Division of Water

Annual Summary Report 2023

Ambient Marine Water Quality, Harbors and Shipping Lane Project

Executive Summary

Monitoring of Alaska's high traffic harbors and shipping lanes provides information about ambient conditions to inform permitting, and to determine if waters meet Alaska Water Quality Standards (WQS). Department of Environmental Conservation (DEC) began limited sampling in 2015 to inform permitting conditions and in 2020 the program was transferred to the Water Quality group with a focus on assessing whether waterbodies are meeting WQS. Presented here is a summary of water quality data collected from 2020 to 2023 by the Ambient Marine Water Quality, Harbors and Shipping Lane Project.

Based on the 2023 data, marine waterbodies are not exceeding water quality criteria, although elevated levels of fecal coliform were documented at one site near Valdez. Assessment of whether harbors are meeting water quality standards are reported in the Integrated Water Quality Monitoring and Assessment Report. Overall, 2023 results meet water quality standards.

DEC plans to rotate intensive monitoring for three to five harbors every two years, ensuring sufficient data is collected to determine if WQS are being met. Limited data collection will continue for all shipping lanes. Passive samplers will be deployed in select harbors to collect continuous water quality parameters, and Microbial Source Tracking will help determine sources of pathogen contamination.

Introduction and Background

To better understand potential cruise ship impacts on marine water quality, DEC monitors ambient conditions (or natural background conditions) in and around Alaska's high traffic harbors and shipping lanes. This information contributes to two program goals. The DEC Water Quality Program's goal of monitoring of state waters for attainment of the Alaska Water Quality Standards (18 AAC 70) (DEC 2022), and the Commercial Passenger Vessel Environmental Compliance Program's (CPVEC) goal of evaluating proposed discharges from cruise ships to marine waters.

Since the passage of the federal cruise ship law in 2000 and establishment of the Commercial Passenger Vessel Environmental Compliance Statues in 2002 (AS 46.03.460[1]) DEC has monitored cruise ship wastewater discharges in Alaska waters. The Alaska Cruise Ship Initiative published a report in 2004[2] that characterized the risks to human and environmental health from commercial passenger vessels wastewater discharges. This report recommended continued monitoring of

[1] https://www.akleg.gov/basis/statutes.asp#46.03.460

[2] Cruise Ship Reports (alaska.gov) see '2004 Impact Assessment'

ambient water quality conditions to build an understanding receiving water conditions, needed to inform mixing zone requirements for the Cruise Ship General Permit[3], and to ensure discharges weren't negatively impacting human and environmental health.

From 2015-2019 sample design was aimed at informing the relatively new general permit. Sampling focused on collecting detailed information in a few harbors (Skagway, Juneau, Seward, Sitka and Hoonah) to inform levels of contaminants allowed in discharge permits with mixing zones. Initially 6 to 12 sites were sampled one to four times per year, providing detailed data for a few harbors.

In 2020 additional Ocean Ranger funds were allocated, and the program was moved from CPVEC to the DEC Water Quality program. The Water Quality program expanded sampling to 18 harbors and the busiest shipping lanes used by cruise ships, for a total of 150 sample sites. Sites were sampled annually from 2020-2022 for metals (total and dissolved copper, nickel, zinc), ammonia as nitrogen, and pathogens (fecal coliform and *Enterococci*). This sampling effort resulted in screening level data. Screening level sampling collects limited data to prioritize future work. Additionally, sites near harbors/communities were sampled 5 times per year for pathogens.

In 2020 and 2021 due to the COVID-19 pandemic there were no large commercial passenger vessels operating in Alaskan waters. This provided an opportunity to sample without the presence of large cruise ships. In 2022 and 2023 large cruise ships returned brining ~1.2 million visitors by cruise ship in 2022 and ~1.6 million in 2023. A comparison of the data between years with and without cruise ships show no statistical differences in years with cruise ships and years without, expect ammonia as nitrogen. A small increase in ammonia as nitrogen was observed, although levels remain well below water quality criteria.

