

Studying Movements of Large Cruise Ships in Asia Using Automatic Identification System Data

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The purpose of this study is to examine the movements of large cruise ships coming to Asia by using Automatic Identification System (AIS) data from 2009 to 2013. According to AIS data, most of the newly built large cruise ships were deployed in the Mediterranean Sea and Northern Europe, not in Asia. On the other hand, some existing cruise ships had been moving from the Mediterranean Sea to Asia in what is called a cascade effect. In conclusion, to foresee the Asian cruise market in the future, focus should remain on the current deployment in the Mediterranean Sea, because there is a possibility that some large cruise ships currently deployed in the Mediterranean Sea will come to Asia in the future. Presently, AIS data cannot perfectly cover the movements of all cruise ships worldwide. However, we expect the data to be organized perfectly as quickly as possible.

Key Words: cruise ship, Automatic Identification System (AIS), IMO Ship identification number, cascade effect

1. INTRODUCTION

The research theme of this paper is the movement of large cruise ships toward Asia by using data from an automatic identification system (AIS).

It is important for port authorities in Asia to track the movements of large cruise ships coming toward the region. Recently, port authorities have been developing their facilities to a scale that accommodates large cruise ships. However, there is no guarantee that large cruise ships will travel to their ports in the future. If they do not receive large cruise ships after the port development, they will incur huge debts. Because their risks are so high, information on the movements of large cruise ships coming to Asia during the past few years will be welcomed by many port authorities.

Concretely, we will answer the following questions in this paper.

- What trends are occurring in the size of cruise ships in Asia?
- Where were some of the newly built cruise ships

deployed first?

- Where did the large cruise ships in Asia come from?

If we examine these mechanisms completely, foreseeing the vessel size of cruise ships coming to Asia in the future will be improved.

However, there is little information available on the movements of cruise ships deployed in Asia. For example, the Asia Cruise Association (CLIA Asia) has stated that hard data on the size of Asian source markets do not exist.¹⁾

The documents published by the European Cruise Council²⁾ and Cruise Lines International Association Europe (CLIA Europe)³⁾ discuss the cruise industry and deployments of cruise ships in the Mediterranean Sea and Northern Europe, but provide little information about the Asian cruise market. Even the documents published by the Cruise Lines International Association (CLIA)^{4),5)} refer to the cruise industry in North America, Alaska, and the Caribbean Sea, but there is little information about Asia.

Despite the passenger count for the Asian Cruise

Market from 2006 to 2012 published in a document by Konzept Analytics⁶, there is little information available on the movements of cruise ships deployed in Asia. Furthermore, even the presentations about deployment in Asia in the October 2013 conference Cruise Shipping Asia-Pacific 2013 contained little information available on the movements of cruise ships deployed in Asia^{7,8,9}. In addition, to the best of the authors' knowledge, no research has been performed to examine the movements of large cruise ships coming to Asia.

Consequently, we can see that most of the new large cruise ships were deployed in the Mediterranean Sea and Northern Europe, not in Asia. On the other hand, some existing cruise ships had been moving from the Mediterranean Sea to Asia in what is called the cascade effect.

In conclusion, to predict the Asian cruise market of the future, you should focus on the following two points. First, you should watch two gross tonnage classes in the range of 70,000–90,000 GT and over 130,000 GT. Second, you should watch over on the current deployment in Mediterranean Sea because some large cruise ships currently deployed in the Mediterranean Sea may come to Asia in the future.

The rest of the article is structured as follows. Trends in the vessel size of cruise ships in Asia, movements of large cruise ships coming to Asia, and originating regions of large cruise ships in Asia are explored in Section 2; results of this study using the AIS data are explained in Section 3; and finally, the results of this study are mentioned in Section 4.

2. METHODS

We picked out all cruise ships worldwide, about 550 vessels, registered as “Passenger (Cruise) Ship” on IHS Maritime’s Sea-web (www.sea-web.com), and organized the data using the International Maritime Organization (IMO) ship identification number allotted by the IMO.

We examined the time and place where all of the cruise ships were deployed using AIS data for five years from 2009 to 2013. After organizing the movement data of deployment of the cruise ships to each port, we divided the data into five main regions: Mediterranean Sea, Northern Europe, Caribbean Sea, North America (including Alaska), and Asia. The other data were classified as the Rest of the World. In this way, we could count the number of deployments of all cruise ships to each region. Figure 1 depicts the regions, broken down by country/area in Table 1.

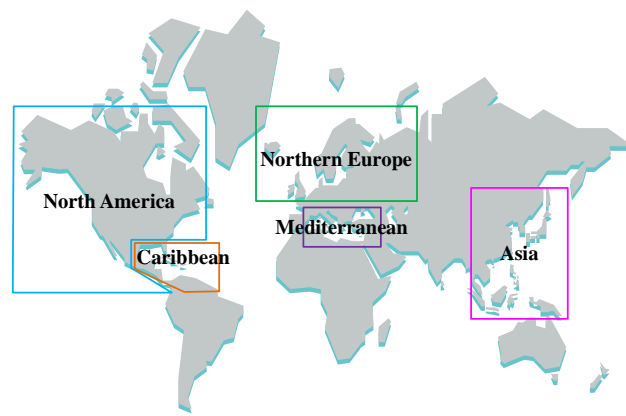


Fig.1 Region classification

Table 1 Regions and the nations/areas comprising them.

