



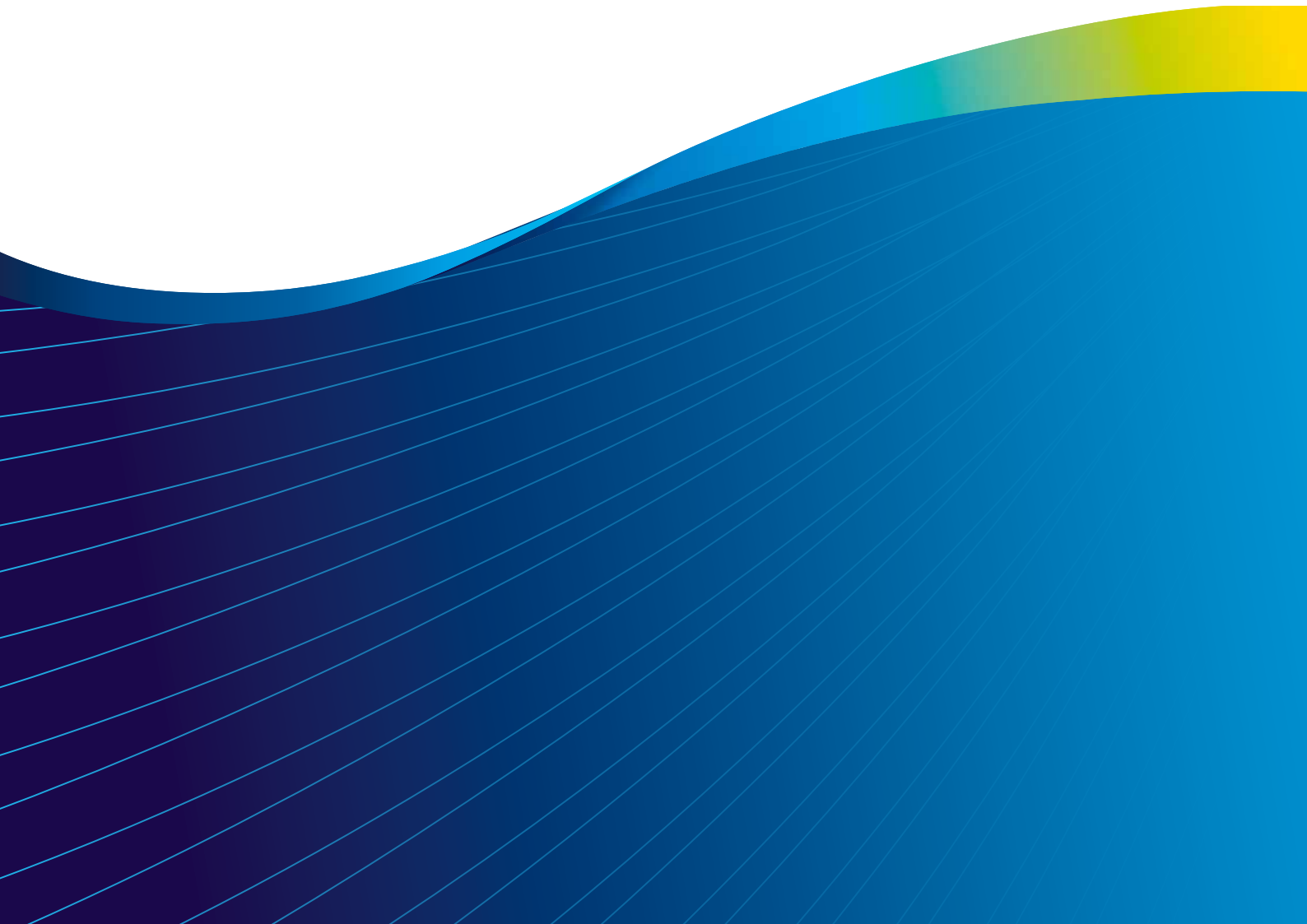
Energy for
generations

ESB FISHERIES CONSERVATION ANNUAL REPORT

(YEAR ENDING DECEMBER 2020)

A report on ESB Fisheries Conservation activities to the
Department of Communications, Climate Action and the Environment.

esb.ie



Contents

Introduction	4
Chapter 1	
The River Shannon	6
Chapter 2	
The River Erne	34
Chapter 3	
The Rivers Clady and Crolla	47
Chapter 4	
The River Liffey	52
Chapter 5	
The River Lee	53



Introduction

When ESB's hydro generation operations were established in Ireland, ESB took on the responsibility of managing, conducting and preserving the fisheries across the rivers where we work.

Our hydro generation stations continue to play a key role in reducing our carbon footprint under ESB's Brighter Future strategy and, once again, ESB has proudly carried out our Fisheries Conservation responsibilities under this strategy during 2020 and through the additional challenges presented by COVID-19.

Our Fisheries Conservation Team works across a wide range of activities each year, with particular focus on operating our three salmon conservation hatcheries, the river habitat restoration programme, the eel trap and transport programme, as well as our fisheries management activities.

The details of these activities for 2020 are included in this report. As always, this work has only been possible with the close support of many different groups, ranging from local angling clubs and community groups, through third level institutions (the National University of Ireland, Galway, University College Cork and Queens University, Belfast), to statutory bodies such as Inland Fisheries Ireland, The Marine Institute, The Department of Communication, Climate Action and Environment and The Department of Agriculture, Environment and Rural Affairs, Northern Ireland.

The support from these external bodies helped make sure that 2020 was a solid year for ESB Fisheries Conservation and will benefit the wider community for many years to come. On behalf of ESB, I'd like to acknowledge the support we've received from everyone and to express our sincerest thanks for doing so throughout 2020.

A handwritten signature in black ink that reads "Pat O'Doherty". The signature is stylized and cursive.

Pat O'Doherty,
Chief Executive, ESB

Notes

The River Shannon An T'Sionainn

Introduction

The River Shannon catchment area including that of the estuary covers approximately 17% of the area of Ireland. It is the longest river in the British Isles and has a total main channel length of almost 400km, of which 25% is estuarine. The lakes of the catchment are naturally productive and can be generally classified as either semi-enriched (mesotrophic) or enriched (eutrophic). Much of the main river channel is lake-like in character reflecting its size, regulated flow and low gradient (falling just 20m over 200km, south of Lough Allen). The largest of the Shannon lakes are Loughs Allen (35km²), Ree (105km²) and Derg (117km²), with the most important tributaries of the Shannon being the Boyle and Suck to the west and the Inny, Brosna, Little Brosna, Nenagh and Mulkear to the east.

Discharge on the River Shannon is regulated at Parteen Regulating Weir. Parteen Regulating Weir diverts water into a headrace canal supplying the 85MW Ardnacrusha generating station and allows a statutory compensation flow (10m³sec⁻¹), equal to the low summer flow before the Shannon scheme, to flow down the Old Shannon river channel.

Ardnacrusa generating station, constructed between 1925 and 1929, harnesses the 10,400km² of the catchment area upstream. During the 1930's, Ardnacrusha supplied almost 90% of the electricity needs but today it accounts for less than 3% of the Republic of Ireland's requirement. However, the ability to generate electricity at short notice when electricity demand suddenly increases makes it very important generation asset.

ESB controls the fishing rights of the entire River Shannon and the role of the maintenance and preservation of the entire fishery resources is undertaken by ESB Fisheries Conservation. The River Shannon fisheries are managed in co-operation with:

- Inland Fisheries Ireland (IFI)
- The Department of Communications, Climate Action and Environment
- The Marine Institute



The Ardnacrusha tailrace and main River Shannon rejoining at the Corbally area of Limerick city.

In addition to the above agencies, both angling and community groups are becoming increasingly involved. ESB extends this strong co-operative approach to the management of the Shannon fisheries with Inland Fisheries Ireland staff and the Shannon Fisheries Partnership Group. ESB also utilises the services of the National University of Ireland, Galway and the Marine Institute.

An outline of the various programmes of work that ESB Fisheries are involved in and the time periods involved are shown in Table 1.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Task
												Silver eel Trap and Transport
												Juvenile eel Trap and Transport
												Tree/Shrub clearance (NPWS)
												Instream habitat works
												Electrical fishing surveys
												Construction of fishing stands, styles, footbridges
												Adult broodstock trapping
												Stripping broodstock
												Hatchery egg to fry stage
												Restocking juvenile salmon (unfed fry, parr)
												Smolt release
												Fish Counters (Ardnacrusha and Parteen)

Table 1. The annual work programmes completed by ESB staff during the year.



An aerial view of Ardnacrusha Hydroelectric Generating Station.

The River Shannon Salmon Management Programme

With the initiation of the River Shannon Salmon Management Programme in 1990, ESB has been proactive in the conservation of the salmon population of the River Shannon. Prior to the Shannon Scheme, the river was renowned as a producer of large multi-sea winter salmon and grilse. With the advent of the hydroelectric scheme, there was a significant reduction of the spawning and nursery habitat in the Old River Shannon channel. In 1959, a Borland–MacDonald fish-lock was constructed at Ardnacrusha and a hatchery unit was constructed at Parteen Regulating Weir. Mitigation measures involved the restocking of the Shannon catchment with annual releases of juvenile salmon produced at this hatchery. However, although the Shannon scheme caused major changes for salmon in the river, the impact of extensive drainage schemes, water regulation and canalisation, intensive farming, afforestation and water pollution have also impacted negatively. Increased marine and coastal exploitation levels since the 1960's followed by the incidence of Ulcerated Dermal Necrosis (UDN), and more recently decreasing marine survival have also added to the reduction in numbers of self-sustaining stocks of salmon (Figure 1).



Flood waters at Parteen Regulating Weir during February 2020.

The overall purpose of the programme is to assist the recovery of wild salmon populations in the cascade catchment area, provide reared smolt to support the recreational fisheries in the Lower Shannon and to protect the biodiversity and ecological productivity of wild salmon populations in the Shannon catchment.

The more specific objectives of the programme were:

- To ensure that the maximum possible number of salmon enter the cascade catchment annually to spawn.
- To investigate fish passage issues for adult and juvenile migrating salmon. Specific areas to be investigated were:
 1. The efficiency rate of the Borland–MacDonald fish lift located in Ardnacrusha.
 2. Smolt passage through a Kaplan turbine located at Ardnacrusha was independently assessed based upon the results of a Heisey Tag test in 2004. The survival rate of smolt migrating during the annual Ardnacrusha salmon smolt generation protocol has been calculated at 89.4%
 3. To increase understanding of salmon populations using micro tagged batch releases of salmon parr, an extensive electrofishing programme and continued restocking of both unfed salmon fry and parr.
- To involve as many statutory and community groups as possible in the execution of the programme.
- An instream and bank side habitat development programme will be applied to selected catchments.

Since 1991, all hatchery reared smolt have been adipose fin-clipped and selected breeding lines have been micro tagged, thus allowing the separation of reared, wild, grilse and multi sea-winter adult salmon. The restocking programme since 1991 has moved to large scale unfed fry planting with the retention of a number of unfed fry for smolt production the following year. These unfed fry plantings are evaluated using electric fishing equipment. The performance of these unfed fry has generally been good compared to the first baseline survey (1990-1992).

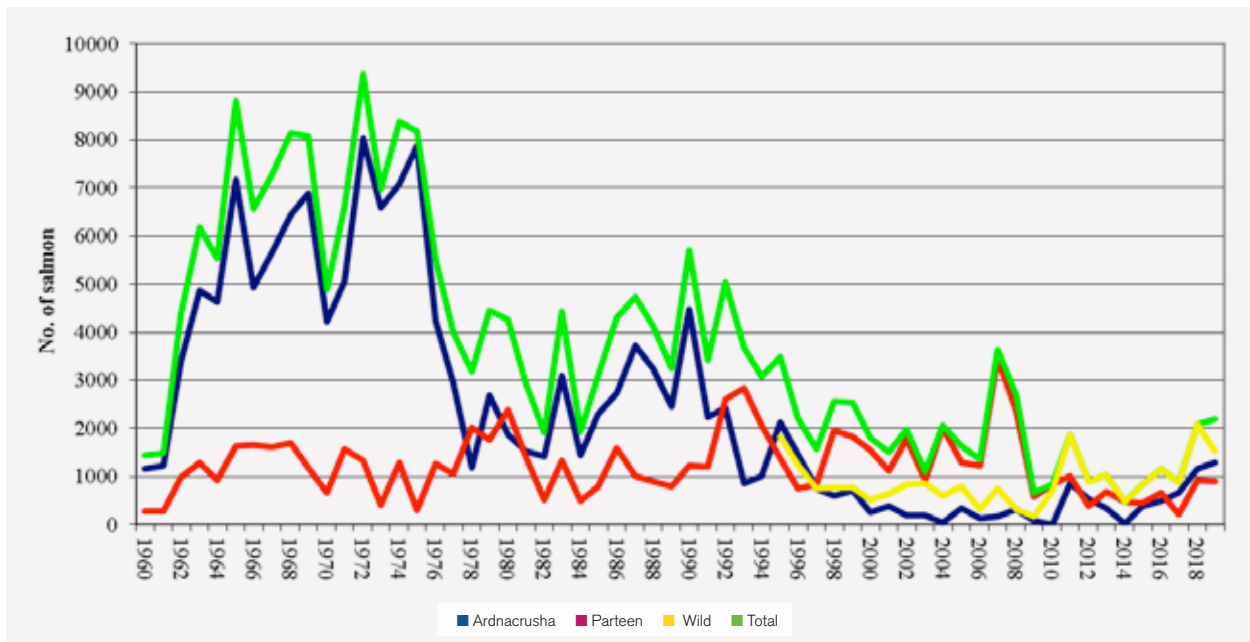


Figure 1. The number of ascending adult salmon through Ardnacrusha and Parteen Regulating Weir on the Lower Shannon catchment for the period 1960 to 2020.

The specific areas of the Shannon catchment which have been selected for habitat restoration works, are those catchments which have been previously drained and which presently suffer from having a homogenous canalised type of habitat, with a capacity of supporting a limited number of fish species and life stages. The list of sites to be worked upon is also reviewed by the Shannon Fisheries Partnership Group which is a partnership arrangement made up of ESB Fisheries Conservation, Inland Fisheries Ireland (IFI) and the Shannon Fisheries Development Company. The catchments worked upon in 2020 included:

1. McNamara's Lake (Lower Shannon).
2. Castleconnell (Lower Shannon).
3. The Little Brosna/ Camcor (Mid Shannon).
4. The Mulkear (Lower Shannon).
5. The Woodford River (L. Derg catchment).

Appropriate Assessments (AA) are carried out, the need for which originates from Article 6(3) of the EU Habitats Directive (Directive 92/43/EEC). This considers whether a plan or project, alone or together with other plans and projects, is likely to have significant effects on any European Sites. This is in view of best scientific knowledge and the conservation objectives of the respective sites. European Sites are those identified as sites

of European Community importance designated as Special Areas of Conservation (SAC) under the Habitats Directive or as Special Protection Areas (SPA) under the Birds Directive.

The first step of the AA process is to carry out a Screening for AA to establish whether, in relation to a particular plan or project, an AA is required. Article 6(3) states "Any plan or project not directly connected with or necessary to the management of the site but likely to have a significant effect thereon, either individually or in combination with other plans or projects, shall be subject to appropriate assessment of its implications for the site in view of the site's conservation objectives. In the light of the conclusions of the assessment of the implications for the site and subject to the provisions of paragraph 4, the competent national authorities shall agree to the plan or project only after having ascertained that it will not adversely affect the integrity of the site concerned and, if appropriate, after having obtained the opinion of the general public."

The provisions of the Habitats Directive have been integrated into the Planning and Development Act 2000 (as amended) and the European Communities (Birds and Natural Habitats) Regulations 2011 (as amended). In accordance with the aforementioned legislation, ESB Fisheries undertakes Screening

for Appropriate Assessment (AA) to assess, in view of best scientific knowledge and the respective conservation objectives for relevant European sites, if proposed works or activities, individually or in combination with other plans or projects would be likely to have significant effects on any European sites.

Each specific site work plan is drafted by IFI staff working in a partnership approach with ESB Fisheries Conservation staff. Where appropriate, the Office of Public Works (OPW) and the National Parks and Wildlife Service (NPWS) are notified of these works and a screening report for an Appropriate Assessment document is completed. Permission for access to the individual work sites are also requested from the local landowners and with the co-operation of the local angling clubs and other recreational riverine users.

