SECTOR GUIDANCE NOTE: PREVENTING WASTE IN THE FISH PROCESSING SUPPLY CHAIN

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SECTOR GUIDANCE NOTE: PREVENTING WASTE IN THE FISH PROCESSING SECTOR

The significant amount of waste produced by the fish processing sector[1] represents a major financial opportunity for organisations throughout the supply chain.

This sector guidance note presents key results from WRAP research and other information on reducing waste and water use in the fish processing sector. It is designed to highlight the issues and show the key actions that organisations in the sector's supply chain can take to prevent waste being produced and save money.

This guidance note covers waste generated by the 500 seafood processors in the UK[2] that supply the main multiple retailers, about 600 independent fishmongers and around 100 wholesale markets. By-products from fish that are part processed at sea and from caught fish that are discarded[3] before landing are not covered here. Fish sourced from aquaculture operations are also excluded[4].

Headlines

- By-products from fish carcasses that are not sold could be better used for consumption and other purposes, potentially reducing disposal costs and increasing sales.
- Process improvements using lean manufacturing techniques could help increase yields and reduce waste[5].
- Significant amounts of packaging are being landfilled – around 30% for some types. Expanded polystyrene (EPS) is still widely used and the full potential for light-weighting, increasing recycled content and alternative reusable systems has not been fully exploited[6].
- For a given process, water use per tonne of final product is highly variable from organisation to organisation indicating that there is potential to reduce water consumption. Effluent charges could also be reduced through better on-site treatment[6].

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1. Waste arisings in the supply of food and drink to households in the UK (visit www.wrap.org.uk/content/waste-arisings-supply-food-and-drink-uk-households).
2. The industry is characterised by a small number of large, multi-unit businesses and a large number of small, single-site businesses.

- European regulations largely prohibit landfilling as a means of disposing of animal by-products. This means the fish-processing sector must consider alternative methods of dealing with by-products.

Key data and research

WRAP research indicates that households waste about 43,000 tonnes of fish and shellfish each year. Of this, around 32,000 tonnes (74%) is avoidable, often because fish is not frozen or consumed before the end of the use-by date[7].

To quantify waste arisings in the supply chain, WRAP developed 'resource maps' that cover 17 individual finfish and shellfish species[6]. The maps are designed to highlight waste issues and help the sector improve resource efficiency.

All fish species processed in the UK contain a high proportion of non-edible content, which ranges from 58% for white fish, such as cod, to 88% for shellfish, such as scallops[6]. Because of the high levels of unavoidable by-products and the highly variable nature of fish processing operations, it has not been possible to quantify the avoidable waste arising from processing.

WRAP's resource maps represent a summary of material flows in the UK supply chain for an individual species of fish.

An example for cod is shown in Figure 1[6] (next page).

