DE BEERS
CANADA
GAHCHO KUÉ PROJECT

April 6, 2012 File: S110-01-08

Chuck Hubert
Environmental Assessment Officer
Mackenzie Valley Environmental Impact Review Board
P.O. Box 938
Yellowknife NT X1A 2N7

Dear Mr. Hubert:

Fisheries & Oceans Canada and Environment Canada Joint Information Request Responses - Gahcho Kué Project Environmental Impact Review

De Beers is pleased to provide the Mackenzie Valley Environmental Impact Review Board with responses to the joint Information Requests submitted by Fisheries & Oceans Canada and Environment Canada.

Sincerely,

Veronica Chisholm

Veronica Chisholm
Permitting Manager

Attachment

c: L. Dow, A/Area Director, Fisheries & Oceans Canada
D. Ash, A/Regional Director, Environmental Protection Operations
L. Lowman, Senior EA Coordinator, EA & Marine Programs Division, EC

April 2012

GAHCHO KUÉ PROJECT ENVIRONMENTAL IMPACT STATEMENT
INFORMATION REQUEST RESPONSES

Information Request Number: DFO&EC_1

Source: Fisheries and Oceans Canada and Environment Canada (DFO&EC)

Subject: Assessment Approach

EIS Section: 6, 8.5, and 9.5–Assessment Approach

Preamble:

In order to assess the extent of impacts of a project on the biophysical environment, the EIS must look at the positive or negative changes and interactions of each project activity, or a combination of activities, on a particular VEC. The assessment approach conducted by DeBeers only looks at individual project activities impacts on a particular VEC.

Request

a) Explain the rationale for the threshold values used (primary, secondary and no linkage) in the pathway analysis in order to determine which impacts should be further evaluated through the effects analysis.

b) Please provide information on the potential synergistic, or cumulative effects, of pathway impacts on fish and fish habitat. This would also include the interaction among primary, secondary, or no linkage pathways. For instance the release of sediment to Area 8 during the construction of dyke A may change water and sediment quality and affect fish habitat (secondary) in combination with the erosion of lake-bottom sediments in Area 8 near the outfall that may also cause changes to water and sediment quality and affect fish habitat and fish (no linkage identified). As well, dewatering of Area 7 to Area 8 may change flow, water levels and channel stability in Area 8 and may negatively affect fish and fish habitat (see Table 8.6-1). The potential interactions of these impacts also need to be considered.

Response

a) Pathway analysis is a screening step that is used to determine the existence and magnitude of linkages from the initial list of potential effects pathways for the Project. This screening step is largely a qualitative assessment, and is intended to focus the effects analysis on pathways that require a more comprehensive assessment of effects on valued components (VCs). Pathways were determined to be primary, secondary (minor), or as having no linkage using professional experience, scientific knowledge, understanding of the ecosystem and the Project, and experience with similar developments and environmental design features.

Each potential pathway is assessed and characterized as follows:

- primary – a primary pathway is likely to result in a measurable environmental change that could contribute to residual effects on a VC relative to baseline or guideline values;
- secondary – a secondary (or minor) pathway could result in a measurable and minor environmental change, but would have a negligible residual effect on a VC relative to baseline or guideline values (e.g., an increase in a water quality parameter that is small compared to the range of baseline values and is well within the water quality guideline for that parameter); or
- no linkage – a no linkage pathway is removed by environmental design features and/or mitigation so that the Project results in no detectable environmental change and, therefore, no residual effects to a VC relative to baseline or guideline values (e.g., air, soil, or water quality guideline).

Primary pathways require further effects analysis and impact classification to determine the environmental significance of Project effects on VCs (see Figure 6.5-1 in the 2010 EIS [De Beers 2010]). Pathways with no linkage to a VC or that are considered minor (secondary) are not analyzed further or classified in the EIS because environmental design features and/or mitigation will remove the pathway (no linkage) or residual effects to the VC can be determined to be negligible through a simple qualitative evaluation of the pathway. Pathways determined to have no linkage to a VC or those that are considered secondary are not predicted to result in environmentally significant effects on VCs.

All primary pathways are assessed in the EIS. However, primary pathways for one VC may end up being secondary or having no linkage to other VCs. For example, as described in Section 6.5 of the 2010 EIS (De Beers 2010), local changes to surface water levels may be a primary pathway for effects on aquatic vegetation, but may be considered a minor pathway for effects on the abundance and distribution of wildlife populations with a larger home range. Accordingly, when local changes in surface water levels are classified as a primary pathway then they are further assessed in the EIS; when the pathway is determined to be secondary, then it is not assessed further.

The rationale for the pathway analysis is explained further in Section 6.5 of the 2010 EIS (De Beers 2010), with summaries provided in the Key Lines of Inquiry for Kennady Lake and Watershed (Section 8.6.1) and Downstream Water Effects (Section 9.6.1).

b) Pathways were identified and assessed individually; however, where effects of more than one pathway were evaluated to be cumulative, this was considered in the analysis. As described in Section 6.6.1 of the 2010 EIS (De Beers 2010), effects statements may have more than one primary pathway that link a Project activity with a change in the environment and an effect on a VC. For example, the pathways for effects to fish and fish habitat include alteration of local flows and drainage areas, and water quality. Incremental effects from the Project to the abundance and distribution of wildlife populations may include changes in habitat quantity and quality, and survival and reproduction.

For the example listed in Part (b) of the Request, the activities of dyke construction, diffusers, and pumped discharge into Area 8 were not expected to interact cumulatively. As described in Section 8.6.2.3 of the 2011 EIS Update (De Beers 2011), the construction of Dyke A is expected to result in a minor, localized increase in total suspended soils (TSS) in Area 8 from the disturbance of the lake bed during the period of construction. The planned construction period is short (one to two months) and very little fine sediment exists in the shallow waters at the narrows where the dyke will be built. Mitigation, including the use of silt curtains, and monitoring programs during construction, will minimize the amount of TSS that results in Area 8. As per the Project Description (see Section 3.9.4.1 of the 2012 EIS Supplement [De Beers 2012]), Dyke A will be constructed prior to the dewatering of Kennady Lake; as a result, any increases in TSS associated with dyke construction would not interact cumulatively with the potential effects from the diffusers or discharge from Area 7.

As described in Section 8.6.2.2 of the 2011 EIS Update (De Beers 2011), any sediment mobilized by the diffusers is expected to limited to the zone of turbulence immediately adjacent to the diffusers. The diffusers will be placed at, or above, the lake surface over a deeper water section of Area 8 to increase the distance between the outfall and the bottom sediments. The pumping of water from Area 7 to Area 8 will only occur while it meets specific water quality criteria, including turbidity and TSS concentrations. When discharge water quality criteria are exceeded, discharge from Area 7 to Area 8 will cease. Due to the mitigation associated with both of these activities, and that effects to water and sediment quality and fish and fish habitat are negligible, they would not interact cumulatively.

References

De Beers (De Beers Canada Inc.). 2010. Environmental Impact Statement for the Gahcho Kué Project. Volumes 1, 2, 3a, 3b, 4, 5, 6a, 6b, 7 and Annexes A through N. Submitted to Mackenzie Valley Environmental Impact Review Board. December 2010.

De Beers. 2011. Environmental Impact Statement for the Gahcho Kué Project. Volumes 3a Revision 2, 3b Revision 2, 4 Revision 2, and 5 Revision 2. Submitted to the Mackenzie Valley Environmental Impact Review Board in Response to the Environmental Impact Statement Conformity Review. July 2011.

De Beers. 2012. Environmental Impact Statement Supplemental Information Submission for the Gahcho Kué Project. Submitted to the Mackenzie Valley Environmental Impact Review Board. April 2012.

April 2012

GAHCHO KUÉ PROJECT ENVIRONMENTAL IMPACT STATEMENT
INFORMATION REQUEST RESPONSES

Information Request Number: DFO_EC_2

Source: Fisheries and Oceans Canada and Environment Canada (DFO&EC)

Subject: Assessment Methodology – Classification of Time Periods – Residual Effects

EIS Section: 6, 8 and 9

Terms of Reference Section:

Preamble:

In Volume 6 the assessment approach for determining the significance of the residual impacts is described, and definitions are provided for the eight classification criteria used which include direction, geographic extent, duration, frequency, reversibility, likelihood, ecological context, and magnitude. Though not explained in Volume 6, Volume 8 and 9 include an additional "classification of time periods" by which to categorize the residual impacts. For example, in Table 8.14-5, the residual impacts are categorized under two time periods, from initiation of the project to 100 years later and the second being after 100 years. In the opinion of DFO and EC, impacts within these timeframes are considered permanent.

Request

a) By choosing such long timeframes (e.g., 100 years), this approach potentially dilutes the significance of the impacts. Please provide a more reasonable time period for the residual effects assessment on fish and habitat within, and downstream of Kennady Lake. Consideration should be given to providing time increments for assessment that relate to specific activities post-closure, physical changes, and biological cycles.

b) Please describe the residual impact on fish and fish habitat that may occur during the various project phases (e.g. construction, operation and decommissions).

c) If needed, how will additional mitigation or monitoring programs be identified for a particular impact at a specific stage in the project if they are combined over a long time period.

d) What is the rationale for having a different temporal boundary for the effects assessment versus the residual impact assessment? For instance in Section 8.5.5 it states that " the effects to water quality and fish in Kennady Lake and its watershed are assessed during construction, operations, and closure phases of the Project."

Response

Preamble: De Beers respectfully disagrees with the opinion of Fisheries and Oceans Canada (DFO) and Environment Canada (EC) that impacts associated within a timeframe of 100 years are considered to be permanent. By definition, with the ecosystem recovering to a stable and productive ecosystem, the impacts are considered temporary. However, it is agreed that the duration of those impacts would be long-term.

a) The 100 year timeframes for the residual impact classification do not dilute the significance of impacts, as the approach was conservative and based on the assessment endpoints selected for the Project. Therefore, as described below, the 100 year timeframes are considered appropriate and reasonable time periods for classification.

The residual impact classification was based on the assessment endpoints, i.e., the suitability of water quality to support a viable aquatic ecosystem, and the abundance and persistence of desired population(s) of lake trout, northern pike, and Arctic grayling, and therefore, focused on persistence and recovery.

As described in Section 9.13.1.1 of the 2010 EIS Update (De Beers 2011), the classification of residual impacts within the first time period was conservatively based on the most negative impact over the 100-year period, rather than the end of this period, when impacts would reflect recovery. The first time period extended from the initiation of the Project to 100 years later and incorporated the construction and operations, and closure phases of the Project, and the expected recovery period in which the Kennady Lake aquatic ecosystem would be in a stable and productive state (i.e., taking into account the duration of the Project during construction, operations, and closure, and recovery during post-closure).

The second period focused on future conditions after 100 years from Project initiation. Once again, the approach was conservative, as rather than classifying one snapshot in time, the classification in this period focused on the ability of the affected ecosystems to recover to a steady state. Due to the conservative approaches outlined above, the classification takes into account the physical changes, biological cycles, and post-closure activities referred to in the Request.

b) Based on the information presented in the 2011 EIS Update, the residual impact classification of projected impacts to water quality and fish in Kennady Lake and downstream of Kennady Lake for the project phases of construction, operations, closure, and post-closure and reclamation are shown in Tables DFO&EC_2-1 and DFO&EC_2-2, respectively.

c) The Aquatics Effects Monitoring Program (AEMP) for the Project is currently being developed. The AEMP will have an overall study design that will be developed according to currently accepted statistical design principles and regulatory guidance and will take into account predicted effects at various stages of the Project. The development of the AEMP will involve regulatory and stakeholder input, as well as consideration of available TK. The AEMP will also allow for adaptive management, so that management response and additional mitigation and/or monitoring can be applied, if necessary.

An environmental monitoring framework is being developed for the Gahcho Kué Project. The objectives of this document are to define the criteria for AEMP monitoring taking a high level approach. The approach to aquatic effects monitoring for the Project is still conceptual, and detailed study designs and methods will be evaluated further through consultation with communities and regulatory agencies, and developed during the licensing phase of the Project.

d) The rationale for using different temporal boundaries for the effects assessment versus the residual impact assessment is as follows. As described in Sections 8.5.4 and 9.5.2 of the EIS Update, the temporal boundaries are linked to the construction, operation, and closure phases of the Project, and also to the post closure period. Effects could occur in any of these phases, and could extend into the post-closure period. To ensure that all potential effects of the Project on the Valued Components (VCs) were considered, the pathway analysis identified and screened the linkages between Project components or activities and the potential effects to receptors within the environment within each of these project phases.

However, the temporal boundaries associated with the residual impact classification were based on the assessment endpoints, i.e., the suitability of water quality to support a viable aquatic ecosystem, and the abundance and persistence of desired population(s) of lake trout, northern pike, and Arctic grayling. As a result, the residual impact classification was focused on persistence of the populations and recovery. The first time period incorporated the construction and operations, and closure phases of the Project, and the expected recovery period in which the aquatic ecosystem would be in a stable and productive state (i.e., taking into account the duration of the Project during construction, operations, and closure, and recovery during post-closure). The second period focused on the ability of the affected ecosystems to recover to a steady state.

References

De Beers (De Beers Canada Inc.). 2011. Environmental Impact Statement for the Gahcho Kué Project. Volumes 3a Revision 2, 3b Revision 2, 4 Revision 2, and 5 Revision 2. Submitted to the Mackenzie Valley Environmental Impact Review Board in Response to the Environmental Impact Statement Conformity Review. July 2011.

Table DFO&EC_2-1 Residual Impact Classification of Projected Impacts to Water Quality and Fish in Kennady Lake – Project Phases and Post-closure

Assessment Endpoint	Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Likelihood
Suitability of water within the Kennady Lake watershed to support a viable and self-sustaining aquatic ecosystem							
Construction	negative	moderate	local	long-term	continuous	reversible	likely
Operations	negative	moderate	local	long-term	continuous	reversible	likely
Closure	negative	moderate	local	long-term	continuous	reversible	likely
Post-Closure and Reclamation	negative	low	local	long-term	continuous	not reversible	likely
Abundance and persistence of Arctic grayling within the Kennady Lake watershed							
Construction	negative	high	local	long-term	continuous	reversible	likely
Operations	negative	high	local	long-term	continuous	reversible	likely
Closure	negative	high	local	long-term	continuous	reversible	likely
Post-Closure and Reclamation	negative	low	local	long-term	continuous	not reversible	likely
Abundance and persistence of lake trout within the Kennady Lake watershed							
Construction	negative	high	local	long-term	continuous	reversible	likely
Operations	negative	high	local	long-term	continuous	reversible	likely
Closure	negative	high	local	long-term	continuous	reversible	likely
Post-Closure and Reclamation	negative	moderate	local	long-term	continuous	not reversible	likely
Abundance and persistence of northern pike within the Kennady Lake watershed							
Construction	negative	high	local	long-term	continuous	reversible	likely
Operations	negative	high	local	long-term	continuous	reversible	likely
Closure	negative	high	local	long-term	continuous	reversible	likely
Post-Closure and Reclamation	neutral - positive	negligible	-	-	-	-	-

"-" = not applicable.

Table DFO&EC_2-2 Residual Impact Classification of Projected Impacts to Water Quality and Fish Downstream of Kennady Lake – Project Phases and Post-closure

Assessment Endpoint	Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Likelihood
Suitability of water in downstream waterbodies to support a viable and self-sustaining aquatic ecosystem							
Construction	negative	negligible	-	-	-	-	-
Operations	negative	negligible	-	-	-	-	-
Closure	negative	negligible	-	-	-	-	-
Post-Closure and Reclamation	negative	negligible	-	-	-	-	-
Abundance and persistence of Arctic grayling in downstream waterbodies							
Construction	negative/ positive	negligible	-	-	-	-	-
Operations	negative	moderate[(a)]	local	medium-term	periodic	reversible	likely
Closure	negative	moderate[(a)]	local	medium-term	periodic	reversible	likely
Post-Closure and Reclamation	neutral	negligible	-	-	-	-	-
Abundance and persistence of lake trout in downstream waterbodies							
Construction	neutral - positive	negligible	-	-	-	-	-
Operations	negative	low	local	medium-term	periodic	reversible	likely
Closure	negative	low	local	medium-term	periodic	reversible	likely
Post-Closure and Reclamation	neutral	negligible	-	-	-	-	-
Abundance and persistence of northern pike in downstream waterbodies							
Construction	neutral- positive	negligible	-	-	-	-	-
Operations	negative	low	local	medium-term	periodic	reversible	likely
Closure	negative	low	local	medium-term	periodic	reversible	likely
Post-Closure and Reclamation	neutral - positive	negligible	-	-	-	-	-

- = not applicable.

[(a)] based on the highest magnitude effect predicted through to completion of Kennady Lake refilling and assumes no mitigation for downstream flows.

April 2012

GAHCHO KUÉ PROJECT ENVIRONMENTAL IMPACT STATEMENT
INFORMATION REQUEST RESPONSES

Information Request Number: DFO&EC_3

Source: Fisheries and Oceans Canada and Environment Canada (DFO&EC)

Subject: Fish Population Estimates

EIS Section: 9.5.1.3 Fish

Terms of Reference Section:

Preamble:

Collecting baseline information on the fish community is an important component of a monitoring program, but sampling itself can impact fish populations. Using a standardized protocol such as Broad Scale Fish Community Monitoring or Nordic Netting allows you to get a snapshot in time without causing unnecessary mortality.

Request

a) It is indicated in the EIS that fish population estimates were undertaken. What are the estimates of the populations? Please identify where the data to support the estimates of fish populations can be found and a description of the baseline data available to support a meaningful assessment of fish populations.

b) It is indicated in the EIS Measurement Endpoints for fish VECs (i.e., Lake Trout, Arctic Grayling and Northern Pike) that abundance and persistence of desired populations will be assessed and the measurement end point is fish numbers. Please indentify if De Beers is proposing to do multiple population estimates or compare relative abundances through a netting program (It is recommended that De Beers consider the implementation of a standardized program such as the Broad Scale Fish Community Monitoring Program or Nordic Netting).

c) Table 9.5-2 lists the Assessment Endpoints and Measurement Endpoints for Valued Components Identified for Water Quality and Fish Downstream of Kennady Lake. Please provide rationale as to why these assessment and measurement endpoints were chosen. Please indicate what monitoring will occur to measure the measurement endpoints.

Response

a) The fish population estimates for Kennady Lake are summarized in Section 8.3.8.2.3 of the 2011 EIS Update (De Beers 2011). A mark/recapture study was conducted in 2004; based on results of this study, there is a 95% probability that the lake trout population in Kennady Lake is greater than 2,300 fish. To further refine the Kennady Lake population estimates, a hydroacoustic survey of pelagic fish was conducted in late summer 2010. The total fish population of Kennady Lake was estimated at 18,977 fish; however, this estimate does not include fish (e.g., young-of-year, small fish) that prefer shallow water where hydroacoustic surveys are generally ineffective. A mean density of 13.4 lake trout per hectare was calculated (or a lake trout population of 10,925 fish).

For the 2004 mark/recapture study in Kennady Lake, additional details are provided in Annex J (Fisheries and Aquatic Resources Baseline) of the 2010 EIS (De Beers 2010). The methods are described in Section J3.5.5. Fish used in the study were captured through gillnetting; a complete summary of gillnetting effort in Kennady Lake in 2004 is provided in Appendix J.I, Table J.I-36 of Annex J. The morphometric, life history, tag, and recapture data can be found in Appendix J.I, Table J.I-57. The results for this study are summarized in Section J4.4.5 (De Beers 2010).

For the 2010 hydroacoustic survey of Kennady Lake, additional details are provided in Addendum JJ (Additional Fish and Aquatic Resources Baseline Information) of the 2010 EIS (De Beers 2010). The methods are described in Section JJ3.4.1. ‘Screen shots’ of echograms (in Visual Analyzer 4.1.3.6) of fish echoes (or targets) from acoustic surveys of Kennady Lake are provided in Appendix JJ.I of Addendum JJ. Depth transects for the hydroacoustic surveys are provided in Appendix JJ.XI, and the fish capture and effort data are in Appendix JJ.XII. Results for this study are summarized in Section JJ4.4.1 (De Beers 2010).

b) The Aquatics Effects Monitoring Program (AEMP) for the Project is currently being developed. As part of the development of this program, target large-bodied and small-bodied species, sampling locations, and standardized sampling techniques will be identified, which may involve population estimates or standardized netting programs, as appropriate. The AEMP will be developed with regulatory and stakeholder input.

c) As described in Section 9.5.1.4 of the 2011 EIS Update (De Beers 2011), assessment endpoints are the ultimate properties of Valued Components (VCs) that should be protected or developed for use by future human generations. As described in Section 9.5.1.1 (De Beers 2011), the selection of VCs were based on issues scoping sessions for the Project with community members, federal and territorial regulators, and other stakeholders, as well as the Terms of Reference. For this key line of inquiry, the water quality and fish were identified as VCs. As per Section 9.5.13 (De Beers 2011), the VC represented by fish included individual fish species, with the selection criteria for the individual fish species described in this section. The assessment endpoints were, therefore, effects statements regarding the protection of the VCs identified for the Project.

As per Section 9.5.1.4 (De Beers 2011), measurement endpoints are defined as quantifiable (i.e., measurable) expressions of the environment that influence the assessment endpoints. The assessment endpoints (i.e., effects statements) are analyzed using quantitative and qualitative methods, based on measurement endpoints. The list of measurement endpoints were developed based on professional experience of potential linkages within the aquatic environment, knowledge of the ecosystem, and understanding of the Project.

As described in the answer to part (b) above, the Aquatics Effects Monitoring Program (AEMP) for the Project is currently being developed. The AEMP will incorporate the key components of the measurements endpoints in Table 9.5-2 in its development. The AEMP will have an overall study design that will be developed according to currently accepted statistical design principles and regulatory guidance and will include hydrology, water quality (effluent and receiving water) and sediment quality components, components focused on lower trophic communities (i.e., plankton, periphyton, and benthic invertebrates), and fish and fish habitat. A groundwater monitoring program and habitat compensation monitoring will also be included as components of the overall aquatic ecosystem monitoring. The development of the AEMP will involve regulatory and stakeholder input, as well as consideration of available TK, and allow for adaptive management.

References

De Beers (De Beers Canada Inc.). 2010. Environmental Impact Statement for the Gahcho Kué Project. Volumes 1, 2, 3a, 3b, 4, 5, 6a, 6b, 7 and Annexes A through N. Submitted to Mackenzie Valley Environmental Impact Review Board. December 2010.

De Beers. 2011. Environmental Impact Statement for the Gahcho Kué Project. Volumes 3a Revision 2, 3b Revision 2, 4 Revision 2, and 5 Revision 2. Submitted to the Mackenzie Valley Environmental Impact Review Board in Response to the Environmental Impact Statement Conformity Review. July 2011.

GAHCHO KUÉ PROJECT ENVIRONMENTAL IMPACT STATEMENT
INFORMATION REQUEST RESPONSES

Information Request Number: DFO&EC_4

Source: Fisheries and Oceans Canada and Environment Canada (DFO&EC)

Subject: Water Chemistry

EIS Section: 9.8 Effects to Surface Water Quality

Terms of Reference Section:

Preamble:

Comprehensive baseline information is essential in order to allow comparisons during construction and operations to detect potential mine effects. Addressing the Information Requests listed below will result in a substantial increase in understanding and definition of baseline conditions within the study area, and will increase the probability that the objectives of the monitoring program will be met.

