Acknowledgments

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List of Leading Companies in China
1. Introduction

1.1 Objective of this Overview
As regulations and quotas in the fisheries sector worldwide are being intensified and the demand for high quality aquatic products is increasing, more and more attention turns to aquaculture as the solution to confront the issue of diminishing supply and increasing demand. To this concern, China is a country that should not be neglected. Currently China's output from aquaculture is the largest in the world and accounts for about 67% of the world's total production. Moreover, China is the only country in which aquaculture output exceeds wild capture output and where more than 90% of the domestic consumption of seafood is from aquaculture. The Chinese government at the same time also attaches great importance in further developing aquaculture as it plays a key role in alleviating poverty in rural areas, ensuring food supply and international trade. Therefore the need for further development of aquaculture worldwide and certainly in China presents many opportunities for cooperation in terms of research and development, farming techniques, food safety and quality, feed, environmental protection, processing etc.

The Ministry of Agriculture, Nature and Food Quality of the Netherlands and the Netherlands Business Support Office (NBSO) in Dalian have joint hands in order to provide the Dutch business community and especially those active in related sectors with a compact, yet complete glance of the status quo of aquaculture in China. Hopefully the content of this overview can serve as a useful map to further explore business opportunities in aquaculture and related sectors in China.

For more detailed information or questions with regards to this overview, please contact NBSO Dalian directly or via www.hollandinchina.org

1.2 Introducing China
The People's Republic of China has a surface of 9.6 million km² and a population 1.3 billion with a yearly growth rate of 0.6%. The country is divided into 22 provinces, 4 municipalities, 5 autonomous regions and 2 special administrative regions (Hong Kong and Macau). China has a one-party political system in which the ruling party sets out the path for economic and social developments in so called “five year plans”. The current policies are based on the 11th five year plan which was enacted in 2006 and will prolong till 2010.

The spectacular economic developments have received much attention worldwide in recent years and China will become the second largest economy in the world.

However, as the costs in all areas are gradually rising, the new challenge for China is going to be how to transform from an economy dependent on low productions costs with relatively low value added into a more knowledge based economy fit for international competition. Another challenge is how to rapidly develop the rural areas in China which has somewhat been left out of the economic growth in recent years in order to avoid social unrest and maintain economic stability.

Given the above two challenges, it can be even better understood why further development of China's agriculture (aquaculture included) is high on the agenda of the central government; a developed agricultural sector can alleviate both challenges at the same time.

1.3 Development of Aquaculture in China
China has a long history in aquaculture dating back more than 2500 years. It actually all started with the pond farming of carps. Fingerlings were caught in the Yangtze River and subsequently transferred to earthen ponds for farming. From that moment onwards, the farming of freshwater species steadily expanded throughout China. The expansion slowed down in early 20th century as the demand for fish seed exceed what could be supplied from the wild. This triggered the government to play a more active role in further developing aquaculture. The stimulating role the government played in the development of aquaculture ranged from providing fish seeds through artificial spawning, researching and developing, introducting new species, developing marine aquaculture and passing on new culture techniques to the small farmers in rural areas engaged in aquaculture. After the opening-up policy was taken in place in 1978, the development of aquaculture further continued in terms of new species, new techniques and the start of bigger and better integrated companies in the field of aquatic products, also the establishment of business forms other than a cooperative or a state owned enterprise became possible (e.g. corporations, individual, joint ventures, ventures with foreign companies) (Hishamunda & Subashinge, 2003).

The government remains an important key facilitator when it comes to aquaculture. In fact, as aquaculture further developed; the bureaucratic system within the government to further facilitate its development also expanded. Below an impression of how this system looks like:

The above figure shows that the role of the government exerts on 3 levels. Level 1 concerns the relevant ministries and local governments. Their role is to set out the objectives stated in the five year plans and to provide for
a good infrastructure for aquaculture development. Level 2 are the research institutes for further scientific R&D and training. The Chinese Academy of Fishery Science and the National Fisheries Research Institutions are the key R&D and training centers, whereas the local research and educational institutions are there to train on a local level and to adapt the R&D from the national centers into workable solutions taken into account the local conditions. Finally is Level 3, there are the Technology Extensions Centers. These centers provide assistance to companies and local farmers when it comes to implementing new technologies and know how coming from the research institutes.

1.4 Government’s 11th 5 year plan for aquaculture

Nowadays, the main development of aquaculture is based on depletion of natural resources and expansion of culture area. At the same time, resources have not been used efficiently and occurrences of diseases are still quite frequent. In the 11th 5 year plan, the government has planned to develop new technologies and healthy culture. The main aims in the field of fisheries during the 11th 5 year plan period are as following:

1. To accelerate the transfer of scientific and technological achievements into commercial/mass production and get an over 50% transferring rate.
2. To set up a complete system of developing good strain seed and corresponding breeding technology. Cultivate around 10 new good species or strains in aquaculture.
3. To achieve a significant improvement on techniques for aquatic organisms conservation and aquatic ecology, and put the scientific achievements in areas of selective capture, prevention of pollutions and recovery of environment to use efficiently.
4. To increase the percentage of processing aquatic products from 35% to 45%, and develop techniques for processing products and value added products.
5. To get a breakthrough in diseases prevention technology of cultured species and food safety control system. Develop more than six new kinds of compound feed and four new kinds of vaccine for aquatic products.

In the period of the 11th 5 year plan, legislation on fishery rights got an important breakthrough. For the first time, it was clearly defined that the farmers’ right of culturing and fishing in waters and tidal area are protected by the law. Some relevant standards for fisheries such as standard of pollution free aquatic product, standard of waste water discharge in freshwater aquaculture have also been set up. Meanwhile, the supervision and testing system of residues of antibiotics and chemicals in aquatic products is improving. The Food Safety Law of the People's Republic of China, which was adopted at the 7th Session of the Standing Committee of the 11th National People's Congress of the People's Republic of China on February 28, 2009, was promulgated and had come into force as of June 1, 2009.
Now that the general context of the environment for aquaculture has been set, the remainder of this overview will shift the perspective to the market. What species are farmed where? What are the trends in the industry and what are the challenges? And most importantly, what are the opportunities for Dutch companies when it comes to China?

A note going forward is that the term “aquatic products” in this overview refers to both cultured and wild capture aquatic products; Aquatic products included fish, shrimp/shrimp/crab, shellfish etc. In case it concerns either cultured or wild capture aquatic products, than the source will be emphasized.

2.1 Main Cultured Species in China
There are currently around 140 kinds of aquaculture species in China, among which, about 90 kinds are fish, 10 kinds are shrimp & crab, 10 kinds are shellfish and 10 kinds are algae.

Marine Aquaculture
Nowadays, the main marine aquaculture species in China are shrimp, scallop, large yellow croaker, turbot, oyster, mussel, abalone, sea cucumber, sea urchin and clam. The major culture species have changed a lot in recent years. For example, farrer’ scallop and Penaeus Chinensis were two major culture species in China twenty years ago. However, with the occurrence of serious diseases and variety degeneration which caused high death rate, the two species vanished gradually. Accordingly, some new species, such as white shrimp and bay scallop, were introduced into China and have become the major culture species. Meanwhile, because of the depletion of natural resources, the yield of some wild caught species like big yellow croaker decreased gradually and artificial cultured species are becoming good substitutes of them. Also, some species were developed to meet new requirements of the people, of which sea cucumber and abalone are two typical examples. In the past a few years, with the rapid increase of people’s income, the demand of high value aquatic products expanded greatly, which has an improvement on the development of culture output.

