2015

WATER QUALITY REPORT

CARCROSS/TAGISH FIRST NATION

ION INDIGENOUS OBSERVATION NETWORK
www.fieldscope.org/map/25

ONE PEOPLE-ONE RIVER
Yukon River Inter-Tribal Watershed Council
www.yritwc.org

TABLE OF CONTENTS

INTRODUCTION

THE YRITWC

The Yukon River Inter-Tribal Watershed Council (YRITWC) is an Indigenous grassroots organization, consisting of 70 First Nations and Tribes, dedicated to the protection and preservation of the Yukon River Watershed. The YRITWC accomplishes this by providing Tribes in Alaska and First Nations in Canada in the Yukon Watershed with technical assistance. We facilitate the development and exchange of information, coordinate efforts between Tribes and First Nations, undertake research, and provide training, education and awareness programs to promote the health of the Watershed and its Indigenous peoples.

Our Mission

"We, the Indigenous Tribes/First Nations from the headwaters to the mouth of the Yukon River, having been placed here by our Creator, do hereby agree to initiate and continue the clean up and preservation of the Yukon River for the protection of our own and future generations of our Tribes/First Nations and for the continuation of our traditional Native way of life."

THE INDIGENOUS OBSERVATION NETWORK

The YRITWC Indigenous Observation Network (ION) is an international Indigenous initiative that combines western Science and Indigenous knowledge to research, sustain and protect our watershed, resources, and cultures. One of the core projects of ION is the water quality project, which has become the largest Indigenous water quality project in the world and YOU are an essential part of it. Our projects connect communities like yours so that your observations and research on your environment have meaning and application at the community, watershed, state, federal and global scales. The YRITWC works to give you the tools and training necessary to operate and manage a large-scale environmental observational network and collect high quality data that can be verified by other communities or scientists. Thank you for making ION a success!

Acknowledgements

While ION would not exist without your community's interest or participation, ION also relies heavily on several key collaborators and various external sources of funding. The cooperation, expertise and financial resources of these partners contribute immensely to the success and sustainability of ION.

The United States Geological Survey (USGS) has played an essential role in the development and support of ION. From 2001-2006, the USGS conducted an intensive research program on the Yukon River. In 2007, the ION used this program as the foundation for its current day water quality program. At the Biennial Summit this year, the YRITWC and USGS will renew their Memorandum of Understanding for an additional 6 years. The USGS provides technical assistance and almost all of the laboratory analysis for this program. USGS also allows YRITWC staff and community members to assist with this analysis providing another opportunity for capacity building for your community.

The Environment Protection Agency's Indian General Assistance Program funds many of the Tribal Environmental Programs that participate in ION. IGAP has played an essential role in ensuring the sustainability and capacity of ION.

The National Science Foundation has funded ION for the past three years to become part of the Arctic Observation Network (AON) and to continue its water monitoring and Indigenous knowledge program.

The Government of Yukon supported the initial development of the Yukon side of the water quality monitoring program for three years (2007-2010). They continue to provide regional and water quality expertise, support and outreach opportunities.

The Administration for Native Americans provided the initial funding for the development of ION and its water quality program (2006-2009).

Over the past two years, National Geographic has provided ION and the YRITWC with access to their "FieldScope" project. FieldScope is a mapping database that has social networking capabilities. Having access to this database is a tremendous resource that will allow for increased participation and access to your data with some capability for analysis by community members.

The YRITWC receives additional funding through competitive proposals from a wide variety of other sources for other projects that the organization and ION carries out. The agencies and ministries mentioned here have directly supported the data presented within these community reports. For additional acknowledgement information, please see the YRITWC website: www.yritwc.org.

Background on water quality

What is "water quality"?

Water quality is really just a measure of the suitability of water for a particular use. Some water is great for drinking and is referred to as being "potable." Some water is not potable (not suitable for drinking) but might make healthy fish habitat or be great for watering your garden.

We cannot tell if a water sample is safe for drinking, or suitable for any other use, just by looking at it. We need to measure certain characteristics of the water, which might be physical, chemical or biological. We can divide the characteristics we are measuring into a few groups (field parameters, major ions, nutrients, dissolved organic carbon and stable water isotopes), which are discussed below.

Water Quality Standards

In order to decide whether water is suitable for a particular use or unsuitable for that use, we need water quality standards. Basically, we need to designate the use of a water body and use water quality criteria to protect that use and prevent pollution. "Designating the use" of a water body means deciding if it is fit or safe for drinking, swimming, fishing, watering crops or some other function. "Water quality criteria" are just numbers and other requirements that our samples have to meet in order to prove that the water is suitable for its use. Currently, the *Canadian Guidelines for the Protection of Aquatic Life* (CCME, 1987) are used to evaluate water quality in Yukon.

Our Water Quality Standards

The YRITWC is developing a Yukon River Watershed Plan to protect and improve the water quality in the Yukon River from the headwaters to the mouth. Development of the plan was recommended at the 2011 YRITWC Biennial Summit, co-hosted by the Ruby Tribal Council in Ruby, AK and approved by all signatory Tribes and First Nations at the 2013 YRITWC Summit, co-hosted by the First Nation of Na-Cho Nyak Dun in Mayo, YT. Currently, the YRITWC is in the process of implementation and governance of the Yukon River Watershed Plan through Alaska Tribes and First Nations water quality legislation. The Yukon River Watershed Plan implementation strategies will also be a major focus point at the upcoming 2015 YRITWC summit, co-hosted by the Native Village of Minto, AK.

The Yukon River Watershed Governance Strategy describes the Tribes' and First Nations' long-term vision and objectives for the Yukon River watershed. The centerpiece of the plan is a set of measurable water quality standards describing the quality of the river water necessary to achieve the plan's vision and objectives. The

water quality standards are specifically aimed at improving and protecting the quality of the river's water to sustain the health of the people, animals and plants of the watershed. The water quality standards in the plan apply *across the entirety of the watershed* (i.e. in both Canada and the United States). The Tribes and First Nations intend these standards to be consistent with the legal and regulatory regimes of the other sovereign governments relevant to the different parts of the Yukon River Watershed: the United States, Canada, Alaska, Yukon, and British Columbia.

<u>Anti-degradation</u>: The other key component of the Water Governance strategy is the emphasis on the concept of "anti-degradation". Anti-degradation essentially states that any degradation (worsening) of water quality (even if it remains above the water quality standard) is unlawful unless there is significant social or economic justification. The data presented within this report allows us to establish baseline conditions, monitor for change, and ultimately determine whether water quality degradation is occurring.

FIELD PARAMETERS

Field parameters are the characteristics of water that you measure when you go out and take a water sample. Many of these parameters tell us multiple stories about the Yukon River. In its current state, our water quality program focuses on parameters that are important for fish habitat, climate change, hydrology and, to a much lesser extent, drinking water. Currently, we have several pilot programs in select communities investigating more specific contaminants. Please contact the YRITWC if you would like to develop or be involved with these other projects.

<u>pH</u>: pH is a measure of how acidic or basic a water sample is. The range of pH values goes from zero to fourteen. Low values of pH indicate acidic waters whereas high values of pH indicate basic waters. The number seven is right in the middle so it is considered neutral. pH can affect the concentration of the anions, cations and nutrients (see "Laboratory Parameters", below) that are dissolved in the water so it is a very important indicator of water quality. The Canadian Guidelines for the Protection of Aquatic Life establish a range of acceptable pH values from 6.5-9.0 (CCME, 1987).

<u>Dissolved oxygen</u>: Even though you can't see it, the water you sample contains a dissolved gas: oxygen. Oxygen gets into the water from the surrounding air and from plants that are undergoing photosynthesis. The oxygen dissolved in the river is critical for the aquatic life (fish and other organisms) living in it. We don't want dissolved oxygen to get too low or the aquatic life could feel stressed or even die.
The Canadian Guidelines for the Protection of Aquatic Life state the following lowest acceptable dissolved oxygen concentrations (CCME, 1987):

- **For warm water biota: early life stages = 6.0 mg/L**
- **For warm water biota: other life stages = 5.5 mg/L**
- **For cold water biota: early life stages = 9.5 mg/L**
- **For cold water biota: other life stages = 6.5 mg/L**

<u>Conductance</u>: Conductance is a measure of how well the water can conduct an electrical current. Water can conduct electrical currents because it contains dissolved charged particles called ions (the anions and cations discussed below). Conductance depends on the amount of solids dissolved in the water: pure water has a low conductance whereas seawater has a high conductance. When the conductance goes up or down, it is telling us something about the amount of dissolved solids in the water.

<u>Temperature</u>: Temperature tells us how hot or cold the water is. Temperature can affect the ability of water to conduct an electrical current, to hold oxygen and certain dissolved solids, and to undergo various reactions so it is very important to measure

every time we take a sample. While temperatures can vary greatly (even within the day), consistently high water temperatures are detrimental to most salmonids (e.g., salmon, whitefish, sheefish, etc.).

LABORATORY PARAMETERS

The rest of the characteristics of water that we are interested in are measured in a laboratory using the samples that you collect in the field. We receive the samples in Fairbanks, process them and send them to the USGS National Research Laboratory in Boulder, Colorado.

Ions: Ions are dissolved particles that have charge. *Anions* are negatively charged ions whereas *cations* are positively charged ions. All natural water samples, including the samples we take around the Yukon watershed, contain ions. Ions typically come from natural sources. The rocks and soil around the watershed naturally contain lots of anions and cations. Water (from rainfall, snowmelt or any other source) comes into contact with the rocks and soil and they react. During this process, some of the ions dissolve into the water. We measure these ions to understand how the water is reacting with its environment, to assess the quality of the water and to monitor for possible sources of contamination.

Anions: Anions are dissolved particles with negative charge. We measure these using the water from the biggest plastic bottle with the white cap in your sample kit. There are three anions that we measure:

- **Alkalinity: Alkalinity is a measure of the capacity of water to neutralize acids. Alkalinity is important for fish and aquatic life because it can help prevent rapid pH changes. Remember that living organisms generally function best in a pH range of six to nine. Rapid pH changes could be caused by acid rain, mining contamination, or other potential sources of acid. Most of the alkalinity in the water we sample comes in the form of bicarbonate. (Baking soda is a type of bicarbonate!) Bicarbonate dissolves in the water when rain falls, infiltrates the ground, and reacts with rocks and soil. Bicarbonate is the most abundant anion in samples collected from the main stem of the Yukon River. It is important that a minimum level of alkalinity be maintained because alkalinity affects pH, which has a direct effect on organisms as well as an indirect effect on the toxicity of some contaminants in the water.**
- **Sulphate: Sulphate, like bicarbonate, dissolves in the water when rain falls, infiltrates the ground, and reacts with rocks and soil. Sulphate is a nutrient (see below). Usually the source of sulphate dissolved in water is natural, but sometimes it comes from fertilizers, mining operations, pulp and paper mills, tanneries or other sources. When sulphate concentrations are very high, the water usually tastes bad and could potentially cause diarrhea or dehydration. Sulphate is typically the second most abundant anion, after bicarbonate, in samples collected from the Yukon River.**

- **<u>Chloride</u>: Some chloride dissolves in the water when it reacts with salts in the rocks and the soil. However, chloride dissolved in water often comes from other sources such as human or animal wastes, which are high in salt, or from salt used on roads for snow and ice control. In lower river communities, it is possible that chloride comes from seawater that the tides are pushing up into the river. When chloride concentrations are very high, the water usually tastes bad and could cause pipes to corrode. In samples collected from the Yukon River, there is typically much less chloride than there is bicarbonate and sulphate, but this is not always true for all bodies of water. The Canadian Guidelines for the Protection of Aquatic Life states that long-term chloride concentrations should not exceed 120 mg/L (CCME, 1987).**

<u>Cations</u>: Cations are dissolved particles with positive charge. We measure these using the water from the tall, thin plastic bottle with the white cap in your sample kit. There are four cations that we measure:

- **<u>Calcium</u>: Calcium dissolves in the water when rain falls, infiltrates the ground, and reacts with rocks and soil. It is the most abundant cation in samples collected from the main stem of the Yukon River. There is currently no evidence of negative health effects caused by calcium in water for human consumption or aquatic life.**
- **<u>Magnesium</u>: Magnesium, like calcium, dissolves in the water when rain falls, infiltrates the ground, and reacts with rocks and soil. It is typically the second most abundant cation, after calcium, in samples collected from the Yukon River. There is currently no evidence of negative health effects caused by magnesium in water for human consumption or aquatic life.**

> **<u>Hardness</u>: When water does not contain much calcium and magnesium, we say that it is "soft water." When water contains a lot of calcium and magnesium, we say that it is "hard water." Hard water requires a lot of soap to produce a lather. It can also form white deposits called "scale" that can clog hot water pipes, boilers and other household appliances. Often people use water softeners to turn hard water into soft water; that is, to reduce the amount of calcium and magnesium in the water. It can be worthwhile to use a softener because soft water is more compatible with soap and extends the lifetime of plumbing.**

- **<u>Sodium</u>: Sodium, like calcium and magnesium, dissolves in the water when rain falls, infiltrates the ground and reacts with rocks and soil. Sometimes sodium dissolved in water, like chloride, comes from human or animal wastes,**

which are high in salt, or from salt used on roads for snow and ice control. In lower river communities, it is possible that sodium comes from seawater that the tides are pushing up into the river. When sodium concentrations are very high, the water usually tastes bad. In samples collected from the Yukon River, there is typically much less sodium than there is calcium and magnesium.

- **<u>Potassium</u>: Potassium, like the other cations, dissolves in the water when rain falls, infiltrates the ground, and reacts with rocks and soil. Sometimes potassium dissolved in water comes from fertilizers. It is the least abundant cation in samples collected from the main stem of the Yukon River. There is currently no evidence of negative health effects caused by potassium in water for human consumption or aquatic life.**

<u>Nutrients</u>: Nutrients are measured using the water from the two identical small plastic bottles in your sample kit. A nutrient is a chemical that an organism needs to live and grow. Nutrients are essential for life but too many of them can degrade habitat for aquatic life and pollute drinking water. Too many nutrients in the water can cause algae to grow excessively and lower the dissolved oxygen in the water, which can impact fish and other aquatic life. This is called eutrophication. Natural sources of nutrients include soils and decaying plant materials (fallen leaves, grass, etc.). Sometimes nutrients dissolved in water come from human or animal wastes, fertilizers, or industrial wastewater. There are two nitrogen-bearing nutrients that we analyze directly from the two small bottles: nitrate and ammonium:

- **<u>Nitrate</u>: Small amounts of nitrate (NO_3) dissolve in the water when it reacts with decaying plant and animal material in the soil. Sometimes nitrate dissolved in water comes from human or animal wastes and fertilizers. We expect to find small amounts of nitrate in our samples, but we are concerned if these amounts ever get too high because nitrate can become toxic (especially to young infants) at elevated concentrations. The Canadian Guidelines for the Protection of Aquatic Life states that long-term nitrate concentrations should not exceed 13 mg/L (CCME, 1987).**
- **<u>Ammonium</u>: As with nitrate, small amounts of ammonium (NH_4) dissolve in the water when it reacts with decaying plant and animal material in the soil. Sometimes ammonium dissolved in water comes from human or animal wastes and fertilizers. The water quality standards for ammonium are dependent on local site conditions (pH and temperature) and are difficult to display in a table or on a graph. There is very little risk from ammonium at the low levels normally encountered in our samples.**
- **<u>Other nutrients</u>: Other nutrients that we analyze include sulphate (discussed above) and dissolved organic carbon (or "DOC"; discussed below).**

Dissolved organic carbon: Dissolved organic carbon (DOC) is a measure of a whole bunch of organic molecules that are dissolved in water. It is measured using the water in the brown glass bottle in your sample kit. Because it is a nutrient, DOC is important and essential for life, especially for microorganisms: tiny life forms like algae, bacteria and fungi. These tiny life forms are the start of the food chain! Our health depends on the health of the fish, which depends on the health of these microorganisms. DOC is also important because it is highly reactive with other substances and can bind with pesticides or metals such as mercury and reduce their toxicity. Under certain conditions, this can allow living organisms to take in toxic materials. So, we measure DOC because it can tell us something about toxic substances in the water and whether or not they are entering the food chain.

Stable water isotopes: Some molecules of water are lighter or heavier than others because of something called "isotopes." We can measure the isotopes in water to try to understand where the samples of water come from (ice? snow? rain? groundwater?) and how they are moving from one place to another. In this way, stable water isotopes can help us understand long-term trends in the watershed, including the effects of climate change. Different isotopes behave differently. Lighter water molecules (that is, water with more light isotopes) are more easily evaporated. Heavier water molecules (that is, water with more heavy isotopes) are more easily precipitated as rain or snow. We use the sample you take in the small, clear glass vial in your sample kit to measure the isotopes in the water. It is extremely important that the sample vial is totally full and has no air bubbles in it. An air bubble could cause the measurement of isotopes to change. We want the isotopes in the sample water to be just like they were when you collected them from the river! Stable water isotopes pose no risk to our health or the health of the river.

Greenhouse Gases: A greenhouse gas can absorb and release energy from the sun and ultimately cause the greenhouse effect that keeps our planet warm. Increasing amounts of greenhouse gases contribute to climate change. Greenhouse gases are in the air but they can also dissolve into the water, just like oxygen does. We measure two greenhouse gases in samples collected at specific locations: carbon dioxide and methane. Every time we breathe out, we are putting some carbon dioxide into the air. Carbon dioxide is also produced whenever we burn fossil fuels like gas, coal or diesel. Methane is the main ingredient in what we call "natural gas." It naturally occurs underground but can also come from manure, landfills, and other places. When the climate warms, the permafrost can melt and release carbon dioxide and methane. So, it's important to monitor how much carbon dioxide and methane are in our water samples because it helps us determine how much climate change is occurring and how climate change is affecting our watershed. Carbon dioxide and methane are typically

found in small amounts in natural water samples, so they generally pose no risk to our health or the health of the river.

WATER QUALITY IN OUR COMMUNITY

Once we (a) understand what we are measuring in the water samples that we collect and (b) know what the relevant water quality standards are, then we can compare our results to the standards and assess our water quality!

