NATIONAL SURVEY OF SEA LICE (*LEPEOPHTHEIRUS SALMONIS* KRØYER AND *CALIGUS ELONGATUS* NORDMANN) ON FISH FARMS IN IRELAND – 2010

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INTRODUCTION

Sea lice infestation presents one of the greatest challenges to marine salmonid fin-fish farming in Ireland. Sea lice are an ectoparasite which occur on many fish worldwide and are regarded as having the most commercially damaging effect on cultured salmon, with major economic losses to the fish farming community resulting each year (Bristow and Berland, 1991; Jackson and Costello, 1991). There are two species of sea lice found on cultured salmonids in Ireland, *Caligus elongatus* Nordmann, a species of parasite that infests 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 and field investigations carried out in Norway, heavy infestation was found to cause fish mortalities (Finstad *et al*., 2000).

L. salmonis has a direct life-cycle (i.e. a single host) with ten stages (Figure 1). Following hatching from paired egg-strings, two free-living nauplii stages 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)

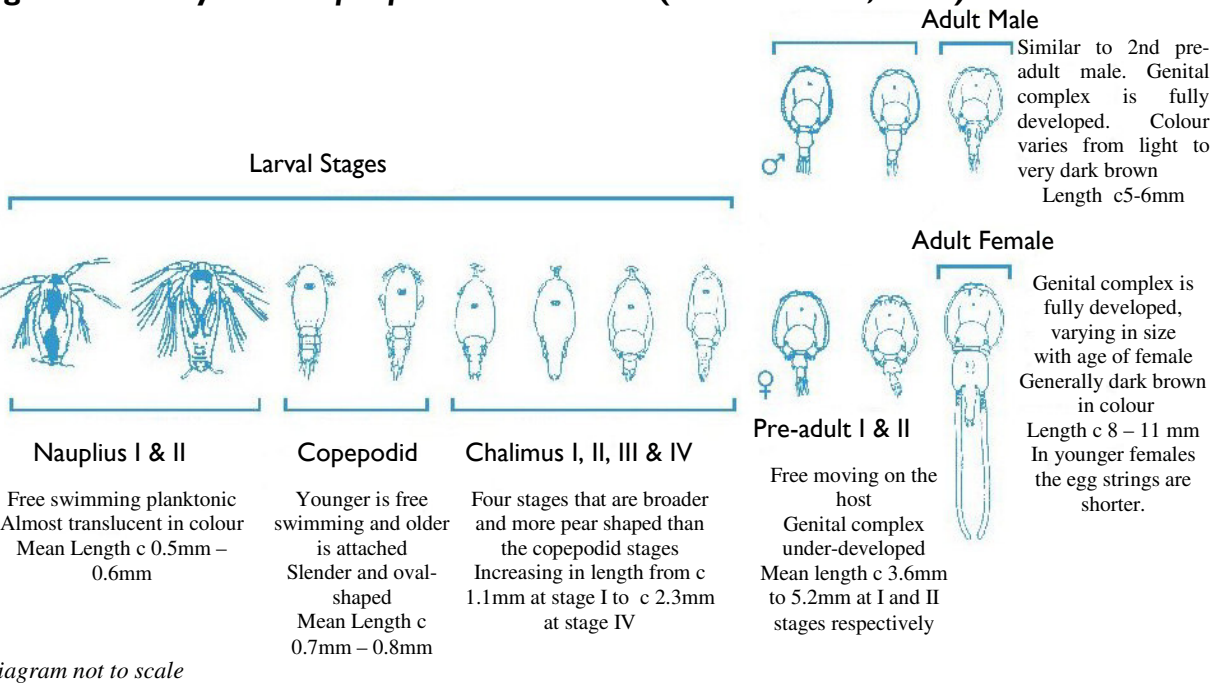
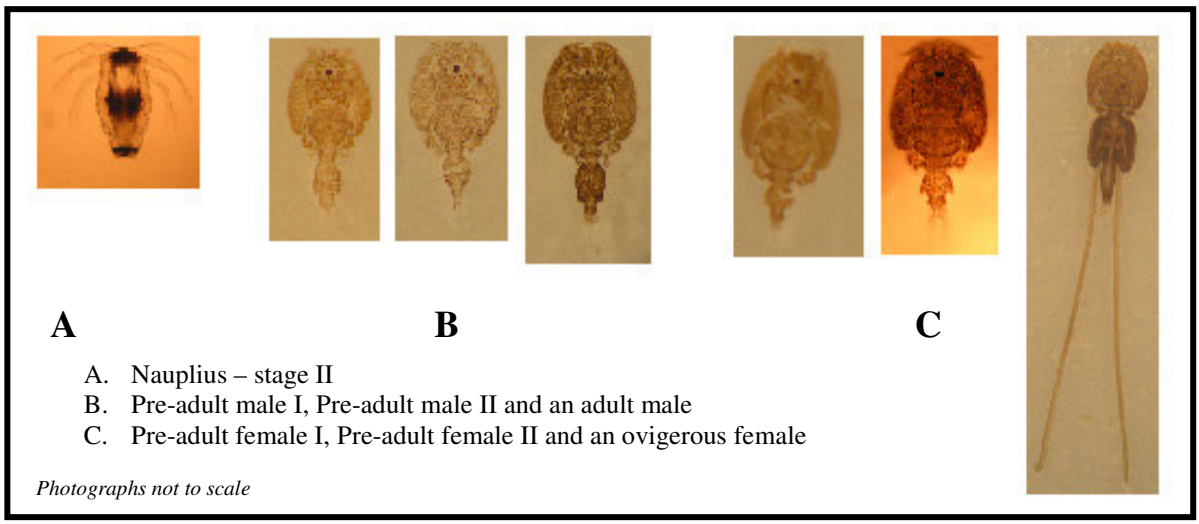


Diagram not to scale

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 then 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 then 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 very 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 purpose 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.*, 2003-2010; 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 visited on 14 occasions throughout the year to monitor sea lice for quantity, species and life stage. Follow-up inspections may be carried out when it is deemed appropriate. Sea lice inspections take place monthly, but with two inspections taking place each month during March, April and May; referred to as the spring period. 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 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 2010, salmonid farms were producing 6 different stocks of fish, namely: 2009 rainbow trout, *Oncorhynchus mykiss* (Walbaum) (rainbow trout first inspected in 2009); 2010 rainbow trout (rainbow trout first inspected in 2010); 2008 Atlantic salmon, *Salmo salar* L. (two-sea-winter salmon), 2009 Atlantic salmon (one-sea-winter salmon), 2010 Atlantic salmon (smolts) and 2011 S½ 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 2010 a total number of 23 sites were inspected around Ireland, see figures 3-5.

