

**Waste Arising from fishing and fish relating industry
in Scotland**

SEPA 2003

Introduction

As part of the local priorities identified through the Area Waste Planning process under the National Waste Strategy: Scotland; wastes arising from fish capture, production and processing sectors were identified as significant issues for the north of Scotland. It was therefore agreed to carry out a desk based study to identify what data on wastes arising from these industries are available.

With the creation of the Scottish Aquaculture Waste Management group it was subsequently decided to extend the scope of this project to the whole of Scotland and to include information provided by members of the group.

This report summarises those findings and lays out some recommendations for future work.

The industry sectors relevant to this report can be summarised as follows

- Aquaculture – Marine Cage Fish Farming
- Aquaculture – Freshwater Fish Farming
- Aquaculture processing
- Shellfish – Cultivation and Sea-Catch
- Offshore capture and processing

The information in this report is gathered from publicly available data sources and responses to questionnaires issued to members of the Scottish Aquaculture Waste Management Group.

AQUACULTURE

Background to Industry

The Aquaculture industry is mainly situated on the west coast mainland and the islands of Scotland. It has been the fastest growing industry in Scotland over the past 20 years, producing over 150,000 tonnes of produce in 2002. This amounted to 50% of Scotland's total food exports (source: SEERAD) and resulted in a turnover of £500 million. Scotland has ideal conditions for Salmon farming, and the rate of growth of the fish farming industry in Scotland's has exceeded that of large competitors such as Norway. Aquaculture is an important economic resource, with the industry directly employing approximately 1,500 workers, and services supporting the industry employing 5,000 (70% of which are in the Highlands). There are many tough challenges and controversial issues surrounding the industry.

The types of waste arising identified for the aquaculture, sea fish industry, processing and fish meal industry were:

- Mortalities
- Cull of Infected Fish
- Packaging Waste
- Fish Waste
- Packaging Waste
- Used Nets, Ropes, Tanks and Cages

Waste Arising Figures

The biological wastes arising from both Fresh Water and Marine Cage Fish Farming consist of routine fish mortalities and catastrophic mortalities.

Routine Mortalities within the farming environment are caused by chronic disease events, equipment failure and post-handling trauma.

Marine Cage Fish Farming

Marine Cage Fish Farming makes up the largest output of fish in the aquaculture sector. There are 86 Marine Cage Fish Farm Operators registered with SEERAD, and SEPA have 320 consented sites throughout the Highlands and Islands. SEPA requires all Marine Cage Fish Farm Operators to record and submit information on a monthly basis. The information requested includes the actual biomass, type of sea lice therapeutant and amount used, amount of feed used, and number of mortalities and weight in kilograms.

Fish Mortalities for Scotland from Marine Cage Fish Farms – 2002 – figures from Annual Returns, SEPA

Total Number of fish mortalities	7,579,581 fish
Total weight of fish mortalities	4888481 Kg / 4888.48 tonnes

Fish Mortalities in Highlands and Islands from Marine Cage fish Farms - 2002 – figures from Annual Returns, SEPA

Area	Fish Mortalities	Weight (Kg)
Highland *	1,525,816	1,163,878.30
Western Isles	1,828,568	1,094,002.32
Orkney	540,372	209,046.49
Shetland	2,608,917	1,567,651.90
TOTAL	6,503,673	4,034,579.82

***Breakdown of Highland Figures**

Area	Fish Mortalities	Weight (Kg)
Dingwall North	111,550	125,905
Dingwall South	125,617	72,121
Fort William	1,260,497	950,831
Thurso	28,152	15,022
TOTAL	1,525,816	1,163,879

(Dingwall North, South, Fort William and Thurso are SEPA geographically divided areas)

Rest of Scotland

Area	Fish Mortalities	Weight (Kg)
Ayr	352,146	56,753.6
Lochgilthead	723,762	797,147.7
TOTAL	1,075,908	853,901.3

Freshwater Salmon and Trout

There is no complete data available for waste arising from the Freshwater Salmon industry. This could be done by questionnaire. This is identified as a data gap. For Salmon, contacting each individual fish farm and requesting the information on the weight of fish removed from the cages due to mortality or culling. This is a large task, however, a competent list of fish farms is available from the work carried out by the recent fish project. This could be carried out by sending a questionnaire to each fish farm. Alternatively, a survey could be carried out. It would be useful before drafting a questionnaire to visit a fish farm and look at the records, discuss waste with operators and officers.

The British Trout Association (BTA) provided Trout waste information which was obtained by the BTA contacting each individual BTA member.

Trout Waste Industry in Highlands - 2003

Waste Type	Amount of Waste (tonnes)
Processed Waste	5 tonnes
Farm Mortalities	100 tonnes

(Borders – Processed Waste 55 tonnes/Farm mortalities 40 tonnes.

Central – Processed Waste 2000 tonnes/Farm mortalities 60 tonnes).