Due to some of the selected areas having undergone arterial drainage during the past few decades, the individual plans aim to change the physical habitat from a drained homogeneous area towards re-creating a naturally heterogeneous habitat. Therefore, many stages of fish will be able to inhabit the newly formed areas and many species of fish will be able to populate a given stretch of river. All the areas being worked upon have a favourable water quality status to ensure the survival of the various fish population both during and after the habitat works.

The habitat work programme may be categorised into two different areas:

(1) Instream work: This work involves the recreation of the riffle-glide-pool sequence that would normally be representative of a healthy un-drained river. However, in many drained rivers this riffle-glide-pool sequence has been removed as part of the drainage process and the bed of the river has been altered and/or lowered. Thus, a homogeneous or 'canalised' river is what remains after the drainage work, which is unsuitable for a naturally balanced fish population. In general, the number of fish species occupying an area, and the number of individual fish is greatly increased if a variety of habitats are present. Instream works includes building stone vortex weirs and alternating deflector placement of random boulders, spawning gravels and rock armor bank protection. The timing of the works is very important as spawning fish may be present during the late

autumn to late spring months. Therefore, all instream works are scheduled for the period May to mid-September. The flood conveyancing capacity of each the rivers remains unaffected, as all in-river structures are designed and built to be submerged in high flow conditions without any damage to the structure or riverbank.

(2) Riparian/bank side work: This work is generally carried out during the winter months as tree pruning is prohibited under law during the bird nesting season. Works include the removal of excess overhanging vegetation, where it causes excessive shade or 'tunneling' of the river. Excessive tunneling by riverbank vegetation prevents light entering the river and thereby reduces the instream productivity. An example of this would be that aquatic plants would be absent where excess riverbank shade exists. Their absence would decrease the source of food for aquatic insects and there would also be a reduction in the amount instream cover available for resident fish to hide and develop individual territories when necessary.

The final task would be to fence the riverbank areas with post and wire, although provision is occasionally made for cattle drinking areas (depending upon land use and the landowner's view). Cattle drinking areas aim to provide restricted access to the river (within a discrete area), whilst preventing cattle trampling an entire river bank area, which thereby may cause later erosion. Provision is made for access to the river by footpaths, gates, footbridges, styles etc., but only after the prior permission of the landowner. Fencing is to the farming Glás scheme standard where required.

ESB habitat works completed during 2020.

ESB habitat works were completed at several locations during 2020. The following sections shows a selection of photographs which along with some text helps to explain the wide variety, scale and quality of the work completed by ESB fisheries staff. Where works were either uncompleted or partially completed in 2020 (due to unplanned changes such as the weather (rainfall/river discharges) or prioritisation of other ESB work, or where the progress of these works be slower than planned), these sites will be completed in 2021.

Mulkear

During October 2020, IFI carried out work on the angling structures already in place at the pumphouse in Annacotty, on the Lower Mulkear. In total, there were 13 structures that needed extensive repairs. Access to the Annacotty site was also cleared. Trees were

selectively removed along with all fallen trees and the access paths were cleared and made safe. Elsewhere, ESB staff also cleared footpaths and discrete sections of the river bank to allow angling access.



Before



During



After

The repair of a 12 ft angling access walkway carried out by IFI during 2020.



Several trees were removed by IFI staff during October 2020 to allow access to the Annacotty fishing stands.



An area of river recently cleared to allow access to the river.



Clearance of a footpath to allow access.



Clearance of a footpath to allow access.



Clearance along a Mulkear river access area.



An area of river recently cleared to allow access to the river.



A new stile alongside and old entrance on the Mulkear River.



The highly invasive Giant Hogweed plant on the Mulkear bank.



Access improvements on Mulkear river.

McNamara's Lake

McNamara's Lake has been extensively upgraded by ESB staff over the past few years. In 2020, there was

general maintenance of the area and the erection of bird nesting boxes.



Vegetation growing adjacent to the footpath at McNamara's Lake.



A lifebuoy adjacent to McNamara's Lake.



A paved section of footpath at McNamara's Lake.



The angling access and fishing pontoon located at McNamara's Lake.

The Little Brosna (Camcor)



A stile and footpath located along the banks of the Camcor River.



A section of footpath along the Camcor River.



Examples of established footpaths along the banks of the Camcor River.



Examples of established footpaths along the banks of the Camcor River.



Examples of instream wooden debris which has been left in the Camcor River.



Examples of a 'kissing-gate' (midground) and footbridge (background) on the Camcor River.



The access path to the footbridge on the Camcor River.



A seating area located on the banks of the Camcor.



A newly cleared footpath on the banks of the Camcor River.

Castleconnell

Habitat improvement and angling access works were completed throughout Castleconnell during 2020. Work was carried out along the riverbanks where some selective clearance was undertaken. The spraying of emerging Giant Hogweed with glyphosate was undertaken by the Castleconnell Fishery Association (CFA). Giant hogweed is one of the first plants to emerge and in 2020 the CFA had persons (courtesy of the Castleconnell CE scheme), committed to the program for the months of April and May. The

best return from this selective spraying is during the early months before other growth catches up. Volunteers from the CFA also 'adopted' a stretch of river to identify straggler plants and spray them in later months. Around June/July the CFA sprayed the other highly invasive non-native plant, the Himalayan Balsam, which was present but not as pervasive. This was mainly done at the bottom of the fishery (Beat 5 and 6).

Woodford River

During 2020 habitat works were carried out by an ESB contractor along a short stretch of the Woodford River, alongside the Woodford GAA pitch in Co. Galway. This section of river was subject to bankside subsidence. Instream structures had been constructed in previous

years along with a fish pass to overcome the presence of a low-head stone barrier located immediately above the bridge, Rock armor was added for an approximate length of 300 metres and the area was re-fenced and gravel laid to allow for public viewing of the area.



The Woodford River in high flows with a series of instream stone weirs and rock armor along the near side of the riverbank.



The Woodford River in high flows with a series of instream stone weirs and rock armor along the near side of the riverbank.



The newly erected fence and gravel at the public viewing area alongside the Woodford River.

River Shannon Salmon Breeding and Genetics Programme

The Parteen Salmon Breeding Programme was initiated in 1990 and is carried out under the supervision of NUI, Galway. The mass selection-breeding programme involves two main breeding lines (grilse or one-sea winter fish, and Multi-Sea Winter (MSW) fish), that have been held separately since the start of the Programme. These two fish types are bred and reared separately at the hatchery prior to release to the sea as smolts. The two main objectives of the programme were to:

- Use selective breeding to significantly increase the percentage of fish returning as MSW salmon.
- To increase the weight of both MSW and grilse salmon.

Grilse lines, which were specifically bred for an increased size and weight, have given the expected improvement in the selected trait for fish captured at sea and those returning to the hatchery. Once the selective breeding programme was initiated in 1990 the proportion of returning two sea-winter spring fish increased dramatically with up to 66% of all females being two sea-winter fish. However, for males the return rate was, and remains much lower, so much so that they are often in short supply for breeding purposes.

In summary, the River Shannon salmon breeding programme at Parteen since 1990 has:

- Established pedigreed grilse and two-sea winter lines of salmon returning to the River Shannon.
- Increased significantly the proportion of two sea-winter salmon in the return to the River Shannon and to the hatchery.
- Proved that selective breeding can increase significantly the size and weight of returning grilse.
- Provided hypotheses to explain the inheritance of maturation phenotypes in salmon.
- Shown that males grow faster than females at sea.
- Given an indication that females return to the coast earlier than males.
- Provided pedigreed salmon for breeding experiments and stimulated further genetic research on salmon.

Future breeding protocols will be aimed at increasing the genetic variability within the selected two sea-winter lines by crossing between year classes. Inevitably, some of the gains achieved so far will be reduced, but it will ensure the genetic health of the lines for the future.

The genetic sampling of all returning hatchery bred fish and the hatchery fish used in the brood stock programme continued in 2020. The sub-sampling of the fish classified as wild also continued but was restricted when compared with previous years. In respect to the former, a collection of samples, from which DNA can be retrieved, exist now for every fish returning to the hatchery between 2010 and 2020. The combination of this material, in addition to information on each individual's size, sex and age, including potentially information on individual parentage, make this a very valuable resource for research and ultimately for the management of the hatchery programme.

Salmon Rearing and Restocking

Parteen Hatchery

Parteen hatchery was constructed at Parteen Regulating Weir in 1959 and was extended in 1970. A phased refurbishment project was initiated in 1997 and the hatchery now has a capacity to incubate up to 4 million salmon ova with an upper limit of 400 pairs of salmon. The hatchery infrastructure has been improved further with the provision of a new water intake line and filtration system. In addition, a new food control sequence for feeding fish was added. Approximately 90,000 adipose fin-clipped smolt are released each year as part of the ranching programme. The main goal of the conservation hatchery is to assist the recovery of wild salmon populations upstream of Parteen and Ardnacrusha and secondly to increase knowledge of salmon using an educational centre. An educational centre located at the hatchery provides a resource for visiting school tours and other interested parties. Present management of the ESB hatchery has continued to be of a high standard (ISO 14001).

Over the past 30 years, surplus ova and juvenile salmon have been used at both national and international levels to help restore salmon stocks of the Rivers Erne, Lee, Deel and the Rhine, Meuse and Thames. In the past, large numbers of Shannon ova were supplied to

outside agencies. The use of Shannon ova in these European salmon restoration schemes promotes international fisheries co-operation and Ireland's unique freshwater fisheries resource. However, in more recent times the Shannon hatchery stock have been used exclusively for the restoration of Shannon salmon stocks.

Production of Ova, Unfed Fry, Parr and Smolt

Juvenile salmon restocking of the Upper Shannon catchment was carried out in 2020. The Little Brosna and Big Brosna rivers were restocked with autumn parr during October 2020. A total of 103,325 parr were released (Little Brosna River: 42,547 and the Big Brosna: 60,778). As many wild salmon spawn within the Lower Shannon catchment area (particularly Lough Derg), there have been no release of hatchery juvenile salmon within the 'Lower' Shannon area for many years.

Date of release	Salmon type		
	Multi-Sea-Winter	Grilse	
April	27,326		Fin clipped and tagged
April		71,128	Fin clipped

Table 2. The number of salmon smolts released from Parteen hatchery in 2020.

A total of 98,454 fin-clipped salmon smolts were released using a fish pump from Parteen hatchery during April 2020 (Table 2). Of this total, 27,326 were

multi sea-winter (MSW) smolt and 71,128 were grilse (one sea- winter fish).

Adult Salmon Census for 2020

The number of salmon are assessed entering the Upper Shannon catchment using two automatic infrared Vaki 'Riverwatcher' units located at the upper exit point of the Borland fish lift located at Ardnacrusha generating station and on the Parteen Regulating Weir fish pass. An upstream adult salmon trap is also situated on one of the pools of the Parteen Regulating Weir fish pass which is used to collect ranched salmon for the period late September to December. Due to Ardnacrusha and Parteen Weir fish counter malfunction, there was no 2020 counter data.

The return of adult salmon to the trap located at Parteen hatchery is shown in Figure 4. The adult salmon trap operated for the period 28th September to the 22nd of December with free passage allowed for all fish before and after this period. The monthly capture of hatchery and wild salmon is shown in Figure 3.

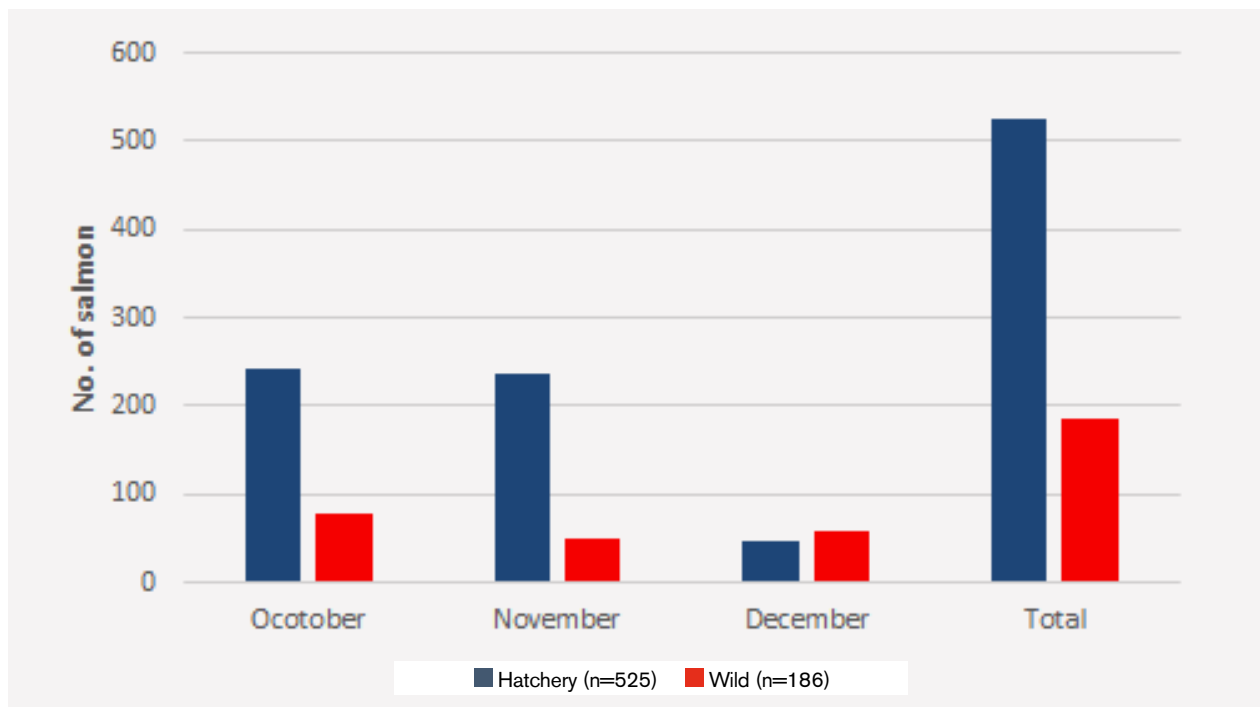


Figure 3. The number of salmon that were captured during 2020 using the adult salmon trap located at Parteen Regulating Weir.

Both fish passes operated fully during the year. It should be noted that at present, it appears nationally and internationally as if very low marine smolt survival rates are having a serious negative effect upon Irish salmon populations.



An Inland Fisheries Ireland patrol at the Ardnacrusha tailrace in April 2020.

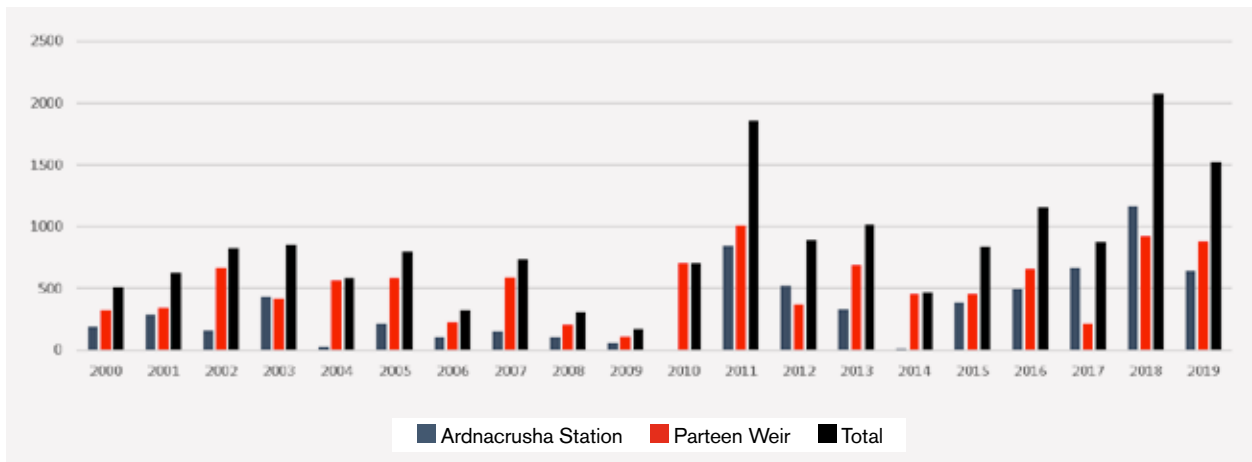


Figure 4. The number of ascending adult wild salmon through (a) Ardnacrusha and (b) Parteen Regulating Weir on the Lower Shannon catchment for the period 2000 to 2019.

