Tri-State Line Marking Discussion
May 13, 2020

Why mark line?

Each observed entangled whale is carefully documented, evaluated, and analyzed by staff with the NOAA Protected Resource Division to glean information on the origin of the entangling gear. Despite this effort, 60% of gear observed and/or recovered in recent years from West Coast whale entanglements has not been attributable to a specific fishery and/or state of origin. From NOAA Fisheries' most comprehensive review of entanglement events (2013- mid-2018; n=183 confirmed entanglements), nearly three-fourths of reports included buoys; however, nearly half of these events with buoys could not be attributed to a specific fishery. Fishery and state of origin information is currently being used to design recommendations for entanglement risk reduction, so accurate information about every entanglement is essential for creating effective changes in fishing practices to protect whales. One way to potentially improve attribution rates is to require lines to be marked in a way that identifies the specific fishery and/or state that it was used in.

Line marking requirements in each state's commercial Dungeness crab fishery have the potential to build on the gear marking regulations already in place within each state, primarily buoy tag requirements for all commercial crab gear. Line marking is also a direct response to NOAA Protected Resource Division's recommended future work to prioritize expansion of fishery gear marking initiatives to be able to accurately identify the origins of entanglements (Saez, et.al, 2020).

Goals of marking line

1. **Identifiable and accurate –** to the state and fishery gear was used in.

2. **Visible** – primarily in photographs of entangled whales since it's uncommon at this time to recover gear from West Coast entanglement events.

3. **Reasonable and cost-effective** - to implement, maintain and track.

4. Others?

Components of line marking

A. Color of marks

1. Mark color(s)
   - Primary goal – distinctly different from each other as possible

     a. WA – adopted red

     b. OR – TBD

- Proposed orange – concerns that orange is a very common color line color so could lead to false positive attributions to OR crab fishery
- Proposed black – concerns that algal growth on line could start getting misidentified as an OR mark and lead to false positive attributions to OR crab fishery

c. CA – no proposal to date

2. Considerations for line color allowances

a. Allow/prohibit the mark color to be the same as the color of the line being used

i. Prohibit the line color in region where the mark is required from being the designated mark color

ii. Designate an alternative mark color for use when the line color is the same as the primary designated mark color

b. Allow 'mark' colored top/bottom shots of line as the mark within size constraints, with requirement for contrasting adjoining line

B. Mark materials/methods

1. No specific requirements, must meet general criteria for visibility

2. Require/prohibit certain materials or methods
   - Main concern is visibility of tracers or zip tie type methods in photographs (see pictures on p.5)

C. Location and number of marks

1. Set number of marks within certain distance from known breaking points? (examples near buoys, close to the pot, above and below shot connections)
   - Less onerous to apply and maintain marks, especially for deeper gear

2. Marks at set intervals (examples – every 5, 10, 15 or 20 fathoms)
   - More likely to be seen the shorter the required interval
   - Potentially more onerous to apply and maintain

D. Size of marks

1. Minimum size requirement needed (examples 12in, 18in, 36in)
   - Ensure the mark is big enough to be seen from photographs
   - East Coast considering moving towards larger than 12in marks closer to the buoys to increase likelihood they will be seen

2. Maximum size requirement needed
    - One way to require the required mark to contrast from the line being used

E. Options for dual/tri permitted vessels

1. Require switching out marks depending on state fished

2. Allow both/all three marks on dual/tri permitted gear
    - Main concern is that the gear wouldn't be identifiable to which state it was being used in

3. Allow registry of a unique line mark identifiable to the boat - mark would still have to meet goals above

F. Prohibiting defined state/fishery line marks from use in other fisheries

- Primary goal – increase probability of accurate identification of gear involved in future entanglement events.

1. Among Tri-State crab fisheries

2. Within other state/federal fixed fisheries – needed/possible

<u>Additional Information</u>

WDFW line marking regulation – adopted Jan 2020
ODFW DRAFT line marking regulation – drafted Jan 2020
Commonly used line in the commercial West Coast Dungeness crab fishery – pictures on p.5
WWEWG – 5/28/19 Line marking discussion notes – p. 6-10
East Coast and Canadian Line Marking Examples – p. 11-22

WDFW line marking regulation (adopted Jan 2020)

WAC 220-340-430
(6) Coastal commercial crab fishery line requirements

(a) All crab pots used in the coastal Dungeness crab fishery shall be set up to use only the amount of line reasonably necessary to compensate for tides, currents, and weather.

