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REVIEW ARTICLE

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SUSTAINING CONSUMER CONFIDENCE IN MIDDLE EAST AQUACULTURE SECURED BY TRACEABILITY SYSTEMS

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Abstract:

In recent years, aquaculture is the fastest growing protein supply for consumers in the Middle East countries. The aquaculture production in the region increased by 111% from 837 247 to 1 768 917 tons between 2005 and 2014. Egypt, Iran and Turkey are the leading countries in aquaculture production but Saudi Arabia, Oman and United Arab Emirates have vast investment plans for future aquaculture projects as the others in the region. Middle East aquaculture still need to grow by nearly 20% to match the regional demand for seafood which is average 12,55 kg fish per capita. This huge necessity for growth raises doubts in regional consumers on the sustainability of aquaculture production.

Sustainable aquaculture systems are being accepted as environmental friendly, profitable, productive and social. But the sustainability is not a measurable entity itself and its analysis relies on indirect criteria or indicators. Traceability is an important indicator that sustains consumer confidence on aquaculture products.

There's an increasing trend on the market for traceability of capture and aquaculture products. Therefore, many countries are developing various solutions for monitoring the aquaculture market. Turkey is one of these countries who's developing computer-based monitoring systems for fisheries and aquaculture production.

In this study, acceptance, progress, and the difficulties in transition to new monitoring system and the prospective contribution of traceability systems on consumer confidence have been investigated in example of Turkey.

Keywords: Sustainable aquaculture, Traceability, Middle East, Consumer confidence, Turkey

Introduction

Aquaculture is the fastest growing protein supply for the consumers in the Middle East countries in recent years. The aquaculture production in the region increased by 111% from 837 247 to 1 768 917 tons between 2005 and 2014 (FAO, 2015) (Figure 1). Aquaculture production across the region is predicted to reach 2.46 million tons as the year 2020. The majority of aquaculture production is supplied from freshwater species like Nile tilapia and rainbow trout. However, the huge consumer demand for shrimp, oysters, crab and mussels is encouraging aquaculture sector to produce such marine species.

Egypt, Iran and Turkey are the leading countries in the Middle East aquaculture production with more than 95% of total share (Table 1). Egypt is producing nearly 65% of total aquaculture production (GLOBEFISH, 2011).

In 2014, the value of aquaculture production reached to nearly 4.4 billion USD by 134% increase in ten years (Figure 2). While the major players continue to grow in Middle East aquaculture industry, the others like Saudi Arabia, Oman and United Arab Emirates (UAE) have started vast investments in aquaculture sector from the last quarter of 2013. Saudi Arabian Ministry of

Agriculture has plans to support aquaculture projects with an additional 10.6 billion USD to produce one million tons of fish in next 16 years. Oman also has plans to invest 1.3 billion USD in aquaculture development up to the year 2020. Another potential producer United Arab Emirates, announced multi-billion USD aquaculture investments for its new aquaculture farms. Aquaculture is expected to be the fastest growing food industry in the Middle East (GLOBEFISH, 2011).

Food and Agricultural Organization (GLOBEFISH, 2011) reported seafood consumption in the Middle East as already above the world average and increasing rapidly. Per capita consumption of seafood in the United Arab Emirates (UAE) is at 51.1 kg, four times the world average and one of the highest worldwide. It is followed by the other fastest growing seafood markets in the region as Oman (36.7kg/per year), Bahrain (16.9 kg/per year), and Qatar (16.5 kg/per year). However, the Middle East aquaculture still needs to grow by nearly 20% to match the regional seafood demand which is average 12.55 kg per capita.

