



Biosecurity Plan for Lough Mask

Document Control	
Client	Western Regional Fisheries Board
Project Title	Biosecurity Plan for Lough Mask
Document Ref.	NI 1073

Rev.	Status	Author	Reviewed By	Approved By	Office of Origin	Issue Date
R04	Final	S. Lowry	M. Wade	R. Holbeach	RPS Planning & Environment	27/01/09

TABLE OF CONTENTS

SUMMARY	3
1.0 INTRODUCTION.....	5
1.1 Background to Project.....	5
1.2 Relevant Legislation	6
1.3 Other Relevant Projects in Ireland.....	7
2.0 SITE DESCRIPTION	9
2.1 Location.....	9
2.2 Conservation Status	9
2.3 Physical	9
2.4 Biological	10
2.5 Socio-Economic.....	11
2.6 Access & Facilities	12
3.0 CURRENT THREATS, VECTORS & PATHWAYS	13
3.1 Current Threats	13
3.2 Vectors	13
3.3 Pathways	15
4.0 RISK ASSESSMENT	17
4.1 Preliminary List of Biosecurity Threats.....	17
4.2 Screening: Potential for Entry.....	17
4.3 Risk Assessment	19
4.4 Management Options	20
5.0 RECOMMENDATIONS FOR PREVENTION OF BIOSECURITY THREATS	21
5.1 Prevention	21
5.2 Monitoring, Early Detection & Rapid Eradication	25
5.3 Management, Containment & Control	26
5.4 Financing.....	26
5.5 Limitations.....	26
6.0 REFERENCES.....	28
APPENDIX I	

SUMMARY

The biosecurity plan examines the current biosecurity threats to Lough Carra and Lough Mask including un-authorised fish introductions, invasive aquatic species infestations and the transmission of fish diseases and recommends practical measures to protect the lakes.

The plan highlights relevant legislation relating to invasive species and other relevant projects in Ireland. Many of these projects are currently in progress and therefore associated data was not fully available during production of the biosecurity plan.

The site description of L. Carra and L. Mask provides details of the location, conservation status, physical and biological features and socio-economic use of the lakes. The lakes are subject to a number of designations including Lough Carra/Mask Complex candidate Special Area of Conservation (cSAC), Lough Mask Special Protected Area (SPA) and Lough Carra SPA. The socio-economic use of the lakes includes water abstraction, water discharge, recreational activities, commercial eel fishing, research and management.

The vectors by which biosecurity threats can be transported into the lakes via intentional and unintentional introduction are primarily associated with the socio-economic use of the lakes. The biosecurity threats and impacts from non-native aquatic species on the freshwater environment of the lakes include competition, predation, hybridization, introduction of parasites and diseases, alteration of habitats and modification of the ecosystem.

The risk assessment undertaken on invasive non-native aquatic species comprises three main stages; the screening of a list of potential biosecurity threats, risk assessment of selected threats and assessment of management options for those threats identified as high and very high risk. The list of potential biosecurity threats consists of 80 non-native aquatic species associated with the freshwater environment. Screening identified 49 species which were considered to have no or very low potential to enter the lakes, these species were not considered to be a current threat to L. Carra and L. Mask and were removed from further assessment. The remaining 31 species were assessed in relation to their associated impacts on biosecurity, economy and health and a total of 22 species considered to be of low to moderate risk were removed from further assessment. The remaining 10 species rated as high risk or very high risk were then assessed to determine appropriate management options.

The plan provides a number of recommendations and options to reduce the risk of invasions and to protect the lake from biosecurity threats. The key recommendation is prevention of entry and establishment of threats in the lakes. In order to facilitate prevention it has been recommended that a boat registration system is adopted on each lake, that access is restricted to a number of designated launch points around each lake and that a code of practice is implemented in order to prevent entry of threats and to raise public awareness. Monitoring is recommended in order to facilitate early detection and rapid eradication of any threats that may enter the lakes. It is also recommended that management plans are put in place to manage those species identified as very high risk, which already exist within the lakes and that contingency plans are put in place to detail containment and control measures for those species considered of high risk.

The plan adopts a best practice approach by incorporating key stakeholder engagement and public consultation. Key stakeholder engagement took the form of a productive workshop which was held on 05 June 2008. Key stakeholders included both statutory and non-statutory bodies either involved in the direct management of the lakes or with technical expertise in relation to invasive species and biosecurity issues. Angling representatives covering both game and course angling were also asked to attend on behalf of these interest groups. A public meeting was held on 24 September 2008 for engagement with anglers and all other interested parties. All interested parties were also invited to provide written submissions. Appendix I provides details of the key stakeholders and organisations contact throughout the project.

1.0 INTRODUCTION

1.1 Background to Project

RPS Planning & Environment have been commissioned by the Western Regional Fisheries Board (WRFB) in partnership with Galway County Council, Mayo County Council, National Parks & Wildlife Service and the Office of Public Works to produce a 'Biosecurity Plan for Lough Mask'.

Biosecurity is the protection of the environment, economy and health of all living things from the impacts associated with biological invasions, parasites and diseases. Biosecurity threats such as these can negatively impact on the native biodiversity of freshwater ecosystems resulting in competition with and predation of native species, alteration of habitats and modification of entire ecosystems.

Lough Mask is situated within the Corrib catchment. The Corrib catchment consists of a chain of Loughs draining from L. Carra in the upper reaches of the system, through L. Mask and L. Corrib and finally into Galway Bay. These 'Great Western Lakes' support salmonid fisheries of major international importance and are Ireland's most important angling asset (WRFB 2004). All three lakes are designated under the EU Habitats Directive 92/43/EEC and EU Birds Directive 79/409/EEC. Ireland therefore has a responsibility to manage and protect these unique lakes.

The need for a 'Biosecurity Plan for Lough Mask' has arisen from the occurrence of biosecurity threats elsewhere in the catchment. Lough Corrib has been subject to a number of threats in recent years including the discovery of zebra mussel *Dreissena polymorpha* and the highly invasive curly waterweed *Lagarosiphon major*.

The WRFB have therefore been pro-active in recognising the need for a biosecurity plan for the upper lakes of the Corrib catchment which to date are not known to be subject to these threats. The implementation of a precautionary approach will ensure risk assessment and prioritisation that will provide cost-effective measures to prevent and/or reduce the impact of biosecurity threats, rather than try to manage such threats once they have become established.

The aim of the biosecurity plan is to examine current threats to L. Mask and to provide practical measures to protect the lake. The biosecurity threats addressed are associated with non-native aquatic species and include un-authorized fish introductions, invasive species infestations and transmission of fish diseases. In order to safeguard L. Mask, it was decided that L. Carra should also be included within the plan.

1.2 Relevant Legislation

1.2.1 The Convention on Biological Diversity (CBD) 1992

Article 8(h) states that each Contracting Party shall "*prevent the introduction of, control or eradicate those alien species which threaten ecosystems, habitats or species*".

1.2.2 The Bern Convention (on the Conservation of European Wildlife and Natural Habitats) 1979

Article 11(2)(b) states that each Contracting Party shall undertake to "*strictly control the introduction of non-native species*".

1.2.3 The Bonn Convention (on the Conservation of Migratory Species and Wild Animals) 1979

Article III (4)(c) states that each Contracting Party shall prevent, reduce or control factors endangering species including "*strictly controlling the introduction of, or controlling or eliminating, already introduced exotic species*". Article V (5)(e) states that each Contracting Party shall undertake "*strict control of the introduction of, or control of already introduced, exotic species detrimental to the migratory species*".

1.2.4 Water Framework Directive (WFD) 2000/60/EC

Article 5 (1) states that each Contracting Party shall undertake a "*review of the impact of human activity on the status of surface waters*". The Directive does not specifically refer to non-native species; however Annex II (1.4) lists pressures to which surface water bodies may be subjected including "*other significant anthropogenic impacts on the status of surface waters*". The intentional or un-intentional introduction of biosecurity threats may be considered as an "anthropogenic impact" that has the potential to compromise the biological elements listed under Annex V (UKTAG 2004).

1.2.5 EU Habitats Directive 92/43/EEC

Article 22 (b) states that Contracting Parties shall “*ensure that the deliberate introduction into the wild of any species which is not native to their territory is regulated so as not to prejudice natural habitats within their natural range or the wild native fauna and flora and, if they consider it necessary, prohibit such introduction*”.

1.2.6 Fish Health Directive 2006/88/EC

The EU Directive on ‘animal health requirements for aquaculture animals and products thereof, and on the prevention and control of certain diseases in aquatic animals’ was transposed into Irish law by the EC (Health of Aquaculture Animals and Products) Regulations 2008. Member States are required to provide notification of the identification of any disease listed under Annex IV Part II of the Directive. There is a requirement under the regulations for ‘aquaculture production businesses’ (including fish hatcheries) to produce Fish Health Management Plans. The plans aim to maintain a high level of disease awareness and preparedness and to ensure the protection of aquaculture animals and the environment.

1.2.7 Wildlife (Amendment) Act 2000

Section 56 (d) 6(b) states that “*where non-native species of wild bird, wild animal or wild flora or any part, product or derivative of such wild bird, wild animal or wild flora have been introduced, the Minister shall, to the extent that it is feasible and appropriate, take measures to ensure that such introductions do not pose a potential hazard to native stocks*”.

