

## **DEVELOPMENT OF CHINESE SEA TRANSPORT AT THE TURN OF XX-XXI CENTURIES[1]**

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*The article reviews the aspects of the Chinese merchant marine development from 1996 to 2011. The authors analyze the processes of vessel fleet modernization, growth of China's port system capabilities, as well as define the role of the fleet in the modern national economy of the PRC.*

**Keywords:** Merchant shipping, modernization of Chinese merchant fleet, sea ports of China, China's exports and imports, Chinese economic security.

Modern economic successes of China were laid down more than thirty years ago, in 1978 with the beginning of «The program of Four Modernizations». Gradually reforming a nation's social and economic structure, the export based strategy «to Go In the Out» has become its next vector of national economy development since 1998. The dynamic growth of foreign trade as main instrument of national development and integration of the country into the world economic environment became an obvious result of it. The PRC export in 1999 increased by 9.6 % in comparison with previous year, in 2000 – by 28.3 %. The import of China also developed in comparable dynamics. The products served as basis of Chinese export while the import supply of oil and ore began to gain the strategic importance.

Highly dynamic integration of the PRC into global economy caused increased requirements to national sea navigation and China started modernization of this sector in the second half of the 1990's.

So, in 1996 China had 1972 sea-going vessels with cumulative deadweight of 36527.8 thousand tons that provided the country the 5th place in the world on quantitative indicators [2]. Essentially smaller cargo capacity and big age of sea-going vessels, insufficient quantity of tankers and container carriers were typical signs of the Chinese merchant marine fleet of that time in comparison with world fleet. For example, average deadweight of vessel was 18.500 t., while in world practice this size was a third more – 23.600 t.

Analyzing publications in the “Review of Maritime Transport” it is possible to say that modernization of merchant marine fleet of China was directed not only on structural updating and quantitative extension but also on ships enlargement.

The ship structure of PRC merchant marine fleet has quantitatively increased by 1.5-2 times from 1996 to 2010. In 2000 there were 2216 vessels in its structure, in 2007 – 3418, and in 2010 – 3651. The tendency of the newly constructed vessels loading capacity growth was also observed. An average ship deadweight made 18.400 t. in 2000, 20.600 t. in 2006 and 29.600 t. in 2010, that corresponds to world tendencies and indicators.

Originally, the priority was given to construction of specialized ship classes. That was typical for world maritime industry and in PRC case was caused by the main tendencies of the Chinese foreign trade-growth of commodity export and increase in oil dependence of national economy. As a result in 2006 48.3 % of container carriers and 39.8 % of tankers were less than 4 years old, i.e. were built after 2002, and 3.3 % of container carriers and 8.2 % of tankers had age less than 10 years.

The new shipbuilding allowed the Chinese container and bulk fleet to reach the world level by age criteria. An average age of container ships maintained by world fleet made for 9 years in the world and 10 years in China, the figures for tankers made for 10 and 11 years respectively.

During this period the construction of multipurpose dry cargo ships and vessels for transportation of bulk cargoes (bulk ships) was limited. 91.9% and 82.4% of vessels of these two classes respectively were older than 10 years in 2006. We believe that the new shipbuilding here was caused by the obvious necessity to replace the worn-out ships and to cover the present day (non-strategic) requirements.

However, in 2010 65.7 % of all newly built vessels were bulk ships and 23.8 % - tankers [3]. We think that it testifies the ongoing modernization of bulk fleet[4] as the second development tendency of merchant marine fleet of the People's Republic of China as well as the continuation of updating of tanker fleet[5].

“Dimensional” transformation of the PRC merchant marine fleet occurred in the first half of the 2000's. If in 1996 and 2000 an average deadweight of a merchant vessel made 18.400 t. in 1996, 18.500 t. in 2000, 20.600 t. in 2006 and 29.600 t. in 2010. It is quite obvious that such increase of loading capacity of new vessels demanded expansion of shipbuilding capacities.

Modernization processes have created modern structure of merchant marine fleet of the People's Republic of China by the outcome of 2006. It included (in cargo loading capacity): bulk ships - 9227 thousand gross-tons or 39.3 % of capacity of national and 4.5 % of world fleet, container carriers - 3246674 thousand gross-tons (13.8 % and 2.9 % respectively), bulk carriers - 4808133 thousand gross-tons (20.5 % and 4.9 %), tankers - 4575902 thousand gross-tons (19.5 % and 2.1 %), other vessel classes - 1630571 thousand gross-tons (6.9 % and 1.7 %).

