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SUMMARY – An evaluation of the share of aquaculture within total seafood supply was achieved under the framework of the MASMANAP EU Concerted Action (CA) which covered nine countries. The seafood supply or "apparent consumption" was calculated for each country by determining national aquatic food production plus imports minus exports. In volume terms, the share of aquaculture in seafood supply is higher in most Mediterranean countries (France, Italy, Spain and Greece) which produce and consume shellfish, marine fish and freshwater fish. In terms of value, France retains the highest share of aquaculture but it is followed by Germany and Norway, reflecting the importance of salmon.

Key words: Aquaculture, trade, seafood supply.

RESUME –*"La part de l'aquaculture dans l'offre totale de produits aquatiques". Une estimation de la part de l'aquaculture dans la consommation totale de produits aquatiques a été réalisée pour neuf pays dans la cadre de l'Action Concertée MASMANAP. La consommation apparente a été calculée pour chaque pays comme étant le résultat de la production plus les importations moins les exportations. En volume, c'est en Norvège grâce au saumon et dans les pays méditerranéens (France, Italie, Espagne, Grèce) qui produisent et consomment une grande variété de coquillages et de poissons d'élevage que la part de l'aquaculture est la plus forte.*

Mots-clés : *Aquaculture, échanges, consommation de produits aquatiques.*

The rationale for assessing the share of aquaculture

Within the wider, global context of declining availability of fisheries resources, aquaculture provides a real alternative for seafood supply to European markets. The aquaculture industry is much younger than the capture fisheries sector; an important comparison that needs to be taken more account of by public policy makers. Aquaculture has to face many constraints, notably, increased competition for space on the sea-shore, absolute dependence on the quality of the environment, a lack of would-be investors and a need for recognition on the markets. Hitherto few precise figures have been available to assess the importance of aquaculture as a component of seafood supply throughout Europe. These data should therefore be useful both at a national level and at the European level for public policy makers.

Moreover, there is a need for objective data in the emergent, and at times, controversial image of aquaculture. Only recently, the BSE crisis has had a highly emotional impact on European consumers and also a real impact on their food purchases. This event has produced different implications for aquaculture in individual locations. An apparent rejection exists by consumers in southern countries (France and Italy) but, on the contrary a more trusting attitude is found in some of the northern countries, notably Germany. In such a troubled yet varied time, it is all the more important to have a clear and accurate assessment of the consumption of aquaculture products within the market.

Methodological aspects

This evaluation of the share of aquaculture in total supply was incorporated within the overall framework of this MASMANAP EU Concerted Action about seafood market studies for the introduction of new aquaculture products. The method used was the "apparent consumption" method, as presented by Sophie Girard in the same seminar. This method calculates, for each country, the seafood supply or "apparent consumption" and is determined by national production plus total imports minus exports of aquatic foods. For the purposes of the MASMANAP CA aquatic food is defined as

products from both capture fisheries and from aquaculture. Production data referring to aquaculture only are also the data used in the MASMANAP work in relevant places in order to determine comparative measures.

As for import and export data for aquaculture, they have been assessed on the basis of Eurostat database (COMEXT). As this database does not mention the wild or farmed origin of the products, the assessment of the origin has been done using expert knowledge within the research team. The identification of the share of farmed origin has been established for each item of the Eurostat database, according to the country of origin or of destination. For instance, it was estimated that 50% of the exports of sea-bass from France to Italy were from aquaculture and that near 100% of the imports of smoked salmon from Norway by Italy were from aquaculture. All the data have been introduced in an electronic spreadsheet, in order to be able to modify and regularly update the ratios as data becomes available.

Data has been gathered in terms of both volume and value. The volume data have been converted to landed weight equivalent, using the same conversion ratios as for the calculation of total seafood supply in the MASMANAP CA. The use of data in value has raised a problem of statistical consistency since the price, which is introduced as a supplementary variable, is measured at the first hand sale level for production statistics and at the wholesale market level for foreign trade. This methodological bias limits the economic relevance of the indicator in each food balance sheet and will not accurately reflect the final consumption figures. Nevertheless, it does permit an otherwise absent assessment at the national level of the share of aquaculture in the total expenses for seafood. This analysis is based upon 1998 data, which are the reference data of the MASMANAP CA; this was determined by common availability at the time of the research in the eight countries of MASMANAP, in addition to Turkey.

