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National Survey of Sea Lice (*Lepeophtheirus salmonis* Krøyer and *Caligus elongatus* Nordmann) on Fish Farms in Ireland - 2011

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NATIONAL SURVEY OF SEA LICE (*LEPEOPHTHEIRUS SALMONIS* KRØYER AND *CALIGUS ELONGATUS* NORDMANN) ON FISH FARMS IN IRELAND – 2011

February 2012

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INTRODUCTION

One of the biggest challenges facing fin-fish farming in Ireland is the problem of sea lice. Sea lice occur worldwide; they are an ectoparasite and are regarded as having the most commercially damaging effect on cultured salmonids, with major economic losses to the fish farming community resulting each year (Bristow and Berland, 1991; Jackson and Costello, 1991; Jansen et *al*, 2012). There are two species of sea lice found in Ireland on cultured salmonids, *Caligus elongatus* Nordmann, which parasitises over 80 different types of marine fish, and *Lepeophtheirus salmonis* Krøyer, which infests only salmonids. *L. salmonis* is regarded as the more damaging parasite of the two species and occurs most frequently on farmed Atlantic salmon and rainbow trout (Jackson and Minchin, 1992; Jackson *et al*., 2005). Sea lice are a cause of concern to the fish farmer due to reduced growth and damage to the fish through scale loss and subsequent secondary infections (Wooten *et al*., 1982). Skin damage can also lead to reduced marketability.

Sea lice primarily inflict mechanical damage which occurs during the course of attachment and feeding (Kabata, 1974; Brandal *et al*., 1976; Jones *et al*., 1990). Inflammation and hyperplasia was recorded in Atlantic salmon after infections with *L. salmonis* (Jones *et al*., 1990; Jonsdottir *et al*., 1992; Nolan *et al*., 2000). Increases in stress hormones caused by sea lice infestations are thought to increase the susceptibility of fish to infectious diseases (MacKinnon, 1998). Severe erosion around the head due to heavy infestations of *L. salmonis* has been recorded previously (Pike, 1989; Berland, 1993). Heavy infestations take place around the head because of the rich supply of mucus secreted in that region (Nolan *et al*., 1999). In experimental field investigations of outward migration of hatchery reared salmon smolts carried out in Norway, heavy infestation was found to cause fish mortalities (Finstad *et al*., 2000; Finstad *et al*., 2005). A lengthy field study of ranched salmon smolts in Ireland quantified early post-smolt mortality associated with sea lice as a minor component of overall marine survival (Jackson *et al.,* 2011a & b).

L. salmonis has a direct life-cycle (i.e. a single host) with ten stages (Figure 1). Following hatching from paired egg-strings, there are two free-living nauplii stages which are dispersed into the plankton. These stages are followed by a copepodid stage where attachment to the host takes place. The copepodid then moults through four attached chalimus stages before becoming a mobile pre-adult male or female. There are two pre-adult stages followed by the fully mature adult phase. The adult female can produce a

number of batches of paired egg-strings, which in turn hatch into the water column to give rise to the next generation (Kabata, 1979; Schram, 1993).

Figure 1. Life cycle of *Lepeophtheirus salmonis* (after Schram, 1993)

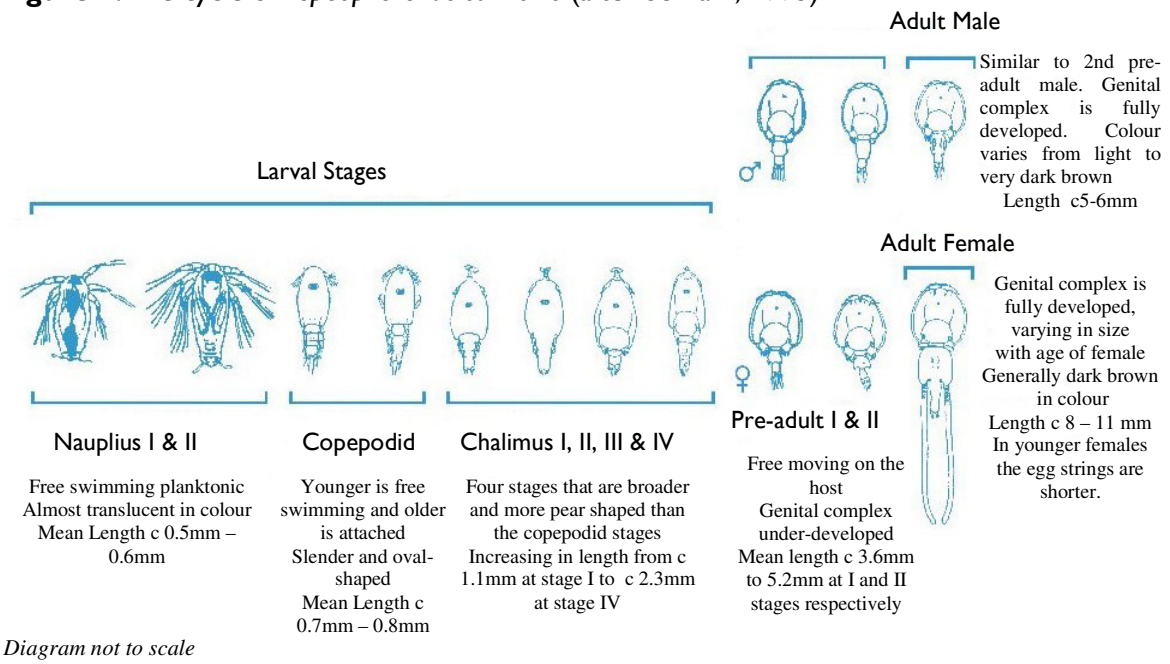
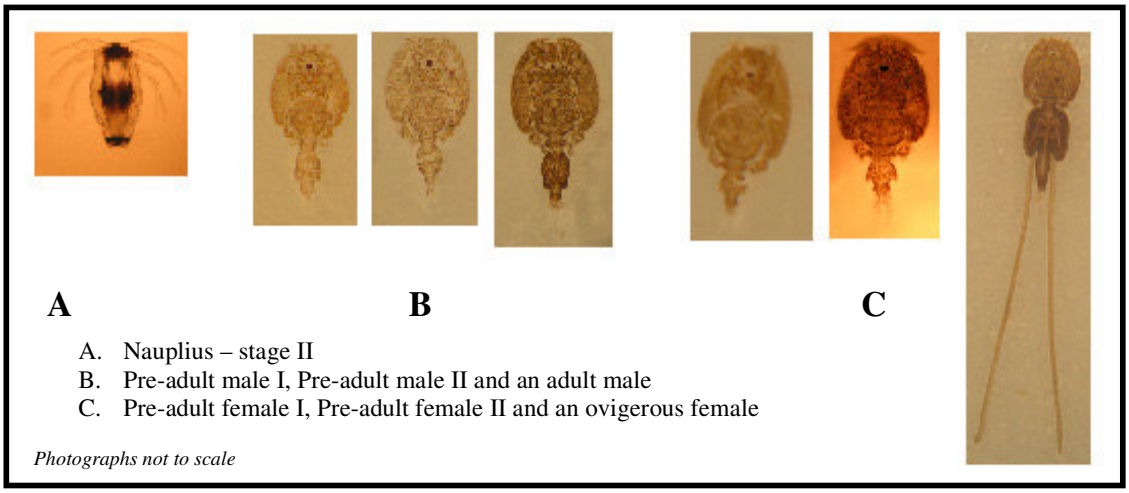


Diagram not to scale

Examples of nauplius, pre-adult and adult male & ovigerous female *L. salmonis* are shown in Figure 2. The mean length for an adult female is 8mm-11mm and an adult male is 5mm-6mm (Schram, 1993).

Figure 2. Photographs of stages of *L. salmonis*.



A. Nauplius – stage II
B. Pre-adult male I, Pre-adult male II and an adult male
C. Pre-adult female I, Pre-adult female II and an ovigerous female

Photographs not to scale

The fact that *C. elongatus* is not as host specific as *L. salmonis* (Kabata, 1979) and that the hosts migrate widely is thought to account for the highly variable levels on farmed

salmonids at different times of the year. *C. elongatus* is smaller in size than *L. salmonis*. averaging approximately 6-8mm in length (Hogans & Trudeau, 1989).

In 1991, the Department of the Marine (DOM) instigated a Sea Lice Monitoring Programme for finfish farms in Ireland (Jackson & Minchin, 1993). In 1993, monitoring was expanded nationwide (Jackson *et al*, 2002; Jackson *et al*, 2005). In May 2000 the protocol for sea lice monitoring was formally published (Monitoring Protocol No.3 for Offshore Finfish Farms – Sea Lice Monitoring and Control) by the Department of Marine and Natural Resources (DMNR).