The following pages illustrate and evaluate the water quality in your community, based on the data that you have gathered. The samples were analyzed at the USGS National Research Laboratory in Boulder, Colorado. The data are publically available from two sources: 1) Schuster et al. 2010 is a USGS Open File Report containing data collected from all sampling locations during the years 2006 through 2008. This Open File Report is available online from the USGS and can be found at: http://pubs.er.usgs.gov/publication/ofr20101241; and 2) Data collected from all sampling locations during the years 2009 through 2013 is available in downloadable Microsoft Excel spreadsheets at: http://wwwbrr.cr.usgs.gov/projects/SWC_Yukon/YukonRiverBasin/. 2014 data is reported here in preliminary form as it has not been through the full process of quality assurance (QA) and quality control (QC). When QA/QC procedures have been completed for this dataset it will be added to the Yukon River Basin website. This website also contains links to USGS Open File Reports containing the data collected by the USGS over the years 2001-2005. An additional USGS resource where Yukon River water-quality data, as well as all water-quality data for the nation, collected by USGS staff is the National Water Information System (NWIS) http://waterdata.usgs.gov/nwis

The following pages illustrate and evaluate the water quality in your community, based on the data that you have gathered. We use the *Canadian Guidelines for the Protection of Aquatic Life* (CCME, 1987) to evaluate the following parameters:

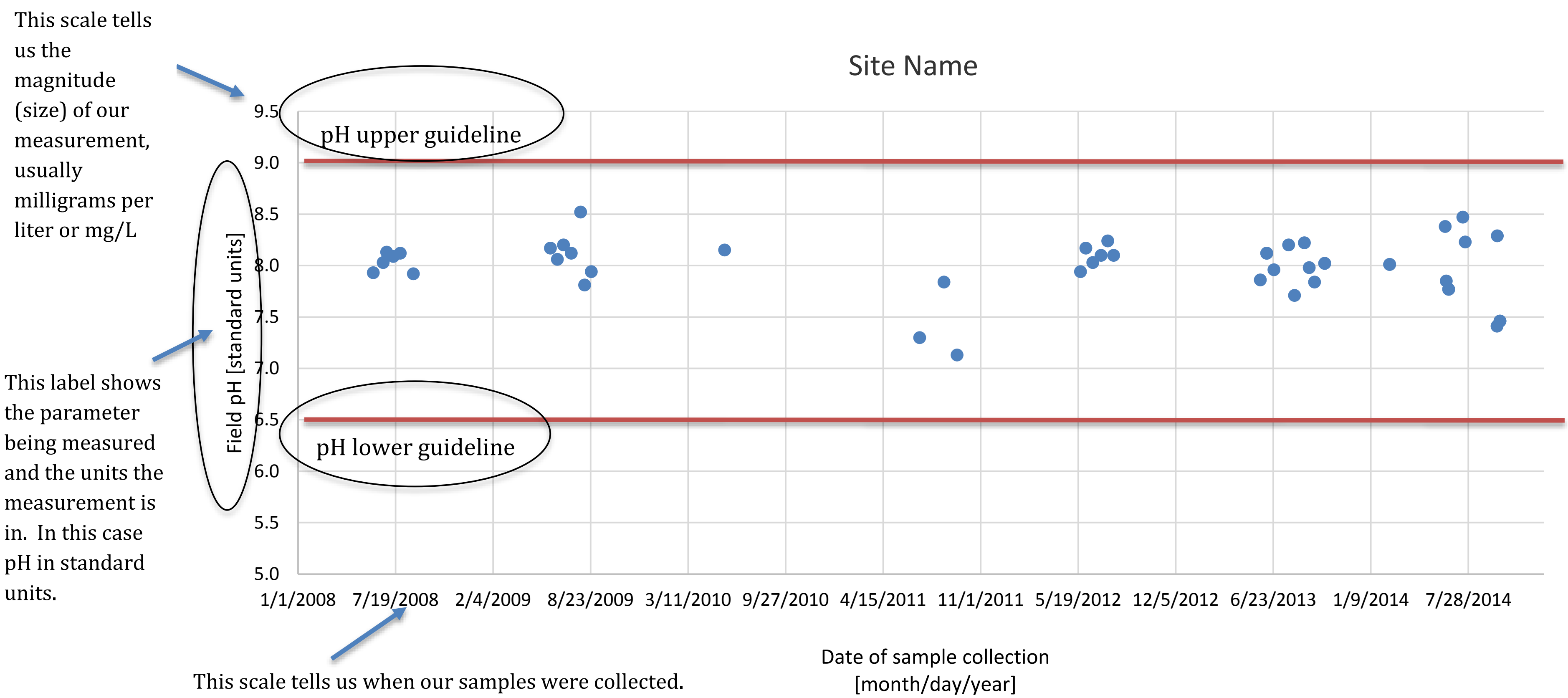
- **pH**
- **Dissolved oxygen**
- **Chloride**
- **Nitrate**

We also provide graphs for the following important parameters:

- **Conductance**
- **Anions and Cations**

TIME SERIES DIAGRAMS

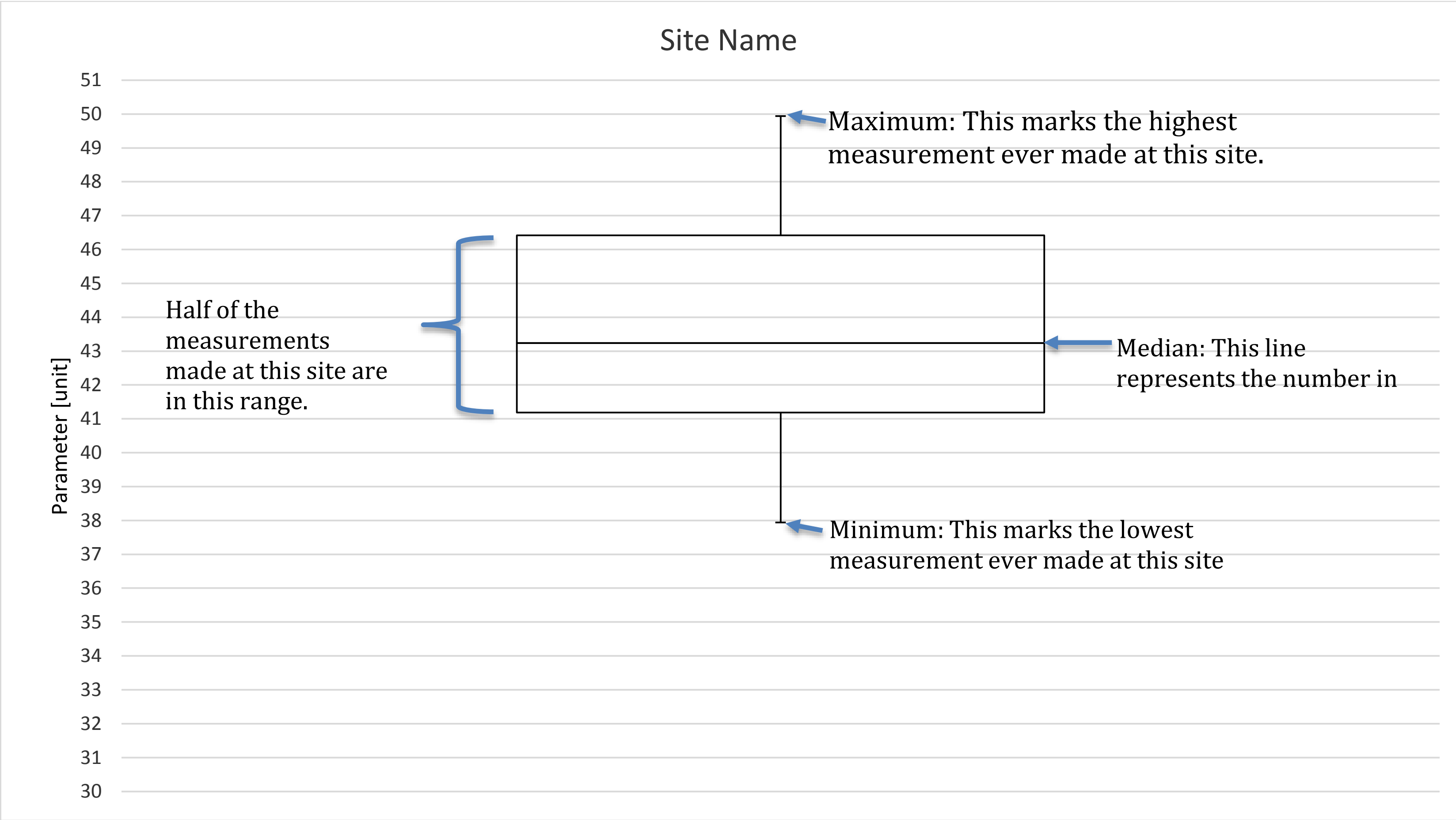
A time series diagram is a way of visualizing, or picturing, how our data looks over time. It is another way of representing a lot of data with a single image. Time series diagrams can help us find patterns in the data. Each point represents a measurement made as a result of one of our sampling trips. The red lines are guidelines. Healthy water is below the upper red line and, where applicable, above the lower red line. Keep in mind that not everything we measure has a guideline and therefore not every time series diagram will have these red lines.



In the pages that follow, you can find time series diagrams for pH, dissolved oxygen, conductance, chloride and nitrate.

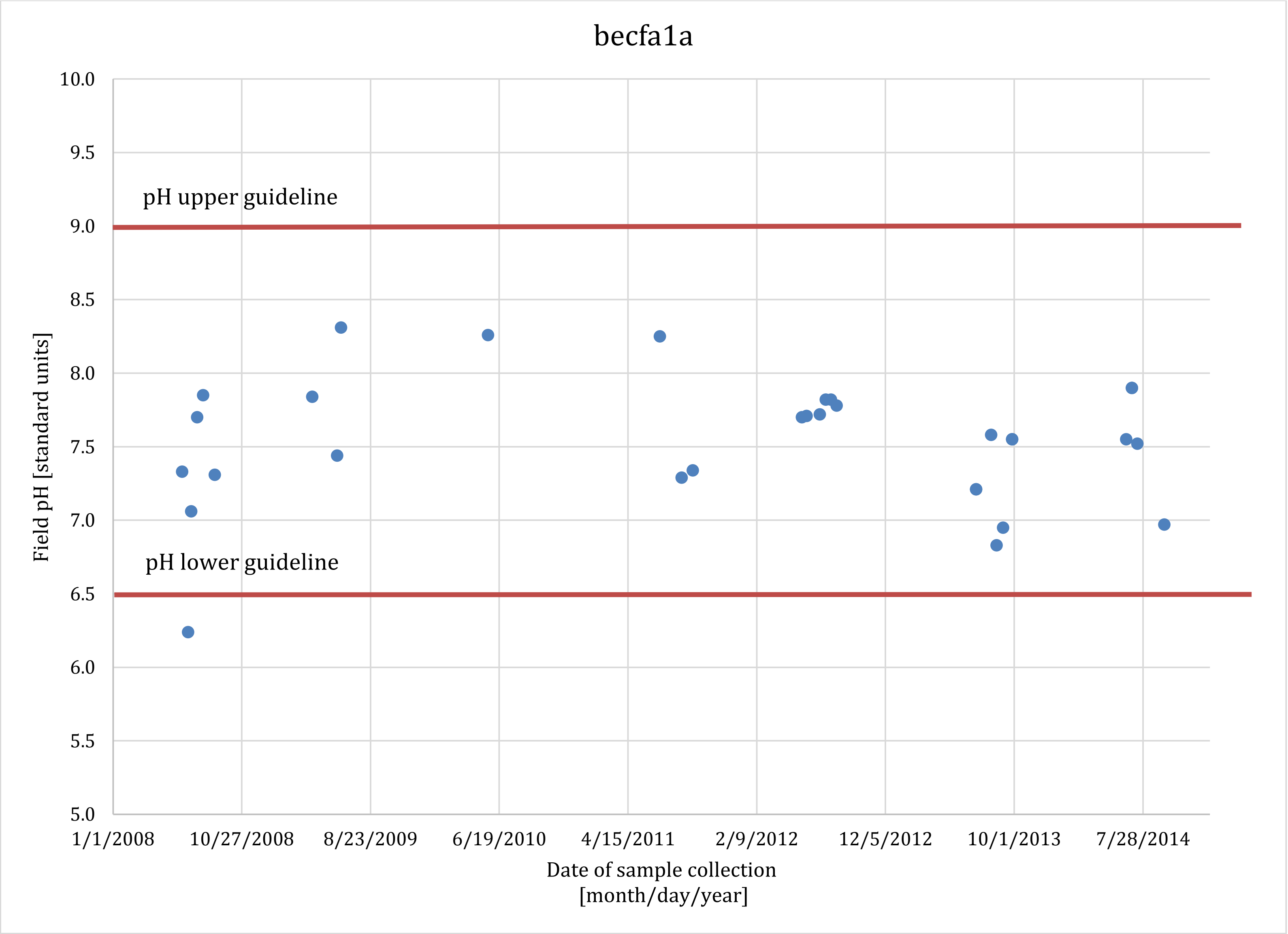
BOX AND WHISKER DIAGRAMS

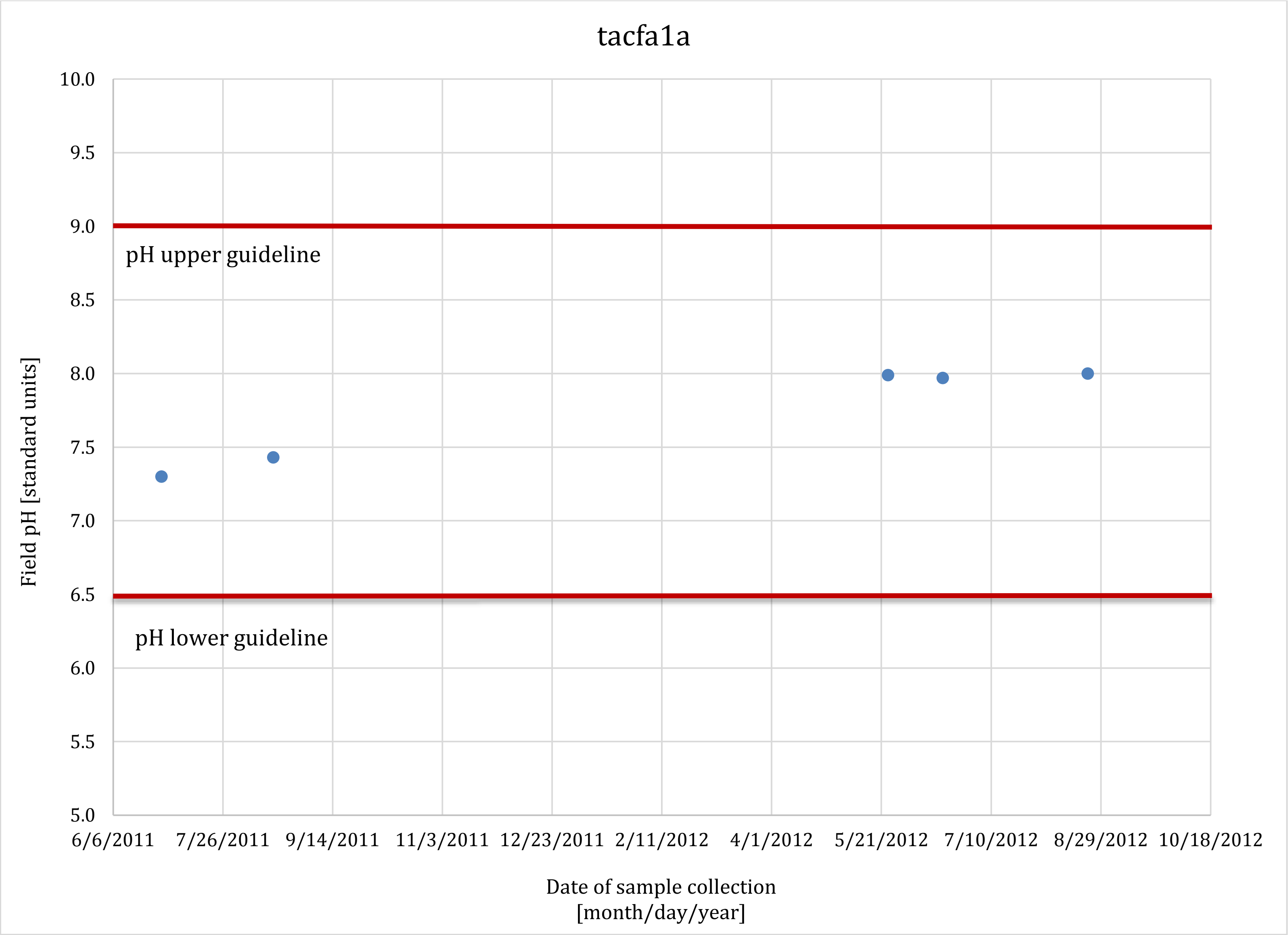
Below are some tips on how to interpret a box and whisker diagram. In the pages that follow, you can find a box and whisker diagrams for the ions (anions and cations) that we analyze in our samples.

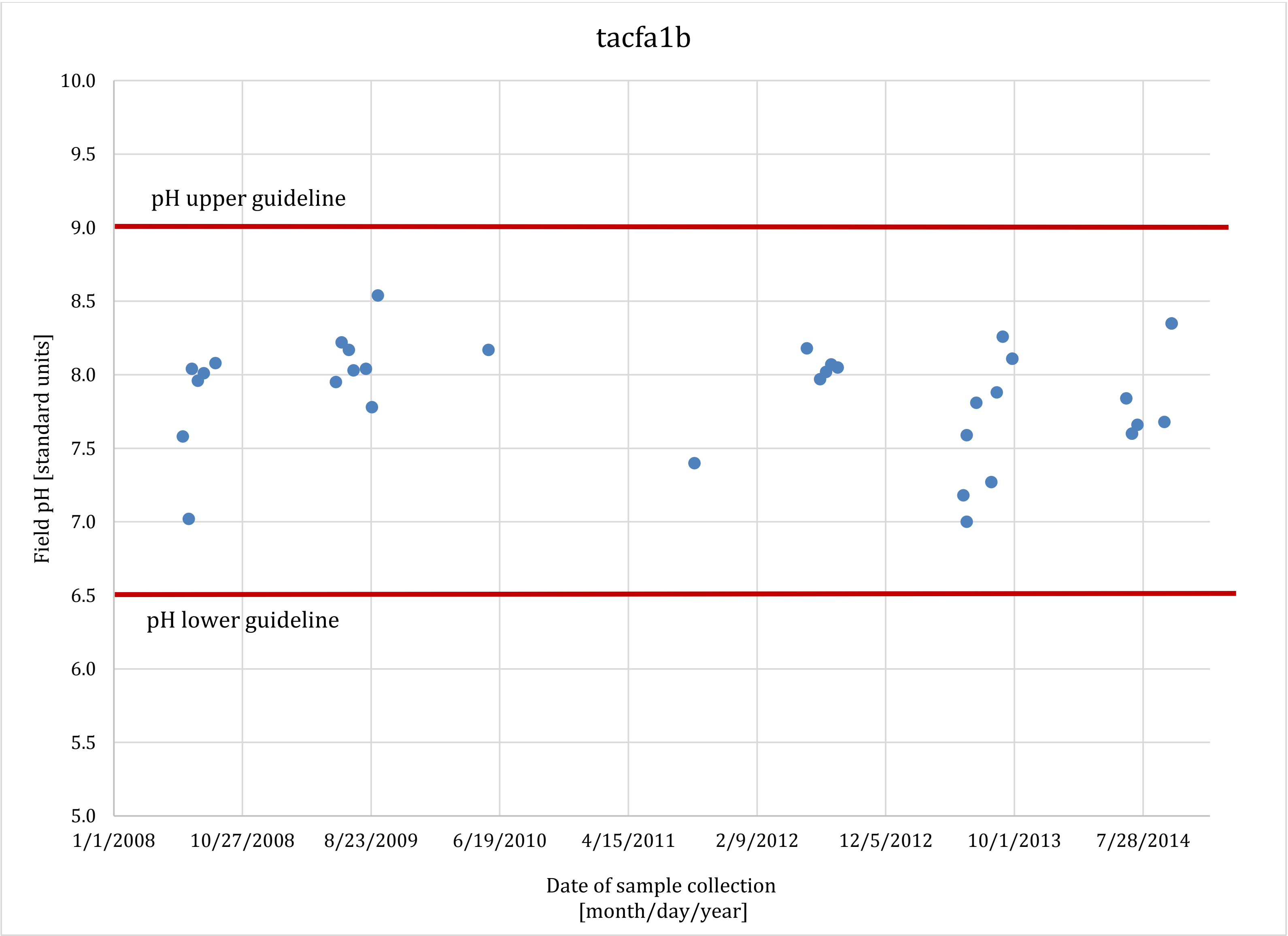


pH – BECFA1A, TACFA1A, TACFA1B

The following page shows the field pH measurements recorded at your sampling sites. The Canadian Guidelines for the Protection of Aquatic Life establish a range of acceptable pH values from 6.5-9.0 (CCME, 1987). All of the field measurements of pH at your sampling site, becfa1a, are between the guidelines except for one (taken in June 2008) that is below the lower guideline. The field pH at your sampling site, becfa1a, has an average value of 7.53. All of the field measurements of pH at your tacfa1a and tacfa1b sampling sites are between the guidelines and have an average value of 7.74 and 7.88, respectively.


becfa1a
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
pH upper guideline
pH lower guideline
Field pH [standard units]
1/1/2008
10/27/2008
8/23/2009
6/19/2010
4/15/2011
2/9/2012
12/5/2012
10/1/2013
7/28/2014
Date of sample collection
[month/day/year]


tacfa1a
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
Field pH [standard units]
pH upper guideline
pH lower guideline
6/6/2011
7/26/2011
9/14/2011
11/3/2011
12/23/2011
2/11/2012
4/1/2012
5/21/2012
7/10/2012
8/29/2012
10/18/2012
Date of sample collection
[month/day/year]


tacfa1b
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
Field pH [standard units]
pH upper guideline
pH lower guideline
1/1/2008
10/27/2008
8/23/2009
6/19/2010
4/15/2011
2/9/2012
12/5/2012
10/1/2013
7/28/2014
Date of sample collection
[month/day/year]

