Figure 5-2. Locations where large minnow traps were set in June-July of 2015.

5.4 Stream electrofishing

5.4.1 Methods

The stream electrofishing typically began near the lake to which the watercourse drained and progressed upstream. One member of the two-person crew operated the Halltech Model 200T backpack electrofisher, set at 950 volts and 60 hertz, and the second person netted the immobilized fish. The coordinates of the sampling sites were determined using a Garmin Oregon 650 gps and the length of watercourse sampled was determined from these coordinates superimposed on a photo-mosaic of the study area using GIS, unless the distance sampled was very short (<10 m), in which case the distance sampled was estimated in the field. The number of electroseconds was also recorded at each location. Slimy Sculpin and Ninespine Stickleback were identified and released as they were captured. Most juvenile salmonids were photographed and released but some were retained as voucher specimens. The identities of voucher specimens were confirmed by opening the abdominal cavity and counting the pyloric caeca using a dissecting microscope. Arctic Char have 20-74 pyloric caeca and Lake Trout typically have 93-208 (Scott and Crossman, 1973). The identities of photographed salmonids were confirmed by comparison to the voucher specimens, as well as using the juvenile salmonid key in McPhail and Lindsey (1970).

5.4.2 Results

The stream electrofishing effort and catches are summarized in **Table 5-3** and the sampling locations are shown in **Figure 5-3** and **Figure 5-4** (June), **Figure 5-5** and **Figure 5-6** (July), and **Figure 5-7**, **Figure 5-8** and **Figure 5-9** (August). The coordinates of the sampling locations are provided in Appendix A. A total of 17 watercourses were electrofished on one or more occasions. Slimy Sculpin and Ninespine Stickleback were the most widely distributed species, and were captured in 11 and 10 different streams respectively. Overall, Ninespine Stickleback were the most abundant species, although this was strongly influenced by the very large catches in watercourse A46-A17 in July. Juvenile Arctic Char and Lake Trout were each captured in low numbers from five watercourses. One juvenile Burbot (*Lota lota*), one juvenile Round Whitefish, and one 32 mm long (TL) juvenile salmonid, not identified to species, were also captured.

Table 5-3. Summary of stream electrofishing effort and catches. Based on size, all of the salmonids and the Burbot are juveniles while the Slimy Sculpin and Ninespine Stickleback are adults. Locations are shown in Figure 5-3 - Figure 5-9.

Watercourse	Location	Date (2015)	distance (m)	electro-seconds	Ninespine Stickleback	Slimy Sculpin	Arctic Char	Lake Trout	Unidentified Salmonid	Burbot	Round Whitefish
A0-A48	**EF-S1**	01-Aug	10	196	2	0	0	0	0	0	0
A113-A47	**EF-S2**	01-Aug	10	68	1	0	0	0	0	0	0
A16-A15	**EF-S3**	25-Aug	43	690	2	5	0	1	0	0	0
A17-A16	**EF-S4**	25-Aug	240	950	0	4	0	1	0	0	0
A18-A17	**EF-S32**	26-Jun	100	878	0	1	0	0	0	0	0
	EF-S5	05-Jul	112	1648	0	5	0	0	0	0	0
	EF-S6	30-Aug	30	210	6	0	0	1	0	0	0
		Total	242	1859	6	5	0	1	0	0	0
A19-A18	**EF-S7**	09-Jul	32	423	0	0	0	0	0	0	0
A46-A17	**EF-S8**	28-Jun	201	579	11	8	1	0	0	0	0
	EF-S9-10	09-Jul	148	925	153	8	1	0	0	0	0
	EF-S11	12-Jul	<10	85	100	0	0	0	0	0	0
	EF-S12	30-Aug	36	470	0	0	0	0	0	0	0
		Total	394	2059	264	16	2	0	0	0	0
A47-A46	**EF-S13**	09-Jul	17	136	0	1	0	0	0	0	0
A50-A17	**EF-S14**	28-Jun	51	265	5	0	0	0	0	0	0
	EF-S15	09-Jul	163	1204	56	9	2	1	0	0	0
	EF-S16	30-Aug	52	180	2	0	1	0	0	1	0
		Total	266	1649	**63**	9	**3**	**1**	0	**1**	0
A53-A17	**EF-S17**	20-Jun	571	1664	7	0	0	0	0	0	0
	EF-S18	08-Jul	182	2142	78	77	5	0	0	0	0
	EF-S19	30-Aug	359	518	0	26	0	4	0	0	0
		Total	**1112**	**4324**	**85**	**103**	**5**	**4**	0	0	0