In May 2008, the Department of Agriculture, Fisheries and Food (DAFF) published "A strategy for the improved pest control on Irish salmon farms". The strategy outlines a comprehensive range of measures to provide for enhanced sea lice control and was developed by a joint DAFF, Marine Institute and Bord Iascaigh Mhara (BIM) workgroup in response to difficulties experienced by farms in achieving the low levels of infestation required by the national control programme. These measures draw on the on-going Single Bay Management process and, through a comprehensive action plan and list of recommendations, seek to advance the suite of tools necessary for improved sea lice control on farms.

The objectives of the national sea lice monitoring programme is:

- To provide an objective measurement of infestation levels on farms.
- To investigate the nature of infestations.
- To provide management information to drive the implementation of control and management strategies.
- To facilitate further development and refinement of this strategy.

The sea lice control and management strategy has five principal components:

- Separation of generations.
- Annual fallowing of sites.
- Early harvest of two-sea-winter fish.
- Targeted treatment regimes, including synchronous treatments.
- Agreed husbandry practises.

These components combine to reduce the development of sea lice infestations and to ensure the most effective treatment of sea lice. They seek to minimise sea lice levels whilst lessening reliance on, and reducing the use of, veterinary medicines. Separation of generations and annual fallowing prevent the vertical transmission of infestations from one

generation to the next thus retarding the population's development. The early harvest of two-sea-winter fish removes a potential reservoir of sea lice, while the agreed husbandry practises and targeted treatments enhance the efficacy of treatment regimes. One important aspect of targeted treatments is carrying out of synchronized autumn/winter treatments to reduce sea lice burdens to as close to zero as practicable, on all fish which are to be over-wintered. This is fundamental to achieving near zero egg-bearing sea lice in spring. The agreed husbandry practises cover a range of related fish health, quality and environmental issues in addition to those specifically related to sea lice control. The Single Bay Management programme serves to facilitate this and provides a forum for exchange of information between farmers.

Over the period since the initiation of Single Bay Management, treatment trigger levels have been progressively reduced from a starting point of 2.0 ovigerous female *L. salmonis* per fish during the spring period to the current levels of 0.5 ovigerous female *L. salmonis* per fish. Outside of the spring period, a level of 2.0 ovigerous female *L. salmonis* per fish acts as a trigger for treatments. Where the number of mobile sea lice is high, treatments are triggered even in the absence of egg bearing females.

In late winter and early spring seawater temperatures are at a minimum and the development rates of sea lice is slower. These temperatures tend to synchronise the development of sea lice larvae. A strategic treatment at this time can break the cycle of infection. Ovigerous female sea lice are those which produce the infective larvae and treatments are timed to remove adult females before they can release larvae. Setting the treatment trigger at 0.5 ovigerous *L. salmonis* per fish in spring ensures that treatments are carried out when a maximum of half of the fish examined have one ovigerous sea lice. This is an optimum time to interrupt sea lice development. Later in the year, the development of new generations are not as synchronized and automatic intervention at a sea lice level of 0.5 ovigerous by way of treatment is not justified. A level of 2.0 ovigerous sea lice per fish has been shown to be a pragmatic level at which intervention by way of treatment is advisable. Levels of mobile and juvenile sea lice are important in advising fish health professionals in developing a sea lice control strategy. However, they are not of themselves appropriate measures upon which to trigger mandatory treatments.

Results of the monitoring programme are sent to the relevant farm within 5-10 days of each inspection. A monthly report of results is circulated to relevant parties and the data

is published annually (O'Donohoe *et al*., 2003-2011; McCarney *et al*., 2002; Copley *et al*., 2001).

Table 1 shows a list of the animal medicines and other remedies available to assist in the control of sea lice.

Table 1. *Options available to assist in the control of sea lice on Atlantic salmon.*

Compound	*Trade Name*	*Licensing status*	*Delivery Method*	*Group*	*Mode of action*	*Stages targeted*	*Withdrawal period*
Animal medicines							
Azamethiphos	Salmosan®	AR-16	Bath	Organo-phosphate	Interferes with nerve transmission by blocking acetylcholinesterase at synapse	Adults, Preadults	24 hours
Cypermethrin	Excis®	Full MA	Bath	Pyrethroid	Interferes with nerve transmission by blocking sodium channels in nerve cells	Adults, Preadults, Chalimus III-IV	24 hours
Deltamethrin	AMX® Alpha Max®	Full MA	Bath	Pyrethroid	Interferes with nerve transmission by blocking sodium channels in nerve cells	Adults, Preadults. Chalimus unknown	5 degree days
Emamectin benzoate	Slice®	Full MA	In-feed	Avermectin	Interferes with neurotranmission disrupting nerve cells causing paralysis and death. Effective at 3- 15°C. Protects fish for up to 11 weeks post treatment.	All stages	Zero
Teflubenzuron	Ektobann®	AR-16	In-feed	Insect Growth Regulator	Inhibits chitin synthesis preventing moulting and growth. Limited efficacy beyond medication period. Not authorized for use below 9°C	Moulting stages - Chalimus, Preadults only	7 days
Teflubenzuron	Calicide®	Full MA	In-feed	Insect Growth Regulator	Inhibits chitin synthesis preventing moulting and growth. Limited efficacy beyond medication period. Not authorized for use below 9°C	Moulting stages - Chalimus, Preadults only	45 degree days
Disinfectants							
Hydrogen peroxide			Bath	Oxidizer	Formation of gas bubbles on and within the sea lice.	Adults, Preadults	
Immuno-stimulants& Food supplements							
	Bio-mos®		In-feed	Extract from yeast wall	Increases mucus production		
	Ecoboost®		In-feed	Blend of aromatic herbs	Immuno-stimulant		
	Ergosan®		In-feed	Seaweed extract	Immuno-stimulant		
Others							
Bioemitters			In cage		Electromagnetic signal		
Wrasse			In cage		Cleaner fish. Issues with wrasse availability and efficacy	Adults, Preadults	

MA - marketing authorisation from the Irish Medicines Board.

All AR16 licences are exceptional authorisations.

METHODOLOGY

Farmed stocks of salmon and trout in Ireland are inspected on 14 occasions throughout the year to monitor sea lice levels. Follow-up inspections may be carried out when it is deemed appropriate. Sea lice inspections take place on a monthly basis, with the exception of the spring period; March, April and May, when two inspections are carried out per month. One inspection is carried out for the December-January period. At each inspection two samples are taken for each generation of fish on site, a sample from a standard cage, which is sampled at each subsequent inspection, and a sample from a random cage, which is selected on the day of the inspection. Thirty fish are examined for each sample by anaesthetising using tricaine methane sulphonate (MS222) in seawater. The seawater is sieved for any detached lice at the end of each sample. Each fish is examined individually for all mobile lice. Lice are removed and placed in a bottle containing 70% ethanol, one sample bottle per fish. In the laboratory the species, quantity and life stage of the sea lice are determined and recorded. The mean number of sea lice per fish is calculated by adding the number of sea lice taken from each fish with the number of detached sea lice from the sieved seawater then dividing by the number of fish examined.

Results presented are mean ovigerous sea lice levels and mean mobile sea lice levels for *L. salmonis* and *C. elongatus*. Total mobile levels estimate successful infestation levels. Ovigerous sea lice levels estimate breeding female populations. The information gathered aims to evaluate the level of sea lice on the fish and to inform the farmer on a sea lice management strategy. Effective parasite control is characterised by a drop in sea lice levels on the subsequent inspection.

In 2011, salmonid farms were producing 5 different stocks of fish, namely: 2010 rainbow trout, *Oncorhynchus mykiss* (Walbaum) (rainbow trout first inspected in 2010); 2011 rainbow trout (rainbow trout first inspected in 2011); 2009 Atlantic salmon, *Salmo salar* L. (two-sea-winter salmon), 2010 Atlantic salmon (one-sea-winter salmon) and 2011 Atlantic salmon (smolts).

There are three discrete regions in Ireland where salmonid farming is carried out; the Southwest (Counties Cork and Kerry), the West (Counties Mayo and Galway) and the Northwest (Co. Donegal). These regions are geographically separate from each other with distances between regions of *c.*160 km from Northwest to West and *c.*200 km from West to Southwest. In 2011 a total number of 23 sites were inspected around Ireland, see figures 3-5.