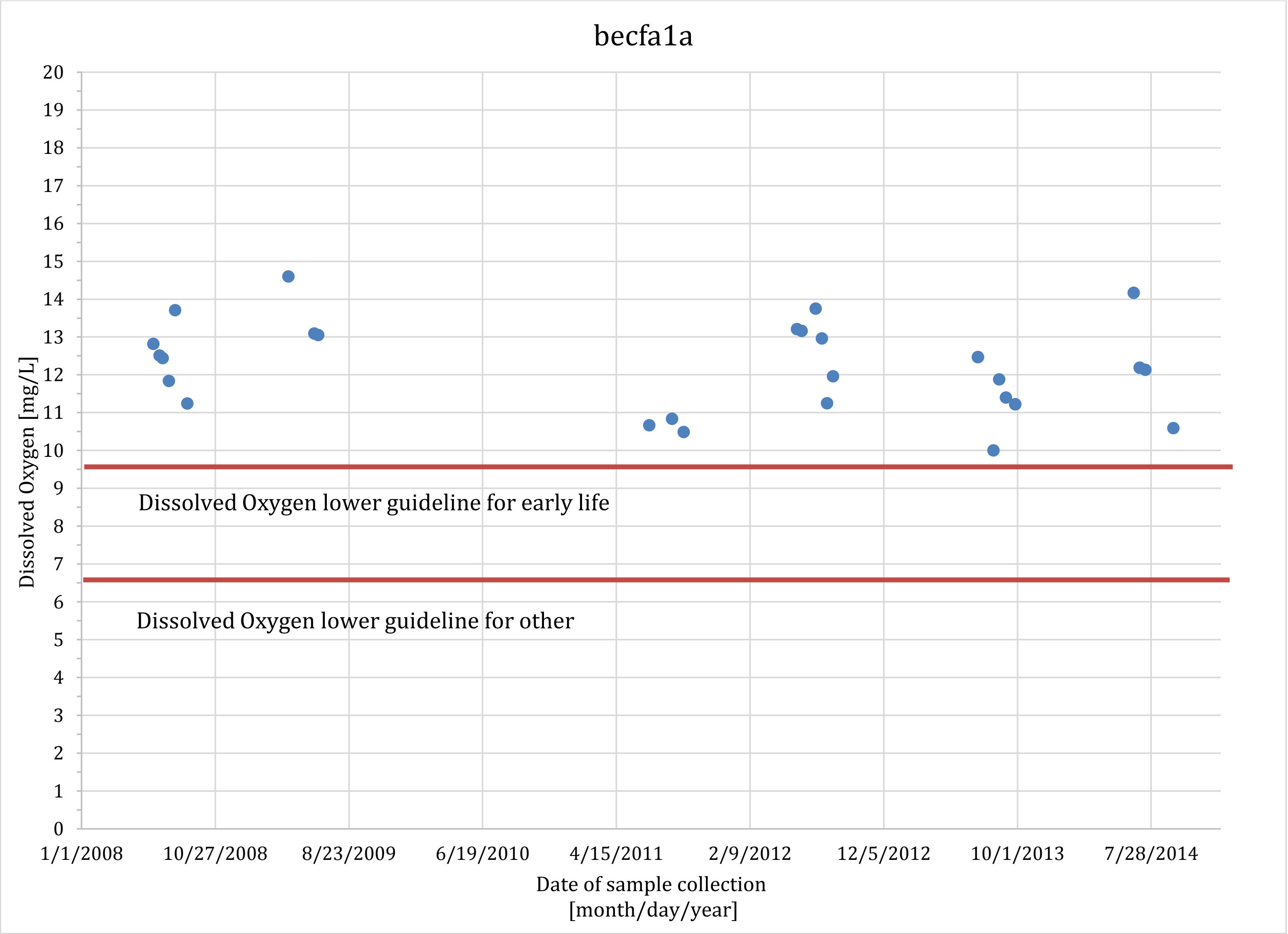
DISSOLVED OXYGEN – BECFA1A, TACFA1A, TACFA1B

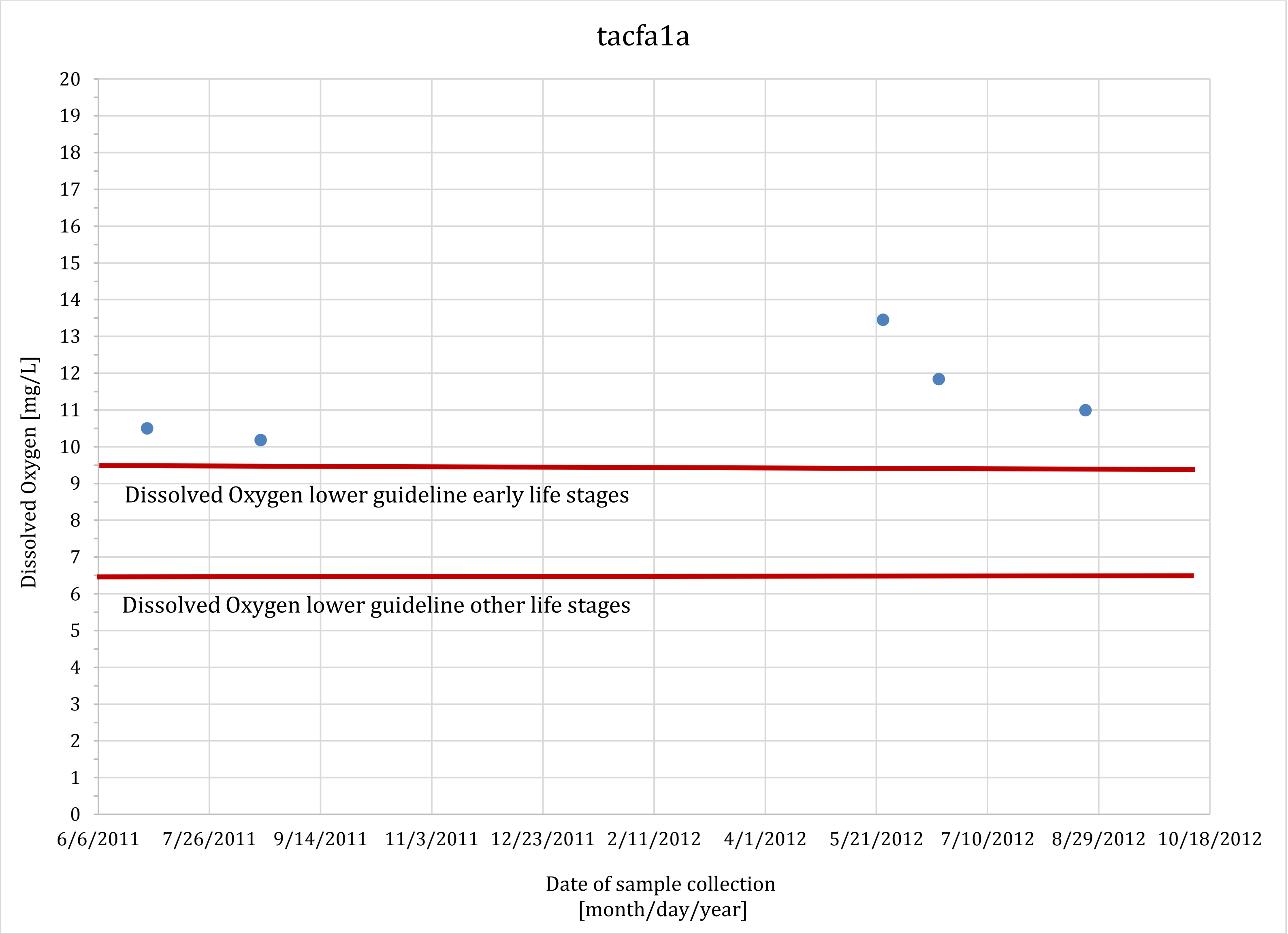
The following page shows the dissolved oxygen measurements recorded at your sampling sites.

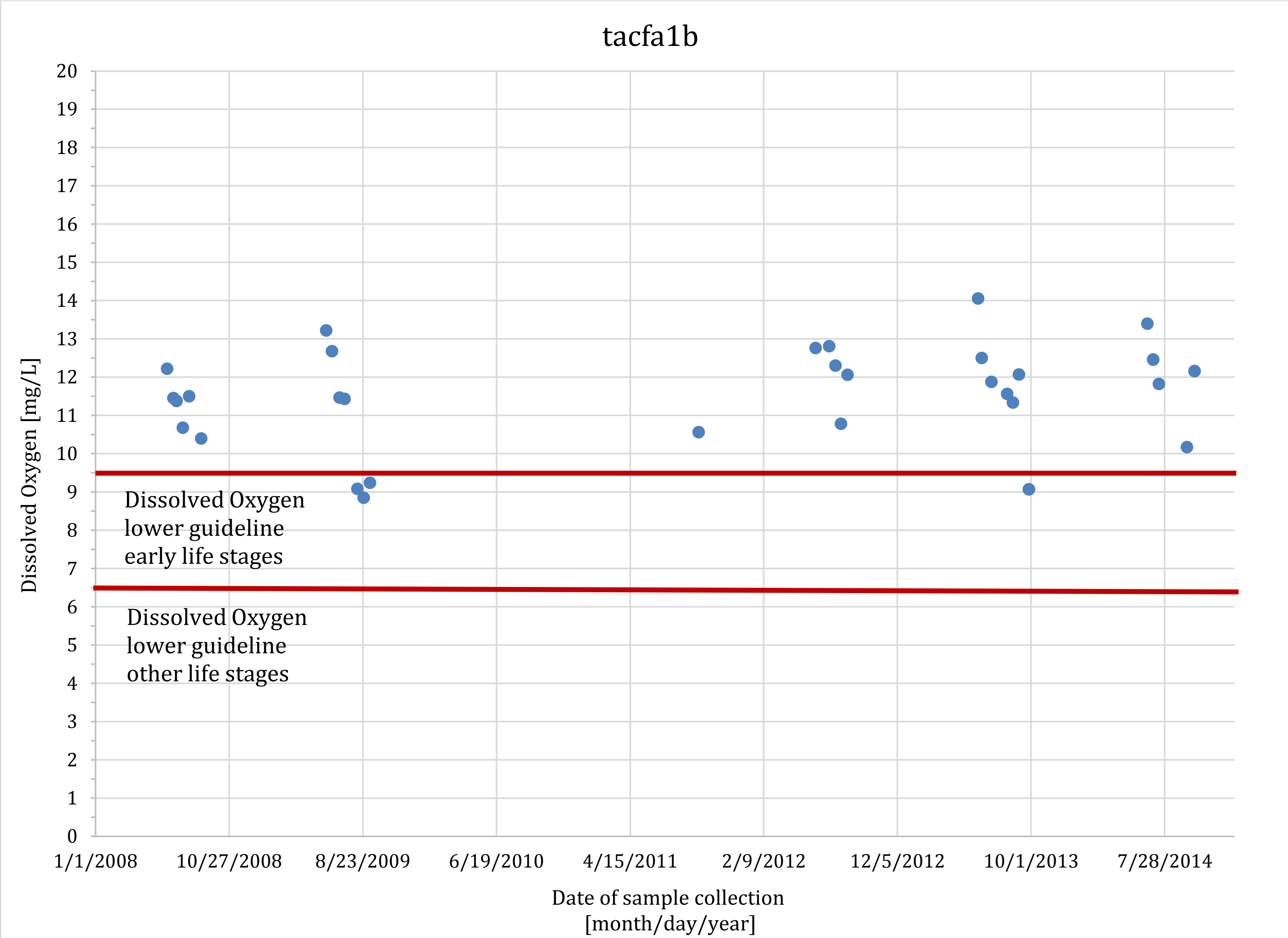
The Canadian Guidelines for the Protection of Aquatic Life state the following lowest acceptable dissolved oxygen concentrations (CCME, 1987):

- **For cold water biota: early life stages = 9.5 mg/L**
- **For cold water biota: other life stages = 6.5 mg/L**

All of the measurements of dissolved oxygen at your sampling sites, becfa1a and tacfa1a are above these guidelines and dissolved oxygen. Concentrations of dissolved oxygen at becfa1a have an average value of 12.2 mg/L and concentrations at tacfa1a have an average value of 11.4 mg/L. There are four dissolved oxygen measurements made at the tacfa1b sampling site that are below the early life stages lower guideline. Concentrations of dissolved oxygen at tacfa1b have an average value of 11.5 mg/L.

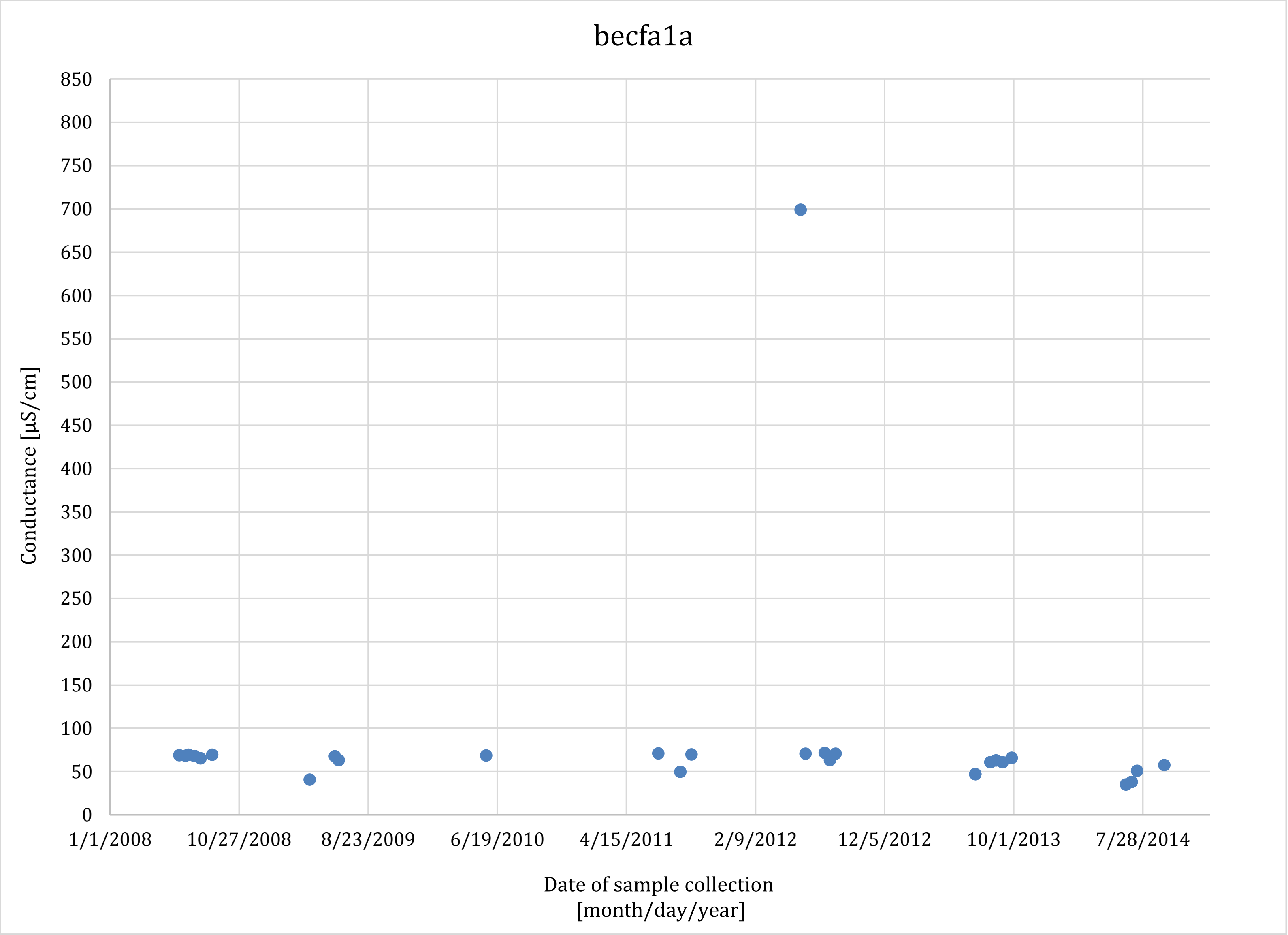

becfa1a
Dissolved Oxygen [mg/L]
20
19
18
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
Dissolved Oxygen lower guideline for early life
Dissolved Oxygen lower guideline for other
1/1/2008
10/27/2008
8/23/2009
6/19/2010
4/15/2011
2/9/2012
12/5/2012
10/1/2013
7/28/2014
Date of sample collection
[month/day/year]

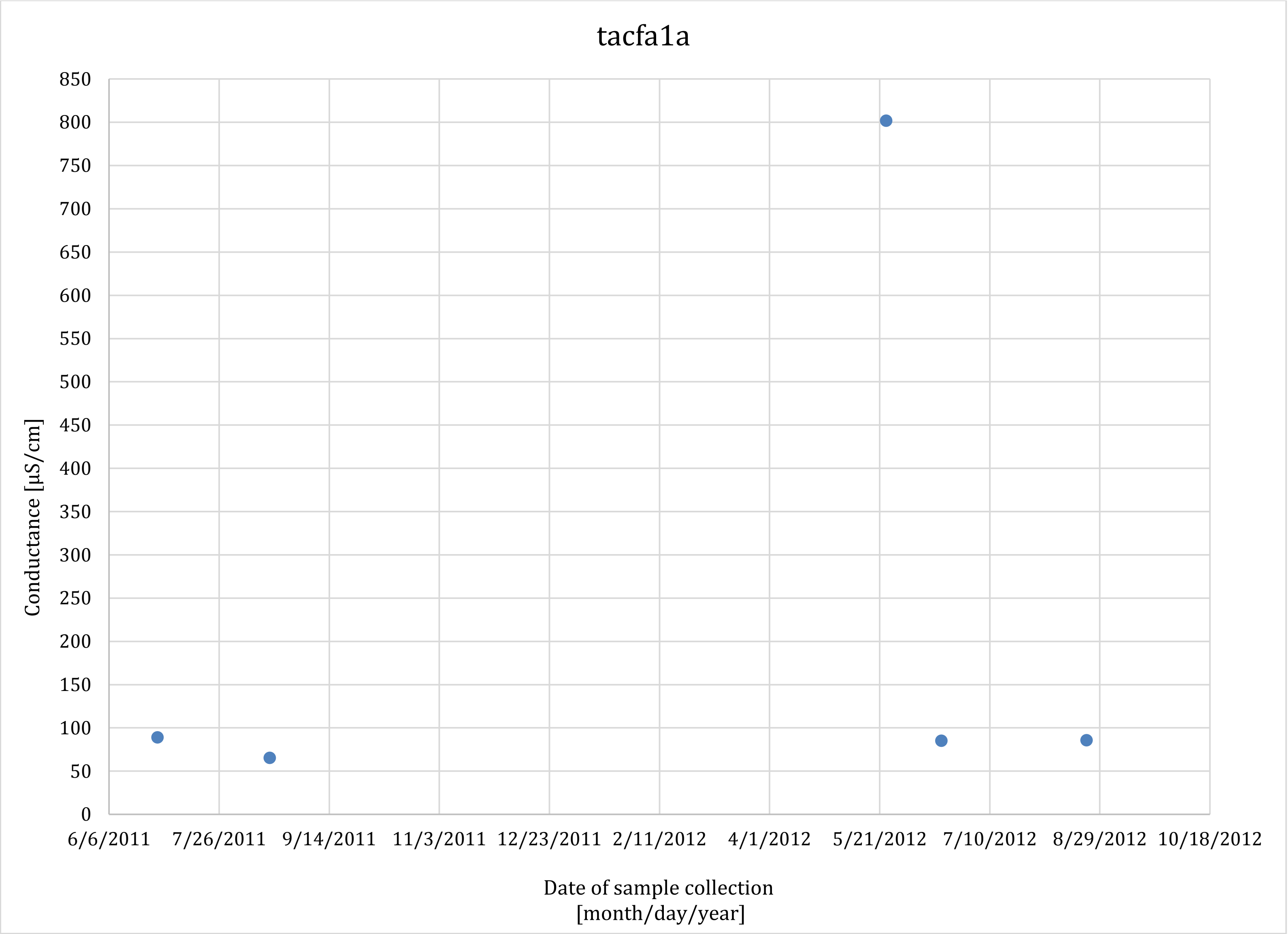

tacfa1a
Dissolved Oxygen [mg/L]
20
19
18
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
Dissolved Oxygen lower guideline early life stages
Dissolved Oxygen lower guideline other life stages
6/6/2011
7/26/2011
9/14/2011
11/3/2011
12/23/2011
2/11/2012
4/1/2012
5/21/2012
7/10/2012
8/29/2012
10/18/2012
Date of sample collection
[month/day/year]

