

THE HARMONIZATION OF FOOD SAFETY AND TRACEABILITY IN FARMED FISH PRODUCTION_AN EXAMPLE OF TAIWAN

Shin-Chang Chen, Department of Aquaculture, National Taiwan Ocean University,

frank@obic.com.tw

Fan-Hua Nan (corresponding author), Department of Aquaculture, National Taiwan Ocean University., fhnan@mail.ntou.edu.tw

Ching-Ta Chuang, Institute of Marine Affairs and Resources Management, National Taiwan Ocean University, ctchuang@mail.ntou.edu.tw

ABSTRACT

There is now an increasing demand among consumers for high-quality and safe aquaculture products. However, in becoming an important contributor to the markets for seafood, the aquaculture industry has become increasingly subject to rigid food safety, traceability, and processing requirements (e.g. Hazard Analysis and Critical Control Point (HACCP), Good Aquaculture Practice (GAP) etc.). In these recent trends, small-scale fish farmers, especially in developing countries and countries in transition, have encountered difficulties in meeting such requirements. On the other hand, although traceability is one of the latest issue in food trade market, there are still different requirements (and definition) in different country and organization. This paper conducts questionnaire surveys and in-depth interviews, and examines the traceability system and supply chain system of the farmed fish industry. Otherwise, In order to reach the spirit of "traceability ", we also take Taiwan seafood industry as an example to show that how traceability and food safety conform the production responsibility, the independent management, food security. Empirical results show that with sustainability, traceability and food safety as the core components, there is a critical need for countries within the region (e.g. Asia) to forge international collaboration, harmonization and transborder policies to develop standards and mechanisms for HACCP, GAP/GHP/GMP, and/or traceability implementation. These standards must not only be accessible to large commercial/industrial production, but must also be beneficial to small-scale fish farmers. Finally, this research provides recommendations for integrating the producing and marketing channels, sustainable development and market strategy for the aquaculture industry are also discussed.

Keywords: traceability, food safety, seafood safety, Good Aquaculture Practice.

INTRODUCTION

There is now an increasing demand among consumers for high-quality and safe aquaculture products. However, in becoming an important contributor to the markets for seafood, the aquaculture industry has become increasingly subject to rigid food safety, traceability, and processing requirements (e.g. Hazard Analysis and Critical Control Point (HACCP), Good Aquaculture Practice (GAP) etc.). Within this decade, food traceability system has developed to improve the security and safety of seafood supply chain. Similar to some other countries, food safety problems occasionally happen in Taiwan such as residual presence of antibiotics in eel and tilapia. Since 2003, Taiwan government has started to promote traceability system in the hope to effectively increase the quality and safety of agricultural and aquaculture products. Other countries, including the US, European Union, Japan, Korea and etc, have been pay more attention on food safety monitoring and risk assessment of food supply chain. Within these recent trends, small-scale fish farmers, especially in developing countries and countries in transition, have encountered difficulties in meeting such requirements. Therefore, empowering them through technological innovations, guidelines and standards on food safety/traceability, and policy and support services has become necessary to enable them to continue to participate in the network of fisheries and aquaculture production, marketing and trade.

FOOD SAFETY CONTROL POINTS OF FARMED FISH INDUSTRY

In general, the performance of seafood marketing system is predominantly decided by many internal and external factors. Internal factors which are emanative from or dependent on the nature of something, such as culture, diet habits, population, politics, public attitude and opinions, commercial-minded heritage, government policy, social structure and market structure. External factors which not directly relevant to the marketing system. Such as producer’s organizations (e.g. fishermen’s associations, farmers’ associations, marketing cooperatives), marketing infrastructure (e.g. assembling, grading, packing, strating, processing, transporting, selling, financing, information, risk-bearing, etc.), wholesale markets (help for transaction prices control), marketing technology (e.g. computerized auction bid system, utilization of automatic machines and market information reporting system for seafood marketing), legislation, government organization, administration and policy. Typical marketing channel and safety control, GAP and cold-chain system, for the regular seafood products can be show in Figure 1.

