Joint assessment report of the effectiveness of buy-back scheme of China

1. Background

According to FAO report published in 2018, the fraction of fish stocks that are within biologically sustainable levels has decreased from 90.0% in 1974 to 66.9% in 2015. In contrast, the stocks fished at biologically unsustainable levels increased from 10% in 1974 to 33.1 % in 2015, with the largest increases in the late 1970s and 1980s (Figure 1, FAO, 2018). Nowadays, lots of fish stock are small-sized, low-aged and premature because of the long-term overexploitation all over the world. One of the important factors for this serious depletion of marine fisheries resources is the excessive fishing intensity (Guo et al., 2003).

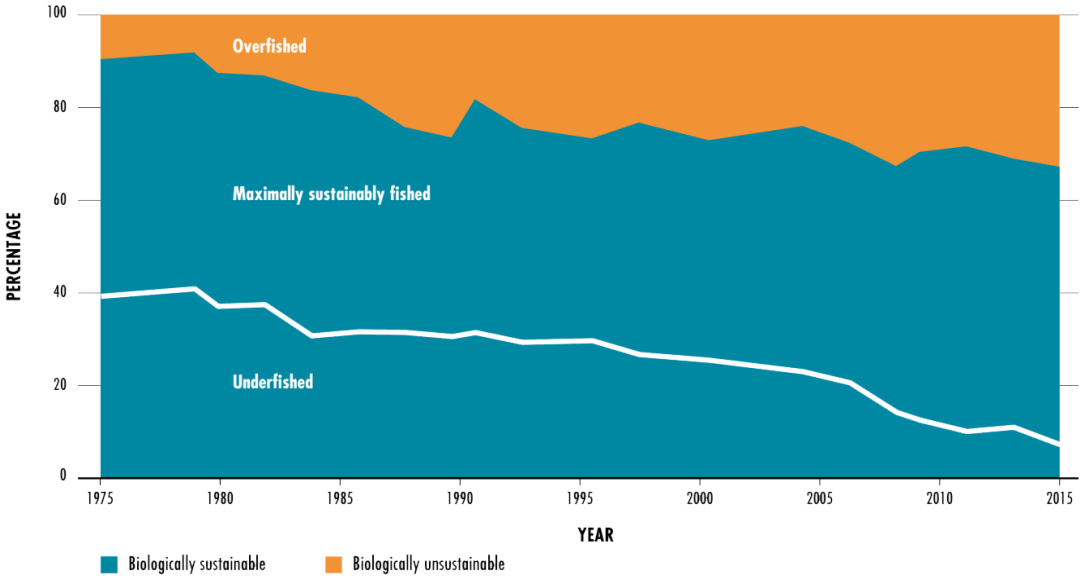


Figure 1 Global trends in the state of the world's marine fish stocks, 1974–2015 (FAO, 2018)

In order to conserve and manage marine fisheries resources, reducing fishing intensity has been implemented globally since decades ago. European Union has implanted "Multi-annual guidance programmes (MAGPs)" since 1980s, and the goal was to reduce the fishing intensity. Because of the depletion of fisheries resources in

the coastal waters and decrease of fishing area after the establishment of Exclusive Economic Zone (EEZ), Republic of Korea has reduced more than 26% of the total fishing vessels. Norway has banned the building of large-size fishing vessels since 1970s. In order to reduce fishing intensity of sardine and cuttlefish, Peru planned to raise US $ 200 million buy back fishing vessels and fishing licenses in 1999. Canada issued a Salmon Fishery Recovery Plan in 1996, which planned to reduce 50% salmon fishing vessels within 5 years. Other countries and regions, such as the United States, Japan, Australia and Taiwan Province of China, have implemented schemes of reducing fishing vessels. Some international and regional fisheries organizations also required their member countries to reduce fishing intensity in recent years (Guo et al., 2003).

China, as the biggest marine capturing country, plays a vital important role in sustainable fisheries and has implemented several effective measures to reach this goal, such as “summer fishing moratorium”, “stock enhancement”, “zero increase of marine capture catch”, “license system” and “buy back scheme” (Liu and Huang, 2005). License system and buy back scheme are used to control and reduce the fishing intensity. In this report, we will introduce why China implemented buy-back scheme and the impact of buy-back scheme on marine capture catch, on the number and horsepower of marine fishing vessels, as well as on the number of marine fishermen. For analysis in the Yellow Sea area, we did not include Zhejiang Province into this report because the fishing activities of Zhejiang mainly carried out in the East China Sea, while the Yellow Sea only accounts for a small proportion.

2. Results

2.1 Implementation of buy-back scheme

With the development of technology, more and more advanced and new technologies are applied to marine fisheries. Marine fishing intensity has not only increased the number of fishing vessels, it has also dramatically improved the efficiency of fishing. Under the contradiction between the surplus marine fishing intensity and the declining of marine fishery resources, under the limitation of various fishery agreements (China has implemented exclusive economic zone system and has

successively signed fishery agreements with Republic of Korea, Japan and Vietnam), and under the protection of summer closure season, the fishing operation space of coastal fishermen has greatly narrowed down.

China officially implemented the policy of reducing fishing vessels in 2003 through the Ministry of Agriculture, and its goal was to reduce 30, 000 vessels reduce 1270, 000 kW power by the end of 2010. In 2015, a subsidy program has been set up for marine fishermen to reduce their fishing vessels and transfer to new industries, providing financial subsidies to fishermen who voluntarily quit marine fishing and transfer to new industries (i.e. buy-back scheme). The Ministry of Agriculture and Rural Affairs held the first centralized dismantling activities of fishing vessels in Zhanjiang in July 2018.

