

TROMSØ BUSINESS SCHOOL, UNIVERSITY OF TROMSØ

# Final Report

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FHF-prosjektet: Produksjon i Kina: Faktorer som påvirker markeder for hvitfisk  
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## *Sammendrag*

The purpose of this project is to analyze the role of China in the global supply chain for whitefish. Special attentions are placed to the global trade flow of whitefish via China, the development of the whitefish processing industry in China, the Chinese domestic demand for imported whitefish, market impact of Chinese products in the European markets, and Brazil as a market for klippfish.

Both quantitative and qualitative methods are applied in the analysis. More advanced econometric modeling is used to estimate the impacts of increasing processing cost and the growing fish quota on the Chinese whitefish processing industry. To better understand the development in China, EU and Brazil, intensive surveys and interviews were conducted in these countries.

The project finds that the Chinese processing industry is facing a big challenge. In the short time between 2011 and 2013, slow demand in the consumption market (i.e., the EU and the USA) made the industry struggle economically. But in the long term, growth of wage cost by about 20% per year will evidently make the industry less competitive. Moreover, the appreciation of the Chinese currency makes Chinese products much more expensive. Efficiency and flexibility of the industry and a good infrastructure in China might compensate the loss of a comparative advantage of cheap labor in the short run; however, some other countries, such as Poland, or Vietnam might substitute the role of China in long run. Norway is still too expensive to process fillets, compared to China.

Pollock from Russia is the main raw fish used to process frozen fillets in China. Norwegian exports of cod to China have greatly increased due to the growth of the cod quota in 2013. USA and the EU are conventionally destination markets for frozen fillets from China. These markets had huge problems during 2011 and 2012. However, demands have been recovering in 2013, particularly in the latter half of the year. The Chinese industry has been expanding the Brazilian market, the African market, and the domestic market as well. The Brazilian market is not only important for klippfish, but also for frozen fillets processed by China.

Along with the significantly growth of Chinas economy, a huge group of middle-class people is looking for high quality seafood. The new concepts such as safety and high quality, environmental friendly, ecological, easy to prepare and to provide good customer service, has become popular in China. At the same time, Norwegian cod perfectly matches these new concepts. New fish shops and special fish counters in big supermarkets are in an increasing rate going to sell good quality whitefish products imported from abroad. We therefore suggest the Norwegian industry explore the Chinese market by co-operating with local businessmen.

As a by-product, we find that there is a problem of miscoding of fish species in both the Chinese and Russian data. Russian data is less reliable than Chinese data. The exports of pollock and cod from Russia were far less reported in the Russian statistics. However, in general, the reliability of data from these countries has been much improved in recent years.

## ***Innledning***

China is currently the world's largest seafood producer. Except for farmed carps for domestic consumption, and tilapia and catfish for exports mainly to the USA, a large portion of production is processing of whitefish for exports. Since 1995, through the development of the free trade zone, China became the main global processing center of wild-caught whitefish. The processing industry has been growing significantly since 2000. However, in recent years, the whole industry has been facing a big challenge. These challenges include appreciation of the Chinese currency, growth of laborers' wage, and the Economic Crisis in 2008. Several companies survived between 2008 and 2011 due to accumulated capital and profit; however, between 2011 and 2012, lots of small companies collapsed.

China has a high consumption level of seafood, especially in the coastal areas. With the growing economy, demand for seafood is expected to grow steadily in the future. Although a large part of this growth will come from domestic aquaculture, some will come from imports. Norwegian seafood meets the demands of middle-class people for safe and quality food very well.

Norway is a supplier of raw fish for the Chinese processing industry and domestic demand, and is a competitor of Chinese processed products in the EU and Brazil as well. The development of the Chinese processing industry and the Chinese markets are thus important for the Norwegian whitefish industry. Therefore the main purpose of this project was to investigate what happened in China, both for whitefish processing and domestic consumption, the competition of Chinese frozen fillets in the EU (*e.g.*, England and France), and what happened in the Brazilian market. These findings are important to the Norwegian whitefish industry to position its role in the world whitefish trade.

Our project team includes Professor Øystein Myrland and Associate Professor, Jinghua Xie, both from University of Tromsø, Professor Jingtian Gao and Professor Jingmei Li from China Ocean University, and Professor Jian Gao from Shanghai Ocean University, China. They are responsible for working packages 1 to 4 and 6. Researcher Finn-Arne Egeness from Nofima AS is responsible for package 5. The members of project board were: Svein Ove Haugland from Norges Råfisklag, Terje Kjølåsøy from Ålesundfisk AS, Olav Holst-Dyrnes from Aker Seafoods ASA, Rolf Domstein from Domstein ASA, Arnt Olav Aarseth from Brødrene Aarseth AS, Odd-Arild Sperre from Nils Sperre AS, and Kyrre Dale from Nordea Bank AS. There were also two observers, Jan Trollvik and Ove Johansen, both from Norges Sjømatråd. In addition, Zuoyou Liu from Hongfu group Co., Ltd, Qingdao and Yichan Gao from Xiyuan Frozen Food, Co., Ltd. Qingdao have been involved throughout our project work.

## ***Problemstilling og formål***

In the four reports submitted on the project, we have covered all the research questions listed in the project proposal. The report "Kinesisk produksjon av fryste

filetprodukter av torsk” analyzed the growing exports of the Chinese processed double frozen fillets in the EU markets and their impacts on the Norwegian fillet industry; The report “Whitefish Processing in China” analyzed the industry processing capacity, cost structure, logistics, product additives, product forms, imports of raw fish and exports of domestically caught products; The report “Klippfisk i Brasil” analyzed the challenges of new products from Portugal and China to the Norwegian products; the report “Whitefish Consumption in China” analyzed the current situation of whitefish demand in the Chinese market, the development of the Chinese economy and its impact on whitefish consumption in the coming years. The final report analyzed the trade flow of whitefish via China, cost differences of processing fillets in the Norwegian and Chinese industry, possible new processing countries instead of China, effects of increasing processing cost in China and the growing fish quota on the world whitefish trade, at same time as we updated with new information in 2013.

Considering the consumption of whitefish in China, new fish shop chain called “One Hundred Meter” has been rapidly extended from 40 shops in Qingdao in July 2013, to 15 shops in Shanghai in a couple of months. These chain shops were established by a CEO of a processing company who we have been in contact with for many years. In the shops, only seafood imported from the Arctic areas are sold. It will be very interesting to follow the development of these shops in the future. Particularly in terms of what consumer segment they attract, and purchasing behavior in terms of buying Norwegian fish.

The findings in this project are important for the Norwegian whitefish industry. Considering the rise of Chinese processing cost by around 10-20% a year, the industry may have to face increased competition from countries such as Poland or Vietnam, or to produce more value-added products in China. On the other hand, China has a huge potential market for high-quality Norwegian whitefish. The question is how to co-operate with local businessmen to have Norway as a preferred brand.

### ***Prosjektgjennomføring***

Both qualitative and quantitative methods were used in the project. The import and export data used in the analysis were provided by Norges Sjømatråd. Chinese statistics on seafood processing, macroeconomic development and seafood consumption were collected from the Chinese official statistics records. These were the Chinese Fishery Statistical Yearbook, Chinese Yearly Book of Economy, Yangtze River Delta Yearly Book, Chinese Statistics Yearly Book of Regional Economy, Yearly Book of Shanghai Economy, and Chinese Business Affairs Yearly Book. The data for processing cost were collected through our field work.

The secondary data of the processing and market information in China, Brazil, Great Britain and France were collected by intensive surveys and interviews. Advanced econometric modeling were used to estimate the impact of rising

processing cost and the growing fish quota on the world whitefish trade.

The project requested Professor Jintian Gao, Professor Jingmei Li and their master students from China Ocean University to conduct surveys and interviews with the whitefish processing industry in Qingdao and the Dalian areas. More than 20 companies were visited. Among them, the project has kept very close contact with CEO Yichuan Gao from Xiyuan Frozen Food, Co., Ltd., and manager Zuoyou Liu from Hongfu group Co., Ltd. These two industry CEO's have been involved throughout the project and has provided immediate new information on what was happening in China. The project has also asked Professor Jian Gao and his PhD and master students to investigate the domestic demand for whitefish in China. They investigated 4 representative cities in China.

To ensure the validity of our findings, and also to help the Norwegian industry and the Chinese industry to have a dialog between each other, the project has organized three workshops, one in July 2012 in Qingdao, and one in June 2013 in Shanghai and another in October 2013 in Tromsø. Researchers, board members and observers, CEO's and managers from the Chinese industry, the Norwegian industry and supermarkets, whole sales companies were all invited. The delegation visited local industry, supermarkets and some organizations. We believe an open and good discussion in these workshops provided a very good platform for the attendants to get valuable information from.

Two observers, Jan Trollvik and Ove Johansen from the Norwegian Seafood Council have helped us to keep a close contact with the Norwegian industry, and to get all the trade data we needed. We think the project has finished its planned tasks. The members in the project organization have had very good communication between each other. The finding of the project should be valuable to the Norwegian industry.

### ***Oppnådde resultater, konklusjon***

The project finds that pollock from Russia is the dominant raw fish for frozen fillet processing in China. According to data in 2012, pollock (lyr), cod (torsk), haddock (hyse) and coalfish (sei) accounted for 56%, 13%, 4% and 1% of the total Chinese imports of whitefish, respectively. Russia, USA, Norway and Japan had a share of 76%, 8%, 7% and 6%, respectively. Some 14% of cod and 80% of haddock were from Norway, which resulted in 7% of the Norwegian share in the total Chinese imports of raw fish. The Norwegian cod is generally 2-3 NOK/kg more expensive than that from other resources. At the same time, the Chinese industry thinks the quality of cod from Norway is higher compared to that from Russia.

The EU and the US are the most important consumption markets for Chinese processed products. According to the data between 2008 and 2012, the EU and USA accounted for 63% and 28% of total Chinese exports. The Brazilian market is growing, having a share of 4% now. Brazil is not only the most important market for the Chinese processed klippfisk, but also has become more important for frozen



fillets. We found that China is expanding the Brazilian market by selling cheap and low quality frozen pollack fillets. The export price of frozen pollock fillets to Brazil was 4-5 NOK/kg lower than that to the EU market.

On average it takes the Chinese industry half a year from importing raw fish to exporting the processed products. It takes 15-30 days to import raw fish from source countries, 15 days for imports from Russia and 30 days for imports from Norway. The industry normally order raw fish 3-5 months before processing, and keep the processed products in storage for 1-2 months, depending on market conditions.

In general, the Chinese processing industry has a problem of overcapacity and is facing big challenges. Starting in 2011, small companies have begun to collapse. In 2012 the industry gained around \$100-200/ton to process cod fillet, and lost \$200-300/ton to process pollock fillet. In 2013, the situation was much better. Although the industry still lost around \$150/ton for processing pollock, industry became much more active with more orders from consumption markets.

We found that the total processing cost was \$1010-1060 in 2012, which included \$105 for electricity, \$490 for wages, \$25 for quality control and management, \$60 for low-value consumables, \$80 for depreciation, and \$200-250 for transportation and custom control. Among these, wage was the largest cost component. It accounted for 49% of the total cost. The main comparative advantage of the Chinese whitefish processing industry is cheap mass labor. This makes it possible for the industry to use manual filleting instead of machine filleting. The yield rate of manual filleting is around 65-70%, much higher than that of machine filleting. However, this advantage is now facing a big challenge when the labor wage and welfare cost for the labor has increased by some 20-30% annually in the last years.

We calculated the total costs of processing cod fillets in Norway using local raw material and exporting it to the EU, and compared this to the total costs of processing cod fillets in China using raw material imported from Norway and re-exporting it to the EU. Our results suggest that it is still too expensive to produce fillets in Norway compared to China. According to the data in March 2013, the total cost for the Norwegian industry was 35.92 NOK/kg, while it was 27.30 NOK/kg for the Chinese industry. The difference of 8.62 NOK/kg is explained by a higher yield rate of manual filleting and cheaper labor cost. An important finding is that this cost difference is almost equal to the price premium the Norwegian seafood industry is able to get in the market. The price difference is mainly because Norwegian industry delivers single frozen products compared to double frozen products from China.

The Chinese domestic demand for whitefish products is currently relatively small and there are market problems. The names used for codfish are ambiguous. Consumers do not know the exact species they are buying. Most codfish currently sold in the Chinese market is actually Alaska pollock. However, with the growing of the Chinese economy, there is a huge potential demand for high quality whitefish products. Examples we found are special counters in big supermarkets and new fish

shops only selling seafood from abroad. Chinese consumers generally believe that foreign products are much safer than domestic products. Food safety is a key issue in China nowadays as a result of frequent food scandals and people's increased sensitivity to this issue. Of vital importance is how the Norwegian industry is able to cooperate with local businessmen to explore the Chinese market together. Salmon from Norway is a significant brand in the Chinese market. It should be possible to have a brand of Atlantic cod from Norway in the near future.

The estimated results of the econometric modeling suggest that if Chinese processing cost increases by 10%, it will raise export price of frozen fillets by 2.1%, and reduce the world demand for frozen fillets by 3.1%. This on the other hand will reduce the total world demand for raw whitefish by 2.3% and price of raw fish by 2.8%.

The role of Norway in the global whitefish industry is complex. Norway is both a raw fish supplier for the Chinese whitefish industry and a competitor with the Chinese products in the EU and Brazilian market. As a raw fish supplier, when the Chinese industry is facing growing costs, the Norwegian industry has to look towards competitive production markets such as Poland or Vietnam. The Chinese cost level still has a comparative advantage in the short run and the loss of advantage might be compensated by increased efficiency and flexibility of the industry. However if wage cost keep increasing, it is unavoidable that China will become too expensive to keep the position of the world's processing center. Our results show that Norway is still too expensive to produce fillets; however Poland could be a substitute producer to China. Poland doesn't only have a lower labor costs, it also has a greater flexibility, both toward sourcing input and proximity to the EU market. They can use both fresh and frozen raw material and sell fresh, frozen and thawed products in the end market. This competitive advantage is created because they are located close to both the raw materials and the consumer market.

