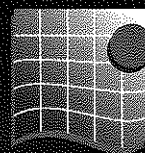
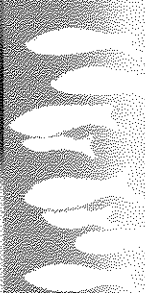


# National Survey of Sea Lice (*Lepeophtheirus salmonis* Krøyer and *Caligus elongatus* Nordmann) on Fish Farms in Ireland - 2002

Pauline O'Donohoe, Suzanne Kennedy, Lorraine Copley, Frank Kane,  
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*Marine Institute*  
Foras na Mara

**NATIONAL SURVEY OF SEA LICE (*LEPEOPHTHEIRUS*  
*SALMONIS* KRØYER AND *CALIGUS ELONGATUS* NORDMANN)  
ON FISH FARMS IN IRELAND – 2002**

**February 2003**

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## INTRODUCTION

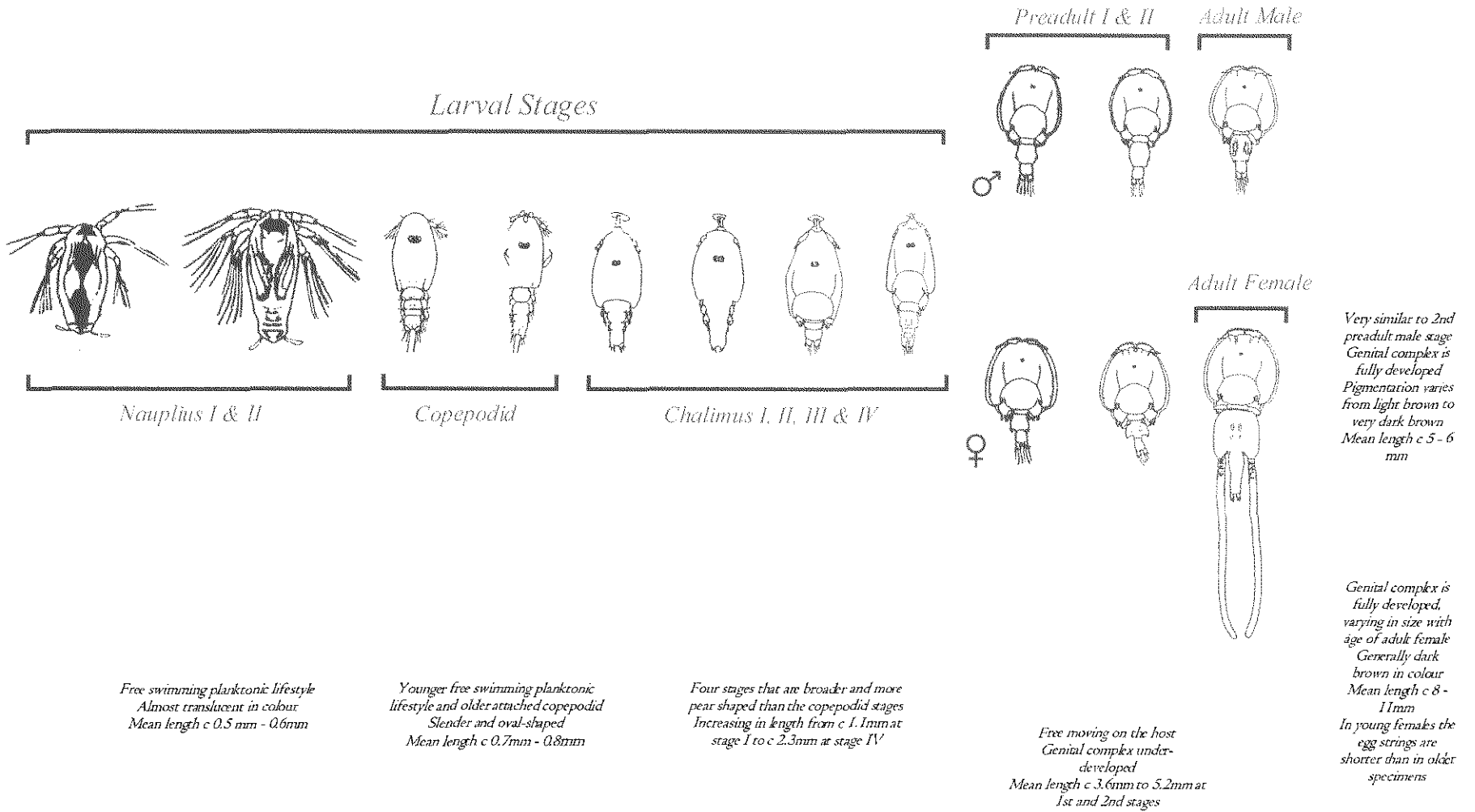
Salmonids farmed in Ireland in 2002 can be divided into the following groups: one year class of rainbow trout *Oncorhynchus mykiss* and three year classes of Atlantic salmon *Salmo salar*. The year classes of salmon include, smolts (2002 generation), one sea-winter salmon (2001 generation) and two sea-winter salmon (2000 generation). S½'s are fish which are transferred to sea in Autumn/Winter of the same year that they are hatched. Their S1 siblings smoltify and are put to sea in early spring, some three to four months later. Salmon which are at sea for a year or longer in April are known as growers/one sea-winter and are treated separately from younger salmon (smolts) and rainbow trout. Those salmon that were put to sea in winter 2001/spring 2002 are referred to as smolts, or 2002 year class fish. During the 2002 sampling period all four groups of farmed fish were examined.

Two species of sea lice are found on cultured salmonids in Ireland, *Caligus elongatus* Nordmann, a species of parasite that infests over eighty different types of marine fish, and *Lepeophtheirus salmonis* Krøyer, which infests only salmon and other salmonids. Sea lice 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 per annum (Bristow and Berland, 1991; Jackson and Costello, 1991). They affect salmon in a variety of ways: mainly by reducing fish growth, loss of scales which leaves the fish open to secondary infections (Wootten *et al.*, 1982) and damaging of fish which reduces marketability.

*Lepeophtheirus salmonis* is regarded as the more serious parasite of the two species and has been found to occur most frequently on farmed salmon (Jackson and Minchin, 1992). 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 have been suggested 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). This is thought to occur 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).

*Lepeophtheirus salmonis* (Caligidae) has a direct life cycle, meaning it has a single host. There are ten stages in the life cycle of *L. salmonis*, each separated by a moult (Kabata, 1979; Schram, 1993). Moulting involves the shedding of the outer shell or cuticle, to expose a new cuticle underneath. After hatching from the egg (which is extruded from the adult female louse in paired egg-strings) a free-living nauplius stage is dispersed into the water column and survives in the plankton for a short time. This is then followed by a second nauplius stage which eventually moults into a copepodid, which can survive in the plankton for a number of days. This copepodid must locate a salmonid host before the parasite can develop further. Copepodids make initial contact with the host by grasping the surface of the host with their mouthparts and driving the clawed second antennae into the epidermis. Following settlement the copepodid moults into the chalimus phase which comprises four stages, characterised

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



Diagrams not to scale

by permanent attachment to the host by a frontal filament (Johannessen, 1978). This frontal filament is lost when the chalimus IV stage develops into the mobile pre-adult male or female. A moult then separates two pre-adult stages after which the fully mature adult develops. The adult female is capable of producing a number of batches of paired egg-strings during her life span, which in turn hatch into the water column giving rise to the next generation. The number of egg-strings that can be produced by an adult female of *L. salmonis* can vary. Ritchie (1993) showed that six pairs of egg-strings were extruded over a period of 50 days at 14°C after one mating. However, Heuch *et al.* (2000) showed that some females, kept at a lower water temperature of 7.2°C, could produce as many as eleven egg-strings, and stated that in the wild this value could be even higher. Various survival times have also been recorded for this species. Earlier studies have given survival times of 75 days at 14°C (Ritchie, 1993) and 191 days at 7°C (Nordhagen, 1997). However, a later study (Nordhagen *et al.*, 2000) indicated that the life span of *L. salmonis* could be up to one year at lower water temperatures.

*Caligus elongatus* is not as host specific as *L. salmonis* and parasitises a wide 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. The developmental stages of *Caligus elongatus* described by Hogans and Trudeau (1989) included nine stages, each separated by a moult as in *L. salmonis*. These stages included two free-living nauplii, a copepodid, four attached chalimi, a pre-adult and adult. However, studies by Piasecki (1996) contradict these earlier findings and states that there are only eight stages in the life cycle of *C. elongatus*. Piasecki (1996) maintains that previous studies labeled young adult individuals of *C. elongatus* as pre-adult stages. The adult life span for *C. elongatus* has been estimated at 260 days for an adult female in typical winter water temperature ranges of 2.2-12°C. Two sets of egg-strings are believed to be produced following a single mating (Piasecki and MacKinnon, 1995).

There are three licensed treatments for sea lice control in Ireland. Two of these treatments, Calicide and Slice, are in-feed treatments and the third, Excis, is a topical treatment. Calicide contains teflubenzuron which acts as a chitin synthesis inhibitor that interferes with the cuticle formation of the louse. It is only 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 causing paralysis or death. It is effective against all stage of the life cycle and has no withdrawal period. The topical treatment Excis contains cypermethrin, which again affects the nervous system. It is effective against all stages of the life cycle and has a 24 hour withdrawal period. The alternation between these treatments is an important management strategy to help combat lice resistance to chemotherapeutants.

The setting of appropriate treatment trigger levels is an integral part of implementing a targeted treatment regime. Treatment trigger levels during the spring period are set close to zero in the range of 0.3 to 0.5 egg bearing females per fish and are also informed by the numbers of 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 egg bearing lice per fish acts as a trigger for treatments. This is only relaxed where fish are under harvest and with the agreement with the Department of Communications, Marine and Natural Resources or its agent.

## METHODOLOGY

Sampling frequency has been determined with regard to sea lice development rates, critical periods and environmental conditions. During winter when temperatures are lower, (December – February) lice development occurs slowly and a low frequency of inspection will detect changes adequately. During the spring rise in temperatures, lice development accelerates therefore more frequent sampling is carried out.

The sampling frequency is fourteen inspections per year, plus any follow-up inspections required where advice to reduce lice levels has been issued. One lice inspection takes place each month at each site where fish are present, with two inspections taking place each month during the spring period March to May. Only one inspection occurs for December / January. At each inspection two samples are taken for each generation of fish on-site. One from a standard cage (which is sampled at each inspection) and one from a random cage (which is selected on the day of the inspection). Thirty fish are examined for each sample. These are anaesthetised in a bin, which at the end of the sample is sieved for any detached lice. Each fish is examined individually for all mobile lice. Lice are removed using forceps and placed in 30ml screw top plastic bottles containing 70% alcohol, one bottle per fish. The results presented in this report refer to mean lice numbers per fish. This was obtained by adding the number of lice taken per fish with the number from the bin, and dividing by the number of fish examined.