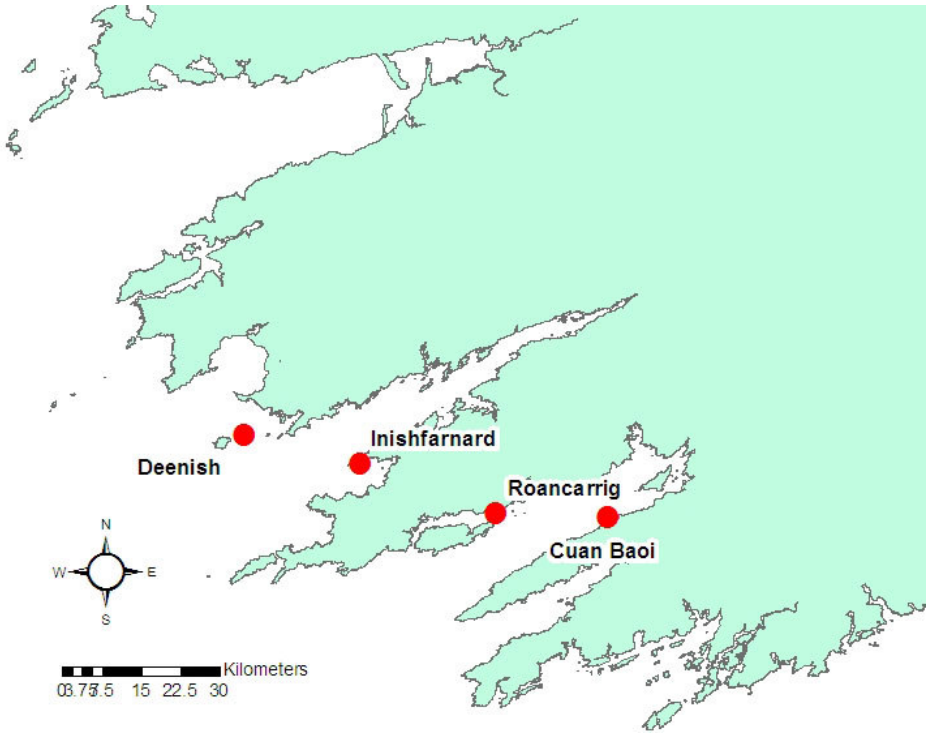


Figure 3. Locations of fish farm sites in the South-western region.

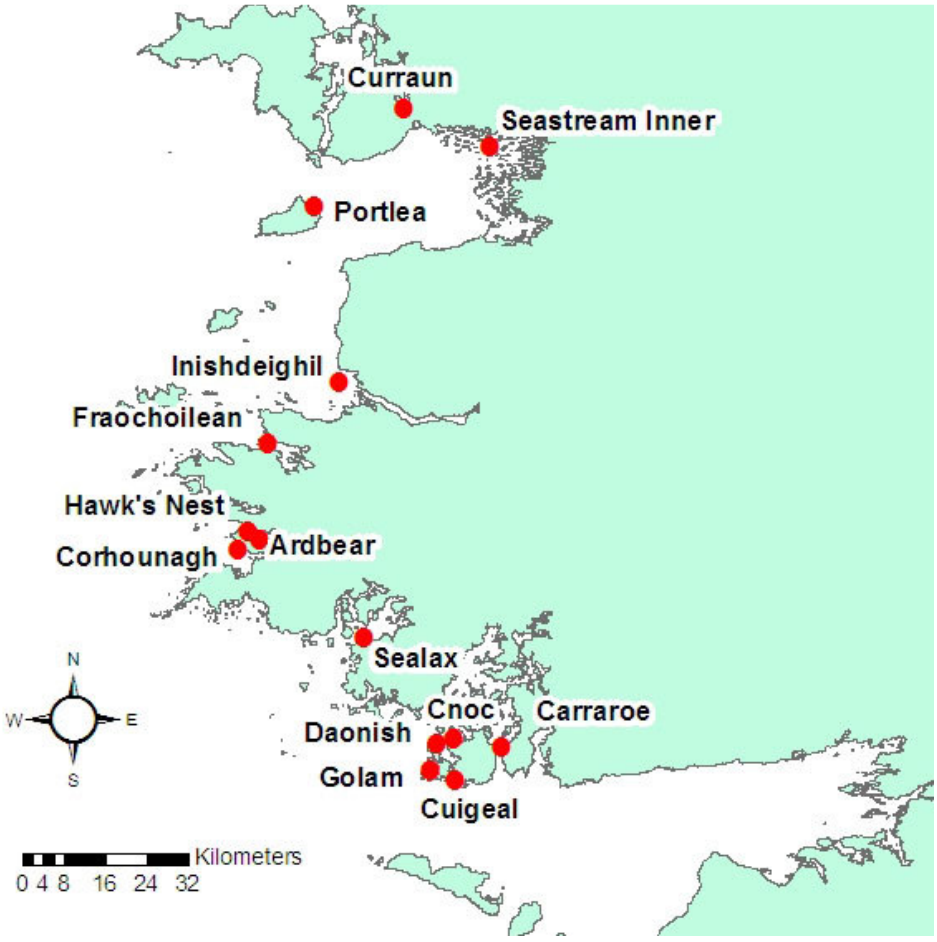


Figure 4. Locations of fish farm sites in the Western region.

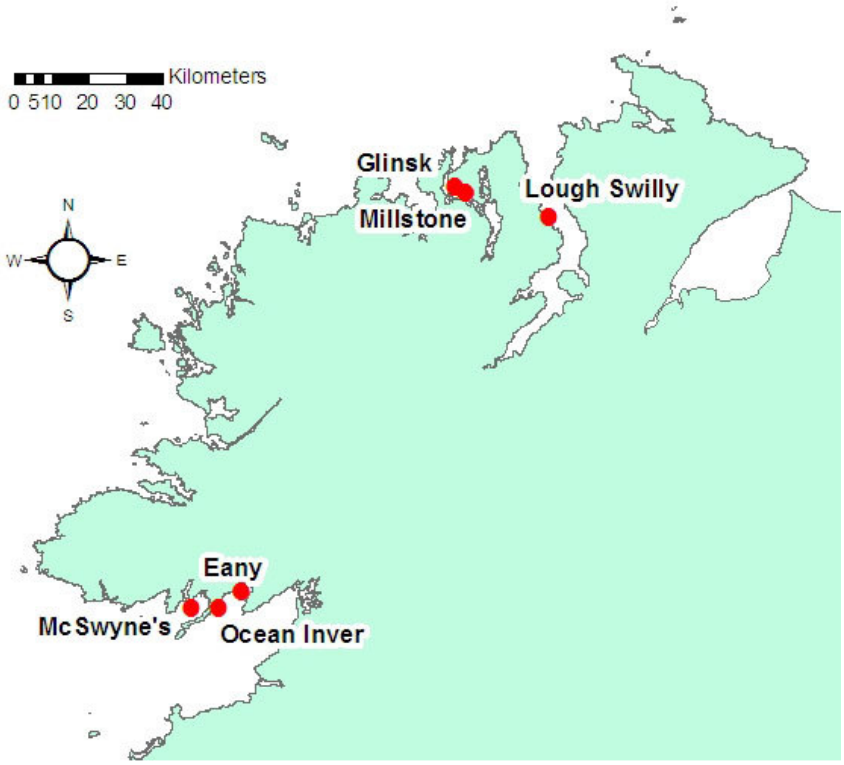


Figure 5. Locations of fish farm sites in North-western region.

RESULTS

In 2010 there were 23 active salmonid sites and 244 sea lice inspections were carried out on these sites. Over 82% of Atlantic salmon samples and 100% 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-six percent of inspections carried out on salmon smolts were below the TTL, 68% of inspections carried out on one-sea-winter salmon were below TTL and 60% of inspections to two-sea-winter salmon were below TTL.