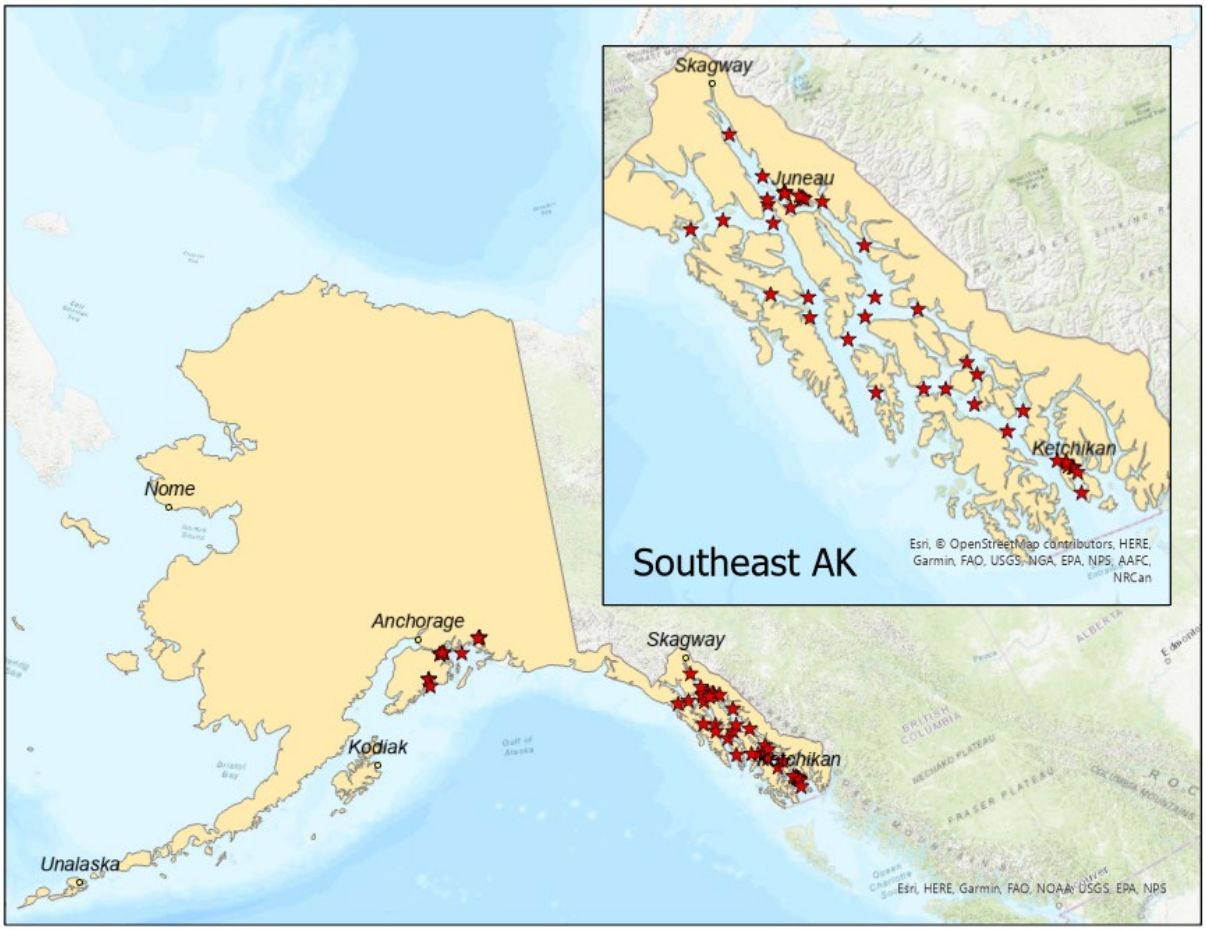
Assessment level sampling collects data more often than screening level and can be used to determine if WQS are being met. In most cases assessment level data must be collected over least two years, with at least 10 unique sample dates, and be collected under an approved Quality Assurance Project Plan. DEC plans to collect assessment level data for the 2023 and 2024 time period for Ketchikan/Ward Cove, Juneau/Auke Bay, Seward, Valdez and Whittier (see Map 1 for sites sampled in 2023). These sites were selected due to high volumes of cruise ship traffic, expected increases in cruise ship activity, and previous sample results. To improve temporal and spatial representation of assessment level data, some sample sites and timing will be adjusted. Screening level data continues to be collected at all shipping lane sites.