The main types of marine aquaculture include as follows:
1. land based culture. This type has been used as the major culture method of shrimp. Some marine crab like swimming crab and Samoan crab also are cultured in the ponds. 2. Offshore culture: Floating raft culture and cage culture are two main types. Floating raft culture normally is used to culture shellfish like scallop, oyster etc. Cage culture is relatively a new technology in China and is used to culture some high value fishes like sea bream, sea bass and big yellow croaker etc. Tidal flat culture: this culture method is used to culture the animals with weak moving ability like scallop, mussel, abalone, sea cucumber and clam etc.

Freshwater Aquaculture
Unlike marine culture, freshwater culture is scattered all over the country. The main species are common carp, bighead carp, silver carp, grass carp, Tilapia, Chinese mitten crab, eel, river crab and shrimp. Most farms of fresh water culture are small scale and distributed in a wide geographical range, which makes freshwater products mainly focusing on local market. Also, in recent years, with the decrease of caught fish outputs and the increase of the price, the outputs of some freshwater fishes such as catfish and tilapia are growing rapidly to meet international market.

Figure 2: Marine culture output of China in 2007

<table>
<thead>
<tr>
<th>Species</th>
<th>Output/MT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shellfish</td>
<td>9,938,377</td>
</tr>
<tr>
<td>Algae</td>
<td>1,355,536</td>
</tr>
<tr>
<td>Crustacean</td>
<td>919,008</td>
</tr>
<tr>
<td>Fish</td>
<td>688,563</td>
</tr>
<tr>
<td>Other</td>
<td>171,916</td>
</tr>
<tr>
<td>Total</td>
<td>13,073,400</td>
</tr>
</tbody>
</table>

Source: China’s Fisheries Yearbook 2008
### Figure 3: Fresh water culture output of China in 2007

<table>
<thead>
<tr>
<th>Species</th>
<th>Output/MT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fish</td>
<td>17,510,820</td>
</tr>
<tr>
<td>Crustacean</td>
<td>1,673,650</td>
</tr>
<tr>
<td>Shellfish</td>
<td>206,455</td>
</tr>
<tr>
<td>Algae</td>
<td>7,464</td>
</tr>
<tr>
<td>Other</td>
<td>311,517</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>19,709,906</strong></td>
</tr>
</tbody>
</table>

- **fish**, 89%
- **algae**, 0%
- **crustacea**, 8%
- **shellfish**, 1%
- **other**, 2%

Source: China’s Fisheries Yearbook 2008

### Figure 4: Map of China

Main types of fresh water culture are as follows:
1. Pond culture: Pond culture is the major culture method in freshwater culture. It account for around 70% in output and 40% in culture area in freshwater culture. However the percentage in total freshwater culture has decreased in recent years.
2. Reservoir culture: Reservoir culture is the second big in freshwater culture. It account for around 12% in output and 30% in area.
3. Lake culture: Lake Culture is the third big in freshwater culture. It held around 8% in output and 24 in area.
4. Channel culture: Channel culture’s scale is a small. The percentage of output and area is around 3 in total freshwater culture.

### 2.2 Geographic Distribution of China’s Aquaculture Sector

Three regions can be pinpointed as the main areas where the total scale of the aquaculture is significant and the products are also sold to the international market. These are:
1. Bohai Sea & Yellow Sea culture zone: In this area, including Liaoning, Hebei, Shandong province and Tianjin city, the major cultured species are shellfish, algae, penaeus, and river crab. Aquaculture in this area is predominantly controlled by large integrated corporations (some of them are also listed), which were cooperatives before 1978.
2. Southeast coastal culture zone: This area includes Zhejiang, Fujian, Guangdong, Guangxi and Hainan province, and the major cultured species in this area are white shrimp, eel, tilapia, large yellow croaker and shellfish. Aquaculture in this area is predominantly controlled by individuals and private companies.

3. Yangtze Valley culture zone: Jiangsu, Anhui, Jiangxi, Hubei, Hunan, Chongqing and Sichuan province are in Yangtze Valley culture zone, and the major species of this area are catfish, river crab and eel. Most of the farms here are family run businesses.

2.3 China’s Aquatic Products Supply Chain
The supply chain for aquatic products can be characterized by two main types based on the difference of target markets. One is the international market; the other is the domestic market.

**International market**
Most exported products are processed aquatic products. The supply chain of exported product is characterized by including the processors. In the past, there are two ways for farmers to sell their products: sell the product to brokers or sell to the processors directly. Recently with more strict controls for food quality and food safety concerns, processors tend to deal with the farmers directly, instead of through brokers. Especially since buying raw material from the brokers is difficult for traceability afterwards and hard to control the use of drugs and chemicals of the farmers. Sometimes, the processors now even provide the varieties and feeds to the farms, while taking part in the daily management of farming and supervise using of the feeds and drugs of the farms.

To ensure the raw materials meet the standard of export seafoods. Some big companies have integrated horizontally. They have hatcheries, farm, feed plant and processing plant. They have every point in the supply chain and have full control over food safety and quality to meet the international market requirements. Local China Inspection Quarantine (CIQ) in each province has also supervised the each point of the supply chain for exported product. The farms must be approved by CIQ before they can supply the product to the processing plant.

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Figure 5: China’s top-8 aquatic producing provinces in 2007

Source: China’s Fisheries Yearbook 2008

Figure 6; Supply chain of China’s aquatic products
**Domestic market**

The most common species for the domestic markets are for example common carp, grass carp, silver carp and bighead carp etc. and all are cultured all over China. The output of these common species accounts for more than 70% in output of fresh culture species (Zhao, 2008). Most of these products are supplied to local market when they are alive.

Farmers often deliver their products to the wholesale markets or wet markets themselves. This happens especially when the farmers are scattered in a wide area. Normally, these farmers are not sensitive to demands of the market. They culture the traditional species that they are used to. An often seen development is that the small individual farmers congregate in an area. Usually in this way, wholesalers can just go to the ponds to purchase fish from multiple farmers.

For some species with high price and only grown in selected areas, the products are not limited to the local market. Wholesalers normally purchase at the farms. The products are transported to other areas by air alive for the high price products of distributed by special vehicles. Then the wholesalers sell the products to the supermarket, fresh market, other wholesalers or organized retailer.

With the requirement for more safe and good quality product in domestic market, e.g. organic product, green product and non-pollution product, a new type of supply chain emerged. Wholesale or processing companies engaged on more intensive cooperation with the farmers. They signed contracts with farmers and monitored the growth and purchased all the products.

2.4 China’s International Trade in Aquatic Products

As the largest aquaculture produce country in the world, the volume of China’s aquatic products account for about 70% of total output of the world, which not only meets the rising domestic demand, but also playing an important role in international trade.

In 2007, China’s aquatic trade volumes and values maintained steady increase, with 6.53 million metric tons of total trade volumes and US$14.46 billion of trade values. Export volumes and values were 3.06 million metric tons and US$9.74 billion, increased at a rate of 1.6% and 4.1% respectively over the previous year. Import volumes and values were 3.46 million metric tons and US$4.72 billion, which increased at a rate of 4.3% and 9.7% respectively over the previous year. From 2001 to 2007, China’s import volumes and values increase 49.7% and 151.06%, and the export volumes and values increase 56.89% and 132.46%. Since 2002, China’s aquatic export values have been holding the first place in the world for 6 successive years, accounting for about 10% of world’s whole values, which makes China the leading country in the field of global aquatic trade.

(1) Exports by country of destination

In 2007, China’s aquatic products were exported mainly to Japan, United States, South Korea, Germany and Hong Kong. Although the first five countries still account for 69% of total export values of China, the proportion has decreased 3% compared to 2006.

