

# Investigation into the impact of fyke nets on otter populations in Ireland



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AN ROINN COMHSHAOIL, OIÐHREACHTA AGUS RIALTAIS ÁITIÚIL

DEPARTMENT OF THE ENVIRONMENT, HERITAGE  
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# Investigation into the impact of fyke nets on otter populations in Ireland

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## SUMMARY

Fyke nets are a fixed fishing gear used primarily in the commercial eel fishing industry. They are, however, being increasingly utilised for scientific surveys and for the capture of coarse fish (i.e. tench) for scientific and relocation purposes. Fyke nets are a non-destructive fishing method, allowing the capture of a wide range of species without incurring significant mortality or damage to the catch which makes them an important tool in fisheries science and management.

Exploitation of the European eel (*Anguilla anguilla*) occurs throughout its European range with considerable regional differences in exploitation patterns, fishing seasons and methods. The fisheries are typically small scale and scattered although in total the eel fishery is one of the most economically important in inland waters. In Ireland, the commercial eel fishery involves harvesting both brown and silver eel using a variety of techniques, the most common of which are baited long-line, fyke nets, coghill nets and baited pots. In 2005, 93 fishermen were authorised to use 2,340 licensed fyke nets in Ireland. The declared commercial eel catch in the Irish Republic is currently approximately 100t.

The Eurasian otter (*Lutra lutra*) is the only otter native to Europe. They are found as far north as the Arctic Circle, across most of Asia and northern Africa. In Ireland, otters are found in fresh and salt water, although coastal otters need access to freshwater to clean their insulating fur. Historically, otter were widely distributed across Europe, but widespread population crashes were recorded in the 1960s and 1970s.

Ireland has long been considered as having one of the most important populations of otter in Europe. Up to the early 1990s over 90% of sites surveyed were positive for signs of otters. A survey carried out in 2004/05 indicated that there has been a significant overall decline in percentage occurrence of otters nationwide of 17.72% or 0.74% per annum over the last 24 years.

The otter is listed on Annex II and Annex IV of the EU Habitats Directive. Because of its Annex II listing, a number of Special Areas of Conservation (SACs) have been designated for its protection across Ireland. Article 12 of the Directive requires Member States to implement a system of strict protection for species listed on Annex IV, including monitoring of the incidental capture and killing of these species.

Otters may be attracted to fish caught in fyke nets and may become trapped and drowned in the process. However, evaluating the relative impact of such accidents on the otter population is complicated. In Ireland there is no legal requirement for reporting of otter deaths by people engaged in fishing operations making it difficult to get evidence, or specific numbers, to evaluate the impact of fishing gear on the otter population. Information on the relative levels of mortality due to anthropogenic factors (i.e. fyke net, road traffic) compared to those of natural mortality are almost unknown.

One previous study in Ireland, covering a period between 1982 and 1992, reported a total of 628 otter mortalities, of which 14% were killed by fishing gear (approximately 9 animals per year) It is not clear, however, how many of these were in fyke nets. In this review, data from scientific fisheries surveys using appreciable fyke net effort have reported between none and 2.5 otters per year being accidentally killed in fyke nets. Probably the largest single survey employing more than 45,000 net nights on the Erne system killed one otter per year. During seven years of fisheries monitoring on the

Shannon in the 1990s, 15 otters were observed as accidental drownings, seven in lake fykes and eight in river nets. Other eel surveys of lakes in Connemara, Mayo, Donegal and Cork reported no otter mortality, although one was taken in a tidal estuary. More recently, fyke nets have been used on surveys, for the Waterframework Directive, of lakes and transitional tidal waters with no otter mortalities being recorded in freshwater and five in tidal waters.

A survey of Fisheries Board Inspectors, staff of the National Parks & Wildlife Service and the scientific literature revealed a similar relatively low level of accidental trapping of otter in fyke nets - 55 otters reported as having died in fykes over a 50 year period. However, it is worth remembering that even the loss of a small number of individuals could have dramatic long-term effects on isolated otter populations.

Otter mortality in fyke nets was recorded from lakes, rivers and estuaries. Within lakes, incidences were more common in shallows near shore and in areas adjacent to river outflow. This was consistent with published data indicating that the chance of catching an otter was higher when fyke nets were set close to the shore (<60m) and/or in relatively shallow water (<2.0m).

During the last 20 years, recruitment of glass eels to European shores has decreased dramatically, and the International Council for Exploration of the Seas (ICES) has recommended that until an international recovery plan for the eel stock is agreed and implemented, exploitation and other forms of anthropogenic mortality of eel should be reduced to as close to zero as possible. The probable reduction in fisheries is likely to lead to an overall reduction in the level of fyke net usage in the commercial fisheries. However, fyke nets will remain a useful tool for scientific surveys of eel and other species.

In Britain in the 1980s, in response to the threat to recovering otter populations, four types of otter guards were tested in a comprehensive fyke net survey under a variety of conditions. The catches in terms of total weight of eels were significantly lower using two of the guards at the base of the funnel (Ring and Square Guards), but not significantly different to the controls with the other two (Front Net and Grid Guards) placed at the mouth of the net. Other published studies showed that 88% of fishermen found the catch of eel was the same with or without otter guards. There was, however, a noticeable reduction in catch of other species such as roach, pike and bream. It is evident that the use of any type of guard on a fyke net will considerably reduce or eliminate the capture of larger species other than eel, such as pike, tench, and other coarse fish. The fitting of otter guards to fyke nets being used for the capture of these larger species is therefore not practicable. One of the remaining unanswered questions is how to avoid the possible drowning of otters in fyke nets being used to catch larger fish species.

Based on our findings, it seems that the level of otter mortality inflicted by fyke nets in Ireland is probably low compared to other causes, such as road traffic. However, the lack of reliable statistics on any forms of otter mortality became obvious and the reporting of otter mortalities, including by fishing gear, should be improved..

A number of recommendations are made towards the reduction or elimination of accidental capture of otter by fyke nets, through a series of avoidance measures or the fitting of otter guards. A probable reduction in the level of commercial fishing activity may also help to alleviate some of the problem, although fyke nets will continue to be a valuable non-destructive fishing engine for eel and other species.

Recommendations are also made that the inclusion of otter guards should be fully assessed within the National framework for the management of eel, and that in specific areas where the opportunity for accidental capture is higher, and in SACs, special attention should be paid to avoiding capture of otter. A consultation process between the fishing authorities and fishermen would help progress these issues.

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# 1 Introduction

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## 1.1 Terms of Reference

This report was commissioned by the National Parks and Wildlife Service of the Department of the Environment, Heritage and Local Government. The terms of reference were to provide:

- A review of the use of fyke nets in Ireland. This review should contain details of the numbers of licensed fishermen and nets, general locations of operation, seasonality of use, relevant domestic and EU legislation governing these operations, etc.;
- A summary of known otter bycatch events;
- Discussion on the potential impact of this bi-catch on otter populations and on the possible value of otter guards;
- Recommendations on future action in relation to monitoring and managing this bi-catch.

## 1.2 Background

The Eurasian otter, *Lutra lutra*, is listed on Annex II and Annex IV of the EU Habitats Directive. Because of its Annex II listing, a number of Special Areas of Conservation (SACs) have been designated for its protection across Ireland. Article 12 of the Directive requires Member States to implement a system of strict protection for species listed on Annex IV. This should include monitoring of the incidental capture and killing of these species.

In Ireland, fyke nets are used primarily as a commercial eel fishing engine, but have also been used for many years as standard equipment for scientific surveying of eel stocks. More recently, fyke nets are now also being used as a non-destructive method of capture for many other fish species, in particular tench, and also in surveys of transitional (tidal) waters for the Waterframework Directive.

Road traffic casualties represent the dominant majority of known deaths of otters in most western European countries at the moment, although accidental drowning in fishing gear remains a factor that requires attention (Reuther, 2002). Fyke nets are known to catch otters on occasion. It has been recognised elsewhere that this bycatch may constitute a significant threat to otter populations. Little data exists for Ireland on the interactions between otters and fyke nets and this investigation will attempt to fill this gap.

## 1.3 Otter

The Eurasian otter, *Lutra lutra*, is the only otter native to Europe (Mitchell-Jones *et al.*, 1999). They are found as far north as the Arctic Circle, across most of Asia and northern Africa. In Ireland, otters are found in fresh and salt water, although coastal otters need

access to freshwater to clean their insulating fur (Hayden & Harrington, 2000). While otters conform to the basic mustelid body shape of a long, slim body and a skull with powerful jaws, they show numerous adaptations to aquatic life. These include webbed toes and a powerful rudder-like tail, used for propulsion under water. Otters are capable of closing their ears and nostrils while underwater. They have two types of fur; stout waterproof guard hairs and a dense, fine under fur which provides insulation. Their fur is chestnut brown and is slightly lighter on the belly.



Otters have a life span of up to 10 years. Their head and body length is approximately 55-110cm and they weigh between 5 and 12kg. Otters diet consists largely of fish, although they also feed on crustaceans, water birds, frogs and small mammals (Bailey & Rochford, 2006). They can use their whiskers as sensing organs underwater, to monitor the movements of their prey.

Otters breed all year round, with a gestation period of about 63 days, after which two or three cubs are born. These are blind at birth and are covered in a dark or grey downy fur, finally opening their eyes after 35 days. The cubs will remain inside the holt, in a nest of straw or weeds for a further couple of weeks, before venturing out into the open with their mother. The cubs are weaned after three to four months and reach sexual maturity after two to three years.

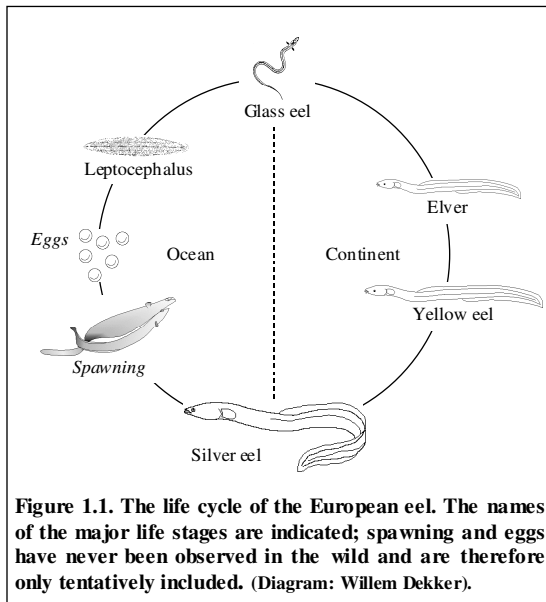
### 1.3.1 Status of Otter

Historically, otter were widely distributed across Europe but widespread population crashes were recorded in the 1960s and 1970s, probably due to toxic chemicals and exacerbated by hunting and habitat loss (Mitchell-Jones *et al.*, 1999). Ireland has long been considered to have one of the most important populations of otter in Europe. In a 1980/81 survey of Ireland covering 2,373 sites, 91.7% (including "oversurveying") were positive for signs of otters (Chapman & Chapman, 1982) and Lunnon (1996) confirmed the wide distribution of the species throughout the country in 1990/91. Lunnon (1996)

also indicated that accidental death from road traffic, fish and shellfish trapping may be of significance but acknowledged that data were unavailable in Ireland.

