Investigating Black Crappie (*Pomoxis nigromaculatus*) populations using age and growth data in Whiteshell Provincial Park, Manitoba

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Abstract

Increasing water temperatures due to climate change may offer some warm water fishes the opportunity to establish sustainable populations in systems that were historically not suitable. Black Crappie (*Pomoxis nigromaculatus*) were introduced into the Whiteshell Provincial Park, in southern Manitoba, in the mid-1940's, which is at the northernmost edge of their distribution range. However, it was not until recently (in the past 10-15 years) that this population has begun to expand and increase in abundance. With the potential for a shifting distribution as a result of warming temperatures, the purpose of this study was to better understand the characteristics of Black Crappie at the northern extent of their range for the goal of successful management.This thesis examined six lakes within the Whiteshell Provincial Park located in southern Manitoba, as well as Lac du Bonnet located just outside the park boundary. I hypothesized that Black Crappie in Manitoba would show differences in population characteristics in relation to more southern populations as a result of cooler temperatures and a shorter growing season associated with northern latitudes. Results of this study showed that Black Crappie in Manitoba grew slower, but were older and larger than more southern populations. Relative weights indicated the Whiteshell Provincial Park population was within the normal range for body condition for this species. Stock density measurements determined that each lake contained high proportions of large sized fish, which is important for recreational fishing. Values of $\delta^{13}C$ and $\delta^{15}N$ suggest that Black Crappie feed on different prey items at the same trophic levels between sites. Organ (gonadosomatic and hepatosomatic) indices suggested that Black Crappie begin to spawn in late May and energy stores recover more quickly post-spawn than southern populations. It is apparent that Black Crappie in the Whiteshell Provincial Park have established thriving populations as an introduced species that contribute to a growing fishery. As range expansion potentially continues, this thesis provides initial data on established Black Crappie population characteristics and provides information on how they may impact new systems.

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Dedication

This thesis is dedicated to the people in my life have continually shown nothing but love and support, my parents Denise Hauger and Daniel Hauger, thank you for all you do for me. Also, my loving fiancé Matthew Jensby, without you who knows how many comma errors my thesis would be full of, I love you.

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Chapter 1:

General Introduction

1.1 Introduction

In the face of a changing climate, increasing water temperatures may offer some fishes the opportunity to establish sustainable populations in systems that were historically not suitable. This shift is already evident in the northern boundary of several cool and warm water fish species in Ontario, Canada, which will likely continue over the next 30 years (Alofs at el. 2014). One species that may increase in abundance or shift its distribution northward is the Black Crappie (*Pomoxis nigromaculatus*). Black Crappie have a wide distribution spanning from Southern Canada to the Gulf of Mexico (Cooke and Philipp 2009), and Black Crappie populations in southern Manitoba, Canada are at the northernmost edge of the distribution for this species. Black Crappie are native to some of the southernmost drainages in Manitoba and have also been stocked throughout the province, specifically introduced unintentionally in Whiteshell Provincial Park, Manitoba, water bodies in the mid-1940s. However, it was not until recently (in the past 10-15 years) that this population has begun to expand and increase in abundance (D. Kroeker, Wildlife & Fisheries Branch, Ministry of Agriculture and Resource Development, personal communication). This species has since established persistent populations through connected waterways across several lakes in the Whiteshell Lake system, and that has attracted attention for recreational angling.

Black Crappie are a freshwater Centrarchid that are found in areas with low water movement such as shallow lakes, ponds or backwater sloughs on slow moving rivers (Edwards et al. 1982). They are often found in water with low turbidity and among structure, such as aquatic macrophytes or submerged wood (Stewart and Watkinson 2007). They have also been known to seek refuge from high winds in bays of lakes and undeveloped shoreline (Reed and Pereira 2009). This is especially true during spawning season when they build their nests in protected areas, usually at the base of vegetation or under some type of cover (Pope and Willis 1997; Siefert and Herman 1977; Reid 1950; Cooke and Philipp 2009).

Black Crappie typically begin to spawn at temperatures between 14 and 22° C, with peak spawning estimated to occur around 18°C (Cooke and Philipp 2009; Stewart and Watkinson 2007). The spawning season tends to be later in the year and shorter at northerly latitudes than what has been documented in more southerly latitudes (Cooke and Philipp 2009). Fecundity for Black Crappie can be high. In a controlled environment, a single female Black Crappie with a mean total length of 243mm can produce an average of 66,130 eggs during a spawning event (Siefert and Herman 1977). In a wild population, female Black Crappie between 225-332mm can produce 33,940 to 348,400 eggs, with a mean of 143,762 (SD ± 108,544) (Baker and Heidinger 1994). However, female fecundity can be highly variable between years or among populations (Dubuc and DeVries 2002). Variable fecundity could explain some of the variation exhibited in the recruitment cycle of Black Crappie, as there are often missing year classes within a population (Sammons et al. 2002). Missing year classes are commonly referred to as the bust in the boom and bust cycles of Black Crappie recruitment (Sammons et al. 2002). In addition to varied fecundity, it is speculated that the boom and bust cycle may be a result of environmental influences such as temperature and wind cover (Allen et al. 2001). As a result, predicting annual changes in population density can be difficult for those managing Black Crappie populations.

Black Crappie are known to be generalist feeders, first feeding on zooplankton immediately after yolk sac absorption, then typically switching to invertebrates when they reach lengths around 120mm (Pine III and Allen 2001). Adult Black Crappie feed mainly on invertebrates and are considered secondary piscivores, never becoming more than 30-40% piscivorous (Keast 1985). Many factors can influence the diet, including morphology, body size, and overall prey availability. Keast (1985) determined that Eastern Ontario Black Crappie fish prey had a mean length of 43mm and were not consumed until the Black Crappie had reached a length around 160mm. Studies suggest that size and abundance of prey determines the rate of growth in a fishery; in other words, the larger or more abundant the prey, the faster the growth rate of the predator (Paloheimo and Dickie 1966; Bennett 1945; Olson 1996). Research has shown the shift from an invertebrate-based diet to one of piscivory coincides with an increased growth rate among juvenile fish (Juanes et al. 1994).

Differences in population characteristics between systems highlights the importance of ecosystem-specific management for Black Crappie. Factors that affect growth in a population include suitable habitat, resource availability, and a balance between predator and prey abundances, which differ among aquatic systems (Jacobson et al. 2018). For example, Guy and Willis (1995) found that mean back-calculated length-at-age for South Dakota Black Crappie was highly variable among habitats. Natural lakes, small impoundments (≤ 40 ha) and large impoundments (> 40 ha) were evaluated for recruitment, growth, condition factor, and size structure, and populations differed among ecosystems, specifically between natural lakes and impoundments (Guy and Willis 1995). Natural lakes featured lower density, faster growth rate, and higher condition factor than populations in impoundments, suggesting larger-sized Black Crappie. Meanwhile, impoundments had more consistent recruitment resulting in higher population densities. This implies that Black Crappie were smaller but more abundant, providing a higher harvest rate by anglers (Guy and Willis 1995). Therefore, it is important to consider lake-specific differences when studying Black Crappie in Manitoba. Knowledge of how population characteristics differ within systems enables managers to implement regulations that help meet the management goals of each individual fishery, such as increasing harvest rate for anglers or increasing abundance of large sized Black Crappie.

Black Crappie possess qualities that could allow them to continue to expand their distribution range even further northward. High tolerance to water temperature changes, high fecundity, and diet variability make them great candidates for range expansion. It is important to consider how this species adapts to a novel environment and how they may impact the ecosystems. This study aims at understanding some basic population characteristics for the Black Crappie populations that have become established towards the northernmost edge of their distribution range, providing some information on how the Black Crappie may affect future novel environments as they expand their distribution range further.

1.2 Research Objectives and Hypotheses

Black Crappie is a valued sportfish throughout much of its range, and as such, population characteristics have been well studied where there are established populations (Cooke and Philipp 2009; Huish 1954; Miller et al. 1990). Further, Black Crappie actively feed at temperatures as low as 6.5°C, making them a popular sportfish for ice fishing enthusiasts (Scott and Crossman 1973; Becker 1983). Relatively little is known about Black Crappie population characteristics in systems located near the edge of its range or in areas where it has been recently established. The establishment of viable Black Crappie populations in the Whiteshell Provincial Park lakes provides an opportunity to assess basic aspects of population characteristics for a relatively recently established population at the northern extent of the species distribution. Estimations of age and growth, body condition, PSD and RSD were conducted for Black Crappie in seven lakes in the Whiteshell Provincial Park.

I conducted this study because information regarding Black Crappie population characteristics in the Whiteshell Provincial Park lake system was previously lacking. I hypothesized that age and growth will differ between Manitoba Black Crappie population and southern populations in the U.S.A. and between sites within Manitoba, while body condition, PSD and RSD will also vary between sites. I predicted that Black Crappie growth rate, body condition and abundance in both PSD and RSD will decrease relative to more southern populations that experience warmer annual temperatures. I also hypothesize that Black Crappie would move between the three interconnected sites. I predict that the largest amount of movement will occur between May and August, as Black Crappie finish spawning and move across the lakes in search of prey. I hypothesized that there will be variations in dietary interactions between sites and that differences in stable isotope signatures will be linked to distinct growth patterns. I predicted that diets featuring higher tropic level interactions would have a faster growth rate as a result of higher caloric consumption in a piscivorous diet than diets containing lower trophic level interactions as estimated by the stable isotope signatures (Simon et al. 2009). I also hypothesized that cooler water temperatures associated with more Northern latitudes will affect spawning time for Black Crappie within the Whiteshell Provincial Park. I predicted that spawning will occur later in late May to early June compared to more southern populations that appear to begin spawning earlier (late April to early May). I hypothesized that all Black Crappie within the Whiteshell Provincial Park will display variations in energy storage depending on capture date, and I predict Black Crappie will exhibit decreased energy storage (reflected through decreased liver weights measured using HSI) in late May due to spawning efforts, followed by increased energy storage post-spawning. This study established baseline data regarding Black Crappie in the Whiteshell Lake system, with the hope of facilitating future research to determine how or why population characteristics may vary compared with southerly Black Crappie populations or even between lakes in the same watershed. Comparing growth rates, relative weights, PSD and RSD, stable isotope values, GSI, and HSI allows fisheries managers to make comparisons between their own populations and others that have been previously studied, which aids in implementing regulations that best suit the population needs.

1.3 Population Characteristics

1.3.1 Age and Growth

There are a variety of parameters that allow biologists to study population characteristics of a species, including growth, body condition, and abundance of various size classes. Age and growth studies are commonly used to provide information for the maintenance of healthy fish populations. Fisheries managers use growth rate as a tool to implement regulations regarding angling practices (such as length and harvest limits) that best suit the population's needs. Evaluating length-at-age is used to determine growth rate among individuals (Bacula et al. 2011). Age is typically determined with the use of hard structures such as otoliths, spines, fin rays, and vertebrae, and uses back-calculation methods to estimate a fish's length at a previous age. Although scales work as a non-lethal aging method, ages from otoliths are proven to be more consistent as scales frequently underrepresent the correct age (Maceina et al. 2007; Robillard and Marsden 1996; McInerny and Cross 1999). Therefore, I used otoliths as the aging method in my thesis.

1.3.2 Von Bertanlanffy

A common tool used in estimating fish growth is the Von Bertalanffy growth function. This function creates a model that predicts time (age) of a fish population to reach a specified length. There are many parametrizations of the Von Bertalanffy growth function, however one commonly used in fisheries is the Beverton-Holt parameterization ($L_t = L_\infty (1 - e^{-K (t - t_0)})$), which involve the use of three parameters that include L_∞ (the asymptotic average maximum body size), K (the rate of growth leading to the asymptotic average), and t_0 (the hypothetical age at which the species has zero length) (Ogle and Isermann 2017). Technology has made these models easy to create and reproduce. I used the program R to run my Von Bertalanffy growth functions, with code provided by Ogle (2013).

1.3.3 Body Condition

Body condition is the measure of an animal's energy storage (Schulte-Hostedde et al. 2005). In general, an animal with greater fat storage is assumed to be in better "condition" (to an extent). In fisheries, body condition has been measured in many ways including the use of Fulton's condition factor, Le Cren's relative condition factor, and relative weight (Ogle 2018a).

Fulton's condition factor assumes that fish stock exhibit isometric growth, which can be a rarity in the wild. This assumption causes the condition factor to differ depending on fish length, which is why its use as a measure of body condition can be contentious (Blackwell et al. 2000b; Ogle 2018a). Le Cren's relative condition factor is generally more consistent at predicting condition across length bins (defined length categories of fish) . However, using Le Cren's relative condition factor, comparisons are restricted to species or regions that have the same slope in the length-weight relationship, and those slopes can vary from one geographical range to another (Jackson and Hurley 2005). As a result, this requires different equations for each region (or for each population), making comparisons across water bodies difficult (Blackwell et al. 2000b; Ogle 2018a). Relative weight (Wr) has been used as an alternative for determining the health of a population and as a measure of body condition (Neumann and Murphy 1992; Brown and Murphy 1991; Jonas et al. 1996). Typically, the optimal relative weight for fish in a "healthy condition" is near 100 Wr (Gabelhouse 1984).

Guy and Willis Wr Equation:

$$Wr = \frac{W}{Ws} * 100$$

For estimating Wr, W is the weight of an individual fish, and Ws is the standard weight for a fish of the same length. This standard weight measurement predicts the 75th percentile mean weight for a given length and has been specified for a variety of species. A specific standard weight (Ws) equation was generated for Black Crappie [$\log10_{Ws}$ (g)=-5.618 + 3.345$\log10_{TL}$ (mm)], where TL is the total length, which provides an expected weight at a given length (Neuman and Murphy 1991). This equation allows the standardization of length-weight comparison between populations. I chose to use the Wr approach because the calculation is simple, the Ws compensates for inherent changes in body form (such as stunted growth), and Wr values can be compared between fish of different lengths and from different populations (Blackwell et al. 2000a).

1.3.4 Proportional and Relative Stock Densities

Stock densities are used to measure the number of fish in different size classes within a system. These size classes are determined by length and the categories were set as stock, quality, preferred, memorable, and trophy sizes. Stock length fish are considered to have little recreational value and the minimum stock length is treated as the size at or near where the fish reaches maturity. Anderson (1980) defined quality length as the size of a fish most anglers like to catch. However, while anglers like to catch quality length fish, a slightly larger fish is preferred, hence the preferred length category. Finally the largest categories are ‘memorable’, the size of fish most anglers remember catching and ‘trophy’, the size of fish which is considered worthy of acknowledgement (Gabelhouse 1984). The length categories for standardized determination of the stock densities were derived from percentages of world-record length for a fish species listed by the International Game Fish Association in 1982 (Gabelhouse 1984; Willis et al. 1993). The world record for Black Crappie in 1982 was 508mm. Proportional stock density (PSD) is the number of quality sized fish in a sample divided by the number of stock sized fish (which is 25-39% of the 1982 world record length) multiplied by 100 (Anderson 1976). Quality, in this sense, is defined as length and assumes that longer fish are better quality for a fishery. Relative stock density (RSD) is the percent of adult fish that are preferred (RSDp), memorable (RSDm), or trophy size (RSDt) relative to the 1982 world record length (Gabelhouse 1984). For Black Crappie, stock = 25-39% of world-record length; quality = 40-49% of world-record length; preferred = 50-59% of world-record length; memorable = 60-74% of world-record length; and trophy = >75% of world-record length (Gabelhouse 1984). The following length categories were determined: Stock (S; 130-199mm), Quality (Q; 200-249mm), Preferred (P; 250-299mm), Memorable (M; 300-379mm), and Trophy (T; ≥ 380mm) (Neumann and Murphy 1991; Gabelhouse 1984).

1.3.5 Movement

Movement and accessibility to high quality habitat play a large role in establishing healthy fish populations. Within the Whiteshell Provincial Park, three of my study sites (Caddy Lake, South Cross Lake, and North Cross Lake) are directly connected through a series of tunnels. These tunnels were originally created during railroad construction in the 1880’s, prior to the introduction of Black Crappie in the area. Previous studies have shown Black Crappie emigration rates range between 0 to 92%, within 16 interconnected west-central Minnesota lakes, suggesting Black Crappie populations in connected lakes are not isolated from one another (Parsons and Reed 2005). It is important to take this type of movement into consideration, as parameters may vary when assessing population characteristics of a species within sites. For example, if population abundance is considered in only one of three interconnected lakes, failing to account for the number of fish located in the connected sites could influence abundance calculations. Movement between interconnected sites can be attributed to an assortment of variables such as reproduction (seeking a suitable spawning area), resource availability and preferred habitat (Hutchings 2002). Assessing whether movement is occurring between these sites could offer important insight into the spatial patterns of Black Crappie within the Whiteshell Provincial Park.

1.3.6 Stable Isotope Analysis

Isotope measurements are elemental measurements that can identify ecological connections (Fry 2007). Through ecological interactions such as prey consumption, trophic fractioning can result in varying amounts of elements being consumed and then taken up by a species. This variation can explain an array of ecological parameters such as changes in diet between species or habitat, food web analysis, or shifting dietary habits over time (Sweeting and Polunin 2009). It is important to understand how diet and growth are affected by spatial distribution in different lakes, especially for attempting to understand how non-native species fit within an ecosystem. Carbon (^{13}C) and nitrogen (^{15}N) are both commonly assessed in fish stable isotope studies (Brush et al. 2012; Gu et al. 1996; Muñoz et al.2011). Carbon is used to determine whether feeding occurs in more pelagic or littoral regions of the system (Post 2002). Nitrogen helps determine the relative trophic position of a species within a food web (Cabana and Rasmussen 1996). The simplest method of assessing trophic level of a consumer in a lake food web is to establish baseline nitrogen values from primary consumers such as snails or mussels, and then compare secondary consumer nitrogen values to the baseline (Post 2002). Understanding trophic positioning of Black Crappie can provide information regarding how the species interacts within an ecosystem. Black Crappie are generalist feeders, first feeding on zooplankton, then typically switching to invertebrates and sometimes being secondary piscivores. Therefore, I used ^{13}C and ^{15}N to understand how Black Crappie fit within specific ecosystems through their trophic position and diet in eastern Manitoba.

1.3.7 Gonadosomatic Index Analysis

Water temperatures are influential towards fish reproductive timing (spawning time). Fish species typically begin spawning around a minimum temperature threshold, meaning populations at one latitude should be expected to begin reproducing later in the year than populations further south and earlier than populations further north (Miranda 2014). The gonadosomatic index (GSI) is a measure used in fisheries assessments that provides an estimate of spawning activity within a fishery. As a ratio of gonad mass to body mass, the GSI is commonly used as an indicator of reproductive periods, with increases in GSI followed by a decrease suggesting spawning occurred (Brewer et al. 2008). Annual reproductive initiation and duration, as affected by water temperature, can be reflected by GSI data because cumulative gonadal weights would be expected to decrease following spawning. Because Black Crappie typically begin to spawn at temperatures between 14 and 22°C (Cooke and Philipp 2009; Stewart and Watkinson 2007) and the population in Whiteshell Provincial Park is on the northernmost edge of the Black Crappie distribution range, it could be expected that the Black Crappie in Manitoba may spawn later in the year compared to more southern populations that appear to begin spawning earlier (late April to early May) (Travnichek et al. 1996). In this study, I examined GSI to determine the approximate spawning time of Black Crappie at some of the coldest water temperatures experienced throughout their distribution range.

1.3.8 Hepatosomatic Index Analysis

The hepatosomatic index (HSI) is used to estimate the energy status of a fish. The HSI is the relative mass of the liver (a major source of energy storage for fish) in relation to the total mass of the fish (Chellappa et al. 1995). Allocation of energy to increased growth or reproductive development can shape the dynamic of a fishery. For younger individuals, energy is typically directed toward growth, and as individuals begin to mature, energy shifts towards reproduction (Jorgensen and Fiksen 2005). In this study I measured the allocation of energy in mature Black Crappie as estimated by the HSI to determine how lipid content may vary from site and month captured. This provided a more in-depth look at the causes of body condition variation within individual systems and at different times.

1.4 General Methods Used in My Thesis for Black Crappie Research in Manitoba

1.4.1 Collections

In an attempt to account for all sizes within the population, samples were obtained using trap nets, gill nets (only in Lac du Bonnet), electrofishing, and angling. Trap nets have been proven to be a reliable way to capture Black Crappie (Pope and Willis 1997). The lead of the net was attached to a sturdy object on shore (ex. log, rock, tree) and the bottom of the net was anchored using cinder blocks attached to the pot to keep the net in place. The lead was 8 meters long, making it difficult to set in deeper parts of each lake as it had to be connected to shore and the mesh size was 8cm (3”). It was typically placed in shallow water while the pot was between 1.5-6 meters deep, depending on the location. This method of collection was performed for the duration of the sample period which lasted from April to September in 2018 and 2019. In Lac du Bonnet Black Crappie were collected as a part of a yearly study monitoring fish populations within the lake. Two gill nets, approximately 25 yards long were placed in the lake. Each net contained varying mesh sizes that began at 5cm (2”) and then increased to 8cm (3”), 9.5cm (3 3/4”), 11cm (4 1/4”) and 13cm (5”).

Electrofishing is a common method that has been used to capture Black Crappie (Sammons et al. 2002; Bonvechio and Hale 2008; Savitz et al. 1996). For my research, electrofishing occurred using an electroshocking boat, which contained a generator that supplied direct current (DC) through a control box to a set of cathodes that were placed at the front of the boat. The current was controlled by the netters at the front of the boat using foot pedals to turn the current on and off. Direct current stimulates the sensory nerves and muscles, momentarily stunning the fish (SFCC 2007). Afterwards, the fish were netted and placed in freshwater tanks on the boat. Electrofishing was most useful during the spawning season when the fish were gathered in groups along the shallow shoreline. It was less efficient after spawning as the fish tended to disperse into deeper areas of the lakes. Boat electrofishing may be biased toward larger sized individuals, possibly due to the fact that larger individuals are easier to spot and net during electrofishing than smaller individuals (Bonvechio and Hale 2008; Sammons et al. 2002); however, in accompaniment with other gear types, variation in the length distributions were captured.

Angling also proved to be an effective method of capture. One study suggested that angling peaks for Black Crappie between 260-320mm, meaning angling can be used to target larger individuals (Miranda and Dorr 2000). For my research, angling was useful as a low-maintenance, supplemental technique that was used in between setting trap nets, which allowed the crew to maximize fishing effort during sampling days.

1.4.2 Methods for Age and Growth, Body Condition, and Stock Density Estimates

In 2018 and 2019 total lengths (mm), fork lengths (mm), and masses (g) of Black Crappie were measured 1,152 in 2018 and 575 in 2019, for a total of 1,727 fish. For a subset of fish, I sampled sagittal otoliths for aging, liver and muscle samples for stable isotope and mercury analysis (part of an undergraduate honours project), stomach samples for diet analysis (part of a different undergraduate honours project), and gill and fin clips were also collected for a future genetics study. To examine the length-at-age relationships, the goal was to obtain 10 sets of otoliths for every 5mm length group to account for all ages within the population. The sagittal otoliths were viewed whole against a black background under a dissecting microscope (Schramm and Doerzbacher 1982). Seasonal growth was accounted for by assigning a decimal age based on the date of capture. Optimal reported growth for Black Crappie is believed to occur in water temperatures between 22 to 25°C (Haines 1980; Edwards et al. 1982); therefore, daily growth percentages were created based on average water temperature each month (accounted for during sampling) for the duration of my field season when water temperatures were within the range predicted to coincide with optimal growth. Growth measurements were determined following Schramm and Doerzbacher (1982). Otolith radius was measured from the center of the otolith to the anterior tip, distance to each opaque band (annuli) was measured in micrometers (µm) along the radius from the center of the otolith to the outer edge of each annuli (Figure 1) using the program ImageJ (Scheider et al. 2012) and the back calculated length-at-age was determined using the Fraser-Lee method (Campana 2011). The Fraser-Lee regression method estimates fish length (L) at a previous age (a) through insertion of the measured size of the otolith (O) at age a into a length-otolith regression derived from samples of the population (Campana 2011).

Fraser-Lee Equation:

$$L_a = d + (L_c - d)\, O_c^{-1}\, O_a$$

Predicted growth was then calculated using a von Bertalanffy growth curve, which measures length over time using the growth rate calculated by the Fraser-Lee method (Ogle 2018b).

Von Bertalanffy Equation:

$$L_t = L_\infty \left(1 - e^{-K(t - t_0)}\right)$$

Where L_t is the length-at-age t, L_∞ is the asymptotic average maximum body size (the mean length a fish would reach if they were to grow for an infinitely long period), K is the rate of growth leading to the asymptotic average, and t_0 is the hypothetical age at which the species has zero length. This was used to predict growth rate over time.

Body condition was estimated using the relative weight (Wr) index. Each population's mean Wr was calculated by using the specific standard weight (Ws) equation for Black Crappie, [$\log10_{Ws}$ (g)=-5.618 + 3.345$\log10_{TL}$ (mm)] (Neumann and Murphy 1991).

The PSD for each population was calculated by using the equation:

$$PSD = \frac{\text{Number of fish} \geq \text{quality length}}{\text{Number of fish} \geq \text{stock length}} \times 100$$

Relative stock density (RSD) was then used to determine the specific number of Preferred (RSDp), Memorable (RSDm), and Trophy (RSDt) fish within the study lakes.

1.4.3 Methods for Movement

Movement was monitored using mark-recapture techniques, in both 2018 and 2019 a total of 697 anchor tags were placed within three study sites containing direct passages to one another making them interconnected (Caddy Lake, South Cross Lake, and North Cross Lake). There was a total of 118 Black Crappie tagged in Caddy Lake, 279 tagged in South Cross Lake, and 300 tagged in North Cross Lake. The anchor tags were inserted at a 45° angle towards the posterior base of the dorsal fin with a Floy Mark II tagging Gun (Floy Tag, Inc.) in accordance with (Tranquilli and Childers 1982). Once the tag was placed the tagging gun was rotated 90°, and removed ensuring that the tag remain safely implanted and was unable to be removed from the Black Crappie (Hartman 2006). After tagging the Black Crappie were released no more then 5 meters away from where they were captured. I relied on a combination of angler reports (via email located on the anchor tag), trap netting, and electrofishing to collect information on released tagged Black Crappie through out these three systems. The information included date of capture, location of capture, total length, and harvest information. Tags were only placed in individuals 200mm or greater, due to tag size and the appropriate sized fish targeted by angling. Fliers were placed around the boat launch and bait shops nearby, encouraging anglers to report any tagged fish they captured.

1.4.4 Methods for Measuring GSI and HSI

In both 2018 and 2019, livers and gonads were sampled and weighed, and the GSI and HSI were measured on 460 Black Crappie (263 females and 197 males) from all seven sites in the Whiteshell Provincial Park. The GSI was measured for each sex using the gonad to body mass ratio, whereas the HSI was measured for each sex using the liver to body mass ratio.

The GSI was calculated by using:

$$GSI = \frac{GM}{(BM-GM)} \times 100$$

Where GM is gonad mass (g) and BM is body mass (g).

The HSI was calculated by using:

$$HSI = \frac{LM}{(BM - LM)} \times 100$$

Where LM is liver mass (g) and BM is body mass (g).

1.4.5 Methods for Stable Isotope Analysis

Liver and muscle tissue samples for stable isotope analysis were expressed in delta (δ) notation defined as the deviation from a standard reference material in parts per thousand (‰). Results of $\delta^{13}C$ are relative to Vienna Pee Dee Belemnite (VPDB) while $\delta^{15}N$ results are relative to atmospheric air and are calculated using the following equation:

$$\delta X = [(Rsample/Rstandard) - 1] \times 1000$$

Where X is ^{13}C or ^{15}N, Rsample is the ratio ($^{13}C/^{12}C$ or $^{15}N/^{14}N$) in the sample, and Rstandard is the ratio in the standard. Samples were then normalized against certified reference materials (USGS40 and 41a). Trophic positioning of Black Crappie was determined by measuring $\delta^{15}N$ values of Black Crappie in relation to baseline $\delta^{15}N$ values of primary consumers (snails), using the equation:

$$\text{Trophic Position} = \lambda + (\delta^{15}N_{\text{secondary consumer}} - \delta^{15}N_{\text{base}})/\Delta_n$$

Where λ is the trophic level of the organism used to estimate $\delta^{15}N_{base}$ (i.e., $\lambda = 2$ for primary consumers such as snails), $\delta^{15}N_{\text{secondary consumer}}$ (Black Crappie) is measured directly, and Δ_n is the enrichment value of $\delta^{15}N$ per trophic level. A standard value of 3.4 for Δ_n is considered applicable for a food web (Post 2002).

Chapter 2:

An Evaluation of the Northernmost Black Crappie Fishery: Age and Growth, Body Condition, Stock Density, and Movement within the Whiteshell Provincial Park

2.1 Introduction

Global mean temperatures are predicted to rise 3 to 4°C within this century (New et al. 2011). Changes in temperature have many considerable effects on fish communities around the globe, highlighted by a shift in the distribution of warm water fisheries northward (Alofs et al. 2014). However, relatively little work has examined how cooler water systems associated with higher latitudes may affect the dynamics of warm water fish populations as they expand northward, especially regarding freshwater fishes. Black Crappie (*Pomoxis nigromaculatus*) are an important recreational sportfish, with populations spanning from Southern Canada to the Southern United States Gulf Coast (Cooke and Philipp 2009). Black Crappie are found in southern Manitoba, Canada, the northernmost population of this species. Because they are considered a warm water species, there is potential for Black Crappie to expand the northern limit of their distribution due to future climate change.

Black Crappie are native to some of the southern drainages in Manitoba, but have also been stocked both intentionally and unintentionally elsewhere in the province (Stewart and Watkinson 2007). Specifically, Black Crappie were unintentionally introduced into the Whiteshell Provincial Park lake system in Manitoba (Figure 2) in the mid-1940s, when a stocking event inadvertently stocked Black Crappie with a population of Smallmouth Bass (*Micropterus dolomieu*) into Star Lake and possibly Barren Lake. Although Black Crappie may have been introduced in the mid-1940's, it was not until recently (in the past 10-15 years) that this population has begun to expand and increase in abundance (D. Kroeker, Wildlife & Fisheries Branch, Ministry of Agriculture and Resource Development, personal communication). With the potential for a shifting distribution of population ranges as a result of warming temperatures, it is important to understand the characteristics of Black Crappie at the edge of their range for the purpose of successful management.

Population characteristics can be measured or estimated using a variety of different approaches. In this sense, I measured growth rate and body condition of Black Crappie within six lakes located in the Whiteshell Provincial Park, as well as Lac du Bonnet which is just outside the park boundaries. Growth rate is a standard measure used to implement regulations (such as length and harvest limits) that best suit the population's needs, that can be measured by back-calculating length-at-age among individuals (Bacula et al. 2011). For my research, I used otoliths to back-calculate length-at-age of Black Crappie. Body condition reflects energy storage for a fish, as greater fat storage is (to an extent) assumed to indicate better "condition" (Schulte-Hostedde et al. 2005). I measured body condition for Black Crappie through relative weight (Wr), which predicts the expected weight of a healthy fish at a given length. I also measured the proportional stock density (PSD) and relative stock density (RSD) within the seven lakes to estimate the percentage of Stock (S), Quality (Q), Preferred (P), Memorable (M), and Trophy (T) fish within the Whiteshell Provincial Park (Gabelhouse 1984). Establishing PSD and RSD for a population shows the percentages of desirable sized fish for angling within a system, which can help in creating management strategies specific to a system. The minimum length categories for standardized determination of PSD and RSD were derived from percentages of the world-record Black Crappie length of 508mm in 1982 (Gabelhouse 1984) (Willis et al. 1993). Finally, I tracked movement of Black Crappie through the interconnected water ways of three lakes in the Whiteshell Provincial Park that included Caddy Lake, South Cross Lake, and North Cross Lake. I used anchor tags and angler reports to monitor movement of Black Crappie that occurred between theses sites. Understanding immigration and emigration of fishes is essential to correctly assessing populations, as dynamics may change due to fluctuations in population sizes. Previous studies indicate Black Crappie may move anywhere from 0 to 584 m/ha within a lake system, with most movement occurring during April to July (Guy et al. 1992). Suggesting that Black Crappie may be able to move long distances and possess the capabilities of traveling between these sites.

In this study, I examined Black Crappie in seven lakes in Eastern Manitoba that are known to contain reproducing populations of Black Crappie. In each lake, growth, condition, and stock density were assessed. I hypothesized that the population characteristics of Black Crappie in Manitoba at the northern limit of their distribution will be altered due to the effects of cool water. I predicted that their growth rate, body condition and abundance in both PSD and RSD would all decrease relative to more southern populations that experience warmer annual temperatures. I also hypothesized that Black Crappie would move between the three interconnected sites. I predicted that the largest amount of movement would occur between May and August, as Black Crappie finish spawning and move across the lakes in search of prey.

2.2 Methods

2.2.1 Sample Sites

Whiteshell Provincial Park has an area of approximately 2,729 km^2 and contains numerous recreational fishing lakes. Many of these lakes have low turbidity, contain structure and shallow edges with aquatic macrophytes available for spawning, which provide suitable habitat for Black Crappie. This study focused on seven lakes that are known to contain reproducing populations of Black Crappie: Star Lake, Caddy Lake, South Cross Lake, North Cross Lake, Jessica Lake, Big Whiteshell Lake, and Lac du Bonnet (Figure 1; Table 1).

2.2.2 Animal Collection

To attempt to sample all size classes within the study sites, samples were obtained using trap nets, gill nets (only in Lac du Bonnet), electrofishing, and angling. Trap nets have been proven as a reliable way to capture Black Crappie (Pope and Willis 1997). The nets were typically placed along the shoreline at a depth of 1.5-6 meters, depending on the location, from April to September in 2018 and 2019. Two gill nets, approximately 25 yards long were placed in Lac du Bonnet in September 2018 and 2019. Each net contained varying mesh sizes that began at 5cm (2”) and then increased to 8cm (3”), 9.5cm (3 3/4”), 11cm (4 1/4”) and 13cm (5”). Electrofishing was useful from April to May when the fish were gathered in groups along the shallow shoreline. However, electrofishing was less efficient from June to September as the fish tended to disperse into deeper areas of the lakes. Angling also proved to be an effective method of capture; however, angling only targets individuals large enough to consume the bait, causing it to be size-selective towards larger individuals. Angling was used throughout the duration of the sampling period.

2.2.3 Data Collection

In 2018 and 2019, the total lengths (mm), fork lengths (mm), and masses (g) of 1,727 Black Crappie were measured. On a subset of individuals, sagittal otoliths were extracted. The goal of the sampling was to obtain 10 sets of otoliths for every 5mm length group to account for all ages within the population, however this was not always possible. The sagittal otoliths were viewed whole against a black background under a dissecting microscope (Schramm and Doerzbacher 1982). Seasonal growth was accounted for by assigning a decimal age based on the temperature at date of capture. Optimal growth for Black Crappie is believed to occur in water temperatures between 22 to 25°C, estimated by using habitat suitability index models (Edwards et al. 1982). Daily growth percentages were created based on average water temperature during the month that population was sampled. Water temperature can vary between lakes in the same system and because I was not able to measure water temperatures for each lake daily throughout my study, I instead averaged together water temperatures from all seven lakes for the growth analysis (Table 2). At the beginning of June, water temperatures reached between 22 and 25°C, and by September water temperature decreased to below those that are predicted as an optimal range for growth. Therefore, the period of highest growth for Black Crappie was potentially between June and September. The distance between otolith annuli was measured using the program ImageJ (Schneider et al. 2012), from which the back calculated length-at-age was determined using the Fraser-Lee method (Campana 2011). The Fraser-Lee regression method estimates fish length (L) at a previous age (a) through insertion of the measured size of the otolith (O) at age a into a length-otolith regression derived from samples of the population (Campana 2011) (Equation 1).

Fraser-Lee Equation:

$$L_a = d + (L_c - d)\, O_c^{-1}\, O_a$$

Predicted growth was calculated using a von Bertalanffy growth curve, which measures length over time using the slope of the age at length relationship from the Fraser-Lee equation (Ogle 2018b) (Equation 2).

Von Bertalanffy Equation:

$$L_t = L_\infty\,(1 - e^{-K(t - t_0)})$$

Where L_t is the length-at-age t, L_∞ is the asymptotic average maximum body size (the mean length a fish would reach if they were to grow for an infinitely long period), K is the rate of growth leading to the asymptotic average, and t_0 is the hypothetical age at which the species has zero length. This was used to predict growth rate over time.

Body condition was estimated using the relative weight (Wr) index (Equation 3).

Guy and Willis Wr Equation:

$$Wr = \frac{W}{Ws} * 100$$

Mean relative weights were averaged for each site and a standard deviation was given. The population's mean Wr was calculated by using the specific standard weight (W_s) equation [$\log10_{Ws}$ (g)=-5.618 + 3.345$\log10_{TL}$ (mm)] for Black Crappie (Neumann and Murphy 1991) (Equation 4). However, I also used the fish collected in this study to generate a Manitoba-specific standard weight equation for Black Crappie by first log transforming the total length and mass for each individual, then creating coefficients from the length and weight values using regression statistics (Kuriakose 2017) (Equation 5).

Proportional stock density (PSD) is the number of quality sized fish in a sample divided by the number of stock sized fish multiplied by 100 (Anderson 1976). Relative stock density (RSD) is the percent of the fish population that are preferred (RSDp), memorable (RSDm), or trophy size (RSDt) (Gabelhouse 1984) (Equation 6).

