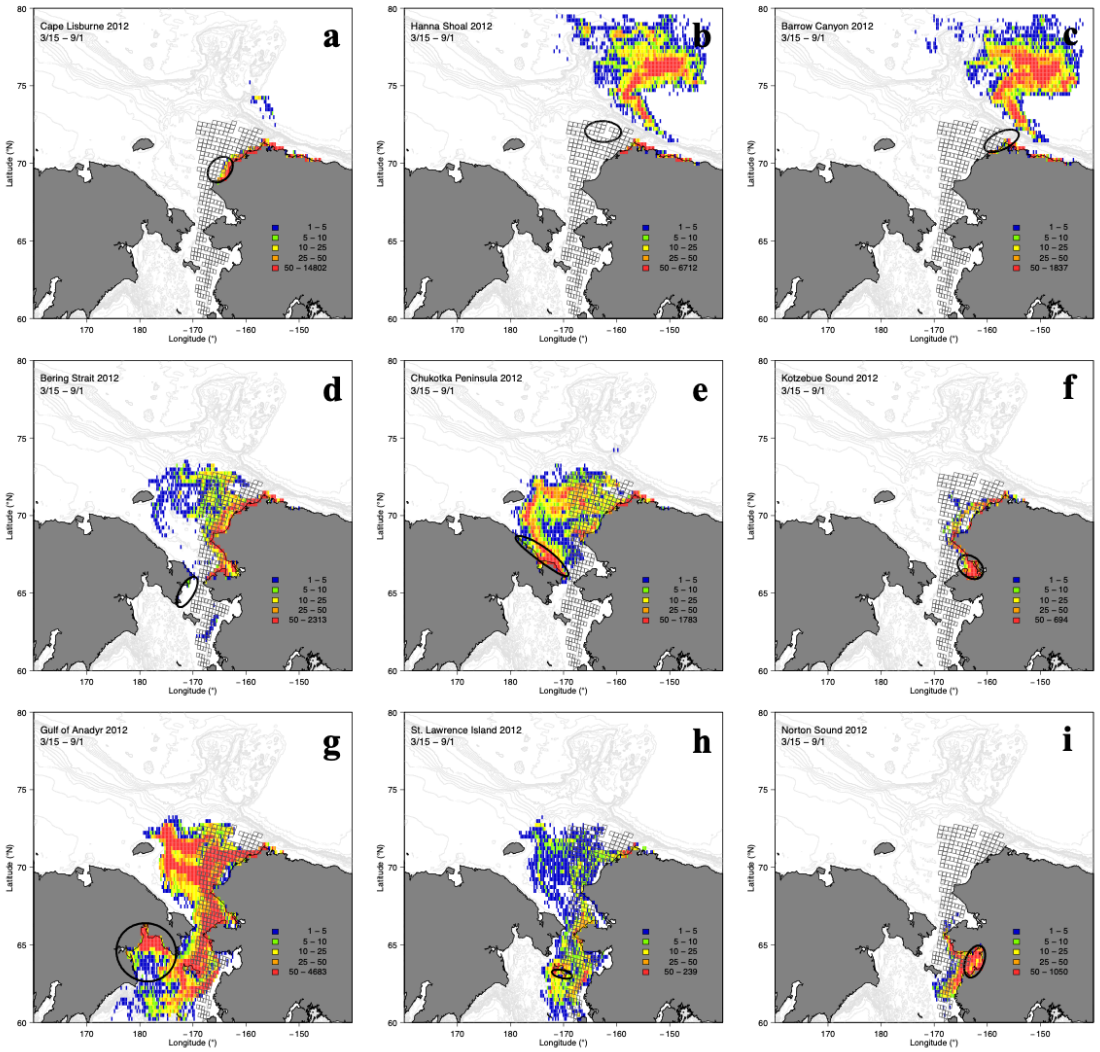
Fig. S2. Distributions of polar cod (*Boreogadus saida*) on 1 September 2012 from passive particle simulations initiated on 15 March from (a) Cape Lisburne, (b) Hanna Shoal, (c) Barrow Canyon, (d) Bering Strait, (e) Chukotka Peninsula, (f) Kotzebue Sound, (g) Gulf of Anadyr, (h) St. Lawrence Island, and (i) Norton Sound hatching areas. Cell colors represent the total number of particles in each 0.25° x 0.25° grid cell. Blue = 1 – 5, green = 5 – 10, yellow = 10 – 25, orange = 25 – 50, red > 50. Black ellipses represent hatching areas. The 30-km x 30-km grid overlaid on the Arctic Ecosystem Integrated Survey acoustic-trawl survey area for the analysis is shown.



