The Peel River Fish Study, 1998 – 1999

with emphasis on broad whitefish (*Coregonus nasus*)

Prepared by
Melanie Toyne
and Ross Tallman
(DFO, Winnipeg)
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Introduction:

Broad whitefish (*Coregonus nasus*) can be found in most rivers and lakes in the Northwest, Nunavut and Yukon Territories, and are fished extensively by Gwich'in, Inuvialuit, Sahtu and Inuit communities for food and commercial purposes (Treble 1995). The Mackenzie Delta populations are very complex because they contain broad whitefish of different life history types. Anadromous broad whitefish migrate between the sea and freshwater at some point in their lives, lacustrine broad whitefish spend their entire life cycle in or near a particular lake, and riverine broad whitefish spend their entire lives in or near a particular river (Reist, 1997). The whitefish that inhabit the Peel River are thought to be of the anadromous type (Freeman, 1997; Reist and Chang-Kue, 1997). They migrate upstream in the fall to spawn in gravel beds with shallow, fast flowing water (Chang-Kue and Jessop, 1997). The eggs develop under the ice throughout the winter and hatch in the spring. They are then washed downstream with the spring flood and swept largely into the Tuktoyaktuk Peninsula and it's tributaries (Reist and Chang-Kue, 1997). Here the young feed and over-winter in the brackish coastal waters until they become sexually mature at around 8 years (Bond and Erickson, 1985). The following fall, the mature fish migrate upstream and join the spawning activities (Chang-Kue and Jessop, 1997). After the first spawning season, some fish do not go back to the Tuktoyaktuk Peninsula. Instead they move downstream but stay in the Mackenzie delta and surrounding lakes to over-winter and feed until their next spawning migration (Chang-Kue and Jessop, 1997). Broad whitefish are thought to spawn only every 2 or 3 years due to energetic constraints involved in the lengthy migration to spawning habitats (Riest & Chang-Kue 1997, Bond & Erickson 1985, Bond 1982).

The Gwich'in community has expressed concerns that potential developments near the Peel River could cause declines in their fish stocks. These concerns were the basis for the development of The Peel River Fish Study, a monitoring program for the Peel River broad whitefish (a.k.a. whitefish: *Coregonus nasus*), lake whitefish (a.k.a. crooked back: *Coregonus autumnalis)*, inconnu (a.k.a. coney: *Stenodus leucicthyes)* and others, by the Gwich'in Renewable Resource Board (GRRB) in conjunction with the Department of Fisheries and Oceans. The GRRB expressed interest in 1) the collection of population baseline data for broad whitefish (and other *Coregonids*) in the Peel River, 2) the timing of spawning migrations of broad whitefish (and other *Coregonids*) up the Peel River, 3) locating broad whitefish spawning areas in the Peel River and 4) describing broad whitefish spawning habitat. The issues directly addressed by the study were collecting population baseline data (fish fork length, weight, sex, maturity stage and fecundity) for all fish caught, the timing of broad whitefish spawning migration, and the identification and description of broad whitefish spawning habitat.

The Peel River contains spawning habitat for 5+ whitefish (*Coregonid*) species (Dillinger et al., 1992; Dryden et al., 1973), but exact locations of those sites are not well known and therefor at risk for damage.

Methods:

Study Area

The Peel River is a large tributary of the Mackenzie River in the lower Mackenzie Delta. It branches off from the Mackenzie River near the town of Ft. McPherson, and runs parallel to the Mackenzie and Arctic Red Rivers. The Peel River has a total length of 274 miles with drainage of 42,529 sq. miles (Dryden et al., 1973). The muddy riverbank is very steep and erosion is evident as trees cling to the edge with roots exposed. The water appears turbid and carries a high silt load (Hatfield et al. 1973). The downstream portion of the river bottom is mostly bedrock, but upstream areas contain extensive gravel beds that provide ideal spawning habitat for broad whitefish (Dryden et al. 1973). There is a large fluctuation in water level and velocity throughout the year due to rain and snow runoff from the mountains (Dryden et al., 1973). During the spring flood, water levels rise several meters, and flooding of camps located atop the steep banks is sometimes a result. During the fall, the water level drops exposing mud and gravel bars resulting in dangerous travel by boat. During the study, air temperature ranged between 9.9^{O}C and –15.7^{O}C in 1998, and between 12^{O}C and -34^{O}C in 1999. The water temperature ranged between 6.7^{O}C and –0.1^{O}C in 1998, and between 7.5^{O}C and –0.9^{O}C in 1999.

Decisions and Rationale

Personnel from the Gwich'in Renewable Resource Board (GRRB) and the Department of Fisheries and Oceans (DFO) met with the Tetlit Renewable Resource Council (RRC) and community members of Ft. McPherson on several occasion to decide on details for the study.

It was decided that 3 camps would be chosen at various points along the Peel River to identify migration timing of the fish as they passed by on their spawning run to upstream waters (Figure 1). The Tetlit RRC selected 3 men from Ft. McPherson based on their camp location, sampling experience, financial need and interest in the project. In 1998 the 3 monitors selected were Fred Koe at Basook Creek (67°44.42N, 134°38.33W), Robert Elias at Scrapper Hill (67°15.72N, 134°53.16W) and Walter Alexie at Trail River (66°40.30N, 134°33.55W). In 1999, Fred Koe was replaced by Leslie Snowshoe at Cutoff (67°38.955N, 134°38.890W) because it was thought that the fish Fred was catching were coming form the Mackenzie and Arctic Red Rivers as well as the Peel River. He caught many more fish than the other 2 monitors and his camp was located near the mouth of the Peel River so fish from other areas could easily have been caught at Fred's camp. Robert Elias was selected again in 1999, and Walter Alexie was replaced by William Teya at Road R. (66°52.790N, 135°00.122W) because Walter was not interested in continuing with the study.

The dates the study was to commence and cease were also decided during the meetings mentioned above. In 1998 the study ran from September 22 to October 31. These dates were chosen in an attempt to allow sampling of early migrating species as well as the broad whitefish migration. However, Walter Alexie had problems with ice running and lost his net as a result. He therefore ceased fishing on October19th. Also, no distinct run of broad whitefish was observed by October 31^{st}, so it was decided to extend the study until November 17th. Robert Elias was chosen to continue working because his camp was in the optimal location since Walter had stopped fishing and we were not confident that Fred was catching only Peel River fish. In 1999, the study ran from October 7^{th} to November 12^{th} in an attempt to catch the later broad whitefish run. However, once again no distinct run was observed by November 12^{th} and the study was again extended. Leslie and Robert continued fishing until November 17th when catches became very small, but William chose not to continue fishing due to low catches.

