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National Survey of Sea Lice (*Lepeophtheirus salmonis* Krøyer and *Caligus elongatus* Nordmann) on Fish Farms in Ireland - 2012

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NATIONAL SURVEY OF SEA LICE (*LEPEOPHTHEIRUS SALMONIS* KRØYER AND *CALIGUS ELONGATUS* NORDMANN) ON FISH FARMS IN IRELAND – 2012

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INTRODUCTION

Sea lice are marine ectoparasites which occur on many species of fish. There are estimated to be approximately 559 species made up of 37 genera (Ahyong *et al*., 2011), including 162 *Lepeophtheirus* species (Walter & Boxshall, 2011) and 268 *Caligus* species (Boxshall 2011). Two species of sea lice are found in Ireland on wild and cultured salmonids, *Caligus elongatus* Nordmann and *Lepeophtheirus salmonis* Krøyer. *L. salmonis* is the larger, and is regarded as the more damaging parasite of the two species; endemic at a high prevalence (>90%) within wild populations (Jackson *et al.,* 2013a), and occurring frequently on farmed Atlantic salmon and rainbow trout (Jackson and Minchin, 1992; Jackson *et al.,* 2005). *L salmonis* infests only salmonids, while *C elongatus* is known to parasitise over 80 different types of marine fish.

Sea lice infestation as a source of marine mortality of outwardly migrating ranched Atlantic salmon smolts has been investigated in long term studies in Ireland (Jackson *et al*., 2013b) and Norway (Skilbrei *et al.,* 2013) with both studies generating similar results. In Ireland marine mortality data on 352,142 migrating salmon from twenty-eight releases, at eight locations along Ireland's South and West coasts covering a 9-year period (2001 to 2009) was reviewed in a meta-analysis. The results though significant suggest that sea lice is a minor and irregular component of marine mortality in the stocks studied indicating it is unlikely to be a significant factor influencing conservation status of stocks of wild salmon in Ireland.

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)

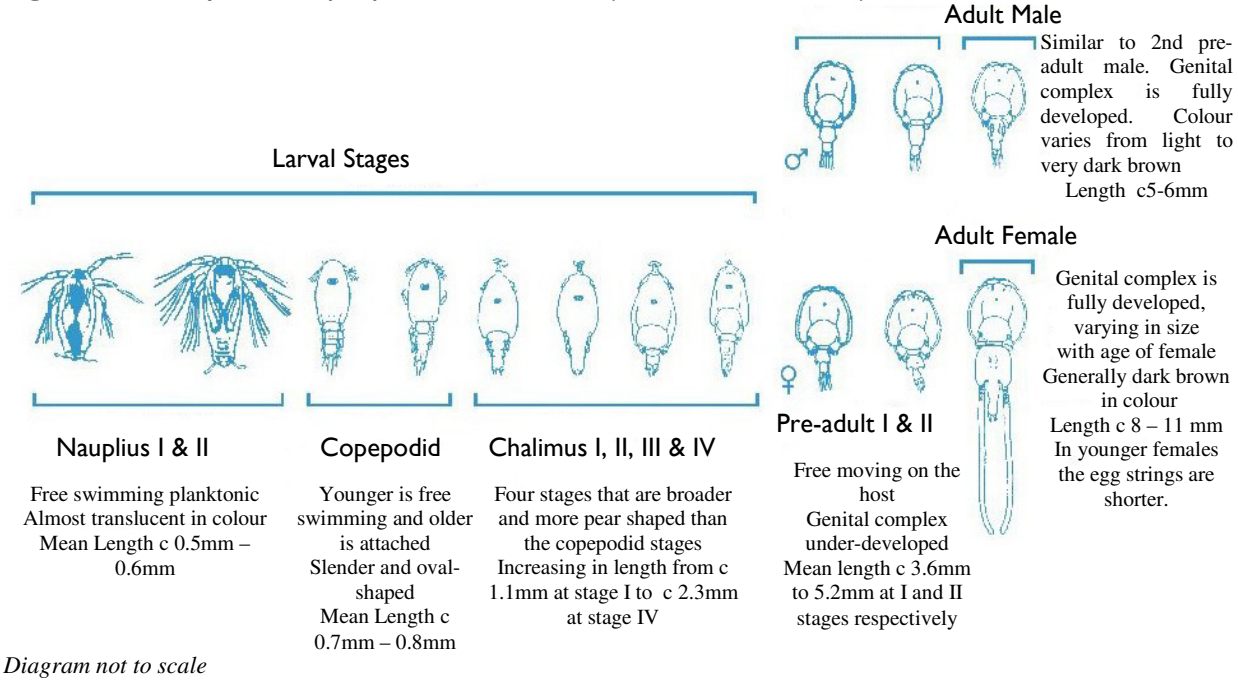
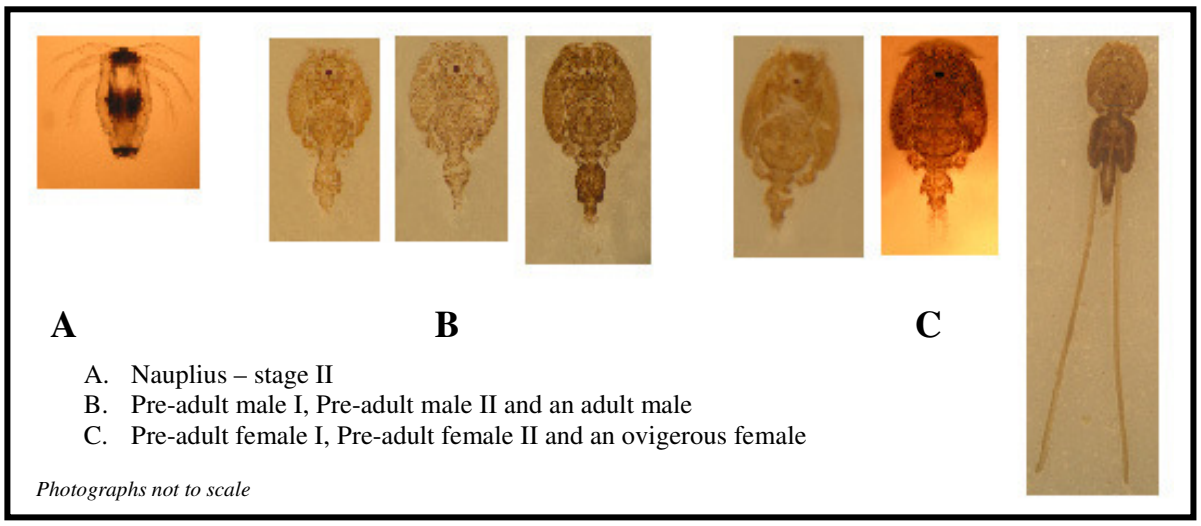


Diagram not to scale

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 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 are:

- 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.

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.*, 2003-2012; 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. *Treatment 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 2012, salmonid farms were producing 5 different stocks of fish, namely: 2011 rainbow trout, *Oncorhynchus mykiss* Walbaum (rainbow trout first inspected in 2011); 2012 rainbow trout (rainbow trout first inspected in 2012); 2010 Atlantic salmon, *Salmo salar* L. (two-sea-winter salmon), 2011 Atlantic salmon (one-sea-winter salmon) and 2012 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 2012 a total number of 23 sites were inspected around Ireland, see figure 3.