Watercourse	Location	Date (2015)	distance (m)	electro-seconds	Ninespine Stickleback	Slimy Sculpin	Arctic Char	Lake Trout	Unidentified Salmonid	Burbot	Round Whitefish
A55-A17	**EF-S20**	21-Jun	166	996	6	0	0	0	0	0	0
	EF-S21	06-Jul	167	3330	20	50	1	0	1		0
	EF-S22	30-Aug	46	483	17	1	0	0	0	0	1
		Total	**379**	**4809**	**43**	**51**	**1**	0	**1**	0	**1**
A56-A55	**EF-S23**	08-Jul	60	634	0	0	0	0	0	0	0
A59-A17	**EF-S24**	27-Jun	126	730	0	6	1	0	0	0	0
	EF-S25	09-Jul	97	1444	2	21	0	0	0	0	0
	EF-S26	30-Aug	181	535	0	7	1	0	0	0	0
		Total	**404**	**2709**	**2**	**34**	**2**	0	0	0	0
A62-A17	**EF-S27**	07-Jul	107	1025	1	0	0	0	0	0	0
A63-A18	**EF-S28**	05-Jul	81	848	0	3	0	0	0	0	0
	EF-S29	07-Jul	81	793	0	3	0	0	0	0	0
		Total	**162**	**1641**	0	**6**	0	0	0	0	0
A-P21-A52	**EF-S30**	01-Aug	5	78	0	0	0	0	0	0	0
A-P23-A17	**EF-S31**	26-Jun	95	582	0	2	0	0	0	0	0
Grand Total			**3569**	**23832**	**469**	**236**	**13**	**8**	**1**	**1**	**1**

Figure 5-3. June 2015 electrofishing locations on tributaries at the north end of Whale Tail Lake.

Figure 5-4. June 2015 electrofishing locations on tributaries at the south end of Whale Tail Lake.

