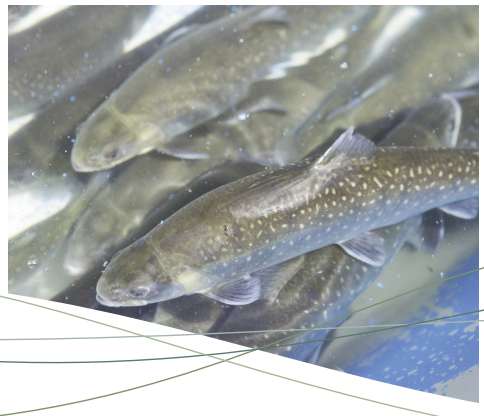
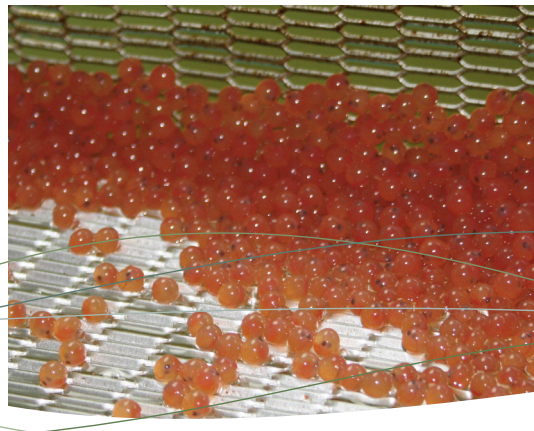
Marine Research Sub-Programme
(NDP 2007–'13) Series

SeaChange
Casadh na Taoide

AQUAPLAN - Health Management for Finfish Aquaculture

Project-based Award





Lead Partner: Marine Institute

Ireland's EU Structural Funds Programmes 2007 - 2013

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EUROPEAN REGIONAL DEVELOPMENT FUND

Marine Institute
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Sea Change: A Marine Knowledge, Research & Innovation Strategy for Ireland

Sea Change—A Marine Knowledge, Research & Innovation Strategy for Ireland 2007-2013—was launched in early 2007 and was the outcome of extensive analysis and consultation with government departments, state agencies, industry and the third-level sector. It outlines a vision for the development of Ireland's marine sector and sets clear objectives aimed at achieving this vision, namely to:

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2. Build new research capacity and capability and utilise fundamental knowledge and technology to create new marine-related commercial opportunities and companies.
3. Inform public policy, governance and regulation by applying the knowledge derived from marine research and monitoring.
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5. Strengthen the economic, social and cultural base of marine dependant regional/rural communities.

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AQUAPLAN: Health Management for Finfish Aquaculture

(PBA/AF/08/003(01))

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SeaChange Casadh na Taoide

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EXECUTIVE SUMMARY

The *AquaPlan* project brought together key stakeholders from the finfish aquaculture industry and state agencies with the aim of drafting and implementing a national strategic plan for fish health in Ireland. Many countries already have well established comprehensive strategies for managing aquatic animal health which are deemed necessary for the sustainable development of the industry. A range of deliverables were produced by the project which are all essential components of the strategic plan for fish health management. A comprehensive manual, *The Farmed Salmonid Health Handbook*, for the salmon and trout industry was developed, and contains detailed and practical information on all aspects of fish stock care, from veterinary issues, environmental protection to legislation and more. Information leaflets were produced on all of the main diseases currently affecting the Irish industry and also those listed under EU legislation. The leaflets form part of the *Handbook* but can also be used separately. An *Emerging Disease Contingency Plan* was also drawn up and outlines specific procedures to be followed in the event of an emerging disease outbreak. The plan also includes maps generated by hydrographic modelling illustrating potential epidemiological zones around marine fish farms based on water movement data collected over a period of twelve months. The project also provided a range of training courses for those involved in the aquaculture industry and relevant training manuals were developed and distributed to participants. Upon completion of the courses, trainees would be able to perform basic disease screening, construct fish health management plans and develop biosecurity programmes.

The project also examined the financial losses due to infectious disease in fish which went to sea between winter 2004 and the spring of 2008. During this period, the three most economically significant diseases on marine based fish farms were sea lice infestations, pancreas disease and gill disorders. Future research initiatives focussing on the management of these diseases could have the potential to result in significant returns and value for money.
All outputs from the project were combined into a national *Strategic Plan for Fish Health Management*. This plan is available as a website (www.fishhealth.ie) and will be regularly updated.

1. INTRODUCTION TO THE AQUAPLAN PROJECT

1.1. Background

Finfish aquaculture is a key economic activity supporting many rural communities in Ireland. In 2007, a total of 1,981 people were employed in the aquaculture industry (finfish and shellfish) including full and part-time employees. That year the finfish sector produced 11,238 tonnes with a value of €58.4 million [1]. This represented a significant reduction on the peak production in 2001 of 25, 082 tonnes (value of €79.2 million). While there are a number of other underlying factors, fish health issues have played a significant role in the decline. Aided by improved markets and product prices, the sector has shown great resilience in recent years through the development of organic salmon farming and improved post-harvest processing techniques and continues to offer employment potential in economically disadvantaged rural areas [2].

One factor in the gradual decline of production has been frequent outbreaks of infectious diseases in Atlantic salmon, a species that dominates the Irish finfish sector. While it is important to note that Ireland remains free of all finfish diseases listed under EU Directive 2006/88/EC other diseases have presented a challenge for the industry. These include the viral diseases, pancreas disease [3,4,5] and infectious pancreatic necrosis [6] as well as gill diseases in recent years [7]. Apart from Atlantic salmon, rainbow trout are also farmed in Ireland, along with a varying production of Arctic char, Atlantic cod, turbot and perch [1]. The ability of the industry to identify and deal with current issues such as pancreas disease and gill pathologies (e.g. amoebic gill disease), along with potential emerging disease threats such as bacterial diseases in rainbow trout, francisellosis in cod and rhabdovirus infections in perch, is a necessity for the sustainable development of the industry. The industry's ability to respond to health issues is dependent upon the level of expertise available within the sector, which is directly related to the level of training available. Therefore, the development of a strategic approach to health management for Irish aquaculture is seen as a priority for increasing production, sustainability and expansion of the finfish sector.

1.2. Project Rationale

Many countries have well established comprehensive strategies which build and enhance capacity for the management of aquatic animal health. In Canada, the Canadian Food Inspection Agency (CFIA) addresses aquatic animal diseases through the *National Aquatic Animal Health Program* which is delivered in conjunction with Fisheries and Oceans Canada (http://www.dfo-mpo.gc.ca/science/enviro/aah-saa/index-eng.htm). In the United States the *National Aquatic Animal Health Program* is run by the US Fish & Wildlife Service (http://www.fws.gov/aah). In Australia, the Department of Agriculture, Fisheries & Forestry oversees *Australia's National Strategic Plan for Aquatic Animal Health* (http://www.daff.gov.au/animal-plant-health/aquatic). In Scotland, *A Code of Good Practice for Scottish Finfish Aquaculture*, initially launched in 2006 and updated in 2011 (http://www.thecodeofgoodpractice.co.uk), is subscribed to by the finfish aquaculture trade bodies and producers are independently audited for compliance.

In Ireland, the Marine Institute set up and chaired the Irish Fish Health Advisory Committee in 2000. In 2005 the Marine Institute was working in collaboration with IFA Aquaculture, and other experts from the industry on the development of the *Code of Practice for Finfish Health*. A marine foresight exercise, carried out as part of the *Sea Change* process [8], identified the development of Codes of Best Practice for farm management and fish health and the establishment of an effective health management regime as specific objectives to be achieved. With the support of the *AquaPlan* project, it was proposed that the Code of Practice would be accompanied by a *Fish Health Handbook* (see Section 2.1) containing technical annexes and information (see Section 2.2), assist in training (see Section 2.4) and would be regularly updated to include the latest developments. The development and implementation of these documents was seen as central to any strategic health management plan for Irish finfish aquaculture (see Section 2.6).

1.3. Project Aims

The *AquaPlan* project aimed to bring together key stakeholders from the aquaculture industry and state agencies, in the drafting and implementation of a national strategic plan for fish health in Ireland. The production of an Irish fish health strategy is seen as a key step towards the sustainable development of the finfish sector. The project builds and enhances the national capacity for the management of finfish health in the aquaculture sector through the production

of a number of documents outlined in this report and the development of training courses and seminars to provide up-skilling opportunities and information dissemination to those working in the sector. The project will provide the basis for the development and implementation of a *Strategic Plan for Fish Health Management* in Ireland.

2. DELIVERABLES OF THE PROJECT

2.1. Fish Health Handbook

A comprehensive manual on fish health for Ireland's salmon and trout farming industry was developed by the project, *The Farmed Salmonid Health Handbook*, which contains detailed and practical information on all aspects of fish stock care ranging from veterinary issues, environmental protection, feed & nutrition, treatments to current legislation. The *Handbook* was compiled by experts from both private and government organisations representing the Irish aquaculture industry including: IFA Aquaculture; the Marine Institute; Vet Aqua International, Global Trust Certification; and the Department of Agriculture, Food and Marine. The handbook was launched on Wednesday, 23rd November 2011 by Mr. Simon Coveney, T.D., Minister of Agriculture, Food and Marine at the Department of Agriculture, Food and Marine in Dublin. In May 2012 a workshop was held at the Marine Institute discussing the handbook with members of the industry.

With the support of AquaPlan, *The Farmed Salmonid Health Handbook* was developed as an accompanying document to the industry's *Code of Practice*. The handbook contains detailed technical and practical information on all aspects of health management when rearing fish and was produced in an A4 folder format and is to be reviewed annually to include the latest developments. It is hoped that the handbook will not only assist producers in establishing a sound framework to protect animal health and welfare on their farms, but also provide a platform for training. According to the handbook, an essential part of the overall fish health plan is a written *Veterinary Health Plan* which must be put into place for each farm. This document should be created in consultation with each farm's designated fish veterinary surgeon and updated at least once a year.

The handbook is available to download from the *AquaPlan* website (www.fishhealth.ie).

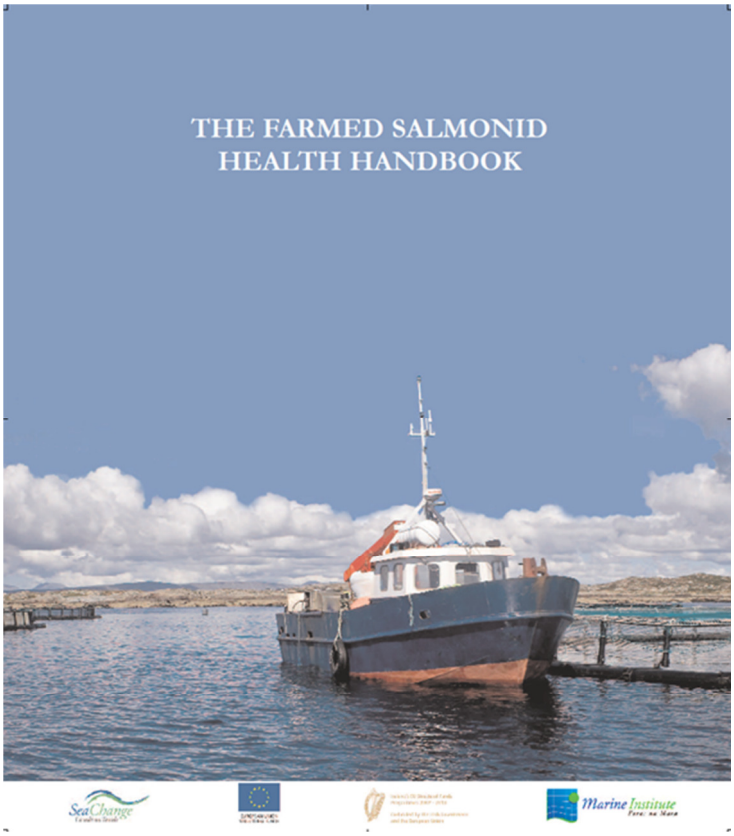


Figure 1: The Farmed Salmonid Health handbook.

2.2. Information Leaflets

Project partners and the Steering Committee met at regular intervals during the project to discuss and produce technical information leaflets on specific areas (biosecurity) and diseases important to the Irish aquaculture industry. The following leaflets were produced and are included in the *Farmed Salmonid Health Handbook* in addition to being available to download from the website. Leaflets were produced under the following three categories 1) listed diseases, 2) non-listed diseases of national importance and 3) technical information leaflets.

