

## APPENDIX B-1

Caribou Harbour and Caribou Channel - dynamics, tides, ice, marine species and fisheries

21 February 2019

### **Submission from Local Fishermen Allan MacCarthy and Greg Egilsson**

#### **Introduction**

Allan MacCarthy and Greg Egilsson are two of approximately 82 (lobster) and 100 (herring) local fishers who fish in the immediate area encompassing and surrounding the effluent outfall discharge location (CH-B) proposed by Northern Pulp. Both have a lifetime of experience fishing in the productive waters of the Northumberland Strait, in the very area where Northern Pulp now seeks to discharge its effluent.

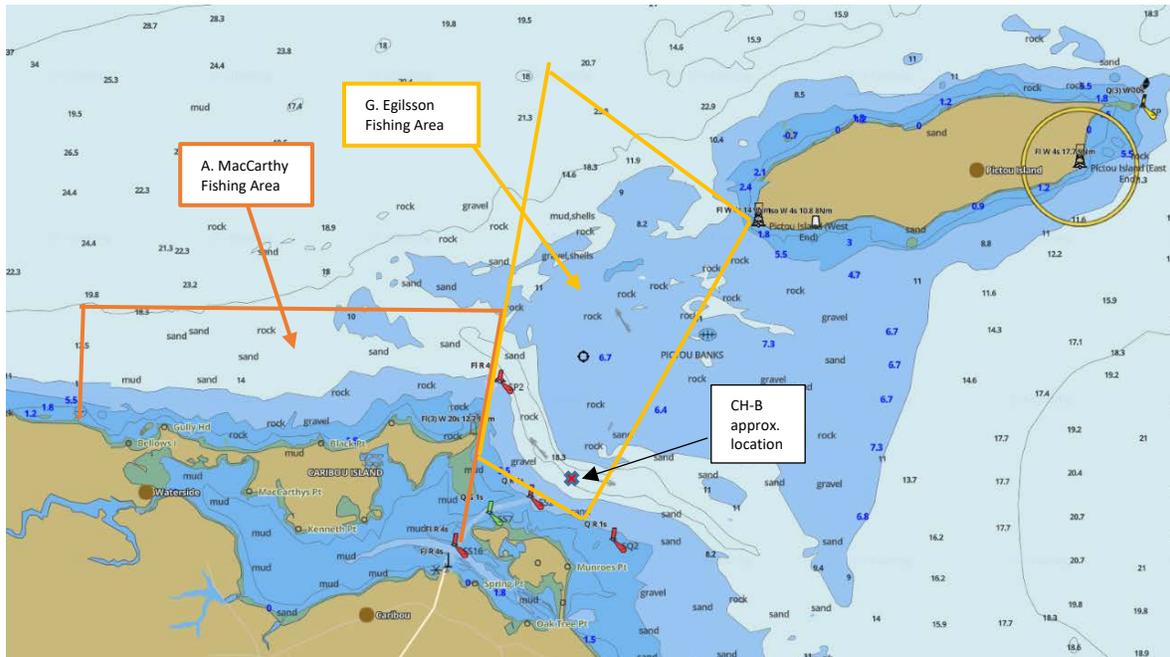
**Allan MacCarthy** is a life-time resident and fisherman in the Caribou-Pictou area. He started out fishing with his dad and his uncle, and has since fished on his own for 40 years. For the last 17 years he has fished in his boat called the "Red Trapper". Mr. MacCarthy holds a Fishing Master Class II and Watch Keeping Mate Certifications. He has both trained in and taught navigation and meteorology at the School of Fisheries in Pictou (now part of the Nova Scotia Community College). Mr. MacCarthy is a past member of the DFO/Industry Gulf Herring Advisory Committee and Scallop Advisory Committee. He fishes lobster, herring, rock crab and scallops in the Northumberland Strait. He has also fished mackerel and, prior to 1998, groundfish there.

Mr. MacCarthy's lobster fishing grounds are located in the Caribou area, and cover an area of approximately 20 nautical miles<sup>2</sup> (37 km<sup>2</sup>) (5 nautical miles (9.2km) east-west x 4 nautical miles (7.4km) north-south), positioned to the north of Caribou Island (see the chart below). The eastern edge of his fishing area is approximately ½ nautical mile from the outfall location (CH-B) proposed by Northern Pulp. Mr. MacCarthy's fishing grounds overlap with about 13 or 14 other fishers who use some of the same territory.

**Greg Egilsson** is likewise a life-long fisherman in the Caribou area. He has fished on his own for 30 years, and for 10 years before that with other fishermen. In his vessel, the "Jenny CE", he fishes lobster, herring and scallops, and has also fished mackerel and groundfish in earlier years. Like Mr. MacCarthy, Mr. Egilsson holds Fishing Master and Watch Keeping Mate certifications and lectured on navigation and meteorology at the Pictou School of Fisheries. He is Chairman of the Gulf NS Herring Federation and represents Area 16F herring fishers (PEI & NS) at local and Gulf Small Pelagics Advisory Committee meetings. He is also a member of the working group for that Committee.