Mediterranean Sea	Albania, Algeria, Bulgaria, Croatia, Cyprus, Egypt, France (southern coast), Gibraltar, Greece, Israel, Italy, Lebanon, Libya, Malta, Monaco, Montenegro, Romania, Russia (Sochi), Slovenia, Spain (southern coast), Syria, Tunisia, Turkey, Ukraine
Northern Europe	Belgium, Channel Islands, Denmark, Estonia, Faroe Islands, Finland, France (northern coast), Germany, Greenland, Guernsey, Iceland, Ireland, Isle of Man, Jersey, Latvia, Lithuania, Netherlands, Norway, Poland, Portugal, Russia, Spain (northern coast), Sweden, United Kingdom
Caribbean Sea	Antigua, Aruba, Bahamas, Barbados, Belize, Cayman Islands, Colombia, Costa Rica (eastern coast), Cuba, Dominica, Dominican Republic, French Guiana, Grenada, Guadeloupe, Guatemala (eastern coast), Guyana, Haiti, Honduras, Jamaica, Martinique, Mexico (eastern coast), Montserrat, Netherlands Antilles, Panama, Puerto Rico, St Kitts & Nevis, St Lucia, St Vincent, Suriname, Trinidad & Tobago, Turks & Caicos Islands, United States of America (southern coast), Venezuela, Virgin Islands
North America	Canada, Costa Rica (western coast), El Salvador, Guatemala (western coast), Mexico (western coast), Nicaragua, Panama (western coast), St Pierre and Miquelon, United States of America
Asia	Brunei, Cambodia, China, Indonesia, Japan, Myanmar, Philippines, Russia (eastern coast), Singapore, South Korea, Taiwan, Thailand, Timor, Vietnam

Next, we explain about AIS data. By IMO regulation, AIS is required to be fitted aboard all ships of 300 gross tonnage and upward engaged on international voyages, cargo ships of 500 gross tonnage and upward not engaged on international voyages, and all

passenger ships irrespective of size.¹⁰⁾ The requirement became effective for all ships as of December 31, 2004.

However, we do not acquire all the AIS data of cruise ships worldwide due to an imperfect system. To exchange AIS data, vessels have to turn off the power to their AIS system. In addition, port authorities sometimes put off the installation of AIS systems. The actual coverage of cruise ships over 10,000 GT by AIS data through all quarters in 2009 was 88.8% and in 2013, it was 94.4%.

The following three steps were used for examining the movements of the large cruise ships coming to Asia.

- (1) Trends in the vessel size of cruise ships in Asia
- (2) Movements of large cruise ships coming to Asia
- (3) Original regions of large cruise ships of Asia

(1) Trends in the vessel size of cruise ships in Asia

a) Trends in average vessel size

We examined the trends in the average vessel size in Asia by comparing with other regions. For this purpose, we adopted four indicators: Gross Tonnage (GT), Draught (D), Breadth (B), and Length (L). Those indicators are calculated by an average defined by a total volume of all vessels divided by numerous ports of call in each region.

First, Fig.2 shows that the region of the largest average GT has been the Caribbean Sea for five years. An average vessel in the Caribbean Sea in 2013 was about 85,700 GT. Note that a region in which the vessel size has been growing larger rapidly is Asia. The average vessel size in Asia in 2013 was about 47,337 GT, up from about 32,308 GT in 2009, for a rise of about 47 percent.

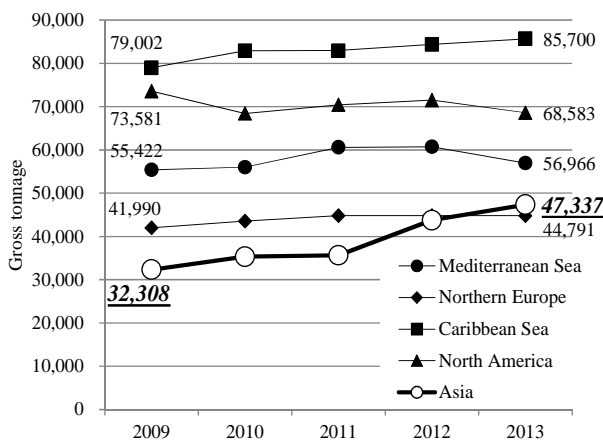


Fig.2 Average Gross Tonnage (GT) by region

Then, Fig.3 shows that the region with the largest Draught (D) size average for the past 5 years has also been the Caribbean Sea; it is about 7.7 m in 2013. On the other hand, Asia's average D in 2013 was about 6.9 m, up from about 6.5 m in 2009 for an increase of about 6 percent.

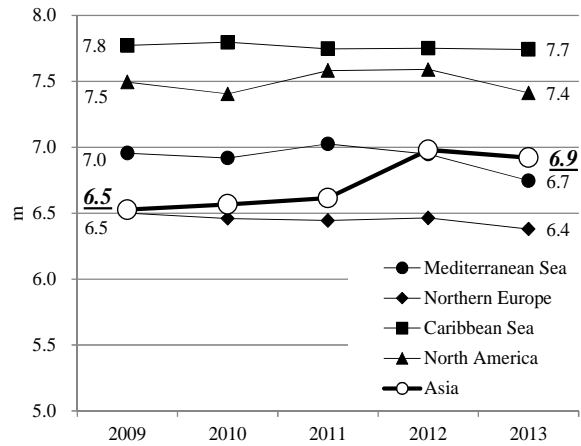


Fig.3 Average Draught (D) by region

Further, Fig.4 shows that the region of the largest average Length (L) size was again the Caribbean Sea through five years; it was about 265.7 m in 2013. On the other hand, Asia's average L in 2013 was about 205.0 m, up about 13% from 182.2 m in 2009.

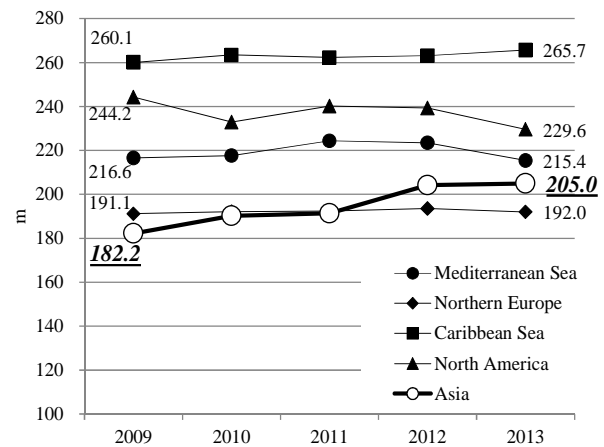


Fig.4 Average Length (L) by region

Finally, Fig.5 shows that the Caribbean Sea is also the region with the largest average Breadth (B) through five years; it was about 32.0 m in 2013. On the other hand, Asia's average B in 2013 was about 27.6 m, up about 8 percent from 2009's level of 25.5 m.