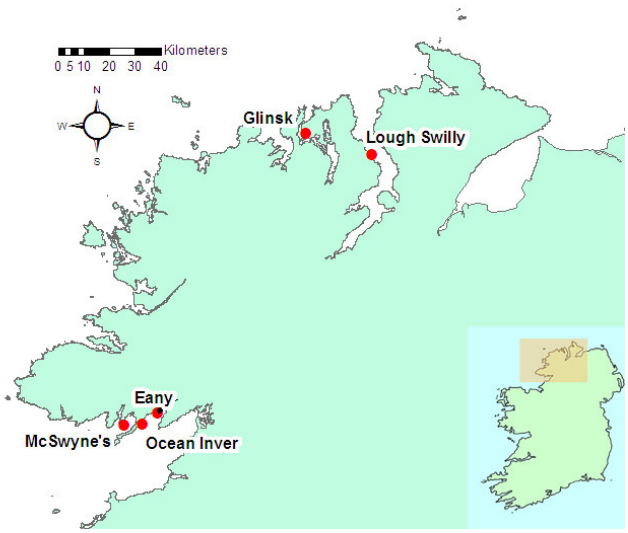


Figure 3. Locations of fish farm sites in the North-west region.

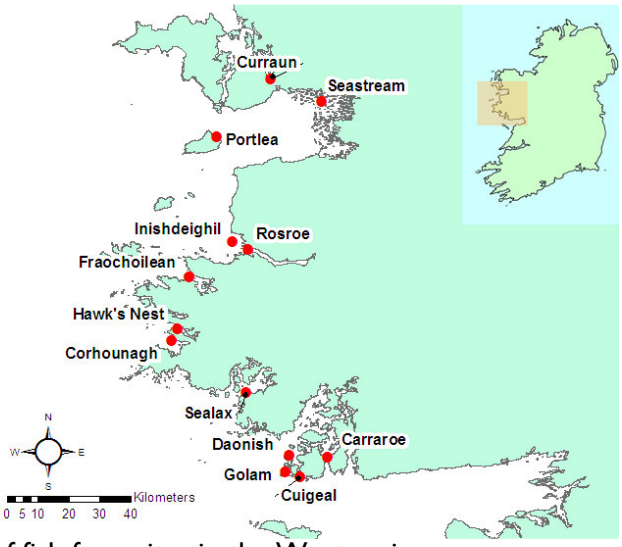


Figure 4. Locations of fish farm sites in the West region.

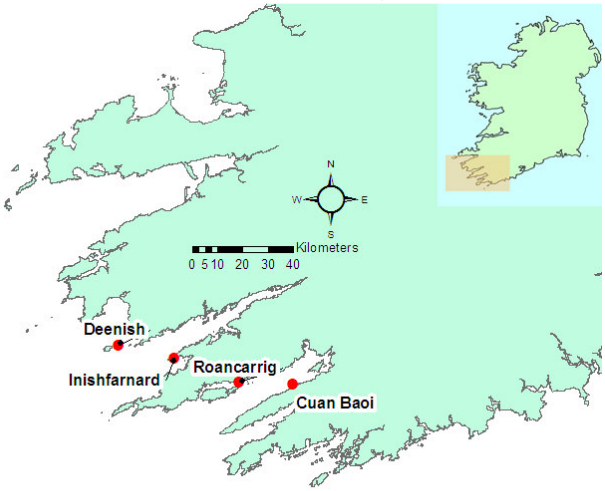


Figure 5. Locations of fish farm sites in South-west region.

RESULTS

During 2011 a total of 236 sea lice inspections were carried out on the 23 active salmonid sites. Over 87% of Atlantic salmon samples and 89% of rainbow trout samples were below the treatment trigger levels (TTL) as outlined in the Monitoring Protocol No.3 for Offshore Finfish Farms – Sea Lice Monitoring and Control, Department of Marine and Natural Resources (2000). Ninety-seven percent of inspections carried out on salmon smolts were below the TTL, 80% of inspections carried out on one-sea-winter salmon were below TTL and 50% of inspections to two-sea-winter salmon were below TTL.

Results of 2011 sea lice inspections for all active salmonid sites for each month are presented in Appendix 1.

Atlantic salmon 2009 (two-sea-winter salmon)

At the beginning of 2011, two-sea-winter salmon were stocked in 3 sites: Corhounagh, Mannin Bay; Seastream Inner, Clew Bay; and Mc Swyne's, Donegal Bay. Table 2 contains the number of inspections per site and number of inspections exceeding the treatment trigger levels.

Table 2. *National breakdown of inspections for 2009 salmon on fish farm sites in 2011.*

Company	Site	Samples in Spring	Over in Spring	Samples outside Spring	Over outside Spring	Total Samples	Total Over	% over in Spring	% over outside Spring	% over total
Southwest		0	0	0	0	0	0			
Mannin Bay Salmon Co. Ltd.	**Corhounagh**	0	0	1	1	1	1		100%	100%
Clare Island Seafarms Ltd.	**Seastream Inner**	2	2	2	0	4	2	100%	0%	50%
West		2	2	3	1	5	3	100%	33%	60%
Ocean Farm Ltd.	**Mc Swyne's**	0	0	1	0	1	0		0%	0%
Northwest	**Totals**	0	0	1	0	1	0	0%	0%	0%
National Totals		2	2	4	1	6	3	100%	25%	50%

A total of 6 visits were undertaken to these sites before harvesting was completed, 50% of inspections were below the treatment trigger levels.

Atlantic salmon 2010 (one-sea-winter salmon)

One-sea-winter salmon were stocked in a total of 11 sites in 9 bays in 2011. Ninety-three visits were undertaken to this generation of fish. Four sites, in 4 bays, continued to stock one-sea-winter salmon in November 2011.

Ovigerous *L. salmonis* levels greater than the treatment trigger level were recorded in a total of 19 inspections (20%) on one-sea-winter fish (see Table 3). Within the critical spring period sea lice levels were in excess of 0.5 ovigerous females per fish on 7

inspections (16%) and outside of the spring period 12 inspections (24%) were in excess of 2.0 ovigerous female *L. salmonis* per fish.

Table 3. *National breakdown of inspections for 2010 salmon on all fish farm sites in 2011.*

	Samples in Spring	Over in Spring	Samples outside Spring	Over outside Spring	Total Samples	Total Over	% over in Spring	% over outside Spring	% over total
National Totals	44	7	49	12	93	19	16%	24%	20%

C. elongatus levels were recorded at numbers greater than 10 per fish on three inspections on these fish, once in December and twice in July. *Caligus elongatus* were common in the southwest throughout the year.

Southwest Region

In the Southwest there were no recorded instances of *L. salmonis* levels greater than the treatment trigger levels (see Table 4).

Table 4. *Breakdown of inspections for 2010 salmon for Southwest sites in 2011.*

Company	Site	Samples in Spring	Over in Spring	Samples outside Spring	Over outside Spring	Total Samples	Total Over	% over in Spring	% over outside Spring	% over total
Murphy's Irish Seafood Ltd	**Cuan Baoi**	6	0	4	0	10	0	0%	0%	0%
Silver King Seafoods Ltd	**Deenish**	1	0	2	0	3	0	0%	0%	0%
	Inishfarnard	6	0	8	0	14	0	0%	0%	0%
Southwest	**Totals**	13	0	14	0	27	0	0%	0%	0%

West Region

In the West, *L. salmonis* infestation levels greater than the treatment trigger were recorded on 3 out of 19 inspections (16%) in the spring period and on 7 out of 22 inspections (32%) outside the spring period (see Table 5).

Table 5. *Breakdown of inspections for 2010 salmon on West sites in 2011.*

Company		Samples in Spring	Over in Spring	Samples outside Spring	Over outside Spring	Total Samples	Total Over	% over in Spring	% over outside Spring	% over total
Muirachmhainni Teo	**Daonish**	6	3	4	1	10	4	50%	25%	40%
Mannin Bay Salmon Co Ltd	**Sealax**	2	0	2	0	4	0	0%	0%	0%
	Corhounagh	5	0	6	3	11	3	0%	50%	27%
	Hawk's nest	0	0	1	1	1	1		100%	100%
Marine Harvest Ireland	**Rosroe**	6	0	7	2	13	2	0%	29%	15%
	Inishdeighil	0	0	2	0	2	0		0%	0%
West	**Totals**	19	3	22	7	41	10	16%	32%	24%

Levels at Daonish, Kilkieran Bay, were in excess of treatment trigger levels for 3 of the 6 inspections in the spring period and 1 of the 4 outside the spring period.

At Corhounagh, Mannin Bay, *L. salmonis* exceeded treatment trigger levels for 3 of the 6 inspections outside the spring but none of the 5 inspections during the spring.

Northwest Region

The treatment trigger levels were exceeded on 4 of the 12 inspections in the spring and 5 of the 13 inspections outside the spring period in the Northwest (see Table 6).

Table 6. *Breakdown of inspections for 2010 salmon on Northwest sites in 2011.*

Company	Site	Samples in Spring	Over in Spring	Samples outside Spring	Over outside Spring	Total Samples	Total Over	% over in Spring	% over outside Spring	% over total
Ocean Farm Ltd.	**Ocean Inver**	6	0	8	2	14	2	0%	25%	14%
Marine Harvest Ireland	**Lough Swilly**	6	4	5	3	11	7	67%	60%	64%
Northwest	**Totals**	12	4	13	5	25	9	33%	38%	36%

Lough Swilly exceeded treatment trigger levels on 4 of the 6 spring inspections and on 3 of the 5 inspections outside spring.