China is a growing competitor in the Brazilian market because the market wants more value added products, which traditionally have high labor cost than the traditional dried and salted Norwegian "Bacalhau". The demand for more value added bacalhau-products in the market indicates an increasing competition from Chinese industry in the future.

### ***Leveranser***

The project has completed all the presentations, reports and paper stated in the application. To better communicate the knowledge of the project findings, we submitted one additional report to sum up the findings in each working packages and also update the information in the reports submitted earlier. The followings are the details of the submissions.

The project findings have been presented in several conferences and meetings. These where: 8/2012: Nor-Fishing, Trondheim; 8/2012: Matfestivalen i Ålesund; 9/2012: FHF, Faggruppe Hvitfisk Filet, Gardermoen; 10/2012: Global Pelagic Forum,

Istanbul; 10/2012: FHF Faggruppe Konvensjonell, Tromsø; 11/2012: Torskefiskkonferansen, Tromsø; 11/2012: Havbrukskonferansen, Oslo; 12/2012: Styremøte; 03/13 FHF Faggruppe Hvitfisk Filet, Gardermoen; 10/2013: Torskefiskkonferansen, Tromsø; and 10/2013: Styre-møte, Tromsø.

Five reports have been submitted to FHF. These are “Kinesisk produksjon av fryste filetprodukter av torsk”, “Klippfisk i Brasil”, “Whitefish Processing in China”, “Whitefish Consumption in China” and this final report. Four articles and papers were published. These are: “Hvem skal produsere fryste torskefileter?” and “Norsk klippfisk taper markedsandeler i Brazil” in Norsk sjømat, “Økt konkurranse for klippfisk av sei i Brasil” in Matindustrien, “Norsk klippfisk taper terreng i Brasil” in Sunnmøresposten and “What determines China’s re-export in the future”, submitted to the academic journal called Journal of Policy Modeling. There were also a couple of newspaper articles.

Three workshops have been arranged. One in Qingdao in July 2012, one in Shanghai in June 2013, and a final one in Tromsø in October 2013.

### ***Kvalitetssikring av prosjektgjennomføring og resultater***

We think the official statistical data, the extensive surveys and interviews helped us to get reliable data. This methodological approach, where we have used multiple methods to study the same phenomena is called triangulation. Since no statistical data are available regarding the domestic Chinese consumption of whitefish, these quantities were estimated based on our market investigations. For this, we have widely discussed this in the submitted reports.

Extensive discussions in the workshops, board meetings and presentations in various conferences have well ensured the validity of the project findings. The articles and journal papers that are submitted to peer-review journals is currently in review and in a publishing process.

## **1. World trade flow of whitefish via China<sup>1</sup>**

China is the world key driver of the seafood industry. It has been the world most important exporter supplying the EU, the USA and Japanese markets since the end of 1990s. However, except for tilapia, shrimp and shellfish, most of the Chinese exports are whitefish fillets based on the raw fish imported from main resource countries including Russia, Norway, Iceland and the USA.

The Chinese statistics have improved since 2012. Specifically, in the import data, Alaska pollock was first time specified; before, it was put together within a large category called other fish. In the export data, the species of the white fish frozen fillets have been specified; before, they were called frozen fillet in general. To keep the statistic terms consistent, we analyze trade flow using the data between 1998 and 2011, and add more information using data 2012 and 2013 later on. All the data used in this section are from the Norwegian Seafood Council (NSC), otherwise noted.

Figure 1 shows that a structural change happened in the year 2000. The Chinese imports were doubled from 625 thousand tons to 1.25 million tons in just one year. They were again doubled from 1.25 million tons to 2.73 million tons, with an average annual growth rate of 8% in the next 10 years between 2000 and 2011. However, the imports decreased by 6.6% in 2012. The total amount in 2012 was 2.55 million tons. Except for pelagic fish, the imports of all the other seafood which were used as raw fish for processing decreased in 2012. This was greatly due to the difficult situation of the Chinese processing that we found in this project<sup>2</sup>: As a result of the Economic Crisis, the Chinese processing industry had many less orders from the main consumption market, i.e. the US and the EU; wage costs in China increased by 20-30% annually; Chinese currency has significantly appreciated in recent years. For instance, the exchange rate of the US dollar against the Chinese currency (RMB) increased from about 1:8 in the year 2006 to 1:6 these days.

### ***1.1 Main seafood categories imported by China***

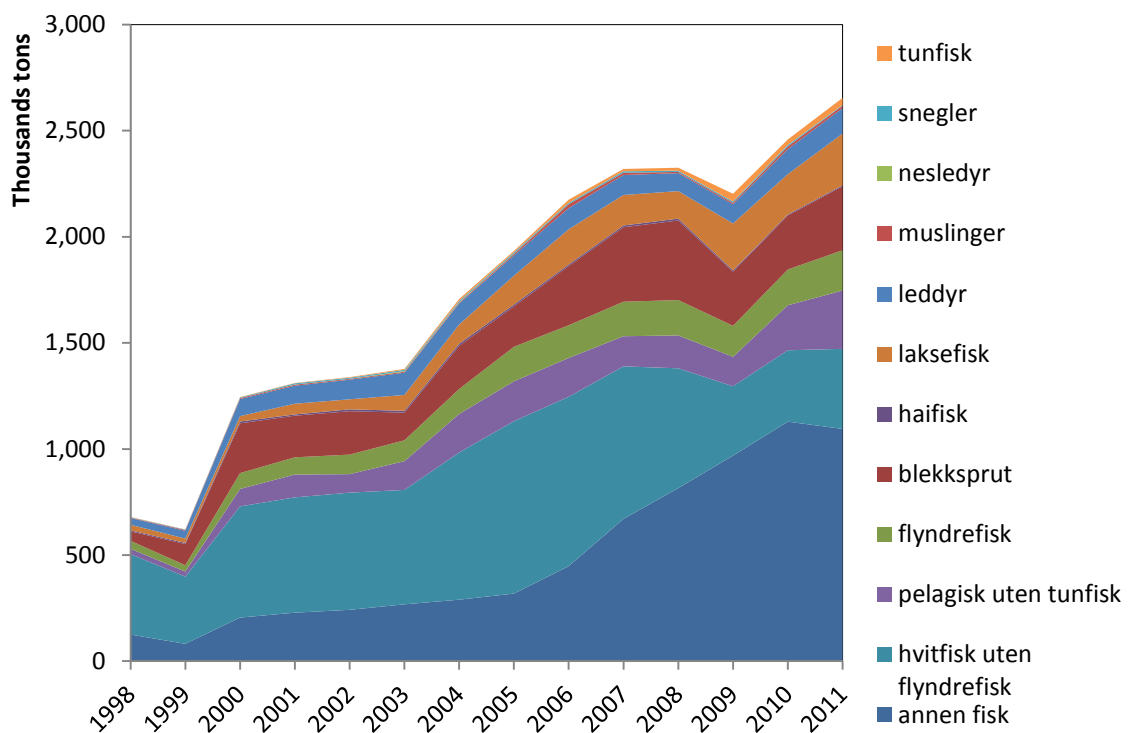
The main seafood categories imported by China are whitefish without flounder (torsk, hyse, sei, hysing, and so on), other fish, Octopus (blekksprut) and pelagic fish. They accounted for 31%, 28%, 13% and 8% of the total Chinese imports respectively between 1998 and 2011 (table 1). Except for Octopus, the above mentioned seafood categories are mainly imports for the purpose of processing and re-exports. Therefore, we conclude that the total Chinese imports of raw fish for processing account for around 67% of the total Chinese seafood imports.

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<sup>1</sup> All the data in Section 1 were provided by the Norwegian Seafood Council (NSC). The data used in Section 1.1 and 1.3 are the Chinese data. Here the Chinese data mean the data reported country is China. The data used from Section 1.4 to 1.8 are the export data reported by the export countries to China or import data reported by the import countries from China.

<sup>2</sup> For the detail, see Section 2 or a separate report on Chinese whitefish processing early submitted

Both figure 1 and table 1 show that there was a significant expansion of other fish and a deduction of whitefish imports between 1998 and 2011. Imports of other fish increased from 18% to 41%, and imports of whitefish without flounder decreased from 56% to 14%. As we mentioned earlier, Alaska Pollock was first time specified under the category of the white fish without flounder in the data of 2012. As a result, the import amounts of white fish without flounder increased from 579 thousand tons to 1,168 thousand tons and other fish decreased from 1,099 thousand tons to 286 thousand tons between 2011 and 2012. Furthermore, figure 2 shows that more than 50% of other fish between 1998 and 2011 was from Russia, some from the USA, Japan and other countries. As we know, Russia is the dominant supplier of Alaska pollock to China. Therefore, we suspect around 55% of other fish before 2012 was actually Alaska pollock. The tremendous expansion of other fish and a deduction of whitefish imports between 1998 and 2011, therefore, suggest that the Chinese industry used much more Alaska pollock as raw fish substitute of cod and haddock.



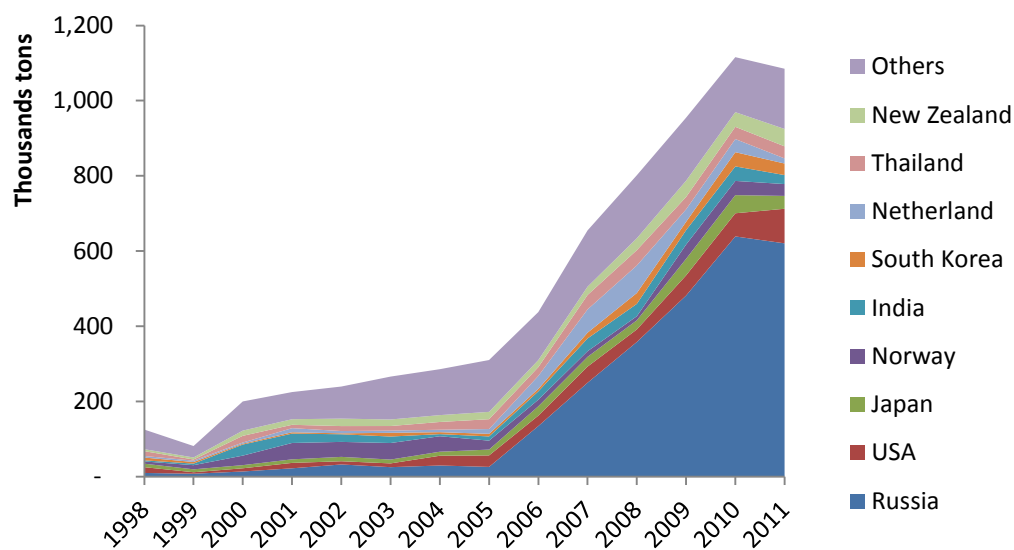
**Figure 1 Chinese imports of main seafood categories (amounts)**

Source: Data provided by the Norwegian Seafood Council (NSC)

**Table 1 Chinese imports of main seafood categories (percentages)**

Year	Hvitfisk uten flyndrefisk	Annen fisk	Blekk sprut	Pelagisk uten tunfisk	Laksefisk	Leddyr	Others
1998	56%	18%	7%	4%	4%	5%	7%
1999	51%	13%	16%	4%	3%	6%	7%
2000	42%	16%	19%	7%	2%	6%	7%
2001	41%	17%	15%	8%	4%	6%	8%
2002	41%	18%	15%	7%	4%	7%	8%
2003	39%	19%	9%	10%	5%	8%	9%
2004	41%	17%	12%	11%	5%	6%	9%
2005	42%	16%	10%	10%	7%	5%	10%
2006	37%	21%	13%	8%	8%	5%	9%
2007	31%	29%	15%	6%	6%	4%	9%
2008	24%	35%	16%	7%	6%	4%	9%
2009	15%	44%	12%	6%	10%	4%	9%
2010	14%	46%	10%	9%	8%	5%	9%
2011	14%	41%	11%	10%	9%	5%	9%
<b>Total</b>	<b>31%</b>	<b>28%</b>	<b>13%</b>	<b>8%</b>	<b>6%</b>	<b>5%</b>	<b>9%</b>

Source: Data provided by the Norwegian Seafood Council (NSC)

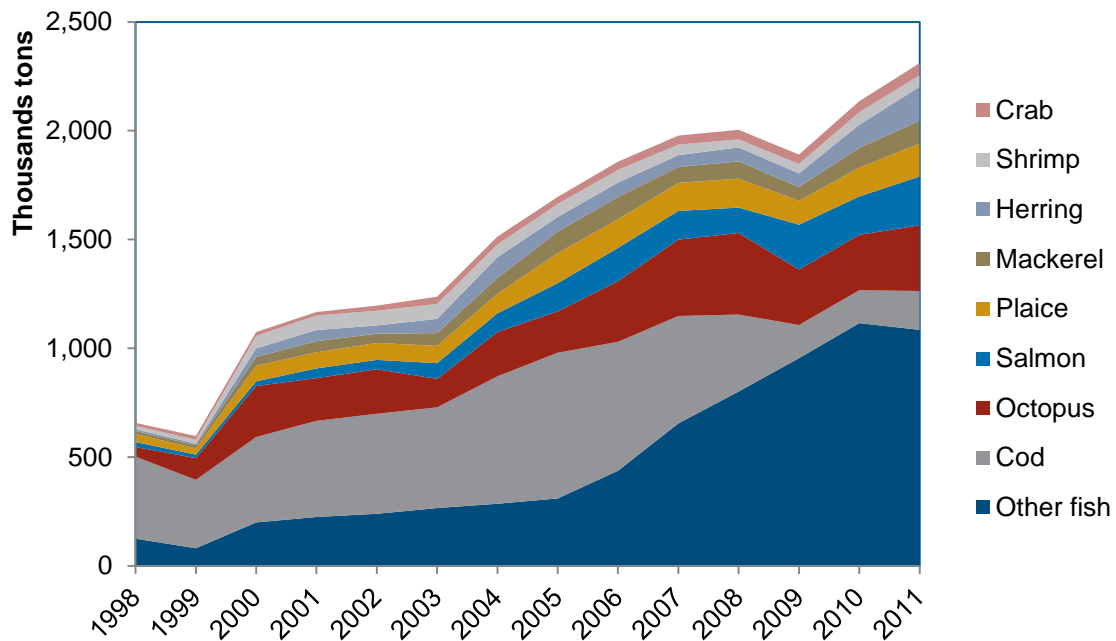


**Figure 2 Chinese imports of other fish**

Source: Data provided by the Norwegian Seafood Council (NSC)

## 1.2 Main seafood species imported by China

To dig into a deeper analysis, we further look at the main species imported by China. Similar to what we have found in the above section, both figure 2 and table 2 show that between 1998 and 2011, other fish, which we concluded that 55% of these were Alaska pollock, expanded tremendously, accounting for 32% of the total Chinese imports. Cod was the second important species imported by China, accounting for 26% of the total imports, although its share had been taking gradually by Alaska pollock. Octopus accounted for 15%; Salmon accounted for 7%, which included the growing import demands for domestic consumption and processing of frozen salmon fillets in China. Mackerel and herring, which are under category of pelagic without tunfisk had share of 5% and 7%, respectively. Shrimp and crab, mainly for domestic consumption, had 2% either.



