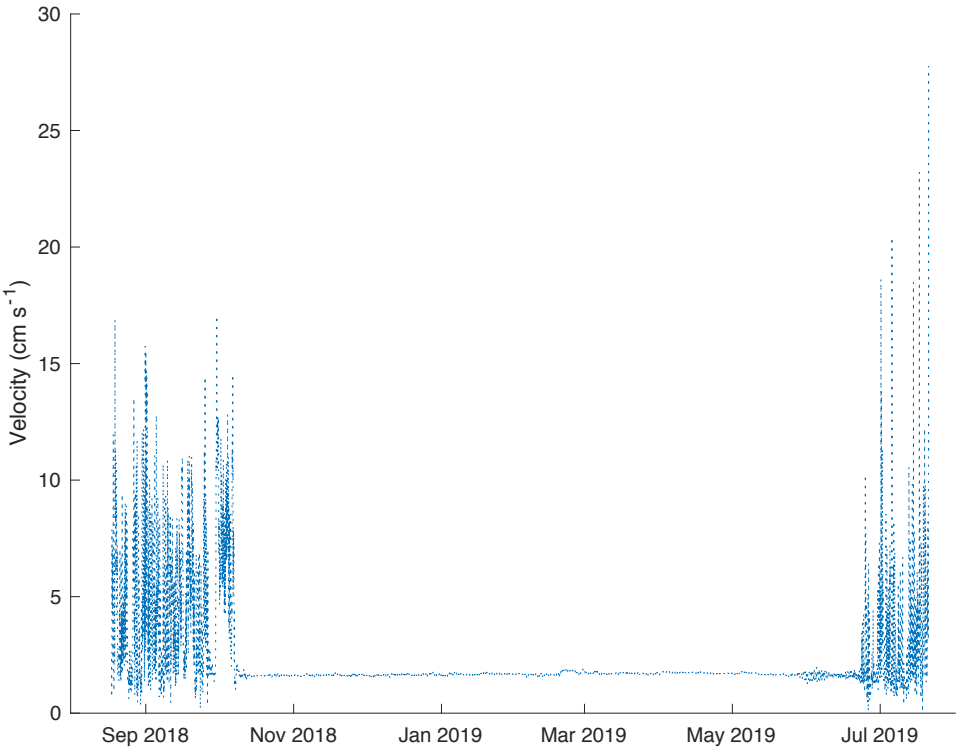
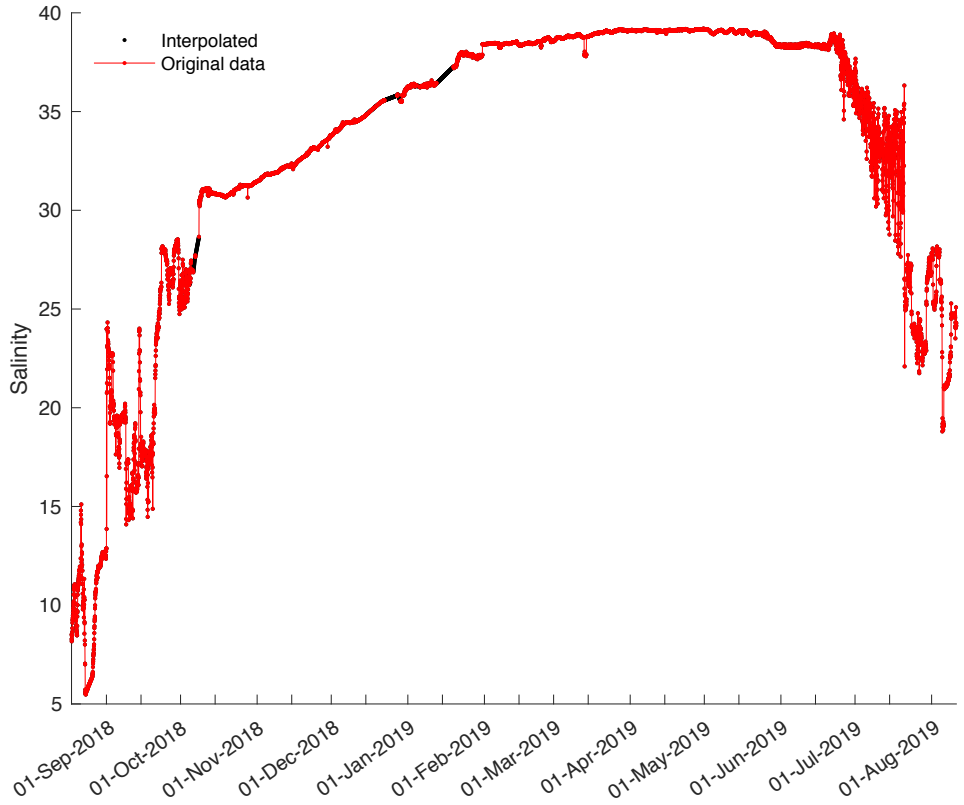
Supplementary Table 1. Discrete measurements of O_2 and pH from data Sonde (YSI), and in situ salinity (RBR). Discrete bottle samples collected for nutrients and carbonate chemistry parameters with reported A_T, pH_T, and bottle salinity. The Break Up season occurs mid- to late-June over two to three weeks when the lagoon transitions from ice cover to open water.