Bailey & Rochford (2006) compared the results of the 1980/81 and 1990/91 surveys with one carried out in 2004/05. Using data corrected to exclude "oversurveying", there has been a significant overall decline in percentage occurrence of otters nationwide of 17.72% or 0.74% per annum over 24 years. Most of this decline appears to have taken place during the first 10 years (13% overall; 1.30% per annum), with 4.72%, or 0.34% per annum since 1990/1991.

There has also been a reduction in the density, but not overall range, of otter in Northern Ireland between the 1980s survey and 2001/02, with a small, but significant, reduction in numbers mostly in areas of marginal habitat (Preston, *et al.*, 2004).



In the 2004/05 survey, while the differences were not statistically significant, the highest percentage occurrence of otters was found in the South Western (74.47%) and South Eastern (72.97%) River Basin Districts. The Eastern RBD, which comprises the catchments of the Boyne, Liffey, Avoca and Nanny, and is the most highly urbanised and populated RBD in the country, had the lowest percentage occurrence of otters at 59.50% (Bailey & Rochford, 2006).

#### 1.4 European Eel

The European eel *Anguilla anguilla* (L.) is found and exploited in fresh, brackish and coastal waters in almost all of Europe and along the Mediterranean coasts of Africa and Asia. The life cycle has still not been fully elucidated (Fig. 1.1), but current evidence supports the view that recruiting eel to European continental waters originate from a single spawning stock in the Atlantic Ocean, presumably in the Sargasso Sea area, where the smallest larvae have been found. Larvae (*Leptocephali*) of progressively larger size are found between the Sargasso Sea and European continental shelf waters. At the shelf edge, the laterally flattened *Leptocephalus* transforms into a rounded glass eel, which has the same shape as an adult eel, but is unpigmented. In Ireland, glass eel migrate into coastal waters and estuaries between October and March/April, before migrating, as pigmented elvers, on into rivers and eventually into lakes and streams between May and September. Following immigration into continental waters, the prolonged yellow, or brown, eel stage begins, which lasts for up to 20 or more years. During this stage, the eels may occupy fresh water or inshore marine and estuarine areas, where they grow, feeding on a wide range of insects, worms, molluscs, crustaceans and fish. Sexual differentiation occurs when the eels are partly grown, though the mechanism is not fully understood and probably depends on local stock density. At the end of the continental growing period, the eels mature and return from the coast to the Atlantic Ocean; this stage is known as the silver eel. Female silver eels grow larger and may be twice as old as males. The biology of the returning silver eel in ocean waters is completely unknown.



## **2 The Eel Fishery**

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Fisheries across Europe and north Africa target the glass eel, brown eel and silver eel stages with considerable geographical differences in patterns of exploitation. The ecological adaptability of the eel in marine, transitional and freshwaters mean that exploitation and fisheries can take place in a wide variety of locations and habitats Moriarty & Dekker (1997).

### **2.1 International**

The continental stock supports small-scale fisheries in rural areas across the continent, and provides main incomes for over 25,000 people. There is a wide variety of gear types in use. The average yield to fisheries in the 1990s was 9,936t in inland fisheries and 5,613t in coastal fisheries (FAO, 2000; Dekker, 2004).

### **2.2 National (data supplied by the Regional Fisheries Boards)**

Glass eel and elver fishing in Ireland is prohibited by law (1959 Fisheries Act, Sec. 173) and it's current government policy that fishing for juvenile eel may only be carried out for the purposes of stock enhancement. Capture of glass eel did not take place in Ireland until the 1990s. This is a tidal activity using a variety of techniques such as anchored nets (tela), Maine fyke net, trawl and dip-net. Upstream migrating elver have been captured since 1959 under statute, for transfer upstream around barriers; first on the Shannon and more latterly on other rivers under the control of the Electricity Supply Board (ESB), using fixed elver traps incorporating elevated ladders and collecting boxes. All juvenile eel captured are released upstream for enhancement.

The commercial eel fishery involves harvesting both brown and silver eel in freshwater and in estuarine or tidal waters. Brown eel are fished using a variety of techniques, the most common of which are baited long-line, fyke nets and baited pots. When silver eel are migrating downstream in the autumn they are caught in fyke nets and stocking-shaped nets called "coghill nets" which are attached to fixed structures in the river flow, often at "eel weirs".

The declared commercial eel catch in the Irish Republic, 2001-2002, was about 100t involving about 150-200 part-time fishermen (data from RFBs/MI), but inadequate reporting and illegal fishing makes this difficult to quantify accurately and maybe a substantial under estimate. The declared commercial catches in 2004 and 2005 were about 120t and 87t respectively. Full details are available in the National Eel "Country" Report for Ireland to the EIFAC/ICES Working Group on Eel (ICES 2006). The level of undeclared catch has not been recently quantified, but in some Regions this may be as much as three to four times the declared catch (McCarthy, O'Farrell, McGovern & Duke 1994).

Recreational eel fishing by rod & line is only carried out by a minority of anglers and there is no statutory, or voluntary, declaration of catch which is probably small. Some "recreational" fishing using fyke nets and baited pots takes place and this is authorized and reported under the commercial legislation.

### **2.3 Regional**

Moriarty & Dekker (1997) reported that in Ireland there are 237 catchments capable of containing eels. It is likely that eels are present in the majority of these systems although commercial fishing probably only takes places in a smaller number of catchments.

Inland fisheries in Ireland are currently managed by the Central Fisheries Board, seven Regional Fisheries Boards, sub-divided into 17 Districts (Fig. 2.1), and the Electricity Supply Board also has statutory responsibility for fisheries regulation and conservation in waters under it's control.. The Regional Fisheries Boards are responsible for maintaining and improving environmental quality and developing and protecting the fisheries resource in their regions. Eel fishing licences and authorizations are issued on a Regional basis.



Map of Ireland Showing the 17 Fishery Districts and the 7 Regional Fisheries Boards

**Figure 2.1.** Map of Ireland showing the seven Regional Fisheries Boards and the 17 Fishery Districts (Source: CFB).

Each Regional Fisheries Board has a local eel management plan or policy. These broadly aim to improve the regulation of eel fisheries and in many cases also include aims towards enhancement of fisheries through upstream transport of glass eel or elvers. The Management of Eel Fishing Bye-Law No.752, 1998, capped the number of longline licences that a Regional Fisheries Board may issue for long line fishing for eels in any district. In addition to the above, the Fisheries (Amendment) Act 1999 delegated authority to the Regional Fisheries Boards to issue authorisations for the use any fishing engine for the capture of eels including any long line, as it sees fit. Many Fisheries Boards are now promoting the use of fyke net over long-line in an effort to reduce mortality of released undersize eels.



## 2.4 Fyke Nets

### 2.4.1 Description

Fyke nets come in many shapes, sizes and configurations, but all operate on the principle of a leader net which guides fish into a hoop net trap with a tapering cod end. Many fyke nets have double leaders which funnel the catch towards the trap and are staked out. The fyke net type authorised for use in Ireland is known as a small Dutch fyke, or summer fyke net (Moriarty, 1975, 1986; Poole, 1990). These consist of two funnel shaped traps facing each other, joined by a leader net, which usually has a mesh size of 16mm. Each trap consists of two chambers and a cod-end with knot to knot mesh sizes of 16, 12 and 10mm and the entrance is usually 50-60cm in diameter. The standard fyke has a leader length of about 8.2m and each trap end is 3.4m long, giving an overall length of about 15m when set. There may be variations in mesh size and length dimensions and these are not stipulated in the legislation. These fyke nets are usually joined end to end and fished in trains of multiple nets, often 5 or 10 in a train. Other fyke net designs with one metre diameter hoops and leader net height require special authorisation.



Silver eel are fished in the upper and middle Shannon catchment using instream coghill nets, similar to single chamber fyke nets with "v" configuration wing leader nets. These vary in shape and size depending on local conditions, ranging from 20m wings (3m high) and 15m chamber to 5-10m wings (1-2m high) and 5m chamber.

### 2.4.2 History

The small fyke net was introduced into Ireland in 1963 and has been operated for the capture of eel in both fresh and tidal water since 1967. Special authorisations were issued to commercial fishermen from 1970. Moriarty (1986) reports that, after effective demonstration by the Department's own research and by information from professional fishermen, fyke nets could be used for eel fishing without harmful effects on other stocks. The fyke net was subsequently listed as a scheduled engine in the 1980 Fisheries Act.

### 2.4.3 Uses – eels

The fyke net was initially introduced into Ireland for the capture of eel. Most of the fyke net use was subsequently for commercial fishing and scientific eel surveys. Currently, the level of scientific fyke net effort is relatively low, compared to the commercial effort, although this may change in the future (Section 5.1).

#### 2.4.4 Uses – Other Species

Due to the relatively small mesh size and the trap like configuration, fyke nets make ideal non-destructive gear for capturing and sampling a wide range of species in addition to eel. Fyke nets have been used to sample tench (O'Maoileidigh & Bracken, 1989) and other coarse fish, crayfish, smelt, trout, salmon smolts and shad and are an important tool for sampling fish species in transitional waters (estuaries and tidal lagoons) under the EU Waterframework Directive (J. King, *pers comm.*).

Fyke nets are the only non-destructive method currently available for the capture of tench (J. Caffrey, *pers comm.*). Naismith & Knights (1994) described a bycatch in fyke nets in the Thames Valley, UK, of 20 different fish species, including crayfish. Poole (1990) reported 15 species taken in 1988 in brackish water.

#### 2.4.5 Legislation

There appears to be a paucity of legislation regulating the use of fyke nets in Irish waters. Fykes were listed as a scheduled engine in the 1980 Fisheries Act.

