



AVIATION



HIGHWAY



MARINE



RAILROAD



PIPELINE

Issued February 15, 2022

MIR-22/03

## Grounding of Fishing Tender Barge *SM-3*

On August 30, 2020, about 2200 local time, the fishing tender barge *SM-3* was anchored and riding out a storm with a crew of six in Nushagak Bay, 5 miles south of Ekuk, Alaska, when the barge broke free from the buoy and began drifting.<sup>1</sup> The crew deployed two emergency anchors, but the barge continued to drift and grounded on the beach. The following morning, the crew evacuated the vessel and were picked up by locals. There was a 3-mile debris field on the beach. No injuries were reported. The barge was later salvaged. Damage to the vessel was estimated at \$4.5 million.



**Figure 1.** *SM-3* under tow before the grounding. (Source: Northline Seafoods)

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<sup>1</sup> (a) In this report, all times are Alaska daylight time, and all miles are nautical miles (1.15 statute miles).  
(b) Visit [nts.gov](https://www.nts.gov) to find additional information in the [public docket](#) for this NTSB investigation (case no. DCA20FM027). Use the [CAROL Query](#) to search investigations.

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<b>Casualty type</b>	Grounding/Stranding
<b>Location</b>	Nushagak Bay, near Ekuk, Alaska 58°45.9' N 158°27.5' W
<b>Date</b>	August 30, 2020
<b>Time</b>	2300 Alaska daylight time (coordinated universal time -8 hrs)
<b>Persons on board</b>	6
<b>Injuries</b>	None
<b>Property damage</b>	\$4.5 million est.
<b>Environmental damage</b>	3-mile debris field on beach; est. 100 gallons diesel unrecoverable
<b>Weather</b>	Visibility 10 mi, rain, winds south-southwest 33 kts, gusts 52 kts, seas southwest swell, current 4-5 kts, flood tide, waves 10-11 ft, air temperature 54°F, water temperature 54°F, sunrise 0729
<b>Waterway information</b>	Bay, 17.5 mi wide at the entrance, tidal range 21 ft, anchorage depth 40 ft (30 ft + 10 ft rising tide at 2300)

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**Figure 2.** Area where the *SM-3* grounded, indicated by the red X. (Background source: Google Maps)

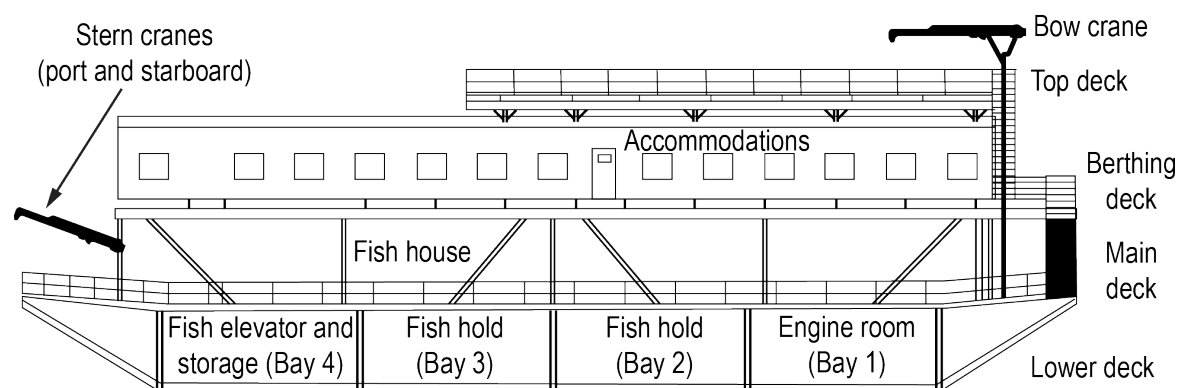
## 1. Factual Information

### 1.1 Background

The steel, single-hulled, non-propelled *SM-3* was constructed as a deck barge in 1966 by Floating Marine Ways in Portland, Oregon. Originally named the *ZB 29*, the vessel was renamed in 1995. Until 2017, when the barge was purchased by Northline Seafoods, the *SM-3* was primarily used for berthing and logging operations in Dall Island, Alaska. In 2018, the barge was towed to Sitka, Alaska.

