

Comparative advantage analysis of shrimp production in Asia

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Shrimp is a fisheries commodity of great importance in the international aquatic product trade, particularly to Asia and some South American nations. Shrimp products are a universally popular food commodity consumed throughout the globe and rarely restricted by gender, age and religion etc. The USA anti-dumping case against Asian countries has brought about much public and governmental attention on the shrimp production sector and its international trade.

In order to analyze the status of Asian shrimp production, and to promote sustainability of its trade, comparative advantage and competitiveness analysis was undertaken. It is hoped that such an analysis will be useful in understanding the current situation of the shrimp industry and its development, and will be helpful in making the shrimp production more efficient and viable.

General information

Asia has favorable natural resources for shrimp production, with the coasts of the Pacific and Indian oceans providing adequate coastal resources. The climate of Asian countries is tropical or subtropical. These favorable natural conditions are suitable for shrimp production and development. Shrimp production includes production from capture and aquaculture and Asian countries take advantage of both. Asia is the most important shrimp producing region of the world, particularly South-East Asia. In 2003, the cultured shrimp from Asia accounted for 85% of the total world cultured shrimp production.

Total shrimp production in the last decades has increased dramatically; the production has increased from 2.63 million tonnes in 1990 to 5.329 million tonnes in 2003. The top five shrimp producing countries of the world are all Asian, i.e. China, India, Indonesia, Thailand and Viet Nam (Table 1). China had the highest share (36.5%) of world shrimp production in 2003.

This article emanates from Yuan Xianhua's PhD thesis submitted to Nanjing University, PR China, and deals with trading aspects of the shrimp sector with special reference to Asia. Shrimp has proved to be the largest trade commodity of aquatic products. In 2003, the total trade value of frozen shrimp and PUD shrimp was US\$ 9.15 billion, and was about 14.8% of total aquatic products trade. The export market price of shrimp from China was the lowest and that from Thailand the highest. Based on the available data market occupation ratio (MOR), the revealed comparative advantage (RCA) and normalized trade balance (NTB) for shrimp in the Asian countries were calculated. Thailand had the largest MOR (21.9%) of the world shrimp market, followed by Indonesia, India, and China of 8.8%, 7.5% and 4.9%, respectively. Among the Asian major shrimp producers, Bangladesh, China, India, Indonesia, Philippines, Thailand and Viet Nam have higher NTB (above 0.70). The RCA for Thailand, China, Indonesia and Philippines have significantly decreased, whilst India and Viet Nam has retained the same level and for Bangladesh the RCA increased since 1998.

Table 1. The world's top 10 countries, in order, in shrimp production in 2003.

Country	Total production		Composition of total production			
	Tonnes (x10 ³)	%	Capture		Aquaculture	
	Tonnes (x10 ³)	%	Tonnes (x10 ³)	%	Tonnes (x10 ³)	%
China	1945	36.5	1452	74.7	493	25.3
India	517	9.7	404	78.1	113	21.9
Indonesia	457	8.6	266	58.2	191	41.8
Thailand	381	7.2	83	21.8	298	78.2
Viet Nam	310	5.8	78	25.2	232	74.8
USA	147	2.8	142	96.9	5	3.1
Greenland	142	2.7	142	100	0	0.0
Canada	121	2.3	121	100	0	0.0
Brazil	117	2.2	26	22.9	90	77.1
Mexico	100	1.9	54	54.1	46	45.9
Other	1092	20.3	755	69.14	337	30.86
Total	5329	100	3524	-	1805	-

Source: FAO, FishStat Plus (<http://www.fao.org/figis>)

Table 2. Top 10 country of shrimp aquaculture production of the world in 2003.

Country	Aquaculture production (1,000 tonnes)	% of total world aquaculture production
China	493	27.3
Thailand	298	16.5
Viet Nam	232	12.8
Indonesia	191	10.6
India	113	6.3
Brazil	90	5.0
Ecuador	57	3.2
Bangladesh	57	3.1
Mexico	46	2.5
Philippines	37	2.1
Other	191	10.6
Total	1805	100.0

Source: FAO, FishStat Plus (<http://www.fao.org/figis>)

Since 1990, the capture shrimp production has decreased year by year, whilst that from aquaculture is increasing at an accelerated rate, and cultured shrimp production now leads in world shrimp supply. In 2003, the top five countries for cultured shrimp were Asian, i.e. China, Thailand, Viet Nam, Indonesia and India. The production from the top five countries took a share of 73.5% of the world cultured shrimp production (Table 2).