2.2.1. Listed Diseases

- Infectious Salmon Anaemia (ISA)
- Infectious Haematopoietic Necrosis (IHN)
- Viral Haemorrhagic Septicaemia (VHS)
- Koi Herpesvirus (KHV
- Gyrodactylosis

2.2.2. Non-Listed Diseases

- Pancreas Disease (PD)
- Furunculosis
- Infectious Pancreatic Necrosis (IPN)
- Francisellosis
- Vibriosis
- Ichthyophthiriosis 'White-Spot Disease'
- Rickettsiosis
- Perch Rhabdovirus
- Rainbow Trout Fry Syndrome
- Amoebic Gill Disease (AGD)

2.2.3. Technical Information Leaflet

- Cleaning & Disinfection
- General Biosecurity

2.3. Disease Contingency Plan

Article 47 of Council Directive 2006/88/EC requires Member States to draw up contingency plans for emerging and exotic diseases of aquaculture animals. These plans must specify the national measures required to maintain high levels of disease awareness and preparedness, ensure environmental protection and the measures to be implemented in the event of an outbreak of an emerging disease[1].

The criteria for drawing up the plans are set out in Council Directive 2006/88/EC, Article 47 and Annex VII and through this project, the *Emerging Disease Contingency Plan* has been drawn up to meet the requirements set out in the Directive.

The detailed procedures to be followed in the farms, laboratories, harvest stations and administration offices in the event of an emerging disease outbreak are set out in this Emerging

[1] "Emerging disease" means a newly identified serious disease, the cause of which may or may not yet be established, that has the potential to be spread within and between populations, such as by way of trade in aquatic animals and/or aquatic animal products. It also means a listed disease identified in a new host species not yet included in Part II of Annex IV of EC Directive 2006/88/EC as a susceptible species.

Disease Contingency Plan and in accordance with the requirement of the Directive, this contingency plan will be reviewed at least every five years and submitted to the Directorate-General for Health & Consumers (DG SANCO) of the European Commission for approval.

A copy of the *Emerging Disease Contingency Plan* is available to download from the website.

2.3.1. Hydrographic Modelling

A prototype disease transport model was incorporated into the Marine Institute's ROMS (Regional Ocean Modelling System) NE Atlantic model. The model incorporated seabed bathymetry data made available by the INFOMAR[2] project. Seawater circulation is driven by winds, heat fluxes and rainfall derived from the Global Forecast System (GFS). The GFS is a global numerical weather prediction system containing a global computer model and variational analysis run by the National Weather Service in the United States. Measurements of freshwater discharge from over 40 Irish rivers are also incorporated into the disease model. The model is also embedded into the large scale North Atlantic model (MERCATOR[3]) to include variations in the North Atlantic current.

The disease transport model was run for a period of 12 months throughout 2009 by the Oceanographic Services team. The model was run every week, so 52 weeks of Lagrangian tracks (floats) were collected from 23 sites representing the main finfish aquaculture sites/bays in use at that time (Figure 2). Floats were released every two hours from each site over the first two days of each week and then tracked for the rest of the week with a lifespan for each float of five days. Each float was released at a depth of three meters. The information collected was then used to develop statistics about the overall transport of potential pathogenic organisms related to the season and the prevailing weather conditions. The aim was to provide information for the development of epidemiological units around marine fish farms.

The area around each site was divided into a grid of 500 x 500 m^2 cells and the number of times a float track intersected each cell was counted (the count for a cell is increased by one if an individual float track intersects the cell at least once). The data collected over the year was aggregated to produce cumulative counts. Each map therefore illustrates the potential area of contamination around the site should it become the focal point of a disease outbreak. For

[2] Integrated Mapping for the Sustainable Development of Ireland's Marine Resources (www.infomar.ie)
[3] See www.mercator-ocean.fr/eng

illustration purposes the current practice of using zones of 5 and 10 km around an infected site are also shown.

The potential risk of disease spread is illustrated for each site by calculating areas where 75, 50 and 25% of the particles have occurred around the respective site. These are shown on the maps as areas of high, medium and low risk of infection (Appendix III).

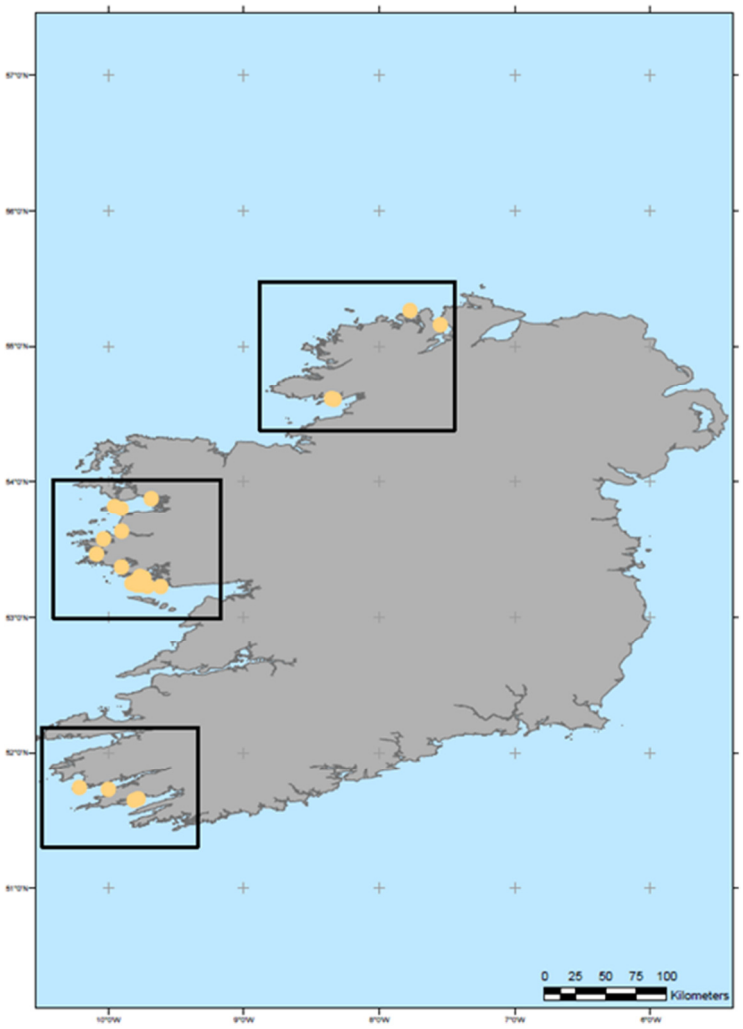


Figure 2: An overview of the three main salmon producing regions in Ireland with the sites used for modelling.

In addition to this, a matrix has been created which illustrates the contact between each of the fish farm sites, determined by the number of particles from each site coming into contact with the other (Table 1). The matrix shows the percentage risk of water moving from one site to another. The first column lists the site names where the water (or pathogen) originates while the other columns show the % risk of the water moving to another site. For example, 100% of

floats from Birbeg went through the Golam site indicating that should a disease outbreak occur in Birbeg, then Golam is at risk from horizontal transmission as all the water flowing from Birbeg will reach Golam. However, only 7% of the floats originating from Golam reach Birbeg indicating that Birbeg is at a much lower risk of infection from Golam.

Table 1: Cross contamination matrix of all 23 sites used in the study. Sites listed in the first column are the originating sites with the relative risk to other sites listed along the top indicated in the table.

SITE NAME	Dee	Cor	Frao	Ini	Por	Cl	Sea	Ini	C M	PP	Red	Bir	Roa	Ar	Gol	Ol	Cui	SS	Ker	Inv	Ean	Gli	Swi
Deenish		0	0	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Corhounagh	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fraochoilean	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Inishfarnard	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Portlea	0	0	0	0		16	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Clare Is Smolt site	0	0	0	0	10		0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sealax	0	0	0	0	0	0		0	2	0	1	9	0	0	7	0	0	0	0	0	0	0	0
Inishdeighil	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Carraig na Meachain	0	0	0	0	0	0	4	0		0	53	20	0	6	41	11	5	0	1	0	0	0	0
Palmer's Point	0	0	0	0	0	0	0	0	0		0	0	57	0	0	0	0	0	0	0	0	0	0
Red Flag	0	0	0	0	0	0	1	0	13	0		17	0	7	60	19	10	0	1	0	0	0	0
Birbeg	0	0	0	0	0	0	1	0	5	0	23		0	16	100	47	13	0	0	0	0	0	0
Roancarrig	0	0	0	0	0	0	0	0	0	36	0	0		0	0	0	0	0	0	0	0	0	0
Ardmore	0	0	0	0	0	0	1	0	3	0	16	38	0		38	95	7	0	0	0	0	0	0
Golam	0	0	0	0	0	0	1	0	6	0	33	7	0	2		7	28	0	1	0	0	0	0
Oilean Iarthach	0	0	0	0	0	0	0	0	0	0	10	9	0	30	50		8	0	0	0	0	0	0
Cuigeal	0	0	0	0	0	0	0	0	7	0	26	7	0	2	82	9		0	3	0	0	0	0
Sea Stream	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0
Kerraun Pt.	0	0	0	0	0	0	1	0	6	0	23	8	0	2	37	7	41	0		0	0	0	0
Ocean Inver	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		10	0	0
Eany	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	26		0	0
Glinsk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0
Lough Swilly	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	

2.4. Training Manuals & Courses

2.4.1. Scope

There has been a gradual decline in the production of fish on an annual basis since 2002. Although a number of factors are involved, the effects of infectious and non-infectious diseases have played an important role in this decline. The proposed training courses aimed to address this issue through the provision of fish health training for those involved in the area of fish production. The courses were primarily developed for fish farm personnel but were also targeted at those involved in the ornamental fish trade, put-and-take fisheries, anglers, state agency staff (Inland Fisheries Ireland, Marine Institute, Bord Iascaigh Mhara, Sea Fisheries Protection Agency and veterinarians employed by the Department of Agriculture, Fisheries and the Marine).

Training was provided at three levels depending on the expertise of those attending the courses and is outlined in Table 2 below.

Table 2: An outline overview of the training courses developed through the AquaPlan project.

AquaPlan Training Course Levels			
	Level 1	Level 2	Level 3
Scope	Preliminary health and disease screening	In depth health and disease diagnosis	Advanced specialist fish disease training
Objectives	Preliminary disease diagnosis Sampling for diagnosis Biosecurity	Competent disease diagnosis Sampling for diagnosis Specific treatments Monitoring and assessing disease	Disease specific – clinical signs, aetiology, diagnosis, treatments, biosecurity
Target	Fish farm personnel, biologists, fishery officers	Fish farm managers, fish health professionals, biologists	Veterinarians, fish health professionals

2.4.2. Objectives

The aims of the training courses were to provide those involved in the finfish aquaculture industry with a basic but comprehensive level of training on fish health issues. Upon completion of each course trainees would be able to screen fish to provide a provisional

diagnosis of disease, construct fish health management plans for the farm and set up biosecurity and disinfection programmes to prevent the introduction/spread of disease.

2.4.3. Manuals

To complement the courses developed and outlined in Table 2 above, a specific training manual was also developed for each course. These manuals were provided for each participant during the courses and are also available to download from the AquaPlan website.

Figure 3: The three training manuals developed through the AquaPlan project.

2.5. Marine Farmed Salmon Health Review

2.5.1. Background

One of the main impediments to increasing output are health issues which impact, not only on survival, but also on growth and performance. The aim of this review was to investigate the financial impact of health conditions in Irish farmed salmon, as such a comprehensive review has never been conducted. A limited number of reports from Norway have studied the financial costs of cardiomyopathy syndrome [9] and pancreas disease [10], while a report by Costello [11] collated and compared estimated direct costs of sea lice from several internationally published reports. Allocating numbers of mortalities to a particular disease is subjective and interpretation is dependent on the consultant veterinarian and/or site biologist. This review aimed to provide an estimate of the financial losses incurred as a result of disease outbreaks on marine salmon farms and only took into account direct losses, such as the value of each fish at the time of death, the impact on feed conversion ratios (FCR), treatment costs, diving costs, mortality disposal costs and costs related to the reduction in fish quality i.e. downgrading. It did not include losses due to a reduced potential profit caused by fish mortalities, nor does it include losses due to storms, predators, physical damage or other production related losses.

