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National Survey of Sea Lice (*Lepeophtheirus salmonis* Krøyer and *Caligus elongatus* Nordmann) on Fish Farms in Ireland - 2014

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NATIONAL SURVEY OF SEA LICE (*LEPEOPHTHEIRUS SALMONIS* KRØYER AND *CALIGUS ELONGATUS* NORDMANN) ON FISH FARMS IN IRELAND – 2014

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INTRODUCTION

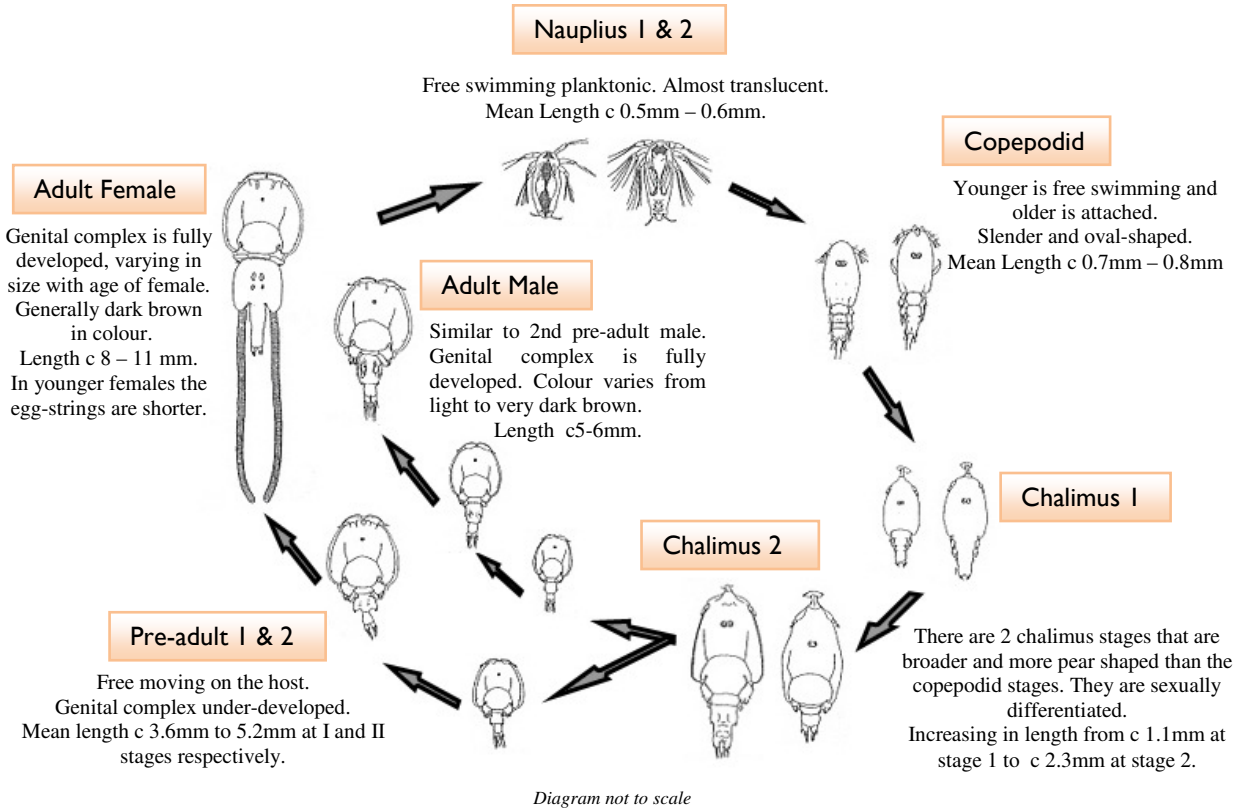
Two main species of sea lice are found on wild and cultured salmonids in Ireland, *Caligus elongatus* and *Lepeophtheirus salmonis*. Sea lice are caligid, copepod, marine ectoparasites which occur on many species of fish. There are estimated to be approximately 559 species made up of 37 genera (Ahyong *et al*., 2011), including 162 *Lepeophtheirus* species (Chad & Goeff, 2011) and 268 *Caligus* species (Boxshall, 2011). *L. salmonis* infests only salmonids, while *C. elongatus* is known to parasitise over 80 different species of marine fish. *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 salmonids (Jackson & Minchin, 1992; Jackson *et al.,* 2005). There are two species of salmonids farmed in Ireland on a commercial basis, Atlantic salmon *Salmo salar* L. and rainbow trout *Oncorhynchus mykiss* Walbaum.

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*., 2011 a & b; Jackson *et al*., 2013b) and Norway (Skilbrei *et al*., 2013; Torrissen *et al*, 2013) with all studies generating similar results. In Ireland marine mortality data on 352,142 migrating salmon from twenty-eight releases, at eight rivers along Ireland's south and west coasts covering a 9-year period (2001 to 2009) was reviewed. The results though significant suggest that sea lice infestation is a minor and irregular source of marine mortality, and is not implicated in the observed decline in survival rate in the stocks studied. This conclusion is further supported by the findings of Jackson *et al*. (2013 b) which found no correlation between the presence of aquaculture and the performance of adjacent wild salmon stocks. Full details of the study and data are set out in the Marine Institute *Irish Fisheries Bulletin No. 43* (Jackson *et al*., 2013c) which concludes that sea lice infestation is unlikely to be a significant factor influencing conservation status of stocks of wild salmon in Ireland.

The lifecycle of *L. salmonis* has 8 stages, comprising of nauplius 1 and 2, copepodid, chalimus 1 and 2, preadult 1 and 2 and the adult stages. The nauplius 1 stage hatches from paired egg-strings and is dispersed in the plankton. It moults to nauplius 2, also planktonic, which is followed by a copepodid, the infective stage where attachment to the host takes place. The copepodid then moults through the attached chalimus stages before becoming a mobile pre-adult. There are two pre-adult stages before maturing to the 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 (Hamre, 2013; Kabata, 1979; Schram, 1993). *L. salmonis* has a direct lifecycle. The mean length for an adult female is 8mm-11mm and an adult male is 5mm-6mm (Schram, 1993). Under experimental conditions female *L. salmonis* survived up to 210 days, producing as many as 11 pairs of egg strings (Boxaspen, 2006). Jackson and Minchin (1992), in Ireland, found fecundity (mean eggs per pair of egg strings) on wild salmon to be 965 ±30, which was higher than for farmed salmon at 758 ±39. This contrasts to a lower fecundity recorded for wild and farmed salmon in Norway where mean egg numbers have been recorded as 304 ±32 with a range from 246 to 366 at 7.2°C (Heuch *et al.* 2000).

Figure 1. Life cycle of *Lepeophtheirus salmonis* (after Schram 1993 & Hamre 2013).



C. elongatus is smaller in size than *L. salmonis* averaging approximately 6-8mm in length (Hogans & Trudeau, 1989). The fact that *C. elongatus* is not as host specific as *L. salmonis* (Kabata, 1979) and that the hosts migrate widely is thought to be a factor in the highly variable levels on farmed salmonids at different times of the year.

History of Sea Lice Monitoring in Ireland

In 1991, the Department of the Marine instigated a Sea Lice Monitoring Programme for finfish farms in Ireland (Jackson & Minchin, 1993) and 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.