A comparison with more recent years is shown in Table 4

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014#	2015	2016	2017#	2018	2019	2020
Ardnacrusha Station	190	286	157	433	25	216	102	150	105	62	-	848	523	328	10	385	493	665	1161	638	-
Parteen Weir	320	343	670	422	563	583	224	589	203	112	706	1011	371	689	457	455	660	210	920	883	186
Total	510	629	827	855	588	799	326	739	308	174#	706	1859	894	1,017	467#	840	1,153	875	2081	1521	186

Table 4. The number of wild salmon ascending the R. Shannon from 2000-2019. Full census data is only available for 2009-2020. # The Ardnacrusha census data for 2009, 2014, 2017 and 2020 were partial counts.

Trout and sea lamprey movements are normally recorded on the Vaki Riverwatcher, which is situated on the upper side of the Borland-MacDonald fish-lock at Ardnacrusha station. However, during 2020 both fish counter malfunctioned and no census data was recorded. Three species of lamprey occur in the Shannon catchment namely the Brook, River and Sea lampreys. Brook lampreys are widely distributed throughout the catchment being routinely recorded in Shannon ESB operated catchment electrofishing surveys. The anadromous sea and river lampreys appear to be confined mainly to the Lower River Shannon. Movements of both river and sea lampreys are normally recorded at Ardnacrusha and Parteen Regulating Weir where they ascend through the fish-lock and fish pass. However, it is thought that many lamprey ascend through the Ardnacrusha fish lock and the Parteen Weir fish pass without being counted as they move through the stainless-steel bars which hold the infra-red scanning units rather than between the scanning units. During 2020, adult sea lamprey were again observed within the lower sections of the Parteen fish pass and in the lower reaches of the Kilmastulla River.



A view of the Parteen Weir fish pass.

Characteristics of hatchery broodstock collected at Parteen during 2020

Identical Grilse and MSW (Multi-Sea Winter) designation characteristics are used for Parteen, Carrigadrohid and Ballyshannon hatcheries. These characteristics are that females up to 71cm and males up to 84cm are considered to be one sea-winter (1SW) or grilse, whereas salmon larger than these are considered to be MSW salmon.



One of the new angling signs on the Castleconnell fishery for the 2020 Season.

Performance of the Shannon Fisheries

Recreational salmon fisheries of the Shannon

The main salmon recreational fisheries are located on the Old River, between Parteen Weir and Limerick City. The most famous of these is the Castleconnell fishery. Up to 2016, the Lower R. Shannon operated on a catch and release system for all wild salmon, whereas a bag-limit operated for hatchery salmon. For 2020 the River Shannon was open for 'catch and release' of salmon. It was 'open' for trout and coarse fishing.



An IFI jet-ski patrol on the in the O'Briensbridge area in January 2020.

Fisheries Protection and Regulation

For the 2020 season, Inland Fisheries Ireland (IFI) staff were engaged by ESB Fisheries Conservation to provide fishery protection services on the Lower Shannon and Mulkear Rivers. IFI is also responsible for the protection of all trout and coarse fish in the Managed Fisheries (the Suck, Brosna, Little Brosna, Camlin and Inny Catchments). Some on-the-spot-fines were issued for minor offences in both fisheries

and several nets were seized. IFI staff responded to several calls about illegal fishing and successful prosecutions were taken.

ESB is committed to working with all Government Agencies including An Garda Síochána, Local Authorities, Environmental Protection Agency and the National Parks and Wildlife Service and Angling Groups in seeking to educate and identify those at risk of damaging the fishery environment.



Very high water on the Castleconnell fishery at the Castle Oaks footbridge in the first week of March 2020.

The National Eel Management Plan and the ESB / NUIG Scientific Programme

The River Shannon is Ireland's largest river, and its extensive lake ecosystems offer some of the country's best eel habitat. It has been the focus of much of the eel population studies in Ireland to date.

During the 2020/2021 season, conservation eel fishing was conducted at three sites, two at Athlone, and one at Killaloe (Figure 5). Fishing began on 7th September at Athlone and 1st November at Killaloe. Fishing ceased at Athlone on 23rd November but continued at Killaloe until 31st December. It is anticipated more fishing will occur at Killaloe in January 2021. A total of 12,849 kg of eels were caught at Athlone, and a further 8,380 kg have been caught to date at Killaloe, giving an overall trap and transport catch of 21,229 kg (Figure 6).

Daily catch rates at Killaloe are shown in Figure 7, along with variation in discharge along the old river channel and the headrace canal leading to Ardnacrusha hydropower station. Discharge was relatively consistent throughout the season, but high catch rates occurred during the dark lunar phase in November.



Figure 5. Map of River Shannon catchment with conservation fishing sites, release point and hydropower dams indicated

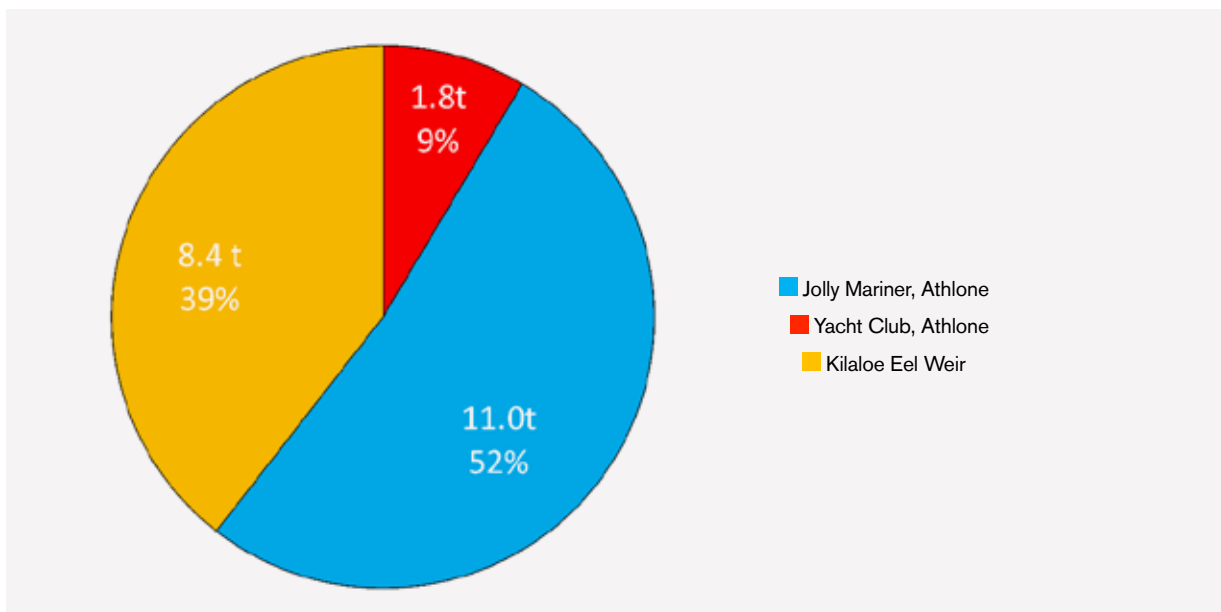


Figure 6. Proportions of the River Shannon trap and transport catch obtained by each fishing crew in the 2020/21 season.

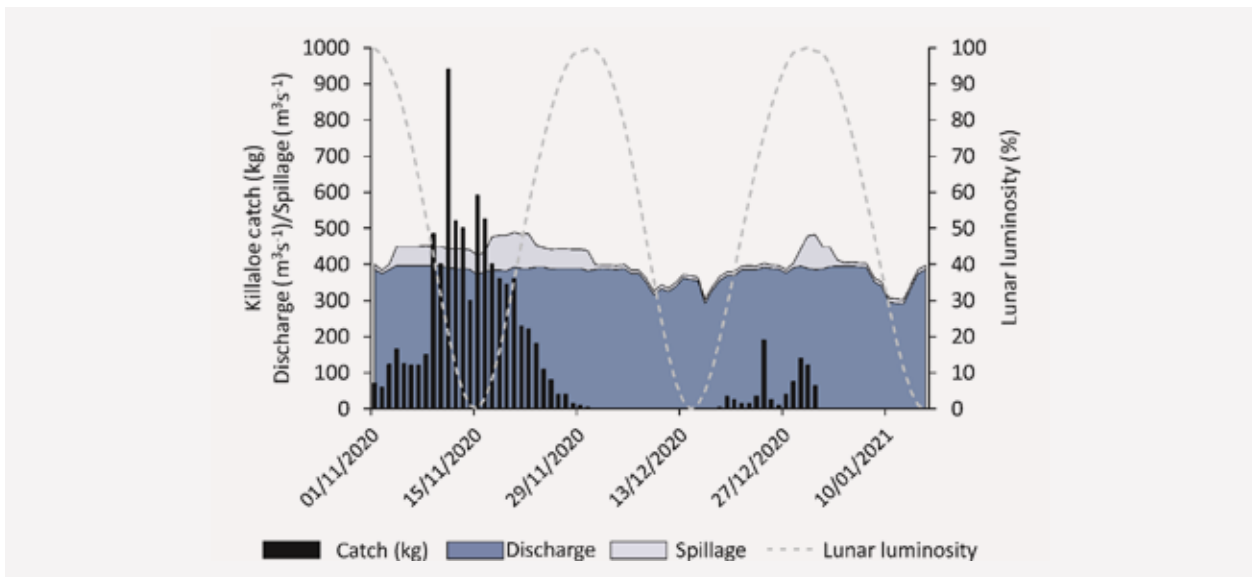


Figure 7. The seasonal variation in daily catches at the Killaloe eel weir during the 2020/21 fishing season together with variation in discharge via Ardnacrusha and as spillage to the Old River Shannon channel.

Production and escapement figures for the River Shannon are summarised in the flow diagram (Figure 8). Production of 41,548 kg is estimated by the trap and transport catch at Killaloe using the fishing efficiency rate of 29.2%, together with the catch from the two Athlone sites. This fishing efficiency rate is based on Mark-Recapture experiments ($n = 14$) conducted by NUIG from 2016/17 – 2019/20. In total 21,299 kg (51.1% of production) was moved beyond the hydropower station through trap and transport. Of the 20,319 kg that moved beyond Killaloe weir, it is estimated that 2,645 kg (13.0%) migrated via the Old River Channel. This is determined by the amount of spillage to the Old River Channel, using a regression model based on historical telemetry studies of route selection. An estimated 21.15% mortality (3,738 kg) at Ardnacrusha hydropower station of the 17,674 kg that entered the headrace, leaves 13,936 kg progressing downstream. This gives an escapement of 37,810 kg, or 91.0% of production. A comparison with previous years is shown in Table 5.

Size frequencies of 469 eels measured at Killaloe are shown in Figure 9. In total, 86.1% of the eels measured were determined to be female. The mean length of eels measured from the River Shannon was 591 mm ($n = 469$, $SD = 121$ mm). The mean length for females was 626 mm ($n = 404$, $SD = 88$ mm) and for males was 377 mm ($n = 65$, $SD = 22$).

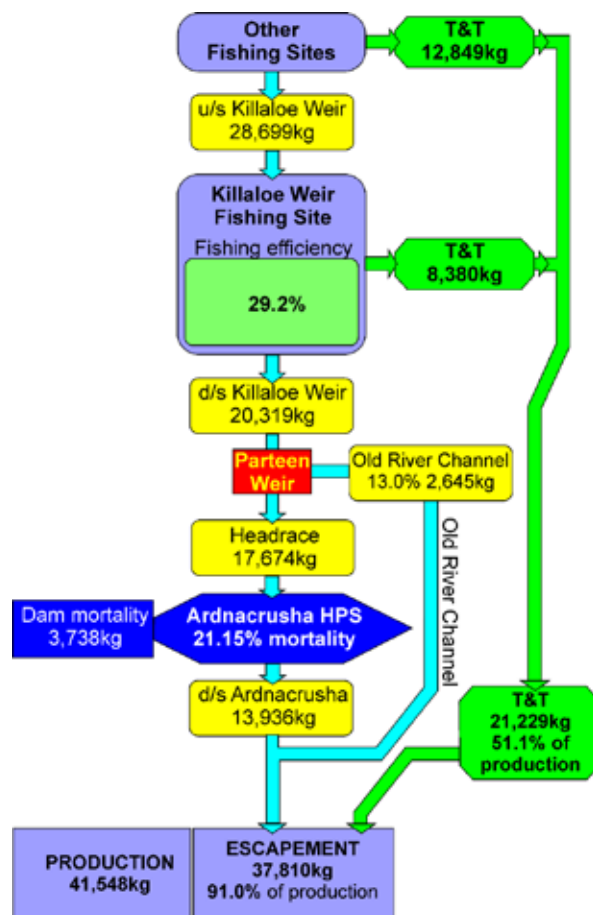


Figure 8. A summary of the analysis of silver eel production and escapement in the River Shannon during the 2020/2021 eel migration season.

Year	Production (kg)	Escapement (kg)	% of Production
2020/21	66,631	37,810	91.0
2019/20	38,028	33,189	87.3
2018/19	32,850	29,613	90.9
2017/18	34,139	31,191	91.4

Table 5. Production and escapement estimations on the River Shannon for 2020/21 and corresponding values for previous seasons.

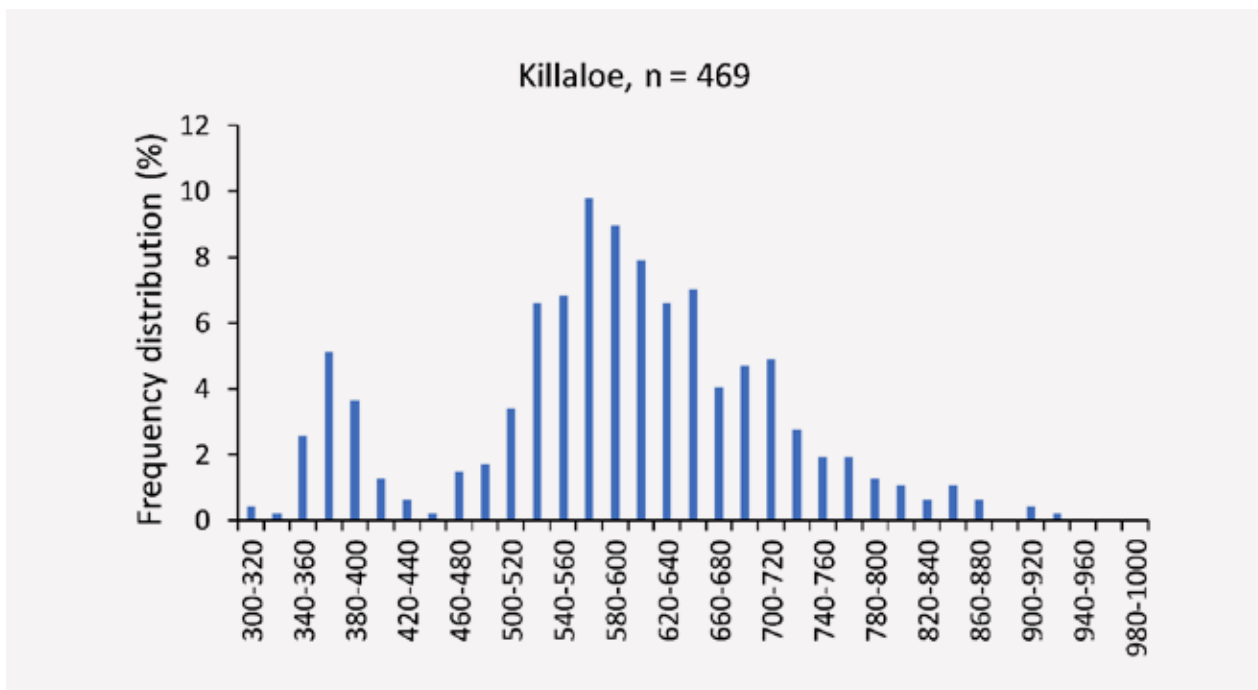


Figure 9. Relative size-frequency distribution of eels from Killaloe measured during the 2020/21 season.

