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Beach Observations of Plastic and Marine Litter along the Northwest Passage

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Research Question

- A need is identified to improve data collection on Plastics for certain parts of the Arctic Ocean region including Canada[1]
- Scientific publications addressing marine litter in this Arctic region are limited[2]
- High uncertainty in planning costly scientific expeditions to most remote areas due to ice conditions
- If ice conditions allow, only limited time (~4-6 weeks) navigable accessibility
- Taking a citizen-science opportunity during a 2019 Northwest Passage expedition this publications addresses the following research question:

What is the status of marine litter on remote shorelines along the Northwest Passage

[1] D. Balton, B. Janis, H.Hrund Logaddottir, M. Maddox, F. Ulmer Policy and Action on Plastic in the Arctic Ocean, October 2019 Workshop Summary & Recommendations. p. 3, Belfer Center for Science and International Affairs and Woodrow Wilson International Center for Scholars, March 2020
[2]M.P.T. Bourdages et al. No plastics detected in seal (Phocidae) stomachs harvested in the eastern Canadian Arctic. Marine Pollution Bulletin 150 (2020) 110772

Methodology

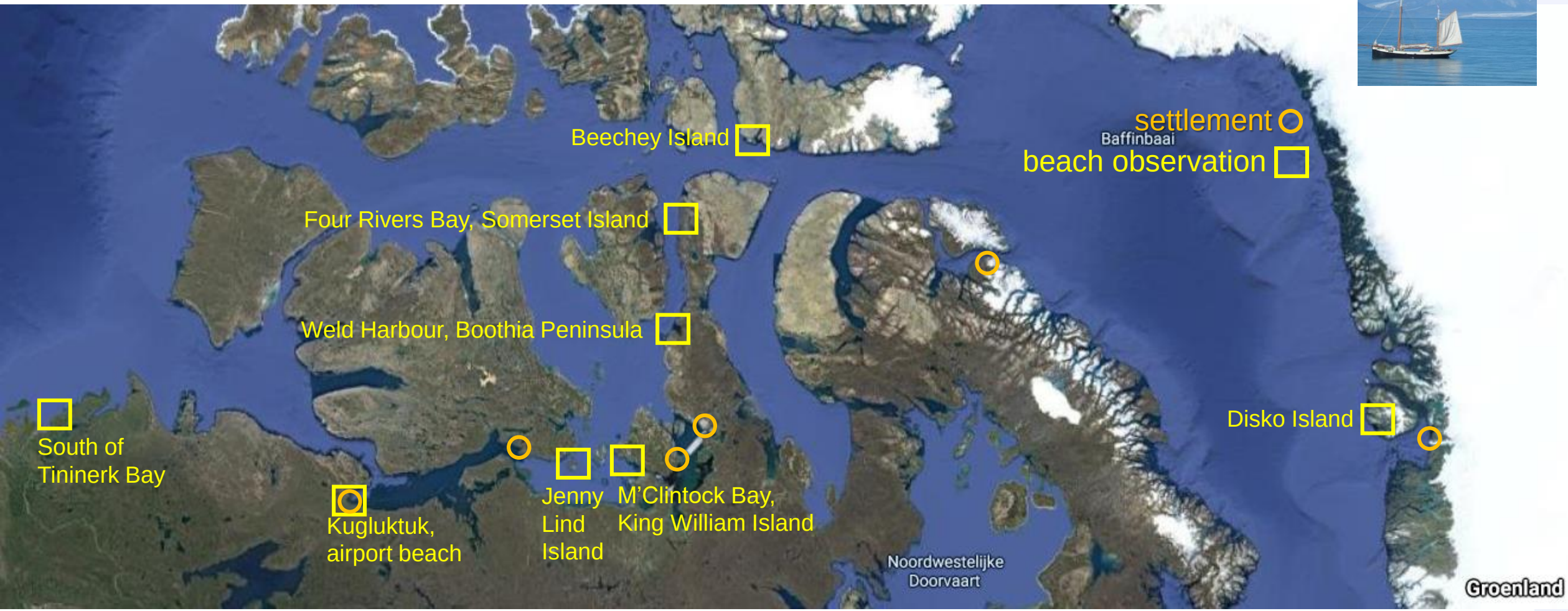
The marine litter status is assessed during the 2019 Northwest Passage expedition of the 1915 gaff ketch herring drifter Tecla[3] by:

- conducting a series of beach observations at all non-settlement landings
- following the OSPAR Guideline for beach observations[4]
  - category and group identifiers adopted for 100m area surveys
  - surveys list date, position and by group: category id, name and amount
  - surveys indicate site characterics such as approximate distance to nearest settlement, decay status and most likely origin of litter
  - beach lengths observed ranging from 100-400 m
  - litter has not been collected, only identified
  - no observations have been conducted at inhabited settlements

[3] Headland et al. Transits of the Northwest Passage to end of the 2019 Navigation Season (Atlantic Ocean ⇔ Artic Ocean ⇔ Pacific Ocean). Scott Polar Research Institute, 18 October 2019

[4] OSPAR Commission, Guideline for Monitoring Marine Litter on the beaches in the OSPAR Maritime Area, 2010

Landfalls of the NWP2019 expedition of the Tecla



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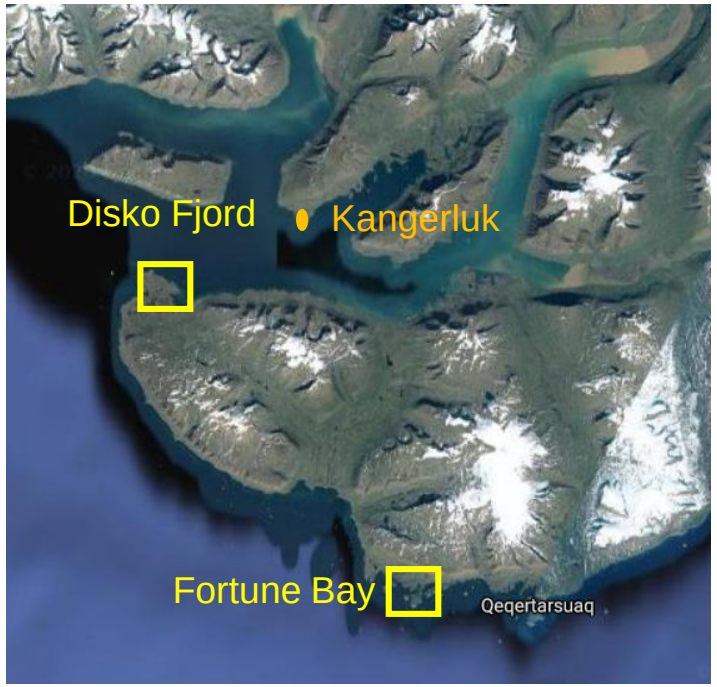
Fortune Bay, Disko Island, Greenland

Date: August 3, 2019

Position: 69.257333 N, -53.741301 W

- 5 km west of Qeqertarsuaq (850p)
- close (300m) to summer homes
- most likely origin: local activities

Total	**29**
Plastic/polystyrene	**21**
2: bags (shopping)	2
4: drink bottle	2
6: food/fast food container	3
10: Jerry can	2
13: Plastic Crates	1
25: Plastic gloves	1
31: Rope/cords/nets < 50cm	2
32: Rope/cors/nets > 50cm	1
38: Buckets	1
40: Industr.packaging/plast. sheeting	2
42: Hard hats	1
46: Plastic/polystyrene pieces<50cm	3
Textiles/cloth	0
Paper + cardboard	**2**
64: Cigarette butts	2
Wood	**3**
69: Pallets	1
75: Other wood items > 50 cm	2
Metal	0
Glass	0
Ceramics & Pottery	0
Sanitary waste	**3**
98: Sani.towels/panty lines/back.strips	3



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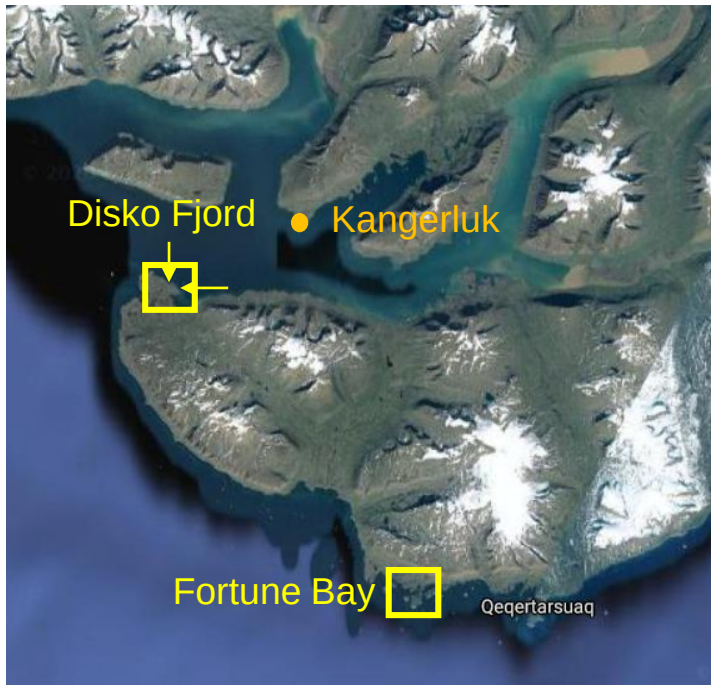
Disko Fjord, Disko Island, Greenland