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 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 minimising 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. 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 rate of sea lice is slower. Rising water temperatures in spring 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 louse. This is a practical time to interrupt sea lice development. Later in the year, the development of new generations are not as synchronised 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 (Copley *et al.*, 2001; McCarney *et al.*, 2002; O'Donohoe *et al.*, 2003-2014).

Sea Lice Control Methods

Along with husbandry and management practices as outlined in the SBM process, chemotherapeutants are used to control the numbers of sea lice on fish. Table 1 shows a list of the animal medicines and other remedies available to assist in the control of sea lice in Ireland. These can either be administered topically or incorporated into the diet.

Topical treatments are administered by bathing the fish in specified concentrations of the medicine. Bath treatments can be conducted in one of three ways: tarping or skirting of the salmon net-pens, or the use of well-boats. Tarpaulin and skirt bath treatments involve decreasing the volume of water in a salmon net-pen by either completely enclosing the net-pen in an impervious tarpaulin (tarping), or by surrounding the net-pen with a series of impervious tarps to a depth below that of the bottom of the raised net without enclosing the bottom of the net-pen (skirting). The prescribed amount of chemotherapeutant to achieve treatment concentration is then added to the net-pen for the recommended time period, at which point the skirt or tarp is removed and the treatment water is released. Well-boat treatments are conducted by pumping cultured salmon into treatment chambers, or wells, in specially designed boats. These boats are fully equipped with fish pumps, water circulation pumps and oxygen equipment (Jackson 2011c). The chemotherapeutant is then added to the well for the prescribed time. Following treatment the treatment water is discharged from the well into the surrounding water, while the well is simultaneously flushed with fresh seawater. Following flushing, the fish are then pumped back into the net-pen (Anon., 2013).

Other treatments are incorporated into the diet. This is a very efficient way to get the required dose to the fish, and has been very effective. However, variability in appetite among fish and the natural hierarchies that exist within a cage can lead to variation in the dosage received. In particular sick fish are likely to consume less feed and therefore less of the drug, which can lead to potential sub-optimal exposure of the parasite to the drug, and in the long term facilitate development of resistance.

The use of wrasse for the control of sea lice is being pursued in Ireland as part of an integrated sea lice management strategy. This is to reduce the reliance on medicinal treatments and also to alleviate any potential for the development of resistance to sea lice medicines. Although other wrasse species were used on salmon farms in the 1990s recent interest has been in stocking the larger and more robust ballan wrasse *Labrus bergylta* (Treasurer, 2013).

The use of filtration methods at harvest sites has proven to be a very successful method for removing all stages of sea lice including egg-strings, preventing sea lice from re-entering the water column and potentially re-infecting salmon stocks adjacent to the harvest area (O'Donohoe & McDermott, 2014).

When using hydrogen peroxide for delousing some sea lice float to the surface in the enclosures during this bath treatment. A surface skimmer solution for removing sea lice from the water is now being trialed in some locations.

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

Compound	*Trade Name*	*Licensing status*	*Delivery Method*	*Group*	*Mode of action*	*Stages targeted*	*Withdrawal period*
Animal medicines							
Cypermethrin	Excis® (product is not available)	Full MA	Bath	Pyrethroid	Interferes with nerve transmission by blocking sodium channels in nerve cells	Adults, Preadults, Chalimus III-IV	10 degree-days
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℃. Protects fish for up to 11 weeks post treatment.	All stages	Zero
Hydrogen peroxide	Paramove 50®	Full MA	Bath	Oxidizer	Gas embolism	Adults, Preadults	Zero
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℃	Moulting stages - Chalimus, Preadults only	45 degree-days
Others							
Wrasse			In cage		Cleaner fish	Adults, Preadults	

MA - marketing authorisation from the Health Products Regulatory Authority (HPRA).

METHODOLOGY

Farmed stocks of Atlantic salmon and rainbow trout in Ireland are inspected on 14 occasions throughout the year to monitor sea lice levels as part of a national programme. Additional follow-up inspections may be carried out when it is deemed appropriate. Sea lice inspections take place twice per month in March, April and May (the Spring period) and then monthly for the remainder of the year. December and January are combined and only one inspection is carried out.

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 chosen 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 sea lice. Sea lice are removed and preserved in 70% ethanol. 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 (including the number of detached sea lice from the sieved seawater). Results presented are mean ovigerous sea lice levels and mean total mobile sea lice levels for *L. salmonis* and *C. elongatus* per fish.

Ovigerous sea lice levels estimate the breeding female population and total mobile levels estimate successful infestation levels. 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 2014, salmonid farms were producing 4 different stocks of fish: 2013 Atlantic salmon (one-sea-winter salmon), 2014 Atlantic salmon (smolts); 2015 Atlantic salmon (smolts inputted in autumn of 2014); and 2013 rainbow trout (fish first inspected in 2013).

There are three distinct 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 2014 a total number of 23 sites were inspected around Ireland, see Figure 2.

