NATIONAL SURVEY OF SEA LICE (*LEPEOPHTHEIRUS SALMONIS* KRØYER AND *CALIGUS ELONGATUS* NORDMANN) ON FISH FARMS IN IRELAND – 2006

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INTRODUCTION

Sea lice are an ectoparasite which occur on many fish worldwide and are regarded as having the most commercially damaging effect on cultured salmon in the world, with major economic losses to the fish farming community resulting each year (Bristow and Berland, 1991; Jackson and Costello, 1991). Sea lice affect salmon in a variety of ways, namely; by reducing fish growth; by causing loss of scales, which leaves the fish open to secondary infections (Wooten *et al*., 1982); and by damaging the fish, which reduces its marketability. The two species of sea lice found on cultured salmonids in Ireland are *Caligus elongatus* Nordmann, a species of parasite that infests over 80 different types of marine fish, and *Lepeophtheirus salmonis* Krøyer, which infests only salmon and other salmonids.

L. salmonis is regarded as the more serious parasite of the two species and has been found to occur most frequently on farmed Atlantic salmon (Jackson and Minchin, 1992; Jackson, D. *et al*, 2005). Most of the damage caused by these parasites is thought to be mechanical, carried out during the course of attachment and feeding (Kabata, 1974; Brandal *et al*., 1976; Jones *et al*., 1990). Inflammation and hyperplasia (enlargement caused by an abnormal increase in the number of cells in an organ or tissue) have been recorded in Atlantic salmon in response to 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 caused by heavy infestations of *L. salmonis* has been recorded previously (Pike, 1989; Berland, 1993). Heavy infestations occur here because of the rich supply of mucus secreted by mucous-cell lined ducts 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) that comprises of ten stages. 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 and this is 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). Examples of adult ovigerous female *L.*

salmonis and adult male *L. salmonis* are shown in Figure 1. The mean length for an adult female is 8mm-11mm and an adult male is 5mm-6mm (Schram, 1993).

C. elongatus is not as host specific as *L. salmonis* and parasitises a range of marine fish (Kabata, 1979). This, combined with the migrating patterns of their hosts, is thought to account for the highly variable levels on farmed salmonids at different times of the year. An example of an adult ovigerous female *C. elongatus* and an adult male *C. elongatus* are shown in Figure 2. *C. elongatus* averages approximately 6-8mm in length (Hogans & Trudeau, 1989).

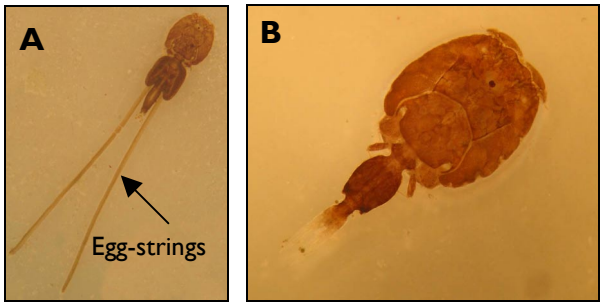

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Figure 1. (A) Adult ovigerous female *L. salmonis*. (B) Adult male *L. salmonis*.

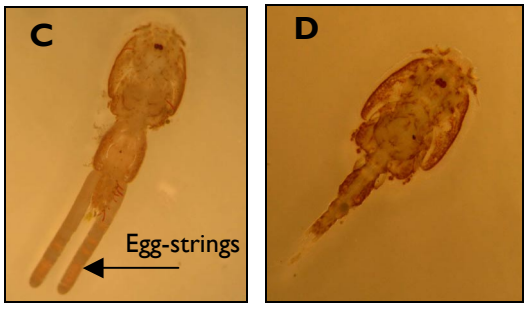

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Figure 2. (C) Adult ovigerous female *C. elongatus*. (D) Adult male *C. elongatus*.

In 1991, the then Department of the Marine instigated a sea lice monitoring programme for finfish farms in Ireland and in 1993, it became a nationwide programme. 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).

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 the 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 practices.

Together, these components work to reduce the development of sea lice infestations and to ensure the most effective treatment of sea lice challenges. They minimise sea lice levels whilst controlling reliance on, and reducing the use of, veterinary medicines. The separation of generations and annual fallowing prevent the vertical transmission of infestations from one generation to the next, thus retarding their development. The early harvest of two-sea-winter fish removes a potential reservoir of lice infestation and the agreed practices and targeted treatments enhance the efficacy of treatment regimes. One important aspect of targeted treatments is the carrying out of autumn / winter treatments to reduce 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 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 lice control.

The setting of appropriate treatment trigger levels is an integral part of implementing a targeted treatment regime. Treatment triggers during the spring period are set close to zero in the range 0.3 to 0.5 egg bearing females per fish and are also informed by the mobile lice on the fish. Where numbers of mobile lice are high, treatments are triggered even in the absence of egg bearing females. Outside of the critical spring period, a level of 2.0 ovigerous female lice per fish acts as a trigger for treatments. Over the period since the initiation of Single Bay Management (SBM), treatment triggers have been progressively reduced from a starting point of 2.0 ovigerous female lice per fish during the spring period to the current levels which are the optimal sustainable at present. Triggered treatments are underpinned by follow up inspections and, where necessary, by sanctions. Sanctions employed include; peer review under the SBM process; conditional fish movement orders; and accelerated harvests.

In late winter and early spring the sea water temperatures are at a minimum and development rates of lice are reduced. This has the effect of tending to synchronise the development of lice larvae. A strategic treatment at this time can break the cycle of infection.

Ovigerous female lice are those which produce the infective larvae and treatments are timed to removed adult females before they can release larvae. Setting the treatment trigger at 0.5 ovigerous lice per fish ensures that treatments are carried out when a maximum of half of the fish examined have any ovigerous lice. This is the optimum time to interrupt lice development. Later in the year generations are not as synchronized and intervention at a lice level of 0.5 ovigerous by way of treatment is generally not justified. A level of 2.0 ovigerous lice per fish has been shown to be a pragmatic level at which intervention by way of treatment is advisable. Levels of mobile lice or juvenile lice are important in advising fish health professionals in developing a 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 the inspection. A monthly report of results is circulated to interested parties and the data is published annually. (O'Donohoe *et al*, 2006; O'Donohoe *et al*, 2005; O'Dohohoe *et al*, 2004; O'Donohoe *et al*, 2003; McCarney *et al*, 2002; Copley *et al*, 2001)

Treatments are administered to farmed fish either as in-feed treatments or as topical / bath treatments. Currently, there are four licensed sea lice treatments in Ireland. Two of these, CALICIDE® and SLICE®, are in-feed and the remaining two, EXCIS® and ALPHAMAX® are topical treatments. CALICIDE® contains teflubenzuron which acts as a chiton synthesis inhibitor that interferes with the cuticle formation of the louse. It is effective against the moulting stages of the life cycle and it has a 7 day withdrawal period. SLICE® contains emamectin benzoate, which interferes with the peripheral nervous system of the louse causing paralysis or death. It is effective against all stages of the life cycle and has no withdrawal period. The topical treatment EXCIS® contains cypermethrin, which also affects the nervous system of the louse. It is effective against all stages of the life cycle and has a 24 hour withdrawal period. ALPHAMAX® contains deltamethrin and again is effective against the nervous system of the louse. It affects adults and pre-adults (it's efficacy against the chalimus stages is unknown) and has a 3 day withdrawal period.

METHODOLOGY

All stocks of salmonids on all farms in Ireland are visited on 14 occasions throughout the year and sea lice numbers are recorded. Follow-up inspections may be carried out where required. Sea lice inspections take place monthly where fish are present, with two inspections taking place each month during March, April and May; referred to as the critical spring period. Only 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 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 them in a container of sea-water, which at the end of the sample is sieved for any lice. Each fish is examined individually for all mobile lice. Lice are removed and placed in a plastic bottle containing 70% alcohol, one bottle per fish. The mean is calculated by adding the number of lice taken from each fish with the number from the sieved sea-water, then dividing by the number of fish examined.

Results presented are mean ovigerous sea lice levels and mean mobile sea lice levels for *Lepeophtheirus salmonis* and *Caligus elongatus*. Total mobile levels estimate successful infestation levels. Ovigerous lice levels estimate successful breeding female populations. The information gathered aims to evaluate the levels of lice on growing fish and to inform the fish farmer on his control strategy, by advising treatment if necessary. Effective parasite control is characterised by a drop in lice levels on the subsequent inspection.

In the year 2006, salmonid farms had 6 different stocks of fish. These were; 2005 rainbow trout (rainbow trout first inspected in 2005); 2006 rainbow trout (rainbow trout first inspected in 2006); 2004 Atlantic salmon (two-sea-winter salmon); 2005 Atlantic salmon (one-sea-winter salmon), 2006 Atlantic salmon (smolts) and Atlantic salmon 2007 $S^1/_2$ (fish stocked at the end of 2006). All generations of farmed fish were examined during the year 2006.

There are three distinct regions in Ireland where salmonid farming is carried out, the West (Counties Mayo and Galway), the Northwest (Co. Donegal) and the Southwest (Counties Cork and Kerry). 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 the year 2006 a total number of 32 sites were inspected around Ireland. See Figures 3-6.