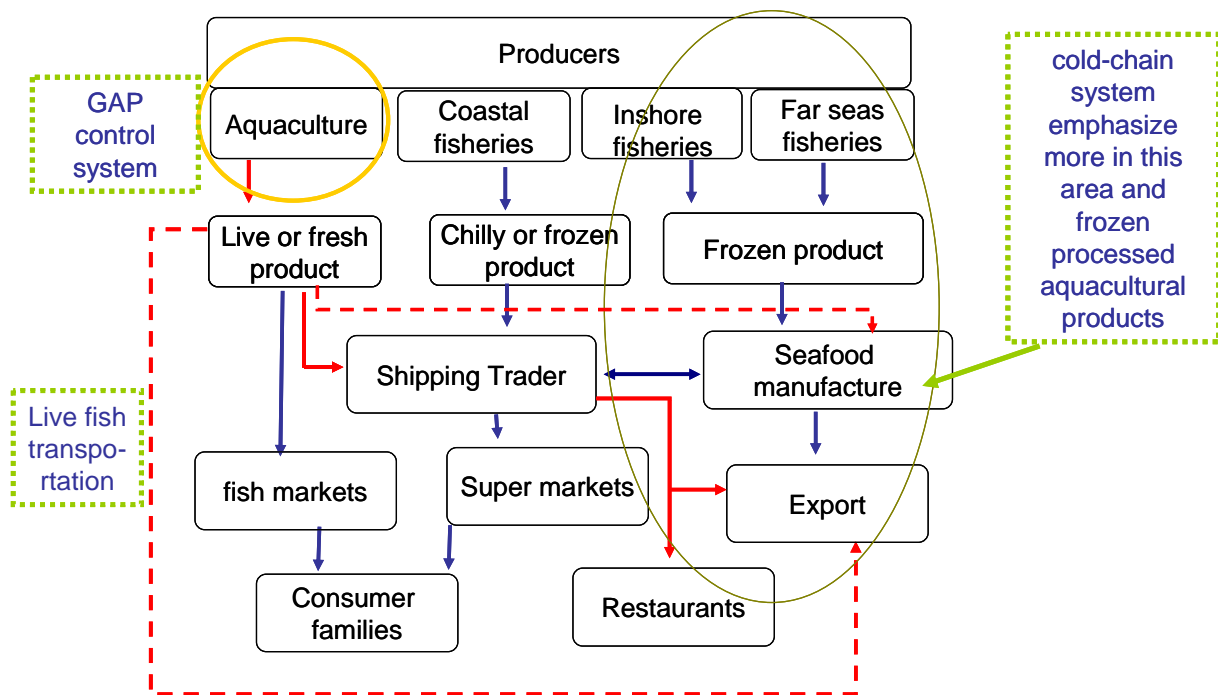


Figure 1. General marketing channel of seafood industry

Source: Nan, F. H and S. C. Chen, 2006.

In farm fish sector, the establishment of traceability system and production resume information for aquaculture products includes feed production, breeding production, testing analysis, transport/wholesale, processing/pack, and sale/consume. If there is something wrong with a product, this traceable system would help us find problems that happened in which chain it occurred. In sale/consume part, we may check when the products are sold and who sells it and via what method. If there is no problem in this part, and then we will trace it to the process/pack part. We would check who process/packs and how they do so. We would also examine the product types and whom they deliver the products to. If there is nothing wrong in this aspect, we may inspect the logistic place and method and who transport the problematic production such a way, seafood safety can be increased by reducing food accidents.

However, what information is required by aquaculture producers in implementing safe and reliable production? The basic answer to this question is for each country to develop standards relevant to aquaculture (water, bacteria, residue, feed and other product standards etc.) based on promulgated laws and regulations, and the promotion of an efficient implementation and information/extension system among fish farmers. In order to reach the spirit of "From Farm to Table ", the seafood traceability and supply chain inducts the spirit of the HACCP and GAP management. The goal conform the production responsibility, the independent management, food security. The check point for seafood industry's traceability and Supply Chain might be including following stages:

- (1) Feed production-Culture production: Who produce and supply feed?
- (2) Culture production-Testing Analysis: Who supply larvae? What kind of feed used? Process record-Medicine management, Dispatch to whom?
- (3) Inspection Analysis: When, where, and how sampling? The result of analysis?
- (4) Logistic: Who transport? The logistic place and way?
- (5) Processing/Pack: Who and How process/pack? Product Type? Delivery to whom?
- (6) Sale/consume stage: Who sales? What kind of way? When to sale? (see Figure 2)

Otherwise, the process improvement must emphasize on GAP/GMP/HACCP and traceability in all sectors of the food supply chain (hatchery and farm; feed, drug, and chemicals; harvesting and marketing; processing plants; import and export control). Also, GAP certification procedures must be developed, to include examination certification system and an electronic traceability in the supply chain management system. Improved traceability of fishery product satisfies the demand for information transparency in the supply chain management.