There are three regions where salmon farming is carried out, the West (Counties Mayo and Galway), the Northwest (Co. Donegal) and the Southwest (Counties Cork and Kerry). These 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 2002 a total number of 45 sites were inspected around the west coast of Ireland. See Figures 2-5.

Results presented are mean ovigerous sea lice levels (egg bearing adult female lice) and mean mobile sea lice levels (lice that have developed beyond the attached chalimus stages) for *Lepeophtheirus salmonis* and *Caligus elongatus*. Total mobile levels estimate successful infection, with ovigerous lice levels estimating successful breeding females. The regularity of the monitoring protocol outlined above aims to evaluate the levels of lice on growing fish and to bring them under control if necessary by advising treatment. Effective parasite control is characterised by a drop in lice levels in the subsequent inspection.



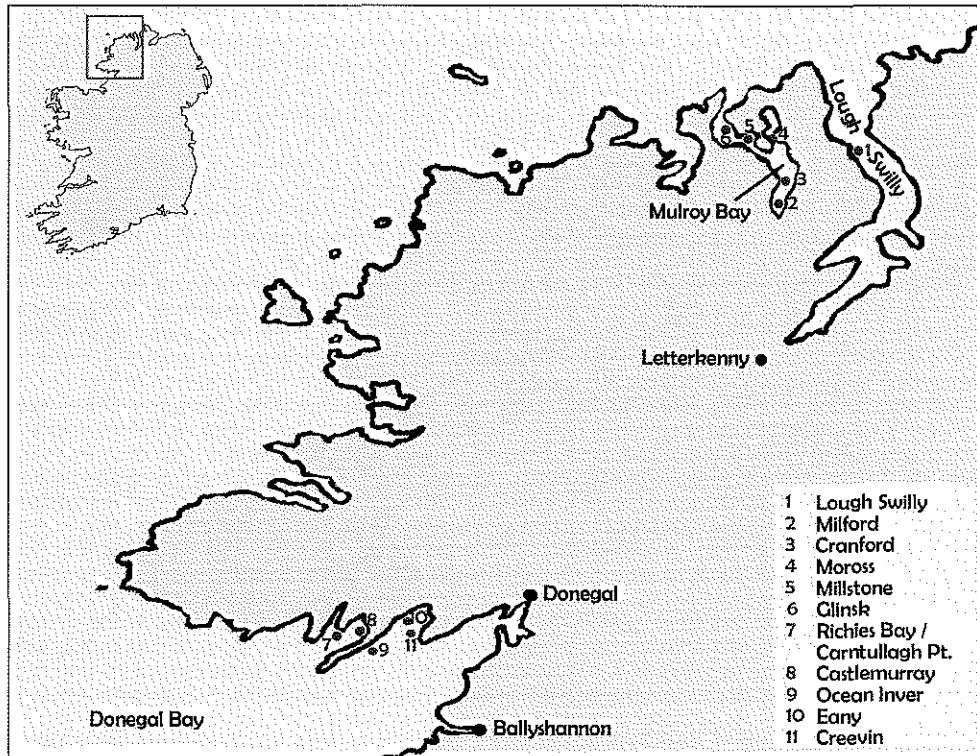


Figure 2. Location of fish farms in Northwest region.

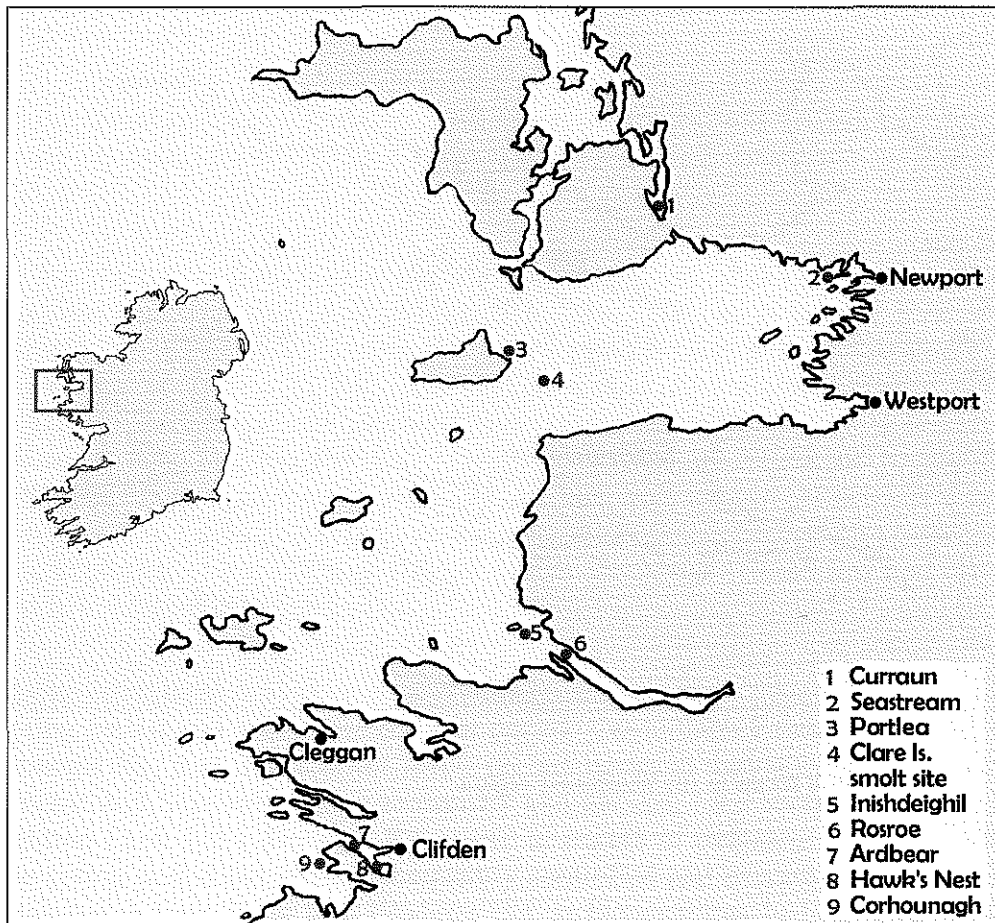


Figure 3. Location of fish farms in the Western region (Clew Bay / Connemara).



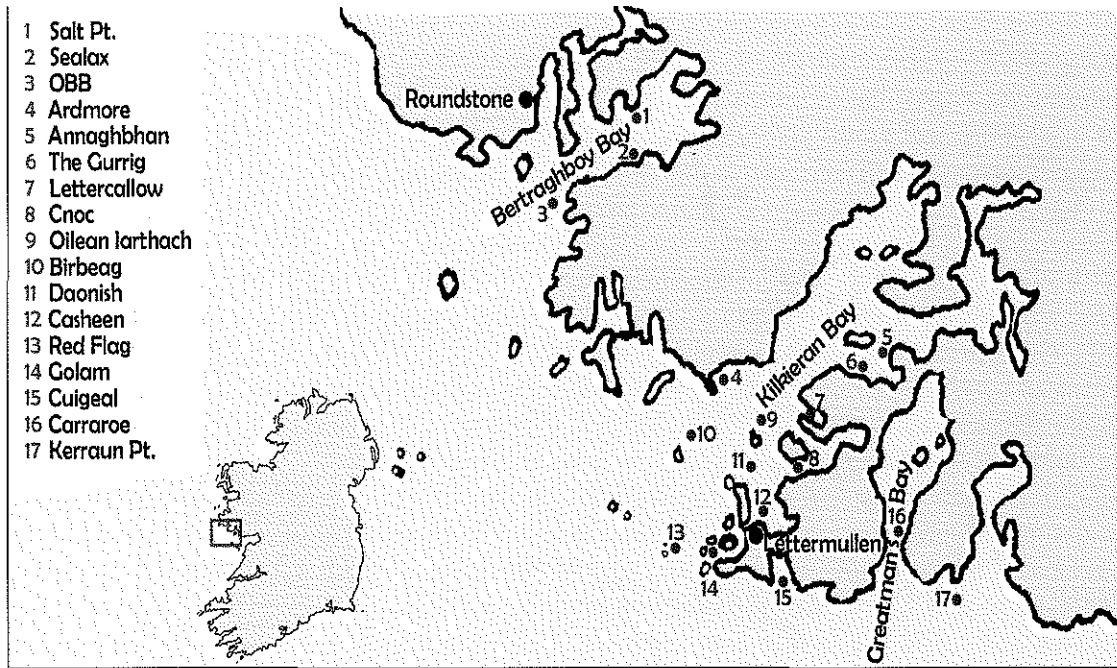


Figure 4. Location of fish farms in the Western region (Connemara).

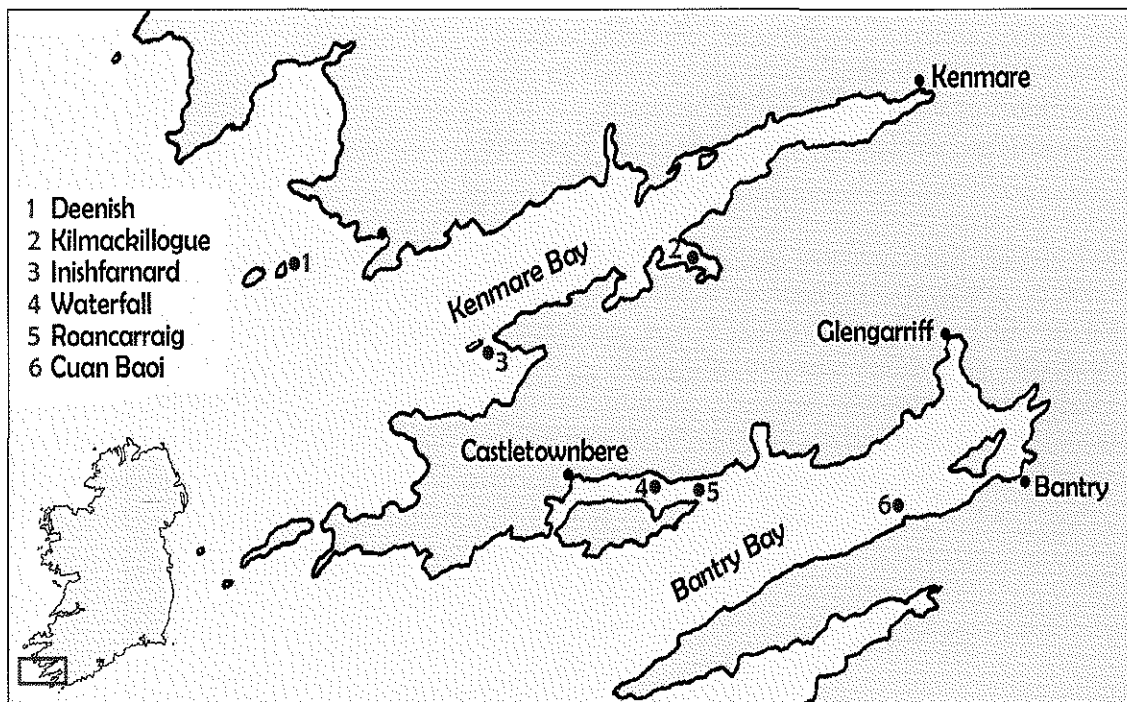


Figure 5. Location of fish farms in the Southwest region.

