Fisheries and Oceans Canada | Pêches et Océans Canada
Science | Sciences

C S A S | ***S C C S***

Canadian Science Advisory Secretariat | **Secrétariat canadien de consultation scientifique**

Research Document 2012/069 | **Document de recherche 2012/069**

Central and Arctic Region | **Région du Centre et de l'Arctique**

Information in support of Assessment of Buffalo River Inconnu, (*Stenodus leucichthys*), Great Slave Lake, Northwest Territories, 1945-2009

Information à l'appui de l'évaluation de l'inconnu, (*Stenodus leucichthys*), de la rivière Buffalo, Grand lac des Esclaves, Territoires du Nord-Ouest, de 1945 à 2009

Melanie VanGerwen-Toyne[1], Chris Day[1], Fred Taptuna[2], Deanna Leonard[2], Stacey Frame[1] and Ross Tallman[1]

Fisheries and Oceans Canada / Pêches et Océans Canada
[1]Freshwater Institute / Institut des eaux douces
501 University Crescent / 501, University Crescent
Winnipeg MB R3T 2N6
Canada

[2]Suite 301 - 5204 - 50th Avenue
Yellowknife, NT
X1A 1E2

ISSN 1499-3848 (Printed / Imprimé)
ISSN 1919-5044 (Online / En ligne)

Canada

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

Correct citation for this publication:

VanGerwen-Toyne, M., Day, A.C., Taptuna, F., Leonard, D., Frame, S., and Tallman, R. 2013. Information in support of Assessment of Buffalo River Inconnu, (*Stenodus leucichthys*), Great Slave Lake, Northwest Territories, 1945-2009. DFO Can. Sci. Advis. Sec. Res. Doc. 2012/069. vii + 81 p.

ABSTRACT

Inconnu have been caught primarily as bycatch in the Lake Whitefish commercial fishery in Great Slave Lake (GSL) since 1945. However, targeting has occurred in some years, including the late 1970s; after which time harvests declined and have remained low. Currently, harvests of Inconnu remain low due to reduced stocks, non-targeting, implementation of closure zones, and decreased fishing effort.

Periodically since 1947, research to document Inconnu distribution and stock status has been undertaken. Results of several mark-recapture studies and a fishery-independent harvest study have shown that the south shore of GSL is an important area for the Buffalo River Inconnu stock. Results of a gillnet sampling program at the mouth of Buffalo River has shown that the targeting of Inconnu in the late 1970s had a profound negative impact on the Buffalo River stock and its biological parameters, and that the status of the stock is still dependent on harvest levels. Fish fork length, age frequency, and size-at-age all showed a reduction after the late 1970s when Inconnu harvests were high. In addition, the percentage of mature individuals caught, especially females, dropped dramatically in the early 1980s. Similarly, catch-per-unit-effort (CPUE) was highest prior to the fishery targeting Inconnu, after which it dropped dramatically. These metrics showed periods of improvement when harvests were lowest, but have not returned to their original state.

Fishing closures implemented by DFO Fisheries and Aquaculture Management have been successful in areas applied, but total Inconnu harvest in the west basin remained above 10,000 kg in 2008-2009. Further recommendations for closure zones based on risk to the Inconnu stock are presented.

RÉSUMÉ

Depuis 1945, l'inconnu est surtout capturé de façon accessoire dans le cadre de la pêche commerciale au grand corégone dans le Grand lac des Esclaves. Cependant, on a observé un ciblage pendant certaines années, notamment vers la fin des années 1970, après quoi les prélèvements ont décliné puis sont demeurés faibles. Actuellement, les prélèvements d'inconnus demeurent faibles en raison du déclin des stocks, de la fin du ciblage, de la mise en œuvre de zones de fermeture de la pêche et d'une diminution de l’effort de la pêche.