Results of 2010 sea lice inspections for all active salmonid sites for each month are presented in Appendix 1.

Atlantic salmon 2008 (two-sea-winter salmon)

At the beginning of 2010, two-sea-winter salmon were stocked in 4 sites: Inishfarnard, Kenmare Bay; Corhounagh, Mannin Bay; Seastream Inner, Clew Bay; and Lough Swilly. Table 2 contains the number of inspections per site and total number of inspections exceeding the treatment trigger levels.

Table 2. National breakdown of inspections for 2008 salmon on fish farm sites in 2010.

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	1	0	1	0	0%	0%	0%
Southwest		0	0	1	0	1	0	0%	0%	0%
Mannin Bay Salmon Co. Ltd.	**Corhounagh**	0	0	1	1	1	1	0%	100%	100%
Clare Island Seafarms Ltd.	**Seastream Inner**	4	3	2	0	6	3	75%	0%	50%
West		4	3	3	1	7	4	75%	33%	57%
Marine Harvest	**Lough Swilly**	0	0	2	0	2	0	0%	0%	0%
Northwest	**Totals**	0	0	2	0	2	0	0%	0%	0%
National Totals		4	3	6	1	10	4	75%	17%	40%

A total of 10 visits were undertaken to these sites before harvesting was completed, 60% of inspections were below the treatment trigger levels.

Atlantic salmon 2009 (one-sea-winter salmon)

One-sea-winter salmon were stocked in a total of 10 sites in 7 bays in 2010. Eighty-four visits were undertaken to this generation of fish. Four sites, in 3 bays, continued to stock one-sea-winter salmon in November 2010.

Ovigerous *L. salmonis* levels greater than the treatment trigger level were recorded in a total of 27 inspections (32%) 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 13 inspections (31%) and outside of the spring period 14 inspections (33%) were in excess of 2.0 ovigerous female *L. salmonis* per fish.

Table 3. National breakdown of inspections for 2009 salmon on all fish farm sites in 2010.

	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	42	13	42	14	84	27	31%	33%	32%

C. elongatus levels were recorded at numbers greater than 10 per fish on two inspections in March and May. *Caligus elongatus* were common at Cuan Baoi throughout the year and on occasions at other sites.

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 2009 salmon for Southwest sites in 2010.

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%
Southwest	**Totals**	12	0	9	0	21	0	0%	0%	0%

West Region

In the West, *L. salmonis* infestation levels greater than the treatment trigger were recorded on 13 out of 24 inspections (54%) in the spring period and on 14 out of 25 inspections (56%) outside the spring period (see Table 5).

Table 5. Breakdown of inspections for 2009 salmon on West sites in 2010.

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	4	4	0	10	4	67%	0%	40%
Muir Gheal Teo	**Cnoc**	0	0	1	1	1	1	0%	100%	100%
Mannin Bay Salmon Co Ltd	**Corhounagh**	6	2	6	6	12	8	33%	100%	67%
	Hawk's nest	0	0	2	1	2	1	0%	50%	50%
Bifand Ltd	**Fraochoilean**	6	5	4	4	10	9	83%	100%	90%
Clare Island Seafarms Ltd.	**Portlea**	6	2	6	1	12	3	33%	17%	25%
	Seastream Inner	0	0	2	1	2	1	0%	50%	50%
West	**Totals**	24	13	25	14	49	27	54%	56%	55%

At Corhounagh, Mannin Bay, *L. salmonis* exceeded treatment trigger levels for 2 of the 6 inspections in the spring and all 6 of the inspections outside the spring.

Fraochoilean, Ballinakill Harbour, exceeded treatment trigger levels for 5 of the 6 spring inspections in the spring and all 4 of the inspections outside the spring period.

Levels at Daonish, Kilkieran Bay, were in excess of treatment trigger levels for 4 of the 6 inspections in the spring period and 0 of the 4 outside the spring period.

Sea lice levels at Portlea in Clew Bay were in excess of treatment trigger levels for 2 of the 6 inspections in spring and 1 of the 6 inspections outside the spring period.

Cnoc, Kilkieran Bay, was above treatment trigger levels for its only inspection, in December-January prior to harvest. Both Hawk's Nest in Clifden Bay and Seastream Inner in Clew Bay had levels above treatment trigger on 1 of their 2 inspections.

Northwest Region

The treatment trigger levels were not exceeded on any of the 14 inspections in the Northwest during 2010 on one-sea-winter salmon (see Table 6).

Table 6. Breakdown of inspections for 2009 salmon on Northwest sites in 2010.

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	0	14	0	0%	0%	0%
Northwest	**Totals**	6	0	8	0	14	0	0%	0%	0%

Atlantic salmon 2010 (smolts)

A total of 108 visits were made to 14 sites stocking Atlantic salmon 2010 S1 and S½ smolts during the year 2010. *L. salmonis* levels were below the treatment trigger level of 0.5 ovigerous female lice per fish for all of the 40 inspections in the spring period. Outside of this period, levels exceeded 2.0 ovigerous female lice per fish on 4 of the 68 inspections (see Table 7).

Table 7. National breakdown of inspections for 2010 salmon on fish farm sites in 2010.

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	8	0	14	0	0%	0%	0%
Silver King Seafoods Ltd	**Inishfarnard**	1	0	6	0	7	0	0%	0%	0%
	Deenish	3	0	6	0	9	0	0%	0%	0%
Southwest	**Totals**	10	0	20	0	30	0	0%	0%	0%
Muirachmhainni Teo	**Cuigeal**	0	0	4	0	4	0	0%	0%	0%
	Golam	6	0	2	0	8	0	0%	0%	0%
	Daonish	0	0	2	0	2	0	0%	0%	0%
Muir Gheal Teo	**Carraroe**	3	0	6	1	9	1	0%	17%	11%
Comhlucht Bradain Chonamara Teo	**Sealax**	3	0	6	0	9	0	0%	0%	0%
Mannin Bay Salmon Co Ltd	**Hawk's nest**	0	0	6	3	6	3	0%	50%	50%
	Ardbear	6	0	2	0	8	0	0%	0%	0%
Marine Harvest	**Inishdeighil**	2	0	6	0	8	0	0%	0%	0%
West	**Totals**	20	0	34	4	54	4	0%	12%	7%
Ocean Farm ltd.	**Ocean Inver**	4	0	6	0	10	0	0%	0%	0%
Marine Harvest	**Glinsk**	5	0	2	0	7	0	0%	0%	0%
	Lough Swilly	1	0	6	0	7	0	0%	0%	0%
Northwest	**Totals**	10	0	14	0	24	0	0%	0%	0%
National Totals		40	0	68	4	108	4	0%	6%	4%

C. elongatus levels exceeded 10 per fish on 1 occasion in Cuan Baoi in November numbers were generally low throughout the year on 2010 smolts but common at some sites on occasions.

Atlantic salmon 2011 (smolts)

There was one inspection to Atlantic salmon 2011 S½ fish directly after they were put to sea, in November. There were no *L. salmonis* recorded on these fish.

Rainbow trout

In 2010 there was 2 year-classes of rainbow trout (2009 and 2010 rainbow trout) stocked between 2 sites, in 2 bays (Table 8). There were 25 inspections carried out on 2009 rainbow trout, all below treatment trigger levels. A total of 16 inspections were carried out on the 2010 rainbow trout stock and again *L. salmonis* levels did not reach treatment trigger levels on any occasion.

