



Transportation  
Safety Board  
of Canada

Bureau de la sécurité  
des transports  
du Canada



# MARINE TRANSPORTATION SAFETY INVESTIGATION REPORT M21A0065

## **CAPSIZING WITH LOSS OF LIFE**

Fishing vessel *Tyhawk*

Gulf of St. Lawrence, 20 nautical miles west of Chéticamp, Nova Scotia

03 April 2021

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## CAPSIZING WITH LOSS OF LIFE

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03 April 2021

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## EXECUTIVE SUMMARY

On 01 April 2021, Fisheries and Oceans Canada (DFO) assessed the weather conditions and notified fish harvesters that the snow crab fishery in area 12 of the Gulf of St. Lawrence would open at 0001 on 03 April 2021. At the time of the notification, there was ice in Richibucto Harbour, New Brunswick, and an excavator was needed to break ice at the wharf to put the *Tyhawk* in the water.

On 02 April at 0435, the master and 4 crew members sailed the 13.61 m open fishing vessel *Tyhawk* from Richibucto, New Brunswick, to Chéticamp, Nova Scotia, for the season. They were joined in Chéticamp by 4 additional crew members, who had driven from Richibucto.

On 03 April, starting at approximately 0240, the *Tyhawk* made 2 voyages from Chéticamp to the fishing grounds. On the first voyage, with the master and all 8 crew members on board, they set about 75 crab traps. During this voyage, ice was accumulating on the vessel. On the second voyage, the master and 4 crew members departed to set about 50 more crab traps.

On the trip to the fishing grounds, the master and 3 crew members napped in the accommodation space while another crew member stood watch. The winds had increased to 20 to 25 knots with 1 to 2 m seas. Waves were hitting the starboard side, and rain and freezing rain were falling. A second crew member came to the wheelhouse where he noticed an accumulation of water in the bilge. He called the master and the other crew members, and the bilge pumps were started. Shortly afterwards, a crew member went under the removable deck to get some of the gear and found water on the main deck. He alerted the other crew members, and the wash-down pump configuration was changed to dewater the bilge. At this time, the weather seemed to increase in severity and the vessel's movements became more severe. Following a significant heel to starboard, the vessel's main deck submerged, allowing water in addition to that already on deck to enter the *Tyhawk*.

Crew members could not reach the lifejackets and immersion suits stowed in the accommodation space or launch the life raft, which had slid under the removable deck.

Shortly afterward, the *Tyhawk* capsized and the master and crew members climbed on to the overturned hull. One crew member called 911. The automatic emergency position-indicating radio beacon (EPIRB) floated free and at 1750, the Joint Rescue Coordination Centre Halifax received notice of an EPIRB signal from the *Tyhawk*.

As the overturned *Tyhawk* sank lower in the water, wave action repeatedly swept the master and 1 crew member clear of the hull and into the water. Eventually, the master and this crew member remained in the water. The fishing vessel *Northumberland Spray* arrived on scene and rescued the 4 *Tyhawk* crew members, but the master could not be located. The *Northumberland Spray* returned to Chéticamp and the 4 crew members received medical assistance. One crew member was pronounced dead. The search for the master continued through the night and all the next day. At 1955 on 04 April 2021, the case was turned over to the RCMP as a missing persons case.

## Modifications without stability assessment

The *Tyhawk* had been modified by the addition of a removable deck. The investigation determined that the *Tyhawk's* stability was compromised in part by the addition of the removable deck, which had not been evaluated for its impact on the vessel's stability. In 2013, Transport Canada (TC) inspected the vessel, issued a deficiency because of the removable deck, and required a stability assessment. The master completed a stability questionnaire in May 2015 and identified the existence of a removable deck, but he did not recognize the deck as a modification that would require a stability assessment. The stability assessment required by TC was not completed, and TC's subsequent inspection documentation did not reference the removable deck.

For small fishing vessels and other small commercial vessels (15 gross tonnage and under) that are not passenger vessels, the definitions of "major modification" (something that "substantially changes" the capacity or size of a fishing vessel) and the requirements for a stability assessment (something that is likely to adversely affect stability) are qualitative and open to interpretation. It is the responsibility of the authorized representative (AR) to identify whether a modification is major.

While TC does provide some guidance to help ARs and masters identify major modifications, compliance with this guidance is voluntary. As well, the guidance is qualitative and requires knowledge of stability to correctly interpret.

Without an objective definition of a major modification, the impact on vessel stability of a major modification may not be identified by ARs, masters, and TC. As a result, there is a risk that vessels will operate without adequate stability for their intended operations. Therefore, the Board recommends that the Department of Transport introduce objective criteria to define major modifications to small fishing vessels and other small commercial vessels (TSB Recommendation M23-06).

Furthermore, TC does not require ARs to seek pre-approval or assessment of planned modifications, which could also assist in identifying whether a modification is likely to negatively affect stability. A systematic assessment by a competent person of all planned modifications, as is done in other countries, can assist in identifying which are major

modifications and when stability assessments are required. Regulatory surveillance gives TC an opportunity to evaluate records of modifications. As many small fishing vessels and other small commercial vessels change hands, having an established record of modifications can help ensure that ARs, masters, and TC have complete and current information when evaluating vessel stability. Therefore, the Board recommends that the Department of Transport require that planned modifications to small fishing vessels and other small commercial vessels be assessed by a competent person, that all records of modifications to these vessels be maintained, and that the records be made available to the Department (TSB Recommendation M23-07).

## **Hazard identification in fisheries resource management**

The master's perception of risk in the planned fishing operation was influenced by several pressures, including economic and community incentives, approvals and certificates, and previous successful experiences. As a result, the master departed for the fishing grounds likely believing the vessel was stable and well adapted for the snow crab fishery.

In this occurrence, DFO moved the opening date for the snow crab fishery almost 3 weeks earlier than previous years' opening dates. This decision was based on the advice of a sub-committee made up of representatives from industry and government. DFO and the sub-committee members considered the selection of the opening date and time for the 2021 snow crab fishery as routine. Consequently, hazards posed by changing the date, such as increased likelihood of colder water, ice, and freezing rain, or by opening the fishery at midnight, increasing the risk of fatigue, were not identified and assessed for safety implications.

Complex decisions, such as those about fisheries resource management, need to consider all relevant areas and interactions and must be supported by a comprehensive, methodical risk assessment. The quality of a risk assessment depends on the robustness of hazard identification. To identify as many hazards as possible, all relevant information must be considered by experts in their fields, including independent safety experts who are not impacted by the decisions.

When fisheries resource management measures and decisions do not consider the interactions between economic, conservation, and safety factors, including their cumulative effects, then decisions may be made for new and complex situations without adequate identification of safety hazards, increasing safety risks for fish harvesters. Therefore, the Board recommends that the Department of Fisheries and Oceans ensure that policies, procedures, and practices include comprehensive identification of hazards and assessment of associated risks to fish harvesters when fisheries resource management decisions are being made and integrate independent safety expertise into these processes (TSB Recommendation M23-08).

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## 1.0 FACTUAL INFORMATION

### 1.1 Particulars of the vessel

Name	<i>Tyhawk</i>
Transport Canada official number	836225
Fisheries and Oceans Canada vessel registration number	159321
Port of registry	Moncton, NB
Flag	Canada
Type	Fishing vessel
Gross tonnage	15.23
Length overall	13.61 m
Built	2001, Guimond Boats Ltd., Escuminac, NB
Propulsion	Self-propelled, single-screw 366 kW
Crew on board	5
Owner and authorized representative	Elsipogtog First Nation, NB
MMSI (maritime mobile service identity)	316027189

### 1.2 Description of the vessel

The *Tyhawk* was a fishing vessel, built in 2001 for the lobster fishery<sup>1</sup> (Figure 1). The vessel was a Northumberland Strait-style vessel, with a moulded hull of glass-reinforced plastic and a small fish hold. The wheelhouse was located forward of midships and was accessible by a sliding door from the port-side aft deck. The accommodation space was located below

<sup>1</sup> The *Tyhawk* was also used in the tuna and snow crab fisheries.



and forward of the wheelhouse and was accessible through an opening from the centre of the wheelhouse as well as from an emergency escape hatch on the forward deck. The engine compartment was located aft of the accommodation space and was accessible through a small hatch in the wheelhouse deck or through a larger hatch on the main deck. The main deck hatch cover sat on a 4-inch coaming and was not watertight.

The *Tyhawk*'s main deck was 1.6 m above the keel. The main deck had 3 hatches along the vessel's centreline. The vessel was of open construction, and the main deck was not watertight. Four scuppers, each approximately 10 cm in diameter, were fitted in the bulwarks, 1 on each side of the aft deck and 2 at the stern. The scuppers drained overboard. They could be closed by threaded plugs and were normally kept closed when the vessel was at sea.

The *Tyhawk* had a removable aluminum deck for use in the snow crab fishery. On the centreline, immediately aft of the wheelhouse and before the removable deck, were a mast and a boom used for retrieving crab traps.

Figure 1. The fishing vessel *Tyhawk*, with a removable deck in place. Note that the rigid 4-person life raft on top of the wheelhouse was not in place on the day of the occurrence. (Source: Fisheries and Oceans Canada)



The wheelhouse was equipped with a vessel monitoring system (VMS),<sup>2</sup> radar, an electronic charting system, a very high frequency–digital selective calling (VHF-DSC) radio,<sup>3</sup> a GPS, and an autopilot. The wheelhouse also contained bilge pump switches, a bilge alarm, and 3 remote monitoring cameras that were displayed on a split screen. Two cameras

<sup>2</sup> A vessel monitoring system (VMS) is a satellite-based, near real-time, position-tracking system used to enhance fisheries surveillance and enforcement by Fisheries and Oceans Canada and to provide data for science research. A VMS unit is required for the snow crab fishery in the Gulf of St. Lawrence.

<sup>3</sup> The radio was correctly registered with Innovation, Science and Economic Development Canada.

monitored the aft deck, and 1 monitored the engine in the engine compartment. The angle of the engine compartment camera could be changed remotely to monitor the bilge area.

The *Tyhawk* was equipped with an inflatable 6-person life raft. A float-free emergency position-indicating radio beacon (EPIRB)<sup>4</sup> was mounted on top of the wheelhouse. Lifejackets and immersion suits were stowed in the accommodation space. The *Tyhawk* was also equipped with a flare gun, 2 fire extinguishers, and a lifebuoy.<sup>5</sup>

### 1.2.1 Removable deck

In 2002, when the *Tyhawk* began participating in the snow crab fishery, a removable deck (Figure 2) and a boom were installed. The removable deck provided space to stow live snow crab on the entire aft (main) deck, while leaving space to stow traps on top of the removable deck. The removable deck weighed approximately 900 kg.

Figure 2. Three photos showing how the removable deck bulwarks sit on the top of the main deck bulwarks (left photo), the gap between the removable deck and the wheelhouse (centre photo), and the stern view of the removable deck (right photo) (Source: Fisheries and Oceans Canada video)



The removable deck was installed in 1 piece over the main deck and bolted to the top of the bulwarks, leaving the area between the main deck and the removable deck unobstructed. The connection between the top of the bulwarks and the removable deck was not watertight. The surface height was about 1.4 m over the main deck (about 0.45 m over the upper edge of the bulwarks). Access to the top of the removable deck was via a set of stairs from the wheelhouse. Access to the space under the removable deck was from the forward end (near the wheelhouse door) or through one of 3 hatches located on top of the removable deck. When the removable deck was in place, the engine compartment was still accessible via the main deck hatch. The removable deck had bulwarks with freeing ports on both sides.

### 1.2.2 Vessel pumps

The vessel was equipped with the following pumps:

- A 12 V automatic bilge pump with a float switch with a capacity of 3700 gallons of water per hour output, in the engine compartment forward

<sup>4</sup> The emergency position-indicating radio beacon was registered to the *Tyhawk* with the Canadian Beacon Registry (National Defence, Canadian Beacon registry, at [https://cbr-rcb.ca/cbr/presentation/other\\_autre/index.php](https://cbr-rcb.ca/cbr/presentation/other_autre/index.php) [last accessed on 18 October 2023]).

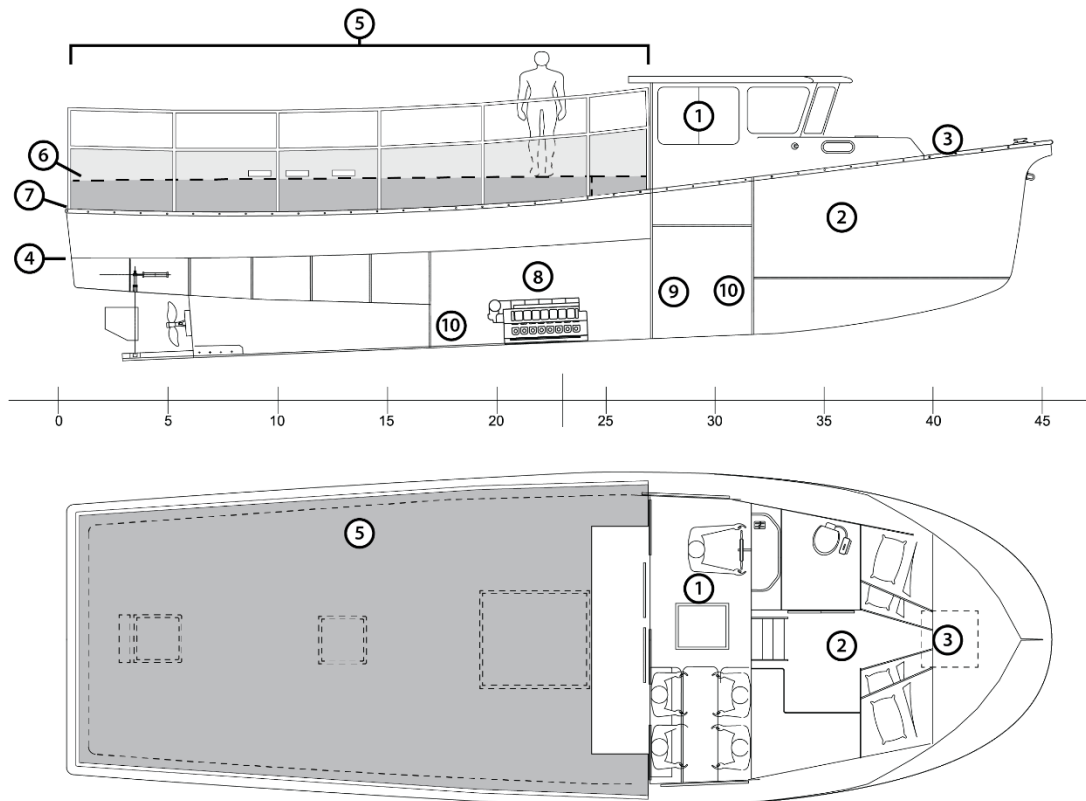
<sup>5</sup> The requirements for lifesaving equipment are described in the *Fishing Vessel Safety Regulations*. (Transport Canada, C.R.C., c. 1486, *Fishing Vessel Safety Regulations* [as amended 23 June 2021], sections 3.25–3.28).

- A 12 V manual bilge pump with a float switch with a capacity of 2000 gallons of water per hour output, in the engine compartment aft
- A 12 V spare portable pump (stowed)
- An engine-driven wash-down pump<sup>6</sup>

A high-level bilge sensor was located forward in the engine compartment (Figure 3).

The fitted pumps on the *Tyhawk* met the requirements for bilge pumps under the *Fishing Vessel Safety Regulations* (FVSR).<sup>7</sup>

Figure 3. Profile and plan diagrams of the *Tyhawk*, showing the wheelhouse (1), the accommodation space (2), the emergency escape hatch (3), the main deck (4), the removable deck structure (5), the walking surface of the removable deck (6), the upper edge of the original bulwarks (7), the engine compartment (8), the high-level bilge sensor (9), and bilge pump locations (10) (Source: TSB, based on drawings from Guimond Boats Ltd.)



<sup>6</sup> This pump was designed for washing down the decks but could be configured for use as a bilge pump by manually changing the suction via a valve in the engine compartment that was accessed through the small hatch in the wheelhouse.

<sup>7</sup> Transport Canada, C.R.C., c. 1486, *Fishing Vessel Safety Regulations*, (as amended 23 June 2021), subsections 3.32(2) and (4).

### 1.3 History of the voyage

Elsipogtog fishing vessels are stored on shore over the winter season. The vessel masters and crews are responsible for de-winterizing the vessels and preparing them for the fishing season. For the *Tyhawk*, preparations included getting the vessel into the water; installing the removable deck and lifesaving equipment; ensuring the vessel had fuel and water and that all mechanical and electrical equipment was functioning; checking, repairing, and loading necessary gear, such as traps,<sup>8</sup> ground lines, and flag poles; and purchasing and loading bait and provisions. The *Tyhawk's* new 6-person life raft was stored unsecured aft of the wheelhouse.

In 2021, when the season beginning date was announced, there was ice in Richibucto Harbour, New Brunswick, and an excavator was needed to break ice at the wharf to put the *Tyhawk* in the water.

On 01 April 2021, Fisheries and Oceans Canada (DFO) assessed the weather conditions and issued a Notice to Fish Harvesters<sup>9</sup> to indicate that the snow crab fishery in area 12 of the Gulf of St. Lawrence would open at 0001<sup>10</sup> on 03 April 2021.

On 02 April at 0435, the master and 4 crew members sailed the *Tyhawk* from Richibucto, New Brunswick, to Chéticamp, Nova Scotia, for the season (Figure 4), a trip of approximately 16 hours. They were joined in Chéticamp by 4 additional crew members, who had driven from Richibucto, a drive of approximately 6 hours. At approximately 2030, the *Tyhawk* arrived in Chéticamp and all crew members began loading the vessel.