Mr. Egilsson's lobster fishing grounds are adjacent to Mr. MacCarthy's to the east (see chart below), but angle northeast toward Pictou Island, and include an area northwest from that line. The proposed outfall point CH-B is positioned inside his territory at the southeast corner. Mr. Egilsson often hauls his first trawl of the day during lobster season in roughly the same location as Northern Pulp's proposed outfall. His fishing grounds overlap with those of about 20 other fishers.

The lobster fishing grounds of Mr. MacCarthy and Mr. Egilsson are marked approximately on the following chart. However, it is important to note that they are only 2 of up to 82 lobster fishers who fish in the Caribou area.



## **Fish species**

### Lobster

The Caribou Channel and the Strait support a large lobster population. The area falls within Lobster Fishing Area (LFA) 26A-1. As indicated above, 82 lobster fishers fish in the area, including the approximately 12 fishers from Pictou Landing First Nation whose fishing grounds are located to the southeast of the proposed outfall.

Lobster larvae float at or near the water surface for about 12 weeks, starting mid-July each year. The larvae are swept along by the currents and may circle Pictou Island in the gyre. Once the lobster begin to mature they drop to the sea floor. Mature lobsters feed on the floor of the Strait, and will be affected by any alteration to the seabed, and the accumulation of pulp mill solids or contaminants in their feeding area.

Lobster are very sensitive to temperature changes. If water temperature rises or drops quickly, lobster typically “disappear” – meaning that they become inactive and do not enter lobster traps.

The Caribou Channel hosts a productive lobster fishery, as do most other parts of the Strait. In the Caribou area, approximately 82 fishers set about 280 traps each, for an estimated total of 22,960 traps (5 traps per trawl). Lobster season falls within May and June. Lobsters are retained if they are of sufficient size<sup>1</sup>; but undersized lobsters, berried females (females carrying eggs) and windows (large females above 110 mm) are returned to the water to ensure a sustainable population.

### Herring

As mentioned above, approximately 100 Nova Scotia herring fishers, and fishers from Prince Edward Island fish in the grounds in the immediate area of the proposed outfall at CH-B. Herring fishers go where the fish are. In the 2018 herring fishery in the Caribou area, 90 percent of the herring were caught within a 2 mile radius of the proposed outfall location (CH-B).

Herring is fished in September and October. It is used as a food fish and also for lobster bait and is important in the food chain for numerous species. Herring stocks have been declining and DFO has designated herring as a “low caution” stock, the step before critical – DFO is watching the fishery closely to determine if it will remain viable. The proposed outfall CH-B is located in the middle of the last major active spawning area for Area 16F herring. Herring spawning grounds have compressed in the past few years as the stock has declined. Very little herring spawning occurs anywhere else in the Eastern Gulf.

During the herring fishery, it is not unusual for the Caribou-Prince Edward Island Ferry to navigate around the herring vessels, as they sometimes fish right in the ferry channel.

### Rock Crab

Mr. MacCarthy also fishes for rock crab, from August to the end of November each year. He and others fish out in a wide area, including near the proposed outfall location CH-B. There are 22 rock crab fishers in the local area. Mr. MacCarthy and Mr. Egilsson have observed large numbers of juvenile rock crab in

---

<sup>1</sup> In 2018, must have a carapace size of at least 73 mm in LFA 26A-1

Caribou Harbour, which is viewed as a crab nursery. Mature crabs tend to seek out cooler deeper water in summer and shallower water in winter.

### Scallops

Mr. Egilsson and Mr. MacCarthy fish scallops in the Caribou area from November to mid-December, outside the DFO-imposed Scallop Buffer Zone. DFO prohibits scallop fishing within one mile of shore or of Pictou Island, in order to protect juvenile lobster and lobster nursery habitat. DFO's website<sup>2</sup> designates this habitat as important to biodiversity conservation, due to its importance for the life-cycle of the species.

Scallops are filter feeders, making them susceptible to contaminant build-up in their local environment.



Detail of Scallop Buffer Zone – SFA 24

### Oysters

While neither Mr. Egilsson nor Mr. MacCarthy harvest oysters themselves, they advise that there is an oyster fishery in Caribou Harbour. Caribou Harbour is open to the Strait only by way of the ferry channel, and Harbour water moves in and out only via that channel, due to blockage of “the Little Entrance” channel into the Strait. As filter feeders, oysters fished in the Harbour are particularly vulnerable to any build-up of contaminants that could occur. As stated below, tides and currents can push water from the Caribou Channel into Caribou Harbour, where it may accumulate until conditions change. The proposed effluent outfall at CH-B is located close to the ferry route by which the water enters the Harbour.

