

2. Statistics

Of the collision accidents between vessels for which JTSTB conducted investigations sometime between October 2008 and March 2014 and published accident investigation reports, there were 50 accidents occurring in marine areas with high traffic density and characteristic occurrence trends (*2). The statistical data for those accidents is shown on charts below.

(*2 Target marine areas: from the mouth of Tokyo Bay to off the Iro Saki (13 cases), near the Akashi Kaikyo Traffic Route east entrance (9 cases), near the Bisan Seto East Traffic Route east entrance (10 cases), near the Kurushima Kaikyo Traffic Route west entrance (6 cases), and from near the Kanmon Passage east entrance to off the Ube City, Yamaguchi Pref. (12 cases))

By the type of vessel

The proportion of cargo ships and tankers is high

The breakdown of the 107 vessels involved in the 50 target accidents (target vessels) by vessel type is as follows: 39 cargo ships (36.4%), 28 fishing vessels (26.2%), and 12 tankers (11.2%) (See Figure 2).

On the other hand, out of 1,084 vessels involved in collision accidents in the 2012 and 2013 years, the breakdown of vessels by vessel type is as follows: 405 fishing vessels (37.4%), 201 cargo ships (18.5%), and 59 tankers (5.4%) (*3). This statistical data shows that the proportions of cargo ships and tankers in the target areas are roughly 2 times higher than in general areas.

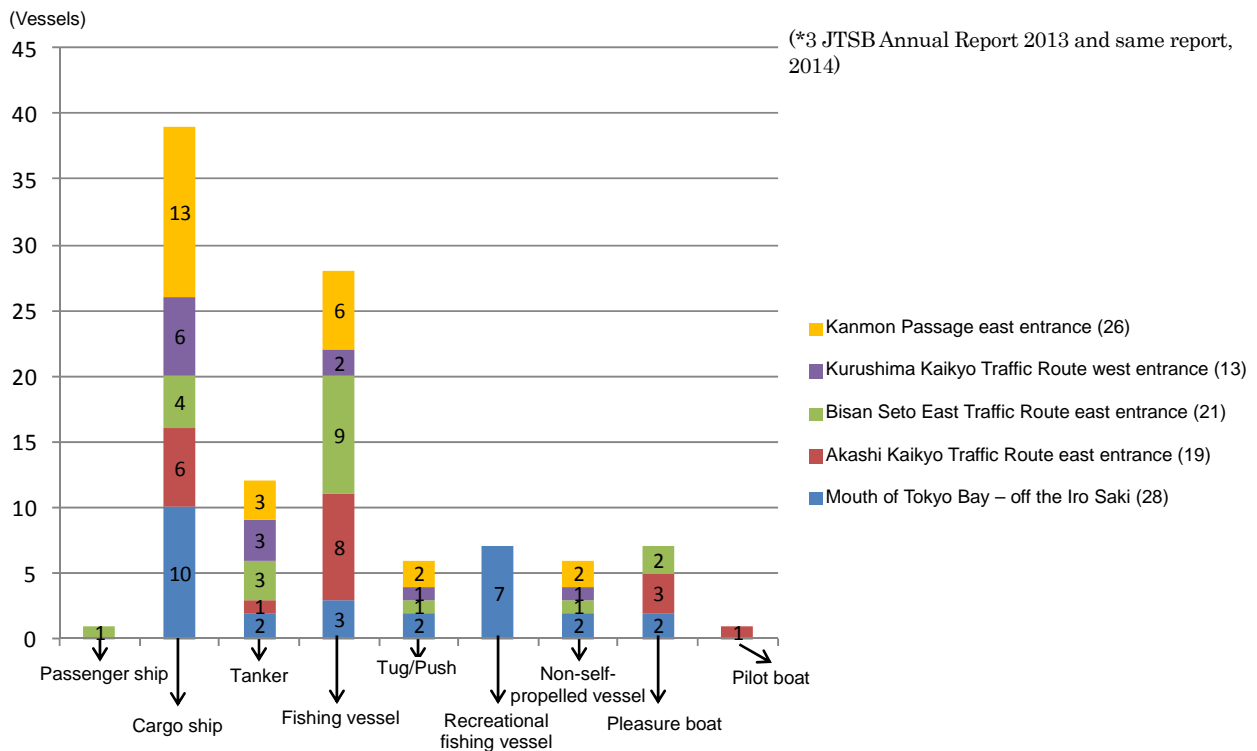


Figure 2: By the type of vessel

Breakdown of accidents by month

As for the number of accidents by month, there were 7 (14.0%) in November, followed by 6 (12.0%) in June. (See Figure 3)

