4. Case studies of the accident

The Shiretoko passenger ship sinking accident was partly due to departing under conditions where wind speeds were expected to reach 8 m/s or wave heights 1.0 m or more, exceeding operational safety standards. Additionally, the grounding accident involving the same vessel a year prior resulted from a failure to recognize the presence of shallow areas. These factors highlight a lack of awareness and measures regarding "the characteristics of the operational area," as detailed in Chapter 3 of this digest.

This chapter reviews grounding, flooding, and sinking accidents where the characteristics of the operational area contributed as causal factors, posing serious risks not only to vessels but also to passengers. By examining past accidents involving small passenger vessels, we aim to reflect on universal lessons learned from both direct and indirect causes, as well as underlying factors, to prevent disasters like the Shiretoko passenger ship sinking accident from recurring.

1. Case of grounding and sinking due to unawareness of reef locations in the operational areas

【Vessel specifications】
Passenger vessel A: 19 GT, registered length 11.95m × beam 4.36m × depth 1.83m
Max capacity: 77 people (including 74 passengers), launched: March 1987

【Accident information】
Type: grounding (followed by sinking)
Date & time: November 19, 2020, around 4:36 PM
Location: northwest off Hasajima, Sakaide City, Kagawa Prefecture
Planned route: Takamatsu Port → Seto Ohashi Circuit → Sakaide Port
Weather & sea conditions: cloudy with occasional sunshine, wind: south, 4–5 m/s, wave height: ~0.5m, visibility: good
Tidal current: eastward, ~1.7 knots
Draft: bow ~0.90m, stern ~1.38m

【Accident summary】
The vessel operated in an unfamiliar area without conducting a prior waterway survey or identifying the locations of reefs. During navigation, the master altered the original voyage plan and ran aground on a rock which covers and uncovers in shallow waters, leading to the vessel's sinking.

Accident Investigation Report Web Link：https://www.mlit.go.jp/jtsb/ship/rep-acci/2023/MA2023-1-3_2020tk0012.pdf

【Factual overview】

1. Passenger Vessel A was normally used as a water taxi offshore of Takamatsu Port. It was chartered for an elementary school field trip on November 19, 2020.

2. **The planned voyage** for the school trip was to depart from Takamatsu Port, head north along the western side of the Seto Ohashi Bridge via the waters south of Yoshima, pass eastward through the Shimotsuiseto Bridge north of Hitsuishi Island, then navigate south along the eastern side of the Seto Ohashi Bridge before arriving at Sakaide Port.

3. The vessel, with the master and one deck crew on board, departed Takamatsu Port at around 3:30 PM on November 19, carrying 60 passengers (52 students and 8 accompanying teachers and staff).

4. At around 4:35 PM on the same day, while navigating west of Wasa Island, north of Yoshima, a supervising teacher was explaining Iwakuro Island, visible off the starboard bow, to the students. Based on his/her own judgment, the master decided to **alter the original voyage plan** and pass under the Seto Ohashi Bridge (Iwakuro Island Bridge) to head east of Iwakuro Island.

5. The master was aware that the usual passage towards the east of Iwakuro Island was between the second and third bridge piers. However, having seen fishing boats pass between the third and fourth bridge piers two to three times in the past, he/she decided to take **a direct course** toward the east of Iwakuro Island by passing between the third and fourth piers.

6. To take a direct course east of Iwakuro Island, the master turned starboard and navigated northeast near the fourth bridge pier. However, Passenger Ship A was **pushed by an eastward current of approximately 1.7 knots** and, at around 4:36 PM, ran aground on the rock which covers and uncovers (commonly known as "Osowai"), which had a water surface height of approximately 2.0 meters.

7. After running aground on Osowai, Passenger Ship A took on **water through a hull breach** at the stern portside bottom, causing it to capsize. At around 5:20 PM, a nearby fishing boat began towing the vessel, but it sank at approximately 5:25 PM northeast of Koyoshima.

8. The passengers (four of whom were injured) and crew were wearing life jackets and waited for rescue either in the water or on the vessel. By around 5:20 PM, all were rescued by nearby fishing boats and a patrol vessel.

For reference, **the key events (4–6) in the accident area are marked by numbers** on the map below.