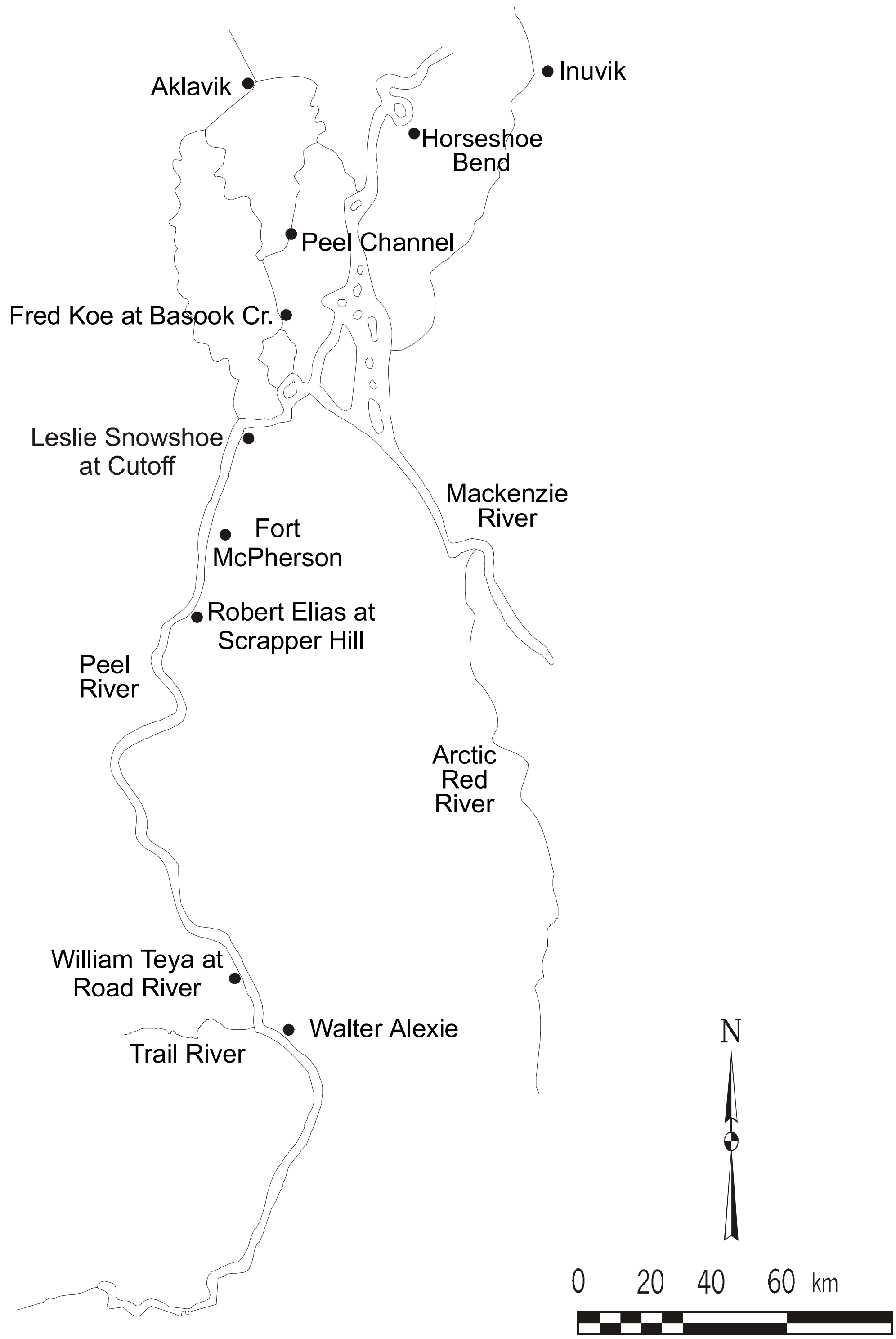


Figure 1. Map of the Peel River indicating sampling locations.

Population baseline data

The monitors were trained to sample fish for fork length (mm), round weight (kg), sex, maturity stage, gonad weight (g), and to collect aging structures (scales, pelvic fin rays and sagital otoliths). Gonads from mature female broad whitefish were bagged and frozen for fecundity analysis. Environmental factors such as air temperature, water temperature, sky cover, wind speed, water level, amount of debris in water and water clarity were also recorded. In 1998, livers were weighed as a stress indicator and muscle samples were collected for contaminant examination. These were not collected in 1999 due to an effort to condense measurements and inadequate supplies to keep the muscle tissue frozen as required for analysis. Each monitor fished from his own camp using a 80' long, 8 ' deep and 5" mesh gill net. A graduate student with DFO (Melanie Toyne) provided the training and participated in the fieldwork using an additional 2 experimental nets (90' long, mesh size 1.5"-2.5" and 90' long, mesh size 3.0-4.0").

Broad whitefish Migration Timing

To estimate the timing of migration of broad whitefish, the monitors recorded the number of fish caught per day. This information was collected for all species, but only analyzed for broad whitefish. The data on broad whitefish from all camps was then compared using a graph of 'number of fish caught' by 'day'. The dates when fishing ceased for freeze-up and commenced afterward was also recorded to determine when the broad whitefish migrated with respect to ice freeze-up.

Broad whitefish Spawning habitat

In 1998, the river was scanned by helicopter in an attempt to see aggregations of broad whitefish under the ice. In 1999, requests for air time (ffrom Polar Continental Shelf) to peruse the location of whitefish spawning sites through radio tracking were not granted therefor location of whitefish spawning sites were not investigated further.

Results:

Population baseline data

The species sampled during the 2 years of the study included broad whitefish, lake whitefish, inconnu, northern pike (a.k.a. jackfish: *Esox lucius*), least cisco (a.k.a. herring: *Coregonus sardinella*) and chum salmon (a.k.a. dog salmon, *Onchorhynchus keta*) (Figures 2a and 2b). Broad whitefish were the most abundant catch in both years, but more were caught in 1998 (n=422) than 1999 (n=300). More northern pike and inconnu were caught in 1998 (n=165, n=119) than in 1999 (n=11, n=99), but lake whitefish remained approximately equal in both years. Many chum salmon were caught in 1998 (n=40), but none in 1999.

In 1998, broad whitefish age ranged from 7 to 21 (n= 410) years with strong cohorts at ages 8 and 12 (Figure 3a). In 1999, broad whitefish age ranged from 5 to 23 (n=284) with the strong cohorts continuing at ages 9 and 13 (Figure 3b).

In 1998, broad whitefish fork length ranged from 420 mm to 610+ mm (n= 421), with the most abundant at length 500 mm (Figure 4a). In 1999, broad whitefish fork length ranged from 410 mm to 600 mm (n=301), with the most at length 490 mm

(Figure 4b). Most camps (Basook Cr. 1998, Scraper Hill 1998, Cutoff 1999 and Scraper Hill 1999) all showed peak frequencies at similar fish lengths (~ 490-500 mm). However, the most frequent size class of broad whitefish caught at the 2 upstream camps (Trail R. 1998 and Road R. 1999) were larger than those caught downstream (fork length of 520 mm and 540 mm respectively).

Broad whitefish length (mm) at age was highly variable in both years (Figures 5a and 5b). There did not appear to be a trend toward increasing size of fish as they aged. The trend lines for each camp in both years were almost parallel to the X-axis. The only exception to this was Trail River in 1998, where the trend line did show a significant increase in size with age.

Broad whitefish fecundity ranged from 30,000 eggs to 90,000 eggs in 1998 (n= 30), but from 10,000 to 90,000 eggs in 1999 (n=59) (Figure 6a and 6b). The fish recorded at Cutoff had a smaller fecundity than fish of equal sizes (fork length) caught at the other camps. When compared to fish of equal size, in only 4 cases did the fecundity at Cutoff fall within that of the other camps. However, 2 fish caught at Cutoff were of smaller size, which could have accounted for the lower fecundity observed in those 2 cases. The fecundity of fish caught at Scrapper Hill had highest overall fecundity.

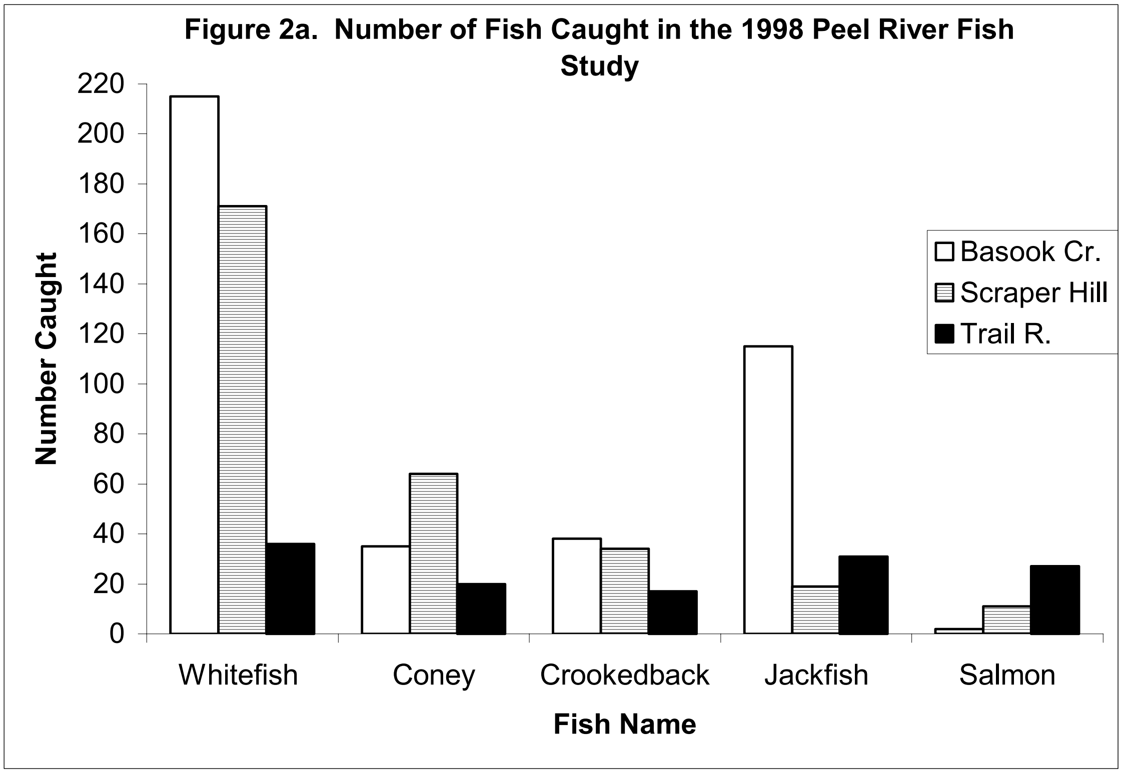


Figure 2a. Number of Fish Caught in the 1998 Peel River Fish Study
220
200
180
160
140
120
100
80
60
40
20
0
Number Caught
Basook Cr.
Scraper Hill
Trail R.
Whitefish
Coney
Crookedback
Jackfish
Salmon
Fish Name