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3. Discards are those parts of the catch that are returned to the sea. Discard rates in European fisheries vary widely, from negligible in some small-scale coastal fisheries, up to 90% of the catches in some trawl fisheries. Seafish Industry Authority (2010). Discards are now under review by the EU with a proposal to ban them by 2013.
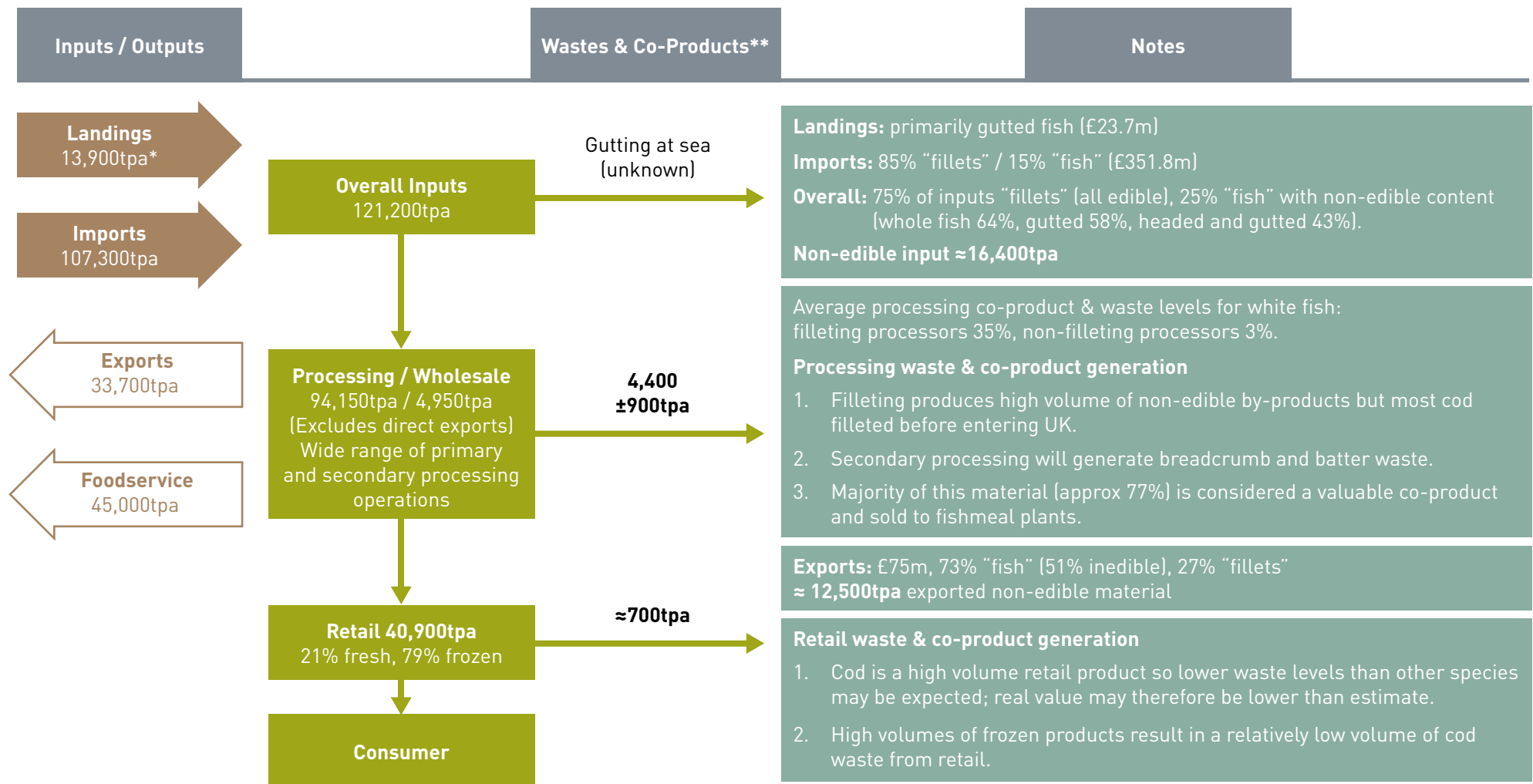4. There are around 560 businesses in the UK involved in aquaculture. Around two-thirds of the employment generated is located in Scotland. A waste minimisation guide for aquaculture was produced by the Scottish Environment Protection Agency (SEPA) (2005). In England and Wales, the Department for Environment, Food and Rural Affairs (Defra) has established an Aquaculture Waste Research and Development Working Group, which is looking at the development of new disposal routes for aquaculture waste.
5. See the Lean Enterprise Academy (www.leanuk.org/).
6. Resource Maps for Fish across Retail and Wholesale Supply Chains, WRAP (2011) (www.wrap.org.uk/content/resource-maps-fish-across-retail-and-wholesale-supply-chains).
7. WRAP announced a reduction in total household food and drink waste of 1.1 million tonnes in November 2011 (www.wrap.org.uk/content/new-estimates-household-food-and-drink-waste-uk). Avoidable food and drink waste reduced by 950,000 tonnes, and the associated value and environmental impact figures have been updated. Research to update estimates for individual food and drink categories has not yet been carried out. Therefore, all figures relating to the breakdown of avoidable food waste should be regarded as approximate. However, these remain the best estimates available (January 2012).

