

CHINESE AQUACULTURE: A COMPARATIVE ANALYSIS OF THE COMPETITIVENESS OF REGIONAL AQUACULTURE INDUSTRIES

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ABSTRACT

In the last 30 years the Chinese Aquaculture Sector has become one of the most rapidly developing areas within Chinese Agriculture. The total output of aquaculture products (more than 51 million tons) has placed China as the world's largest producer of aquaculture products since 1990, with more than 70% of the world's production. This article is a tentative comprehensive assessment of China's regional competitive strengths in aquaculture industries by means of the projection pursuit model (PP). Firstly, it clarifies the study scope and the relevant concepts. Secondly, it goes into the specifications of the competitiveness indexes of regional aquaculture industries. Thirdly, it presents an introduction to the projection pursuit model and the five steps involved in its application. Lastly, it first gives a brief overview of aquaculture in China mainland, then, it calculates and assesses the aquaculture competitiveness levels of various regions in China mainland by projection pursuit model, and, based on these calculated results, it ranks China's provinces, municipalities, and autonomous regions in terms of aquaculture competitive power, and, finally, it classifies and assesses various regions on the basis of the above assessment results.

Keywords:

Aquaculture in China-mainland, comprehensive assessment of industrial competitiveness, projection pursuit model

DEFINITION OF THE SCOPE OF STUDY AND RELEVANT CONCEPTS

Definition of the study scope

The scope of this study is defined in terms of "region" and "industry". "Regions" in this article refer to the administrative regions such as provinces, autonomous regions and directly governed regions in China mainland. As for Taiwan, Hong Kong, and Macaw, due to their difference in statistical criteria and indexes, they are not included in this study for the completeness and comparability of the data. Besides, Tibet is excluded from this assessment for its incomplete data. Therefore, the "regions" assessed in this paper refer to the 30 provinces, autonomous regions and directly governed city regions in China mainland. Defined in terms of "industry", the regional aquaculture studied in this paper refers to the aquaculture in specific administrative regions of China mainland, including sea-water aquaculture and inland Aquaculture.

Connotation of the competitiveness of regional aquaculture industries

Regional aquaculture competitiveness refers to the comprehensive competitive power of aquaculture a region possesses and has already manifested in the market. Specifically, it means, under present conditions, the various capacities a region possesses and is capable of fulfillment, including capacities of adaptability, profitability, expansibility, risk resistance, and sustainable development, as required by the market demands. It reflects the development level and comprehensive strength of a region in aquaculture at a

certain stage. Assessment of the aquiculture competitive power levels of the various regions allows a quantified description of the competitive power of a region in aquiculture at a certain time, and the comparative levels of various regions in aquiculture competitiveness at the same period.

SETTING OF THE ASSESSMENT INDEXES FOR REGIONAL COMPETITIVENESS IN AQUICULTURE INDUSTRIES

Principles for the setting of indexes

The competitive power in aquiculture of a region is subject to the influences and constraints of many factors, and therefore, its assessment requires the setting of indexes that are characteristic of aquiculture. It is our belief that the index system should conform to the following principles.

First, to be all round and systematic. Unlike other industries, this industry is most characterized by its highly dependence on natural resources. As the production processes for live fish, shrimp, crab, and shellfish are very demanding on the environmental factors, it determines the complexity in the analysis of the aquiculture competitive power. The indexes set should reflect the characteristics of aquiculture comprehensively.

Second, to be operable. Quantified indexes reflect a region's competitive strength in aquiculture, so the set indexes should have data easy to collect, calculate and analyze, and in case of indexes hard to quantify, use similar quantifiable indexes as substitute.

Third, to be comparable. The ultimate aim of the assessment of competitive strength of a region in aquiculture is to compare the competitive strengths of different regions in aquiculture. For that purpose, highly comparability in the selection of indexes and the setting up of an index system is recommendable. This calls for complete and identical index data for the assessment of the competitive strengths in aquiculture of different regions. Consistence of the system ensures assessment of the competitive strengths of different regions in aquiculture by the same criterion.

Indexes for assessment of competitiveness level of a region in aquiculture

The competitive strength level of a region in aquiculture is the result of the interplay of many capacities of a region in a certain period or at a certain point of time. It mainly consists of capacities in five respects, namely, the capacity for market take-up, capacity for profit making, capacity for risk resistance, capacity for expansion, and capacity for sustainable development. Here we list the representative indexes reflecting the various capacities as follows.