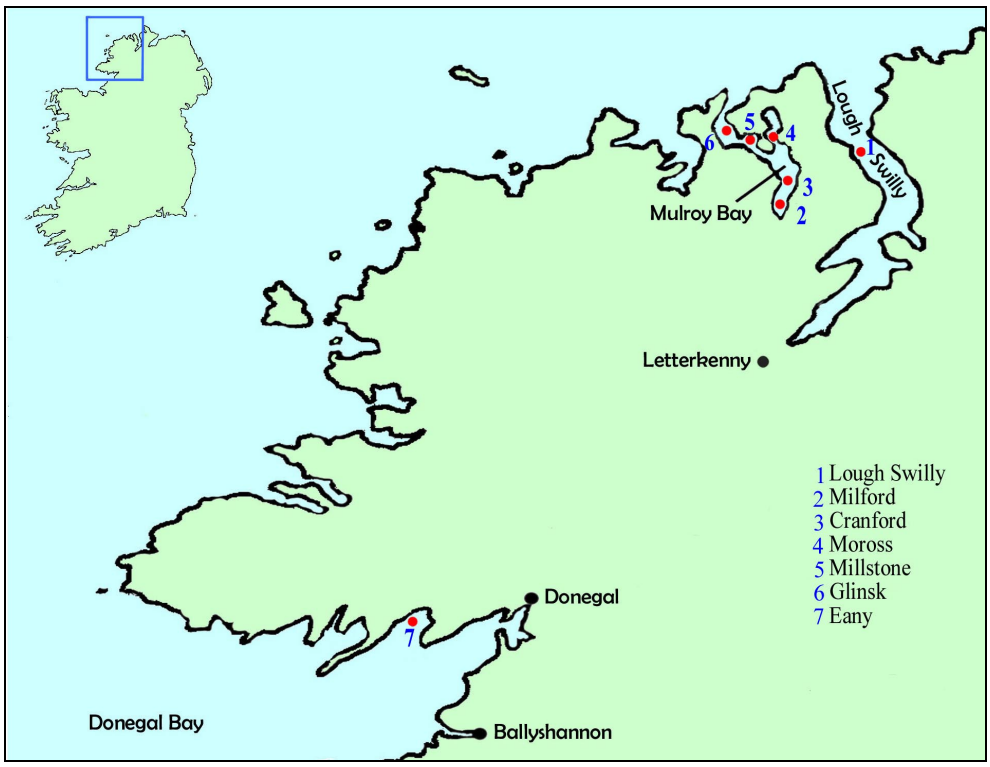

Figure 3. Locations of fish farm sites in Northwest region.

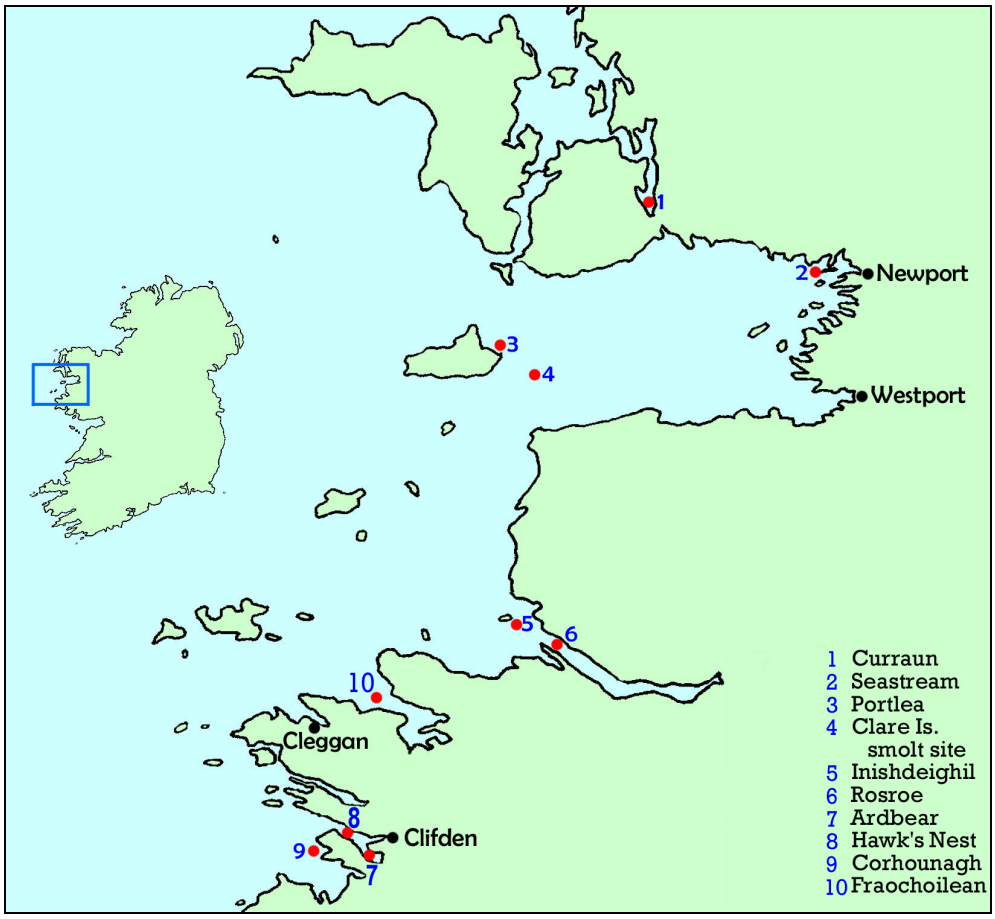

Figure 4. Locations of fish farm sites in the West region (Clew Bay / Connemara).

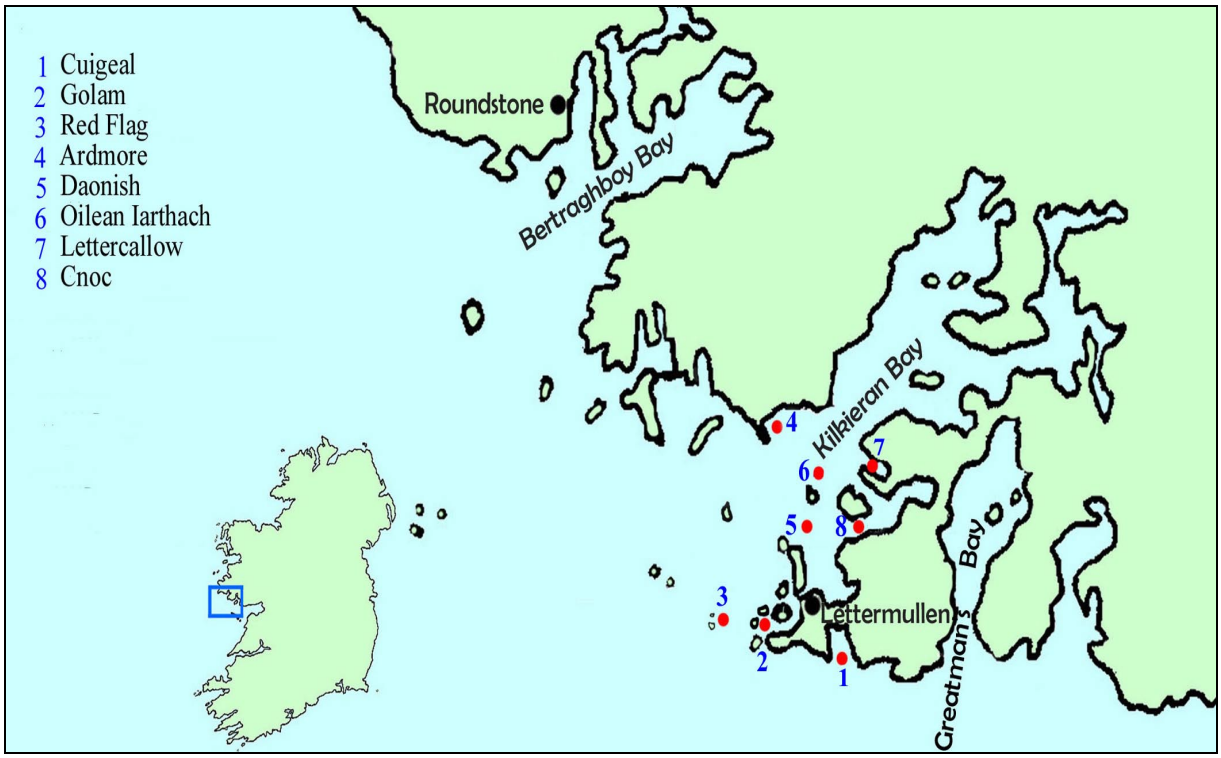

Figure 5. Locations of fish farm sites in the West region (Connemara).

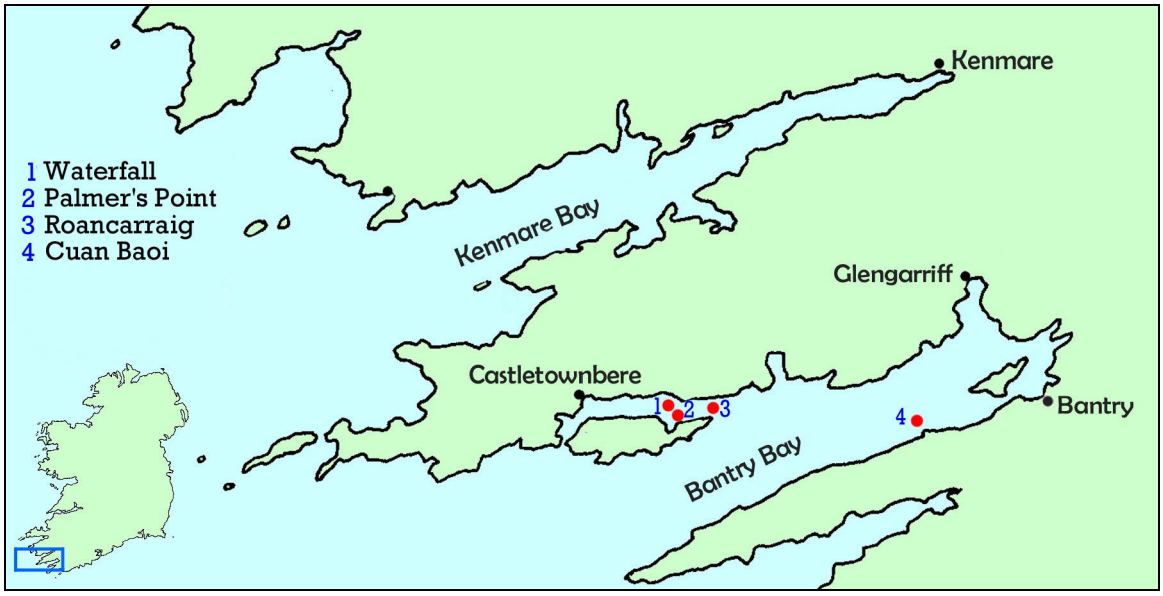

Figure 6. Locations of fish farm sites in the Southwest region.