Table 8. National breakdown of inspections for Rainbow Trout on fish farm sites in 2010.

Rainbow Trout 2009 stocked in 2010

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**	6	0	7	0	13	0	0%	0%	0%
Northwest	**Totals**	6	0	7	0	13	0	0%	0%	0%
National Totals		12	0	13	0	25	0	0%	0%	0%

Rainbow Trout 2010 stocked in 2010

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**	1	0	6	0	7	0	0%	0%	0%
West		1	0	6	0	7	0	0%	0%	0%
Eany Fish Products Ltd	**Eany**	3	0	6	0	9	0	0%	0%	0%
Northwest	**Totals**	3	0	6	0	9	0	0%	0%	0%
National Totals		4	0	12	0	16	0	0%	0%	0%

Sampling record

One inspection was missed in 2010 due technical difficulties.

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 18 occasions during the spring period on a bay basis. These occurred in Ballinakill Harbour (3), Mannin Bay (2), Kilkieran Bay (2) and Clew Bay (1). On 14 out of 37 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 (6), Ballinakill Harbour (4), Clew Bay (2), Kilkieran Bay (1) and Clifden Bay (1).

Mean mobile levels per bay in excess of 10 *L. salmonis* per fish were recorded on 19 occasions and 10 of these instances had means of greater than 20 mobile lice per fish. The maximum level recorded was 43.57 mobile sea lice per fish in Mannin Bay in June.

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 2010.

Mean ovigerous *L. salmonis*

	Dec/Jan	*Feb*	*Mar*	*Apr*	*May*	*Jun*	*Jul*	*Aug*	*Sep*	*Oct*	*Nov*
Bantry Bay	0.05	0.14	0.17	0.13	0.16	0.09	0.30	1.00	HO		
Kilkieran Bay	3.54	0.23	0.54	0.34	0.98	0.46	1.00	HO			
Mannin Bay	HO		0.05	0.82	0.70	5.64	6.63	4.32	8.94	8.41	7.04
Clifden Bay	0.55	2.53	HO								
Ballinakill Harbour	6.07	4.63	1.62	1.06	2.18	12.30	14.46	HO			
Clew Bay	1.31	2.82	0.42	0.08	0.61	0.37	1.20	0.79	1.06	0.48	6.05
Donegal Bay	0.03	0.17	0.00	0.00	0.00	0.00	0.04	0.06	0.30	0.39	0.76

Mean mobile *L. salmonis*

	Dec/Jan	*Feb*	*Mar*	*Apr*	*May*	*Jun*	*Jul*	*Aug*	*Sep*	*Oct*	*Nov*
Bantry Bay	0.24	0.43	0.76	0.76	0.88	0.35	0.66	1.17	HO		
Kilkieran Bay	16.88	13.26	9.75	1.78	5.48	1.38	2.91	HO			
Mannin Bay	HO		2.77	4.31	7.43	43.57	13.35	16.97	20.79	16.24	28.72
Clifden Bay	14.16	16.70	HO								
Ballinakill Harbour	22.13	24.70	20.53	28.63	13.43	36.27	38.29	HO			
Clew Bay	6.86	28.70	3.33	4.13	5.55	2.45	2.49	4.06	2.42	2.47	15.75
Donegal Bay	0.54	1.60	0.15	0.10	0.04	0.06	0.04	0.11	0.75	2.53	3.42

Mean ovigerous *C. elongatus*

	Dec/Jan	*Feb*	*Mar*	*Apr*	*May*	*Jun*	*Jul*	*Aug*	*Sep*	*Oct*	*Nov*
Bantry Bay	1.26	1.31	2.42	1.15	1.60	2.23	3.38	5.00	HO		
Kilkieran Bay	0.00	0.02	0.05	0.06	0.33	0.29	2.24	HO			
Mannin Bay	HO		0.00	0.10	0.10	1.34	0.02	0.00	0.02	0.02	0.38
Clifden Bay	0.02	0.00	HO								
Ballinakill Harbour	0.13	0.00	0.00	0.01	0.00	0.12	0.75	HO			
Clew Bay	0.00	0.30	0.04	0.12	0.95	0.60	0.43	5.46	0.76	0.07	1.17
Donegal Bay	0.04	0.14	0.02	0.00	0.16	0.06	0.19	0.45	1.32	1.97	0.00

Mean mobile *C. elongatus*

	Dec/Jan	*Feb*	*Mar*	*Apr*	*May*	*Jun*	*Jul*	*Aug*	*Sep*	*Oct*	*Nov*
Bantry Bay	2.71	5.80	6.05	4.78	3.22	4.93	6.20	8.89	HO		
Kilkieran Bay	0.01	0.04	0.29	0.23	0.53	0.50	3.67	HO			
Mannin Bay	HO		0.00	0.16	0.18	2.50	0.02	0.03	0.02	0.07	0.63
Clifden Bay	0.07	0.16	HO								
Ballinakill Harbour	0.22	0.05	0.03	0.02	0.01	0.26	1.64	HO			
Clew Bay	0.07	1.38	0.40	0.32	2.51	5.39	0.50	9.35	1.03	0.27	2.04
Donegal Bay	0.13	0.21	0.04	0.01	0.43	0.11	0.26	1.00	2.82	4.64	0.02

HO = Harvested 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 2010 the ovigerous mean levels did not reach TTL at all in the Southwest or Northwest. Regional mean ovigerous *L. salmonis* levels were in excess of TTL for all three spring months in 2010 in the West and also all inspections outside the spring period.

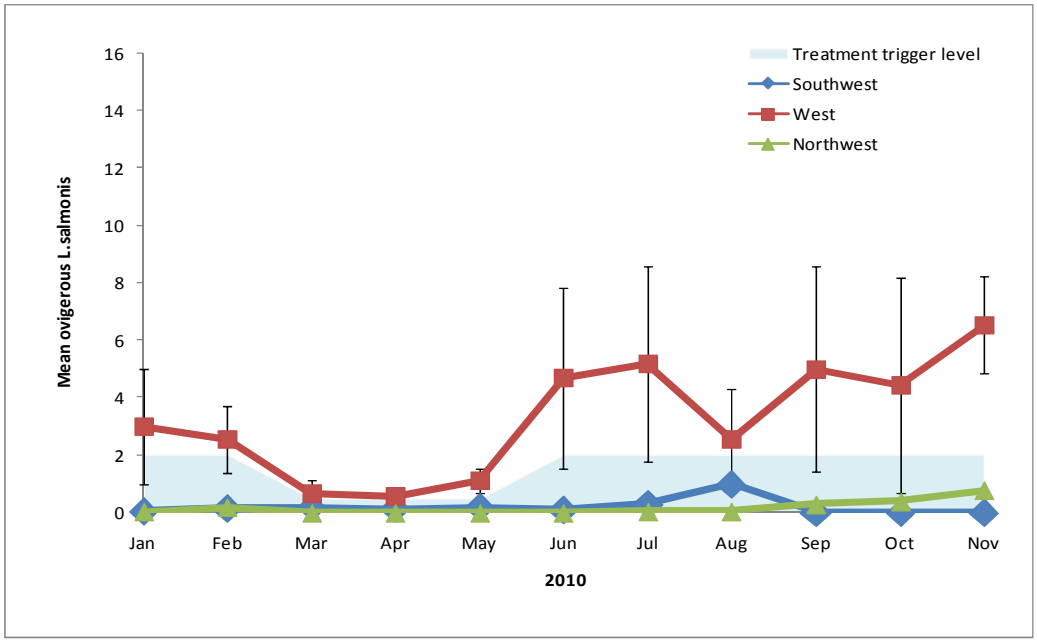


Figure 6. Mean (SE) ovigerous *L. salmonis* per month per region in 2010 on one-sea-winter fish.