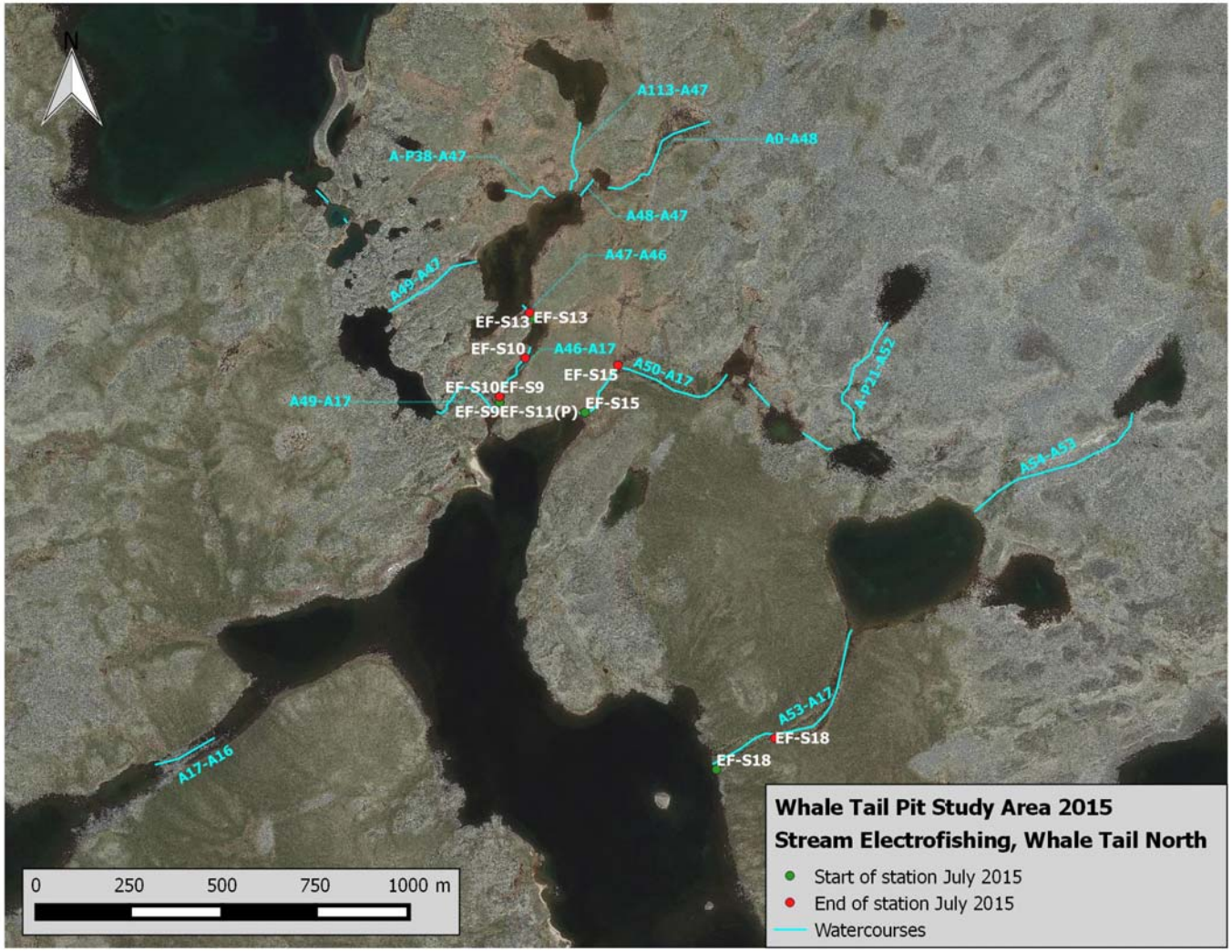

Figure 5-5. July 2015 electrofishing locations on tributaries at the north end of Whale Tail Lake.

Figure 5-6. July 2015 electrofishing locations on tributaries at the south end of Whale Tail Lake.