RESULTS

Atlantic salmon 2007 S$^{1}/_{2}$ (Smolts)

There were 2 inspections carried out to this stock in November 2006, just after they were inputted to sea. Both inspections recorded numbers below the treatment trigger levels.

Atlantic salmon 2006 (Smolts)

A total of 145 visits were undertaken at 21 sites stocking S1 and S½ smolts during the year 2006. *Lepeophtheirus salmonis* levels were maintained below the treatment trigger level of 0.5 ovigerous female lice per fish for all of the 57 inspections in the critical spring period. Outside of this period levels exceeded 2.0 ovigerous female lice per fish on 10 of the 89 inspections.

Caligus elongatus levels remained low throughout the year on 2006 smolts.

Atlantic salmon 2005 (one-sea-winter salmon)

One-sea-winter salmon were stocked in a total of 18 sites in 10 bays in 2006. One hundred and fifty-seven visits were undertaken to this generation of fish. Four sites, in 4 bays, continued to stock one-sea-winter salmon in November 2006.

Ovigerous *L. salmonis* levels greater than the treatment trigger level were recorded in a total of 68 inspections (43%) on one-sea-winter fish. Within the critical spring period, lice levels were in excess of 0.5 ovigerous females per fish on 45 inspections (55%) and outside of the spring period 23 inspections (31%) were in excess of 2.0 ovigerous female lice per fish.

C. elongatus levels were consistently recorded at a low level throughout the year, with the exception in the Southwest in February, March and May and also in Clew Bay in February. The highest levels recorded were 17.80 mobile *C. elongatus* per fish.

Southwest Region

In the Southwest region, 7 of the 12 inspections in the spring period (March to May) were in excess of treatment trigger levels and none of the 11 inspections outside the spring period exceeded the treatment trigger levels.

Levels at Roancarraig (Silver King Seafoods Ltd), Bantry Bay, were in excess of treatment trigger levels for 5 out of 6 inspections in the spring period and none of the 4 inspections outside the spring period.

West Region

In the West region, lice infestation levels greater than the treatment trigger were recorded on 22 out of 41 inspections (54%) in the spring period and on 9 out of 33 inspections (27%) outside the spring period.

Levels at Daonish (Muirachmhainni Teo), Kilkieran Bay, were in excess of treatment trigger levels for 5 out of 6 inspections in the spring period and 1 of the 3 inspections outside the spring period.

At Corhounagh (Mannin Bay Salmon Co. Ltd.), Mannin Bay, levels exceeded treatment trigger levels for both spring inspections in May, again in June, September and November.

Treatment trigger levels were exceeded in Cnoc (Muir Gheal Teo), Kilkieran Bay, in February and on 4 occasions in the spring but were below treatment trigger levels in June on the last inspection before harvest.

Lice levels were in excess of treatment trigger levels at Rosroe (Celtic Atlantic Salmon (Killary) Ltd.) for both inspections in April and again on the final 2 inspections in July and August prior to harvest.

Lice levels at Portlea (Clare Island Seafarms Ltd), Clew Bay, were in excess of treatment trigger levels for 4 of the 6 inspections in spring and 1 of the 6 inspections out side the spring period.

Seastream outer (Clare Island Seafarms Ltd), Clew Bay, had sea lice levels in excess of treatment trigger levels in February and for 4 of the 5 inspections in spring. Infestation levels were below treatment trigger levels in May prior to harvest.

Northwest Region

The treatment trigger levels were exceeded on 16 out of 29 inspections (55%) in the Northwest region during the critical spring period and on 14 out of 31 inspections (45%) outside that period.

Lough Swilly (Marine Harvest) 2005 fish had lice levels at or above the treatment trigger levels for 9 of the 13 inspections. Sea lice levels were in excess of treatment trigger levels for the second inspection in April, both inspections in May, also June through till November. Millstone (Marine Harvest), Mulroy Bay, had elevated lice levels for April, May, July, August, September and October. Cranford A (Marine Harvest), Mulroy Bay, had lice levels in excess of treatment trigger levels in December/January, February, March, April and May. The fish were harvested out in June.

Sea lice levels in Donegal Bay, in the Northwest region, did not exceed treatment trigger levels in 2006.

Atlantic salmon 2004 (two-sea-winter salmon)

At the beginning of 2005, two-sea-winter salmon were still being stocked on four sites; Seastream Inner (Clare Island Seafarm Ltd., Clew Bay) 6 inspections; Cranford A (Marine Harvest) 1 inspection; Millstone (Marine Harvest) 4 inspections and Lough Swilly (Marine Harvest) 1 inspection. A total of 12 visits were undertaken to these sites before harvesting was completed, with 58.33% of inspections exceeding treatment trigger levels.

Rainbow trout

In 2006 there were 2005 rainbow trout and 2006 rainbow trout stocked between 4 sites. Curraun (Curraun Fisheries Ltd) Bealacragher Bay stocked 2005 rainbow trout. There were a total of 8 inspections carried out on this stock in 2006. Sea lice levels did not reach treatment trigger levels for any inspection.

Thirty-six inspections were carried out on the 2006 rainbow trout, stocked at Palmer's Point and Waterfall (John Power Ltd), Bantry Bay; Curraun (Curraun Fisheries Ltd) Bealacragher Bay and Eany Fish Products Ltd, Donegal Bay. All except one of the 36 inspections were below treatment trigger levels.

Sampling record

In March 2006, one site inspection was missed due to adverse weather conditions.

All the mean values for each farm visit can be seen in Appendix 1.

Monthly Trends: *Lepeophtheirus salmonis* and *Caligus elongatus*

Mean ovigerous and mean mobile *L. salmonis* and *C. elongatus* levels for each bay are shown in Table 1 for one-sea-winter salmon throughout the year. Monthly ovigerous *L. salmonis* levels were greater than the treatment trigger level of 0.5 ovigerous lice per fish on 16 occasions during the critical spring period on a bay basis. These occurred in Bantry Bay (3), Kilkieran Bay (3), Mulroy Bay (3), Mannin Bay (2), Lough Swilly (2), Clew Bay (2), and Killary Harbour (1). On 16 occasions outside of the critical spring period, mean ovigerous levels of 2.0 ovigerous females per fish or greater were recorded. These occurred in Lough Swilly (6), Mulroy Bay (4), Mannin Bay (3), Killary Harbour (2), and Clew Bay (1).

Mean mobile levels in excess of 10 *L.. salmonis* per fish were recorded on 21 occasions and 12 of these showed means of greater than 20 mobile lice per fish. Four of these were over 40 mobile lice per fish. The highest level recorded was 85.93 mobile lice per fish in Mannin Bay in November.

Regional Monthly Means

L. salmonis monthly mean figures for one-sea-winter salmon are shown in Figures 7 and 8 for each of the three regions where lice inspections were carried out. Regional monthly mean *L. salmonis* levels were in excess of treatment trigger levels in all 3 regions for all three spring months in 2006. In the southwest there were no mean figures in excess of treatment trigger levels outside the spring period. In the West region monthly mean ovigerous levels were in excess of treatment trigger levels outside of the spring period in August, September and November. In the Northwest region monthly mean ovigerous levels exceeded the treatment trigger levels from June to November inclusive outside of the spring period.

Total mobile lice levels exceeded 10 sea lice per fish in March, May, August, September and November in the West region. In the Northwest total mobile levels exceeded 10 per fish from July to November, inclusive. The highest level recorded was 45.32 mobile lice per fish, this was in the West in November.

Annual trends

L. salmonis ovigerous and mobile lice level trends are compared in Figures 9 and 10 for one-sea-winter salmon in the month of May from 1991 to 2006. The mean number of ovigerous lice per fish, and the mean number of mobile lice per fish are presented. From 1998 to 2001 the levels decreased steadily for both ovigerous and total mobile lice. Mean ovigerous *L. salmonis* levels increased in 2002, remained steady in 2003 and show a slight decrease again in 2004. In 2005 and 2006 levels increased and are the highest since 1993. Mean mobile levels increased from 2001 to 2002 and again from 2002 to 2003 but show a reduction in the 2004 figure. Levels increased in 2005 and again in 2006 where levels are at their highest since 1998.

Table 1. Mean ovigerous and mean mobile *Lepeophtheirus salmonis* and *Caligus elongatus* per months, for one-sea-winter salmon for each bay inspected in the year 2006.

