Water Quality Measures in Alaska's Ports and Shipping Lanes: 2020 Annual Report

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Alaska Department of Environmental Conservation
Division of Water

By:

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Cover Photograph: Valdez "New" Small Boat Harbor

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Summary

The Alaska Department of Environmental Conservation (ADEC), Division of Water (DOW), Water Quality Standards, Assessment & Restoration (WQSAR), implemented a water quality assessment project from late June through September of 2020. The project was a continuation and expansion upon water quality monitoring that was initiated in 2015. The 2020 assessment project was conducted to evaluate water quality during the period of decreased ship traffic due to the Covid-19 pandemic. Water sampling was conducted at six or more sites within 16 ports from Nome to Ketchikan, and at 20 sampling sites distributed among major shipping lanes throughout southeast Alaska. Sites were selected to represent potential pollutant sources (e.g. small boat harbors, cruise ship berths, municipal stormwater, commercial shipping) and mid-channel sites.

Sampling was conducted using methods previously established by the ADEC DOW Commercial Passenger Vessel Environmental Compliance Program (CVECP) modified to evaluate compliance with Alaska Water Quality Standards (18 AAC 70) (DEC 2018a). At each shipping lane site and at sites within ports, water samples were collected and analyzed for fecal coliform and *Enterococci* bacteria, ammonia-N, copper (Cu), nickel (Ni), and zinc (Zn). Water temperature, pH, salinity, and dissolved oxygen were measured concurrent with water sampling at 1m, 2m, 3m, and 4m water depths. Water sampling for fecal coliform and *Enterococci* in ports was repeated on four subsequent dates in order to obtain 5 samples within a 30-day period. Concentrations of ammonia-N and metals, and geometric mean bacterial concentrations were compared to Alaska Water Quality Standard (WQS) numeric criteria (WQC) (18 AAC 70) (DEC 2018b) (see inset).

	Water Quality Criteria
Fecal Coliforms	Geometric mean of 14 cfu/100 ml and ≤10% of the samples < 31 cfu/100 ml.
Enterococci	Geometric mean of samples may not exceed 35 enterococci CFU/100 ml.
Ammonia-N	0.3 mg/L (chronic criteria pH of 8.6, temperature of 15°C, and 30 ppt salinity)
Dissolved Copper (Cu)	3.1 µg/L (chronic)
Dissolved Nickel (Ni)	8.2 µg/L (chronic)
Dissolved Zinc (Zn)	81 µg/L (chronic)

Fecal coliform bacteria were found to exceed WQC in some Southcentral and Southeast Ports, often at sites in or near small boat harbors. Water sample collection in Northwest and Western Alaska ports, Dutch Harbor and Nome, was limited to bacterial analyses due to Covid-19 travel restrictions. In Dutch Harbor geometric mean fecal coliform concentrations at all sites were below 14 cfu/100 ml (WQS for Water Use: Water Supply, Seafood Harvesting for Consumption of Raw Mollusks or other Raw Aquatic Life (18 AAC 70.020 (b)(14)(D)). Fecal coliform WQC were exceeded at one site near Nome. In Southcentral Alaska ports, fecal coliform geometric means exceeded 14 cfu/100 ml at one or more sites within the Kodiak, Valdez, Seward, and Homer ports, but not in Anchorage or Whittier. Fecal coliform bacteria were generally absent from samples collected in Southeast open water shipping lanes (90% of the sites) but were present in most Southeast ports. Concentrations exceeded WQS numeric criteria at one or more of the sites near Juneau, Hoonah, Petersburg, Ward Cove, and Ketchikan, but not in Haines, Skagway, Auke Bay, Sitka, or Wrangell.

We evaluated ammonia-N concentrations for exceedances with the lowest WQS numeric criteria for the range of observed conditions. WQS numeric criteria for ammonia-N are temperature, pH, and salinity dependent and are lower for chronic than acute exposure. The lowest numeric criteria for the range of pH and salinity observed among sampling sites is 0.3 mg/L (chronic criteria pH of 8.6, temperature of

15°C, and 30 ppt salinity) (DEC 2018b, Appendix G). Average ammonia-N concentrations were < 0.043 mg/L at all sampling ports. Concentrations in 90% of the open water Southeast Shipping Lanes sites were < method detection limits (MDL) of 0.003 mg/L.

Average total and dissolved concentrations of Cu, Ni, and Zn were < 3.27µg/L at all ports except for sampling sites in Knik Arm near Anchorage where WQS numeric criteria were exceeded at multiple sampling sites.

Introduction

The Alaska Department of Environmental Conservation, Division of Water, initiated a water sampling program to determine the ambient water quality of Alaska ports and harbors beginning in 2015. Initial sampling was conducted at multiple sites during the spring and fall, prior to and following the cruise ship season, in Skagway and Juneau. Sampling in these ports continued through 2017, with a single sampling event during the cruise ship season in the Skagway Harbor (ARRI 2018). The program was expanded in 2018 to include sites in Sitka, Hoonah, and Ketchikan (ARRI 2019) and in 2019, Ketchikan and Seward (ARRI 2020).

The sampling program was expanded in 2020 in response to the cancellation of cruise ship voyages to Alaska due to the Covid-19 pandemic. Summer samples in the absence of cruise ships provided an opportunity to evaluate potential local pollution sources (e.g. stormwater runoff, point-source discharges, and small boat and small commercial activities).

Sampling in 2020 was expanded from six to 16 ports throughout Alaska with sampling occurring at six or more sites within each port. Bacterial sampling (fecal coliforms and *Enterococci*) was conducted at all sampling sites and the frequency increased to five sampling dates within a 30-day period to ensure compliance with DEC bacteria assessment criteria. Sampling also was expanded to include 20 sites located within major waterways or shipping lanes throughout Southeast Alaska.

Methods

The water sampling plan, sample collection, handling, and analyses was conducted following the approved Quality Assurance and Project Plan (ARRI 2020).

Sampling Locations and Dates

Water sampling was conducted from late June through July at 16 harbors (Table 1). Within each harbor. Water samples were also collected in September at 20 sampling sites distributed throughout open waters of Southeast Alaska (Table 2).

Sample Collection

Water samples were collected from ~1 meter depth. Harbor water was pumped through Teflon tubing into laboratory-provided sample bottles (ALS Environmental) using a peristaltic pump (Solonist 410). Tubing and bottles were flushed for approximately three minutes prior to sample collection at each sampling location. Water samples were collected in sample bottles provided by the analytical laboratory. All sample bottles contained acid preservative and were contained within two layers of plastic bags. Water samples for dissolved metals were field filtered using a 0.45 µm filter.

Table 1. Port sampling locations, number of sites within each port and dates waters samples were collected for biological, ammonia-N, and metals (copper, nickel, and zinc) analyses. Water temperature, pH, salinity, and dissolved oxygen were measured concurrent with sampling for metals and ammonia.

Port Name	Number of Site	Biological Sampling Dates					Ammonia Sampling Date	Metals Sampling Date
Anchorage	6	7/6/2020	7/9/2020	7/13/2020	7/14/2020	7/28/2020	7/27/2020	7/27/2020
Dutch Harbor (Unalaska)	6	9/26/2020	9/28/2020	10/2/2020	10/3/2020	10/9/2020	Not Sampled	Not Sampled
Haines	6	7/1/2020	7/7/2020	7/9/2020	7/14/2020	7/16/2020	6/27/2020	6/27/2020
Homer	6	7/23/2020	7/28/2020	7/30/2020	8/5/2020	8/14/2020	7/23/2020	7/23/2020
Hoonah	8	7/7/2020	7/20/2020	7/23/2020	7/27/2020	7/30/2020	7/7/2020	7/7/2020
Juneau	11	7/8/2020	7/13/2020	7/15/2020	7/20/2020	7/23/2020	7/2/2020	7/2/2020
Auke Bay	2	7/8/2020	7/13/2020	7/15/2020	7/20/2020	7/23/2020	7/2/2020	7/2/2020
Ketchikan	12	7/9/2020	7/13/2020	7/16/2020	7/20/2020	7/23/2020	7/9/2020	7/9/2020
Ward Cove	6	7/9/2020	7/13/2020	7/16/2020	7/20/2020	7/23/2020	7/9/2020	7/9/2020
Kodiak	6	8/6/2020	8/11/2020	8/13/2020	8/17/2020	8/25/2020	8/6/2020	8/6/2020
Nome	6	8/26/2020	8/27/2020	8/28/2020	8/31/2020	9/1/2020	Not Sampled	Not Sampled
Petersburg	6	7/9/2020	7/12/2020	7/21/2020	7/22/2020	7/27/2020	7/9/2020	7/9/2020
Seward	6	7/9/2020	7/14/2020	7/15/2020	7/20/2020	7/22/2020	7/20/2020	7/20/2020
Sitka	10	7/6/2020	7/9/2020	7/13/2020	7/23/2020	8/4/2020	7/6/2020	7/6/2020
Skagway	7	6/29/2020	7/1/2020	7/9/2020	7/14/2020	7/16/2020	6/29/2020	6/29/2020
Valdez	6	7/31/2020	8/4/2020	8/18/2020	8/20/2020	8/24/2020	7/31/2020	7/31/2020
Whittier	6	6/12/2020	6/18/2020	6/19/2020	7/1/2020	7/8/2020	7/19/2020	7/19/2020
Wrangell	6	7/9/2020	7/12/2020	7/21/2020	7/22/2020	7/27/2020	7/9/2020	7/9/2020
Total Port Samples	122							

Table 2. Dates water samples were collected and water quality parameters measured in shipping lanes of Southeast Alaska major waterbodies.

Waterbody Name	Number of Locations	Bacteria Sampling Date	Ammonia Sampling Date	Metals Sampling Date
Lynn Canal	2	9/17/2020	9/17/2020	9/17/2020
Chatham Strait	2	9/17,18/2020	9/17,18/2020	9/17,18/2020
Icy Strait	2	9/17/2020	9/17/2020	9/17/2020
Stephens Passage	3	9/18,20/2020	9/18,20/2020	9/18,20/2020
Fredrick Sound	3	9/18/2020	9/18/2020	9/18/2020
Sumner Strait	3	9/19/2020	9/19/2020	9/19/2020
Clarence Strait	3	9/19,24/2020	9/19,24/2020	9/19,24/2020
Stikine Strait	1	9/19/2020	9/19/2020	9/19/2020
Nichols Passage	1	9/24/2020	9/24/2020	9/24/2020
Total Locations	20			

Water temperature, pH, salinity, and dissolved oxygen were measured at 1, 2, 3, and 4 meter depths at each sampling location. Water pH and salinity was measured with a YSI 1030 meter and dissolved oxygen and temperature with a YSI Pro ODO meter and probe. The pH meter was checked for accuracy using a 7.01 pH standard prior to field data collection. If inaccurate, the meter was recalibrated using pH 7.01 and pH 10.01 standards. The dissolved oxygen meter was calibrated using the 100% air saturation method prior to field collection in each port.

Analytical Methods

Water samples were analyzed by ALS Environmental by EPA method 200.8 following reductive precipitation reaction to obtain concentration of dissolved and total Cu, Ni, and Zn. Ammonia-N was analyzed using EPA method 350.1. Laboratory MDLs were: ammonia-N 0.003 mg/L, total and dissolved Cu 0.02 µg/L, total and dissolved Ni 0.03 µg/L, and total and dissolved Zn 0.20 µg/L.

Water samples were analyzed for total fecal coliforms and *Enterococci* by Admiralty Environmental (Juneau), ARS Aleut Analytical, LLC (Anchorage), and R&M Engineering (Ketchikan) using EPA method 9222D and *Enterococci* by the most probable number method. MDL for fecal coliform bacteria was 1 cfu/100 ml and for *Enterococci* 1 MPN/100 ml (ARS Aleut) or 2 cfu/100ml and 10 MPN/100 ml (Admiralty Environmental and R&M Engineering).

Quality Assurance

Field quality assurance measures included trip blanks, equipment blanks, and field replicates. Trip blanks were laboratory provided metals-free sealed sample bottles. Trip blanks travelled with the sample bottles and field samples and remained sealed until analyzed for total Cu, Ni, and Zn. Equipment blanks are samples of laboratory provided deionized water collected in the field using the same methods as field sample collection. Equipment blanks were collected prior to initiating field sampling. Equipment blanks were analyzed for ammonia-N and total and dissolved metals. Replicate water samples were collected at one sampling sites in most ports.

Quality assurance sample results are provided in Appendix A.

Results

Anchorage-Cook Inlet

The locations of water sampling sites in Cook Inlet (Knik Arm adjacent to the municipality of Anchorage) are shown in Figure 1. ANC01 was near the mouth of Ship Creek and ANC02 and ANC03 were adjacent to the commercial dock. Sites ANC04 through ANC06 were located in the middle of Knik Arm.

Water temperatures in late July, 2020, were near 15°C and did not change with water depth to 4 m (Table 3). Salinity was low averaging 8.2 ppt among sites at 1 m water depth. Water salinity was slightly lower at 1m water depth near the mouth of Ship Creek and lower at mid-inlet sites further up Knik Arm. Water pH was near 8 and dissolved oxygen concentrations averaged 9.26 mg/L.

Concentrations of fecal coliform bacteria and *Enterococci* did not exceed WQC with the highest geometric mean values of 9.3 cfu/100 ml and 6.8 MPN/100 ml, respectively, at ANC01 near the mouth of Ship Creek. A single sample did exceed 31 cfu/100 ml at this site (see Appendix B). Fecal coliform concentrations exceeding WQC have been reported for Lower Ship Creek (Davis and Davis 2011).

Ammonia-N concentrations were above MDL of 0.003 at 4 of the 6 sampling sites. Cu, Ni, and Zn concentrations were higher than all of the other 2020 sampling locations (Table 4). Dissolved Cu concentrations exceed chronic and acute WQC (3.1 µg/L and 4.8 µg/L, respectively) at all sampling sites except ANC06. The WQC for dissolved Ni (8.2 µg/L) was exceeded at two of the sampling sites ANC02 and ANC03.

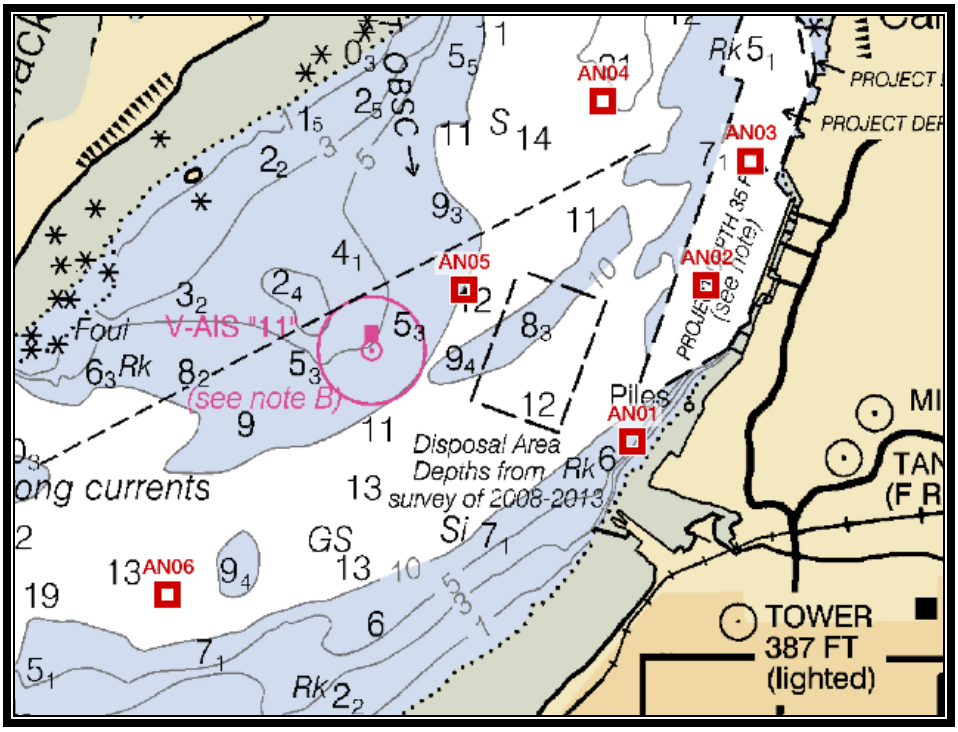

Figure 1. Locations of sampling sites in Knik Arm near the Port of Anchorage.

Table 3. Water temperatures (C), salinity (ppt), pH, and dissolved oxygen (D.O. mg/L) from 1 to 4m water depths at Port of Anchorage sampling sites on July 27, 2020.

Temperature (C)	**1m**	**2m**	**3m**	**4m**	**Salinity (ppt)**	**1m**	**2m**	**3m**	**4m**
ANC01	15.1	15.2	15.4	15.4	ANC01	7.4	8.3	8.9	9.0
ANC02	15.2	15.3	15.3	15.4	ANC02	7.9	8.2	8.3	8.5
ANC03	15.3	15.2	15.2	15.1	ANC03	7.5	7.6	7.6	7.6
ANC04	15.2	15.2	15.2	15.2	ANC04	7.8	7.8	7.8	7.9
ANC05	15.6	15.6	15.5	15.4	ANC05	9.3	9.4	9.4	9.4
ANC06	16.0	15.7	15.6	15.5	ANC06	9.0	9.2	9.4	9.5
Average	15.4	15.4	15.4	15.3	Average	8.2	8.4	8.6	8.7
pH					**D.O.**				
	1m	**2m**	**3m**	**4m**	**(mg/L)**	**1m**	**2m**	**3m**	**4m**
ANC01	8.06	8.04	8.04	8.05	ANC01	9.25	9.21	9.20	9.19
ANC02	8.14	8.12	8.10	8.10	ANC02	9.19	9.24	9.23	9.22
ANC03	8.21	8.16	7.96	8.07	ANC03	9.27	9.26	9.26	9.24
ANC04	8.51	8.34	8.19	8.17	ANC04	9.27	9.25	9.24	9.22
ANC05	8.04	8.04	8.04	8.03	ANC05	9.28	9.26	9.25	9.26
ANC06	8.05	8.04	8.05	8.06	ANC06	9.28	9.28	9.26	9.27
Average	8.17	8.12	8.06	8.08	Average	9.26	9.25	9.24	9.23

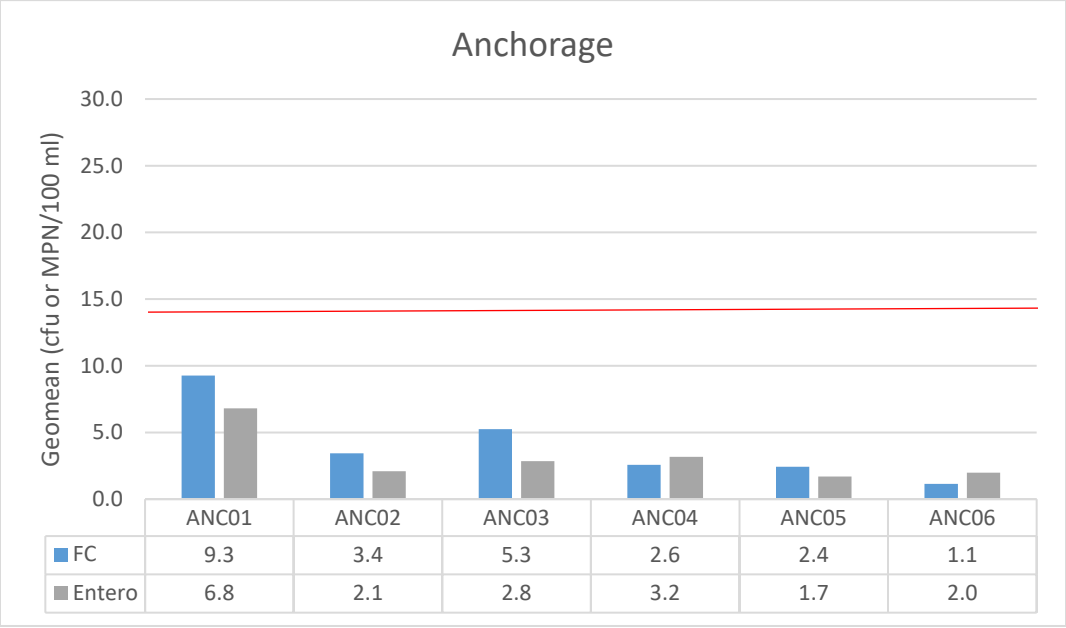

Figure 2. Geometric mean concentrations of fecal coliform (red line is WQC) and *Enterococci* bacteria at the 6 sampling sites near Anchorage.

Table 4. Concentrations of ammonia-N and metals at the 6 Anchorage sampling sites. T is total and D is dissolved. Bolded values exceeded WQC for dissolved Cu (3.1 µg/L) and Ni (8.2 µg/L).

Site	Ammonia-N (mg/L)	T-Cu (µg/L)	D-Cu (µg/L)	T-Ni (µg/L)	D-Ni (µg/L)	T-Zn (µg/L)	D-Zn (µg/L)
ANC01	0.010	8.72	**6.75**	5.98	4.64	13.10	9.88
ANC02	0.010	17.70	**13.40**	11.40	**8.59**	26.90	19.80
ANC03	0.002	18.70	**12.90**	11.80	**8.67**	28.90	19.60
ANC04	0.020	19.60	**8.93**	12.20	6.21	29.50	13.50
ANC05	0.010	16.30	**8.32**	10.70	5.91	25.40	13.00
ANC06	0.002	10.50	1.43	7.29	1.46	16.40	1.59
Average	0.009	15.25	8.62	9.90	5.91	23.37	12.90

Kodiak

The location of sampling sites near Kodiak are shown in Figure 3. KO01 was located within the Inner small boat harbor, KO02 was near the cruise ship berths, and KO03 was in Dog Bay small boat harbor. KO04 was near the end of East Marine Way, KO05 was in Mills Bay and KO06 was off shore.

Water temperature averaged 12.4 C, salinity 31 ppt, pH 8.15 and dissolved oxygen 10.33 mg/L (Table 5). Water quality parameters did not vary with depth or among sampling locations.

Concentrations of fecal coliform bacteria and *Enterococci* exceeded WQC with the highest geometric mean values of 17.4 cfu/100 ml at KO02 and 15.5 cfu/100 ml at KO04 and the lowest geometric mean value was 3.6 cfu/100 ml at KO03 in Dog Bay Harbor (Figure 4).

Ammonia-N concentrations averaged 0.023 mg/L among Kodiak sampling sites with the highest values at KO01, the Inner Harbor, and KO04, near East Marine Way (Table 6). Concentration of metals were well below chronic and acute WQ numeric criteria with the highest concentrations at KO03, in Dog Bay Harbor.

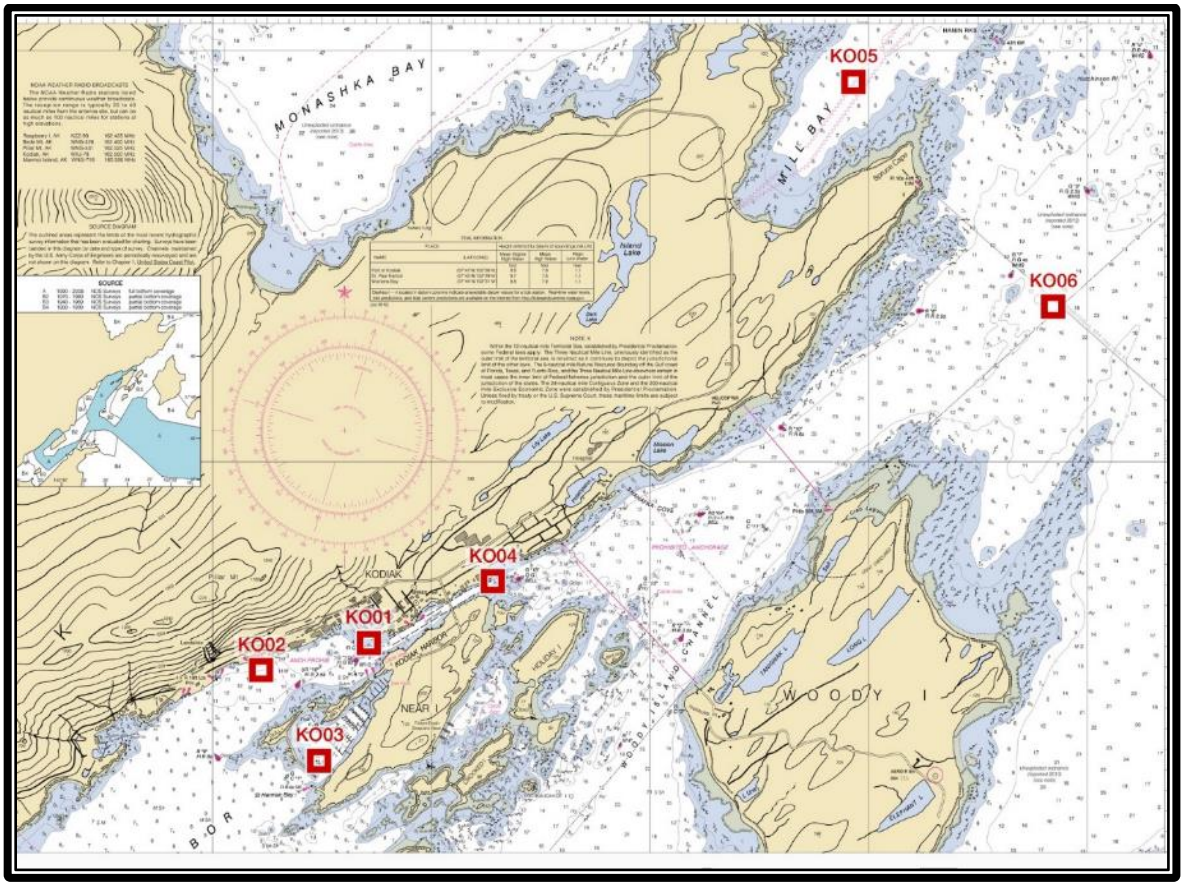

Figure 3. Location of 2020 sampling sites near Kodiak.

Table 5. Water temperatures (C), salinity (ppt), pH, and dissolved oxygen (D.O. mg/L) from 1 to 4m water depths at Kodiak sampling sites on August 5, 2020.

Temp (C)	1m	2m	3m	4m
KDK01	11.80	11.70	11.60	11.60
KDK02	13.60	13.20	12.50	12.30
KDK03	12.80	12.50	12.70	12.30
KDK04	12.00	11.90	11.90	11.90
KDK05	13.30	13.00	12.60	12.20
KDK06	11.00	10.90	10.90	10.90
Average	12.42	12.20	12.03	11.87

Salinity (ppt)	1m	2m	3m	4m
KDK01	31.60	31.70	31.70	31.80
KDK02	31.20	31.50	31.80	31.80
KDK03	31.80	31.70	31.80	31.80
KDK04	31.80	31.80	31.80	31.80
KDK05	31.60	31.60	31.70	31.70
KDK06	31.90	31.80	31.90	31.90
Average	31.65	31.68	31.78	31.80

pH	1m	2m	3m	4m
KDK01	8.07	8.04	8.03	8.03
KDK02	8.16	8.17	8.18	8.18
KDK03	8.16	8.15	8.16	8.14
KDK04	8.12	8.14	8.13	8.14
KDK05	8.20	8.20	8.27	8.28
KDK06	8.21	8.21	8.21	8.21
Average	8.15	8.15	8.16	8.16

D.O. (mg/L)	1m	2m	3m	4m
KDK01	9.82	9.80	9.82	9.84
KDK02	10.51	10.53	10.56	10.53
KDK03	10.66	10.56	10.64	10.43
KDK04	10.02	10.03	9.98	9.98
KDK05	10.45	10.66	10.93	11.25
KDK06	10.49	10.59	10.60	10.59
Average	10.33	10.36	10.42	10.44

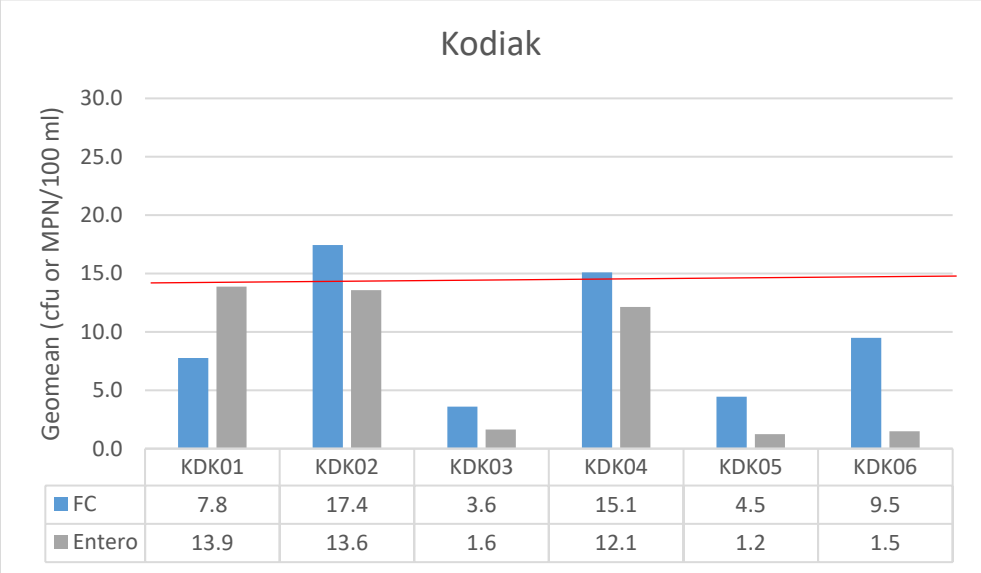

Figure 4. Geometric mean concentrations of fecal coliform (red line is WQC) and *Enterococci* bacteria at the six sampling sites near Kodiak.

Table 6. Concentrations of ammonia-N and metals at the six Kodiak sampling sites.