Request

a) Provide a description of baseline water chemistry for all lakes and streams in the study area. It is suggested that a box-plot analysis (median, 25%, 75%, and definition of outliers) and Piper Plots be used to define upper and lower bounds of baseline water chemistry.

b) Provide model total suspended solids (TSS) concentrations related to construction, operation and closure conditions.

c) Define the sampling sites that will be used for the AEMP for all water quality parameters.

Response

a) A comprehensive description of baseline water quality for the Kennady Lake watershed and downstream lakes is provided in Annex I and Addendum II of the EIS (De Beers 2010, with summary information provided in Sections 8.3 and 9.3 of the 2011 EIS Update [De Beers 2011]). These data represent lakes and streams in the Kennady Lake watershed (Tables 8.3-21 and 8.3-23) collected between 1995 and 2010, the L and M watersheds (Table 9.3-19) collected between 1998 and 2010, the N watersheds

(Table 9.3-21) collected between 1998 and 2010, and Lake 410 and Kirk Lake (Table 9.3-24) collected between 2004 and 2010. This data represent 33 locations for physico-chemical field water quality measurements (surface) and 28 locations for water column profiles and chemical analyses during open-water seasons in the Kennady Lake watershed. For the downstream lakes and streams, this data represent 19 sampled locations for physico-chemical field water quality measurements (surface) and 16 sampled locations for water column profiles and chemical analyses during open-water seasons. However, limited data were collected during under-ice conditions: the data represent 5 sampled locations in the Kennady Lake watershed for physico-chemical field water quality measurements (surface) and 5 sampled locations for water column profiles and chemical analyses, and for the downstream lakes, the data represent 5 sampled locations in the Kennady Lake watershed for physico-chemical field water quality measurements (surface) and 3 sampled locations for water column profiles and chemical analyses.

Supplemental monitoring was conducted in the Kennady Lake watershed and the LSA in 2011, with the data presented in Golder (2012). For the Kennady Lake watershed, the 2011 monitoring program sampled 11 lake sites during under-ice conditions and 11 lake sites and one stream site (inlets/outlets) during open-water conditions for water quality profile measurements and chemical analyses. For the downstream lakes, the program included 19 lake sites during under-ice conditions and 23 lake sites and five stream sites (inlets/outlets) during open-water conditions for water quality profile measurements and chemical analyses. An additional open water quality program was conducted in 2011 to collect pre-development AEMP-type data: this included comprehensive sampling in Lake 410, Lake N11, East Lake, and Area 8 in shallow and deep lake zones. This data will be reported in 2012. De Beers is committed to ongoing monitoring, with focussed work in 2012 including monitoring at five screened reference lakes during under-ice and open water conditions, and in the D-E-N lakes during open water conditions.

Summary statistics of baseline data collected from lakes in the Kennady Lake and downstream watersheds prior to 2011 have been presented in tabular form (i.e., median, minimum, maximum, number of observations and water quality guideline exceedances) in the 2011 EIS Update (De Beers 2011) (see Tables 8.3-21, 8.3-23, 9.3-19, 9.3-21, and 9.3-24). As suggested by the author, box plots and piper plots have been generated for water quality parameters measured in the downstream lakes, separated by under-ice and open water conditions and include the following:

Boxplots

- Figure DFO&EC 4-1 for Kennady Lake Areas 2 to 8 [A for under-ice data and B for open-water data]);
- Figure DFO&EC 4-2 for Small Lakes within Kennady Lake watershed; and
- Figure DFO&EC 4-3 for Downstream Lakes.

Piper Plots

- Figure DFO&EC 4-4 for Kennady Lake Areas;
- Figure DFO&EC 4-5 for Small Lakes in Kennady Lake watershed; and,
- Figure DFO&EC 4-6 for Downstream Lakes.

Data collected in the 2011 supplemental monitoring program have also been included in these plots.

As many of the water quality parameters in downstream lakes were measured under the analytical method detection limit (MDL), especially in the earlier sampling program, we have set conditions on the data presented in the plots. For example, only those parameters that had measurements that exceeded CCME water quality guidelines or were detected in more than 50% samples have been presented. Therefore, not all parameters that were analyzed have been presented. Boxplots have not been generated for the stream water quality data, due to insufficient data.

b) The maximum modelled TSS concentrations in Kennady Lake (post-closure) and Area 8 (during construction and operation, closure, and closure) is 2 mg/L (Tables 8.8-1 and 8.8-15 in Section 8 the July 2011 EIS Update [De Beers 2011]), and 1.3 mg/L for Lake N11 and Lake 410 (Tables 9.8-4 and 9.8-6, Section 9 of the July 2011 EIS Update [De Beers 2011]).

While it is understood that there will be some elevation of TSS in Kennady Lake as a result of the dewatering and operational discharge to Lake N11 and Area 8, any discharge will be limited by discharge water quality criteria to minimize TSS loading to the receiving lake, i.e., De Beers will not discharge water if it exceeds TSS criteria. Although some TSS will be sourced from these discharges, the extent of this effect within Lake N11 is likely to be limited to a mixing zone adjacent to the diffuser or outfall. Mitigation and adaptive management may be considered to further reduce any potential for TSS loading. For some supporting context, pumped discharge of treated effluent to Snap Lake at the Snap Lake Mine from 2004 to 2011 possesses a range of TSS of less than detection to 20 mg/L (available from SNP reports on the MVEIRB website); however, samples collected throughout the water column at the diffuser locations consistently have non-detectable TSS concentrations.

Similarly, some elevation in TSS concentrations is expected around the shoreline of lakes that will be raised, or subject to water increases or decrease resulting from isolation or pumped discharges. However, the effects of these TSS increases are expected to be minor and localized to the shoreline, with limited influence on the whole lake TSS concentrations.

c) An environmental monitoring framework is being developed for the Gahcho Kué Project. The objectives of this document are to define the criteria for AEMP monitoring taking a high level approach. The approach to aquatic effects monitoring for the Project is still conceptual, and detailed study designs and methods will be evaluated further through consultation with regulatory agencies and communities, and developed during the licensing phase of the Project.

The objectives of the AEMP are as follows:

- to evaluate the short-term and long-term effects of the Gahcho Kue Project on the aquatic ecosystems of surrounding and downstream surface waters;
- to estimate the spatial and temporal extent of effects;
- to compare the results of monitoring to EIS predictions;
- to provide the data necessary for adaptive management; and
- to evaluate the effectiveness of mitigation implemented as part of adaptive management.

It is anticipated that the AEMP study area will generally be equivalent to the aquatics LSA defined in the EIS and will encompass a portion of the Lockhart River watershed (De Beers 2011), with the potential exception of reference lakes. The study area is defined by the watersheds of the lakes and streams that may be directly affected by the proposed Project, and includes the Kennady Lake watershed and downstream watersheds, to the outlet of Kirk Lake (see Figure 10.1-3 in De Beers [2011]).

Reference lakes and streams will be selected during detailed study design, and may be located outside the Lockhart River watershed. Reference waterbodies will be chosen that best represent conditions outside of the influence of the Project, but match exposure areas in terms of physical characteristics and biological communities. For example, flows and lake morphology would be comparable between exposure and reference areas to minimize variation in water and sediment quality and biota. Sampling areas will be shared among components to the maximum extent possible; i.e., all aquatic components will be sampled at a standard set of core stations within each selected sampling area, with the exception of large-bodied fish, which will require a program of larger spatial scale and may necessitate selection of different reference areas to maximize similarity in fish community between reference and exposure areas.

Based on predicted water quality (especially nutrient concentrations) and hydrology (flow and water level changes), sampling areas are anticipated to be located in Kennady Lake, selected lakes in the N watershed (Lake N1, Lake N11 and possibly others) and the A, B, D, and E watersheds, as well as Lake 410 and at least two suitable reference lakes. It may be necessary to select lakes representative of certain types or levels of predicted effects, rather than monitoring all potentially affected lakes. Stream sampling areas will be selected based on fish habitat characteristics, in relation to predicted effects to hydrology and water quality.

Monitoring methods (i.e., sampling methods, chemistry analyses) will be consistent with those used during the baseline studies, to the extent possible. Field and laboratory procedures will include quality assurance/quality control (QA/QC) processes for all aspects of sampling and analysis, including data acquisition, sampling, as well as data analysis and interpretation. Components of the AEMP will be designed according to a statistically-based study design that incorporates regulatory guidance and currently accepted scientific principles.

Seasonality and frequency of sampling will vary by component and Project phase. For example, sediment and benthic invertebrates will be sampled once per year, while water quality sampling will be seasonal (i.e., open water and ice-cover periods). Monthly sampling may be considered for plankton, chlorophyll *a* and clarity (e.g., light attenuation, colour, Secchi depth) measurements at least during the first few years of monitoring. Initially and during periods of rapid change in water quality (e.g., after breaching of Dyke A), sampling frequency will likely be annual, but may be reduced to once every three years during periods of stable water quality.

The specifics of the AEMP design are expected to change over the life of the Project as part of adaptive management practices, and as dictated by changes in potential effects resulting from mine activity. In addition, the scope of the AEMP is expected to change, because monitoring effort in watersheds adjacent and downstream of Kennady Lake is expected to decline when operations cease. However, monitoring of Kennady Lake and the reference lake(s) will be maintained during all phases of the Project, although frequency of sampling may vary by project phase. Habitat compensation monitoring, a groundwater monitoring program and any supplemental monitoring will also be included as components of the overall aquatic ecosystem monitoring, but will not be part of the AEMP.

References

De Beers (De Beers Canada Inc.). 2010. Environmental Impact Statement for the Gahcho Kué Project. Volumes 1, 2, 3a, 3b, 4, 5, 6a, 6b, 7 and Annexes A through N. Submitted to Mackenzie Valley Environmental Impact Review Board. December 2010.

De Beers. 2011. Environmental Impact Statement Conformity Response. Submitted to the Mackenzie Valley Environmental Impact Review Board in Response to the Environmental Impact Statement Conformity Review, July 2011.

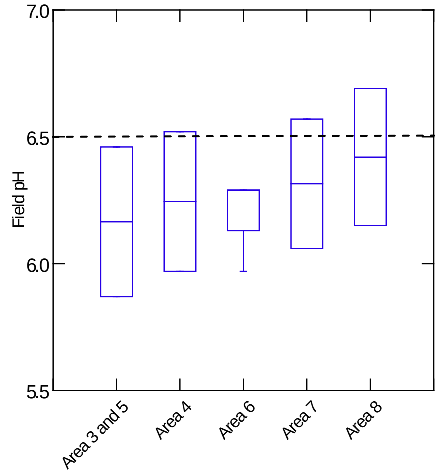
Golder (Golder Associates Ltd). 2012. 2011 Water Quality and Sediment Quality Supplemental Monitoring Report. Supplemental Information Submission for the Gahcho Kué Project.

Figure DFO&EC 4-1: Summary of Historical Water Quality Data in Box Plots for Kennady Lake Areas during 1995 to 2011. A) Under-Ice Conditions B) Open-Water Conditions

Note: The box and whisker plot visually marks the following statistics: horizontal line within each box indicates the median of the data, outer edges of each box indicate 25th and 75th percentile, whiskers indicate minimum and maximum and the dotted line crossing the entire plot denotes CCME Water Quality Guidelines (not shown in case of no exceedances). In the case of dependent variables (i.e. pH, temperature, hardness), the guideline is based on the median value of the dataset.

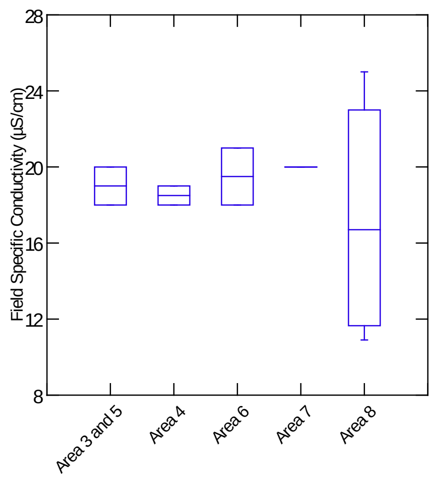
Outliers (asterisk signs) were discrete data points with values more than 1.5 times the inter-quartile range and extreme outliers (open circles) were more than 3.0 times the inter-quartile range. Some extreme outlier values are not plotted but reported in the footnote. The number of data used to derive the box and whisker plots are also noted in the footnote. Data with concentrations reported as being below the detection limit were adjusted to the MDL value.

Figure DFO&EC 4-1.A1: Under-Ice Field pH in Kennady Lake Areas



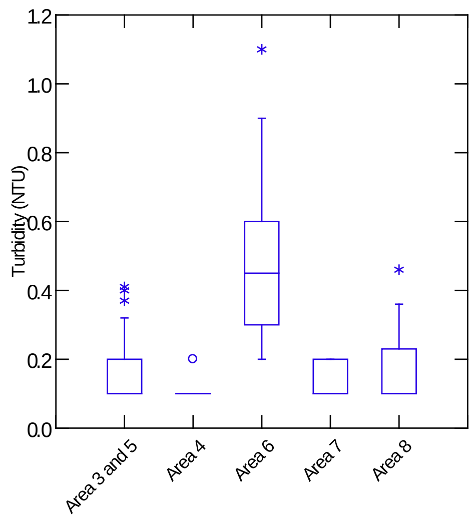
Note: Sample count per site: Areas 3 and 5 = 2; Area 4 = 2; Area 6 = 3; Area 7 = 2; Area 8 = 2.

Figure DFO&EC 4-1.A2: Under-Ice Specific Conductivity in Kennady Lake Areas



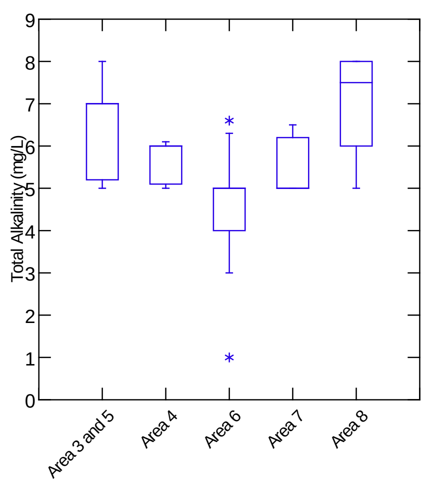
Note: µS/cm = microSiemens per centimetre.
Sample count per site: Areas 3 and 5 = 2; Area 4 = 2; Area 6 = 2; Area 7 = 2; Area 8 = 4.

Figure DFO&EC 4-1.A3: Under-Ice Turbidity in Kennady Lake Areas



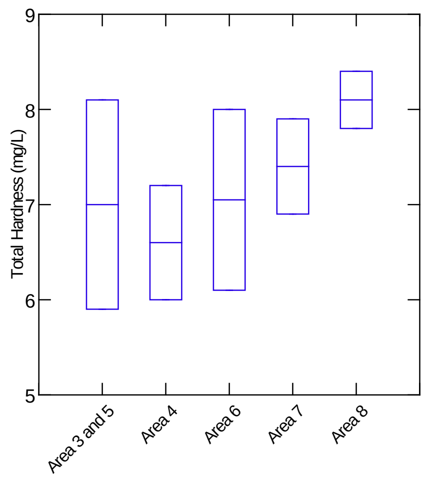
Note: NTU = Nephelometric Turbidity Units.
Sample count per site: Areas 3 and 5 = 32; Area 4 = 5; Area 6 = 20; Area 7 = 5; Area 8 = 28.
Extreme outlier not plotted = 1.9 NTU at Area 6

Figure DFO&EC 4-1.A4: Under-Ice Total Alkalinity in Kennady Lake Areas



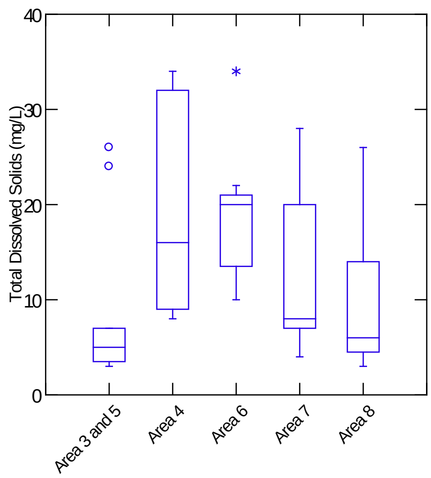
Note: mg/L = milligrams per litre; total alkalinity presented as calcium carbonate.
Sample count per site: Areas 3 and 5 = 41; Area 4 = 5; Area 6 = 23; Area 7 = 5; Area 8 = 28.

Figure DFO&EC 4-1.A5: Under-Ice Total Hardness in Kennady Lake Areas



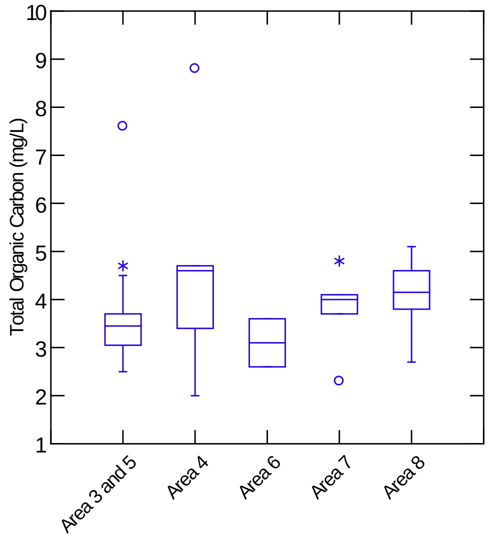
Note: mg/L = milligrams per litre; total hardness presented as calcium carbonate.
Sample count per site: Areas 3 and 5 = 2; Area 4 = 2; Area 6 = 2; Area 7 = 2; Area 8 = 2.

Figure DFO&EC 4-1.A6: Under-Ice Total Dissolved Solids in Kennady Lake Areas



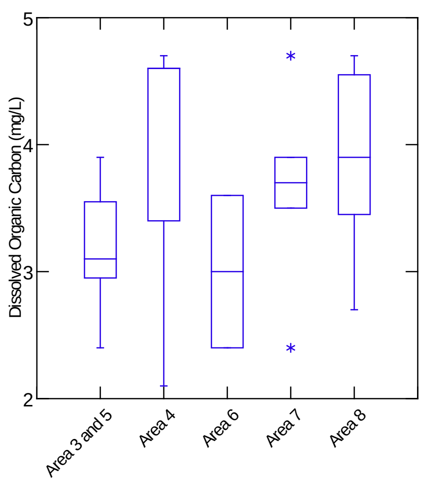
Note: mg/L = milligrams per litre.
Sample count per site: Areas 3 and 5 = 11; Area 4 = 5; Area 6 = 15; Area 7 = 5; Area 8 = 8.

Figure DFO&EC 4-1.A7: Under-Ice Total Organic Carbon in Kennady Lake Areas



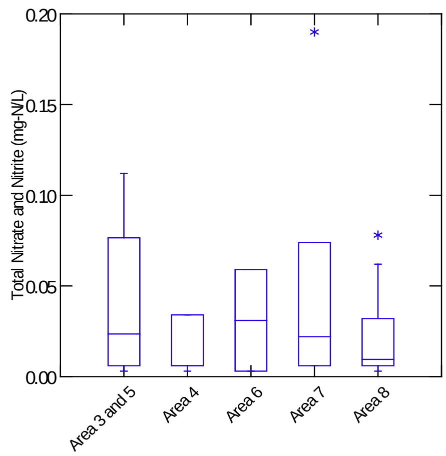
Note: mg/L = milligrams per litre.
Sample count per site: Areas 3 and 5 = 32; Area 4 = 5; Area 6 = 2; Area 7 = 5; Area 8 = 8.

Figure DFO&EC 4-1.A8: Under-Ice Dissolved Organic Carbon in Kennady Lake Areas



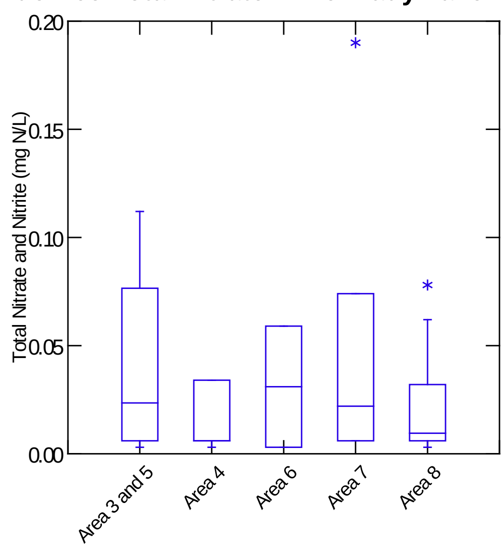
Note: mg/L = milligrams per litre.
Sample count per site: Areas 3 and 5 = 11; Area 4 = 5; Area 6 = 2; Area 7 = 5; Area 8 = 8.

Figure DFO&EC 4-1.A9: Under-Ice Total Nitrate and Nitrite in Kennady Lake Areas



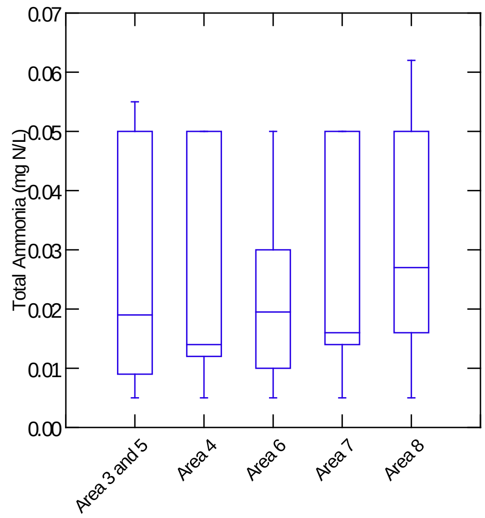
Note: mg N/L = milligrams nitrogen per litre.
Sample count per site was: Areas 3 and 5 = 28; Area 4 = 5; Area 6 = 2; Area 7 = 5; Area 8 = 20.
Extreme outlier not plotted = 0.34 mg/L at Areas 3 and 5.

Figure DFO&EC 4-1.A10: Under-Ice Total Nitrate in Kennady Lake Areas



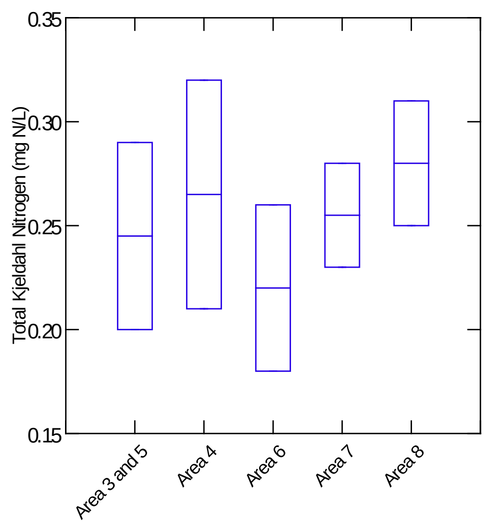
Note: mg N/L = milligrams nitrogen per litre.
Sample count per site: Areas 3 and 5 = 41; Area 4 = 5; Area 6 = 2; Area 7 = 5; Area 8 = 20.