Results

The share of aquaculture in the production

Table 1 shows a wide range of values amongst the different countries with regard to the share of aquaculture in the production volume of aquatic products. It goes from 4% in Portugal to 35% in Greece. Four Mediterranean countries, i.e. Greece, France, Italy and Spain have the highest share with ratios over 22%. In the case of Greece, the weight of aquaculture is due to both mussels and marine fish (sea-bass and sea-bream). In the case of France, it is mainly due to oysters and trout. In the case of Italy and Spain, it is due primarily to mussels, then trout and lastly to marine fish farming. The northern European countries, i.e. Norway, the UK and Germany have a ratio around 20%, mainly due to fish farming (salmon for UK, salmon and trout for Norway and carp for Germany). Despite the striking progress of sea-bass and sea-bream farming in Turkey, the share of aquaculture does not exceed 9% yet. As for Portugal, aquaculture is still marginal.

In terms of value, the share of aquaculture is commonly more important (Table 2), except in the countries where bivalves farming is the major form of aquaculture, like Italy and Spain. Thanks to the high value of salmon, the UK and Norway derive 38% and 29% respectively of their primary seafood production revenues from aquaculture.

The share of aquaculture in the international trade of seafood products

Except for Greece, whose 66% of the exports of seafood products in volume are due to aquaculture, the ratio of aquaculture in country exports is found to be below 20% for the other cases considered (Table 3). Norway, the UK and Turkey are above average due to their exports of farmed fish coming from domestic production. Germany ranks second because of an important flow of re-exported salmon, mussels and shrimps after processing. This phenomenon of re-exportation is also present in the UK for bivalves and shrimps. On the contrary, the share of aquaculture in exports is low for the other Mediterranean countries, Italy, France, Spain and Portugal.

In the nine countries studied the share of aquaculture in seafood imports is still lower than that in exports (Table 4). France and Italy are the countries for which the ratio is highest in terms of volume;

around 18% for France due to purchases of salmon, shrimps, mussels and scallops and around 15% in Italy due to purchases of sea-bass, sea-bream and mussels. Germany ranks third thanks to imports of fresh water fish and of salmon. Although Greece imports very small volumes of seafood, the share of aquaculture reaches 9% due to carp purchases. In Spain, most of the imports of aquaculture products are shrimps from South America. Tables 5 and 6 present the results of the assessment in value of seafood export and import data on the basis of Eurostat data.

The share of aquaculture in the seafood supply

In the Mediterranean countries and in Norway the share of aquaculture in the domestic seafood supply is the highest in volume, with 27% in France, 22% in Italy, 19% for Norway, 17% in Spain and 15% in Greece (Table 7). In the case of France and Italy, the supply of farmed shellfish is slightly more important than that of farmed fish. On the contrary, shellfish is dominant in Spain and fish in Greece. In Norway, this result is due to the high level of salmon consumption. The ratio of aquaculture in the apparent consumption of seafood is between 12% and 15% in other northern European countries, mainly due to farmed fish (salmon in the UK, freshwater fish in Germany).

In terms of value (Table 8), the situation is different due to the high unit value of farmed fish and of oyster. This factor maintains France as the premier country where the share of aquaculture in the seafood supply in value is the highest, with almost 30%. That is also the reason why Germany, Norway and Greece have high positions. On the contrary, Italy and Spain have lower scores due to the importance of mussels in their seafood consumption.