Atlantic salmon 2011 (smolts)

A total of 98 inspections were made to 11 sites stocking Atlantic salmon 2011 S1 and S½ smolts during the year 2011. *L. salmonis* levels were below the treatment trigger level of 0.5 ovigerous female lice per fish for all of the 35 inspections in the spring period. Outside of this period, levels exceeded 2.0 ovigerous female lice per fish on 3 of the 63 inspections (see Table 7).

Table 7. *National breakdown of inspections for 2011 salmon on fish farm sites in 2011.*

Company	Site	Samples in Spring	Over in Spring	Samples outside Spring	Over outside Spring	Total Samples	Total Over	% over in Spring	% over outside Spring	% over total
Murphy's Irish Seafood Ltd	**Cuan Baoi**	6	0	7	0	13	0	0%	0%	0%
Silver King Seafoods Ltd	**Roancarraig**	6	0	8	0	14	0	0%	0%	0%
	Deenish	0	0	6	0	6	0		0%	0%
Southwest	**Totals**	12	0	21	0	33	0	0%	0%	0%
Muirachmhainni Teo	**Cuigeal**	0	0	3	0	3	0		0%	0%
	Golam	6	0	5	0	11	0	0%	0%	0%
	Daonish	0	0	2	0	2	0		0%	0%
Bifand Ltd	**Fraochoilean**	6	0	8	1	14	1	0%	13%	7%
Mannin Bay Salmon Co Ltd	**Hawk's nest**	3	0	6	0	9	0	0%	0%	0%
Clare Island Seafarms Ltd	**Portlea**	2	0	6	0	8	0	0%	0%	0%
West	**Totals**	17	0	30	1	47	1	0%	3%	2%
Ocean Farm ltd.	**Mc Swyne's**	2	0	6	0	8	0	0%	0%	0%
Marine Harvest	**Glinsk**	4	0	6	2	10	2	0%	33%	20%
Northwest	**Totals**	6	0	12	2	18	2	0%	17%	11%
National Totals		35	0	63	3	98	3	0%	5%	3%

C. elongatus levels remained low on this stock at all sites throughout the year.

Rainbow trout

In 2011 there was 2 year-classes of rainbow trout (2010 and 2011 rainbow trout) stocked between 3 sites, in 3 bays (Table 8). There were 18 inspections carried out on 2010 rainbow trout, 2 of which exceeded treatment trigger levels. A total of 21 inspections were carried out on the 2011 rainbow trout stock and again 2 inspections exceeded treatment trigger *L. salmonis* levels.

Table 8. *National breakdown of inspections for Rainbow Trout on fish farm sites in 2011.*

Rainbow Trout 2010 stocked in 2011

Company	Site	Samples in Spring	Over in Spring	Samples outside Spring	Over outside Spring	Total Samples	Total Over	% over in Spring	% over outside Spring	% over total
Curraun Fisheries Ltd	**Curraun**	6	0	6	0	12	0	0%	0%	0%
West		6	0	6	0	12	0	0%	0%	0%
Eany Fish Products Ltd	**Eany**	4	2	2	0	6	2	50%	0%	33%
Northwest	**Totals**	4	2	2	0	6	2	50%	0%	33%
National Totals		10	2	8	0	18	2	20%	0%	11%

Rainbow Trout 2011 stocked in 2011

Company	Site	Samples in Spring	Over in Spring	Samples outside Spring	Over outside Spring	Total Samples	Total Over	% over in Spring	% over outside Spring	% over total
Curraun Blue Ltd	**Seastream Outer**	0	0	6	0	6	0		0%	0%
	Curraun	0	0	2	0	2	0		0%	0%
West		0	0	8	0	8	0		0%	0%
Eany Fish Products Ltd	**Eany**	6	0	7	2	13	2	0%	29%	15%
Northwest	**Totals**	6	0	7	2	13	2	0%	29%	15%
National Totals		6	0	15	2	21	2	0%	13%	10%

Sampling record

There were no missed inspections in the 2011 sampling year.

One-sea-winter salmon monthly trend by Bay

Mean ovigerous and mean mobile *L. salmonis* and *C. elongatus* levels for each bay are shown in Table 9 for one-sea-winter salmon throughout the year. Monthly ovigerous *L. salmonis* levels were greater than the spring treatment trigger level of 0.5 ovigerous sea lice per fish on 4 of the 22 occasions during the spring period on a bay basis. These occurred in Kilkieran Bay (2 occasions) and Lough Swilly (2 occasions). On 12 out of 46 inspections, outside of the spring period, mean ovigerous levels of 2.0 ovigerous females per fish or greater were recorded. These occurred in Mannin Bay (3 occasions), Lough Swilly (3 occasions), Killary Harbour (2 occasions), Donegal Bay (2 occasions), Kilkieran Bay (1 occasion) and Clifden Bay (1 occasion).

Mean mobile levels per bay in excess of 10 *L. salmonis* per fish were recorded on 11 occasions and 5 of these instances had means of greater than 20 mobile lice per fish. The maximum level recorded was 43.36 mobile sea lice per fish.

Table 9. Mean ovigerous and mean mobile *Lepeophtheirus salmonis* and *Caligus elongatus* levels per months, for one-sea-winter salmon, for each bay inspected in the year 2011.

Mean ovigerous *L. salmonis*

	Dec/Jan	*Feb*	*Mar*	*Apr*	*May*	*Jun*	*Jul*	*Aug*	*Sep*	*Oct*	*Nov*
Bantry Bay	0.05	0.00	0.02	0.00	0.00	0.11	0.00	HO			
Kenmare Bay	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.00	0.03	0.00
Kilkieran Bay	0.40	0.17	0.54	0.14	0.76	0.72	2.59	HO			
Bertraghboy Bay	0.00	0.00	0.04	TO							
Mannin Bay			0.00	0.01	0.12	0.02	0.30	1.45	7.09	7.93	8.97
Clifden Bay	3.62	HO									
Killary Harbour	0.08	0.05	0.04	0.04	0.27	0.35	4.09	3.76	1.78	0.48	0.97
Donegal Bay	0.43	0.38	0.01	0.02	0.02	0.33	0.81	0.00	3.08	4.29	0.00
Lough Swilly	0.83	0.71	0.53	0.75	1.12	3.12	2.18	7.86	HO		

Mean mobile *L. salmonis*

	Dec/Jan	*Feb*	*Mar*	*Apr*	*May*	*Jun*	*Jul*	*Aug*	*Sep*	*Oct*	*Nov*
Bantry Bay	0.15	0.00	0.02	0.02	0.05	0.11	0.12	HO			
Kenmare Bay	0.00	0.01	0.00	0.00	0.04	0.00	0.11	0.10	0.05	0.18	0.04
Kilkieran Bay	1.70	1.12	1.86	1.96	3.26	3.00	6.41	HO			
Bertraghboy Bay	0.14	0.05	0.19	TO							
Mannin Bay			0.10	0.10	0.38	0.11	1.78	2.95	13.15	20.97	17.31
Clifden Bay	30.66	HO									
Killary Harbour	0.40	0.21	0.29	0.70	1.58	2.03	10.78	43.36	20.90	18.14	8.25
Donegal Bay	1.91	2.50	1.29	2.21	0.18	0.60	1.85	0.03	13.48	13.95	0.12
Lough Swilly	7.93	2.62	3.63	5.45	4.34	7.76	4.44	27.62	HO		

Mean ovigerous *C. elongatus*

	Dec/Jan	*Feb*	*Mar*	*Apr*	*May*	*Jun*	*Jul*	*Aug*	*Sep*	*Oct*	*Nov*
Bantry Bay	7.05	0.86	1.62	0.97	1.82	0.32	3.29	HO			
Kenmare Bay	0.01	0.53	0.50	0.35	0.40	0.50	4.42	1.60	0.60	0.55	0.36
Kilkieran Bay	0.05	0.20	0.26	0.05	0.13	0.08	0.97	HO			
Bertraghboy Bay	1.32	1.68	1.94	TO							
Mannin Bay			0.16	0.05	0.75	0.59	1.06	0.27	0.11	0.00	0.00
Clifden Bay	0.10	HO									
Killary Harbour	2.91	0.00	0.00	0.00	0.02	0.05	0.03	1.12	0.03	0.00	0.08
Donegal Bay	0.19	0.38	0.12	0.52	0.11	1.20	0.51	0.00	0.63	0.14	0.02
Lough Swilly	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.18	HO		