**Figure 3 Chinese imports of main species (amounts)**

Source: Data provided by the Norwegian Seafood Council (NSC)

**Table 2 Chinese imports of main seafood species (percentages)**

Year	Other fish	Cod	Octopus	Salmon	Plaice	Mackerel	Herring	Shrimp	Crab	Total
1998	19%	57%	7%	3%	6%	2%	1%	2%	2%	100%
1999	14%	53%	17%	3%	5%	2%	1%	3%	3%	100%
2000	19%	37%	22%	2%	7%	4%	4%	5%	2%	100%
2001	19%	38%	17%	4%	6%	4%	4%	6%	1%	100%
2002	20%	38%	17%	4%	7%	4%	3%	6%	2%	100%
2003	21%	37%	11%	6%	6%	5%	5%	6%	3%	100%
2004	19%	39%	13%	6%	6%	5%	6%	4%	2%	100%
2005	18%	39%	11%	8%	8%	6%	4%	4%	2%	100%
2006	24%	32%	15%	8%	7%	5%	4%	3%	2%	100%
2007	33%	25%	18%	7%	7%	4%	3%	2%	2%	100%
2008	40%	18%	19%	6%	7%	4%	3%	2%	2%	100%
2009	50%	8%	13%	11%	6%	3%	3%	2%	2%	100%
2010	52%	7%	12%	8%	6%	4%	5%	3%	2%	100%
2011	47%	8%	13%	10%	7%	5%	7%	2%	2%	100%
<b>Total</b>	<b>32%</b>	<b>26%</b>	<b>15%</b>	<b>7%</b>	<b>6%</b>	<b>4%</b>	<b>4%</b>	<b>3%</b>	<b>2%</b>	<b>100%</b>

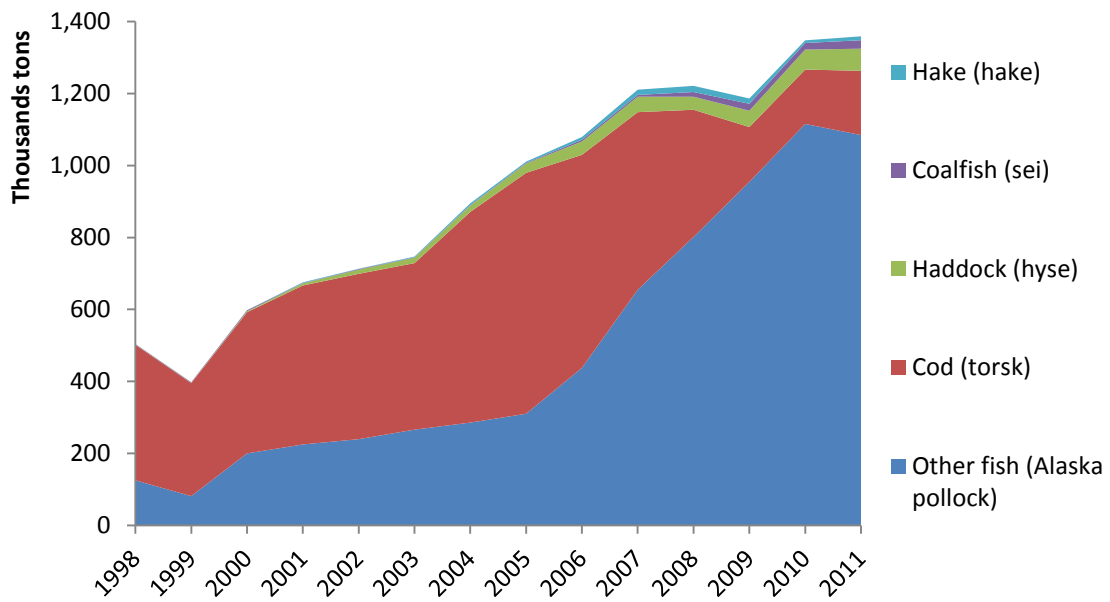
Source: Data provided by the Norwegian Seafood Council (NSC)

### ***1.3 Main whitefish species imported by China***

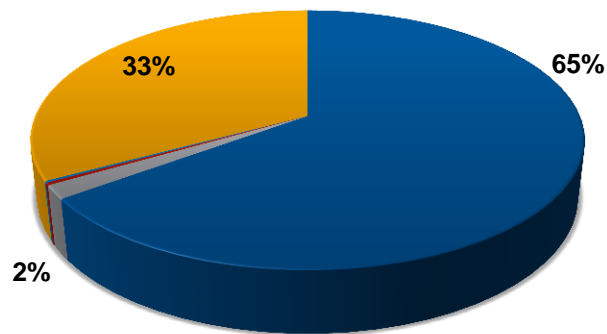
The white fish species, which include pollock, cod, haddock, coalfish and hake, are the main raw fish for processing in China, and also the main fish species exported from Norway to China, except for salmon. Therefore, they are the focus of our project. Figure 4 presents the Chinese imports of main whitefish species between 1998 and 2011. Here, as we analyzed, around 55% of the other fish was Alaska pollock, not all of them.

During the period, Alaska pollock and cod are the main species imported by China for processing and re-export. The imports of Alaska pollock increased significantly since 2005. It resulted in the relatively changes in shares of Alaska pollock and cod. Between 2000 and 2005, the share of cod was 65% (figure 5), compared to 26% between 2006 and 2011 (figure 6). On the contrary, the share of other fish increased from 33% to 68%. However, we suspect some of cod imports were miscoded as Alaska pollock, since if we look at the import data of main consumption markets (e.g., the USA and the EU) for Chinese processed products, we found their imports of cod products from China slightly increased, instead of big decline indicated here between 2006 and 2011. We will discuss this problem further later on.



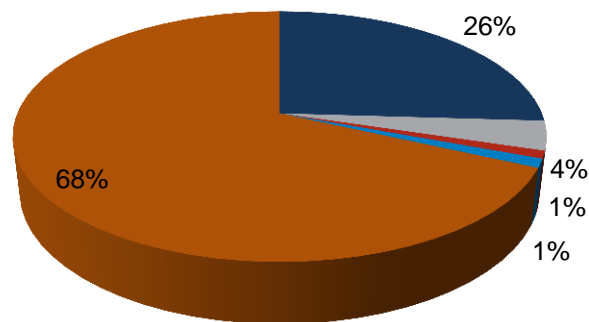


**Figure 4 Chinese imports of main white fish species**  
 Source: Data provided by the Norwegian Seafood Council (NSC)



■ Cod (torsk) ■ Haddock (hyse) ■ Hake (hake) ■ Coalfish (sei) ■ Other fish (Alaska Pollock)

**Figure 5 Chinese imports of white fish (2000-2005)**  
 Source: Data provided by the Norwegian Seafood Council (NSC)



■ Cod (torsk) ■ Haddock (hyse) ■ Hake (hake) ■ Coalfish (sei) ■ Other fish (Alaska Pollock)

**Figure 6 Chinese imports of white fish (2006-2011)**

Source: Data provided by the Norwegian Seafood Council (NSC)

As we mentioned, we can get the exact amount of pollock imported by China first time in 2012. Table 3 presented that the total imports of pollock was around 651 thousand tons, accounting for 56% of the total Chinese white fish imports in 2012. Imports of cod were 156 thousand tons, 13% of total whitefish imports. Haddock, coalfish, and hake accounted for 4%, 1% and 1%, respectively. Compared to that in 2011, the imports of cod, haddock, coalfish and hake all decreased significantly, by 13%, 19%, 49% and 9%, respectively. As we stated earlier, this was due to the difficult situation of the whitefish processing industry in China.

**Table 3 Chinese imports of main white fish species 2012 vs. 2011**

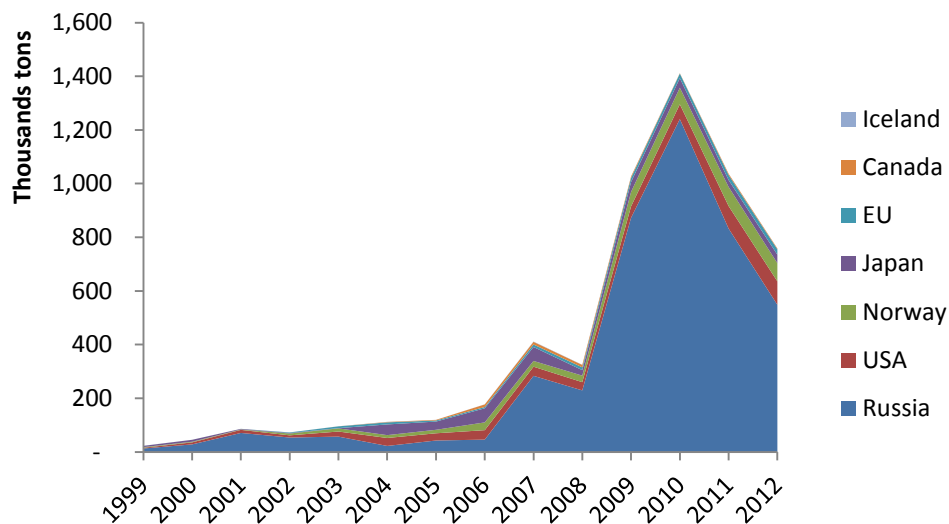
	2012		Growth rate	2011
	Import amount (tons)	Shares		Import amount (tons)
Pollack (lyr)	650,974	56%		
Torsk	156,119	13%	-13%	178,508
Trådstjert	62,194	5%	-36%	97,376
Hyse	50,009	4%	-19%	61,596
Andre torskefisker	36,654	3%		
Sei	11,893	1%	-49%	23,512
Hake (lysing)	9,825	1%	-9%	10,842
Other	190,653	16%	-8%	207,418
Total	1,168,322	100%		

Source: Data provided by the Norwegian Seafood Council (NSC)

### 1.4 Main whitefish exporting countries to China

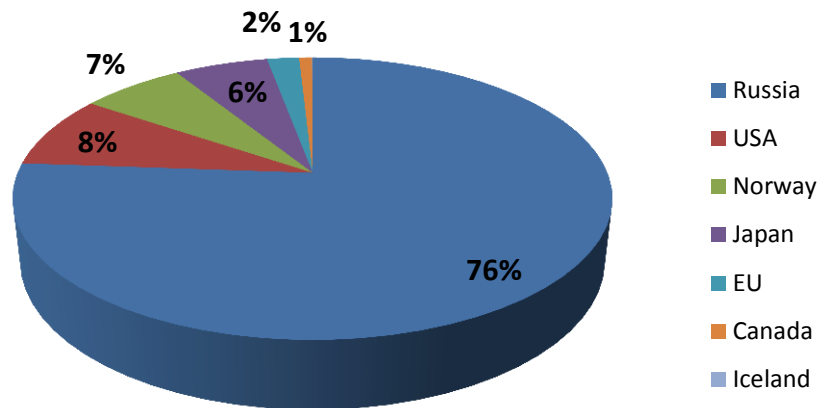
Russia, Norway, USA and Japan are the main resource countries of the white fish exporting to China. Since the Chinese reported data are widely suspected to have problems of miscoding or other problems, here we use the export data reported by these exporting countries. The reliability of the data will be further discussed in Section 1.7.

Both Figure 7 and Figure 8 suggest that the dominate exporter is Russia. It accounted for 76% of the total Chinese imports of the whitefish. The USA, Norway and Japan accounted for 8%, 7% and 6%, respectively. Figure 7 shows that the exports of whitefish, which include pollock, cod, haddock, coalfish and hake, from the main resources increased tremendously since 2007. The amount was 412 thousand tons in 2007 and tripled to 1,411 thousand tons in 2010, then followed by huge declines in 2011 and 2012. They were 1,037 thousand tons in 2011 and 758 thousand tons in 2012. However, we suspect the Russian data are not precise, both the Chinese import data from Russia and the import data of the main consumption markets show that the Chinese imports from Russia before 2008 was much bigger than the Russian reported data; and there were no significant decline in 2011 and 2012 as presented in Figure 7. We will further discuss this problem later on.