2.5.2. Data Collection

Detailed questionnaires were sent to every Irish salmon farm that transferred fish to sea between the winter of 2004 and the spring of 2008, covering four cohorts of fish (Table 3). Over the four year period there were 53 inputs and data was received concerning 35 of these, representing a return of 66%. The questionnaire looked for information on the stock (numbers, densities, strain, biomass etc) and information was also collected in relation to specific diseases diagnosed on the farms, such as number of mortalities, impact on FCR, cost of treatments/disposal and weight at mortality. Feed prices during the study period were obtained from the suppliers and sales prices from the sales organisations.

Table 3.

Farmed salmon cohorts covered in the study.			
	Hatched	**Transferred to Sea**	**Harvested**
Cohort '04	Spring 2004	Winter 2004/Spring 2005	2006/2007
Cohort '05	Spring 2005	Winter 2005/Spring 2006	2007/2008
Cohort '06	Spring 2006	Winter 2006/Spring 2007	2008/2009
Cohort '07	Spring 2007	Winter 2007/Spring 2008	2009/2010

2.5.3. Calculation of Disease Costs

A comprehensive computer model was developed to interpret the data collected and a scientific actuarial analysis and loss adjustment was carried out. The model only accounted for direct losses, as mentioned above, and consisted of the following five categories:

- Value of mortalities – based on insurance loss adjustment table, taking into account the size of the fish at the time of death.
- Increased feed costs – estimated based on the effect of disease on the feed conversion rate (FCR).
- Loss due to production fish – based on the quality of the final product.
- Cost of treatments.
- Cost of mortality collection/disposal – includes divers, boats, disinfection, transport and rendering of waste.

2.5.4. Diseases

There were eleven specific conditions which occurred during the study period and were included in the analysis: 1) gill disorders (GD), 2) pancreas disease (PD), 3) failed smolt (FS), 4) algal bloom (AB), 5) sea lice (SL), 6) unspecified lesions (UL), 7) rickettsiosis (R), 8) jaw deformity (JD), 9) infectious pancreatic necrosis (IPN), 10) brain parasite (BP), 11) vibriosis (V).

2.5.5. Data

The calculations in the full report were divided into the following categories:

- Estimated total marine disease mortality expressed as a % of the input number
- Estimated total marine disease cost (ETMDC)
- ETMDC expressed as €/tonne harvested
- ETMDC expressed as % of the total sales value

The main findings of the report were that over the period of 2004 – 2008, the three most economically significant diseases in the marine environment were sea lice, pancreas disease and gill disorders which accounted for 91% of the total calculated costs.

When the estimated total marine disease cost is expressed as €/tonne harvested it was found that the average loss for the four cohorts combined was €1,179/tonne. As the average sales price achieved for the combined cohorts was €4,928/tonne, this represents some 24% of the sales price. The loss in Cohort '04 was €1,175/tonne, €1,058 in '05, €1,562 in '06 and €920 in '07. This analysis took into account the changes in sales price achieved for each cohort (which had increased significantly over the period of the study). This was predominantly a result of the switch from producing conventional salmon to organic salmon. The data indicated that the average sales price in cohort '04 was €4,307/tonne, cohort '05 was €4,664/tonne, cohort '06 was €4,744/tonne and cohort '07 was €5,999/tonne. This explains the drop in Cohort '07 to an estimated disease cost of €920/tonne, but also reflects a lower rate of mortality for that cohort.

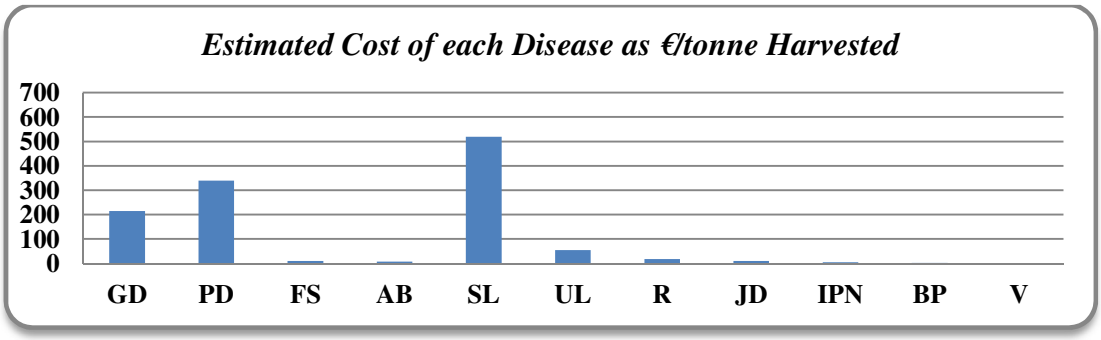


Figure 4: The estimated cost of each disease expressed as €/tonne harvested in all cohorts combined (2004 – 2008).

The diseases sea lice (SL), pancreas diseas (PD) and gill disorders (GD) accounted for the bulk of the costs (Figure 4). Sea lice were the most significant disease cost at €519/tonne (primarily due to the costs of treatments), followed by pancreas disease at €339/tonne and gill disorders at €214/tonne.

Overall the results of the study showed that these three main diseases accounted for the majority of costs during the marine phase of production. Future research initiatives focussing on the management of these three diseases could have the potential to result in significant returns for the industry if they were to be successful in reducing the impact and management costs associated with those diseases.

2.6. Strategic Plan for Fish Health Management

The *AquaPlan* project represented a joint approach of industry and government working together to implement an integrated and planned approach to fish health in Ireland. The aim is to develop a comprehensive national strategy to build and enhance sustainable production of farmed finfish in Ireland. The plan will outline a range of components to help develop a national approach to emergency contingency planning and response, to aid the overall management of aquatic animal health and act as a resource to be accessed for relevant information.

The *Strategic Plan for Fish Health Management* will take the form of a web site incorporated into the Fish Health website (www.fishhealth.ie) with specific sections dealing with the following topics:

- Farmed Salmonid Health handbook
- Information Leaflets
- Contingency Planning
- Seminars & Training

The *AquaPlan* steering group will continue to meet twice a year and be expanded to include relevant personnel from the industry and external experts when required. Through this group the website will be updated and the specific pages expanded to include the latest information and developments pertaining to aquatic animal health.

APPENDIX I: PROJECT OUTPUTS

Reports

The Farmed Salmonid Health Handbook

Disease Information Leaflets

Contingency Plan for New & Emerging Diseases.

Presentations

G. Nolan, K. Lyons, N. Ruane, D. Jackson, J. Silke and R. Raine. Oceanographic modelling products as a decision support to the Irish aquaculture sector. *ICES Annual Science Conference*. Nantes, France, September 2010.

Trade Press Articles

AquaPlan – improving the health of Irish farmed fish. Inshore Ireland (May/June 2009) pg 18

First annual fish health seminar. Inshore Ireland (July/August 2009) pg 16

Fish health the cornerstone of Irish aquaculture. Marine Times (February 2012) pg 21

Training Manuals

Fish Disease Manual. Vet Aqua International, March 2010, 72 pp.

Fish Health Manual I. Vet Aqua International, October 2010, 46 pp.

Fish Health Manual II. Vet Aqua International, April 2011, 40 pp.

Training Courses/Workshops

April 2010: Workshop on zooplankton sampling and identification including sea lice.

June 2010: Three day course on fish health for veterinary inspectors from Department of Agriculture, Food and the Marine.

May 2011: Two day course for fish farm personnel on fish health and zooplankton/phytoplankton sampling & identification.

May 2012: One day workshop on the Farmed Salmonid Health Handbook.

Industry Seminars

11 June 2009 – 1st AquaPlan Fish Health Seminar, Marine Institute, Galway.

6 October 2010 – 2nd AquaPlan Fish Health Seminar, Marine Institute, Galway.

7 December 2011 – 3rd AquaPlan Fish Health Seminar, Marine Institute, Galway.

APPENDIX II: SEMINAR AGENDAS

Fish Health Seminar I

June 11, 2009

Marine Institute, Galway

Programme

Introduction and overview of the AquaPlan project	**9.30 – 10.00**
Neil Ruane (Marine Institute)	
Health management in Ireland: mandatory and voluntary aspects	
Fiona Geoghegan (Marine Institute), Kevin Murphy (KPM Aqua/Vet-Aqua)	**10.00 – 10.45**
The control and eradication of a VHS outbreak in England	
Kevin Denham, (CEFAS)	**10.45 – 11.30**
BREAK 11.30 – 12.00	
ISA in the Faroe Islands – from disaster to best in the class	
Peter Østergård (Aquamed)	**12.00 – 12.45**
New and emerging disease threats for Irish aquaculture	
Hamish Rodger (Vet-Aqua International)	**12.45 – 13.30**
LUNCH 13.30 – 14.30	
Control and management of sea lice in Scotland	
Chris Findlay (Fish Vet Group)	**14.30 – 15.15**
Recent advances in PD research and practical implications	
Marian McLoughlin (Aquatic Veterinary Services)	**15.15 – 16.00**
BREAK 16.00 – 16.20	
Gill Diseases – current challenges and potential solutions	
Susie Mitchell (Vet-Aqua International/Trinity College Dublin)	**16.20 – 17.00**

Fish Health Seminar II

October 6 2010

Marine Institute, Galway

Programme

Introduction and overview of the AquaPlan project	**9.30 – 10.00**
Neil Ruane (Marine Institute)	
The Salmonid Health Handbook	
Kevin Murphy (KPM Aqua/Vet-Aqua)	**10.00 – 10.30**
Interactions between jellyfish and aquaculture	
Tom Doyle (University College Cork)	**10.30 – 11.15**
BREAK 11.15 – 11.45	
Sea Lice control and monitoring in Ireland	
Dave Jackson (Marine Institute)	**11.45 – 12.30**
Hydrographic modelling and its application to fish health issues	
Glenn Nolan (Marine Institute)	**12.30 – 13.15**
LUNCH 13.15 – 14.15	
Scotland update: the current situation in relation to ISA and BKD	
Eann Munro (Marine Scotland)	**14.15 – 15.00**
Norway update: disease situation with specific reference to gill disease	
Duncan Colquhoun (National Veterinary Institute, Norway)	**15.00 – 15.45**
An overview of Koi Herpesvirus	
Owen Donohue (Marine Institute) & Keith Way (CEFAS)	**15.45 – 16.30**

Fish Health Seminar III

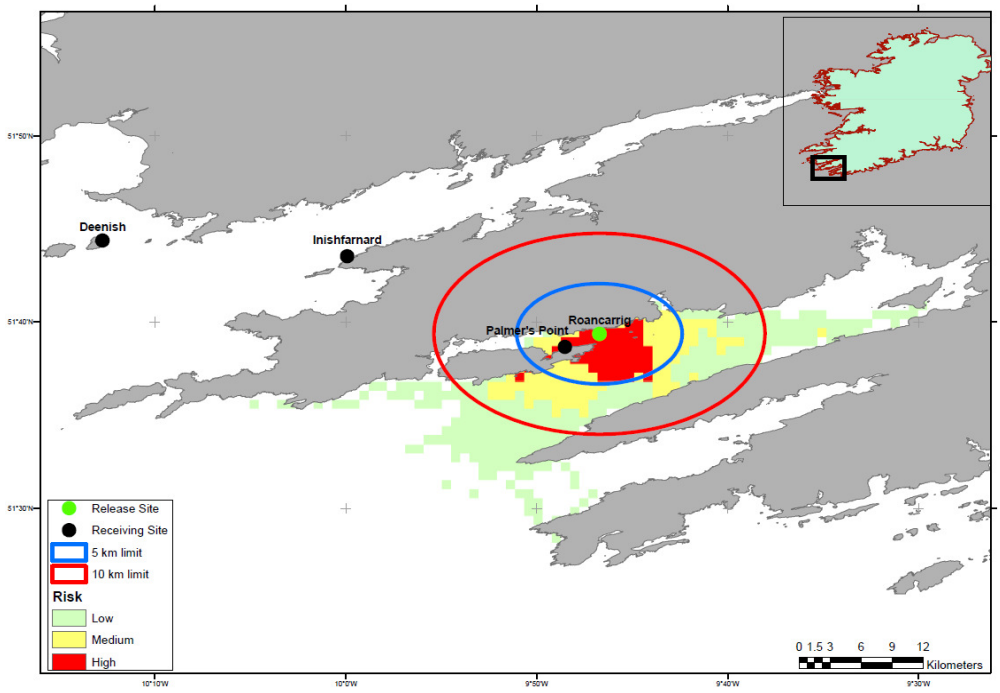
December 7 2011
Marine Institute, Galway