1.2.8 Regional Fisheries Board Policy

The national policy of the fisheries boards in Ireland is to preserve indigenous and naturalised fishes and to prohibit the introduction of non-native and potentially invasive species. The fisheries boards also implement regulations relating to the use of live bait and the transfer of fish between waters, and adopt a proactive approach in order to minimise the potential impact of cultured fish on wild fish populations.

1.3 Other Relevant Projects in Ireland

1.3.1 Invasive Species in Ireland

An all-Ireland review of invasive species in Ireland was jointly commissioned by the National Parks & Wildlife Service and the Environment & Heritage Service in 2004. The result was

the 'Invasive Species in Ireland' report, which recommends 10 key actions to both Governments. The key actions aim to reduce the risk of invasions, control and manage both established and new invasive species, monitor impacts, raise public awareness, improve legislation and address international obligations (Stokes *et al.* 2006).

The key actions of the report formed the basis of the Invasive Species in Ireland project which commenced in 2006. The objectives of the project are to reduce the risk of new invasions, develop contingency plans, produce management plans, engage stakeholders, develop codes of practice, raise public awareness, recommend surveillance, monitoring and recording programmes and to review legislation. The project is currently ongoing and is due to be completed in 2009 (Anonymous 2008).

1.3.2 Alien Invasive Species in Irish Water Bodies

The Alien Invasive Species in Irish Water Bodies project is funded under the Environmental Protection Agency; Science, Technology, Research and Innovation for the Environment (STRIVE) Programme 2007-2013. The project aims to address the knowledge gap identified under the WFD for invasive alien species in Ireland's River Basin Districts (ISI 2008).

1.2.3 National Invasive Species Ireland Database

There is currently no central database for maintaining invasive species records in Ireland. The National Biodiversity Data Centre has therefore established a National Invasive Species Database. The aim of the database is to provide centralised up-to-date information on the distribution of invasive species in Ireland that will play a key role in recording, monitoring and surveillance programs. The website is currently under construction (NBDC 2008).

1.2.4 Aquatic Invasive Species Lough Corrib & Grand Canal

The Central Fisheries Board (CFB) has recently obtained funding from the EU Life+ Programme for a project to protect Lough Corrib and the Grand and Barrow canals from aquatic invasive species. The aim of the project is to protect native biodiversity by managing high impact aquatic invasive species that have become established in Lough Corrib and the Grand Canal. The project is due to commence in the first quarter of 2009 (CFB 2008).

2.0 SITE DESCRIPTION

2.1 Location

The Corrib catchment consists of a chain of Loughs draining from L. Carra in the upper reaches of the system, through L. Mask and L. Corrib, down into the River Corrib and finally into Galway Bay. A map of the Corrib catchment can be found in Figure 2.1.1. L. Carra is the uppermost lake in the catchment and is situated entirely within County Mayo. The majority of L. Mask is within County Mayo; the southern shore however is within County Galway. L. Corrib is entirely within County Galway. Only L. Carra and L. Mask will be featured within the biosecurity plan.

2.2 Conservation Status

L. Carra and L. Mask are both designated as a candidate Special Area of Conservation (cSAC) and Special Protected Areas (SPA). The Lough Carra/Mask Complex cSAC was proposed as eligible for identification as a Site of Community Importance (SCI) in January 2002. Lough Carra and Lough Mask were both classified as SPAs in November 1995.

2.3 Physical

L. Carra is a shallow hard water marl lake just over 1600ha in size with an average depth of 1.25m and maximum depth of 9m. It is predominately spring fed with only a few inflowing streams and is hydrologically linked to L. Mask via the Keel River (NPWS 2000).

L. Mask is a lowland oligotrophic lake with an area of over 8000ha. The eastern shore of the lake is shallow, whereas the western shore is considerably deeper with a long narrow trench with a maximum depth of 58m (NPWS 2000). The main inflowing rivers into L. Mask include the Cloon River, Keel River, Robe River, Finny River, Strahnalong River, Owenbrin River, and Glensaul River. The lake is linked to L. Corrib via a natural underground karstic system.

An artificial canal was excavated at Cong in the 1840's in an attempt to connect L. Mask and L. Corrib however the canal was unable to retain water due to the nature of the underlying porous limestone. The canal is now used as a drainage channel; the water level within the channel fluctuates depending on the time of year. There is a metal fish barrier on the canal at Cong that was installed in the 1980's in order to prevent the movement of fish, primarily roach, between L. Corrib and L. Mask. The recent recording of L. Mask ferox trout downstream of the fish barrier demonstrates that the occasional fish can move between

lakes during large scale flood events when the fish barrier can be over topped. The fish barrier has become damaged in recent years and was repaired as a joint project between the Office of Public Works and the WRFB in 2008. In order to ensure the free flow of water through the fish barrier WRFB staff, located at the Cong Salmon Hatchery, undertake regular maintenance in order to prevent the build up of debris at the barrier.

2.4 Biological

L. Carra and L. Mask are both designated as a candidate Special Area of Conservation (cSAC) and Special Protected Areas (SPA). The lakes consist of a diverse range of habitats, six of which are listed on Annex I of the Habitats Directive. The habitats include limestone pavement, caladium fen, hard water lake, lowland oligotrophic lake, alkaline fen and dry heath.

These habitats in turn support a number of species listed in the Habitats and Birds Directives. Species listed under Annex II of the Habitats Directive include white-clawed crayfish *Austropotamobius pallipes* which has been recorded from L. Carra and otter *Lutra lutra*. The lakes are also important for wintering and breeding birds and support three Annex I species listed under the Birds Directive (NPWS 2000).

A number of Red Data Book species can be found in the lakes including lesser bearded stonewort *Chara curta* and rugged stonewort *Chara rudis*. These are species of green algae that resemble higher plants. They require high pH, high water quality and good water clarity and indicate a healthy ecosystem. They also provide habitat for invertebrates, other algae and food for invertebrates and water birds.

L. Carra currently contains the native fish species; brown trout *Salmo trutta*, European eel *Anguilla anguilla* and stickleback *Gasterosteidae* spp. Introduced non-native species include pike *Esox lucius*, perch *Perca fluviatilis* and minnow *Phoxinus phoxinus* (McGarrigle & Champ 1999 & NS Share 2005).

L. Mask currently contains the native fish species; brown trout, including the sub-populations ferox trout, which feed on fish and gillaroo, which feed primarily on molluscs, European eel, and stickleback spp. It supports a population of the glacial relict species Arctic char, which is considered vulnerable due to a decline across its range and no legal protection (Maitland 2004). The lake also supports a population of rare shrimp *Niphargus* spp. Introduced non-

native fish species include roach *Rutilus rutilus*, rudd *Scardinius erythrophthalmus*, bream *Abramis brama*, pike, perch and minnow (McGarrigle & Champ 1999, NPWS 2000 & NS Share 2005). Typically, salmon *Salmo salar* do not run north of L. Corrib into L. Mask or L. Carra. There have however been recordings of L. Corrib salmon in both the Cong canal and L. Mask; L. Mask ferox trout have also been recorded in the Cong canal, which demonstrates that the occasional fish can move between lakes.

The European eel is now considered to be outside safe biological limits and measures for protecting eels and establishing measures for the recovery of stocks have now been introduced under Council Regulation EC No 1100/2007 of 18 September 2007 and new plans are in preparation to put these measures into effect in Ireland in 2009.

2.5 Socio-Economic

2.5.1 Water Abstraction / Discharge

Water abstraction for local water supply occurs at both lakes. The main abstractions from L. Carra are the Robeen Group Water Scheme at Brownstown and Ballyglass/Carnacon Group Scheme at Castlecarra. There are no point discharges to L. Carra.

The main abstraction from L. Mask is for the Lough Mask Regional Water Supply Scheme; the recent expansion of the Tourmakeady Treatment Plant has recently increased abstraction to a volume of 37,000m³/day (NDP 2004). There are also a number of discharges from local sewage treatment works. The main point discharges to L. Mask are via rivers that arise from Claremorris, Ballinrobe, Hollymount, Ballindine, Clonbur and Tourmakeady.

2.5.2 Recreation

Recreational activity is the primary use of the lakes, the main activities consist of trout angling with some pike angling and shooting. The angling season for brown trout is 1st March to 30th September on L. Carra and 15th February to 30th September on L. Mask. There is no closed season for coarse fishing and coarse fish species can be fished all year round. The duck shooting season is from 1st September to 31st January.

2.5.3 Commercial Eel Fishing

European eel is commercially fished within the catchment. All commercial fishermen require a licence and an authorisation, which are issued by the Regional Fisheries Boards. The

number of licences available is capped. The WRFB currently issue approximately 18 authorisations for annual eel fishing. Eel fishing is carried out using long lines, coghill nets and fyke nets. The authorisations are issued by fishery district and are currently not lake specific. The recently prepared WRFB Eel Management Plan states that the present status of the fishery is one of limited catches, declining stocks and poor recruitment.