In comparison to the rest of Scotland, waste arising from trout farms is low. The method of disposal is mainly ensiling, and this is normally carried out on site in a standard plastic drum and stored on site. Some smaller farms will

send waste to landfill. The industry has no effective process with dealing with mortalities, and no local infrastructure in place. The Animal By Products (Scotland) Regulations 2003 have raised many issues for the industry which require to be resolved. This requires guidance from the relevant government bodies.

Catastrophic Mortalities are mass fish kills from external impacts, for example jelly fish kills and algal blooms.

The Infectious Salmon Anaemia (ISA) Outbreak in 1998 and 1999, the FRS estimate that **1,000 tonnes** of Atlantic Salmon were slaughtered, ensiled and exported under licence to Norway (Source: FRS). This figure can be used as a baseline for any future outbreaks of ISA.

Year	Weight of fish mortalities in tonnes
1999	403 tonnes
2000	<100 tonnes
2001	5,754 tonnes
2002	2,552 tonnes
2003	<200 tonnes

Source: FRS (Unpublished data)

These figures vary significantly from year to year.

A survey carried out within the Aquaculture industry indicated that the estimated cost of waste was £22.5 million, and through the use of simple low cost, or no cost improvements, over £5 million worth of savings could be made. (Source: Envirowise)

SEA CATCH INDUSTRY

The Sea Fish industry is important to the rural economy of Scotland. In the Highlands and Islands, income from fish landings accounted for 6% of the area's Gross Domestic Product. Fisheries provide jobs in rural coastal areas, where there are few alternatives and communities are dependant on fishing.

Main wastes generated within the industry are identified as:

- Fish Processing Waste – Landed and Disposal to Sea
- Used nets and ropes
- Packaging materials
- Surplus or unmarketable fish

Waste Arising

Highlands and Islands

Quantities of Demersal waste by Port of Landing 2001

Fish Waste Type	Port	Tonnes
Demersal Waste	Shetland	2768
Demersal Waste	Wick	2158
Demersal Waste	Kinlochbervie	1753
Demersal Waste	Mallaig	1433
Demersal Waste	Lochinver	1218
Demersal Waste	Ullapool	803
Demersal Waste	Stornoway	151
Demersal Waste	Orkney	91
	Total Demersal Waste for Highlands and Islands	10375

(Total Waste figure for Scotland is 28,150 tonnes)

Quantities of Nephrops Waste by Port of Landing 2001

Nephrops Waste	Mallaig	702
Nephrops Waste	Stornoway	517
Nephrops Waste	Lochinver	158
Nephrops Waste	Ullapool	73
Nephrops Waste	Scrabster	65
Nephrops Waste	Gairloch	62
Nephrops Waste	Portree	34
Nephrops Waste	Other Scotland	55
	Total Nephrops Waste for Highlands and Islands	1666

(Total Waste figure for Scotland 5,490 tonnes)

Total Demersal and Nephrops Waste	12041
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SHELLFISH INDUSTRY

There are 2 categories of shellfish production – this is cultivation and wild sea-catch.

CULTIVATION SHELLFISH INDUSTRY

There is a small but very active cultivated shellfish sector in Scotland. The Shellfish Farming industry in Scotland is on a much smaller scale than other finfish, and is typically to supplement income from other activities, such as fishing, tourism and crofting. Cultivated shellfish in Scotland includes Pacific Oysters, Native Oysters, Mussels, Queens and Scallops.

There are 2 informal classification of shellfish - crustacean [crabs, lobsters, prawns (nephros)] and Mollusca (mussels, oyster, scallops).

In 1998, 3.3 million oysters were produced for table, 4 million scallops and queens, and 1,300 tonnes of mussels. This is a very small volume in comparison with other EU countries, such as Spain and France. Production trends can be rather erratic due to variable market conditions.

Number of companies registered by region and species 2001 (Source FRS – Scottish Shellfish Farm Production Survey 2001)

	Highland	Orkney	Shetland	Western Isles	Total No. of companies
Pacific Oyster	7	1	0	1	9
Scallop	7	0	0	0	7
Queen	1	0	0	0	1
Mussel	14	0	17	5	36
Total	29	1	17	6	

The information gathered on waste arisings for cultivation (see Appendix *) is based on the information from the Scottish Shellfish Production Survey 2001. Information from Fisheries Research gives the average weight of each shellfish, and details how much of this each shellfish is waste. This gives an estimate of waste arising from shellfish to table, but there is also an on-growing sector. For the on-growing, this only allows the minimum waste arising figure. This does also not identify where the waste arises, as shellfish sold with shells, then this may go into the municipal waste stream, or may end up abroad.

SEA CATCH SHELLFISH

The two species of shellfish which accounts for the majority of shellfish landings by the UK fleet are crabs (19%), nephrops (21%) and scallops (16%). Figures for the amount of shell fish caught in the Highlands. Approximately 52,000 tonnes of shellfish were landed in Scotland in 2001 from UK and Foreign Vessels (Source: Scottish Executive Scottish Fisheries Statistics 2001). There is no breakdown of shellfish landed in the Highlands. From this information, there is no way to identify a breakdown of the species caught, nor the volumes of waste arising.