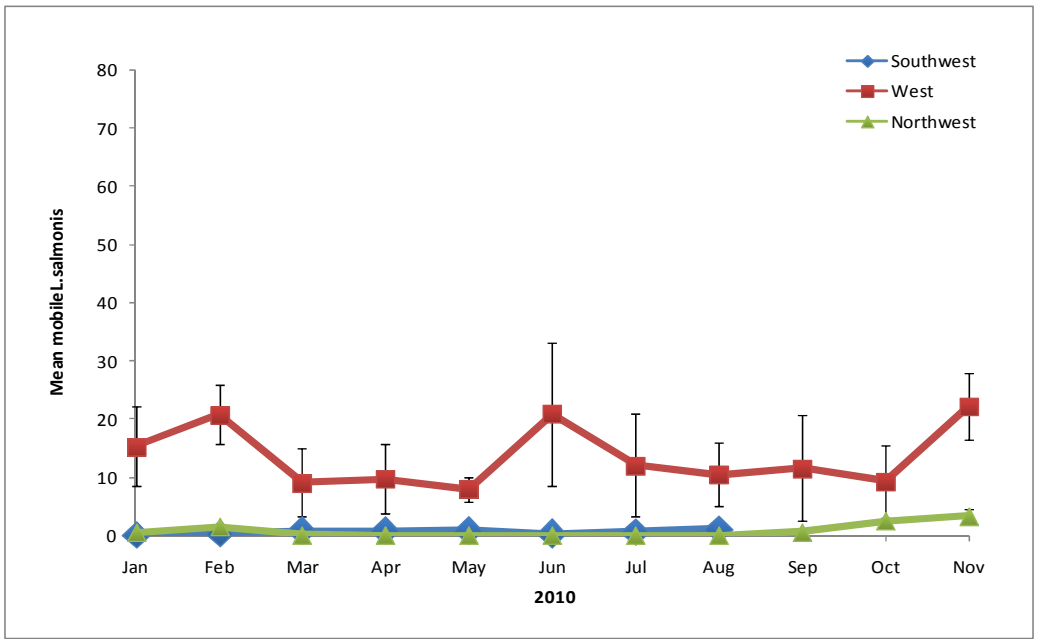


Figure 7. Mean (SE) mobile *L. salmonis* per month per region in 2010 on one-sea-winter fish.

Total mobile *L. salmonis* levels exceeded 10 sea lice per fish in all months except October outside the sping period, in the West and they were just below 10 per fish for each inspection during the spring months in the West region. In the Southwest total mobile levels peaked at 1.17 mobile sea lice per fish and at 3.42 mobile sea lice per fish 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 2010. The mean number of ovigerous and mobile *L. salmonis* per fish are presented.

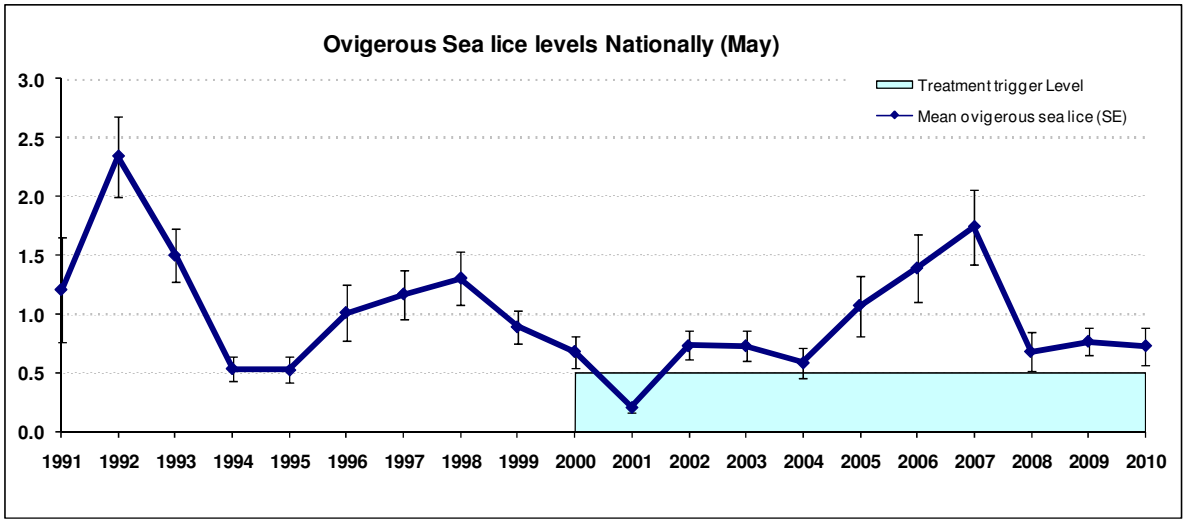


Figure 8. Annual trend (May mean) (SE) ovigerous *L. salmonis* on one-sea-winter salmon.

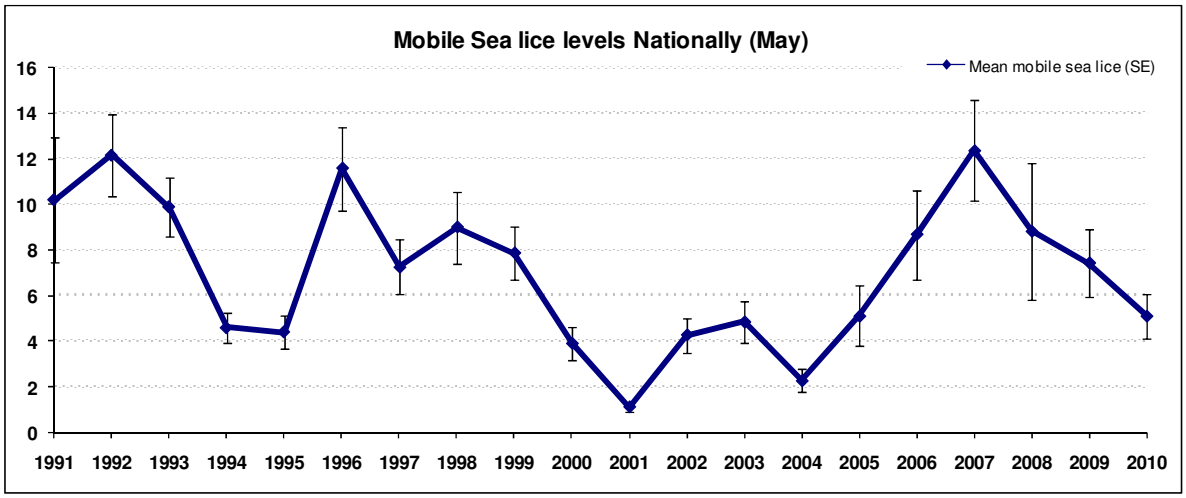


Figure 9. Annual trend (May mean) (SE) mobile *L. salmonis* on one-sea-winter salmon.