For example, Zhoushan, an important fishery city in Zhejiang Province, decreased 14.9% of fishing vessels whereas the horsepower increased 17.5% within 10 years from 2007 to 2016. According to buy-back scheme of Zhejiang Province, marine fishing will be reduced about 2,580 vessels (12.4% of the total fishing vessels) and 430, 000 kW power. Zhoushan will reduce 733 fishing vessels and 132, 000 kW power, accounting for almost one-third of Zhejiang Province. The fishermen will lose their job or even quit fishing because of the implementation of buy-back scheme. For this reason, the scheme clearly proposes to give a relevant compensation to the ship owners involved in the reduction based on the power of the fishing vessels. The compensation includes 1) the national subsidy standard for vessel reduction is 5000 yuan/kW, 2) part of the subsidy fund for fishing vessel diesel price issued by the province should be used to raise the subsidy standard for reducing vessels, and 3) local subsidies will be provided in various forms to encourage the transfer of fishermen to secondary and tertiary fishery industries such as aquaculture and recreational fisheries and other non-fishery industries. For example, in Daishan County, the fishing vessel owners will receive an one-time subsidy of 80, 000 yuan if they change their job to recreational fishery, fishing homestay and other tourism related industries; for those who actively apply for the marine shipping specialist course, 50% tuition subsidy will be given.

For another example, Yantai, a coastal city in Shandong Province, reduced the

number of marine fishing vessels by 784 with a total power of 12,722 kW, accounting for 15% of the total number of fishing vessels from 2015 to 2018. The compensation of these dismantled fishing vessels were mainly from 1) the national standard subsidy of 5000 yuan/kW for dismantled vessels, 2) the provincial ceiling subsidy standard of 3000 yuan/kW for fishing vessel diesel which will reduce 1000 yuan/kW year by year, those saved money will be used to raise the subsidy standard for dismantled fishing vessels. By the end of March 2019, Yantai had dismantled 750 fishing vessels, accounting for 95% of the initial plan and involving more than 2,200 fishery workers.

2.2 Analysis of marine fishing vessels and fisherman

Based on China Fishery Statistical Yearbook published by Ministry of Agriculture and Rural Affairs of the People's Republic of China (former Ministry of Agriculture of the People's Republic of China), the number of marine capture fishing vessels of China decreased all the time from 2003 to 2018 (except 2009 and 2013 that rebounded a little) (Figure 2a). The highest number of marine capture fishing vessels of China occurred in 2003, which is about 225 thousand fishing vessels. By 2018, the fishing vessels have been reduced to about 156 thousand.

The trend of marine capture fishing vessels of four provinces and one city fishing in the Yellow Sea is similar to that of China nationwide. The marine capture fishing vessels of four provinces and one city fishing in the Yellow Sea decreased all the time from 2003 to 2018 (except 2013 that rebounded a little) (Figure 2b). The highest number of marine capture fishing vessels of four provinces and one city fishing in the Yellow Sea occurred in 2003, which is about 80 thousand fishing vessels. By 2018, the fishing vessels have been reduced to about 47 thousand.

For horsepower of marine capture fishing vessels, however, nationwide and four provinces and one city fishing in the Yellow Sea have opposite trends compared with number of fishing vessels (Figure 2), i.e. they increased steadily from 2003 to 2015 (except 2010 and 2012 for nationwide and 2004, 2006 and 2012 for four provinces and one city), and then suddenly drop down from 2016 up to now. The peak of horsepower of nationwide is 14.42 million kW in 2015, while that of four provinces and one city

fishing in the Yellow Sea is 4.15 million kW in 2015.

