Sea Trial 2022 05 29-31

Testing four different weakened buoy lines during normal snow crab fishing

(May 29-31, 2022)
Vessel: Carlo G.
21050.0002

Observer: Yvon Theriault
ver: Aug 2nd, 2022

NB: Texts referring to figures and tables are linked to actual tables and figures - Use update field command to update the figure/table numbering.

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Purpose

- To test a weak rope, a sleeve, a release link during the actual fishing season 2022 in CFA12
- To measure the included angle between two sections of the hauling rope around the hauler wheel v. hauling time
- To calculate vectorial forces and plot tension profiles during normal hauling of 150 snow crab trap using traditional hauling buoy lines
- To calculate vectorial forces and plot tension profiles during hauling of 4 snow crab traps with weakened hauling buoy lines
- To associate tension profiles with fishing activities.

Methods

Boat and crew

- Carlo G.
- Captain: Joel Gionet
- Deckmen: Michel, André, Denis, Carlo
- Observer from Corbo: Yvon Theriault

Hauling system

Figure 1: The hauling system of the Carlo G

Hauler wheel

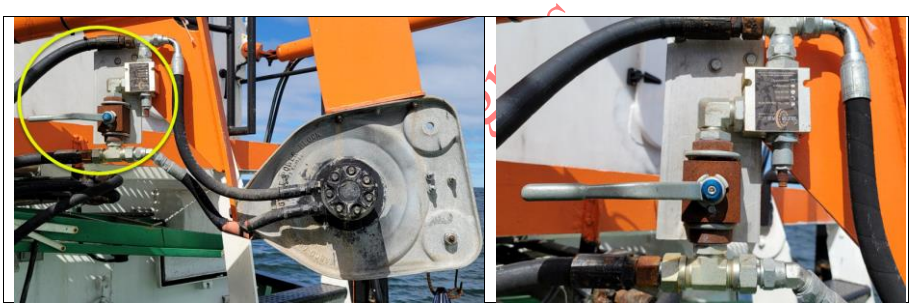
- Hauler wheel: 15" OD, width ¾ " ID.
- Condition: The inside of the two plates was smooth.

Figure 2: Hauler wheel configuration

Limiter

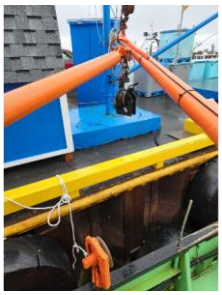
- The limiter was installed in 2021 by Corbo and set at 1700 lbf.
- The limiter was switched on only during the hauling of the 4 weakened buoy lines
- Limiter was not calibrated in 2022.

Figure 3: The hydraulic by-pass valve (Limiter) at left of the hauler wheel



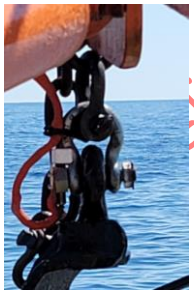
Shackle load cell

The shackle load cell (tensiometer) was attached to the boom as shown in
Figure 6: Extension cord responsible for tensiometer meter fluctuation (pic by Mikael Arseneau)



The tensiometer was occasionally tared before hauling to make allowance for the weight of the pulley.

Figure 4: Shackle load cell

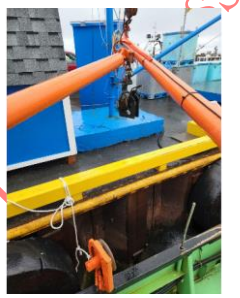


Two problems were observed in the pilot cabin. First, the “as shown” in Figure 5 the tensiometer display meter in the pilot house is not ideally located for a direct line of sight (#1) from the position of the operator of the control valve of the hauler wheel, i.e., the operator cannot view both the tensiometer display meter and the hauling operation without a significant movement of the head. In contrast, the proposed new location #2 would allow easier viewing of both the tension meter display and hauling operation, as suggested by line of sight #2.

Figure 5: Tensiometer display meter is not aligned with the line of sight #1 of the operator

Second, the display meter exhibited wild fluctuation in lbf readings, as much as ±200 lbf after taring (“zero”) the load cell. The most probable cause of this fluctuation was due to a broken neutral wire inside of the electrical extension cord located on the boom (Figure 6).[1]

Figure 6: Extension cord responsible for tensiometer meter fluctuation (pic by Mikael Arseneau)



Camera

Figure 7 shows the deck camera of the Carlo G installed by Corbo and located above and behind the hauler wheel at a distance of ~10’. Unfortunately, it was found after the fishing season that the camera was not recording!