**Table 1: Aquatic Products Exports by Country of Destination**

<table>
<thead>
<tr>
<th>Country</th>
<th>2006 Value</th>
<th>2007 Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Japan</td>
<td>2,802</td>
<td>2,734</td>
</tr>
<tr>
<td>United States</td>
<td>1,738</td>
<td>1,729</td>
</tr>
<tr>
<td>Korea, South</td>
<td>993</td>
<td>973</td>
</tr>
<tr>
<td>Germany</td>
<td>360</td>
<td>384</td>
</tr>
<tr>
<td>Hong Kong</td>
<td>287</td>
<td>314</td>
</tr>
<tr>
<td>Russia</td>
<td>176</td>
<td>300</td>
</tr>
<tr>
<td>Spain</td>
<td>239</td>
<td>241</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>212</td>
<td>228</td>
</tr>
<tr>
<td>Canada</td>
<td>186</td>
<td>211</td>
</tr>
<tr>
<td>Malaysia</td>
<td>177</td>
<td>185</td>
</tr>
<tr>
<td>Mexico</td>
<td>189</td>
<td>173</td>
</tr>
<tr>
<td>Taiwan</td>
<td>93</td>
<td>137</td>
</tr>
<tr>
<td>Belgium</td>
<td>116</td>
<td>130</td>
</tr>
<tr>
<td>Netherlands</td>
<td>111</td>
<td>120</td>
</tr>
<tr>
<td>Australia</td>
<td>103</td>
<td>111</td>
</tr>
<tr>
<td>France</td>
<td>94</td>
<td>102</td>
</tr>
<tr>
<td>Thailand</td>
<td>39</td>
<td>48</td>
</tr>
<tr>
<td>Other</td>
<td>686</td>
<td>790</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>8,601</strong></td>
<td><strong>8,909</strong></td>
</tr>
</tbody>
</table>

Source: World Trade Atlas

(2) Main export provinces

Based on regional distribution of export values, Shandong, Liaoning, Guangdong, Zhejiang, Fujian and Hainan are the first six provinces in 2007, the aggregate values of which account for 92.5% of the total export values of China. Relying on its established seafood processing industry, Shandong province is still the first aquatic export province in China. Guangdong province, influenced by the decrease of shrimp export has declined 6.4% on its export values. Liaoning province has overtaken Guangdong to become the second aquatic export province in China due to its rapid expanding
seafood processing industry.

The first four export inland provinces are Hubei, Jiangxi, Jilin and Anhui. But here the values and volumes are insignificant compared to the coastal provinces.

Table 2: Main export provinces of aquatic products in 2007

<table>
<thead>
<tr>
<th>First Six Coastal Provinces</th>
<th>Volume (thousand metric ton)</th>
<th>Value (US$ billion)</th>
<th>Value Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shandong</td>
<td>1075</td>
<td>3.4</td>
<td>34.9</td>
</tr>
<tr>
<td>Liaoning</td>
<td>577</td>
<td>1.49</td>
<td>15.3</td>
</tr>
<tr>
<td>Guangdong</td>
<td>415</td>
<td>1.47</td>
<td>15.1</td>
</tr>
<tr>
<td>Zhejiang</td>
<td>425</td>
<td>1.3</td>
<td>13.4</td>
</tr>
<tr>
<td>Fujian</td>
<td>280</td>
<td>1.03</td>
<td>10.5</td>
</tr>
<tr>
<td>Hainan</td>
<td>93</td>
<td>0.32</td>
<td>3.3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>First Four Inland Provinces</th>
<th>Volume (thousand metric ton)</th>
<th>Value (US$ billion)</th>
<th>Value Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hubei</td>
<td>15</td>
<td>0.07</td>
<td>0.8</td>
</tr>
<tr>
<td>Jiangxi</td>
<td>8</td>
<td>0.07</td>
<td>0.7</td>
</tr>
<tr>
<td>Jilin</td>
<td>16</td>
<td>0.05</td>
<td>0.5</td>
</tr>
<tr>
<td>Anhui</td>
<td>3</td>
<td>0.02</td>
<td>0.2</td>
</tr>
</tbody>
</table>

Source: China’s Fisheries Yearbook 2008

(3) Export species

The dominant export species of aquatic products remained stable in 2007, and the first five products on export values are shrimp, shellfish, eel, tilapia and large yellow croaker. Compared with the situation in 2006, the export value of shrimp, eel and large yellow croaker has decreased with 9.1%, 9.1% and 6.9% respectively. Among the fastest growing export species in China are tilapia and shellfish.

Table 3: Export Species of Aquatic Products

<table>
<thead>
<tr>
<th>Species</th>
<th>Percentage on Values (%)</th>
<th>Amount (thousand metric tons)</th>
<th>Values (US$ billion)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shrimp</td>
<td>19.2</td>
<td>21.6</td>
<td>11.4</td>
</tr>
<tr>
<td>Shellfish</td>
<td>15.8</td>
<td>29</td>
<td>9.4</td>
</tr>
<tr>
<td>Eel</td>
<td>11.3</td>
<td>5.9</td>
<td>6.7</td>
</tr>
<tr>
<td>Tilapia</td>
<td>8.2</td>
<td>21.5</td>
<td>4.9</td>
</tr>
<tr>
<td>Large Yellow Croaker</td>
<td>2.6</td>
<td>4.8</td>
<td>1.54</td>
</tr>
<tr>
<td>Crawfish</td>
<td>2.5</td>
<td>2.5</td>
<td>1.5</td>
</tr>
</tbody>
</table>

Source: China’s Fisheries Yearbook 2008

(4) Import by country of origin

In 2007, China’s import quantity of aquatic products was 3.46 million metric tons, including 1.64 million metric tons of given processing material, 0.97 million metric tons of fish flour, and 0.86 million metric tons of aquatic products for people’s consumption.

The main import countries are Russia, United States, Japan, Norway, Canada and South Korea, the aggregate values of which account for 71.4% of the total import values of China.

Table 4: Aquatic Products Imports by Country of Origin (Value: $ million)

<table>
<thead>
<tr>
<th>Country</th>
<th>2006</th>
<th>2007</th>
</tr>
</thead>
<tbody>
<tr>
<td>Russia</td>
<td>1213</td>
<td>1340</td>
</tr>
<tr>
<td>United States</td>
<td>409</td>
<td>463</td>
</tr>
<tr>
<td>Japan</td>
<td>235</td>
<td>209</td>
</tr>
<tr>
<td>Norway</td>
<td>160</td>
<td>173</td>
</tr>
<tr>
<td>Canada</td>
<td>174</td>
<td>163</td>
</tr>
<tr>
<td>Korea, South</td>
<td>78</td>
<td>142</td>
</tr>
<tr>
<td>Thailand</td>
<td>67</td>
<td>97</td>
</tr>
<tr>
<td>India</td>
<td>91</td>
<td>86</td>
</tr>
<tr>
<td>Netherlands</td>
<td>83</td>
<td>95</td>
</tr>
<tr>
<td>Peru</td>
<td>64</td>
<td>66</td>
</tr>
<tr>
<td>New Zealand</td>
<td>56</td>
<td>58</td>
</tr>
<tr>
<td>Taiwan</td>
<td>32</td>
<td>49</td>
</tr>
<tr>
<td>Indonesia</td>
<td>43</td>
<td>40</td>
</tr>
<tr>
<td>Korea, North</td>
<td>44</td>
<td>31</td>
</tr>
<tr>
<td>Chile</td>
<td>34</td>
<td>28</td>
</tr>
<tr>
<td>Other</td>
<td>402</td>
<td>456</td>
</tr>
<tr>
<td>Total</td>
<td>3,184</td>
<td>3,487</td>
</tr>
</tbody>
</table>

Source: World Trade Atlas
This chapter will focus on some main aquaculture species, which at the same time are also species that might be interesting for the Dutch companies. For each of the species, a brief description will be provided along with the culture methods in case of China.