À plusieurs reprises depuis 1947, on a mené des recherches visant à documenter la répartition et l'état du stock d'inconnu. Les résultats de plusieurs études de marquage et recapture ainsi que d'une étude indépendante de la pêche ont montré que la rive sud du Grand lac des Esclaves est une zone importante pour le stock d'inconnus de la rivière Buffalo. Les résultats d'un programme d'échantillonnage au filet maillant mené à l'embouchure de la rivière Buffalo ont révélé que le ciblage des inconnus vers la fin des années 1970 avait eu d'importantes répercussions négatives sur le stock de la rivière Buffalo et ses paramètres biologiques. Les résultats ont aussi permis de constater que le stock dépend toujours des niveaux de prises. La longueur à la fourche, la fréquence par rapport à l'âge et la taille selon l'âge du poisson ont toutes affiché une diminution après les années 1970, c'est-à-dire quand les récoltes d'inconnus étaient élevées. En outre, le pourcentage d'individus matures prélevés, en particulier les femelles, a sérieusement chuté au début des années 1980. De même, les captures par unité d'effort (CPUE) étaient plus élevées avant la pêche ciblée à l'inconnu, après quoi elles ont beaucoup diminué. Ces données ont révélé des périodes d'amélioration lorsque les prélèvements étaient moins importants, mais le stock n'a jamais retrouvé son état d'origine.

Les fermetures de la pêche mises en œuvre par Gestion des pêches et de l'aquaculture du MPO ont donné de bons résultats dans les zones concernées, mais les prélèvements totaux d'inconnus dans le bassin ouest étaient encore supérieurs à 10 000 kg en 2008-2009. D'autres recommandations relatives à des zones de fermetures fondées sur le risque pour le stock d'inconnus sont présentées.

INTRODUCTION

A commercial fishery was established on Great Slave Lake in 1945 (Rawson 1947). Lake Whitefish is the target species and Inconnu is a bycatch species, but targeting of Inconnu has occurred in some years. While genetic stock discrimination has not occurred to definitively define the Inconnu stocks of GSL, fall spawning runs of Inconnu have been reported historically in the Buffalo River, Taltson River, Slave River, Little Buffalo River, Hay River, Yellowknife River, and Mackenzie River (Rawson 1947, Fuller 1955). However, Inconnu presence in many of these systems is now rare relative to past run sizes. Concern for the Inconnu of GSL has been voiced repeatedly (Keleher 1972, Day and Low 1993, Stewart 1999) and many studies have been performed to increase knowledge and understanding of Inconnu. In GSL, studies focusing on Inconnu distribution have been performed and relative abundance and commercial harvests trends have been tracked. Further, a monitoring program at the mouth of the Buffalo River has been conducted to monitor the status of that Inconnu stock; the data from which was used to develop a Precautionary Approach Model for the stock and placed the stock in the Critical Zone (Day et al. 2013). All of these studies provided information that was used by Fisheries Management to introduce geographic and temporal fishing closure zones in attempts to protect the Inconnu.

This report summarizes the distribution and relative abundance of Inconnu in GSL from the inception of the commercial fishery through 2008-09, and the impact of harvest on abundance and other population dynamic factors. Simply stated, the Inconnu in Buffalo River are subjected to high harvest rates in the Western GSL, resulting in population declines. Also summarized here are the recommendations by Science to Fisheries Management and the resulting actions taken by Fisheries Management in efforts to protect the stock.

BACKGROUND

The Buffalo River originates in Buffalo Lake and empties into Great Slave Lake (GSL) 40 km east of the town of Hay River, Northwest Territories (Figure 1). Buffalo River drains an area of 17,638 km^2 and is generally swift and shallow with water depths peaking at 2.0 m in the main channel during the spring run-off period (Rawson 1950).