PSD was calculated by using the equation:

$$\text{PSD} = \frac{\text{Number of fish} \geq \text{quality length}}{\text{Number of fish} \geq \text{stock length}} \times 100$$

Length categories were set as: Stock (S; 130-199mm), Quality (Q; 200-249mm), Preferred (P; 250-299mm), Memorable (M; 300-379mm), and Trophy (T; ≥ 380mm) (Neumann and Murphy 1991; Gabelhouse 1984). The number of Preferred (RSDp), Memorable (RSDm), and Trophy (RSDt) fish within the Whiteshell Provincial Park and within each individual lake was then determined. Estimations of PSD and RSD were conducted for all 1,727 Black Crappie collected from all seven lakes in the study.

Three study sites contained direct passages to one another making them interconnected. Within these sites I conducted a tagging study where anchor tags containing a unique identification number for each fish and a contact address were implemented. The goal was to have anglers report the location where they caught Black Crappie using the contact information. There was a total of 118 Black Crappie tagged in Caddy Lake, 279 tagged in South Cross Lake, and 300 tagged in North Cross Lake. The purpose of this tagging study was to understand if any direct movement occurred throughout these sites.

2.3 Results

Mean length-at-age estimates were produced for 671 Black Crappie (Table 3) and relative weight was assessed for 538 Black Crappie. Comparing length-at-age measurements between lakes showed variations between the different water bodies (P-value: $< 2.2e\text{-}16$, $R^2 = 0.81$) (Figure 3). For example, in North Cross Lake, fish estimated to be age 6 were between 184 – 301 (mm), whereas fish at age 6 in South Cross Lake were between 278 – 326 (mm) (Table 3). Jessica Lake had the oldest fish at age 15 that measured between 367-386mm, while in Caddy Lake I caught the most small fish (76 yearling fish ranging from 53-86mm) (Table 3).

Using back-calculated length-at-age estimates, a von Bertalanffy growth model that included all sites produced an overall growth curve of $TL = 382(1\text{-}e^{-0.248(age-.152)})$ in Manitoba (Figure 4). Von Bertalanffy growth models were also created for each individual lake (Figure 5; Table 4). The lakes with the fastest growth of Black Crappie were South Cross Lake (K = 0.384), Big Whiteshell Lake (K = 0.357), and North Cross Lake (K = 0.255). Black Crappie in Caddy Lake (K = 0.189), Lac du Bonnet (K = 0.207), and Star Lake (K = 0.243) all showed slower growth, while fish in Jessica Lake displayed the slowest growth (K = 0.185). Caddy Lake featured the largest asymptotic length at 414mm, while the lake exhibiting the smallest asymptotic length was North Cross Lake at 320mm (Table 4).

Based on the standard weight equation for determining Black Crappie body condition, the lakes with the largest Wr values were South Cross Lake, North Cross Lake, and Caddy Lake, all of which had Wr values exceeding 100. All the remaining lakes exhibited Wr values between 92-98 (Table 5). Using all of the data collected, I created the Manitoba specific Black Crappie standard weight equation [$\log_{10}Ws(g)=-5.280 + 3.204\log TL(mm)$] (Equation 5). This equation increased or maintained the Wr sizes compared with the published standard weight equation, with the largest Wr values found in South Cross Lake, North Cross Lake, and Caddy Lake, the remaining lakes exhibiting values between 97-100 (Table 6).

Proportional and relative stock densities were calculated between sites. All sites contained high proportions of quality sized Black Crappie, between 78-99% (Table 7). Black Crappie collected from Caddy Lake, North Cross lake, Star Lake, and Lac du Bonnet did not exceed sizes that were larger than memorable-sized fish, while fish collected from South Cross Lake, Jessica Lake, and Big Whiteshell Lake all had Black Crappie that were in the trophy category (Figure 6). Star Lake (23% preferred and 6% memorable) and North Cross Lake (70% preferred and 2% memorable) featured the lowest percentages of preferred- and memorable-sized fish. South Cross Lake (98% preferred and 83% memorable) and Big Whiteshell Lake (96% preferred and 84% memorable) exhibited the highest percentages of fish in the preferred and memorable category. Jessica Lake (2%) and Big Whiteshell Lake (4%) had the highest percentage of Black Crappie in the trophy category.

Of the 697 total tags placed between the three interconnected sites, only 50 tags were reported back, with 3 reports indicating movement into another lake. The reported movements occurred between May and September.

2.4 Discussion

Estimations of age and growth, body condition, PSD and RSD were conducted for Black Crappie from seven lakes in the Whiteshell Provincial Park. Previous work on 81 Black Crappie populations from across the United States found that growth followed a curve of $TL = 286(1-e^{-0.443(age-0.273)})$ (Jackson and Hurley 2005). The population of Black Crappie in the Whiteshell Provincial Park followed a curve of $TL = 382(1-e^{-0.248(age-.152)})$. The rate of growth (K=-0.248) suggests that the overall Black Crappie population within the Whiteshell Provincial Park grows slower than Black Crappie growth averaged across the United States (K=-0.443) (Jackson and Hurley 2005). However, the asymptotic length of the Black Crappie in the Whiteshell Provincial Park (L_∞ = 382mm) is larger than the asymptotic length of the 81 populations measured across the United States (L_∞ = 286mm). Among the Whiteshell Provincial Park sites, the lakes that indicated the fastest growth rates for Black Crappie were South Cross Lake, Big Whiteshell Lake and North Cross Lake, with South Cross Lake displaying the fastest overall growth. Conversely, Jessica Lake exhibited the slowest growth rates of all the lakes. Variations in the growth curves for Black Crappie between lakes suggest that sites likely vary in factors such as suitable habitat, resource availability and angler pressure. A comprehensive assessment of the diet between the different lakes is required to determine some of the factors that contribute to the differences in growth between lakes.

Body condition was estimated using the relative weight (Wr) index for Black Crappie. South Cross Lake had the largest Wr of all sites (111), while Big Whiteshell had the smallest (92). Populations ranging from 80 to 100 are generally thought to meet standard body conditions for that species (Wright 2000). A population with a mean Wr less than 80 is considered below the standard for body condition and can be a result of prey limitation (Pope et al. 2010). A population with a mean Wr greater than 100 is relatively heavy for that species, which suggests that the population has higher energy stores than other populations (Pope et al. 2010). I hypothesized that Black Crappie in the Whiteshell Provincial Park would have a decreased Wr in comparison to more Southerly populations because water temperatures are warm for a comparatively shorter period of time in Manitoba, providing a shorter window for available resource consumption. Mean Wr values for southerly Black Crappie populations were Wr=91 in High Rock Lake, North Carolina (Nelson and Dorsey 2005), Wr=97 in Baldwin Cooling Pond, Illinois (Baker and Heidinger 1994), and Wr=113 in natural lakes throughout South Dakota (Guy and Willis 1995). My results suggest that latitude did not play a major role in limiting body condition. Instead it appears that body condition for Black Crappie in Manitoba is within the normal range for this species despite Manitoba being on the northern edge of the species' distribution. Black Crappie in all seven of the Whiteshell Provincial Park lakes studied ranged in Wr values from 96-113 using the Manitoba specific Wr equation. This implies that all seven lakes contain Black Crappie populations that have a similar body condition. Black Crappie body condition in the Whiteshell Provincial Park was normal in relation to an ideal Wr of 100, suggesting that adequate food resources are available in each lake examined.

Differences in body condition in centrarchids can be a result of several factors such as interspecific competition. For example, when accounting for similar densities and preferred habitat, Green Sunfish (*Lepomis cyanellus*) introduced into an area containing Bluegill Sunfish (*Lepomis macrochirus*) will out-compete the Bluegill Sunfish, causing increased growth and fitness for the Green Sunfish and decreased growth and fitness for the Bluegill Sunfish (Werner and Hall 1977). Interspecific competition can also affect Black Crappie. According to a study in a Tennessee, USA, impoundment using bioenergetic modeling, the seasonal proportion of maximum consumption between top predator species (including Black Crappie, Largemouth Bass (*Micropterus salmoides*), Striped Bass (*Morone saxatilis*), and Walleye (*Sander vitreus*)) showed that autumn (Sept.-Nov.) and spring (Mar.-May) exhibited the highest potential interspecific competition between species (Raborn et al.2004). For Black Crappie, summer (Jun.-Aug.) and winter (Dec.-Feb.) provided the least potential for interspecific competition, most likely because summer has the greatest annual prey abundance for these predators, while winter coincides with lower metabolic rates that decrease the need for Black Crappie to feed as heavily compared to the rest of the year leading to reduced interspecific competition (Raborn et al. 2004). My field season lasted from April to September, therefore I may have been capturing Black Crappie when there was higher interspecific competition early on and lower competition as the summer progressed. It should be noted that I did not directly assess interspecific competition in this study. However, Black Crappie with the lowest mean relative weight were found in Big Whiteshell Lake (92 standard Wr; 96 Manitoba-specific Wr), suggesting that interspecific competition may have had a more pronounced role in limiting relative weight in this lake. Given that Wr values of >80 are typically still indicative of a relatively normal weight in a fish population, any role interspecific competition may have played in Big Whiteshell Lake did not lead to reduced body condition (Wright 2000).

For fish a desire to provide recreation or harvest for anglers is often the goal for fisheries managers (Pope et al. 2010). I used PSD and RSD to visualize percentages of desirable sized fish within a system, which can help in creating management strategies specific to a system. Within the study sites, the highest percentages of preferred (for consumption) sized fish were located in South Cross Lake, Jessica Lake and Big Whiteshell Lake. Those lakes also contained the highest percentages of trophy sized fish. Depending on the purpose for the recreational system being managed, proper balance between size classes is key. For example, if the intent for a lake is to manage for trophy sized fish, then implementing a length limit that targets individuals in the preferred and memorable sizes may allow individuals in those populations to grow into the trophy stage. Black Crappie are generally more abundant in smaller size ranges, therefore limiting harvest of trophy size fish and implementing a relatively increased harvest limit for preferred and memorable sizes would potentially allow for long-term trophy size population stability (Gwinn et al. 2015). It is also important to understand how fishing pressure on a system can cause disruption between size classes. One study performed on numerous Minnesota, USA, lakes using data obtained from an annual fishing contest over a 58-year study period showed that the total number of trophy sized Black Crappie entries decreased significantly after 1960, potentially as a result of increased fishing pressure put on these systems from fishing contests (Olson and Cunningham 1989). With the highest densities of trophy sized fish located in South Cross, Jessica, and Big Whiteshell Lakes, these water bodies may be at a similar risk of increased pressure from anglers in the Whiteshell Provincial Park system. Of these three lakes with the highest densities of trophy sized fish, South Cross and Big Whiteshell Lakes were fished the heaviest based on personal observations throughout the duration of my field season. While Jessica Lake did not appear to be fished as heavily, potential pressure in the future could manifest with increased interest in angling trophy sized Black Crappie. Setting limits based on population size structure for each specific water body (i.e., implementing distinct limits that correspond with each lake's Black Crappie RSD) may be an option worth considering for lakes throughout the Whiteshell system.

Two lakes in particular (Caddy and Big Whiteshell Lakes) displayed major discrepancies in Black Crappie population characteristics hat provide a good example of lake-specific population characteristics in the Whiteshell Provincial Park system. Black Crappie in Caddy Lake displayed slow growth rates, high body condition, and the highest percentage of fish caught below stock size. A wide variety of factors could be influencing these characteristics that would require further study. However, it appears that lake use, particularly regarding harvest pressure, may be one factor contributing towards these specific population characteristics. Based on observations of other anglers during my field seasons, Caddy Lake was one of the most heavily fished lakes in the Whiteshell Provincial Park system for Black Crappie. By contrast, Black Crappie in Big Whiteshell Lake displayed a faster growth rate, the lowest body condition, and the highest percentage of trophy fish out of the seven lakes studied. Despite a higher trophy fish population, Big Whiteshell Lake did not appear to be fished as heavily for Black Crappie during our field season compared to Caddy Lake. Differences observed regarding lake use by anglers may be because Big Whiteshell Lake is significantly larger (nearly six times the size of Caddy Lake), which makes tracking Black Crappie for summer harvest more difficult as they are able to spread throughout the system. In the future it would be beneficial to conduct angler surveys in these locations to determine the number of anglers fishing each site. Another explanation for the differences in data I gathered for Black Crappie population characteristics between Caddy and Big Whiteshell Lakes could be time of capture. Caddy Lake was the earliest lake sampled for my research (April-May), whereas Big Whiteshell was one of the latest sampled (July). This may have influenced data analysis, including the number of fish captured as a result of varying fish movement and availability that occurs during different times of the year.

Overall, Black Crappie in the Whiteshell Provincial Park display slower growth, but grow to longer lengths, than more southerly Black Crappie populations in the U.S.A. Growth in fisheries is considered to be highly variable and can be affected by both environment and genetics (McDowall 1994). Temperature is thought to be one of the leading causes of fluctuation in growth, with 90% of growth occurring in the summer months for temperate fish (Wrenn 1979, cited in Ficke et al. 2007). Black Crappie in the Whiteshell may be growing slower because they have a shorter window of time (i.e. summer) when water temperature reaches an optimal growth temperature threshold. Although these fish grow slower, age may indicate why large numbers of large Black Crappie were found in the sites. The majority of Black Crappie studies contain only fish between the ages of 1 to 7 years old due to a lack of information on older fish within those studies (Guy and Willis 1995; Kruse et al. 1993; Ellison 1984). Information regarding older Black Crappie has been developed, though publications are relatively limited and sparsely available (Bailey et al. 2015). The Black Crappie within the Whiteshell Provincial Park system ranged in age from 1 to 15 years old (with a significant amount of fish aged 7 and older), suggesting that Black Crappie in Manitoba are longer lived than Black Crappie in other populations.

The stock densities calculated in this study provide the first available size class proportions specific for Black Crappie within the Whiteshell Provincial Park lakes. Having these proportions available provides useful population data for fisheries managers to implement regulations based on proportions of size classes in each unique system. The current regulations on harvest for Black Crappie in the Southeast region of Manitoba is limited to a daily possession of six with no length regulations implemented) (Manitoba 2020 Angler's Guide, 2020). Other known southerly trophy fisheries implement a daily harvest limit of 15 to 20 Black Crappie that must exceed 10 or 12 inches (254 or 305mm), depending on the fishery (Kentucky Department of Fish & Wildlife Fishing Regulations, 2020; MDWFP - Grenada Lake, 2020). Such regulations are suitable for Black Crappie populations in those specific regions, potentially because individuals grow to larger sizes more quickly in more southerly regions (Miranda 2014). Black Crappie growth in the Whiteshell Provincial Park is comparatively slower, meaning regulations should limit the amount of harvest on trophy sized fish. For example, slot limits unique to each lake may be a beneficial technique to balance size classes within a system. Slot limits are a fishing regulation which requires anglers to harvest a defined size range of fish, typically protecting specific size classes from being harvested (Sullivan 2017). Slot limits have worked in other systems; for example, in Derby pond, Delaware, USA, Largemouth Bass (*Micropterus salmoides*) were showing signs of a "moderately dense population" in a balanced fish community (Martin 1995). However, the objective was to manage for a trophy fishery by increasing the proportion of larger individuals in the system. Slot limits were successfully implemented, and anglers reported higher catches of trophy sized fish within three years (Martin 1995).

The tags indicated that movement between sites was infrequent (if it occurred at all), with only 3 of the 50 reported fish being captured in a waterbody different than the original tagging location. However, it is unclear if these fish moved naturally or if they were translocated by anglers. For example, I was notified that one tagged fish was caught by anglers in Caddy Lake and transferred to North Cross Lake by boat, where it was released in place of a larger, non-tagged Black Crappie in order to comply with the regulatory harvest limit of 6 fish. With limited information regarding these movements, I could not conclude whether migration was naturally occurring between these sites. It is interesting, however, to note that distribution of Black Crappie throughout the Whiteshell Provincial Park may be influenced more by human interaction than previously considered. It is known that recreational anglers have caused many fish translocations whether directly or indirectly, which may explain the increased range expansion of non-native species, such as the Black Crappie in southern Manitoba (Gozlan et al. 2010). One study of bait bucket transferring (the releasing of live bait into a system) showed a probability of 1.2/100 that an angler would release live bait from the Mississippi River drainages into the Hudson Bay (based on a single angler on a single angling day). While that probability is low, considering the number of anglers and angling days in a year, the probability of bait bucket transferring occurring multiple times in one year is high (Ludwig and Leitch 1996). While the Black Crappie is likely not being used as a bait source, it is fair to consider that anglers may be translocating fish for recreational use as is evident in Wyoming, where a study concluded that of 62 unauthorized fish introductions, 50% were illegal stockings by the public (Rahel 2004). Most notably, Walleye (a common sport fish) were found in Gillette Fishing Lake (which contained no previous Walleye populations) in 2002. This lake had had never been stocked by the Wyoming Game and Fish Department and had no drainages that led into this system, meaning that illegal stocking was most likely the cause (Rahel 2004). While there is no definitive evidence of illegal stocking occurring with Black Crappie in southern Manitoba, it is necessary to consider this may be a source of continual range expansion for future management.

Chapter Two Tables and Figures

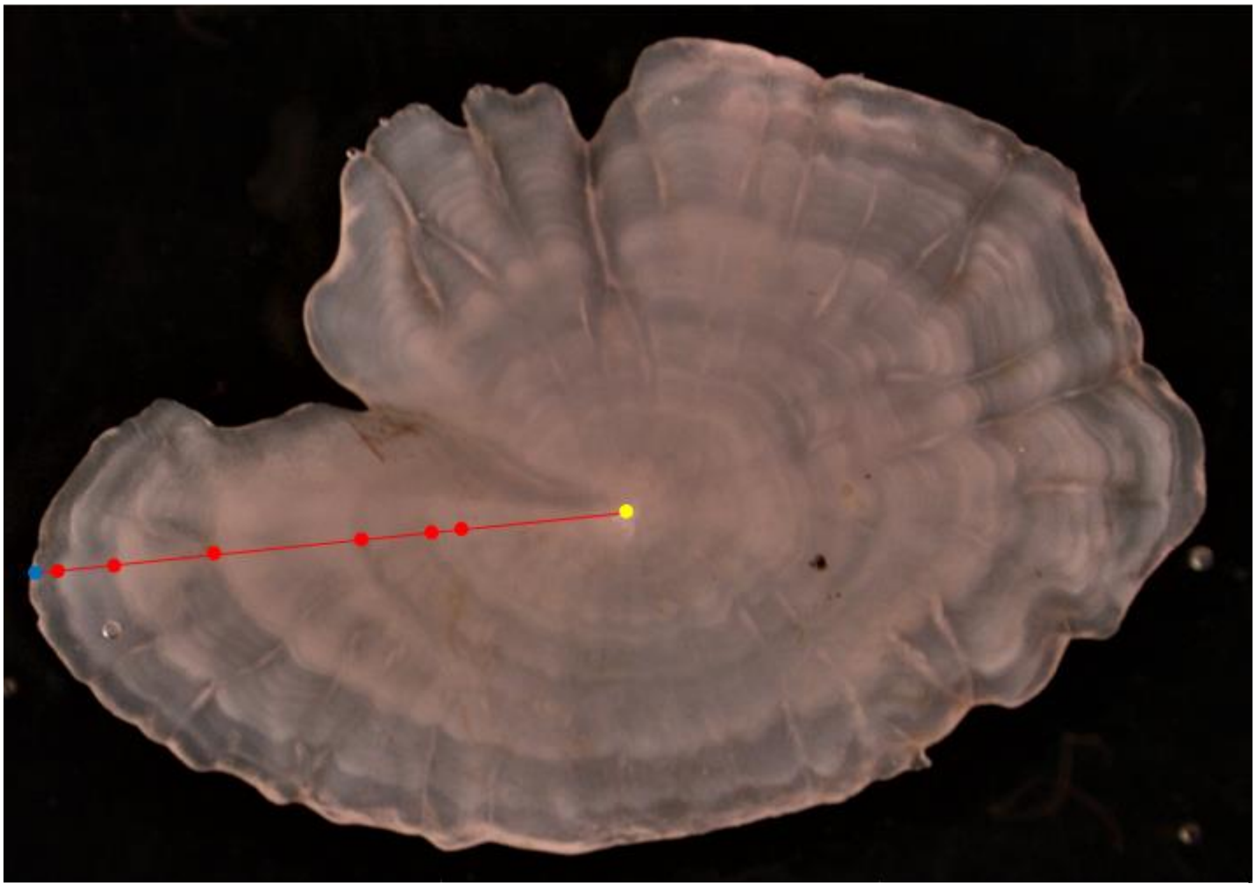


Figure 1. Otolith radius is the red line, measuring the radius from the center of the otolith (yellow dot) to the anterior tip of the otolith (blue dot). The distance between each annuli (red dots) were measured along the radius of the otolith.

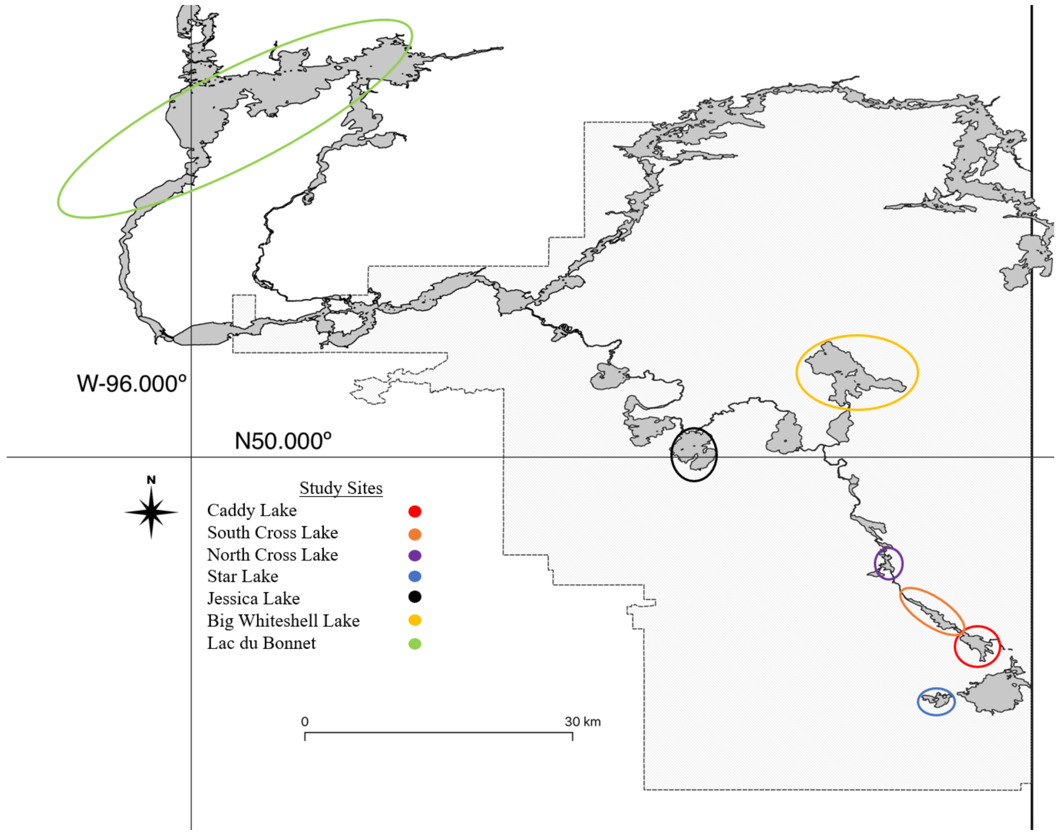


Figure 2. Map of lakes sampled for Black Crappie (*Pomoxis nigromaculatus*), the shaded area is the Whiteshell Provincial Park, Manitoba, Canada in 2018 and 2019.

Table 1. 2018 and 2019, site information of lakes located in the Whiteshell Provincial Park. Data includes surface area (hectares), depth (meters), number of Black Crappie (*Pomoxis nigromaculatus*) measured, total number of Black Crappie captured per year per site, and additional species captured.

Lake	Surface Area in Hectares (ha)	Max Depth in Meters (m)	Number of Black Crappie Measured in Each Site	Total Number of Black Crappie per Year Captured at Each Site	Species Captured in Each Site
Caddy Lake	319.4	8.3	547	271 (2018) 245 (2019)	*Sander vitreus, Catostomus commersoni, Micropterus dolomieu, Perca flavescens, Esox lucius, Ambloplites rupestris, Notropis hudsonius, Lota lota*
South Cross Lake	274.3	3.5	422	338 (2018) 85 (2019)	*Sander vitreus, Catostomus commersoni, Micropterus dolomieu, Perca flavescens, Esox lucius, Notropis hudsonius*
North Cross Lake	112.2	8.8	415	372 (2018) 44 (2019)	*Sander vitreus, Catostomus commersoni, Micropterus dolomieu, Perca flavescens, Esox Lucius, Ambloplites rupestris*
Jessica Lake	879	3.9	121	39 (2018) 82 (2019)	*Sander vitreus, Catostomus commersoni, Micropterus dolomieu, Perca flavescens, Esox lucius, Ambloplites rupestris, Lota lota*

Star Lake	161.2	7.3	97	50 (2018) 47 (2019)	*Micropterus dolomieu, Perca flavescens, Esox lucius*
Lac du Bonnet	8400	26	104	68 (2018) 36 (2019)	*Sander vitreus, Esox lucius, Sander canadensis, Perca flavescens, Moxostoma macrolepidotum, Moxostoma anisurum, Catostomus commersonii, Acipenser fulvescens, Coregonus artedi, Coregonus clupeaformis, Micropterus dolomieu*
Big Whiteshell Lake	1750.4	10.4	56	14 (2018) 36 (2019)	*Sander vitreus, Catostomus commersoni, Perca flavescens, Esox lucius, Ambloplites rupestris*

*All information on lakes was taken from anglers atlas, with the exemption of Lac du Bonnet, whose information was taken from (Wheeland and Rose n.d.)

Table 2. 2019, Average monthly water temperature (°C) for each lake measured during days of sampling (mean ± SD). Number of sample days varied between sites for each month.

Month	Caddy Lake	South Cross Lake	North Cross Lake	Jessica Lake	Star Lake	Lac du Bonnet	Big Whiteshell Lake	Average Across all Waterbodies
May	9.7	15	16.6	-	14.5	-	-	15.3 ± 2.57
June	24.1	23.6	21.3	21.2	22	-	-	22.4 ± 1.19
July	20	22.3	24.2	21.6	-	-	21.2	21.8 ± 1.39
August	-	-	-	20.7	-	-	-	20.7 ± 0
September	-	-	-	-	-	17	-	17 ± 0

Table 3. Mean total length (mm) by age class for Black Crappie (*Pomoxis nigromaculatus)* collected in Whiteshell Provincial Park, Manitoba, 2018 and 2019. Length ranges are at the top. Mean total length is in bold. n = Number of individuals.

Lake ID	Mean Length at age 1	Mean Length at age 2	Mean Length at age 3	Mean Length at age 4	Mean Length at age 5	Mean Length at age 6	Mean Length at age 7	Mean Length at age 8	Mean Length at age 9	Mean Length at age 10	Mean Length at age 11	Mean Length at age 12	Mean Length at age 13	Mean Length at age 14	Mean Length at age 15
Caddy Lake	53-86 **72** (n=76)	73-210 **131** (n=15)	105-256 **147** (n=30)	121-286 **250** (n=10)	254-310 **297** (n=7)	288-332 **310** (n=9)	312-339 **323** (n=8)	290-344 **326** (n=7)	320-358 **344** (n=4)	324-362 **346** (n=13)	364-370 **367** (n=2)	349-373 **359** (n=5)	355 **355** (n=1)	339-342 **341** (n=2)	-
South Cross Lake	66-73 **70** (n=2)	82-120 **107** (n=5)	114-270 **219** (n=7)	242-291 **277** (n=6)	280-346 **311** (n=13)	278-330 **309** (n=13)	270-362 **320** (n=17)	302-364 **333** (n=10)	362-387 **374** (n=3)	378 **378** (n=1)	356-361 **359** (n=2)	368 **368** (n=1)	-	-	-
North Cross Lake	-	-	162-237 **204** (n=14)	192-227 **208** (n=13)	221-285 **260** (n=13)	184-301 **266** (n=19)	247-308 **274** (n=14)	253-285 **272** (n=5)	-	314 **314** (n=1)	-	-	-	-	-
Star Lake	63-134 **101** (n=8)	122-194 **156** (n=7)	192-254 **219** (n=30)	216-256 **238** (n=17)	280-346 **283** (n=9)	310-321 **316** (n=2)	-	-	-	-	-	-	-	-	-
Big Whiteshell Lake	106 **106** (n=1)	104-130 **112** (n=6)	245-278 **259** (n=4)	267-309 **289** (n=3)	306 **306** (n=1)	295-360 **330** (n=11)	328-375 **350** (n=12)	346-382 **365** (n=9)	340 **340** (n=1)	-	-	-	-	-	-
Jessica Lake	-	142-236 **172** (n=6)	256-295 **268** (n=8)	266-280 **272** (n=9)	272-281 **276** (n=8)	280-309 **288** (n=12)	282-368 **314** (n=8)	284-339 **325** (n=6)	310-351 **330** (n=7)	334-356 **346** (n=8)	348-380 **359** (n=8)	-	378 **378** (n=1)	364-388 **372** (n=4)	367-386 **376** (n=5)
Lac du Bonnet	60-88 **73** (n=31)	170-194 **185** (n=7)	192-252 **227** (n=17)	220-268 **249** (n=25)	254-302 **273** (n=7)	252-320 **287** (n=6)	300-321 **311** (n=2)	332 **332** (n=1)	-	-	-	-	-	-	-

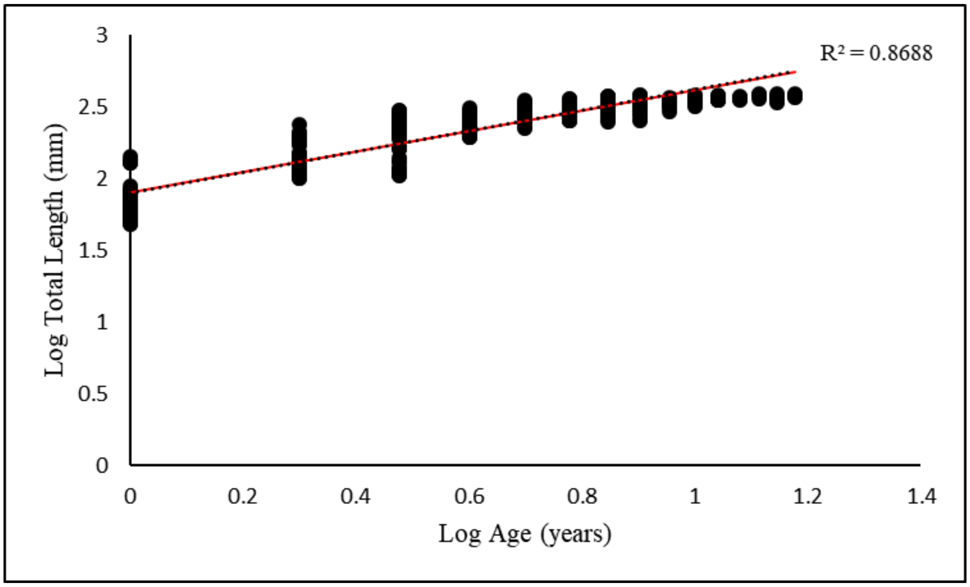


Figure 3. Natural log transformed total length (mm) and age +1 (years) of Black Crappie (*Pomoxis nigromaculatus)* from the Whiteshell Provincial Park, 2018 to 2019, with best-fit line superimposed.

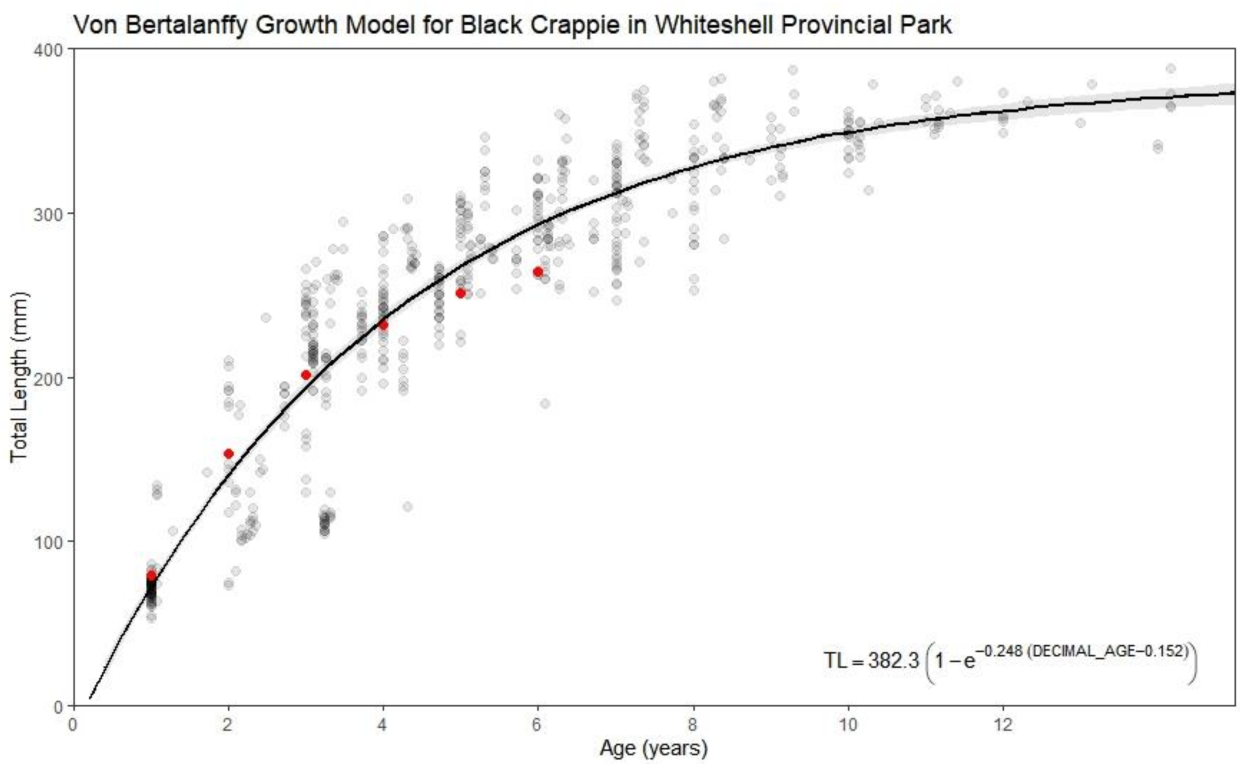


Figure 4. Von Bertalanffy growth curve for Black Crappie (*Pomoxis nigromaculatus)* through out the Whiteshell Provincial Park. The red dots indicate the growth average of the 81 populations found across the United States.

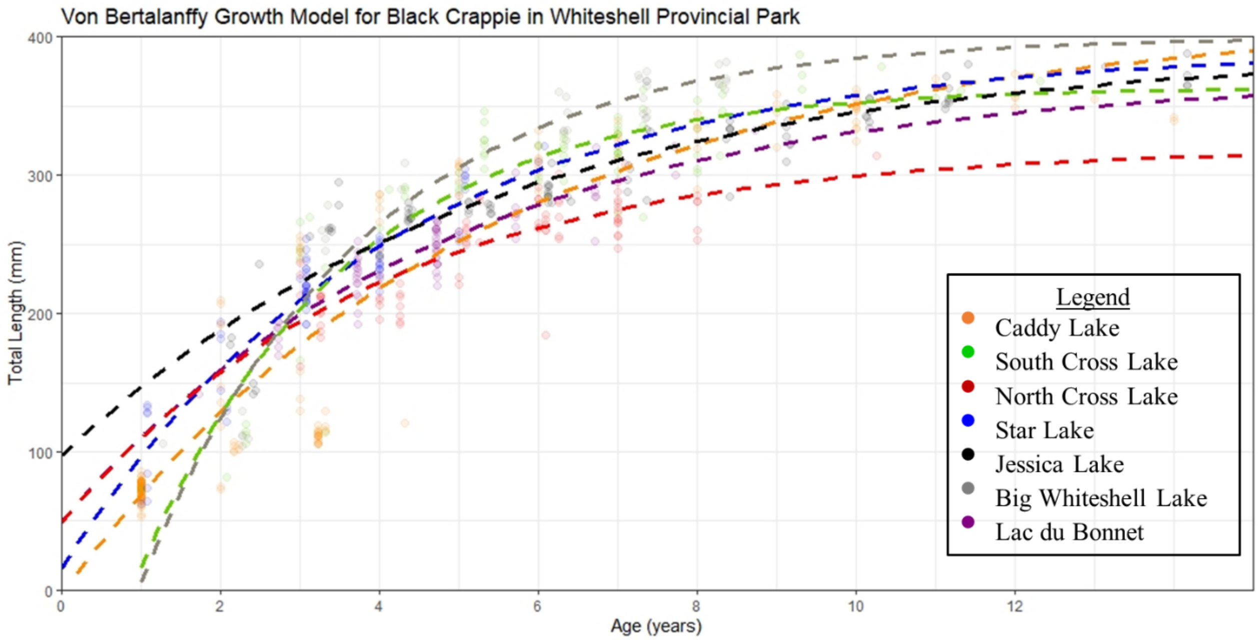


Figure 5. Von Bertalanffy growth curves, between sites, for Black Crappie (*Pomoxis nigromaculatus)* through out the Whiteshell Provincial Park, 2018 and 2019.