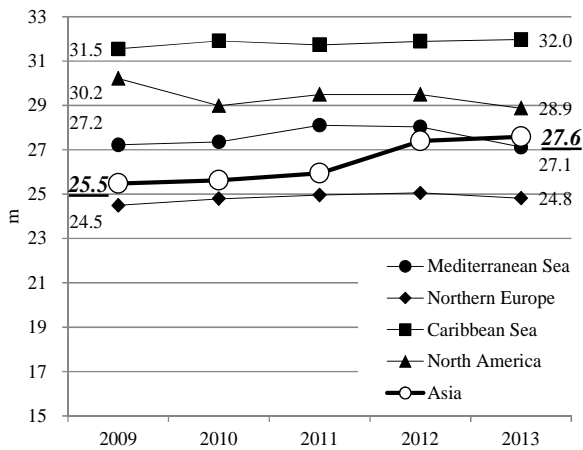


Fig.5 Average Breadth (B) by region

b) Trends in vessel size by class

In the prior subsection, we found that the cruise vessel size of Asia grew larger rapidly. Next, we focused on each class of vessel size, and we examined trends in the average vessel size in Asia by comparison with the others. Note that data for the vessels of less than 10,000 GT were removed because the number of deployments of small cruise ships was too frequent and repetitive in short-distance navigation.

First Fig.6 shows the trends in vessel size classified by Gross Tonnage (GT). We divided GT into nine classes: 10,000–29,999 GT, 30,000–49,999 GT, 50,000–69,999 GT, 70,000–89,999 GT, 90,000–109,999 GT, 110,000–129,999 GT, 130,000–149,999 GT, 150,000–169,999 GT, and 170,000 GT and over.

The GT class with the maximum number of port calls in Asia in 2013 was 10,000–29,999 GT. Judging by the number of port calls, we found that the small cruise ship was still the mainstream in Asia. Remarkably, the vessel sizes of 70,000–89,999 GT and 130,000–149,999 GT have been increasing from 2011 to 2013. Some midsize ships, such as Costa Victoria (75,166 GT) and Costa Atlantica (85,619 GT) deployed in Asia, causing the class of 70,000–89,999 GT to become larger in the region. Some large cruise ships, such as Voyager Of The Seas (137,276 GT) and Mariner Of The Seas (138,279 GT), were also deployed here, causing the class of 130,000–149,999 GT in Asia to become larger.

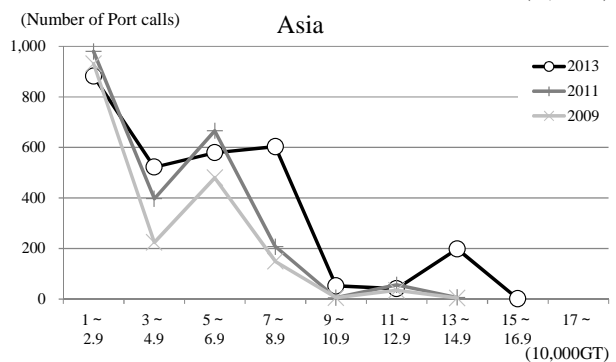
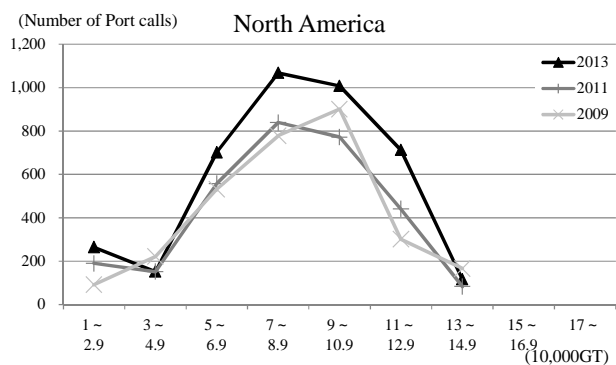
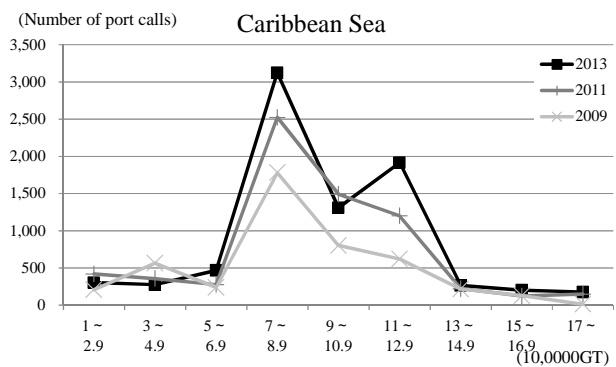
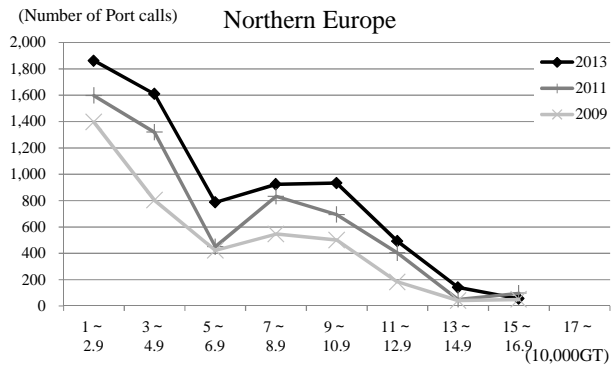
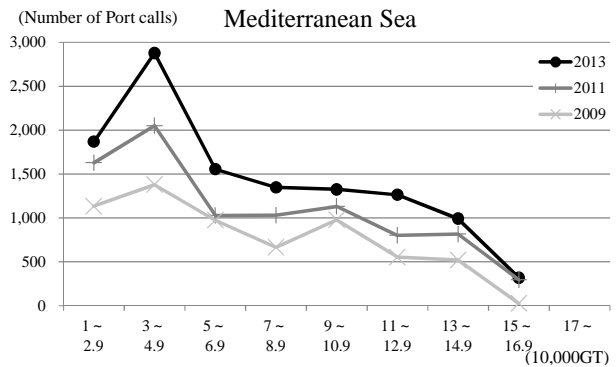