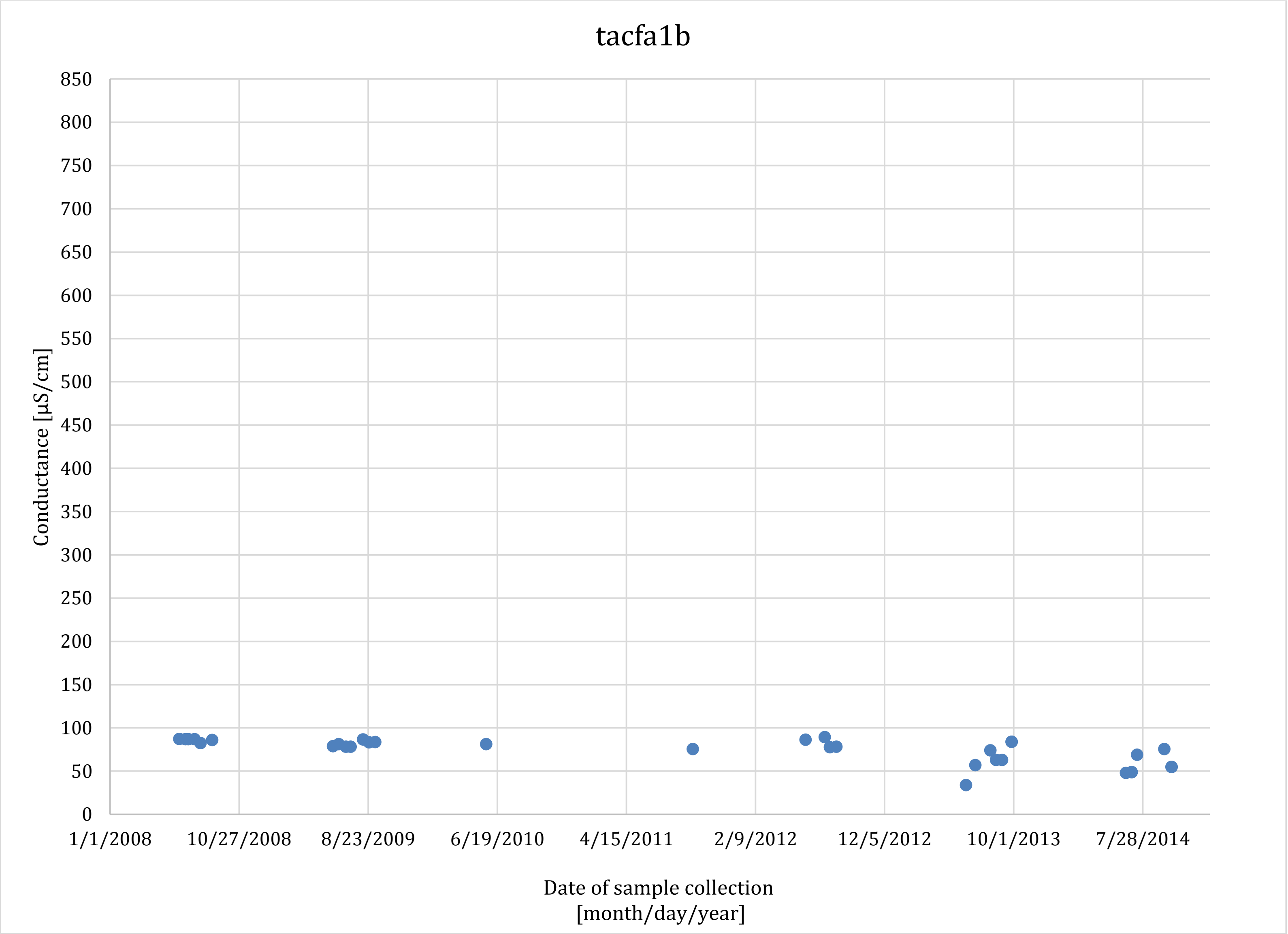

tacfa1b
20
19
18
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
Dissolved Oxygen [mg/L]
Dissolved Oxygen
lower guideline
early life stages
Dissolved Oxygen
lower guideline
other life stages
1/1/2008
10/27/2008
8/23/2009
6/19/2010
4/15/2011
2/9/2012
12/5/2012
10/1/2013
7/28/2014
Date of sample collection
[month/day/year]

CONDUCTANCE – BECFA1A, TACFA1A, TACFA1B

The following page shows the conductance measurements recorded at your sampling site. The Canadian Guidelines for the Protection of Aquatic Life do not include a guideline for conductance. However, conductance is a very important parameter. Recall that when the conductance goes up or down, it is telling us something about the amount of dissolved solids in the water. The conductance at the becfa1a sampling site has an average value of 81.5 µS/cm and conductance at the tacfa1a sampling site has an average value of 225.4 µS/cm though there is one sample collected in May 2012 that is much higher than the others at both becfa1a and tacfa1a. We need to investigate whether this is a natural value or sampling error. Conductance measurements made at the tacfa1b sampling site have an average value of 73.8 µS/cm.


becfa1a
850
800
750
700
650
600
550
500
450
400
350
300
250
200
150
100
50
0
Conductance [µS/cm]
1/1/2008
10/27/2008
8/23/2009
6/19/2010
4/15/2011
2/9/2012
12/5/2012
10/1/2013
7/28/2014
Date of sample collection
[month/day/year]


tacfa1a
850
800
750
700
650
600
550
500
450
400
350
300
250
200
150
100
50
0
Conductance [µS/cm]
6/6/2011
7/26/2011
9/14/2011
11/3/2011
12/23/2011
2/11/2012
4/1/2012
5/21/2012
7/10/2012
8/29/2012
10/18/2012
Date of sample collection
[month/day/year]

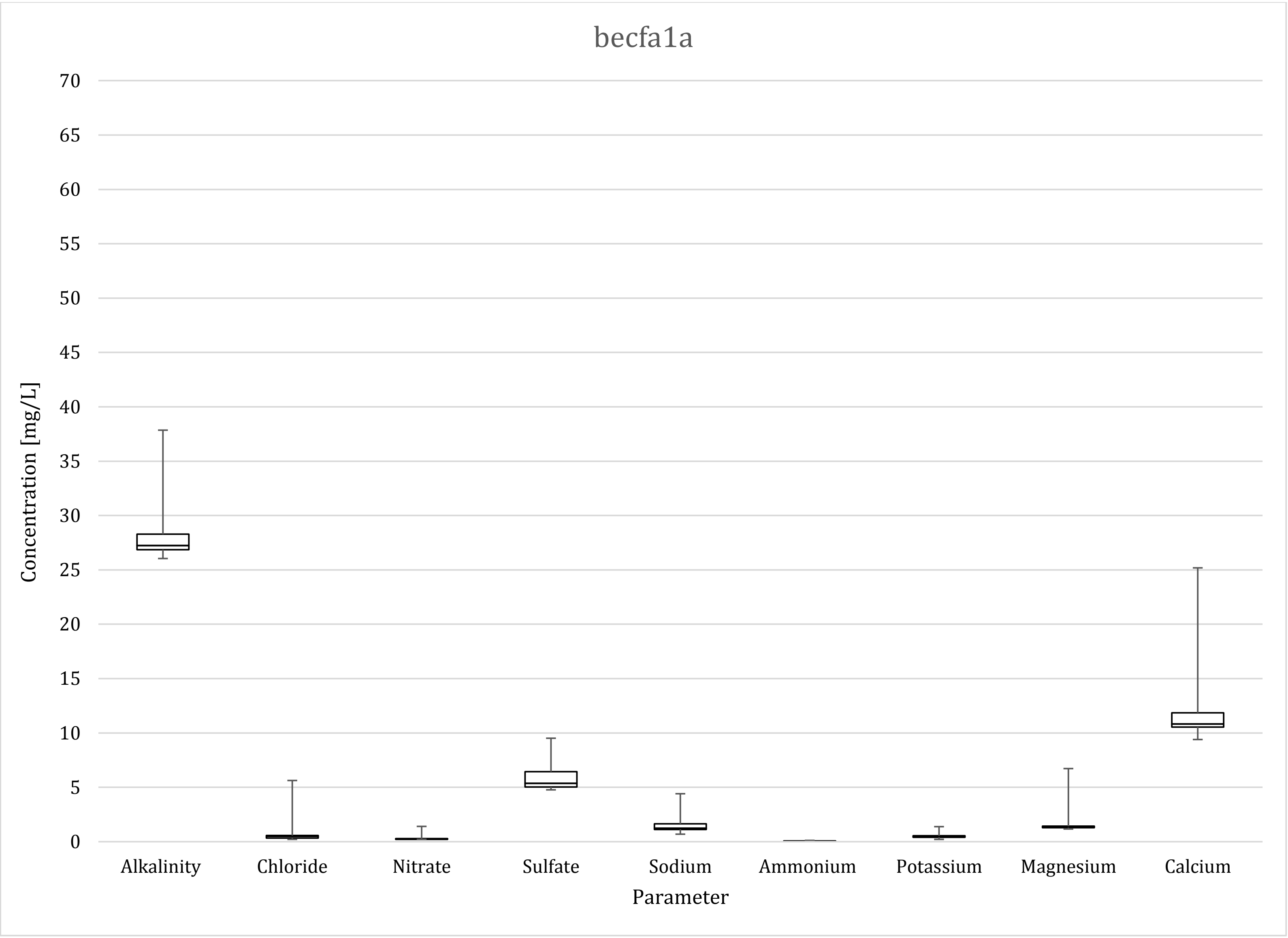

tacfa1b
Conductance [µS/cm]
850
800
750
700
650
600
550
500
450
400
350
300
250
200
150
100
50
0
1/1/2008
10/27/2008
8/23/2009
6/19/2010
4/15/2011
2/9/2012
12/5/2012
10/1/2013
7/28/2014
Date of sample collection
[month/day/year]

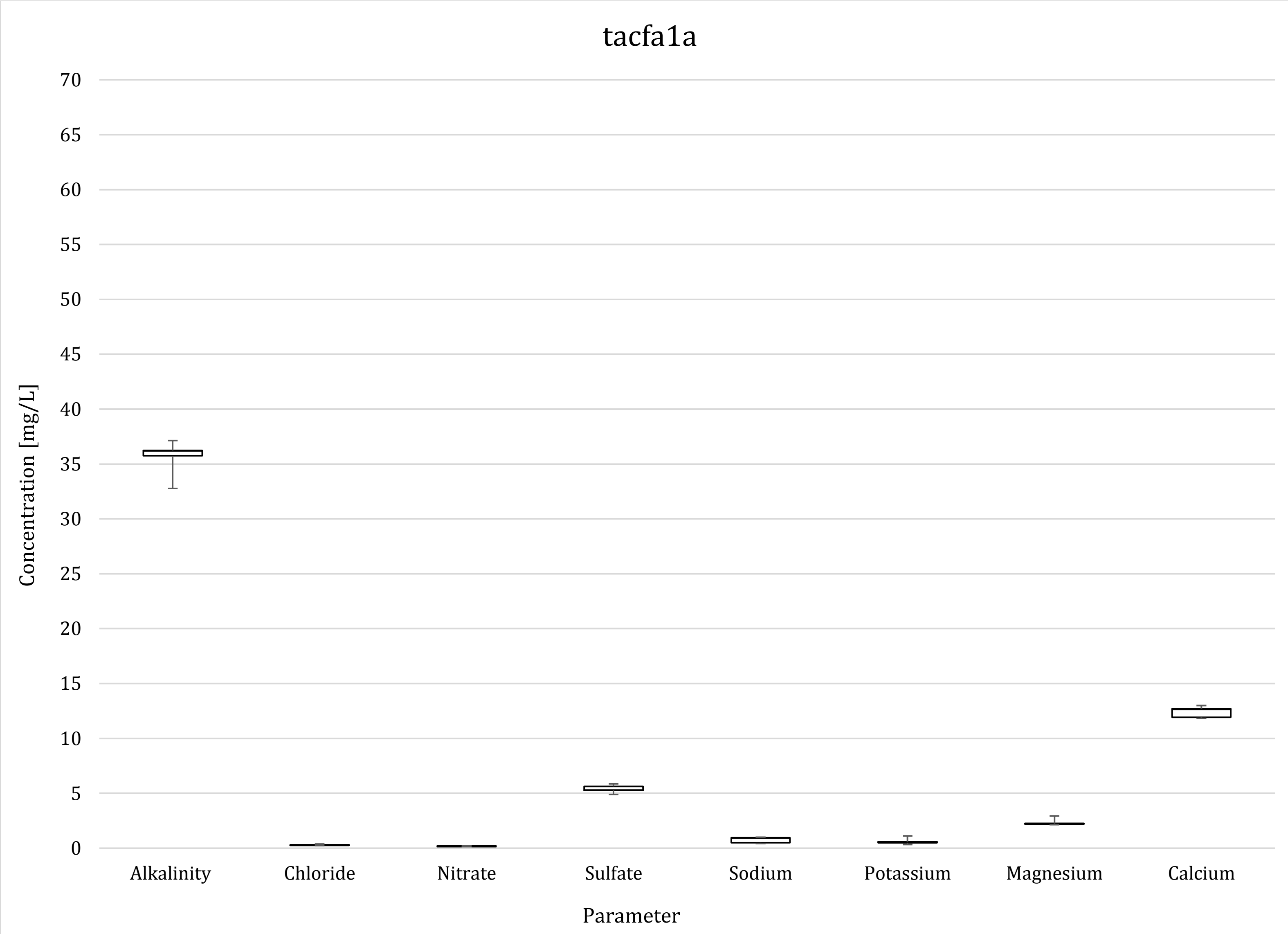
ANIONS AND CATIONS

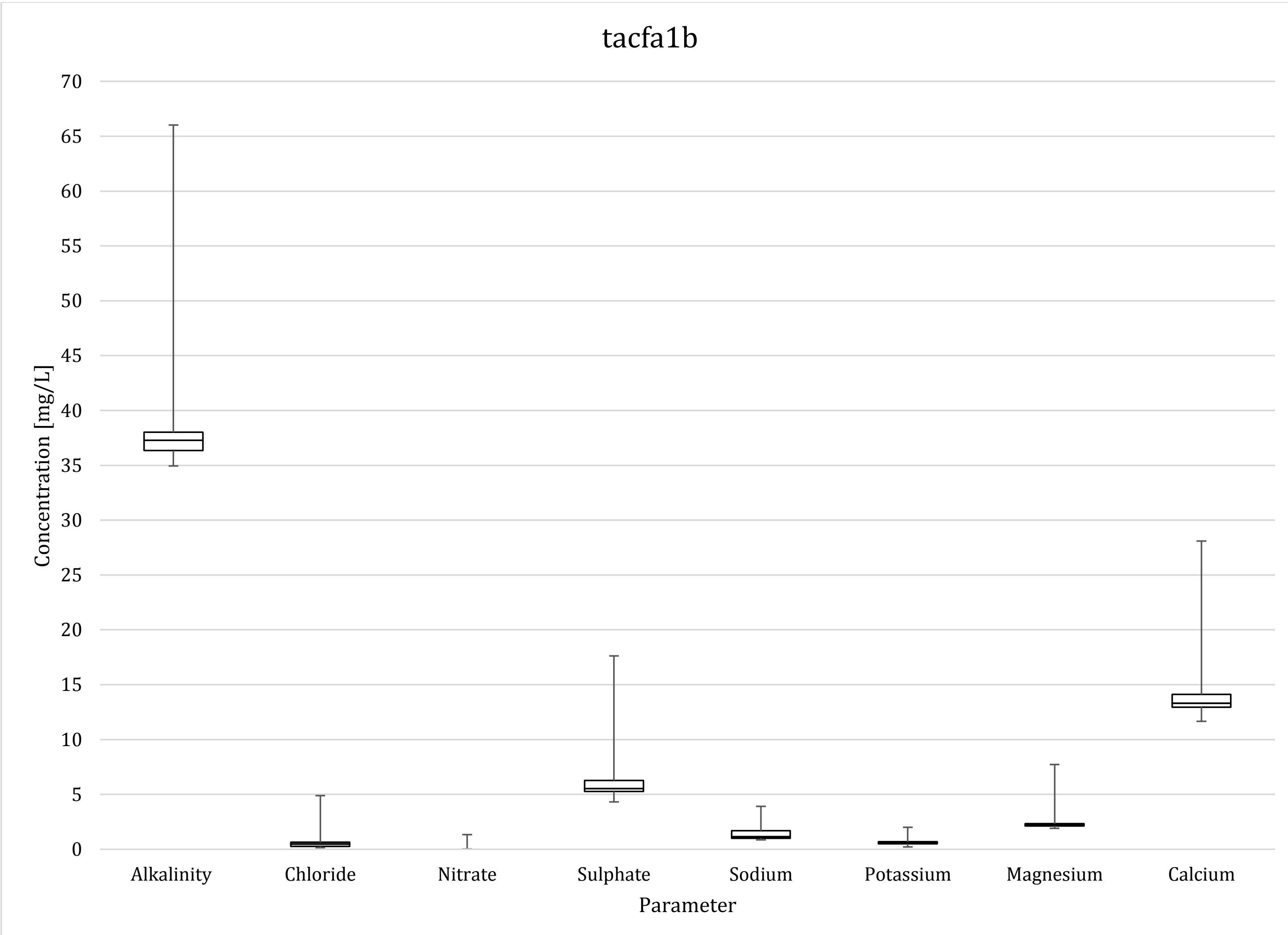
The following page shows a box and whisker diagram for all of the ions (anions and cations) analyzed in samples taken at your sampling site. The diagram shows that alkalinity is abundant in your samples. There are also significant concentrations of calcium and sulphate in your samples. There are relatively small concentrations of magnesium and sodium in your samples and only "trace" (very small) concentrations of potassium, nitrate, and ammonium.

Since the most abundant anion is alkalinity (in the form of bicarbonate) and the most abundant cation is calcium, we can classify your water as "bicarbonate-calcium-type" water. Most water samples from healthy, natural river systems around the world are "bicarbonate-calcium-type" water.

You will notice that all of your samples are above the lower guideline for alkalinity and below the upper guideline for chloride. Based on these data, there are no indications of impacts to the habitat that our river provides to so many organisms. The following pages show us a more detailed view of the measurements of alkalinity and chloride concentrations made over time.