Figure DFO&EC 4-1.A11: Under-Ice Total Ammonia in Kennady Lake Areas



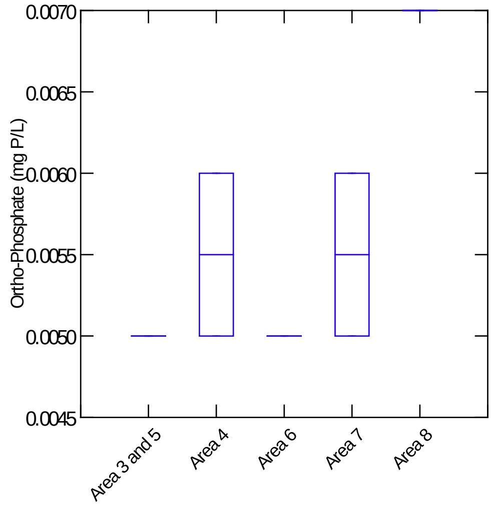
Note: mg N/L = milligrams nitrogen per litre.
Sample count per site: Areas 3 and 5 = 41; Area 4 = 5; Area 6 = 22; Area 7 = 5; Area 8 = 28.

Figure DFO&EC 4-1.A12: Under-Ice Total Kjeldahl Nitrogen in Kennady Lake Areas



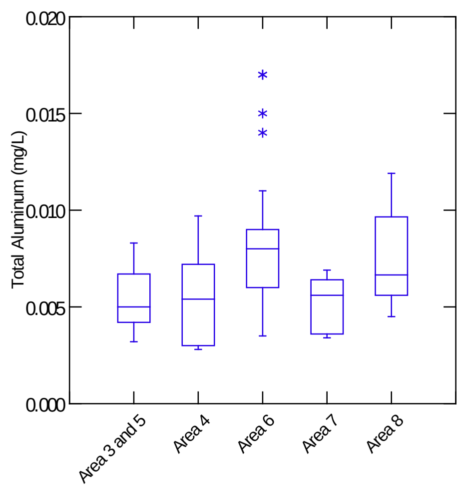
Note: mg N/L = milligrams nitrogen per litre.
Sample count per site: Areas 3 and 5 = 2; Area 4 = 2; Area 6 = 2; Area 7 = 2; Area 8 = 2.

Figure DFO&EC 4-1.A13: Under-Ice Orthophosphate in Kennady Lake Areas



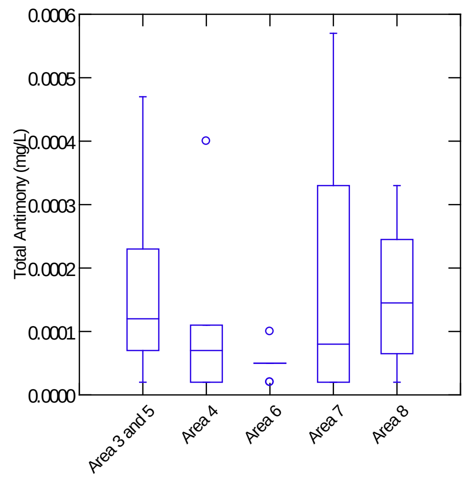
Note: mg P/L = milligrams phosphorus per litre.
Sample count per site: Areas 3 and 5 = 2; Area 4 = 2; Area 6 = 2; Area 7 = 2; Area 8 = 2.

Figure DFO&EC 4-1.A14: Under-Ice Total Aluminum in Kennady Lake Areas



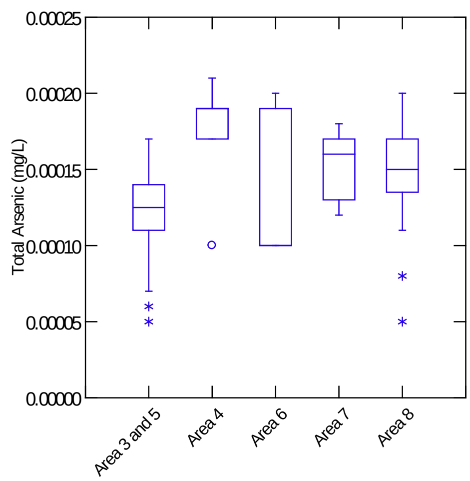
Note: mg/L = milligrams per litre.
Sample count per site: Areas 3 and 5 = 41; Area 4 = 5; Area 6 = 22; Area 7 = 5; Area 8 = 28.
Extreme outlier not plotted = 0.05 mg/L at Area 6.

Figure DFO&EC 4-1.A15: Under-Ice Total Antimony in Kennady Lake Areas



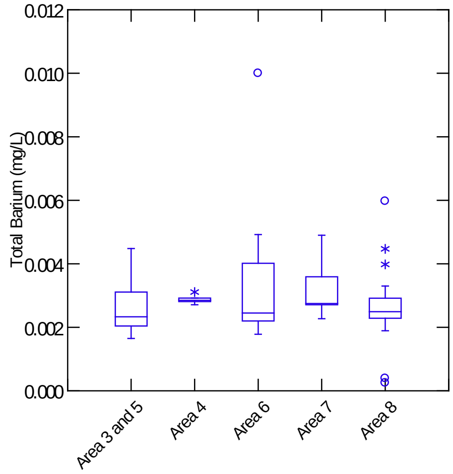
Note: mg/L = milligrams per litre.
Sample count per site: Areas 3 and 5 = 41; Area 4 = 5; Area 6 = 23; Area 7 = 5; Area 8 = 28.

Figure DFO&EC 4-1.A16: Under-Ice Total Arsenic in Kennady Lake Areas



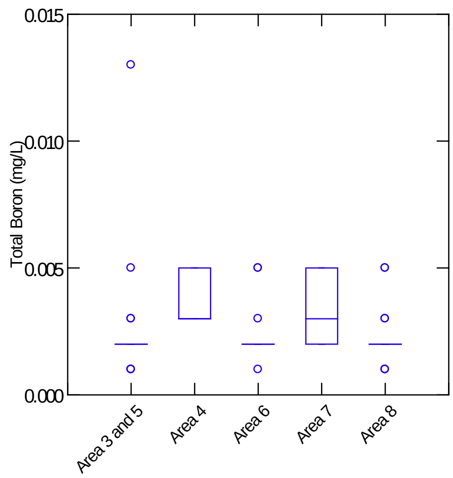
Note: mg/L = milligrams per litre.
Sample count per site: Areas 3 and 5 = 40; Area 4 = 5; Area 6 = 23; Area 7 = 5; Area 8 = 28.
Extreme outlier not plotted = 0.0007 mg/L at Areas 3 and 5.

Figure DFO&EC 4-1.A17: Under-Ice Total Barium in Kennady Lake Areas



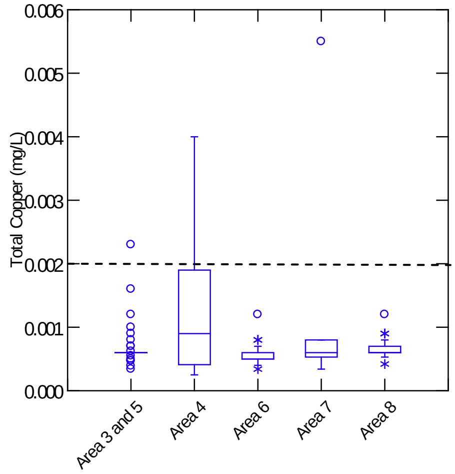
Note: mg/L = milligrams per litre.
Sample count per site: Areas 3 and 5 = 41; Area 4 = 5; Area 6 = 23; Area 7 = 5; Area 8 = 28.

Figure DFO&EC 4-1.A18: Under-Ice Total Boron in Kennady Lake Areas



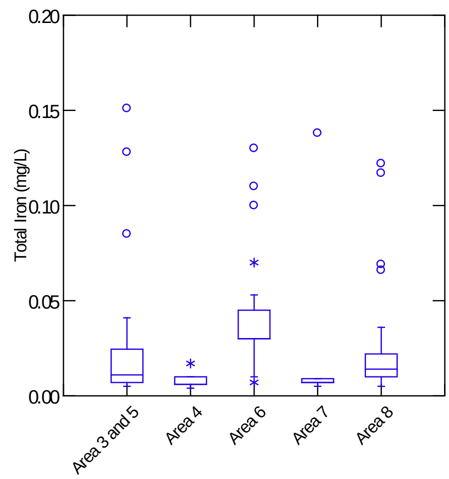
Note: mg/L = milligrams per litre.
Sample count per site: Areas 3 and 5 = 41; Area 4 = 5; Area 6 = 22; Area 7 = 5; Area 8 = 28.

Figure DFO&EC 4-1.A19: Under-Ice Total Copper in Kennady Lake Areas



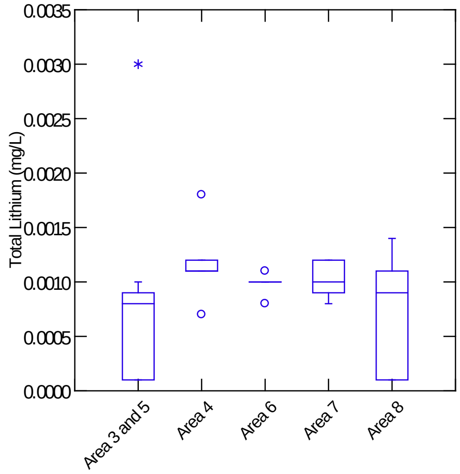
Note: mg/L = milligrams per litre.
Sample count per site: Areas 3 and 5 = 39; Area 4 = 5; Area 6 = 22; Area 7 = 5; Area 8 = 28.
Extreme outliers not plotted = 0.0153 and 0.311 mg/L at Areas 3 and 5 and 0.01 mg/L at Area 6.

Figure DFO&EC 4-1.A20: Under-Ice Total Iron in Kennady Lake Areas



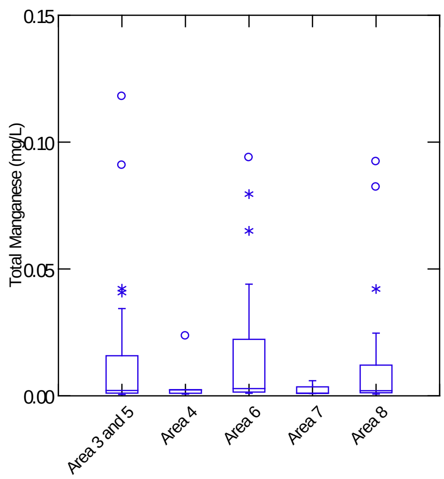
Note: mg/L = milligrams per litre.
Sample count per site: Areas 3 and 5 = 39; Area 4 = 5; Area 6 = 23; Area 7 = 5; Area 8 = 27.
Extreme outliers not plotted = 0.261 and 0.433 mg/L at Areas 3 and 5 and 0.596 mg/L at Area 8.

Figure DFO&EC 4-1.A21: Under-Ice Total Lithium in Kennady Lake Areas



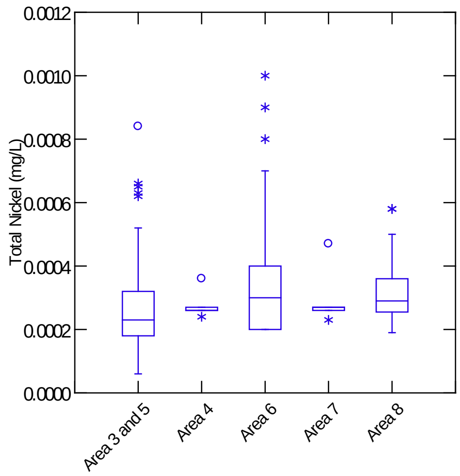
Note: mg/L = milligrams per litre.
Sample count per site: Areas 3 and 5 = 41; Area 4 = 5; Area 6 = 22; Area 7 = 5; Area 8 = 28.
Extreme outlier not plotted = 0.015 mg/L at Area 6.

Figure DFO&EC 4-1.A22: Under-Ice Total Manganese in Kennady Lake Areas



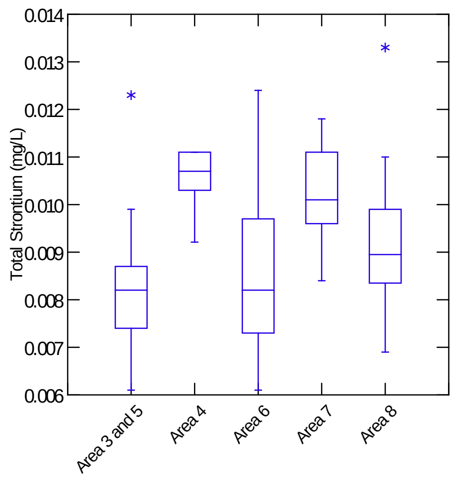
Note: mg/L = milligrams per litre.
Sample count per site: Areas 3 and 5 = 35; Area 4 = 5; Area 6 = 23; Area 7 = 4; Area 8 = 26.
Extreme outliers not plotted = 0.134, 0.18, 0.202, 0.24, 0.251and 0.378 mg/L at Areas 3 and 5; 0.201 mg/L at Area 7, and 0.207 and 0.438 mg/L at Area 8.

Figure DFO&EC 4-1.A23: Under-Ice Total Nickel in Kennady Lake Areas



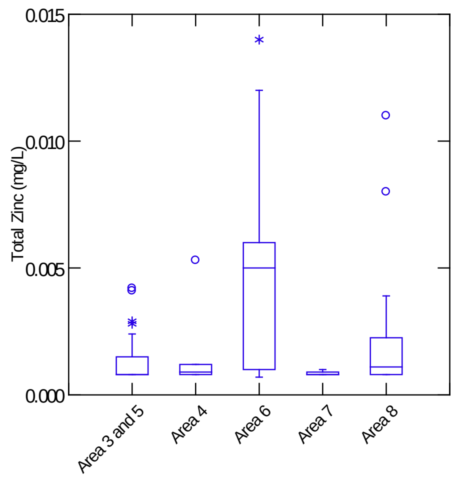
Note: mg/L = milligrams per litre.
Sample count per site: Areas 3 and 5 = 41; Area 4 = 5; Area 6 = 22; Area 7 = 5; Area 8 = 28.

Figure DFO&EC 4-1.A24: Under-Ice Total Strontium in Kennady Lake Areas



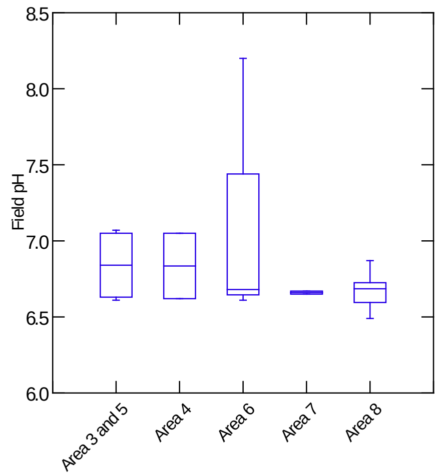
Note: mg/L = milligrams per litre.
Sample count per site: Areas 3 and 5 = 41; Area 4 = 5; Area 6 = 23; Area 7 = 5; Area 8 = 28.

Figure DFO&EC 4-1.A25: Under-Ice Total Zinc in Kennady Lake Areas



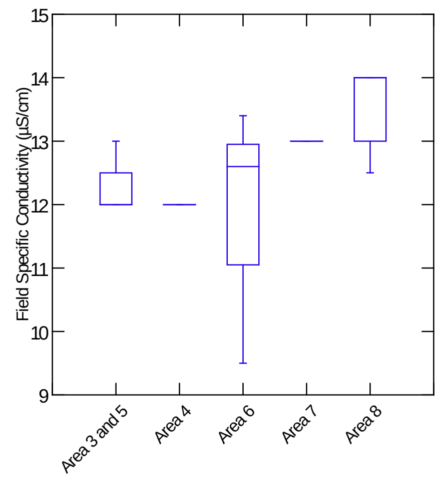
Note: mg/L = milligrams per litre.
Sample count per site: Areas 3 and 5 = 41; Area 4 = 5; Area 6 = 23; Area 7 = 5; Area 8 = 28.

Figure DFO&EC 4-1.B1: Open-Water Field pH in Kennady Lake Areas



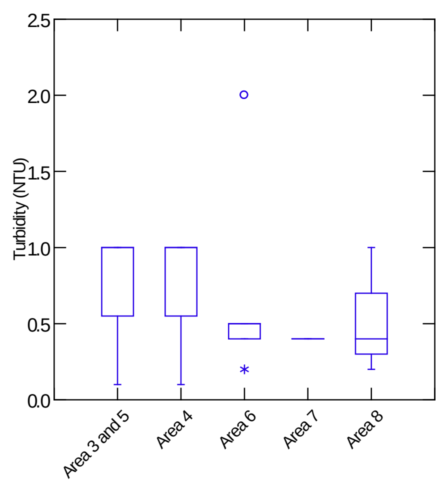
Note: Sample count per site: Areas 3 and 5 = 5; Area 4 = 3; Area 6 = 13; Area 7 = 2; Area 8 = 16.

Figure DFO&EC 4-1.B2: Open-Water Specific Conductivity in Kennady Lake Areas



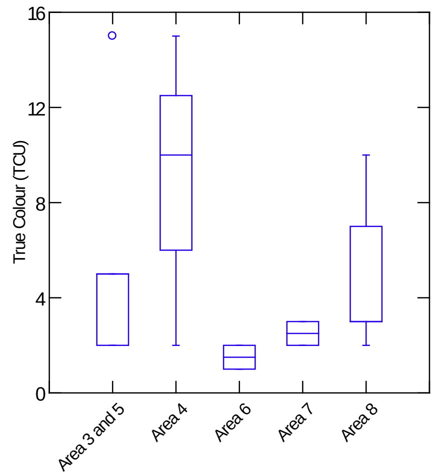
Note: µS/cm = microSiemens per centimetre.
Sample count per site: Areas 3 and 5 = 5; Area 4 = 3; Area 6 = 13; Area 7 = 2; Area 8 = 16.

Figure DFO&EC 4-1.B3: Open-Water Turbidity in Kennady Lake Areas



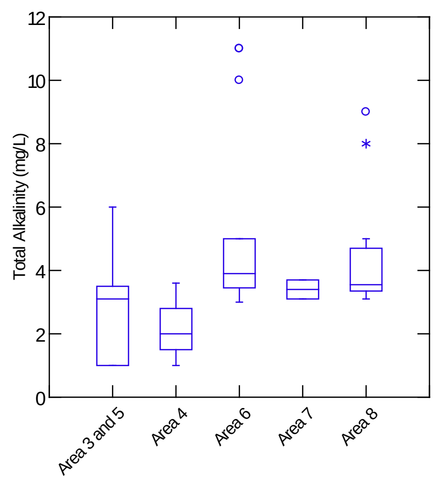
Note: NTU = Nephelometric Turbidity Units.
Sample count per site: Areas 3 and 5 = 4; Area 4 = 3; Area 6 = 9; Area 7 =1; Area 8 = 15.

Figure DFO&EC 4-1.B4: Open-Water True Colour in Kennady Lake Areas



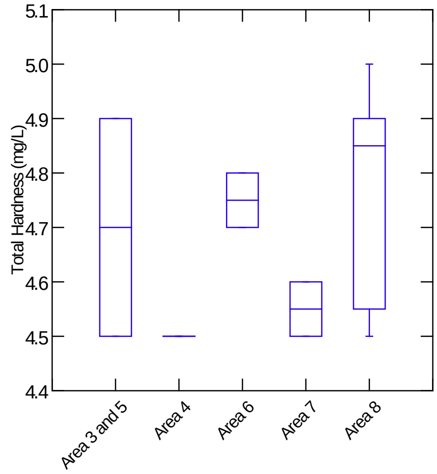
Note: TCU = True Colour Units.
Sample count per site: Areas 3 and 5 = 5; Area 4 = 3; Area 6 = 4; Area 7 = 2; Area 8 = 16.

Figure DFO&EC 4-1.B5: Open-Water Total Alkalinity in Kennady Lake Areas



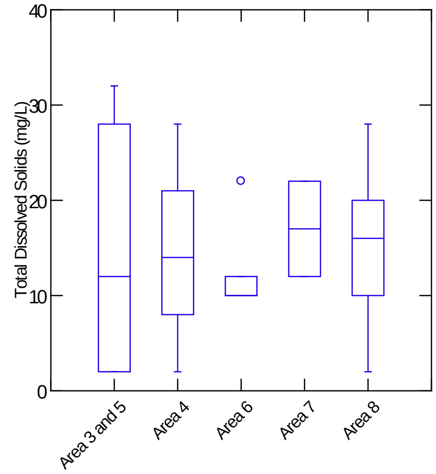
Note: mg/L = milligrams per litre; total alkalinity presented as calcium carbonate.
Sample count per site: Areas 3 and 5 = 5; Area 4 = 3; Area 6 = 20; Area 7 = 2; Area 8 = 16.

Figure DFO&EC 4-1.B6: Open-Water Hardness in Kennady Lake Areas



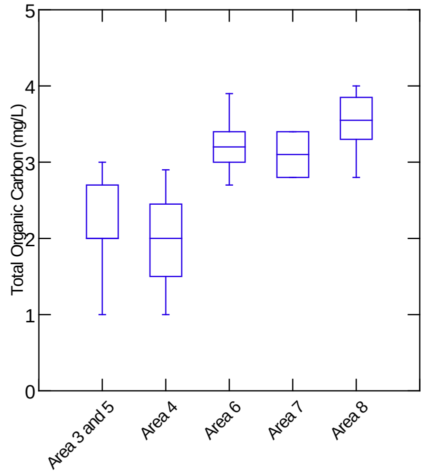
Note: mg/L = milligrams per litre.
Sample count per site: Areas 3 and 5 = 5; Area 4 = 3; Area 6 = 20; Area 7 = 2; Area 8 = 16.

Figure DFO&EC 4-1.B7: Open-Water Total Dissolved Solids in Kennady Lake Areas



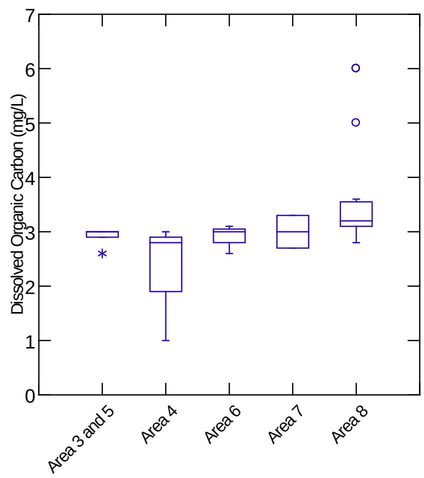
Note: mg/L = milligrams per litre.
Sample count per site: Areas 3 and 5 = 5; Area 4 = 3; Area 6 = 5; Area 7 = 2; Area 8 = 16.

Figure DFO&EC 4-1.B8: Open-Water Total Organic Carbon in Kennady Lake Areas



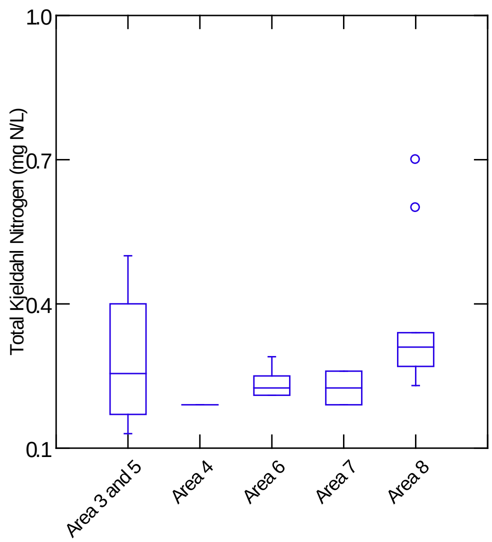
Note: mg/L = milligrams per litre.
Sample count per site: Areas 3 and 5 = 5; Area 4 = 3; Area 6 = 8; Area 7 = 2; Area 8 = 16.