Indexes of the capacity for market take-up

In this paper, the capacity for market take-up of a region in aquiculture is measured by the indexes for the aquiculture product's market share, which represent the scale of the industry, and by the export rate of the aquiculture products. The market share of a region's aquiculture amounts to the annual total yield of aquiculture products of a region divided by the national total yield in the same year. The bigger the relative value, the bigger the domestic market share. Export rate of aquatic products amounts to the annual monetary value for aquatic products divided by the national total monetary value for aquatic products in the same year, and it represents the capacity of a region for taking up the international market of aquatic products.

C_1 = aquiculture market share (%)

C_2 = export rate of aquatic products (%)

Indexes for capacity of profit making

The capacity for profit making of a region's aquaculture means its capacity to make profits through production operation, and it is the fundamental guarantee for the fulfillment of effective accumulation and maintenance of normal development. As for regional aquaculture, the capacity for profit making is mainly indicated by production scale and the cost-benefit rate determined by production cost and market price.

C_3 = gross product of aquaculture (10,000 Yuan)

C_4 = cost-benefit rate for intensive culture of fresh water fish (%)

In general, for aquaculture, the bigger the production scale is, the lower the unit cost, and the higher the market prize, the higher capacity for profit making. Conversely, it will have a weaker capacity. As a result, we take regional gross product of aquaculture to represent the production scale of a region. Cost-benefit rate is a direct reflection of production cost and benefit for aquaculture, and, consequently it determined, to a degree, the choice of the scale of the regional aquaculture industry and the type of production operation. For the limited data available, this paper refers to the results of a sampling survey on the cost-benefit among farmers of intensive culture of fresh water fishes published in *National Agricultural Cost-benefit Compilation 2004* (China Statistics Press, 2004) compiled by the Price Bureau under the National Development and Reform Commission. Due to the gap of data on the cost for marine culture, this paper only deals with the cost for fresh water aquaculture.

Indexes of the capacity for risk resistance

The capacity for risk resistance in regional aquaculture means the capacity of a regional aquaculture enterprise to minimize the losses from various risks in order to maintain the stability of aquaculture production and the sustained development of the industry. The risks for aquaculture mainly come from two aspects: risks from nature and risks from the market. Here, we indicate these two risks with indexes of disaster-induced monetary value loss and specialization degree of aquaculture.

C_5 = nature disaster-induced monetary value loss per hectare: 10,000 Yuan (reverse index)

C_6 = index of relative degree of specialization for regional aquaculture

C_7 = relative index of the progress in general adoption of market principles

Disaster-induced monetary value loss is a reverse index. Less regional disaster-induced monetary value loss in a period means less liability from natural risks of a region's aquaculture. Conversely, it means greater negative influences on the region from natural risks.

The relative degree of specialization of regional aquaculture amounts to the relative value of a region's gross product of aquaculture and its gross product of farming, forestry, animal husbandry and fishery in relative to the national gross product of aquaculture and the national gross product of farming, forestry, animal husbandry, and fishery. When the factor is more than 1, it shows that the regional specialization degree in aquaculture exceeds the national average level, and the region has a surplus of product, and it is a region of export, and comparatively more competitive; and when the factor is less than 1, it is comparatively less competitive.

Regional degree of general adoption of the market principles reflects the socialization degree in regional aquaculture and the adaptability of the regional aquaculture products to the market. With a higher degree, if the regional aquaculture products can meets the market demands in variety and quantity, then the regional aquaculture is capable of resisting and relieving market risks. The relative indexes for the progress of general adoption of the market principles in this paper come from *China's General Adoption of Market Principles --- a Report on the Relative Progress of General Adoption of Market Principles of Various Regions* --- compiled by Fan Gang with the National Economics Research Institute under China Economic Reform Research Fund ---, and they serve as the indexes for regional degree of general adoption of market principles.

Indexes of the capacity for expansion and sustainable development

The regional capacity for expansion of aquiculture means a region's capacity to increase the scale and enhance the level of its aquiculture industry. Regional capacity for sustainable development of aquiculture means the supporting strength a region is available for the sustained development of its aquiculture industry.