Site	Ammonia-N (mg/L)	T-Cu (µg/L)	D-Cu (µg/L)	T-Ni (µg/L)	D-Ni (µg/L)	T-Zn (µg/L)	D-Zn (µg/L)
KDK01	0.057	0.60	0.44	0.39	0.34	1.66	1.85
KDK02	0.011	0.58	0.49	0.40	0.36	0.64	0.45
KDK03	0.008	1.10	0.87	0.35	0.36	9.25	6.11
KDK04	0.046	0.55	0.37	0.36	0.34	1.69	2.02
KDK05	0.002	0.40	0.32	0.36	0.32	1.53	1.54
KDK06	0.016	0.25	0.24	0.32	0.33	0.26	0.23
Average	0.023	0.58	0.46	0.36	0.34	2.51	2.03

Dutch Harbor

Dutch Harbor sampling sites are shown in Figure 5. Sampling sites DH02 through DH04 were located adjacent to port facilities, DH05 was near the Unalaska APL dock, and DH06 within Iliuiuk Harbor.

Due to Covid-19 travel restrictions, water quality parameters were not measured in Dutch Harbor and water samples were not collected for ammonia-N and metals analyses.

Fecal coliform and *Enterococci* bacteria concentrations did not exceed WQC (Figure 6). Geometric mean concentrations of fecal coliform bacteria ranged from 2.8 cfu/100 ml at the outside sampling site (DH01) to 9.4 cfu/100 ml at DH03 and DH05 (Figure 6). *Enterococci* concentrations were highest in the Iliuiuk Harbor at 14.7 MPN/100 ml.

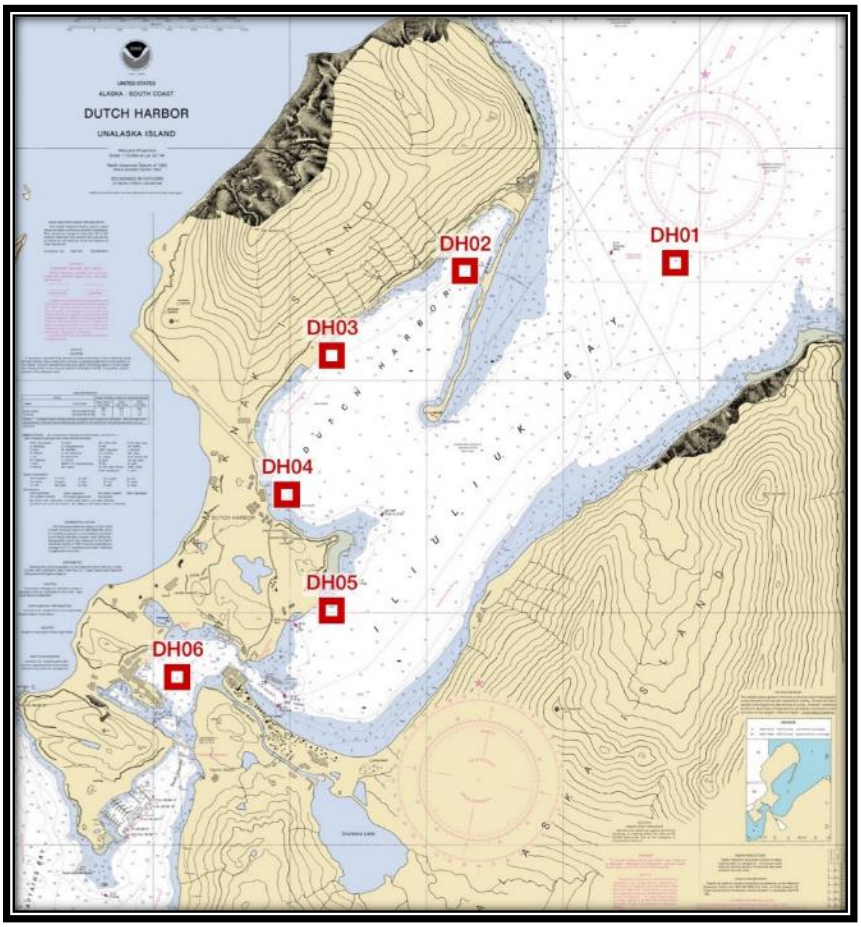

Figure 5. Locations of Dutch Harbor sampling sites.

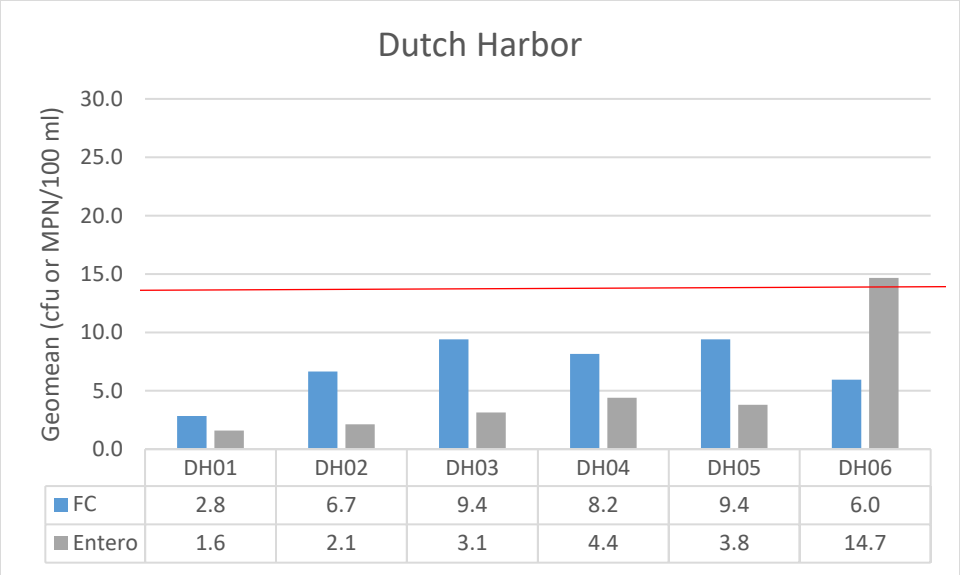

Figure 6. Dutch Harbor geometric mean concentrations of fecal coliform bacteria (red line marks WQC of 14 cfu/100 ml) and *Enterococci*.

Nome-Norton Sound

Sampling sites near Nome were located at the Cruise Ship Berth (NO01), Inner Harbor (N0)2, near the beach camps (NO03, off of Front Street (NO04), Fort Davis (NO05) and offshore (NO06) (Figure 7).

Due to Covid-19 travel restrictions, water quality parameters were not measured in Norton Sound near Nome and water samples were not collected for ammonia-N and metals analyses.

Fecal coliform and *Enterococci* bacteria concentrations exceeded WQC at one sampling site (Figure 8). Bacteria concentrations were low at all sites except for the Inner Harbor where fecal coliforms exceeded 16 cfu/100 ml with a single high value of 69 cfu/100ml. A single high value of 114 cfu/100 ml was also recorded at NO03.

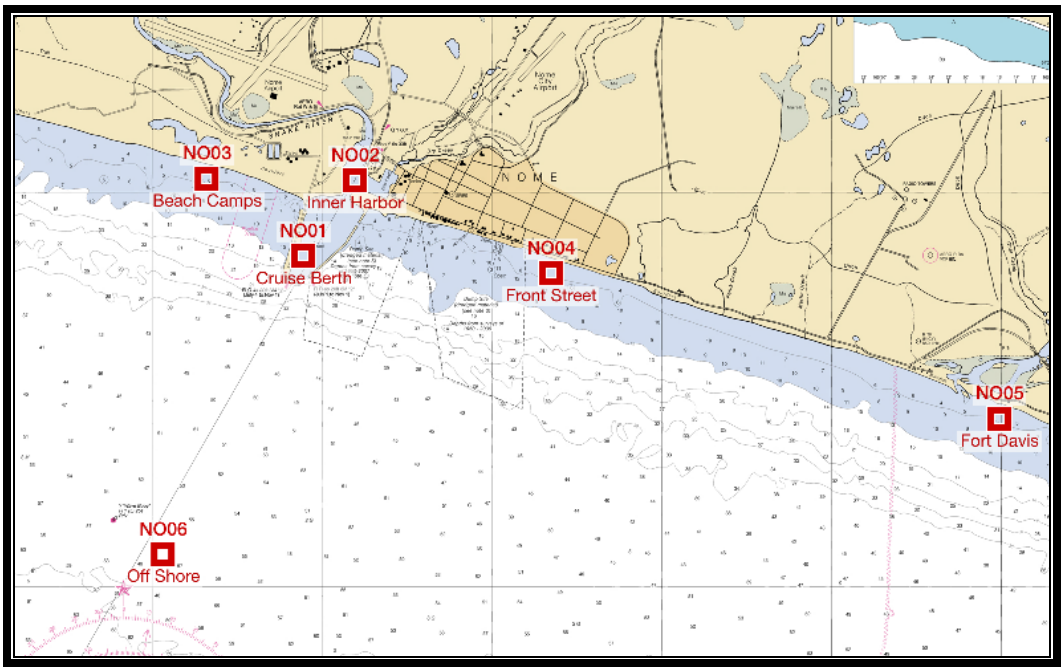

Figure 7. Locations of sampling sites in Norton Sound near the city of Nome.

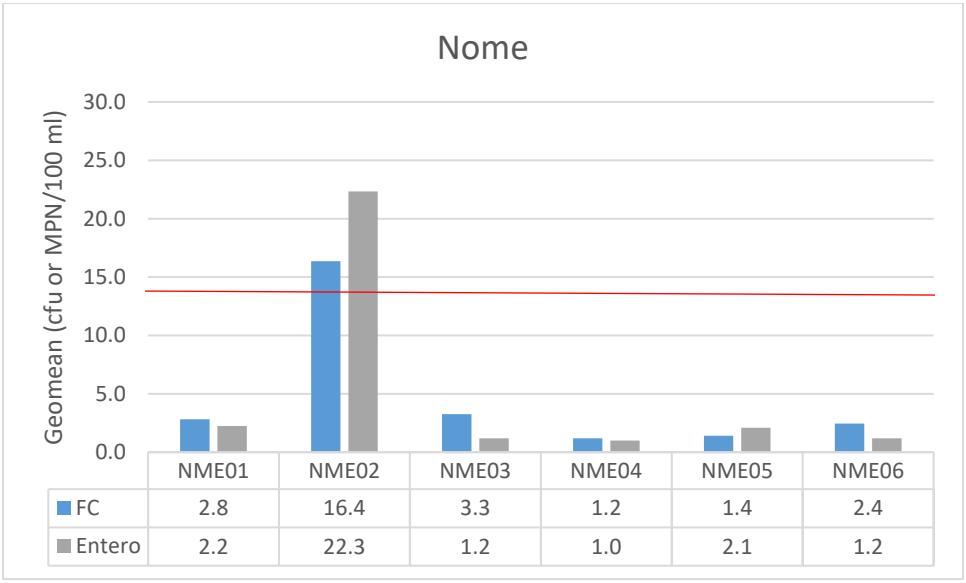

Figure 8. Geometric mean concentrations of fecal coliform (red line marks WQC of 14 cfu/100 ml) and *Enterococci* bacteria at the six sampling locations near Nome. Red line is WQ numeric criteria for fecal coliform bacteria.

Valdez Harbor-Valdez Arm

Sampling site in Valdez Arm near the City of Valdez were located nearshore west of town (VA01), adjacent to the cruise ship and Alaska Marine Highway berth (VA03), between the berth and the small boat harbor breakwater (VA02), within the old small boat harbor (VA04), just outside of the new small boat harbor (VA05), and in the middle of Valdez Arm (VA06) (Figure 9).

Average water temperature was 11 C, surface salinity 3.3 ppt, pH 8.2, and dissolve oxygen 10.98 mg/L (Table 7). Water quality parameters did varied slightly among sites. For example, pH ranged from 8.20 at VA02 to 8.40 at VA06. Average salinity, at 1m water depth, ranged from 2.3 to 5.5 ppt. Water temperature, salinity, and pH all increased with water depth while dissolved oxygen tended to decrease. Average salinity was 3.3 ppt at 1m and 20.4 at 4m water depth. Water temperatures were colder in the top 1 m (average 11.0°C) than at 4m (14.1°C).

Fecal coliform bacteria concentrations exceeded WQ numeric criteria at four sampling sites (VA02, VA03, VA04, and VA05) (Figure 10). Fecal coliform bacteria were the highest at VA04, in the small boat harbor, at geometric mean concentrations of 48.9 cfu/100 ml (WQS = 14 cfu/100 ml). Fecal coliform concentrations at VA02 and VA04 also exceeded 31 cfu/100 ml on three of the five sampling dates, at VA03 on two, and at VA05 on one of the five sampling dates. Geometric mean concentrations of *Enterococci* ranged from 2.2 MPN/100 ml at VA06 in the middle of Valdez Arm, to 21.3 MPN/100 ml at VA04.

Ammonia-N concentrations were below MDLs at all sampling sites except for VA03 and VA04 (Table 8). Concentrations at these two sites, while above MDLs, were still low at < 0.03 mg/L. Average concentrations of total Cu, Ni, and Zn were < 2.0 µg/L and dissolved metals were < 1 µg/L. Total and dissolved concentrations of Cu and Zn were greatest at VA04.

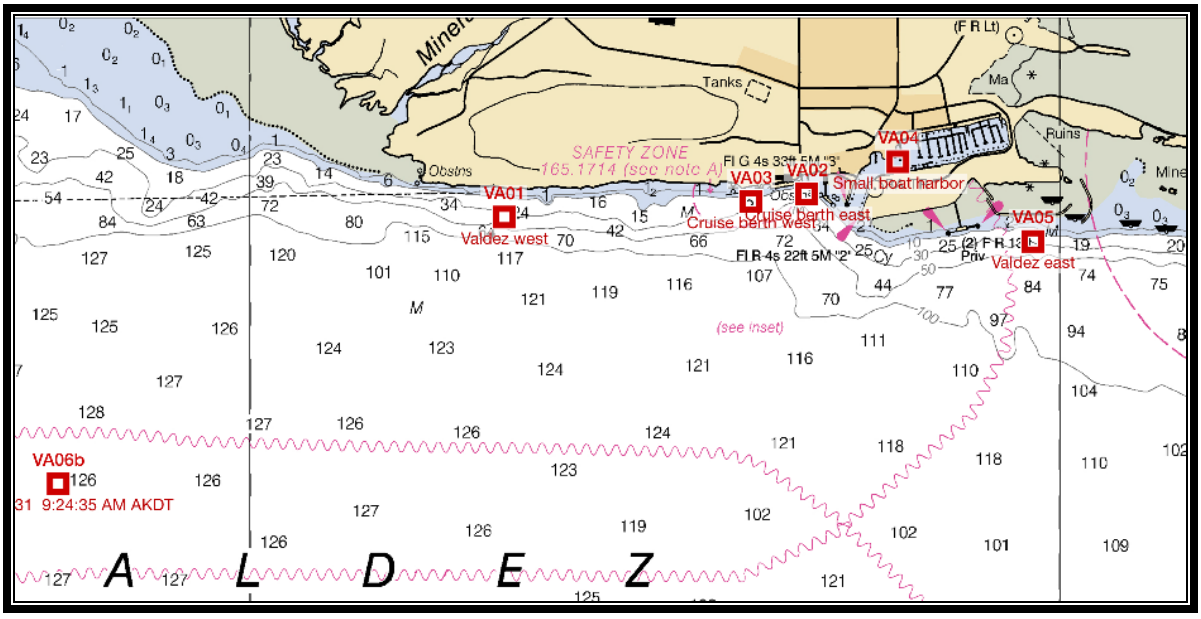

Figure 9. Location of sampling sites in Valdez Arm near the city of Valdez.

Table 7. Water temperatures (C), salinity (ppt), pH, and dissolved oxygen (D.O. mg/L) from 1 to 4m water depths at Valdez sampling sites on July 31, 2020.

Temp (C)	1m	2m	3m	4m
VA01	10.60	13.10	13.60	14.00
VA02	10.06	12.20	13.80	14.40
VA03	11.00	12.50	13.60	14.00
VA04	11.10	11.80	12.60	13.50
VA05	11.40	13.10	14.00	14.50
VA06	11.90	12.60	14.00	14.40
Ave	11.01	12.55	13.60	14.13

Salinity (ppt)	1m	2m	3m	4m
VA01	2.50	7.10	12.50	17.60
VA02	2.30	6.70	18.90	23.00
VA03	2.60	7.00	15.40	21.90
VA04	3.00	4.30	11.10	19.90
VA05	4.10	12.00	18.90	24.10
VA06	5.50	8.30	13.80	16.00
Ave	3.33	7.57	15.10	20.42

pH	1m	2m	3m	4m
VA01	8.15	8.40	8.42	8.50
VA02	8.10	8.04	8.44	8.47
VA03	8.14	8.16	8.35	8.44
VA04	7.90	7.79	7.89	8.15
VA05	8.29	8.23	8.47	8.45
VA06	8.42	8.42	8.52	8.44
Ave	8.17	8.17	8.35	8.41

D.O. (mg/L)	1m	2m	3m	4m
VA01	11.11	10.92	10.88	10.86
VA02	10.96	10.99	10.64	10.57
VA03	11.03	11.08	10.92	10.82
VA04	10.82	10.84	10.68	10.35
VA05	10.81	10.95	10.78	10.61
VA06	11.15	10.98	10.75	10.68
Ave	10.98	10.96	10.78	10.65

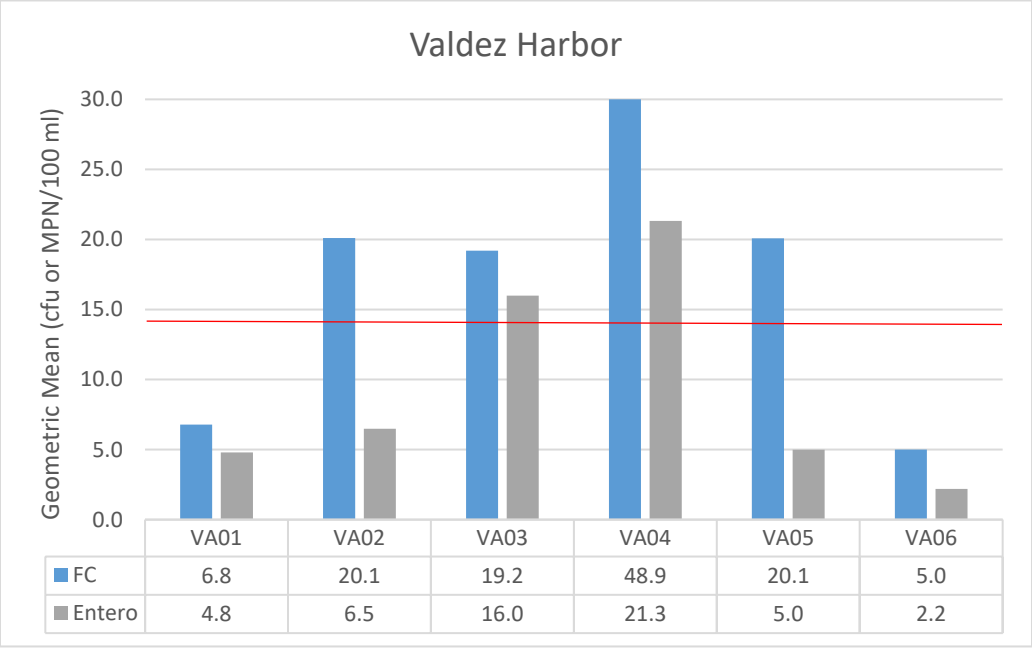

Figure 10. Geometric mean concentrations of fecal coliform (red line marks WQ numeric criteria of 14 cfu/100 ml) and *Enterococci* bacteria at the 6 sampling sites near Valdez.

Table 8. Concentrations of ammonia and metals at the Valdez sampling sites. Values of 0.5 x MDL are shown were results are < MDL and are used to calculate location averages. T is total and D is dissolved.

Site	Ammonia-N (mg/L)	T-Cu (µg/L)	D-Cu (µg/L)	T-Ni (µg/L)	D-Ni (µg/L)	T-Zn (µg/L)	D-Zn (µg/L)
VA01	0.002	0.73	0.31	0.95	0.62	0.83	0.10
VA02	0.002	1.60	0.21	1.66	0.68	2.32	0.32
VA03	0.020	1.14	0.27	1.35	0.64	1.60	0.33
VA04	0.026	1.64	0.44	1.40	0.65	4.81	3.15
VA05	0.002	1.73	0.22	1.78	0.69	2.56	0.58
VA06	0.002	0.73	0.33	0.99	0.59	0.97	0.23
Average	0.009	1.26	0.30	1.36	0.65	2.18	0.79

Whittier-Passage Canal

Sampling sites in Passage Canal were distributed from the head of Passage Canal (WH01), at the entrances to both small boat harbors (WH02 and WH04), at the cruise ship berth (WH03) near the AMHS dock (WH05) and in the middle of the canal near Decision Point (WH06) (Figure 11).

Waters of Passage Canal near Whittier has lower surface water salinity and slightly higher surface water temperatures (Table 9). Salinity in the top 1 meter ranged from 16.5 to 20.6 ppt (WH01 through WH05) but increased to a consistent 22 to 23 ppt at 4m depth. Average water temperature at 4m water depth was 0.4°C colder than at 1m depth. Average pH was 8.35 with little variability among sites or with water depth. Dissolved oxygen was slightly lower in the small boat harbor (WH04) compared to the other sampling sites.

Geometric mean fecal coliform and *Enterococci* concentrations were low at all sampling sites (Figure 12). Geometric mean fecal coliforms ranged from 4.3 to 8.5 cfu/100 ml. and the maximum recorded value among all sites and dates was 36 cfu/100ml.

Ammonia-N concentrations were < MDLs at all sampling sites except WH04, in the small boat harbor. Concentrations of Cu and Zn were also highest at the WH04 site. Average metals concentrations of total Cu and Ni were < 1.0 µg/L and concentrations of Zn < 3.0 µg/L (Table 10).

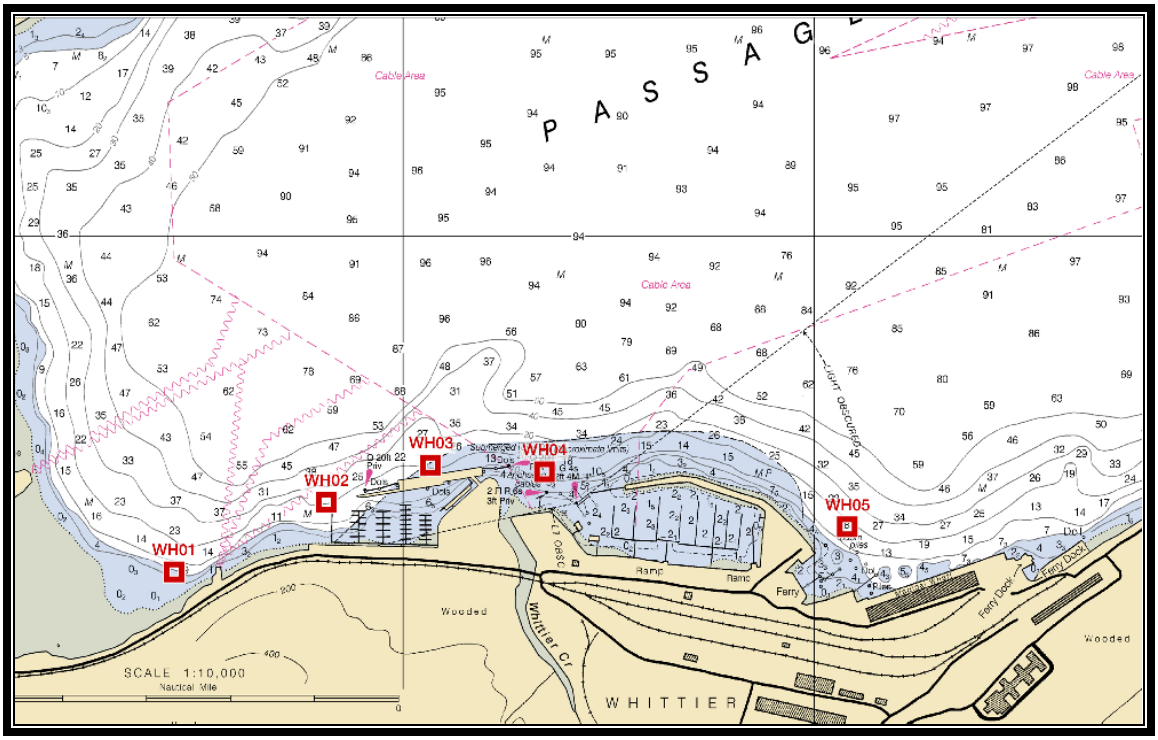

Figure 11. Location of five of the six sampling sites near Whittier. WH06 is located in mid Passage Canal at Decision Point.

Table 9. Water temperatures (C), salinity (ppt), pH, and dissolved oxygen (D.O. mg/L) from 1 to 4m water depths at Whittier sampling sites on July 19, 2020.

Temp (C)	1m	2m	3m	4m
WH01	15.60	15.60	14.70	14.90
WH02	15.30	15.30	15.40	15.00
WH03	15.40	15.30	15.20	14.80
WH04	15.50	15.10	14.90	14.70
WH05	15.20	15.40	15.10	15.00
WH06	15.00	15.00	15.00	15.00
Average	15.33	15.28	15.05	14.90

Salinity (ppt)	1m	2m	3m	4m
WH01	20.60	21.50	21.90	22.60
WH02	16.50	20.90	21.80	22.00
WH03	19.60	21.30	21.80	22.60
WH04	20.40	21.30	22.30	22.60
WH05	16.80	21.20	21.90	22.50
WH06	22.20	22.30	22.20	22.30
Average	19.35	21.42	21.98	22.43

pH	1m	2m	3m	4m
WH01	8.35	8.35	8.36	8.36
WH02	8.36	8.35	8.30	8.42
WH03	8.32	8.32	8.28	8.39
WH04	8.30	8.29	8.32	8.29
WH05	8.38	8.33	8.38	8.40
WH06	8.40	8.40	8.36	8.41
Average	8.35	8.34	8.33	8.38

D.O. (mg/L)	1m	2m	3m	4m
WH01	10.03	9.95	10.02	10.03
WH02	10.09	10.19	9.96	10.14
WH03	10.01	9.99	9.97	10.03
WH04	9.88	9.98	9.93	9.98
WH05	10.14	9.99	10.05	10.08
WH06	10.08	10.10	10.09	10.08
Average	10.04	10.03	10.00	10.06

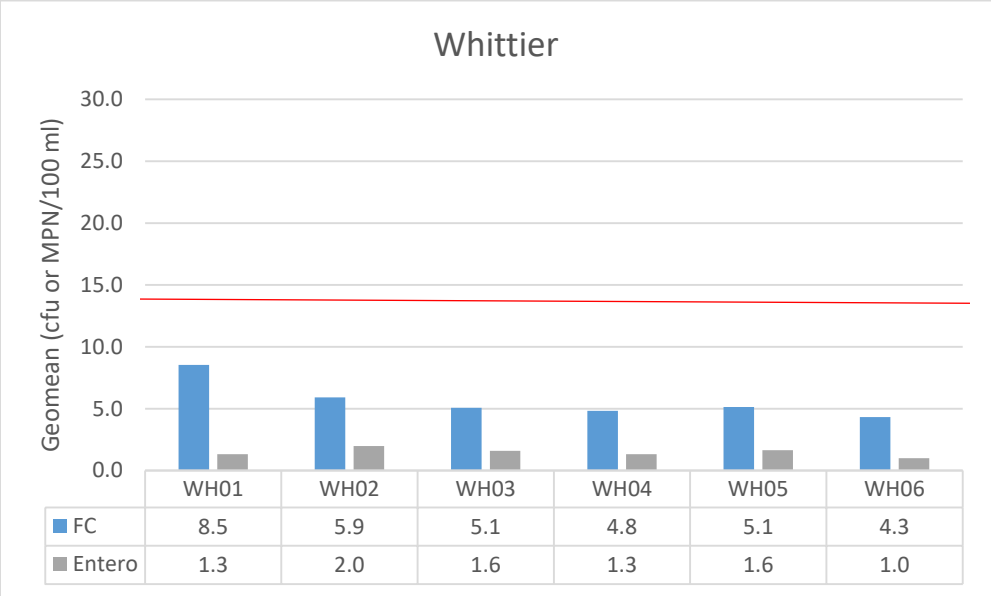

Figure 12. Geometric mean concentrations of fecal coliform and *Enterococci* bacteria at the 6 sampling sites near Whittier. Red line is WQ numeric criteria for fecal coliforms 14 cfu/100 ml.

Table 10. Concentrations of ammonia and metals at the Whittier sampling sites. Values of 0.5 x MDL are shown were results are < MDL and are used to calculate location averages. T is total and D is dissolved.

Site	Ammonia-N (mg/L)	T-Cu (µg/L)	D-Cu (µg/L)	T-Ni (µg/L)	D-Ni (µg/L)	T-Zn (µg/L)	D-Zn (µg/L)
WH01	0.002	0.59	0.50	0.63	0.53	0.94	1.42
WH02	0.002	0.81	0.56	0.68	0.46	3.12	1.20
WH03	0.002	0.73	0.44	0.73	0.46	1.57	0.62
WH04	0.023	1.48	0.92	0.57	0.50	7.04	3.57
WH05	0.002	0.69	0.40	0.79	0.47	1.39	0.42
WH06	0.002	0.45	0.57	0.53	0.63	0.40	2.27
Average	0.005	0.79	0.57	0.66	0.51	2.41	1.58

Seward-Resurrection Bay

Sampling sites in Resurrection Bay near Seward were selected to be representative of the nearshore zone east of the harbor (SE01), the off-shore open water (SE06), commercial docks (SE02 and SE03), the small boat harbor (SE04) and potential urban runoff (SE05) (Figure 13).

Water quality characteristics were similar among sites and with water depth (Table 11). Average water temperatures was 13.3°C with slightly warmer water within the small boat harbor and cooler at SE01 at 4m water depth. Average salinity was 28.6 ppt at 1m water depth and slightly at SE01 at 4m depth.