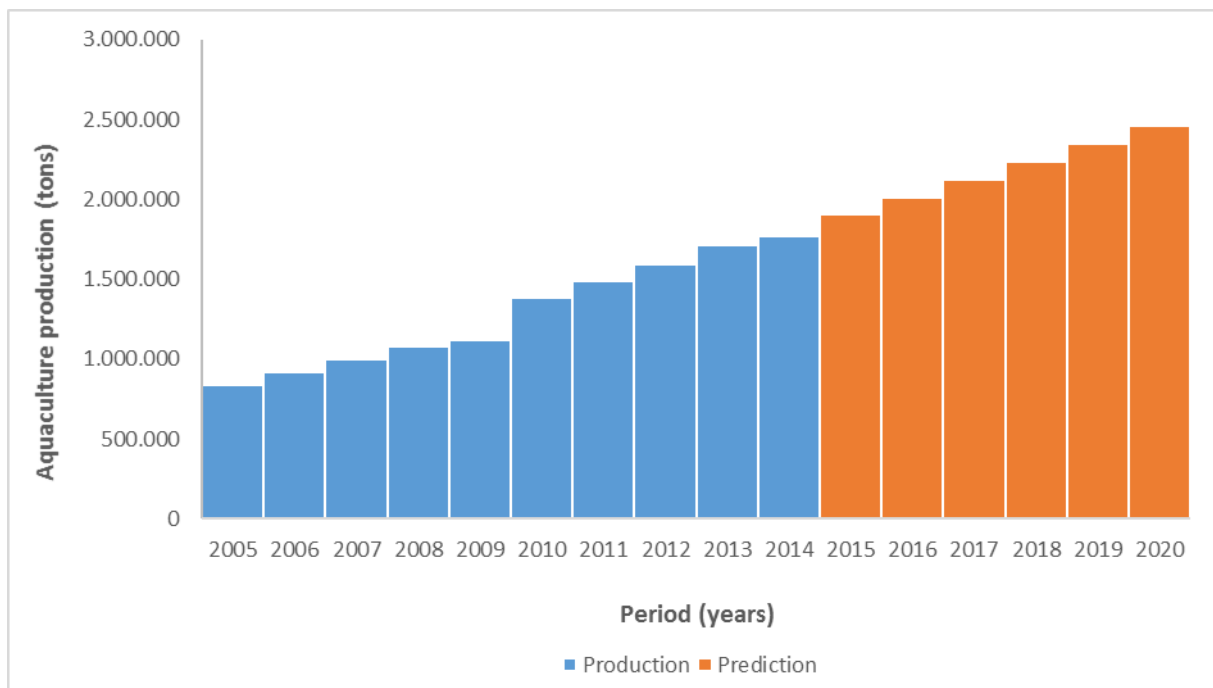
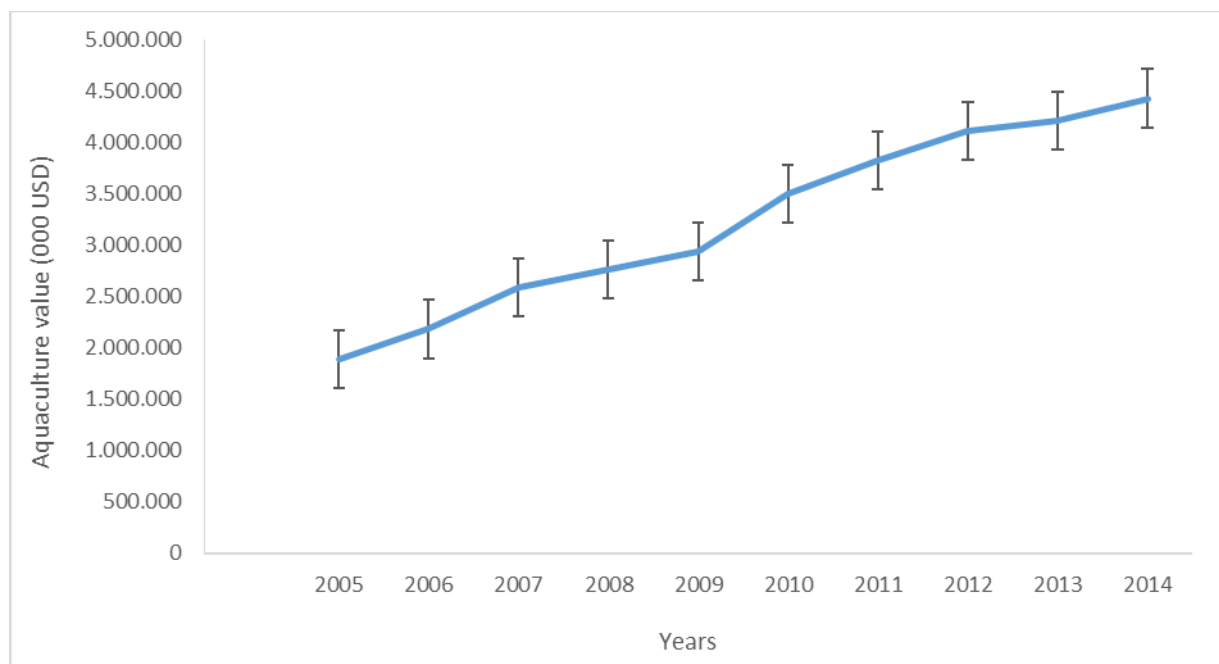


Figure 1. Aquaculture production and prediction in the Middle East countries between 2005 and 2020 (FAO, 2015).

