University of Lethbridge

Hester Jiskoot

hester.jiskoot@uleth.ca

Dept. of Geography & Environment
Lethbridge, AB, Canada

Deltares

Peter Gijsbers

peter.gijsbers@deltares.nl

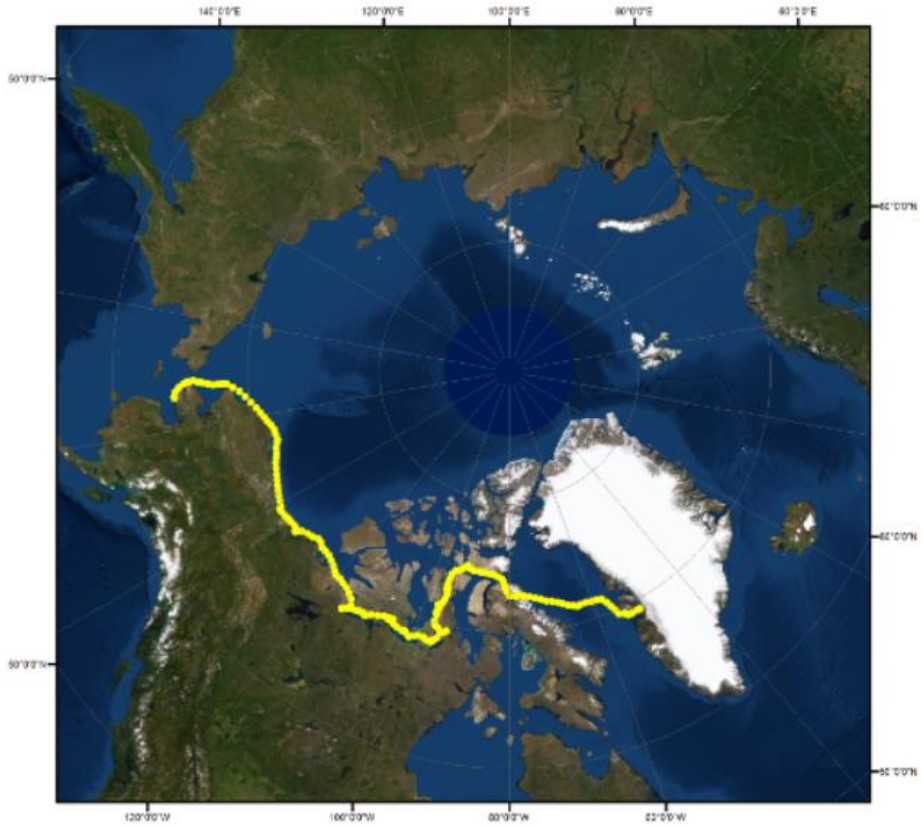
Dept. of Inland Water Systems
Delft, The Netherlands

Beach Observations of Plastic and Marine Litter along the Northwest Passage

id: EGU2020-7312

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 the Canadian Arctic region are limited[2] due to
  - 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 publication aims to make the data collected available to the wider research audience to help answer the 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

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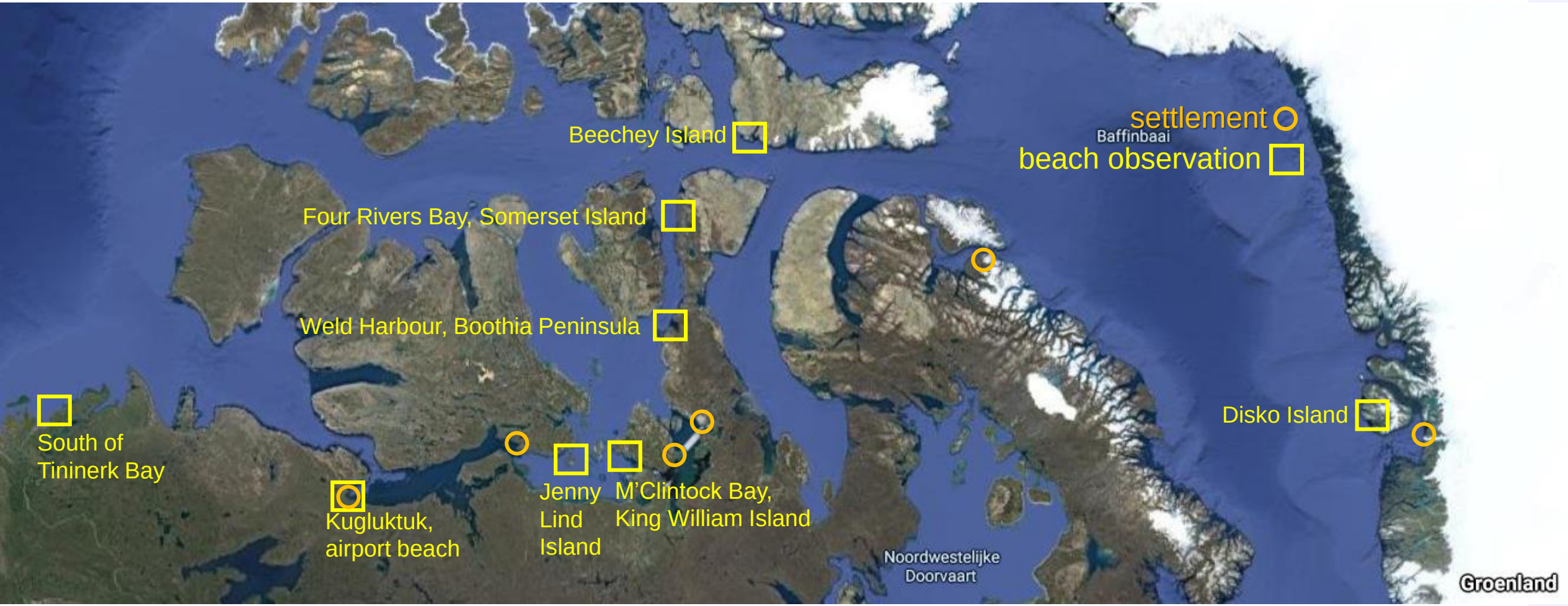
Methodology