(b) (i) Beginning December 1, 2020, it is unlawful for a coastal Dungeness crab fishery license holder to use line that connects the main buoy to the crab pot that is not marked sufficiently to identify it as gear used in the Washington coastal Dungeness crab fishery.

(ii) Each shellfish pot used in the Washington coastal commercial Dungeness crab fishery must be rigged with line that is marked with 12 inches of red in at least two places. At a minimum, 12 inches of line must be marked in red, no more than one fathom from the main buoy and no more than one fathom from the pot.

ODFW DRAFT language

635-005-0480
Dungeness Crab Buoy Tag and Gear Marking Requirement

It is *unlawful* for commercial purposes to:

(3) Use commercial Dungeness crab gear in the Columbia River or Pacific Ocean unless the line connecting the main buoy to the pot or ring is marked as follows:

(a) The line must be marked in at least two places:

(A) Within six feet of the main buoy; and

(B) Within six feet of the pot or ring;

(b) Each mark must be at least 12 inches; and

(c) Each mark must be orange.

Image 1: Line colors commonly sold by Englund Marine for use in the commercial Dungeness crab fishery on the West Coast. Photo by Sheila Garber.

Image 2: Collection of lines sold by Englund Marine with line tracers. Photos by Sheila Garber.

LINE/GEAR MARKINGS
Discussion document for May 28th meeting

MANAGERS/FISHERMEN:
Role: To first determine what the goals are of marking—related to management actions that might be taken in response to information gained from successful marking (entanglements/domoic acid, etc). That should ultimately inform what the marking scheme should be. Would be different based on needs – state level, fishery or more fine?

- How much information do managers want regarding the origin of entanglements in their fisheries
- Is there a need to know regionally/locally where gear was set?
- Information specific to which fishery within a state, so management actions could be targeted at that level?

WHALE EXPERTS:
Role: In terms of the what/how to mark based on the objectives set—provide advice (from forensic observations and disentangling whales) the things that would make the marks most helpful to them:

Advice:

HOW MANY MARKS AND WHERE TO MARK

- as much marking as possible but at least top, middle and bottom; plus beyond a certain depth, a mark at a regular interval (e.g. every 10 fathoms)
- as much marking as possible in the upper portion of the gear.
    - marks relatively near the floats (including trailer buoy lines if possible)
    - marks 5 fms below the floats
- marking above and below (within about 5-10 fm) of each shot connection
- regular marks along the line can be used to both confirm or rule out specific fisheries, and could provide information even if the gear isn't retrieved.
- Distinguishing between states and fisheries would also be ideal, but it definitely depends on what is reasonable and possible for fishermen – and knowing that many fish in multiple states or multiple fisheries with the same lines, their input is invaluable for determining if we can reasonably differentiate between areas. If needed, those multi-state fishers could have their own unique mark or add an additional color stripe in the middle of a Washingtonmark, for example.
- It really does all depend on what is possible, cost-effective, and reasonable for the fishermen to implement, and the states to manage.
- Caution against gear marking that is too simplistic. On the East Coast, all trap/pot fisheries in the entire Northeast region (which includes Maine, New Hampshire, Massachusetts, Rhode Island, and Connecticut, plus federal waters) have a red gear mark, which the exception of a handful of exempted areas and two specific high-whale-use areas (Jordan Basin and Jeffreys Ledge). It's impossible to

distinguish between states if an entangled whale shows up with red-marked line, and 61% of marked gear recovered has a red mark but can't be further identified to state or fishery. There is now a desire to differentiate between NE states, and in some areas even between state and federal waters, mostly to prove that whales are not getting entangled in certain areas. We definitely have larger areas of state waters here, but for example if we assigned one color marking to the whole "Pacific Northwest" region, we still wouldn't be able to tell if an entangled whale with line marked with "Pacific Northwest" colors had Oregon or Washington gear.