Table 4. Von Bertalanffy growth equations for Black Crappie (*Pomoxis nigromaculatus*) for each site in Whiteshell Provincial Park.

Lake ID	Von Bertalanffy Growth Equation
Caddy Lake	$TL = 414(1-e^{-0.189(age-0.038)})$
South Cross Lake	$TL = 364(1-e^{-0.384(age-0.877)})$
North Cross Lake	$TL = 320 (1-e^{-0.255(age+0.645)})$
Star Lake	$TL = 391(1-e^{-0.243(age+0.17)})$
Jessica Lake	$TL = 391 (1-e^{-0.185(age+1.55)})$
Big Whiteshell Lake	$TL = 400 (1-e^{-0.357(age-0.955)})$
Lac du Bonnet	$TL = 372 (1-e^{-0.207(age+0.694)})$

Table 5. Average Relative weight (Wr), with standard deviations, of Black Crappie (*Pomoxis nigromaculatus*) for each site in Whiteshell Provincial Park, 2018 to 2019.

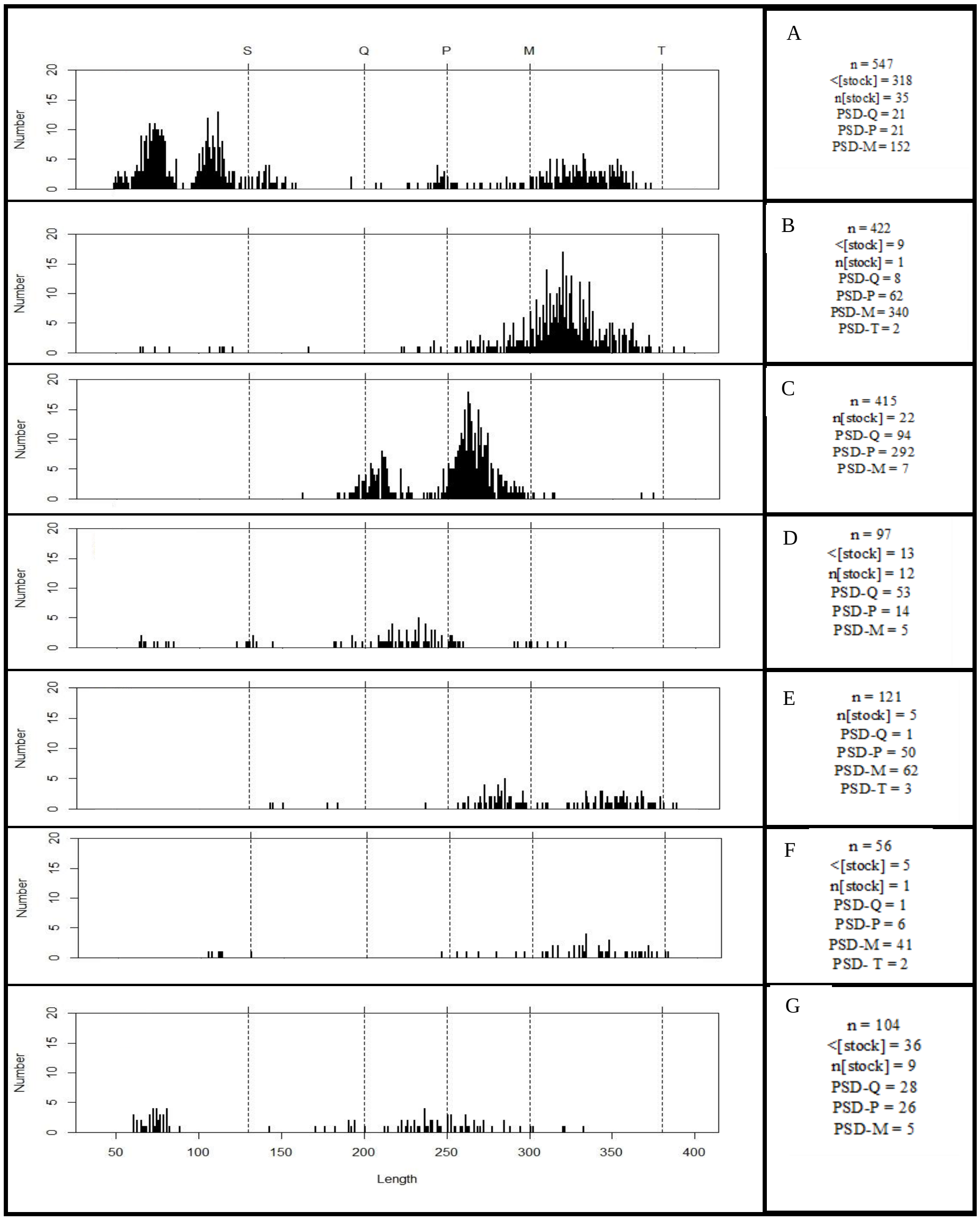
Lake	Mean Relative Weight (Wr)
Caddy Lake	106 ± 55.71
South Cross Lake	111 ± 75.16
North Cross Lake	102 ± 20.61
Star Lake	98 ± 4.30
Jessica Lake	97 ± 9.72
Big Whiteshell Lake	92 ± 7.31
Lac du Bonnet	97 ± 6.05

Table 6. Average Relative weight (Wr), with standard deviations, of Black Crappie (*Pomoxis nigromaculatus*) for each site in Whiteshell Provincial Park, using the Manitoba specific equation for relative weight, 2018 to 2019.

Lake	Manitoba Specific Mean Relative Weight (Wr)
Caddy Lake	109 ± 55.01
South Cross Lake	113 ± 74.94
North Cross Lake	102 ± 19.18
Star Lake	97 ± 4.01
Jessica Lake	100 ± 9.23
Big Whiteshell Lake	96 ± 6.30
Lac du Bonnet	97 ± 6.0

Table 7. 2018 and 2019, percentages of proportional and relative stock density for Black Crappie (*Pomoxis nigromaculatus*) at each site in the Whiteshell Provincial Park.

Lake	PSD	RSD(p)	RSD(m)	RSD(t)
All Lakes	78	62	45	0.5
Caddy Lake	85	76	66	-
South Cross Lake	99	98	83	0.5
North Cross Lake	95	70	2	-
Star Lake	86	23	6	-
Jessica Lake	96	95	54	2
Big Whiteshell Lake	98	96	84	4
Lac du Bonnet	87	46	7	-



A = Caddy Lake, B = South Cross Lake, C = North Cross Lake, D = Star Lake, E = Jessica Lake, F = Big Whiteshell Lake, G = Lac du Bonnet

Figure 6. Histograms illustrating the proportional stock density (PSD) of Black Crappie between sites. The categories are as followed: Stock (S), Quality (Q), Preferred (P), Memorable (M), and Trophy (T).

Chapter 3:

Using Stable Isotope Analysis, Gonadosomatic Index, and Hepatosomatic Index to Assess Trophic Level, Spawning Time, and Energy Allocation in Black Crappie (*Pomoxis nigromaculatus*) at the Most Northern Extent of Their Range

3.1 Introduction

Black Crappie (*Pomoxis nigromaculatus*) diet and ecosystem dynamics have been studied across North America (Ellison 1984; Guy and Willis 1995; Miller et al. 1990; Raborn et al. 2004). However, little research has focused on populations of Black Crappie at the northernmost edge of their distribution. Black Crappie have a wide distribution spanning from Southern Canada to the Southern United States Gulf Coast (Cooke and Philipp 2009). While they are native to some of the southernmost drainages in Manitoba, unintentional stocking, which is believed to have occurred in the mid-1940's, has introduced Black Crappie in the Whiteshell Provincial Park water system. The Black Crappie population within the Whiteshell was relatively limited in abundance and range until recently. In the past 10-15 years this population has begun to expand and increase in abundance establishing reproducing populations through interconnected waterways across several lakes in the Whiteshell Lake system (D. Kroeker, Wildlife & Fisheries Branch, Ministry of Agriculture and Resource Development, personal communication). As these fish continue expanding their distribution, it is unclear how these non-native fish are affecting the ecology of native fish populations. Understanding Black Crappie diet, reproduction, and energy allocation within these systems will provide insights into the basic biology of Black Crappie in Whiteshell Provincial Park.

The purpose of this study was to assess dietary interactions, spawning time, and energy allocation in Black Crappie (*Pomoxis nigromaculatus*) at the most northern extent of their range. Dietary habits were assessed through stable isotope analysis, reproductive periods were determined using the gonadosomatic index (GSI), and energy allocation was calculated from the hepatosomatic index (HSI). Stable isotopes were used to understand the diet of Black Crappie in three lakes in the Whiteshell Provincial Park. I examined carbon (^{13}C) and nitrogen (^{15}N) in wild caught Black Crappie, both of which are commonly assessed in diet studies (Brush et al. 2012; Gu et al. 1996; Muñoz et al. 2011). In lake systems, ^{13}C is measured to determine whether feeding occurs in more pelagic or littoral regions (Post 2002). The relative trophic position of a species within a food web is determined by measuring $\delta^{15}N$ values (Cabana and Rasmussen 1996). The simplest method of assessing trophic level of a consumer in a lake food web is to establish baseline $\delta^{15}N$ values from primary consumers such as snails or mussels, and then compare secondary consumer $\delta^{15}N$ values to the baseline (Post 2002). Aquatic trophic levels are assigned using integers (i.e.; 1 = primary producers, 2 = primary consumers, 3 = secondary consumers, etc.) (Carscallen et al. 2012). I hypothesized that there will be variations in dietary interactions between sites and that differences in stable isotope signatures will be linked to distinct growth patterns (see chapter 2). I predicted that diets featuring higher tropic level interactions would have a faster growth rate as a result of higher caloric consumption in a piscivorous diet than diets containing lower trophic level interactions as estimated by the stable isotope signatures (Simon et al. 2009). I used the GSI to estimate when spawning occurs in Manitoba. I hypothesized that Black Crappie within the Whiteshell Provincial Park will start spawning later, in late May to early June, compared to more southern populations (that spawn in April to early May) as result of cooler water temperatures in Manitoba. Lastly, I used HSI to estimate energy allocation from lipid content in Black Crappie liver. Energy is typically directed toward growth among younger individuals, and as an individual begins to mature, energy shifts towards reproduction (Jorgensen and Fiksen 2006). In this study, I measured the allocation of energy in mature Black Crappie to examine variations in energy storage depending on capture date (during and post-spawning). I predicted that Black Crappie would have lower HSI in early June as spawning ends due to energy use associated with spawning and that there would be increased energy storage post-spawning season as the fish prepare for the winter season. Also, HSI may be related to trophic position as the intake of higher caloric food may lead to higher energy storage and produce a heavier relative liver weight.

3.2 Methods

3.2.1 Stable Isotope Analysis

In the summer of 2018, I collected liver and muscle tissue samples from two sites (Lac du Bonnet and Jessica Lake). These samples were used for a pilot study to determine if stable isotope signatures could be used to differentiate between lakes in the system. Variations were seen between the sites and confirmed that we could use stable isotope analysis to look at the variability in $\delta^{13}C$ and $\delta^{15}N$ between sites (D. Yurkowski, Fisheries and Oceans Canada, personal communication). In the summer of 2019, liver and muscle tissue samples were collected from Black Crappie at seven different sites in the Whiteshell Provincial Park (Figure 2): Caddy Lake, South Cross Lake, North Cross Lake, Star Lake, Jessica Lake, Big Whiteshell Lake, and Lac du Bonnet; however, only three sites could be processed prior to the COVID-19 shutdown. Therefore, my study focuses on three lakes: Caddy Lake, North Cross Lake and Star Lake. Within those sites, liver and muscle tissue samples from 128 fish were processed (Caddy Lake, n=31; North Cross Lake, n=47; Star Lake, n=50).

Stable isotope analysis was performed at the Freshwater Institute, Fisheries and Oceans Canada, Winnipeg, Manitoba. To prepare the liver and muscle tissue samples for stable isotope analysis, they were freeze dried, ground into a fine powder using a mortar and pestle, and then weighed into 3.5x5mm tin cups (Costech Analytical, Santa Clarita, CA). The samples were then analysed using a continuous flow isotope DELTA V™ Isotope Ratio Mass Spectrometer (Thermofisher Scientific, Waltham, MA) equipped with a zero blank auto sampler and a 4010 elemental analyzer (Costech Analytical). The stable isotope results are expressed in delta (δ) notation defined as the deviation from a standard reference material in parts per thousand (‰) (Equation 7). The $\delta^{13}C$ results are relative to Vienna Pee Dee Belemnite (VPDB), while $\delta^{15}N$ results are relative to atmospheric air. The values were calculated using the following equation:

$$\delta X = [(Rsample/Rstandard) - 1] \times 1000$$

Where X is ^{13}C or ^{15}N, Rsample is the ratio ($^{13}C/^{12}C$ or $^{15}N/^{14}N$) in the sample while Rstandard is the ratio in the standard. Samples were normalized against certified reference materials (USGS40 and 41a). Trophic positioning of Black Crappie within each system was determined by measuring

$\delta^{15}N$ values of Black Crappie in relation to baseline $\delta^{15}N$ values of primary consumers (snails) gathered from each lake, using the equation:

$$\text{Trophic Position} = \lambda + (\delta^{15}N_{\text{secondary consumer}} - \delta^{15}N_{\text{base}})/\Delta_n$$

Where λ is the trophic level of the organism used to estimate $\delta^{15}N_{base}$ (i.e., $\lambda = 2$ for primary consumers such as snails), $\delta^{15}N_{\text{secondary consumer}}$ (Black Crappie) is measured directly, and Δ_n is the enrichment value of $\delta^{15}N$ per trophic level. A standard value of 3.4 for Δ_n is considered applicable for a food web (Post 2002) (Equation 8).

3.2.2 Gonadosomatic and Hepatosomatic Indices

In both 2018 and 2019, the GSI and HSI were measured on 460 Black Crappie (263 females and 197 males) from all seven sites in the Whiteshell Provincial Park. The GSI was measured for each sex using the gonad to body mass ratio, whereas the HSI was measured for each sex using the liver to body mass ratio.

GSI was calculated by using:

$$GSI = \frac{GM}{(BM - GM)} X\ 100$$

Where GM is gonad mass (g) and BM is body mass (g) (Equation 9).

HSI was calculated by using:

$$HSI = \frac{LM}{(BM - LM)} X\ 100$$

Where LM is liver mass (g) and BM is body mass (g) (Equation 10).

<u>3.3 Results</u>

Stable isotope samples were split between sites and the tissues were sampled separately, presented as means ± SD against total length (mm). Caddy Lake $\delta^{13}C$ values were -26.07 ± 0.96 in the liver and -26.15 ± 1.72 in the muscle tissue samples. Caddy Lake $\delta^{15}N$ values were 9.84 ± 0.46 (liver) and 9.76 ± 0.79 (muscle). North Cross Lake $\delta^{13}C$ values were -32.67 ± 0.59 (liver) and -31.95 ± 0.69 (muscle). North Cross Lake $\delta^{15}N$ values were 9.29 ± 0.37 (liver) and 9.14 ±

0.50 (muscle). Star Lake $\delta^{13}C$ values were -32.73 ± 0.58 (liver) and -31.65 ± 0.43 (muscle). Star Lake $\delta^{15}N$ values were 10.54 ± 0.45 (liver) and 11.11 ± 0.46 (muscle) (Table 8; Figures 7 & 8). Stable isotope values were not influenced by total length (mm). Baseline $\delta^{13}C$ values (measured from snails) were -21.31 for Caddy Lake, -21.71 for North Cross Lake, and -26.59 for Star Lake. Baseline $\delta^{15}N$ values were 3.75 for Caddy Lake, 3.86 for North Cross Lake, and 5.82 for Star Lake. Trophic positioning is presented for each lake as mean value ± SD. The trophic position values of Black Crappie in Caddy Lake were 3.78 ± 0.13, in North Cross Lake were 3.58 ± 0.19, and in Star Lake were 3.48 ± 0.16 (Table 9).

The GSI was averaged (mean ± SD) for each month for male and female Black Crappie (Table 8). The highest values occurred in May, for females, at 5.75 ± 2.13 and in September, for males, at 0.90 ± 0.41. The GSI subsequently decreased in June (3.44 ± 1.73), July (1.07 ± 0.96), and August (0.72 ± 0.32) for females (Table 10). However, in September there was a slight increase to 1.57 ± 0.46 (Table 10; Figure 9). The GSI also decreased in June (0.28 ± 0.14) and July (0.14 ± 0.06) for males (Table 10), then began to increase in September (0.90 ± 0.41) (Table 10; Figure 10). I used a Kruskal Wallis test to determine that there were statistical differences between the sites (chi-squared = 61.77, df = 6, p-value = 2.0-12).The HSI was averaged for each month between male and female Black Crappie and followed similar trends as the GSI between sexes, the difference was HSI for male Black Crappie was highest in May (1.47 ± 0.60) instead of September (0.99 ± 0.36), everything else followed the same general trend (Table 10). I used a Tukey post hoc test to determine that there were statistical differences between the sites (P-value: <2e-16).

3.4 Discussion

Stable isotope analysis showed different groupings of $\delta^{13}C$ and $\delta^{15}N$ values in fish between lakes. The most significant difference observed from the stable isotope analysis was variation in $\delta^{13}C$ in Caddy Lake, which showed $\delta^{13}C$ values noticeably higher (i.e., closer to 0) in relation to North Cross Lake and Star Lake. This distinction in $\delta^{13}C$ suggests differences in primary carbon source consumption between Caddy Lake and the other two sites, meaning that Black Crappie in Caddy Lake may be feeding more littorally than in the other two sites because higher $\delta^{13}C$ values are typical of more littoral-based food webs (Post 2002). Standard deviation of

$\delta^{15}N$ values show no significant differences between Black Crappie among all three lakes (with the exception of slightly increased $\delta^{15}N$ values of muscle tissue in Star Lake). Baseline $\delta^{15}N$ values from Star Lake were noticeably higher than in both Caddy and North Cross Lakes, which likely explains the increased $\delta^{15}N$ values observed in the muscle tissue of Black Crappie in that system. In comparison to the baseline $\delta^{15}N$ values, Black Crappie in all three lakes appear to be secondary consumers at relatively similar trophic positioning. Values of $\delta^{15}N$ and $\delta^{13}C$ for both liver and muscle tissue showed similar grouping patterns across all sites. I hypothesized that there would be variations in dietary interactions between sites and that these interactions would have an impact on distinct growth patterns. I also predicted that diets featuring higher tropic level interactions would have a faster growth rate (as a result of higher caloric consumption in a piscivorous diet) than diets containing lower trophic level interactions as estimated by the stable isotope signatures (Simon et al. 2009). My results suggest that there are different feeding interactions between systems, with stable isotope analysis illustrating that Black Crappie in Caddy Lake feed more littorally, while Black Crappie in North Cross or Star Lakes feed more pelagic. Based on $\delta^{15}N$ values compared to the baseline in each lake, trophic positioning was not significantly different in any of the three lakes studies. However, growth rates did vary; North Cross Lake showed the fastest growth (as determined by von Bertalanffy growth models), followed closely by Star Lake, while Caddy Lake displayed noticeably slower growth compared to both (see chapter 2). I was not able to conclude whether diet influenced growth of Black Crappie between sites in the Whitesehll Provincial Park system, though it does not appear that varying growth rates observed between each site were influenced by higher or lower trophic positioning. Furthermore, it is unclear why the stable isotope signatures within Caddy Lake showed lower $\delta^{13}C$ values in comparison with the other lakes, though time of capture between sites may offer one explanation. For example, hatching of yearling fish or insects could have played a role in altering stable isotope concentrations of Black Crappie between capture dates, as the main food source for the fish likely shifted during my field season as prey items became more attainable. In 2019, I sampled both North Cross and Star Lakes in May, with Caddy Lake in May-June. Varying times of capture over the field season would have led to temporal differences in diet, which would be in addition to spatial differences between sites.

Water temperature influences spawning in fish, ultimately determining the timeframe during which fish begin to spawn (Graham and Orth 1986). Black Crappie are a warm water fish and are believed to begin spawning in temperatures around 18°C (Cooke and Philipp 2009). More southerly populations of Black Crappie experience earlier spawning dates; for example, newly hatched Black Crappie in Weiss Lake, Alabama, USA were captured between April 22nd and May 24th, suggesting a spawning date in early April (Travnichek, Maceina, and Dunham 1996). Further north, spawning dates for Black Crappie populations occur later; for example, in Richmond Lake, South Dakota, USA, newly hatched Black Crappie were captured between May 29th - June 28th in 1994, June 10th – July 6th in 1995, and June 14th – July 4th in 1996 (Pope and Willis 1998). Black Crappie in west-central lakes in Minnesota (Bergen, Crooked, and Cowdry Lakes) also exhibited spawning dates later in the year more similar to Black Crappie populations in the Whiteshell Provincial Park, with spawning occurring over a three-week period from mid-May to early June (Reed and Pereira 2009). Black Crappie in the Whiteshell Provincial Park are on the Northernmost edge of there distribution, therefore I predicted that spawning time may be later, occurring in late May to early June, than observed in other systems as a result of cooler water temperatures. In agreement, the GSI patterns suggest that Black Crappie likely spawn in late May. More precisely, observations of specific sampling dates showed that GSI for female Black Crappie was highest from May 23rd to 28th and decreased from June to September (except for one outlier in late June) (Figure 6). Similarly, male Black Crappie showed a pattern of high GSI in May that decreased until August, at which point it started to increase again (Figure 7).

Water temperature can vary between lakes in the same system, however because I was not able to measure water temperatures for each lake daily throughout my study, I averaged water temperatures from all seven lakes. Average water temperature across waterbodies was 15.3°C in May and 22.4°C in June. The difference in average temperature between May and June suggests that if 18°C is the temperature when spawning begins for Black Crappie in Manitoba, that temperature was reached between late May and June. Although the potential for spawning at lower or higher water temperatures can not be ruled out by the data collected in my study. However, based on the assumption that Black Crappie spawn at water temperatures around 18°C, and because of the decrease in the GSI of males and females in June, spawning likely occurred towards the end of May for Black Crappie in the Whiteshell Provincial Park.

Energy allocation may also contribute to understanding spawning dates. Measuring liver mass to body mass ratio, or HSI can help in determining the relative energy storage in a fish at the time of capture. My results showed that HSI followed the same trend as GSI, with HSI at its highest in May, then dropped until September where a slight increase occurred. The pattern of HSI decreasing after the spawn is likely a result of energy exhausted during reproduction (Bulow et al. 1978; Beuchel et al. 2013). The slight increase observed in September may be evidence of liver energy reserves beginning to restore in preparation for the upcoming winter and the next spawning season. Black Crappie in Buckeye Lake, Ohio showed the same general pattern and that liver size increases in September – October, indicating increased energy stores (Beuchel et al.2013). If Black Crappie spawning in the Whiteshell Provincial Park occurs later in the year than the Ohio population, it could be expected that energy allocation would be exhausted afterwards and the HSI would begin recovering later in the year than the Ohio population. However, my results suggest that relative liver size begins to recover around the same time as more southerly populations (i.e., September), at least compared to the Ohio population. Determining the reasons behind HSI rebounding earlier among Manitoba Black Crappie than I expected would require further investigation into the relationship between energy allocation and seasonal changes. One speculative explanation could be that Black Crappie in the Whiteshell lakes system experience a long period of over-wintering, meaning it is necessary to accumulate more fat to sustain themselves. At higher latitudes compared to more southerly populations, Black Crappie in the Whiteshell system may demonstrate an adaptive response to earlier onset of cold-water temperatures by beginning to store energy reserves earlier as well.

Chapter Three Tables and Figures

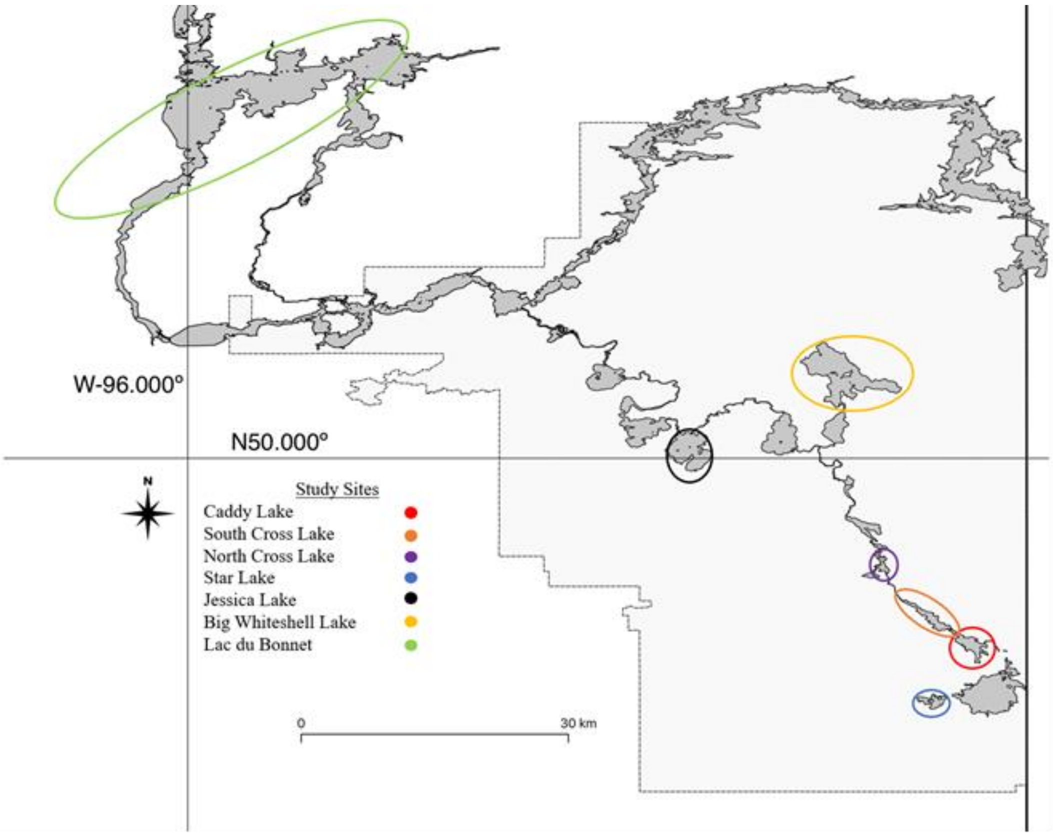


Figure 2. Map of lakes sampled for Black Crappie (*Pomoxis nigromaculatus*), the shaded area is the Whiteshell Provincial Park, Manitoba, Canada in 2018 and 2019.

Table 8. 2019, Isotopic signatures of δ13C and δ15N, averaged by tissue (mean ± standard deviation) between three lakes in The Whiteshell Provincial Park.

Site	Liver		Muscle	
	δ15N	δ13C	δ15N	δ13C
Caddy Lake	9.84 ± 0.46	-26.07 ± 0.96	9.76 ± 0.79	-26.15 ± 1.72
North Cross Lake	9.29 ± 0.37	-32.67 ± 0.59	9.14 ± 0.50	-31.95 ± 0.69
Star Lake	10.54 ± 0.45	-32.73 ± 0.58	11.11 ± 0.46	-31.65 ± 0.43

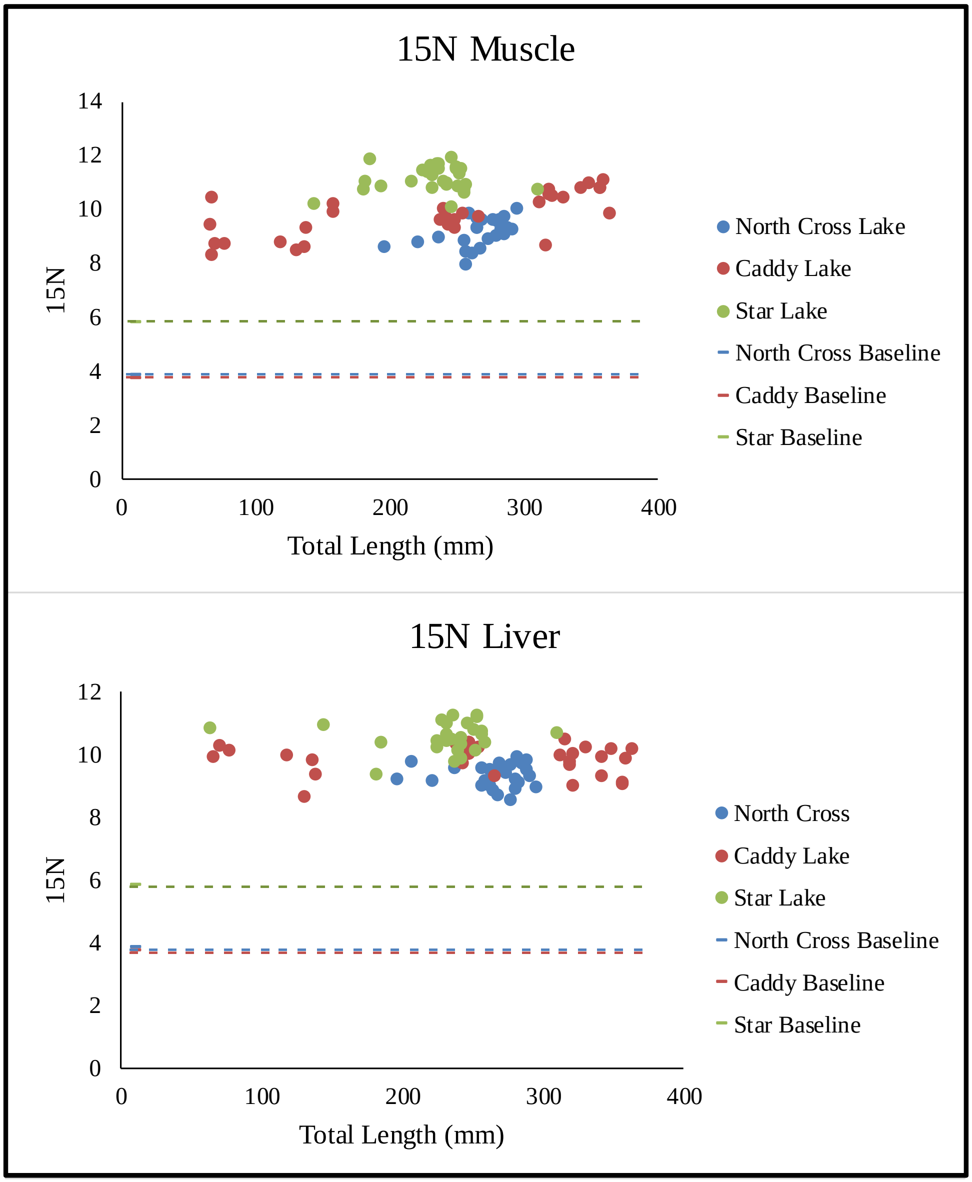


Figure 7. 2019, Isotopic signatures of δ15N in liver and muscle tissues against total length (mm) of three lakes in Whiteshell Provincial Park. One snail from each lake was used to measure baseline signatures.

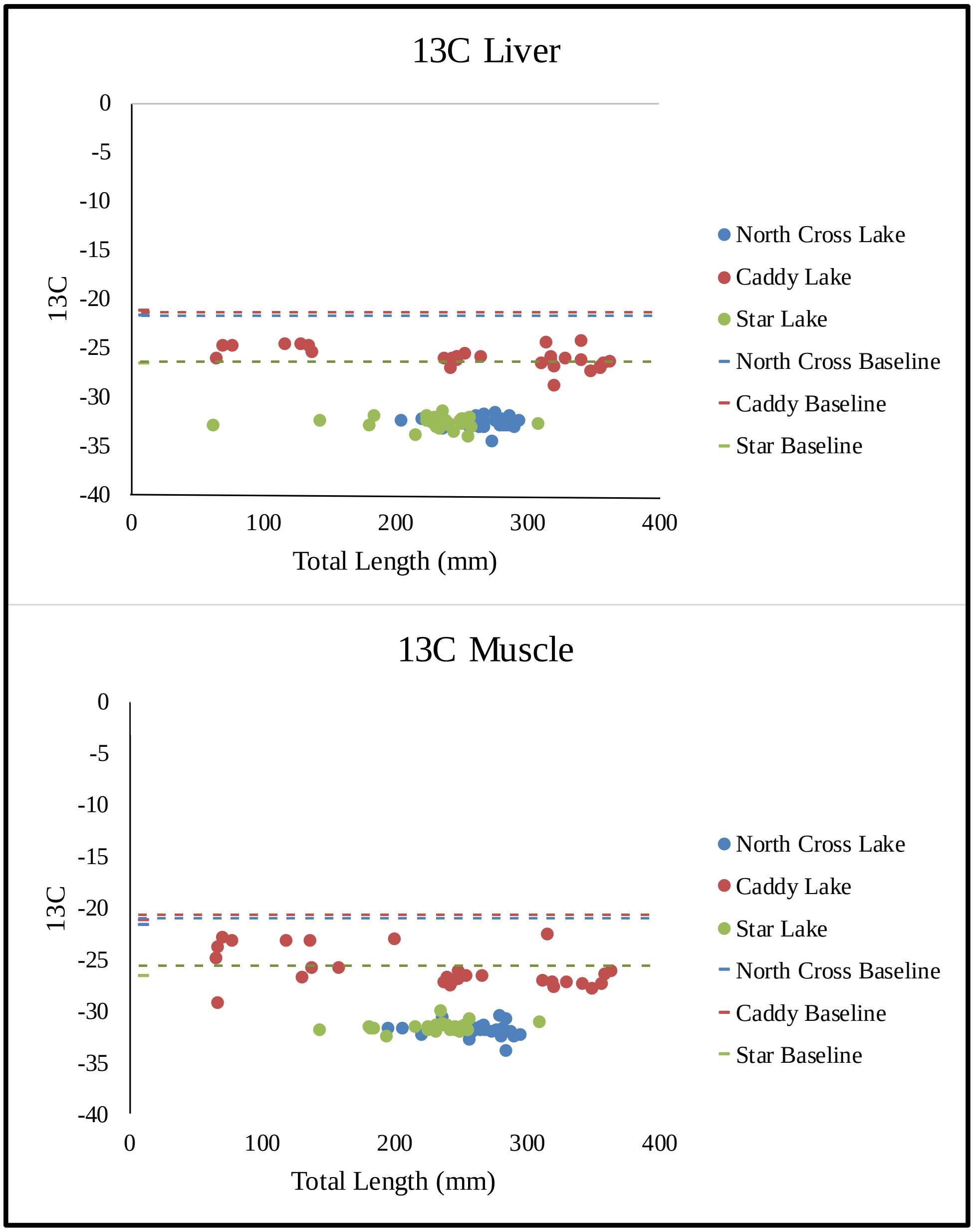


Figure 8. 2019, Isotopic signatures of δ13C in liver and muscle tissues against total length (mm) of three lakes in in Whiteshell Provincial Park. One snail from each lake was used to measure baseline signatures.

Table 9. 2019, Average trophic position of Black crappie (*Pomoxis nigromaculatus)* between three sites in Whiteshell Provincial Park.

Site	Average Trophic Position	SD
Caddy Lake	3.78	0.19
North Cross Lake	3.58	0.13
Star Lake	3.48	0.16

Table 10. Gonadosomatic and hepatosomatic indices of male and female Black Crappie (*Pomoxis nigromaculatus)* from the Whiteshell Provincial Park, 2018 to 2019, averaged by month, (mean ± standard deviation).