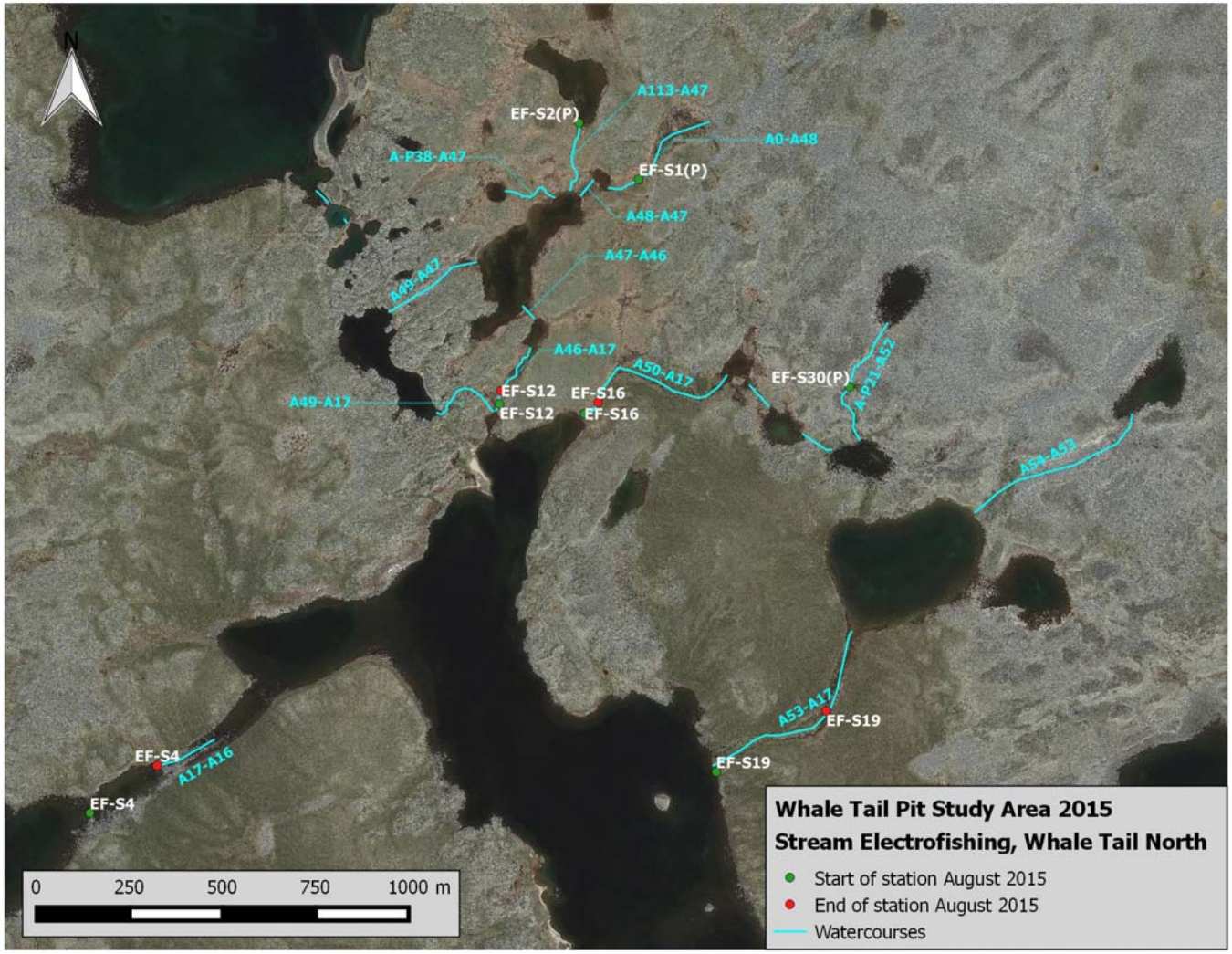

Figure 5-7. August 2015 electrofishing locations on tributaries at the north end of Whale Tail Lake.

Figure 5-8. August 2015 electrofishing locations on tributaries at the south end of Whale Tail Lake.