Commenté [YTPi1]: @Pascale Légère, @Véronique Loubier-Chiasson
Trouver et notez la raison pour ça ici.

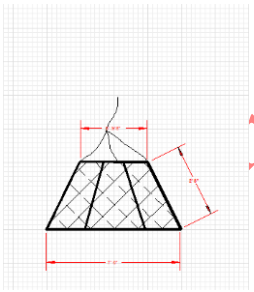
[1] Report on repairing the tensiometer system by Mikael Arseneau: Project # 2105.0002 2022-06-07 Carlo G; file: CARLOG.G 20220607.docx

Figure 7: Location of the deck camera

Traps

Only four (4) standard snow crab traps were used for testing four different weakened buoylines (Figure 8). This was done while fishing with 150 standard traps and buoylines.

Figure 8: Trap dimension



rogress

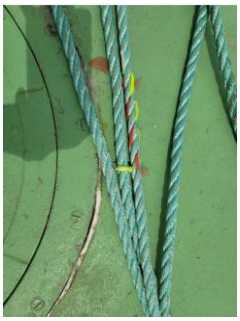
Tension measurement

Fishing with traditional buoy lines

150 buoy lines (75-fa normal hauling ⅝" green 3-strands ropes (50% sinking:50% floating) (Figure 9):

- 37.5-fa ⅝" HydroPro sinking rope attached to the main buoy
- 37.5-fa ⅝" Polysteel floating rope hooked to the ganglion of the snow crab trap

Figure 9: Traditional HydroPro-Polysteel 5/8" buoy line



Hauling rate measurement

The hauling time is:

$$\Delta t = t_f - t_i \quad (1)$$

where:

- Δt is the time hauling (s)
- t_f is the time when trap on the gunwale
- t_i is the time when hauling line is on the directional pulley (usually 0)

The timer to time the hauling rate was started when the buoyline was set on the directional pulley and stopped when the trap being hauled was at the top of the gunwale.

The hauling rate (R in m/s) is:

$$R = 75 \text{ fa} \times 1.83 \text{ m/fa} \div \Delta t \quad (2)$$

Included angle measurement

Included angles of the two strings of the buoyline around the hauler wheel were videotaped at least three times with a Samsung cell phone located perpendicular to the boom at a distance of about 2 fa (**Erreur ! Source du r envoi introuvable.**). The first measurement was done at 08:26 (May 30th) and the last one completed at 08:42 am. Included angle measurements were conducted only with traditional buoy lines and determined with a protractor from various video frames (Figure 11).

Figure 10: Position of the camera for measuring the included angle of the traditional buoyline segments around the hauler wheel

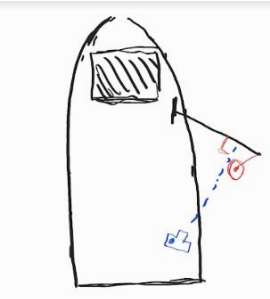


Figure 11: Included angle of two strings of the 5/8" traditional buoyline around the directional pulley

Tension

Tension was measured with the limiter turned **off.** The vectorial tensions in the traditional buoy lines were calculated using the average included angle above and the following equations.

Voltage to shackle load cell tension

Richard's equation here (3)

Commenté [YTPi2]: @Richard Thomas, ing
Pourrais-tu placer ton equation pour conversion voltage à lbf du shackle icic svp.

Shackle load cell tension to rope tension

$$T = W/(2x(\cos(radians(angle/2)))) \quad (4)$$

where:

- T is the vectorial tension in lbf or kN
- W is the shackle load cell reading in lbf or kN
- "Angle" is the included angle around the directional pulley in degrees

Fishing with weakened buoy lines

Traps

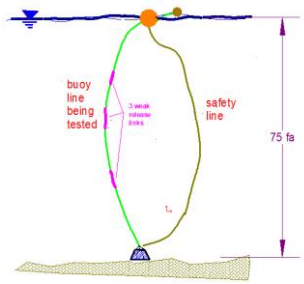
Four (4) standard snow crab traps were used during actual snow crab fishing to test the performance of

Weakened buoy lines

Four (4) different weakened buoylines were tested one time. Three of the four weakened buoylines (#1, #2, #3) were each made of three 1-fa weak release links inserted within a 75-fa HydroPro-Polysteel buoy line. The fourth

weakened buoyline tested (#4) was a full-length manufactured red weak rope from a supplier. The various configurations of the weakened buoylines tested are described below.