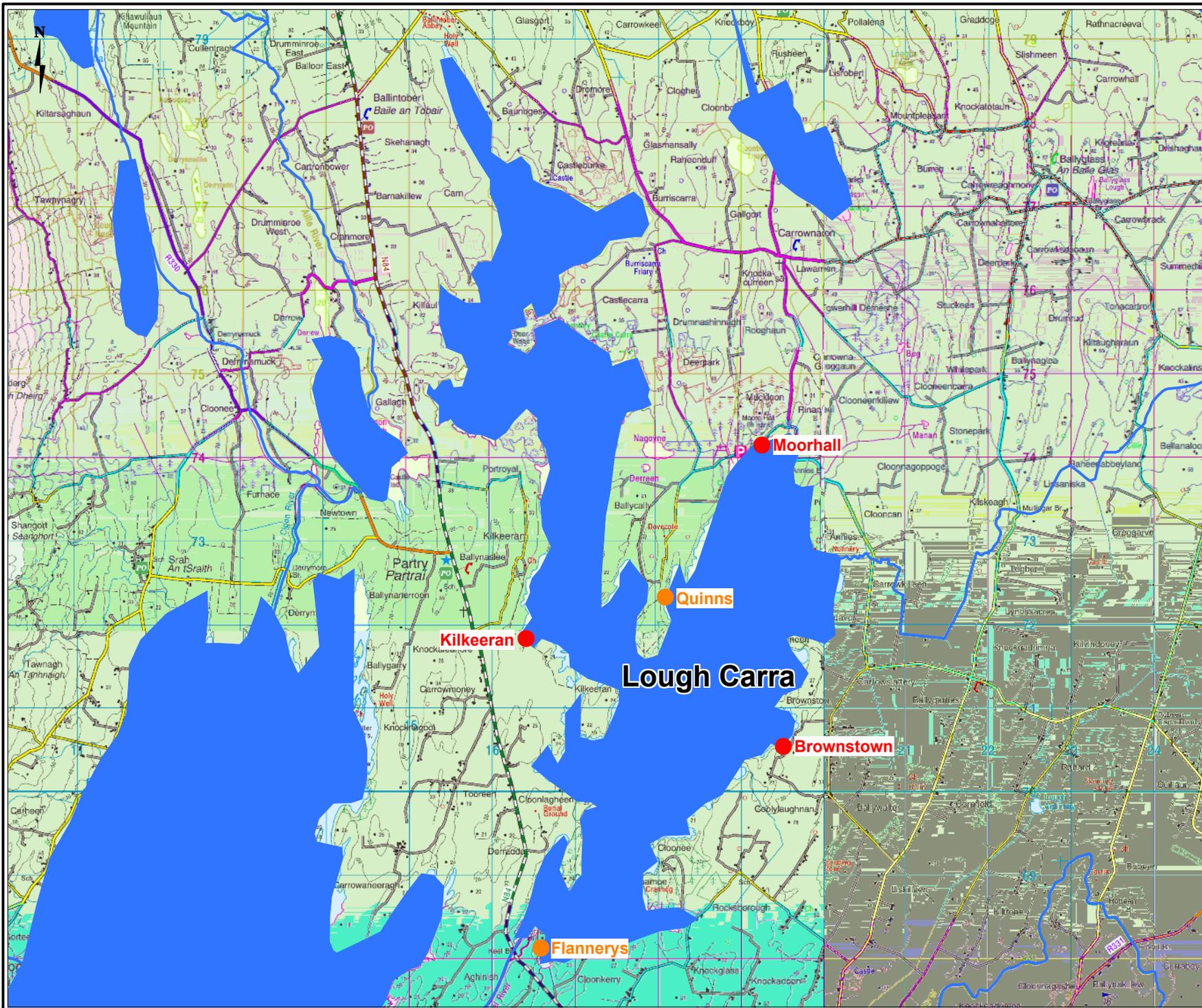
2.5.4 Research & Management

Scientific research is also ongoing at both lakes, much of which is undertaken by University College Galway (NPWS 2000) and the CFB. The WRFB carry out fisheries management of the lakes including stock surveys, stock management, drainage re-habilitation, river enhancement, water quality monitoring and improvement of angling facilities.

2.6 Access & Facilities

There are 6 access points around L. Carra of these four are public and two are private access points. A map illustrating the location of each access point can be found in Figure 2.6.1. There is no slipway or secure access at any of the public access points however two of the sites include boat moorings. An annual boat census carried out in 2007 and 2008 by the WRFB recorded an average of 153 boats moored on L. Carra. All four public access points have signage in relation to the introduction and spread of zebra mussel.

There are 33 access points around L. Mask of these 18 are public and 15 are private. A map illustrating the location of each access point can be found in Figure 2.6.2. Facilities at each of the access points vary considerably. Only one of the 18 public access points includes a slipway, secure access and boat moorings; one includes a slipway and secure access only; two include slipways only; four include secure access only and 11 have no facilities. The annual boat census recorded an average of 545 boats moored on L. Mask. A total of 15 public access points have signage in relation to the introduction and spread of zebra mussel.



Legend

- Blue line
- Red dot
- Orange dot

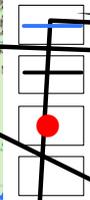
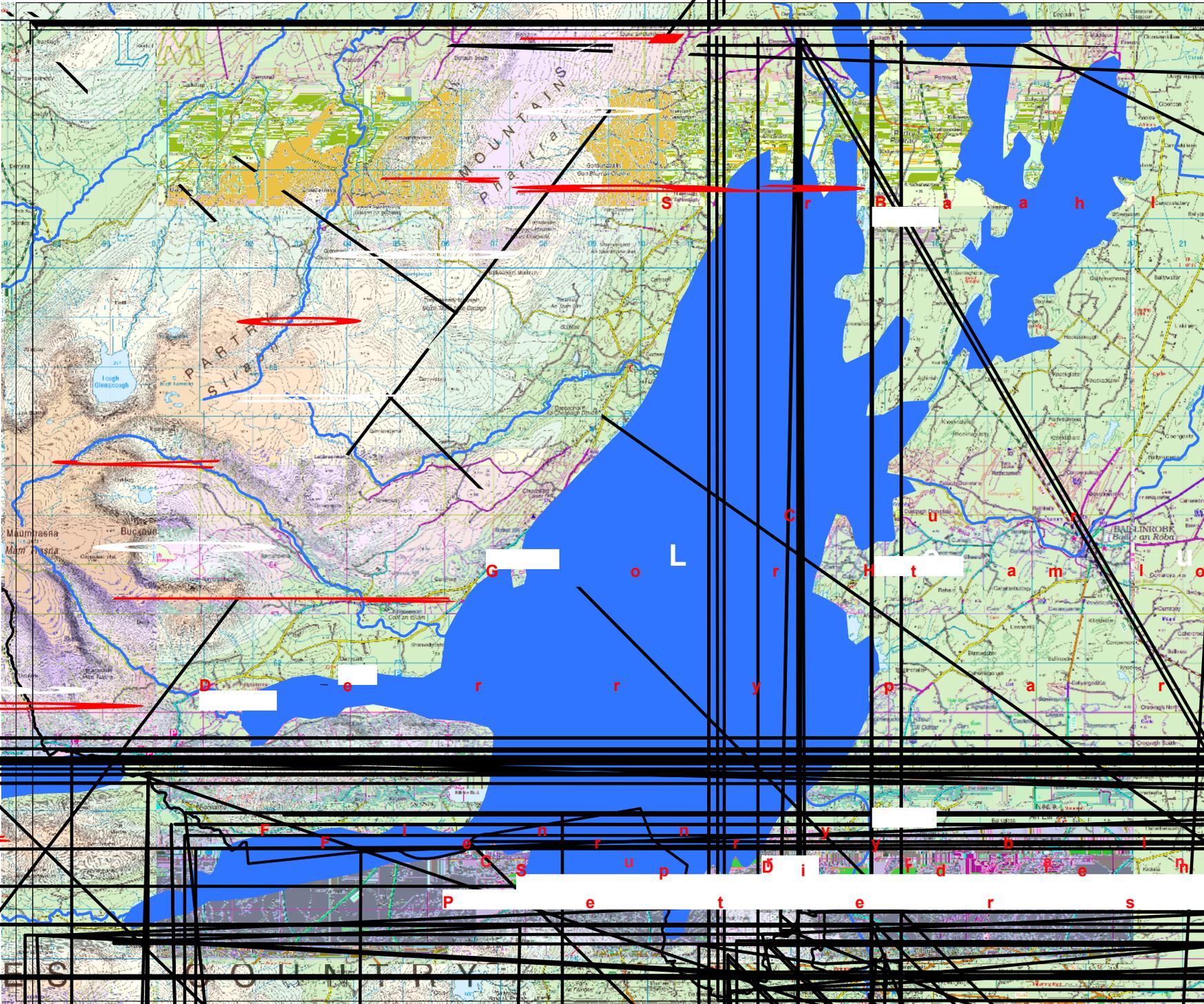
Client
 The Western Regional Fisheries Board
 Bord Iascaigh Réigiúnach an Iarthair

Project
 Biosecurity Plan for Lough Mask

Title
 Lough Carra Access Points

Figure 2.6.1

RPS T F W



l y

a g
l r s e

k



RPS

ES COUNTRY

3.0 CURRENT THREATS, VECTORS & PATHWAYS

3.1 Current Threats

There are a number of threats within the Corrib catchment that have the potential to impact on the freshwater environment of L. Mask and L. Carra. These include pollution, eutrophication, water abstraction, wastewater discharge, recreational pressure (WRBD 2007, NPWS 2008 & WRFB 2007) and biosecurity threats.