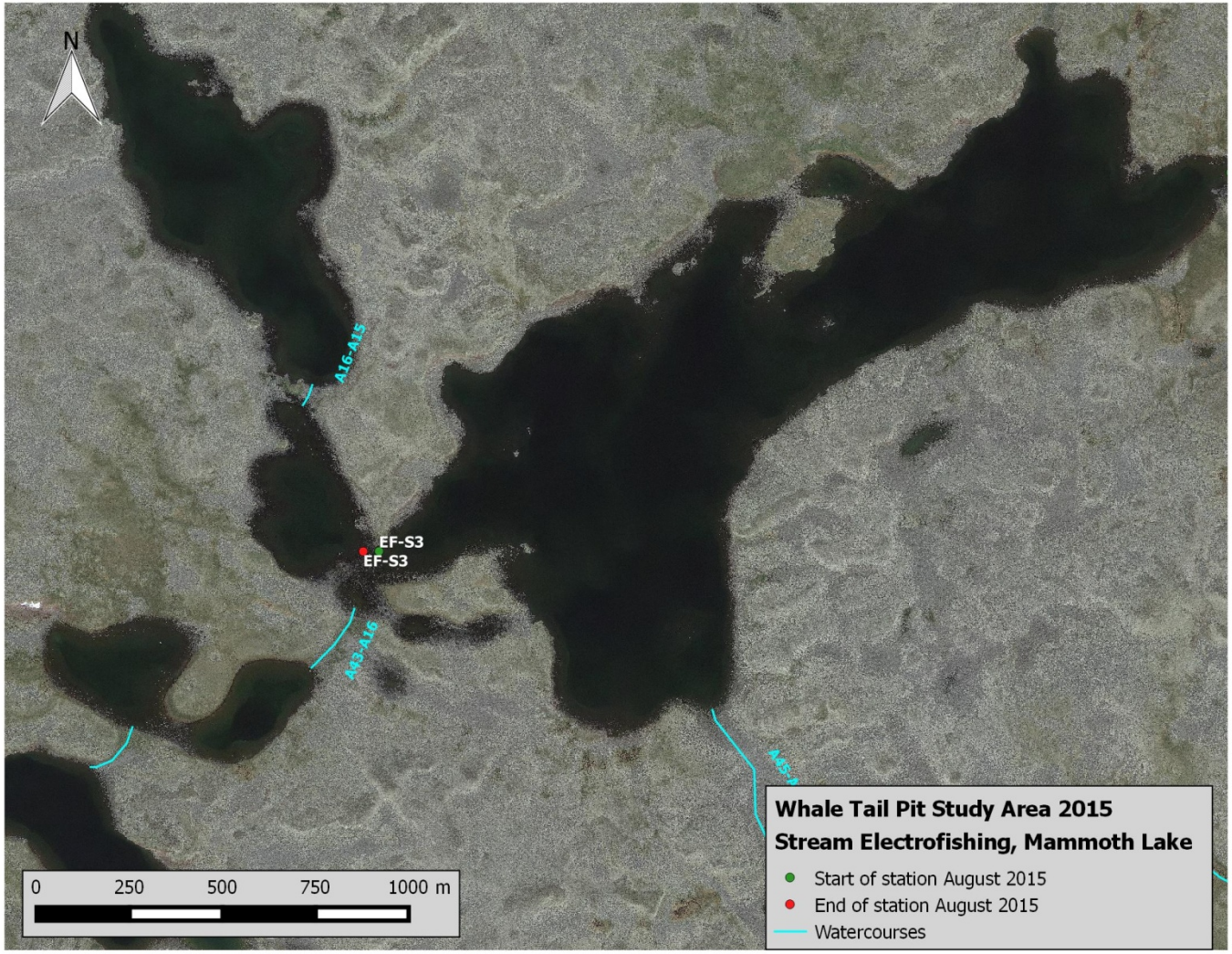

Figure 5-9. August 2015 electrofishing location near the outlet of Mammoth Lake.

6.0 HABITAT CHARACTERIZATION AND FISH SAMPLING OF SMALL LAKES AND PONDS

6.1 Methods

Fish sampling was conducted and the habitat was characterized on a number of lakes that are connected by surface flow to Whale Tail and Mammoth Lakes and two small lakes that drain to Nemo Lake. Where depth was sufficient, a jon boat powered by an outboard motor and equipped with a Humminbird 798ci HD SI Sonar unit was used to conduct the work.

In lakes with adequate depth, a standard AEM index gill net gang comprised of 22.7 m long and 1.8 m deep panels of 126, 102, 76, 51, 38, and 25 mm stretched mesh (total gang length = 136.4 m) was set, orientated to cross a deep (usually the deepest) portion of the lake and a shallow near-shore or shoal area, to maximize the variety of habitat fished. In lake A113 only three panels of gill net were set (38 mm, 51 mm and 76 mm) due to the small size of the lake. Most net sets were of short duration (range 1.6 – 3.3 hours) but occasionally sets were overnight. The date and time of deployment and lifts were recorded, the coordinates at each end of each net were determined using a Garmin Oregon 650 gps, and the depth at each end was determined using the sonar unit. The number of individuals of each species captured in each net was recorded. Each fish was examined for external anomalies and fork length was determined to the nearest mm using a standard fish measuring board. The total weight of each individual weighing more than 500 g was determined to the nearest 10 grams using a Rapala digital hanging scale. The total weight of individuals weighing less than 500 g was determined to the nearest g, or in some cases nearest 0.1 g, using an Ohaus Scout Pro Model 6001 electronic balance. Fish that were alive were tagged with a numbered Floy tag and released.