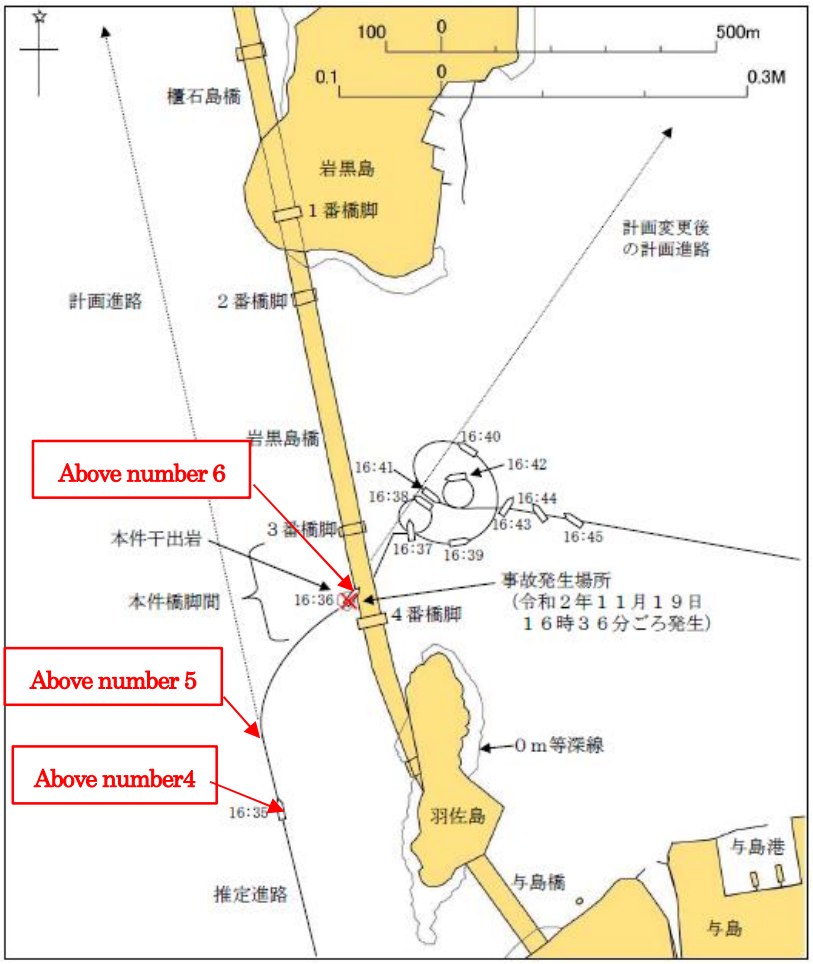

Figure 18- Around the accident area

Additionally, the tidal conditions at the time when passenger ship A ran aground are shown in the following chart.

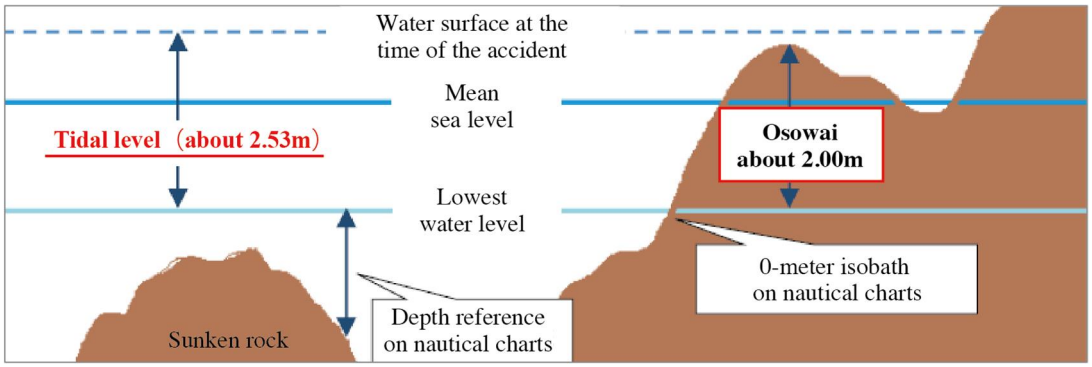

Figure 19-Tidal conditions at the time of the grounding

At the time of the accident, **the tide level was approximately 2.53 meters** above the lowest water level, which serves as the depth reference on nautical charts. Since Osowai protrudes about 2.00 meters above the lowest water level, it was submerged at this tide level. As a result, the depth from the water surface to the top of Osowai was about 0.5 meters.

Given that passenger ship A had a bow draft of approximately 0.90 meters and a stern draft of approximately 1.38 meters at the time of the accident, it is clear that the vessel could not safely pass over Osowai, which was about 0.5 meters below the water surface.