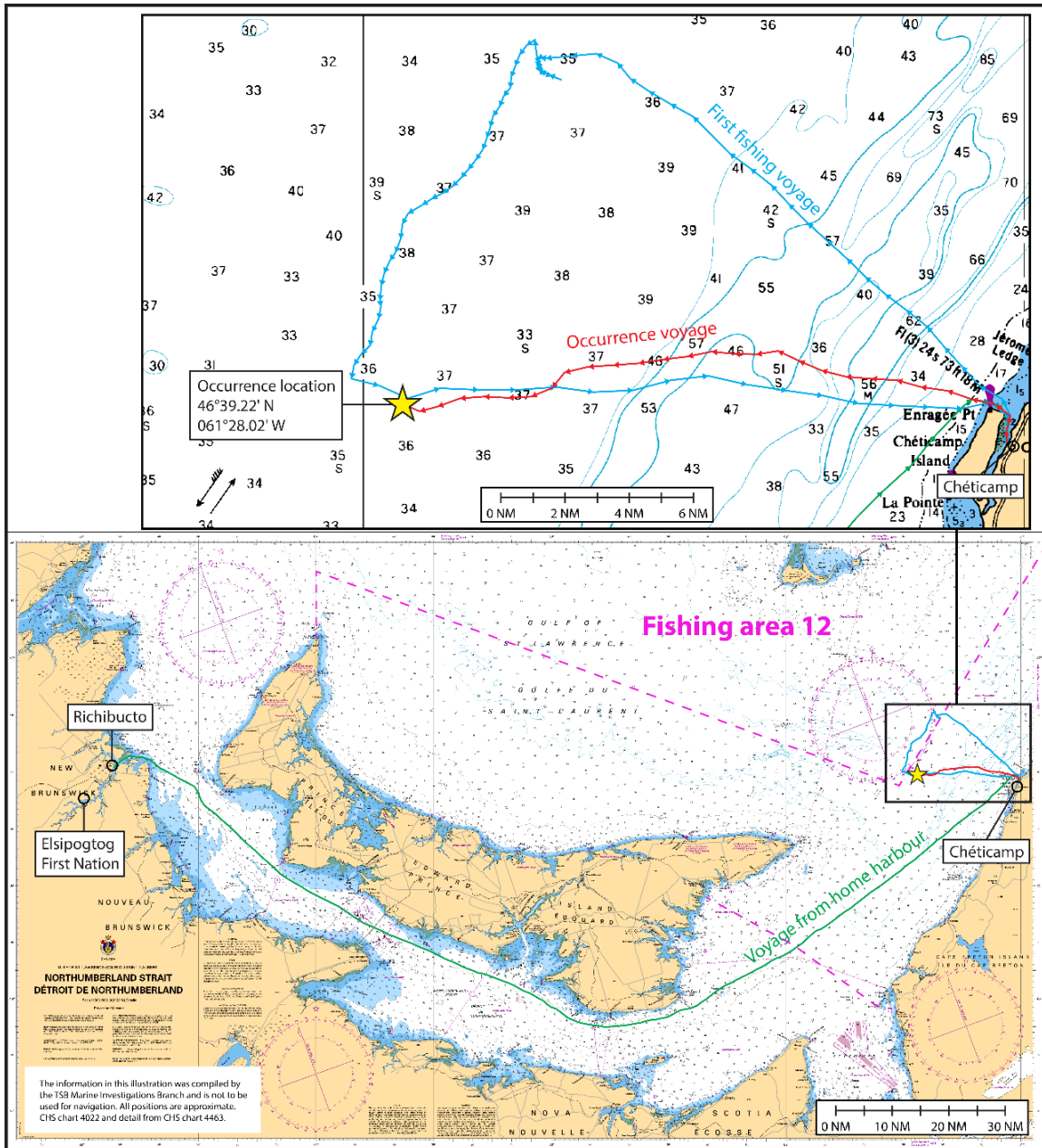
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<sup>8</sup> A snow crab trap is conically shaped and stackable, with a bottom diameter of approximately 2 m. A string of 25 traps and associated lines weighs approximately 500 kg.

<sup>9</sup> Fisheries and Oceans Canada, "2021 - Snow crab fishery opening date: Crab Fishing Areas 12 (12, 18, 25 and 26) and 12E," at <https://www.dfo-mpo.gc.ca/fisheries-peches/commercial-commerciale/atl-arc/2021/snow-crab-open-12-crabe-neige-ouvert-eng.html> (last accessed on 18 October 2023).

<sup>10</sup> All times are Atlantic Daylight Time (Coordinated Universal Time minus 3 hours).

Figure 4. Chart of the occurrence location near Chéticamp (inset image) with main image showing the route from the home harbour (Source of main image: Canadian Hydrographic Service chart 4022, with TSB annotations. Source of inset image: Canadian Hydrographic Service chart 4463, with TSB annotations)



On 03 April at approximately 0240, the *Tyhawk* departed Chéticamp, with the master and all 8 crew members on board and about 75 crab traps stowed unsecured on top of the removable deck. The voyage of 20 nautical miles (NM) to the fishing grounds took approximately 2 hours. During the voyage, ice was accumulating on the vessel. The master and crew members set the crab traps and returned to Chéticamp, arriving at approximately 1110. On this voyage, the *Tyhawk* encountered winds of around 15 knots and wave heights of approximately 1 m, with rain and freezing rain.

When they arrived in Chéticamp, the 4 crew members who had travelled to Chéticamp on the *Tyhawk* left the vessel to rest and warm up. The 4 other crew members (crew

members 1 to 4) loaded about 50 crab traps. The traps were stowed as on the previous voyage, unsecured on top of the removable deck, and the associated gear (ropes in crates, approximately 225 kg of bait, and buoys) was stowed between the removable deck and the main deck.

At approximately 1520, the *Tyhawk* left Chéticamp again with the master and crew members 1 to 4 to set the crab traps close to the first set of traps. Once the vessel was out of the harbour, crew members 2, 3, and 4 went below to nap. Some time later, the master was relieved of the watch at the wheel by crew member 1. The master and the other 3 crew members remained in the accommodation space and napped.

During the voyage, the winds had increased to 20 to 25 knots with wave heights of 1 to 2 m. Waves were hitting the starboard side, and rain and freezing rain were falling. After some time, crew member 2 came to the wheelhouse and crew member 1 asked him to take over the wheel.

When crew member 2 took the wheel, he adjusted the camera angle in the engine compartment and noticed an accumulation of water in the bilge. At approximately 1735, crew members 1 and 2 called the master, who came to the wheelhouse, took the wheel, and manually activated both bilge pumps. The other crew members were also wakened at this time, and the master directed them to prepare to set the traps.

At approximately 1740,<sup>11</sup> crew member 2 went under the removable deck to get some of the gear. He found water on the main deck and alerted the other crew members. The water had accumulated mostly toward the stern.<sup>12</sup> Crew member 4 responded by opening the hatch in the wheelhouse to access the engine compartment and changed the wash-down pump configuration to dewater the bilge. Crew member 2 looked over the side to watch for signs of dewatering but observed only a little water flowing out. At this time, the weather seemed to become more severe, as did the vessel's movements.

Approximately a minute later, the vessel heeled to starboard, causing the water and spare gear on the main deck and the traps on the removable deck to also shift to starboard. Crew member 3, who had just arrived on deck from the accommodation space, was temporarily stuck between the stacks of traps as the vessel listed. Other crew members helped crew member 3 out of the traps, and crew member 3 remained on deck. The master used his telephone to text a distress message to the master of the *Northumberland Spray*, who was fishing approximately 6 NM away. The master of the *Tyhawk* also pushed the VHF-DSC radio distress button, but no distress signal was received by any nearby VHF-DSC station.<sup>13</sup> The vessel's starboard side was listing enough to submerge the main deck edge and allow more water to enter the *Tyhawk*.

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<sup>11</sup> At 1740, DFO received the final position update from the *Tyhawk* VMS. The vessel was at position 46°38.99' N, 061°28.01' W, moving at 8.2 knots on a heading of 266° true.

<sup>12</sup> The investigation could not determine whether the bilge was already filled or whether the water was trapped on the main deck and seeping down into the bilge.

<sup>13</sup> The distress button on a digital selective calling radio must be held for approximately 3 to 5 seconds.

Still in the wheelhouse, crew member 1 attempted to reach the lifejackets and immersion suits stowed in the accommodation space but could not, owing to the deteriorating situation. Meanwhile, crew member 2 attempted to launch the life raft, which was unsecured on the main deck, but it slid under the removable deck. Crew member 4 left the engine compartment through the wheelhouse and stood by on the removable deck.

At approximately 1742, the vessel's list to starboard had increased to the point that the vessel capsized at 46°39.22' N, 061°28.02' W (Figure 4). Crew member 3 scrambled over the side of the vessel onto the overturned hull. He then called 911. Crew members 2 and 4 entered the water as the vessel capsized and then climbed onto the hull. The master helped crew member 1 out of the window of the wheelhouse before following through himself, and both entered the water before climbing onto the overturned hull.

At 1746, the 911 call was reported to the Joint Rescue Coordination Centre Halifax, which initiated a mayday call through Maritime Communications and Traffic Services Sydney at 1749 and began to task resources. The automatic EPIRB, which was correctly registered, floated free and functioned as intended approximately 3 minutes after the capsizing. At 1750, Joint Rescue Coordination Centre Halifax received notice of an EPIRB signal from the *Tyhawk*.

As the overturned *Tyhawk* sank lower in the water, wave action repeatedly swept the master and crew member 4 clear of the hull and into the water. The other crew members pulled them back onto the hull several times but, eventually, crew member 4 and the master remained in the water.

At 1834, the fishing vessel *Northumberland Spray* arrived on scene and rescued the *Tyhawk* crew members 1, 2, 3, and 4, but the master could not be located. The *Northumberland Spray* returned to Chéticamp, and the 4 crew members received medical assistance. Crew member 4 was pronounced dead.

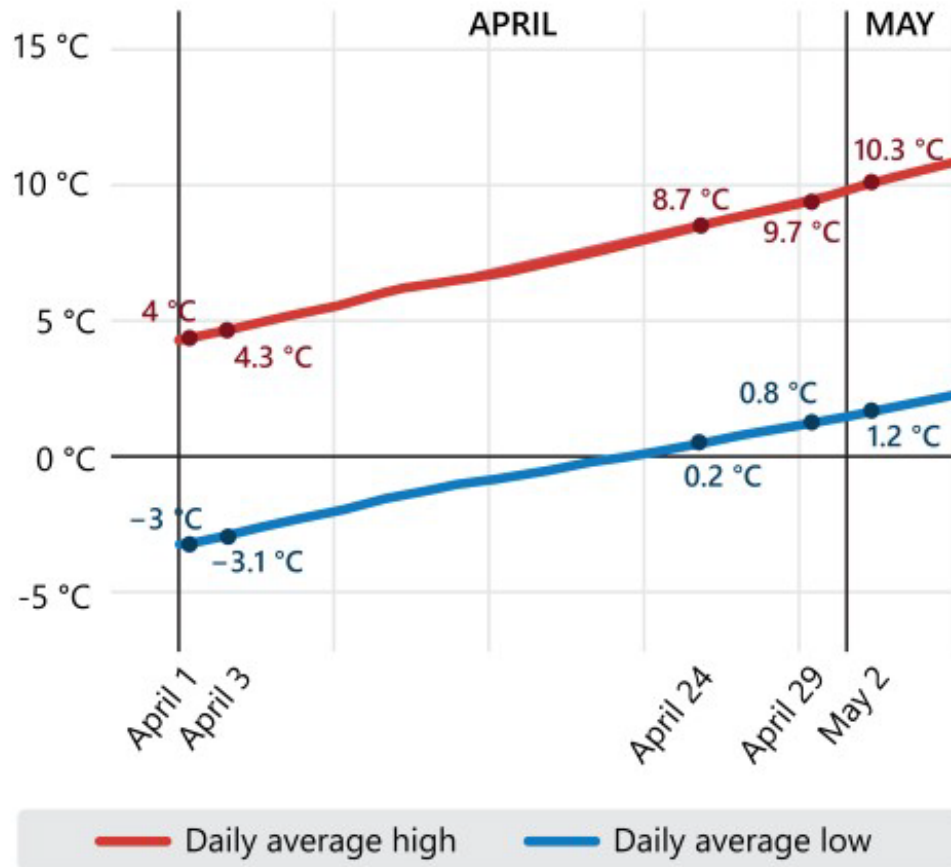
The search for the master continued through the night and all the next day. At 1955 on 04 April 2021, the case was turned over to the RCMP as a missing persons case.

## 1.4 Environmental conditions

The weather forecast issued by Environment and Climate Change Canada for Gulf-Magdalen-Eastern Half area for 1000 on Saturday 03 April 2021 was for northeasterly winds of 15 knots increasing to 20 knots late Saturday afternoon, then veering to easterly winds of 25 knots by Sunday morning; periods of freezing rain changing to snow near midnight; and visibility 1 mile or less. The air temperature was 1 °C and the water temperature was -0.6 °C.

Average temperatures at the beginning of April tend to be below or close to freezing, as compared with temperatures at the end of April—the usual season-opening dates—when the average low temperature is above freezing (Figure 5). There were 12 hours and 57 minutes of daylight on 03 April 2021.

Figure 5. Graph showing the average high and low air temperatures at Chéticamp in April and May (2010–2018), with dates of season openings in other years (2018–2021). Temperatures in early April are much more likely to be around or below freezing. (Source: TSB, based on data from Weather Spark)



## 1.5 Vessel certification

The *Tyhawk* held a current inspection certificate for vessels of more than 15 gross tonnage (GT) and of less than 150 GT for near coastal voyages, class II.<sup>14</sup> The vessel also had a current safe manning document.

The 2017 safe manning document for the *Tyhawk* indicated it was a day vessel.<sup>15</sup> Watch requirements for day-vessel use were for the master to have a Fishing Master, Fourth Class certificate or a Certificate of Service Fishing Master 60 GT and for 1 other crew member to have a valid Marine Emergency Duties (MED) Basic Safety training certificate. An additional certified watchkeeper was required for operating overnight without a stay in port.

<sup>14</sup> Near coastal voyages, class II, include voyages up to 25 nautical miles from shore.

<sup>15</sup> Labour Canada defines a “day vessel” as one without sleeping accommodations (Labour Canada, SOR/2010-120, *Maritime Occupational Health and Safety Regulations* [as amended 02 May 2022], section 1). In safe manning documents, Transport Canada (TC) also uses “day vessel” to mean a vessel where rest in port is expected overnight.



## 1.6 Personnel certification and experience

The master held a Certificate of Service Fishing Master 60 GT, issued in 2008.<sup>16</sup> The master had completed MED Basic Safety training in 2001 and Radio Operator Certificate – Maritime Commercial training in 2005. The master had over 20 years of fishing experience.

Crew member 1 had completed 2 previous fishing voyages.

Crew member 2 had taken the Small Vessel Operators Proficiency training as well as chart work, navigation safety, and MED Basic Safety (2016). Crew member 2 had 8 years of fishing experience and was assigned to the Elsipogtog vessel *Lady Margaret I* as the master.

Crew member 3 was on his first fishing voyage.

Crew member 4 had over 3 years of fishing experience.

Crew members 1 to 4 were originally assigned to the *Lady Margaret I* and were unfamiliar with the *Tyhawk*.

## 1.7 Vessel insurance survey

The principal function of an insurance survey is to determine the condition of a vessel and its current market and replacement values.

In December 2020, an insurance survey of the *Tyhawk* was completed. Comments stated the vessel was in good condition and showed no sign of excessive wear and tear or fibreglass delamination.

## 1.8 Elsipogtog operations

At the time of the occurrence, Elsipogtog First Nation had 62 vessels registered with Transport Canada (TC) and was the authorized representative (AR) for all of these vessels. Twelve of the registered vessels were required to be inspected and certified by TC. The Elsipogtog First Nation had licences issued by DFO to fish for 20 species. All the Elsipogtog vessels used for the snow crab fishery were less than 45 feet long.<sup>17</sup> In the southern Gulf of St. Lawrence, many vessels used in the snow crab fishery are longer.

For the Elsipogtog fleet, many of the responsibilities of the AR were carried out by the Elsipogtog director of fisheries. The person in this role managed TC requirements and the DFO fishing licences. As well, the director of fisheries attended the season-opening meeting with DFO and other fish harvesters.

Approximately 360 people work in the Elsipogtog fish harvesting operations, either as fish harvesters or as employees of the community-owned fish plant.

<sup>16</sup> A Certificate of Service indicates that a candidate has completed 7 fishing seasons over at least 7 years before 01 July 2007. Certificates of Service were put into place during the transition to the certification requirements for fishing vessel masters under the *Marine Personnel Regulations*, which came into force in 2008. Before 2008, the only training required by a candidate was Marine Emergency Duties Basic Safety and Radio Operator Certificate – Maritime Commercial. Certificates of Service are no longer issued.

<sup>17</sup> Vessels of up to 65 feet long may be used in the snow crab fishery.

## 1.9 Transport Canada oversight and responsibilities

TC is the federal regulatory authority responsible for crew and vessel safety. TC has expertise in vessel stability and hull integrity and is often called upon to provide this expertise to advisory groups. TC is also responsible for outreach, which includes promoting safety and security and collaborating with other organizations that influence crew and vessel safety.

A part of TC's oversight of crew and vessel safety is to ensure that ARs register their vessels and have their vessels inspected when they require certification. Before 2007, only vessels of more than 15 GT were required to be registered. In 2007, when the *Canada Shipping Act, 2001* (CSA 2001) came into effect, vessels of 15 GT or less were also required to register with TC. The expanded requirement to register affected thousands of commercial fishing vessels. As part of the registration process, TC requires a tonnage measurement.

The *Vessel Safety Certificates Regulations*<sup>18</sup> require that all vessels of more than 15 GT that are used for commercial purposes have a valid inspection certificate, identifying compliance with pertinent regulations, before undertaking operations. TC performs the required inspection for certification, as requested by an AR.

For fishing vessels of more than 15 GT, such as the *Tyhawk*, inspections are required every 4 years. Once an inspection for certification has been requested, a marine safety inspector visits the vessel, inspects the hull, machinery, and lifesaving equipment and reviews documentation, such as Canadian maritime documents, written procedures, and maintenance records.<sup>19</sup> TC inspectors record deficiencies and inspection results in the Ship Inspection Reporting System. The inspection process includes a step to verify that previous deficiencies are rectified.<sup>20</sup> Inspectors may review information about previous inspections in the Ship Inspection Reporting System.