Figure DFO&EC 4-1.B9: Open-Water Dissolved Organic Carbon in Kennady Lake Areas



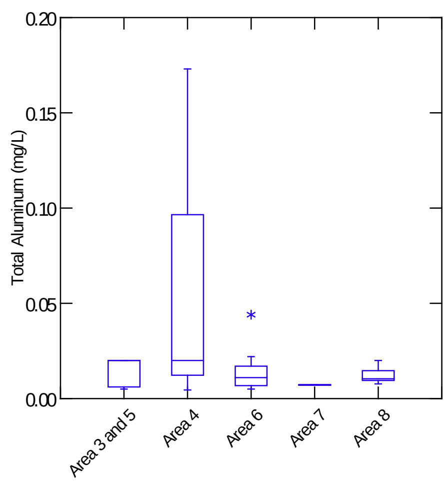
Note: mg/L = milligrams per litre.
Sample count per site: Areas 3 and 5 = 5; Area 4 = 3; Area 6 = 4; Area 7 = 2; Area 8 = 16.

Figure DFO&EC 4-1.B10: Open-Water Total Kjeldahl Nitrogen in Kennady Lake Areas



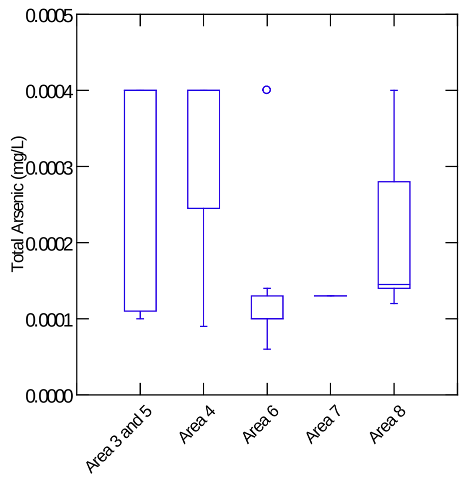
Note: mg N/L = milligrams nitrogen per litre.
Sample count per site: Areas 3 and 5 = 5; Area 4 = 1; Area 6 = 6; Area 7 = 2; Area 8 = 14.
Extreme outlier not plotted = 1.3 mg N/L at Areas 3 and 5.

Figure DFO&EC 4-1.B11: Open-Water Total Aluminum in Kennady Lake Areas



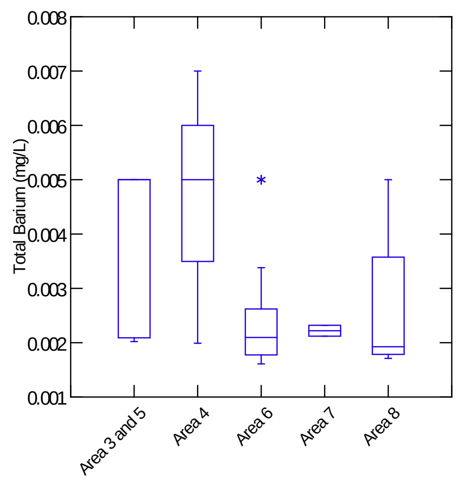
Note: mg/L = milligrams per litre.
Sample count per site: Areas 3 and 5 = 5; Area 4 = 3; Area 6 = 26; Area 7 = 2; Area 8 = 16.
Extreme outlier not plotted = 0.73 mg/L at Area 6.

Figure DFO&EC 4-1.B12: Open-Water Total Arsenic in Kennady Lake Areas



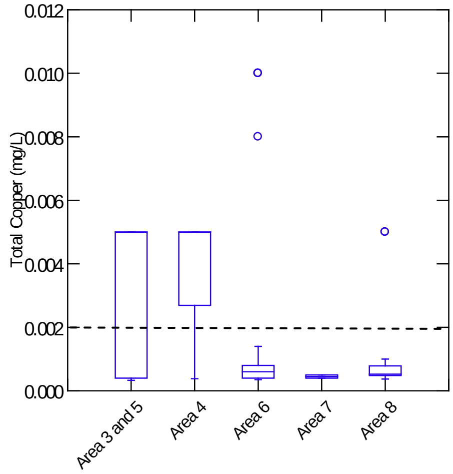
Note: mg/L = milligrams per litre.
Sample count per site: Areas 3 and 5 = 5; Area 4 = 3; Area 6 = 26; Area 7 = 2; Area 8 = 16.
Extreme outlier not plotted = 0.001 mg/L at Area 6.

Figure DFO&EC 4-1.B13: Open-Water Total Barium in Kennady Lake Areas



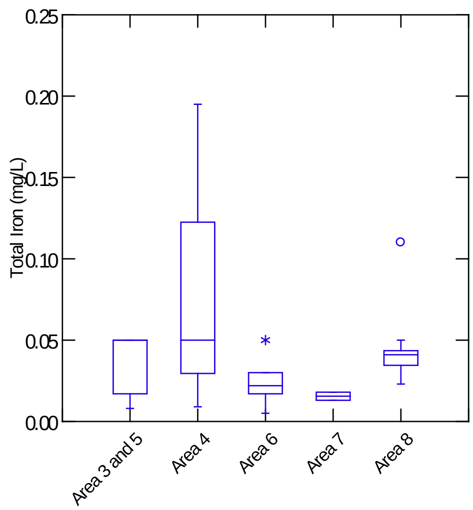
Note: mg/L = milligrams per litre.
Sample count per site was: Areas 3 and 5 = 5; Area 4 = 3; Area 6 = 24; Area 7 = 2; Area 8 = 16.

Figure DFO&EC 4-1.B14: Open-Water Total Copper in Kennady Lake Areas



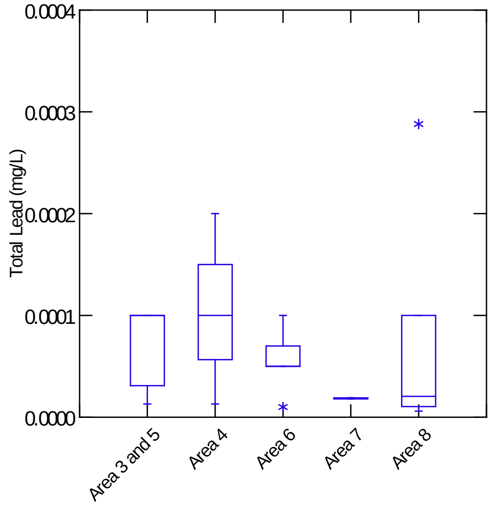
Note: mg/L = milligrams per litre.
Sample count per site: Areas 3 and 5 = 5; Area 4 = 3; Area 6 = 27; Area 7 = 2; Area 8 = 16.

Figure DFO&EC 4-1.B15: Open-Water Total Iron in Kennady Lake Areas



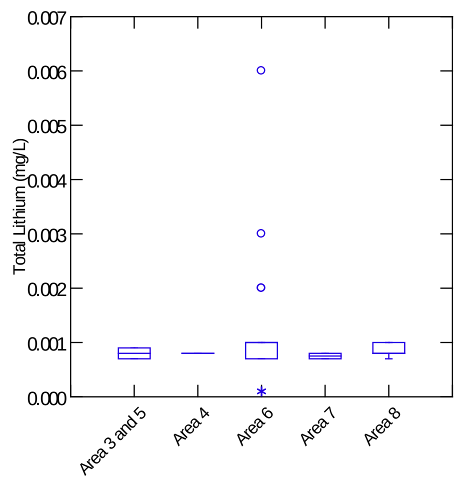
Note: mg/L = milligrams per litre.
Sample count per site: Areas 3 and 5 = 5; Area 4 = 3; Area 6 = 27; Area 7 = 2; Area 8 = 16.

Figure DFO&EC 4-1.B16: Open-Water Total Lead in Kennady Lake Areas



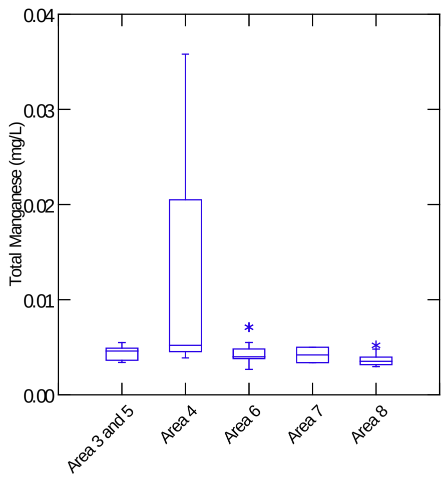
Note: mg/L = milligrams per litre.
Sample count per site: Areas 3 and 5 = 5; Area 4 = 3; Area 6 = 24; Area 7 = 2; Area 8 = 16.

Figure DFO&EC 4-1.B17: Open-Water Total Lithium in Kennady Lake Areas



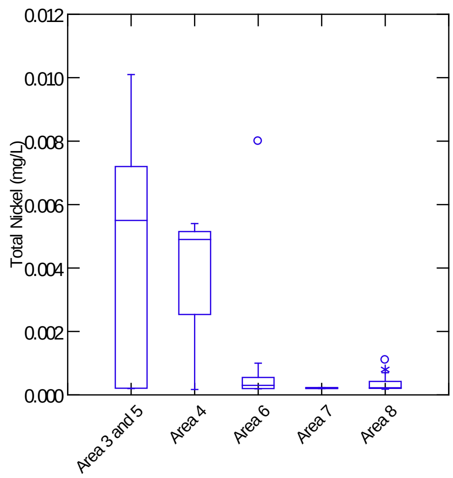
Note: mg/L = milligrams per litre.
Sample count per site: Areas 3 and 5 = 2; Area 4 = 1; Area 6 = 18; Area 7 = 2; Area 8 = 12.

Figure DFO&EC 4-1.B18: Open-Water Total Manganese in Kennady Lake Areas



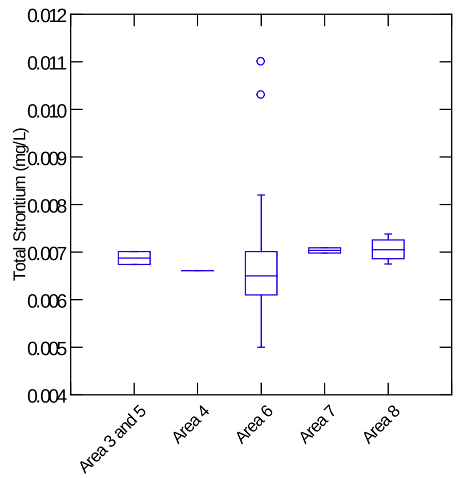
Note: mg/L = milligrams per litre.
Sample count per site: Areas 3 and 5 = 5; Area 4 = 3; Area 6 = 27; Area 7 = 2; Area 8 = 16.

Figure DFO&EC 4-1.B19: Open-Water Total Nickel in Kennady Lake Areas



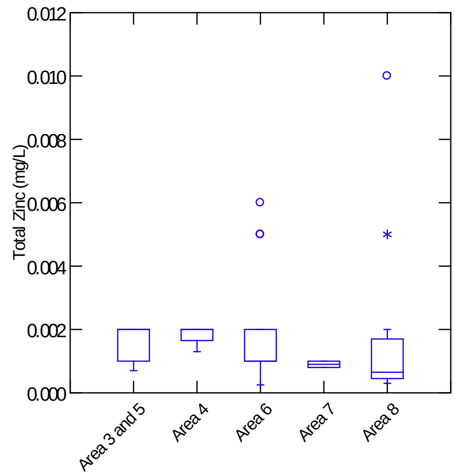
Note: mg/L = milligrams per litre.
Sample count per site: Areas 3 and 5 = 5; Area 4 = 3; Area 6 = 27; Area 7 = 2; Area 8 = 16.

Figure DFO&EC 4-1.B20: Open-Water Total Strontium in Kennady Lake Areas



Note: mg/L = milligrams per litre.
Sample count per site was: Areas 3 and 5 = 2; Area 4 = 1; Area 6 = 24; Area 7 = 2; Area 8 = 12.
Extreme outlier not plotted = 0.02 mg/L at Area 6.

Figure DFO&EC 4-1.B21: Open-Water Total Zinc in Kennady Lake Areas



Note: mg/L = milligrams per litre.
Sample count per site was: Areas 3 and 5 = 5; Area 4 = 3; Area 6 = 26; Area 7 = 2; Area 8 = 16.
Extreme outlier not plotted = 0.063 mg/L at Area 6.

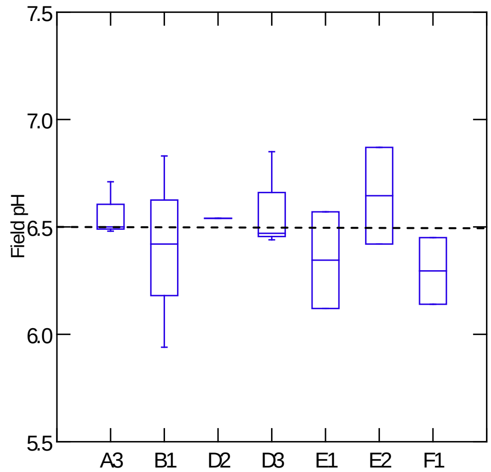
Figure DFO&EC 4-2: Summary of Historical Water Quality Data (open-water data only) in Box Plots for Small Lakes of Kennady Lake Watershed during 1995 to 2011

Open-Water Condition data only

Note: The box and whisker plot visually marks the following statistics: horizontal line within each box indicates the median of the data, outer edges of each box indicate 25th and 75th percentile whiskers indicate minimum and maximum and the dotted line crossing the entire plot denotes CCME Water Quality Guidelines (not shown in case of no exceedances). In the case of dependent variables (i.e. pH, temperature, hardness), the guideline is based on the median value of the dataset.

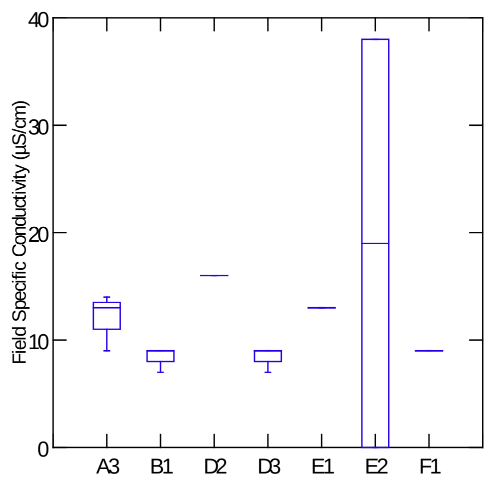
Outliers (asterisk signs) were discrete data points with values more than 1.5 times the inter-quartile range and extreme outliers (open circles) were more than 3.0 times the inter-quartile range. Some extreme outlier values are not plotted but reported in the footnote. The number of data used to derive the box and whisker plots are also noted in the footnote. Data with concentrations reported as being below the detection limit were adjusted to the MDL value.

Figure DFO&EC 4-2.1: Open-Water Field pH in Small Lakes of Kennady Lake Watershed



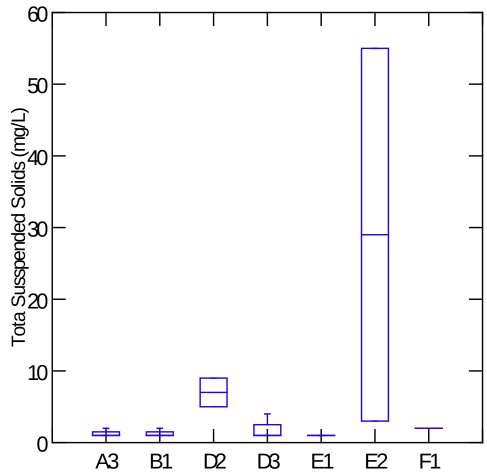
Note: Sample count per site: A3 = 3; B1 = 3; D2 = 2; D3 = 3; E1 = 2; E2 = 2; F1 = 2.

Figure DFO&EC 4-2.2: Open-Water Specific Conductivity in Small Lakes of Kennady Lake Watershed



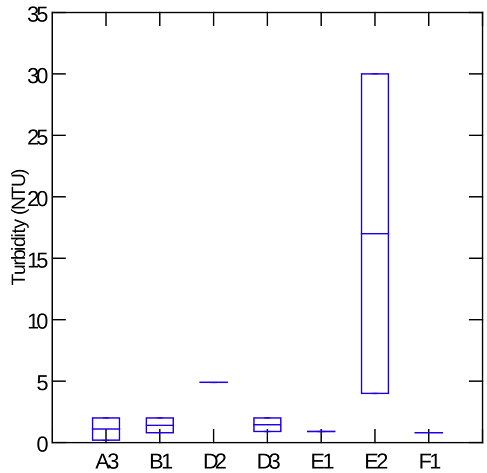
Note: µS/cm = microSiemens per centimetre.
Sample count per site: A3 = 3; B1 = 3; D2 = 2; D3 = 3; E1 = 2; E2 = 2; F1 = 2.

Figure DFO&EC 4-2.3: Open-Water Total Suspended Solids in Small Lakes of Kennady Lake Watershed



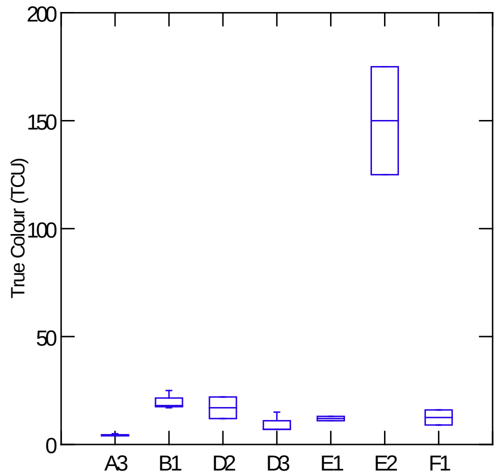
Note: mg/L = milligrams per litre.
Sample count per site: A3 = 3; B1 = 3; D2 = 2; D3 = 3; E1 = 2; E2 = 2; F1 = 2.

Figure DFO&EC 4-2.4: Open-Water Turbidity in Small Lakes of Kennady Lake Watershed



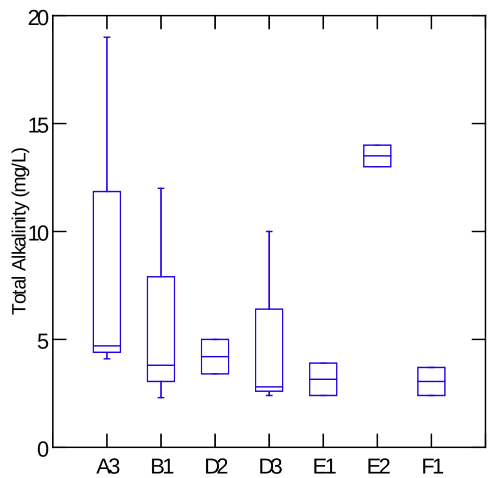
Note: NTU = Nephelometric Turbidity Units.
Sample count per site: A3 = 2; B1 = 2; D2 = 1; D3 = 2; E1 = 1; E2 = 2; F1 = 1.

Figure DFO&EC 4-2.5: Open-Water True Colour in Small Lakes of Kennady Lake Watershed



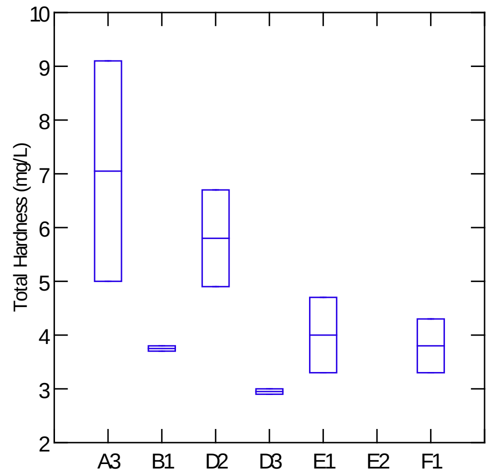
Note: TCU = True Colour Units.
Sample count per site: A3 = 3; B1 = 3; D2 = 2; D3 = 3; E1 = 2; E2 = 2; F1 = 2.

Figure DFO&EC 4-2.6: Open-Water Total Alkalinity in Small Lakes of Kennady Lake Watershed



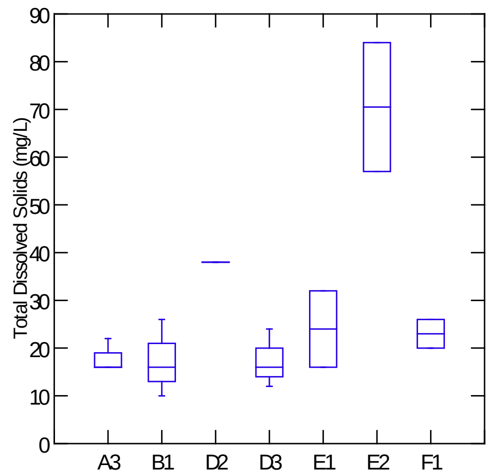
Note: mg/L = milligrams per litre; total alkalinity presented as calcium carbonate.
Sample count per site: A3 = 3; B1 = 3; D2 = 2; D3 = 3; E1 = 2; E2 = 2; F1 = 2.

Figure DFO&EC 4-2.7: Open-Water Total Hardness in Small Lakes of Kennady Lake Watershed



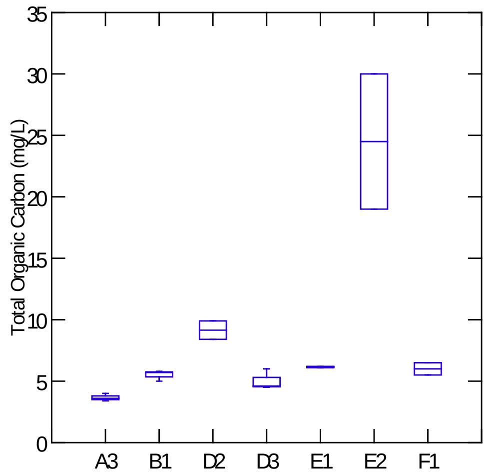
Note: mg/L = milligrams per litre.
Sample count per site: A3 = 2; B1 = 2; D2 = 2; D3 = 2; E1 = 2; E2 = 0; F1 = 2.

Figure DFO&EC 4-2.8: Open-Water Total Dissolved Solids in Small Lakes of Kennady Lake Watershed



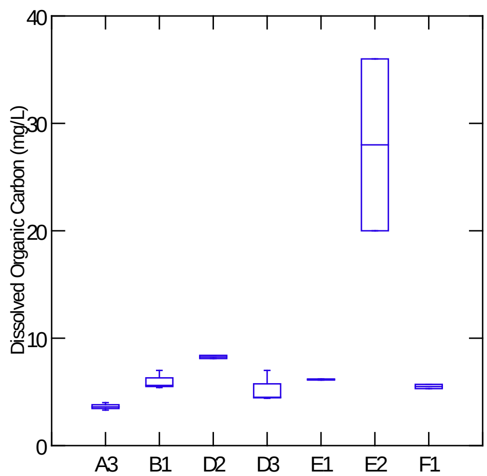
Note: mg/L = milligrams per litre.
Sample count per site: A3 = 3; B1 = 3; D2 = 2; D3 = 3; E1 = 2; E2 = 2; F1 = 2.