The Inconnu is a member of the whitefish family (subfamily coregoninae) which is distributed in northwestern North America and Eurasian arctic watersheds (Scott and Crossman 1973). In GSL, the Inconnu are freshwater migratory as opposed to their anadromous counterparts further North (Howland et al. 2001). Inconnu are usually found in shallow, inshore areas of the main body of the lake; however, mature fish ascend rivers for spawning and some Inconnu enter deeper waters in winter, although rarely in waters deeper than 30 m (Fuller 1955, Howland et al. 2000). Inconnu are fast growing and the largest recorded fish was caught in Buffalo River in the early 1940s; weighing almost 25 kg (Scott and Crossman 1973). GSL Inconnu reach sexual maturity between the ages of seven to 10 years (Scott and Crossman 1998). In late September, mature Inconnu start to migrate up the Buffalo River to spawn in Buffalo Lake or its tributaries and a concerted run of spent individuals re-entering GSL occurs in early to mid-October (Larkin, MS cited in Fuller 1955). Young Inconnu remain in Buffalo Lake or its tributaries for approximately four years feeding on invertebrates before they move into GSL and feed on small fish (Fuller 1955, Larkin, MS cited in Fuller 1955). There is a smaller run of Inconnu into Buffalo River in the spring time, but its purpose is not well understood (Fuller 1955); perhaps for feeding. However, a large congregation of INCO does occur in the spring at the mouth of Buffalo River.

The commercial fishery has operated on GSL since 1945 (Rawson 1947) using bottom-set gillnets with mesh size ranging from 127 mm to 140 mm. For the purpose of monitoring the

commercial harvest, GSL has been divided into a variety of management areas over the years, for which boundaries, nomenclature, and quotas have changed. At present, there are seven management areas for which the boundaries have remained more or less fixed since 1972 (Figure 2). Throughout the fishery operations, there have been up to four fish plants open on GSL but only one remained open in 2009, and since 2006-2007 it has only been opened in the summer months.

More detailed information on the study area, biology of Inconnu, Inconnu stocks in GSL, and the GSL commercial fishery, can be found in Day et al. (2013).

ASSESSMENT

COMMERCIAL HARVEST TRENDS

All harvest records are recorded in Fishing Year, which is from November 1 to October 31 of the following year and measured as round weight (Yaremchuk et al. 1989, DFO Fisheries Management unpublished records). Fishing effort data from the commercial fishery is not available.

The harvest of Inconnu from GSL has varied dramatically since commercial fishing was initiated in 1945 (Figure 2, Table 3). Catches ranged from a high of 163,000 in 1948-1949 to a minimum of 10,156 kg in 2007-2008. Inconnu are primarily caught as bycatch in the Lake Whitefish fishery, but have been targeted in some years (as evidenced by disproportionally high Inconnu harvests compared to Lake Whitefish harvests, as well as fisher communication explaining that Inconnu was targeted due to increased price paid for the sale of Inconnu). The most notable case of targeting occurred during 1977-1978 and 1978-1979 when the Inconnu harvest averaged 152,966 kg +/- 450 kg. Since that time, harvests of Inconnu have decreased dramatically due to stock depletion, non-targeting, implementation of closure zones, and decreased effort. In 2008-2009, 13,141 kg of Inconnu were removed from GSL by the commercial fishery.

Since Inconnu are caught primarily as a bycatch in the Lake Whitefish fishery, it would be expected that Inconnu harvest would follow the same relative trend as Lake Whitefish harvest. This is generally true, but a few exceptions occur (Figure 3). Particularly noticeable is the period mentioned earlier (1977-1978 and 1978-1979) when targeting of Inconnu was apparent because while harvest of Lake Whitefish did increase slightly, Inconnu harvest increased greatly. Afterward, even when Lake Whitefish harvest peaked in 1987-1988, Inconnu harvest remained low relative to peak periods. From that point on, Lake Whitefish harvest generally decreased steadily, but Inconnu harvest varied with periods of decline interspersed with years of higher relative harvest, particularly in 1988-1989, 1996-1997, 2002-2003 and 2003-2004. The last two years may have also been affected by targeting of Inconnu.

Harvest in Management Areas

GSL is divided into seven management areas; 1 West (IW), 1 East (IE), 2 (II), 3 (III), 4 (IV), 5 (V), and 6 (VI) (Figure 1). Area VI was closed to all commercial fishing in 1974 and is managed exclusively for the subsistence and sport fisheries. Harvest of Inconnu in the remaining management areas is variable; however, the Inconnu harvest in Area IE (818,738 kg, 38%) and V (709,658 kg, 33%) are higher than that of any other area (Figure 4, Table 3). As will be discussed in the next section, tagging data suggest that Inconnu from the Slave River reside primarily in Area V, while it is Inconnu from the Buffalo River that primarily frequent the west basin (which includes IE).