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 characteristics such as approximate distance to nearest settlement, decay status and most likely origin of litter
  - beach lengths observed ranging from 100-400 m
  - litter was not collected, only identified
  - no observations were 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

Disembarkments of the NWP2019 expedition of the Tecla



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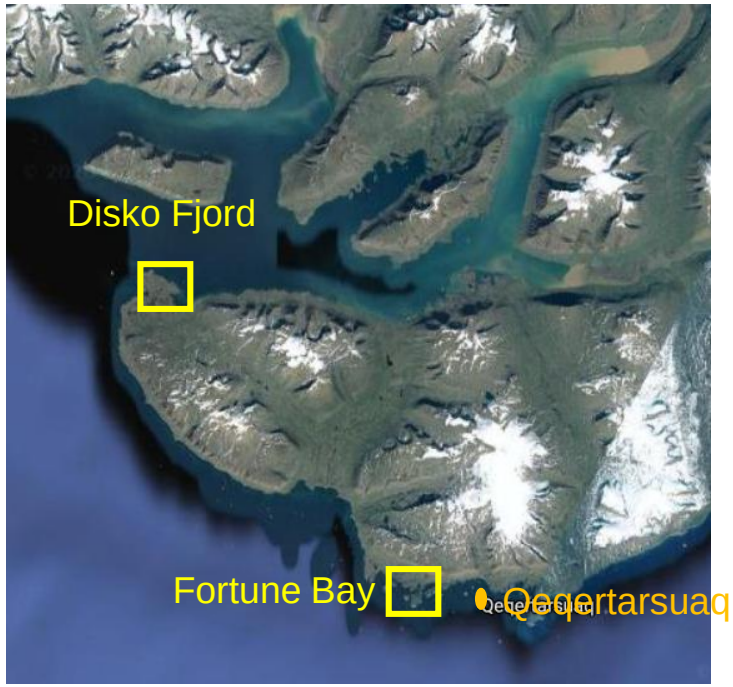
Fortune Bay, Disko Island, Greenland

Date: 3 August 2019

Position: 69.257333 N, -53.741301 W

- 5 km west of Qeqertarsuaq (850 p)
- close (300 m) 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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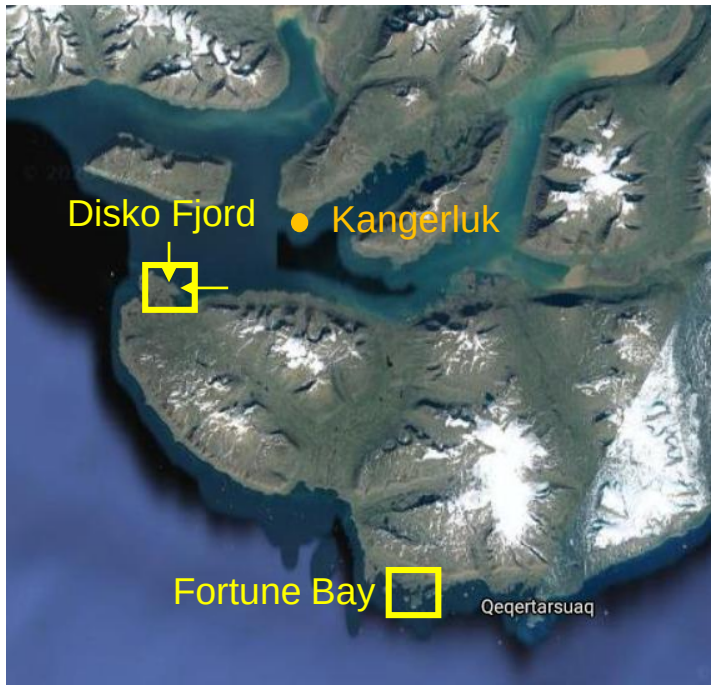
Disko Fjord, Disko Island, Greenland

