

Progress on Processing and Utilization of Aquatic Products in China

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The development of fisheries in China has made constant progress and the output of fisheries products reached 52.5×10^6 tons in 2006. Changes in aquatic products processing and utilization have gradually developed along with the development of modern science and technology, improvement of distribution and marketing systems, and globalization of the world's economy. Attention to the quality and safety of aquatic products has been paid at all levels, and maintaining freshness and constructing processing systems have been enhanced gradually in China.

The general trend of aquatic product processing and utilization in China has been to select and breed suitable species as raw material for food processing, to process and create new products on an industrial scale, to develop safety/healthy/functional/convenience/recreational foods for the domestic market, to apply novel technologies from research to develop high quality/standard/suitable products for the international market, etc. In order to satisfy consumers' requirements and meet the needs for industrial development, we had better realize integral management among farming, processing and selling of aquatic products, specialize the processing species, make production based on raw materials, standardize the quality control system and scientific management on production, advance the processing technology, with large-scale, close network, utilizing more information, and marketing guidance, etc.

KEYWORDS aquatic products; processing; utilization; quality and safety

1. Current Situation and Review of Fisheries in China

Fishery production in China keeps increasing steadily. In 2006, the yield of fishery products reached to 52.5×10^6 tons, and a total output value of 820×10^9 RMB, while

the net income of a fisherman reached to 6,100 RMB. The total quantity of import and export was 6.337×10^6 tons, valued at 13.66×10^9 USD in 2006. Of which, the quantity of exports was 3.015×10^6 tons, and it amounted to 9.36×10^9 USD, increasing by 17.4 and 18.7% compared with the previous year, respectively, the import quantity

was 3.322×10^6 tons, and the amount of imports was 4.3×10^9 USD, decreasing by 9.2 and 4.4% from the previous year, respectively. Trade surplus was 5.06×10^9 USD, increasing by 1.63×10^9 USD compared with the previous year. The amount of exports of fishery products accounts for 30.2% of the total exports of agricultural products, and continues in first place of the large amount of agricultural products' export. From the information presented at the Fishery Specialized Meeting of the National Agriculture Workshop, according to the central government's requirement of constructing a resource-saving and environment-friendly society, we implement negative growth in marine fishing output, and vigorously explore changes in the methods of cultivation, so the quality of aquaculture and fishery development has been improved to some extent. The practice proved that only by implementing scientific developments, insisting on changing the main direction of the growth of fisheries, and unceasingly impelling the fishermen to transform from a quantity to an ecological quality style of fishing, can implement the continuous and healthy development of fisheries.

2. Current Situation of Aquatic Product Processing and Utilization in China

The processing and utilization of aquatic products are the extension of commercial fishing and aquaculture, and it is a bridge which links aquaculture and the fishery market of high value-added products. As the living standard of the Chinese people has significantly improved, and the consumption level enhances unceasingly with changes in the dietary preferences, there is a high demand for quality foods, especially high quality aquatic products. The demands for aquatic products present new characteristics of diversification, convenience, nutrition, safety, and individuality.

The demanded quantity of fishery products for the domestic and international market rises unceasingly and the export of high quality fishery products, increases to some extent compared to before. Besides live/fresh fishery products, as well as frozen, and/or dried, salted and/or smoked products are still the main processed fishery products in the domestic market, and the quantity has clearly increased. Because of the relatively lower processing cost of these three kinds of products, and with the improvement of transportation conditions and the establishment of the food cold-chain, these kinds of products will still dominate the consumer market for a long time in the future. The main products are entire frozen whole fish, frozen fish fillet, fresh fish fillet, salted and/or smoked products, canned foods, surimi products, roasted fish fillet, and so on. For the international export trade of aquatic products, besides the processed materials from buyers and feeding material in China, the processed goods for export include roast eel, roast laver, squid filament, tilapia fillet, channel catfish fillet, shrimp, naked body of squid, octopus, crayfish, canned mud fish food, crab meat, etc. These products are mainly exported to Japan, the USA, Korea and the EU, and the product-exporting market is unitary in which the roast eel is mainly supplied to Japan, tilapia fillet, channel catfish fillet and crayfish are mainly supplied to the USA, and roast laver is mainly supplied to the USA and Korea. In addition, the processing of value-added fishery products has also been enhanced to a certain degree, but in China about a 30% processing rate of fishery products was still the average level in the world, while the processing rate of aquatic products has reached 50–70% in some developed countries.