When Inconnu harvest data from the west basin (Areas IW, IE, II, and III) are pooled, peak harvests in 1977-1978 and 1978-1979 are evident (Figure 5, Table 3). Subsequently, harvest was greatly reduced in 1981-1982 and 1982-1983 and varied thereafter, but never returned to pre-1978 levels.

INCONNU DISTRIBUTION

Mark-recapture programs

Inconnu in GSL have been the focus of several mark-recapture studies undertaken by DFO. In all studies, fish were caught with gillnets, marked with T-bar anchor tags, and were recaptured in the commercial Lake Whitefish fishery in GSL, as well as by subsistence, domestic, and sport fishers, and by fishers outside GSL.

From 1995 to 1999, 1,394 Inconnu were marked in the Slave River at Fort Smith and Salt River (Table 4). Of these, 297 tags have been returned to DFO (Figure 6, Table 5). The majority (48%, n=142) of fish recaptured were in Area V, 28% (n=84) were caught in the west basin and 6% (n=18) in Area IV. These results suggest that the majority of Inconnu utilizing the Slave River inhabit Area V of GSL, but some can also be found in the west basin.

Similarly, from May 24 to June 7, 1994, 198 Inconnu were marked at Resdelta Channel; the largest and eastern-most channel of the Slave River where it flows into GSL. A total of 30 tags (15%) were returned to DFO. Again, the majority (n=16, 53%) of tags returned were from fish captured in Area V (Figure 7, Table 6). Seven tags (23%) were returned from fish caught in the west basin. These results also suggest that the majority of Inconnu utilizing the Slave River inhabit Area V of GSL, but some can also be found in the west basin.

The largest Inconnu mark-recapture study was initiated in 1995. Fish were marked (tagged) with external T-bar anchor tags in 1995, 1997, 1999, 2000, 2003, 2006, 2007, and 2008. Inconnu were tagged in late May or early June at the mouth of the Buffalo River. At this time, the study site was intermittently clear of ice, allowing the capture of Inconnu, but the greater GSL remained ice-covered. Fish were caught initially using a 133 mm (5.25-inch) mesh gillnet but the fish were being caught by the gills and harmed. The gear was therefore changed to a 108 mm (4.25-inch) mesh net which snagged Inconnu by the mouth and caused less harm to the fish. Once landed, Inconnu were assigned a sample number, measured for fork length (mm), tagged, stripped of a few scales (for ageing purposes), and released into the water. A reward of $10 was offered for the return of a tag. Information on the date and location the fish was caught was requested when the tags were submitted to DFO. Tagged fish were recaptured primarily in the commercial, but also by subsistence, domestic, and sport fishers, and by fishers outside GSL.

A total of 1,029 Inconnu have been tagged at the mouth of Buffalo River (Table 7). Of these, 178 (17.3%) have been returned to DFO (Figure 8, Table 8). There are likely other tagged fish that were caught but not reported to DFO. Of the returned tags, 155 (87.1%) were caught in the west basin of GSL (IE, IW, III) or the rivers along the west basin (Hay River, Little Buffalo River). Further, 148 (95.5%) of the tags returned from the west basin were caught along the south shore. This highlights the importance of the south shore of the west basin for the Buffalo River stock of Inconnu, but is also dependent of fisher effort location.

Tag recovery data also indicate that at least part of the Inconnu population which congregates in spring at the river mouth, enters the Buffalo River in early summer and slowly migrates 90 km inland to Buffalo Lake. Inconnu then congregate in the fall at the mouths of the rivers draining into Buffalo Lake. They then leave these river mouths, presumably to spawn upstream, and appear again at these areas in early winter, presumably after spawning has occurred. This