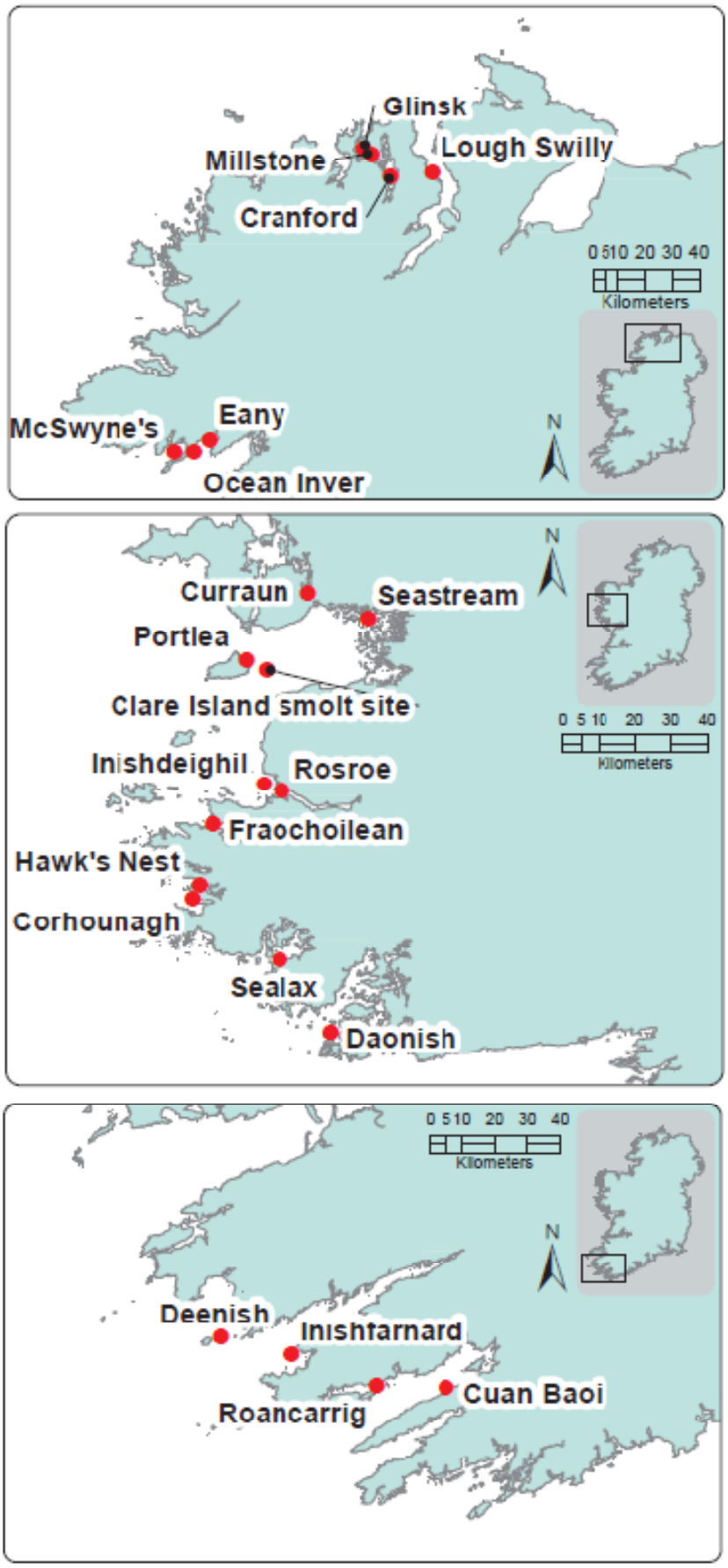


Figure 3. Locations of fish farm sites.

RESULTS

During 2012 a total of 254 sea lice inspections were carried out on the 23 active salmonid sites. Over 83% of Atlantic salmon samples and 94% 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-eight percent of the 99 inspections carried out on salmon smolts were below the TTL, 74% of the 110 inspections carried out on one-sea-winter salmon were below TTL and 43% of the 7 inspections to two-sea-winter salmon were below TTL.

Results of 2012 sea lice inspections for all active salmonid sites for each month are presented in Appendix 1.

Atlantic salmon 2010 (two-sea-winter salmon)

At the beginning of 2012, two-sea-winter salmon were stocked in 3 sites: Inishfarnard, Kenmare Bay; Rosroe, Killary Harbour; and Millstone, Mulroy 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 2010 salmon on fish farm sites in 2012.*

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
Silverking Seafoods Ltd.	**Inishfarnard**	0	0	2	0	2	0	0%	0%	0%
Southwest		0	0	2	0	2	0	0%	0%	0%
Marine Harvest Irl.	**Rosroe**	0	0	2	2	2	2	0%	100%	100%
West		0	0	2	2	2	2	0%	100%	100%
Marine Harvest Irl.	**Millstone**	2	2	1	0	3	2	100%	0%	67%
Northwest	**Totals**	2	2	1	0	3	2	100%	0%	67%
National Totals		2	2	5	2	7	4	100%	40%	57%

Atlantic salmon 2011 (one-sea-winter salmon)

One-sea-winter salmon were stocked in a total of 12 sites in 10 bays in 2012. One hundred and nine visits were undertaken to this generation of fish. Four sites, in 4 bays, continued to stock one-sea-winter salmon in November 2012.

Ovigerous *L. salmonis* levels greater than the treatment trigger level were recorded in a total of 29 inspections (26%) 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 12

inspections (22%) and outside of the spring period 17 inspections (31%) were in excess of 2.0 ovigerous female *L. salmonis* per fish.

Table 3. *National breakdown of inspections for 2011 salmon on all fish farm sites in 2012.*

	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	55	12	55	17	110	29	22%	31%	26%

C. elongatus levels were recorded at numbers greater than 10 per fish on 2 inspections on these fish, once in March and once in May. *Caligus elongatus* were present 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 2011 salmon for Southwest sites in 2012.*

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	5	0	11	0	0%	0%	0%
Silver King Seafoods Ltd	**Roancarraig**	6	0	4	0	10	0	0%	0%	0%
	Inishfarnard	6	0	5	0	11	0	0%	0%	0%
	Deenish	0	0	1	0	1	0	0%	0%	0%
Southwest	**Totals**	18	0	15	0	33	0	0%	0%	0%

West Region

In the West, *L. salmonis* infestation levels greater than the treatment trigger were recorded on 7 out of 25 inspections (28%) in the spring period and on 10 out of 24 inspections (42%) outside the spring period (see Table 5).

Table 5. *Breakdown of inspections for 2011 salmon on West sites in 2012.*

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	1	4	0	10	1	17%	0%	10%
Mannin Bay Salmon Co Ltd	**Corhounagh**	6	2	6	4	12	6	33%	67%	50%
	Hawk's nest	6	2	3	3	9	5	33%	100%	56%
Bifand Ltd	**Fraochoilean**	1	1	3	2	4	3	100%	67%	75%
Clare Island seafarms Ltd	**Portlea**	6	1	8	1	14	2	17%	13%	14%
West	**Totals**	25	7	24	10	49	17	28%	42%	35%

At Corhounagh, Mannin Bay, *L. salmonis* exceeded treatment trigger levels for 2 of the 6 inspections in the spring and 4 of the 6 inspections outside the spring. Levels at Hawk's Nest, Clifden Bay, were above treatment trigger levels for 2 of the 6 inspections in the spring and 3 of the 6 inspections outside the spring period. Fraochoilean, Ballinakill

Harbour, exceeded treatment trigger levels for its one spring inspection and for 2 of the 3 inspections outside spring.