WQS are assessed based on a regional area called an assessment unit that delineates a waterbody. Monitoring data from each assessment unit is pooled and compared against WQS, and determinations are made for each pollutant. Assessment units for many marine waterbodies were delineated in 2023 and will define areas of analysis going forward. Monitoring sites were

[3] Large Cruise Ship General Permit (alaska.gov)

selected for better spatial representation within the assessment unit. Data collected through the program in 2023 included 34 assessment units, in seven of these assessment level data will be collected by 2024.

Summary reports for 2015-22 can be found at DEC's website[4]. Presented below are data summaries for the 2023 season compared with past sampling efforts from 2020 through 2022. These years were chosen for greater comparable since sample sites and protocol remained consistent during this time.



Map 1. Sample sites in 2023

[4] https://dec.alaska.gov/water/water-quality/nonpoint-source-control/water-quality-resources/reports *search: Juneau and Skagway Harbors Ambient Water Quality Monitoring (2015, 2018, 2019), Marine Water Quality Summary Report (2020), Water Quality Measures in Alaska's Ports and Shipping Lanes (2021, 2022).*

Data Summaries

The following figures present monitoring results from the 2023 season alongside data from 2020-2022. The number of samples collected from 2020 - 23 are included in each graph by the community's name as 'n='. In all graphs the most stringent water quality criteria is represented by the grey bar.

Metals and Ammonia-N

Figure 1. Sample results for Dissolved Copper and the water quality criteria (grey bar) of 3.1 micrograms per liter.

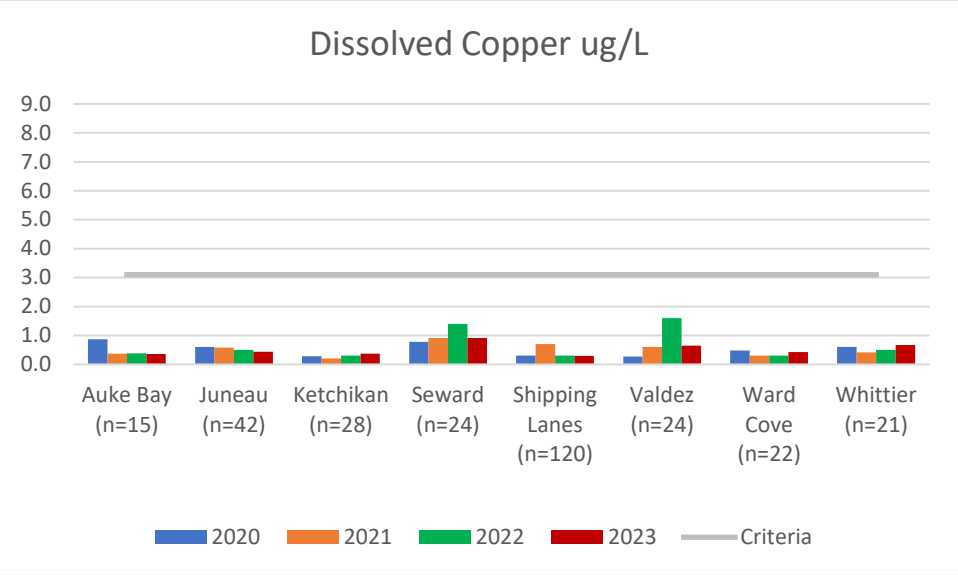


Figure 2. Sample results for Dissolved Nickel and the water quality criteria (grey bar) of 8.2 micrograms per liter.