In January 2019, the hull framing and plating was extensively renewed, and the vessel was converted to a fishing tender barge. As an uninspected fishing industry vessel, no US Coast Guard-certificated mariners were required on board. On May 12, because of the substantial changes to the *SM-3* implemented during the conversion, the Coast Guard witnessed an incline test performed on the barge that was used to develop a stability letter and stability instructions (dated May 24) for the barge tow to Bristol Bay. A dockside exam was completed the same month, and the barge was issued a fishing vessel decal valid for 2 years. (Dockside exams primarily focus on lifesaving equipment on board the vessel, not the hull or machinery as required for Coast Guard-inspected vessels.)

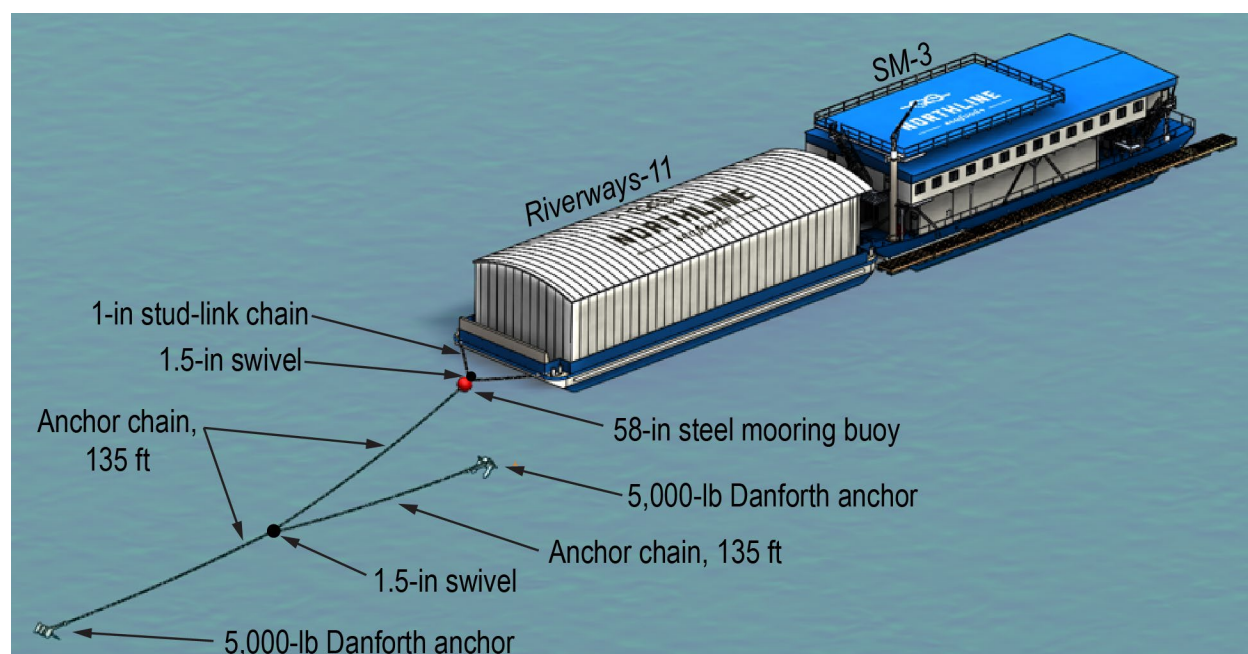
The *SM-3* had four decks. Within the barge hull was the lower deck, consisting of four compartments: an engine room (Bay 1), two fish tank holds (Bays 2 and 3), and a pump, maintenance, and storage room, which also contained a fish elevator (Bay 4). The four compartments were separated by watertight bulkheads, each fitted with a watertight door. The main deck had an enclosed fish house, used for processing fish, and three deck cranes (one on the bow and two on the stern). Above the main deck was the berthing deck, which housed crew accommodations. Above the accommodations forward on the vessel was the former helipad, also referred to as the top deck, which was used for storage.



**Figure 3.** *SM-3* profile. (Background source: Northline Seafoods)

## 1.2 Event Sequence

On May 21, 2020, in anticipation of the opening of the 2020 salmon season in Bristol Bay on June 1, the *SM-3* was positioned in Nushagak Bay, 5 miles southeast of the village of Ekuk, along with its two support vessels: the 150-foot-long cargo holding barge *Riverways-11* and the 70-foot-long workboat *Sea Mount*. With the assistance of a tugboat, the *SM-3* was anchored (along with the *Riverways-11*) using its mooring and ground tackle system (purchased in 2019 and used during the 2019 season). The *SM-3* and the *Riverways-11* were connected bow-to-bow with lines, and a ramp was used to drive fork trucks between them.