Fishery competent departments have paid more attention to the processing and utilization industry of aquatic products, and the regional distribution is clear in China. Important bases for processing aquatic

products have already been established in coastal provinces and cities, such as in Liaoning Province (Dalian), Shandong Province (Qingdao, Yantai, Weihai), Jiangsu Province (Yancheng, Nantong), Zhejiang Province (Zhoushan, Ningbo, Wenzhou), Fujian Province (Xiamen, Fuzhou, Dongshan), Guangdong Province (Zhanjiang, Shantou, Chaozhou), Guangxi Province (Beihai), and so on. But interior provinces, such as Hubei, Anhui, Jiangxi, have also gradually established their status as important areas for processing and utilization of freshwater fishes. In 2006, the overall situation of fishery product processing enterprises improved, and there had been a batch of highly profitable enterprises, such as the Dalian Zhangzidao Fishery Limited Company, whose deep processing project of marine products was awarded the honor of "The Demonstration Project of National Agricultural Product Deep-processing Special Project". The Dalian Zhangzidao Fishery Limited Company is the only deep-processing enterprise of marine products, among the 38 demonstration project enterprises announced at this congress. Through the exploratory development and expansion in the past few years, this company has led in the deep-processing of the marine products in the interior of our country. It has achieved international standards which provided the impetus for advancing seafood industrialization development and the industrial promotion in China.

Advances in processing technology and research into fishery product processing have also made marked progress, for example, in developing the natural food additive of phycoerythrin derived from red algae, production of alginate products derived from seaweeds, extraction of natural compounds from marine life and fishery processing offal, especially bioactive components, functional foods and medicines using aquatic products as raw material. The technology to sustain the freshness of aquatic products has

grown rapidly, especially in the food cold-chain. The preserving and processing methods of freshwater fishes have been improved unceasingly, in particular the level of sustaining the freshness of marine fish has achieved or approached international level. The aquatic product processing and the finished products present the tendency of comprehensiveness, high value, and multi-varieties, lengthening the industrial chain and enhancing the comprehensive benefit of fishery production. With the development of biochemistry, fermentation technology and applied technologies, the utilization level of low-valued fishery products and processing offal will be further enhanced.

The Ministry of Science and Technology, Ministry of Agriculture and all levels of local authorities in China have attached more importance and technology investment to the processing and utilization technologies of aquatic products. For example, the 11th Five-year Significant Project supported by the Ministry of Science and Technology has focused on the "Critical technology research and industrialization development of food processing—The development of new products made from large amounts of low-value fishery products and the industrialization demonstration of ultra-low temperature quickly frozen equipment", and "Critical technologies of food safety—Synthesis demonstration of the safety production of aquatic products". The ocean technology area in the "863" Plan directly targeting marine animals and plant resources has objectives to develop highly effective processing of marine products and new types of high value-added products, and conduct research into the quality and safety control of seafood, and develop new seafood (except functional foods) and high value-added products, for example, refer to the Year 2006 Topics "Deep-processing Technologies of the Marine Products". The implementation of these projects is expected to further promote the processing and utilization technical levels of fishery products

in China, to help some of the processing mainstay enterprises and play the role of demonstration and guidance, and to instill new vigor into the fast development of the fishery product processing industry.

As aquatic products are special food resources, they have the inherent characteristics of perishability, seasonality, regionality, and concentricity. At the same time, there are large differences from terrestrial food resources, and the facility condition of fishery product processing is generally simple and crude, the application of equipment is backward, efficiency is low, energy consumption is high, the technical craft is weak, types of products are few, the strength of the research and development of new products is not enough, the product package is simple and crude, and they are still at the stage of keeping-freshness and preservation of the traditional raw materials. So the simple processing and utilization of fishery products and small-scale manufacturing of the fishery foods results in failing to form a good management system of industrialized production. For example, edible freshwater fish that accounts for a large portion of China's fishery product are consumed mainly in live/fresh state, and this condition has obviously not been changed yet. Insufficient application of new technologies, new techniques and new equipment hinder the improvement of aquatic product processing. Faced with the ever-varying situation in consumption level and product structure, the freshness retention and preserving technologies of fishery products in distribution also requires thorough research and innovation. The history of the aquatic product processing industry was impressive and the system was self-formed, while its basic research started later, and applied and high-tech research were weaker. The mutual permeation among disciplines is still insufficient, lacking independent technological innovation. The transformation efficiency of achievement is low, lacking the technical pedestal and reserve

adapted for supporting the fast development of the aquatic product processing industry.

