Offshore Index Assessment Program

2011 Summary Report

Upper Great Lakes Management Unit
Lake Huron
Report: PS-LHA-IA11-SUM

Upper Great Lakes Management Unit
Lake Huron
Report PS-LHA-IA11-SUM

Offshore Index Assessment Program

2011 Summary Report

J.D. Speers

Ontario Ministry of Natural Resources
Upper Great Lakes Management Unit
Lake Huron

MNR # 62713
ISSN 1929-3402 (Online)
ISBN 978-1-4435-9447-9 (2011 ed.)

Printed in Ontario, Canada

Additional copies of this publication are available at a cost
of twenty dollars each (including G.S.T.) from the address below.

Upper Great Lakes Management Unit
Lake Huron Office
Ontario Ministry of Natural Resources
1450 Seventh Avenue East
Owen Sound, Ontario
N4K 2Z1

Cheques or money orders should be made payable to the
Minister of Finance and payment must accompany the order.

Cette publication (technique) n'est disponible qu'en anglais.

Table of Contents

Introduction

The Lake Huron office of the Upper Great Lakes Management Unit conducts annual index gill net surveys throughout the Canadian waters of Lake Huron. These waters include the main basin, Georgian Bay, and the North Channel. These surveys are collectively known as the offshore index assessment program. Its purpose is to monitor the populations of commercially exploited fish species and to collect information about the offshore fish community. The primary objective of the offshore index program is to characterize the strength of the year classes of commercially exploited fish species before they are susceptible to commercial fishing gear. The offshore index program is also an important tool for measuring the progress of lake trout (*Salvelinus namaycush*) rehabilitation in the lake.

The offshore index program consists of overnight sets of standardized, monofilament gill nets set on the lake's bottom at various locations throughout Lake Huron (Figure 1). The offshore index program has remained essentially unchanged since its inception with only minor modifications to the sampling protocol due to logistical and financial constraints. As a result, the offshore index program provides an invaluable, long-term, trend-through-time record of the offshore fish community in Lake Huron.

This report summarizes the individual offshore index projects conducted during 2011. Each project consisted of several net sets at a specific location during a specific time period. Any changes to the sampling process that deviated from the long-term protocol are described. Catch per unit of effort (CPUE), length-at-age, and pre-recruit indices are calculated for select species. Differences between the results of this and past field seasons are briefly discussed.

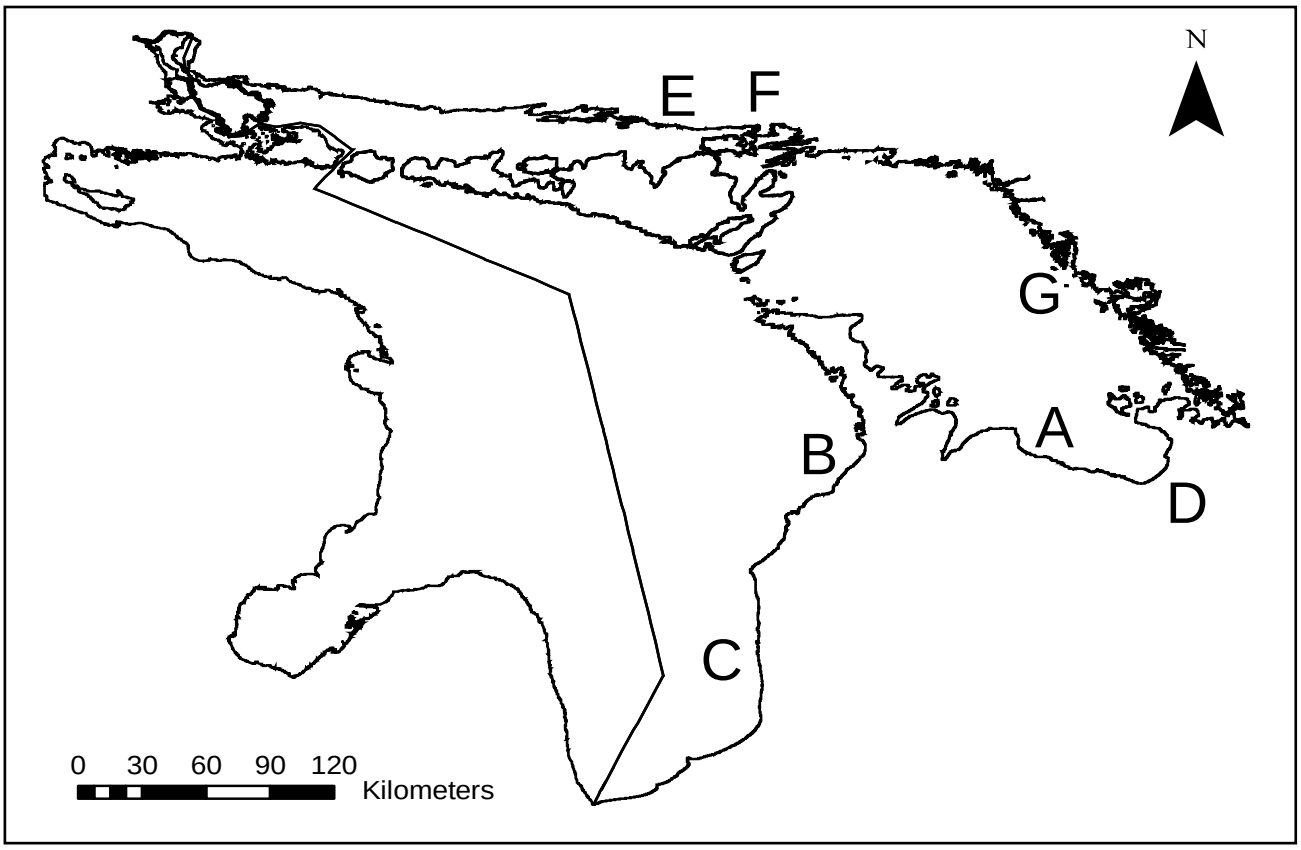

Figure 1. General locations of the offshore index assessment projects conducted in Lake Huron during 2011. The projects were conducted near Cape Rich (A), Southampton (B), Grand Bend (C), Collingwood (D), Clapperton Island (E), Frazer Bay (F), and the Limestone Islands (G).

Materials and Methods

Depending on project, the survey design of the offshore index program includes both a fixed and random component. Projects with a long-term time series are essentially fixed-site surveys where the index nets are set in roughly the same place every year to monitor the offshore fish community through time. Projects with a fixed-site survey design are the Cape Rich, Southampton, Grand Bend, and Clapperton Island projects. Projects without existing fixed stations employed a depth-stratified, randomized survey design. In these projects, net set locations were randomly selected within several depth strata from a 1 km grid overlay. The depths used to define these strata depends on the available habitat, project objective, and proximity to other offshore index projects. The actual depth strata that were used in each project are described in the Results section. Projects that used a randomized survey design were the Collingwood, Frazer Bay, and Limestone Islands projects. The Clapperton Island project incorporated both a random- and fixed-site component; nets set shallower than 15 m were set at historical sampling stations to maintain the long-term time series for yellow perch in the project, while the location of nets set in deeper water to target lake trout and lake whitefish were randomly selected from a 1 km grid overlay.

The offshore index program uses only multi-mesh monofilament gillnets set directly on the lake's bottom. The meshes are described by their stretch measure. Usually three of these nets are set each day. All of the nets consisted of a 15 m panel of 32 mm (1.25”) mesh, a 25 m panel of 38 mm (1.5”) mesh, and 50 m panels of 51 mm (2.0”), 64 mm (2.5”), 76 mm (3.0”), 89 mm (3.5”), 102 mm (4.0”), 114 mm (4.5”), and 127 mm (5.0”) mesh ordered from smallest mesh to largest mesh. This gear is identified as GL32. A 50 m panel of 140 mm (5.5”) mesh and a 50 m panel of 153 mm (6.0”) mesh were added to the third net. The order of the meshes in this net, identified as GL21, was randomized between projects and seasons. The collection of the individual panels that make up each net are referred to here as a net “gang”. During most projects, the nets were set perpendicular to the depth contours to maximize the catch and to reduce the variability between catches. Nets were set parallel to the depth contours during the Clapperton Island project due to rapid changes in depth in that area. The offshore index program was conducted exclusively from the Ontario Ministry of Natural Resources’ research vessel, the *Huron Explorer I*.

Detailed information was collected about each net set. Latitude, longitude, Secchi depth, weather conditions, and surface water temperature were recorded. The water depth at each mesh was also noted. Temperature loggers were attached to each end of the net to log changes in water temperature while the nets were in the water. Set duration lasted between 20 and 24 hours unless unsafe conditions were created by inclement weather. Instances where weather prevented net

retrieval for an extended period of time were accounted for in calculations of relative abundance by using effective net nights to compensate for gear saturation. If a net fished for more than one night, the number of nights fished was adjusted by a factor of 0.7. Thus a net that fished for two consecutive nights was considered to have fished for 1.4 effective net nights for the purposes of CPUE calculations (0.7 x 2 = 1.4).

Biological information was collected from the catch. As each net was lifted the catch was segregated by mesh size into containers to facilitate the collection of biological information by mesh size. Fork length, total length, aging structures (if required), and round weight were measured for up to 20 individuals of each species from each mesh size. In instances where more than 20 individuals of a single species were captured in one mesh size, a sub-sample of 20 was randomly selected for these biological measurements. Fork length and aging structures (if required) were collected from the next 30 individuals. All remaining individuals were counted. Sea lamprey (*Petromyzon marinus*) marks were recorded using Great Lakes Fishery Commission standards (Ebener et al. 2006) from all of the fish that were sampled. Salmonids and lake whitefish (*Coregonus clupeaformis*) were examined for clipped fins. Depending on the objectives of the individual project, any combination of aging structures (scales, otoliths, or fin rays), stomachs, or tissue samples may have been collected as well.

The structure used to age each fish varied by species. Age was determined from scale samples for most species. Cisco (*Coregonus artedi*) were aged using otoliths. Lake trout were assigned an age based on their clipped fins or a coded wire tag number. Lake trout without a coded wire tag or an unambiguous, year-specific fin clip were assigned an age using otoliths.

If sufficient biological information was collected, more information about a species' population was calculated. If enough age and length data were available from a particular species and project, a Von Bertalanffy growth curve was estimated. If enough maturity data was also collected, age-at-maturity was estimated using logistic regression. Growth and maturity curves were generated separately for males and females.

Average CPUE is listed for each species in each summary table. In most instances, CPUE was the average number of fish of a given species caught in those nets where at least one individual of that species was caught. This is appropriate for non-target species because a number of nets were set that would not be expected to catch those species. For example, nets targeting bloater (*Coregonus hoyi*) would not be expected to catch species found in shallower water, such as smallmouth bass (*Micropterus dolomieu*). Consequently the bloater-targeting nets should not be included in the calculation of average CPUE for smallmouth bass. However, for target species the average CPUE

includes the catch from only net sets targeting that species, even if that species was not caught. The offshore index program targets lake trout, lake whitefish, “deepwater” chub (cisco other than *Coregonus artedi*), and yellow perch (*Perca flavescens*).

Pre-recruit indices (Hughes 1989) were calculated for some commercially exploited species caught during the program. The pre-recruit index uses age-specific CPUE data to infer the relative abundance of cohorts before they are susceptible to commercial fishing gear (referred to here as “pre-recruits”). The age-specific CPUE values are standardized to a value of ten to allow comparisons between year classes. Values greater than ten indicate that a year class is stronger than average (greater than average abundance) while a value less than ten indicates that a year class is weaker than average (Mohr et al. 1997). The index values listed in this report are an average of up to four age-specific, standardized CPUE values from each year class, depending on species and project.

Results

Projects were conducted in both traditional and new locations. Georgian Bay (near Cape Rich), the central main basin (near Southampton), the southern main basin (near Grand Bend), and the North Channel (near Clapperton Island) were the traditional locations that were sampled this year. Two projects were conducted in each of the southern and central portions of the main basin near Grand Bend and Southampton, respectively. The first one took place in the spring (June) and the other in the fall (September). Three new locations were selected this year in which to run a project to increase the spatial coverage of the offshore index program; near the Limestone Islands in Georgian Bay, offshore of Collingwood in Georgian Bay, and within Frazer Bay in the North Channel. The location of all projects are shown in Figure 1.

The 155 nets (65.55 km of gear) set this year captured a total of 28 fish species and 8 858 individuals. Of these, 3 629 were biologically sampled. The most common species were yellow perch (61 % of catch), chub (11 %), and white sucker (*Catostomus commersoni*, 7 %). Of the 174 lake trout that were sampled, 96 (55.2 %) were unclipped and presumed to be naturally produced. This percentage is higher than last year and the highest ever observed in the offshore index program. The increase is likely due to wide-spread natural reproduction that has been observed in many areas of Lake Huron, especially the main basin.

Georgian Bay (Cape Rich) **[LHA_IA11_002]**

This project was conducted in Georgian Bay near Cape Rich between August 17 and August 24 (Table 1). The depth of the nets ranged between 21.5 m and 84.2 m. All 9 nets fished for approximately 24 hours. Algal fouling did not have any obvious impact on catch. Chub, lake trout, lake whitefish, and yellow perch were targeted. The position of each net is shown in Figure 2.

Thirteen fish species were caught during this project (Table 2). The most common species were rainbow smelt (*Osmerus mordax*, 22.7 % of catch), lake trout (14.8 %), and round goby (*Neogobius melanostomus*, 14.8 %). Too few individuals of each species were captured to construct meaningful plots of their biological attributes.

Average CPUE for this project was 9.8 fish/night. Rainbow smelt had the highest average CPUE (20.0), followed by round goby (13.0), and round whitefish (*Prosopium cylindraceum*, 5.5). All of the round goby were caught in the 38 mm mesh.

Table 1. Set information for the fishing gear deployed in Georgian Bay near Cape Rich during the 2011 offshore index program.

Sample Number	Set Date	Latitude	Longitude	Gear Code	Effort Duration (hrs)	Average Depth (m)
201	17-Aug-11	44° 40.87'	-80° 32.70'	GL32	22.11	84.2
202	17-Aug-11	44° 40.58'	-80° 33.41'	GL32	22.86	76.5
203	17-Aug-11	44° 41.91'	-80° 37.04'	GL21	24.15	21.5
204	18-Aug-11	44° 38.14'	-80° 36.09'	GL32	22.31	32.4
205	18-Aug-11	44° 37.69'	-80° 35.98'	GL32	21.70	30.1
206	18-Aug-11	44° 37.90'	-80° 32.98'	GL21	20.68	34.9
207	23-Aug-11	44° 38.70'	-80° 30.94'	GL32	24.16	48.2
208	23-Aug-11	44° 39.15'	-80° 31.88'	GL32	24.38	57.6
209	23-Aug-11	44° 38.15'	-80° 28.82'	GL21	22.68	38.2

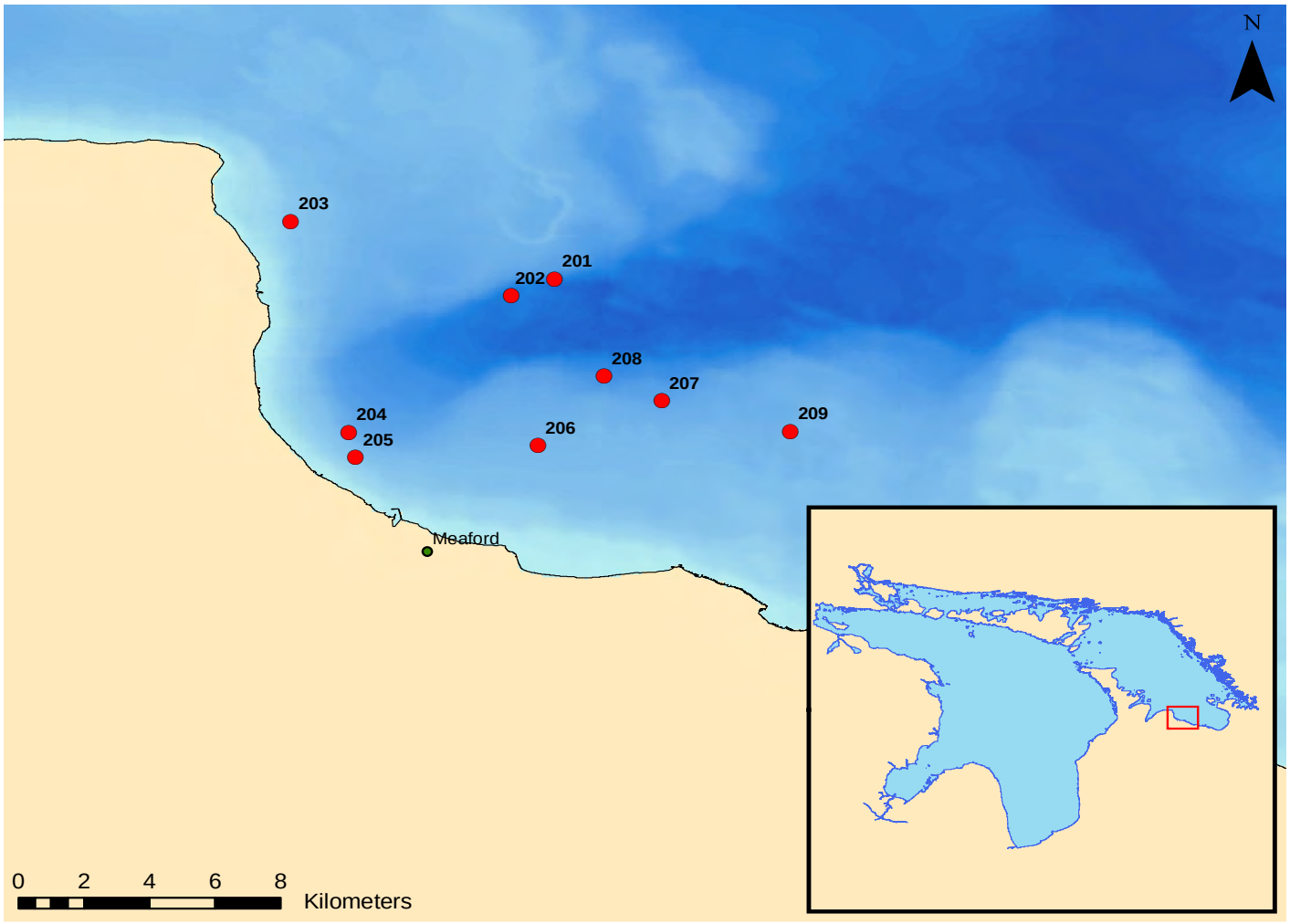

Figure 2. Offshore index sampling locations in Georgian Bay near Cape Rich during 2011 (project code LHA_IA11_002). Chub, lake trout, lake whitefish, and yellow perch were targeted.

Table 2. Count of the number of fish by species caught in each mesh size of the gill nets set in Georgian Bay near Cape Rich during the 2011 offshore index program. Catch per unit effort (CPUE) is the mean number of fish caught per net each night.

	Mesh Size (mm)												
Species	**032**	**038**	**051**	**064**	**076**	**089**	**102**	**114**	**127**	**140**	**153**	**Total**	**CPUE**
Brown Trout							1					1	1.00
Burbot				3	1	2						6	1.20
Chinook Salmon				1								1	1.00
Chub	5	2										7	1.00
Lake Chub		4										4	4.00
Lake Trout			1	3	1	1	2	3	1	1		13	1.20
Lake Whitefish			2				1					3	0.00
Longnose Sucker						2	2					4	4.00
Rainbow Smelt		2	8	1	3		3	3				20	20.00
Rainbow Trout							1					1	1.00
Round Goby		13										13	13.00
Round Whitefish			4	5	1		1					11	5.50
White Sucker			1		1	1		1				4	4.00
Total	5	21	16	13	7	6	11	7	1	1	0	88	

Georgian Bay (Collingwood) **[LHA_IA11_003]**

This project was run in Georgian Bay near Collingwood between August 08 and August 12 (Table 3). This project was run to evaluate the progress towards lake trout rehabilitation in the area. The depth of the nets ranged between 33.8 m and 71.2 m and encompassed four depth strata: <25 m, 25-45 m, 45-60 m, and >60 m. Three of the 9 nets fished for more than one night due to inclement weather creating unsafe work conditions. These three nets were the only nets where algal fouling appeared to have an obvious affect on catch. Chub, lake trout, and lake whitefish were targeted. The position of each net is shown in Figure 3.

Ten fish species were caught during this project (Table 4). The most common species were round goby (36.8 % of the catch), burbot (*Lota lota*, 17.6 %), and chub (14.7 %). Too few individuals of each species were captured to construct meaningful plots of their biological attributes.

Average CPUE for this project was 6.7 fish/night. Round goby had the highest mean CPUE (6.0), followed by burbot (5.0), and chub (3.3). Nearly 85% of the round goby were caught in the 32 mm mesh.

Table 3. Set information for the fishing gear deployed in Georgian Bay near Collingwood during the 2011 offshore index program.