3.1 Tilapia
Tilapia, originally grown in Africa, is a tropical species, which is one of the most common aquaculture species in the world. The culture volume of tilapia is only less than the carp in the world. Tilapia has the advantages of fast growing, high tolerance to low dissolved oxygen, easy breeding, less occurrence of diseases and high yield etc. Since first introduced to China in 1978, Tilapia has become a major culture species of which the culture area and output have been increasing in recent years. Guangdong, Fujian and Hainan are the first three tilapia culture provinces.

Two kinds of culture methods for tilapia are used in China.

**Pond culture**
Pond culture includes single species culture and multiple species culture. The theory of multiple species culture is that some different species eat different type foods and live in the different layer of the waters. The space and food can be utilized utmost in multiple species culture. This method normally is used in intensive and semi-intensive culture. Common carp, bighead carp, grass carp and silver carp can be chosen to culture together with tilapia. With the density 30,000-42,000 fish per acre, the yield of single species culture can be 12,000-50,000 kilograms per acre. Tilapia culture needs rich nutrient water, and fertilization is very important. As omnivore species, tilapia likes to eat plankton and organic debris, and the former grows well in rich nutrient water. Normally fermented manure and green manure are used as fertilizers. Under the condition of enough dissolved oxygen, the fertilizing should be frequent and the principle of fertilizing is small amount with high frequency.

**Cage culture**
Cage culture is a new culture method developed in recent years, which is usually used in reservoir and big river. The feed for tilapia should have 28 percent of protein at least and the conversion ratio is around 1.7-2. The culture site of tilapia should meet the conditions of smooth tide, light wind & wave and no frequently ship passing by. Although the initial cost of cage culture is higher than other culture methods, cage culture has many advantages such as easy harvesting, less feed loss and high density in unit waters etc. Especially, cage culture can limit the fish to contact the bottom, which prevent muddy taste of fish flesh effectively.

3.2 Shrimp
Main cultured shrimp species in China include white shrimp (Vannamel Shrimp), Shrimp (Macyobrachiun rosebergii) and Penaeus Chinensis. In last centenary, Penaeus Chinensis was the major shrimp culture species. The culture of Penaeus Chinensis was spread from north to the south along the Chinese coastline. The outbreak of disease caused by vibration in 1990s had a very significant impact on shrimp culture in China and the whole industry of Penaeus Chinensis almost collapsed. In late 1990s, white shrimp was introduced into China. The characteristic of white shrimp are good resistance to the disease and fast growing. In the last decade, the white shrimp culture has been growing very rapidly and has become the most important species in terms of culture area and output in shrimp culture. The major culture areas include Guangdong, Guangxi and Hainan provinces. The degeneration of the variety is one of the major issues with white shrimp culture. Some companies introduced brood stock from OI (Ocean Institute in Hawaii) yearly to maintain the good strain of the variety. The key point of shrimp breeding is the water quality. The site of hatchery must be selected at an area with pollution free water. The breeding water should be treated based on the process of deposition-filter sanitation.

Three main methods for shrimp culture are employed in China.

**Extensive culture**
The shrimps are cultured in shallow-water ponds and culture with some fish species. No feeding or only small amount feed are put into the ponds. Normally the area of the ponds is relatively big, though the output is very low. The advantage of this culture method is low cost, rare occurrences of the disease and big size of the product.

**Intensive culture**
This culture method is characterized by high density culture and high output. The output can be 10-40MT/ hectare. Shrimp are cultured in cement pond and feed totally with artificial compound feed. With good management, the feed conversion rate can be less than 1.0.

**Semi-intensive culture**
Normally, shrimps are cultured in pond with earth bottom. Feeding the shrimp with fresh feed and compound feed alternately. Culture density is lower than intensive culture.

3.3 Catfish
Catfish is a relative new aquaculture species in China. The culture technology and artificial breeding technology matured around 1997 and mass culture of catfish began after 1997 (Wang, et al, 2007). In 2003, the catfish exported from Vietnam was under antidumping list by US government. This gave China’s catfish culture a very good chance for expansion in the international market. Since 2003, the catfish culture
has grown very fast both in terms of culture area and output.

Catfish is China is cultured mainly as following:

Typically the incubating tank is built in cement. The depth of water should be between 0.5-1m. Water need to be filtered strictly. Density of the egg is around 30,000egg/per square meter. With the temperature 20°C, the membrane of the egg will be broken. The larvae can be taken out from 3 days later from the incubator and grow into the ponds. In pond culture, the catfish can be cultured together with other fish. The catfish can be cultured with bighead carp, silver carp. With the percentage around 55% catfish, 15% silver carp and 30% bighead carp, a high survival rate can be achieved.

One big problem affecting the quality of catfish is the muddy taste of flesh. The cause of muddy taste is that the fish like to stay at the bottom and eat small muddy granule. As such more and more farmers are using cage culture method, the muddy taste can be avoided, because the fish has no chance to contact bottom. The site should be chosen at wide open waters like river, lake and reservoir with clear water, high dissolved oxygen. During the fry period, the catfish can kill each other, so the culture density needs to be controlled, and the fries need to be graded timely. When the fries’ length is shorter than 5-7 cm, it is better to feed the fries mainly with fresh feed like earthworm etc. When the fish grow longer, artificial feed can be used. The catfish like to eat in the nighttime, so it is important to feed the fish around 11-12PM. Feed Conversion ratio is around 1.3 when feeding with normal formulated feed.

3.4 Scallop
Around 30 species scallop are existing in China. Currently two among them are the major culture species. Japanese scallop and bay scallop. Japanese species grow well under low temperature. It is mainly cultured in the Dalian area. Bay scallop is mainly cultured in Liaoning Province, Shandong Province and Hebei Province. Breeding of the scallop: With the temperature 21-28°C, after 7-10 days’ culture, the brood stock can be ready for breeding. Direct exposing under sunshine is a very efficient way to induce the discharging of the eggs. 2-3 sperm around one egg is a good percentage. During the larvae period, single cell algae are used to feed. The larvae culture temperature should be control between 26-29.5°C. When growing to 2mm, the scallop needs to move to the sea to grow up. There are two main culture methods for scallops in China.

Floating raft culture
The master strings are fixed to the seabed. Connected strings are floated by the raft. Culture cage are fixed to the floating strings. The advantage of this method is easy harvest, high density culture. Daily management of the culture is very important. The cages are easily covered by algae and other shellfish like barnacle, and this will have influence on the water exchange of the cage. The scallop filters the water to get their food like small algae. Poor exchange of water will influence the food intake of the scallop and then slow the growth of the product.

Sea bed culture
The seeds are spread on the seabed directly. In this method, the scallop’s environment is as wild scallop. The scallop is cultured longer than floating raft culture to get big size products. Daily management is simple. However, the harvest is not as easy as the other culture method.

3.5 Oyster
Around 100 species live in the world and around 20 species can be found in China. Oyster is one of the most common culture species alongshore. It can be found along all Chinese coastlines. The breeding method of oyster is very similar to the scallop. Recently year tripolyploid induction of oyster has become a mature technique. Some area has culture the tripolyploid oyster in commercial scale.