## RESULTS

### *Atlantic salmon 2002 (Smolts)*

A total of 198 visits were undertaken at 32 sites stocking S1 and S½ smolts during the year 2002. *Lepeophtheirus salmonis* levels were maintained below the treatment trigger level of 0.5 ovigerous female lice per fish throughout the critical spring period. Outside of this period levels exceeded 2.0 ovigerous female lice per fish on 4 occasions.

*Caligus elongatus* levels remained low throughout the year on 2002 smolts.

### *Atlantic salmon 2001 (one sea-winter salmon)*

One sea-winter salmon were stocked in a total of 26 sites in 11 bays in 2002. Two hundred and thirteen visits were undertaken to this generation of fish. A total of 4 bays continued to stock one sea-winter salmon in November 2002.

*Lepeophtheirus salmonis* levels were generally controlled throughout the year. Ovigerous *L. salmonis* levels greater than the treatment trigger levels were recorded in a total of 51 inspections. Within the critical spring period lice levels were in excess of 0.5 ovigerous females per fish on 37 occasions. Fourteen were outside the critical spring period when ovigerous lice treatment trigger levels are set at a mean of 2.0 ovigerous lice per fish.

In the Southwest region, Cuan Baoí (Cuan Baoí Seafarms Ltd.) had elevated lice levels on one occasion in May, which was controlled, and again in September and October.

In the Western region, 6 sites had elevated lice levels in the spring period. Levels at Casheen and Daonish (both Muirachmhainni Teó.) in Kilkieran Bay were each elevated on 3 occasions during the spring period. Lice levels at Ardmore (Éisc Ui Flathartha Teó.) also in Kilkieran Bay exceeded the treatment trigger levels on 5 occasions during the same period. *Lepeophtheirus salmonis* levels at Hawks Nest (Mannin Bay Salmon Co. Ltd.) were in excess of treatment trigger levels in December/January, levels again rose on one occasion in March. In Corhounagh (Mannin Bay Salmon Co. Ltd.) levels were exceeded in May and in September prior to completion of harvest. Cnoc (Muir Gheal Teo.) in Kilkieran Bay had elevated lice levels in March prior to harvest.

In the Northwest region, 8 sites were above treatment trigger levels in the critical spring period and 6 sites outside that period. Carntullagh Point (Ocean Farm Ltd.) in Donegal Bay had elevated lice levels on one occasion during the spring period and in August and September prior to transfer and harvest. Lice levels at Creevin (Creevin Salmon Farm Ltd.), Donegal Bay, were in excess of treatment trigger levels early in the spring period but were subsequently controlled and exceeded levels again on one occasion in June. Eany Fish Products Ltd. in Donegal Bay had elevated lice levels on 3 visits, twice in May and once prior to harvest in July. Cranford A (Marine Harvest) in Mulroy Bay had lice levels in excess of treatment trigger levels from January to May. Elevated lice levels were recorded at Moross (Marine Harvest) in Mulroy Bay

on 5 occasions during the critical spring period. Lough Swilly (Marine Harvest) showed lice levels above the treatment trigger levels on 2 occasions in the spring period and again in September and October, before controlling lice prior to harvest in November. Lice levels exceeded treatment trigger levels at Inver Bay (Ocean farm Ltd.) in Donegal Bay on 1 visit in March and at Richies Bay (Ocean farm Ltd.) in Donegal Bay on 1 occasion in September.

*Caligus elongatus* levels were consistently maintained at a very low level throughout the year. Levels rose slightly in March, May, June and August in the Southwest region and in the Western region in January, February and August. In the Northwest levels rose once in February.

#### ***Atlantic salmon 2000 (two sea-winter salmon)***

At the beginning of 2002 two sea-winter salmon were stocked on 3 sites, Richies Bay (Ocean farm Ltd.) in Donegal Bay, Glinsk (Marine Harvest) in Mulroy Bay and in Lough Swilly (Marine Harvest). A total of 6 visits were undertaken to these sites before harvesting was completed. *Lepeophtheirus salmonis* levels on these fish were above the treatment trigger levels for 3 of these visits.

*Caligus elongatus* levels were recorded in relatively high numbers at Lough Swilly (Marine Harvest) in February.

#### ***Rainbow trout***

There were 4 sites stocking rainbow trout in the year 2002. A total of 35 farm visits were undertaken during the year. *L. salmonis* and *C. elongatus* levels remained very low throughout the year.

Mean values for each farm visit can be seen in Appendix 1.

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

*Lepeophtheirus salmonis* and *Caligus elongatus* mean ovigerous and mean mobile levels are shown in Table 1 for one sea-winter salmon, per bay, for each month of the sampling year. Mean ovigerous *L. salmonis* levels were greater than the treatment trigger level of 0.5 ovigerous lice per fish on 9 occasions during the critical spring period. These occurred in Kilkieran Bay, Mannin Bay, Donegal Bay, Mulroy Bay and Lough Swilly. In Kilkieran Bay and Mulroy Bay mean levels were in excess of treatment trigger levels throughout the critical spring period. Ovigerous *L. salmonis* levels greater than 2.0 ovigerous females per fish outside of the critical spring period were recorded on occasion in Bantry Bay, Mannin Bay, Donegal Bay and Lough Swilly. Generally these occurred during periods when fish were undergoing harvest. Outside of harvest time there was one occasion in Mannin Bay when ovigerous lice levels were greater than 2.0 ovigerous females per fish but these levels were controlled for the subsequent inspection.

*Caligus elongatus* levels during the year 2002 were very low. There were four occasions when numbers were elevated. These were recorded in Bantry Bay, Bertraghboy Bay and Clew Bay at varying times of the year.

Table 1 Mean ovigerous and mean mobile *Lepeophtheirus salmonis* and *Caligus elongatus* per month, for one sea-winter salmon for each bay inspected in the year 2002.

Mean ovigerous *Lepeophtheirus salmonis*

	Bantry Bay	Kenmare Bay	Greatman's Bay	Kilkieran Bay	Bertraghboy Bay	Mannin Bay	Killary Harbour	Clew Bay	Donegal Bay	Mulroy Bay	Lough Swilly
Dec / Jan	0.30	0.38	1.19	0.67	0.48	3.87	0.17	0.64	0.48	0.96	0.17
February	0.19	0.07	HO	0.15	0.34	0.27	0.05	Missed*	0.89	1.22	0.03
March	0.24	0.00	-	0.90	0.24	0.38	0.26	0.11	0.36	0.92	0.05
April	0.12	0.04	-	0.63	Missed**	0.35	0.13	0.02	0.16	0.74	0.12
May	0.49	0.06	-	0.53	0.12	1.90	0.04	0.04	0.66	1.55	1.67
June	0.40	0.06	-	0.70	HO	0.17	0.04	0.00	1.58	0.12	0.22
July	1.23	0.09	-	1.38	-	0.43	0.00	0.02	1.43	0.09	0.30
August	1.19	0.37	-	HO	-	0.16	0.76	0.35	2.77	0.20	1.02
September	3.13	0.30	-	-	-	2.40	HO	0.98	2.18	0.22	3.02
October	3.56	0.13	-	-	-	HO	-	1.04	2.18	0.25	2.27
November	H	HO	-	-	-	-	-	Missed*	1.86	0.33	1.55

Mean mobile *Lepeophtheirus salmonis*

	Bantry Bay	Kenmare Bay	Greatman's Bay	Kilkieran Bay	Bertraghboy Bay	Mannin Bay	Killary Harbour	Clew Bay	Donegal Bay	Mulroy Bay	Lough Swilly
Dec / Jan	1.70	4.74	6.30	3.60	2.73	26.35	1.96	3.32	5.25	5.43	1.27
February	0.79	0.54	HO	0.23	3.20	0.90	0.41	Missed*	3.75	3.23	1.90
March	1.39	0.13	-	5.62	1.26	11.25	2.66	0.48	1.94	2.78	0.13
April	0.65	0.22	-	2.77	Missed**	4.29	0.43	0.06	1.06	2.97	1.29
May	2.62	0.46	-	2.17	0.62	8.67	0.19	0.18	3.62	10.32	10.69
June	2.55	0.47	-	2.47	HO	0.60	0.07	0.05	6.27	0.40	0.49
July	5.03	0.28	-	3.86	-	0.70	0.38	0.12	6.17	0.85	0.63
August	5.85	1.04	-	HO	-	7.44	3.62	1.17	11.35	1.96	5.69
September	10.13	0.82	-	-	-	4.67	HO	2.60	8.42	0.87	23.31
October	11.94	1.16	-	-	-	HO	-	4.20	5.21	0.67	11.85
November	H	HO	-	-	-	-	-	Missed*	8.52	1.59	2.45

Mean ovigerous *Caligus elongatus*

	Bantry Bay	Kenmare Bay	Greatman's Bay	Kilkieran Bay	Bertraghboy Bay	Mannin Bay	Killary Harbour	Clew Bay	Donegal Bay	Mulroy Bay	Lough Swilly
Dec / Jan	0.87	0.29	0.28	0.07	3.25	0.00	0.03	0.05	0.12	0.22	0.10
February	1.99	0.03	HO	0.00	1.60	0.00	0.00	Missed*	0.04	0.04	1.90
March	2.05	0.03	-	0.22	0.04	0.00	0.00	0.01	0.03	0.02	0.03
April	1.25	0.20	-	0.02	Missed**	0.02	0.00	0.00	0.04	0.00	0.08
May	2.19	0.59	-	0.07	0.00	0.06	0.00	0.09	0.15	0.05	0.89
June	1.10	0.62	-	0.03	HO	0.00	0.02	0.08	0.15	0.00	0.00
July	1.89	1.33	-	0.07	-	0.00	0.02	0.25	0.13	0.03	0.02
August	0.22	1.79	-	HO	-	0.25	0.18	2.42	0.01	0.00	0.15
September	0.07	0.14	-	-	-	0.03	HO	1.74	0.00	0.00	0.29
October	0.02	0.03	-	-	-	0.45	-	0.45	0.00	0.00	0.04
November	H	HO	-	-	-	-	-	Missed*	-	-	0.00

Mean mobile *Caligus elongatus*

	Bantry Bay	Kenmare Bay	Greatman's Bay	Kilkieran Bay	Bertraghboy Bay	Mannin Bay	Killary Harbour	Clew Bay	Donegal Bay	Mulroy Bay	Lough Swilly
Dec / Jan	1.30	0.71	0.60	0.32	6.29	0.08	0.03	0.08	0.32	0.44	0.43
February	3.57	0.07	HO	0.00	2.88	0.00	0.00	Missed*	0.08	0.07	5.80
March	4.12	0.09	-	0.31	0.13	0.00	0.01	0.06	0.06	0.08	0.10
April	4.32	0.45	-	0.05	Missed**	0.06	0.00	0.01	0.16	0.03	0.38
May	4.03	0.91	-	0.14	0.00	0.16	0.00	0.21	0.30	0.19	1.93
June	2.92	1.27	-	0.07	HO	0.02	0.04	0.26	0.27	0.00	0.00
July	3.82	2.39	-	0.10	-	0.00	0.07	0.70	0.48	0.05	0.05
August	0.35	3.35	-	HO	-	0.73	0.26	6.10	0.01	0.00	0.34
September	0.07	0.21	-	-	-	0.17	HO	3.50	0.00	0.00	0.90
October	0.07	0.07	-	-	-	HO	-	1.53	0.00	0.00	0.04
November	H	HO	-	-	-	-	-	Missed*	0.00	0.02	0.00

HO = Harvested out H=Harvesting \* Missed due to adverse weather conditions \*\*Missed due to technical difficulties

### **Regional Monthly Means**

*Lepeophtheirus salmonis* monthly mean figures for one sea-winter salmon are shown in Figures 6 and 7 for each of the three regions inspected. *L. salmonis* in the Northwest and West were above the treatment trigger levels in March and May. In the Northwest region ovigerous levels were in excess of treatment trigger levels on 21 visits and in the Western region levels were exceeded on 15 visits. Outside of the critical spring period average levels for the regions did not exceed 2.0 ovigerous lice per fish at any time. Mobile lice levels were maintained within treatment trigger levels for most regions with the exception of the Northwest where levels rose from July to September.