**Figure 7 Main exporters of whitefish to China (amounts)**

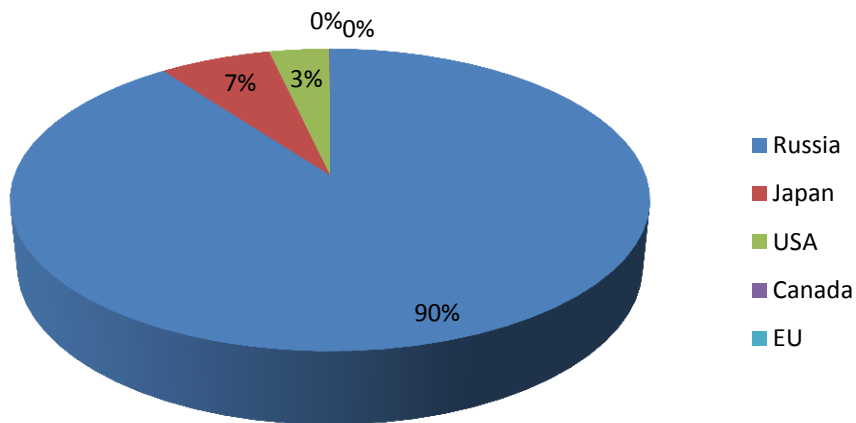
Source: Data provided by the Norwegian Seafood Council (NSC)



**Figure 8 Main exporters of whitefish to China (shares)**

Source: Data provided by the Norwegian Seafood Council (NSC)

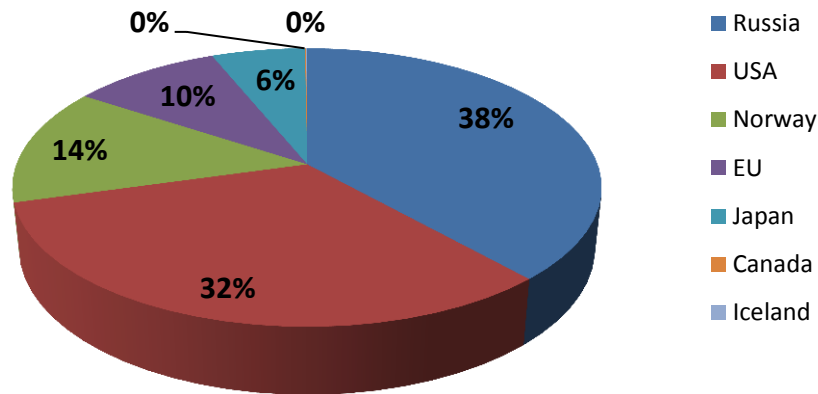
Since the main export of Russia is Alaska pollock, there is no surprise that the biggest exporter, Russia accounted for 90% of the Chinese pollock imports. The left 10% was 7% from Japan and 3% from USA (figure 9).



**Figure 9 Main exporters of pollock (1yr) to China**

Source: Data provided by the Norwegian Seafood Council (NSC)

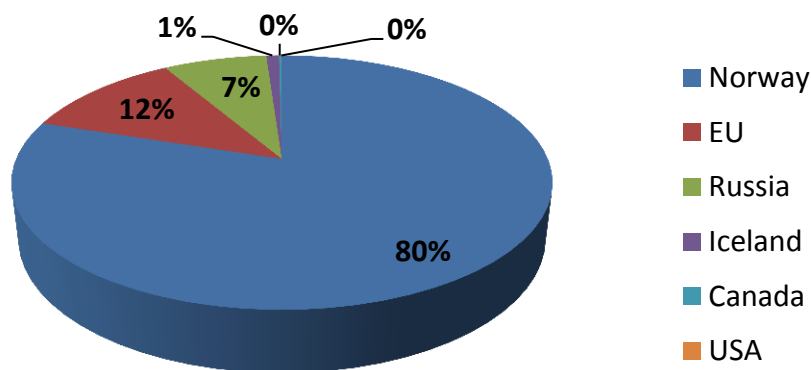
Cod is the second largest species imported by China as raw fish for processing and re-exports. Russia again is the biggest exporter, accounting for 38% of the total Chinese imports. The USA, Norway, EU and Japan accounted for 32%, 14%, 10% and 6%, respectively.



**Figure 10 Main exporters of cod (torsk) to China**

Source: Data provided by the Norwegian Seafood Council (NSC)

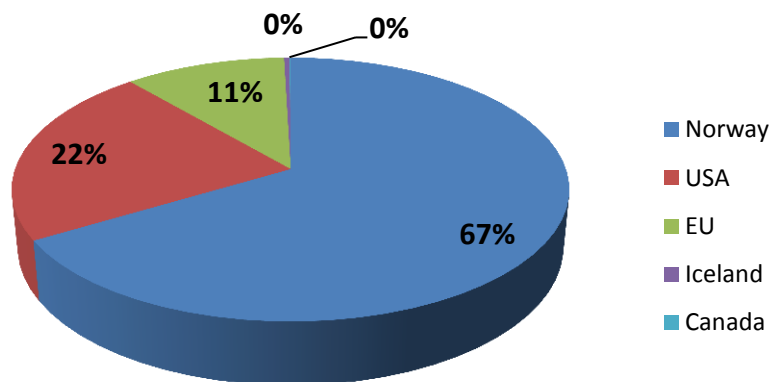
Haddock accounted for about 4% of the total Chinese imports. Norway was the biggest exporter, accounting for 80% of the Chinese imports. EU had 12% export share and Russia 7%.



**Figure 11 Main exporters of Haddock (hyse) to China**

Source: Data provided by the Norwegian Seafood Council (NSC)

According to the data reported by the main resources countries, total exports of coalfish from these countries are 10,606 thousand tons per year between 1999 and 2012, which was 3% of the total Chinese imports of the whitefish. Among them, again, Norway is the biggest supplier, had 67% shares. The USA and the EU accounted for 22% and 11%, respectively.



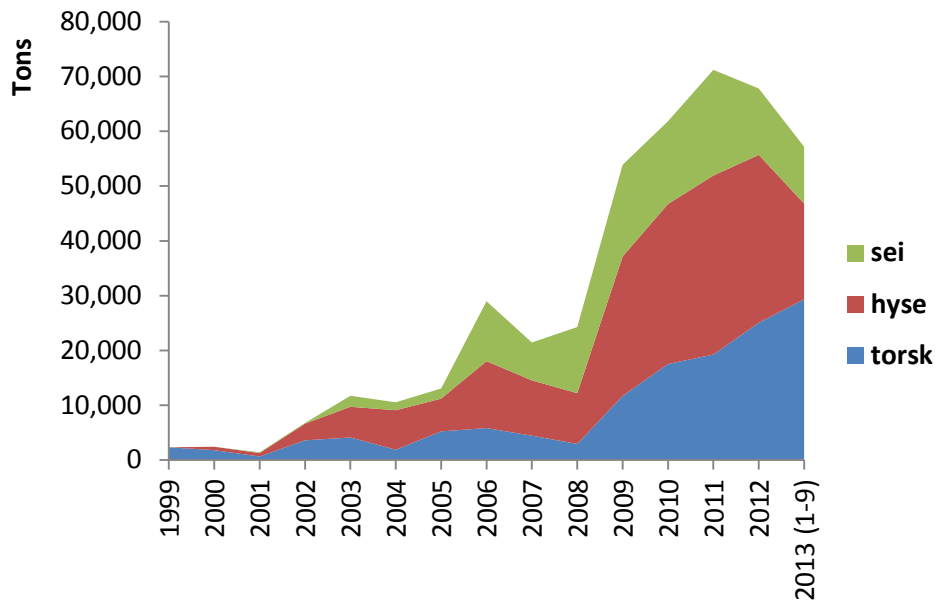
**Figure 12 Main exporters of coalfish (sei) to China**

Source: Data provided by the Norwegian Seafood Council (NSC)

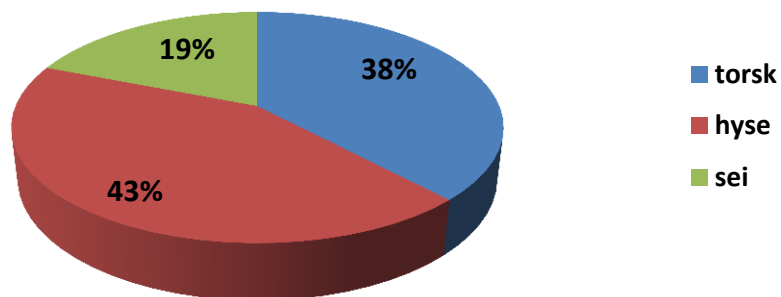
### ***1.5 Norwegian exports of whitefish to China***

As we analyzed in Section 1.4, Norway accounted for 7% of the total Chinese whitefish imports between 1999 and 2012. Figure 13 and 14 presented the whitefish species exported from Norway to China. They are Atlantic cod (torsk), haddock (hyse) and coalfish (sei). Averagely, they had shares of 43%, 38% and 19%, respectively. Between 1999 and 2011, along with the enormous growth of the Chinese whitefish processing, the Norwegian exports of the whitefish increased from 2, 238 tons to 71,213 tons. In 2012, the exports was 67,807 thousand tons, decreased by about 5%. Among them, exports of cod actually increased from 19,257 tons in 2011 to 25,057 tons in 2012. However, exports of haddock decreased from 32,657 tons to 30,631 tons, and exports of coalfish decreased from 19,287 tons to 12,106 tons.

The exports of cod, haddock and coalfish between January and September 2013 were 29,351, 17,455 and 10,361 tons, respectively. Obviously, the exports of cod in the first 9 months of 2013 were more than that of the whole year 2012. This is well explained by the changes in the Norwegian cod and haddock quotas. The growth of cod quota and decline of haddock quota made more export of cod and less export of haddock to China. This also made the export cod price from Norway to China decrease from 17.0 NOK/kg to 14.9 NOK/kg, and haddock price increase from 12.5 NOK/kg to 17.2 NOK/kg during 2012 and the first nine months of 2013.



**Figure 13 Norwegian exports of main whitefish to China (amounts)**  
 Source: Data provided by the Norwegian Seafood Council (NSC)

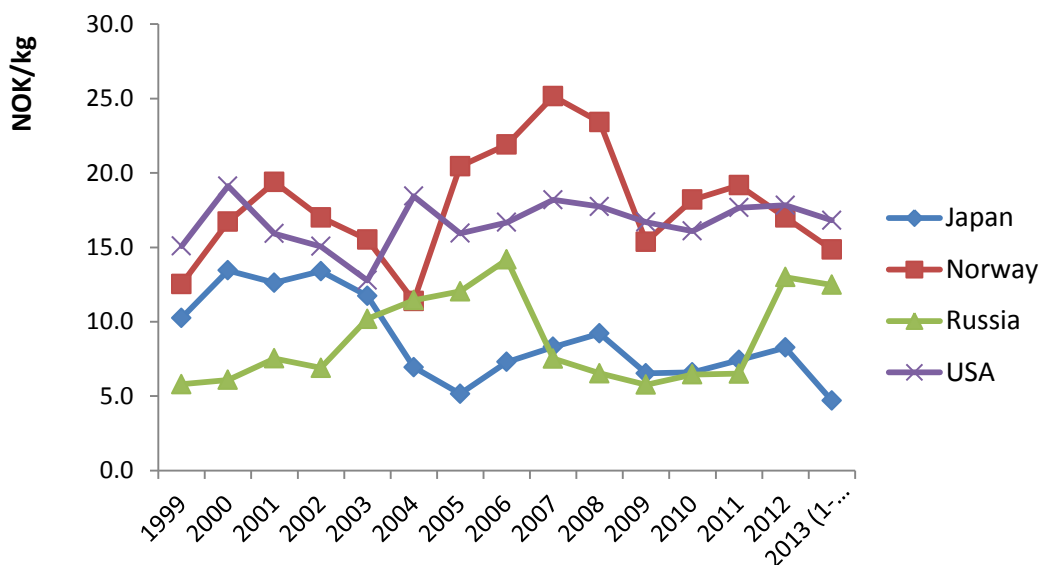


**Figure 14 Norwegian exports of main whitefish to China (shares)**  
 Source: Data provided by the Norwegian Seafood Council (NSC)

Figure 15 presented the export prices of cod from Norway, Russia, Japan and USA. In general, the price of the Norwegian cod is the highest, much higher than that of Russia and Japan. The difference, of course, is partly explained by the species. Cod from Norway is Atlantic cod. A substantial share of cod from Russia and Japan are Pacific cod. However, some businessmen from the Chinese processing industry in Qingdao area stated that even with the same species, Atlantic cod, Norwegian price is at least 2-3 NOK/kg more expensive than other sources. However, industry

still would like to buy Atlantic cod from Norway so far prices are not so much different since they mentioned the Norwegian cod were much better handled than that from other countries, particularly compared to Russian cod. The yield rate of fillets can be, therefore, higher.

Something out of our expectation here is that the significant growth of cod quota has dragged down the export price of Norwegian cod to China from 19.2 NOK/kg in 2011 to 17.0 NOK/kg in 2012 and 14.9 NOK/kg in the first 9 months of 2013. However, the corresponding USA prices were 17.7, 17.8 and 16.8 NOK/kg, respectively. Similarly, Russia price didn't decline in 2012 and declined from 13.0 to 12.5 NOK/kg this year. The lag and relatively small responses of price declines for the USA and Russia cod might be due to the following two reasons. One reason is that as mentioned by the industry people in Qingdao area, when the industry had the problem to earn money, they preferred not to buy raw fish, instead of processing raw fish provided by buyers of the final processed fillets. Another reason is that some multinational companies have their processing plants in China. They control the whole value chain from raw fish to the final destination markets. There are many American based multinational processing companies in China. Therefore American prices might be not really market prices; instead, it is a kind of internal prices of some vertical linked companies.



**Figure 15 Export prices of cod from main resources countries to China**

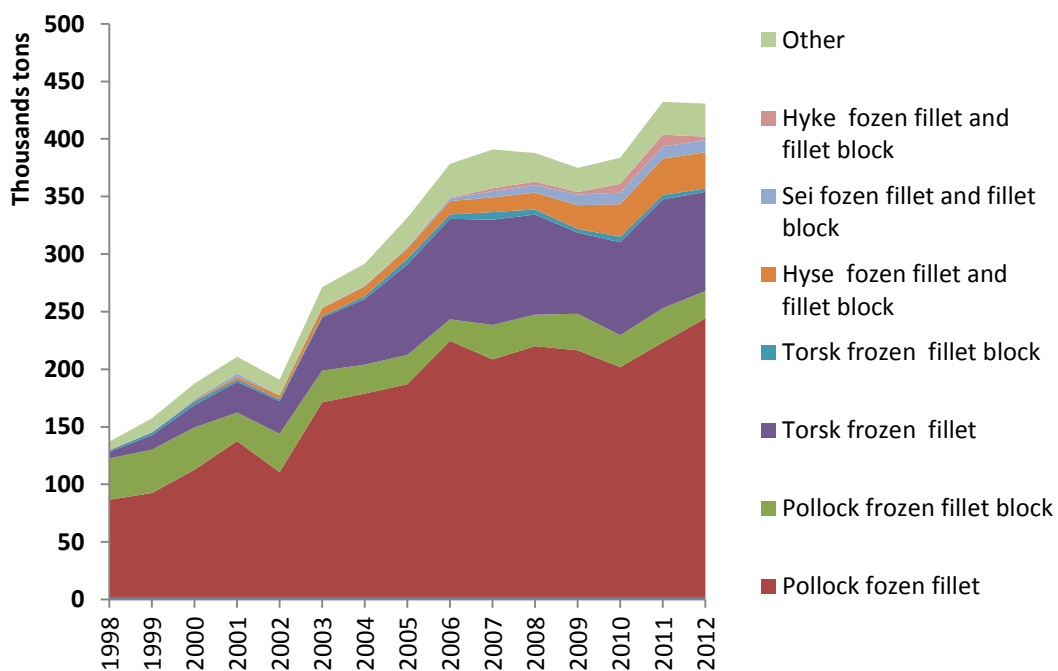
Source: Data provided by the Norwegian Seafood Council (NSC)



### 1.6 Main export products of the Chinese processed whitefish products

Instead of using the Chinese export data, here again we use the import data of the main consumption countries (e.g., the USA and the EU), for one reason is that before 2012, frozen fillets is an aggregated name in the Chinese statistics without specified by species, and another reason is that, in general, the Chinese statistics is less reliable compared to the EU or/and the USA data.