If deficiencies are found during an inspection, the AR is notified. Depending on the severity that the inspector assigns to the deficiency, the AR may be required to fix the deficiency before the vessel sails or may be given a period of time to correct it. A proposal to correct an identified deficiency can be submitted to the Marine Technical Review Board for exemptions or equivalency related to regulatory requirements. Inspectors may also change the required corrective action at any time if the severity changes. Depending on the deficiencies and need for follow-up, inspectors may issue a short-term certificate, choose to not issue a certificate, or detain a vessel if the vessel has an existing inspection certificate. Based on information received from TC, in the period from 01 January 2021 to 30 June 2022, 1093 certificates were issued to Canadian fishing vessels of more than 15 to

<sup>18</sup> Transport Canada, SOR/2021-135, *Vessel Safety Certificates Regulations* (as amended 23 June 2021), subsections 13(1) and 13(2).

<sup>19</sup> Transport Canada, "Getting your 15 to 150 gross tonnage vessel inspected and certified," at <https://tc.canada.ca/en/marine-transportation/marine-safety/getting-your-15-150-gross-tonnage-vessel-inspected-certified> (last accessed on 18 October 2023).

<sup>20</sup> Transport Canada, TP 13585E, *Marine Safety Management System: Tier II-Procedure, Process for the Review of Detention Orders*, at <https://tc.canada.ca/sites/default/files/migrated/tp13585e.pdf> (last accessed on 18 October 2023).

150 GT. Of these certificates, 244 were short-term certificates. In the same period, 424 vessels in this range were required to fix a deficiency before sailing, and 6 vessels were detained.

As well as inspections for certification, TC occasionally conducts concentrated inspection campaigns (CICs). CICs are a series of inspections that focus on specific areas of safety concern on selected vessels. CICs focus on areas where marine safety inspectors have observed high levels of deficiencies, or where new regulatory requirements have recently come into effect. TC's 2021/2022 CIC focused on compliance with the FVSR. A summary of the findings was presented at the spring 2022 meeting of the Canadian Marine Advisory Council.<sup>21</sup> The campaign inspected 101 fishing vessels, 83% of which were greater than 15 GT and therefore subject to inspection. The campaign found that 62% of the 101 vessels had safety deficiencies. The campaign also found that

- the largest number of deficiencies were related to the absence of procedures, records, and drills;
- 17% of respondents said they had a major vessel modification, of which 41% had not tracked or notified TC of the modifications;
- 30% of fishing vessel crews could not demonstrate their knowledge of procedures;
- 79% of vessels did not have up-to-date certificates; and
- 80% of vessels had overdue deficiency notices from previous inspections.

TC may also perform risk-based inspections on a vessel of any size.<sup>22</sup> For example, after this occurrence, TC received a complaint and inspected 7 vessels using removable decks and operating in the crab fishery in the Chéticamp area. All 7 vessels received deficiency notices, and all were required to either complete a stability assessment or uninstall their removable deck before sailing.

When a violation of safety regulations is identified through accident reports, regulatory investigations, or vessel inspections, TC can issue 1 or more of the following to ARs or masters: written or verbal warnings, notices of violation, assurance of compliance, or administrative monetary penalties.

Following the occurrence, TC issued a notice of violation with an administrative monetary penalty to Elsipogtog First Nation. The penalty was for failing to ensure that the *Tyhawk* and its machinery and equipment met the requirements of the FVSR and failing to develop written procedures for the safe operation of the vessel and for emergencies.<sup>23</sup>

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<sup>21</sup> Transport Canada Marine Safety and Security, *2021/2022 Concentrated Inspection Campaign Summary of Findings*, presented at the Canadian Marine Advisory Council spring meeting (May 2022).

<sup>22</sup> In Marine Transportation Safety Investigation Report M20P0229, it was estimated that TC inspections applied to only about 3% of all fishing vessels in a given year.

<sup>23</sup> Transport Canada, "Administrative Enforcement Action Summaries," at <https://tc.canada.ca/en/marine-transportation/marine-safety/administrative-enforcement-action-summaries> (last accessed on 18 October 2023).

### 1.9.1 Major modifications

A major modification is “either a single modification or repair, or a series of modifications or repairs, that substantially changes the capacity or size of a fishing vessel or the nature of a system on board a fishing vessel and that affects its watertight integrity or its stability.”<sup>24</sup> The terms “substantially” and “affects” are qualitative and open to different interpretations. This definition was included in the FVSR as part of the amendments to the *Small Fishing Vessel Inspection Regulations* (SFVIR). A 2016 regulatory impact analysis statement related to these amendments estimated that 25% of fishing vessels would make major modifications.<sup>25</sup> Some years later, Fish Safe NS estimated that the majority of fishing vessels in Nova Scotia have made unreported modifications.<sup>26</sup> Furthermore, the definition for major modification is also used for small commercial vessels other than fishing vessels.<sup>27</sup>

TC does not require ARs to seek pre-approval or assessment of planned modifications. In some other countries, owners of fishing vessels are required to seek approval before any modifications are carried out.<sup>28,29</sup> Several TSB investigations<sup>30</sup> have identified vessels where major modifications were made but not identified.

### 1.9.2 Gross tonnage of a vessel

Gross tonnage is a measure of the vessel’s size based on the volume of all enclosed space on board a vessel. The gross tonnage is used to determine the safety standards to which the vessel is built, and which inspection certification is required. The gross tonnage is also important to fish harvesters, as it is an indicator of capacity, which is important for storing fishing gear and catch.

When a vessel is designed, the gross tonnage is estimated. If the gross tonnage is estimated to be more than 15 GT, TC examines construction plans to confirm that the vessel will be safe and suitable for the voyages for which it is intended. If the gross tonnage is estimated to be of 15 GT or less, TC does not examine the construction plans. Before 2017, the SFVIR applied, and these included a detailed safety standard for construction of vessels of more

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<sup>24</sup> Transport Canada, C.R.C., c. 1486, *Fishing Vessel Safety Regulations* (as amended 23 June 2021), subsection 3.48(3).

<sup>25</sup> Government of Canada, *Canada Gazette*, Part I, Vol. 150, No. 6 (06 February 2016), Regulations Amending the *Small Fishing Vessel Inspection Regulations*.

<sup>26</sup> Fish Safe NS, email from Executive Director to TSB investigators (03 March 2022).

<sup>27</sup> Transport Canada, SOR/2010-91, *Small Vessel Regulations* (as amended 23 June 2021), subsection 710(3).

<sup>28</sup> UK Maritime and Coastguard Agency, Statutory guidance MIN 593: “Amendment 1 Vessel Modifications – pre-approval by MCA” (15 February 2022), at <https://www.gov.uk/government/publications/min-593-f-amendment-1-vessel-modifications-pre-approval-by-mca/min-593-amendment-1-vessel-modifications-pre-approval-by-mca> (last accessed on 18 October 2023).

<sup>29</sup> United States Marine Safety Center, Procedure: GEN-06 (14 January 2021), *Major Conversion Determinations*, at <https://www.dco.uscg.mil/Portals/9/MSC/PRG/PRG.GEN-06.2021.01.14.Major%20Conversion%20Determinations.pdf> (last accessed on 18 October 2023).

<sup>30</sup> TSB marine transportation safety investigation reports M20A0434, M19A0025, M18A0425, M15P0286, M15A0189, and M00C0033.

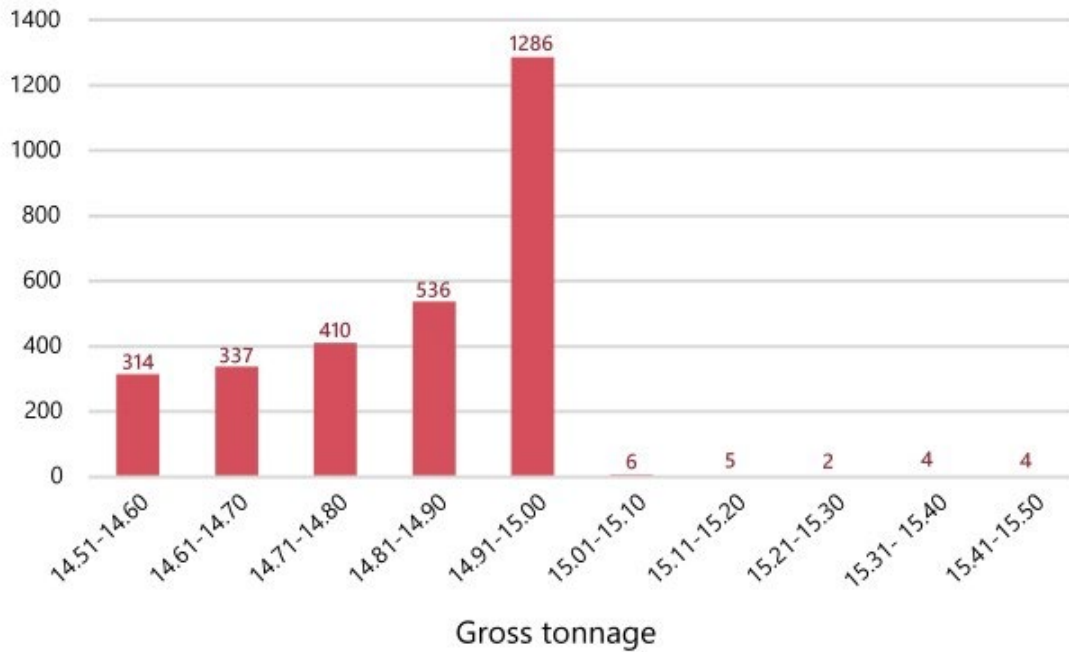
than 15 GT. Starting in 2017, the FVSR apply, and these include the same safety standard. For example, these regulations include specifications for items such as mechanical bilge pump arrangements; underwater fittings; engine shaft diameters; watertight decks, hatchways, and bulkheads; freeing ports; ventilation; and emergency lighting. The SFVIR did not have a specified safety standard for these items for vessels of 15 GT or less, and, subsequently, the FVSR does not either.

After a vessel is built and before it can be registered with TC, gross tonnage must be measured or assigned to replace the gross tonnage estimated at the planning stage. Gross tonnage may be measured according to the International Tonnage Convention or by using a simplified method based on length, breadth, and depth measurements.<sup>31</sup> TC does not verify measurements recorded in the registry. Many fishing vessels are registered with a gross tonnage of just under 15 GT (Figure 6). The TSB has found that many fishing vessel owners are unaware of the requirement to register this size of vessel, and there are many unregistered fishing vessels for which the exact gross tonnage is unknown. Some of these unregistered vessels are being registered as a result of ongoing work by both DFO and TC in response to TSB Recommendation M22-01. As these fishing vessels are registered, they are measured, and some are found to be of 15 GT or more.

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<sup>31</sup> Vessels of under 12 m in length may also use an assigned formal tonnage. For example, for vessels of 10 m or more but less than 12 m in length, the assigned formal tonnage is 14.99 GT. (Transport Canada, TP 13430E, *Standard for the Tonnage Measurement of Vessels*, at <https://tc.canada.ca/en/marine-transportation/marine-safety/standard-tonnage-measurement-vessels-tp-13430-e#part-3-tonnage-measurement-of-ships-less-than-24-metres-in-length-3-1-general> [last accessed on 18 October 2023]).

Figure 6. Number of fishing vessels registered with Transport Canada by gross tonnage, from 14.51 to 15.50 gross tonnage (Source: TSB, based on Transport Canada registry data from 12 July 2022)



### 1.9.3 Vessel certification timeline

The *Tyhawk* entered service in 2001. Because the initial estimate of gross tonnage was less than 15 GT, the vessel did not require an inspection certificate and was not inspected by TC.<sup>32</sup>

In 2006, Elsipogtog First Nation initiated registration of the *Tyhawk* and provided a gross tonnage of 14.75 GT. In 2011, as part of the registration process, the *Tyhawk* was measured by a certified tonnage measurer and found to be 15.23 GT. This gross tonnage was entered in the TC registry. As a result, in 2012, the *Tyhawk* became subject to TC oversight for vessels of more than 15 GT, which includes inspections for certification.

In April 2013, TC inspected the *Tyhawk*. The removable deck was in place at the time of the inspection. The duration of a certificate resulting from an inspection without deficiencies is 48 months. In this case, the certificate was issued for a period of 6 months, until October 2013. The inspection certificate was issued with a lengthy deficiency notice of regulatory non-compliances attached. The notice included an undersized engine shaft, a requirement to add an escape hatch, and a requirement to perform a stability assessment because the vessel had been modified by the addition of the removable deck. The AR or master was required to complete a stability questionnaire. These deficiencies needed to be addressed so that the *Tyhawk* could comply with the safety standard for vessels of more than 15 GT.

<sup>32</sup> If the plans for a vessel show that it will be more than 15 GT, an inspection is required before the vessel enters into service.

In May 2014, TC conducted a follow-up inspection on the *Tyhawk*. The stability questionnaire that was required to be completed the previous year remained incomplete. The inspector issued another short-term inspection certificate for 6 months until October 2014.

In May 2015, TC conducted another follow-up inspection. During this inspection, the master completed and submitted the stability questionnaire (Appendix A provides the questionnaire form). The master identified the removable deck as being on board but did not identify it as a stability risk factor that contributed substantial top-side weight.<sup>33</sup> The master also identified traps/pots and a loading boom/crane as being on board. An inspection certificate was issued for the rest of the term, which expired in April 2017.

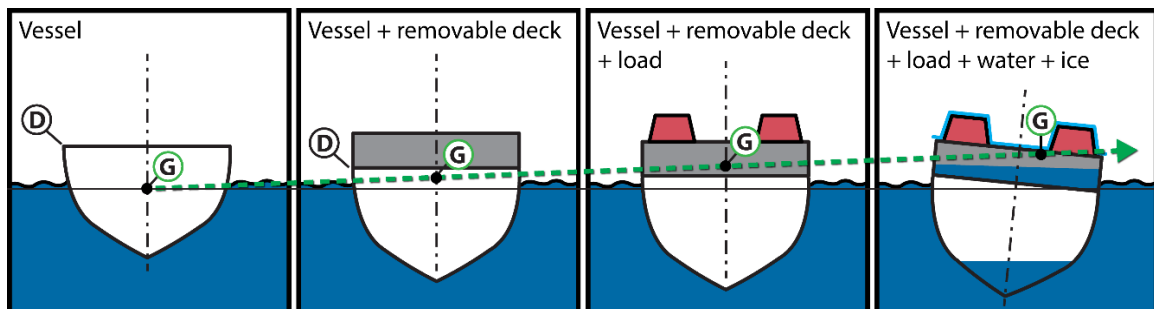
In April 2017, TC inspected the *Tyhawk* again. An inspection certificate for the full term (4 years) was issued, and no deficiencies were noted. Records show that some, but not all, of the items on the original June 2013 deficiency notice had been addressed. The removable deck was not in place at the time of the inspection, and TC considered that the deficiencies related to the removable deck identified in 2013 no longer existed.

The *Tyhawk* did not have any Marine Technical Review Board exemptions or equivalencies in place.

## 1.10 Stability

Stability refers to a vessel's ability to return to an upright position when disturbed by an external force, such as wind and waves or fishing operations. There are numerous factors that can affect a vessel's stability, such as its watertight integrity, the effects of additions or modifications, the amount and location of gear and catch on board, ice accumulation, its freeboard, and spaces where water can accumulate (Figure 7). All fishing vessels are required to have adequate stability to safely carry out fishing operations.<sup>34</sup>

Figure 7. Diagram of stability changes as the vessel acquires weight from modifications and operations, showing the position of the downflooding point (D) and how the freeboard decreases and the centre of gravity (G) rises (Source: TSB)



<sup>33</sup> TSB Marine Investigation Report M09L0074 describes another occurrence in which stability risk factors were not identified on the TC stability questionnaire.

<sup>34</sup> Transport Canada, C.R.C., c. 1486, *Fishing Vessel Safety Regulations* (as amended 23 June 2021), section 3.45 and subsection 3.46(2).

Vessel characteristics that affect stability include the following:

- **Centre of gravity:** The location of the centre of gravity is affected by the shape of the vessel, the weight of the vessel and its contents, and how the weight is distributed. Weight overall affects how low the vessel sits in the water (freeboard).
- **The lowest point where water can enter (the downflooding point):** This point differs depending on the construction of the vessel. For an open vessel, this point is normally at the top of the bulwarks.
- **Spaces where fluids, fish, or similar items can accumulate and move around freely with the motion of the vessel:** Water or fish trapped on deck or in bilges will seriously threaten a vessel's stability by causing the centre of gravity to shift due to the free surface effect.

Understanding a vessel's stability and how it is affected by different factors is important for estimating risks. For many fish harvesters, experiencing a vessel's movements in a variety of operating conditions is their sole indication of whether a vessel is stable.<sup>35</sup> However, this is not the same as measuring the vessel's ability to right itself, which can be done only by performing a stability assessment and documenting the results, in a stability booklet.<sup>36</sup> Regulations require that stability assessments be performed by "competent persons," as defined by the FVSR.<sup>37</sup> The AR and master are required to identify factors that affect stability. The roles and responsibilities of the AR are defined in the CSA 2001. Unlike masters and other marine personnel, ARs do not require certification or training. Masters receive stability training for certification. In this occurrence, the master had a Certificate of Service, which is based on years of service and does not require stability training.

The FVSR require fishing vessels to have a stability assessment if they are operating in freezing spray.<sup>38</sup> These assessments should provide safe operating limits to masters and crews, such as minimum freeboard to maintain, maximum cargo to load, as well as safe sequences for loading and stowing cargo and gear, and for managing ice accumulation and free surface effects.

Ship Safety Bulletin (SSB) 04/2000<sup>39</sup> warns of the dangers of undetected accumulation of water on fishing vessels and recommends the use of bilge alarms. SSB 09/2002<sup>40</sup> describes the need for maintenance and testing of bilge pump and water detection systems.

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<sup>35</sup> TSB Marine Investigation Report M09Z0001, Safety Issues Investigation into Fishing Safety in Canada.

<sup>36</sup> In 2022, a simplified stability assessment cost about \$2200 and a full assessment averaged \$10 000.

<sup>37</sup> Transport Canada, C.R.C., c. 1486, *Fishing Vessel Safety Regulations* (as amended 23 June 2021), subsection 3.53(1).

<sup>38</sup> *Ibid.*, subsection 3.05(1).

<sup>39</sup> Transport Canada, Ship Safety Bulletin 04/2000: Flooding Detection on Fishing Vessels, at <https://tc.canada.ca/en/marine-transportation/marine-safety/ship-safety-bulletins/bulletin-no-04-2000> (last accessed on 19 October 2023).