Mean ovigerous *L. salmonis*

	Dec/Jan	*Feb*	*Mar*	*Apr*	*May*	*Jun*	*Jul*	*Aug*	*Sep*	*Oct*	*Nov*
Bantry Bay	0.50	1.06	1.30	0.64	0.68	0.39	1.27	1.83	1.39	1.38	HO
Kilkieran Bay	0.48	1.87	0.79	0.83	3.68	1.74	HO				
Mannin Bay	0.03	0.62	0.83	0.22	1.76	3.00	0.11	1.71	5.06	0.89	17.30
Ballinakill Bay	0.24	0.09	0.15	0.27	0.04	1.55	0.73	HO			
Killary Harbour	0.04	0.12	0.16	4.77	0.18	0.12	2.89	6.30	HO		
Clew Bay	0.30	1.39	1.16	1.37	0.14	1.11	0.42	3.64	1.67	0.00	0.88
Donegal Bay	0.30	0.72	0.06	0.06	0.07	HO					
Mulroy bay	1.22	1.02	1.12	1.21	1.40	1.45	5.50	2.82	5.97	10.37	1.61
Lough Swilly	0.52	0.71	0.32	0.72	2.32	2.74	3.18	6.35	3.91	13.25	8.65

Mean mobile *L. salmonis*

	Dec/Jan	*Feb*	*Mar*	*Apr*	*May*	*Jun*	*Jul*	*Aug*	*Sep*	*Oct*	*Nov*
Bantry Bay	2.76	2.97	8.18	1.23	3.05	0.52	7.00	4.10	2.29	3.07	HO
Kilkieran Bay	1.85	3.87	13.08	8.89	16.44	3.33	HO				
Mannin Bay	0.17	2.80	2.22	2.73	13.55	10.35	0.35	2.00	44.68	1.28	85.93
Ballinakill Bay	0.75	0.12	1.95	0.53	0.57	2.41	2.23	HO			
Killary Harbour	0.13	0.82	28.71	23.87	26.94	1.44	23.15	40.37	HO		
Clew Bay	1.24	6.51	5.33	6.17	0.79	3.21	0.84	7.73	11.79	0.15	4.71
Donegal Bay	1.05	3.49	0.37	0.21	0.16	HO					
Mulroy bay	5.16	1.97	3.43	6.06	5.57	3.38	14.32	15.24	18.57	24.18	7.33
Lough Swilly	1.56	1.23	4.74	6.63	6.72	11.87	8.21	25.88	27.47	38.88	51.61

Mean ovigerous *C. elongatus*

	Dec/Jan	*Feb*	*Mar*	*Apr*	*May*	*Jun*	*Jul*	*Aug*	*Sep*	*Oct*	*Nov*
Bantry Bay	0.65	1.97	3.87	0.07	1.87	0.02	3.13	0.38	0.13	0.52	HO
Kilkieran Bay	0.00	0.00	0.00	0.02	0.34	0.05	HO				
Mannin Bay	0.07	0.00	0.00	0.00	0.01	0.20	0.00	0.00	0.15	0.06	1.56
Ballinakill Bay	0.02	0.00	0.01	0.00	0.00	0.17	0.27	HO			
Killary Harbour	0.00	0.02	0.16	0.00	0.00	0.23	0.04	0.00	HO		
Clew Bay	0.05	3.38	0.58	0.76	0.10	0.46	0.00	0.62	0.44	0.00	1.18
Donegal Bay	0.35	3.35	0.00	0.04	0.06	HO					
Mulroy bay	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00
Lough Swilly	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Mean mobile *C. elongatus*

	Dec/Jan	*Feb*	*Mar*	*Apr*	*May*	*Jun*	*Jul*	*Aug*	*Sep*	*Oct*	*Nov*
Bantry Bay	1.41	4.38	8.71	0.29	4.08	0.16	6.79	0.79	0.19	1.00	HO
Kilkieran Bay	0.01	0.00	0.04	0.14	0.55	0.21	HO				
Mannin Bay	0.07	0.00	0.00	0.02	0.09	0.34	0.00	0.00	0.18	0.09	3.63
Ballinakill Bay	0.02	0.00	0.10	0.01	0.01	0.38	0.60	HO			
Killary Harbour	0.00	0.02	0.49	0.00	0.00	0.38	0.10	0.03	HO		
Clew Bay	0.14	6.24	1.19	1.50	0.16	0.82	0.04	1.11	0.89	0.02	2.01
Donegal Bay	0.78	5.85	0.01	0.16	0.06	HO					
Mulroy bay	0.00	0.01	0.00	0.05	0.00	0.00	0.04	0.00	0.00	0.00	0.00
Lough Swilly	0.03	0.00	0.00	0.01	0.02	0.00	0.00	0.00	0.00	0.00	0.00

HO = Harvested out

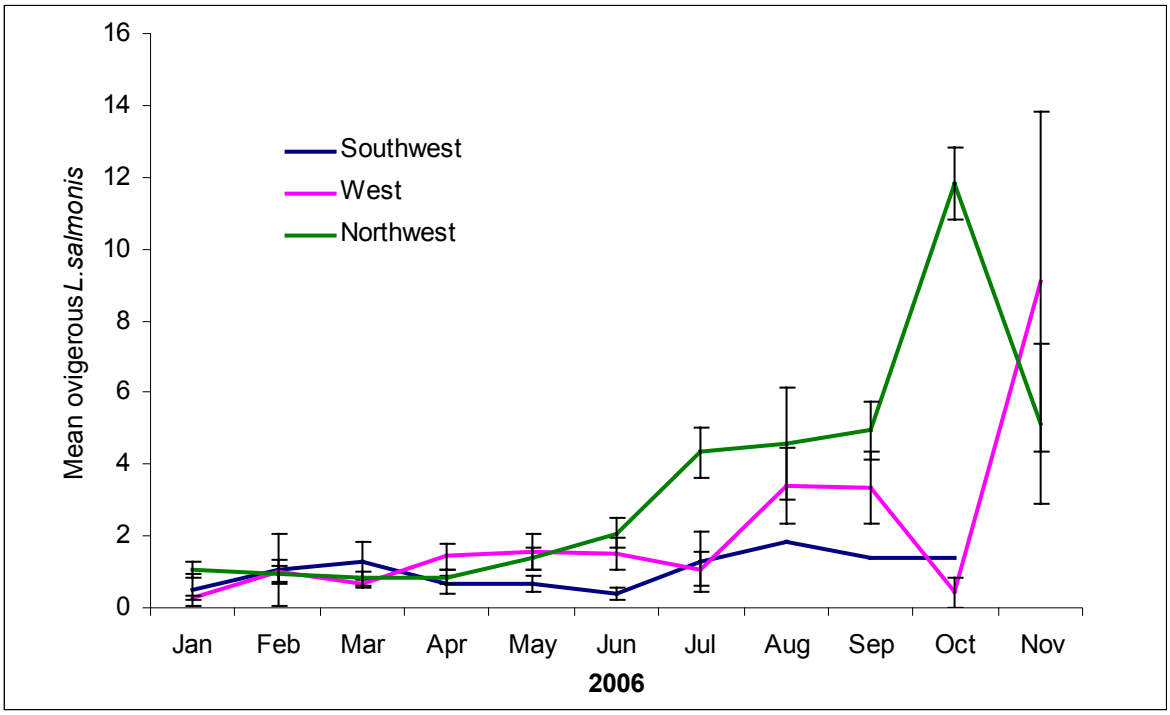

Figure 7. Mean (SE) ovigerous *L. salmonis* per month per region in 2006.

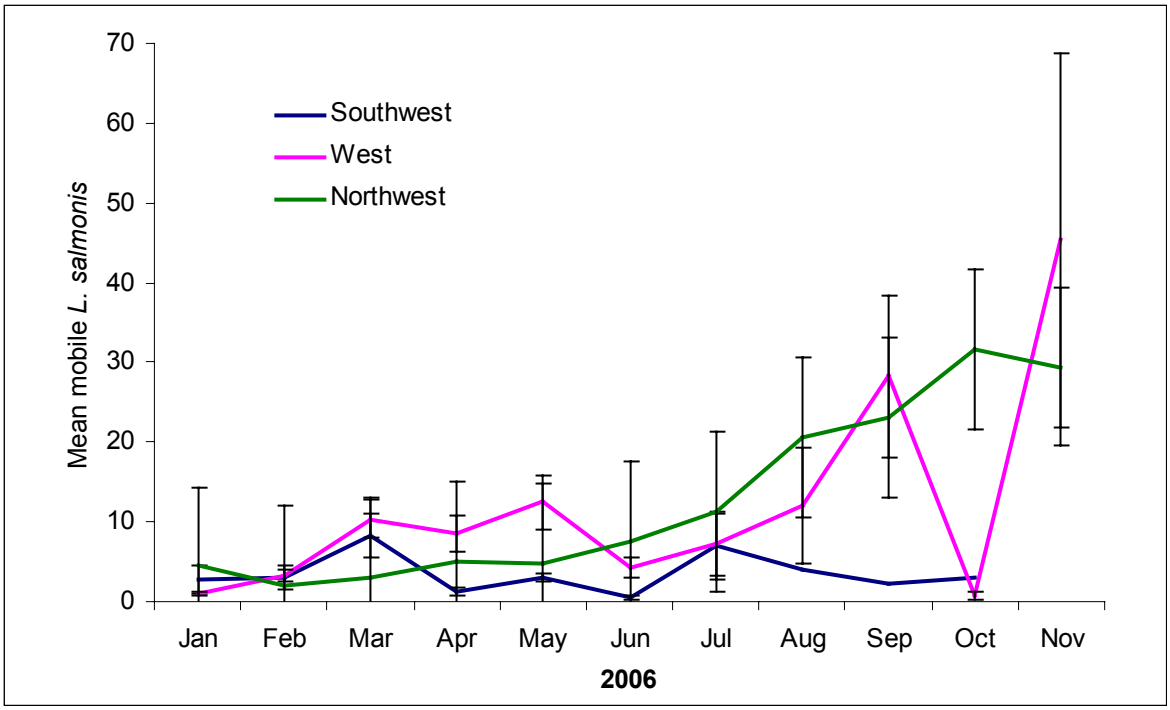

Figure 8. Mean (SE) mobile *L. salmonis* per month per region in 2006.

