

## American Eel Sampling in Lake Champlain 2010 Progress Report

### Introduction

American eel *Anguilla rostrata* support important commercial fisheries where populations remain at harvestable levels. However, downward trends in harvest data have raised concern for the population of eel in the United States and Canada. Organizations such as the Great Lakes Fishery Commission and the Atlantic States Marine Fisheries Commission have identified the eel as a high research priority and/or have prepared management plans for the species ([www.glfc.org/research/Priorities.pdf](http://www.glfc.org/research/Priorities.pdf), [http://www.asafc.org/species Documents/eel/annual reports/fmpreviews/eelFMPreview06.pdf](http://www.asafc.org/species/Documents/eel/annualreports/fmpreviews/eelFMPreview06.pdf) ).

The Richelieu River connects northern Lake Champlain to the St. Lawrence River and supported a commercial eel fishery until it was closed in 1998 because harvest dramatically declined. The rebuilding of two dams on the river has been partly to blame for the decline (Verdon et al. 2003). The Dams at Saint-Ours, Québec and Chambly, Québec were refurbished in the mid 1960s. Evidence of these dams' impacts on eel recruitment to Lake Champlain can be seen in eel surveys in 1979 and 1985. Mark-recapture studies conducted in three Lake Champlain bays, Paradise Bay, Keelers Bay and Converse Bay indicated a decline in estimated population size (Labar and Facey 1983, Labar 1987) and an increase in average size of eel caught, reflecting an aging population that has not been sufficiently supplemented by recruits. Total catch in Paradise Bay declined from 85 eels captured in 1979 to 50 in 1985. Keeler Bay eel catch dropped from 146 eels captured to 81 eels; and Converse Bay catch dropped from 138 to 78 eels.

In 1997 an eel ladder was constructed at the dam in Chambly and in 2001 a fish ladder and an eel ladder were built at St Ours. Faune Québec, in cooperation with a commercial fishermen union and Hydro- Québec, initiated a ten-year eel stocking program in 2005 in the Richelieu River to further enhance eel recruitment. From 2005 to 2008 an average of about 692,000 elvers (circa 50-60 mm TL) were transferred annually from the Atlantic Coast (Nova Scotia, Canada) to the Richelieu River (Table 1), where they were scatter stocked during the daytime in the first 15 km of the river, between Saint-Paul-de-l'Île-aux-Noix and the Canada-US border.

In order to monitor the success of these stocking efforts and new passage facilities, Québec asked the United States Fish and Wildlife Service's Lake Champlain Fish and Wildlife Resources Office in Essex Junction, Vermont for assistance by repeating the Lake Champlain surveys. The Service conducted eel surveys in 2007 and 2010. This report presents the findings of the 2010 sampling efforts.

Also included in this report is data provided by the Vermont Department of Fish and Wildlife (VTDFW). VTDFW fisheries biologists recorded data from incidental catches

of American eel on southern Lake Champlain during black bass electro-fishing index surveys on southern Lake Champlain. Twenty index stations were sampled from Dresden Narrows to Chimney Point from July 8 to the 20, 2010. All eels captured were measured for total length, and weighed. All eels were also scanned with a Biomark PIT tag reader. See Appendix for details.

## **Study Area**

Lake Champlain (1,140 km<sup>2</sup>) borders New York and Vermont and extends into Québec (Figure 1). Keeler and Paradise Bays are situated on the eastern side of South Hero, Vermont in what is described as the Northeast Arm of the lake. Converse Bay is located further south on the lake in the town of Charlotte/Ferrisburg. All the bays varied in substrate from mud with vegetation to bear rock. In addition to the bays, the shoreline along Grand Isle, Vermont was also sampled.

## **Methods**

Electro-fishing was conducted by boat with a pulsed direct current of 3.0 - 6.0 amps. Sampling was conducted after dark when eels were presumed to be most active. Sampling transects were electronically recorded using a global positioning unit and followed the shoreline generally staying in less than 2 meters depth. An effort of one hour was selected as the sampling time which covered approximately 2 kilometers of shoreline. Collected eels were anesthetized, measured, weighed and implanted with a passive integrated transponder tag (Biomark, model TX1405L) near the back of the head and released.