Cumulative capacity of merchant marine fleet this year made 23488 thousand gross-tons, and by the outcome of 2010 it has increased to 30077 thousand gross-tons, with increase in a share of bulk ships – to 44.3 %, container carriers - to 14.6 % and tankers – to 18.1 %, and reduction of dry cargo ships – to 15.6 %. We believe these changes were caused by the requirements of national economy which is dependent on import supply of ore and oil, and export focused on the foreign commodity market [6].

Development of national commercial shipping was promoted in many respects by the credit policy of China providing cheap financial resources for construction (including for import) and exploitation of vessels. For example, the volume of such credits made for 12.2 bln. dollars in “Bank of China” portfolio in 2009, though it was slightly reduced (by 10 %) in comparison with previous years. The «COSCO» alone received credit resources for the total sum of 42.2 billion yuans provided by nine largest Chinese banks and 8.8 billion yuans by other creditors.

The leader of merchant shipping in China is the company «COSCO - China Ocean Shipping Company (Group)» (or «COSCO Group»)[7], founded in 1961 and at present (2012) possessing 559 trading vessels - 158 container carriers, 245 bulk ships, 52 tankers, 83 bulk carriers, 8 vessels for transportation of oversized cargoes, 2 “roll-on” ships and 11 vessels of other types. Functioning in holding structure, «COSCO» controls the activities of many subsidiaries[8], largest of which work in spheres of container transportations (2 companies), bulk (5 companies), liquids (1 company) and oversized cargoes (2 companies).

Along with «COSCO» several other shipping companies operate in PRC (2007): «Shanghai Ocean Shipping», «China Shipping container lines Co. Ltd», «Xu Chang Hai Shipping Inc.», «China Shipping Development Co. Ltd. Tramp Co», «Dalian Dahai Aquatic Shipping Co. Ltd», «Yuehai Railway Co., Ltd», «Chongqing New Century Cruises Co. Ltd», «Yangzhou Shipping (HK) Company Limited», «Linkway Shipping Limited» and others [9].

Transfer of sea vessels under «a convenient flag» actively progressed in China since the turn of the XXI century and has actually become a specific feature of maritime transport policy evolution. The flag of convenience was carried by 568 (28.8 % from cumulative ship structure) Chinese vessels in 1996, 599 (27.0 %) in 2000, 1314 (38.4 %) in 2006 and 1607 (44.0 %) in 2010.

As a rule, large and new vessels pass «under a flag». In 2006 54.2% of the deadweight supervised by China was operated in this way and in 2010 its share has risen to 62.8%

It is known that «convenient flags» used by Chinese ship-owners represent more than thirty states, in particular (2011): 23978000 t. under the flag of Panama, 735000 t. - Liberia, 1425000 t. - the Marshall Islands, 242000 t. - Bahamas and 106000 t. - Malta. For example, 57 (36 %) container ships, 77 (31.4 %) bulkers, 11 (21.1 %) tankers and 11 (13.2 %) dry-cargo vessels of “COSCO” work under the flag of Panama [10].

Again, this phenomenon corresponds to world tendencies[11] and supports the integration of Chinese shipping into the international transport system and attracts foreign resources.

Universal tendency of the present is the containerization of sea freight transportation. If in 1990 the container turnover through ports

of the world made 85 million TEU, within 20 years it grew six times, to 531.4 million TEU. 1502 container carriers operated in the world and 1.2 million TEU containers were used in 1990, and in 2010 – 9688 vessels and 16.2 million containers.

The ports of China started to “be connected” to containerization processes from the beginning of the 2000’s. It is known that in 1995 the cumulative container turnover of continental China (without Hong Kong) made 4678.9 thousand TEU (2.8% of the world turnover and three times less than Singapore alone). The next years there was really «a container boom». The Chinese ports processed 81927.0 thousand TEU (18.6 % of a world turnover) in 2006 and 128544.5 thousand TEU (24.2 %) in 2010.

