Advances in Social Sciences Research Journal – Vol. 12, No. 07
Publication Date: July 23, 2025
DOI:10.14738/assrj.1207.19140.
Kunieda, Y., Nunome, A., Kanayama, E., & Chotechaung, N. (2025). Disaster Relief by Ship Challenges and Responses Obtained from Disaster Relief Experience. *Advances in Social Sciences Research Journal*, 12(07). 284-297.

Disaster Relief by Ship Challenges and Responses Obtained from Disaster Relief Experience

Yoshiaki Kunieda
National Institute of Technology,
Toyama College, Toyama, Japan

Akihiro Nunome
National Institute of Technology,
Toyama College, Toyama, Japan

Emi Kanayama
National Institute of Technology,
Toyama College, Toyama, Japan

Naruphun Chotechaung
Faculty of International Maritime Studies,
Kasetsart University, Chon Buri, Thailand

ABSTRACT

This study focused on the disaster relief activities carried out by the training ship *Wakashio Maru* in the wake of the 2024 Noto Peninsula Earthquake and it examined the characteristics and effectiveness of the ships, as well as the challenges related to disaster relief. Ships can perform a variety of roles in response to disasters, such as by transporting large quantities of supplies and personnel from the sea to areas where ground transportation is difficult or impossible, providing evacuation shelters and medical support and serving as communication hubs. In particular, the self-sufficient lifeline functions of large ferries and training ships, as well as the mental health care that they can provide to disaster victims, are strengths that other modes of transportation do not have. However, there are also challenges that are specific to ships, such as berthing restrictions, weather and sea conditions and limitations of their cargo-handling equipment. We note that to provide effective disaster relief, it is essential to conduct training and prepare equipment in advance and to establish information sharing systems with local governments and related organisations.

Keywords: Training ship *Wakashio Maru*, Disaster relief, Ship characteristics, Information communication system.

INTRODUCTION

Since the Great East Japan Earthquake of 11 March 2011, with its epicentre off the coast of Sanriku, there have been 36 earthquakes with a maximum seismic intensity of 6-lower or above on the Japanese scale [1]. In addition, four earthquakes had a maximum seismic intensity of 7 [2].

At 4:10 p.m. on 1 January 2024, an earthquake with a maximum seismic intensity of seven occurred with an epicentre at a very shallow point, approximately 30 km north-northeast of Wajima, at the tip of the Noto Peninsula in Ishikawa Prefecture. At 4:22 p.m., a major tsunami warning was issued for the Noto region and a tsunami warning was issued for a wide area along the coast of the Sea of Japan. The earthquake led to a series of disasters, including tsunami damage, landslides, liquefaction, the collapse of houses and the disruption of transportation networks, causing extensive damage throughout the Hokuriku region. In this peninsula region, where transportation networks were disrupted, relief supplies were transported to Nanao City by the training ship *Wakashio Maru* of Toyoma College of the National Institute of Technology (Toyama KOSEN) and delivered to evacuation centres [3].

This paper reviews the disaster relief efforts performed by ships in the context of the 2024 Noto Peninsula Earthquake, examines ways to enhance the effectiveness of such efforts and explores the potential of ship-based disaster relief based on the experiences of the 1995 Great Hanshin Earthquake and the Great East Japan Earthquake.

Disaster Relief Efforts by the Wakashio Maru on the Noto Peninsula Earthquake

The Noto Peninsula earthquake registered a seismic intensity of 5+ in Toyama Prefecture, and it caused considerable damage. Although Toyama Prefecture is relatively close to the disaster area, there was fortunately no significant damage to the campus of Toyama KOSEN, the *Wakashio Maru* or the wharf. Most municipalities in the quake-affected areas were not accepting relief supplies from individuals or recruiting volunteers. On 10 January, a Wednesday, we received a call from the Ishikawa Prefecture Regional Medical Promotion Office asking if we could cooperate in transporting medical professionals from Suzu to Nanao Bay using Toyama KOSEN's own vessel, based on a proposal from the disaster medical assistance team (DMAT). After we responded that we could immediately accept the project, we contacted the Ishikawa Prefectural government to discuss details; they replied that there would be no request for transportation by the *Wakashio Maru* on the 10th. We sent information regarding the *Wakashio Maru*'s support capability and waited for a request, but there was no response, so we contacted the Ishikawa Prefectural Office for confirmation. The office seemed to be in some degree of confusion and the support of the *Wakashio Maru* was cancelled.