<sup>40</sup> Transport Canada, Ship Safety Bulletin 09/2002: Bilge Pumping Systems: Early Detection Saves Lives, at <https://tc.canada.ca/en/marine-transportation/marine-safety/ship-safety-bulletins/bulletin-no-09-2002> (last accessed on 19 October 2023).



Neither the *Tyhawk's* original stability nor the effects of the removable deck on its stability were ever formally assessed.

### 1.10.1 Vessel construction

Adequate vessel stability begins with the original design and construction of the vessel. A vessel of closed construction has a fixed watertight deck covering the entire hull above the deepest operating waterline and freeing ports with an area not larger than 4% of the bulwark area. For these vessels, buoyancy and stability are mainly provided by the volume of the hull below the deck, which is designed and maintained to be watertight. When the deck is surrounded by a bulwark, the size, number, and location of freeing ports in the bulwark should be sufficient<sup>41</sup> to drain water freely and quickly overboard to avoid a reduction in stability from free surface effect.

A vessel of open construction (open vessel) does not have a watertight deck and relies on bilge pumps fitted below the deck to remove any water that enters the vessel. Buoyancy and stability are provided by the watertight hull, which extends to the top of the bulwarks. Although an open vessel may have scuppers to drain the deck while washing it down, scuppers are usually closed when the vessel is at sea and are not intended to function as freeing ports. An open vessel is vulnerable to swamping as a result of water coming over the sides, especially if the vessel has minimal freeboard.<sup>42</sup> The risk of swamping may be mitigated by limiting operations to relatively calm waters and providing means to efficiently remove any water. An open vessel is usually of less than 15 GT.

The *Tyhawk* was built as an open vessel, on which the deck was not watertight and bilge pumps were the means of shedding water. The *Tyhawk* routinely operated with the removable deck in place. When the vessel operated with the removable deck, as was the case during the 2013 inspection, TC's 2013 deficiency notice noted that the "portable deck converts hull from open to closed."

### 1.10.2 Stability guidance

In anticipation of the FVSR coming into force, TC established an interim measure to determine whether inspected fishing vessels of more than 15 GT would require a stability booklet. SSB 04/2006<sup>43</sup> introduced a stability questionnaire for masters and ARs. This questionnaire continues to be used to guide ARs and masters in identifying stability risk factors and helping them decide what to do if these factors are present.

The questionnaire is divided into vessel particulars (sections 1 and 2) and stability requirements, including risk factors (sections 3 and 4). On the questionnaire, there is no

<sup>41</sup> Transport Canada, C.R.C., c. 1486, *Fishing Vessel Safety Regulations* (as amended 06 October 2020), subsection 29.1(1).

<sup>42</sup> Swamping was identified as a factor in the following TSB marine transportation safety investigation reports: M20A0258, M20A0160, M19A0025, M16A0327, and M14A0289.

<sup>43</sup> Transport Canada, Ship Safety Bulletin 04/2006: Safety of Small Fishing Vessels: Information to Owners/Masters about Stability Booklets, at <https://tc.canada.ca/en/marine-transportation/marine-safety/ship-safety-bulletins/bulletin-no-04-2006> (last accessed on 19 October 2023).

guidance to connect the vessel particulars and the stability risk factors or to refer to other sources of guidance (Appendix A provides the full questionnaire).

The SSB's *Purpose* section states that owners (ARs) and masters are strongly encouraged to have a stability assessment for their vessels if any risk factors are identified. Potential stability risk factors are described using terms such as "substantial" and "significant."

On the completed stability questionnaire for the *Tyhawk*, multiple decks, traps/pots, and loading boom/crane were identified in vessel particulars, and no stability risk factors were identified in stability requirements.

Independently of the stability questionnaire, SSB 01/2008<sup>44</sup> was issued to explain how modifications can affect vessel stability. SSB 01/2008 provided guidelines on how to voluntarily record modifications and when to have stability evaluated. SSB 03/2019,<sup>45</sup> which superseded SSB 01/2008, explains that, in accordance with the FVSR, when a fishing vessel undergoes a major modification (or a change in activity that is likely to adversely affect its stability), a stability assessment is required. It also introduced a new form, Fishing Vessel Record of Modifications Affecting Stability, that indicates that modifications over 100 kg should be recorded and that a competent person should be consulted when the weight of modification(s) becomes significant (a change of 2% of displacement is given as a guide). This SSB also highlights the obligation to update operational procedures when a vessel is modified, to account for changes that may affect stability, and to provide a new owner with any vessel records when ownership of a fishing vessel is transferred. Small commercial vessels other than fishing vessels have less specific guidance on modifications available.<sup>46</sup>

It is fairly common for a fishing vessel to be modified several times over its lifetime, to a point where the modifications have affected its stability.<sup>47</sup> In 2018, TC provided guidance to

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<sup>44</sup> Transport Canada, Ship Safety Bulletin 01/2008: Fishing Vessel Safety: Record of Modifications, at <https://tc.canada.ca/en/marine-transportation/marine-safety/ship-safety-bulletins/fishing-vessel-safety-record-modifications-ssb-no-01-2008> (last accessed on 19 October 2023). This bulletin has been replaced by SSB 03/2019.

<sup>45</sup> Transport Canada, Ship Safety Bulletin 03/2019: Fishing Vessel Safety Regulations: Stability, major modifications and record of modifications, at <https://tc.canada.ca/en/marine-transportation/marine-safety/ship-safety-bulletins/fishing-vessel-safety-regulations-stability-major-modifications-record-modifications-ssb-no-03-2019> (last accessed on 19 October 2023).

<sup>46</sup> Vessels built in or before 2005 were covered under Transport Canada, TP 14619E, *Transport Canada Simplified Assessment of Intact Stability & Buoyancy of Small Non-Pleasure Vessels: Assessment Guide*, at <https://tc.canada.ca/en/marine-transportation/marine-safety/tp-14619-transport-canada-simplified-assessment-intact-stability-buoyancy-small-non-pleasure-vessels-assessment-guide> (last accessed on 19 October 2023). Vessels built after 2005 are covered under International Standards Organization, ISO 12217-1, *Small Craft Stability and Buoyancy Assessment and Categorization*.

<sup>47</sup> TSB Marine Investigation Report M09Z0001, Safety Issues Investigation into Fishing Safety in Canada.

owners and operators to help them identify major modifications or changes in activity and determine adequate stability.<sup>48,49</sup>

### 1.10.3 Removable decks and stability

A removable deck may adversely affect the stability of a vessel as follows:

- First, the weight of the deck raises the vessel's centre of gravity, reducing the vessel's capacity to right itself when rolled.
- Second, all gear, cargo, and personnel loaded on the removable deck are at a higher position on the vessel, which further raises the centre of gravity and further reduces a vessel's capacity to right itself. Ice accumulation also adds weight higher on the vessel.
- Third, the removable deck provides an uninterrupted space below which water can accumulate, creating a free surface effect.

TC's *Guidelines for fishing vessel major modification or a change in activity*<sup>50</sup> warn fish harvesters that having a removable deck in place will negatively affect a vessel's stability. Compliance with this guidance is voluntary.

Using the lightship displacement of a vessel similar in length, breadth, and depth to the *Tyhawk*, the investigation estimated the removable deck to be nearly 8% of the vessel's lightship displacement.

## 1.11 Fishing safety

Fishing safety is the responsibility of the AR, master, and crew of the vessel. Fishing safety is governed and affected by others, such as TC, DFO, and provincial workplace safety organizations. Fish harvesters must interact with TC to obtain Canadian maritime documents for their vessels and crews and to demonstrate compliance with regulations. Fish harvesters must also interact with DFO to obtain licences and to report on catch and activity, as required. Fish harvesters may also be part of DFO advisory and decision-making committees.

The AR of a vessel is required to act on all matters related to a vessel that are not otherwise assigned to any other person under the CSA 2001. Specifically, ARs are responsible for ensuring that the vessel and its machinery and equipment meet the regulations, developing procedures to safely operate the vessel and to deal with emergencies, and ensuring that

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<sup>48</sup> Transport Canada, TP 15392E, *Guidelines for fishing vessel major modification or a change in activity*, at <https://tc.canada.ca/en/marine-transportation/marine-safety/tp-15392e-guidelines-fishing-vessel-major-modification-change-activity> (last accessed on 19 October 2023).

<sup>49</sup> Transport Canada, TP 15393E, *Adequate stability and safety guidelines for fishing vessels*, at <http://www.tc.gc.ca/eng/marinesafety/adequate-stability-safety-guidelines-fishing-vessels.html> (last accessed on 19 October 2023).

<sup>50</sup> Transport Canada, TP 15392E, *Guidelines for fishing vessel major modification or a change in activity*, section 5, at <https://tc.canada.ca/en/marine-transportation/marine-safety/tp-15392e-guidelines-fishing-vessel-major-modification-change-activity> (last accessed on 19 October 2023).

crew members receive safety training.<sup>51</sup> The master of a vessel is required to take all reasonable steps to ensure the safety of the vessel and of persons who are on board.<sup>52</sup> Furthermore, the FVSR indicate that the master and AR are both responsible for ensuring that the regulations are followed.<sup>53</sup>

The TSB's Safety Issues Investigation into Fishing Safety in Canada (SII on fishing safety),<sup>54</sup> a comprehensive national review of safety issues in the fishing industry, revealed a complex relationship and interdependence among these issues. The SII on fishing safety identified 10 significant safety issues that are interconnected and that require attention, of which the following are analyzed in this occurrence:

- Vessel stability, vessel modifications, and knowledge of stability principles
- Regulatory approach to safety
- Work practices in fishing operations
- How fisheries management measures identify and reduce safety risks

Other unsafe conditions identified in the SII on fishing safety were also noted, but not analyzed in the investigation of this occurrence (Appendix B). The safety of fish harvesters will continue to be compromised until the fishing community recognizes and addresses the complex relationship and interdependence among safety issues.

### 1.11.1 Collaboration between Fisheries and Oceans Canada and Transport Canada

TC, DFO, and the Canadian Coast Guard have signed a *Memorandum of Understanding between Fisheries and Oceans Canada (DFO) and Transport Canada (TC) regarding safety at Sea of Commercial Fish Harvesters* (MOU) to ensure collaboration on safety at sea for commercial fish harvesters. The MOU was first signed in 2006 and was updated in 2015.<sup>55</sup> It states that each participating organization must establish principles to promote a safety culture and consider the safety of fish harvesters when creating or revising rules, regulations, policies, and plans that affect fish harvesters. The MOU also states that the organizations will meet as required to discuss fishing vessel safety issues. All participating organizations at the national and regional levels should discuss safety issues through the advisory process, and results will be reflected in documents such as DFO's integrated fisheries management plans (IFMPs) if required.<sup>56</sup>

<sup>51</sup> Government of Canada, S.C. 2001, c. 26, *Canada Shipping Act, 2001* (as amended 30 July 2019), subsection 106(1).

<sup>52</sup> *Ibid.*, subsection 109(1).

<sup>53</sup> Transport Canada, *Fishing Vessel Safety Regulations* (as amended 23 June 2021), section 3.02.

<sup>54</sup> TSB Marine Investigation Report M09Z0001, Safety Issues Investigation into Fishing Safety in Canada.

<sup>55</sup> Transport Canada, TP 13585E, *Memorandum of Understanding Between Fisheries and Oceans Canada (DFO) and Transport Canada (TC) Regarding safety at Sea of Commercial Fish Harvesters* (06 November 2015), at <https://tc.canada.ca/en/marine-transportation/marine-safety/memorandum-understanding-between-fisheries-oceans-canada-dfo-transport-canada-tc-regarding-safety-sea-commercial-fish-harvesters> (last accessed on 19 October 2023).

<sup>56</sup> *Ibid.*

Although DFO does not have a fishing safety policy, it does acknowledge that it has a role to play in incorporating safety into the development of fishery management plans and policies.<sup>57</sup>

## 1.12 The snow crab fishery

The snow crab fishery is an important fishery for Atlantic fish harvesters. It is the first fishery of the year for many fish harvesters, including Elsipogtog First Nation.

The snow crab fishery in the southern Gulf of St. Lawrence is separated into several catch areas, called “crab fishing areas.”<sup>58</sup> Catch can be landed only at certain designated ports, which are detailed in the fishing licence.<sup>59</sup> Area 12, where the *Tyhawk* was fishing, generally opens between mid-April and early May. The snow crab fishery in area 12 often starts at midnight on the opening day.

In the snow crab fishery, total allowable catch (TAC) is set for all of area 12. Indigenous communities are issued communal licences.<sup>60</sup> Communal licence holders are assigned a percentage of the TAC and may allocate traps to designated vessels the way that is most favourable to them; there is a maximum of 150 traps per vessel. In 2020, Elsipogtog First Nation designated 29 vessels to harvest snow crab, including the *Tyhawk* and the *Lady Margaret I*. In 2021, Elsipogtog First Nation designated 27 vessels to harvest snow crab, including the *Tyhawk* but not the *Lady Margaret I*. The *Lady Margaret I*'s traps were allocated to the *Tyhawk* and the per-pound price earned by the crew was set higher because they were combining allocations.

### 1.12.1 Fisheries and Oceans Canada plans and measures

DFO's role is to protect and manage Canada's fisheries, to ensure economic opportunities for coastal communities and fisheries, and to protect and restore Canada's oceans and marine ecosystems.<sup>61</sup> For these roles, DFO sets policies and participates in international agreements; it develops, implements, and manages fisheries measures and decisions (including protection measures); and enforces fisheries resource management (FRM) measures. The Canadian Coast Guard, which, among its roles, provides search and rescue services, is also part of DFO.

A key process in fisheries management is the development and implementation of an IFMP, which is approved by the minister. In most fisheries, an IFMP is a multi-year plan. IFMPs

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<sup>57</sup> Fisheries and Oceans Canada, “Roles and responsibilities,” at <https://www.dfo-mpo.gc.ca/fisheries-peches/safety-securite/roles-eng.html> (last accessed on 19 October 2023).

<sup>58</sup> The southern Gulf of St. Lawrence also includes Area 19, which has a different season and opening date.

<sup>59</sup> Designated ports are ports where the organizations that monitor landings for DFO operate (dockside monitoring). DFO designates the organizations that monitor landings by region and the ports by fishery.

<sup>60</sup> Fisheries and Oceans Canada, SOR/93-332, *Aboriginal Communal Fishing Licences Regulations* (as amended 01 April 2009).

<sup>61</sup> Fisheries and Oceans Canada, “Mandate and role,” at <https://www.dfo-mpo.gc.ca/about-notre-sujet/mandate-mandat-eng.htm> (last accessed on 19 October 2023).

define and communicate the objectives of a specific fishery, including allocation and management of TAC and management of gear; the specific management measures to maintain the sustainability of the resource; and other relevant legislation, regulations, and policies. An IFMP<sup>62</sup> is developed through a complex consultation process. Consultation includes industry stakeholders, fish harvesters, First Nation communities, ecosystem and ocean scientists, and others, and it considers scientific, industry-based, and socio-economic factors. DFO recommends that resource managers include a section on safety at sea in IFMPs, although not all plans contain this section. In some regions, safety advocates such as TC and workplace safety organizations contribute to the *Safety at sea* section.

The area where the *Tyhawk* was fishing is managed under the Southern Gulf of St. Lawrence Snow Crab IFMP<sup>63</sup> and overlaps with the habitat of the North Atlantic right whale (NARW), which is a species at risk.<sup>64</sup> The NARW is threatened as a result of vessel noise, disturbance and collisions, injury and mortality from fishing gear entanglement, and habitat change and loss. In 2017, after 17 NARW incidents in the Gulf of St. Lawrence (12 deaths and 5 entanglements), DFO closed the Gulf of St. Lawrence snow crab fishery early as an emergency protection measure.<sup>65</sup> Beginning in the 2018 season, fisheries management measures were created to protect the NARW, including temporary closures and the exploration of new fishing technologies and methods. For the snow crab fishery, these protection measures also included changing the season closing date, which shortened the season by almost one third. DFO, the U.S. National Oceanic and Atmospheric Administration,<sup>66</sup> TC, and industry representatives participated in and advised on the development of these protection measures.

Once approved, the IFMP is reviewed by the Southern Gulf of St. Lawrence Snow Crab Advisory Committee. This advisory committee comprises various sections of the fishing industry, including TC when invited, and meets to provide a forum for consultation on matters such as TAC and other management measures and to provide advice to the Minister of Fisheries and Oceans. At the 2021 advisory committee meeting, TC gave a presentation about vessel registration. The advisory committee updates the terms of reference for the Committee for Setting the Opening Date for the Fishery Area 12 Snow Crab (a subcommittee), which defines the protocol for proposing the season-opening date.

In 2018, a Pan-Atlantic Roundtable on North Atlantic right whales meeting was held, at which participants offered suggestions and advice for consideration when developing the

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<sup>62</sup> Fisheries and Oceans Canada, "Preparing an Integrated Fisheries Management Plan (IFMP)" (30 January 2013), at <https://www.dfo-mpo.gc.ca/fisheries-peches/ifmp-gmp/guidance-guide/preparing-ifmp-pgip-elaboration-eng.html> (last accessed on 19 October 2023).

<sup>63</sup> Fisheries and Oceans Canada, "Integrated Fisheries Management Plan - Snow Crab in the Southern Gulf of Saint Lawrence," at <https://www.glf.dfo-mpo.gc.ca/glf/en/integrated-fisheries-management-plan-snow-crab-southern-gulf-saint-lawrence> (last accessed on 19 October 2023).

<sup>64</sup> Government of Canada, S.C. 2002, c. 29, *Species at Risk Act* (as amended 03 February 2022).

<sup>65</sup> Fisheries and Oceans Canada, "A summary of comments from the 2018 Pan-Atlantic Roundtable on North Atlantic right whales," at <https://www.dfo-mpo.gc.ca/species-especies/publications/mammals-mammiferes/2018-roundtable-table ronde/index-eng.html> (last accessed on 19 October 2023).

<sup>66</sup> The whale incidents also affected U.S. fisheries and regulators.

2019 protection measures. The participants included representatives from the fishing industry across Atlantic Canada and the Minister of Fisheries and Oceans. One suggestion was to open the snow crab fishery 10 to 15 days early to allow the catch before the arrival of the NARW. In 2020, as a measure to reduce the economic impact of the early season closure, the advisory committee amended the terms of reference to encourage the subcommittee to open the fishery as early as possible.