Figure 16 shows that frozen fillets are the dominant processed products exported from China to the world, accounting for 76% of the total Chinese exports in the recent five years between 2008 and 2012. Pollock fillets, pollock fillet block, cod fillet, cod fillet block, haddock fillet and fillet block, coalfish fillet and fillet block, hake fillet and fillet block had the shares of 55%, 7%, 21%, 1% , 6%, 2% and 1%, respectively. Others products including salted fish, klippfisk, tørfish, fish meat and by products of all the whitefish species only had share of 6%. The total exports are almost the same in 2011 and 2012. However, exports of Alaska pollock fillets and blocks increased by 6 % , cod fillets and blocks decreased by 10% in 2012.



**Figure 16 Main processed products exported from China**

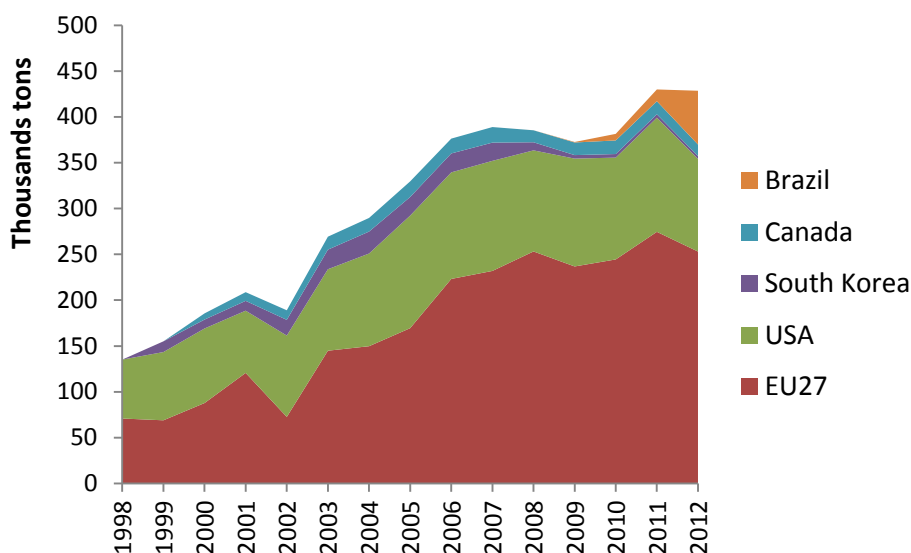
Source: Data provided by the Norwegian Seafood Council (NSC)

### 1.7 Main export markets of the Chinese processed whitefish products

The EU and the USA are the two dominant markets for the Chinese processed whitefish products. Figure 17 shows that the EU and the USA imports increased from 70,874 tons to 274,518 tons, and from 64,283 tons to 124,591 tons, respectively between 1998 and 2011. Demands from the both markets declined in

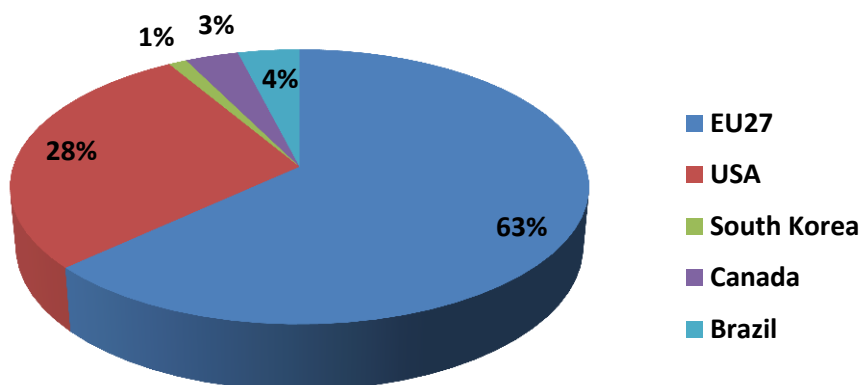
2012. It decreased by 8% and 19%, respectively. On the other hand, as shown by figure 17, the Brazil imports increased significantly after 2008. It increased from 28 tons in 2009 to 58,643 tons in 2011, and further to 79,187 tons in 2012. The growth of the Brazil market made the total Chinese exports of the whitefish processed products had the same level in 2011 and 2012. Without the contribution of Brazil imports, the exports would decrease by 11%. Brazil is usually recognized as a growing market for salted fish and klippfisk. However, we found it also became a growing market for the frozen fillets in 2011 and 2012. We will discuss this in detail afterwards.

If we look at the market shares of the import countries of the Chinese processed products in the recent five years, between 2008 and 2012, the average share of the EU, the USA, Brazil, Canada, and South Korea was 63%, 28%, 4%, 3% and 1% respectively (figure 18).



**Figure 17 Main export markets for the Chinese processed products (amounts)**

Source: Data provided by the Norwegian Seafood Council (NSC)

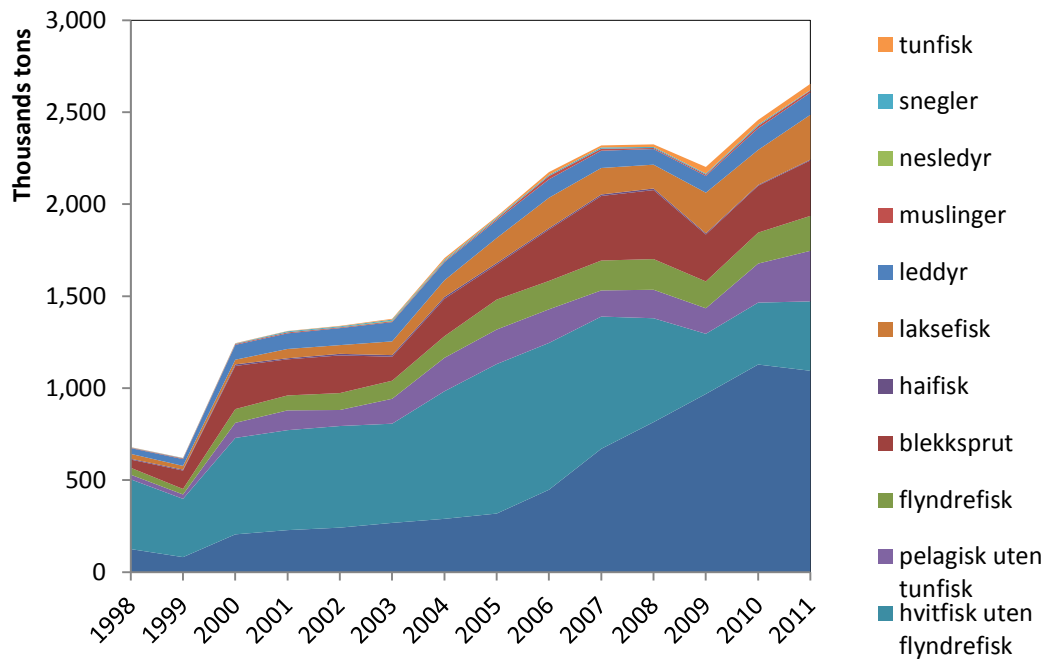


**Figure 18 Main export markets for the Chinese processed products (Shares 2008-2012)**

Source: Data provided by the Norwegian Seafood Council (NSC)

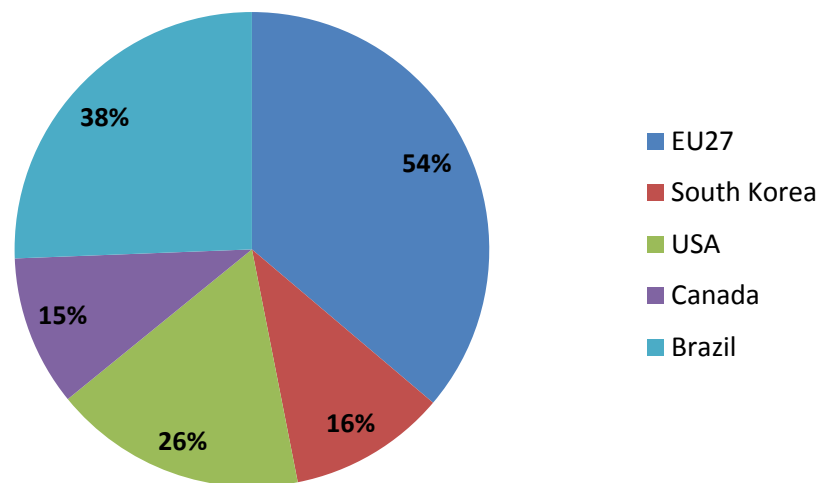
Although exports of salted fish and klippfisk are quite small in the Chinese total exports, we would further analyze the main export markets for these products, since they are particularly interesting to the Norwegian industry.

Total Chinese exports of salted fish, klippfisk and dry fish increased from 1,005 tons 11, 888 tons between 1998 and 2011 and dropped to 10,183 tons in 2012 (figure 19). Brazil is the second largest and most growing market. The Brazil imports increased from 29 tons in 2009 to 3,288 tons in 2012, and dropped to 2,718 tons in 2012. Between 2010 and 2012, the market shares for the EU, Brazil, the USA, South Korea and Canada were 54%, 38%, 26%, 16% and 15%, respectively (figure 20).



**Figure 19 Main export markets for the Chinese processed salted fish, klippfisk and dry fish (amounts)**

Source: Data provided by the Norwegian Seafood Council (NSC)

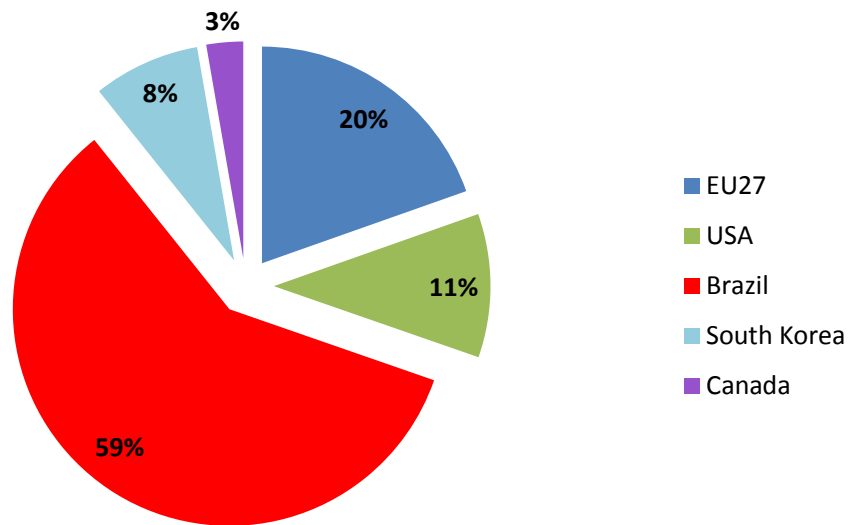


**Figure 20 Main export markets for the Chinese processed salted fish, klippfisk and dry fish (shares between 2010 and 2012)**

Source: Data provided by the Norwegian Seafood Council (NSC)

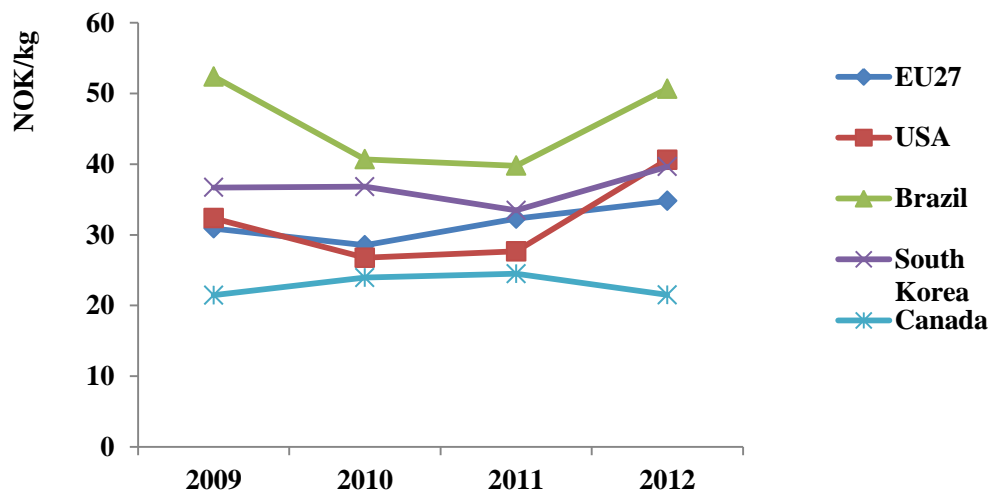
### **1.8 Brazil market for the Chinese processed whitefish products**

Total Chinese export of Klippfisk was 5,506 tons in 2011 and 3,796 tons in 2012. Brazil is the most important markets for the Chinese processed klippfisk, accounting for 59% of the total share between 2010 and 2012 (figure 21). The export price to Brazil is the highest. The average export price to Brazil, South Korea, the EU, the USA, and Canada was 44, 36, 32, 28, and 24 NOK/kg during 2010 and 2012 (figure 22).