Consideration and Preparation for Disaster Relief by the *Wakashio Maru*

Toyama KOSEN, located in the vicinity of the disaster-stricken area, did not merely wait for requests for assistance but proactively initiated disaster relief efforts in response to the needs of the affected areas. Under the leadership of the president as the overall project coordinator, discussions of disaster support were performed. Because it was judged appropriate to transport relief supplies and because, for large quantities of items, marine transportation was easier than land transportation, Toyama KOSEN prepared to provide support as Toyama KOSEN to transport relief supplies using *Wakashio Maru*.

After confirming with Ishikawa Prefecture, Wajima City, Suzu City and Nanao City about their receiving arrangements, support requests and port conditions, we were informed that the seabed was rising at Wajima Port and Iida Port in Suzu City, so we decided to transport relief supplies to Nanao Port to avoid the risk of a secondary disaster.

Nanao City requested three types of relief supplies: (1) drinking water (in 2-litre PET bottles), (2) food and (3) blue sheets. Of these, we decided to transport drinking water, which was relatively easy to obtain and we proceeded to make arrangements with the goal of transporting 300 cases of drinking water of six 2-litre PET bottles. The purchase of drinking water was funded by donations from Toyama KOSEN faculty and staff. Later, Japan System Care Corporation, a joint research partner, offered to transport 100 cases of drinking water with volunteers for the day of transportation, resulting in the transportation of 400 cases of drinking water.

Securing a Berth

The port facilities at the time of the earthquake were managed centrally by the Ministry of Land, Infrastructure, Transport and Tourism (MLIT) and information on vessel arrivals and departures, as well as applications to use berths, were made through the MLIT's website. In the application procedure. a provisional application is submitted for berth use; after receiving a provisional permit for port entry, berth adjustments are made and then use of the berth is permitted. It took a considerable amount of time to determine the berthing location, requiring a phone call to the MLIT and coordination with the Ministry of Defense, Japan Coast Guard and other agencies.

At the Port of Nanao, there were only a limited number of berths where the *Wakashio Maru* could berth, due to the damage to the berths and the berthing of other support vessels and considerable time was required to determine which berth to use. Due to the damage, the only berths available for the *Wakashio Maru* were the west side of Pier 1 in the Yata-shin area, the east side of Pier 2 in the Yata-shin area and Pier 3 in the Ota area. A former Shin Nihonkai Ferry vessel had been chartered by the Ministry of Defense and was moored at Pier 3 in the Ota area as a rest facility for disaster victims. A Japan Coast Guard patrol boat was moored at the east of Pier No. 2 in the Yata-shin area to support the water supply. On the west side of Pier No. 1 in the Yata-shin area, the *Natchan World* chartered by the Ministry of Defense was moored at the inner part of the pier as a disaster management base. After the patrol boat at the east side of Pier No. 2 in the Yata-shin area had its water delivered, we asked if we could berth the *Wakashio Maru* until the next patrol boat arrived, but the request was not granted. Although the space on the aft side of *Natchan World* on the west side of Pier 1 in the Yata-shin area was not long enough for *Wakashio Maru* to berth, we requested to be able to berth at this location in default of any other place. The decision was not an easy one to make, as it was reported that the part of the pier to be used had been damaged, but in the end, it was decided that the *Wakashio Maru* would be moored with its bow protruding 10 metres from the edge of the pier. There was no local means of delivering relief supplies to the victims from the pier, so the city of Nanao requested that they be taken to a tent warehouse near the base of the No. 2 pier in the Yata-shin area. Therefore, it was decided to assign personnel to unload water from the ship to the pier and personnel to transport from the pier to the tent warehouse and unload from the vehicle.