### 1.12.2 Annual decision for the snow crab season-opening date

The season-opening date is set by DFO based on the proposal of the subcommittee. The terms of reference for the subcommittee include its mandate, membership, and safety factors to consider for the opening. In 2021, this subcommittee was made up of 17 members. Of the 17 members, 13 were from the industry and 4 were from government (Appendix C). Industry is responsible for chairing the meetings, and other participants can be invited as necessary. In 2021, the director of fisheries from Elsipogtog First Nation was a member.

The subcommittee coordinates activities related to the season opening and ensures that the season opens in the safest way possible. The terms of reference require the subcommittee to consider the following safety factors every year:

- Ice conditions in the southern Gulf of St. Lawrence
- Ice-free access to the wharves designated for landing snow crab (for which DFO makes all necessary efforts to provide icebreaking services)
- Wind speed and freezing spray forecasts

At the final subcommittee meeting on 01 April 2021,<sup>67</sup> a consensus was reached and a date was proposed that was almost 3 weeks earlier than dates for the previous 4 years.

The meeting minutes noted that 2 members expressed concern about the proposed opening date because of safety and readiness, given the forecast weather conditions and the ice conditions at their home ports. The subcommittee concluded that the terms of reference did not require all ports to be ice-free and that it remained the responsibility of masters to ensure that it was safe to proceed on the opening day.

DFO requires 48 hours' notice of an agreed-upon opening date. After the subcommittee proposes a season-opening date, DFO reviews the proposal, advice, and weather forecasts at 36 hours before the proposed opening date and then makes the final decision. DFO does not keep records of discussions at these final meetings.

In 2021, the weather forecast met the criteria to open the season, and the fishery was opened on 03 April. Table 1 shows the opening dates for the fishery from 2017 to 2021.

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<sup>67</sup> The subcommittee met 4 times, on 15 March, 22 March, 29 March, and 01 April 2021.

**Table 1. Planned season dates, planned season length, and actual season length for snow crab fishing area 12 from 2017 (the year when the NARW emergency measures began) to 2021**

Year	Planned season dates	Planned season length (days)	Actual season length (days)
2017	25 April to 28 July	95	87
2018	29 April to 01 July	64	64
2019	02 May to 01 July	61	61
2020*	24 April to 01 July	69	69
2021	03 April to 30 June	89	89

\*In 2020, 1 part of the fishery area was temporarily closed for 15 days beginning on 16 May.

### 1.13 Risk management

Managing risks means making decisions about how to mitigate or eliminate risks that have been identified and assessed. The general steps of risk assessment are to ask the following:<sup>68</sup>

- What might possibly go wrong? (Identify hazards)
- How serious could the effects be? How likely are they? (Assess risks)
- Can matters be improved? (Analyze risk-control measures)
- What would it cost and how much better would it be? (Cost-benefit assessment)
- What actions should be taken? (Make recommendations to decision makers)

There are 4 ways to manage identified risks: transfer, eliminate, accept, or mitigate. Once risks are managed, it is important to assess any residual risks introduced by the measures selected. In the context of FRM measures and decisions, for example, this means that any measures to reduce the harm to a species or to protect income need to be further assessed for any residual risks.

These general risk-management steps are linear and work well in simple situations. Complexity and frequency of the risk-based decisions being made factor into how risks are managed.

In more complex situations, hazards exist in multiple areas, interacting and creating additional hazards. As well, hazards may affect individuals involved in the situation differently. A risk assessment for a complex situation needs to be more comprehensive, considering multiple concerns and pressures, including interactions and cumulative effects. As well, it is important to ensure that independent expertise for all relevant areas is included. For DFO, the situations are complex, and FRM decisions must balance economic, conservation, and safety concerns. In this occurrence, in addition to these concerns,

<sup>68</sup> International Maritime Organization, MSC-MEPC.2/Circ. 12/Rev. 2 (09 April 2018), Revised Guidelines for Formal Safety Assessment (FSA) for use in the IMO rule-making process, at <https://wwwcdn.imo.org/localresources/en/OurWork/Safety/Documents/MSC-MEPC%202-Circ%2012-Rev%202.pdf> (last accessed on 19 October 2023).



international and time pressures related to the NARW protection measures increased the complexity of the decisions.

For routine situations, hazards have typically been thoroughly identified and assessed beforehand. Therefore, the results of previous hazard identification and risk assessment stages can be relied on and the focus of risk management can shift to the cost-benefit assessment and recommendation stages. DFO opens fishing seasons regularly, and the decision about opening the 2021 snow crab season was managed as a routine situation rather than as a new situation. New situations also benefit from a comprehensive risk assessment.

### 1.13.1 Hazard identification

The quality of a risk assessment depends on the completeness of the hazard identification stage. To identify hazards completely, a list of all relevant scenarios, with potential causes, contributing factors, and outcomes, must be identified, and the hazards and associated risks must be listed. To make this step effective, a wide variety of sources of risk information should be considered and involved, such as previous incidents, expert opinions, and regulatory guidance.

The ability to detect and identify hazards depends particularly on the risk assessment team's understanding and tolerance of risk.<sup>69</sup> Many factors influence risk perception and tolerance, including the nature of the hazardous activity, pressure to accept risk, local and global experiences, and the outcomes and consequences of previous decisions.

### 1.13.2 Decision making

Risks associated with each hazard must be assessed according to the possible consequences if humans or property are exposed to the hazards. This is done by defining the probability and severity of a consequence that could result from the hazard. For effective decision making, clear criteria defining what level of risk is acceptable must be understood. This applies to both risks and residual risks.

## 1.14 Cold-water immersion

When crew members are at sea, there is a risk that they may be exposed to the hazards associated with water immersion. The main effects are caused by cold-water exposure (water 15 °C or colder) and water ingestion. If a person enters the water, immersion is followed by physical and psychological effects:<sup>70</sup>

- The person will experience a large gasp and subsequent hyperventilation, causing small muscle spasms, within the first 2 minutes (cold shock response). If the person's mouth is below water level, water is aspirated into the lungs. There can also be a rapid and significant increase in heart rate and blood pressure, particularly in older or less healthy people.

<sup>69</sup> J. Inouye, *Risk Perception: Theories, Strategies, and Next Steps* (National Safety Council, 2014), pp. 1–12.

<sup>70</sup> F. Golden and M. Tipton, *Essentials of Sea Survival* (Human Kinetics, 2002), pp. 51–117.

- Muscles are affected within 5 to 30 minutes (cold incapacitation). The fine muscles of the hands may be the first to be affected, reducing the ability to don or hold onto a flotation device. Cognition will progressively become impaired.
- The body begins to cool (hypothermia). The full effects of hypothermia usually require at least 30 minutes.
- Some people may experience impaired thinking and ineffective performance (declining cognitive ability), resulting from states such as confusion and paralyzing anxiety, or from becoming stunned and bewildered. Other body responses may then result from confusion, anxiety, or similar states, such as a rapid heart rate, trembling, weakness and nausea, all of which can exacerbate the effects of cold-water immersion, particularly hyperventilation, which will then increase the probability of water intake.

As a result of any of these effects, the person may eventually drown.

Life rafts, lifejackets, personal flotation devices (PFDs), and immersion suits are lifesaving appliances that protect against the effects of cold-water immersion. The FVSR require the carriage of lifejackets and PFDs. Lifejackets are designed for vessel abandonment, and PFDs are designed for continuous use while working on deck. Federal regulations<sup>71</sup> require fish harvesters to wear PFDs or lifejackets if a risk to harvesters is present. However, many fish harvesters continue to work on deck without wearing a PFD, stating that it is not practical, normal, or necessary to use one.<sup>72</sup> For vessels on near-coastal Class 2 voyages, the FVSR also require a life raft with sufficient capacity to carry the number of persons on board, an EPIRB, and immersion or anti-exposure work suits for each person on board if the water temperature is less than 15 °C.<sup>73</sup> Life rafts must be stored in a manner that allows them to float free if the vessel sinks.<sup>74</sup>

The *Tyhawk* was carrying PFDs and lifejackets. The crew members were fishing without wearing PFDs. The *Tyhawk* was carrying a 6-person life raft, which was stored unsecured aft of the wheelhouse.

## 1.15 Fatigue and sleep inertia

Fatigue can lead to impairments in general cognitive functioning, problem solving, decision making, memory, attention, vigilance, and reaction time. When a person is fatigued, it takes longer to perceive, interpret, understand, and react to normal and emergency events.<sup>75</sup>

<sup>71</sup> Transport Canada, C.R.C., c. 1486, *Fishing Vessel Safety Regulations* (as amended 23 June 2021), section 3.09.

<sup>72</sup> TSB Marine Investigation Report M09Z0001, Safety Issues Investigation into Fishing Safety in Canada, stated that fish harvesters often underestimate the risk of falling overboard.

<sup>73</sup> Transport Canada, C.R.C., c. 1486, *Fishing Vessel Safety Regulations* (as amended 23 June 2021), subsection 3.28(1).

<sup>74</sup> *Ibid.*, section 3.29.

<sup>75</sup> International Maritime Organization, "Fatigue," at <https://www.imo.org/en/OurWork/HumanElement/Pages/Fatigue.aspx> (last accessed on 19 October 2023).

Fatigue is widespread in the fishing industry due to many factors, including high crew workload, unsafe operating practices, adverse weather conditions, and insufficient awareness of fatigue and its effects. Fish harvesters rarely have training in risk factors for fatigue, operational conditions that contribute to fatigue, and strategies for managing fatigue. Such training is not required for crews. TC has established hours of work and rest requirements, but these do not apply to fishing vessels of less than 100 GT.<sup>76</sup>

Sleep inertia is a period of confusion and decreased alertness after sudden awakening. Sleep inertia impairs the essential cognitive abilities of vigilance and alertness necessary for rational decision making and can reduce decision-making performance for up to 30 minutes.<sup>77</sup> Sleep inertia is influenced by many fatigue factors, particularly the sleep stage before awakening and prior sleep deprivation.<sup>78</sup>

Certain risk factors can be examined to determine the likelihood that a crew member was fatigued at the time of an occurrence: acute sleep disruption, chronic sleep disruption, continuous or prolonged wakefulness, circadian rhythm effects, sleep disorders, medical or psychological conditions, and illnesses or drugs that could lead to fatigue.

Acute sleep disruption is caused by significant reductions in the quantity or quality of sleep. The quantity of sleep is normally considered to be significantly reduced when the reduction is at least 30 minutes. The quality of sleep may be reduced by awakenings or other significant changes to the individual's normal pattern of sleep. When acute sleep disruption is present, 22 hours of wakefulness is the upper limit at which almost all aspects of human performance decline due to fatigue,<sup>79</sup> although impairment can begin after 17 hours of continuous wakefulness. Additionally, because the biological drive for sleep during the night hours is much stronger than during the day hours, fatigue may result following fewer hours of continuous or prolonged wakefulness if these hours are at night rather than during the day; this is true even for regular night workers.<sup>80</sup>

Restorative sleep is required to address fatigue related to any or all of these risk factors. For sleep to be restorative, it should occur at night in a period of at least 7, and up to 9, continuous hours.<sup>81</sup>

Controlled rest (napping following a schedule) is an effective countermeasure for the effects of fatigue when used within a fatigue management strategy or system. Controlled rest, even

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<sup>76</sup> Transport Canada, SOR/2007-115, *Marine Personnel Regulations* (as amended 23 June 2021), section 319.

<sup>77</sup> D. Bruck and D. L. Pisani, "The effects of sleep inertia on decision-making performance," *Journal of Sleep Research*, Vol. 8, Issue 2 (1999), pp. 95–103.

<sup>78</sup> P. Tassi and A. Muzet, "Sleep inertia," *Sleep Medicine Reviews*, Vol. 4, Issue 4 (August 2000), pp. 341–353.

<sup>79</sup> N. Lamond and D. Dawson, "Quantifying the performance impairment associated with fatigue," *Journal of Sleep Research*, Vol. 8, No. 4 (1999), pp. 255–262.

<sup>80</sup> T. Åkerstedt, M. Nordin, L. Alfredsson, et al., "Sleep and sleepiness: an impact of entering or leaving shiftwork – a prospective study," *The Journal of Biological and Medical Rhythm Research*, Vol. 27, No. 5 (2010), pp. 987–996.

<sup>81</sup> M. Hirshkowitz, K. Whiton, S. M. Albert, et al., "National Sleep Foundation's sleep time duration recommendations: methodology and results summary," *Sleep Health*, Vol. 1, Issue 1 (March 2015), pp. 40–43.

for as short a period as 10 to 30 minutes, can be restorative and reduce the risk of impairment from fatigue if taken under appropriate conditions (e.g., in an environment that is conducive to napping).<sup>82</sup> However, this is a temporary fatigue management strategy. Ad hoc, uncontrolled naps and falling asleep spontaneously are not considered restorative sleep. The SII on fishing safety found that fish harvesters accept fatigue as a normal part of doing business and generally do not recognize the signs of fatigue.

During some of the occurrence voyage, crew member 1 was maintaining the watch while the other crew members and the master napped. Crew accommodation space aboard the *Tyhawk* was suboptimal for restorative sleep. For the first voyage, there were 4 bunks for the 9 people on board. The accommodation space was very cold on both voyages.

Crew members 1 and 2 were awake when water was accumulating in the engine compartment was first noticed. The master and the remaining crew members were wakened while the vessel was transiting to the fishing grounds. At the time of the vessel's capsizing, the master had been awake for approximately 37 hours and the crew members had been awake for approximately 34 hours with a few needed, but short, poor-quality, and uncontrolled naps during that time period.

## 1.16 Medical factors

In December 2018, following the legalization of cannabis, TC issued SSB 12/2018, *Legalization of cannabis in Canada and vessel operation*.<sup>83</sup> The purpose of this SSB is to remind ARs and seafarers of their responsibility to operate vessels safely and of the effects of cannabis on human performance.

The use of drugs and alcohol on board fishing vessels has been identified as a growing concern by members of the fishing industry. During the investigation, it was reported that there was cannabis use on the *Tyhawk*. There is no mandatory post-occurrence drug and alcohol testing for individuals involved in occurrences, limiting the ability to determine whether drugs and alcohol were a factor in an occurrence.<sup>84</sup>

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<sup>82</sup> A. J. Tietzel and L. C. Lack, "The recuperative value of brief and ultra-brief naps on alertness and cognitive performance," *Journal of Sleep Research*, Vol. 11, No. 3 (2002), pp. 213–218.

<sup>83</sup> Transport Canada, Ship Safety Bulletin 12/2018: Legalization of cannabis in Canada and vessel operation (12 October 2018), at <https://tc.canada.ca/en/marine-transportation/marine-safety/ship-safety-bulletins/legalization-cannabis-canada-vessel-operation-ssb-no-12-2018> (last accessed on 19 October 2023).

<sup>84</sup> In 2017, the Board recommended that the Department of Transport collaborate with industry to include drug and alcohol testing as part of a comprehensive substance abuse program to reduce the risk of impairment of persons while engaged in safety-sensitive functions (TSB Aviation Investigation Report A15P0081).

## 1.17 Previous occurrences

Over a 10-year period,<sup>85</sup> the TSB investigated 19 occurrences similar to this one, resulting in 34 fatalities. These investigations identified factors that compromise vessel stability, such as reduced freeboard, raised centre of gravity, modifications, and free surface effects.<sup>86</sup>

Over the same period, the TSB recorded 7 additional occurrences, resulting in 11 fishing-related fatalities,<sup>87</sup> that were likely related to stability issues. However, an investigation report was not published for these occurrences.

## 1.18 Active recommendations

### 1.18.1 Stability and personal flotation recommendations

Small fishing vessels<sup>88</sup> represent more than 99% of the entire Canadian fishing fleet of vessels registered with TC. For the majority of these small fishing vessels, such as the *Tyhawk*, there is no requirement for stability assessments or for crew to be provided with understandable stability guidance based on a stability assessment. Following an occurrence on 05 September 2015, in which the large fishing vessel *Caledonian* suddenly capsized 20 NM west of Nootka Sound, British Columbia, and 3 crew members died,<sup>89</sup> the Board recommended that

the Department of Transport require that all small fishing vessels undergo a stability assessment and establish standards to ensure that the stability information is adequate and readily available to the crew.

#### **TSB Recommendation M16-03**

The Board also considered that fish harvesters often operate in harsh physical and environmental conditions, and the risk of going overboard is high. TSB investigations have shown that wearing a PFD increases the chance of survival when people enter the water. The Board therefore also recommended that

<sup>85</sup> From 01 January 2012 to 31 December 2021, the TSB recorded 106 fishing-related fatalities in 70 occurrences.

<sup>86</sup> TSB marine transportation safety investigation reports M21A0315, M20P0229, M20A0434, M20A0160, M18A0454, M18A0425, M18A0303, M18A0078, M18A0076, M17C0061, M17P0052, M16A0327, M16A0140, M15P0286, M15A0189, M14A0289, M14P0121, M12W0062, and M12W0054.

<sup>87</sup> TSB marine transportation safety occurrences M21A0412, M21A0161, M19A0082, M14C0162, M13L0151, M13N0006, and M12M0046.

<sup>88</sup> Small fishing vessels are those of less than 150 GT and less than 24.4 m in length.

<sup>89</sup> TSB Marine Investigation Report M15P0286.

the Department of Transport require persons to wear suitable personal flotation devices at all times when on the deck of a commercial fishing vessel or when on board a commercial fishing vessel without a deck or deck structure and that the Department of Transport ensure programs are developed to confirm compliance.

**TSB Recommendation M16-05**

In the case of the *Tyhawk*, the vessel modifications were not assessed for effects on stability. Stability factors have played a significant role in numerous fishing vessel accidents since 1990. As well, at the time of the occurrence, none of the *Tyhawk's* crew was wearing a PFD.

Since issuing Recommendation M16-03, the TSB has followed up annually with TC on action being taken to address it. As part of its response to M16-03 in December 2022, TC lists multiple initiatives that address fishing safety. However, these initiatives predominantly affect vessels of over 15 GT, rather than the many smaller fishing vessels that have not had their stability assessed. The initiatives include TC's CIC on fishing vessels. The CIC included all sizes of vessel, but the largest proportion consisted of those between 15 GT and 150 GT. The CIC highlighted "Stability and modifications" as an area requiring action, which TC will address by developing new outreach materials, by reviewing the current tools available to Marine Safety inspectors, and by updating its processes.