Date: 3 August 2019

Position: 69.440 N, -54.17 W

- 11 km west of Kangerluk (<50 p)
- 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: 12 August 12 2019

Position: 74.725 N, -91.844 W

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

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: 14 August 14 2019

Position: 72.741 N, -95.525 W

- very remote, 250 km 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: 16 August 2019

Position: 71.093 N, -96.327 W

- very remote, 450 km 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

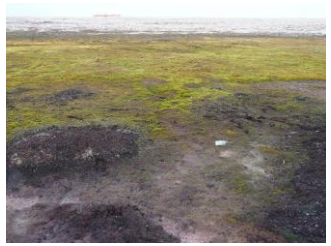
Date: 22 August 2019

Position: 68.645 N, -97.747 W

- radar station site: Gladstone CAM2
- remote, 120 km W. of Gjoa Haven (1300 p)
- 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: 25 August 2019

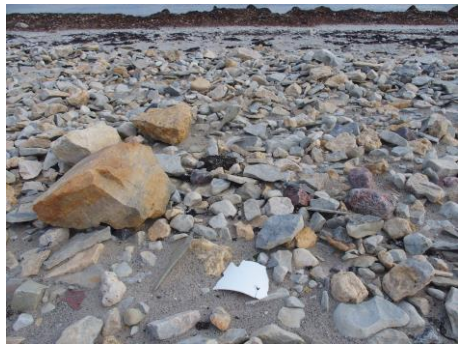
Position: 68.65 N, -101.70 W

- radar station site: Jenny Lind CAM1
- remote, 260 km E. Cambridge Bay (1620 p)
- 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: 2 September 2019

Position: 67.825 N, -115.155 W

- beach near airport
- 3 km East of Kugluktuk (1490 p)
- 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: 7 September 2019