C_8 = added value of aquiculture product (10,000 Yuan)

C_9 = export-oriented degree of aquiculture

C_{10} = average unit yield of aquiculture

Added value of aquiculture product means the gross results of the regional production activities of aquiculture in a checking period in the form of currency. The calculating method: deduct the input in aquiculture from the gross output of aquiculture. The index of export-orientation degree serves to describe the regional export degree of aquiculture, an important index for measurement of a region's degree of opening up to the outside world and its capacity for exterior market expansion. Here is the calculation equation: the export-orientation degree of the industry = (the relative specialization factor of regional industry minus 1) / the relative specialization factor of regional industry. Generally, the regional export-orientation degree is directly proportional to the regional competitive strength; and vice verse.

Table 1 Indexes of regional aquiculture competitiveness

System of indexes for assessment of regional aquiculture competitive strength level	1.	indexes of the capacity of market take-up	(C1) market share of the aquiculture (%) (C2) export rate of aquiculture products (%)
	2.	indexes of the capacity for making profits	(C3) gross product of aquiculture (100 million Yuan) (C4) cost-benefit rate for intensive culture of freshwater fish (%)
	3.	indexes of the capacity of resisting risks	(C5) disaster-induced monetary value loss in aquiculture waters (reserve index)
	4.	indexes of the capacity for expansion	(C6) specialization factor of aquiculture production (C7) relative index of the progress of general adoption of market principles
	5.	indexes of the capacity for sustainable development	(C8) added value of aquiculture (10,000Yuan) (C9) export-orientation degree of the industry (C10) unit yield level of aquiculture

EXPLANATION OF THE COMPUTATION METHOD

This paper adopts an approach that combines qualitative analysis and quantitative analysis. While qualitative analysis mainly allows an elaboration of regional in aquiculture competitive strength in terms of connotation and logic, quantitative analysis mainly makes for an accurate measurement of the strength by means of measurement of index data and therefore ensures more objectiveness and comparability of the research result. This paper adopts the projection pursuit comprehensive method to compute the aquiculture competitive strength level of every region, and it process the data with DPS data processing system (Tang Qiyi, 2002).

Projection pursuit means to project high dimensional data onto low dimensional space and to analyze the characteristics of high dimensional data based on the distribution structure of the data projected on the low space. Suppose the No. j i index of No. i sample is x_{ij}^0 ($i = 1, \dots, n; j = 1, \dots, m$), and n is the total number of samples, m is the total number of the assessment index, then here are the steps to set up the projection pursuit model for comprehensive assessment of regional aquiculture competitive strength:

First, non-dimensionalize the data. Before the measurement and computation, get the raw data non-dimensionalized, that is,

$$x_{ij} = \frac{x_{ij}^0}{x_{j\max}^0} \quad (1)$$

In the formula, $x_{j\max}^0$ means the maximum sample value of the No. j index.

Second, linearise projection. This paper selects lineal projection, that is, to study the high dimensional data by projecting it onto a one-dimensional space. Suppose a is the M-dimension projection direction vector, then formula (2) serves to describe the single-dimensional characteristics of x_{ij} :

$$z_i = \sum_{j=1}^m a_j x_{ij} \quad (i = 1, \dots, n) \quad (2)$$

Third, to build the objective function, namely to get the maximum value of between class distance $s(a)$ and class density $d(a)$ of z_i at the same time on the one-dimensional space. Then comes the formula for the definition of the objective function $Q(a)$:

$$Q(a) = s(a) \times d(a) \quad (3)$$

Compute the between class distance with the projection characteristic value standard deviation of the sample sequence.

$$s(a) = \sqrt{\frac{\sum_{i=1}^n (z_i - \bar{z})^2}{n-1}} \quad (4)$$

In the formula, \bar{z} is the mean value of projection characteristic value z_i . A bigger $s(a)$ means a wider distribution of the sample. The definition of intra-class density is:

$$d(a) = \sum_{i=1}^n \sum_{k=1}^n (R - r_{ik}) f(R - r_{ik}) \quad (5)$$

In the formula, $r_{ik} = |z_i - z_k|$ ($k = 1, \dots, n$) refers to the distance between two projection characteristic values; R refers to density window width, and is relative to data characteristics, and in the paper $R = 0.1$; $f(R - r_{ik})$ is a unit step function. When $R > r_{ik}$ $f(R - r_{ik}) = 1$, otherwise, $f(R - r_{ik}) = 0$. The value of $d(a)$ is proportional to the obviousness of the clustering of samples.