Loading Relief Supplies Onto the Training Ship Wakashio Maru

Due to the confusion after the earthquake, 400 cases of 6-packs of 2-litre PET bottles as relief supplies were expected to be available by Wednesday, January 24 and they were temporarily stored at the seaside training centre. After the availability of the relief supplies was confirmed, the transportation of the supplies was set for Saturday, January 27, with a backup date set for the following day, Sunday, January 28. An application was submitted to the MLIT on Thursday,

January 18 for berthing at the west side of Pier 1 in the Yada-shin Area of the Port of Nanao. A provisional permit for berthing and mooring was issued on Saturday, January 20. The drinking water was loaded from the seaside training centre onto the *Wakashio Maru* in the afternoon of Friday, January 26, in the classrooms and corridors of the *Wakashio Maru* with the help of student volunteers (Fig. 1). On the same day, the transportation plan was submitted to the Ministry of Land, Infrastructure, Transport and Tourism and was shared with Nanao City and the Japan Coast Guard.

Fig. 1: Loading supplies [3]

Transport of Relief Supplies by the Wakashio Maru

The *Wakashio Maru*, loaded with relief supplies, departed the port at 6:00 a.m. on Saturday, 27 January (see Figure 2) and headed for the Port of Nanao. In addition to the crew of the *Wakashio Maru*, there were a total of 14 people on board, including 13 faculty and staff, who would be responsible for unloading relief supplies and one person from Japan System Care Corporation, a joint research partner.

Fig. 2: The Wakashio Maru sets sail before sunrise [3]

At the same time, two minivans and a light truck headed overland to the Port of Nanao to transport the relief supplies to be unloaded from *Wakashio Maru* to the tent warehouse designated by the city of Nanao. After meeting with Nanao City officials at the tent warehouse, the faculty and staff in these vehicles were requested to transport the supplies directly to evacuation centres approximately 2 km from the port instead.

Wakashio Maru arrived at the west side of Pier 1 in the Yata-shin area of the Port of Nanao at around 10:00 a.m., as scheduled, with its bow a few meters out from the edge of the pier, as shown in Figure 3. Immediately after arriving at the pier, relief supplies of drinking water were

unloaded onto the pier using a bucket relay system. After 30 minutes of unloading, the *Wakashio Maru* departed from the port. The relief supplies were then loaded onto two minivans and a light truck that had arrived overland and transported to the designated evacuation centres. Each vehicle made approximately four round trips between the pier and the evacuation centre and in addition, a vehicle from the city of Nanao came to assist, delivering all 400 cases of drinking water.

Fig 3: Unloading relief supplies [3]

DISASTER RELIEF BY SHIP

In the event of a large-scale disaster, land, sea and air transportation must work together to establish an effective support system. In particular, when roads are cut off due to earthquakes or heavy rain, it may become difficult to transport people and supplies. Under such situations, transportation and support by vessels play an extremely important role. Following the examples of the Noto Peninsula Earthquake, the Great Hanshin-Awaji Earthquake and the Great East Japan Earthquake, the ways that disaster support by ship can be effective are examined and discussed below.

Search and Rescue for Missing Persons

Vessels have played a major role in the search and rescue of people who have been swept out to sea by tsunamis and mudslides. Search and rescue at sea is a race against time and requires rapid response. While some may be able to survive temporarily by holding onto a floating object, such objects may interfere with search and rescue operations and vessel navigation. Care should be taken to avoid allowing damage to the propeller that would make navigation impossible. While searches by small vessels are advantageous in narrow areas, such as along the coast, extensive offshore searches require the assistance of larger vessels. Rescue following

discovery will require the coordination of small boats and helicopters and it is assumed that the on-board boats and other support tools of large vessels will be utilised.

Medical Support

Vessels above a certain size are generally equipped with medical facilities and training ships and passenger ships often have medical personnel on board who can provide first aid and medical treatment in the event of a disaster. Vessels having a gross tonnage of 3,000 tons and operating in an ocean-going area or a major coastal area are required to appoint a health officer and to carry a certain amount of medical supplies.

In addition, medical teams, such as DMATs and rescue teams, can be brought on board to provide medical care and treatment and to perform health checks, medical consultations and counselling. Vessels can also be used to transport medical personnel and injured or sick people.

Fire Fighting

Firefighting conducted at sea by firefighting vessels are effective for fires in coastal facilities caused by earthquakes. In addition, firefighting from commercial vessels using firefighting equipment may be effective in fires near the coast, where firefighting by vessels is feasible.