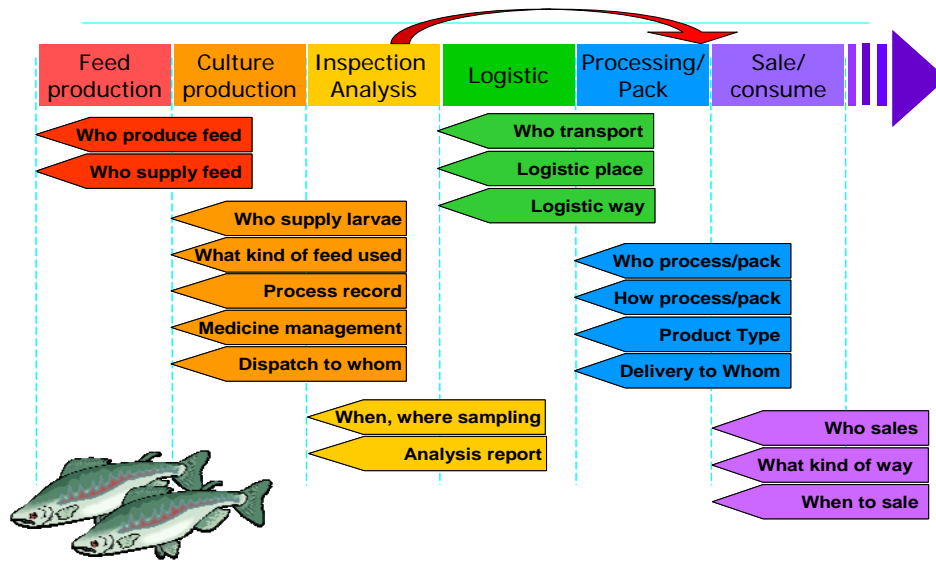


Figure 2. The tracing point in seafood Supply Chain

Source: Nan, F. H and S. C. Chen, 2005.

THE DEFINITION OF TRACEABILITY

Transparency of the entire seafood chain is the principle of promoting food traceability. It is expected to provide buyers and consumers the related information about feed production, culture production, processing, inspection, and distribution. Although traceability is one of the latest issue in food trade market, there're still different requirements (and definition) in different country and organization.

In EU, traceability is defined as “The ability to trace and follow a food, feed, food-producing animal or substance intend to be, or expected to be incorporate into a food or feed, through all stages of production, processing and distribution.” In Ireland, traceability is defined as “Food Business Organizations must be able to identify from whom and to whom a product has been supplied and have systems and procedures in place that allow this information to be made available to the Food Safety Authority of official agency upon their request. ” In brief, Ireland’s requirement relies in the “one step back – one step forward” approach. In Global GAP, they define traceability as “The ability to retrace the history, use or location of a product (that is the origin of materials and parts, the history of processes applied to the product, or the distribution and placement of the product after delivery) by the means of recorded identification.” However, in Eurofish’s definition, ‘Traceability’ is the ability to trace, follow and identify UNIQUELY a product unit or batch through all stages of production, processing and distribution. In ISO organization, the requirement of traceability is “The ability to trace the history, application or location of that which is under consideration... when considering products this can relate to the origin of materials and parts, and the processing history.”

In Asian countries, Japan defined traceability as “”A system of releasing information or sufficient information on the rearing history of products.” Otherwise, producers should record, keep and release the production information of their products and interested consumers are able to access the information. Finally, in Taiwan, traceability is “The complete records, which are including the production, the processing, the sub package, the shipping and sale, could be tracing back and publicly of agricultural product.” In Japan, the requirement of traceability is “A system of releasing information or sufficient information on the rearing history of products”. And the producers should record, keep and release the production information of their products and interested consumers are able to access the information. (Table 1)