【Probable Cause of the accident】

The causes of the grounding can be classified as follows:

(Direct cause)

- The GPS plotter was not properly used, leading to a failure to notice the presence of Osowai.

(Indirect causes)

- The vessel was **carried toward the shallow area** with Osowai due to the eastward tidal current.
- **A direct course** was taken toward the east of Iwakuro Island, **passing between the third and fourth bridge piers.**
- **The original voyage plan was changed on the spot** without a thorough understanding of the reef locations in the operating area.
- No prior **hydrographic survey** of the operating area was conducted.
- No nautical chart with **clearing lines** was available on board.

(Background factors)

- The master **assumed he/she understood the reef locations** based on only a few past voyages **in the area**.
- The safety manager failed to provide regular in-house training in accordance with **the safety management regulations.**

【Safety Actions】

The accident investigation report outlines the following prevention measures:

- Before departure, conduct a hydrographic survey using nautical charts to identify the location of obstacles and plan a safe voyage plan.
- Be aware that electronic navigation charts (new pec) may not provide detailed information on obstacles like a rock which covers and uncovers or actual shorelines
- Avoid sudden route changes without prior hydrographic surveys
- Use GPS plotters with detailed display settings to verify vessel position accurately
- Keep onboard charts marked with clearing lines as per safety management regulations
- Safety managers must conduct regular safety training based on safety management regulations and relevant laws

【Lesson learned】

This accident occurred when a master, primarily operating a sea taxi near Takamatsu Port, chartered a vessel in an unfamiliar area **without conducting a prior hydrographic survey or setting clearing lines**. Relying on limited past experience, the master **abruptly changed the original voyage plan** and navigated closer to shallow waters to shorten the route, ultimately grounded due to pressure of tidal currents.

While the accident was mainly caused by the master's human error, the underlying factors included the safety manager's failure to provide **training on organizational safety management regulations** and the master's mistaken **assumptions** about his/her knowledge of the reef locations.

Additionally, since the master also served as the operations manager, there was no independent oversight or guidance on the appropriateness of his voyage plan or changes.

The master failed to implement practical procedures suited to the "characteristics of the operating area," and the overall safety management system was not properly enforced within the organization. In this sense, the accident shares fundamental similarities with the Shiretoko passenger ship sinking accident.

The accident occurred in an inland sea, where calm waters, a sea temperature of about 20°C, the presence of nearby fishing vessels, and the passengers remained calm during the evacuation. These factors contributed to a coordinated and swift rescue operation allowing all to be rescued before nightfall. However, if any of these conditions had been different, the consequences could have been much more severe.

↓

Let go of assumptions like "It should be fine" and always return to the basics, prioritizing safe navigation at all times!

2. Case of capsizing and sinking due to unique oceanographic conditions in the operating areas

【Vessel specifications】

Motorboat A: gross tonnage: less than 5 tons, registered length: 5.40m × width: 2.10m × depth: 1.00m, maximum capacity: 6 persons (including 5 passengers), launched: October 1995

【Accident information】

Type of accident: capsizing (presumed to have sunk)
Date and time: around 5:40 AM on June 26, 2011
Location: Offshore, south of Imagireguchi, Lake Hamana, Shizuoka Prefecture
Planned route: Marina in Lake Hamana → offshore Enshunada (around 3 km south of Lake Hamana, near an artificial reef) → Marina in Lake Hamana
Weather & sea conditions: cloudy, almost no wind, wave height approx. 3.0m
Tidal current: southward flow of approx. 1.0 knot from Imagireguchi into the open sea
Draft: bow draft approx. 0.3m, stern draft approx. 0.5m (freeboard approx. 0.6m)

【Accident summary】

Despite a wave warning for southern Hamamatsu (Enshu South) due to Typhoon No. 5 in the East China Sea, the boat departed. After observing 2m waves at Imagireguchi in Lake Hamana, it continued 3 km offshore to an artificial reef, where three fellow passengers fished. On the return trip, as waves increased, a 3m wave struck the stern south of Imagireguchi, causing the boat to capsize. One fellow passenger drowned.

Accident Investigation Report Web Link：https://www.mlit.go.jp/jtsb/ship/rep-acci/2013/MA2013-2-1_2012tk0044.pdf (Japanese only)

【Facts and circumstances】

To enhance clarity and understanding, the facts and circumstances of this accident are first presented by outlining the characteristics of the accident area. Then, they are organized using the "Variation Tree Analysis (VTA)" model.