As a result of the Great East Japan Earthquake, a fire broke out in an LPG tank at an oil refinery in Ichihara City, Chiba Prefecture and a firefighting vessel and a patrol boat with enhanced firefighting capabilities fought the fire. While it was difficult to fight the fire from land, it was effective to fight the fire from the sea side by firefighting boats with self-supporting spraying capabilities [4].

Transport of Relief Supplies

Relief supplies, such as water, foodstuffs, daily commodities and fuel, can be transported in large quantities by ship. However, the type and quantity of relief supplies that can be transported differ in relation to the type of vessel. For example, in transporting water, the capacity of the given vessel's freshwater tank and whether this tank holds drinking water or water for other uses may differ. Various modes of transportation are possible, such as loading water directly into tanks on board, carrying it as commercially available bottled drinking water or filling polyethylene tanks.

For example, during the Noto Peninsula earthquake, a Japan Coast Guard patrol boat supplied water loaded in tanks to local water trucks [5]. The water was likely suitable for drinking but was intended for daily use, such as washing and bathing. *Wakashio Maru* transported commercially available bottled drinking water at the request of Nanao City. It is important to provide the relief supplies required in the affected areas in the form needed, insofar as this is possible.

Transportation of People

Transportation of people can include a variety of cases, such as the evacuation of victims from a disaster area to a safe location, the transportation of the injured and unwell to medical facilities, the transportation of volunteers and restoration workers to the disaster area and even the dispatch of medical personnel to perform medical support. When a large number of victims are to be transported at one time, it is necessary to properly manage boarding capacity.

URL: http://dx.doi.org/10.14738/assrj.1207.19140

In addition to the application of necessary equipment, such as life jackets, it is necessary to obtain a temporary navigation permit to ensure safety. In such cases, the Maritime Bureau of the MLIT or the competent regional transport bureaus must be coordinated with and a careful and prompt response is required, placing the highest priority on human life.

Use as a Shelter and Other Facilities

Ships are equipped with various facilities to make all aspects of life at sea possible. This makes it possible to use berthing ships as temporary evacuation centres. Passenger ships, such as ferries, are the most suitable evacuation centres, but cargo ships and training ships can also provide a certain level of support, although the number of people that they can accept is limited. In addition, ships can be used to accommodate restoration workers and others working in the disaster area. In particular, it is important to be able to provide baths and showers to disaster victims who may not have other access to bathing facilities.

At the time of the Great East Japan Earthquake, the training ship *Kaiwo Maru* of the National Institute for Sea Training was dispatched to Onahama Port to provide bathing and hot meals to the citizens and onboard meals, bathing and lodging for nuclear power plant personnel who were responding to the disaster [6]. In the most recent Noto Peninsula earthquake, the Ministry of Defense chartered the 17,000 gross-ton ferry *Hakuou* and dispatched it to Nanao Port in relation to the PFI (Private-Finance-Initiative) method. In this case, hot baths and meals were provided to disaster victims [7].

Provision of Food and Other Support to Evacuation Centres

Vessel crew can provide food for victims who are unable to come to the vessel at its berth and continue to live in evacuation centres. While the provision of hot food prepared on board is a great support for disaster victims, it is necessary to secure transportation to get the food to the evacuation centres.

At the time of the Great Hanshin Earthquake, the training ships *Ginga Maru*, *Hokuto Maru* and *Kaiwo Maru* of the Independent Administrative Institution National Institute for Sea Training provided meals for evacuees at the Kobe Merchant Marine University and the Maritime Technical College, which served as evacuation centres [8]. In addition, at the time of the Great East Japan Earthquake, the crew of the *Kaiwo Maru*, which was dispatched to the port of Onahama, visited several evacuation centres within a 10-kilometre radius to ascertain the specific needs of the victims and its crew provided meals at five evacuation centres [6]. Furthermore, during the Great Hanshin Earthquake, cadets and crew members worked with local government officials to assist in sorting and loading/unloading relief supplies at evacuation centres and other locations [8].