## **Results/Discussion**

Eel sampling occurred on the nights of July 15 (Paradise and Keeler Bay), July 20 (Converse Bay) and August 18 (Grand Isle) in 2010 (Figures 2, 3 and 4). One American eel was collected in Paradise and Keeler Bay and one other eel was observed but not captured in Paradise Bay (Table 2). Twenty-five eels were collected from Converse Bay while 20-30 small eels were observed but not captured. These small eels were difficult to net over the rough substrate on which they were found. Fourteen eels were collected along the Grand Isle shoreline and an additional 3-5 small eels missed.

Eels collected ranged in size from 282 millimeters (mm) to 672 mm. Mean length was 458 mm (sd = 83) and mean weight was 208 grams (sd = 131). As noted above, many smaller eels were observed but not netted.

Table 3 compares the 2010 and 2007 eel sampling efforts. It would appear that recruitment of eels to the main lake portion of Lake Champlain has been good. However, movement of eel into the Northeast Arm (Keeler and Paradise bay) has been less successful. The Northeast Arm is somewhat isolated from the main lake by highway and old railroad causeways. Access into the Northeast Arm is limited to small openings in

these causeways that allow boat traffic to pass. It would be expected that recruitment into this portion of the lake would be less rapid than the main lake.

While the main lake sampling has shown some promising results, other sampling unrelated to these efforts has also shown an expansion of eel abundance. The Vermont Department of Fish and Wildlife initiated a bass survey in lower Lake Champlain (Bridport, Vermont to West Haven, Vermont) in 2010 (see Appendix). Twenty stations were electro-fished with a total effort of more than 7 hours expended collecting bass. During this sampling 61 eels were also collected and 73 additional eels were observed but not netted.

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### **References**

- Labar, G. W. 1987. Changes in population structure of American eels, *Anguilla rostrata*, in Lake Champlain, Vermont, U.S.A., after initiation of a commercial fishery. Presented at the 1987 meeting of the European Inland Fisheries Advisory Council Working Party on Eel, Bristol, England, 12-16 April, 1987.
- Labar, G. W., and D. E. Facey. 1983. Local movements and inshore population sizes of American eels in Lake Champlain, Vermont. *Transactions of the American Fisheries Society* 112:114-116.
- Verdon, R., D. Desrochers, and P. Dumont. 2003. Recruitment of American eels in the Richelieu River and Lake Champlain: Provision of upstream passage as a regional-scale solution to a large-scale problem. *American Fisheries Society Symposium* 33: 125-138.

Table 1. Summary of American eel stocking in the upper Richelieu River.

Year	Number of glass eels
2005	600,000
2006	1,000,000
2007	425,500
2008	746,000
2009	0
2010	0