Fourth, optimize the projection direction. When formula (3) reaches its maximum value, the “ a ” then is the best projection direction that best reflects the data characteristics. Then we may convert the problem to find the optimal projection direction into the problem of non-linear optimization as described by formula (6). In this paper, we use the following formula for a solution:

$$\begin{cases} \max Q(a) \\ \|a\| = 1 \end{cases} \quad (6)$$

Fifth, make a comprehensive analysis of the optimized a , to compute the characteristic value of projection z_i which reflects the comprehensive information of the various assessment indexes, and make a comprehensive assessment and analysis of the samples using the difference levels of z_i .

MEASUREMENT AND ASSESSMENT OF REGIONAL AQUICULTURE COMPETITIVENESS LEVELS IN CHINA-MAINLAND

overview of aquiculture in China

Since 1990, China has been the biggest country for the total output of aquaculture products in the world, and its aquiculture output exceeds 70% of the total global aquiculture output. According to statistics, in 2005, China's aquatic output has reached 51.0165 million tons, including 33.9325 million tons of aquiculture output, accounting for 67% of the total aquatic output; the marine aquiculture output 13.8478 million tons, accounting for 40% of the total aquiculture output (49% of the total output of marine products); the inland aquiculture output 20.0847 million tons, accounting for 60% of the total output of aquiculture (89% of the output of inland aquatic products); China had an aquiculture area of 7.5453 million hectares, including 1.6945 million hectares for marine aquiculture, accounting for 22.45% of the total area of aquiculture. Considered from the product structure of the aquiculture, in the marine aquiculture, aquiculture of shellfish ranks first either in area or output, accounting for 21% and 77.09% of the area and total output of marine aquiculture; in inland aquiculture, the output of fish has kept a steady percentage of 90% of the total output of inland aquiculture, followed by the aquiculture of crustacean, shellfish and algae.

Measurement of the regional aquiculture competitiveness level

Here's a collection of the relevant data sorted out of the indexes of the 30 provinces, autonomous regions, and directly governed city regions in aquiculture competitive strength.

Table 2 Index data of competitiveness of the regional aquiculture in China mainland

REGIONS	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10
Beijing	0.3118	0.1711	8.92	9.78	2.04	0.4255	6.30	2213.00	-1.35	3266.0
Tianjin	1.0663	0.6728	30.49	24.38	2.50	1.5815	6.58	145066.00	0.37	4876.5
Hebei	1.5652	0.9440	44.76	15.62	5.88	0.2355	6.70	255319.00	-3.25	3668.5
Shanxi	0.0819	0.0002	2.34	16.09	2.04	0.0608	4.57	2846.00	-15.45	1971.0
Inner Mongolia	0.1607	0.0002	4.60	16.09	6.25	0.0675	3.45	16356.00	-13.82	444.0
Liaoning	6.6234	14.9635	189.41	16.09	3.57	1.5675	5.60	1106034.00	0.36	4063.5
Jilin	0.2359	0.2703	6.75	16.09	0.04	0.0897	4.51	16881.00	-10.15	467.0
Heilongjiang	1.2322	0.0271	35.24	10.06	2.04	0.3875	3.97	105712.00	-1.58	999.0
Shanghai	1.3207	1.4099	37.77	4.94	0.42	1.8969	6.59	86870.00	0.47	6838.0
Jiangsu	14.0524	1.4922	401.87	12.02	4.76	2.0778	7.04	1715165.00	0.52	3485.5
Zhejiang	6.3278	14.6303	180.96	16.18	0.82	1.6979	8.24	1112979.00	0.41	5674.5
Anhui	4.5811	0.1005	131.01	29.42	3.33	0.9959	5.40	721108.00	0.00	2336.0
Fujian	9.9537	12.4977	284.65	14.69	0.60	2.7011	7.28	1634509.00	0.63	13218.0