Northwest Region

The treatment trigger levels were exceeded on 5 of the 12 inspections in the spring and 7 of the 16 inspections outside the spring period in the Northwest (see Table 6).

Table 6. *Breakdown of inspections for 2011 salmon on Northwest sites in 2012.*

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.	**Mc Swyne's**	6	0	8	2	14	2	0%	25%	14%
Marine Harvest Ireland	**Glinsk**	0	0	1	0	1	0	0%	0%	0%
	Lough Swilly	6	5	7	5	13	10	83%	71%	77%
Northwest	**Totals**	12	5	16	7	28	12	42%	44%	43%

Lough Swilly exceeded treatment trigger levels on 5 of the 6 spring inspections and on 5 of the 7 inspections outside the spring period.

Atlantic salmon 2012 (smolts)

A total of 99 inspections were made to 10 sites stocking Atlantic salmon 2012 S1 and S½ smolts during the year 2012. *L. salmonis* levels were below the treatment trigger level of 0.5 ovigerous female lice per fish for all of the 38 inspections in the spring period. Outside of this period, levels exceeded 2.0 ovigerous *L. salmonis* per fish on 2 of the 61 inspections (see Table 7).

Table 7. *National breakdown of inspections for 2012 salmon on fish farm sites in 2012.*

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	4	0	6	0	10	0	0%	0%	0%
Southwest	**Totals**	16	0	21	0	37	0	0%	0%	0%
Comhlucht Bradain Chonamara Teo	**Sealax**	6	0	8	0	14	0	0%	0%	0%
Rosroe Salmon Ltd	**Inishdeighil**	2	0	6	0	8	0	0%	0%	0%
Clare Island Seafarms Ltd	**CI smolt site**	2	0	3	0	5	0	0%	0%	0%
	Seastream Inner	0	0	3	0	3	0	0%	0%	0%
West	**Totals**	10	0	20	0	30	0	0%	0%	0%
Ocean Farm ltd.	**Oceaninver**	4	0	6	0	10	0	0%	0%	0%
Marine Harvest	**Cranford A**	6	0	8	2	14	2	0%	25%	14%
	Glinsk	2	0	6	0	8	0	0%	0%	0%
Northwest	**Totals**	12	0	20	2	32	2	0%	10%	6%
National Totals		38	0	61	2	99	2	0%	3%	2%

C. elongatus levels were greater than 10 per fish on one occasion in July on these fish.

Rainbow trout

In 2011 there was 2 year-classes of rainbow trout, 2011 and 2012 rainbow trout, stocked between 3 sites, in 3 bays (Table 8). There were 17 inspections carried out on 2011 rainbow trout, 2 of which exceeded treatment trigger levels. A total of 21 inspections were carried out on the 2012 rainbow trout stock and no inspection exceeded treatment trigger levels.

Table 8. *National breakdown of inspections for Rainbow Trout on fish farm sites in 2012.*

Rainbow Trout 2011 stocked in 2012

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**	1	0	2	0	3	0	0%	0%	0%
	Curraun	6	0	4	1	10	1	0%	25%	10%
West		7	0	6	1	13	1	0%	17%	8%
Eany Fish Products Ltd	**Eany**	2	1	2	0	4	1	50%	0%	25%
Northwest	**Totals**	2	1	2	0	4	1	50%	0%	25%
National Totals		9	1	8	1	17	2	11%	13%	12%

Rainbow Trout 2012 stocked in 2012

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	**Curraun**	3	0	4	0	7	0	0%	0%	0%
West		3	0	4	0	7	0	0%	0%	0%
Eany Fish Products Ltd	**Eany**	6	0	8	0	14	0	0%	0%	0%
Northwest	**Totals**	6	0	8	0	14	0	0%	0%	0%
National Totals		9	0	12	0	21	0	0%	0%	0%

Sampling record

Due to technical difficulties, inspections were not carried out at Curraun, Bealacragher Bay in August and September. All other samples were obtained.

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 8 of the 25 occasions during the spring period on a bay basis. On 17 out of 50 inspections, outside of the spring period, mean ovigerous levels of 2.0 ovigerous females per fish or greater were recorded. These occurred in Lough Swilly (5 occasions), Mannin Bay (4 occasions), Clifden Bay (3 occasions), Ballinakill Harbour (2 occasions), Donegal Bay (2 occasions) and Clew Bay (1 occasion).

Mean mobile levels per bay in excess of 10 *L. salmonis* per fish were recorded on 16 occasions and 7 of these instances had means of greater than 20 mobile lice per fish. The maximum level recorded was 71.72 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 2012.

Mean ovigerous L. salmonis

	Dec/Jan	*Feb*	*Mar*	*Apr*	*May*	*Jun*	*Jul*	*Aug*	*Sep*	*Oct*	*Nov*
Bantry Bay	0.00	0.00	0.00	0.01	0.02	0.00	0.02	0.10	HO		
Kenmare Bay	0.05	0.00	0.20	0.01	0.08	0.19	0.07	1.98	0.00	HO	
Kilkieran Bay	0.13	0.23	0.22	0.37	0.88	1.15	1.07	HO			
Mannin Bay			0.12	0.82	0.73	1.17	3.99	0.33	6.74	9.36	5.56
Clifden Bay	2.61	2.63	0.33	0.36	0.67	3.52	TO				
Ballinakill Harbour	6.68	2.90	0.65	TO							
Clew Bay	2.08	0.59	0.63	0.14	0.21	0.10	0.31	0.29	0.05	0.34	1.20
Donegal Bay	0.48	0.11	0.07	0.06	0.28	0.27	0.34	2.50	1.50	3.49	0.07
Mulroy Bay	1.70	TO									
Lough Swilly		1.05	0.43	1.26	1.09	1.63	6.04	5.87	11.05	9.35	6.23

Mean mobile L. salmonis

	Dec/Jan	*Feb*	*Mar*	*Apr*	*May*	*Jun*	*Jul*	*Aug*	*Sep*	*Oct*	*Nov*
Bantry Bay	0.03	0.00	0.05	0.02	0.08	0.02	0.03	0.19	HO		
Kenmare Bay	0.10	0.16	2.64	0.77	1.54	1.36	0.40	9.44	1.29	HO	
Kilkieran Bay	1.19	1.73	0.96	1.70	1.76	2.27	1.84	HO			
Mannin Bay			3.30	4.52	5.26	2.80	7.81	4.48	14.10	26.59	15.23
Clifden Bay	15.43	8.86	2.97	3.58	8.93	7.20	TO				
Ballinakill Harbour	27.86	14.76	6.81	TO							
Clew Bay	6.35	6.90	1.95	1.11	0.97	0.23	0.95	0.39	0.37	1.69	5.28
Donegal Bay	1.79	0.67	20.76	1.17	0.65	1.31	1.20	6.29	13.42	16.72	0.40
Mulroy Bay	14.37	TO									
Lough Swilly		2.77	2.51	18.79	5.20	4.87	12.67	55.55	71.72	54.00	44.88