long drawn out summer migration is also characteristic of anadromous Inconnu. In contrast, the fall downstream runs of post spawning Inconnu are synchronous and pronounced. It is not known if the Inconnu which enter the Buffalo River spawn only in the drainages of Buffalo Lake. Perhaps there are separate stocks which spawn in the lower Buffalo River and in the upper reaches of the streams which drain into Buffalo Lake. Fishermen have reported that there is also movement of Inconnu into the mouth of the Buffalo River in fall. If this speculation is true, that discrete stocks my utilize different reaches of the Buffalo River system for spawning, then GSL Inconnu are similar to Inconnu stocks in the Yukon River drainage system where Alt (1988) has found discrete local populations in the Upper Yukon and anadromous populations in the Lower Yukon. Nothing is known of the size of the spring Buffalo River upstream migration or of its size relative to the size of the fall upstream migration. Letichevskiy (1975) found that for Inconnu of the Volga River, the ratio of fall to spring migrants was two to one.

Fishery-Independent Harvest Study

While there have been several informative Inconnu mark-recapture studies in GSL, the return of marked fish has occurred primarily from the commercial fishery. This provides insight into the location of Inconnu with relation to the areas fished by the commercial fishery, but may not reflect the full distribution of the Inconnu stock(s). Further, in the past, some commercial fishers have reported that they could avoid catching Inconnu by avoiding certain fishing locations, but recently some fishers have been reporting that they are now catching Inconnu everywhere and they are becoming harder to avoid. Therefore, the Fishery-Independent Harvest Study (FIHS) was initiated in 2009 by DFO to document the spatial and temporal distribution of Inconnu in GSL management Area IE throughout the summer months, independently of what was being caught, or areas fished, by the commercial fishery.
This study design involved random, depth-stratified sampling in GSL Area IE. The area was divided into 24 grids at varying water depths (Figure 9). The deepest water (> 30.5 m) in the area was excluded because the fishing boat hired was small and venturing into deeper waters would have been hazardous. A commercial fisherman was hired from June 28 – Aug 31, 2009 to set a single gillnet (127 mm, 3.7 m deep, 91.4 m long) in two grids per day, hauling the following suitable day (weather permitting). CPUE, number of Inconnu caught per 24 hours, per net) information was recorded and a sub-sample (five per species caught, per day) of fish were lethally sampled for biological characteristics (biological results not discussed here).

A total of 65 net-sets were performed (Figure 10). Each grid received zero (grid 21) to seven (grid 5) sets (Table 9), based on a random number table used for selection. A total of 2,442 fish were caught during the study; of which 77 (3.2%) were Inconnu (Table 10). Note, information was insufficient in two instances therefore those fish were removed from further analyses. Inconnu were caught in 32 of the 65 net sets (49.2%, Table 11). The CPUE of Inconnu was low in all areas, ranging from 0.00 (nets set but no Inconnu caught) to 0.23 (five Inconnu caught) (Table 11).

Inconnu were caught most frequently in relatively shallow waters. A positive correlation between water depth at net set site and grid ID was observed (Figure 11, R^2=0.66) (confirming that the grid sites near shore were shallower than the grid sites offshore), and a weak negative correlation was found in the relationship between Inconnu CPUE and water depth (Figure 12, R^2 = 0.049). However, when the data for the lower two grid regions and upper two grid regions were pooled, a difference was found in the spatial distribution of Inconnu caught. Inconnu were captured almost exclusively in the lower two grid regions (grids 1-15, near shore, Figure 13). Forty-nine nets were set in the lower two grid regions, of which 32 sets (65%) caught Inconnu (n=72 INCO, Table 11). Conversely, 15 nets were set in the upper two grid regions (grids 16-24) but Inconnu were caught in only three sets (20%, n=3 Inconnu; one per set, two sets in grid 20) (Table 11). While the effort was not equal in the two regions, this is accounted for in the CPUE calculations and there was a significantly higher CPUE in the lower grid regions (T-test,

p<0.05, n=61; data were incomplete in three sets, therefore CPUE could not be calculated for those sets). The grids were set up in a depth stratified manner, therefore it is not surprising that in the lower grids; the ones closer to shore, the nets were set is significantly shallower water (T-test, p<0.05, n=64). Further, no Inconnu were caught in water deeper than 23.5 m (Table 12). This supports the remarks described earlier in which local fishers said Inconnu were not caught in off-shore, deeper waters.