Activity Base

Ships normally communicate with land via radio communication and they are equipped with radio communication functions, such as maritime satellite communication and VHF radio telephones, among other means. Using these means of communication, various types of information can be collected and shared and ships can function as a base of operations in the event of a disaster. In fact, at the time of the Noto Peninsula earthquake, the Ministry of Defense dispatched a large catamaran-type ferry, *Natchan World*, to the Port of Nanao, using a PFI

method. This vessel was used as a disaster response base to collect and share information from national and local government officials dispatched to disaster-stricken cities and towns [9].

On-board Mobile Base Station

With the use of mobile phone base station functions on board ship and using antennas to transmit radio waves from the sea to land, technology can be utilised to for communications in coastal areas. For example, installing radio equipment and antennas similar to those of a mobile base station vehicle on a submarine = cable-laying vessel or training ship, it can be operated as a shipboard mobile base station.

CHALLENGES IN DISASTER RELIEF BY SHIP

In the event of a large-scale disaster, whether they command transport by land, sea or air, all responsible bodies must work together to provide effective assistance. This section examines the challenges of disaster relief by ship.

Issues Related to Berthing

It is necessary to berth at the nearest port to appropriately transport people and relief supplies and to deliver them to a disaster area. Normally, it is necessary to have a berth length of about 1.5 times the length of the support ship, but when a port is damaged, there may be limited or no suitable berths available for berthing. In addition, other support vessels dispatched by the Ministry of Defense, Japan Coast Guard and similar bodies will have priority to berth; in addition, other support vessels may seek a berth, so coordination will be necessary.

The Noto Peninsula earthquake caused the seabed to rise in some places and the reduced water depth could have resulted in the risk of grounding and damage to the bottom of a ship attempting to berth in some harbours [10]. The depth of the water may also fall when landslides caused by heavy rainfall extend to the sea. Due to the Great East Japan Earthquake, many objects were washed out to sea by the tsunami and became obstacles on the ocean bed. The Japan Coast Guard cleared the route and vessels were able to safely enter port within about a week. In addition, in some cases, houses and various other objects are washed out to sea by a tsunami and drift, obstructing safe navigation. In the event of other disasters, accurate information on navigational safety must be obtained from the Japan Coast Guard and other reliable organisations and assistance must be provided safely, without causing a secondary disaster. In the case of an earthquake disaster, the strength of the mooring bits may be greatly reduced in addition to damage caused to the pier. If it is not possible to berth at a pier, anchoring offshore should be considered, transporting people and relief supplies ashore in small boats. Although this is less efficient than berthing, it is effective when ground transport is cut off. Then, the small boats are not limited to berths, but can also be attached to breakwaters and, depending on the situation, can be launched on sandy beaches. During the response to the Great Hanshin Earthquake, a training ship of the National Institute for Sea Training anchored offshore, dispatching disaster relief personnel by onboard boats, carrying food prepared on board ship. However, small boats are susceptible to adverse weather conditions, so safe lowering and lifting of the boat requires the skill of the crew and regular training is essential.

Crew Safety and Labour Management

Ships engaged in disaster relief activities often experience long working hours and irregular work patterns, which could lead to increased safety risks due to reduced crew concentrations

URL: http://dx.doi.org/10.14738/assrj.1207.19140

and accumulated fatigue. Increased contact with evacuees and support personnel also increases the risk of infectious diseases. To reduce these risks, captains and health managers need to ensure proper labour management, including control of working hours, establishing rest periods and adjusting work rotations. In addition, the onshore management division is required to constantly monitor the status of the work and the physical condition of the crew and establish a system to continuously back up the onboard support system through securing support personnel, dispatching replacement personnel and providing material support as needed. To manage hygiene, it is important to ensure thorough infection control measures, such as hand hygiene, gargling and oral care, wearing masks, ensuring ventilation and dealing with those with fever, led by a hygiene manager. In addition, maintenance of the ship's environment (the cleaning and disinfection of common areas), ensuring a good sleeping environment and dealing with mental stress (including providing a counselling system) are also important aspects of health and safety management. Furthermore, in the special work environment of disaster relief, it is essential to provide mental health care in regular health checks and communication, as crew members may overexert themselves due to their sense of mission and tension.

The use of labour management guidelines and sanitation management items in checklist form is considered effective. An example of each is shown in Tables 1 and 2.

