BRGMON-4 Project Water Use Plan

Carpenter Reservoir and Middle Bridge River Fish Habitat and Population Monitoring

Implementation Year 1

Reference: BRGMON - 4

Progress Report

Study Period: October 16, 2012 – March 31, 2013

A.E. (Gene) Tisdale, *AScT*
Tisdale Environmental Consulting Inc.
190 Battle Street West
Kamloops, BC V2C 1G9

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EXECUTIVE SUMMARY

Objectives

The BRG Consultative Committee (BRG CC) developed aquatic ecosystem objectives for Carpenter Reservoir that are measured in terms of abundance and diversity of fish populations present in the reservoir. However, it was not possible, with the existing information on the Carpenter Reservoir ecosystem to develop explicit fish population level performance measures that directly reflected these objectives. Specific gaps in data and understanding were identified in: 1) the relative abundance, distribution and life history requirements of species of fish in the Carpenter Reservoir and its tributaries, and, 2) the relationship between operating parameters (i.e., maximum/minimum elevation, timing of reservoir filling) of the reservoir and the impact factors reflected by the performance measures for determining the productivity of fish populations. Given the scope of these data gaps and the schedule of the BRG WUP it was not possible to conduct required studies in the time available (one year).

To provide required information for the required trade-off assessments, habitat-based performance measures related to specific key operating impacts were developed. These performance measures independently assessed operating impacts that are believed to cause mortality or sub-lethal impacts to fish (stranding, entrainment, tributary backwatering) and trophic production required to support existing fish populations (littoral productivity, pelagic productivity). The application of the performance measures did help make trade-off decisions however they required an extensive amount of qualitative judgment about which factors were most important in the regulation of fish population abundance and diversity. As these judgments could not be supported with technical data, there remains significant uncertainty about how well the assessments actually reflect population response to different reservoir operating strategies as the relative importance of each impact factor is not currently known. To resolve these data gaps and uncertainties the BRG CC has therefore recommended fish habitat and population monitoring to obtain better information on the abundance, life history, habitat

use of fish populations, and to assess how reservoir operating parameters (minimum or maximum annual elevation) impact reservoir habitats and fish populations.

Management Questions

Key management uncertainties encountered in the development of the BRG WUP associated with fish populations in Carpenter Reservoir and Middle Bridge River were related to three issues. First, there is considerable uncertainty about the fundamental characteristics of the fish community in Carpenter Reservoir and its tributaries (species composition, abundance, distribution, and life history). This lack of information limited the BRG CC capability to develop appropriate performance *Bridge-Seton Water Use Plan Monitoring Program Terms of Reference January 23, 2012 BC Hydro Page 35* measures to assess how well given alternatives met overall aquatic ecosystem objectives. Second, the relative influence of the operating parameters of the reservoir (minimum annual elevation, maximum annual elevation, annual drawdown, reservoir fill schedules), how this relates to the identified performance measures (i.e., stranding, entrainment, tributary backwatering, littoral productivity, pelagic productivity) was not known. This created significant uncertainty about each of these impacts individual influences the long term productivity of Carpenter Reservoir fish populations. Third, there is considerable uncertainty about the impacts of the in stream flow regime of the Middle Bridge River (which is largely controlled by La Joie Generating Station) on fish populations. Of particular importance for the selection of the current operating alternative (N2-P) was uncertainty about the potential for dewatering of whitefish eggs during winter months and how this would impact the whitefish population found in Middle Bridge River and Carpenter Reservoir. The time sequence of changes to Carpenter reservoir operations will be summarized in the reporting. A 2.2 m spill buffer was implemented in ~1992, with some incursions above this level. Following the CC process, operations targeted a) maintaining operating flexibility while minimizing spills into lower Bridge River and Seton River, b) reducing the depth that winter drawdown to maintain littoral productivity, c) target max EL at 648m to promote riparian development, and where needed allow incursions above that but only with duration that does not exceed tolerance of vegetation. These targets are implemented more formally in 2011 when the Water Use Plan and

revised Water Licence were implemented. The primary management questions that the proposed monitoring program will address are:

1) What are the basic biological characteristics of parameters of fish populations in Carpenter Reservoir and Middle Bridge River?
2) Will the selected alternative result in positive, negative or neutral impact on abundance and diversity of fish populations.
3) Which are the key operating parameters that contribute to reduced or improved productivity of fish populations in Carpenter Reservoir and Middle Bridge River?
4) Is there a relationship between specific characteristics of the in stream flow in Middle Bridge River that contribute to reduced or improved productivity of fish populations in Carpenter Reservoir and Middle Bridge River?
5) Can refinements be made to the operation of Carpenter Reservoir and management of in stream flow releases from La Joie Generating Station into the Middle Bridge River to improve protection or enhance fish populations in both of these areas, or can existing constraints be relaxed?

Detailed Hypotheses about the Impacts of Carpenter Reservoir Operation on Fish

Two primary hypotheses (and sub-hypotheses) associated with these management questions are listed below. The first hypothesis is associated with direct operational impacts on fish: *Bridge-Seton Water Use Plan Monitoring Program Terms of Reference January 23, 2012 BC Hydro Page 36.*

H1: The abundance and diversity of Carpenter Reservoir fish populations is limited by habitat impacts directly related to the operation of the reservoir.
H1A: Operation of the reservoir at low elevations reduces fish productivity due to stranding of fish or fish eggs.
H1B: Operation of the reservoir at low elevations (typically during later winter to early-spring) reduces productivity of fish populations due to fish entrainment from the reservoir.

H1C: Operation of the reservoir at low elevations reduces littoral productivity and this results in reduced abundance and diversity of Carpenter Reservoir fish populations.
H1D: Operation of the reservoir at low elevations reduces pelagic productivity and this results in reduced abundance and diversity of Carpenter Reservoir fish populations.
H2: The abundance and diversity of Carpenter Reservoir fish populations is limited by habitat impacts directly related to the operation of the La Joie Generating Station.
H2A: Operation of the reservoir or La Joie Generating Station restricts the amount available effective spawning habitat (through egg dewatering) in Middle Bridge River and this limits the productivity of Carpenter Reservoir fish populations.

These hypotheses will be tested using data from general fish population monitoring, rather than specific surveys for fish stranding, entrainment, dewatering, and littoral or pelagic productivity. Thus, they will be tested using inferences based on a weight-of-evidence, rather than direct tests. These hypotheses have significant consequences for the predicted impacts of operations on fish, however, they could not be resolved with scientific data during the WUP and professional judgment and experience from other reservoirs was used to help support critical trade-off decisions.

Tisdale Environmental Consulting Inc. (TEC Inc.) was retained by St'at'imc Eco-Resources to collect biological and physical data, as noted above, with inferences to assess the two primary hypotheses (and sub-hypotheses) associated with these management questions.

The BRGMON – 4 project officially began October 10, 2012, but field data collection began on October 16, 2012. Field studies to date have been directed to assessing the rocky mountain whitefish (*Prosopium williamsoni* – MW) spawning activity in the middle Bridge River (MBR), downstream of La Joie Dam from October 16, 2012 through to December 21, 2012. This study was conducted within a similar time frame and methodology as a previous studies conducted in 2005 and 2009 (Tisdale, 2005, 2009). In addition to the 2005/2009 study results, limited anecdotal biological information was available regarding the presence of MW within the MBR from fish salvage procedures

occurring during La Joie generating station (LAJ GS) flow manipulations and from fish collected during a stable isotope analysis of Carpenter Lake Reservoir. Specific temporal and spatial information relative to MBR MW is required to effectively manage seasonal discharge manipulation at LAJ GS to minimize potential impact on the spawning and rearing MW population.

Physical biological data was collected by angling MW within the MBR and deploying spawning mats in areas where spawning was suspected to occur. Angled MW were identified to sex where possible and measured for length (mm), weight (gm), and sexual maturity (green or ripe) on a weekly basis during the study period. Scales were collected for ageing of fish and half duplex (HDX) passive integrated transponder (PIT) tags were injected into each fish. Bull trout were also incidentally captured, measured for length and weight, and PIT tagged before being released. Spawning mats were placed in five locations in the study area and examined for presence of eggs on a weekly basis.

Spawning occurred from approximately November 15, 2012 to approximately December 21, 2012, with peak spawning occurring near November 22, 2012. Spawning was observed in water ranging from 0.72 meters to 1.5 meters in depth and in velocities averaging 0.51 meters per second (m/s). All spawning was observed within the mainstem portions of the MBR; no side-channel spawning was noted. Peak of spawning occurred at a water temperature of approximately 6.4 ^{o}C (to be confirmed for 2012). Most aged males (34%) were first time spawners at age 3 years, with 43% of the males being repeat spawners to a maximum age of 6 years. Approximately 54% of the female MW were first time spawners at age 4, with 41% repeat spawners noted to a maximum age of 6 years old. Hatching of MW eggs in the MBR is estimated to begin in mid January with peak hatching near the third week of February.

This document will evolve and include upcoming field data collection.

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1.0 INTRODUCTION AND BACKGROUND

The Bridge River system, originating at the Bridge Glacier, has a drainage area of 3,650 km^2 (Rood and Hamilton, 1995). The upper Bridge River flows into Downton Lake reservoir where it is contained by an impoundment constructed by B.C. Hydro and Power Authority (BC Hydro) for hydroelectric generation at the LAJ GS. This facility is located at the eastern end of Downton Lake reservoir near the community of Goldbridge, B.C. The La Joie facility is the first of three generating facilities operated by B.C. Hydro in the Bridge River watershed. Water passes through the La Joie facility from Downton Lake reservoir to the middle Bridge River. The Hurley River joins with the MBR approximately 1 km downstream of the La Joie facility (right bank) and empties into Carpenter Lake reservoir. Carpenter Lake reservoir is contained by Terzaghi Dam built in 1960 to replace the Mission Dam built in 1920. Carpenter Lake reservoir stores water for the Bridge River generating facility located on the north shore of Seton Lake reservoir near the community of Shalalth, B.C. A low-head dam is located at the eastern end of Seton Lake reservoir. Water from Seton Lake reservoir is split at the Seton Dam with a portion flowing through the dam into Seton River and a portion diverted into the Seton generating facility located on the west bank of the Fraser River near the community of Lillooet, B.C. The hydroelectric generation system supplies a maximum rated output of 546 MW (**Figure 1**).

Prior to hydroelectric development in the Bridge River drainage, anadromous fish were present up to an impasse falls at the now present La Joie Dam site. The construction of the Mission (Terzaghi) Dam and La Joie Dam on the Bridge River divided the formerly contiguous river into three biologically disconnected sections: i) lower Bridger River downstream of Terzaghi Dam, ii) Carpenter Lake reservoir and middle Bridge River between Terzaghi and La Joie Dams, and iii) Downton Lake reservoir and upper Bridge River upstream of La Joie Dam (**Figure 1**). Anadromous fish are now limited to the lower Bridge River downstream of the Terzaghi Dam.