The Shannon Juvenile Eel Programme

ESB have been capturing upward migrating juvenile eel at several Lower Shannon locations for many decades. In recent times, efforts have been concentrated at Ardnacrusha station and Parteen Regulating Weir. The three Parteen Regulating Weir and three Ardnacrusha located juvenile eel traps were put into service on the 16th March 2020.

Fishing activity ceased at sites on a phased basis over the period 21st August to the 16th September. A total catch of 1,172.57kg were captured and transported during 2020 (Table 6). This compares to a total of 413.4kg and 1,402.5kg for 2019 and 2018. The catches of juvenile eel (1,059.7kg) at Parteen Regulating Weir were a mixed catch of fingerling eel and elver. All catches of juvenile eel are released into the Shannon catchment above Ardnacrusha station and Parteen Weir. The results of the 2020 elver catches again show the Shannon catch to be in decline (along with the European trend). The trapping of juvenile eel will continue in 2021. The Ardnacrusha elver traps have been extensively refurbished over the period 2017-2020. This refurbishment included;

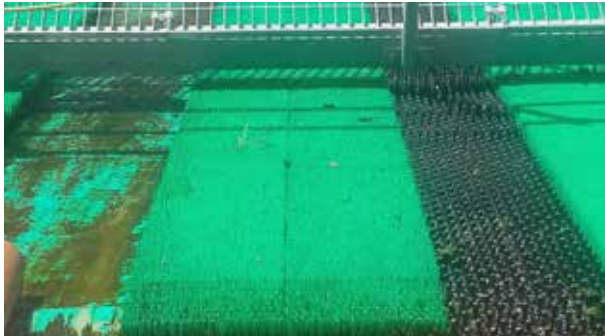
- The provision of increased water supplies at a variety of differing locations to the old Ardnacrusha elver ramp trap. Water from existing discharge points were also diverted and now discharge close to, or onto the ramp area. This increased discharge helps attract juvenile eel to the main trapping area.
- The provision netting at all sites to deter avian predators.
- A walkway was added to allow easy access to the large ramp area. This will also allow regular servicing/maintenance of the site.
- The replacement of the older matt climbing substrate with a new bristle type of matt substrate. These bristle matts are of varying spacing intervals which therefore facilitate juvenile eels of varying length and climbing abilities to access the traps.
- New elver traps (see photographs), were added at two locations. These were designed to allow for differing bristle matt spacing sizes to reflect the different sizes/ages of the upward migrating juvenile eel.

	Parteen Weir			Ardnacrusha		
	Old trap (fish pass)	New trap (fish pass)	Middle bank	Large trap	Fish pass trap	Mechanical workshop trap
March (16/3/2020)	0	0	0	0	0	0
April	0	0	0	0	0	0
May	30.7	0	0	29.12	0	0
June	63.75	0	0	30.35	0	0
July	34.46	0	0	6.96	0	0.1
August		8.5	0.1	45.54	0.2	0
September (16/9/2020)	0.45	Trap closed	Trap closed	0.44	Trap closed	Trap closed
Total catch	1,051	8.5	0.1	112.4	0.2	0.1

Table 6. The catch of juvenile eel at the three ESB operated locations for 2020. The entire catch of 1,172.57kg were released into the Shannon catchment above Parteen Regulating Weir and Ardnacrusha Generating Station. These catches represent both elver and larger juvenile or 'bootlace' eel (particularly those captured at Parteen Regulating Weir).



Before and after views of the Ardnacrusha elver trap with the new elver climbing substrate and water supplies added. Also included are a new walkway, attraction flow and diversion of existing flows onto the ramp area. A new elver collection box was also added to facilitate the trapping of elvers from the area in front of the Borland Fish lift.



A photograph showing new elver climbing substrate of differing dimensions to facilitate the differing lengths/ages of the upward migrating juvenile eel.



An aerial view of the upgraded Ardnacrusha elver trapping facilities.



A new elver trap located downstream of Ardnacrusha on the north bank.



The 'new' and 'old' juvenile eel traps located on the Co. Tipperary bankside of Parteen Regulating Weir.



Juvenile eel within the box on one of the elver traps located at Parteen Weir.

River Erne An Éirne

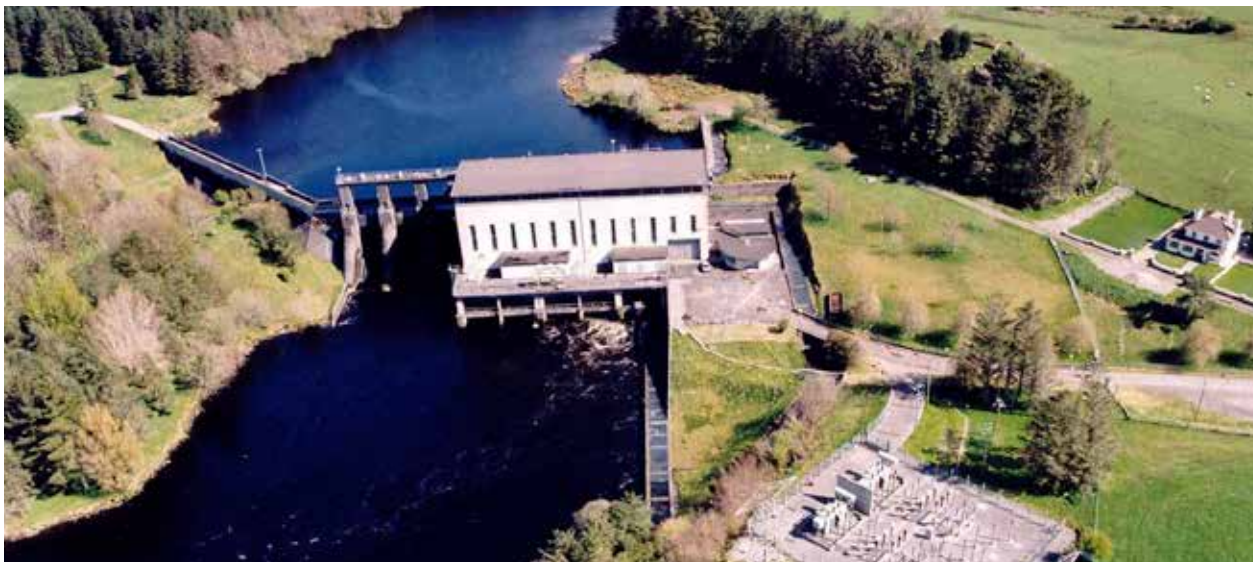
Introduction

The River Erne is a transboundary river system, with large stretches in both Northern Ireland and the Republic of Ireland. It has a catchment area of 4,374km², rises in Co. Cavan and flows for almost 100km through Loughs Gowna and Oughter and Upper and Lower Lough Erne before entering the sea at Ballyshannon, Co. Donegal.

The hydroelectric scheme was constructed during 1946-1955 and consists of two generating stations. The capacity of the Erne scheme today is 20MW at Cliff and 45MW at Cathaleen's Fall. The hydro scheme involved major drainage works within the mid-catchment area and significant cross border

co-operation during its construction. A total of 98.8% of the catchment area is harnessed for hydroelectricity generation. The scheme also involved the creation of Assaroe Lake (2.3km²) between the two hydroelectric installations. The River Erne has an average annual flow of 98.1m³sec⁻¹.

ESB own the fishing rights in the Lower River Erne, Assaroe Lake and some tributaries in Co. Donegal. The remaining catchment area of the Erne is under the control of the Department of Agriculture, Environment and Rural Affairs (DAERA, Northern Ireland) and Inland Fisheries Ireland (IFI).



An aerial view of Cliff station, on the River Erne.



A downstream aerial view of Cliff station, on the River Erne with Assaroe Lake in the background.



An aerial view of Assaroe lake and Cathaleen's Fall station on the Lower River Erne with Ballyshannon town and the Erne estuary in the background.

The River Erne ESB Salmon Work plan

Prior to the Erne scheme, the Lower River Erne was famous for its salmon angling and contained an extensive spawning and nursery habitat. The annual numbers of salmon entering the Erne system remained at a high level until the late 1960's, but thereafter fell to lower levels (Figure 10).

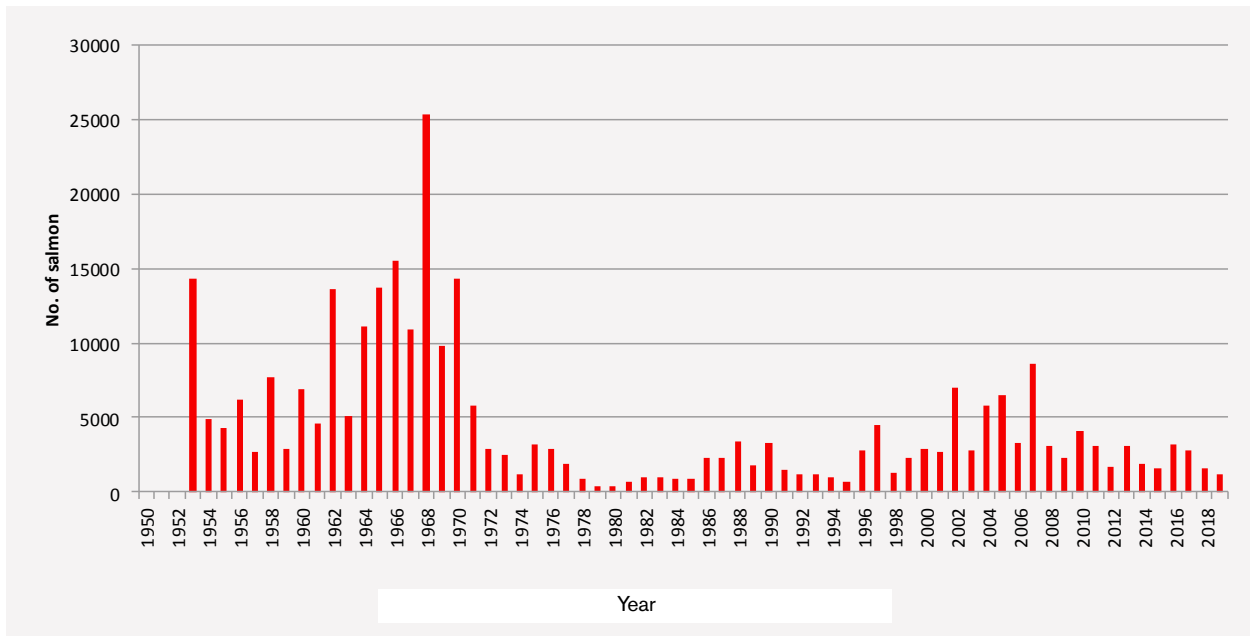


Figure 10. The number of salmon ascending the fish pass at Cathaleen's Fall hydroelectric generating station on the Lower Erne from 1953 to 2019. No census data was available for 2020.

However, although the Erne scheme caused major changes for salmon in the river, particularly within the lower reaches between Belleek and the sea, the impact of extensive drainage schemes in the middle and upper catchment areas, water regulation and canalisation, intensive farming, afforestation and extensive water pollution have also impacted negatively. Increased marine and coastal exploitation levels since the 1960's followed by the incidence of Ulcerated Dermal Necrosis (UDN), and more recently decreasing marine survival have also added to the reduction in numbers of self-sustaining stocks of salmon.

The River Erne Salmon Management Programme was initiated in 1995. It was a cross border programme set up to address the problem of low salmon runs in the Erne catchment. The programme was funded through European Union Interreg II and was comprised of several partners in Northern Ireland and the Republic Ireland. A list of recommendations was produced by the scientific steering group for the future work necessary to achieve the aim of a self-sustaining wild population of salmon and thus, to establish a high-quality rod fishery. Arising from these recommendations, an ESB

Fisheries Work Plan was formulated to list and assess the various areas that ESB is directly involved in. These areas are:

- The restocking and ranching activities of the Ballyshannon Hatchery.
- Juvenile salmon passage.
- Adult salmon passage.

Ballyshannon Hatchery

Ballyshannon hatchery has been operating since 1983 and is located immediately downstream of Cathaleen's Fall generating station. The water intake for the hatchery is taken at 4.2m depth from Assaroe Lake. Hatchery operations in the past have been affected by poor water quality in the Lower River Erne. The addition of a 'Bermuli' filter and a sand-pressure filter unit to the fish farm and hatchery building unit intake has resulted in greatly improved water quality, thus resulting in the production of higher quality ova, unfed fry and juvenile salmon. The current annual target production for this facility is approx. 1.5 million unfed fry and 50,000 - 60,000 smolts for release into the Erne catchment.

River Erne Breeding Programme and the characteristics of brood fish collected at Ballyshannon during 2020

The current breeding programme at Ballyshannon, which is carried out under the direction of NUI, Galway, utilises Erne ranched salmon and these have been divided into two groups: Grilse and multi sea winter (MSW) salmon. These two lines are held separately, and mating is on a one to one basis to ensure genetic diversity. The designation characteristics for returning adults salmon are that females up to 71cm and males up to 84cm are considered to be one sea-winter salmon (1SW) or grilse, whereas salmon larger than these are considered to be multi sea-winter (MSW) salmon. A total of 1,347 hatchery salmon were taken as broodstock in October – December.

Production of Ova, Unfed Fry, Parr and Smolt

During 2020, a total of 552,463 juvenile salmon were produced from the 2019 adult salmon broodstock returns. The release locations of 502,000 juvenile salmon and the months of release are given in Table 7. A total of 50,463 adipose fin-clipped salmon smolt were released from Ballyshannon hatchery during April 2020. As the return of adult hatchery broodstock was high towards the end of 2020, the ‘excess stock’ were released into the Colebrook and Swanlinbar River systems in December.

Month		Stock Stage	Release Catchment	Fish No.
April		Unfed-Fry	The Glenfarne River (ROI)	116,000
April		Unfed-Fry	The Swanlinbar River (ROI)	109,000
May		Unfed-Fry	The Termon River (ROI)	44,000
April		Unfed-Fry	The Waterfoot River (ROI)	35,000
Total				304,000
April	Sinclipped & microtagged	Smolt	Ballyshannon hatchery	11,471
April	Finclipped	Smolt	Ballyshannon hatchery	3,484
April	Finclipped	Smolt	Ballyshannon hatchery	35,508
Total				50,463
July		Fry	The Colebrooke River (NI)	70,000
July		Fry	The Claddagh River (NI)	30,000
July		Fry	The Swanlinbar River (NI)	68,000
July		Fry	The Arney River (NI)	30,000
Total				198,000
December	Male	Adult hatchery broodstock	The Colebrook River (NI)	100
December	Female	Adult hatchery broodstock	The Colebrook River (NI)	100
December	Male	Adult hatchery broodstock	The Swanlinbar River (ROI)	246
December	Female	Adult hatchery broodstock	The Swanlinbar River (ROI)	171
Total				617

Table 7. Details of the numbers of juvenile salmon and their location of release on the River Erne in 2020. An end of year release of adult hatchery broodstock was also completed.

Juvenile Salmon Smolt Passage – The Erne Stations Smolt Generation Protocol

The Erne stations smolt generation protocol involves continuous night-time generation to near maximum efficiency during the months of April and May. Generation ceases at 12pm due to the upward movement of elvers within the Erne estuary. For the 2020 smolt season, this continuous generation protocol was always maintained for both Cliff and Cathaleen's Fall generating stations.

Adult Salmon Census and Return Rates

Returning adult salmon numbers are assessed using two 'Vaki Riverwatcher' automatic fish counters. These counters utilise infra-red technology and provide information on fish movements and behaviour of fish within the fish passes at Cathaleen's Fall and Cliff. Most salmon normally ascend Cathaleen's Fall fish pass in the late afternoon and evening periods, whereas fish tend to ascend the Cliff fish pass towards the evening time. Due to fish counter malfunctions no census data was available for the 2020 season. An adult trap was put in place from the 31st September to begin the trapping of returning adult fin-clipped salmon. Although no census data was available for 2020 the Cliff station adult census figures are shown for previous years in Table 8.

Year	Number of salmon
2020	-
2019	1,184
2018	1,564
2017	2,775
2016	3,174
2015	1,565
2014	1,910
2013	3,038
2012	1,672
2011	2,068
2010	2,284
2009	1,136
2008	2,411
2007	2,962
2006	1,238
2005	1,280
2004	947
2003	849
2002	1,444
2001	475
2000	311

Table 8. The annual census of salmon at ascending the fish pass located at Cliff hydroelectric station on the River Erne for the period 1999-2019. No census data was available for 2020.