Table 1: Example of labour-management guideline checklist (for disaster relief ships)

Item	Check contents	Implementation checklist (✓)	Remarks/responses
1	Prepare and adhere to work shift schedule	□	Clarification of working hours and rest periods
2	Adjustment of daily working hours to not exceed 12 hours	□	Record the reason for any excess
3	Rest and nap time every 6 hours	□	Promoting the use of nap rooms
4	Ensure intervals between work (at least 8 hours)	□	Confirmation of impact on next workday
5	Confirmation of fatigue levels and operation of the reporting system	□	Self-reporting system or supervisor observation
6	Monitoring the status of alternate staff arrangements	□	Working with onshore supporters
7	Daily health observation and communication by captains, chiefs and others	□	Working with onshore supporters
8	Management and retention of work and rest records	□	Management by logbook or special form
9	Clarification of labour management responsibilities and organise the system of instructions	□	Establishment of a system of instruction diagram
10	Establishment of a system for receiving labour-related problems and complaints	□	Posting of emergency contact information and other relevant information

Table 2: Example hygiene control checklist (for disaster relief ships)

Item	Check contents	Implementation checklist (✓)	Remarks/responses
1	Hand sanitisers and soaps are always available and are replenished	□	Alcohol concentration 70% or more
2	Wash hands and gargle regularly (in the morning, before meals, on the way back to the ship and at other points)	□	Notices posted for public awareness
3	Distribution of oral care tools (toothbrushes, mouthwash and so on) and confirmation of use	□	Recommended for use after every meal
4	Regular cleaning and disinfection of shared facilities (toilets, door knobs, handrails and other surfaces)	□	Recommended twice or more per day
5	Securing isolation space when infectious diseases occur	□	Preparation of a manual for responding to fever
6	Daily temperature and health records of crew members and passengers	□	Managed in a health record book
7	Confirmation of stockpiles of personal protective equipment such as masks and gloves	□	Inventory management including reserves
8	Ensure ventilation (air conditioning inside the ship and regular opening of windows)	□	Managed in a journal or on special forms
9	Weekly hygiene inspections performed by a hygiene manager	□	Establishment of a command system chart
10	Consideration for mental health care (consultation services, communication)	□	Posting emergency contact information and other relevant information

Need for Information Gathering

Accurate information gathering is essential for ship-bound disaster relief operations. Ensuring safe ship navigation and entry into and departure from ports is the top priority. The following are examples of necessary safety information with respect to shipping routes.

- Damage to ports and navigation routes (highest priority)

Information about the loss of navigation aids, the subsidence or uplift of port structures and damage to wharves due to earthquakes and tsunamis

- Changes in the seabed topography (changes in water depth due to tsunami deposits, landslides or liquefaction)

Location information on sunken and drifting objects

- Drifting containers, ships, houses, trees or other objects
- Whether a port is usable

URL: http://dx.doi.org/10.14738/assrj.1207.19140

- Availability of a berthing wharf and whether refugee and relief supplies can be loaded and unloaded
- Status of designated no-sailing zones and closed shipping lanes

This information can be obtained from public agencies, such as the MLIT, the Japan Coast Guard and local governments, as well as from sister ships and local agents.

The following information is also essential for safe navigation:

- Tsunami warning/advisory (risk of tsunami recurrence due to aftershocks)
- Information about aftershocks
- Wind direction and speed, wave height, tidal currents and tides (affecting the berthing and unloading of support vessels)
- Approach of typhoons, low pressure systems or other weather phenomena

The data can be obtained from Japan Meteorological Agency, Japan Coast Guard and private weather information services.

The following information is important for communication and reporting related to the safety of ship navigation.

- Operational status of vessel traffic service (VTS) in the disaster-stricken area
- Response to inadequate maritime traffic control where VTS is suspended
- Navigation information from Japan Coast Guard and local governments
- Notifications including navigation warnings, no-sail zones, temporary navigation routes and emergency support base ports
- Satellite communication and wireless communication feasibility
- Information on the use of satellite communications and emergency communications equipment where land communications are unavailable

Furthermore, information on traffic conditions in the area of the disaster and the movement of other vessels are also important.