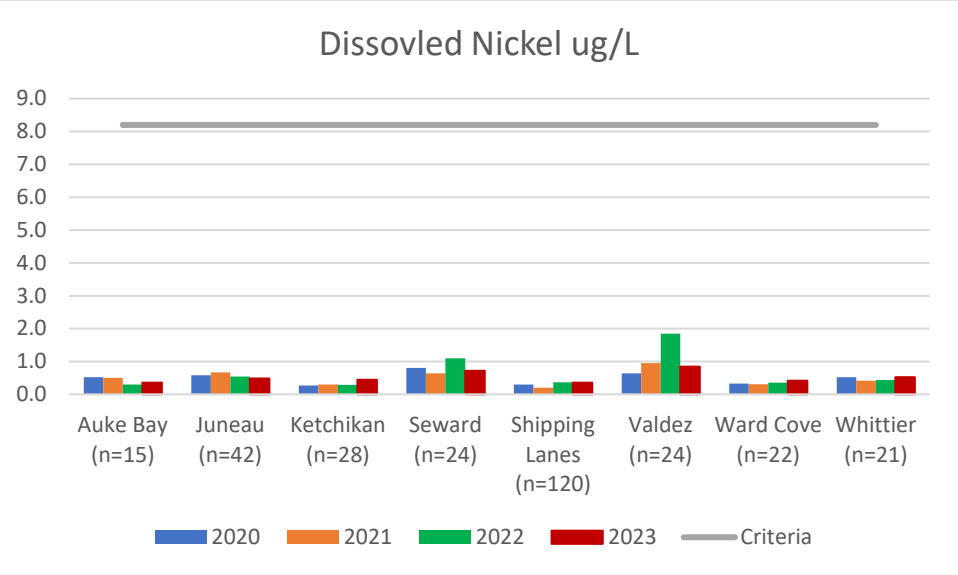


Figure 3. Sample results for Dissolved Zinc and the water quality criteria (grey bar) of 86 micrograms per liter.

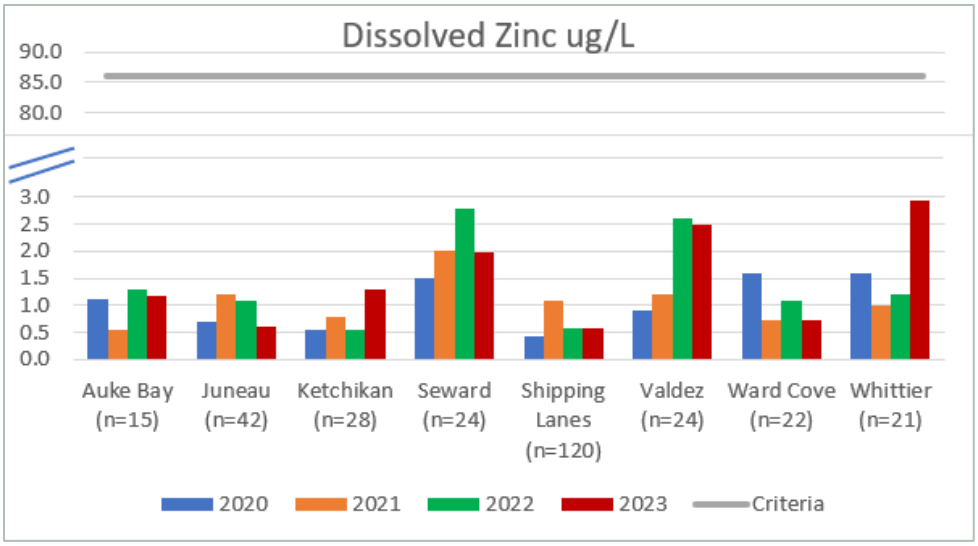
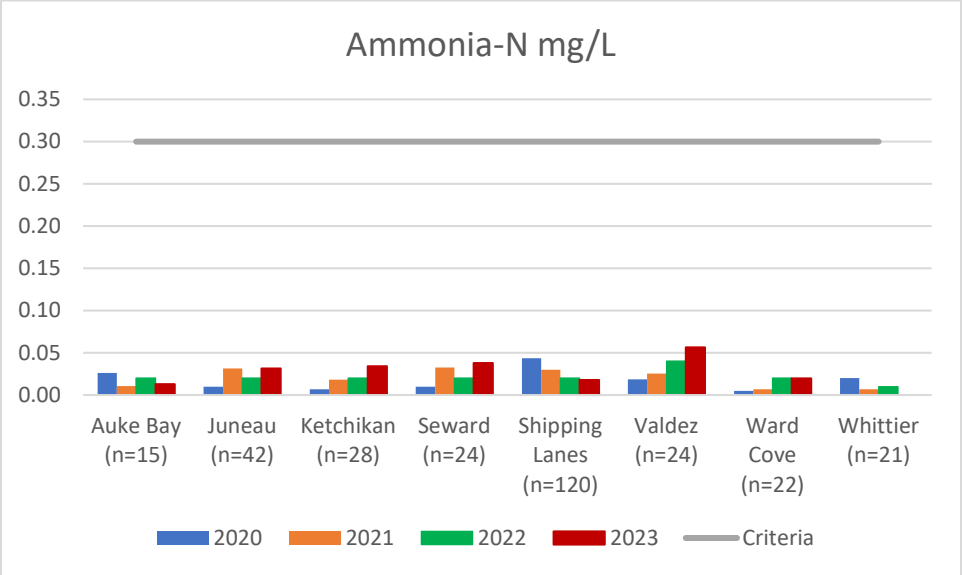