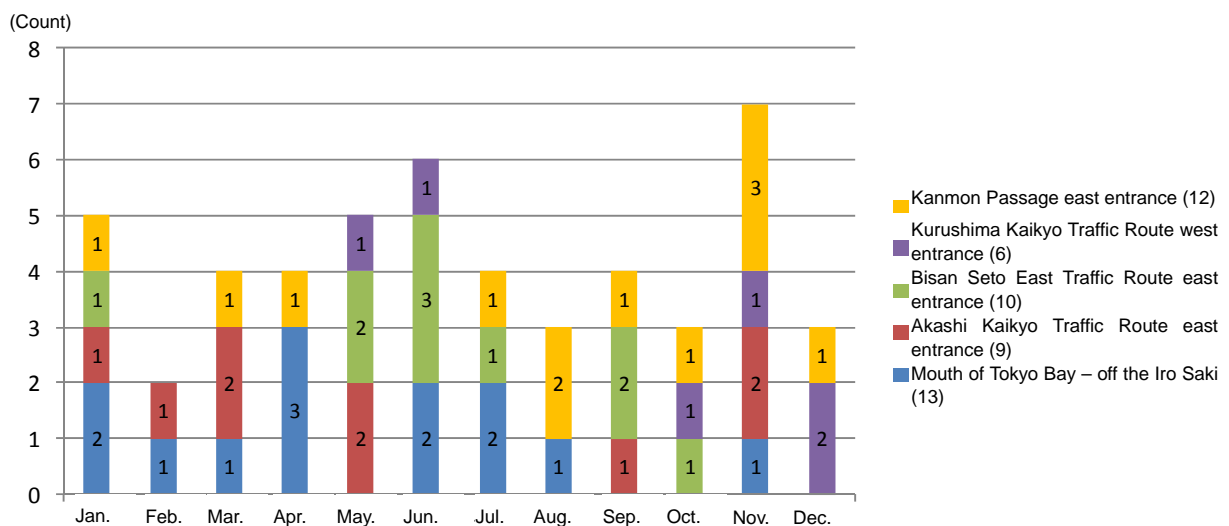


Figure 3: Number of accidents by month

Breakdown of accidents by the time of day and day/night conditions

Many accidents occurred between 11:00 and 13:00

As for the number of accidents by the time of day, 6 accidents occurred from 12:00 to 13:00 (12.0%), followed by 5 accidents each occurring from 11:00 to 12:00 and from 13:00 to 14:00 (10.0%) (See Figure 4).

In comparison between the daytime and night-time there were 30 accidents occurring in the daytime (60.0%) and 20 in the night-time (40.0%). 8 out of the 9 accidents occurred in the daytime near the eastern entrance to the Akashi Kaikyo Traffic Route, and 5 out of the 6 accidents occurred at night-time near the western entrance to the Kurushima Kaikyo Traffic Route (See Table 1).

(*4 Day and night are differentiated according to the time of sunrise and sunset.)

Table 1: Number of accidents separated by day/night (Cases)

Marine area	Day	Night	Total
Mouth of Tokyo Bay – off the Iro Saki	8	5	13
Akashi Kaikyo Traffic Route east entrance	8	1	9
Bisan Seto East Traffic Route east entrance	5	5	10
Kurushima Kaikyo Traffic Route west entrance	1	5	6
Kanmon Passage east entrance	8	4	12
	30	20	50
	60.0%	40.0%	100.0%

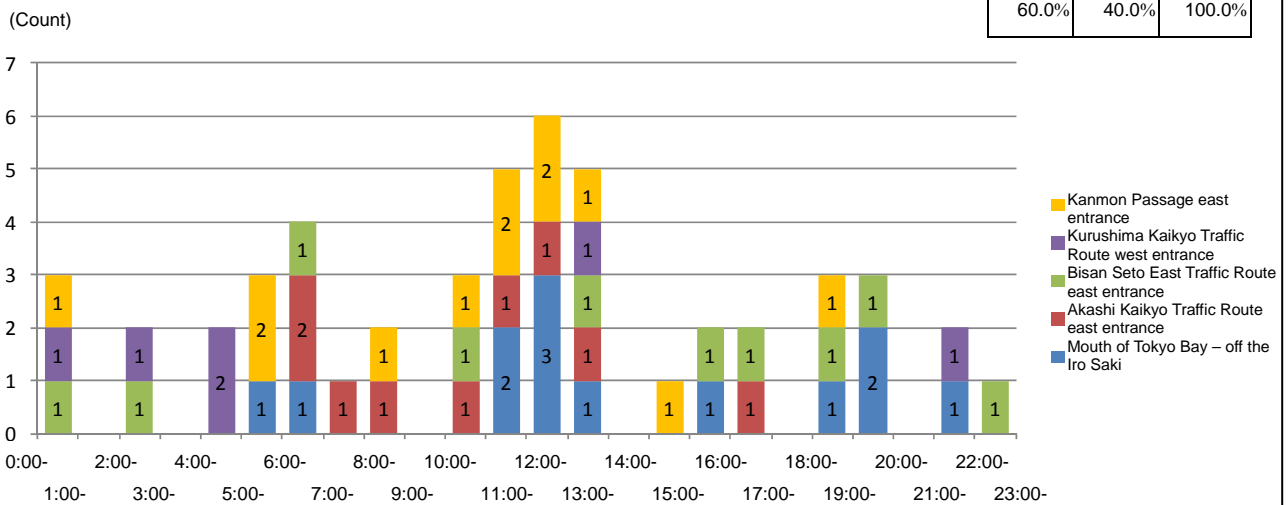


Figure 4: Number of accidents by the time of day

“Traffic density” in J-MARISIS

“Traffic density” is described in J-MARISIS as indicated below.

“A traffic density map, developed by the National Maritime Research Institute, produced by means of calculating the number of vessels passing through a mesh of one minute of latitude by one minute of longitude in 2012 based on AIS(*5) information provided by a vessel information company. Colors are used to represent density levels; 1-15, 16-30, 31-100, 100-300, and 301 and above. Please note that the traffic density map does not illustrate the exact traffic volume of vessels equipped with AIS since some data may be lost by the condition of radio propagation and other technical reasons.”

(*5 “AIS: Automatic Identification System” refers to the device that enables vessels to automatically send and receive information regarding vessels’ identification codes, types, names, positions, courses, destinations, etc. in order to exchange information between vessels and navigation aid facilities of shore stations. The vessel position refers to the position of GPS antenna.)

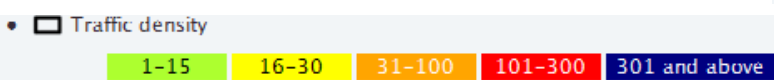


Figure 5: Explanation of “traffic density” in J-MARISIS

Conditions of target marine areas

We will now look into the relationship between traffic density in J-MARISIS and accident occurrence trends, and the courses of target vessels by vessel type for each target marine area (in the display of courses of target vessels by vessel type, the headings of vessels drifting or at anchor are indicated by ship symbols).