Moriarty (1999) comprehensively reviewed the existing legislation and the following gives extracts pertinent to fyke nets.

##### *The 1959 Consolidation Act*

*Section 9* as amended by Section 3 of the Fisheries (Amendment) Act 1962 empowers the Minister to make bye-laws for the government, management, protection and improvement of fisheries and any other matter or thing relating in any manner to the government and protection of the fisheries. The Management of Eel Fishing Bye-Law No. 752, 1998 which caps the number of longlines licenses that may be issued in any Fishery District was made under the above section.

*Section 14* in effect allows the Minister to issue an Authorisation to catch, attempt to catch and have in possession any specified fish, caught by any specified method. It has been used extensively not only for strictly scientific purposes but also to allow commercial fishermen to use methods which have not been covered by the existing legislation. It is also used to permit fishing in particular places, such as narrow estuaries, where fixed engines are normally prohibited. Ultimately, as happened with the fyke net, amending legislation may be enacted to regularise the fishery.

*Section 90* provides for the forfeiture of licences as an optional penalty for offences.

*Section 95* generally forbids the use of nets in fresh water. Subsection 1(d), however, permits the use of a net 'constructed for the capture of eel'.

*Section 100* permits the use of a fixed engine which was in operation in one or more of the years 1936, 1937 or 1938. These were the years immediately preceding the 1939 Act which prohibited the erection of fixed engines in fresh water. Subsection 4 excluded the long-line from this prohibition and was repealed in the 1994 Amendment – with the intention of equating the long-line with fixed engines and therefore requiring that long-lines be operated only when duly authorised.



*Subsection 5* allows the Minister to authorise the use of a fixed engine for eel. An Authorisation under this Subsection is the usual instrument to allow fishing for silver eel.

*Section 102* forbids the erection of a fixed engine in an estuary where the breadth of the channel at low water of spring tide is less than three quarters of a mile. This provision was primarily part of salmon conservation legislation and Section 14 has been used frequently to allow the operation of small fyke nets in such estuaries.

### ***The 1980 Amendment***

*Section 18* allows the Central Board or a Regional Board to ‘take fish from a fishery by any means whatsoever’. This would allow a Board’s employees to capture glass eel or elver.

### ***The 1994 Amendment***

*Section 18* amended Section 95(1) of the 1959 Act to bring eel nets under the authorisation regulations of its Section 100.

*Section 19* increased penalties for existing offences and introduced penalties for failure to comply with the conditions of a Section 100 authorisation. By removing Subsection 1 of Section 100 it simplified the issuing of authorisations for new fixed engines. The Section was intended to bring the long-line under the same regulations as fyke nets and other gear but was found defective by a Circuit Court judgement in March 1997 which held that the long-line was not a ‘fixed engine’.

This led to the re-instatement of the unsatisfactory situation whereby Regional Fisheries Boards were required to issue a long-line licence to any person applying. The intended effect of Section 19 of the Fisheries (Amendment) Act of 1994 was to allow Regional Fisheries Boards to control all forms of eel fishing, including the use of the long-line which was deemed to be a fixed engine. Until a further amendment is made, full control of eel fishing in the interests of stock conservation will not be possible. As a temporary measure a bye-law, capping the number of long-line licenses to equal the numbers issued in 1997, was introduced in 1998 and re-issued in 1999.

## **2.4.6 The Irish Eel Review 2003**

The Irish Eel Review Group reported to the Minister for Communications, Marine and Natural Resources in 2003 (Anon., 2003). The Group acknowledged the complex, long-lived life cycle of the eel, the dramatic decline in juvenile recruitment and indicated that the development of management plans is urgently needed at both the national and international level with a priority to protect and increase the number of spawners migrating successfully from European waters. The Group sought, through consultation with relevant stake-holders and compilation of the data available from fishery managers and fishery scientists investigating Irish eel populations, to summarize and interpret all available information on these topics and to formulate a specific set of recommendations that address the issues specified in its terms of reference. The following excerpts from the Group Report were pertinent to fyke nets:

The Irish Eel Review Group commented: "*There is currently no legislation to control the use of baited eel pots or fyke-nets in estuaries*" and there is no National close season for fyke nets. The Southern Regional Fisheries Board proposed to introduce a close season for fykes and to cap the number of licences issued for fykes in the Waterford estuary to nine, as issued in 1996 (Anon, 2003).

The Irish Eel Review Group also discussed the prioritisation of fyke nets over long-lines – a recommendation that may have to be reviewed in the light of proposed EU Regulations on eel stock recovery: "*With the exception of well established long-line fisheries where it can be shown that such fishing is sustainable, the fishing method for brown eel should be restricted to fyke-nets. Only the traditional 2ft x 12mm nets should be permitted. Increased PR and awareness with other fisheries (i.e. trout, coarse) will be required to facilitate this.*

*It is anticipated that in many catchments eel stocks will only be exploitable on a sustainable basis using fyke-nets. These nets have the advantage of being able to release small eel unharmed by having escape rings fitted. All fyke-nets should have rings capable of allowing eel of less than 120 grams to escape and the fitting of otter guards should also be assessed. Fyke-nets generally have little or no effect on other fish species.*

*Fishermen using fyke nets should be required to attach unique identification tags (issued annually by relevant RFB with license) to each end of every chain of fyke nets to identify legitimate nets from those being fished illegally. Identification tags should be attached directly to base of net chain, either surface or submerged, in consultation with the relevant RFB."*

#### **2.4.7 Enforcement**

There is currently a level of illegal, or unauthorised, fishing using fyke nets and it is difficult to ascertain details of the illegal fishery. Fyke nets don't require baiting, or regular servicing, making policing of the fishery difficult.

Enforcement is difficult and costly, mainly because fishing can be carried out effectively between sunset and dawn. Serious problems in bringing prosecutions have been largely met by provisions of the 1994 Amendment (Moriarty, 1999).

There is currently no legal requirement for fishermen to report their bycatch, including mammals, to fisheries or wildlife authorities.

#### **2.4.8 Seasonality**

The seasonality of eel fishing in Ireland is directly related to the peak movements and high activity periods of each life stage of the eel. Table 2.1 summarises the general periods of eel migration and fishing activity in the Republic of Ireland. Local and climatic factors may introduce anomalies to these periods but these would be unusual.

## ***Juvenile Eel***

Glass eel arrive off the coast between October and March/April and migrate upstream between April and September as both pigmented elvers and older bootlace eel. Glass eel and elver fishing in Ireland is prohibited by law (1959 Fisheries Act, Sec. 173). Experimental fishing for enhancement has been carried out in the last decade using a variety of methods, dip nets, trawl, Maine fyke net and tela net, and as these nets are all generally manned while fishing, they pose little or no threat to otter. Fixed trap monitoring of elver takes place at physical barriers and these traps also pose little threat to otter.



Elver trap at ESB, Ardnacrusha.

## ***Brown Eel***

The commercial eel fishery in Ireland involves harvesting both brown and silver eel in freshwater and in estuarine or tidal waters. Brown eel are fished using a variety of techniques, the most common of which are baited long-line, fyke nets and baited pots.

No national close season exists for brown eel although close seasons are already in place for a number of individual catchments – see text table below.



Fyke net fishing

Peak brown eel fishing takes place between early May and the end September. Additional fishing may also take place later in the year, more often in tidal waters. As the majority of fyke nets are fished unbaited they rely on natural eel activity to be effective. Therefore, fyke nets work most efficiently for brown eel in the warmer months of the year.

| District  | River System  | Closed Season     |
|-----------|---|-------------------|
| Limerick  | River Shannon (except with lines and hooks)   | 1 Feb to 30 June  |
|           | River Shannon, lakes and tributaries, with lines and hooks (other than single rod and line) | 1 Feb to 30 April |
|           | Rest of District  | 1 Jan to 30 June  |
| Kerry     | Between Dunmore Head and Kerry Head   | 1 Jan to 30 June  |
| Galway    | Corrib or Galway River  | 11 Feb to 30 June |
| Connemara | Whole District, with lines and hooks (other than single rod and line)                       | 11 Jan to 9 April |
| Drogheda  | Any river in the District   | 1 Dec to 30 June  |

## Silver Eel

Silver eel capture takes place during the downstream migration in autumn and winter, mostly at fixed stations or 'weirs' using coghill nets. Fyke netting also takes place near lake outflows and in the larger rivers using standard and "V" wing fyke nets.

The "normal" season for silver eel migration in Ireland is between August and January, with the main run in September to November, depending on lunar phase, water temperature and water level. Migration periods favour the dark moon phase with high water levels.



Coghill nets.

**Table 2.1.** Seasonality of eel activity and periods of fishing effort.

|                        | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Glass Eel Arrival      |     |     |     |     |     |     |     |     |     |     |     |     |
| Glass Eel Fishing      |     |     |     |     |     |     |     |     |     |     |     |     |
| Elver Trapping         |     |     |     |     |     |     |     |     |     |     |     |     |
| Peak Migration         |     |     |     |     |     |     |     |     |     |     |     |     |
| Brown Eel Fishing      |     |     |     |     |     |     |     |     |     |     |     |     |
| Freshwater             |     |     |     |     |     |     |     |     |     |     |     |     |
| Tidal                  |     |     |     |     |     |     |     |     |     |     |     |     |
| Silver Eel Migration   |     |     |     |     |     |     |     |     |     |     |     |     |
| Natural                |     |     |     |     |     |     |     |     |     |     |     |     |
| Flow Regulated Shannon |     |     |     |     |     |     |     |     |     |     |     |     |

### 2.4.9 Commercial Fyke Net Effort (data supplied by the Regional Fisheries Boards)

Commercial fyke net effort for brown eel is largely focussed on the warmer months of the year, between June and September, with some fishing in May and after September. Some additional large fyke nets are authorised, but these are largely confined to the Corrib system.

Fishing effort is not generally monitored in the Irish eel fishery. There is no log-book or statutory recording system for fishermen and there is no eel dealer register or regular monitoring of eel dealers. There is no register of vessels, or even the number of individuals actively fishing. Table 2.2 gives the number of eel licences issued per Fishery Region in 2005; a total of 93 licences were issued for fyke nets in 2005. Not all licences are actively fished and it is also not clear whether these licences target brown or silver eel. It is also difficult to ascertain the number of fishermen, or vessels, from the number of licences.

