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Collision Analyze and Map Plotting of Korea – Japan navigating vessels

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Key words *: Ship Collision, Sea disaster, Human error, Plotting, GIS, Korea – Japan Passage*

1. Background

Many of Japanese cargoes make a transshipment through Busan port of South Korea[(1)]. And Korean shipping companies occupy most of the container capacity in Korea - Japan route[(2)]. Therefore, it can be said that this route is very important for the shipping industry of two countries.

Despite this importance, there are a lot of ships between two countries, including cargo ships, passenger ships, tugboats, and fishing boats. And it makes sea area congested and causes more collision. So, it is necessary to clarify the situation and cause of the collision on this passage to prevent economic loss and to save human lives. There is research on collisions which occurred in both territorial waters. Kim (2006)[(3)] and Kim (2011)[(4)] focus on human factors in ship accidents in Korean waters and Lee (2013)[(5)] described collisions between fishing vessel and non-fishing vessel using written verdicts. In Japan, Yamashita (2013) pointed out characteristics of ship's collision in Seto Inland Sea using GIS[(6)]. However, no studies focus on accidents such as collision of Korea – Japan navigating vessels.

With these backgrounds, this study aims to make clear characteristic of the actual situation of collision accidents which Korea – Japan navigating vessels involved.

2. Methodology

In this study, Korea Central Marine Safety Tribunal's written verdict, special survey report[(7)], and ship accident investigation report of Japan Transport Safety Board (JTSB)[(8)] from 2010 to 2020 were analyzed. And all accidents picked up were that their arrival or departure ports are clearly stated as Korea and Japan.

With those data sources, characteristics of vessels and accidents were investigated. Also, positions of collisions accidents were marked on map with each characteristic that analyzed at above phase on map with a freeware GIS (Geographic Information System) software, QGIS. For the GIS, open street map was used in this study.

3. Result

3.1 Overview

First of all, entire 49 collisions were occurred due to human factors; 30 case of improper lookout (61%), 11 cases of inappropriate navigation (23%), and 8 cases of inappropriate maneuvering (16%). Secondly, it was found that collisions between cargo ship and fishing boat recorded 27 cases (55%). Collisions of cargo ship – cargo ship follow (16 cases, 33%). Cargo ship – Tugboat accidents were 4 cases (8%). Thirdly, when focusing on the encounter situation and applicated navigational rule, crossing situation and restricted ability in maneuvering, anchoring and local rule was the largest with 17 cases, 11 cases, 6 cases, 6 cases, respectively.

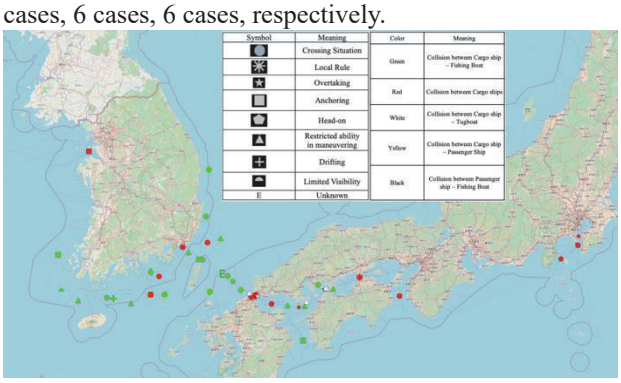

Figure 1. All collision accidents plotted on map

Additionally, attributable reasons of accidents were usually on Korea – Japan navigating vessels. Among 46 collisions except 3 that happened between Korea – Japan vessel, 36 accidents (76%) were caused because of the fault of them.

Lastly, it was found that there were each 10 accidents in the Korean Strait, the Seto Inland Sea, and the southern coast of Korea respectively, and 6 cases were occurred in the Kanmon Strait as shown on the figure 1.

3.2 Fishing Boat – Cargo Ship

Figure 2. Hazard map of accidents between cargo ship and fishing boat

Collisions between cargo ship and fishing boat were the largest number. In details, crossing situation was 10 cases, restricted ability in maneuvering was 8 cases, anchoring 5 cases, head-on, restricted visibility, drifting, and other cases were each 1 case. Main factors in this type of accident were 23 cases of improper lookout and 4 cases of inappropriate navigation.

