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Recovered Gear Analysis of North Atlantic Right Whale Eg #3920 "Cottontail"

Photo credit: NOAA Fisheries/Peter Duley

Canada

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Executive summary

This report summarizes the data collected on gear removed from the North Atlantic right whale catalogued as Eg #3920, named “Cottontail”, during a partial disentanglement event on October 19, 2020 off Nantucket Island, Massachusetts (MA) and subsequently from the floating carcass on February 28, 2021 located off Myrtle Beach, South Carolina and again on March 10, 2021 off Beaufort, North Carolina (NC).

The report refers to gear descriptions and measurements by six sources:

(i) the United States (U.S.) National Marine Fisheries Service (NMFS) Gear Specialists (NMFS No. E22-20) (NMFS Cottontail Gear Analysis)
(ii) the Marine Animal Entanglement Response Program, Center for Coastal Studies, Provincetown, MA
(iii) Marine Mammal Stranding Program, University of North Carolina, Wilmington, NC
(iv) Georgia Department of Natural Resources, Wildlife Conservation Section
(v) Polysteel Atlantic Ltd., Sydney, Nova Scotia, Canada
(vi) Enterprises Shippagan Ltd., New Brunswick, Canada

Gear data were also accessed from records of previous right whale entanglements from the New England Aquarium to assist in the analysis. Opportunity to virtually view the gear removed on October 19, 2020 was made possible by NMFS on January 7, 2021 at their gear warehouse in Rhode Island. Photographs of the recovered gear and of the disentanglement efforts on all three dates were provided in the sources identified above, some of which are presented in this report.

Inferences of the origins of the gear are given based on the data, Fisheries and Oceans Canada (DFO) and NMFS regulations and interviews with a number of individuals that are listed in Perspectives. Annexes 1 to 3 include flowcharts of the report’s contents.

Conclusion of gear origin: Indeterminate of fishery or country.

Recovered gear

Measurement abbreviations

- **ft**: feet
- **mm**: millimetres
- **cm**: centimetres
- **m**: metres

October 19, 2020: Initial disentanglement event

Event ID and/or Date: Eg #3920 “Cottontail”

Event type (stranding, floater, disentanglement): Partial Disentanglement

Species: Right Whale

Country of origin: (U.S. – south of Nantucket Island, MA)

Buoy line/rope:

- **Floating (positively buoyant):** Yes
  - **Diameter**: 5/8 inch (NMFS Report)
  - **Length**: 90 ft (NMFS Report) (97 ft according to measurements taken by Center for Coastal Studies, Provincetown, MA). Yellow tracer present.
  - **Line Markings**: Orange 8 inch length of braided twine tucked once through line about 8 fathoms from 19 inch loop (NMFS Report)

- **Sinking (negatively buoyant):** None (NMFS Report)

Ground line: None (NMFS Report)

Buoys: None (NMFS Report)

Weak link: None (NMFS Report)

Trap/Pot: None (NMFS Report)

Netting: None (NMFS Report)

Splices: None (NMFS Report)

Exhibit A: Approximately 97 ft of 5/8 inch diameter float rope, including a 19 inch loop, that was removed from Cottontail on October 19, 2020 and laid out on the ground.

Exhibit B: Two tucks between strands of 5/8 inch diameter float rope adjacent to the 19 inch loop removed from Cottontail on October 19, 2020.

Exhibit C: Orange braided twine (length 8 inches) tucked once through 5/8 inch diameter float rope at a distance of approximately 8 fathoms from the 19 inch loop removed from Cottontail on October 19, 2020.

February 28, 2021: Gear removed from carcass off the coast of South Carolina

Event type (stranding, floater, disentanglement): Floater

Country: U.S., off coast of South Carolina

Buoy line/rope:

- **Floating:** Yes (three stranded of similar type from October 19 partial disentanglement) (NMFS Report)
    - **Diameter:** 5/8 inch (NMFS Report)
    - **Length:** three segments of 27 ft, 78 ft and 15 inches (NMFS Report) with yellow tracer
    - **Line Markings:** Orange 8 inch braided twine interlaced in 27 ft segment, Orange 6 inch braided twine interlaced in 78 ft segment (NMFS Report)

- **Sinking:** Yes (three stranded with two lead filaments) (NMFS Report)
    - **Diameter:** 5/8 inch
    - **Length:** a single segment of 102 ft (17 fathoms) (NMFS Report) with yellow tracer
    - **Line Markings:** None

Ground line: None (NMFS Report)

Buoys: None (NMFS Report)

Weak link: None (NMFS Report)

Trap/Pot: None (NMFS Report)

Netting: None (NMFS Report)

Splices: None (NMFS Report)

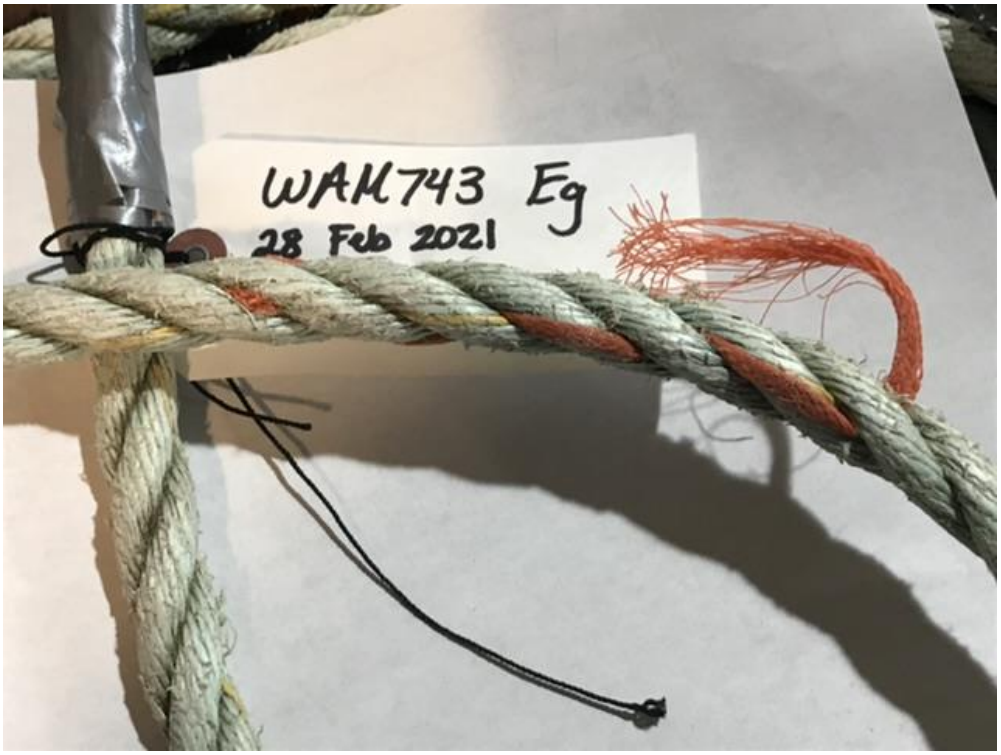


Exhibit D: Orange twine interlaced in a segment of 5/8 inch diameter float rope removed from Cottontail on February 28, 2021.