An upstream adult salmon trap, situated in one of the pools of the Cathaleen's Fall fish pass, is located at Cathaleen's Fall stations. In line with previous years, this trapping facility was only used towards the end of the year (October-December). The reason for the short period of use is to minimise any negative effect to the main wild run of fish (the wild salmon run usually peaks for the months of June/July/August). Thus, it was possible to avoid handling the fresh run wild salmon whilst at the same time ensuring that enough hatchery reared returning salmon were trapped and used for restocking purposes at Ballyshannon hatchery. However, the non-operation of the trap during the early summer period also meant that the 'hatchery' or 'wild' component of the adult census figure could not be fully assessed since the normally operating two Vaki counters do not differentiate between 'hatchery reared' and 'wild' salmon at this site. No blockages within the pools of either Cliff or Cathaleen's Fall fish passes occurred during 2020. Up to December 2020, a total of 1,347 of hatchery salmon were intercepted either within the trap (Table 10 and Figure 9) and above the trap (Table 10 and Figure 10) on Cathaleen's Fall fish pass. The fish trap began operation on the 4th October and ceased on the 22nd December. A total of 72 wild salmon were also recorded, but these were released into the pool immediately above the trap (Table 10).

Stripping of adult hatchery broodstock commenced on the 24th November and ended on the 23rd December. As the full hatchery target had been met (300 pairs) excess stock were released into the Colebrook and Swanlinbar rivers in December 2020. Details of this hatchery release is given in Table 10.

From 2004 to present, halogen lights were fitted to the underside of the downstream platform, i.e. the bottom 8 pools of the fish pass. The lights are switched off for the period 12 midnight to 4am. These lights were fitted in an area of poor lighting (which may impede upward fish movement). In addition to these lights, the draft tube gates were removed from this area in 2005, thus allowing natural light to penetrate the entire area. Since then, the significant 'holding-up' of adult salmon within this previously dimly lit area has been eliminated.

During 2020, further genetic sampling of Erne salmon was undertaken using the adult trap facilities located at Cathaleen's Fall fish pass. Sub samples of both wild and hatchery salmon were sent to University College Cork.

	Salmon within trap				Salmon removed from above trap			
	Hatchery		Wild		Hatchery		Wild	
	Male	Female	Male	Female	Male	Female	Male	Female
September	0	0	0	0	0	0	0	0
October	309	316	27	22	48	39	8	7
November	80	187	7	16	140	152	22	29
December	3	1	0	0	51	21	2	2
Total	392	594	34	38	239	212	32	38

Table 9. The trapping of hatchery broodstock and wild salmon for the latter end of 2020. All hatchery fish are removed to the hatchery whereas all wild fish are released.

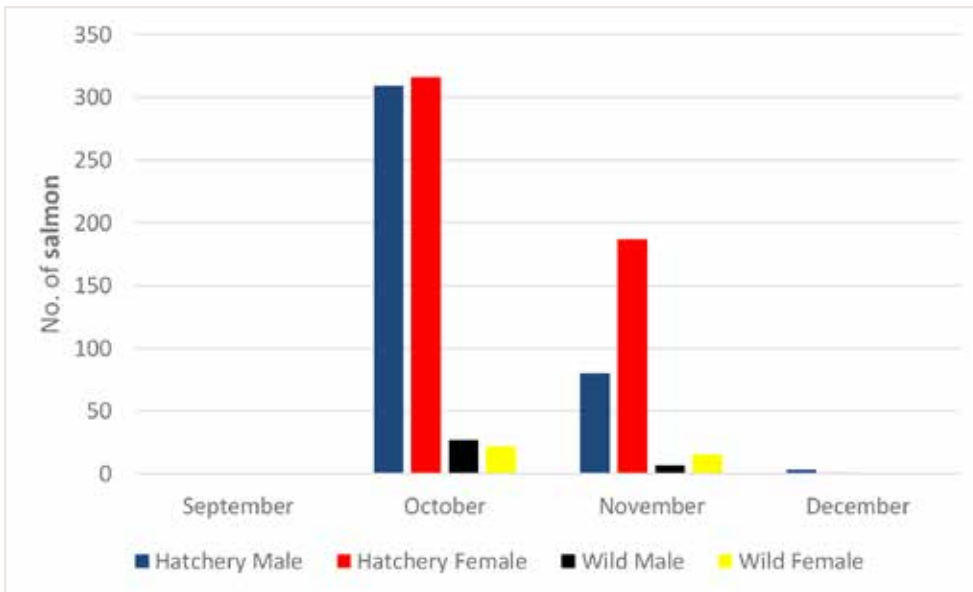


Figure 9. The trapping of hatchery broodstock and wild salmon entering the fish trap located at Cathaleen's Fall station fish pass for the latter end of 2020. All hatchery fish are removed to the hatchery whereas all wild fish are released.

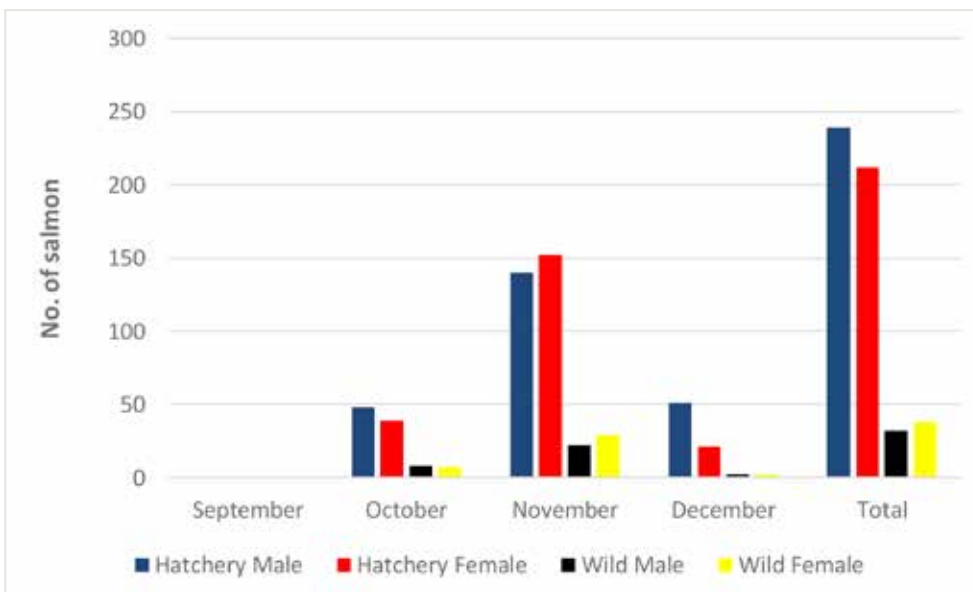


Figure 10. The trapping of hatchery broodstock and wild salmon Taken from the pool above the fish trap located at Cathaleen's Fall station fish pass for the latter end of 2020. All hatchery fish are removed to the hatchery whereas all wild fish are released.

Month	Stock Stage	Release Catchment	Fish No.
December	Male	The Colebrook River (NI)	100
December	Female	The Colebrook River (NI)	100
December	Male	The Swanlinbar River (ROI)	246
December	Female	The Waterfoot River (ROI)	171
Total			617

Table 10. Details of the end of year release of adult hatchery broodstock.

Eel Stock Enhancement

A total catch of 408.33kg was reported for the three Cathaleen’s Fall elver traps during 2020. Details of the release locations into the Erne catchment above the hydro-stations are given below in Table 11 and the catch per month is shown in Table 12. All three traps were closed on the 28th of August. The catch of elver for the period 1960 to 2020 is shown in Figure 11. In 2014 a new elver monitoring/trapping protocol was agreed between ESB, Inland Fisheries Ireland and Department of Agriculture, Environment and Rural Affairs, Northern Ireland. The plan involved greater

surveillance of the Erne elver traps and more frequent emptying of these traps. Also, during the period 2014 - 2018, significant upgrades were also carried out on the trap infrastructure which included the provision of greater water supplies and improved aeration systems.

New elver ramp climbing substrates were also fitted to each of the three climbing ramps. A new entrance onto the ramp at the Southbank was added in 2017 to allow direct access from the fish pass entrance. An additional new trap (Northern Bank), was added to the two pre-existing Cathaleen’s Fall traps in 2015.

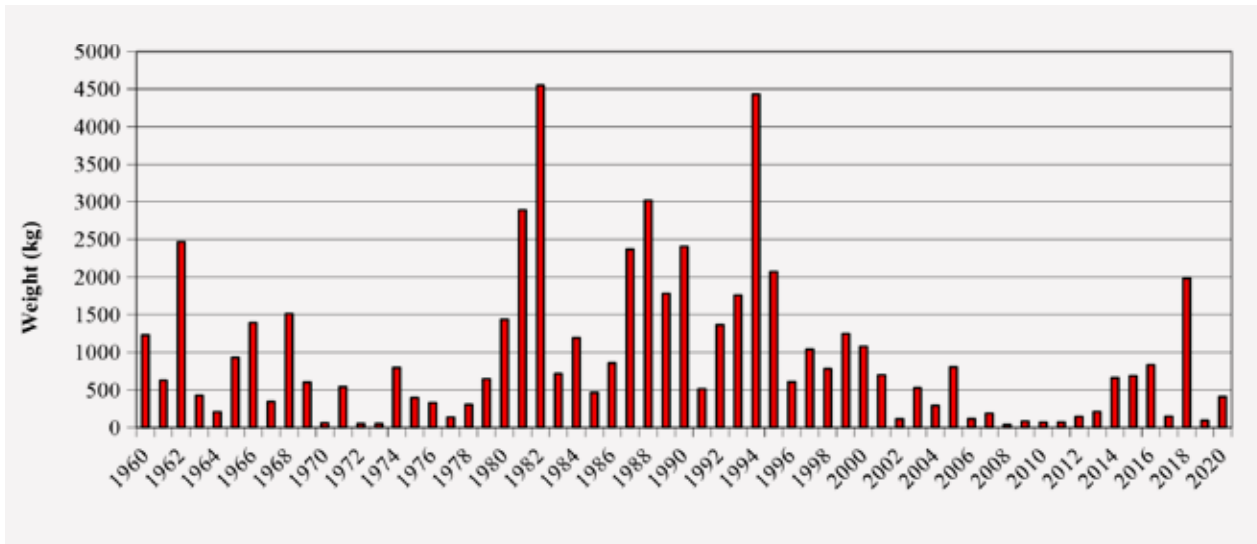


Figure 11. The catch of juvenile eel from Cathaleen’s Fall generating station for 1960-2020.

Table 11. The catch (Kg) and release locations of juvenile eel captured at Cathaleen's Fall generating station in 2020.

Date	Fish Pass Trap	G5 Box	Northern Bank Trap	Total (kg)	Stocked Area
08/04/2020	3.48	32	1.32	36.8	Garvary
09/04/2020	0.01	14.08	0.15	14.24	Rossigh
10/04/2020	0	0.82	0.26	1.08	Rosclare
13/04/2020	0	11.2	0.2	11.4	Pump House
14/04/2020	0	16.81	0.56	17.37	Muckcross
15/04/2020	0	6.3	0.95	7.25	Pump House
17/04/2020	0	2.12	0.15	2.27	Lusty Beg
20/04/2020	0	3.26	0.32	3.58	Lusty Beg
21/04/2020	0	13	1.48	14.48	Muckcross
22/04/2020	0.01	11.5	2	13.51	Upper MacNean
23/04/2020	0	1.7	0.32	2.02	Lusty Beg
25/04/2020	0.1	0.4	0.2	0.7	Garvary
28/04/2020	0	0.92	0.5	1.42	Muckcross
01/05/2020	0.65	4.8	2.55	8	Camagh Bay
05/05/2020	3.7	16.5	9	29.2	Camagh Bay
06/05/2020	45.55	10.5	7.62	63.67	Bellanaleck & Ely Lodge
07/05/2020	22.04	2.04	0.82	24.9	Lusty Beg
08/05/2020	2.8	0.68	0.1	3.58	Pump House
09/05/2020	7.44	1	0.22	8.66	Rossigh
10/05/2020	5.16	0.84	0.36	6.36	Garvary
11/05/2020	3.5	0.2	0.5	4.2	Camagh Bay
13/05/2020	1.96	0.8	0.36	3.12	Garvary
15/05/2020	3	0.14	0.2	3.34	Ely Lodge
18/05/2020	2.76	3.42	2.74	8.92	Lusty Beg
21/05/2020	1.6	7.32	5.78	14.7	Rosclare
22/05/2020	0.24	3.8	2.4	6.44	Round O
23/05/2020	0.24	1.84	0.92	3	Muckcross
26/05/2020	0.92	1.72	0.84	3.48	Camagh Bay
29/05/2020	0.94	1.2	2.2	4.34	Camagh Bay
02/06/2020	2.18	4.8	2.02	9	Bellanaleck
06/06/2020	3.54	1.26	0.78	5.58	Bellanaleck
09/06/2020	0.88	0.24	0.1	1.22	Garvary
12/06/2020	0.98	0.12	0.2	1.3	Pump House
15/06/2020	0.9	0.15	0.1	1.15	Ely Lodge
19/06/2020	2.26	0.96	0.48	3.7	Muckcross
22/06/2020	1.32	0.28	0.36	1.96	Enniskillen
26/06/2020	1.6	4	0.7	6.3	Camagh Bay
29/06/2020	0.12	4.32	0.22	4.66	Lusty Beg
03/07/2020	0.5	7.7	0.1	8.3	Pump House
10/07/2020	0	0.1	0	0.1	Camagh Bay
17/07/2020	0	2.5	0	2.5	Garvary
20/07/2020	0.02	0.16	0.02	0.2	Garvary
24/07/2020	0	0.15	0.02	0.17	Garvary
28/07/2020	0	2.5	0.02	2.52	Pump House
31/07/2020	0	1.5	0	1.5	Pump House
04/08/2020	0	0.75	0	0.75	Pump House

Date	Fish Pass Trap	G5 Box	Northern Bank Trap	Total (kg)	Stocked Area
07/08/2020	0	0.2	0	0.2	Pump House
11/08/2020	0	1	0	1	Pump House
14/08/2020	0	5	0	5	Rosslare
17/08/2020	0	15	0	15	Rosslare
19/08/2020	0.2	1	0	1.2	Camagh Bay
21/08/2020	0	5	0	5	Camagh Bay
24/08/2020	0	7	0	7	Rosslare
28/08/2020	0	1	0	1	Camagh Bay

Table 12. The catch and release locations of elver captured at Cathaleen's Fall generating station for each month of trapping in 2020.

	Fish pass trap	G5 trap	Northern bank trap	Total catch (Kg)
April	3.6	114.1	8.4	126.12
May	102.5	56.8	36.61	195.91
June	13.78	16.13	4.96	34.87
July	0.52	14.61	0.16	15.29
August	0.2	35.95	0	36.15



The 'Portora Gates' site on the mid Erne catchment (Enniskillen town).



The marker buoys across the river delineates the Silver eel fishing area.

The River Erne Eel Programme

The River Erne is a transboundary river system, with large stretches in both Northern Ireland and the Republic of Ireland.

During the 2020/21 season, fishing was conducted by conservation fishing crews at six sites, as shown in Figure 12. Fishing started at all sites from 8th September 2020, except for Roscor Bridge, where

fishing commenced on 11th October. Fishing ceased at most sites on 23rd November but continued at Roscor Bridge until 21st December. The total catch contributed to the Trap and Transport programme was 46,957 kg. The proportions caught at each site are shown in Figure 13.