<sup>2</sup> DFO - Scallop Buffer Zones (SFA 21, 22, 24) - <http://www.dfo-mpo.gc.ca/oceans/oeabcm-amcepz/refuges/sfa-zpp-eng.html>

### Bathymetry and Depths

Northern Pulp’s proposed outfall at point CH-B in the Caribou Channel is to be placed in a relatively deep and narrow part of the channel, 20 m deep and about 0.1 nautical miles (0.2 km) wide. From there the channel slopes upward to the much shallower waters found on either side of the channel (at depths of approximately 7 to 9 m).

Depths are shown in metres in the attached chart. A pipeline leading to the outfall will have to travel across areas with depths in a range of 0 to 8 m. As discussed further below, this makes the pipeline leading to the outfall very vulnerable to ice damage and increases the likelihood of rupture and leakage.

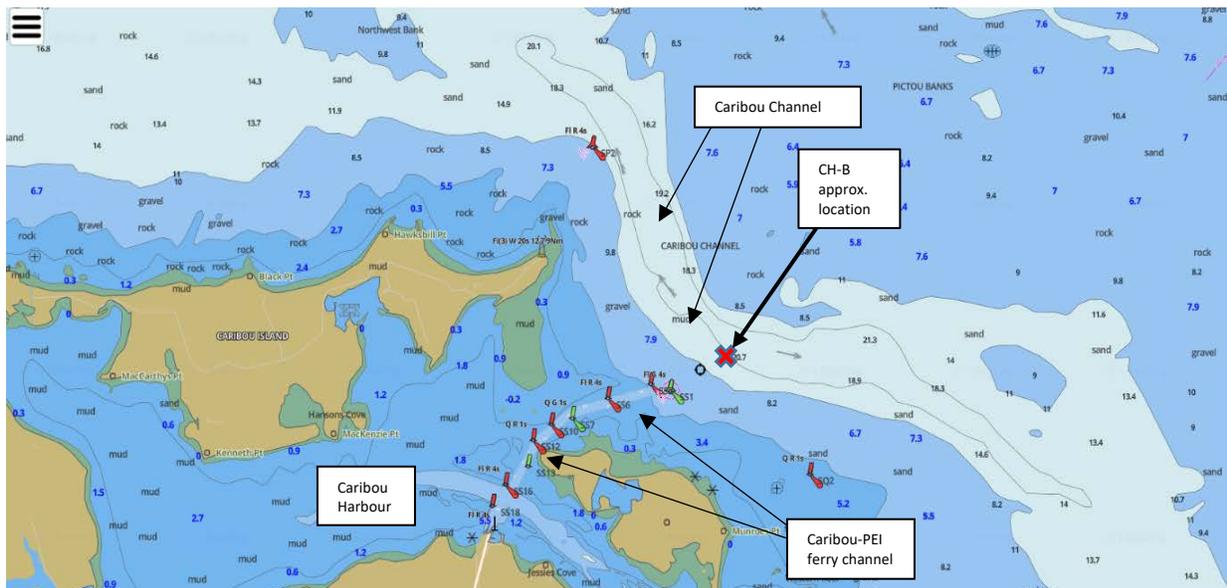


Chart of Caribou Channel and surrounding area

The Caribou-Prince Edward Island Ferry departs Caribou Harbour via the ferry channel. The ferry channel has to be dredged to maintain sufficient depth for the ferry. Prior to the creation of the dredged ferry channel, people would walk their cattle at low tide through the shallow water between Munroe’s Island and Caribou Island.

Until recent decades, there was a passage between Munroe’s Island and the mainland called the “little entrance”. Winds and tides have since filled the little entrance and blocked that passage, effectively joining Munroe’s Island to the mainland and limiting the flushing of Caribou Harbour. This is indicative of the shifting sea bottom, which is common in this area.

## **Currents and Tides**

Currents are complex in the Caribou Channel area and are very localized. The water moves back and forth with the tides, but on the south side of the Channel will also flow into Caribou Harbour. The channel area between Caribou Island and Pictou Island is narrower than the Strait on either end of the channel, and the water must speed up as the tides push it through in both directions. As the water moves through the channel, it causes an upwelling effect up the slopes on either side of the channel.

Northern Pulp's materials say that water movement due to tides is southeast and northwest.<sup>3</sup> While the falling tide does move southeast, the rising tide generally moves more north than northwest. Northern Pulp has made very general assumptions about its proposed outfall location, but has taken no steps to actually measure currents in the outfall area, or along the pipeline route, despite its proposed placement in the midst of an area used by local fishers.

The tide moves southeastwards through the channel, and then roughly northwards, and repeats this pattern, on approximately 6 hour intervals. Tides vary in height, but there is a roughly 4 to 5 foot differential between low and high tide, with 6 feet on a full moon. There is an approximately 1 hour period of slack tide between each high and low tide during which the water does not flow in any significant way and no meaningful dispersal would occur in Caribou Channel. Slack tides can last up to 2 hours during the summer months.