- Risk of congestion in waters where many different types of vessels gather
- Degree of concentration of vessels such as those of the Self-Defence Forces, those of the Coast Guard, commercial ships, ferries, water supply ships and medical ships.
- Monitoring other vessels' movements using the automatic identification system (some vessels may be unable to use their radio equipment for this purpose due to damage)
- Temporary changes to maritime traffic rules (e.g. priority passage for emergency assistance vessels)

It is essential to grasp these points for safe navigation. The following restrictions on the operation of one's own ship and supply information are available.

- Fuel, fresh water and food supply port information
- In disaster-stricken areas, supplies may not be available, so it is important to identify relay points and supply ports in advance.
- Information on emergency ports and temporary anchorages
- Information on crew labour and safety (including areas where disembarkation from ships is not possible)

It is necessary not only to grasp this information in advance but also to collect the latest information to respond to rapidly changing situations. It is also important to gather information on what the disaster-stricken area needs. For example, is it necessary to transport personnel or supplies? If supplies are needed, it is important to accurately identify whether water, food, blankets or other items are needed, as otherwise, the relief efforts may be wasted. This information can be obtained in on-site investigations and communication with local governments. Information that is published online by local governments is also useful.

Transportation by ship is only available to the port and thereafter, it is necessary to transport supplies and evacuated persons by ground transportation. Because support will be wasted if means of transportation are not established, it is important to ensure the flow of information between bases and strengthen coordination with land-based support.

Challenges Specific to Ships

Ships float on the surface of the ocean and are affected by waves and currents, leading to constant swaying and vibration. These motions can adversely affect the physical condition of those on board, which can be a major problem, especially when ships are used as shelters or rest areas. For those who are not accustomed to onboard ship, seasickness and fatigue are likely to occur, making it difficult to remain on board.

In addition, this swaying and vibration during the transportation of supplies by ship can hinder their safe transport. In addition to load collapse resulting from the ship's swaying, temperature changes, humidity and vibrations can damage the quality of the goods. Load collapse can endanger personnel on board and damage the ship's hull, so it is necessary to ensure safe loading using appropriate loading plans, load weight distribution and secure lashing.

Ships also meet with the following unique challenges.

- Dependence on weather and sea conditions: navigation may be restricted due to severe weather or high waves, which may delay the arrival of disaster relief.
- Limitations to coordination with land-based facilities: even after berthing, efficient unloading of cargo and transportation of personnel may be difficult if land-based transportation infrastructure such as cargo handling equipment, cranes and vehicles are damaged
- Independence of power and communications infrastructure: although ships are equipped with their own power and communications equipment, there is the risk that communication with the outside world will be restricted in the event of equipment failure due to a harsh environment or excessive use.

Due to these challenges, disaster relief by ship requires training, equipment inspections and the formulation of operational plans that are based on disaster scenarios.

CONSIDERATIONS

In the event of a large-scale disaster, it is necessary for land, sea and air resources to coordinate and provide effective support. In this context, consideration should be given to more effective means of providing support that leverage the following characteristics of ships.

(1) Mobility: Even when roads are cut off in a disaster-stricken area due to an earthquake or other damage, it is possible to obtain access from the sea. Although there are restrictions resulting from the sea area and geography, support provided by ships of a size that is appropriate to the needs of the disaster area can be effective. Depending on the specifics of the situation, it may be effective to have large ships and small ships work together, combining their characteristics to provide support.
(2) Transport capacity: Generally, ships are capable of transporting large quantities of cargo. Depending on the size and type of the ship, it is possible to transport a large number of people or a large quantity of cargo at once. It is important to select the appropriate type of ship with respect to the number of people that are to be transported, the quantity and shape of the cargo and other factors.
(3) Accommodation capacity: Large ferries and training ships can temporarily accommodate a large number of disaster victims. Even general merchant ships at berth can accept a certain number of disaster victims.
(4) Life support functions: Ships are equipped with food storage facilities, toilets, heating and cooling systems, power generation equipment and other amenities, enabling them to function as self-sufficient life support systems. As a result, they can provide comfortable living conditions for disaster victims for a certain period of time. They can also provide bathing and shower facilities, which are difficult for land-based shelters to provide.
(5) Information functions: Vessels use wireless communications to maintain contact with land in normal circumstances and are equipped with communication means such as maritime satellite communications and VHF radio telephones. Using these to gather information, ships can serve as information hubs for disaster relief.
(6) Establishment of internal control: Vessels have a clear chain of command headed by a captain and have well-developed safety management procedures, enabling coordinated action in the event of an emergency. In the context of a disaster, it is important to determine on the most appropriate measures based on the information gathered, under strong leadership and to implement organisational support.
(7) Portability (mobile support base): Ships can serve as mobile support bases, providing support while moving between disaster areas as needed. They can also flexibly respond to requests for expanded support for other regions and to changes in priority support areas.
(8) Long-term stay and response capabilities: Ships that are equipped with self-sufficiency functions can remain in a disaster area for long periods of time and continue providing support as long as they have fuel, food and other supplies on board, even where land-based infrastructure is still not operational.
(9) Expandable multifunctionality: Ships' structure can integrate multiple functions such as medical care, command centres, communications and cooking. Depending upon the stage of the disaster, it may be possible to install and expand the necessary functions to provide integrated support.
(10) Provision of mental health care space: By providing air-conditioning, privacy, bathing facilities and other amenities, a ship can enable evacuated persons to feel physically and mentally secure. This may reduce stress during long-term evacuation.