Statistically, no significant difference was found between the mean CPUE of Inconnu caught in June (0.04, n=1), July (0.04, n=20) or August (0.02, n=16) (ANOVA, p=0.64, df=2). However, there did appear to be a difference in temporal distribution observed in the Inconnu CPUE throughout the study. Only one net was lifted in June, on June 28 in grid 6; therefore, analysis for the month of June is not possible other than to say Inconnu were there at that time (Figure 14 and 15). In July, Inconnu were most dispersed and fish were caught in 13 different grids (57% of fished grids), including the two occurrences of Inconnu caught in grids far from shore (grids 20 and 22). In August, Inconnu were caught in six grids (26% of grids fished). The highest CPUE of Inconnu was in late August in grid 5 (Aug 30 CPUE 0.23, Aug 31 CPUE 0.23, Table 11, Figure 14). The second highest Inconnu CPUE was July 18 in grid 14 (CPUE 0.20). These results suggest that Inconnu are more dispersed in July than August, but do not reveal the cause.

GSL is subject to a thermocline from mid-July through September at approximately 15 m (Blanken et al. 2000); therefore, a change in water temperature at depth may be one reason for the temporal distributions seen in the Buffalo River Inconnu. However, when this was tested, no significant difference was found in the depth of water Inconnu were caught in between July and August (T-test, p=0.258, n=32; only sets which captured Inconnu were included in the analysis).

General observations and hypotheses may be developed based on these results regarding spatial and temporal distribution of Inconnu in GSL Area IE, but the number of Inconnu caught was low; therefore the data should be regarded as an introduction rather than a conclusion to the distributional habits of Inconnu. Continuation of the study should provide more data to boost the power of analyses.

STOCK STATUS

All Inconnu data used in the biological assessment and CPUE analysis were collected during a DFO-run gillnet sampling program, independent of the commercial fishery. The study occurred at the mouth of the Buffalo River in GSL in the spring (May-June) in varying years between 1947 and 2008. Fish were caught with 140 mm (5.5-inch) gillnets until 1977, after which gillnets of 133 mm (5.25-inch) were used. This was consistent with the gear used in the commercial Lake Whitefish fishery (note: the legal size was changed to 127 mm (5-inch) in 1997 but fishers found detangling fish in this mesh size to be too cumbersome and therefore continued to use 133 mm mesh nets).

Biological Information

Age

All Inconnu were aged using scales. This method has been shown to underestimate age of Inconnu 10 years and older (Howland et al. 2004). An age-comparison study for Inconnu from the Buffalo River was also undertaken using scales, otoliths, and fin rays collected in 1993. Paired T-tests resulted in no significant difference (p>0.05) in ages between otoliths and fin rays, but both were significantly different than age estimated from scales (p<0.05, DFO unpubl.

data); thus the interpretation of age-related results for fish 10 years of age and older should be cautious.

The age-frequency distributions are shown in Figure 16. The frequency of ages 18 years and older are summed and represented in the last category. At the onset of the Lake Whitefish commercial fishery, the age-frequency distributions of Inconnu were unimodal and ranged from four to 24 years old. Fish this old have not been recorded in the spring survey program since then, but younger fish have (Figure 16). The age-frequency distribution in 2008 ranged from five to 12 years old.