(1) From the mouth of Tokyo Bay to off the Iro Saki (13 cases)

Many accidents involving recreational fishing vessels on Saturdays and Sundays

- In J-MARISIS, an area shown in blue, indicating high traffic density, extends from off the Tsurugi Saki (Miura City, Kanagawa Pref.) to off the Mikomoto Shima (Shimoda City, Shizuoka Pref.) with a width of approximately 5 km (See Figure 6).
- Many cargo ships and tankers sailed in the northeast to southwest direction. Fishing vessels and recreational fishing vessels sailed in different courses from those of cargo ships and tankers, with their courses intersecting (See Figure 7).
- Among the 13 accidents, 5 accidents (7 vessels) involved recreational fishing vessels. 1 accident on Saturday and 4 accidents on Sundays occurred between 5:00 to 14:00. The states of movement of the recreational fishing vessels were as follows: fishing while in a drifting state (3 vessels), underway with the skipper asleep (2 vessels), and underway in order to move location (2 vessels) (There were no accidents involving recreational fishing vessels in the other target areas).
- 9 people sustained fatalities or injuries: fishing visitors on recreational fishing vessels (1 fatality, 1 seriously injured, 3 slightly injured), a skipper (1 slightly injured), a skipper of a pleasure boat (1 slightly injured), and passengers (2 slightly injured).

○ Refer to Case 1 on page 10.

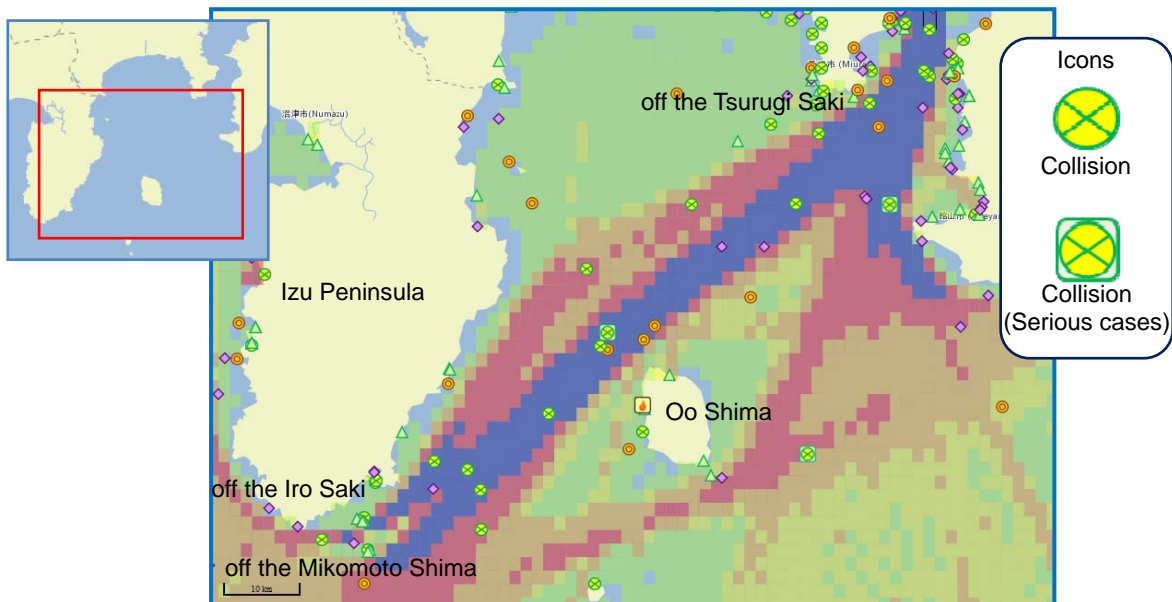


Figure 6: Traffic density and accident locations according to J-MARISIS (from the mouth of Tokyo Bay to off the Iro Saki)

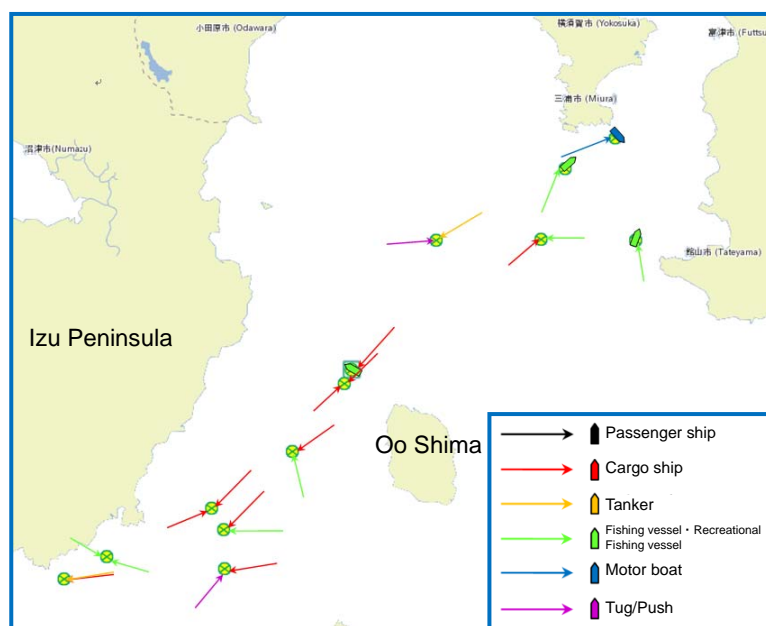


Figure 7: Vessel courses by vessel type (from the mouth of Tokyo Bay to off the Iro Saki)

(2) Near the Akashi Kaikyo Traffic Route east entrance (9 cases)

There were many accidents involving fishing vessels in the daytime

- In J-MARISIS, the areas near the eastern and western entrances to the Akashi Kaikyo Traffic Route are shown in blue and red, indicating high traffic density.
- Among accidents occurring near the eastern and western entrances to the route, a higher number occurred near the eastern entrance.
- Out of the 9 accidents, 8 occurred in the daytime. 7 of those accidents (8 vessels) involved fishing vessels, and their states of movement were as follows: fishing while sailing (5 vessels), fishing while in a drifting state (1 vessel), and underway in order to move location (2 vessels).
- Out of the fishing vessels that were sailing, excluding the 2 vessels that were engaged in two-boat trawling, all 4 of the remaining vessels were sailing toward the northwest.
- 5 people sustained injuries: skippers of pleasure boats (2 slightly injured) and passengers (3 slightly injured).