WASTE ARISING AND WASTE DISPOSAL METHODS

The fate of shellfish waste and volume of waste arising from the industry has not been uncovered by this study. A number of shellfish producers and processors were contacted, but no clear and concise information was established. Two disposal methods mentioned were landfilling of waste and disposal at sea.

A further, in depth study would be required to determine the amount of waste arising from the cultivation and sea catch industries (this may be insignificant amounts), and the methods of disposing of this waste. This would require industry input, or even be industry lead to produce waste solutions, benefits and savings.

Problems that arise from shell fish is that they are sold in two different ways, for table and for on-growing. Table shellfish would result in waste, however on-growing would require information from elsewhere, and this may be abroad. In addition to this, seafood for table is mostly sold live in shells, which would result in waste arising in the municipal (household) and commercial (hotels and restaurants) waste streams, and may arise abroad.

Shells are marketable products, but require cleaning to remove viscera and animal matter.

Future potential uses for shell fish waste are:

- Roadfill and Hardcore (crushed shells)
- Drainage
- Fertiliser
- Reuse for decoration
- Nutritional enhancer for
- Use in Animal feeds such as Hen Feed as Calcium enhancer
- Use of Chitin and Chitosan (food additives, paper strengtheners, skin and hair products, medical purposes).

FISH PROCESSING INDUSTRY

There are 6 Fish Processing Plants in the Highlands and Islands of Scotland.

It is reported that these plants produce significant amounts of waste.

The information on volume of waste arisings and disposal routes would be relatively easy to collect as accurate records will be held at each location.

Analysis of Data – Gaps Identified

The main gaps in data have been identified as the waste arising from Freshwater fish farming. Fish farms should currently be recording how many fish mortalities have occurred under SEPA consent conditions, and should also have records relating to the other wastes. (see recommendation 1)

There is a gap in the data of waste arising within the fish processing industry. (see recommendation 2).

There remains a gap in data of waste from the Shellfish Industry, both sea catch and cultivation shellfish. There is a requirement for accurate data to develop waste solutions. More assistance is required from the industry (see recommendation 3).

There is currently a gap in data in the volume of ensiled waste which would need to be determined before recommendations and solutions could be determined. (recommendation 4)

Recommendations for future work

No	Recommendation	Lead/ Involvement
1	Recommendation that data gathering is carried to determine waste arising from Fresh Water Fish Farming. This would only be achieved by contacting each farm directly, and asking for information. SEPA holds contact details of all fish farms. A questionnaire and a project proposal has been prepared. See attached proposal. This work could be carried out on a Scotland wide basis (most farms will be located in the Highlands and Islands), and this information could be used in the National Work	SEPA Lead/ Freshwater Fish Farming Industry involvement
2	Recommendation that Information on fish Processing Waste is gathered. This could be carried out by phone or by site visit as this would involve only 6 plants and would give overall figures of waste arising from each processor, how this waste is disposed of, and identify best practice.	SEPA Lead/Fish Processor involvement
3	Recommendation that further work be carried out on the Shellfish Industry to determine the amount of waste arising from the shellfish industry, and current and potential waste disposal methods. Once this has been established, then the infrastructure requires to be looked at. There are several methods to reduce and recycling shell waste, and they have a high nutritional value, can be used as infill, roads, fertilisers, and can be sold on for decoration, or for value added production. This requires further work, but has many different business opportunities for local entrepreneurs. This work should be led by the Shellfish Industry.	Shell fish Industry Lead/SEPA Involvement
4	Recommendation that data is gathered on the amount of fish is currently being ensiled. This information is required to determine how much material is currently being ensiled, how much ensiled waste is being transported to Norway, and will be the basis to identify if more localised solutions would be beneficial. This work would require the assistance of specialised companies and the services that they currently offer and solutions which could be developed. Awaiting information from companies based in the Highlands.	SEPA Lead/ Operator and Industry Involvement
5	Recommendation that Develop localised solutions – ie collection points for packaging waste, collection for mortalities, ensiling, new technology, mobile ensiling units. Value from waste is the main objective, and better utilisation for waste is required. Better use of raw materials is required. A general survey of how work is carried out, why is it carried out in that way, speak to different companies and operators, and identify best practices and bad practices. Identify cross industry links (ie – agriculture packaging waste – picked up and transported to central location for pick up from large recycling company – this is currently happening in the Highlands, and is an opportunity for further development).	Industry Lead, SEPA & LECs involvement

6	Recommendation that further development is carried out on the marine cage fish farm returns database to collect further data on waste and waste disposal (currently only collects number and weight of mortalities). This will give baseline data and historical records. This is a prime opportunity to gather data, without extra development work and costs, but would not begin until January 2005.	SEPA Lead/Marine Cage Fish farming industry involvement
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