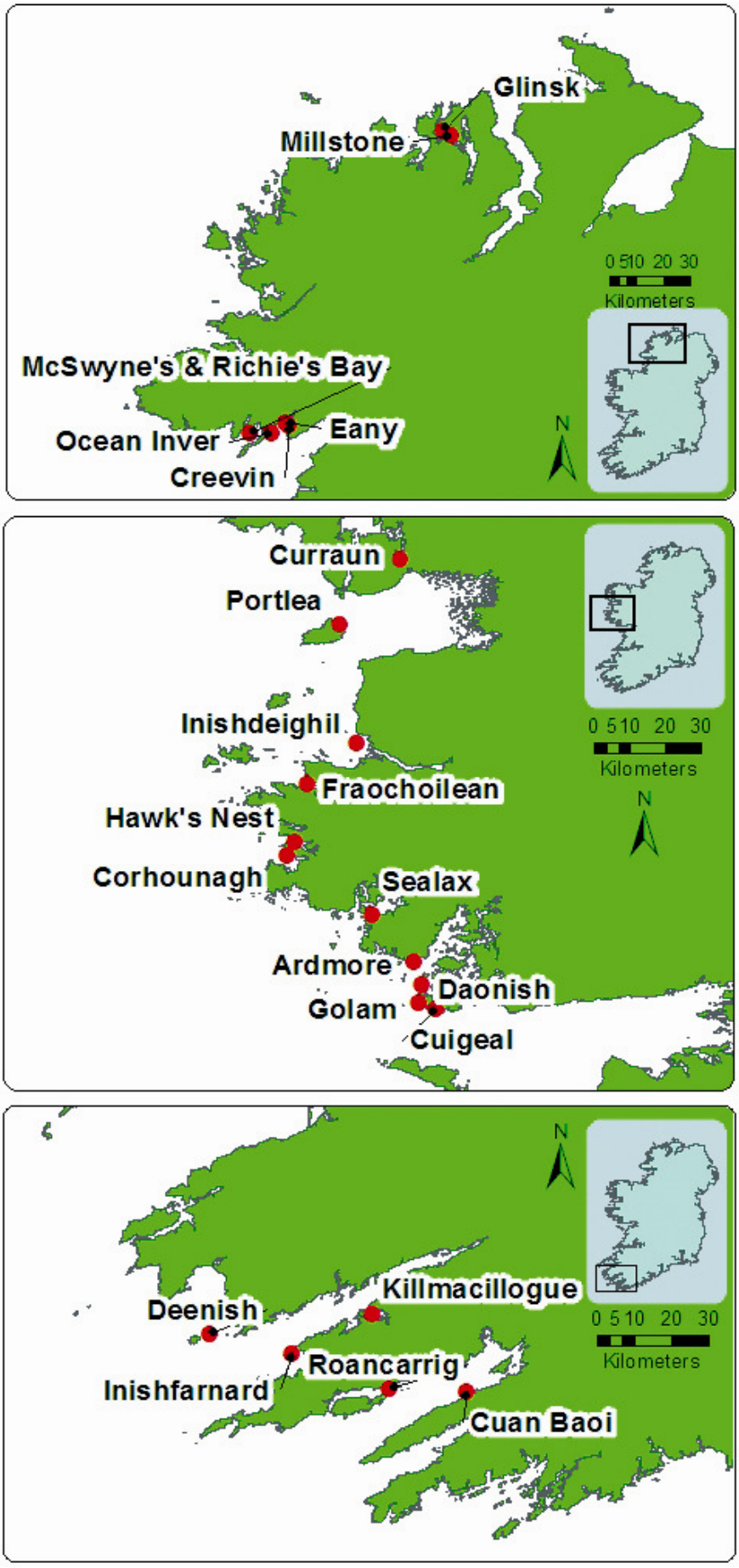


Figure 2. Locations of fish farm sites.

RESULTS

During 2014 a total of 242 sea lice inspections were carried out on the 23 active farm sites. Over 84% of Atlantic salmon samples and 90% 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)*. Of the 125 inspections carried out on salmon smolts, 94% were below the TTL and 71% of the 105 inspections carried out on one-sea-winter salmon were below TTL. There were no two-sea-winter salmon stocked in 2014.

Results of 2014 sea lice inspections to all active salmonid sites for each month are presented in Appendix 1.

Atlantic salmon 2013 (one-sea-winter salmon)

One-sea-winter salmon were stocked in a total of 12 sites in 8 bays in 2014. One hundred and five visits were undertaken to this generation of fish. All one-sea-winter salmon were harvested out by November 2014.

Ovigerous *L. salmonis* levels greater than the TTL were recorded in a total of 30 inspections (29%) on one-sea-winter fish (Table 2). Within the critical spring period sea lice levels were in excess of 0.5 ovigerous females per fish on 14 inspections (26%) and outside of the spring period 16 inspections (31%) were in excess of 2.0 ovigerous female *L. salmonis* per fish.

Table 2. *Summary of inspections results on one-sea-winter (1SW) salmon nationally in 2014.*

	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	54	14	51	16	105	30	26%	31%	29%

C. elongatus levels were recorded at numbers greater than 10 individuals per fish on 4 inspections to these fish, all 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 (Table 3).

Table 3. *Summary of inspections results on 1SW salmon in the Southwest in 2014.*

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%
Marine Harvest Ireland	**Roancarraig**	6	0	3	0	9	0	0%	0%	0%
	Deenish	6	0	7	0	13	0	0%	0%	0%
Southwest	**Totals**	18	0	17	0	35	0	0%	0%	0%

West Region

In the West, *L. salmonis* infestation levels greater than the treatment trigger were recorded on 7 out of 18 inspections (39%) in the spring period and on 5 out of 13 inspections (38%) outside the spring period (Table 4).

Table 4. *Summary of inspections results on 1SW salmon in the West in 2014.*

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
Comhlucht Bradain Chonamara Teo	**Sealax**	6	1	7	3	13	4	17%	43%	31%
Bradan Beo Teo	**Daonish**	6	0	2	0	8	0	0%	0%	0%
Mannin Bay Salmon Co Ltd	**Corhounagh**	3	3	1	1	4	4	100%	100%	100%
Bifand Ltd	**Fraochoilean**	3	3	2	1	5	4	100%	50%	80%
Clare Island Seafarms Ltd	**Portlea**	0	0	1	0	1	0	0%	0%	0%
West	**Totals**	18	7	13	5	31	12	39%	38%	39%

At Corhounagh, Mannin Bay, *L. salmonis* exceeded treatment trigger levels for all of the 3 inspections in the spring and also the one inspection outside the spring period. Levels at Fraochoilean, Ballinakill Harbour, were above treatment trigger levels for all of the 3 inspections in the spring and 1 of the 2 inspections outside the spring. Sealax, Bertraghboy Bay, exceeded levels for 1 of the 6 spring inspections and for 3 of the 7 inspections outside the spring period.

Northwest Region

The treatment trigger levels were exceeded on 7 of the 18 inspections in the spring and 11 of the 21 inspections outside the spring period in the Northwest (Table 5).

Table 5. *Summary of inspections results on 1SW salmon in the Northwest in 2014.*

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.	**McSwyne's**	6	4	6	4	12	8	67%	67%	67%
	Richie's Bay	0	0	4	4	4	4	0%	100%	100%
Marine Harvest Ireland	**Creevin**	6	1	6	2	12	3	17%	33%	25%
	Eany	6	2	5	1	11	3	33%	20%	27%
Northwest	**Totals**	18	7	21	11	39	18	39%	52%	46%

McSwyne's, Donegal Bay, exceeded treatment trigger levels on 4 of the 6 spring inspections, and also on 4 of the 6 inspections outside the spring period. Richie's Bay was above TTLs for all 4 inspections outside the spring period. Sea lice levels at Eany were above TTLs for 2 of the 6 spring inspections and one of 5 inspections outside spring. Creevin exceeded spring TTLs for one of the 6 spring inspections and 2 of the 6 inspections outside spring.

Atlantic salmon 2014 (smolts)

A total of 125 inspections were made to 15 sites stocking Atlantic salmon 2014 S1 and S½ smolts during the year 2014. *L. salmonis* levels were below the TTL of 0.5 ovigerous female lice per fish for all of the 48 inspections in the spring period and for 69 of the 77 samples outside of this period (Table 6).

Table 6. *Summary of inspections results on salmon smolts nationally in 2014.*

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**	0	0	5	0	5	0	0%	0%	0%
	Killmacillogue	6	0	3	0	9	0	0%	0%	0%
Marine Harvest Ireland	**Roancarraig**	6	0	8	0	14	0	0%	0%	0%
	Inishfarnard	2	0	6	0	8	0	0%	0%	0%
Southwest	**Totals**	14	0	22	0	36	0	0%	0%	0%
Bradan Beo Teo	**Cuigeal**	1	0	3	0	4	0	0%	0%	0%
	Daonish	0	0	4	0	4	0	0%	0%	0%
	Golam	5	0	2	0	7	0	0%	0%	0%
Marine Harvest Ireland	**Ardmore**	6	0	8	2	14	2	0%	25%	14%
Mannin Bay Salmon Company Ltd	**Corhounagh**	0	0	4	2	4	2	0%	50%	50%
	Hawk's Nest	6	0	4	1	10	1	0%	25%	10%
Rosroe Salmon Ltd	**Inishdeighil**	3	0	6	0	9	0	0%	0%	0%
Clare Island Seafarms Ltd	**Portlea**	3	0	6	0	9	0	0%	0%	0%
West	**Totals**	24	0	37	5	61	5	0%	14%	8%
Ocean Farm Ltd	**Ocean Inver**	6	0	6	3	12	3	0%	50%	25%
Marine Harvest Ireland	**Glinsk**	2	0	6	0	8	0	0%	0%	0%
	Millstone	2	0	6	0	8	0	0%	0%	0%
Northwest	**Totals**	10	0	18	3	28	3	0%	17%	11%
National Totals		48	0	77	8	125	8	0%	10%	6%

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

Atlantic salmon 2015 S½ (smolts)

Two inspections were carried out on this stock of fish, on two sites in the west, neither of which reached treatment trigger levels.