### **Annual trends**

Lice level trends are compared in Figures 8 and 9 for one sea-winter salmon in the month of May from 1991 to 2002. The mean number of ovigerous lice per fish, and the mean number of mobile lice per fish are examined. From 1998 to 2001 the levels decreased steadily for both ovigerous and total mobile lice. A higher average value was observed for 2002.

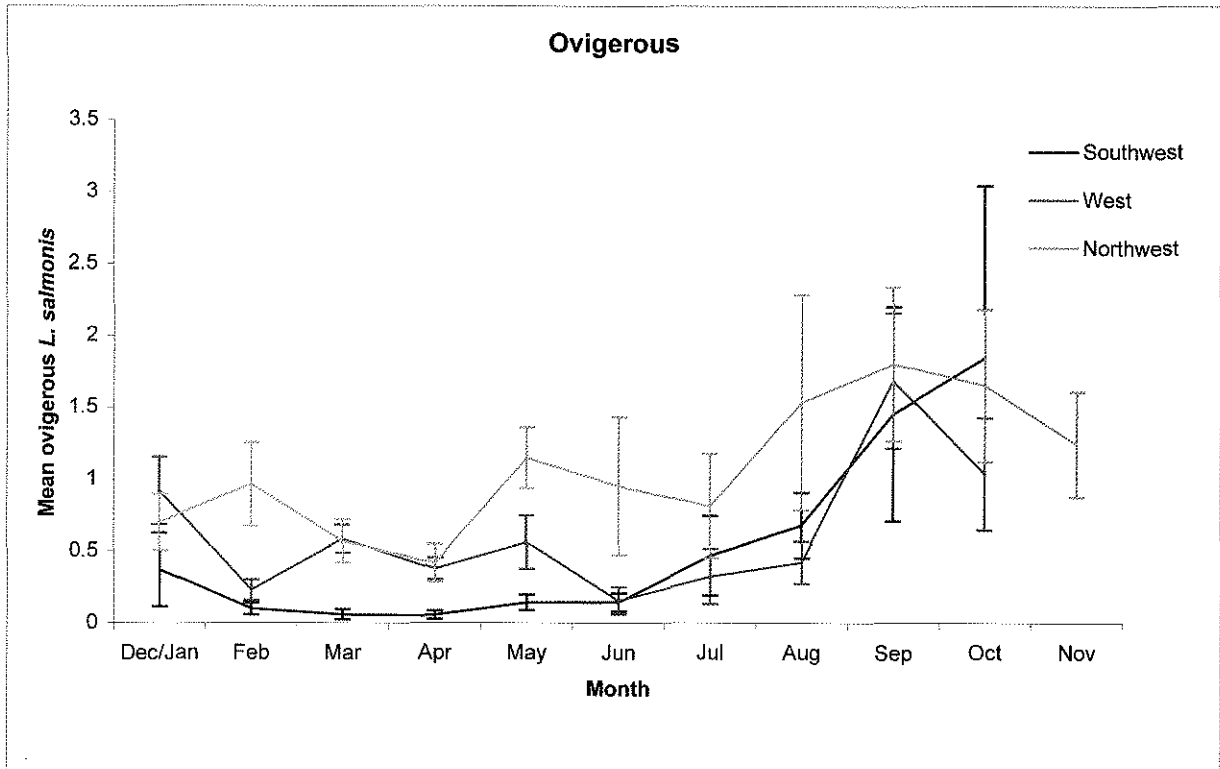


Figure 6. Mean ovigerous *L. salmonis* per month per region in 2002.

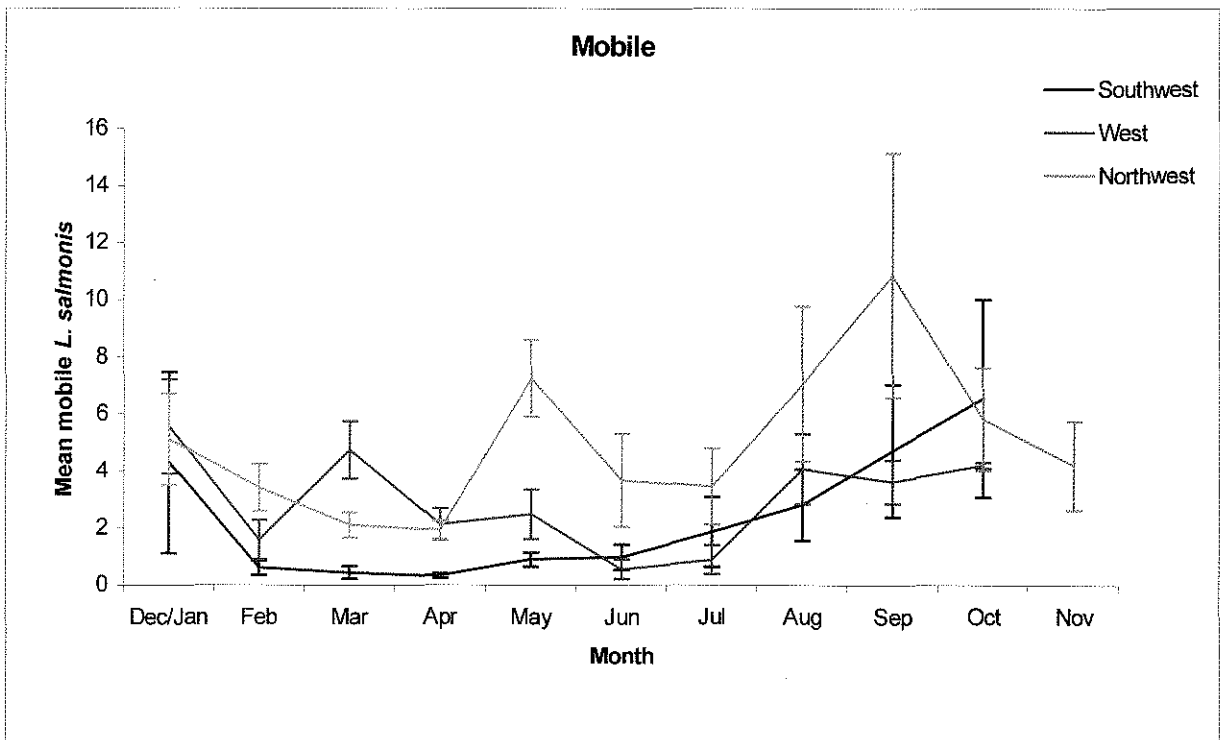


Figure 7. Mean mobile *L. salmonis* per month per region in 2002.

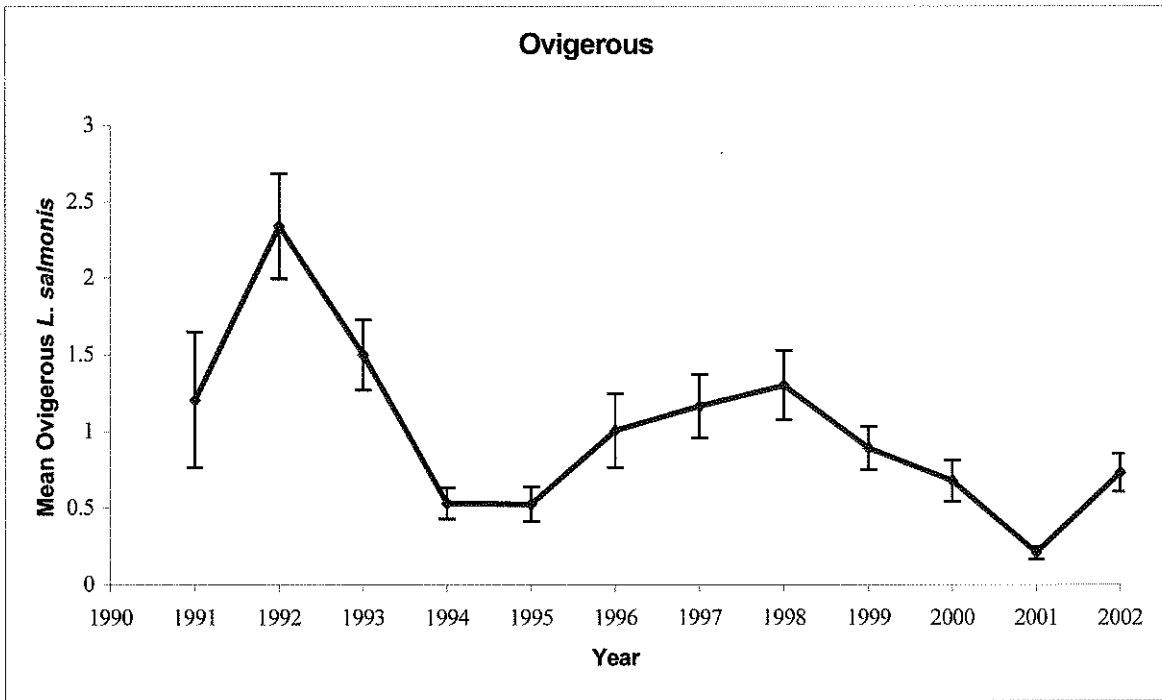


Figure 8. May mean (SE) ovigerous *L. salmonis* on one sea-winter salmon.