Figure DFO&EC 4-2.9: Open-Water Total Organic Carbon in Small Lakes of Kennady Lake Watershed



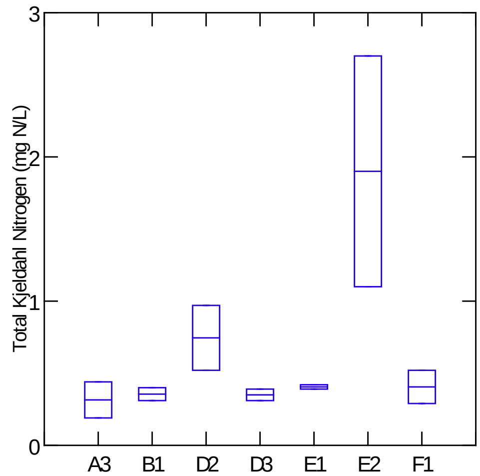
Note: mg/L = milligrams per litre.
Sample count per site: A3 = 3; B1 = 3; D2 = 2; D3 = 3; E1 = 2; E2 = 2; F1 = 2.

Figure DFO&EC 4-2.10: Open-Water Dissolved Organic Carbon in Small Lakes of Kennady Lake Watershed



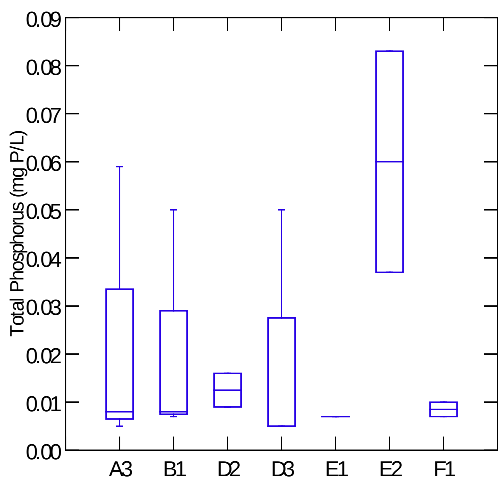
Note: mg/L = milligrams per litre.
Sample count per site: A3 = 3; B1 = 3; D2 = 2; D3 = 3; E1 = 2; E2 = 2; F1 = 2.

Figure DFO&EC 4-2.11: Open-Water Total Kjeldahl Nitrogen in Small Lakes of Kennady Lake Watershed



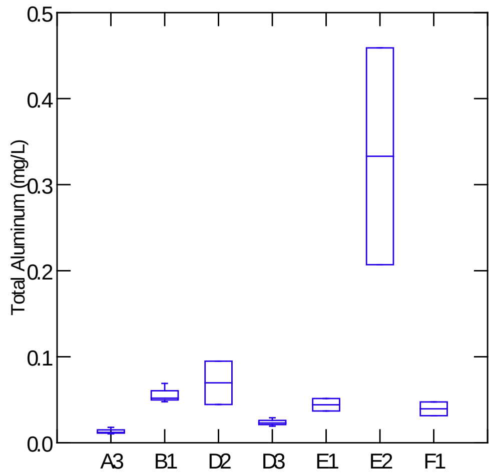
Note: mg N/L = milligrams nitrogen per litre.
Sample count per site: A3 = 3; B1 = 3; D2 = 2; D3 = 3; E1 = 2; E2 = 2; F1 = 2.

Figure DFO&EC 4-2.12: Open-Water Total Phosphorus in Small Lakes of Kennady Lake Watershed



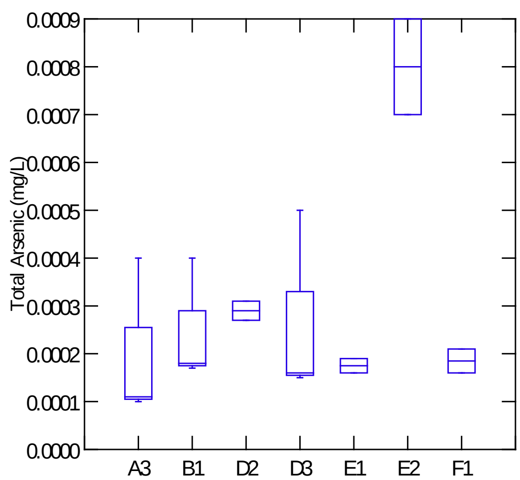
Note: mg P/L = milligrams phosphorus per litre.
Sample count per site: A3 = 3; B1 = 3; D2 = 2; D3 = 3; E1 = 2; E2 = 2; F1 = 2.

Figure DFO&EC 4-2.13: Open-Water Total Aluminum in Small Lakes of Kennady Lake Watershed



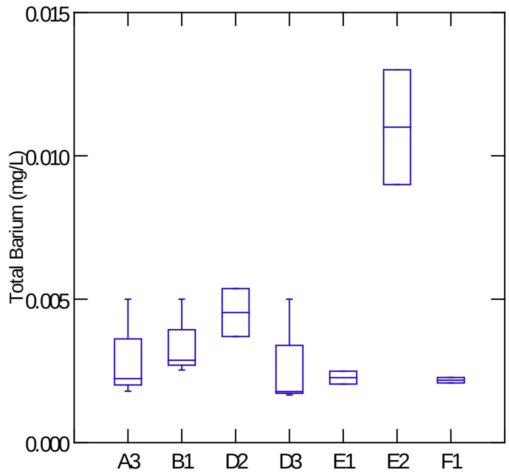
Note: mg/L = milligrams per litre.
Sample count per site: A3 = 3; B1 = 3; D2 = 2; D3 = 3; E1 = 2; E2 = 2; F1 = 2.

Figure DFO&EC 4-2.14: Open-Water Total Arsenic in Small Lakes of Kennady Lake Watershed



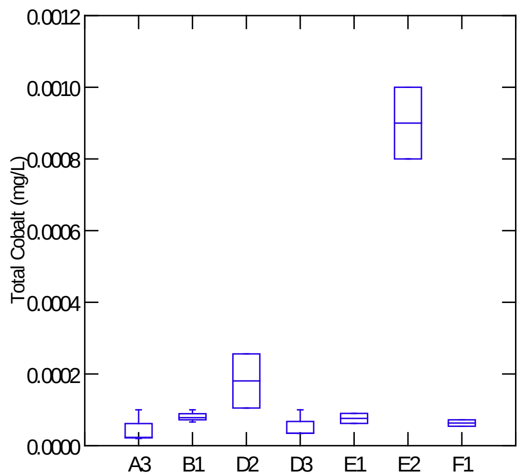
Note: mg/L = milligrams per litre.
Sample count per site: A3 = 3; B1 = 3; D2 = 2; D3 = 3; E1 = 2; E2 = 2; F1 = 2.

Figure DFO&EC 4-2.15: Open-Water Total Barium in Small Lakes of Kennady Lake Watershed



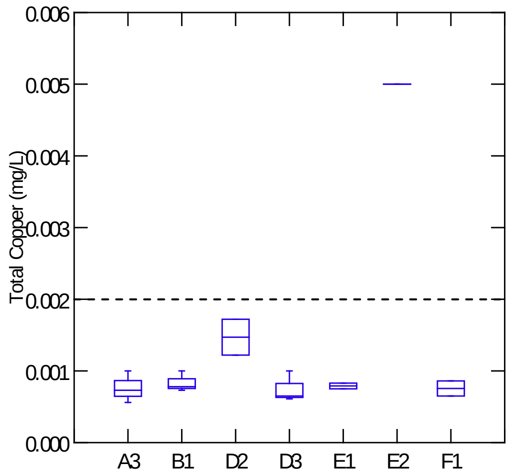
Note: mg/L = milligrams per litre.
Sample count per site: A3 = 3; B1 = 3; D2 = 2; D3 = 3; E1 = 2; E2 = 2; F1 = 2.

Figure DFO&EC 4-2.16: Open-Water Total Cobalt in Small Lakes of Kennady Lake Watershed



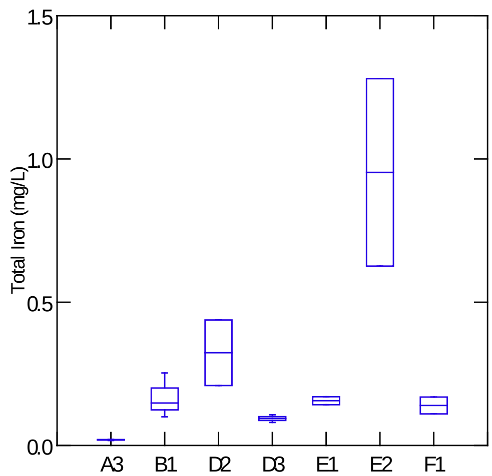
Note: mg/L = milligrams per litre.
Sample count per site: A3 = 3; B1 = 3; D2 = 2; D3 = 3; E1 = 2; E2 = 2; F1 = 2.

Figure DFO&EC 4-2.17: Open-Water Total Copper in Small Lakes of Kennady Lake Watershed



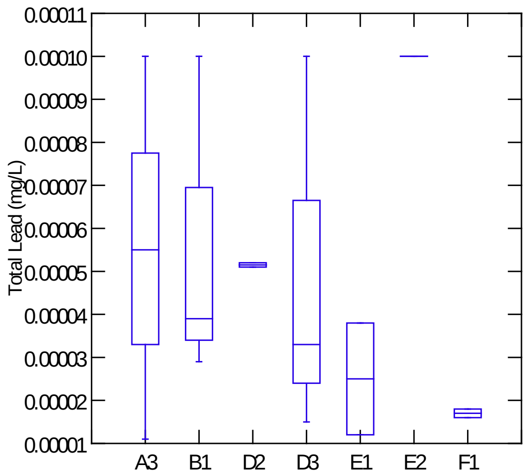
Note: mg/L = milligrams per litre.
Sample count per site: A3 = 3; B1 = 3; D2 = 2; D3 = 3; E1 = 2; E2 = 2; F1 = 2.

Figure DFO&EC 4-2.18: Open-Water Total Iron in Small Lakes of Kennady Lake Watershed



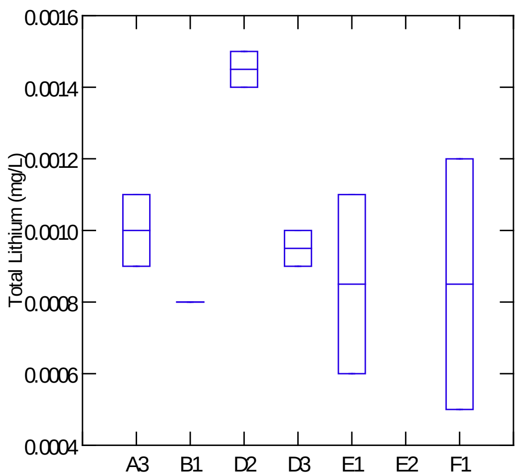
Note: mg/L = milligrams per litre.
Sample count per site: A3 = 3; B1 = 3; D2 = 2; D3 = 3; E1 = 2; E2 = 2; F1 = 2.

Figure DFO&EC 4-2.19: Open-Water Total Lead in Small Lakes of Kennady Lake Watershed



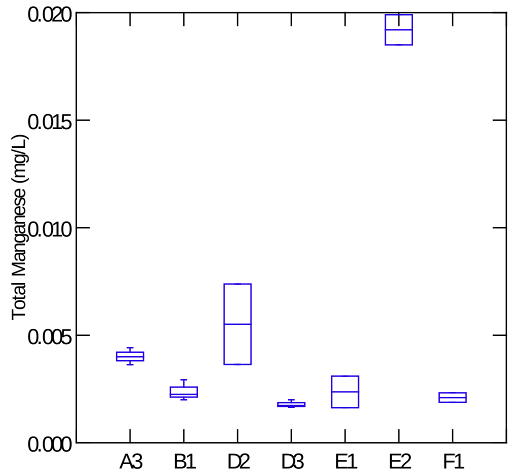
Note: mg/L = milligrams per litre.
Sample count per site: A3 = 3; B1 = 3; D2 = 2; D3 = 3; E1 = 2; E2 = 2; F1 = 2.

Figure DFO&EC 4-2.20: Open-Water Total Lithium in Small Lakes of Kennady Lake Watershed



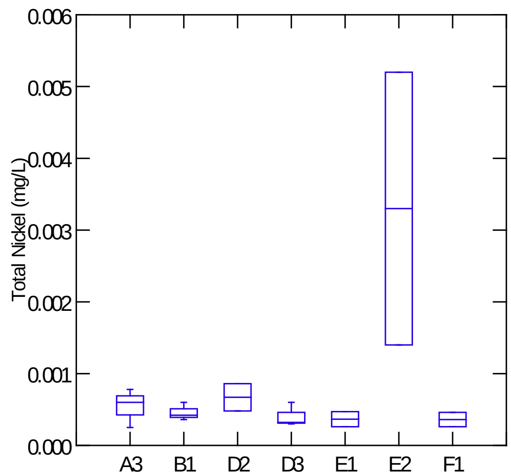
Note: mg/L = milligrams per litre.
Sample count per site: A3 = 1; B1 = 1; D2 = 2; D3 = 1; E1 = 2; E2 = 0; F1 = 2.

Figure DFO&EC 4-2.21: Open-Water Total Manganese in Small Lakes of Kennady Lake Watershed



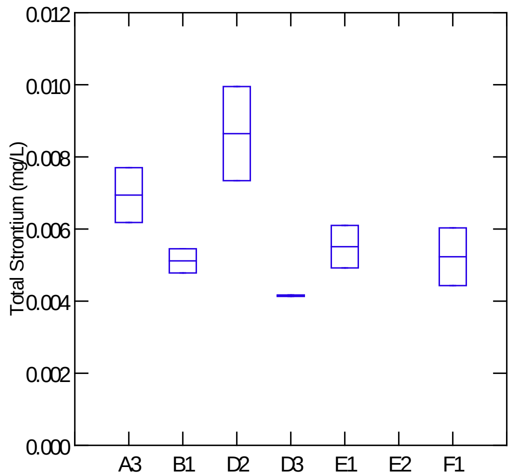
Note: mg/L = milligrams per litre.
Sample count per site: A3 = 3; B1 = 3; D2 = 2; D3 = 3; E1 = 2; E2 = 2; F1 = 2.

Figure DFO&EC 4-2.22: Open-Water Total Nickel in Small Lakes of Kennady Lake Watershed



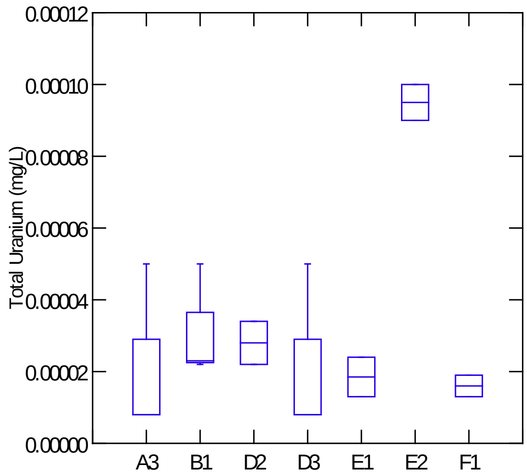
Note: mg/L = milligrams per litre.
Sample count per site was: A3 = 3; B1 = 3; D2 = 2; D3 = 3; E1 = 2; E2 = 2; F1 = 2.

Figure DFO&EC 4-2.23: Open-Water Total Strontium in Small Lakes of Kennady Lake Watershed



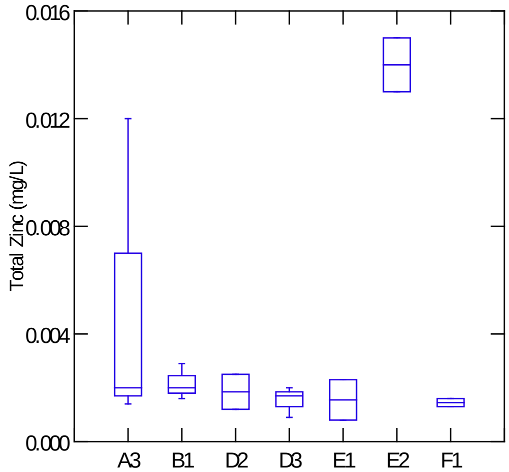
Note: mg/L = milligrams per litre.
Sample count per site: A3 = 2; B1 = 2; D2 = 2; D3 = 2; E1 = 2; E2 = 0; F1 = 2.

Figure DFO&EC 4-2.24: Open-Water Total Uranium in Small Lakes of Kennady Lake Watershed



Note: mg/L = milligrams per litre.
Sample count per site: A3 = 3; B1 = 3; D2 = 2; D3 = 3; E1 = 2; E2 = 2; F1 = 2.

Figure DFO&EC 4-2.25: Open-Water Total Zinc in Small Lakes of Kennady Lake Watershed



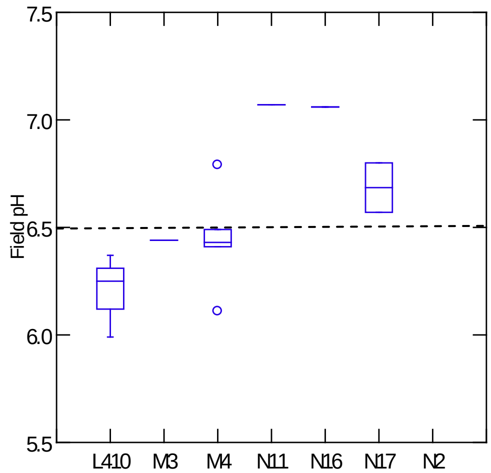
Note: mg/L = milligrams per litre.
Sample count per site: A3 = 3; B1 = 3; D2 = 2; D3 = 3; E1 = 2; E2 = 2; F1 = 2.

Figure DFO&EC 4-3: Summary of historical Water Quality Data in Box Plots for Downstream Lakes of Kennady Lake during 1998 to 2011. A) Under-Ice Conditions, B) Open-Water Conditions.

Note: The box and whisker plot visually marks the following statistics: horizontal line within each box indicates the median of the data, outer edges of each box indicate 25th and 75th percentile whiskers indicate minimum and maximum and the dotted line crossing the entire plot denotes CCME Water Quality Guidelines (not shown in case of no exceedances). In the case of dependent variables (i.e. pH, temperature, hardness), the guideline is based on the median value of the dataset.

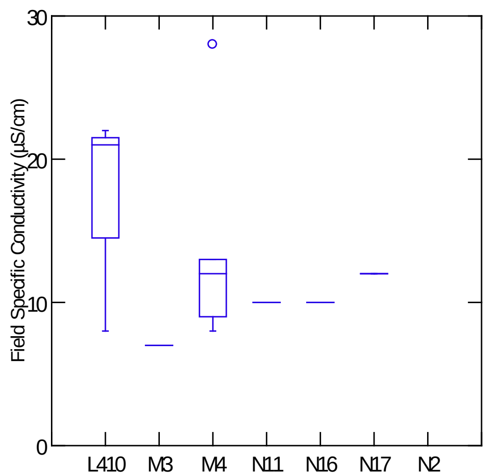
Outliers (asterisk signs) were discrete data points with values more than 1.5 times the inter-quartile range and extreme outliers (open circles) were more than 3.0 times the inter-quartile range. Some extreme outlier values are not plotted but reported in the footnote. The number of data used to derive the box and whisker plots are also noted in the footnote. Data with concentrations reported as being below the detection limit were adjusted to the MDL value.

Figure DFO&EC 4-3.A1: Under-Ice Field pH in Downstream Lakes



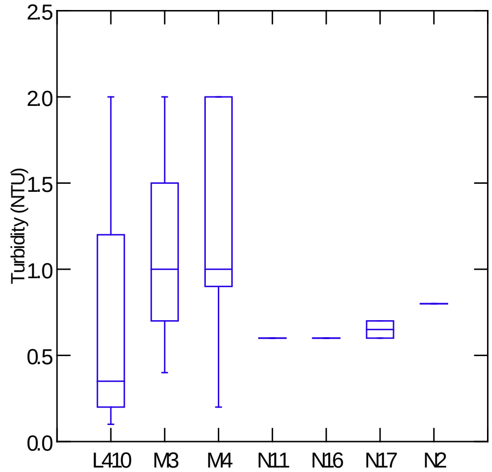
Note: Sample count per site: L410 = 4; M3 = 3; M4 = 6; N11 = 1; N16 = 1; N17 = 2; N2 = 1.

Figure DFO&EC 4-3.A2: Under-Ice Specific Conductivity in Downstream Lakes



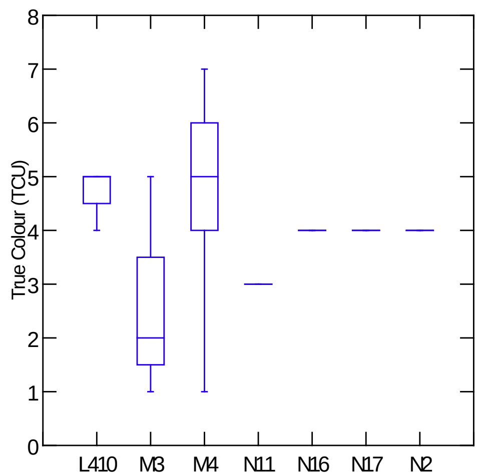
Note: µS/cm = microSiemens per centimetre.
Sample count per site: L410 = 4; M3 = 3; M4 = 6; N11 = 1; N16 = 1; N17 = 2; N2 = 1.

Figure DFO&EC 4-3.A3: Under-Ice Turbidity in Downstream Lakes



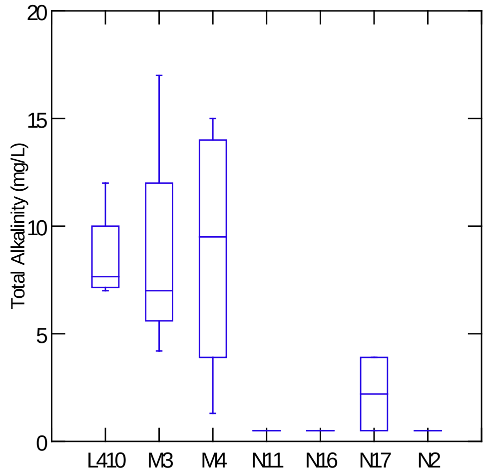
Note: NTU = Nephelometric Turbidity Units.
Sample count per site: L410 = 4; M3 = 3; M4 = 5; N11 = 1; N16 = 1; N17 = 2; N2 = 1.

Figure DFO&EC 4-3.A4: Under-Ice True Colour in Downstream Lakes



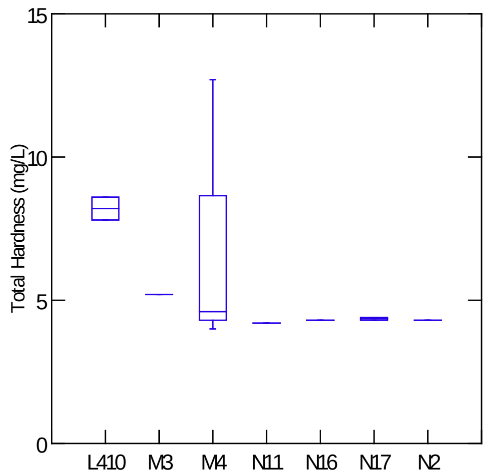
Note: TCU = True Colour Units.
Sample count per site: L410 = 4; M3 = 3; M4 = 6; N11 = 1; N16 = 1; N17 = 2; N2 = 1.