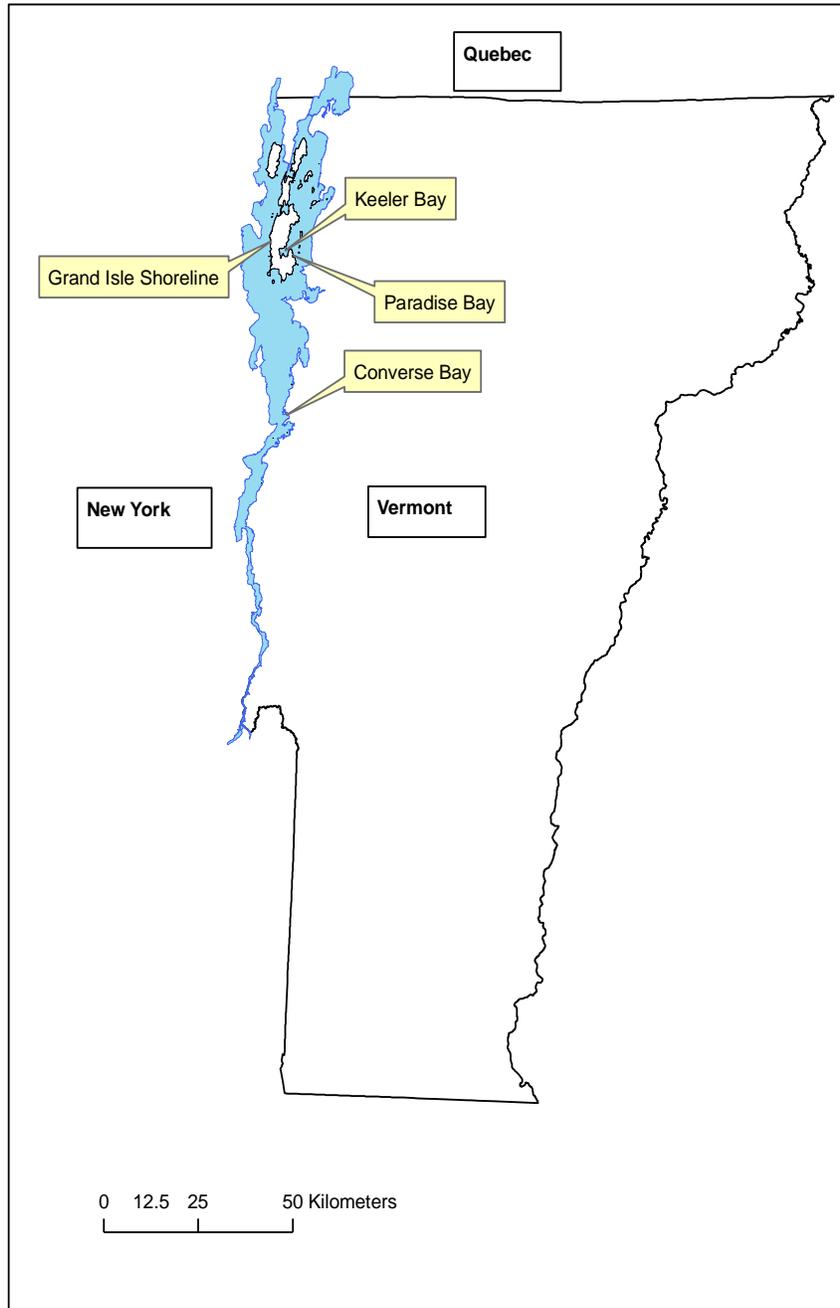
Table 2. American eel sampled in Lake Champlain 2010.

Location	Fish No	PIT Number	Length (mm)	Weight (g)
Paradise Bay	1	4875461C26	560	400
Keeler Bay	1	48754E3339	538	460
Converse Bay	1	4876087724	530	280
Converse Bay	2	48752D602C	460	160
Converse Bay	3	48751D710A	548	320
Converse Bay	4	4875444523	499	240
Converse Bay	5	4878001E2A	402	100
Converse Bay	6	48767A4D31	478	180
Converse Bay	7	48752A5723	505	260
Converse Bay	8	487554784D	393	80
Converse Bay	9	48753A745B	337	60
Converse Bay	10	4875193268	475	220
Converse Bay	11	487535006D	515	280
Converse Bay	12		282	20
Converse Bay	13	48753A4A4E	493	180
Converse Bay	14	486B236E7F	540	300
Converse Bay	15	786A530130	545	380
Converse Bay	16	48753D220D	377	100
Converse Bay	17	487529660E	390	80
Converse Bay	18	48751F4033	480	220
Converse Bay	19	48754F545A	486	220
Converse Bay	20	486A3C0928	410	100
Converse Bay	21	48756A0E20	448	160
Converse Bay	22	486A450D6B	457	180
Converse Bay	23	4875342F31	490	220
Converse Bay	24	4877597875	392	100
Converse Bay	25	48751B045C	510	240
Grand Isle - Wilcox Point	1	4876764015	560	400
Grand Isle - Wilcox Point	2	487555030C	490	360
Grand Isle - Wilcox Point	3	48753C475A	672	640
Grand Isle - Wilcox Point	4	487668520F	520	320
Grand Isle - Wilcox Point	5		312	60
Grand Isle - Wilcox Point	6	4875551146	515	260
Grand Isle - Wilcox Point	7	486A5F4B60	443	140
Grand Isle - Wilcox Point	8	4876096F6F	493	240
Grand Isle - Wilcox Point	9	487608092F	415	120
Grand Isle - Wilcox Point	10	48752B466A	383	120
Grand Isle - Wilcox Point	11	487550553D	393	120
Grand Isle - Wilcox Point	12	4875632008	411	80
Grand Isle - Wilcox Point	13	48751B3E53	338	100
Grand Isle - Wilcox Point	14		282	20