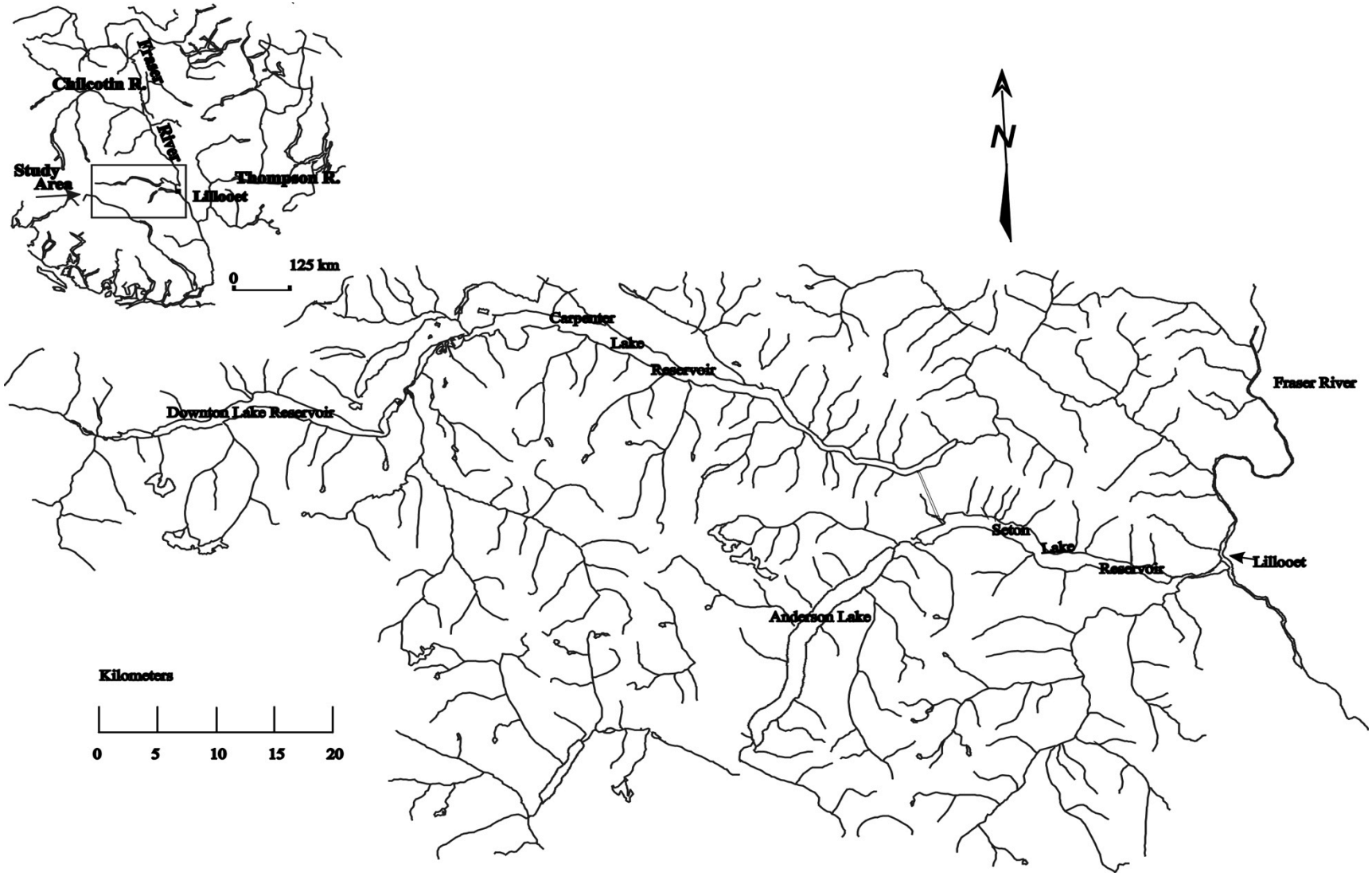
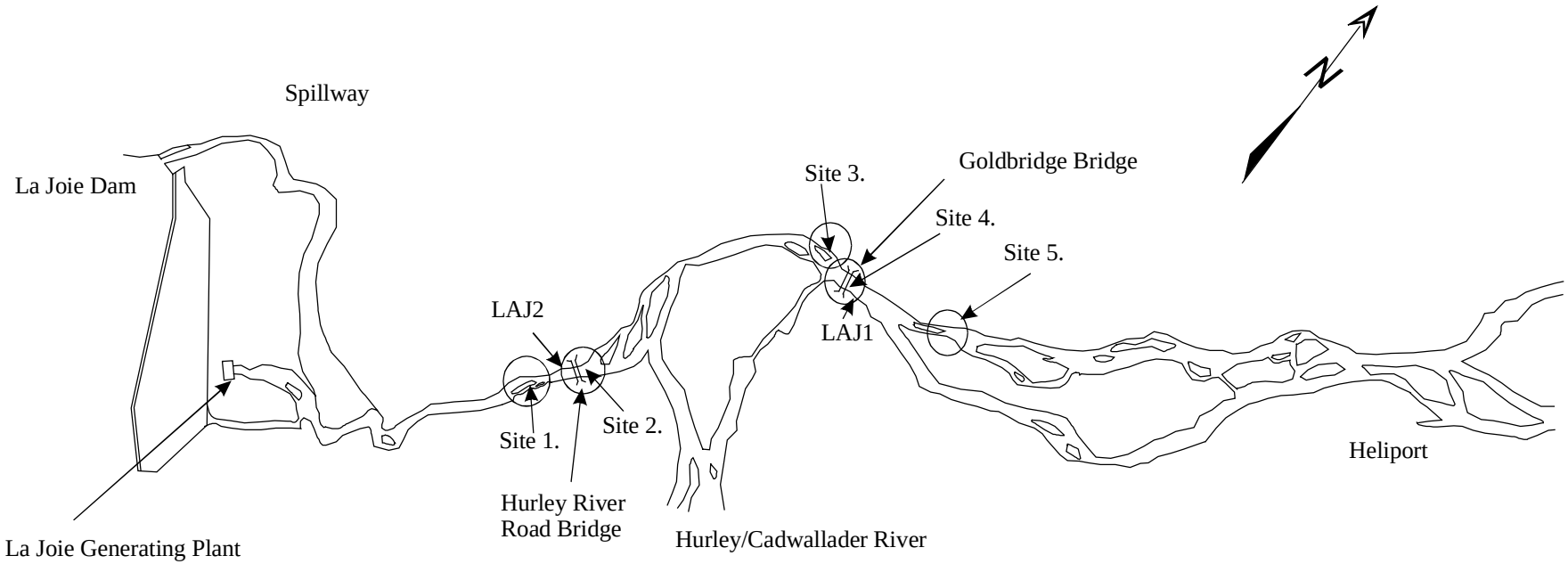


Figure 1. Bridge-Seton River Watershed



Egg Mat Locations

Site 1. Upstream of the Hurley River Bridge (Rbank)
Site 2. Immediately Downstream of the Hurley River Bridge (Lbank)
Site 3. Downstream of the First Island Sidechannel
Site 4. Goldbridge Bridge (Rbank)
Site 5. Downstream of the Goldbridge Bridge (LBank)

Kilometers

0 1 2

Figure 2. The middle Bridge River showing relative locations of spawning mat deployment.

2.0 METHODS AND MATERIALS

2.1 Physical Sampling Methods

Water Quality

An HF Scientific Model DRT-15CE turbidity meter was used to collect Nepholemetric Turbidity Unit (NTU) measurements from each tributary. The meter was calibrated daily using a 0.02 NTU calibration cuvette prior to sampling. The turbidity reading was taken to be the mean of three readings recorded from each cuvette sample over a period of thirty seconds. A mean, standard deviation, variance and standard error were also calculated from the three readings.

Water Temperatures

Water temperatures (non-standardized timing) were recorded using a red spirit-filled, glass-stemmed pocket thermometer. The thermometer was immersed in the main flow for a minimum of one minute before the temperature was recorded in degrees Celsius (MoELP, 1995). Two Stowaway^{TM} Tidbit datalogger units (-5^{o}C to +37^{o}C) were installed in the middle Bridge River with the first at LAJ1, approximately 100m downstream of the Goldbridge Bridge (right bank) and the second at LAJ2, approximately 20 meters upstream of the Hurley River Bridge (left bank) (**Figure 2**). Water temperature data was recorded every eight hours to determine minimum and maximum daily temperatures. Stowaway ^{TM} Tidbit dataloggers are documented accurate to within 0.1 ^{o}C (ONSET Computer Corp. 1998).

Spawning Depth/Velocity Measurements

Depth and velocity measurements, in areas noted to have spawning activity, were conducted by wading and measuring depth with the aid of a Swoffer Model 2100 flow meter and depth gauge. Depth was measured in meters and velocity was measured in meters per second.

Spawning Habitat Assessment

Spawning habitat was measured by wading into each area noted to have spawning activity. A sample of substrate composition was collected with the aid of a spade shovel.

Spawning Mat Deployment and Egg Enumeration

Spawning mats, 0.77m x 0.92m in dimension, were deployed by wading into the MBR and placed along hydraulic seams in areas suspected of spawning activity (**Plate #1**). Each mat was anchored to the shoreline with the aid of 3/8 inch polypropylene rope. Individual mats were carefully removed from the MBR on a weekly basis and examined for eggs deposited during the previous week. Both sides of the mats required inspection, as eggs traveling with the current became entangled in the underside of the mat material as well directly on top.

Capture Methods

Mountain Whitefish were captured during the survey period from the MBR on a weekly basis by angling. Commercially cured single salmon eggs on a #12-2457 scud hook, weighted with lead split-shot weights on 6 pound (2.7 kg) line, were drifted with a quill float using a light-weight 9 foot (2.75m) fishing rod through areas thought to hold maturing MW.

2.2 Biological Sampling

When possible, a minimum of 30 fish were captured each sampling period. Captured MW were measured for fork length to the nearest millimeter. Sex and maturity were noted by hand-extruding eggs/milt. Scale samples were collected from the area between the insertion of the dorsal fin and the origin of the anal fin approximately 4-5 scale rows above the lateral line (Bison, 1991; MoELP, 1995). Fish that were positively identified to sex by extrusion of eggs/milt were noted as mature. Scales were mounted between two glass slides in the field and location, species, length, date and scale number were appropriately noted. Most captured fish were PIT tagged along the right side adjacent to the dorsal fin with a hypodermic syringe (**Plate 7**). Each PIT tag was then scanned and

recorded along with the biological data collected. All MW were returned unharmed to the location where they were captured.

Scale Analysis

Scales were magnified 22x and viewed with a Micron 780 microfiche reader. The highest quality scale from each sample (not regenerated) was selected. Zones of closely adjacent circuli were identified as annuli. Annuli having irregularly broken circuli were identified as spawning checks (MoELP, 1995; Casselman 1990). Mild irregularities such as "cross-over" circuli were not identified as spawning checks. Each scale was read twice to ensure consistency in results.

3.0 RESULTS AND DISCUSSION

A primary objective of this assessment involved the handling of as many fish as possible, up to 30 or more per weekly session, in an attempt to determine oncoming ripening of fish and possible locations to deploy egg collection mats. All areas that would typically hold adult fish of any species were angled i.e. pools, riffles and seams between fast water and back-eddies. Few fish were captured prior to the spawning period in areas not associated with the confluence of the main tributary to the MBR, the Hurley-Cadwallader River. Most fish captured in mid-October were either visibly immature juveniles or green maturing fish (not showing signs of sexual maturity i.e. expulsion of sperm/milt, nuptial tubercles for males and expulsion of eggs for females). After exploring the MBR starting from the outflow from the La Joie Dam and working downstream, a large population of holding fish was located at the confluence of the Hurley-Cadwallader River at the Goldbridge Bridge. Five egg collection mats were deployed in three areas where mature fish were known to be spawning during the 2005/2009 study period. These areas were as follows (**Figure 2**):

Site 1. One mat at the seam of the confluence of a side-channel on the right bank approximately 100m upstream of the Hurley River Road bridge (**Plate 2**).
Site 2. One mat at the seam located between the fast and slow moving water immediately downstream of the Hurley River Bridge, left bank (**Plate 3**).
Site 3. One mat on the left bank across from the Hurley-Cadwallader confluence near the Goldbridge bridge (**Plate 4**).
Site 4. One mat at the seam created by the Hurley-Cadwallader confluence with the MBR near the Goldbridge Bridge (**Plate 5**).
Site 5. One mat on the left bank approximately 150m downstream of the Goldbridge bridge (**Plate 6**).

October 16, 2012 – October 25, 2012

During the first two weeks of the study, thirty fish were captured at each weekly sampling interval. A majority of the fish captured (73%) were green females, with a noticeable lack of males (18%) in the captured population. No ripe females were captured to this point.