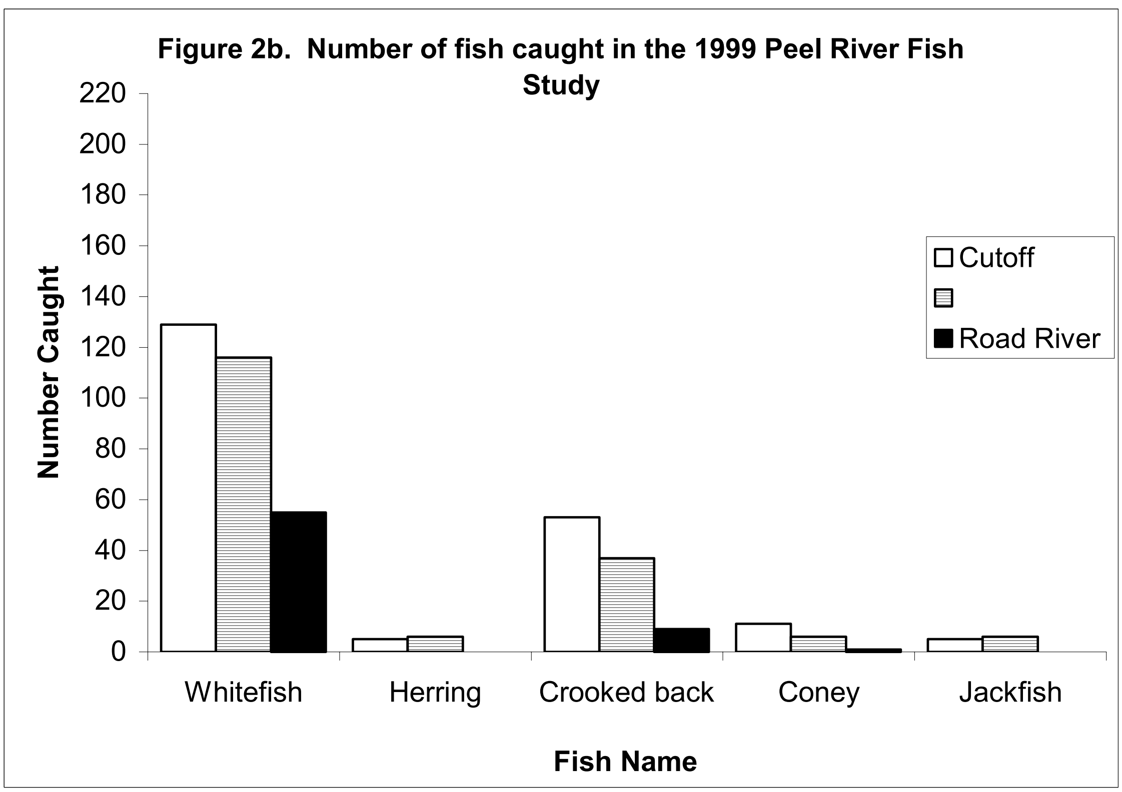


Figure 2b. Number of fish caught in the 1999 Peel River Fish Study
220
200
180
160
140
120
100
80
60
40
20
0
Number Caught
Cutoff
Road River
Whitefish
Herring
Crooked back
Coney
Jackfish
Fish Name

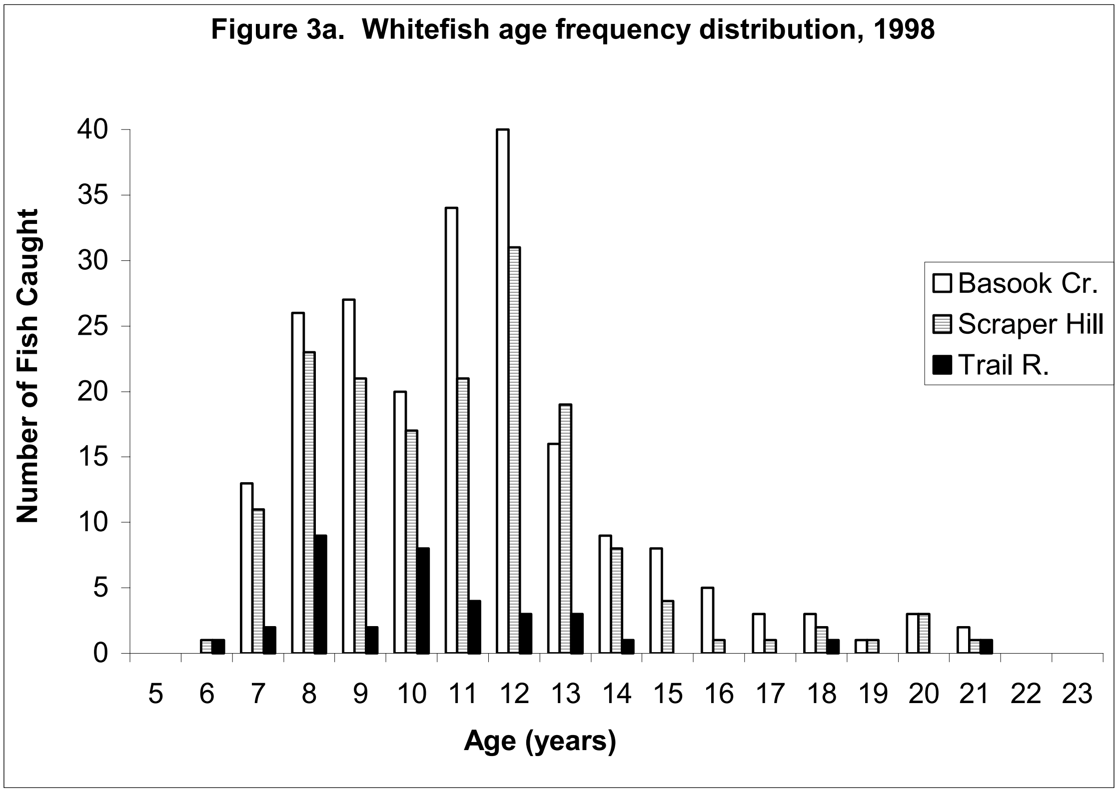


Figure 3a. Whitefish age frequency distribution, 1998
Number of Fish Caught
Age (years)
Basook Cr.
Scraper Hill
Trail R.
0
5
10
15
20
25
30
35
40
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23