Although this case does not involve a small passenger vessel, it is introduced as a reference due to its relevance—both in using a small boat for passenger transport and in the nature of the accident.

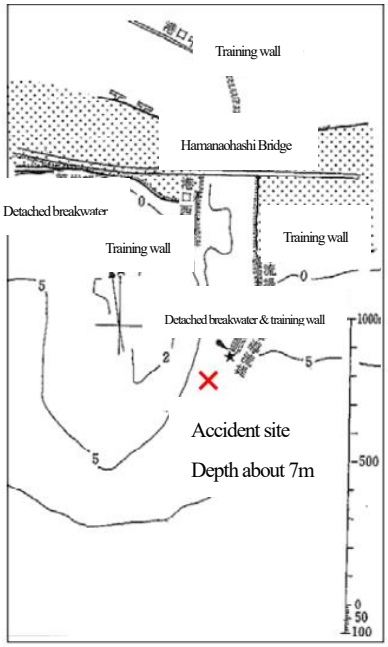

Figure 20-Overview of Imagireguchi

(Characteristics of the accident area)

Imagireguchi in Lake Hamana is a 200m-wide inlet connecting to the Enshu-nada Sea. As the offshore water depth gradually decreases from 10m to 2m near the inlet, incoming waves undergo a transformation. When these regular offshore waves reach the shallow waters, their wavelength shortens while their height increases, often resulting in steep **breaking waves (surf waves)** due to the abrupt change in wave shape.

According to testimony from local fisheries cooperative officials interviewed during the investigation, when **the outgoing tide flows** southward from Imagireguchi, it can **collide with large offshore swells, wind waves, or the Enshu-nada current, generating** extremely high waves—sometimes reaching up to 5 meters. Notably, on the day of the accident, no local fishing boats were operating.

(Chronology of events)

June 26

4:30 AM: Around 4:30 AM: **Departed** with three fellow passengers despite a wave advisory (Note 1)

Observed **about 2.0m wave heights** near Imagireguchi but continued toward the fishing spot

5:00: Around 5 AM: Reached an artificial reef about 3 km south of Imagireguchi, set the engine to neutral, and began fishing

5:20: Between 5:10 and 5:20 AM: Noted increasing wave heights, **decided to stop fishing and return to port**

Increased speed to 15 km/h near the southern tip of the offshore breakwater and proceeded north toward Imagireguchi

While navigating a section where the water depth gradually decreased from 9m to 5m, the boat encountered breaking waves from the **stern** (south side), moving at approximately 25–30 km/h with a height of about 3.0m

5:40: Around 5:40 AM, a high wave of about 3.0m struck from the port stern, washing into the boat

The vessel capsized (and likely sank soon after) approximately 120m southwest of the offshore breakwater lighthouse in a water depth of about 7m

8:25: The master and two of the three fellow passengers sustained injuries but were rescued; the remaining passenger drowned (Note 2)

master (judgement & actions) Vessel (motion & condition)

Note 1 : Wave Advisory issued by the Shizuoka Meteorological Observatory at 2:42 AM on June 26, 2011, for southern Hamamatsu (Enshu South). It warned of 3.0m wind waves and swells persisting into the early hours of June 27.

Note 2 : The fellow passengers who drowned was on the exposed deck at the time of capsizing and was not wearing a life jacket.

In VTA, bold-framed boxes represent **"variation factors"**, indicating deviations from normal **judgment, actions, or events** related to the accident. In this case, the identified variation factors include: 1)**Judgment:** Departing despite the issuance of a wave advisory, 2)**Action:** Continuing navigation after observing 2m waves near Imagireguchi, 3)**Action:** Navigating while being hit by breaking waves (3.0m) from the stern at 25–30 km/h, 4)**Event:** A high wave striking from the port stern, leading to water ingress.

Additionally, a **"○ (red circle)"** next to a box represents an **"exclusion node,"** emphasizing that the accident would not have occurred if the factor had been eliminated. Since exclusion nodes are equivalent to direct causes or underlying factors, they typically overlap with variation factor boxes.