In general, the situation of aquatic product processing and utilization in China still has a large disparity when compared to the developed countries, and also has a large disparity when compared to domestic agricultural products processing industry, for example, cereals, oils, livestock, poultry and milk. However, the development potential of processing and utilization of aquatic products is certainly huge.

3. Developmental Tendency of Aquatic Product Processing and Utilization

Aquatic products are an important source of animal protein in human food, which plays a vital role in promoting human health. Along with the enhancement of people's living standards, aquatic products have received more and more favorable attention due to their high levels of protein and many kinds of highly unsaturated fatty acids. According to the "*World Fishery Forecast for 2020*" published by the American International Food Policy Research Society and World Fishery Center, the quantity of aquatic product consumption in the world will reach 127.8 million tons (mainly that of fish and shrimp). The demand for aquatic products in developed countries is still increasing. If bird and animal flu epidemics erupt in some nations, the quantity of consumption of aquatic product will increase; the cultivation of specialty and superior aquatic products has increased on a large scale in China. Therefore the issues of food quality and safety require a high level of attention. Because the export of aquatic products is sufficient, and the quality is unceasingly enhanced, Chinese aquatic products receive more and more favor due to their high quality and reasonable prices. Meanwhile, the average consumption quantity per capita of aquatic products is not so high, while the national

aquatic product ultimate output has reached 51.0165 million tons; annual aquatic product consumption per capita is 39.02 kilograms, in which aquatic product consumption per urban resident had reached approximately 16 kilograms (while it is 92 kilograms in Japan). But in rural areas, the consumption amounts to only one-third of that of the cities. Aquatic product average consumption per capita in China will reach to 44 kilograms at the end of "the 11th Five-Year Plan", and the average consumption per person will reach to 12 kilograms. Obviously, the broad countryside consumer market of aquatic products has not yet been truly established and developed. Along with the stable development of the economy in China, the rapid expansion of the tourism leisure industry, there has been rapid development of the export-oriented fishery and net loads of aquatic products entering supermarkets. Consequently, potential need for high quality, nutritional and safe aquatic products in the domestic market is greater. The gap in the international aquatic product consumer market will mainly rely on the supplementation of aquacultured products in the future because marine bio-resources are declining in the world. Fisheries in China have some advantages such as large-scale cultivation and production, advanced technology, rich labor force resources and strong processing ability. The growing demand in both domestic and international markets for aquatic products will contribute to China's competitive advantage and provide a broad opportunity for China's fishery development as well as it becoming a world fishery powerful nation.

According to the request from the central government for comprehensive construction of a well-off society and realization of the fishery modernization, during the period of the "11th Five-Year Plan", the fishery development must diligently complete four big basic tasks: guarantee secure supplies of aquatic products, a steady increase in income of fishermen (farmers), promote the sustain-

able development of fishery, and promote the harmonious development of society in rural areas supporting fishing. In comparison with the traditional fishery, the modern fishery follows the idea of resource conservation, environment amity and sustainable development, taking in modern science, technology and facility equipment in support, utilizing the advanced production modes and management means, forming an integrated industrial system of agriculture, industry and trade, as well as producing, processing and selling, and thus realizing a fishery industry that shapes the economy, ecology and social efficiency.

The development of an aquatic product processing industry will not only have an impact on fishery production but also promote the entire fishery economy. So it can impel transformation from a traditional to modern fishery, with extensive management to intensive farming, sole production to multiplex production; relieve bottlenecks caused by delays in the processing industry, and encourage economic growth. Aquatic product processing in one place will not only lead to the formation of multi-links among industry groups, realizing industrialized and serialized production, and making the regional economy prosperous; but also arrange re-employment for fisherman, maintain social stability as well as drive coordinated development among the inter-linked industries.