A section of shoreline was electrofished with a Halltech Model 200T backpack electrofisher, set at 950 volts and 250 hertz. The intent was primarily to determine what species were present, so the length of shoreline electrofished varied with habitat diversity and catch. The number of individuals of each species were recorded, as were the coordinates at each end of the electrofished shoreline, determined using a Garmin Oregon 650 gps unit.

The sonar unit was used to record georeferenced standard and side-scan sonar data. Straight, parallel boat runs, orientated to best characterize the lake's features, were used to record slightly overlapping side-scan images of the lake bottom. Additional sonar recordings were then made to obtain standard sonar data for as much of the lake bottom as was practical. In lakes for which these data were to be used to prepare bathymetric maps, a higher density of sonar transects were collected and a stake was driven into the ground at the water’s edge. This elevation was later determined by a survey crew so that the depth data could be converted to elevations. Visual point observations of the substrate were also made, either from the surface where the water was clear and shallow enough, or using an Aqua-Vu 740c underwater colour video system where the water was deeper. All visual substrate observations were georeferenced with a Garmin GPSmap76CSx gps unit.

The side-scan images were processed using ReefMaster software (ver. 1.8) to create a single georeferenced side-scan mosaic of the lake's bottom, and the standard sonar data were processed to create maps of bottom hardness and water depth. ReefMaster determines bottom hardness by an analysis of the sonar output/input ratio, and lag, to calculate a unitless relative hardness and roughness value that is displayed as a colour-coded map. The georeferenced data (side-scan image, bottom hardness and water depth maps, and visual point observations) were layered using GIS software (QGIS version 2.8). Using the overlaid data, with reference to the oblique aerial photographs, the various substrate types were identified and hand digitized into substrate maps. The water depth data for selected lakes was extracted from the sonar recordings and provided to AEM in ASCI file format for use by the sub-consultant undertaking the bathymetric mapping of all the Whale Tail Pit Study Area Lakes.

A number of smaller, shallow ponds near the north end of Whale Tail Lake were also investigated, some on two occasions. The substrates in these ponds were visually assessed from shore, and a portion of shoreline was electrofished. Images of these ponds were included in the oblique aerial photographs taken in 2014 and 2015.

6.2 Results

The fish catches for each of the small lakes and ponds that were sampled are presented in **Table 6-1** and the sampling locations are shown in **Figure 6-1**, **Figure 6-2**, **Figure 6-3** and **Figure 6-4**. The information for individual gill nets and electrofishing transects are provided in Appendix A (**Table A 2** and **Table A 5** respectively). The substrate maps have been provided to AEM under separate cover.

Table 6-1. Summary of 2015 gill net and electrofishing catches in small lakes and ponds (na indicates the gear type was not used).

	Gill net catches				Electrofishing catches	
Lake	Lake Trout	Arctic Char	Round Whitefish	Burbot	Ninespine Stickleback	Slimy Sculpin
A18	0	0	0	0	16	3
A19	0	0	0	0	7	1
A20	10	0	6	0	0	0
A22	2	1	0	0	1	10
A45	0	0	0	0	3	0
A47	0	1	0	0	>100	0
A49	0	0	0	0	0	3
A50	na	na	na	na	0	0
A51	na	na	na	na	0	0
A52	na	na	na	na	0	0
A53	1	1	0	0	2	0
A54	na	na	na	na	0	0
A55	5	0	0	1	0	2
A62	3	0	0	0	na	na
A63	1	0	0	0	0	3
A65	2	0	2	0	3	6
A113[1]	0	0	0	0	16	0
A-P5	na	na	na	na	0	0
A-P18	na	na	na	na	0	0
A-P21	na	na	na	na	0	0
A-P33	na	na	na	na	0	0
A-P37	na	na	na	na	0	0
A-P38	na	na	na	na	1	0
A-P49	na	na	na	na	0	0
A-P51	na	na	na	na	0	0
A-P67	dry on August 1, 2015					
C40	na	na	na	na	0	0
C42	na	na	na	na	0	0