Rainbow trout

In 2014 there was one year-classes of rainbow trout, 2013 rainbow trout, stocked in 1 site (Table 7). There were 10 inspections carried out on the stock, one of which reached treatment trigger levels.

Table 7. *Summary of inspections results on rainbow trout nationally in 2014.*

Rainbow Trout 2013 stocked in 2014										
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	6	0	4	1	10	1	0%	25%	10%
West		6	0	4	1	10	1	0%	25%	10%
National Totals		6	0	4	1	10	1	0%	25%	10%

Sampling record

All samples were obtained during the 2014 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 8 for one-sea-winter salmon throughout the year. Monthly ovigerous *L. salmonis* levels greater than the spring TTL of 0.5 ovigerous sea lice per fish were recorded on 5 of the 19 occasions. Of these there were 2 in Mannin Bay, 2 in Ballinakill Harbour and 1 in Donegal Bay.

Mean ovigerous levels of 2.0 ovigerous females per fish or greater were recorded on 9 out of 33 inspections, outside of the spring period, These occurred in Donegal Bay on 4 occasions, Bertraghboy Bay on 3 occasions, and Ballinakill Harbour and Mannin Bay on 1 occasion each.

Mean mobile levels per bay in excess of 10 *L. salmonis* per fish were recorded on 10 occasions, 3 of these instances had means of greater than 20 mobile lice per fish. The maximum bay mean level recorded was 65.68 mobile sea lice per fish.

Table 8. Mean ovigerous and mean mobile *Lepeophtheirus salmonis* and *Caligus elongatus* levels per month, for one-sea-winter salmon, for each bay inspected in the year 2014.

Mean ovigerous *L. salmonis*

	Dec/ Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
Bantry Bay	0.00	0.01	0.02	0.03	0.00	0.06	0.30	0.00	0.00	0.00	HO
Kenmare Bay	0.00	0.03	0.02	0.01	0.01	0.00	0.08	0.07	0.15	0.23	HO
Kilkieran Bay	0.25	0.67	0.18	0.11	0.27	HO					
Bertraghboy Bay	0.00	0.04	0.01	0.12	0.38	0.37	0.44	3.11	2.25	5.79	HO
Mannin Bay	HO			4.39	3.90	5.73	HO				
Ballinakill Harbour	0.86	2.90	4.85	2.16	HO						
Clew Bay	0.28	HO									
Donegal Bay	1.43	0.22	0.31	0.32	2.11	2.15	2.72	10.98	22.21	HO	

Mean mobile *L. salmonis*

	Dec/ Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
Bantry Bay	0.00	0.01	0.05	0.07	0.06	0.17	0.40	0.17	0.00	0.08	HO
Kenmare Bay	0.05	0.05	0.05	0.04	0.08	0.03	0.25	0.07	0.34	0.28	HO
Kilkieran Bay	0.75	1.30	0.66	2.20	1.36	HO					
Bertraghboy Bay	0.10	0.18	0.19	0.44	1.28	3.72	0.94	4.87	5.48	8.57	HO
Mannin Bay	HO			16.89	16.35	13.49	HO				
Ballinakill Harbour	4.42	12.17	24.81	13.51	HO						
Clew Bay	1.36	HO									
Donegal Bay	5.99	5.01	7.68	1.69	12.20	6.47	11.16	38.07	65.68	HO	

Mean ovigerous *C. elongatus*

	Dec/ Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
Bantry Bay	2.85	2.05	1.96	2.89	1.60	0.70	3.60	0.25	0.20	0.25	HO
Kenmare Bay	3.23	1.07	0.98	0.26	0.63	0.28	1.72	1.93	2.08	0.64	HO
Kilkieran Bay	0.08	0.52	0.34	0.06	0.00	HO					
Bertraghboy Bay	0.90	2.31	0.52	0.37	0.75	0.90	0.00	0.14	0.00	0.10	HO
Mannin Bay	HO			0.00	0.01	0.00	HO				
Ballinakill Harbour	0.52	0.05	0.05	0.00	HO						
Clew Bay	0.05	HO									
Donegal Bay	0.36	0.14	0.53	0.01	0.27	0.00	0.04	0.07	0.13	HO	

Mean mobile *C. elongatus*

	Dec/ Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
Bantry Bay	7.63	6.17	5.05	6.81	2.93	1.56	9.20	0.75	0.40	2.58	HO
Kenmare Bay	6.02	2.49	1.60	0.70	1.43	0.75	7.23	3.07	4.65	1.37	HO
Kilkieran Bay	0.12	0.82	0.39	0.21	0.01	HO					
Bertraghboy Bay	1.90	4.00	0.68	0.74	1.20	1.54	0.10	0.17	0.02	0.16	HO
Mannin Bay	HO			0.00	0.01	0.00	HO				
Ballinakill Harbour	0.67	0.20	0.08	0.00	HO						
Clew Bay	0.22	HO									
Donegal Bay	0.84	0.65	1.35	0.03	0.75	0.00	0.06	0.12	0.15	HO	

HO = Harvested out

Regional monthly means for one-sea-winter salmon

L. salmonis ovigerous and mobile monthly mean levels per fish for one-sea-winter salmon regionally are shown in Figures 3 and 4. In the spring period of 2014 the ovigerous mean sea lice levels per fish exceeded TTLs for March, April and May in the West, and for May in the Northwest.

Outside the spring regional mean ovigerous *L. salmonis* levels per fish were in excess of TTL in June, July, August and September in the Northwest and also for June, August, September and October in the West.

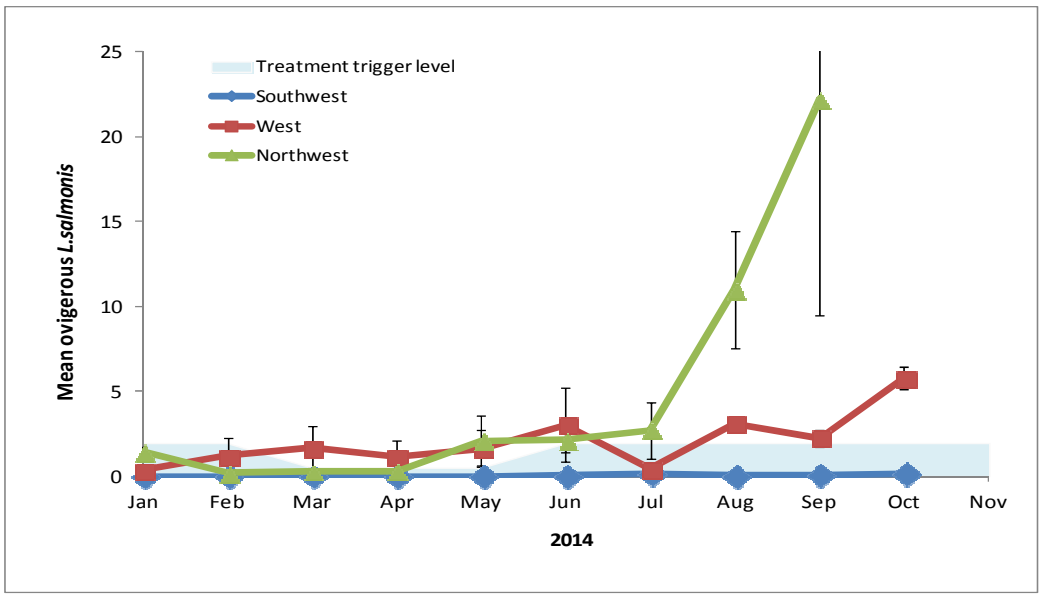


Figure 3. Mean (SE) ovigerous *L. salmonis* per fish per month per region in 2014 on one-sea-winter fish.