Jiangxi	4.6304	0.9164	132.42	6.34	2.27	1.5690	5.12	926930.00	0.36	3859.0
Shandong	10.0778	31.6200	288.20	16.09	0.86	1.0430	6.22	1730610.00	0.04	6131.0
Henan	1.1293	0.0218	32.29	19.93	1.85	0.1362	5.97	218685.00	-6.34	2097.0
Hubei	6.9716	0.3912	199.37	12.58	1.89	1.4699	5.53	1286964.00	0.32	4075.0
Hunan	4.2987	0.0451	122.93	2.33	16.67	0.8031	5.99	774235.00	-0.25	3413.0
Guangdong	15.1177	17.8388	432.33	33.57	1.14	2.5080	8.33	1354095.00	0.60	8771.5
Guangxi	3.4564	0.3840	98.84	16.09	2.00	0.9544	5.28	573295.00	-0.05	9557.0
Hannan	1.9395	1.5251	55.47	16.09	2.63	1.5803	5.65	355834.00	0.37	7489.5
Chongqing	0.7730	0.0000	22.11	16.09	7.69	0.4509	5.57	174648.00	-1.22	3409.0
Sichuan	2.5720	0.0231	73.55	10.98	5.00	0.4082	5.29	463394.00	-1.45	4546.0
Guizhou	0.2865	0.0000	8.19	16.09	2.04	0.1952	3.86	53580.00	-4.12	1904.0
Yunnan	0.7341	0.0317	20.99	13.06	14.29	0.2719	3.39	41923.00	-2.68	2474.0
Shaanxi	0.1632	0.0007	4.67	46.11	0.32	0.0896	4.48	10342.00	-10.17	2386.0
Gansu	0.0272	0.0009	0.78	16.09	0.16	0.0204	4.02	6935.00	-48.13	744.0
Qinghai	0.0038	0.0036	0.11	16.09	2.04	0.0159	2.00	720.00	-62.02	39.0
Ningxian	0.1384	0.0000	3.96	16.09	2.04	0.3941	2.69	16621.00	-1.54	3336.0
Xijiang	0.1667	0.0179	4.77	16.09	2.08	0.0907	2.90	15446.00	-10.02	950.0

Source: China Fishery Statistics Yearbook.

We compute the above data using a comprehensive projection pursuit method, and get the results below through the foregoing computation procedure: the standard deviation of projection value $s(a)$ is 2.2215, local density $d(a)$ is 17.7952, and objective function $Q(a)$ is 39.5330.

Table 3: PP Measurement Result

S	PV	Order	S	PV	Order	S	PV	Order
GD	5.4121	1	AH	0.4213	11	YN	-1.5331	21
FJ	4.2660	2	TJ	0.4191	12	HLJ	-1.5599	22
SD	3.8401	3	Hunan	0.4191	13	GZ	-1.7388	23
JS	3.2195	4	SH	0.4190	14	JL	-1.8543	24
ZJ	2.9450	5	HB	-0.2481	15	Sx	-1.8543	25
LN	2.0205	6	SC	-0.4232	16	NX	-1.9093	26
HB	1.1574	7	CQ	-0.6585	17	IM	-2.1923	27
JX	0.4849	8	BJ	-0.7943	18	XJ	-2.3242	28
HN	0.4576	9	Hn	-0.8544	19	GS	-2.8629	29
GX	0.4386	10	SX	-1.2816	20	QH	-3.8308	30

Note: In Table 3, "S" signifies "Sample", and "PV" "Projection Value". As for the provinces, autonomous regions, and directly governed city regions, GD is short for Guangdong, FJ for Fujian, SD for Shandong, JS for Jiangsu, ZJ for Zhejiang, LN for Liaoning, HB for Hubei, JX for Jiangxi, HN for Hainan, GX for Guangxi, AH for Anhui, TJ for Tianjin, SH for Shanghai, HB for Hebei, SC for Sichuan, CQ for Chongqing, BJ for Beijing, Hn for Henan, SX for Shaanxi, YN for Yunnan, HLJ for Heilongjiang, GZ for Guizhou, JL for Jilin, Sx for Shanxi, NX for Ningxia, IM for Inner Mongolia, XJ for Xinjiang, GS for Gansu, QH for Qinghai.

