

TRACKING FISHERIES LANDINGS IN THE NORTH ATLANTIC*

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ABSTRACT

The aim of this paper is to develop a spreadsheet-based framework to help track the flow of fish landings within the North Atlantic region, and to identify profit margins to the various product sectors. We start by estimating the amount of domestic consumption for each country, which is the total fish landings, plus the amount of import, minus the amount of export. As we focus mainly on the trade in North Atlantic, we limit the import and export amounts to those within the region. Next, we determine the proportion of the major product forms under which they are marketed, e.g. fresh, frozen, salted, smoked, industrial, etc. For each product, we follow its marketing channel through various distributing sectors, i.e. wholesalers, retailers and restaurants and food services. In all cases, both the quantity and the value of traded products are recorded, as well as the operating costs of each sector. The results derived are used to identify the sectors or product forms that capture most of the economic benefits from the fishes of the North Atlantic. This knowledge, when used with other information and coupled with further investigation on ownership patterns in the fishing sector, will contribute to the development of management policies that are both ecologically and socio-economically viable.

INTRODUCTION

The objective is to develop an analytical system that will help us track the flow of fish landings within the North Atlantic region (NA). We therefore provide a diagram illustrating the flow of fish landings into their various product forms that go through different distributing sectors, such as wholesalers, retailers, restaurants and other food services. The process involves compiling information about landings, products, processing, trading, marketing and consumption of the major fish species of each NA country. This is based largely on the existing databases (international, regional and national), publications and reports. In addition to the quantities and values of each product, cost data are obtained. An Excel spreadsheet is used as a compilation tool to illustrate the marketing channels of North Atlantic fishery products. Ultimately, we hope to provide an insight into the contribution of

each marketing sector to the whole NA fishery, and to highlight the role of each sector in the distribution of food products derived from fishery resources. This information could be used in conjunction with other knowledge to assist policy makers in the development of policies leading to sustainable and socio-economically viable management of the fishery resources of the North Atlantic.

Similar to Roy et al (1994) in the analysis of the U.S. market for Canadian Atlantic cod, we focus on the supply side of the fish products. Acknowledging the difficulty in obtaining the required data, as most fish species are reported as aggregated fish product, we do not attempt to use a sophisticated model to analyse the market structure of the fish trade. Rather, we aim to make use of available data and systematically follow each fish product, both fresh at landings and processed, through its distributing channel. Conceptually, the steps in the analysis include:

1. Starting with the total fish landings¹ from the waters of each major fishing nation within the North Atlantic region, we track how these landings flow into the different product forms under which they are marketed. That is, fresh, frozen, salted, smoked, industrial, etc. Appropriate conversion factors must be used to take into consideration the recoveries and yields of raw materials (see for example, Crapo et al. 1993).
2. Determine what portion of the product forms is consumed in the domestic market in each relevant country versus the export market.
3. Find out what portion of the product forms are exported to countries within and outside the North Atlantic region.
4. In the case of fish exported to countries outside the North Atlantic region, nothing more happens to them in our framework – they are assumed to flow into a “sink”. In similar fashion, imports from non-NA countries are ignored. This is important because the focus in this exercise is what happens to fish caught within North Atlantic waters, and how the catch may impact the sustainable use of these natural resources.²

¹ These amounts must be adjusted for the unreported catch based on Watson et al. (2000) to further investigate the discrepancy between amount traded and the amount consumed, if any.

² We acknowledge, of course, that by doing so, it might seem as if we ignore the actual trade pattern of fishery product around the world. The problem of the sink and the source will disappear once the analysis extends to the global level.

5. In the case of fish exported to countries within the NA, the amount exported is further split into the various countries to which there are exported to. It should be noted that the exports from country A to country B are also the imports to country B from country A.
6. The total portion of the landings used domestically is then added to all the imports from other countries within the NA to get the total fish from North Atlantic waters that are actually utilized in the particular country under consideration.
7. The landing in (6) above is then split into how much goes to (i) the restaurant/food services sector (direct to consumers), (ii) the processors and distributors' sector (both for human consumption and industrial use), and (iii) to retailers (to consumers-fresh seafood).
8. Prices per unit of fish for the different products are collected, and applied to the quantity of products marketed by a given sector to obtain the revenues accruing to each of the sectors mentioned above.
9. Cost of landing fish are collected and combined with the prices of the products marketed by the different sectors to calculate the average margin³ received by each sector.
10. The information under points (8) and (9) are combined to determine the profitability of the different product sectors. This then helps us to isolate the sector(s) that captures most of the benefits from the fishes of the North Atlantic.