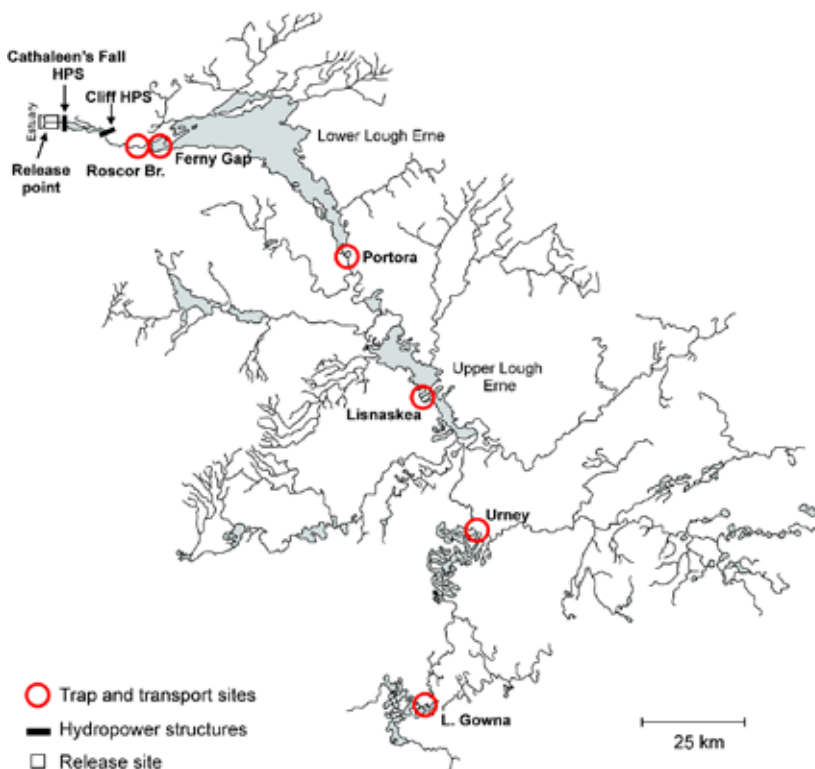


Figure 12. Map of River Erne catchment with conservation fishing sites, release point and hydropower dams indicated.

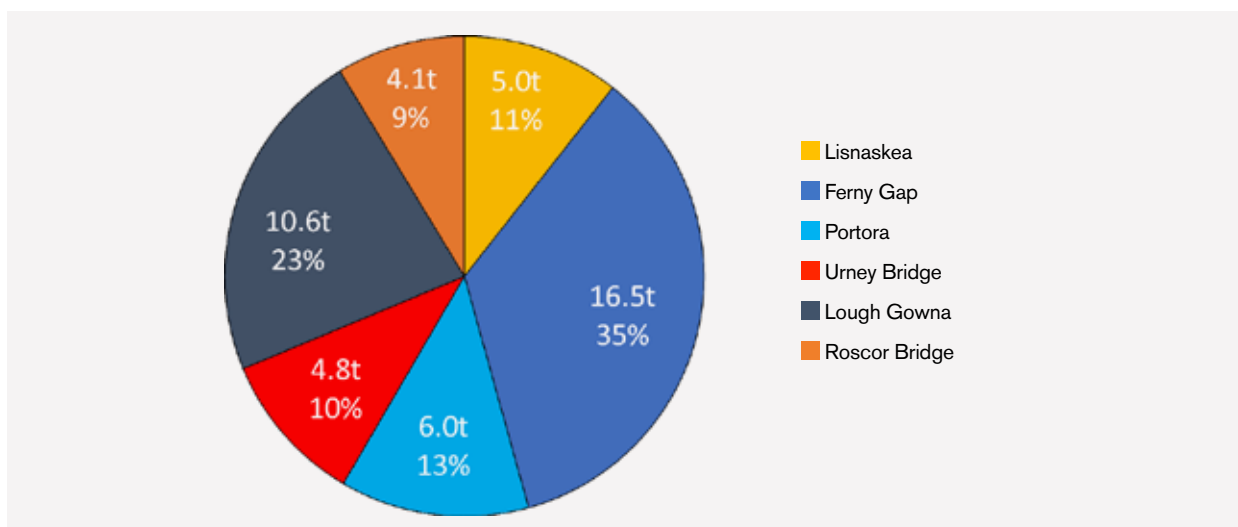


Figure 13. Proportions of the River Erne trap and transport catch obtained by each fishing crew in the 2020/21 season.

The variation in the daily catches at the experimental fishing site at Roscor Bridge are shown in Figure

14, with catch levels (and therefore fish migration) affected by discharge level and lunar cycle stage.

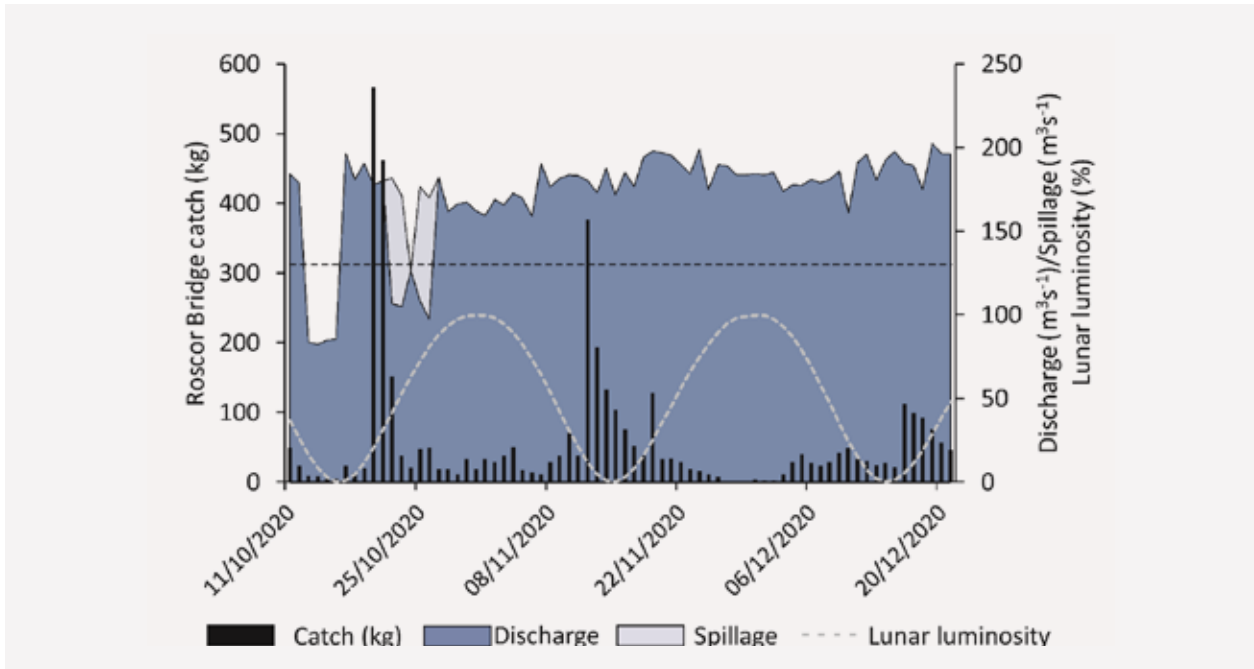


Figure 14. Variation in daily catches at the Roscor Bridge fishing site, in relation to lunar cycle and discharge during the 2020/21 season (the threshold discharge of $130 \text{ m}^3\text{s}^{-1}$ used in population analyses is indicated by a dashed black line).

Production and escapement estimates for the River Erne are summarised in the flow diagram (Figure 15). The silver eel production was estimated to be 65,263 kg, and escapement was estimated to be 56,885 kg (87.2% of production). The trap and transport catch of 46,957 kg at the six fishing sites represented 72.0% of the production (exceeding the 50% target by 14,325 kg).

42,874 kg of eels were moved by trap and transport from the five fishing sites upstream of Roscor Bridge. Fishing efficiency rates for calculating production and escapement were based on several mark/recapture experiments carried out by NUI Galway at the experimental fishing site at Roscor Bridge from 2010/11 to 2015/16 at low discharge ($< 130 \text{ m}^3\text{s}^{-1} = 9.78\%$) and high discharge ($> 130 \text{ m}^3\text{s}^{-1} = 18.43\%$). These were used with the trap and transport catch at Roscor Bridge (4,083 kg) to calculate the biomass of eels arriving there based on the flow conditions throughout the season.

18,306 kg of eels are estimated to have passed Roscor Bridge and moved through the hydropower

stations at Cliff and Cathleen's Fall. Mortality at each station is based on historic telemetry work conducted by NUI Galway at the two stations, depending on the operations of the dams throughout the season. Estimated mortality rates under different flow conditions are given in Table 13. Total mortality was estimated to be 4,650 kg at Cliff and 3,728 kg at Cathleen's Fall.

In total, 9,928 kg of eels are estimated to have navigated beyond the hydropower stations, and with the trap and transport quantity of 46,957 kg, a total escapement of 56,885 kg is estimated; 87.2% of the production.

Size-frequency distributions for 299 eels were measured at the Ferny Gap fishing site (Figure 16). 91.0% of these fish ($n = 272$) were determined to be female, based on the size frequencies (eels over 440 mm are considered to be female). The mean length of eels measured from the River Erne was 570 mm (SD = 93 mm). The mean length for females was 585 mm ($n = 272$, SD = 78 mm) and for males was 383 mm ($n = 27$, SD = 30 mm).

Table 13. Mortality rates (based on unpublished NUIG telemetry results) at two hydropower stations, depending on station operation.

Operation	Cliff	Cathaleen's Fall
No flow	0%	0%
Generation & Spillage	7.9%	7.7% (half-load)
		15.4% (full-load)
Generation only (no spillage)	26.7%	27.3%
Overall mortality 2019/20	25.4%	27.3%

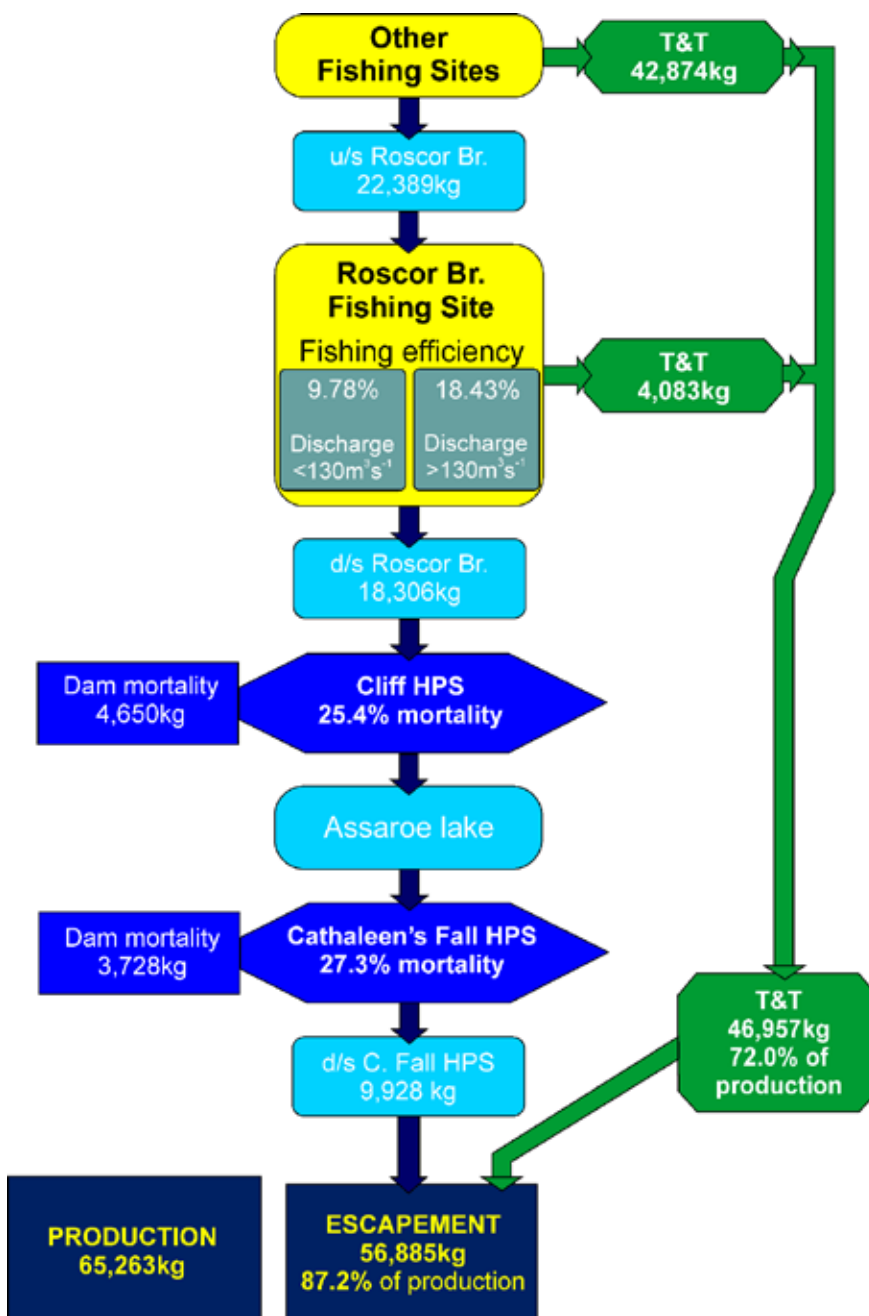


Figure 15. A summary of the analysis of silver eel production and escapement in the River Erne during the 2020/21 eel migration season.

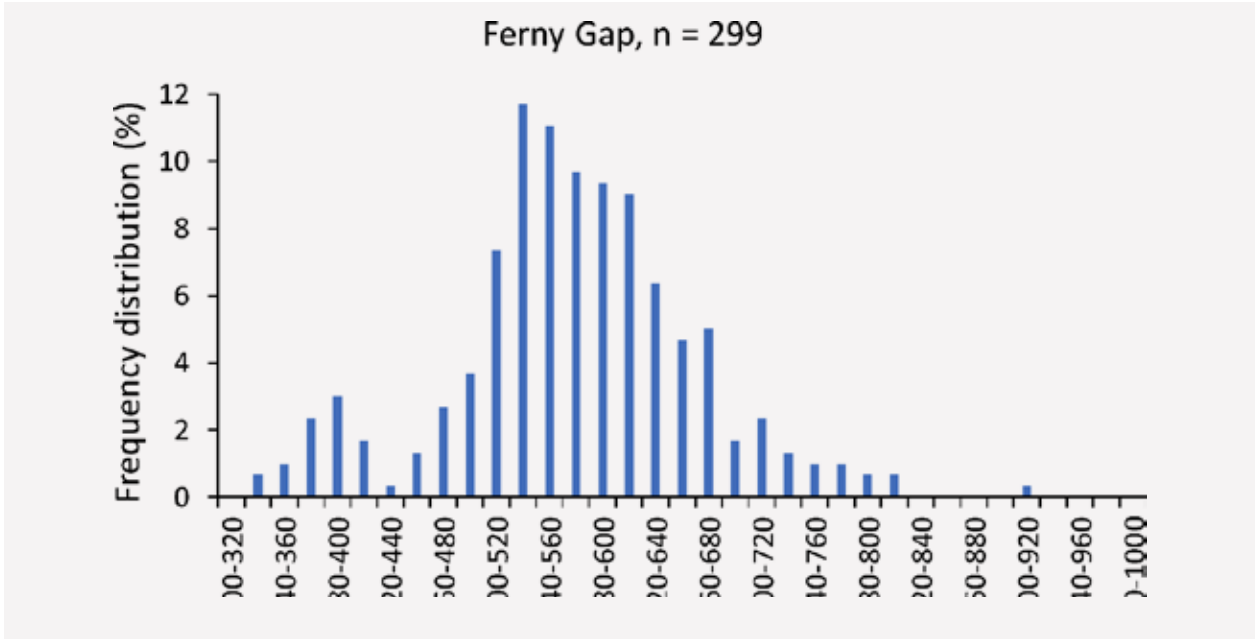


Figure 16. Relative size-frequency distribution of eels from the 'Ferry Gap' fishing site during the 2020/21 season.



The same site with the area being prepared for concrete being laid.



The River Erne silver eel release site located at the tidal limit of the Erne estuary, showing the inner compound where silver eels captured during the Erne Trap and Transport process, are released.



The entrance to the Erne Eel release site on the Lower Erne system being improved.

Clady and Crollly An Chláidigh agus an Chroithlí

Introduction

The Clady River, situated in North Donegal was harnessed for the generation of electricity during the 1950's. The scheme involved the creation of a diversion canal and penstock from the Clady River approximately 3km from the sea and the transfer via this canal and penstock to a generating station, which discharges to the Crollly estuary. Both of these small moorland river systems have a combined catchment area of 153km². The Clady drains Lough Nacung, the outflow of which is regulated by Gweedore regulating weir. Due to the diversion of water, Clady salmon destined for the River Clady may enter the Crollly estuary at times depending upon discharge.