Oyster has the habit to stick itself to some objects when they are larvae. Oyster has no moving ability after it attached to some objects. There are many methods for oyster culture. Cement pole culture method is the most common method currently. The cement poles are put in the spat tanks and the spat will stick to the cement poles. Around Oct 1, the ement poles are moved to the sea in intertidal zone. Normally, the poles are inserted into the bottom separately if the area is with hard bottom. If the area is with soft bottom, the poles are piled together and inserted to the bottom on the bottom and this can improve the ability to wind resistance. Floating long lines culture method is another common culture method that is used in the area with strong wave and wind.

3.6 Mussel
Mussel is one of the most early cultured shellfish species in China. However since the 1990s, the mussel has become one of the pest species for scallop culture with the rapid development of scallop floating raft culture. The farmers have tried many methods to get rid of the mussel attaching to the raft. Recently, some diseases occurred in scallop culture and this has led to high death rate of scallop culture in some areas. Under this kind of situation, mussel culture shows its advantages: low cost, fast growing, high production. As such mussel culture is regaining popularity in some areas. Culture site should be selected in areas with good water quality and efficient water exchange. Floating raft culture and lone lines culture are two major culture methods for mussel culture. Though breeding technique of mussel is quite mature, the seed of mussel is very easy to collect in nature. The seed can be collected in nature in March by set string near to the area where have high density of mature mussel. Normally the string is made of rubber from broken tires.
Despite that China’s aquaculture has grown very fast since last decade, this expansion was mainly based on expansion of culture area and production capacity. Looking forward what seem to be the ongoing trends in the industry?

4.1 New Species
Chinese are very interested in new species and like to try the new foods. Normally a new product can sell a good price. Many species have been introduced into China in the last three decades. Tilapia was introduced from Africa in 1970s. Bay scallop and Japanese scallop were introduced from Mexico and Japan respectively in 1980s. Turbot was introduced from Europe in 1990s. The introductions of these products were very successful. Today these species have become important aquaculture species in China. To introduce new culture species from foreign country used to be very popular for Chinese researchers and farmers in the past. Nowadays the government emphasizes the risks of introducing foreign species and it has enacted very strict regulation for introducing foreign species. In recent research, the researchers focus more on improving the quality of existing strains and species. Some high quality aquaculture strains have been successfully cultivated, below some examples:

No. 1 Pujiang of bluntnose black bream: The advantage of the strain is fast growing. The growing speed can be 30% faster comparing to normal strains. The product can grow to market size one month earlier comparing to the normal strain.

No.1 yellow sea of Chinese shrimp: The strain’s advantages are fast growing and high ability of stress resistance. Comparing to normal strains, the new strain’s advantages are: around 26% faster in weight growing and 40% lower in occurrence of the diseases.

Xin ji fu Tilapia: The strain’s advantages are: fast growing, high percentage of flesh, late gonad mature. The growth rate is around 30% faster than normal strains.

Peng lai hong Farrer’s Scallop: comparing to normal strain, Peng lai hong has following advantages: fast growing, high tolerance to high temperature and good stress resistance. Average increasing of output can achieve from 35% to 68% in unit culture area. The strain has been mass-scale cultured in around Yellow sea & Bohai sea area.

Zhong Ke Hong Bay scallop: Comparing to the normal strains of bay scallop, the grow rate of Zhong Ke Hong is faster around 15.6% than normal strain, and is 19.2% higher in survive rate and 29.3% higher in meat weight/individual weight percentage (Tang Hui Ming, 2006).

The strains that were successfully introduced from abroad in recent years included for instance the black sea bass (Centropristis striata L.). This was introduced to China from America in 2003. Over one million seedlings were obtained by large-scale product in 2006. This species is suitable for deep eater cage culture, industrial culture and pond culture in the temperate zone and the semitropical zone of east and southeast China. It is expected that this product could be not only sold in domestic market, but also exported to occident (Lei Qi Lin et al, 2007).

4.2 New Techniques
China’s academies of science and universities are the main sources for new technologies and innovation. In the past, the scientific achievements of the institutes and universities haven’t been transferred into mass production efficiently and in time. Recently, the government has realized this problem and begins to improve transferring efficiency of new research achievements. At the same time, some academies begin to cooperate with farming companies. Disease curing and prevention, health farming and cultivation of good quality strain are the main interests of the research area. Some new technologies are elaborated below:

GMO engineering has been used in some aquaculture species. Polyploid breeding of some species have achieved and come to mass production. The polyploidy product has the advantages in growth, yield and stress resistance ability. For example, the triploid product has the characteristic of sterility, and no need to consume energy for gonad growth, and it has a great significant advantage in growth. Normally polyploid can be induced by biological, chemical and physical methods.

The disease prevention and treatment of aquaculture species become an important issue when the intensive aquaculture getting more and more popular. In the past, antibiotic has been used to solve the problem. However nowadays the antibiotic abuses make some bacteria get drug resistance, on the other hand, most antibiotics have been prohibited to use in aquaculture. Under this circumstance, some immunopotentiator are studied to improve the anti diseases ability of the cultured species. Currently, Taurine, lactoferrine and Vitamin E have been used to improve the immunity of the products and have got good effects.

Traditional Chinese herb medicines begins to use in aquaculture in recent years. Using the Chinese herb medicine can get following effects: decrease the feed...
Conversion ratio, improve the growth rate, cure some diseases and also can prevent some diseases.

Nowadays, a number of preparations of probiotics are commercially available and have been introduced to fish, shrimp and molluscan farming as feed additives, or are incorporated in pond water. These products are effective in supporting the health of aquatic animals.

Replacement of fish meal is always a hot subject to study. Feed cost is the main cost in finfish aquaculture and account for around 50% of the total cost (Guo, et al., 2005). Feed Cost is mainly decided by feed price and feed conversion ratio. The price of feed in mainly determined by the protein sources, of which, fishmeal is the essential and traditional one. Recently many researches have been conducted to find the substitute of fishmeal. Following cheap protein feedstuffs, poultry by product meal, meat and bone meal, feather meal, blood meal, soybean meal, cottonseed meal and rapeseed meal, have been used as part of protein source in feed recently.

In China, fish vaccines had been researched around 30 years before, they went through a rapid development period and now are at a new age. Though fish vaccines is mainly stay on research stage, they began to used in commercial production more and more recently. Fish vaccines can play an important role in control of fish diseases, especially in the control of some malignant infectious diseases.

With increasing demand for environment friendly aquaculture, the use of probiotics in aquaculture is now accepted. In Guangdong area, some farmers have used the probiotics to improve the quality of the water. Recent research also shows that the use of commercial probiotics in Penaeus vannamei Pond can reduce concentration of nitrogen and phosphorus and increase the shrimp yields (Wang et al., 2008).

Overwinter technique has been used in some expensive species cultured in north. For example, abalone takes very long time to grow to commercial size because it stops growing in winter time due to low temperature. It takes around three years to grow to the commercial size. Overwinter technique is to move the products to the south e.g. Fujian province in the winter. The products are shipped to the south by sea and culture in the cage. Normally the products are moved to the south from October and back around May next year. Using the method, the survived rate of the products increase in winter time, and most important the products keep growing and can reach the commercial size one year earlier comparing to the traditional method. Recently some farmers have begun to send other species e.g. sea cucumber to the south overwinter.

Geography information system (GIS) played a great role in the management an display of marine data, especially in the three dimensional modeling, visualization and quantitative analysis since 1990s (Su, et al., 2006). Recently using GIS as a tool to survey the farming pond of shell fish alongshore is ongoing in Liaoning province. Using GIS, more accurate data in aquaculture area, the density of the cultured pond can be acquired. This can help the government to set proper policy and allocate water resource in a more sustainable way.