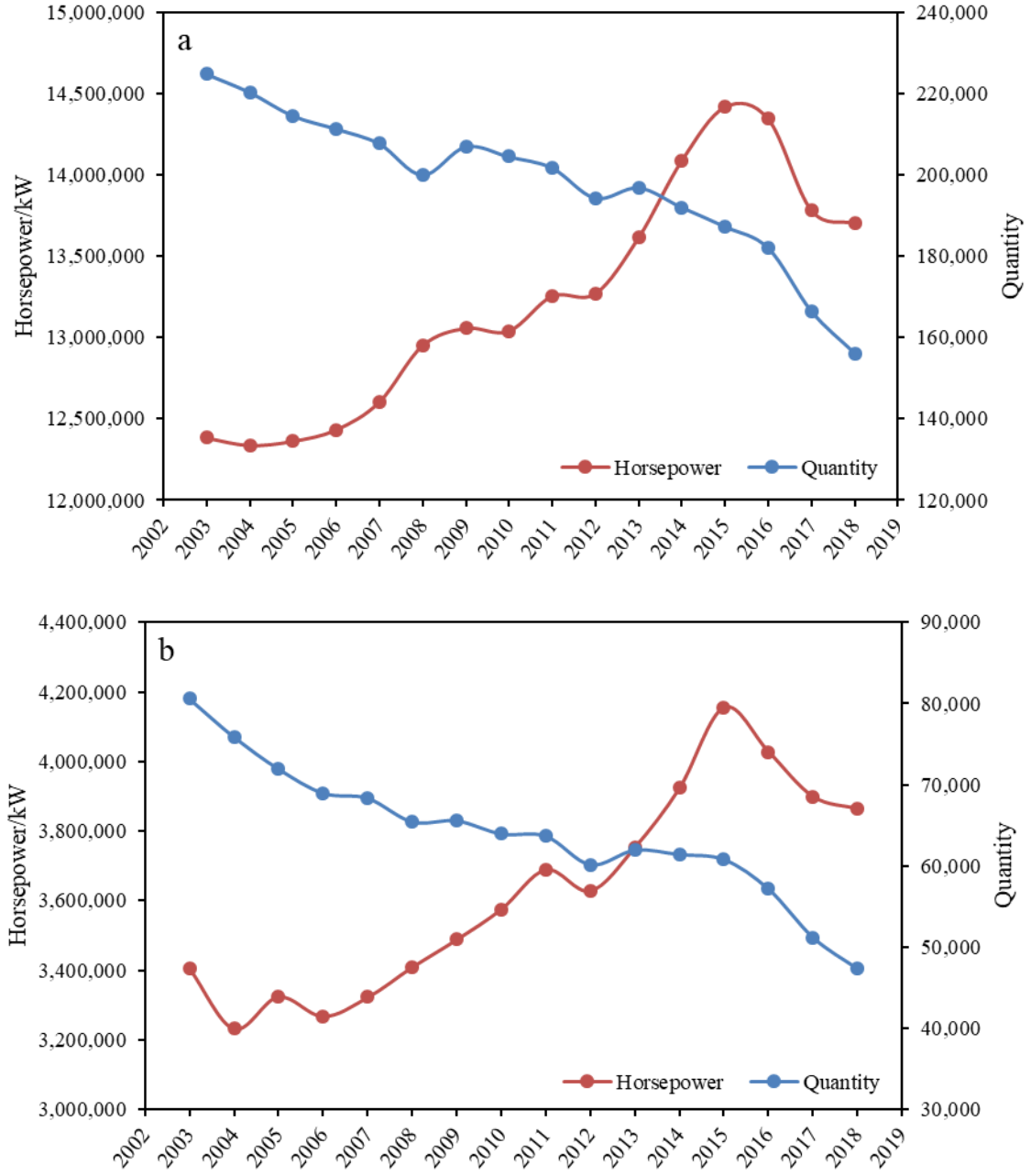
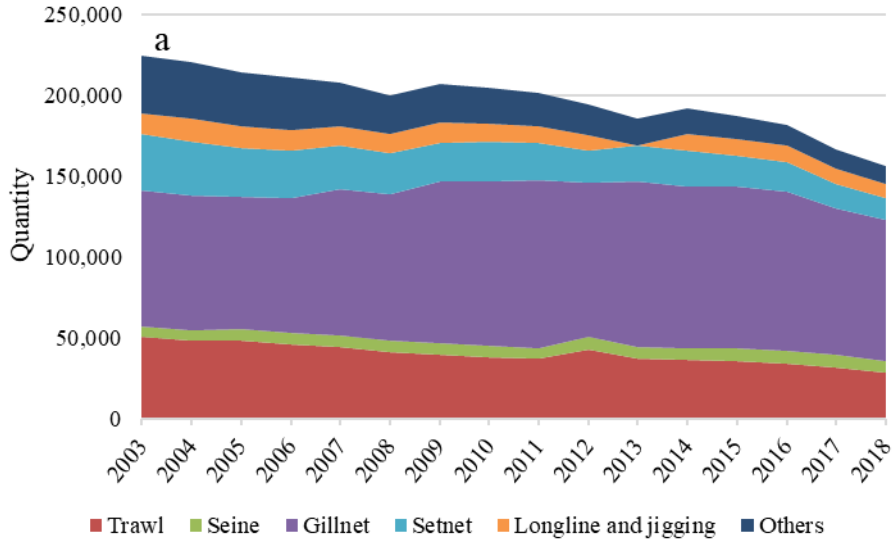


Figure 2 Quantity and horsepower of marine fishing vessels of nationwide (a) and four provinces and one city fishing in the Yellow Sea (b).

The Yearbooks started to sort fishing vessels by gear since 2003. The catch data sorted by gear in 2005 were not available in the Yearbooks. For quantity of fishing vessels of nationwide (Figure 3a), gillnet has the largest amount of vessel, followed by trawl and setnet, while seine has the smallest proportion. Trawl continuously decreased from more than 50, 000 to less than 37, 000 until 2011, and then rebounded in 2012 and

continuously decreased again to less than 29, 000; seine fluctuated from ca. 6, 000 to ca. 8, 000; gillnet fluctuate from 81,000 to 104,000, and decreased sharply in recent years; setnet decreased almost every year since 2003 (from ca. 35, 000 to ca. 13, 000); longline and jigging decreased from ca. 15, 000 to ca. 9, 000; category of "others" generally decreased from ca. 36, 000 to ca. 11, 000 since 2003.

For horsepower of fishing vessels of nationwide (Figure 3b), trawl accounts for the largest proportion, followed by gillnet and setnet, while seine has the smallest proportion in the first years. Trawl reached its peak of 6.80 million kW in 2015, and decreased to 6.06 million kW in 2018; seine increased continuously from 0.35 million kW to 1.30 million kW and started to decrease last year; gillnet increased continuously from 2.43 million kW to 3.99 million kW and started to decrease in 2017; setnet decreased continuously from 1.23 million kW to 0.62 million kW; longline and jigging fluctuated from 0.55 million kW to 1.34 million kW, and it kept growing in recent years; the category of "others" generally decreased from ca. 1.11 million kW to 0.60 million kW since 2003.