Figure DFO&EC 4-3.A5: Under-Ice Total Alkalinity in Downstream Lakes



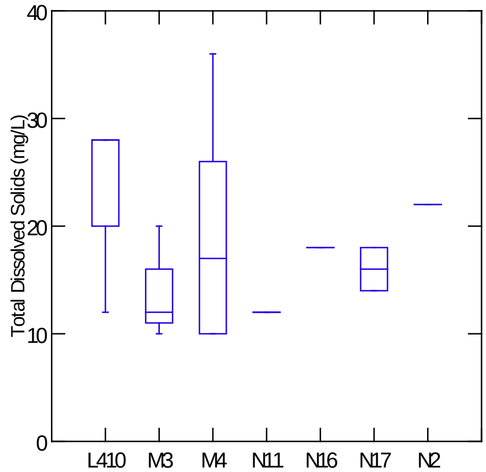
Note: mg/L = milligrams per litre; total alkalinity presented as calcium carbonate.
Sample count per site: L410 = 4; M3 = 3; M4 = 6; N11 = 1; N16 = 1; N17 = 2; N2 = 1.

Figure DFO&EC 4-3.A6: Under-Ice Total Hardness in Downstream Lakes



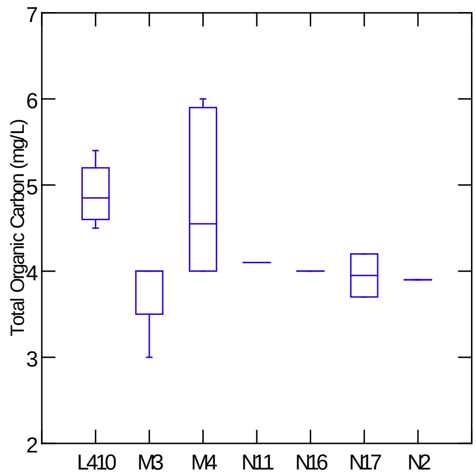
Note: mg/L = milligrams per litre.
Sample count per site: L410 = 2; M3 = 1; M4 = 3; N11 = 1; N16 = 1; N17 = 2; N2 = 1.

Figure DFO&EC 4-3.A7: Under-Ice Total Dissolved Solids in Downstream Lakes



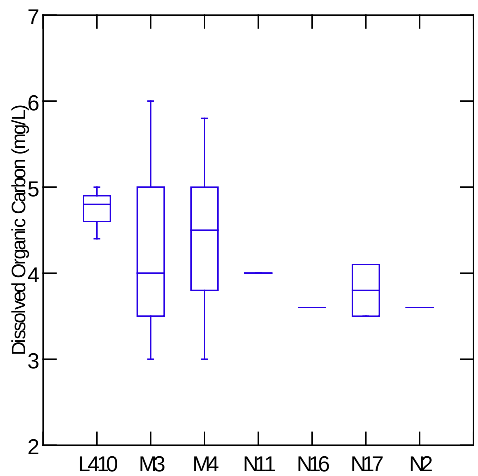
Note: mg/L = milligrams per litre.
Sample count per site: L410 = 3; M3 = 3; M4 = 6; N11 = 1; N16 = 1; N17 = 2; N2 = 1.

Figure DFO&EC 4-3.A8: Under-Ice Total Organic Carbon in Downstream Lakes



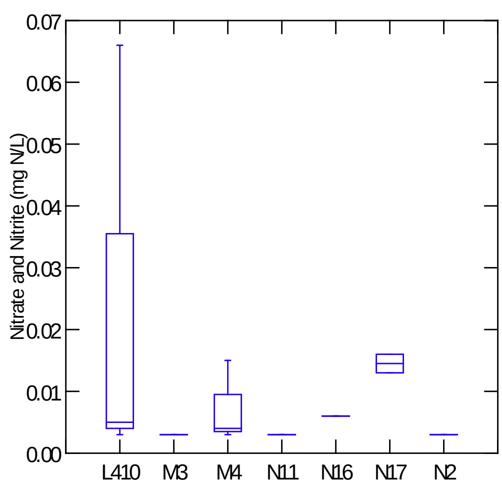
Note: mg/L = milligrams per litre.
Sample count per site: L410 = 4; M3 = 3; M4 = 6; N11 = 1; N16 = 1; N17 = 2; N2 = 1.

Figure DFO&EC 4-3.A9: Under-Ice Dissolved Organic Carbon in Downstream Lakes



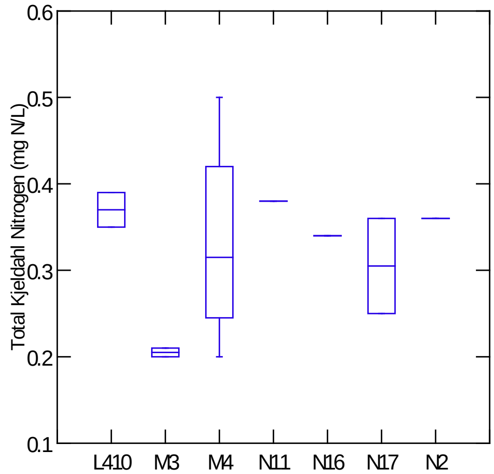
Note: mg/L = milligrams per litre.
Sample count per site: L410 = 3; M3 = 3; M4 = 6; N11 = 1; N16 = 1; N17 = 2; N2 = 1.

Figure DFO&EC 4-3.A10: Under-Ice Total Nitrate and Nitrite in Downstream Lakes



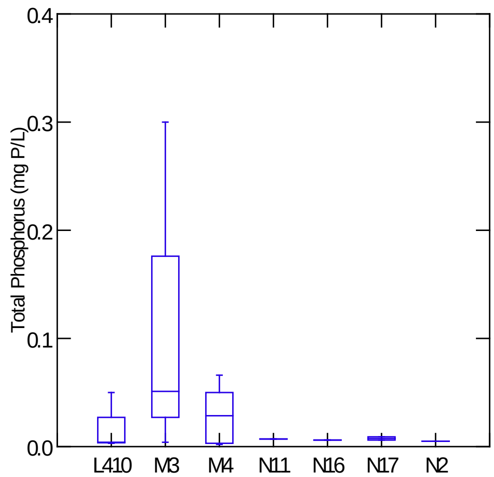
Note: mg N/L = milligrams nitrogen per litre.
Sample count per site: L410 = 3; M3 = 1; M4 = 3; N11 = 1; N16 = 1; N17 = 2; N2 = 1.

Figure DFO&EC 4-3.A11: Under-Ice Total Kjeldahl Nitrogen in Downstream Lakes



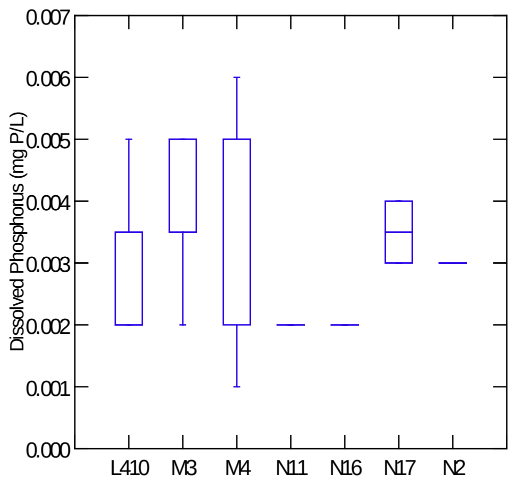
Note: mg N/L = milligrams nitrogen per litre.
Sample count per site: L410 = 2; M3 = 2; M4 = 4; N11 = 1; N16 = 1; N17 = 2; N2 = 1.

Figure DFO&EC 4-3.A12: Under-Ice Total Phosphorus in Downstream Lakes



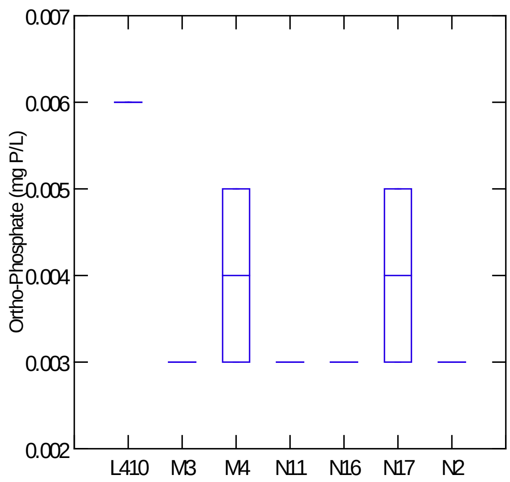
Note: mg P/L = milligrams phosphorus per litre.
Sample count per site: L410 = 3; M3 = 4; M4 = 6; N11 = 1; N16 = 1; N17 = 2; N2 = 1.

Figure DFO&EC 4-3.A13: Under-Ice Dissolved Phosphorus in Downstream Lakes



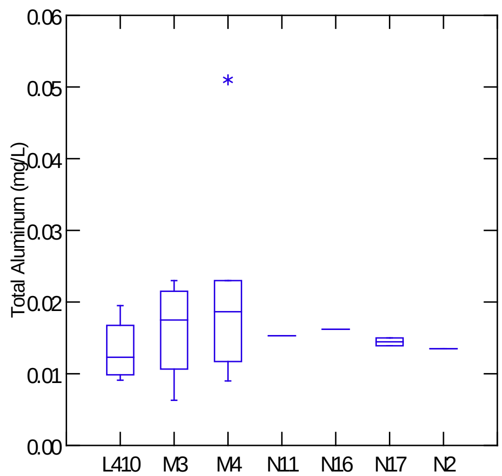
Note: mg P/L = milligrams phosphorus per litre.
Sample count per site: L410 = 3; M3 = 3; M4 = 6; N11 = 1; N16 = 1; N17 = 2; N2 = 1.

Figure DFO&EC 4-3.A14: Under-Ice Orthophosphate in Downstream Lakes



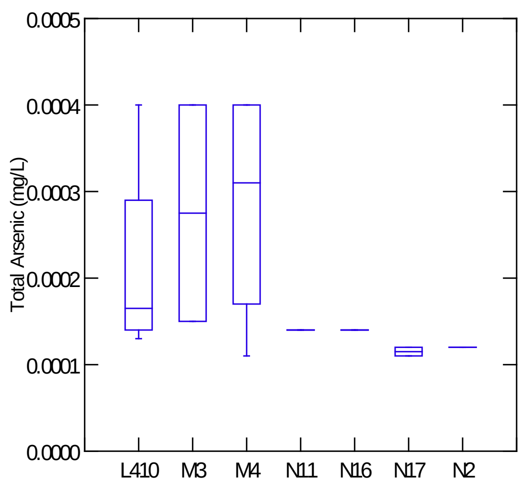
Note: mg P/L = milligrams phosphorus per litre.
Sample count per site: L410 = 2; M3 = 1; M4 = 2; N11 = 1; N16 = 1; N17 = 2; N2 = 1.

Figure DFO&EC 4-3.A15: Under-Ice Total Aluminum in Downstream Lakes



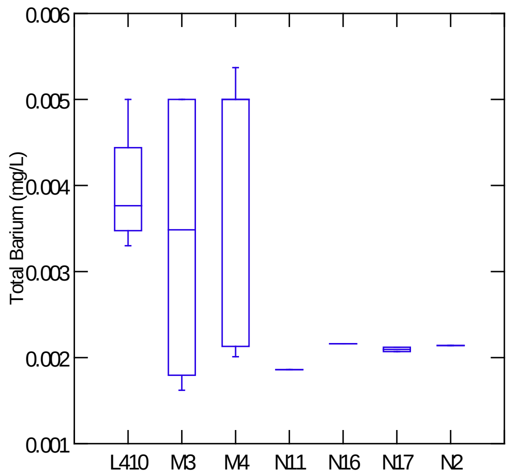
Note: mg/L = milligrams per litre.
Sample count per site: L410 = 4; M3 = 4; M4 = 6; N11 = 1; N16 = 1; N17 = 2; N2 = 1.

Figure DFO&EC 4-3.A16: Under-Ice Total Arsenic in Downstream Lakes



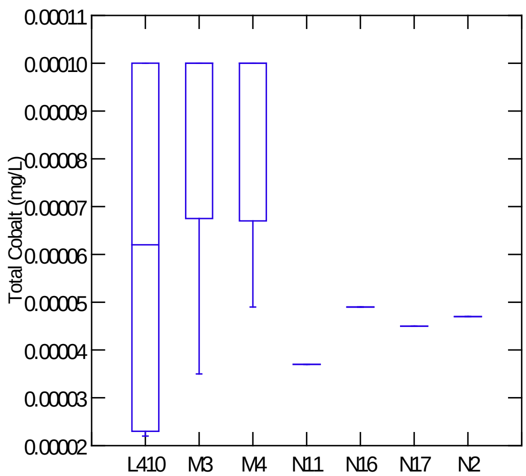
Note: mg/L = milligrams per litre.
Sample count per site was: L410 = 4; M3 = 4; M4 = 5; N11 = 1; N16 = 1; N17 = 2; N2 = 1.
Extreme outlier not plotted = 0.0008 mg/L at Lake M4.

Figure DFO&EC 4-3.A17: Under-Ice Total Barium in Downstream Lakes



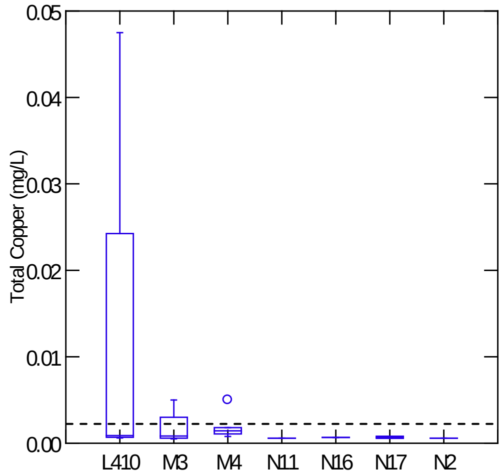
Note: mg/L = milligrams per litre.
Sample count per site: L410 = 4; M3 = 4; M4 = 6; N11 = 1; N16 = 1; N17 = 2; N2 = 1.

Figure DFO&EC 4-3.A18: Under-Ice Total Cobalt in Downstream Lakes



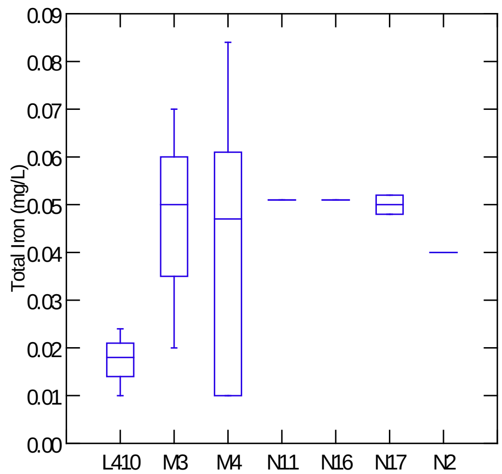
Note: mg/L = milligrams per litre.
Sample count per site: L410 = 4; M3 = 4; M4 = 6; N11 = 1; N16 = 1; N17 = 2; N2 = 1.

Figure DFO&EC 4-3.A19: Under-Ice Total Copper in Downstream Lakes



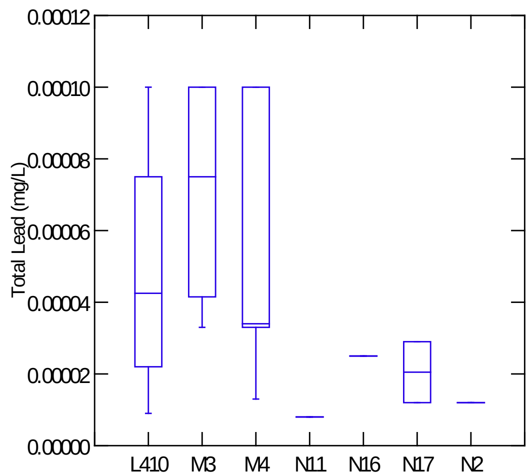
Note: mg/L = milligrams per litre.
Sample count per site: L410 = 4; M3 = 4; M4 = 6; N11 = 1; N16 = 1; N17 = 2; N2 = 1.

Figure DFO&EC 4-3.A20: Under-Ice Total Iron in Downstream Lakes



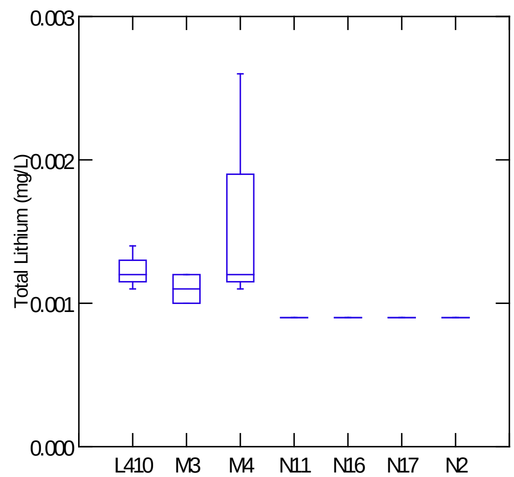
Note: mg/L = milligrams per litre.
Sample count per site: L410 = 4; M3 = 4; M4 = 6; N11 = 1; N16 = 1; N17 = 2; N2 = 1.

Figure DFO&EC 4-3.A21: Under-Ice Total Lead in Downstream Lakes



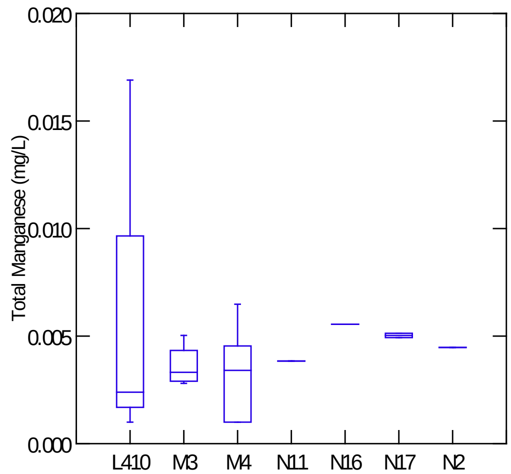
Note: mg/L = milligrams per litre.
Sample count per site was: L410 = 4; M3 = 4; M4 = 5; N11 = 1; N16 = 1; N17 = 2; N2 = 1.
Extreme outlier not plotted = 0.0004 mg/L Lake M4.

Figure DFO&EC 4-3.A22: Under-Ice Total Lithium in Downstream Lakes



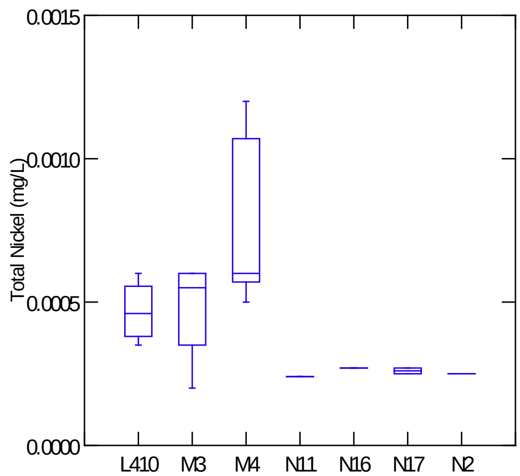
Note: mg/L = milligrams per litre.
Sample count per site: L410 = 3; M3 = 2; M4 = 3; N11 = 1; N16 = 1; N17 = 2; N2 = 1.

Figure DFO&EC 4-3.A23: Under-Ice Total Manganese in Downstream Lakes



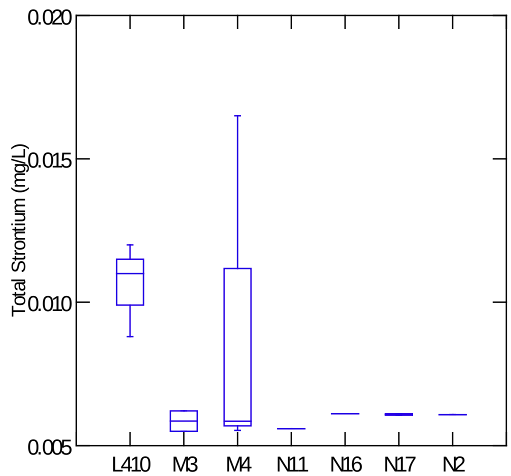
Note: mg/L = milligrams per litre.
Sample count per site: L410 = 4; M3 = 4; M4 = 6; N11 = 1; N16 = 1; N17 = 2; N2 = 1.

Figure DFO&EC 4-3.A24: Under-Ice Total Nickel in Downstream Lakes



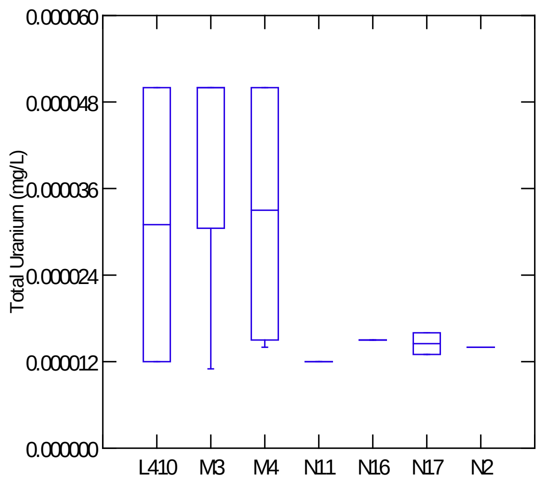
Note: mg/L = milligrams per litre.
Sample count per site was: L410 = 4; M3 = 4; M4 = 5; N11 = 1; N16 = 1; N17 = 2; N2 = 1.

Figure DFO&EC 4-3.A25: Under-Ice Total Strontium in Downstream Lakes



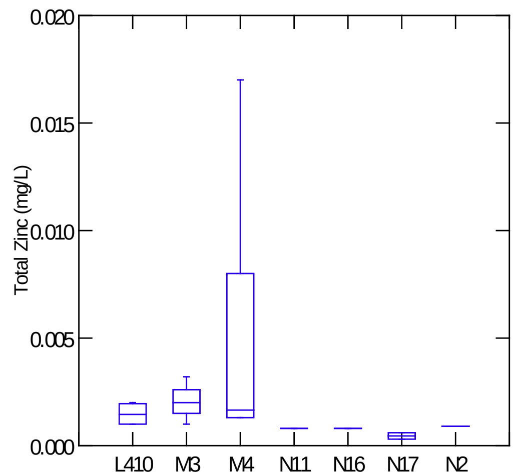
Note: mg/L = milligrams per litre.
Sample count per site: L410 = 3; M3 = 2; M4 = 3; N11 = 1; N16 = 1; N17 = 2; N2 = 1.