Abstract: Polar cod (*Boreogadus saida*) and saffron cod (*Eleginus gracilis*) are the most abundant and ecologically important forage fishes in the Pacific Arctic marine ecosystem, yet little is known about their spawning locations or the habitats occupied by their early life stages (ELS). We developed a biophysical transport model coupled to a Pan-Arctic hydrodynamic ocean circulation model to identify potential spawning locations and examine connectivity between the northern Bering, Chukchi, and Beaufort seas. We simulated the growth and transport of newly hatched polar cod and saffron cod larvae until the early juvenile stage (to 45 mm in length) using circulation model hindcasts from 2004 – 2015. Analyses identified species-specific differences in dispersal trajectories, despite similar hatch times and locations. Strong interannual variability in growth and dispersal was linked to several global-scale climate indices, suggesting that larval growth and transport may be sensitive to environmental perturbations. Results show that polar cod spawned in the northern Chukchi Sea may be an important source of larvae for the Beaufort Sea and Arctic Basin, while observed larval aggregations in the Chukchi Sea likely originated in the northern Bering and southern Chukchi seas. This study provides new information about potential spawning times and locations for polar cod and saffron cod in the Pacific Arctic and helps to identify important ELS habitat. This knowledge can help improve the management of these species and, by examining how larval connectivity changes in response to changing environmental conditions, improve our ability to anticipate how these species may respond in a rapidly changing Arctic.

Vestfals, C.D., Mueter, F.J., Hedstrom, K.S., Laurel, B.J., Petrik, C.M., Duffy-Anderson, J.T., Danielson, S.L. (*submitted*). **Modeling the dispersal of polar cod (*Boreogadus saida*) and saffron cod (*Eleginus gracilis*) early life stages in the Pacific Arctic using a biophysical transport model.** Progress in Oceanography.

Gardner WD, Richardson MJ, Mishonov AV, Lam PJ, Xiang Y. (submitted) **Sources, Distribution, and Dynamics of Particulate Matter Along Trans-Arctic Sections.** JGR.

Abstract In Fall 2015, trans-Arctic surveys of hydrographic and biological parameters were made using two ships: one going from Bering Strait (USCG Healy) and the other from Barents Sea (R/V Polarstern) and meeting at the North Pole. Sections of beam attenuation due to particles were overlain by chlorophyll, temperature, salinity, nitrate and silicate contours and compared with particle composition from large-volume, size-fractionated filtered samples. Nutrient-rich Pacific water coming through Bering Strait sinks below the low-salinity, nutrient-poor Polar Mixed Layer, and forms a thick lens of high salinity water known as Halocline waters. The Mixed Layer and ice pack limit light availability for photosynthesis in surface waters of Canada Basin, but subsurface chlorophyll maxima are observed. Primary production appears much higher in Barents Sea than in Chukchi and Beaufort Seas because nutrient-rich water entering Barents Sea from the Atlantic is not isolated from surface waters by strong stratification. Atlantic water freezes, and high-density water cascades into shallow basins in Barents Sea and into Nansen Basin, eroding sediment that forms patches of nepheloid layers in the shallow basins. Currents moving swiftly through the Bering Strait erode and carry sediment-laden waters onto the Chukchi Shelf and Sea, much of it moving in and above Barrow Canyon and along the shelf edge forming intermediate nepheloid layers. Rivers along the Siberian margin also supply sediment to the Arctic basins. Nepheloid layers in the deep basins are very weak, consistent with a lack of strong currents in the deep basins.