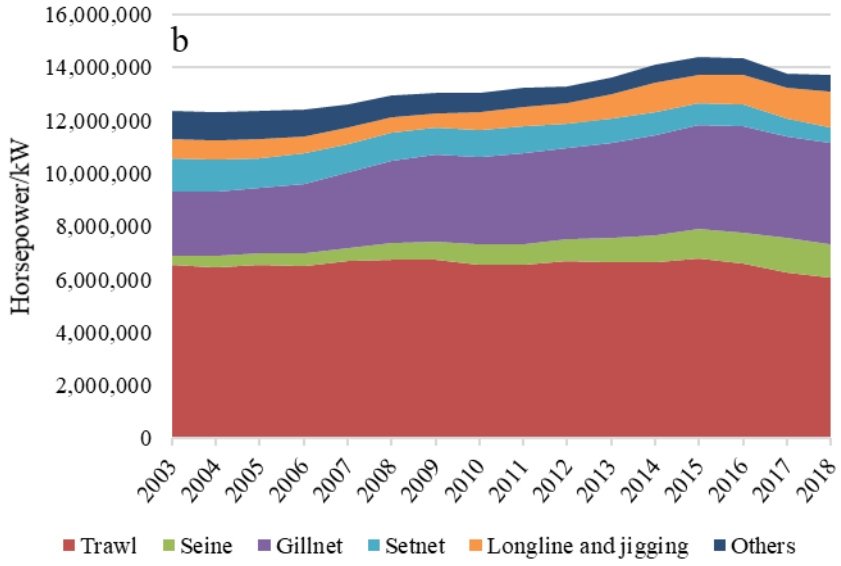


Figure 3 Quantity and horsepower of marine fishing vessels of China sorted by fishing gears

For quantity of fishing vessels of four provinces and one city fishing in the Yellow Sea (Figure 4a), gillnet has the largest amount of vessel, followed by trawl and setnet, while seine has the smallest proportion. Trawl has a decreased trend from more than 18, 000 to less than 15, 000 before 2011, and then rebounded in 2012 and continuously decreased again to less than 12, 000; seine fluctuated from 111 to 770; gillnet reached its peak of ca. 34, 000, and decreased to ca. 27, 000 in 2018; setnet decreased almost every year since 2003 (from ca. 15, 000 to less than 6, 000); longline and jigging fluctuated from 3, 294 to 2, 050, and decreased continuously in recent years; the category of "others" generally decreased from more than 15, 000 to less than 2, 000 since 2003.

For horsepower of fishing vessels of four provinces and one city fishing in the Yellow Sea (Figure 4b), trawl accounts for the largest proportion, followed by gillnet and setnet, while seine has the smallest proportion for most of the time. Trawl reached its peak of 2.03 million kW in 2015, and decreased to 1.80 million kW in 2018; seine decreased continuously from ca. 35, 000 kW to ca. 22, 000 kW and started to increase after 2011 and reached peak of ca. 114, 000 in 2017; gillnet decreased in the first four years and then increased continuously from 0.82 million kW to its peak of 1.51 million kW in 2016 and started to decrease then; setnet has a general decrease trend from 0.38

million kW to 0.15 million kW; longline and jigging fluctuated from 0.06 million kW to 0.28 million kW, and it had relative high values in recent years; the category of "others" generally decreased from ca. 0.40 million kW to 0.05 million kW since 2003.