March 10, 2021: Gear removed from carcass off the coast of North Carolina

Event type (stranding, floater, disentanglement): Floater

Country: U.S., off coast of North Carolina

Buoy line/rope:

- **Floating:** Yes (three stranded) (Georgia Department of Natural Resources Report) of similar type from October 19 partial disentanglement and February 28 removal from carcass
    - **Diameter**: 5/8 inch (Georgia Department of Natural Resources Report)
    - **Length:** two segments of 12 ft and 17 ft with yellow tracer (Georgia Department of Natural Resources Report)
    - **Line Markings:** None (Georgia Department of Natural Resources Report)

- **Sinking:** Yes (three stranded with lead filaments) (Georgia Department of Natural Resources Report)
    - **Diameter:** 5/8 inch
    - **Length:** Two segments each of 13.5 ft and another segment of approximately 12 ft with yellow tracer (Georgia Department of Natural Resources Report)
    - **Line Markings:** Orange 6.5 inch length of braided twine interlaced in one of the 13.5 ft segments (Georgia Department of Natural Resources Report)

Ground line: None (Georgia Department of Natural Resources Report)

Buoys: None (Georgia Department of Natural Resources Report)

Weak link: None (Georgia Department of Natural Resources Report)

Trap/Pot: None (Georgia Department of Natural Resources Report)

Netting: None (Georgia Department of Natural Resources Report)

Splices: None (Georgia Department of Natural Resources Report)

Exhibit E: Beaded lead filaments exposed from a segment of the sinking rope removed from Cottontail on March 10, 2021.

Accuracy of line diameter measurement

Center for Coastal Studies (Provincetown, MA) that conducted the disentanglement on October 19, 2020 measured the line diameter to 0.1 mm and found it to be closer to 9/16 inch than 5/8 inch (their measurement was 14.5 mm). The conversion of 9/16 inches is 14.3 mm and 5/8 inches is 15.9 mm.

Repeatability of line diameter measurements is a point of concern. Rope is not circular in diameter and is flexible resulting in some variation among measurements by the same person and different persons. The diameter can also vary along different lengths of the line with rope further towards the fishing gear being more flattened due to elongation. Polysteel Atlantic Ltd. has indicated that three employees can come up with different measurements of the same rope in their plant. If the rope is indeed a 9/16 inch product, it would change the perspective on fishery origin. 9/16 inch rope is rarely used in the snow crab fishery compared to larger diameters.

Another method to indirectly derive diameter is to weigh a known length and scale up to the known weight of a full coil at production. It is also known that stated rope diameters vary among manufacturers with some consistently producing a product that is less than the label on the product.

During a NOAA/DFO video conference call on January 7, 2021, NMFS Gear Specialists agreed to send a sample to Polysteel Atlantic Ltd. for validation of line diameter and whether the rope came from their plant as reported in the initial gear analysis by NMFS.

After receipt of a 2 ft segment, Polysteel Atlantic Ltd. confirmed that the rope removed on October 19, 2020 is 5/8 inch in diameter and further described a number of features common in the trade (Annex 4). Their analysis of its characteristics revealed the rope was not produced by Polysteel Atlantic Ltd.

Orange line markers (types, distances and significance)

A buoy line mark made of orange twine was a requirement in the Crab Fishing Area (CFA) 12 (southern Gulf of St. Lawrence) in 2018 and 2019 (CFA12E = yellow, CFA12F = blue, and CFA19 = green twine). This was to be placed once every 27.4 m (90 ft) and was to be a minimum 15 cm in length.

Beginning in 2020, DFO put in place a very extensive gear marking program that spanned all non-tended, fixed gear fisheries in Atlantic Canada. Two to three 15 cm or longer coloured twine segments (interlaced length) along the buoy line at specific intervals as identified in conditions of licence were required. Specifically, coloured twine segments were to be placed at top, middle and bottom of the buoy line, though in the case of the CFA areas identified above the 27.4 m interval also remained permissible (Update to the conditions of licences related to the mandatory colour scheme for gear marking in eastern Canada).

In the snow crab fishery, one of the coloured twines was to be orange. The other two colours identified the DFO Region and Fishing Area. The coloured twines could also be inserted as coloured yarns (tracers) throughout the length of the rope at manufacture (however using coloured twine and tracers in the same section of rope is not a valid regulatory mark).

In the U.S., a single orange line marker is required in trap/pot fisheries to a depth of 100 fathoms from Long Island, New York (NY) (excluding Long Island Sound) to the northern state line of South Carolina and waters off mid-Florida (27º31'N to 29º00'N). For each buoy line, three are required, with one placed at each of the top, middle and bottom. The method of applying the buoy line marker in the U.S. is flexible (e.g., paint, tape, twine, etc.) and, if a single colour, each mark is to be 12 inches in length (Mid-Atlantic trap/pot fisheries requirements and management areas and Southeast trap/pot fisheries requirements and management areas).

For the rope removed from Cottontail on October 19, 2020, the orange twine was inserted in a manner that could also have been a warning to crew during hauling that the end of the buoy line was approaching (Gear Alert Marker). That is, alerting the crew to be ready as the fishing gear

would follow a certain distance from that marker. In this case, the marker was 8 fathoms (48 ft) from the 19 inch loop. To attach the twine, the 8 inch long segment of orange twine presumably was folded at about mid-point, with the created loop tucked under a strand and the two bitter ends passed through the loop and cinched up against the rope. Whether it had a dual purpose, to also act as a buoy line marker is uncertain.