Figure 4. Sample results for Ammonia as Nitrogen and the water quality criteria (grey bar) of .3 milligrams per liter.



Pathogens

To assess whether marine waters are meeting the water quality standard for pathogens, 5 sample events must occur within a thirty-day period, over at least two years. Fecal coliform and

Enterococci were sampled at 3 – 6 sites in and around Ketchikan/Ward Cove, Juneau/Auke Bay, Seward, Valdez and Whittier. Geometric means are presented below for each area.

Figure 5. Geometric means of sample results for Enterococci and the water quality criteria (grey bar) of 35 Most Probable Number per 100mL.

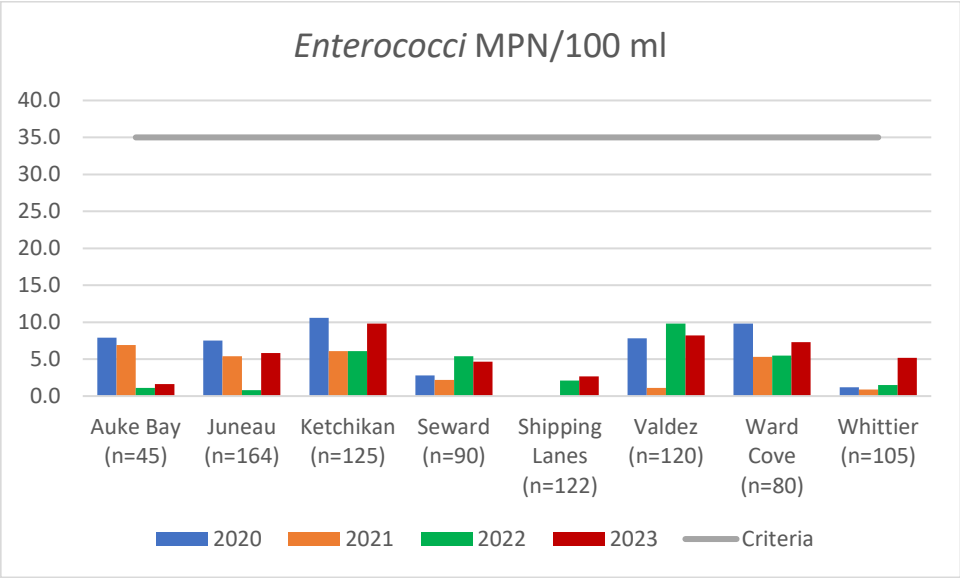
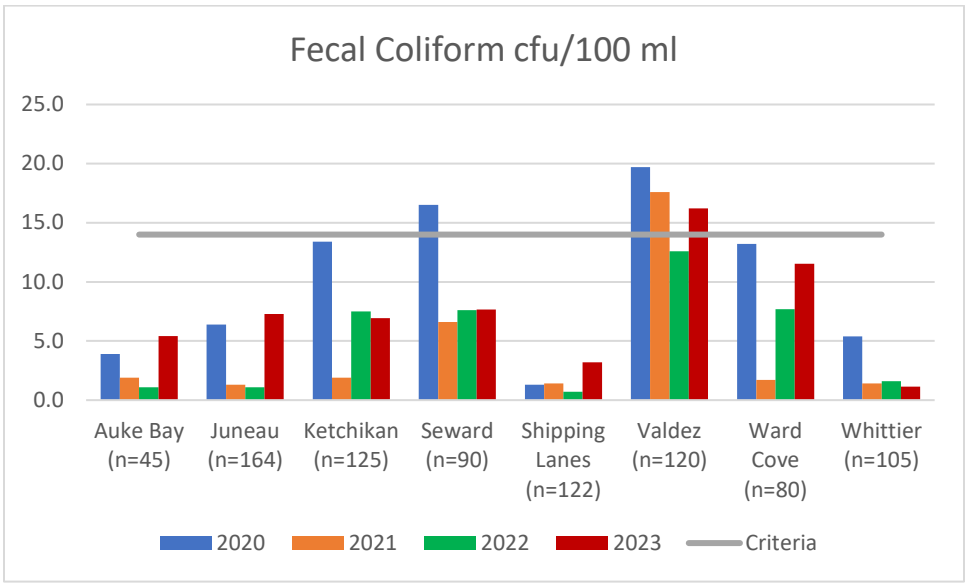
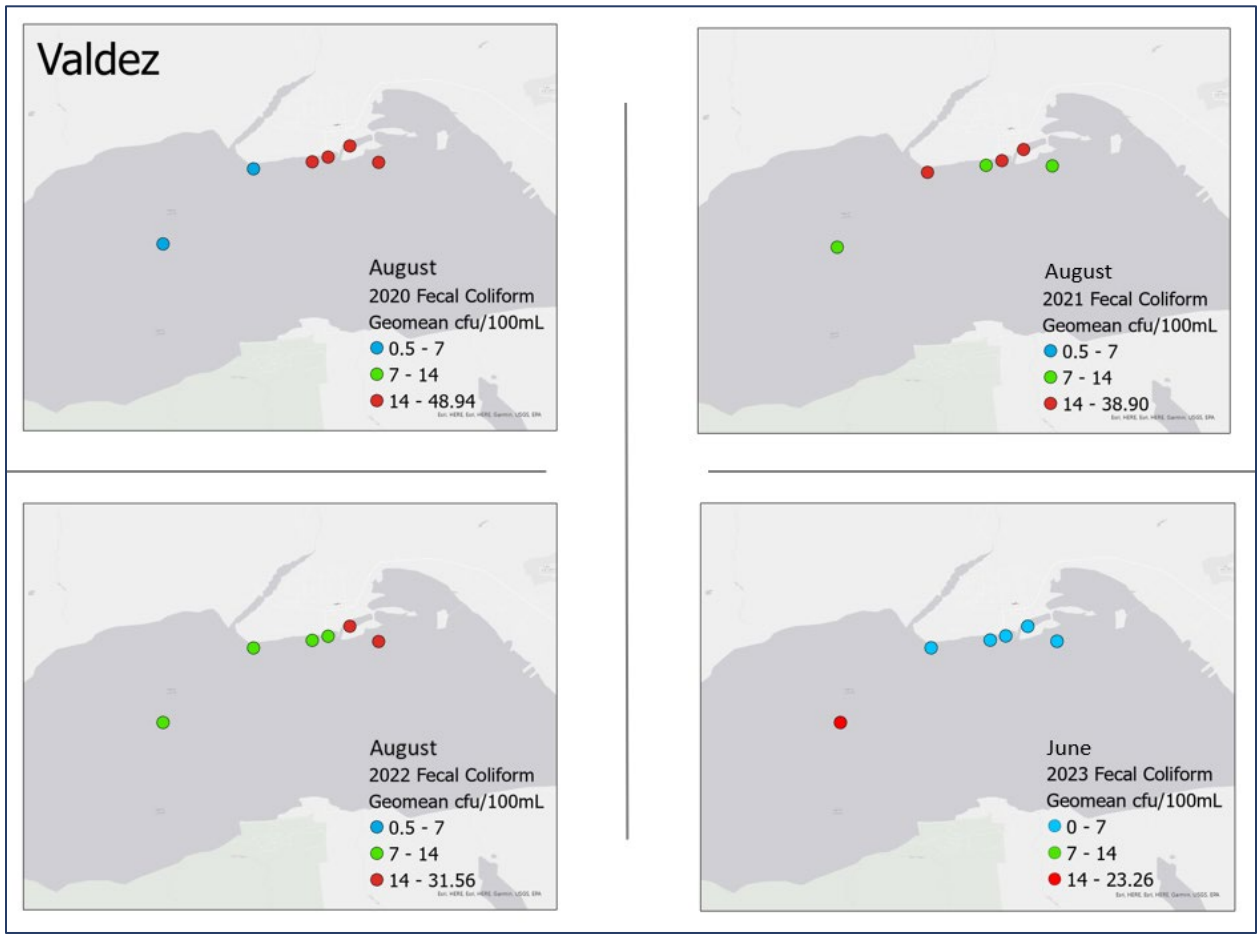