Date: August 3, 2019

Position: 69.440 N, -54.17 W

- 11km west of Kangerluk (<50p)
- derelict and overgrown fishing gear

Site	N beach	SE beach
Total	**24**	**23**
Plastic/polystyrene	**24**	**15**
4: drink bottle	2	
5: cleaner container		1
10: Jerry can	1	1
13: Plastic Crates		1
15: Plastic Caps/lids		2
18: Comb/hair brushes	1	
31: Rope/cords/nets < 50cm	4	
32: Rope/cors/nets > 50cm	2	3
33: Tangled nets/cord	5	1
34: Fish boxes	2	3
37: Floats/bouys	3	1
40: Industrial packaging/plastic sheeting		1
43: Shotgun cartidges	3	1
44: Shoes/sandals	1	
Metal	**0**	**8**
85: Oil drums (old/rusty)		5
89: Other metal pieces > 50cm		3



South East beach

North beach

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Union Bay, Beechey Island, Nunavut, Canada

Date: August 12, 2019

Position: 74.725 N, -91.844 W

- remote, 60 km East of Resolute (200p)
- most likely origin: floatsam

Total	**2**
Plastic/polystyrene	**1**
5: cleaner container	1
Metal	**1**
78: Drink cans	1

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Four Rivers Bay, Somerset Island, Nunavut, Canada

Date: August 14, 2019

Position: 72.741 N, -95.525 W

- very remote, 250km South of Resolute
- most likely origin: jetsam, possibly left behind

Total	**2**
Metal	**1**
85: Oil drums (old/rusty)	1
Glass	**1**
90: Glass bottles	1

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Weld Harbour, Boothia Peninsular, Nunavut, Canada

Date: August 16, 2019

Position: 71.093 N, -96.327 W

- very remote, 450km South of Resolute
- most likely origin: flotsam

Total	**4**
Plastic/polystyrene	**4**
39: Strapping bands	3
46: Plastic/polystyrene pieces<50cm	1

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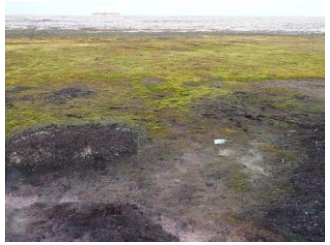
M’Clintock Bay, King William Island, Nunavut, Canada

Date: August 22, 2019

Position: 68.645 N, -97.747 W

- radar station site: Gladstone CAM2
- remote, 120km W. of Gjoa Haven (1300p)
- most likely origin: waste dump former settlement (W), recent flotsam (F)

	W	F
Total	**99**	**3**
Plastic/polystyrene	**36**	**3**
4: drink bottle		1
15: Plastic Caps/lids		1
18: Comb/hair brushes	1	
31: Rope/cords/nets < 50cm	15	
43: Shotgun cartidges	2	
45: Foam sponge	2	
46: Plastic/polystyrene pieces<50cm	16	
48: Other plastic/polystyrene items		1
Textiles/cloth	**16**	**0**
54: Clothing	15	
55: Furnishing	1	
Metal	**43**	**0**
79: Electric appliances	3	
82: Food cans (metal)	5	
83: Industrial metal scrap	5	
85: Oil drums (old/rusty)	1	
88: Other metal pieces < 50cm	15	
89: Other metal pieces > 50cm	14	
Ceramics & Pottery	**4**	**0**
95: Other ceramic/pottery items	4	



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Jenny Lind Island, Nunavut, Canada

Date: August 25, 2019

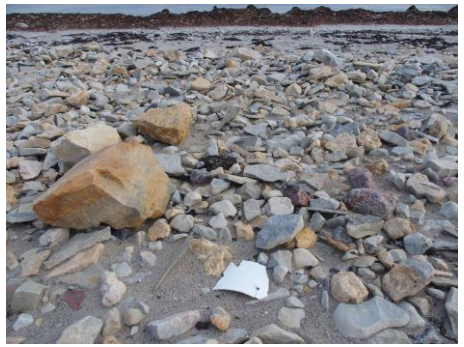
Position: 68.65 N, -101.70 W

- radar station site: Jenny Lind CAM1
- remote, 260km E. Cambridge Bay (1620p)
- most likely origin: military camp (Bay side, W), flotsam (Gulf side, E)