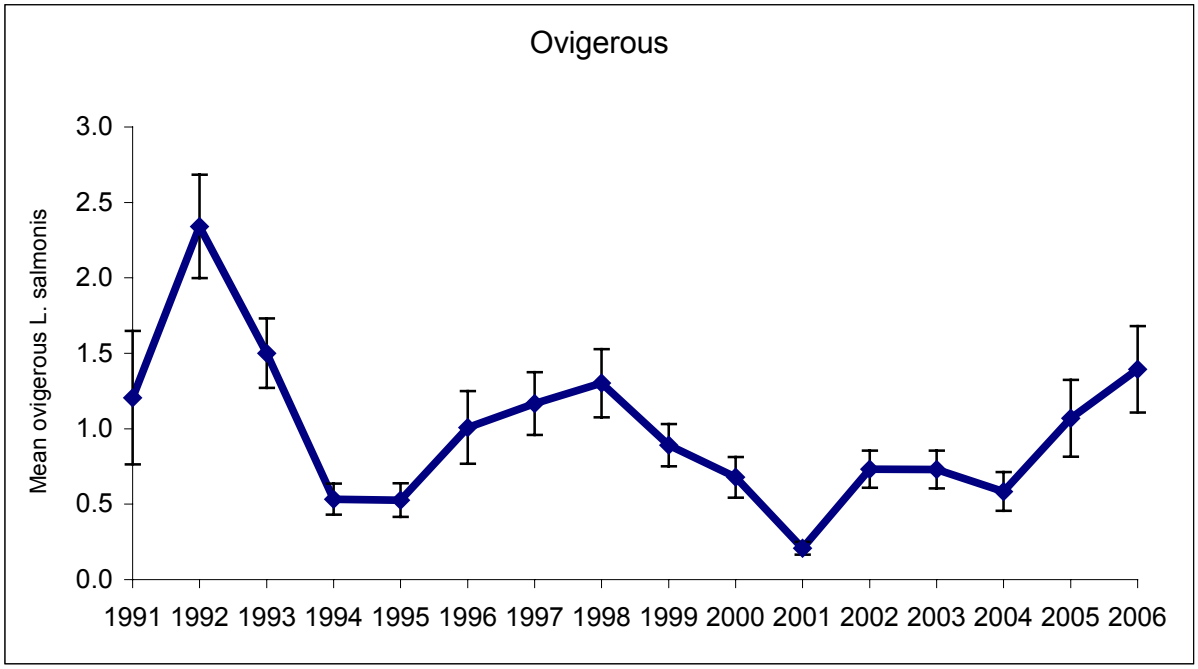

Figure 9. Annual trend (May mean) (SE) ovigerous *L. salmonis* on one-sea-winter salmon.

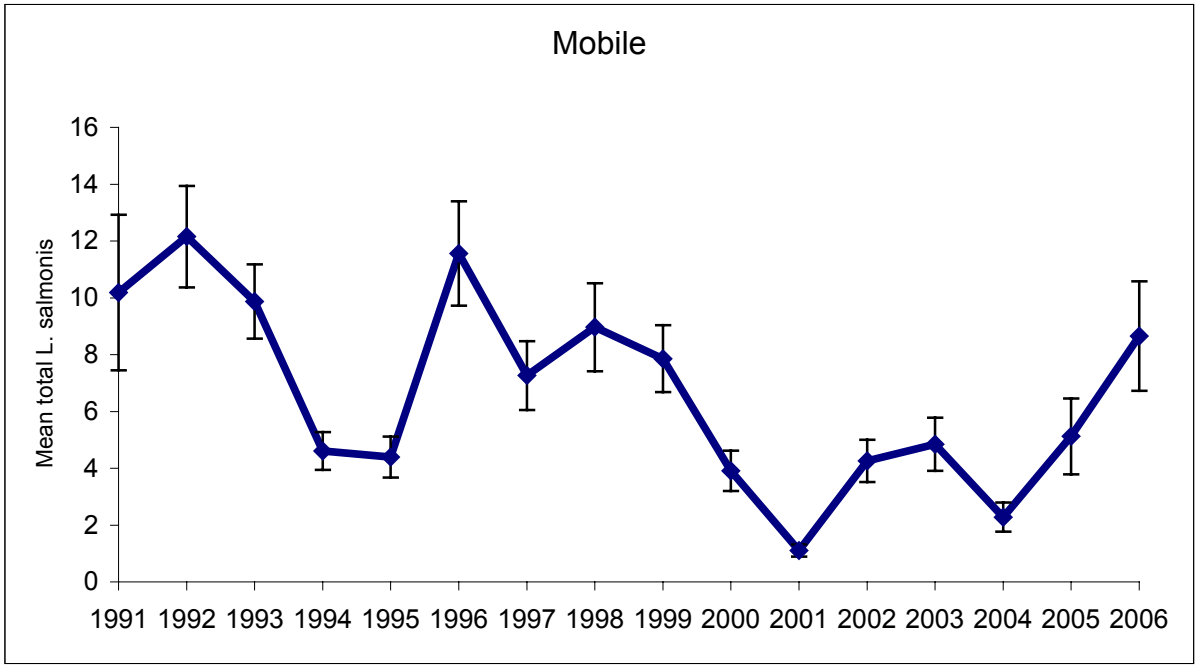

Figure 10. Annual trend (May mean) (SE) mobile *L. salmonis* on one-sea-winter salmon.

DISCUSSION

In 2006, of the 317 sea lice inspections carried out on salmonids, 73.2% of Atlantic salmon samples and 97.7% of Rainbow trout samples were below the treatment trigger levels outlined in DCMNR protocols. In the smolt stock, 93.2% of inspections did not exceed the treatment trigger levels, 56.7% of inspections on one-sea-winter salmon were below the treatment trigger levels and 41.7% of inspections on two-sea-winter salmon were below treatment trigger levels.

On one-sea-winter salmon sea lice levels exceeded treatment trigger levels for 30.4% of inspections in the Southwest, for 41.9% of inspections in the West and for 50% of inspections in the Northwest. During the critical spring period 58.3%, 53.7% and 55.2% of inspections exceeded the treatment trigger in the Southwest, West and Northwest respectively. The monthly trend of lice levels on one-sea-winter salmon show that in the Southwest, lice levels were in excess of treatment trigger levels for the whole spring period but better control of infestation was achieved outside the spring period. Mean lice levels in the West region on one-sea-winter salmon were elevated for the spring period, also in August, September and November. In the Northwest region, lice levels were elevated from March right through to November, inclusive.

For the year as a whole for one-sea-winter salmon, sea lice numbers in all regions were in excess of treatment trigger levels in the spring period but remained steady until June where numbers in the West and Northwest began to rise significantly, reaching a peak of 45.32 total *L. salmonis* per fish in November in the West and 31.53 *L. salmonis* per fish in October in the Northwest.

Of the 12 inspections carried out on two-sea-winter fish, between Dec/Jan 06 and the last inspection in April 06 before the stocks were completely harvested out, the maximum level reached was 12.74 mobile lice per fish in the West and 62.04 mobile lice per fish in the Northwest. In the West 83.3% of inspections were below treatment trigger levels and in the Northwest all of the 6 inspections were in excess of treatment trigger levels.

Out of a total of 317 inspections to all stocks, lice numbers greater than a mean of 10 *L. salmonis* per fish were recorded on 55 inspections in 2006 compared with 52 out of 327 inspections in 2005. Means greater than 20 *L. salmonis* per fish were recorded on 26 of these inspections, an increase from 21 in 2005 (O'Donohoe et al., 2006). Lice are known to cause damage to fish at these levels (Wooten et al., 1982). The maximum level recorded was 85.93 mobile *L. salmonis* in 2006.

Comparing the May mean annual trend *L. salmonis* graphs (figs. 9 &10) it shows that there was an increase in both the May mean ovigerous levels and May mean mobile levels nationally. The mean ovigerous level is the highest recorded in 12 years and the mobile is the highest since 1998.

Lice management and control this year has been hampered in some regions for a number of reasons; high water temperatures; problems with treatment; fish health; and bay management all being cited as key factors.

Warmer sea temperatures have been a complicating factor in the management of sea lice. Increases in water temperature leads to an acceleration in the life cycle of the sea louse and also an increase in reproductive output (Hogans and Trudeau, 1989). In the last number of years mean monthly sea temperatures have been steadily climbing with average sea temperature being 0.02°C higher in 2006 than in 2005, 0.25°C higher than 2004 and 1.38°C higher than the 30 year mean. Temperatures for January and February were 1.4°C higher and 1.7°C, respectively higher than the 30 year mean (worked from source data from Met Éireann-www.met.ie).

It should be noted that the treatment effort in some areas has not always achieved full clearance of sea lice and levels may still be in excess of treatment trigger levels on the subsequent inspections. It is suspected that there may be reduced sensitivity in some lice populations to certain chemotheraputants being used for sea lice control in Ireland. Other factors that may have contributed to ineffective clearances may be the use of full or partial skirts in carrying out a treatment. It is generally agreed that the most effective method of using a bath treatment is in a well boat. Here there is total control over water volume and concentration of chemotheraputant. However, due to the limited availability of well boats in Ireland, it may not always be possible to get a well boat when required and they often need to be booked weeks in advance. This makes proactive lice management difficult as populations can change dramatically while waiting on a well boat to administer lice treatments. The alternative is to use a full enclosure with oxygenation. This involves

covering the sides and the bottom of the cage with tarpaulins so the water volume is controlled and concentrations can be gauged accurately. Full or partial skirts, where only a part of the cage is covered which allow water to exchange out the bottom or gaps, are not as effective.

Not treating all the fish present at a site can also lead to rapid re-infestation of those fish just treated and can undermine the efficacy of subsequent treatments. Failing to carry out synchronous treatments between sites will also contribute to these problems.

Fish health combined with environmental issues such as high levels of harmful plankton present and high temperatures, especially during the summer months, also served to delay treatments or reduce their effectiveness.