Figure DFO&EC 4-3.A26: Under-Ice Total Uranium in Downstream Lakes



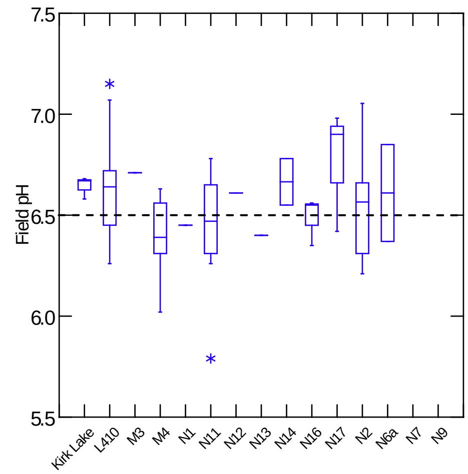
Note: mg/L = milligrams per litre.
Sample count per site: L410 = 4; M3 = 3; M4 = 6; N11 = 1; N16 = 1; N17 = 2; N2 = 1.

Figure DFO&EC 4-3.A27: Under-Ice Total Zinc in Downstream Lakes



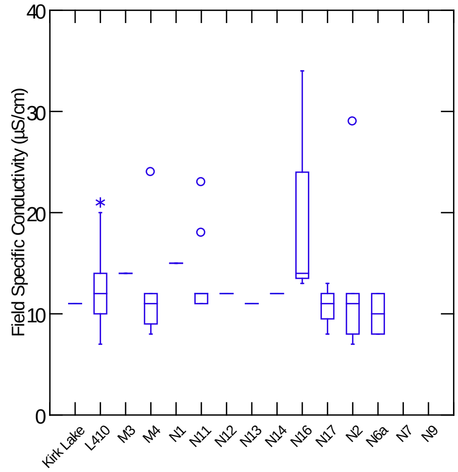
Note: mg/L = milligrams per litre.
Sample count per site was: L410 = 4; M3 = 4; M4 = 6; N11 = 1; N16 = 1; N17 = 2; N2 = 1.

Figure DFO&EC 4-3.B1: Open-Water Field pH in Downstream Lakes



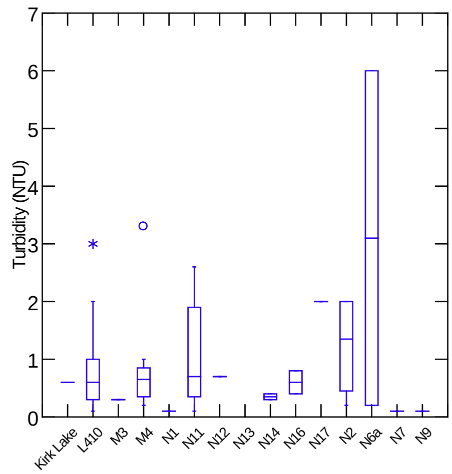
Note: Sample count per site: Kirk Lake = 3; L410 = 33; M3 = 1; M4 = 10; N1 = 1; N11 = 14; N12 = 1; N13 = 1; N14 = 2; N16 = 3; N17 = 3; N2 = 6; N6a = 2; N7 = 3; N9 = 3.

Figure DFO&EC 4-3.B2: Open-Water Specific Conductivity in Downstream Lakes



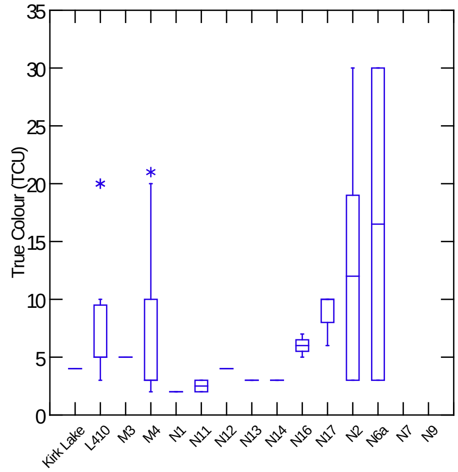
Note: µS/cm = microSiemens per centimetre.
Sample count per site: Kirk Lake = 3; L410 = 33; M3 = 1; M4 = 10; N1 = 1; N11 = 14; N12 = 1; N13 = 1; N14 = 2; N16 = 3; N17 = 3; N2 = 6; N6a = 2; N7 = 3; N9 = 3.

Figure DFO&EC 4-3.B3: Open-Water Turbidity in Downstream Lakes



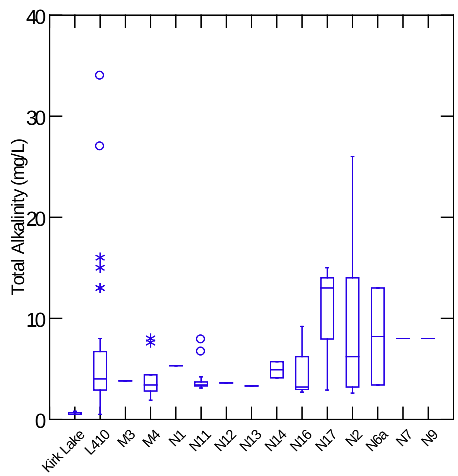
Note: NTU = Nephelometric Turbidity Units.
Sample count per site: Kirk Lake = 3; L410 = 27; M3 = 1; M4 = 8; N1 = 1; N11 = 12; N12 = 1; N13 = 0; N14 = 2; N16 = 2; N17 = 2; N2 = 4; N6a = 2; N7 = 3; N9 = 3.

Figure DFO&EC 4-3.B4: Open-Water True Colour in Downstream Lakes



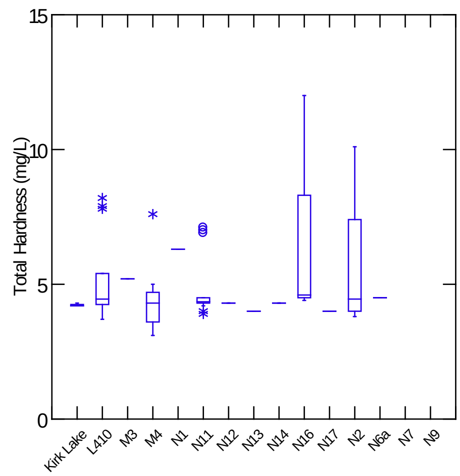
Note: TCU = True Colour Units.
Sample count per site: Kirk Lake = 3; L410 = 27; M3 = 1; M4 = 10; N1 = 1; N11 = 14; N12 = 1; N13 = 1; N14 = 2; N16 = 3; N17 = 3; N2 = 6; N6a = 2; N7 = 0; N9 = 0.

Figure DFO&EC 4-3.B5: Open-Water Total Alkalinity in Downstream Lakes



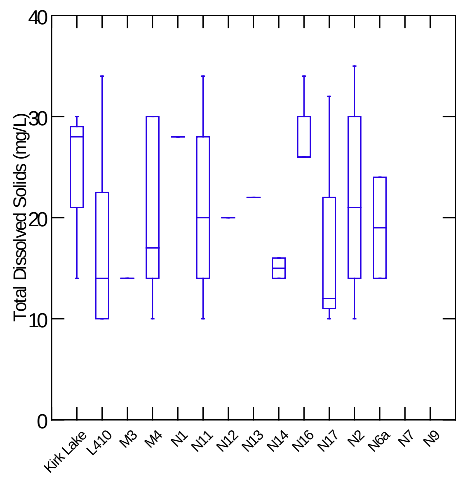
Note: mg/L = milligrams per litre; total alkalinity presented as calcium carbonate.
Sample count per site: Kirk Lake = 3; L410 = 33; M3 = 1; M4 = 10; N1 = 1; N11 = 14; N12 = 1; N13 = 1; N14 = 2; N16 = 3; N17 = 3; N2 = 6; N6a = 2; N7 = 3; N9 = 3.

Figure DFO&EC 4-3.B6: Open-Water Total Hardness in Downstream Lakes



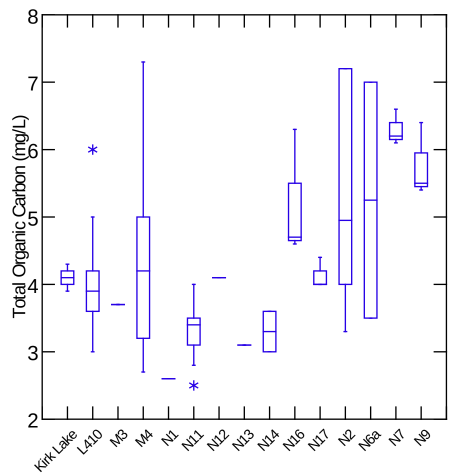
Note: mg/L = milligrams per litre.
Sample count per site: Kirk Lake = 3; L410 = 16; M3 = 1; M4 = 9; N1 = 1; N11 = 14; N12 = 1; N13 = 1; N14 = 2; N16 = 3; N17 = 1; N2 = 4; N6a = 1; N7 = 0; N9 = 0.

Figure DFO&EC 4-3.B7: Open-Water Total Dissolved Solids in Downstream Lakes



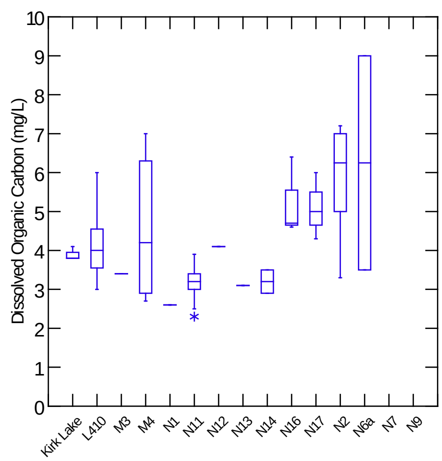
Note: mg/L = milligrams per litre.
Sample count per site: Kirk Lake = 3; L410 = 32; M3 = 1; M4 = 10; N1 = 1; N11 = 13; N12 = 1; N13 = 1; N14 = 2; N16 = 3; N17 = 3; N2 = 6; N6a = 2; N7 = 0; N9 = 0.
Extreme outlier not plotted = 52 mg/L at Lake 410 and 52 mg/L and Lake N11.

Figure DFO&EC 4-3.B8: Open-Water Total Organic Carbon in Downstream Lakes



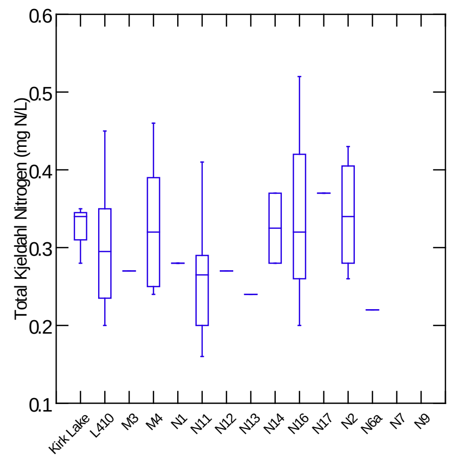
Note: mg/L = milligrams per litre.
Sample count per site: Kirk Lake = 3; L410 = 33; M3 = 1; M4 = 10; N1 = 1; N11 = 14; N12 = 1; N13 = 1; N14 = 2; N16 = 3; N17 = 3; N2 = 6; N6a = 2; N7 = 3; N9 = 3.

Figure DFO&EC 4-3.B9: Open-Water Dissolved Organic Carbon in Downstream Lakes



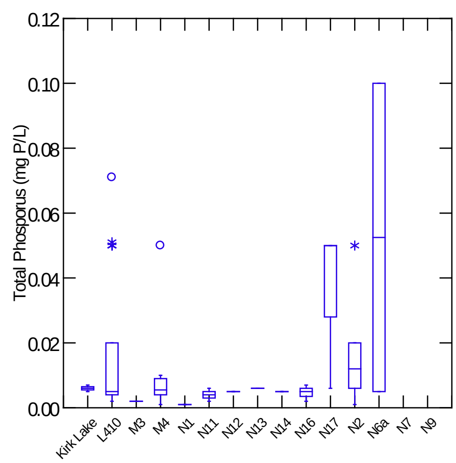
Note: mg/L = milligrams per litre.
Sample count per site: Kirk Lake = 3; L410 = 27; M3 = 1; M4 = 10; N1 = 1; N11 = 14; N12 = 1; N13 = 1; N14 = 2; N16 = 3; N17 = 3; N2 = 6; N6a = 2; N7 = 0; N9 = 0.

Figure DFO&EC 4-3.B10: Open-Water Total Kjeldahl Nitrogen in Downstream Lakes



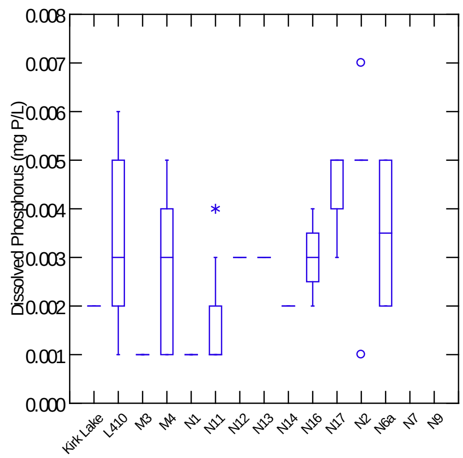
Note: mg N/L = milligrams nitrogen per litre.
Sample count per site was: Kirk Lake = 3; L410 = 24; M3 = 1; M4 = 9; N1 = 1; N11 = 14; N12 = 1; N13 = 1; N14 = 2; N16 = 3; N17 = 1; N2 =4; N6a = 1; N7 = 0; N9 = 0.
Extreme outlier not plotted = 0.63 mg/L at Lake N4.

Figure DFO&EC 4-3.B11: Open-Water Total Phosphorus in Downstream Lakes



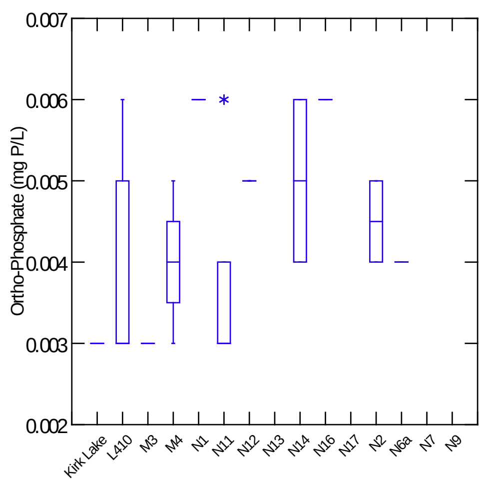
Note: mg P/L = milligrams phosphorus per litre.
Sample count per site: Kirk Lake = 3; L410 = 27; M3 = 1; M4 = 10; N1 = 1; N11 = 14; N12 = 1; N13 = 1; N14 = 2; N16 = 3; N17 = 1; N2 = 6; N6a = 2; N7 = 0; N9 = 0.

Figure DFO&EC 4-3.B12: Open-Water Dissolved Phosphorus in Downstream Lakes



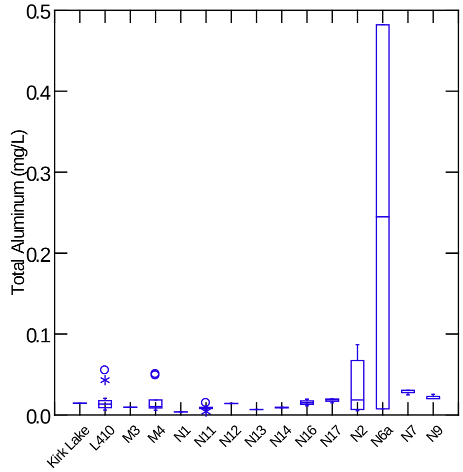
Note: mg P/L = milligrams phosphorus per litre.
Sample count per site: Kirk Lake = 3; L410 = 27; M3 = 1; M4 = 10; N1 = 1; N11 = 14; N12 = 1; N13 = 1; N14 = 2; N16 = 3; N17 = 3; N2 = 6; N6a = 2; N7 = 0; N9 = 0.

Figure DFO&EC 4-3.B13: Open-Water Orthophosphate in Downstream Lakes



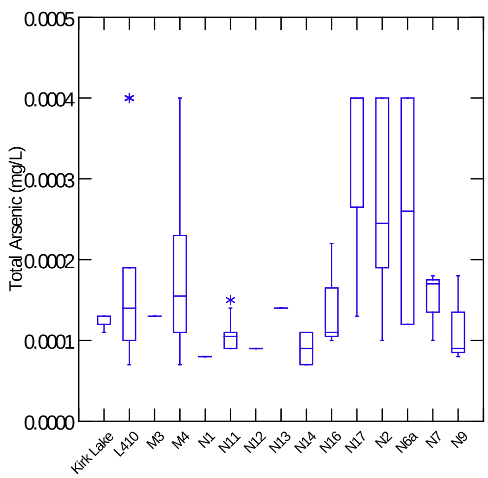
Note: mg P/L = milligrams phosphorus per litre.
Sample count per site: Kirk Lake = 3; L410 = 13; M3 = 1; M4 = 7; N1 = 1; N11 = 12; N12 = 1; N13 = 0; N14 = 2; N16 = 2; N17 = 0; N2 = 2; N6a = 1; N7 = 0; N9 = 0.

Figure DFO&EC 4-3.B14: Open-Water Total Aluminum in Downstream Lakes



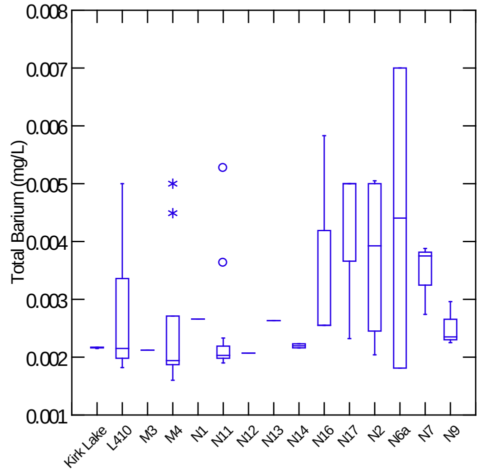
Note: mg/L = milligrams per litre.
Sample count per site: Kirk Lake = 3; L410 = 33; M3 = 1; M4 = 10; N1 = 1; N11 = 14; N12 = 1; N13 = 1; N14 = 2; N16 = 3; N17 = 3; N2 = 6; N6a = 2; N7 = 3; N9 = 3.

Figure DFO&EC 4-3.B15: Open-Water Total Arsenic in Downstream Lakes



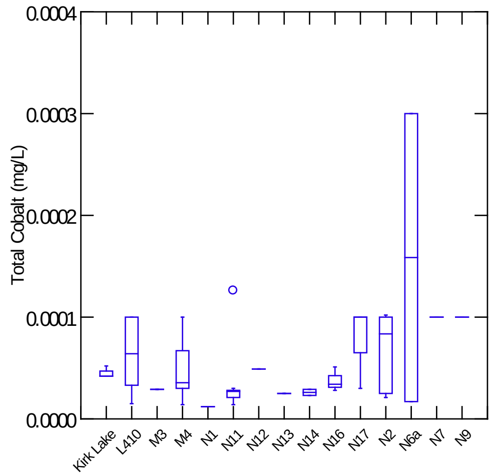
Note: mg/L = milligrams per litre.
Sample count per site: Kirk Lake = 3; L410 = 33; M3 = 1; M4 = 10; N1 = 1; N11 = 14; N12 = 1; N13 = 1; N14 = 2; N16 = 3; N17 = 3; N2 = 6; N6a = 2; N7 = 3; N9 = 3.

Figure DFO&EC 4-3.B16: Open-Water Total Barium in Downstream Lakes



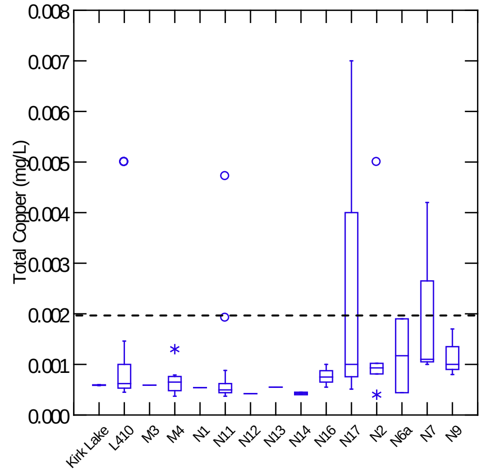
Note: mg/L = milligrams per litre.
Sample count per site: Kirk Lake = 3; L410 = 33; M3 = 1; M4 = 10; N1 = 1; N11 = 14; N12 = 1; N13 = 1; N14 = 2; N16 = 3; N17 = 3; N2 = 6; N6a = 2; N7 = 3; N9 = 3.

Figure DFO&EC 4-3.B17: Open-Water Total Cobalt in Downstream Lakes



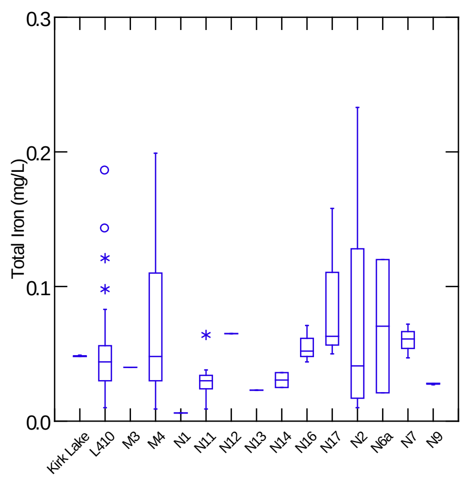
Note: mg/L = milligrams per litre.
Sample count per site was: Kirk Lake = 3; L410 = 33; M3 = 1; M4 = 10; N1 = 1; N11 = 14; N12 = 1; N13 = 1; N14 = 2; N16 = 3; N17 = 3; N2 = 6; N6a = 2; N7 = 3; N9 = 3.
Extreme outlier not plotted = 0.00178 mg/L Lake N11.

Figure DFO&EC 4-3.B18: Open-Water Total Copper in Downstream Lakes



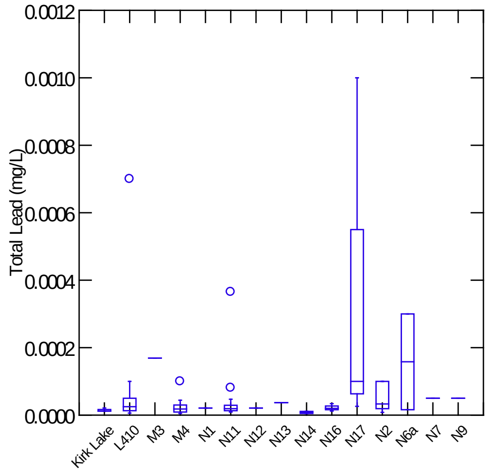
Note: mg/L = milligrams per litre.
Sample count per site: Kirk Lake = 3; L410 = 33; M3 = 1; M4 = 10; N1 = 1; N11 = 14; N12 = 1; N13 = 1; N14 = 2; N16 = 3; N17 = 3; N2 = 6; N6a = 2; N7 = 3; N9 = 3.