The biosecurity plan aims to address those threats associated with invasive non-native aquatic species that have the potential to impact on the freshwater environment of the lakes. There are also a number of non-native terrestrial species that can impact on the riparian zone and are of concern from a fisheries context. These species include giant hogweed *Heracleum mantegazzianum*, Japanese knotweed *Fallopia japonica* and rhododendron *Rhododendron ponticum* and mink *Mustela vison* to name a few. Terrestrial species are not addressed within the current plan however it is recommended that these species are included in the future.

Threats can have a number of negative impacts on the native species and habitats of the lakes including competition and predation of native species, hybridization, the introduction of parasites and pathogens, alteration of habitats and modification of the ecosystem. Threats can also result in impacts on recreational activities, research and management activities, water abstractions and discharges.

The consequence of such threats and their impacts can cause problems for both the environment and the local economy. There are direct economic costs associated with preventing, controlling and managing threats. Biosecurity threats also have the potential to compromise the status of the lakes in terms of a number of EU Directives and also statutory obligations under domestic legislation.

3.2 Vectors

A vector is defined as the means by which a biosecurity threat can be transported to a new location. There are number of vectors that have the potential to introduce biosecurity threats to L. Carra and L. Mask:

3.2.1 Recreation

Recreational activities have the potential to transport biosecurity threats from a contaminated lake to an uncontaminated lake. Activities such as fishing and boating are the most likely vectors to introduce a threat into these lakes. Vectors such as these have the potential to introduce threats via the movement of contaminated trailers, boats, fishing equipment and float tubes. Other activities which include the use of canoes, kayaks, dinghies and jet skis, could also be considered as potential vectors, although activities such as these are not common on the lakes. There is also potential to introduce non-native fish species from the use of live bait for pike fishing, which is an illegal activity. It is thought that this is how roach was introduced into the lakes.

3.2.2 Commercial Eel Fishing

Commercial eel fishing and the transport of live eels around the catchment have the potential to transport biosecurity threats to new locations. The movement of contaminated fishing equipment and the exchange of water from holding tanks by dealers recharging eel tanks has the potential to introduce a new threat into an uncontaminated lake.

3.2.3 Research & Management

Research and management activities have the potential to transport biosecurity threats from a contaminated lake to an uncontaminated lake. These vectors have the potential to introduce threats via the movement of contaminated boats, trailers and survey equipment.

3.2.4 Fish Hatcheries

There are a number of fish hatcheries within the Corrib catchment that have the potential to impact on wild fish populations with the introduction of fish diseases. Existing fish hatcheries include the WRFB Cong Salmon Hatchery, Corrib Anglers Federation trout hatchery and Galway Aquatic Enterprises salmon hatchery. Stofniskur Ireland Ltd has recently received planning permission for a large scale salmon, rainbow trout and char hatchery. There have also been a number of transient hatcheries at Ballinrobe and Tourmakeady.

3.2.5 Horticulture & Pet Shops

There are a number of retail establishments within the local area and in the wider catchment that have been known to sell invasive non-native aquatic plants. The disposal of unwanted plants or the release of unwanted exotic pets has the potential to seriously threaten the lakes.

3.2.6 Wildlife

Wildlife has also been identified as a potential vector, in particular the movement of birds and the possibility of the spread of invasive non-native plant species. There is no evidence however to confirm that this has been a vector for the spread of non-native plant species.

3.3 Pathways

A pathway is defined as the route by which a biosecurity threat can be transported to a new location. There are three main pathways by which biosecurity threats can enter L. Carra and L. Mask:

3.3.1 Intentional introduction

There is currently unlimited potential for intentional introduction to take place at L. Carra and L. Mask. There is unrestricted access to the lakes and no regulations in relation to access or the movement of boats. The introduction of non-native fish species for recreational sport is the most likely form of intentional introduction. The introduction of non-native fish species or fish species that are not indigenous to the lakes may also be a pathway for the introduction of parasites and pathogens.

3.3.2 Unintentional introduction

Unintentional introduction from recreational activities and commercial eel fishing is considered the most likely pathway for biosecurity threats to enter L. Mask and L. Carra. It is considered that the movement of boats between lakes is the most likely pathway for a new threat to enter L. Carra and L. Mask. There is a considerable volume of boat movement to and from L. Mask; less so from L. Carra. It is thought that most boats travel from other lakes within the catchment such as L. Corrib. Ireland's small geographic area however makes it easy to travel with a small boat and trailer a long distance in a relatively short period of time. There are a number of boats which are known to travel from other catchments both within Ireland and Northern Ireland. The threat from unintentional introduction is likely to be associated with unknown contamination of boats, engines, trailers and angling equipment. It is thought that the movement of coarse angling keep nets has resulted in zebra mussel infestations at other lakes within the catchment.

3.3.3 Natural Spread

It is considered that natural spread is the least likely pathway for biosecurity threats to enter L. Mask and L. Carra. Entry via water would be through the inputs to these lakes. L. Carra is a spring fed lake and has only a few inflowing rivers and therefore water entering the lake

is not likely to be contaminated. L. Mask has a number of inflowing rivers but these and a number of lakes upstream are not currently known to be subject to the majority of biosecurity threats. L. Mask is linked to L. Corrib via a karstic underground system and it is not likely that this will facilitate upstream natural spread.

4.0 RISK ASSESSMENT

The aim of the risk assessment was to produce a list of threats that have the potential to impact on L. Carra and L. Mask, to prioritise the threats, to assess the potential impacts of the threats and to provide management guidelines for those threats identified as high or very high risk. The risk assessment relates to the biosecurity threats of non-native aquatic species on the freshwater environment of L. Carra and L. Mask.

4.1 Preliminary List of Biosecurity Threats

The first stage was to produce a list of potential threats including un-authorized fish introductions, invasive species infestations and transmission of fish diseases. It was decided to utilise the list of species compiled as part of the Invasive Species Ireland project (ISI 2008). The project identified 557 species including vertebrates, invertebrates, vascular plants, parasites and pathogens. A total of 72 of these species are associated with the freshwater environment and these species were included within the risk assessment. A further eight fish parasites and diseases identified in the EU Fish Health Directive 2006/88/EC and in Council Decision 2004/453/EC were also included within the risk assessment. A full list of the species included within the risk assessment can be found in Table 4.2.2.

4.2 Screening: Potential for Entry

The second stage was to separate the species for which there was current potential for entry into L. Carra and L. Mask from those for which there was no or low current potential for entry. The potential for entry was based on the current known distribution of the species in Ireland and its dispersal ability; either via intentional introduction, un-intentional introduction or natural spread. Species were identified as either widespread with a wide distribution throughout Ireland, scattered with a local distribution at a number of sites throughout Ireland or local and restricted to a particular site within Ireland. The assessment was based on a ranked scale of 1-4 indicating low, moderate, high and very high potential for entry as illustrated in Table 4.2.1. The results of screening can be found in Table 4.2.2. Those species with a low risk of entry were removed from further assessment. A total of 49 species not considered to be a current threat to the lakes were therefore removed from the assessment.

Table 4.2.1 Potential for Entry

Entry Ranking		Distribution
1	Threats that have low potential to enter L. Carra & L. Mask	Present in Great Britain but not currently present in Ireland
2	Threats that have moderate potential to enter L. Carra & L. Mask	Present in Ireland but not currently present within the Corrib catchment
3	Threats that have high potential to enter L. Carra & L. Mask	Present within the in Corrib catchment
4	Threats that have very high potential to enter L. Carra & L. Mask	Currently present in L. Carra or L. Mask

Table 4.2.2: Screening: Potential for Entry

Common name	Scientific Name	Distribution			Dispersal Ability	Entry Ranking
		Ireland	Corrib Catchment	L. Mask & Carra		
	<i>Triturus alpestris</i>					1
	<i>Salvelinus fontinalis</i>					1
	<i>Corbula amurensis</i>					1
	<i>Monopterus albus</i>					1
	<i>Aristichthys nobilis</i>					1
	<i>Rhodeus sericeus</i>					1
	<i>Abramis brama</i>					4
	<i>Ameiurus nebulosus</i>					2
	<i>Rana catesbeiana</i>					1
	<i>Elodea canadensis</i>					4
	<i>Cyprinus carpio</i>					2
	<i>Leuciscus cephalus</i>					2
	<i>Aphanomycea astaci</i>					2
	<i>Lagarosiphon major</i>					3
	<i>Leuciscus leuciscus</i>					2
	<i>Gambusia holbrooki</i>					1
	<i>Cabomba caroliniana</i>					1
						1
	<i>Argulus</i>					4
	<i>Gyrodactylus salaris</i>					1