Programme

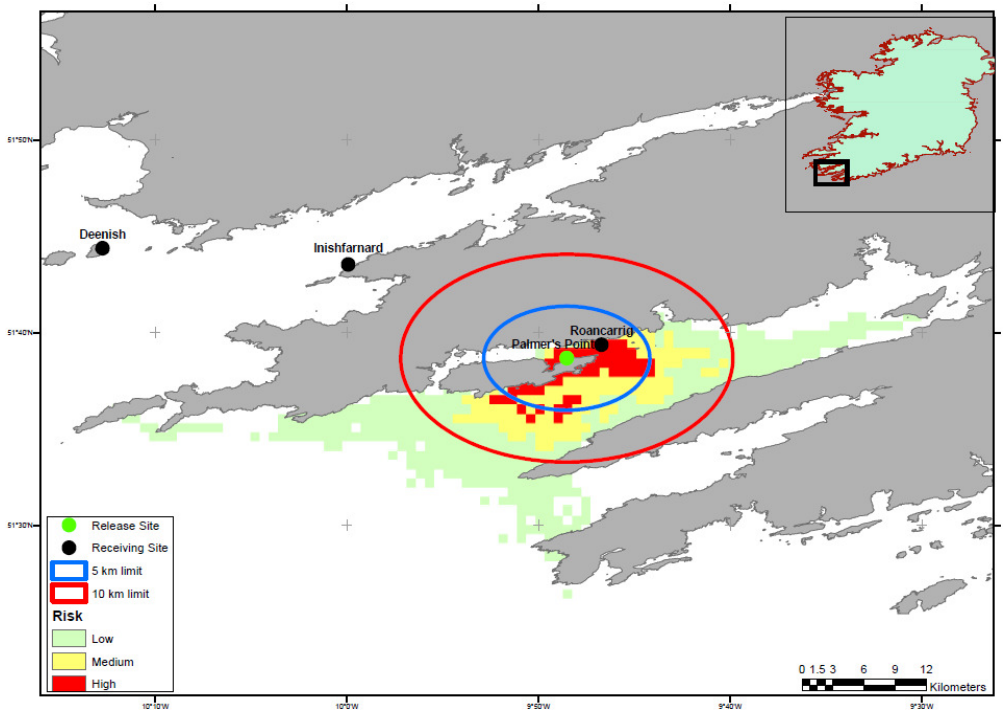
Introduction & Welcome	
Fiona Geoghegan (Marine Institute)	**9.45 – 9.55**
The GILPAT and AQUAPLAN projects	
Neil Ruane (Marine Institute)	**9.55 – 10.15**
Fish Health Update at Home & Abroad	
Hamish Rodger (Vet-Aqua)	**10.15 – 10.45**
Molecular diagnosis of viral disease in Irish aquaculture	
Neil Ruane (Marine Institute)	**10.45 – 11.15**
BREAK 11.15 – 11.45	
Gill disease: emerging pathogens and their significance	
Susie Mitchell (Vet Aqua)	**11.45 – 12.30**
Hydrographic modelling and its application to fish health issues	
Glenn Nolan (Marine Institute)	**12.30 – 13.15**
LUNCH 13.15 – 14.15	
A summary of jellyfish and aquaculture interactions: where to next?	
Tom Doyle (CMRC, UCC)	**14.15 – 15.00**
An assessment of the economic impact of fish disease in Ireland	
Kevin Murphy (KPM Aqua/Vet Aqua)	**15.00 – 15.45**

APPENDIX III: HYDROGRAPHIC MAPS

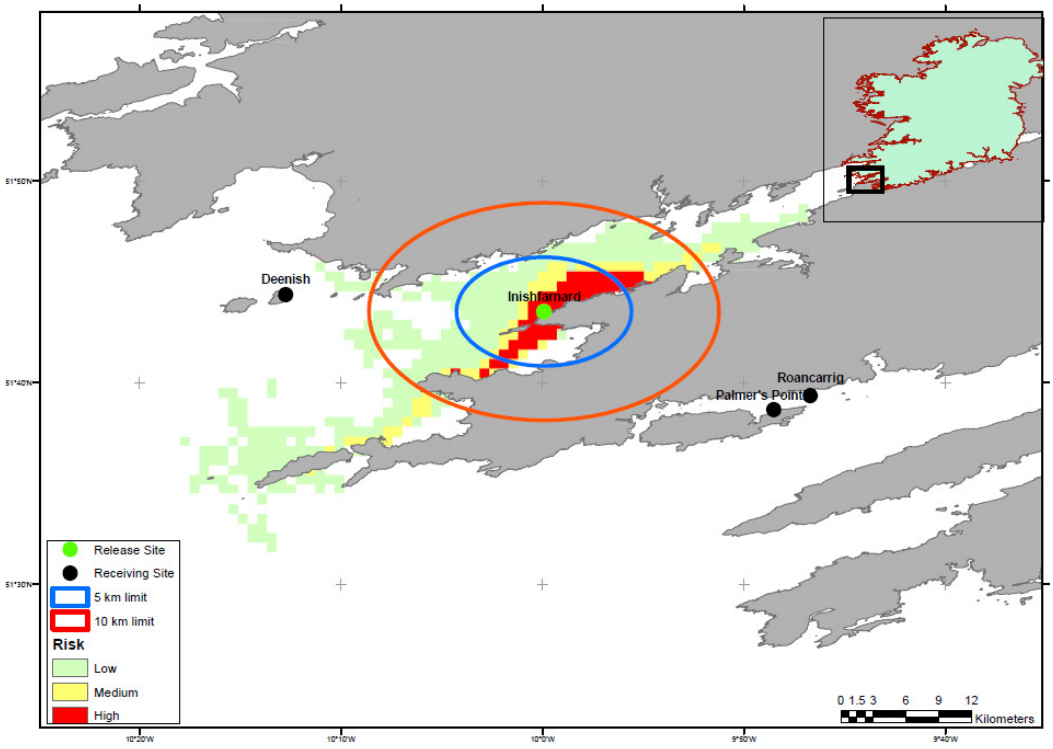
1. Roancarraig (Bantry Bay)



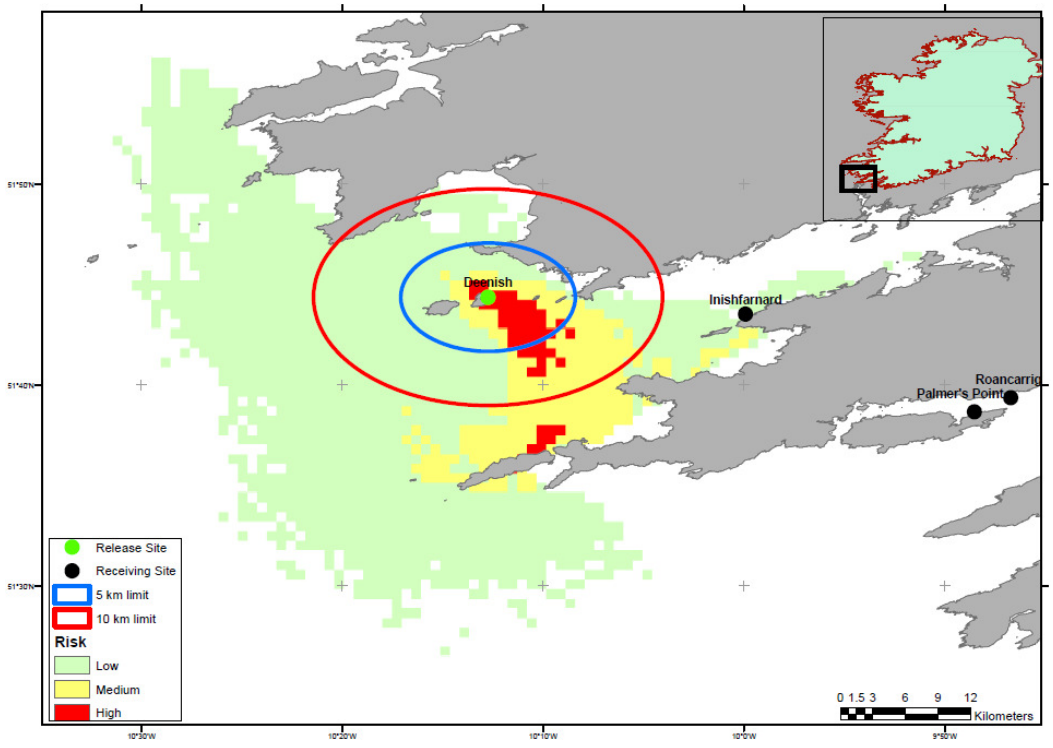
2. Palmers Point (Bantry Bay)



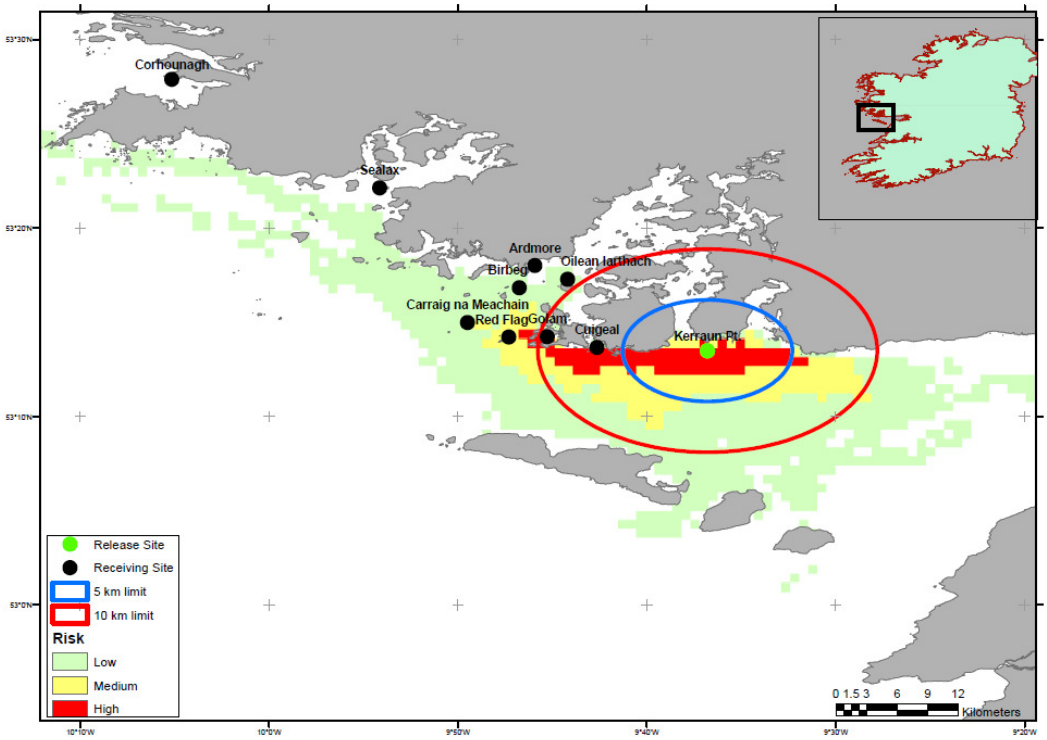
3. Inishfarnard (Kenmare Bay)