In 2006 the People’s Republic of China started modernization of seaports system[12] as a result of which eight port complexes were created, specializing on:

- coal transportation - Tsinkhuandao, Tangshan, Tianjin, Tsingtao, Zhichzhao, Lyanyyungan, etc.;
- import of iron ore, taking into account placement of the metallurgical enterprises nearby, with potential of servicing vessels of 200000-300000 t. deadweight;
- service of petroleum import, with petrochemical enterprises located nearby, processing vessels of 200000-300000 t. deadweight;
- container turnover - Dalian, Tianjin, Tsingtao, Shanghai, Ningbo, Suzhou, Hsiamen, Shenchzhen and Guangzhou.

As a result it is possible to conclude that modernization of merchant marine fleet of the People’s Republic of China during the considered period was carried out dynamically. The comparison of rates of indicator gains concerning merchant marine fleet condition and container turnover in PRC ports allows allocating the next periods of its performance:

- The first stage of modernization, mid-1990’s – mid-2000’s – the period of rapid development of shipping branch in China. It is certified by increase of vessels number (173.3 % in ten years) and ports container turnover (by 17.4 times in 1997-2006), improvement of vessels age characteristics and formation of base fleet structure in accordance with foreign trade requirements.

- The second stage of modernization, from the mid-2000’s till 2010,

characterized by more sedate gain rates, both in comparison with world dynamics, and with national indicators of the previous periods. So, the vessels gain on deadweight in 2010 made 153.4 % comparing to 2006 (140.8% in the world). The increase of ports container turnover made for 156.9% and 132.8% respectfully, that is substantially lower than in previous periods in PRC[13]. The merchant marine fleet and the port system corresponding to the international standards have been created at that period that allowed PRC to become one of world leading shipping powers (at least, quantitatively).

It is difficult to underestimate the role of maritime transport for modern development of national economy in China. Basing on data of «World investment report» (UNCTAD)[14] in 2010 a Chinese import of strategic raw materials from 28 countries of Asia, Africa and America was provided by maritime transport in 24 cases, from which 17 - in the sphere of petroleum products, 4 – raw materials of mining industry, and 4 – raw materials for steel industry. From the point of view of national production export, we will note that in 2010 the share of the People's Republic of China made 10.4% of the world export of goods that in its cumulative cost is equal to 1577.9 bln. Dollars. 19.7% were exported to EU countries, 17.9%, to USA, 8.7% to ASEAN countries and 7.7% to Japan[15]. We believe that the specified sizes visibly reflect a role of maritime transport in the Chinese economy.

Meanwhile, the qualitative role of merchant marine fleet in national economy can be defined by means of such indicators as sufficiency for ensuring foreign trade of the country and its non-dependence on the world freight market[16]. Thus, in 2003 goods turnover on the terms of «FOB»[17] made more than 80 % of volume of foreign trade of China, and 10% of oil products were transported by the Chinese vessels[18], other 90% - by the chartered tonnage[19].

The publications “Review of Maritime Transport” and other informative sources do not contain data on modern filling of these indicators. However, considering “post-modernization” characteristics of merchant marine fleet of the People's Republic of China it is possible to predict a gain in these figures, but a gain that excludes any strategic changes of a role that merchant marine fleet plays in supporting foreign trade of PRC.

For example, with enormous growth of container turnover in the ports of PRC the container capacity of Chinese vessels as well as its own container stores remain on comparatively low level. The leading Chinese (COSCO, CSCL) and Hong Kong (OOCL) container transportation companies (all in TOP -20 world rating) commonly operated 352 container carriers and 1,4 million containers in 2010 (3.6% and 8.6% of the world capacity). That is obviously too little to ensure self-sufficiency of national export, even taking into account the potential of other shipping companies.

More than one-and-a-half gain of a sea import of oil and oil products, from 147.3 million t. in 2005 to 261.2 million t. in 2010[20], obviously can not be provided by own tanker fleet. It is predetermined both by insufficient quantity of tankers[21] and its sizes that are smaller than average world practice[22].

Anyway, the increasing involvement of China in world shipping and growing dependence on world freight processes is evident. These factors can not but create threat for economic security of PRC.

We think that the leadership of the People's Republic of China is informed on these problems and understands the hopelessness of quantitative capacity-building of merchant marine fleet.

In its turn, we have grounds to assume the existence of Chinese portfolio investments into assets of foreign shipping companies with the widest range of the pursued goals – from a simple extraction of profits to establishing business management control and even replacement of the owners.