4.3 New Aquaculture Area
China is the only country which aquaculture output is higher than fishing output. The inland freshwater aquaculture mainly focuses on local market and the scale of the culture is relatively stable. Especially in recent years, aquaculture has become a fast growing sector in some provinces. Hainan is currently the fastest growing province in aquaculture in China. Especially for tilapia, Hainan has become the second biggest province in terms of output. The output of tilapia is around 0.26MMT in 2007 and account for 16% of China. Tilapia is a real export-oriented species. With the stricter rules when it comes to wild catch, especially tilapia has become a good substitute for wild caught species. Thus tilapia culture in Hainan has very good prospects looking into the future.
Although in general the future for aquaculture in China looks promising, there are still a lot of important challenges need to be addressed in order to take this industry to a higher level.

5. Challenges

5.1 Feed
Recently, intensive culture system has become a usual culture method than extensive culture system in China. In intensive culture, the fish are totally feeded by artificial compound feed. Feeds cost is usually the single greatest operating expense of intensive fish culture, and accounts for 50% or more of the total operation costs. Therefore the feed has played a more important role in aquaculture. The feed is composed of protein, amino acids, fat, fatty acids, carbohydrates, fiber etc.

The demand of feed increases fast in the meanwhile with the aquaculture expansion. The lack of rich protein supplements has become a serious issue in feed industry. Fish meal usually as the protein supplement of compound feed, and it accounts for a very big percentage of it. However the fishmeal product declined in recently years while the price of fish meal goes higher.

The farmed fish industry of the world is no longer relies entirely on fishmeal feed. Due to the high price of the fishmeal, alternatives materials such as soy protein concentrate and wheat gluten have been used as substitutes. Meanwhile higher prices of the fishmeal stimulate the innovative approaches to reuse protein from seafood processing by-products, much of which is currently discarded. Decades of research have shown that proteins derived from grains such as corn, wheat and barley can provide the protein-rich ingredients needed in feeds (Josupeit, 2007).

Meantime, food safety has become a very serious issue in China’s feed industry. In the past, some feed manufacturers were found to add some antibiotics into feed to improve anti-disease ability in order to get more market share. Antibiotics such as chloramphenicol, nitrofurans and fluoroquinolone etc. have been found in feeds in the past. On the other hand many farmers are not well educated, they don’t know the risk of over use the antibiotics. They would like to choose the feeds that have good characteristic to prevent diseases and decrease the death rate and lower price. All of these made the feed plant’s abused antibiotics. Some feed plants that have no social responsibilities have been found to add Melamine as fake protein into feeds to reduce the cost and lower the price. In recent years, Chinese government has made many efforts to improve the supervision system. The situation is getting better. At the same time, some seafood processing plants which have enough financial support has built a complete supply chain of the all industry to ensure the food safety. Some companies have their own hatchery, culture pond, feed plant and processing plant.

5.2 Food Safety
In traditional Chinese aquaculture, fish were cultured extensively. The farmers had no habit and no incentive to use chemicals and antibiotics in farming. However since the last decade, as aquaculture became much more intensive, more diseases also occurred in aquaculture. Consequently the farmers started to use chemicals and antibiotics to cure and prevent the diseases, and to decrease the death rate during transportation. Chemicals and antibiotics have been found throughout the whole supply chain: breeding, feed, grow up culturing and transportation of live fish. Some fish drugs are safe and approved to use in aquaculture, however many chemicals and antibiotics were found in aquaculture in China that are actually forbidden to use by the government such as Nitrofuran, Fluoroquinolone, Chloramphenicol, Gentian Violet, Malachite Green and Melamine etc.. The safety issue, especially using chemicals and antibiotics have become a very serious problem in China’s aquaculture.

Nowadays Chinese government is making a lot of efforts to improve the food safety and quality. Firstly, the training of farmers has been emphasized. In China most farmers are not well educated and have no much knowledge on regulations and rules. Many of them don’t know about the chemicals and antibiotics which forbidden to use and their impacts for the health risk. In some areas, short training programs have been hold by local governments to teach the farmer about the related knowledge. Secondly, the traceability system was built. The finished products are companied with the lot number of raw materials. Based on the lot number, the products can be traced to the culture ponds. Thirdly, testing and monitor
technique are the basic of food safety control. Many researches in testing and monitor technique area had been conducted recently.

5.3 Limit on Expansion of Space for Aquaculture
China's aquaculture expansion has mainly relied on increasing the production capacity and farming area (Jorge et al, 2009). Together with the more demand of products, the more space is needed for aquaculture, that caused some conflicts of the fast expansion of the industry. China is a country that short of freshwater resource per capita. In many areas, domestic water is shortage. At the same time, aquaculture in lakes, rivers and reservoirs made the water eutropic and have influenced the supply of domestic water. If wastewater of aquaculture contains too much nutrients, the structure of natural species may be influenced and local ecosystem will be destroyed. The problem has caused more attention of the government. More strict regulations had been made by the government related with the quality standards of the wastewater. On the other hand, with the fast grow of the Chinese economy; other industries have also developed very fast. Many heavy pollution industries e.g. papermaking, chemical industry would like to build the plants and need a big amount of water. The existence and expansion of these plants have limited the development of aquaculture.

For the seawater culture, the intensive culture has caused the water eutropic in some area. In recently year, the red tide erupted more frequently alongshore. It becomes a vicious circle. The wastewater from aquaculture and other industries made the pollution of the water and cause the red tide. On the other hand, the frequent occurrences of red tide have caused a great economic loss on breeding seafood, fishing, human health, and damaged coastal tourism. How to balance the development of aquaculture and to protect environment is a challenge that need to be solved.
Although China has a huge output in aquaculture, the output was contributed by a lot of small scale farmers. The technique of the most farmers are not developed and their productivity remained lower level. On the other hand, though the aquaculture output in the Netherlands is much lower than the output of China, the culture technique is very advanced. Introducing advanced culture technique, such as techniques of eel and catfish culture to China should be well considered.

Shellfish culture in the Netherlands has developed over the last 150 years. It is very experienced in culture shellfish in an environment friendly way and preserve the sustainability of the farming. Though the shellfish culture grew rapidly in recent years, it has also paid more and more attention on protect environmental friendly and sustainability. With the stricter regulation in environment protection in China, development of environment friendly and sustainable shellfish culture will be a key policy going forward. As such the techniques and experiences of Dutch shellfish culture can be useful and helpful.

Shellfish production e.g. scallop, mussel and oyster etc in China is huge. Comparing to the shellfish culture in the Netherlands, the shellfish culture in China has a big advantage in culture space and production costs. Currently it is forbidden to export shellfish from China to EU. Together with more control in culture area, farming method, traceability, the improvement of lab tests and more supervision system by government, re-opening of EU market may become possible. Building channels to export to EU or cooperating to build the culture system of shellfish can therefore be considered an opportunity in the future.

In China, the traditional method to improve the water quality of pond and breeding tanks is to change the water frequently, and the water is discharged to the nearby lake or river. Local waters system are easy to get eutropic and local water ecosystem is badly impacted. In China more than 70% inland water are polluted (Jiang et al, 2008). At the same time, freshwater resource in China is in shortage. The amount per capita is around quarter of the figure per capita worldwide. In this situation, recirculated aquaculture system (RAS) is a very good choice. RAS is a closed culture system and is characterized by reusing of treated wastewater from system. RAS has the great advantage to discharge very small amount of water to environment while the consumptive use of culture water is very low. In the Netherlands RAS has been a very mature technique but in China it is still a very new concept. It will be a good opportunity to consider building RAS with technique from Dutch. The main challenge of the program would be however that the costs of production are quite high compared with the traditional farming methods.