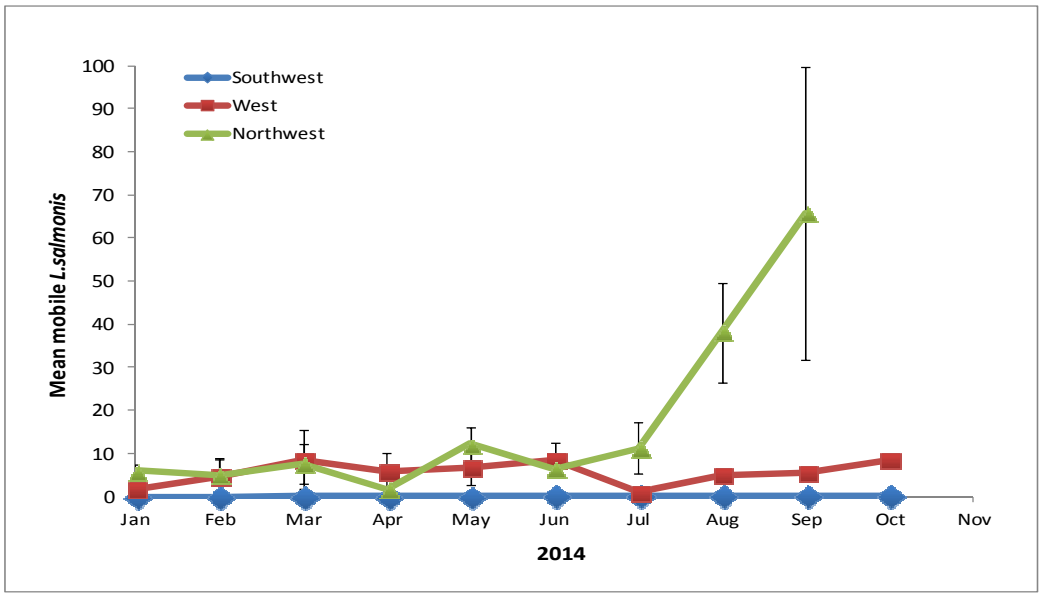


Figure 4. Mean (SE) mobile *L. salmonis* per fish per month per region in 2014 on one-sea-winter fish.

Total mobile *L. salmonis* levels exceeded 10 sea lice per fish in May, July, August, and September in the Northwest but on no occasion in the West or Southwest. Total regional mean mobile *L. salmonis* levels peaked at 0.3 mobile sea lice per fish in the Southwest, 8.6 mobile sea lice per fish in the West and at 65.68 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 5 and 6 for one-sea-winter salmon in the month of May from 1991 to 2014.

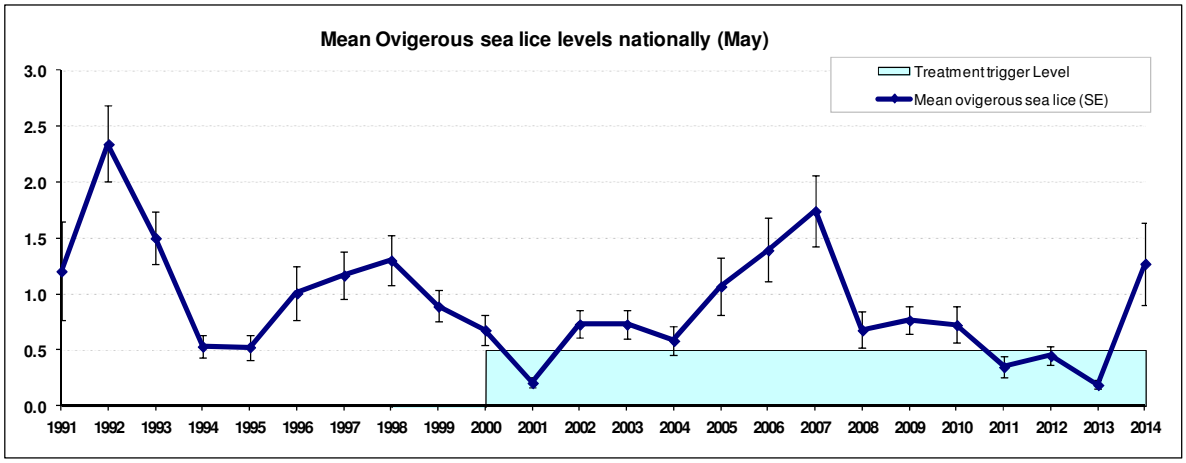


Figure 5. Annual trend (May mean) (SE) ovigerous *L. salmonis* on one-sea-winter salmon.

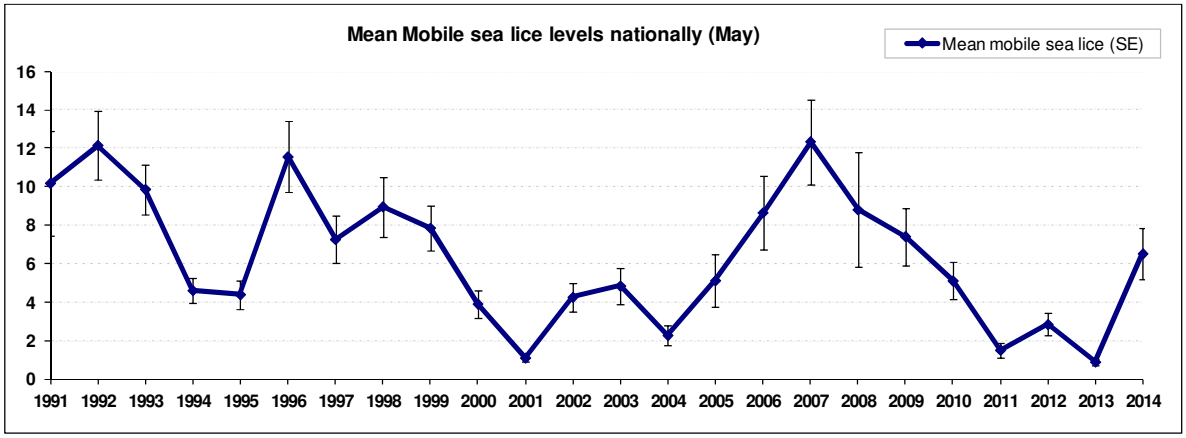


Figure 6. Annual trend (May mean) (SE) mobile *L. salmonis* on one-sea-winter salmon.

Mean ovigerous *L. salmonis* levels in May of 2014 rose to 1.27, compared to 0.19 in 2013 which were the lowest on record. Total mobile levels also increased from 0.89 sea lice per fish in May of 2013 (lowest on record) to 6.25 total mobile sea lice per fish in 2014.

DISCUSSION

As has been the case in previous years, sea lice levels on smolts in 2014 were low. Ninety four percent of sea lice inspections on smolts were below the Treatment Trigger Levels (TTL), this compares with 100 % in 2013 and 98% in 2012.