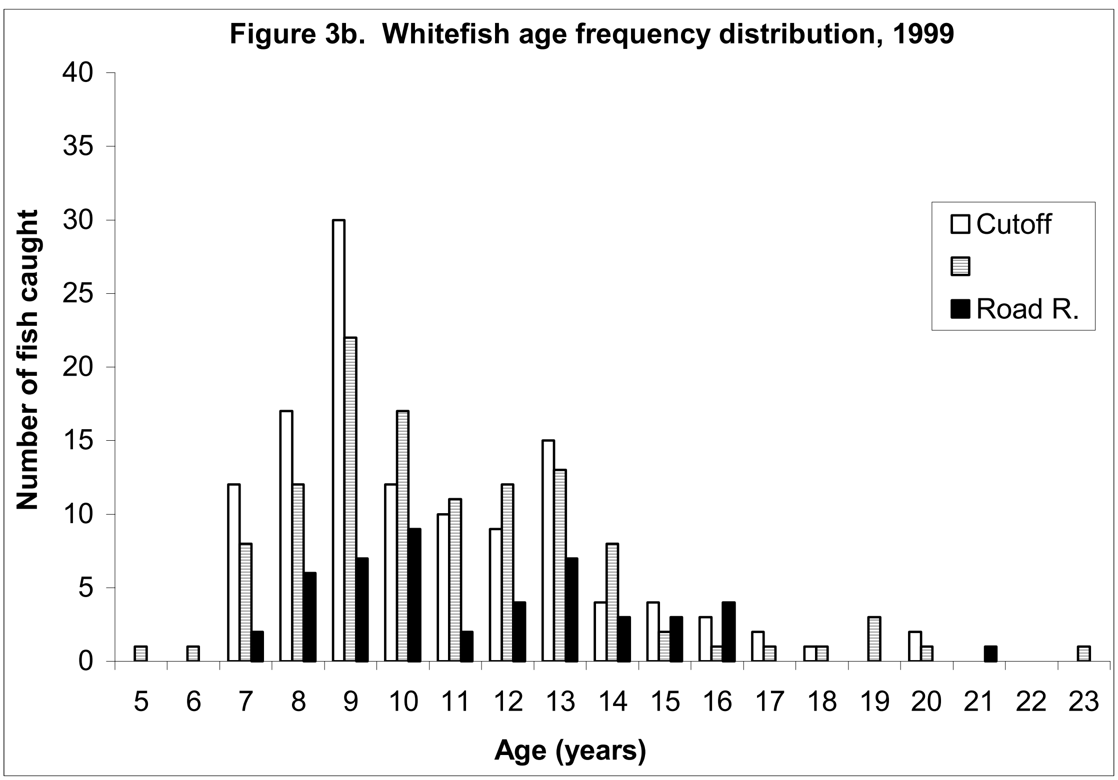


Figure 3b. Whitefish age frequency distribution, 1999
Number of fish caught
Age (years)
Cutoff
Road R.
0
5
10
15
20
25
30
35
40
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23

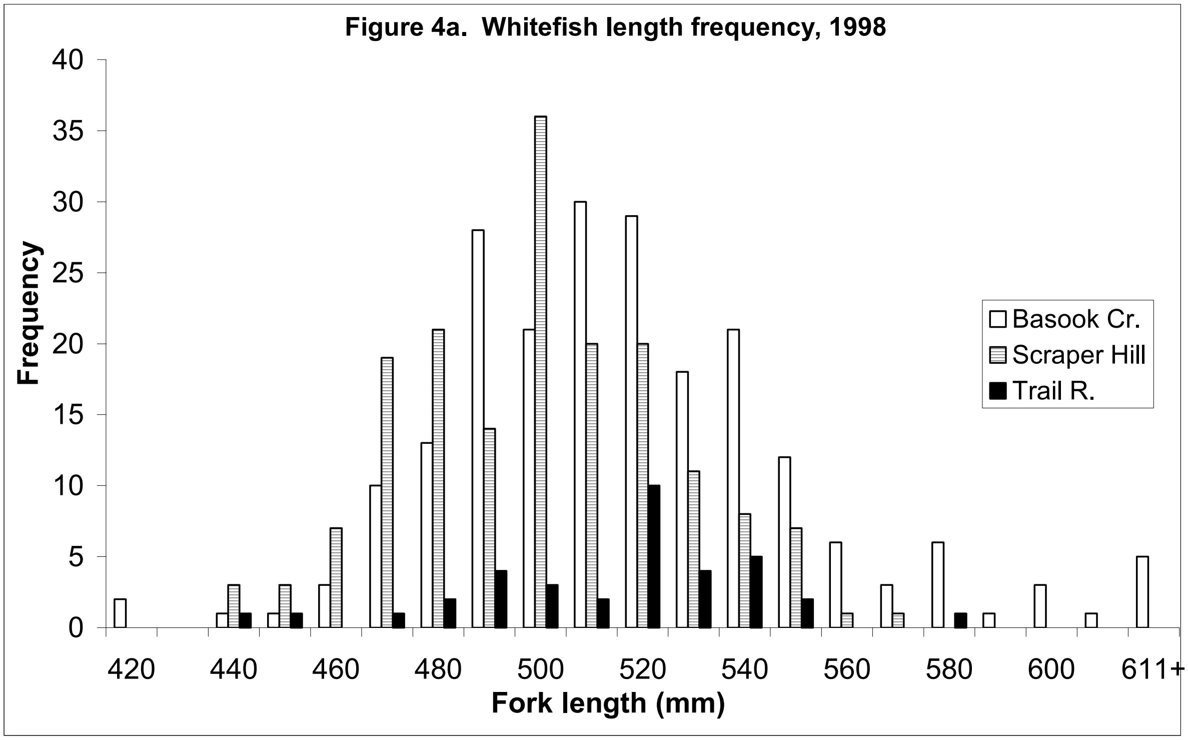


Figure 4a. Whitefish length frequency, 1998
40
35
30
25
20
15
10
5
0
Frequency
Basook Cr.
Scraper Hill
Trail R.
420
440
460
480
500
520
540
560
580
600
611+
Fork length (mm)

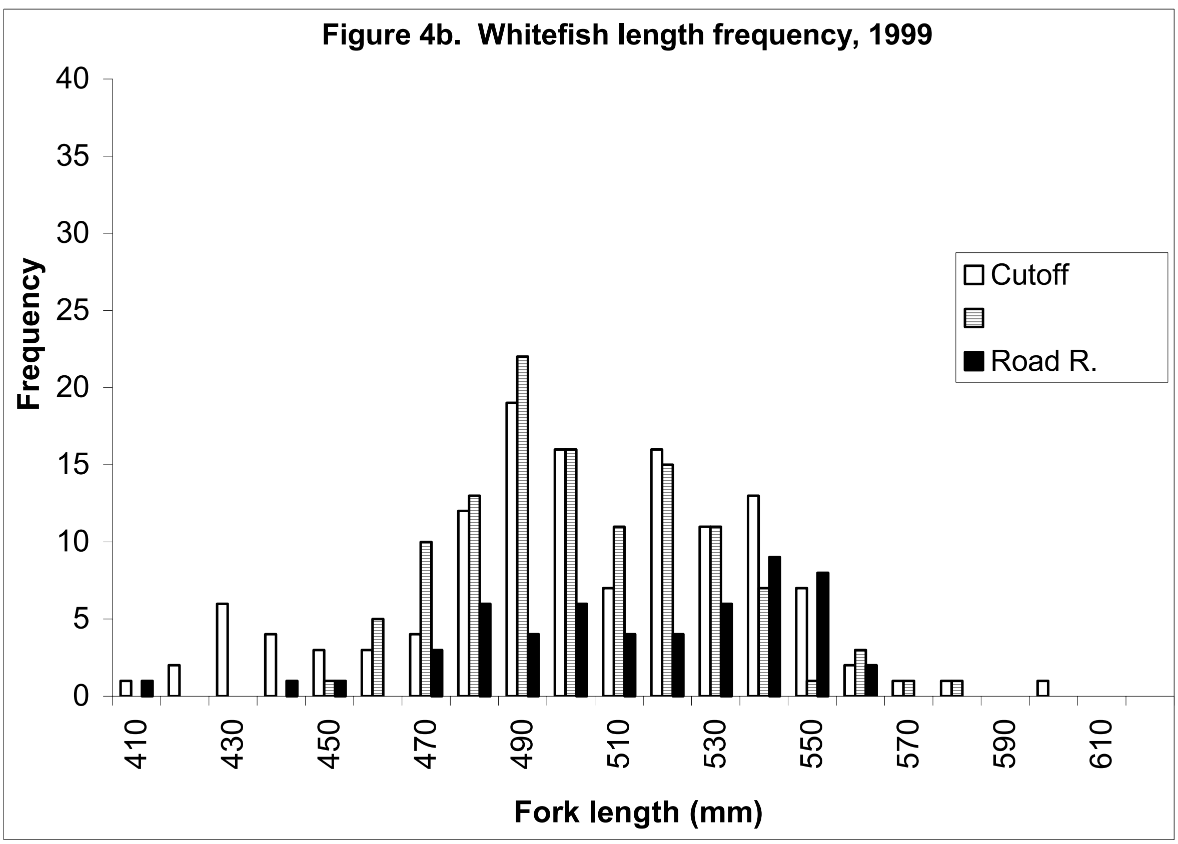


Figure 4b. Whitefish length frequency, 1999
40
35
30
25
20
15
10
5
0
Frequency
Cutoff
Road R.
410
430
450
470
490
510
530
550
570
590
610
Fork length (mm)