### **Slack tide periods in Caribou Harbour**

In Caribou Harbour, there are four slack tide periods per day. Fishermen estimate that in the vicinity of the proposed outfall, slack tides last on average 45 minutes, four times a day.

Local fishermen describe a slack tide as "when everything stops, even in a dynamic area." They also describe water movement as much slower than normal for a period of time before and after a slack tide period. Slack tide periods are a preferred time for herring fishing.

Periods of slack tide vary in different bodies of water and under different conditions. Currents, wind direction and stress, and tidal heights affect the duration of slack tide periods.

Duration of slack water at a given location is inversely related to the height of the tide at that location. The smaller the tide, the longer the period of slack tide will last. Tidal flow in the Caribou Harbour area can be quite small. See the image on the next page.

---

<sup>3</sup> Addendum to Receiving Water Study, p. 18.

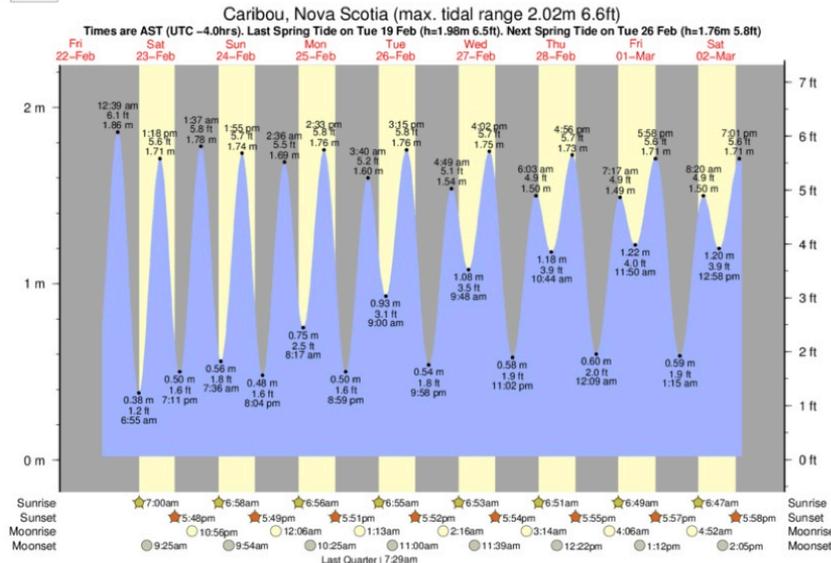
# Caribou Harbour and Caribou Channel - dynamics, tides, ice, marine species and fisheries – Page 7



## TIDE CHART FOR CARIBOU SHOWING LOW AND HIGH TIDE TIMES FOR THE NEXT 7 DAYS

Tide Times are AST (UTC -4.0hrs). Last Spring High Tide at Caribou was on Tue 19 Feb (height:1.98m 6.5ft). Next Spring High Tide at Caribou will be on Tue 26 Feb (height:1.76m 5.8ft).

Tide datum: Mean Lower Low Water.



Caribou Tide Chart. The largest known tidal range at Caribou is 2.02m 6.6 feet.

### CARIBOU TIDE CHART KEY:

The tide chart above shows the height and times of high tide and low tide for **Caribou, Nova Scotia**. The red flashing dot shows the tide time right now. The yellow shading corresponds to daylight hours between sunrise and sunset at Caribou.

NOTE: Use of this site for Caribou, Nova Scotia tide times is subject to our terms.

Variations in the strength of the current will also vary the time when the stream reverses, altering the time and duration of slack water. Northern Pulp’s Receiving Water Study does not account for slack tides or their effect on predicted diffusion of effluent released from the proposed pipe at CH-B.

Northern Pulp’s submissions do not take into account storms and storm surges and the heavier waves that can occur, especially in the fall. During rough weather and storm surges, very high water levels occur within the Harbour, and can be 5 or 6 feet higher than typical as shown in the photos on the next page.

These extreme tide events can last for several days, when combined with winds and waves from the northeast, holding the high water in Caribou Harbour. At such times, if effluent were to be discharged in the channel at CH-B, it would not disperse to the east or north – rather it would be pushed into Caribou Harbour and might accumulate there until the dynamic changed.



Regular High tide in Caribou Harbour



High tide in Caribou Harbour during a storm in the fall of 2018

Water can also enter the Harbour via movement of vessel traffic. When the PEI ferry enters Caribou Harbour from the Caribou Channel, it pushes in a wall of water with it from the channel. The wave is high enough to “surf”.