**Figure 4.** *SM-3* and *Riverways-11* anchoring arrangement at the beginning of the season (not to scale). (Background source: Northline Seafoods)

During the season, the *SM-3* provided tender services (ice, fuel, and water) to fishing boats that operated in the area that came alongside the *SM-3* to sell their catch, and also “processed” fish. Up to 40 crewmembers, led by the person in charge (PIC), who was also the company’s chief executive officer, worked on board the *SM-3* in 12- to 16-hour shifts to freeze fish whole, box fish, and transfer pallets of frozen salmon over a ramp to the holding barge by fork truck. When the holding barge had enough frozen fish to fill six containers, a contract vessel with deck containers tied up alongside the *SM-3*, and the *SM-3*’s deck cranes offloaded cargo onto the contract vessel for transport to Dillingham, Alaska, 21 miles north of where the vessel was anchored.

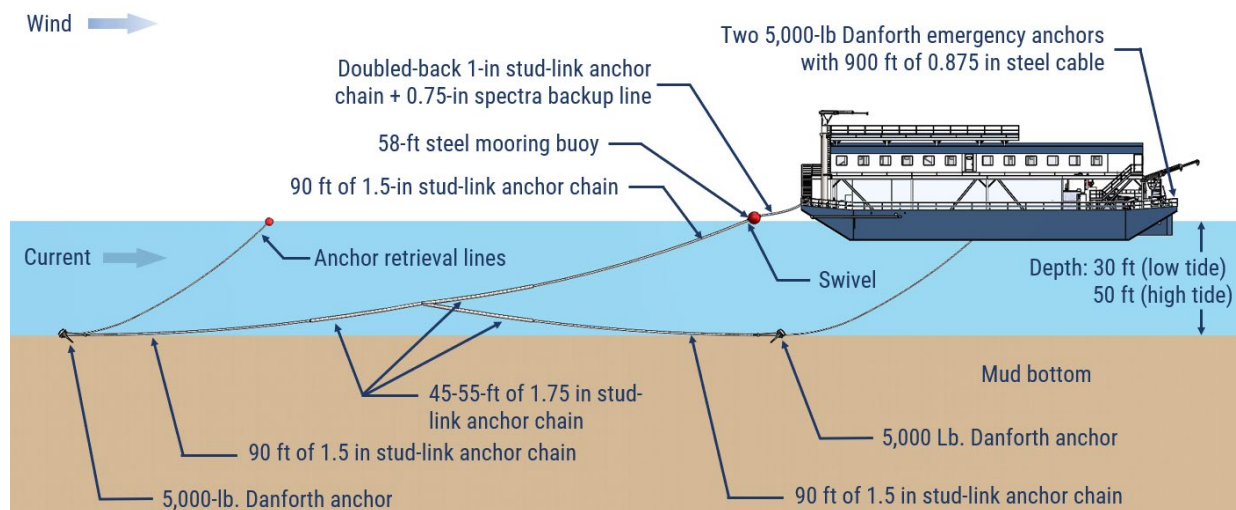
About 2.5 months after the season began, on August 19, the *SM-3* ended major fish operations with 17 crewmembers on board. The crew took the next few days to freeze and move fish, wrapping up the season. By August 23-24, all but eight

crewmembers (six for barge line handling and two for the *Sea Mount*) had been paid and sent home. The remaining crew, which included the PIC, senior deckhand (who was also the IT manager), operations manager, fish house manager, and two deckhands on the *SM-3*, and a captain and deckhand on the *Riverways-11*, began preparing the barges for winter layup. The PIC and IT manager discussed their need for a 3-day window of good weather to move both barges to their separate winter layup locations (1 day to move the *Riverways-11* to Dillingham; 1 day to recover the ground tackle system; and 1 day to move the *SM-3* to Naknek).

On Tuesday, August 25 at 1810, the National Weather Service (NWS) in Anchorage, Alaska, identified a storm that was forecasted to produce storm-force conditions and potential hurricane-force winds at the end of the week. About the same time, the company and the *SM-3*'s crew began tracking the storm using a free weather-monitoring application, which visually depicted current and forecasted winds, waves, and precipitation (among other things) but did not include NWS advisories/warnings and did not have archive capability. The PIC said that about 3-4 days out, predictions firmed up that the storm would come through the area.