At the time of report writing, the Board considered the response to Recommendation M16-03 to be Unsatisfactory.<sup>90</sup> TC has stated that it does not intend to take further regulatory steps to make stability assessments mandatory for all small fishing vessels, and it will focus on education and outreach opportunities.

In its December 2022 response to Recommendation M16-05, TC indicated its support for the workplace education and awareness campaigns by various provinces and the fishing industry but views the wearing of PFDs while aboard in all circumstances as requiring a shift in safety culture in the fishing industry. TC also indicated that it will take steps to address the risk of falling overboard through regulatory provisions in phase 2 of the FVSR. These provisions would include mandatory wearing of PFDs on fishing vessels with exposed decks, unless there are guard rails of a specific height, the use of a harness for specific activities, and the use of non-skid paint on decks.

The lack of a regulatory requirement for wearing a PFD leaves the determination of what constitutes a dangerous situation up to individuals. As a consequence, fish harvesters remain vulnerable to rapid changes in circumstances, such as a sudden change in weather or equipment failure. In addition, not wearing a PFD leaves crew members without protection should they enter the water.

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<sup>90</sup> An Unsatisfactory rating is assigned when recommendations have been issued and outstanding for more than 5 years and there is no precise action plan or timeline provided to complete the required safety actions. This rating applies to situations where, in the Board's view, the safety deficiency will continue to put persons, property, or the environment at risk.

At the time of report writing, the Board considered the response to Recommendation M16-05 to be Satisfactory in Part.<sup>91</sup>

In June 2016, the small fishing vessel C19496NB was engaged in lobster fishing with 3 people on board when the vessel rapidly began taking on water and capsized about 0.5 NM from Miller Brook Wharf, Salmon Beach, New Brunswick. Two crew members died. It was determined that none of the crew members were wearing lifejackets or PFDs<sup>92</sup> when the vessel capsized. Because the capsizing occurred quickly, there was no time for the crew members to access and don the lifejackets stowed on board.<sup>93</sup>

The TSB considers that implementing explicit requirements for fish harvesters to wear PFDs would significantly reduce the loss of life associated with going overboard and has already made similar recommendations to TC and WorkSafeNB. In 2017, the Board also recommended that

the government of New Brunswick and WorkSafeNB require persons to wear suitable personal flotation devices at all times when on the deck of a commercial fishing vessel or on board a commercial fishing vessel without a deck or deck structure and that WorkSafeNB ensure that programs are developed to confirm compliance.

#### **TSB Recommendation M17-04**

In the *Tyhawk* occurrence, the situation developed quickly, and there was no time for the crew members to access and don the lifejackets, PFDs, or immersion suits that were stowed on board.

The New Brunswick and WorkSafeNB responses indicate ongoing efforts to develop an education, awareness, and training campaign that includes highlighting the importance of wearing PFDs. Effective 01 June 2024, amendments to the province's *Occupational Health and Safety Act* will include adding fishing vessels to the definition of "place of employment," and the use of PFDs aboard fishing vessels will be required.

The Board considers the response to Recommendation M17-04 to show Satisfactory Intent.<sup>94</sup>

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<sup>91</sup> A Satisfactory in Part rating is assigned if the planned action or the action taken will reduce but not substantially reduce or eliminate the deficiency, and meaningful progress has been made since the recommendation was issued.

<sup>92</sup> Personal flotation devices are designed for constant wear. Lifejackets are designed to be worn in cold water and provide more flotation and thermal protection.

<sup>93</sup> TSB Marine Investigation Report M16A0140.

<sup>94</sup> A Satisfactory Intent rating is assigned if the planned action, when fully implemented, will substantially reduce or eliminate the safety deficiency, and meaningful progress has been made since the recommendation was issued. However, for the present, the action has not been sufficiently advanced to reduce the risks to transportation safety. The TSB will monitor the progress of the implementation of the planned actions and will reassess the deficiency on an annual basis or when otherwise warranted.

## 1.18.2 Fatigue

Following an occurrence on 13 October 2016 in which the tug *Nathan E. Stewart* and the tank barge *DBL 55* went aground after the watchkeeper on the bridge, who was fatigued, fell asleep,<sup>95</sup> the Board made 2 recommendations related to fatigue. In the first recommendation, the Board recommended that

the Department of Transport require that watchkeepers whose work and rest periods are regulated by the *Marine Personnel Regulations* receive practical fatigue education and awareness training in order to help identify and prevent the risks of fatigue.

### **TSB Recommendation M18-01**

In the second recommendation, the Board recommended that

the Department of Transport require vessel owners whose watchkeepers' work and rest periods are regulated by the *Marine Personnel Regulations* to implement a comprehensive fatigue management plan tailored specifically for their operation, to reduce the risk of fatigue.

### **TSB Recommendation M18-02**

In this 2016 occurrence, both recommendations were aimed at managing fatigue in watchkeepers. In the occurrence involving the *Tyhawk*, fatigue was not managed, and the crew was likely fatigued at the time of the occurrence.

In response to these recommendations, TC implemented a 5-year Fatigue Action Plan to address fatigue among seafarers. TC also proposed amendments to the *Marine Personnel Regulations*. However, the publication of the new *Marine Personnel Regulations* in the *Canada Gazette*, Part I has been significantly delayed. As well, fishing vessels of less than 100 GT, like the *Tyhawk*, are exempt from the work and rest requirements. At the time of report writing, TC's response to Recommendation M18-01 was assessed as Satisfactory Intent and TC's response to Recommendation M18-02 was assessed as Unsatisfactory.

## 1.19 TSB Watchlist

The TSB Watchlist identifies the key safety issues that need to be addressed to make Canada's transportation system even safer.

**Commercial fishing safety is a Watchlist 2022 issue.** The Board placed commercial fishing safety on the Watchlist in 2010. Every year, the same safety deficiencies and unsafe work practices on board fishing vessels continue to put at risk the lives of thousands of Canadian fish harvesters and the livelihoods of their families and communities. From 2018 to 2020, there were 45 fish harvester fatalities, which is the highest fatality count for a 3-year period in over 20 years. This occurrence involving the *Tyhawk* demonstrates continued issues with regulatory oversight related to unsafe work practices, the implementation of requirements based on gross tonnage estimates and measurements, and vessel modifications.

<sup>95</sup> TSB Marine Investigation Report M16P0378.



**ACTION REQUIRED**

**Commercial fishing safety** will remain on the Watchlist until there are sufficient indications that a sound safety culture has taken root throughout the industry and in fishing communities across the country, namely:

- TC and DFO work together to ensure that fish harvesters meet all requirements before they operate commercially.
- Federal and provincial authorities coordinate regulatory oversight of commercial fisheries.
- TC, provincial workplace safety authorities, and fish harvester associations promote existing user-friendly guidelines on vessel stability designed to reduce unsafe practices.
- Spurred by the leadership of industry and safety advocates, there is marked and widespread evidence that harvesters are taking ownership of safety, specifically with respect to the use of stability guidelines, PFDs, immersion suits, emergency signalling devices, and safe work practices.

**Fatigue management in rail, marine, and air transportation is a Watchlist 2022 issue.**

The work/rest provisions in the *Marine Personnel Regulations* do not apply to approximately 95% of fishing vessels, and there is no requirement in the regulations for comprehensive fatigue awareness training or fatigue management plans. Given the long hours and high levels of physical and mental exertion involved in commercial fishing, fish harvesters need greater awareness of the risks associated with fatigue and effective strategies to mitigate its risks. Without a change in the safety culture of the fishing industry, fatigue management plans are likely to be ignored.

Fatigue has been identified in previous TSB reports as a contributing factor to accidents, and fish harvesters have confirmed that fatigue risk factors are widespread in the commercial fishing industry. The presence of fatigue risk factors in this occurrence demonstrates that fatigue persists as an issue in the commercial fishing industry.

**ACTION REQUIRED**

**Fatigue management in marine transportation** will remain on the Watchlist until

- TC requires that watchkeepers whose work and rest periods are regulated by the *Marine Personnel Regulations* receive practical fatigue education and awareness training to help identify and prevent the risks of fatigue;
- vessel owners are required to implement fatigue management plans, including education on the detrimental effects of fatigue and support to mariners in reporting, managing, and mitigating fatigue;
- TC reviews the domestic hours of work and rest provisions in the *Marine Personnel Regulations* in light of the most recent knowledge from fatigue science and, at a minimum, ensures consistency with the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers.

**Regulatory surveillance is a Watchlist 2022 issue.**

TC's surveillance program is not always effective, nor does it address all commercial vessels. For example, the TSB continues to see that Canadian vessels of up to 15 GT as well as those carrying 12 passengers or less go largely uninspected, and the CSA 2001 places responsibility for safety on ARs. However, many owners or ARs of small vessels have limited awareness of key sections of the CSA 2001 or of the broader regulatory framework.

In the *Tyhawk* occurrence, the risks of the vessel modifications were unrecognized and unmitigated, which contributed to the vessel capsizing.

**ACTION REQUIRED**

**Regulatory surveillance in marine transportation** will remain on the Watchlist until

- TC provides more oversight of the commercial vessel inspection process by demonstrating that its surveillance and monitoring are effective in ensuring that ARs and recognized organizations are ensuring vessel compliance with regulatory requirements; and
- TC demonstrates an increase in proactive surveillance.

## 2.0 ANALYSIS

On the opening day of the 2021 snow crab season in the southern Gulf of St. Lawrence, the *Tyhawk* capsized. Three crew members survived, 1 was fatally injured, and the master remains missing. The analysis will look at the cumulative effects of multiple factors that resulted in the total loss of the vessel's stability and in the loss of life, as well as at influences on fish harvesters' acceptance of risk. The analysis will also look at the role of Transport Canada (TC) oversight and at the risk assessment and decision-making processes used by Fisheries and Oceans Canada (DFO) for fisheries resource management (FRM).

### 2.1 Loss of stability

When a vessel experiences a total loss of stability, it may capsize due to even a small force. During fishing operations, a vessel's stability is constantly changing, and the consequences of these changes may not be easily recognized. It is therefore essential for masters to apply a practical working knowledge of vessel stability and to be aware of how various factors compromise stability.

Factors that affected the *Tyhawk's* stability included vessel construction, modifications, and loading; environmental conditions; and vessel downflooding and free surface effects.

- **Construction.** Vessels of open construction, such as the *Tyhawk*, lack a watertight deck and so do not have freeing ports. Although they have scuppers for washing the deck (which can drain over the side of the vessel), these are closed when the vessel is at sea and cannot be used to shed water during operations. Therefore, without adequate freeboard, open vessels are vulnerable to water that comes over the sides and accumulates on the main deck and in the bilge.
- **Modifications.** Major modifications, which can also include a series of modifications or repairs, are common on fishing vessels. The *Tyhawk's* removable deck and the boom both added weight and so reduced the freeboard of the vessel. As well, the weight was added above the main deck, which raised the centre of gravity of the vessel.
- **Loading.** The vessel was loaded with unsecured crab traps on the removable deck and associated gear and bait on the main deck. This added weight high on the vessel, further raising the vessel's centre of gravity. The added weight further reduced the vessel's freeboard. This loading was based on past successful experience with snow crab operations on the *Tyhawk* using the removable deck. The *Tyhawk* had not had a stability assessment or stability booklet; therefore, no additional information about the actual safe operating limits of the vessel was available to the master for use in decisions about loading.
- **Environmental conditions.** On the first day of the snow crab season, freezing rain was accumulating as ice on the superstructure and gear, and rain was accumulating on the vessel, both of which added weight above the centre of gravity and reduced the freeboard. Waves and wind were increasing throughout the occurrence voyage, which also brought water over the side of the vessel.
- **Downflooding.** As the *Tyhawk's* freeboard decreased and the environmental conditions worsened, the amount of water coming over the side of the bulwarks and

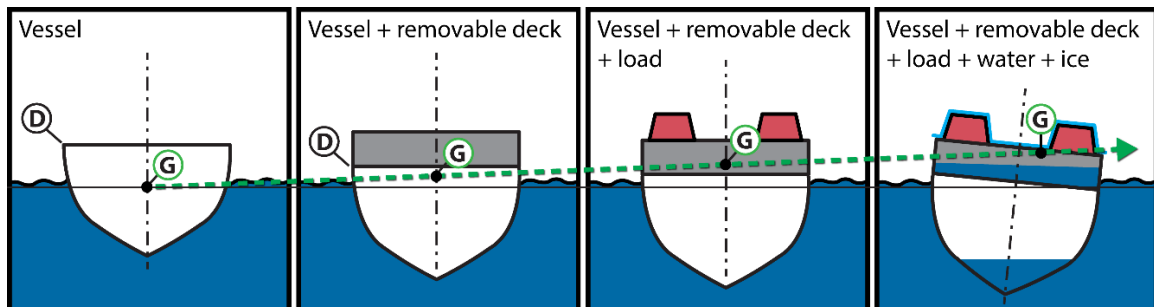
accumulating on the main deck and in the bilge increased. As water accumulates in a vessel undetected, stability may be reduced. It is essential to identify accumulating water without delay by means of properly working and appropriately placed bilge alarms and visual inspections of where water can accumulate.

The investigation could not determine whether the bilge pumps engaged or why the bilge alarm did not notify the crew of water accumulation.

- **Free surface effects.** As an open boat without freeing ports, the *Tyhawk* accumulated water on the main deck under the removable deck. The water would have shifted the full breadth of the vessel as the vessel moved. This would have exacerbated the movement of the vessel itself, to the point that the vessel listed to starboard far enough that all the unsecured traps and gear shifted as well, and the deck edge was immersed.

Past TSB investigation reports into stability-related accidents<sup>96</sup> have shown that it is usually a combination of factors that leads to a stability occurrence (Figure 8), as was the case with the *Tyhawk*.

Figure 8. Diagram of stability changes as the vessel acquires weight from modifications and operations, showing the position of the downflooding point (D) and how the freeboard decreases and the centre of gravity (G) rises. (Source: TSB)



#### Findings as to causes and contributing factors

The removable deck, unsecured gear, and accumulation of rain and freezing rain above the waterline caused the vessel's centre of gravity to be raised and the freeboard to be lowered.

The open construction of the vessel meant that the vessel did not shed water from the decks, causing water accumulation on deck and in the bilge.

The cumulative effects of stability factors and the resulting free surface effects compromised the vessel's stability to the point that it capsized.

## 2.2 Cold-water immersion

Lifesaving appliances provide flotation and protect against cold water and environmental conditions when crew members enter the water or must abandon their vessel. At the time

<sup>96</sup> TSB marine transportation safety investigation reports M21A0315, M20A0160, M18A0303, M18A0078, M17P0052, M16A0327, M16A0140, M15P0286, M14A0289, and M12W0054.

of the occurrence, the water and air temperatures were near zero, which is a serious hazard to human survival.

The master and crew were on deck fishing without wearing personal flotation devices (PFDs). This is a common practice on fishing vessels and remains a concern in outstanding recommendations and on the TSB Watchlist. As well, when the vessel listed severely to starboard, there was no time to access the accommodation space to retrieve the lifejackets or immersion suits.

The life raft had recently been replaced but had not yet been secured according to regulations; as a result, it fell under the removable deck instead of being accessible for manual launching or floating free when needed. After the vessel capsized, the only place for the crew to stay out of the water was on the overturned hull above the surface.

#### Finding as to causes and contributing factors

Because the lifejackets, immersion suits, and PFDs were not accessible and the unsecured life raft had shifted out of reach, when the vessel capsized, the crew were exposed to the cold water without flotation or protection from the elements, which contributed to the loss of life of 1 crew member and to another crew member being declared missing.

## 2.3 Fatigue

Sleep-related fatigue and sleep inertia are known to impair performance and cognitive functioning. Work practices that result in fatigue are a known problem in the fishing industry, as is fatigue management in the marine industry in general. Commercial fishing safety has been on the TSB Watchlist since 2010, and fatigue management for the marine sector has been on the TSB Watchlist since 2018.

Small fishing vessels like the *Tyhawk* are often crewed and set up for day-vessel operations; the safe manning document for the *Tyhawk* specified safe manning requirements for operations as a day vessel. However, the snow crab fishery often opens at midnight,<sup>97</sup> as it did in 2021, and continues without interruption to season end. Furthermore, there is competition for the most productive fishing grounds at the beginning of the season. Therefore, fishing begins as soon as the season is open to maximize the catch and associated profits.

#### Finding: Other

In this occurrence, the *Tyhawk* operated in day and night conditions without an additional qualified watchkeeper, which was not in accordance with the crewing requirements of its safe manning document.

When the vessel capsized, the master and the crew had been awake for approximately 34 to 37 hours with only a few needed, but short, poor-quality, and uncontrolled naps. Before the occurrence voyage, they had travelled from Richibucto, New Brunswick, to Chéticamp, Nova Scotia, and had made a voyage from Chéticamp to the fishing grounds. Their sleep in these 2 days was disrupted by travel and fishing activities, creating an acute sleep disruption.

<sup>97</sup> DFO's British Columbia and Quebec regions restrict some fisheries to daylight hours only.

Additionally, they were awake during their circadian lows, which contributed to circadian rhythm effects. Based on the hours reported awake and the early morning and night awake periods, the fatigue risk factors of acute sleep disruption, prolonged wakefulness, and circadian rhythm effects were present. The master and crew were likely fatigued at the time of the occurrence.

For some of the occurrence voyage, crew member 1 was on watch at the wheel and the others were napping below to obtain needed sleep. Water accumulated in the engine compartment bilge during this time and went unnoticed by the crew member at the wheel. This crew member was on his third fishing voyage and was unfamiliar with the operation of the vessel and its equipment. When crew member 2 came to the bridge, water was noticed in the engine compartment, and the master and the remaining crew members were wakened quickly.

#### Finding as to causes and contributing factors

To obtain needed sleep, all but 1 crew member were napping in the accommodation space. The crew member who was at the wheel was not familiar with the operation of the vessel and its equipment, which, in the absence of a bilge alarm sounding, delayed the detection of the accumulating water in the engine compartment bilge and on the main deck.

Sleep inertia impairs the essential cognitive abilities of vigilance and alertness necessary for rational decision making and was likely affecting the master after he was wakened. Sleep inertia likely affected the master's decision to direct the crew to fish rather than investigating the source of the water ingress and recognizing the deteriorating situation. Additionally, the master was likely still subject to sleep inertia during the abandonment of the vessel, given the short amount of time that had elapsed since he had awoken.