Mean ovigerous C. elongatus

	Dec/Jan	*Feb*	*Mar*	*Apr*	*May*	*Jun*	*Jul*	*Aug*	*Sep*	*Oct*	*Nov*
Bantry Bay	1.22	0.27	2.06	1.92	1.73	0.85	1.33	1.67	HO		
Kenmare Bay	0.72	0.15	2.78	0.49	2.95	1.66	2.11	2.16	0.00	HO	
Kilkieran Bay	0.20	0.24	0.05	0.02	0.03	0.19	0.76	HO			
Mannin Bay			0.00	0.00	0.00	0.00	0.08	0.00	0.02	0.00	0.00
Clifden Bay	0.00	0.00	0.00	0.00	0.02	0.02	TO				
Ballinakill Harbour	0.00	0.00	0.00	TO							
Clew Bay	0.52	0.00	0.00	0.01	0.01	0.00	1.03	0.31	0.00	0.00	0.07
Donegal Bay	0.00	0.08	0.99	0.79	0.68	1.23	0.00	0.50	0.00	0.00	0.00
Mulroy Bay	0.24	TO									
Lough Swilly		0.00	0.07	0.30	0.01	0.00	0.02	0.34	0.00	0.00	0.03

Mean mobile C. elongatus

	Dec/Jan	*Feb*	*Mar*	*Apr*	*May*	*Jun*	*Jul*	*Aug*	*Sep*	*Oct*	*Nov*
Bantry Bay	4.11	1.23	7.73	4.56	5.14	2.18	5.00	2.52	HO		
Kenmare Bay	1.75	1.02	7.73	1.85	6.40	3.30	3.48	4.71	0.00	HO	
Kilkieran Bay	0.65	0.52	0.11	0.07	0.09	0.23	0.94	HO			
Mannin Bay			0.00	0.01	0.00	0.02	0.16	0.00	0.06	0.00	0.00
Clifden Bay	0.00	0.00	0.00	0.01	0.03	0.05	TO				
Ballinakill Harbour	0.00	0.00	0.00	TO							
Clew Bay	1.13	0.00	0.00	0.01	0.02	0.05	1.44	0.39	0.00	0.00	0.33
Donegal Bay	0.00	0.13	3.01	1.78	0.98	2.58	0.02	0.78	0.00	0.00	0.00
Mulroy Bay	0.91	TO									
Lough Swilly		0.00	0.13	0.87	0.04	0.03	0.04	0.96	0.00	0.00	0.15

HO = Harvested out TO =Transferred out

Regional monthly means for one-sea-winter salmon

L. salmonis ovigerous and mobile monthly mean data for one-sea-winter salmon regionally are shown in Figures 4 and 5. In the spring period of 2012 the ovigerous mean levels did not reach TTL at all in the Southwest. Sea lice levels reached a mean of 0.62 ovigerous *L. salmonis* in the West in May and were 0.66 and 0.82 in April and May, respectively, in the Northwest. Outside the spring regional mean ovigerous *L. salmonis* levels were in excess of TTL from January, September, October and November in the West, and in January and June through to November in the Northwest.

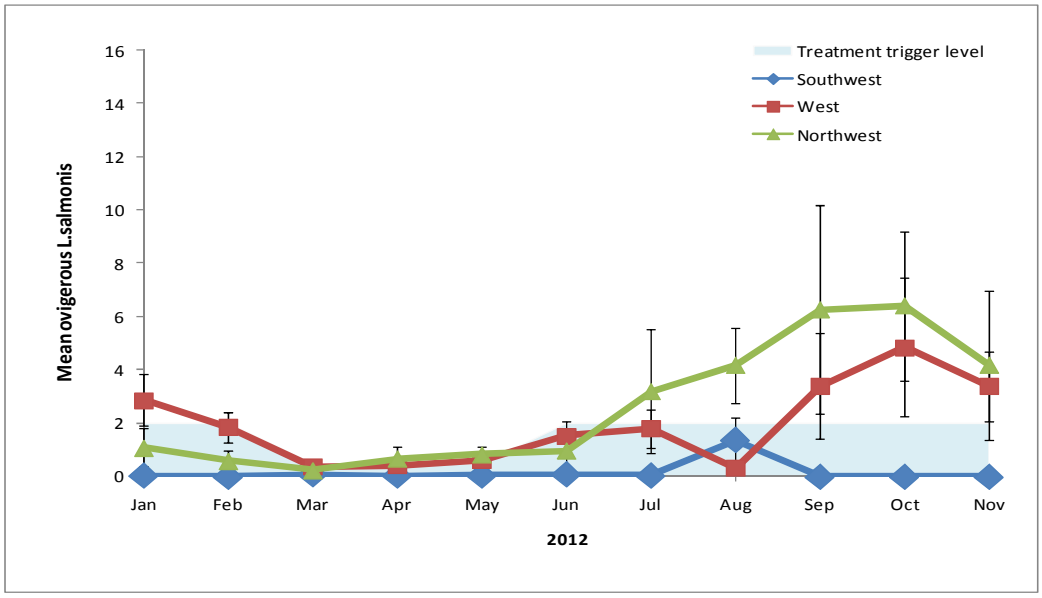


Figure 4. Mean (SE) ovigerous *L. salmonis* per month per region in 2012 on one-sea-winter fish.

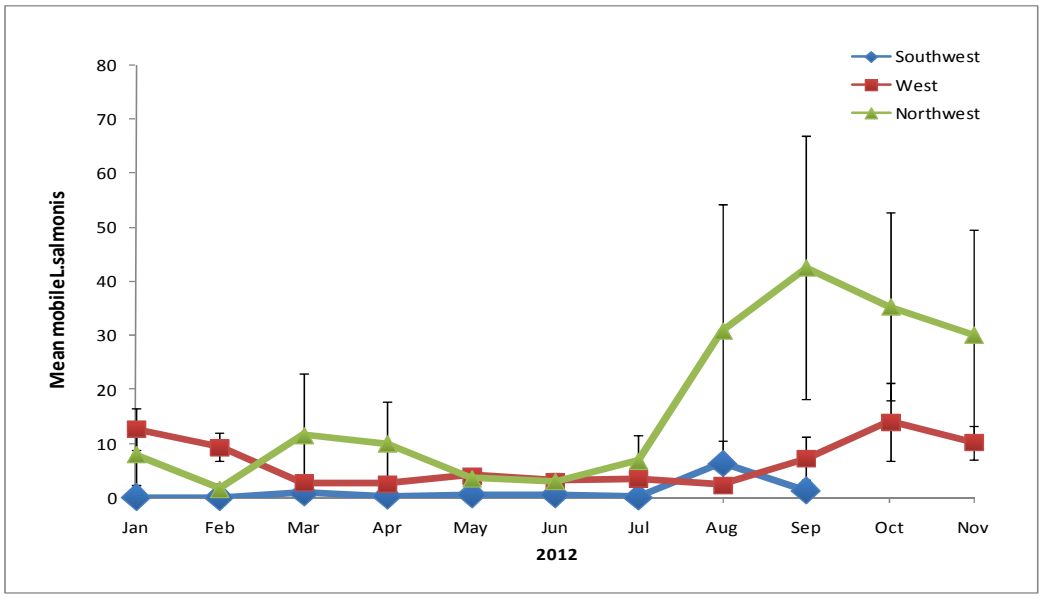


Figure 5. Mean (SE) mobile *L. salmonis* per month per region in 2012 on one-sea-winter fish.