Geometric mean concentrations of fecal coliform bacteria exceeded 14 cfu/100 ml at sites SE01, SE02 and SE03 and at each of these sites exceeded 31 cfu/100 ml on one or more sampling dates (Figure 14). Geometric mean concentrations of *Enterococci* were highest at SE02 (5.3 MPN/100 ml). The highest single value for all sampling sites and dates was 24 MPN/100 ml, also at site SE03.

Ammonia-N was present at concentrations above MDLs at all sampling sites with the lowest concentrations at site SE01 and SE06. Average concentrations of total and dissolved Cu and Ni were ≤ 2.0 µg/L, and average concentrations of Zn ≤ 3.0 µg/L. Total and dissolved metals were much higher than average concentrations at SE01; however, dissolved concentrations did not exceed acute or chronic WQC (Table 12).

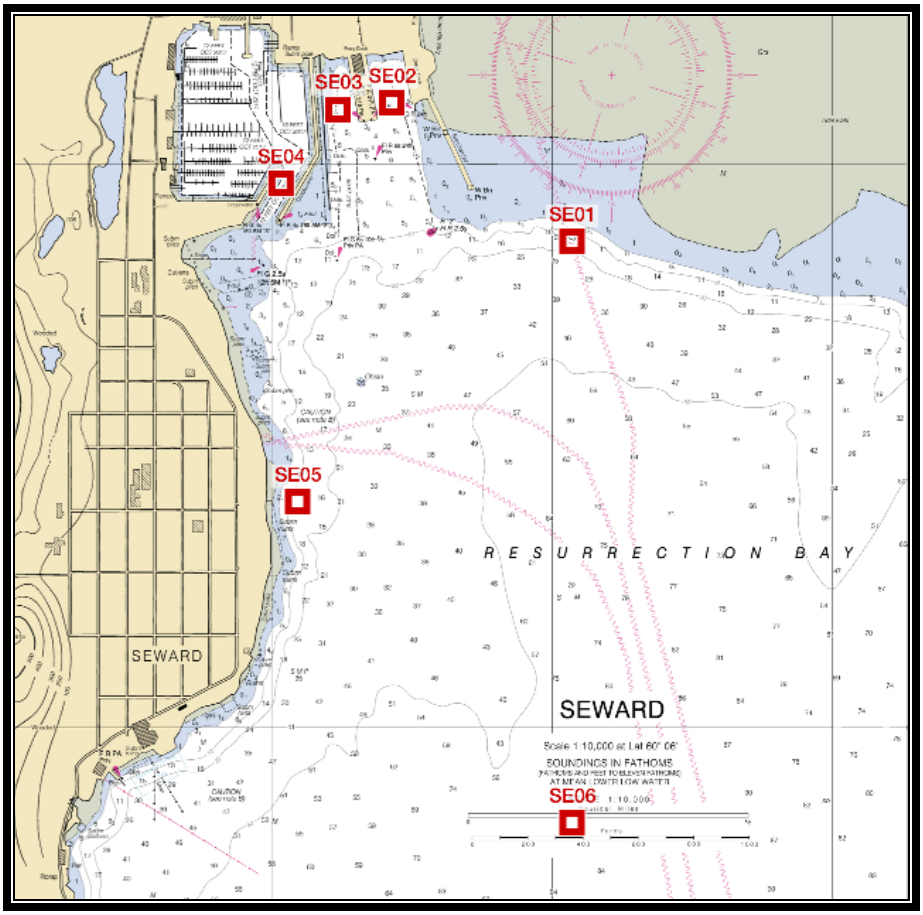

Figure 13. Location of sampling sites near Seward.

Table 11. Water temperatures (C), salinity (ppt), pH, and dissolved oxygen (D.O. mg/L) from 1 to 4m water depths at Seward sampling sites on July 20, 2020.

Temp (C)	**1m**	**2m**	**3m**	**4m**
SE01	13.2	13.2	13.2	12.7
SE02	13.1	13.1	13.0	12.9
SE03	12.9	12.9	12.9	13.1
SE04	14.0	13.7	13.2	14.4
SE05	13.5	13.5	13.8	13.7
SE06	13.0	13.0	13.1	13.0
Ave	13.3	13.2	13.2	13.3

Salinity (ppt)	**1m**	**2m**	**3m**	**4m**
SE01	29.90	29.90	29.90	25.60
SE02	29.80	29.90	30.00	29.70
SE03	30.00	30.10	30.10	29.90
SE04	28.40	29.30	29.80	25.20
SE05	26.90	27.10	27.80	26.60
SE06	26.80	27.20	27.60	26.80
Ave	28.63	28.92	29.20	27.30

pH	**1m**	**2m**	**3m**	**4m**
SE01	8.21	8.24	8.22	8.23
SE02	8.18	8.21	8.19	8.18
SE03	8.20	8.20	8.21	8.20
SE04	8.40	8.15	8.16	8.10
SE05	8.18	8.19	8.18	8.18
SE06	8.21	8.22	8.22	8.20
Ave	8.23	8.20	8.20	8.18

D.O. (mg/L)	**1m**	**2m**	**3m**	**4m**
SE01	11.68	11.67	11.68	11.66
SE02	11.15	11.26	11.31	11.04
SE03	11.18	11.32	11.37	11.16
SE04	10.33	10.74	10.98	10.07
SE05	10.44	10.59	10.69	10.34
SE06	10.98	11.08	11.15	10.40
Ave	10.96	11.11	11.20	10.78

Figure 14. Geometric mean concentrations of fecal coliform and *Enterococci* bacteria at the 6 sampling sites near Seward. Red line is the WQC for fecal coliform bacteria (14 cfu/100 ml).

Table 12. Concentrations of ammonia and metals at the Seward sampling sites. Values of 0.5 x MDL are shown were results are < MDL and are used to calculate location averages. T is total and D is dissolved.

Site	Ammonia-N (mg/L)	T-Cu (µg/L)	D-Cu (µg/L)	T-Ni (µg/L)	D-Ni (µg/L)	T-Zn (µg/L)	D-Zn (µg/L)
SE01	0.006	8.21	1.90	6.68	1.90	10.80	3.10
SE02	0.020	0.50	0.37	0.60	0.46	0.97	0.65
SE03	0.019	0.43	0.37	0.48	0.44	0.62	0.45
SE04	0.019	1.24	1.10	0.69	0.49	3.05	3.14
SE05	0.014	0.89	0.54	0.94	0.61	1.65	0.90
SE06	0.009	1.10	0.55	1.19	0.62	1.69	0.75
Average	0.015	2.06	0.81	1.76	0.75	3.13	1.50

Homer Harbor-Kachemak Bay

Sampling sites in Kachemak Bay near the Homer Spit were located slightly off-shore north (HR01) and south (HR06) of the Homer Spit, within the small boat harbor (HR02), north of the harbor breakwater (HR03), at the AMHS dock (HR04), and at the larger cruise ship berth (HR05) (Figure 15).

There were only small differences in water quality parameters among sites or with water depth. Among the sampling sites conditions within the small boat harbor were slightly different than conditions outside the boat harbor (Table 13). Average water temperature among sites was 12.8°C, but approximately 1°C cooler at HR02, within the small boat harbor. Salinity within the small boat harbor (28.3 ppt average) was higher than the average among sites (24.0 ppt). The pH within the small boat harbor (8.17) was slightly lower than the average value (8.26) and concentration of dissolved oxygen (10.7 mg/L) slightly higher (10.3 mg/L).

Fecal coliform bacteria were more abundant within the small boat harbor than other sampling sites (Figure 16). Geometric mean concentrations of fecal coliforms within the small boat harbor exceeded WQC numeric values and two of the five samples (40%) were > 31 cfu/100ml. Geometric means at the remaining sites were < 10 cfu/100 ml. The geometric mean concentrations of *Enterococci* were < 5 MPN/100 ml at all sites except for HR02, where the mean was 5.5 MPN/100 ml.

Ammonia-N concentrations were < MDLs (0.003 mg/L) at all sites and concentrations of total and dissolved Cu, Ni, and Zn ≤ 1.0 µg/L. Among the sites, Cu and Zn concentrations were highest within the small boat harbor.

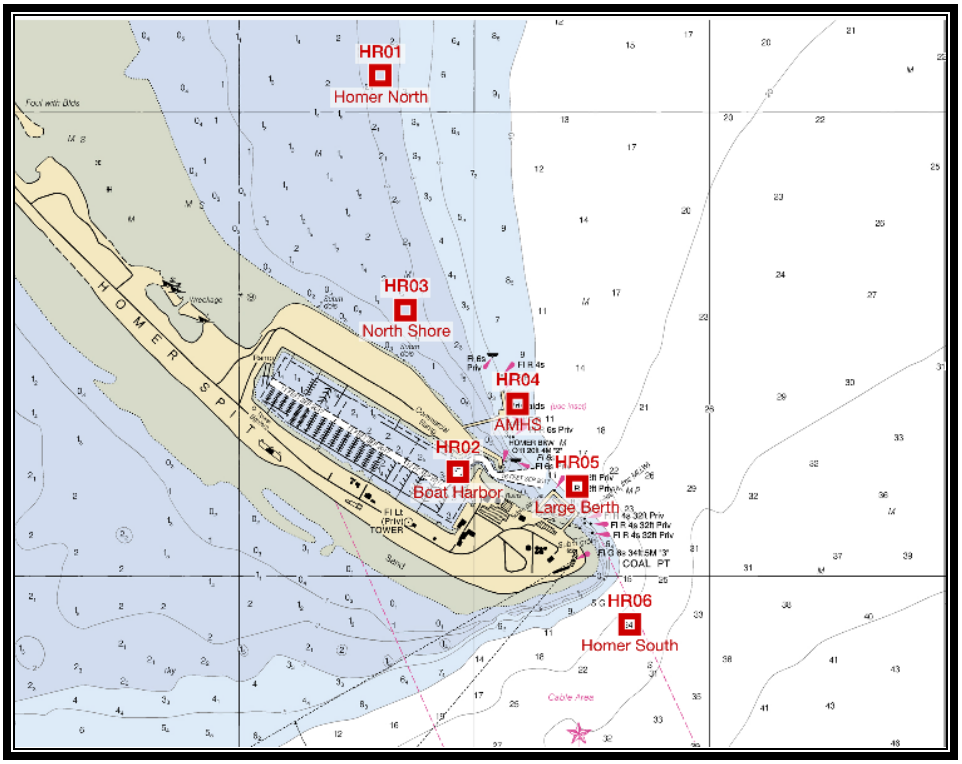

Figure 15. Location of the six sampling sites in Kachemak Bay near the Homer small boat harbor and cruise ship berth.

Table 13. Water temperatures (C), salinity (ppt), pH, and dissolved oxygen (D.O. mg/L) from 1 to 4m water depths at Homer sampling sites on July 23, 2020.

Temp (C)	1m	2m	3m	4m
HR01	12.80	12.70	12.50	13.10
HR02	11.90	11.80	11.00	12.00
HR03	13.00	12.90	12.80	13.10
HR04	13.00	13.00	12.90	13.40
HR05	13.10	13.10	13.00	13.30
HR06	13.00	12.10	11.70	13.40
Average	12.80	12.60	12.32	13.05

Salinity (ppt)	1m	2m	3m	4m
HR01	22.50	23.70	24.60	21.90
HR02	27.70	28.20	29.60	27.60
HR03	22.70	23.10	23.50	22.30
HR04	22.80	22.90	22.90	22.20
HR05	22.70	22.80	22.80	22.50
HR06	23.20	25.60	26.90	22.40
Average	23.60	24.38	25.05	23.15

pH	1m	2m	3m	4m
HR01	8.56	8.49	8.45	8.23
HR02	8.17	8.16	8.13	8.17
HR03	8.18	8.19	8.19	8.18
HR04	8.17	8.17	8.17	8.17
HR05	8.25	8.23	8.21	8.29
HR06	8.21	8.17	8.15	8.22
Average	8.26	8.24	8.22	8.21

D.O. (mg/L)	1m	2m	3m	4m
HR01	10.13	10.18	10.30	10.07
HR02	10.73	10.80	10.80	10.66
HR03	10.22	10.28	0.23	10.18
HR04	10.22	10.27	10.27	10.17
HR05	10.13	10.19	10.23	10.04
HR06	10.25	10.38	10.57	10.25
Average	10.28	10.35	8.73	10.23

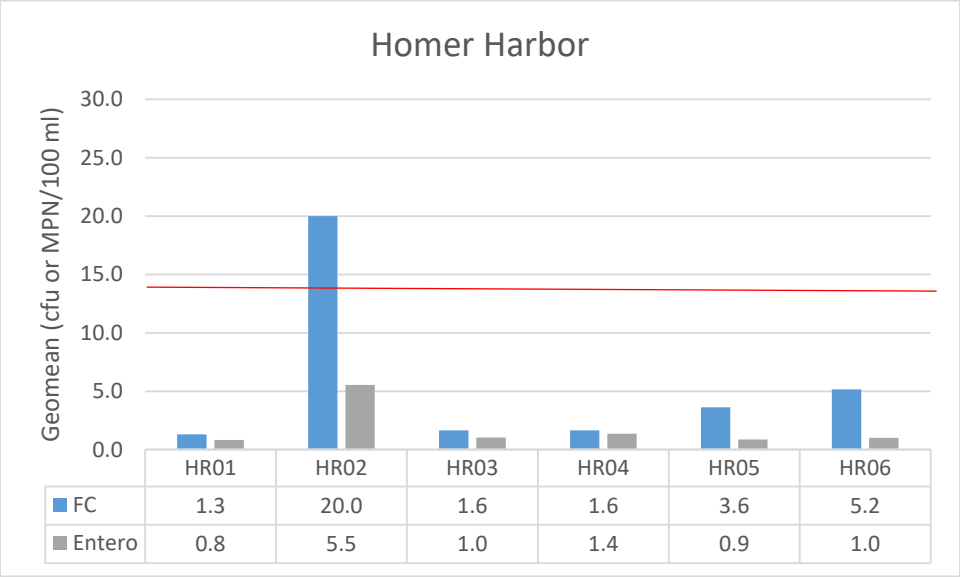

Figure 16. Geometric mean concentrations of fecal coliform and *Enterococci* bacteria at the six sampling sites near Homer. Red line is WQ numeric criteria for fecal coliforms 14 cfu/100 ml.

Table 14. Concentrations of ammonia and metals at the Homer sampling sites. Values of 0.5 x MDL are shown were results are < MDL and are used to calculate location averages. T is total and D is dissolved.

Site	Ammonia-N (mg/L)	T-Cu (µg/L)	D-Cu (µg/L)	T-Ni (ug/L)	D-Ni (µg/L)	T=Zn (µg/L)	D-Zn (µg/L)
HR01	0.0015	0.75	0.46	0.77	0.47	0.83	0.10
HR02	0.0015	0.99	0.77	0.48	0.42	3.16	2.66
HR03	0.0015	0.78	0.46	0.70	0.47	0.77	0.32
HR04	0.0015	0.75	0.46	0.67	0.45	0.71	0.22
HR05	0.0015	0.67	0.46	0.64	0.45	0.68	0.40
HR06	0.0015	0.61	0.47	0.59	0.43	0.57	0.10
Average	0.0015	0.76	0.51	0.64	0.45	1.12	0.63

Haines-Chilkoot Inlet

Sampling sites in Chilkoot Inlet were located near-shore north (HA06) and south (HA01) of Haines, slightly off-shore (HA03), within (HA04) and directly north (HA05) of the small boat harbor and adjacent to the cruise ship berth (HA02) (Figure 17).

There were only minor differences in water quality parameters among Chilkoot Inlet sampling sites. Average water temperature among sites on June 27, was 12.02°C at 1m water depth and decreased to 11.6°C at 4m (Table 15). Salinity was low in Chilkoot Inlet at an average among sites of 7.32 ppt at 1m water depth increasing to 9.93 ppt at 4m. Average pH (8.37) and average dissolved oxygen (10.90 mg/L) increased slightly with water depth.

Fecal coliform and Entercocci bacteria were present at low concentrations (Figure18). Fecal coliforms were present above MDL of 1 cfu/100 ml in 14 of the 30 samples collected. Geometric means ranged from 1.1 to 2.0 cfu/100 ml and the maximum single value was 5 cfu/100 ml. Geometric mean concentrations of *Enterococci* were 5 MPN/100 ml, which is 0.5 times the MDL of 10 MPN/100 ml.

Ammonia-N concentrations were below MDLs at three of the six sampling sites, with the greatest concentrations at HA04 and HA05 (within and north of the small boat harbor) (Table 16). Average concentrations of total and dissolved Cu, Ni, and Zn were < 1.0 µg/L.

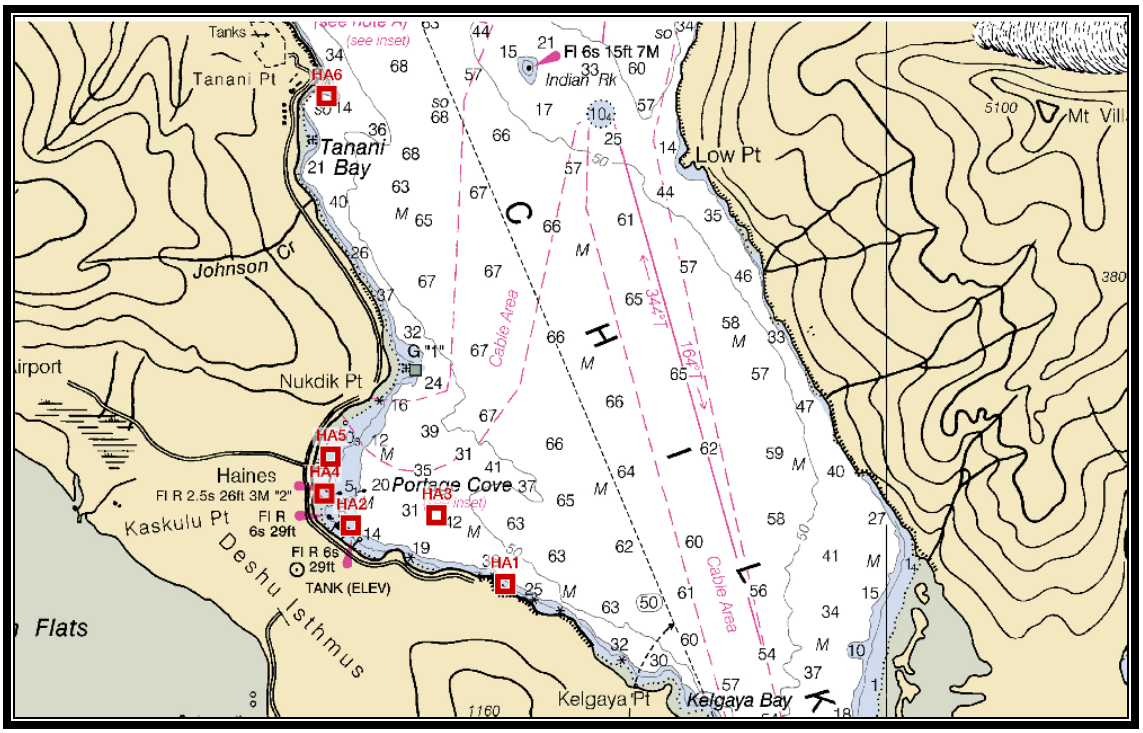

Figure 17. Location of the six sampling sites near Haines.

Table 15. Water temperatures (C), salinity (ppt), pH, and dissolved oxygen (D.O. mg/L) from 1 to 4m water depths at Haines sampling sites on June 27, 2020.

Temp (C)	1 m	2 m	3 m	4 m
HA01	12.00	11.70	11.50	11.40
HA02	12.00	11.70	11.50	11.60
HA03	12.00	11.90	11.70	11.80
HA04	12.40	11.90	11.60	11.50
HA05	11.80	11.80	11.70	11.60
HA06	11.90	11.90	11.90	11.90
Average	12.02	11.82	11.65	11.63

Salinity (ppt)	1 m	2 m	3 m	4 m
HA01	7.40	8.10	9.70	9.70
HA02	6.90	7.40	8.30	9.10
HA03	7.30	7.50	8.44	10.50
HA04	7.10	7.70	8.50	9.60
HA05	7.50	7.70	8.30	9.80
HA06	7.70	8.90	9.40	10.90
Average	7.32	7.88	8.77	9.93

pH	1 m	2 m	3 m	4 m
HA01	8.33	8.43	8.40	8.39
HA02	8.38	8.39	8.38	8.40
HA03	8.44	8.44	8.44	8.51
HA04	8.27	8.29	8.32	8.52
HA05	8.38	8.41	8.35	8.36
HA06	8.43	8.41	8.44	8.43
Average	8.37	8.40	8.39	8.44

D.O. (mg/L)	1 m	2 m	3 m	4 m
HA01	10.65	10.96	10.92	10.82
HA02	10.74	10.98	11.50	12.32
HA03	11.00	11.03	10.97	11.07
HA04	10.26	10.67	10.70	10.51
HA05	11.36	11.62	12.10	12.60
HA06	11.41	11.61	12.20	12.98
Average	10.90	11.15	11.40	11.72

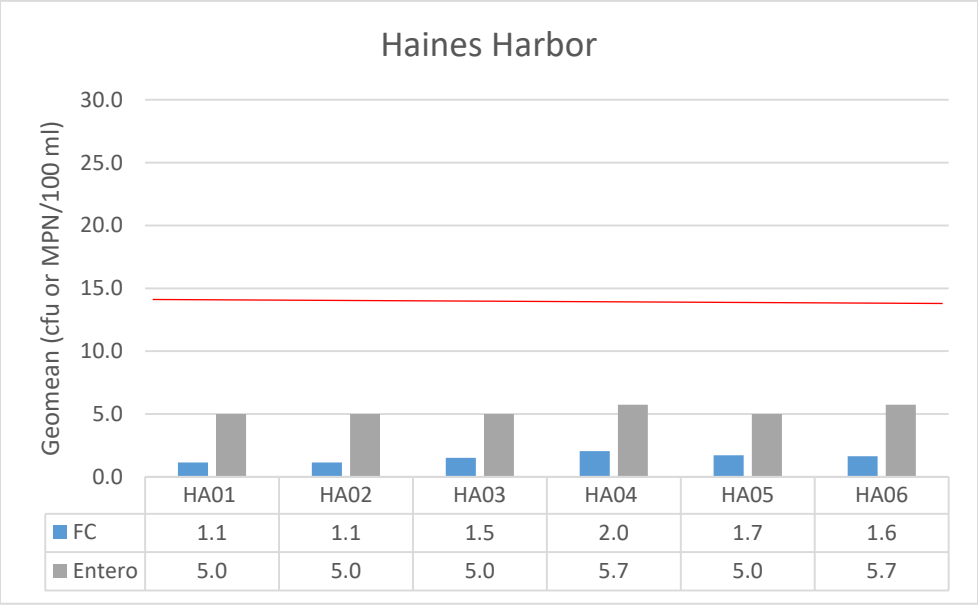

Figure 18. Geometric mean concentrations of fecal coliform and *Enterococci* bacteria at the seven sampling sites near Haines. The MDL for *Enterococci* was 10 MPN/100 ml. Values below the MDL were reported as 5 MPN/100 ml. Red line is WQ numeric criteria for fecal coliforms 14 cfu/100 ml.

Table 16. Concentrations of ammonia and metals at the Haines sampling sites. Values of 0.5 x MDL are shown were results are < MDL and are used to calculate location averages. T is total and D is dissolved.

Site	Ammonia-N (mg/L)	T-Cu (µg/L)	D-Cu (µg/L)	T-Ni (µg/L)	D-Ni (µg/L)	T-Zn (µg/L)	D-Zn (µg/L)
HA01	0.0015	0.37	0.31	0.25	0.21	0.77	0.33
HA02	0.0015	0.47	0.52	0.28	0.60	1.02	0.39
HA03	0.0030	0.37	0.33	0.24	0.27	0.67	0.32
HA04	0.0130	0.67	0.49	0.26	0.27	1.86	1.18
HA05	0.0130	0.41	0.34	0.26	0.27	0.65	0.42
HA06	0.0015	0.42	0.36	0.24	0.26	0.61	0.45
Average	0.0056	0.45	0.39	0.26	0.31	0.93	0.52

Skagway-Taiya Inlet

Skagway sampling sites were located near the mouth of the Skagway River (SK01), the commercial Ore Dock (SK02), adjacent to the cruise ship berth and near the mouth of Pullen Creek (SK03), in the small boat harbor (SK04), near the cruise ship berths (SK05) in open water near the harbor and berths (SK06) and off-shore in the middle of Taiya Inlet (SK07) (Figure 19).

Average water temperatures among sites in late June were 11.26°C and increased slightly with water depth (Table 17). Water temperatures were coldest at SK01 near the mouth of the Skagway River. Salinity was very low ranging from 2.2 ppt at SK01 (1m depth) to 5.3 ppt at SK07. Salinity at 4m depth was similar among sites ranging from 4.4 ppt at SK01 to 5.3 ppt at SK07.

Fecal coliform bacteria were below detection limits in 21 of the 35 samples collected. Site geometric means ranged from 1.0 cfu/100 ml to 2.8 cfu/100 and the single greatest value was 8 cfu/100 ml (Figure 20). *Enterococci* were below the MDL of 10 MPN/100 ml on all sites and sampling dates except July 14, when values ranged from the 10 to 20 MPN/100 ml.

Ammonia-N was at concentrations above the MDL at all sampling sites except for SK07, located off-shore and the average among sites was 0.014 mg/L (Table 18). Average concentrations of total and dissolved Cu and Ni were < 1.0 µg/L and total and dissolved Zn < 3.0 µg/L. Concentrations of total Zn were greatest at SK01 and SK06.

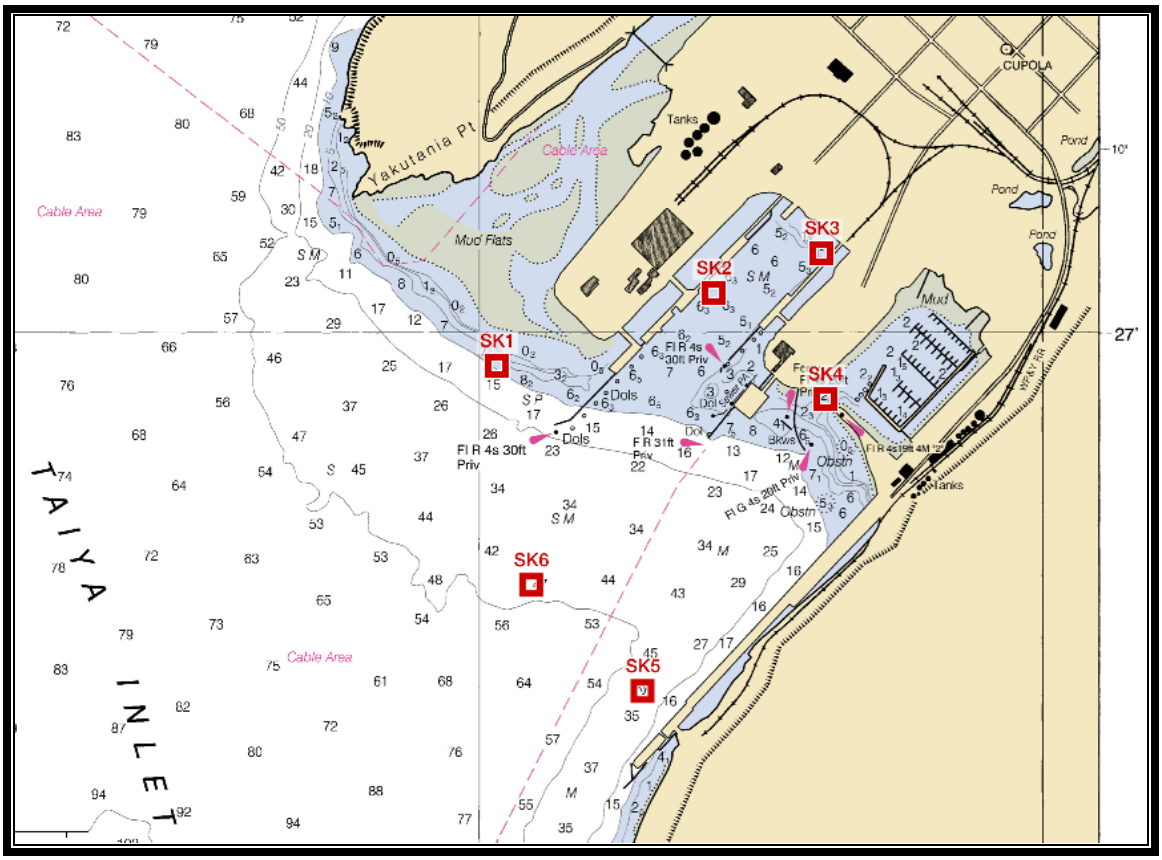

Figure 19. Location of six of the seven sampling sites near Skagway. The seventh site, (SK07) was located in the middle of Taiya Inlet approximately 3 miles from the Skagway small boat harbor.

Table 17. Water temperatures (C), salinity (ppt), pH, and dissolved oxygen (D.O. mg/L) from 1m to 4m water depths at Skagway sampling sites on June 29, 2020.