Male		
Month	GSI	HSI
May	0.67 ± 0.84	1.47 ± 0.60
June	0.28 ± 0.14	0.93 ± 0.97
July	0.14 ± 0.06	0.72 ± 0.18
August	0.16 ± 0.09	0.73 ± 0.12
September	0.90 ± 0.41	0.99 ± 0.36

Female		
Month	GSI	HSI
May	5.75 ± 2.13	1.75 ± 0.47
June	3.44 ± 1.73	1.10 ± 0.26
July	1.07 ± 0.96	0.87 ± 0.46
August	0.72 ± 0.32	0.75 ± 0.23
September	1.57 ± 0.46	1.17 ± 0.56

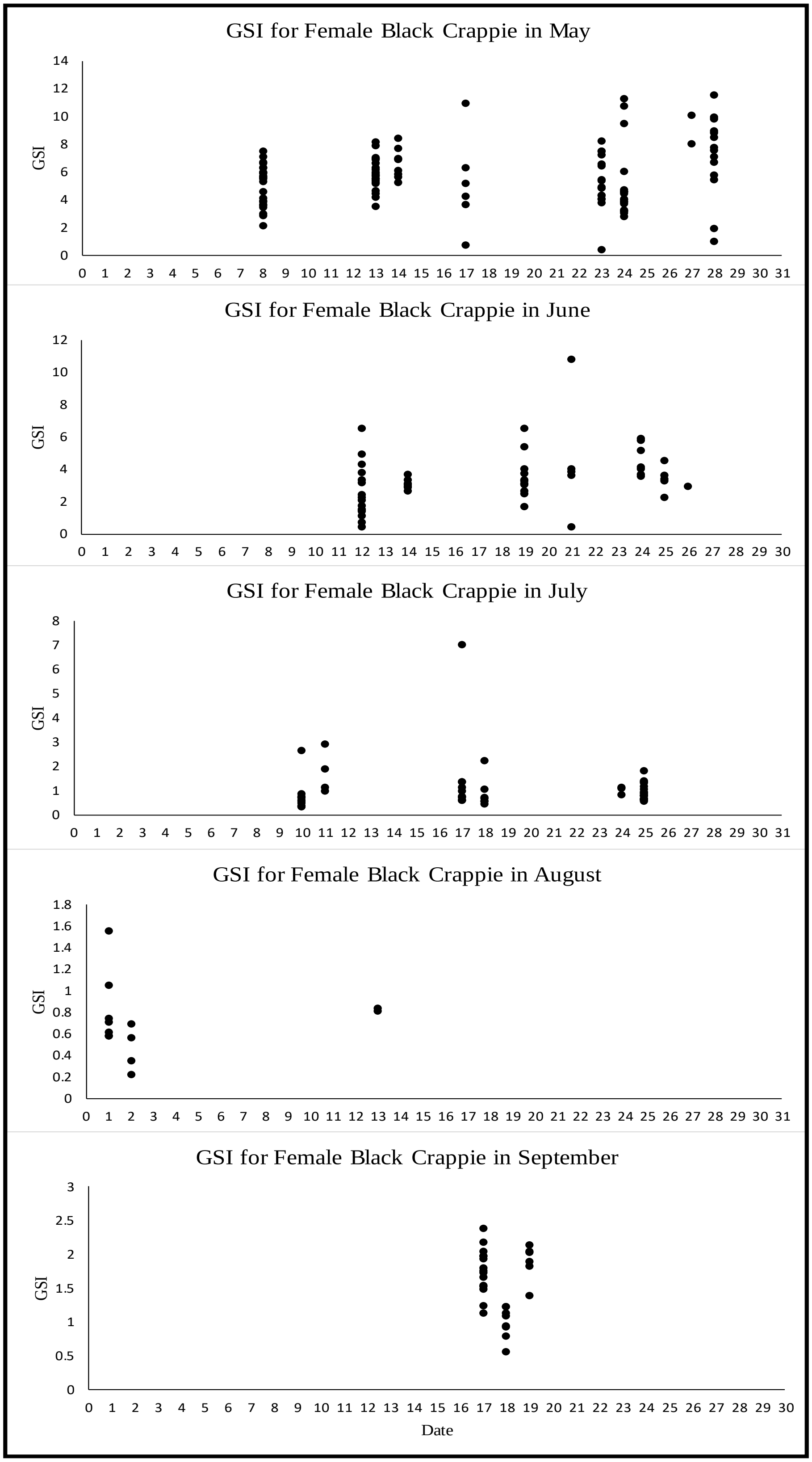


Figure 9. Gonadosomatic index (GSI) for female Black Crappie (*Pomoxis nigromaculatus)* throughout the Whiteshell Provincial Park, 2018 to 2019, by month. Note: scales change on the y-axis each month.

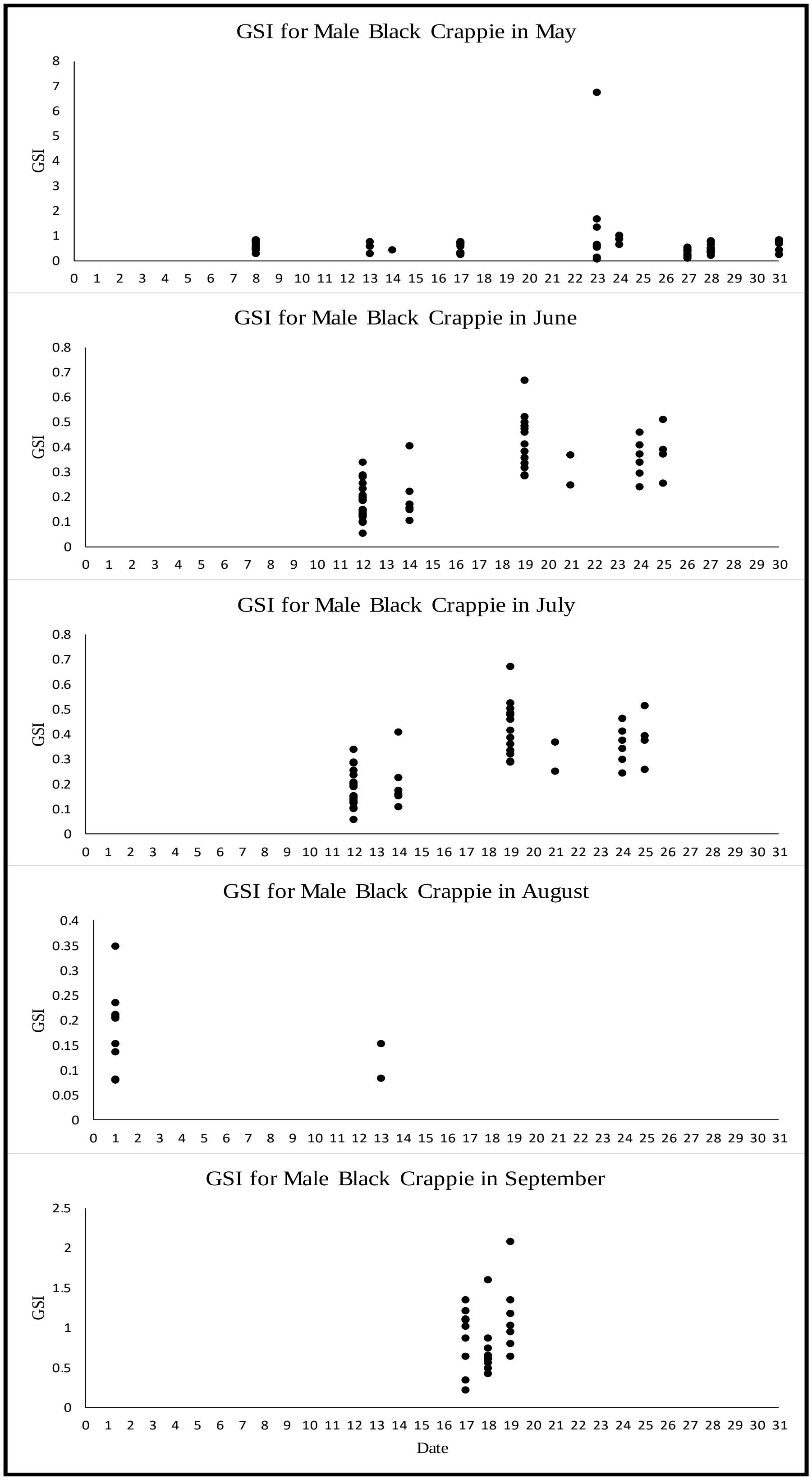


Figure 10. Gonadosomatic index (GSI) for male Black Crappie (*Pomoxis nigromaculatus)* throughout the Whiteshell Provincial Park, 2018 to 2019, by month. Note: scales change on the y-axis each month.

Chapter 4:

Overall Conclusion

4.1 Conclusion

4.1.1 Age and Growth, Body Condition, PSD/RSD, and Movement

It is apparent that Black Crappie in the Whiteshell Provincial Park have established thriving populations that contribute to a popular fishery as an introduced species. I predicted that Black Crappie growth rate would be slower, body condition would be lower, and density of larger size classes would be limited as measured by both PSD and RSD relative to more southern populations that experience warmer annual temperatures. My predictions were correct in that Black Crappie within the Whiteshell Provincial Park grow slower, but become larger than average populations across the United States (Jackson and Hurley 2005). However, my assessment of relative weights for each lake suggest that Black Crappie have normal body condition relative to more southerly populations. It appears that prey resources for Black Crappie in the Whiteshell system are currently adequate in relation to the density of Black Crappie. Continual monitoring of the predator and prey abundances in each water body will be important to asses if adequate resources are avalible to sustain current body condition values. In addition, PSD and RSD were unique to each site, though each lake within my study contained high proportions of quality sized or above Black Crappie. If the aim of the Black Crappie fishery management is to promote the continued growth of trophy sized individuals, then further regulations may help to protect those larger fish. Because these fish are slow growing, it is important that overharvest of large fish is minimized as it takes individuals longer to grow to trophy sizes. I suggest the use of slot limits as a solution to preserving the trophy sized Black Crappie in the Whiteshell Provincial Park. More specifically, slot limits or regulations that are unique to each lake (as each lake varies in population size structure of Black Crappie) may be most beneficial. Finally, I hypothesized that Black Crappie would move between the three interconnected sites and predicted that the largest amount of movement would occur between May and August, as Black Crappie finish spawning and move across the lakes in search of prey. Recapture and collection of tagged fish by anglers was limited with only 50 fish reported. Due to non-standardized recapture methods, my study was inconclusive at measuring Black Crappie movement between sites.

4.1.2 Stable Isotopes, GSI, HSI

I predicted that diets featuring higher tropic level interactions would have a faster growth rate as a result of higher caloric consumption in a piscivorous diet than diets containing lower trophic level interactions as estimated by the stable isotope signatures. Among the three lakes I sampled for stable isotopes from Whiteshell Provincial Park, Black Crappie appear to feed at similar trophic positionings as secondary consumers based on $\delta^{15}N$ values. A very basic freshwater lake food web consists of primary producers (plants), primary consumers (plant eaters), secondary consumers (eating the plant eaters), and tertiary consumers (eating only the secondary consumers and are typically top predators) (Post 2002). As a result, growth rate could not be compared with trophic level interactions. However, $\delta^{13}C$ values suggest that Black Crappie may feed on different prey items or feed at more pelagic/littoral areas within the same trophic levels. From the GSI data, it appears that Black Crappie begin to spawn in late May. This agrees with my prediction that spawning would occur later in late May to early June, compared to more southern populations that appear to begin spawning earlier (late April to early May). I predict Black Crappie will exhibit decreased energy storage (reflected through decreased liver weights measured using HSI) in late May due to spawning efforts, followed by increased energy storage post-spawning. My HSI results partially agreed with my prediction, as Black Crappie energy reserves (based on liver size) began to decline post-spawning in late May but began to recover around the same time (September) as more southerly populations. This suggests that Black Crappie in the Whiteshell Provincial Park display a relatively shorter recovery time for regaining energy stores. In 2020, the opening date for the fishing season in the Whiteshell Provincial Park was set for May 9th, meaning that spawning likely occurred shortly after anglers were able to fish those lakes. Putting fishing pressure on a system during times of low energy reserves could cause increased stress on a population, with the potential to inadvertently affect reproduction by causing stress during a time of high energetic cost. Additionally, removing breeding individuals from a population before they spawn could negatively affect overall population densities. However, from my results analyzing body condition and size class structure, it does not appear that harvest during the spawn is having a negative affect on the Black Crappie population. In the future, if Black Crappie recruitment begins to decline, restricting angler access during spawning may be one strategy to help protect vulnerable Black Crappie populations.

4.1.3 Recommendations

The purpose of this project was to establish data regarding population characteristics of Black Crappie at the most northern extent of their distribution. While my research has provided initial data for seven lakes in the Whiteshell Provincial Park, further investigations into Black Crappie would provide additional insight regarding how the species interacts with the environment at northerly latitudes. Continual monitoring of age, growth, body condition, and stock density will be key for sustaining a healthy Black Crappie population in the Whiteshell Provincial Park system. Additional areas of study that may be beneficial to understanding these particular Black Crappie populations may be genetics and stomach content analysis. Examining DNA sequences could help to identify whether there has been genetic divergence between populations or if specific genotypes contributed to the recent population and geographic expanses. Examining stomach contents of Black Crappie may provide a more in-depth understanding of any differing dietary interactions between water bodies. Dietary interactions may be a factor that influences growth. As such, investigations into genetics and gut contents may help to further understand Black Crappie in Manitoba. To facilitate future studies, this thesis provides initial data for Black Crappie in the Whiteshell Provincial Park system that can inform management practices for this species.

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Appendix - Project Data Set

ID	UID	Total L. (mm)	Fork L.(mm)	Mass (g)	Sex	Liver (g)	Gonads (g)	Floy Tag #	Method	LakeID	Year	Age (years)	Otoliths
10	BC1169	346	X	X	F	X	X	X	Angled	BWS	2018	8	Y
11	BC1170	325	X	X	F	X	X	X	Angled	BWS	2018	6	Y
12	BC1171	295	X	X	M	X	X	X	Angled	BWS	2018	6	Y
2	BC1172	308	X	X	M	X	X	X	Angled	BWS	2018	X	Y
1	BC1173	332	X	X	F	X	X	X	Angled	BWS	2018	7	Y
3	BC1174	315	X	X	F	X	X	X	Angled	BWS	2018	6	Y
4	BC1175	346	X	X	M	X	X	X	Angled	BWS	2018	8	Y
5	BC1176	328	X	X	M	X	X	X	Angled	BWS	2018	7	Y
6	BC1177	306	X	X	M	X	X	X	Angled	BWS	2018	5	Y
7	BC1178	340	X	X	F	X	X	X	Angled	BWS	2018	9	Y
8	BC1179	330	X	X	F	X	X	X	Angled	BWS	2018	7	Y
9	BC1180	315	X	X	M	X	X	X	Angled	BWS	2018	6	Y
13	BC1181	328	X	X	F	X	X	X	Angled	BWS	2018	X	Y
14	BC1182	330	X	X	F	X	X	X	Angled	BWS	2018	6	Y
1	BC1183	312	X	X	M	X	X	X	Angled	BWS	2018	5	Y
2	BC1184	340	X	X	F	X	X	X	Angled	BWS	2018	7	Y
3	BC1185	312	X	X	M	X	X	X	Angled	BWS	2018	X	Y
4	BC1186	322	X	X	F	X	X	X	Angled	BWS	2018	X	Y
5	BC1187	332	X	X	M	X	X	X	Angled	BWS	2018	X	Y
6	BC1188	350	X	X	F	X	X	X	Angled	BWS	2018	X	Y
1	BC1	324	X	598	F	12.4	22	X	Electrofished	Caddy	2018	7	Y
2	BC2	306	X	482.2	F	9.8	20.8	X	Electrofished	Caddy	2018	5	Y
3	BC3	356	X	743	F	16.9	47	X	Electrofished	Caddy	2018	10	Y
4	BC4	358	X	784.3	F	16	40.7	X	Electrofished	Caddy	2018	9	Y
5	BC5	332	X	693.1	M	11.2	4.1	X	Electrofished	Caddy	2018	6	Y
6	BC6	346	X	745	M	14.5	5.1	X	Electrofished	Caddy	2018	10	Y
7	BC7	348	X	764	M	10.6	5.7	X	Electrofished	Caddy	2018	10	Y
8	BC8	308	X	611.5	M	9.9	4.7	X	Electrofished	Caddy	2018	5	Y
9	BC9	312	X	521.3	M	8	1.8	X	Electrofished	Caddy	2018	7	Y
10	BC10	304	X	497.5	M	8.3	3.7	X	Electrofished	Caddy	2018	6	Y
11	BC11	345	X	757.8	F	12.5	83.4	X	Electrofished	Caddy	2018	9	Y
12	BC12	210	X	149.7	M	7.2	0.4	X	Electrofished	Caddy	2018	2	Y
13	BC13	192	X	101.1	F	1.7	0.8	X	Electrofished	Caddy	2018	2	Y
14	BC14	192	X	111.9	M	1.3	0.4	X	Electrofished	Caddy	2018	2	Y
15	BC15	207	X	138.9	M	2	0.5	X	Electrofished	Caddy	2018	2	Y
16	BC16	74	X	5.2	U	X	X	X	Electrofished	Caddy	2018	1	Y
17	BC17	64	X	3.1	U	X	X	X	Electrofished	Caddy	2018	1	Y
18	BC18	55	X	1.7	U	X	X	X	Electrofished	Caddy	2018	1	Y
19	BC19	78	X	5.6	U	X	X	X	Electrofished	Caddy	2018	1	Y
20	BC20	78	X	5.8	U	X	X	X	Electrofished	Caddy	2018	1	Y
21	BC21	79	X	6.2	U	X	X	X	Electrofished	Caddy	2018	1	Y
22	BC22	76	X	5.6	U	X	X	X	Electrofished	Caddy	2018	1	Y
23	BC23	78	X	5.6	U	X	X	X	Electrofished	Caddy	2018	1	Y
24	BC24	67	X	3.8	U	X	X	X	Electrofished	Caddy	2018	1	Y
25	BC25	69	X	4	U	X	X	X	Electrofished	Caddy	2018	1	Y
26	BC26	64	X	2.8	U	X	X	X	Electrofished	Caddy	2018	1	Y
27	BC27	63	X	3	U	X	X	X	Electrofished	Caddy	2018	1	Y
28	BC28	61	X	2.5	U	X	X	X	Electrofished	Caddy	2018	1	Y
29	BC29	75	X	5.4	U	X	X	X	Electrofished	Caddy	2018	1	Y
30	BC30	77	X	5.5	U	X	X	X	Electrofished	Caddy	2018	1	Y
31	BC31	72	X	4.5	U	X	X	X	Electrofished	Caddy	2018	1	Y
32	BC32	65	X	3.4	U	X	X	X	Electrofished	Caddy	2018	1	Y
33	BC33	73	X	4.3	U	X	X	X	Electrofished	Caddy	2018	1	Y
34	BC34	72	X	4.4	U	X	X	X	Electrofished	Caddy	2018	1	Y
35	BC35	60	X	2.5	U	X	X	X	Electrofished	Caddy	2018	1	Y
36	BC36	65	X	3.4	U	X	X	X	Electrofished	Caddy	2018	1	Y
37	BC37	52	X	1.6	U	X	X	X	Electrofished	Caddy	2018	1	Y
38	BC38	55	X	2.2	U	X	X	X	Electrofished	Caddy	2018	1	Y
39	BC39	51	X	1.4	U	X	X	X	Electrofished	Caddy	2018	1	Y
40	BC40	65	X	3.1	U	X	X	X	Electrofished	Caddy	2018	1	Y
41	BC41	51	X	1.6	U	X	X	X	Electrofished	Caddy	2018	1	Y
42	BC42	65	X	2.7	U	X	X	X	Electrofished	Caddy	2018	1	Y
43	BC43	65	X	3.3	U	X	X	X	Electrofished	Caddy	2018	1	Y
44	BC44	63	X	3.2	U	X	X	X	Electrofished	Caddy	2018	1	Y
45	BC45	68	X	3.6	U	X	X	X	Electrofished	Caddy	2018	1	Y
46	BC46	70	X	3.7	U	X	X	X	Electrofished	Caddy	2018	1	Y
47	BC47	70	X	4	U	X	X	X	Electrofished	Caddy	2018	1	Y
48	BC48	56	X	1.9	U	X	X	X	Electrofished	Caddy	2018	1	Y
49	BC49	73	X	4.5	U	X	X	X	Electrofished	Caddy	2018	1	Y
50	BC50	68	X	3.9	U	X	X	X	Electrofished	Caddy	2018	1	Y
51	BC51	54	X	1.8	U	X	X	X	Electrofished	Caddy	2018	1	Y
52	BC52	62	X	2.6	U	X	X	X	Electrofished	Caddy	2018	1	Y
53	BC53	52	X	1.6	U	X	X	X	Electrofished	Caddy	2018	1	Y
54	BC54	59	X	2.4	U	X	X	X	Electrofished	Caddy	2018	1	Y

55	BC55	57	X	2	U	X	X	X	Electrofished	Caddy	2018	1	Y
56	BC56	73	X	5	U	X	X	X	Electrofished	Caddy	2018	1	Y
57	BC57	69	X	3.5	U	X	X	X	Electrofished	Caddy	2018	1	Y
58	BC58	73	X	5	U	X	X	X	Electrofished	Caddy	2018	1	Y
59	BC59	72	X	4.5	U	X	X	X	Electrofished	Caddy	2018	1	Y
60	BC60	69	X	4	U	X	X	X	Electrofished	Caddy	2018	1	Y
61	BC61	59	X	2.2	U	X	X	X	Electrofished	Caddy	2018	1	Y
62	BC62	56	X	2.4	U	X	X	X	Electrofished	Caddy	2018	1	Y
63	BC63	67	X	3.7	U	X	X	X	Electrofished	Caddy	2018	1	Y
64	BC64	71	X	4.4	U	X	X	X	Electrofished	Caddy	2018	1	Y
65	BC65	61	X	2.8	U	X	X	X	Electrofished	Caddy	2018	1	Y
66	BC66	72	X	4.7	U	X	X	X	Electrofished	Caddy	2018	1	Y
67	BC67	49	X	1.3	U	X	X	X	Electrofished	Caddy	2018	1	Y
68	BC68	65	X	3.5	U	X	X	X	Electrofished	Caddy	2018	1	Y
69	BC69	50	X	1.4	U	X	X	X	Electrofished	Caddy	2018	1	Y
70	BC70	48	X	1.3	U	X	X	X	Electrofished	Caddy	2018	1	Y
71	BC71	70	X	4.1	U	X	X	X	Electrofished	Caddy	2018	1	Y
72	BC72	63	X	2.7	U	X	X	X	Electrofished	Caddy	2018	1	Y
73	BC73	51	X	1.4	U	X	X	X	Electrofished	Caddy	2018	1	Y
74	BC74	49	X	1.2	U	X	X	X	Electrofished	Caddy	2018	1	Y
75	BC75	53	X	1.6	U	X	X	X	Electrofished	Caddy	2018	1	Y
76	BC76	76	X	5.1	U	X	X	X	Electrofished	Caddy	2018	1	Y
1	BC77	338	X	639.2	F	8.5	20.6	X	Trap Net	Caddy	2018	10	Y
2	BC78	350	X	676.5	F	7.4	22.4	X	Trap Net	Caddy	2018	9	Y
3	BC79	296	X	430	F	7	20	X	Trap Net	Caddy	2018	3	Y
4	BC80	302	X	498.3	F	5.2	53.8	X	Trap Net	Caddy	2018	5	Y
5	BC81	351	X	640.4	F	6.9	24.8	X	Trap Net	Caddy	2018	9	Y
6	BC82	304	X	471.3	F	6.8	18.9	X	Trap Net	Caddy	2018	X	Y
7	BC83	307	X	463.7	F	8.7	21.4	X	Trap Net	Caddy	2018	6	Y
8	BC84	348	X	683.1	F	9.7	32.6	X	Trap Net	Caddy	2018	9	Y
9	BC85	350	X	634.7	F	9.8	28.6	X	Trap Net	Caddy	2018	10	Y
10	BC86	288	X	411.1	M	5.8	4.2	X	Trap Net	Caddy	2018	5	Y
11	BC87	302	X	515	F	4.4	49	X	Trap Net	Caddy	2018	6	Y
12	BC88	256	X	295.4	M	4.8	2.6	X	Trap Net	Caddy	2018	3	Y
13	BC89	356	X	731.4	F	13.4	33.6	X	Trap Net	Caddy	2018	12	Y
14	BC90	322	X	531.8	F	7.4	15	X	Trap Net	Caddy	2018	7	Y
15	BC91	334	X	647.8	F	11.7	26.5	X	Trap Net	Caddy	2018	8	Y
16	BC92	327	X	553.1	F	8.3	20.8	X	Trap Net	Caddy	2018	7	Y
17	BC93	310	X	425.8	F	6.9	13.3	X	Trap Net	Caddy	2018	5	Y
18	BC94	339	X	578.7	F	8.6	22.6	X	Trap Net	Caddy	2018	7	Y
19	BC95	333	X	589.1	F	9.3	36	X	Trap Net	Caddy	2018	8	Y
20	BC96	310	X	521.2	M	5.6	3.6	X	Trap Net	Caddy	2018	6	Y
21	BC97	362	X	727.4	F	12	23.5	X	Trap Net	Caddy	2018	10	Y
22	BC98	337	X	682.3	F	7.4	77.2	X	Trap Net	Caddy	2018	8	Y
1	BC264	77	74	X	X	X	X	X	Electrofished	Caddy	2018	X	N
2	BC265	78	76	X	X	X	X	X	Electrofished	Caddy	2018	X	N
3	BC266	67	64	X	X	X	X	X	Electrofished	Caddy	2018	X	N
4	BC267	77	72	X	X	X	X	X	Electrofished	Caddy	2018	X	N
5	BC268	81	78	X	X	X	X	X	Electrofished	Caddy	2018	X	N
6	BC269	86	83	X	X	X	X	X	Electrofished	Caddy	2018	X	N
7	BC270	55	52	X	X	X	X	X	Electrofished	Caddy	2018	X	N
8	BC271	76	72	X	X	X	X	X	Electrofished	Caddy	2018	X	N
9	BC272	70	66	X	X	X	X	X	Electrofished	Caddy	2018	X	N
10	BC273	86	80	X	X	X	X	X	Electrofished	Caddy	2018	X	N
11	BC274	82	77	X	X	X	X	X	Electrofished	Caddy	2018	X	N
12	BC275	72	67	X	X	X	X	X	Electrofished	Caddy	2018	X	N
13	BC276	75	72	X	X	X	X	X	Electrofished	Caddy	2018	X	N
14	BC277	62	59	X	X	X	X	X	Electrofished	Caddy	2018	X	N
15	BC278	76	75	X	X	X	X	X	Electrofished	Caddy	2018	X	N
16	BC279	84	80	X	X	X	X	X	Electrofished	Caddy	2018	X	N
17	BC280	80	76	X	X	X	X	X	Electrofished	Caddy	2018	X	N
18	BC281	65	62	X	X	X	X	X	Electrofished	Caddy	2018	X	N
19	BC282	67	62	X	X	X	X	X	Electrofished	Caddy	2018	X	N
20	BC283	67	62	X	X	X	X	X	Electrofished	Caddy	2018	X	N
21	BC284	84	80	X	X	X	X	X	Electrofished	Caddy	2018	X	N
22	BC285	79	76	X	X	X	X	X	Electrofished	Caddy	2018	X	N
1	BC286	337	322	625.8	X	X	X	99	Trap Net	Caddy	2018	X	N
2	BC287	362	346	730.2	X	X	X	101	Trap Net	Caddy	2018	X	N
3	BC288	348	334	713.2	X	X	X	102	Trap Net	Caddy	2018	X	N
4	BC289	343	310	704.8	X	X	X	103	Trap Net	Caddy	2018	X	N
5	BC290	333	320	605.1	X	X	X	104	Trap Net	Caddy	2018	X	N
6	BC291	301	290	428	X	X	X	105	Trap Net	Caddy	2018	X	N
7	BC292	358	330	740.3	X	X	X	106	Trap Net	Caddy	2018	X	N
8	BC293	339	326	692.5	X	X	X	107	Trap Net	Caddy	2018	X	N
9	BC294	353	335	720.9	X	X	X	108	Trap Net	Caddy	2018	X	N
10	BC295	350	334	669.8	X	X	X	109	Trap Net	Caddy	2018	X	N
11	BC296	316	300	509.7	X	X	X	110	Trap Net	Caddy	2018	X	N

12	BC297	323	312	562.5	X	X	X	111	Trap Net	Caddy	2018	X	N
13	BC298	342	330	718.4	X	X	X	112	Trap Net	Caddy	2018	X	N
14	BC299	353	340	706.6	X	X	X	113	Trap Net	Caddy	2018	X	N
15	BC300	271	261	346.5	X	X	X	114	Trap Net	Caddy	2018	X	N
16	BC301	327	300	535.8	X	X	X	115	Trap Net	Caddy	2018	X	N
17	BC302	313	298	463.2	X	X	X	116	Trap Net	Caddy	2018	X	N
18	BC303	306	290	492.2	X	X	X	117	Trap Net	Caddy	2018	X	N
19	BC304	329	315	587.4	X	X	X	118	Trap Net	Caddy	2018	X	N
20	BC305	331	320	603.2	X	X	X	119	Trap Net	Caddy	2018	X	N
21	BC306	326	314	551.3	X	X	X	120	Trap Net	Caddy	2018	X	N
22	BC307	82	70	X	X	X	X	X	Trap Net	Caddy	2018	X	N
1	BC320	255	245	294	X	X	X	133	Trap Net	Caddy	2018	X	N
2	BC321	308	297	492.1	X	X	X	134	Trap Net	Caddy	2018	X	N
3	BC322	330	323	632.3	X	X	X	135	Trap Net	Caddy	2018	X	N
4	BC323	328	316	609	X	X	X	136	Trap Net	Caddy	2018	X	N
5	BC324	109	104	16.6	X	X	X	X	Trap Net	Caddy	2018	X	N
6	BC325	105	98	15.9	X	X	X	X	Trap Net	Caddy	2018	X	N
7	BC326	104	100	15.5	F	X	X	X	Trap Net	Caddy	2018	2	Y
8	BC327	107	100	16.7	U	X	X	X	Trap Net	Caddy	2018	2	Y
9	BC328	101	96	15.2	M	X	X	X	Trap Net	Caddy	2018	2	Y
10	BC329	100	96	15	U	X	X	X	Trap Net	Caddy	2018	2	Y
11	BC330	333	320	594.8	X	X	X	137	Trap Net	Caddy	2018	X	N
12	BC331	328	315	556	X	X	X	138	Trap Net	Caddy	2018	X	N
13	BC332	227	220	200.6	X	X	X	139	Trap Net	Caddy	2018	X	N
1	BC476	107	100	16.2	X	X	X	X	Trap Net	Caddy	2018	X	N
2	BC477	112	109	20.3	X	X	X	X	Trap Net	Caddy	2018	X	N
3	BC478	103	98	15.8	X	X	X	X	Trap Net	Caddy	2018	X	N
4	BC479	111	106	20.2	X	X	X	X	Trap Net	Caddy	2018	X	N
5	BC480	105	100	16.2	X	X	X	X	Trap Net	Caddy	2018	X	N
6	BC481	104	99	17.8	X	X	X	X	Trap Net	Caddy	2018	X	N
7	BC482	108	102	17	X	X	X	X	Trap Net	Caddy	2018	X	N
8	BC483	103	98	16.5	X	X	X	X	Trap Net	Caddy	2018	X	N
9	BC484	100	96	15.1	X	X	X	X	Trap Net	Caddy	2018	X	N
10	BC485	95	89	12.1	X	X	X	X	Trap Net	Caddy	2018	X	N
11	BC486	105	100	15.9	X	X	X	X	Trap Net	Caddy	2018	X	N
12	BC487	102	98	17.7	X	X	X	X	Trap Net	Caddy	2018	X	N
13	BC488	105	99	16.4	X	X	X	X	Trap Net	Caddy	2018	X	N
14	BC489	111	106	19.4	X	X	X	X	Trap Net	Caddy	2018	X	N
15	BC490	100	96	12.8	X	X	X	X	Trap Net	Caddy	2018	X	N
16	BC491	107	102	16.7	X	X	X	X	Trap Net	Caddy	2018	X	N
17	BC492	115	111	16.9	X	X	X	X	Trap Net	Caddy	2018	X	N
18	BC493	102	96	14.5	X	X	X	X	Trap Net	Caddy	2018	X	N
19	BC494	100	92	12.5	X	X	X	X	Trap Net	Caddy	2018	X	N
20	BC495	109	102	17.6	X	X	X	X	Trap Net	Caddy	2018	X	N
21	BC496	103	98	16.2	X	X	X	X	Trap Net	Caddy	2018	X	N
22	BC497	108	102	18.1	X	X	X	X	Trap Net	Caddy	2018	X	N
23	BC498	106	102	17.1	X	X	X	X	Trap Net	Caddy	2018	X	N
24	BC499	102	100	14.7	X	X	X	X	Trap Net	Caddy	2018	X	N
25	BC500	102	100	15.1	X	X	X	X	Trap Net	Caddy	2018	X	N
26	BC501	108	100	19.3	X	X	X	X	Trap Net	Caddy	2018	X	N
27	BC502	97	93	13.2	X	X	X	X	Trap Net	Caddy	2018	X	N
28	BC503	96	91	12.6	X	X	X	X	Trap Net	Caddy	2018	X	N
29	BC504	115	111	22.7	X	X	X	X	Trap Net	Caddy	2018	X	N
30	BC505	104	98	15.8	X	X	X	X	Trap Net	Caddy	2018	X	N
31	BC506	108	102	18.3	X	X	X	X	Trap Net	Caddy	2018	X	N
32	BC507	111	103	20.4	X	X	X	X	Trap Net	Caddy	2018	X	Y
33	BC508	102	96	15	X	X	X	X	Trap Net	Caddy	2018	X	N
34	BC509	99	94	13	X	X	X	X	Trap Net	Caddy	2018	X	N
35	BC510	116	112	22.6	X	X	X	X	Trap Net	Caddy	2018	X	Y
36	BC511	316	308	522.4	X	X	X	286	Trap Net	Caddy	2018	X	N
37	BC512	312	294	455.8	X	X	X	287	Trap Net	Caddy	2018	X	N
38	BC513	307	299	497.8	X	X	X	288	Trap Net	Caddy	2018	X	N
39	BC514	320	310	533.3	X	X	X	289	Trap Net	Caddy	2018	X	N
40	BC515	338	330	695.5	X	X	X	290	Trap Net	Caddy	2018	X	N
41	BC516	320	306	607.4	X	X	X	291	Trap Net	Caddy	2018	X	N
42	BC517	100	95	X	X	X	X	X	Trap Net	Caddy	2018	X	N
43	BC518	99	94	X	X	X	X	X	Trap Net	Caddy	2018	X	N
44	BC519	102	96	X	X	X	X	X	Trap Net	Caddy	2018	X	N
45	BC520	105	100	X	X	X	X	X	Trap Net	Caddy	2018	X	N
46	BC521	107	100	X	X	X	X	X	Trap Net	Caddy	2018	X	N
47	BC522	108	102	X	X	X	X	X	Trap Net	Caddy	2018	X	N
1	BC523	340	326	660.1	X	X	X	292	Trap Net	Caddy	2018	X	N
2	BC524	344	330	708.1	X	X	X	293	Trap Net	Caddy	2018	X	N
3	BC525	335	320	604.5	X	X	X	294	Trap Net	Caddy	2018	X	N
4	BC526	301	290	477.3	X	X	X	295	Trap Net	Caddy	2018	X	N
5	BC527	106	102	16.1	X	X	X	X	Trap Net	Caddy	2018	X	N
6	BC528	90	86	8.3	X	X	X	X	Trap Net	Caddy	2018	X	N