Table 1. The definition of traceability

Country/Organization	Definition/Requirements of Traceability
EU (EC 178/2002)	The ability to trace and follow a food, feed, food-producing animal or substance intend to be, or expected to be incorporate into a food or feed, through all stages of production, processing and distribution.
Ireland (Guidance Note No.10 Produce Recall and Traceability, BIM*)	Food Business Organizations must be able to identify from whom and to whom a product has been supplied and have systems and procedures in place that allow this information to be made available to the Food Safety Authority of official agency upon their request. The requirement relies in the “one step back – one step forward” approach.
Global GAP (EurepGAP)	The ability to retrace the history, use or location of a product (that is the origin of materials and parts, the history of processes applied to the product, or the distribution and placement of the product after delivery) by the means of recorded identification".
Eurofish	‘Traceability’ is the ability to trace, follow and identify UNIQUELY a product unit or batch through all stages of production, processing and distribution.
ISO	The ability to trace the history, application or location of that which is under consideration... when considering products this can relate to the origin of materials and parts, and the processing history.
Japan (JAS)	A system of releasing information or sufficient information on the rearing history of products. Producers should record, keep and release the production information of their products and interested consumers are able to access the information.
Taiwan (Guideline for the Authorized Validation of Agricultural Product Traceability, Council of agriculture, Executive Yuan)	The complete records, which are including the production, the processing, the sub package, the shipping and sale, could be tracing back and publicly of agricultural product.

*BIM is the Irish State agency with responsibility for developing the Irish Sea Fishing and Aquaculture industries.

TRACEABILITY PROGRESS AND IT SYSTEM IN TAIWAN

In Taiwan, food traceability is established on Good Manufacturing Practice of Foods (GMP), Hazard Analysis Critical Control Point (HACCP) and so on. It systematically elevates the reliability of the seafood supply chain, which enhances not only seafood sanitation but also the safety. Therefore, on one hand, food traceability system can ensure food safety and public health. In 2004, Taiwan’s Council of agriculture (COA) cultivation and operation of Good Aquaculture Practice (GAP) were conducted in the field. Information systems were developed for farmers to input the information about their breeding information and operation procedures into computers to help manage their fish farm production. Standard GAP operational procedures were set up for fishermen to key in their aquafarm into computers for making barcode labels on their products.

In 2005 and 2006, Taiwan COA further expanded the scale of the traceability system by incorporating the production of fourteen species of fish, including grouper, tilapia, eel, milkfish, white shrimp, cobia, clams, and etc. Besides seafood, COA also established the Taiwan Good Agricultural Practice (TGAP) for a total of 80 products was then drawn up, and pilot farms were selected for these products allowing the evaluation and revision of TGAP operational procedures to meet the requirements of the traceability system. Furthermore, COA also established an integrated database, “Taiwan Agriculture and Food Traceability System” (TAFT). This database was established mainly based on or by referring to the latest international standard ISO-9001:2000, JAS, HACCP and GlobalGAP with content including (1) the flow chart about operational procedures of production and distribution, (2) a list of risk management about production and distribution, (3) a check list of production and distribution work, (4) a recording notebook for production and distribution, (5) a calendar of cultivation management, (6) the operational standard of fertilization, and (7) a table for pest and blight prevention. The recording notebook for production and distribution is compulsory for farmers to fill in those including personal basic information, tables of examination and analyses, planting and breeding area graphs, the recording tables for material procurement, and the recording of cultivation, fertilization, pests and blight prevention, harvesting and post-harvesting processing and distribution, etc.(Fen-Lan Chen and etc., 2007).

In January 2007, “Agricultural Production and Certification Act” was enacted by the Legislation Yuan, Taiwan R.O.C. and announced for execution by the President. This Act has a great impact to the future agricultural production in Taiwan which leads Taiwan agriculture and aquaculture into the era of “certification” and “traceability” as well as provides a legal basis for the promotion of traceability system in Taiwan. The aspects about traceability stated in this Act are as the follows:

1. Traceability was officially taken as a legal term, and traceability products were given a legal status.
2. The Act clearly stipulates that the government can enforce the execution of traceability system by announcement regarding certain agricultural products, and also applies to the imported agricultural products.
3. This Act stipulates the business holders of agricultural products who shall implement the traceability system to be responsible for providing and maintaining the traceability information.
4. This Act incorporates the traceability system into the certification and accreditation of agricultural products, clearly stipulating that traceability shall undergo certification.
5. Related punishment is stipulated in this Act.

The COA set up a consistent tracing code encoding standard, and structured the nation-wide traceability database, TAFT, for consumers to search for the information of agricultural/aquaculture products. In 2007, Taiwan COA further integrated the MIS of different fields such as fishery, crops, livestock, and poultry. All traceability information can be searched and displayed in TAFT, which collects the data of all agricultural/aquaculture products for consumers’ search and trace as well as for supermarkets to import related information. TAFT is also used by the certification and accreditation institutions for certification approval, product certification approval, and expiry date management. Under these sub-databases, there are various different MIS systems for different production units to set up and upload their product information into the database of individual field. To allow the information exchange within this large IT system, open XML standard was employed. So as long as following this standard, traceability data can be successfully uploaded into TAFT (Figures 3, 4 and 5).