Shrimp trade of the world

Among all fisheries products traded, shrimp was the most important commodity. In the last 20 years, the shrimp trade accounted for over 20% of the total fisheries product trade. In 2003, the total shrimp imports of the world were 1.955 million MT, valued at US\$12 billion. Shrimp has proved to be the largest trade commodity of aquatic products. In 2003, the total trade value of frozen shrimp and PUD shrimp was US\$ 9.15 billion, and was about 14.8% of total aquatic products trade. The trade value of prepared and chilled shrimp was US\$ 2.396 billion, and US\$ 0.457 billion for other shrimp products.

In recent years, the trade of shrimp products has developed very rapidly. Developed countries, such as USA, Japan and European countries are the major importers of shrimp products. Developing countries, especially Asian countries, act as the main shrimp supplier of the world. In 2003, the importation of shrimp to USA reached 500 000 tonnes, approximately 27.8% of

the world's imports, and were followed by Japan, Spain, Demark and France. Approximately 61.6% of the imported shrimp was consumed by people living in the developed countries, such as US, Japan and Europe (Table 3).

With continued increasing demand on shrimp products, the shrimp trade has also become highly competitive, and more countries are being engaged in shrimp production. Since 1990, Asian countries have become the major supplier of shrimp exports to the developed countries. Thailand and China were the major exporting countries, followed by India, Viet Nam and Indonesia. (Table 4).

Market occupation ratio (MOR)

The market occupation ratio can be represented by the percentage of shrimp exports from one country to that of the world. Table 5 shows the shrimp market occupation ratio of Asian major shrimp producers from 1990-2003. Comparing the average market occupation ratio in 1990-2003; the result show that Thailand had the largest market occupation ratio (21.9%) of the world shrimp market, followed by Indonesia, India, and China of 8.8%, 7.5% and 4.9%, respectively. Since 1990, Thailand has lead shrimp exportation to the world.

Market price

The market price of exportation was calculated by dividing the total exportation value with the total exportation amount of each country. In 1990-2003, China has the lowest average price (US\$ 4.95) for shrimp exports, while Thailand has the highest (US\$ 9.54). The export price fluctuated during the last 14 years. In 1994 to 2000, the price was higher, and after 2000, the market price was decreased for all countries.

Revealed comparative advantage (RCA)

Revealed comparative advantage (RCA) is based on observed trade patterns. An increase in the value of RCA means an increase in a country's competitiveness in a commodity. It can be computed by the formula below:

$$RCA_{ik} = (X_{ik}/X_i) / (W_k/W)$$

Where RCA_{ik} represents k commodity in country i has the revealed comparative advantage, X_{ik} is exports of commodity j by country i, X_i is the total exports by country i, W_k is the world total exports of commodity k, W is the world total exports of all commodities. If $RCA_{ik} > 1$, it shows that the exports by the country is focused on few commodities, and it has a comparative advantage on that commodity; $RCA_{ik} < 1$, indicates that the country has wide trade commodities range, and it has no comparative advantage on the particular commodity.

Table 3. Top 5 countries, in order, of world shrimp importation in 1999-2003.

1999		2000		2001		2002		2003	
Country	%	Country	%	Country	%	Country	%	Country	%
USA	25.8	USA	23.1	USA	23.5	USA	23.7	USA	27.8
Japan	22.8	Japan	20.2	Japan	16.8	Japan	16.2	Japan	13.0
Spain	8.5	Spain	9.3	Spain	7.5	Spain	6.9	Spain	9.7
France	5.3	Denmark	5.1	Canada	5.5	Denmark	5.9	Denmark	5.8
Canada	4.8	Canada	4.9	Denmark	4.8	China	4.8	France	5.3

Table 4. Top 5 countries of shrimp exporters of the world in 1999-2003 (MT).

1999		2000		2001		2002		2003	
Country	Export	Country	Export	Country	Export	Country	Export	Country	Export
Thailand	240551	Thailand	249638	Thailand	255600	Thailand	211659	Thailand	234044
India	127640	India	128827	India	140565	India	169854	China	188464
Ecuador	94605	Indonesia	104793	Indonesia	115372	China	132626	India	174842
Indonesia	90733	China	93881	China	105999	Vietnam	114883	Vietnam	124865
China	66496	Denmark	92807	Denmark	87825	Indonesia	112054	Indonesia	122651

Source: FAO, Fish Stat Plus

Table 5. MOR of Asia major shrimp production countries (1990-2003) (%).