Sea lice levels on one-sea-winter salmon rose in 2014 compared to 2013 which were the lowest on record. In 2014 71% of inspections were below TTL compared to 82% in 2013 and 74% in 2012. During the spring period in the Northwest 61% of inspections were below the TTL compared to 95% in 2013. In the West, for the same period, 61% were below TTL compared to 78% in 2013. The Southwest continued to have no breaches of protocol levels in 2014.

The sea lice levels for one-sea-winter salmon outside the spring period show that 48% of inspections were below TTL in the Northwest, 62% were below in the West and 100% in the Southwest. These compare to 67% in the Northwest, 53% below in the West, and 100% in the Southwest during 2013.

Sea lice levels in excess of 10 *L. salmonis* mobiles per fish on one-sea-winter salmon nationally were recorded on 23 occasions compared to 13 occasions in 2013 and 17 in 2012, 11 of these inspections had means of greater than 20 mobile *L. salmonis* per fish which was greater than 2013, when 8 inspection recorded sea lice levels in excess of 20 mobile *L. salmonis* per fish. Four of these inspections had levels greater than 40 *L. salmonis* per fish, compared to 5 in 2013. The highest mean sea lice level recorded for one-sea-winter salmon was 137.67 mobile *L. salmonis* per fish, this compares to 84.02 mobile *L. salmonis* per fish in 2013 and 71.72 mobile *L. salmonis* per fish in 2012. There were no unusually high numbers of *Caligus elongatus* recorded in 2014.

Average sea lice levels in the first half of 2014 were higher than the same periods in both 2013 and 2012. This increase was primarily as a result of infestation levels at three bays.

Many factors have contributed to these increases including challenges to fish health, husbandry practices and treatment efficacy. A further factor is undoubtedly regression towards the mean, following 3 years of very low sea lice infections.

The sea lice levels recorded in 2014 underline the requirement to optimise sea lice control by; ensuring the early implementation of strategic winter treatments; optimising treatment efficacy, including treatment rotation; and the implementation of SBM practices.

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.
n<10	Ten fish or less were inspected in one or both cages sampled.
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:	A fish of the family Salmonidae. 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 (also known as S0):	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. They are sometimes referred to 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 2014.

	Date	*Lepeophtheirus salmonis*		*Caligus elongatus*	
		F + eggs	Total	F + eggs	Total
BANTRY BAY					
MARINE HARVEST IRL.					
Roancarraig-Ahabeg					
Atlantic Salmon, 2013 S1/2	14/01/2014	0.00	0.00	1.84	5.89
	19/02/2014	0.02	0.02	2.61	8.42
	05/03/2014	0.04	0.05	2.19	6.10
	27/03/2014	0.00	0.02	1.04	2.35
	10/04/2014	0.02	0.04	1.96	4.81
	24/04/2014	0.05	0.07	1.50	3.82
	13/05/2014	0.00	0.09	3.22	5.30
	29/05/2014	0.00	0.08	0.67	1.28
	19/06/2014	0.03	0.20	0.85	1.95
				Harvested out	
Atlantic Salmon, 2014 S1/2	14/01/2014	0.00	0.00	0.10	0.49
	19/02/2014	0.00	0.00	0.04	0.06
	05/03/2014	0.00	0.00	0.00	0.28
	27/03/2014	0.02	0.02	0.35	1.85
	10/04/2014	0.00	0.02	0.65	1.67
	24/04/2014	0.02	0.05	1.81	6.82
	13/05/2014	0.00	0.03	1.18	2.32
	29/05/2014	0.00	0.00	0.16	0.29
	19/06/2014	0.00	0.00	0.04	0.04
	24/07/2014	0.04	0.08	1.09	5.45
	15/08/2014	0.03	0.05	0.03	0.90
	18/09/2014	0.07	0.32	1.45	2.67
	28/10/2014	0.07	0.28	0.00	0.02
	19/11/2014	0.31	0.62	0.12	0.23

	Date	*Lepeophtheirus salmonis*		*Caligus elongatus*	
		F + eggs	Total	F + eggs	Total
MURPHY'S IRISH SEAFOOD LTD.					
Cuan Baoi					
Atlantic Salmon, 2013	15/01/2014	Sampled Atlantic salmon, 2013 S1/2			
	27/02/2014	0.00	0.00	0.92	1.67
	06/03/2014	Sampled Atlantic salmon 2013 S1/2			
	26/03/2014	0.00	0.10	4.20	10.30
	09/04/2014	Sampled Atlantic salmon 2013 S1/2			
	23/04/2014	Sampled Atlantic salmon 2013 S1/2			
	12/05/2014	0.00	0.00	0.53	0.87
	28/05/2014	0.00	0.13	2.07	4.53
	17/06/2014	Sampled Atlantic salmon 2013 S1/2			
	22/07/2014	Sampled Atlantic salmon 2013 S1/2			
	14/08/2014	0.00	0.17	0.25	0.75
	16/09/2014	0.00	0.00	0.20	0.40
	28/10/2014	0.00	0.08	0.25	2.58
	18/11/2014	On starve for harvest			
Atlantic Salmon, 2013 S1/2	15/01/2014	0.00	0.00	4.88	11.13
	27/02/2014	Sampled Atlantic salmon 2013			
	06/03/2014	0.04	0.07	1.11	3.11
	26/03/2014	Sampled Atlantic salmon 2013			
	09/04/2014	0.00	0.10	4.77	10.00
	23/04/2014	0.03	0.13	5.68	13.58
	12/05/2014	Sampled Atlantic salmon 2013			
	28/05/2014	0.00	0.00	0.80	1.93
	17/06/2014	0.11	0.11	0.41	0.78
	22/07/2014	0.30	0.40	3.60	9.20
		Harvested out			
Atlantic Salmon, 2014 S1/2	22/07/2014	0.03	0.03	0.00	0.13
	14/08/2014	0.04	0.04	0.04	0.07
	16/09/2014	0.00	0.00	0.30	0.80
	28/10/2014	0.00	0.06	0.47	3.16
	18/11/2014	0.04	0.30	2.89	5.81

	Date	*Lepeophtheirus salmonis*		*Caligus elongatus*	
		F + eggs	Total	F + eggs	Total
KENMARE BAY					
MARINE HARVEST IRL.					
Deenish					
Atlantic Salmon, 2013	14/01/2014	0.00	0.05	3.23	6.02
	19/02/2014	0.03	0.05	1.07	2.49
	05/03/2014	0.02	0.02	0.98	1.69
	26/03/2014	0.02	0.09	0.99	1.51
	09/04/2014	0.00	0.03	0.23	0.33
	23/04/2014	0.02	0.05	0.28	1.08
	13/05/2014	0.02	0.14	0.61	1.56
	28/05/2014	0.00	0.02	0.64	1.31
	18/06/2014	0.00	0.03	0.28	0.75
	23/07/2014	0.08	0.25	1.72	7.23
	14/08/2014	0.07	0.07	1.93	3.07
	17/09/2014	0.15	0.34	2.08	4.65
	29/10/2014	0.23	0.28	0.64	1.37
				Harvested out	
Inishfarnard					
Atlantic Salmon, 2014	13/05/2014	0.00	0.02	0.08	0.30
	29/05/2014	0.00	0.04	0.18	0.38
	18/06/2014	0.00	0.06	0.50	1.32
	23/07/2014	0.00	0.00	0.00	0.06
	15/08/2014	0.00	0.10	0.17	0.26
	18/09/2014	0.00	0.00	0.00	0.00
	28/10/2014	0.03	0.28	0.23	0.85
	19/11/2014	0.13	0.36	0.23	0.69