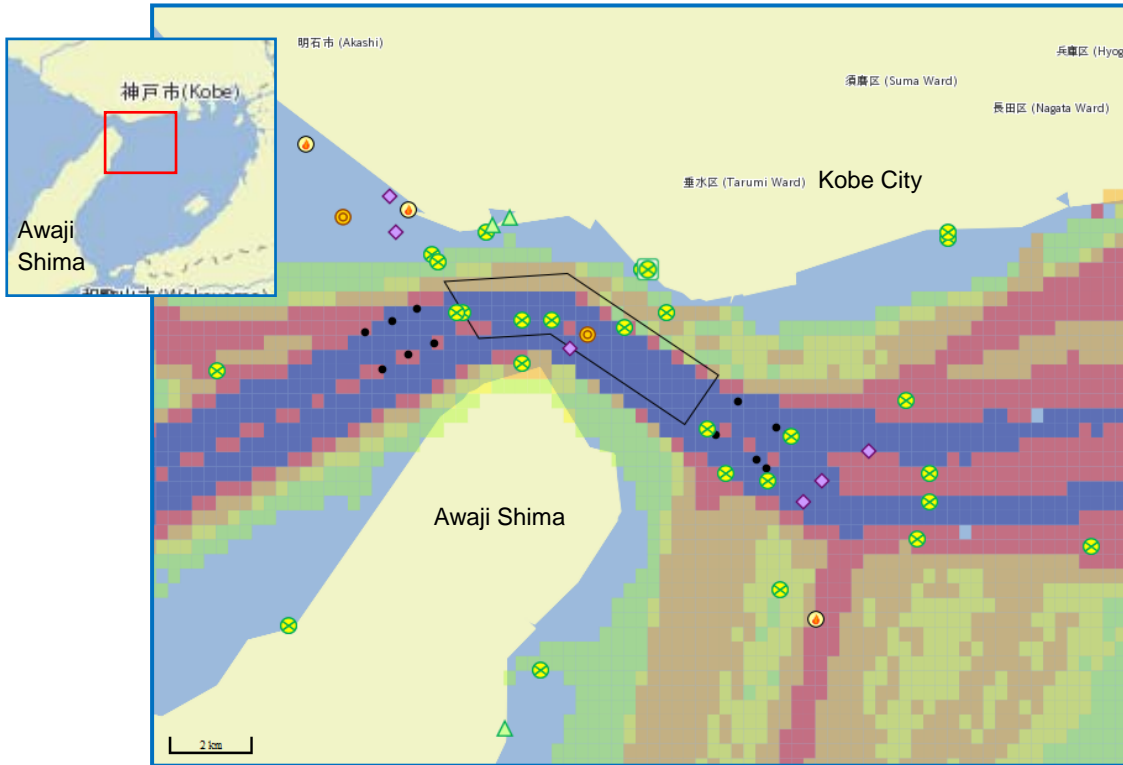


Figure 8: Traffic density and accident locations according to J-MARISIS (near the Akashi Kaikyo Traffic Route)

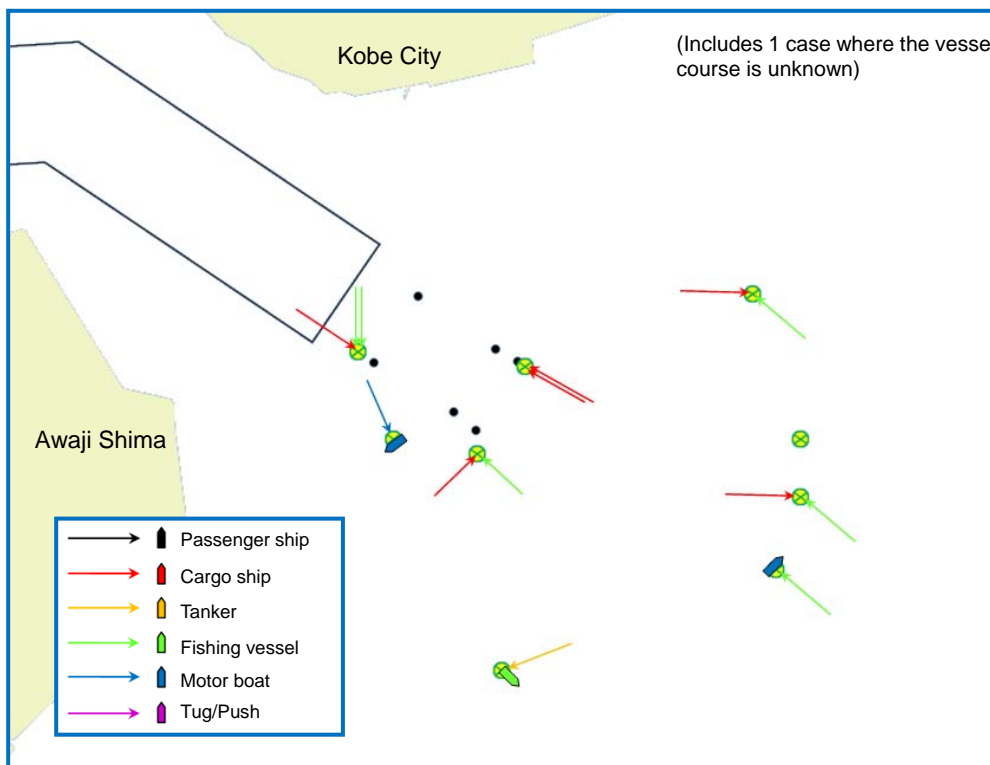


Figure 9: Vessel courses by vessel type (near the Akashi Kaikyo Traffic Route east entrance)

(3) Near the Bisan Seto East Traffic Route east entrance (10 cases)

There were many accidents involving small bottom-trawlers

- In J-MARISIS, the area along the recommended route extending from the Akashi Kaikyo Traffic Route shown in blue, and the area extending from the Naruto Strait shown in blue and red, both indicating high traffic density, converge near the eastern entrance to the Bisan Seto East Traffic Route with a width of approximately 2 km.
 - In this area, 12 of the 21 vessels were sailing toward the east-northeast and east.
 - Out of the 10 accidents, 8 accidents involved fishing vessels (9 vessels in total), 8 of which were small bottom-trawlers. All 9 vessels were underway, and the states of movement of those vessels were as follows: undergoing fish selection work (4 vessels), fishing (2 vessels), undergoing net washing work (1 vessel), moving between fishing grounds (1 vessel), and unknown due to the death of the skipper (1 vessel).
 - 2 people sustained fatalities or injuries, both of whom were skippers of fishing vessels (1 fatality and 1 slightly injured).
- Refer to Case 2 on page 12.