Figure 12: Weakened buoy line configuration for testing sleeve, BreakAway release links



- Weakened buoy line #1: 75-fa HydroPro:Polysteel 5/8" rope with 3x 1-fa new sleeve weak links inserted at 33%, 50% and 75% of the initial length
- Weakened buoy line #2: 75-fa HydroPro:Polysteel $\frac{5}{8}$ " rope with 3x 1-fa new BreakAway $\frac{7}{16}$ " release links by CoastLine (pic # 20220530_162425) inserted at 33%, 50% and 75% of the initial length (BreakAway: 65" between eyelets. Eyelet diameter: $1\frac{1}{2}$" (Figure 13).

Figure 13: One of the three BreakAway release links attached to the 75-fa HydroPro-Polysteel buoy line

- Weakened buoy line # 3: 75-fa ⅝" red weak rope manufactured by supplier (37.5-fa sinking:37.5-fa floating) previously run through the hauler wheel 9 times (Age): 9) during the fishing season 2022. The sinking rope section was attached to the main buoy and the floating section hooked to the bridle/gangion of the trap
- Weakened buoy line #4: 75-fa ⅝" line assembled with a new 37.5 fa ⅝" red weak rope (sinking) attached to the main buoy spliced with 37.5 fa ⅝" Polysteel (floating) rope hooked to the bridle/ganglion of the trap.

Safety lines

Each of the four (4) traps with a weakened buoy line was secured with a 75-fa safety line (HydroPro - Polysteel) in case of a failure during the hauling stage.

The safely line was fasten at the main buoy and at the bridle, as the weakened buoyline.

Entanglements

The safety line and the weakened buoy line often became entangled as shown in Figure 14. It was thus necessary to hold manually the safety line to reduce potential entanglements during the testing as shown in Figure 15.

Included angle

The angle between the two sections of the weakened buoy line during hauling was not measured because of the hindrance of the safety line.

Tension

Tension was measured with the limiter turned **on** and previously set at 1700 lbf. The vectorial tension in the weakened buoy line was calculated using the average included angle measured in hauling traditional buoy lines (Polystee-HydroPro) as discussed earlier.

Figure 14: Entanglement of safety line with weakened buoylines

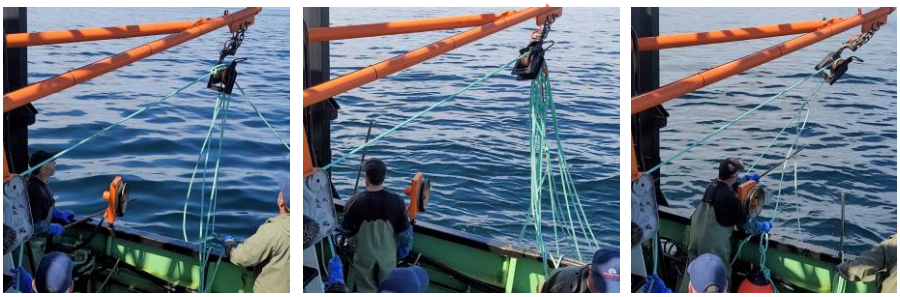


Figure 15: Holding the safety line to avoid entanglement with the weakened buoy line

Fishing conditions

- Departure (Caraquet harbour): May 29th, 2022, 12:00 (noon)
- Time synchronizations:

    - deck camera: __?____. Was not recording!
    - tensiometer time: 09:41 AST
    - clock: 09:34 AST
- Fishing zone: CFA12 - 15h from Caraquet harbour
- Depth of fishing: 40 ± 2 fa
- Type of seafloor: sandy
- Start of traditional fishing: Monday morning (May 30th), at 03:15
- Weather: Beaufort scale: 0 (sunny day, calm)
- Hauling 150 normal traps and resetting: May 31st, 03:15 am to ~16:00
- Hauling 4 traps with weakened buoy lines: May 30th, 15:30 to 15:50
- Fishing runs - East-west direction.
- During hauling, boat at idle speed
- Setting traps – About a dozen traps with low catches were reset after the hauling the last of the 150 traps
- Left the fishing zone: May 30th, 2022, ~20:00 due to incoming storm
- End of trip (Caraquet): May 31st, 2022, 11:15 am
- Limiter off during traditional fishing
- Limiter on while fishing with the 4 weakened buoy lines

Results

Tension - Fishing with traditional buoy lines

Traditional fishing activities

The overall cycle time between two haulings is ~1min and 20 sec. Individual cycle times of various steps are shown in Table 1.