Fig.6 Number of port calls by Gross Tonnage (GT) class

Next, Fig.7 shows the trends in vessel size by Draught (D) size. We divided Draught into nine classes: under 1.9 m, 2.0–2.9 m, 3.0–3.9 m, 4.0–4.9 m, 5.0–5.9 m, 6.0–6.9 m, 7.0–7.9 m, 8.0–8.9 m, and 9.0 m and over. The D class with the maximum number of port calls in Asia in 2013 was 8.0–8.9 m. The second highest number of port calls was the 7.0–7.9 m class. Both classes were the mainstream in Asia.

Further, Fig.8 shows the trends in vessel size by Breadth (B) class, which we again divide into nine classes under 9.9 m, 10.0–14.9 m, 15.0–19.9 m, 20.0–24.9 m, 25.0–29.9 m, 30.0–34.9 m, 35.0–39.9 m, 40.0–44.9 m, and 45.0 m and over. The B class with the maximum number of port calls in Asia in 2013 was 30.0–34.9 m, followed by 25.0–29.9 m. Both classes were the mainstream in Asia.

Finally Fig.9 shows the trends in vessel size by class of Length (L). We divided Length into eight classes: under 49 m, 50–99 m, 100–149 m, 150–199 m, 200–249 m, 250–299 m, 300–349 m, and 350 m and over. The L class with the maximum number of port calls in Asia in 2013 was 200–249 m, followed by 150–199 m and 250–299 m. The range of 150–299 m was the mainstream in Asia.