November 1 – November 08, 2012

The first ripe females were captured on November 01, 2012 representing 13% of the captured females. The relative number of males captured was still low (17%) on November 01, 2012, but increased significantly by November 08, 2012 to 60% of the captured population (**Table 1**). It was also noted that as more fish were becoming ripe, more surface activity (rolling fish) was present at spawning locations. A majority of the mature males were easily distinguishable by November 08, 2012, with nuptial tubercles (hardened bumps) along the sides of the male fish extending from the pectoral fins to the caudal fin with sperm/milt easily expelled during handling (**Plate 8**). Nuptial tubercles developed on scales on the sides of spawning males were reported by Hagen (1970) as very transitory. Vladykov (1970) reported development of tubercles on the first 3 or 4 rows of scales above and below the lateral line but not on the head.

November 15, 2012

Four of the seven females captured were ripe; this represented 57% of the female population. The males captured represented 77% of the captured population. The first eggs, a total of 20, were found on the egg collection mats on this date at sites one, two, three and four (1 on the site one mat, 1 on the site two mat, 1 on the site three mat, and 17 on the site four mat) (**Appendix II**).

November 22, 2010

During this sampling period fish were plentiful and easily captured, with 32 fish being sampled. All (100%) of the females captured on this date were ripe. The males captured represented 66% of the captured population. The egg count on all five mats increased to a total of 522 on this date (14 on the site one mat, 21 on the site two mat, 14 on the site three mat, 52 at the site four mat and 421 at the site five mat). This was the highest number of eggs collected as well as the highest ratio of ripe females handled during the survey period, therefore this was determined to be the peak of spawning activity (**Figures 4 and 5, Table 1**). Peak of spawning during the 2005 study appeared to be similar, occurring on November 23, 2005, while 2009 was approximately one week later (November 29, 2009). The water temperature at LAJ2 during peak of spawning was

approximately 6.4 ^{o}C during 2009 (**Figure 3**). The 2012 water temperature data was not available at the time this report was completed.

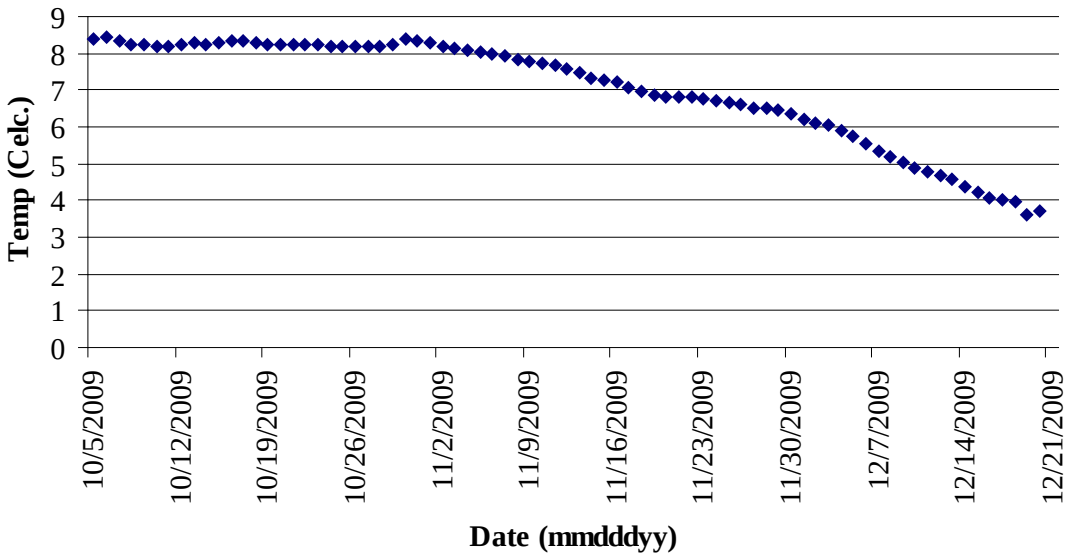


Figure 3. Water temperature readings collected with an electronic datalogger at LAJ2 during 2009 (2012 data not available at the time of writing).

November 29, 2012

As with the previous week's sampling, fish were plentiful and easily captured during this sampling period. Fourteen of the seventeen females captured on November 29, 2012 were ripe and either fully gravid or partially spawned; this represented 82% of the female population captured this date. The first kelt female was captured on this day as well as two green gravid females. The males captured represented 67% of the population, with 15% of those being kelts. The egg count on all five mats decreased to a total of 355 (16 on the site one mat, 56 on the site two mat, 12 on the site three mat, 34 at the site four mat and 237 at the site five mat).

December 06, 2012 – December 21, 2012

The relative abundance of MW began to decrease; 30 fish were captured and sampled on December 06, 2012, 29 on December 14, 2012 and 25 on December 21, 2012. The number of kelts was increasing in both sexes, with 100% of the females captured on the final day of sampling being kelts. The number of eggs found on the egg collection mats had decreased to 176, 110 and 18 on the final three respective sampling events. Although 18 eggs collectively were found on the mats, no green females or gravid ripe females were captured on December 21, 2012; this was the final day of field sampling. Spawning activity during the 2005 study appeared to be completed by December 13, 2005, and still continuing following the last day of sampling on December 21, 2009.

Table 1. Summary of fish captured during the 2012 MBR MW spawning assessment.

Date	Total Captured	Immature	Mature Males	Kelt Males	Mature Green F	Kelt Females	Mature Ripe F	Mature Partial F	% of Females Ripe
16-Oct-12	30	2	7	0	21	0	0	0	0%
25-Oct-12	30	3	4	0	23	0	0	0	0%
01-Nov-12	30	9	5	0	14	0	2	0	13%
08-Nov-12	30	0	18	0	3	0	9	0	75%
15-Nov-12	30	0	23	0	3	0	4	0	57%
22-Nov-12	32	0	21	0	0	0	11	0	100%
29-Nov-12	30	0	17	3	2	1	7	7	82%
06-Dec-12	30	1	8	5	2	7	7	3	53%
14-Dec-12	29	0	13	6	0	5	5	1	55%
20-Dec-12	25	1	1	9	0	14	0	0	0%

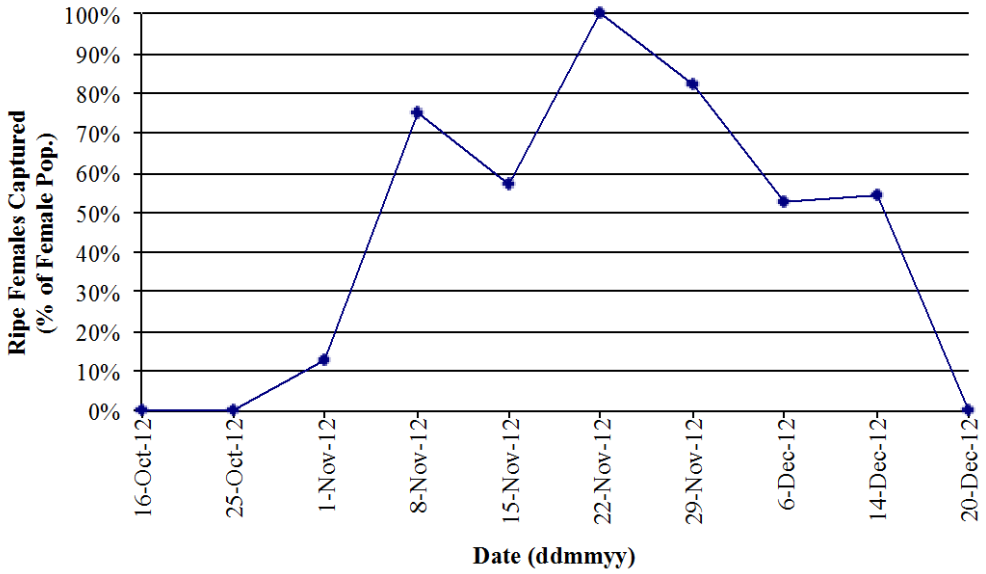


Figure 4. The percentage of ripe females relative to the weekly captured female population throughout the 2009 survey period.

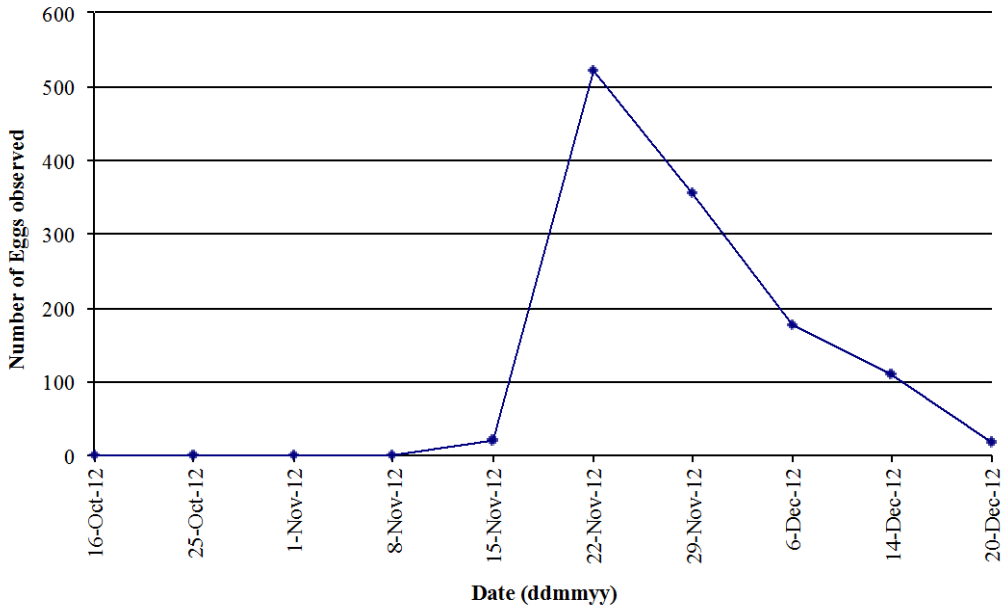


Figure 5. The total number of eggs observed per week throughout the 2012 survey period.

3.1 Biological Sampling Summary

Life history traits of mountain whitefish are extremely variable depending on location, type, and habitat. (Scott and Crossman, 1973). Scales collected and aged from mature mountain whitefish captured in the MBR during this assessment showed a wide range of life history. While the age of the fish could readily be determined, scale analysis (circuli growth) was inconclusive in most cases as to whether the fish had spawned the previous year(s), due to lack of calcium regeneration typically noted in rainbow trout. Many of the fish captured appeared to be gravid females, but eggs could not be expelled. These fish were, therefore, identified as immature or green gravid fish and not used in the mature fish fork length frequency analysis or maturity calculation analysis.

Fork Length Frequency Analysis Results

Minimum, maximum and mean fork lengths of mature male MW captured during the 2012 survey were 200 mm, 335 mm and 286.3 mm, respectively (n=156, **Figure 6**). Minimum, maximum and mean fork lengths of mature female MW captured during the 2012 survey were 210 mm, 350 mm and 300.2 mm, respectively (n=151). Minimum, maximum and mean fork lengths of mature male MW captured during the 2009 survey were 220 mm, 330 mm and 286.8 mm, respectively (n=112). Minimum, maximum and mean fork lengths of mature female MW captured during the 2009 survey were 251 mm, 340 mm and 292.2 mm, respectively (n=142). During the 2005 study, the mean fork length of males and females captured was 283.2 mm and 292.2 mm respectively.