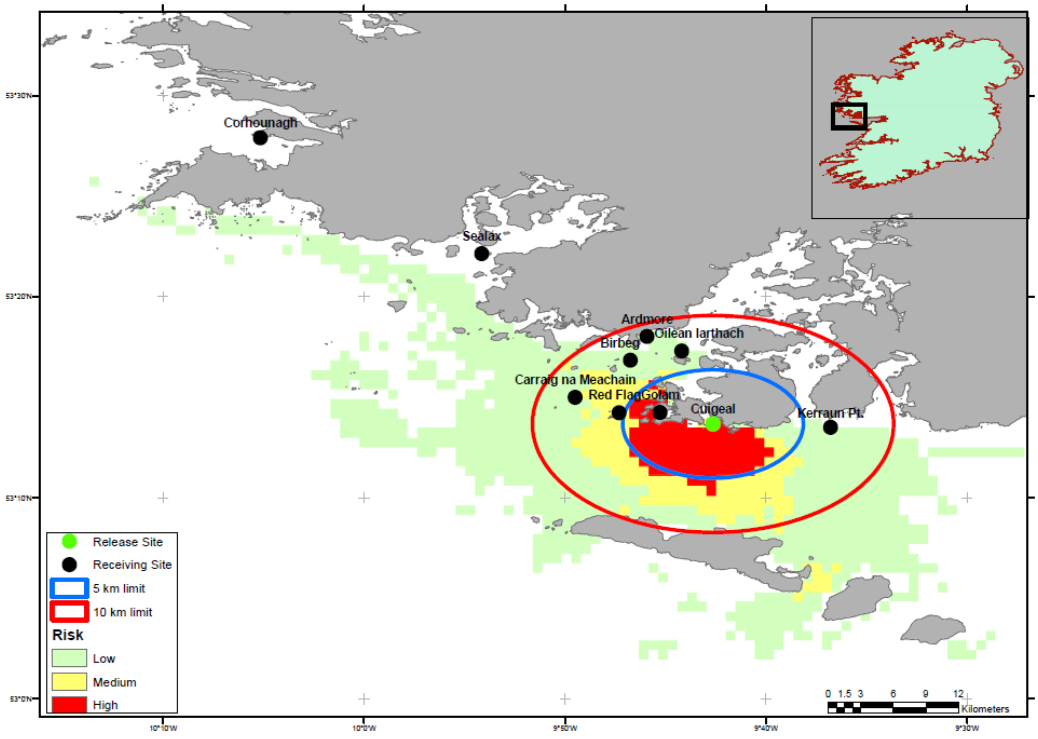
4. Deenish (Kenmare Bay)



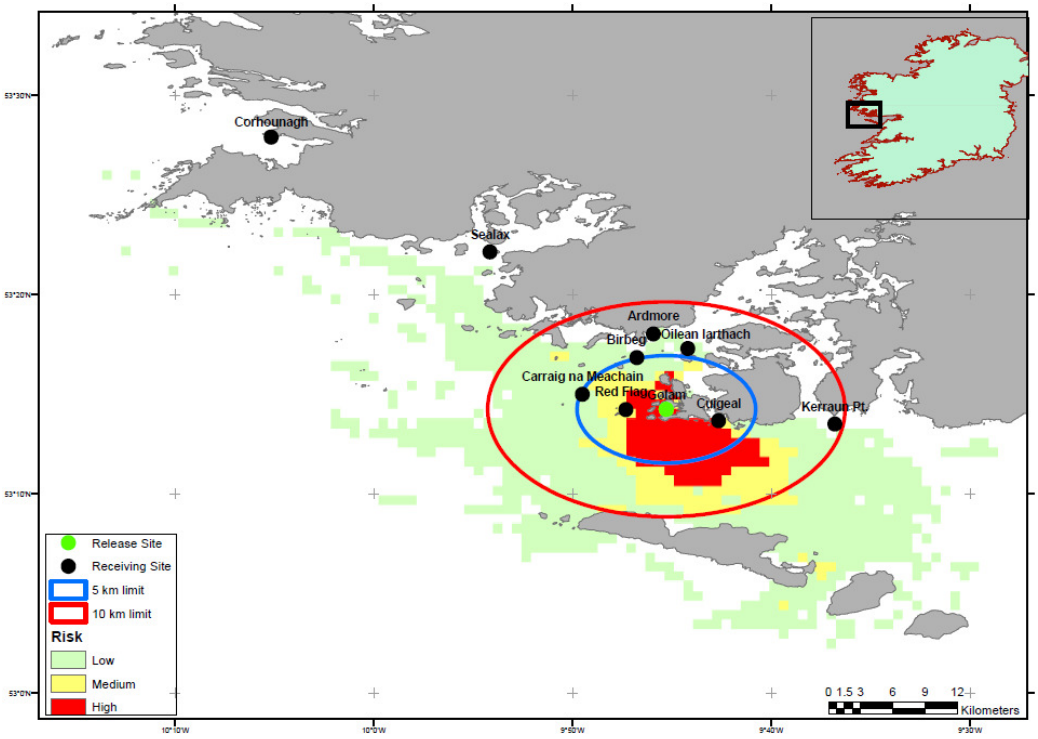
5. Kerraun Point (Kilkieran Bay)



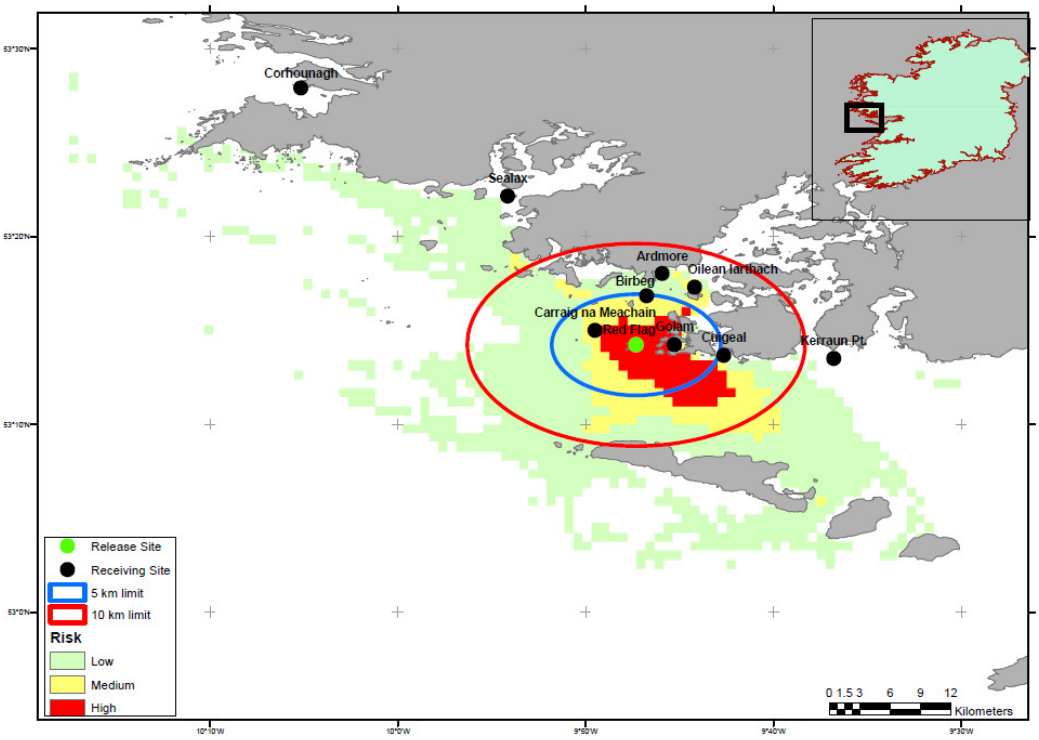
6. Cuigeal (Kilkieran Bay)



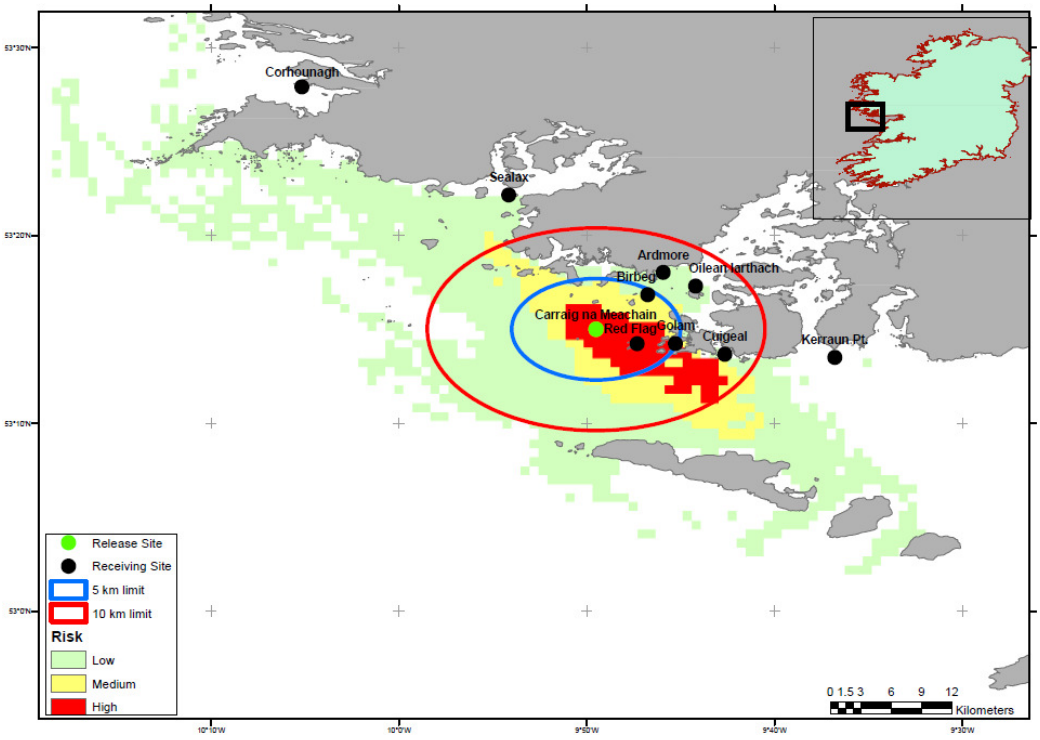
7. Golam (Kilkieran Bay)



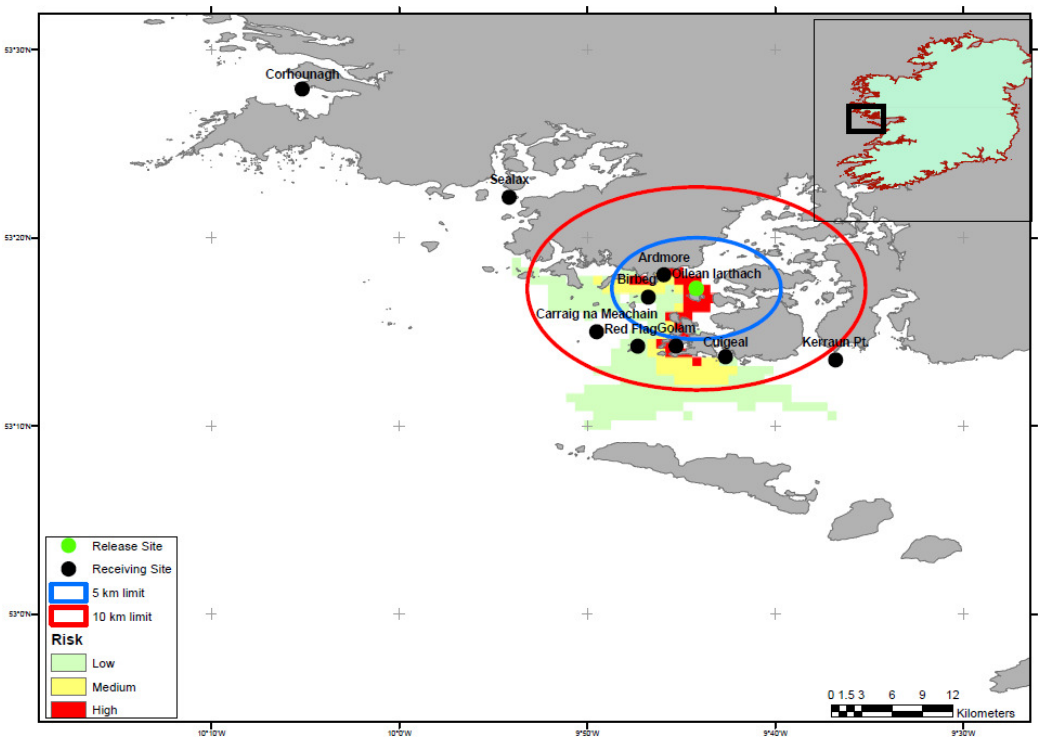
8. Red Flag (Kilkieran Bay)