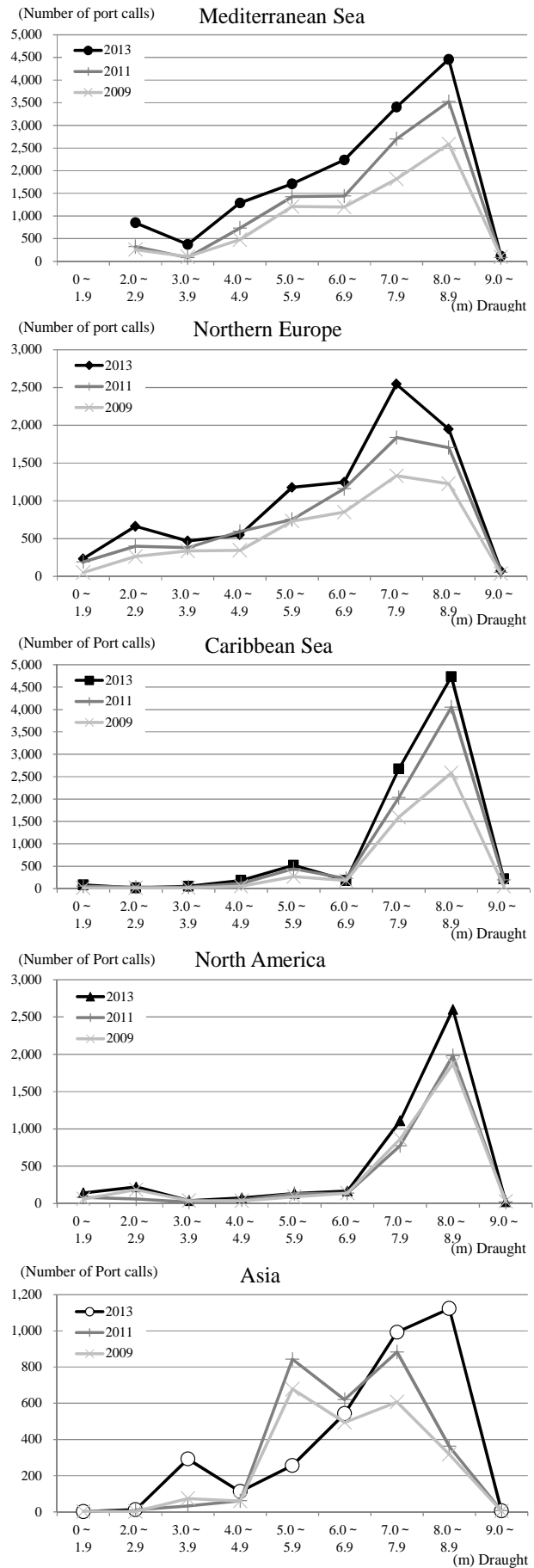


Fig.7 Number of port calls by Draught (D) class

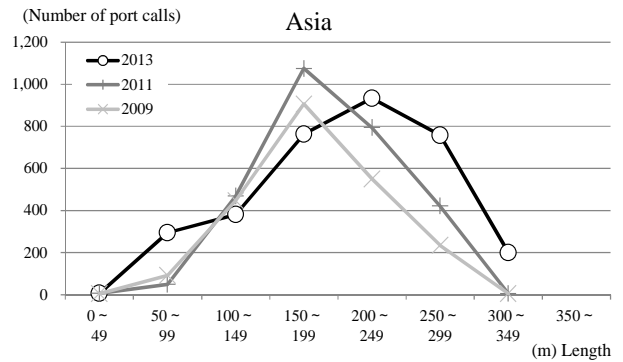
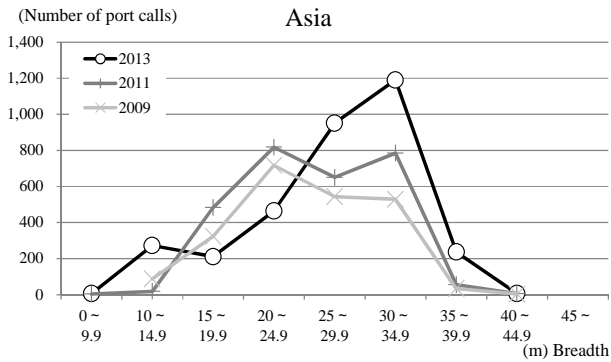
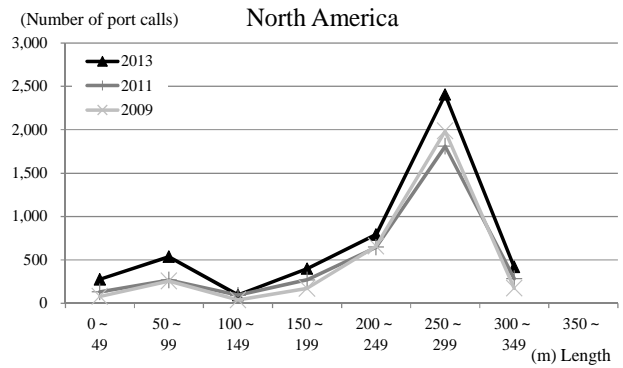
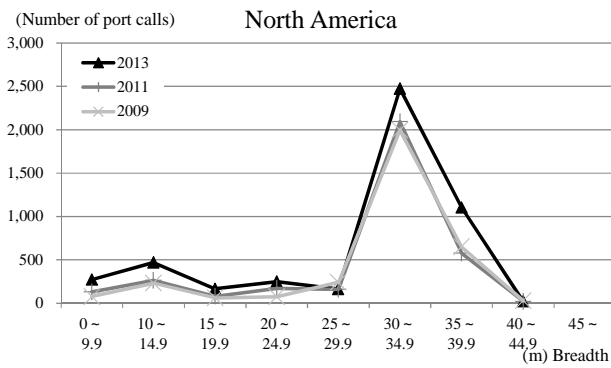
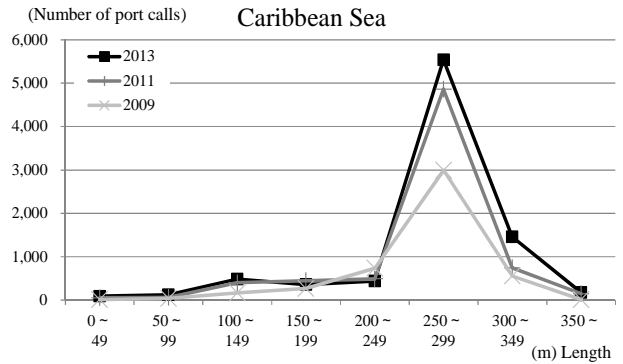
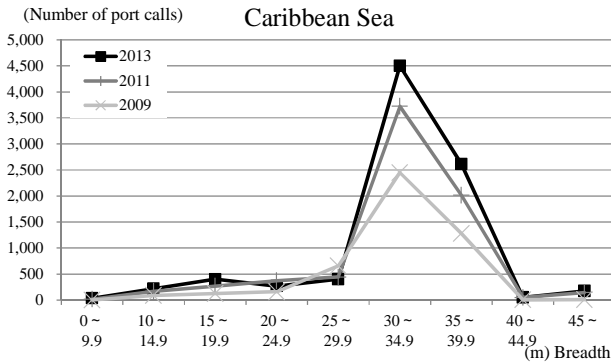
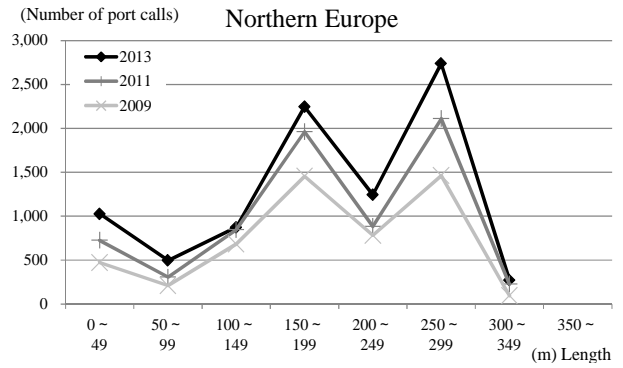
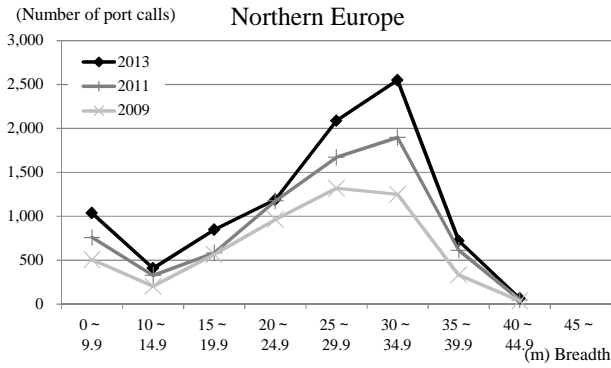
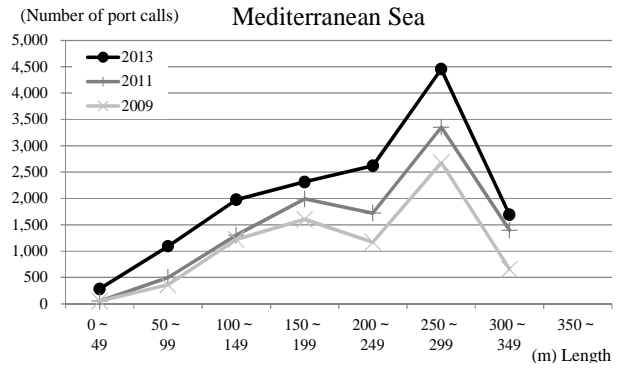
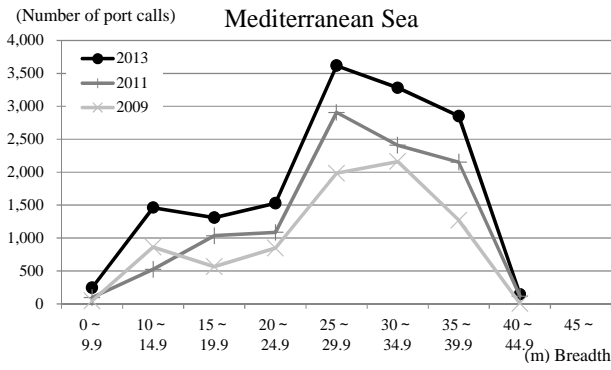