The developing guidelines of aquatic product processing will focus on technical innovation in refined and deep processing, raising comprehensive utilization levels and benefits. Based on the demands of international and domestic markets, it is necessary to adjust the product structure, and advance the establishment of a processing system for freshwater fish, shellfish, pelagic fish and algae, thus developing positively aquatic products which are nutritiously high, low in fat, non-polluting and environmentally friendly. We need to cultivate one batch of leading enterprises of aquatic product

processing which has large-scale management, a strong ability of management, good economic efficiency and with an independent brand name. We should construct and develop the logistics for aquatic products, strengthen the construction and management of aquatic product market, develop refined and deep processing of aquatic products, develop and utilize frozen surimi in particular, develop top grade, compound products and aquatic biological healthy products, which are all value-added. We should pay special attention to the comprehensive utilization of freshwater fish and pelagic fish, construction of bases, and matching cold-chain facilities for purifying and processing shellfish. The promotion of processing and exportation of aquatic products should be implemented. We can unceasingly enhance the exportation proportion of refined and deep processing products and can expand the international market further by developing well-known branded goods, supporting key enterprises, expanding the export trade of processed cultured products, steadily developing processing with buyer's materials steadily, and simultaneously persisting in the exportation of traditional primary products and refined and deep processing products.

We should promote the quality and safety level of aquatic products, because sea foods are different from other industrial consumables. When we are faced with a food technology barrier, we can't only depend on government negotiation or file a lawsuit with the WTO, but also depend on the product's prestige and quality to convince consumers from import country. We can make our exported aquatic product become "disburden food", "exempting from inspection food" through promoting quality. Therefore, we should continue to strengthen the development construction of a standard system for aquatic products, comprehensively carry out the HACCP management system, form and revise a batch of standards for quality, variety, production technology and the ecolog-

cal environment of aquatic products. Gradual networking with international circles and cultivating famous brand aquatic products are needed to enhance the products' competitiveness.

According to the actual and present situation of our country (bottleneck), the development level overseas (tendency) and the development needs of the 11th Five-Year Plan in technical industry (goal), processing and utilization of aquatic products had better conduct research and development of special topics as follows: processing technology of large-scale and ultra-low temperature freezing technology in distant seas to maintain freshness and the research of its equipment (the value storage in marine fish is of high priority, rapidly freezing large-sized fish is difficult, researching storage processing equipment in small-sized efficient ships is difficult); effective developed technology of small-sized but high production, fat-rich pelagic fish (small, fat-rich fish belonged to low value fish traditionally, however, in fact their healthy nutritive value is higher, so it is crucial to control the quality change caused by oxidative rancidity); processing and utilization of surimi (including the suitability of raw materials, new processing craft for surimi, making intermediate material into products, market management and development of surimi-based products); freshness-keeping and purification technology and equipment for shellfish (mainly referring to circulation and freshness, and the key technology is the guarantee of safety and effective purification that can reduce pollution); refined and deep processing technology for shrimp (nowadays convenience frozen preserved foods have changed the present situation of a sole variety of frozen shelled shrimp); comprehensive utilization technology of seafood wastes (the reason being that massive inedible wastes like fish heads, fish skin, internal organs, fish bones, carapace and shells, etc. are generated during processing, their full and

highly effective development and utilization may not only change waste into treasure but also reduce pollution, it may also clean production systems and increase benefit. Research and exploiting resources for collagen, highly unsaturated fatty acids, active peptide, polysaccharide and animal calcium are important); new effective development and utilization technology of algae (including functional food, new energy, technical drawings); effective development of marine micro-organism (including screening and utilization of superiority function fungi, control of harmful fungi, utilization of micro-organism metabolites, etc.); high-tech's application in keeping freshness, processing, and comprehensive utilization of marine products (including fast quality testing, hurdle technology, Ultra-high pressure technology,

supercritical CO₂ fluid extraction, ultra-micro pulverization, nano-technology, ohmic heating, microwave technology, freeze-drying in vacuum, and so on).

In conclusion, the processing and utilization of aquatic products are a new strategic opportunity period, which will also face more challenges. We expected to achieve greater progress and breakthroughs in some aspects: developing and utilizing aquatic biological resources with rich and high productivity, promoting and applying novel technologies for modern food processing, researching and developing new healthy foods, perfecting and enhancing the supervise and control level of quality and safety management for aquatic products, making a enormous contribution to sustainable development of fishery and food industry.

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