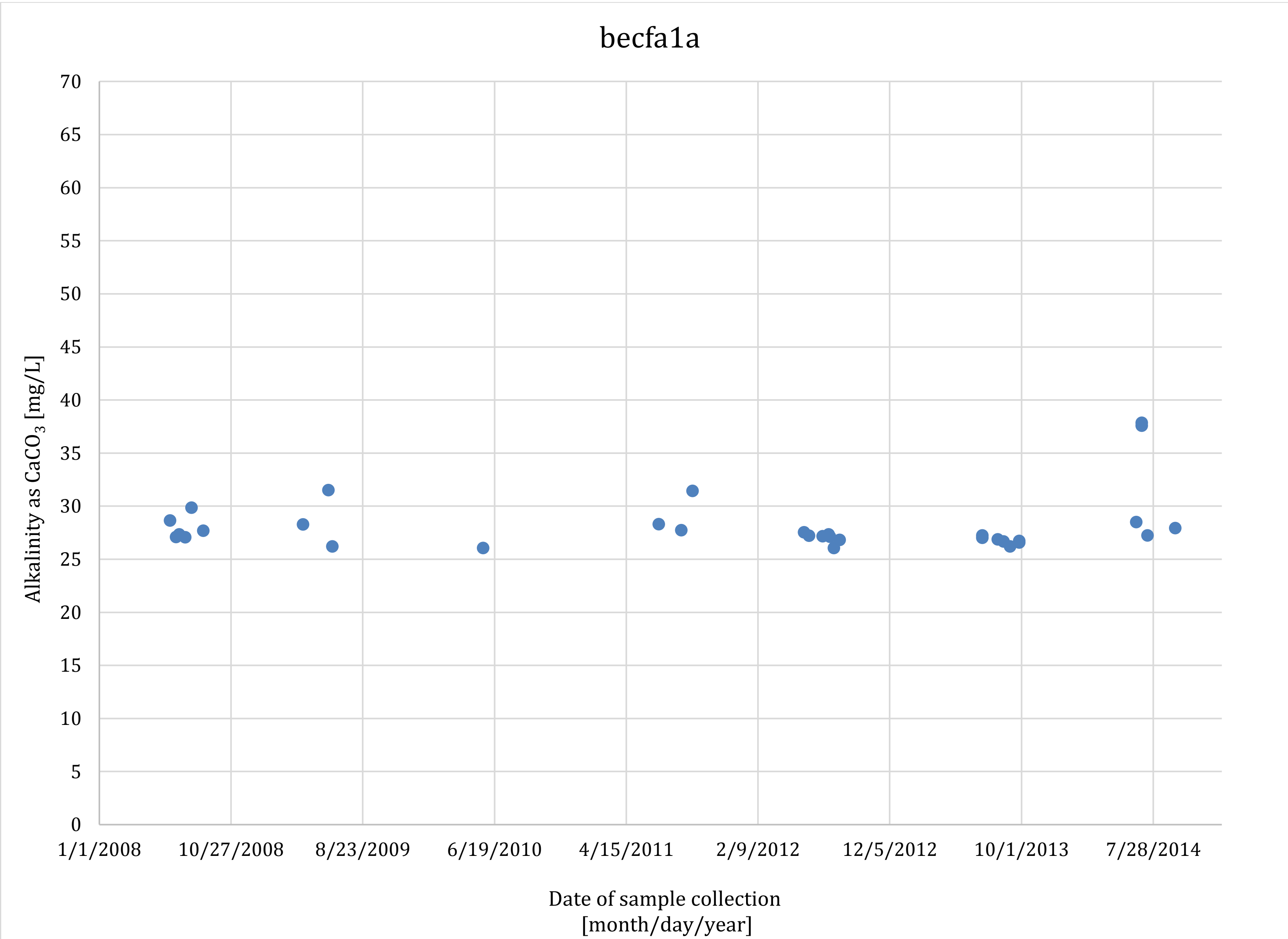

becfa1a
Concentration [mg/L]
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
Alkalinity
Chloride
Nitrate
Sulfate
Sodium
Ammonium
Potassium
Magnesium
Calcium
Parameter

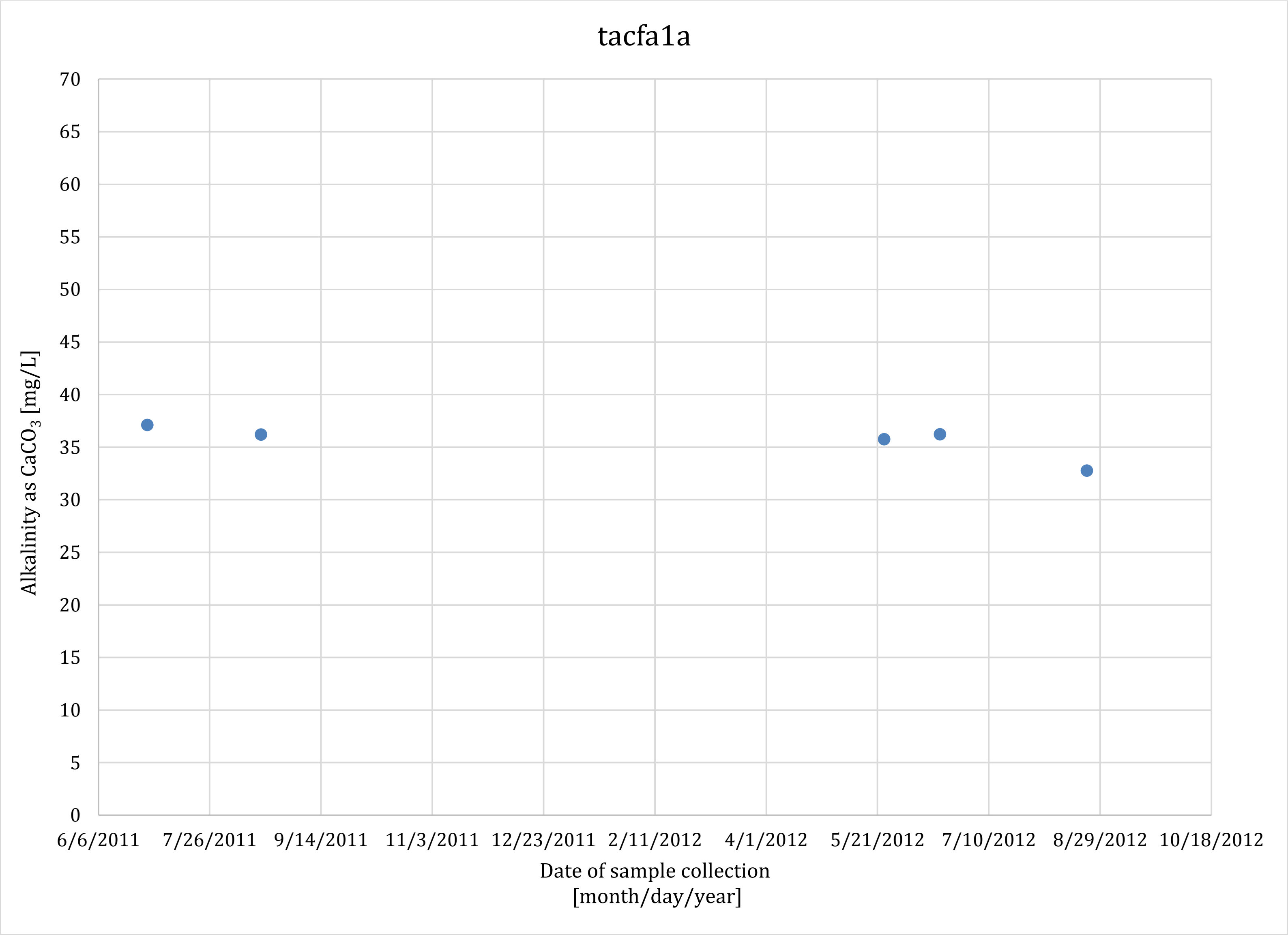

tacfa1a
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
Concentration [mg/L]
Alkalinity
Chloride
Nitrate
Sulfate
Sodium
Potassium
Magnesium
Calcium
Parameter

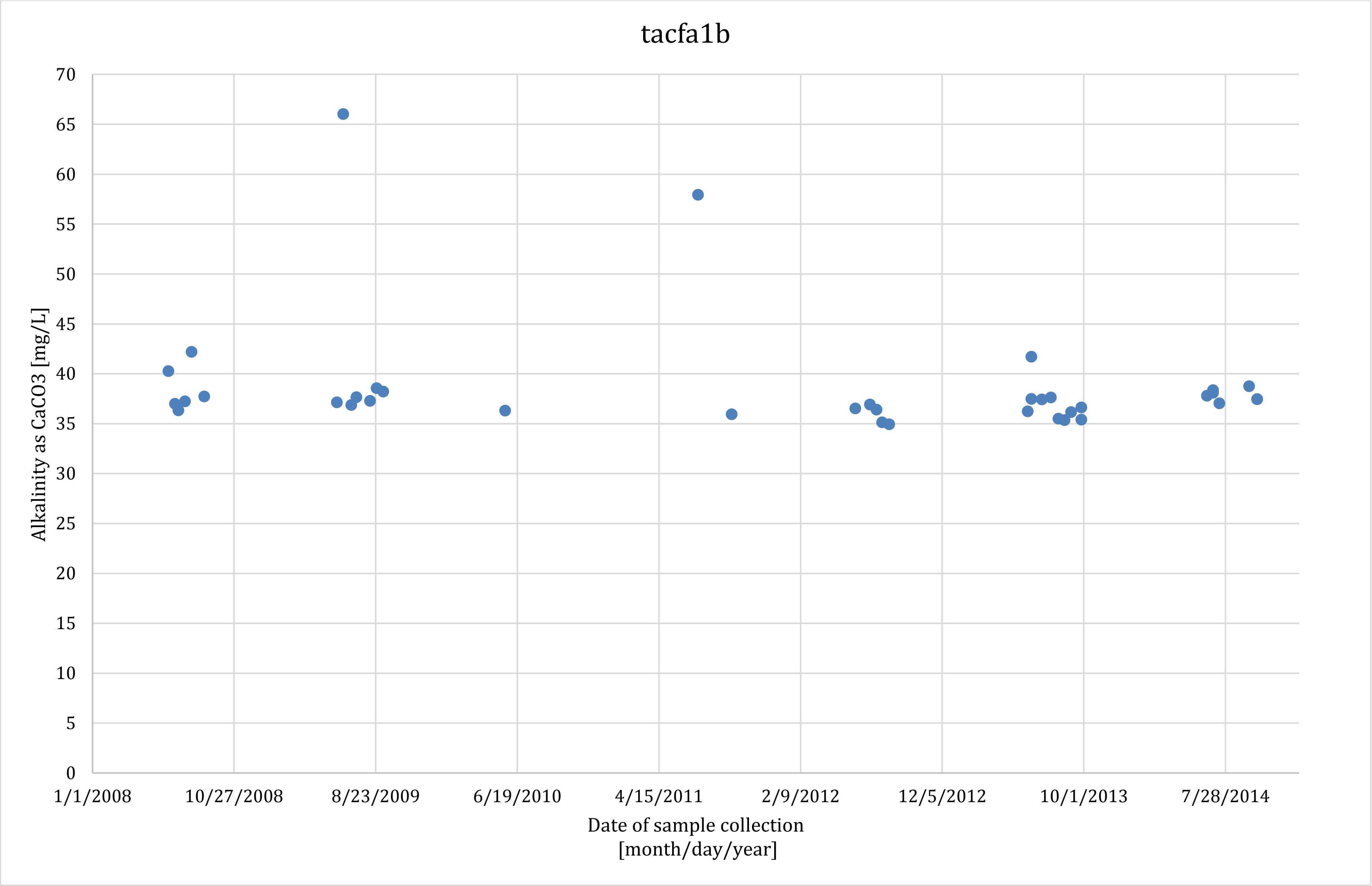

tacfa1b
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
Concentration [mg/L]
Alkalinity
Chloride
Nitrate
Sulphate
Sodium
Potassium
Magnesium
Calcium
Parameter

ALKALINITY – BECFA1A, TACFA1A, TACFA1B

The following page shows the alkalinity of samples taken at your sampling site. The Canadian Guidelines for the Protection of Aquatic Life do not include a guideline for alkalinity. Alkalinity in your samples from becfa1a have an average value of 28.2 mg/L. Those from tacfa1a have an average value of 35.6 mg/L and samples collected from tacfa1b have an average value of 38.6 mg/L.


becfa1a
Alkalinity as $CaCO_3$ [mg/L]
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
1/1/2008
10/27/2008
8/23/2009
6/19/2010
4/15/2011
2/9/2012
12/5/2012
10/1/2013
7/28/2014
Date of sample collection
[month/day/year]

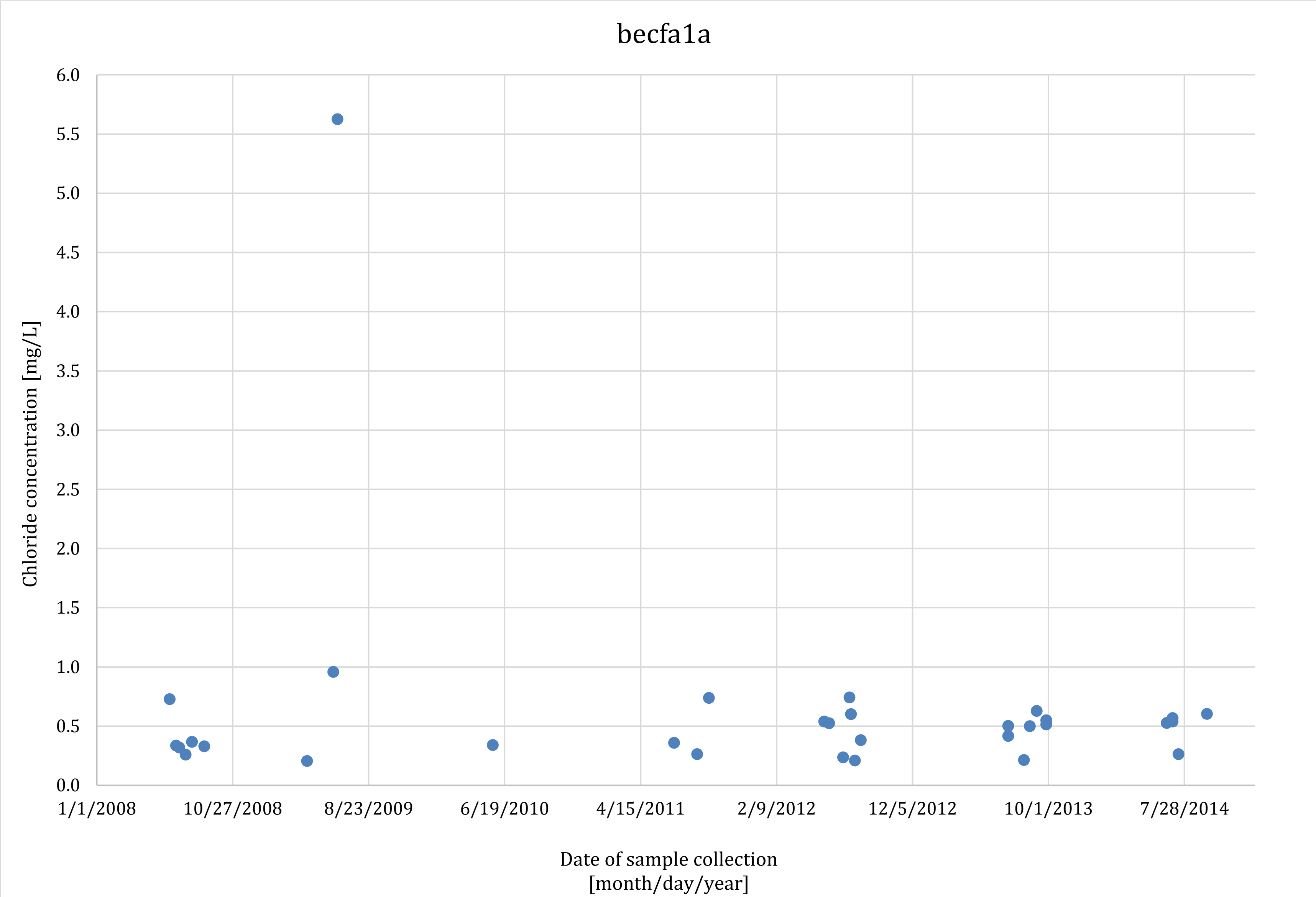

tacfa1a
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
Alkalinity as CaCO3 [mg/L]
6/6/2011
7/26/2011
9/14/2011
11/3/2011
12/23/2011
2/11/2012
4/1/2012
5/21/2012
7/10/2012
8/29/2012
10/18/2012
Date of sample collection
[month/day/year]

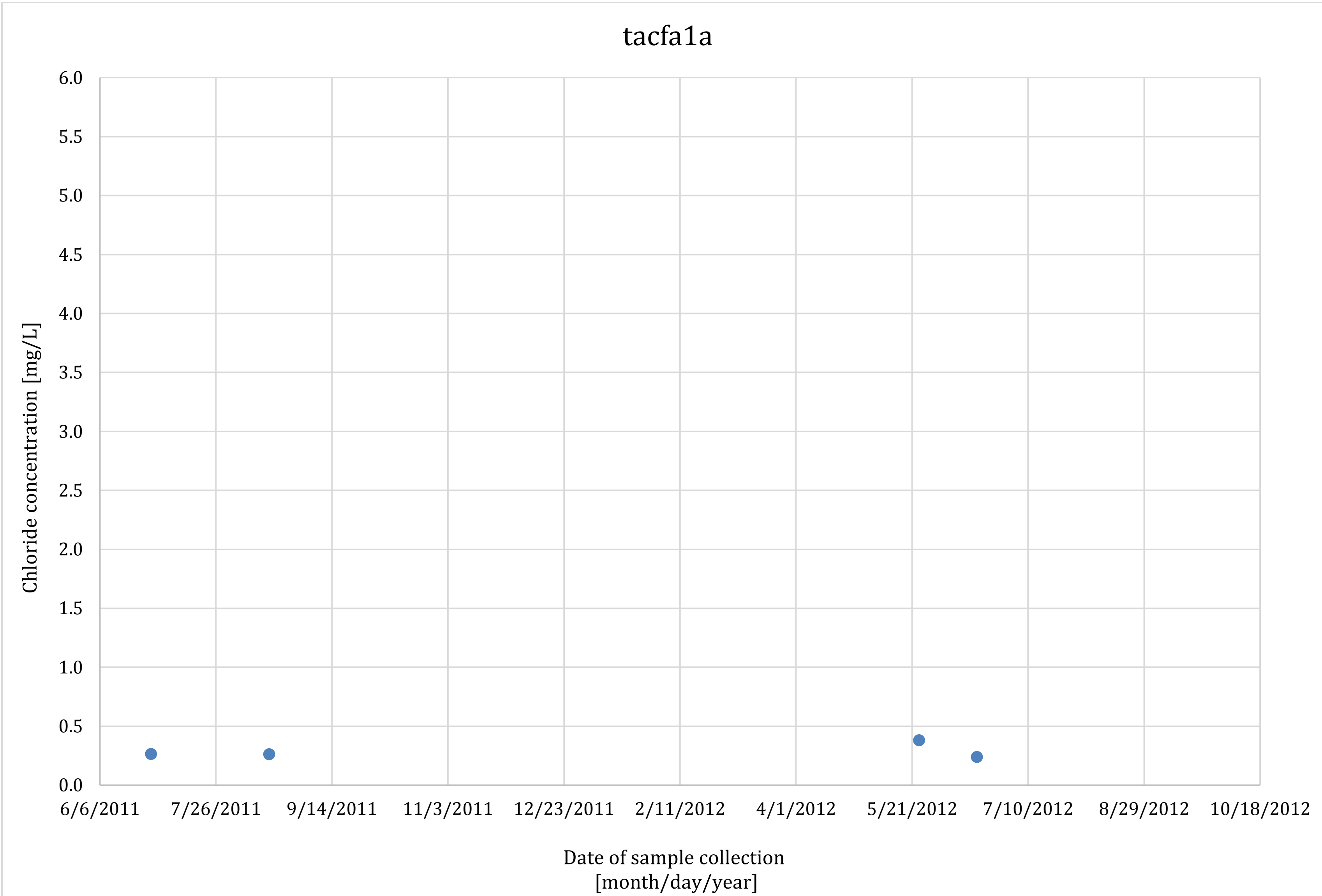

tacfa1b
Alkalinity as CaCO3 [mg/L]
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
1/1/2008
10/27/2008
8/23/2009
6/19/2010
4/15/2011
2/9/2012
12/5/2012
10/1/2013
7/28/2014
Date of sample collection
[month/day/year]