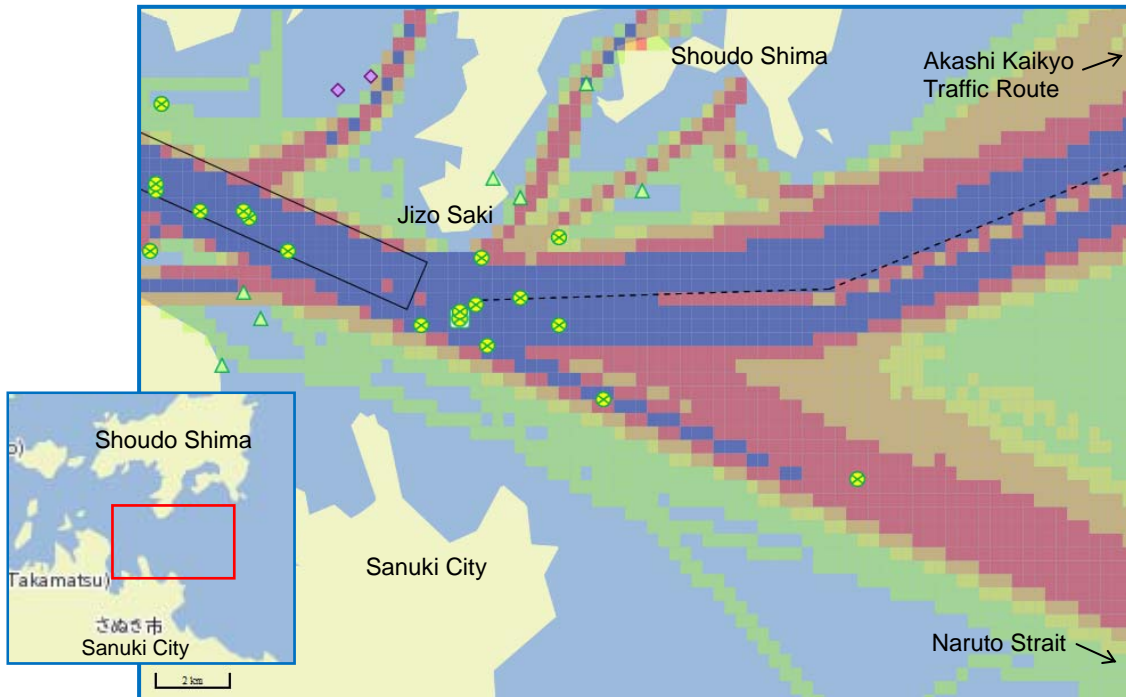


Figure 10: Traffic density and accident locations according to J-MARISIS (near the Bisan Seto East Traffic Route east entrance)

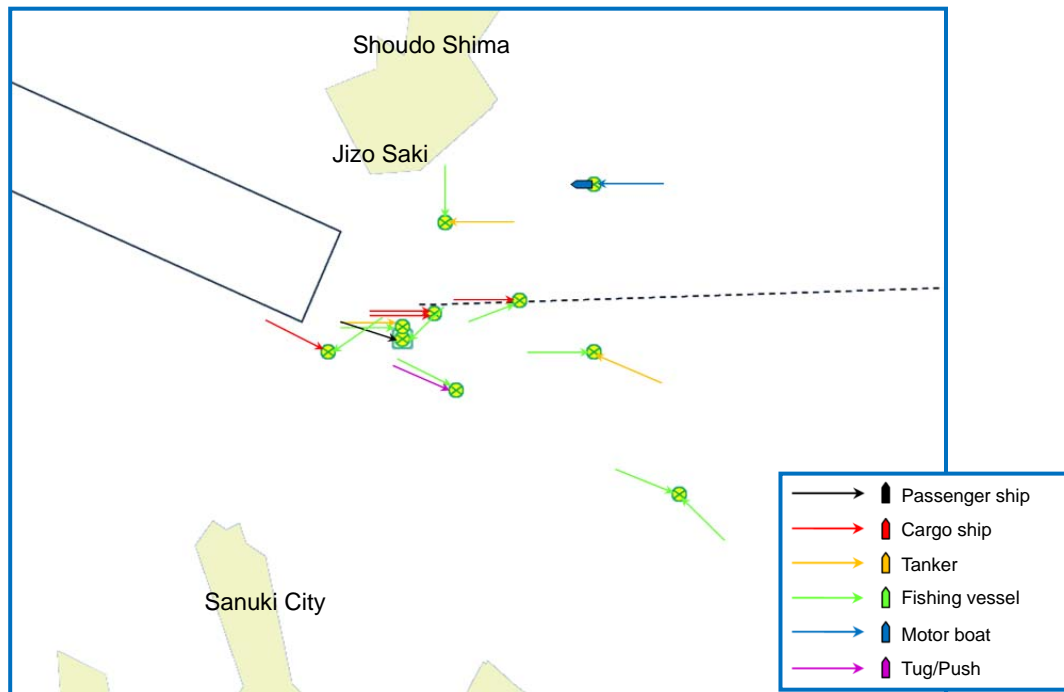


Figure 11: Vessel courses by vessel type (near the Bisan Seto East Traffic Route east entrance)

(4) Near the Kurushima Kaikyo Traffic Route west entrance (6 cases)

A 3-vessel collision accident occurred at night-time involving a tanker and cargo ships

- In J-MARISIS, the areas near the eastern and western entrances to the Kurushima Kaikyo Traffic Route are shown in blue and red, indicating high traffic density. At the west of the route, there are areas of blue extending in the southwest to northeast direction on the Shikoku side (off the Kajitorinohana) and in the west-southwest to east-northeast direction between Oosakishimo Shima and Itsuki Shima, converging near the western entrance with a width of approximately 2 km.
- Among accidents occurring near the eastern and western entrances to the route, a higher number occurred near the western entrance.
- Out of the 6 accidents, 5 occurred in the night-time. 1 of which was a collision accident involving 3 vessels (1 tanker and 2 cargo ships). ○ Refer to Case 3 on page 14.
- There were also accidents that occurred partially due to the Kurushima Kaikyo Traffic Route's unique rule: "Sail Naka Suido along with the tidal current, sail Nishi Suido against the tidal current". ○ Refer to Case 4 on page 17.
- 1 person sustained a fatality: the skipper of a fishing vessel.