It is important to fully utilise the characteristics of such ships to provide efficient and effective disaster relief. Furthermore, to provide effective support, ships must collect as much accurate

information as possible and establish a system to ensure that necessary responses are carried out. Disaster response centres require experts from different fields to gather analyse information appropriately and implement a wide range of response measures quickly and reliably. It is extremely important to establish a system in which personnel dispatched from the Self-Defence Forces, the Japan Coast Guard and national and local governments can collaborate and, under the leadership of selected leaders, implement measures in order of priority.

CONCLUSION

This paper examined the effectiveness and challenges of disaster relief provided by ships, based on the support activities of the training ship *Wakashio Maru* in the Noto Peninsula earthquake and other earthquake disasters. Ships have many useful features, such as being able to move around easily, transporting large quantities of goods and materials and keeping people alive in hostile environments. In the disaster context, they can provide a number of functions, such as transporting supplies and people, providing medical help and serving as shelters. However, their use also encounters challenges such as the difficulty of berthing, the effects of swaying and weather conditions and the difficulty of coordinating with land-based operations. In future disaster relief efforts, it will be essential to establish training, planning and coordination systems in advance, during normal times, taking into account these characteristics and challenges. In particular, it is necessary to strengthen information sharing and cooperation with government agencies, the Self-Defence Forces and the Japan Coast Guard, as well as establishing a flexible disaster response system combining various support measures, including ships.

References

[1] Japan Weather Association, Past earthquake information, https://earthquake.tenki.jp/bousai/earthquake/entries/level-6-minus/

[2] Japan Weather Association, Past earthquake information, https://earthquake.tenki.jp/bousai/earthquake/entries/level-7/

[3] National Institute of Technology, Toyama College, We delivered relief supplies to Nanao City on Saturday, January 27, using the training ship Wakashio Maru, https://www.nc-toyama.ac.jp/2024/01/31/25237/

[4] Japan Coast Guard, Maritime Safety Report 2022https://www.kaiho.mlit.go.jp/info/books/report2012/html/tokushu/p022_02_01.html

[5] Japan Coast Guard, Maritime safety report 2024, https://www.kaiho.mlit.go.jp/info/books/report2024/html/honpen/5_05_clm14.html

[6] Sakane, Y., Relief activities by training ships of the National Institute for Sea Traning in the Great East Japan Earthquake, Journal of the JIME, 2012. 47(2): p. 45-50.

[7] Transportation news, etc., https://trafficnews.jp/post/130481.

[8] Makoto Inui, Relief activities conducted by training ships in the Great Hanshin Earthquake, http://cs.maritime.kobe-u.ac.jp/symposium/Inui.pdf

[9] Ship news, etc., https://funeco.jp/news/news-22641/

[10] Watanabe, M., Y. Nakamura, and Y. Suzuki, Geographical review of Japan series, tectonic landforms and co-seismic uplift in the southwestern coastal area of the Noto Peninsula, Central Japan, 2024. 23(10): p. 1196-1204.