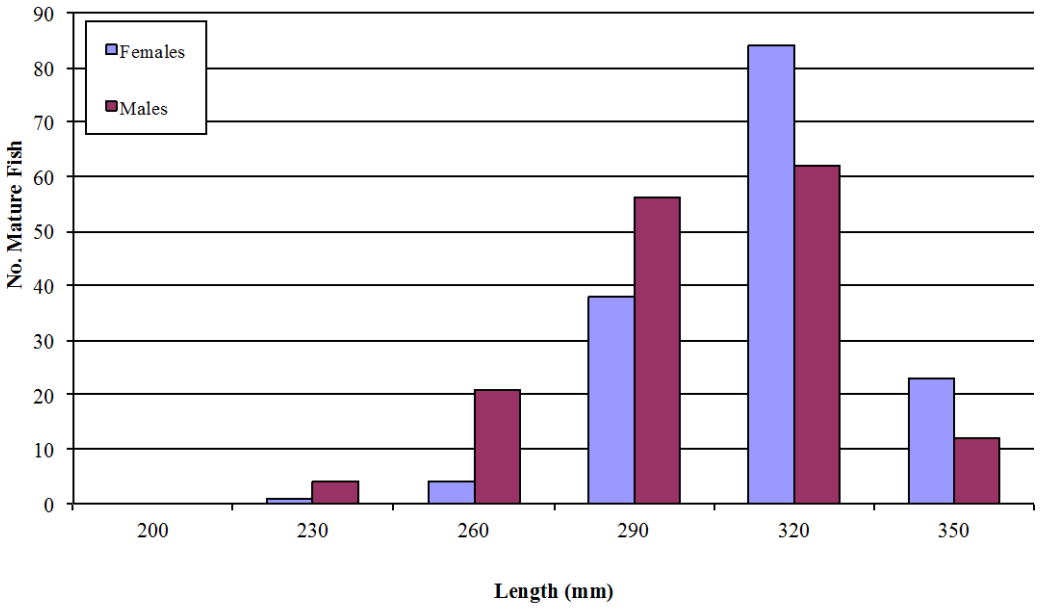


Figure 6. Fork length frequency of mature Mountain Whitefish (males n=155, females n=150) sampled during 2012 MBR MW spawning assessment.

Age Analysis Results

Sixty-eight males were sampled for age. Of those aged, 23 (34%) were first time spawners at 3 years of age and aged 2S, 13 (19%) were first time spawners at 4 years of age and aged 3S. No first time spawners at 5 years of age were noted. Eighteen additional males (26%) were repeat spawners at 4 years of age and aged 2SS, and 5 additional males (7%) were repeat spawners at 5 years of age and aged 2SSS. Three scales collected were regenerated and unable to be read. This was consistent with findings reported by Scott and Crossman (1973), and McPhail and Troffe (1998) where most MW become sexually mature at age 3 or 4 years of age.

Sixty-one females were sampled for age. Of those aged, 46 (54%) were first time spawners at 4 years of age and aged 3S. Twenty females (33%) were repeat spawners at 5 years of age and aged 3SS. Two fish were aged 2SS and one was aged 2SS; these fish may have been misidentified as females that were actually green males early in the sampling period. One fish (2%) was aged 3SSS and one (2%) aged 4SS.

During the 2005 and 2009 study periods, a majority of the fish captured were also first time spawners at an age of 4 years (3S).

3.2 Spawning Habitat and Biology

Spawning substrate was not measured until verification by presence of spawning MW was established. Once ripe adult female MW had been captured or eggs were collected at a specific site, substrate composition was sampled and depth/velocity measurements taken. Substrate habitat varied greatly from 50% boulder, 25% cobble and 25% gravel to 0% boulder and 75% gravel, 25% fines. The only consistency in measured substrate was the presence of clean gravel within the spawning areas. Depths of verified spawning habitat were a minimum of 0.72m, a maximum of 1.50m, and an average of 0.96m depth (n=5, S.E. 0.141) with a minimum of 0.15 m/s, a maximum of 0.95 m/s, and an average of 0.51 m/s velocity (n=5, S.E. 0.139) (**Table 2**). Spawning at depths ranging from 0.13m to 1.22m was noted in Montana by Brown (1952). Although nocturnal spawning was reported by McPhail and Lindsey (1970) in Kootenay Lake and Brown (1952) in Montana, nocturnal spawning could not be verified in the MBR due to high turbidity causing poor visibility. All spawning was observed within the mainstem portions of the MBR; no side-channel spawning was noted. Presence of spawning fish within side-channel habitat was sampled by angling only; no egg collection mats were placed in side-channel habitat during the 2012 study. Egg collection mats placed within side-channel habitat during the 2005 study resulted in no eggs being collected.

Eggs collected from females that were not yet water-hardened averaged 2 mm in diameter while eggs collected from the spawning mats averaged 3.5 mm in diameter (Tisdale, 2005). Brown (1952) found average water-hardened eggs were 3.7 mm in diameter. Although fecundity counts were not conducted during this MBR MW survey, most studies indicate averages of approximately 5000 eggs per 454 gram female (Scott and Crossman, 1973). In Montana, as reported by Brown (1952), eggs deposited in late October or early November hatched in early March and newly hatched fry could be found in stream shallows for a few weeks, but at lengths of 30mm to 40mm they moved off-shore.

Table 2. Spawning Habitat Substrate Composition and Depth/Velocity Profiles Within the Middle Bridge River during the 2012 study.

Site	Boulder (%)	Cobble (%)	Gravel (%)	Fines (%)	Depth (m)	Velocity m/s)
Egg Mat #1	50	25	25	0	1.50	0.50
Egg Mat #2	25	25	25	25	0.75	0.65
Egg Mat #3	50	40	10	0	0.92	0.15
Egg Mat #4	0	0	75	25	0.93	0.30
Egg Mat #5	40	25	30	5	0.72	0.95

3.3 Egg Incubation and Hatching

Water temperature for the MBR at LAJ2 was not available at the time this report was written to permit calculation of egg incubation to hatching. However, data was available for the 2005 period and used to estimate the approximate expected timing of hatching. A 327 ATU (accumulated thermal unit) requirement to hatch MW eggs was assumed (Pers. Comm. D. Schmidt, Golder Associates Ltd). Utilizing physical data collected during the 2009 study period, with the first eggs being collected on the mats on Nov 09, 2009 and the peak of spawn at approximately Nov. 30, 2009, MW eggs in the MBR should begin hatching approximately January 8, 2010 with peak of hatch near February 22, 2010. As the peak of spawning noted in 2012 was similar to that of 2009, expected hatching time was likely similar to the 2009 estimate.

3.4 Flow Constraints

After reviewing four years of data (2007-2009, 2012) and taking into consideration the relative spawning location, water depth and velocity, and relative abundance of adult MW in the MBR, it does not appear that the MBR MW spawning population is being impacted by the existing flow regime. No critical spawning habitat will be dewatered unless the MBR elevation is decreased by more than approximately 0.4 meters from where it was during the course of this study period. The one possible exception was November 13-19, 2007, where discharge in the middle Bridge River decreased from ~43 cms to ~18.3 cms and back up again during LaJoie plant maintenance activities. This caused a temporary decrease in the middle Bridge River stage by approximately 0.25 meters. This would have occurred at the beginning of the spawning period, leaving

spawning habitat noted during the 2009 study period covered by a minimum of approximately 0.15 meters depth.

4.0 CONCLUSIONS AND RECOMMENDATIONS

The 2012 MBR MW assessment provides the following insights:

- Observed spawning occurred from approximately November 15, 2012 until beyond December 21, 2012, with peak spawning occurring near November 22, 2012. During the 2009 study period, spawning occurred from approximately November 16, 2009 through to beyond December 21, 2009, with peak spawning occurring near November 30, 2009. During the 2005 study period, spawning occurred from approximately November 17, 2005 through December 22, 2005, with peak spawning occurring near November 23, 2005.
- Observed spawning occurred in water ranging from 0.72 m to 1.5 m in depth and in velocities averaging 0.51 m/s. Observed spawning occurred in water ranging from 0.95 m to 1.5 m in depth and in velocities averaging 0.52 m/s. All spawning appeared to occur in mainstem habitat only.
- First time spawning MW males were predominantly three years old and MW females were predominantly four years old in 2005, 2009 and 2012 studies.
- The minimum, maximum and mean length of mature male MW in the MBR was 200mm, 335mm and 286.3mm respectively in the 2012 study. The minimum, maximum and mean length of mature male MW in the MBR was 220mm, 330mm and 286.8mm respectively in the 2009 study. The minimum, maximum and mean length of mature male MW in the MBR was 229mm, 327mm and 283.2mm respectively during the 2005 study.
- The minimum, maximum and mean length of mature female MW in the MBR was 210mm, 350mm and 300.2mm respectively in the 2012 study. The minimum, maximum and mean length of mature female MW in the MBR was 251mm, 340mm and 292.2mm respectively in the 2009 study. The minimum, maximum and mean length of mature female MW in the MBR was 204mm, 331mm and 292mm respectively during the 2005 study.
- Hatching of MW eggs in the MBR should begin in mid January with peak hatching near the end of February.

- The existing flow regime did not appear to have impacted spawning MW or spawning habitat during the 2007-2009, 2012 period.

Recommendations for future MW studies on the MBR include:

- **Repeated Spawning Assessment.** A repeat of 2012 methodologies should be undertaken to gain a better understanding of temporal and spatial aspects regarding MW spawning.

- **Juvenile and adult MW biological sampling**. Juvenile capture with the aid of Gee traps, scoop seines and electrofishing should be undertaken in March/April to expand the scale database in an attempt to gain a better understanding of life histories. Additional capture and sampling during spawning periods is also recommended to collect scale samples from mature and foraging fish. Angling is the preferred method of capture for adults due to minimal disturbance of spawning fish.

- **Egg Distribution**. Egg distribution to shallow, slow moving water should be investigated by placement of egg mats downstream of known spawning habitat in areas known to dewater during flow regime manipulation to assess potential egg loss.

- **PIT Tag Antennae Placement.** An antennae needs to be placed across the MBR downstream of the noted spawning areas to determine when MW (and others) migrate into and out of the area for spawning activities.

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6.0 APPENDICES

Appendix I. MBR MW 2012 Biological Detail Data.