As well, the water in the Caribou Channel is part of a gyre/current that circles Pictou Island, in a counter-clockwise rotation, rather than strictly east-west. The Pictou Island gyre is well-known to fishers. In one winter during the 1930s, a ferry vessel became stuck in the ice south of Pictou Island. The gyre moved the vessel with the ice around Pictou Island three times over the winter, until the thaw released the ice's grip on the ferry in the spring. Gyres in the Strait and localized currents in the Caribou Channel and around Pictou Island were also noted in a series of drift bottle studies conducted by DFO scientists in the 1960s<sup>4</sup>. Mr. MacCarthy and Mr. Egilsson believe that the significant effects of the Pictou Island gyre, and how it might affect effluent dispersal or build-up, are not analysed or considered in Northern Pulp's materials.

Northern Pulp's materials fail to account for the significant localized water flow dynamics in the Caribou area, and in the Strait overall. Northern Pulp's failure to take basic measurements of currents and other dynamics results in incorrect and oversimplified modelling of crucial water flows.

### Swells and Wave action

The largest waves in the Caribou area occur in the fall. They come generally from the Northwest with the prevailing winds, although the largest storms with the highest tides come out of the Northeast every fall and winter. Allan and Greg observe that storms have become more frequent and more violent over the past 40 years.

---

<sup>4</sup> Lauzier, L.M., 1965. Drift bottle observations in Northumberland Strait, Gulf of St. Lawrence. Journal Fisheries Research Board of Canada 22(2), 353-368.

## **Ice**

Ice is typically present in the Caribou area from the end of December through April, but can set in earlier and remain later if temperatures are cooler than normal. Due to ice conditions, the Caribou-Prince Edward Island Ferry does not run from late December until the beginning of May. See in Appendix A, the Ice Chart for 3 February 2019 for the Gulf of St. Lawrence, including the Northumberland Strait. This chart is updated daily and Mr. MacCarthy reviews it on a regular basis.

In the shallows of the inshore area the ice freezes to the bottom. The fishermen call this “fast ice”. Further out into the deeper water drift ice forms on the surface. As water splashes on to the ice, it builds up into thicker and thicker layers.

These photos were taken by Mr. MacCarthy in 2014 off Caribou Island, and show the fast ice in the foreground and the ridge of sea ice farther out.



In the photo below, the sea ice is resting on the bottom which makes it stand far out of the water.



When, due to ice thickness or low tide, ice sheets rest on the sea floor, they will freeze to boulders and sediment. When high tide returns it lifts the ice and frozen material from the sea floor and moves it elsewhere. The ice in the Strait has picked up concrete vessel anchors weighing 2200 pounds and moved them far from their original location, such that they could not be located by divers. Ice also moved a 5000 lb piece of armour stone a considerable distance within the Strait. If wind or currents move the ice sheets, ice can also scour across the sea floor. Scour can be enhanced if boulders or other material have frozen on to the bottom of the ice. Ice scour can occur quite deep, even as deep as the proposed outfall position. As indicated in Stantec's Preliminary Receiving Water Study, in 1991 an undersea fiber optic cable to Prince Edward Island was broken by ice at a depth of over 18 metres.<sup>5</sup> Divers have reported ice scour occurring as deep as 20 m.

---

<sup>5</sup> Stantec, Preliminary Receiving Water Study, August 2017, at page 4.81.

Ice can be pushed up on to shore by the wind. In spring the ice begins breaking up into large icebergs and ice pans. At this time, when the wind blows from the northeast, it pushes the ice into harbours where it can pile up 25 (7.6m) to 30 feet (9m) high. See the photo below, taken near Caribou Lighthouse.



Given the dynamics observed by Mr. MacCarthy and Mr. Egilsson, any pipeline or diffuser installed on or under the sea floor, whether in shallow water or at a depth of 20 m, would be vulnerable to ice damage. Likewise, any piping infrastructure on or near the shore could be damaged from ice moving on to the shore. Attempts to protect the pipeline by trenching or covering it with armour stone would be insufficient, given the ice's ability to scour and move heavy objects and sediment, and the shifting sea bottom in that area.

## Wind

Mr. MacCarthy and Mr. Egilsson reviewed the wind directions as recorded in a recent air emissions study of the Pictou Area.<sup>6</sup> They agree that Figure 2 in the study report accurately captured the typical wind patterns<sup>7</sup> but note that the winds are much stronger offshore than at the Granton station where the data was tracked for the Pictou study.

Figure 2 is reproduced below:

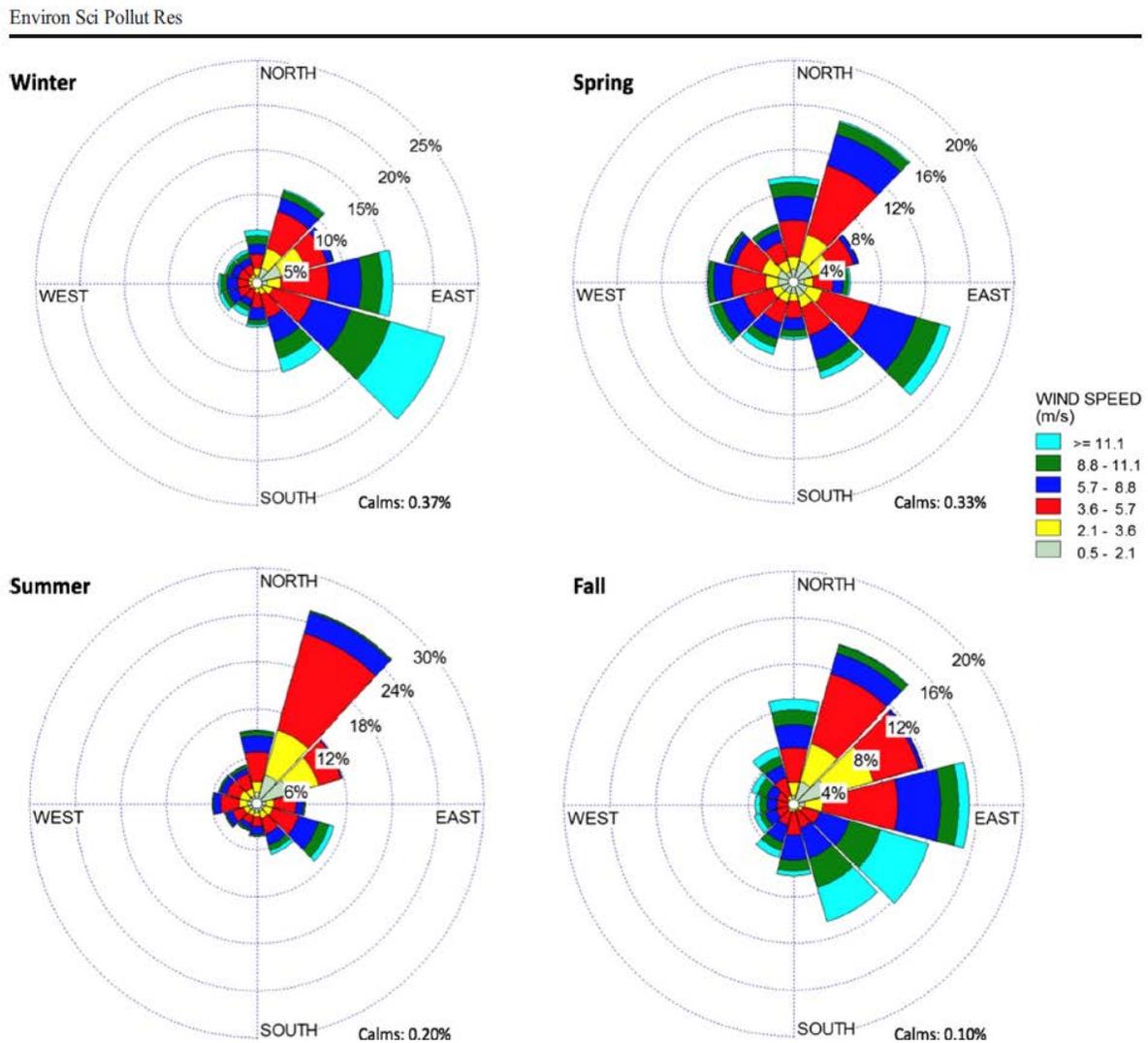


Fig. 2 Seasonal (2006–2013) wind rose simulations using WRPlot View™ (blowing to direction). Percentages represent frequency of wind direction

<sup>6</sup> Hoffman, E., Guernsey, J.R., Walker, T.R. et al., Pilot study investigating ambient air toxics emissions near a Canadian kraft pulp and paper facility in Pictou County, Nova Scotia, Environmental Science and Pollution Research (2017) 24: 20685. <https://doi.org/10.1007/s11356-017-9719-5>.

<sup>7</sup> Pilot study investigating ambient air toxics emissions, *supra*, at p. 20689, Figure 2.