						1
						1
						1
						1
						1
						1
						1
						1
	<i>Cercopagis pengoi</i>					1
	<i>Hydrocotyle ranunculoides</i>					2
	<i>Ludwigia peploides</i>					1
	<i>Dikerogammarus villosus</i>					1
	<i>Crangonyx pseudogracilis</i>					2
	<i>Gammarus pulex</i>					4
	<i>Gammarus tigrinus</i>					2
	<i>Nymphoides peltata</i>					2
	<i>Batrachochytrium dendrobatidis</i>					1
	<i>Salvinia molesta</i>					1
	<i>Carassius auratus</i>					1
	<i>Ctenopharyngodon idella</i>					1
	<i>Gobio gobio</i>					3
	<i>Egeria densa</i>					2
	<i>Micropterus salmoides</i>					1

	<i>Lemna minuta</i>					4
	<i>Procambarus clarkii</i>					1
	<i>Phoxinus phoxinus</i>					4
	<i>Oreochromis mossambicus</i>					1
	<i>Crassula helmsii</i>					2
	<i>Astacus astacus</i> & <i>Astacus leptodactylus</i>					1
	<i>Elodea nuttallii</i>					2
	<i>Leuciscus idus</i>					1
	<i>Myriophyllum aquaticum</i>					3
	<i>Perca fluviatilis</i>					4
	<i>Esox lucius</i>					4
	<i>Oncorhynchus gorbuscha</i>					1
	<i>Hemimysis anomala</i>					1
	<i>Dreissena bugensis</i>					1
	<i>Oncorhynchus mykiss</i>					2
	<i>Trachemys scripta elegans</i>					1
	<i>Rutilus rutilus</i>					4
	<i>Neogobius melanostomus</i>					1
	<i>Scardinius erythrophthalmus</i>					4
	<i>Gymnocephalus cernuus</i>					1
	<i>Pacificastacus leniusculus</i>					1
	<i>Hypophthalmichthys molitrix</i>					1
	<i>Orconectes limosus</i>					1

	<i>Noemacheilus barbatulus</i>					3
	<i>Anguillicola crassus</i>					4
	<i>Tinca tinca</i>					3
	<i>Pseudorasbora parva</i>					1
	<i>Clarias batrachus</i>					1
	<i>Trapa natans</i>					1
	<i>Azolla filiculoides</i>					2
	<i>Daphnia lumholtzi</i>					1
	<i>Eichhornia crassipes</i>					1
	<i>Ludwigia grandiflora / Ludwigia uruguayensis</i>					1
	<i>Ipomoea aquatica</i>					1
	<i>Silurus glanis</i>					1
	<i>Gambusia affinis</i>					1
	<i>Stizostedion lucioperca</i>					1
	<i>Dreissena polymorpha</i>					3

4.3 Risk Assessment

The biosecurity threats with current potential for entry into L. Carra and L. Mask identified from the screening stage were then subject to risk assessment to priorities the threats and assess the potential impacts of these threats on the lakes. As the risk assessment relates to biosecurity threats associated with non-native aquatic species it was assumed that if a species had potential for entry it therefore had potential to establish within the lakes. The impacts of each threat were assessed in relation to biodiversity, economy and health. Information on the impacts associated with each threat was obtained from a wide variety of sources (NMNI 2008, ISI 2008, ISSG 2008 & DAISIE 2008). The assessment of impact is based on a ranked scale of 1-4 indicating low, moderate, high and very high as illustrated in Table 4.3.1. The results of the risk assessment can be found in Table 4.3.2.

Table 4.3.1 Potential Impacts on Biodiversity, Economy & Health

Impact Ranking		Biodiversity	Economy	Health
1	Low	A species that has no known potential to have a negative impact on biodiversity	No known economic impact	No known health risk to flora or fauna
2	Moderate	A species that has unknown or low potential to have a negative impact on biodiversity	Low or unknown economic impact.	
3	High	A species that has moderate to high potential to have a negative impact on biodiversity	Moderate economic impact	Parasite/pathogen or carrier of parasite/pathogen of health risk to flora or fauna
4	Very High	A species that has a low to high potential to have a negative impact on a protected species, SAC, SPA or WFD	High economic impact	Parasite/pathogen or carrier of parasite/pathogen of health risk to a protected species of flora or fauna

Table 4.3.2: Impact Risk Assessment

Common name	Scientific Name	Impact	Impact			Impact Ranking
			Biodiversity	Economy	Health	
Bream	<i>Abramis brama</i>	Competition with native fish species. Alteration of ecosystem with decreased plant growth & increased turbidity & nutrient release.	2	1	1	2
Brown bullhead catfish	<i>Ameiurus nebulosus</i>	Competition with native fish species. Unknown impacts, but potential for impact on native trout <i>Salmo trutta</i> , eel <i>Anguilla anguilla</i> & white-clawed crayfish <i>Austropotamobius pallipes</i> .	4	2	1	4
Canadian waterweed	<i>Elodea canadensis</i>	Competition with native flora. Alteration of ecosystem physically & with nutrient enrichment.	2	2	1	2
Carp	<i>Cyprinus carpio</i>	Alteration of ecosystem with decreased plant growth & increased turbidity & nutrient release. Potential introduction of fish parasites & pathogens.	4	2	1	4
Chub	<i>Leuciscus cephalus</i>	Competition with native fish species. Potential introduction of fish parasites & pathogens.	4	2	3	4
Crayfish plague	<i>Aphanomycea astaci</i>	Pathogen of native white-clawed crayfish <i>Austropotamobius pallipes</i> .	4	3	4	4
Curly waterweed	<i>Lagarosiphon major</i>	Competition with & displacement of native flora. Alteration of ecosystem physically, with nutrient enrichment & change in water pH to more alkaline conditions. Disruption of recreational activities.	4	3	1	4
Dace	<i>Leuciscus leuciscus</i>	Competition with & displacement of native fish species, in particular native salmonids with which it has similar habitat preferences.	4	2	1	4
Fish lice	<i>Argulus</i>	Parasite of various fish species.	2	3	2	3

Floating pennywort	<i>Hydrocotyle ranunculoides</i>	Competition with & displacement of native flora. Alteration of ecosystem physically & with de-oxygenation. Disruption of recreational activities.	4	3	1	4
Freshwater shrimp	<i>Crangonyx pseudogracilis</i>	Competition with & displacement of native invertebrates.	4	1	1	4
Freshwater shrimp	<i>Gammarus pulex</i>	Competition with & predation & displacement of native invertebrates. Unknown impact on native fish species. Potential introduction of parasites & pathogens.	4	1	1	4
Freshwater shrimp	<i>Gammarus tigrinus</i>	Competition with & predation of native invertebrates.	4	1	1	4
Fringed water-lily	<i>Nymphoides peltata</i>	Alteration of ecosystem	4	2	1	4
Gudgeon	<i>Gobio gobio</i>	Competition with native fish populations.	1	1	1	1
Large-flowered waterweed	<i>Egeria densa</i>	Competition with & displacement of native flora. Disruption of recreational activities.	3	3	1	3
Least duckweed	<i>Lemna minuta</i>		4	1	1	4
Minnow	<i>Phoxinus phoxinus</i>	Competition with native fish populations.	1	1	1	1
New Zealand pigmyweed	<i>Crassula helmsii</i>	Competition & displacement of native flora. Alteration of habitat physically & with de-oxygenation. Disruption of recreational activities.	4	2	1	4
Nuttall's waterweed	<i>Elodea nuttallii</i>	Competition & displacement of native flora. Alteration of habitat physically & with release of metals from sediment & nutrient enrichment. Disruption of recreational activities.	4	3	1	4
Parrots feather	<i>Myriophyllum aquaticum</i>	Competition with & displacement of native flora species. Disruption of recreational activities.	4	2	1	4
Perch	<i>Perca fluviatilis</i>	Competition with native fish populations.	4	1	1	4

Pike	<i>Esox lucius</i>	Predation of native fish species	4	2	3	4
Rainbow trout	<i>Oncorhynchus mykiss</i>	Competition with native fish populations. Hybridization with native trout. Potential introduction of parasites & pathogens.	2	1	3	3
Roach	<i>Rutilus rutilus</i>	Competition with & displacement of native fish species. Alteration of ecosystem with nutrient release. Linked to extinction of Arctic char <i>Salvelinus alpinus</i> in L. Corrib.	4	2	1	4
Rudd	<i>Scardinius erythrophthalmus</i>	Competition with native fish populations.	2	1	1	2
Stoneloach	<i>Noemacheilus barbatulus</i>	Competition with native fish populations.	1	1	1	1
Swimbladder nematode	<i>Anguillicola crassus</i>	Parasite of native freshwater eels <i>Anguilla anguilla</i> .	3	3	3	3
Tench	<i>Tinca tinca</i>	Competition with & displacement of native fish species. Alteration of ecosystem with decreased plant growth & increased turbidity & nutrient release.	2	2	1	2
Water fern	<i>Azolla filiculoides</i>	Competition with & displacement of native flora species. Alteration of ecosystem due to de-oxygenation.	4	3	3	4
Zebra mussel	<i>Dreissena polymorpha</i>	Alteration of food web reducing phytoplankton & zooplankton decreasing food supply of native fish species. Alteration of freshwater ecosystem by increased water clarity, macrophyte growth, nutrient enrichment & colonisation of salmonid spawning grounds. Competition with native freshwater mussel & benthic invertebrates. Fouling of hard surfaces.	4	4	1	4

The rankings for entry (Table 4.2.2) were then combined with the rankings for impact (Table 4.3.2) to provide an overall risk ranking for each species. The method used to combine the rankings and provide an overall ranking is shown in Table 4.3.3.