Each Regional Fisheries Board has a policy on the number of fyke nets permitted for each licence, and in some cases the locations where they are permitted to fish. The total number of fishermen authorised to use fyke nets in 2005 was 93 and the breakdown by Fishery District is in Table 2.3, giving a national total of 2,340 licensed nets. Figure 2.2 gives a rough graphical representation of where the main fyke net efforts are directed. Fyke nets are used throughout the midlands in the Shannon and Erne catchments which is unclear in Figure 2.2.

It is difficult to convert the number of licensed nets in Table 2.3 into an actual fishing effort, as many licensed fisherman either don't fish at all or only fish for a limited period of the year. In some areas for example, such as in the south east, fyke nets are used during the weaker tides and baited pots are used when the tides are too strong for fyke nets.

#### **2.4.10 Survey Fyke Net Effort**

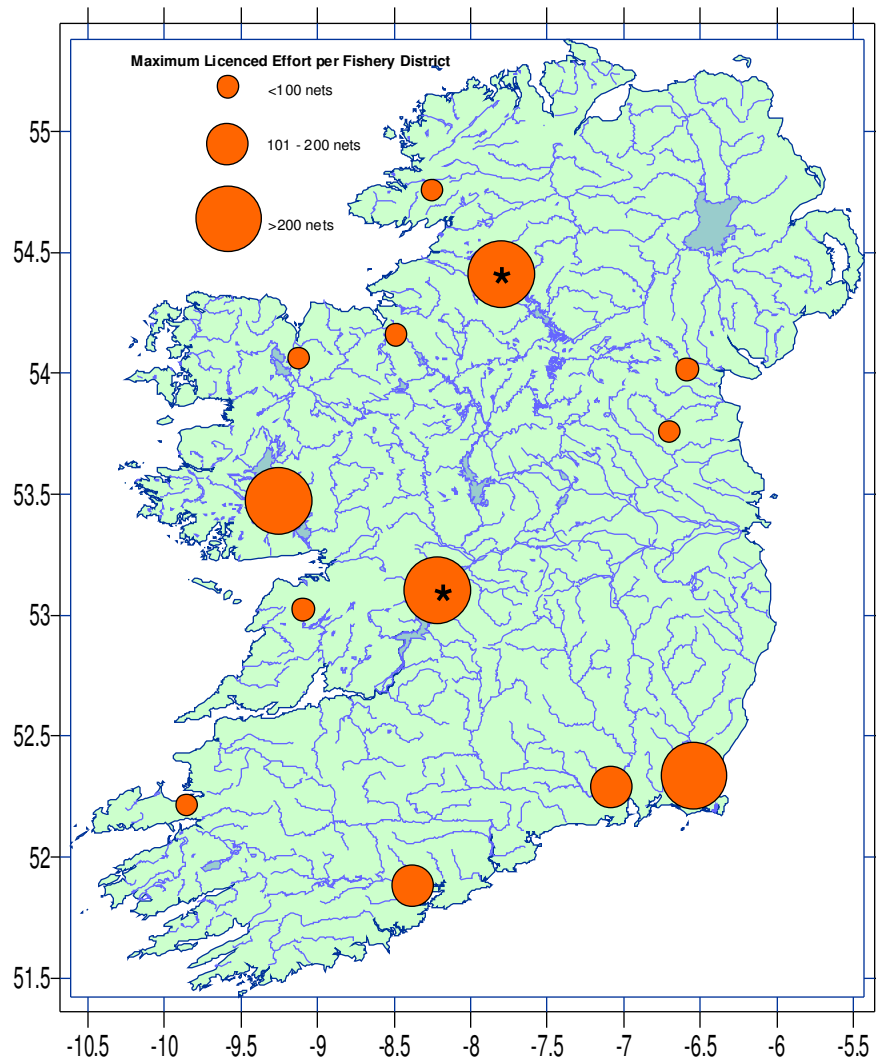
Fyke nets are used for scientific surveys and non-destructive capture of both eels and many other fish species. The effort involved reflects the needs of the particular survey and it was difficult to ascertain the levels of effort used in the last few years. For example, the Erne Eel Enhancement Programme used fyke nets in an intensive survey of the Erne rivers and lakes, deploying more than 45,000 net nights between 1998 and 2000 (Matthews *et al.*, 2001).

**Table 2.2.** Number of eel fishing licences/authorisations issued in each Fishery Region in 2005.

| <b>Fishery Region</b> | <b>Type</b>   | <b>Number</b> | <b>Comment</b>                                |
|-----------------------|---------------|---------------|---|
| Eastern               | Longline      | 3             |   |
|                       | Fyke          | 15            |   |
|                       | Coghill       | 7             |   |
| Southern              | Fyke          | 3             | 80 nets                                       |
|                       | Pots          | 20            | 197 pots                                      |
|                       | Coghill       | 2             |   |
| South Western         | Fyke/Pot      | 9             | 20 nets/licence                               |
| Shannon               | Longline      | 6             | capped @ 10                                   |
|                       | Longline      | 16            | by ESB  |
|                       | Fyke          | 7             |   |
|                       | Fyke          | 14            | by ESB  |
|                       | Coghill       | 2             |   |
|                       | Coghill       | 20 max        | by ESB @ Killaloe                             |
|                       | Coghill       | 23            | by ESB, 1 net to each fisherman               |
| Western               | Longline      | 1             |   |
|                       | Fyke          | 21            | 2 are for tot 60 nets x 1m high               |
|                       | Trap          | 1             |   |
|                       | Gap, Eye, Net | 23            | inc. 14 nets in Galway Fishery or fyke option |
| North Western         | Longline      | 14            |   |
|                       | Fyke          | 7             |   |
|                       | Coghill       | 1             | on trial basis/not fished in '05              |
| Northern              | Longline      | 24            | Republic capped @ 32                          |
|                       | Fyke          | 17            | 20 nets/licence                               |
|                       | <b>Total</b>  | <b>256</b>    |   |

**Table 2.3 .** The number of fyke nets licensed by each Regional Fisheries Board in 2005.

| <b>Region</b> | <b>District</b> | <b>No Licences</b> | <b>Maximum<br/>Licenced Effort</b> |
|---------------|-----------------|--------------------|------------------------------------|
| Eastern       | Dundalk         | 2                  | 40                                 |
|               | Drogheda        | 3                  | 60                                 |
|               | Dublin          | 0                  | 0                                  |
|               | Wexford         | 10                 | 200                                |
| Southern      | Waterford       | 3                  | 120                                |
|               | Lismore         | 0                  | 0                                  |
| South Western | Cork            | 7                  | 140                                |
|               | Kerry           | 2                  | 40                                 |
| Shannon       | Non Shannon     | 7                  | 140                                |
|               | Shannon/ESB     | 14                 | 700                                |
| Western       | Galway          | 21                 | 420                                |
|               | Connemara       | 0                  | 0                                  |
|               | Ballinakill     | 0                  | 0                                  |
| North Western | Bangor          | 0                  | 0                                  |
|               | Ballina         | 3                  | 60                                 |
|               | Sligo           | 4                  | 80                                 |
| Northern      | Ballyshannon    | 15                 | 300                                |
|               | Letterkenny     | 2                  | 40                                 |
| <b>Total</b>  |                 | <b>93</b>          | <b>2340</b>                        |



**Figure 2.2.** Graphical representation of the maximum fyke net effort (number of individual nets) licensed per Fishery District. The location of the circles, with the exception of the two marked \*, indicate the general location of the use of the fyke nets. In the case of the two marked \*, fykes are used throughout the Shannon and Erne catchments.



### 3 Special Areas of Conservation (SACs) for Otter

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Special Areas of Conservation (SACs) are prime wildlife conservation areas in the country, considered to be important in a European as well as an Irish context. The legal basis on which SACs are selected and designated is the [EU Habitats Directive\(92/43/EEC\)](#), transposed into Irish law in the European Union (Natural Habitats) Regulations, 1997. These Regulations have since been amended twice with [SI 233/1998](#) & [SI 378/2005](#). The Directive lists (Annex I) certain habitats that must be protected within SACs. Irish habitats include raised bogs, blanket bogs, turloughs, sand dunes, machair (flat sandy plains on the north and west coasts), heaths, lakes, rivers, woodlands, estuaries and sea inlets. There is also a list (Annex II) of species which must be afforded protection and, for Ireland, this includes the **Otter**, Bottle-Nosed Dolphin, Freshwater Pearl Mussel and the Killarney Fern.