#### Finding as to causes and contributing factors

Sleep inertia likely affected the master's recognition of the deteriorating situation and the effectiveness of the abandonment of the vessel.

## 2.4 Influences on fish harvesters' perception of risk

Fish harvesters do not assess risk independently of other priorities, and their decisions are influenced by many competing pressures. If it seems likely that the fishing season will open and that fishing operations will go ahead, then risks are often accepted. As well, the TSB has determined that some fish harvesters consider that accidents are inevitable because fishing is a dangerous occupation.<sup>98</sup> Some factors that influence fish harvester decisions are the following:<sup>99</sup>

- There may be economic and community pressures to go fishing and create employment opportunities. These pressures often outweigh any mitigation of risks that would limit opportunities to maximize the catch, such as waiting for better weather conditions for fishing operations or waiting for daylight.

<sup>98</sup> TSB Marine Investigation Report M09Z0001, Safety Issues Investigation into Fishing Safety in Canada.

<sup>99</sup> TSB Marine Transportation Safety Investigation Report M20P0229.

- Certificates, licences, and vessel surveys from governments, other organizations, and insurers may be broadly perceived as overall approval.
- Fish harvesters may rely on confidence in their own skills, actions, and experience. They may not perceive the value of regulatory requirements and related items, such as stability booklets.
- Previous accident-free years reinforce fish harvester confidence in the safety of their operation; as a result, fish harvesters unknowingly accept the actual risks involved.

The master undertook the intended voyages 20 nautical miles off Chéticamp in a 13.61 m vessel fitted with a removable deck and in the weather conditions on the day set by DFO for the start of the snow crab season. His perception of risk was likely influenced by the following:

- Snow crab is an economically important fishery for the fish harvesters and the community.
- The season was at risk of being shortened because of North Atlantic right whale protection measures.
- Additional traps had been allocated to the *Tyhawk* from another vessel, and these traps required more voyages to set them.
- Going out on opening day established the harvesters' presence in the most productive area.
- The master held the required certificate and training.
- The valid certificate of inspection from TC did not note any deficiencies, and previous deficiencies that had been noted were cleared by the TC inspector.
- The December 2020 marine insurance survey assessed the vessel to be in good condition.
- The annual communal licence was issued by DFO.
- The community designated the *Tyhawk* for the DFO communal licence.
- The master had 20 years' experience fishing snow crab in the same area.

#### Finding as to causes and contributing factors

The master's perception of risk in the planned fishing operation was influenced by several pressures, including economic and community incentives, approvals and certificates, and previous successful experiences. As a result, the master departed for the fishing grounds likely believing the vessel was stable and well adapted for the snow crab fishery.

## 2.5 Major modifications without stability assessment

A fishing vessel is modified for various reasons, such as to create more storage or deck space by extending the stern or adding a removable deck.

Major modifications, which include a series of modifications or repairs, can negatively alter a vessel's stability and watertight integrity from its original design. The definition of major modification includes words such as "substantial" and "affects," which are qualitative and

may be open to different interpretations. The *Canada Shipping Act, 2001* and its associated regulations place the responsibility on the authorized representative (AR) or master to decide whether these modifications require a stability assessment. Although TC provides guidance to ARs and masters to help with this decision, compliance with this guidance is voluntary. Furthermore, without an understanding of vessel stability, this guidance is difficult to use. As a result, a systematic assessment of all planned modifications, such as that done in other countries, can assist in identifying which are major modifications.

Economic considerations also make it less likely that fish harvesters will record major modifications to their vessels and conduct a stability assessment. Stability assessments can be costly, and the TSB's Safety Issues Investigation into Fishing Safety in Canada found that fish harvesters focus their spending on measures to increase productivity rather than preparing for an occurrence they view as unlikely.

In this occurrence, the removable deck and the boom were in place. Although neither the removable deck nor the boom were reported to TC as major modifications, the investigation determined that the *Tyhawk's* removable deck was a major modification due to its significant weight and location. Following TC's inspection of the *Tyhawk* in 2013, the removable deck was identified as a deficiency because it converted the *Tyhawk* from an open to a closed vessel. The deficiency notice required the AR to have a stability questionnaire completed and signed by the master and to have a stability assessment done. However, on the completed stability questionnaire, the master indicated that no modifications that affected stability had been made. Given the master's training and knowledge, the qualitative definition of major modification, the stability questionnaire's separation of vessel particulars and stability risk factors, and its subjective nature, the likelihood was low that the master would have indicated that a stability assessment was needed for the *Tyhawk*.

In 2017, TC inspected the vessel without the removable deck in place, cleared the deficiency, and issued an inspection certificate. The inspection certificate did not contain any notes about the use of the removable deck. Therefore, the removable deck and other modifications to the *Tyhawk* were not evaluated for their effect on stability by a stability expert, and a stability assessment was not done.

Several investigations<sup>100</sup> have identified vessels to which major modifications were made but were not identified. However, this investigation determined that fish harvesters do not always understand what a major modification is. Therefore, although 17% of respondents in TC's concentrated inspection campaign indicated that they had made a major modification, the actual number could be considerably higher, possibly even higher than TC's estimate of 25% given in its Regulatory Impact Analysis Statement for the *Fishing Vessel Safety Regulations*.

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<sup>100</sup> TSB marine transportation safety investigation reports M20A0434, M19A0025, M18A0425, M15P0286, M15A0189, and M00C0033.



### Finding as to risk

Without an objective definition of a major modification, the impact on vessel stability of a major modification may not be identified by ARs, masters, and TC. As a result, there is a risk that vessels will operate without adequate stability for their intended operations.

## 2.6 Transport Canada levels of oversight and certification

TC uses a vessel's gross tonnage to determine the level of oversight and the safety standards that will be applied to the vessel. When 15 gross tonnage (GT) is reached, significant differences in both the level of oversight and safety standards apply. The investigation determined that fish harvesters can be strongly motivated to keep vessel gross tonnage under 15 GT for a variety of reasons, including fewer regulatory requirements and less oversight. The distribution of gross tonnages in the vessel registry, which shows a large number of vessels of just under 15 GT, supports this.

When a new vessel is designed to be of 15 GT or less, the tonnage is estimated, and TC's approval of plans and certification are not required. After a vessel is built and before it can be registered with TC, gross tonnage must be calculated or assigned to replace the gross tonnage estimated at the planning stage.<sup>101,102</sup> Therefore, a vessel may be built to the standard applicable to vessels of 15 GT or less but then inspected for certification against a different standard if the tonnage exceeds 15 GT after construction is complete. This subsequent application of a different standard can create more variability in deficiencies and outcomes, and it can make compliance both difficult and expensive.

Once a fishing vessel of more than 15 GT is built, it requires recertification every 4 years. Major modifications may be costly and require additional costs to certify. A vessel that requires additional work to meet certification requirements will incur further costs for the additional modifications, stability assessments, additional paperwork, and related loss of operational time.

Marine safety inspectors have a variety of compliance tools to assist in enforcing safety standards, but they must use professional judgment in deciding which tool is appropriate for each situation. When faced with a situation in which compliance is very difficult or impossible due to a change in the applicability of a safety standard, each inspector must try to find the best compromise to keep vessels operating. Consequently, there is a lot of variability in certification, including the use of full-term versus short-term certificates, or downgrading of deficiencies.

In 2001, the *Small Fishing Vessel Inspection Regulations* standard required for fishing vessels of more than 15 GT was the same as the standard required under the *Fishing Vessel Safety Regulations* that superseded the *Small Fishing Vessel Inspection Regulations* in 2017.

<sup>101</sup> Transport Canada, TP 14070E, *Small Commercial Vessel Safety Guide*, Chapter 8: Keep Your Vessel Stable, at <https://tc.canada.ca/en/marine-transportation/marine-safety/chapter-8-keep-your-vessel-stable> (last accessed on 19 October 2023).

<sup>102</sup> The issue of inaccurate gross tonnage and the need for TC oversight has been investigated previously with respect to tugs (TSB Marine Transportation Safety Investigation Report M17P0244).

However, because the *Tyhawk* was estimated to be of less than 15 GT when it was built in 2001, this standard was not applied. As a result, there was no standard as to the specific diameter of the engine shaft, hatch coaming heights, and water tightness of hatchways, or a requirement for an escape hatch when the vessel was built. Ten years later, in 2011, when the vessel was measured for registration, the gross tonnage was found to be more than 15. Upon initial inspection in 2013, the engine shaft diameter and escape hatch were noted as deficiencies and later corrected. Some other deficiencies were not noted.

When tonnage is measured after a vessel is built, and there are subsequent modifications to meet the new safety standards, compliance may be challenging. Variability in the standards not being met, the level of risk of non-compliance, and the use of enforcement tools by TC inspectors may lead to certification inspections having different results. This inconsistent application of the regulations can result in an increased risk to fish harvesters' safety.

#### Finding as to risk

Safety standards are based on vessel gross tonnage. Without an accurate and timely measurement of gross tonnage, the standards that apply to a vessel may change, making it difficult for ARs to comply with safety standards and for regulators to consistently enforce them.

## 2.7 Fisheries resource management for the snow crab fishery

DFO's mandate is to protect and manage Canada's fisheries, to ensure economic opportunities for coastal communities and fisheries, and to protect and restore Canada's oceans and marine ecosystems. This mandate is diverse, and DFO measures and decisions around FRM may affect fish harvester safety by influencing decisions around fishing activities.<sup>103</sup>

To make FRM measures and decisions, DFO evaluates economic risks, human safety risks, and risks to communities, fish populations, and the environment. Risk assessment to balance economic, conservation, and safety concerns in such complex situations needs to consider multiple concerns and pressures, including interactions and cumulative effects. At the first step of risk assessment, all relevant scenarios with potential causes, contributing factors, and outcomes must be identified using a wide variety of sources of risk information, such as previous incidents, expert opinions, and regulatory guidance.

In this occurrence, the season opening was treated as a routine situation by DFO; as a result, the risks were considered for a situation that occurred often in similar conditions. The protocol for the season-opening proposal considered ice and weather conditions, by including the ice service specialist and the Canadian Coast Guard, as well as economic considerations, by including fish harvesters and industry members, and search and rescue capabilities, also by including the Canadian Coast Guard. However, the protocol did not

<sup>103</sup> For example, in a 2018 occurrence, a vessel capsized in a corridor that had been defined by DFO for the passage of lobster fishing boats through a closed fishing area but that took these vessels on a riskier route. (Transportation Safety Board of Canada, Marine Safety Advisory 03/19: Consultation regarding the implementation of the corridor in LFA 24 [19 December 2019]).

consider other hazards or identify other independent experts, such as experts in stability and vessel safety. When the opening date was shifted earlier by almost 3 weeks, this allowed harvesting to take place in water and air temperatures that were below freezing, on average, increasing the likelihood of freezing rain and the risks associated with cold weather conditions and ice accumulation. However, since the season-opening decision had been made routinely for the last several years, it was not seen as a new situation, and these new hazards were not identified as sources of additional risk.

TC is the regulatory authority for marine vessel safety and has experts in this area. TC provides guidance to DFO on risks and hazards related to vessel construction and stability and personnel safety. However, at the meeting of the Southern Gulf of St. Lawrence Snow Crab Advisory Committee, TC discussed a topic not relevant to the hazards of the snow crab fishery. TC was not invited to attend season-opening meetings of the Committee for Setting the Opening Date for the Fishery Area 12 Snow Crab (which is a subcommittee). TC was therefore unable to provide input regarding safety on DFO's protocol for the season-opening proposal.

Additionally, the industry representatives present at the season-opening meetings shared concerns and information about safety and economics. However, the industry representatives are not independent; any decision taken would affect their incomes or profits, and they were likely more tolerant of accepting safety risks than economic losses.

The following policies and measures, for which not all hazards were comprehensively identified, affected this occurrence:

- The fishing industry is typically engaged and involved in identifying potential designated ports for catch monitoring and landings. However, home ports are not required to be ice free when the season opens. Additionally, designating ports for monitoring catch requires many fish harvesters to travel extended periods before the opening of the season, impacting fish harvesters' fatigue levels.
- North Atlantic right whale (NARW) protection policies, which were developed as part of international commitments and implemented in 2018, shortened the snow crab season by about one third. The effects of a shorter season on fish harvester incomes were considered and accepted because the NARW situation was urgent, but this created pressure to start the season earlier, when the weather conditions are colder and inclement.

The subcommittee followed the season-opening protocol to balance economic considerations and fish harvester and vessel safety. However, the season-opening protocol considered only wind and ice on the fishing grounds; it did not consider other factors. In area 12 in 2021, fish harvesters had to prepare fishing equipment sooner than expected and in weather colder than usual. Also, freezing rain was present and some home ports were still iced in, which increased the risks of ice accumulation and damage to vessels. Air temperatures were also colder than usual, and there was a risk of cold-water immersion.

These factors are risks for all vessels but especially for smaller, open fishing vessels. In general, crews of these vessels are more likely to enter the water, where cold-water immersion is a life-threatening hazard. However, vessel size and construction are not considered in the season-opening protocol. For the Elsipogtog First Nation and other fish

harvesters who operate smaller vessels, the snow crab fishery is usually the first fishery of the season.

#### Finding as to risk

When FRM measures and decisions do not consider the interactions among economic, conservation, and safety factors, including their cumulative effects, then decisions may be made for new and complex situations without adequate identification of safety hazards, increasing safety risks for fish harvesters.

## 3.0 FINDINGS

### 3.1 Findings as to causes and contributing factors

These are conditions, acts or safety deficiencies that were found to have caused or contributed to this occurrence.

1. The removable deck, unsecured gear, and accumulation of rain and freezing rain above the waterline caused the vessel's centre of gravity to be raised and the freeboard to be lowered.
2. The open construction of the vessel meant that the vessel did not shed water from the decks, causing water accumulation on deck and in the bilge.
3. The cumulative effects of stability factors and the resulting free surface effects compromised the vessel's stability to the point that it capsized.
4. Because the lifejackets, immersion suits, and personal flotation devices were not accessible and the unsecured life raft had shifted out of reach, when the vessel capsized, the crew were exposed to the cold water without flotation or protection from the elements, which contributed to the loss of life of 1 crew member and to another crew member being declared missing.
5. To obtain needed sleep, all but 1 crew member were napping in the accommodation space. The crew member who was at the wheel was not familiar with the operation of the vessel and its equipment, which, in the absence of a bilge alarm sounding, delayed the detection of the accumulating water in the engine compartment bilge and on the main deck.
6. Sleep inertia likely affected the master's recognition of the deteriorating situation and the effectiveness of the abandonment of the vessel.
7. The master's perception of risk in the planned fishing operation was influenced by several pressures, including economic and community incentives, approvals and certificates, and previous successful experiences. As a result, the master departed for the fishing grounds likely believing the vessel was stable and well adapted for the snow crab fishery.

### 3.2 Findings as to risk

These are conditions, unsafe acts or safety deficiencies that were found not to be a factor in this occurrence but could have adverse consequences in future occurrences.

1. Without an objective definition of a major modification, the impact on vessel stability of a major modification may not be identified by authorized representatives, masters, and Transport Canada. As a result, there is a risk that vessels will operate without adequate stability for their intended operations.

2. Safety standards are based on vessel gross tonnage. Without an accurate and timely measurement of gross tonnage, the standards that apply to a vessel may change, making it difficult for authorized representatives to comply with safety standards and for regulators to consistently enforce them.
3. When fisheries resource management measures and decisions do not consider the interactions among economic, conservation, and safety factors, including their cumulative effects, then decisions may be made for new and complex situations without adequate identification of safety hazards, increasing safety risks for fish harvesters.

### 3.3 Other findings

These items could enhance safety, resolve an issue of controversy, or provide a data point for future safety studies.

1. In this occurrence, the *Tyhawk* operated in day and night conditions without an additional qualified watchkeeper, which was not in accordance with the crewing requirements of its safe manning document.

## 4.0 SAFETY ACTION

### 4.1 Safety action taken

The Board is not aware of any safety action taken following this occurrence.

### 4.2 Safety action required

On 03 April 2021, while transiting to crab fishing area 12 in the southern Gulf of St. Lawrence, the 13.61 m open fishing vessel *Tyhawk* capsized. At 1744 Atlantic Daylight Time, authorities were alerted by a 911 call made by a crew member. At approximately 1834, the fishing vessel *Northumberland Spray* arrived on scene and recovered 4 crew members. One crew member subsequently died. As of April 2023, the master remained missing.

#### 4.2.1 Definition of major modification

The investigation determined that the *Tyhawk's* stability was compromised in part by the addition of a removable deck, which had not been evaluated for its impact on the vessel's stability. In 2013, Transport Canada (TC) inspected the vessel, issued a deficiency notice because of the removable deck, and required a stability assessment. The master completed a stability questionnaire in May 2015 and identified the removable deck, but he did not recognize the deck as a modification that would require a stability assessment. The stability assessment required by TC was not completed, and TC's subsequent inspection documentation did not refer to the removable deck.

In accordance with the *Fishing Vessel Safety Regulations*, stability assessments are required for all new fishing vessels<sup>104</sup> over 9 m and those that have undergone a major modification or a change in activity that is likely to adversely affect their stability.<sup>105</sup> TC's definition of major modification is

[...] a modification or repair, or a series of modifications or repairs, that substantially changes the capacity or size of a fishing vessel or the nature of a system on board a fishing vessel, that affects its watertight integrity or its stability.<sup>106</sup>

For other small commercial vessels (15 gross tonnage and under) that are not passenger vessels, the definition of a major modification in the *Small Vessel Regulations* is similar. It is the responsibility of the authorized representative (AR) to identify whether a modification is major.

Both the *Fishing Vessel Safety Regulations* definition of major modification (that "substantially changes") and the requirements for stability assessment (likely to adversely

<sup>104</sup> In this context, "new" is defined according to the date when the *Fishing Vessel Safety Regulations* came into force (Transport Canada, C.R.C., c. 1486, *Fishing Vessel Safety Regulations* [as amended 23 June 2021], part 0.1, subsection 3.01[1]).

<sup>105</sup> Ibid., section 3.48.