Temp (C)	1m	2m	3m	4m
SK01	9.10	11.70	11.90	11.90
SK02	11.10	11.30	11.20	11.40
SK03	11.00	11.10	11.20	11.90
SK04	11.30	11.40	11.60	12.00
SK05	12.10	12.10	12.20	12.20
SK06	11.80	11.80	11.80	12.10
SK07	12.40	12.40	12.40	12.40
Average	11.26	11.69	11.76	11.99

Salinity (ppt)	1m	2m	3m	4m
SK01	2.20	4.30	4.40	4.40
SK02	3.60	3.70	3.70	4.10
SK03	3.40	3.40	3.60	4.40
SK04	3.70	3.80	3.90	4.50
SK05	4.60	4.70	4.80	4.90
SK06	4.30	4.30	4.40	4.50
SK07	5.30	5.30	5.30	5.30
Average	3.87	4.21	4.30	4.59

pH	1m	2m	3m	4m
SK01	8.08	8.01	7.53	8.27
SK02	8.02	8.41	8.18	7.96
SK03	8.01	8.00	7.99	8.03
SK04	8.05	8.02	7.99	8.05
SK05	8.15	8.22	8.24	8.24
SK06	8.19	8.20	8.19	8.22
SK07	8.38	8.36	8.35	8.34
Average	8.13	8.17	8.07	8.16

D.O. (mg/L)	1m	2m	3m	4m
SK01	10.51	10.60	10.48	10.43
SK02	10.30	10.40	10.41	10.42
SK03	10.34	10.41	10.45	10.44
SK04	10.19	10.25	10.23	10.26
SK05	10.35	10.44	10.43	10.43
SK06	10.40	10.44	10.44	10.45
SK07	10.33	10.36	10.37	10.36
Average	10.35	10.41	10.40	10.40

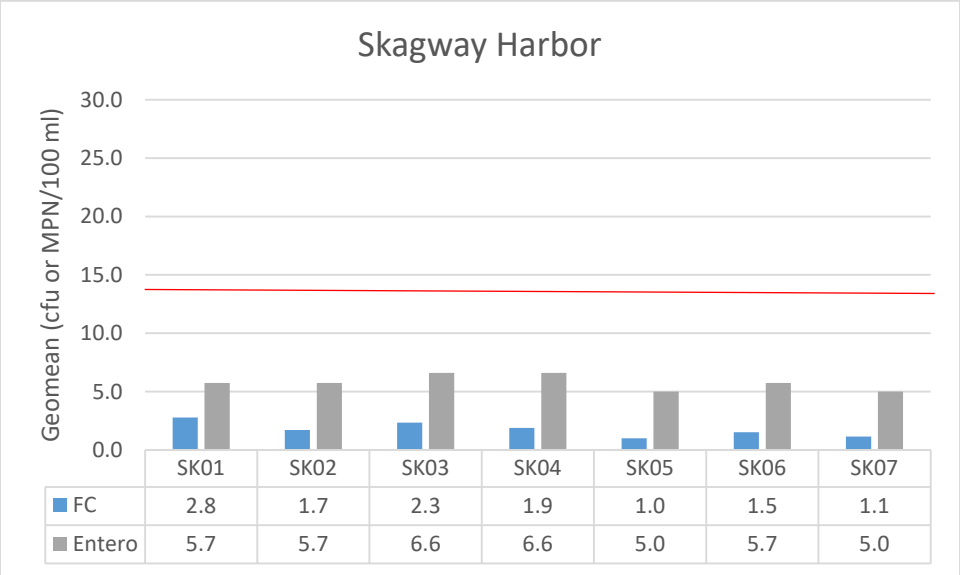

Figure 20. Geometric mean concentrations of fecal coliform and *Enterococci* bacteria at the seven sampling sites near Skagway. The MDL for *Enterococci* was 10 MPN/100 ml. Values below the MDL were reported as 5 MPN/100 ml. Red line is WQ numeric criteria for fecal coliforms 14 cfu/100 ml.

Table 18. Concentrations of ammonia and metals at the Skagway sampling sites. Values of 0.5 x MDL are shown were results are < MDL and are used to calculate location averages. T is total and D is dissolved.

Site	Ammonia-N (mg/L)	T-Cu (µg/L)	D-Cu (µg/L)	T-Ni (µg/L)	D-Ni (µg/L)	T-Zn (µg/L)	D-Zn (µg/L)
SK01	0.003	0.90	0.88	0.54	0.52	4.94	4.52
SK02	0.011	0.35	0.38	0.20	0.25	1.87	2.23
SK03	0.006	0.33	0.46	0.17	0.21	1.82	1.90
SK04	0.018	0.36	0.42	0.16	0.20	1.73	1.92
SK05	0.030	0.32	0.39	0.22	0.23	1.73	2.52
SK06	0.028	0.37	0.40	0.24	0.22	4.83	2.06
SK07	0.002	0.31	0.34	0.18	0.23	1.43	1.54
Average	0.014	0.42	0.47	0.24	0.27	2.62	2.38

Juneau-Auke Bay and Gastineau Channel

Sampling sites in Gastineau Channel were located in mid-inlet south of the Douglas Bridge (JU01), close to downtown and near two tie-ups (JU02), at the cruise ship (JU05) and Princess Cruise Lines private berth (JN07), mid-inlet (JN06), Carnival Cruise Lines private berth (JU08), mid-channel (JU09), City of Juneau Harris (JU11) and Aurora (JU12) small boat harbors, outside the Douglas small boat harbor (JU10) and south of the rock dump and Alaska Marine Lines tie-ups (JU13) (Figure 21).

Auke Bay sites were located at the entrance to the Fishermen's Bend/Statter Harbor small boat harbor (AU01) and near the Auke Bay Loading Facility and AMHS dock (AU02) (Figure 22).

Water temperatures tended to be warmer in Auke Bay than in Gastineau Channel and surface waters in both locations were less saline at 1m than 4m water depth (Table 19). Average water temperatures in Auke Bay were 14.5°C at 1m water depth decreasing to 12.8°C at 4m. Water temperatures were warmer near Fishermen's Bend (AU01). Average water temperatures in Gastineau Channel were approximately 2°C cooler than in Auke Bay at 1m and 4m water depth. All sites in both locations had lower surface water salinity at approximately 15 ppt at 1m water depth and 18 to 19 ppt at 4m. The pH decreased and dissolved oxygen increased slightly with depth.

Geometric mean fecal coliform concentrations ranged from 1.7 cfu/100 ml, in mid-channel (JU09) to 20.4 cfu/100 ml (JU11) in Harris Harbor (Figure 13). Three of the five samples collected in the Harris small boat harbor also exceeded 31 cfu/100 ml. Two of the five samples collected at JU02 exceeded 31 cfu/100 ml; however, the geometric mean was < 20 cfu/100 ml. The geometric mean concentrations of *Enterococci* ranged from 5 MPN/100 ml (0.5 x the MDL) to 11.8 MPN/100 ml in the Harris small boat harbor.

Ammonia-N concentrations were greater than MDLs at two sampling sites: Fishermen's Bend (AU01) and Harris small boat harbor (JU11) (Table 20). Average total and dissolved Cu and Ni concentrations were < 1.0 µg/L and Zn < 2.0 µg/L. None of the sampling sites had concentrations of metals more than 1 µg/L less than or greater than the mean.

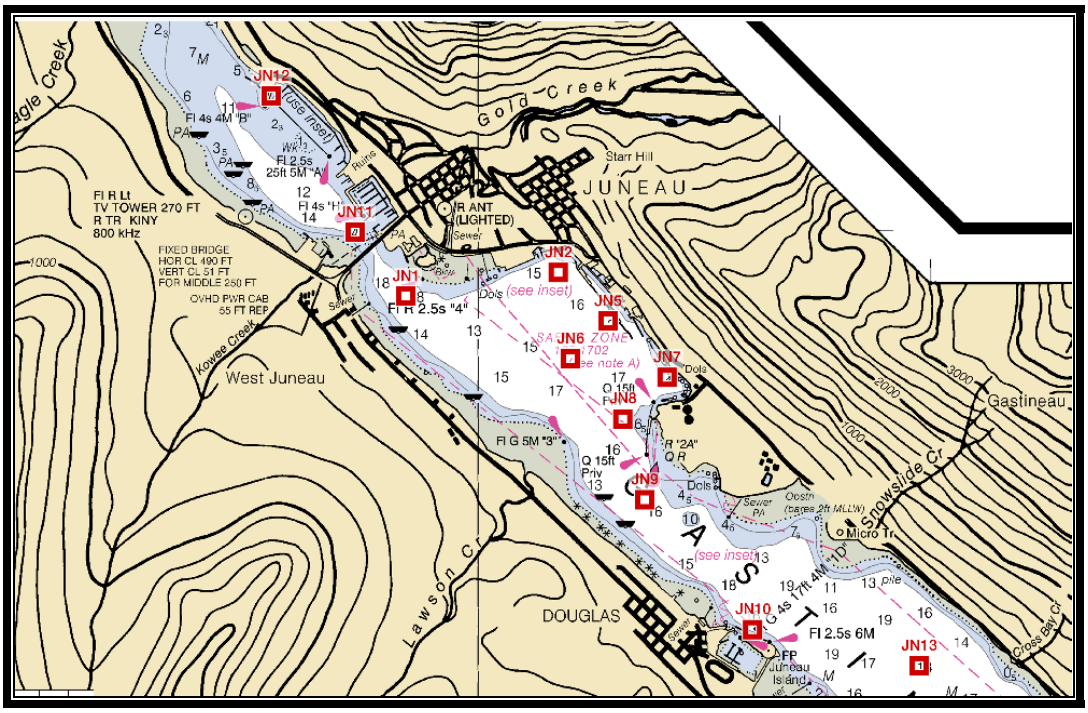

Figure 21. Locations of the 13 sampling sites near Juneau.

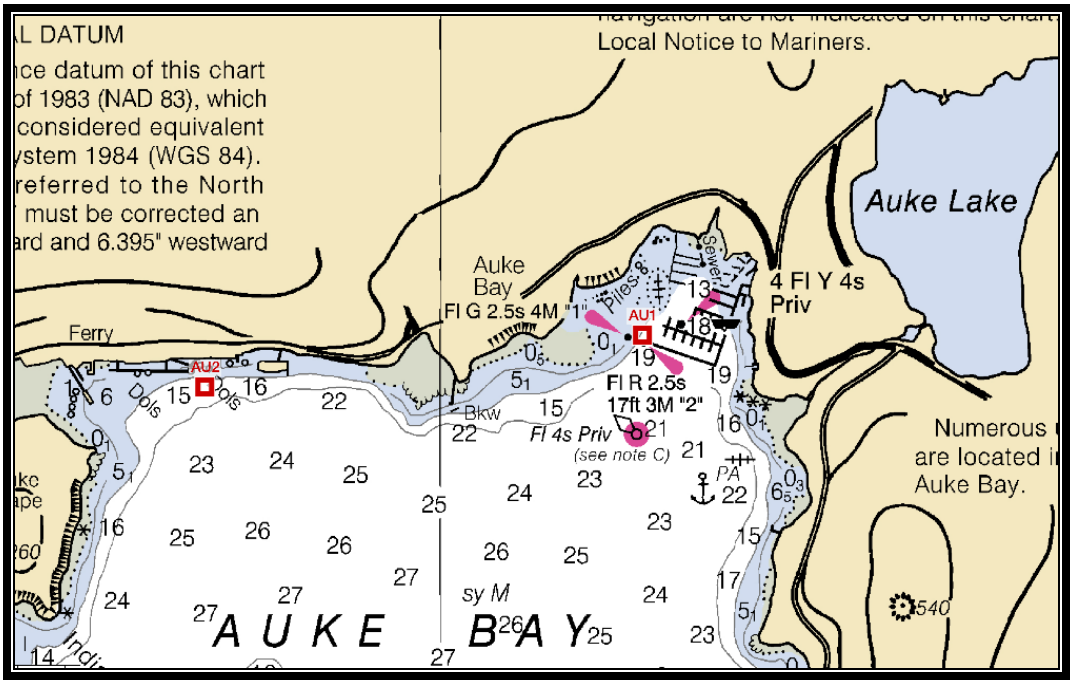

Figure 22. Locations of the two sampling sites in Auke Bay.

Table 19. Water temperatures (C), salinity (ppt), pH, and dissolved oxygen (D.O. mg/L) from 1 to 4m water depths at Juneau and Auke Bay sampling sites on July 2, 2020.

Temp (C)	1 m	2 m	3 m	4 m
AU01	15.20	13.80	13.20	12.70
AU02	13.80	15.60	14.80	13.00
JU01	11.20	10.30	10.00	9.80
JU02	11.90	11.10	10.40	10.00
JU05	12.40	12.40	10.80	10.30
JU06	11.70	11.20	10.60	10.10
JU07	13.20	12.80	10.80	9.90
JU08	12.80	11.80	11.30	11.80
JU09	12.80	11.20	10.30	9.60
JU10	13.20	12.30	11.00	10.00
JU11	11.20	11.00	10.00	9.70
JU12	11.30	10.70	10.50	10.20
JU13	12.70	12.10	11.20	10.40
Auke Bay Average	14.50	14.70	14.00	12.85
Juneau Average	12.22	11.54	10.63	10.16

Salinity (ppt)	1 m	2 m	3 m	4 m
AU01	15.30	16.70	17.40	18.20
AU02	14.10	14.40	15.40	17.90
JU01	16.50	18.30	18.90	19.70
JU02	15.50	16.40	17.50	18.40
JU05	14.90	15.00	17.10	17.80
JU06	15.20	16.50	17.50	19.10
JU07	14.40	14.50	17.10	19.00
JU08	14.80	15.10	15.70	18.00
JU09	14.90	16.30	18.20	20.60
JU10	14.60	15.30	17.20	19.20
JU11	16.40	16.70	18.60	19.90
JU12	16.90	17.40	17.60	18.10
JU13	14.80	15.20	16.10	18.10
Auke Bay Average	14.70	15.55	16.40	18.05
Juneau Average	15.35	16.06	17.41	18.90

pH	1 m	2 m	3 m	4 m
AU01	8.49	8.60	8.60	8.66
AU02	8.60	8.60	8.65	8.65
JU01	8.32	8.24	8.24	8.30
JU02	8.43	8.48	8.39	8.34
JU05	8.56	8.56	8.51	8.40
JU06	8.52	8.48	8.42	8.42
JU07	8.59	8.55	8.55	8.29
JU08	8.63	8.60	8.58	8.49
JU09	8.55	8.59	8.45	8.42
JU10	8.51	8.52	8.46	8.32
JU11	8.38	8.39	8.34	8.33
JU12	8.39	8.40	8.37	8.37
JU13	8.67	8.65	8.60	8.60
Auke Bay Average	8.55	8.60	8.63	8.66
Juneau Average	8.50	8.50	8.45	8.39

D.O. (mg/L)	1 m	2 m	3 m	4 m
AU01	10.73	11.63	12.26	12.50
AU02	10.26	10.33	10.99	12.10
JU01	11.48	11.35	11.39	11.61
JU02	11.90	12.34	12.36	12.11
JU05	11.97	12.27	12.32	12.32
JU06	12.11	12.30	12.51	12.46
JU07	12.10	12.18	12.28	12.00
JU08	11.85	12.34	12.64	12.54
JU09	12.20	12.80	12.52	12.18
JU10	12.06	12.18	12.35	12.38
JU11	11.54	11.55	11.57	11.48
JU12	11.25	11.29	11.28	11.42
JU13	12.44	12.64	13.11	13.09
Auke Bay Average	10.50	10.98	11.63	12.30
Juneau Average	11.90	12.11	12.21	12.14

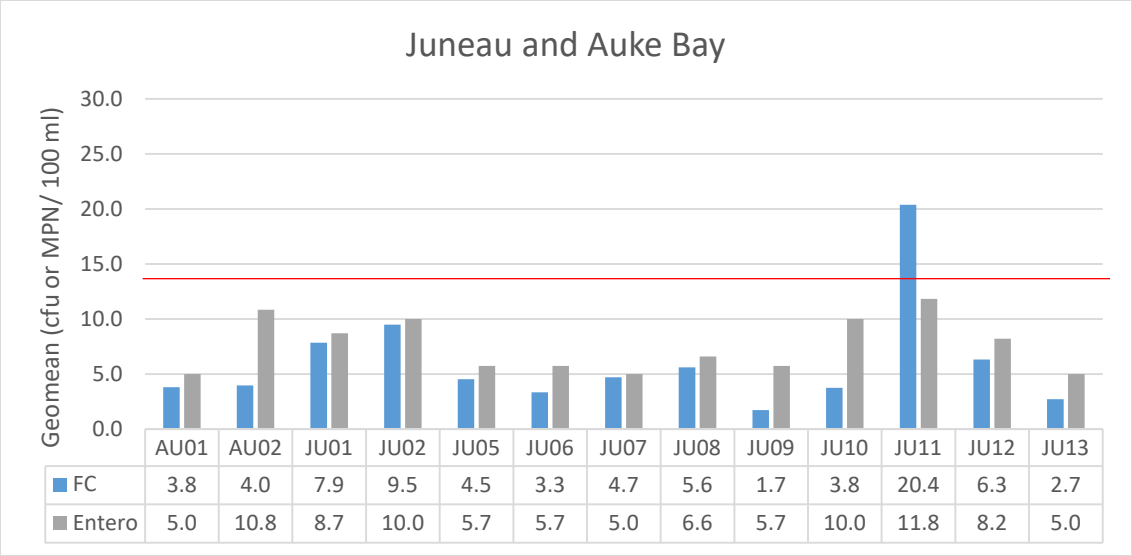

Figure 23. Geometric mean concentrations of fecal coliform and *Enterococci* bacteria at the seven sampling sites in Auke bay and near Juneau. The MDL for *Enterococci* was 10 MPN/100 ml. Values below the MDL were reported as 5 MPN/100 ml. Red line is WQ numeric criteria for fecal coliforms 14 cfu/100 ml.

Table 20. Concentrations of ammonia and metals at the Auke Bay and Juneau sampling sites. Values of 0.5 x MDL are shown were results are < MDL and are used to calculate location averages. T is total and D is dissolved.

Site	Ammonia-N (mg/L)	T-Cu (µg/L)	D- Cu (µg/L)	T-Ni (µg/L)	D-Ni (µg/L)	T-Zn (µg/L)	D-Zn (µg/L)
AU01	0.0260	0.94	1.12	0.57	0.51	1.99	1.77
AU02	0.0015	1.01	0.62	0.59	0.53	1.33	0.49
JU01	0.0015	0.68	0.56	0.68	0.59	1.60	0.89
JU02	0.0015	0.59	0.52	0.62	0.57	1.20	0.72
JU05	0.0015	0.64	0.52	0.66	0.57	1.25	0.43
JU06	0.0015	0.63	0.54	0.65	0.60	1.20	0.70
JU07	0.0015	0.64	0.56	0.68	0.56	1.12	0.44
JU08	0.0015	0.66	0.62	0.69	0.59	1.16	0.42
JU09	0.0015	0.65	0.62	0.66	0.57	1.07	0.35
JU10	0.0015	0.66	0.55	0.68	0.57	0.96	0.25
JU11	0.0050	0.84	0.71	0.66	0.57	2.28	1.74
JU12	0.0015	0.66	0.58	0.61	0.57	1.36	1.08
JU13	0.0015	0.78	0.55	0.70	0.57	1.13	0.25
Auke Bay Average	0.0138	0.98	0.87	0.58	0.52	1.66	1.13
Juneau Average	0.0018	0.68	0.58	0.66	0.58	1.30	0.66

Hoonah-Port Fredrick

Sampling sites near Hoonah were located off-shore near the cruise ship berth (HO04), east of Cannery Point (HO01), at the Cannery Point cruise ship berth (HO02) near the Icy Strait Cannery dock (HO03), the AMHS Berth (HO05), near the city berths and fuel dock (HO06), at the entrance to the small boat harbor (HO07), and in the shallow estuary (HO08).

Water quality parameters were consistent among sites and water depths (Table 21). Water temperatures at 1m water depth ranged from 13.1°C to 14.2°C among sites, and from 12.6°C to 13.5°C at 4m water depth. Average salinity was 25.2 ppt at 1m and 26.4 ppt at 4m water depth. The pH was 8.4 and dissolved oxygen 12 mg/L.

The geometric mean concentration of fecal coliform bacteria exceed WQ numeric criteria at HO08 (Estuary Site) and exceeded 31 cfu/100 ml on three of the five sampling dates (Figure 25). Fecal coliform geometric means at the remainder of the sites ranged from 1.7 cfu/100 ml (HO01) to 6.2 cfu/100 ml (HO05). Concentrations of *Enterococci* were below MDLs (10 MPN/100 ml) in 29 of the 40 samples collected. The highest single value was 52 MPN/100 ml at HO08.

Ammonia-N concentrations were below or near MDLs (0.003 mg/L) at all sampling sites. Concentrations of metals were low with total and dissolved Cu, Ni, and Zn < 0.5 µg/L at all sampling sites (Table 22).

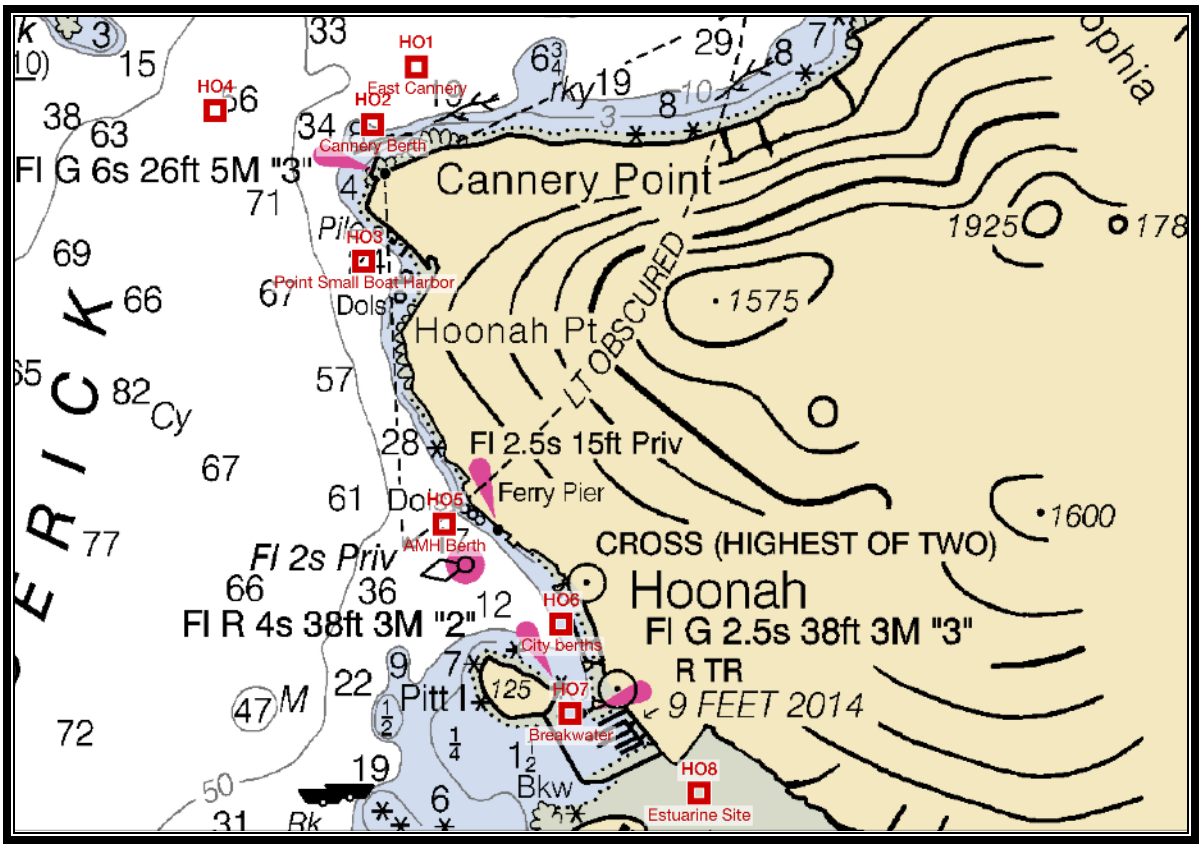

Figure 24. Location of the eight sampling sites near Hoonah.

Table 21. Water temperatures (C), salinity (ppt), pH, and dissolved oxygen (D.O. mg/L) from 1 to 4m water depths at Hoonah sampling sites on July 7, 2020.

Temp (C)	1m	2m	3m	4m
HO01	13.40	13.00	12.70	12.60
HO02	13.10	13.00	12.80	12.80
HO04	13.90	14.30	13.80	13.40
HO03	13.40	13.40	13.50	13.40
HO05	14.20	14.10	13.80	12.70
HO06	14.20	14.10	13.70	13.50
HO07	13.70	13.70	13.10	N/A
HO08	14.20	13.90	N/A	N/A
Average	13.76	13.69	13.34	13.07

Salinity (ppt)	1m	2m	3m	4m
HO01	25.70	25.90	26.00	26.10
HO02	25.40	25.70	26.30	26.30
HO04	25.30	25.50	25.80	26.00
HO03	23.90	25.40	24.60	26.10
HO05	25.10	25.20	25.60	27.40
HO06	25.10	25.50	25.80	26.40
HO07	25.50	25.70	27.00	N/A
HO08	25.40	26.00	N/A	N/A
Average	25.18	25.61	25.87	26.38

pH	1m	2m	3m	4m
HO01	8.40	8.43	8.42	8.43
HO02	8.41	8.44	8.44	8.44
HO04	8.48	8.51	8.51	8.47
HO03	8.49	8.50	8.67	8.54
HO05	8.50	8.50	8.24	8.48
HO06	8.47	8.47	8.45	8.42
HO07	8.43	8.43	8.39	N/A
HO08	8.47	8.47	N/A	N/A
Average	8.46	8.47	8.45	8.46

D.O. (mg/L)	1m	2m	3m	4m
HO01	11.78	11.91	12.00	12.02
HO02	11.64	11.85	12.17	12.25
HO04	11.75	11.89	12.17	12.22
HO03	11.57	11.65	11.74	11.85
HO05	11.77	11.77	11.76	13.24
HO06	11.76	11.64	11.65	11.69
HO07	11.25	11.39	11.83	N/A
HO08	11.69	11.86	N/A	N/A
Average	11.65	11.75	11.90	12.21

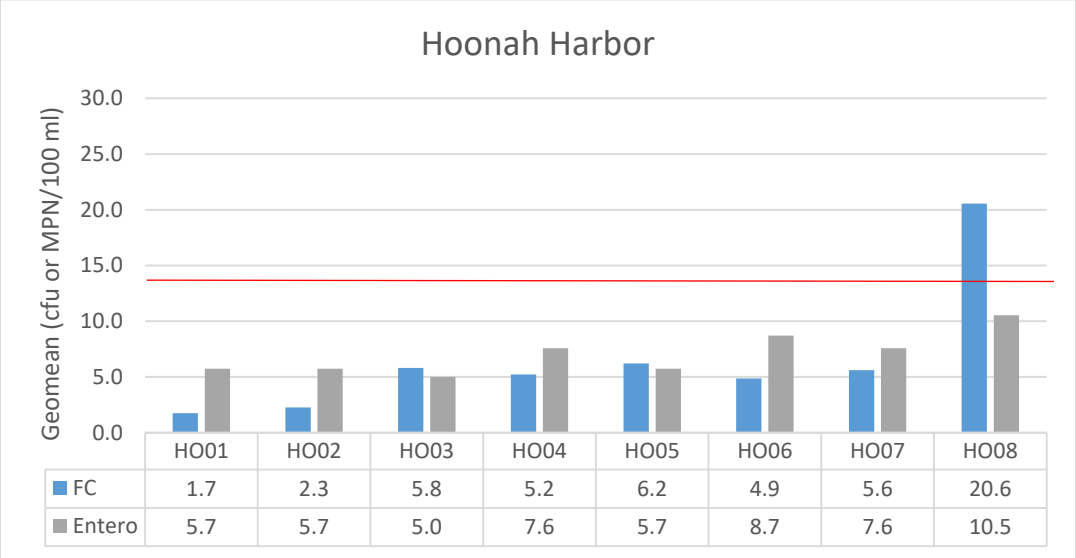

Figure 25. Geometric mean concentrations of fecal coliform and *Enterococci* bacteria at the eight sampling sites near Hoonah. The MDL for *Enterococci* was 10 MPN/100 ml. Values below the MDL were reported as 5 MPN/100 ml. Red line is WQ numeric criteria for fecal coliforms 14 cfu/100 ml.

Table 22. Concentrations of ammonia and metals at the Hoonah sampling sites. Values of 0.5 x MDL are shown were results are < MDL and are used to calculate location averages. T is total and D is dissolved.

Site	Ammonia-N (mg/L)	T-Cu (µg/L)	D-Cu (µg/L)	T-Ni (µg/L)	D-Ni (µg/L)	T-Zn (µg/L)	D-Zn (µg/L)
HO01	0.002	0.30	0.28	0.37	0.35	0.10	0.10
HO02	0.002	0.28	0.27	0.34	0.34	0.10	0.10
HO03	0.002	0.29	0.27	0.36	0.32	0.10	0.21
HO04	0.002	0.28	0.26	0.34	0.33	0.21	0.10
HO05	0.004	0.33	0.27	0.41	0.34	0.26	0.10
HO06	0.002	0.33	0.28	0.36	0.34	0.30	0.21
HO07	0.002	0.30	0.31	0.37	0.34	0.41	0.42
HO08	0.002	0.32	0.28	0.37	0.34	0.31	0.10
Average	0.002	0.30	0.28	0.37	0.34	0.22	0.17

Sitka-Sitka Sound

Sampling sites near Sitka were selected to represent small boat harbors (SI01, SI05, SI06, SI07), outside the harbor breakwater (SI08 an SI03), cruise ship anchorages (SI02 and SI04) (Figure 26), and near the AMHS dock (SI09 and SI10) (Figure 27).

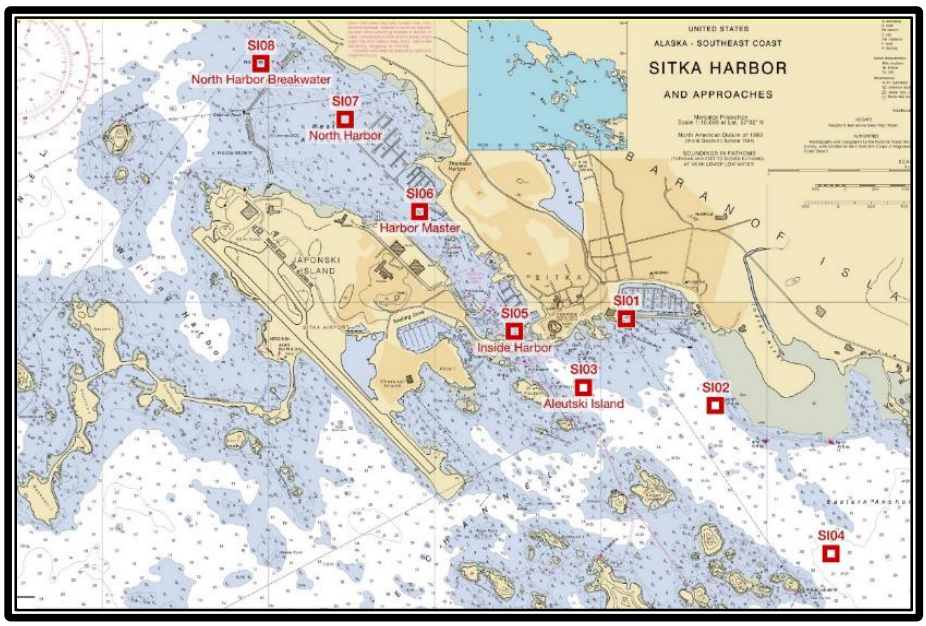

Figure 26. Locations of the eight sampling sites near Sitka.