Mean mobile *C. elongatus*

	Dec/Jan	*Feb*	*Mar*	*Apr*	*May*	*Jun*	*Jul*	*Aug*	*Sep*	*Oct*	*Nov*
Bantry Bay	25.47	6.16	3.67	2.61	4.29	0.74	11.59	HO			
Kenmare Bay	0.26	1.84	1.02	1.07	1.21	0.80	12.21	4.35	1.10	1.78	0.55
Kilkieran Bay	0.15	0.34	0.51	0.17	0.21	0.17	2.19	HO			
Bertraghboy Bay	3.59	3.62	4.11	TO							
Mannin Bay			0.24	1.18	1.55	1.68	2.82	0.89	0.22	0.00	0.03
Clifden Bay	0.14	HO									
Killary Harbour	8.64	0.00	0.00	0.00	0.07	0.08	0.09	2.12	0.40	0.05	0.16
Donegal Bay	0.35	0.62	0.52	0.97	0.32	1.92	1.28	0.02	0.98	0.17	0.02
Lough Swilly	0.03	0.00	0.00	0.01	0.00	0.00	0.00	0.36	HO		

HO = Harvested out TO =Transferred out

Regional monthly means for one-sea-winter salmon

L. salmonis monthly mean figures for one-sea-winter salmon regionally are shown in Figures 6 and 7. In the spring period of 2011 the ovigerous mean levels did not reach TTL at all in the Southwest or the west and were only slightly over in May in the Northwest. Outside the spring regional mean ovigerous *L. salmonis* levels were in excess of TTL from July to end of year in the west and for the months of August, September and October in the Northwest.

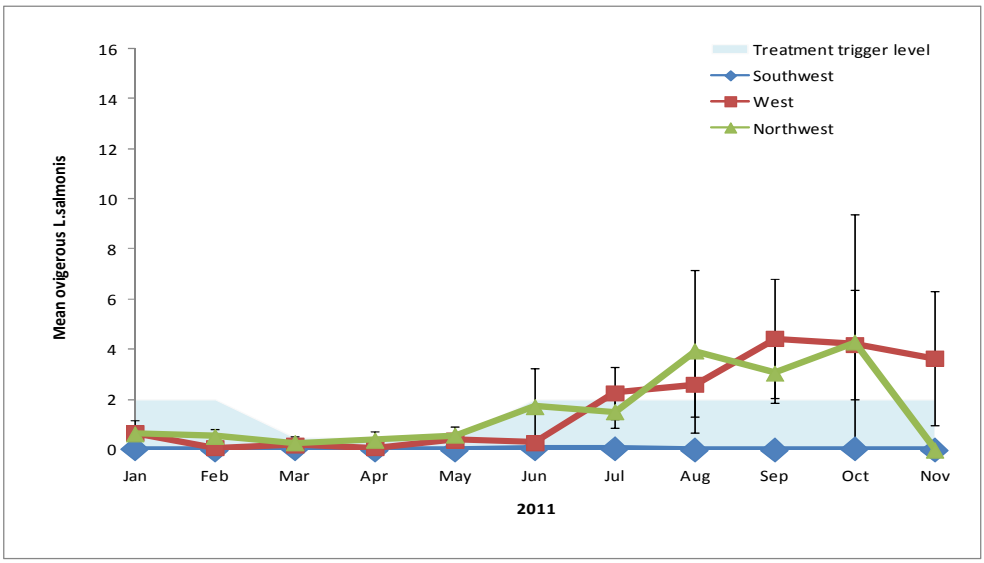


Figure 6. Mean (SE) ovigerous *L. salmonis* per month per region in 2011 on one-sea-winter fish.

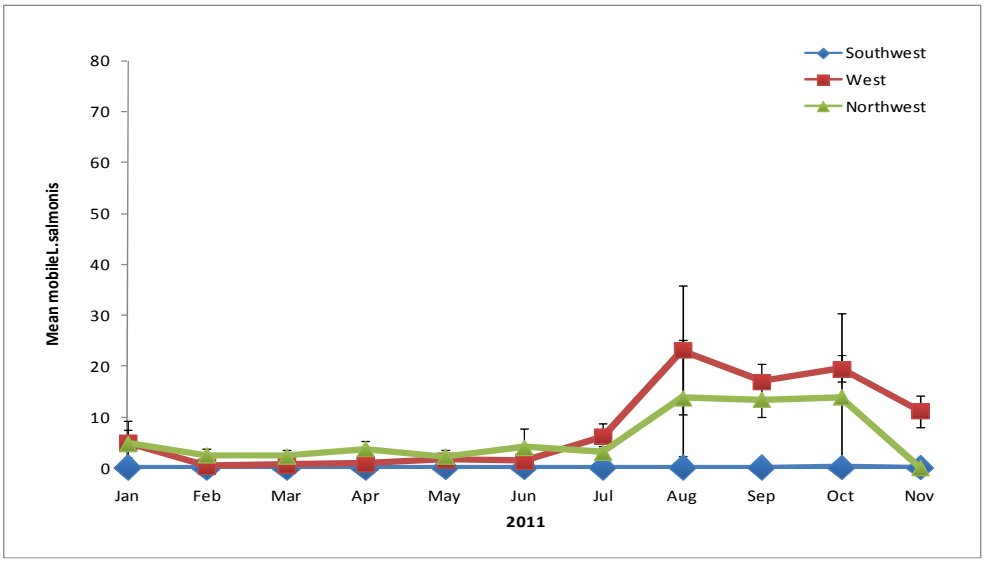


Figure 7. Mean (SE) mobile *L. salmonis* per month per region in 2011 on one-sea-winter fish.

Total mobile *L. salmonis* levels exceeded 10 sea lice per fish from August to November in the West and from August to October in the Northwest. Total regional mean mobile *L.*

salmonis levels peaked at 0.11 mobile sea lice per fish in the Southwest, 23.15 mobile sea lice per fish in the West and at 13.95 mobile sea lice per fish in November in the Northwest.

Annual trends

The annual trends of *L. salmonis* ovigerous and mobile sea lice levels are compared in Figures 8 and 9 for one-sea-winter salmon in the month of May from 1991 to 2011. The mean number of ovigerous and mobile *L. salmonis* per fish are presented.

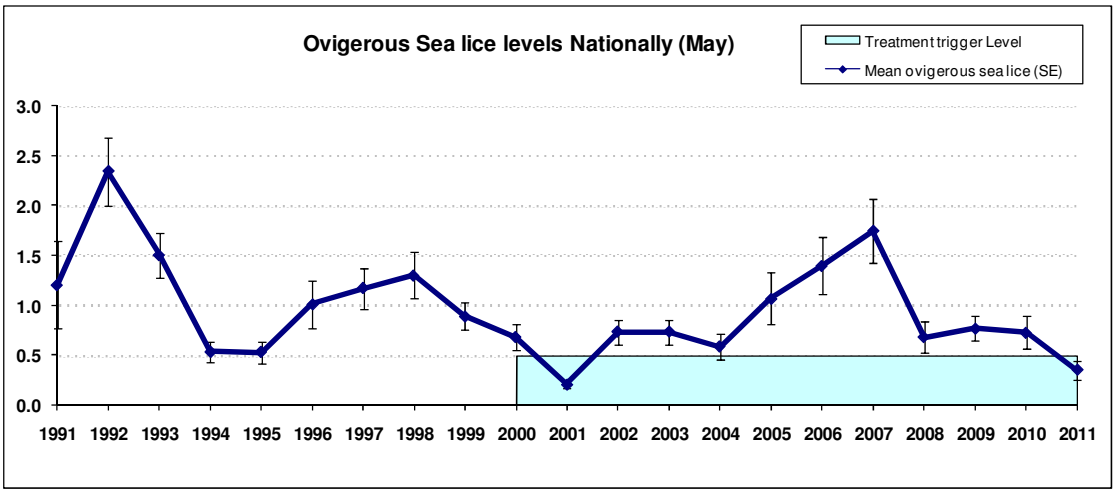


Figure 8. Annual trend (May mean) (SE) ovigerous *L. salmonis* on one-sea-winter salmon.