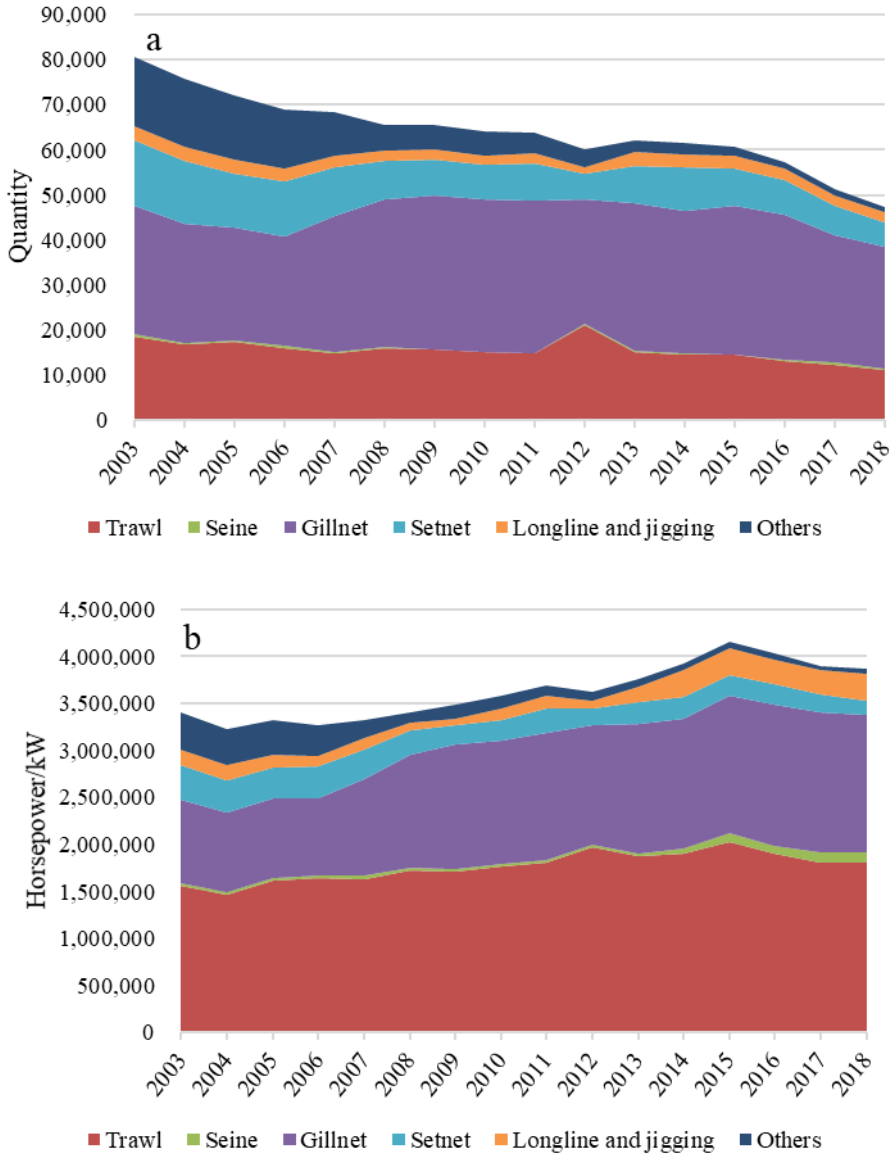


Figure 4 Quantity and horsepower of marine fishing vessels of four provinces and one city fishing in the Yellow Sea sorted by fishing gears

For quantity of fisherman, nationwide trend increased much faster than that of four provinces and one city fishing in the Yellow Sea (Figure 5). Notably, the datapoint of nationwide in 1999 is an outlier because of lacking data of Guangxi Province. For nationwide, the quantity fisherman increased steadily until 2013 with a peak of 3.91 million, and it started to decrease then. For four provinces and one city fishing in the

Yellow Sea, the quantity fisherman increased slowly before 2008, the number suddenly increased in 2008 and then increased slowly until 2012 with a peak of 1.73 million, and decreased after then.

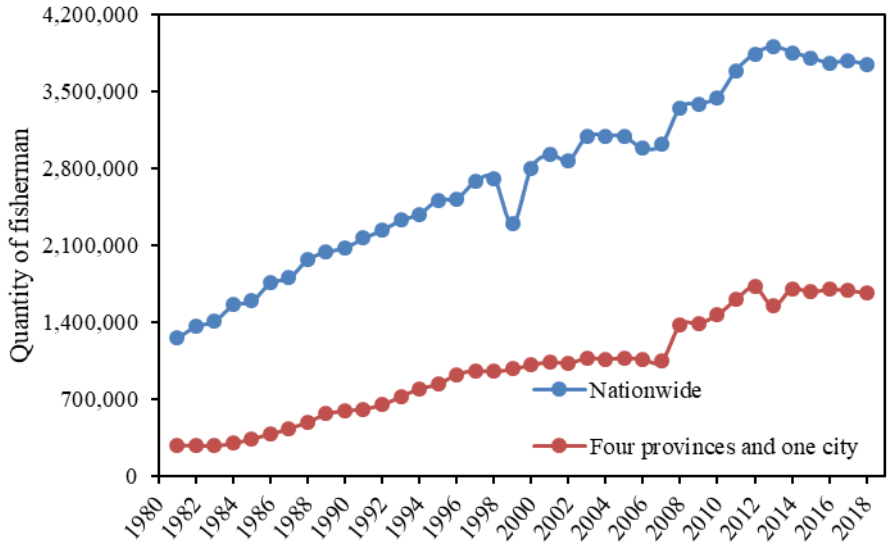


Figure 5 Quantity of marine fisherman of nationwide and four provinces and one city fishing in the Yellow Sea

2.3 Analysis of marine capture catch

For catch of nationwide (Figure 6), it increased very quickly before 1996, and then kept relative stable for two decades, and then deceased after 2015. For catch of four provinces and one city fishing in the Yellow Sea (Figure 6), it increased steadily before 1995, and suddenly increased in 1996, and decreased a little in 1998 and two years after, and kept stable in the following 14 years, and then decreased.

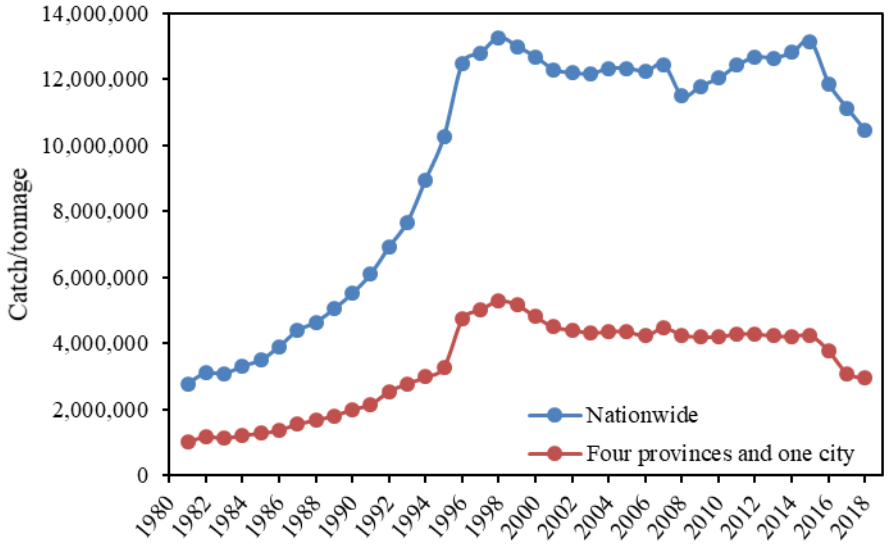


Figure 6 Total marine capture catch of nationwide and four provinces and one city fishing in the Yellow Sea.