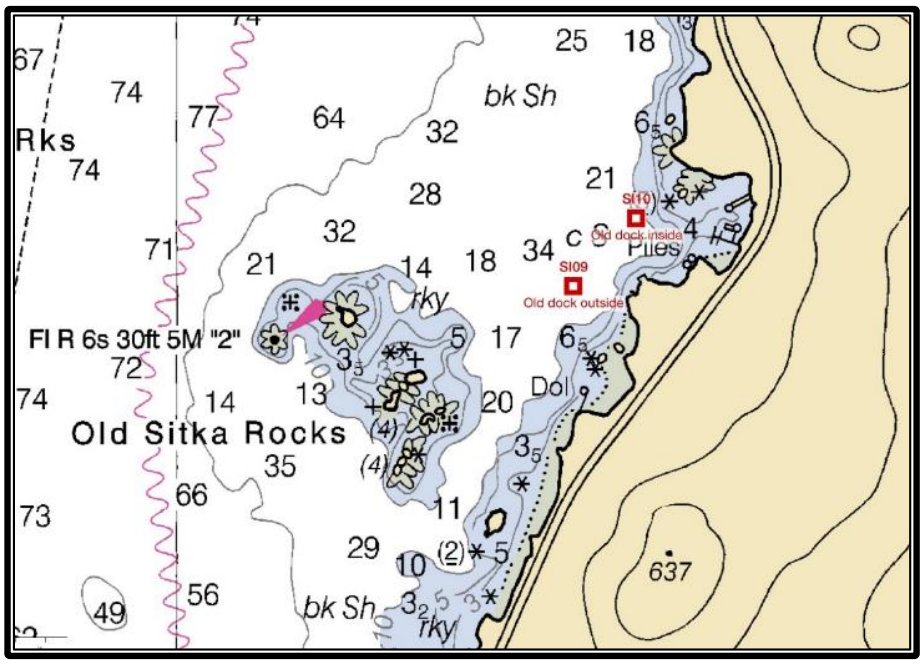

Figure 27. Sampling sites north of Sitka near the AMHS berth.

Surface waters at the selected sampling sites were slightly warmer and less saline than at 4m water depth (Table 23). Water temperatures averaged 14°C at 1m water depth and ranged from 13° to 14°C. Average water temperature at 4m water depth was 12.3°C. Salinity at 1m water depth averaged 26.6 ppt among sites (range 24 to 29 ppt) and 30.2 ppt at 4m water depth (range 30.0 to 30.5 ppt). Average pH (8.24) and dissolved oxygen (11.1 mg/L) was fairly consistent among sampling sites and depths.

Geometric mean fecal coliform and *Enterococci* bacteria concentrations are shown in Figure 28. Fecal coliform geometric means ranged from 1.9 to 6.6 cfu/100 ml and none of the individual samples exceeded 31 cfu/100 ml. All but two samples analyzed for *Enterococci* were at or below the MDL resulting in geometric means near 5 MDL/100 ml (0.5 x the MDL).

Ammonia-N concentrations were below the MDL of 0.003 mg/L at nine of the 10 sampling sites and 0.004 mg/L at the remaining site (Table 24). Average concentrations of total and dissolved Cu, Ni, and Zn were < 1.0 µg/L.

Table 23. Water temperatures (C), salinity (ppt), pH, and dissolved oxygen (D.O. mg/L) from 1 to 4m water depths at Sitka sampling sites on July 6, 2020.

Temp (C)	**1m**	**2m**	**3m**	**4m**
SI01	14.00	13.10	12.60	12.10
SI02	13.80	13.40	13.10	12.20
SI03	13.90	13.30	13.00	12.00
SI04	14.20	13.50	12.60	12.40
SI05	14.00	13.50	12.90	12.30
SI06	13.60	13.00	12.70	12.30
SI07	13.60	13.50	13.00	12.50
SI08	13.90	13.80	13.50	12.80
SI09	13.40	12.80	12.80	12.60
SI10	13.10	12.70	12.40	12.10
Average	13.75	13.26	12.86	12.33

Salinity (ppt)	**1m**	**2m**	**3m**	**4m**
SI01	25.40	29.50	30.10	30.40
SI02	24.00	28.90	29.70	30.50
SI03	25.70	28.70	29.50	30.40
SI04	24.50	28.90	30.10	30.20
SI05	25.00	28.50	29.60	30.30
SI06	26.50	29.40	29.80	30.10
SI07	28.60	28.90	29.60	30.20
SI08	29.10	29.10	29.20	30.00
SI09	29.00	29.90	29.90	30.00
SI10	28.30	29.90	30.10	30.30
Average	26.61	29.17	29.76	30.24

pH	**1m**	**2m**	**3m**	**4m**
SI01	8.22	8.23	8.25	8.24
SI02	8.18	8.26	8.24	8.24
SI03	8.23	8.24	8.24	8.25
SI04	8.26	8.26	8.24	8.28
SI05	8.25	8.24	8.26	8.27
SI06	8.22	8.23	8.24	8.24
SI07	8.22	8.23	8.25	8.25
SI08	8.28	8.26	8.26	8.29
SI09	8.27	8.29	8.29	8.33
SI10	8.31	8.30	8.31	8.31
Average	8.24	8.25	8.26	8.27

D.O. (mg/L)	**1m**	**2m**	**3m**	**4m**
SI01	10.82	11.35	11.47	11.64
SI02	10.70	11.11	11.39	11.39
SI03	10.60	10.98	11.17	11.55
SI04	11.08	11.26	11.54	11.72
SI05	10.74	10.94	11.44	11.57
SI06	10.91	11.07	11.35	11.49
SI07	11.05	11.25	11.66	11.70
SI08	10.88	11.19	11.28	11.59
SI09	11.86	12.27	12.36	12.36
SI10	12.37	12.58	12.51	12.56
Average	11.10	11.40	11.62	11.76

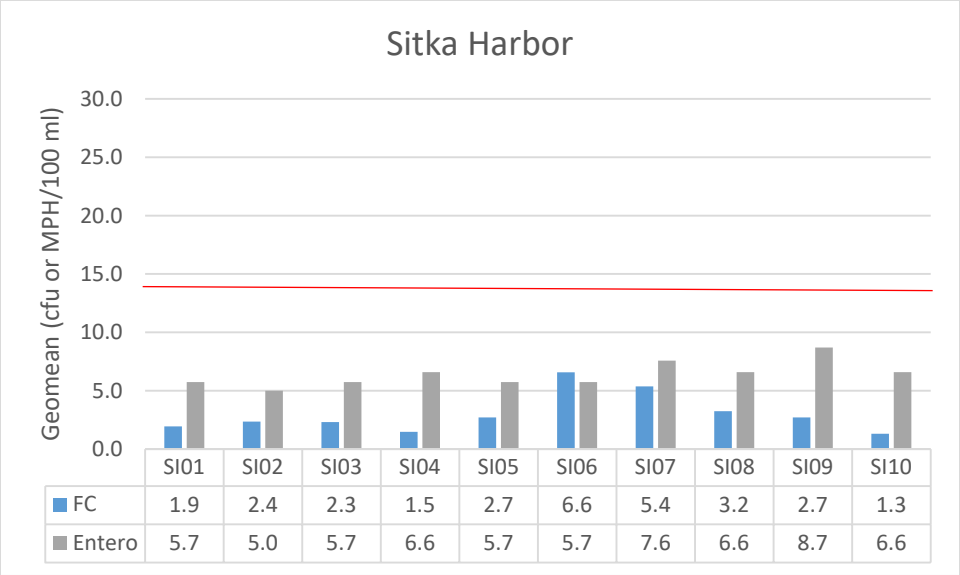

Figure 28. Geometric mean concentrations of fecal coliform and *Enterococci* bacteria at the ten sampling sites near Sitka. The MDL for *Enterococci* was 10 MPN/100 ml. Values below the MDL were reported as 5 MPN/100 ml. Red line is WQ numeric criteria for fecal coliforms 14 cfu/100 ml.

Table 24 Concentrations of ammonia and metals at the Sitka sampling sites. Values of 0.5 x MDL are shown were results are < MDL and are used to calculate location averages. T is total and D is dissolved.

Site	Ammonia-N (mg/L)	T-Cu (µg/L)	D-Cu (µg/L)	T-Ni (µg/L)	D-Ni (µg/L)	T-Zn (µg/L)	D-Zn (µg/L)
SI01	0.002	0.60	0.37	0.28	0.25	0.79	0.56
SI02	0.002	0.28	0.26	0.29	0.24	0.56	0.48
SI03	0.002	0.29	0.26	0.28	0.24	0.43	0.57
SI04	0.002	0.22	0.24	0.25	0.23	0.42	0.35
SI05	0.004	0.26	0.27	0.25	0.25	0.57	0.56
SI06	0.002	0.64	0.90	0.25	0.25	1.77	1.36
SI07	0.002	0.77	0.77	0.27	0.25	2.64	2.12
SI08	0.002	0.28	0.42	0.25	0.23	0.76	0.81
SI09	0.002	0.28	0.27	0.26	0.24	0.54	0.43
SI10	0.002	0.27	0.26	0.27	0.23	0.81	0.37
Average	0.002	0.39	0.40	0.27	0.24	0.93	0.76

Petersburg-Wrangell Narrows

Sampling sites near Petersburg were located in Wrangell Narrows at bracketing the berths and harbors (PE01 and PE06), at the north end of the small boat harbor (PE02), at the small boat harbor entrance (PE03), near the fuel dock (PE04), and the AMHS dock (PE05) (Figure 29).

Water temperatures in Wrangell Narrows near Petersburg were colder than most other sampled harbors. Water temperature averaged 10.7°C at 1m water depth and 10.3°C at 4m. Salinity ranged from 24 to 26 ppt at 1m depth and was consistent at 26 ppt at 4m water depth. The pH and concentration of dissolved oxygen were lower than most other harbors at average 1m depth values of 8.13 and 9.16 mg/L.

Geometric mean concentrations of fecal coliform bacteria exceeded WQ numeric criteria of 14 cfu/100 ml at PE02 and PE03, near northern end of the small boat harbor (Figure 30). At both of these sites, one or more samples exceeded 31 cfu/100 ml. A maximum high count of 283 cfu/100 ml was recorded at PE02 on July 21, 2020. *Enterococci* bacteria ranged from 5.7 to 16.4 MPN/100 ml with highest counts at PE02.

Ammonia-N concentrations were above MDL at all sampling sites and the average of all sites was 0.043 mg/L. Average concentrations of total and dissolved metals were < 1.0 µg/L (Table 26). Concentrations of metals varied only slightly among sites.

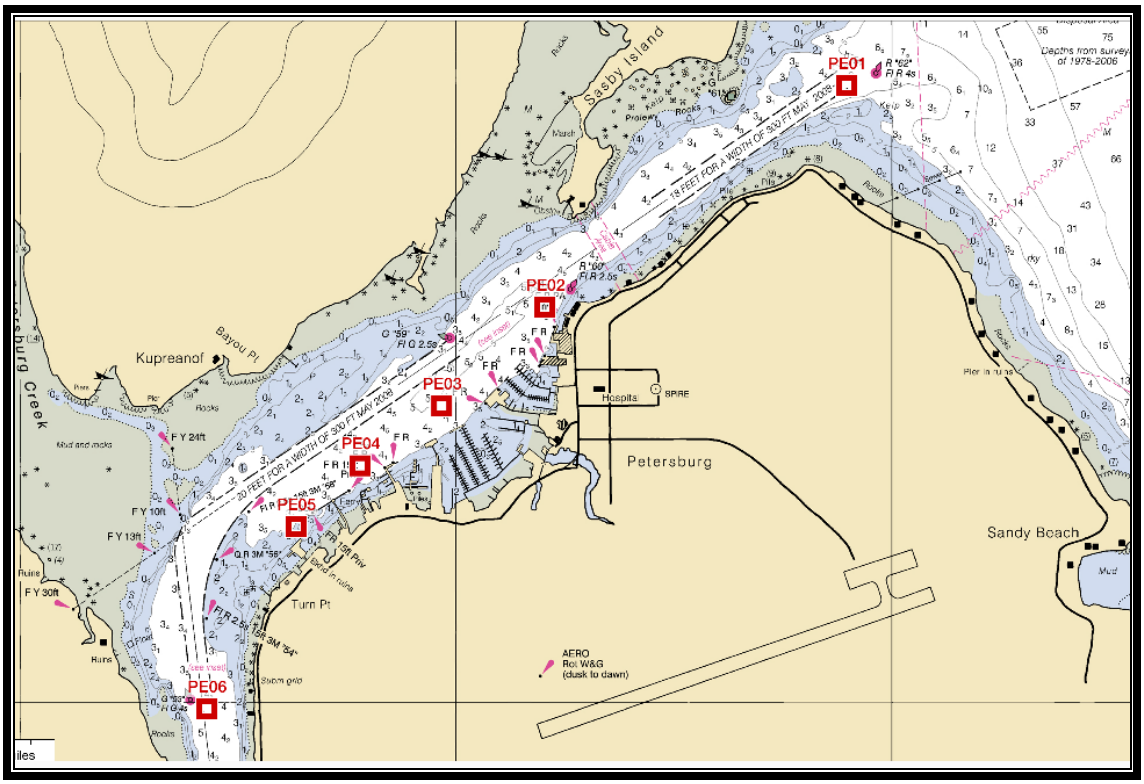

Figure 29. Locations of the six sampling sites near Petersburg.

Table 25. Water temperatures (C), salinity (ppt), pH, and dissolved oxygen (D.O. mg/L) from 1 to 4m water depths at Petersburg sampling sites on July 12, 2020.

Temp (C)	1m	2m	3m	4m
PE01	10.30	10.20	10.10	10.10
PE02	10.90	10.70	10.50	10.60
PE03	10.90	10.50	10.40	10.40
PE04	10.70	10.40	10.30	10.30
PE05	10.40	10.30	10.20	10.20
PE06	11.10	10.20	10.10	10.20
Average	10.72	10.38	10.27	10.30

Salinity (ppt)	1m	2m	3m	4m
PE01	25.80	26.10	26.20	26.30
PE02	24.10	25.30	25.90	25.70
PE03	24.80	26.30	26.30	26.30
PE04	25.00	26.30	26.50	26.50
PE05	26.30	26.40	26.20	26.60
PE06	22.40	25.40	26.20	26.10
Average	24.73	25.97	26.22	26.25

pH	1m	2m	3m	4m
PE01	8.03	8.06	8.06	7.98
PE02	8.09	8.10	8.10	8.12
PE03	8.13	8.10	8.10	8.09
PE04	8.04	8.05	8.06	8.15
PE05	8.06	8.07	8.08	8.36
PE06	8.42	8.16	8.34	8.31
Average	8.13	8.09	8.12	8.17

D.O. (mg/L)	1m	2m	3m	4m
PE01	9.72	9.80	9.80	9.79
PE02	9.89	9.98	9.97	9.77
PE03	9.84	9.90	9.91	9.94
PE04	9.74	9.77	9.83	9.84
PE05	9.74	26.40	9.85	9.88
PE06	10.20	10.15	10.10	10.23
Average	9.86	12.67	9.91	9.91

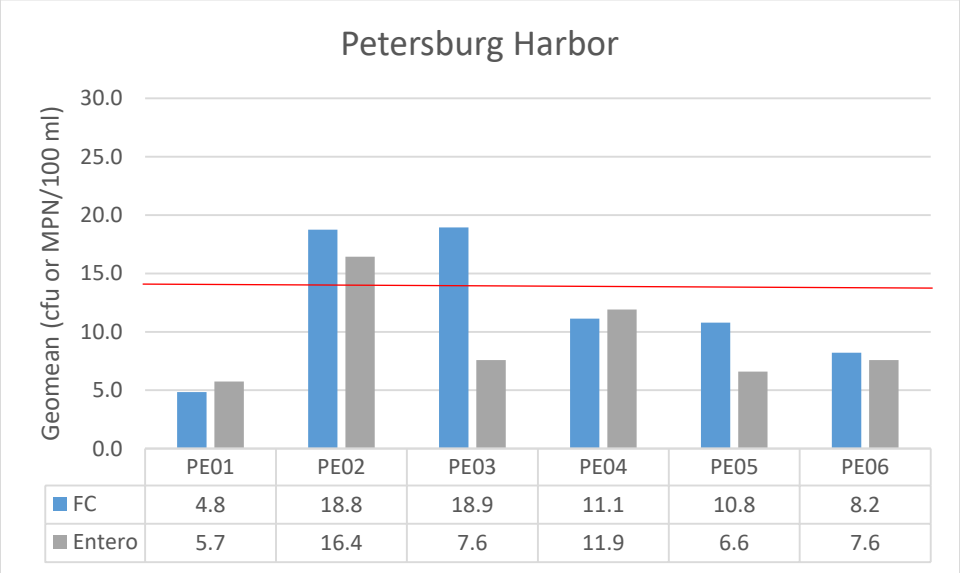

Figure 30. Geometric mean concentrations of fecal coliform and *Enterococci* bacteria at the six sampling sites near Petersburg. The MDL for *Enterococci* was 10 MPN/100 ml. Values below the MDL were reported as 5 MPN/100 ml. Red line is WQ numeric criteria for fecal coliforms 14 cfu/100 ml.

Table 26. Concentrations of ammonia and metals at the Petersburg sampling sites. Values of 0.5 x MDL are shown were results are < MDL and are used to calculate location averages. T is total and D is dissolved.

Site	Ammonia-N (mg/L)	T-Cu (µg/L)	D-Cu (µg/L)	T-Ni (µg/L)	D-Ni (µg/L)	T-Zn (µg/L)	D-Zn (µg/L)
PE01	0.048	0.41	0.45	0.40	0.37	0.83	1.59
PE02	0.040	0.38	0.45	0.37	0.38	0.37	0.63
PE03	0.045	0.38	0.37	0.38	0.36	0.40	0.46
PE04	0.041	0.40	0.36	0.38	0.36	0.39	0.42
PE05	0.041	0.40	0.36	0.37	0.35	0.42	0.40
PE06	0.043	0.46	0.49	0.42	0.49	1.04	2.09
Average	0.043	0.41	0.41	0.39	0.39	0.58	0.93

Wrangell-Sumner Strait

Wrangell sampling sites were distributed from north, near the airport runway (WR01) along the shoreline to the southern small boat harbor (WR05). WR03 was at the city dock and WR04 was in the northern small boat harbor. WR06 was located offshore (Figure 31)

Wrangell was characterized by less saline surface waters due to fresh water from the Stikine River. Average salinity at 1m water depth was 13.95 ppt but increased to 17.83 ppt at 4m. Water temperatures, pH, and dissolved oxygen did not vary with water depth.

Fecal coliform concentrations were below WQ numeric criteria of 14 cfu/100 ml (Figure 32). Both of the sites located in the small boat harbors (WR04 and WR05) had one or more values > 31 cfu/100 ml. *Enterococci* were below the MDL of 10 MPN/100 ml on most sampling dates at all sites; however, a high value of 295 MPN/100 ml occurred at site WR05.

Concentrations of ammonia-N were below the MDL of 0.003 mg/L at all sampling sites (Table 28). Concentrations Cu, Ni, and Zn were higher than all of the other Southeast Ports sampled. However, concentrations were still lower than WQC with all total and dissolved metals < 3.3 µg/L. Metals concentrations were highest at WR01, which, based on apparent turbidity, was more influenced by the Stikine River.

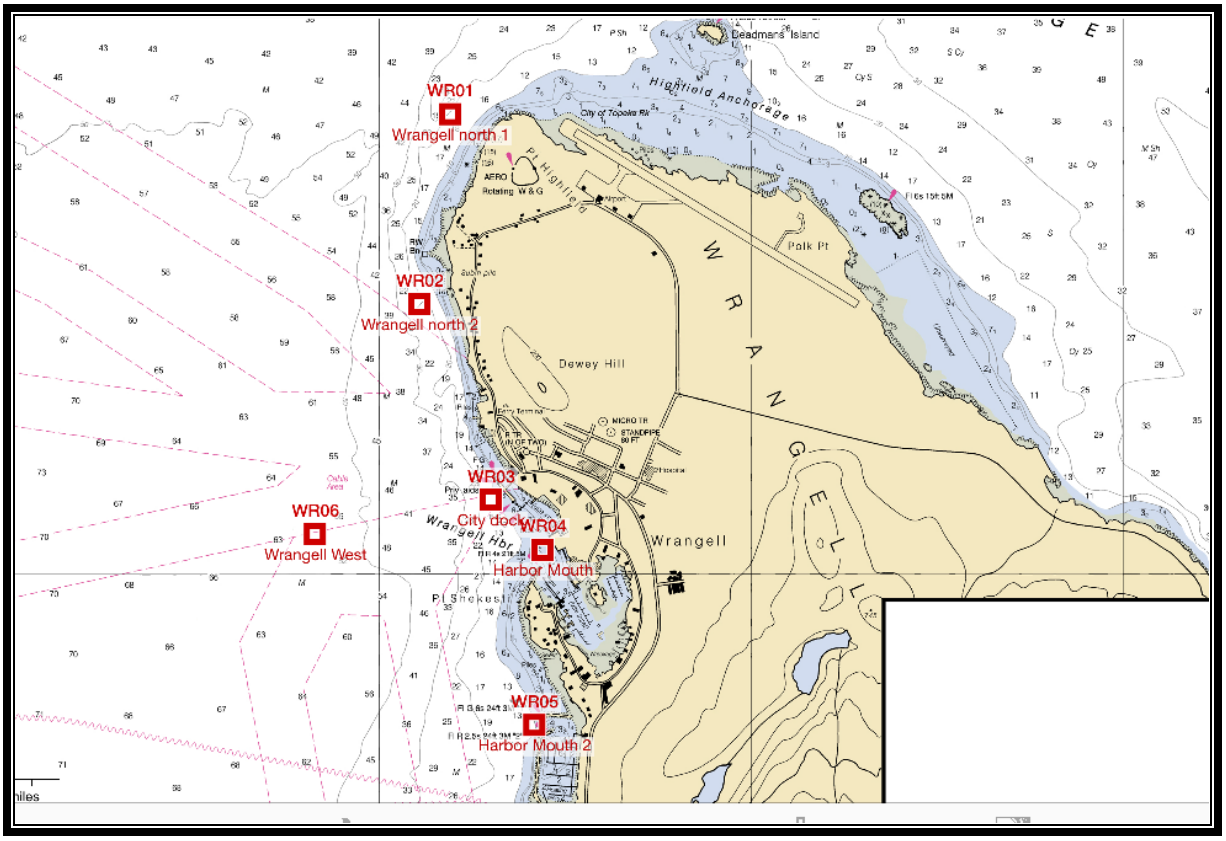

Figure 31. Locations of the six sampling sites near Wrangell.

Table 27. Water temperatures (C), salinity (ppt), pH, and dissolved oxygen (D.O. mg/L) from 1 to 4m water depths at Wrangell sampling sites on July 12, 2020.

Temp (C)	1m	2m	3m	4m
WR01	11.20	11.30	12.10	12.20
WR02	13.50	12.30	12.70	12.60
WR03	12.50	12.80	12.80	12.70
WR04	12.20	12.60	12.70	12.70
WR05	12.90	12.70	12.80	12.70
WR06	13.00	12.80	12.80	12.90
Average	12.55	12.42	12.65	12.63

Salinity (ppt)	1m	2m	3m	4m
WR01	11.70	11.80	11.70	12.60
WR02	12.40	13.70	15.30	16.30
WR03	14.90	18.50	19.00	20.00
WR04	11.50	14.70	18.10	18.80
WR05	18.50	19.30	21.10	21.20
WR06	14.70	15.20	15.60	18.10
Average	13.95	15.53	16.80	17.83

pH	1m	2m	3m	4m
WR01	8.18	8.22	8.66	8.52
WR02	8.16	8.34	8.38	8.34
WR03	8.42	8.43	8.46	8.58
WR04	8.33	8.36	8.35	8.34
WR05	8.34	8.36	8.11	8.57
WR06	8.52	8.35	8.66	8.62
Average	8.33	8.34	8.44	8.50

D.O. (mg/L)	1m	2m	3m	4m
WR01	10.31	10.42	10.52	10.53
WR02	10.30	10.55	10.58	10.52
WR03	10.48	10.60	10.74	10.72
WR04	10.35	10.47	10.40	10.46
WR05	10.29	10.49	10.89	11.04
WR06	10.45	10.50	10.60	10.82
Average	10.36	10.51	10.62	10.68

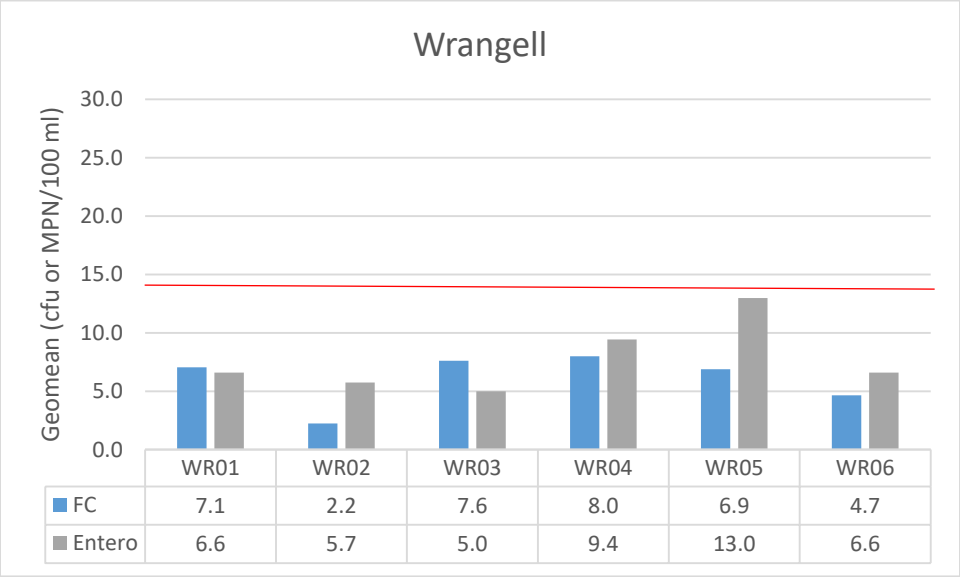

Figure 32. Geometric mean concentrations of fecal coliform and *Enterococci* bacteria at the six sampling sites near Wrangell. The MDL for *Enterococci* was 10 MPN/100 ml. Values below the MDL were reported as 5 MPN/100 ml. Red line is WQ numeric criteria for fecal coliforms 14 cfu/100 ml.

Table 28. Concentrations of ammonia and metals at the Wrangell sampling sites. Values of 0.5 x MDL are shown were results are < MDL and are used to calculate location averages. T is total and D is dissolved.

Site	Ammonia-N (mg/L)	T-Cu (µg/L)	D-Cu (µg/L)	T-Ni (µg/L)	D-Ni (µg/L)	T-Zn (µg/L)	D-Zn (µg/L)
WR01	0.002	6.16	2.99	3.77	1.04	7.88	3.84
WR02	0.002	2.30	2.10	1.67	1.12	2.94	2.13
WR03	0.002	2.38	1.60	1.72	0.75	3.03	1.50
WR04	0.002	2.17	1.91	1.66	1.01	2.84	2.77
WR05	0.002	1.23	1.05	0.90	0.71	1.45	1.12
WR06	0.002	1.21	1.35	0.93	0.65	1.45	1.21
Average	0.002	2.58	1.83	1.78	0.88	3.27	2.10

Ward Cove

Ward Cove sampling sites were distributed along northwest (WA02 and WA03) and southeast shores (WA05 and WA06), with one site located at the mouth of Ward Creek (WA04) and one site at the mouth of the cove (WA01) (Figure 33).

There was little variability in water quality parameters within Ward Cove (Table 29). Water temperatures were approximately 1°C warmer in Ward Cove compared to the site near Tongass Narrows (WA01). Compared to WA01, the remaining Ward Cove sites were slightly less saline and slightly higher in dissolved oxygen.

Fecal coliform bacteria were present at all of the sampling sites and, on at least one sampling date, maximum values were over 31 cfu/100 ml at all sites. The geometric mean range from 9 to 19 cfu/100 ml and was > 14 cfu/100 ml at WA03, WA04, and WA06 (Figure 34). *Enterococci* were also present at all sites with geometric means > MDLs.

Average ammonia-N concentrations was low and concentrations were below the MDL of 0.003 mg/L at all of the sites except WA06 (Table30). Total and dissolved Cu and Ni were < 1.0 µg/L at all sites, and concentrations of total and dissolved Zn were >1.0 and < 2.5 µg/L.