Figure 1: WRAP resource map for cod

Inputs / Outputs	Wastes & Co-Products**	Notes

Landings 13,900tpa*

Imports 107,300tpa

Overall Inputs 121,200tpa

Gutting at sea (unknown)

Landings: primarily gutted fish (£23.7m)

Imports: 85% "fillets" / 15% "fish" (£351.8m)

Overall: 75% of inputs "fillets" (all edible), 25% "fish" with non-edible content (whole fish 64%, gutted 58%, headed and gutted 43%).

Non-edible input ≈16,400tpa

Exports 33,700tpa

Foodservice 45,000tpa

Processing / Wholesale 94,150tpa / 4,950tpa (Excludes direct exports) Wide range of primary and secondary processing operations

4,400 ±900tpa

Average processing co-product & waste levels for white fish: filleting processors 35%, non-filleting processors 3%.

Processing waste & co-product generation

1. Filleting produces high volume of non-edible by-products but most cod filleted before entering UK.
2. Secondary processing will generate breadcrumb and batter waste.
3. Majority of this material (approx 77%) is considered a valuable co-product and sold to fishmeal plants.

Exports: £75m, 73% "fish" (51% inedible), 27% "fillets" **≈ 12,500tpa** exported non-edible material

Retail 40,900tpa 21% fresh, 79% frozen

≈700tpa

Retail waste & co-product generation

1. Cod is a high volume retail product so lower waste levels than other species may be expected; real value may therefore be lower than estimate.
2. High volumes of frozen products result in a relatively low volume of cod waste from retail.

Consumer

*   tpa - tonnes per annum

**   Co-products – unavoidable secondary products of fish processing, which cannot be utilised for human food products but have a marketable value to the producer. Within the finfish industry, the majority of non-edible components are considered to be valuable co-products, and are sold to fishmeal plants for conversion into animal feed products. Non-edible material may be viewed as a co-product by one fish processor, but as a waste by another depending on the availability of outlets for the material.

By-products – unavoidable secondary products from the processing of fish. By-products have a negligible or negative value to the producer and are generally considered to be waste. A by-product which has value can be defined as a co-product. For example, crab shell is a by-product which is inevitably produced by crab processors. A crab processor may view this shell as a co-product if they derive a value from it or as a waste if they have to pay for its disposal.

Over 133,000 tonnes of fish waste, including by-products, is generated by the processing sector in total per year. This amounts to 12.7% of total inputs by weight[6].

At retail sites, waste is estimated to vary between 3% and 8% (a total of around 6,800 tonnes) with most waste being disposed of to rendering operations with meat products[6]. Although fish has a short shelf life, demand is fairly stable and the multiple retailers have long-established relationships with the major seafood processing companies.

Multiple retailers have around 87% of the market. The most popular fish is salmon, followed closely by tuna, cod, haddock and prawns. Most of the salmon bought in the UK comes from fish farms.

Taking action

A recent survey of the fish processing sector[8] revealed that around a third of processors believe environmental issues have no effect on their businesses. The survey also showed that many processors are unable to quantify the costs of waste treatment and disposal.

The fish processing sector has an opportunity to minimise all types of waste to reduce costs and benefit the environment. For most processors, measurement is the first step towards effective management.

Because of the small scale and remote location of many processors, landfill derogations can be given by regulators. Moving waste material up the waste hierarchy (see Figure 2) to avoid the 'Disposal' route will provide environmental benefits and avoid costs. These should be considered on a case-by-case basis by individual processors or, where feasible, by processors working together.

Figure 2: The waste hierarchy

Prevention — If you can't prevent it then...

Preparing for reuse — If you can't prepare for reuse, then...

Recycle — If you can't recycle, then...

Recover other value — If you can't recover value (e.g.energy), then...