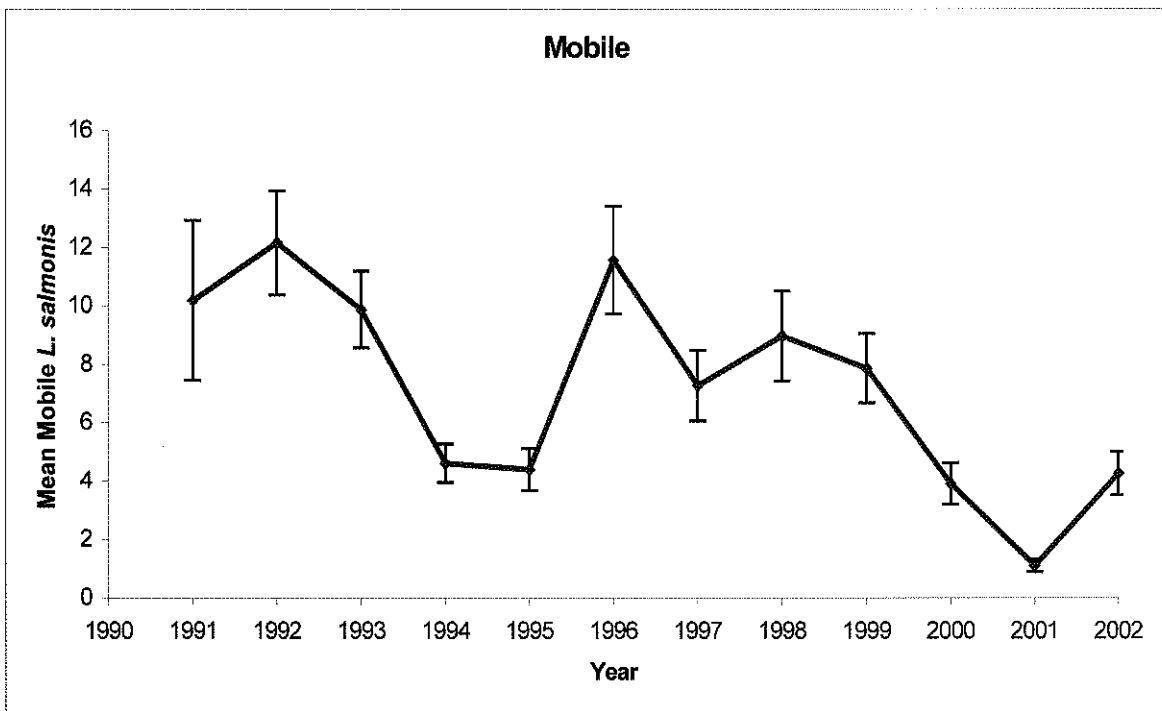


Figure 9. May mean (SE) mobile *L. salmonis* on one sea-winter salmon.



## DISCUSSION

A cornerstone of sea lice management in Ireland is the concept of Single Bay Management (SBM), which is a locally based, co-operative approach to management of sea lice and disease within a bay. It relies on integrated management rather than treatment to control sea lice.

One such practice is the annual fallowing of production sites. A bay or site is considered fallow when there are no fish stocks present. A minimum of 30 days is required. In studies in Ireland and Scotland, it was shown that a longer period of time was taken for significant infestation to build up on new smolts put to sea following a fallow period, thereby delaying the need for chemical treatment (Jackson and Minchin, 1993; Grant and Treasurer, 1993). Mixed generation sites also showed rapid infestation on incoming smolts (Grant and Treasurer, 1993). The practice of fallowing and single generation sites was seen to reduce the lice burden on farmed salmon smolts going into their first winter along the west coast of Ireland (Report of the Sea Trout Working Group, 1994). Fallowing and separation of generations of stock on site and within bays has long been used as a key single bay management tool in Ireland to prevent cross contamination between fish (Report of the Sea Trout Working Group, 1992, 1993 and 1994). The early harvesting of two sea-winter fish is a recommended SBM element and an important co-operative approach is the establishment of agreed codes of practice between farms to minimise sea lice levels. Studies have shown that significant benefits were achieved when a late winter treatment was administered at a number of fish farm sites in Scotland (Wadsworth *et al.*, 1998). These included a reduction of mobile lice infection levels and a reduction in the future need for treatments. The co-ordination of targeted treatments, synchronised to maximise the effect within a bay and prevent cross contamination from untreated fish is an integral part of SBM. Lower sea lice infestations have been attained in Ireland where the implementation and synchronisation of management practices have been employed (Jackson *et al.*, 2002). In Scotland synchronous treatments with adjacent farms in appropriate areas was shown to improve lice control (Wadsworth *et al.*, 1998). By using treatments correctly to their optimum effect, through knowledge of the life cycle of the sea lice, longer intervals between treatments was achieved. In addition, Single Bay Management establishes a forum for information exchange, this involves holding regular meetings with all producers within a bay to discuss issues and plan management strategies.

This year 87% of inspections complied with the Department of Communications, Marine and Natural Resources Protocol No.3 (Monitoring Protocol No. 3 for Offshore Finfish Farms – Sea lice Monitoring and Control). Twelve visits were missed due to adverse weather conditions.

Lice levels on smolts were low in the year 2002. In the one sea-winter fish, elevated *Lepeophtheirus salmonis* levels were recorded in the West and Northwest during the spring period and prior to harvesting. During the spring period average lice levels were consistently elevated in Kilkieran Bay and Mulroy Bay. There was an increase in the May 2002 mean values of both mobile and ovigerous *L. salmonis* on one sea winter salmon (Figure 7 and 8), compared to recent years. It is possible that this is related to higher seawater temperatures during the previous winter/spring period. Seawater temperatures were on average 1.5°C higher in 2002 during the first four

months of the year (mean 8.6°C) than the same period in 2001 (mean 7.1°C, source: Met Éireann). *Lepeophtheirus salmonis* has been shown to develop more slowly at lower water temperatures (Johnson and Albright, 1991), with higher water temperatures leading to a reduced generation time (Hogans and Trudeau, 1989). Boxaspen (1997) found higher lice abundances in the late spring following warmer than average water temperatures for the previous winter. She concluded that it was possible to predict the development of *L. salmonis* numbers during the summer by combining sea lice counts and temperature data from the previous winter. However, Revie *et al.* (2002) found that water temperature had no apparent effect on mean chalimus and mobile counts, in a study on sea lice counts from fish farms in Scotland.

The occurrence of Pancreas Disease on a number of sites in the West and Northwest made the treating of fish more difficult and may have contributed to increased lice levels. It is possible that fallowing procedures and separation of generations were not carried out to an effective level. This may have been a contributory factor in the control of sea lice and disease. Future control of both sea lice infestations and disease will rely on the successful implementation of SBM, with careful planning of synchronised treatments and rotation of treatment types.

### SUMMARY

Lice levels on smolts were generally maintained at a low level throughout the year. Elevated *L. salmonis* levels were recorded on one sea-winter fish at Mulroy Bay and Kilkieran Bay throughout the critical spring period. In Lough Swilly, Donegal Bay and Bantry Bay elevated *L. salmonis* levels were generally associated with harvest practices.

Low *Caligus elongatus* levels were observed throughout the year.

*Lepeophtheirus salmonis* and *C. elongatus* levels on rainbow trout remained very low on all generations.

Glossary of terms used:

- Ovigerous lice:* egg bearing female lice.
- Mobile lice:* all lice that are mobile, male and female that have developed beyond the attached larval stage.
- Std. cage:* the selected cage which is sampled at each inspection.
- Ran. (R) cage:* a cage which is selected by the inspector on the day of inspection.
- Smolt (S1):* this is a stage in the life cycle of the salmon when it changes from a freshwater fish to a seawater fish during the process of smoltification, generally in the Spring approximately 15 months after hatching.
- S1/2:* this is a smolt which has had a faster development than an S1 smolt and is ready to go to sea the Autumn/Winter before, approximately 11 months.
- Grower:* a fish which has been at sea for one year or more

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## APPENDIX 1. SEA LICE MONITORING ON SALMONID FARMS 2002

	Date	<i>Lepeophtheirus salmonis</i>		<i>Caligus elongatus</i>	
		F + eggs	Total	F + eggs	Total
<b>BANTRY BAY</b>					
<b>BEARA ATLANTIC SALMON LTD</b>					
<b>Roanearraig</b>					
Atlantic salmon, 2002	10/01/02	0.00	0.00	0.00	0.00
S1/2	12/02/02	0.00	0.03	0.18	0.37
	05/03/02	0.00	0.14	0.27	0.64
	21/03/02	0.00	0.10	0.23	1.46
	09/04/02	0.00	0.00	1.57	3.00
	23/04/02	0.00	0.13	0.37	0.90
	08/05/02	0.00	0.10	0.43	0.63
	22/05/02	0.00	0.13	0.29	0.35
	25/06/02	0.00	0.17	0.77	3.03
	16/07/02	0.19	0.90	1.71	5.03
	16/08/02	0.26	0.77	0.55	0.99
	12/09/02	0.32	1.00	0.03	0.03
	01/10/02	1.00	5.70	0.10	0.10
	20/11/02	6.45	24.00	0.79	1.38
Atlantic salmon, 2002	09/04/02	0.00	0.00	0.40	0.93
	23/04/02	0.00	0.33	0.57	3.07
	08/05/02	0.03	0.37	1.03	2.03
	22/05/02	0.00	0.00	0.00	0.10
	25/06/02	0.00	0.00	0.34	1.52
	16/07/02	0.00	0.10	1.00	3.90
	12/09/02	0.23	1.05	0.13	0.17
	01/10/02	0.09	0.82	0.00	0.00
	20/11/02	5.93	27.28	1.31	2.55
<b>LASINGERS</b>					
<b>CUAN BAOI SEAFARMS LTD.</b>					
<b>Cuan Banoi</b>					
Atlantic salmon, 2001	11/12/01	0.30	1.70	0.87	1.30
	12/02/02	0.19	0.79	1.99	3.57
	05/03/02	0.40	2.55	4.08	8.13
	22/03/02	0.07	0.23	0.02	0.12
	09/04/02	0.24	0.77	0.85	3.74
	23/04/02	0.00	0.54	1.65	4.91
	08/05/02	0.80	2.50	1.70	3.87
	22/05/02	0.34	2.68	2.44	4.12
	25/06/02	0.40	2.55	1.10	2.92
	16/07/02	1.23	5.03	1.89	3.82
	16/08/02	1.19	5.85	0.22	0.35
	12/09/02	3.13	10.13	0.07	0.07
	01/10/02	3.56	11.94	0.02	0.07
Atlantic salmon, 2002	25/06/02	0.00	0.00	0.05	0.05
	16/07/02	0.00	0.14	0.62	0.90
	16/08/02	0.03	0.84	0.26	0.32
	12/09/02	0.00	1.50	0.00	0.00
	01/10/02	0.33	1.87	0.00	0.00
	20/11/02	0.50	2.47	0.38	0.72