Figure 5a. Whitefish length at age, 1998

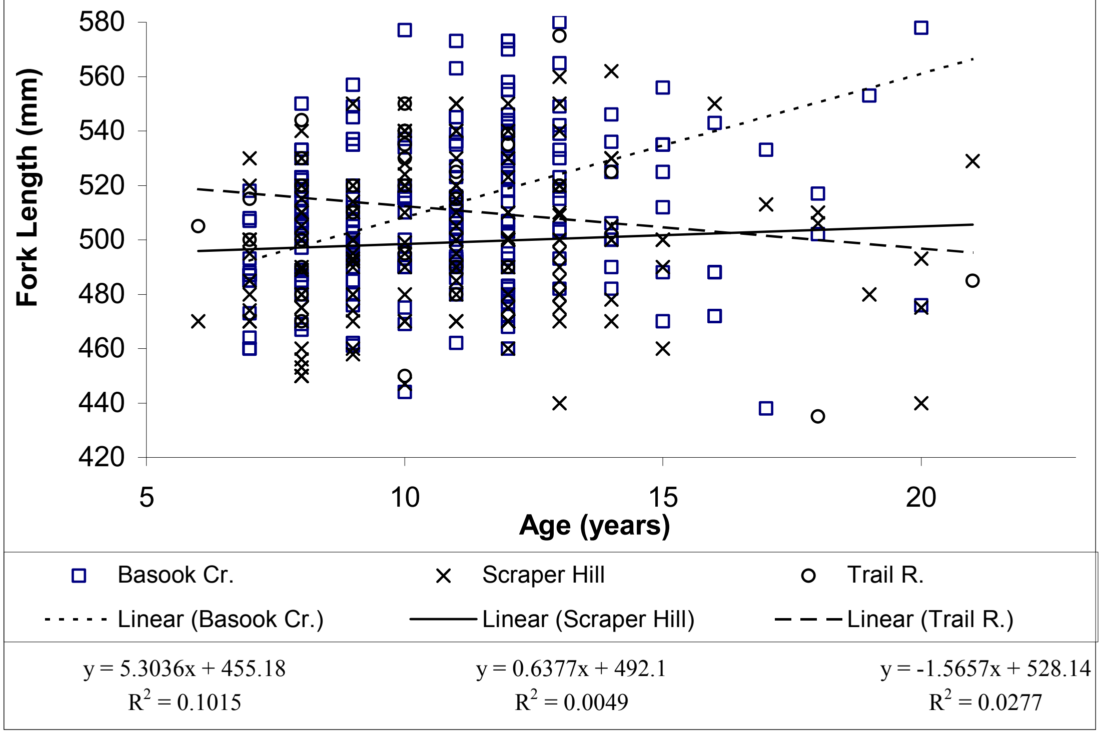


Figure 5b. Whitefish length at age, 1999

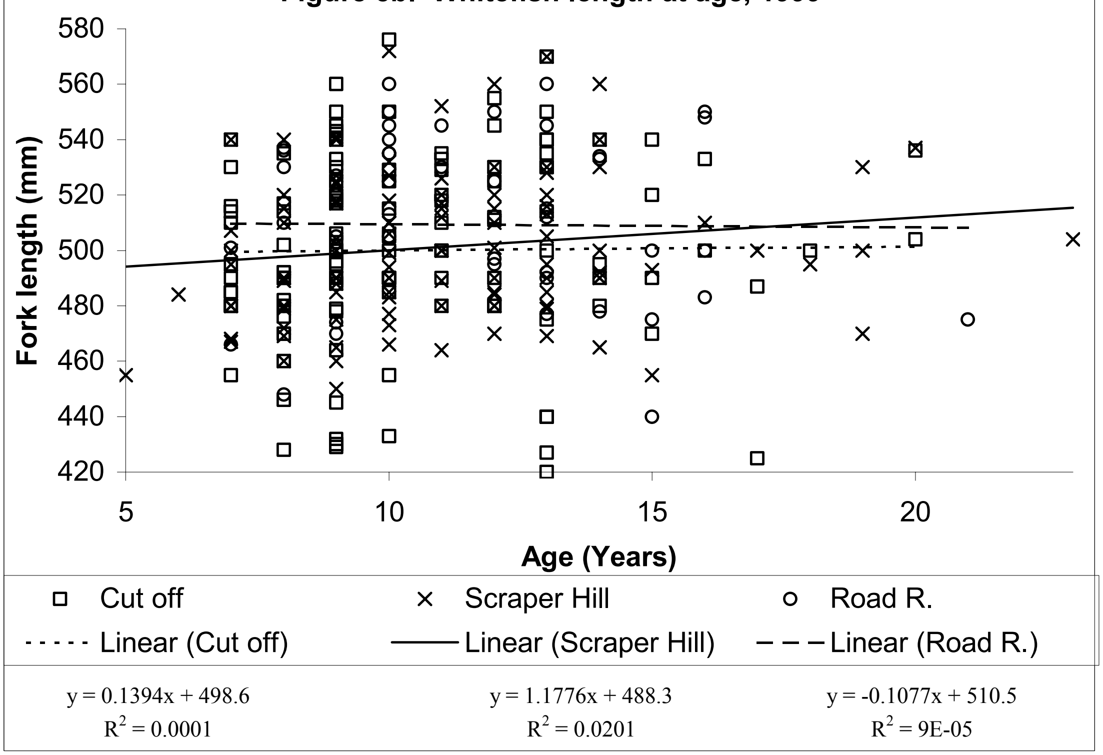


Figure 6a. Whitefish fecundity at size, 1998

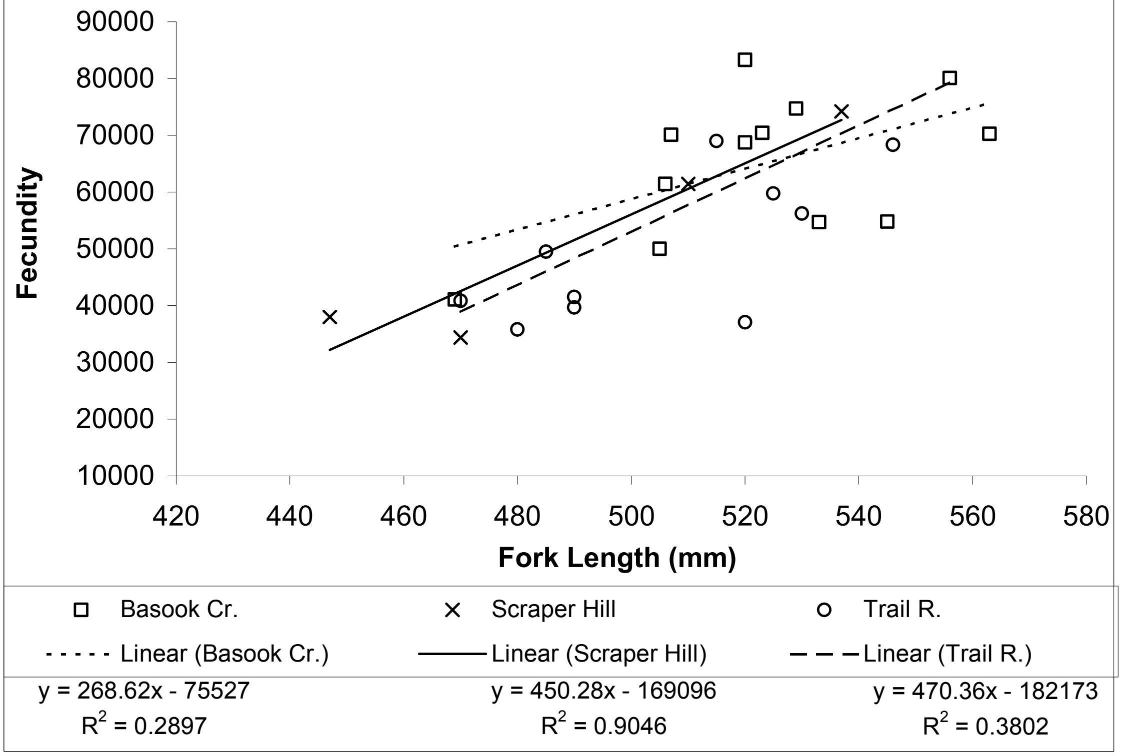
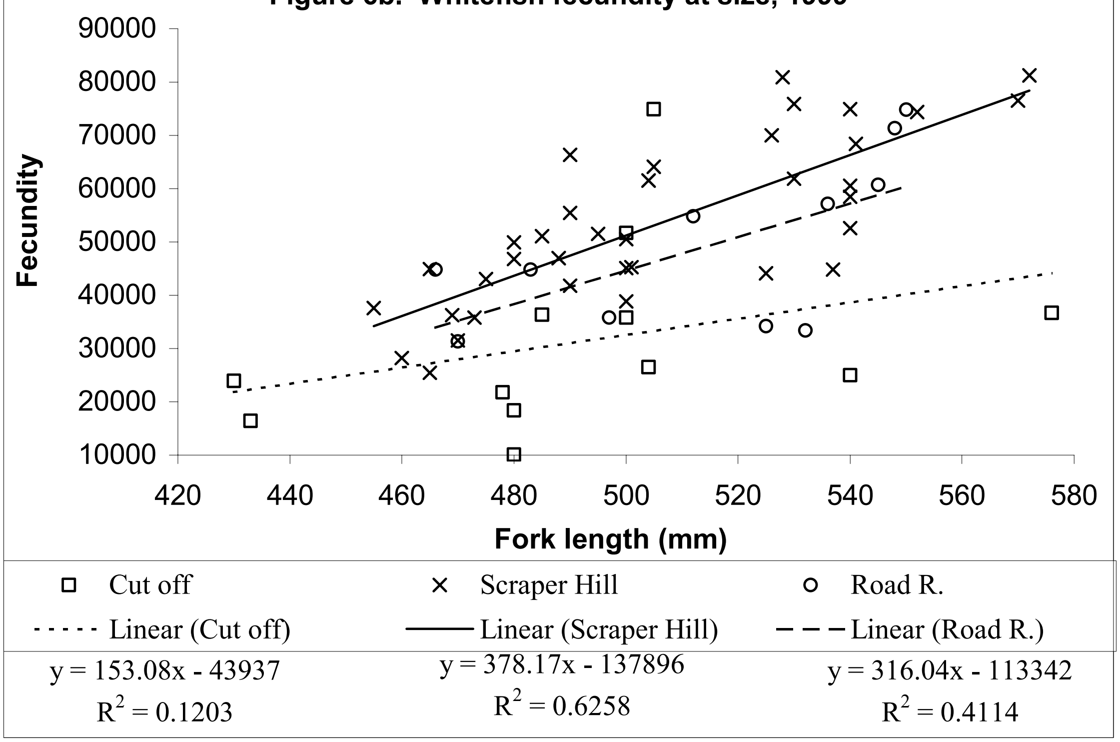