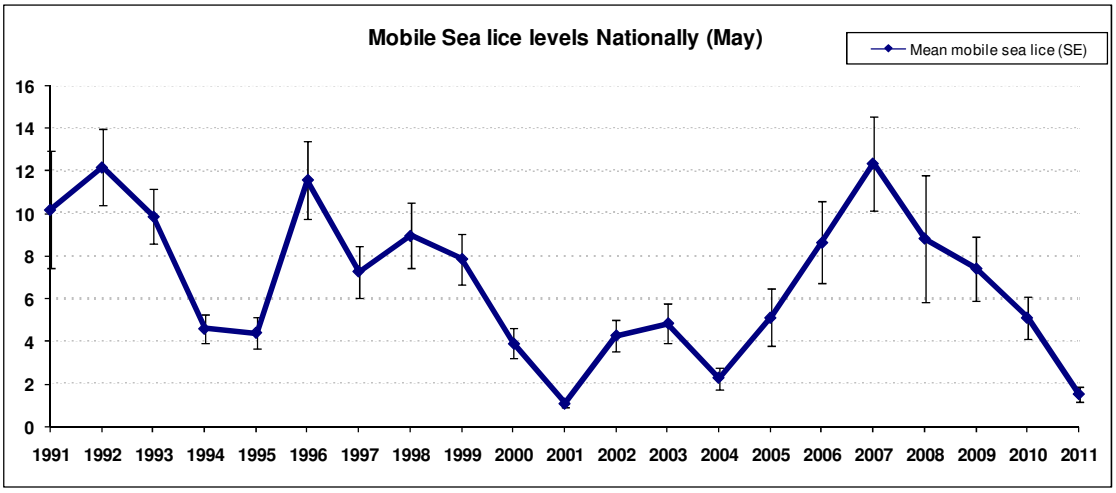


Figure 9. Annual trend (May mean) (SE) mobile *L. salmonis* on one-sea-winter salmon.

Mean ovigerous L. salmonis levels in 2011 are lower than the previous years at 0.35 *L. salmonis* per fish. There was also a decrease in the total mobile levels from 5.11 total mobile sea lice per fish in 2010 to 1.51 total mobile sea lice per fish in 2011. This continues a downward trend from 2007.

DISCUSSION

Ninety seven percent of sea lice inspections of smolts were below the treatment trigger levels (TTL) in 2011, this compares with 96 % in 2010 and 89% in 2009. Eighty percent of inspections were below TTL on one-sea-winter salmon compared to 68% in 2010 and 69% in 2009. Fifty percent of inspections of two-sea-winter salmon were below treatment trigger levels compared to 60% in 2010 and 76% in 2009.

Sea lice levels on one-sea-winter salmon during the critical spring period were below TTL for 84% of inspections in the West, 67% in the Northwest and 100% in the Southwest. This represents an improvement in the west from 46% in 2010 and a decline in the Northwest from 100%. The Southwest continued to have no breaches of protocol levels in 2011, which was also the case in 2010 and 2009.

The levels for one-sea-winter salmon for the rest of the year show that 68% of inspections were below TTL in the West, 62% were below in the Northwest and 100% in the Southwest. These compare to 44% in the West and 100% below in the Northwest and Southwest during 2010.

Sea lice levels in excess of mobile 10 *L. salmonis* per fish on one-sea-winter fish nationally were recorded on 11 occasions compared to 22 occasions in 2010, 5 of these inspections had means of greater than 20 mobile *L. salmonis* per fish which was much lower than 2010, when 12 inspection recorded lice levels in excess of 20 mobile *L. salmonis* per fish. For one-sea-winter salmon the highest mean sea lice level recorded was 43.36 mobile *L. salmonis* per fish, this compares to 43.57 mobile *L. salmonis* per fish in 2010.

The May mean mobile *L. salmonis* annual trend graphs of one-sea-winter fish (figures 8 & 9) show that a continuing reduction in infestation levels, which has been consistent since 2007, has continued, with levels at their lowest since 2001 and the second lowest on record. The May mean ovigerous *L. salmonis* levels show a dramatic decrease compared to 2010 and also continues a decreasing trend with the levels also being the second lowest recorded.

Regionally sea lice levels in 2011 have improved as compared to 2010, particularly in the West. Control has been very good in all regions for the first seven months of 2011, levels began to rise at some sites in the Autumn. This may be due to fish health issues or treatment that proved less than successful in clearing sea lice numbers.

Weekly on–farm self monitoring of sea lice has proved to be a pro-active step in assessing the development of sea lice populations. Farms can act promptly to changes in sea lice populations and carry out targeted treatments at an early stage. This is very important to maximise the benefits of the treatments. It is also important to complete sea lice counts following a treatment to judge the success of a particular product and to access the requirement for a follow up treatment if sea lice are still present. Allowing sea lice numbers to increase at a site has proved problematic and it becomes difficult to regain control subsequently, especially in years of high ambient temperature. Successful separation of generations in conjunction with fallowing has shown to be highly beneficial in preventing the transfer of sea lice between stocks.

Sea lice levels were low at most sites at the beginning of the year and subsequently good control was maintained for the spring and early summer period, highlighting the importance and effectiveness of a synchronised autumn / winter treatment at sites and within bays.

Regular sea lice monitoring and a proactive treatment regime is key to having successful sea lice control. Alternating the use of treatments and targeting treatments effectively on developing sea lice populations is vital to achieving a successful result and in prolonging the effective life of the treatments.

GLOSSARY

Grower:	A fish which has been at sea for one complete year or longer.
Hyperplasia	Enlargement caused by an abnormal increase in the number of cells in an organ or tissue.
Mobile lice:	All sea lice that are mobile – male and female (pre-adult and adult stages) sea lice that have developed beyond the attached larval stages.
Ovigerous lice:	An egg bearing adult female sea lice.
Random (Ran.) Cage:	A cage which is selected by the inspector on the day of inspection.
Salmonids:	All salmonids spawn in fresh water, but in many cases, the fish spend most of their life at sea, returning to the rivers only to reproduce. It includes salmon, trout and charr.
Standard (Std.) Cage:	The selected cage which is sampled at each inspection.
S1 Smolt:	This pertains to a stage in the life cycle of the salmon when it changes from being a freshwater fish to a seawater fish, a process known as smoltification. These fish are transported to the saltwater environment in the spring, which is approximately 15 months after they were hatched.
S½ Smolt:	These fish are exposed to manipulated photoperiods to hasten the onset of smoltification. Hence an S½ smolt is ready to go to sea during the Autumn/Winter, approximately 11 months after hatching. Also known as S0 (S zero) smolts.
SE:	Standard error (error bars in the graphs) is the standard error of the mean of a sample from a population with a normal distribution, which is equal to the standard deviation of the normal distribution divided by the square root of the sample size.

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APPENDIX 1. Mean sea lice levels on salmonid farms in 2011.

	Date	*Lepeophtheirus salmonis*		*Caligus elongatus*	
		F + eggs	Total	F + eggs	Total
BANTRY BAY					
MURPHYS IRISH SEAFOOD					
Cuan Baoi					
Atlantic Salmon, 2010 S1/2	14/12/2010	0.05	0.15	7.05	25.47
	01/02/2011	0.00	0.00	0.86	6.16
	01/03/2011	0.00	0.00	1.07	3.07
	22/03/2011	0.03	0.03	2.17	4.27
	07/04/2011	0.00	0.00	0.89	2.18
	19/04/2011	0.00	0.04	1.04	3.04
	03/05/2011	0.00	0.00	0.46	2.00
	20/05/2011	0.00	0.09	3.17	6.57
	14/06/2011	0.11	0.11	0.32	0.74
	04/07/2011	0.00	0.12	3.29	11.59
			Harvested Out		
Atlantic Salmon, 2011 S1/2	01/02/2011	0.00	0.00	0.00	0.00
	01/03/2011	0.00	0.00	0.00	0.00
	22/03/2011	0.00	0.00	0.07	0.17
	07/04/2011	0.00	0.00	0.08	0.30
	19/04/2011	0.00	0.00	0.28	1.25
	03/05/2011	0.00	0.00	0.33	0.67
	20/05/2011	0.00	0.00	0.08	0.47
	14/06/2011	0.00	0.00	0.28	2.03
	04/07/2011	0.00	0.06	1.50	3.63
	10/08/2011	0.00	0.14	1.21	1.93
	20/09/2011	0.00	0.00	0.11	0.17
	11/10/2011	0.00	0.00	0.00	0.10
	09/11/2011	0.00	0.00	1.17	3.60
SILVER KING SEAFOODS LTD.					
Roancarraig					
Atlantic Salmon, 2011 S1/2	14/12/2010	0.00	0.00	1.69	5.08
	09/02/2011	0.00	0.00	0.00	0.04
	02/03/2011	0.00	0.00	0.00	0.04
	23/03/2011	0.00	0.00	0.00	0.05
	08/04/2011	0.00	0.00	0.05	0.62
	20/04/2011	0.00	0.00	0.23	0.59