The company president, who was located in Sitka, stated that he and the PIC discussed whether to move the *Riverways-11* or leave the two barges connected. Because the two barges had not ridden well while tied together in one instance of rough weather earlier in the summer, the PIC did not believe they would do well together in the upcoming storm. There was only one towboat close enough to tow the barges, and since the *Riverways-11*'s regular layup location (Dillingham) was closer than the *SM-3*'s (Naknek), the president and PIC agreed that the *Riverways-11* would be towed away for layup. They decided that the best option for the *SM-3* was to ride out the storm at anchor in the relative safety of Nushagak Bay because there was not enough time to retrieve the *SM-3*'s ground tackle system, then safely tow the *SM-3* to its winter layup site (67 miles away) across the unprotected Kvichak Bay.

In the early morning on Thursday, August 27, the *Riverways-11*'s emergency anchor and cable were put on board the *SM-3*, and the holding barge's mooring buoy chain was attached to the *SM-3* at the bow. A contract towing vessel towed the *Riverways-11* to Dillingham for winter layup.



**Figure 5.** *SM-3* ground tackle system at the time of the casualty when the water depth was about 40 feet. (Source: Northline Seafoods)

The IT manager said that on August 28, with the storm 2 days out, the forecasts for the storm worsened. On August 29, the PIC sent the workboat *Sea Mount* and its two crewmembers to ride out the storm in the Dillingham small boat basin. The *SM-3* crew spent the day preparing for the storm. Throughout the day, the NWS issued a special weather statement and a storm warning, forecasting strong southeast winds at 40 knots with gusts up to 65 knots in the afternoon, and seas 7 feet building to 14 feet.

On August 30, the wind picked up in the afternoon as predicted. The PIC estimated winds at 50 or 60 mph (43 or 52 knots), and he stated that after a lull, the full effect of the storm was upon them about 1800. Recorded observations at the airport at Clark's Point (6 miles north-northwest of the area where the barge was anchored) showed sustained winds from the south-southwest over 30 knots for about 7 hours, with maximum sustained winds at 41 knots at 1630 and wind gusts over 50 knots for about 3.5 hours (from 1630-2156). In the galley on the berthing deck, the crew secured equipment on wheels that began to move. Additionally, to prevent water damage, the generator on the main deck was secured and the load transferred to the backup generator in the engine room. The IT manager said the crew initially stayed in the galley, watching waves break over the bow; when it was too dark to see (twilight ended at 2221), they went to the recreation room. The depth at the anchorage was about 40 feet, and the PIC estimated seas in the area were 8-10 feet.

About 2300, the PIC was awoken by a "motion change in the barge;" he stated that he knew immediately that the barge was drifting. He went to the recreation room and told the crew the barge was no longer connected to the mooring buoy. The PIC, IT manager, and operations manager went out on deck to the stern and observed the *SM-3* broadside (port side) to the wind and waves, drifting toward a beach that was 2.1 miles

to the east of where they had anchored. They went to the barge's stern to release the emergency anchor, and the PIC estimated that, about 5 minutes after noticing the drift, the first emergency anchor was let go from the stern with 900 feet of steel cable. The *SM-3* swung around so that the barge's stern was facing into the waves, but it continued to drift. The IT manager stated that the emergency anchor did not "slow down [their] movement towards shore at all."

The PIC, IT manager, and operations manager, joined by the fish house manager and a deckhand, next began working to deploy the second emergency anchor. They used the barge's cranes to move the emergency anchor and shackle it onto the first emergency anchor's 900-foot-long steel cable. About 25 minutes after the *SM-3* began drifting, the second emergency anchor was deployed from the stern down the steel cable using the deck cranes. The operations manager stated that, with both emergency anchors deployed and both cables under strain, he thought the anchors held for a moment, but then the barge continued to move toward the beach, so the crew took shelter in the fish house.

About 5 minutes later, the *SM-3*'s bow grounded on Flounder Flat, a sandy beach. Incoming waves turned the barge starboard side to the shore with a slight list to port. The PIC stayed by a weathertight door in the fish house; the rest of the crew mustered above in the recreation room. They all wore life jackets and weather gear. The PIC noted that the vessel shuddered as incoming waves hit the beached barge's port side. Water ran over the main deck against the house, and, at the same time, floated the barge, moving it up the beach. Each time the water receded, the barge would settle on and wrack against the beach. The PIC stated that he was concerned that the wracking motion at the end of each incoming wave would collapse the upper decks, and he deemed it unsafe to attempt to jump to shore, so he had the crew take shelter below in Bay 4 (fish elevator and storage room) of the lower deck. He stated that he knew high tide would not occur until about 0200 (the National Oceanic and Atmospheric Administration predicted high tide would occur at 0240), so they were "going to be in this for a couple hours until it settled."