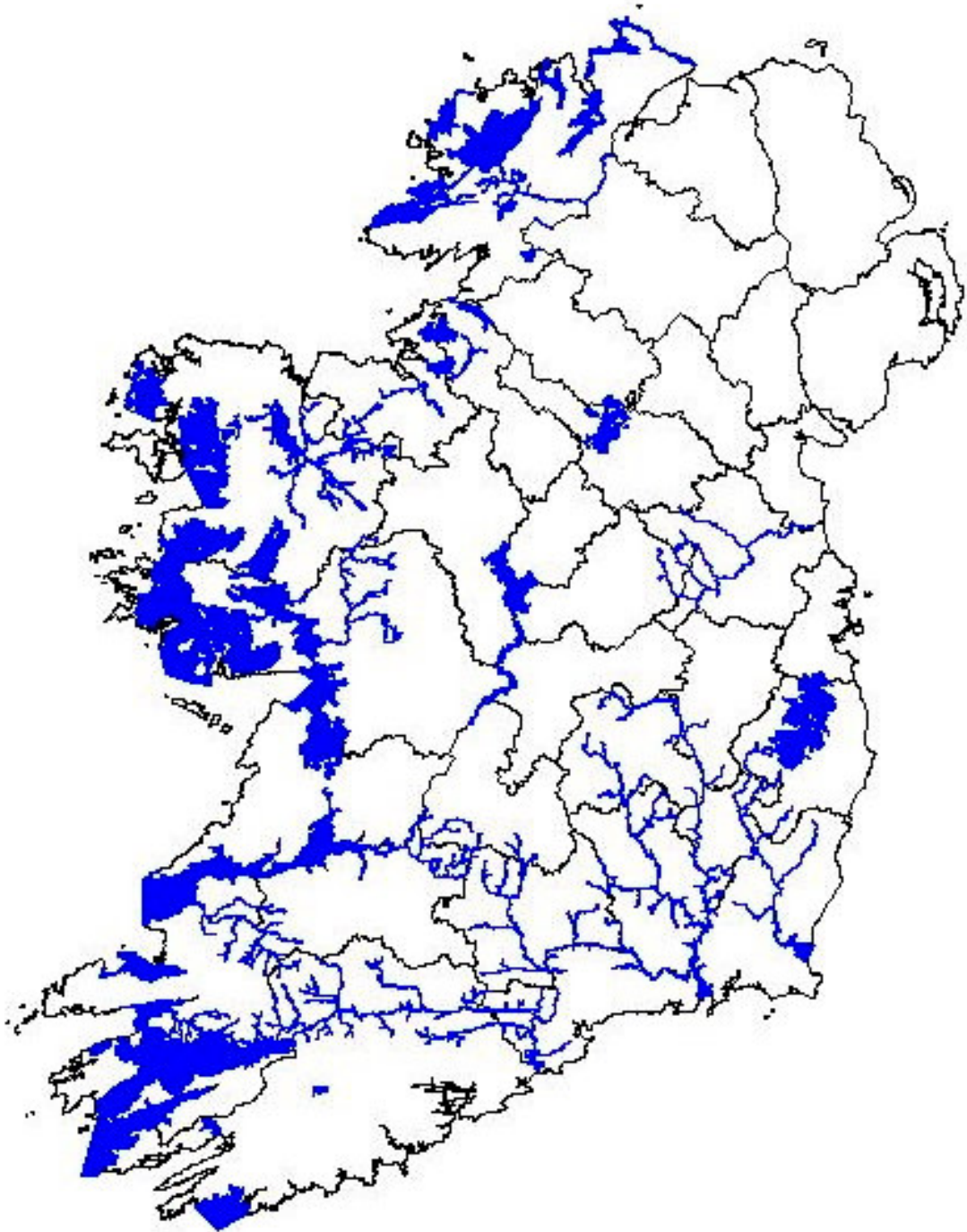
#### 3.1 SACs

To date, Ireland has transmitted 413 sites to the European Commission as candidate Special Areas of Conservation, of which there are 45 SACs specifically listed for otter (Table 3.1) and their location is indicated in Figure 3.1. In the 2004/05 national survey of otter in Ireland (Bailey & Rochford, 2006), it was shown that there was no difference in percentage occurrence of otter between sites within and outside of these SACs.

#### 3.2 SACs & Specific Fisheries

While it is acknowledged that the otter is widely distributed throughout Ireland, certain habitats and areas have received SAC protection for otter (Section 3.1). Some of these SACs coincide with areas of known commercial, or scientific, fyke net activity. There were 13 SACs where appreciable fyke net effort occurred within the last five years and these are highlighted in Table 3.1.

Conversely, it is clear from Figures 2.1 and 3.1 that all of the areas identified with appreciable fyke net effort, with the exception of some lakes in the Shannon and Erne catchments, fall within the zones covered by SAC protection for otter.



**Figure 3.1.** Map of Ireland showing the Special Areas of Conservation (SACs) for otter in blue. [Source: NPWS]

**Table 3.1.** Site names and codes for Special Areas of Conservation specifically for otter. The codes highlighted in yellow are areas where significant fyke net fisheries are known to take place.

| Site Code: | Site Name:  |
|------------|---|
| 000007     | LOUGH OUGHTER AND ASSOCIATED LOUGHS                                       |
| 000032     | DROMORE WOODS AND LOUGHS  |
| 000057     | MOYREE RIVER SYSTEM   |
| 000090     | GLENGARRIFF HARBOUR AND WOODLAND  |
| 000101     | ROARINGWATER BAY AND ISLANDS  |
| 000108     | THE GEARAGH   |
| 000190     | SLIEVE TOOHEY/TORMORE ISLAND/LOUGHROS BEG BAY                             |
| 000197     | WEST OF ARDARA/MAAS ROAD  |
| 000216     | RIVER SHANNON CALLOWS   |
| 000268     | GALWAY BAY COMPLEX  |
| 000297     | LOUGH CORRIB  |
| 000343     | CASTLEMAINE HARBOUR   |
| 000365     | KILLARNEY NATIONAL PARK, MACGILLYCUDDY'S REEKS AND CARAGH RIVER CATCHMENT |
| 000428     | LOUGH MELVIN  |
| 000440     | LOUGH REE   |
| 000470     | MULLET/BLACKSOD BAY COMPLEX   |
| 000534     | OWENDUFF/NEPHIN COMPLEX   |
| 000623     | BEN BULBEN, GLENIFF AND GLENADE COMPLEX                                   |
| 000781     | SLANEY RIVER VALLEY   |
| 001141     | GWEEDORE BAY AND ISLANDS  |
| 001482     | CLEW BAY COMPLEX  |
| 001774     | LOUGH CARRA/MASK COMPLEX  |
| 001898     | UNSHIN RIVER  |
| 001926     | EAST BURREN COMPLEX   |
| 001932     | MWEELREA/SHEEFFRY/ERRIFF COMPLEX  |
| 001976     | LOUGH GILL  |
| 002012     | NORTH INISHOWEN COAST   |
| 002031     | THE TWELVE BENS/GARRAUN COMPLEX   |
| 002034     | CONNEMARA BOG COMPLEX   |
| 002047     | CLOGHERNAGORE BOG AND GLENVEAGH NATIONAL PARK                             |
| 002070     | TRALEE BAY AND MAGHAREES PENINSULA, WEST TO CLOGHANE                      |
| 002111     | KILKIERAN BAY AND ISLANDS   |
| 002122     | WICKLOW MOUNTAINS   |
| 002137     | LOWER RIVER SUIR  |
| 002158     | KENMARE RIVER   |
| 002159     | MULROY BAY  |
| 002162     | RIVER BARROW AND RIVER NORE   |
| 002165     | LOWER RIVER SHANNON   |
| 002170     | BLACKWATER RIVER (CORK/WATERFORD)   |
| 002173     | BLACKWATER RIVER (KERRY)  |
| 002277     | GWEEDORE COAST  |
| 002287     | LOUGH SWILLY  |
| 002298     | RIVER MOY   |
| 002299     | RIVER BOYNE AND RIVER BLACKWATER  |
| 002301     | RIVER FINN  |

## 4 Survey of Otter Bycatch

It is well known that otters may be attracted to fish caught in fyke nets and other trap type fishing gear and that they may become trapped and drowned in the process (Chapman & Chapman, 1982; Cullen & McCarthy, 2002; Jeffries, Green & Green, 1984; Madsen, 1991; Matthews *et al.*, 2001; Poole, 1990; Reuther, 2002). However, evaluating the relative impact of fyke net mortality on the otter population is a much more difficult process. Information on the relative levels of mortality due to anthropogenic factors (i.e. fyke net, road traffic) compared to levels of natural mortality are almost unknown, and this possible bias towards some forms of mortality can lead to misconceptions about the major threats to otters (Reuther, 2002).

It is often difficult, or impossible, to identify the cause of death of an otter, although the number of otters reported dead from "unknown" causes is surprisingly low (Reuther, 2002). O'Sullivan (1996) quoted eight major and 16 specific threats to otters, with fyke nets and fish traps constituting 7% of the specific threats (Table 4.1). O'Sullivan & Fitzgerald (1995) reported, for a period between 1982 and 1992, a total of 628 otters found dead in Ireland, of which 14% were killed by fishing gear.

Reuther (2002) also identified a specific problem related to the possibility that fishermen fail to report all otters found dead in fishing gear and admits that it is often difficult, or impossible, to get evidence or specific numbers to support this assumption. In fact, in Ireland there is no requirement for any reporting of otter deaths by fishermen or other personnel engaged in fishing operations. It is also possible that some fishermen feel that the reporting of dead otters might result in more restrictions and therefore such accidents should be concealed (Reuther, 2002).

**Table 4.1.** The major and specific threats (percentage of times listed) to otters in 29 European countries/regions, ranging from Ireland to Siberia (from O'Sullivan (1996)).

| Major threats                | %  | Specific threats/areas of conflict | %  |
|------------------------------|----|------------------------------------|----|
| Habitat destruction          | 28 | River/wetland drainage             | 17 |
| Water pollution              | 25 | Sand/gravel abstraction            | 3  |
| Mortalities/illegal killings | 19 | Water abstraction                  | 1  |
| Recreation/disturbances      | 13 | Urbanisation                       | 5  |
| Hydroelectric schemes        | 5  | Organic pollution                  | 14 |
| Aquaculture/fisheries        | 5  | Industrial pollution               | 14 |
| Oil spillages                | 1  | Acidification/forestry             | 3  |
| American mink                | 1  | Poisonous marine algae             | 1  |
|                              |    | Aquaculture/fisheries              | 8  |
|                              |    | Fyke nets/fish traps               | 7  |
|                              |    | Mammal traps                       | 5  |
|                              |    | Hunting/killing                    | 8  |
|                              |    | Road traffic                       | 9  |
|                              |    | Angling                            | 2  |
|                              |    | Boating                            | 1  |
|                              |    | Tourism                            | 2  |

(Data source: modified from Foster-Turley *et al.* (1990). The criteria used to classify threats are not necessarily mutually exclusive.)

## 4.1 Literature & Fish Stock Survey Review

### 4.1.1 Ireland

A review of literature was carried out and relatively little quantitative information was found on otter bycatch by fyke nets in Ireland. Table 4.2 presents a summary of recently published information and also collates information from unpublished surveys undertaken in the last few years. Chapman & Chapman (1982) reported that otters were known to be accidentally drowned in fish traps on the Corrib. They quote Fairley (1972; *pers comm.*) that all but one of 33 bodies examined were from fish traps, the coghill nets in the Galway Fishery and some from local pelt trapping. It is unclear whether the fish traps were fyke nets or some other form of trap. Chapman & Chapman (1982) also reported eight otters drowned in fish traps in four small lakes in Dromore, Co. Clare, in 1975, but again the type of fish trap was not made clear.

Moriarty (1986) reports on fish bycatch taken in over 5,500 net nights but makes no reference to mammals, nor specifically to otters. Approximately five otters were caught in almost 40 years of fyke net surveying and this was considered insignificant relative to the cost and effort of fitting otter guards to the nets (Moriarty, *pers comm.*).

Poole (1990) carried out a survey of the Burrishoole Catchment, north Mayo, in 1987 and 1988 using trains of 10 fyke nets in both tidal and freshwater. With a fishing effort of 2,123 net nights, one otter was trapped and drowned. This occurred in 1988 in the tidal portion of the riverine estuary between L. Furnace and the sea. It is possible that the nets were partially stranded, or dry, during low tide and the otter may have entered during low water. Additional surveys have been undertaken in the Burrishoole catchment and north Clew Bay area subsequent to the Poole (1990) survey with a total effort of at least 2,572.5 net nights (Marine Institute, unpublished). No further incidences of otter mortalities occurred.

