Rivers as a plastic pollution pathway to the Arctic Ocean

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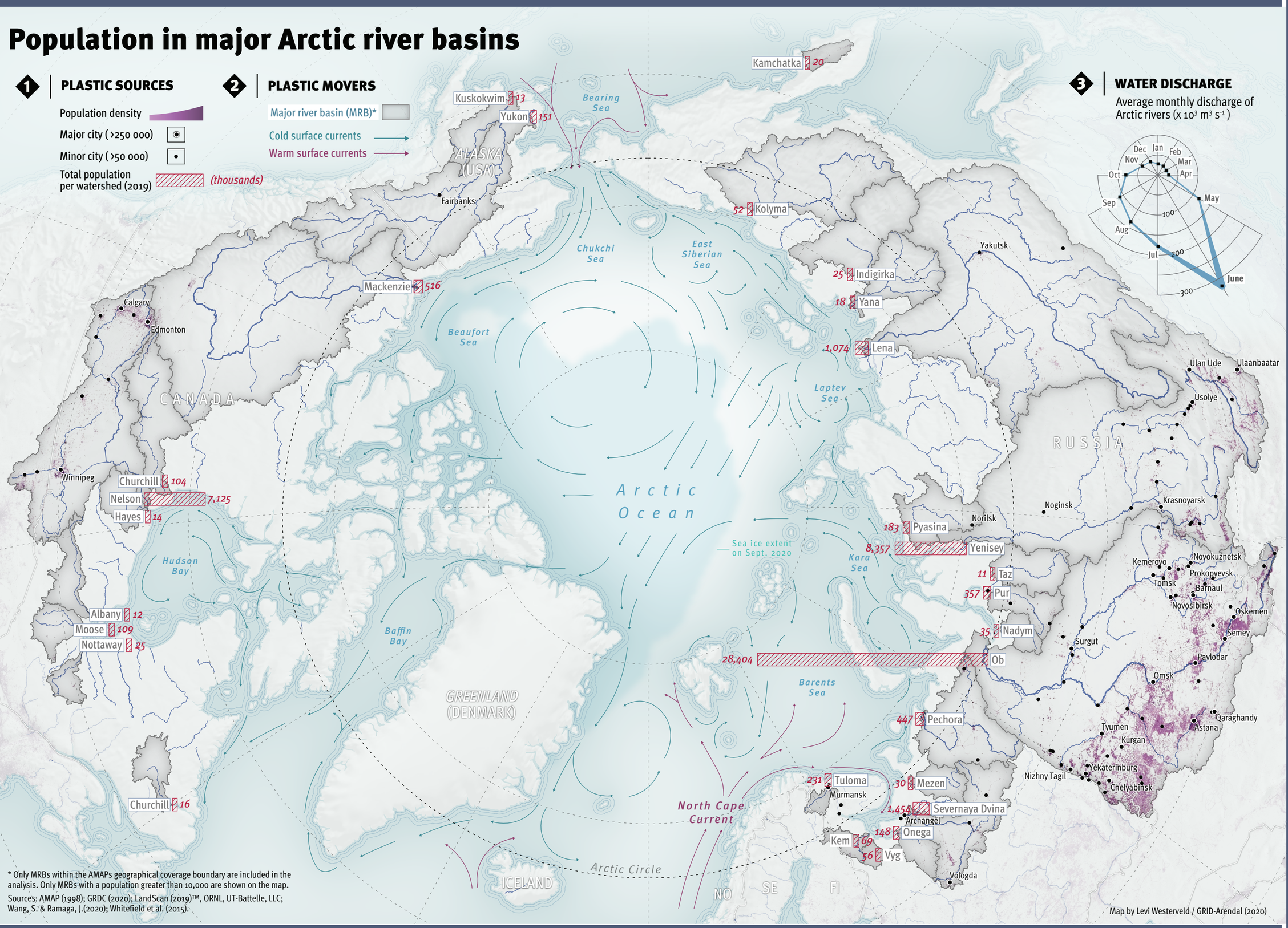
Population in major Arctic river basins



* Only MRBs within the AMAPs geographical coverage boundary are included in the analysis. Only MRBs with a population greater than 10,000 are shown on the map.

Sources: AMAP (1998); GRDC (2020); LandScan (2019)™, ORNL, UT-Battelle, LLC; Wang, S. & Ramaga, J.(2020); Whitefield et al. (2015).

Map by Levi Westerveld / GRID-Arendal (2020)

Plastic pollution in the world's oceans is a growing global concern, including in the Arctic Ocean. The primary contributor to this pollution is considered to be land-based sources. While coastal and marine contributions have been widely studied, assessments from inland populations through riverine systems lack the same attention[1,2,3]. Plastic pollution in freshwater systems associated with human activity, can enter rivers through natural processes such as wind and rainfall-induced runoff if not directly dumped[2].

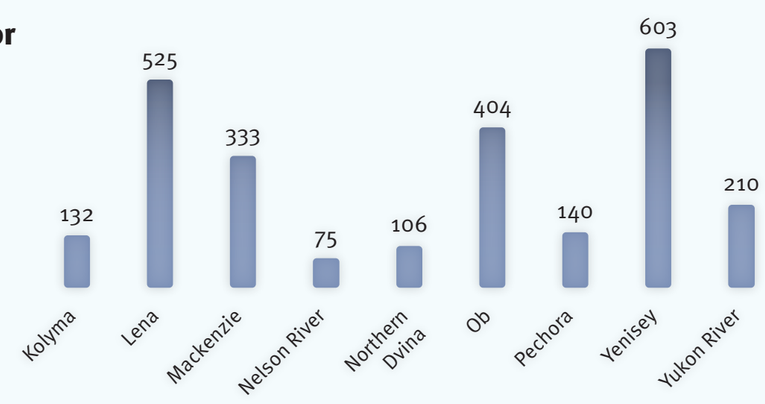
The Arctic Ocean constitutes just over 1% of the global ocean volume but receives about 10% of the global river discharge[4]. The four rivers with the largest yearly runoff to the Arctic Ocean are the Yenisei, Lena, Ob, and Mackenzie river, all of which have their headwaters in sub-Arctic regions[5]. Approximately 4 million people live in the Arctic, with the Barents and Russian Arctic region being the most populated. There are at least an additional 50 million people situated within the catchment areas of the rivers flowing into the Arctic[6].

To address the knowledge gap regarding Arctic rivers as a source of plastic pollution, a map was created to illustrate rivers connecting population hotspots outside of the Arctic to the Arctic Ocean. River catchments with significant human activity can act as pathways of plastic pollution into the Arctic Ocean, particularly during summer when river discharge peaks due to snow and ice melt. Evidence suggests only a fraction of land-based plastic pollution reaches the ocean through rivers, often retained in or around waterways[2].

Nevertheless, the Severnaya Dvina river plays a role in microplastic transport to the White Sea[7], and reports indicate microplastic presence in Siberia's Ob, Lena, and Tom (tributary of Ob) rivers. Their river discharge is the second largest microplastic source, behind Atlantic water input, to the Eurasian basin[8,9], one of the two main basins in the Arctic Ocean.

Discharge of Major Arctic Rivers

Mean annual discharge (km3/year)



Numbers retrieved from AMAP (1998)[5]

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