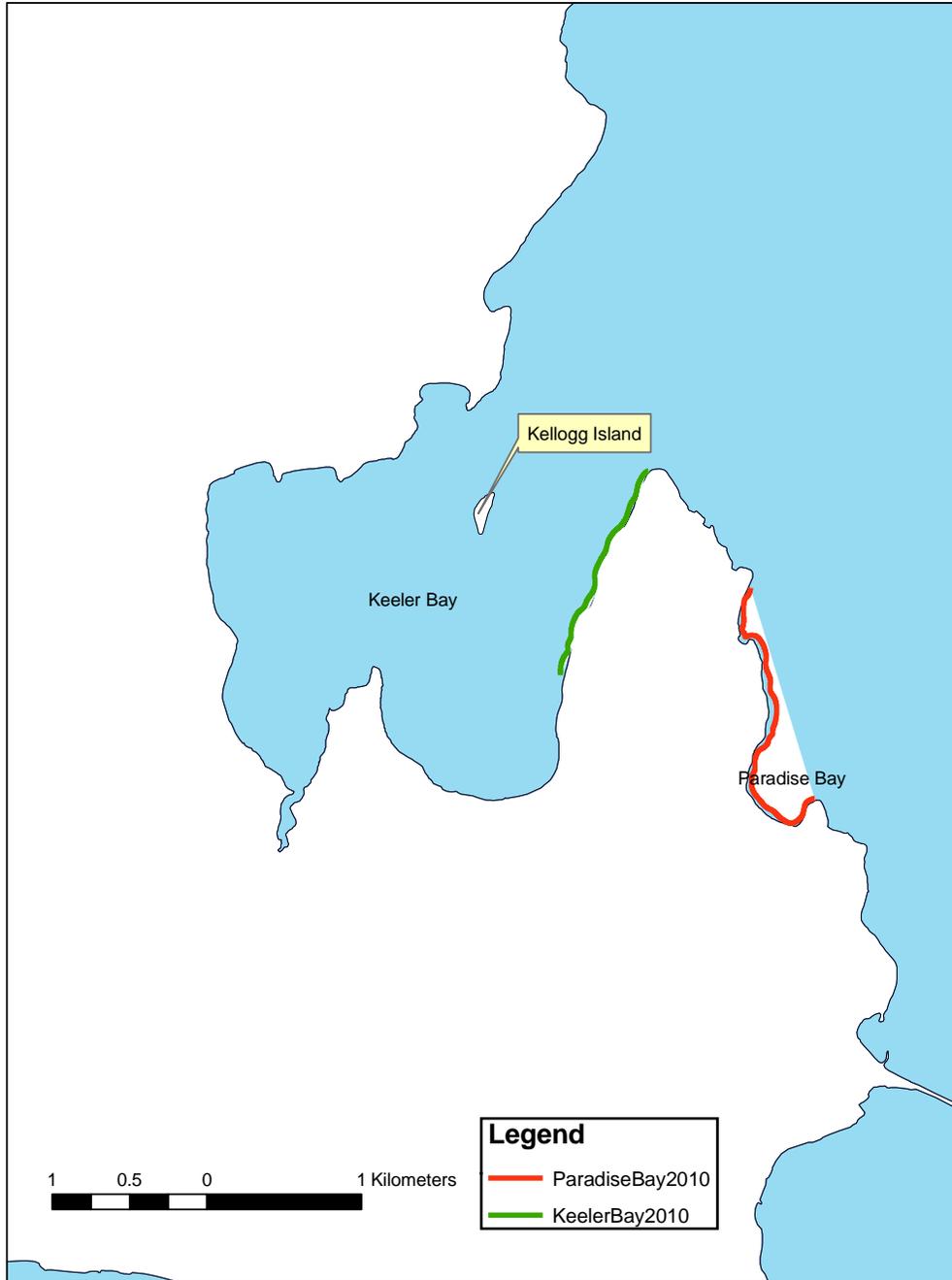
Table 3. Comparison of 2007 and 2010 American eel sampling efforts in Lake Champlain.