	Date	<i>Lepeophtheirus salmonis</i>		<i>Caligus elongatus</i>	
		F + eggs	Total	F + eggs	Total
<b>JOHN POWER LTD.</b>					
<b>Waterfall</b>					
Rainbow trout, 2001	11/12/01	0.04	0.67	2.70	4.60
	February	Missed due to technical difficulties			
	05/03/02	0.07	0.42	1.45	2.13
	21/03/02	0.00	0.02	0.27	1.42
	09/04/02	0.00	0.00	0.00	0.03
	23/04/02	0.00	0.00	0.02	0.14
	08/05/02	0.00	0.00	0.03	0.05
	22/05/02	0.00	0.09	0.44	0.72
	25/06/02	0.00	0.33	0.37	1.30
Rainbow trout, 2002	25/06/02	0.00	0.07	0.13	0.53
	16/07/02	0.00	0.00	0.00	0.10
<b>KENMARE BAY</b>					
<b>BEARA ATLANTIC SALMON LTD.</b>					
<b>Deenish</b>					
Atlantic salmon, 2001	09/01/02	0.02	0.05	0.02	0.02
	14/02/02	0.00	0.02	0.07	0.15
	07/03/02	0.00	0.05	0.02	0.04
	20/03/02	0.00	0.09	0.05	0.05
	11/04/02	0.02	0.07	0.07	0.10
	25/04/02	0.03	0.14	0.08	0.17
	10/05/02	0.03	0.17	0.19	0.35
	30/05/02	0.05	0.17	0.33	0.48
	27/06/02	0.04	0.14	0.58	1.27
	18/07/02	0.00	0.02	1.52	2.73
	15/08/02	0.18	0.51	2.65	4.88
	18/09/02	0.30	0.82	0.20	0.30
	03/10/02	0.13	1.16	0.03	0.07
<b>Kealincha- Inishfarnard</b>					
Atlantic salmon, 2001	11/12/01	0.02	0.02	0.02	0.02
	13/02/02	0.00	0.00	0.02	0.02
	06/03/02	0.00	0.00	0.03	0.13
	21/03/02	0.00	0.10	0.10	0.27
	10/04/02	0.07	0.27	0.49	1.30
	24/04/02	0.03	0.10	0.53	1.12
	09/05/02	0.05	0.29	0.84	1.30
	30/05/02	0.12	0.40	2.19	3.29
	26/06/02	0.13	0.37	1.25	2.52
	17/07/02	0.18	0.55	1.14	2.05
	15/08/02	0.67	1.40	0.07	0.30
	12/09/02	0.43	1.73	0.03	0.03
	October	Missed due to adverse weather conditions			
Atlantic salmon, 2002	26/06/02	0.00	0.05	0.60	1.25
	17/07/02	0.00	0.05	0.72	1.13
	15/08/02	0.12	0.65	1.33	2.26
	12/09/02	0.07	0.52	0.02	0.02
	October	Missed due to adverse weather conditions			
	19/11/02	0.00	0.00	0.00	0.05



	Date	<i>Lepeophtheirus salmonis</i>		<i>Caligus elongatus</i>	
		F + eggs	Total	F + eggs	Total
<b>LASINGERS</b>					
<b>ST KILLIAN'S HARVEST LTD</b>					
<b>Kilmacillogue</b>					
Atlantic salmon, 2001	09/01/02	1.12	14.17	0.84	2.09
S1/2	13/02/02	0.22	1.62	0.00	0.05
	06/03/02	0.00	0.33	0.00	0.00
	20/03/02	0.02	0.20	0.00	0.05
	10/04/02	0.07	0.39	0.00	0.00
	24/04/02	0.02	0.35	0.02	0.03
	09/05/02	0.02	0.59	0.02	0.05
	21/05/02	0.08	1.17	0.00	0.00
	26/06/02	0.02	0.90	0.02	0.04
Atlantic salmon, 2002	10/04/02	0.00	0.38	0.00	0.02
	24/04/02	0.00	1.49	0.00	0.02
	09/05/02	0.02	5.99	0.02	0.02
	21/05/02	0.00	4.39	0.00	0.39
	26/06/02	0.00	0.24	0.00	0.02
	17/07/02	0.00	0.18	0.02	0.09
	14/08/02	0.07	1.92	0.00	0.07
	11/09/02	0.07	0.48	0.00	0.00
	02/10/02	0.10	1.44	0.02	0.05
	19/11/02	0.10	0.79	0.08	0.27

**GREATMAN'S BAY****TAIRGEOIRI BIAMARA ATLANTACH TEO.****Carraroe**

Atlantic salmon, 2001	23/01/02	1.19	6.30	0.28	0.60
S1/2					
Atlantic salmon, 2002	12/04/02	0.00	0.10	0.00	0.00
S1/2	26/04/02	0.00	0.13	0.00	0.00
	14/05/02	0.00	0.12	0.00	0.02
	30/05/02	0.00	0.10	0.09	0.14
	21/06/02	0.00	0.30	0.15	0.27
	17/07/02	0.20	0.85	0.20	0.47
	27/08/02	0.07	0.13	0.00	0.00
	10/09/02	0.04	0.22	0.00	0.00
	07/10/02	0.27	2.10	0.04	0.05
	04/11/02	1.34	11.16	0.05	0.23

**Kerraun Pt.**

Atlantic salmon, 2002	25/06/02	0.00	0.05	0.02	0.15
	17/07/02	0.00	0.09	0.00	0.03
	27/08/02	0.00	0.06	0.00	0.00
	10/09/02	0.00	0.05	0.00	0.00
	October				Fish transferred to Annaghban and The Gurrig

**MUIRACHMHAINNI TEO****Cuigeal**

Atlantic salmon, 2002	24/07/02	0.05	0.65	0.14	0.17
S1/2	21/08/02	0.07	0.52	0.00	0.00

Fish transferred to Daonish and Casheen

	Date	<i>Lepeophtheirus salmonis</i>		<i>Caligus elongatus</i>	
		F + eggs	Total	F + eggs	Total
<b>KILKIERAN BAY</b>					
<b>MUIRACHMHAINNI TEO.</b>					
<b>Casheen</b>					
Atlantic salmon, 2001	24/01/02	0.12	0.52	0.00	0.04
	February	Missed due to adverse weather conditions			
	13/03/02	1.06	15.50	0.39	0.53
	27/03/02	0.74	5.74	0.05	0.05
	15/04/02	0.37	2.27	0.00	0.03
	24/04/02	0.63	3.87	0.00	0.00
Atlantic salmon, 2002	25/09/02	0.06	0.45	0.00	0.00
S1/2	October	On starve for harvest			
	08/11/02	0.37	0.73	0.00	0.00
<b>Daonish</b>					
Atlantic salmon, 2001	24/01/02	0.22	1.13	0.11	0.51
	February	Missed due to adverse weather conditions			
	13/03/02	1.33	7.95	1.08	1.39
	27/03/02	0.65	3.00	0.04	0.09
	15/04/02	0.41	2.41	0.00	0.04
	24/04/02	0.75	2.20	0.00	0.00
	16/05/02	0.40	0.81	0.00	0.00
	31/05/02	0.08	0.20	0.00	0.09
Atlantic salmon, 2002	25/09/02	0.12	0.74	0.02	0.02
S1/2	24/10/02	1.00	13.80	0.09	0.35
	14/11/02	2.68	10.60	0.10	0.16
<b>Golam</b>					
Atlantic salmon, 2002	24/01/02	0.00	0.03	0.00	0.00
S1/2	22/02/02	0.00	0.06	0.00	0.02
	13/03/02	0.05	0.54	0.02	0.05
	27/03/02	0.00	1.39	0.00	0.10
	12/04/02	0.05	1.92	0.02	0.05
	24/04/02	0.00	0.69	0.02	0.02
	May	Fish being transferred to Red Flag			
	21/06/02	0.00	0.03	0.00	0.04
		Fish transferred to Red Flag and Cuigeal			
<b>Red Flag</b>					
Atlantic salmon, 2002	16/05/02	0.00	0.10	0.02	0.07
S1/2	31/05/02	0.02	0.20	0.14	0.24
	21/06/02	0.00	0.15	0.34	0.82
	24/07/02	0.08	0.82	0.04	0.12
	21/08/02	0.04	0.33	0.00	0.00
		Fish transferred to Daonish and Casheen			
<b>MUIR GHEAL TEO.</b>					
<b>Cnoc</b>					
Atlantic salmon, 2001	25/01/02	0.77	3.67	0.09	0.17
S1/2	February	Missed due to adverse weather conditions			
	22/03/02	0.92	1.67	0.02	0.05
Atlantic salmon, 2002	20/09/01	0.21	0.64	0.00	0.00
S1/2	30/10/02	2.91	32.46	0.03	0.20
	27/11/02	1.49	14.13	0.02	0.12

	Date	<i>Lepeophtheirus salmonis</i>		<i>Caligus elongatus</i>		
		F + eggs	Total	F + eggs	Total	
<b>Lettercallow</b>						
Atlantic salmon, 2002	25/01/02	0.00	0.02	0.00	0.00	
S1/2	22/02/02	0.00	0.02	0.00	0.00	
	14/03/02	0.00	0.30	0.02	0.04	
	29/03/02	0.00	0.74	0.00	0.00	
	12/04/02	0.02	2.00	0.02	0.02	
	26/04/02	0.02	0.78	0.00	0.00	
	15/05/02	0.02	1.05	0.00	0.00	
	29/05/02	0.00	0.30	0.00	0.03	
	June		Fish transferred to Oilean Iarthach			
<b>Oilean Iarthach</b>						
Atlantic salmon, 2002	15/05/02	0.00	0.39	0.00	0.03	
S1/2	29/05/02	0.00	0.18	0.05	0.07	
	21/06/02	0.00	0.10	0.04	0.05	
	25/07/02	0.33	2.06	0.00	0.10	
	28/08/02	0.17	0.37	0.00	0.00	
	20/09/02	0.03	1.10	0.00	0.03	
<b>TAIRGEOIRI BIAMARA ATLANTACH TEO.</b>						
<b>Annaghbhan</b>						
Atlantic salmon, 2002	23/01/02	0.00	0.00	0.00	0.00	
S1/2	21/02/02	0.00	0.10	0.00	0.00	
	14/03/02	0.02	1.65	0.02	0.03	
	28/03/02	0.02	0.50	0.00	0.00	
	12/04/02	0.00	0.07	0.00	0.00	
	26/04/02	0.00	0.17	0.00	0.00	
	14/05/02	0.00	0.00	0.00	0.00	
	30/05/02	0.00	0.40	0.00	0.00	
	25/06/02	0.00	1.24	0.00	0.00	
	25/07/02	0.00	0.14	0.00	0.00	
	23/08/02	0.82	3.37	0.00	0.00	
	10/09/02	0.28	1.07	0.00	0.00	
	31/10/02	1.21	7.83	0.00	0.07	
	25/11/02	1.65	9.51	0.00	0.06	
Atlantic salmon, 2002	31/10/02	0.00	0.27	0.00	0.00	
<b>The Gurrig</b>						
Atlantic salmon, 2001	14/12/01	1.52	5.52	0.00	0.00	
S1/2	21/02/02	0.15	0.23	0.00	0.00	
	14/03/02	0.17	1.22	0.00	0.00	
	28/03/02	0.15	5.40	0.00	0.00	
Atlantic salmon, 2002	31/10/02	0.00	0.13	0.00	0.00	
	25/11/02	0.02	0.42	0.00	0.00	