Norway and to a lesser extent, Portugal. For the U.S. market, in particular, annual report on the seafood trade is published (see for example, Seafood Market Analyst 1997). The last source of information, concerning the development and the structure of the markets and other information relating to the marketing of the fishery products, is obtained through agency reports and publications. Additionally, it might be necessary to contact some of the major distributors and processors in each country to gain further information about their enterprises, particularly about the distribution of their products and the costs related to their operation.

CONSTRUCTION OF THE MARKET ANATOMY FOR NORTH ATLANTIC

The construction of the market anatomy of fishery products within the NA relies almost entirely on secondary source of information, both published and unpublished data. Initial inputs, such as landings, values, imports, exports, etc., come from existing global and regional databases, such as FAO's GLOBEFISH, FAOSTAT, OECD Statistics, and the European Commission Fisheries Statistical Bulletin (see short descriptions in Box 1). The next set of data comes from national statistical agencies, some of which can be accessed via their website (see example in Box 1), and some are available as printed reports. Countries where substantial amount of information is available on-line include U.S.A., Canada, Iceland,

³ The margin is the difference between the price received by a sector and the price they paid per unit plus the cost of handling and processing by the sector.

BOX 1: EXAMPLES OF DATABASES AND INFORMATION ON TRADE AND MARKETING OF FISHERY PRODUCTS

FAO - The Food and Agriculture Organization of the United Nations (FAO) maintain several fishery statistical databases, two of which are used in the study, i.e., FAOSTAT and GLOBEFISH.

FAOSTAT is an on-line and multilingual databases currently containing over 1 million time-series records covering international statistics in several areas such as production, trade, food balance sheets, fishery products, forestry products, etc. Specific information about fishery products, both primary and processed, can be obtained from FAOSTAT Fisheries Data. The database is available free of charge via the web (<http://apps.fao.org>) or in CD-ROM.

GLOBEFISH is an integral part of the Fish INFOnetwork set up by FAO to provide regional marketing information. The core of GLOBEFISH is the databank containing fish price information, international trade statistics, catch and production data as well as news items of relevance to fisheries and fish trade. Information is available as publications or on-line service to subscribers.

OECD Statistics: OECD (Organisation for Economic Co-operation and Development) provides economic statistics on food, agriculture and fisheries, via their web page (<http://www.oecd.org/statlist>). Information on international trade in goods and services and foreign trade by commodity are available. (Note: no database is available via internet, some are free documents, but mostly one needs to subscribe or buy)

The European Commission - The European Commission web site contains important information on fisheries, under statistical bulletin (<http://europa.eu.int/comm/dg14/bull/enbull.htm>). The last update in March 1997 provides tables summarising fisheries data, including landings, external trade, processing industry, consumption, and markets. Most of these data come within the EU, such as Eurostat-Comext, and some data are obtained from FAO.

Fisheries and Oceans Canada (DFO) provides statistical services on a wide range of fisheries data including Canadian landings and Canada's international trade quarterly, fisheries products and stocks on an ad hoc basis, the Annual Statistical Review of Canadian Fisheries, Recreational Fisheries in Canada based on a five-year survey cycle and also provides, on request, customised reports covering currently available data. Information on imports, exports and trades are also provided. The web address for this database is <http://www.ncr.dfo.ca/communic/statistics/>.

The US National Marine Fisheries Services (NMFS) provides fisheries statistics and economics data via their web page (<http://www.st.nmfs.gov>). Extensive information is available on imports, exports and marketing of the fishery products. A review of processed fishery products is also available.

North Atlantic Solutions (NAS) - The NAS project is an umbrella organisation for Icelandic fish companies who export their products and services. The project is run by the Trade Council of Iceland. (<http://hubble.mmedia.is/intranet/nas/vefsidur.nsf/index/1?open>). This web page provides links to The Icelandic Ministry of Fisheries, which also contains useful information on the disposition of catches and processing.