With plotting positions of collision on GIS map, it was found where collisions between cargo ship and fishing boat usually occur as shown on figure 2. Accidents mainly occurred in South Coast of Korea and Korea Strait (Tsushima Strait), each 8 and 9 cases.

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3.3 Between Cargo Ships

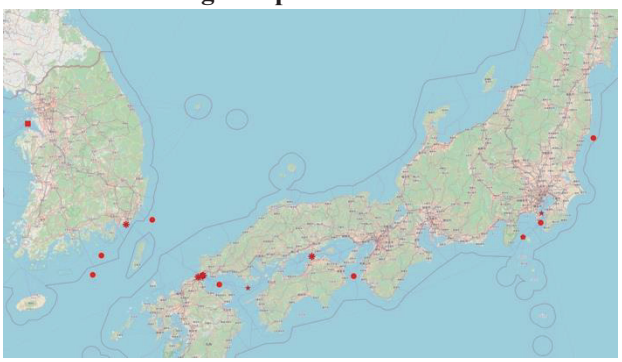

Figure 3. Hazard map of accidents between cargo ships (Korea and Japan)

Those accidents usually happened in strait, channel, or inland sea. Especially, as shown on figure 3, Kanmon Straits, Seto Inland Sea, and Uraga channel were the main place of collisions. Conversely, only few collisions occurred in Korea Strait and South Coast of Korea.

Initially, among 16 collisions, reasons attributable to the collision were 9 cases for Korea-Japan ships and 4 cases for opponent ships and 3 cases were accidents between vessels who navigate between Korea and Japan. Secondly, there were 4 accidents caused by improper lookout, 7 accidents caused by inappropriate maneuvering, and 5 accidents caused by inappropriate navigation. Especially, in collision caused by inappropriate maneuvering, there was a problem of unreasonable entry and maneuvering or the misuse of VHF. At last, 7 collisions occurred in the Crossing situation, 5 in the local rule situation applied to each port or special sea area, 2 in overtaking, 1 in anchoring, and 1 in head-on.

3.4 Cargo ship - Tugboat

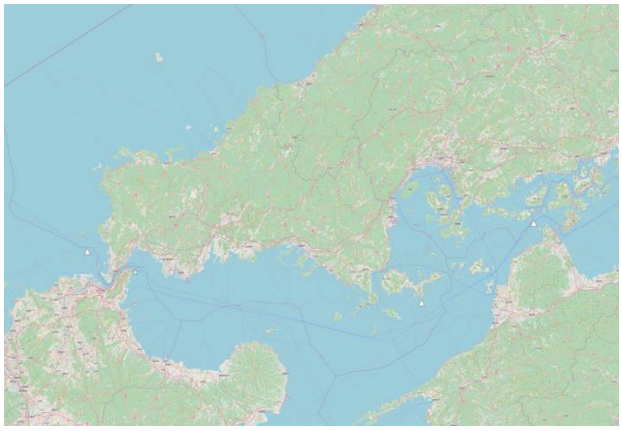

Figure 4. Hazard map of accidents between cargo ship and tugboat

There were 4 collisions (8.2%) between cargo ship and tugboat. All collisions occurred in Japanese territory sea and well-known congested sea area; 2 in Kanmon Strait, 2 in Seto Inland Sea. Besides, they happened because of the fault of Korea – Japan navigating vessels.

Also, all reasons of imputation were mainly on cargo ships who navigate between Korea and Japan.

4. Consideration

The actual situation and characteristics of Korea – Japan route can be suggested through this study. Initially, collision occurs throughout the entire route as shown in GIS hazard map. Especially, accidents between fishing boat and cargo ship usually occur in Korea Strait and South Sea of Korea. Also, fishing boats on this route may operate in drowsy condition due to fatigue[9-11]. In contrast, there is a high risk of collision with cargo ships on Kanmon Straits. In addition, accidents related with cargo ships are mainly caused by the improper lookout and the misuse of VHF.

Achknowledgment

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