Table 4.3.3 Overall Ranking of Entry & Impact

		Potential for Entry		
		2	3	4
Potential Impacts on Biodiversity, Economy & Health	1	Low	Low	Moderate
	2	Low	Moderate	Moderate
	3	Moderate	High	High
	4	Moderate	High	Very High

The output from this stage of the risk assessment was a list of 10 species that were ranked as high or very high risk. Those species with a low to moderate risk were removed from further assessment. A total of 22 species considered to be of low to moderate risk were therefore removed from the assessment.

4.4 Management Options

The final stage was to provide appropriate management options for the 10 species identified in the risk assessment as high or very high risk. Management options were therefore compiled for a total of 10 species which were either currently present within the lakes or at high risk of entry with the potential to impact on the ecosystem should they become established in the future. The results can be found in Table 4.4.1.

The recommended management options for the remaining species identified as low and medium risk is prevention from entry and establishment in the lakes.

Those species removed from the risk assessment at the screening stage are not currently considered to be of threat to the lakes. Many of these species are not currently established in Ireland; however these species may become a threat in the future. The recommended option for these species is to continually review and update of the risk assessment.

Table 4.4.1: Management Options

Common name	Scientific Name	Overall Rank	Management Factors	Management Methods	Management Strategy
Curly waterweed	<i>Lagarosiphon major</i>	High	Complete eradication difficult with well-established and extensive infestations. Difficult to remove all stem fragments. Use of herbicide to control submerged plants likely to have negative impact on native submerged species.	Physical removal by hand, by machine or by suction dredge. Careful use of herbicides.	Prevention. Early detection and removal of plants before it becomes established.
Fish lice	<i>Argulus</i>	High	Use of chemotherapeutants that are both appropriate for use in the aquatic environment and non-toxic to the host.	No known management method for wild fish populations.	No management strategy as is already present in the lakes and there is no known management method for wild fish populations.
Freshwater shrimp	<i>Gammarus pulex</i>	Very High		No known management method.	Currently no management strategy as is already present in the lakes and there is no known management method for wild fish populations.
Least duckweed	<i>Lemna minuta</i>	Very High	Growth of species is encouraged by nutrient enrichment. Use of herbicide to control submerged plants likely to have negative impact on native submerged species.	Physical removal by mechanically dragging booms or brushes across the water surface. Careful use of herbicides.	Prevention. Early detection and removal of plants before they become established.
Parrots feather	<i>Myriophyllum aquaticum</i>	High	Complete eradication difficult with well-established and extensive infestations as it is difficult to remove all stem fragments; use of herbicide to control submerged plants likely to have negative impact on native submerged species.	Physical removal by hand, by machine or by suction dredge. Careful use of herbicides.	Prevention. Early detection and removal of plants before they become established.

Perch	<i>Perca fluviatilis</i>	Very High	Fish removal is expensive and time consuming and may impact on native fish. Removal however is effective at reducing and maintaining populations.	Regular removal of fish by netting to maintain the population at a level that does not cause a detrimental impact on native fish populations.	Maintenance/reduction of population. Production of a Management Plan.
Pike	<i>Esox lucius</i>	Very High	Fish removal is expensive and time consuming and may impact on native fish. Removal however is effective at reducing and maintaining populations. Species is considered a coarse fish in Ireland and maintenance will only be undertaken where the species is causing a detrimental impact on native fish populations.	Regular removal of fish by netting to maintain the population at a level that does not cause a detrimental impact on native fish populations.	Maintenance/reduction of population. Production of a Management Plan.
Roach	<i>Rutilus rutilus</i>	Very High	Fish removal is expensive and time consuming and may impact on native fish. Removal however is effective at reducing and maintaining populations.	Regular removal of fish by netting to maintain the population at a level that does not cause a detrimental impact on native fish populations.	Maintenance/reduction of population. Production of a Management Plan.
Swim-bladder nematode	<i>Anguillicola crassus</i>	High	No biological or pharmaceutical anthelmintic controls exist for this parasite in the wild.	No known management method for wild fish populations.	No management strategy as is already present in the lakes and there is no known management method for wild fish populations.
Zebra mussel	<i>Dreissena polymorpha</i>	High	Currently no successful methods for management (management options available apply to cleaning of hard structures).	Currently no known successful management method.	Prevention. Early detection and removal of plants before they become established.

5.0 RECOMMENDATIONS FOR PREVENTION OF BIOSECURITY THREATS

The final section of the plan provides practical recommendations for preventative measures to reduce the risk of threats and to protect L. Carra and L. Mask. Biosecurity will be a shared responsibility between all stakeholders with an in interest in the lakes. Inter-departmental action will also be required to ensure that the integrity of the lakes is not compromised. A systematic and co-ordinated approach must be adopted between all stakeholders where key roles are defined and adequate funding is obtained to implement the plan.

5.1 Prevention

5.1.1 Legislation

- There is a need for national legislative requirements in relation to biosecurity threats; this is being addressed by a number of ongoing projects in Ireland and is outside the scope of the biosecurity plan.

5.1.2 Biosecurity Forum

- A Biosecurity Forum should be developed incorporating all stakeholders with an interest in the lakes in order to provide a vehicle for the implementation and delivery of the long term aspects of the plan. The forum would also enable stakeholders to have input into the plan and to obtain feedback on progress.

5.1.3 Lake Closure

- Consideration should be given to the option of closure of the lakes to all boat movements between 1st October and 14th February each year. There would be no restrictions however on coarse fishing from the shore of the lakes.

5.1.4 Boat Movements

Option 1 – Ban Movement of Boats

- Boats would be registered as Resident Boats. Resident Boats are defined as those that are used on one specific lake only; in this case either L. Carra or L. Mask. The movement of boats to or from any other lake within the catchment, Ireland or Northern Ireland would therefore be strictly prohibited.

- A boat registration system would be implemented on the lakes and an adhesive sticker would be issued during registration to identify Resident Boats. It would be a condition that registration stickers must be displayed on each boat at all times.
- Penalties for non-compliance with the boat registration system including any boat found on the lakes without an up to date registered sticker would result in immediate boat confiscation and a monetary fine.
- Specific regulations would be required to be put in place in order to take account of angling competitions.

Option 2 - Boat Registration System

- A boat registration system would be implemented on the lakes. Boats would be registered as either Resident Boats or Guest Boats and an adhesive sticker would be issued during registration to identify each boat. It would be a condition that registration stickers must be displayed on every boat at all times. A log book would also be issued with each registered boat to identify the name of the boat owner, the origin of the boat and any boat movements.
- Resident Boats are defined as those that are used on one specific lake only; in this case either L. Carra or L. Mask. The owners of Resident Boats would be required to sign a declaration to ensure that each boat is only for use on one specific lake only.
- Guest Boats are defined as those boats that travel to and from other lakes within Ireland. There would be a requirement for the boat owner to produce proof of receipt to ensure each boat, engine and trailer had been thoroughly cleaned. The owners of Guest Boats would also be required to have each boat, engine and trailer inspected by 'authorised personnel' prior to launch at a designated launch site. All watercraft including boats, yachts, float tubes, canoes, kayaks, dinghies and jet skis would be considered within this category and would also have to abide by with the registration system. Registration of Guest Boats would be given a specific time limit upon which registration expires. Registration will automatically expire once a boat leaves the specific lake.
- Inspections would only be undertaken by trained and 'authorised personnel'; it is proposed that 'authorised personnel' would include NPWS staff, WRFB staff and designated Water Keepers. 'Authorised personnel' could also be involved in the context of an inspectorate, to undertake random spot checks on log books to encourage full participation in the scheme.