Year	Bangladesh	China	India	Indonesia	Malaysia	Philippines	Thailand	Viet Nam
1990	2.2	10.0	4.9	9.4	1.7	3.2	14.4	1.6
1991	1.9	6.9	6.3	9.9	1.9	3.7	17.9	2.3
1992	1.8	7.7	5.9	9.3	1.7	2.8	20.5	2.8
1993	2.2	4.9	7.3	10.0	1.5	2.8	23.2	3.3
1994	2.8	3.9	8.3	9.5	1.5	2.6	25.7	3.4
1995	2.8	3.4	6.8	8.9	1.5	2.1	26.6	2.9
1996	2.9	2.2	7.5	8.8	1.4	1.6	25.5	2.7
1997	2.4	2.7	7.9	8.6	1.6	1.3	24.7	3.9
1998	2.5	2.3	7.7	8.7	0.9	1.3	23.4	4.6
1999	2.5	2.5	8.3	8.0	0.9	1.5	24.3	5.1
2000	2.9	3.5	8.5	8.9	0.9	1.4	25.4	6.2
2001	3.2	4.4	7.8	8.6	1.1	1.2	21.5	7.5
2002	2.6	6.1	9.1	7.9	2.0	1.6	17.3	9.2
2003	2.7	8.1	8.2	7.2	1.1	1.2	15.8	9.7
Average	2.5	4.9	7.5	8.8	1.4	2.0	21.9	4.7

Source: Calculated through the data from FAO, Fish stat plus

In table 7, the RCA of shrimp in major Asia shrimp production was calculated. Thailand, China, Indonesia and Philippines have significantly decreasing RCAs, whilst India, Viet Nam has retained the same level of RCA.

For Bangladesh the RCA increased since 1998. Malaysia has the lowest RCA among Asian countries, with an average of 1.14. The decreasing RCA in Thailand and China showed a significant losing of comparative advantage for shrimp products, and could be related to a major shift in the species cultured.

Normalized trade balance (NTB)

Normalized trade balance also known as net exportation ratio, shows the difference between exports and imports,

and indicates the comparative advantage in production. It can be calculated by:

$$NTB = X - M / (X + M)$$

Where X represents the export of the product and M represents the imports of the commodity. The value of NTB is between -1 and +1, if NTB is -1, it means the country only imports the commodity; In the view of exportation, when NTB is near +1, it has high international competitiveness in the product.

Among the Asian major shrimp producers, Bangladesh, China, India, Indonesia, Philippines, Thailand and Viet Nam have higher NTB (above 0.70), indicative of that the country has more shrimp exports than the imports and the higher comparative advantage of shrimp production. The NTB of Bangladesh and India is about 1.00,

that is these two countries only export shrimp products, and thereby have extremely high comparative advantage.

Conclusion and recommendation

By analyzing the market occupation ratio, export prices, RCA and NTB, the Asian major shrimp producing countries seem to have a higher comparative advantage in shrimp production. With rapid developments of shrimp products trade, Asian countries will become the most important producers of shrimp globally.

Each country has different performance of comparative advantage: for example Thailand Indonesia and India had higher market occupation ratio, China had the lowest exportation price; Thailand, China and Viet Nam had the higher

Table 6. The average export price of major Asia shrimp producers (1990-2003) (US\$/kg).

Year	Bangladesh	China	India	Indonesia	Malaysia	Philippines	Thailand	Viet Nam
1990	5.81	5.96	5.60	7.37	4.90	8.75	8.62	3.74
1991	6.31	6.05	5.52	8.11	5.14	8.81	8.26	4.20
1992	5.90	5.74	5.80	7.94	5.61	8.78	8.65	4.35
1993	7.23	5.50	6.20	8.96	5.58	9.68	9.73	4.79
1994	8.57	5.64	7.27	10.27	6.36	10.63	10.44	5.00
1995	10.06	6.26	6.94	11.01	7.22	11.69	11.40	6.85
1996	10.21	4.74	6.51	10.03	6.47	6.61	10.72	6.31
1997	7.87	4.41	7.20	10.85	7.28	11.71	11.81	5.89
1998	10.73	3.74	6.35	6.75	5.28	7.28	9.32	6.86
1999	11.76	3.62	6.17	8.42	5.51	9.58	9.63	7.82
2000	10.85	4.00	6.98	9.05	5.37	7.43	10.81	9.75
2001	9.94	4.29	5.74	7.69	4.34	6.37	8.69	8.90
2002	7.93	4.60	5.34	7.05	4.57	7.33	8.14	8.28
2003	9.66	4.68	5.13	6.43	4.24	5.76	7.40	8.47
Average	8.77	4.95	6.20	8.57	5.56	8.60	9.54	6.52

Source: Calculated through the data from FAO, Fish stat plus

Table 7. RCA of Asia major shrimp producers, 1990-2003.