7	BC529	103	98	15.7	X	X	X	X	Trap Net	Caddy	2018	X	N
8	BC530	99	96	13.1	X	X	X	X	Trap Net	Caddy	2018	X	N
9	BC531	112	108	20.1	X	X	X	X	Trap Net	Caddy	2018	X	N
10	BC532	106	100	16.3	X	X	X	X	Trap Net	Caddy	2018	X	N
11	BC533	101	96	12.7	X	X	X	X	Trap Net	Caddy	2018	X	N
12	BC534	111	104	17.2	X	X	X	X	Trap Net	Caddy	2018	X	N
13	BC535	98	92	10.2	X	X	X	X	Trap Net	Caddy	2018	X	N
14	BC536	109	101	14.4	X	X	X	X	Trap Net	Caddy	2018	X	N
15	BC537	109	104	20.2	X	X	X	X	Trap Net	Caddy	2018	X	N
16	BC538	108	102	19.2	X	X	X	X	Trap Net	Caddy	2018	X	N
17	BC539	105	100	15.5	X	X	X	X	Trap Net	Caddy	2018	2	Y
18	BC540	114	111	23.1	X	X	X	X	Trap Net	Caddy	2018	3	Y
19	BC541	110	106	20.8	X	X	X	X	Trap Net	Caddy	2018	3	Y
20	BC542	104	100	15.6	X	X	X	X	Trap Net	Caddy	2018	X	N
21	BC543	310	298	X	X	X	X	296	Trap Net	Caddy	2018	X	N
22	BC544	105	100	X	X	X	X	X	Trap Net	Caddy	2018	X	N
23	BC545	109	100	X	X	X	X	X	Trap Net	Caddy	2018	X	N
24	BC546	108	102	X	X	X	X	X	Trap Net	Caddy	2018	X	N
25	BC547	110	104	X	X	X	X	X	Trap Net	Caddy	2018	X	N
26	BC548	112	108	X	X	X	X	X	Trap Net	Caddy	2018	X	N
27	BC549	114	108	X	X	X	X	X	Trap Net	Caddy	2018	X	N
28	BC550	105	99	X	X	X	X	X	Trap Net	Caddy	2018	X	N
29	BC551	118	111	X	X	X	X	X	Trap Net	Caddy	2018	X	N
30	BC552	111	106	X	X	X	X	X	Trap Net	Caddy	2018	X	N
31	BC553	102	98	X	X	X	X	X	Trap Net	Caddy	2018	X	N
32	BC554	101	98	X	X	X	X	X	Trap Net	Caddy	2018	X	N
33	BC555	114	109	X	X	X	X	X	Trap Net	Caddy	2018	X	N
34	BC556	100	96	X	X	X	X	X	Trap Net	Caddy	2018	X	N
35	BC557	112	107	X	X	X	X	X	Trap Net	Caddy	2018	X	N
36	BC558	114	111	X	X	X	X	X	Trap Net	Caddy	2018	X	N
37	BC559	104	100	X	X	X	X	X	Trap Net	Caddy	2018	X	N
38	BC560	111	105	X	X	X	X	X	Trap Net	Caddy	2018	X	N
39	BC561	113	108	X	X	X	X	X	Trap Net	Caddy	2018	X	N
40	BC562	111	103	X	X	X	X	X	Trap Net	Caddy	2018	X	N
41	BC563	105	100	X	X	X	X	X	Trap Net	Caddy	2018	X	N
42	BC564	104	99	X	X	X	X	X	Trap Net	Caddy	2018	X	N
43	BC565	98	95	X	X	X	X	X	Trap Net	Caddy	2018	X	N
44	BC566	117	111	X	X	X	X	X	Trap Net	Caddy	2018	X	N
45	BC567	106	102	X	X	X	X	X	Trap Net	Caddy	2018	3	Y
46	BC568	105	100	X	X	X	X	X	Trap Net	Caddy	2018	3	Y
47	BC569	111	104	X	X	X	X	X	Trap Net	Caddy	2018	3	Y
48	BC570	106	102	X	X	X	X	X	Trap Net	Caddy	2018	3	Y
49	BC571	106	100	X	X	X	X	X	Trap Net	Caddy	2018	3	Y
50	BC572	114	111	X	X	X	X	X	Trap Net	Caddy	2018	3	Y
51	BC573	119	114	X	X	X	X	X	Trap Net	Caddy	2018	3	Y
52	BC574	112	106	X	X	X	X	X	Trap Net	Caddy	2018	3	Y
53	BC575	111	105	X	X	X	X	X	Trap Net	Caddy	2018	3	Y
54	BC576	111	106	X	X	X	X	X	Trap Net	Caddy	2018	3	Y
55	BC577	110	102	X	X	X	X	X	Trap Net	Caddy	2018	X	N
1	BC914	331	312	621.4	X	X	X	545	Trap Net	Caddy	2018	X	N
2	BC915	250	243	279.1	X	X	X	546	Trap Net	Caddy	2018	X	N
1	BC952	115	111	20.6	X	X	X	X	Trap Net	Caddy	2018	3	Y
2	BC953	128	112	30.1	X	X	X	X	Trap Net	Caddy	2018	X	Y
3	BC954	107	102	16.9	X	X	X	X	Trap Net	Caddy	2018	X	Y
4	BC955	111	104	18.5	X	X	X	X	Trap Net	Caddy	2018	X	Y
5	BC956	121	118	26.6	X	X	X	X	Trap Net	Caddy	2018	X	Y
6	BC957	109	105	17.4	X	X	X	X	Trap Net	Caddy	2018	X	Y
1	BC958	340	329	648.5	X	X	X	579	Trap Net	Caddy	2018	X	N
2	BC959	330	310	605.8	X	X	X	580	Trap Net	Caddy	2018	X	N
3	BC960	108	102	14.4	X	X	X	X	Trap Net	Caddy	2018	3	Y
4	BC961	112	108	15	X	X	X	X	Trap Net	Caddy	2018	3	Y
1	BC962	309	290	506.2	X	X	X	583	Trap Net	Caddy	2018	X	N
2	BC963	332	326	603.6	X	X	X	584	Trap Net	Caddy	2018	X	N
3	BC964	353	340	742.8	X	X	X	585	Trap Net	Caddy	2018	X	N
4	BC965	348	332	694.2	X	X	X	586	Trap Net	Caddy	2018	X	N
5	BC966	280	267	398	X	X	X	587	Trap Net	Caddy	2018	X	N
6	BC967	115	111	19.9	X	X	X	X	Trap Net	Caddy	2018	X	Y
7	BC968	114	108	19.5	X	X	X	X	Trap Net	Caddy	2018	X	Y
8	BC969	124	119	26.5	X	X	X	X	Trap Net	Caddy	2018	X	Y
9	BC970	104	87	14.2	X	X	X	X	Trap Net	Caddy	2018	X	Y
10	BC971	125	120	29.5	X	X	X	X	Trap Net	Caddy	2018	X	Y
12	BC972	120	114	25	X	X	X	X	Trap Net	Caddy	2018	X	Y
13	BC973	106	102	17.9	X	X	X	X	Trap Net	Caddy	2018	X	Y
14	BC974	105	99	16.4	X	X	X	X	Trap Net	Caddy	2018	X	Y
15	BC975	111	104	182	X	X	X	X	Trap Net	Caddy	2018	X	Y
16	BC976	114	109	21.3	X	X	X	X	Trap Net	Caddy	2018	X	Y
17	BC977	113	108	18.8	X	X	X	X	Trap Net	Caddy	2018	X	Y

18	BC978	111	104	17.8	X	X	X	X	Trap Net	Caddy	2018	X	Y
19	BC979	104	100	14.8	X	X	X	X	Trap Net	Caddy	2018	X	Y
20	BC980	105	100	13.3	X	X	X	X	Trap Net	Caddy	2018	X	Y
21	BC981	108	102	16.6	X	X	X	X	Trap Net	Caddy	2018	X	Y
22	BC982	112	108	19.8	X	X	X	X	Trap Net	Caddy	2018	X	Y
23	BC983	130	123	34.4	M	X	X	X	Trap Net	Caddy	2018	X	Y
24	BC984	118	104	24.3	M	X	X	X	Trap Net	Caddy	2018	X	Y
25	BC985	116	111	23	U	X	X	X	Trap Net	Caddy	2018	X	Y
26	BC986	121	116	24.8	M	X	X	X	Trap Net	Caddy	2018	X	Y
27	BC987	115	111	23.5	U	X	X	X	Trap Net	Caddy	2018	X	Y
1	BC1037	270	254	320.3	X	X	X	599	Trap Net	Caddy	2018	X	N
2	BC1038	352	332	757.4	X	X	X	600	Trap Net	Caddy	2018	X	N
3	BC1039	329	310	623.1	X	X	X	626	Trap Net	Caddy	2018	X	N
4	BC1040	300	288	468.9	X	X	X	627	Trap Net	Caddy	2018	X	N
5	BC1041	316	300	550.1	X	X	X	628	Trap Net	Caddy	2018	X	N
6	BC1042	109	104	18.5	X	X	X	X	Trap Net	Caddy	2018	X	N
1	BC1062	326	316	580.7	F	3.6	3.7	X	Trap Net	Jessica	2018	8	Y
2	BC1063	268	258	349.9	F	2.7	4.9	X	Trap Net	Jessica	2018	4	Y
3	BC1064	333	318	587.6	F	3.9	3.7	X	Trap Net	Jessica	2018	7	Y
4	BC1065	282	262	425.4	F	3.6	2.4	X	Trap Net	Jessica	2018	7	Y
5	BC1066	260	248	309.6	F	2	2	X	Trap Net	Jessica	2018	3	Y
6	BC1067	280	270	363.1	M	3	0.6	X	Trap Net	Jessica	2018	4	Y
7	BC1068	262	252	298.9	F	2.4	2.4	X	Trap Net	Jessica	2018	3	Y
8	BC1069	276	268	356.6	M	2.1	0.4	X	Trap Net	Jessica	2018	4	Y
9	BC1070	279	270	345.9	F	2.7	2.3	X	Trap Net	Jessica	2018	5	Y
10	BC1071	368	356	311.3	F	2.4	1.9	X	Trap Net	Jessica	2018	7	Y
11	BC1072	270	265	365.5	F	3.4	6.7	X	Trap Net	Jessica	2018	4	Y
12	BC1073	272	254	349	F	3.2	2.4	X	Trap Net	Jessica	2018	4	Y
13	BC1074	284	272	392.2	F	3	5.3	X	Trap Net	Jessica	2018	6	Y
14	BC1075	266	258	314.6	F	2.2	2.5	X	Trap Net	Jessica	2018	4	Y
1	BC1076	269	255	293	M	2.1	0.4	X	Trap Net	Jessica	2018	4	Y
2	BC1077	284	274	398.8	F	3.5	6.2	X	Trap Net	Jessica	2018	8	Y
3	BC1078	281	270	377.6	M	2.9	0.8	X	Trap Net	Jessica	2018	6	Y
4	BC1079	276	263	339.3	F	2	2.4	X	Trap Net	Jessica	2018	5	Y
5	BC1080	259	250	296	F	2.5	2.2	X	Trap Net	Jessica	2018	3	Y
6	BC1081	262	254	287.9	M	2.4	0.6	X	Trap Net	Jessica	2018	3	Y
7	BC1082	278	268	372	M	3.3	0.3	X	Trap Net	Jessica	2018	5	Y
8	BC1083	272	259	326.8	F	3.1	1.9	X	Trap Net	Jessica	2018	5	Y
9	BC1084	331	320	665.9	F	6.7	7	X	Trap Net	Jessica	2018	7	Y
10	BC1085	269	259	324.2	M	2.6	0.5	X	Trap Net	Jessica	2018	4	Y
11	BC1086	334	322	631	M	4.2	2.2	X	Trap Net	Jessica	2018	8	Y
12	BC1087	333	320	673	F	8.2	3.9	X	Trap Net	Jessica	2018	8	Y
13	BC1088	380	364	860.3	F	7	5.3	X	Trap Net	Jessica	2018	11	Y
14	BC1089	333	321	605.6	M	3.4	0.5	X	Trap Net	Jessica	2018	8	Y
15	BC1090	339	328	635	M	4.7	1.3	X	Trap Net	Jessica	2018	8	Y
16	BC1091	355	345	763.1	M	6.7	1.8	X	Trap Net	Jessica	2018	10	Y
1	BC1092	150	144	57.2	F	0.3	0.2	X	Trap Net	Jessica	2018	2	Y
2	BC1093	142	134	45.2	F	0.2	0.1	X	Trap Net	Jessica	2018	2	Y
3	BC1094	275	261	353	F	2.1	2	X	Trap Net	Jessica	2018	4	Y
4	BC1095	272	263	334.1	F	2.7	2.3	X	Trap Net	Jessica	2018	5	Y
1	BC1096	144	136	45.2	M	0.2	0	X	Trap Net	Jessica	2018	2	Y
1	BC1097	278	268	388.9	M	2.7	0.6	X	Trap Net	Jessica	2018	3	Y
2	BC1098	295	284	445.6	F	2.1	3.6	X	Trap Net	Jessica	2018	3	Y
3	BC1099	236	230	236.2	M	1.8	0.2	X	Trap Net	Jessica	2018	2	Y
4	BC1100	273	264	320.8	F	1.8	2.7	X	Trap Net	Jessica	2018	3	Y
1	BC1101	176	168	75.7	F	0.4	0.7	X	Gill Net	Lac du Bonnet	2018	2	Y
2	BC1102	194	182	126.6	F	0.4	1	X	Gill Net	Lac du Bonnet	2018	2	Y
3	BC1103	230	222	194	M	1.6	1.7	X	Gill Net	Lac du Bonnet	2018	3	Y
4	BC1104	220	210	162.6	M	0.8	0.7	X	Gill Net	Lac du Bonnet	2018	4	Y
5	BC1105	236	228	224.1	M	1.6	1.4	X	Gill Net	Lac du Bonnet	2018	4	Y
6	BC1106	212	200	154.2	M	1	1	X	Gill Net	Lac du Bonnet	2018	3	Y
7	BC1107	200	192	113.5	F	0.7	1.4	X	Gill Net	Lac du Bonnet	2018	3	Y
8	BC1108	320	312	555.1	F	3.9	6.8	X	Gill Net	Lac du Bonnet	2018	6	Y
9	BC1109	266	256	325.6	M	1.7	1.6	X	Gill Net	Lac du Bonnet	2018	4	Y
10	BC1110	72	70	4.6	U	X	X	X	Gill Net	Lac du Bonnet	2018	1	Y
11	BC1111	70	62	3	U	X	X	X	Gill Net	Lac du Bonnet	2018	1	Y
12	BC1112	74	70	4.4	U	X	X	X	Gill Net	Lac du Bonnet	2018	1	Y
13	BC1113	74	70	5.8	U	X	X	X	Gill Net	Lac du Bonnet	2018	1	Y
14	BC1114	62	58	2.9	U	X	X	X	Gill Net	Lac du Bonnet	2018	1	Y
15	BC1115	192	182	106	M	0.8	1.7	X	Gill Net	Lac du Bonnet	2018	3	Y
16	BC1116	266	256	282.3	M	2.8	2.1	X	Gill Net	Lac du Bonnet	2018	4	Y
17	BC1117	250	242	265.8	F	1.3	2.5	X	Gill Net	Lac du Bonnet	2018	4	Y
18	BC1118	258	246	263.8	M	1.5	1.6	X	Gill Net	Lac du Bonnet	2018	4	Y
19	BC1119	240	230	212.4	F	1.5	2.4	X	Gill Net	Lac du Bonnet	2018	3	Y
20	BC1120	252	242	248.8	M	1.6	1.4	X	Gill Net	Lac du Bonnet	2018	3	Y
21	BC1121	194	188	100.8	F	0.9	1.1	X	Gill Net	Lac du Bonnet	2018	2	Y
22	BC1122	182	176	88.5	F	0.2	0.5	X	Gill Net	Lac du Bonnet	2018	2	Y

23	BC1123	142	130	33.5	F	X	X	X	Gill Net	Lac du Bonnet	2018	1	Y
24	BC1124	170	164	71.8	F	X	X	X	Gill Net	Lac du Bonnet	2018	2	Y
25	BC1125	80	76	6	U	X	X	X	Gill Net	Lac du Bonnet	2018	1	Y
26	BC1126	82	78	9.1	U	X	X	X	Gill Net	Lac du Bonnet	2018	1	Y
27	BC1127	70	68	5	U	X	X	X	Gill Net	Lac du Bonnet	2018	1	Y
28	BC1128	76	70	6.7	U	X	X	X	Gill Net	Lac du Bonnet	2018	1	Y
29	BC1129	68	70	4.3	U	X	X	X	Gill Net	Lac du Bonnet	2018	1	Y
30	BC1130	74	70	5.7	U	X	X	X	Gill Net	Lac du Bonnet	2018	1	Y
31	BC1131	78	72	5.2	U	X	X	X	Gill Net	Lac du Bonnet	2018	1	Y
32	BC1132	66	64	4	U	X	X	X	Gill Net	Lac du Bonnet	2018	1	Y
33	BC1133	60	X	5.8	U	X	X	X	Gill Net	Lac du Bonnet	2018	1	Y
34	BC1134	60	54	3.2	U	X	X	X	Gill Net	Lac du Bonnet	2018	1	Y
35	BC1135	74	70	6.6	U	X	X	X	Gill Net	Lac du Bonnet	2018	1	Y
36	BC1136	67	64	4.1	U	X	X	X	Gill Net	Lac du Bonnet	2018	1	Y
37	BC1137	76	72	6.2	U	X	X	X	Gill Net	Lac du Bonnet	2018	1	Y
38	BC1138	80	72	7.3	U	X	X	X	Gill Net	Lac du Bonnet	2018	1	Y
39	BC1139	72	68	5.6	U	X	X	X	Gill Net	Lac du Bonnet	2018	1	Y
40	BC1140	76	72	7	U	X	X	X	Gill Net	Lac du Bonnet	2018	1	Y
41	BC1141	62	60	3	U	X	X	X	Gill Net	Lac du Bonnet	2018	1	Y
42	BC1142	75	72	6.9	U	X	X	X	Gill Net	Lac du Bonnet	2018	1	Y
43	BC1143	78	74	7.2	U	X	X	X	Gill Net	Lac du Bonnet	2018	1	Y
44	BC1144	65	60	3.4	U	X	X	X	Gill Net	Lac du Bonnet	2018	1	Y
45	BC1145	75	70	6.3	U	X	X	X	Gill Net	Lac du Bonnet	2018	1	Y
46	BC1146	65	62	4.9	U	X	X	X	Gill Net	Lac du Bonnet	2018	1	Y
47	BC1147	73	70	6.5	U	X	X	X	Gill Net	Lac du Bonnet	2018	1	Y
48	BC1148	72	68	6.1	U	X	X	X	Gill Net	Lac du Bonnet	2018	1	Y
49	BC1149	80	74	7.1	U	X	X	X	Gill Net	Lac du Bonnet	2018	1	Y
50	BC1150	88	82	9.1	U	X	X	X	Gill Net	Lac du Bonnet	2018	1	Y
51	BC1151	80	72	6.5	U	X	X	X	Gill Net	Lac du Bonnet	2018	1	Y
52	BC1152	70	62	3.2	U	X	X	X	Gill Net	Lac du Bonnet	2018	1	Y
53	BC1153	60	58	3.5	U	X	X	X	Gill Net	Lac du Bonnet	2018	1	Y
54	BC1154	78	74	7.4	U	X	X	X	Gill Net	Lac du Bonnet	2018	1	Y
55	BC1155	72	68	5.4	U	X	X	X	Gill Net	Lac du Bonnet	2018	1	Y
56	BC1156	294	286	440.6	M	2.4	4.2	X	Gill Net	Lac du Bonnet	2018	6	Y
57	BC1157	332	320	557.1	M	4.8	3.6	X	Gill Net	Lac du Bonnet	2018	8	Y
58	BC1158	236	226	211.3	M	2	2.5	X	Gill Net	Lac du Bonnet	2018	4	Y
59	BC1159	300	286	406.2	F	3.8	7.7	X	Gill Net	Lac du Bonnet	2018	7	Y
60	BC1160	284	270	394.1	F	1.2	7.2	X	Gill Net	Lac du Bonnet	2018	6	Y
61	BC1161	272	268	347.2	M	4	2.8	X	Gill Net	Lac du Bonnet	2018	5	Y
62	BC1162	245	234	229.8	F	3.2	3.2	X	Gill Net	Lac du Bonnet	2018	4	Y
63	BC1163	244	236	224.2	F	3.8	4.6	X	Gill Net	Lac du Bonnet	2018	3	Y
64	BC1164	226	220	194.3	M	1.8	2	X	Gill Net	Lac du Bonnet	2018	4	Y
65	BC1165	222	216	155.7	M	0.9	2.1	X	Gill Net	Lac du Bonnet	2018	3	Y
66	BC1166	190	180	96	M	1.5	2	X	Gill Net	Lac du Bonnet	2018	2	Y
67	BC1167	232	224	202.1	F	3.5	4.1	X	Gill Net	Lac du Bonnet	2018	3	Y
68	BC1168	236	232	196.4	F	3.7	4.2	X	Gill Net	Lac du Bonnet	2018	4	Y
1	BC149	264	249	271.5	F	2.1	8.1	X	Trap Net	North Cross	2018	6	Y
2	BC150	268	254	265.4	M	2.1	0.6	X	Trap Net	North Cross	2018	6	Y
3	BC151	255	248	254.5	F	2.2	7.9	X	Trap Net	North Cross	2018	6	Y
4	BC152	260	252	285.6	M	1.4	0.5	X	Trap Net	North Cross	2018	5	Y
5	BC153	266	258	278.1	M	1	0.3	X	Trap Net	North Cross	2018	5	Y
6	BC154	250	237	239.3	F	2.2	6.4	X	Trap Net	North Cross	2018	5	Y
7	BC155	251	238	259.5	F	2.1	8.8	X	Trap Net	North Cross	2018	5	Y
8	BC156	262	248	287.8	F	2.8	10.7	X	Trap Net	North Cross	2018	5	Y
9	BC157	271	262	343.9	M	2.4	1.4	X	Trap Net	North Cross	2018	6	Y
10	BC158	260	253	252.4	M	1.4	0.4	X	Trap Net	North Cross	2018	6	Y
11	BC159	308	292	440.3	F	5.4	13.7	X	Trap Net	North Cross	2018	7	Y
12	BC160	260	250	262.5	M	1.9	0.4	X	Trap Net	North Cross	2018	6	Y
13	BC161	184	184	234.9	F	2.5	6.8	X	Trap Net	North Cross	2018	6	Y
1	BC308	262	250	314.3	X	X	X	121	Trap Net	North Cross	2018	X	N
2	BC309	277	265	363.2	X	X	X	122	Trap Net	North Cross	2018	X	N
3	BC310	258	249	273.2	X	X	X	123	Trap Net	North Cross	2018	X	N
4	BC311	264	253	313.8	X	X	X	124	Trap Net	North Cross	2018	X	N
5	BC312	259	248	302.2	X	X	X	125	Trap Net	North Cross	2018	X	N
6	BC313	290	280	409.2	X	X	X	126	Trap Net	North Cross	2018	X	N
7	BC314	263	250	312.1	X	X	X	127	Trap Net	North Cross	2018	X	N
8	BC315	250	241	272.7	X	X	X	128	Trap Net	North Cross	2018	X	N
9	BC316	270	258	330.4	X	X	X	129	Trap Net	North Cross	2018	X	N
10	BC317	271	254	319.6	X	X	X	130	Trap Net	North Cross	2018	X	N
11	BC318	193	183	112.2	X	X	X	131	Trap Net	North Cross	2018	X	N
12	BC319	255	248	289.1	X	X	X	132	Trap Net	North Cross	2018	X	N
1	BC336	200	190	113.5	X	X	X	144	Trap Net	North Cross	2018	X	N
2	BC337	255	240	265.6	X	X	X	145	Trap Net	North Cross	2018	X	N
3	BC338	194	184	113	X	X	X	146	Trap Net	North Cross	2018	X	N
4	BC339	199	196	132.5	X	X	X	147	Trap Net	North Cross	2018	X	N
5	BC340	203	196	143.4	X	X	X	149	Trap Net	North Cross	2018	X	N
6	BC341	190	180	115.3	X	X	X	150	Trap Net	North Cross	2018	X	N

7	BC342	262	250	299	X	X	X	151	Trap Net	North Cross	2018	X	N
8	BC343	263	251	325.6	X	X	X	152	Trap Net	North Cross	2018	X	N
9	BC344	268	255	309	X	X	X	153	Trap Net	North Cross	2018	X	N
10	BC345	208	200	154.3	X	X	X	155	Trap Net	North Cross	2018	X	N
11	BC346	199	189	124.6	X	X	X	156	Trap Net	North Cross	2018	X	N
1	BC578	258	244	270.4	X	X	X	297	Angled	North Cross	2018	X	N
2	BC579	280	270	359.1	X	X	X	298	Angled	North Cross	2018	X	N
3	BC580	261	247	295.4	X	X	X	299	Angled	North Cross	2018	X	N
4	BC581	264	250	284.3	X	X	X	300	Angled	North Cross	2018	X	N
5	BC582	255	242	255.7	X	X	X	142	Angled	North Cross	2018	X	N
6	BC583	287	277	371.2	X	X	X	148	Angled	North Cross	2018	X	N
7	BC584	263	250	305.7	X	X	X	154	Angled	North Cross	2018	X	N
8	BC585	313	302	508.1	X	X	X	160	Angled	North Cross	2018	X	N
9	BC586	274	260	344.9	X	X	X	301	Angled	North Cross	2018	X	N
10	BC587	196	190	120.2	X	X	X	302	Angled	North Cross	2018	X	N
11	BC588	263	250	286.6	X	X	X	303	Angled	North Cross	2018	X	N
12	BC589	293	280	419.3	X	X	X	304	Angled	North Cross	2018	X	N
13	BC590	260	249	300.1	X	X	X	305	Angled	North Cross	2018	X	N
14	BC591	251	240	262	X	X	X	306	Angled	North Cross	2018	X	N
15	BC592	256	240	264.2	X	X	X	307	Angled	North Cross	2018	X	N
16	BC593	268	253	324	X	X	X	308	Angled	North Cross	2018	X	N
17	BC594	254	242	263.5	X	X	X	309	Angled	North Cross	2018	X	N
18	BC595	276	260	332.4	X	X	X	310	Angled	North Cross	2018	X	N
19	BC596	264	250	288.3	X	X	X	311	Angled	North Cross	2018	X	N
20	BC597	218	210	156.9	X	X	X	312	Angled	North Cross	2018	X	N
21	BC598	273	262	331.1	X	X	X	313	Angled	North Cross	2018	X	N
22	BC599	270	258	333.2	X	X	X	314	Angled	North Cross	2018	X	N
23	BC600	273	262	337.5	X	X	X	315	Angled	North Cross	2018	X	N
24	BC601	273	258	340	X	X	X	316	Angled	North Cross	2018	X	N
25	BC602	290	275	374.7	X	X	X	317	Angled	North Cross	2018	X	N
26	BC603	265	250	304.3	X	X	X	318	Angled	North Cross	2018	X	N
27	BC604	263	252	312.1	X	X	X	319	Angled	North Cross	2018	X	N
28	BC605	253	242	255.6	X	X	X	320	Angled	North Cross	2018	X	N
29	BC606	213	200	156	X	X	X	321	Angled	North Cross	2018	X	N
30	BC607	199	188	125.2	X	X	X	322	Angled	North Cross	2018	X	N
31	BC608	272	260	334.6	X	X	X	323	Angled	North Cross	2018	X	N
32	BC609	211	200	154.2	X	X	X	324	Angled	North Cross	2018	X	N
33	BC610	274	262	343.6	X	X	X	325	Angled	North Cross	2018	X	N
34	BC611	269	254	309.9	X	X	X	326	Angled	North Cross	2018	X	N
35	BC612	265	252	306.5	X	X	X	327	Angled	North Cross	2018	X	N
36	BC613	294	280	403.1	X	X	X	328	Angled	North Cross	2018	X	N
37	BC614	256	244	289.7	X	X	X	329	Angled	North Cross	2018	X	N
38	BC615	247	231	247.6	X	X	X	330	Angled	North Cross	2018	X	N
39	BC616	210	200	144.7	X	X	X	331	Angled	North Cross	2018	X	N
40	BC617	259	247	289.8	X	X	X	332	Angled	North Cross	2018	X	N
41	BC618	202	190	129.3	X	X	X	333	Angled	North Cross	2018	X	N
42	BC619	263	251	292	X	X	X	334	Angled	North Cross	2018	X	N
43	BC620	263	252	295.7	X	X	X	335	Angled	North Cross	2018	X	N
44	BC621	249	231	258.2	X	X	X	336	Angled	North Cross	2018	X	N
45	BC622	211	200	154.2	X	X	X	337	Angled	North Cross	2018	X	N
46	BC623	261	245	304.3	X	X	X	338	Angled	North Cross	2018	X	N
47	BC624	205	196	131.2	X	X	X	339	Angled	North Cross	2018	X	N
48	BC625	262	249	278.9	X	X	X	340	Angled	North Cross	2018	X	N
49	BC626	257	240	287.9	X	X	X	341	Angled	North Cross	2018	X	N
50	BC627	198	186	120.7	X	X	X	342	Angled	North Cross	2018	X	N
51	BC628	216	206	162.4	X	X	X	343	Angled	North Cross	2018	X	N
52	BC629	264	250	288.8	X	X	X	344	Angled	North Cross	2018	X	N
53	BC630	293	281	403.3	X	X	X	345	Angled	North Cross	2018	X	N
54	BC631	266	250	306.2	X	X	X	346	Angled	North Cross	2018	X	N
55	BC632	257	243	282.7	X	X	X	347	Angled	North Cross	2018	X	N
56	BC633	290	276	404.3	X	X	X	348	Angled	North Cross	2018	X	N
57	BC634	250	240	257.6	X	X	X	349	Angled	North Cross	2018	X	N
58	BC635	203	194	130.2	X	X	X	350	Angled	North Cross	2018	X	N
59	BC636	253	239	255.1	X	X	X	351	Angled	North Cross	2018	X	N
60	BC637	258	244	286.6	X	X	X	352	Angled	North Cross	2018	X	N
61	BC638	240	225	216.4	X	X	X	353	Angled	North Cross	2018	X	N
62	BC639	271	256	306.8	X	X	X	354	Angled	North Cross	2018	X	N
63	BC640	270	258	307.4	X	X	X	355	Angled	North Cross	2018	X	N
64	BC641	210	200	142	X	X	X	356	Angled	North Cross	2018	X	N
66	BC643	296	285	441.6	X	X	X	357	Angled	North Cross	2018	X	N
67	BC644	273	264	339.2	X	X	X	358	Angled	North Cross	2018	X	N
68	BC645	255	242	290.1	X	X	X	359	Angled	North Cross	2018	X	N
69	BC646	211	204	154.3	X	X	X	360	Angled	North Cross	2018	X	N
70	BC647	211	200	153.5	X	X	X	361	Angled	North Cross	2018	X	N
71	BC648	265	254	311.3	X	X	X	362	Angled	North Cross	2018	X	N
72	BC649	268	258	346.9	X	X	X	363	Angled	North Cross	2018	X	N
73	BC650	274	257	316.9	X	X	X	364	Angled	North Cross	2018	X	N

74	BC651	264	525	292.9	X	X	X	365	Angled	North Cross	2018	X	N
75	BC652	259	247	282.5	X	X	X	366	Angled	North Cross	2018	X	N
76	BC653	272	261	312.6	X	X	X	367	Angled	North Cross	2018	X	N
78	BC654	264	250	302.7	X	X	X	368	Angled	North Cross	2018	X	N
79	BC655	257	246	285.7	X	X	X	369	Angled	North Cross	2018	X	N
80	BC656	210	202	153.7	X	X	X	370	Angled	North Cross	2018	X	N
81	BC657	261	250	288.5	X	X	X	371	Angled	North Cross	2018	X	N
82	BC658	254	244	255.6	X	X	X	372	Angled	North Cross	2018	X	N
83	BC659	270	255	304.5	X	X	X	373	Angled	North Cross	2018	X	N
84	BC660	367	360	308.8	X	X	X	374	Angled	North Cross	2018	X	N
85	BC661	244	234	237.8	X	X	X	375	Angled	North Cross	2018	X	N
86	BC662	256	245	283.5	X	X	X	376	Angled	North Cross	2018	X	N
87	BC663	271	258	299.5	X	X	X	377	Angled	North Cross	2018	X	N
88	BC664	261	252	290.1	X	X	X	378	Angled	North Cross	2018	X	N
89	BC665	276	262	336.2	X	X	X	379	Angled	North Cross	2018	X	N
90	BC666	253	241	261.8	X	X	X	380	Angled	North Cross	2018	X	N
91	BC667	262	250	307.5	X	X	X	381	Angled	North Cross	2018	X	N
92	BC668	252	240	272.4	X	X	X	382	Angled	North Cross	2018	X	N
93	BC669	258	246	274.4	X	X	X	383	Angled	North Cross	2018	X	N
94	BC670	269	253	288.2	X	X	X	384	Angled	North Cross	2018	X	N
95	BC671	250	237	265.4	X	X	X	385	Angled	North Cross	2018	X	N
96	BC672	212	206	160.1	X	X	X	386	Angled	North Cross	2018	X	N
97	BC673	267	255	317.7	X	X	X	387	Angled	North Cross	2018	X	N
98	BC674	248	234	248.8	X	X	X	388	Angled	North Cross	2018	X	N
99	BC675	244	235	261.4	X	X	X	389	Angled	North Cross	2018	X	N
100	BC676	239	226	229.9	X	X	X	390	Angled	North Cross	2018	X	N
101	BC677	266	252	293.4	X	X	X	391	Angled	North Cross	2018	X	N
102	BC678	260	248	289.6	X	X	X	392	Angled	North Cross	2018	X	N
103	BC679	272	258	309.3	X	X	X	393	Angled	North Cross	2018	X	N
104	BC680	255	244	289.2	X	X	X	394	Angled	North Cross	2018	X	N
105	BC681	204	196	144.5	X	X	X	395	Angled	North Cross	2018	X	N
106	BC682	200	190	131.6	X	X	X	396	Angled	North Cross	2018	X	N
107	BC683	221	210	184.6	X	X	X	397	Angled	North Cross	2018	X	N
108	BC684	276	262	338.6	X	X	X	398	Angled	North Cross	2018	X	N
109	BC685	210	200	150.7	X	X	X	399	Angled	North Cross	2018	X	N
110	BC686	256	244	259.2	X	X	X	400	Angled	North Cross	2018	X	N
111	BC687	267	254	304.5	X	X	X	601	Anlged	North Cross	2018	X	N
112	BC688	252	242	301.1	X	X	X	121	Angled	North Cross	2018	X	N
113	BC689	250	238	268.1	X	X	X	602	Angled	North Cross	2018	X	N
114	BC690	374	359	345.1	X	X	X	603	Angled	North Cross	2018	X	N
115	BC691	258	247	273.5	X	X	X	604	Angled	North Cross	2018	X	N
116	BC692	266	252	310.9	X	X	X	605	Angled	North Cross	2018	X	N
117	BC693	266	254	316.9	X	X	X	606	Angled	North Cross	2018	X	N
118	BC694	276	260	328.2	X	X	X	608	Angled	North Cross	2018	X	N
119	BC695	273	260	322.1	X	X	X	607	Angled	North Cross	2018	X	N
120	BC696	196	186	115.3	X	X	X	322	Angled	North Cross	2018	X	N
121	BC697	262	248	290.9	X	X	X	609	Angled	North Cross	2018	X	N
122	BC698	275	264	325.6	X	X	X	610	Angled	North Cross	2018	X	N
123	BC699	211	192	132.7	X	X	X	612	Angled	North Cross	2018	X	N
124	BC700	267	252	314.5	X	X	X	613	Angled	North Cross	2018	X	N
125	BC701	258	246	270.9	X	X	X	614	Angled	North Cross	2018	X	N
126	BC702	249	237	264	X	X	X	615	Angled	North Cross	2018	X	N
127	BC703	210	201	149.8	X	X	X	616	Angled	North Cross	2018	X	N
128	BC704	257	242	254.5	X	X	X	617	Angled	North Cross	2018	X	N
129	BC705	268	254	302.3	X	X	X	618	Angled	North Cross	2018	X	N
130	BC706	262	250	303.7	X	X	X	619	Angled	North Cross	2018	X	N
131	BC707	260	250	282.4	X	X	X	620	Angled	North Cross	2018	X	N
132	BC708	211	200	153.2	X	X	X	621	Angled	North Cross	2018	X	N
133	BC709	260	247	255	X	X	X	622	Angled	North Cross	2018	X	N
134	BC710	203	196	130.4	X	X	X	623	Angled	North Cross	2018	X	N
1	BC711	258	247	274.1	X	X	X	624	Angled	North Cross	2018	X	N
2	BC712	269	255	322.6	X	X	X	625	Angled	North Cross	2018	X	N
3	BC713	215	204	162	X	X	X	401	Angled	North Cross	2018	X	N
4	BC714	208	196	142.8	X	X	X	402	Angled	North Cross	2018	X	N
5	BC715	265	252	298.2	X	X	X	403	Angled	North Cross	2018	X	N
6	BC716	263	250	295.6	X	X	X	404	Angled	North Cross	2018	X	N
7	BC717	205	194	141	X	X	X	405	Angled	North Cross	2018	X	N
8	BC718	221	210	163.9	X	X	X	406	Angled	North Cross	2018	X	N
9	BC719	195	186	123.4	X	X	X	407	Angled	North Cross	2018	X	N
10	BC720	270	255	300.3	X	X	X	408	Angled	North Cross	2018	X	N
11	BC721	203	192	132.7	X	X	X	409	Angled	North Cross	2018	X	N
12	BC722	264	246	277.3	X	X	X	410	Angled	North Cross	2018	X	N
13	BC723	285	270	360.7	X	X	X	411	Angled	North Cross	2018	X	N
14	BC724	265	251	297.6	X	X	X	412	Angled	North Cross	2018	X	N
15	BC725	267	254	295.4	X	X	X	413	Angled	North Cross	2018	X	N
16	BC726	262	250	297.2	X	X	X	414	Angled	North Cross	2018	X	N
17	BC727	259	249	278.4	X	X	X	415	Angled	North Cross	2018	X	N