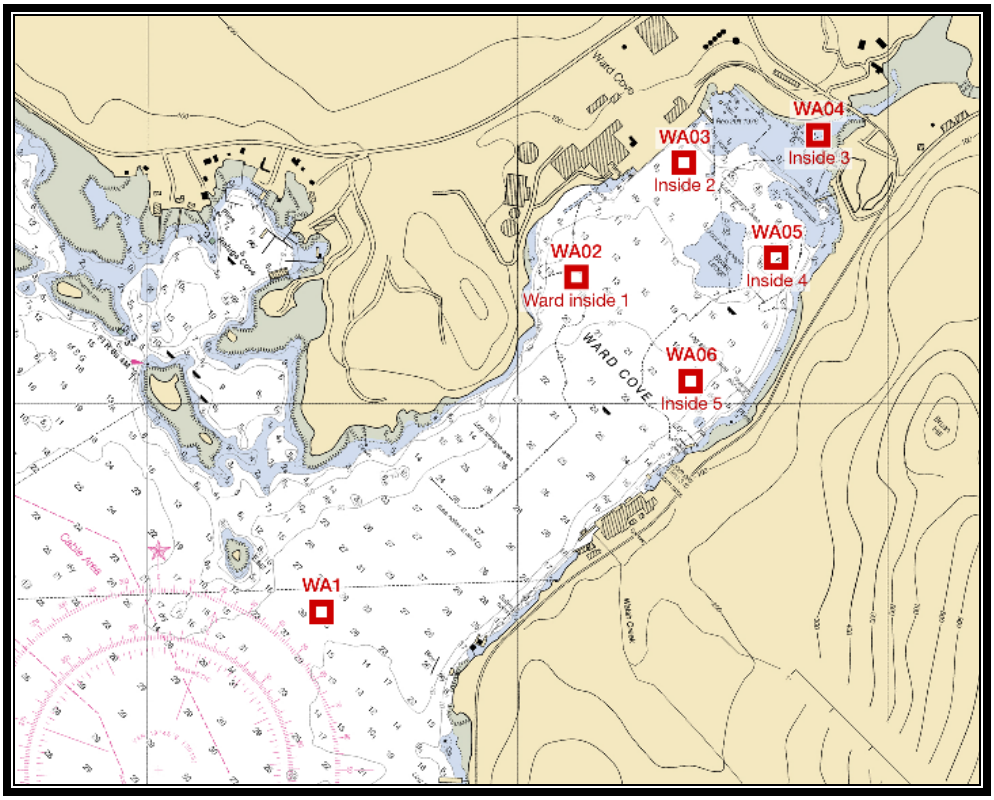

Figure 33. Locations of the six sampling sites in Ward Cove.

Table 29. Water temperatures (C), salinity (ppt), pH, and dissolved oxygen (D.O. mg/L) from 1 to 4m water depths at Ward Cove sampling sites on July 9, 2020.

Temp (C)	1m	2m	3m	4m
WA01	13.30	13.00	12.90	12.90
WA02	14.50	14.30	14.20	13.60
WA03	14.10	13.90	13.80	13.80
WA04	14.50	14.20	13.90	13.70
WA05	14.40	14.20	13.80	13.70
WA06	13.90	13.80	13.70	13.70
Average	14.12	13.90	13.72	13.57

Salinity (ppt)	1m	2m	3m	4m
WA01	26.40	26.50	26.50	26.50
WA02	25.20	25.60	25.70	26.00
WA03	24.20	25.80	25.90	26.00
WA04	24.20	25.80	25.80	26.00
WA05	24.60	25.60	25.90	26.00
WA06	25.10	25.10	25.80	25.90
Average	24.95	25.73	25.93	26.07

pH	1m	2m	3m	4m
WA01				
WA02	8.61	8.62	8.62	8.62
WA03	8.61	8.63	8.64	8.62
WA04	8.59	8.60	8.61	8.61
WA05	8.61	8.62	8.62	8.53
WA06	8.51	8.55	8.55	8.55
Average	8.59	8.60	8.60	8.59

D.O. (mg/L)	1m	2m	3m	4m
WA01	10.50	10.44	10.36	10.35
WA02	10.95	11.02	11.03	11.06
WA03	11.39	11.52	11.65	11.64
WA04	11.25	11.41	11.34	11.40
WA05	11.33	11.39	11.45	11.54
WA06	11.36	11.37	11.29	11.26
Average	11.13	11.19	11.19	11.21

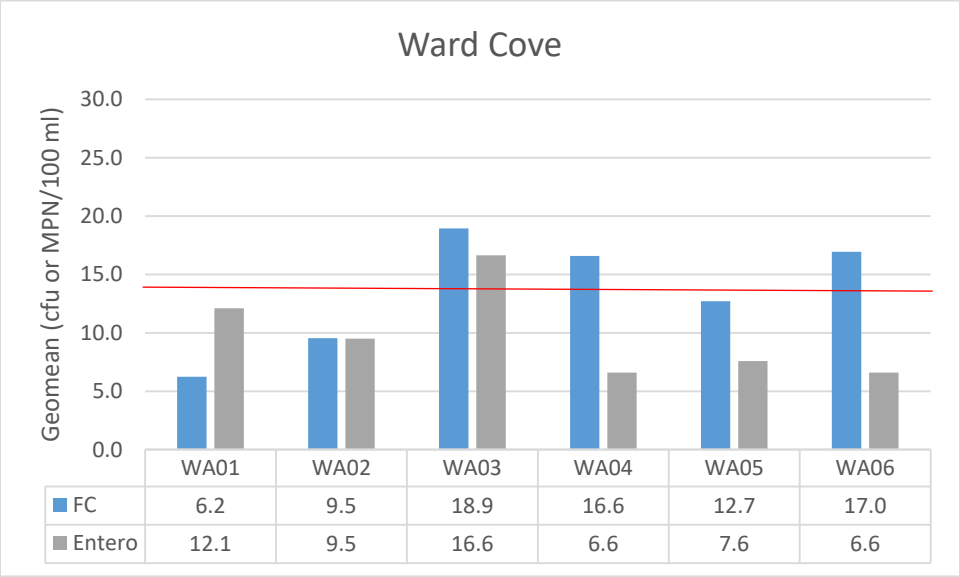

Figure 34. Geometric mean concentrations of fecal coliform and *Enterococci* bacteria at the six sampling sites in Ward Cove. The MDL for *Enterococci* was 10 MPN/100 ml. Values below the MDL were reported as 5 MPN/100 ml. Red line is WQ numeric criteria for fecal coliforms 14 cfu/100 ml.

Table 30. Concentrations of ammonia and metals at the Ward Cove sampling sites. Values of 0.5 x MDL are shown were results are < MDL and are used to calculate location averages. T is total and D is dissolved.

Site	Ammonia-N (mg/L)	T-Cu (µg/L)	D-Cu (µg/L)	T-Ni (µg/L)	D-Ni (µg/L)	T-Zn (µg/L)	D-Zn (µg/L)
WA01	0.002	0.3	0.48	0.28	0.29	1.07	0.55
WA02	0.002	0.48	0.42	0.31	0.3	1.57	1.09
WA03	0.002	0.58	0.51	0.37	0.35	1.73	1.52
WA04	0.002	0.61	0.55	0.35	0.38	2.05	1.83
WA05	0.002	0.62	0.58	0.33	0.3	2.5	2.07
WA06	0.005	0.49	0.58	0.31	0.31	1.66	2.27
Average	0.002	0.51	0.52	0.33	0.32	1.76	1.56

Ketchikan-Tongass Narrows

Sampling site in Tongass Narrows near Ketchikan were representative of the north and south channel (KE07 and KE09), near cruise ship berths (KE04, KE05, KE08), Thomas Basin (a small boat harbor), the mouth of Ketchikan Creek (KE01), and within the middle of the channel (KE02, KE03, and KE06) (Figure 35).

There was very little variability in water quality parameters among sites or with depth except for the fresh water influence at KE01. Average water temperature was 13.9°C but 13°6 at KE01. Surface salinity at KE01 was 21.9 ppt which was less than the average salinity of 23.6 ppt, but increased to 24.7 ppt at 4m water depth (Table 31). The pH and dissolved oxygen concentrations at KE01 were also slightly below average Tongass narrows values of 8.62 and 10.24 mg/L respectively.

Fecal coliform bacteria were present at all Tongass Narrows sampling sites with geometric means ranging from 3.6 cfu/100 ml at KE09 in the North Channel to 16.6 at KE04, adjacent to one of the cruise ship berths (Figure 36). Fecal coliform bacteria exceeded WQC in Thomas Basin with a geometric mean of 44 cfu/100 ml and four of the five samples with concentrations > 31 cfu/100 ml. The concentrations of fecal coliforms also exceeded WQC at KE04 and three of the five samples exceeded 31 cfu/100 ml.

Concentrations of ammonia-N and total and dissolved metals were low at all sites (Table 32). Average ammonia-N concentration was 0.004 mg/L with values below MDL of 0.003 mg/L at 5 of the 9 sampling sites including the site in Thomas Basin. Average total and dissolved metals concentrations were < 1 µg/L. The highest metals concentrations were at KE04 where total and dissolved Zn was > 1 and< 2 µg/L.

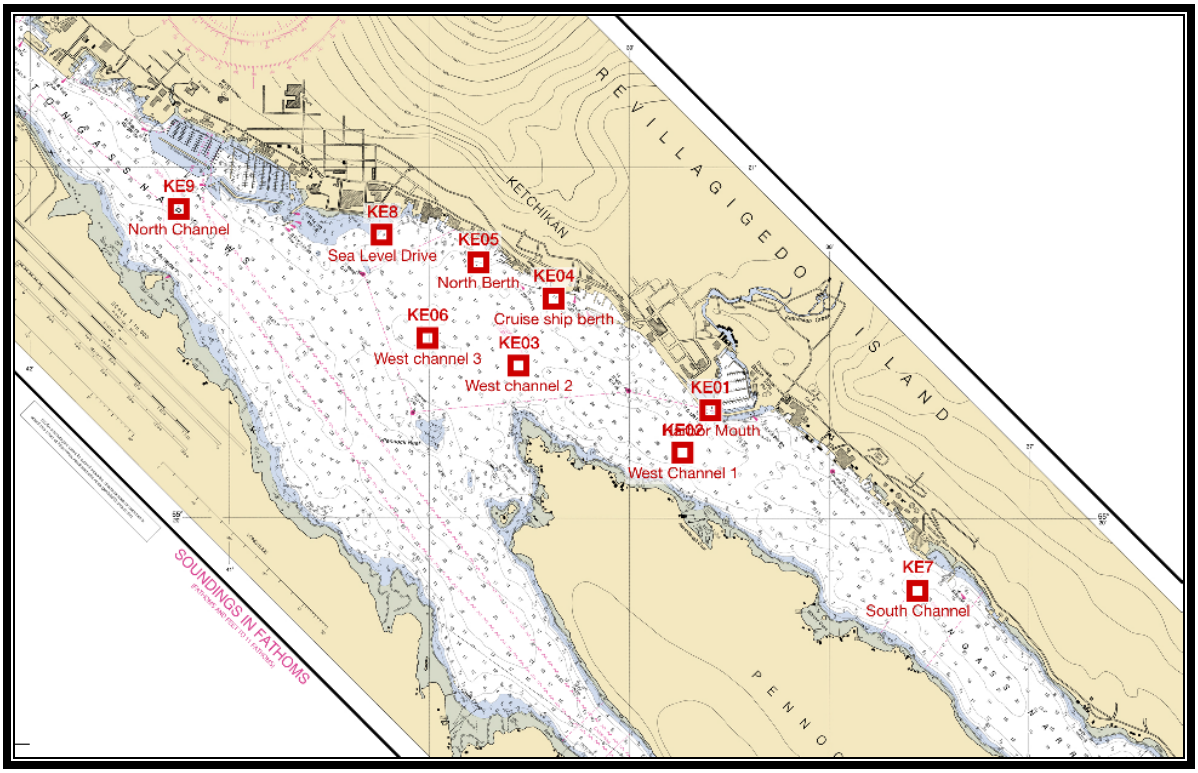

Figure 35. Locations of the nine sampling sites near Ketchikan.

Table 31. Water temperatures (C), salinity (ppt), pH, and dissolved oxygen (D.O. mg/L) from 1 to 4m water depths at Ketchikan sampling sites on July 9, 2020.

Temp (C)	1m	2m	3m	4m
KE01	13.70	13.70	13.60	13.50
KE02	14.10	14.90	13.60	13.60
KE03	14.10	14.00	14.00	13.90
KE04	13.90	13.80	13.60	13.10
KE05	14.00	13.90	13.80	13.70
KE06	13.70	13.70	13.70	13.60
KE07	14.10	14.00	13.70	13.50
KE08	13.90	13.80	13.70	13.70
KE09	14.10	14.00	13.80	13.60
Average	13.96	13.98	13.72	13.58

Salinity (ppt)	1m	2m	3m	4m
KE01	21.90	23.80	24.10	24.70
KE02	23.90	24.20	24.60	24.70
KE03	23.10	24.00	24.00	24.10
KE04	23.80	24.10	24.60	25.20
KE05	24.00	24.10	24.50	24.60
KE06	24.20	24.50	24.70	24.80
KE07	24.00	24.10	24.60	24.70
KE08	23.70	24.40	24.40	24.60
KE09	23.80	23.90	24.70	24.80
Average	23.60	24.12	24.47	24.69

pH	1m	2m	3m	4m
KE01	8.59	8.58	8.58	8.45
KE02	8.63	8.62	8.61	8.48
KE03	8.61	8.62	8.62	8.54
KE04	8.61	8.60	8.59	8.51
KE05	8.62	8.63	8.62	8.56
KE06	8.62	8.62	8.63	8.50
KE07	8.62	8.61	8.60	8.59
KE08	8.62	8.62	8.62	8.45
KE09	8.63	8.63	8.61	8.53
Average	8.62	8.61	8.61	8.51

D.O. (mg/L)	1m	2m	3m	4m
KE01	10.05	10.05	10.03	9.97
KE02	10.34	10.29	10.19	10.15
KE03	10.26	10.28	10.26	10.22
KE04	10.17	10.11	10.04	9.97
KE05	10.28	10.27	10.24	10.20
KE06	10.21	10.25	10.26	10.26
KE07	10.27	10.26	10.19	10.15
KE08	10.25	10.25	10.23	10.22
KE09	10.29	10.32	10.27	10.27
Average	10.24	10.23	10.19	10.16

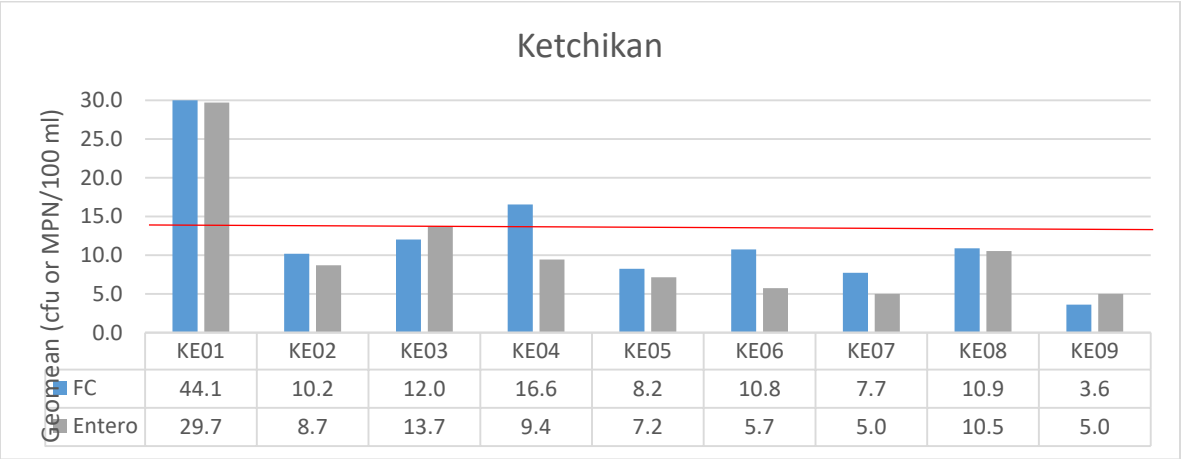

Figure 36. Geometric mean concentrations of fecal coliform and *Enterococci* bacteria at the nine sampling sites near Ketchikan. The MDL for *Enterococci* was 10 MPN/100 ml. Values below the MDL were reported as 5 MPN/100 ml. Red line is WQ numeric criteria for fecal coliforms 14 cfu/100 ml.

Table 32. Concentrations of ammonia and metals at the Ketchikan sampling sites. Values of 0.5 x MDL are shown were results are < MDL and are used to calculate location averages. T is total and D is dissolved.

Site	Ammonia-N (mg/L)	T-Cu (µg/L)	D-Cu (µg/L)	T-Ni (µg/L)	D-Ni (µg/L)	T-Zn (µg/L)	D- Zn (µg/L)
KE01	0.002	0.46	0.43	0.28	0.26	1.93	1.83
KE02	0.008	0.26	0.23	0.27	0.27	0.10	0.21
KE03	0.002	0.31	0.30	0.28	0.27	0.36	0.42
KE04	0.002	0.42	0.37	0.28	0.27	1.24	1.12
KE05	0.011	0.33	0.27	0.28	0.27	0.81	0.33
KE06	0.002	0.35	0.25	0.29	0.26	0.55	0.25
KE07	0.005	0.26	0.25	0.27	0.27	0.24	0.43
KE08	0.003	0.30	0.27	0.28	0.29	0.49	0.45
KE09	0.002	0.27	0.25	0.27	0.27	0.30	0.25
Average	0.004	0.33	0.29	0.28	0.27	0.67	0.59

Shipping Lanes

Water samples were collected in September within all major channels (canals, straights, sounds, and passages) in Southeast Alaska (Figures 38 and 39). Site names are based on the first letters of the channel names.

There was little variability in water quality parameters among sampling sites or with water depth, with the exception of sites in Sumner Strait, and to a lesser extent, Icy Strait (IS02) where salinity was slightly higher, and water temperature, pH, and dissolved oxygen lower that average values. Water temperature among all sites averaged 10.6°C and ranged from 13.5°C in Clarence Strait to 8.1°C in Sumner Strait (Table 33). There were only small differences in water temperature with depth among these open water sites with an average decrease of 1.3°C from 1m to 4m water depth. There was very small differences in salinity among sites which ranged from near 25 to 30 ppt for most sites. Surface salinity was lowest at SP02, in Taku Inlet, at 19.8 ppt due to freshwater from the Taku River. There was little variation in salinity with depth with the exception of SP02 where salinity increased from 19.8 to 23.6 ppt at 4 m water depth. Salinity was highest (>30 ppt) at the sampling sites in Sumner Strait. Average pH among sites was 8.2 and ranged from 7.8 (Sumner Strait) to 8.5 (Fredrick Sound) (Table 34). Dissolved oxygen was very low in Sumner Strait (6.5 to 8.5 mg/L), and Icy Strait (IS02), but near or above the average of 10.10 mg/L at the other sites.

Fecal coliform bacteria, *Enterococci* bacteria, and concentrations of ammonia-N were below MDL during the single sampling event at all sampling sites, with exception being the sites located on the North and South end of Tongass Narrows (CS01 and NI01) (Figure 40 and Table 35). CS01 also had high concentrations of total Cu and total Zn. Concentrations of total and dissolved metals at the other Shipping Lanes sites were below 1 µg/L except for the site it Taku Inlet (SP020 where concentrations of total metals were > 1 and < 2 µg/L.

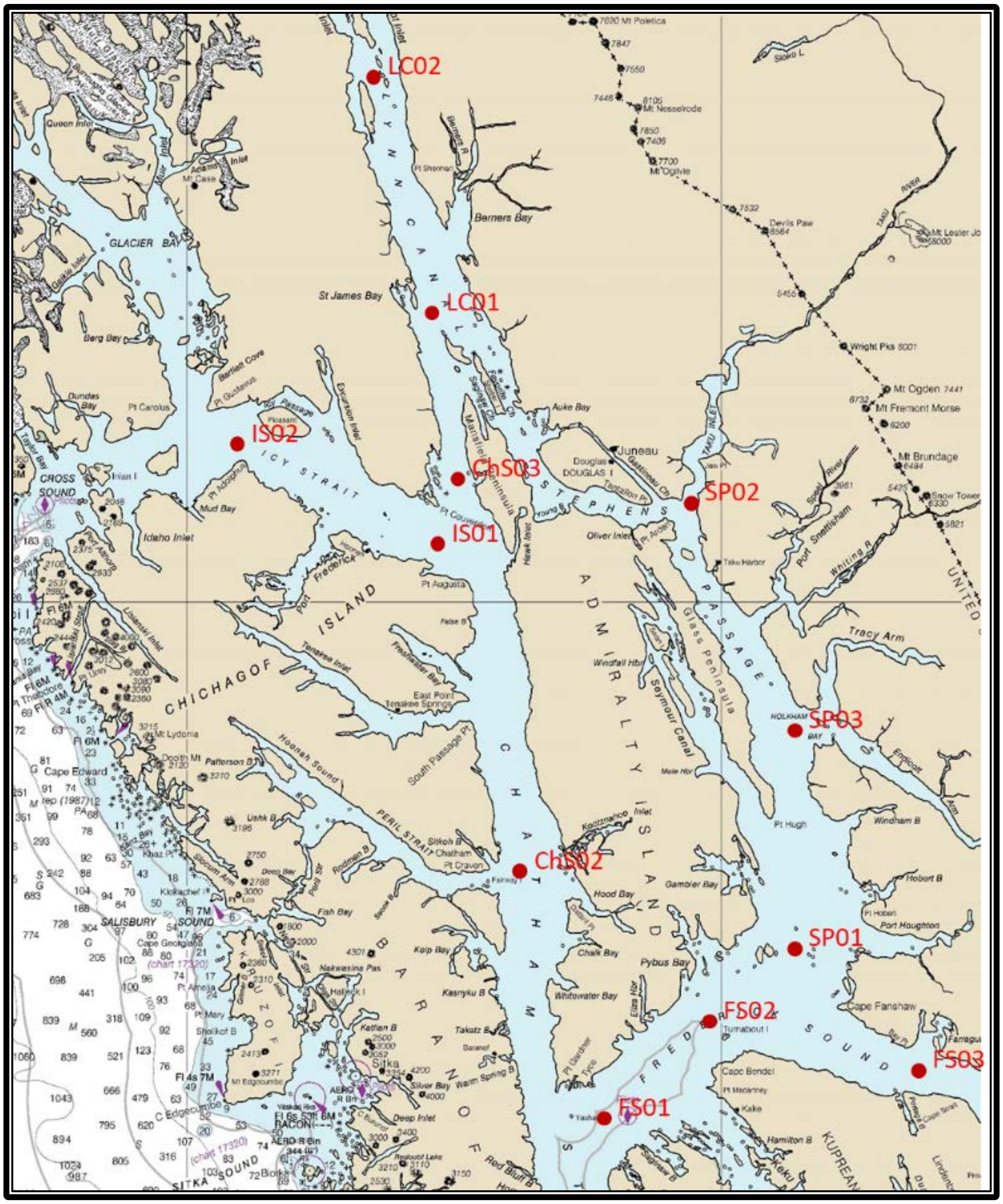

Figure 37. Locations of the 12 northern Shipping Lanes sampling sites.

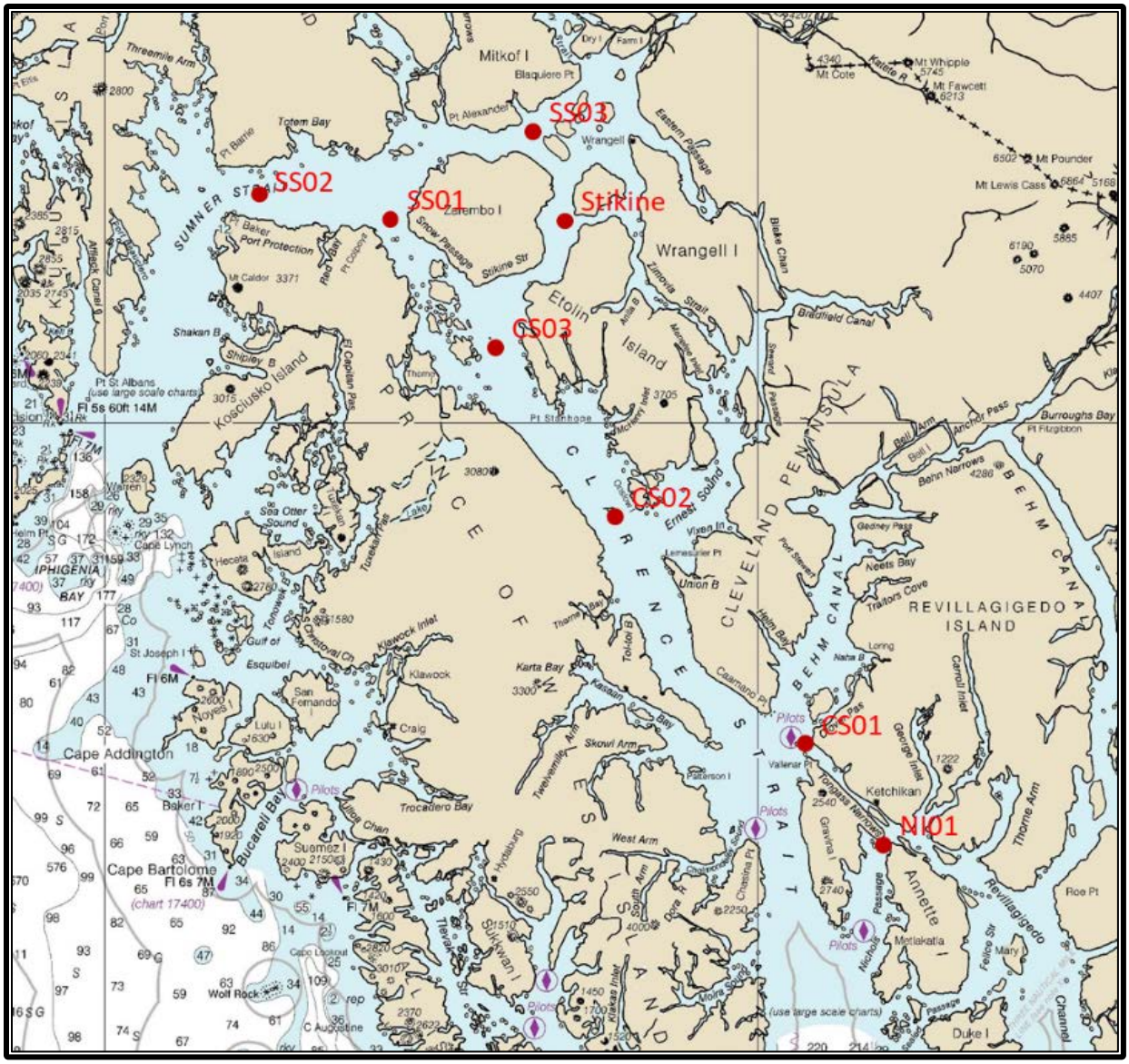

Figure 38. Locations of eight south Shipping Lanes sampling sites.

Table 33. Water temperatures (C) and salinity (ppt) from 1 to 4m water depths at Shipping Lane sampling sites on September 17 through 20, and 24th, 2020.

Temp (C)	1m	2m	3m	4m
CHS02	10.50	10.50	10.50	10.50
CHS03	10.50	10.40	10.30	10.20
CS01	11.70	11.70	11.70	11.70
CS02	13.50	13.50	13.50	13.50
CS03	12.80	12.80	12.80	12.60
FS01	10.10	9.90	9.60	9.40
FS02	10.00	10.00	9.00	8.70
FS03	9.30	9.20	9.20	9.10
IS01	11.10	11.10	11.10	11.10
IS02	8.40	8.50	8.40	8.40
LC01	10.00	10.00	9.90	9.90
LC02	9.80	9.80	9.70	9.60
NI01	12.30	12.30	12.30	12.30
SP01	9.40	9.10	8.90	8.90
SP02	8.30	8.40	8.70	8.70
SP03	8.50	8.50	8.30	8.40
SS01	8.10	8.00	8.00	8.00
SS02	8.20	8.20	8.10	8.10
SS03	9.30	9.20	9.00	8.90
Stikine	10.60	10.50	10.40	10.30

Salinity (ppt)	1m	2m	3m	4m
CHS02	26.80	26.80	26.80	26.90
CHS03	25.30	26.10	26.20	26.20
CS01	27.20	27.20	27.20	27.20
CS02	25.10	25.10	25.10	25.10
CS03	23.30	25.20	25.20	25.23
FS01	26.50	26.80	27.30	27.80
FS02	27.50	27.60	29.00	29.40
FS03	27.00	27.10	27.20	27.60
IS01	23.30	23.30	23.30	23.30
IS02	29.40	29.50	29.40	29.50
LC01	26.70	26.80	27.10	27.20
LC02	25.70	25.90	26.00	26.40
NI01	25.70	25.70	25.70	25.70
SP01	27.90	28.30	28.50	28.60
SP02	19.80	20.20	21.20	23.60
SP03	28.20	28.20	28.30	28.30
SS01	31.30	31.40	31.40	31.40
SS02	31.30	31.30	31.30	31.30
SS03	26.70	27.70	28.60	28.70
Stikine	26.30	26.40	26.70	26.70

Table 34. Water pH and dissolved oxygen (D.O.) from 1 to 4m water depths at Shipping Lane sampling sites on September 17 through 20, and 24th, 2020.

pH				
	1m	2m	3m	4m
CHS02	8.29	8.29	8.26	8.23
CHS03	8.20	8.19	8.24	8.14
CS01	8.16	8.16	8.14	8.21
CS02	8.39	8.39	8.35	8.35
CS03	8.43	8.43	8.43	8.39
FS01	8.51	8.47	8.26	8.26
FS02	8.44	8.39	8.15	8.07
FS03	8.50	8.52	8.56	8.33
IS01	8.41	8.41	8.39	8.41
IS02	8.00	8.00	7.97	8.00
LC01	8.22	8.18	8.12	8.13
LC02	8.16	8.15	8.14	8.15
NI01	8.36	8.35	8.77	8.77
SP01	8.38	8.44	8.35	8.39
SP02	8.11	8.04	8.12	8.02
SP03	8.29	8.30	8.26	8.23
SS01	7.85	7.85	7.86	7.85
SS02	7.88	7.88	7.88	7.88
SS03	7.86	7.85	7.85	7.85
Stikine	7.98	7.95	7.97	7.92

D.O. (mg/L)	1m	2m	3m	4m
CHS02	10.89	10.84	10.83	10.79
CHS03	10.56	10.56	10.54	10.57
CS01	9.06	9.06	9.15	9.05
CS02	10.53	10.51	10.50	10.48
CS03	11.78	11.76	11.74	11.67
FS01	13.37	12.80	11.94	11.70
FS02	12.67	12.52	10.77	9.61
FS03	10.68	10.61	10.45	10.14
IS01	11.64	11.64	11.65	11.67
IS02	8.25	8.60	8.33	8.24
LC01	10.37	10.34	10.20	10.14
LC02	10.50	10.56	10.52	10.47
NI01	9.81	9.79	9.81	9.80
SP01	11.37	11.02	10.52	10.28
SP02	10.16	10.15	10.06	10.05
SP03	12.25	12.25	12.03	11.98
SS01	5.80	5.78	5.74	5.71
SS02	6.54	6.27	6.16	6.11
SS03	7.35	7.22	6.95	6.83
Stikine	8.51	8.46	8.36	8.31

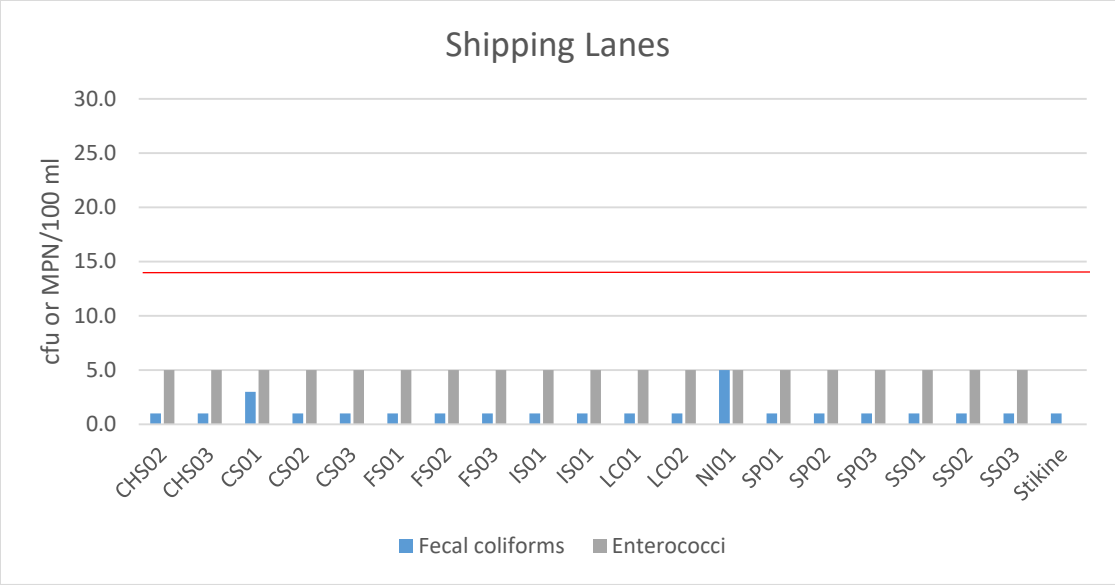

Figure 39. Concentrations of fecal coliform and *Enterococci* bacteria at the 20 shipping lane sites. The MDL for *Enterococci* was 10 MPN/100 ml. Values below the MDL were reported as 5 MPN/100 ml. Red line is WQ numeric criteria for fecal coliforms 14 cfu/100 ml.