Finally, a review of Single Bay Management fallow plans at the end of 2006 indicated that a sufficient fallow period (of at least 1 month) was not undertaken in a number of sites, particularly in the Northwest and West regions. Fallowing of sites helps break the sea lice life cycle and thus is important in the overall management of sea lice at a site and within a bay (Jackson *et al*, 1997; Jackson *et al*, 2002). The practice of multiple generations on a site also needs to be considered, particularly in the areas where lice control has been less than successful.

Glossary of terms used

Ovigerous lice:	An egg bearing adult female sea lice
Mobile lice:	All lice that are mobile – male and female (pre-adult and adult stages) sea lice that have developed beyond the attached larval stages
Standard (Std.) Cage:	The selected cage which is sampled at each inspection
Random (Ran.) Cage:	A cage which is selected by the inspector on the day of 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
S1/2 Smolt:	These fish are exposed to manipulated photoperiods to hasten the onset of smoltification. Hence an S1/2 smolt is ready to go to sea during the Autumn/Winter, approximately 11 months after hatching. Also known as S0(S zero) smolts.
Grower:	A fish which has been at sea for one complete year or longer
Rainbow Trout (1), (2):	Trout can be stocked at any stage during the year. The number refers to the earliest stocked fish on site and so forth.
SE:	Standard error (error bars in the graphs): the standard error of the mean of a sample from a population with a normal distribution that 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 per inspection on salmonid farms in 2006

	Date	*Lepeophtheirus salmonis*		*Caligus elongatus*	
		F + eggs	Total	F + eggs	Total
BANTRY BAY					
LASINGERS					
Cuan Baoi Seafarms Ltd					
Atlantic salmon, 2005	07/12/05	0.00	0.30	0.70	1.63
	13/02/06	0.06	3.94	5.81	12.39
	02/03/06	0.61	4.52	8.26	16.87
	22/03/06	1.60	4.03	6.83	10.53
	06/04/06	0.00	0.20	0.07	0.40
	19/04/06	0.03	0.10	0.17	1.07
	04/05/06	0.07	2.87	3.97	10.07
	16/05/06	0.37	3.43	5.20	10.40
	15/06/06	0.67	0.77	0.03	0.30
	11/07/06	0.38	1.69	3.00	8.09
	16/08/06	1.83	4.10	0.38	0.79
	12/09/06	1.39	2.29	0.13	0.19
	10/10/06	1.38	3.07	0.52	1.00
			Harvested out		
Atlantic salmon, 2006	16/05/06	0.00	0.00	0.00	0.08
	15/06/06	0.00	0.00	0.03	0.11
	11/07/06	0.00	0.10	0.50	0.80
	16/08/06	0.03	0.91	0.21	0.38
	12/09/06	0.37	1.00	0.17	0.27
	10/10/06	0.11	0.29	0.11	0.17
	22/11/06	0.00	0.00	2.00	3.00
SILVER KING SEAFOODS LTD					
Roancarraig					
Atlantic salmon, 2005 S1/2	07/12/05	1.38	6.41	0.91	1.91
	13/02/06	3.05	4.81	0.09	0.55
	02/03/06	2.63	11.06	1.19	8.25
	22/03/06	2.91	20.57	3.48	7.74
	06/04/06	1.67	2.70	0.00	0.06
	19/04/06	0.46	1.07	0.04	0.07
	04/05/06	0.70	1.80	0.10	0.47
	16/05/06	0.73	3.40	0.70	1.73
	15/06/06	0.37	0.57	0.03	0.17
	11/07/06	2.92	15.17	3.83	8.67
			Harvested out		

	Date	*Lepeophtheirus salmonis*		*Caligus elongatus*	
		F + eggs	Total	F + eggs	Total
Atlantic salmon, 2005	07/12/05	0.13	1.57	0.33	0.70
	13/02/06	0.07	0.17	0.00	0.20
	02/03/06	0.00	2.03	0.11	2.44
	22/03/06	0.04	6.88	3.32	6.40
	06/04/06	0.56	1.59	0.00	0.07
	19/04/06	0.11	0.29	0.18	0.32
	04/05/06	0.50	2.00	0.70	0.90
	16/05/06	1.70	4.82	0.52	0.91
	15/06/06	0.13	0.22	0.00	0.00
	11/07/06	0.52	4.13	2.57	3.61
			Harvested out		
Atlantic salmon, 2006 S1/2	02/03/06	0.00	0.58	0.14	0.33
	22/03/06	0.00	0.03	0.00	0.02
	06/04/06	0.00	0.00	0.00	0.03
	19/04/06	0.00	0.03	0.02	0.06
	04/05/06	0.00	0.29	0.07	0.15
	16/05/06	0.00	0.18	0.00	0.07
	15/06/06	0.00	0.11	0.17	0.57
	11/07/06	0.13	1.03	1.23	2.73
	16/08/06	0.51	2.14	0.30	0.58
	12/09/06	1.26	2.61	0.16	0.39
	10/10/06	0.17	0.83	0.02	0.02
	22/11/06	0.20	2.40	1.53	4.20
Atlantic salmon, 2006	04/05/06	0.00	0.07	0.00	0.03
	16/05/06	0.00	0.08	0.03	0.03
	15/06/06	0.00	0.00	0.27	0.70
	11/07/06	0.03	0.08	0.20	0.43
			Sampled 2006 S1/2		
			Sampled 2006 S1/2		
			Sampled 2006 S1/2		
	22/11/06	0.27	0.87	0.00	0.07

	Date	*Lepeophtheirus salmonis*		*Caligus elongatus*	
		F + eggs	Total	F + eggs	Total
JOHN POWER LTD					
Palmer's Point					
Rainbow trout 2006 (1)	13/02/06	0.00	1.51	1.80	4.40
	02/03/06	0.02	0.41	0.17	0.37
	22/03/06	0.00	0.07	0.00	0.00
	06/04/06	0.00	0.03	0.00	0.00
	19/04/06	0.00	0.06	0.03	0.13
	04/05/06	0.00	1.33	0.67	0.67
	16/05/06	0.00	0.36	0.10	0.15
	15/06/06	0.20	0.67	0.07	0.10
	11/07/06	0.66	4.96	1.97	4.45
			Harvested out		
Waterfall					
Rainbow trout 2006 (1)	22/11/06	0.11	0.97	0.40	1.04
GREATMAN'S BAY					
Cuigheal					
Atlantic salmon, 2006 S 1/2	05/05/06	0.00	0.77	0.10	0.32
	17/05/06	0.02	1.81	0.11	0.28
	14/06/06	0.45	2.85	1.93	6.12
	04/07/06	0.46	8.14	3.08	6.27
	09/08/06	1.60	2.30	0.00	0.00
	06/09/06	0.82	3.88	0.21	0.26
			Moved to Daonish		
Atlantic salmon, 2006	17/05/06	0.00	0.22	0.02	0.03
	14/06/06	0.00	0.23	0.16	0.29
	04/07/06	0.00	1.44	0.18	0.25
	09/08/06	0.39	1.32	0.00	0.00
	06/09/06	0.14	0.87	0.00	0.00
	23/10/06	1.25	15.52	0.00	0.02
	15/11/06	0.29	0.97	0.00	0.00

	Date	*Lepeophtheirus salmonis*		*Caligus elongatus*	
		F + eggs	Total	F + eggs	Total
KILKIERAN BAY					
MUIRACHMHAINNI TEO					
Daonish					
Atlantic salmon, 2005 S 1/2	01/12/05	0.60	1.53	0.00	0.00
	17/02/06	1.65	3.65	0.00	0.00
	08/03/06	1.00	29.02	0.00	0.12
	29/03/06	0.58	7.92	0.00	0.03
	05/04/06	0.34	5.64	0.02	0.05
	20/04/06	1.82	10.67	0.02	0.31
	05/05/06	1.66	13.86	0.42	0.59
	17/05/06	7.44	22.22	0.77	1.38
	23/06/06	3.28	6.10	0.10	0.31
			Harvested out		
Atlantic salmon, 2006 S 1/2	23/10/06	0.93	26.47	0.18	0.31
	15/11/06	3.93	27.05	0.21	0.40
Golam					
Atlantic salmon, 2006 S 1/2	17/02/06	0.00	0.59	0.03	0.03
	08/03/06	0.00	2.79	0.00	0.05
	29/03/06	0.04	1.75	0.02	0.08
	05/04/06	0.02	0.95	0.00	0.02
	20/04/06	0.00	0.79	0.02	0.04
	05/05/06	0.00	0.73	0.00	0.02
Atlantic salmon, 2007 S 1/2	15/11/06	0.00	3.40	0.00	0.10
Red Flag					
Atlantic salmon, 2006 S 1/2	31/05/06	0.06	3.97	0.28	0.46
	14/06/06	0.33	7.41	2.62	6.03
	04/07/06	0.11	2.01	0.03	0.09
	09/08/06	1.38	6.11	0.00	0.00
	06/09/06	0.60	3.82	0.00	0.00
			Moved to Daonish		