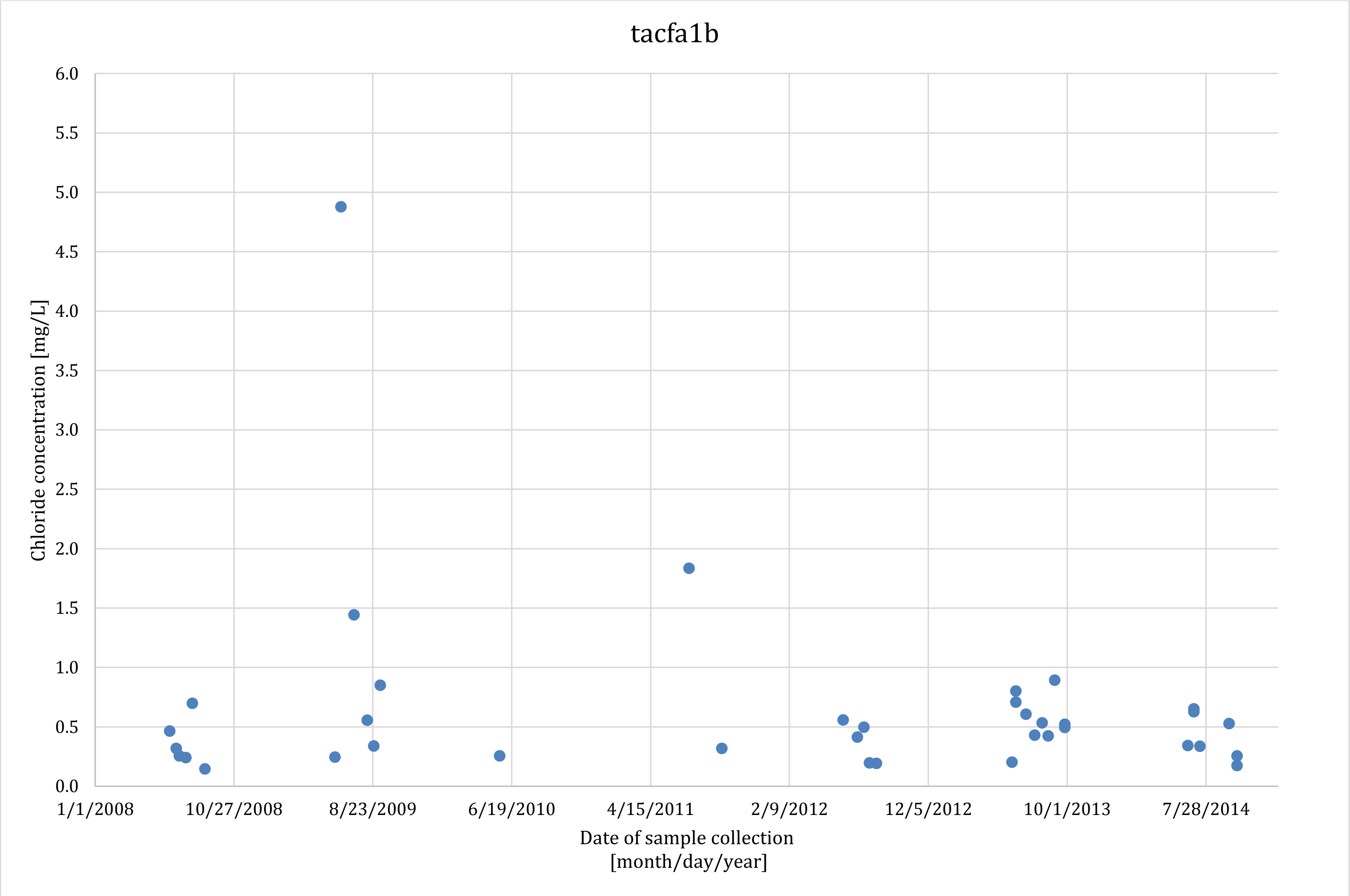
CHLORIDE – BECFA1A, TACFA1A, TACFA1B

The following page shows the chloride concentration in samples taken at your sampling sites. The Canadian Guidelines for the Protection of Aquatic Life states that long-term chloride concentrations should not exceed 120 mg/L (CCME, 1987). All of your samples, from all three of your sampling locations, are far below this upper guideline; in fact, chloride concentrations in your samples from becfa1a have an average value of 0.6 mg/L, those from tacfa1a have an average value of 0.03, and samples collected from tacfa1b have an average value of 0.6 mg/L.

There are two samples, collected in June 2009 from becfa1a and tacfa1b that have higher concentration than all of the other samples. Do you see it? It is still well below the upper guideline and therefore did not pose any risk for your community.


becfa1a
Chloride concentration [mg/L]
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
1/1/2008
10/27/2008
8/23/2009
6/19/2010
4/15/2011
2/9/2012
12/5/2012
10/1/2013
7/28/2014
Date of sample collection
[month/day/year]

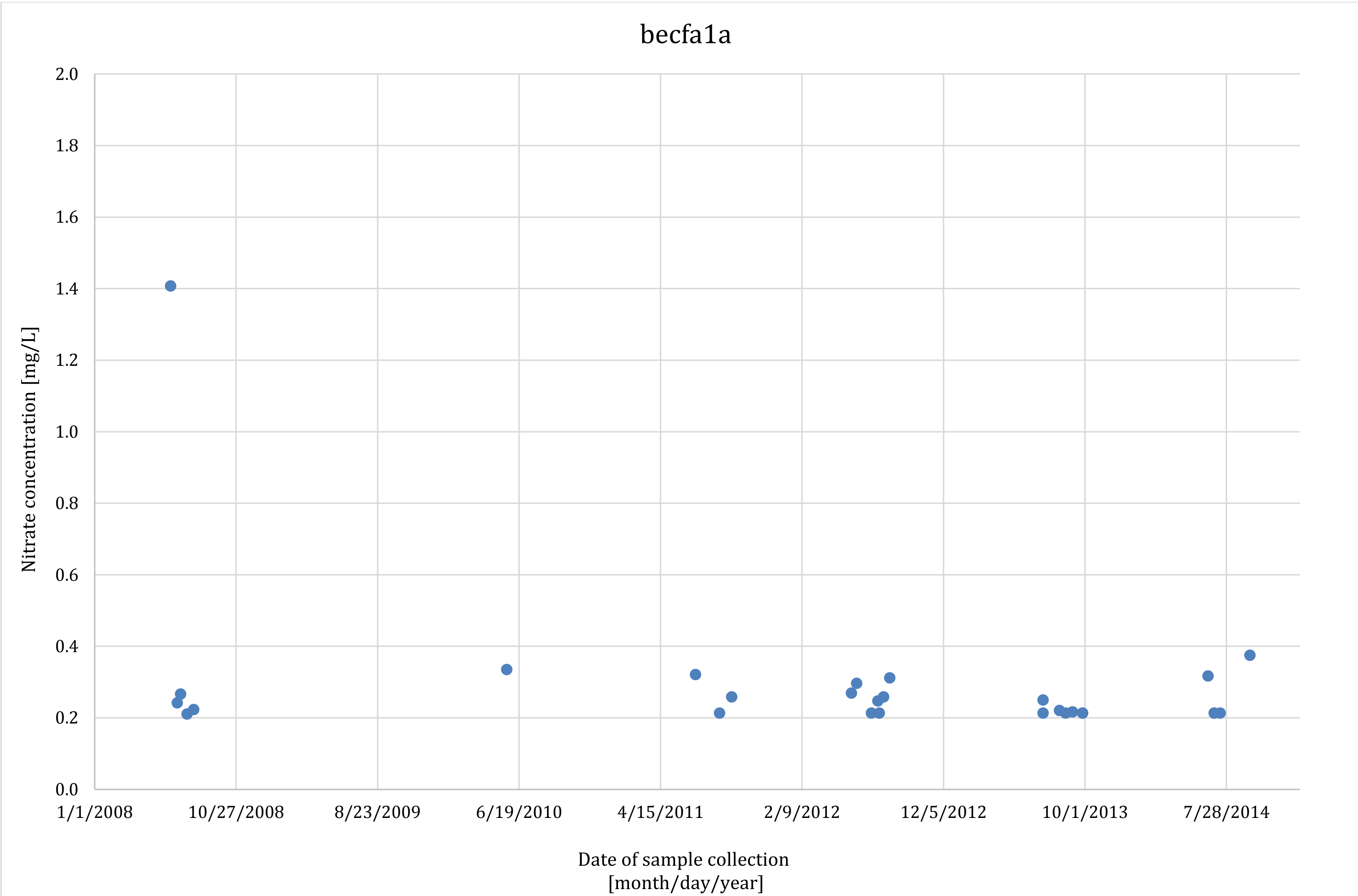

tacfa1a
Chloride concentration [mg/L]
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
6/6/2011
7/26/2011
9/14/2011
11/3/2011
12/23/2011
2/11/2012
4/1/2012
5/21/2012
7/10/2012
8/29/2012
10/18/2012
Date of sample collection
[month/day/year]

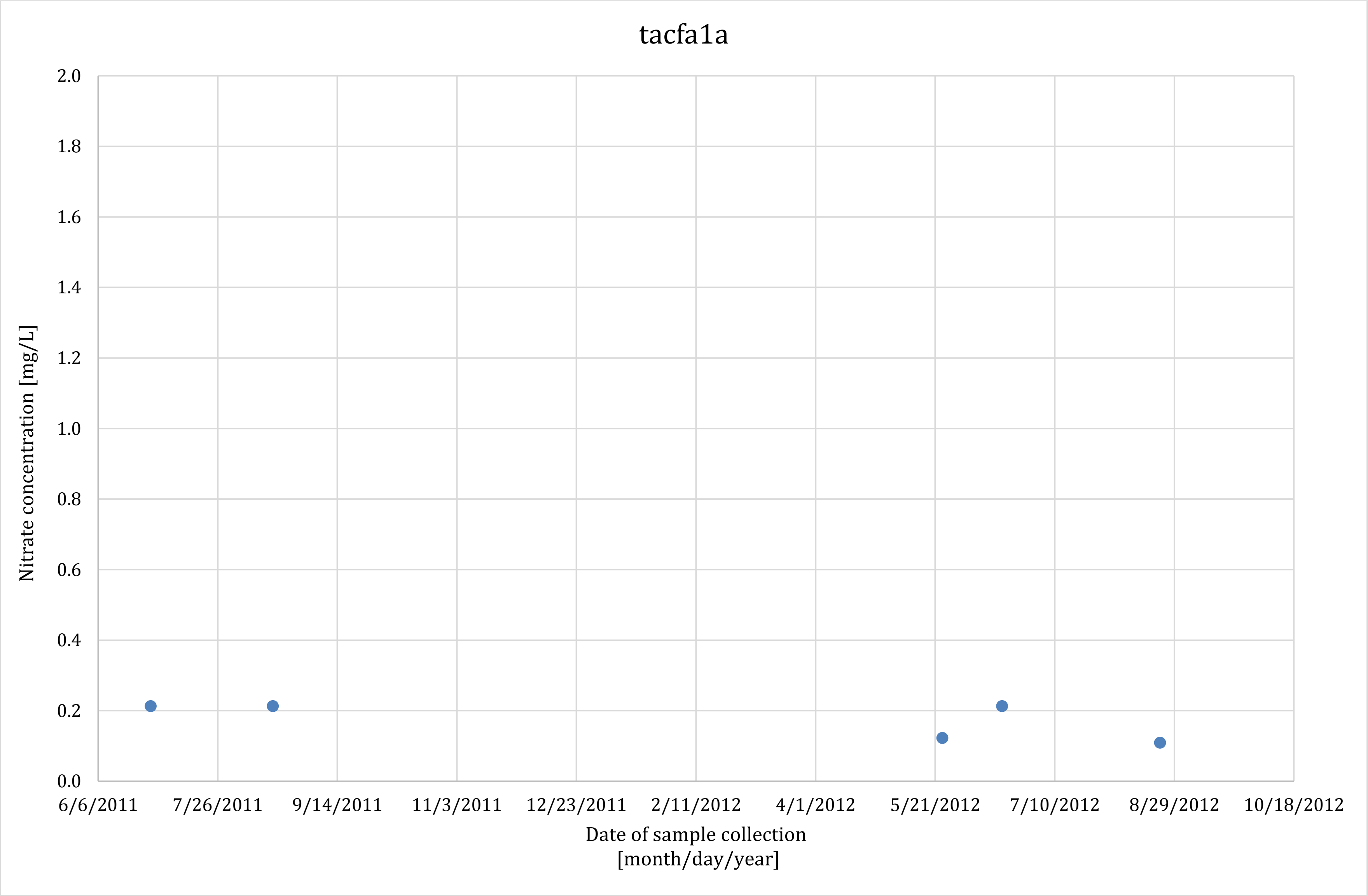

tacfa1b
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
Chloride concentration [mg/L]
1/1/2008
10/27/2008
8/23/2009
6/19/2010
4/15/2011
2/9/2012
12/5/2012
10/1/2013
7/28/2014
Date of sample collection
[month/day/year]

NITRATE – BECFA1A, TACFA1A, TACFA1B

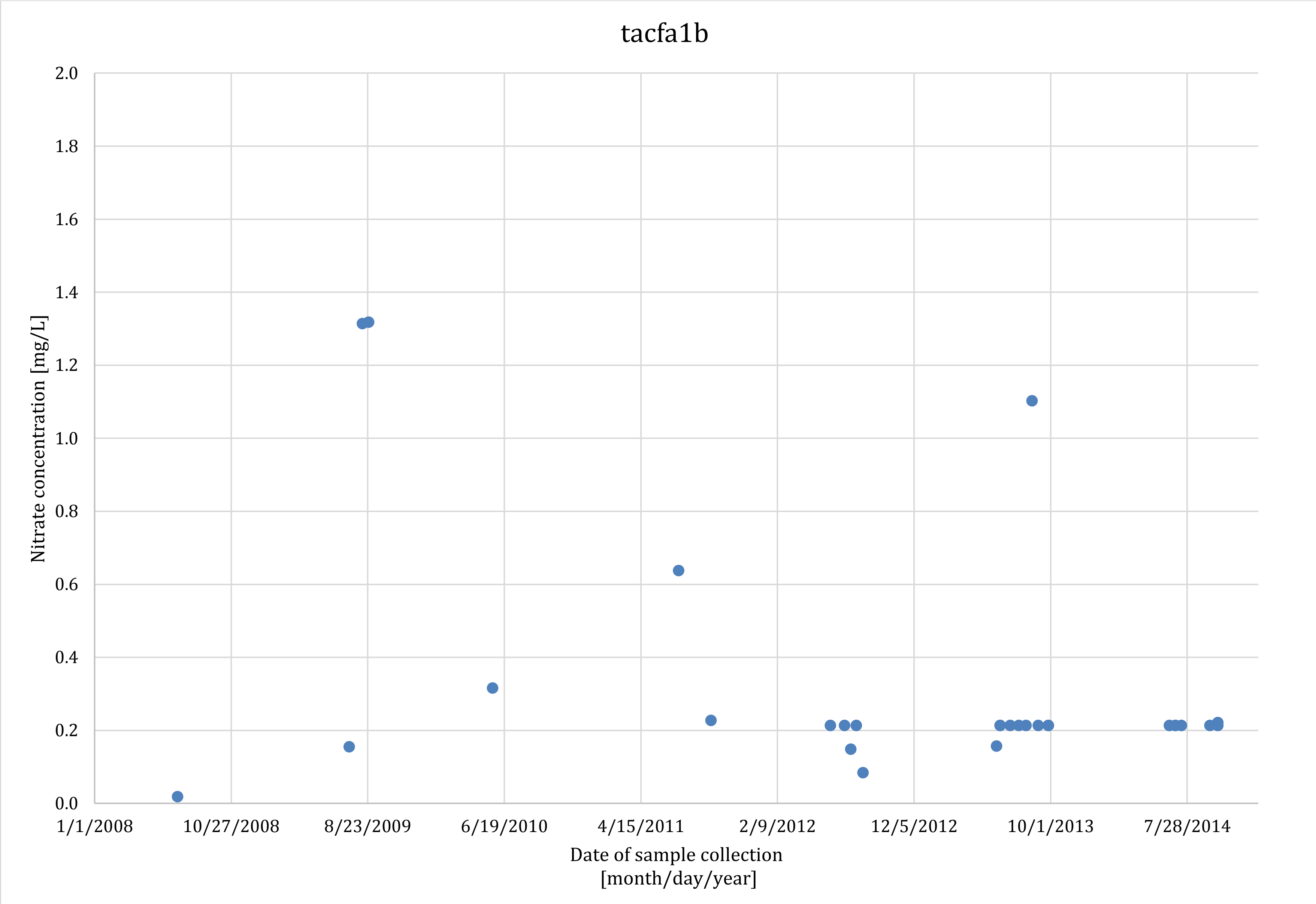
The following page shows the nitrate concentration in samples taken at your sampling sites. The Canadian Guidelines for the Protection of Aquatic Life states that long-term nitrate concentrations should not exceed 13 mg/L (CCME, 1987). Nitrate concentrations in your samples collected from becfa1a have an average value of 0.3 mg/L. Samples collected from tacfa1a have an average concentration of 0.2 mg/L.

There is one sample from becfa1a, collected in 2008, and several samples from tacfa1b that have higher concentration than all of the other samples. Do you see it? They are still well below the upper guideline and therefore did not pose any risk for your community.


becfa1a
Nitrate concentration [mg/L]
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1/1/2008
10/27/2008
8/23/2009
6/19/2010
4/15/2011
2/9/2012
12/5/2012
10/1/2013
7/28/2014
Date of sample collection
[month/day/year]



tacfa1a
Nitrate concentration [mg/L]
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
6/6/2011
7/26/2011
9/14/2011
11/3/2011
12/23/2011
2/11/2012
4/1/2012
5/21/2012
7/10/2012
8/29/2012
10/18/2012
Date of sample collection
[month/day/year]


tacfa1b
Nitrate concentration [mg/L]
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1/1/2008
10/27/2008
8/23/2009
6/19/2010
4/15/2011
2/9/2012
12/5/2012
10/1/2013
7/28/2014
Date of sample collection
[month/day/year]

OTHER PARAMETERS

There are several other parameters (including dissolved organic carbon, stable water isotopes, and greenhouse gases) that we have analyzed in your water samples. These parameters are best interpreted across the whole Yukon River Watershed instead of looking at them on a site-by-site basis. We are currently working on a watershed-wide report that will include graphs and interpretations of this data. Please contact us for further information!

FREQUENTLY ASKED QUESTIONS

HOW CAN WE USE THESE DATA?

"Baseline conditions" are terms used to refer to what water is like in its current state. The data you collect are baseline data, which help us determine the present conditions of the river.

Much like getting to know someone, it takes time to understand the natural fluctuations of a river. When you spend time with another person and become their friend, you can tell how they are feeling and see when they are sick or sad or angry. When you spend time getting to know the river, you can also tell when it's changing in a way that's not natural. This understanding of the river's cycle is critical for identifying changes that could be harmful or unhealthy.

Collecting baseline data is a long process because the river does have a way of changing naturally over time. (We all know that every year is a little different in terms of break-up and freeze-up dates, flooding, storms, etc.) It is critical that we continue to sample the river every year so that we can understand these natural variations and then determine if and how other processes such as climate change and industrial development might be affecting the water quality as well. It is this data, collected over a long time, which helps us to definitively identify water quality problems and decide how to fix them.

This information can be incredibly useful in a number of different ways:

- **To monitor the impacts of climate change. We can look to see if the water quality is changing in a way that is significant and linked to climate change.**
- **To ensure healthy habitat for fish and other organisms. We can review the water quality and compare the data to standards and guidelines for aquatic life.**
- **To protect our water quality from industrial or other forms of development. If any developments are planned upstream of a sampling location, we can use the baseline data to show what your water quality is like naturally. Then, we can assert our water rights to ensure that the natural water quality is not impacted. Baseline data are powerful!**

WHY DOES THE WATER QUALITY CHANGE OVER THE COURSE OF THE SUMMER?

Water quality is complicated and depends on many different factors. However, one of the most important factors is how much water is flowing in the river, which we call "discharge." We can't really understand water quality without understanding water quantity! The amount of water in the river can greatly affect the habitat of fish and aquatic life and can potentially dilute wastes and contaminants in the river. Discharge can change a lot over the course of the summer, depending on your sampling location.

All of the sampling sites in the Yukon River Watershed have periods of low flow in the winter when the rivers are locked under a layer of ice. However, the patterns of discharge in the summer can vary greatly depending on location. For example, a site located downstream of a melting glacier will behave differently than a site located downstream of a lake. These patterns of summer discharge will affect the water quality data that we record during the course of the summer field season.

WHY DO THE WINTER DATA LOOK DIFFERENT THAN THE SUMMER DATA?