Total mobile *L. salmonis* levels exceeded 10 sea lice per fish in January, October and November in the West and in March and August to November in the Northwest. Total regional mean mobile *L. salmonis* levels peaked at 6.36 mobile sea lice per fish in the Southwest, 14.14 mobile sea lice per fish in the West and at 42.57 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 6 and 7 for one-sea-winter salmon in the month of May from 1991 to 2012.

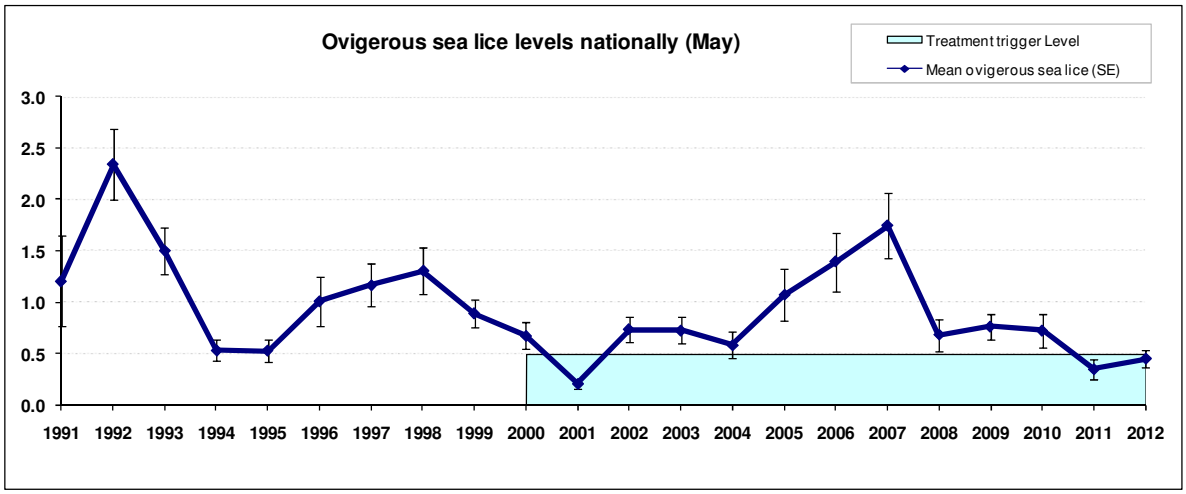


Figure 6. Annual trend (May mean) (SE) ovigerous *L. salmonis* on one-sea-winter salmon.

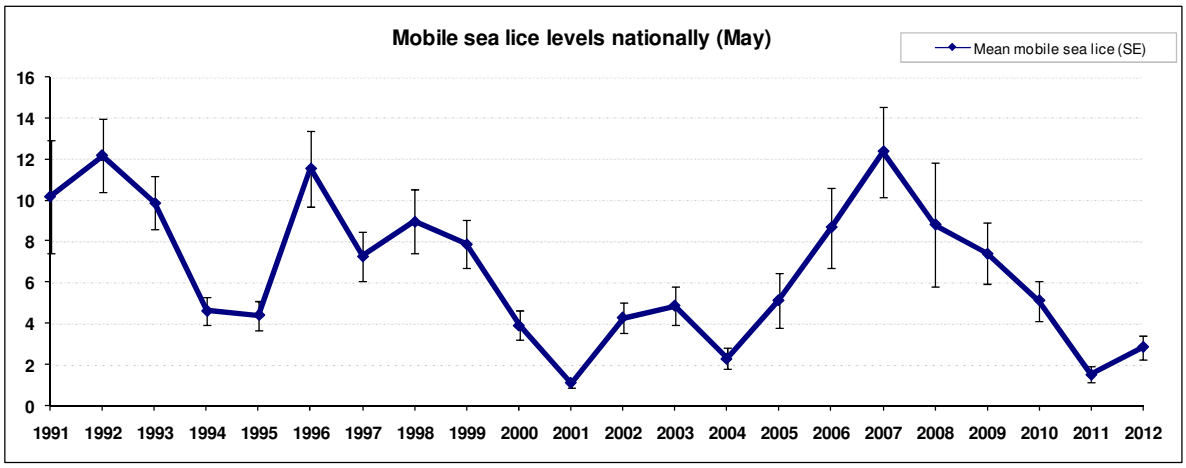


Figure 7. Annual trend (May mean) (SE) mobile *L. salmonis* on one-sea-winter salmon.

Mean ovigerous *L. salmonis* levels in 2012 were slightly higher than the previous year's at 0.45 *L. salmonis* per fish. Total mobile levels also increased from 1.51 total mobile sea lice per fish in 2011 to 2.84 total mobile sea lice per fish in 2012.

DISCUSSION

Sea lice levels on smolts in 2012 continue to show low levels of infestation as has been the case in previous years. Ninety eight percent of sea lice inspections of smolts were below the treatment trigger levels (TTL), this compares with 97 % in 2011 and 96% in 2010.

Seventy-four percent of inspections were below TTL on one-sea-winter salmon compared to 80% in 2011 and 68% in 2010. Sea lice levels on one-sea-winter salmon during the critical spring period were below TTL for 72% of inspections in the West, 58% in the Northwest and 100% in the Southwest. Sea Lice levels in the West and Northwest increased slightly in 2012, this is reflected in a small decrease in the number of inspections that were below TTLs, as compared to 2011 where 84% of inspections were below the treatment trigger level in the West and 67% in the Northwest. The Southwest continued to have no breaches of protocol levels in 2012, which was also the case in 2011 and 2010. The levels for one-sea-winter salmon for the rest of the year show that 58% of inspections were below TTL in the West, 56% were below in the Northwest and 100% in the Southwest. These compare to 68% in the West, 62% below in the Northwest and 100% in the Southwest during 2011. Sea lice levels in excess of 10 *L. salmonis* mobiles per fish on one-sea-winter fish nationally were recorded on 17 occasions compared to 11 occasions in 2011 and 22 in 2010, 9 of these inspections had means of greater than 20 mobile *L. salmonis* per fish which was higher than 2011, when 5 inspection recorded lice levels in excess of 20 mobile *L. salmonis* per fish and 12 occasions in 2010. For one-sea-winter salmon the highest mean sea lice level recorded was 71.72 mobile *L. salmonis* per fish, this compares to 43.36 mobile *L. salmonis* per fish in 2011and 43.57 mobile *L. salmonis* per fish in 2010.

Forty-three percent of inspections of two-sea-winter salmon were below treatment trigger levels compared to 50% in 2011 and 60% in 2010.

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.

Regionally sea lice levels in 2012 have increased as compared to 2011 particularly in the Northwest, an increase was also evident in the West. While sea lice levels have increased slightly, the May mean annual trends of *L. salmonis* ovigerous sea lice levels for one sea

winter remains within the TTL set out in the Monitoring protocol and is the third lowest level recorded since the Monitoring programme began in 1991.

Control of sea lice levels proved difficult in some areas of the country for periods throughout 2012 due to fish health problems, however the treatments used to combat these issues in some cases may have had a reducing effect on the numbers of sea lice, e.g. the use of freshwater and hydrogen peroxide for the treatment of Amoebic Gill Disease .