For the rope removed on February 28 and March 10, 2021, the three orange interlaced twine segments represented buoy line markers and not Gear Alert Markers. Of particular note is the absence of an orange line marker in the 17 fathom length of recovered line on February 28, 2021. This is inconsistent with DFO regulations of line markings in 2018 and 2019, as a mark should have been present once every 15 fathoms. This configuration is also inconsistent with marking requirements put in place in 2020 when additional coloured twine markings were required.

According to the Chief of Operations, Conservation and Protection (Gulf Region), inspection on wharves takes place prior to the fishing seasons (snow crab, lobster) for gear compliance in all areas in the Gulf of St. Lawrence. Gear marking education sessions were given to fishers, fishermen's associations and First Nation communities prior to the start of fishing seasons (2018, 2019 and 2020). Pamphlets were given to fishers with instructions on North Atlantic right whale measures as provided by DFO's Atlantic Marine Mammal Hub.

Requirements of condition of licence, if not met by the harvester, can result in severe consequences. According to the *Fisheries Act*: "an offence punishable on summary conviction and liable, for a first offence, to a fine not exceeding one hundred thousand dollars and, for any subsequent offence, to a fine not exceeding one hundred thousand dollars or to imprisonment for a term not exceeding one year, or to both."

In U.S. trap/pot fisheries, three line markings are required per buoy line. For gear removed from Cottontail, three orange line marks were recovered. If a greater number were recovered, these marks collectively would have been inconsistent with U.S. gear markings. The gear collected from deceased Cottontail was considered by NOAA Gear Specialists and the Marine Mammal Stranding Program, University of North Carolina, to be line

associated with the October 19, 2020 partial disentanglement and consistent with a single vertical line.

One should also consider that some harvesters may be delinquent in how they fix buoy line markers to their gear such that they are not in complete accordance with fishery regulations or that gear markings may not persist in their initial state after gear has been deployed numerous times. A U.S. disentanglement team member reported that U.S. buoy line markings on recovered gear of large whales have been observed to be variable in length (i.e., also less than12 inches) and in their quality of colour. Thus the shorter orange markings observed on the gear removed from Cottontail could possibly be non-compliant and illegal U.S. markings. Supplement C: ALWTRP Gear Marking notes 12 inch coloured required marks can be accomplished in a variety of ways (e.g., coloured twine, spray paint, and electrical tape). Misinterpretation of the 12 inch aspect of the regulation is possible. For example, a 12 inch segment of 3 mm diameter twine interlaced in a three stranded 5/8 inch diameter rope generates an 8.5 inch long integrated mark not a 12 inch long mark (18 inches of twine results in a 12 inch mark).

Marked differences in compliance rates of gear marking between Canada and U.S., if they exist, would presumably also influence judgement of gear origin.

Designation of location of 19 inch loop

Observations from the Center for Coastal Studies disentanglement team was that a “heavy weight” was on the section of the line descending along the left flank of Cottontail. The section of the line bearing the 19 inch loop that was observed floating was located at the opposite end to that of the unobserved weight. The tension coil that was created by the disentanglement team upon cutting the rope was presumably due to the tautness in the line as the whale was swimming away from the team at time of cutting. This is caused when a cut is made of rope that is under high tension as one strand recoils and subsequently the other two strands recoil. One would surmise that the 19 inch loop is therefore related to the surface buoy as the opposite end had a heavy weight attached to it.

Designation of which end of the line (19 inch loop or other unobserved end) was attached to the fishing gear is problematic because the heavy object below Cottontail was never observed and therefore not identified. Observations of Cottontail during the partial disentanglement on October 19 were accessed to address this.

When Cottontail was stationary, a large quantity of rope on its right flank came to the surface though none from the left flank where no bitter end was observed. Nor was any rope on the left flank brought to the surface during rapid swimming, whereas the rope of the right flank trailed at the surface.

The NMFS report infers the heavy end of the fishing gear was initially attached to the 19 inch loop on the right flank, but the observations of the response team note a heavy weight on the left flank. Gear analysis reports ranging from 1981-2017 were accessed from the New England Aquarium website and viewed to assess the historical data on incidence of secondary fishing gear in right whale entanglements.

In only six of the 111 entanglement cases reviewed did an entangled right whale become entangled in secondary gear (Eg #3603, 3823, 3821, 3392, 3445, and 2233) and of these six, only one was associated with snow crab gear (Eg #3603). Thus, the occurrence of picking up secondary gear by entangled right whales is uncommon, suggesting the weight on the left flank was associated with the initial entanglement and the 19 inch loop on the right flank was associated with the surface buoy system.

Furthermore, from the photographs, the organic build up on the recovered rope (360 ft in total) is greatest on/near the 19 inch loop suggesting this part of the rope spent more time in surface waters that would generate organic growth compared to rope that presumably was at deeper depths.

Two tucks back into a line to finish an attachment to a buoy or trap/anchor

The use of one or two tucks is in part a function of how much extra rope there is left after tying a knot. Consultations with a number of snow crab and lobster fishers indicate that either one or two tucks can be used. The retrieved line had two tucks. Securing the bitter end back into the buoy line by one vs two tucks is not considered a strong determinant of origin of fishery or country.

A determinant of 19 inch loop with two tucks to denote Canadian snow crab gear

The use of former recovered gear stored in the NMFS gear warehouse in Rhode Island (Eg# 3530 – “Ruffian”) to associate Cottontail gear with Canadian snow crab rests in part on an attachment method to the remnants of a funnel shaped trap similar to that used to fish snow crab. Namely, that the attachment method to the recovered trap is unfamiliar to U.S. commercial fishers.

However, based on the information above, the 19 inch loop recovered from Cottontail was perhaps not attached to the fishing gear, but to a surface buoy. Buoy attachment methods may vary widely among fishers, fisheries and type/size of buoys.

Although a 19 inch loop may roll out after the bridle snaps from a double clove hitch or double rolling hitch type knot used in snow crab fisheries, a 19 inch loop can also be created by fishers from a wide number of fisheries for other purposes, such as attaching primary and secondary buoys, as noted in the “Other perspectives” section below. Also, the NMFS Report does not provide evidence from the NMFS gear warehouse that a 19 inch loop in combination with two tucks was ever observed on known snow crab surface buoys. An unverified assumption is also made that this “unique attachment method” does not occur in other fisheries in Canada or is used for something other than fishing.