18	BC728	274	238	245.3	X	X	X	416	Angled	North Cross	2018	X	N
19	BC729	247	264	311.5	X	X	X	417	Angled	North Cross	2018	X	N
20	BC730	212	199	156	X	X	X	418	Angled	North Cross	2018	X	N
21	BC731	260	248	268.8	X	X	X	419	Angled	North Cross	2018	X	N
22	BC732	263	249	290.1	X	X	X	420	Angled	North Cross	2018	X	N
23	BC733	264	248	287.8	X	X	X	421	Angled	North Cross	2018	X	N
24	BC734	270	259	330.3	X	X	X	422	Angled	North Cross	2018	X	N
25	BC735	261	246	298.6	X	X	X	423	Angled	North Cross	2018	X	N
26	BC736	256	244	255.7	X	X	X	424	Angled	North Cross	2018	X	N
27	BC737	272	258	322.1	X	X	X	425	Angled	North Cross	2018	X	N
28	BC738	272	259	337.2	X	X	X	426	Angled	North Cross	2018	X	N
29	BC739	273	256	323	X	X	X	427	Angled	North Cross	2018	X	N
30	BC740	257	240	255	X	X	X	428	Angled	North Cross	2018	X	N
1	BC741	302	285	387.3	X	X	X	429	Angled	North Cross	2018	X	N
2	BC742	267	250	305.2	X	X	X	430	Angled	North Cross	2018	X	N
3	BC743	204	190	134.6	X	X	X	431	Angled	North Cross	2018	X	N
4	BC744	266	251	318.6	X	X	X	432	Angled	North Cross	2018	X	N
5	BC745	270	254	315.3	X	X	X	433	Angled	North Cross	2018	X	N
6	BC746	259	243	275.4	X	X	X	434	Angled	North Cross	2018	X	N
7	BC747	274	255	311.3	X	X	X	435	Angled	North Cross	2018	X	N
8	BC748	295	280	405.6	X	X	X	436	Angled	North Cross	2018	X	N
9	BC749	263	249	285.8	X	X	X	437	Angled	North Cross	2018	X	N
10	BC750	266	250	321.5	X	X	X	438	Angled	North Cross	2018	X	N
11	BC751	282	270	361.5	X	X	X	439	Angled	North Cross	2018	X	N
12	BC752	277	263	336.2	X	X	X	440	Angled	North Cross	2018	X	N
13	BC753	259	249	305.6	X	X	X	441	Angled	North Cross	2018	X	N
14	BC754	272	258	349	X	X	X	442	Angled	North Cross	2018	X	N
15	BC755	264	252	318.1	X	X	X	443	Angled	North Cross	2018	X	N
16	BC756	268	256	328.6	X	X	X	444	Angled	North Cross	2018	X	N
17	BC757	265	252	314	X	X	X	445	Angled	North Cross	2018	X	N
18	BC758	196	190	112.5	X	X	X	446	Angled	North Cross	2018	X	N
19	BC759	206	195	126.6	X	X	X	447	Angled	North Cross	2018	X	N
20	BC760	263	250	298.7	X	X	X	448	Angled	North Cross	2018	X	N
21	BC761	268	256	341.6	X	X	X	449	Angled	North Cross	2018	X	N
22	BC762	262	248	316.6	X	X	X	450	Angled	North Cross	2018	X	N
23	BC763	266	251	309	X	X	X	611	Angled	North Cross	2018	X	N
24	BC764	271	255	311.1	X	X	X	451	Angled	North Cross	2018	X	N
25	BC765	268	252	312.7	X	X	X	452	Angled	North Cross	2018	X	N
26	BC766	207	199	144.1	X	X	X	453	Angled	North Cross	2018	X	N
27	BC767	206	198	142.3	X	X	X	454	Angled	North Cross	2018	X	N
28	BC768	268	252	327.5	X	X	X	455	Angled	North Cross	2018	X	N
29	BC769	263	242	286.3	X	X	X	456	Angled	North Cross	2018	X	N
30	BC770	225	213	186.5	X	X	X	457	Angled	North Cross	2018	X	N
31	BC771	268	253	414.3	X	X	X	458	Angled	North Cross	2018	X	N
32	BC772	270	256	316.4	X	X	X	X	Angled	North Cross	2018	X	N
33	BC773	268	252	308.6	X	X	X	459	Angled	North Cross	2018	X	N
34	BC774	262	245	291.2	X	X	X	460	Angled	North Cross	2018	X	N
35	BC775	261	248	308.9	X	X	X	461	Angled	North Cross	2018	X	N
36	BC776	258	244	273.3	X	X	X	462	Angled	North Cross	2018	X	N
37	BC777	273	258	317.8	X	X	X	463	Angled	North Cross	2018	X	N
38	BC778	260	248	304.1	X	X	X	464	Angled	North Cross	2018	X	N
39	BC779	259	247	276.3	X	X	X	465	Angled	North Cross	2018	X	N
40	BC780	246	236	232.3	X	X	X	466	Angled	North Cross	2018	X	N
41	BC781	263	256	305.3	X	X	X	X	Angled	North Cross	2018	X	N
42	BC782	274	262	339.3	X	X	X	467	Angled	North Cross	2018	X	N
43	BC783	277	260	337.8	X	X	X	468	Angled	North Cross	2018	X	N
44	BC784	270	258	313.1	X	X	X	469	Angled	North Cross	2018	X	N
45	BC785	273	259	314.3	X	X	X	470	Angled	North Cross	2018	X	N
46	BC786	221	210	176.5	X	X	X	471	Angled	North Cross	2018	X	N
47	BC787	255	242	275.6	X	X	X	472	Angled	North Cross	2018	X	N
48	BC788	208	198	148.3	X	X	X	473	Angled	North Cross	2018	X	N
49	BC789	205	194	141.9	X	X	X	474	Angled	North Cross	2018	X	N
50	BC790	247	234	252.3	X	X	X	475	Angled	North Cross	2018	X	N
51	BC791	183	176	97.3	X	X	X	X	Angled	North Cross	2018	X	N
52	BC792	262	246	294	X	X	X	476	Angled	North Cross	2018	X	N
53	BC793	271	256	320.9	X	X	X	477	Angled	North Cross	2018	X	N
54	BC794	272	257	304	X	X	X	478	Angled	North Cross	2018	X	N
55	BC795	200	190	118.2	X	X	X	480	Angled	North Cross	2018	X	N
56	BC796	262	250	307.1	X	X	X	481	Angled	North Cross	2018	X	N
57	BC797	258	245	264.1	X	X	X	482	Angled	North Cross	2018	X	N
58	BC798	269	249	293.2	X	X	X	483	Angled	North Cross	2018	X	N
59	BC799	207	200	140.9	X	X	X	484	Angled	North Cross	2018	X	N
60	BC800	271	253	318.2	X	X	X	485	Angled	North Cross	2018	X	N
61	BC801	207	197	140.1	X	X	X	486	Angled	North Cross	2018	X	N
62	BC802	252	237	235.5	X	X	X	487	Angled	North Cross	2018	X	N
63	BC803	262	251	197.8	X	X	X	488	Angled	North Cross	2018	X	N
64	BC804	268	252	299.8	X	X	X	489	Angled	North Cross	2018	X	N

65	BC805	275	263	355.6	X	X	X	490	Angled	North Cross	2018	X	N
66	BC806	264	248	290.1	X	X	X	491	Angled	North Cross	2018	X	N
67	BC807	213	202	150.5	X	X	X	492	Angled	North Cross	2018	X	N
68	BC808	257	246	278.8	X	X	X	493	Angled	North Cross	2018	X	N
69	BC809	257	245	284.2	X	X	X	494	Angled	North Cross	2018	X	N
70	BC810	274	260	309.8	X	X	X	495	Angled	North Cross	2018	X	N
71	BC811	235	224	209.8	X	X	X	496	Angled	North Cross	2018	X	N
72	BC812	266	253	316.4	X	X	X	497	Angled	North Cross	2018	X	N
73	BC813	260	250	302	X	X	X	498	Angled	North Cross	2018	X	N
74	BC814	270	254	315.2	X	X	X	499	Angled	North Cross	2018	X	N
75	BC815	207	196	148	X	X	X	500	Angled	North Cross	2018	X	N
76	BC816	198	189	121.3	X	X	X	479	Angled	North Cross	2018	X	N
77	BC817	217	204	162.1	X	X	X	501	Angled	North Cross	2018	X	N
78	BC818	253	238	246.2	X	X	X	502	Angled	North Cross	2018	X	N
79	BC819	274	260	320.1	X	X	X	503	Angled	North Cross	2018	X	N
80	BC820	204	192	129.5	X	X	X	504	Angled	North Cross	2018	X	N
81	BC821	266	252	317.1	X	X	X	505	Angled	North Cross	2018	X	N
82	BC822	286	271	353.5	X	X	X	506	Angled	North Cross	2018	X	N
83	BC823	202	192	129.2	X	X	X	507	Angled	North Cross	2018	X	N
84	BC824	260	242	279.8	X	X	X	508	Angled	North Cross	2018	X	N
85	BC825	273	260	338.1	X	X	X	509	Angled	North Cross	2018	X	N
86	BC826	256	246	276.5	X	X	X	510	Angled	North Cross	2018	X	N
87	BC827	292	279	403.2	X	X	X	511	Angled	North Cross	2018	X	N
88	BC828	242	229	244.2	X	X	X	512	Angled	North Cross	2018	X	N
89	BC829	263	248	278.7	X	X	X	513	Angled	North Cross	2018	X	N
90	BC830	203	192	136.2	X	X	X	514	Angled	North Cross	2018	X	N
91	BC831	268	254	320.5	X	X	X	515	Angled	North Cross	2018	X	N
92	BC832	280	255	311.2	X	X	X	516	Angled	North Cross	2018	X	N
93	BC833	268	255	314	X	X	X	517	Angled	North Cross	2018	X	N
94	BC834	252	241	263.5	X	X	X	518	Angled	North Cross	2018	X	N
95	BC835	277	262	345.1	X	X	X	519	Angled	North Cross	2018	X	N
96	BC836	288	272	362	X	X	X	520	Angled	North Cross	2018	X	N
97	BC837	254	241	268.8	X	X	X	521	Angled	North Cross	2018	X	N
98	BC838	298	280	398.6	X	X	X	522	Angled	North Cross	2018	X	N
99	BC839	258	246	286.6	X	X	X	523	Angled	North Cross	2018	X	N
100	BC840	261	249	285.3	X	X	X	524	Angled	North Cross	2018	X	N
101	BC841	195	188	114.2	X	X	X	525	Angled	North Cross	2018	X	N
102	BC842	264	250	306.1	X	X	X	526	Angled	North Cross	2018	X	N
103	BC843	203	194	126	X	X	X	527	Angled	North Cross	2018	X	N
104	BC844	208	198	142.6	X	X	X	528	Angled	North Cross	2018	X	N
105	BC845	269	254	314.1	X	X	X	529	Angled	North Cross	2018	X	N
106	BC846	280	264	356.1	X	X	X	530	Angled	North Cross	2018	X	N
107	BC847	274	260	337.6	X	X	X	531	Angled	North Cross	2018	X	N
108	BC848	213	202	158.4	X	X	X	532	Angled	North Cross	2018	X	N
109	BC849	250	238	261.2	X	X	X	533	Angled	North Cross	2018	X	N
110	BC850	281	264	342.3	X	X	X	534	Angled	North Cross	2018	X	N
111	BC851	269	255	313.3	X	X	X	535	Angled	North Cross	2018	X	N
112	BC852	204	192	145	X	X	X	536	Angled	North Cross	2018	X	N
113	BC853	257	242	280.1	X	X	X	537	Angled	North Cross	2018	X	N
114	BC854	187	176	108.1	X	X	X	X	Angled	North Cross	2018	X	N
115	BC855	226	216	192	X	X	X	538	Angled	North Cross	2018	X	N
116	BC856	213	200	151.3	X	X	X	539	Angled	North Cross	2018	X	N
117	BC857	212	200	156.1	X	X	X	540	Angled	North Cross	2018	X	N
118	BC858	204	191	152.4	X	X	X	541	Angled	North Cross	2018	X	N
119	BC859	291	280	380	X	X	X	542	Angled	North Cross	2018	X	N
120	BC860	289	274	378.4	X	X	X	543	Angled	North Cross	2018	X	N
121	BC861	261	249	286	X	X	X	544	Angled	North Cross	2018	X	N
1	BC862	284	270	364.4	M	2.1	0.4	X	Angled	North Cross	2018	5	Y
2	BC863	278	268	329.1	X	X	X	X	Angled	North Cross	2018	X	N
3	BC864	201	190	127	M	0.8	0.1	X	Angled	North Cross	2018	3	Y
4	BC865	269	258	297.7	X	X	X	X	Angled	North Cross	2018	X	N
5	BC866	262	258	278.2	X	X	X	X	Angled	North Cross	2018	X	N
6	BC867	262	247	287.8	X	X	X	X	Angled	North Cross	2018	X	N
7	BC868	281	270	350.1	M	2.3	0.5	X	Angled	North Cross	2018	5	Y
8	BC869	274	262	318.8	X	X	X	X	Angled	North Cross	2018	X	N
9	BC870	254	240	256.6	X	X	X	X	Angled	North Cross	2018	X	N
10	BC871	260	250	292.3	X	X	X	X	Angled	North Cross	2018	X	N
11	BC872	260	249	285.3	X	X	X	X	Angled	North Cross	2018	X	N
12	BC873	212	200	143.5	F	0.9	0.5	X	Angled	North Cross	2018	3	Y
13	BC874	247	236	266	X	X	X	X	Angled	North Cross	2018	X	N
14	BC875	212	200	153.6	M	0.9	0.1	X	Angled	North Cross	2018	3	Y
15	BC876	276	262	327.2	X	X	X	X	Angled	North Cross	2018	X	N
16	BC877	270	256	337.4	X	X	X	X	Angled	North Cross	2018	X	N
17	BC878	198	188	117.5	M	0.8	0.1	X	Angled	North Cross	2018	4	Y
18	BC879	205	194	133.6	F	0.8	0.5	X	Angled	North Cross	2018	4	Y
19	BC880	301	288	453.3	M	4	0.7	X	Angled	North Cross	2018	6	Y
20	BC881	280	262	322.5	M	2.1	0.6	X	Angled	North Cross	2018	6	Y

21	BC882	254	234	224.8	X	X	X	X	Angled	North Cross	2018	X	N
22	BC883	258	246	284.1	X	X	X	X	Angled	North Cross	2018	X	N
23	BC884	251	235	254.7	X	X	X	X	Angled	North Cross	2018	X	N
24	BC885	263	248	294.6	X	X	X	X	Angled	North Cross	2018	X	N
25	BC886	214	202	155.5	M	0.5	0	X	Angled	North Cross	2018	4	Y
26	BC887	251	238	268.5	F	2.1	2.4	X	Angled	North Cross	2018	5	Y
27	BC888	282	268	343.6	M	3.8	0.4	X	Angled	North Cross	2018	6	Y
28	BC889	263	250	333.4	M	1.8	0.4	X	Angled	North Cross	2018	X	Y
29	BC890	260	247	270	X	X	X	X	Angled	North Cross	2018	X	N
30	BC891	272	257	332.5	X	X	X	X	Angled	North Cross	2018	X	N
31	BC892	262	248	281.1	X	X	X	X	Angled	North Cross	2018	X	N
32	BC893	259	244	273.1	X	X	X	X	Angled	North Cross	2018	X	N
33	BC894	252	238	271.6	X	X	X	X	Angled	North Cross	2018	X	N
34	BC895	192	182	116.9	M	0.7	0	X	Angled	North Cross	2018	4	Y
35	BC896	212	200	152.1	M	1	0	X	Angled	North Cross	2018	3	Y
36	BC897	254	240	262.2	X	X	X	X	Angled	North Cross	2018	X	N
37	BC898	208	200	140.7	X	X	X	X	Angled	North Cross	2018	X	N
38	BC899	210	200	146.3	X	X	X	X	Angled	North Cross	2018	X	N
39	BC900	314	298	447.5	F	6.2	2.8	X	Angled	North Cross	2018	10	Y
40	BC901	256	246	283.8	F	3.2	2.2	X	Angled	North Cross	2018	6	Y
41	BC902	212	200	149.3	M	0.9	0	X	Angled	North Cross	2018	4	Y
42	BC903	191	182	107.2	F	0.7	0.6	X	Angled	North Cross	2018	3	Y
43	BC904	282	266	348.9	X	X	X	X	Angled	North Cross	2018	X	N
44	BC905	251	236	262.8	X	X	X	X	Angled	North Cross	2018	X	N
45	BC906	259	243	268.7	X	X	X	X	Angled	North Cross	2018	X	N
46	BC907	284	266	373	M	2.9	0.2	X	Angled	North Cross	2018	5	Y
47	BC908	194	184	115.5	F	0.7	0.4	X	Angled	North Cross	2018	4	Y
48	BC909	254	240	269.3	F	2.3	2	X	Angled	North Cross	2018	6	Y
49	BC910	214	202	146.1	M	1.1	0	X	Angled	North Cross	2018	3	Y
50	BC911	222	204	183.4	F	1.7	1.3	X	Angled	North Cross	2018	4	Y
51	BC912	210	204	154.5	M	1.1	0	X	Angled	North Cross	2018	3	Y
52	BC913	200	194	123.9	F	1.1	0.6	X	Angled	North Cross	2018	3	Y
1	BC148	82	80	8.7	F	X	X	X	Electrofished	South Cross	2018	X	N
1	BC162	346	330	727.5	X	X	X	1	Trap Net	South Cross	2018	X	N
2	BC163	372	351	817.6	X	X	X	2	Trap Net	South Cross	2018	X	N
3	BC164	330	314	659.6	X	X	X	3	Trap Net	South Cross	2018	X	N
4	BC165	324	310	609.2	X	X	X	4	Trap Net	South Cross	2018	X	N
5	BC166	362	343	782	X	X	X	5	Trap Net	South Cross	2018	X	N
6	BC167	314	306	514	X	X	X	7	Trap Net	South Cross	2018	X	N
7	BC168	326	314	608.2	X	X	X	8	Trap Net	South Cross	2018	X	N
8	BC169	336	322	652.8	X	X	X	9	Trap Net	South Cross	2018	X	N
9	BC170	333	320	612	X	X	X	10	Trap Net	South Cross	2018	X	N
10	BC171	319	309	546.9	X	X	X	11	Trap Net	South Cross	2018	X	N
11	BC172	319	309	558.5	X	X	X	12	Trap Net	South Cross	2018	X	N
12	BC173	324	314	557.2	X	X	X	13	Trap Net	South Cross	2018	X	N
13	BC174	332	325	654.9	X	X	X	14	Trap Net	South Cross	2018	X	N
14	BC175	304	296	487.2	X	X	X	15	Trap Net	South Cross	2018	X	N
15	BC176	279	270	382.4	X	X	X	16	Trap Net	South Cross	2018	X	N
16	BC177	327	315	614	X	X	X	17	Trap Net	South Cross	2018	X	N
17	BC178	336	329	690.3	X	X	X	18	Trap Net	South Cross	2018	X	N
18	BC179	304	292	452.8	X	X	X	19	Trap Net	South Cross	2018	X	N
19	BC180	312	300	521.9	X	X	X	20	Trap Net	South Cross	2018	X	N
20	BC181	304	295	497	X	X	X	21	Trap Net	South Cross	2018	X	N
21	BC182	328	320	617	X	X	X	22	Trap Net	South Cross	2018	X	N
22	BC183	322	312	542.1	X	X	X	23	Trap Net	South Cross	2018	X	N
23	BC184	320	308	597.1	X	X	X	24	Trap Net	South Cross	2018	X	N
24	BC185	338	328	644.1	X	X	X	25	Trap Net	South Cross	2018	X	N
25	BC186	310	300	325.2	X	X	X	26	Trap Net	South Cross	2018	X	N
26	BC187	268	259	372.2	X	X	X	27	Trap Net	South Cross	2018	X	N
27	BC188	334	324	647.9	X	X	X	28	Trap Net	South Cross	2018	X	N
28	BC189	286	274	425.5	X	X	X	29	Trap Net	South Cross	2018	X	N
29	BC190	322	316	552.8	X	X	X	30	Trap Net	South Cross	2018	X	N
30	BC191	348	336	701.3	X	X	X	31	Trap Net	South Cross	2018	X	N
31	BC192	310	292	492.2	X	X	X	32	Trap Net	South Cross	2018	X	N
32	BC193	317	306	548.1	X	X	X	33	Trap Net	South Cross	2018	X	N
33	BC194	321	312	559.5	X	X	X	34	Trap Net	South Cross	2018	X	N
34	BC195	342	332	680.1	X	X	X	35	Trap Net	South Cross	2018	X	N
35	BC196	334	325	651.4	X	X	X	36	Trap Net	South Cross	2018	X	N
36	BC197	312	303	513.2	X	X	X	37	Trap Net	South Cross	2018	X	N
37	BC198	310	292	501.9	X	X	X	38	Trap Net	South Cross	2018	X	N
38	BC199	301	290	475.8	X	X	X	39	Trap Net	South Cross	2018	X	N
39	BC200	316	310	523.1	X	X	X	40	Trap Net	South Cross	2018	X	N
40	BC201	321	309	562.1	X	X	X	41	Trap Net	South Cross	2018	X	N
41	BC202	393	379	417.2	X	X	X	42	Trap Net	South Cross	2018	X	N
42	BC203	328	318	602	X	X	X	43	Trap Net	South Cross	2018	X	N
43	BC204	315	304	534.7	X	X	X	44	Trap Net	South Cross	2018	X	N
44	BC205	317	300	564.9	X	X	X	45	Trap Net	South Cross	2018	X	N

45	BC206	309	300	528	X	X	X	46	Trap Net	South Cross	2018	X	N
46	BC207	320	309	529.3	X	X	X	47	Trap Net	South Cross	2018	X	N
47	BC208	319	308	604.3	X	X	X	48	Trap Net	South Cross	2018	X	N
48	BC209	371	356	841.5	X	X	X	49	Trap Net	South Cross	2018	X	N
49	BC210	333	320	664.1	X	X	X	50	Trap Net	South Cross	2018	X	N
50	BC211	336	324	654.5	X	X	X	6	Trap Net	South Cross	2018	X	N
51	BC212	304	292	446.2	X	X	X	51	Trap Net	South Cross	2018	X	N
52	BC213	314	300	532.8	X	X	X	52	Trap Net	South Cross	2018	X	N
53	BC214	323	310	589.6	X	X	X	53	Trap Net	South Cross	2018	X	N
54	BC215	322	315	541.5	X	X	X	54	Trap Net	South Cross	2018	X	N
55	BC216	304	292	444.9	X	X	X	55	Trap Net	South Cross	2018	X	N
56	BC217	350	334	726.6	X	X	X	56	Trap Net	South Cross	2018	X	N
57	BC218	329	319	648.1	X	X	X	57	Trap Net	South Cross	2018	X	N
58	BC219	321	306	555.2	X	X	X	58	Trap Net	South Cross	2018	X	N
59	BC220	274	266	336.5	X	X	X	59	Trap Net	South Cross	2018	X	N
60	BC221	326	306	584.2	X	X	X	60	Trap Net	South Cross	2018	X	N
61	BC222	300	289	443.5	X	X	X	61	Trap Net	South Cross	2018	X	N
62	BC223	318	309	566	X	X	X	62	Trap Net	South Cross	2018	X	N
63	BC224	332	324	617.4	X	X	X	63	Trap Net	South Cross	2018	X	N
64	BC225	319	310	556.6	X	X	X	64	Trap Net	South Cross	2018	X	N
65	BC226	222	218	186.7	X	X	X	66	Trap Net	South Cross	2018	X	N
66	BC227	324	314	596.4	X	X	X	67	Trap Net	South Cross	2018	X	N
67	BC228	280	268	376.7	X	X	X	68	Trap Net	South Cross	2018	X	N
68	BC229	302	290	458.1	X	X	X	69	Trap Net	South Cross	2018	X	N
69	BC230	302	293	502.8	X	X	X	70	Trap Net	South Cross	2018	X	N
70	BC231	269	260	343.6	X	X	X	71	Trap Net	South Cross	2018	X	N
71	BC232	322	312	589.6	X	X	X	72	Trap Net	South Cross	2018	X	N
72	BC233	320	313	614.4	X	X	X	73	Trap Net	South Cross	2018	X	N
73	BC234	264	256	339.7	X	X	X	74	Trap Net	South Cross	2018	X	N
74	BC235	338	326	677	X	X	X	75	Trap Net	South Cross	2018	X	N
75	BC236	324	318	612.1	X	X	X	65	Trap Net	South Cross	2018	X	N
76	BC237	338	324	646	F	X	X	X	Trap Net	South Cross	2018	8	Y
77	BC238	284	272	409.2	M	X	X	X	Trap Net	South Cross	2018	6	Y
78	BC239	270	280	380.6	F	X	X	X	Trap Net	South Cross	2018	3	Y
79	BC240	290	278	413.3	F	X	13.4	X	Trap Net	South Cross	2018	4	Y
80	BC241	310	299	497.4	X	X	X	76	Trap Net	South Cross	2018	X	N
81	BC242	330	312	626.9	X	X	X	77	Trap Net	South Cross	2018	X	N
82	BC243	363	345	815.7	X	X	X	78	Trap Net	South Cross	2018	X	N
83	BC244	331	313	626.6	X	X	X	79	Trap Net	South Cross	2018	X	N
84	BC245	335	320	637.7	X	X	X	80	Trap Net	South Cross	2018	X	N
85	BC246	345	326	653.7	X	X	X	81	Trap Net	South Cross	2018	X	N
86	BC247	310	300	535.4	X	X	X	82	Trap Net	South Cross	2018	X	N
87	BC248	339	326	655.4	X	X	X	83	Trap Net	South Cross	2018	X	N
88	BC249	300	292	474.5	X	X	X	84	Trap Net	South Cross	2018	X	N
89	BC250	326	314	621	X	X	X	85	Trap Net	South Cross	2018	X	N
90	BC251	334	326	686.1	X	X	X	86	Trap Net	South Cross	2018	X	N
91	BC252	325	312	576.8	X	X	X	87	Trap Net	South Cross	2018	X	N
92	BC253	334	320	674.3	X	X	X	88	Trap Net	South Cross	2018	X	N
93	BC254	320	310	539.7	X	X	X	89	Trap Net	South Cross	2018	X	N
94	BC255	320	310	570.5	X	X	X	90	Trap Net	South Cross	2018	X	N
95	BC256	308	300	484	X	X	X	91	Trap Net	South Cross	2018	X	N
96	BC257	290	276	473	X	X	X	92	Trap Net	South Cross	2018	X	N
97	BC258	318	302	566	X	X	X	93	Trap Net	South Cross	2018	X	N
98	BC259	320	306	558.2	X	X	X	94/95	Trap Net	South Cross	2018	X	N
99	BC260	296	308	529.9	X	X	X	96	Trap Net	South Cross	2018	X	N
100	BC261	324	312	566	X	X	X	97	Trap Net	South Cross	2018	X	N
101	BC262	296	276	428.7	X	X	X	98	Trap Net	South Cross	2018	X	N
102	BC263	284	272	390.3	X	X	X	100	Trap Net	South Cross	2018	X	N
1	BC333	307	297	X	X	X	X	140	Angled	South Cross	2018	X	N
2	BC334	295	280	X	X	X	X	141	Angled	South Cross	2018	X	N
3	BC335	357	348	X	X	X	X	143	Angled	South Cross	2018	X	N
1	BC347	300	285	X	X	X	X	157	Angled	South Cross	2018	X	N
2	BC348	308	298	X	X	X	X	158	Angled	South Cross	2018	X	N
3	BC349	352	342	X	X	X	X	159	Angled	South Cross	2018	X	N
4	BC350	308	286	X	X	X	X	161	Angled	South Cross	2018	X	N
5	BC351	305	295	X	X	X	X	162	Angled	South Cross	2018	X	N
6	BC352	332	322	X	X	X	X	163	Angled	South Cross	2018	X	N
7	BC353	350	335	664.6	X	X	X	164	Trap Net	South Cross	2018	X	N
8	BC354	326	314	566.5	X	X	X	165	Trap Net	South Cross	2018	X	N
9	BC355	293	280	419.9	X	X	X	166	Trap Net	South Cross	2018	X	N
10	BC356	282	271	375.6	X	X	X	167	Trap Net	South Cross	2018	X	N
11	BC357	337	325	603.4	X	X	X	168	Trap Net	South Cross	2018	X	N
12	BC358	312	300	527.4	X	X	X	169	Trap Net	South Cross	2018	X	N
13	BC359	309	298	454.1	X	X	X	170	Trap Net	South Cross	2018	X	N
14	BC360	322	310	588.2	X	X	X	171	Trap Net	South Cross	2018	X	N
15	BC361	313	300	521.6	X	X	X	172	Trap Net	South Cross	2018	X	N
16	BC362	325	306	519.9	X	X	X	173	Trap Net	South Cross	2018	X	N

17	BC363	306	293	448.4	X	X	X	174	Trap Net	South Cross	2018	X	N
18	BC364	275	263	349.8	X	X	X	175	Trap Net	South Cross	2018	X	N
19	BC365	323	310	584.3	X	X	X	176	Trap Net	South Cross	2018	X	N
20	BC366	288	276	415.4	X	X	X	177	Trap Net	South Cross	2018	X	N
21	BC367	287	276	402.4	X	X	X	178	Trap Net	South Cross	2018	X	N
22	BC368	352	333	757.4	X	X	X	179	Trap Net	South Cross	2018	X	N
23	BC369	320	306	558.6	X	X	X	180	Trap Net	South Cross	2018	X	N
24	BC370	335	320	631	X	X	X	181	Trap Net	South Cross	2018	X	N
25	BC371	325	315	612	X	X	X	182	Trap Net	South Cross	2018	X	N
26	BC372	330	319	644.8	X	X	X	183	Trap Net	South Cross	2018	X	N
27	BC373	356	340	692.2	X	X	X	184	Trap Net	South Cross	2018	X	N
28	BC374	365	350	913	X	X	X	185	Trap Net	South Cross	2018	X	N
29	BC375	300	286	435.6	X	X	X	186	Trap Net	South Cross	2018	X	N
30	BC376	327	310	601.2	X	X	X	187	Trap Net	South Cross	2018	X	N
31	BC377	318	304	591	X	X	X	188	Trap Net	South Cross	2018	X	N
32	BC378	315	300	573.2	X	X	X	189	Trap Net	South Cross	2018	X	N
33	BC379	358	350	748	X	X	X	190	Trap Net	South Cross	2018	X	N
34	BC380	300	290	452.2	X	X	X	191	Trap Net	South Cross	2018	X	N
35	BC381	325	305	561.2	X	X	X	192	Trap Net	South Cross	2018	X	N
36	BC382	276	265	398.3	X	X	X	193	Trap Net	South Cross	2018	X	N
37	BC383	304	198	508.1	X	X	X	194	Trap Net	South Cross	2018	X	N
38	BC384	323	310	593.8	X	X	X	195	Trap Net	South Cross	2018	X	N
39	BC385	294	282	468.2	X	X	X	196	Trap Net	South Cross	2018	X	N
40	BC386	344	330	632.7	X	X	X	197	Trap Net	South Cross	2018	X	N
41	BC387	320	310	608.2	X	X	X	198	Trap Net	South Cross	2018	X	N
42	BC388	348	332	738.2	X	X	X	199	Trap Net	South Cross	2018	X	N
43	BC389	305	290	453	X	X	X	200	Trap Net	South Cross	2018	X	N
44	BC390	370	350	844.8	X	X	X	201	Trap Net	South Cross	2018	X	N
45	BC391	336	324	667.8	X	X	X	202	Trap Net	South Cross	2018	X	N
46	BC392	308	300	472.2	X	X	X	203	Trap Net	South Cross	2018	X	N
47	BC393	306	298	465.1	X	X	X	204	Trap Net	South Cross	2018	X	N
48	BC394	310	300	492.2	X	X	X	205	Trap Net	South Cross	2018	X	N
49	BC395	320	301	560.9	X	X	X	206	Trap Net	South Cross	2018	X	N
50	BC396	361	328	786.5	X	X	X	207	Trap Net	South Cross	2018	X	N
51	BC397	344	331	712	X	X	X	208	Trap Net	South Cross	2018	X	N
52	BC398	361	351	776.2	X	X	X	209	Trap Net	South Cross	2018	X	N
53	BC399	310	300	484.6	X	X	X	210	Trap Net	South Cross	2018	X	N
54	BC400	313	301	561.3	X	X	X	211	Trap Net	South Cross	2018	X	N
55	BC401	277	265	374.5	X	X	X	212	Trap Net	South Cross	2018	X	N
56	BC402	328	315	613.6	X	X	X	213	Trap Net	South Cross	2018	X	N
57	BC403	330	320	654	X	X	X	214	Trap Net	South Cross	2018	X	N
58	BC404	325	314	571.9	X	X	X	215	Trap Net	South Cross	2018	X	N
59	BC405	288	276	407.4	X	X	X	216	Trap Net	South Cross	2018	X	N
60	BC406	315	308	508.1	X	X	X	217	Trap Net	South Cross	2018	X	N
61	BC407	306	294	490	X	X	X	218	Trap Net	South Cross	2018	X	N
62	BC408	305	298	502	X	X	X	219	Trap Net	South Cross	2018	X	N
63	BC409	255	248	285.3	X	X	X	220	Trap Net	South Cross	2018	X	N
64	BC410	306	294	492.5	X	X	X	221	Trap Net	South Cross	2018	X	N
65	BC411	348	334	730.6	X	X	X	222	Trap Net	South Cross	2018	X	N
66	BC412	329	318	613.3	X	X	X	223	Trap Net	South Cross	2018	X	N
67	BC413	372	360	866.4	X	X	X	224	Trap Net	South Cross	2018	X	N
68	BC414	335	325	703.2	X	X	X	225	Trap Net	South Cross	2018	X	N
69	BC415	324	314	523	X	X	X	226	Trap Net	South Cross	2018	X	N
70	BC416	309	299	577.6	X	X	X	227	Trap Net	South Cross	2018	X	N
71	BC417	312	302	542	X	X	X	228	Trap Net	South Cross	2018	X	N
72	BC418	322	312	348.2	X	X	X	229	Trap Net	South Cross	2018	X	N
73	BC419	292	278	395.2	X	X	X	230	Trap Net	South Cross	2018	X	N
74	BC420	304	296	453.1	X	X	X	231	Trap Net	South Cross	2018	X	N
75	BC421	308	298	542.9	X	X	X	232	Trap Net	South Cross	2018	X	N
76	BC422	290	278	467.3	X	X	X	233	Trap Net	South Cross	2018	X	N
77	BC423	327	317	604.4	X	X	X	234	Trap Net	South Cross	2018	X	N
78	BC424	350	336	738.4	X	X	X	235	Trap Net	South Cross	2018	X	N
79	BC425	312	300	548.9	X	X	X	236	Trap Net	South Cross	2018	X	N
80	BC426	336	324	652.5	X	X	X	237	Trap Net	South Cross	2018	X	N
81	BC427	258	242	630.1	X	X	X	238	Trap Net	South Cross	2018	X	N
82	BC428	310	300	489.1	X	X	X	239	Trap Net	South Cross	2018	X	N
83	BC429	296	284	468.9	X	X	X	240	Trap Net	South Cross	2018	X	N
84	BC430	350	342	724.8	X	X	X	241	Trap Net	South Cross	2018	X	N
85	BC431	272	260	362	X	X	X	242	Trap Net	South Cross	2018	X	N
86	BC432	321	310	579	X	X	X	243	Trap Net	South Cross	2018	X	N
87	BC433	320	310	568	X	X	X	244	Trap Net	South Cross	2018	X	N
88	BC434	299	288	464.7	X	X	X	245	Trap Net	South Cross	2018	X	N
89	BC435	314	300	531	X	X	X	246	Trap Net	South Cross	2018	X	N
90	BC436	325	310	582	X	X	X	247	Trap Net	South Cross	2018	X	N
91	BC437	330	320	630.6	X	X	X	248	Trap Net	South Cross	2018	X	N
92	BC438	336	328	637.2	X	X	X	249	Trap Net	South Cross	2018	X	N
93	BC439	330	314	613.2	X	X	X	250	Trap Net	South Cross	2018	X	N