To introduce the good variety of China mitten crab from the Netherlands back to China is a market with good prospects. It is reported that China mitten crab was introduced into the Netherlands in 1930s by ship accidentally. The variety of the crab in the Netherlands maintains very pure while in China the variety has degenerated. The mitten crab market in China is huge and the price of the product is quite high. Some people have delivered small amounts of river crab from the Netherlands as brood stock and obtained good sales.

Though there are some huge scale companies in feed industry, the management system is not advanced yet, while the demand for reliable and good quality feed is increasing. Investments in the feed industry can therefore be considered.

Though the export amount of aquatic products of China is quite considerable, big percentage of exported products is only primarily processed. Recently more and more foreign buyers are interested in value-added products. As a result, many processors begin to consider buying equipments like auto-breaded machine, frying machine etc. Dutch companies involved in the processing machines business should therefore seriously explore how to benefit from this development.
7. SWOT Analysis and Conclusion

7.1 SWOT Analysis

**Strengths**
- Low labor cost
- Favorable geography for farming a wide range of species
- Strong government support

Low labor cost: Though the labor cost keep increasing worldwide, the labor costs in China are still very low comparing to the developed countries. Especially considering exporting products produced in China, cost efficiencies is obviously can be found.

Geographically diverse: The big size of China makes it has geographically suitable places for aquaculture, whether in tropical or more temperate and even frigid zones. The types of waters include sea, freshwater lake, and brine lakes in China, so there are so many different aquatic species may be farmed.

Government’s support in the 11th 5 year plan: In 11th 5 year plan, the government pays more attention to the development of agriculture including fisheries. Many policies and financial support are given to further develop the agriculture and to promote further investments.

**Weaknesses**
- Food quality and food safety
- Transportation
- Lack of technology

Food quality and food safety: Food quality and safety is a serious issue in aquaculture as well as in the whole food industry in China. Chemicals and antibiotics have been detected in some aquatic products in the recent past years. This issue is also high on the agenda of the central government and as such it can be assumed that much still will happen in this area, as without clear guarantees on the food quality and safety of the products, further expansion in this growing market will be seriously inhibited.

Transportation: The aquatic products are perishable and must be kept in the circumstance of low temperature. Especially for the domestic market, the people have the habit to buy fish alive instead of processed. It increases the cost and difficulty of transportation and in this area, there are many things still can be improved.

Lack of technology: Though the aquaculture has very fast growth in past decades, many of them are based on resource consumption with low technique level. Low technology causes low productivity. At the same time, the low technology causes the waste of resources.

**Opportunities**
- Growing domestic market due to rising incomes
- Introduction of new species
- Demand for processed and frozen products

Growing domestic market: With the people's incomes increasing, the lifestyle of the people changes. The people would like to eat more healthy food. Aquatic product is called white meat by Chinese, and is considered to be healthier than red meat. Seafood is considered as a real delicacy food by the Chinese people although it is usually rather expensive, however, as the incomes are rising in China, it can be expected that seafood consumption will also continue to increase.

Introduction of new species: According to the favorable geographic conditions and more demand for seafood in general, big opportunities lies in introducing new species in China either for the domestic or the international market. Especially when looking at that China is also importing more and more seafood that they do not have themselves.

Demand for processed and frozen products: Currently, Chinese customers like to buy alive or fresh products. But if this kind of products can not be sold soon, they are easily perished and need to be thrown away. With the lifestyles and the daily working life are changing, there is an ongoing trend of people want to have more processed, but healthy and easy to cook food in the future.

**Threats**
- Food safety issues
- Increasing labor costs
- Disease of the cultured species
- Degeneration of variety
- Pollution of culture area

Food Safety issues: If the government can’t find a really efficient system to ensure the food safety, and can not re-establish the food safety reputation of Chinese food in international market The Chinese may lose the trust of consumers abroad.

Increasing labor costs: The labor costs in general have been increasing in recent years. Aquaculture is a rather labor intensive industry; if the labor costs keep increasing and get too high, the Chinese product will lose price advantage on the international market.

Disease occurring: The intensive culture gets more popular in China as the productivity can be improved through this method. On the other hand, the occurrence of diseases are more frequent, and more and more new
diseases appeared. The diseases have become the threat for intensive culture in China.

Degeneration of variety: With the intensive culture and contamination of the different variety, many good varieties have been found degenerating year on year. Degeneration of the variety causes the decreasing of anti-resistance ability, high death rate and less value in nutrient, etc.

Pollution of culture area: While China's industry has developed very fast, many water systems have been polluted by the industrial wastewater. The polluted water may contain heavy metal, harmful chemicals and does not suitable for aquaculture. If the water quality can't be controlled at a good level, there will be less space to meet the aquaculture standard in the future.

7.2 Conclusion
Aquaculture is a very important industry in China's agricultural development. The industry has grown rapidly in terms of culture area, production and export in recent years. However the food safety and quality issue still remain an inhibiting issue in the industry. In order to really improve all the separate linkages in the whole supply chain, it is need to be critically reviewed starting from the strain, the feed, culture method to processing and transportation etc. The technology and innovation also play important roles closely to solve the problem of how to improve the food quality and safety. Chinese research institutes and bigger companies do not have enough capable to transfer their R&D results in the area of aquaculture, the challenge remains how to disseminate all these technologies to the small farmers who is now still a majority of engaged in aquaculture with not much technological insight.

Another important issue concerns the sustainability of the industry. Much of the expansion of the industry till now has been depenced on depleting natural resources, while pollution in the waters of China caused serious threat to sound aquaculture. New ways of aquaculture and new technologies are therefore not only needed in order to enhance the quality, quantity and safety of the aquatic products, but also much needed to steer the further development of aquaculture in China into a sustainable way, so that the industry can indeed fulfill its promise and provide good products to meet the rising demands both in the domestic as the worldwide marketplace.

It can therefore be concluded that Dutch companies, with its strengths in R&D on water treatment, food quality and safety control, certainly can make valuable contributions to the further development of aquaculture in China.
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List of Leading Companies in China

Company: China National Fisheries Corp.
Address: 9F, Ganjiakou Mansion, NO.21 Sanlihe Road, Haidian District, Beijing
Phone: +86 (10) 68312228
Fax: +86 (535) 88372176
Website: www.cnfc.com.cn
Main business: Ocean Capture, Seafood processing, sale and transportation

Company: Dalian Zhangzidao Fishery Group Co. Ltd.
Address: No.26 Renmin Road, Zhongshan District, Dalian
Phone: +86 (411) 82659666
Fax: +86 (411) 82634187
Website: www.zhangzidao.com
Main business: Culture and trade of scallop, sea cucumber and abalone

Company: Allied Pacific Food (Dalian) Co., Ltd.
Address: 888 Yong Zheng Industrial Area, San Li, Jinzhou District, Dalian
Phone: +86 (411) 87821188
Fax: +86 (411) 87821199
Website: www.alliedpacificfood.com
Main business: Shrimp breeding, culture, processing

Company: Zhanjiang Guolian Aquatic Products Co., Ltd.
Address: No.6 Yongping South Road, Pingle Industry Region, Zhanjiang,
Phone: +86 (759) 3153888
Fax: +86 (759) 3399177
Website: www.gl-fish.com
Main business: Shrimp and tilapia breeding, culture, processing

Address: No.18 Aokema Street, Laishan District, Yantai
Phone: +86 (535) 6729999
Fax: +86 (535) 6729191
Website: www.yt-fishery.com
Main business: Marine culture, Sea food processing, International trade

