联合国粮食及农业组织 | Food and Agriculture Organization of the United Nations | Organisation des Nations Unies pour l'alimentation et l'agriculture | Продовольственная и сельскохозяйственная организация Объединенных Наций | Organización de las Naciones Unidas para la Alimentación y la Agricultura | منظمة الأغذية والزراعة للأمم المتحدة

COMMITTEE ON FISHERIES

SUB-COMMITTEE ON FISH TRADE

Fifteenth Session

Agadir, Morocco, 22–26 February 2016

THE IMPACT OF AQUACULTURE SUPPLY ON TRADE AND CONSUMPTION

Executive Summary

This paper presents a short overview of aquaculture production and supply to world markets over the last few decades with an analysis of the impact this has had in a number of relevant areas, including distribution and logistics, food safety, consumption, pricing as well as direct and indirect food security.

Suggested action by the Sub-Committee

- Contribute experience on the impact of aquaculture supply in national, regional and international markets;
- Provide guidance on FAO's coverage of aquaculture in its activities related to markets, trade and market access;
- Make recommendations for the work of the Sub-Committee on Fish Trade (COFI:FT) related to aquaculture and its collaboration with the Sub-Committee on Aquaculture.

BACKGROUND

1. Over the last two decades, annual supply of aquaculture products has risen from 24 million tonnes in 1995 to an estimated 78 million tonnes in 2015, or from an almost marginal share in overall human seafood consumption of 28 percent in 1995 to more than 50 percent in 2015. This phenomenal growth in both absolute and relative numbers has made the aquaculture sector the world's fastest growing food producing sector during this period.

2. Despite the fact that the bulk of aquaculture production takes place in Asia (89 percent of the total); the contribution of aquaculture to local, regional and international food security has risen in all regions of the world, including South, Central and North America, Europe, Africa and Oceania. This has occurred not only through improved supply from trade but also through increases in local production. In fact, of late the highest growth rates in aquaculture production have been observed in those regions where average per capita consumption of fish and fishery products has traditionally been the lowest, i.e. South and Central America, and Africa, and where new domestic production therefore can have a higher marginal contribution towards food security than elsewhere.

3. International trade statistics do not distinguish between wild and farmed origin of the products. Hence, the exact breakdown between products of capture fisheries and aquaculture in international trade is open to interpretation. Estimates indicate that aquaculture products represent (2013) between 20–25 percent of volumes but ranging between 33–35 percent of value, providing evidence that an important segment of the industry is export oriented and a producer of relatively high-value products destined for international markets. If fish products for direct human consumption only are considered, the share increases to 26–28 percent of traded volumes and 35–37 percent of value (2013).

4. It should be remembered, however, that the distinction between the two sectors, capture fisheries and aquaculture, is not always clear-cut and many important capture fisheries are in fact hatchery based. This includes salmon fisheries in North America, the Russian Federation and Japan. Another example is bluefin tuna farming, which is based on capture of smaller specimens kept in pens and grown until ready for market.

5. World capture fisheries production has stabilized over the last decade at around 90 million tonnes; it is thus the expanding aquaculture sector that has boosted average consumption of fish and fishery products at the global level, from 15 kg per capita in 1995 to about 20 kg in 2015.

6. Given the dominant role of China in overall production, these consumption figures can also be presented separately: 13.5 kg per capita in 1995 for the world excluding China, rising to 15.1 kg in 2012; for China alone, 20.3 kg per capita in 1995 and 35.4 kg in 2012.

7. Data on per capita fish consumption by capture/aquaculture at country level are not calculated by FAO. However, according to estimates, the share of aquaculture in global fish food consumption, excluding China, was of about 33 percent in 2013, growing from about 15 percent in 1995. This would further underline that although the impact of China's enormous aquaculture production on world consumption is substantial, the aquaculture sector also without China has become global with significant presence and impact in all regions, supplying local, regional and international markets with nutritious and attractive products, generating economic benefits and jobs for local economies.

8. Therefore, there can be no doubt that the aquaculture sector, both through rising domestic production and through trade, has had the potential to impact markets and consumers all over the world. In the following sections a closer look will be taken at how this impact has manifested itself in different areas within the global seafood sector and through global supply and value chains.

