once their spawning grounds have been identified. It is also an ideal method for collecting fish samples in shallow water for dietary analysis.

4. Continue to monitor annually a selection of stream sites to check on juvenile trout stock levels.
5. Continue the annual fish stock monitoring programme using the same gill netting technique in use since 1978.
6. Take a series of sediment cores in the lake, to examine historical patterns in zooplankton standing crop and composition. Any changes in the zooplankton over the last 20 years should be reflected in the core samples. If changes have occurred it may be possible to relate these to fluctuations in cultural eutrophication and fish stocks over the study period (1978 to date)..
7. In the early to mid-1980's trawling operations using "half deckers" powered by 25 HP inboard diesel engines were used in the winter months in an attempt to control the expanding roach populations at that time. The highest cropping rate in any one winter period was 27 tonnes of roach – this was probably only a small fraction of the total standing crop – research in other European countries suggests that the roach standing crop in Lough Sheelin could, at times, be of the order of 1,000 tonnes. Further investigation indicated that this trawling operation was only removing fish from the younger adult year-classes – i.e. the trawls were not moving quickly enough to catch the older fish.

If this proposed research programme indicates that there can, at times, be serious competition between juvenile trout and roach at the zooplankton feeding level then there may be a necessity to control roach populations. Experience in Europe has also indicated that their control would also help to reduce the level of cultural

eutrophication – i.e. by reducing the “grazing pressure” of roach on zooplankton - the presence of large zooplankton populations can help to reduce phytoplankton levels..

Any such roach control programme will involve the use of either purse seine and/or trawling techniques. Clearly, larger boats than those employed in the 1980’s are required. Currently there is no expertise in the Fisheries Boards in this area. It is suggested that, with the possible assistance of relevant staff from B.I.M., that trials with suitably trained staff be run as part of this programme.

7. WHY SHEELIN?

The proposed programme, over an initial five year period, would have significant costs. However, as pointed out, the existing problems on Lough Sheelin may well be a preface to a similar suite of problems arising on most other Irish trout lakes (see Section 5). A greater data base is available on Lough Sheelin, over a longer period, in relation to fluctuations in fish stocks and fluctuations and impacts of cultural eutrophication on the lake, than is available for any other Irish (and most European) waters. It is likely therefore, that an interpretation of the results of such an R & D programme on Lough Sheelin, will be more revealing than on waters where little background information is available. The data would certainly be of significant value in relation to updating a strategy for the management of all Irish trout lakes in the future.

7.1. Costs and Benefits

The costs of this R & D programme would be significant. Currently, neither the Central or Shannon Regional Fisheries Board have either the personnel or the resources to undertake such a programme. It is likely that all costs to both Boards over the period of a five year programme would be *circa* £2.0m. The long term benefits of this catchment management exercise, incorporating biomanipulative techniques to maintain natural biodiversity and water quality, are very significant in a national context. It would form the basis of sustainable fishery management programmes for all Irish lake trout fisheries well into the future.

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