Note that the 19 inch loop off of Cottontail had much more organic build up than a similar looking loop on gear removed from Ruffian. Both, by NOAA accounts, were attached to traps where little or no light exists at depths fished for snow crab in the cold Canadian spring waters where traps are fished for only two to three months a year. Seafloor water temperatures in the southern Gulf of St. Lawrence have been reported to predominantly range from -1 to 1^{o}C from May to June (based on temperature data from a sensor placed on a fisher's snow crab trap in 2017 that was set in a number of locations; two sets had temperatures of 2 and 3^{o}C). Annual DFO hydrographic data also confirms seafloor temperatures less than 3^{o}C on the crab fishing grounds. This adds more conflicting evidence for the 19 inch loop from Cottontail to have been attached to a snow crab trap as in the case of Ruffian when a loop was known to be attached to a snow crab trap it was relatively clean in appearance.

Conversations with snow crab harvesters indicate that rope at the trap attachment does not biofoul. This raises the question of whether the Cottontail recovered gear could also be U.S. derelict fishing gear that uses an orange marker? The Southern Nearshore Trap/Pot Waters fisheries have had the orange mark regulation since 2015. Furthermore, sea surface temperatures rise to more than 20^{o}C in these mid-Atlantic and southern waters, as recorded by NOAA, where fisheries such as lobster can be prosecuted for 11 months of the year. These environmental conditions and fishing practices are more likely to generate algal growth on rope especially if near or on the ocean surface.

Exhibit F: Rope attachment at snow crab trap and associated buoy line of recovered gear after 350 days of being derelict in the southern Gulf of St. Lawrence (2020 to 2021). DFO Ghost Gear Report filed by snow crab fisher that both lost and found his own trap nearly a year later as verified by trap tag number. Note cleanliness of line relative to the condition of the 19 inch loop recovered from Cottontail shown in Exhibits A and B.

Length of rope recovered and not recovered from Cottontail

On October 19, the length of rope that could be observed around Cottontail was between 300-400 ft as estimated by a Canadian disentangler when viewing the photographs of the U.S. response team. There also was considerable rope descending down below the whale to the presumed fishing gear (trap, trawl and/or anchor). The total estimated rope of the intact buoy line was at minimum 500-600 ft (see “Other perspectives”). A

cumulative sum of 360 ft of rope (232 ft floating and 128 ft sinking comprised of nine segments) were collected from Cottontail on October 19, February 28 and March 10. Hence, if the gear is from a U.S. fishery, it would be from one that fishes at deep depths.

In the U.S., the ALWTRP Southern Nearshore Waters trap/pot fisheries that require an orange marker extends to the 100 fathom (600 ft) depth contour along the U.S. coast from Long Island (excluding Long Island Sound) to the northern state line of South Carolina and includes waters off mid-Florida. This length of rope is consistent with buoy line that could be fished in these waters.

Use of 5/8 inch diameter buoy line in ALWTRP Southern Nearshore Trap/Pot Waters

Dialogue with a Canadian rope manufacturer indicates that 5/8 and ¾ inch floating and sinking rope is sold to vendors in NY state and elsewhere along the U.S. eastern seaboard. Statements that U.S. harvesters do not use 5/8 inch diameter rope with an orange buoy line marker do not represent regulatory measures. Fishing lobster trawls, for example, to a depth of 600 ft in which many pots are simultaneously suspended in the water column is not inconsistent with the deployment of 5/8 inch diameter line, according to dialogue with a Canadian rope manufacturer.

Sightings of Cottontail in 2020

Cottontail was sighted twice in U.S. waters in 2020, once in March with no gear and then in October with gear. The second sighting was near the area in which buoy lines in trap/pot fisheries are to be marked with an orange mark. Cottontail was not sighted in Canadian waters in 2020 despite extensive NARW surveillance, though was sighted there in earlier years. The sightings analyses conducted by DFO scientists for 2020 includes both thorough reviews of day-to-day sightings and incidental reporting, as well as efforts to identify individuals.

At the time of the partial disentanglement on October 19, 2020, the body of the 11-year-old male was described as being in not great condition. It is difficult to use this as a diagnostic tool of when the entanglement occurred.

Canadian industry perspectives

There are biased and non-biased responses to queries. A non-biased response is preferred and therefore, with the exception of one fisher, when asking a number of snow crab and lobster harvesters to describe their fishing gear they were intentionally not shown photos nor had the gear described to them that was removed from Cottontail, even after the questioning was completed.

Southern Gulf of St. Lawrence (CFA12) snow crab fisher:

- 25+ years of experience
- did not review photos

When attaching his 5/8 inch buoy line to the bridle he uses three wraps, a bow line and one tuck. He uses sinking rope on the top and floating on the bottom.

Snow crab fisher (CFA22) out of Glace Bay, Sydney, Nova Scotia:

- 57+ years of experience
- did not review photos

When attaching his 5/8 inch buoy line (which is approximately 60 fathoms sinking at the top and 100 fathoms floating at the bottom), he ends his attachment by one tuck and if extra rope is lengthy, he will add another tuck.

President, Lobster Fishing Area 34:

- 30+ years of experience in lobster fishery in SW Nova Scotia
- did not review photos

The fishery uses ½ or 9/16 inch diameter rope with a few using 7/32 inch as buoy line. The connection to the trap is made by way of an 8 inch spliced loop to which the floating buoy line is attached by two half hitches. The bitter end may be taped to buoy line or other means like a tuck.

Southwest Nova Scotia Lobster Fisher:

- 35+ years of experience
- frequent volunteer for experimental gear trials in previous 20 years
- did not review photos

He uses an 8 inch spliced loop to which ½ inch floating buoy line is attached approximately 6 fathoms from the anchor. This 6 fathom section is 15/32 inch floating rope. He then uses 15/32 inch floating rope between each of his successive 14 traps and these connecting ropes are each 16 fathoms in length. At the surface, he uses 8 fathom 7/16 inch floating for his primary and secondary buoy lines, then 8 fathoms of sinking 7/16 inch connected by splice to 20 fathoms of 7/16 inch floating and connected by splice to another 20 fathoms of 7/16 inch floating and then 30 fathoms of ½ inch floating to which he attaches the 8 inch eye splice described above. His eye splice acts as the warning to crew that the anchor is approaching.