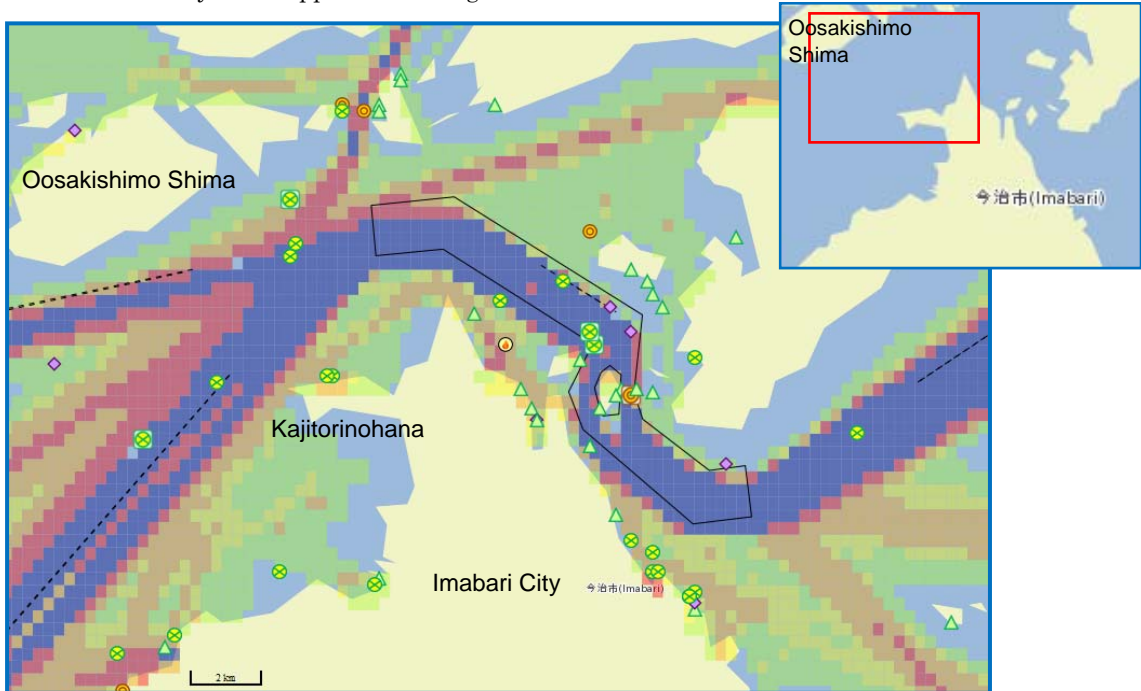


Figure 12: Traffic density and accident locations according to J-MARISIS (near the Kurushima Kaikyo Traffic Route)

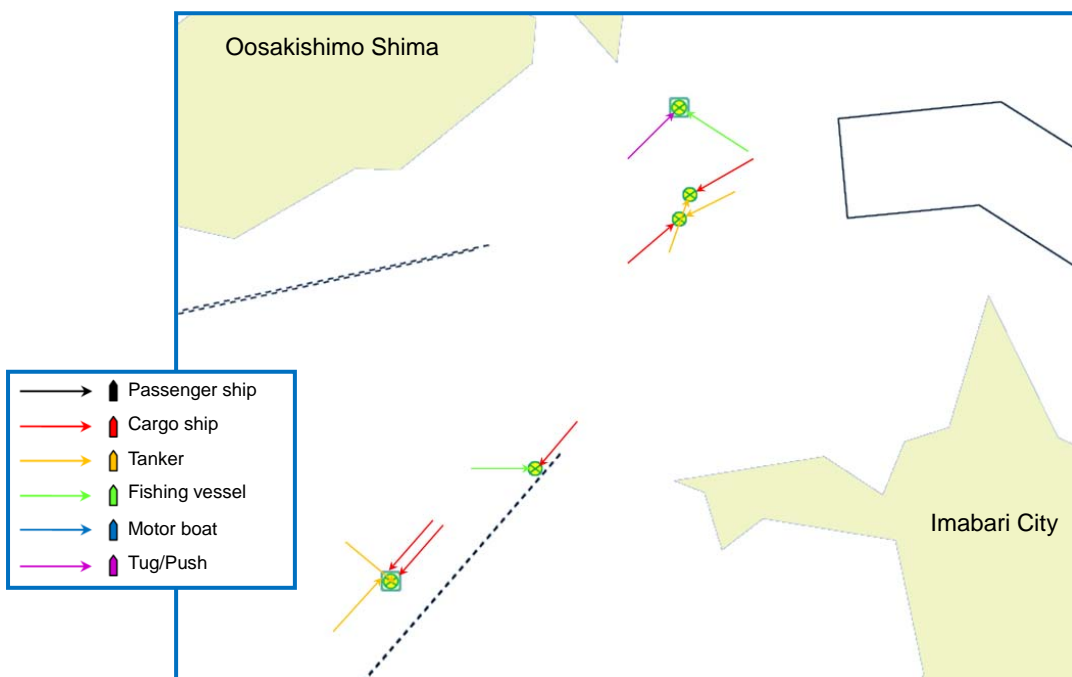


Figure 13: Vessel courses by vessel type (near the Kurushima Kaikyo Traffic Route west entrance)