Date (ddmmyy)	Tag Type	Tag Number	Location	Species	Length (mm)	Weight (gm)	Scale	Age (yrs)	Sex (M/F)	Maturity (Mat/Imm)	Condition (Gr/Part/Kelt)	Spawning (Green/Ripe)	Recap	Notes
16-Oct-12		No Tag Applied	HRB	MW	292	252.5	MW121016.001	2SS	M	Mature				
16-Oct-12		No Tag Applied	HRB	MW	297	340.3	MW121016.002	3S	F	Mature	Gravid	Green		
16-Oct-12		No Tag Applied	HRB	MW	265	247.9	MW121016.003	3S	F	Mature	Gravid	Green		
16-Oct-12		No Tag Applied	HRB	MW	275	307.1	MW121016.004	3SS	F	Mature	Gravid	Green		
16-Oct-12		No Tag Applied	HRB	MW	248	173.7	MW121016.005	2S	M	Mature				
16-Oct-12		No Tag Applied	GBB	MW	215	93.0	MW121016.006	2+	UNK	Immature				
16-Oct-12		No Tag Applied	GBB	MW	312	382.6	MW121016.007	3S	F	Mature	Gravid	Green		
16-Oct-12		No Tag Applied	GBB	MW	200	85.0	MW121016.008	2+	UNK	Immature				
16-Oct-12		No Tag Applied	GBB	MW	310	390.0	MW121016.009	3SS	F	Mature	Gravid	Green		
16-Oct-12		No Tag Applied	GBB	MW	275	251.0	MW121016.010	3S	F	Mature	Gravid	Green		
16-Oct-12		No Tag Applied	GBB	MW	305	290.6	MW121016.011	3SS	F	Mature	Gravid	Green		
16-Oct-12		No Tag Applied	GBB	MW	306	364.4	MW121016.012	3S	F	Mature	Gravid	Green		
16-Oct-12		No Tag Applied	GBB	MW	272	231.0	MW121016.013	3S	M	Mature				
16-Oct-12		No Tag Applied	GBB	MW	251	181.0	MW121016.014	2S	M	Mature				
16-Oct-12		No Tag Applied	GBB	MW	276	303.0	MW121016.015	3SS	F	Mature	Gravid	Green		
16-Oct-12		No Tag Applied	GBB	MW	294	313.0	MW121016.016	3S	F	Mature	Gravid	Green		
16-Oct-12		No Tag Applied	GBB	MW	288	306.0	MW121016.017	DAMAGED	F	Mature	Gravid	Green		
16-Oct-12		No Tag Applied	GBB	MW	327	426.0	MW121016.018	3SS	F	Mature	Gravid	Green		
16-Oct-12		No Tag Applied	GBB	MW	247	171.5	MW121016.019	2S	M	Mature				
17-Oct-12		No Tag Applied	GBB	MW	271	224.8	MW121017.020	2SS	M	Mature				
17-Oct-12		No Tag Applied	GBB	MW	300	356.5	MW121017.021	3S	F	Mature	Gravid	Green		
17-Oct-12		No Tag Applied	GBB	MW	328	445.0	MW121017.022	3S	F	Mature	Gravid	Green		
17-Oct-12		No Tag Applied	GBB	MW	309	449.0	MW121017.023	3SS	F	Mature	Gravid	Green		
17-Oct-12		No Tag Applied	GBB	MW	296	340.0	MW121017.024	3SS	F	Mature	Gravid	Green		
17-Oct-12		No Tag Applied	GBB	MW	265	213.7	MW121017.025	3S	F	Mature	Gravid	Green		
17-Oct-12		No Tag Applied	GBB	MW	300	387.5	MW121017.026	3SS	F	Mature	Gravid	Green		
17-Oct-12		No Tag Applied	GBB	MW	254	186.0	MW121017.027	2S	M	Mature				
17-Oct-12		No Tag Applied	GBB	MW	307	254.0	MW121017.028	3S	F	Mature	Gravid	Green		
17-Oct-12		No Tag Applied	GBB	MW	308	352.0	MW121017.029	DAMAGED	F	Mature	Gravid	Green		
17-Oct-12		No Tag Applied	GBB	MW	338	489.0	MW121017.030	3SS	F	Mature	Gravid	Green		
25-Oct-12	HDX	900 226000086023	GBB	MW	261	187.0	MW121025.001	3+	UNK	Immature				
25-Oct-12	HDX	900 226000086019	GBB	MW	283	328.0	MW121025.002	2SS	F	Mature	Gravid	Green		
25-Oct-12	HDX	900 226000086027	GBB	MW	274	186.0	MW121025.003	3SS	F	Mature	Gravid	Green		
25-Oct-12	HDX	900 226000086009	GBB	MW	305	307.0	MW121025.004	3SS	F	Mature	Gravid	Green		
25-Oct-12	HDX	900 226000086029	GBB	MW	281	236.0	MW121025.005	DAMAGED	M	Mature				
25-Oct-12	HDX	900 226000085949	GBB	MW	276	271.0	MW121025.006	3S	F	Mature	Gravid	Green		
25-Oct-12	HDX	900 226000085977	GBB	MW	308	426.0	MW121025.007	3S	F	Mature	Gravid	Green		
25-Oct-12	HDX	900 226000086036	GBB	MW	304	354.0	MW121025.008	3SS	F	Mature	Gravid	Green		
25-Oct-12	HDX	900 226000085971	GBB	MW	328	473.0	MW121025.009	4SS	F	Mature	Gravid	Green		
25-Oct-12	HDX	900 226000085948	GBB	MW	288	271.0	MW121025.010	3S	M	Mature				
25-Oct-12	HDX	900 226000086024	GBB	MW	298	364.0	MW121025.011	3S	F	Mature	Gravid	Green		
25-Oct-12	HDX	900 226000085970	GBB	MW	304	396.0	MW121025.012	3S	F	Mature	Gravid	Green		
25-Oct-12	HDX	900 226000085984	GBB	MW	271	235.0	MW121025.013	3S	M	Mature				

Appendix I. MBR MW 2012 Biological Detail Data (Cont).

Date	Tag	Tag	Location	Species	Length	Weight	Scale	Age	Sex	Maturity	Condition	Spawning	Recap	Notes
(ddmmyy)	Type	Number			(mm)	(gm)		(yrs)	(M/F)	(Mat/Imm)	(Gr/Part/Kelt)	(Green/Ripe)		
25-Oct-12	HDX	900 226000086005	GBB	MW	265	220.0	MW121025.014	3S	UNK	Immature				
25-Oct-12	HDX	900 226000086018	GBB	MW	272	238.0	MW121025.015	3S	M	Mature				
25-Oct-12	HDX	900 226000085986	GBB	MW	308	308.0	MW121025.016	3S	F	Mature	Gravid	Green		
25-Oct-12	HDX	900 226000086034	GBB	MW	310	393.0	MW121025.017	3SS	F	Mature	Gravid	Green		
25-Oct-12	HDX	900 226000085963	GBB	MW	284	285.0	MW121025.018	3SS	F	Mature	Gravid	Green		
25-Oct-12	HDX	900 226000086041	GBB	MW	305	301.0	MW121025.019	3SS	F	Mature	Gravid	Green		
25-Oct-12	HDX	900 226000085978	GBB	BT	465	763.0	BT121025.001	3+	UNK	Immature				
25-Oct-12	HDX	900 226000086000	GBB	MW	270	217.0	MW121025.020	3S	F	Mature	Gravid	Green		
25-Oct-12	HDX	900 226000085964	GBB	MW	305	432.0	MW121025.021	3S	F	Mature	Gravid	Green		
25-Oct-12	HDX	900 226000085974	GBB	MW	309	408.0	MW121025.022	2SSS	F	Mature	Gravid	Green		
25-Oct-12	HDX	900 226000085998	GBB	MW	324	444.0	MW121025.023	3S	F	Mature	Gravid	Green		
25-Oct-12	HDX	900 226000085959	GBB	BT	490	794.0	BT121025.002	4+	UNK	Immature				
25-Oct-12	HDX	900 226000085990	GBB	MW	242	150.0	MW121025.024	2+	UNK	Immature				
25-Oct-12	HDX	900 226000085972	GBB	BT	384	579.0	BT121025.003	3+	UNK	Immature				
25-Oct-12	HDX	900 226000085967	GBB	MW	302	363.0	MW121025.025	3SS	F	Mature	Gravid	Green		
25-Oct-12	HDX	900 226000085982	GBB	MW	330	529.0	MW121025.026	3S	F	Mature	Gravid	Green		
25-Oct-12	HDX	900 226000085962	GBB	MW	302	372.0	MW121025.027	3S	F	Mature	Gravid	Green		
25-Oct-12	HDX	900 226000085965	GBB	MW	283	312.0	MW121025.028	3S	F	Mature	Gravid	Green		
25-Oct-12	HDX	900 226000086040	GBB	MW	293	327.0	MW121025.029	3SS	F	Mature	Gravid	Green		
26-Oct-12	HDX	900 226000085987	GBB	MW	300	400.0	MW121026.001	3S	F	Mature	Gravid	Green		
1-Nov-12	HDX	900 226000085954	HRB	MW	273	250.0	MW121101.001	DAMAGED	F	Mature	Gravid	Green		
1-Nov-12	HDX	900 226000085985	HRB	MW	252	191.0	MW121101.002	3S	F	Mature	Gravid	Green		
1-Nov-12	HDX	900 226000086026	HRB	MW	283	316.0	MW121101.003	3S	F	Mature	Gravid	Green		
1-Nov-12	HDX	900 226000086031	HRB	MW	262	230.0	MW121101.004	3S	F	Mature	Gravid	Green		
1-Nov-12	HDX	900 226000085961	HRB	MW	262	207.0	MW121101.005	2+	UNK	Immature				
1-Nov-12	HDX	900 226000086007	HRB	MW	268	227.0	MW121101.006	3S	M	Mature		Tubercles		
1-Nov-12		No Tag Applied	HRB	MW	273	250.0	MW121101.007	3S	F	Mature	Gravid	Green		
1-Nov-12	HDX	900 226000086044	HRB	MW	260	246.0	MW121101.008	3S	F	Mature	Gravid	Green		
1-Nov-12		No Tag Applied	HRB	MW	292	268.0	MW121101.009	2SS	M	Mature				
1-Nov-12	HDX	900 226000086015	HRB	BT	388	466.0	BT121101.001	3+	UNK	Immature				
1-Nov-12	HDX	900 226000085994	HRB	MW	330	472.0	MW121101.010	3SS	F	Mature	Gravid	Green		
1-Nov-12	HDX	900 226000085958	HRB	MW	289	263.0	MW121101.011	3S	F	Mature	Gravid	Green		
1-Nov-12	HDX	900 226000085968	HRB	MW	293	278.0	MW121101.012	3SS	UNK	Immature				
1-Nov-12	HDX	900 226000085955	HRB	MW	249	189.0	MW121101.013	2+	UNK	Immature				
1-Nov-12	HDX	900 226000085999	HRB	MW	299	320.0	MW121101.014	3S	UNK	Immature				
1-Nov-12	HDX	900 226000085996	HRB	MW	280	279.0	MW121101.015	3S	F	Mature	Gravid	Ripe		
1-Nov-12	HDX	900 226000085960	HRB	MW	285	299.0	MW121101.016	3SS	F	Mature	Gravid	Green		
1-Nov-12	HDX	900 226000086008	HRB	MW	334	480.0	MW121101.017	3SSSS	UNK	Immature				
1-Nov-12	HDX	900 226000086011	HRB	MW	268	205.0	MW121101.018	3S	UNK	Immature				
1-Nov-12	HDX	900 226000086006	HRB	BT	405	678.0	BT121101.002	3+	UNK	Immature				
1-Nov-12	HDX	900 226000086002	HRB	BT	410	622.0	BT121101.003	3+	UNK	Immature				
1-Nov-12	HDX	900 226000086039	HRB	MW	228	135.0	MW121101.019	3S	UNK	Immature				
1-Nov-12	HDX	900 226000086014	HRB	MW	272	220.0	MW121101.020	3S	UNK	Immature				

Appendix I. MBR MW 2012 Biological Detail Data (Cont).