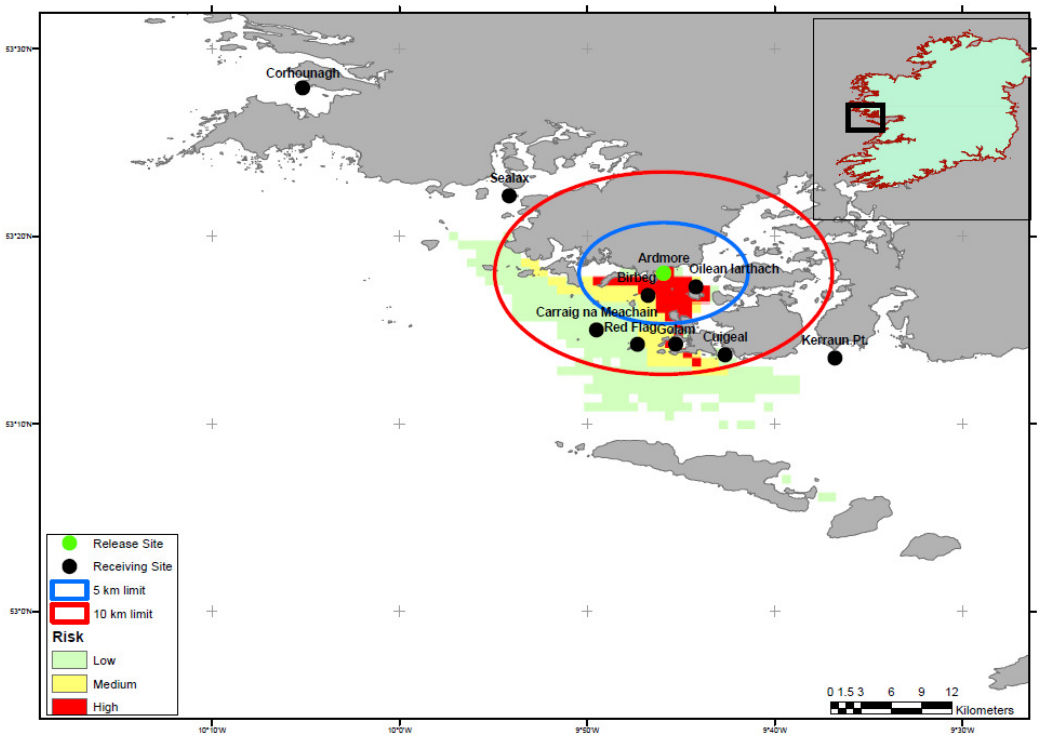
9. Carraig na Meachain (Kilkieran Bay)



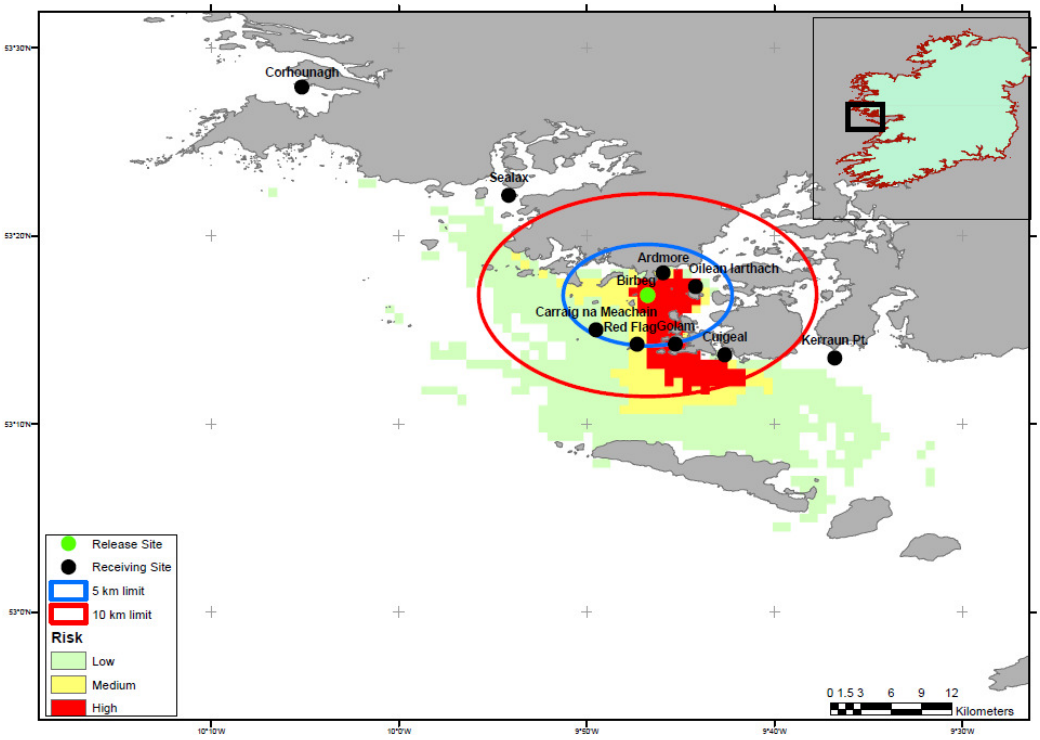
10. Oilean Iarthach (Kilkieran Bay)



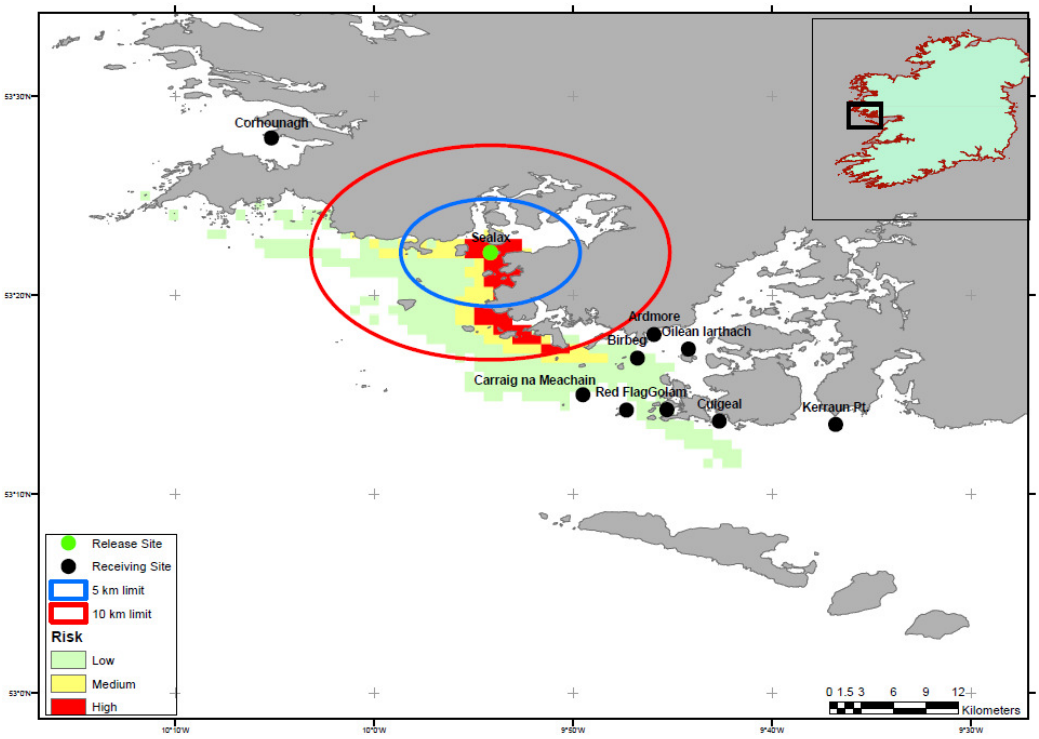
11. Ardmore (Kilkieran Bay)



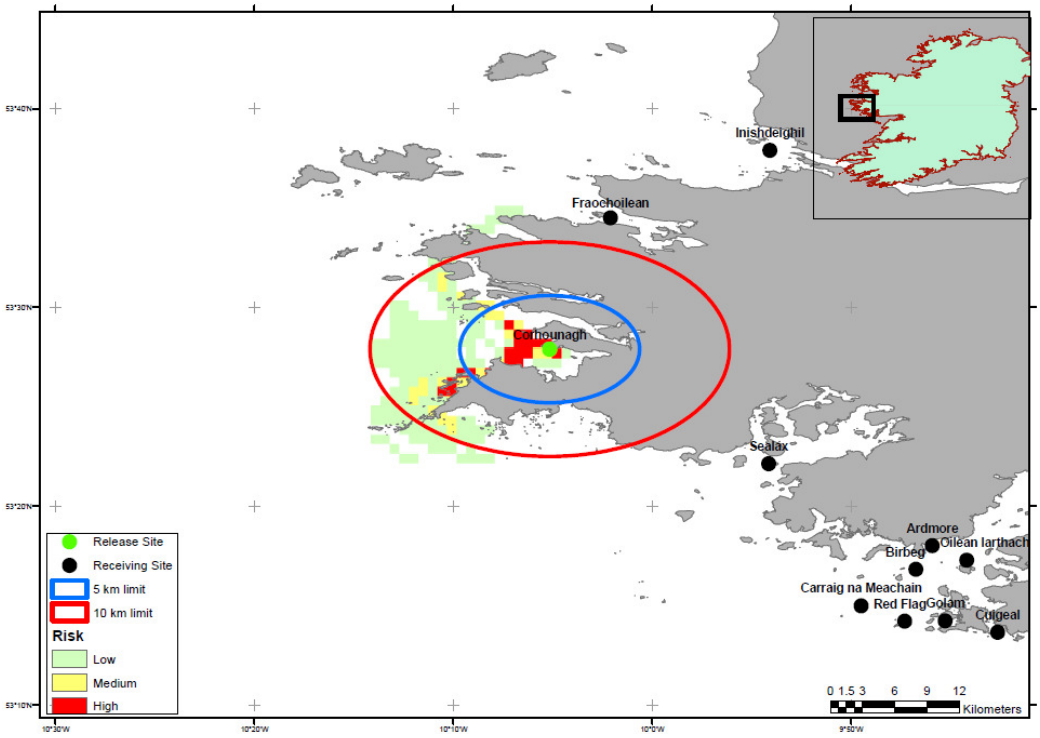
12. Birbeg (Kilkieran Bay)



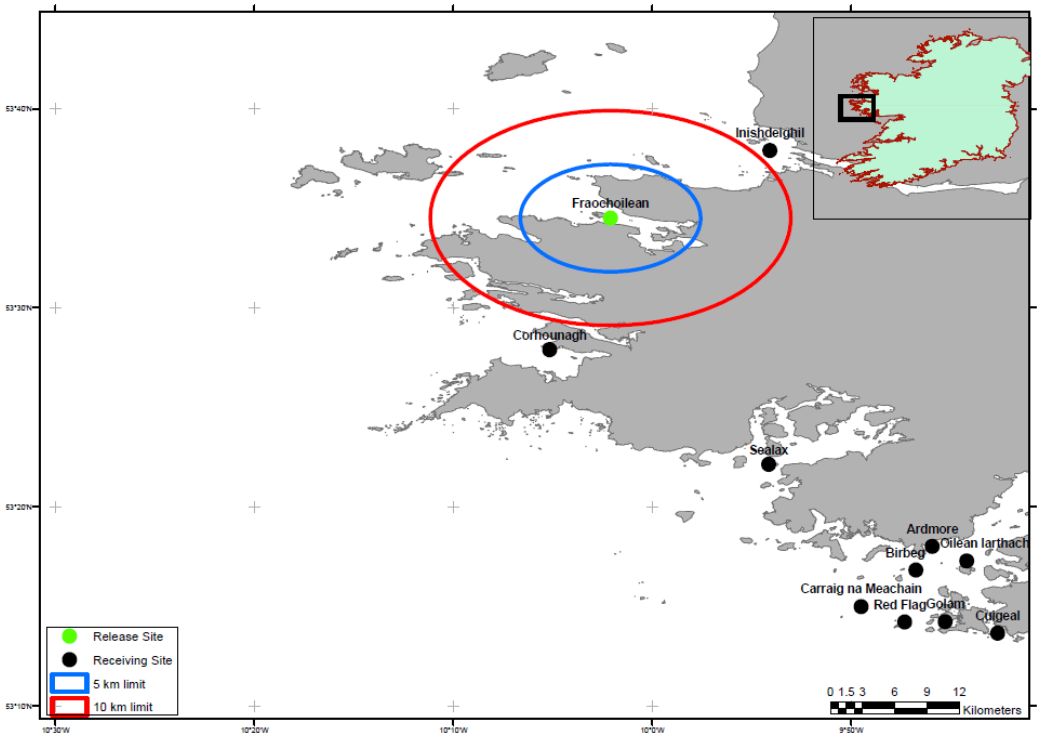
13. Sealax (Bertraghboy Bay)