President, CFA19 snow crab fishery (off Cape Breton, Nova Scotia):

- 28 years as a snow crab fisher
- did not review photos

99% of snow crab fishers in his area use 5/8 inch (no ¾ inch). 100 to 130 fathoms of buoy line. 15 fathoms of floating 5/8 inch attached to a 20 inch eye splice to which 20-25 fathoms of weighted line and then 60-75 fathoms of floating 5/8 inch which is connected to the bridle. He uses three wraps and two tucks to complete the attachment. The bitter end may be taped or not. To the same 20 inch eye splice at the surface is attached a 5/16 or 3/8 inch 7 ft length of rope that is connected to the buoy by a bowline. This is his method, he commented that there exists a wide range of methods by which fishers attach their buoy line to the trap and the surface buoys.

Southern Gulf of St. Lawrence (CFA12) snow crab fisher:

- 25+ years of experience
- reviewed photos

When attaching his 5/8 inch buoy line to the bridle he uses three wraps round the bridle followed by a half hitch and one tuck. Sinking 5/8 inch on top and floating rope on the bottom. In 2018 and 2019, he added 15 cm orange marks using interlaced twine along the length of his buoy lines. This

means one mark every 27.4 m. He consulted with another fisher who uses four wraps around the bridle followed by a half hitch and one tuck. This other fisher has seen as many as five wraps and occasionally two tucks.

DFO Conservation and Protection (C&P) perspectives

Director, C&P, Gulf Region:

- 35 years of experience as a fishery officer
- includes comments from another C&P officer from Gulf Region

He reviewed the photos of October 19, 2020. He pointed out that the 19 inch loop was originally connected to the surface buoy and the tension coil was in the direction of where the fishing gear was attached. He observed the higher build-up of organic matter as one gets closer to the 19 inch loop. He indicated that a wide number of methods are used to connect rope to the buoy and although ideally the surface line should be negatively buoyant some fishers initially had it reversed. He confirmed that the tension coil was formed due to the cut made on rope that was under tension and noted the different angles of lines on each side of Cottontail's body with the right flank showing rope nearer the surface and apparently this is the end that had the 19 inch loop.

Chief, Enforcement Programs, C&P Maritimes Region:

- 9 years of experience with 6 years doing trap compliance checks in the Bay of Fundy
- reviewed photos of the recovered gear of October 19, 2020

He indicated that the 19 inch loop could be fishing gear, but then again there is no certainty. A loop of this kind could also be used on the end of a mooring line. From the photos, he was uncertain if he saw another piece of rope entering into the area of the tension coil. This was based on some strands with a yellow tracer and some without. It was difficult to confirm from the photos provided (he did not view the photos of Cottontail with trailing rope). He noted that the tension coil is formed after a cut is made on rope that is under tension. He noted that the orange marker could have been a mark placed on the rope to help judge that a trap is coming close to the surface. One uses a colour that differs from the colour of the rope.

Other perspectives

President, Polysteel Atlantic Ltd., North Sydney, Nova Scotia:

- since mid-1980s
- reviewed photos

He indicated the difficulty in distinguishing Polysteel Atlantic Ltd. rope from other brands without actually cutting it and inspecting the method of manufacture. From enlarging one of the photos provided, he counted the number of bundles between two successive yellow tracers on the same strand. However, he requested a small piece to further examine its construction to assess whether it came from his Nova Scotia plant. He indicated a manufacturer from overseas produces a product with a similar external appearance but has a different construct and the overseas product is also used in a number of east coast fisheries.

His analysis, based on a variety of techniques, would also reveal whether the rope removed from Cottontail was 9/16 or 5/8 inch and his conclusion was the latter. He noted that 5/8 inch is common in lobster trawls in deep water in northeast U.S. waters and has sold both 5/8 and ¾ inch diameter rope to fishers in NY state, an area where an orange mark is used in trap/pot fisheries. These large diameters have also been sold by Polysteel Atlantic Ltd. to other areas in the eastern U.S. including floating and sinking varieties. With reference to the photos of leaded line recovered, he reported his company does not sell this type of line with a yellow tracer. In conclusion, from a review of its characteristics, he reported his company did not produce any of the rope recovered from Cottontail.

President, Enterprises Shippagan Ltd., a wholesaler of commercial fishing supplies in New Brunswick

Was provided with a one foot sample of the floating rope removed from Cottontail on October 19. After examination, they reported that the internal composition does not match the product they sell. It contained one more string (twisted yarn package) per strand than their product. Furthermore, the leaded rope removed from Cottontail was characterized by a yellow tracer, which according to the company does not match the colour of tracer of their product.

A member of Campobello Whale and Rescue Team (18 years) and lobster fisher in Bay of Fundy (23 years):

He viewed the photographs and video of October 19, 2020 and estimated the amount of total rope involved in the entanglement at 500-600 ft, though without seeing what was attached to below the whale it is difficult to be too accurate. He pointed out that a 19 inch loop is not uncommon to be used as an attachment point for a short, thinner line to one or more surface buoys in a number of fisheries. The diameter and length of the recovered line in his mind is common in U.S. offshore lobster, Canadian lobster trawl and Canadian snow crab.

Director, Marine Animal Entanglement Response, Center of Coastal Studies, Provincetown, MA.:

He was present during the partial disentanglement event in October 19, 2020. He commented that methods used in U.S. fisheries when marking buoy lines with coloured marks range widely in their characteristics. For example, he has observed faded blue paint and red electrical tape spanning a two inch length of rope (the regulatory length being 12 inches). This observation is of particular value as it represents a third party perspective independent of fishing industry and government agency.

Conclusions

- The dual use of an orange buoy line mark and twine to denote markings in a Canadian snow crab fishery (2018 and 2019 only) and in fisheries in the U.S. Atlantic Large Whale Take Reduction Plan Southern Nearshore Trap/Pot Waters (since 2015) confounds the ability with complete certainty to identify country of origin. In 2020, the only fishery that was using a single orange mark to designate gear was in the U.S.
- The collection of a 17 fathom length of rope on February 28, 2021 with no line markings, if of Canadian origin, does not comply with DFO fishing regulations, as a line marking was to be placed one every 15 fathoms in the years 2018 and 2019 when a single colour mark was required.
- The lengths of the orange line markings recovered were 6, 6.5 and 8 inches not the required 12 inches stipulated in U.S. fishing

regulations, whether these are non-compliant and illegal U.S. marks is also possible as observations of line markings in the U.S. of less than 12 inches have been reported.