Statistics Norway (SN) is a central institution producing official statistics for Norway. Information provided in the yearbook includes catch by species (quantity and value) imports-exports of principal commodities, and operating results of fishing vessels. (<http://www.ssb.no/www-open/english/yearbook>)

Market channel

A spreadsheet is developed to systematically consolidate the above information to provide an overall picture of the market channel of fishery products in the North Atlantic (Figure 1). In general, we start with landings of a given species (e.g. cod, herring, etc.) in a given country in the region and follow the processing and distributing channels that it goes through, in various product forms, e.g. fresh, frozen, dried, etc., before it reaches consumers. Both the amount in tonne and the value in US \$ are recorded. For each product form, including fresh fish, the total amount distributed in the market is the amount landed plus the imported amount from all NA countries under consideration. The amount of other products, though not available in the landing record, is approximated using either the proportion of domestic consumption or the proportion of imports of these products, or assumed if not known. The main product forms varies from species but generally include fresh, frozen (block, fillet), dried/salted, canned and fish meal. Again, appropriate conversion factor is used to proportion the amount landed as raw materials into the finished products.

The distributing sectors considered in the analysis include processors, wholesalers, retailers (e.g. fish and seafood stores, fish mongers, etc.), supermarkets and grocers, and restaurant and other food services. It should be noted that not all products go through all sectors in the channel. As well, we do not imply that the distributors at the end of the chain have no direct access to the products. On the contrary, some of the distributors in the middle of the channel might not play an important role in certain fisheries. Retailers, for example, could serve as intermediate between wholesalers and consumers at the end of the channel. In the case of big supermarkets buying directly from wholesalers or processors, however, retailers might not appear at all in the marketing chain. Consumers and exporters sit at the end of the channel as the final destination of the products. Only the amount exported to NA countries are included in the study and re-entered as imports. The exclusion of fish trade that involves countries other than those in NA may pose some problems in the analysis of the fish market, as a good proportion of fish consumed within the NA countries is imported from other region. The framework developed here can easily be applied to track the fisheries landings around the world, as we plan to do.

The cascading effect of the fishery products occurs at all levels of distribution. For example, fresh fish can be sold to processors, wholesalers, retailers, supermarket, restaurants, and in some cases, directly to consumers, and to exporters. The amount sold to

processors and the imported amount to processing sector gets redistributed as other products to wholesalers, retailers, etc. For any one processed product, the amount wholesalers sell to the market is thus equivalent to the amount processors sell to wholesalers. However, the amount retailers sell to those that follow in the marketing channel include both the amount bought from processors and the amount bought from wholesalers. It is also assumed that supermarkets distribute their products to both restaurants and consumers, while the only outlet for restaurants is consumer. Exporters are assumed to receive the products either directly from fishers (if fresh) or from processors. Consumers, on the other hand, buy most of the products from fish and seafood stores, supermarkets and restaurants.

A similar approach is taken to incorporate values of fishery products in the analysis (Figure 2). Data mostly available include landing values, import and export prices. The prices of fishery products related to other sectors in the market channel are inferred from existing databases, national fishery statistic and country reports, publications, and personal communication. The analysis of the value of the fishery products allow us to investigate further into the importance of each marketing sector to the fishing industry in the North Atlantic and its varying degree of socio-economic impacts. When prices are used in the model, selling prices represent unit prices in all cases. For instance, unit price of fresh fish at landing is the ex-vessel price. The unit price of frozen fish from processing plants sold to wholesale, retail and other distributors are selling prices set by processors. As shown in Figure 2, the price of imports and exports vary depending on the origins and the destinations of the products.

The available data, particularly from existing databases and literature, provide a basis for the construction of the market channel. Nevertheless, many pieces are still missing and several assumptions must be made in order to obtain the complete structure. The model presented in this paper provides the basic framework to analyse the flow of fishery products in NA and could be easily fine-tuned once information becomes more available.

DETERMINING ECONOMIC BENEFITS TO MARKETING SECTORS

Two approaches will be employed in a complementary manner to help us calculate the gross economic benefit to each sector. First, we use the quantity and the price information of fishery products distributed through the various market sectors. This gross benefit is then split into three main components: (i) the total cost of acquiring the

Species - Atlantic Cod

Country - Portugal

Product form - Fresh (from landing to various sectors)