Table 4 Projection direction result of PP model operation

Variable	Projection direction
C1	0.0881
C2	0.1848
C3	0.0954
C4	0.0168
C5	0.0055
C6	0.1361
C7	0.2582
C8	0.0814
C9	0.0865
C10	0.0473

Make systematic cluster analysis of the above ten indexes: first, standardize the data, then, adopt the chi-square distance, and finally adopt the squares of deviations and clustering, and we get the result of the cluster analysis:

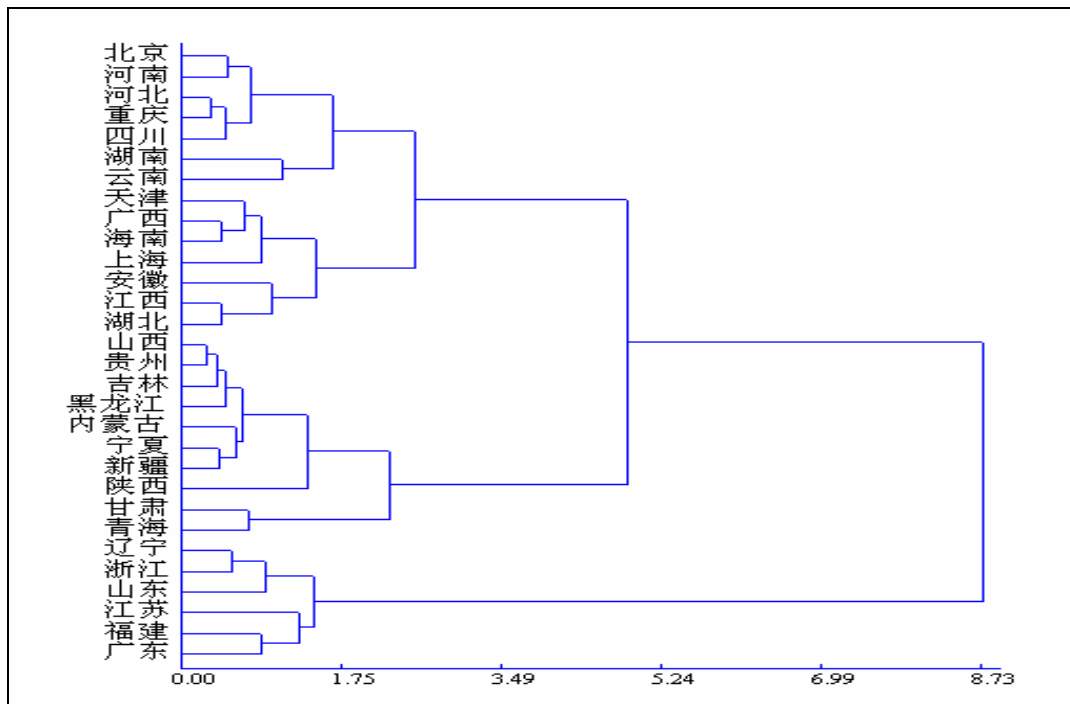


Chart1 Sketch of cluster analysis result

According to the ranking of regional competitive strength, and on the principle of affinity, combine the PP competitive strength indexes with clustering results, we may classify into four types the regions of China in terms of aquaculture competitive strength. These “types” signify the relative superiority and inferiority of the relevant regions in terms of competitive strength, and “A, B, C, D” signify the ranking order of the four types of region, with Type A ranking first and Type D last. Type A regions include Shandong, Jiangsu, Guangdong, Hubei, Liaoning, Fujian, and Zhejiang; Type B regions include Hunan, Anhui, Sichuan, Jiangxi, Guangxi, Heilongjiang, Tianjin, Hebei, and Shanghai; Type C regions include Yunnan, Hainan, Beijing, Jilin, Henan, Xijiang, and Chongqing; Type D regions include Guizhou, Inner Mongolia, Shaanxi,

Shanxi, Ningxia, Gansu, and Qinghai. Use the geological data system ARC GIS software to draw a classification sketch of the regions according to the computation results of the comprehensive indexes as follows.