Table 1: Steps taken and activity duration of traditional fishing activities

Step	Activity desc.	Cycle time (s)
1	Grabbing main buoy and kicker	14
2	Lifting main buoy over small pulley and haul the buoy line	5
3	Lifting buoy line over boom pulley and hauler wheel	5
4	Hauling the buoy line until trap is on the gunwale	60
5	Moving trap to above stand and open net to empty trap	21
6	Lowering empty trap to the stand	2
7	Throwing empty trap overboard (buoy line is unrolling)	40
8	Sorting crabs by size	106
9	Emptying and refilling bait bags	10
10	Lifting the stand for the next hauling cycle	7
11	Bicycling to the next trap position	19

Commenté [YTPi3]: @Véronique Loubier-Chiasson @Pascale Légère @Dounia Daoud, PhD Calculer cycle time |(s) à partir des images tirées de troisvidéos

Hauling with traditional buoy lines

Hauling rate

Table 2 lists the individual hauling times and corresponding hauling rates of three of the 150 traps with 75-fa traditional buoy lines (08:26-08:42, on May 30th, 2022, limiter off). Individual hauling time of 60-69 s represent about 80% of the overall cycling time between two haulings. The average overall hauling rate is 2.2 ± 0.2 (n=3) calculated using Equations #1 and #2.

Table 2: Hauling rates of traditional buoylines/traps (limiter off)

Run #	Time hauling (s)	Rate (m/s)
1	60	2.3
2	69	2.0
3	61	2.2
		2.2 ± 0.2 (n=3)

Included angle vs hauling time

Figure 13 shows the included angle value range (triplicate) of the traditional buoy line around the directional pulley. The average included angle is ave ±

std^{o} (n=3), which was used to calculate tensions (vectorial force) in the buoy line during individual hauling.

Figure 16: Included angle vs hauling time

Vidéo 1: Angle = 90,8 Vidéo 2: Angle = 91,0 Vidéo 3: Angle = 92,6 *Voir document Excel – Angle_2022

Tension profile

Figure 17 shows the tension, calculated from Equation #3, in three traditional buoylines vs time during the hauling of three individual snow crab traps. The vectorial force --- above/below the 1700 lbf line.

The last portion of tension profile reveals the overall weight of the initial catch. This reading does not indicate the selling by weight of the final catch because of the sorting out of undersized crabs from the initial catch. There was one crossover of hauling lines from another fisher at about 14:30 AST, May 30th, 2022

Figure 17: Tension profiles of three traditional hauling buoy lines during snow crab fishing 2022

Tension - Fishing with weakened buoy lines

Hauling with weakened buoy lines

Hauling of the 4 weakened buoy lines carried out from 15:30 – 15:43 (May 30th, 2022). Limiter was turned on.

Table 3: Results of hauling weakened buoy lines

Buoy line # (75-fa)	Configuration	Comment
1	75-fa HydroPro:Polysteel with 3x 1-fa sleeve release links	Failure
2	75-fa HydroPro:Polysteel with 3x 1-fa BreakAway release links	Failure

Commenté [YTPi4]: @Véronique Loubier-Chiasson @Pascale Légère @Dounia Daoud, PhD
Tracez les angles en fonction du temps de levée à partir des trois vidéos (samsung Note 20) prises à 90 degrés du boom

Commenté [YTPi5R4]: @Dounia Daoud, PhD Suggestion: Ask V /or P to do this figure

Commenté [YTPi6]: @Véronique Loubier-Chiasson @Pascale Légère @Dounia Daoud, PhD
Tracez les tension (vectorielle) en fonction du temps de trois levées et aussi celui du crossover à appro. 14:30

Commenté [YTPi7R6]: @Dounia Daoud, PhD Suggestion: Ask V /or P to do this figure

3	75-fa Weak red rope (sinking 37.5 fa : floating 37.5 fa)	Successful
4	75-fa Weak rope/Polysteel (sinking 37.5 fa : floating 37.5 fa)	Failure

Failure points

The failure points are summarized in Table 4: Points of failure of weakened buoy lines.