A comprehensive survey of the Shannon eel fishery carried out over a six year period from 1992 to 1998, included daily reporting by the fishing crews and verification by independent observers (Cullen & McCarthy, 2002). They describe three methods of eel fishing with nets in the Shannon, traditional fyke net fishing in the Shannon lakes, larger fykes with "V-wings" staked in the rivers for silver eel capture and coghill net fishing in Killaloe for silver eel. A total of 15 otter and 3 mink were reported killed over the six year period although no data on fyke net effort was included. Seven otter and three mink were caught by the lake fyke nets, in L. Allen (2 otter) and L. Derg (5 otter and 3 mink) and eight otter were caught by the river fyke nets, in Meelick and Portumna.

Matthews *et al.* (2001) produced probably the most comprehensive dataset using trains of 10 fyke nets in a three year survey of the Erne system. The survey, undertaken by professional fishing crews in 1998, 1999 and 2000, involved a total of 45,806 fyke net (pair of traps) nights throughout the entire Erne Catchment. Three instances of otters drowning as bycatch were recorded during the course of the survey giving a mortality rate of one otter for approximately every 15,000 net nights. Matthews *et al.* (2001) record that all the mortalities occurred in shallow water (<5.0m depth) in the River Erne between Lower L. Erne and Belleek.

Other eel surveys of lakes in Connemara, Mayo, Donegal and Cork reported (McCarthy, *pers comm.*) no otter mortality, although one was taken in a tidal estuary. More recently, fyke nets have been used on surveys, for the Waterframework Directive, of lakes and

transitional tidal waters with no otters being recorded in freshwater and five in tidal waters (Table 4.2).

**Table 4.2.** Fisheries surveys where information was available on the number of otters accidentally killed.

| Year      | Survey Type          | Survey Location               | Fyke Effort | No. of Otter Mortalities | No. of Otter/Year Years | Source |                                |
|-----------|----------------------|-------------------------------|-------------|--------------------------|-------------------------|--------|--------------------------------|
|           | Coarse fish          | Inland waterways & L. Sheelii | 800         | 3                        | 20                      | 0.2    | J. Caffrey <i>pers. comm.</i>  |
| 2001-2006 | Smelt, crayfish, WFD | Var. including Suir & Slaney  |             | 5                        | 5                       | 1.0    | J. King <i>pers. comm.</i>     |
| 1998-2000 | Eel                  | Erne                          | 45,806      | 3                        | 3                       | 1.0    | Matthews <i>et al.</i> 2001    |
| 1960-2000 | Eel                  | National                      |             | 5                        | 40                      | 0.1    | C. Moriarty <i>pers. comm.</i> |
| 1951-2006 | Eel                  | Wexford                       |             | 2                        | 50                      | 0.0    | P. Doherty <i>pers. comm.</i>  |
| 2005-2006 | WFD - NSSHARE        | Border areas - NI             | 81-243      | 0                        | 2                       | 0.0    | R. Rosell <i>pers. comm.</i>   |
| 2005-2006 | WFD - NSSHARE        | Border areas - ROI            | 78-234      | 0                        | 2                       | 0.0    | CFB <i>pers. comm.</i>         |
| 2005      | Eel                  | Screebe                       |             | 0                        | 1                       | 0.0    | K. McCarthy <i>pers. comm.</i> |
| 2005      | Eel                  | Clady - Crolly                |             | 0                        | 1                       | 0.0    | K. McCarthy <i>pers. comm.</i> |
| 2006      | Eel                  | Lee                           |             | 0                        | 1                       | 0.0    | K. McCarthy <i>pers. comm.</i> |
| 1987-1988 | Eel                  | Burrishoole                   | 2,123.50    | 1                        | 2                       | 0.5    | Poole, 1990                    |
| 1990-2005 | Eel                  | Burrishoole                   | 443         | 0                        | 16                      | 0.0    | Poole unpublished              |
| 1992-1998 | Eel                  | Shannon                       |             | 15                       | 7                       | 2.1    | Cullen & McCarthy, 2002        |

#### 4.1.2 International

Reuther (2002) reviewed numerous publications on the proportions of otters killed in fishing gear in eleven European countries and regions. These ranged from 8% in Sweden (1980-2000) to 72% in Denmark (1967-1981) but the proportion killed specifically by fyke nets compared to other fishing gear was not reported by Reuther (2002).

In the UK, few mammals (1 vole), birds (10) or shellfish were drowned in a fyke net survey of the Thames Valley in a fyke net effort of 796.5 net nights (Naismith & Knights, 1994). No otters were drowned during this survey. They recommend setting nets below water level to avoid trapping surface swimming birds and fitting otter guards, in spite of not catching any otters.

Koed & Dieperink (1999) quote Jeffries, Green & Green (1984) and Madsen (1991) stating that accidental drowning in eel traps has been known as a major cause of death for more than a decade. However, the fyke nets they describe are used largely in rivers and of a different configuration to most of those used in Ireland. Madsen *et al.* (1999) reported that there was a significant reduction in the number of drowned otters in Denmark, since 1989. Between 1979 and 1993, a total of 194 dead otters were examined, of which 45.4% were killed by traffic and 32.5% were drowned, mostly in fish traps (including crayfish traps and fyke nets). The decrease in drownings (42.9% in 1989 to 9.7% in 1993) was largely attributed to the introduction in 1987 of compulsory fitting of otter guards, or stop grids. It is now compulsory to have otter guards fitted in all Danish freshwaters (Madsen & Sjøgaard, 2001).

Madsen (*pers comm.*) described otters drowned in fish traps, including in both single (60-90cm entrance) and double (50cm entrance & joint leader). Between 1980 and 1989, 96 otters were examined and 41 (44.4%) of these had drowned, a preponderance of which were sub-adults. Most of the otters were drowned in water less than 1.5m, and the deepest was from 2.5m. The distance from land to the fatal fish traps varied between 0-200m but the majority were drowned within 60m of the shore. Other studies from Scotland and the

Netherlands indicate a link between shallow depths and the likelihood of accidentally trapping otters, with an increased chance of trapping otters in depths of less than 2m and a reducing chance down to 4-5m (Reuther, 2002).

## **4.2 Questionnaire**

Two questionnaires were issued in September 2006 in order to get some data on the levels of otter mortalities attributed to fyke nets. One questionnaire was sent to the District Inspectors of the Regional Fisheries Boards (RFB) (Appendix 1) and a second questionnaire (Appendix 2) was sent to the National Park & Wildlife Service (NPWS) Divisional, Regional and Deputy Regional Managers, Divisional Ecologists, District Conservation Officers and the Conservation Rangers.

In total, 138 questionnaires were issued and of these 60 were returned completed (44%) (Table 4.3). A contributory factor to the apparently low level of return was the forwarding of questionnaires from NPWS Managers, Conservation Officers etc. to Conservation Rangers, for example, who had already been circulated with their own questionnaire. There is also the possibility of double reporting of dead otters, with the same incidence being reported by both the RFB and the NPWS.

It should be noted that there is no obligation for fishermen, or the general public, to report otter mortalities, to either the RFBs or the NPWS. Therefore, the data reported in the questionnaires is a compilation of reports, chance observations of deaths, such as road kills etc, and observations during routine net inspections as carried out by the RFBs. It is also possible that some fishermen feel that the reporting of dead otters might result in more restrictions and therefore such accidents should be concealed (as observed by Reuther, 2002). The number of otter mortalities reported in the questionnaires (Tables 4.3 & 4.4) are therefore likely to be underestimated.

### **4.2.1 Numbers**

The number of mortalities attributable to specific causes differed between the correspondents, probably due to the varying degrees of exposure of the correspondents to the various sources of otter mortalities and the lack of any "requirement" for reporting. For example, none of the RFB Inspectors reported otter mortalities caused by anything other than fishing gear.

In the questionnaire survey, 124 otter mortalities were reported, of which 21 were attributed to fyke nets (16.9%) (Table 4.3).

It would appear from the limited survey undertaken that about half the otter mortalities due to fyke nets were reported in Connacht with none being reported from Ulster (RoI). There was a more even spread of reporting for the total otter mortalities, with the highest in Munster and the lowest in Connacht (Table 4.4)

The otter mortalities were reported for periods from 1 to 26 years, making it difficult to obtain an annual estimate of mortality. The fyke net mortalities were reported over an

average time period of 8 years (1-26 years) and when calculated out it gave an average otter mortality of 0.9 otters per year in fyke nets.

**Table 4.3.** Details of the number of questionnaire issued, returned and the number of otter mortalities reported, due to fyke nets and other causes.

| Agency                   | No of Questionnaires | No. of Returns | No. of morts by fyke net | No. of morts by others | Total mortalities |
|--------------------------|----------------------|----------------|--------------------------|------------------------|-------------------|
| Regional Fisheries Board |                      |                |                          |                        |                   |
| Inspectors               | 23                   | 19             | 14                       | 0                      | 14                |
| NPWS Rangers             | 79                   | 30             | 3                        | 60                     | 63                |
| NPWS Ecol./Cons. Off.    | 16                   | 9              | 3                        | 23                     | 26                |
| NPWS Managers            | 20                   | 2              | 1                        | 20                     | 21                |
| Total                    | 138                  | 60             | 21                       | 103                    | 124               |

**Table 4.4.** Reported total otter mortalities and those caused by fyke nets in each province.

| Province | Mortalities by Fyke Net | % Fyke | Total Mortalities | %    |
|----------|-------------------------|--------|-------------------|------|
| Leinster | 5                       | 23.8   | 27                | 22.9 |
| Munster  | 5                       | 23.8   | 42                | 35.6 |
| Connacht | 11                      | 52.4   | 21                | 17.8 |
| Ulster   | 0                       | 0.0    | 28                | 23.7 |
| Total    | 21                      |        | 118*              |      |

\* doesn't include 6 otters reported for Connacht/Ulster but not allocated to either.