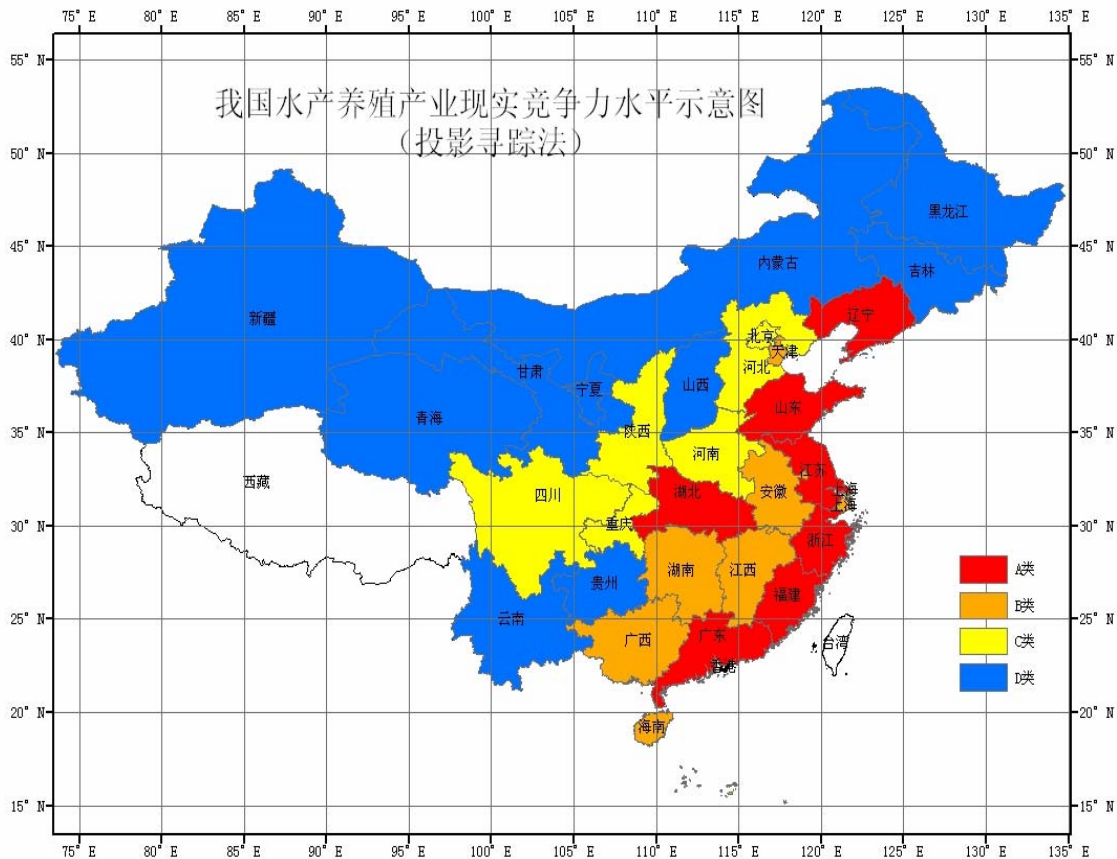


Chart 2 Classification sketch of the regions in aquiculture competitiveness based on the results by means of PP computation

Assessment of the competitiveness in aquiculture of the regions in China Mainland

The calculation result of the regional aquiculture competitive strength levels shows, according to relative competitive strength, the 30 regions of Mainland China may fall into 4 types. Type A regions, Guangdong, Fujian, Jiangsu, Shandong, Zhejiang, Liaoning, and Hubei, are most competitive in aquiculture. Type B regions, Hunan, Anhui, Guangxi, Jiangxi, Hainan, Tianjin, Shanghai, Sichuan, and Hebei, are relatively competitive in aquiculture. Type C regions, Chongqing, Yunnan, Henan, Shaanxi, Beijing, and Heilongjiang, are average in aquiculture competitive strength. Type D regions, Guizhou, Ningxia, Inner Mongolia, Shanxi, Jilin, Xinjiang, Gansu, and Qinghai, have relatively weaker competitive strength in aquiculture. The result of computation also shows the relative importance of the various factors influencing the competitive strength of aquiculture: the first factor is the capacity for resisting risks, followed by the relative specialization factor, gross product, and market share. More specifically, the relative index of progress of general adoption of market principles, and export rate of aquatic products are two factors more

important, followed by the relative index of specialization of aquiculture, gross product of aquiculture, and market share of aquiculture products. Consequently, those regions that are comparatively good in these respects or factors are comparatively competitive; conversely, they are less competitive.

Due to the specific difference in the capacity for market take-up, capacity for making profits, capacity for resisting risks, and capacity for expansion between the various regions, even the regions of the same type of competitive strength in aquiculture show their distinctive features. Take the most competitive regions of Type A, Type B and the least competitive regions of Type D for instance.