Mean ovigerous L. salmonis levels in 2010 are similar to 2009 and 2008 at 0.72 *L. salmonis* per fish. There is a drop in the total mobile levels from 7.42 total mobile sea lice per fish in 2009 to 5.11 total mobile sea lice per fish in 2010. This continues a downward trend from 2007.

DISCUSSION

Ninety six percent of sea lice inspections of smolts were below the treatment trigger levels (TTL) in 2010, this compares with 89% in 2009. Sixty-eight percent of inspections were below TTL on one-sea-winter salmon compared to 69% in 2009. Sixty percent of inspections of two-sea-winter salmon were below treatment trigger levels compared to 76% in 2009.

During the critical spring period, sea lice levels were below TTL for 46% of inspections on one-sea-winter salmon in the West and 100% were below treatment trigger levels in both the Northwest and Southwest. This represents an improvement from 39% in the West and 89% in the Northwest. All inspections were below treatment trigger levels in the Southwest for both 2009 and 2010.

The levels for the rest of the year show that 44% of inspections are below TTL in the West and 100% below TTL in the Northwest and Southwest. These compare to 56% and 86% below in the West and Northwest respectively and 100% in the Southwest in 2009 for one-sea-winter salmon.

Levels in excess of 10 *L. salmonis* per fish on one-sea-winter fish nationally were recorded on 22 occasions which shows a reduction from 32 occasions in 2009, 12 of these inspections had means of greater than 20 mobile *L. salmonis* per fish which is the same as 2009. For one-sea-winter salmon the highest mean sea lice level recorded was 43.57 mobile *L. salmonis* per fish, this compares to 38.37 mobile *L. salmonis* per fish in 2009 and 118.11 mobile *L. salmonis* per fish in 2008.

The May mean *L. salmonis* annual trend graphs of one-sea-winter fish (figures 8 & 9) show that a reduction in infestation levels which has been recorded since 2007, has been maintained. Ovigerous *L. salmonis* levels were similar to those of 2009 and mobile sea lice levels continued a decreasing trend.

Ongoing monitoring of sea lice is undertaken by some of the production companies, which has proven to be a crucial tool in assessing the development of sea lice populations. This practise gives the ability to act promptly to changes in sea lice populations and to carry out treatments at an early stage, thus impeding the development of sea lice populations. This is very important to maximise the benefits of treatments. Efficient use of sites allows for successful separation of generations and this, in conjunction with fallowing has shown to be highly beneficial in preventing the transfer of sea lice between stocks.

Having a well developed sea lice management policy, with 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.
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 2010.

	Date	*Lepeophtheirus salmonis*		*Caligus elongatus*		
		F + eggs	Total	F + eggs	Total	
BANTRY BAY						
MURPHYS IRISH SEAFOOD						
Cuan Baoi						
Atlantic salmon 2009 S1/2	09/12/2009	0.11	0.21	2.21	5.54	
	02/02/2010	0.17	0.33	2.50	9.17	n=6
	02/03/2010	0.04	0.08	6.16	13.12	
	24/03/2010	0.03	0.24	2.62	7.41	
	08/04/2010	0.00	0.40	1.73	8.13	
	22/04/2010	0.00	0.75	2.75	9.50	
	04/05/2010	0.25	0.88	1.71	4.08	
	26/05/2010	0.36	1.40	6.68	12.84	
	15/06/2010	0.20	0.70	4.30	8.30	
	15/07/2010	0.71	1.29	4.55	8.23	
	12/08/2010	1.00	1.17	5.00	8.89	
				Harvested Out		
Atlantic salmon 2010 S1/2	09/12/2009	0.00	0.00	0.16	1.00	
	02/02/2010	0.00	0.07	0.48	1.48	
	02/03/2010	0.00	0.00	0.00	0.03	
	24/03/2010	0.00	0.00	0.03	0.06	
	08/04/2010	0.00	0.03	0.03	0.17	
	22/04/2010	0.00	0.12	0.09	0.68	
	04/05/2010	0.00	0.06	0.18	0.94	
	26/05/2010	0.00	0.00	0.47	1.69	
	15/06/2010	0.07	0.13	1.63	2.83	
	07/07/2010	0.00	0.00	0.00	0.03	
	12/08/2010	0.00	0.03	0.37	0.77	
	08/09/2010	0.03	0.21	2.24	5.28	
	12/10/2010	0.07	0.07	1.37	2.20	
	10/11/2010	0.09	0.14	4.37	12.19	

SILVER KING SEAFOODS LTD.

Roancarraig

Atlantic salmon 2009 S1/2	10/12/2009	0.02	0.26	0.79	1.30
	02/02/2010	0.13	0.49	0.72	4.12
	02/03/2010	0.14	0.62	1.27	2.34
	23/03/2010	0.33	1.52	1.59	5.56
	08/04/2010	0.39	1.69	1.21	5.51
	22/04/2010	0.00	0.00	0.00	0.02
	04/05/2010	0.03	0.55	0.11	0.37
	27/05/2010	0.15	0.94	0.49	0.83
	16/06/2010	0.04	0.18	1.20	3.25
	07/07/2010	0.10	0.35	2.80	5.18
				Harvested Out	
Atlantic salmon 2011 S1/2	24/11/2010	0.00	0.00	0.16	2.63

KENMARE BAY

SILVER KING SEAFOODS LTD.

Deenish

Atlantic salmon 2010	23/04/2010	0.00	0.00	0.30	1.99
	04/05/2010	0.00	0.02	0.70	1.74
	27/05/2010	0.00	0.03	0.41	0.80
	17/06/2010	0.00	0.00	0.08	0.11
	07/07/2010	0.00	0.01	0.23	0.57
	11/08/2010	0.00	0.00	0.31	0.72
	07/09/2010	0.00	0.05	0.60	1.72
	13/10/2010	0.00	0.04	0.43	1.25
	24/11/2010	0.02	0.04	0.94	2.09

Inishfarnard

Atlantic salmon 2008	10/12/2009	1.49	4.24	0.77	1.45
				Harvested Out	
Atlantic salmon 2010	27/05/2010	0.00	0.00	0.03	0.09
	16/06/2010	0.00	0.00	0.04	0.05
	07/07/2010	0.00	0.00	0.07	0.12
	11/08/2010	0.00	0.00	0.25	0.34
	07/09/2010	0.02	0.08	0.16	0.76
	12/10/2010	0.00	0.02	0.46	1.22
	10/11/2010	0.00	0.02	0.31	0.65

GREATMAN'S BAY

MUIR GHAEL TEO.

Carraroe

Atlantic salmon 2010	28/04/2010	0.00	0.00	0.00	0.68
	05/05/2010	0.00	0.00	0.18	0.61
	18/05/2010	0.00	0.57	0.06	0.41
	03/06/2010	0.00	0.10	0.15	0.62
	05/07/2010	0.00	0.13	0.03	0.12
	13/08/2010	0.17	0.85	0.00	0.04
	08/09/2010	0.26	1.51	0.00	0.00
	21/10/2010	1.93	6.18	0.39	0.93
	29/11/2010	2.08	6.41	0.59	1.07

MUIRACHMHAINNI TEO.