Since September 2010, ESB signed a fisheries management agreement with Inland Fisheries Ireland (IFI) in relation to the Clady and Crollly rivers. Under this co-operative initiative, ESB remains as the fishery owner but IFI and the local angling clubs manage the rivers with the aim of increasing the tourism potential. During 2020, IFI staff continued: checks on fishing permits and licenses, fisheries protection work, environmental monitoring and liaising with local stakeholders including local authorities, angling clubs and landowners. In addition to this, some angling access and fisheries habitat improvement works were completed.

Regular compensation flow along with several 'freshets' are maintained on the Clady to assist the upstream passage of salmon and sea trout. These freshets are released from Gweedore weir during the summer months when the mainly grilse salmon run is at its peak. A small Borland-MacDonald fish lift, 10 metres in height is located at Gweedore Weir, the upper exit of which is fitted with a Vaki Riverwatcher fish counter for assessing the daily run of ascending adult salmon. However, during 2020 this fish counter was not operational and therefore no census data was generated for the catchment. The main fishing areas on the Clady River are downstream of Gweedore regulating weir. On the River Crollly, the main fishing areas are located on pools in the lower river and downstream of Lough Anure.

The Clady catchment (which includes both Loughs Nacung and Dunlewy), has previously been shown by a National University of Ireland research team to hold a healthy population of Brown trout and Arctic char. Apart from Brown trout, Arctic char and small numbers of eels, no other fish species were recorded. Occasional specimens of Arctic char are reported captured by anglers on the two lakes.



A view of Mount Errigal from Gweedore Regulating Weir Clady which is located on the Clady River.

Salmon and Recreational Angling

Adult salmon ascending the upper Clady river pass through the fish lock located at Gweedore Weir. The Clady and Crolla Rivers were both open as recreational salmon angling fisheries for 2020 under a blue tag system. In some of the previous years, both rivers had operated as catch and release fisheries (C+R), and were lightly fished, most likely due to the C+R status. However, both catchments have always been open for brown trout fishing. Fishing permits were made available at 'O'Donnell's Service Station' and 'An Chuir Hotel' which is located within either catchment. IFI again supplied an angling boat on the shores of Lough Nacung on the Clady system for visiting anglers to access the lough.

Two seasonal Fisheries Officers were employed on a dual role covering both fisheries protection and development. Due to the Covid 19 pandemic, there was a shortened angling season in place and therefore some protection work was curtailed. Details of their 2020 work is as follows:

Protection

During the course of protection duties, both officers carried out angler license and permit checks, conducted covert and overt surveillance operations, and liaised with relevant stakeholders, local authorities, land owners and the Gardaí. Environmental monitoring was also an integral part of their daily duties. Coastal patrols were carried out along the Gweedore Bay coastline as far as Bunaniver Bay in the North and Rinn na Feirste Bay to the South. No illegal netting activity was found within the confines of the Clady and Crolla estuaries, but seizures of nets were recorded elsewhere.

Angling licenses and fishing permits were checked on the Clady, Crolla and Gweedore Estuary. Fixed Charge Notices (on the spot fines) were issued during the angling season, under Section 178 of the 1959 Fisheries Consolidation Act as Amended (unauthorised entry onto a 'several fishery'). The presence of both officers on both the Clady and Crolla fisheries throughout the angling season ensured a high level of compliance with angling regulations. The timing of patrols was varied throughout the season and both officers were often required to work during the

freshets when angling activity was greatest. This gave both salmon and seatrout an excellent opportunity to run the Clady River, but also resulted in extra angling activity for both Fishery Officers to police.



A photograph of the one of the salmon smolt screens which are fitted to the intake canal of Clady station, prior to the annual smolt migration.

Development

Works carried out in 2020 consisted mainly of maintenance of prior work completed along the Clady River. Both Fisheries Officers carried out regular bank clearance and access improvements initiatives along the Clady and Crolla Rivers. This included strimming and general maintenance of existing access pathways and clearance of shrubbery and trees to allow access for anglers. Both officers worked closely with the local Crolla Angling Club and Udaras to carry out extensive access maintenance along the entire length of the Crolla River.



Two fresh run salmon caught by anglers on the Clady Rive.



An illegal drift net seized off Inishbeg Island (400m in length) with one salmon enmeshed.



Clearance of footpaths to allow angling access onto the Clady River.



Selective clearance of bankside vegetation at 'Divers Pool', on the Clady River.



Selective bank clearance at 'Cox's Pool', on the Clady River.



Selective bank clearance at 'Cox's Pool', on the Clady River.

Environmental Monitoring

Water levels were monitored daily and reported to the Glenties Angling Centre. Movement of fish and angling catch reports were included in reports when

available. Water quality was visually inspected as a routine undertaking.

The River Liffey An Lifé

Introduction

The River Liffey, having a catchment area of 1,369km², rises in the Wicklow mountains and flows over 50km before entering the sea at Dublin. Three hydroelectric generating stations were constructed on the river during the 1940's. In addition to the supply of water for hydroelectric generation, the 5,600-acre reservoir also provides a water supply to Dublin city. A total of 62% of the catchment lies above Leixlip generating station, which was commissioned in 1949. The two upstream stations, Poulaphouca and Golden Falls are situated above and at the historical upper limit of salmon distribution in the catchment, respectively.

In addition to salmon and brown trout, the River Liffey holds stocks of roach, bream, roach-bream hybrids, perch, tench, pike, rudd and eel. Coarse fishing predominates on the Leixlip and Poulaphouca reservoirs, whereas the best trout fishing is from Lucan upstream. The best salmon fishing is noted on the stretch of river between Straffan and Islandbridge. ESB controls the fishing rights on the reservoirs, and in the immediate vicinity of the power stations.

Salmon

Salmon entering the upper Liffey need only ascend the fish pass at Leixlip generating station, as only this station lies in the path of these migrating fish.

The fish counting facilities at Leixlip station were removed due to Marine Institute operational reduction and therefore no census data will be recorded at this site for future years. However, the recent annual numbers of salmon ascending the fish pass at Leixlip indicates that the fishery installation (fish pass and spillway gates), are working satisfactorily and that sufficient numbers of smolts are not using the Kaplan turbine as a downstream migration route. During the annual smolt season (mid-March to mid-June 2020), a salmon smolt generation protocol is implemented which allows for the spilling of surface water through a spillway gate and also through the fish lift located at the station.

Recreational fisheries of the River Liffey

Although owned and managed by ESB, Poulaphouca reservoir is currently leased to the Dublin Trout Anglers Association. The fishery, located at Blessington, Co. Wicklow, is a mixed one and there is provision of easy access points and car parking facilities. During 2020, a total of 4,500 yearling trout were released on a monthly basis into Poulaphouca. In addition to these released fish, the survivors of stockings in previous years were also captured during 2019. There were reports of good catches of wild fish during the months of June, but low water levels impacted fishing during the later months. Fishing was also good upon Poulaphouca reservoir, but low water levels impacted fishing during the later months. Poor pike fishing was reported at both sites which was similar to previous years. Again, like previous years, some illegal nets were removed from Poulaphouca reservoir by ESB staff.

River Lee An Laoí

Introduction

The River Lee flows eastwards for over 90km from a mountainous region near Gougane Barra Lake in West Cork to enter the sea at Cork City (Figure 15).

The River Lee has a catchment area of 1,253km² and an average flow of 27.1m³sec⁻¹.

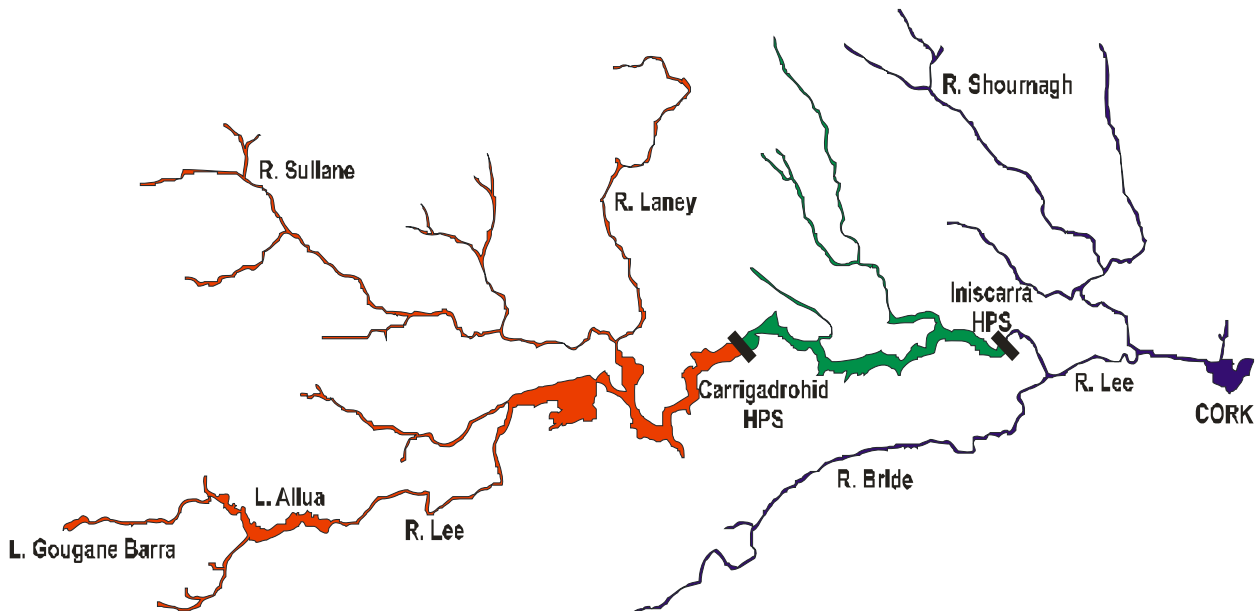


Figure 15. The River Lee catchment with the lower, middle and upper catchment areas differentiated by colour.

The central valleys of the River Lee were flooded as the result of construction of the hydroelectric scheme. Construction commenced in 1953, and both Carrigadrohid and Iniscarra generating stations were commissioned in 1957. Two large reservoirs were created, Carrigadrohid (5.3km²) and Iniscarra (9.3km²), upstream of both stations. A significant percentage (27%) of the Lee catchment is located downstream of the hydroelectric station and this area comprises the Shournagh, Martin and Bride tributaries where naturally spawned salmon stocks occur. The tidal section of the

River Lee is approximately 14.5km downstream of Iniscarra. The fishing rights of the reservoirs and some river stretches located downstream of Iniscarra dam are controlled by ESB.

In addition to salmon and eel, the other main fishable species within the Lee system also include brown trout, pike, perch, rudd, roach and bream. The River Lee offers some excellent coarse fish angling, as there are significant stocks of coarse fish species within each of the two reservoirs.



Hatchery reared salmon smolt being captured for the for later release into the River Lee.



Juvenile salmon being loaded onto transport trailers for release into the River Lee.



Hatchery reared salmon smolt being released into the River Lee at Iniscarra cemetery.

The River Lee Salmon Management Programme

Initiated in 1994, the River Lee Management Programme aims to assess the current status of salmon populations in the catchment, with a view to managing stocks at acceptable levels of abundance. Prior to the hydroelectric scheme, important salmon fisheries existed in the lower and middle reaches of the river and salmon are believed to have spawned throughout the catchment. The impact of the scheme was immediate and was related to water quality (large quantities of decomposing vegetation causing deoxygenation), discharging to the lower river from the newly flooding reservoirs upstream of Carrigadrohid and Iniscarra. Within five years of construction the River Lee stock of salmon had collapsed.

In order to mitigate this problem, large numbers of fingerling salmon of River Shannon origin were stocked out into the area above Carrigadrohid dam. The results obtained from smolt traps on the Borland-MacDonald fish-locks during the 1960's indicated that the smolt output was poor, and as a result, the area downstream of Carrigadrohid was concentrated upon for restocking purposes. Carrigadrohid hatchery was established in 1956 as a smolt producing facility with the objective of releasing smolt and lower mode parr downstream of Iniscarra dam. Reared smolt were adipose fin clipped in selected years and it was determined that virtually all adults returning to Iniscarra were of hatchery origin. Since 1993, all reared smolt have been adipose fin-clipped and selected lines have also been coded wire tagged. This has facilitated the separation of reared and wild adult salmon.

An electric fishing survey, carried out in 1993, indicated that naturally spawned juvenile salmon occurred at all sites sampled below Iniscarra and at satisfactory densities. However, upstream of Iniscarra, juvenile salmon were present only at sites close to the reservoirs. These sites were surveyed again in 2001, 2003, 2005 and 2009 and the results were similar

to the 1993 survey in that a very healthy salmon population predominated below Iniscarra station, whereas only isolated populations were to be above the stations (largely as a result of restocking efforts).

The area above the two stations has been annually restocked with juvenile salmon and, in addition, a smolt generation protocol has been introduced to facilitate downward smolt migration. This smolt generation protocol involves the continuous spilling of water through the Borland-MacDonald fish-lock at Iniscarra, coupled with a cessation of night-time generation during the months of April and May. Depending upon the availability of water, a continuous generation protocol was maintained at Carrigadrohid during April and May 2019.

Carrigadrohid hatchery

Carrigadrohid hatchery was officially opened in 1956 and extended in 1970. It is located immediately downstream of Carrigadrohid generating station. The annual target production is 1 million unfed fry and 50,000 smolts for release into the Lee catchment. There is no commercial aquaculture activity in the hatchery unit.

Production of ova, unfed fry, parr and smolt

A total of 60 pairs of salmon were stripped in December 2020. The progeny of these fertilised eggs (n=97,712 fertilised ova), will be either retained within the hatchery for on-rearing or released as juvenile salmon into the Upper Lee in 2021. A total of 59,489 fin-clipped salmon smolts were released into the lower reaches of the Lee in during the period 23rd March to the 8th April 2020 (Table 14). The slightly longer release period was due to the Covid-19 Pandemic and the biosecurity measures in place for ESB staff. The site these were released from is the Phoenix Kayak club in Cork city.

Smolt	Location of release	Month	Number released
Lee	Below Iniscarra station	March and April	59,489 (including 12,202 tagged, code 47/09/31)

Table 14. The number of juvenile salmon (smolts) released from Carrigadrohid hatchery in 2020.

Lee generating protocol to assist smolt migration

A night time generating protocol was implemented at Carrigadrohid generating station during the months of April and June for the 2019 smolt season. As in previous years, water was discharged continuously (approximately 3m³sec⁻¹), through the fish-locks in order to encourage smolts to descend via this route.

No night time generation is undertaken at Inscarra, except when necessary during flood episodes. High discharges are maintained on the lower River Lee immediately after the releases of the adipose fin-clipped reared smolts in order to assist smolt migration.



A view of the south side of the Lee Weir showing the centrally located fish pass.

Performance of the River Lee Recreational Salmon Fisheries in 2020

At the ESB Inscarra fishery, the declared minimum catch was 88 salmon. Previous years catches are shown in Table 15. Of the 88 rod captured salmon in 2020, 42.5% were wild salmon (weights varied from 3lbs to 12lbs), the remainder being hatchery adipose fin-clipped salmon (weights varied from 3 to 10.5lbs). The monthly distribution of the declared rod catch is shown in Table 16. Due to Covid-19, fishing activity and access was at times somewhat restricted, and was atypical when compared to previous years.

Year	Rod Catch
2020	88
2019	29
2018	30
2017	72
2016	62
2015	35
2014	128
2013	78
2012	302
2011	200
2010	218
2009	372
2008	131
2007	574
2006	227

Table 15. The performance of the Inscarra salmon rod fishery during 2006 – 2020.

	Wild	Hatchery	Total
March	2	1	2
April	5	4	3
May	5	6	7
June	2	2	14
July	9	9	12
August	5	5	7
September	9	9	7
	37	51	88

Table 16. The monthly distribution of rod captured salmon, (n=88) on the ESB owned Iniscarra fishery for 2020.