As for the most competitive seven regions (provinces) of aquiculture --- Guangdong, Fujian, Jiangsu, Shandong, Zhejiang, Liaoning, and Hubei --- each of the above factors plays a different role in their competitive strength. Guangdong ranks first or second in terms of the capacity for resisting risks and the capacity for expansion, and it ranks first and has quite a comfortable lead over other regions in its capacity for making profit in aquiculture. Fujian is somehow inferior to Guangdong in terms of its capacity for resisting risks, but it has an absolute lead in the capacity for expansion, and ranks among the top of the provinces in terms of the capacity for market take-up. Jiangsu is approximately equal to Fujian in terms of Fujian in terms of the capacity for resisting risks, ranks among the top of the provinces in the capacity for expansion and market take-up, and is second only to Guangdong in terms of the capacity for making profit. Shandong ranks among the top provinces in the capacity for resisting risks, the capacity for expansion, and the capacity for sustainable development, and it ranks first in terms of the capacity for market take-up. Zhejiang and Liaoning are comparatively similar, and they both rank among the top 5 provinces in terms of the capacity for resisting risks, with Zhejiang have a more perceptible advantage in this respect, and Zhejiang has a more obvious advantage over Liaoning in the capacity for expansion and market take-up. Hubei ranks among the top provinces in terms of the capacity for resting risks and expansion, and it also ranks before the majority of the provinces in terms of the capacity for market take-up and making profit despite its disadvantage in these respects in relative to Guangdong, Shandong and other provinces, and therefore it shows quite a powerful competitive strength.

As for the seven provinces and two municipalities that have relatively strong competitive strengths in aquiculture, namely Hunan, Anhui, Guangxi, Jiangxi, Hainan, Tianjin, Shanghai, Sichuan, and Hebei, the aspects that constitute their actual competitive strengths also show different characteristics. Hunan ranks above the average national level in terms of the capacity for expansion, exceeding more than half of the regions, and it has an obvious advantage. For its capacity for market take-up lower than the national average, it still ranks among the top provinces and municipalities. It shows its most obvious advantage in the capacity for resisting risks, holding a quite comfortable lead over others. Still, it has yet to improve its capacity for making profits. Anhui and Jiangxi are somehow similar, and they are both strong in the capacity fro resisting risks and expansion and have comparatively obvious advantage in market take-up, and Jiangxi exceeds slightly exceeds Anhui in this respect. Still, Anhui ranks among the top few in China in terms of the capacity of making profits. Guangxi and Hainan are comparatively similar and they both have a strong capacity for resisting risks and for expansion, and their capacity for market take-up, though lower than the national average, is still higher more than half of the provinces and municipalities, and as such have a certain advantage. Tianjin and Hebei are comparatively similar, and, for their comparative weak capacity for market take-up and making profits, they have a comparatively strong capacity for resisting risks and for expansion, both higher than the national average, and both rank among the national top eight. Shanghai has no advantage in market take-up and making profits, but it exceeds way above the national average and ranks among the top, and shows more apparent edge in expansion, second only to Fujian, Guangxi, Guangdong and Hainan. As for Sichuan, though its capacity for resisting risks is lower than the national average, it is quite close to the average level, and higher than that of over one third of the provinces and municipalities. It is comparatively strong in the capacity for expansion and ranks above the majority of the provinces and municipalities. Its capacity for market take-up, though lower than the national average, is still higher than that of over half of the provinces and municipalities.

As for the eight provinces of comparatively weak competitive strength in aquiculture, namely Guizhou, Ningxia, Inner Mongolia, Shanxi, Jilin, Xinjiang, Gusu, and Qinghai, they bear comparatively much similarity in their actual level of competitive strength. Guizhou is much backward in the capacity for resisting risks, market take-up, but it ranks first in the capacity of aquiculture expansion of all the Type D provinces, and it exceed some of the provinces of Type C in this respect. Inner Mongolia, Shanxi, and Jilin have a comparatively high capacity for resisting risks among the Type D provinces, exceeding far Gansu, Qinghai, Ningxia, and Xijiang. Gansu, Qinghai, Ningxia, and Xinjiang are the weakest in actual competitive strength. Gansu and Ningxia slightly exceed Qinghai and Xinjiang in terms of resisting risks and expansion. Qinghai is the weakest in the capacity for expansion. Xinjiang and Ningxia exceed slightly Gansu and Qinghai in terms of market take-up and making profits.

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