Country of origin*	Quantity (t)	FP	FW	FR	FS	FFS	FC	FX	Destination							
		Processors prop.	Wholesalers prop.	Retailers prop.	Supermarket prop.	Rest/Food services prop.	Consumers prop.	Exporters prop.								
Total am. Traded	C = (A+B)	0.75	0.75 C	0.10	0.10 C	0.08	0.08 C	0.05	0.05 C	0.01	0.01 C	0.01	0.01 C	0.005	D	NA countries
Domestic landings	A															Canada
Imports from NA	B		Wholesale distribution	WR	WS	WFS	WC	WX								Denmark
Canada				(t) prop.	(t) prop.	(t) prop.	(t) prop.	(t) prop.	(t) prop.	(t) prop.	(t) prop.	(t) prop.	(t) prop.	(t) prop.	(t) prop.	Faeroe Is.
Denmark			E = 0.10C	0.40	0.40 E	0.30	0.30 E	0.20	0.20 E	0.100	0.10 E	0.00	0.00 E	0.00 E		France
Faeroe Is.																Germany
France				Retail distribution	RS	RFS	RC	RX								Ghana
Germany					(t) prop.	(t) prop.	(t) prop.	(t) prop.	(t) prop.	(t) prop.	(t) prop.	(t) prop.	(t) prop.	(t) prop.	(t) prop.	Iceland
Ghana				F = 0.08 C + 0.40 E	0.35	0.35 F	0.35	0.35 F	0.300	0.30 F	0.00	0.00 F	0.00 F	0.00 F		Morocco
Iceland																Netherlands
Morocco					Supermarket distribution	SFS	SC	SX								Norway
Netherlands					(t) prop.	(t) prop.	(t) prop.	(t) prop.	(t) prop.	(t) prop.	(t) prop.	(t) prop.	(t) prop.	(t) prop.	(t) prop.	Poland
Norway					G = 0.05 C + 0.30 E + 0.35 F	0.20	0.20 G	0.800	0.80 G	0.00	0.00 G	0.00 G	0.00 G	0.00 G		Portugal
Poland																Russian Fed.
Portugal						Food service distribution	FSC	FSX								Spain
Russian Fed.						(t) prop.	(t) prop.	(t) prop.	(t) prop.	(t) prop.	(t) prop.	(t) prop.	(t) prop.	(t) prop.	(t) prop.	Sweden
Spain						H = 0.01C + 0.20 E + 0.35 F + 0.20G	1.000	1.00 H	0.00	0.00 H	0.00 H	0.00 H	0.00 H	0.00 H		UK
Sweden																USA
UK																Other EU
USA																Others
Oher EU																TOTAL
Others																
Total imports																

Legend for headings:

1) F = Fisher, P = Processor, W = Wholesaler, R = Retailer, S = Supermarket/Grocers, FS = Restaurant/Food Service, C = Consumer, X = Exporter

2) Thus, FP = Amount sold from Fisher to Processor, FW = Amount sold from Fisher to Wholesaler, etc.

Figure 1 Distribution of fishery products through various marketing sectors (hypothetical data)

Atlantic Cod
 Portugal
 m - Fresh (from landing to various sectors)

Origin*	Quantity (t)	Unit price (\$/t)	Value (\$)	Unit price (\$/t)	FW Wholesalers prop. (t)	Value (\$)	FR Retailers prop. (t)	Unit price (\$/t)	Value (\$)	(continued)
Graded	C = (A+B)		TV = VD + VI	0.75 C	FP 0.10	0.10 C	FW * 0.1C	0.08	FR	FR * 0.08C
ending	A	PA	VD = PA * A							
NA	B = B1 + B2 + ... + B17	VI = VI1 + VI2 + ... + VI17	Wholesale distribution							
nada	B1	PB1	VI1 = PB1 * B1							
mark	B2	PB2	VI2 = PB2 * B2		E = 0.10C			0.40	WR	WR * 0.40E
pe Is.	B3	PB3	VI3 = PB3 * B3							
ance	.	.	.							
many	.	.	.							
hana	.	.	.							
eland	.	.	.							
occo	.	.	.							
ands	.	.	.							
rway	.	.	.							
oland	.	.	.							
tugal	.	.	.							
Fed.	.	.	.							
Spain	.	.	.							
eden	.	.	.							
UK	.	.	.							
USA	B17	PB17	VI17 = PB17*B17							
r EU										
thers										
ports										