However, basing on “Review of Maritime Transport” and other publications we do not see a direct evidence of this assumption. From the «World investment report» (UNCTAD)[23] it is known that in 2010 volumes of proceeding portfolio investments (FDI outward stock) of China made 297.6 bln. dollars. But, this document does not provide direct data on the Chinese portfolio investments into foreign shipping business.

Probably, such investment activity of the People's Republic of China can be revealed by analyzing annual reports of world shipping companies. But, we believe it is a subject of additional and rather laborious research.

Table 1. Age structure of the People's Republic of China' merchant marine fleet in comparison with world fleet, 2006[24].

Vessel's type	PLA's merchant fleet (world's fleet), %					Average age, years
	0-4 years	5-9 years	10-14 years	15-19 years	20, more	
On whole fleet:	19.7(21.6)	7.0(19.0)	10.7(19.1)	10.6(9.0)	52.0(31.3)	16.2(12.9)
- bulk ships	10.1(21.6)	7.5(19.0)	9.8(19.1)	14.8(9.0)	57.8(31.3)	18.0(12.9)
- container carriers	48.8(34.7)	3.3(25.7)	16.8(18.6)	8.5(8.0)	22.6(13.0)	10.0(9.1)
- bulk carriers	2.4(10.1)	6.3(25.7)	3.9(18.6)	6.2(8.0)	81.1(31.3)	21.1(17.4)
- tankers	39.8(30.3)	8.2(25.0)	15.0(16.4)	7.0(14.6)	30.1(13.6)	11.4(10.0)
- others	15.2(19.6)	8.3(14.4)	10.7(10.7)	10.6(9.1)	56.6(46.3)	17.0(15.1)

Table 2. Dynamics of PLA's merchant marine fleet capacity growth in comparison with world fleet, in 2006 and 2009[25].

Vessel type	PLA's merchant fleet		World fleet, gross tonnage	Specific weight of the PRC in world fleet, %
	Capacity, gross tonnage	Specific weight, %		
2006				
On whole fleet:	23 488 427	100.0	720 788 856	3.3
- bulk ships	9 227 147	39.3	204 552 682	4.5
- container carriers	3 246 674	13.8	110 686 630	2.9
- bulk carriers	4 808 133	20.5	98 213 506	4.9
- tankers	4 575 902	19.5	213 748 432	2.1
- others	1 630 571	6.9	93 587 606	1.7
2009				
On whole fleet:	30 077 129	100.0	no data	no data
- bulk ships	13 314 691	44.3	no data	no data
- container carriers	4 393 418	14.6	no data	no data
- bulk carriers	4 701 668	15.6	no data	no data
- tankers	5 446 345	18.1	no data	no data
- others	2 221 007	7.4	no data	no data



Table 3. Dynamics of ship indicators of PLA's sea merchant fleet comparing with the world fleet development, 1996-2010[26].

Indicator	Period					Gain to a result of the previous period, %			Growth rate 1996 = 100 %
	1996	2000	2006	2010	2010	2000	2006	2010	
<i>PLA's sea merchant</i>									
Vessels, total:	1 972	2 216	3 418	3 651		112.4	154.2	106.8	185.1
- under national flag	1 594	1 617	1 870	2 044		101.4	115.6	109.3	128.2
- under foreign flag	568	599	1 314	1 607		105.5	219.4	122.3	282.9
Deadweight (dwt), 1000 t.:	36 527.7	40 733.7	70 390.0	107 969.5		111.5	172.8	153.4	295.6
- under national flag	23 162.3	22 340.9	32 229.0	46 207.5		96.4	144.3	143.4	199.5
- under foreign flag	13 095.4	19 392.8	38 161.0	67 762.0		148.1	196.8	177.6	517.5
Average dwt of a vessel, 1000 t.	18.5	18.4	20.6	29.6		100.0	111.9	143.7	160.0
- under national flag	14.5	13.8	17.2	22.6		95.2	124.6	131.4	155.8
- under foreign flag	23.0	32.4	29.0	42.2		140.8	89.5	145.5	183.5
<i>World fleet</i>									
Vessels, total:	28 754	30 508	34 882	45 662		106.1	114.3	130.9	158.8
- under national flag	17 274	16 306	16 407	no data		94.4	100.6	-	-
- under foreign flag	11 480	14 202	18 415	no data		123.7	129.7	-	-
Deadweight (dwt), 1000 t.:	680 044.5	749 599.3	978 557.0	1 378 230.9		110.2	130.5	140.8	202.7
- under national flag	303 417.8	282 107.7	329 259.0	no data		92.9	116.7	-	-
- under foreign flag	376 629.7	467 491.6	649 908.0	no data		124.1	139.0	-	-
Average dwt of a vessel, 1000 t.	23.6	24.6	28.0	30.2		104.2	113.8	107.6	128.0
<i>The People's Republic of China in world sea merchant marine fleet system</i>									
Specific weight of ship structure, %	6.8	7.3	9.7	8.0		-	-	-	-
Specific weight of deadweight, %	5.4	5.4	7.2	7.8		-	-	-	-
Place in the world (on deadweight)	5	4	4	4		-	-	-	-