	Date	*Lepeophtheirus salmonis*		*Caligus elongatus*	
		F + eggs	Total	F + eggs	Total
	04/05/2011	0.00	0.00	0.70	1.67
	19/05/2011	0.00	0.00	1.01	2.07
	15/06/2011	0.00	0.02	1.04	2.35
	05/07/2011	0.00	0.02	2.75	5.54
	11/08/2011	0.02	0.08	1.49	3.19
	20/09/2011	0.00	0.02	0.18	0.63
	12/10/2011	0.00	0.00	0.51	1.40
	09/11/2011	0.00	0.00	0.26	0.66
KENMARE BAY					
Deenish					
Atlantic Salmon, 2010	11/01/2011	0.00	0.00	0.02	0.29
	01/02/2011	0.00	0.02	0.95	3.39
	01/03/2011	0.00	0.00	1.46	2.69
			Transferred to Inishfarnard		
Atlantic Salmon, 2011	16/06/2011	0.00	0.00	0.27	0.82
	06/07/2011	0.00	0.02	1.73	3.75
	12/08/2011	0.00	0.02	1.74	4.46
	21/09/2011	0.00	0.00	0.57	1.40
	12/10/2011	0.00	0.04	2.22	5.84
	10/11/2011	0.00	0.00	0.11	0.54
Inishfarnard					
Atlantic Salmon, 2010	14/12/2010	0.00	0.00	0.00	0.23
	09/02/2011	0.00	0.00	0.10	0.30
	02/03/2011	0.00	0.00	0.00	0.14
	23/03/2011	0.00	0.00	0.04	0.24
	08/04/2011	0.00	0.00	0.70	1.95
	20/04/2011	0.00	0.00	0.00	0.18
	04/05/2011	0.00	0.07	0.37	1.16
	19/05/2011	0.00	0.00	0.44	1.25
	15/06/2011	0.00	0.00	0.50	0.80
	05/07/2011	0.05	0.11	4.42	12.21
	11/08/2011	0.00	0.10	1.60	4.35
	20/09/2011	0.00	0.05	0.60	1.10
	13/10/2011	0.03	0.18	0.55	1.78
	09/11/2011	0.00	0.04	0.36	0.55

	Date	*Lepeophtheirus salmonis*		*Caligus elongatus*	
		F + eggs	Total	F + eggs	Total
GREATMAN'S BAY					
MUIR GHAEL TEO.					
Carraroe					
Atlantic Salmon, 2010			Transferred to Daonish		
MUIRACHMHAINNI TEO.					
Cuigeal					
Atlantic Salmon, 2011 S1/2	25/07/2011	0.13	0.79	0.14	0.27
	16/08/2011	0.53	1.51	0.21	0.59
	16/09/2011	0.27	0.82	0.00	0.00
			Transferred to Daonish		
Atlantic Salmon, 2011	16/09//2011		Sampled Atlantic salmon 2011 S1/2		
			Transferred to Daonish		
KILKIERAN BAY					
Daonish					
Atlantic Salmon, 2010	10/12/2010	0.27	1.43	0.03	0.07
	17/02/2011	0.17	1.03	0.13	0.20
	03/03/2011	0.31	1.76	0.21	0.41
	18/03/2011	0.31	1.72	0.14	0.41
	14/04/2011	0.16	0.90	0.00	0.13
	21/04/2011	0.19	2.24	0.11	0.14
	13/05/2011	0.20	1.97	0.11	0.17
	31/05/2011	0.64	2.45	0.21	0.24
	28/06/2011	0.72	3.00	0.08	0.17
	25/07/2011	2.59	6.41	0.97	2.19
			Harvested Out		
Atlantic Salmon, 2010 S1/2	10/12/2010	0.53	1.97	0.07	0.23
	17/02/2011	0.17	1.20	0.27	0.47
	03/03/2011	0.84	2.06	0.38	0.66
	18/03/2011	0.68	1.91	0.29	0.56
	14/04/2011	0.14	0.93	0.00	0.11
	21/04/2011	0.08	3.76	0.08	0.28
	13/05/2011	0.64	2.64	0.09	0.12
	31/05/2011	1.56	5.96	0.11	0.30
			Harvested Out		

	Date	*Lepeophtheirus salmonis*		*Caligus elongatus*	
		F + eggs	Total	F + eggs	Total
Atlantic Salmon, 2011	03/10/2011	0.03	0.06	0.00	0.00
	16/11/2011	Sampled Atlantic salmon 2011 S1/2			
Atlantic Salmon, 2011 S1/2	03/10/2011	0.17	0.43	0.00	0.00
	16/11/2011	0.19	0.62	0.00	0.04
Golam					
Atlantic Salmon, 2011	21/04/2011	0.00	0.43	0.07	0.33
	13/05/2011	0.00	0.10	0.10	0.10
	31/05/2011	0.00	0.48	0.09	0.25
	28/06/2011	0.00	0.84	0.06	0.16
	25/07/2011	0.10	0.71	0.02	0.07
	16/08/2011	0.32	1.25	0.04	0.18
			Transferred to Cuigeal		
Atlantic Salmon, 2011 S1/2	10/12/2010	0.00	0.03	0.00	0.04
	17/02/2011	0.09	0.66	0.41	0.78
	03/03/2011	0.04	0.57	0.49	0.95
	18/03/2011	0.02	0.61	0.33	0.51
	14/04/2011	0.02	1.67	0.27	0.60
	21/04/2011	0.00	1.83	0.45	1.10
	13/05/2011	0.10	1.97	0.80	1.27
	31/05/2011	0.03	1.89	0.31	0.54
	28/06/2011	0.08	1.54	0.11	0.19
			Transferred to Cuigeal		
BERTRAGHBOY BAY					
COMHLUCHT BRADAIN CHONAMARA TEO					
Sealax					
Atlantic Salmon, 2010	25/01/2011	0.00	0.14	1.32	3.59
	16/02/2011	0.00	0.05	1.68	3.62
	02/03/2011	0.07	0.28	2.71	5.57
	24/03/2011	0.00	0.00	0.42	1.21
			Transferred to Corhounagh		

	Date	*Lepeophtheirus salmonis*		*Caligus elongatus*	
		F + eggs	Total	F + eggs	Total
MANNIN BAY					
MANNIN BAY SALMON COMPANY LTD.					
Corhounagh					
Atlantic Salmon, 2009	14/12/2010	8.70	51.97	0.63	1.17
			Harvested Out		
Atlantic Salmon, 2010	16/03/2011	0.00	0.10	0.16	0.24
	08/04/2011	0.02	0.08	0.02	0.12
	19/04/2011	0.00	0.12	0.09	2.24
	05/05/2011	0.02	0.23	0.90	2.11
	19/05/2011	0.23	0.53	0.60	0.99
	07/06/2011	0.02	0.11	0.59	1.68
	12/07/2011	0.30	1.78	1.06	2.82
	09/08/2011	1.45	2.95	0.27	0.89
	15/09/2011	7.09	13.15	0.11	0.22
	20/10/2011	7.93	20.97	0.00	0.00
	15/11/2011	8.97	17.31	0.00	0.03
CLIFDEN BAY					
Hawks Nest					
Atlantic Salmon, 2010 S1/2	14/12/2010	3.62	30.66	0.10	0.14
			Harvested Out		
Atlantic Salmon, 2011	19/04/2011	0.00	0.02	0.00	0.12
	05/05/2011	0.00	0.00	0.03	0.04
	19/05/2011	0.00	0.02	0.07	0.26
	07/06/2011	0.00	0.02	0.37	0.67
	12/07/2011	0.00	0.14	0.87	1.77
	09/08/2011	0.00	0.22	1.05	1.95
	15/09/2011	0.75	2.67	0.56	2.01
	04/10/2011	0.74	3.68	0.00	0.05
	15/11/2011	0.93	14.60	0.00	0.02

	Date	*Lepeophtheirus salmonis*		*Caligus elongatus*	
		F + eggs	Total	F + eggs	Total
BALLINAKILL HARBOUR					
BIFAND LTD.					
Fraochoilean					
Atlantic Salmon, 2011 S1/2	15/12/2010	0.00	0.00	0.02	0.04
	01/02/2011	0.00	0.03	0.49	1.10
	01/03/2011	0.00	0.04	0.28	0.33
	15/03/2011	0.00	0.03	0.23	0.30
	07/04/2011	0.00	0.07	0.13	0.36
	20/04/2011	0.00	0.08	0.22	0.34
	06/05/2011	0.00	0.07	0.15	0.30
	20/05/2011	0.00	0.03	0.25	0.53
	03/06/2011	0.02	0.13	0.39	0.94
	01/07/2011	0.08	0.37	0.88	2.26
	10/08/2011	0.21	1.85	1.61	4.72
	08/09/2011	1.10	4.07	0.36	1.38
	04/10/2011	1.54	4.04	0.00	0.00
	07/11/2011	2.08	7.99	0.00	0.00
KILLARY HARBOUR					
MARINE HARVEST IRL.					
Inishdeighil					
Atlantic Salmon, 2010	21/01/2011	0.08	0.40	2.91	8.64
	10/02/2011	0.10	0.30	0.00	0.00
			Transferred to Rosroe		
Rosroe					
Atlantic Salmon, 2010	28/02/2011	0.00	0.12	0.00	0.00
	09/03/2011	0.08	0.25	0.00	0.00
	25/03/2011	0.00	0.32	0.00	0.00
	07/04/2011	0.00	0.80	0.00	0.00
	18/04/2011	0.09	0.60	0.00	0.00
	12/05/2011	0.17	1.19	0.00	0.02
	19/05/2011	0.37	1.98	0.05	0.13
	03/06/2011	0.35	2.03	0.05	0.08
	27/07/2011	4.09	10.78	0.03	0.09
	31/08/2011	3.76	43.36	1.12	2.12
	15/09/2011	1.78	20.90	0.03	0.40
	14/10/2011	0.48	18.14	0.00	0.05
	30/11/2011	0.97	8.25	0.08	0.16