CONSUMPTION, DISTRIBUTION AND LOGISTICS

9. It is obvious that the strong growth in aquaculture production would not have been possible without a positive response from investors, markets and consumers. Furthermore this growth in markets reflects not only rising population numbers but a significant shift in demand towards products that consumers perceive as being attractive and for which income elasticities are high. Therefore, demand has been facilitated by growing purchasing power in both the developed and developing world, where many of the emerging economies have registered some of the highest growth rates in seafood consumption during this period. In this context, it is positive to note the strong recent growth in aquaculture production for domestic consumption in the Sub-Saharan region, and in South and Central America, in particular of freshwater species such as tilapia.

10. Because of the widely recognized health benefits of fish and fishery products, many countries have included them in national food security policies and campaigns that have further boosted consumption of fish and fishery products, including from aquaculture. Clearly, this growing demand has attracted imports, but strong domestic demand is also one of the main underlying drivers behind aquaculture development in many regions.

11. The rise in aquaculture production has been further boosted by growth in modern retail channels such as supermarkets and hypermarkets, and in many countries more than 70 to 80 percent of retail purchases of seafood take place there. This is a big shift from only a few decades ago when traditional fishmongers and municipal markets were the main retail outlets for such purchases in most countries.

12. There are many reasons why aquaculture products have found particular favour with the modern retail channels compared with seafood of wild origin. One major factor is the higher degree of predictability in terms of delivery compared with most wild products where seasonality and bad weather play a larger role. The retail chain, therefore, is better able to plan ahead its purchases, integrate its seafood purchases in the overall purchasing programmes for food products for a given period and manage its promotional activities accordingly.

13. An additional factor is price. Although prices for aquaculture products are not necessarily lower, they are more stable and with quotations being less volatile than for wild products, it is therefore easier for operators to enter into purchasing agreements with a set price covering the entire contract period. This has been further facilitated by the advent of a forward market for some aquaculture products such as salmon, where both the producer and the retailer can hedge their contracts and thereby reduce their risk from price shifts. It should be noted that although the market prices for many aquaculture species can indeed be cyclical, and similar to many agricultural price patterns, on the whole they are less volatile than for products from capture fisheries for which uncertain weather conditions, changing quotas and fluctuating energy costs have a much higher impact. With further growth and importance of the aquaculture sector more innovation is likely to be seen in the financial services offered to the industry in the future, including in areas such as insurance.

14. It should also be noted that the allocation of secure rights is as important in the aquaculture industry as it is in the capture fisheries sector, principally linked to water, sites and production licenses. In addition, for the sector's further growth both appropriate regulations and access to capital as well as to markets and animal health services are important prerequisites. Unfortunately, many countries still lack specific regulatory frameworks and legislation to address the particular characteristics of the sector.

15. An additional feature of aquaculture production is that of a more standardized product compared with wild origin and a higher concentration of supply around a few high volume species and a more limited range of sizes and weights. This increases economies of scale with cost reductions in both production and distribution. It should also be noted that the aquaculture sector has a potentially large advantage in handling at the post-harvest level with a high degree of control over harvest and slaughtering operations with an immediate entry into a controlled cold-chain. This has positive effects on the quality and safety of the product at subsequent levels in the supply-chain and on reducing post-

harvest losses. At the same time, the aquaculture sector has the ability to supply products meeting specific market requirements, e.g. salmon with higher fat content preferred for smoking.

16. The issue of economies of scale has also had a profound impact on the aquaculture sector itself. With growing concentration on the demand side, the fragmentation of supply at times has caused the sector to compete principally on price with negative consequences for profitability as well as quality, innovation, product development and the ability to undertake any long-term marketing efforts. Over the last few decades though, the situation has changed and for species such as Atlantic salmon, European seabass and seabream but also for shrimp and intensive tilapia production, the structure of the industry has been transformed with a concentration in many countries of production capacity among a reduced number of operators. Similar industry developments can be observed in other food producing sectors, which are a reminder that the aquaculture sector is subject to the same economic laws as other productive sectors, and although concentration in itself cannot be the objective, it does have the potential to improve economic efficiency and access for consumers but also to increase the overall welfare gains to society from the aquaculture sector.