Figure 6b. Whitefish fecundity at size, 1999



Broad whitefish Migration timing

In 1998, ice freeze-up occurred from October 7th to October 12th (Figure 6a). After this time, the abundance of broad whitefish caught increased first at Basook Creek, the most downstream location and then at Scrapper Hill, the 2nd most downstream location. At Basook Creek, the number of broad whitefish caught in 1 day increased from October 14th to October 25th, and then catches continuously decreased until fishing ceased on October 31st. At Scraper Hill, the number of broad whitefish caught in 1 day increased on October 20th and continued to be high until November 15th. Basook Cr. caught a much higher concentration of broad whitefish during the peak, while Scraper Hill caught less each day but for a longer time span. The number of broad whitefish caught at Trail River also increased immediately after ice freeze-up, but fishing ceased on October 20th.

In 1999, ice freeze-up occurred from October 1st to October 7th (Figure 6b). However, Leslie Snowshoe at Cutoff was not able to start fishing until October 11th and William Teya at Road River was not able to start fishing until October 19th. Broad whitefish catch abundance at Cutoff appeared to have occurred in 3 cycles of increasing and decreasing catches. The first cycle started on October 10th, peaked on October 18th and decreased until October 26th. The 2nd cycle began immediately after, peaked on November 2nd, and decreased until November 9th. Again a 3rd cycle started immediately after, peaked on November 10th, and decreased until fishing ceased on November 17th. The same cycle occurred at Scrapper Hill, except not as distinct. At Scrapper Hill the first cycle started on October 10th, peaked on October 20th, and decreased until October 26th. The 2nd cycle began at that time, peaked on November

3rd, and decreased until November 11th. The 3rd cycle began immediately, peaked on November 12th, and decreased until fishing ceased on November 17th. At Road River, William did not fish continuously throughout the study, which made interpretation of the results difficult. There appeared to be a cycle of increasing and decreasing catches which initiated on October 19th (when fishing began), peaked on October 26th, and decreased until October 31st. Fishing ceased at this time, resumed November 6th, and ceased again on November 11th. No pattern was discernable during this time.

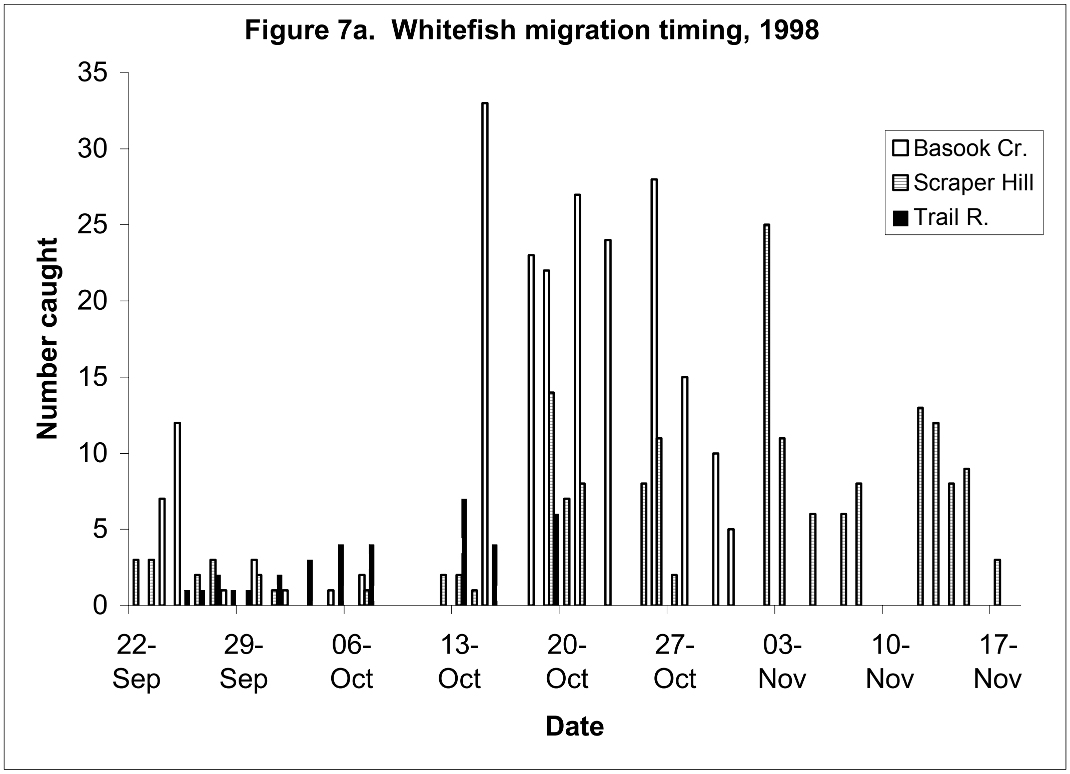


Figure 7a. Whitefish migration timing, 1998
Number caught
35
30
25
20
15
10
5
0
22-
Sep
29-
Sep
06-
Oct
13-
Oct
20-
Oct
27-
Oct
03-
Nov
10-
Nov
17-
Nov
Date
Basook Cr.
Scraper Hill
Trail R.