	Date	*Lepeophtheirus salmonis*		*Caligus elongatus*	
		F + eggs	Total	F + eggs	Total
CLEW BAY					
CLARE ISLAND SEAFARMS LTD.					
Portlea					
Atlantic Salmon, 2011	20/05/2011	0.00	0.04	0.02	0.07
	27/05/2011	0.00	0.07	0.31	0.58
	17/06/2011	0.00	0.07	1.02	1.92
	12/07/2011	0.05	0.22	4.20	9.07
	05/08/2011	0.14	0.56	0.47	1.19
	29/09/2011	0.36	1.61	0.36	1.14
	26/10/2011	0.30	1.47	0.27	0.48
	18/11/2011	0.95	2.93	0.42	0.76
Seastream Inner					
Atlantic Salmon, 2009	15/12/2010	1.80	5.99	1.28	2.23
	09/02/2011	0.98	8.21	0.02	0.02
	11/03/2011	6.95	9.34	0.00	0.00
	25/03/2011	0.82	1.38	0.00	0.00
			Harvested Out		
CURRAUN BLUE LTD.					
Seastream Outer					
Rainbow Trout, 2011 (1)	24/06/2011	0.00	0.93	0.23	1.47
	14/07/2011	0.13	0.50	0.27	0.53
	09/08/2011	0.07	0.33	0.23	0.80
	22/09/2011	0.07	0.30	0.07	0.07
	25/10/2011	0.03	0.19	0.39	0.45
	22/11/2011	0.13	0.13	0.04	0.04

	Date	*Lepeophtheirus salmonis*		*Caligus elongatus*	
		F + eggs	Total	F + eggs	Total
BEALACRAGHER BAY					
CURRAN FISHERIES LTD.					
Curraun					
Rainbow Trout, 2010 (1)			Harvested Out		
Rainbow Trout, 2010 (2)	27/01/2011	0.74	4.42	0.00	0.00
	10/02/2011	0.50	1.65	0.00	0.00
	07/03/2011	0.00	0.03	0.00	0.00
	25/03/2011	0.00	0.07	0.00	0.00
	15/04/2011	0.00	0.24	0.00	0.00
	27/04/2011	0.00	0.10	0.00	0.00
	13/05/2011	0.00	0.29	0.00	0.00
	31/05/2011	0.09	0.75	0.00	0.00
	24/06/2011	0.38	2.14	0.00	0.00
	28/07/2011	1.48	6.74	0.00	0.00
	15/08/2011	0.73	7.62	0.00	0.00
	30/09/2011	1.33	11.60	0.00	0.00
			Harvested out		
CURRAUN BLUE LTD.					
Rainbow Trout, 2011 (1)	25/10/2011	0.00	5.83	0.00	0.03
	28/11/2011	0.15	7.30	0.00	0.00

	Date	*Lepeophtheirus salmonis*		*Caligus elongatus*	
		F + eggs	Total	F + eggs	Total
DONEGAL BAY					
EANY FISH PRODUCTS LTD.					
Eany					
Rainbow Trout, 2009 (3)			Harvested Out		
Rainbow Trout, 2010 (1)	14/12/2010	0.86	4.59	0.08	0.24
	09/02/2011	0.69	13.01	0.09	0.18
	02/03/2011	1.88	10.82	0.43	0.70
	24/03/2011	1.14	7.43	0.43	0.43
	07/04/2011	0.32	2.00	0.03	0.03
	21/04/2011	0.21	0.79	0.00	0.00
			Harvested Out		
Rainbow Trout, 2010 (2)	14/12/2010	0.48	3.17	0.14	0.45
			Graded to RT 2010 (1)		
Rainbow Trout, 2011 (1)	09/02/2011	0.02	3.40	0.07	0.12
	02/03/2011	0.00	1.87	0.00	0.00
	24/03/2011	0.02	2.18	0.02	0.12
	07/04/2011	0.00	0.16	0.00	0.00
	21/04/2011	0.00	0.15	0.00	0.02
	05/05/2011	0.02	0.13	0.00	0.00
	31/05/2011	0.00	0.14	0.02	0.14
	23/06/2011	0.00	0.05	0.00	0.22
	14/07/2011	0.18	2.00	0.53	1.00
	03/08/2011	1.96	9.15	2.07	3.82
	15/09/2011	3.91	18.17	0.04	0.04
	11/10/2011	4.47	20.20	0.00	0.00
			Harvested Out		
Rainbow Trout, 2011 (2)	23/06/2011	0.00	0.00	0.25	0.40
	14/07/2011	0.02	0.43	0.59	0.75
	03/08/2011	0.23	2.90	1.31	2.83
	15/09/2011	0.82	5.65	0.02	0.02
	11/10/2011	1.16	13.15	0.00	0.02
	08/11/2011	1.20	6.69	0.00	0.00

	Date	*Lepeophtheirus salmonis*		*Caligus elongatus*	
		F + eggs	Total	F + eggs	Total
OCEAN FARM LTD.					
Mc Swynes					
Atlantic Salmon, 2009	14/12/2010	0.04	1.67	0.11	0.33
			Harvested Out		
Atlantic Salmon, 2011	05/05/2011	0.00	0.13	0.20	0.48
	27/05/2011	0.00	0.06	0.22	0.34
	23/06/2011	0.00	0.02	0.12	0.30
	14/07/2011	0.00	0.20	0.31	0.65
	03/08/2011	0.04	0.25	0.45	0.80
	15/09/2011	0.29	0.47	0.21	0.45
	11/10/2011	0.60	4.34	0.78	2.08
	15/11/2011	1.80	27.61	1.89	4.59
Ocean Inver					
Atlantic Salmon, 2010	14/12/2010	0.43	1.91	0.19	0.35
	09/02/2011	0.38	2.50	0.38	0.62
	02/03/2011	0.00	0.03	0.07	0.10
	24/03/2011	0.02	2.55	0.18	0.95
	07/04/2011	0.00	4.15	1.03	1.94
	21/04/2011	0.03	0.27	0.00	0.00
	05/05/2011	0.02	0.02	0.03	0.06
	27/05/2011	0.02	0.35	0.20	0.58
	23/06/2011	0.33	0.60	1.20	1.92
	14/07/2011	0.81	1.85	0.51	1.28
	03/08/2011	0.00	0.03	0.00	0.02
	15/09/2011	3.08	13.48	0.63	0.98
	11/10/2011	4.29	13.95	0.14	0.17
	21/11/2011	0.00	0.12	0.02	0.02

	Date	*Lepeophtheirus salmonis*		*Caligus elongatus*	
		F + eggs	Total	F + eggs	Total
MULROY BAY					
MARINE HARVEST IRL.					
Glinsk					
Atlantic Salmon, 2011	08/04/2011	0.00	0.02	0.00	0.04
	20/04/2011	0.00	0.09	0.00	0.02
	04/05/2011	0.00	0.84	0.03	0.17
	26/05/2011	0.02	0.54	0.39	0.68
	16/06/2011	0.00	0.34	0.00	0.00
	07/07/2011	0.00	0.41	0.00	0.00
	30/08/2011	0.55	3.94	0.08	0.13
	23/09/2011	2.31	12.35	0.07	0.08
	12/10/2011	4.06	16.38	0.00	0.09
	08/11/2011	1.62	8.52	0.03	0.03
LOUGH SWILLY					
Lough Swilly					
Atlantic Salmon, 2010 S1/2	15/12/2010	0.83	7.93	0.00	0.03
	01/02/2011	0.71	2.62	0.00	0.00
	01/03/2011	0.92	3.33	0.00	0.00
	29/03/2011	0.15	3.94	0.00	0.00
	08/04/2011	0.29	3.90	0.02	0.02
	20/04/2011	1.22	6.99	0.00	0.00
	04/05/2011	1.08	4.69	0.00	0.00
	31/05/2011	1.15	4.00	0.00	0.00
	16/06/2011	3.12	7.76	0.00	0.00
	26/07/2011	2.18	4.44	0.00	0.00
	30/08/2011	7.86	27.62	0.18	0.36
			Harvested Out		

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