Cuigeal

Atlantic salmon 2010 S1/2	03/06/2010	0.16	1.07	0.33	1.30
	05/07/2010	0.13	0.82	0.16	0.33
	13/08/2010	0.63	1.50	0.00	0.03
	08/09/2010	0.40	0.92	0.00	0.11
			Transferred to Daonish		

KILKIERAN BAY

MUIR GHAEL TEO.

Cnoc

Atlantic salmon 2009 S1/2	22/12/2009	6.34	28.27	0.00	0.00
			Transferred to Daonish		

MUIRACHMHAINNI TEO.

Daonish

Atlantic salmon 2009 S1/2	22/12/2009	0.74	5.49	0.00	0.02
	01/02/2010	0.23	13.26	0.02	0.04
	12/03/2010	0.32	14.52	0.08	0.48
	24/03/2010	0.76	4.99	0.02	0.10
	16/04/2010	0.51	2.08	0.00	0.26
	30/04/2010	0.18	1.49	0.11	0.20
	10/05/2010	0.88	6.35	0.53	0.81
	26/05/2010	1.08	4.62	0.13	0.26
	11/06/2010	0.46	1.38	0.29	0.50
	14/07/2010	1.00	2.91	2.24	3.67
			Harvested Out		

Atlantic salmon 2010 S1/2	21/10/2010	0.85	2.44	1.88	2.82
	29/11/2010	0.39	1.38	0.37	0.74
Golam					
Atlantic salmon 2010 S1/2	14/01/2010	0.08	8.28	0.17	0.51
	01/02/2010	0.15	11.56	0.25	0.55
	09/03/2010	0.04	4.52	0.02	0.10
	25/03/2010	0.09	2.26	0.05	0.42
	14/04/2010	0.04	0.82	0.15	0.30
	21/04/2010	0.00	0.89	0.18	0.55
	10/05/2010	0.02	0.98	0.13	0.41
	18/05/2010	0.02	1.38	0.47	0.70
			Transferred to Cuigeal		

BERTRAGHBOY BAY

MANNIN BAY SALMON COMPANY LTD.

Sealax

Atlantic salmon 2010	23/04/2010	0.00	0.00	0.00	0.02
	06/05/2010	0.00	0.09	0.07	0.42
	20/05/2010	0.00	0.08	0.09	0.15
	16/06/2010	0.00	0.04	0.68	1.69
	13/07/2010	0.01	0.07	4.60	7.26
	10/08/2010	0.00	0.07	0.02	0.10
	02/09/2010	0.00	0.08	0.02	0.12
	12/10/2010	0.00	0.06	0.57	1.53
	10/11/2010	0.00	0.04	2.46	5.31

MANNIN BAY

Corhounagh

Atlantic salmon 2008	14/12/2009	10.70	64.07	0.44	0.93
			Harvested out		
Atlantic salmon 2009	02/03/2010	0.07	1.98	0.00	0.00
	16/03/2010	0.03	3.56	0.00	0.00
	09/04/2010	0.43	4.17	0.05	0.15
	22/04/2010	1.21	4.46	0.14	0.17
	07/05/2010	1.08	2.85	0.19	0.35
	25/05/2010	0.32	12.01	0.02	0.02
	17/06/2010	5.64	43.57	1.34	2.50
	20/07/2010	6.63	13.35	0.02	0.02
	27/08/2010	4.32	16.97	0.00	0.03
	22/09/2010	8.94	20.79	0.02	0.02
	12/10/2010	8.41	16.24	0.02	0.07
	23/11/2010	7.04	28.72	0.38	0.63

CLIFDEN BAY

Ardbear

Atlantic salmon 2010 S1/2	03/12/2009	0.00	1.65	0.00	0.00
	11/02/2010	0.04	1.92	0.00	0.00
	02/03/2010	0.06	1.12	0.00	0.00
	16/03/2010	0.02	1.61	0.00	0.00
	09/04/2010	0.02	6.58	0.00	0.00
	22/04/2010	0.03	0.52	0.00	0.00
	07/05/2010	0.00	0.49	0.00	0.00
	20/05/2010	0.00	1.37	0.02	0.05
			Transferred to Hawk's Nest		

Hawk's Nest

Atlantic salmon 2009	03/12/2009	0.55	14.16	0.02	0.07
	11/02/2010	2.53	16.70	0.00	0.16
			Transferred to Corhounagh		
Atlantic salmon 2010 S1/2	22/06/2010	0.05	4.99	0.59	1.47
	13/07/2010	0.45	12.28	1.42	2.89
	27/08/2010	1.10	27.48	0.00	0.03
	16/09/2010	9.16	26.77	0.00	0.02
	19/10/2010	9.36	46.98	0.51	0.85
	23/11/2010	4.29	46.71	0.00	0.07

BALLINAKILL HARBOUR

BIFAND LTD.

Fraochoilean

Atlantic salmon 2009 S1/2	22/12/2009	6.07	22.13	0.13	0.22
	19/02/2010	4.63	24.70	0.00	0.05
	05/03/2010	3.09	34.74	0.00	0.06
	22/03/2010	0.16	6.33	0.00	0.00
	13/04/2010	0.80	34.14	0.00	0.02
	23/04/2010	1.32	23.12	0.02	0.02
	11/05/2010	2.22	12.28	0.00	0.00
	25/05/2010	2.15	14.58	0.00	0.02
	25/06/2010	12.30	36.27	0.12	0.26
	19/07/2010	14.46	38.29	0.75	1.64
			Harvested Out		

KILLARY HARBOUR

MARINE HARVEST

Inishdeighil

Atlantic salmon 2010	13/05/2010	0.00	0.02	0.00	0.05
	27/05/2010	0.00	0.02	0.03	0.15
	10/06/2010	0.00	0.00	0.09	0.20
	09/07/2010	0.02	0.11	3.11	7.19
	12/08/2010	0.03	0.44	0.00	0.00
	03/09/2010	0.02	0.30	0.01	0.06
	11/10/2010	0.03	0.09	0.10	0.36
	10/11/2010	0.02	0.27	0.64	1.36

CLEW BAY

CLARE ISLAND SEAFARMS LTD.

Portlea

Atlantic salmon 2009	11/12/2009	1.31	6.86	0.00	0.07
	11/02/2010	2.82	28.70	0.30	1.38
	11/03/2010	0.32	2.71	0.05	0.31
	24/03/2010	0.52	3.95	0.04	0.49
	13/04/2010	0.10	4.00	0.17	0.45
	23/04/2010	0.05	4.27	0.07	0.19
	14/05/2010	0.33	5.33	0.61	1.74
	26/05/2010	0.90	5.77	1.28	3.29
	25/06/2010	0.37	2.45	0.60	5.39
	28/07/2010	1.20	2.49	0.43	0.50
	13/08/2010	0.79	4.06	5.46	9.35
	16/09/2010	1.06	2.42	0.76	1.03
			Transferred to Seastream Inner		

Seastream Inner

Atlantic salmon 2008	09/12/2009	0.31	1.19	0.02	0.03
	11/02/2010	1.13	7.13	0.73	1.26
	11/03/2010	0.64	3.09	0.75	0.98
	24/03/2010	0.69	8.00	0.48	0.89
	09/04/2010	0.27	3.18	0.32	0.40
	23/04/2010	0.54	7.02	0.54	0.76
			Harvested Out		
Atlantic salmon 2009	13/10/2010	0.48	2.47	0.07	0.27
	19/11/2010	6.05	15.75	1.17	2.04

BEALACRAGHER BAY

CURRAN BLUE LTD.