Discussion and prospects

There is significant heterogeneity between these nine countries with regards to the share of aquaculture in their production, international trade and supply of seafood. A typology can be built which sorts the countries into seven groups according to their position towards aquaculture products:

(i) group 1:	producer / importer / consumer	France, Italy
(ii) group 2:	producer / consumer	Spain
(iii) group 3:	producer / exporter / consumer	Greece, Norway
(iv) group 4:	producer / exporter	UK
(v) group 5:	importer / exporter	Germany
(vi) group 6:	exporter	Turkey
(vii) group 7:	aquaculture marginal	Portugal

Despite the interesting insights to the data revealed by this analysis several deficiencies should be appreciated in the approach adopted: (i) the general lack of precision of the international trade statistics which contain many confusing components and sometimes preclude wholly accurate comparisons; (ii) the need for expert knowledge to assess the farmed or wild origin of the products in the absence of relevant information in the statistical data; this may change with new labelling laws from January 2002 but retrospectively it remains a problem; (iii) the rapid evolution of the aquaculture industry which makes it possible to buy new products from aquaculture from different places, yet these are not always immediately incorporated within the official data; and (iv) the presence of inter-annual variations in the trade statistics, in particular due to movements of storage in the canning and the frozen products trade sectors.

In order to lessen the impact of these sources of bias remedial actions might include: (i) provide a regular update of expert knowledge and keep informed of the evolution not only of the aquaculture sector but also of the processing industry and of the distribution channels; and (ii) undertake this type of analysis every year in order to generate chronological series making it possible to identify any perturbations of the data and highlight underlying trends.

Table 1. Seafood production in volume – 1998 (tonnes) (source: MASMANAP)

	France	Germany	Greece	Italy	Norway	Portugal	Spain	UK	Turkey
Aquaculture	265,795	61,000	65,480	218,500	438,000	8,968	314,462	131,000	45,180
Fish	64,066	36,000	37,815	65,500	436,000	4,630	40,383	124,000	43,360
Shellfish	201,729	25,000	27,665	153,000	2,000	4,338	274,079	7,000	1,820
Fisheries	568,876	239,000	119,900	545,896	1,788,000	210,747	1,104,838	504,000	431,648
Fish	474,062	222,000	110,489	432,500	1,731,000	189,115	971,717	394,100	412,245
Shellfish	94,814	17,000	9,411	113,396	57,000	21,632	133,121	109,900	19,403
Fisheries+Aquaculture	834,671	300,000	185,380	764,396	2,226,000	219,715	1,419,300	635,000	476,828
Fish	538,128	258,000	148,304	498,000	2,167,000	193,745	1,012,100	518,100	455,605
Shellfish	296,543	42,000	37,076	266,396	59,000	25,970	407,200	116,900	21,223
Share of aquaculture	32%	20%	35%	29%	20%	4%	22%	21%	9%

Table 2. Seafood production in value – 1998 (1000 €) (source: MASMANAP)

	France	Germany	Greece	Italy	Norway	Portugal	Spain	UK	Turkey
Fisheries+Aquaculture	1,513,787	387,000	555,000	2,255,788	4,311,152	331,200	2,442,648	1,236,768	1,266,738
Fisheries	999,364	302,755	315,000	1,826,644	3,041,779	297,000	2,190,000	766,768	1,019,462
Aquaculture	514,424	84,245	240,000	429,144	1,269,373	34,200	252,648	470,000	247,276
Share of aquaculture	34%	22%	43%	19%	29%	10%	10%	38%	20%

Table 3. Seafood exports in volume – 1998 (tonnes) (source: Eurostat/MASMANAP)

	France	Germany	Greece	Italy	Norway	Portugal	Spain	UK	Turkey
Aquaculture	39,659	89,578	37,042	17,778	339,000	2,699	60,609	85,644	5,712
Fish	20,317	63,278	21,305	8,523	339,000	2,232	9,135	63,965	5,712
Shellfish	19,342	26,300	15,737	9,255	0	467	51,474	21,678	0
Fisheries+Aquaculture	404,000	468,000	56,000	136,000	2,050,000	104,000	739,000	482,000	31,838
Fish	335,000	429,000	37,000	92,000	2,018,000	93,000	551,000	369,000	18,309
Shellfish	69,000	39,000	19,000	44,000	32,000	11,000	188,000	113,000	13,529
Share of aquaculture	10%	19%	66%	13%	17%	3%	8%	18%	18%