Sample Number	Set Date	Latitude	Longitude	Gear Code	Effort Duration (hrs)	Average Depth (m)
301	08-Aug-11	44° 43.44'	-80° 16.29'	GL32	23.83	69.5
302	08-Aug-11	44° 42.09'	-80° 16.36'	GL32	23.61	71.3
303	08-Aug-11	44° 36.50'	-80° 13.19'	GL21	23.30	66.3
304	09-Aug-11	44° 33.91'	-80° 11.11'	GL32	18.03	55.7
305	09-Aug-11	44° 33.43'	-80° 10.59'	GL32	17.39	53.7
306	09-Aug-11	44° 33.29'	-80° 09.37'	GL21	20.08	49.5
307	10-Aug-11	44° 34.37'	-80° 05.37'	GL32	50.56	33.8
308	10-Aug-11	44° 33.22'	-80° 05.83'	GL32	49.46	35.1
309	10-Aug-11	44° 32.00'	-80° 10.26'	GL21	47.65	36.4

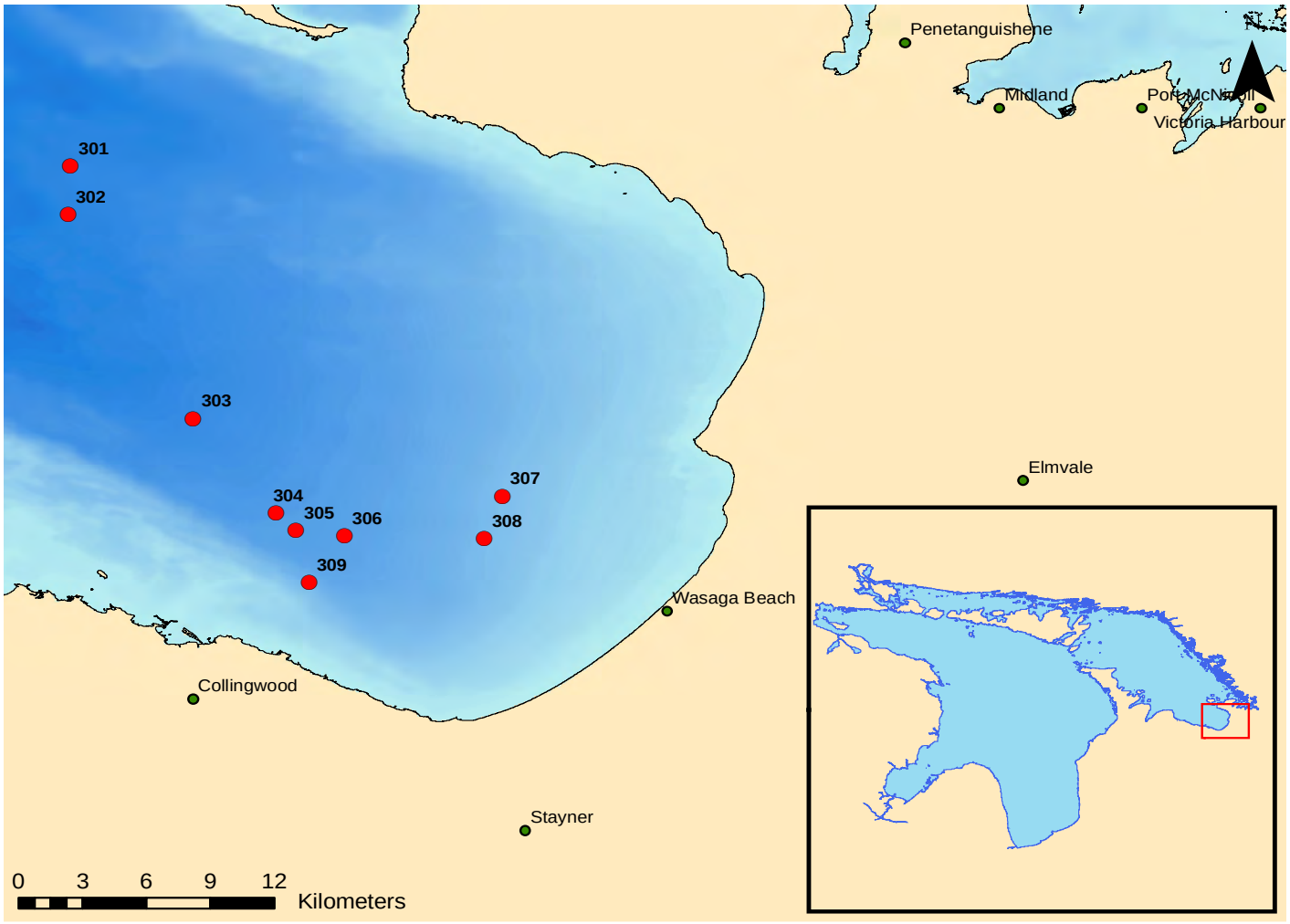

Figure 3. Offshore index sampling locations in Georgian Bay near Collingwood during 2011 (project code LHA_IA11_003). Chub, lake trout, and lake whitefish were targeted.

Table 4. Count of the number of fish by species caught in each mesh size of the gill nets set in Georgian Bay near Collingwood during the 2011 offshore index program. Catch per unit effort (CPUE) is the mean number of fish caught per net each night.

	Mesh Size (mm)												
Species	**032**	**038**	**051**	**064**	**076**	**089**	**102**	**114**	**127**	**140**	**153**	**Total**	**CPUE**
Burbot			1	6	3	1	1					12	5.00
Chub	5	5										10	3.33
Cisco					1							1	0.71
Lake Trout				1	1		1	1				4	0.33
Lake Whitefish			1	3	1	1	1	1	1			9	0.95
Rainbow Smelt			1	1								2	1.00
Round Goby	21	1	2	1								25	5.95
Round Whitefish			1	2								3	1.07
Sea Lamprey							1					1	1.00
White Sucker								1				1	0.71
Total	26	6	6	14	6	2	4	3	1	0	0	68	

Georgian Bay (Limestone Islands) **[LHA_IA11_01B]**

This project was run in Georgian Bay near the Limestone Islands between August 02 and August 05 (Table 5). This project was run to evaluate the progress towards lake trout rehabilitation in the area. The depth of the nets ranged between 13.9 m and 35.8 m and encompassed two depth strata: <25 m and 25-50 m. All 9 nets fished for approximately 24 hours. Algal fouling appeared to have an obvious affect on catch in one net. Lake trout and lake whitefish were targeted. The position of each net is shown in Figure 4.

Eleven fish species were caught during this project (Table 6). The most common species were longnose sucker (*Catostomus catostomus*, 57.0 % of the catch), round whitefish (10.2 %), and lake whitefish (8.6 %). Too few individuals of each species were captured to construct meaningful plots of their biological attributes.

Average CPUE for this project was 14.2 fish/night. Longnose sucker had the highest mean CPUE (12.2), followed by round whitefish (6.5), and cisco (3.5). Nearly 80% of the round whitefish were caught in the 51 mm mesh.

Table 5. Set information for the fishing gear deployed in Georgian Bay near the Limestone Islands during the 2011 offshore index program.

Sample Number	Set Date	Latitude	Longitude	Gear Code	Effort Duration (hrs)	Average Depth (m)
101	02-Aug-11	45° 20.46'	-80° 33.23'	GL32	19.64	19.7
102	02-Aug-11	45° 21.85'	-80° 32.03'	GL32	20.60	21.7
103	02-Aug-11	45° 21.94'	-80° 30.23'	GL21	19.61	23.5
104	03-Aug-11	45° 22.99'	-80° 33.64'	GL32	22.73	13.9
105	03-Aug-11	45° 23.11'	-80° 35.09'	GL32	22.98	27.2
106	03-Aug-11	45° 24.09'	-80° 36.80'	GL21	23.23	15.7
107	04-Aug-11	45° 26.51'	-80° 37.54'	GL32	19.21	31.6
108	04-Aug-11	45° 25.55'	-80° 37.78'	GL32	19.96	35.8
109	04-Aug-11	45° 23.95'	-80° 39.95'	GL21	21.20	28.0

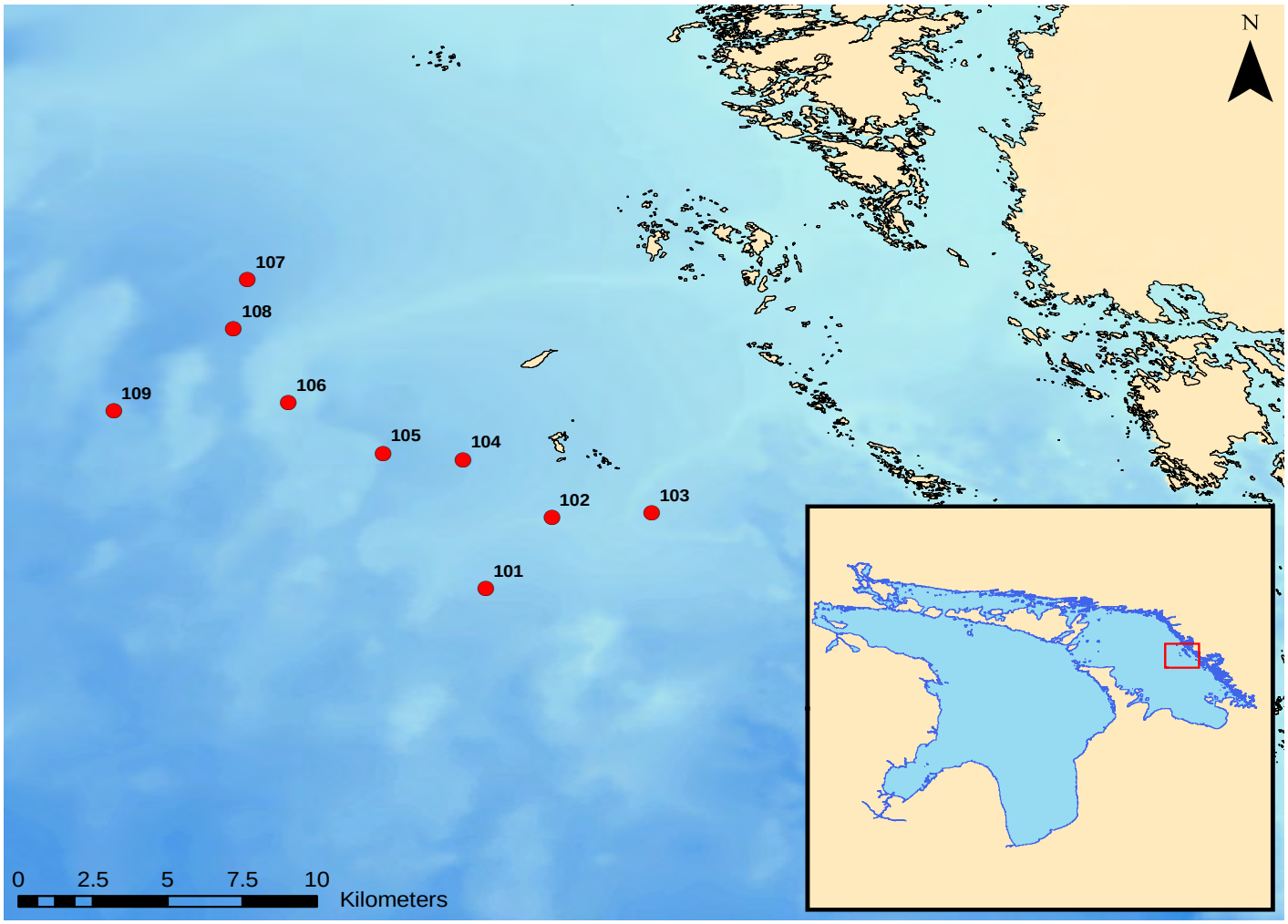

Figure 4. Offshore index sampling locations in Georgian Bay near the Limestone Islands during 2011 (project code LHA_IA11_01B). Lake trout and lake whitefish were targeted.

Table 6. Count of the number of fish by species caught in each mesh size of the gill nets set in Georgian Bay near the Limestone Islands during the 2011 offshore index program. Catch per unit effort (CPUE) is the mean number of fish caught per net each night.

	Mesh Size (mm)												
Species	**032**	**038**	**051**	**064**	**076**	**089**	**102**	**114**	**127**	**140**	**153**	**Total**	**CPUE**
Burbot			1	5	1	1	1		1			10	1.43
Chinook Salmon					1							1	1.00
Cisco			2	3	2							7	3.50
Lake Chub	6											6	3.00
Lake Trout					1		1					2	0.17
Lake Whitefish						1	3		5	1	1	11	0.67
Longnose Sucker	1	5	16	13	15	11	8	4				73	12.17
Rainbow Smelt	1				1							2	1.00
Round Goby		2										2	1.00
Round Whitefish	2	1	10									13	6.50
Yellow Perch			1									1	1.00
Total	10	8	30	21	21	13	13	4	6	1	1	128	

Central Lake Huron (Southampton) - Spring **[LHA_IA11_005]**

This project was conducted in the central main basin near Southampton between May 30 and June 17 (Table 7). The depth of the nets ranged between 18.4 m and 119.0 m. Three of the 23 nets fished for more than one night due to inclement weather creating unsafe work conditions. Algal fouling did not have any obvious impact on catch. Chub, lake whitefish, and yellow perch were sought. The position of each net is shown in Figure 5.

Ten fish species were caught during this project (Table 8). The most common species were lake whitefish (33.0 % of catch), lake trout (27.0 %), and yellow perch (14.8 %). Plots of the biological attributes of the lake trout (Figure 6) and lake whitefish (Figure 7) captured during this project were constructed.

Average CPUE for this project was 4.4 fish/night. Yellow perch had the highest mean CPUE (2.7), followed by lake whitefish (2.0), and lake trout (1.6). Over 80 % of the yellow perch were caught in the two smallest mesh sizes (32 mm and 38 mm).

Table 7. Set information for the fishing gear deployed in the spring in the central main basin near Southampton during the 2011 offshore index program.

Sample Number	Set Date	Latitude	Longitude	Gear Code	Effort Duration (hrs)	Average Depth (m)
501	30-May-11	44° 36.14'	-81° 26.31'	GL32	21.10	44.3
502	30-May-11	44° 36.80'	-81° 26.78'	GL32	21.10	45.9
504	31-May-11	44° 36.72'	-81° 22.63'	GL32	70.98	30.9
505	31-May-11	44° 37.48'	-81° 22.16'	GL32	71.96	30.7
506	31-May-11	44° 37.47'	-81° 21.56'	GL21	71.38	26.9
507	06-Jun-11	44° 41.08'	-81° 28.34'	GL32	22.16	48.3
508	06-Jun-11	44° 41.66'	-81° 27.90'	GL32	22.50	47.4
509	06-Jun-11	44° 41.66'	-81° 27.28'	GL21	22.71	45.3
510	07-Jun-11	44° 41.16'	-81° 22.74'	GL32	22.11	29.2
511	07-Jun-11	44° 41.74'	-81° 22.46'	GL32	22.93	28.5
512	07-Jun-11	44° 41.68'	-81° 23.73'	GL21	23.56	32.0
513	08-Jun-11	44° 41.32'	-81° 19.87'	GL32	21.65	19.0
514	08-Jun-11	44° 41.88'	-81° 20.32'	GL32	22.20	19.0
515	08-Jun-11	44° 41.88'	-81° 21.52'	GL21	23.00	22.7
516	09-Jun-11	44° 32.41'	-81° 29.62'	GL32	19.83	41.2
517	09-Jun-11	44° 31.77'	-81° 29.97'	GL32	19.13	40.9
518	09-Jun-11	44° 32.69'	-81° 30.30'	GL21	20.39	46.4
519	15-Jun-11	44° 36.57'	-81° 37.60'	GL32	22.70	109.0
520	15-Jun-11	44° 37.11'	-81° 37.82'	GL32	23.53	116.0
521	15-Jun-11	44° 37.78'	-81° 37.52'	GL21	24.43	119.0
522	16-Jun-11	44° 29.41'	-81° 25.60'	GL32	20.31	18.4
523	16-Jun-11	44° 30.17'	-81° 25.48'	GL32	20.95	20.4
524	16-Jun-11	44° 31.00'	-81° 24.88'	GL21	21.63	19.3

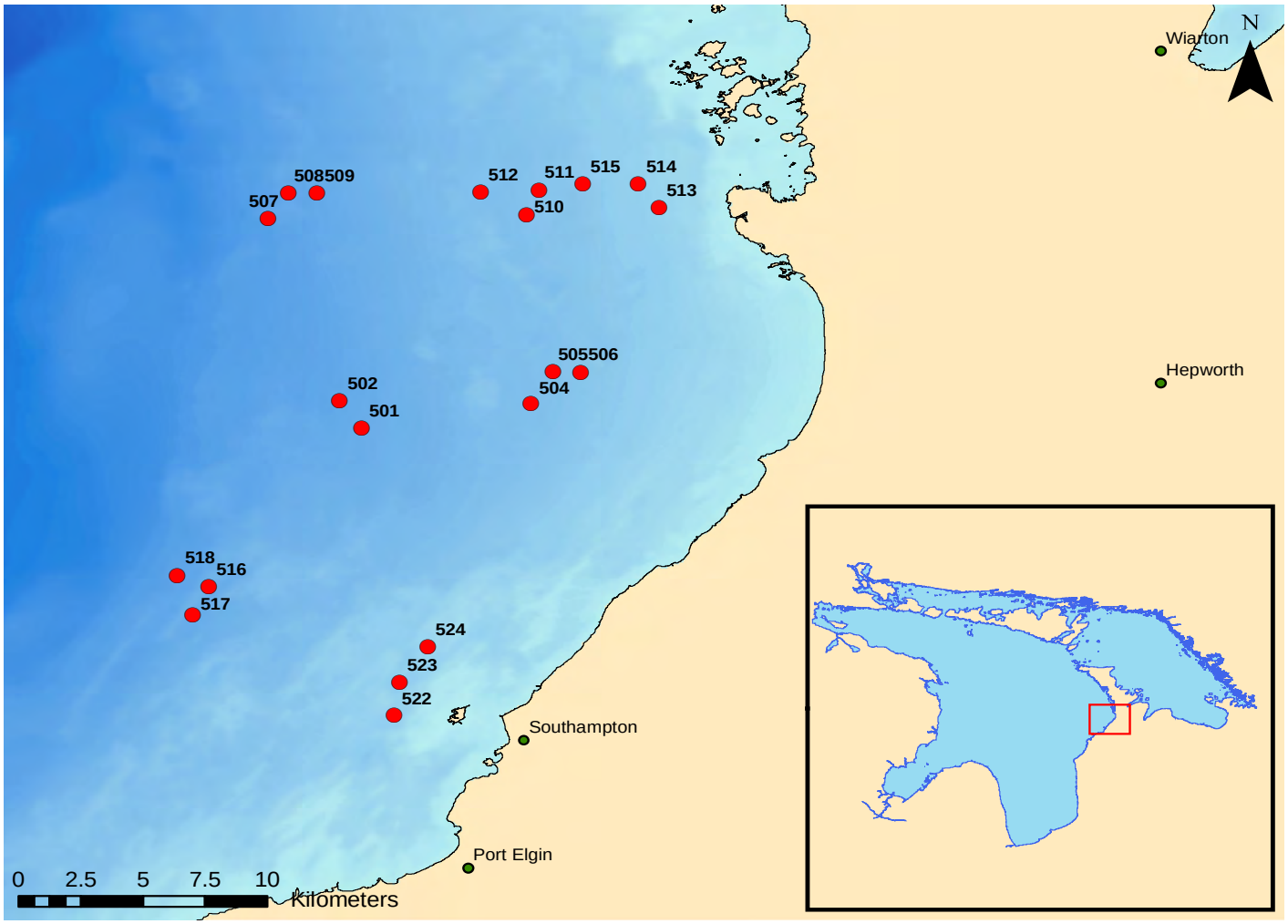

Figure 5. Offshore index sampling locations in the central main basin near Southampton during 2011 (project code LHA_IA11_005) during the spring (June). Chub, lake whitefish, and yellow perch were targeted.

Table 8. Count of the number of fish by species caught in each mesh size of the gill nets set in the central main basin near Southampton in the spring during the 2011 offshore index program. Catch per unit effort (CPUE) is the mean number of fish caught per net each night.

	Mesh Size (mm)												
Species	**032**	**038**	**051**	**064**	**076**	**089**	**102**	**114**	**127**	**140**	**153**	**Total**	**CPUE**
Burbot					2		2	3	1			8	1.29
Chub	4	5	1									10	1.50
Cisco					3							3	0.58
Lake Trout				3	9	5	2	9	2	1		31	1.61
Lake Whitefish					2	6	5	16	7	2		38	2.03
Longnose Sucker			1	1	1		2					5	0.82
Rainbow Smelt		1										1	1.00
Rock Bass			1									1	1.00
Round Whitefish					1							1	1.00
Yellow Perch	7	7		2		1						17	2.67
Total	11	13	3	6	18	12	11	28	10	3	0	115	

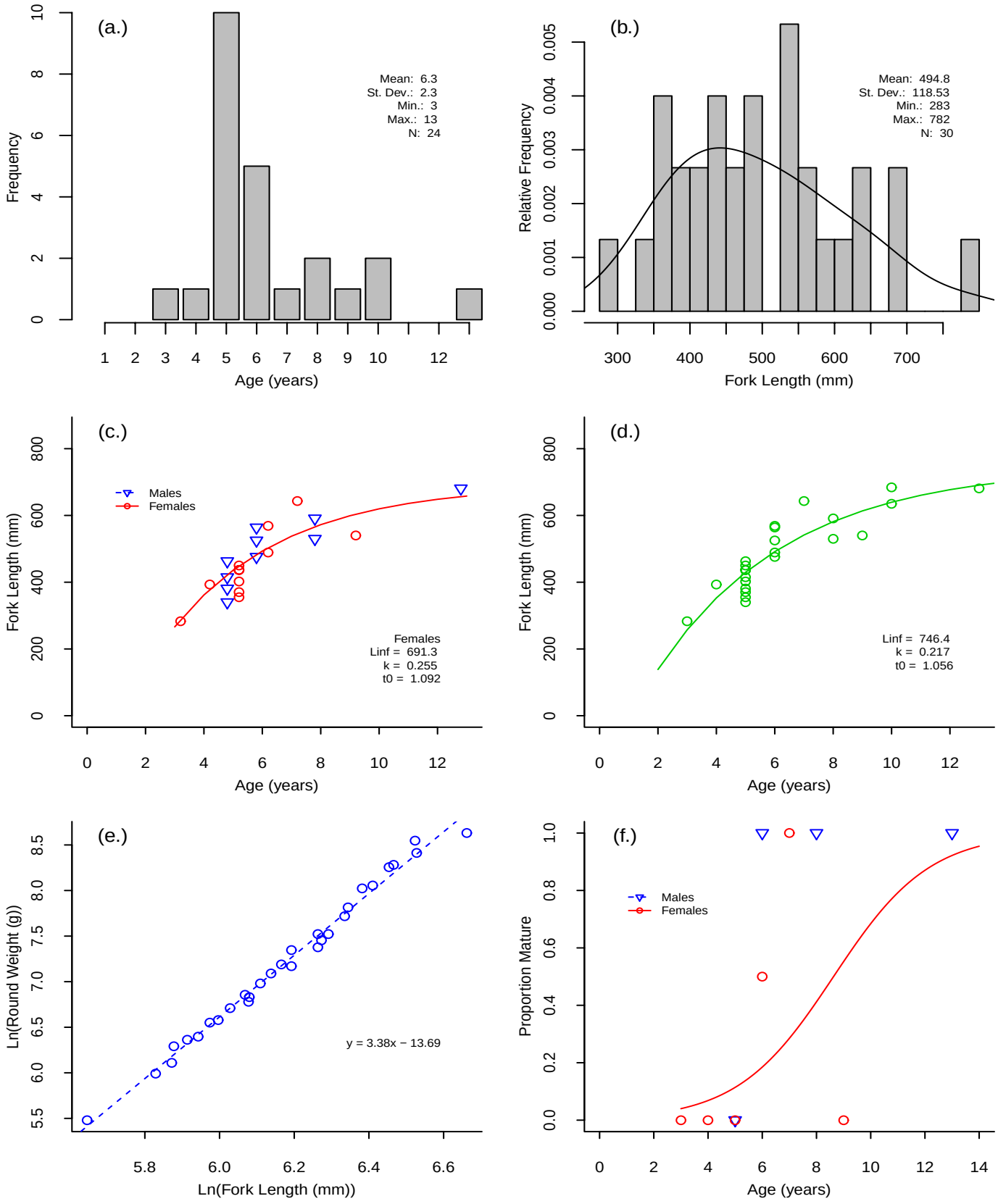

Figure 6. Lake trout age distribution (a), fork length distribution (b), fork length-at-age (by sex (c) and all fish combined (d)), weight-at length (e), and maturity-at-age (f) from the Southampton project (LHA_IA11_005), June 2011.