Company: Shanghai Fisheries General Corporation
Address: No.448 Gongqing Road, Shanghai
Phone: +86 (21) 65686677
Fax: +86 (21) 65692500
Website: www.sfgc.com.cn
Main business: Ocean Capture, Seafood processing and Wholesale, International trade

Company: Beijing Fisheries Corporation
Address: No.42 Yongwai Orchard, Fengtai District, Beijing
Phone: +86 (10) 67213195
Fax: +86 (10) 69012260
Website: www.bjfcg.com
Main business: Ocean fishing, aquatic products processing, fish feed production, storage and transportation

Company: Zhejiang Ocean Fisheries Group Co., Ltd.
Address: 27/F Commercial Center, 11 Qingchun Road, Hangzhou
Phone: +86 (571) 87230057
Fax: +86 (571) 87227956
Website: www.zheyu.cn
Main business: Ocean Capture and Seafood processing

Company: Liancheng Overseas Fishery (Shenzhen) Co., Ltd.
Address: 4203 Landmark Tower, 4028 Jintian Road, Futian District, Shenzhen
Phone: +86 (755) 21513700
Fax: +86 (755) 21513677
Website: www.iszl.cn
Main business: Ocean capture and international trade of aquatic products

Company: Xulong Food Group Co., Ltd.
Address: 568 Economic Development Road, Cixi City, Ningbo
Phone: +86 (574) 63026181
Fax: +86 (574) 63026182
Website: www.cnxulong.com
Main business: Eel cultivating, processing and export
<table>
<thead>
<tr>
<th>Company</th>
<th>Address</th>
<th>Phone</th>
<th>Fax</th>
<th>Website</th>
<th>Main business</th>
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</thead>
<tbody>
<tr>
<td>Rui'an Huasheng Aquatic Products Factory</td>
<td>No.388 Binjiang Road, Rui'an</td>
<td>+86 (577) 65601988</td>
<td>+86 (577) 65601799</td>
<td><a href="http://www.rahssc.com">www.rahssc.com</a></td>
<td>Seafood processing and international trade</td>
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<tr>
<td>Wan'an Aquatic Products Co., Ltd.</td>
<td>Industrial Garden, Wan'an County, Jiangxi Province 343800</td>
<td>+86 (756) 5839613</td>
<td></td>
<td><a href="http://www.wananaquatic.com">www.wananaquatic.com</a></td>
<td>Culture, processing and international trade of aquatic products</td>
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<tr>
<td>Deyan Aquatic Products and Foodstuff Co., Ltd.</td>
<td>No. 6 Refrigeratory, First Xudong Road, Wuhan</td>
<td>+86 (27) 86811662</td>
<td>+86 (27) 86728120</td>
<td><a href="http://www.hhdeyan.com">www.hhdeyan.com</a></td>
<td>Culture, processing and international trade of aquatic products</td>
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<tr>
<td>Homey Group Co., Ltd.</td>
<td>Shazuizi, Hushan town, Rongcheng City, Shandong Province</td>
<td>+86 (631) 7438073</td>
<td></td>
<td><a href="http://www.homely.com.cn">www.homely.com.cn</a></td>
<td>Ocean Capture, culture, processing and trade of aquatic products</td>
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<tr>
<td>Xiamen Tongan Yuanshui Seaproducts Co., Ltd.</td>
<td>No. 599-609, North Second Fangyang Road, Xiang'an District, Xiamen</td>
<td>+86 (592) 7766757</td>
<td>+86 (592) 7083999</td>
<td><a href="http://www.yuanshui.net.cn">www.yuanshui.net.cn</a></td>
<td>Seaproducts freezing, processing and export</td>
</tr>
<tr>
<td>Hainan Quebec Ocean Fisheries Co., Ltd.</td>
<td>Junmin Road, Qinglan Town, Wenchang City, Hainan Province</td>
<td>+86 (898) 63326680</td>
<td>+86 (898) 63326632</td>
<td><a href="http://www.csn.com.cn">www.csn.com.cn</a></td>
<td>Ocean capture, culture and processing of seafood</td>
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<tr>
<td>Tongwei Group Co., Ltd.</td>
<td>High-tech Zone, Chengdu</td>
<td>+86 (28) 85188888</td>
<td>+86 (28) 85199999</td>
<td><a href="http://www.tongwei.com">www.tongwei.com</a></td>
<td>Feed</td>
</tr>
<tr>
<td>Zhengbang Group Co., Ltd.</td>
<td>No.569 Aixihu Road 1, High-tech Development Zone, Nanchang 8 Aaokea Street, Laishan District, Yantai</td>
<td>+86 (791) 6397495</td>
<td>+86 (791) 6397834</td>
<td><a href="http://www.Zhengbang.com">www.Zhengbang.com</a></td>
<td>Feed</td>
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<tr>
<td>Jiangsu Zhengchang Group Co., Ltd.</td>
<td>No.28 Zhengchang Road, Economic &amp; Technical Development Zone, Liyang, Jiangsu</td>
<td>+86 (21) 64188282</td>
<td>+86 (21) 64163299</td>
<td><a href="http://www.Zhengchang.com">www.Zhengchang.com</a></td>
<td>Feed</td>
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<tr>
<td>Coland Holdings Company limited</td>
<td>No.10 Jianshe Road, Economic Development Zone, Fuzhou</td>
<td>+86 (591) 83985747</td>
<td>+86 (591) 83987907</td>
<td><a href="http://www.coland.com.cn">www.coland.com.cn</a></td>
<td>Feed and seafood processing</td>
</tr>
</tbody>
</table>
Company: Zhenghong Science and Technology Co., Ltd
Address: Zhenghong Science and Technology Mansion, Yueyang
Phone: +86 (730) 5728005
Website: www.chinazhjt.com.cn
Main business: Feed

Company: Beijing Challenge Bio-Technology Limited Company
Address: No. 12 Zhongguancun South Street, Haidian District, Beijing
Phone: +86 (10) 62116723
Fax: +86 (10) 62146102
Website: www.challenge.com.cn
Main business: Feed

Company: Nanchang Yabo Industrial Co., Ltd.
Address: No. 398 Fuying Street, Economic & Technology Development Zone, Nanchang
Phone: +86 (791) 3890088
Fax: +86 (791) 3891827
Website: www.ncyabo.cn
Main business: Feed
Information of seafood fairs

China Fisheries & Seafood Expo
Time: Nov. 3rd-5th, 2009
Place: Qingdao International Convention Center
Phone: +86 (10) 58672620
Website: www.seafarechina.com

Guangzhou International Fishery Expo
Time: Sep. 4th-7th, 2009
Place: Liuhua Exhibition Center, China Import and Export Fair
Phone: +86 (20) 62859326
Website: www.anboshow.cn

Shanghai International Fisheries & Seafood Exposition
Time: Dec. 9th-12th, 2009
Place: Shanghai Guangda Convention Center
Phone: +86 (21) 37821132
Website: www.sifse.com

Fuzhou International Fishery Expo
Time: Sep. 19th-21st, 2009
Place: Fuzhou International Convention Center
Phone: +86 (592) 5078295
Website: www.fishexpo.cn

Taizhou International Fishery Expo
Time: Sep. 2nd-4th, 2009
Place: Taizhou International Convention Center
Phone: +86 (20) 38358081

China Green Food Expo
Time: Oct. 15th-18th, 2009
Place: Nanchang International Convention Center
Phone: +86 (791) 6202823
Website: www.cgfexpo.com

Natural Plant Feed Additive Application Communication Fair
Time: August, 2009
Place: Beijing
Phone: +86 (10) 62135097