Table 1. Aquaculture production and share of the Middle East countries in production between 2005-2014 (FAO, 2015)

Countries	2005-2014 total aquaculture production (tons)	Share in total aquaculture (%)
Egypt	8 328 377	64.56
Iran	2 143 365	16.61
Turkey	1 739 760	13.49
Israel	208 626	1.62
Iraq	188 931	1.46
Saudi Arabia	185 486	1.44
Syria	72 462	0.56
Lebanon	10 644	0.08
Jordan	5 931	0.05
United Arab Emirates	5 918	0.05
Kuwait	3 344	0.03
Oman	1 754	0.01
Yemen	1 680	0.01
Palestine	1 506	0.01
Qatar	375	0.01
Bahrain	24	0.01

**Figure 2.** Total aquaculture value in the Middle East between 2005-2014 (FAO, 2015)

In terms of preferences, Middle Eastern consumers take into consideration whether a product is farm raised or wild caught. Many consumers prefer wild fish due to the perceptions that they are more natural, fresher, tastier and healthier than the farmed ones. But the fact is that the wild stocks have reached their limits and no more increase is expected in the amount of Middle East fisheries in the future. While the governments are investing in aquaculture, negative perceptions are the main limiting factors on the consumption of farmed fish in the region.

Sustainability Perceptions of the Consumers

Consumers attention to sustainability is an emerging trend in the region. This trend offers significant advantages to local authorities in promoting safe and sustainable aquaculture products. Nielsen (2014) reported that 63% of consumers are willing to pay more for products and services from companies that are committed to positive social and environmental impact covering sustainable production in the Middle East region. The government of UAE launched a campaign entitled "Choose Wisely" which is aiming to educate consumers on the sustainability of fish. The campaign provides consumers with a color coded system to provide information about which species are over exploited, considered sustainable or good alternatives (WWF, 2011). Such encouraging campaigns and efforts to inform consumers on sustainability of seafood are also being carried out in Turkey, Iran, Saudi Arabia, Kuwait and Egypt. The growing consumer interest in sustainability would be a good promotion tool for aquaculture (Parreño-Marchante, Alvarez-Melcon, Trebar & Filippin, 2014).

Sustainable aquaculture systems are being accepted as environmental friendly, profitable, productive and social. The principles of sustainable aquaculture cover legal production, respect to environment, sustainability of species, technological improvement, research and development, environmental ethics, labelling and traceability.

Traceability as an Indicator for Sustainable Seafood

Sustainability is not a measurable entity itself and its analysis relies on indirect criteria or indicators. Traceability is an important indicator and tool that sustains consumer confidence on aquaculture production. In 2002, European Commis-

sion introduced food and ingredient traceability systems through General Food Law to ensure consumer confidence in European Union (van Rijswijk, Frewer, Menozzi & Faioli, 2008). The regulation (EC) N° 178/2002 defines traceability as: "The ability to trace and follow a food, feed, food-producing animal or substance intended to be, or expected to be incorporated into a food or feed, through all stages of production, processing and distribution". The aim of the commission was to promote and use traceability as a tool for proving food security inside the European Union. This regulation was also willing to force consumers to ask for traceability in food supply chains for imported products. The main advantage of traceability is giving confidence to suppliers and consumers that what they are buying is legal, safe and fairly traded. It also helps to motivate consumers to buy more domestic products and support domestic production (Fisher, 2015).

Food safety and ecological problems are affecting consumers' confidence and arousing suspicion about the origin and the condition of food all over the world (Moretti, Turchini, Bellagamba & Caprino, 2003; Thompson, Sylvia & Morrissey, 2005). Aquaculture is a complicated production method based on many scientific and biological procedures. The high-level production systems include many ingredients and ecological factors which are not easy to understand by the most consumers. Moreover, not only ingredients but also environment problems like pollution, pesticide and antibiotics residues affect the quality and safety of aquaculture products (Hsu, Chen & Wang, 2008). Today, consumers tend to find out more information about the ingredients, the origins, processing procedures and transportation of aquaculture products.

Traceability in Aquaculture

Traceability in aquaculture allows consumer to get all high-level information from seed to plate (Figure 3). Those information includes feed types and ingredients, origin of the broodstock, hatchery procedures, harvest date, storage conditions, processing, transport and trade which are also present in traceability database of the farms. Labels are extrinsic cues that can assist consumers inferring product quality and forming quality expectations, which in turn influence a whole range of attitudes and behaviors related to food purchasing, meal preparation, satisfaction and future purchase decisions (Brunsø, Fjord & Grunert, 2002; Verbeke & Ward, 2006).