Figure DFO&EC 4-3.B19: Open-Water Total Iron in Downstream Lakes



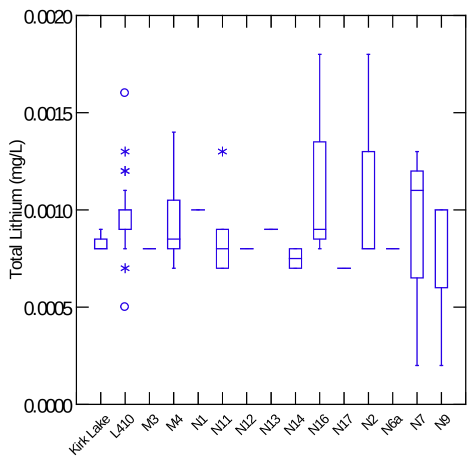
Note: mg/L = milligrams per litre.
Sample count per site was: Kirk Lake = 3; L410 = 33; M3 = 1; M4 = 10; N1 = 1; N11 = 14; N12 = 1; N13 = 1; N14 = 2; N16 = 3; N17 = 3; N2 = 6; N6a = 2; N7 = 3; N9 = 3.
Extreme outlier not plotted = 0.343 mg/L Lake N11.

Figure DFO&EC 4-3.B20: Open-Water Total Lead in Downstream Lakes



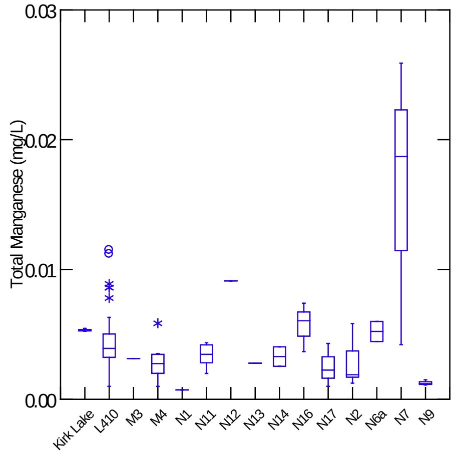
Note: mg/L = milligrams per litre.
Sample count per site: Kirk Lake = 3; L410 = 33; M3 = 1; M4 = 10; N1 = 1; N11 = 14; N12 = 1; N13 = 1; N14 = 2; N16 = 3; N17 = 3; N2 = 6; N6a = 2; N7 = 3; N9 = 3.

Figure DFO&EC 4-3.B21: Open-Water Total Lithium in Downstream Lakes



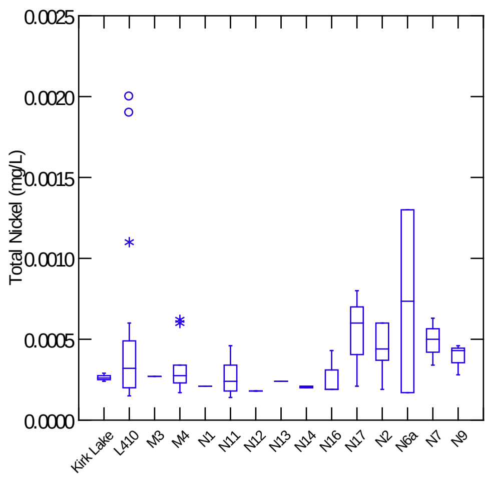
Note: mg/L = milligrams per litre.
Sample count per site was: Kirk Lake = 3; L410 = 25; M3 = 1; M4 = 9; N1 = 1; N11 = 14; N12 = 1; N13 = 1; N14 = 2; N16 = 3; N17 = 1; N2 = 4; N6a = 1; N7 = 3; N9 = 3.
Extreme outlier not plotted = 0.0094 mg/L at Lake M4.

Figure DFO&EC 4-3.B22: Open-Water Total Manganese in Downstream Lakes



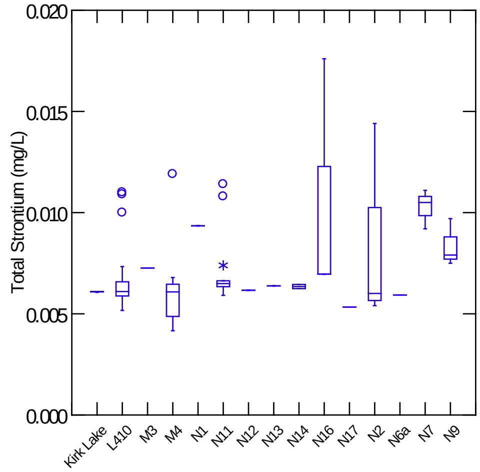
Note: mg/L = milligrams per litre.
Sample count per site was: Kirk Lake = 3; L410 = 33; M3 = 1; M4 = 10; N1 = 1; N11 = 14; N12 = 1; N13 = 1; N14 = 2; N16 = 3; N17 = 3; N2 = 6; N6a = 2; N7 = 3; N9 = 3.
Extreme outlier not plotted = 0.213 mg/L at Lake N11.

Figure DFO&EC 4-3.B23: Open-Water Total Nickel in Downstream Lakes



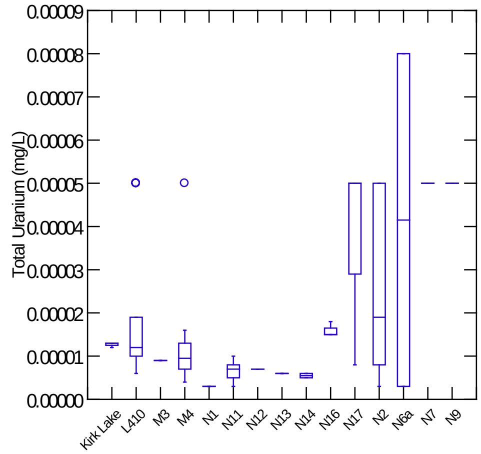
Note: mg/L = milligrams per litre.
Sample count per site was: Kirk Lake = 3; L410 = 33; M3 = 1; M4 = 10; N1 = 1; N11 = 14; N12 = 1; N13 = 1; N14 = 2; N16 = 3; N17 = 3; N2 = 6; N6a = 2; N7 = 3; N9 = 3.
Extreme outlier not plotted = 0.006 mg/L at Lake N11.

Figure DFO&EC 4-3.B24: Open-Water Total Strontium in Downstream Lakes



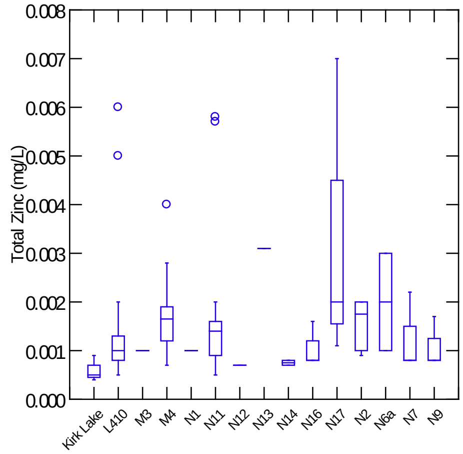
Note: mg/L = milligrams per litre.
Sample count per site: Kirk Lake = 3; L410 = 25; M3 = 1; M4 = 9; N1 = 1; N11 = 14; N12 = 1; N13 = 1; N14 = 2; N16 = 3; N17 = 1; N2 = 4; N6a = 1; N7 = 3; N9 = 3.

Figure DFO&EC 4-3.B25: Open-Water Total Uranium in Downstream Lakes



Note: mg/L = milligrams per litre.
Sample count per site: Kirk Lake = 3; L410 = 33; M3 = 1; M4 = 10; N1 = 1; N11 = 14; N12 = 1; N13 = 1; N14 = 2; N16 = 3; N17 = 3; N2 = 6; N6a = 2; N7 = 3; N9 = 3.

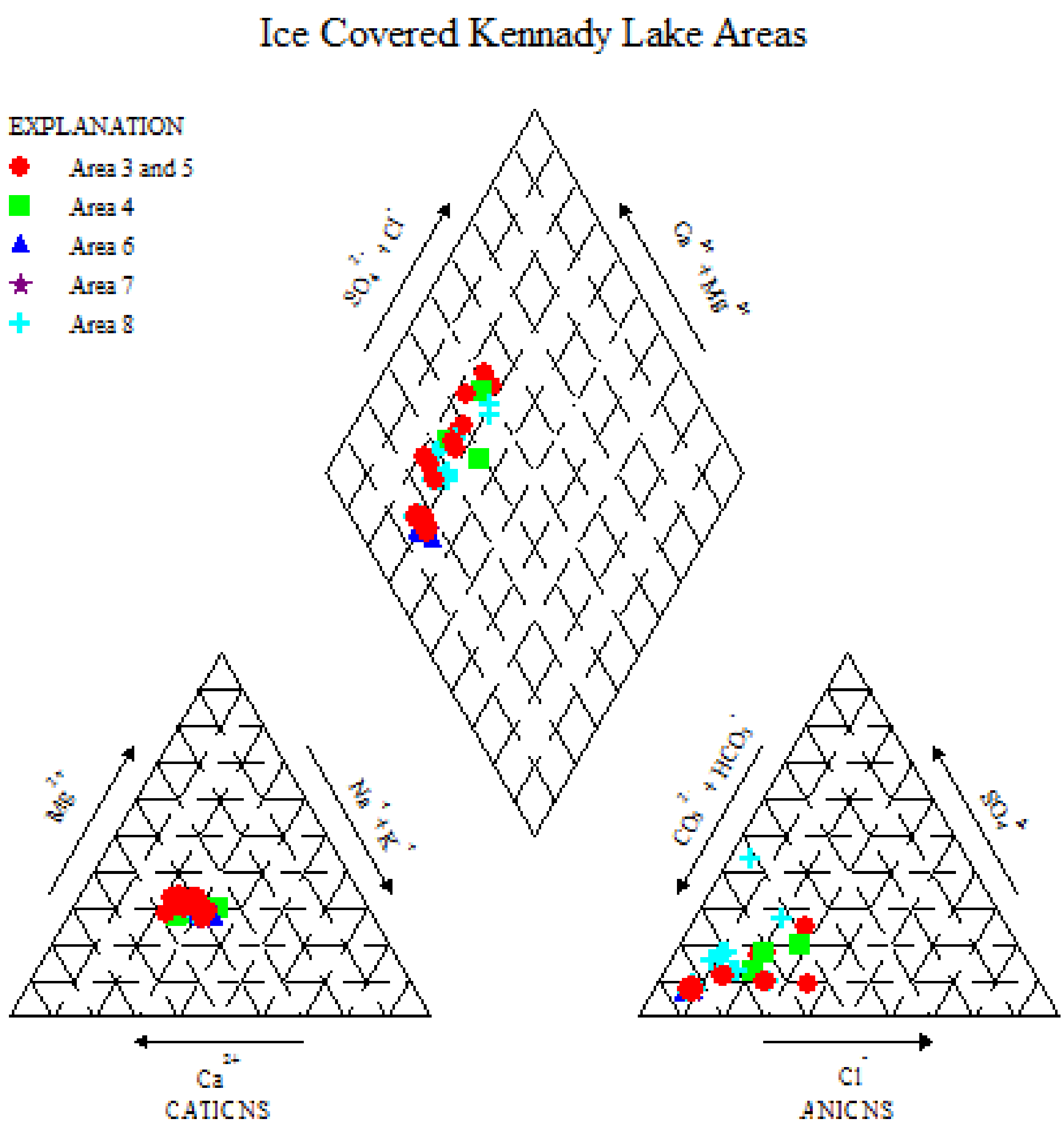
Figure DFO&EC 4-3.B26: Open-Water Total Zinc in Downstream Lakes



Note: mg/L = milligrams per litre.
Sample count per site was: Kirk Lake = 3; L410 = 33; M3 = 1; M4 = 10; N1 = 1; N11 = 14; N12 = 1; N13 = 1; N14 = 2; N16 = 3; N17 = 3; N2 = 6; N6a = 2; N7 = 3; N9 = 3.
Extreme outliers not plotted = 0.014 mg/L at Lake N11 and 0.024 mg/L at Lake 410.

Figure DFO&EC 4-4: Piper Plots Showing Relative Distribution of Major Ions in Samples Collected from Kennady Lake Areas during 1995 to 2011

A: ice-covered conditions



B: open water conditions

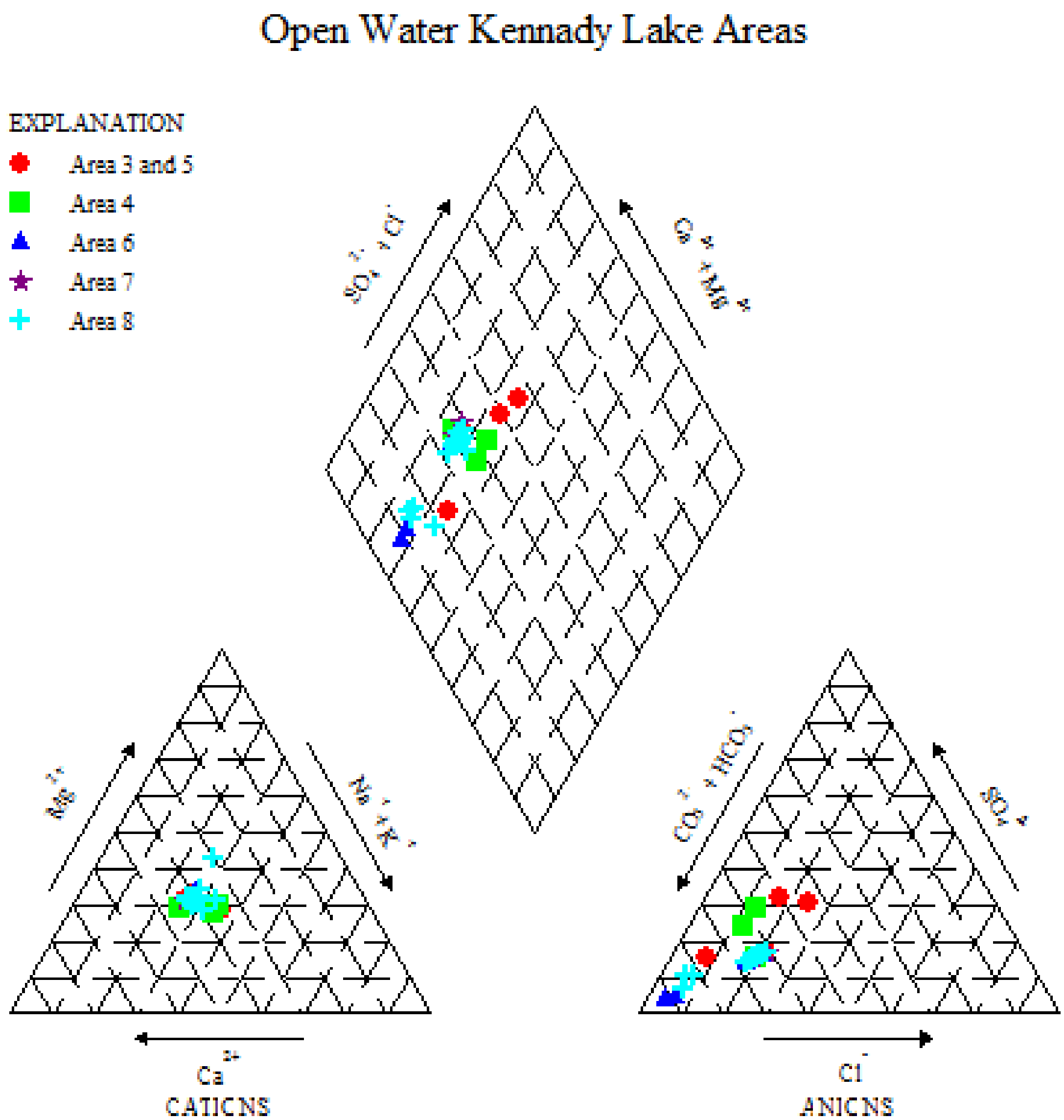


Figure DFO&EC 4-5: Piper Plots Showing Relative Distribution of Major Ions in Samples Collected from Small Lakes in the Kennady Lake during 1995 to 2011

Open water conditions

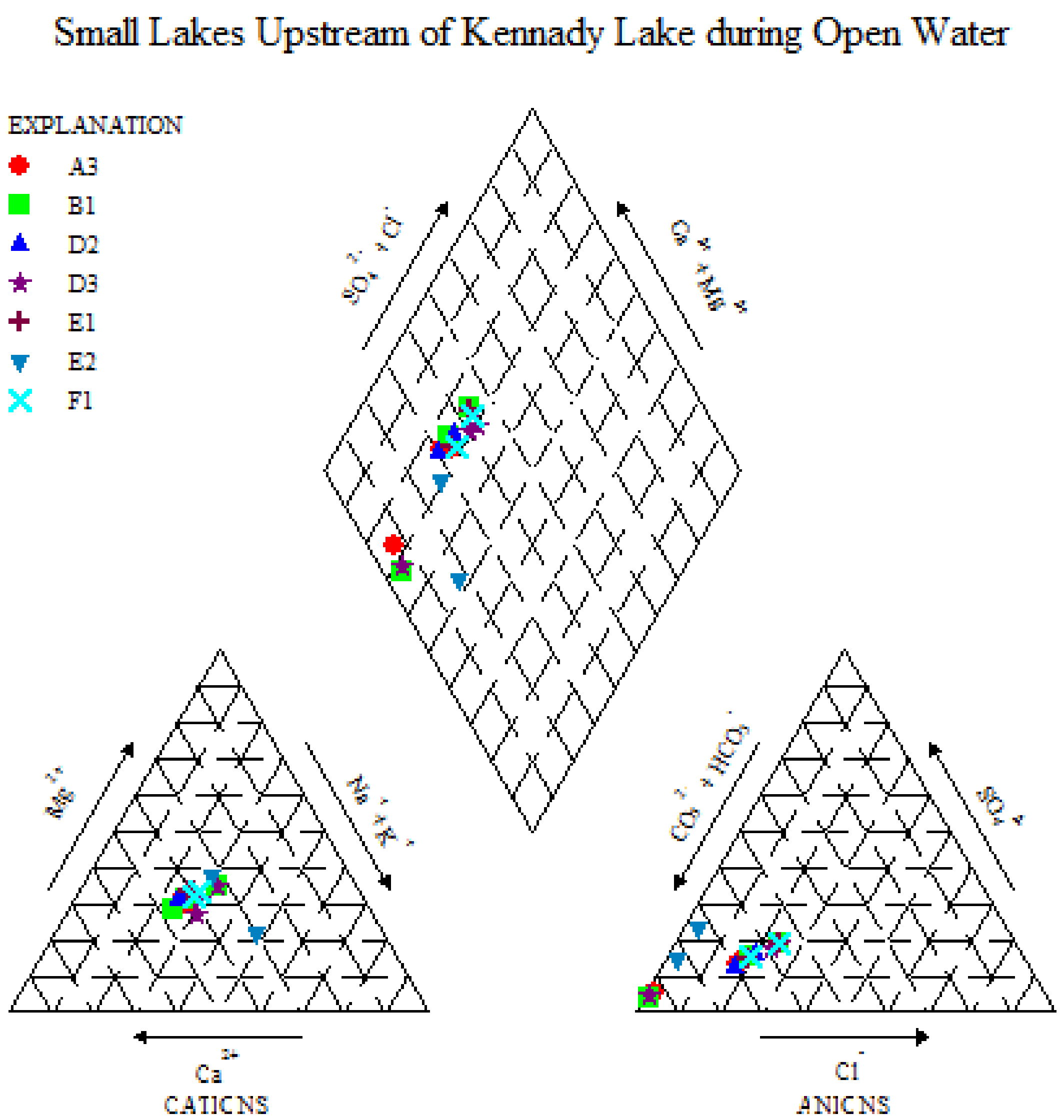
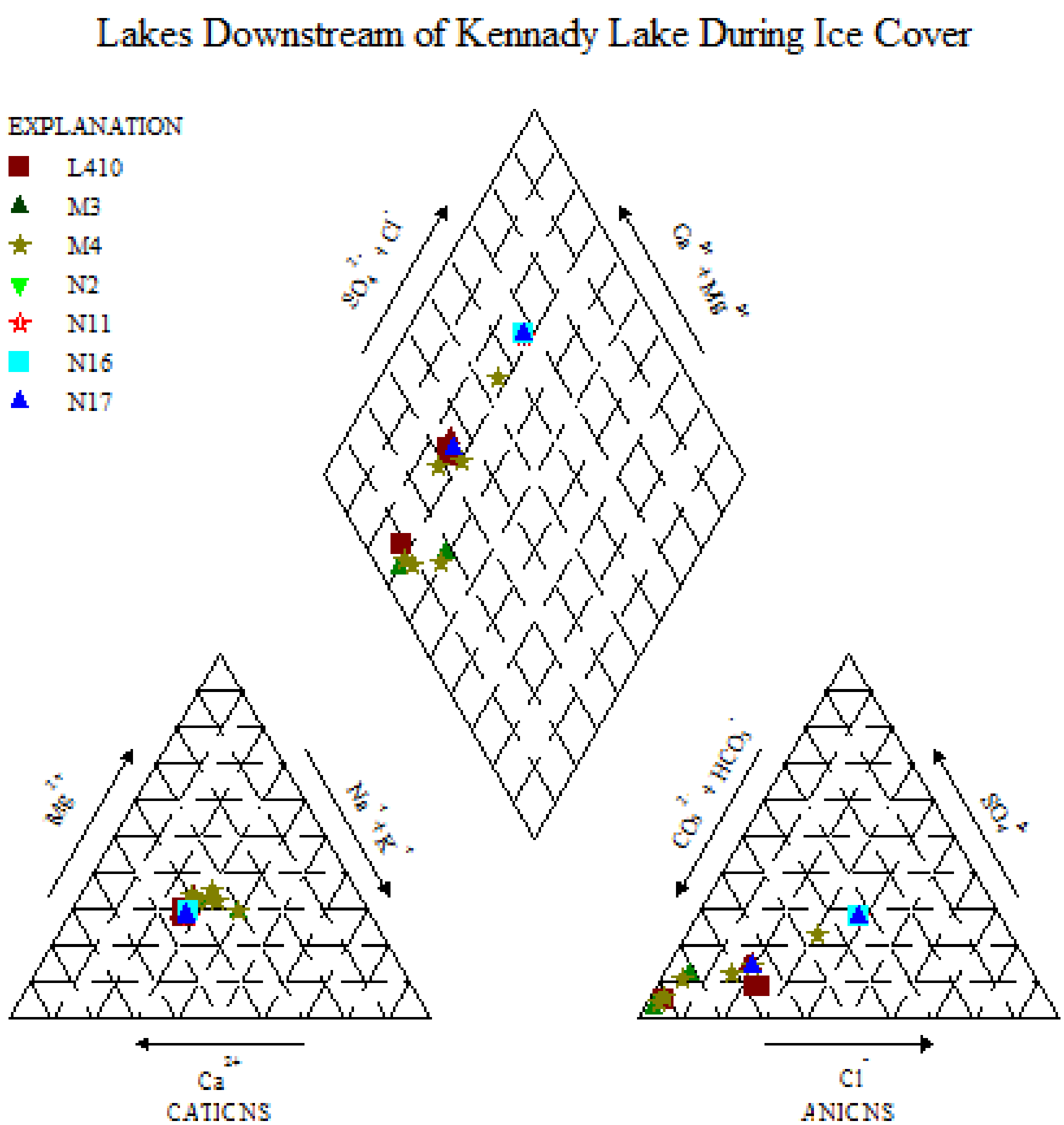


Figure DFO&EC 4-6: Piper Plots Showing Relative Distribution of Major Ions in Samples Collected from Downstream Lakes during 1998 to 2011

A. Under-ice conditions



B. Open water conditions