Year	Number of eels collected			
	Keeler Bay	Paradise Bay	Converse Bay	Grand Isle shoreline
2007	0	0	0	1
2010	1	1	25	14

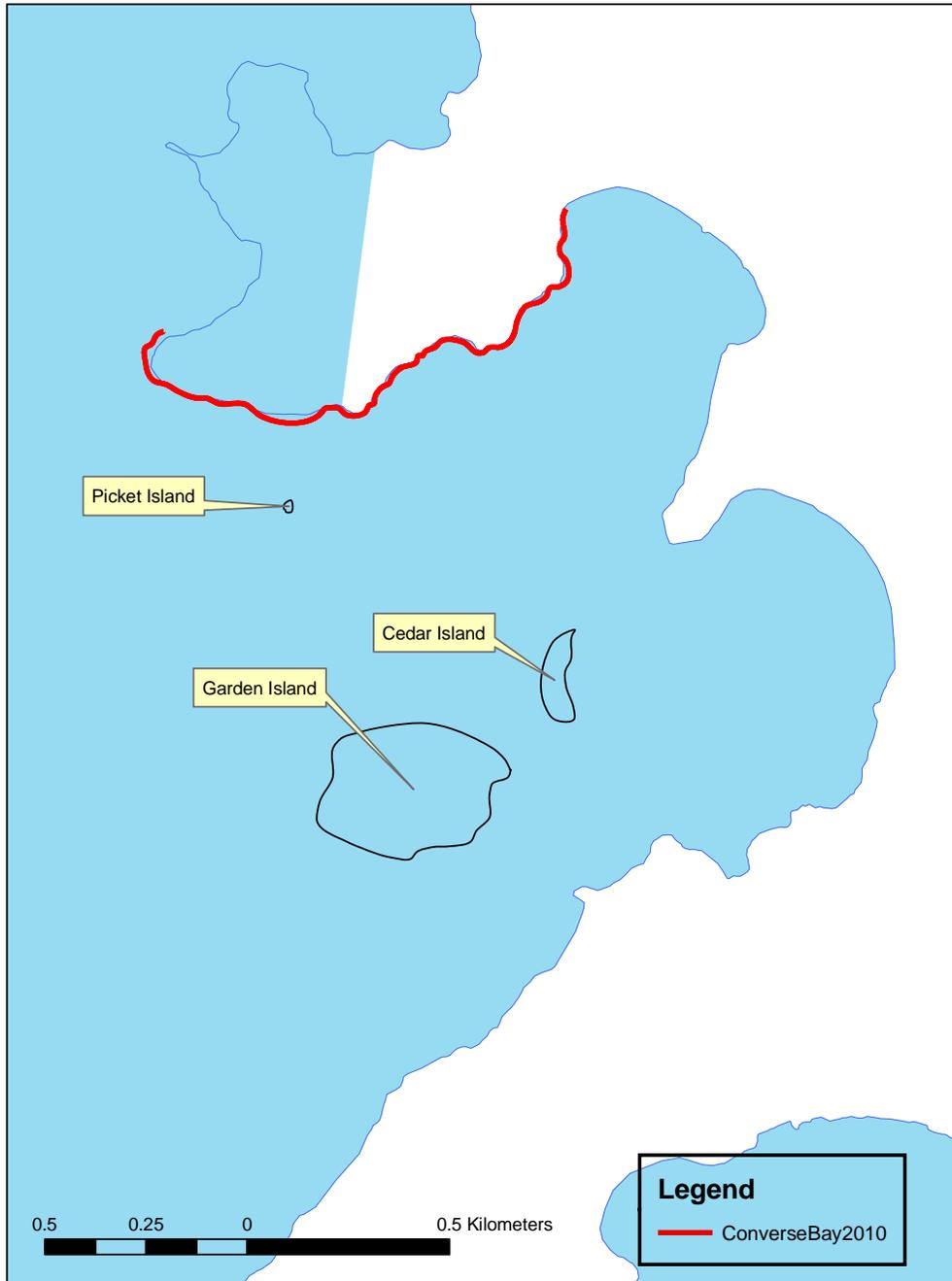
**Figure 1. Map of Lake Champlain showing sampling areas.**