The PIC estimated that after about an hour in the surf, the freezer unit over Bay 1 (the engine room) broke away, and water from the main deck splashed down on the generator control panel. At the same time, the barge's slight port list suddenly shifted to about 10° to starboard, and the fish house gave way. The crew moved forward to Bay 3 (the aftmost fish hold), and the PIC secured power to the generator and closed the watertight doors on the lower deck. About 0400, with the *SM-3* still surrounded in heavy surf, the wracking stopped, and the barge settled on the beach.

About 0700, the crew abandoned the *SM-3* directly on to the beach and were met by two locals in vehicles. The barge was aground, 5 miles from Ekuk, at the highwater line against Ekuk Bluff. None of the crew reported any injuries or sought

medical attention. Drug and alcohol tests were not conducted because the company determined none of the crew were directly involved in the casualty.



**Figure 6.** *SM-3* after the grounding. (Source: Alaska Marine Surveyors, Inc.)

## 1.3 Additional Information

### 1.3.1 Damage and Salvage

On September 3, a marine surveyor attended the grounded barge in Ekuk. The surveyor's preliminary damage report stated that the barge's hull sustained structural damage in the engine room. Additionally, the superstructure, which included the top, berthing, and main decks, had collapsed on and crushed the fish house, and the entire superstructure was shifted to the starboard side partially on the beach. The report stated that there was an extensive debris field, which extended 1.5 miles on each side of the barge, and a slight diesel odor. The cost to repair the barge and replace equipment was estimated to be \$4.5 million.

On October 19 and 20, the *SM-3* was removed from the beach and towed to Naknek. On October 20 and 21, both mooring anchor assemblies were retrieved offshore approximately where the *SM-3* had anchored. The mooring buoy had separated at the upper padeye assembly into two pieces. The top padeye section of the mooring buoy was found with three shackles attached to it and connected to the barge's bow by the double-back 1-inch anchor chain and 0.75-inch polyethylene backup line. The two emergency anchors, still attached to their mooring wire, which remained



secured to the barge, were recovered about 225 feet from the location where the SM-3 grounded.

### 1.3.2 Mooring Buoy

The mooring buoy was 58 inches in diameter, made of steel, and foam-filled, with a wall thickness of 3/16 inches (0.3125 millimeters), a weight of 679 pounds, and 3,000 pounds of buoyancy. The D-shaped padeye was about 12 inches long and 1.25 inches thick. Requests to the supplier (Blue Ocean Tackle Inc.) to get manufacturer information and design specifications went unanswered.

After the grounding, the mooring buoy's damaged upper round curved cap piece was cut off and sent, along with the upper padeye assembly, to a materials testing laboratory for failure analysis. The laboratory reported that the buoy had "functionally failed—a separating crack had formed at the fillet weld of the topside padeye [which connected to the barge via a chain and line], thus allowing the uncontrolled separation of the padeye." The laboratory found that a small fatigue crack had been present at one end of the buoy's topside padeye, thus "providing a mechanical stress riser;" the crack initiated at the outer surface of the padeye at the base of the fillet weld and progressed inward radially. The fatigue zone reached a depth of about 5 millimeters (0.2 inches), and the section total thickness in that area was about 7.3 millimeters (0.3 inches). The crack proceeded into and across the shell in overstress, ultimately separating the padeye and adjoining shell material from the rest of the buoy. The materials testing laboratory found no metallurgical or welding-related defects.



**Figure 7.** SM-3 mooring buoy: failed padeye (with three shackles) that separated from buoy (left), damaged top with padeye missing (center), and undamaged bottom padeye (right). (Source: Alaska Marine Surveyors and Northline Seafoods)



**Figure 8.** Simulated direction of the tear/shear failure from buoy shell (left); padeye removed, cross-section removed from weld macro-etched and fractured face cleaned (center); close-up of the fatigue crack (right). (Source: Simon Forensic, LLC)

## 2. Analysis

Once fishing operations were completed, a 3-day window of good weather was needed to move the *SM-3* and its holding barge, *Riverways-11*, to their winter layup locations. However, a rapidly developing storm was forecasted to hit the area where the barge was anchored about August 29-30, leaving the crew only 3 days to prepare and move both barges. Since there were not enough resources available to prepare and tow both barges to their separate layup locations, management determined only one barge could be moved to its winter layup location before the storm arrived. Given that the *SM-3* would be moved to Naknek, which was a longer journey and would have involved exposing the barge to the storm's winds from the south-southwest, management's decision to instead move the *Riverways-11* to Dillingham and have the *SM-3* remain anchored (using the barge's ground tackle system) and wait out the storm was reasonable.