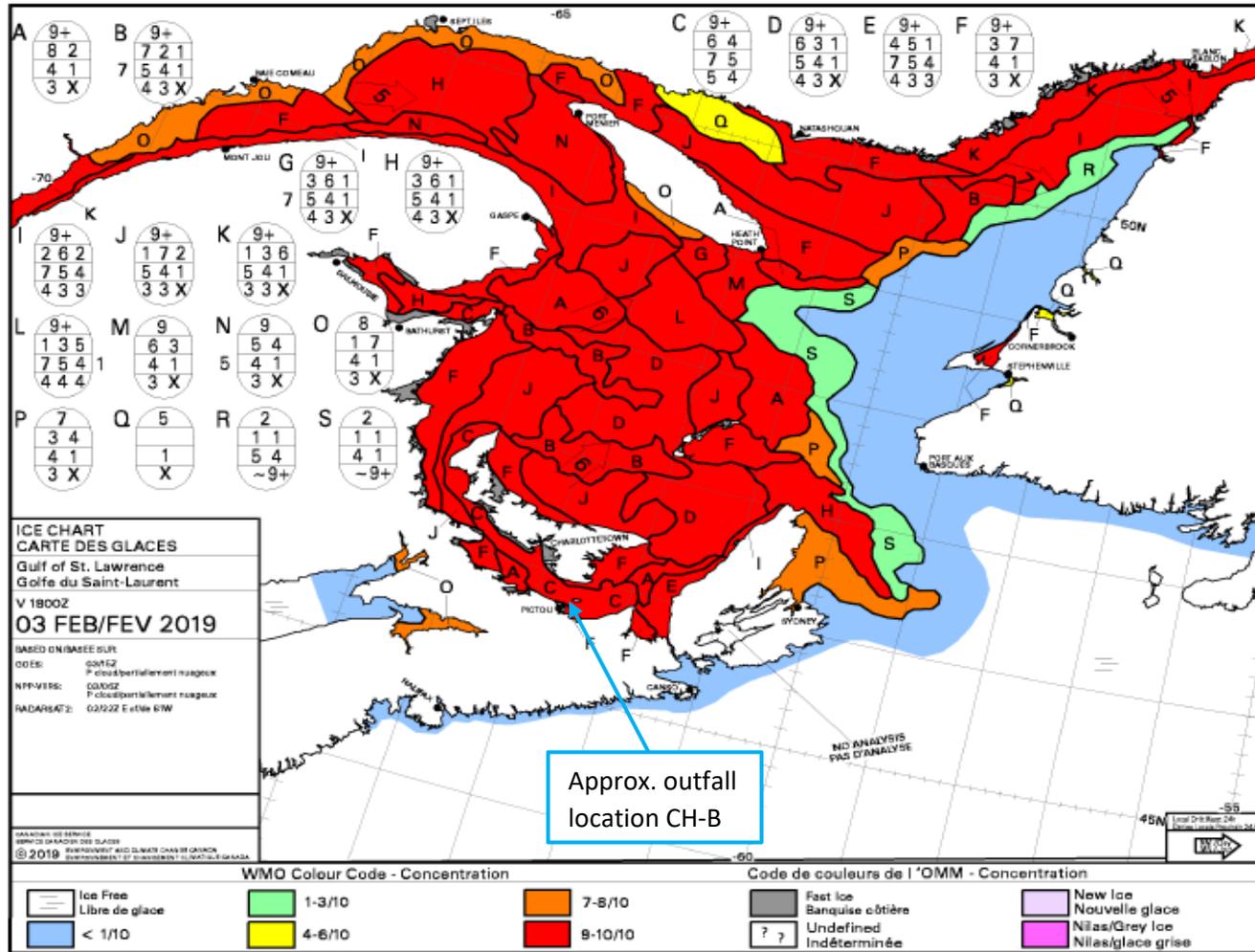
## **Conclusion**

Mr. MacCarthy and Mr. Egilsson believe that much of the above information was not taken into account by Northern Pulp and its consultants in the process of developing its materials and providing information on the ability of the Caribou Channel and the Northumberland Strait to neutralize the impacts of a continuous effluent flow into that environment.

Contrary to the conclusions of Northern Pulp's consultants, the carrying capacity of the Strait, combined with the currents, overall and local, does not permit quick and complete dispersal of the constant flow of effluent and its constituents. The effluent will not simply vanish, but will circulate and build up within the system of local tides, currents and dynamics in the Strait, creating an unreasonable and serious risk of harm to fish and fish habitat.

Further, the pipeline and the diffusers are extremely vulnerable to damage from ice, storms and other forces, likely resulting in effluent discharge into Caribou Harbour, or other parts of the Caribou area. Such discharges could go undetected for weeks or months due to ice cover, and because there is no effective monitoring equipment installed on the pipeline and diffuser. Likewise, in the event of a rupture or leak, pipeline infrastructure repair would be extremely difficult or impossible prior to ice breakup in spring. All of these factors present serious individual and cumulative risks to the fishery and to the marine environment.

APPENDIX A



## APPENDIX B-2

March 5, 2019

Re: Northern Pulp Replacement Effluent Treatment Project

My name is Rob MacKay. I live in Central Caribou, NS. I am a master diver and have been for almost 3 decades. I have over 4000 dives in and around the Pictou County area. I have spent many years on the bottom in the Caribou area and I have seen a lot of changes made by ice each year.

Here are a few examples.