Figure 6. Geometric means of sample results for Fecal Coliform and the water quality criteria (grey bar) of 14 colony forming units per 100mL.

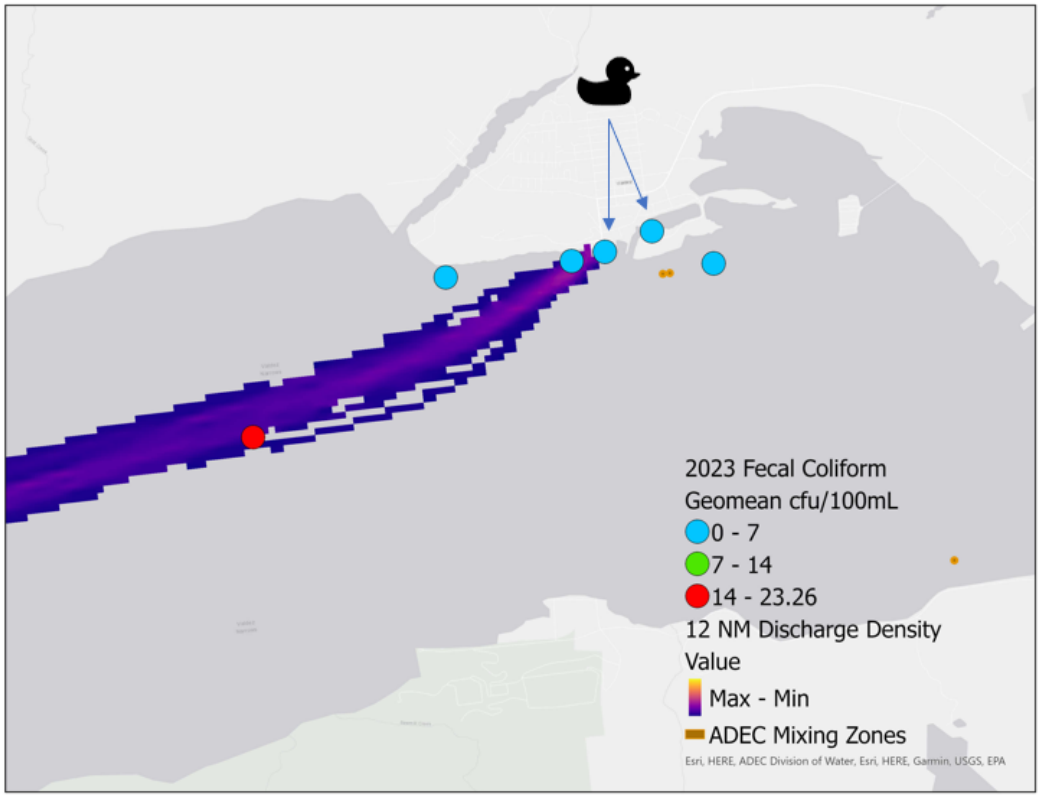


When looking at individual sample results in 2023 only one location, near Valdez exceeded criteria for fecal coliform (see Map 2). Exceedances of water quality criteria refer only to single instances or single sample site where the parameter exceeds the magnitude of the water quality criterion; further analyses that consider the frequency and duration of those exceedances are needed to determine whether waterbodies meet regulatory water quality standards overall. The distance of this sample site from community sources leads us to conclude that elevated levels could be from naturally occurring sources and/or discharges while ships are underway. Cruise ships have an authorized mixing zone while underway, WQS must be met at the edge of the mixing zone.

Two sites were analyzed using Microbial Source Tracking, which provides information about fecal coliform sources. Both results indicated bird as the source (not dog or human waste). Permitted discharges and sample results are included in Map 3.



Map 2. Time series of fecal coliform results in and around Valdez Harbor.



Map 3. Sample Sites near Valdez Harbor with red dots denoting an exceedance of the water quality criteria in 2023, based on the geomean of 5 samples. Shore based mixing zones are shown in mustard yellow, and cruise ship discharges are shown in purple. The bird icon denotes that the sources of bacteria are from bird for the two sites that were analyzed for microbial sources.

Future Direction

With an estimated 1.65 million cruise ship passengers in 2023[5] and expected increases in the future, it is important that DEC continues to monitor marine water quality. In the future this program will provide assessment level data for marine waters with a rotating focus on harbors that receive 10 or more cruise ships, while continuing to provide screening level data in busy shipping lanes used by the cruise ship industry.