#### 4.2.2 Habitat

The survey questionnaires requested information on the general locations and habitat where otters were most recorded as being trapped in fykes. These were as follows (not ranked in order):

Estuaries/Tidal



Rivers

Shallow areas of lakes

In lakes adjacent to river mouths

It is apparent that the use of fyke nets in areas of shallow and/or flowing water increases the opportunity of accidental trapping and death of otters. This is a similar finding to the observations by Madsen and Reuther described in Section 4.1.2, where the majority of otter deaths were observed in water less than 2.5m deep and within 60m of the shore. The higher probability of capture in running water may be a function of a number of factors, including proximity to the shore and the higher percentage occurrence of otters in this habitat (Bailey & Rochford, 2006).

#### **4.2.3 Other Causes of Mortality**

The questionnaire survey identified five general causes of otter mortality as follows (not ranked in order):

Road traffic

Railways

Heavy machinery

Fyke nets

Other fishing gear (i.e. lobster pots, coghill nets)

The relative importance of each of these causes of mortality is difficult to estimate, but road kills were probably the most common occurrence, followed by fyke nets. Bailey & Rochford (2006) also indicate road kills as being a significant source of mortality. Road kills, however, are probably the most "visible" of all the forms of mortality possibly leading to an over estimation of their importance relative to other forms of mortality.

### **4.3 Impact on Otter Populations**

Relatively little information currently exists on the overall level of mortality of otter in Ireland, nor on the breakdown of the various causes of mortality. This makes it difficult to transfer the data on fyke net inflicted mortality to the population level. It is equally difficult to assess whether the 55 otters reported (literature, pers comm. & questionnaires) over a 50 year period as having died in fykes is accurate, and the impact that this would have had on the local or national population of otter. Bailey & Rochford (2006) state that even the loss of a small number of individuals from a relatively isolated population could have dramatic effects on its long-term prospects.

## **5 Review of Management**

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Currently, there are no statutory instruments for the co-ordinated management of the European eel stock, its exploitation or other impacts.

The current use of fyke nets and the legislation and recommendations of the Irish Eel Review Group were presented in Section 2.4. Fyke nets have the advantage that they are a non-destructive method for the capture of eel, and many other fish species, and most fish bycatch can be returned to the water alive and unharmed. However, mammalian and avian bycatch will be drowned if accidentally trapped in the nets. There is also the disadvantage that the nets do not necessarily require daily servicing by fishermen. This can lead to a deterioration in the quality of the eel catch, but also means that an accumulation of fish in the nets over a number of nights may act as an attractant (bait) for otters and other piscivorous predators.

### **5.1 Eel Management Plans**

#### **5.1.1 Scientific Advice**

The European Inland Fisheries Advisory Commission (EIFAC) Working Group on Eel (WGEEL) has been active since the 1970's and has acted as a major focus for collation of eel data and biology through its symposia in the 1980s and 1990s. A widespread decline in recruitment was observed between 1983 and 1985. By 1993, this decline in recruitment, along with a stock-wide reduction in landings, was leading to serious concern. International Council for Exploration of the Seas (ICES) have advised the EU that recruitment of eel is now at an historical low, with no obvious signs of recovery, and exploitation of the stock is biologically unsustainable. The Eel Working Group recommended that an international recovery plan for the European eel stock should be urgently developed and that, until such a plan is agreed and implemented, exploitation and other anthropogenic impacts should be reduced to as close to zero as possible. Such plans must include an escapement target (probably 40% of the potential production under unfished, unpolluted and unobstructed conditions) and will require reductions in fisheries and other management measures aimed at other anthropogenic impacts on habitat quality, quantity and accessibility

#### **5.1.2 EU Recovery Plan for Eel Stocks**

The EU issued a draft Action Plan for the Recovery of the Eel Stock in 2003 (COM 2003, 573), a Draft Regulation in March 2005 (COM 2005, 472) and an amended Draft Regulation in May 2006. The Regulation proposes to: apply immediate actions to preserve the remaining stocks and spawner output through a series of strict fishery measures and require Member States to develop eel management plans (MPs), at the river basin level with the ultimate target of achieving 40% Spawning Stock Biomass (SSB) of pristine stock at historical recruitment.

It is also proposed to include eel, in all waters (coastal and inland), in the Common Fisheries Policy, and consequently the EU Data Collection Regulation (DCR) will

become mandatory for eel; it is currently mandatory for eel in coastal waters (Council Regulation 1543/2000 and Commission Regulations 1639/2001, 1581/2004). The present level of scientific knowledge and data collection hinders the estimation of the 40% target, or even the adoption of proxy targets for the 40% escapement of silver eel.

It is likely that in order to achieve the escapement targets proposed (40% SSB under historical conditions, including levels of recruitment) a significant, or total, closure of many, or all, fisheries will be required. In the event of a Member State being unable to provide Eel Management Plans, or sufficiently demonstrate the spawning target, the EU have proposed to introduce mandatory "emergency" actions significantly reducing fishing effort and turbine mortality of eel.

The probable reduction in fisheries is likely to lead to a reduction in the level of fyke net effort in the commercial fisheries. However, fyke nets will remain a useful tool for scientific surveys of eel and other species.

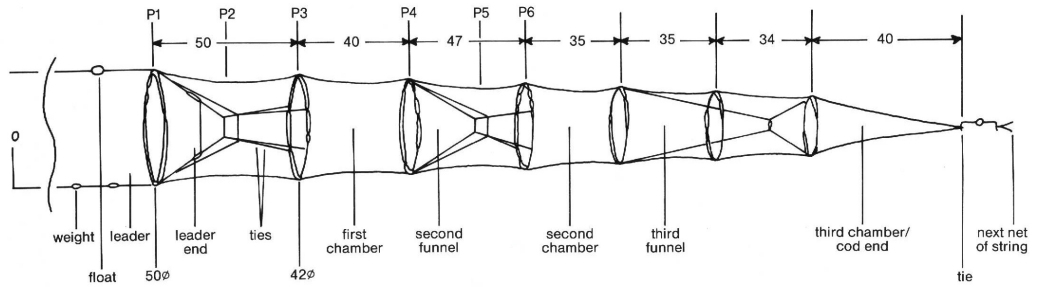
## **5.2 Otter Guards**

### **5.2.1 Design (Vincent Wildlife Trust, 1988)**

In response to the growing threat to recovering otter populations in the 1980s in Britain, the Vincent Wildlife Trust investigated the design of various guards for preventing access to fish and shellfish traps. Specific otter guards were designed for fitting to fyke nets, allowing free passage of eel, but preventing otters from passing into the traps end of the net (Vincent Wildlife Trust, 1988).

Two factors were considered when the Steering Committee was proposing designs for fyke net otter guards (Vincent Wildlife Trust, 1988); first the size of aperture required to prevent or deter entry by otters; and second, the best position to place the guard in the net. For a guard to allow the free passage of eels but not otters, the size of the space or spaces need to be as large as possible but limited to the dimensions slightly smaller than those of the smallest adult or independent immature otters. Cubs don't appear to be vulnerable to entering fyke nets as they remain dependent on their mother, if the mother is deterred from entering this should minimize the chances of cubs entering alone.

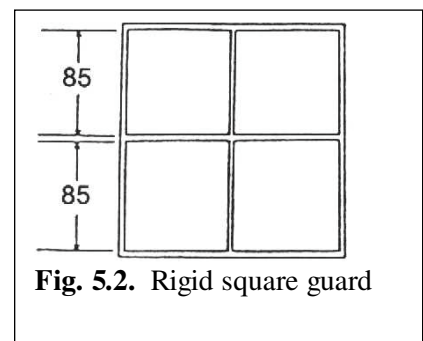
The Vincent Wildlife Trust (1988) collated information on the dimensions of otters and proposed the largest sizes which could be used for rings was 95mm diameter (female otters have passed through 115mm diameter rings); rigid square grids at 85mm bar length (diagonal 105mm) and flexible nets at 75mm bar length (circumference, 300mm). For the guard to be effective (i.e. prevent otters but allow eels through), it would have to be positioned between the first hoop (position P1) and the end of the first funnel (position P2) (Fig. 5.1; Vincent Wildlife Trust, 1988).



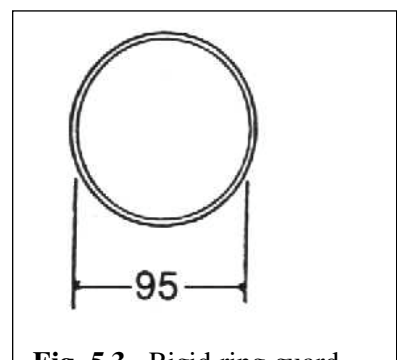
**Figure 5.1.** Schematic diagram of one trap end of a summer fyke net, showing positions P1, P2 and P5 used for fixing otter guards and test devices (Taken from: Vincent Wildlife Trust, 1988).

The Vincent Wildlife Trust (1988) designed four guards based on the criteria described above and these are summarized here:

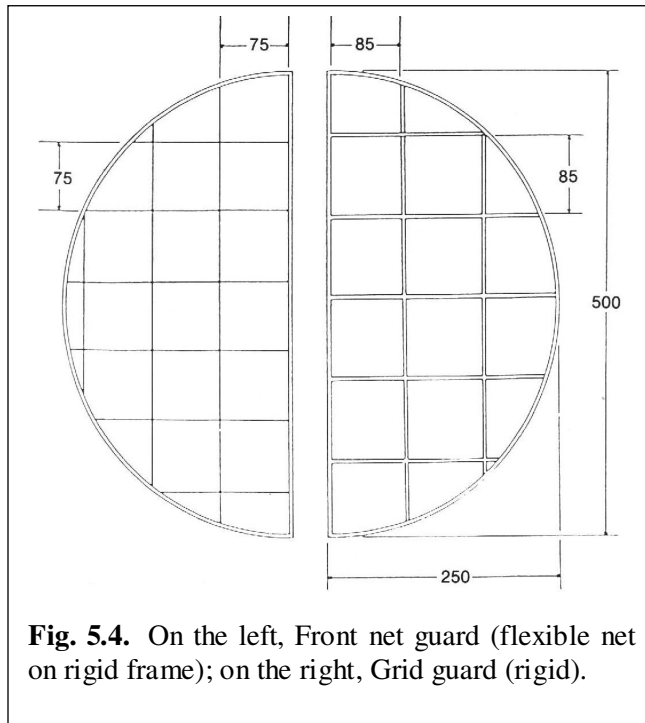
1. Square or S guard: a small rigid square grid made of 3mm diameter marine grade stainless steel, forming four square apertures with 85mm sides (Fig. 5.2), fitted to the inner end of the first fyke funnel (Fig. 5.1; Position P2).