Disposal — Landfill if no alternative available.

The practices on the following pages are designed to prevent waste in the supply chain from sea to plate.

8.   2008 Survey of the UK Seafood Processing Industry, Sea Fish Industry Authority (2009).

1. Develop new product pathways

Around 77% of processing waste from white fish and 95% from pelagics (herring, mackerel and tuna) is used as co-products by the fishmeal industry.

The amount of shellfish by-products used is lower because there are fewer outlets for shell, which is produced in large quantities by some operations. There is continued research into the extraction of value-added materials from shell waste which could change this situation.

Solutions
- Build on export markets for by-products, such as fish heads, or the wider use of fish frames as flavouring where these offer economic benefits compared with fishmeal processing.
- Small processors and those in remote locations could benefit from collaborative programmes designed to optimise collection or exploit market opportunities.
- Develop markets for shell products that could include aggregates, filter media and use for decorative purpose. Regulatory clarification on 'free of flesh' shell is required to realise this potential.

2. Process improvements

Processors work to maximise yields, although value added as a percentage of sales in companies has remained unchanged[8]. There is a high level of variability in processing operations with several different types of fish being handled to produce a complex range of products.

Based on experience in other food sectors where short runs, machine changeovers and packaging operations are prevalent, it is probable that lean-manufacturing principles[5] could be more widely used in the fish-processing sector, including small processing operations.

A production line that is used for a variety of species, products and packaging format/ sizes, can result in product waste at changeover, high levels of cleaning (significant water use) and high set-up losses.

Solutions
- Implement total productive maintenance (TPM)[9].
- Measure 'overall effective efficiency' (OEE) of critical processes determined by Availability x Performance x Quality and aim for a metric in excess of 75%[10].
- Look for bottlenecks that might be caused by poor line balance due to an uneven spread of workload between individuals and/or machines.

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9. There is a considerable volume of material on preventive maintenance describing the approach and what is involved, good examples can be found at http://world-class-manufacturing.com and www.jipm.or.jp/en/

10. This is a challenging level for most processing operations that are new to lean manufacturing principles.

3. Packaging optimisation

Throughout the supply chain, a wide range of packaging material is used, but plastic boxes or tubs, EPS fish boxes and cardboard boxes are the most common. Significant amounts of EPS and cardboard are still being disposed of to landfill[6].

While the main multiple retailers have fish counters, an increasing proportion of fish is sold pre-packed.

Solutions
- Wider replacement of EPS fish boxes with alternative reusable and recyclable transit packaging. However, because of weight and insulation properties, replacements for EPS need to provide optimum benefits that may conflict – lower waste to landfill, but increased energy requirement for transportation.
- Light-weighting of primary packs (e.g. using dimpled bases to collect liquid removes the need for an absorbent pad in trays, reducing the thickness of packaging material and using smaller labels).
- Using a greater proportion of recycled content such as polyethylene terephthalate (PET) in trays.
- Innovation in design from the use of pouches to packaging that stays with the fish during cooking.

4. Water

The fish processing sector uses many water-intensive processes and it appears that the cost of water as a proportion of sales has been increasing[8]. Since 2005, plants have been subject to regulatory control[11] and are required to use clean water in all food operations.

In WRAP's resource maps project[6], only 26% of companies provided data on water use and only 11% on effluent management. This suggests that neither is widely measured.

Solutions
- Measuring water use, including sub-metering for different plants and processes, can result in no- or low-cost water reduction measures.
- Conduct water audits to benchmark water use and effluent generation for different operations.
- Greater take up of the Federation House Commitment (FHC)[12].

11. An Integrated Pollution Prevention and Control (IPPC) permit is required by all plants producing more than 75 tonnes a day. To obtain a permit, companies must show they are applying 'best available techniques' (BAT).

12. Visit www.fhc2020.co.uk/fhc/cms

For further information on resource efficiency in the retail sector, please visit
www.wrap.org.uk/retail

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