(5) From near the Kanmon Passage east entrance to off the Ube City, Yamaguchi Pref. (12 cases)

Accidents occurred involving vessels that were at anchor

- In J-MARISIS, the area along the recommended route from near the eastern entrance to the Kanmon Passage to off the Ube City, Yamaguchi Pref. is shown in blue and red, indicating high traffic density.
- Out of the 12 accidents, 3 accidents (4 vessels) involved vessels that were at anchor (3 cargo ships (waiting for the tide to turn, waiting for entry into port, and unknown) and 1 fishing vessel (fishing using diving apparatus)). For 3 of the 4 vessels, the accidents occurred north of the recommended route (there were no accidents involving vessels at anchor in the other target areas).
- Out of the 12 accidents, 4 occurred between vessels sailing in the same direction, all of which were underway in the southeast direction.
- 1 person sustained injury: a deckhand of a fishing vessel (slightly injured).

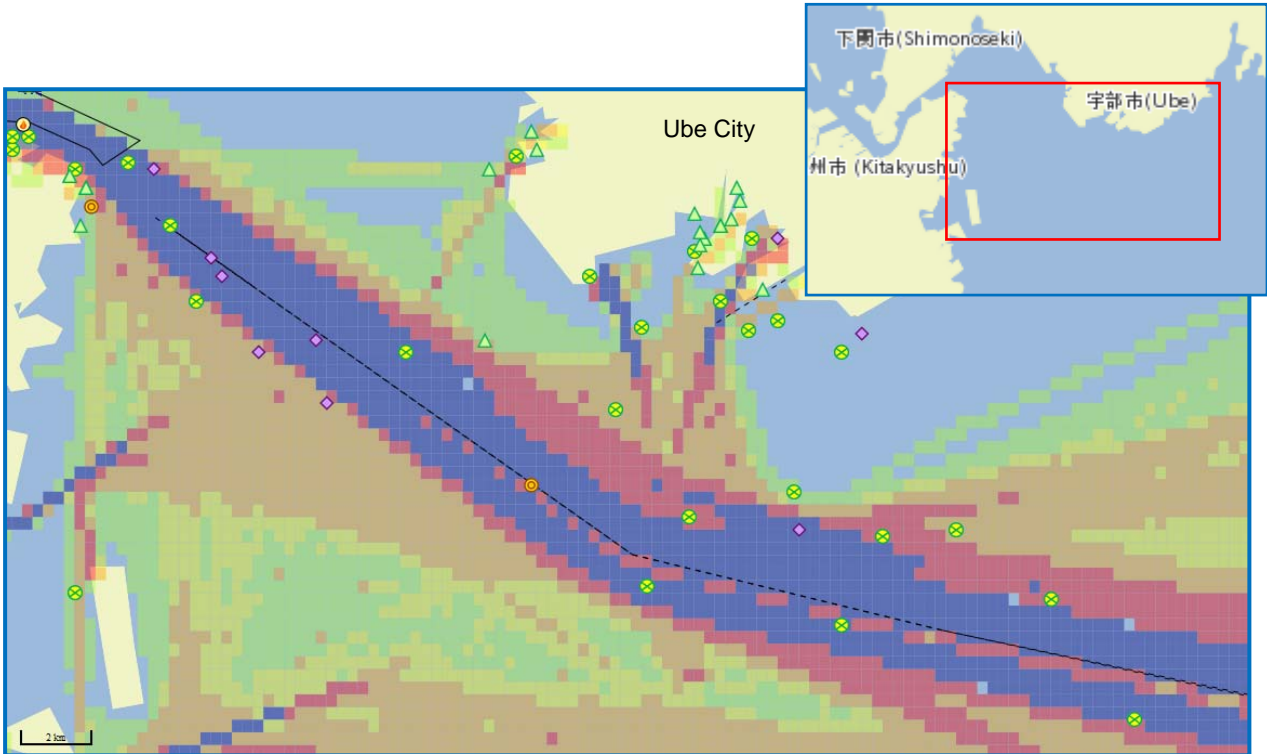


Figure 14: Traffic density and accident locations according to J-MARISIS (from near the Kanmon Passage east entrance to off the Ube City, Yamaguchi Pref.)