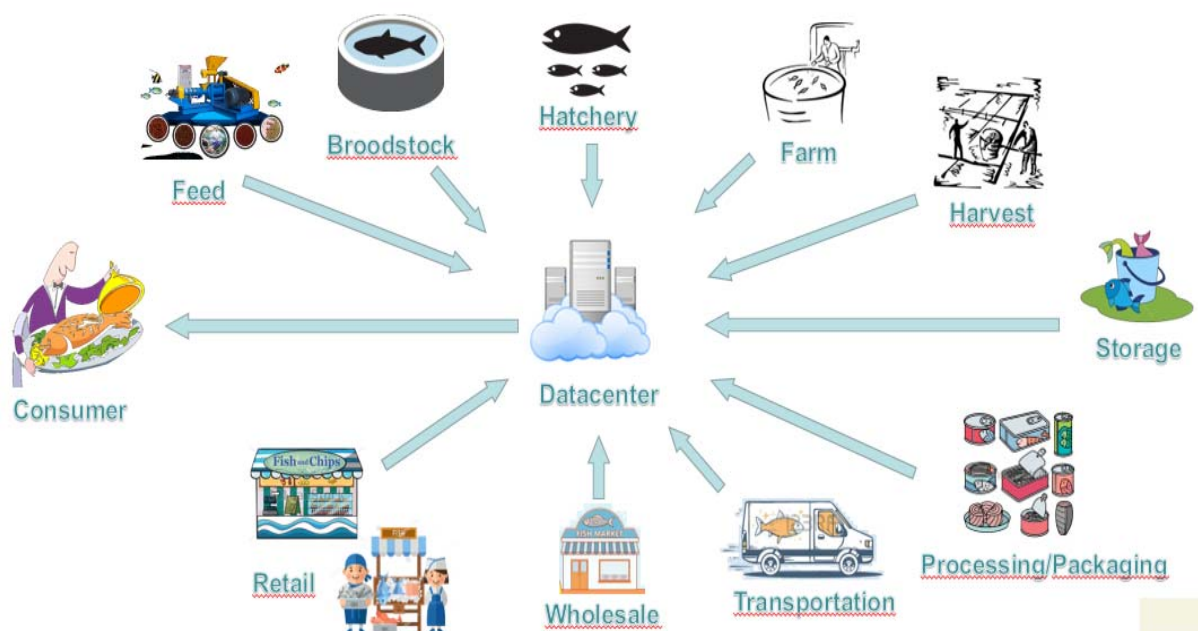


Figure 3. Information chain from seed to plate in aquaculture

The information collected on the database of aquaculture farms like commercial and scientific names of produced species, production methods, geographic location, harvest date, type (fresh, frozen or defrost product), best before date, nutritional values and other additional information are presented to the consumers through the product labels. QR and barcodes on the labels allow supply chain professionals to instantly know everything about the products they buy and sell. Also, these barcodes are essential tools for tracing products through electronic information systems.

Aquaculture Traceability in Turkey

There's an increasing trend on the market for traceability of capture and aquaculture products. Many countries of the world have started to implement traceability systems and compose new regulations on fisheries and aquaculture to sustain consumer confidence on seafood security. Turkey is one of these countries who's developing computer-based monitoring systems for fisheries and aquaculture production.

Turkey has started to implement monitoring applications for fisheries and aquaculture in order to ensure the traceability of fishery products from the source to the consumer. In this context electronic information systems and its infrastructure are being improved since 2007. A new regulation

for recording, control, audit and ensuring traceability of aquaculture and fisheries products was also accepted. The efforts on determining quality criteria of fisheries and aquaculture products, control and supervision of traceability and consumer information has gained legal support by the new "Seafood Marketing Standards and Consumer Information Regulation".

The "Aquaculture Register System", developed for monitoring aquaculture operations and production is managed by Ministry of Agriculture and Livestock, General Directorate of Fisheries and Aquaculture and production information of all aquaculture enterprises are being kept on the system. These enterprises are obliged to enroll in the Aquaculture Registry System to get insurance, credit support, best agriculture production certificate and other legal procedures.

The best advantages of Aquaculture Registry System are:

- Traceability of cultured products back to broodstock and eggs,
- Keeping records of all life stages of reared fish like biomass, production unit, production amount and species,
- Movement traceability of aquaculture species including all life stages,

- Keeping records of all treated fish according to national legislations,
- Traceability of harvested fish until processing,
- Detection of production sites with all geographic coordinates

In this context, the system fills an important gap for monitoring of aquaculture operations. Currently, all aquaculture farms have not yet completed their registration process but input of information into the system is intensively in progress.