MARKS on TRAILER BUOYS:

- Would be very useful given that multiple buoys are often seen and/or buoys trailing whereas the main buoy might be caught up on/under the whale. Something simple like one letter or shape on multiple sides of the buoy.
  - Marking gear where the orientation has to be perfect to see it clearly and/or where we have to get the gear in hand will not offer much benefit.
  - Color bands around the buoy (potentially tied to line marking color system)

SIZE OF LINE MARKS

- 12" long like used on the East Coast gives some ability to detect at some range (and from photographs) (if 2 colors each would be 6 inches at each mark)

- May 2019 new information: the Atlantic Large Whale Take Reduction Team has been discussing some modifications of their current line marking requirements. Of particular interest is that they are considering requiring a much larger mark (3 ft long instead of 12 inches) for the marking at the top of the vertical lines, and requiring that mark to be within a few fathoms of the buoy so that it might be more likely visible when floats are observed which is very common just like it is here on the west coast.

HOW TO MARK:

- Paint, tape, Novabraid sleeves
- Things like zip ties, twine, straps, etc. are helpful if the gear is collected, but since we are also still working on improving reporting and response on the West Coast, often there are only photos to work with on getting info.

COLOR OF LINE MARKS

- Distinguish between states with colors... but try to avoid using colors/patterns that can easily be confused in field (e.g.one state using blue, another black)

- Using at least two colors to distinguish a marking pattern is a good idea, in case one particular color/mark is not clear, but the other is.
- Depending on how long we want the markings to last for, we need to be aware of fading. Reds and orange-colored markings are “fugitive,” that is, colors at that end of the spectrum fade fairly rapidly.
- An alternative to specific colors (or in addition to colors) is patterning. A combination of markers would last longer visually. For example, using various combinations of dark (d), neutral (n), and white (w).
  Examples:
  Marks could be d-n-w; n-d-w; d-w-n; d-d-w; n-w-w; d-d-d; w-w-d; n-n-n; etc.
  - Having two marks is an option to add to the mix : d-n, n-w, d-d, etc.
  - Can also introduce non-fugitive colors to the mix such as black (and gray), blues, greens, and violets which can also be dark, medium, or light. That is you can have dark blue, medium blue, and a light blue for three options. Same for greens. Same for grays. (The possible combinations are in the many hundreds)

  Examples:
  Marks could be dg-w-mb; w-w-lb; lb,mb,db; lg,mgray,dv
  (Dark Green - White – Medium Blue; White - White - Light Blue; Light Blue - Medium Blue - Dark Blue, Light Green - Medium Gray - Dark Violet.)
- Things like zip ties, twine, straps, etc. are helpful if the gear is collected, but since we are also still working on improving reporting and response on the West Coast, often there are only photos to work with on getting info.

MARKING EXPERIMENTAL GEAR

- marking experimental gear is a good idea. Perhaps just an additional mark in the pattern will be sufficient.
  - probably won't necessarily confirm that these gear configurations are better at avoiding entanglements in the short term given the complexity of experimental design necessary to do that, but certainly could help identify something that doesn't offer much benefit earlier rather than later if we see those marks on entangled whales.
  - it will take several years and a good experimental design to have enough data to say anything conclusive about gear modifications.

HOW TO MARK

- The methods used on the East Coast: electrical tape, thread twisted into the line and paint - all seemed to work. Paint seemed to be the least persistent, though.

BUOY TAGS

- Buoy tags have been very helpful in determining fishery and state based on shape and color. Buoy tags can be seen in entangled whale photos and drone footage.