Position: 69.600 N, -132.9765 W

- 8 km North of Tuktoyaktuk (900 p)
- 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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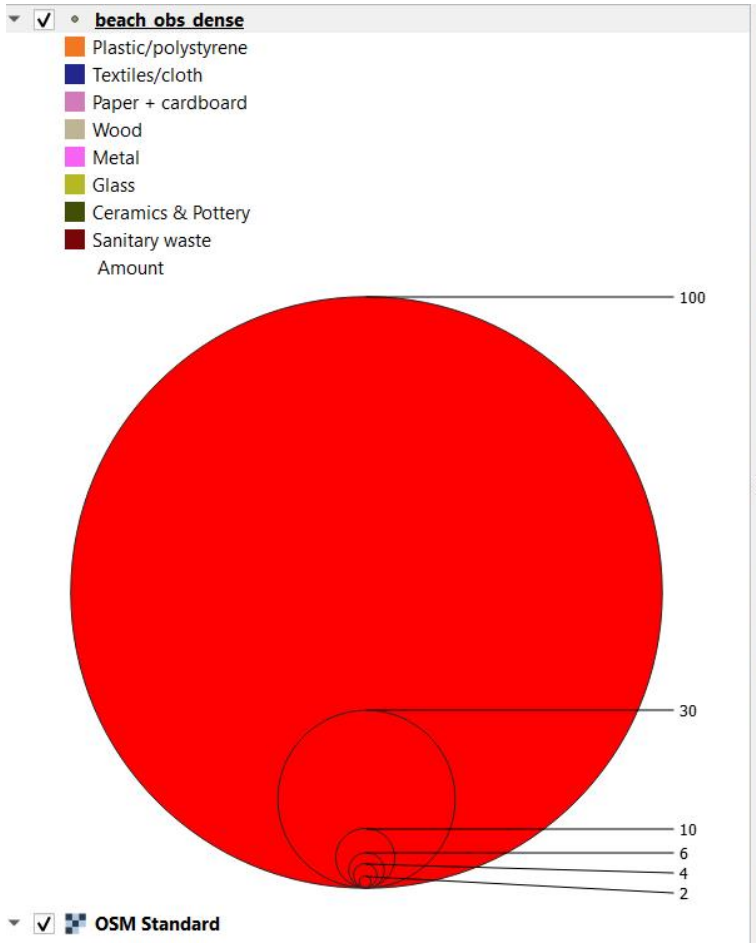
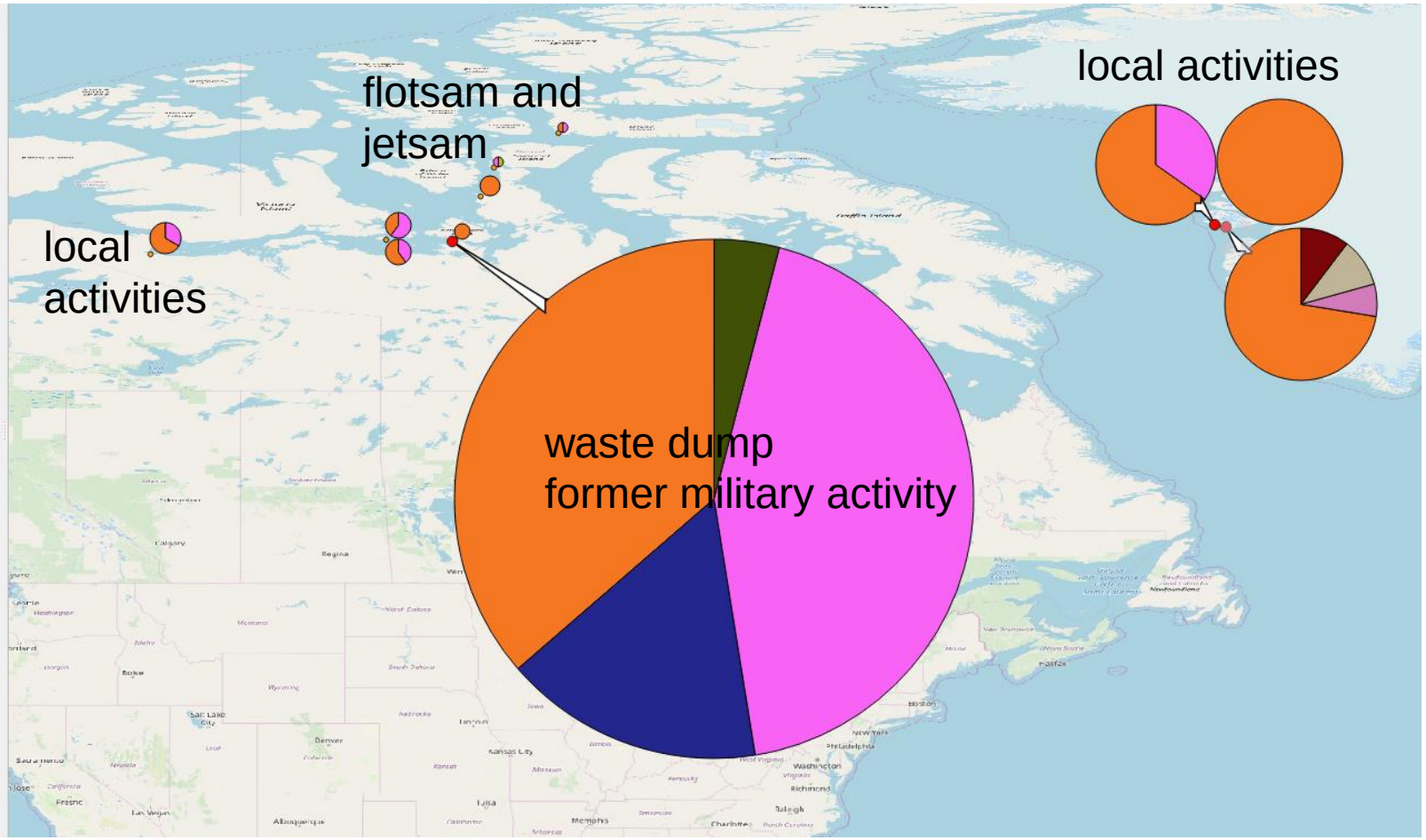
Map based overview of observations and origins





Analysis and 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]

# of identified items	Total	Plastic	Rubber	Textiles	Paper	Wood	Metal	Glass	Ceramics
Total flotsam/jetsam	24	16	0	1	0	0	6	1	0
Total local activities	87	67	0	0	2	3	12	0	0
Total former waste dump	99	36	0	16	0	0	43	0	4

[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 with bleached items (mostly cleaner containers, other plastic pieces, drink cans) providing the most visible evidence
- Where (abandoned) settlements are at close range pollution from local activities can be discovered with drink bottles, food containers, fishing derelict, shotgun cartridges, drink cans and oil drums providing the most visible evidence
- Flotsam and jetsam are small contributors compared to local activities (current or former)
- Former local activities, current local activities, 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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