	Date	<i>Lepeophtheirus salmonis</i>		<i>Caligus elongatus</i>	
		F + eggs	Total	F + eggs	Total
<b>EISC UI FLATHARTHA TEO.</b>					
<b>Ardmore</b>					
Atlantic salmon, 2001	30/01/02	0.72	7.15	0.17	0.90
	February	Missed due to adverse weather conditions			
	15/03/02	1.66	5.77	0.39	0.63
	27/03/02	1.45	4.39	0.05	0.10
	12/04/02	1.05	4.57	0.08	0.19
	25/04/02	0.46	1.62	0.00	0.02
	15/05/02	0.93	4.19	0.00	0.05
	30/05/02	0.71	3.47	0.30	0.44
	28/06/02	0.70	2.47	0.03	0.07
	11/07/02	1.38	3.86	0.07	0.10
Atlantic salmon, 2002	15/11/02	0.25	1.80	0.24	0.40
<b>Birbeag</b>					
Atlantic salmon, 2002	28/06/02	0.02	1.74	1.00	2.29
	11/07/02	0.00	0.00	0.02	0.05
	28/08/02	0.03	0.03	0.00	0.00
	19/09/02	0.07	0.84	0.30	0.42
	24/10/02	0.24	0.42	0.00	0.00
		Fish transferred to Ardmore			
<b>BERTRAGHBOY BAY</b>					
<b>GAELIC SEAFOODS LTD.</b>					
<b>Salt Point</b>					
Atlantic salmon, 2001	30/01/02	0.44	2.43	2.51	5.59
	25/02/02	0.60	5.32	3.07	5.54
	27/03/02	0.43	2.09	0.10	0.22
	April	Missed due to technical difficulties			
	02/05/02	0.21	1.07	0.00	0.00
<b>Sealax</b>					
Atlantic salmon, 2001	30/01/02	0.51	3.03	4.00	7.00
	25/02/02	0.09	1.09	0.14	0.22
	15/03/02	0.24	1.29	0.02	0.15
	27/03/02	0.05	0.40	0.00	0.02
	April	Missed due to technical difficulties			
	02/05/02	0.03	0.17	0.00	0.00
<b>MANNIN BAY</b>					
<b>MANNIN BAY SALMON CO. LTD.</b>					
<b>Hawk's Nest</b>					
Atlantic salmon, 2001	17/01/02	3.87	26.35	0.00	0.08
	21/02/02	0.27	0.90	0.00	0.00
	07/03/02	0.73	22.42	0.00	0.00
	26/03/02	0.03	0.09	0.00	0.00
	09/04/02	0.37	1.53	0.02	0.09
	30/04/02	0.34	7.05	0.02	0.04
	May	Fish transferred to Corhounagh			
Atlantic salmon, 2002	19/07/02	0.00	0.12	0.00	0.00
	30/08/02	0.08	0.42	0.00	0.00
	20/09/02	0.30	1.14	0.08	0.12
	30/10/02	0.04	0.15	0.00	0.02
	26/11/02	0.08	0.29	0.00	0.00

	Date	<i>Lepeophtheirus salmonis</i>		<i>Caligus elongatus</i>	
		F + eggs	Total	F + eggs	Total
<b>Corhounagh</b>					
Atlantic salmon, 2001	10/05/02	2.15	9.30	0.00	0.02
	31/05/02	1.65	8.05	0.12	0.30
	21/06/02	0.17	0.60	0.00	0.02
	19/07/02	0.43	0.70	0.00	0.00
	30/08/02	0.16	7.44	0.25	0.73
	20/09/02	2.40	4.67	0.03	0.17
<b>Ardbear</b>					
Atlantic salmon, 2002	21/06/02	0.00	0.10	0.00	0.00
	July		Fish transferred to Hawk's Nest		

## KILLARY HARBOUR

### KILLARY SALMON CO. LTD.

#### Rosroe

Atlantic salmon, 2001	29/01/02	0.17	1.96	0.03	0.03
	21/02/02	0.05	0.41	0.00	0.00
	07/03/02	0.20	2.93	0.00	0.02
	26/03/02	0.33	2.38	0.00	0.00
	09/04/02	0.13	0.27	0.00	0.00
	30/04/02	0.14	0.59	0.00	0.00
	17/05/02	0.05	0.27	0.00	0.00
	31/05/02	0.03	0.11	0.00	0.00
	27/06/02	0.04	0.07	0.02	0.04
	26/07/02	0.00	0.38	0.02	0.07
	29/08/02	0.76	3.62	0.18	0.26

#### Inishdeighil

Atlantic salmon, 2002	27/06/02	0.00	0.04	0.02	0.10
	26/07/02	0.07	0.63	0.27	0.51
	29/08/02	0.17	0.69	0.00	0.00
	20/09/02	0.10	0.26	0.00	0.00
	30/10/02	0.04	0.93	0.02	0.03
	14/11/02	0.16	2.65	0.03	0.43

## CLEW BAY

### CLARE ISLAND SEAFARM LTD.

#### Portlea

Atlantic salmon, 2001	30/01/02	0.64	3.32	0.05	0.08
	February	Missed due to adverse weather conditions			
	06/03/02	0.32	1.30	0.04	0.11
	26/03/02	0.00	0.07	0.00	0.00
	05/04/02	0.02	0.10	0.00	0.00
	17/04/02	0.02	0.02	0.00	0.02
	09/05/02	0.00	0.02	0.02	0.05
	30/05/02	0.08	0.35	0.17	0.37
	25/06/02	0.00	0.05	0.08	0.26
	11/07/02	0.02	0.12	0.25	0.70
	15/08/02	0.35	1.17	2.42	6.10
	26/09/02	0.98	2.60	1.74	3.50
	15/10/02	1.04	4.20	0.45	1.53
	November	Missed due to adverse weather conditions			

#### Smolt site

Atlantic salmon, 2002	25/06/02	0.00	0.00	0.25	0.58
	11/07/02	0.00	0.10	1.50	2.40
	29/08/02	0.02	0.21	0.29	0.45
	26/09/02	0.18	0.71	0.97	1.97
	15/10/02	0.32	1.98	0.77	1.98
	November	Missed due to adverse weather conditions			

	Date	<i>Lepeophtheirus salmonis</i>		<i>Caligus elongatus</i>	
		F + eggs	Total	F + eggs	Total
<b>SEASTREAM LTD.</b>					
Rainbow trout, 2001	19/12/01	0.00	0.10	0.19	0.57
	February	Missed due to adverse weather conditions			
	05/03/02	0.05	0.94	0.95	1.29
	25/03/02	0.02	0.12	0.07	0.24
	04/04/02	0.35	2.40	0.52	1.08
	16/04/02	0.00	0.00	0.00	0.03
	08/05/02	0.00	0.22	0.00	0.00
	29/05/02	0.00	0.55	0.08	0.18
	24/06/02	0.02	0.10	0.08	0.20

## BEALACRAGHER BAY

### CURRAUN FISHERIES LTD.

Rainbow trout, 2002	February	Missed due to adverse weather conditions			
	05/03/02	0.02	0.32	0.03	0.03
	25/03/02	0.02	0.02	0.00	0.00
	04/04/02	0.00	0.00	0.00	0.02
	16/04/02	0.02	0.02	0.00	0.00
	08/05/02	0.02	0.17	0.02	0.02
	29/05/02	0.02	0.04	0.00	0.00
	24/06/02	0.05	0.21	0.00	0.00
Rainbow trout, 2002	24/06/02	0.03	0.35	0.03	0.08
	28/11/02	0.00	0.00	0.00	0.00

## DONEGAL BAY

### OCEAN FARM LTD.

#### Inver Bay

Atlantic salmon, 2001	23/01/02	0.84	2.94	0.02	0.03
S1/2	14/02/02	1.62	3.28	0.04	0.04
	13/03/02	0.61	1.56	0.03	0.03
	28/03/02	0.39	0.63	0.02	0.04
	10/04/02	0.07	0.15	0.00	0.00
	24/04/02	0.07	0.13	0.00	0.03
	15/05/02	0.02	0.03	0.00	0.00
	28/05/02	0.09	0.12	0.00	0.02
	28/06/02	0.10	0.40	0.10	0.30
Atlantic salmon, 2002	28/06/02	0.00	0.10	0.00	0.00
	23/07/02	0.02	0.71	0.08	0.14
	21/08/02	0.10	1.57	0.02	0.05
	18/09/02	0.11	0.47	0.00	0.00
	24/10/02	0.02	4.00	0.00	0.00
	19/11/02	1.49	9.12	0.00	0.08

	Date	<i>Lepeophtheirus salmonis</i>		<i>Caligus elongatus</i>	
		F + eggs	Total	F + eggs	Total
<b>McSwyne's Carntullagh Pt.</b>					
Atlantic salmon, 2001	24/01/02	0.03	0.22	0.00	0.05
	14/02/02	0.02	0.19	0.00	0.04
	14/03/02	0.03	0.17	0.00	0.00
	28/03/02	0.00	0.09	0.00	0.02
	11/04/02	0.02	0.20	0.00	0.00
	23/04/02	0.04	1.63	0.02	0.12
	16/05/02	0.54	5.91	0.03	0.16
	May	Missed due to adverse weather conditions			
	27/06/02	0.90	4.55	0.00	0.02
	24/07/02	1.17	3.73	0.00	0.07
	20/08/02	2.38	8.66	0.00	0.00
	17/09/02	2.18	8.42	0.00	0.00
		Fish transferred to Richie's Bay			
<b>Castlemurray</b>					
Atlantic salmon, 2002	27/06/02	0.00	2.29	0.00	0.00
	24/07/02	0.05	1.09	0.00	0.00
	20/08/02	0.09	2.45	0.00	0.04
	17/09/02	0.31	5.65	0.00	0.00
	October	Missed due to adverse weather conditions			
	20/11/02	0.52	4.00	0.00	0.00
<b>Richie's Bay</b>					
Atlantic salmon, 2000	24/01/02	0.00	2.10	0.02	0.15
	14/02/02	0.10	3.60	0.20	0.50
	14/03/02	1.33	4.10	0.00	0.10
Atlantic salmon, 2001	20/08/02	5.63	22.37	0.00	0.00
	September	On starve for harvest			
	24/10/02	1.17	4.20	0.00	0.00
	20/11/02	1.86	8.52	0.00	0.00
<b>CREEVIN SALMON FARM LTD.</b>					
<b>Inver Bay</b>					
Atlantic salmon, 2001	14/03/02	0.82	5.54	0.00	0.00
S1/2	29/03/02	0.90	5.93	0.03	0.17
	11/04/02	0.67	2.17	0.00	0.00
	23/04/02	0.37	1.80	0.27	0.93
	15/05/02	0.33	1.67	0.03	0.37
	28/05/02	0.20	4.90	0.40	0.80
Atlantic salmon, 2001	24/01/02	0.89	12.81	0.45	1.12
	13/02/02	1.66	5.46	0.02	0.05
	March	On starve for harvest			
	29/03/02	0.58	4.29	0.23	0.35
	11/04/02	0.13	2.13	0.00	0.00
	23/04/02	0.63	1.69	0.22	0.69
	15/05/02	0.30	1.13	0.07	0.13
	28/05/02	0.23	3.87	0.17	0.33
	28/06/02	4.57	14.83	0.57	0.90
	23/07/02	0.50	11.00	0.50	1.50
	21/08/02	0.30	3.03	0.03	0.03
	September	Missed due to technical difficulties			
	24/10/02	4.20	7.23	0.00	0.00