94	BC440	325	310	591.2	X	X	X	251	Trap Net	South Cross	2018	X	N
95	BC441	319	310	524.4	X	X	X	252	Trap Net	South Cross	2018	X	N
96	BC442	330	314	573.2	X	X	X	253	Trap Net	South Cross	2018	X	N
97	BC443	316	306	577.2	X	X	X	254	Trap Net	South Cross	2018	X	N
98	BC444	317	307	554.6	X	X	X	255	Trap Net	South Cross	2018	X	N
99	BC445	284	274	392.2	X	X	X	256	Trap Net	South Cross	2018	X	N
100	BC446	301	290	513.2	X	X	X	257	Trap Net	South Cross	2018	X	N
101	BC447	361	340	833.7	X	X	X	258	Trap Net	South Cross	2018	X	N
102	BC448	311	300	523.2	X	X	X	259	Trap Net	South Cross	2018	X	N
103	BC449	325	314	581	X	X	X	260	Trap Net	South Cross	2018	X	N
104	BC450	316	300	529.8	X	X	X	261	Trap Net	South Cross	2018	X	N
105	BC451	308	298	504.3	X	X	X	262	Trap Net	South Cross	2018	X	N
106	BC452	325	310	607	X	X	X	263	Trap Net	South Cross	2018	X	N
107	BC453	313	298	522.3	X	X	X	264	Trap Net	South Cross	2018	X	N
108	BC454	307	296	482.3	X	X	X	265	Trap Net	South Cross	2018	X	N
109	BC455	232	222	235.4	X	X	X	266	Trap Net	South Cross	2018	X	N
110	BC456	224	218	196.4	X	X	X	267	Trap Net	South Cross	2018	X	N
111	BC457	270	257	374.7	X	X	X	268	Trap Net	South Cross	2018	X	N
112	BC458	310	300	487.8	X	X	X	269	Trap Net	South Cross	2018	X	N
113	BC459	264	258	316.2	X	X	X	270	Trap Net	South Cross	2018	X	N
114	BC460	265	259	326.2	X	X	X	271	Trap Net	South Cross	2018	X	N
115	BC461	324	310	597.8	X	X	X	272	Trap Net	South Cross	2018	X	N
116	BC462	320	310	588.2	X	X	X	63	Trap Net	South Cross	2018	X	N
117	BC463	308	299	537.4	X	X	X	273	Trap Net	South Cross	2018	X	N
118	BC464	347	332	747.2	X	X	X	274	Trap Net	South Cross	2018	X	N
119	BC465	330	318	617.2	X	X	X	275	Trap Net	South Cross	2018	X	N
120	BC466	320	312	583.2	X	X	X	276	Trap Net	South Cross	2018	X	N
121	BC467	300	289	479.9	X	X	X	277	Trap Net	South Cross	2018	X	N
122	BC468	320	292	571.9	X	X	X	278	Trap Net	South Cross	2018	X	N
123	BC469	298	290	469	X	X	X	279	Trap Net	South Cross	2018	X	N
124	BC470	357	342	818.6	X	X	X	280	Trap Net	South Cross	2018	X	N
125	BC471	320	309	544.6	X	X	X	281	Trap Net	South Cross	2018	X	N
126	BC472	310	298	526.4	X	X	X	282	Trap Net	South Cross	2018	X	N
127	BC473	324	308	588.1	X	X	X	283	Trap Net	South Cross	2018	X	N
128	BC474	287	276	408.2	X	X	X	284	Trap Net	South Cross	2018	X	N
129	BC475	301	290	548.6	X	X	X	285	Trap Net	South Cross	2018	X	N
1	BC916	318	304	X	X	X	X	547	Trap Net	South Cross	2018	X	N
2	BC917	348	330	X	X	X	X	548	Trap Net	South Cross	2018	X	N
1	BC918	312	297	439.9	X	X	X	549	Trap Net	South Cross	2018	X	N
2	BC919	310	296	537.3	X	X	X	550	Trap Net	South Cross	2018	X	N
3	BC920	328	314	670.1	X	X	X	551	Trap Net	South Cross	2018	X	N
4	BC921	322	310	549.1	X	X	X	552	Trap Net	South Cross	2018	X	N
5	BC922	293	278	427.1	X	X	X	553	Trap Net	South Cross	2018	X	N
6	BC923	335	318	619.2	X	X	X	554	Trap Net	South Cross	2018	X	N
7	BC924	332	316	674.2	X	X	X	555	Trap Net	South Cross	2018	X	N
8	BC925	338	320	655.3	X	X	X	556	Trap Net	South Cross	2018	X	N
9	BC926	362	352	918.9	X	X	X	557	Trap Net	South Cross	2018	X	N
10	BC927	343	330	719.2	X	X	X	558	Trap Net	South Cross	2018	X	N
11	BC928	312	256	529.1	X	X	X	559	Trap Net	South Cross	2018	X	N
12	BC929	318	303	570.6	X	X	X	560	Trap Net	South Cross	2018	X	N
13	BC930	308	296	482.6	X	X	X	561	Trap Net	South Cross	2018	X	N
14	BC931	320	308	600	X	X	X	562	Trap Net	South Cross	2018	X	N
15	BC932	336	320	607.5	X	X	X	563	Trap Net	South Cross	2018	X	N
16	BC933	318	304	537.3	X	X	X	564	Trap Net	South Cross	2018	X	N
17	BC934	301	289	454.2	X	X	X	565	Trap Net	South Cross	2018	X	N
18	BC935	350	340	791.1	X	X	X	566	Trap Net	South Cross	2018	X	N
19	BC936	317	304	571	X	X	X	567	Trap Net	South Cross	2018	X	N
20	BC937	332	319	655.4	X	X	X	568	Trap Net	South Cross	2018	X	N
21	BC938	275	260	315.1	X	X	X	569	Trap Net	South Cross	2018	X	N
22	BC939	360	339	816.1	X	X	X	570	Trap Net	South Cross	2018	X	N
23	BC940	309	298	513.7	X	X	X	571	Trap Net	South Cross	2018	X	N
24	BC941	310	292	464.3	X	X	X	572	Trap Net	South Cross	2018	X	N
25	BC942	318	304	505.1	X	X	X	573	Trap Net	South Cross	2018	X	N
26	BC943	320	305	606.3	X	X	X	574	Trap Net	South Cross	2018	X	N
27	BC944	325	312	584.6	X	X	X	575	Trap Net	South Cross	2018	X	N
28	BC945	312	300	544.1	X	X	X	576	Trap Net	South Cross	2018	X	N
29	BC946	242	236	256	X	X	X	577	Trap Net	South Cross	2018	X	N
30	BC947	354	340	785.5	X	X	X	578	Trap Net	South Cross	2018	X	N
31	BC948	387	380	1013.5	X	X	X	X	Trap Net	South Cross	2018	13	Y
32	BC949	314	300	564.1	X	X	X	X	Trap Net	South Cross	2018	8	Y
1	BC950	321	308	X	X	X	X	581	Angled	South Cross	2018	X	N
2	BC951	320	306	X	X	X	X	582	Angled	South Cross	2018	X	N
1	BC988	332	318	X	X	X	X	588	Trap Net	South Cross	2018	X	N
2	BC989	373	352	X	X	X	X	589	Trap Net	South Cross	2018	X	N
3	BC990	354	332	X	X	X	X	590	Trap Net	South Cross	2018	X	N
4	BC991	357	338	X	X	X	X	591	Trap Net	South Cross	2018	X	N
5	BC992	362	350	X	X	X	X	592	Trap Net	South Cross	2018	X	N

6	BC993	284	272	X	X	X	X	593	Trap Net	South Cross	2018	X	N
7	BC994	334	320	X	X	X	X	594	Trap Net	South Cross	2018	X	N
8	BC995	289	274	X	X	X	X	595	Trap Net	South Cross	2018	X	N
9	BC996	330	315	X	X	X	X	596	Trap Net	South Cross	2018	X	N
10	BC997	354	340	X	X	X	X	597	Trap Net	South Cross	2018	X	N
11	BC998	311	298	X	X	X	X	598	Trap Net	South Cross	2018	X	N
12	BC999	262	248	X	X	X	X	X	Trap Net	South Cross	2018	X	N
13	BC1000	312	292	X	X	X	X	X	Trap Net	South Cross	2018	X	N
14	BC1001	318	308	X	X	X	X	X	Trap Net	South Cross	2018	X	N
15	BC1002	315	304	X	X	X	X	X	Trap Net	South Cross	2018	X	N
16	BC1003	256	248	X	X	X	X	X	Trap Net	South Cross	2018	X	N
17	BC1004	306	294	X	X	X	X	X	Trap Net	South Cross	2018	X	N
18	BC1005	322	314	X	X	X	X	X	Trap Net	South Cross	2018	X	N
19	BC1006	310	300	X	X	X	X	X	Trap Net	South Cross	2018	X	N
20	BC1007	296	282	X	X	X	X	X	Trap Net	South Cross	2018	X	N
21	BC1008	332	314	X	X	X	X	X	Trap Net	South Cross	2018	X	N
22	BC1009	292	278	X	X	X	X	X	Trap Net	South Cross	2018	X	N
23	BC1010	290	278	404.8	F	2.6	2.4	X	Trap Net	South Cross	2018	4	Y
24	BC1011	378	360	894.6	F	33.5	63	X	Trap Net	South Cross	2018	10	Y
25	BC1012	330	316	587.8	M	4.2	0.9	X	Trap Net	South Cross	2018	6	Y
26	BC1013	348	338	687.5	M	4	1.6	X	Trap Net	South Cross	2018	7	Y
27	BC1014	316	302	535.4	F	4.1	6.2	X	Trap Net	South Cross	2018	5	Y
28	BC1015	304	293	479.3	F	4.5	3.7	X	Trap Net	South Cross	2018	5	Y
29	BC1016	325	312	513.5	M	2.7	1.1	X	Trap Net	South Cross	2018	5	Y
30	BC1017	309	290	548.7	M	5.6	1.3	X	Trap Net	South Cross	2018	6	Y
31	BC1018	319	305	552	F	3.7	3.3	X	Trap Net	South Cross	2018	6	Y
32	BC1019	338	328	649.3	M	8.3	0.7	X	Trap Net	South Cross	2018	5	Y
33	BC1020	372	350	872.1	M	7	1.5	X	Trap Net	South Cross	2018	10	Y
34	BC1021	368	350	778.7	F	7.8	4.8	X	Trap Net	South Cross	2018	12	Y
35	BC1022	325	302	606.9	F	4.6	8.4	X	Trap Net	South Cross	2018	5	Y
36	BC1023	314	300	520.9	M	3.3	0.6	X	Trap Net	South Cross	2018	5	Y
37	BC1024	322	310	562.1	F	3.8	5.5	X	Trap Net	South Cross	2018	5	Y
38	BC1025	322	312	561.9	M	4.1	1.3	X	Trap Net	South Cross	2018	6	Y
39	BC1026	326	312	555.1	F	5.5	7.7	X	Trap Net	South Cross	2018	6	Y
40	BC1027	358	348	886.1	F	1.2	6.3	X	Trap Net	South Cross	2018	8	Y
41	BC1028	361	342	796.8	M	5.9	1.3	X	Trap Net	South Cross	2018	11	Y
42	BC1029	314	300	555.2	M	5.3	0.2	X	Trap Net	South Cross	2018	6	Y
43	BC1030	33	30	0.3	U	X	X	X	Trap Net	South Cross	2018	X	N
44	BC1031	336	320	737.6	M	5.8	1.2	X	Trap Net	South Cross	2018	7	Y
45	BC1032	296	284	433.4	M	3.8	0.3	X	Trap Net	South Cross	2018	6	Y
46	BC1033	284	270	382.3	F	2.9	2.9	X	Trap Net	South Cross	2018	4	Y
47	BC1034	114	111	20.6	U	X	X	X	Trap Net	South Cross	2018	3	Y
48	BC1035	120	114	23.5	U	X	X	X	Trap Net	South Cross	2018	2	Y
49	BC1036	106	100	14.1	U	X	X	X	Trap Net	South Cross	2018	2	Y
1	BC1043	313	294	543.5	X	X	X	X	Trap Net	South Cross	2018	2	N
2	BC1044	318	307	531.6	X	X	X	X	Trap Net	South Cross	2018	2	N
3	BC1045	338	325	655.9	X	X	X	X	Trap Net	South Cross	2018	2	N
4	BC1046	324	318	647.6	X	X	X	X	Trap Net	South Cross	2018	2	N
5	BC1047	324	312	552.7	X	X	X	X	Trap Net	South Cross	2018	2	N
6	BC1048	315	300	532.1	X	X	X	X	Trap Net	South Cross	2018	1	N
7	BC1049	316	302	526.5	X	X	X	X	Trap Net	South Cross	2018	1	N
8	BC1050	306	292	442.7	X	X	X	X	Trap Net	South Cross	2018	1	N
9	BC1051	346	332	719.7	F	5.1	4.2	X	Trap Net	South Cross	2018	5	Y
10	BC1052	115	111	21.7	U			X	Trap Net	South Cross	2018	2	Y
11	BC1053	362	344	801.3	M	6.1	1.7	X	Trap Net	South Cross	2018	9	Y
12	BC1054	346	332	701.5	F	6	15.7	X	Trap Net	South Cross	2018	8	Y
13	BC1055	362	344	784.8	F	6.5	8.4	X	Trap Net	South Cross	2018	7	Y
14	BC1056	364	348	814.9	M	5.6	1.4	X	Trap Net	South Cross	2018	8	Y
15	BC1057	291	284	431.4	F	3.4	2.5	X	Trap Net	South Cross	2018	4	Y
16	BC1058	270	254	320.3	F	1.9	2.2	X	Trap Net	South Cross	2018	7	Y
17	BC1059	233	221	196.5	F	1	0.9	X	Trap Net	South Cross	2018	3	Y
18	BC1060	112	106	19.3	U	X	X	X	Trap Net	South Cross	2018	2	Y
1	BC99	292	282	389.8	F	5.3	17	X	Electrofished	Star	2018	5	Y
2	BC100	300	286	434.8	F	4.1	16.7	X	Electrofished	Star	2018	5	Y
3	BC101	299	288	431.5	M	5.4	0.9	X	Electrofished	Star	2018	5	Y
4	BC102	304	292	440.9	M	4.1	1.5	X	Electrofished	Star	2018	5	Y
5	BC103	216	208	157.7	F	1.7	2.4	X	Electrofished	Star	2018	3	Y
6	BC104	290	280	414.3	M	30	1.2	X	Electrofished	Star	2018	5	Y
7	BC105	321	308	524.3	F	4.5	13	X	Electrofished	Star	2018	6	Y
8	BC106	297	287	430.2	F	4.1	9.9	X	Electrofished	Star	2018	5	Y
9	BC107	214	206	152.4	F	1.5	20	X	Electrofished	Star	2018	3	Y
10	BC108	220	214	165.6	F	1.4	0.8	X	Electrofished	Star	2018	3	Y
11	BC109	230	206	186	F	1.1	3.9	X	Electrofished	Star	2018	X	Y
12	BC110	220	210	159.5	M	1.1	0.3	X	Electrofished	Star	2018	3	Y
13	BC111	214	206	151.7	M	1.4	0.2	X	Electrofished	Star	2018	3	Y
14	BC112	246	238	255.8	F	2.1	8.6	X	Electrofished	Star	2018	3	Y
15	BC113	238	228	211.7	M	2.1	0.5	X	Electrofished	Star	2018	3	Y

16	BC114	221	211	172.7	M	2.1	0.1	X	Electrofished	Star	2018	3	Y
17	BC115	216	208	150.3	M	1	0.3	X	Electrofished	Star	2018	3	Y
18	BC116	254	245	263.9	M	1.3	0.4	X	Electrofished	Star	2018	3	Y
19	BC117	208	200	141.1	M	1.4	0.2	X	Electrofished	Star	2018	3	Y
20	BC118	209	200	139.1	F	1.4	6.9	X	Electrofished	Star	2018	3	Y
21	BC119	240	232	213.2	F	1.9	6.8	X	Electrofished	Star	2018	3	Y
22	BC120	232	224	197.7	M	2.1	0.2	X	Electrofished	Star	2018	3	Y
23	BC121	214	204	152	F	1.3	2.7	X	Electrofished	Star	2018	3	Y
24	BC122	192	182	103.5	M	0.8	0.2	X	Electrofished	Star	2018	3	Y
25	BC123	216	208	156.1	M	1.8	0.4	X	Electrofished	Star	2018	3	Y
26	BC124	208	198	140.2	F	1.8	2.1	X	Electrofished	Star	2018	3	Y
27	BC125	211	202	144.5	F	1.6	2.1	X	Electrofished	Star	2018	3	Y
28	BC126	230	220	183.2	F	1.4	1.4	X	Electrofished	Star	2018	3	Y
29	BC127	210	200	149.5	M	1	0.2	X	Electrofished	Star	2018	3	Y
30	BC128	232	220	192.2	M	1.7	0.2	X	Electrofished	Star	2018	3	Y
31	BC129	213	206	147.5	M	1.6	0.3	X	Electrofished	Star	2018	3	Y
32	BC130	226	216	176.6	M	1.6	0.5	X	Electrofished	Star	2018	3	Y
33	BC131	203	192	131	M	1.3	0.2	X	Electrofished	Star	2018	3	Y
34	BC132	220	208	161.3	M	1	0.2	X	Electrofished	Star	2018	3	Y
35	BC133	215	208	156.9	F	1.2	10.3	X	Electrofished	Star	2018	X	N
36	BC134	218	208	158.2	M	1.2	0.2	X	Electrofished	Star	2018	3	Y
37	BC135	212	202	134.2	M	1.1	0.2	X	Electrofished	Star	2018	3	Y
38	BC136	192	184	104.9	M	1		X	Electrofished	Star	2018	3	Y
39	BC137	198	190	113.1	F	1.2	1.3	X	Electrofished	Star	2018	X	N
40	BC138	122	119	25.5	F	X	X	X	Electrofished	Star	2018	2	Y
41	BC139	128	120	28.7	F	X	X	X	Electrofished	Star	2018	1	Y
42	BC140	130	124	24	U	X	X	X	Electrofished	Star	2018	2	Y
43	BC141	132	126	28.7	M	X	X	X	Electrofished	Star	2018	2	Y
44	BC142	129	122	31.5	M	X	X	X	Electrofished	Star	2018	1	Y
45	BC143	134	126	34.9	M	X	X	X	Electrofished	Star	2018	1	Y
46	BC144	64	60	3.1	U	X	X	X	Electrofished	Star	2018	1	Y
47	BC145	132	126	31.6	F	X	X	X	Electrofished	Star	2018	1	Y
48	BC146	74	70	5.3	U	X	X	X	Electrofished	Star	2018	1	Y
49	BC147	84	80	6.5	U	X	X	X	Electrofished	Star	2018	1	Y
1	BC1061	316	302	X	X	X	X	X	Trap Net	Star	2018	X	N
1	BC1692	372	360	858.8	F	8.9	22.7	X	Trap Net	BWS	2019	7	Y
2	BC1693	360	348	757.3	M	4.4	0.5	X	Trap Net	BWS	2019	6	Y
3	BC1694	370	354	743.9	F	5.8	7.4	X	Trap Net	BWS	2019	7	Y
4	BC1695	380	366	956.8	F	7	11.1	X	Trap Net	BWS	2019	8	Y
5	BC1696	366	352	856.4	F	10.8	16.2	X	Trap Net	BWS	2019	8	Y
6	BC1697	365	350	852.1	F	6.5	24.9	X	Trap Net	BWS	2019	8	Y
7	BC1698	260	248	285	M	1.8	0.3	X	Trap Net	BWS	2019	3	Y
8	BC1699	111	106	18.7	F	X	X	X	Trap Net	BWS	2019	2	Y
9	BC1700	112	107	20.3	M	X	X	X	Trap Net	BWS	2019	2	Y
10	BC1701	130	122	33.7	U	X	X	X	Trap Net	BWS	2019	2	Y
11	BC1702	104	100	14.1	U	X	X	X	Trap Net	BWS	2019	2	Y
12	BC1703	106	100	17.6	U	X	X	X	Trap Net	BWS	2019	2	Y
13	BC1704	290	277	373.9	M	2.2	1.2	X	Angled	BWS	2019	4	Y
14	BC1705	331	320	592.4	M	2.6	0.7	X	Trap Net	BWS	2019	6	Y
15	BC1706	356	342	753.6	F	5.8	5.5	X	Trap Net	BWS	2019	7	Y
16	BC1707	309	298	490.8	M	2.7	0.6	X	Trap Net	BWS	2019	4	Y
17	BC1708	344	332	638.2	M	3.2	0.5	X	Trap Net	BWS	2019	7	Y
18	BC1709	332	316	539.3	M	3.3	0.9	X	Trap Net	BWS	2019	6	Y
19	BC1710	245	232	266	M	2.3	0.3	X	Trap Net	BWS	2019	3	Y
20	BC1711	254	242	277.1	M	2.5	0.5	X	Trap Net	BWS	2019	3	Y
21	BC1712	267	253	323.3	M	2.2	0.4	X	Trap Net	BWS	2019	4	Y
22	BC1713	341	323	621.2	M	3.9	0.4	X	Trap Net	BWS	2019	7	Y
23	BC1714	278	268	384.9	M	3.7	0.5	X	Trap Net	BWS	2019	3	Y
24	BC1715	110	100	21	F	X	X	X	Trap Net	BWS	2019	2	Y
25	BC1716	325	312	600.6	F	4.7	6.8	X	Trap Net	BWS	2019	8	Y
26	BC1717	362	349	751.7	F	7.3	8.4	X	Trap Net	BWS	2019	8	Y
27	BC1718	357	342	793	F	6.4	6.7	X	Trap Net	BWS	2019	6	Y
28	BC1719	346	333	699.9	F	5.7	5.7	X	Trap Net	BWS	2019	7	Y
29	BC1720	368	352	776.8	F	7.1	8.4	X	Trap Net	BWS	2019	8	Y
30	BC1721	370	352	849.9	M	7.1	1	X	Trap Net	BWS	2019	8	Y
31	BC1722	375	360	839.4	F	10.1	11.2	X	Trap Net	BWS	2019	7	Y
32	BC1723	364	349	792.2	F	4.6	7.6	X	Trap Net	BWS	2019	7	Y
33	BC1724	345	328	711	M	5.9	1.5	X	Trap Net	BWS	2019	6	Y
34	BC1725	342	328	650.5	F	5.1	6	X	Trap Net	BWS	2019	7	Y
35	BC1726	382	370	987.7	F	8.9	8.8	X	Trap Net	BWS	2019	8	Y
36	BC1727	332	316	635.5	F	7	7.4	X	Trap Net	BWS	2019	6	Y
11	BC1189	321	310	612	M	10.1	5.2	X	Electrofished	Caddy	2019	5	Y
12	BC1190	320	306	603.1	F	14.7	25.2	X	Electrofished	Caddy	2019	6	Y
13	BC1191	248	240	271.4	F	5.8	10.1	X	Electrofished	Caddy	2019	3	Y
14	BC1192	244	232	220	M	2.6	1.1	X	Electrofished	Caddy	2019	3	Y
15	BC1193	244	232	238.2	F	3.6	8.4	X	Electrofished	Caddy	2019	3	Y
16	BC1194	286	272	426	F	4.6	15.4	X	Electrofished	Caddy	2019	4	Y

17	BC1195	238	225	225.8	M	3	1.7	X	Electrofished	Caddy	2019	4	Y
18	BC1196	321	306	626.7	F	13.3	41.7	X	Electrofished	Caddy	2019	7	Y
19	BC1197	252	244	262.9	M	2.6	1.3	X	Electrofished	Caddy	2019	4	Y
20	BC1198	370	348	835.2	F	14.6	47.4	X	Electrofished	Caddy	2019	11	Y
21	BC1199	247	238	255.3	F	2.3	5.5	X	Electrofished	Caddy	2019	4	Y
22	BC1200	344	324	710	F	16.6	42.9	X	Electrofished	Caddy	2019	8	Y
23	BC1201	248	236	257.1	F	3.5	7.4	X	Electrofished	Caddy	2019	X	Y
24	BC1202	355	338	760	M	8.5	2.3	X	Electrofished	Caddy	2019	10	Y
25	BC1203	266	256	310.4	M	4	1.8	X	Electrofished	Caddy	2019	4	Y
26	BC1204	243	234	222.1	F	4.2	6.7	X	Electrofished	Caddy	2019	5	Y
27	BC1205	364	344	811.3	M	5.7	5.3	X	Electrofished	Caddy	2019	12	Y
28	BC1206	330	316	661.4	F	13.6	38	X	Electrofished	Caddy	2019	8	Y
29	BC1207	358	331	802.9	F	15	51.2	X	Electrofished	Caddy	2019	12	Y
30	BC1208	290	275	375.7	F	X	21.2	X	Electrofished	Caddy	2019	9	Y
31	BC1209	357	339	758.9	F	19.4	57.4	X	Electrofished	Caddy	2019	12	Y
32	BC1210	349	322	700.4	F	15	38.8	X	Electrofished	Caddy	2019	12	Y
33	BC1211	373	352	821.2	M	11.5	3.8	X	Electrofished	Caddy	2019	12	Y
34	BC1212	324	308	630.2	F	12	37.4	X	Electrofished	Caddy	2019	8	Y
35	BC1213	355	337	805.1	F	21	43	X	Electrofished	Caddy	2019	13	Y
36	BC1214	339	320	690.2	F	13.2	32	X	Electrofished	Caddy	2019	14	Y
37	BC1215	254	244	290.4	F	5.5	19.5	X	Electrofished	Caddy	2019	5	Y
38	BC1216	342	329	712.6	F	17.2	45.1	X	Electrofished	Caddy	2019	14	Y
39	BC1217	334	314	708.2	F	14.5	42.7	X	Electrofished	Caddy	2019	10	Y
40	BC1218	359	340	767.8	F	13.1	54.9	X	Electrofished	Caddy	2019	12	Y
41	BC1219	247	240	248.1	M	2.1	2.1	X	Electrofished	Caddy	2019	4	Y
42	BC1220	248	234	261.4	F	4.4	10.2	X	Electrofished	Caddy	2019	4	Y
43	BC1221	319	300	562.5	M	6.8	4.7	X	Electrofished	Caddy	2019	8	Y
44	BC1222	240	232	231.5	F	5.1	9.2	X	Electrofished	Caddy	2019	4	Y
45	BC1223	147	138	45	M	X	X	X	Electrofished	Caddy	2019	2	Y
46	BC1224	75	70	5.4		X	X	X	Electrofished	Caddy	2019	2	Y
47	BC1225	73	68	5.1		X	X	X	Electrofished	Caddy	2019	2	Y
1	BC1256	343	330	736.2	X	X	X	635	Electrofished	Caddy	2019	X	N
2	BC1257	351	326	783.2	X	X	X	636	Electrofished	Caddy	2019	X	N
3	BC1258	324	306	632.2	F	13	49	X	Electrofished	Caddy	2019	10	Y
4	BC1259	328	308	622.1	X	X	X	637	Electrofished	Caddy	2019	X	N
5	BC1260	354	339	850.1	X	X	X	638	Electrofished	Caddy	2019	X	N
6	BC1261	345	324	767.3	X	X	X	639	Electrofished	Caddy	2019	X	N
7	BC1262	312	294	576.7	F	11.1	39.9	X	Electrofished	Caddy	2019	7	Y
8	BC1263	355	332	793.8	X	X	X	640	Electrofished	Caddy	2019	X	N
9	BC1264	350	330	763.2	X	X	X	641	Electrofished	Caddy	2019	X	N
10	BC1265	355	338	808.1	X	X	X	642	Electrofished	Caddy	2019	X	N
11	BC1266	276	259	377.6	M	3.8	1.7	X	Electrofished	Caddy	2019	4	Y
12	BC1267	333	320	689.3	F	15.3	58.5	X	Electrofished	Caddy	2019	10	Y
13	BC1268	326	310	653.3	X	X	X	651	Electrofished	Caddy	2019	X	N
14	BC1269	312	300	583.7	F	12.4	40.9	X	Electrofished	Caddy	2019	6	Y
15	BC1270	342	330	741.5	X	X	X	652	Electrofished	Caddy	2019	X	N
16	BC1271	322	309	615.3	X	X	X	653	Electrofished	Caddy	2019	X	N
17	BC1272	320	310	587.3	X	X	X	654	Electrofished	Caddy	2019	X	N
18	BC1273	282	278	425.1	F	7.4	22.5	X	Electrofished	Caddy	2019	4	Y
19	BC1274	311	292	545.6	F	10.5	33.5	X	Electrofished	Caddy	2019	6	Y
20	BC1275	286	275	432.5	F	8.8	24.5	X	Electrofished	Caddy	2019	4	Y
21	BC1276	244	233	246.3	X	X	X	655	Electrofished	Caddy	2019	X	N
22	BC1277	232	220	217	X	X	X	657	Electrofished	Caddy	2019	X	N
23	BC1278	245	232	248	X	X	X	658	Electrofished	Caddy	2019	X	N
24	BC1279	250	240	280.1	X	X	X	659	Electrofished	Caddy	2019	X	N
25	BC1280	306	290	512.7	F	9.7	30	X	Electrofished	Caddy	2019	5	Y
26	BC1281	244	236	264.5	X	X	X	660	Electrofished	Caddy	2019	X	N
27	BC1282	138	130	33.3	F	X	X	X	Electrofished	Caddy	2019	3	Y
28	BC1283	75	70	5.2	X	X	X	X	Electrofished	Caddy	2019	1	Y
29	BC1284	62	58	2.9	X	X	X	X	Electrofished	Caddy	2019	1	Y
30	BC1285	77	72	5.4	X	X	X	X	Electrofished	Caddy	2019	1	Y
31	BC1286	72	68	3.5	X	X	X	X	Electrofished	Caddy	2019	1	Y
32	BC1287	70	68	3.2	X	X	X	X	Electrofished	Caddy	2019	1	Y
33	BC1288	62	60	2.2	X	X	X	X	Electrofished	Caddy	2019	1	Y
34	BC1289	77	74	5.6	X	X	X	X	Electrofished	Caddy	2019	1	Y
35	BC1290	68	64	3.9	X	X	X	X	Electrofished	Caddy	2019	1	Y
36	BC1291	70	67	3.4	X	X	X	X	Electrofished	Caddy	2019	1	Y
37	BC1292	74	72	4.4	X	X	X	X	Electrofished	Caddy	2019	1	Y
38	BC1293	71	66	4.2	X	X	X	X	Electrofished	Caddy	2019	1	Y
39	BC1294	118	110	19.5	X	X	X	X	Electrofished	Caddy	2019	2	Y
40	BC1295	66	64	2.8	X	X	X	X	Electrofished	Caddy	2019	1	Y
41	BC1296	136	126	31	X	X	X	X	Electrofished	Caddy	2019	2	Y
1	BC1297	315	294	602.1	X	X	X	634	Electrofished	Caddy	2019	X	N
2	BC1298	158	150	50.8	M	1	X	X	Electrofished	Caddy	2019	3	Y
3	BC1299	130	121	27.5	M	0.4	X	X	Electrofished	Caddy	2019	3	Y
4	BC1300	67	62	4.3	U	X	X	X	Electrofished	Caddy	2019	1	Y
5	BC1301	77	72	6.2	U	X	X	X	Electrofished	Caddy	2019	1	Y

6	BC1302	80	74	6.3	U	X	X	X	Electrofished	Caddy	2019	1	Y
7	BC1303	67	62	3.4	U	X	X	X	Electrofished	Caddy	2019	1	Y
1	BC1304	142	136	38.2	X	X	X	X	Electrofished	Caddy	2019	X	N
2	BC1305	78	76	5.7	X	X	X	X	Electrofished	Caddy	2019	X	N
3	BC1306	70	66	3.3	X	X	X	X	Electrofished	Caddy	2019	X	N
4	BC1307	74	71	5.1	X	X	X	X	Electrofished	Caddy	2019	X	N
5	BC1308	140	135	35.7	X	X	X	X	Electrofished	Caddy	2019	X	N
6	BC1309	72	68	2.7	X	X	X	X	Electrofished	Caddy	2019	X	N
7	BC1310	78	76	6.2	X	X	X	X	Electrofished	Caddy	2019	X	N
8	BC1311	86	83	5.6	X	X	X	X	Electrofished	Caddy	2019	X	N
9	BC1312	142	138	40.9	X	X	X	X	Electrofished	Caddy	2019	X	N
10	BC1313	139	133	37.2	X	X	X	X	Electrofished	Caddy	2019	X	N
11	BC1314	85	78	6.7	X	X	X	X	Electrofished	Caddy	2019	X	N
12	BC1315	79	77	6	X	X	X	X	Electrofished	Caddy	2019	X	N
13	BC1316	136	130	32.3	X	X	X	X	Electrofished	Caddy	2019	X	N
14	BC1317	73	70	4.4	X	X	X	X	Electrofished	Caddy	2019	X	N
15	BC1318	143	138	39.3	X	X	X	X	Electrofished	Caddy	2019	X	N
16	BC1319	152	147	46.1	X	X	X	X	Electrofished	Caddy	2019	X	N
17	BC1320	71	67	2.5	X	X	X	X	Electrofished	Caddy	2019	X	N
18	BC1321	76	71	4.4	X	X	X	X	Electrofished	Caddy	2019	X	N
19	BC1322	70	67	3.7	X	X	X	X	Electrofished	Caddy	2019	X	N
20	BC1323	67	65	4.3	X	X	X	X	Electrofished	Caddy	2019	X	N
21	BC1324	86	82	7.5	X	X	X	X	Electrofished	Caddy	2019	X	N
22	BC1325	75	71	5.7	X	X	X	X	Electrofished	Caddy	2019	X	N
23	BC1326	76	73	6.3	X	X	X	X	Electrofished	Caddy	2019	X	N
24	BC1327	128	122	25.7	X	X	X	X	Electrofished	Caddy	2019	X	N
25	BC1328	135	131	30.7	X	X	X	X	Electrofished	Caddy	2019	X	N
26	BC1329	132	127	30.5	X	X	X	X	Electrofished	Caddy	2019	X	N
27	BC1330	66	64	3.8	X	X	X	X	Electrofished	Caddy	2019	X	N
28	BC1331	70	68	3.5	X	X	X	X	Electrofished	Caddy	2019	X	N
29	BC1332	82	78	7.3	X	X	X	X	Electrofished	Caddy	2019	X	N
30	BC1333	140	133	32.3	X	X	X	X	Electrofished	Caddy	2019	X	N
31	BC1334	120	112	20.6	X	X	X	X	Electrofished	Caddy	2019	X	N
32	BC1335	156	150	43.4	X	X	X	X	Electrofished	Caddy	2019	X	N
33	BC1336	142	136	38.2	X	X	X	X	Electrofished	Caddy	2019	X	N
34	BC1337	345	X	766.3	X	X	X	661	Electrofished	Caddy	2019	X	N
35	BC1338	320	304	619.7	X	X	X	662	Electrofished	Caddy	2019	X	N
36	BC1339	326	310	594.4	X	X	X	663	Electrofished	Caddy	2019	X	N
37	BC1340	136	129	34.1	X	X	X	X	Electrofished	Caddy	2019	X	N
38	BC1341	139	133	36.6	X	X	X	X	Electrofished	Caddy	2019	X	N
39	BC1342	362	347	709.3	X	X	X	664	Electrofished	Caddy	2019	X	N
40	BC1343	343	330	762.1	X	X	X	665	Electrofished	Caddy	2019	X	N
41	BC1344	262	251	290.7	X	X	X	666	Electrofished	Caddy	2019	X	N
42	BC1345	246	238	259.4	X	X	X	667	Electrofished	Caddy	2019	X	N
43	BC1346	140	136	39.1	X	X	X	X	Electrofished	Caddy	2019	X	N
44	BC1347	315	300	581.2	X	X	X	668	Electrofished	Caddy	2019	X	N
45	BC1348	81	78	6	X	X	X	X	Electrofished	Caddy	2019	X	N
46	BC1349	333	316	639.2	X	X	X	669	Electrofished	Caddy	2019	X	N
47	BC1350	68	X	5.4	X	X	X	X	Electrofished	Caddy	2019	X	N
48	BC1351	326	310	661.8	X	X	X	670	Electrofished	Caddy	2019	X	N
49	BC1352	71	67	4.6	X	X	X	X	Electrofished	Caddy	2019	X	N
50	BC1353	291	276	408.7	X	X	X	671	Electrofished	Caddy	2019	X	N
51	BC1354	120	114	23.3	X	X	X	X	Electrofished	Caddy	2019	X	N
52	BC1355	349	301	795.3	X	X	X	672	Electrofished	Caddy	2019	X	N
53	BC1356	317	296	593.4	X	X	X	673	Electrofished	Caddy	2019	X	N
54	BC1357	294	281	457.6	X	X	X	674	Electrofished	Caddy	2019	X	N
55	BC1358	226	218	176.5	X	X	X	675	Electrofished	Caddy	2019	X	N
56	BC1359	328	312	625.3	X	X	X	676	Electrofished	Caddy	2019	X	N
1	BC1362	71	67	3.4	X	X	X	X	Electrofished	Caddy	2019	X	Y
2	BC1363	69	64	2.9	X	X	X	X	Electrofished	Caddy	2019	X	Y
3	BC1364	66	62	3.6	X	X	X	X	Electrofished	Caddy	2019	X	Y
1	BC1365	78	72	6.2	X	X	X	X	Electrofished	Caddy	2019	X	Y
2	BC1366	145	138	42.5	X	X	X	X	Electrofished	Caddy	2019	X	Y
3	BC1367	132	122	26.7	X	X	X	X	Electrofished	Caddy	2019	X	Y
4	BC1368	152	144	49.6	X	X	X	X	Electrofished	Caddy	2019	X	Y
5	BC1369	121	116	24.6	X	X	X	X	Electrofished	Caddy	2019	X	Y
6	BC1370	79	74	6.7	X	X	X	X	Electrofished	Caddy	2019	X	Y
7	BC1371	68	63	5.5	X	X	X	X	Electrofished	Caddy	2019	X	Y
8	BC1372	68	65	4.4	X	X	X	X	Electrofished	Caddy	2019	X	Y
9	BC1373	150	141	44.2	X	X	X	X	Electrofished	Caddy	2019	X	Y
10	BC1374	83	76	8.7	X	X	X	X	Electrofished	Caddy	2019	X	Y
11	BC1375	125	108	27.5	X	X	X	X	Electrofished	Caddy	2019	X	Y
12	BC1376	74	68	7.1	X	X	X	X	Electrofished	Caddy	2019	X	Y
13	BC1377	75	70	7.4	X	X	X	X	Electrofished	Caddy	2019	X	Y
14	BC1378	79	72	8.5	X	X	X	X	Electrofished	Caddy	2019	X	Y
15	BC1379	71	68	6.6	X	X	X	X	Electrofished	Caddy	2019	X	Y
16	BC1380	74	70	7.1	X	X	X	X	Electrofished	Caddy	2019	X	Y