Table 35. Concentrations of ammonia and metals at the Shipping Lanes sampling sites. Values of 0.5 x MDL are shown were results are < MDL and are used to calculate location averages. T is total and D is dissolved.

Site	Ammonia-N (mg/L)	T-Cu (µg/L)	D-Cu (µg/L)	T-Ni (µg/L)	D-Ni (µg/L)	T-Zn (µg/L)	D-Zn (µg/L)
CHS02	0.002	0.24	0.20	0.38	0.34	0.24	0.10
CHS03	0.002	0.28	0.23	0.36	0.33	0.25	0.10
CS01	0.038	22.50	0.43	0.41	0.33	14.80	0.98
CS02	0.002	0.26	0.24	0.30	0.28	0.10	0.21
CS03	0.002	0.29	0.26	0.32	0.32	0.10	0.10
FS01	0.002	0.27	0.23	0.39	0.37	0.40	0.25
FS02	0.002	0.31	0.24	0.44	0.38	2.25	0.92
FS03	0.002	0.32	0.28	0.41	0.38	0.28	0.28
IS01	0.002	0.26	0.23	0.35	0.35	0.43	0.10
IS02	0.002	0.30	0.22	0.51	0.44	0.42	0.30
LC01	0.002	0.28	0.21	0.40	0.35	0.58	0.61
LC02	0.002	0.25	0.25	0.43	0.35	0.25	0.10
NI01	0.049	0.32	0.23	0.30	0.29	0.26	0.33
SP01	0.002	0.27	0.22	0.39	0.36	0.35	0.28
SP02	0.002	1.14	0.41	1.69	0.83	1.96	0.49
SP03	0.002	0.28	0.25	0.40	0.41	0.30	0.21

Site	Ammonia-N (mg/L)	T-Cu (µg/L)	D-Cu (µg/L)	T-Ni (µg/L)	D-Ni (µg/L)	T-Zn (µg/L)	D-Zn (µg/L)
SS01	0.002	0.25	0.17	0.46	0.36	0.80	0.47
SS02	0.002	0.22	0.16	0.42	0.35	0.61	0.54
SS03	0.002	0.57	0.36	0.60	0.42	0.70	0.49
Stikine	0.002	0.39	0.31	0.41	0.37	0.47	0.34
Average	0.006	1.45	0.26	0.47	0.38	1.28	0.36

Site Comparisons

The average port concentrations of ammonia-N, Cu, Ni, and Zn are shown in Table 36. Ammonia-N was below MDL (0.003 mg/L) in six of the 16 ports and in 18 of the 20 Shipping Lanes sampling sites. Ammonia-N concentrations were ≤ 1 mg/L in 8 sites and the maximum average port value was 0.043 mg/L in Wrangell Narrows by Petersburg (Table 36).

Total Cu concentrations ranged from 0.30 µg/L to 15.25 µg/L; however, average concentrations were < 1.0µg/L at 12 of the 16 ports, and < 3.0 µg/L at 15 of the 16 ports (Table 36). Dissolved Cu was < 1.0 µg/L at 14 of the 16 sites, 1.83 µg/L in Wrangell, and 8.62 µg/L in Anchorage. Similar trends were observed for Ni and Zn. Average dissolved Ni was < 1.0 µg/L, and average dissolved Zn was < 3.0 µg/L at all ports except for Anchorage.

Table 36. Average port concentrations of Ammonia-N and total (T) and dissolved (D) metals, sorted by port name.

	Ammonia-N (mg/L)	T-Cu (µg/L)	D-Cu (µg/L)	T-Ni (µg/L)	D-Ni (µg/L)	T-Zn (µg/L)	D-Zn (µg/L)
Anchorage	0.009	15.25	8.62	9.90	5.91	23.37	12.90
Auke Bay	0.014	0.98	0.87	0.58	0.52	1.66	1.13
Haines	0.006	0.45	0.39	0.26	0.31	0.93	0.52
Homer	0.002	0.76	0.51	0.64	0.45	1.12	0.63
Hoonah	0.002	0.30	0.28	0.37	0.34	0.22	0.17
Juneau	0.002	0.68	0.58	0.66	0.58	1.30	0.66
Ketchikan	0.004	0.33	0.29	0.28	0.27	0.67	0.59
Kodiak	0.023	0.58	0.46	0.36	0.34	2.51	2.03
Petersburg	0.043	0.41	0.41	0.39	0.39	0.58	0.93
Seward	0.015	2.06	0.81	1.76	0.75	3.13	1.50
S. Lanes	0.006	1.45	0.26	0.47	0.38	1.28	0.36
Sitka	0.002	0.39	0.40	0.27	0.24	0.93	0.76
Skagway	0.014	0.42	0.47	0.24	0.27	2.62	2.38
Valdez	0.009	1.26	0.30	1.36	0.65	2.18	0.79
Ward Cove	0.002	0.51	0.52	0.33	0.32	1.76	1.56
Whittier	0.005	0.79	0.57	0.66	0.51	2.41	1.58
Wrangell	0.002	2.58	1.83	1.78	0.88	3.27	2.10
Maximum	0.043	15.25	8.62	9.90	5.91	23.37	12.90
Minimum	0.002	0.30	0.26	0.24	0.24	0.22	0.17

Ocean water temperatures, pH, and dissolved oxygen concentrations were similar among sampling ports. Water temperatures at 1m water depth, measured from late June through September, ranged from 10 to 15°C. The pH ranged from 8.13 to 8.62 and dissolved oxygen from 9.2 to 11.9 mg/L. Salinity was variable among site ranging from approximately 4 ppt in Valdez and Skagway to 30 ppt in Seward and Kodiak (Table 37).

A total of six ports had one or more sites with geometric mean fecal coliform bacteria counts > 20 cfu/100 ml: Valdez (3), Seward (2), Homer (1), Juneau (1), Hoonah (1), and Ketchikan (1). All of these sites also had concentrations of fecal coliform bacteria > 40 cfu/100 ml in one or more of the five samples. In Seward high fecal counts were found at sites near the commercial and cruise ship berths. At all of the other sites high fecal coliforms were found at sites associated with small boat harbors.

Table 37. Average port water temperature, salinity, pH, and dissolved oxygen (D.0.).

	Temperature (C)	**Salinity (ppt)**	**pH**	**D.O. (mg/L)**
Anchorage	15.40	8.15	8.17	9.26
Auke Bay	14.50	14.70	8.55	10.50
Haines	12.02	7.32	8.37	10.90
Homer	12.80	23.60	8.26	10.28
Hoonah	13.76	25.18	8.46	11.65
Juneau	12.22	15.35	8.50	11.90
Ketchikan	13.96	23.60	8.62	10.24
Kodiak	12.42	31.65	8.15	10.33
Petersburg	10.72	24.73	8.13	9.86
Seward	13.28	28.63	8.23	10.96
Shipping Lanes	10.12	26.55	8.22	10.10
Sitka	13.75	26.61	8.24	11.10
Skagway	11.26	3.87	8.13	10.35
Valdez	11.01	3.33	8.17	10.98
Ward Cove	14.12	24.95	8.33	11.13
Whittier	15.33	19.35	8.35	10.04
Wrangell	12.55	13.95	8.33	10.36
Maximum	15.40	31.65	8.62	11.90
Minimum	10.12	3.33	8.13	9.26

References

ARRI. 2018. CPVEC Ambient Water Quality Monitoring: Juneau and Skagway Harbors September 2015 through October 2017. Final Report for the Alaska Department of Environmental Conservation, Division of Water, Commercial Passenger Vessel Environmental Compliance Program. Aquatic Restoration and Research Institute, Talkeetna AK.

ARRI 2019. CPVEC Ambient Water Quality Monitoring: Sitka, Hoonah, and Ketchikan Harbors 2018. Final Report for the Alaska Department of Environmental Conservation, Division of Water, Commercial Passenger Vessel Environmental Compliance Program. Aquatic Restoration and Research Institute, Talkeetna AK.

ARRI. 2020. CPVEC Ambient Water Quality Monitoring: Ketchikan (2018-2019) and Seward Harbors (2019). Final Report for the Alaska Department of Environmental Conservation, Division of Water, Commercial Passenger Vessel Environmental Compliance Program. Aquatic Restoration and Research Institute, Talkeetna AK.

Davis, J.C. and G.A. Davis. 2011. Lower Ship Creek Water Quality Monitoring as Related to Petroleum Hydrocarbon Pollution and Fecal Coliform Bacteria. Final Report for the Alaska Department of Environmental Conservation. Contract No. 18-6002. The Aquatic Restoration and Research Institute. Talkeetna, AK.

DEC. 2018a. Department of Environmental Conservation 18 AAC 70 Water Quality Standards as Amended as of April 6 2018.

DEC 2018b. State of Alaska Department of Environmental Conservation. Alaska Water Quality Criteria for Toxic and Other Deleterious Organic and Inorganic Substances Amended as of April 6 2108.

Appendix A. Quality Assurance

Metals were present in trip blanks at concentrations near MDLs. Trip blanks are sealed sample bottles of distilled water within double layers of plastic bags and are never opened. Trip blanks accompany the sample bottles throughout sampling and shipping. Therefore, metals in trip blanks are either present in the distilled water, enter the sample bottles in transit, or are the result of variability in the analytical methods. Total Cu was present in six, and Ni and Zn in two of the 11 trip blanks (Table 38). Excluding sample values below MDLs, average metal concentrations ranged from 0.05 µg/L (Cu) to 0.55 µg/L (Zn).

Ammonia-N and metals were present in equipment blanks. Equipment blanks are samples of laboratory-provide distilled water collected in the field using the same methods as field samples. Ammonia-N and metals can be present in sample bottles, tubing, filters, or preservative or contaminate samples through wind dispersed particles, transferred from the boat or samplers. Cu was also present in 11 of the 12 equipment blanks at an average concentration of 0.09 µg/L. Ni was present in one or two of the 12 equipment blanks. Zn was present in four to six of the 12 equipment blanks. Therefore, sample results for total and dissolved metals may be biased high and concentrations marine waters may be lower than reported values.

Sample precision was calculated from field replicate samples (difference/average). Field replicates were not split samples but were collected sequentially. Replicate samples were collected from a drifting boat; therefore, depending on winds and tides, replicates were not always collected from the exact same locations. Precision was only calculated when both sample values were > MDL. Precision quality objectives (0.20) were met for total and dissolved Cu and Ni but for Zn (Table 39). The maximum difference in replicate samples analyzed for dissolved Cu was 0.18 µg/L and for Ni, 0.22 µg/L. These concentrations are close to the method reporting limits of 0.10 and 0.20 µg/L, respectively. Five of the 11 field replicates analyzed for dissolved Zn, and four of the 11 field replicates analyzed for total Zn did not meet the precision quality objectives. The maximum differences in concentrations were 1.7 µg/L (dissolved Zn) and 2.9 µg/L (total Zn). The average difference between replicate samples of total and dissolved Zn was 0.5 µg/L. Because concentrations of Zn in marine waters (< 0.33 µg/L) were generally much less than WQC (81 µg/L), these small differences will not affect project objectives, but should be taken into consideration when used to authorize wastewater discharge.

The temperatures of water samples upon receipt at the analytical laboratories are shown in Table 40. The temperatures of water samples analyzed for fecal coliforms and *Enterococcus* bacteria met the quality assurance objective (<10°C), except for two samples. Water samples collected for ammonia-N analyses were acidified, but cooler temperatures exceeded quality objectives particularly for samples collected in the Homer, Ketchikan, Ward Cove, Petersburg, and Wrangell Harbors. Therefore reported concentrations may be biased low and actual concentrations may be higher than reported. However, ammonia-N concentrations were near MDLs at most of the sampling sites.

Table 38. Total number of blanks collected, number of samples with values > MDL, and average value of samples when value > MDL.

Measure	Type of Blank	Total Samples	Samples values >MDL	Average of Samples with value > MDL
Total Cu (µg/L)	Trip Blank	11	6	0.05
Total Ni (µg/L)	Trip Blank	11	2	0.07
Total Zn (µg/L)	Trip Blank	11	2	0.55
Ammonia-N (mg/L)	Equipment	13	5	0.06
Dissolved Cu (µg/L)	Equipment	12	11	0.09
Total Cu (µg/L)	Equipment	12	11	0.09
Dissolved Ni (µg/L)	Equipment	12	1	0.12
Total Ni (µg/L)	Equipment	12	2	0.25
Dissolved Zn (µg/L)	Equipment	12	6	0.54
Total Zn (µg/L)	Equipment	12	4	2.95

Table 39. Sample precision from field replicates. Precision was calculated when original and replicate sample values were > MDL. Quality objectives for precision (< 0.20) were met for Ammonia-N, Cu, and Ni but not for total and dissolved Zn.

Measure	Total Samples	Number of Samples	Precision
Ammonia-N (mg/L)	11	3	0.20
Dissolved Cu (µg/L)	11	11	0.11
Total Cu (µg/L)	11	11	0.01
Dissolved Ni (µg/L)	11	11	0.06
Total Ni (µg/L)	11	11	0.07
Dissolved Zn (µg/L)	11	9	0.46
Total Zn (µg/L)	11	9	0.34

Table 40. Port sampling dates and cooler temperatures upon receipt at the analytical laboratory. Temperatures of bacteria samples rarely exceeded holding temperature of 10°C. Cooler temperatures of Ammonia-N exceeded 4°C at most sites due to extended shipping Federal Express shipping times related to Covid-19 (Bolded). Samples for metals were field filtered and acid preserved and do not require holding at low temperatures. NR is not recorded by the analytical laboratory.

Port Name	Bacteria Sampling Dates/Cooler Temp					Ammonia/Metals Sampling Date/Cooler Temp
Anchorage	7/6/2020; 8.9°C	7/9/2020; 5.2°C	7/13/2020; **10.7°C**	7/14/2020; **10.8°C**	7/27,28/2020; 3.5°C/11.2°C	7/27/2020; **10.0°C**
Dutch Harbor (Unalaska)	9/26/2020; 5.0°C	9/28/2020; 5.3°C	10/2/2020; 5.9°C	10/3/2020; 4.2°C	10/9/2020; 5.4°C	Not Sampled
Haines	7/1/2020; 4.47°C	7/7/2020; 5.11°C	7/9/2020; 5.12°C	7/14/2020; 2.8°C	7/16/2020; 6.82°C	6/27/2020; **5.9°C**
Homer	7/23/2020; 6.2°C	7/28/2020; 6.4°C	7/30/2020; 4.8°C	8/5/2020; 3.7°C	8/14/2020; 6.9°C	7/23/2020; **15.6°C**
Hoonah	7/7/2020; 9.7°C	7/20/2020; 2.69°C	7/23/2020; 6.10°C	7/27/2020; 2.48°C	7/30/2020; 3.69°C	7/7/2020; **5.7°C**
Juneau	7/8/2020; 9.27°C	7/13/2020; 6.54°C	7/15/2020; 6.6°C	7/20/2020; 4.71°C	7/23/2020; 7.41°C	7/2/2020; **7.4°C**
Auke Bay	7/8/2020: 9.27°C	7/13/2020; 6.54°C	7/15/2020; 6.6°C	7/20/2020; 4.71°C	7/23/2020; 7.41°C	7/2/2020; **7.4°C**
Ketchikan	7/9/2020; NR	7/13/2020; NR	7/16/2020; NR	7/20/2020; NR	7/23/2020; NR	7/9/2020; **19.3°C**
Ward Cove	7/9/2020; NR	7/13/2020; NR	7/16/2020; NR	7/20/2020; NR	7/23/2020; NR	7/9/2020; **19.3°C**
Kodiak	8/6/2020; 4.2°C	8/11/2020; 3.82	8/13/2020; 3.3°C	8/17/2020; 5.72°C	8/25/2020; 6.0°C	8/6/2020; **4.5°C**
Nome	8/26/2020; 4.7°C	8/27/2020 3.6°C	8/28/2020; 3.7°C	8/31/2020; 7.6°C	9/1/2020; 4.2°C	Not Sampled
Petersburg	7/9/2020; 4.54°C	7/12/2020; NR	7/21/2020; NR	7/22/2020; 6.91°C	7/27/2020; NR	7/9/2020; **16.8°C**
Seward	7/9/2020; 5.8°C	7/14/2020; 6.1°C	7/15/2020; 5.9°C	7/20/2020; 6.9°C	7/22/2020; 6.4°C	7/20/2020; **4.6°C**
Sitka	7/6/2020; 9.8°C	7/9/2020; 7.48°C	7/13/2020; 5.78°C	7/23/2020; 8.0°C	8/4/2020; 7.87°C	7/6/2020; **5.3°C**
Skagway	6/29/2020; 8.19°C	7/1/2020; 4.97°C	7/9/2020; 2.09°C	7/14/2020; 5.89°C	7/16/2020; 0.84°C	6/29/2020; **5.9°C**

Port Name	Bacteria Sampling Dates/Cooler Temp					Ammonia/Metals Sampling Date/Cooler Temp
Valdez	7/31/2020; 5.1°C	8/4/2020; 3.9°C	8/18/2020; 8.0°C	8/20/2020; 8.0°C	8/24/2020; 5.6°C	7/31/2020; 1.5°C
Whittier	6/12/2020; 3.8°C	6/18/2020; 5.1°C	6/19/2020; 4.9°C	7/1/2020; 5.1°C	7/8/2020; 4.5°C	7/19/2020; 3.6°C
Wrangell	7/9/2020; 5.34°C	7/12/2020; NR	7/21/2020; NR	7/22/2020; 7.28°C	7/27/2020; NR	7/9/2020; **16.8°C**
Shipping Lanes	5/17/2020; 6.4°C	5/18/2020; 4.9°C	5/19/2020; 1.3°C	5/20/2020; 2.02°C		9/18,19,20/2020; **5.4°C**
Shipping Lanes	5/24/2020; NR					9/24/2020; **5.9°C**

Appendix B. Fecal Coliform Results

Harbor	Site	Date	Fecal Coliforms (cfu/100 ml)	*Enterococci* (MPN/100ml)
Anchorage	ANC01	7/6/2020	42.00	20.30
Anchorage	ANC01	7/9/2020	4.00	4.10
Anchorage	ANC01	7/13/2020	11.00	6.30
Anchorage	ANC01	7/14/2020	37.00	4.10
Anchorage	ANC01	7/28/2020	1.00	<1.00
Anchorage	ANC02	7/6/2020	8.00	2.00
Anchorage	ANC02	7/9/2020	1.00	1.00
Anchorage	ANC02	7/13/2020	10.00	3.10
Anchorage	ANC02	7/14/2020	3.00	3.10
Anchorage	ANC02	7/28/2020	2.00	3.10
Anchorage	ANC03	7/6/2020	2.35	1.00
Anchorage	ANC03	7/9/2020	10.00	5.20
Anchorage	ANC03	7/13/2020	17.00	6.30
Anchorage	ANC03	7/14/2020	1.00	2.00
Anchorage	ANC03	7/28/2020	10.00	1.00
Anchorage	ANC04	7/6/2020	1.18	1.00
Anchorage	ANC04	7/9/2020	3.00	6.30
Anchorage	ANC04	7/13/2020	4.00	3.10
Anchorage	ANC04	7/14/2020	2.00	5.20
Anchorage	ANC04	7/28/2020	4.00	7.40
Anchorage	ANC05	7/6/2020	3.53	4.10
Anchorage	ANC05	7/9/2020	3.00	2.00
Anchorage	ANC05	7/13/2020	<1.00	<1.00
Anchorage	ANC05	7/14/2020	2.00	1.00
Anchorage	ANC06	7/6/2020	<1.00	<1.00
Anchorage	ANC06	7/9/2020	1.00	1.00
Anchorage	ANC06	7/13/2020	2.00	15.60
Anchorage	ANC06	7/14/2020	1.00	1.00
Dutch Harbor	DH01	9/26/2020	<1.00	1.00
Dutch Harbor	DH01	9/28/2020	<1.00	2.00
Dutch Harbor	DH01	10/2/2020	8.00	1.00
Dutch Harbor	DH01	10/3/2020	23.00	<1.00
Dutch Harbor	DH01	10/9/2020	<1.00	5.20
Dutch Harbor	DH02	9/26/2020	2.00	3.00
Dutch Harbor	DH02	9/28/2020	6.00	2.00
Dutch Harbor	DH02	10/2/2020	31.00	1.00
Dutch Harbor	DH02	10/3/2020	5.00	1.00
Dutch Harbor	DH02	10/9/2020	7.00	7.20

Harbor	Site	Date	Fecal Coliforms (cfu/100 ml)	*Enterococci* (MPN/100ml)
Dutch Harbor	DH03	9/26/2020	73.00	6.30
Dutch Harbor	DH03	9/28/2020	<1.00	4.10
Dutch Harbor	DH03	10/2/2020	28.00	1.00
Dutch Harbor	DH03	10/3/2020	9.00	<1.00
Dutch Harbor	DH03	10/9/2020	4.00	11.90
Dutch Harbor	DH04	9/26/2020	19.00	4.10
Dutch Harbor	DH04	9/28/2020	1.00	3.00
Dutch Harbor	DH04	10/2/2020	17.00	3.00
Dutch Harbor	DH04	10/3/2020	16.00	1.00
Dutch Harbor	DH04	10/9/2020	7.00	44.80
Dutch Harbor	DH05	9/26/2020	1.00	12.00
Dutch Harbor	DH05	9/28/2020	2.00	6.30
Dutch Harbor	DH05	10/2/2020	28.00	5.20
Dutch Harbor	DH05	10/3/2020	41.00	2.00
Dutch Harbor	DH05	10/9/2020	32.00	1.00
Dutch Harbor	DH06	9/26/2020	3.00	7.30
Dutch Harbor	DH06	9/28/2020	<1.00	7.50
Dutch Harbor	DH06	10/2/2020	26.00	8.60
Dutch Harbor	DH06	10/3/2020	8.00	16.90
Dutch Harbor	DH06	10/9/2020	12.00	85.50
Haines	HA01	7/1/2020	<2.0	<10
Haines	HA01	7/7/2020	<2.0	<10
Haines	HA01	7/9/2020	<2.0	<10
Haines	HA01	7/14/2020	2.00	<10
Haines	HA01	7/14/2020	2.00	<10
Haines	HA01	7/16/2020	<2.00	<10
Haines	HA01	7/16/2020	<2.00	<10
Haines	HA02	7/1/2020	2.00	<10
Haines	HA02	7/7/2020	<2.0	<10
Haines	HA02	7/9/2020	<2.0	<10
Haines	HA02	7/14/2020	<2.00	<10
Haines	HA02	7/14/2020	<2.00	<10
Haines	HA02	7/16/2020	<2.00	<10
Haines	HA02	7/16/2020	<2.00	<10
Haines	HA03	7/1/2020	<2.0	<10
Haines	HA03	7/7/2020	2.00	<10
Haines	HA03	7/9/2020	2.00	<10
Haines	HA03	7/14/2020	2.00	<10
Haines	HA03	7/14/2020	2.00	<10
Haines	HA03	7/16/2020	<2.00	<10
Haines	HA03	7/16/2020	<2.00	<10

Harbor	Site	Date	Fecal Coliforms (cfu/100 ml)	*Enterococci* (MPN/100ml)
Haines	HA04	7/1/2020	2.00	<10
Haines	HA04	7/7/2020	3.00	<10
Haines	HA04	7/9/2020	2.00	10.00
Haines	HA04	7/14/2020	<2.00	<10
Haines	HA04	7/14/2020	<2.00	<10
Haines	HA04	7/16/2020	3.00	<10
Haines	HA04	7/16/2020	3.00	<10
Haines	HA05	7/1/2020	5.00	<10
Haines	HA05	7/7/2020	3.00	<10
Haines	HA05	7/9/2020	<2.0	<10
Haines	HA05	7/14/2020	<2.00	<10
Haines	HA05	7/14/2020	<2.00	<10
Haines	HA05	7/16/2020	<2.00	<10
Haines	HA05	7/16/2020	<2.00	<10
Haines	HA06	7/1/2020	2.00	<10
Haines	HA06	7/7/2020	<2.0	<10
Haines	HA06	7/9/2020	3.00	10.00
Haines	HA06	7/14/2020	<2.00	<10
Haines	HA06	7/14/2020	<2.0.	<10
Haines	HA06	7/16/2020	2.00	<10
Haines	HA06	7/16/2020	2.00	<10
Homer	HR01	7/23/2020	5.00	3.10
Homer	HR01	7/28/2020	<1.00	1.00
Homer	HR01	7/30/2020	3.00	<1.00
Homer	HR01	8/5/2020	1.00	<1.00
Homer	HR01	8/14/2020	<1.00	<1.00
Homer	HR02	7/23/2020	8.00	<1.00
Homer	HR02	7/28/2020	53.00	9.70
Homer	HR02	7/30/2020	10.00	9.60
Homer	HR02	8/5/2020	63.00	27.50
Homer	HR02	8/14/2020	12.00	4.10
Homer	HR03	7/23/2020	6.00	3.10
Homer	HR03	7/28/2020	4.00	<1.00
Homer	HR03	7/30/2020	1.00	<1.00
Homer	HR03	8/5/2020	<1.00	<1.00
Homer	HR03	8/14/2020	1.00	3.10
Homer	HR04	7/23/2020	<1.00	<1.00
Homer	HR04	7/28/2020	1.00	2.00
Homer	HR04	7/30/2020	6.00	<1.00
Homer	HR04	8/5/2020	<1.00	3.10
Homer	HR04	8/14/2020	8.00	3.10

Harbor	Site	Date	Fecal Coliforms (cfu/100 ml)	*Enterococci* (MPN/100ml)
Homer	HR05	7/23/2020	21.00	1.00
Homer	HR05	7/28/2020	2.00	<1.00
Homer	HR05	7/30/2020	5.00	1.00
Homer	HR05	8/5/2020	1.00	2.00
Homer	HR05	8/14/2020	3.00	<1.00
Homer	HR06	7/23/2020	13.00	1.00
Homer	HR06	7/28/2020	7.00	<1.00
Homer	HR06	7/30/2020	<1.00	<1.00
Homer	HR06	8/5/2020	8.00	8.50
Homer	HR06	8/14/2020	10.00	<1.00
Hoonah	HO01	7/7/2020	<2.00	<10
Hoonah	HO01	7/20/2020	2.00	10.00
Hoonah	HO01	7/23/2020	<2.00	<10
Hoonah	HO01	7/27/2020	8.00	<10
Hoonah	HO01	7/30/2020	<2.00	<10
Hoonah	HO02	7/7/2020	<2.0	<10
Hoonah	HO02	7/20/2020	5.00	<10
Hoonah	HO02	7/23/2020	<2.00	10.00
Hoonah	HO02	7/27/2020	12.00	<10
Hoonah	HO02	7/30/2020	<2.00	<10
Hoonah	HO03	7/7/2020	2.00	<10
Hoonah	HO03	7/20/2020	5.00	<10
Hoonah	HO03	7/23/2020	10.00	<10
Hoonah	HO03	7/27/2020	22.00	<10
Hoonah	HO03	7/30/2020	3.00	<10
Hoonah	HO04	7/7/2020	<2.00	<10
Hoonah	HO04	7/20/2020	48.00	<10
Hoonah	HO04	7/23/2020	3.00	10.00
Hoonah	HO04	7/27/2020	27.00	20.00
Hoonah	HO04	7/30/2020	<2.00	<10
Hoonah	HO05	7/7/2020	<2.00	<10
Hoonah	HO05	7/20/2020	44.00	10.00
Hoonah	HO05	7/23/2020	2.00	<10
Hoonah	HO05	7/27/2020	35.00	<10
Hoonah	HO05	7/30/2020	3.00	<10
Hoonah	HO06	7/7/2020	2.00	10.00
Hoonah	HO06	7/20/2020	17.00	<10
Hoonah	HO06	7/23/2020	<2.00	<10
Hoonah	HO06	7/27/2020	80.00	40.00
Hoonah	HO06	7/30/2020	<2.00	<10
Hoonah	HO07	7/7/2020	2.00	<10