	Date	*Lepeophtheirus salmonis*		*Caligus elongatus*	
		F + eggs	Total	F + eggs	Total
MUIR GHEAL TEO					
Cnoc					
Atlantic salmon, 2005 S 1/2	15/12/05	0.37	2.17	0.00	0.02
	20/02/06	2.09	4.09	0.00	0.00
	08/03/06	1.39	12.47	0.00	0.00
	27/03/06	0.21	2.91	0.00	0.00
	06/04/06	0.23	1.99	0.00	0.00
	21/04/06	0.96	17.25	0.05	0.20
	04/05/06	1.15	21.64	0.16	0.25
	23/05/06	4.47	8.04	0.00	0.00
	27/06/06	0.20	0.55	0.00	0.10
			Harvested out		
Atlantic salmon, 2006 S 1/2	10/10/06	1.84	14.49	0.04	0.05
	03/11/06	1.46	5.19	0.00	0.00
Lettercallow					
Atlantic salmon, 2006 S 1/2	20/02/06	0.00	0.56	0.00	0.00
	08/03/06	0.03	4.49	0.00	0.02
	27/03/06	0.04	4.01	0.00	0.02
	06/04/06	0.13	1.72	0.00	0.03
	21/04/06	0.02	0.81	0.00	0.00
	04/05/06	0.06	0.90	0.00	0.00
	23/05/06	0.02	1.80	0.00	0.00
			Moved to Oilean Iarthach		
Oilean Iarthach					
Atlantic salmon, 2006 S 1/2	27/06/06	4.92	22.31	0.00	0.02
	14/07/06	3.88	9.09	0.00	0.03
	23/08/06	0.62	1.15	0.00	0.00
	12/09/06	1.47	8.43	0.07	0.09
			Moved to Cnoc		
EISC UI FLATHARTHA TEO					
Ardmore					
Atlantic salmon, 2006	23/05/06	0.00	0.75	0.00	0.00
	31/05/06	0.00	1.92	0.05	0.14
	27/06/06	0.00	2.15	0.09	0.16
	28/07/06	0.13	5.21	0.00	0.00
	31/08/06	0.48	1.28	0.00	0.00
	15/09/06	1.07	6.94	0.00	0.02
	17/10/06	1.59	4.20	0.00	0.00
	09/11/06	1.19	6.88	0.00	0.00

	Date	*Lepeophtheirus salmonis*		*Caligus elongatus*	
		F + eggs	Total	F + eggs	Total
MANNIN BAY					
MANNIN BAY SALMON CO LTD					
Corhounagh					
Atlantic salmon, 2005	30/03/06	0.19	0.47	0.00	0.00
	10/04/06	0.00	0.31	0.00	0.00
	25/04/06	0.33	3.94	0.00	0.03
	12/05/06	0.81	8.68	0.00	0.12
	30/05/06	2.71	18.42	0.02	0.06
	29/06/06	3.00	10.35	0.20	0.34
	20/07/06	0.11	0.35	0.00	0.00
	25/08/06	1.71	2.00	0.00	0.00
	12/09/06	5.06	44.68	0.15	0.18
	12/10/06	0.89	1.28	0.06	0.09
	24/11/06	17.30	85.93	1.56	3.63
Hawk's nest					
Atlantic salmon, 2005	08/12/05	0.03	0.17	0.07	0.07
	17/02/06	0.62	2.80	0.00	0.00
	03/03/06	1.48	3.98	0.00	0.00
Atlantic salmon, 2006	30/05/06	0.00	0.03	0.00	0.00
	16/06/06	0.00	0.82	0.02	0.07
	20/07/06	0.02	0.67	0.00	0.09
	25/08/06	0.03	1.87	0.07	0.12
	12/09/06	0.45	3.05	0.12	0.14
	12/10/06	1.47	5.30	0.00	0.00
	17/11/06	1.34	50.18	0.00	0.29
Ardbear					
Atlantic salmon, 2006 S 1/2	17/02/06	0.00	0.03	0.00	0.00
	03/03/06	0.00	0.15	0.00	0.00
	30/03/06	0.00	1.20	0.00	0.00
	10/04/06	0.00	2.08	0.00	0.00
	24/04/06	0.06	4.37	0.00	0.00
	12/05/06	0.00	0.22	0.00	0.02

	Date	*Lepeophtheirus salmonis*		*Caligus elongatus*	
		F + eggs	Total	F + eggs	Total
BALLINAKILL BAY					
BIFAND LTD					
Fraochoilean					
Atlantic salmon, 2005 S 1/2	08/12/05	0.24	0.75	0.02	0.02
	17/02/06	0.09	0.12	0.00	0.00
	03/03/06	0.19	3.49	0.02	0.19
	31/03/06	0.11	0.41	0.00	0.02
	13/04/06	0.28	0.50	0.00	0.02
	25/04/06	0.26	0.57	0.00	0.00
	12/05/06	0.06	0.09	0.00	0.00
	30/05/06	0.00	1.53	0.00	0.03
	29/06/06	1.55	2.41	0.17	0.38
	11/07/06	0.73	2.23	0.27	0.60
			Harvested out		
Atlantic salmon, 2006 S 1/2	30/05/06	0.00	0.00	0.00	0.00
	29/06/06	0.07	0.52	1.62	2.53
	11/07/06	0.04	0.80	2.44	4.30
	25/08/06	1.92	19.00	3.64	7.77
	21/09/06	0.24	2.77	0.30	0.50
	12/10/06	1.12	2.22	0.05	0.07
	07/11/06	0.47	6.26	0.00	0.03
KILLARY HARBOUR					
CELTIC ATLANTIC SALMON (KILLARY) LTD					
Rosroe					
Atlantic salmon, 2005	14/12/05	0.04	0.13	0.00	0.00
	17/02/06	0.12	0.82	0.02	0.02
	07/03/06	0.19	14.95	0.00	0.23
	31/03/06	0.13	42.47	0.33	0.76
	12/04/06	5.70	40.33	0.00	0.00
	27/04/06	3.85	7.42	0.00	0.00
	12/05/06	0.06	0.33	0.00	0.00
	30/05/06	0.29	53.55	0.00	0.00
	23/06/06	0.12	1.44	0.23	0.38
	24/07/06	2.89	23.15	0.04	0.10
	28/08/06	6.30	40.37	0.00	0.03
			Harvested out		

	Date	*Lepeophtheirus salmonis*		*Caligus elongatus*	
		F + eggs	Total	F + eggs	Total
Inishdeighil					
Atlantic salmon, 2006	07/03/06	0.02	0.02	0.00	0.00
	31/03/06	0.00	2.00	0.00	0.03
	12/04/06	0.00	0.15	0.00	0.00
	27/04/06	0.00	0.43	0.00	0.00
	12/05/06	0.00	0.98	0.00	0.00
	30/05/06	0.02	16.21	0.00	0.00
	23/06/06	0.00	0.26	0.04	0.05
	24/07/06	0.37	2.00	0.00	0.00
	28/08/06	0.43	0.96	0.00	0.00
	29/09/06	0.31	1.25	0.02	0.02
	20/10/06	0.37	1.89	0.02	0.02
	24/11/06	0.65	6.46	0.05	0.14

CLEW BAY

CLARE ISLAND SEAFARMS LTD

Portlea

Atlantic salmon, 2005	08/12/05	0.27	1.35	0.02	0.07
	02/02/06	0.55	4.72	0.15	0.46
	03/03/06	1.21	5.58	0.69	1.17
	30/03/06	0.97	6.80	0.85	2.11
	10/04/06	1.25	6.66	0.69	1.82
	27/04/06	1.66	8.62	1.60	2.63
	15/05/06	0.14	0.44	0.11	0.15
	25/05/06	0.11	1.36	0.14	0.27
	14/06/06	1.11	3.21	0.46	0.82
	13/07/06	0.42	0.84	0.00	0.04
	22/08/06	3.64	7.73	0.62	1.11
	14/09/06	1.67	11.79	0.44	0.89
Atlantic salmon, 2006	18/10/06	0.07	0.47	0.00	0.00
	24/11/06	0.28	1.70	0.02	0.09

Clare Island smolt site

Atlantic salmon, 2006	27/04/06	0.00	1.25	0.02	0.14
	15/05/06	0.00	0.18	0.00	0.00
	25/05/06	0.00	0.30	0.00	0.01
	14/06/06	0.00	0.03	0.00	0.00
	13/07/06	0.00	0.56	0.39	0.73
	22/08/06	0.31	1.00	0.22	0.35
	14/09/06	0.04	1.96	0.54	0.70

	Date	*Lepeophtheirus salmonis*		*Caligus elongatus*	
		F + eggs	Total	F + eggs	Total
			Moved to Portlea		
Seastream Inner					
Atlantic salmon, 2004	08/12/05	0.30	1.36	0.24	0.73
	02/02/06	0.38	0.84	0.07	0.30
	03/03/06	0.48	0.90	0.15	0.50
	28/03/06	0.73	1.87	0.17	1.12
	10/04/06	0.47	12.74	2.47	5.49
	27/04/06	0.20	0.37	0.00	0.00
			Harvested out		
Atlantic salmon, 2005	17/10/06	0.00	0.15	0.00	0.02
	24/11/06	0.88	4.71	1.18	2.01
Seastream Outer					
Atlantic salmon, 2005	08/12/05	0.37	1.03	0.10	0.27
	02/02/06	3.08	10.08	9.84	17.80
	03/03/06	0.77	3.00	0.07	0.07
	28/03/06	1.81	4.25	0.33	0.50
	10/04/06	0.78	2.52	0.00	0.03
	27/04/06	1.63	3.97	0.00	0.07
	15/05/06	0.21	0.36	0.00	0.00
			Harvested out		

BEALACRAGHER BAY

CURRAUN FISHERIES LTD

Curraun					
Rainbow trout 2005	14/12/05	0.27	2.44	0.00	0.00
	03/02/06	0.03	0.52	0.00	0.03
	02/03/06	0.00	0.66	0.00	0.00
	22/03/06	0.10	0.67	0.05	0.10
	11/04/06	0.00	0.57	0.00	0.00
	26/04/06	0.10	0.63	0.03	0.03
	12/05/06	0.03	0.24	0.00	0.03
	26/05/06	0.27	1.20	0.00	0.00
			On starve for harvest		