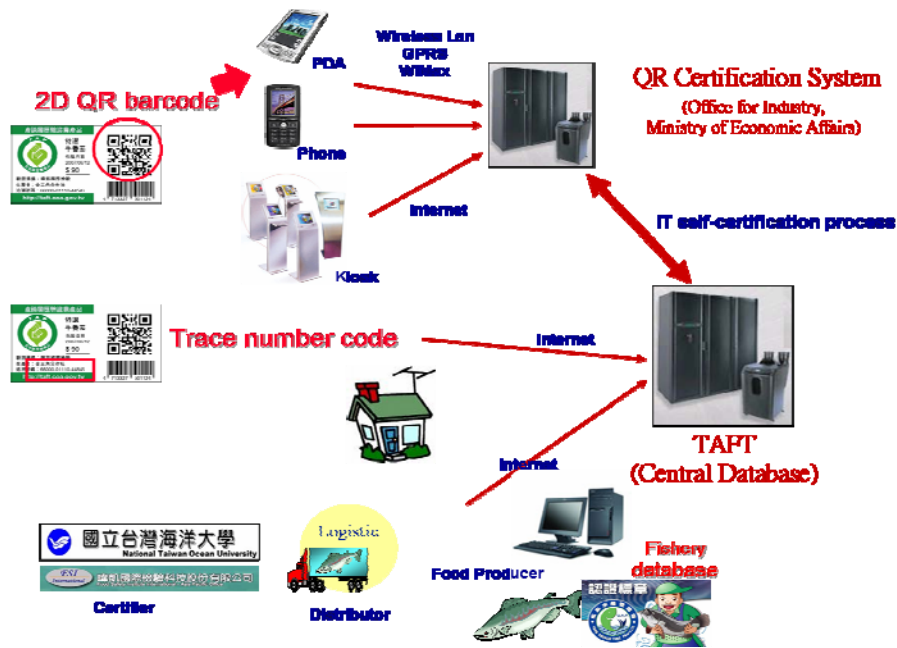


Figure 3. The traceability system of Taiwan

Source: Fen-Lan Chen and etc., 2007.



Figure 4. The traceability IT system of Taiwan

Source: Fen-Lan Chen and etc., 2007.

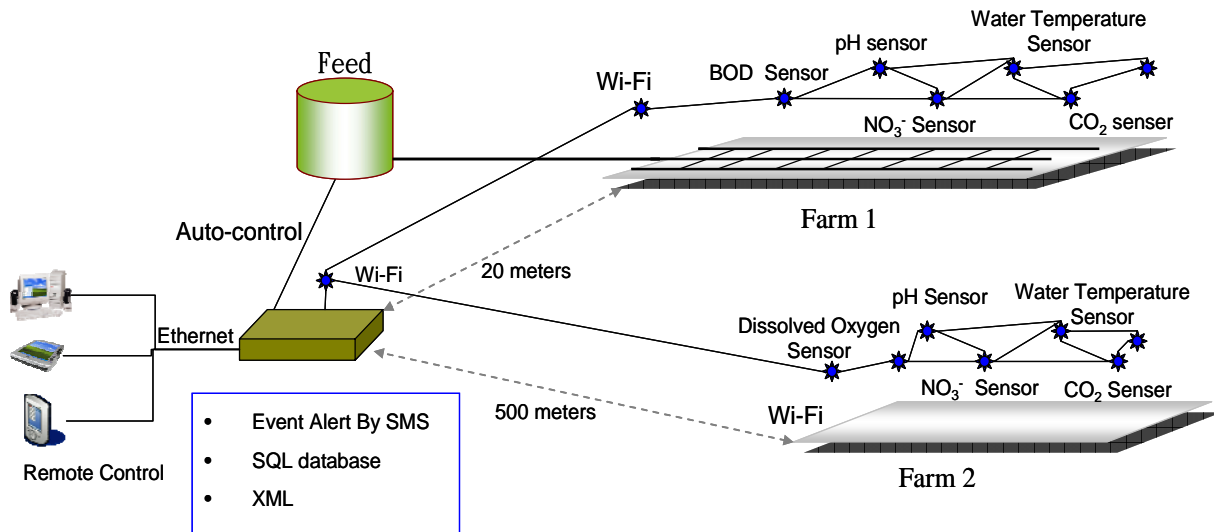


Figure 5. The automatic record IT system of Taiwan

Source: Ocean Business International Corp. and HANAQUA TECH Inc., Taiwan, 2008.