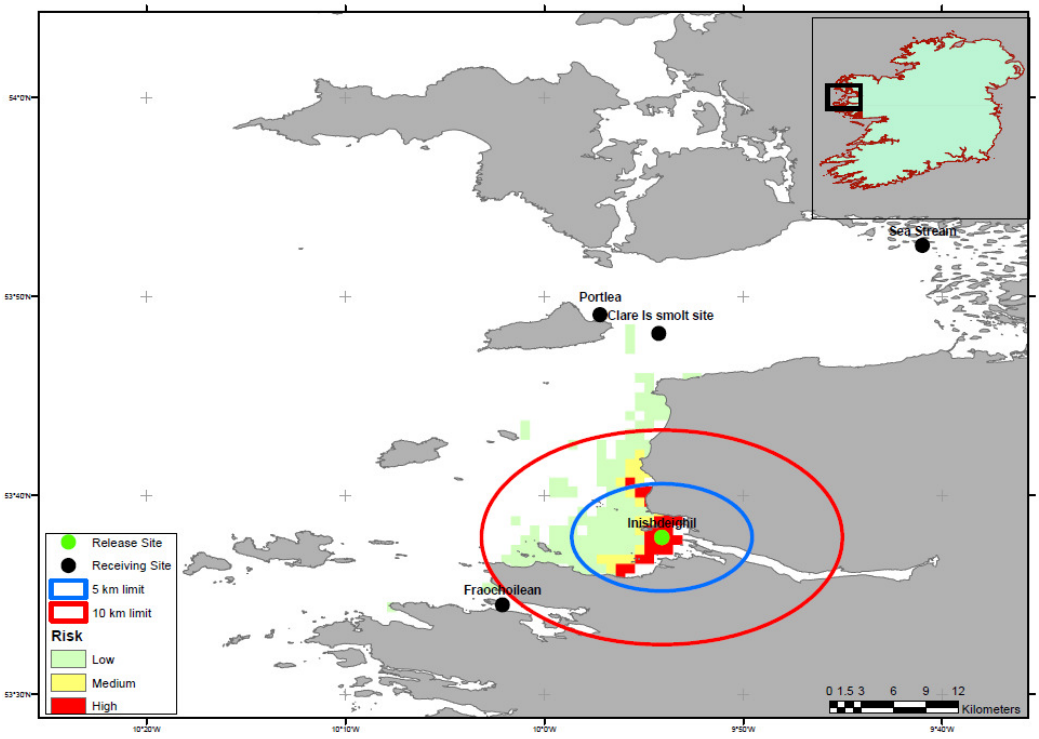
14. Corhounagh (Mannin Bay)



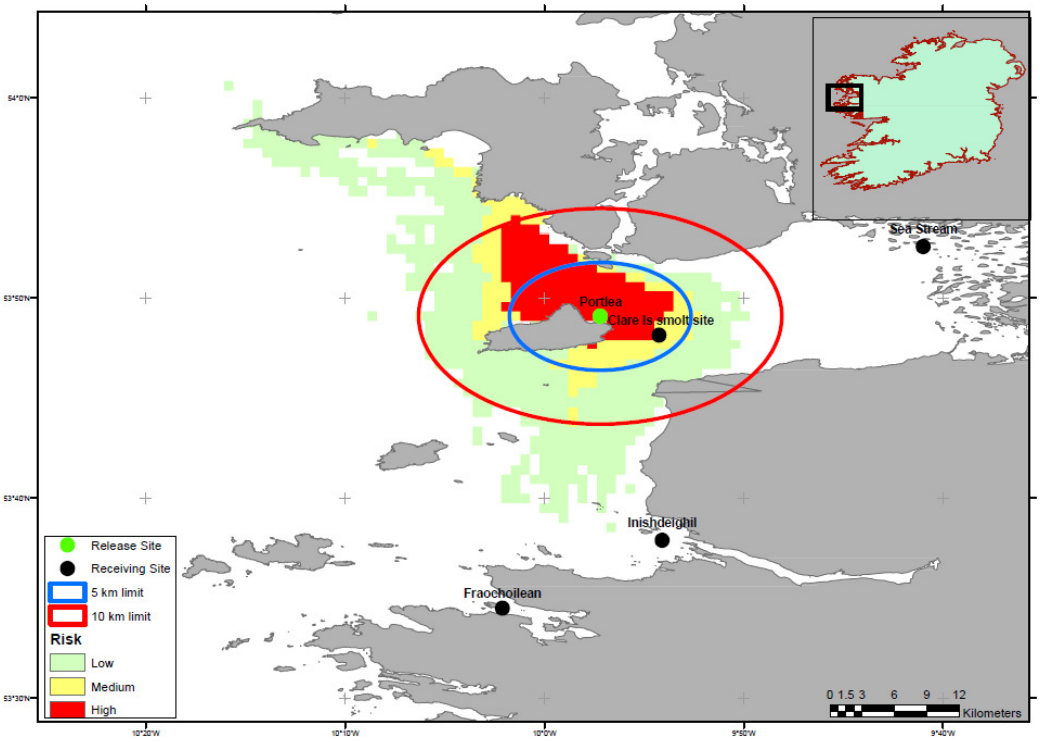
15. Fraochoilean (Ballinakill Harbour) – no data collected as model could not resolve site



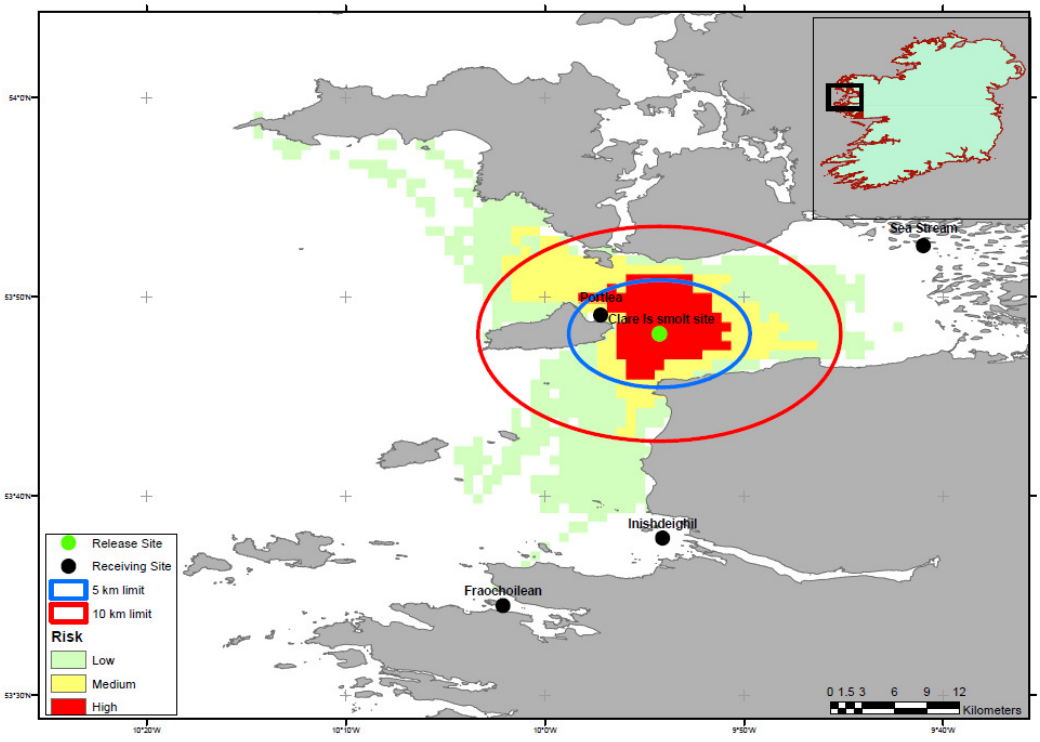
16. Inishdeighil (Killary Harbour)



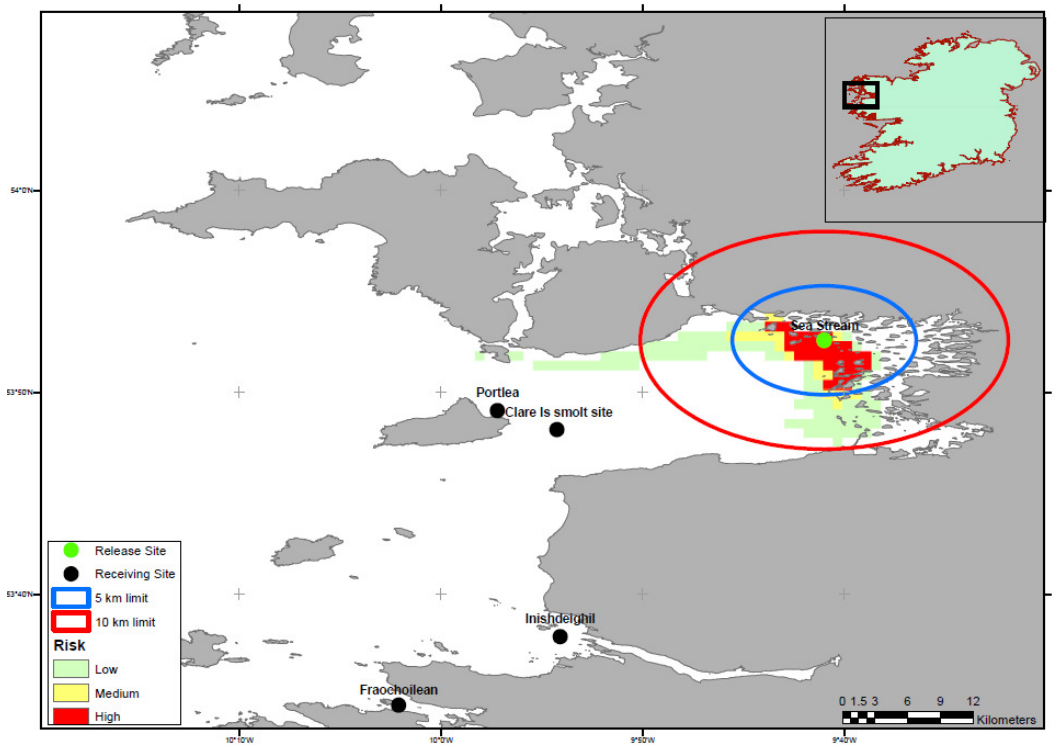
17. Portlea (Clew Bay)



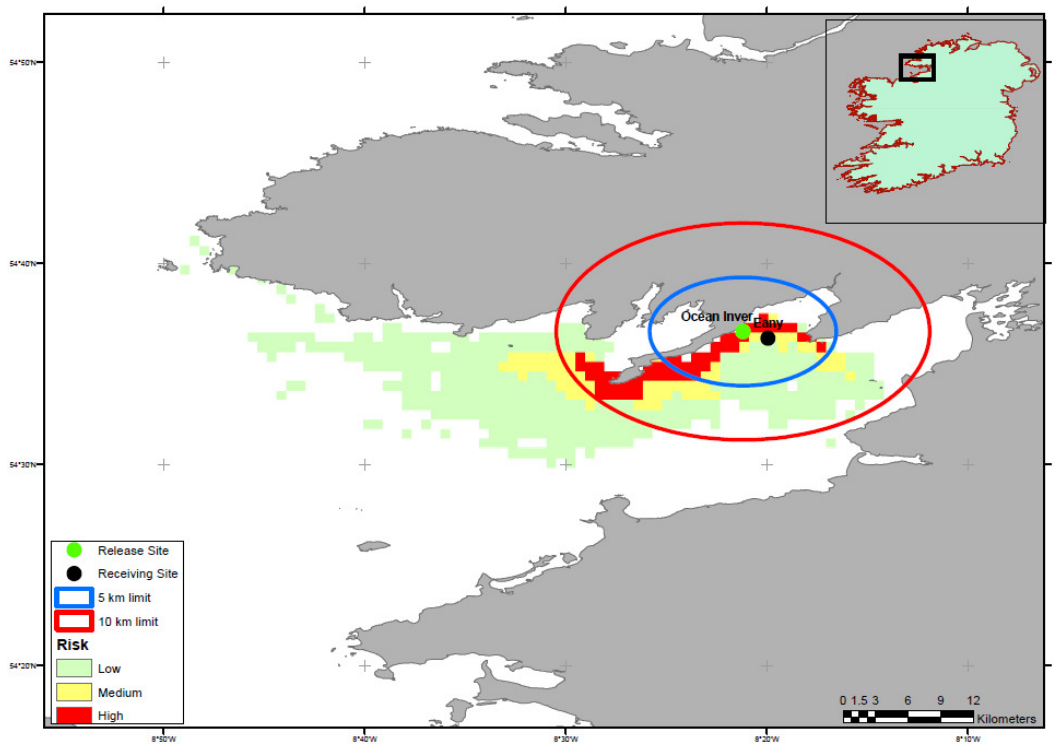
18. Clare Island Smolt Site (Clew Bay)