	Date	*Lepeophtheirus salmonis*		*Caligus elongatus*	
		F + eggs	Total	F + eggs	Total
MURPHY'S IRISH SEAFOOD LTD.					
Kilmacillogue					
Atlantic Salmon, 2014 S1/2	15/01/2014	0.00	0.02	1.08	1.96
	20/02/2014	0.00	0.00	0.35	0.52
	06/03/2014	0.00	0.00	0.11	0.21
	27/03/2014	0.00	0.00	0.06	0.12
	10/04/2014	0.00	0.01	0.08	0.11
	24/04/2014	0.00	0.02	0.06	0.12
	13/05/2014	0.00	0.00	0.02	0.02
	28/05/2014	0.00	0.00	0.04	0.07
	19/06/2014	0.00	0.00	0.04	0.05
			Transferred to Cuan Baoi		
GREATMAN'S BAY					
BRADAN BEO TEO.					
Cuigeal					
Atlantic Salmon, 2014 S1/2	30/05/2014	0.04	0.14	0.00	0.03
	20/06/2014	0.03	0.12	0.22	0.40
	09/07/2014	0.08	0.50	0.07	0.09
	22/08/2014	0.25	0.77	0.05	0.10
			Transferred to Daonish		
KILKIERAN BAY					
Daonish					
Atlantic Salmon, 2013 S1/2	06/12/2013	0.25	0.75	0.08	0.12
	18/02/2014	0.67	1.30	0.52	0.82
	13/03/2014	0.20	0.70	0.29	0.32
	27/03/2014	0.15	0.62	0.39	0.47
	10/04/2014	0.13	1.90	0.04	0.07
	17/04/2014	0.10	2.50	0.08	0.35
	16/05/2014	0.29	1.25	0.00	0.02
	28/05/2014	0.24	1.59	0.00	0.00
			Harvested out		
Atlantic Salmon, 2014 S1/2	22/08/2014	0.09	0.78	0.00	0.02
	23/09/2014	0.73	3.63	0.00	0.00
	28/10/2014	0.09	3.55	0.00	0.00
	20/11/2014	0.42	1.97	0.00	0.00

	Date	*Lepeophtheirus salmonis*		*Caligus elongatus*	
		F + eggs	Total	F + eggs	Total
Golam					
Atlantic Salmon, 2014 S1/2	20/01/2014	0.02	0.16	0.41	0.56
	18/02/2014	0.03	0.16	0.42	0.51
	13/03/2014	0.02	0.38	0.37	0.45
	27/03/2014	0.04	0.30	0.00	0.00
	10/04/2014	0.00	0.23	0.00	0.00
	17/04/2014	0.02	0.18	0.00	0.02
	16/05/2014	0.03	0.74	0.07	0.16
			Transferred to Cuigeal		
Atlantic Salmon, 2015 S1/2	20/11/2014	0.00	2.12	0.00	0.04
MARINE HARVEST IRL.					
Ardmore					
Atlantic Salmon, 2014 S1/2	21/01/2014	0.02	0.12	0.50	0.94
	19/02/2014	0.02	0.11	0.65	0.87
	11/03/2014	0.04	0.82	0.60	0.79
	28/03/2014	0.02	0.74	0.17	0.39
	14/04/2014	0.03	0.50	0.00	0.00
	22/04/2014	0.00	0.47	0.00	0.00
	14/05/2014	0.00	0.50	0.00	0.04
	27/05/2014	0.04	0.87	0.05	0.20
	24/06/2014	0.13	0.76	0.43	0.91
	07/07/2014	0.05	0.25	0.05	0.15
	15/08/2014	0.49	1.24	0.00	0.02
	09/09/2014	0.94	3.47	0.20	0.34
	13/10/2014	2.40	7.46	0.17	0.25
	25/11/2014	4.35	7.92	0.00	0.00

	Date	*Lepeophtheirus salmonis*		*Caligus elongatus*	
		F + eggs	Total	F + eggs	Total
BERTRAGHBOY BAY					
COMHLUCHT BRADAIN CHONAMARA TEO					
Sealax					
Atlantic Salmon, 2013b	14/01/2014	0.00	0.10	0.90	1.90
	07/02/2014	0.04	0.18	2.31	4.00
	07/03/2014	0.00	0.20	0.76	1.01
	28/03/2014	0.02	0.19	0.28	0.35
	04/04/2014	0.07	0.27	0.52	0.69
	22/04/2014	0.17	0.61	0.22	0.78
	13/05/2014	0.60	1.84	1.20	1.77
	29/05/2014	0.16	0.73	0.31	0.63
	17/06/2014	0.37	3.72	0.90	1.54
	10/07/2014	0.44	0.94	0.00	0.10
	01/08/2014	3.11	4.87	0.14	0.17
	11/09/2014	2.25	5.48	0.00	0.02
	02/10/2014	5.79	8.57	0.10	0.16
				Harvested out	
MANNIN BAY					
MANNIN BAY SALMON COMPANY LTD.					
Corhounagh					
Atlantic Salmon, 2013 S1/2	29/04/2014	4.39	16.89	0.00	0.00
	15/05/2014	2.77	14.87	0.00	0.00
	29/05/2014	5.03	17.83	0.02	0.02
	13/06/2014	5.73	13.49	0.00	0.00
				Harvested Out	
Atlantic Salmon, 2014 S1/2	26/08/2014	0.34	0.76	0.00	0.11
	10/09/2014	0.41	7.33	0.44	1.16
	14/10/2014	2.86	8.44	0.30	0.56
	28/11/2014	6.87	12.52	0.58	0.78

	Date	*Lepeophtheirus salmonis*		*Caligus elongatus*	
		F + eggs	Total	F + eggs	Total
CLIFDEN BAY					
Hawks Nest					
Atlantic Salmon, 2014 S1/2	09/01/2014	0.00	0.00	0.08	0.14
	07/02/2014	0.00	0.00	0.20	0.21
	10/03/2014	0.00	0.00	0.07	0.17
	26/03/2014	0.00	0.03	0.10	0.15
	02/04/2014	0.02	0.05	0.04	0.08
	16/04/2014	0.00	0.00	0.04	0.11
	08/05/2014	0.00	0.04	0.09	0.10
	20/05/2014	0.02	3.89	0.09	0.20
	23/06/2014	4.02	6.67	0.00	0.00
	11/07/2014	0.40	1.49	0.00	0.00
			Transferred to Corhounagh		
BALLINAKILL HARBOUR					
BIFAND LTD.					
Fraochoilean					
Atlantic Salmon, 2013 S1/2	03/12/2013	0.86	4.42	0.52	0.67
	28/02/2014	2.90	12.17	0.05	0.20
	14/03/2014	3.60	18.40	0.04	0.08
	31/03/2014	6.10	31.22	0.06	0.09
	11/04/2014	2.16	13.51	0.00	0.00
			Transferred to Corhounagh		
Atlantic Salmon, 2015 S1/2	24/11/2014	0.00	0.00	0.00	0.10
KILLARY HARBOUR					
ROSROE SALMON LTD.					
Inishdeighil					
Atlantic Salmon, 2014	24/04/2014	0.00	0.22	0.04	0.19
	09/05/2014	0.00	0.12	0.06	0.14
	22/05/2014	0.00	0.04	0.03	0.04
	12/06/2014	0.00	0.02	0.02	0.14
	08/07/2014	0.00	0.00	0.17	0.32
	13/08/2014	0.03	0.06	0.12	0.36
	19/09/2014	0.15	0.34	0.19	0.57
	24/10/2014	0.09	0.85	0.39	0.64
	28/11/2014	0.21	3.37	1.02	2.20