It is convenient for users to print out labels from the traceability information system. (Fen-Lan Chen and etc., 2007) After aqua farmers have harvested their fish, they can input the command of harvest into a computer. They can further enter the post-harvesting treatments information for making the label print-out. This traceability system also automatically gives a new tracing code to the labels. After confirming that the information is correctly uploaded to TAFT through internet, TAFT converts the information into WML and HTM files for browsing. The information will be presented to the Taiwan QR certification system for further confirmation. A 255 bytes encrypted password will be given back to users who should decode the encrypted password on the terminal of client before they can print out the QR symbol. This entire process is named as IT self-certification process, which ensures the completeness and accuracy of information for future tracing and searching.

CONCLUSION

Traceability is an integrating work process from farms to folk. In Taiwan, we have established a certification system and TGAP standard, and IT systems to integrate the entire procedures from production to consumer. This traceability work has been started recently in Taiwan. With sustainability, traceability and food safety as the core components, there is a critical need for countries within the region (e.g. Asia) to forge international collaboration, harmonization and transborder policies to develop standards and mechanisms for HACCP, GAP/GHP/GMP, and/or traceability implementation. These standards must not only be accessible to large commercial/industrial production, but must also be beneficial to small-scale fish farmers.

Finally, some countries are more advanced in terms of implementing food safety and traceability protocols, while others are still in the level of consolidating a mix of best practices in aquaculture production aimed at sustainability of the aquaculture environment, and preventing/minimizing contamination and chemical hazards. Hence, countries need to harmonize food safety/traceability procedures suitable to the region’s aquaculture conditions, and considering the differences in the level of socio-economic and technological development among countries.

REFERENCES

- Chuang, C. T., 2003, The Application of Supply Chain Management in Aquaculture, Aquaculture, Taiwan, Vol. 40, p 11-13.
- Chen, S. C., 2006, The report of studying of traceability system and hygienic management mechanism in seafood product in EU, Council of agriculture, Executive Yuan, Taiwan, pp. 28.
- Derrick, S. and M. Dillon, 2004, A Guide to Traceability within the Fish Industry, Eurofish International Organization, pp. 78.
- Dillon M., 2007. Traceability in Food. Blackwell Publishers.
- EAN international. 2005. Fresh produce traceability guidelines.
- European Communities. 2002. Regulation (EC) No. 178/2002 of the European Parliament and of the council of 28 January 2002.
- Fen-Lan Chen, F. Sheu, S.H. Hu, and F.H. Nan, 2006, An Outlook on the Traceability Progress, Legal Environment and its Supporting Information Technology System in Taiwan, seminar of Innovative Technologies and Management Schemes for Eco-Friendly Fish Farm Management and Production of Safe Aquaculture Foods, pp. 9.
- FDA. 2004. FDA Issues Final Rule on the Establishment and Maintenance of Records to Enhance the Security of the U.S. Food Supply Under the Bioterrorism Act. FDA News December 6, 2004 <http://www.fda.gov/bbs/topics/news/2004/NEW01143.html>
- Food Safety Department, World Health Organization. 2002. Terrorist Threats to Food - Guidelines for Establishing and Strengthening Prevention and Response Systems, 2002.
- Food Safety Authority of Ireland, 2006, New Food Law, Are You Ready?, pp. 25.
- Jung, S. M., 2004, An Analysis of Willingness to Pay for HACCP Certification of Fisheries Products by Consumers from Taipei County and Taipei City, Institute of Applied Economics, National Taiwan Ocean University, Taiwan, pp. 101.
- Nan, F. H and S. C. Chen, 2005, The Establishment of Good Aquaculture Practice, Development and innovation of white shrimp aquaculture, Fishery Research Institute, Keelung, Taiwan, Vol. 6, p129-145.
- Shen, T. K., 2003, Analysis of Farmers' Opinion and Planning for Groupers Supply Chain System in Taiwan, department of Applied Economics, National Taiwan Ocean University, Taiwan, pp. 153.
- Smith I and Furness A. 2006. Improving traceability in food processing and distribution. CRC Press.
<http://ec.europa.eu/>
http://eur-lex.europa.eu/en/repert/index_04.htm
<http://www.iso.org/>
<http://www.eurepgap.org/>