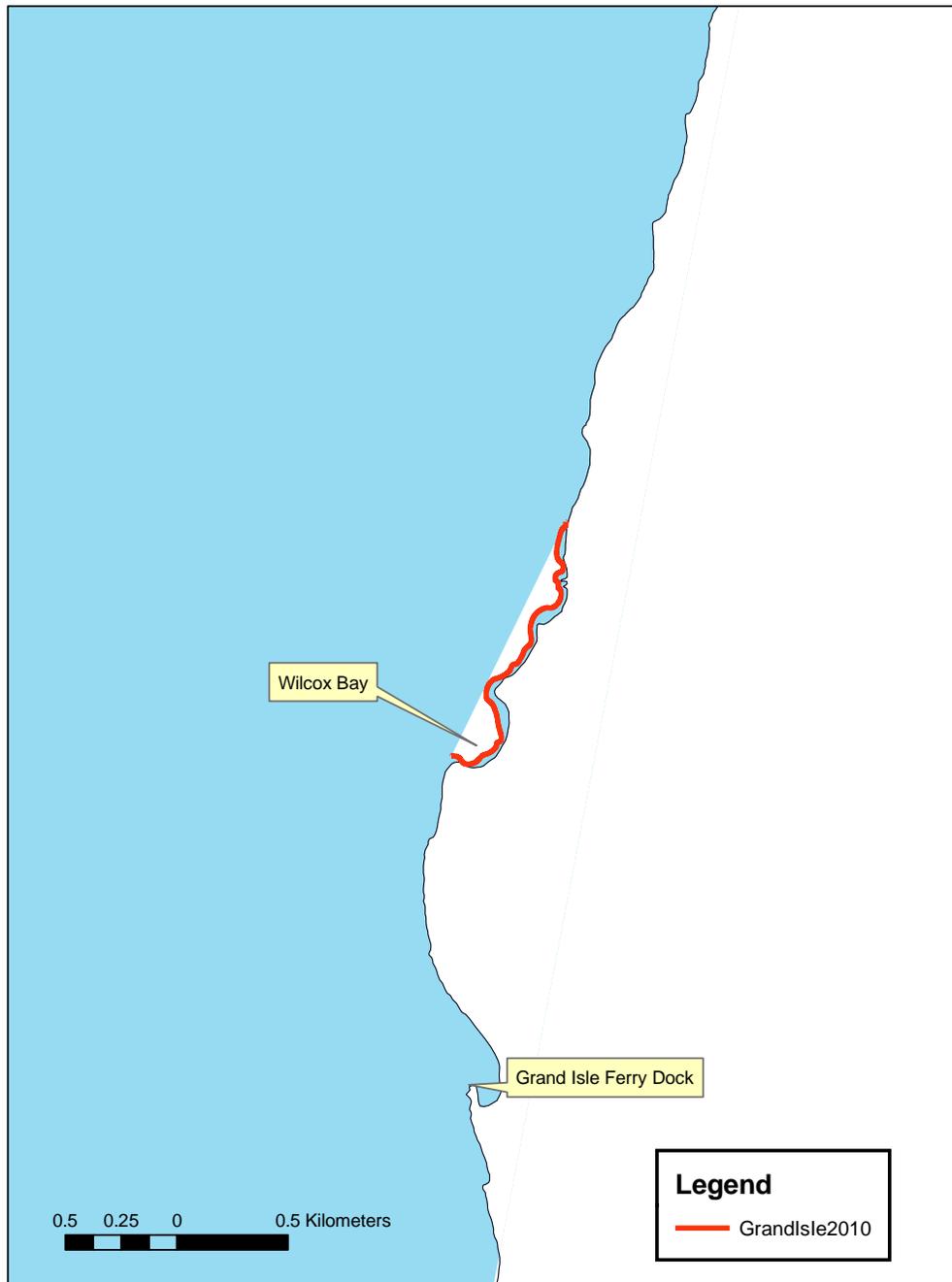
**Figure 2. Map of Keeler and Paradise Bay showing electro-fishing transects.**