- Tag presence is easiest to determine from photos of entanglement; shape and color are second (ID to state/fishery); then being able to read a tag (ID to specific fisherman) is third. Double sided buoy tags are helpful.
    - ID to a specific fisherman allows for conversations that potentially lead to better understanding of gear configuration, timing of entanglement, and location of gear set.
- Currently there is a limited set of shapes and colors of buoy tags in use; therefore it has been easier to determine information, however, if all fixed gear fisheries adopted a buoy tag (as will happen in California), it would be more difficult to determine fishery/state unless tags were distinctive

QUESTIONS:
Would be helpful to have multiple fishermen from multiple fisheries document what happens to markings during the fishing season (buoys, line markings):

- Changes in color of line markings
- Changes in buoy color, fouling and warping that occurs from fishing practices\
    - Then could compare that information with buoys seen on entangled whales… what happens to a buoy while being dragged behind a whale?

Atlantic Large Whale Take Reduction Plan—gear marking scheme July 2018

Surface Buoy Marking

SURFACE BUOYS ARE TO BE MARKED WITH:

Markings to help identify the associated vessel or fishery by including one of the following:

- the owner's boat registration number and/or US vessel documentation number;
- Federeal commercial fishing permit number; or
- Whatever positive identification is required by the vessel's home-port state.

When marking is not already required by state or federal regulations, the letters and numbers must meet the following requirements:

- At least 1-inch (2.5cm) in height;
- Block letters or Arabic numbers; and
- In a color that contrasts with the color of the buoy.

Buoy Line Marking:

BUOY LINES ARE TO BE MARKED WITH:

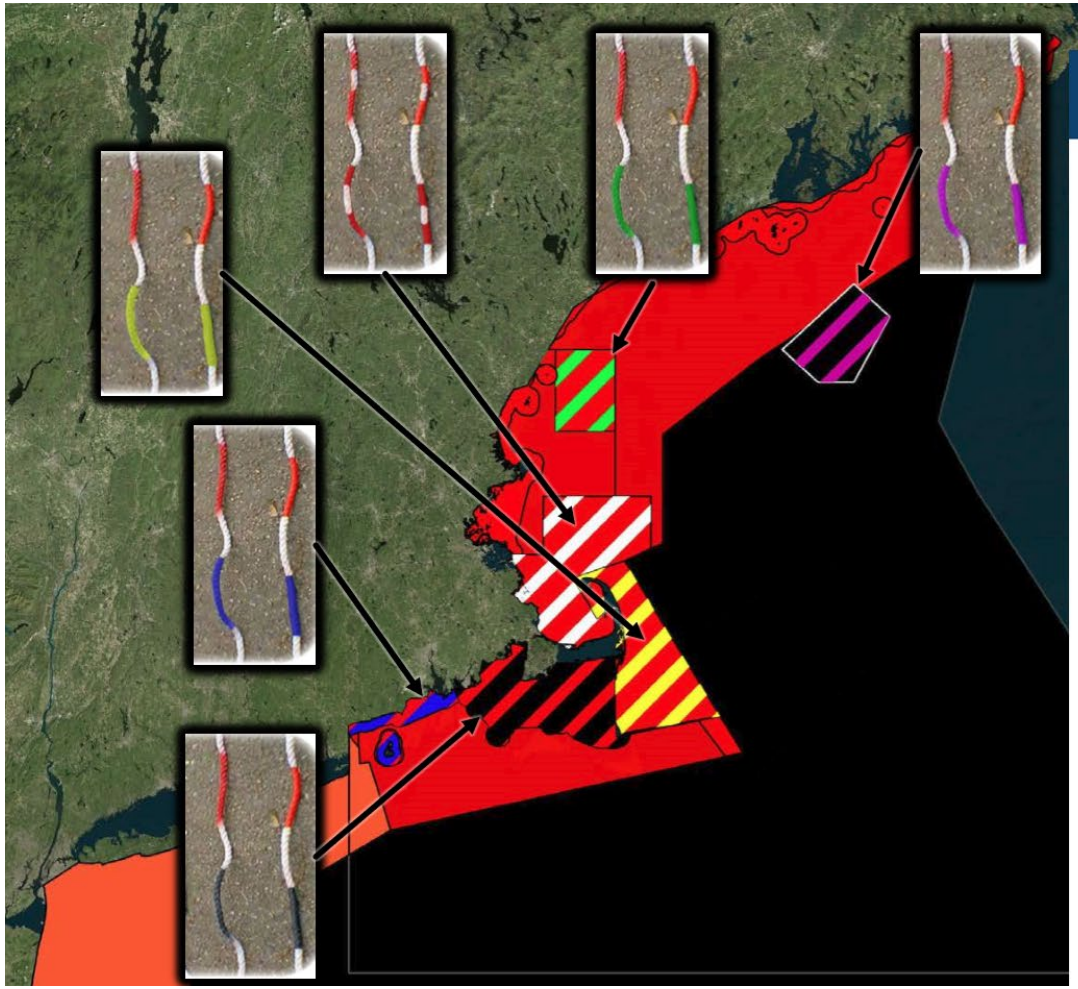
THREE 12 inch (30.48 cm) colored marks:

- one at the top of the buoy line,
- one midway along the buoy line, and
- one at the bottom of the buoy line.

If the mark consists of two colors, EACH COLOR mark may be 6-inches for a TOTAL MARK of 12-inches.

Each color code must be permanently affixed on or along the line and each color code must be clearly visible when the gear is hauled or removed from the water.

Additional information on gear marking techniques can be found in Supplement C- Gear Marking.



Trap/Pot Gear Marking- All Regions (Continued)

GEAR MARKING COLOR	APPLICABLE TRAP/POT MANAGEMENT AREA
RED	• Massachusetts Restricted Area • Northern Nearshore Trap/Pot Waters • Northern Inshore State Trap/Pot Waters • Stellwagen Bank Jeffreys Ledge Restricted Area • Great South Channel Restricted Area overlapping Lobster Management Area (LMA) 2 and/or the Outer Cape (OC) LMA.
ORANGE	• Southern Nearshore Trap/Pot Waters.
BLACK	• Offshore Trap/Pot Waters; Great South Channel Restricted Area overlapping with the LMA 2/3 Overlap and/or LMA 3
BLUE & ORANGE	• Southeast Restricted Area North- state waters
GREEN & ORANGE	• Southeast Restricted Area North- Federal waters
RED & BLUE	• Min. trap per trawl exempt RI state waters (singles)
RED & WHITE	• Min. trap per trawl exempt MA state waters in LMA 1 (singles)
RED & BLACK	• Min. trap per trawl exempt MA state waters in LMA 2 (singles)
RED & YELLOW	• Min. trap per trawl exempt MA waters in Outer Cape (singles)
RED & PURPLE	• Jordan Basin (Trap/Pot) overlapping LMA 1
BLACK & PURPLE	• Jordan Basin (Trap/Pot) overlapping Offshore Trap/Pot Waters
RED & ORANGE	• Isle of Shoals group, Maine
RED & GREEN	• Jeffreys Ledge (Trap/Pot)

GEAR MARKING
EASTERN CANADA
for non-tended fixed gear fisheries

In February 2019 Minister Wilkinson announced that Canada would phase-in mandatory gear marking for all fixed-gear fisheries in 2020. Please find below the Eastern Canada gear marking framework.

BRIEF OVERVIEW

- The purpose of these measures are to identify gear from different fisheries, regions and sub-regions in Canada, to support efforts to address lost gear and reduce marine mammal entanglements, and to distinguish between US and Canadian gear involved in marine mammal entanglements.
- To help differentiate between Canadian and US gear marks, the Canadian scheme uses different colour combinations and methods for applying colour marks to rope. For example, the US marking scheme uses segments of different colours in a length of rope (i.e. a 6 inch segment of red followed by a six inch segment of blue), rather than interlacing strands of colour in the full length of a segment of rope. The US also uses tape and paint to add colour segments to rope, rather than integrating lines of coloured twine.