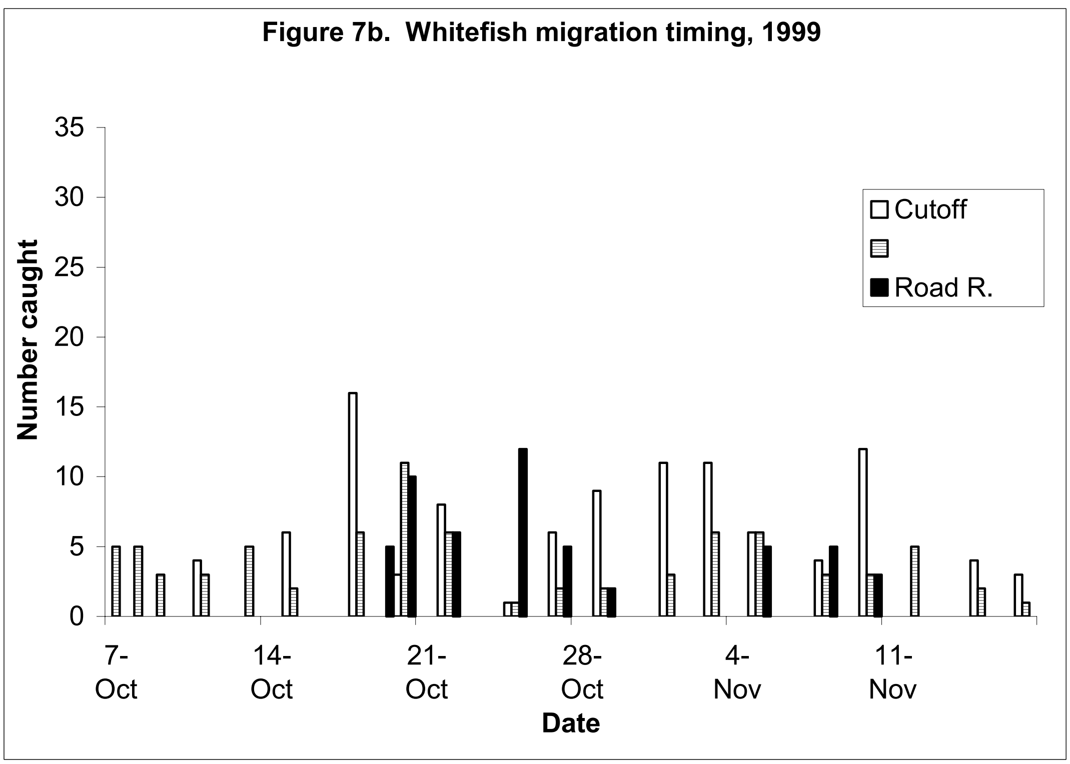


Figure 7b. Whitefish migration timing, 1999
Number caught
35
30
25
20
15
10
5
0
7-
Oct
14-
Oct
21-
Oct
28-
Oct
4-
Nov
11-
Nov
Date
Cutoff
Road R.

Broad whitefish Spawning habitat

In 1998, a helicopter was used in an attempt to visually locate spawning aggregations of broad whitefish and describe the spawning habitat. However, the effort was unsuccessful due to ice flowing in the water and murky water preventing observers from seeing where/if broad whitefish were gathering under the ice. Monitors and other members of Ft. McPherson were asked if they knew of any spawning sites for broad whitefish, but no one knew of a particular area. Due to the unsuccessful attempt in 1998 to locate spawning aggregations by helicopter, this was not attempted in 1999. Instead, a request for airtime with a fixed winged aircraft was made (to Polar Continental Shelf) to pursue the location of spawning aggregations via radio tracking of broad whitefish. However, the request was not granted so no attempt was made in 1999 to locate broad whitefish spawning habitat. Due to these problems, no description of broad whitefish spawning habitat was feasible.

Discussion of Results:

Population biological data

This study was planned around the efforts to sample the broad whitefish spawning migration, therefor it was not surprising to find that broad whitefish was the most abundant catch in both years of the study (Figures 2a & 2b). However, less broad whitefish were caught in 1999 than in the previous year. This may have been due to the lack of influence of fish caught at Basook Creek in 1998, which were suspected of being from the Mackenzie and/or Arctic Red River as well as the Peel River. Other species caught during the study (lake whitefish, inconnu, northern pike and least cisco) have all been reported in catches from the lower Mackenzie delta (Jessop & Chang-Kue 1993, Reist & Bond 1988, Anderson 1995, Stewart 1996, Yaremchuk et al. 1989). The decrease in catch of inconnu and northern pike in 1999 was probably due to the later start of the study. The abundance of lake whitefish remained approximately equal in both years, probably because the study overlapped the migration timing of the species in both years. Although, the monitors noted to me that there never used to be many lake whitefish in the Peel River and now there appeared to be many. The occurrence of chum salmon in 1998 was not repeated in 1999, but the reasoning for the 1998 appearance has yet to be identified to my knowledge. While the occurrence of this species is rare in the Peel River, it was not unique to 1998. Jessop and Chang-Kue (1993) also reported catching a single specimen of chum salmon.

The youngest broad whitefish caught during the 2 years of this study were 5 years, but occurrences of fish less than 7 years were rare (n=4) (Figures 3a & 3b). This indicated that the population probably reached sexually maturity at age 7 or 8 and only then joined the spawning migration. This estimation of age-at-maturity was consistent with other broad whitefish studies in the Mackenzie Delta (Bond & Erickson 1985, Bond 1982, Stein et al. 1973). The most frequently caught ages ranged from 7 – 15 years, after which the number of older individuals caught decreased continuously to age 23. This range of ages has also been reported in other broad whitefish research from the lower Mackenzie Delta (Treble & Tallman 1997, Bond & Erickson 1985, Bond 1982, Jessop & Chang-Kue 1993 (age 6-13)). There were two strong cohorts evident in the study. One cohort at age 8 in 1998 (age 9 in 1999) and a second cohort at age 12 in 1998 (age 13 in 1999). The cohort with the greater abundance was reversed in the 2 years of the study. That is, in 1998 the age 12-13 cohort was largest, while in 1999 the age 8-9 cohort was largest. This could indicate that the same whitefish did not spawn every year. Riest & Chang-Kue (1997), Bond & Erickson (1985) and Bond (1982) suggested that Mackenzie broad whitefish probably spawn every 2nd or 3rd year due to the short growing season, low productivity, and yearly climatic variation typical in arctic environments. They proposed that adults are unable to acquire sufficient amounts of food to successfully reproduce in consecutive years. Further monitoring of this in the Peel River would provide more clarity.

The length frequency of broad whitefish caught during the 2 years of the study ranged from 410 mm to 620 mm (Figures 4a & 4b). This range of length values for broad whitefish has been reported by other research in the lower Mackenzie Delta as well (Treble & Tallman 1997, Jessop & Chang-Kue 1993, Norton 1997). These results are biased by the fact that mostly 5" gill nets were used throughout the study. However, I fished with a multi-mesh net and did not catch smaller fish. Leslie Snowshoe at Cutoff also fished with a smaller mesh net for personal purposes, and he sometimes sampled fish from this net. It was not clear which fish he caught in the 5 inch or 4 inch nets since he did not record this information, but he did catch more of the smaller broad whitefish (410 mm – 440 mm) than the other monitors from both years of the study. The overall most abundant size class caught in 1998 was 510 mm, while in 1999 it was 490 mm. These results were interesting because in 1998 it was the older age cohort (12-13 years) that was more abundant, and in 1999 the younger age cohort (8-9 years) was more abundant. If this was not an artifact of some type, it could have suggested that there was a positive relationship between the size and age of broad whitefish.

Contrary to the results above that suggested a positive relationship between broad whitefish size and age, the broad whitefish length-at-age results of this study were highly variable at all camps, and showed no obvious trends (Figures 5a & 5b). Fish caught of all sizes were all ages. This may be due to the fact that the broad whitefish caught during the study were mature spawners, most over age 7. The immature broad whitefish probably devoted all their energy (food consumption) to growth, but when sexual maturity was reached (at approximately age 7) energy was divided between growth, reproduction, and the migration to spawning habitat. This appeared to have resulted in the mature fish having had little energy left to direct to growth and therefor the growth rate after sexual maturity was minimal. In essence then, it suggested that the size of fish caught in the study was a reflection of the size the individual fish were when they reached sexual maturity. Naturally, growth continued after sexual maturity, but at a reduced rate and the size obtained did not correlate to age. As noted above, Leslie Snowshoe at Cuttoff sometimes sampled smaller fish which may have been caught in a smaller mesh net, but those smaller fish were still of older ages (minimum age 7 years). Tallman (1997) presented a graph of length-at-age data for broad whitefish from various Canadian Rivers that depicted a positive relationship, however the data were from fish of ages 1-15 years, so the overall relationship was not exactly that of what was observed in the Peel River.