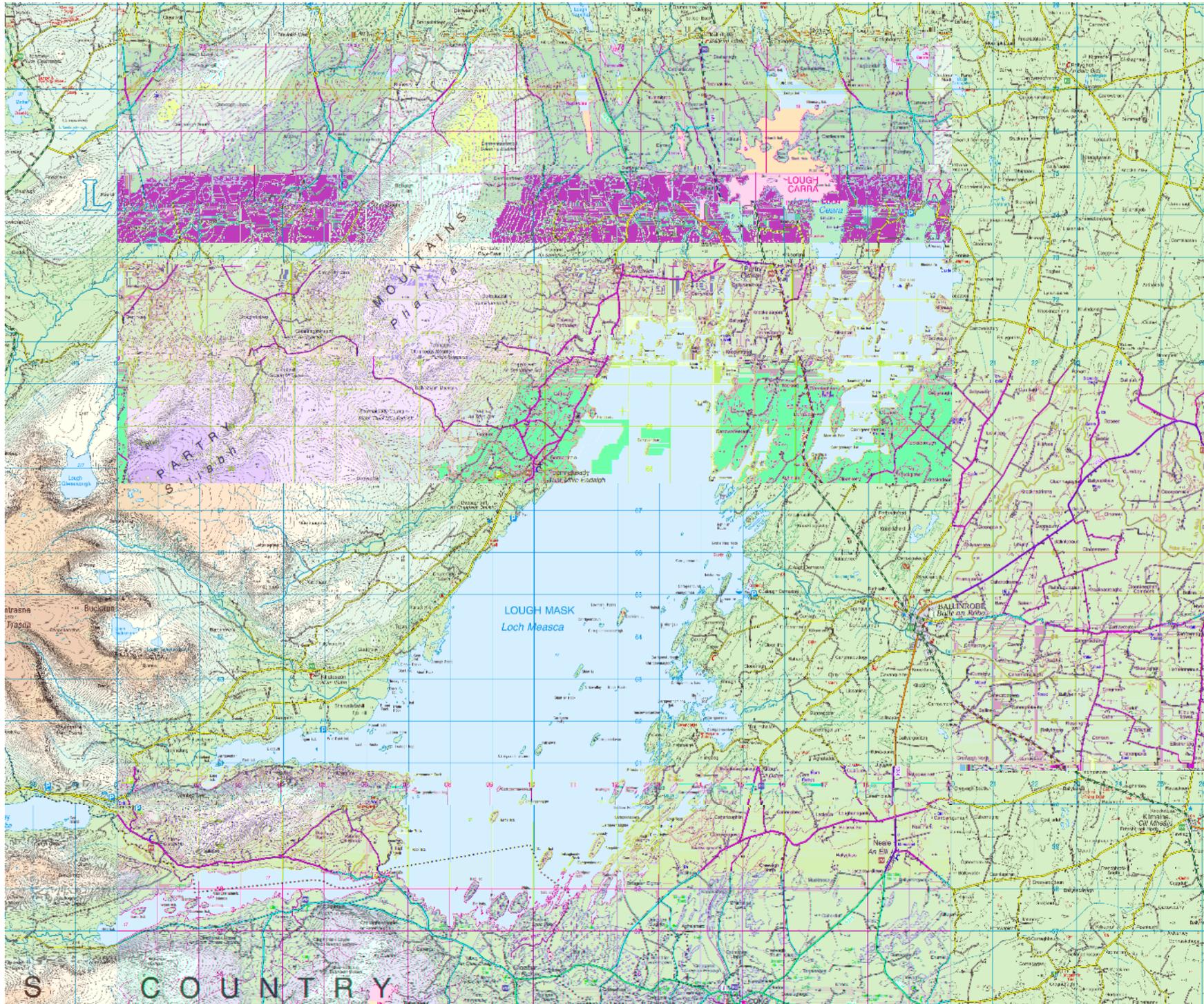
- There would be a requirement for a system to be put in place so that prior to boat launch arrangements could be made for boat inspections by ‘authorised personnel’, this could take the form of designated days for boat launch or a designated site where boats are taken to be inspected. Once each boat has been inspected the log book would be signed and authorisation would be given for access to the lakes at a designated launch site.
- Penalties for non-compliance with the boat registration system including any boat found on the lakes without an in date registered sticker or log book that is not up to date would result in immediate boat confiscation and a monetary fine.
- All angling competitions held on the lakes would also have to abide by the boat registration system.

5.1.5 Restricted Access

- Access points around the lakes should be restricted to a select number of designated launch sites with appropriate facilities. It is suggested that the designated launch sites on L. Carra be restricted to Brownstown and Moorhall and the designated launch sites on L. Mask be restricted to Cushlough, Srah, Tourmakedy Pier and Rosshill. A map illustrating the location of the designated launch sites can be found in Figure 5.1.5.1. All other existing access points around both lakes should be closed to the public for boat access.
- All designated access points should have appropriate facilities including a slipway, secure access, biosecurity signage and information in relation to the boat registration system and the code of practice.
- Those with private access points to the lakes will face penalties in the form of monetary fines if they allow public access to the lake.

5.1.6 Water Keepers

- New Water Keepers should be appointed under either existing legislation or under a new by-law. Water Keepers would be considered ‘authorised personnel’.
- The role of a Water Keeper would be to undertake visual boat, engine and trailer inspections of Guest Boats for compliance with the boat registration system; provide general advice to boat owners regarding biosecurity threats, the boat registration system and the code of practice; and would undertake surveillance of the lakes reporting directly to WRFB officers.



- Water Keepers would be appropriately trained in the identification of biosecurity threats, the methods involved in undertaking boat inspections and surveillance techniques.

5.1.7 Code of Practice

- A Code of Practice should be introduced on the lakes to prevent the entry of new biosecurity threats and to increase awareness among users of the lakes. The code should be implemented by all potential vectors including those related to recreation, commercial eel fishing, research and management.
- The code would apply to all watercraft and any other equipment that comes into contact with water including boats, engines, trailers, vehicle tyres, float tubes, canoes, kayaks, dinghies and jet skis together with fishing and shooting equipment including rods, landing nets, keep-nets, tackle, sacks, decoys, footwear and clothing.
- The introduction non native species into the lakes or the movement of any fish or plant species between lakes would be strictly prohibited.
- The use of all live bait in the lakes would be discouraged. The use live fish bait is illegal and would be strictly prohibited.
- Inspect all watercraft and any other equipment that comes into contact with water for signs of contamination before entering and before leaving any lake. Drain all water from watercraft and equipment. Remove all obvious signs of contamination and dispose of responsibly where it cannot return to the aquatic environment. Do not move contaminated watercraft or equipment between lakes.
- Thoroughly clean all watercraft and equipment with hot water or steam and allow to dry for a minimum of four days. Chemically disinfect all pre-cleaned equipment to ensure additional protection by spraying or wiping with a solution of disinfectant. Once disinfection is complete rinse equipment with uncontaminated water. Dispose of all disinfected washing responsibly where it cannot return to the aquatic environment.
- Thoroughly clean all fishing and shooting equipment including rods, landing nets, keep-nets, tackle, sacks, decoys, chains, ropes, footwear and clothing with hot water or steam. Dry at a minimum temperature of 20°c for at least of 48 hours. Chemically disinfect all pre-cleaned equipment to ensure additional protection by immersion for a minimum of 15 minutes, spraying or wiping with a solution of disinfectant. Once disinfection is complete rinse equipment with uncontaminated water. Dispose of all disinfected washing responsibly where it cannot return to the aquatic environment.

- Those who do not want to decontaminate equipment should restrict the use of all equipment to a single lake. Although the procedures within the code of practice would still be recommended as a matter of good practice.
- All watercraft must adhere to the conditions of the boat registration system.

5.1.8 Education & Awareness

- A publicity campaign to accompany the launch of the biosecurity plan should be undertaken to raise public awareness.
- A biosecurity web page should be set up on the WRFB website providing information on biosecurity threats, the boat registration system and the implementation of the biosecurity plan. The web site should enable the public to obtain feedback on progress of the plan. The web page should be kept up to date regularly.
- An education and awareness campaign should be aimed at each of the potential vectors and should be specific to their particular activities. The code of practice should be reviewed and development in consultation with stakeholders in order to fully take account of all potential activities.
- Dissemination of information leaflets on biosecurity threats should be included with all angling competition applications and during competition events.
- Identification workshops should be held to raise awareness of biosecurity threats and damage they can cause to the lakes.
- A campaign should also be targeted at local garden centres, supermarkets and pet shops to raise awareness in relation to invasive non-native plants species.

5.2 Monitoring, Early Detection & Rapid Eradication

- The biosecurity plan should be reviewed every 1-3 years and the risk assessment updated annually or as and when necessary in order to take account of new biosecurity threats within Ireland and to assess their potential impact on the lakes.
- A monitoring and surveillance programme should be put in place to facilitate early detection of biosecurity threats. It is recommended that the programme should be undertaken annually, jointly by the NPWS and WRFB. Ongoing surveillance would also be undertaken by Water Keepers. If a threat is detected Contingency Plans should be implemented immediately so that the threat can be eradicated within a limited time period before the species becomes established.
- An online surveillance and incident reporting system should be set up as part of the biosecurity web page. The system would enable the reporting of potential biosecurity

threats and would enable rapid identification, containment and control to be undertaken in order to eradicate the threat. The information should be stored on a database that will feed into the National Invasive Species Database of the National Biodiversity Centre.

5.3 Management, Containment & Control

- Management Plans should be put in place for threats that were identified in the risk assessment as very high risk and have already become established in the lake.
- Contingency Plans should be put in place for threats that were identified in the risk assessment as high risk. Contingency planning would ensure immediate and urgent action upon identification of new threats and eradication within a limited time period before the species becomes established.
- Pre-planning with the production of Management Plans and Contingency Plans would be more a cost effective option than having to take ongoing management should a species become established.