Gear Marking method to be applied in Eastern Canada

1) Colour combination are to be implemented using two different strands of twine interlaced on the same segment of rope (see picture Annex1):
   a) One colour will be used to identify fisheries from a specific Region – to be interlaced on the same segment of rope as the second colour.
   b) A second colour will be used to identify target Species of a fishery – to be interlaced on the same segment of rope as the first colour. Each species will be attributed the same colour across all Regions in Eastern Canada (i.e. yellow for lobster).
2) For snow crab and lobster fisheries only, a third colour will be used to mark different fishing areas in each region. The third colour will be added to a subsequent segment of rope immediately after the segment of rope with the first two colours, and will not be interlaced with the first and second colour. For example, the Area 12A Crab fishery in the Gulf will have a segment of green and orange strands interlaced in the rope, followed by a segment of rope with only an orange strand interlaced (see Figure B in Annex 1).
3) Gear marking will be mandatory for ropes attaching the fishing gear to the primary buoy (vertical line). It could also be included on other rope sections when applicable, at the discretion of fish harvesters, such as the rope section attaching the primary buoy to the secondary buoy, and rope from trap to trap set on a same line (ground lines).
4) At a minimum, gear marking will be required at the top, middle and bottom of the vertical line (aligned with minimum requirements in the US) or every 27.4m throughout the length of the rope (aligned with existing practice in GLF and QC). Each strand marking must be a minimum of 15cm in length.
5) Use of a “tracer” as an alternative to colour coding requirements will be permitted. Given that a tracer can’t be added to existing rope, unlike coloured twine which can be integrated into existing rope, the use of tracers could be phased-in as ropes are replaced. The tracer, a silver transparent tape inside the full length of the rope, must have a visible inscription identifying country, region, species and fishing area. (See ANNEX 3)

MANDATORY COLOUR SCHEME (Region and Species colours)

	GLF - blue		MAR - black		NL - red		QC - green		Multi-region fishery [1]	
Toad crab	X	purple			X	purple	X	purple		
Rock crab	X	Blue*	X	blue	X	blue	X	blue		
Lobster	X	yellow	X	yellow	X	yellow	X	yellow		
Whelk	X	white	X	white	X	white	X	white		
Snow crab	X	orange	X	orange	X	orange	X	orange	X	orange
Gillnet - small pelagic	X	grey	X	grey	X	grey	X	grey		
Gillnet – groundfish	X	brown	X	brown	X	brown	X	brown		
Longline	X	pink	X	pink	X	pink	X	pink		
Squid (trap)					X	green				
Cod (trap/pot)					X	red*				
Shrimp trap			X	green						
Hagfish			X	black*						
Red crab			X	red						
Jonah crab			X	purple						
Lobs., rock crab and jonah crab [2]			X	3						
Clearwater LFA 41			X	3						

*Blue & blue, black & black and/or red & red combination means there should be <u>two distinct strands of the same colour</u> interlaced within the same rope section (one single strand <u>is not</u> acceptable)

[1] *"Multi-region fishery"* is specific to instances of inter-regionally managed fisheries, where each Region is wholly responsible for managing their own fleet but they share the exact same fishing area, licence conditions, and so on, as another fleet in another Region. Each Region issues the same licence conditions to their harvesters. A common base colour was given to ensure a regional division was not created within a shared industry.

[2] As some fish harvesters in Maritimes Region use the same gear to fish all three fisheries (lobster, rock crab and Jonah crab), at this time they will have a different colour than others to acknowledge, at a minimum, that it can be from either of those fisheries.

[3] Pattern strand is necessary as no other solid colours are available. The selected fisheries must use a twine that contains a two colour pattern on one of the single strands (yellow/black pattern, red/white pattern). This is to be used in addition to the Regional colour. See Annex 2 for a pamphlet showing examples of twine colours including a yellow/black patterned strand colour and a red/white pattern strand colour (respectively named "lemon tartan" and "Oh Canada" in pamphlet).

EASTERN CANADA COLOR SCHEME PER FISHING AREA (third color)
FOR LOBSTER & SNOW CRAB

As some of the interregional snow crab fisheries in the Gulf of St Lawrence already have some colour marking, efforts were made to avoid completely new colour schemes.

The following is the Eastern Canada break down of the colour scheme for lobster and snow crab fishing areas, per Region:

- the double stacked cells represent the regional colour (top) and species colour (bottom), with the single cell immediately to their right representing the fishing area colour.

Additional notes:

- Areas showing "none" in the single cell means that a third color is not applied.
- Some harvesters fish in multiple fishing areas. Unless otherwise specified, the category "*Multiple area*" includes these fish harvesters only. This was done so twines do not have to be interchanged between fisheries.