Fig.8 Number of port calls by Breadth (B) class

Fig.9 Number of port calls by Length (L) class

(2) Movements of large cruise ships coming to Asia

We examined the movements of existing and newly built large cruise ships worldwide. The term “large cruise ship” is used by many people in the cruise industry today. For example, the ACA 2013 White Paper said that “most large ship cruise lines are categorized that they operate of at least 1,000 passengers, with tonnage over 50,000 GRT and LOA (Length overall) exceeding 200 m.”¹⁾ We defined “large cruise ship” as a vessel carrying at least 1,000 passengers, with tonnage over 50,000 GT and an LOA exceeding 200 m.

Furthermore, we divided a year into quarters because the deployment of most cruise ships changes around the four seasons. For example, since the best season for cruise tourism in Japan is during spring and summer, accurately from April to September, there are many cruise ships coming to Japan at that time. The deployment of cruise ships in Japan during those best seasons changes where ships are deployed in other regions (Oceania, Southeast Asia, Caribbean Sea, etc.). In short, it is necessary to check the deployment of cruise ships on a quarterly basis. Note that if a cruise ship were deployed in multiple regions during one quarter, we adopted the region with the maximum number of ports of call as the ship’s representative region.

a) Movements of newly built large cruise ships

We analyzed regions where newly large cruise ships were first deployed. According to IHS Maritime’s Sea-web, the number of new large cruise ships deployed from 2009 to 2013 in the world was 33 vessels. After we picked out data for ports of call of those, we divided the data into the nine main cruise

regions of the world. The main regions add the five regions previously described to four other main regions, South America, Africa, Oceania, and Middle East and South Asia. Figure 10 depicts the regions, broken down by country/area in Table 1 and 2.

Table 2 Four other main regions and the nations/areas comprising them.

South America	Argentina, Brazil, Chile, Ecuador, Falkland Islands, Peru, South Georgia, Uruguay
Africa	Canary Islands, Cape Verde Islands, Comoros, Djibouti, Eritrea, Ghana, Kenya, Madagascar, Madeira, Mauritius, Morocco, Mozambique, Namibia, Reunion, Senegal, Seychelles, South Africa, Sudan, Tanzania, Togo
Oceania	American Samoa, Australia, Christmas Island, Fiji, French Polynesia, Guam, Kiribati, Marshall Islands, Micronesia, New Caledonia, New Zealand, Norfolk Island, Palau, Papua New Guinea, Samoa, Solomon Islands, Tonga, Vanuatu
Middle East and South Asia	Bahrain, Egypt, India, Iran, Israel, Jordan, Kuwait, Maldives, Oman, Pakistan, Qatar, Saudi Arabia, Sri Lanka, United Arab Emirates, Yemen

The results of analyzing where the new large cruise ships were deployed first are illustrated in Fig.10. A double circle is the region where a new large cruise ship deployed first, and a filled-in box means the region where one deployed next.

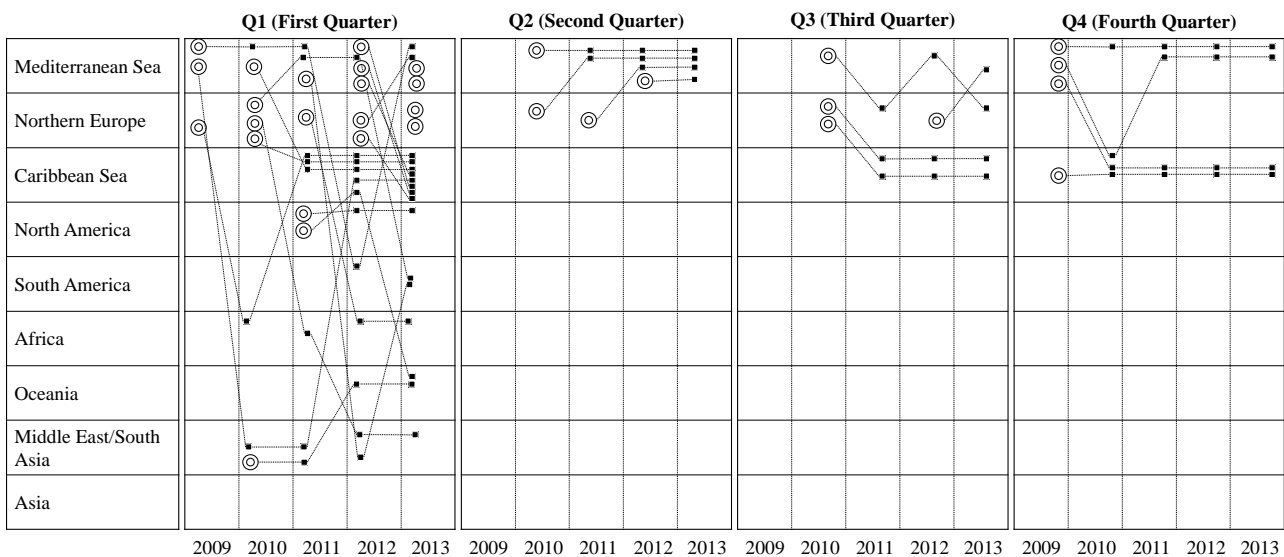


Fig.10 Regions where new large cruise ships were deployed first

Through all the quarters, the region with the maximum number of first deployment of a new large cruise ship was the Mediterranean Sea with 15 vessels. The second highest was Northern Europe with 14 vessels. Those two regions together make up about 88 percent of new large cruise ship deployments. In short, most of the new large cruise ships were deployed in Europe. On the other hand, no new large cruise ship was deployed first or second in Asia from 2009 to 2013.