Origin*	Quantity (t)	Unit price (\$/t)	Value (\$)	Unit price (\$/t)	FC Consumers prop. (t)	Value (\$)	FX Exporters prop. (t)	Unit price (\$/t)	Value (\$)	Quantity (t)
0.05	0.05 C	FS	FS * 0.05C	0.01 C	Fres 0.01	0.01 C	FC * 0.01C	0.005		VE 2+...+D17
0.30	0.30 E	WS	WS * 0.30 E	0.20 E	Wres 0.100	0.10 E	WC * 0.1 E	0.00	0	D1 D2 D3
0.35	0.35 F	RS	RS * 0.35 F	0.35 F	Rres 0.300	0.30 F	RC * 0.3 F	0.00	0	.
G = 0.05 C + 0.30 E + 0.35 F				0.20 G	Sres 0.800	0.80 G	SC * 0.8 G	0.00	0	.
Food service distribution										.
				H = 0.01C + 0.20 E + 0.35 F + 0.20G	FSC prop. 1.000	1.00 H	esC * 1.0H	0.00	0	D17

Headings:
 r, P = Processor, W = Wholesaler, R = Retailer, S = Supermarket/Grocers, FS = Restaurant/Food Service, C = Consumer, X = Exporter
 = Amount sold from Fisher to Processor, FW = Amount sold from Fisher to Wholesaler, etc.

Figure 2 Values of fishery products in each distributing sector (hypothetical data)

sector's raw materials (the price paid to the sector's suppliers), (ii) the cost of handling and processing of the raw materials, and (iii) the margin received by the sector. In the case of the processing sector, for instance, the split can be expressed in a simple way as:

$$GB = c_r + m + c_h \quad \dots 1)$$

where, GB denotes the gross economic benefits, c_r is the price paid to the supplier(s) of the sector's raw materials, c_h is the handling and processing costs, and m is the margin or value added by the sector. Since GB is the revenue from the sale of its products and c_h is the price paid by the sector to its suppliers, there are only two unknowns in the above equation, namely, m and c_h . c_h can be estimated using a combination of both secondary and survey data. Hence the margin, m , can be calculated. Secondly, we look at the profit and loss accounts of fishing companies for supplementary information on the profitability of the various sectors of the fishing sector.

DISCUSSION AND EXTENSION OF CURRENT WORK TO THE ENTIRE NORTH ATLANTIC

Figure 1 is an example of the market flow of one product, originated from one country. A similar model is needed for other products and for all NA countries before aggregation process can take place. This process would take place first at the product level, then at the country level. Using the model (both for quantities and values), we can arrive at an overall market anatomy for NA fisheries, as exemplified by Figure 3. Three main components incorporated in the anatomy are the quantity of fishery products traded in NA, the traded values and the economic benefits obtained by each distributing sector, as described in the section above.

A complete flow of the market channel involves the distribution of products from fishers to consumers through processors, wholesalers, retailers, supermarkets/groceries, and restaurants/food services. In addition to the domestic landings of the catch, there is a certain amount of imports within NA that again goes through the same channel. The total value of products traded in the market is therefore based on the quantity and the price at each sector, including the import amount. For example, fish processors in NA receive their products from three main sources: directly from fishers, from wholesalers and from importers. As processors pay different prices to each of these suppliers, the total value of fishery products that they trade (VP) is:

$$VP = \sum_i p_i q_i \quad \dots 2)$$

where p and q are quantities and prices bought from and paid to i , where i = fishers, wholesalers and importers.

Similarly, the total value of fishery products that wholesalers trade (VW) is:

$$VW = \sum_j p_j q_j \quad \dots 3)$$

where p and q are quantities and prices bought from and paid to j , where j = fishers, processors and importers.

The same calculation is carried out for other sectors in the market until the products reach consumers. At that level, the total value of fishery products that consumers receive (VC) is given by:

$$VC = \sum_k p_k q_k \quad \dots 4)$$

where p and q are quantities and prices bought from and paid to k , where k = fishers, processors, wholesalers, retailers, supermarkets and restaurants.

It is implicit that the amount of imports from NA countries should balance with the amount of exports to NA countries, and to include both would result in double counting. It should also be noted that a reverse channel is possible, concerning the trading between processors and wholesalers, and this difference should be accounted for in the total amount traded.

CONCLUSION

The anatomy of the fishery products, as illustrated in Figure 3, is a good starting point for determining the sector(s) in the industry that capture(s) most of the economic benefits from the fishery. This information, coupled with knowledge about the ownership patterns in the fishing sector, can assist policy makers in designing sustainable ecosystem use policies, such as in the development of market intervention instruments, and in setting appropriate tax systems. It should be noted, however, that to arrive at such a simplistic diagram requires large aggregations of secondary data and to a lesser extent, information from personal contacts. In addition, information on marketing behaviour, and the approximation of costs and benefits associated with each product at each distributing sector are needed. Acknowledging that several assumptions had to be made to draw up the proposed framework, the methodology presented is useful as a tool for the compilation of different kinds of data from various sources on the processing and marketing of fishery products in North Atlantic.