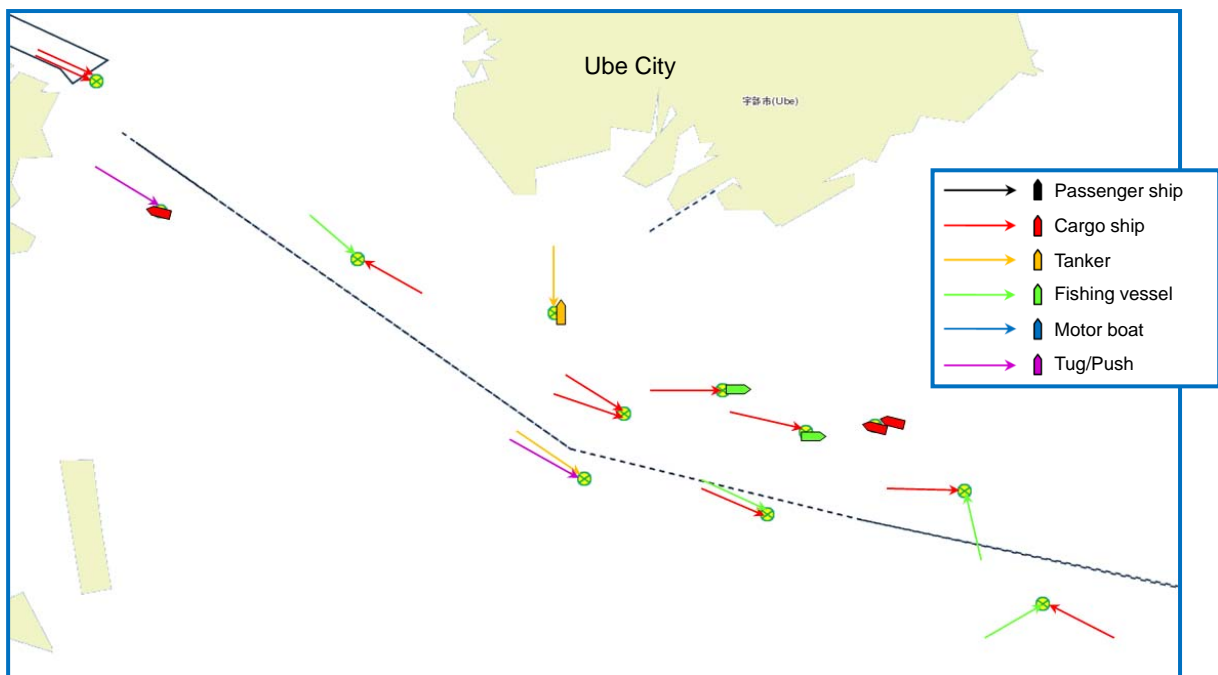


Figure 15: Vessel courses by vessel type (from near the Kanmon Passage east entrance to off the Ube City, Yamaguchi Pref.)

Human factors contribute to all the accidents

When the accident causes described in accident investigation are categorized into human factors, mechanical factors, environmental factors, and organizational factors, the number of accidents caused by human factors is 40 (80.0%), and the number by human/environmental factors is 8 (16.0%). All of them involved “human factors or a combination of multiple factors involving human factors” (See Figure 16).

Moreover, categorizing the vessels involved in the 50 human factor-related accidents into “failed in detection”, where necessary elements were not identified; “judgment errors” including wrong assumptions and presumptions; “inappropriate actions” including carelessness, omission of confirmation, and sloppy operational practices; “unsafe actions” (*6); and “falling asleep”, there were 40 vessels with “inappropriate actions” (44.0%), 33 vessels with “judgment errors” (36.3%), and 9 vessels with “unsafe actions” (9.9%) (See Figure 17) (excluding vessels for which the cause is unclear, and non-self-propelled vessels).

*6 Any deliberate action which might impede the safety of oneself or others without its intention. (This is the original definition of this digest.)

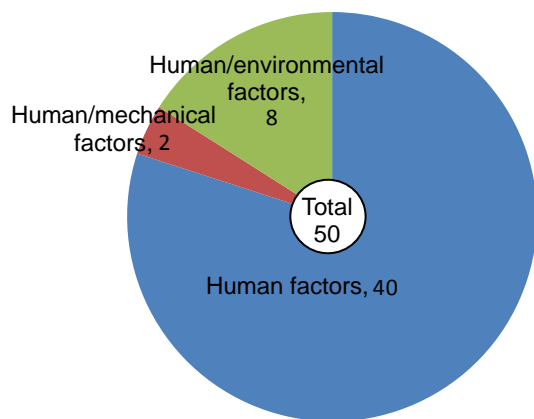


Figure 16: Breakdown of cause categories

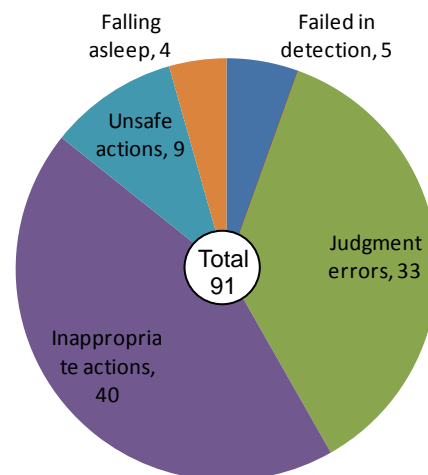


Figure 17: Number of vessels by human factor error types

“Judgment errors”, the most frequent cause following “Inappropriate actions”, are characterized by a fact that 32 of the 33 vessels made “wrong assumptions.” When these cases are categorized by the size of the vessels involved, i.e., vessels less than 20 tons and those 20 tons and larger, there were 7 vessels less than 20 tons where “after confirming the surroundings, we did not see any other vessels that would be obstacles to our passage, and therefore believed that there were no other vessels in the vicinity”; and 7 vessels 20 tons and larger where “after confirming the other vessel, we believed that we could pass-by safely.” The thought of “being able to pass-by safely” was only made by vessels 20 tons and larger (See Figure 18).

Examples of factors

Failed in detection

- Failed to notice the other vessel until collision occurred.

Judgment errors

- Assumed that the other vessel would take evasive actions, and continued to sail while maintaining course and speed.
- Assumed that there were no coastal vessels sailing amid a group of fishing vessels, and did not keep a proper lookout to starboard.

Inappropriate actions

- Turned to port under restricted-visibility conditions due to fog.
- Did not keep a lookout to compensate for blind spots caused by surfacing of the bow.

Unsafe action

- Did not confirm the proximity with the other vessel.

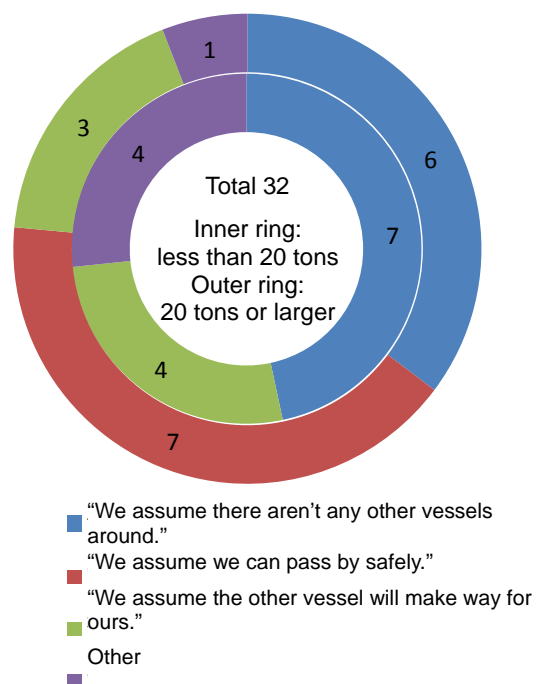


Figure 18: Content of “mistaken assumptions”