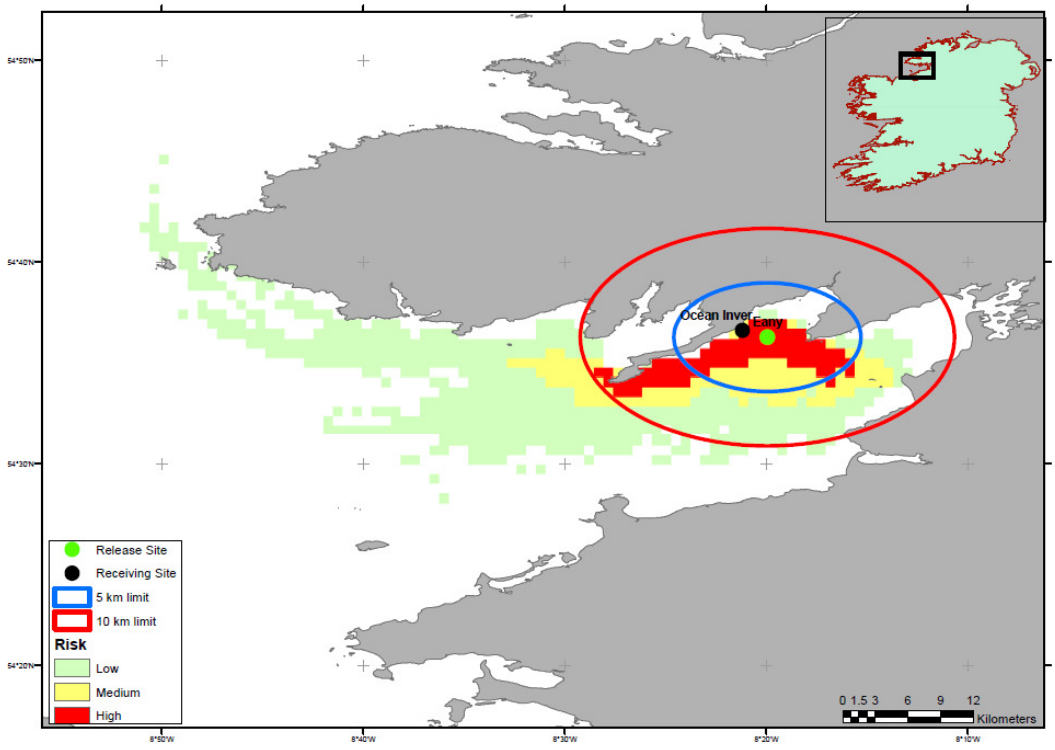
19. Sea Stream (Clew Bay)



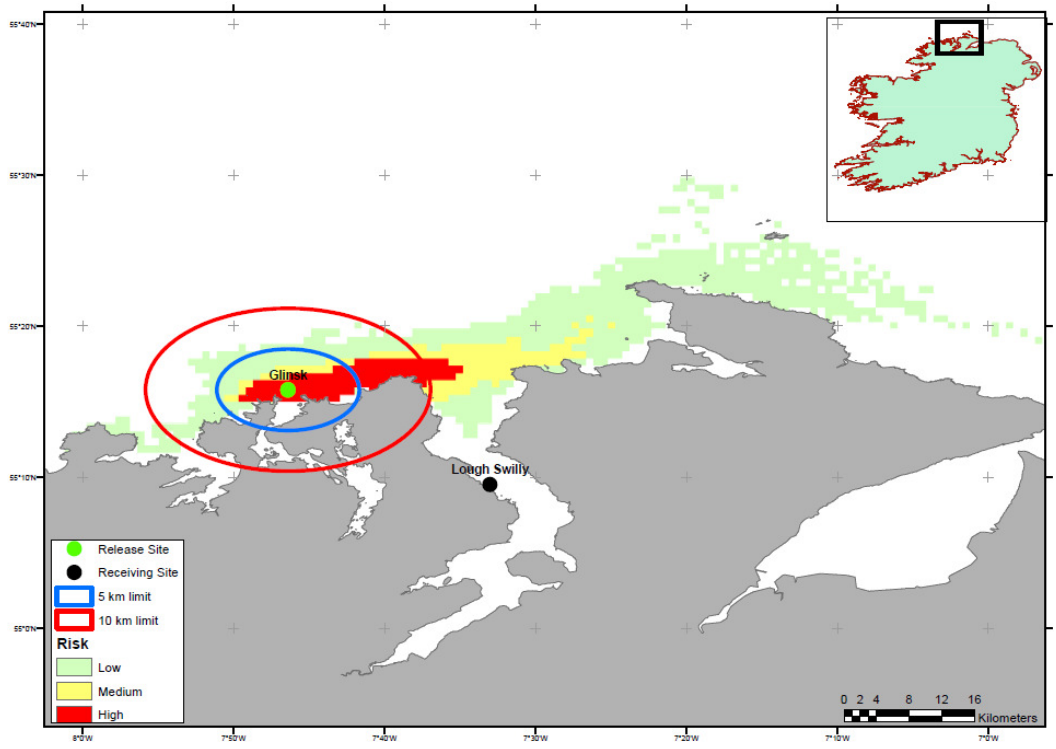
20. Ocean Inver (Donegal Bay)



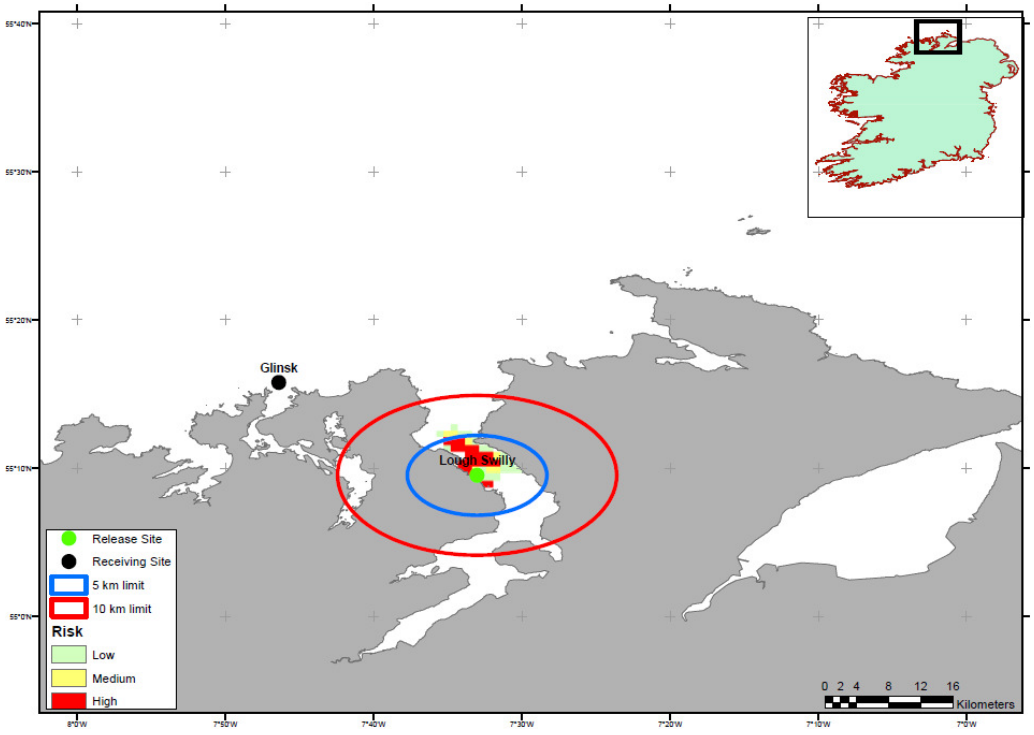
21. Eany (Donegal Bay)



22. Glinsk (Mulroy Bay)



23. Lough Swilly



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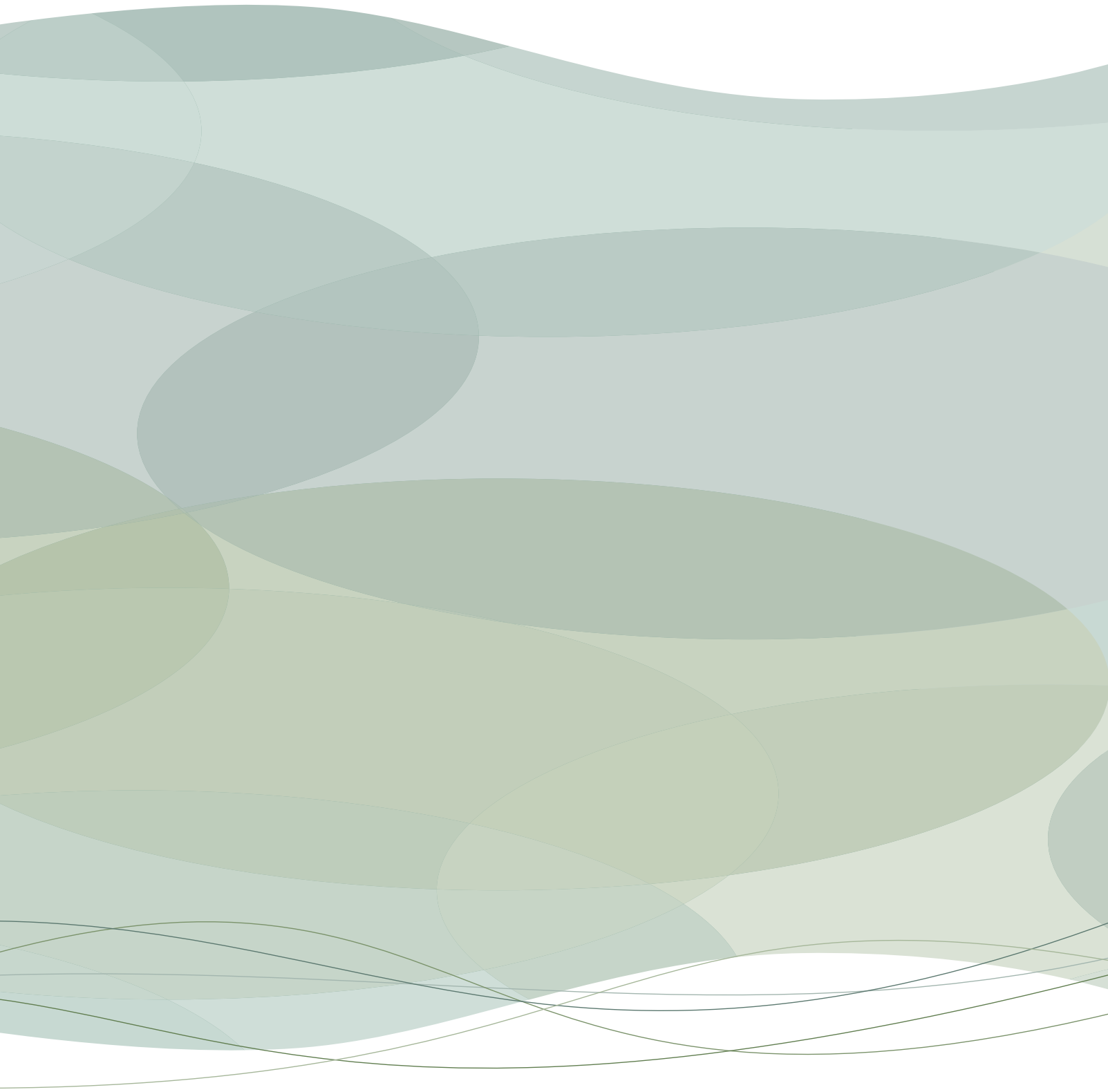

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