Date (ddmmyy)	Tag Type	Tag Number	Location	Species	Length (mm)	Weight (gm)	Scale	Age (yrs)	Sex (M/F)	Maturity (Mat/Imm)	Condition (Gr/Part/Kelt)	Spawning (Green/Ripe)	Recap	Notes
1-Nov-12	HDX	900 226000086022	HRB	MW	296	364.0	MW121101.021	3SS	F	Mature	Gravid	Green		
1-Nov-12	HDX	900 226000086045	HRB	MW	298	263.0	MW121101.022	2SS	M	Mature		Tubercles		
1-Nov-12	HDX	900 226000086021	HRB	MW	285	283.0	MW121101.023	3S	F	Mature	Gravid	Green		
1-Nov-12		No Tag Applied	HRB	MW	311	439.0	MW121101.024	3SSS	F	Mature	Gravid	Green		
1-Nov-12	HDX	900 226000085950	HRB	MW	289	286.0	MW121101.025	3S	M	Mature				
1-Nov-12	HDX	900 226000085957	HRB	MW	276	315.0	MW121101.026	3S	F	Mature	Gravid	Green		
1-Nov-12	HDX	900 226000085966	HRB	MW	284	314.0	MW121101.027	3S	F	Mature	Gravid	Green		
1-Nov-12	HDX	900 226000086025	HRB	MW	248	162.0	MW121101.028	2S	M	Mature				
1-Nov-12	HDX	900 226000085976	HRB	MW	281	240.0	MW121101.029	2S	UNK	Immature				
1-Nov-12	HDX	900 226000085995	HRB	MW	325	392.0	MW121101.030	3S	F	Mature	Gravid	Ripe		
8-Nov-12	HDX	900 226000086004	Site #5	MW	292	387.0	MW121108.001	2SS	M	Mature				
8-Nov-12		No Tag Applied	Site #5	MW	309	360.0	MW121108.002	2SSS	M	Mature				
8-Nov-12	HDX	900 226000085992	Site #5	MW	248	162.0	MW121108.003	2S	M	Mature				
8-Nov-12	HDX	900 226000086013	Site #5	MW	250	161.0	MW121108.004	2S	M	Mature				
8-Nov-12	HDX	900 226000085993	Site #5	MW	308	416.0			F	Mature	Gravid	Green		
8-Nov-12	HDX	900 226000085979	Site #5	MW	282	277.0			F	Mature	Gravid	Ripe		
8-Nov-12	HDX	900 226000085951	Site #5	MW	320	370.0	MW121108.005	3SSS	M	Mature				
8-Nov-12	HDX	900 226000085953	Site #5	MW	311	408.0			F	Mature	Gravid	Green		
8-Nov-12	HDX	900 226000085975	Site #5	MW	289	264.0	MW121108.006	2SS	M	Mature				
8-Nov-12		No Tag Applied	Site #5	MW	259	198.0	MW121108.007	2S	M	Mature				
8-Nov-12	HDX	900 226000085969	Site #5	MW	285	283.0	MW121108.008	2SS	M	Mature				
8-Nov-12	HDX	900 226000086030	Site #5	BT	435	805.0	BT121108.001	3+	UNK	Immature				
8-Nov-12	HDX	900 226000085983	Site #5	MW	310	329.0	MW121108.009	2SS	M	Mature				
8-Nov-12	HDX	900 226000086035	Site #5	MW	286	279.0			F	Mature	Gravid	Ripe		
8-Nov-12	HDX	900 226000086033	Site #5	MW	286	331.0			F	Mature	Gravid	Ripe		
8-Nov-12	HDX	900 226000086047	Site #5	MW	268	205.0	MW121108.010	2S	M	Mature				
8-Nov-12	HDX	900 226000086003	Site #5	MW	299	328.0	MW121108.011	2SS	M	Mature				
8-Nov-12	HDX	900 226000085956	HRB	MW	259	211.0	MW121108.012	2S	M	Mature				
8-Nov-12	HDX	900 226000086017	HRB	MW	247	171.0	MW121108.013	2S	M	Mature				
8-Nov-12	HDX	900 226000086010	HRB	MW	289	321.0			F	Mature	Gravid	Green		
8-Nov-12	HDX	900 226000086032	HRB	MW	270	253.0	MW121108.014	2S	M	Mature				
8-Nov-12	HDX	900 226000086028	HRB	MW	310	366.0	MW121108.015	2SSS	M	Mature				
8-Nov-12	HDX	900 226000085952	HRB	MW	274	221.0			F	Mature	Gravid	Ripe		
8-Nov-12	HDX	900 226000085980	HRB	MW	298	347.0			F	Mature	Gravid	Ripe		
8-Nov-12	HDX	900 226000085973	HRB	MW	320	358.0			F	Mature	Gravid	Ripe		
8-Nov-12	HDX	900 226000086043	HRB	MW	310	389.0			F	Mature	Gravid	Ripe		
8-Nov-12	HDX	900 226000086020	HRB	MW	301	329.0	MW121108.016	2SSS	M	Mature				
8-Nov-12	HDX	900 226000086037	HRB	MW	297	371.0			F	Mature	Gravid	Ripe		
8-Nov-12	HDX	900 226000085981	HRB	MW	265	223.0	MW121108.017	2S	M	Mature				
8-Nov-12	HDX	900 226000085991	HRB	MW	260	203.0	MW121108.018	2SS	M	Mature				
8-Nov-12	HDX	900 226000085988	HRB	MW	266	245.0			F	Mature	Gravid	Ripe		
15-Nov-12	HDX	900 226000086038	Site #5	MW	294	285.0	MW121115.001	3S	M	Mature				
15-Nov-12	HDX	900 226000086012	Site #5	MW	284	256.0	MW121115.002	3S	M	Mature				

Appendix I. MBR MW 2012 Biological Detail Data (Cont).

Date	Tag	Tag	Location	Species	Length	Weight	Scale	Age	Sex	Maturity	Condition	Spawning	Recap	Notes
(ddmmyy)	Type	Number			(mm)	(gm)		(yrs)	(M/F)	(Mat/Imm)	(Gr/Part/Kelt)	(Green/Ripe)		
15-Nov-12	HDX	900 226000085997	Site #5	MW	268	244.0	MW121115.003	3S	M	Mature				
15-Nov-12	HDX	900 226000086046	Site #5	MW	260	188.0			F	Mature	Gravid	Ripe		
15-Nov-12	HDX	900 226000086882	Site #5	MW	278	229.0	MW121115.004	3S	M	Mature				
15-Nov-12	HDX	900 226000086953	Site #5	MW	314	436.0			F	Mature	Gravid	Ripe		
15-Nov-12	HDX	900 226000086928	Site #5	MW	315	343.0	MW121115.005	3SS	M	Mature				
15-Nov-12	HDX	900 226000086918	Site #5	MW	283	258.0	MW121115.006	2SS	M	Mature				
15-Nov-12	HDX	900 226000086896	Site #5	MW	308	419.0	MW121115.007	2SS	F	Mature	Gravid	Green		
15-Nov-12	HDX	900 226000086955	Site #5	MW	326	394.0	MW121115.008	DAMAGED	M	Mature				
15-Nov-12	HDX	900 226000086900	Site #5	MW	295	363.0			F	Mature	Gravid	Green		
15-Nov-12	HDX	900 226000086903	Site #5	MW	300	314.0	MW121115.009	DAMAGED	M	Mature				
15-Nov-12	HDX	900 226000086938	Site #5	MW	311	376.0	MW121115.010	2SS	M	Mature				
15-Nov-12	HDX	900 226000086940	Site #5	MW	240	143.0	MW121115.011	2S	M	Mature				
15-Nov-12	HDX	900 226000086887	Site #5	MW	250	182.0	MW121115.012	2S	M	Mature				
15-Nov-12	HDX	900 226000086954	Site #5	MW	295	280.0			F	Mature	Gravid	Ripe		
15-Nov-12	HDX	900 226000086907	Site #5	MW	291	217.0	MW121115.013	3S	M	Mature				
15-Nov-12	HDX	900 226000086890	Site #5	MW	241	158.0	MW121115.014	2S	M	Mature				
15-Nov-12	HDX	900 226000086923	Site #5	MW	270	218.0	MW121115.015	2SSS	M	Mature				
15-Nov-12	HDX	900 226000086944	Site #5	MW	281	191.0	MW121115.016	2S	M	Mature				
15-Nov-12	HDX	900 226000086888	Site #5	MW	283	319.0	MW121115.017	2S	M	Mature				
15-Nov-12	HDX	900 226000086914	Site #5	MW	304	318.0	MW121115.018	2SS	M	Mature				
15-Nov-12	HDX	900 226000086898	Site #5	MW	260	195.0	MW121115.019	2S	M	Mature				
15-Nov-12	HDX	900 226000086873	Site #5	MW	296	290.0			F	Mature	Gravid	Ripe		
15-Nov-12	HDX	900 226000086870	Site #5	MW	316	359.0	MW121115.020	2SS	M	Mature				
15-Nov-12	HDX	900 226000086925	Site #5	MW	260	191.0	MW121115.021	2SS	M	Mature				
15-Nov-12	HDX	900 226000086922	Site #5	MW	285	276.0	MW121115.022	3S	M	Mature				
15-Nov-12	HDX	900 226000086920	Site #5	MW	292	328.0			F	Mature	Gravid	Green		
15-Nov-12	HDX	900 226000086880	Site #5	MW	293	309.0	MW121115.023	3S	M	Mature				
15-Nov-12	HDX	900 226000086910	Site #5	MW	280	261.0	MW121115.024	2SS	M	Mature				
22-Nov-12	HDX	900 226000086883	HRB	MW	320	356.0	MW121122.001	3SS	M	Mature				
22-Nov-12	HDX	900 226000086965	HRB	MW	265	218.0	MW121122.002	2S	M	Mature				
22-Nov-12	HDX	900 226000086877	HRB	MW	325	400.0			F	Mature	Gravid	Ripe		
22-Nov-12	HDX	900 226000086927	HRB	MW	298	280.0	MW121122.003	2S	M	Mature				
22-Nov-12	HDX	900 226000086885	HRB	MW	305	282.0	MW121122.004	2SS	M	Mature				
22-Nov-12	HDX	900 226000086872	HRB	MW	275	227.0			F	Mature	Gravid	Ripe		
22-Nov-12	HDX	900 226000086904	HRB	MW	300	391.0			F	Mature	Gravid	Ripe		
22-Nov-12	HDX	900 226000086909	HRB	MW	305	340.0	MW121122.005	2SS	M	Mature				
22-Nov-12	HDX	900 226000086915	HRB	MW	331	407.0	MW121122.006	3SSS	M	Mature				
22-Nov-12	HDX	900 226000086952	HRB	MW	252	177.0	MW121122.007	2S	M	Mature				
22-Nov-12	HDX	900 226000086962	HRB	MW	285	330.0			F	Mature	Gravid	Ripe		
22-Nov-12	HDX	900 226000086874	HRB	BT	462	774.0	BT121122.001		UNK	Immature				
22-Nov-12	HDX	900 226000086930	HRB	MW	323	348.0	MW121122.008	2SSS	M	Mature				
22-Nov-12	HDX	900 226000086951	HRB	MW	210	425.0			F	Mature	Gravid	Ripe		
22-Nov-12	HDX	900 226000086913	HRB	MW	305	298.0	MW121122.009	3SS	M	Mature				

Appendix I. MBR MW 2012 Biological Detail Data (Cont).

Date (ddmmyy)	Tag Type	Tag Number	Location	Species	Length (mm)	Weight (gm)	Scale	Age (yrs)	Sex (M/F)	Maturity (Mat/Imm)	Condition (Gr/Part/Kelt)	Spawning (Green/Ripe)	Recap	Notes
22-Nov-12	HDX	900 226000086893	HRB	MW	305	335.0			F	Mature	Gravid	Ripe		
22-Nov-12	HDX	900 226000086879	HRB	MW	290	360.0			F	Mature	Gravid	Ripe		
22-Nov-12	HDX	900 226000086958	HRB	MW	331	415.0			F	Mature	Gravid	Ripe		
22-Nov-12	HDX	900 226000086935	HRB	MW	298	319.0	MW121122.010	3SS	M	Mature				
22-Nov-12	HDX	900 226000086871	HRB	BT	585	1734.0	BT121122.002		F	Kelt				
22-Nov-12	HDX	900 226000086931	HRB	BT	442	840.0			UNK	Immature				
22-Nov-12	HDX	900 226000086933	HRB	BT	480	982.0	BT121122.003		UNK	Immature				
22-Nov-12	HDX	900 226000086874	HRB	BT	462	775.0			UNK	Immature			RECAP	
22-Nov-12	HDX	900 226000086886	HRB	MW	263	211.0			M	Mature				
22-Nov-12	HDX	900 226000086876	HRB	BT	520	1155.0			M	Kelt				
22-Nov-12	HDX	900 226000086929	HRB	MW	270	204.0			M	Mature				
22-Nov-12	HDX	900 226000086948	HRB	MW	306	385.0			F	Mature	Gravid	Ripe		
22-Nov-12	HDX	900 226000086916	HRB	MW	253	153.0			F	Mature	Gravid	Ripe		
22-Nov-12	HDX	900 226000086869	HRB	MW	288	320.0			F	Mature	Gravid	Ripe		
22-Nov-12	HDX	900 226000086967	HRB	MW	315	358.0			M	Mature				
22-Nov-12	HDX	900 226000086931	HRB	BT	442	840.0	BT121122.004		UNK	Immature			RECAP	
22-Nov-12	HDX	900 226000086901	HRB	MW	275	203.0			M	Mature				
22-Nov-12	HDX	900 226000086881	HRB	MW	265	227.0			M	Mature				
22-Nov-12	HDX	900 226000086934	HRB	MW	300	330.0			M	Mature				
22-Nov-12	HDX	900 226000086875	HRB	MW	301	298.0			M	Mature				
22-Nov-12	HDX	900 226000086937	HRB	MW	307	330.0			M	Mature				
22-Nov-12	HDX	900 226000086912	HRB	MW	250	166.0			M	Mature				
22-Nov-12	HDX	900 226000086942	HRB	MW	321	363.0			M	Mature				
22-Nov-12	HDX	900 226000086906	HRB	MW	295	272.0			M	Mature				
22-Nov-12	HDX	900 226000086926	HRB	BT	524	1170.0			UNK	Immature				
29-Nov-12	HDX	900 226000086932	GBB	MW	307	376.0			F	Mature	Partial	Ripe		
29-Nov-12	HDX	900 226000086905	GBB	MW	320	396.0			F	Mature	Kelt	Ripe		
29-Nov-12	HDX	900 226000086917	GBB	MW	268	235.0			M	Mature	Kelt			
29-Nov-12	HDX	900 226000086936	GBB	MW	312	333.0			F	Mature	Partial	Ripe		
29-Nov-12	HDX	900 226000086968	GBB	MW	302	331.0			F	Mature	Partial	Ripe		
29-Nov-12	HDX	900 226000086908	GBB	BT	440	844.0			UNK	Immature				
29-Nov-12	HDX	900 226000086939	GBB	MW	304	310.0			M	Mature	Kelt			
29-Nov-12	HDX	900 226000086941	GBB	MW	312	447.0			F	Mature	Gravid	Ripe		
29-Nov-12	HDX	900 226000086950	HRB	MW	321	347.0			M	Mature				
29-Nov-12	HDX	900 226000086933	HRB	BT	480	917.0			UNK	Immature			RECAP	
29-Nov-12	HDX	900 226000086949	HRB	MW	274	234.0			M	Mature				
29-Nov-12	HDX	900 226000086889	HRB	MW	274	220.0			M	Mature				
29-Nov-12	HDX	900 226000086911	HRB	MW	319	324.0			M	Mature				
29-Nov-12	HDX	900 226000086961	HRB	BT	400	554.0	BT121129.001		UNK	Immature				
29-Nov-12	HDX	900 226000086947	HRB	MW	302	299.0			M	Mature				
29-Nov-12	HDX	900 226000086933	HRB	BT	480	917.0			UNK	Immature			RECAP	
29-Nov-12	HDX	900 226000086892	HRB	BT	328	331.0	BT121129.002		UNK	Immature				
29-Nov-12	HDX	900 226000086921	HRB	MW	298	290.0			M	Mature				