<sup>106</sup> Ibid., subsection 3.48(3). The *Small Vessel Regulations* definition is almost identical (Transport Canada, SOR/2010-91, *Small Vessel Regulations* [as amended 23 June 2021], subsection 710[3]).

affect stability) are qualitative and open to interpretation. While TC does provide some guidance to help ARs and masters identify major modifications,<sup>107,108</sup> the guidance is qualitative and requires knowledge of stability to interpret it correctly. Compliance with the guidance is voluntary. In contrast, TC's guidance for maintaining a record of modifications is quantitative, noting that changes in weight of more than 100 kg should be tracked.

In this occurrence, the Board found that, without an objective definition of a major modification, ARs, masters, and TC may not identify the impact on vessel stability of a major modification. As a result, there is a risk that vessels will operate without adequate stability for their intended operations.

Regulators have a role to play in supporting the consistent identification of major modifications by providing specific, measurable, and understandable criteria. Therefore, the Board recommends that

the Department of Transport introduce objective criteria to define major modifications to small fishing vessels and other small commercial vessels.

**TSB Recommendation M23-06**

TC does not require ARs to seek pre-approval or assessment of planned modifications, which could also assist in identifying whether a modification is likely to negatively affect stability. In contrast, the United Kingdom requires that owners of fishing vessels seek approval from the Maritime and Coastguard Agency before carrying out modifications.<sup>109</sup> There is no consistent understanding of what constitutes a major modification for small commercial vessels in Canada,<sup>110</sup> and the true scope of this issue is difficult to quantify. In its 2016 regulatory impact analysis statement, TC estimated that 25% of fishing vessels would make major modifications,<sup>111</sup> whereas Fish Safe NS estimated that most fishing vessels in

<sup>107</sup> Transport Canada, Ship Safety Bulletin 04/2006: Safety of Small Fishing Vessels: Information to Owners/Masters about Stability Booklets, at <https://tc.canada.ca/en/marine-transportation/marine-safety/ship-safety-bulletins/bulletin-no-04-2006> (last accessed on 19 October 2023), which contains a stability questionnaire, Transport Canada, TP 15392E, *Guidelines for fishing vessel major modification or a change in activity*, section 5, at <https://tc.canada.ca/en/marine-transportation/marine-safety/tp-15392e-guidelines-fishing-vessel-major-modification-change-activity> (last accessed on 19 October 2023).

<sup>108</sup> Transport Canada, TP 15393E, *Adequate stability and safety guidelines for fishing vessels*, at <http://www.tc.gc.ca/eng/marinesafety/adequate-stability-safety-guidelines-fishing-vessels.html> (last accessed on 19 October 2023).

<sup>109</sup> UK Maritime and Coastguard Agency, Statutory guidance MIN 593 "Amendment 1 Vessel Modifications – pre-approval by MCA" (15 February 2022), at <https://www.gov.uk/government/publications/min-593-f-amendment-1-vessel-modifications-pre-approval-by-mca/min-593-amendment-1-vessel-modifications-pre-approval-by-mca> (last accessed on 19 October 2023).

<sup>110</sup> Small commercial vessels in this context are fishing vessels of 150 GT and under and other commercial vessels of 15 GT and under.

<sup>111</sup> Government of Canada, *Canada Gazette*, Part 1, Vol 150, No. 6 (06 February 2016), "One-for-One" Rule, Regulations Amending the *Small Fishing Inspection Regulations*: Regulatory Impact Analysis Statement.



Nova Scotia have made unreported modifications. In addition, TSB investigations have routinely identified vessels to which major modifications were made and not identified.<sup>112</sup>

While ARs are responsible for vessel safety, TC is responsible for regulatory surveillance. A systematic assessment by a competent person of all planned modifications, as is done in other countries, can assist in identifying which are major modifications and when stability assessments are required. Regulatory surveillance gives TC an opportunity to evaluate records of modifications. As many small fishing vessels and other small commercial vessels change hands, having an established record of modifications can help ensure that ARs, masters, and TC have complete and current information when evaluating vessel stability.

To help ARs, masters, and TC inspectors verify that vessels are operating with adequate stability, the Board recommends that

the Department of Transport require that planned modifications to small fishing vessels and other small commercial vessels be assessed by a competent person, that all records of modifications to these vessels be maintained, and that the records be made available to the Department.

**TSB Recommendation M23-07**

#### 4.2.2 Hazard identification in fisheries resource management decisions

In this occurrence, Fisheries and Oceans Canada (DFO) moved the opening date for the snow crab fishery forward by almost 3 weeks from previous years. This decision was based on the advice of a subcommittee composed of representatives from industry and government. DFO and the subcommittee members considered the selection of the opening date and time for the 2021 snow crab fishery as routine. Consequently, hazards posed by changing the date, which would increase the likelihood of colder water, ice, and freezing rain, or by opening the fishery at midnight, which would increase the risk of fatigue, were not identified and assessed for safety implications.

Fisheries resource management (FRM) decisions are complex, balancing economic, conservation, and safety concerns and their interactions and cumulative effects. In 2021, the season-opening decision was influenced by many FRM measures and policies. All commercial fishing vessels in Canada, the number of which is estimated at 18 000 to 29 000 vessels,<sup>113</sup> are subject to FRM measures that influence the actions and behaviours of fish harvesters.<sup>114</sup>

The TSB has previously investigated occurrences in which FRM measures were implemented and fish harvester safety was affected. For example, in September 2018,

<sup>112</sup> For recent examples, see TSB marine transportation safety investigation reports M21P0229, M20A0434, M20A0160, M19A0030, M19A0025, M18A0425, M15A0189, M15P0286, and M00C0033.

<sup>113</sup> On 31 March 2023, TC's records listed 18 365 vessels actively registered with TC as fishing vessels. Vessel registration may be suspended for various reasons while a vessel continues fishing. If suspended vessels are included, the number of vessels registered with TC as a fishing vessel was 25 410. A few thousand more fishing vessels receive commercial fishing licences but may not have registered with TC. See TSB Marine transportation recommendation M22-01 for background and updates.

<sup>114</sup> TSB Marine Investigation Report M09Z0001, Safety Issues Investigation into Fishing Safety in Canada.

2 people died when the fishing vessel *Kyla Ann* capsized near North Cape, Prince Edward Island, while following a DFO-defined corridor instead of the established navigational route.<sup>115</sup> In 2016, 2 people died and 2 others were presumed drowned after the crew of the *Pop's Pride* sailed in adverse sea conditions in order to ensure the FRM measures were met.<sup>116</sup> The TSB's Safety Issues Investigation into Fishing Safety in Canada, published in 2012, identified FRM as 1 of the 10 significant safety issues associated with fishing accidents. The report indicated that "meeting resource management measures can contribute to risk-taking" and expressed "concern that the safety risks associated with fisheries management measures are not adequately identified and addressed."<sup>117</sup>

FRM measures can have positive consequences for safety, whether they were implemented for that reason or not. For example, in the British Columbia and Quebec regions, some fisheries are restricted to daylight hours.

Complex decisions, such as those concerning FRM, need to consider all relevant areas and interactions and must be supported by a comprehensive, methodical risk assessment. The quality of a risk assessment depends on the robustness of hazard identification. To identify as many hazards as possible, all relevant information must be considered by experts in their fields, including independent safety experts who are not affected by the decisions.

When FRM measures and decisions do not consider the interactions between economic, conservation, and safety factors, including their cumulative effects, then decisions may be made for new and complex situations without adequate identification of safety hazards, increasing safety risks for fish harvesters. The Board therefore recommends that

the Department of Fisheries and Oceans ensure that policies, procedures, and practices include comprehensive identification of hazards and assessment of associated risks to fish harvesters when fisheries resource management decisions are being made and integrate independent safety expertise into these processes.

**TSB Recommendation M23-08**

This report concludes the Transportation Safety Board of Canada's investigation into this occurrence. The Board authorized the release of this report on 02 August 2023. It was officially released on 22 November 2023.

Visit the Transportation Safety Board of Canada's website ([www.tsb.gc.ca](http://www.tsb.gc.ca)) for information about the TSB and its products and services. You will also find the Watchlist, which identifies the key safety issues that need to be addressed to make Canada's transportation system even safer. In each case, the TSB has found that actions taken to date are inadequate, and that industry and regulators need to take additional concrete measures to eliminate the risks.

<sup>115</sup> TSB Marine Transportation Safety Investigation M18A0303. The vessel capsized when it was following DFO licence requirements to use a defined travel corridor instead of using the safest established navigational route. The travel corridor was defined as part of fisheries resource management enforcement measures.

<sup>116</sup> TSB Marine Investigation Report M16A0327.

<sup>117</sup> TSB Marine Investigation Report M09Z0001, Safety Issues Investigation into Fishing Safety in Canada.

## APPENDICES

## Appendix A – Stability questionnaire


**STABILITY INFORMATION QUESTIONNAIRE**  
 FOR A COMMERCIAL FISHING VESSEL

**QUESTIONNAIRE SUR LA STABILITÉ**  
 CONCERNANT UN BATEAU DE PÊCHE COMMERCIALE
**NOTE:**

Use this form to determine whether your vessel's characteristics indicate a stability booklet is required on board.  
 Utiliser le présent formulaire pour déterminer si, selon les caractéristiques de votre bateau, un livret de stabilité est requis à bord du bateau.

**VESSEL PARTICULARS - CARACTÉRISTIQUES DU BATEAU**

Vessel name - Nom du bateau	Vessel type - Type de bateau <input type="checkbox"/> Decked Ponté <input type="checkbox"/> Undecked Non ponté	Voyage class - Classe de voyage
Beginning of fishing operations (month/day) - Début de la saison des opérations (mois/jour)		End of fishing operations (month/day) - Fin de la saison des opérations (mois/jour)
Vessel length - Longueur du bateau	Vessel breadth - Largeur du bateau	Vessel depth - Creux du bateau
1. What type(s) of fishing operation is the vessel performing? - Quel type de pêche le bateau pratique-t-il ?		
<input type="checkbox"/> Gill net Filet maillant <input type="checkbox"/> Trolling À la traîne <input type="checkbox"/> Longline Palangre <input type="checkbox"/> Seining Pêche à la senne <input type="checkbox"/> Pots/traps Casiers/pièges <input type="checkbox"/> Trawling Chalutier <input type="checkbox"/> Diving Plongeur <input type="checkbox"/> Others Autres _____		
a) What fish species? - Quelle(s) espèce(s) de poisson?	b) Number of pots/traps stowed on deck? (if applicable) Nombre de cages cordées sur le pont? (si applicable)	c) Mass of fish carried on deck? (if applicable) Masse de poisson transportée en ponté? (si applicable) kg
2. a) What type of fishing gear or top side weight does the vessel carry? (above main deck) Quel type d'équipements de pêche ou de poids en hauteur le bateau transporte-t-il? (au-dessus du pont principal)		
<input type="checkbox"/> Gantry Portique <input type="checkbox"/> Seine/traps skiff Bateau auxiliaire <input type="checkbox"/> Shelter deck Pont abri <input type="checkbox"/> Aft Platform Plate-forme arrière <input type="checkbox"/> Net drum Enrouleur de filet <input type="checkbox"/> Spare nets Filets de recharge <input type="checkbox"/> Multi deck Plusieurs ponts <input type="checkbox"/> Loading boom / crane Bôme / grue de chargement <input type="checkbox"/> Warping winch Treuil <input type="checkbox"/> Paravanes Paravannes <input type="checkbox"/> Fish processing equipment (boiler, plate freezer) Équipement de transformation du poisson (chaudière, congélateur à plaque) <input type="checkbox"/> Pots/traps Casiers/pièges <input type="checkbox"/> Ice accumulation Accumulation de glace <input type="checkbox"/> Live well Vivier <input type="checkbox"/> Others Autres _____		
b) Does the vessel carry multiple sets of gear at one time? - Est-ce que le bateau transporte plusieurs gréments de pêche en même temps?		
<input type="checkbox"/> Yes Oui <input type="checkbox"/> No Non		

**STABILITY REQUIREMENTS - EXIGENCES DE STABILITÉ**

3. Does this vessel carry capelin or herring? - Est-ce que ce bateau transporte du capelan ou du hareng?

Yes  
Oui  No  
Non

A stability booklet is required if the vessel is used to catch capelin and/or herring and is of closed (decked) construction. **Small Fishing Vessel Inspection Regulations - Sections 5 and 29.**

Un livret de stabilité est requis si le bateau est ponté et utilisé pour la pêche au capelan et/ou au hareng. **Règlement sur l'inspection des petits bateaux de pêche - articles 5 et 29.**

85-0428 (0603-01)

4. Do any of the following stability risk factors apply to this vessel? - Est-ce que l'un des facteurs de risque suivants est applicable à ce bateau?

i) an anti-roll tank  
a une citerne antiroulis

ii) carries liquid cargoes and / or fitted with live wells  
transporte des cargaisons liquides et/ou est équipé de cale à eau vive

iii) substantial top side weight, (significant weights with a high centre of gravity (ex : gantry))\*  
a du poids substantiel en hauteur, (poids significatifs ayant un centre de gravité élevé (ex : portique))\*

iv) the vessel operates in an area and time of year where icing may occur.\*  
le bateau opère dans un endroit pendant une saison de l'année où il peut y avoir une accumulation de glace.\*

v) has significant windage (the projected lateral area is unusually high relative to the length of the vessel.)\*  
dérivation importante (la surface latérale en dehors de l'eau est particulièrement haute par rapport à la longueur du bâtiment.)\*

vi) has had modifications or changed fishing operations in a way that reduces stability, for example, from pots/traps to trawling, or larger nets/drum where the height or weight above deck is increased.\*  
a subi des modifications ou a changé d'activités de pêche, faisant en sorte que la stabilité a été réduite; par exemple, passage des casiers/pièges au chalutage, ou utilisation de filets/tambours plus grands dont la taille et le poids au-dessus du pont sont plus importants.\*

\* If in doubt, consult a marine consultant or Transport Canada. - \* En cas de doute, consultez un consultant maritime ou Transports Canada.

Yes  
Oui                       No  
Non

A stability booklet is required if the vessel has any of the above risk factors. **Small Fishing Vessel Inspection Regulations - Section 48:**  
Un livret de stabilité est requis lorsque le bateau rencontre l'un des facteurs de risque ci-dessus. **Règlement sur l'inspection des petits bateaux de pêche - article 48 :**

**IF NONE OF THE CHARACTERISTICS IN 3 OR 4 ARE APPLICABLE TO THE VESSEL LEAVE THE REMAINDER OF THE QUESTIONNAIRE BLANK AND SIGN AT THE BOTTOM, OTHERWISE CONTINUE.**

**SI AUCUNE DES CARACTÉRISTIQUES DANS LA CASE 3 OU 4 NE S'APPLIQUE, LAISSER LE QUESTIONNAIRE CI-APRÈS EN BLANC ET SIGNER AU BAS DE LA PAGE. SI TEL N'EST PAS LE CAS, VEUILLEZ CONTINUER.**

5. If a stability booklet is required, is there a copy onboard the vessel? - Si un livret de stabilité est requis, y a-t-il une copie à bord du bateau?

Yes  
Oui                       No  
Non

**If no, take steps to have a booklet prepared. - Si non, faites des démarches pour obtenir un livret.**

6. Has the vessel been modified since the inclining? - Est-ce que le bateau a été modifié depuis l'essai d'inclinaison?

Yes  
Oui                       No  
Non

Description of modifications - Description des modifications

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

If YES, have the modifications been accounted for in the stability booklet? If they haven't, take steps to have the booklet updated.  
Si OUI, est-ce que les modifications ont été prises en compte dans le livret? Sinon, faites des démarches pour mettre à jour le livret.

**THIS IS TO CERTIFY** that this record is correct in all respects. - **IL EST CERTIFIÉ** que la présente fiche est correcte à tous les égards.

\_\_\_\_\_

Master name - Nom du capitaine

\_\_\_\_\_

Master signature - Signature du capitaine

\_\_\_\_\_

Date  
(yyyy-mm-dd - aaaa-mm-jj)

## Appendix B – Circumstances of this occurrence related to the significant safety issues identified in the Safety Issues Investigation into Fishing Safety in Canada (M09Z0001)

Safety significant issue	Findings of the Safety Issues Investigation into Fishing Safety in Canada	Relationship to this occurrence
<b>Lifesaving appliances</b>	Fish harvesters do not always conduct drills, while some assume that training, certification, and experience guarantee quick reaction time in an emergency.	Although the <i>Tyhawk</i> was crewed with crew unfamiliar with the vessel, they did not conduct a safety drill before sailing.
	Fish harvesters may fit their vessels with lifesaving equipment only for regulatory compliance.	On the first voyage to set traps, the <i>Tyhawk's</i> crew complement was beyond the limits of life raft.
	Fish harvesters fit and stow lifesaving equipment to minimize impact on fishing operations.	When the <i>Tyhawk</i> rolled to starboard, a crew member attempted to retrieve immersion suits and PFDs, but they were not accessible.
<b>Training</b>	Fish harvesters generally conduct their business based on knowledge, skills, and attitude gained primarily through experience.	As the unsafe conditions worsened, an uncertified crew member unfamiliar with the vessel was on watch.
	Fish harvesters assess and manage their risk based on experience.	
<b>Regulatory approach to safety</b>	Some provinces have workers' compensation boards provide dockside training and educational materials.	There is no fishing safety association in New Brunswick.
	Some provinces have workers' compensation board policies that apply specifically to fish harvesters.	The New Brunswick workers' compensation board (WorkSafeNB) does not have policies related to fish harvesters.
	Marine emergency duties training is only mandatory for those crew necessary to meet the safe manning requirement.	Only 2 of the 5 crew on board the <i>Tyhawk</i> at the time of the occurrence had marine emergency duties training.

## **Appendix C – Membership of the Committee for Setting the Opening Date for the Fishery Area 12 Snow Crab**

The terms of reference for this committee<sup>118</sup> state that the committee membership is as follows:

- 4 representatives from the traditional mid-shore fleets
- 2 representatives from the traditional in-shore fleets
- 4 representatives from other fleets: 1 each from New Brunswick, Quebec, Prince Edward Island, and Nova Scotia
- 1 representative for each First Nation
- 2 representatives from the processing sector
- 2 representatives from Fisheries and Oceans Canada
- representatives from the Canadian Coast Guard
- 1 ice service specialist from Environment and Climate Change Canada

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<sup>118</sup> Fisheries and Oceans Canada, Terms of Reference: Committee for Setting the Opening Date for the Fishery Area 12 Snow Crab (February 2020).