Turkish aquaculture sector fully integrated into the latest processes and quality management systems as BRC, IFS, Global GAP and HACCP certification process and all production process from broodstock to processed product are being entirely monitored by inner traceability infrastructure of the enterprises. These certificates determine the reliability level of the companies' products in the commercial sense. But highly complex information and terms included in such certificates are not informative for the regular consumer level. Moreover, certification procedures only monitor products until the processing and packaging stage whereas consumers need a fully tracing process from egg to plate which is common in all over the world.

There are intensive studies supported by the Seafood Marketing Standards and Consumer Information Regulations on labelling and barcoding which are an important part of traceability in aquaculture. In addition to labelling, an infrastructure that allows consumers to monitor whole production stages of seafood will be functional by these studies.

At this stage, many companies have started initiatives to ensure traceability of their products by consumers in order to increase their effectiveness on the market. Consumers can get detailed information about the production site, production stages, feeds and packaging date by entering the serial number on the label of the fish into the web page of the farms. Such individual initiatives are very positive approaches to gain consumer confidence on aquaculture products. But a centralized Aquaculture Registry System covering the whole aquaculture production would be more effective on overall consumer perceptions.

Conclusion

The traceability provides confidence to suppliers and customers about purchased seafood is legal, safe and fairly traded. On a positive aspect, having improved traceability encourages and promotes the consumption of aquaculture products thereby helping the economy of aquaculture farms to improve. It helps to induce a sense of confidence in farm grown fish. Moreover, better traceability also helps facilitate national and international trade by taking the domestically produced fish to markets inside and outside the region and creating a demand for it.

Conclusion

In conclusion, there is a growing concern on sustainable fisheries and aquaculture around the world. While more consumers demanding sustainable, organic and non-genetically modified foods increasing, traceability is the only tool that can certify a product that meets these claims.

References

- Brunso, K., Fjord, T.A. & Grunert, K.G. (2002). Consumers' food choice and quality perception. *The Aarhus School of Business Publ., Aarhus, Denmark.*
- FAO (2015). FIGIS-Time-series query on Aquaculture. Retrieved from http://www.fao.org/figis/servlet/SQServlet?file=/work/FIGIS/prod/webapps/figis/tem/hqp_867079343649441433.xml&outtype=html (accessed 10.5.2016)
- Fisher, W. (2015). Benefits of Food Traceability. *Food Safety Magazine*. Retrieved from <http://http://www.foodsafetymagazine.com/newsletter/benefits-of-food-traceability/> (accessed 4.5.2016)
- GLOBEFISH. (2011). *Markets in the Middle East: market, trade and consumption*. Retrieved from <http://www.fao.org/in-action/globefish/fishery-information/resource-detail/en/c/338542/> (accessed 10.5.2016)
- Hsu, Y.-C., Chen, A.-P., & Wang, C.-H. (2008). *A RFID-enabled traceability system for the supply chain of live fish*. Paper presented at the 2008 IEEE International Conference on Automation and Logistics.
- Moretti, V.M., Turchini, G.M., Bellagamba, F. & Caprino, F. (2003). Traceability Issues in

- Fishery and Aquaculture Products. *Veterinary Research Communications*, 27(1), 497-505.
doi:10.1023/B:VERC.0000014207.01900.5c
- Nielsen, N. (2014). *Doing well by doing good*. Retrieved from <http://www.nielsen.com/us/en/insights/reports/2014/doing-well-by-doing-good.html> (accessed 4.5.2016)
- Parreño-Marchante, A., Alvarez-Melcon, A., Trebar, M. & Filippin, P. (2014). Advanced traceability system in aquaculture supply chain. *Journal of Food Engineering*, 122, 99-109.
- Thompson, M., Sylvia, G. & Morrissey, M. (2005). Seafood traceability in the United States: Current trends, system design, and potential applications. *Comprehensive Reviews in Food Science and Food Safety*, 4(1), 1-7.
- van Rijswijk, W., Frewer, L.J., Menozzi, D. & Faioli, G. (2008). Consumer perceptions of traceability: A cross-national comparison of the associated benefits. *Food quality and Preference*, 19(5), 452-464.
- Verbeke, W. & Ward, R. W. (2006). Consumer interest in information cues denoting quality, traceability and origin: An application of ordered probit models to beef labels. *Food quality and Preference*, 17(6), 453-467.
doi: 10.1016/j.foodqual.2005.05.010
- WWF (2011). "Choose Wisely" campaign in Starwood Abu Dhabi restaurants. Retrieved from <http://www.wwf.org/bhutan.org.bt/?198771/Choose-Wisely-campaign-in-Starwood-Abu-Dhabi-restaurants> (accessed 12.5.2016)