Year	Bangladesh	China	India	Indonesia	Malaysia	Philippines	Thailand	Viet Nam
1990	1.20	206.90	9.54	12.59	2.00	13.61	206.54	23.12
1991	0.93	143.39	12.45	11.94	1.96	14.92	301.45	39.39
1992	0.81	138.66	11.37	10.34	1.58	10.71	298.60	40.59
1993	0.92	72.45	12.81	10.24	1.17	9.42	293.38	41.13
1994	0.98	58.02	14.29	10.23	1.07	8.30	274.40	36.20
1995	0.96	50.55	11.38	10.11	1.05	6.30	251.62	27.26
1996	1.04	27.79	12.23	9.48	0.99	4.13	189.15	20.16
1997	0.75	31.50	12.57	8.56	1.17	2.83	150.03	23.64
1998	26.80	0.69	12.67	9.85	0.76	2.46	24.04	26.95
1999	25.41	0.73	12.72	9.26	0.59	2.25	23.41	24.83
2000	29.00	0.90	12.74	9.15	0.62	2.18	23.40	27.22
2001	32.59	1.01	11.00	9.36	0.75	0.97	87.46	0.08
2002	27.39	1.21	11.89	8.93	1.35	2.79	16.16	35.84
2003	28.47	1.38	10.98	8.87	0.85	2.36	14.74	35.94
Average	12.66	52.51	12.05	9.92	1.14	5.95	153.88	28.74

Source: WTO database and FAO, Fish stat plus

Table 8. NTB of Asia major shrimp producers in 1990-2003.

Year	Bangladesh	China	India	Indonesia	Malaysia	Philippines	Thailand	Viet Nam
1990	1.00	0.99	1.00	1.00	0.71	1.00	0.98	1.00
1991	1.00	0.96	1.00	1.00	0.67	1.00	0.98	1.00
1992	1.00	0.95	1.00	0.98	0.53	1.00	0.98	1.00
1993	1.00	0.93	1.00	1.00	0.48	1.00	0.97	1.00
1994	1.00	0.74	1.00	1.00	0.49	1.00	0.97	1.00
1995	1.00	0.74	1.00	1.00	0.46	1.00	0.95	1.00
1996	1.00	0.64	1.00	0.99	0.49	1.00	0.95	1.00
1997	1.00	0.71	1.00	0.99	0.55	1.00	0.94	1.00
1998	0.99	0.68	1.00	0.99	0.36	1.00	0.90	1.00
1999	1.00	0.60	1.00	0.98	0.42	1.00	0.91	0.99
2000	1.00	0.48	1.00	0.98	0.46	1.00	0.90	0.99
2001	1.00	0.55	1.00	0.98	0.36	0.99	0.87	0.99
2002	1.00	0.71	0.99	0.97	0.53	0.97	0.82	0.89
2003	1.00	0.74	0.99	0.97	0.24	0.98	0.84	0.83
Average	1.00	0.74	1.00	0.99	0.48	1.00	0.93	0.98

Source: FAO, Fish Stat Plus

RCA, and all major shrimp production countries had higher NTB of shrimp trade. This evidence shows the very high potential for shrimp production.

In view of the increasing demand for shrimp products and the high tariffs on exportation, the new international trade regulations need to be adjusted. These regulations have required the Asian countries to confront new challenges to produce better quality shrimp and do so efficiently. Between 1990-2003, the comparative advantage index of some major shrimp producers decreased, indicating that the competitiveness in Asia's shrimp products was weakening. This may be caused by higher export tariffs, higher product quality and higher sanitation standards, traceability system and organic production systems being put into place.

To strengthen Asia's shrimp products competitiveness, further efforts should be made to advance shrimp

industrialization forward by developing leading shrimp enterprises. The better management and sustainable development of shrimp production is required and studies and monitoring of international competitiveness should be strengthened. New technology in shrimp disease prevention, new seed production systems, and environmental friendly aquaculture practices for sustainable development, and more international cooperation programs need to be encouraged to satisfy the world shrimp market.

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