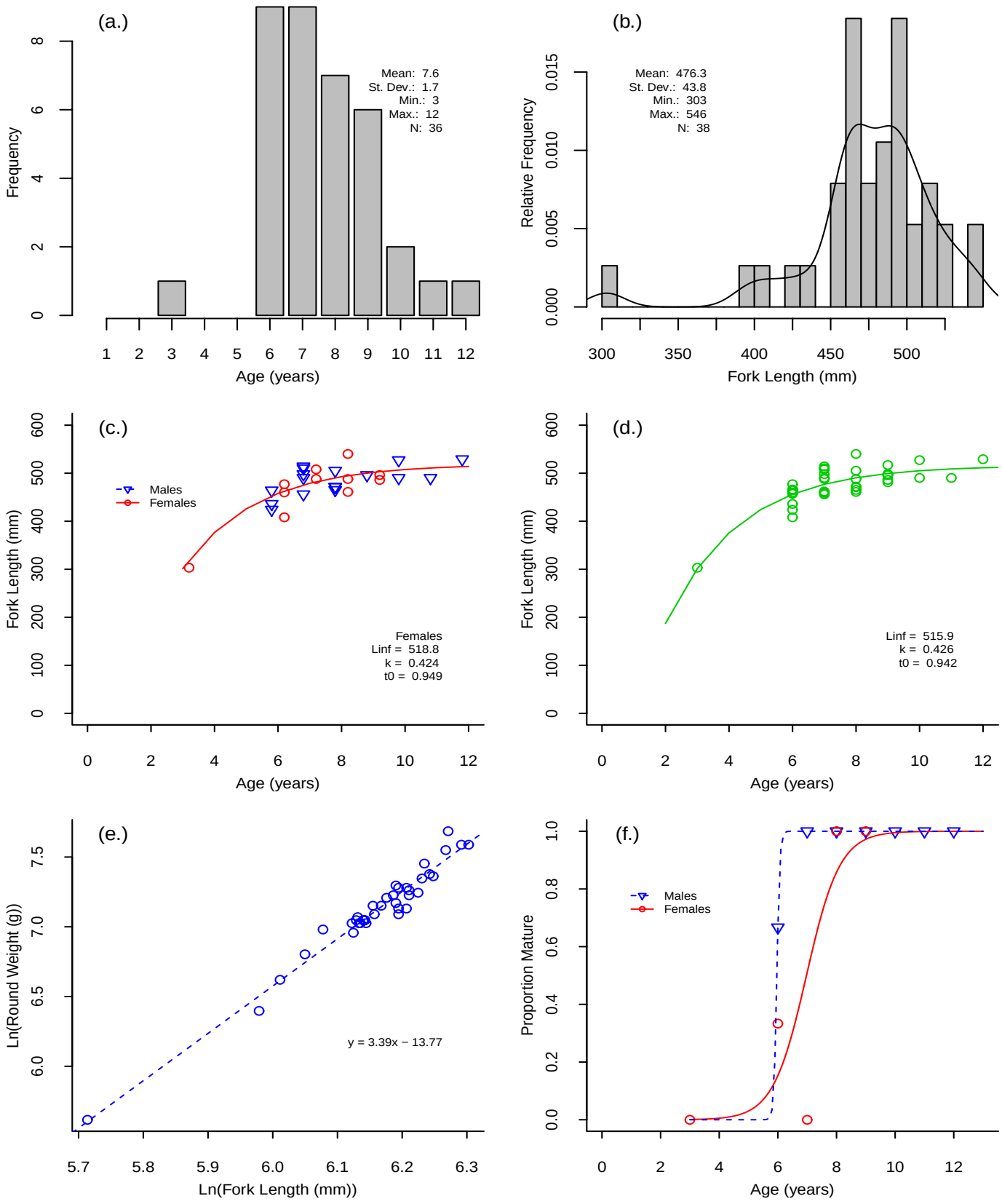

Figure 7. Lake whitefish age distribution (a), fork length distribution (b), fork length-at-age (by sex (c) and all fish combined (d)), weight-at length (e), and maturity-at-age (f) from the Southampton project (LHA_IA11_005), June 2011.

Central Lake Huron (Southampton) - Fall **[LHA_IA11_005]**

This project was conducted in the central main basin near Southampton between August 31 and September 16 (Table 9). The depth of the nets ranged between 16.1 m and 42.6 m. Six of the 15 nets fished for more than one night due to inclement weather creating unsafe work conditions. Algal fouling appeared to have an obvious affect on catch in one net. Lake whitefish and yellow perch were targeted. The position of each net is shown in Figure 8.

Fifteen fish species were caught during this project (Table 10). The most common species were yellow perch (65.2 % of the catch), alewife (6.9 %), and chub (5.1 %). Plots of the biological attributes of the lake whitefish (Figure 9), chub (Figure 10), and yellow perch (Figure 11) captured during this project were constructed.

Average CPUE for this project was 33.6 fish/night. Yellow perch had the highest mean CPUE (157.7), followed by alewife (14.3), and Chinook salmon (5.7). All of the alewife caught were confined to the two smallest mesh sizes; 32 mm and 38 mm.

Table 9. Set information for the fishing gear deployed in the fall in the central main basin near Southampton during the 2011 offshore index program.

Sample Number	Set Date	Latitude	Longitude	Gear Code	Effort Duration (hrs)	Average Depth (m)
551	31-Aug-11	44° 40.92'	-81° 22.07'	GL32	23.85	27.4
552	31-Aug-11	44° 40.37'	-81° 21.75'	GL32	23.08	27.1
553	31-Aug-11	44° 40.40'	-81° 20.35'	GL21	22.28	21.6
554	01-Sep-11	44° 41.80'	-81° 19.58'	GL32	22.03	16.5
555	01-Sep-11	44° 41.10'	-81° 19.73'	GL32	22.28	16.1
556	01-Sep-11	44° 40.35'	-81° 19.36'	GL21	22.65	17.4
557	06-Sep-11	44° 35.94'	-81° 21.77'	GL32	25.00	25.4
558	06-Sep-11	44° 35.11'	-81° 21.84'	GL32	24.21	24.7
559	06-Sep-11	44° 35.07'	-81° 22.74'	GL21	23.60	29.5
560	07-Sep-11	44° 35.96'	-81° 26.17'	GL32	45.85	42.6
561	07-Sep-11	44° 35.25'	-81° 26.03'	GL32	45.18	42.3
562	07-Sep-11	44° 34.95'	-81° 25.33'	GL21	44.48	38.7
563	12-Sep-11	44° 39.88'	-81° 24.97'	GL32	96.26	36.5
564	12-Sep-11	44° 39.31'	-81° 24.46'	GL32	95.95	35.6
565	12-Sep-11	44° 37.96'	-81° 25.13'	GL21	95.61	33.5

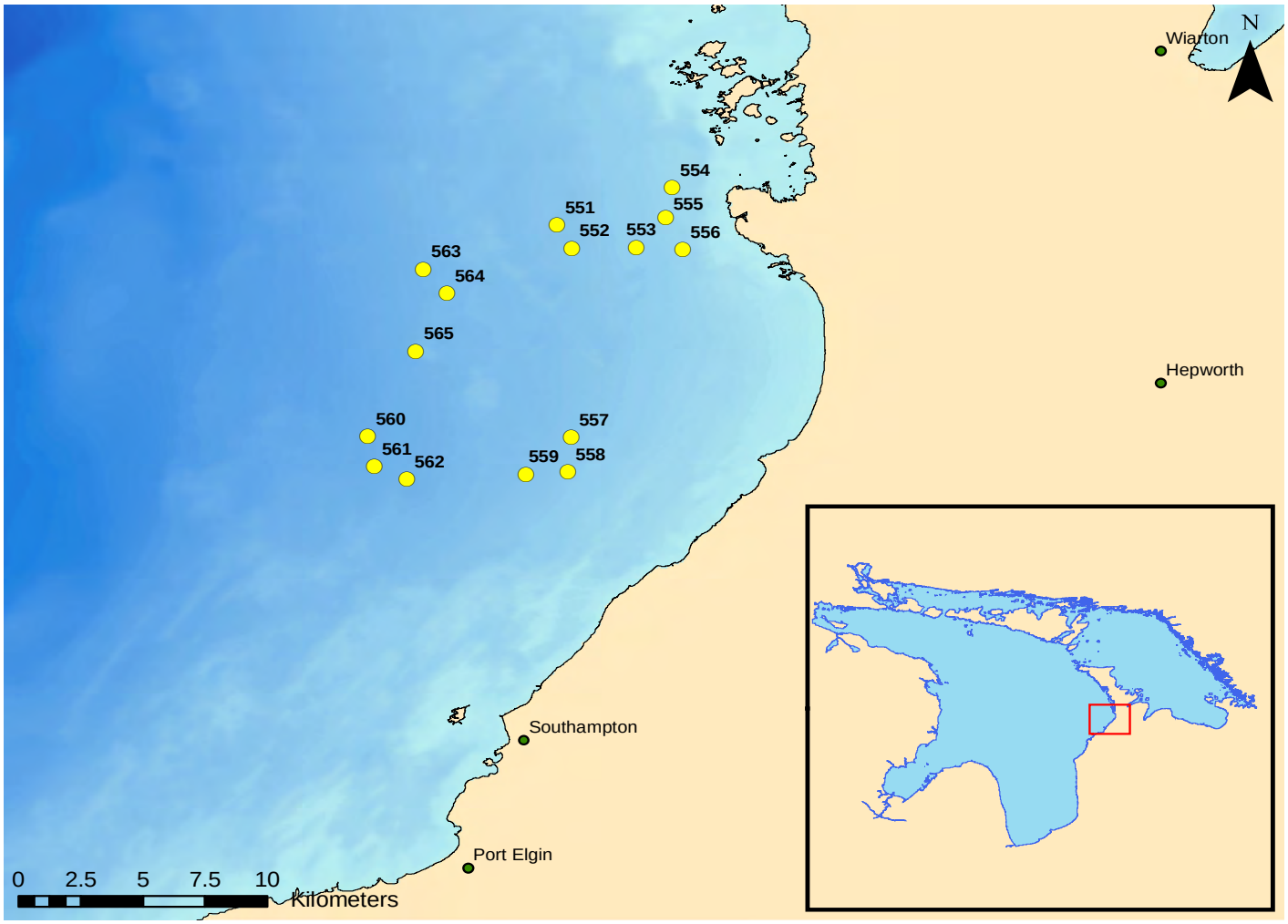

Figure 8. Offshore index sampling locations in the central main basin near Southampton during 2011 (project code LHA_IA11_005) during the fall (September). Lake whitefish and yellow perch were targeted.

Table 10. Count of the number of fish by species caught in each mesh size of the gill nets set in the central main basin near Southampton in the fall during the 2011 offshore index program. Catch per unit effort (CPUE) is the mean number of fish caught per net each night.

	Mesh Size (mm)												
Species	**032**	**038**	**051**	**064**	**076**	**089**	**102**	**114**	**127**	**140**	**153**	**Total**	**CPUE**
Alewife	5	38										43	14.33
Burbot				1	6	5	1	2	1			16	1.70
Chinook Salmon	1	2	9	1	2	1	1					17	5.67
Chub	32	5										37	3.63
Cisco	1		15									16	5.33
Lake Chub	2	1										3	3.00
Lake Trout				1	4	2	1	6	4		1	19	1.22
Lake Whitefish		1		1	2	2	5	12	13			36	1.94
Longnose Sucker					1	1	2	2				6	0.70
Rainbow Smelt		3	14	3	4	2	6	2	1			35	5.15
Round Goby	8											8	1.43
Round Whitefish		1	2	3	5	2						13	1.71
Smallmouth Bass				1								1	1.00
White Sucker			1	1								2	2.00
Yellow Perch	307	93	58	14	1							473	157.67
Total	356	144	99	26	25	15	16	24	19	0	1	725	

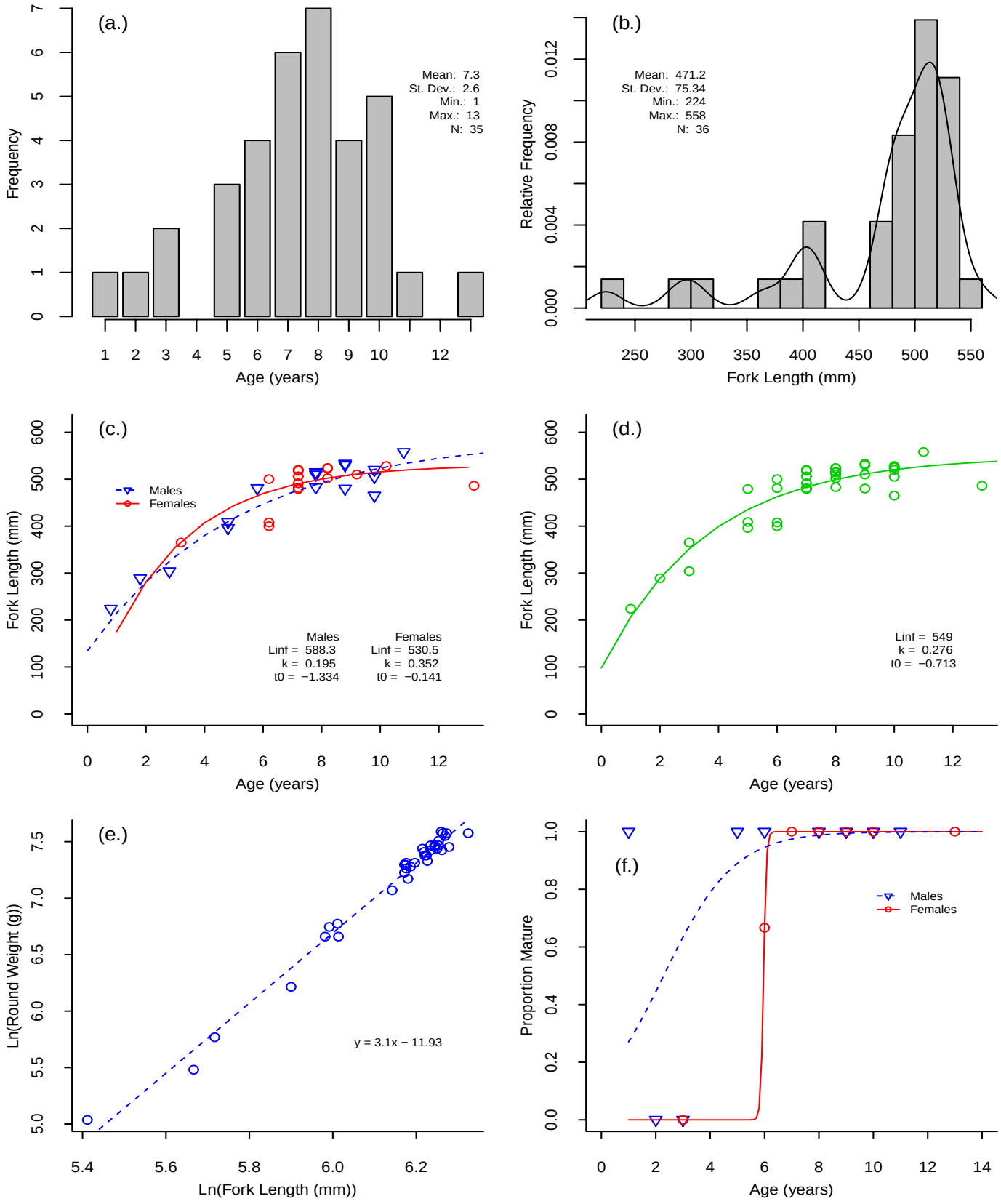

Figure 9. Lake whitefish age distribution (a), fork length distribution (b), fork length-at-age (by sex (c) and all fish combined (d)), weight-at length (e), and maturity-at-age (f) from the Southampton project (LHA_IA11_005), September 2011.

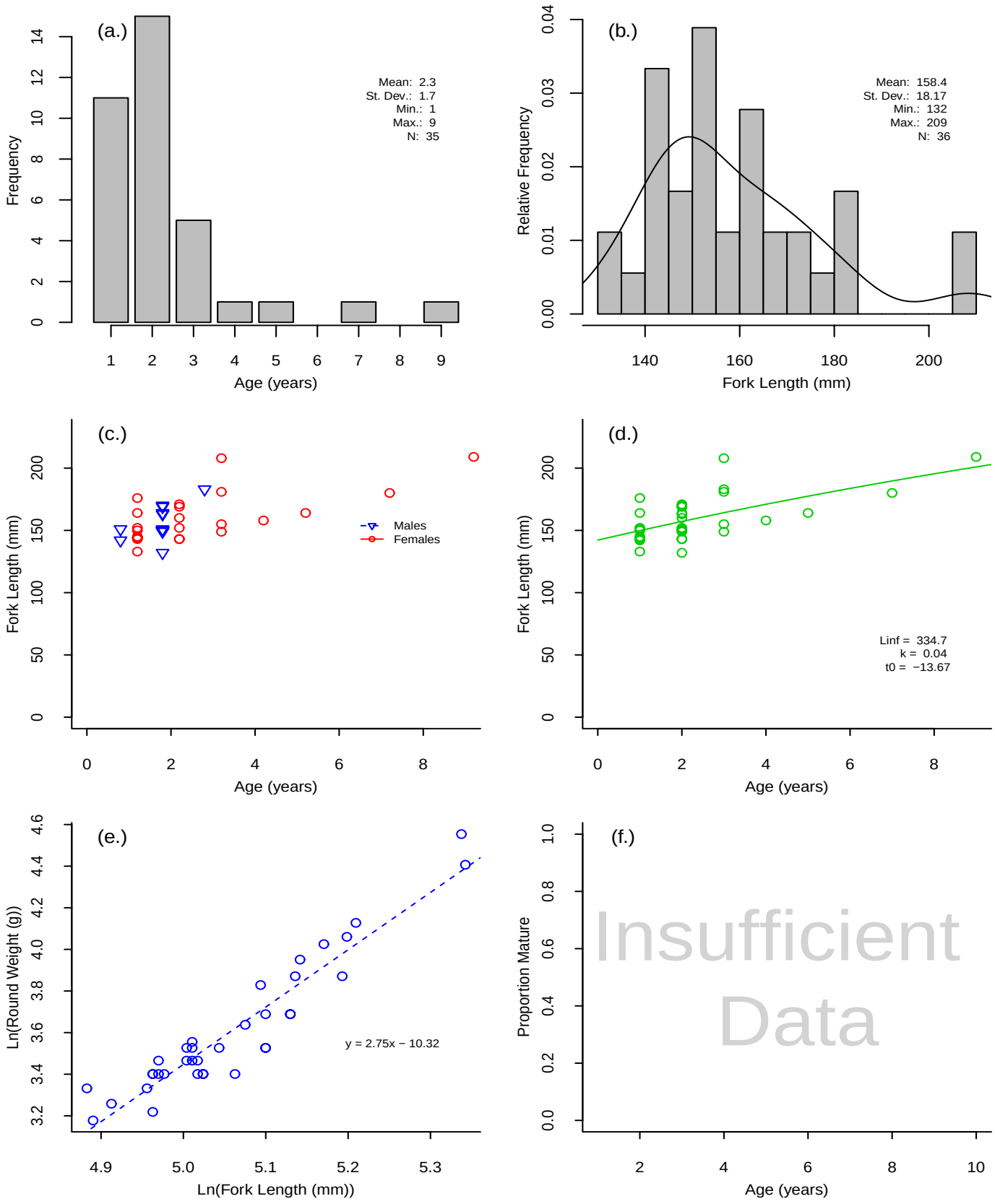

Figure 10. Chub age distribution (a), fork length distribution (b), fork length-at-age (by sex (c) and all fish combined (d)), weight-at length (e), and maturity-at-age (f) from the Southampton project (LHA_IA11_005), September 2011.