- The designation of the 19 inch loop as only being consistent with Canadian snow crab gear is based on non-regulated fishing methods and low sample size and is not considered a determinant of fishery or country of origin.
- Statements that U.S. harvesters do not use 5/8 inch diameter line with an orange buoy line marker are not regulatory measures. Fishing lobster trawls to a depth of 600 ft which occurs in the ALWTRP Southern Nearshore Trap/Pot Waters in which many pots are simultaneously suspended in the water column during retrieval is not inconsistent with using 5/8 inch diameter line, according to dialogue with a Canadian rope manufacturer.
- Two key rope wholesalers in eastern Canada do not sell the exact types of 5/8 inch ropes removed from Cottontail as the internal construct and tracer colour on these types of rope do not match their products.
- The detection of Cottontail both gear free and entangled in U.S. waters in 2020 and the absence of evidence of Cottontail in Canadian waters despite extensive monitoring efforts, increases the possibility that the gear is from a U.S. orange marking fishery, in particular the U.S. ALWTRP Southern Nearshore Trap/Pot Waters.

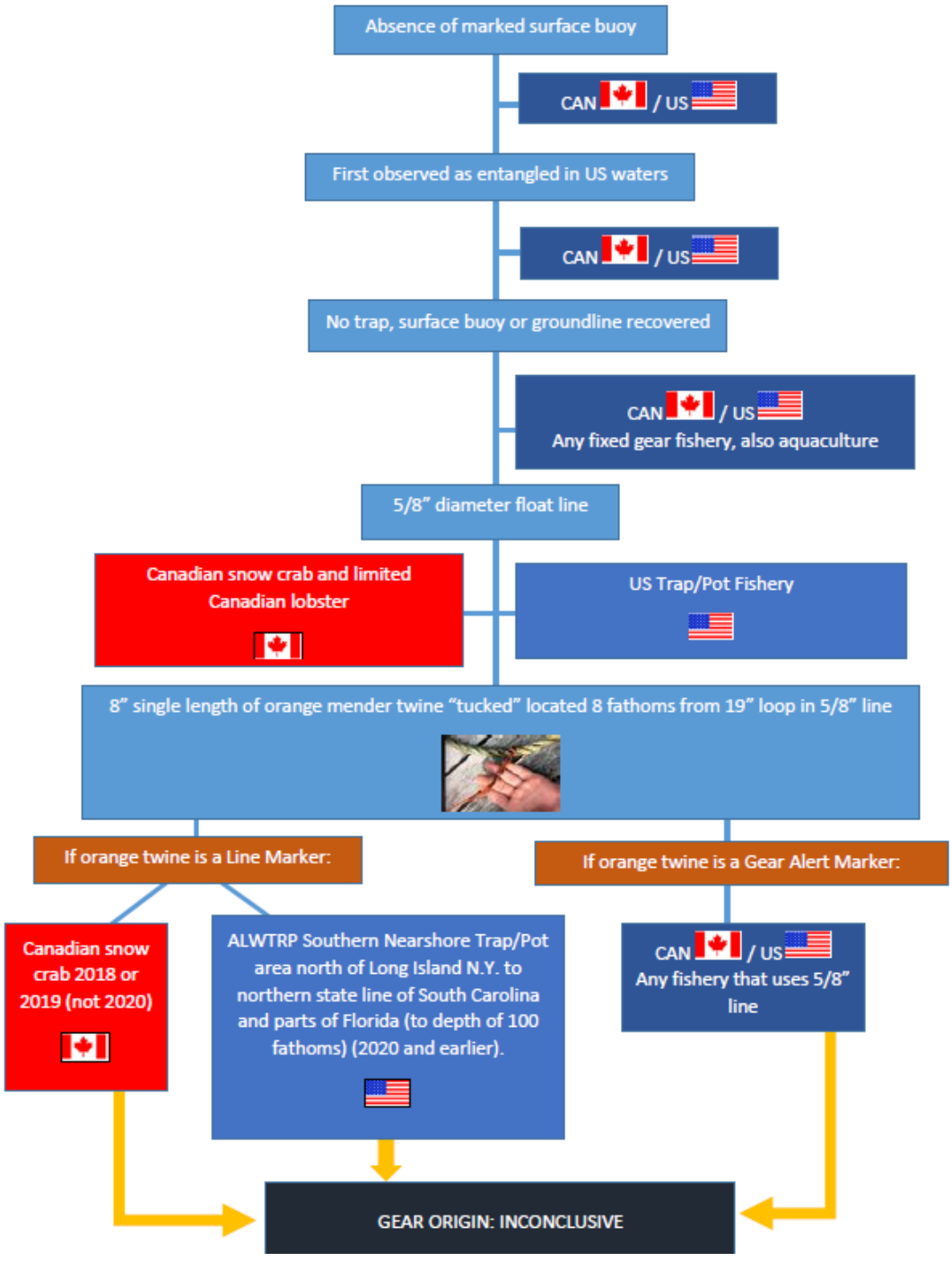
Conclusion of gear origin: Indeterminate finding of fishery or country.

Report prepared by Edward Trippel, Research Scientist, for Adam Burns, Director General, Fisheries Resource Management, Fisheries and Oceans Canada