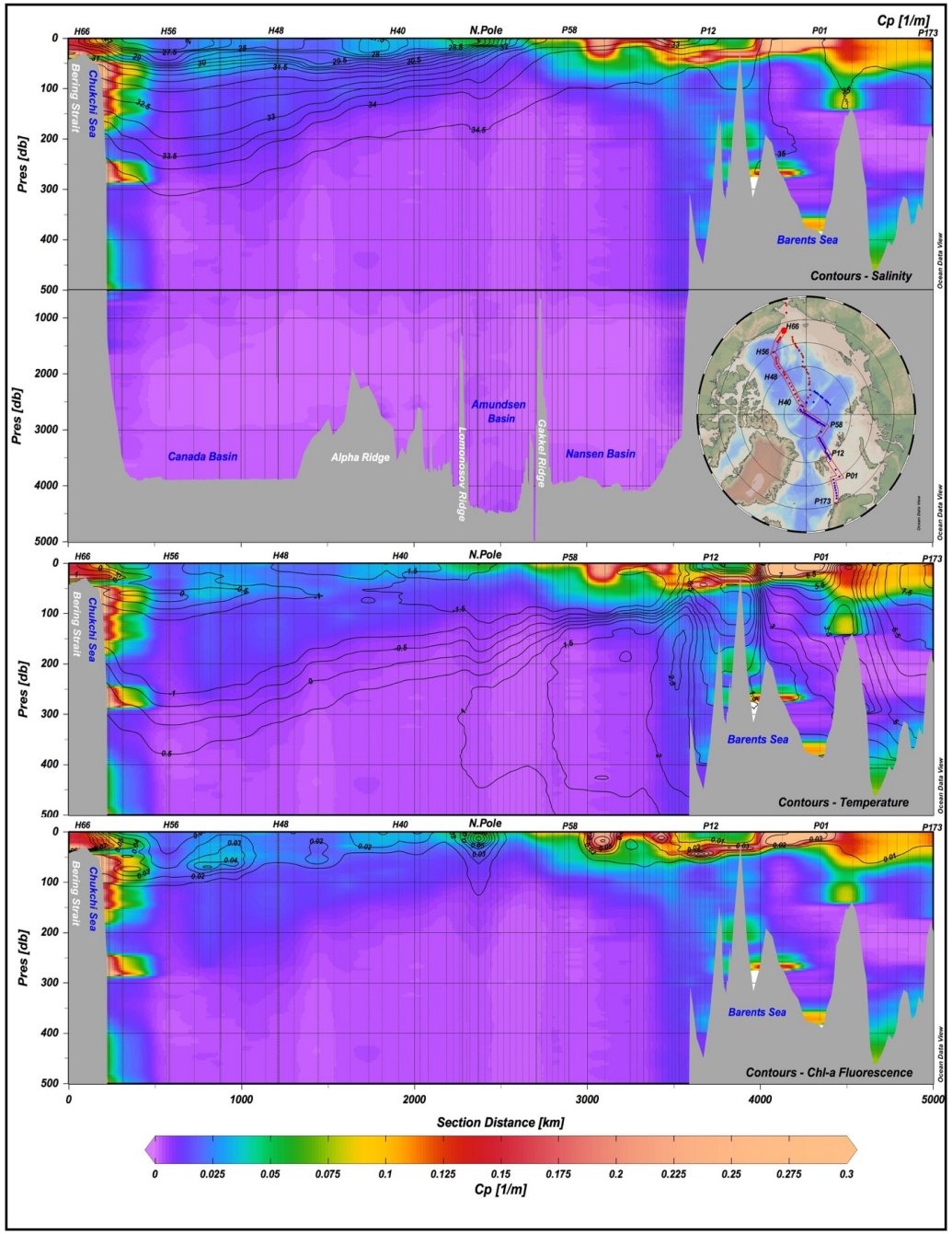


Figure 3. The trans-Arctic Bering Strait (Southbound) from Norway transect of Cp (color scale) with contours of a) Salinity, b) Temperature °C), and c) Chlorophyll-a Fluorescence. Station numbers along the transect line are at the top of sections (H for Healy, P for Polarstern). Distance (km) along track from the Bering Straits are below the bottom panel.

Jessica Fitzsimmons: NSF Chemical Oceanography (OCE-1713677), which officially finished at the end of 2019. The goal of the project was to measure the dissolved micronutrient and contaminant trace metal concentrations across the Western Arctic as part of the U.S. GEOTRACES Arctic GN01 expedition and, alongside other chemical tracers, define the processes controlling their biogeochemistry. The two month expedition took place in August-October 2015, and they have been analyzing samples, comparing to other International GEOTRACES groups (namely Canadian GN03 in the Canadian Arctic Archipelago and German/Dutch GN04 in the Eastern Arctic), and publishing our results since then.

All dissolved metal (Fe, Mn, Zn, Cu, Cd, Ni, Pb) concentrations were submitted to the GEOTRACES Standards & Intercalibration Committee for assessment and inclusion in the GEOTRACES Intermediate Data Product 2021. This will provide maps of dissolved micronutrient & contaminant trace metal sections for public use and education, as here on www.egeotraces.org.

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A comparison of marine Fe and Mn cycling: U.S. GEOTRACES GN01 Western Arctic case study

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JGR Oceans

RESEARCH ARTICLE
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Key Points:
- The Transpolar Drift is a source of shelf- and river-derived elements to the central Arctic Ocean
- The TPD is rich in dissolved organic matter (DOM), which facilitates long-range transport of trace metals that form complexes with DOM
- Margin trace element fluxes may increase with future Arctic warming due to DOM release from permafrost thaw and increasing river discharge

Supporting Information:
- Supporting Information S1
- Data Set S1

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Citation:

The Transpolar Drift as a Source of Riverine and Shelf-Derived Trace Elements to the Central Arctic Ocean

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