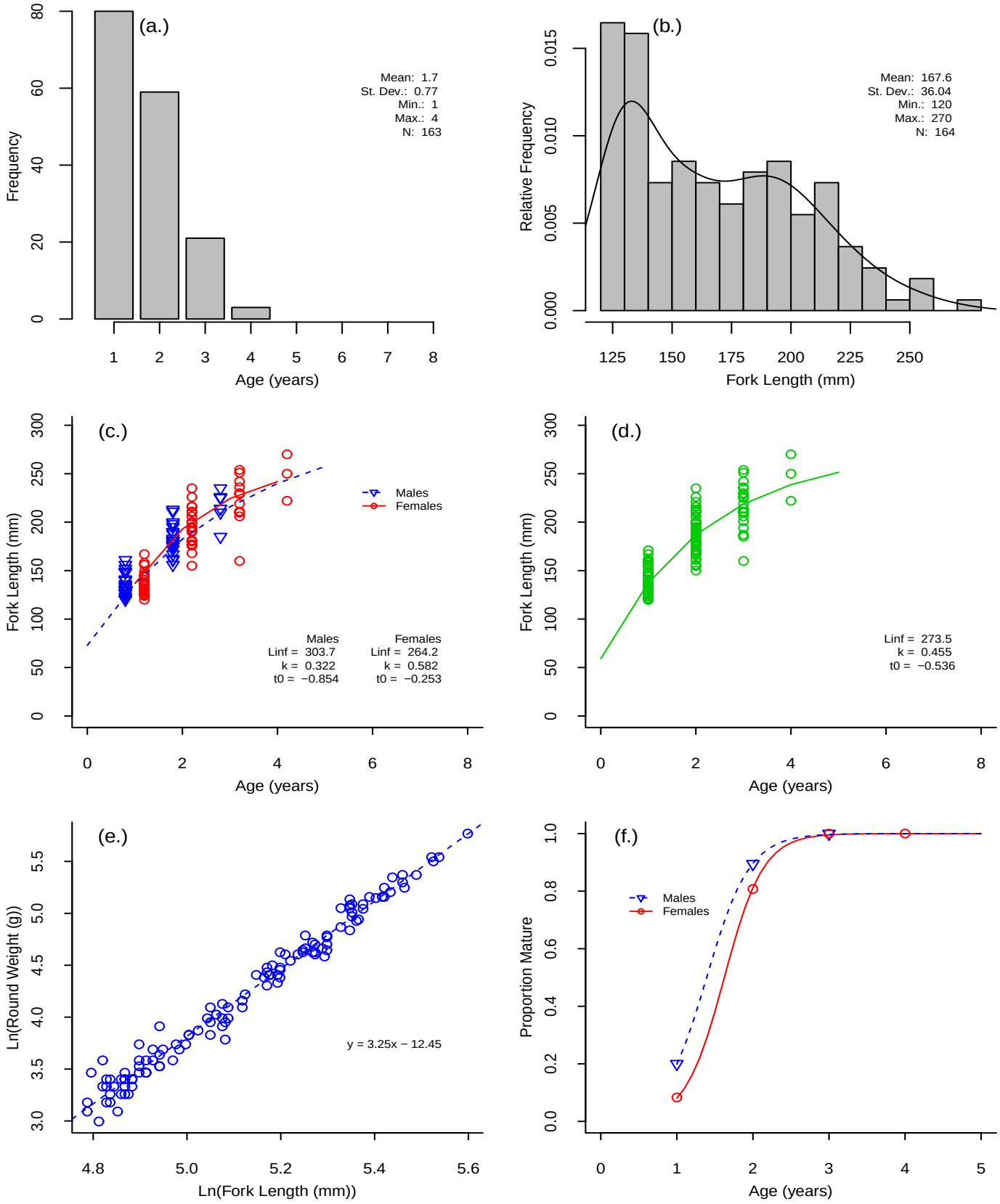

Figure 11. Yellow perch age distribution (a), fork length distribution (b), fork length-at-age (by sex (c) and all fish combined (d)), weight-at length (e), and maturity-at-age (f) from the Southampton project (LHA_IA11_005), September 2011.

Southern Lake Huron (Grand Bend) - Spring **[LHA_IA11_006]**

This project was conducted in the southern main basin near Grand Bend between June 18 and June 30 (Table 11). The depth of the nets ranged between 12.5 m and 50.7 m. Three of the 24 nets fished for more than one night due to inclement weather creating unsafe work conditions. Algal fouling did not have any obvious impact on catch. Lake whitefish, chub, and yellow perch were sought. The position of each net is shown in Figure 12.

Thirteen fish species were caught during this project (Table 12). The most common species were yellow perch (86.5 % of the catch), chub (6.1 %), and lake whitefish (4.0 %). Plots of the biological attributes of the lake whitefish (Figure 13), chub (Figure 14), and yellow perch (Figure 15) captured during this project were constructed.

Average CPUE for this project was 143.4 fish/night. Yellow perch had the highest mean CPUE (398.8), followed by chub (21.0), and lake whitefish (8.5). Over 95 % of the chub were caught in the 32 mm mesh.

Table 11. Set information for the fishing gear deployed in the spring in the southern main basin near Grand Bend during the 2011 offshore index program.

Sample Number	Set Date	Latitude	Longitude	Gear Code	Effort Duration (hrs)	Average Depth (m)
601	18-Jun-11	43° 36.53'	-81° 51.76'	GL32	19.33	32.1
602	18-Jun-11	43° 37.21'	-81° 52.06'	GL32	19.20	32.5
603	18-Jun-11	43° 37.26'	-81° 52.83'	GL21	18.76	41.0
604	19-Jun-11	43° 32.99'	-81° 55.82'	GL32	22.41	50.7
605	19-Jun-11	43° 32.45'	-81° 55.52'	GL32	21.36	49.3
606	19-Jun-11	43° 32.36'	-81° 54.63'	GL21	22.75	41.4
607	20-Jun-11	43° 21.54'	-82° 00.47'	GL32	20.20	34.7
608	20-Jun-11	43° 20.96'	-82° 01.05'	GL32	20.83	34.4
609	20-Jun-11	43° 20.18'	-82° 02.02'	GL21	21.60	33.1
610	21-Jun-11	43° 18.69'	-81° 56.60'	GL32	20.33	22.6
611	21-Jun-11	43° 18.07'	-81° 56.93'	GL32	21.03	22.5
612	21-Jun-11	43° 18.62'	-81° 58.69'	GL21	22.04	27.2
613	22-Jun-11	43° 24.43'	-81° 56.28'	GL32	19.03	31.8
614	22-Jun-11	43° 25.09'	-81° 56.27'	GL32	19.33	31.8
615	22-Jun-11	43° 25.61'	-81° 57.17'	GL21	19.48	36.3
616	23-Jun-11	43° 33.35'	-81° 51.81'	GL32	21.11	29.3
617	23-Jun-11	43° 33.97'	-81° 52.04'	GL32	20.70	29.8
618	23-Jun-11	43° 34.07'	-81° 50.81'	GL21	19.71	24.4
619	27-Jun-11	43° 19.67'	-81° 51.99'	GL32	19.60	18.0
620	27-Jun-11	43° 19.32'	-81° 52.77'	GL32	19.91	18.2
621	27-Jun-11	43° 18.57'	-81° 51.82'	GL21	20.46	15.8
622	28-Jun-11	43° 33.20'	-81° 45.42'	GL32	40.91	13.6
623	28-Jun-11	43° 32.69'	-81° 45.84'	GL32	42.21	13.7
624	28-Jun-11	43° 32.19'	-81° 45.00'	GL21	44.03	12.5

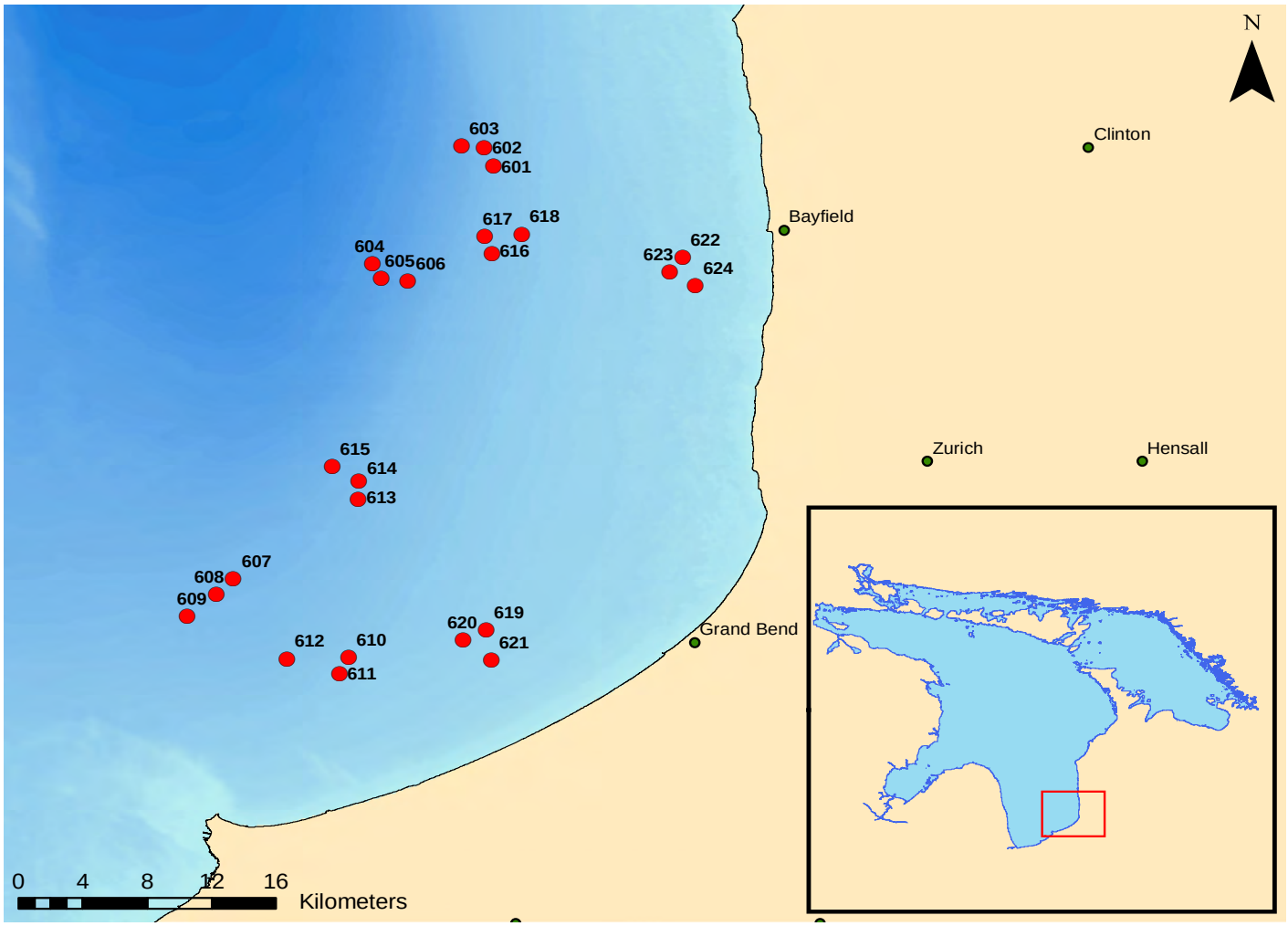

Figure 12. Offshore index sampling locations in the southern main basin near Grand Bend during 2011 (project code LHA_IA11_006) during the spring (June). Chub, lake whitefish, and yellow perch were targeted.

Table 12. Count of the number of fish by species caught in each mesh size of the gill nets set in the southern main basin near Grand Bend in the spring during the 2011 offshore index program. Catch per unit effort (CPUE) is the mean number of fish caught per net each night.

	Mesh Size (mm)												
Species	**032**	**038**	**051**	**064**	**076**	**089**	**102**	**114**	**127**	**140**	**153**	**Total**	**CPUE**
Chub	213	7	2									222	1.00
Cisco		1										1	20.67
Lake Trout		2			1	2	3	3	2		1	14	1.56
Lake Whitefish		9	23	12	15	25	34	21	6			145	8.47
Longnose Sucker					1	8	4	1				14	2.26
Rainbow Smelt	9		2		1		1					13	1.63
Round Goby	3											3	2.14
Smallmouth Bass				1								1	0.71
Stonecat	1											1	1.00
Walleye				1		4	8	2				15	2.42
White Bass				1								1	0.71
White Sucker				6	7	18	20	6				57	7.92
Yellow Perch	1436	931	623	105	27	4	1					3127	398.75
Total	1662	950	650	126	52	61	71	33	8	0	1	3614	

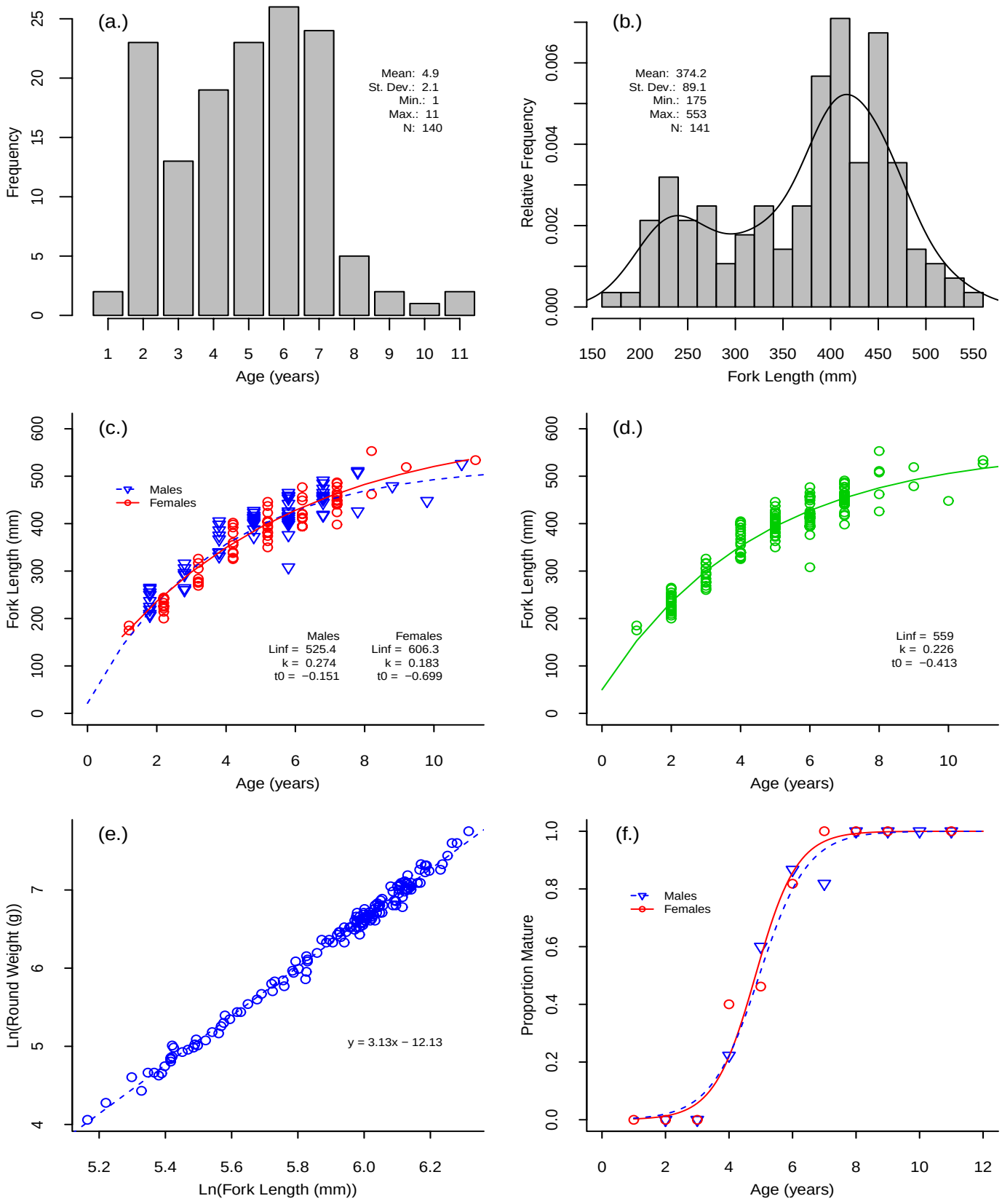

Figure 13. Lake whitefish age distribution (a), fork length distribution (b), fork length-at-age (by sex (c) and all fish combined (d)), weight-at length (e), and maturity-at-age (f) from the Grand Bend project (LHA_IA11_006), June 2011.

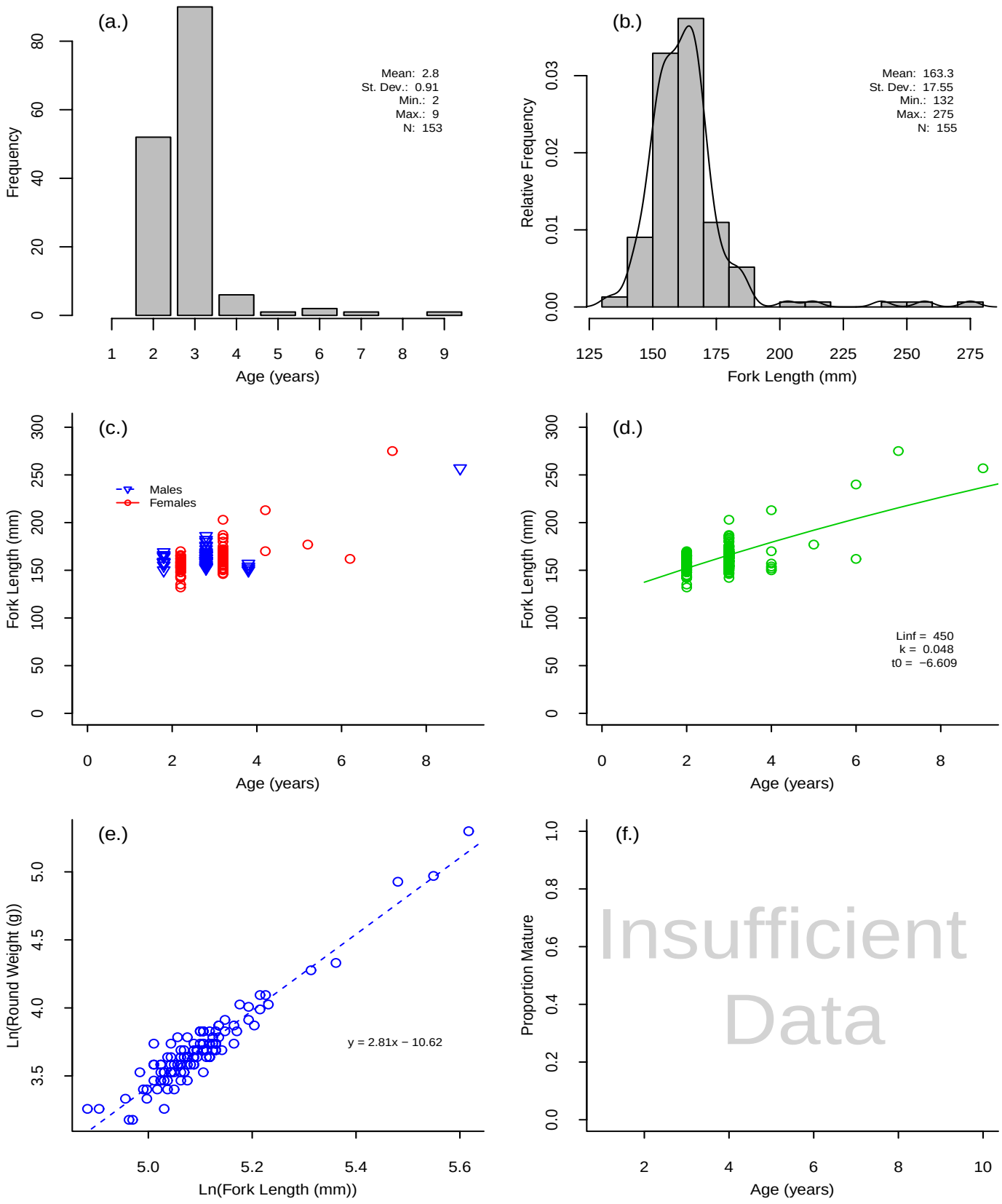

Figure 14. Chub age distribution (a), fork length distribution (b), fork length-at-age (by sex (c) and all fish combined (d)), weight-at length (e), and maturity-at-age (f) from the Grand Bend project (LHA_IA11_006), June 2011.