**Figure 21 Main export markets for the Chinese processed klippfisk (shares between 2010 and 2012)**

Source: Data provided by the Norwegian Seafood Council (NSC)

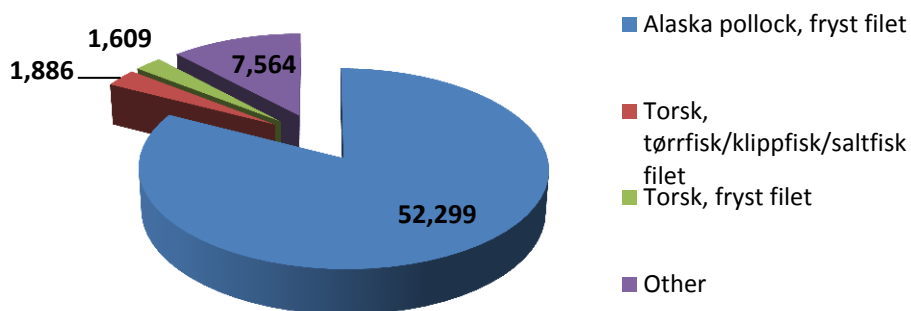


**Figure 22 Prices of the Chinese klippfisk in the main export markets (between 2010 and 2012)**

Source: Data provided by the Norwegian Seafood Council (NSC)

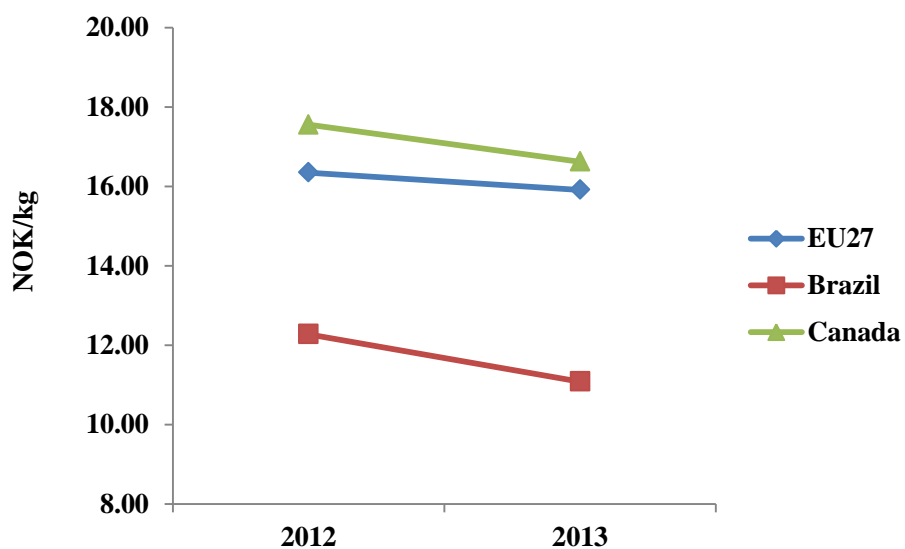
Brazil is the most important klippfisk market to China. However, if we looked at the total exports of China to Brazil (figure 23) in 2012, frozen Alaska pollock fillets became the main export item. There were no exports of frozen Alaska pollock fillets recorded in 2011; while, the amount reached 52.299 tons in 2012, compared to 1,886 tons adding-up imports of salted cod, klippfisk and tørfisk. The exports were already 50, 980 tons in the first 9 months of 2013.

There are different product specification of Alaska pollock items in the EU and other import countries data. To make price comparable, we selected the exact same HS number for the Alaska pollock fillets in Brazil and other import countries, we found import prices of Brazil were lowest (Figure 24). It was around 4-5 NOK/kg lower than the biggest market, the EU. We therefore suspect that when the EU and USA markets became weak, the Chinese processing industry has been trying to expand the market in Brazil by selling the relative low prices and low quality products. This is consistent with the information that we collected from the processing companies in Qingdao area, China.



**Figure 23 Brazil imports of the whitefish products from China (2012)**

Source: Data provided by the Norwegian Seafood Council (NSC)



**Figure 24 Import prices of frozen Alaska pollock fillets from China (2012-2013.09)**

Source: Data provided by the Norwegian Seafood Council (NSC)

### ***1.9 Reliability of the Chinese statistics***

The reliability problem of the Chinese statistics has been widely questioned. As we noted early in the above sections, all the data in Section 1 were provided by the Norwegian Seafood Council. The data used from Section 1.1 to 1.3 are data reported by China, and the data used from Section 1.4 to 1.8 are data reported by the each export country of raw fish (e.g., Norway, Russia) or the import country/region of final processed products (e.g., the USA and the EU).

Russia is a dominate whitefish exporter to China and Norway is one of countries believed to have reliable statistics. We therefore compare the exports data of these two countries to the Chinese import data from them.

Table 4 presented imports of the whitefish from Russia according to the data reported by the China statistics. And table 5 presented exports of the whitefish from Russia to China according to the data reported by the Russian statistics. In principle, they should be identical. However, in reality they are not comparable before 2008 and the problem was much improved after 2008.

In the Chinese data, as we mentioned, pollock was not specified, but put in the category called other fish before 2012. Cod was specified but the import volumes were much more than the export volume reported by the Russian data. This problem was incredibly worse before 2008. Haddock, coalfish and hake imports from Russia were rather small, compared to pollock and cod, but the same problem existed. However, starting from 2012, we found the Chinese data and the Russia data were much closer. In 2012, the import of pollock was 574,013 tons according to the Chinese data and 536,289 tons according to the Russian data; cod volume was still higher in the Chinese data. It was 65,337 tons in the Chinese data and 11,911 tons in the Russia data in 2012. The total import volume of the whitefish species were 18% and 27% higher in the Chinese data than that in the Russian data in 2012 and in the first 9 months of 2013, respectively.

It is difficult to say whether the problems are from the Russian statistics or the Chinese statistics. It might be from both sides. In the following analysis, we used the export volume of the processed products from China reported by the main buying countries (e.g., the EU and the USA) to check how much raw fish were imported in China each year. We found the Chinese import data were comparatively more reliable than the Russian export data.



**Table 4 Whitefish imports from Russia reported by China (tons)**

Year	Pollack (lyr)	Torsk	Hyse	Andre torsk fisker	Sei	Annen hvitfisk	Hake (lysing)	Total
1999		283,078			861			
2000		352,987	1,177		568	142		
2001		375,220	4,156		-	12		
2002		422,342	9,471		183	-	0	
2003		392,314	12,344		190	-	301	
2004		411,846	9,446		254		185	
2005		499,088	16,513		804	238	911	
2006		396,857	25,588		1,198	34	213	
2007		344,125	28,521		682	48	799	
2008		243,927	18,929		844	-	181	
2009		75,209	10,642		62	852	20	
2010		60,730	13,841		355	0	1	
2011		86,764	20,522		688	3,064	21	
2012	574,013	65,337	19,604	5,138	374	2	1,439	665,907
2013 (1-9)	444,205	48,880	8,052	2,298	91	-	237	503,763

Source: Data provided by the Norwegian Seafood Council (NSC)

**Table 5 Whitefish exports to China reported by Russia (tons)**

Year	Pollack (lyr)	Torsk	Hyse	Sei	Total
1999	10,309	2,553			12,862
2000	18,654	9,523			28,177
2001	61,706	9,060	48		70,814
2002	44,501	8,754	436		53,691
2003	49,088	8,018	24		57,129
2004	8,374	14,046	6		22,426
2005	25,509	16,458	620		42,587
2006	16,069	26,967	2,920		45,955
2007	213,442	61,302	8,875		283,619
2008	184,978	42,587	1,861		229,426
2009	840,187	31,698	829	-	872,714
2010	1,210,602	29,717	285	-	1,240,605
2011	804,996	27,584	-	-	832,580
2012	536,289	11,911	88		548,289
2013 (1-9)	361,250	5,083	-		366,332

Source: Data provided by the Norwegian Seafood Council (NSC)

We presented the import volume of raw fish and export volume of the Chinese processed products in table 6 using the export data of main resources countries, *i.e.*, Russia, the USA, Japan, Norway, the EU, Canada and Iceland, and the import data of main consumption markets of the Chinese processed products, *i.e.*, the EU, the USA, Canada, Japan, South Korea, Brazil, Hong Kong and Taiwan. Export in REW means that the product weight (PW) has been converted to the equivalent round fish weight. We used converting rate of 0.7 according to the yield rate of processing frozen fillet provided by the industry in Qingdao. Table 6 shows that the export volumes were incredibly much higher than imported raw fish between 1999 and 2008. Since Russia is dominant exporter of pollock and also an important exporter of cod to China, we therefore conclude that Russia data was not reliable before 2008. The export of pollock and cod from Russia was far less reported in the Russian statistics.

**Table 6 Whitefish exports to China and imports of processed products from China (I)**

	Pollock			Codfish(torsk, hyse, sei and hake)			Total
	Export (REW)	Import	Export/ import	Export (REW)	Import	Export/ import	Export/ import
1999	192,141	11,024	1743%	29,690	11,906	249%	967%
2000	224,437	21,527	1043%	40,684	23,870	170%	584%
2001	241,847	66,799	362%	56,388	19,368	291%	346%
2002	212,882	46,886	454%	57,090	25,889	221%	371%
2003	290,369	52,482	553%	94,371	43,154	219%	402%
2004	302,300	53,491	565%	111,595	58,737	190%	369%
2005	315,269	58,113	543%	155,609	61,570	253%	393%
2006	359,368	66,801	538%	178,229	110,659	161%	303%
2007	355,513	267,388	133%	200,063	144,078	139%	135%
2008	362,680	206,921	175%	188,429	117,940	160%	170%
2009	361,203	892,523	40%	171,510	134,439	128%	52%
2010	336,136	1,269,949	26%	209,151	141,453	148%	39%
2011	366,926	866,657	42%	247,667	170,197	146%	59%
2012	317,020	600,414	53%	211,622	157,932	134%	70%

Note: using data reported by the each export country of raw fish and import country of Chinese processed products.

Source: Data provided by the Norwegian Seafood Council (NSC)

In Table 7, the data in the columns of import volume were replaced by the Chinese import data, instead of export data reported by the resource countries (e.g., Russia) in table 6. As we discussed, if we use the relative change in the Chinese import of other fish when pollock was separately specified in 2012 and 2013, we

suspect the ratio of pollock in the other fish was around 55-60% before 2012. Therefore, the Chinese import volumes of pollock before 2012 was calculated by the import of other fish multiply by 60%. Now if we look at the ratio of import and export for each species (i.e., pollock, codfish), and for the total aggregation of the whitefish, we can see it is much more reasonable than that in table 6.

Table 7 shows that Chinese import of pollock might be overstated and codfish might be understated before 2008. There existed the problem of mislabeling between the different whitefish species. If we look at the ratios of import and export of the total whitefish species, they suggest that around 50-60% of the imported white fish were processed and re-exported. The numbers between 2010 and 2012 suggested that around 30-40% of the imported whitefish remained in Chinese domestic market, they are mainly Alaska pollock. This finding is quite close to what we have found in the field works of investigating the Chinese whitefish consumption markets<sup>3</sup>.

**Table 7 Whitefish exports to China and imports of processed products from China (II)**

	Pollock			Codfish(torsk, hyse, sei and hake)			Total
	Export (REW)	Import	Export/import	Export (REW)	Import	Export/import	Export/import
1999	192,141	48,685	395%	29,690	316,424	9%	61%
2000	224,437	119,904	187%	40,684	398,044	10%	51%
2001	241,847	134,824	179%	56,388	450,706	13%	51%
2002	212,882	143,637	148%	57,090	473,745	12%	44%
2003	290,369	159,518	182%	94,371	481,215	20%	60%
2004	302,300	171,315	176%	111,595	609,538	18%	53%
2005	315,269	185,978	170%	155,609	701,039	22%	53%
2006	359,368	262,487	137%	178,229	641,996	28%	59%
2007	355,513	392,889	90%	200,063	556,225	36%	59%
2008	362,680	480,901	75%	188,429	420,129	45%	61%
2009	361,203	572,751	63%	171,510	231,980	74%	66%
2010	336,136	669,431	50%	209,151	232,441	90%	60%
2011	366,926	650,924	56%	247,667	274,458	90%	66%
2012	317,020	650,974	49%	211,622	227,847	134%	60%

Note: using import data reported by China and export data reported by import country of Chinese processed products.

Source: Data provided by the Norwegian Seafood Council (NSC)

<sup>3</sup> For the detail, see Section 3 or a separate report on Chinese domestic consumption of whitefish early submitted.

Table 8 and 9 presented the Chinese import volumes of the whitefish reported by the Chinese data and the Norwegian data, respectively. Again, we found the Chinese data and the Norwegian data were quite different. Similarly as analyzed above, the problem was much worse before 2008 and got much better afterwards. However, differently from the above finding that the total import volumes of the whitefish reported in the Russian data were much smaller than in the Chinese data, here we found the opposite: the total import volumes of the whitefish imports from Norway were less reported in the Chinese statistics than in the Norwegian export data.