Abrasion

The fibers around the sinking elements of the red weak sinking weak rope section were visible due to wear and tear (Figure 18). It is believed that the fibers surrounding the weighing elements are more susceptible to wear and tear caused by the rubbing of the buoy line against the side or underneath of the boat during hauling activities. This probably contributes to a loss of the tensile strength.

Commenté [YTPi8]: @Véronique Loubier-Chiasson @Pascale Légère @Dounia Daoud, PhD
Obtenez de Joel cette photo de la "manufactured" weak red rope faible (âgé de : 9 levées le 30 mai) - si possible)

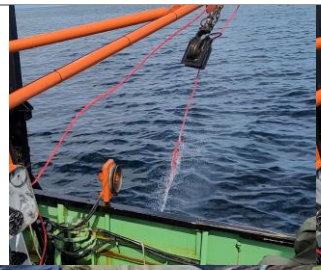
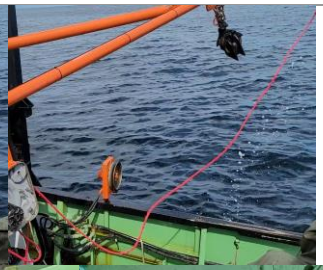
Commenté [YTPi9R8]: @Dounia Daoud, PhD Suggestion: Ask V /or P to do this figure

Figure 18: Weak rope sinking elements exposed by wear and tear

There seems to be no obvious solution to avoid this rubbing effect as the hauling buoy line will, at some point during the initial phase of the hauling, touch the side of the boat or its underneath as the whereabouts of the buoy line in the water is obscured. Lengthening the boom is not a viable solution.

Table 4: Points of failure of weakened buoy lines

Buoy line # (75-fa)	**Pic**	**Failure point**
1	 	Safety line hauled instead of the weakened buoy line with three 1-fa sleeves and line entanglement
2	  	At the 2nd 1-fa BreakAway release link in the weakened buoy line

4		   	At the splice between the 37.5-fa weak red sinking rope and the 37.5-fa Polysteel sinking rope

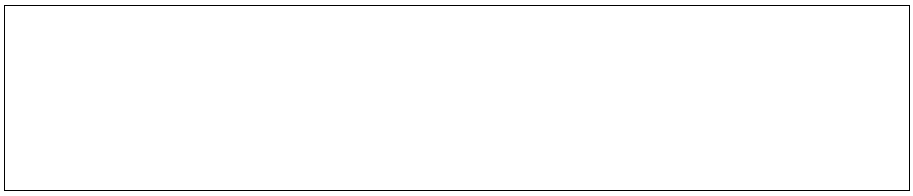
Tension profile

Figure 19 shows the tensions in three weakened buoy lines #2, #3 and #4 during the hauling of the corresponding snow crab traps. The effect of the safety line on the tension was not taken in account.

Commenté [YTPi10]: @Véronique Loubier-Chiasson @Pascale Légère @Dounia Daoud, PhD
Calculer les tensions vs time pour les trois weakened buoy lines #2, 3 et 4 en utilisant l'angle moyen determinér dans la 1ere parti.

Commenté [YTPi11R10]: @Dounia Daoud, PhD
Suggestion: Ask V /or P to do this figure

Figure 19: Tension profiles of weakened buoy lines



Recommendations

1. that the full red weak rope buoyline (sinking/floating) manufactured wholly by the company be further tested as it is the best prospective weak rope to use (as per current results)
2. that, in future tension testing of weak ropes, the safety line be tied to a cement block tethered to the trap by a 75-fa rope, in order to shun its entanglement with the weakened buoyline being tested.
3. that the BreakAway release link be toughened up for condition at 4°C (breaking strength to be tested at 4°C) and retested
4. that a device be devised and tested to reduce the wear and tear of weak rope caused by the rubbing of a weakened buoy line against the side or underneath of the boat during hauling activities
5. that the tensiometer display meter in the pilot room be moved from the present wall location to the left side of the wall, in front of the captain line of sight
6. that the onboard camera be checked to confirm that it is set to on.