17. There has been considerable vertical integration among some of the aquaculture sub-sectors, for example in salmon or bass and bream production. This has enabled significant private sector investment in selective breeding programmes to produce faster-growing, later maturing and disease resistant strains.

18. It should be noted, however, that with increasing innovation and reliance on technology, the aquaculture sector cannot be considered in any way particularly labour intensive. Although jobs are indeed created both at the production and harvesting level with positive impacts on the rural economy in particular, most job creation takes place at the processing level, which remains labour intensive. The situation in developing countries differs to some extent, especially for extensive aquaculture operations, but intensive export-oriented aquaculture production follows much the same trend as in developed countries with most of the job creation to be found at the processing stage.

19. The rise of aquaculture has also had a profound impact on logistics and distribution. The larger volumes of farmed product have on one hand created the need for new transportation solutions, and on the other hand the higher volumes have reduced the cost of distribution, thereby increasing the competiveness of farmed product compared with other food and protein sources. This has enabled farmed seafood to create new markets and reach new consumers all over the world. This is especially the case for fresh, chilled or smoked product where both regional distribution by truck and interregional and international distribution by air, especially of fillets, have facilitated access to markets and consumers of regular supplies of farmed product.

20. Without doubt the distribution of frozen aquaculture products has also expanded dramatically, facilitated by increased volumes and much reduced transportation costs. One example is the success of frozen whole tilapia and catfish from Asia, which have gained access to a number of new markets in all regions of the world, in fact at times encountering resistance from local producers who see their own market shares reduced. Lower transportation costs have also encouraged third country processing and many aquaculture products undergo primary or secondary processing in third countries before being shipped onwards to the importing markets of final consumption.

21. The improved solutions in logistics and distribution resulting from increased volumes for aquaculture products have also provided new opportunities for products from capture fisheries. Regular and more frequent deliveries at lower transportation costs have facilitated access to new markets for wild products as well, making the overall availability of fish and fishery products to consumers better than ever before.

22. It should be noted that the growing concentration of seafood sales in the modern retail channel and the general growth of supermarkets and hypermarkets is also the result of the need for more effective models of distribution in response to a worldwide trend of urbanization. This phenomenon occurs in both developed and developing countries; today more than 50 percent of the world’s population live in

urban centres and increasingly rely on modern retail outlets for their food purchases, including in a number of megacities with populations above 10 million. However, the structure of the retail sector itself is in constant development and in the future, undoubtedly many more novel and innovative solutions will be seen, aided by information technology and internet based options.

MARKET ACCESS

23. A prerequisite for further growth in supply from aquaculture is continued access to world markets. In general, barriers to market access for fish and fishery products today are more related to mandatory import requirements on quality and safety than other factors such as import tariffs. This is especially the case for the three large import markets, the European Union, the United States of America and Japan where import tariffs are very low or inexistent, except for a few value-added products and particular species. However, many developing countries continue to apply high import tariffs for fish and fishery products, and although this usually reflects fiscal policy rather than being a protective measure, it does have detrimental effects on regional trade. Over time, thanks to regional and bilateral trade agreements, such tariffs are bound to fall further, also in developing countries with some exceptions accorded to least-developed countries (LDCs).

24. The ability of adhering to constantly evolving import requirements can be a challenge for most exporting countries. These include areas such as quality and safety, but are increasingly also related to technical standards and labelling and, more recently, to voluntary certification for biological sustainability as well as social and labour conditions within the industry and its suppliers. Some of these import requirements are regulatory, and therefore binding, but also private companies, whether retailers, processors or restaurant chains, increasingly set their own specifications that producers have to meet.

25. A number of specific certification schemes for aquaculture products can be found in the market, operated by either private institutions, non-governmental organizations (NGOs), national governments or producer associations ranging from labelled product to business to business certification schemes. The trend is clearly one of certification of some sort becoming a prerequisite for entering many important markets, in particular the larger retail and food service operators.