GULF REGION

Lobster fishing area colors

23		24		25		26A		26B		Multiple areas	
blue	red	blue	green	Blue	none	blue	white	blue	black	blue	yellow
yellow		Yellow		Yellow		yellow		yellow		yellow	

Snow Crab fishing area colors

12		12E		12F		19		Multiple areas	
yellow	none	yellow	yellow	yellow	blue	blue	green	blue	yellow
orange		orange		orange		orange		orange	

MARITIMES REGION

Lobster fishing area colors

27		28		29		30		31A		31B		32	
black	blue	black	grey	black	**brown**	black	yellow / black pattern	black	pink	black	purple	black	white
yellow		yellow		yellow		yellow		yellow		yellow		yellow	

33		34		35		36		38	
Black	orange	black	none	black	green	black	red	black	black
Yellow		yellow		yellow		yellow		yellow	

41 Clearwater		multi species		multiple areas	
black	none	black	corresponding LFA color	black	yellow
red/white		yellow/black		yellow	

Snow crab fishing area colors

North-ENS		23		24		4x		Multiple areas	
black	none	black	green	black	**black**	black	blue	black	yellow
orange		orange		orange		orange		Orange	

NEWFOUNLAND & LABRADOR REGION

Lobster fishing area colors

3	4	5	6	7	8	9
red / yellow	red / black / white pattern	red / yellow / black pattern	red / orange	red / green	red / black	red / brown
red / red / white pattern	red / yellow	red / yellow	red / yellow	red / yellow	red / yellow	red / yellow

10	11	12	13A	13B
red / yellow	red / none	red / red	red / blue	red / yellow
grey	yellow	yellow	yellow	yellow

14A	14B	14C
red / white	red / purple	red / pink
yellow	yellow	yellow

Snow crab management area colors

2J North	2J South	3A	3B, 3C, 3BC	3D	4	5A
red / navy blue	red / blue	red / black / white pattern	red / yellow / black pattern	red / black / blue pattern	red / yellow / green pattern	red / red / white pattern
orange	orange	orange	orange	orange	orange	orange

6A	6B	6C, 8A	9A	3LNO < 65'	3NO > 65'	11E
red / pink / blue pattern	red / red / green pattern	red / orange	red / black	red / purple	red / grey	red / pink
orange	orange	orange	orange	orange	orange	orange

11W	10A Inner	10A Outer, 10B, 11S	Outside 8 mile	Area 12 inshore	13
red / red	brown	white	yellow	green	none
orange					

QUEBEC REGION

Lobster fishing area colors

15		16		17		18		19		20A		20B	
green	red	green	green	green	black	green	blue	green	**brown**	green	white	green	grey
yellow		yellow		yellow		yellow		yellow		yellow		yellow	

21		22		Multiple areas	
green	orange	green	none	green	yellow
yellow		yellow		yellow	

Snow crab fishing area colors

12		12A		12B		12C		12E		12F		13	
yellow	none	green	green	green	blue	green	pink	yellow	yellow	yellow	blue	green	none
orange		orange		orange		orange		orange		orange		orange	

14		15		16		16A		17		Multiple areas	
green	white	green	orange	green	red	green	none	green	**black**	green	yellow
orange		orange		orange		orange		orange		orange	

ANNEX 1

Figure A - Colour combo identifying Region and Species
as per colour scheme this is Quebec (green), snow crab (orange) interlaced on same rope section

Figure B - Colour combo identifying Region, Species and Fishing Area
Region & species interlaced on same section of rope, Fishing area on subsequent section of rope
as per colour scheme this would be Quebec (green), snow crab (orange), CFA 12A (green)

ANNEX 2

Canadian company pamphlet showing twine colours and patterns:

There are companies for which the price does not differ between the different colours and patterns : 50 ft = $6.70 / 100 ft = $9.25 / 1000 ft = $50.50

All colours are in stock, and it takes only one to two days to make more if needed.

ANNEX 3

Sample of rope with tracer exposed for gear analysis.