Appendix I. MBR MW 2012 Biological Detail Data (Cont).

Date (ddmmyy)	Tag Type	Tag Number	Location	Species	Length (mm)	Weight (gm)	Scale	Age (yrs)	Sex (M/F)	Maturity (Mat/Imm)	Condition (Gr/Part/Kelt)	Spawning (Green/Ripe)	Recap	Notes
29-Nov-12	HDX	900 226000086943	HRB	MW	268	211.0			M	Mature				
29-Nov-12	HDX	900 226000086966	HRB	MW	309	329.0			M	Mature				
29-Nov-12	HDX	900 226000086924	HRB	BT	480	1012.0	BT121129.003		UNK	Immature				
29-Nov-12	HDX	900 226000086960	HRB	MW	282	341.0			F	Mature	Gravid	Ripe		
29-Nov-12	HDX	900 226000086894	HRB	MW	260	190.0			M	Mature	Kelt			
29-Nov-12	HDX	900 226000086956	HRB	MW	319	363.0			M	Mature				
29-Nov-12	HDX	900 226000086895	HRB	MW	279	231.0			M	Mature				
29-Nov-12	HDX	900 226000086892	HRB	BT	328	331.0			UNK	Immature			RECAP	
29-Nov-12	HDX	900 226000086891	HRB	BT	391	481.0	BT121129.004		UNK	Immature				
29-Nov-12	HDX	900 226000086919	HRB	MW	310	391.0			F	Mature	Gravid	Green		
29-Nov-12	HDX	900 226000086946	HRB	MW	319	368.0			F	Mature	Partial	Ripe		
29-Nov-12	HDX	900 226000086902	HRB	MW	304	386.0			F	Mature	Partial	Ripe		
29-Nov-12	HDX	900 226000086878	HRB	BT	352	466.0	BT121129.005		UNK	Immature				
29-Nov-12	HDX	900 226000086963	HRB	MW	318	442.0			F	Mature	Gravid	Ripe		
29-Nov-12	HDX	900 226000086964	HRB	MW	289	316.0			F	Mature	Gravid	Ripe		
29-Nov-12	HDX	900 226000086957	HRB	MW	229	248.0			F	Mature	Gravid	Green		
29-Nov-12	HDX	900 226000086899	HRB	MW	301	322.0			F	Mature	Gravid	Ripe		
29-Nov-12	HDX	900 226000086891	HRB	BT	391	481.0			UNK	Immature			RECAP	
29-Nov-12	HDX	900 226000086897	HRB	MW	330	444.0			F	Mature	Gravid	Ripe		
29-Nov-12	HDX	900 226000086891	HRB	BT	391	481.0			UNK	Immature			RECAP	
29-Nov-12	HDX	900 226000086884	HRB	MW	275	228.0			F	Mature	Partial	Ripe		
30-Nov-12	HDX	900 226000086945	HRB	MW	291	313.0			M	Mature				
30-Nov-12	HDX	900 226000080746	HRB	MW	290	310.0			M	Mature				
30-Nov-12	HDX	900 226000080679	HRB	MW	316	374.0			M	Mature				
30-Nov-12	HDX	900 226000086876	HRB	BT	520	1155.0			M	Mature	Kelt		RECAP	
30-Nov-12	HDX	900 226000080656	HRB	MW	323	512.0			F	Mature	Gravid	Ripe		
30-Nov-12	HDX	900 226000080719	HRB	BT	468	1014.0			UNK	Immature				
30-Nov-12	HDX	900 226000080712	HRB	BT	666	2900.0	BT121130.001		UNK	Immature				
30-Nov-12	HDX	900 226000080693	HRB	MW	287	263.0			M	Mature				
30-Nov-12	HDX	900 226000080701	HRB	MW	263	193.0			F	Mature	Kelt	Ripe		
30-Nov-12	HDX	900 226000080737	HRB	BT	685	2869.0	BT121130.002		M	Mature	Kelt			
30-Nov-12	HDX	900 226000080655	HRB	BT	590	2150.0	BT121130.003		M	Mature	Kelt			
30-Nov-12	HDX	900 226000080661	HRB	MW	275	206.0			M	Mature				
30-Nov-12	HDX	900 226000080710	HRB	MW	310	298.0			M	Mature				
30-Nov-12	HDX	900 226000080708	HRB	MW	319	316.0			M	Mature				
30-Nov-12	HDX	900 226000086961	HRB	BT	400	555.0			UNK	Immature			RECAP	
6-Dec-12	HDX	900 226000080679	HRB	MW	316	374.0			M	Mature				
6-Dec-12	HDX	900 226000080655	HRB	BT	590	2150.0			M	Mature	Kelt		RECAP	
6-Dec-12	HDX	900 226000080733	HRB	MW	275	263.0			M	Mature	Kelt			
6-Dec-12	HDX	900 226000080711	HRB	MW	311	352.0			M	Mature	Kelt			
6-Dec-12	HDX	900 226000080740	HRB	MW	269	210.0			M	Mature	Kelt			
6-Dec-12	HDX	900 226000080697	HRB	MW	316	314.0			M	Mature	Kelt			
6-Dec-12	HDX	900 226000080707	HRB	MW	280	226.0			M	Mature	Kelt			

Appendix I. MBR MW 2012 Biological Detail Data (Cont).

Date	Tag	Tag	Location	Species	Length	Weight	Scale	Age	Sex	Maturity	Condition	Spawning	Recap	Notes
(ddmmyy)	Type	Number			(mm)	(gm)		(yrs)	(M/F)	(Mat/Imm)	(Gr/Part/Kelt)	(Green/Ripe)		
6-Dec-12	HDX	900 226000080685	HRB	MW	307	359.0			M	Mature				
6-Dec-12	HDX	900 226000080649	HRB	MW	328	344.0			M	Mature				
6-Dec-12	HDX	900 226000080688	HRB	MW	280	228.0			M	Mature				
6-Dec-12	HDX	900 226000080704	HRB	MW	304	303.0			M	Mature				
6-Dec-12	HDX	900 226000080651	HRB	MW	306	321.0			M	Mature				
6-Dec-12	HDX	900 226000080724	HRB	MW	310	389.0			F	Mature	Gravid	Ripe		
6-Dec-12	HDX	900 226000080686	HRB	MW	316	323.0			F	Mature	Gravid	Ripe		
6-Dec-12	HDX	900 226000080654	GBB	MW	326	392.0			F	Mature	Partial	Ripe		
6-Dec-12	HDX	900 226000080715	GBB	MW	310	421.0			F	Mature	Gravid	Ripe		
6-Dec-12	HDX	900 226000080670	GBB	MW	322	457.0			F	Mature	Gravid	Green		
6-Dec-12	HDX	900 226000080673	GBB	MW	318	337.0			F	Mature	Kelt			
6-Dec-12			GBB	BT	690	3560.0	BT121206.001		UNK	Immature				Tagged but not scanned
6-Dec-12	HDX	900 226000080666	GBB	MW	311	338.0			F	Mature	Partial	Ripe		
6-Dec-12	HDX	900 226000080731	GBB	BT	510	1079.0	BT121206.002		UNK	Immature				
6-Dec-12	HDX	900 226000080721	GBB	BT	428	667.0	BT121206.003		UNK	Immature				
6-Dec-12	HDX	900 226000080677	GBB	MW	298	344.0			F	Mature	Gravid	Green		
6-Dec-12	HDX	900 226000080705	GBB	MW	296	281.0			F	Mature	Kelt			
6-Dec-12	HDX	900 226000080743	GBB	MW	314	354.0			M	Mature				
6-Dec-12	HDX	900 226000080652	GBB	MW	289	255.0			F	Mature	Kelt			
6-Dec-12	HDX	900 226000080657	GBB	MW	320	377.0			F	Mature	Gravid	Ripe		
6-Dec-12	HDX	900 226000080668	GBB	MW	278	239.0			UNK	Immature				
6-Dec-12	HDX	900 226000080732	GBB	MW	318	332.0			F	Mature	Kelt			
6-Dec-12	HDX	900 226000080744	GBB	MW	325	375.0			F	Mature	Gravid	Ripe		
6-Dec-12	HDX	900 226000086041	GBB	MW	302	286.0			F	Mature	Kelt		RECAP	
6-Dec-12	HDX	900 226000080742	GBB	MW	318	375.0			F	Mature	Gravid	Ripe		
6-Dec-12			GBB	MW	320	348.0			F	Mature	Gravid	Ripe		Tagged but not scanned
6-Dec-12	HDX	900 226000080648	GBB	BT	480	1069.0	BT121206.004		UNK	Immature				
6-Dec-12	HDX	900 226000080680	GBB	MW	336	374.0			F	Mature	Partial	Ripe		
6-Dec-12	HDX	900 226000080714	GBB	MW	298	310.0			F	Mature	Kelt			
6-Dec-12	HDX	900 226000080667	GBB	MW	300	295.0			M	Mature				
6-Dec-12	HDX	900 226000080727	GBB	MW	322	313.0			F	Mature	Kelt			
14-Dec-12	HDX	900 226000080739	HRB	MW	295	298.0			M	Mature				
14-Dec-12	HDX	900 226000080722	HRB	MW	318	346.0			M	Mature				
14-Dec-12	HDX	900 226000080716	HRB	MW	281	249.0			M	Mature				
14-Dec-12	HDX	900 226000080660	HRB	MW	300	331.0			F	Mature	Gravid	Ripe		
14-Dec-12	HDX	900 226000080689	HRB	MW	316	346.0			M	Mature				
14-Dec-12	HDX	900 226000080650	HRB	MW	306	331.0			M	Mature				
14-Dec-12	HDX	900 226000080729	HRB	MW	335	419.0			M	Mature				
14-Dec-12	HDX	900 226000080691	HRB	MW	288	251.0			M	Mature				
14-Dec-12	HDX	900 226000080671	HRB	MW	282	240.0			M	Mature				
14-Dec-12	HDX	900 226000080662	HRB	MW	328	367.0			M	Mature				
14-Dec-12	HDX	900 226000080735	HRB	MW	298	348.0			F	Mature	Gravid	Ripe		
14-Dec-12	HDX	900 226000080694	HRB	MW	330	385.0			M	Mature				

Appendix I. MBR MW 2012 Biological Detail Data (Cont).