Harbor	Site	Date	Fecal Coliforms (cfu/100 ml)	*Enterococci* (MPN/100ml)
Hoonah	HO07	7/20/2020	22.00	20.00
Hoonah	HO07	7/23/2020	<2.00	<10
Hoonah	HO07	7/27/2020	42.00	10.00
Hoonah	HO07	7/30/2020	3.00	<10
Hoonah	HO08	7/7/2020	5.00	10.00
Hoonah	HO08	7/20/2020	48.00	52.00
Hoonah	HO08	7/23/2020	52.00	10.00
Hoonah	HO08	7/27/2020	42.00	<10
Hoonah	HO08	7/30/2020	7.00	<10
Juneau	AU01	7/8/2020	8.00	<10
Juneau	AU01	7/13/2020	5.00	<10
Juneau	AU01	7/15/2020	2.00	<10
Juneau	AU01	7/20/2020	2.00	<10
Juneau	AU01	7/23/2020	5.00	<10
Juneau	AU02	7/8/2020	<2.00	<10
Juneau	AU02	7/13/2020	<2.00	<10
Juneau	AU02	7/15/2020	2.00	10.00
Juneau	AU02	7/20/2020	33.00	30.00
Juneau	AU02	7/23/2020	15.00	20.00
Juneau	JU01	7/8/2020	10.00	10.00
Juneau	JU01	7/13/2020	3.00	<10
Juneau	JU01	7/15/2020	10.00	20.00
Juneau	JU01	7/20/2020	20.00	10.00
Juneau	JU01	7/23/2020	5.00	<10
Juneau	JU02	7/8/2020	33.00	10.00
Juneau	JU02	7/13/2020	2.00	<10
Juneau	JU02	7/15/2020	<2.00	20.00
Juneau	JU02	7/20/2020	15.00	<10
Juneau	JU02	7/23/2020	78.00	20.00
Juneau	JU05	7/8/2020	8.00	<10
Juneau	JU05	7/13/2020	<2.00	<10
Juneau	JU05	7/15/2020	2.00	10.00
Juneau	JU05	7/20/2020	12.00	<10
Juneau	JU05	7/23/2020	10.00	<10
Juneau	JU06	7/8/2020	<2.00	<10
Juneau	JU06	7/13/2020	2.00	<10
Juneau	JU06	7/15/2020	3.00	<10
Juneau	JU06	7/20/2020	10.00	10.00
Juneau	JU06	7/23/2020	7.00	<10
Juneau	JU07	7/8/2020	3.00	<10
Juneau	JU07	7/13/2020	<2.00	<10

Harbor	Site	Date	Fecal Coliforms (cfu/100 ml)	*Enterococci* (MPN/100ml)
Juneau	JU07	7/15/2020	13.00	<10
Juneau	JU07	7/20/2020	12.00	<10
Juneau	JU07	7/23/2020	5.00	<10
Juneau	JU08	7/8/2020	2.00	<10
Juneau	JU08	7/13/2020	2.00	<10
Juneau	JU08	7/15/2020	10.00	10.00
Juneau	JU08	7/20/2020	20.00	10.00
Juneau	JU08	7/23/2020	7.00	<10
Juneau	JU09	7/8/2020	2.00	<10
Juneau	JU09	7/13/2020	<2.00	<10
Juneau	JU09	7/15/2020	<2.00	<10
Juneau	JU09	7/20/2020	8.00	10.00
Juneau	JU09	7/23/2020	<2.00	20.00
Juneau	JU10	7/8/2020	<2.00	<10
Juneau	JU10	7/13/2020	<2.00	10.00
Juneau	JU10	7/15/2020	5.00	10.00
Juneau	JU10	7/20/2020	10.00	10.00
Juneau	JU10	7/23/2020	15.00	<10
Juneau	JU11	7/8/2020	8.00	<10
Juneau	JU11	7/13/2020	8.00	10.00
Juneau	JU11	7/15/2020	78.00	31.00
Juneau	JU11	7/20/2020	22.00	30.00
Juneau	JU11	7/23/2020	32.00	<10
Juneau	JU12	7/8/2020	13.00	<10
Juneau	JU12	7/13/2020	<2.00	<10
Juneau	JU12	7/15/2020	17.00	30.00
Juneau	JU12	7/20/2020	23.00	10.00
Juneau	JU12	7/23/2020	2.00	<10
Juneau	JU13	7/8/2020	3.00	<10
Juneau	JU13	7/13/2020	<2.00	<10
Juneau	JU13	7/15/2020	5.00	<10
Juneau	JU13	7/20/2020	5.00	<10
Juneau	JU13	7/23/2020	2.00	<10
Ketchikan	KE01	7/9/2020	14.00	20.00
Ketchikan	KE01	7/13/2020	34.00	10.00
Ketchikan	KE01	7/16/2020	47.00	10.00
Ketchikan	KE01	7/20/2020	138.00	374.00
Ketchikan	KE01	7/23/2020	54.00	31.00
Ketchikan	KE02	7/9/2020	5.00	<10
Ketchikan	KE02	7/13/2020	83.00	10.00
Ketchikan	KE02	7/16/2020	11.00	20.00

Harbor	Site	Date	Fecal Coliforms (cfu/100 ml)	*Enterococci* (MPN/100ml)
Ketchikan	KE02	7/20/2020	4.00	<10
Ketchikan	KE02	7/23/2020	6.00	10.00
Ketchikan	KE03	7/9/2020	14.00	31.00
Ketchikan	KE03	7/13/2020	10.00	10.00
Ketchikan	KE03	7/16/2020	6.00	<10
Ketchikan	KE03	7/20/2020	13.00	10.00
Ketchikan	KE03	7/23/2020	23.00	31.00
Ketchikan	KE04	7/9/2020	38.00	30.00
Ketchikan	KE04	7/13/2020	2.00	<10
Ketchikan	KE04	7/16/2020	8.00	<10
Ketchikan	KE04	7/20/2020	57.00	10.00
Ketchikan	KE04	7/23/2020	36.00	10.00
Ketchikan	KE05	7/9/2020	<1	<10
Ketchikan	KE05	7/13/2020	6.00	<10
Ketchikan	KE05	7/16/2020	4.00	<10
Ketchikan	KE05	7/20/2020	61.00	<10
Ketchikan	KE05	7/23/2020	26.00	30.00
Ketchikan	KE06	7/9/2020	7.00	10.00
Ketchikan	KE06	7/13/2020	9.00	<10
Ketchikan	KE06	7/16/2020	8.00	<10
Ketchikan	KE06	7/20/2020	15.00	<10
Ketchikan	KE06	7/23/2020	19.00	<10
Ketchikan	KE07	7/9/2020	7.00	<10
Ketchikan	KE07	7/13/2020	11.00	<10
Ketchikan	KE07	7/16/2020	<10	<10
Ketchikan	KE07	7/20/2020	9.00	<10
Ketchikan	KE07	7/23/2020	8.00	<10
Ketchikan	KE08	7/9/2020	4.00	20.00
Ketchikan	KE08	7/13/2020	8.00	<10
Ketchikan	KE08	7/16/2020	5.00	<10
Ketchikan	KE08	7/20/2020	30.00	<10
Ketchikan	KE08	7/23/2020	32.00	52.00
Ketchikan	KE09	7/9/2020	13.00	<10
Ketchikan	KE09	7/13/2020	1.00	<10
Ketchikan	KE09	7/16/2020	1.00	<10
Ketchikan	KE09	7/20/2020	6.00	<10
Ketchikan	KE09	7/23/2020	8.00	<10
Kodiak	KDK01	8/6/2020	56.00	58.30
Kodiak	KDK01	8/11/2020	1.00	6.10
Kodiak	KDK01	8/13/2020	9.00	10.90
Kodiak	KDK01	8/17/2020	4.00	32.30

Harbor	Site	Date	Fecal Coliforms (cfu/100 ml)	*Enterococci* (MPN/100ml)
Kodiak	KDK01	8/25/2020	14.00	4.10
Kodiak	KDK02	8/6/2020	16.00	14.50
Kodiak	KDK02	8/11/2020	90.00	<100
Kodiak	KDK02	8/13/2020	8.00	6.30
Kodiak	KDK02	8/17/2020	10.00	50.40
Kodiak	KDK02	8/25/2020	14.00	1.00
Kodiak	KDK03	8/6/2020	10.00	2.00
Kodiak	KDK03	8/11/2020	<1.00	1.00
Kodiak	KDK03	8/13/2020	6.00	2.00
Kodiak	KDK03	8/17/2020	2.00	3.00
Kodiak	KDK03	8/25/2020	5.00	<1.00
Kodiak	KDK04	8/6/2020	38.00	18.50
Kodiak	KDK04	8/11/2020	4.00	3.10
Kodiak	KDK04	8/13/2020	28.00	13.40
Kodiak	KDK04	8/17/2020	8.00	83.60
Kodiak	KDK04	8/25/2020	23.00	4.10
Kodiak	KDK05	8/6/2020	5.00	3.00
Kodiak	KDK05	8/11/2020	2.00	<1.00
Kodiak	KDK05	8/13/2020	5.00	<1.00
Kodiak	KDK05	8/17/2020	<1.00	<1.00
Kodiak	KDK05	8/25/2020	35.00	<1.00
Kodiak	KDK06	8/6/2020	20.00	<1.00
Kodiak	KDK06	8/11/2020	2.00	<1.00
Kodiak	KDK06	8/13/2020	16.00	<1.00
Kodiak	KDK06	8/17/2020	4.00	7.20
Kodiak	KDK06	8/25/2020	30.00	1.00
Nome	NME01	8/26/2020	1.00	3.10
Nome	NME01	8/27/2020	7.00	1.00
Nome	NME01	8/31/2020	9.00	2.00
Nome	NME01	9/1/2020	<1.00	4.10
Nome	NME02	8/26/2020	2.00	31.70
Nome	NME02	8/27/2020	26.00	56.50
Nome	NME02	8/31/2020	20.00	44.80
Nome	NME02	9/1/2020	69.00	3.10
Nome	NME03	8/26/2020	114.00	2.00
Nome	NME03	8/27/2020	1.00	1.00
Nome	NME03	8/31/2020	<1.00	<1.00
Nome	NME03	9/1/2020	<1.00	<1.00
Nome	NME04	8/26/2020	<1.00	<1.00
Nome	NME04	8/27/2020	<1.00	<1.00
Nome	NME04	8/31/2020	2.00	<1.00

Harbor	Site	Date	Fecal Coliforms (cfu/100 ml)	*Enterococci* (MPN/100ml)
Nome	NME04	9/1/2020	<1.00	1.00
Nome	NME05	8/26/2020	4.00	3.10
Nome	NME05	8/27/2020	<1.00	1.00
Nome	NME05	8/31/2020	1.00	6.30
Nome	NME05	9/1/2020	1.00	<1.00
Nome	NME06	8/26/2020	3.00	<1.00
Nome	NME06	8/27/2020	2.00	1.00
Nome	NME06	8/31/2020	1.00	<1.00
Nome	NME06	9/1/2020	6.00	2.00
Petersburg	PE01	7/9/2020	<2.00	<10
Petersburg	PE01	7/12/2020	14.00	<10
Petersburg	PE01	7/21/2020	9.00	10.00
Petersburg	PE01	7/22/2020	<2.00	<10
Petersburg	PE01	7/27/2020	21.00	<10
Petersburg	PE02	7/9/2020	3.00	<10
Petersburg	PE02	7/12/2020	10.00	20.00
Petersburg	PE02	7/21/2020	283.00	20.00
Petersburg	PE02	7/22/2020	7.00	30.00
Petersburg	PE02	7/27/2020	39.00	20.00
Petersburg	PE03	7/9/2020	3.00	<10
Petersburg	PE03	7/12/2020	25.00	20.00
Petersburg	PE03	7/21/2020	44.00	<10
Petersburg	PE03	7/22/2020	18.00	<10
Petersburg	PE03	7/27/2020	41.00	10.00
Petersburg	PE04	7/9/2020	3.00	<10
Petersburg	PE04	7/12/2020	7.00	<10
Petersburg	PE04	7/21/2020	68.00	31.00
Petersburg	PE04	7/22/2020	3.00	10.00
Petersburg	PE04	7/27/2020	40.00	31.00
Petersburg	PE05	7/9/2020	3.00	<10
Petersburg	PE05	7/12/2020	5.00	<10
Petersburg	PE05	7/21/2020	61.00	10.00
Petersburg	PE05	7/22/2020	8.00	<10
Petersburg	PE05	7/27/2020	20.00	10.00
Petersburg	PE06	7/9/2020	2.00	<10
Petersburg	PE06	7/12/2020	3.00	<10
Petersburg	PE06	7/21/2020	23.00	10.00
Petersburg	PE06	7/22/2020	10.00	10.00
Petersburg	PE06	7/27/2020	27.00	10.00
Seward	SE01	7/9/2020	26.00	5.30
Seward	SE01	7/14/2020	2.00	<1.00

Harbor	Site	Date	Fecal Coliforms (cfu/100 ml)	*Enterococci* (MPN/100ml)
Seward	SE01	7/15/2020	12.00	1.00
Seward	SE01	7/20/2020	65.00	13.20
Seward	SE01	7/22/2020	30.00	17.30
Seward	SE02	7/9/2020	10.00	4.10
Seward	SE02	7/14/2020	13.00	3.00
Seward	SE02	7/15/2020	200.00	14.50
Seward	SE02	7/20/2020	33.00	1.00
Seward	SE02	7/22/2020	200.00	24.30
Seward	SE03	7/9/2020	29.00	<1.00
Seward	SE03	7/14/2020	44.00	5.20
Seward	SE03	7/15/2020	16.00	2.00
Seward	SE03	7/20/2020	16.00	1.00
Seward	SE03	7/22/2020	24.00	2.00
Seward	SE04	7/9/2020	8.00	1.00
Seward	SE04	7/14/2020	<1.00	8.60
Seward	SE04	7/15/2020	1.00	8.60
Seward	SE04	7/20/2020	13.00	2.00
Seward	SE04	7/22/2020	9.00	3.10
Seward	SE05	7/9/2020	11.00	1.00
Seward	SE05	7/14/2020	2.00	1.00
Seward	SE05	7/15/2020	4.00	1.00
Seward	SE05	7/20/2020	15.00	2.00
Seward	SE05	7/22/2020	3.00	4.10
Seward	SE06	7/9/2020	4.00	2.00
Seward	SE06	7/14/2020	6.00	<1.00
Seward	SE06	7/15/2020	3.00	2.00
Seward	SE06	7/20/2020	14.00	<1.00
Seward	SE06	7/22/2020	6.00	5.20
Shipping Lanes	CHS02	9/18/2020	<2.00	<10
Shipping Lanes	CHS03	9/17/2020	<2.0	<10
Shipping Lanes	CS01	9/24/2020	3.00	<10
Shipping Lanes	CS02	9/19/2020	<2.0	<10
Shipping Lanes	CS03	9/19/2020	<2.0	<10
Shipping Lanes	FS01	9/18/2020	<2.00	<10
Shipping Lanes	FS02	9/18/2020	<2.00	<10
Shipping Lanes	FS03	9/18/2020	<2.00	<10
Shipping Lanes	IS01	9/17/2020	<2.00	<10
Shipping Lanes	IS01	9/17/2020	<2.00	<10
Shipping Lanes	LC01	9/17/2020	<2.00	<10
Shipping Lanes	LC02	9/17/2020	<2.00	<10
Shipping Lanes	NI01	9/24/2020	5.00	<10

Harbor	Site	Date	Fecal Coliforms (cfu/100 ml)	*Enterococci* (MPN/100ml)
Shipping Lanes	SP01	9/18/2020	<2.00	<10
Shipping Lanes	SP02	9/20/2020	<2.0	<10
Shipping Lanes	SP03	9/20/2020	<2.0	<10
Shipping Lanes	SS01	9/19/2020	<2.0	<10
Shipping Lanes	SS02	9/19/2020	<2.0	<10
Shipping Lanes	SS03	9/19/2020	<2.0	<10
Shipping Lanes	Stikine	9/19/2020	<2.0	<10
Sitka	SI01	8/4/2020	7.00	<10
Sitka	SI02	8/4/2020	12.00	<10
Sitka	SI03	8/4/2020	22.00	10.00
Sitka	SI04	8/4/2020	7.00	<10
Sitka	SI05	8/4/2020	7.00	<10
Sitka	SI06	8/4/2020	7.00	<10
Sitka	SI07	8/4/2020	13.00	20.00
Sitka	SI08	8/4/2020	12.00	<10
Sitka	SI09	8/4/2020	3.00	20.00
Sitka	SI10	8/4/2020	2.00	10.00
Sitka	SI01	7/6/2020	<2.0	<10
Sitka	SI01	7/9/2020	<2.0	<10
Sitka	SI01	7/13/2020	2.00	<10
Sitka	SI01	7/23/2020	2.00	10.00
Sitka	SI02	7/6/2020	<2.0	<10
Sitka	SI02	7/9/2020	<2.0	<10
Sitka	SI02	7/13/2020	2.00	<10
Sitka	SI02	7/23/2020	3.00	<10
Sitka	SI03	7/6/2020	<2.0	<10
Sitka	SI03	7/9/2020	<2.0	<10
Sitka	SI03	7/13/2020	<2.0	<10
Sitka	SI03	7/23/2020	3.00	<10
Sitka	SI04	7/6/2020	<2.0	10.00
Sitka	SI04	7/9/2020	<2.0	10.00
Sitka	SI04	7/13/2020	<2.0	<10
Sitka	SI04	7/23/2020	<2.0	<10
Sitka	SI05	7/6/2020	<2.0	10.00
Sitka	SI05	7/9/2020	<2.0	<10
Sitka	SI05	7/13/2020	3.00	<10
Sitka	SI05	7/23/2020	7.00	<10
Sitka	SI06	7/6/2020	2.00	<10
Sitka	SI06	7/9/2020	22.00	10.00
Sitka	SI06	7/13/2020	5.00	<10
Sitka	SI06	7/23/2020	8.00	<10

Harbor	Site	Date	Fecal Coliforms (cfu/100 ml)	*Enterococci* (MPN/100ml)
Sitka	SI07	7/6/2020	<2.0	<10
Sitka	SI07	7/9/2020	23.00	<10
Sitka	SI07	7/13/2020	5.00	<10
Sitka	SI07	7/23/2020	3.00	10.00
Sitka	SI08	7/6/2020	<2.0	10.00
Sitka	SI08	7/9/2020	30.00	10.00
Sitka	SI08	7/13/2020	<2.0	<10
Sitka	SI08	7/23/2020	<2.0	<10
Sitka	SI09	7/6/2020	7.00	<10
Sitka	SI09	7/9/2020	7.00	<10
Sitka	SI09	7/13/2020	<2.0	<10
Sitka	SI09	7/23/2020	<2.0	20.00
Sitka	SI10	7/6/2020	<2.0	<10
Sitka	SI10	7/9/2020	2.00	<10
Sitka	SI10	7/13/2020	<2.0	<10
Sitka	SI10	7/23/2020	<2.0	10.00
Skagway	SK01	6/29/2020	7.00	<10
Skagway	SK01	7/1/2020	<2.00	<10
Skagway	SK01	7/9/2020	<2.00	<10
Skagway	SK01	7/14/2020	8.00	10.00
Skagway	SK01	14-Jul	8.00	10.00
Skagway	SK01	7/16/2020	3.00	<10
Skagway	SK02	6/29/2020	<2.00	<10
Skagway	SK02	7/1/2020	3.00	<10
Skagway	SK02	7/9/2020	<2.00	<10
Skagway	SK02	7/14/2020	5.00	10.00
Skagway	SK02	14-Jul	5.00	10.00
Skagway	SK02	7/16/2020	<2.00	<10
Skagway	SK03	6/29/2020	7.00	<10
Skagway	SK03	7/1/2020	5.00	<10
Skagway	SK03	7/9/2020	<2.00	<10
Skagway	SK03	7/14/2020	<2.00	20.00
Skagway	SK03	14-Jul	<2.00	20.00
Skagway	SK03	7/16/2020	2.00	<10
Skagway	SK04	6/29/2020	3.00	<10
Skagway	SK04	7/1/2020	<2.00	<10
Skagway	SK04	7/9/2020	2.00	<10
Skagway	SK04	7/14/2020	2.00	20.00
Skagway	SK04	14-Jul	2.00	20.00
Skagway	SK04	7/16/2020	2.00	<10
Skagway	SK05	6/29/2020	<2.00	<10

Harbor	Site	Date	Fecal Coliforms (cfu/100 ml)	*Enterococci* (MPN/100ml)
Skagway	SK05	7/1/2020	<2.00	<10
Skagway	SK05	7/9/2020	<2.00	<10
Skagway	SK05	7/14/2020	<2.00	<10
Skagway	SK05	14-Jul	<2.00	<10
Skagway	SK05	7/16/2020	<2.00	<10
Skagway	SK06	6/29/2020	2.00	<10
Skagway	SK06	7/1/2020	<2.00	<10
Skagway	SK06	7/9/2020	2.00	<10
Skagway	SK06	7/14/2020	2.00	10.00
Skagway	SK06	14-Jul	2.00	10.00
Skagway	SK06	7/16/2020	<2.00	<10
Skagway	SK07	6/29/2020	<2.00	<10
Skagway	SK07	7/1/2020	<2.00	<10
Skagway	SK07	7/9/2020	2.00	<10
Skagway	SK07	14-Jul	<2.00	<10
Skagway	SK07	7/16/2020	<2.00	<10
Skagway	SK07	7/14/2020	<2.00	<10
Valdez	VA01	7/31/2020	<1.00	2.00
Valdez	VA01	8/4/2020	18.00	2.00
Valdez	VA01	8/18/2020	200.00	42.80
Valdez	VA01	8/20/2020	1.00	3.10
Valdez	VA01	8/24/2020	4.00	5.20
Valdez	VA02	7/31/2020	1.00	2.00
Valdez	VA02	8/4/2020	10.00	7.50
Valdez	VA02	8/18/2020	200.00	28.80
Valdez	VA02	8/20/2020	41.00	4.10
Valdez	VA02	8/24/2020	40.00	6.30
Valdez	VA03	7/31/2020	2.00	3.00
Valdez	VA03	8/4/2020	4.00	88.80
Valdez	VA03	8/18/2020	200.00	25.30
Valdez	VA03	8/20/2020	136.00	9.70
Valdez	VA03	8/24/2020	12.00	5.20
Valdez	VA04	7/31/2020	200.00	8.40
Valdez	VA04	8/4/2020	17.00	69.70
Valdez	VA04	8/18/2020	116.00	29.20
Valdez	VA04	8/20/2020	89.00	12.10
Valdez	VA04	8/24/2020	8.00	5.20
Valdez	VA05	7/31/2020	22.00	12.10
Valdez	VA05	8/4/2020	10.00	2.00
Valdez	VA05	8/18/2020	165.00	25.60
Valdez	VA05	8/20/2020	6.00	<1.00

Harbor	Site	Date	Fecal Coliforms (cfu/100 ml)	*Enterococci* (MPN/100ml)
Valdez	VA05	8/24/2020	15.00	4.10
Valdez	VA06	7/31/2020	<1.00	<1.00
Valdez	VA06	8/4/2020	<1.00	1.00
Valdez	VA06	8/18/2020	80.00	23.30
Valdez	VA06	8/20/2020	3.00	1.00
Valdez	VA06	8/24/2020	13.00	4.10
Ward Cove	WA01	7/9/2020	<1.00	10.00
Ward Cove	WA01	7/13/2020	<1.00	10.00
Ward Cove	WA01	7/16/2020	31.00	52.00
Ward Cove	WA01	7/20/2020	18.00	10.00
Ward Cove	WA01	7/23/2020	17.00	<10
Ward Cove	WA02	7/9/2020	2.00	<10
Ward Cove	WA02	7/13/2020	2.00	<10
Ward Cove	WA02	7/16/2020	50.00	10.00
Ward Cove	WA02	7/20/2020	33.00	31.00
Ward Cove	WA02	7/23/2020	12.00	10.00
Ward Cove	WA03	7/9/2020	5.00	10.00
Ward Cove	WA03	7/13/2020	5.00	10.00
Ward Cove	WA03	7/16/2020	80.00	30.00
Ward Cove	WA03	7/20/2020	122.00	85.00
Ward Cove	WA03	7/23/2020	10.00	<10
Ward Cove	WA04	7/9/2020	8.00	<10
Ward Cove	WA04	7/13/2020	8.00	<10
Ward Cove	WA04	7/16/2020	54.00	10.00
Ward Cove	WA04	7/20/2020	26.00	10.00
Ward Cove	WA04	7/23/2020	14.00	<10
Ward Cove	WA05	7/9/2020	3.00	<10
Ward Cove	WA05	7/13/2020	3.00	<10
Ward Cove	WA05	7/16/2020	54.00	20.00
Ward Cove	WA05	7/20/2020	38.00	10.00
Ward Cove	WA05	7/23/2020	18.00	<10
Ward Cove	WA06	7/9/2020	6.00	<10
Ward Cove	WA06	7/13/2020	6.00	<10
Ward Cove	WA06	7/16/2020	65.00	10.00
Ward Cove	WA06	7/20/2020	46.00	10.00
Ward Cove	WA06	7/23/2020	13.00	<10
Whittier	WH01	6/12/2020	<9.00	<1.00
Whittier	WH01	6/18/2020	18.00	1.00
Whittier	WH01	6/19/2020	9.01	<2.00
Whittier	WH01	7/1/2020	8.00	<1.00
Whittier	WH01	7/8/2020	7.00	4.10

Harbor	Site	Date	Fecal Coliforms (cfu/100 ml)	*Enterococci* (MPN/100ml)
Whittier	WH02	6/12/2020	<9.00	<1.00
Whittier	WH02	6/18/2020	9.01	9.80
Whittier	WH02	6/19/2020	<9.00	1.00
Whittier	WH02	7/1/2020	16.00	1.00
Whittier	WH02	7/8/2020	2.00	3.10
Whittier	WH03	6/12/2020	<9.00	2.00
Whittier	WH03	6/18/2020	9.01	1.00
Whittier	WH03	6/19/2020	<9.00	<2.00
Whittier	WH03	7/1/2020	3.00	<1.00
Whittier	WH03	7/8/2020	5.00	5.20
Whittier	WH04	6/12/2020	<9.00	<2.00
Whittier	WH04	6/18/2020	<9.00	<2.00
Whittier	WH04	6/19/2020	<9.00	2.00
Whittier	WH04	7/1/2020	7.00	1.00
Whittier	WH04	7/8/2020	3.00	2.00
Whittier	WH05	6/12/2020	<9.00	3.00
Whittier	WH05	6/18/2020	36.00	2.00
Whittier	WH05	6/19/2020	<9.00	<1.00
Whittier	WH05	7/1/2020	4.00	2.00
Whittier	WH05	7/8/2020	1.00	<1.00
Whittier	WH06	6/12/2020	<9.00	<2.00
Whittier	WH06	6/18/2020	<9.00	<2.00
Whittier	WH06	6/19/2020	<9.00	<2.00
Whittier	WH06	7/1/2020	4.00	<1.00
Whittier	WH06	7/8/2020	3.00	<1.00
Wrangell	WR01	7/9/2020	2.00	<10
Wrangell	WR01	7/12/2020	21.00	<10
Wrangell	WR01	7/21/2020	8.00	<10
Wrangell	WR01	7/22/2020	2.00	10.00
Wrangell	WR01	7/27/2020	26.00	10.00
Wrangell	WR02	7/9/2020	<2.00	<10
Wrangell	WR02	7/12/2020	1.00	<10
Wrangell	WR02	7/21/2020	4.00	<10
Wrangell	WR02	7/22/2020	2.00	<10
Wrangell	WR02	7/27/2020	7.00	10.00
Wrangell	WR03	7/9/2020	<2.00	<10
Wrangell	WR03	7/12/2020	17.00	<10
Wrangell	WR03	7/21/2020	30.00	<10
Wrangell	WR03	7/22/2020	5.00	<10
Wrangell	WR03	7/27/2020	10.00	<10
Wrangell	WR04	7/9/2020	3.00	<10

Harbor	Site	Date	Fecal Coliforms (cfu/100 ml)	*Enterococci* (MPN/100ml)
Wrangell	WR04	7/12/2020	33.00	30.00
Wrangell	WR04	7/21/2020	<1.00	<10
Wrangell	WR04	7/22/2020	7.00	<10
Wrangell	WR04	7/27/2020	47.00	20.00
Wrangell	WR05	7/9/2020	<2.0	<10
Wrangell	WR05	7/12/2020	6.00	10.00
Wrangell	WR05	7/21/2020	54.00	<10
Wrangell	WR05	7/22/2020	12.00	<10
Wrangell	WR05	7/27/2020	4.00	295.00
Wrangell	WR06	7/9/2020	3.00	<10
Wrangell	WR06	7/12/2020	<1.00	<10
Wrangell	WR06	7/21/2020	29.00	10.00
Wrangell	WR06	7/22/2020	<2.00	<10
Wrangell	WR06	7/27/2020	25.00	10.00