b) Movements of existing large cruise ships

We analyzed regions where existing large cruise ships were moved in 2009 and 2013. The number of existing large cruise ships deployed in 2013 in the world was over 150 vessels. After we picked out data of their ports of call, we divided the data into the five main regions and the rest of the world. Focusing on each vessel's IMO numbers, we identified the region where each cruise ship was deployed in 2009 and 2013.

The results of the regions where the existing large cruise ships were deployed in 2009 and 2013 are illustrated in Fig.11.

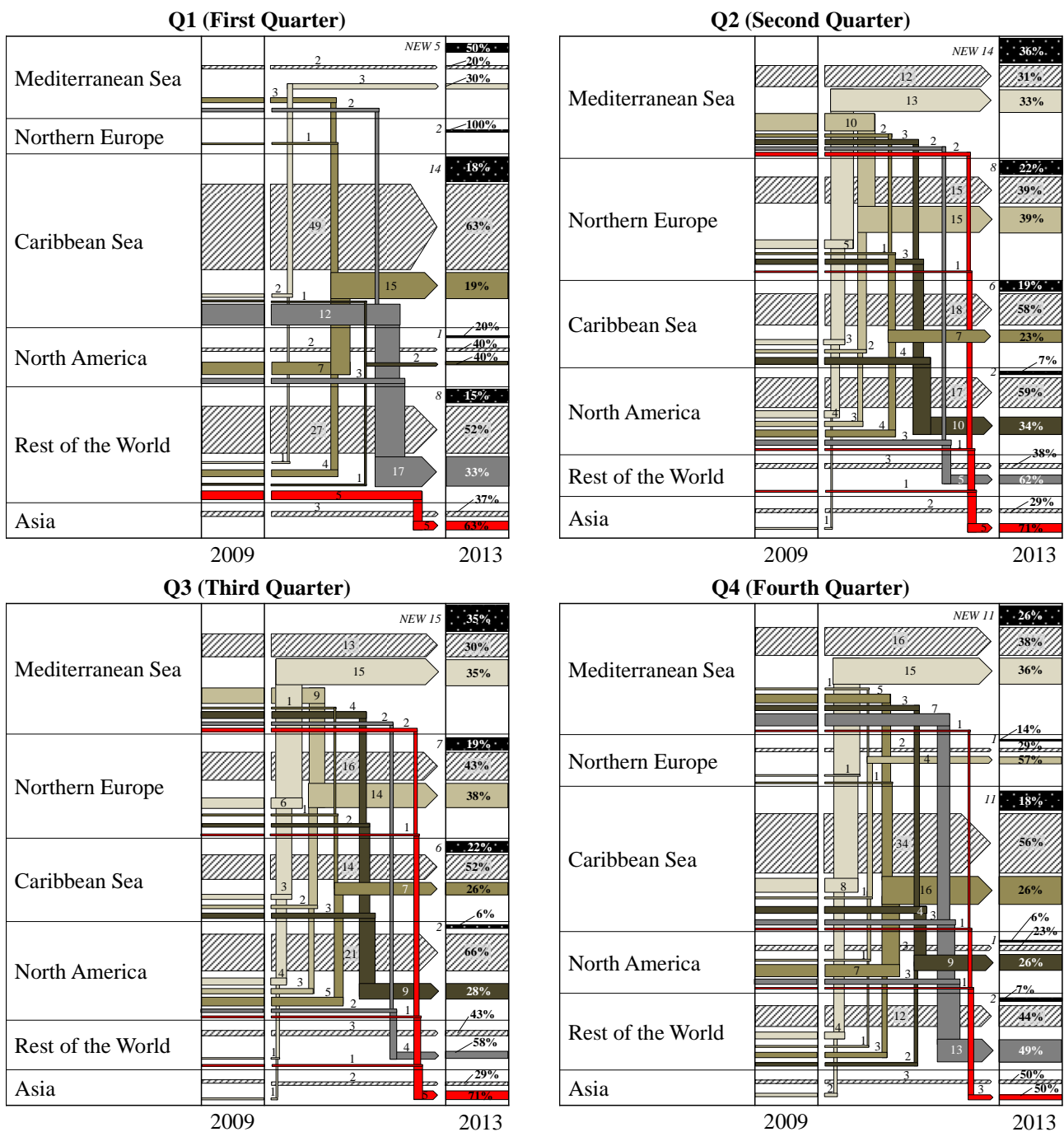


Fig.11 Movements of the existing large cruise ships

Through all the quarters, we found that most of the existing large cruise ships of Asia in 2013 had been moved from all over the world—Mediterranean Sea, Northern Europe, Caribbean Sea, North America, and the Rest of the World. In the first quarter (Q1) of 2013, 63 percent of the existing large cruise ships deployed in Asia had been deployed elsewhere in 2009. In the second and third quarter (Q2/Q3), statistics were 71 percent. In the fourth quarter of 2013, it was 50 percent.

(3) Original regions of large cruise ships in Asia

Where did the large cruise ships in Asia come from? If we study the original regions of these ships, the information about the original regions will bring us to estimate the cruise vessel size of the future in Asia.

For that reason, we picked out the large cruise ships of Asia in 2013, and we examined that data back five years, from 2009 to 2013.

As a result, we learned that from second quarter to fourth quarter, the maximum number of the large cruise ships of Asia came from the Mediterranean Sea. Only the first quarter saw movement from Oceania.