**Table 8 Whitefish imports from Norway reported by China (tons)**

<b>Year</b>	<b>Torsk</b>	<b>Hyse</b>	<b>Sei</b>	<b>Andre torskefisker</b>	<b>Total</b>
1999	950	0	0		952
2000	1,340	233	0		1,772
2001	430	358	0		790
2002	558	238			864
2003	2,970	1,688	429		5,087
2004	4,777	6,616	234		11,670
2005	4,374	5,860	264		10,498
2006	10,793	8,464	2,896		22,225
2007	10,781	10,469	3,077		24,478
2008	6,742	8,924	8,643		24,329
2009	16,930	23,875	14,261		55,118
2010	16,036	32,805	11,921		60,862
2011	14,485	36,528	17,021		68,236
2012	19,529	28,325	9,253	955	58,062
2013 (1-9)	28,031	20,230	8,091	252	56,604
<b>Total</b>	<b>138,727</b>	<b>184,613</b>	<b>76,088</b>	<b>1,207</b>	<b>401,547</b>

Source: Data provided by the Norwegian Seafood Council (NSC)

**Table 9 Whitefish exports to China reported by Norway (tons)**

Year	Torsk	Hyse	Sei	Total
1999	2,340		1	2,340
2000	1,818	619	0	2,438
2001	657	634	131	1,422
2002	3,611	3,043	116	6,770
2003	4,129	5,596	2,013	11,738
2004	1,896	7,212	1,441	10,549
2005	5,244	5,964	1,856	13,065
2006	5,847	12,207	10,926	28,982
2007	4,458	10,091	6,907	21,491
2008	2,949	9,262	12,066	24,277
2009	11,712	25,451	16,711	53,875
2010	17,537	29,188	15,101	61,826
2011	19,257	32,657	19,287	71,213
2012	25,057	30,631	12,106	67,807
2013 (1-9)	29,351	17,455	10,361	57,408
Total	135,865	190,010	109,024	435,202

Source: Data provided by the Norwegian Seafood Council (NSC)

To conclude, we found that the imported data of the whitefish reported by the Chinese statistics have the problem of the validity, particularly before 2008. The problem was getting much better after. It is difficult to say whether the Chinese import data were overstated or low-stated than the export data reported by the export countries. Both situations existed. One thing we can conclude here is that there existed the problem of miscoding between the different whitefish species in the Chinese statistics. For example, pollock might be miscoded as cod, and coalfish was mislabeled as cod or haddock and so on. Compared to the Russian data, the Chinese data were more reliable. Obviously, the Russian data were significantly less registered before 2008.

## 2. Whitefish processing in China<sup>4</sup>

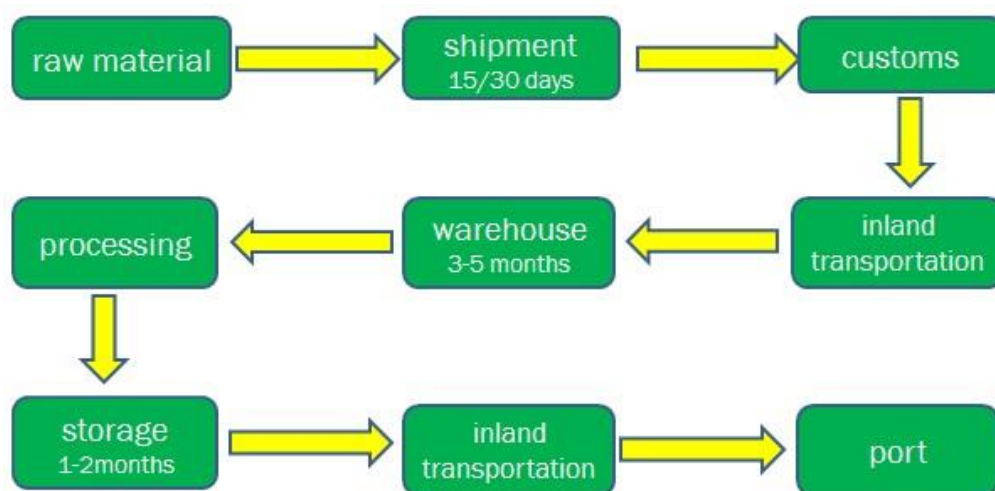
The project has asked two professors and their master students from China Ocean University to conduct intensive surveys and interviews with 20 processing companies in Qingdao and Dalian area. The project has also kept close follow-up contacts with two managers from big processing companies in Qingdao. A detailed report have been submitted in 2012, here we sum up the main findings and also

<sup>4</sup> A separate report has been submitted in 2012.

update the information we got in 2013.

Averagely, it took half a year in the whole process from importing raw material to exporting processed products. Chart 1 presents the detailed time schedule for each stage. It takes 15-30 days to import raw fish from resource countries, 15 days for imports from Russia and 30 days for imports from Norway. Industries normally order raw fish 3-5 months before processing, and keep the processed products in storage for 1-2 months, depending on market demand.

**Chart 1 the Flow Chart**



Source: Data collected by surveys and interviews with the Chinese processing industry

In general, the Chinese seafood processing industry had the problem of overcapacity and was facing a big challenge. This is the same for whitefish processing industry in Qingdao and Dalian areas. Starting from 2011, small companies have begun to collapse. Big companies still kept some production in order to keep the factory running and to keep skilled workers for the future, but at a much smaller scale. The companies tried to survive by expanding the new markets in Brazil and some African countries (*e.g.*, Pacific Andes Group), processing more value added products, processing products for domestic consumption, and optimizing internal cost control and management. Most of processing companies are risk averse. They prefer to process specific asked products ordered by buyers. The situation was worst in 2012, it was much better in 2013.

In 2012 the industry gained around \$100-200/ton to process cod fillet, and lost \$200-300/ton to process pollock fillet. Since pollock is the main product in Chinese processing industry, the industry in general lost money. We found in 2013, the situation was much better. Although the industry still lost around \$150 /ton for processing of pollock, however the business became much more active with more orders from consumption markets. This was joint result of recovering demand in the

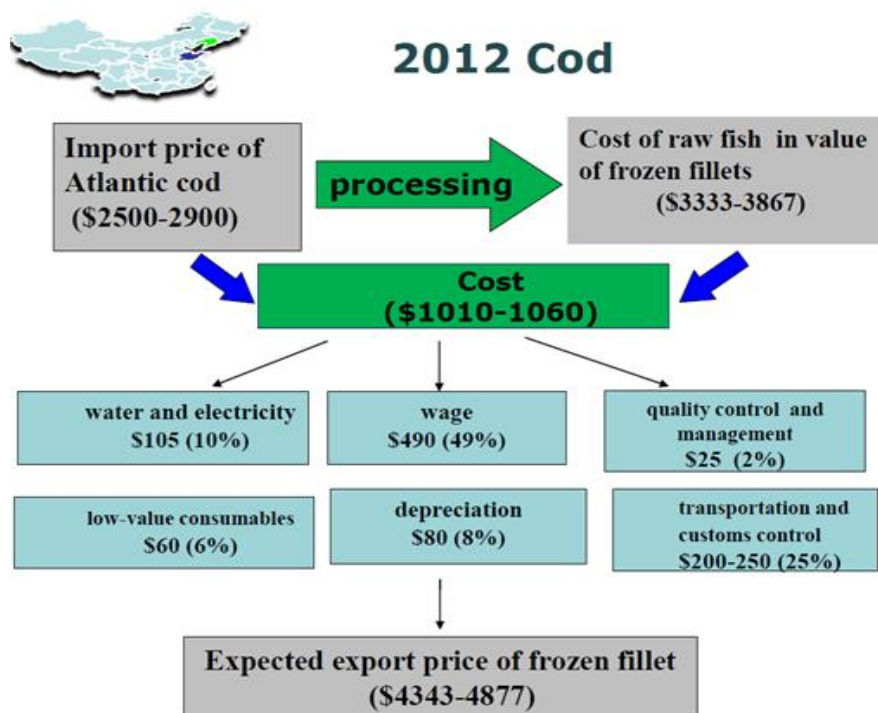
consumption market, the EU and the USA, and much lower prices of raw fish due to the increasing cod quotas.

We found that the total processing cost was \$1010-1060 in 2012. It was same for cod and pollock since they were processed in exactly same lines<sup>5</sup>. Figure 25 presents the cost structure of Atlantic cod processing in China in 2012. The average import price of Atlantic cod was \$2500-2900/ton (raw fish). We take an average yield rate of 70%. This means that to produce one ton of frozen fillet, the cost of raw fish was between \$3333-3867. The total processing cost of processing one ton of frozen fillet in China was \$1010-1060/ton, which included \$105 for electricity, \$490 for wage, \$25 for the quality control and management, \$60 for the low-value consumables, \$80 for the depreciation, and \$200-250 for the transportation and custom control. Among them, it is evident that wages are the largest cost component. It accounted for 49% of the total cost. Adding up the cost of raw fish and processing, the expected price of one ton frozen fillet should be \$4344-4877 in order to cover the total costs. Otherwise, the industry would lose money. The actual export price provided by the industry visited was \$4500-5000. It means the industry had an average profit margin of some \$150/ton.

As we all know, the main comparative advantages of the Chinese whitefish processing industry is the cheap mass labor. This makes it possible for industry to use manual filleting instead of machine filleting. The yield rate of manual filleting is around 65-70%, much higher than that of machine filleting. However, this advantage is now facing a big challenge when the labor wage and welfare cost for the labor have increased by some 20-30% annually for the last years (Figure 26). According to what given by the industries (table 10), wage cost increased by another 10-20% in 2013.

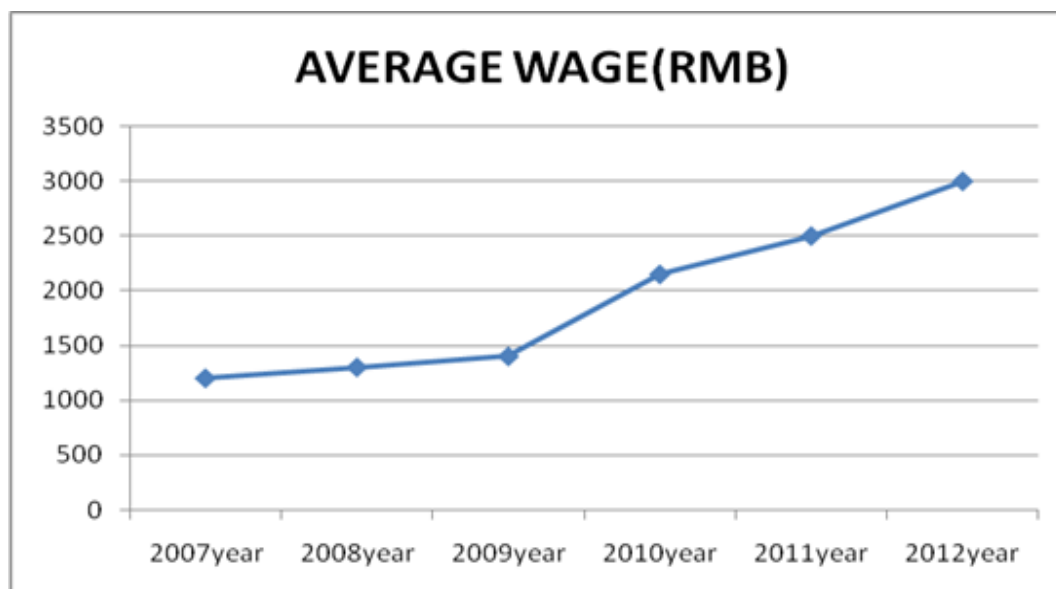
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<sup>5</sup> For detailed discussion of the cost structures, please read the report on Chinese processing early submitted. Here to make readers easy to follow, we illustrate the analyses of cost structure for cod.



**Figure 25 Map of cost structure for cod in China**

Source: Data collected by surveys and interviews with the Chinese processing industry



**Figure 26 The trend of workers' average wage in aquatic product processing companies from 2007 to 2012 in Shandong province**

Source: Chinese Yearly Statistics



**Table 10 Wage cost for whitefish processing in Qingdao in 2013**

Type of Job	Wage(RMB/month)
slicing	4000—6000
peeling	3500—4200
other processing job	3200—3500
assisting job (such as cleaning)	2600—3000

Source: Data collected by surveys and interviews with the Chinese processing industry

Although the wage cost has increased significantly, the managers in the industry think the bad situation in 2012 was mainly due to slow demand from the consumption markets. Some of the managers emphasized that a portion of the industry produce products according to what was asked for by their buyers. If the consumption markets improve, and if the EU and the US buyers cannot find a better substitute country to produce instead of China, the buyers would cover the cost induced by the growing wages. This is consistent with the improved situation in 2013 when the EU and the USA were recovering demand.

At the same time, managers from the industry does not think some developing countries like Vietnam can replace China for seafood processing in the short run. Although the wage cost is lower there, the less developed logistics and the bureaucracy in reality make the cost even higher. They emphasized that the comparative advantage of the Chinese industry is not only cheap labor, but also favorable industry clusters, production flexibility, logistic and industry entrepreneurship.

The processing industry also identified large potential target market of domestic consumers. The industry had an intention to produce more products to meet the domestic demand. They believe with extraordinary growth of the overall economy and extension of middle class in China, people in cities can afford to pay price. Frequently happened scandals in China along with people becoming more conscious with food safety, whitefish harvested in clean oceans are become popular. In addition, young people in China have a different consuming habit from their parents. They do not know how to cook whole fish, they need something convenient, fast, easy, and nutritious, therefore, and processed whitefish fillet is a good choice.

### **3. Compare whitefish processing costs in Norway and in China**

We compared the costs of cod fillet processing in China and in Norway as asked by Aker Seafood AS in March 2013. The following data are therefore based on the business in March 2013. The processing cost in China is based on the interviews of processing companies; the processing cost of Norway was provided by Norfima by the personal contact; and the transportation cost was provided by Eimship by the

personal email. Some processing cost numbers were also provided by Aker Seafood AS. The analysis is presented in table 11.

We took the minimum price of cod 10.50 NOK/kg in Norway. The cost of freezing the landed fish was 1.50 NOK/kg, handing cost of sorting and *etc.* was another 1.50 NOK/kg, and the transportation cost from Northern Norway to China was 1.73 NOK/kg. There is no custom duty in China if the imported raw material will be processed and re-exported afterwards. Therefore, the cost of imported raw fish for processing industry in China is added up to 15.23 NOK/kg. The yield rate of processing frozen fillet from whole Atlantic cod given by Chinese industry was between 0.70-0.80, depending on the size and quality of the fish. The Norwegian industry suggested a number of 0.69 yield rate in China. And one Chinese company also mentioned 0.82. The most possible number by stochastic technique is 0.77 then, which means to process 1 kg of frozen fillet, we need 1.30 kg of raw fish. The cost of imported raw fish to process 1 kg of frozen fillet becomes  $15.23 \times 1.30 = 19.77$  NOK.