5.4 Financing

- An annual fee would be charged for each boat as part of the boat registration system. It is anticipated that the registration fees obtained will be used to provide a limited source of funding to implement the recommendations of the biosecurity plan that will benefit recreational users of the lakes.
- It is fundamental to the success of the biosecurity plan that a source of sufficient long-term funding is secured in order to implement recommendations relating to the policing of the boat licensing system, ongoing monitoring programmes, the production of eradication and management plans and the operation of eradication and management programmes.
- It is recommended that the following sources of funding are investigated; European funding, national and local government, private sector funding and funding under the 'polluters pays principle'.

5.5 Limitations

- There were a number of limitations to the production the "Biosecurity Plan for Lough Mask". The principle aim of the plan was to examine current threats to L. Mask only. In order to safeguard L. Mask, it was decided that L. Carra should also be included within the remit of the plan. It is recommended however that the plan be extended to include all lakes and rivers within the Corrib catchment and that the recommendations of the plan

are adopted on a catchment basis. The plan can be used as a template and applied to other lakes.

- The risk assessment addressed biosecurity threats associated with non-native aquatic species and included un-authorized fish introductions, invasive species infestations and transmission of fish diseases. It is recommended that the plan be extended to include terrestrial species that also have the potential to threaten the lakes. There are a number of terrestrial species including giant hogweed, Japanese knotweed, rhododendron and mink that are currently present within the catchment.

6.0 REFERENCES

Anonymous (2008) *Invasive Species Ireland Risk Assessment*, viewed on 20 October 2008, <http://www.invasivespeciesireland.com/downloads/risk_assessment.asp>.

Central Fisheries Board (2008) *CFB secures €1.5 million in EU funding to help in the fight against aquatic invasive species*, Press Release date: November 10th, 2008, viewed on 19th December 2008, <<http://www.cfb.ie>>.

Commission Decision 2004/453/EC of 29 April 2004 implementing Council Directive 91/67/EEC as regards measures against certain diseases in aquaculture animals.

Council Directive 2000/60/EC of the Council European Parliament and of the 23 October 2000 establishing a framework for community action in the field of water quality.

Council Directive 2006/88/EC of 24 October 2006 on animal health requirements for aquaculture animals and products thereof, and on the prevention and control of certain diseases in aquatic animals.

Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora.

Council Regulation (EC) No 1100/2007 of 18 September 2007 establishing measures for the recovery of the stock of European eel.

Delivering Alien Invasive Species Inventories for Europe (2008) *European Invasive Alien Species Gateway*, viewed 07 November 2008, <<http://www.europe-aliens.org>>.

Invasive Species in Ireland (2008) *Invasive Species Ireland*, viewed on 06 November 2008, <<http://www.invasivespeciesireland.com/strive/default.asp>>.

Invasive Species Specialist Group (2008) *Global Invasive Species Database*, viewed 07 November, <<http://www.issg.org/database>>.

Irish Statue Book, Public Act, No. 39/1976 Wildlife Act, 1976 & No.3 8/2000 Wildlife (Amendment) Act 2000.

Irish Statute Book, Statutory Instruments, S.I. No. 261 of 2008 European Communities (Health of Aquaculture Animals and Products) Regulations 2008.

Maitland, P. S. (2004) Ireland's Most Threatened and Rare Freshwater Fish: An International Perspective on Fish Conservation, *Biology and Environment: Proceedings of the Royal Irish Academy*, **Vol. 104B**, No. 3, p5-16

McGarrigle, M. L. & Champ, W. S. T. (1999) Keeping pristine lakes clean: Loughs Conn and Mask, Western Ireland, *Hydrobiologia*, **395/396**, p455-469.

National Biodiversity Data Centre (2008) *Invasive Species Website*, viewed on 06 November 2008, <http://www.biodiversityireland.ie/index2.php?page_id=5&tab_id=35>.

National Development Plan 2007-2013 *Lough Mask Regional Water Supply Scheme*, viewed on 12 November 2008, <[http://ndp.ie/docs/Lough Mask Regional Water Supply Scheme/1390.htm](http://ndp.ie/docs/Lough%20Mask%20Regional%20Water%20Supply%20Scheme/1390.htm)>.

National Museums Northern Ireland (2008) *Invasive Alien Species in Northern Ireland*, viewed on 06 November 2008, <<http://www.habitas.org.uk/invasive/index.html>>.

National Parks & Wildlife Service (2000) *Conservation Plan for L. Carra/L. Mask cSAC (1774) & SPAs (51,62) (July, 2000)*, NPWS, Dublin.

National Parks & Wildlife Service (2008) *The Status of EU Protected Habitats & Species in Ireland*, NPWS, Dublin.

National Parks & Wildlife Service, *Conservation Sites*, NPWS, Dublin, viewed 05 March 2008, <<http://www.npws.ie/en/ConservationSites>>.

North South Share River Basin Management Project (2005) North South Shared Aquatic Resources (NS Share), Task 6.9: Classification Tool for Fish in Lakes: Plan for Development/Conceptual Model, (T1 A6.9 - 1.1), viewed 19 January 2008, <<http://www.nsshare.com>>.

Shannon Regional Fisheries Board (2008) *Serious concern expressed as visiting anglers import live fish for Pike bait*, Press Release date: May 7th, 2008, viewed on 30 October 2008, <<http://www.shannon-fishery-board.ie/press-2008.htm>>.

Stokes, K., O'Neill, K. & McDonald, R.A. (2004) *Invasive Species in Ireland*, Unpublished report to Environment & Heritage Service and National Parks & Wildlife Service, Quercus, Queens University Belfast, Belfast.

United Kingdom Technical Advisory Group (2004) *Guidance on the assessment of alien species pressures* (Final), UKTAG.

Western Regional Fisheries Board (2004) *The Corrib System*, WRFB, Galway, viewed 05 March 2008, <http://www.wrfb.ie/gameangling/galway/galway_district_home.php>.

Western Regional Fisheries Board (2007) *Angling Reports 2007*.

Western River Basin District (2007) *Water matters "Have your say!"*, Castle Print, Galway.

APPENDIX I

Table 1 provides a list of key stakeholders involved in the direct management of the Lough or with technical expertise in relation to invasive species and biosecurity issues invited to the initial stakeholder meeting. A number of angling representatives covering both game and course fishing were also asked to attend on behalf of these interest groups.

Table 1: Key Stakeholders & Attendance at Workshop

Key Stakeholders	
Name of Organisation	Attendance At Workshop
Carra Mask Water Protection Group	Yes
Central Fisheries Board	
Environmental Protection Agency	
Galway County Council	
Galway Institute of Technology	
Invasive Species Ireland	
Marine Institute	
Mayo County Council	Yes
National Anglers Representative Ireland	
National Parks & Wildlife Service	Yes
North Western Regional Fisheries Board	Yes
NUI Galway	
Office of Public Works	Yes
Recreational Angling Ireland	
The Angling Council of Ireland	
Western Regional Fisheries Board	Yes
Western River Basin District	Yes
Western Zebra Mussel Initiative	Yes

Table 2 provides a list of angling clubs contacted by telephone, email and letter regarding details for of the invitation for written submissions and details of the public meeting. The list also identifies Clubs from which written submissions were received.

Table 2: Angling Clubs

Angling Clubs	
Name of Club	Written Submission
Angling Council of Ireland	
Annaghdown Angling Club	
Athenry Angling Club	
B.A.I.T.S.	
Ballindiff Bay Angling Club	
Ballinrobe & District Anglers	
Ballkeeran/Killenmore	
Belcarra Fishing Club	
Braithrecht na Coirbe	
Carra-Mask Angling Federation	Yes
Castlebar Anglers	
Chasla & an Cheathru Rua	
Clifden Trout Anglers	
Clonbur Anglers	
Collinamuck Angling Club	
Commercial Boat Club	
Cong Angling Club	
Connaght Angling Council	
Conn & Cullen Anglers	
Cornamona & District Anglers Association	
Cross Angling Club	
Galway & Corrib Anglers Association	
Galway West Garda Angling Club	
Headford & Corrib Anglers Association	
Irish Federation of Pike Anglers	Yes

Kilbride Flyfishers Club	
Lough Arrow	
Lough Carra Trout Anglers Association	
Lough Mask Anglers	
Lough Mask Angling & Trout Development Association	
Loughrea Anglers Association	
Moycullen Angling Club	
National Anglers Representative Ireland	
National Coarse Fishing Federation of Ireland	
Newport Angling Club	
Oughterard Anglers & Boatmen's Association	
Partry Angling Club	
St. Colemans Angler's Association	
Tourmakeady Anglers	
Trout Anglers Federation of Ireland	Yes
Tuam & District Anglers	
Tuam Anglers Association	
Tullykyne Anglers	
Westport Trout Anglers	

Table 3: Organisations in Attendance at Public Meeting

This table includes the organisations that attended and participated in the Public Meeting.

Public Meeting
Ballinrobe District Anglers
Carra Mask Corrib Water Protection Group
Carra-Mask Angling Federation
Clonbur Angling Club
Conn & Cullen Anglers
Connaght Angling Council
Federation of Irish Salmon & Sea Trout Anglers
Independant
Kilbridge Flyfishing Club
North Western Regional Fisheries Board
NUI Galway
Partry Angling Club
Petersburg Outdoor Education Centre
RPS Planning & Environment
Trout Anglers Federation of Ireland
Western Regional Fisheries Board