**Figure 3. Map of Converse Bay showing electro-fishing transects.**



**Figure 4. Map of Grand Isle shoreline showing electro-fishing transect.**



## **APPENDIX**

American eels collected by the Vermont Department of Fish & Wildlife in 2010.

1. Table 1. Summary of American eels collected by Vermont Department and Fish & Wildlife during bass sampling on southern Lake Champlain in 2010.
2. Figure 1. Bass sampling station locations of Vermont Department of Fish & Wildlife.

Table 1. Summary of American eels collected by Vermont Department and Fish & Wildlife during bass sampling on southern Lake Champlain in 2010.

Year	Month/Day	Station	Effort (sec)	Species	Length (mm)	Weight	Additional Eels Seen
2010	708	1	1064	276	568	390	
2010	708	1		276	506	258	+2
2010	708	2	1511	276	444	159	
2010	708	2		276	325	52	
2010	708	2		276	277	32	
2010	708	2		276	255	30	+7
2010	708	3	1676	276	400	96	
2010	708	3		276	445	156	
2010	708	3		276	345	80	
2010	708	3		276	370	80	
2010	708	3		276	280	32	
2010	708	3		276	344	63	
2010	708	3		276	304	39	
2010	708	3		276	267	25	
2010	708	3		276	310	36	
2010	708	3		276	300	46	
2010	708	3		276	235	27	
2010	708	3		276	350	74	
2010	708	3		276	327	72	
2010	708	3		276	377	97	
2010	708	3		276	220	16	
2010	708	3		276	298	42	+35
2010	708	4	1321				+5
2010	714	5	1535				+1
2010	714	6	1105	276	430	124	
2010	714	6		276	460	155	
2010	714	7	1491	276	563	364	
2010	714	7		276	378	87	
2010	714	7		276	270	14	
2010	714	8	1715	276	581	386	
2010	714	8		276	302	38	
2010	715	9	1024	276	465	180	
2010	715	9		276	590	343	
2010	715	12	1520	276	599	423	
2010	715	12		276	349	72	
2010	719	13	1676	276	283	37	
2010	719	13		276	372	83	+2

Table 1. Continued.

Year	Month/Day	Station	Effort (sec)	Species	Length (mm)	Weight	Additional Eels Seen
2010	720	14	1804	276	640	548	
2010	720	14		276	337	73	
2010	720	14		276	378	91	
2010	720	14		276	508	316	
2010	720	14		276	438	181	
2010	720	14		276	463	184	+5
2010	720	15	2022	276	523	326	
2010	720	15		276	387	113	
2010	720	15		276	550	358	
2010	720	15		276	411	115	
2010	720	15		276	537	292	
2010	720	15		276	407	115	
2010	720	15		276	496	244	
2010	720	15		276	374	90	+7
2010	719	16	1413				+4
2010	719	17	1476	276	375	112	
2010	719	17		276	626	546	
2010	719	18	1720	276	500	95	
2010	719	18		276	445	179	
2010	719	18		276	306	43	
2010	719	18		276	255	27	+4
2010	720	19	1002				+1
2010	720	20	988	276	505	245	
2010	720	20		276	443	160	

Figure 1. Bass sampling station locations of Vermont Department of Fish & Wildlife.