For catch in different sea areas (Figure 7), East China Sea has the largest proportion of catch all the time, followed by South China Sea, Yellow Sea and Bohai Sea. Distant-water catch were recorded before 2007 and then recorded separative after 2007. The trends among years for these sea areas were similar to that of the total catch showed in Figure 6.

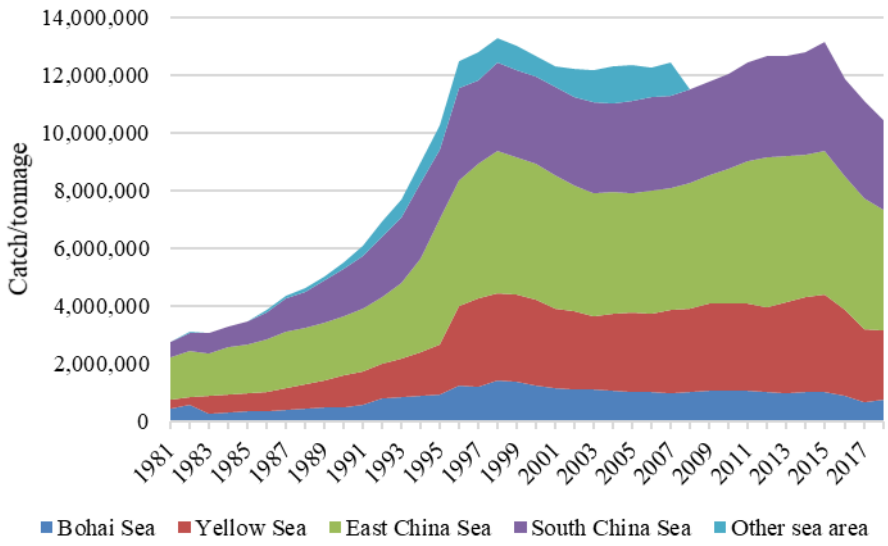
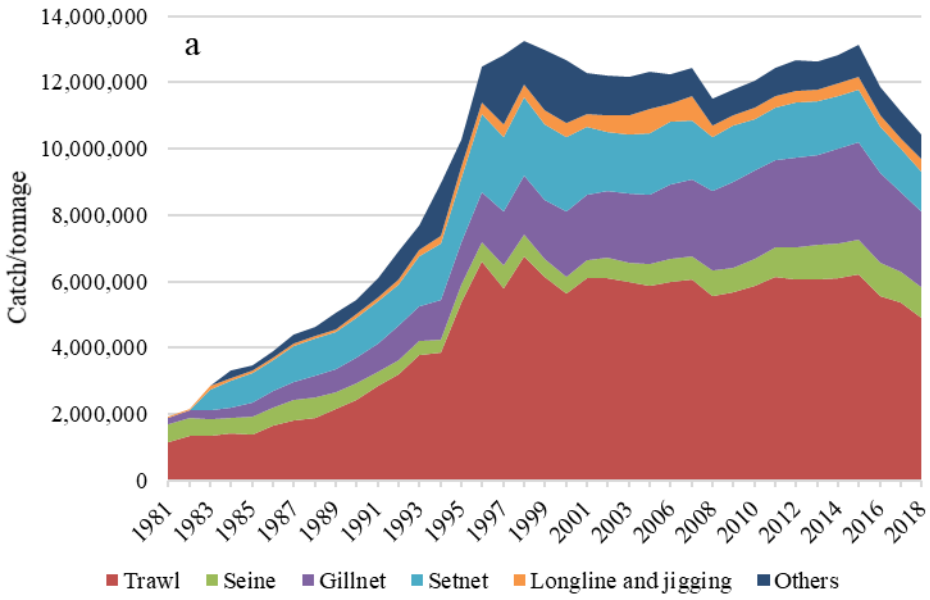


Figure 7 Marine capture catch sorted by sea areas.

For marine capture catch of nationwide sorted by fishing gears (Figure 8a), trawl has the largest proportion. Second largest proportion was setnet before 2001 and was gillnet after 2002. Longline and jigging has the smallest proportion. For marine capture catch of four provinces and one city fishing in the Yellow Sea sorted by fishing gears (Figure 8b), trawl has the largest proportion. Second largest proportion was setnet before 2001 and was gillnet after 2002. Longline and jigging had the smallest proportion before 1996 and after 2017, and seine had the smallest proportion for the other period.