The ESB owned section of the Lee fishery located downstream of Iniscarra station fished poorly in the beginning of the season with catches rising slightly towards season end. This was despite the large numbers of anglers present on the fishery particularly early morning and during evenings. ‘Catch and release’ of salmon was commonly practiced by many anglers

and the routine checking of permits by ESB and IFI staff helped with the management of the fishery. The largest salmon recorded on the Iniscarra fishery was caught in early June and was 12lbs weight (wild origin). The weight distribution of salmon captured at the Iniscarra fishery is shown in Figure 17.

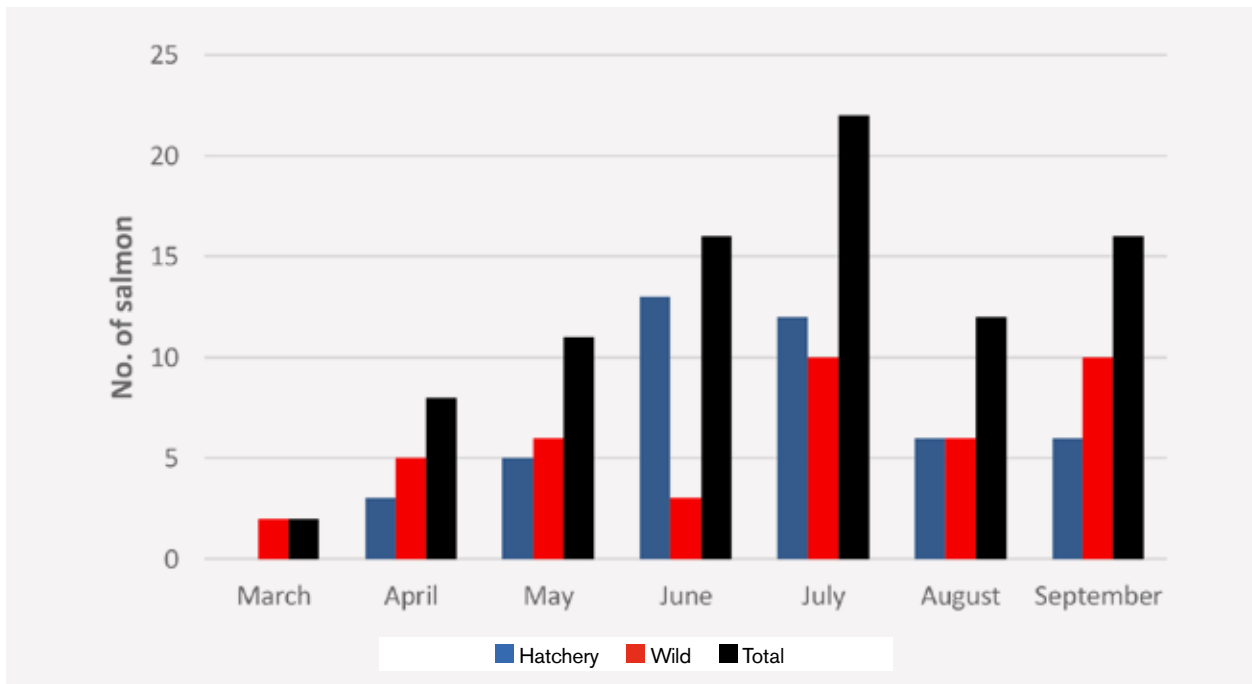


Figure 16. The monthly capture of hatchery and wild salmon in the Iniscarra angling fishery.

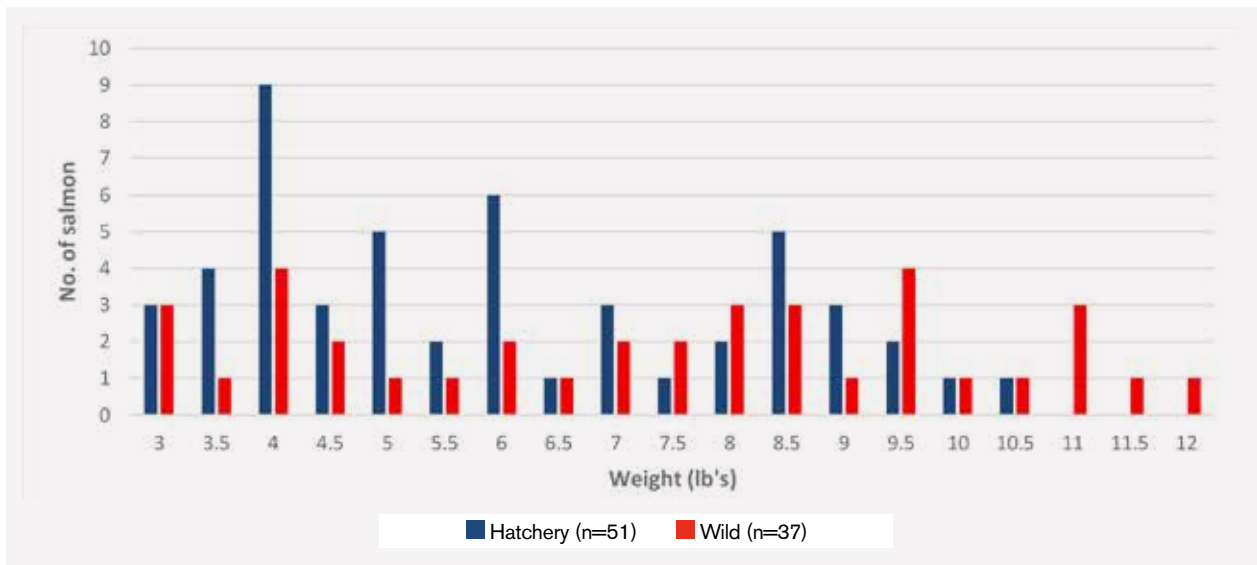


Figure 17. The weights (lb's) of hatchery and wild salmon caught by anglers on the ESB owned Iniscarra fishery during 2020.

Salmon census at Iniscarra Generating Station

The automatic fish counting system is situated at the upper exit of the Borland-MacDonald fish lift located at Iniscarra station. However, due to continuous malfunctions of the fish counter there was no census data for 2020.

The operation of the fish lock was continuous for the year and adult trap began operation on the 24th September and ended on the 2nd December 2020. All ascending hatchery salmon (n=206) were removed from the upper chamber of the fish-lock and transferred to Carrigadrohid hatchery. All wild salmon (n=164) were immediately released above Iniscarra station. The monthly capture of salmon is

shown in Figure 18 and Table 22. All adipose fin-clipped or reared salmon were removed and retained at Carrigadrohid hatchery for breeding purposes. The stripping programme ended on the 11th December and ended on the 31st December. In total 40 pairs were successfully stripped and a small number of fish which remained unripe in late December 2020, were released early in 2021 at Coolea in the Upper River Lee. All stripped hatchery fish (which were not micro-tagged), were released at Iniscarra cemetery which is located below Iniscarra station.

The stripping of the broodstock resulted in a total of 97,712 fertilised ova.

	Hatchery (n=206)		Wild (n=164)		Total
	Male	Female	Male	Female	
September	0	0	0	0	0
October	68	40	9	117	234
November	45	6	17	1	69
December	41	6	19	1	67
	154	52	45	119	370

Table 17. The monthly capture of hatchery and wild salmon in the Iniscarra station adult salmon trap.

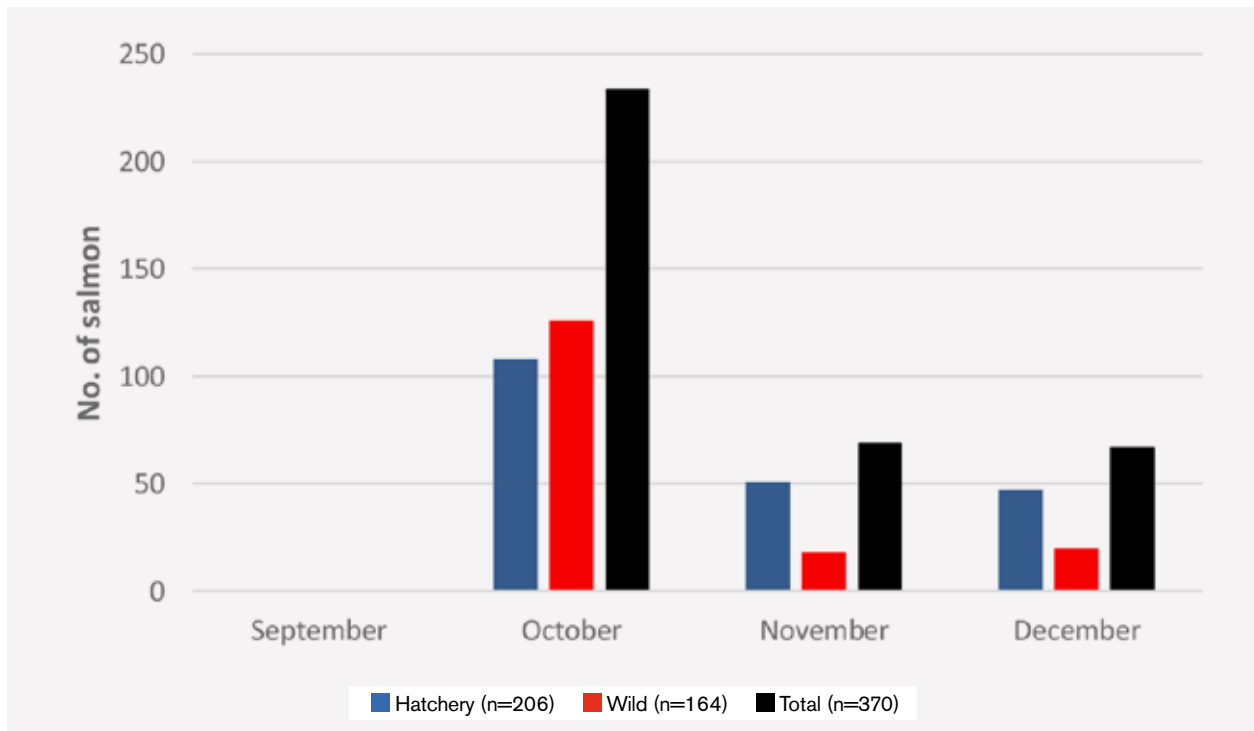


Figure 18. The monthly capture of hatchery and wild salmon in the Iniscarra station salmon trap.

Characteristics of reared and wild salmon collected at Iniscarra

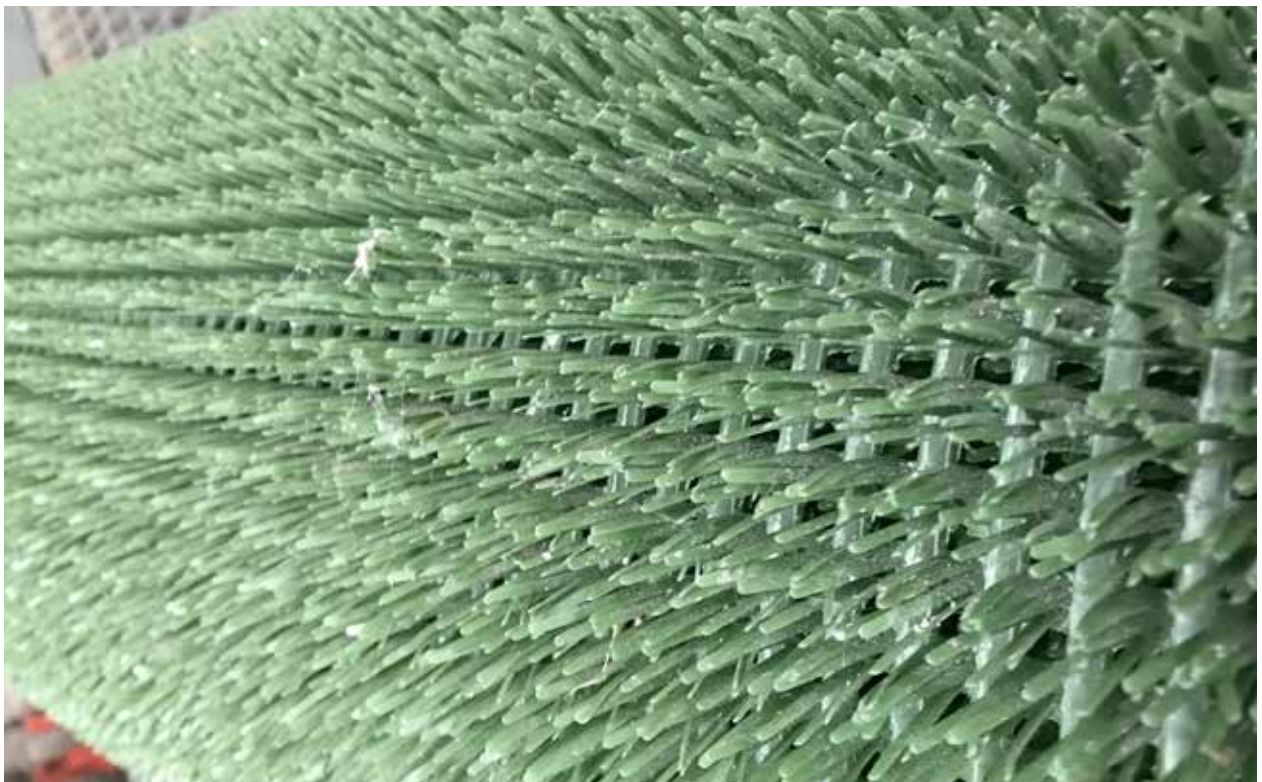
Of the 66 reared salmon transferred to the hatchery in 2020, three were designated as MSW fish. All wild returning salmon (n=25) trapped in 2020 were immediately released above Iniscarra station. Both MSW and grilse designation characteristics are used for Carrigadrohid, Parteen and Ballyshannon hatcheries. The designation characteristics are that females up to 71cm and males up to 84cm are considered to be one sea-winter (1SW) or grilse, whereas salmon larger than these are considered to be MSW salmon.

The River Lee Eel Programme

In the 2020/21 season, silver eel fishing took place on the River Lee sequentially at several different locations in Iniscarra Lake between August and October. The total catch was 1,082kg, which exceeds the annual R. Lee target of 500 kg.



Carrigadrohid station.



The artificial climbing substrate used for the Iniscarra trap.

The ESB River Lee Trap and Transport catches from 2009-2020 and the achievement of the annual 500kg target is shown in Table 18.

Year	Amount transported (t)	Target	Relation to target
2009	0.079	0.5	16%
2010	0.278	0.5	56%
2011	0.731	0.5	146%
2012	0.234	0.5	47%
2013	0.824	0.5	165%
2014	0.670	0.5	134%
2015	0.515	0.5	103%
2016	0.0435	0.5	8.7%
2017	0.542	0.5	108.4%
2018	0.035	0.5	0.7%
2019	1.098	0.5	219.6%
2020	1.082	0.5	216.4%
Total	5.006 tonnes		

Table 18. The total amounts (t) of silver eel trapped and transported on the River Lee 2009-2020, and the success relative to the target of 500kg set in the National Eel Management Plan.

Juvenile eel

An elver trap was first put in place in the area immediately below Iniscarra station during 2008. The total catch for 2020 was 5.65kg. These juvenile eels were primarily 'bootlace eel' rather than elvers. The trap operated from the 16th March until the 27th September 2020. Like previous years, the catches were largely recorded for the period early June to the end of August (Table 18). The catches were released into the mid-catchment of the River Bride, which enters the River Lee below Iniscarra station.

	Catch amount
March	0
April	0
May	0
June	0
July	31 individuals, plus 225g
August	170g
September	170g
Total	5.65kgs

Table 19. The total catch of the Iniscarra elver trap in 2020.

Coarse Fish

Iniscarra reservoir is predominantly a coarse fishery where bream, rudd, roach, pike, perch and a small number of eel are recorded. Bream were again the predominant fish occurring in large numbers. The number of visiting anglers appears have gradually increased over the past number of years but due to the Covid-19 pandemic angling numbers were much

reduced for 2020. Access to the lake has been improved by ESB over the past number of years particularly at Inisleena on the Iniscarra reservoir. Pike are particularly in abundance downstream of Carrigadrohid generating station.

Notes

ESB Fisheries Conservation Section
Electricity Supply Board, Ardnacrusha, Co. Clare,
Republic of Ireland

Tel: +353 61 345589 Fax: +353 61 344560