During the storm, the mooring buoy's topside padeye separated from the buoy (and the ground tackle system), causing the *SM-3* to drift and eventually ground on a beach about 2 miles east of the location where it had anchored. A postcasualty examination of the buoy showed that a 1.25-inch-wide fatigue crack had formed at the padeye's fillet weld, moving across nearly two-thirds of the weld before failing abruptly and tearing the cap plate it was welded to. Investigators were unable to determine whether the fatigue crack existed before the storm or developed as a result of it. If the crack existed before the storm, a visual inspection may have revealed it, particularly if the area was painted; however, the crew did not report any issues with the mooring buoy, and the company did not report regularly inspecting it. The buoy had been purchased in 2019 and was deployed in relatively calm weather (with only one instance of rough weather) during the 2019 and 2020 seasons. Therefore, the padeye may not have been

subjected to enough strain to initiate the fatigue crack until the August 30, 2020, storm. If the crack was preexisting, it contributed to the failure of the buoy in the storm; if it was not preexisting, the forces on the buoy during the storm resulted in the fatigue crack and complete separation of the padeye and adjoining shell material from the buoy.

It is possible that the mooring buoy failed due to a problem with the design of either the buoy itself or the ground tackle system as a whole. Based on the company's description of the ground tackle system, 270 feet of anchor chain connected the anchors to the mooring buoy. Having adequate scope—that is, the ratio of anchor chain to water depth—ensures that the anchor's designed holding power is achieved and prevents dragging. In light to moderate weather, the minimum scope generally accepted is 5:1, and in worsening conditions, the scope can be increased.<sup>2</sup> At the location where the *SM-3* was anchored, the maximum depth of the Nushagak Bay was 50 feet at high tide, meaning that there would be about 5 feet of anchor chain for each foot of depth in the bay (a scope of about 5:1), which was appropriate for the barge's safe anchorage in the area under normal conditions. According to the National Oceanic and Atmospheric Administration, about 2300, when the barge separated from the buoy, the water depth was 40 feet, at which point the anchor chain had a scope of 6.75:1. Regardless, there was no indication that either of the primary anchors dragged, so scope was likely not a factor. Therefore, the effect of the storm on the barge resulted in forces that exceeded the capability of the weakest link in the ground tackle system's components—in this case, the mooring buoy.

The lowest known general rating for a component in the ground tackle system was the breaking strength of the swivel, about 143,000 pounds. Requests to the supplier for exact design and manufacturing specifications for the mooring buoy went unanswered. Investigators were therefore unable to determine if the capability of the buoy was exceeded, or if there was a design flaw or manufacturing error.

## 3. Conclusions

### 3.1 Probable Cause

The National Transportation Safety Board determines that the probable cause of the grounding of the fishing tender barge *SM-3* was a fatigue crack in one of the mooring buoy's padeye welds, which resulted in the padeye separating from the buoy's

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<sup>2</sup> Safety4Seas, "Tips for right anchoring," <https://safety4sea.com/tips-for-right-anchoring/> (accessed January 25, 2022).

spherical steel plating, causing the barge to break free from its buoy and anchors and drift ashore during a storm.

### **3.2 Lessons Learned: Ground Tackle System Design**

In addition to fitting mooring chains of sufficient length to provide adequate scope for anchorages, mariners must consider the strength of each component of a ground tackle system and should reference marine standards for design. Bending loads can be significantly higher than straight-line pull. The working load limit of each component should be equal to or greater than the ground tackle system's maximum calculated load to avoid weak points in the system.

Vessel	<i>SM-3</i>
Type	Fishing (fishing tender barge)
Flag	United States
Port of registry	Ketchikan, Alaska
Year built	1966 (converted in 2019)
Official number (US)	505535
IMO number	N/A
Classification society	N/A
Length (overall)	150.0 ft (45.7 m)
Beam	42.0 ft (12.8 m)
Draft (casualty)	6.0 ft (1.8 m) est.
Tonnage	91 GRT
Engine power; manufacturer	N/A

NTSB investigators worked closely with our counterparts from **Coast Guard Sector Anchorage** throughout this investigation.

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For more detailed background information on this report, visit the NTSB investigations website and search for NTSB accident ID DCA20FM027. Recent publications are available in their entirety on the NTSB website. Other information about available publications also may be obtained from the website or by contacting—

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