	Date	*Lepeophtheirus salmonis*		*Caligus elongatus*	
		F + eggs	Total	F + eggs	Total
CLEW BAY					
CLARE ISLAND SEAFARMS LTD.					
Portlea					
Atlantic Salmon, 2013	09/01/2014	0.28	1.36	0.05	0.22
			Transferred to Eany		
Atlantic Salmon, 2014	23/04/2014	0.00	0.00	0.02	0.02
	16/05/2014	0.00	0.35	0.11	1.31
	28/05/2014	0.00	0.00	0.10	0.18
	19/06/2014	0.00	0.09	0.62	1.69
	24/07/2014	0.02	0.04	9.05	16.85
	26/08/2014	0.00	0.05	0.00	0.00
	26/09/2014	0.00	0.04	0.00	0.02
	28/10/2014	0.07	0.18	1.11	1.66
	29/11/2014	0.00	0.00	0.02	0.04
BEALACRAGHER BAY					
CURRAUN BLUE LTD.					
Curraun					
Rainbow Trout, 2013 (2)	03/12/2013	0.02	0.13	0.00	0.00
	14/02/2014	0.03	0.32	0.00	0.00
	04/03/2014	0.02	0.34	0.00	0.00
	28/03/2014	0.02	0.09	0.00	0.00
	10/04/2014	0.04	0.05	0.00	0.00
	29/04/2014	0.02	0.09	0.00	0.00
	08/05/2014	0.03	0.12	0.00	0.00
	27/05/2014	0.00	0.23	0.00	0.02
	30/06/2014	0.98	3.82	0.07	0.14
	28/07/2014	6.70	15.40	0.00	0.00
			Harvested out		

	Date	*Lepeophtheirus salmonis*		*Caligus elongatus*	
		F + eggs	Total	F + eggs	Total
DONEGAL BAY					
MARINE HARVEST IRL.					
Creevin					
Atlantic Salmon, 2013	03/12/2013	1.20	4.44	0.06	0.13
	17/02/2014	0.02	0.07	0.10	0.14
	13/03/2014	0.02	4.06	0.10	0.34
	28/03/2014	0.02	4.67	0.11	0.25
	15/04/2014	0.22	1.99	0.00	0.00
	24/04/2014	0.00	0.20	0.02	0.03
	16/05/2014	0.21	12.27	0.07	0.63
	29/05/2014	4.34	13.75	0.60	1.11
	19/06/2014	1.11	3.10	0.00	0.00
	24/07/2014	1.38	9.51	0.00	0.05
	14/08/2014	6.99	26.70	0.05	0.08
	16/09/2014	10.25	39.17	0.18	0.18
				Harvested out	
Eany					
Atlantic Salmon, 2013	17/02/2014	0.62	1.86	0.03	0.03
	13/03/2014	0.42	3.45	0.05	0.17
	28/03/2014	0.40	1.53	0.00	0.00
	15/04/2014	0.22	2.84	0.02	0.10
	24/04/2014	0.10	1.06	0.00	0.07
	16/05/2014	0.75	16.43	0.22	0.75
	29/05/2014	6.09	20.51	0.69	1.58
	19/06/2014	1.52	5.59	0.00	0.00
	24/07/2014	0.39	4.41	0.00	0.00
	14/08/2014	10.40	51.45	0.10	0.13
				Harvested out	
Atlantic Salmon, 2013 S1/2	03/12/2013	1.54	7.83	0.02	0.03
	17/02/2014	0.25	5.47	0.16	0.50
				Harvested out	

	Date	*Lepeophtheirus salmonis*		*Caligus elongatus*	
		F + eggs	Total	F + eggs	Total
OCEAN FARM LTD.					
Mc Swynes					
Atlantic Salmon, 2013	03/12/2013	1.57	5.72	0.99	2.35
	17/02/2014	0.20	11.30	0.23	1.56
	12/03/2014	0.20	25.56	2.93	7.31
	27/03/2014	0.81	6.83	0.02	0.03
	14/04/2014	0.37	1.27	0.00	0.00
	23/04/2014	1.02	2.78	0.00	0.00
	15/05/2014	0.65	3.79	0.00	0.02
	21/05/2014	0.64	6.47	0.02	0.43
	17/06/2014	2.87	8.69	0.00	0.00
	22/07/2014	3.74	8.98	0.02	0.02
	15/08/2014	12.04	32.79	0.06	0.14
	30/09/2014	48.08	137.67	0.17	0.25
			Harvested out		
Ocean Inver					
Atlantic Salmon, 2014	12/03/2014	0.00	1.45	0.42	1.16
	27/03/2014	0.00	0.81	0.13	0.25
	14/04/2014	0.02	1.44	0.33	0.49
	23/04/2014	0.05	1.06	0.12	0.33
	15/05/2014	0.03	2.86	0.40	0.95
	21/05/2014	0.07	2.97	0.69	1.83
	17/06/2014	0.02	1.06	0.00	0.00
	22/07/2014	0.15	1.24	0.02	0.03
	15/08/2014	2.64	11.30	0.16	0.24
	23/09/2014	2.35	9.57	0.02	0.02
	30/10/2014	3.23	6.56	0.00	0.00
	25/11/2014	0.38	0.93	0.00	0.00
Richie's Bay					
Atlantic Salmon, 2013	17/06/2014	4.08	10.54	0.00	0.00
	22/07/2014	8.03	32.35	0.23	0.26
	15/08/2014	18.00	44.65	0.05	0.15
	23/09/2014	20.24	46.71	0.00	0.00
			Harvested out		

	Date	*Lepeophtheirus salmonis*		*Caligus elongatus*	
		F + eggs	Total	F + eggs	Total
MULROY BAY					
MARINE HARVEST IRL.					
Glinsk					
Atlantic Salmon, 2014	08/05/2014	0.00	0.00	0.00	0.09
	22/05/2014	0.00	0.00	0.03	0.19
	18/06/2014	0.00	0.00	0.03	0.03
	23/07/2014	0.00	0.00	0.00	0.00
	13/08/2014	0.00	0.03	0.02	0.07
	02/09/2014	0.00	0.00	0.00	0.00
	09/10/2014	0.00	0.00	0.00	0.00
	26/11/2014	0.00	0.00	0.04	0.05
Millstone					
Atlantic Salmon, 2014	08/05/2014	0.00	0.00	0.00	0.02
	22/05/2014	0.00	0.00	0.02	0.08
	18/06/2014	0.00	0.00	0.03	0.03
	23/07/2014	0.00	0.00	0.00	0.00
	13/08/2014	0.00	0.02	0.03	0.07
	02/09/2014	0.00	0.00	0.00	0.00
	09/10/2014	0.00	0.07	0.00	0.00
	26/11/2014	0.02	0.10	0.82	2.30

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