Table 4. Dynamics of PRC seaports container turnover comparing with Asian countries and world practice, 1997-2010[26].

Country	Volume of a port turnover, one million TEU				Gain to a result of the previous period, %			Growth rate by 1997
	1997	2000	2006	2010	2000	2006	2010	
PRC	4 678.9*	11726.7**	81927.0	128544.5	250.6	698.6	156.9	in 27.5 times
Hong Kong	14567.2	18100.0	23539.0	23532.0	124.5	130.0	100.0	in 1.6 times
Singapore	14175.3	17096.0	24796.0	29178.2	120.4	145.0	117.7	in 2 times
Republic of Korea	5636.9	8530.4	15521.1	18487.6	151.3	181.9	119.1	in 3.3 times
India	1460.9	2313.6	5642.6	8942.7	158.4	243.9	158.5	in 6 times
World turnover	165123.0	222294.0	440000.0	531400.7	134.6	197.9	132.8	in 3.2 times
<i>The People's Republic of China in system of a seaports world container turnover</i>								
PRC, %	2.8	5.3	18.6	24.2	-	-	-	in 8.6 times
World turnover, %	100.0	100.0	100.0	100.0	-	-	-	-

\* Data for 1995;

\*\* Total turnover of Shanghai, Shenchzenya and Tsingtao.

Table 5. People's Republic of China import of oil and oil products[28].

Exporter: country/region	2005		2010		Import growth rate, 2005=100 %	Import absolute growth, 1 mln t.
	1 mln t.	%	1 mln t.	%		
USA	0.4	0.2	2.5	0.8	625.0	+2.1
Canada	-	-	0.9	0.3	-	+0.9
Mexico	-	-	1.2	0.4	-	+1.2
Central and S.America	5.3	3.2	24.1	8.2	454.7	+18.8
Europe	0.6	0.3	1.3	0.4	216.7	+0.7
CIS	19.6	11.7	33.3	11.3	169.9	+13.7
Middle East	67.4	40.4	118.4	40.2	175.7	+51.0
North Africa	3.2	1.9	10.1	3.4	315.6	+6.9
Western Africa	28.6	17.1	43.7	14.8	152.8	+15.1
East and South Africa	6.7	4.0	12.7	4.3	189.5	+6.0
Australasia	1.2	0.7	7.2	2.4	600.0	+6.0
India	-	-	0.6	0.2	-	+0.6
Japan	3.3	2.0	2.7	0.9	81.8	-0.6
Singapore	-	-	7.0	2.4	-	+7.0
Other countries of Asia	30.6	18.3	28.8	9.8	94.1	-1.8
Total:	166.9	100.0	294.5	100.0	176.4	+127.6
- from them shipping	147.3	88.2	261.2	67.9	177.3	+113.9
<i>The People's Republic of China in system of a world import of oil and oil products</i>						
PLA	166.9	6.8	294.5	11.2	176.4	+127.6
World's import	2461.5	100.0	2633.5	100.0	107.0	+172.0

## ENDNOTES

1. Here and below if isn't specified other, are used data of the publications "Review of Maritime Transport" UNCTAD for 1997-2011.

2. In practice of «Review of Maritime Transport» are considered vessels by deadweight (dwt) over 100 t.

3. See TOP 20 economies for shipbuilding, 2010 deliveries (built tonnage %)// Review of Maritime Transport. 2010, p. 147.

4. So, bulk fleet of "COSCO" in 2011 had 245 vessels (see below), of which 49 (20%) vessels were constructed after 2006, including 10 vessels by deadweight of 300 thousand t., 8 - deadweight of 200 000 t. and 28 – deadweight less than 100 000 t.