1. Gary, a fisher from Toney River, asked me to go and look for a couple of lobster traps he lost in 32 feet of water. I came across an ice scour on the bottom that was probably 4 feet deep and wide enough that you could fit a small car in. This was located just west of Toney River, in lobster bottom about ½ km from land. This would be about 10 miles from the proposed outfall location.
2. Another fisher from Toney River named Barry had a trawl hung up on bottom several years ago and he asked me to go look for it. It was tangled up in a buoy and chain from Prince Edward Island. The buoy had dragged from northern PEI. It weighed approximately 5000 pounds and had a 4000-pound stone mooring attached to it. We figured out where the buoy was from by prying a tag with serial number off the solar panel on the side of the buoy. It was a fairway buoy, one of the larger ones. This was found just west of the Ballast Island, Caribou Island, about 5 miles from the proposed outfall location, about ½ km from land.
3. In Caribou Harbour I used to help every spring installing the navigation buoys in the channel with Ed George and Paul Logan. Sometimes the ice would drag them for miles and it was all we could do to drag them back into place. Some of the large navigation buoys in Caribou are about 30" around and about 23 feet long. Buoys weigh from 150 to 5000 lbs. Buoy anchors are 2000-pound blocks with 500 pounds of chain on them depending on the depth. Larger buoys would have double the weight on them. DFO tend to use larger ones, such as the Gull Rock buoy and the last green Caribou buoy which is also a RACON buoy that shows up on radar as a Morse code letter. The navigation buoys are located in the channel in Caribou Harbour, parallel to the proposed pipe route.

The channel shifts from time to time mostly due to storms. Ice and tide also move sand around as it is very shallow in this area. Storms can pile ice up to 30 feet high which can dig deep into the soft bottom. This could damage the buried pipe.

If the pipe is covered in armour stone, the sand on either side will be undermined by wind and wave action exposing the pipe to the full force of the ice in winter. If no armour stone is used, those same fall storms could easily expose the pipe, as anyone living near a beach knows how easily sand is shifted by storm winds and waves. Either way the pipe is unlikely to survive extreme conditions in this area.

The armour stone proposed for this pipe would likely be moved around by the ice and could end up in the channel used by Northumberland Ferries which is barely deep enough to begin with.

The sea bottom in the area of the proposed pipe is very fragile. It's mostly sand and in the inner harbour, mud and eel grass. The eel grass is very fine and important to juveniles and larvae of lobster and crab.

I have personally witnessed the things that I have described above.

Robert L MacKay  
711 Central Caribou Rd, NS  
B0K1H0

## APPENDIX B-3

March 4, 2019

Re: Northern Pulp Replacement Effluent Treatment Facility Environmental Assessment

My name is Barry Sutherland. I have been a fisherman for 27 years. I fish in and around the area of Caribou Harbour and have great concern over the possibility of an effluent pipe in this area.

Caribou Harbour is one of the largest rock crab nurseries in the Eastern Gulf. It contains millions of female and juvenile crab. I have fished rock crab for several years. I fish Hillsborough, PEI and from Wallace Harbour to Caribou Harbour in Nova Scotia. Female crab can be found in all the bays and inlets, but for some reason Caribou Harbour holds a far greater number of female and juvenile crab than all the other areas.

The survival of the lobster industry in this end of the Strait depends on the health of this rock crab nursery. Crab is the main food supply for lobster.

I am concerned about the potential impact of a pipe carrying and **continuously discharging up to 3 million litres an hour** of effluent through three diffusers, and the potential that this will produce noise and/or vibration that would disturb marine life.

I would like to draw the Minister's attention to the potential impact of noise and/or vibration from the diffusers on the marine species in Caribou Harbour and surrounding area. This issue has not been addressed in Northern Pulp's submission. I believe this issue must be fully addressed before any approval is given. Noise and vibration can carry long distances under water and change conditions which make a habitat favourable for many species.

I also believe that Northern Pulp's plan to excavate a trench through the centre of this very special eco-system may disrupt the fishery in this area.

The DFO description of Scallop Buffer Zone 21, 22 and 24, which runs 1 nautical mile from the nearest point of land and includes the entire proposed pipeline and outfall, states that the ecological components of interest protected by the buffer zone are "juvenile American lobster and habitat that is important to biodiversity" and states "specifically American lobster nursery habitat is important for the life-cycle of the species."

The description also states, "No other human activities that take place in this area are incompatible with the conservation of the ecological components of interest" and that "These closures offer protection to other important species and habitats in the southern Gulf of St. Lawrence." As an example, DFO refers to SFA 22 containing "rock crab (an important prey for several species and a commercial species." <http://www.dfo-mpo.gc.ca/oceans/oeabcm-amcepz/refuges/sfa-zpp-eng.html>

Caribou Harbour is home to the largest commercial fishing fleet in the Northumberland Strait. The strong lobster catches in this area are the result of the continuous food supply from the rock crab nursery. The potential destruction of this crab habitat will have devastating consequences on the lobster industry in this area. No studies have been done on the possible effect noise and/or vibration from this effluent pipe could have on local marine life. When foreign material is dumped into the environment, it will have an effect. Sometimes it takes years to realize how big that effect will be and then it is too late to fix it. Northern Pulp needs do something environmentally friendly, not something that is economically beneficial to themselves.

Sincerely,

Barry Sutherland  
40 Sutherlands Lane  
RR2 Scotsburn, Pictou County  
Nova Scotia B0K1R0  
debbie\_and\_barry@hotmail.com