	Date	<i>Lepeophtheirus salmonis</i>		<i>Caligus elongatus</i>	
		F + eggs	Total	F + eggs	Total
Atlantic salmon, 2002 S1/2	24/01/02	0.00	2.97	0.09	0.13
	13/02/02	0.00	0.03	0.00	0.00
	14/03/02	0.00	0.13	0.00	0.00
	29/03/02	0.00	0.00	0.00	0.00
	11/04/02	0.00	0.17	0.00	0.00
	23/04/02	0.00	0.06	0.00	0.00
	15/05/02	0.00	0.47	0.00	0.00
	28/05/02	0.00	0.04	0.00	0.00
	28/06/02	0.06	0.50	0.00	0.03
	23/07/02	0.07	1.00	0.00	0.00
	21/08/02	0.57	1.73	0.00	0.00
	17/09/02	0.25	3.64	0.00	0.00
	24/10/02	0.16	1.74	0.00	0.03
	19/11/02	0.97	3.60	0.00	0.03
Atlantic salmon, 2002	28/06/02	0.00	0.11	0.00	0.00
	23/07/02	0.00	1.79	0.00	0.07
	21/08/02	0.67	2.50	0.00	0.00
	17/09/02	0.18	1.06	0.00	0.00
	24/10/02	0.33	1.93	0.00	0.00
	19/11/02	0.56	1.81	0.00	0.00

#### EANY FISH PRODUCTS LTD.

##### Inver Bay

Atlantic salmon, 2001	23/01/02	0.15	5.06	0.00	0.09
	13/02/02	0.29	6.07	0.11	0.21
	13/03/02	0.07	0.23	0.02	0.02
	29/03/02	0.16	2.52	0.03	0.23
	10/04/02	0.05	0.37	0.02	0.04
	24/04/02	0.19	2.14	0.05	0.32
	16/05/02	1.00	4.40	0.45	0.62
	28/05/02	2.45	9.07	0.20	0.52
	27/06/02	1.43	7.03	0.10	0.10
	23/07/02	2.90	6.23	0.03	0.30
Atlantic salmon, 2002 S1/2	29/03/02	0.00	0.00	0.00	0.00
	10/04/02	0.00	0.00	0.00	0.00
	24/04/02	0.00	0.03	0.00	0.03
	16/05/02	0.00	0.00	0.00	0.00
	28/05/02	0.00	0.03	0.00	0.00
	27/06/02	0.00	5.12	0.21	0.39
	23/07/02	1.43	3.37	0.00	0.07
	20/08/02	0.00	0.04	0.00	0.00
	18/09/02	0.33	3.77	0.00	0.00
	24/10/02	1.00	3.83	0.00	0.00
20/11/02	1.43	19.30	0.03	0.10	
Atlantic salmon, 2002	27/06/02	0.25	3.46	0.00	0.04
	23/07/02	0.00	0.44	0.00	0.00
	20/08/02	0.27	0.50	0.00	0.00
	18/09/02	0.25	2.46	0.00	0.00
	24/10/02	0.31	2.94	0.00	0.00
	20/11/02	0.32	2.14	0.02	0.03

	Date	<i>Lepeophtheirus salmonis</i>		<i>Caligus elongatus</i>	
		F + eggs	Total	F + eggs	Total
Rainbow trout, 2001	23/01/02	0.03	1.77	0.00	0.06
	13/02/02	0.00	0.30	0.00	0.00
	13/03/02	0.07	2.83	0.00	0.10
	29/03/02	0.00	1.50	0.03	0.10
	10/04/02	0.00	0.80	0.00	0.00
	24/04/02	0.00	0.70	0.00	0.15
	16/05/02	0.00	2.17	0.10	0.13
	28/05/02	0.00	3.93	0.10	0.20
	27/06/02	0.00	0.20	0.00	0.00
	23/07/02	0.23	8.63	0.10	0.26

## MULROY BAY

### MARINE HARVEST

#### Cranford A

Atlantic salmon, 2001 S1/2	08/01/02	2.24	13.41	0.63	1.25
	27/02/02	2.90	7.82	0.10	0.20
	14/03/02	2.20	9.40	0.13	0.27
	20/03/02	1.54	3.18	0.00	0.00
	04/04/02	2.34	4.90	0.02	0.02
	16/04/02	2.45	6.10	0.02	0.07
	08/05/02	1.73	6.31	0.00	0.04
	23/05/02	2.49	9.60	0.09	0.27
Atlantic salmon, 2002 S1/2	25/06/02	0.05	1.00	0.00	0.02
	17/07/02	0.27	2.90	0.02	0.09
	14/08/02	0.04	0.58	0.00	0.00
	17/09/02	2.20	9.70	0.00	0.00
	15/10/02	0.55	2.67	0.00	0.00
	05/11/02	0.90	12.65	0.00	0.00

#### Cranford C

Atlantic salmon, 2002 S1/2	27/02/02	0.00	0.05	0.00	0.00
	13/03/02	0.00	0.89	0.00	0.00
	20/03/02	0.00	1.30	0.00	0.00
	04/04/02	0.00	2.70	0.00	0.02
	16/04/02	0.00	0.22	0.00	0.05
	08/05/02	0.00	1.15	0.00	0.02
	23/05/02	0.07	2.47	0.00	0.00

Fish transferred to Cranford A

#### Moross

Atlantic salmon, 2001 S1/2	08/01/02	0.55	1.84	0.00	0.00
	February	Missed due to adverse weather conditions			
	13/03/02	2.74	6.92	0.07	0.28
	21/03/02	0.69	1.24	0.02	0.02
	04/04/02	0.30	0.85	0.00	0.00
	16/04/02	0.54	0.97	0.00	0.00
	09/05/02	2.06	20.53	0.03	0.03
	23/05/02	1.45	4.90	0.02	0.05
Atlantic salmon, 2002 S1/2	25/06/02	0.13	2.14	0.00	0.00
	17/07/02	0.04	1.80	0.00	0.04
	14/08/02	0.27	4.99	0.00	0.00
	17/09/02	0.42	1.74	0.00	0.00
	15/10/02	0.29	2.67	0.00	0.02
	05/11/02	0.26	0.82	0.00	0.00

	Date	<i>Lepeophtheirus salmonis</i>		<i>Caligus elongatus</i>	
		F + eggs	Total	F + eggs	Total
<b>Moross I</b>					
Atlantic salmon, 2002 S1/2	27/02/02	0.00	0.00	0.00	0.00
	13/03/02	0.00	0.00	0.00	0.00
	20/03/02	0.00	0.05	0.00	0.00
	04/04/02	0.00	0.39	0.00	0.02
	16/04/02	0.00	1.64	0.00	0.00
	09/05/02	0.05	1.69	0.00	0.02
	23/05/02	0.10	2.93	0.00	0.02
		Fish transferred to Moross			
<b>Glinsk</b>					
Atlantic salmon, 2000	09/01/02	3.53	8.43	0.17	0.40
Atlantic salmon 2002	26/06/02	0.00	0.07	0.00	0.00
	18/07/02	0.00	0.16	0.02	0.02
	15/08/02	0.32	1.65	0.00	0.00
	18/09/02	0.33	2.27	0.00	0.00
	16/10/02	0.13	0.95	0.00	0.00
	06/11/02	0.02	0.99	0.02	0.02
<b>Millstone</b>					
Atlantic salmon, 2001	09/01/02	0.40	1.37	0.02	0.09
	28/02/02	0.35	0.62	0.00	0.00
	14/03/02	0.08	0.74	0.00	0.06
	21/03/02	0.15	0.88	0.00	0.05
	05/04/02	0.19	3.35	0.00	0.02
	17/04/02	0.05	2.07	0.00	0.02
	09/05/02	0.15	9.98	0.12	0.25
	22/05/02	1.42	10.61	0.08	0.53
	26/06/02	0.12	0.40	0.00	0.00
	18/07/02	0.09	0.85	0.03	0.05
	15/08/02	0.20	1.96	0.00	0.00
	18/09/02	0.22	0.87	0.00	0.00
	16/10/02	0.25	0.67	0.00	0.00
	06/11/02	0.33	1.59	0.00	0.02
	<b>Milford</b>				
Atlantic salmon, 2001	09/01/02	0.02	1.10	0.02	0.03
	27/02/02	0.40	1.26	0.02	0.02
	14/03/02	0.31	2.04	0.00	0.03
	21/03/02	0.29	1.14	0.00	0.00
	05/04/02	0.07	1.12	0.00	0.00
	17/04/02	0.02	4.39	0.00	0.10
	May		Fish transferred to Millstone		
Atlantic salmon 2002	26/06/02	0.00	0.00	0.00	0.00
	18/07/02	0.00	0.00	0.00	0.00
	15/08/02	0.00	0.00	0.00	0.00
	18/09/02	0.02	0.07	0.00	0.00
	16/10/02	0.00	0.05	0.00	0.00
	06/11/02	0.00	0.29	0.00	0.00

	Date	<i>Lepeophtheirus salmonis</i>		<i>Caligus elongatus</i>	
		F + eggs	Total	F + eggs	Total
<b>LOUGH SWILLY</b>					
<b>MARINE HARVEST</b>					
Atlantic salmon, 2000	08/01/02	5.07	11.90	0.53	0.90
	28/02/02	1.17	5.30	4.37	10.57
Atlantic salmon, 2001	08/01/02	0.17	1.27	0.10	0.43
	28/02/02	0.03	1.90	1.90	5.80
	13/03/02	0.07	0.13	0.05	0.12
	20/03/02	0.04	0.13	0.02	0.09
	04/04/02	0.18	0.79	0.02	0.20
	16/04/02	0.05	1.80	0.15	0.55
	08/05/02	1.16	5.00	0.36	0.97
	22/05/02	2.17	16.37	1.42	2.88
	25/06/02	0.22	0.49	0.00	0.00
	17/07/02	0.30	0.63	0.02	0.05
	14/08/02	1.02	5.69	0.15	0.34
	17/09/02	3.02	23.31	0.29	0.90
	15/10/02	2.27	11.85	0.04	0.04
05/11/02	1.55	2.45	0.00	0.00	

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ISSN 0332-1789