Season	Zone	Date (UTC)	O_2 (mg L^{-1})	pH YSI (NBS)	Salinity: RBR Concerto
Open Water 2018	Surface	4-Aug-2018 --:--	11.5	7.9	5.99
	Bottom	4-Aug-2018 --:--	12.4	7.8	36.28
		17-Aug-2018 21:00*	—	—	—
	Pore Water	7-Aug-2018 --:--	—	—	—
Ice Cover 2018 — 2019	Surface	26-Apr-2019 06:10	11.5	7.4	38.2
		26-Apr-2019 21:50*		—	—
	Bottom	26-Apr-2019 06:10	5.0	7.1	39.7
		21-Apr-2019 22:05*	—	—	—
	Pore Water	26-Apr-2019 --:--	—		—
Break Up 2019	Surface	21-Jun-2019 --:--	13.3	7.7	4.4
	Bottom	21-Jun-2019 --:--	17.5	7.7	39
	Pore Water	20-Jun-2019 --:--	—	—	—
Open Water 2019	Surface	08-Aug-2019 ~20:30	9.7	7.8	25.9
	Bottom	08-Aug-2019 ~20:30	9.7	7.9	25.9
	Pore Water	09-Aug-2019 ~18:00	—	—	—

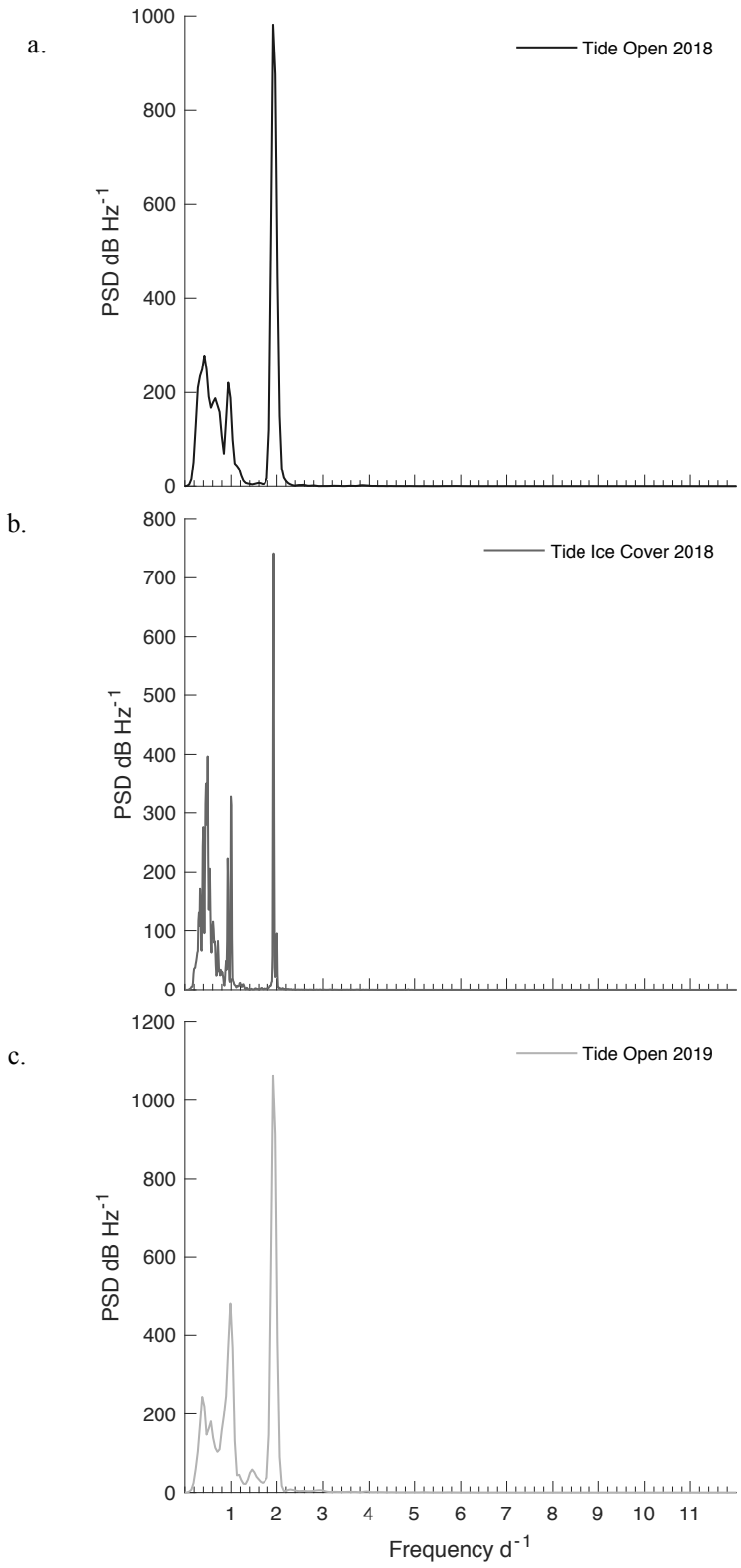
NH_4^+ (µg L^{-1})	PO_4^{3-} (µg L^{-1})	SiO_2 (µg L^{-1})	TA (µmol kg^{-1})	Salinity: bottle	pH: spec (Total scale)
0.8	—	—	—	—	—
2.1	41.8	—	—	—	—
—	—	—	Rep_1 1645.1* Rep_2 1645.2*	12.1* 12.0*	8.146* 8.005*
683.1	1409.5		—	—	—
—	—	—	—	—	—
21.5*	152.6*	729*	—	—	—
—	—	—	—	—	—
61.7*	123.1*	1307*	Rep_1 3160.6* Rep_2 3171.3*	39.1* 39.0*	7.524* 7.646*
3764.7	853.5	5343	—	—	—
3.2	21	194	—	—	—
9.0	133.3	8.0	Rep_1 3059.1 Rep_2 3073.1	32.3 32.3	—
646.1	338.7	437	—	—	—
8	9.5	187	—	—	—
10.7	14	214	—	—	—
8013	757.7	26430	—	—	—



Supplementary Figure 1. Times series of current speed in Kaktovik Lagoon for entire deployment period from 17 August 2018 to 11 August 2019.



Supplementary Figure 2. Times series of salinity in Kaktovik Lagoon for entire deployment period from 17 August 2018 to 11 August 2019. Black dots show interpolated salinity values which replaced invalid measurements.



Supplementary Figure 3. Power Spectral Density for tide during open phase 2018 (**a**), ice-covered phase 2018 – 2019 (**b**), and open phase 2019 (**c**).