	B	G
Total	**5**	**5**
Plastic/polystyrene	**3**	**2**
4: drink bottle	1	
5: cleaner container		1
19: Crisps/sweet packets, lolly sticks	2	
38: Buckets		1
Metal	**2**	**3**
78: Drink cans	2	2
88: Other metal pieces < 50cm		1

Bay side, non bleached

Gulf side bleached/decayed



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Kugluktuk, Nunavut, Canada

Date: September 2, 2019

Position: 67.825 N, -115.155 W

- beach near airport
- 3km East of Kugluktuk (1490p)
- most likely origin: local campers

Total	**6**
Plastic/polystyrene	**4**
4: drink bottle	1
6: food/fast food container	1
47: Plastic/polystyrene pieces>50cm	1
48: Other plastic/polystyrene items	1
Metal	**2**
78: Drink cans	1
88: Other metal pieces < 50cm	1

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Tininerk Bay, Northwest Territories, Canada

Date: September 7, 2019

Position: 69.600 N, -132.9765 W

- 8km North of Tuktoyaktuk (900p)
- most likely origin: flotsam and jetsam deposits from Mackenzie river

Total	**7**
Plastic/polystyrene	**6**
5: cleaner container	1
8: engine oil container <50cm	1
40: Industr.packaging/plast. sheeting	1
46: Plastic/polystyrene pieces<50cm	3
Textiles/cloth	**1**
55: Furnishing	1