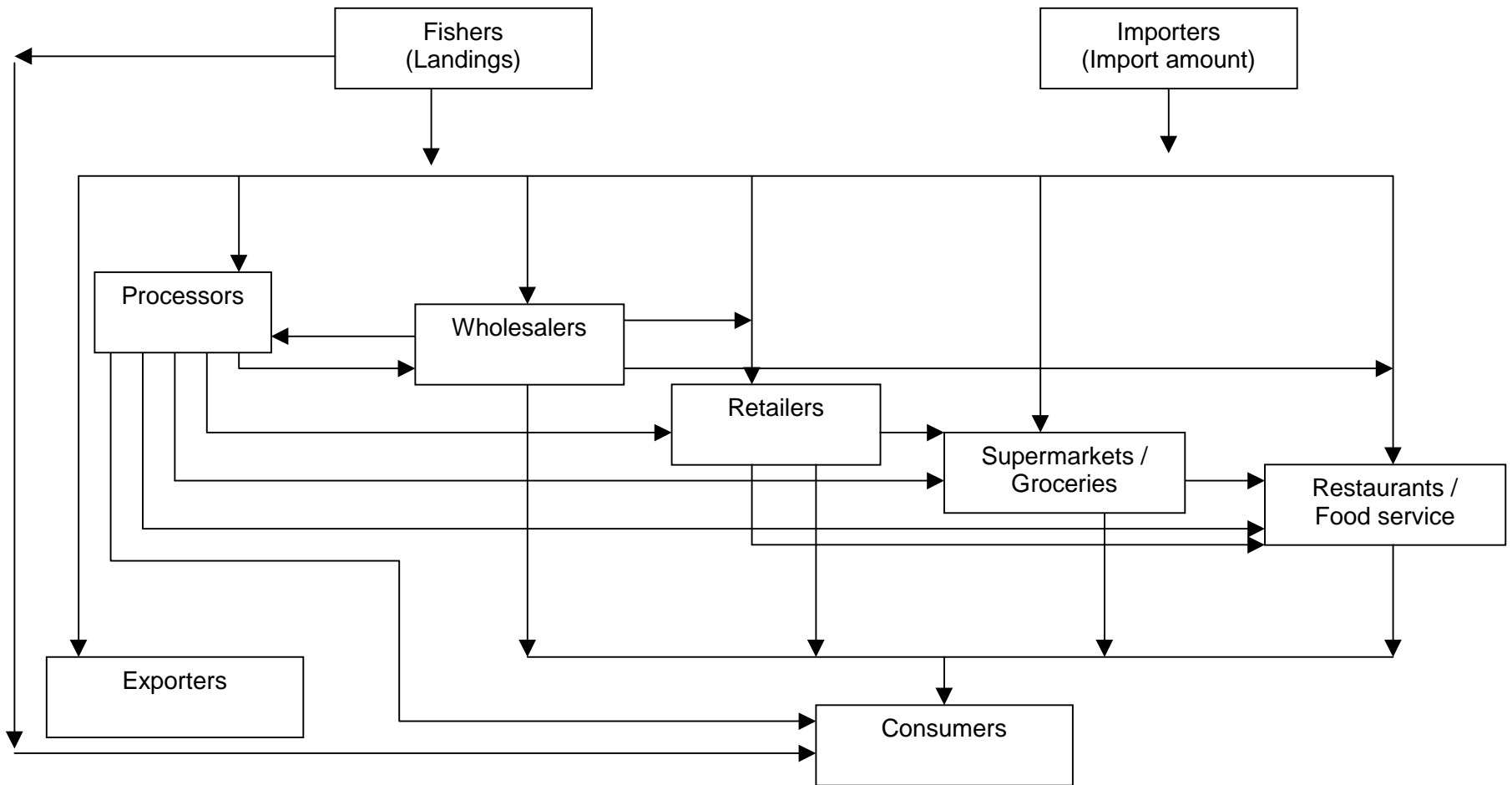


Figure 3 Schematic representation of the flow of products derived from North Atlantic fisheries.

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