A regular on-farm sea lice monitoring programme and a proactive treatment regime has proven to be essential to prevent the increase of sea lice populations. Alternating the use of treatments and targeting treatments effectively on developing sea lice infestations is vital to achieving a successful result and in prolonging the effective life of the treatments. For those bays where there is more than one operator the Single Bay Management Process is crucial to achieving successful sea lice control as synchronous bay-wide treatments are required for maximum effectiveness. Fallowing, separation of generations and the early harvest of two-sea-winter fish have also proven to be key elements in an integrated approach to sea lice control.

GLOSSARY

Grower:	A fish which has been at sea for one complete year or longer.
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 2012.

	Date	*Lepeophtheirus salmonis*		*Caligus elongatus*	
		F + eggs	Total	F + eggs	Total
BANTRY BAY					
MURPHY'S IRISH SEAFOOD LTD.					
Cuan Baoi					
Atlantic Salmon, 2011 S1/2	09/01/2012	0.00	0.00	0.77	2.03
	20/02/2012	0.00	0.00	0.43	2.23
	05/03/2012	0.00	0.02	1.70	8.97
	22/03/2012	0.00	0.12	2.94	10.67
	11/04/2012	0.00	0.00	3.08	8.09
	25/04/2012	0.00	0.03	1.80	3.13
	09/05/2012	0.04	0.07	1.42	7.44
	24/05/2012	0.00	0.05	3.40	7.92
	19/06/2012	0.00	0.03	1.37	3.53
	03/07/2012	0.05	0.10	2.35	8.75
	07/08/2012	0.10	0.19	1.67	2.52
				Harvested Out	
Atlantic Salmon, 2012 S1/2	20/02/2012	0.00	0.00	0.00	0.00
	05/03/2012	0.00	0.00	0.00	0.18
	22/03/2012	0.00	0.00	0.07	0.17
	11/04/2012	0.00	0.00	0.49	1.97
	25/04/2012	0.00	0.00	0.53	1.09
	09/05/2012	0.00	0.00	0.54	3.87
	24/05/2012	0.00	0.00	0.12	0.38
	19/06/2012	0.00	0.00	0.79	1.82
	03/07/2012	0.00	0.03	5.65	18.16
	07/08/2012	0.00	0.12	4.58	9.27
	17/09/2012	0.00	0.00	0.00	0.00
	19/10/2012	0.00	0.00	0.03	0.03
	07/11/2012	0.00	0.00	0.13	0.61
SILVER KING SEAFOODS LTD.					
Roancarraig					
Atlantic Salmon, 2011 S1/2	10/01/2012	0.00	0.04	1.45	5.16

	Date	*Lepeophtheirus salmonis*		*Caligus elongatus*	
		F + eggs	Total	F + eggs	Total
	21/02/2012	0.00	0.00	0.11	0.24
	06/03/2012	0.00	0.02	0.63	3.18
	23/03/2012	0.00	0.04	2.97	8.12
	12/04/2012	0.00	0.00	1.49	3.22
	25/04/2012	0.02	0.06	1.26	3.10
	16/05/2012	0.02	0.16	1.21	3.29
	25/05/2012	0.02	0.06	0.90	1.90
	20/06/2012	0.00	0.02	0.59	1.51
	04/07/2012	0.00	0.00	0.82	3.13
			Harvested Out		
Atlantic Salmon, 2012 S1/2	10/01/2012	0.00	0.00	0.58	1.58
	21/02/2012	0.00	0.00	0.00	0.03
	06/03/2012	0.00	0.02	0.03	0.17
	23/03/2012	0.00	0.01	0.10	1.16
	12/04/2012	0.00	0.00	0.05	0.12
	25/04/2012	0.00	0.00	0.08	1.12
	16/05/2012	0.00	0.00	0.17	0.44
	25/05/2012	0.00	0.00	1.05	2.40
	20/06/2012	0.00	0.02	0.39	1.11
	04/07/2012	0.00	0.00	3.52	7.61
	07/08/2012	0.00	0.05	3.15	7.45
	18/09/2012	0.07	0.13	0.24	0.78
	19/10/2012	0.00	0.00	0.28	0.61
	08/11/2012	0.00	0.03	0.46	1.02
KENMARE BAY					
Deenish					
Atlantic Salmon, 2011	11/01/2012	0.05	0.10	0.72	1.75
			Transferred to Inishfarnard		
Atlantic Salmon, 2012	11/04/2012	0.00	0.02	0.03	0.76
	24/04/2012	0.00	0.05	0.05	0.23
	09/05/2012	0.00	0.04	0.10	0.21
	24/05/2012	0.00	0.00	0.07	0.11
	19/06/2012	0.00	0.00	0.01	0.02
	03/07/2012	0.00	0.00	0.16	0.41
	08/08/2012	0.00	0.16	0.55	1.52

	Date	*Lepeophtheirus salmonis*		*Caligus elongatus*	
		F + eggs	Total	F + eggs	Total
	19/09/2012	0.14	0.65	0.00	0.00
	19/10/2012	0.08	0.12	0.00	0.04
	08/11/2012	0.06	0.10	0.02	0.03
Inishfarnard					
Atlantic Salmon, 2010	10/01/2012	0.16	0.29	1.50	2.15
	28/02/2012	0.80	4.73	5.13	10.93
			Harvested Out		
Atlantic Salmon, 2011	21/02/2012	0.00	0.16	0.15	1.02
	06/03/2012	0.00	2.73	2.49	9.70
	23/03/2012	0.39	2.55	3.08	5.76
	12/04/2012	0.00	0.11	0.00	0.14
	24/04/2012	0.02	1.42	0.99	3.57
	10/05/2012	0.15	3.05	5.73	12.48
	25/05/2012	0.00	0.03	0.17	0.32
	20/06/2012	0.19	1.36	1.66	3.30
	04/07/2012	0.07	0.40	2.11	3.48
	07/08/2012	1.98	9.44	2.16	4.71
	18/09/2012	0.00	1.29	0.00	0.00
			Harvested Out		
KILKIERAN BAY					
MUIRACHMHAINNI TEO.					
Daonish					
Atlantic Salmon, 2011	12/01/2012		Sampled Atlantic salmon 2011 S1/2		
	07/02/2012		Sampled Atlantic salmon 2011 S1/2		
	13/03/2012	0.26	0.78	0.15	0.26
	28/03/2012	0.11	1.39	0.00	0.00
	11/04/2012		Sampled Atlantic salmon 2011 S1/2		
	30/04/2012		Sampled Atlantic salmon 2011 S1/2		
	15/05/2012		Sampled Atlantic salmon 2011 S1/2		
	29/05/2012	0.43	1.13	0.00	0.00
	19/06/2012	1.15	2.27	0.19	0.23
	19/07/2012	1.57	2.90	1.38	1.62
			Harvested Out		
Atlantic Salmon, 2011 S1/2	12/01/2012	0.13	1.19	0.20	0.65
	07/02/2012	0.23	1.73	0.24	0.52