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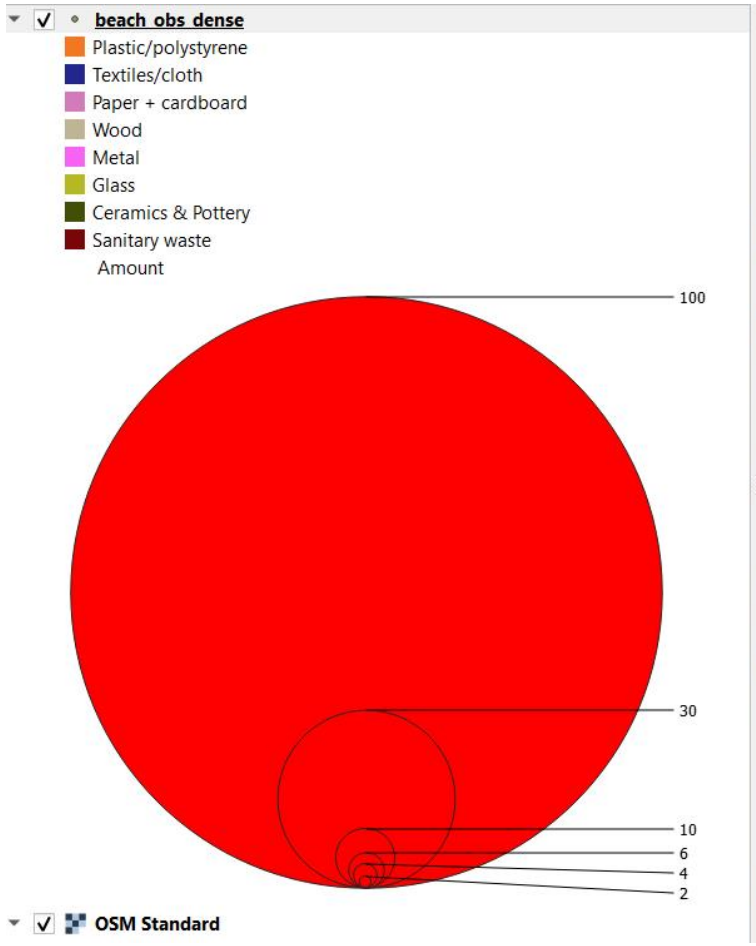
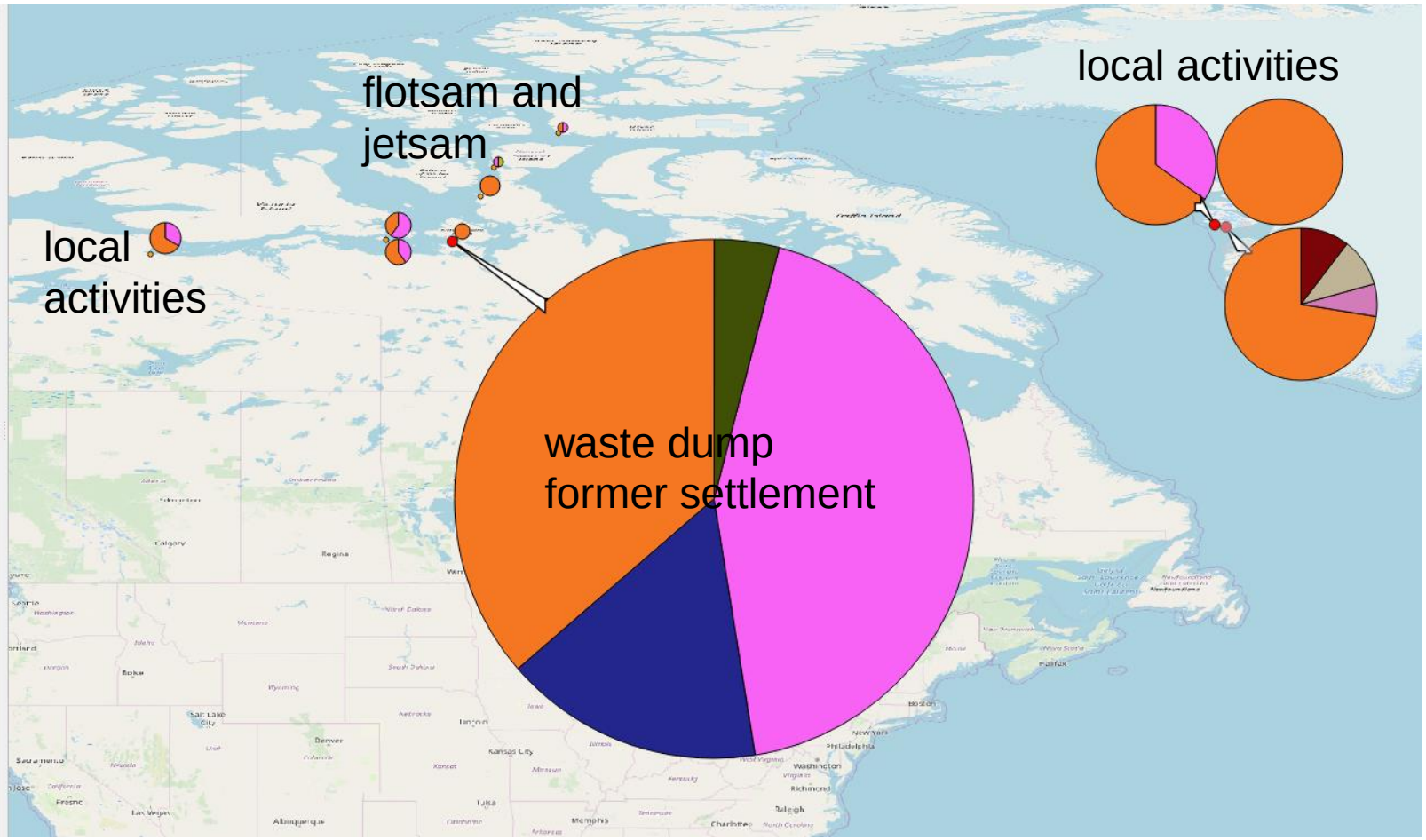
Map based overview of observations and origins





Discussion

The beach observations reveal the following types of pollution origins:

- remote shorelines show signs of decayed flotsam and jetsam, although oil drums may also have been left behind
- shorelines within short distance (<15 km) of inhabited settlements show signs of local activities such as camping, hunting and fishing
- shorelines near radar sites show signs of military camping activities
- abandoned settlements near radar stations such as the Distant Early Warning Line radar site Gladstone on King William Island, Nunavut and the abandoned LORAN site at Nipisat on Disko Island shown significant sights of environmental disturbances[5]

[5] Lackenbauer, Whitney P. "The Cold War on Canadian Soil: Militarizing a Northern Environment." American Society for Environmental History, Vol. 12, No. 4. Special Issue on Canada (Oct 2007), 932.

Conclusions

- The beaches of the Canadian Arctic Archipelago, which are blocked by sea ice during most of the year, are not pristine.
- Truly remote places have received marine pollution for decades to centuries.
- Where (abandoned) settlements are at close range pollution from local activities can be discovered
- Ocean currents, wind patterns, ice rafting, distance to river mouths, and flotsam, jetsam and derelict all determine the type and amount of marine litter along the Northwest Passage.

Many thanks to the Tecla and crew for its 2019 NWP expedition

Photos: Peter Gijsbers, Jim Shaw
Satellite Images: © Google Earth

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