Broad whitefish fecundity showed a positive correlation to size at all camps throughout the study (Figures 6a & 6b). This correlation has been demonstrated in other research as well (Snyder & Dingle 1989). The fecundity values recorded in this study were close to the range of those reported for broad whitefish from the Arctic Red

River, which were 10,000 – 70,000 eggs (Chudobiak 1995). The minimum fecundity values recorded in 1999 were somewhat less than those recorded in 1998 (10,000 & 30,000 respectively). This appeared to have been influenced by the fecundity values recorded at Cutoff, which were almost always below those of the other camps for a given size. The 2 lowest fecundity values were recorded at Cutoff, but these fish were a smaller size and therefore the reduced fecundity was not unusual. However, many of the other fish caught at Cutoff that displayed reduced fecundity were from fish of larger sizes, which would be expected to have higher fecundity. One explanation for this could be that of monitor sampling error. Broad whitefish eggs were a favorite among residents of Ft. McPherson and often they were sold in town. It was possible that Leslie was saving some eggs from each fish for sale, without realizing the analytical consequences (I heard advertisements on the local radio station that he had eggs for sale). Road River also had a few fish with lower fecundities, but these may be the result of the camp location. Road River was the most upstream location, which is closest to spawning habitat and therefore the fish were quite ripe. At this stage of maturity the gonad tissue breaks down and the eggs are released into the body cavity where they can be easily expelled upon handling. I observed this happening many times at Road River, and also noted that William was extremely careful when collecting the eggs. I do not feel it is like that the lower fecundities recorded at William's camp were a result of monitor error.

Broad whitefish Migration Timing

Many authors have stated that the broad whitefish spawning occurs shortly after ice freeze-up (Reist & Bond 1988, Chang-Kue & Jessop 1997). This study supported that research. In 1998 of this study the broad whitefish catch frequency did increase visibly after freeze-up (Figure 7a & 7b). However, in 1999 it was decided to start the study later in hopes of seeing a more dramatic increase and following decrease in abundance of broad whitefish caught each day. Unfortunately, the ice slush started running earlier in 1999 which prevented monitors from sampling before ice freeze-up.

In 1998, the broad whitefish caught at Basook Creek (Fred Koe) increased in abundance shortly after freeze-up. Robert Elias (at Scraper Hill) did have an increase in broad whitefish catch shortly after Fred, but to a much lesser degree and longer duration. There was large peak in abundance at Scraper Hill in early November, but this may have been due to an accumulation of fish in the net if it hadn't been checked for many days prior. Whitefish catch at Scraper Hill continued to be moderate through the end of the study. The number of broad whitefish caught at Walter's camp at Trail River did increase after freeze-up as well. However, due to slush running under the ice, Walter was not able to reach his net and consequently it was lost. This prevented the following of further catches at the most upstream camp. There was no clear sequence of peak catch abundance's following from the most downstream camp (Basook Cr.) through to the most upstream camp (Trail R.).

In 1999, there appeared to be a regular cycle of increasing and then decreasing abundance of broad whitefish caught each day at each camp (Figure 7b). This was most evident at Cutoff, but also occurred strongly at Scrapper Hill. This pattern may have reflected a tendency for fish of differing size or sex to migrate at different times. It is not uncommon in migrating species for fish of differing status to migrate at different times. For example, the larger fish may be at an advantage in that they do not require as much time (food energy) to prepare for the migration and can therefor run upstream first and travel farthest to utilize the best spawning habitat. Also, it is not uncommon for the female fish to migrate upstream first to find appropriate spawning habitat and have the males follow later. This does appear to be the case in the Peel River, and it was agreed among the monitors in this study that in the Peel River, the female broad whitefish migrated first, followed later by the larger male fish and then the smaller male fish. This cyclic pattern was not clearly detected at Road River, likely due to inconsistent fishing. William was unable to begin fishing as early as the other monitors due to poor ice conditions, and later became stranded in Ft. McPherson for many days also due to poor ice conditions. Unlike in 1998, the 1999 results did show a sequence of broad whitefish abundance increasing first at the most downstream camp (Cutoff), followed by the mediate camp (Scrapper Hill), and lastly at the most upstream camp (Road River). There was 3 cycles noted at both Cutoff and Scrapper Hill, and in all 3 the abundance of broad whitefish caught each day peaked first at Cutoff and followed shortly after at Scrapper Hill.

The results of this study support literature that the broad whitefish do migrate upstream shortly after ice freeze-up. However, the literature suggested a concerted run of broad whitefish during a short time span, but this study does not support that. In 1998 and 1999, it appeared that the run of broad whitefish migrating up the Peel River to presumed spawning habitat was limited to that after ice freeze-up, but the run was less intense and of a longer duration than we had expected.

Broad whitefish Spawning habitat

Unfortunately, the efforts to locate and describe broad whitefish spawning habitat were unfulfilled by this study. Future work could include radio tracking of the fish and interviews of the people living along the Peel River. Chang-Kue and Jessop (1997) did a radio tracking study of broad whitefish and did track some individuals migrating up the Peel River. They found a single broad whitefish that migrated up to near Trail River and remained in that area throughout their study. They described this area as containing mostly cobble and gravel bottom, a good habitat for spawning. Norton (1997) also suggested the area near Snake River was a spawning area for broad whitefish.

Reflections and Recommendations for the Future

I feel it is critical to provide more in depth training for the monitors and to be consistent with the monitors chosen for the study. The monitors made errors because they were making decisions, with good intentions, but without realizing they had negative results for the project. More detailed training involving theory as well as practice would help to explain why each step is important and should not be changed.

The camp locations used varied in successfulness. Basook Cr. had results that may indicate they were catching fish from other populations. Trail and Road R. both had problems with freeze up and overflow and therefor lost active time in the study.

Scrapper Hill seemed to have the best location. He was able to start fishing soonest after freeze-up and had little problems throughout the study.

It may be beneficial to use smaller mesh sizes to be sure that the youngest whitefish ages are really 5-7 and not just that smaller and younger fish are getting through the net. Cutoff used a smaller mesh net for his own purposes and caught smaller whitefish. However, I used a multi-mesh net of sizes from 1.5 – 4 inches, but did not catch many smaller whitefish. I feel this is worth further investigation. However, caution must be used if this is to be done because small fish that may be caught may not be part of the anadromous population that is migrating to spawning habitat. There may also be a population of broad whitefish that remain in the river their entire life cycles (personal communications with Ken Change-Kue, Department of Fisheries & Oceans).

Some community members were concerned that the study did not record the runs of others fish besides broad whitefish. A possible solution could be to have one monitor start fishing early and continue through November, but to add another monitor when the broad whitefish start going through. I would recommend hiring Fred Koe to do the long term monitoring from his camp near Ft. McPherson and then to add Robert Elias at Scrapper Hill during the broad whitefish run. There may be benefits to having camps spread throughout the Peel River, but the downstream locations are producing unclear results with potential fish from outside the Peel River and the upstream locations appear to be more subjected to environmental restrictions. Consultation with community members can decide whether the environmental related problems encountered upstream are normal or isolated events.

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Appendix

Camp locations:

- Fred Koe at Basook Cr., 67°44.42N, 134°38.33W (1998)
- Robert Elias at Scraper Hill, 67°15.72N, 134°53.16W (1998 & 1999)
- Walter Alexie at Trail R., 66°40.30N, 134°33.55W (1998)
- Leslie Snowshoe at Cutoff, 67°38.955N, 134°38.890W (1999)
- William Teya at Road R., 66°52.790N, 135°00.122W (1999)

Species Names:

- whitefish a.k.a. broad whitefish (*Coregonus nasus*)
- crookedback a.k.a. lake whitefish (*Coregonus clupeaformis*)
- coney a.k.a. inconnu (*Stenodus lucicthyes*)
- herring a.k.a. least cisco (*Coregonus sardinella*)
- little coney a.k.a. arctic cisco (*Coregonus autumnalis)*
- jackfish a.k.a. northern pike (*Esox lucius*)
- dog salmon a.k.a. chum salmon (*Onchorhynchus keta*)

Fish Codes:

BDWT – broad whitefish
LKWT – lake whitefish
INCO – inconnu
LSCS – least cisco
ARCS- arctic cisco
CHUM – chum salmon
LNSK – longnose sucker
MNWT – mountain whitefish
NRPK – northern pike

Dates fished per camp.						
1998						
Camp	Start	stop (freeze)	Start	Stop	Days fished	Fish caught
Basook Cr.	Sept. 24	Oct. 7	Oct. 15	Oct. 28	16	346
Scraper Hill	Sept. 22	Oct. 7	Oct. 12	Nov. 17	26	254
Trail R.	Sept. 25	Oct. 7	Oct. 13	Oct. 19	12	124
1999						
Cutoff	-	-	Oct. 7	Nov. 17	20	203
Scraper Hill	-	-	Oct. 7	Nov. 17	22	173
Road R.	-	-	Oct. 20	Nov. 12	10	69