2. Ring or R guard: a rigid ring with 95mm diameter, made of 3mm diameter marine grade stainless steel (Fig. 5.3), fitted to the fyke in the same position as the square excluder, the inner end of the first funnel (Fig. 5.1; Position P2).



3. Front net or F guard: a flexible front net, composed of a 75mm bar length, 4Z multifilament "nylon" gill net attached to a plastic coated 3mm diameter mild steel frame (Fig. 5.4), fitted to the fyke entrance or first hoop (Fig. 5.1; Position P1).

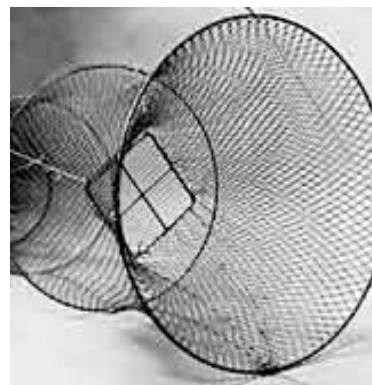


**Fig. 5.4.** On the left, Front net guard (flexible net on rigid frame); on the right, Grid guard (rigid).

4. Grid or G guard: a large rigid front grid composed of square apertures with 85mm sides and attached to a frame, all made of plastic coated 3mm diameter mild steel (Fig. 5.4), fitted to the fyke entrance or first hoop (Fig. 5.1; Position P1).

Marine grade stainless steel or plastic coated mild steel wire were considered by the Vincent Wildlife Trust to be the most suitable for reasons of strength, ease of construction, and resistance to corrosion.

The Square and Ring guards were best sewn into position onto the fyke, whilst the Front net and Grid guards were attached in two halves or 'D's either side of the fyke leader, using six plastic ratchet straps or cable ties. Front net and Grid guards may not require a frame if they are attached to a fyke for long periods, or on a purpose built fyke. The overall size and shape of the latter two guards would depend on the size and shape of the fyke entrance while the Square and Ring guards could be fitted unadapted to a wide range of fyke net designs.



*Photo: Merete Jepsen*  
 From: National Environmental Research Institute, Danish Ministry of Environment

### 5.2.2 Use of guards

There are conflicting reports on whether the fitting of otter guards to fyke net entrances affects the catches of eels or the efficiency of servicing the nets. Koed & Dieperink (1999) found that in river fyke nets (leader height 90cm), the guards (75 mm nylon netting mounted on the first hoop) significantly reduced the catches, causing a 30% reduction of eel catch and a 53-55% reduction of the salmonid catch, while they quote other studies (Berg, 1993); Pedersen & Koed (1995) that showed no impact on catch. The use of the otter guards also significantly increased the hauling time in their study, largely due to the time required for cleaning debris off the guards. It is not clear whether the reduction in catch reported by Koed & Dieperink (1999), the only one in the literature, was caused by the river flow being obstructed by the guards, or the guards being partially obstructed with debris. Such obstruction would not occur to any great extent in sluggish or still waters.

In the UK (Vincent Wildlife Trust, 1988) the four main types of guards were tested in a comprehensive fyke net survey under a variety of conditions. The catches in terms of total weight of eels were significantly lower using two of the guards at the base of the funnel (Ring and Square Guards), but not significantly different to the controls with the other two (Front Net and Grid Guards) placed at the mouth of the net. Additional analysis showed that there were significant reductions in the numbers of eel caught with all four guard types. The catch of eels greater than 100g showed no significant difference to the control catch for three guard types (Ring, Front net and Grid) but did show a significant reduction with the Square guard. Both water flow and clarity (turbidity) affected the efficiency of some of the guards but many of the statistical tests were not significant.

Two studies by Madsen (1991) showed that 88% of fishermen found the catch of eel was the same with or without otter guards. There was, however, a noticeable reduction in catch of other species such as roach, pike and bream.

There is evidence to suggest that the use of any type of guard on a fyke net will considerably reduce or eliminate the capture of larger species other than eel, such as pike, tench, and other coarse fish. In the case where fyke nets are used as a non-destructive sampling or capture method for these species the fitting of guards would appear to be counter-productive. One of the remaining unanswered questions is how to avoid the drowning of otters in fyke nets being used to catch larger fish species (Reuther, 2002).

The attitudes of Danish fishermen to the otter guards (Madsen, 1991) were an important parameter in his investigation. Out of 40 fishermen sent questionnaires, 32 replied, of which 94% maintained that the otter guards were a reasonable compromise between protection of the otter population and the protection of fishing rights.

**Practicalities using Guards; reproduced from Vincent Wildlife Trust Report (1988).**

1. Square Guard. This guard fitted well to the inner end of the first fyke funnel, with little distortion of the net when sewn into position.

Clearing of nets and removal of debris by hand through the fyke entrance was less of a problem on nets fitted with Square excluders than other guards. This type of guard was strong, relatively cheap and easy to produce.

2. Ring Guard. Attachment of ring excluders to the fyke considerably reduced the aperture of the inner end of the first fyke funnel, resulting in curtaining of the netting and an increase in the angle at which the funnel restricted. It is possible that large eels considered the reduced fyke entrance small enough to be used as a refuge; a principle applied to refuge pots.

The Ring guard was simple, strong and relatively cheap. Clearing of nets through the fyke entrance was considerably hampered.

3. Front Net Guard. Catches were very variable and more debris was trapped by this guard than any other. At many sites algae became trapped in the guard netting twine and this increased the area available to trap larger debris. Debris blockage may be a major problem associated with this excluder.

Turbulence may also have been a problem. Front net and Grid guards were probably fitted to the least favourable fishing position on the fyke, at the net entrance, so fish were not inside the net before they encountered the guards. Otters, however, would have little chance of becoming trapped within the fyke.

Though relatively expensive, time consuming to construct and not strong, this guard was light and easily fitted to the fyke. Permanent attachment to the fyke could be achieved without a guard frame, so reducing costs considerably. However, concern has been expressed at the possibility that large coarse fish and salmonids could be gill netted by this guard.

4. Grid Guard. Build-up of debris during trials appeared to be less of a problem in Grid guarded nets than Front net guarded nets, probably due to the smooth plastic coat on the Grid guards which would also be expected to reduce turbulence.

Net stacks, before and after fishing, containing Grid excluders were unstable, particularly in a rocking boat. These guards were heavy and the most expensive to produce, but were strong and easily fitted and removed.

## 6 Conclusions & Recommendations

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It is clear from this report that fyke nets do cause the accidental mortality of otters in Ireland although at a relatively low level (55 otters in 50 years). However, this is probably not the major source of mortality and assessing its impact on the overall otter population is difficult. It should be noted that even the loss of a small number of individuals from a relatively isolated population could have dramatic effects on its long-term prospects. A number of means of reducing, or eliminating, the possibility of accidental capture were discussed:

- \* Avoid shallow areas (<2m) and don't set fyke nets within 60m of the shoreline.
- \* Avoid areas where fyke nets are more likely to come in contact with otters, such as rivers, river outflows from lakes and estuaries. Avoid shallow areas, or tidal areas where the nets may become stranded or uncovered at low tide.
- \* Ensure regular servicing of nets so that a build up of catch does not act as an attractant, or bait.
- \* An improvement in communication with fishermen is required in order to support otter conservation.
- \* Fit otter guards to the fyke net entrances – this could be voluntary, mandatory for the whole country or mandatory for specific areas where there is a higher likelihood of otter entrapment. Such mandatory fitting of otter guards will require legislation, enforcement and may incur cost to both the State and the individual fisherman.

The report identified the probability that commercial fyke net effort may be reduced in the future, although fyke nets will still be an important tool for fisheries surveys and the non-destructive capture of other fish species. The Irish Eel Review Group recommended the use of fyke nets as the only sustainable method of exploitation for eel and also recommended that the fitting of otter guards should be assessed. These recommendations will need review within the proposed EU Eel Action Plan for the recovery of the eel stock.

- \* Undertake an assessment of the feasibility and impact of fitting otter guards to fyke nets within the National Management Framework for eel. This should include:
  - a consultation process between agencies and stakeholders.
  - consideration of the implications for the use of fyke nets as an eel survey tool, particularly where historical comparisons are required.
  - consideration of the implications for the use of fyke nets as a non-destructive capture method for other fish species, such as tench and estuarine fish, where little alternative exists.

The lack of reliable statistics on any forms of otter mortality became obvious. This made it impossible to assess the relative importance of the various forms of anthropogenic mortality on otter, including fyke nets.

- \* Improve the reporting of all forms of otter mortalities



- \* This should include monitoring of the incidental capture and mortality of otter in all types of fishing gear. A confidential, but statutory, approach to this may be required.

The otter is a protected species and candidate Special Areas of Conservation have been listed for the protection of the otter.

- \* A consultation process should apply to all licences issued, or reissued, in these areas. Approaches to reduce, or eliminate, the accidental trapping of otter in fykes, as discussed above, could then become conditions of the fishing licence.
- \* Fisheries within SACs should be closely monitored and the data used to inform the management and conservation process.

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## **8 Acknowledgements**

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Would you support the fitting of otter guards to fyke nets?    Yes     No

Any                    comments                    on                    otter                    deaths?

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Any    comments    on    management    of    fyke    nets    and    otter    guards?

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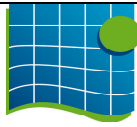
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Many thanks for your cooperation with this survey. If you have any further comments, please call Russell Poole on 098 42300 or email [russell.poole@marine.ie](mailto:russell.poole@marine.ie).

## Annex 2: Questionnaire sent to National Parks & Wildlife Service

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*Marine Institute*  
Foras na Mara

### Questionnaire – NPWS

Name: \_\_\_\_\_

Address: \_\_\_\_\_

Contact Number: \_\_\_\_\_

Agency/Company: \_\_\_\_\_

Position: \_\_\_\_\_

Have you any knowledge of otter mortalities in your region? Yes  No

Total of otter mortalities?  In how many years?

Mortalities attributed to fyke nets  In how many years?

Describe habitat where otters were caught i.e. river, shallows, estuary or lake.

\_\_\_\_\_

Would you support the fitting of otter guards to fyke nets? Yes  No

Continued overleaf

Any comments on otter deaths?

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Any comments on management of fyke nets and otter guards? \_

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Many thanks for your cooperation with this survey. If you have any further comments, please call Russell Poole on 098 42300 or email [russell.poole@marine.ie](mailto:russell.poole@marine.ie).