Date	Tag	Tag	Location	Species	Length	Weight	Scale	Age	Sex	Maturity	Condition	Spawning	Recap	Notes
(ddmmyy)	Type	Number			(mm)	(gm)		(yrs)	(M/F)	(Mat/Imm)	(Gr/Part/Kelt)	(Green/Ripe)		
14-Dec-12	HDX	900 226000080735	HRB	MW	296	347.0			F	Mature	Gravid	Ripe		
14-Dec-12	HDX	900 226000080678	HRB	MW	247	166.0	MW121214.001	2S	M	Mature				
14-Dec-12	HDX	900 226000080699	HRB	MW	295	269.0			M	Mature				
14-Dec-12	HDX	900 226000080718	HRB	BT	455	813.0	BT121214.001		UNK	Immature				
14-Dec-12	HDX	900 226000080717	GBB	MW	316	399.0			M	Mature				
14-Dec-12	HDX	900 226000080709	GBB	MW	312	341.0			F	Mature	Kelt			
14-Dec-12	HDX	900 226000080734	GBB	MW	295	295.0			M	Mature	Kelt			
14-Dec-12	HDX	900 226000080665	GBB	MW	330	399.0			M	Mature	Kelt			
14-Dec-12	HDX	900 226000080720	GBB	MW	320	350.0			F	Mature	Gravid	Ripe		
14-Dec-12	HDX	900 226000080700	GBB	MW	292	263.0			F	Mature	Kelt			
14-Dec-12	HDX	900 226000080700	GBB	MW	278	206.0			M	Mature	Kelt			
14-Dec-12	HDX	900 226000080703	GBB	MW	300	379.0			F	Mature	Gravid	Ripe		
14-Dec-12	HDX	900 226000080696	GBB	MW	329	400.0			F	Mature	Partial	Ripe		
14-Dec-12	HDX	900 226000080725	GBB	MW	320	370.0			F	Mature	Kelt			
14-Dec-12	HDX	900 226000080687	GBB	MW	318	376.0			M	Mature	Kelt			
14-Dec-12	HDX	900 226000080713	GBB	MW	276	244.0			F	Mature	Kelt			
14-Dec-12	HDX	900 226000080726	GBB	MW	288	264.0			M	Mature	Kelt			
14-Dec-12	HDX	900 226000080728	GBB	MW	318	318.0			F	Mature	Kelt			
14-Dec-12	HDX	900 226000080741	GBB	MW	300	308.0			M	Mature	Kelt			
20-Dec-12	HDX	900 226000080664	HRB	MW	263	203.0			M	Mature	Kelt			
20-Dec-12	HDX	900 226000080706	HRB	MW	272	221.0			M	Mature	Kelt			
20-Dec-12	HDX	900 226000080698	HRB	MW	350	399.0			F	Mature	Kelt			
20-Dec-12	HDX	900 226000080723	HRB	MW	265	201.0			M	Mature	Kelt			
20-Dec-12	HDX	900 226000080653	HRB	MW	293	299.0			M	Mature	Kelt			
20-Dec-12	HDX	900 226000080675	HRB	MW	305	331.0			F	Mature	Kelt			
20-Dec-12	HDX	900 226000080659	HRB	MW	285	245.0			M	Mature				
20-Dec-12	HDX	900 226000080747	HRB	MW	229	128.0			UNK	Immature				
20-Dec-12	HDX	900 226000080669	HRB	MW	312	319.0			F	Mature	Kelt			
20-Dec-12	HDX	900 226000080672	HRB	MW	306	320.0			F	Mature	Kelt			
20-Dec-12	HDX	900 226000080676	HRB	MW	296	295.0			F	Mature	Kelt			
20-Dec-12	HDX	900 226000086041	GBB	MW	300	308.0			F	Mature	Kelt			
20-Dec-12	HDX	900 226000080736	GBB	MW	303	288.0			M	Mature	Kelt			
20-Dec-12	HDX	900 226000080663	GBB	MW	310	326.0			F	Mature	Kelt			
20-Dec-12	HDX	900 226000080745	GBB	MW	318	341.0			F	Mature	Kelt			
20-Dec-12	HDX	900 226000086905	GBB	MW	331	379.0			F	Mature	Kelt			
20-Dec-12	HDX	900 226000080702	GBB	MW	300	316.0			F	Mature	Kelt			
20-Dec-12	HDX	900 226000080692	GBB	MW	316	356.0			F	Mature	Kelt			
20-Dec-12	HDX	900 226000080730	GBB	MW	322	325.0			F	Mature	Kelt			
21-Dec-12	HDX	900 226000080695	GBB	MW	325	353.0			F	Mature	Kelt			
21-Dec-12	HDX	900 226000080681	GBB	MW	326	382.0			F	Mature	Kelt			
21-Dec-12	HDX	900 226000080684	GBB	MW	331	332.0			M	Mature	Kelt			
21-Dec-12	HDX	900 226000080738	HRB	MW	310	328.0			M	Mature	Kelt			
21-Dec-12	HDX	900 226000086783	HRB	MW	300	276.0			M	Mature	Kelt			
21-Dec-12	HDX	900 226000086787	HRB	MW	274	204.0			M	Mature	Kelt			

Appendix III. MBR 2012 Egg Collection Mat Data.

Date	Location	Eggs Present	Egg Total	Comments
16-Oct-12	#1 U/S HRB	0		Mat Placed
16-Oct-12	#2 D/S HRB	0		Mat Placed
16-Oct-12	#3 U/S GBBr	0		Mat Placed
16-Oct-12	#4 D/S GBBr	0		Mat Placed
16-Oct-12	#5 150m D/S GBBr	0	0	Mat Placed
25-Oct-12	#1 U/S HRB	0		
25-Oct-12	#2 D/S HRB	0		
25-Oct-12	#3 U/S GBBr	0		
25-Oct-12	#4 D/S GBBr	0		
25-Oct-12	#5 150m D/S GBBr	0	0	
01-Nov-12	#1 U/S HRB	0		
01-Nov-12	#2 D/S HRB	0		
01-Nov-12	#3 U/S GBBr	0		
01-Nov-12	#4 D/S GBBr	0		
01-Nov-12	#5 150m D/S GBBr	0	0	
08-Nov-12	#1 U/S HRB	0		
08-Nov-12	#2 D/S HRB	0		
08-Nov-12	#3 U/S GBBr	0		
08-Nov-12	#4 D/S GBBr	0		
08-Nov-12	#5 150m D/S GBBr	0	0	
15-Nov-12	#1 U/S HRB	1		
15-Nov-12	#2 D/S HRB	1		
15-Nov-12	#3 U/S GBBr	1		
15-Nov-12	#4 D/S GBBr	17		
15-Nov-12	#5 150m D/S GBBr	0	20	
22-Nov-12	#1 U/S HRB	14		
22-Nov-12	#2 D/S HRB	21		
22-Nov-12	#3 U/S GBBr	14		
22-Nov-12	#4 D/S GBBr	52		
22-Nov-12	#5 150m D/S GBBr	421	522	
29-Nov-12	#1 U/S HRB	16		
29-Nov-12	#2 D/S HRB	56		
29-Nov-12	#3 U/S GBBr	12		
29-Nov-12	#4 D/S GBBr	34		
29-Nov-12	#5 150m D/S GBBr	237	355	
06-Dec-12	#1 U/S HRB	9		
06-Dec-12	#2 D/S HRB	15		
06-Dec-12	#3 U/S GBBr	19		
06-Dec-12	#4 D/S GBBr	90		
06-Dec-12	#5 150m D/S GBBr	43	176	
14-Dec-12	#1 U/S HRB	0		
14-Dec-12	#2 D/S HRB	59		
14-Dec-12	#3 U/S GBBr	3		
14-Dec-12	#4 D/S GBBr	13		
14-Dec-12	#5 150m D/S GBBr	35	110	
20-Dec-12	#1 U/S HRB	3		
20-Dec-12	#2 D/S HRB	3		
20-Dec-12	#3 U/S GBBr	3		
20-Dec-12	#4 D/S GBBr	2		
20-Dec-12	#5 150m D/S GBBr	7	18	

Plate 1. Five egg collection mats 0.77 m x 0.92 m were used during the 2012 MBR MW survey.

Plate 2. Site #1 was located at the confluence of the side channel upstream of the Hurley River Bridge.

Plate 3. Site #2 was located immediately downstream of the Hurley River Bridge.

Plate 4. Site #3 was located immediately upstream of the Goldbridge bridge across from the Hurley-Cadwallader confluence (Left Bank).

Plate 5. Site #4 was located immediately downstream of the Goldbridge Bridge.

Plate 6 Site #5 was located approximately 150m downstream of the Goldbridge bridge along the left bank.

Plate 7 MW were PIT tagged on the right side of the dorsal fin to determine rate of recapture.

Plate 8. MW eggs were enumerated on the egg collection mats on a weekly basis.

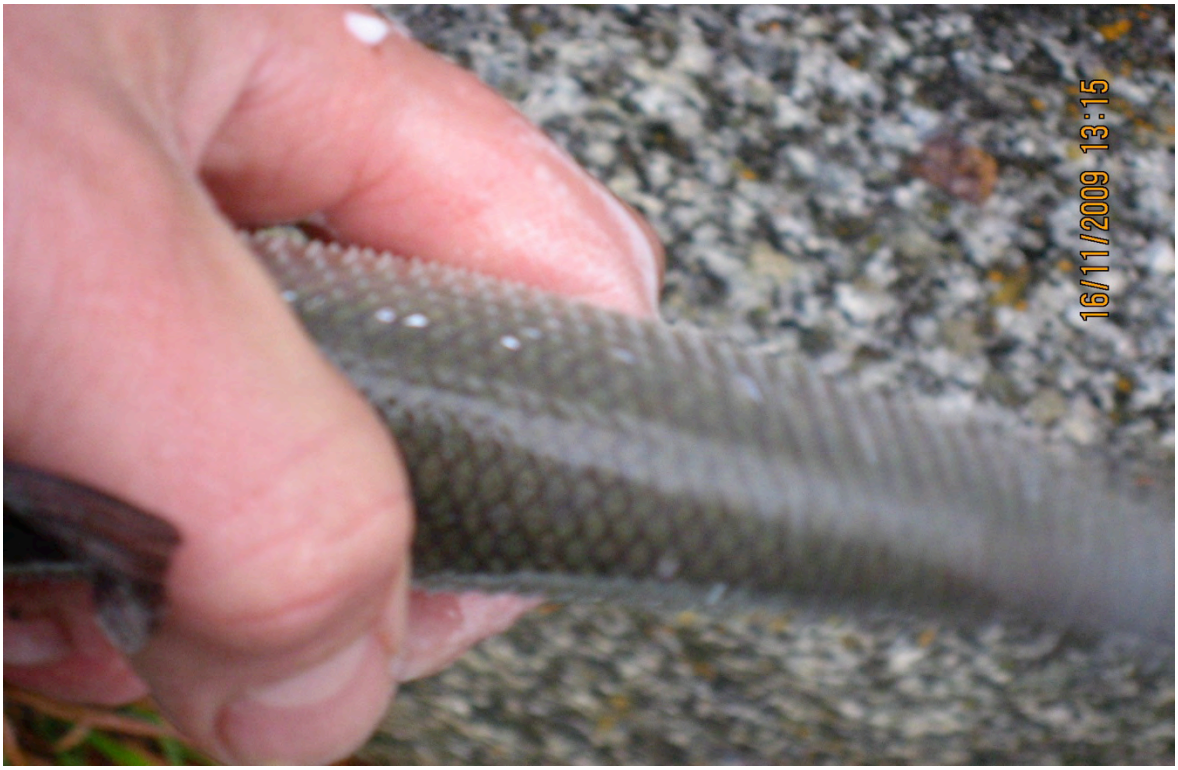

Plate 9. Nuptial tubercles were observed along the sides of mature male MW.