CAPACITY BUILDING

26. Capacity building, training and transfer of experience and know-how are needed to meet these requirements. Investments are often needed in infrastructure, in particular in improving the cold chain from the landing or harvesting site and onwards through the entire supply chain. Much of the focus so far has been on the export-oriented production, but there are also large unmet needs in improving domestic infrastructure for distribution of fish and fishery products in many countries in the world. Some capacity-building is being provided by international organizations and agencies, and also by the importing countries themselves, but more support is clearly needed, including through initiatives such as Aid for Trade by the World Trade Organization (WTO).

27. The fragmented industry structure in many countries, with a large number of small aquaculture operators, makes capacity building a challenge. However, innovative solutions, such as clusters or self-help groups, have proved to be effective to introduce better practices and certification. This shows that the issue of size is not insurmountable and that organizational structures can be found to alleviate the problem of fragmentation. One successful example can be found in public and private partnerships where matching funds are made available to build capacity, improve environmental management and working conditions of both large farms and clusters of farms in developing countries, thereby facilitating greater access to international markets.

ACCEPTANCE OF AQUACULTURE PRODUCTS IN THE MARKET PLACE: PERCEPTIONS

28. Whereas the aquaculture sector in its early growth phase during the 1960s, 1970s and part of the 1980s was welcomed by most observers as the means to solve future demand needs for seafood and to lessen excessive pressure on the world's oceans, the early welcome would subsequently turn to a more lukewarm reception if not open hostility and outright rejection by some observers. Despite this, the industry has continued to grow but there is still no wide-spread recognition of the sector's key contribution to current seafood needs for world consumers and its role in improving rural livelihoods as an important economic activity.

29. In particular, the rapid growth of intensive aquaculture production has caused concerns about environmental impacts, human health and social issues. Some scientific uncertainties and conflicting information about seafood consumption have further bewildered the public. Moreover, negative reports by the mass media and some Civil Society Organizations have amplified the mistrust towards the sector. It is also recognized by many that the industry's efforts to promote aquaculture have sometimes increased the mistrust by glossing over difficulties and not addressing environmental problems with frankness. While the negative image is often driven by concerns associated with a few commodities or certain aquaculture systems, it prejudices the whole industry.

30. Negative consumer perceptions can directly affect sales and prices of farmed products. While the opposition to aquaculture development is strongest in the Western world, the intensification of aquaculture production processes, in combination with higher education levels and income in emerging economies, may lead to increased public awareness of environmental impacts and fish product safety in these regions. Thus, public perceptions of aquaculture are likely to become more critical to the future success or failure of the industry.

31. Even though the wealth of information on food production available to consumers has never been better, the public's lack of awareness of and experience with aquaculture makes it difficult for people to know what information to trust. When confronted with negative information, most people cannot refer to previous experiences with this activity, as they can for agricultural farming and fishing. Thus fear of the unknown can lead to opposition to an activity and refusal of its products without even understanding why. Modern aquaculture is still at an early stage of development, and despite many improvements in its production processes towards greater sustainability, a 'perception gap' exists between the way modern aquaculture is carried out and public understanding of the industry. It is therefore crucial to communicate better the important role that a responsible aquaculture sector can play in addressing urgent social and economic issues such as food security, employment and maintenance of essential services in rural areas.

THE IMPACT OF AQUACULTURE ON PRICES

32. In competitive markets, fish prices are primarily determined by supply and demand interactions, the prices of substitutes, transportation and production costs. The specifics of these determinants, however, differ significantly, in many cases, between wild capture fisheries and the aquaculture sector. Given that the growth of aquaculture is expected to continue in the long term, it is important that policymakers and other industry stakeholders have a good understanding of how these differences can affect global seafood markets and price trends.

33. Fisheries and aquaculture are fundamentally different means of food production, and hence each entails an entirely different cost structure, a different set of risk factors and different technology. Firstly, the nature of aquaculture operations, particularly the predictability of production and consistency of product, lends itself to horizontal and vertical integration of the supply chain and longer-term supply contracts. This can have implications for price transmission in the supply chain as contract pricing inhibits this transmission whereas spot pricing does not, but also appears to reduce the price volatility of individual species.