Taking an interval of a possible yield rate between 0.69 and 0.82, we calculated the cost for raw fish between minimum 18.57 NOK/kg and maximum 22.07 NOK/kg, with a mid-value of 20.30 NOK/kg. Processing cost in China, which includes labor, electricity and so on is 6.09 NOK/kg. The shipping cost for finished products from main ports of China to Rotterdam, Netherland was 0.81 NOK/kg. It yields a total cost between 25.5-29.0 NOK/kg for China industry to import the raw fish of cod from Norway, process it as frozen fillet and re-export it to main markets in Europe. To make it more scientifically, we also presented a possible distribution of the total cost for Chinese industry by technique of simulation. The probability density function (PDF) shows the most possible (mean) cost was 27.3 NOK/kg in China.

For the cost in Norway, similarly, we took minimum price of cod 10.50 NOK/kg. We assume industry using fresh landed fish to process frozen fillet. So the cost for raw material is landing price plus 1.50 NOK/kg for handing cost. The price of raw fish turns to be 12.00 NOK/kg. According to data provided by Norfima, the yield rate of processing cod fillet or lion is between 0.53-0.57. We take a suggested number of 0.54. It means the cost of raw fish to process 1 kg of fresh fillet or lion is 22.22 NOK/kg. Total processing cost including packing cost, wage, freezing cost and other operation cost and sales cost is 12.20 NOK/kg. Here we do not know if other operation cost includes freezing cost already or not. If the answer is yes, then here the problem of double counting exists. Transportation cost from Northern Norway to Rotterdam for frozen fillet was 1.50 NOK/kg. Adding up all the above numbers, we get the total cost for Norwegian industry to use its own cod resource and process it as frozen fillet and then export to Europe was 35.92 NOK/kg.

The main differences between costs of the Norwegian industry and the Chinese industry come from higher yield rate in Kina (54% vs. 77%) and much lower processing cost in China. Due to higher yield rate, the cost of raw fish to processing 1 kg of frozen fillet is 2.4 NOK more in Norway than that in China. The processing cost, which includes labor, packing and *etc.* is 6.1 NOK more in Norway than that in

China. Therefore the total cost was 35.92 NOK/kg in Norway compared to 26.67 NOK/kg in China, which means a difference of 9.25 NOK/kg.

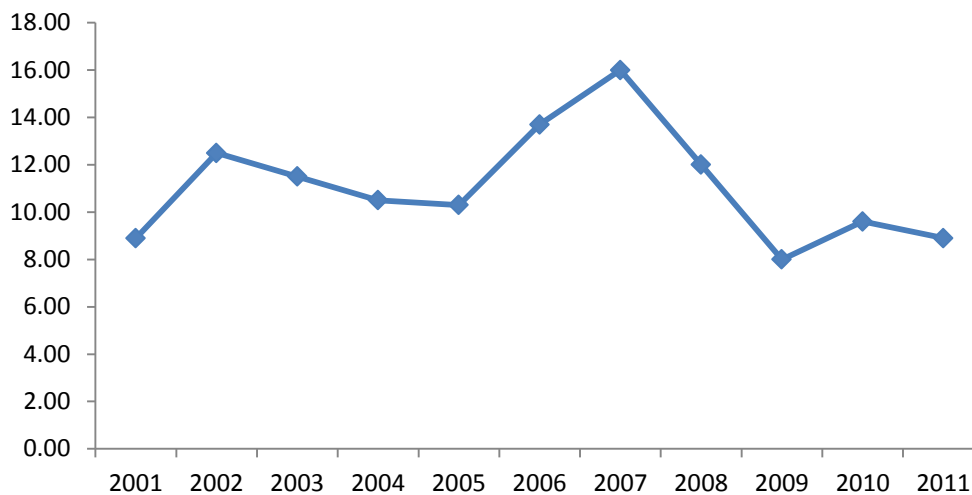
To process fresh fillet in Norway, we can save the freezing cost of 1.50 NOK/kg, but have to add a cost of 5.0 NOK/kg to transport fresh fillet from Norway to, for example, France, using truck, instead of 1.50 NOK/kg for frozen fillet using shipping containers. In that case, we get a total cost of Norwegian export of fresh fillet to EU 37.92 NOK/kg, which is 11.25 NOK/kg more than the cost for Chinese industry export frozen fillet to EU.

The attached following figure is provided by Finn-Arne Egeness from Nofima. He is also responsible for one of package work in our project. The figure shows the price difference of frozen fillet from Norway and China in the EU market between 2001 and 2011 was between 8-16 NOK/kg, with most possibility of around 10 NOK/kg. This means that the margin between Norwegian frozen fillets and Chinese frozen fillets was just to meet the higher production cost in Norway.

**Table 11 Cost differences in processing cod in Norway and China**

	<b>China (frozen fillet)</b>	<b>Norway (frozen fillet)</b>	<b>Norway (fresh fillet)</b>	<b>N-C(Frozen)</b>	<b>N-C(Fresh)</b>
Yield rate	77%	54%	54%	-23%	-23%
Raw fish cost	19.77	22.22	22.22	2.45	2.45
Processing cost	6.09	12.20	10.70	6.11	4.61
Transportation cost to EU	0.81	1.50	5.00	0.70	4.20
Total cost	26.67	35.92	37.92	9.25	11.25

Source: Own calculation



**Figure 27 Price differences between frozen fillet from Norway and China in the EU market**

Source: Provided by Finn-Arne Egeness from Nofima.

#### 4. Whitefish consumption in China<sup>6</sup>

The project has asked Professor Jian Gao and his graduate students from Shanghai Ocean University to investigate the whitefish demand in China. They visited different markets in representative cities named Shanghai, Beijing, Hefei and Suzhou.

The project found although whitefish had a potential market in China along with substantial growing of middle class consumers, but the total demand was relatively small and there existed problems. The most serious problem was an ambiguous name of codfish. Many fishes were called cod with corresponding Chinese name “Xueyu”. They include silver pout (*anoplopoma fimbria*), Atlantic and Pacific cod, haddock, coalfish, hoki, Alaska pollack and even *Gadus macrocephalus*.

*Anoplopoma fimbria* is relatively widely accepted as “Xueyu” by high-income group in China, and used either as nutrition food for children or used as quality dish in restaurants of urban areas or wedding and funeral events in developed rural areas in southeastern China. The price is around *Anoplopoma fimbria* is very high, around 200 RMB/kg.

Although average customers didn’t know species exactly, we found the persons who were working within the market actually know species clearly. The reason why businessmen would like to use a general name “Xueyu” in the market is that majority of so called “Xueyu” sold in the domestic market is Alaska Pollack, which is much cheaper and in lower quality than Atlantic cod or pacific cod. We found that,

<sup>6</sup> A separate report has been submitted in 2012

when Atlantic and Pacific cod were sold, it was clearly noted as cod and most often was also associated with the origin of countries.

Regarding to the products sold in China (figure 28). They are mainly frozen Alaska whole cod sold inner land and breaded pollock pieces in eastern cities. The prices are relatively low. However, there is a growing demand for high quality safe goods. Alaska pollack block and fish figures, which were originally produced and packaged abroad, were sold in very high prices in one of supermarket counter in Qingdao, where only imported foods were sold. Except for a small stick of label written in Chinese, all the others presented in the package were in English and/or in other foreign languages. This kind of package is to convince buyers the products are originally from abroad. As a result of food scandals frequently happening in China, consumers are conscious about food safety. Generally, Chinese people believe the foreign products are much safer than domestic products.



**Figure 28 Codfish products in China**

Sources: project investigation

Another example is the newly establish fish shop called “One Hundred Meters”. The first 40 chain shops were established in Qingdao in July 2013. They were rapidly expanded to many cities in China including Shanghai. The owner of the shops is CEO of a processing company in Qingdao, who has been highly involved in

our project. “One Hundred Meters” means that the shops only sell imported seafood from Arctic areas. Five new but popular concepts are emphasized by the shops. They are: safe and of high quality, environmental friendly, ecological, easy to prepare and give good customer service.

## 5. What determines China’s re-export in the future?<sup>7</sup>

In a general case, raw materials imported by China can be processed into final products for re-exports or consumed domestically. The re-export demand depends on the export price and global economic activities. Similarly, the domestic demand is determined by the domestic price and domestic economic activities. On the supply side, the price and capacity of exports are the main forces driving raw materials exported by foreign suppliers. With the foregoing assumptions, we used econometric modeling to evaluate the determinations of China’s re-exports. The model allows for interactions and feedback effects between re-export demand, domestic demand, and import supply. The fully specified model facilitates a better understanding of the connections between the vertical and the horizontal markets. The simulations conducted after the model further permit an analysis of the consequence of changes in determinants for the re-exports.

The simulated reduce-form elasticities presented in table 12 suggest that if the Chinese processing cost increases by 10%, it will raise export price of frozen fillet by 2.1%, and reduce the world demand for frozen fillets by 3.1%, which will result in a decline of price of raw fish by 2.8% and world total demand for whitefish by 2.3%. On the other hand, if the world whitefish quota increases by 10%, it will reduce price of raw fish by 2.6%, price of processed frozen fillet by 1.6%, and raise world total demand for whitefish by 2.8%. World economy (*e.g.*, the EU and the USA) is important. When the world economy grows by 10%, it will raise demand for whitefish by 2.4%, which makes price of raw fish and price of processed frozen fillet by 2.9% and 1.8% respectively. The elasticities also suggest that growing Chinese economy will induce more domestic demand and thus reduce the portion of export.

Exchange rate is always important for international trade. The estimated elasticities indicate that appreciation of Chinese currency makes the price of frozen fillet in the EU or USA market more expensive, which substantially reduces Chinese export volume. Although the impact of Chinese currency is more important than that of processing cost and fish quota, it is decided by world macro economy and is not the focus of this project.

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<sup>7</sup> A separate manuscript was submitted together with the report, which was also sent to a journal for academic reviews.

**Table 12 Determinates to Chinese re-exports**

	<b>World Economy (10%)</b>	<b>Chinese Economy (10%)</b>	<b>Chinese Processing Cost (10%)</b>	<b>Chinese Currency (10%)</b>	<b>World fish quota (10%)</b>
Import price of raw fish	2.9%	1.7%	-2.8%	0.6%	-2.6%
Export price of frozen fillet	1.8%	1.0%	2.1%	4.2%	-1.6%
Domestic price	2.2%	1.3%	0.4%	-7.0%	-1.9%
Export volume	5.8%	-1.5%	-3.1%	-6.2%	2.3%
Domestic consumption volume	-4.2%	7.2%	-0.8%	13.6%	3.8%
Total demand	2.4%	1.4%	-2.3%	0.5%	2.8%

Source: Own estimation

## 6. Strategic suggestion to the Norwegian whitefish industry

The analyses from section 1 to section 5 suggest that China is the world most important whitefish processing center, but it is facing a big challenge in recently years. When the EU and USA demand became slow, the Chinese industry has been expanding the Brazil and African markets. The world demand for whitefish seems to recover in 2013; however, the processing costs in China will unavoidably grow in the long term due to increase of wage every year. But at the same time, along with significant growth of the Chinese income, China could be a potential consumption market for whitefish products.

The role of Norway in world whitefish industry is complex. Norway is both a raw fish supplier for the Chinese whitefish industry and a competitor in consumption market, particularly in the EU market. Although the Chinese cost still has comparative advantage in short run and loss of advantage might be compensated by well-developed infrastructure and logistics, flexibility of production industry entrepreneurship, increasing cost will definitely make the Chinese processing industry lose its comparative advantage in long run. The question is just whether it will happen in 5 years, or in 10 years. As a raw fish supplier, it is time for the Norwegian industry to look for a possible substitute such as Poland or Vietnam, or to cooperate with the Chinese industry to develop more value-added products.

Poland is close to both whitefish resource countries and consumption markets. It takes only 2-3 days for the Polish processing industry to purchase raw fish from Norway or Russia, and at the same time, processed products can be immediately distributed to the EU market. Contrastively, it takes around 6 months (Chart 1) for the Chinese processing industry. As we discussed in the magazine paper “Hvem skal

producere fryste torskefileter?”, localizing production not only greatly reduces capital binding cost, but also enhances the possibility of market-oriented production. Moreover, localizing also makes it possible for the Polish industry to use both fresh and frozen raw fish. The frozen fillets made of fresh fish are considered higher quality.

Results given in Section 3 show that processing cost is still much higher in Norway than in China. Norwegian frozen fillets thus cannot compete with Chinese products in prices in the EU market. As presented by figure 27, prices of frozen fillets from Norway is about 8-16 NOK/kg higher than that from China. This on the other hand, means that the EU consumers regard Norwegian products higher quality than Chinese products and would like to pay higher prices for quality. If Norwegian industry can further promote its quality and educate consumer to identify the credibility of Norwegian products, it is possible than more fillets can be processed in Norway.

Finally, we greatly suggest that the Norwegian industry should explore the substantially growing Chinese domestic market. There are several changes happening in the Chinese market, first, with significant income growth, people demand high quality protein food. Statistics indicate that potential demand for fish is higher than its main substitutes: pork, beef and eggs. Second, domestic seafood supply cannot meet the demand for domestic consumption and export. Third, there is an increasing demand for imported high quality seafood, e.g., lobster, king crab and salmon. Fourth, Chinese usually prefer having wild fish, which is considered tastier and less polluted compared to farmed fish. However, as natural resources are greatly destroyed and the Chinese government is working hard to protect resources, supply of farmed fish overweighs wild fish in China. Fifth, with frequent happening of food safety scandals and overall problems of environmental pollution in China, a huge group of well-educated and high-income people are seeking for safe food from abroad. Finally, Increasing income, high price inflation in China and appreciation of the Chinese currency (RMB) make the imported seafood relatively cheaper than before and become affordable for some people.

As we analyzed in Section 4, although there is a huge potential demand for Norwegian whitefish, the industry should help Chinese consumers identify quality differences between different species, particularly between Alaska pollock and Atlantic cod. Norwegian cod perfectly matches with the coming new concepts in the Chinese market. They are safe and of high quality, environmental friendly, ecological, easy to prepare and give good customer service. “One Hundred Meters” shop, which we discussed in Section 4 could be a good channel to promote the Norwegian fish. The importance is how to cooperate with local businessmen and establish a long term relationship to explore the Chinese markets together. Salmon from Norway is a significant brand in the Chinese market. It is possible to have the brand of Atlantic cod from Norway in the near future.