5. By the outcome of the first decade the People's Republic of China became the world leader in shipbuilding, having constructed in 2010 of 61 499 thousand t of deadweight (41.1 % of world shipbuilding), having overtaken South Korea (49 924 thousand t of dwt, 33,3 %) and Japan (32 958 thousand t. of dwt, 21.7 %). Specialization on bulk vessels, and South Korean – on container became characteristic feature of the Chinese shipbuilding.

6. At a course (6.84 yuan/dollars, 2009) these sums are adequate 6.2 and 1,4 bln.\$.

7. See «COSCO Group» (<http://www.cosco.com/en/index.jsp>).

8. In fact, «COSCO» - the versatile corporation integrated into economy of many countries and, besides a cargo transportation, carrying out ship-building and ship-repair activity, production and service of containers, vessels trade and ship supply, and making through subsidiary («COSCO Finance Co., LTD», assets in 2006 – 10 billion yuans) financial operations anyway connected with sea navigation and foreign trade.

9. It is made on the basis of the review of register passports of vessels «Chinese classification society» (the sea register), it is available from URL: [http://psmis.ccs.org.cn/shipinfo\\_en/shipsearch\\_new.asp?page=1...64, 66...123](http://psmis.ccs.org.cn/shipinfo_en/shipsearch_new.asp?page=1...64, 66...123). Review made by author in 2006.

10. See «COSCO Group» (<http://www.cosco.com/en/index.jsp>).

11. In 2000 under «convenient flags» 39.9 % of world deadweight, in 2006 – 66.4 % were maintained.

12. See "Zhenmin Zhibao" from 09/18/2006.

13. Lagging behind growth rates of world container turnover at this time can be caused by financial crisis of 2008-2009 which negative results were reflected in China to a lesser extent.

14. See World investment report UNCTAD, 2011, p. 49.

15. See Salitsky And., Tomberg I. Foreign economic relations of the People's Republic of China: new tendencies (<http://www.ru.journal-neo.com/>) referring to: - International Trade Statistics 2010. Geneva: WTO, 2010. P. 14; World Trade 2010,

Prospects for 2011. Geneva: WTO, 2011. P. 19, 21; - Zhonghua Renmin gunhego 2010 nannies Kuomintang jingji he shehuey fazhan Tongji gunbao. stats.gov.cn

16. The merchant marine fleet of the USSR in the 1980<sup>th</sup> provided more than 3/4 export of the country that with guarantee protected national economy from tactical changes of the freight market.

17. «FOB – free on board», the term from practice of the international trade, defining a duty of the exporter to transfer the goods to a carrier. In analytical practice by this indicator is defined degree of dependence of national trade from the international carriers.

18. See Influence of potential of development of the Chinese economy on East&West logistics/Dzhanmin Ho//conf. materials “Transport&logistics”, Tallinn, Estonia, 12/03/2003. <http://www.eatu.ru/>.

19. It is considered that for ensuring strategic safety, it is necessary to transport by national fleet not less than 50% of all oil import. Own fleet of supertankers allows Japan to transport 80% of imported oil, and the South Korean tanker fleet delivers 30% of an import - see. Weekly sea bulletin No. 8 /Voitenko M.//Digest of world sea mass media of 1/24-5/1/2005

20. See BP Statistical Review of World Energy, 2006 (p. 20), 2011(p. 18).

21. Cumulative deadweight of the People’s Republic of China tanker fleet this year made 1,64 million t.

22. In the world market for transportations of oil are used tankers by loading capacity of 270-300 thousand t mainly. Meanwhile, as shows the analysis of ship structure of “COSCO Group”, the fleet of this company had 12 tankers deadweight of 300 thousand t., five 100-150 thousand t., and other vessels have the deadweight, essential less than 100 thousand t.

23. See World investment report UNCTAD, 2011, p. 187-194. Thus investments huaqiao (Chinese living outside of the country) in foreign business aren’t considered.

24. Review of Maritime Transport, 2007, p. 127.

25. Review of Maritime Transport, 2007, p.125; 2010, p.154.

26. Review of Maritime Transport, 1997, p. 29; 2001, p. 29; 2007, p. 32; 2011, pp. 43-44.

27. Review of Maritime Transport, 1997, pp. 68, 69; 2001, pp. 65, 66; 2007, pp. 86, 87; 2011, pp. 87-89.

28. BP Statistical Review of World Energy, 2006 (river 20), 2011 (river 18).