1. Only 3 panels of net set (38 mm, 51 mm and 76 mm)

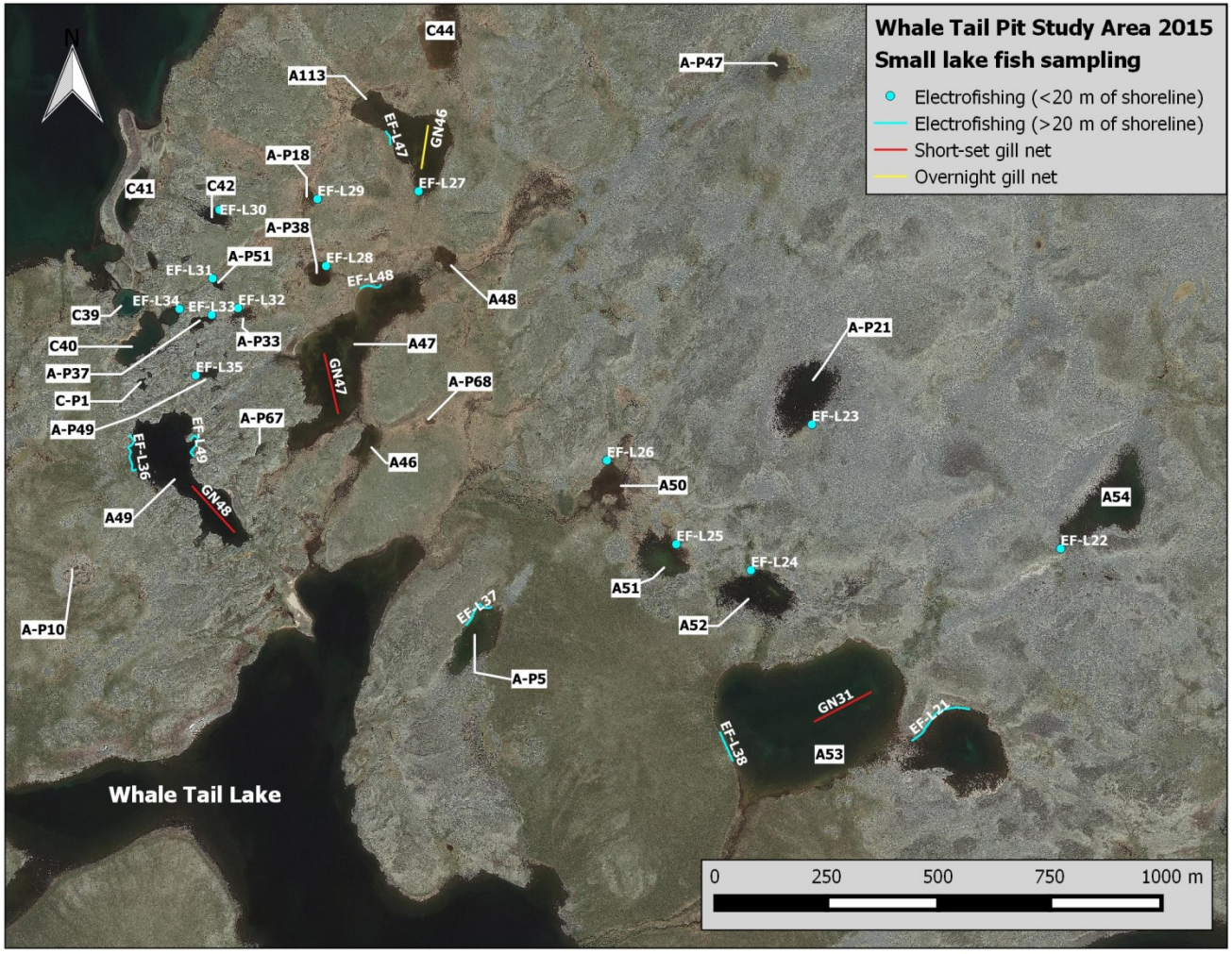

Figure 6-1. Fish sampling locations in lakes A47, A49, and A53 and smaller lake and ponds near the north end of Whale Tail Lake, 2015.