	Date	*Lepeophtheirus salmonis*		*Caligus elongatus*	
		F + eggs	Total	F + eggs	Total
	13/03/2012	0.33	0.80	0.03	0.07
	28/03/2012	0.18	0.85	0.00	0.09
	11/04/2012	0.47	2.25	0.03	0.12
	30/04/2012	0.27	1.16	0.02	0.02
	15/05/2012	1.38	2.48	0.07	0.18
	29/05/2012	0.33	0.93	0.00	0.00
	19/06/2012	Sampled Atlantic salmon 2011			
	19/07/2012	0.57	0.78	0.13	0.26
		Harvested Out			

BERTRAGHBOY BAY

COMHLUCHT BRADAIN CHONAMARA TEO

Sealax

Atlantic Salmon, 2012 S1/2	09/12/2011	0.00	0.00	0.00	0.09
	06/02/2012	0.00	0.11	0.03	0.10
	13/03/2012	0.00	0.00	0.02	0.16
	28/03/2012	0.00	0.00	0.07	0.10
	04/04/2012	0.00	0.03	0.07	0.12
	23/04/2012	0.00	0.00	0.07	0.12
	10/05/2012	0.00	0.00	0.06	0.07
	21/05/2012	0.00	0.02	0.07	0.12
	28/06/2012	0.00	0.00	0.47	0.58
	17/07/2012	0.02	0.11	0.55	2.21
	24/08/2012	0.00	0.10	0.00	0.02
	20/09/2012	0.00	0.11	0.06	0.15
	19/10/2012	0.04	0.04	0.20	0.35
	14/11/2012	0.15	0.47	0.86	1.74

MANNIN BAY

MANNIN BAY SALMON COMPANY LTD.

Corhounagh

Atlantic Salmon, 2010	Harvested Out				
Atlantic Salmon, 2011	27/08/2012	0.33	4.48	0.00	0.00
	28/09/2012	6.74	14.10	0.02	0.06

	Date	*Lepeophtheirus salmonis*		*Caligus elongatus*	
		F + eggs	Total	F + eggs	Total
	24/10/2012	9.36	26.59	0.00	0.00
	16/11/2012	5.56	15.23	0.00	0.00
Atlantic Salmon, 2011 S1/2	12/03/2012	0.15	2.81	0.00	0.00
	27/03/2012	0.09	3.79	0.00	0.00
	04/04/2012	0.38	5.14	0.00	0.03
	24/04/2012	1.26	3.89	0.00	0.00
	10/05/2012	0.36	3.51	0.00	0.00
	25/05/2012	1.10	7.01	0.00	0.00
	20/06/2012	1.17	2.80	0.00	0.02
	27/07/2012	3.99	7.81	0.08	0.16
			Harvested Out		

CLIFDEN BAY

Hawks Nest

Atlantic Salmon, 2011	24/01/2012	2.61	15.43	0.00	0.00
	14/02/2012	2.63	8.86	0.00	0.00
	06/03/2012	0.26	2.09	0.00	0.00
	27/03/2012	0.40	3.84	0.00	0.00
	13/04/2012	0.15	4.49	0.00	0.02
	25/04/2012	0.57	2.67	0.00	0.00
	14/05/2012	0.44	7.43	0.00	0.00
	25/05/2012	0.90	10.43	0.03	0.07
	22/06/2012	3.52	7.20	0.02	0.05
			Transferred to Corhounagh		

BALLINAKILL HARBOUR

BIFAND LTD.

Fraochoilean

Atlantic Salmon, 2011 S1/2	27/01/2012	6.68	27.86	0.00	0.00
	09/02/2012	4.08	23.16	0.00	0.00
	23/02/2012	1.72	6.35	0.00	0.00
	01/03/2012	0.65	6.81	0.00	0.00
			Transferred to Corhounagh		

	Date	*Lepeophtheirus salmonis*		*Caligus elongatus*	
		F + eggs	Total	F + eggs	Total
KILLARY HARBOUR					
MARINE HARVEST IRL.					
Rosroe					
Atlantic Salmon, 2010	24/01/2012	9.72	37.11	0.02	0.06
	15/02/2012	3.30	24.02	0.04	0.07
			Harvested Out		
ROSROE SALMON LTD.					
Inishdeighil					
Atlantic Salmon, 2012	03/05/2012	0.00	0.02	0.01	0.04
	18/05/2012	0.00	0.00	0.00	0.00
	15/06/2012	0.00	0.00	0.12	0.22
	06/07/2012	0.00	0.05	0.58	1.29
	17/08/2012	0.00	0.05	0.00	0.00
	19/09/2012	0.00	0.00	0.00	0.02
	23/10/2012	0.00	0.10	0.07	0.24
	28/11/2012	0.00	0.25	0.59	1.30
CLEW BAY					
CLARE ISLAND SEAFARMS LTD.					
Clare Island Smolt Site					
Atlantic Salmon, 2012	02/05/2012	0.00	0.17	0.00	0.04
	18/05/2012	0.00	0.05	0.00	0.00
	19/06/2012	0.00	0.21	0.08	0.29
	27/07/2012	0.02	0.16	0.12	0.16
	21/08/2012	0.00	0.00	0.12	0.12
			Transferred to Seastream Inner		
Portlea					
Atlantic Salmon, 2011	09/01/2012	2.08	6.35	0.52	1.13
	29/02/2012	0.59	6.90	0.00	0.00
	16/03/2012	0.78	2.40	0.00	0.00
	30/03/2012	0.48	1.50	0.00	0.00
	19/04/2012	0.19	0.67	0.00	0.00

	Date	*Lepeophtheirus salmonis*		*Caligus elongatus*	
		F + eggs	Total	F + eggs	Total
	27/04/2012	0.08	1.55	0.02	0.02
	02/05/2012	0.12	1.02	0.02	0.04
	18/05/2012	0.30	0.93	0.00	0.00
	19/06/2012	0.10	0.23	0.00	0.05
	27/07/2012	0.31	0.95	1.03	1.44
	21/08/2012	0.29	0.39	0.31	0.39
	21/09/2012	0.05	0.37	0.00	0.00
	05/10/2012	0.34	1.69	0.00	0.00
	14/11/2012	1.20	5.28	0.07	0.33
Seastream Inner					
Atlantic Salmon, 2012	20/09/2012	0.00	0.05	0.00	0.00
	10/10/2012	0.00	0.66	0.00	0.00
	30/11/2012	0.30	4.46	0.71	1.36
CURRAUN BLUE LTD.					
Seastream Outer					
Rainbow Trout, 2011 (1)	26/01/2012	0.00	0.55	0.05	0.20
	28/02/2012	0.12	1.08	0.04	0.08
	13/03/2012	0.20	0.44	0.00	0.00
			Harvested Out		
BEALACRAGHER BAY					
CURRAN FISHERIES LTD.					
Curraun					
Rainbow Trout, 2010 (2)			Harvested Out		
CURRAUN BLUE LTD.					
Rainbow Trout, 2011 (1)	26/01/2012	0.18	1.34	0.00	0.02
	28/02/2012	0.12	0.72	0.00	0.00
	09/03/2012	0.07	0.70	0.00	0.00
	29/03/2012	0.08	0.33	0.00	0.00
	11/04/2012	0.07	0.67	0.00	0.00
	27/04/2012	0.20	0.60	0.00	0.00
	11/05/2012	0.17	1.00	0.00	0.00
	24/05/2012	0.20	1.79	0.00	0.00
	18/06/2012	0.87	3.50	0.00	0.00

	Date	*Lepeophtheirus salmonis*		*Caligus elongatus*	
		F + eggs	Total	F + eggs	Total
	16/07/2012	2.57	9.27	0.00	0.00
			Harvested Out		
Rainbow Trout, 2012 (1)	11/04/2012	0.00	0.39	0.00	0.00
	27/04/2012		Sampled Rainbow Trout, 2011 (1)		
	11/05/2012	0.00	0.76	0.00	0.00
	24/05/2012	0.00	0.23	0.00	0.00
	18/06/2012	0.00	0.70	0.00	0.00
	16/07/2012	0.70	3.27	0.00	0.00
	31/08/2012		Missed due to technical reasons		
	28/09/2012		Missed due to technical reasons		
	18/10/2012	0.06	0.52	0.00	0.00
	22/11/2012	0.24	6.80	0.00	0.00

DONEGAL BAY

EANY FISH PRODUCTS LTD.