March 30, 2021

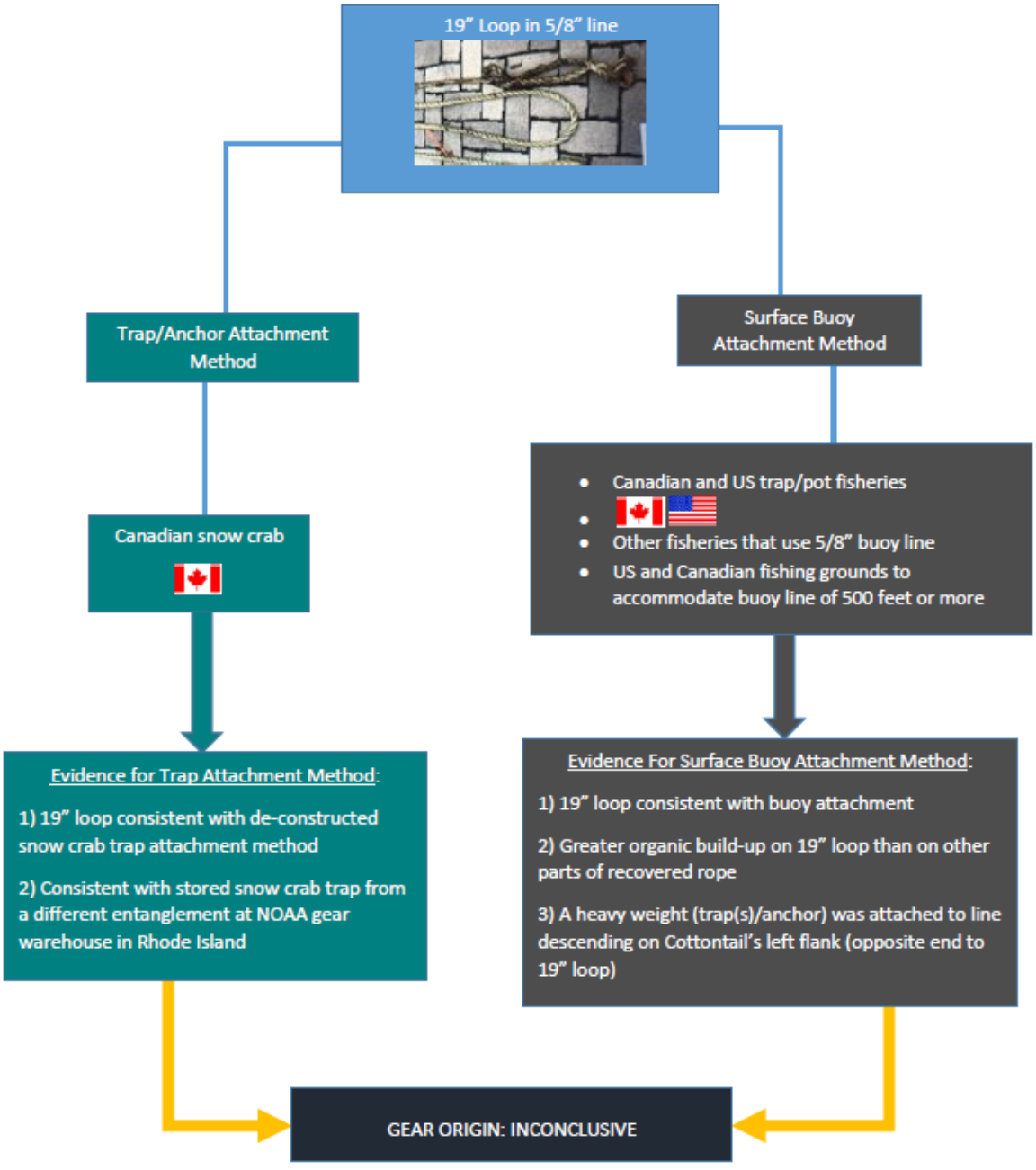
Annex 1

Flowchart of origin of gear by country and fishery based on presence of 5/8 inch diameter rope removed from Cottontail on October 19, 2020



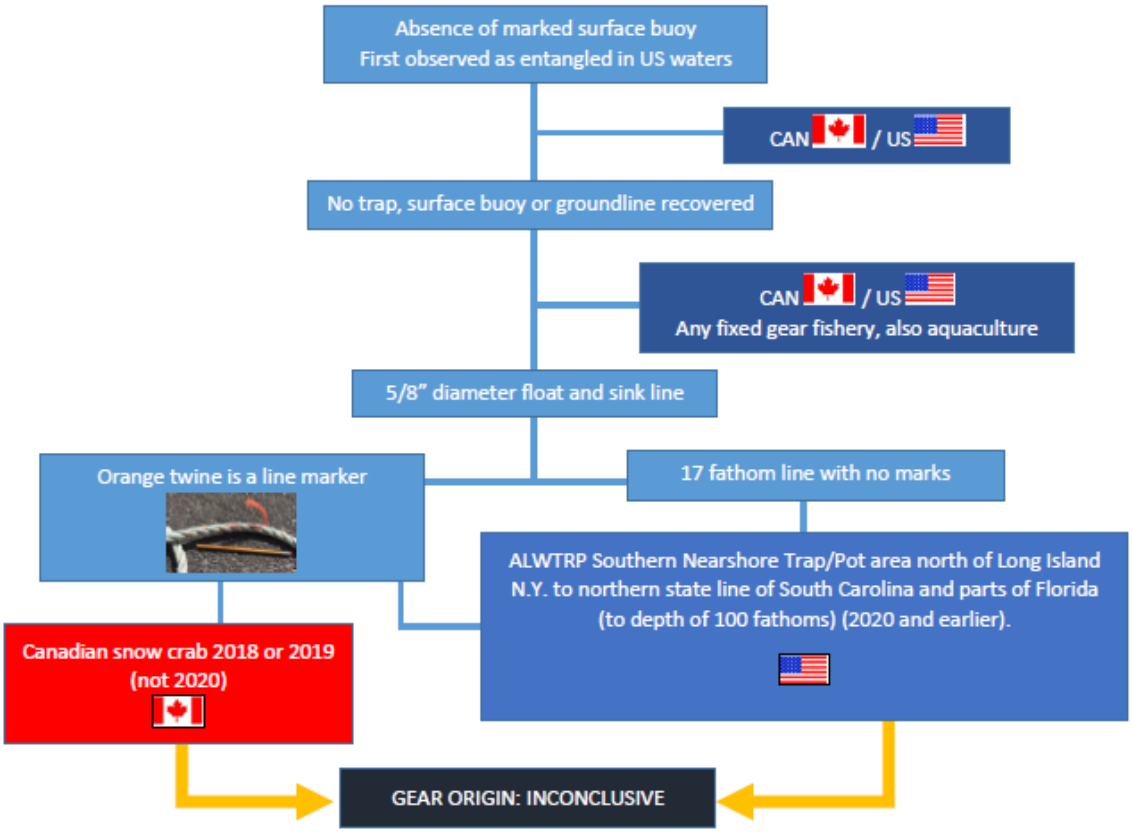
Annex 2

Flowchart of origin of gear by country and fishery based on presence of a 19 inch loop on 5/8 diameter rope removed from Cottontail on October 19, 2020 in relation to possible attachment to a trap/anchor or surface buoy.



Annex 3

Flowchart of origin of gear by country and fishery based on float and sink rope removed from the carcass of Cottontail on February 28 and March 10, 2021. Includes scenarios by how Cottontail may have become entangled in either U.S. or Canadian waters.