Curraun

Rainbow trout 2009 (1)	27/01/2010	0.00	0.73	0.00	0.00
	12/02/2010	0.00	0.00	0.00	0.00
	09/03/2010	0.00	0.00	0.00	0.00
	30/03/2010	0.00	0.10	0.00	0.00
	21/04/2010	0.04	0.83	0.00	0.00
			Harvested Out		
Rainbow trout 2009 (2)	27/01/2010	0.43	1.63	0.00	0.00
	12/02/2010	0.03	0.13	0.00	0.00
	09/03/2010	0.00	0.00	0.00	0.00
	30/03/2010	0.00	0.07	0.00	0.00
	21/04/2010	0.00	0.13	0.00	0.00
	30/04/2010	0.00	0.09	0.00	0.00
	13/05/2010	0.00	0.17	0.00	0.00
	28/05/2010	0.00	0.00	0.00	0.00
	24/06/2010	0.00	0.03	0.00	0.00
	22/07/2010	0.03	0.23	0.00	0.00
	31/08/2010	0.10	0.43	0.00	0.00
	29/09/2010	0.37	2.77	0.00	0.00
			Harvested Out		
Rainbow trout 2010 (1)	28/05/2010	0.00	0.10	0.00	0.00
	24/06/2010	0.00	0.00	0.00	0.03
	22/07/2010	0.03	0.07	0.00	0.00
	31/08/2010	0.03	0.40	0.00	0.00
	29/09/2010	0.23	1.87	0.00	0.00
	22/10/2010	1.43	6.07	0.00	0.00
	30/11/2010	0.17	6.34	0.00	0.00
Rainbow trout 2010 (2)	22/10/2010	0.17	2.70	0.00	0.00
	30/11/2010	0.43	11.77	0.00	0.00

DONEGAL BAY

EANY FISH PRODUCTS LTD.

Eany

Rainbow trout 2009 (1)	15/12/2009	0.08	0.25	0.00	0.08
	03/02/2010	0.00	0.07	0.00	0.00
			Harvested Out		
Rainbow trout 2009 (2)	15/12/2009	0.10	0.59	0.00	0.00
	03/02/2010	0.02	0.09	0.00	0.00
	04/03/2010	0.04	0.18	0.00	0.00
	16/03/2010	0.00	0.00	0.00	0.07
			Harvested Out		
Rainbow trout 2009 (3)	15/12/2009	0.00	0.00	0.00	0.00
	03/02/2010	0.00	0.02	0.00	0.00
	04/03/2010	0.00	0.02	0.02	0.13
	16/03/2010	0.00	0.04	0.04	0.04
	15/04/2010	0.02	0.06	0.03	0.14
	27/04/2010	0.00	0.00	0.00	0.13
	05/05/2010	0.00	0.02	0.02	0.02
	25/05/2010	0.00	0.00	0.00	0.00
	10/06/2010	0.00	0.02	0.06	0.06
	21/07/2010	0.00	0.10	0.00	0.04
	10/08/2010	0.04	0.13	0.00	0.00
	21/09/2010	0.20	0.49	0.00	0.00
	12/10/2010	0.27	1.93	0.00	0.05
	23/11/2010		On starve for harvest		
Rainbow trout 2010 (1)	15/04/2010	0.00	0.00	0.00	0.05
	27/04/2010		Missed due to technical difficulties		
	05/05/2010	0.00	0.00	0.00	0.00
	25/05/2010	0.00	0.02	0.07	0.07
	10/06/2010	0.00	0.00	0.00	0.00
	21/07/2010	0.00	0.03	0.03	0.05
	10/08/2010	0.04	0.13	0.00	0.00
	21/09/2010	0.03	0.40	0.00	0.00
	12/10/2010	0.16	3.03	0.03	0.13
	23/11/2010	1.47	4.27	0.06	0.06
Rainbow trout 2010 (2)	21/09/2010	0.00	0.27	0.00	0.00
	12/10/2010	0.00	1.53	0.00	0.17
	23/11/2010	0.97	2.97	0.03	0.07

OCEAN FARM LTD.

Mc Swyne's

Atlantic salmon 2009	15/12/2009	0.03	0.54	0.04	0.13
	03/02/2010	0.17	1.60	0.14	0.21
	04/03/2010	0.00	0.04	0.03	0.03
	16/03/2010	0.00	0.25	0.00	0.06
	20/04/2010	0.00	0.19	0.00	0.02
	27/04/2010	0.00	0.02	0.00	0.00
	05/05/2010	0.00	0.00	0.00	0.00
	25/05/2010	0.00	0.07	0.31	0.87
	10/06/2010	0.00	0.06	0.06	0.11
	21/07/2010	0.04	0.04	0.19	0.26
	11/08/2010	0.06	0.11	0.45	1.00
	21/09/2010	0.30	0.75	1.32	2.82
	12/10/2010	0.39	2.53	1.97	4.64
	24/11/2010	0.76	3.42	0.00	0.02

Ocean Inver

Atlantic salmon 2010	20/04/2010	0.00	0.04	0.04	0.40
	27/04/2010	0.00	0.05	0.00	0.18
	05/05/2010	0.00	0.00	0.00	0.11
	25/05/2010	0.00	0.00	0.05	0.08
	10/06/2010	0.00	0.00	0.00	0.03
	21/07/2010	0.00	0.04	0.12	0.14
	11/08/2010	0.01	0.03	0.04	0.05
	21/09/2010	0.05	0.20	0.12	0.12
	12/10/2010	0.03	0.26	0.07	0.13
	24/11/2010	0.13	0.79	0.02	0.15

MULROY BAY

MARINE HARVEST

Glinsk

Atlantic salmon 2010 S1/2	14/01/2010	0.03	0.56	0.00	0.00
	17/02/2010	0.00	0.05	0.00	0.00
	03/03/2010	0.00	0.27	0.00	0.00
	23/03/2010	0.00	0.05	0.00	0.02
	16/04/2010	0.00	0.08	0.00	0.00
	28/04/2010	0.00	0.03	0.00	0.17
	06/05/2010	0.00	0.14	0.02	0.05
			Transferred to Lough Swilly		

LOUGH SWILLY

Lough Swilly

Atlantic salmon 2008	14/01/2010	0.73	6.28	0.05	0.10
	17/02/2010	0.59	4.81	1.41	2.30
			Transferred to Millstone for harvesting		
Atlantic salmon 2010 S1/2	26/05/2010	0.00	0.22	0.29	0.36
	22/06/2010	0.02	0.02	0.09	0.10
	27/07/2010	0.14	1.11	0.59	1.12
	10/08/2010	0.29	1.16	0.06	0.23
	22/09/2010	1.14	3.36	0.00	0.00
	22/10/2010	0.55	2.51	0.00	0.02
	10/11/2010	0.48	19.47	0.00	0.04