Table 4. Seafood imports in volume – 1998 (tonnes) (source: Eurostat/MASMANAP)

	France	Germany	Greece	Italy	Norway	Portugal	Spain	UK	Turkey
Aquaculture	246,779	209,836	11,578	142,617	1,134	13,278	113,530	60,059	213
Fish	127,479	184,210	9,945	62,169	450	8,331	37,695	30,152	213
Shellfish	119,300	25,626	1,633	80,447	684	4,947	75,835	29,907	0
Fisheries+Aquaculture	1,334,000	1,527,000	131,000	935,000	360,000	362,000	1,455,000	783,000	39,478
Fish	977,000	1,444,000	95,000	643,000	333,000	312,000	992,000	680,000	36,773
Shellfish	357,000	83,000	36,000	292,000	27,000	50,000	463,000	103,000	2,705
Share of aquaculture	18%	14%	9%	15%	<1%	4%	8%	8%	1%

Table 5. Seafood exports in value – 1998 (1000 €) (source: MASMANAP)

	France	Germany	Greece	Italy	Norway	Portugal	Spain	UK	Turkey
Aquaculture	145,063	240,666	128,012	38,254	825,600	10,250	96,858	286,023	27,381
Fisheries+Aquaculture	930,141	925,783	228,108	325,543	2,925,240	244,100	1,399,209	1,110,892	129,560
Share of aquaculture	16%	26%	56%	12%	28%	4%	7%	26%	21%

Table 6. Seafood imports in value – 1998 (1000 €) (source: MASMANAP)

	France	Germany	Greece	Italy	Norway	Portugal	Spain	UK	Turkey
Aquaculture	666,376	641,212	25,663	423,851	4,933	34,505	460,328	260,696	1,488
Fisheries+Aquaculture	2,998,083	2,275,826	260,778	2,449,233	418,132	839,396	3,244,196	1,927,365	59,424
Share of aquaculture	22%	28%	10%	17%	1%	4%	14%	14%	3%

Table 7. Seafood supply in volume – 1998 (tonnes) (source: MASMANAP)

	France	Germany	Greece	Italy	Norway	Portugal	Spain	UK	Turkey
Fisheries	1,258,720	1,177,740	220,364	1,220,057	435,866	458,168	1,767,917	842,838	444,787
Fish	964,630	1,116,068	179,848	929,854	384,550	402,017	1,384,157	738,914	436,208
Shellfish	294,091	61,671	40,516	290,203	51,316	56,152	383,761	103,924	8,579
Aquaculture	470,885	181,260	40,016	343,339	100,134	19,547	367,383	93,162	39,681
Fish	171,228	156,932	26,456	119,146	97,450	10,729	68,943	90,186	37,861
Shellfish	299,657	24,329	13,560	224,193	2,684	8,818	298,439	2,976	1,820
Fisheries+Aquaculture	1,729,605	1,359,000	260,380	1,563,396	536,000	477,715	2,135,300	936,000	484,468
Fish	1,135,857	1,273,000	206,304	1,049,000	482,000	412,745	1,453,100	829,100	474,069
Shellfish	593,748	86,000	54,076	514,396	54,000	64,970	682,200	106,900	10,399
Share of aquaculture	27%	13%	15%	22%	19%	4%	17%	10%	8%

Table 8. Seafood supply in value – 1998 (1000 €) (source: MASMANAP)

	France	Germany	Greece	Italy	Norway	Portugal	Spain	UK	Turkey
Fisheries+Aquaculture	3,532,672	1,737,043	587 670	4,379,478	1,804,044	926,496	4,287,635	2,053,241	1,196,602
Aquaculture	1,033,237	469,546	137 650	814,741	448,706	58,454	616,118	444,673	221,383
Fisheries	2,499,435	1,267,497	450 020	3,564,737	1,355,338	868,042	3,671,517	1,608,568	975,218
Share of aquaculture	29%	27%	23%	19%	25%	6%	14%	22%	19%