Scenario for ALWTRP Southern Nearshore Trap/Pot Waters:

- "Cottontail's" presence was undetected in Canadian waters in 2020 despite extensive NARW surveillance.
- "Cottontail" was first sighted with gear in US waters, near area where single orange line marker is currently required, Long Island, N.Y. to northern state line of South Carolina and parts of Florida (2020 and earlier).
- Estimated 500 feet of observed 5/8" line is consistent with length of buoy line used in ALWTRP Southern Nearshore trap/pot area where fished to depths of maximum 600 feet.
- The 19" loop represents the surface buoy attachment and the associated US trap/pot would have been trailing below "Cottontail".

Scenario for derelict Canadian snow crab gear in 2018 or 2019 (not 2020):

- "Cottontail" was sighted in March 2020 in US waters without gear and again in October 2020 in US, but this time with gear (partially disentangled in October 2020). "Cottontail's" carcass was observed off the coast of South Carolina in February 2021, and observed again in March.
- The US designated "buoy end", which descended to depth beneath "Cottontail", became entangled in secondary fishing gear and remained present in October 2020.
- In 2020, DFO launched extensive buoy line marking requirements that required 2-3 different coloured twine segments for each fishery. Markings of this kind were absent on the lines recovered. Since a single orange mark was augmented with 1-2 additional different coloured twine markers in close proximity to each other on a buoy line, for this to be a Canadian snow crab entanglement, "Cottontail" would had to have become entangled in derelict fishing gear.

Annex 4

Sample analysis by Polysteel Atlantic Ltd. of rope removed from Cottontail on October 19, 2020.

POLYSTEEL ATLANTIC LTD.
468 Portsway Avenue, Sydport Industrial Park, Edwardsville, Nova Scotia, B2A 4T8, Canada
Ph. (902) 562-8889 • Fx. (902) 562-8887 • info@polysteel.ca

To: Dr. Ed Trippel
Date: 07-February 2021
From: Sean Burke, President

RE: Sample Analysis of rope from whale entanglement

Thank you for facilitating the receipt by Polysteel Atlantic of a sample of rope retrieved from an entangled North Atlantic Right Whale in conjunction with our mutual goal of gathering as much information as possible regarding its original source in terms of geography and original use. The sample length was sufficient to make several observations in terms of manufacturing construction but was not of a sufficient length for us to determine a breaking strength although the construction will lead to some guidance on this characteristic. When applicable we have included comparative measurements and data from an unused sample manufactured by Polysteel Atlantic. We have used red notations on the pictures of the provided sample and yellow notations on our sample from inventory. Our findings are as follows:

Diameter of Sample

While the diameter may be altered somewhat by the fact that the sample was used and possibly stretched it did appear to be in fairly good condition and therefore the measurements should be accurate enough to draw a reasonable conclusion regarding the diameter. This can be validated through a comparison of the linear density and what would be an industry norm for a coil of the measured diameter. A measurement of the diameter using callipers indicated the sample was approximately 16mm which, in our industry, is the equivalent of 5/8 inch diameter. A small change in diameter from the original construction after a product is used and potentially stressed is normal. It is not uncommon for different manufacturers to have slight variations in the actual diameters of product due to the nature of the underlying extrusion process of the filaments.

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Linear Density

This process allow us to measure and compare the extrapolated weight of a coil of rope to a pre-defined standard. We use this process internally as a production quality verification procedure. In this instance we can use the calculation to provide additional assurance with respect to the diameter of the rope. Our process involved weighing a 1 foot sample of the provided product and calculating the equivalent weight of a 1200 foot coil which we then compared to our internal standards. The 1 foot sample weighed 0.0790 lbs which when multiplied by 1200 would indicate a full coil would weigh approx. 95 lbs. This is consistent with our own internal standards for a 5/8 inch diameter product of this type (a floating co-polymer material).

Manufacturer

While we were not able to determine a manufacturer based on the sample we were able to conclude that this was **not** a product manufactured by Polysteel Atlantic. This was done by examining the underlying construction of the sample compared to our own construction. Rope manufacturing involves 3 distinct processes:

1) Extrusion – this involves the melting of raw material and forming individual filaments. Manufacturers can use different sizes of initial filaments but the norm would be 3,000 Denier which is the size Polysteel typically extrudes and also what appears to be used in the sample.
2) Twisted Yarn – this product resembles a Baler Twine and is constructed by selecting a number of extruded filaments and twisting them together. Different sizes of twisted packages are used for different types of product construction with a fairly wide variety between manufacturers in this industry. This is typically how manufacturers can be identified or at least the list of possibilities reduced.
3) Rope – in twisted products this involves twisting a number of twisted yarn packages into individual strands of the rope and then twisting these strands together to form the end product.

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Polysteel Atlantic manufacturers 5/8 Diameter floating rope using 8 twisted yarn packages in each strand whereas the sample provided appears to used 19 twisted yarn packages. The Polysteel twisted yarn packages would use more individual filaments than those in the sample and thus be larger, allowing for a smaller number in the complete rope strand to achieve the same diameter. The difference in appearance is also noticeable when the products are compared side by side.

Lay Length of the Rope

The lay length is the measurement of distance between a full twist of the rope. This measurement is then used in conjunction with the diameter to calculate the Pitch of the rope which is indicative of the amount of twisting in the rope – the shorter the measurement the harder the lay. It is worthwhile noting that there are differences between manufacturers in how they use these measurements to label their products but they are a good indicator of how strongly twisted the rope is and what its potential use could be. Our educated guess would be that the sample provided is a medium or medium/soft lay product. The sample of Polysteel used in comparison is a soft lay rope and you can see in the pictures the longer lay length.

Conclusions

- The sample provided appears to be a 5/8 diameter floating product (based on the absence of lead or polyester as well as the calculated weight of the coil).

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- The sample appears to be a medium lay construction
- The sample was not manufactured by Polysteel Atlantic
- This type of product is used in a variety of marine related industries including the following:
    - Canadian crab fishery
    - Canadian lobster fishery (small quantities and specific areas)
    - US offshore lobster fishery
    - Ocean based aquacultures operations

Please do not hesitate to contact me if you have any questions or if we can be of further assistance.

Sincerely,
POLYSTEEL ATLANTIC LIMITED

Original signed by

Sean Burke
President