Good eye! Summer (open-water) and winter (under-ice) water quality is often very different. Lots of people and communities have known this for years. Traditional knowledge about water quality has led many communities to a practice of drinking river water collected through holes in the ice in the winter but rarely drinking river water in the summer.

The rivers of the Yukon River Watershed are typically covered with ice from mid-to-late October until mid-to-late May. During this period, there is less flow in the river because snow and ice are not melting, rain is not falling and flowing across the surface, etc. However, groundwater continues to seep into the river under the ice. The contribution of groundwater to the river is called "base flow." Groundwater is typically more concentrated than surface water, generally having a greater conductance and more total dissolved solids. So we expect winter samples, in general, to have a greater conductance and more total dissolved solids than summer samples.

When the rivers are covered with ice the flowing water is no longer in contact with the air. It is more difficult for the water to dissolve oxygen from the air with a barrier of ice above it. So we expect winter samples, in general, to have lower readings of dissolved oxygen compared to summer samples.

IS OUR WATER CONTAMINATED?

The first thing that we should note is that the ION project is not monitoring drinking water. We are working to understand the background (natural) water quality of the

Yukon River and its important tributaries. We are not testing all of the important parameters (such as Giardia—more commonly known as "beaver fever"—and E. coli) that a community needs to test in order to assess its drinking water supply. However, we are analyzing various parameters that are potential contaminants (such as nitrate) and indicators of contamination (such as chloride, sulphate, and sodium).

When <u>any</u> of the parameters we analyze exceeds a national regulation or guideline, *or* if <u>any</u> of the parameters we analyze suggests to us that some form of contamination has occurred, we will report this to you.

If you have other, specific concerns about contamination of the water in your community, please bring them to our attention! The YRIWTC would be happy to assist you in seeking funds to address your specific concerns.

IS CLIMATE CHANGE AFFECTING OUR WATER QUALITY?

This is a complicated question but a very important one! Based on the data collected so far, climate change may be affecting the water quality of the Yukon River Watershed but more research is needed. The climate is warming and warmer air temperatures can cause the permafrost to degrade. Permafrost is ground that is frozen for two or more years. The active layer is the top layer of soil above the permafrost thaws during summer and freezes during winter. The YRITWC monitors changes in the thickness of the active layer through our "Active Layer Network" (ALN). Changes in the thickness of the active layer can change the water quality, quantity and timing of water flowing in our rivers. Your work is helping us understand how climate change is affecting the water quality of the Yukon River Watershed. Please contact us if your community is interested in participating in our ALN project!

WHAT ELSE CAN WE DO TO PROTECT OUR WATER QUALITY?

There are many things you can do to protect your water quality!

One of the most important actions a community can take is to consistently monitor their water. In order to protect our water quality, we need to know the "baseline conditions," which simply means what the water is like naturally. Since the natural water quality can vary over time, it is critical that we sample regularly over a long time period. <u>One</u> sample doesn't provide us with very much information. <u>Many</u>

samples can allow us to identify sudden or significant changes, which might be the result of climate change, contamination or other processes

Other actions you can take to protect your water quality range from daily individual actions such as not littering or long-term community projects like integrated watershed management planning. Here is a list of things that you and your community can do:

- **<u>Make sure your sewage facility is up to current standards</u> and isn't at risk of flooding.**
- **<u>Keep your landfill contained.</u> Several things you can do; make sure your landfill isn't so close to the river that run-off and flooding are risks; that it is lined; and that hazardous waste such as car/snow machine batteries are properly disposed of.**
- **<u>Report any development and environmental change happening around you.</u> Let us know if there is a site (a mine, for example) that concerns you and we will work with you to continue monitoring and protecting your water quality. We are also beginning a new project that focuses on recording local knowledge. We want to know what sort of environmental changes you and your community have been seeing over the years. We would love to hear what you have to say and would also like your involvement in shaping this project. Your participation will help us understand the dynamic nature of your water quality and how we can all work together to protect it.**
- **<u>Apply for your own funding</u> and take your water quality testing to the next level! We are constantly seeking funding to support our water quality monitoring network; your help in finding new funds is always very much appreciated! Additional funding could help us begin testing for more than just the basic water quality parameters. In the future we would love to help you test for specific contaminants, heavy metals, and *drinking* water quality in your communities. See below for more specific information on additional funding.**
- **As development pressures continue to influence many of our communities, we should think about documenting sufficient water quantity for drinking, fish habitat, spiritual, or other important uses. Essentially, this would mean to measure 'baseline conditions" for water quantity within these important water sources for communities.**

HOW CAN WE APPLY FOR ADDITIONAL FUNDING?

Beyond participating in the ION Program, there are several opportunities you might consider to maintain and/or expand water quality monitoring in your community. The YRITWC Science Department is more than happy to assist you in developing your proposal. There are many funding opportunities out there in both the public and private sectors, below are just a few options to explore:

- **Government of Canada:**
  - **Health Canada**
  - **Environment Canada**
  - **Natural Resources Canada (Earth Science Sector)**
- **Government of Yukon:**
  - **Community Development Fund (CDF)**
- **Private Foundations:**
  - **RBC Foundation's Blue Water Project**
  - **TD Friends of the Environment Foundation**
  - **Walter and Duncan Gordon Foundation**
  - **TIDES Canada**

Again, the YRITWC Science Department is happy to work with you and welcomes the opportunity to partner with your community on protecting our watershed!

REFERENCES

Canadian Council of Ministers of the Environment (CCME), 1987. Water Quality Guidelines for the Protection of Aquatic Life. Accessed online: June 2013.

APPENDIX

DATA FOR BECFA1A– BENNETT LAKE OUTLET

BECFA1A - FIELD MEASUREMENTS

USGS ID	Date	Water Temperature °C	Field pH standard units	Field Specific Conductance µS/cm	Field Dissolved Oxygen mg/L	Laboratory pH standard units
9429	6/10/2008	5.00	7.33	69	12.80	7.42
9472	6/24/2008	6.40	6.24	68	12.50	7.56
9477	7/1/2008	7.40	7.06	70	12.40	7.55
9751	7/15/2008	8.40	7.70	68	11.80	7.50
9771	7/29/2008	8.60	7.85	65	13.70	7.39
9892	8/25/2008	10.0	7.31	553	11.20	7.01
10053	4/9/2009	0.50	7.84	40.8	14.6	NA
10196	6/6/2009	5.80	7.44	67.7	13.1	NA
10224	6/15/2009	7.90	8.31	63.4	13.1	NA
10857	5/24/2010	5.00	8.26	68.7	NA	7.34
12647	6/28/2011	7.92	8.25	71.0	10.7	NA
12933	8/18/2011	10.6	7.29	49.8	10.8	NA
13972	9/13/2011	9.60	7.34	69.7	10.5	NA
13147	5/24/2012	3.00	7.70	699.0	13.2	NA
13157	6/4/2012	3.20	7.71	70.7	13.2	NA
13303	7/5/2012	6.20	7.72	NA	13.8	NA
13336	7/19/2012	7.50	7.82	71.7	13.0	NA
13506	7/31/2012	9.20	7.82	63.2	11.3	NA
13627	8/13/2012	10.2	7.78	70.6	12.0	NA
14043	7/22/2012	NA	NA	NA	NA	NA
14004	7/4/2013	9.64	7.21	47.0	12.5	7.47
14005	7/4/2013	9.64	7.21	47.0	12.5	7.51
14111	8/8/2013	14.8	7.58	61.0	10.0	7.09
14125	8/21/2013	13.3	6.83	63.0	11.9	7.39
14176	9/5/2013	12.4	6.95	61.0	11.4	7.92
14245	9/26/2013	10.3	7.55	66.0	11.2	7.84
14246	9/26/2013	10.3	7.55	66.0	11.2	7.63
14399	6/19/2014*	5.99	7.55	35	14.17	7.30
14454	7/15/2014*	9.80	7.52	51	12.13	7.57
14548	9/16/2014*	10.1	6.97	57.5	10.59	7.52
14427	7/2/2014*	NA	7.90	38	12.19	7.71
14426	7/2/2014*	NA	7.90	38	12.19	7.71

BECFA1A - MAJOR ANIONS & ISOTOPES

USGS ID	Date	Chloride mg/L	Sulfate mg/L	Nitrate mg/L	Alkalinity mg/L	Deuterium	Oxygen -18
9429	6/10/2008	0.73	5.10	1.41	28.66	-144.9	-19.00
9472	6/24/2008	0.34	4.43	0.242	27.10	-145.1	-18.97
9477	7/1/2008	0.32	4.63	0.267	27.35	-145.5	-18.96
9751	7/15/2008	0.26	4.38	0.211	27.08	-145.6	-18.99
9771	7/29/2008	0.37	4.36	0.223	29.86	-145.9	-18.94
9892	8/25/2008	0.33	6.28	< 0.012	27.68	-147.9	-18.90
10053	4/9/2009	0.21	7.02	< 0.012	28.28	-149.9	-19.1E
10196	6/6/2009	0.96	6.72	< 0.012	31.53	-163.9	-20.90
10224	6/15/2009	5.63	5.85	< 0.012	26.22	-119.7	-15.90
10857	5/24/2010	0.34	5.09	0.246	26.07	-146.4	-19.06
12647	6/28/2011	0.36	4.83	0.321	28.31	NA	NA
12933	8/18/2011	0.26	4.83	< 0.213	27.73	NA	NA
13972	9/13/2011	0.74	4.89	0.258	31.44	NA	NA
13147	5/24/2012	0.54	5.76	0.269	27.54	NA	NA
13157	6/4/2012	0.52	5.72	0.296	27.22	NA	NA
13303	7/5/2012	0.24	5.31	< 0.213	27.17	NA	NA
13336	7/19/2012	0.74	4.76	0.247	27.36	NA	NA
13506	7/31/2012	0.21	4.92	0.258	26.05	NA	NA
13627	8/13/2012	0.38	5.16	0.312	26.83	NA	NA
14043	7/22/2012	0.60	4.98	< 0.213	27.13	NA	NA
14004	7/4/2013	0.50	5.24	< 0.213	27.24	NA	NA
14005	7/4/2013	0.42	5.15	0.250	27.04	NA	NA
14111	8/8/2013	0.21	5.47	0.221	26.87	NA	NA
14125	8/21/2013	0.50	5.41	< 0.213	26.68	NA	NA
14176	9/5/2013	0.63	5.10	0.216	26.21	NA	NA
14245	9/26/2013	0.55	4.96	< 0.213	26.58	NA	NA
14246	9/26/2013	0.51	5.03	< 0.213	26.73	NA	NA
14399	6/19/2014*	0.53	5.00	0.317	28.51	NA	NA
14454	7/15/2014*	0.26	5.24	< 0.213	27.24	NA	NA
14548	9/16/2014*	0.60	5.28	0.375	27.94	NA	NA
14427	7/2/2014*	0.54	8.51	< 0.213	37.57	NA	NA
14426	7/2/20148	0.57	8.46	< 0.213	37.85	NA	NA

*LABORATORY DATA FROM SAMPLES COLLECTED IN 2014 ARE CONSIDERED PRELIMINARY AND ARE SUBJECT TO USGS QUALITY ASSURANCE AND QUALITY CONTROL APPROVAL.

<: LESS THAN

E: ESTIMATED

NA: NOT MEASURED

BECFA1A - MAJOR CATIONS

USGS ID	Date	Ammonium mg/L	Calcium mg/L	Potassium mg/L	Magnesium mg/L	Sodium mg/L
9429	6/10/2008	< 0.016	10.87	0.47	1.33	2.41
9472	6/24/2008	< 0.016	11.04	0.44	1.35	1.38
9477	7/1/2008	< 0.016	11.29	0.47	1.49	1.17
9751	7/15/2008	< 0.016	11.54	0.48	1.22	1.12
9771	7/29/2008	< 0.016	NA	NA	NA	NA
9892	8/25/2008	< 0.016	12.16	0.62	1.30	1.34
10053	4/9/2009	< 0.016	12.91	0.58	1.27	1.35
10196	6/6/2009	< 0.016	12.40	0.53	1.31	4.41
10224	6/15/2009	< 0.016	11.62	6.80	1.24	1.34
10857	5/24/2010	0.212	9.39	0.45	1.29	1.18
12647	6/28/2011	NA	9.68	0.45	1.16	0.69
12933	8/18/2011	NA	9.52	0.22	1.26	3.47
13972	9/13/2011	NA	NA	NA	NA	NA
13147	5/24/2012	NA	10.62	0.40	1.40	1.10
13157	6/4/2012	NA	10.76	0.40	1.37	1.11
13303	7/5/2012	NA	10.53	0.28	1.36	1.21
13336	7/19/2012	NA	10.03	0.28	1.41	1.08
13506	7/31/2012	NA	10.95	0.33	1.41	1.03
13627	8/13/2012	NA	9.84	0.30	1.39	1.01
14043	7/22/2012	< 0.034	11.24	0.59	1.44	1.30
14004	7/4/2013	0.056	10.61	0.56	1.28	1.28
14005	7/4/2013	0.084	10.36	0.54	1.27	1.25
14111	8/8/2013	< 0.034	13.21	1.38	1.58	2.12
14125	8/21/2013	< 0.034	10.77	0.43	1.39	1.05
14176	9/5/2013	< 0.034	10.14	0.40	1.29	1.05
14245	9/26/2013	< 0.034	11.03	0.46	1.24	1.21
14246	9/26/2013	< 0.034	10.72	0.49	1.21	1.16
14399	6/19/2014	< 0.034	10.72	0.42	1.29	1.18
14454	7/15/2014	< 0.034	11.96	0.52	1.42	2.38
14548	9/16/2014	< 0.034	10.57	0.37	1.52	1.51
14427	7/2/2014	0.122	14.66	0.36	1.90	2.52
14426	7/2/2014		15.26	0.63	2.03	1.70

*LABORATORY DATA FROM SAMPLES COLLECTED IN 2014 ARE CONSIDERED PRELIMINARY AND ARE SUBJECT TO USGS QUALITY ASSURANCE AND QUALITY CONTROL APPROVAL.

<: LESS THAN

E: ESTIMATED

NA: NOT MEASURED

BECFA1A - CARBON

USGS ID	Date	Carbon Dioxide ppmv	Methane ppmv	Dissolved Inorganic Carbon umoles/L	UV Absorbance 254 nm	Dissolved Organic Carbon mg/L C	SUVA [L/(mg carbon*m)]
9429	6/10/2008	16	6.2	650	0.026	1.4	1.9
9472	6/24/2008	NA	NA	NA	0.028	1.3	2.1
9477	7/1/2008	NA	NA	NA	0.025	1.2	2
9751	7/15/2008	NA	NA	NA	0.027	1.4	2
9771	7/29/2008	NA	NA	NA	0.023	1.2	2,0
9892	8/25/2008	NA	NA	NA	0.027	1.5	1.8
10053	4/9/2009	NA	NA	NA	0.035E	3.3E	1.0E
10196	6/6/2009	NA	NA	NA	0.028	1.4	2.0
10224	6/15/2009	NA	NA	NA	0.024	1.3	1.9
10857	5/24/2010	NA	NA	NA	0.023	1.4	1.7
12647	6/28/2011	NA	NA	NA	0.020	1.3	1.6
12933	8/18/2011	NA	NA	NA	0.027	1.7	1.6
13972	9/13/2011	NA	NA	NA	0.022	1.4	1.6
13147	5/24/2012	NA	NA	NA	0.055	1.1	5.2
13157	6/4/2012	NA	NA	NA	0.026	1.1	2.3
13303	7/5/2012	NA	NA	NA	0.026	1.1	2.3
13336	7/19/2012	NA	NA	NA	0.029	1.4	2.1
13506	7/31/2012	NA	NA	NA	NA	NA	NA
13627	8/13/2012	NA	NA	NA	0.028	1.3	2.2
14043	7/22/2012	0.028	1.9	1.5	NA	NA	NA
14004	7/4/2013	NA	NA	NA	0.028	1.4	2.0
14005	7/4/2013	NA	NA	NA	0.028	1.3	2.1
14111	8/8/2013	NA	NA	NA	0.020	1.2	1.6
14125	8/21/2013	NA	NA	NA	0.024	1.2	1.9
14176	9/5/2013	NA	NA	NA	0.020E	1.2	2.0E
14245	9/26/2013	NA	NA	NA	0.030E	1.4E	1.9E
14246	9/26/2013	NA	NA	NA	0.020E	1.5E	1.7E
14399	6/19/2014*	NA	NA	NA	0.026	1.3	2.0
14454	7/15/2014*	NA	NA	NA	0.022	1.3	1.7
14548	9/16/2014*	NA	NA	NA	0.022	1.3	1.7
14427	7/2/2014*	NA	NA	NA	0.027	1.4	1.9
14426	7/2/2014*	NA	NA	NA	0.032	1.4	2.2

*LABORATORY DATA FROM SAMPLES COLLECTED IN 2014 ARE CONSIDERED PRELIMINARY AND ARE SUBJECT TO USGS QUALITY ASSURANCE AND QUALITY CONTROL APPROVAL.

<: LESS THAN

E: ESTIMATED

NA: NOT MEASURED

BECFA1A - TRACE METALS

USGS ID	Date	Barium µg/L	Copper µg/L	Iron µg/L	Manganese µg/L	Nickel µg/L	Silica mg/L	Strontium µg/L	Zinc µg/L
9429	6/10/2008	NA	NA	NA	NA	NA	NA	NA	NA
9472	6/24/2008	NA	NA	NA	NA	NA	NA	NA	NA
9477	7/1/2008	NA	NA	NA	NA	NA	NA	NA	NA
9751	7/15/2008	NA	NA	NA	NA	NA	NA	NA	NA
9771	7/29/2008	NA	NA	NA	NA	NA	NA	NA	NA
9892	8/25/2008	NA	NA	NA	NA	NA	NA	NA	NA
10053	4/9/2009	NA	NA	NA	NA	NA	NA	NA	NA
10196	6/6/2009	NA	NA	NA	NA	NA	NA	NA	NA
10224	6/15/2009	NA	NA	NA	NA	NA	NA	NA	NA
10857	5/24/2010	NA	NA	NA	NA	NA	NA	NA	NA
12647	6/28/2011	13	NA	4.7	1.2	NA	3.4	55	NA
12933	8/18/2011	67	NA	9.0	0.6	NA	3.7	55	NA
13972	9/13/2011	NA	NA	NA	NA	NA	NA	NA	NA
13147	5/24/2012	24	<1.2	11	0.81	<2.2	3.7	76	17
13157	6/4/2012	28	<1.2	4.7	0.52	<2.2	3.8	76	27
13303	7/5/2012	37	<1.2	4.3	0.52	<2.2	3.7	78	54
13336	7/19/2012	31	0.80	4.1	0.85	<-0.17	3.0	85	30
13506	7/31/2012	16	<1.1	2.7	0.73	<1.1	2.9	106	7.2
13627	8/13/2012	23	1.9	2.8	1.0	0.06	2.8	83	20
14043	7/22/2012	28	7.7	1.0	3.9	73	NA	NA	NA
14004	7/4/2013	24	NA	12	1.4	NA	3.8	69	NA
14005	7/4/2013	24	NA	< 2.5	0.99	NA	3.7	68	NA
14111	8/8/2013	46	NA	298	11	NA	4.6	83	NA
14125	8/21/2013	31	NA	4.4	0.73	NA	3.8	77	NA
14176	9/5/2013	30	NA	7.9	0.47	NA	3.6	72	NA
14245	9/26/2013	33	NA	NA	0.31	NA	3.6	68	NA
14246	9/26/2013	26	NA	NA	1.1	NA	3.5	67	NA
14399	6/19/2014*	26	NA	< 2.4	< 0.19	NA	3.5	67.7	NA
14454	7/15/2014*	30	NA	4.5	0.92	NA	3.5	72.5	NA
14548	9/16/2014*	48	NA	< 1.7	0.62	NA	3.8	71.3	NA
14427	7/2/2014*	145	NA	14	2.9	NA	4.6	87.2	NA
14426	7/2/2014*	40	NA	16	3.1	NA	4.8	94.7	NA

*LABORATORY DATA FROM SAMPLES COLLECTED IN 2014 ARE CONSIDERED PRELIMINARY AND ARE SUBJECT TO USGS QUALITY ASSURANCE AND QUALITY CONTROL APPROVAL.