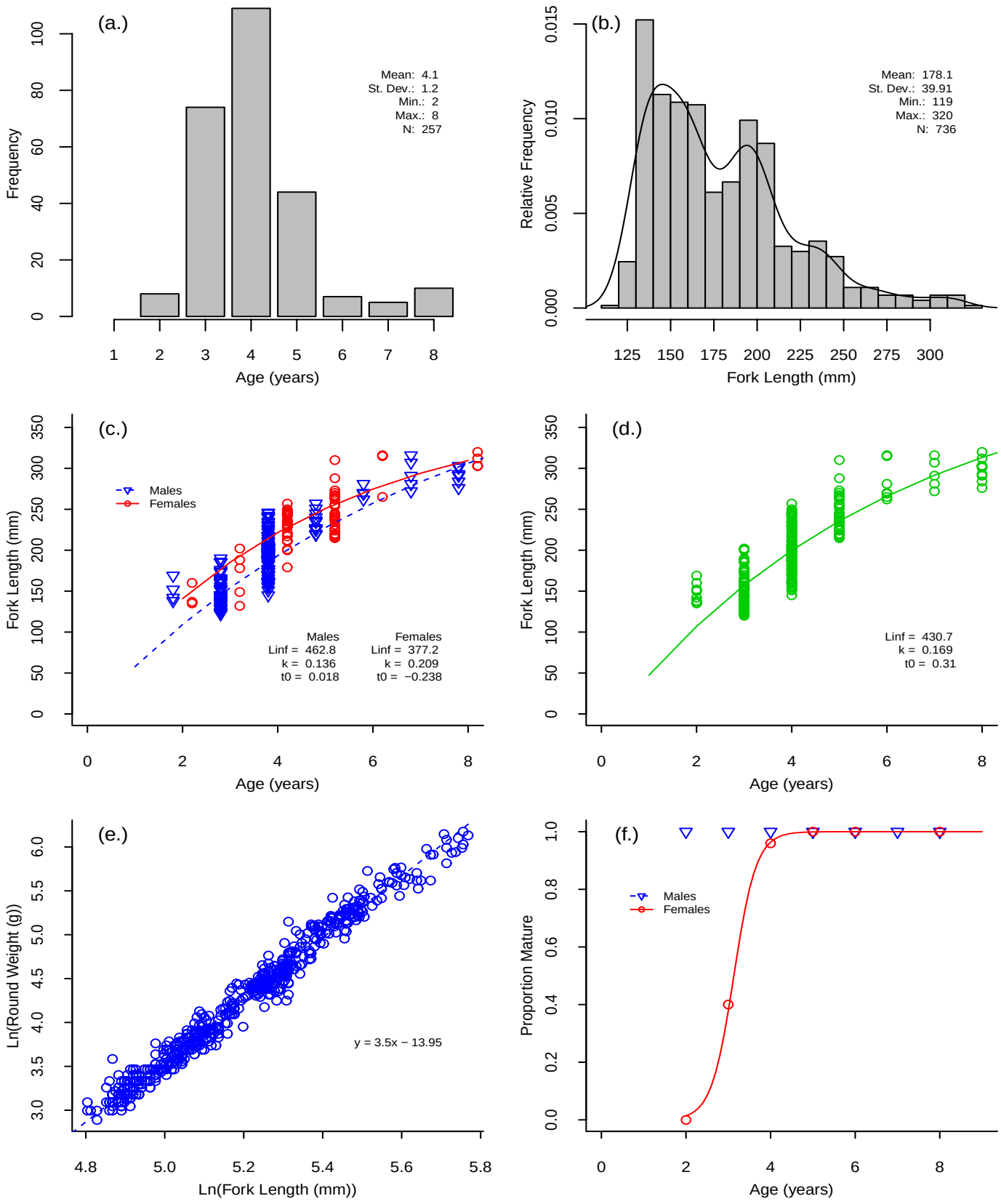

Figure 15. Yellow perch age distribution (a), fork length distribution (b), fork length-at-age (by sex (c) and all fish combined (d)), weight-at length (e), and maturity-at-age (f) from the Grand Bend project (LHA_IA11_006), June 2011.

Southern Lake Huron (Grand Bend) - Fall **[LHA_IA11_006]**

This project was conducted in the southern main basin near Grand Bend between September 21 and October 06 (Table 13). The depth of the nets ranged between 9.4 m and 40.2 m. All 21 net sets were approximately 24 hours in duration. Algal fouling did not have any obvious impact on catch. Lake whitefish and yellow perch were targeted. The position of each net is shown in Figure 16.

Seventeen fish species were caught during this project (Table 14). The most common species were yellow perch (51.1 % of the catch), chub (22.9 %) and lake whitefish (9.4 %). Plots of the biological attributes of the lake trout (Figure 17), lake whitefish (Figure 18), chub (Figure 19), and yellow perch (Figure 20) captured during this project were constructed.

Average CPUE for this project was 127.1 fish/night. Yellow perch had the highest mean CPUE (128.0), followed by chub (50.9), and lake whitefish (18.7). Lake whitefish were caught in every mesh size except the largest (153 mm).

Table 13. Set information for the fishing gear deployed in the fall in the southern main basin near Grand Bend during the 2011 offshore index program.

Sample Number	Set Date	Latitude	Longitude	Gear Code	Effort Duration (hrs)	Average Depth (m)
651	21-Sep-11	43° 37.80'	-81° 52.76'	GL32	23.00	37.5
652	21-Sep-11	43° 37.18'	-81° 52.86'	GL32	23.56	40.2
653	21-Sep-11	43° 37.08'	-81° 52.27'	GL21	23.83	33.5
654	22-Sep-11	43° 35.64'	-81° 48.62'	GL32	20.03	19.5
655	22-Sep-11	43° 35.05'	-81° 48.19'	GL32	19.29	18.9
656	22-Sep-11	43° 35.68'	-81° 50.82'	GL21	21.68	24.0
657	26-Sep-11	43° 19.43'	-81° 52.31'	GL32	20.83	17.1
658	26-Sep-11	43° 19.07'	-81° 53.05'	GL32	20.68	17.9
659	26-Sep-11	43° 18.42'	-81° 52.00'	GL21	20.05	15.5
660	27-Sep-11	43° 19.28'	-81° 58.20'	GL32	22.51	27.0
661	27-Sep-11	43° 18.58'	-81° 58.51'	GL32	22.20	26.5
662	27-Sep-11	43° 17.85'	-81° 57.41'	GL21	21.87	22.8
663	28-Sep-11	43° 24.25'	-81° 56.20'	GL32	20.68	31.1
664	28-Sep-11	43° 23.55'	-81° 56.79'	GL32	21.35	30.7
665	28-Sep-11	43° 22.67'	-81° 55.08'	GL21	22.08	26.3
666	04-Oct-11	43° 33.22'	-81° 52.15'	GL32	20.75	30.2
667	04-Oct-11	43° 34.07'	-81° 52.24'	GL32	21.10	30.2
668	04-Oct-11	43° 33.89'	-81° 51.15'	GL21	22.41	25.0
669	05-Oct-11	43° 32.53'	-81° 44.64'	GL32	20.90	12.3
670	05-Oct-11	43° 33.17'	-81° 44.96'	GL32	21.01	12.0
671	05-Oct-11	43° 33.25'	-81° 43.34'	GL21	21.20	9.4

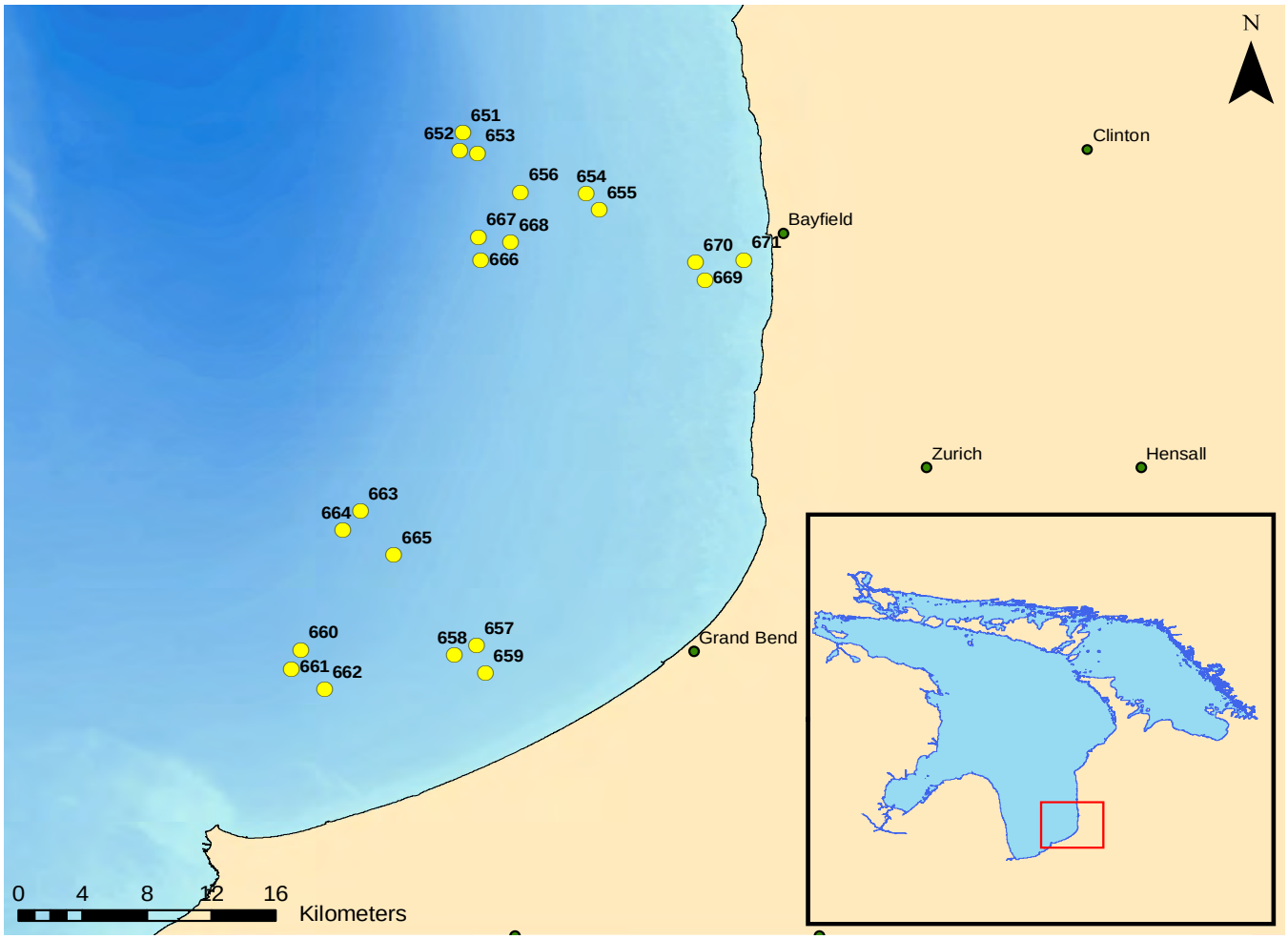

Figure 16. Offshore index sampling locations in the southern main basin near Grand Bend during 2011 (project code LHA_IA11_006) during the fall (September). Lake whitefish and yellow perch were targeted.

Table 14. Count of the number of fish by species caught in each mesh size of the gill nets set in the southern main basin near Grand Bend in the fall during the 2011 offshore index program. Catch per unit effort (CPUE) is the mean number of fish caught per net each night.

	Mesh Size (mm)												
Species	**032**	**038**	**051**	**064**	**076**	**089**	**102**	**114**	**127**	**140**	**153**	**Total**	**CPUE**
Burbot					3							3	1.00
Channel Catfish									1			1	1.00
Chinook Salmon			6	10	2				1			19	3.17
Chub	525	76	6	4								611	50.92
Cisco	3	1	3	1		1						9	1.80
Gizzard Shad	1				6	27	8	13	16	3	3	77	15.40
Lake Trout		1	2	1	5	2	2	3	5		2	23	2.30
Lake Whitefish	2	3	117	93	9	13	6	6	2	1		252	18.67
Longnose Sucker		2	9	6	8	9	1	4				39	6.50
Rainbow Smelt	5	9	6	23	16	11	10	3	2	1		86	8.60
Redhorse Suckers			1									1	1.00
Round Goby	32	7										39	6.50
Walleye			1			1	1		2			5	1.25
White Bass		1	3									4	1.00
White Perch	4	11	2	1	1							19	4.75
White Sucker	3	1	12	34	22	28	8	8	1			117	11.70
Yellow Perch	546	435	204	115	43	18	2	2				1365	128.00
Total	1121	547	372	288	115	110	38	39	30	5	5	2670	

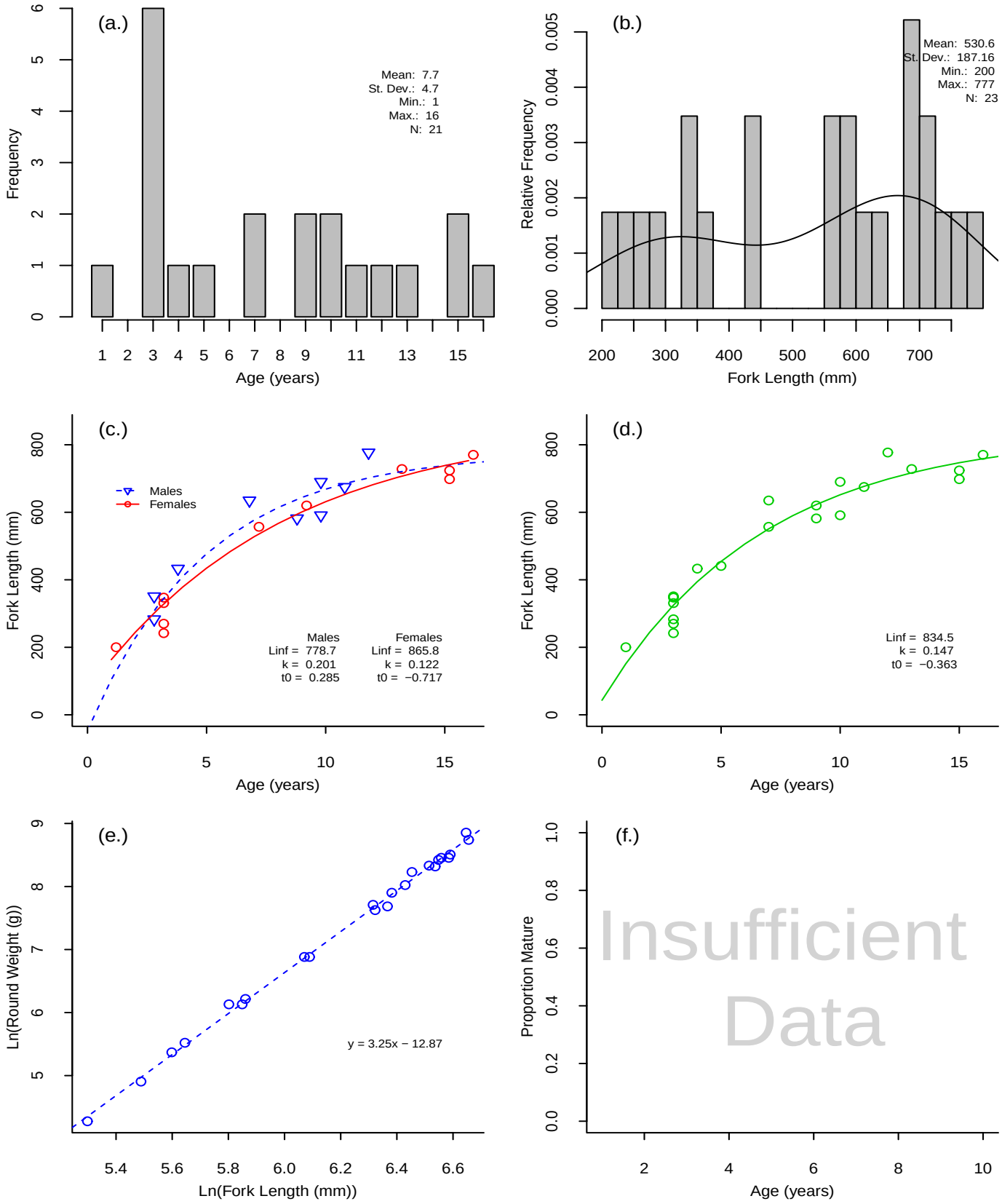

Figure 17. Lake trout age distribution (a), fork length distribution (b), fork length-at-age (by sex (c) and all fish combined (d)), weight-at length (e), and maturity-at-age (f) from the Grand Bend project (LHA_IA11_006), September 2011.

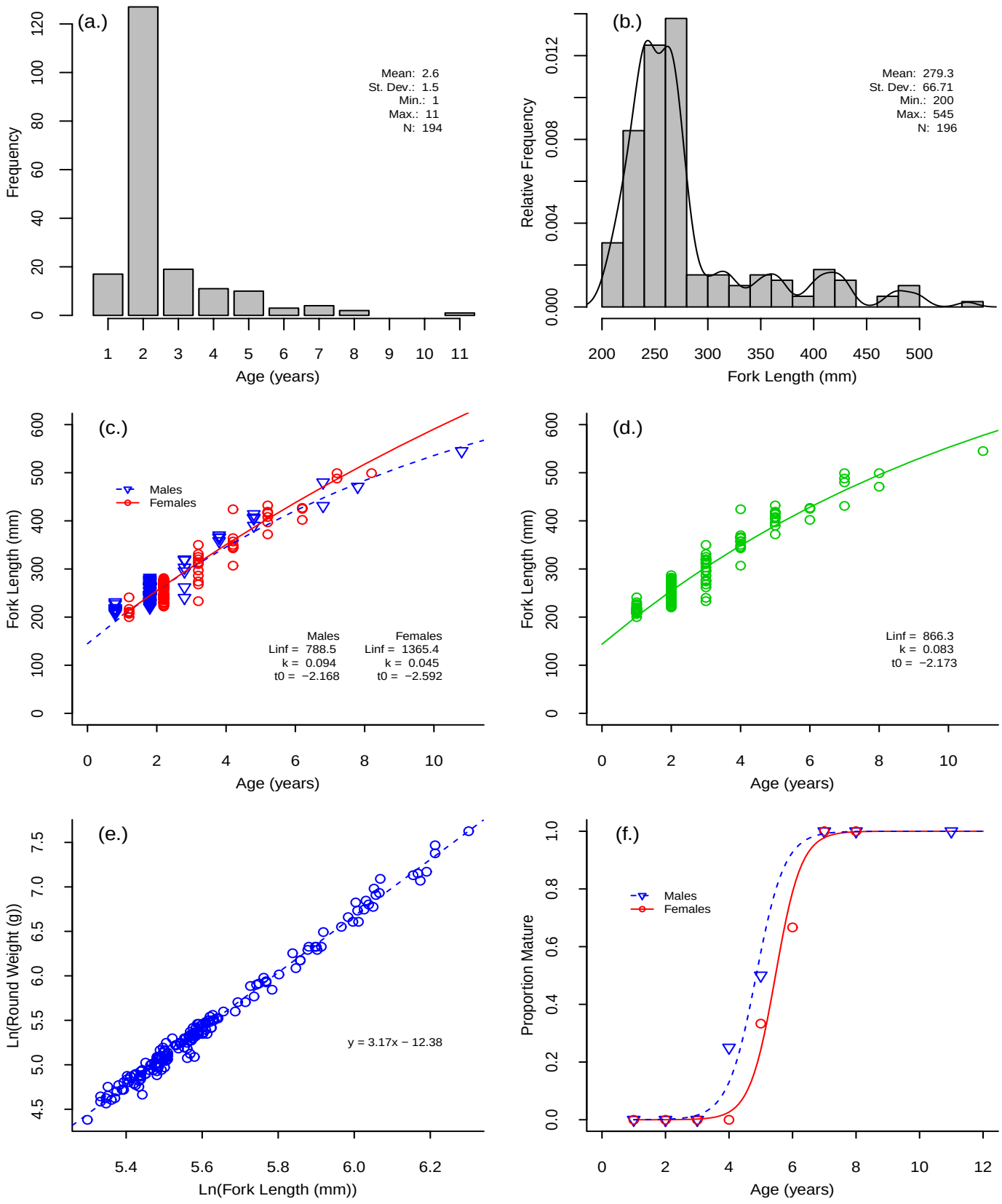

Figure 18. Lake whitefish age distribution (a), fork length distribution (b), fork length-at-age (by sex (c) and all fish combined (d)), weight-at length (e), and maturity-at-age (f) from the Grand Bend project (LHA_IA11_006), September 2011.

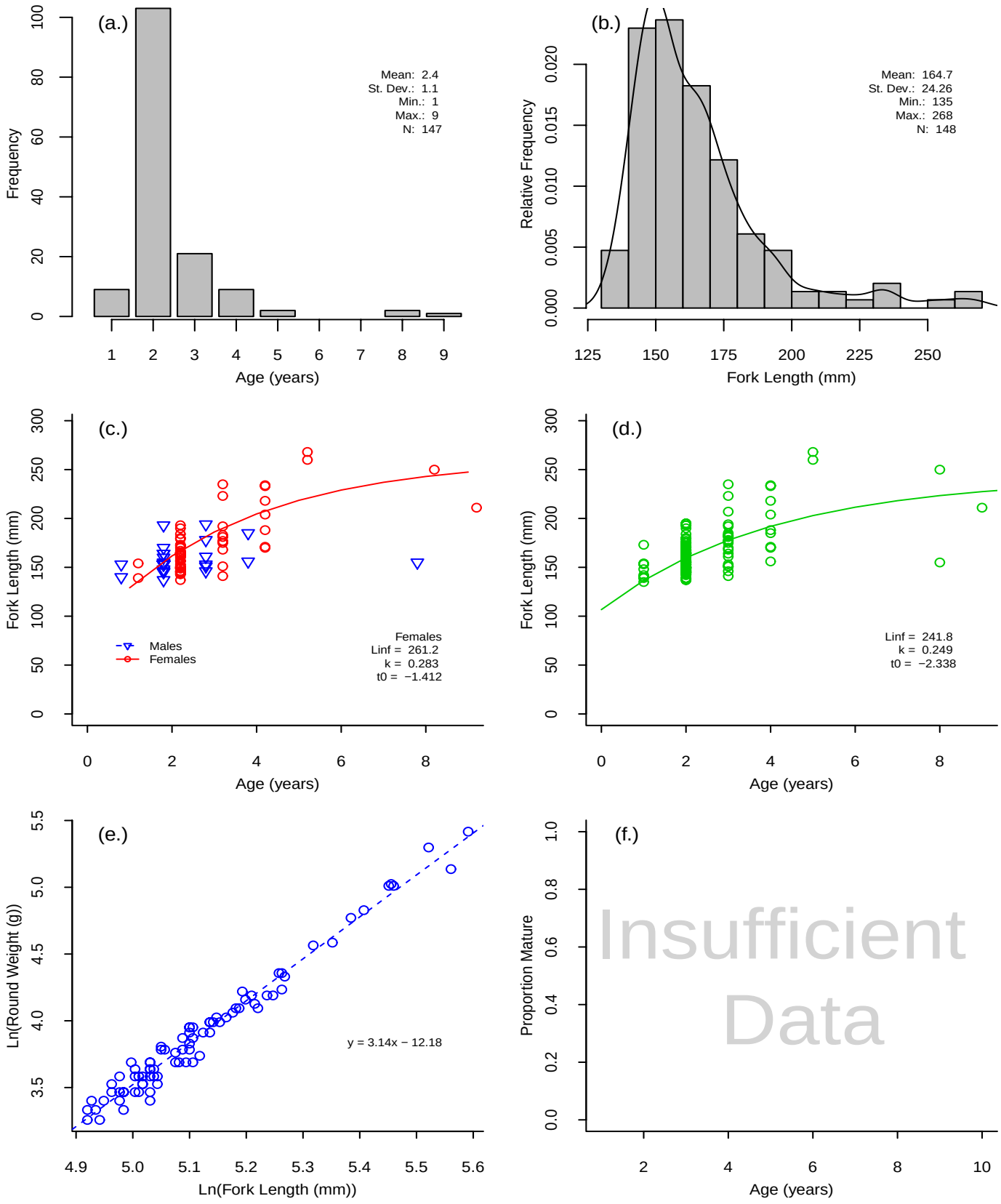

Figure 19. Chub age distribution (a), fork length distribution (b), fork length-at-age (by sex (c) and all fish combined (d)), weight-at length (e), and maturity-at-age (f) from the Grand Bend project (LHA_IA11_006), September 2011.