34. Crucially, aquaculture operators also have more control over the production process and as a result are able to take advantage of the relatively greater scope for technological innovation to drive down costs. Over time, this has allowed the aquaculture industry to sustain a long-term reduction in prices and increase its share of several markets traditionally supplied by capture fisheries. At the same time, the contribution of aquaculture to an otherwise stagnating global fish supply, together with the industry's capacity for product innovation and supply chain efficiency, has allowed for the creation of entirely new markets.

35. With half of the fish and fishery products we consume now coming from aquaculture, there is competition between wild and farmed seafood taking place in markets across the world. However, seafood markets are complex and highly segmented, and production technology is only one possible product attribute. Species, product form and origin are all important factors by which consumers distinguish between products. Hence, the degree to which farmed and wild species are actually competing in today's seafood markets depends on which market is being analysed.

36. The higher the degree of integration in a given market, the more exposed fish of one production technology will be to price competition of the other, and hence to any advantage or disadvantage resulting from lower or higher production costs, consistency of supply or any other particular feature of that technology. At the same time, highly integrated markets leave all participants potentially vulnerable to variations in supply volumes (e.g. disease) or demand shocks (e.g. negative media publicity). The degree of market integration of farmed and wild fish is also important for policymakers as it implies that policies intended to increase prices of a particular species produced by a particular set of producers (e.g. a domestic industry) cannot be effective in the long-term if lower-priced fish in the same segment can be supplied to the same market by a different set of producers.

37. While there have been numerous studies analysing the degree of integration between wild and farmed fish in a range of markets, there is no overall consensus as to whether farmed fish prices will always respond to those of wild fish or vice versa. This depends on the species, the product form and the market being analysed. However, some heavily traded species such as salmon and shrimp do appear to display a significant degree of integration in terms of prices, suggesting that increased supply from aquaculture in these markets has been and will continue to be a major influencing factor on price trends for both production technologies.

QUALITY AND SAFETY ISSUES RELATED TO AQUACULTURE PRODUCTS

38. In terms of quality and safety, there are some issues that are particular or have a higher incidence for aquaculture products compared with those from capture fisheries. The most important one is the use of antibiotics. However, this problem has been drastically reduced in comparison with a few decades ago, with aquatic health management in general now a primary concern for both producers and regulatory authorities. The need for antibiotics has further declined thanks to the development of effective vaccines for many species and improved egg and juvenile quality from hatcheries.

39. For some substances, however, the situation remains one of concern. One example is the use of non-authorized substances such as nitrofuran (metabolite) and nitrofurazone (semicarbazide (SEM)), which causes a high percentage of rejections in the European Union (Member Organization) for imported fish products, as shown in the Rapid Alert System for Food and Feed (RASFF) portal[1].

40. Residue levels of authorized substances above maximum residue level (MRL) are also an increasing problem, and there have been alerts due to levels above MRL for sulfadiazine and amoxicillin in 2015.

[1] http://ec.europa.eu/food/safety/rasff/portal/index_en.htm

41. Regarding microorganisms and histamine and other amines levels in wild compared with farmed fish, there are no major differences because this depends to a large extent on handling.

42. The major cause of rejections as reported by the European Union (Member Organization) for crustaceans, more specifically farmed shrimp, are due to residue levels above MRL for sulfadiazine, oxytetracycline, tetracycline, undeclared sulphite, and the use of prohibited substances such as nitrofuran (metabolite) furazolidone (3-amino-2-oxazolidinone (AOZ)) and chloramphenicol. The latter, though, has been absent among European Union (Member Organization) rejections since 2011. This shows that capacity building and better practices can lead to important improvement in results.

43. The situation is complicated somewhat by the fact that drug residues found in aquaculture products can have their origin in substances contained in the feed used in the production process or by substances added later during the freezing and processing phase in order to lengthen the shelf-life of the product. It should also be noted that aquaculture products that are perfectly healthy at origin can become contaminated later during processing in others countries.

44. Molluscs do not show differences in rejections between farmed and wild origin as the most traded ones are bivalve mollusc for which food safety depends on the quality of the water in which they are grown and harvested.