<: LESS THAN

E: ESTIMATED

NA: NOT MEASURED

DATA FOR TACFA1A– TAGISH RIVER

TACFA1A -FIELD MEASUREMENTS

USGS ID	Date	Water Temp	Field pH	Field Specific Conductance	Field Dissolved Oxygen	Laboratory pH
12654	6/28/2011	11.40	7.30	89.0	10.5	
12936	8/18/2011	13.30	7.43	65.2	10.2	
13145	5/24/2012	4.60	7.99	802.0	13.5	
13227	6/18/2012	7.70	7.97	85.0	11.8	
13667	8/23/2012	13.10	8.00	85.8	11.0	

TACFA1A - MAJOR ANIONS

USGS ID	Date	Chloride mg/L	Sulfate mg/L	Nitrate mg/L	Alkalinity mg/L
12654	6/28/2011	0.27	5.3	< 0.213	37.1
12936	8/18/2011	0.26	4.9	< 0.213	36.2
13145	5/24/2012	0.38	5.6	0.122	35.8
13227	6/18/2012	0.24	5.9	< 0.213	36.2
13667	8/23/2012	NA	5.3	0.109	32.8

TACFA1A – MAJOR CATIONS

USGS ID	Date	Ammonium mg/L	Calcium mg/L	Potassium mg/L	Magnesium mg/L	Sodium mg/L
12654	6/28/2011		11.92	1.1	2.9	0.43
12936	8/18/2011		12.64	0.5	2.1	0.49
13145	5/24/2012	NA	12.72	0.6	2.2	0.95
13227	6/18/2012	NA	13.00	0.5	2.2	0.93
13667	8/23/2012	NA	11.84	0.3	2.2	1.01

TACFA1A - CARBON

USGS ID	Date	Carbon Dioxide ppmv	Methane ppmv	Dissolved Inorganic Carbon umoles/L	UV Absorbance 254 nm	Dissolved Organic Carbon mg/L C	SUVA [L/(mg carbon*m)]
12654	6/28/2011	722	4.4	514	0.013	1.2	1.0
12936	8/18/2011	NA	NA	NA	0.013	1.3	2.7
13145	5/24/2012	NA	NA	NA	0.014	1.1	1.3
13227	6/18/2012	NA	NA	NA	0.015	1.1	1.4
13667	8/23/2012	NA	NA	NA	0.019	1.3	1.5

TACFA1A - TRACE METALS

<: LESS THAN

USGS ID	Date	Barium µg/L	Copper µg/L	Iron µg/L	Manganese µg/L	Nickel µg/L	Silica mg/L	Strontium µg/L	Zinc µg/L
12654	6/28/2011	24	NA	424	3.5	NA	4.5	56	NA
12936	8/18/2011	37	NA	8.9	0.40	NA	2.5	72	NA
13145	5/24/2012	30	<1.2	48	1.8	<2.2	2.5	74	23
13227	6/18/2012	24	<1.2	<4.3	0.34	<2.2	2.7	78	10
13667	8/23/2012	57	0.38	7.0	0.36	0.12	2.0	80	29

E: ESTIMATED

NA: NOT MEASURED

DATA FOR TACFA1B– TAGISH RIVER

TACFA1B - FIELD MEASUREMENTS & LABORATORY PH

USGS ID	Date	Water Temperature °C	Field pH standard units	Field Specific Conductance µS/cm	Field Dissolved Oxygen mg/L	Laboratory pH standard units
9428	6/10/2008	7.00	7.58	87	12.20	7.82
9473	7/1/2008	10.90	8.04	87	11.40	7.66
9474	6/24/2008	9.80	7.02	87	11.50	7.67
9753	7/15/2008	11.90	7.96	87	10.70	7.74
9772	7/29/2008	11.70	8.01	83	11.50	7.92
9884	8/25/2008	11.60	8.08	86	10.40	8.08
10185	6/2/2009	8.50	7.95	78.8	13.2	NA
10221	6/15/2009	9.40	8.22	81.1	12.7	NA
10257	7/2/2009	10.90	8.17	78.2	11.5	NA
10244	7/13/2009	12.20	8.03	78.2	11.4	NA
10382	8/3/2009	15.30	8.04	86.5	9.4	NA
10412	8/11/2009	14.20	7.78	83.4	9.1	NA
10433	8/25/2009	12.70	8.54	83.6	8.9	NA
10573	9/8/2009	12.20	8.17	81.3	9.2	NA
10852	5/24/2010	10.60	8.2	83.5	NA	7.53
12703	7/7/2011	15.00	NA	NA	NA	NA
12979	9/16/2011	10.60	7.40	75.5	10.6	NA
13162	6/4/2012	7.30	8.18	86.3	12.8	NA
13304	7/5/2012	9.80	7.97	NA	12.8	NA
13333	7/19/2012	10.60	8.02	89.4	12.3	NA
13508	7/31/2012	12.20	8.07	77.5	10.8	NA
13625	8/15/2012	13.60	8.05	78.2	12.1	NA
13902	6/4/2013	4.00	7.18	NA	14.1	7.58
13945	6/12/2013	11.00	7.59	34.0	12.5	7.52
13947	6/12/2013	11.00	7.00	NA	NA	7.4
14006	7/4/2013	12.30	7.81	57.0	11.9	7.42
14044	7/23/2013	NA	NA	NA	NA	7.38
14114	8/8/2013	16.45	7.27	74.0	11.6	7.32
14127	8/21/2013	14.75	7.88	63.0	11.3	7.50
14172	9/4/2013	14.23	8.26	63.0	12.1	7.71
14247	9/26/2013	10.75	8.11	84.0	9.1	7.76
14248	9/26/2013	10.75	8.11	84.0	9.1	7.95
14397	6/19/2014*	9.4	7.84	48	13.4	7.53
14452	7/15/2014*	13.2	7.66	69	11.82	7.67
14549	9/16/2014*	12.03	7.68	75.4	10.17	7.63
14424	7/2/2014*	10.67	7.6	49	12.46	7.74
14569	10/3/2014*	6.31	8.35	55	12.16	7.35
14425	7/2/2014*	10.7	7.60	49	12.46	7.83
14570	10/3/2014*	6.31	8.35	55	12.16	7.52

TACFA1B - MAJOR ANIONS & ISOTOPES

USGS ID	Date	Chloride mg/L	Sulfate mg/L	Nitrate mg/L	Alkalinity mg/L	Deuterium	Oxygen -18
9428	6/10/2008	0.46	5.23	< 0.012	40.29	-143.9	-18.6
9473	7/1/2008	0.26	4.60	0.019 E	36.35	-145.2	-18.6
9474	6/24/2008	0.32	3.19	0.031 E	37.00	-140.5	-18.5
9753	7/15/2008	0.24	4.63	< 0.012	37.26	-142.3	-18.6
9772	7/29/2008	0.70	4.57	0.037 E	42.21	-143.2	-18.6
9884	8/25/2008	0.15	6.10	< 0.012	37.75	-145.6	-18.7
10185	6/2/2009	0.25	6.47	< 0.012	37.16	-161	-19.6
10221	6/15/2009	4.88	6.18	< 0.012	66.05	-168	-21.4
10257	7/2/2009	NA	NA	NA	36.87	-165	-20.6
10244	7/13/2009	1.44	4.56	0.154	37.67	-146	-18.4
10382	8/3/2009	1.01	5.41	2.58	43.39	-169	-21.6
10412	8/11/2009	0.56	4.92	1.31	37.30	-146	-18.7
10433	8/25/2009	0.34	4.90	1.32	38.56	-169	-21.3
10573	9/8/2009	0.85	4.91	< 0.012	38.22	-146	-17.8
10852	5/24/2010	0.26	5.10	0.134	36.32	-144	-18.6
12703	7/7/2011	1.83	17.61	0.638	57.95	NA	NA
12979	9/16/2011	0.32	4.98	0.228	35.94	NA	NA
13162	6/4/2012	0.56	5.74	< 0.213	36.54	NA	NA
13304	7/5/2012	0.41	5.55	< 0.213	36.91	NA	NA
13333	7/19/2012	0.50	5.38	0.148	36.41	NA	NA
13508	7/31/2012	0.20	5.08	< 0.213	35.14	NA	NA
13625	8/15/2012	0.19	5.28	0.084	34.95	NA	NA
13902	6/4/2013	0.20	5.18	0.157	36.23	NA	NA
13945	6/12/2013	0.71	5.53	< 0.213	41.71	NA	NA
13947	6/12/2013	0.80	5.62	< 0.213	37.49	NA	NA
14006	7/4/2013	0.61	5.60	< 0.213	37.43	NA	NA
14044	7/23/2013	0.43	5.10	< 0.213	37.64	NA	NA
14114	8/8/2013	0.53	5.82	< 0.213	35.51	NA	NA
14127	8/21/2013	0.42	5.53	1.10	35.36	NA	NA
14172	9/4/2013	0.89	5.33	< 0.213	36.16	NA	NA
14247	9/26/2013	0.50	5.29	< 0.213	35.40	NA	NA
14248	9/26/2013	0.52	5.31	< 0.213	36.63	NA	NA
14397	6/19/2014*	0.34	5.50	< 0.213	37.79	NA	NA
14452	7/15/2014*	0.34	5.39	< 0.213	37.06	NA	NA
14549	9/16/2014*	0.53	5.25	< 0.213	38.76	NA	NA
14424	7/2/2014*	0.63	5.23	< 0.213	38.11	NA	NA
14569	10/3/2014*	0.26	5.12	0.221	37.46	NA	NA
14425	7/2/2014*	0.65	5.32	< 0.213	38.37	NA	NA
14570	10/3/2014*	0.17	5.16	< 0.213	37.45	NA	NA

TACFA1B – MAJOR CATIONS

USGS ID	Date	Ammonium mg/L	Calcium mg/L	Potassium mg/L	Magnesium mg/L	Sodium mg/L
9428	6/10/2008	< 0.016	14.07	0.57	2.31	2.54
9473	7/1/2008	< 0.016	13.66	0.54	2.30	0.96
9474	6/24/2008	< 0.016	13.58	0.54	2.26	1.26
9753	7/15/2008	0.146	14.51	0.69	2.18	1.02
9772	7/29/2008	< 0.016	14.13	0.31	2.11	3.89
9884	8/25/2008	< 0.016	14.47	0.73	2.19	0.95
10185	6/2/2009	< 0.016	14.68	0.80	2.04	1.30
10221	6/15/2009	< 0.016	14.38	6.05	2.12	1.35
10257	7/2/2009	< 0.016	28.11	1.71	7.71	2.89
10244	7/13/2009	0.119	13.83	0.55	1.96	2.42
10382	8/3/2009	< 0.016	13.31	0.55	2.21	4.66
10412	8/11/2009	0.034	12.95	0.80	2.00	1.46
10433	8/25/2009	< 0.016	13.22	0.63	1.97	1.17
10573	9/8/2009	< 0.016	12.84	0.52	2.44	1.74
10852	5/24/2010	0.113	11.92	0.61	2.33	1.04
12703	7/7/2011	NA	20.46	0.96	4.17	2.27
12979	9/16/2011	NA	12.05	0.31	1.90	1.30
13162	6/4/2012	NA	12.85	0.52	2.17	0.92
13304	7/5/2012	NA	13.06	0.49	2.13	0.99
13333	7/19/2012	NA	11.92	0.40	2.15	0.85
13508	7/31/2012	NA	13.06	0.43	2.23	0.86
13625	8/15/2012	NA	11.89	0.39	2.17	1.13
13902	6/4/2013	< 0.034	12.73	0.64	2.11	0.98
13945	6/12/2013	0.151	13.08	0.58	2.15	1.32
13947	6/12/2013	0.220	13.02	0.46	2.12	1.36
14006	7/4/2013	< 0.034	13.08	0.69	2.05	1.17
14044	7/23/2013	< 0.034	13.63	0.79	2.28	1.14
14114	8/8/2013	< 0.034	12.65	0.52	2.06	0.95
14127	8/21/2013	< 0.034	13.02	0.55	2.26	0.92
14172	9/4/2013	< 0.034	11.66	0.60	2.16	0.95
14247	9/26/2013	< 0.034	14.06	0.67	2.18	1.05
14248	9/26/2013	< 0.034	13.85	0.70	2.12	1.02
14397	6/19/2014*	< 0.034	13.04	0.21	2.11	2.14
14452	7/15/2014*	< 0.034	15.46	0.26	2.33	2.36
14549	9/16/2014*	< 0.034	12.84	0.59	2.27	1.16
14424	7/2/2014*	0.050	13.54	0.80	2.17	1.13
14569	10/3/2014*	< 0.034	12.94	0.67	2.54	1.08
14425	7/2/2014*	0.077	13.76	0.49	2.19	2.08
14570	10/3/2014*	< 0.034	13.02	0.66	2.40	1.03

TACFA1B - CARBON

USGS ID	Date	Carbon Dioxide ppmv	Methane ppmv	Dissolved Inorganic Carbon umoles/L	UV Absorbance 254 nm	Dissolved Organic Carbon mg/L C	SUVA [L/(mg carbon*m)]
9428	6/10/2008	207	4.6	877	0.016	1.2	1.3
9473	7/1/2008	NA	NA	NA	0.018	1.3	1.4
9474	6/24/2008	NA	NA	NA	0.016	1	1.5
9753	7/15/2008	NA	NA	NA	0.017	1.2	1.4
9772	7/29/2008	NA	NA	NA	0.014	1	1.4
9884	8/25/2008	NA	NA	NA	0.017	1.2	1.4
10185	6/2/2009	NA	NA	NA	0.017	1.2	1.5
10221	6/15/2009	NA	NA	NA	0.017	1.1	1.6
10257	7/2/2009	NA	NA	NA	0.015	1.3	1.2
10244	7/13/2009	NA	NA	NA	0.016	1.3	1.3
10382	8/3/2009	NA	NA	NA	0.034	1.7	2.1
10412	8/11/2009	NA	NA	NA	0.025E	4.4E	0.60E
10433	8/25/2009	NA	NA	NA	0.025	1.4	1.7
10573	9/8/2009	NA	NA	NA	0.020	1.3	1.5
10852	5/24/2010	NA	NA	NA	0.016	1.3	1.2
12703	7/7/2011	NA	NA	NA	0.384	9.5	4.1
12979	9/16/2011	NA	NA	NA	0.018	1.2	1.5
13162	6/4/2012	NA	NA	NA	0.018	1.1	1.7
13304	7/5/2012	NA	NA	NA	0.014	1.1	1.2
13333	7/19/2012	NA	NA	NA	0.017	1.1	1.6
13508	7/31/2012	NA	NA	NA	0.017	2.0	0.8
13625	8/15/2012	NA	NA	NA	0.019	1.1	1.7
13902	6/4/2013	NA	NA	NA	0.263	8.2	3.2
13945	6/12/2013	NA	NA	NA	0.021	1.3	1.6
13947	6/12/2013	NA	NA	NA	0.020	1.4	1.4
14006	7/4/2013	NA	NA	NA	0.035	2.3	1.5
14044	7/23/2013	NA	NA	NA	0.016	1.5	1.0
14114	8/8/2013	NA	NA	NA	0.014	1.2	1.1
14127	8/21/2013	NA	NA	NA	0.016	1.1	1.4
14172	9/4/2013	NA	NA	NA	0.010E	1.0	1.3E
14247	9/26/2013	NA	NA	NA	0.020E	1.7E	0.94E
14248	9/26/2013	NA	NA	NA	0.010E	1.1E	1.3E
14397	6/19/2014*	NA	NA	NA	0.019	1.4	1.4
14452	7/15/2014*	NA	NA	NA	0.068	1.5	4.6
14549	9/16/2014*	NA	NA	NA	0.014	1.1	1.2
14424	7/2/2014*	NA	NA	NA	0.017	1.1	1.6
14569	10/3/2014*	NA	NA	NA	1E-02	0.9	1.4
14425	7/2/2014*	NA	NA	NA	0.016	1.1	1.5
14570	10/3/2014*	NA	NA	NA	1.33E-02	0.9	1.5

TACFA1B - TRACE METALS

USGS ID	Date	Barium µg/L	Copper µg/L	Iron µg/L	Manganese µg/L	Nickel µg/L	Silica mg/L	Strontium µg/L	Zinc µg/L
9428	6/10/2008	NA	NA	NA	NA	NA	NA	NA	NA
9473	7/1/2008	NA	NA	NA	NA	NA	NA	NA	NA
9474	6/24/2008	NA	NA	NA	NA	NA	NA	NA	NA
9753	7/15/2008	NA	NA	NA	NA	NA	NA	NA	NA
9772	7/29/2008	NA	NA	NA	NA	NA	NA	NA	NA
9884	8/25/2008	NA	NA	NA	NA	NA	NA	NA	NA
10185	6/2/2009	NA	NA	NA	NA	NA	NA	NA	NA
10221	6/15/2009	NA	NA	NA	NA	NA	NA	NA	NA
10257	7/2/2009	NA	NA	NA	NA	NA	NA	NA	NA
10244	7/13/2009	NA	NA	NA	NA	NA	NA	NA	NA
10382	8/3/2009	NA	NA	NA	NA	NA	NA	NA	NA
10412	8/11/2009	NA	NA	NA	NA	NA	NA	NA	NA
10433	8/25/2009	NA	NA	NA	NA	NA	NA	NA	NA
10573	9/8/2009	NA	NA	NA	NA	NA	NA	NA	NA
10852	5/24/2010	NA	NA	NA	NA	NA	NA	NA	NA
12703	7/7/2011	189	NA	170	28	NA	6.6	76	NA
12979	9/16/2011	120	NA	2.1	0.35	NA	2.4	54	NA
13162	6/4/2012	31.5	<1.2	<4.3	0.64	<2.2	2.5	72	20
13304	7/5/2012	32.3	<1.2	<4.3	0.51	<2.2	2.9	76	29
13333	7/19/2012	31.5	0.96	5.2	0.46	<-0.17	2.0	79	16
13508	7/31/2012	23.5	<1.1	0.93	0.44	<1.1	2.0	101	7.9
13625	8/15/2012	27.8	2.9	11	0.71	1.37	2.0	81	18
13902	6/4/2013	22.6	NA	21	0.37	NA	2.5	65	NA
13945	6/12/2013	55.1	NA	2.7	1.3	NA	2.6	69	NA
13947	6/12/2013	153	NA	44	1.3	NA	2.7	68	NA
14006	7/4/2013	31.8	NA	4.4	1.1	NA	2.8	70	NA
14044	7/23/2013	33.8	NA	< 1.5	0.42	NA	2.7	72	NA
14114	8/8/2013	33.4	NA	9.4	0.57	NA	2.6	72	NA
14127	8/21/2013	39.6	NA	5.8	0.50	NA	2.7	75	NA
14172	9/4/2013	44.5	NA	< 1.3	0.28	NA	2.6	71	NA
14247	9/26/2013	39.8	NA	NA	0.24	NA	2.5	66	NA
14248	9/26/2013	34.9	NA	NA	0.33	NA	2.5	65	NA
14397	6/19/2014*	273	NA	< 2.4	0.40	NA	2.7	67	NA
14452	7/15/2014*	294	NA	< 2.1	0.31	NA	2.7	77	NA
14549	9/16/2014*	44.8	NA	0.47	0.39	NA	2.6	68	NA
14424	7/2/2014*	36.8	NA	< 2.1	< 0.19	NA	2.6	71	NA
14569	10/3/2014*	34.6	NA	< 1.7	0.22	NA	2.8	65	NA
14425	7/2/2014*	267	NA	< 2.1	< 0.19	NA	2.6	72	NA
14570	10/3/2014*	33.9	NA	< 1.7	0.12	NA	2.7	65	NA

*LABORATORY DATA FROM SAMPLES COLLECTED IN 2014 ARE CONSIDERED PRELIMINARY AND ARE SUBJECT TO USGS QUALITY ASSURANCE AND QUALITY CONTROL APPROVAL.

<: LESS THAN

E: ESTIMATED

NA: NOT MEASURED

Location of sampling sites, becfa1a, tacfa1a, tacfa1b