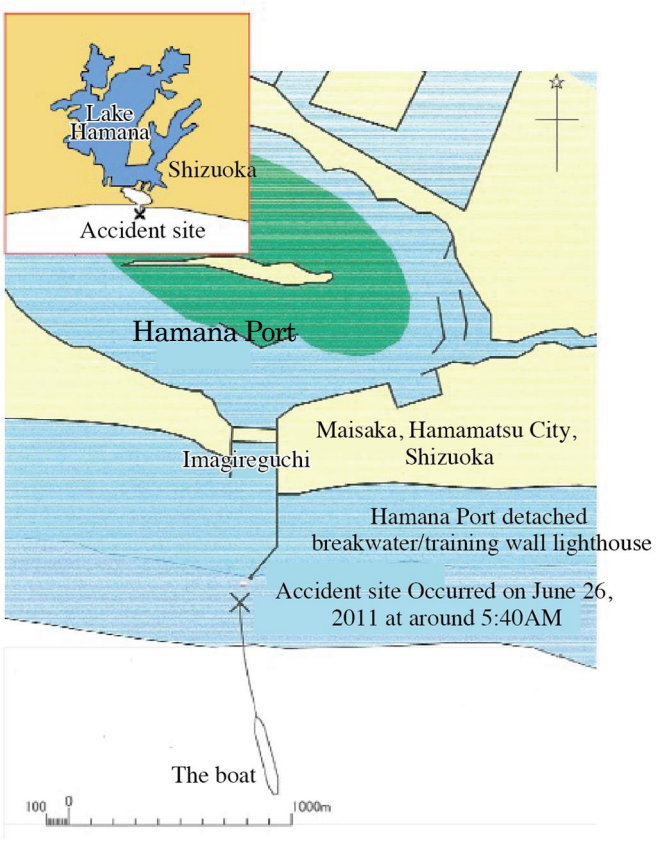

Figure 21 - Estimated navigation route

When classifying the direct causes, indirect causes, and background factors of the capsizing, the following categories apply:

(Direct cause)

- The vessel was **struck by a high wave** from the port stern

(Indirect cause)

- While returning to port after observing an increase in wave height at the fishing site, the vessel navigated north toward Imagireguchi, **receiving breaking waves** with a speed of approximately 25–30 km/h and a height of about 3.0m **in the direction of the stern.**

(Background factors)

- The vessel departed despite the issuance of **a wave warning** predicting continuous swells and wave heights of approximately 3.0m.
- Although **weather conditions** around Lake Hamana were **calm**, swells propagating from the open sea broke near Imagireguchi, where they collided with the ebb tide, **creating high waves**.

【Safety Actions】

The accident investigation report includes a request to the Hamana Lake Comprehensive Environmental Foundation, which is responsible for ensuring navigation safety in Lake Hamana, to inform small vessel operators, including motorboats, of the following key points.

1. Check tidal currents and weather conditions and if high waves are expected south of Imagireguchi, the small vessels should avoid departing from Lake Hamana due to the risk of capsizing.

【Lesson Learned】

This accident occurred despite calm weather conditions near Lake Hamana. However, swells propagated due to the influence of Typhoon No. 5 moving northward in the East China Sea had become breaking waves offshore from Imagireguchi. These breaking waves combined with the ebb tide, resulting in high waves that struck the port stern, ultimately causing the vessel to capsize.

Additionally, once the wave speed exceeded the vessel speed, the risk of broaching increased significantly.

Furthermore, the lack of appropriate navigation decisions based on the characteristics of the navigation area suggests similarities between this accident and the Shiretoko passenger ship sinking accident.

Therefore, operators of small vessels, including small passenger ships, must take the following measures to prevent similar accidents.

1. Operators navigating offshore areas must consider the possibility of waves propagating from distant typhoons or intense low-pressure systems, even in calm weather. They should obtain and analyze meteorological and oceanographic information before departure and prioritize safety by considering trip cancellations when warnings or advisories are issued by the Japan Meteorological Agency.

2. If worsening sea conditions are forecasted, avoid making hasty departure decisions without a clear course change. Depart only after confirming that sea conditions have improved.

3. Operators using harbors with insufficient wave protection must be familiar with areas prone to high waves due to breaking waves, tidal currents, and river outflows. Additionally, they should actively share knowledge with industry peers, local fishing cooperatives, and marinas.

4. Fully understand the structural characteristics and maneuvering performance of your small vessel, establish appropriate operating standards based on the vessel and navigation area, and always prioritize safety. Even if your operations are not subject to the Maritime Transport Act, strive to establish your own safety standards accordingly.

5. Prepare for unexpected rough weather by acquiring knowledge and skills in heavy-weather navigation, such as avoiding "heaving to" and broaching. To achieve this, first develop the ability to read wave directions effectively.

"There is no moment to spare at sea": Once you're on the water, there's no easy turning back. Always stay vigilant of the sea and your vessel's condition, avoid unnecessary risks, and ensure safe navigation!