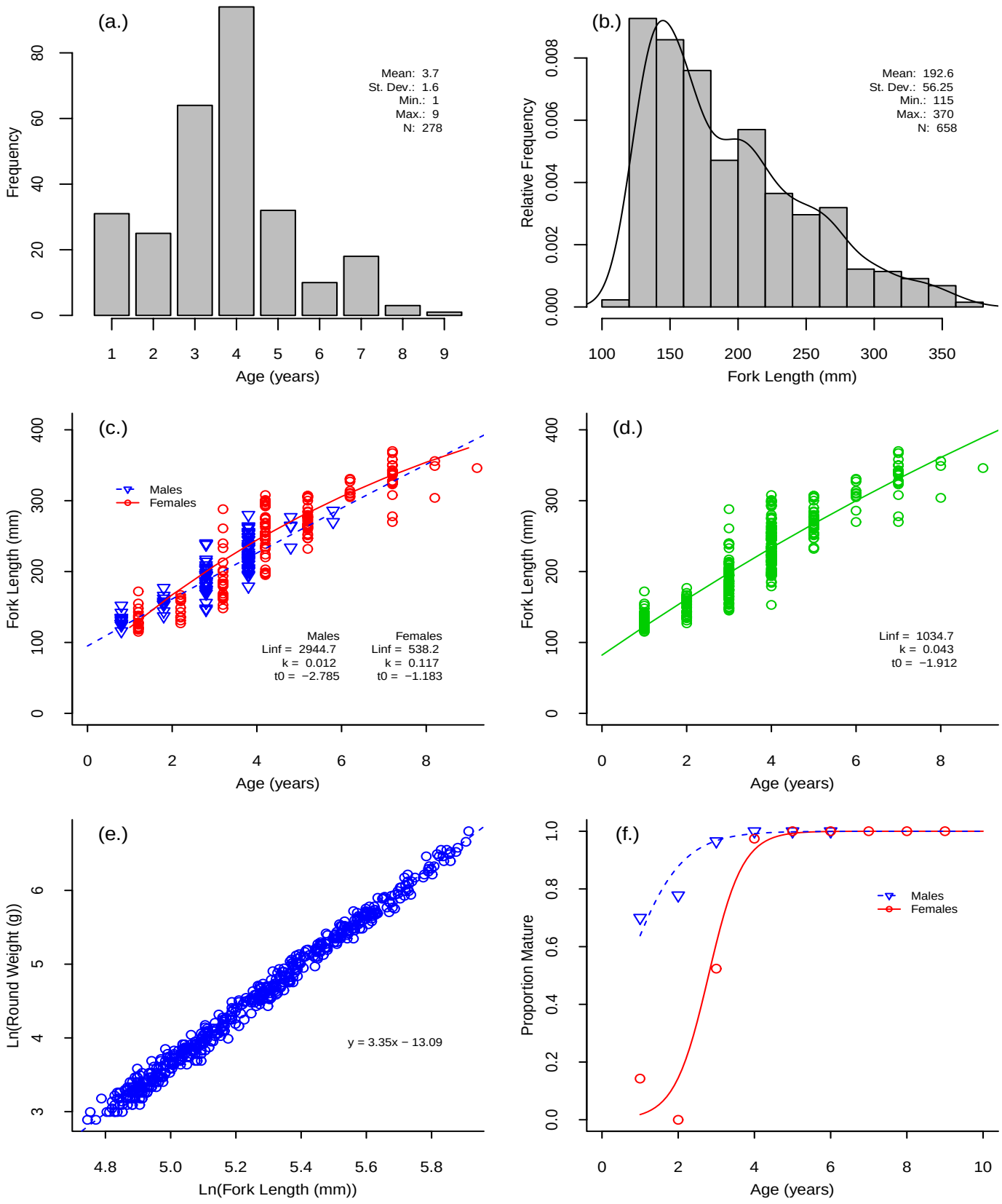

Figure 20. Yellow perch age distribution (a), fork length distribution (b), fork length-at-age (by sex (c) and all fish combined (d)), weight-at length (e), and maturity-at-age (f) from the Grand Bend project (LHA_IA11_006), September 2011.

North Channel (Clapperton Island) **[LHA_IA11_007]**

This project was conducted in the north channel near Clapperton Island between July 07 and July 14 (Table 15). The depth of the nets ranged between 9.1 m and 41.2 m. All 21 net sets were approximately 24 hours in duration. Algal fouling did not have any obvious impact on catch. Lake trout and yellow perch were targeted. The position of each net is shown in Figure 21.

Seventeen fish species were caught during this project (Table 16). The most common species were yellow perch (59.0 % of the catch), white sucker (10.4 %) and cisco (10.1 %). Plots of the biological attributes of the lake whitefish (Figure 22), cisco (Figure 23), and yellow perch (Figure 24) captured during this project were constructed.

Average CPUE for this project was 29.8 fish/night. Yellow perch had the highest mean CPUE (30.8), followed by white sucker (9.3), and cisco (5.3). Rainbow smelt were caught in every mesh size from the smallest (32 mm) to the fourth largest (114 mm).

Table 15. Set information for the fishing gear deployed in the North Channel near Clapperton Island during the 2011 offshore index program.

Sample Number	Set Date	Latitude	Longitude	Gear Code	Effort Duration (hrs)	Average Depth (m)
701	07-Jul-11	45° 56.60'	-82° 05.50'	GL32	26.96	10.5
702	07-Jul-11	45° 56.07'	-82° 05.72'	GL32	26.21	10.7
703	07-Jul-11	45° 55.82'	-82° 05.99'	GL21	25.31	13.6
704	08-Jul-11	45° 57.29'	-82° 08.70'	GL32	20.33	41.2
705	08-Jul-11	45° 59.38'	-82° 09.86'	GL32	20.53	34.7
706	08-Jul-11	45° 59.72'	-82° 07.14'	GL21	20.70	24.7
707	09-Jul-11	46° 01.76'	-82° 11.06'	GL32	21.13	13.7
708	09-Jul-11	46° 01.44'	-82° 11.21'	GL32	21.25	11.9
709	09-Jul-11	46° 00.98'	-82° 10.99'	GL21	21.38	14.1
710	10-Jul-11	46° 04.06'	-82° 05.97'	GL32	20.81	37.3
711	10-Jul-11	46° 03.19'	-82° 05.11'	GL32	21.41	40.2
712	10-Jul-11	46° 01.81'	-82° 07.96'	GL21	22.46	38.3
713	11-Jul-11	46° 04.15'	-82° 16.84'	GL32	24.43	27.3
714	11-Jul-11	46° 04.04'	-82° 13.11'	GL32	24.00	40.8
715	11-Jul-11	46° 02.82'	-82° 11.73'	GL21	23.75	37.1
716	12-Jul-11	46° 02.90'	-82° 19.01'	GL32	22.63	11.2
717	12-Jul-11	46° 02.65'	-82° 19.58'	GL32	21.95	10.3
718	12-Jul-11	46° 02.29'	-82° 21.05'	GL21	21.25	9.3
719	13-Jul-11	45° 57.44'	-82° 16.81'	GL32	19.09	11.2
720	13-Jul-11	45° 58.00'	-82° 16.83'	GL32	19.31	10.2
721	13-Jul-11	45° 58.56'	-82° 16.55'	GL21	19.48	9.1

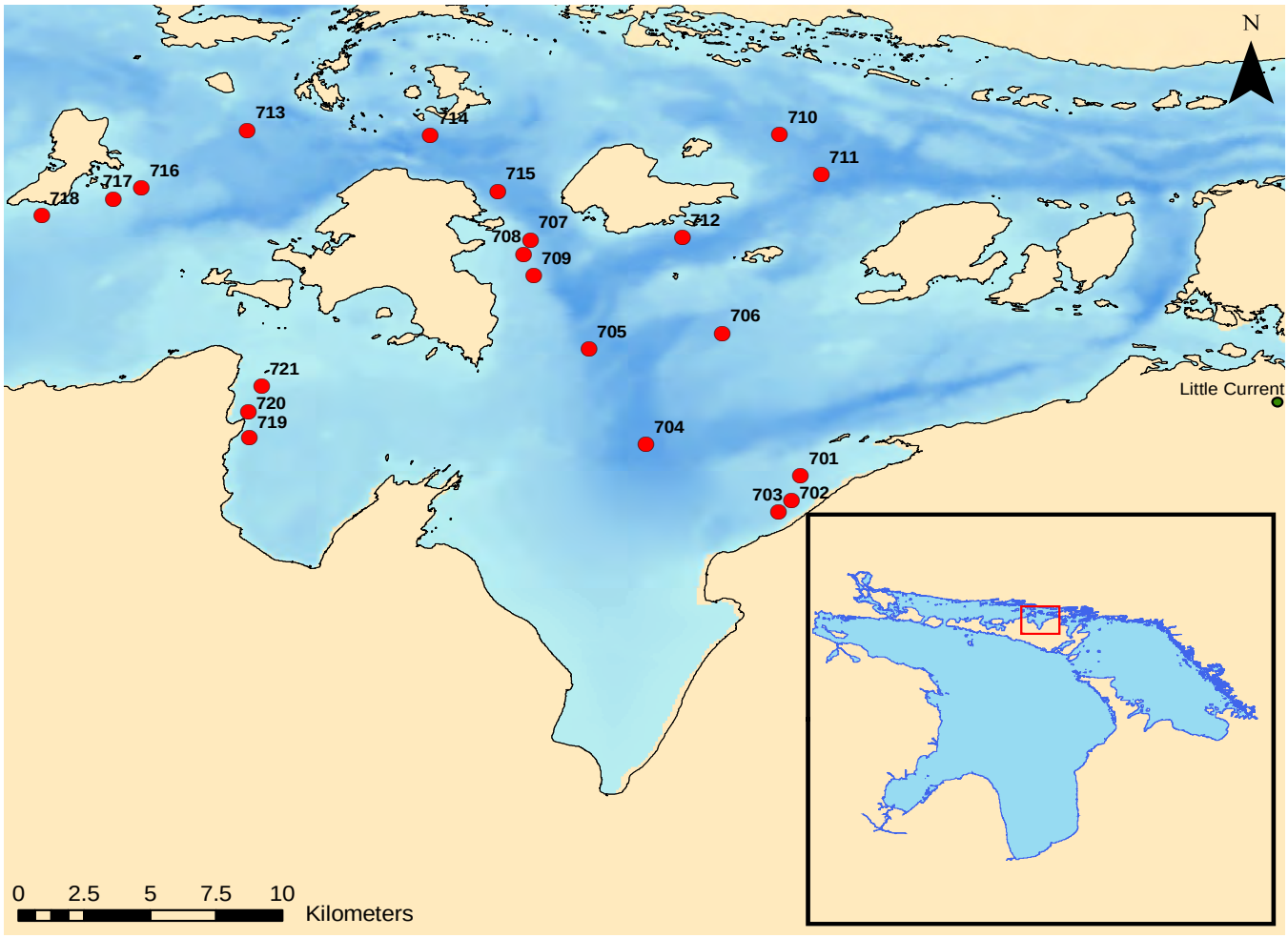

Figure 21. Offshore index sampling locations in the North Channel near Clapperton Island during 2011 (project code LHA_IA11_007). Lake trout and yellow perch were targeted.

Table 16. Count of the number of fish by species caught in each mesh size of the gill nets set in the North Channel near Clapperton Island during the 2011 offshore index program. Catch per unit effort (CPUE) is the mean number of fish caught per net each night.

	Mesh Size (mm)												
Species	**032**	**038**	**051**	**064**	**076**	**089**	**102**	**114**	**127**	**140**	**153**	**Total**	**CPUE**
Burbot				1	1		1					3	1.50
Chub		1	5									6	1.20
Cisco		4	14	25	13	2	5					63	5.25
Gizzard Shad			1									1	1.00
Lake Chub	1	1										2	2.00
Lake Sturgeon								1				1	1.00
Lake Trout						2	1					3	0.33
Lake Whitefish		1	1	2	2	4	4	3	4			21	3.50
Rainbow Smelt	8	3	16	10	8	2	3	2				52	4.00
Rainbow Trout			2	4	4	2					1	13	1.63
Rock Bass		3	1	2								6	1.50
Round Goby		1										1	1.00
Round Whitefish		4	5	4		1	1					15	1.67
Trout-perch	2											2	2.00
Walleye								2				2	2.00
White Sucker		1	3	14	10	10	12	8	6	1		65	9.29
Yellow Perch	44	112	133	77	3							369	30.75
Total	55	131	181	139	41	23	27	16	10	1	1	625	

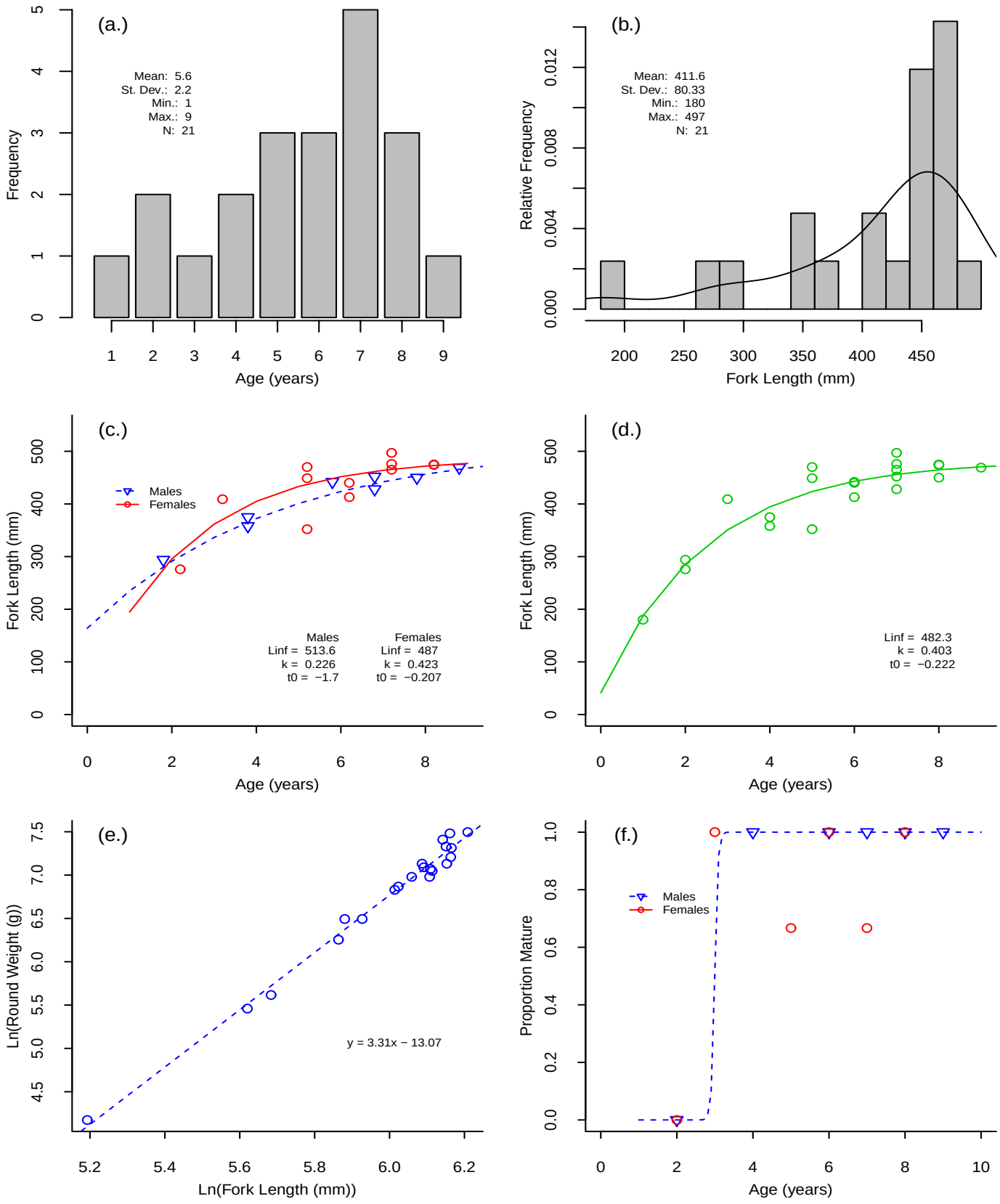

Figure 22. Lake whitefish age distribution (a), fork length distribution (b), fork length-at-age (by sex (c) and all fish combined (d)), weight-at length (e), and maturity-at-age (f) from the Clapperton Island project (LHA_IA11_007).

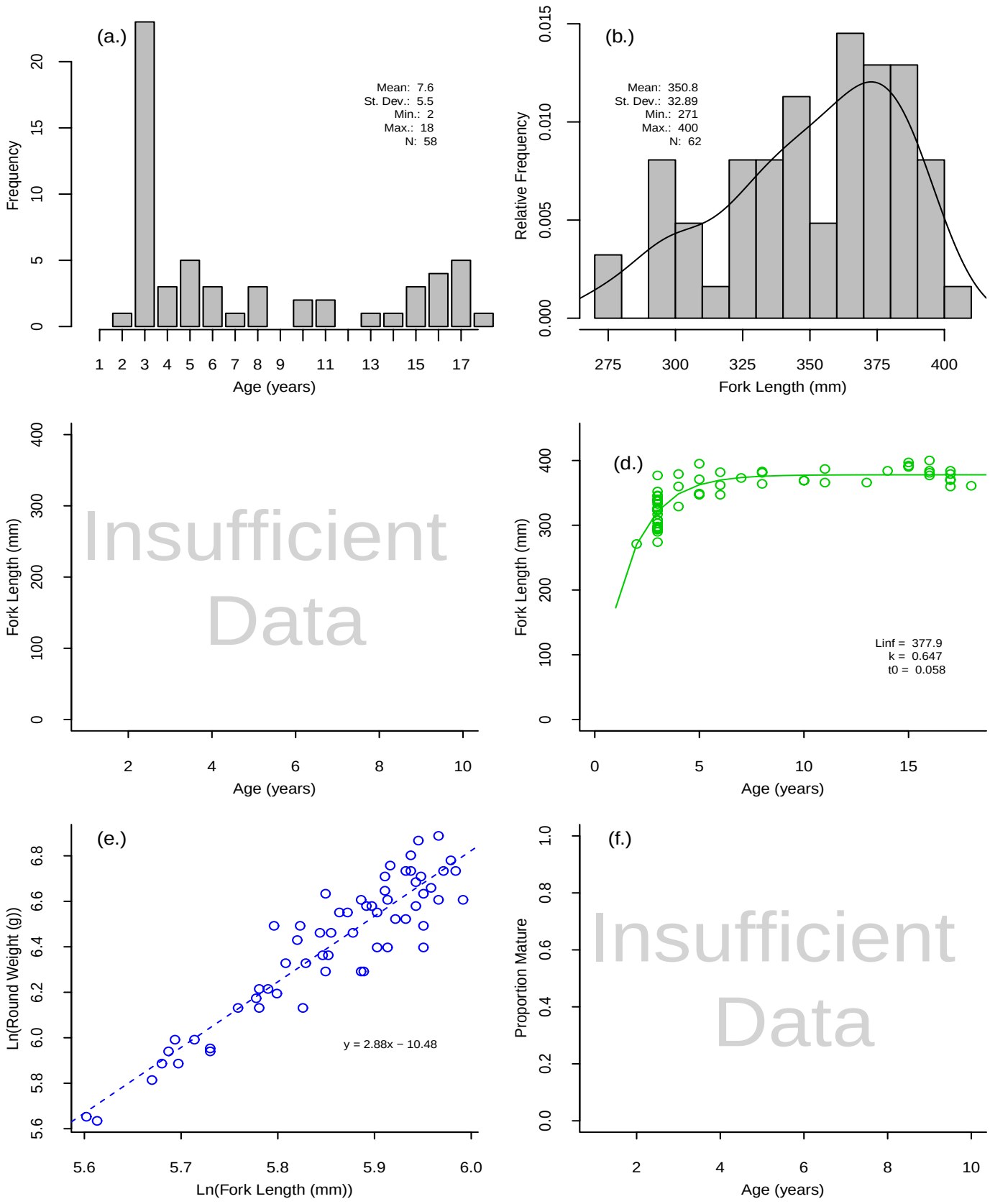

Figure 23. Cisco age distribution (a), fork length distribution (b), fork length-at-age (by sex (c) and all fish combined (d)), weight-at length (e), and maturity-at-age (f) from the Clapperton Island project (LHA_IA11_007).