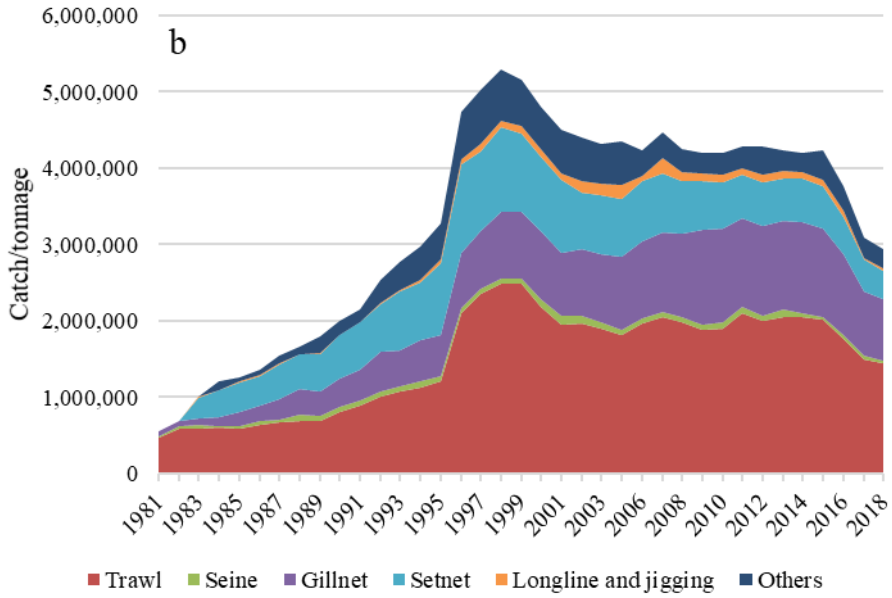


Figure 8 Marine capture catch of nationwide (a) and four provinces and one city fishing in the Yellow Sea (b) sorted by fishing gears.

2.4 Analysis of catch per unit effort (CPUE)

The CPUE of nationwide is relative lower than that of four provinces and one city fishing in the Yellow Sea (Figure 9), which has changed in the last two years. For the CPUE of nationwide, the peak was 1.00 tonnage/kW in 2004 and 2005, and the lowest value occurred in 2018 with 0.76 tonnage/kW; the CPUE kept stable in the first five years (around 1.00 tonnage/kW), and decreased in 2008, then increased in the following four years, and deceased again in the last six years. For the CPUE of four provinces and one city fishing in the Yellow Sea, the peak was 1.35 tonnage/kW in 2004, and the lowest value occurred in 2018 with 0.76 tonnage/kW; the CPUE decreased all the time in general except 2004, 2007 and 2012.

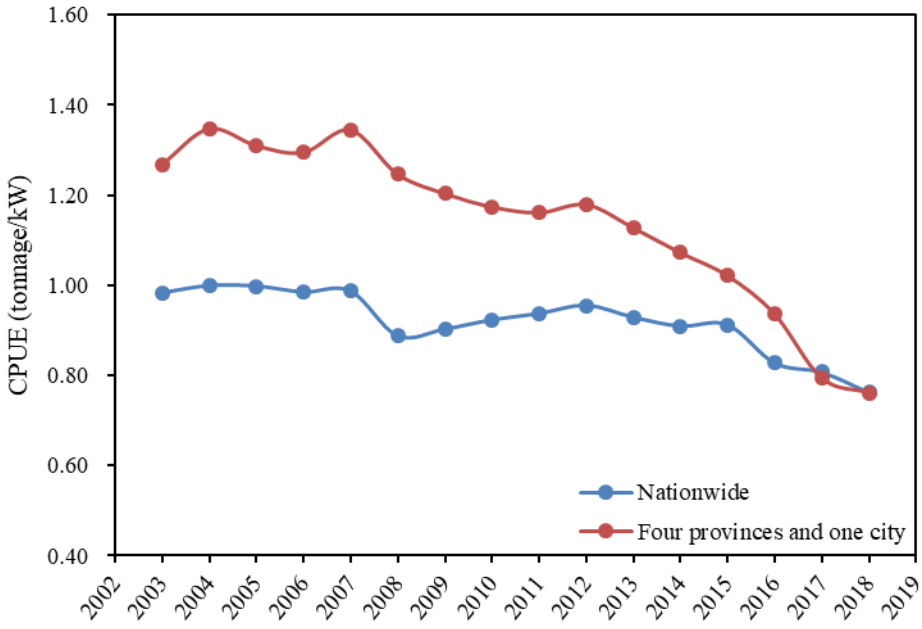


Figure 9 CPUE of nationwide and four provinces and one city fishing in the Yellow Sea.

CPUE of nationwide and four provinces and one city fishing in the Yellow Sea sorted by fishing gears have totally different trend in the last three decades (Figure 10).

For CPUE of nationwide sorted by fishing gears (Figure 10a), setnet has the highest CPUE all the time except the first two years and has a general increase tendency in the last three decades (1.46-1.98 tonnage/kW). Seine had the highest CPUE among gears for the first two years (more than 1.60 tonnage/kW), and then decreased sharply to ca. 0.98 tonnage/kW within 3 years, and increased a little in the following four years, and decreased again to 0.97. Trawl and gillnet are relative stable compare to other gears, and trawl (0.81-0.94 tonnage/kW) is a little bit higher than gillnet (0.60-0.86 tonnage/kW). Gillnet slightly decreased in the last 6 years. Longline and jigging started to steadily decrease from 1.00 tonnage/kW in 2008 to 0.28 tonnage/kW in 2018. The category of "others" increased 0.87 tonnage/kW in 2006 to 1.47 tonnage/kW in 2012 and then fluctuated around this level after then.