Assessment level data collection will be completed for Juneau, Auke Bay, Ketchikan and Ward Cove, and Seward by July 2024 for metals and pathogens. In September 2024, pathogens data collection will be completed in Valdez and Whitter. Based on past sample results, preliminary analysis indicates that WQS are being met. Results will be available through the 2024 and 2026 Alaska Integrated Water Quality Monitoring and Assessment Report.

[5] https://www.adn.com/alaska-news/2023/11/06/alaska-breaks-cruise-ship-passenger-record-as-tourism-rebounds-from-the-covid-19-pandemic/

In 2024 we will begin resampling at most established sites to assess changes over time. Passive samplers deployed in Juneau, Ketchikan, Seward and Valdez will take continuous readings of temperature, pH, conductivity, salinity and dissolved oxygen. This will contribute to our understanding of fluctuations in the natural system and provide greater context for the sampling that is occurring. For example, we know that there are more metals present in water with high conductivity. If sampling occurred at a time when conductivity was at its highest, we can expect that those sample results would be the most elevated to occur over the season. Microbial Source Tracking will be used in areas with elevated pathogen levels to identify sources of pathogens. In 2025 we plan to work with a contractor to compile all available data for marine water quality and complete a comprehensive report.

Conclusion

It is difficult to assess large marine water bodies with certainty due to their size, and the volume of water moving with tidal action, as such these data do have their limitations. We are using DEC's vetted and established tools found in the Consolidated Assessment Listing Methodology[6] to conduct assessment of waterbodies based on the best science and knowledge available.

Based on data presented here, cruise ship industry discharges do not appear to negatively impact ambient marine water quality. By delineating marine assessment units and collecting assessment level data we will be able to move forward with more certainty in determining the status of water quality in harbors frequently used by the cruise ship industry.

[6] https://dec.alaska.gov/ search CALM 2021