Eany

Rainbow Trout, 2011 (2)	11/01/2012	1.76	9.37	0.00	0.00
	07/02/2012	0.87	4.20	0.03	0.07
	01/03/2012	0.42	3.73	0.06	0.06
	15/03/2012	0.52	5.09	0.00	0.09
			Harvested Out		
Rainbow Trout, 2012 (1)	11/01/2012	0.35	3.99	0.00	0.00
	07/02/2012	0.15	0.80	0.00	0.02
	01/03/2012	0.04	1.69	0.00	0.02
	15/03/2012	0.11	3.71	0.06	0.25
	11/04/2012	0.08	0.28	0.00	0.00
	24/04/2012	0.00	0.02	0.00	0.00
	09/05/2012	0.00	0.00	0.00	0.00
	29/05/2012	0.00	0.00	0.00	0.00
	13/06/2012	0.00	0.03	0.00	0.02
	17/07/2012	0.02	0.22	0.09	0.12
	15/08/2012	0.00	0.09	0.03	0.03
	20/09/2012	0.00	0.00	0.00	0.00
	09/10/2012	0.00	0.23	0.00	0.00
			Harvested Out		

	Date	*Lepeophtheirus salmonis*		*Caligus elongatus*		
		F + eggs	Total	F + eggs	Total	
Rainbow Trout, 2012 (2)	29/05/2012	0.00	0.00	0.00	0.00	
	13/06/2012	0.00	0.00	0.00	0.04	
	17/07/2012	0.02	0.23	0.19	0.27	
	15/08/2012	0.03	0.08	0.22	0.24	
	20/09/2012	0.00	0.00	0.00	0.00	
	09/10/2012	0.00	0.32	0.00	0.00	
	14/11/2012	0.16	0.97	0.00	0.00	
OCEAN FARM LTD.						
Mc Swynes						
Atlantic Salmon, 2011	16/01/2012	0.48	1.79	0.00	0.00	n=8
	07/02/2012	0.11	0.67	0.08	0.13	
	01/03/2012	0.14	41.43	1.86	5.87	
	29/03/2012	0.00	0.10	0.11	0.15	
	11/04/2012	0.00	0.17	0.15	0.89	
	24/04/2012	0.12	2.18	1.42	2.67	
	09/05/2012	0.12	0.61	0.79	1.15	
	29/05/2012	0.44	0.69	0.56	0.81	
	13/06/2012	0.27	1.31	1.23	2.58	
	18/07/2012	0.34	1.20	0.00	0.02	
	17/08/2012	2.50	6.29	0.50	0.78	
	26/09/2012	1.50	13.42	0.00	0.00	
	09/10/2012	3.49	16.72	0.00	0.00	
	14/11/2012	0.07	0.40	0.00	0.00	
Ocean Inver						
Atlantic Salmon, 2010				Harvested Out		
Atlantic Salmon, 2012	11/04/2012	0.00	0.24	0.11	0.61	
	24/04/2012	0.00	0.09	0.45	0.88	
	09/05/2012	0.00	0.06	0.51	0.72	
	29/05/2012	0.00	0.00	0.39	0.46	
	13/06/2012	0.00	0.06	0.50	0.72	
	17/07/2012	0.03	0.20	1.90	3.40	
	17/08/2012	0.07	0.18	0.67	0.91	
	20/09/2012	0.00	0.00	0.02	0.02	
	09/10/2012	0.02	0.13	0.02	0.02	

	Date	*Lepeophtheirus salmonis*		*Caligus elongatus*	
		F + eggs	Total	F + eggs	Total
	14/11/2012	0.00	0.84	0.05	0.09
MULROY BAY					
MARINE HARVEST IRL.					
Cranford A					
Atlantic Salmon, 2012 S1/2	10/01/2012	0.27	2.94	0.00	0.00
	16/02/2012	0.14	3.26	0.00	0.00
	16/03/2012	0.05	7.95	0.00	0.00
	30/03/2012	0.09	13.15	0.02	0.08
	12/04/2012	0.09	6.95	0.00	0.05
	27/04/2012	0.07	3.17	0.02	0.07
	09/05/2012	0.05	3.35	0.00	0.03
	29/05/2012	0.08	1.62	0.00	0.00
	28/06/2012	0.09	0.62	0.04	0.08
	18/07/2012	0.18	3.59	0.42	1.76
	16/08/2012	2.59	10.17	0.00	0.06
	21/09/2012	10.79	58.06	0.11	0.36
	24/10/2012	0.94	6.03	0.03	0.03
	13/11/2012	0.33	19.67	0.09	0.09
Glinsk					
Atlantic Salmon, 2011	10/01/2012	1.70	14.37	0.24	0.91
			Transferred to Lough Swilly		
Atlantic Salmon, 2012	09/05/2012	0.01	0.62	0.00	0.01
	29/05/2012	0.02	0.68	0.00	0.05
	28/06/2012	0.03	0.51	0.10	0.14
	18/07/2012	0.02	0.27	0.12	0.56
	16/08/2012	0.89	3.70	0.60	1.09
	21/09/2012	0.41	2.35	0.00	0.00
	24/10/2012	0.83	6.38	0.00	0.03
	13/11/2012	0.19	2.22	0.02	0.13
Millstone					
Atlantic Salmon, 2010	16/02/2012	1.79	9.53	0.05	0.05
	16/03/2012	2.05	15.80	0.05	0.15
	30/03/2012	1.29	6.24	0.00	0.05

	Date	*Lepeophtheirus salmonis*		*Caligus elongatus*	
		F + eggs	Total	F + eggs	Total
			Harvested Out		
LOUGH SWILLY					
Lough Swilly					
Atlantic Salmon, 2011	16/02/2012	1.05	2.77	0.00	0.00
	16/03/2012	0.36	1.97	0.07	0.17
	30/03/2012	0.50	3.05	0.07	0.09
	12/04/2012	0.80	7.25	0.19	0.27
	27/04/2012	1.72	30.33	0.42	1.47
	09/05/2012	1.04	6.05	0.00	0.05
	29/05/2012	1.15	4.36	0.02	0.03
	06/06/2012	1.63	4.87	0.00	0.03
	27/07/2012	6.04	12.67	0.02	0.04
	16/08/2012	5.87	55.55	0.34	0.96
	21/09/2012	11.05	71.72	0.00	0.00
	24/10/2012	9.35	54.00	0.00	0.00
	13/11/2012	6.23	44.88	0.03	0.15

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