For CPUE of four provinces and one city fishing in the Yellow Sea sorted by fishing gears (Figure 10b), trawl and gillnet have the similar trend with the nationwide, trawl ranged from 0.80 to 1.26 tonnage/kW and gillnet ranged from 0.55-1.23 tonnage/kW. Seine and the category of "others" have fluctuant trends compare to others. Seine decreased in the first two years and increased from 1.79 tonnage/kW in 2004 to

3.83 tonnage/kW in 2010, and decreased sharply until 2015 to 0.79 tonnage/kW, and kept stable in last three years. The category of "others" generally has a increase trend from 1.30 tonnage/kW in 2003 to 6.48 tonnage/kW in 2017 and then decreased to 5.03 tonnage/kW in 2018. Setnet fluctuated from 2.03 to 3.19 tonnage/kW. Longline and jigging fluctuated from 0.09 to 1.76 tonnage/kW, and kept decreasing since 2012 and reached the minimum in 2018.

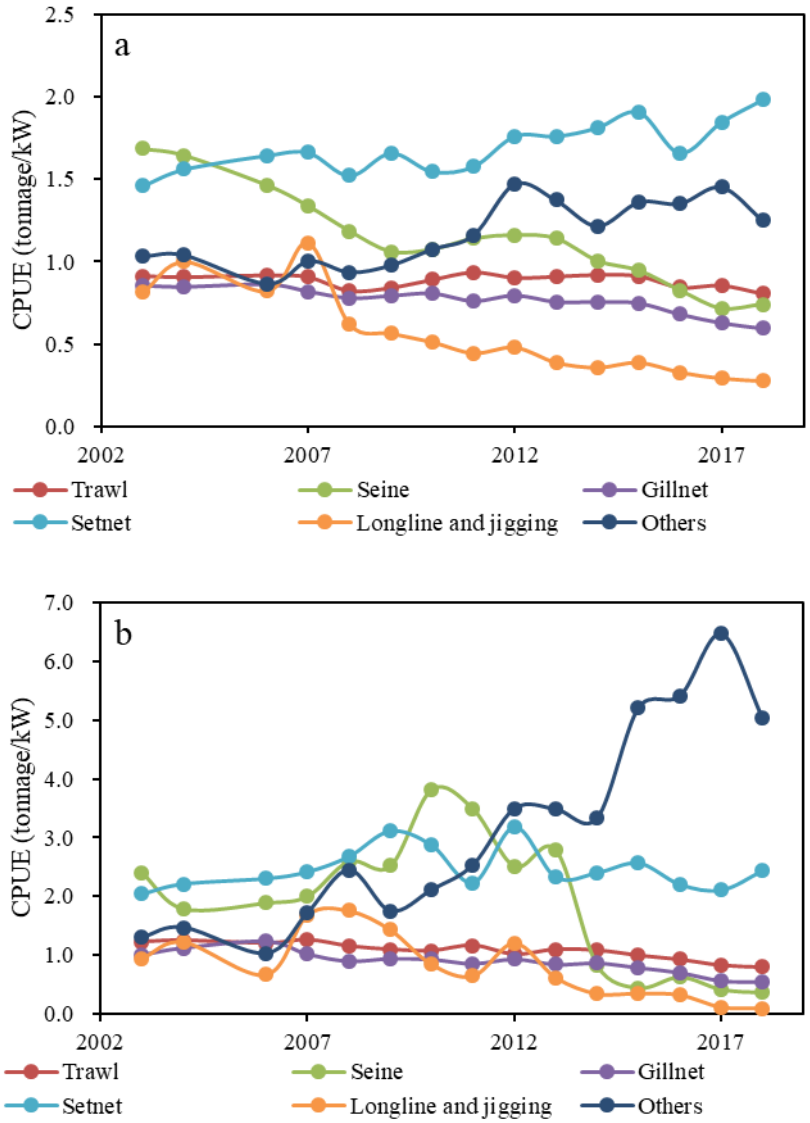


Figure 10 CPUE of nationwide (a) and four provinces and one city fishing in the Yellow Sea (b) sorted by fishing gears.

3. Future prospect

The key to the success of buy-back scheme is whether the fishermen are properly placed. In order to make the fishermen self-reliant, the government plays a supporting

role, and to make it well managed in a number of ways.

Increase the education training intensity of fishermen. Improving the quality of fishery workers and creating employment opportunities for them; making training plans and implementing them well, and actively carrying out technical training for fishermen who have transferred to other industries so that their business abilities can be further improved. For instance, helping them to improve the information in various fishery markets and provide them with some technical assistance in aquaculture to improve their competitiveness in their work.

Strengthen the implementation of supportive policies. It is necessary to increase the policy support for the transfer of fishery labor force into other industries, and strongly encourage fishermen to transfer to other industries; simplifying the approval processing procedure of transferring fishermen to other industries; at the same time, reduce the tax for those transferred fishermen. For example, the government should support the policy of re-employment of fishery labor in the recreational fishery, and also provide support for the transfer of fishermen whose boats have been reduced.

Develop new job opportunities for transferred fishermen. Combined with the local construction plans, through the government assistance and market operation, developing effective carriers for marine aquaculture, market circulation, aquatic product processing, and recreational fisheries can be encouraged.

Strengthen fishery law enforcement supervision. In order to prevent the IUU involved in fishing, and to eradicate other illegal behavior of fisheries, the municipal and county-level fishery law enforcement teams need to increase law enforcement supervision frequency. Strict inspections and paying attention to rectification, and ensuring that the rectification is carried out in all directions, and work should be carried out in all aspects to maximize the protection of fishery resources.

As for the old wooden fishing boats that fishermen voluntarily scrap and eliminate, and the fishing boats that cause heavy damage to the marine environment, the government should actively guide them to upgrade their fishing boats or upgrade the fishing boats to fiberglass standard.

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