17	BC1381	75	72	7.3	X	X	X	X	Electrofished	Caddy	2019	X	Y
18	BC1382	68	64	6.1	X	X	X	X	Electrofished	Caddy	2019	X	Y
19	BC1383	64	60	5.8	X	X	X	X	Electrofished	Caddy	2019	X	Y
20	BC1384	61	58	4.3	X	X	X	X	Electrofished	Caddy	2019	X	Y
21	BC1385	60	58	3.8	X	X	X	X	Electrofished	Caddy	2019	X	Y
22	BC1386	73	68	4.5	X	X	X	X	Electrofished	Caddy	2019	X	Y
23	BC1387	151	146	49.4	X	X	X	X	Electrofished	Caddy	2019	X	Y
24	BC1388	147	138	41.8	X	X	X	X	Electrofished	Caddy	2019	X	Y
25	BC1389	77	74	5.6	X	X	X	X	Electrofished	Caddy	2019	X	Y
26	BC1390	144	137	42.2	X	X	X	X	Electrofished	Caddy	2019	X	Y
27	BC1391	139	130	35.3	X	X	X	X	Electrofished	Caddy	2019	X	Y
28	BC1392	76	72	6.5	X	X	X	X	Electrofished	Caddy	2019	X	Y
29	BC1393	77	72	6.4	X	X	X	X	Electrofished	Caddy	2019	X	Y
30	BC1394	114	109	21.5	X	X	X	X	Electrofished	Caddy	2019	X	Y
31	BC1395	140	132	36.5	X	X	X	X	Electrofished	Caddy	2019	X	Y
32	BC1396	135	128	35.3	X	X	X	X	Electrofished	Caddy	2019	X	Y
33	BC1397	74	70	7.7	X	X	X	X	Electrofished	Caddy	2019	X	Y
34	BC1398	70	65	6.8	X	X	X	X	Electrofished	Caddy	2019	X	Y
35	BC1399	71	66	5.6	X	X	X	X	Electrofished	Caddy	2019	X	Y
36	BC1400	79	74	7.3	X	X	X	X	Electrofished	Caddy	2019	X	Y
37	BC1401	74	70	6.6	X	X	X	X	Electrofished	Caddy	2019	X	Y
38	BC1402	321	303	598.8	X	X	X	677	Electrofished	Caddy	2019	X	N
39	BC1403	65	62	4.4	X	X	X	X	Electrofished	Caddy	2019	X	Y
40	BC1404	73	66	5.2	X	X	X	X	Electrofished	Caddy	2019	X	Y
41	BC1405	71	66	5.3	X	X	X	X	Electrofished	Caddy	2019	X	Y
42	BC1406	79	75	6.5	X	X	X	X	Electrofished	Caddy	2019	X	Y
43	BC1407	53	50	1.2	X	X	X	X	Electrofished	Caddy	2019	X	Y
44	BC1408	76	71	4.1	X	X	X	X	Electrofished	Caddy	2019	X	Y
45	BC1409	78	64	4.9	X	X	X	X	Electrofished	Caddy	2019	X	Y
46	BC1410	86	80	5.4	X	X	X	X	Electrofished	Caddy	2019	X	Y
47	BC1411	74	70	4.8	X	X	X	X	Electrofished	Caddy	2019	X	Y
48	BC1412	73	68	4.3	X	X	X	X	Electrofished	Caddy	2019	X	Y
49	BC1413	73	70	4.1	X	X	X	X	Electrofished	Caddy	2019	X	Y
50	BC1414	75	61	4.6	X	X	X	X	Electrofished	Caddy	2019	X	Y
51	BC1415	65	61	3.8	X	X	X	X	Electrofished	Caddy	2019	X	Y
52	BC1416	75	70	5.4	X	X	X	X	Electrofished	Caddy	2019	X	Y
53	BC1417	68	64	5.5	X	X	X	X	Electrofished	Caddy	2019	X	Y
54	BC1418	83	76	7.4	X	X	X	X	Electrofished	Caddy	2019	X	Y
55	BC1419	72	68	6.2	X	X	X	X	Electrofished	Caddy	2019	X	Y
56	BC1420	72	66	5.8	X	X	X	X	Electrofished	Caddy	2019	X	Y
57	BC1421	69	64	6	X	X	X	X	Electrofished	Caddy	2019	X	Y
58	BC1422	74	70	5.4	X	X	X	X	Electrofished	Caddy	2019	X	Y
59	BC1423	74	70	5.3	X	X	X	X	Electrofished	Caddy	2019	X	Y
60	BC1424	75	70	7.3	X	X	X	X	Electrofished	Caddy	2019	X	Y
61	BC1425	79	75	7.6	X	X	X	X	Electrofished	Caddy	2019	X	Y
62	BC1426	78	74	6.8	X	X	X	X	Electrofished	Caddy	2019	X	Y
63	BC1427	68	64	5.5	X	X	X	X	Electrofished	Caddy	2019	X	Y
64	BC1428	76	72	7.2	X	X	X	X	Electrofished	Caddy	2019	X	Y
65	BC1429	77	73	6.4	X	X	X	X	Electrofished	Caddy	2019	X	Y
1	BC1482	146	138	40.1	X	X	X	X	Electrofished	Caddy	2019	X	N
2	BC1483	142	138	39.2	X	X	X	X	Electrofished	Caddy	2019	X	N
3	BC1484	77	72	5.7	X	X	X	X	Electrofished	Caddy	2019	X	N
4	BC1485	70	68	4.7	X	X	X	X	Electrofished	Caddy	2019	X	N
5	BC1486	72	69	4.9	X	X	X	X	Electrofished	Caddy	2019	X	N
6	BC1487	354	340	861.4	M	X	X	683	Electrofished	Caddy	2019	X	N
7	BC1488	332	318	612.2	M	X	X	684	Electrofished	Caddy	2019	X	N
8	BC1489	332	313	612.3	M	X	X	685	Electrofished	Caddy	2019	X	N
9	BC1490	336	316	678.6	M	X	X	686	Electrofished	Caddy	2019	X	N
10	BC1491	356	340	767.5	M	X	X	687	Electrofished	Caddy	2019	X	N
1	BC1540	336	318	647.7	X	X	X	688	Electrofished	Caddy	2019	X	N
2	BC1541	332	318	648.2	X	X	X	689	Electrofished	Caddy	2019	X	N
3	BC1542	353	336	764.6	X	X	X	690	Electrofished	Caddy	2019	X	N
4	BC1543	242	233	243	X	X	X	691	Electrofished	Caddy	2019	X	N
5	BC1544	332	316	696.6	X	X	X	692	Electrofished	Caddy	2019	X	N
6	BC1545	246	231	251	X	X	X	693	Electrofished	Caddy	2019	X	N
7	BC1546	316	303	556.1	X	X	X	694	Electrofished	Caddy	2019	X	N
1	BC1547	73	70	X	X	X	X	X	Electrofished	Caddy	2019	X	N
2	BC1548	334	319	X	X	X	X	695	Electrofished	Caddy	2019	X	N
3	BC1549	325	311	X	X	X	X	696	Electrofished	Caddy	2019	X	N
4	BC1550	360	348	X	X	X	X	697	Electrofished	Caddy	2019	X	N
5	BC1551	318	307	X	X	X	X	698	Electrofished	Caddy	2019	X	N
6	BC1552	316	304	X	X	X	X	699	Electrofished	Caddy	2019	X	N
7	BC1553	341	327	X	X	X	X	700	Electrofished	Caddy	2019	X	N
8	BC1554	300	288	X	X	X	X	851	Electrofished	Caddy	2019	X	N
9	BC1555	323	308	X	X	X	X	852	Electrofished	Caddy	2019	X	N
10	BC1556	352	341	X	X	X	X	113	Electrofished	Caddy	2019	X	N
11	BC1557	353	338	X	X	X	X	690	Electrofished	Caddy	2019	X	N

1	BC1558	317	302	579.4	X	X	X	853	Electrofished	Caddy	2019	X	N
2	BC1559	351	342	781.4	X	X	X	854	Electrofished	Caddy	2019	X	N
3	BC1560	321	310	564.9	X	X	X	855	Electrofished	Caddy	2019	X	N
4	BC1561	295	284	483.7	X	X	X	856	Electrofished	Caddy	2019	X	N
5	BC1562	337	324	629.5	X	X	X	857	Electrofished	Caddy	2019	X	N
6	BC1563	312	300	517.2	X	X	X	858	Electrofished	Caddy	2019	X	N
7	BC1564	329	315	566.2	X	X	X	859	Electrofished	Caddy	2019	X	N
8	BC1565	253	242	269.8	X	X	X	860	Electrofished	Caddy	2019	X	N
1	BC1566	275	268	335.5	M	4.2	1.6	X	Trap Net	Jessica	2019	5	Y
2	BC1567	293	280	405.7	M	2.6	1.3	X	Trap Net	Jessica	2019	6	Y
3	BC1568	310	290	455.9	M	4.2	2.1	X	Trap Net	Jessica	2019	9	Y
4	BC1569	328	314	597.1	M	4.3	4	X	Trap Net	Jessica	2019	9	Y
5	BC1570	177	170	92.8	F	1.7	1.6	X	Trap Net	Jessica	2019	2	Y
6	BC1571	375	360	829.5	F	12.6	28	X	Trap Net	Jessica	2019	15	Y
7	BC1572	288	274	411.1	F	3.5	13.6	X	Trap Net	Jessica	2019	7	Y
8	BC1573	280	269	342.7	M	1.8	1.8	X	Trap Net	Jessica	2019	6	Y
9	BC1574	343	322	655.8	M	4.7	3.3	X	Trap Net	Jessica	2019	10	Y
10	BC1575	351	332	781.6	F	9.3	24.2	X	Trap Net	Jessica	2019	11	Y
11	BC1576	281	272	401.5	F	3.3	26.4	X	Trap Net	Jessica	2019	5	Y
12	BC1577	348	336	722.7	M	6	2.1	X	Trap Net	Jessica	2019	11	Y
13	BC1578	378	363	953.6	F	14.5	51.8	X	Trap Net	Jessica	2019	15	Y
14	BC1579	335	322	649.1	M	4.3	2.5	X	Trap Net	Jessica	2019	9	Y
15	BC1580	256	246	308.4	M	2.4	1.5	X	Trap Net	Jessica	2019	3	Y
16	BC1581	351	340	763.7	F	9.5	19.1	X	Trap Net	Jessica	2019	9	Y
17	BC1582	284	274	401.8	F	3.8	12.6	X	Trap Net	Jessica	2019	6	Y
18	BC1583	291	280	453.2	M	3.7	1.3	X	Trap Net	Jessica	2019	6	Y
19	BC1584	272	262	355.7	M	3.4	1.2	X	Trap Net	Jessica	2019	5	Y
20	BC1585	297	282	482.4	F	7.3	18.3	X	Trap Net	Jessica	2019	7	Y
21	BC1586	288	280	425.3	F	4.8	17.2	X	Trap Net	Jessica	2019	6	Y
22	BC1587	280	272	389.9	F	3.9	10.5	X	Trap Net	Jessica	2019	5	Y
23	BC1588	284	270	415.9	M	3.7	1.5	X	Trap Net	Jessica	2019	6	Y
24	BC1589	286	275	434.1	M	2.9	1.8	X	Trap Net	Jessica	2019	6	Y
25	BC1590	378	364	937.7	F	6.7	38.1	X	Trap Net	Jessica	2019	13	Y
26	BC1591	292	280	437	M	3.5	1.1	X	Trap Net	Jessica	2019	6	Y
27	BC1592	307	292	481.7	F	4.9	52.3	X	Trap Net	Jessica	2019	7	Y
28	BC1593	183	174	125.3	F	1.2	0.6	X	Trap Net	Jessica	2019	2	Y
29	BC1594	371	354	885	F	10.3	34.4	X	Trap Net	Jessica	2019	11	Y
30	BC1595	342	326	701.8	F	8.3	25.7	X	Trap Net	Jessica	2019	10	Y
31	BC1596	339	330	675.3	M	3.7	2.5	X	Trap Net	Jessica	2019	9	Y
32	BC1597	294	280	446.2	X	X	X	X	Trap Net	Jessica	2019	X	N
33	BC1598	347	332	704.1	X	X	X	X	Trap Net	Jessica	2019	X	N
34	BC1599	345	332	772.5	X	X	X	X	Trap Net	Jessica	2019	X	N
35	BC1600	346	332	698.5	X	X	X	X	Trap Net	Jessica	2019	X	N
36	BC1601	295	284	428.3	X	X	X	X	Trap Net	Jessica	2019	X	N
37	BC1602	295	282	465.3	X	X	X	X	Trap Net	Jessica	2019	X	N
38	BC1603	352	337	739.3	M	5.5	2.2	X	Trap Net	Jessica	2019	11	Y
39	BC1604	334	320	613.7	M	5.2	2.1	X	Trap Net	Jessica	2019	10	Y
40	BC1605	346	334	693	M	3.3	3.2	X	Trap Net	Jessica	2019	10	Y
41	BC1606	356	333	801	M	5.2	3	X	Trap Net	Jessica	2019	11	Y
42	BC1607	386	368	873.6	F	11.8	45.4	X	Trap Net	Jessica	2019	15	Y
43	BC1608	365	350	875	M	7.2	3.6	X	Trap Net	Jessica	2019	14	Y
44	BC1609	373	360	858.2	M	6.7	2.1	X	Trap Net	Jessica	2019	15	Y
45	BC1610	364	352	773.5	F	12	44.8	X	Trap Net	Jessica	2019	X	Y
46	BC1611	367	352	853.9	F	12	30.9	X	Trap Net	Jessica	2019	15	Y
47	BC1612	304	290	498.8	F	6	18.5	X	Trap Net	Jessica	2019	7	Y
48	BC1613	354	340	812.6	F	11	32.9	X	Trap Net	Jessica	2019	11	Y
49	BC1614	363	347	888.3	F	10	36.9	X	Trap Net	Jessica	2019	11	Y
50	BC1615	356	342	779.5	F	11.7	46.3	X	Trap Net	Jessica	2019	10	Y
51	BC1616	282	268	378.4	X	X	X	X	Trap Net	Jessica	2019	X	N
52	BC1617	282	270	385.3	X	X	X	X	Trap Net	Jessica	2019	X	N
53	BC1618	287	274	419.9	X	X	X	X	Trap Net	Jessica	2019	X	N
54	BC1619	287	275	411.9	X	X	X	X	Trap Net	Jessica	2019	X	N
55	BC1620	358	X	716.6	X	X	X	X	Trap Net	Jessica	2019	X	N
56	BC1621	356	339	855.6	X	X	X	X	Trap Net	Jessica	2019	X	N
57	BC1622	360	348	846.8	X	X	X	X	Trap Net	Jessica	2019	X	N
58	BC1623	354	340	773.1	X	X	X	X	Trap Net	Jessica	2019	X	N
59	BC1624	357	342	741.1	X	X	X	X	Trap Net	Jessica	2019	X	N
60	BC1625	349	331	744	X	X	X	X	Trap Net	Jessica	2019	X	N
61	BC1626	352	339	741.6	X	X	X	X	Trap Net	Jessica	2019	X	N
62	BC1627	367	356	820	X	X	X	X	Trap Net	Jessica	2019	X	N
63	BC1628	368	349	733.6	X	X	X	X	Trap Net	Jessica	2019	X	N
64	BC1629	367	352	814.6	X	X	X	X	Trap Net	Jessica	2019	X	N
65	BC1630	342	330	688.3	X	X	X	X	Trap Net	Jessica	2019	X	N
66	BC1631	374	360	981	X	X	X	X	Trap Net	Jessica	2019	X	N
67	BC1632	323	308	543	M	3.3	1.4	X	Trap Net	Jessica	2019	9	Y
68	BC1633	280	270	398.1	F	4.3	9	X	Trap Net	Jessica	2019	6	Y
69	BC1634	342	328	644.6	X	X	X	X	Trap Net	Jessica	2019	X	N

70	BC1635	296	283	399.7	X	X	X	X	Trap Net	Jessica	2019	X	N
71	BC1636	358	344	831.4	X	X	X	X	Trap Net	Jessica	2019	X	N
72	BC1637	309	295	542.7	F	5.5	18.5	X	Trap Net	Jessica	2019	6	Y
73	BC1638	284	270	358.5	X	X	X	X	Trap Net	Jessica	2019	X	N
74	BC1639	364	349	836.4	M	4.9	3.3	X	Trap Net	Jessica	2019	14	Y
75	BC1640	322	307	586.2	M	4.1	2.2	X	Trap Net	Jessica	2019	9	Y
76	BC1641	353	336	802.8	X	X	X	X	Trap Net	Jessica	2019	X	N
77	BC1642	355	320	739	M	5.1	3.8	X	Trap Net	Jessica	2019	10	Y
78	BC1643	343	328	683.6	X	X	X	X	Trap Net	Jessica	2019	X	N
79	BC1644	343	329	693.3	F	7.5	25.2	X	Trap Net	Jessica	2019	X	Y
80	BC1645	338	322	632.7	F	8.7	28.9	X	Trap Net	Jessica	2019	10	Y
81	BC1646	372	352	903.4	F	10.9	30	X	Trap Net	Jessica	2019	14	Y
82	BC1647	388	368	1012.1	F	10.9	30	X	Trap Net	Jessica	2019	14	Y
1	BC1728	214	210	165.5	M	X	X	X	Gill Net	Lac du Bonnet	2019	3	Y
2	BC1729	288	282	415.7	F	4.8	4.7	X	Gill Net	Lac du Bonnet	2019	6	Y
3	BC1730	252	244	265.3	F	2.4	3.3	X	Gill Net	Lac du Bonnet	2019	6	Y
4	BC1731	241	230	229.3	M	2.3	0.5	X	Gill Net	Lac du Bonnet	2019	X	Y
5	BC1732	261	252	284.4	M	2.5	X	X	Gill Net	Lac du Bonnet	2019	4	Y
6	BC1733	268	260	293.3	F	4	5.8	X	Gill Net	Lac du Bonnet	2019	4	Y
7	BC1734	254	243	250.8	F	3.2	4.5	X	Gill Net	Lac du Bonnet	2019	5	Y
8	BC1735	321	314	512.9	F	5.2	7.9	X	Gill Net	Lac du Bonnet	2019	7	Y
9	BC1736	222	212	176.1	F	2.4	3.4	X	Gill Net	Lac du Bonnet	2019	3	Y
10	BC1737	236	214	193.5	M	3.9	X	X	Gill Net	Lac du Bonnet	2019	3	Y
11	BC1738	252	242	248.8	F	2.9	4.3	X	Gill Net	Lac du Bonnet	2019	4	Y
12	BC1739	259	247	275.8	F	3.6	4.2	X	Gill Net	Lac du Bonnet	2019	4	Y
13	BC1740	272	262	316	F	4.5	4.7	X	Gill Net	Lac du Bonnet	2019	5	Y
14	BC1741	228	224	188.8	M	2.8	2.3	X	Gill Net	Lac du Bonnet	2019	3	Y
15	BC1742	190	184	105.2	F	2.5	2.3	X	Gill Net	Lac du Bonnet	2019	2	Y
16	BC1743	262	252	305.5	F	2.3	5.1	X	Gill Net	Lac du Bonnet	2019	4	Y
17	BC1744	263	250	303.5	M	X	X	X	Gill Net	Lac du Bonnet	2019	5	Y
18	BC1745	284	276	353.4	M	4.2	3.6	X	Gill Net	Lac du Bonnet	2019	6	Y
19	BC1746	255	248	250	F	3.9	5.1	X	Gill Net	Lac du Bonnet	2019	4	Y
20	BC1747	244	232	220.8	F	3.9	3.9	X	Gill Net	Lac du Bonnet	2019	4	Y
21	BC1748	261	252	282	M	3.9	3.1	X	Gill Net	Lac du Bonnet	2019	4	Y
22	BC1749	246	242	223.1	M	3.8	3	X	Gill Net	Lac du Bonnet	2019	4	Y
23	BC1750	233	223	192.6	F	3.8	4.6	X	Gill Net	Lac du Bonnet	2019	3	Y
24	BC1751	277	266	325	M	4.8	3.6	X	Gill Net	Lac du Bonnet	2019	5	Y
25	BC1752	302	298	432.2	M	4.3	1.5	X	Gill Net	Lac du Bonnet	2019	5	Y
26	BC1753	270	256	308.9	F	5.3	6.1	X	Gill Net	Lac du Bonnet	2019	5	Y
27	BC1754	261	248	282.3	M	3.2	1.8	X	Gill Net	Lac du Bonnet	2019	4	Y
28	BC1755	230	212	183	M	2.3	1.6	X	Gill Net	Lac du Bonnet	2019	4	Y
29	BC1756	226	204	167.5	F	X	1.8	X	Gill Net	Lac du Bonnet	2019	X	Y
30	BC1757	250	240	218.3	F	1.8	2	X	Gill Net	Lac du Bonnet	2019	4	Y
31	BC1758	240	234	211.2	X	X	X	X	Gill Net	Lac du Bonnet	2019	4	N
32	BC1759	237	216	195.3	X	X	X	X	Gill Net	Lac du Bonnet	2019	3	N
33	BC1760	241	230	205.7	X	X	X	X	Gill Net	Lac du Bonnet	2019	4	N
34	BC1761	238	226	213.5	X	X	X	X	Gill Net	Lac du Bonnet	2019	3	N
35	BC1762	225	220	185.1	X	X	X	X	Gill Net	Lac du Bonnet	2019	3	N
36	BC1763	250	247	232.8	X	X	X	X	Gill Net	Lac du Bonnet	2019	4	N
11	BC1648	265	250	297.7	M	4.9	0.7	X	Trap Net	North Cross	2019	7	Y
12	BC1649	269	252	350.7	M	8.3	1.2	X	Trap Net	North Cross	2019	7	Y
13	BC1650	265	252	327.8	M	6	2.2	X	Trap Net	North Cross	2019	6	Y
14	BC1651	280	268	391.9	F	7	38.5	X	Trap Net	North Cross	2019	7	Y
15	BC1652	288	270	399.9	M	6.6	3.2	X	Trap Net	North Cross	2019	7	Y
16	BC1653	221	210	275.9	M	3.5	1.1	X	Trap Net	North Cross	2019	4	Y
17	BC1654	262	250	293.2	M	3.5	2.4	X	Trap Net	North Cross	2019	6	Y
18	BC1655	281	266	361.2	F	5.3	28.2	X	Trap Net	North Cross	2019	8	Y
19	BC1656	260	246	323.7	F	5	32.3	X	Trap Net	North Cross	2019	8	Y
20	BC1657	256	242	293.8	F	3	22.3	X	Trap Net	North Cross	2019	7	Y
21	BC1658	257	248	283.6	F	4.3	25.1	X	Trap Net	North Cross	2019	7	Y
22	BC1659	285	270	368.7	M	4.5	1.4	X	Trap Net	North Cross	2019	8	Y
23	BC1660	266	252	329.9	F	5.3	29.7	X	Trap Net	North Cross	2019	7	Y
24	BC1661	196	190	112	F	1.6	1.2	X	Trap Net	North Cross	2019	4	Y
25	BC1662	211	202	151.9	M	3	0.6	X	Trap Net	North Cross	2019	4	Y
26	BC1663	227	218	167.5	F	2.6	11.3	X	Trap Net	North Cross	2019	4	Y
27	BC1664	206	197	144	F	1.3	2.8	X	Trap Net	North Cross	2019	4	Y
28	BC1665	253	242	278.5	F	3.6	19.8	X	Trap Net	North Cross	2019	8	Y
29	BC1666	268	252	319.5	M	3.5	1.5	X	Trap Net	North Cross	2019	7	Y
30	BC1667	237	226	216.6	M	3.1	0.9	X	Trap Net	North Cross	2019	3	Y
31	BC1668	228	218	190.1	M	3.5	1	X	Trap Net	North Cross	2019	3	Y
32	BC1669	281	268	364.6	M	5.6	1.9	X	Trap Net	North Cross	2019	8	Y
33	BC1670	221	210	178.2	F	1.5	15.2	X	Trap Net	North Cross	2019	5	Y
34	BC1671	210	200	155.7	F	1.9	9.1	X	Trap Net	North Cross	2019	4	Y
35	BC1672	264	250	316.2	X	X	X	X	Trap Net	North Cross	2019	X	N
36	BC1673	284	272	387.5	X	X	X	X	Trap Net	North Cross	2019	X	N
37	BC1674	247	240	247.6	F	3.8	13.5	X	Trap Net	North Cross	2019	7	Y
38	BC1675	226	218	191.7	M	2.8	1	X	Trap Net	North Cross	2019	5	Y

39	BC1676	213	200	161.7	F	2	18.7	X	Trap Net	North Cross	2019	3	Y
40	BC1677	162	154	62.3	M	0.2	X	X	Trap Net	North Cross	2019	3	Y
41	BC1678	270	260	336.3	X	X	X	X	Trap Net	North Cross	2019	X	N
42	BC1679	269	260	339.3	X	X	X	X	Trap Net	North Cross	2019	X	N
43	BC1680	272	260	365.8	X	X	X	X	Trap Net	North Cross	2019	X	N
44	BC1681	276	262	383	X	X	X	X	Trap Net	North Cross	2019	X	N
1	BC1682	259	246	298.7	F	4.7	24.1	X	Trap Net	North Cross	2019	5	Y
2	BC1683	283	269	357.6	M	4.4	1.7	X	Trap Net	North Cross	2019	6	Y
3	BC1684	283	268	368	M	4.6	0.9	X	Trap Net	North Cross	2019	6	Y
4	BC1685	274	260	328.5	M	4.7	1.4	X	Trap Net	North Cross	2019	7	Y
5	BC1686	277	269	338.9	M	4.4	0.4	X	Trap Net	North Cross	2019	7	Y
6	BC1687	295	284	450.5	M	8.1	2.6	X	Trap Net	North Cross	2019	7	Y
7	BC1688	282	270	375.4	M	5.7	1.2	X	Trap Net	North Cross	2019	7	Y
8	BC1689	291	276	394.9	M	4.7	0.8	X	Trap Net	North Cross	2019	6	Y
9	BC1690	285	272	354	M	4.6	1.5	X	Trap Net	North Cross	2019	5	Y
10	BC1691	262	250	320.1	F	4.8	32.4	X	Trap Net	North Cross	2019	6	Y
1	BC1226	302	288	484	F	8.9	25.1	X	Electrofished	South Cross	2019	5	Y
2	BC1227	336	322	667.1	F	13.7	53	X	Electrofished	South Cross	2019	7	Y
3	BC1228	314	300	555.9	F	11.7	38.5	X	Electrofished	South Cross	2019	8	Y
4	BC1229	332	312	640.9	F	15.5	35.5	X	Electrofished	South Cross	2019	7	Y
5	BC1230	280	270	388.7	F	7	22.5	X	Electrofished	South Cross	2019	5	Y
6	BC1231	334	322	718.6	F	13.4	44.6	X	Electrofished	South Cross	2019	8	Y
7	BC1232	278	264	360.8	F	6.4	16.1	X	Electrofished	South Cross	2019	6	Y
8	BC1233	354	336	796.2	F	17.6	65.5	X	Electrofished	South Cross	2019	8	Y
9	BC1234	356	340	837.7	F	19.2	58.7	X	Electrofished	South Cross	2019	11	Y
10	BC1235	342	322	710.6	F	15.4	39.3	X	Electrofished	South Cross	2019	7	Y
11	BC1236	330	316	608.8	F	13.4	40.7	X	Electrofished	South Cross	2019	7	Y
12	BC1237	290	274	427	F	5.9	23.1	X	Electrofished	South Cross	2019	5	Y
13	BC1238	316	302	585.8	F	12.6	37.2	X	Electrofished	South Cross	2019	7	Y
14	BC1239	262	252	323.7	F	5.6	18.6	X	Electrofished	South Cross	2019	4	Y
15	BC1240	330	312	649.3	F	11.9	34.5	X	Electrofished	South Cross	2019	7	Y
16	BC1241	356	328	729.8	F	15.3	51.7	X	Electrofished	South Cross	2019	X	Y
17	BC1242	242	232	235.4	M	2.8	X	X	Electrofished	South Cross	2019	4	Y
18	BC1243	166	X	70.9	M	X	X	X	Electrofished	South Cross	2019	3	Y
19	BC1244	312	298	578.5	F	9.8	33.5	X	Electrofished	South Cross	2019	7	Y
20	BC1245	316	304	567	M	7.5	4.5	X	Electrofished	South Cross	2019	7	Y
21	BC1246	318	300	534.9	F	11.4	37.3	X	Electrofished	South Cross	2019	7	Y
22	BC1247	304	288	468	F	10.2	26.1	X	Electrofished	South Cross	2019	8	Y
23	BC1248	316	300	563.3	F	10.6	26.4	X	Electrofished	South Cross	2019	7	Y
24	BC1249	322	300	649.3	F	X	45.1	X	Electrofished	South Cross	2019	6	Y
25	BC1250	266	258	340.1	M	4.5	2	X	Electrofished	South Cross	2019	3	Y
26	BC1251	288	272	412.2	F	9.2	24.4	X	Electrofished	South Cross	2019	5	Y
27	BC1252	246	232	252.3	F	5.1	10.7	X	Electrofished	South Cross	2019	3	Y
28	BC1253	296	282	436.7	F	6.2	15.5	X	Electrofished	South Cross	2019	6	Y
29	BC1254	240	232	234.4	M	4	0.7	X	Electrofished	South Cross	2019	3	Y
30	BC1255	272	260	374.1	F	7.4	22.4	X	Electrofished	South Cross	2019	7	Y
1	BC1360	73	68	3.2	X	X	X	X	Electrofished	South Cross	2019	1	Y
2	BC1361	66	60	2.4	X	X	X	X	Electrofished	South Cross	2019	1	Y
1	BC1430	64	61	3.9	X	X	X	X	Electrofished	South Cross	2019	X	N
2	BC1431	351	332	780.6	X	X	X	679	Electrofished	South Cross	2019	X	N
3	BC1432	313	298	530.2	X	X	X	680	Electrofished	South Cross	2019	X	N
4	BC1433	329	312	621.2	X	X	X	681	Electrofished	South Cross	2019	X	N
5	BC1434	346	330	738.9	X	X	X	682	Electrofished	South Cross	2019	X	N
1	BC1492	302	284	435.6	M	3.9	1.2	X	Angled	South Cross	2019	8	Y
2	BC1493	333	320	625.7	X	X	X	X	Angled	South Cross	2019	X	N
3	BC1494	333	319	620.5	X	X	X	X	Angled	South Cross	2019	X	N
4	BC1495	303	290	495.8	M	7.9	3.6	X	Angled	South Cross	2019	7	Y
5	BC1496	295	284	452.8	M	X	X	X	Angled	South Cross	2019	X	N
6	BC1497	322	307	598.6	X	X	X	X	Angled	South Cross	2019	X	N
7	BC1498	351	332	668.4	X	X	X	X	Angled	South Cross	2019	X	N
8	BC1499	360	344	816.8	X	X	X	X	Angled	South Cross	2019	X	N
9	BC1500	337	325	681.3	X	X	X	X	Angled	South Cross	2019	X	N
10	BC1501	322	312	615.2	X	X	X	X	Angled	South Cross	2019	X	N
11	BC1502	336	324	659.9	X	X	X	X	Angled	South Cross	2019	X	N
12	BC1503	333	322	869.7	X	X	X	X	Angled	South Cross	2019	X	N
13	BC1504	317	302	542.7	X	X	X	X	Angled	South Cross	2019	X	N
14	BC1505	338	324	600.4	X	X	X	X	Angled	South Cross	2019	X	N
15	BC1506	342	328	630.3	X	X	X	X	Angled	South Cross	2019	X	N
16	BC1507	351	334	764	X	X	X	X	Angled	South Cross	2019	X	N
17	BC1508	336	322	622.2	X	X	X	X	Angled	South Cross	2019	X	N
18	BC1509	321	304	541.4	M	1.1	4.3	X	Angled	South Cross	2019	6	Y
19	BC1510	294	284	419.3	M	6	3.6	X	Angled	South Cross	2019	5	Y
20	BC1511	297	284	468.2	M	9.8	2.2	X	Angled	South Cross	2019	7	Y
21	BC1512	298	286	476.6	M	8	4.1	X	Angled	South Cross	2019	6	Y
22	BC1513	323	310	572.7	X	X	X	X	Angled	South Cross	2019	X	N
23	BC1514	327	312	610.1	X	X	X	X	Angled	South Cross	2019	X	N
24	BC1515	310	292	487.7	X	X	X	X	Angled	South Cross	2019	X	N

25	BC1516	341	326	696.9	X	X	X	X	Angled	South Cross	2019	X	N
26	BC1517	343	330	694.6	X	X	X	X	Angled	South Cross	2019	X	N
27	BC1518	342	303	590.6	X	X	X	X	Angled	South Cross	2019	X	N
28	BC1519	345	330	705.3	X	X	X	X	Angled	South Cross	2019	X	N
29	BC1520	314	299	591.6	X	X	X	X	Angled	South Cross	2019	X	N
30	BC1521	332	316	660.4	X	X	X	X	Angled	South Cross	2019	X	N
31	BC1522	316	300	589.2	X	X	X	X	Angled	South Cross	2019	X	N
32	BC1523	319	306	559.8	X	X	X	X	Angled	South Cross	2019	X	N
33	BC1524	318	302	561.8	X	X	X	X	Angled	South Cross	2019	X	N
34	BC1525	319	303	543.7	X	X	X	X	Angled	South Cross	2019	X	N
35	BC1526	345	324	670.1	X	X	X	X	Angled	South Cross	2019	X	N
36	BC1527	366	342	851.2	X	X	X	X	Angled	South Cross	2019	X	N
37	BC1528	357	340	765.8	X	X	X	X	Angled	South Cross	2019	X	N
38	BC1529	364	350	857.8	X	X	X	X	Angled	South Cross	2019	X	N
39	BC1530	340	322	676.6	X	X	X	X	Angled	South Cross	2019	X	N
40	BC1531	358	340	766.7	X	X	X	X	Angled	South Cross	2019	X	N
41	BC1532	300	289	472.2	X	X	X	X	Angled	South Cross	2019	X	N
42	BC1533	336	320	648.7	X	X	X	X	Angled	South Cross	2019	X	N
43	BC1534	311	300	537.4	X	X	X	X	Angled	South Cross	2019	X	N
44	BC1535	340	328	645.8	X	X	X	X	Angled	South Cross	2019	X	N
45	BC1536	325	315	596.7	X	X	X	X	Angled	South Cross	2019	X	N
46	BC1537	331	316	613.2	X	X	X	X	Angled	South Cross	2019	X	N
47	BC1538	316	300	579.6	X	X	X	X	Angled	South Cross	2019	X	N
48	BC1539	315	300	512.9	X	X	X	X	Angled	South Cross	2019	X	N
1	BC1435	253	244	280.8	F	5.3	15.4	X	Electrofished	Star	2019	4	Y
2	BC1436	232	222	181.5	F	1.8	9.8	X	Electrofished	Star	2019	4	Y
3	BC1437	246	235	233.3	M	1.7	1.4	X	Electrofished	Star	2019	4	Y
4	BC1438	240	230	225.6	F	3.4	11.2	X	Electrofished	Star	2019	4	Y
5	BC1439	237	228	209.6	F	3.2	9.2	X	Electrofished	Star	2019	4	Y
6	BC1440	228	220	186.7	F	2.4	8.1	X	Electrofished	Star	2019	4	Y
7	BC1441	242	231	220.9	F	2.4	8.4	X	Electrofished	Star	2019	4	Y
8	BC1442	310	292	499.8	F	8.6	41.4	X	Electrofished	Star	2019	6	Y
9	BC1443	259	248	270.9	F	4.4	11.1	X	Electrofished	Star	2019	5	Y
10	BC1444	242	230	222.3	F	7.3	16.2	X	Electrofished	Star	2019	4	Y
11	BC1445	63	60	2.6	U	X	X	X	Electrofished	Star	2019	1	Y
12	BC1446	231	220	198.1	F	3	14.9	X	Electrofished	Star	2019	4	Y
13	BC1447	235	223	194.9	M	3.1	0.2	X	Electrofished	Star	2019	4	Y
14	BC1448	256	244	278.8	M	4.6	0.5	X	Electrofished	Star	2019	4	Y
15	BC1449	251	240	227.1	F	3.3	11.1	X	Electrofished	Star	2019	4	Y
16	BC1450	185	179	86.9	F	X	X	X	Electrofished	Star	2019	2	Y
17	BC1451	225	217	171.3	F	2.2	0.8	X	Electrofished	Star	2019	3	Y
18	BC1452	232	222	182.7	M	2.2	12.4	X	Electrofished	Star	2019	4	Y
19	BC1453	225	212	172.9	F	3.4	8.5	X	Electrofished	Star	2019	4	Y
20	BC1454	236	224	191.2	F	3	12.6	X	Electrofished	Star	2019	4	Y
21	BC1455	252	242	284.3	F	4.2	21.5	X	Electrofished	Star	2019	5	Y
22	BC1456	257	242	257.8	F	4.8	10.5	X	Electrofished	Star	2019	5	Y
23	BC1457	250	240	249	F	3.3	16.1	X	Electrofished	Star	2019	4	Y
24	BC1458	232	222	186.8	F	X	X	X	Electrofished	Star	2019	X	N
25	BC1459	144	132	34.9	M	0.5	X	X	Electrofished	Star	2019	2	Y
26	BC1460	182	172	87.2	M	0.4	0.5	X	Electrofished	Star	2019	2	Y
27	BC1461	236	224	209	X	X	X	X	Electrofished	Star	2019	X	N
28	BC1462	222	211	167.3	X	X	X	X	Electrofished	Star	2019	X	N
29	BC1463	229	218	180.1	M	X	X	X	Electrofished	Star	2019	X	N
30	BC1464	244	232	225.8	M	X	X	X	Electrofished	Star	2019	X	N
31	BC1465	216	206	150.9	M	2.2	1	X	Electrofished	Star	2019	4	Y
32	BC1466	240	230	204.4	X	X	X	X	Electrofished	Star	2019	X	N
33	BC1467	251	240	244	M	X	X	X	Electrofished	Star	2019	X	N
34	BC1468	236	222	200	X	X	X	X	Electrofished	Star	2019	X	N
35	BC1469	225	210	184.6	X	X	X	X	Electrofished	Star	2019	X	N
36	BC1470	230	221	186	X	X	X	X	Electrofished	Star	2019	X	N
37	BC1471	252	246	258.4	M	X	X	X	Electrofished	Star	2019	X	N
38	BC1472	236	222	195.1	X	X	X	X	Electrofished	Star	2019	X	N
39	BC1473	242	230	229.8	X	X	X	X	Electrofished	Star	2019	X	N
40	BC1474	181	174	83	M	1.3	1.4	X	Electrofished	Star	2019	X	Y
41	BC1475	194	192	101.4	M	1.7	1.4	X	Electrofished	Star	2019	2	Y
42	BC1476	64	60	2.1	U	X	X	X	Electrofished	Star	2019	1	Y
43	BC1477	81	78	6.1	U	X	X	X	Electrofished	Star	2019	1	Y
44	BC1478	72	68	3.3	U	X	X	X	Electrofished	Star	2019	1	Y
45	BC1479	66	64	2.7	U	X	X	X	Electrofished	Star	2019	1	Y
46	BC1480	79	75	4.7	U	X	X	X	Electrofished	Star	2019	1	Y
47	BC1481	67	65	3.2	U	X	X	X	Electrofished	Star	2019	1	Y