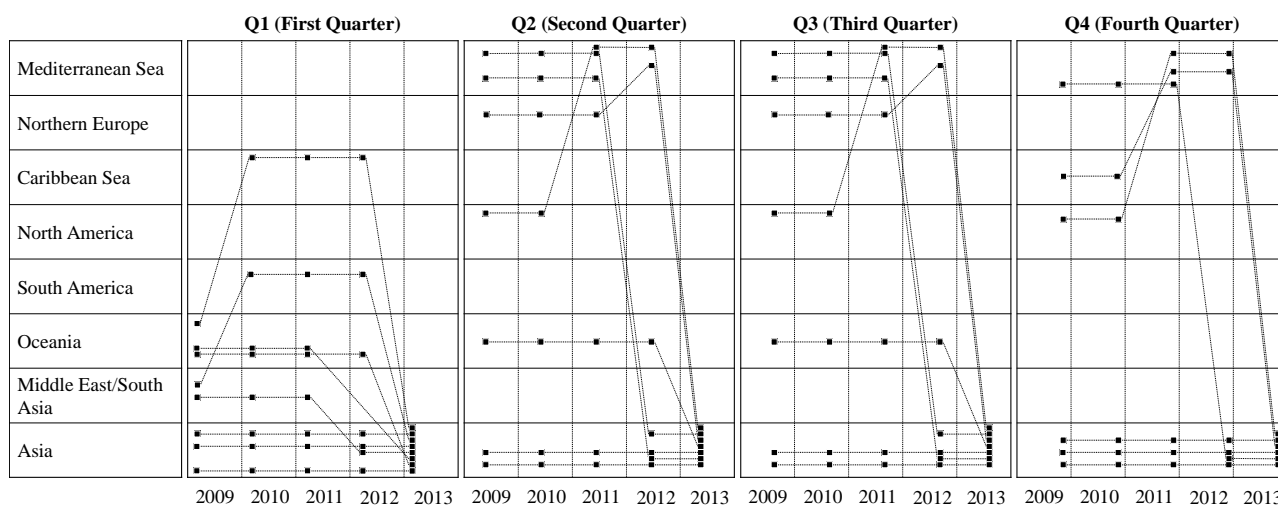


Fig.12 Tracking movements of large cruise ships from the original region to Asia

3. RESULTS

The example results show:

1. Trends in the average of vessel size. Although the region with the largest vessel size is the Caribbean Sea, the vessel size of Asia has rapidly become larger recently.
2. Trends in vessel size by class. Although the tonnage class with the maximum number of port calls in Asia in 2013 was 10,000–29,999 GT, the mainstream in Asia has shifted to the classes of 70,000–89,999 GT and 130,000–149,999 GT by growth rate.
3. Movements of newly built large cruise ships. Most of the new large cruise ships were deployed in the Mediterranean Sea and Northern Europe. The combined number for those two regions was 88 percent. In short, most of the new large cruise ships were deployed in Europe. On the other hand, no such ships were deployed first or second in Asia during the past five years.

4. Movements of existing large cruise ships. We found that most of the existing large cruise ships of Asia in 2013 were moved from all over the world—Mediterranean Sea, Northern Europe, Caribbean Sea, North America, and the Rest of the World.
5. Original regions of large cruise ships of Asia. Most of the large cruise ships of Asia in 2013 came from the Mediterranean Sea. Only the first quarter saw large cruise ships from Oceania.

4. DISCUSSION

The purpose of this study was to examine the movements of large cruise ships coming to Asia.

As a result, we learned that most of the new large cruise ships were deployed in the Mediterranean Sea and Northern Europe. In fact, we found that no newly built cruise ships were deployed in Asia. However, some existing cruise ships were deployed from the Mediterranean Sea to Asia in what is called

the cascade effect. It means the phenomenon that one thing will spread one after the other like cascading waterfalls become a small stage. In this case, it means that the deployment of the new large cruise ships in the Mediterranean Sea causes the vessel size in Asia to be growing larger rapidly.

In reality, AIS data cannot perfectly cover movements of all cruise ships worldwide yet, but we expect the data to be organized as well as possible.

Although one of the results in this paper states that newly large cruise ships could not see first or second deployment in Asia from 2009 to 2013. However, Royal Caribbean Cruises announced that its next new large cruise ship, Quantum Of The Seas, will be deployed first in the Caribbean Sea in November 2014. Later, it will be deployed second in Asia in summer 2015. Since the Asian cruise market will be expanding, we should focus on the deployment of the new large cruise ships in the future.

In conclusion, for foreseeing Asian cruise market of the future, we should check the following two points. First, watch the two classes with range of 70,000–90,000 GT and over 130,000 GT. Second, focus on current deployments in the Mediterranean Sea because there is a possibility that some large cruise ships deployed in the Mediterranean Sea currently will come to Asia in the future.

5. CONCLUSION

Movements of large cruise ships around the world, including Asia, are examined using AIS data for five years ranging from 2009 to 2013. As a result, we found that a newly built cruise ship does not cause the vessel size of Asia to become larger. The main cause is existing large cruise ships moved from all over the world to Asia. In particular, existing large cruise ships coming to Asia started from the Mediterranean Sea.

In conclusion, we have learned the following from this study.

1. The vessel size of Asia has grown larger more rapidly than in other regions. In particular, we should focus on the two classes, range of 70,000–90,000 GT and over 130,000 GT.
2. Where did the large cruise ships of Asia come from? The answer is the Mediterranean Sea. During the past five years, none of the

new large cruise ships were first or second deployed in Asia from 2009 to 2013. Namely, the movement of existing large cruise ships from the Mediterranean Sea and Oceania to Asia caused the vessel size of Asia to become large. For this result, we focus on the current deployment in the Mediterranean Sea, because some large cruise ships deployed in the Mediterranean Sea currently may come to Asia in the future.

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