	Date	*Lepeophtheirus salmonis*		*Caligus elongatus*	
		F + eggs	Total	F + eggs	Total
Rainbow trout 2006 (1)	03/02/06	0.00	0.21	0.04	0.04
	02/03/06	0.00	0.21	0.00	0.00
	22/03/06	0.00	0.23	0.00	0.00
	11/04/06	0.00	0.10	0.00	0.00
	26/04/06	0.00	0.00	0.03	0.03
	12/05/06	0.00	0.08	0.03	0.03
	26/05/06	0.04	0.88	0.04	0.04
	15/06/06	0.11	6.11	0.61	0.93
	13/07/06	0.00	0.23	0.00	0.00
	22/08/06	0.04	1.56	0.00	0.00
	14/09/06	0.00	5.84	0.00	0.06
	17/10/06	0.03	0.19	0.00	0.00
	23/11/06	0.32	3.18	0.00	0.00
Rainbow trout 2006 (2)	12/05/06	0.00	0.05	0.02	0.03
	26/05/06	0.00	0.28	0.03	0.03
	15/06/06	0.03	0.69	0.09	0.11
	13/07/06	0.13	1.30	0.00	0.03
	22/08/06	0.00	4.97	0.03	0.09
	14/09/06	0.00	4.44	0.00	0.04
	17/10/06	0.33	2.00	0.00	0.00
	23/11/06	0.50	3.60	0.03	0.03

	Date	*Lepeophtheirus salmonis*		*Caligus elongatus*	
		F + eggs	Total	F + eggs	Total
DONEGAL BAY					
EANY FISH PRODUCTS LTD					
Inver Bay					
Atlantic salmon, 2005	06/12/05	0.30	1.05	0.35	0.78
	06/02/06	0.72	3.49	3.35	5.85
	07/03/06	0.09	0.61	0.00	0.02
	27/03/06	0.04	0.13	0.00	0.00
	11/04/06	0.02	0.22	0.00	0.15
	26/04/06	0.10	0.21	0.08	0.18
	09/05/06	0.05	0.14	0.06	0.06
	25/05/06	0.12	0.21	0.06	0.06
			Harvested out		
Rainbow trout 2006 (1)	06/02/06	0.00	0.41	0.40	1.13
	07/03/06	0.04	1.03	0.77	3.41
	27/03/06	0.00	0.59	0.25	0.54
	11/04/06	0.07	2.14	0.72	1.66
	26/04/06	0.05	0.86	1.02	2.62
	09/05/06	0.06	0.24	1.03	2.03
	25/05/06	0.04	0.04	0.15	0.30
Rainbow trout 2006 (2)	30/06/06	0.00	0.04	0.43	0.49
	11/07/06	0.00	0.04	0.06	0.10
	16/08/06	0.00	0.00	0.00	0.05
	14/09/06	0.08	0.44	0.00	0.00
	26/10/06	0.40	5.37	0.02	0.02
	28/11/06	2.83	9.25	0.00	0.00
MULROY BAY					
MARINE HARVEST					
Milford					
Atlantic salmon, 2005	07/12/05	0.40	2.87	0.00	0.00
	25/01/06	0.88	4.47	0.00	0.00
	08/02/06	1.23	3.29	0.00	0.00
Atlantic salmon, 2006	10/05/06	0.00	0.14	0.00	0.00
	23/05/06	0.00	0.01	0.00	0.00
	15/06/06	0.00	0.00	0.00	0.00
	13/07/06	0.00	0.00	0.00	0.00
	16/08/06	0.00	0.05	0.00	0.00
	06/09/06	0.07	0.30	0.00	0.00
	04/10/06	0.09	0.67	0.00	0.00
	01/11/06	0.41	2.23	0.00	0.00

	Date	*Lepeophtheirus salmonis*		*Caligus elongatus*	
		F + eggs	Total	F + eggs	Total
Cranford A					
Atlantic salmon, 2004	06/12/05	16.82	41.09	0.00	0.00
Atlantic salmon, 2005 S 1/2	06/12/05	2.08	11.16	0.00	0.00
	24/01/06	2.57	5.23	0.00	0.00
	07/02/06	2.61	4.17	0.00	0.00
	01/03/06	1.53	2.44	0.00	0.00
	23/03/06	2.83	7.78	0.00	0.03
	04/04/06	2.30	8.49	0.00	0.02
	19/04/05	1.75	9.16	0.00	0.00
	09/05/06	1.46	4.02	0.00	0.00
	23/05/06	3.92	12.46	0.00	0.00
			Harvested out		
Atlantic salmon, 2006 S 1/2	07/02/06	0.07	0.97	0.00	0.00
	01/03/06	0.00	0.47	0.00	0.00
	23/03/06	0.00	1.59	0.00	0.00
	04/04/06	0.00	1.83	0.00	0.18
	19/04/06	0.02	3.03	0.00	0.00
	09/05/06	0.03	2.81	0.00	0.02
	23/05/06	0.00	0.87	0.00	0.00
	14/06/06	0.02	0.77	0.00	0.00
	12/07/06	0.25	2.02	0.00	0.00
	16/08/06	3.37	12.25	0.00	0.00
	06/09/06	2.41	7.76	0.00	0.00
	05/10/06	6.22	26.45	0.00	0.00
	01/11/06	8.48	31.04	0.00	0.00
Atlantic salmon, 2007 S 1/2	01/11/06	0.00	3.50	0.00	0.00
Moross I					
Atlantic salmon, 2005 S 1/2	06/12/06	2.64	15.76	0.00	0.00
	24/01/06	1.18	1.87	0.00	0.00
	07/02/06	0.94	1.21	0.00	0.00
	01/03/06	1.27	2.86	0.00	0.00
	22/03/06	1.02	3.55	0.00	0.00
	04/04/06	0.40	1.41	0.00	0.16
	19/04/06	0.28	1.91	0.00	0.00
	09/05/06	0.33	6.67	0.00	0.00

	Date	*Lepeophtheirus salmonis*		*Caligus elongatus*	
		F + eggs	Total	F + eggs	Total
Moross					
Atlantic salmon, 2006 S 1/2	07/02/06	0.00	2.02	0.00	0.00
	01/03/06	0.00	0.19	0.00	0.00
	22/03/06	0.00	1.21	0.00	0.00
	04/04/06	0.00	0.68	0.00	0.02
Millstone					
Atlantic salmon, 2004	06/12/05	9.13	42.71	0.00	0.00
	25/01/06	6.01	15.33	0.00	0.00
	07/02/06	2.93	5.99	0.00	0.00
	01/03/06	5.38	9.59	0.00	0.00
Atlantic salmon, 2005	06/12/05	0.14	0.90	0.00	0.00
	25/01/06	1.12	3.18	0.00	0.00
	07/02/06	0.31	1.09	0.02	0.02
	01/03/06	0.40	1.99	0.00	0.00
	22/03/06	0.25	3.40	0.00	0.00
	05/04/06	0.59	5.05	0.00	0.02
	20/04/06	1.47	8.29	0.00	0.07
	10/05/06	0.77	3.05	0.00	0.00
	24/05/06	1.24	5.67	0.00	0.00
	14/06/06	1.45	3.38	0.00	0.00
	12/07/06	5.50	14.32	0.02	0.04
	16/08/06	2.82	15.24	0.00	0.00
	06/09/06	5.97	18.57	0.00	0.00
	04/10/06	10.37	24.18	0.00	0.00
	01/11/06	1.61	7.33	0.00	0.00
Atlantic salmon, 2006 S 1/2	20/04/06	0.00	0.44	0.00	0.00
	10/05/06	0.00	1.12	0.00	0.00
	24/05/06	0.02	1.30	0.00	0.00
	14/06/06	0.00	0.21	0.00	0.00
	12/07/06	0.27	5.26	0.00	0.00
	16/08/06	2.07	20.92	0.00	0.00
	06/09/06	1.61	17.65	0.00	0.02
	04/10/06	3.08	17.69	0.00	0.00
	01/11/06	1.00	11.32	0.00	0.00

	Date	*Lepeophtheirus salmonis*		*Caligus elongatus*	
		F + eggs	Total	F + eggs	Total
Glinsk					
Atlantic salmon, 2005	06/12/05	0.21	1.60	0.00	0.00
	25/01/06	1.05	4.60	0.00	0.00
	07/02/06	0.13	0.75	0.00	0.02
	01/03/06	0.52	2.04	0.00	0.00
Atlantic salmon, 2006	05/04/06	0.00	0.00	0.00	0.00
	20/04/06	0.00	0.42	0.00	0.02
	10/05/06	0.00	0.26	0.00	0.00
	23/05/06	0.00	0.13	0.00	0.00
	14/06/06	0.02	0.25	0.00	0.00
	12/07/06	0.02	0.64	0.00	0.00
	17/08/06	1.32	16.09	0.00	0.00
	07/09/06	2.40	12.45	0.00	0.02
	04/10/06	1.26	9.89	0.00	0.00
	01/11/06	0.31	6.79	0.00	0.00
LOUGH SWILLY					
MARINE HARVEST					
Atlantic salmon, 2004	07/12/05	16.78	62.04	0.00	0.00
			Harvested out		
Atlantic salmon, 2005	24/01/06	0.52	1.56	0.00	0.03
	08/02/06	0.71	1.23	0.00	0.00
	March (1)	Missed due to bad weather			
	22/03/06	0.32	4.74	0.00	0.00
	04/04/06	0.37	5.57	0.00	0.02
	19/04/06	1.06	7.70	0.00	0.00
	09/05/06	2.75	8.07	0.00	0.04
	23/05/06	1.88	5.37	0.00	0.00
	14/06/06	2.74	11.87	0.00	0.00
	12/07/06	3.18	8.21	0.00	0.00
	17/08/06	6.35	25.88	0.00	0.00
	07/09/06	3.91	27.47	0.00	0.00
	05/10/06	13.25	38.88	0.00	0.00
	02/11/06	8.65	51.61	0.00	0.00