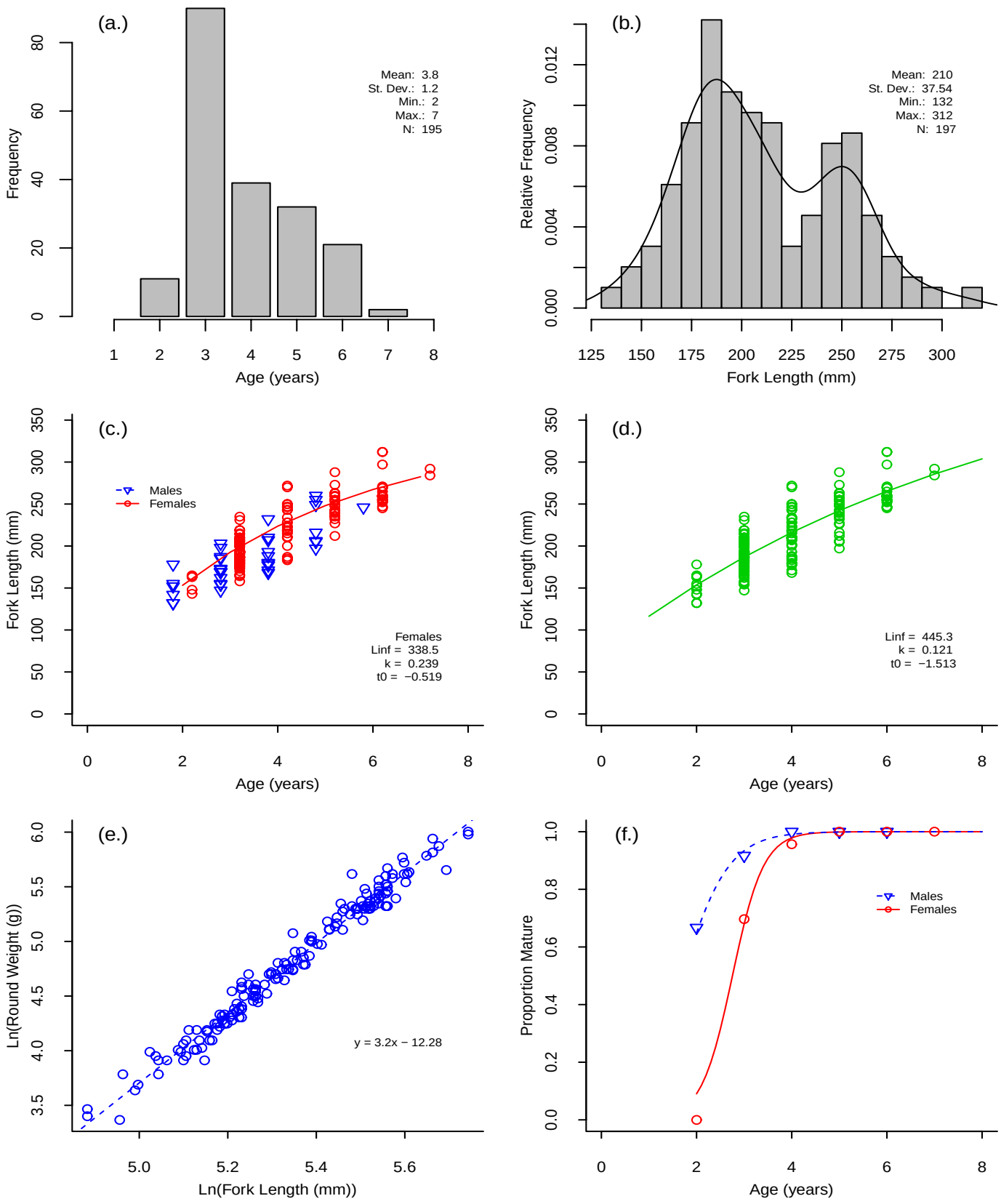

Figure 24. Yellow perch age distribution (a), fork length distribution (b), fork length-at-age (by sex (c) and all fish combined (d)), weight-at length (e), and maturity-at-age (f) from the Clapperton Island project (LHA_IA11_007).

North Channel (Frazer Bay) **[LHA_IA11_008]**

This project was conducted in the north channel within Frazer Bay between July 20 and July 28 (Table 17). This project was run to evaluate the progress towards lake trout rehabilitation in the area. The depth of the nets ranged between 10.4 m and 38.0 m. All 24 net sets were approximately 24 hours in duration. Algal fouling did not have any obvious impact on catch. Lake trout, lake whitefish, and yellow perch were targeted. The position of each net is shown in Figure 25.

Thirteen fish species were caught during this project (Table 18). The most common species were white sucker (47.3 % of the catch), round whitefish (14.4 %) and lake whitefish (10.2 %). Plots of the biological attributes of the lake trout (Figure 26), lake whitefish (Figure 27), cisco (Figure 28), round whitefish (Figure 29), and chub (Figure 30) captured during this project were constructed.

Average CPUE for this project was 34.4 fish/night. White sucker had the highest mean CPUE (78.0), followed by round whitefish (7.0), and cisco (3.7). Lake trout were caught in every mesh size.

Table 17. Set information for the fishing gear deployed in the North Channel within Frazer Bay during the 2011 offshore index program.

Sample Number	Set Date	Latitude	Longitude	Gear Code	Effort Duration (hrs)	Average Depth (m)
801	20-Jul-11	45° 57.01'	-81° 49.55'	GL32	17.89	17.5
802	20-Jul-11	45° 55.61'	-81° 49.70'	GL32	18.41	12.5
803	20-Jul-11	45° 54.28'	-81° 49.36'	GL21	18.63	10.4
804	21-Jul-11	45° 57.87'	-81° 40.18'	GL32	20.81	17.1
805	21-Jul-11	45° 59.72'	-81° 37.37'	GL32	21.03	19.3
806	21-Jul-11	45° 59.58'	-81° 41.66'	GL21	21.08	38.0
807	22-Jul-11	45° 55.13'	-81° 41.41'	GL32	21.56	20.4
808	22-Jul-11	45° 56.98'	-81° 44.15'	GL32	21.43	20.4
809	22-Jul-11	45° 57.56'	-81° 43.99'	GL21	21.16	21.8
810	23-Jul-11	45° 54.52'	-81° 40.94'	GL32	23.10	25.7
811	23-Jul-11	45° 54.18'	-81° 42.85'	GL32	22.23	29.7
812	23-Jul-11	45° 54.46'	-81° 43.87'	GL21	21.40	37.8
813	24-Jul-11	45° 53.13'	-81° 45.12'	GL32	22.63	26.8
814	24-Jul-11	45° 52.91'	-81° 46.39'	GL32	22.86	19.4
815	24-Jul-11	45° 55.29'	-81° 45.14'	GL21	21.23	23.3
816	25-Jul-11	45° 50.41'	-81° 46.42'	GL32	22.98	26.4
817	25-Jul-11	45° 50.17'	-81° 45.71'	GL32	22.51	24.3
818	25-Jul-11	45° 49.44'	-81° 46.61'	GL21	22.95	24.6
819	26-Jul-11	45° 46.78'	-81° 48.03'	GL32	24.18	25.2
820	26-Jul-11	45° 47.89'	-81° 47.41'	GL32	24.05	25.8
821	26-Jul-11	45° 48.58'	-81° 46.96'	GL21	23.81	24.9
822	27-Jul-11	45° 47.47'	-81° 48.99'	GL32	21.60	29.8
823	27-Jul-11	45° 49.40'	-81° 48.84'	GL32	21.81	24.1
824	27-Jul-11	45° 49.93'	-81° 48.24'	GL21	21.93	23.4

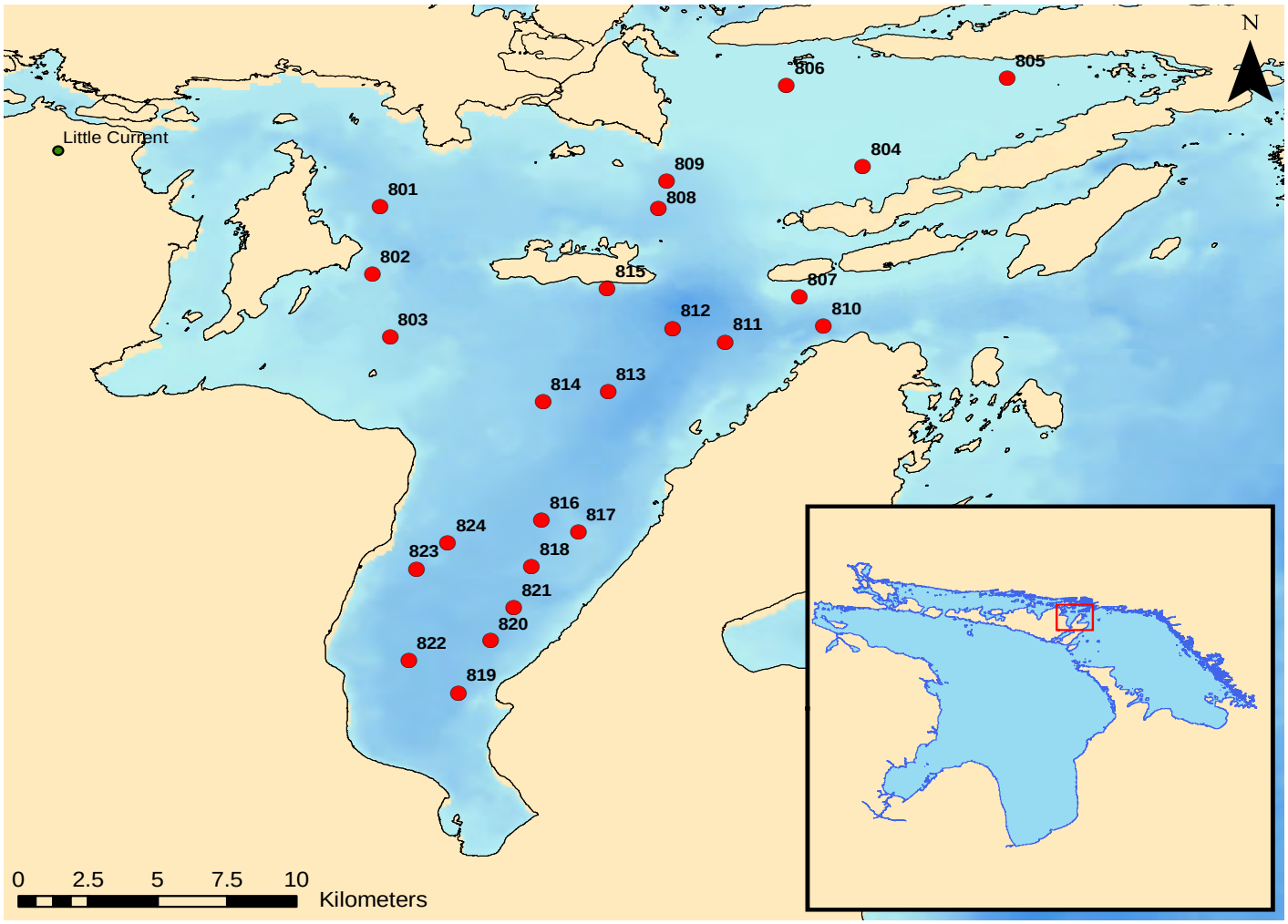

Figure 25. Offshore index sampling locations in the North Channel in Frazer Bay during 2011 (project code LHA_IA11_008). Lake trout, lake whitefish, and yellow perch were targeted.

Table 18. Count of the number of fish by species caught in each mesh size of the gill nets set in the North Channel in Frazer Bay during the 2011 offshore index program. Catch per unit effort (CPUE) is the mean number of fish caught per net each night.

	Mesh Size (mm)												
Species	**032**	**038**	**051**	**064**	**076**	**089**	**102**	**114**	**127**	**140**	**153**	**Total**	**CPUE**
Burbot		1			1	5	2	1				10	2.50
Chub	13	12	2	1	1							29	3.22
Cisco	3	2	4	17	22	13	2					63	3.71
Lake Chub	1											1	1.00
Lake Trout	3	3	5	11	11	4	11	9	6	2	1	66	1.00
Lake Whitefish		1	6	1	14	10	20	23	7	2		84	2.20
Longnose Sucker			1	2	4	4	2					13	3.25
Rainbow Smelt	3	5	6	8	2	3	2	1			1	31	2.38
Rainbow Trout					1							1	1.00
Round Goby	2											2	2.00
Round Whitefish		2	34	40	31	11	1					119	7.00
White Sucker		4	81	133	88	45	15	9	13	2		390	78.00
Yellow Perch	1	8	7									16	1.00
Total	26	38	146	213	175	95	55	43	26	6	2	825	

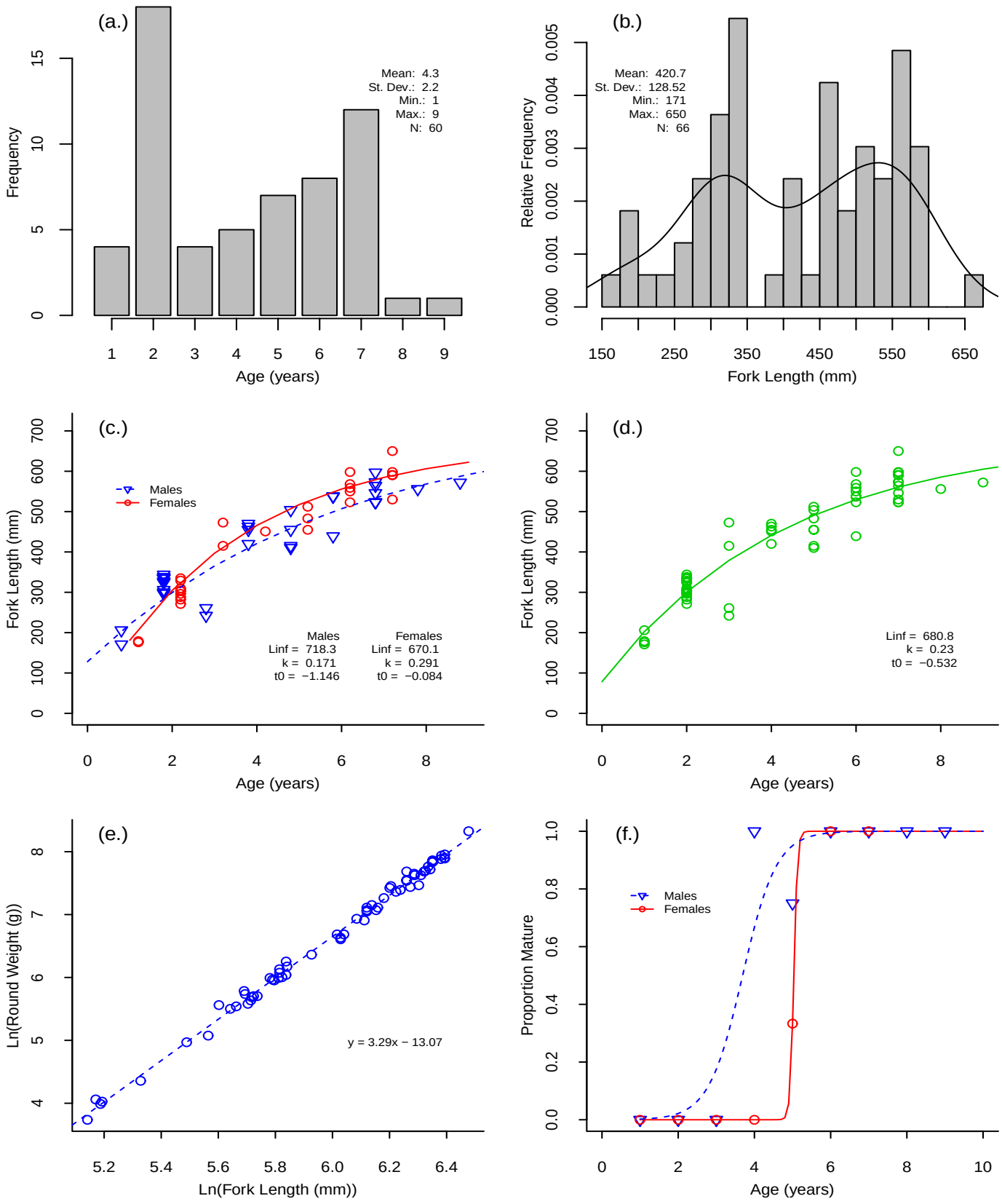

Figure 26. Lake trout age distribution (a), fork length distribution (b), fork length-at-age (by sex (c) and all fish combined (d)), weight-at length (e), and maturity-at-age (f) from the Frazer Bay project (LHA_IA11_008).

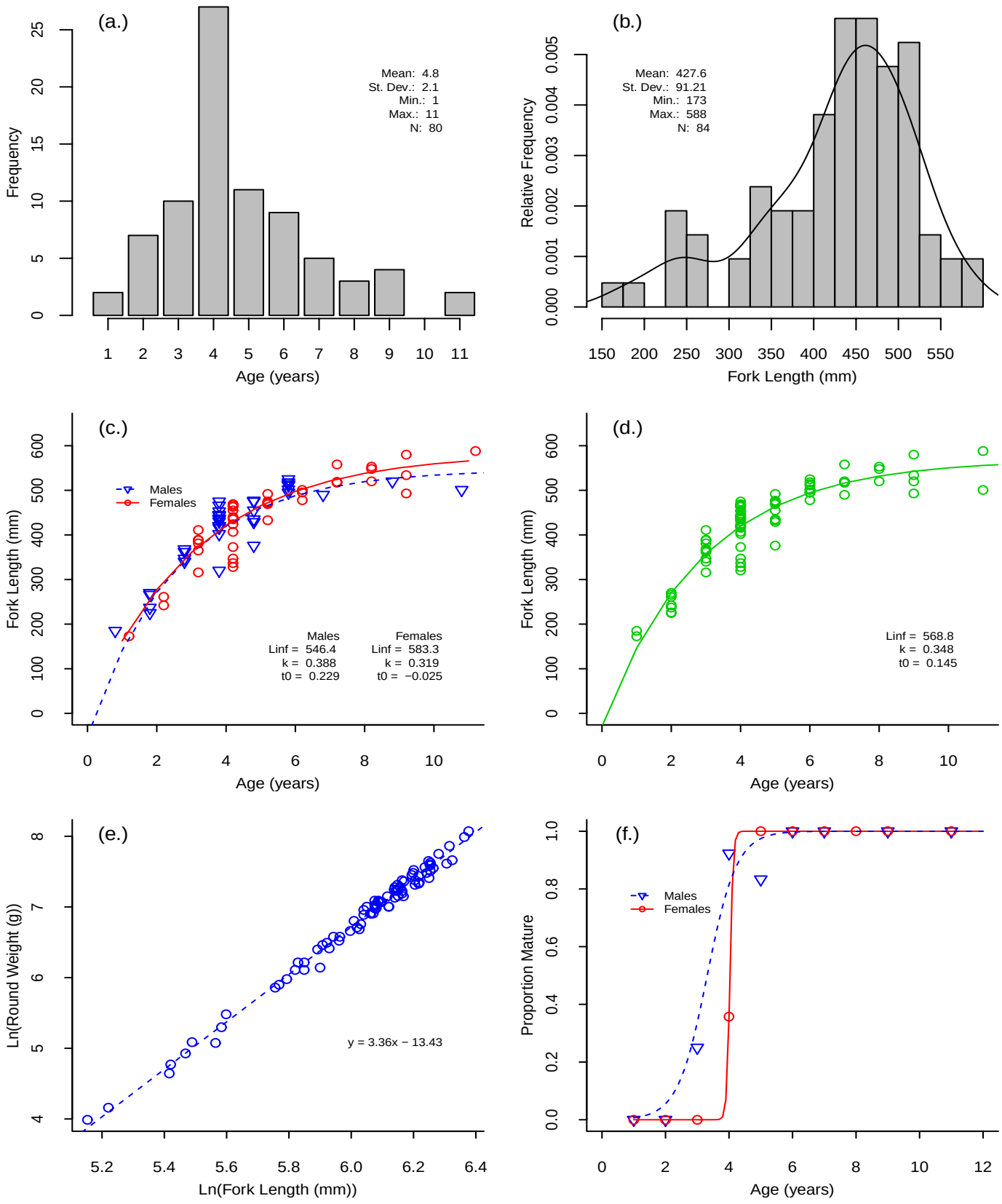

Figure 27. Lake whitefish age distribution (a), fork length distribution (b), fork length-at-age (by sex (c) and all fish combined (d)), weight-at length (e), and maturity-at-age (f) from the Frazer Bay project (LHA_IA11_008).

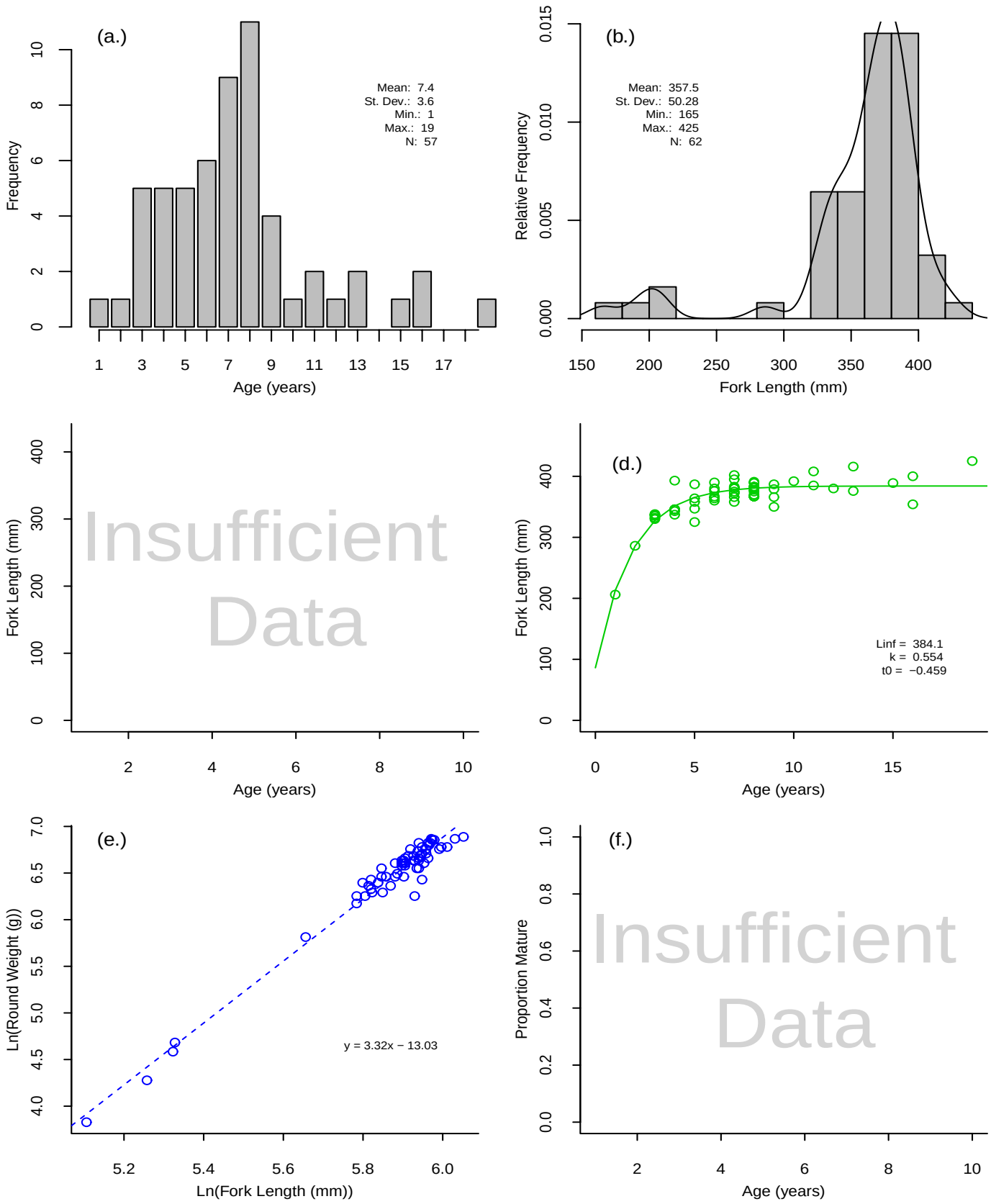

Figure 28. Cisco age distribution (a), fork length distribution (b), fork length-at-age (by sex (c) and all fish combined (d)), weight-at length (e), and maturity-at-age (f) from the Frazer Bay project (LHA_IA11_008).