45. However, it should not be forgotten that aquaculture products entering international trade have been subject to close scrutiny for their safeness for consumption. In fact, the major number of alerts registered in recent years by major importing markets has not been directly related to the intrinsic safety of the product but for other causes of detention, such as absence of health certificate and incorrect labelling. Consumers, therefore, should have confidence in the competent authorities responsible for food safety but also exercise sound judgement regarding freshness and appearance as for any other food product.

FAO AND AQUACULTURE

46. With the sector's growth in both absolute numbers and as a share of overall supply, it is only natural that issues related to aquaculture also play a greater role in FAO's work. The Secretariats of the two sub-committees of the Committee of Fisheries (COFI) work closely together with the aim of coordinating their respective work programmes to avoid duplication and unnecessary overlap, as well as aiming for a better integration of aquaculture issues into the wider agenda of market access, trade, food security, nutrition and consumption.

THE FUTURE

47. It has been seen that over the last two to three decades, the aquaculture sector has grown from being an emerging and promising industry to a global and highly dynamic reality that contributes more than 50 percent of the world's food fish consumption and represents about 35 percent of internationally traded seafood. Value projections done by FAO in cooperation with the Organization for Economic Co-operation and Development (OECD), and with World Bank (WB) and the International Food Policy Research Institute (IFPRI), indicate that driven by strong underlying demand trends, the sector will further develop and, depending on the parameters used, have a share in total fish consumption of 56 percent in 2024 and 62 percent in 2030.

48. This shift in the relative shares between the two origins, capture fisheries and aquaculture, provides challenges as well as opportunities for both sectors. For the capture fisheries industry, the opportunities lie in improving quality through better handling practices, reducing discards, waste and post-harvest losses, development of new products and markets, including by-products, and in general, supplying products more targeted to consumer needs than aiming to sell what is being landed. Value addition will certainly play a role but so will the supply of super-fresh fish relying on innovative chilling, packaging and distribution technology. In general, opportunities lie in creating value through placement

of species and products in higher-paying market categories at the right time, improving the products' profiles and highlighting the uniqueness of the product and its natural origin.

49. For aquaculture, new technology and continuous innovation will increase yields and improve efficiency, reducing costs and securing access at acceptable costs for mass markets of consumers. At the same time, increased segmentation and new solutions in logistics and packaging will broaden consumer choice and it is likely that both large scale producers as well as specialists will develop products for niche markets, including of organic products. Challenges remain in balancing the need for more intensified production with higher output per unit of land and water without increasing its environmental footprint, including more efficient energy use associated with aeriation and pumping.

50. Improved technology is likely to reinforce the already ongoing trend towards more direct human consumption of small pelagic species, rather than serving as raw material for meal and oil. The fishmeal industry therefore will further increase its reliance on by-products from the processing industry, which already constitute about 25 percent of its raw material needs. The aquaculture industry will therefore solve its future feed needs for carnivorous species through improved conversion factors, higher vegetable content, alternative sources, such as seaweed, and more raw material for meal and oil sourced from by-products in the seafood processing industry.

51. Further concentration in the aquaculture sector can be expected at all levels in the same way as in other industries in general and food industries in particular. Innovation will probably be more intense in the smaller and medium-sized companies, which will be absorbed by the larger groups through takeovers and acquisitions. Consumers will have access to a number of fairly standardized products at accessible prices mainly supplied by the aquaculture sector but also by a number of high value products coming both from capture fisheries and specialized niche producers in the aquaculture sector.

52. Marketing efforts in the sector will be much intensified with a number of brands developed as in other food sectors. Price competition will be important as for any other good, but companies will aim to build loyalty through branding, differentiation and marketing campaigns. In this respect, there are likely to be some parallels with the developments in the poultry industry.

53. Although the three large importing markets for fish and fishery products will continue to be important, their role will be diminished compared with that of today. A higher degree of production will be channelled to domestic and regional markets and much of the additional aquaculture production in developing countries will be targeting domestic consumers, especially of freshwater species.

54. Small-scale producers will continue to play an important role in the sector for the supply of both farmed and wild product. However, new constellations with producer networks, clusters and other forms of formal and informal collaboration will be essential in order to increase their competitive position within the value chains of the future, thereby attaining a more equitable share of the economic value and benefit created.