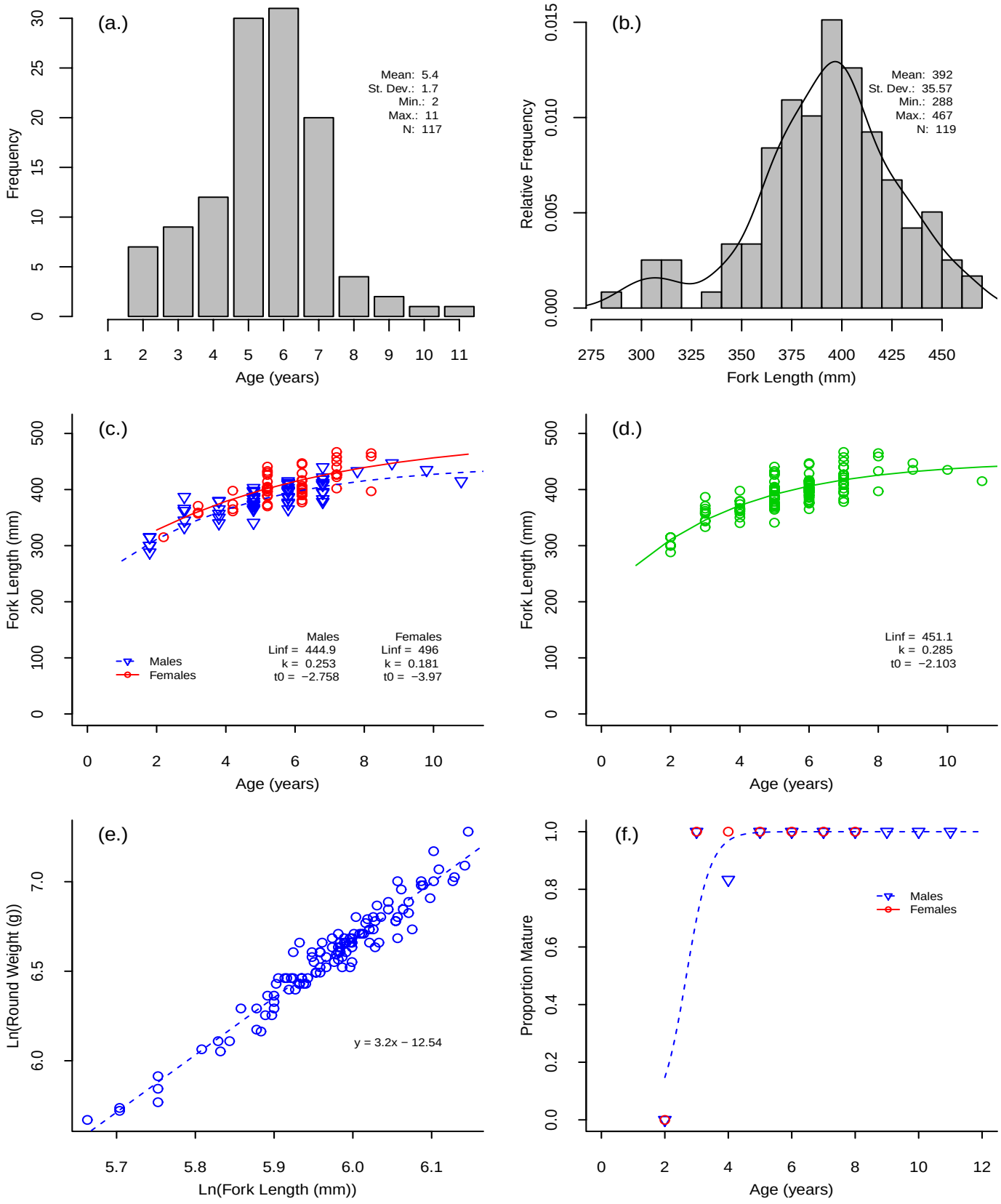

Figure 29. Round whitefish age distribution (a), fork length distribution (b), fork length-at-age (by sex (c) and all fish combined (d)), weight-at length (e), and maturity-at-age (f) from the Frazer Bay project (LHA_IA11_008).

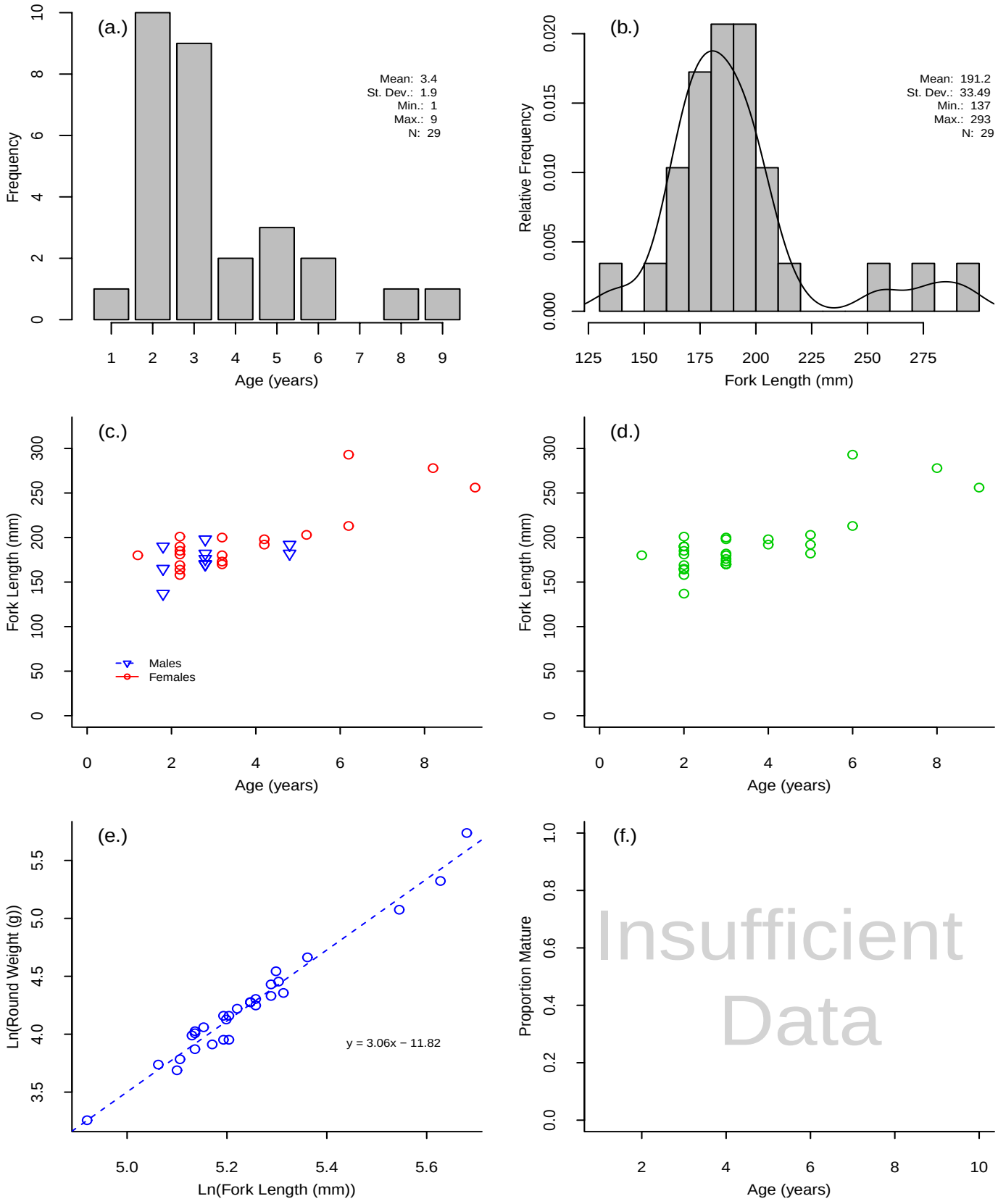

Figure 30. Chub age distribution (a), fork length distribution (b), fork length-at-age (by sex (c) and all fish combined (d)), weight-at length (e), and maturity-at-age (f) from the Frazer Bay project (LHA_IA11_008).

Pre-Recruit Indices

Lake Whitefish

In general, the strength of the recent year classes of lake whitefish has remained low (Table 19). The last strong year class in the central main basin was the 2003 year class. This year class still persists in the catch at a similar frequency as the much weaker 2004 and 2005 year classes. While the 2008 year class shows some improvement, all year classes after the 2003 year class have been very weak. In Georgian Bay there has not been a strong year class since the 2001 year class. While this year class is still present in the fishery, the 2003 and 2006 year classes made up a significant portion of the catch in this year's program. The year classes in the southern main basin are relatively stronger than the other two regions. However, the strength of the year classes after the 2005 year class are still weaker than the long-term average for this region, except for the 2009 year class which is similar in initial strength to the 2004 year class.

Chub

The strength of the year classes of chub is very different between the central and southern portions of the main basin (Table 19). The central main basin has produced weak year classes of chub every year after the 2000 year class with a slight increase in strength for the 2007 and 2008 year classes. In contrast, the southern main basin has produced strong year classes from 2003 to 2005, and again in 2009. The strength of the 2009 year class in this region is the strongest ever calculated for this area. Although somewhat eclipsed by the 2009 year class and below average in strength, the 2008 year class is at least three times as strong as the 2006 and 2007 year classes.

Yellow Perch

The strength of the year classes of yellow perch is highly variable throughout Lake Huron (Table 19). With the exception of the 2008 year class, there have been strong year classes every year since 2005 in the central main basin. The opposite trend has occurred in the North Channel, where 2005 was the last strong year class. In the southern main basin the last strong year class was the 2003 year class, which continues to be present in very low numbers. However, the 2007 year class is slightly stronger than the long-term average, an improvement from the weak year classes between 2004 to 2006 and 2008 to 2010. The 2008 year class appears to be weak in all regions.

Table 19. Pre-recruit indices for lake whitefish, chub, and yellow perch from select Quota Management Areas (QMAs) in Lake Huron. Indices for each QMA are calculated using data from their respective projects; 4-4 from the central main basin, 4-5 from the southern main basin, 5-8 from southern Georgian Bay, and 6-1 from the North Channel.

		Lake Whitefish			Chub		Yellow Perch		
	QMA	4-4	4-5	5-8	4-4	4-5	4-4	4-5	6-1
Year	Cut Off	1	10	1	1	20	1	20	1
Class	Ages	1-3	1-3	1-3	2-4	2-4	1-3	1-3	1-4
1988									
1989					15.40	25.23			
1990		36.27	16.86	30.53	24.04	14.48	11.13	18.48	10.15
1991		18.40	13.49	13.30	4.91	6.43	72.38	21.21	10.32
1992		13.09	2.52	7.74	0.83	1.00	1.00	0.68	0.52
1993		9.80	13.09	10.01	3.12	3.85	9.00	8.94	7.00
1994		9.17	6.83	1.67	3.34	8.04	1.04	25.15	4.02
1995		7.97	7.75	16.20	5.17	6.44	3.03	19.86	8.88
1996		10.16	5.33	8.02	5.83	5.15	0.14	2.40	6.43
1997		6.95	10.02	1.86	17.24	6.44	0.97	5.13	15.42
1998		25.87	18.40	18.35	36.20	14.26	18.79	47.56	28.04
1999		25.06	9.32	56.23	30.05	10.54	1.47	3.87	7.55
2000		8.76	5.17	21.81	23.66	4.98	2.44	1.24	7.16
2001		7.94	6.97	22.66	7.90	0.00	3.53	2.13	0.39
2002		2.75	4.47	3.50	1.96	5.95	2.51	6.66	8.84
2003		24.85	29.75	0.49	2.23	21.70	7.41	24.73	7.97
2004		4.80	13.09	0.06	2.22	23.75	2.38	3.18	9.91
2005		1.56	12.82	0.62	0.00	22.50	7.80	4.03	37.64
2006		0.00	7.42	0.12	1.40	1.89	10.57	3.34	6.82
2007		0.43	8.23	0.23	3.24	2.82	38.43	11.21	5.46
2008		6.17	3.04	0.86	3.34	6.78	7.49	4.67	6.52
2009		0.11	13.44	0.42	1.04	31.02	16.60	3.22	0.84
2010		0.66	4.30	0.73			26.88	2.30	0.00
Mean		10.51	10.11	10.26	9.20	10.63	11.67	10.48	9.04

Discussion

Two more fish species and more than twice as many individuals were caught this year compared to last year. This is expected because effort increased from 117 nets in 2010 to 155 nets in 2011. This increase is primarily due to logistical constraints last year related to preparing a new research vessel for use in this program. The number of species captured this year increased by 2 to 28, a value still within the typical range encountered over the offshore index program's history. This increase resulted from the capture of one or two individuals from species irregularly caught during the offshore index program. Program-wide CPUE increased from a record low of 36.5 in 2010 to 59.8 in 2011. This CPUE is consistent with the low CPUEs observed since 2003. Yellow perch remained the most frequently remained captured species. Surprisingly, chub were the second most frequently caught species. White sucker were the third most common species.

Lake Whitefish Trends

In southern Georgian Bay the CPUE of lake whitefish decreased from its slight increase in 2009, continuing the downward trend which began in 2004. Last year 47 lake whitefish were captured in this area. These fish ranged from 1 to 11 years old. This year we captured 3. This is very low even when the difference in effort between 2010 and 2011 is taken into consideration. When all projects run in Georgian Bay are examined together, all ages from 1 to 11 are present with the 2003 and 2006 year classes the most common (4 and 5 individuals out of 22, respectively).

The CPUE of lake whitefish in the central main basin has been consistently low over the past 10 years. While CPUE in the fall of 2008 dropped to its lowest level in more than 20 years, fall CPUE values in 2009 to 2011 have remained at the lower levels seen over the past 10 years. CPUE in the spring remains well below the long-term average. In 2011 spring CPUE was the second lowest recorded over the past decade. The catch in this region was largely dominated by fish older than five.

The CPUE of lake whitefish in the southern main basin has remained stable since 2005. Unlike the central main basin, younger fish were present and older fish were much less prominent in this location. In particular the 2009 year class dominated the catch, comprising 65 % of the lake whitefish caught and aged in the fall (194 individuals).

Chub Trends

Chub in Georgian Bay and the central main basin continue to be present in very low numbers. The CPUE of chub in southern Georgian Bay was consistent with the long-term (post-2000) average. In the central main basin chub CPUE remained low as well. The CPUE of chub near Collingwood was relatively high compared to the areas around Southampton and Cape Rich. No chub were caught near the Limestone Islands. In both Georgian Bay and the central main basin the 2009 and 2010 year classes were the most common. However, all year classes remain very weak.

In the southern main basin the CPUE of chub is typically higher in the fall than in the spring. This year was no exception. CPUE of chub was higher than the long-term average in both seasons. In particular, CPUE of chub in the fall was at a 20-year high. The 2008 year class dominated the catch in the spring, while the 2009 year class dominated in the fall. The predicted strength of this latter year class is the strongest ever calculated for this area.

Yellow Perch Trends

The CPUE of yellow perch in the central main basin remains variable over the last 15 years. This year the CPUE of perch was consistent with the long-term average in the spring but relatively high in the fall. Fall CPUE has been increasing since 2009. The strong 2009 and 2010 year classes comprised much of the catch while the once-strong 2008 year class was much less common than it was in 2010. Perch older than 2 are rare.

In the southern main basin the CPUE of yellow perch varied depending on season. CPUE in the spring was relatively high; a similar CPUE has not been observed since 2000. CPUE in the fall was consistent with the long-term average and has experienced a slight decline since 2009. The catch was composed of a broad age range; fish from age 1 to age 9 were all present with the 2007 (age 4) year class the strongest.

Lake Trout Trends

The CPUE of lake trout has remained relatively stable in the main basin. In the southern main basin CPUE tends to be a little higher in the fall than in the spring. While the mean age of lake trout sampled in the central main basin has increased steadily from 4.5 in 2003 to 7.2 in 2010, it fell to 6.3 in 2011. Similarly, in the southern main basin from mean age increased from 4.7 in 2003 to 8.7 in 2010 with a decline to 7.8 in 2011. The broad age distribution of lake trout with many mature year classes is encouraging from a lake trout rehabilitation perspective.

Unlike the stable CPUE observed in the main basin, the CPUE of lake trout in southern Georgian Bay has been decreasing from its small recovery in 2009. CPUE still remains well below those values observed prior to 2004. The decline in CPUE observed in 2010 continued in 2011. The 2009 CPUE of 5.3 is now down to 1.2. CPUE from the project near Collingwood was lower at 0.3 and lower still near the Limestone Islands at 0.2. When all Georgian Bay projects are grouped together ages 2 to 6 and 13 were all present with no particular year class especially common.

Nearly 100 unclipped lake trout were observed during the offshore index program this year, most of which were from the projects near Southampton in the main basin and within Frazer Bay in the North Channel. In Frazer Bay 57.6 % of the lake trout encountered were unclipped. Unclipped lake trout in the central main basin rose to 79.6 % of the 49 lake trout which were examined for clipped fins. The percentage of unclipped lake trout in this location has been increasing steadily since the early 1990s and has increased by 25 % from 2009 to 2010 and again from 2010 to 2011. The high percentage (32.8 %) of unclipped lake trout that were captured last year off of Cape Rich in southern Georgian Bay fell dramatically this year (15.4 % of 13 fish). However this is still well above the long-term average (approximately 5.0 %). Sample sizes from the other Georgian Bay projects were too small to draw meaningful conclusions about the size of the unclipped lake trout population. In the southern main basin the percentage of unclipped trout has been increasing rapidly since 2006. In 2011 unclipped lake trout comprised 35.1 % of all lake trout checked for fin clips; the second highest frequency ever observed.

Summary

All of the projects planned for the 2011 offshore index program were completed successfully. Algal fouling impeded the effectiveness of the fishing gear in 5 of the 155 (3.2 %) net sets. In general these nets were set for more than one night, giving algae more time to accumulate on the gear.

The strength of the year classes of lake whitefish, chub, and yellow perch varies by location. The 2005 year class of lake whitefish remains strong in the southern main basin. The pre-recruit indices also indicate that the 2009 year class is stronger than average. The pre-recruit index forecasts a less weak 2008 year class of lake whitefish in the central main basin, all other year classes after 2003 have been much weaker. The last strong year class of lake whitefish in southern Georgian Bay was the 2001 year class. The pre-recruit index forecasts a very strong 2009 year class of chub in the southern main basin, following up the strong 2003 to 2005 year classes. In the central main basin a strong year class of chub has not occurred since 2000. The 2007 year class of yellow perch is still very strong in the central main basin, followed by the 2009 and 2010 year classes. The 2007 year

class is the only strong year class in the southern main basin since the 2003 year class. The 2005 year class was the last strong year class of yellow perch in the north channel.

The percentage of unclipped (and potentially wild) lake trout in the catch continues to rise, especially in the central main basin (79.6 % of 49). While a lower percentage (15.4 % of 13) of unclipped lake trout was seen again in southern Georgian Bay this year, it is still a much higher percentage than the long-term average. Of the 37 lake trout that were sampled from the southern main basin, 35.1 % were unclipped. Last year 27.3 % of the 33 lake trout captured in this area that were examined for fin clips were unclipped. No unclipped lake trout were caught in the North Channel around Clapperton Island. No unclipped lake trout have ever been caught during an index project in this region.

Acknowledgements

I would like to thank our dedicated field crew for collecting the data used in this report: Aaron Barnes, John Brookham, Ed deLaplante, Brandon MacLean, Mike Pinder, Terry Walmsely, and Darrell Wilson. I would also like to express my appreciation to Steve Gile and Lloyd Mohr, who both provided editorial comments for this document.

References

Ebener, M.P., King, E.L. Jr., and Edsall, T.A. 2006. Application of a dichotomous key to the classification of sea lamprey marks on Great Lakes fish. Great Lakes Fish. Comm. Misc. Publ. 2006-02.

Hughes, D. 1989. Calculation of pre-recruit index. Lake Huron Management Unit. Unpublished Report.

Mohr, L.C., McLeish, D.A., Rawson, M., Liskauskas, A.P. and Gile, S.R. 1997. Management, Exploitation, and Dynamics of Lake Whitefish (*Coregonus clupeaformis*) and Lake Trout (*Salvelinus namaycush*) Stocks Surrounding the Bruce Peninsula. Ontario Ministry of Natural Resources. Lake Huron Management Unit. Report 02-97.