The age-frequency distributions in 1947 and 1948 were not significantly different from one another (Kolmogorov-Smirnov, $p=0.199$), but both were significantly different than all other years (Kolmogorov-Smirnov, $p<0.05$, Table 13). There was no significant difference in age frequency distributions from 1955 through 1981, except all were significantly different than 1978 (Kolmogorov-Smirnov, Table 13). This is interesting since we would have expected to see a significant difference in 1979, not 1978; the data collected in this program were done so in the spring each year, but while fishing did occur during the winter, the majority of the catch was generally encountered in the summer fishery. Therefore, we expected to see the full impact from the high harvest in 1978 in the spring survey collection from 1979. While the impact of the 1978 harvest was not recorded in the age-frequency distribution in 1979, an interesting correlation did occur with regards to spawning recruits. In 1978, the seven year old cohort represented the largest portion of the catch (Figure 16) and would have been the last group of fish sampled in the spring survey before the high harvest later that summer. By 1983, this cohort of fish was no longer represented in the catch, but its direct offspring (spawned in 1978) was evident as four year old fish (Figure 16). From 1983 through 1987, this cohort dominated. By 1990, the last of this cohort remained as 11-year old fish but a new distribution of younger fish was already establishing. Not, surprisingly, the age-frequency distributions were significantly different from 1982 through 1989, except in two cases (1977-1987, and 1978-1989). This pattern might suggest that recruitment failure had occurred due to high harvests in 1978, but it is also possible that it constitutes an important survival event as well. That is, the strong cohort could represent an atypically strong survival event in 1978/1979 where conditions were very positive and resulted in an unusually large number of offspring spawned/survived that year. From 1990 on, there were an increased proportion of comparisons which resulted in no significant difference between years, but a non-significant result was still the minority of cases (Table 13).

A significant difference in mean age was evident when comparing all years (ANOVA, $df=28$, $p<0.05$), as well as in numerous years when compared pairwise (Bonferonni, $p<0.0018$, Table 14). The mean age of Inconnu was highest at the onset of the commercial fishery in 1947 (8.9 years, Figure 17), which was not significantly different from mean age in 1948 but both were significantly older than any other year in a pairwise comparison, with the exception of 1948 compared to 1976, when no significant difference was found. This is not surprising as a reduction in the older age classes (larger fish) would be expected at the onset of a new size-selective fishery. However, there was then a downward trend (with annual variation) until 1983, when the mean age was at its lowest recorded age (4.9 years). The mean age in 1983 was not significantly different from 1984 but then both were significantly younger than all other years, with the exception of the pairwise comparison between 2007, in which no significant difference was found (Table 14). Subsequently, mean age increased steadily until 1986 (6.7 years). This corresponds with the cohort spawned in 1978 which is observed moving through the age-frequency distribution in the 1980s. From 1987 through 1999 mean age remained relatively consistent (between 6.2 and 7.1 years, Figure 17) with significant differences found in only two cases when compared pairwise (Table 14). By 2003, mean age rose to 7.3 years and was significantly higher than most years after 1982 when compared pairwise. Mean age remained

above 7 years in 2006, but in 2007 dropped to 5.2 years. The year 2007 was significantly lower than all but three other years (1983, 1984, 1985) when compared pairwise. Interestingly, harvest in the west basin reached 39,147 kg in 2003-04 and declined steadily until 2006-07, at 5,782 kg. In 2008, mean age rose again to 7.1 years and harvest increased slightly.

Fork Length

The fork length-frequency distributions are shown in Figure 18. Fish length was rounded down to the lower 20 mm size class for graphical purposes. The frequency of fork lengths of 1,000 mm and larger are summed and represented in the last category.

At the onset of the Lake Whitefish commercial fishery in 1947 and 1948, the length-frequency distributions of Inconnu were unimodal, ranged from 521 mm to 1,230 mm (Figure 18), and not significantly different from one another (Kolmogorov-Smirnov, $p=0.40$). However, the distributions were significantly different ($p<0.05$) in 1947 and 1948 when compared to all future years, except 2003 (Table 15). From 1955 through 1978, the length frequency distributions were not significantly different in 29 of 125 (25.6%) possible future year combinations (Table 15). Conversely, in 1979, the distribution was almost uniform in frequency with no length class contributing more than 10% of the catch and was significantly different (Kolmogorov-Smirnov, $p<0.05$) from all other years (Table 15). In fact, pairwise comparison of the period from 1979 through 1987 to all other future years was the most variable in distributions; in only three of 162 (1.8%) possible year combinations were no significant differences (Kolmogorov-Smirnov, $p>0.05$) found. In 1980 and 1981, the years following the high harvest years, there was a notable lack of fish over 700 mm, but the younger length classes were represented (Figure 18). As with the age data, the offspring cohort of the 1978 spawners moved through 1983 to 1987 in a relatively compact and dominant unit; likely the cause of the high percentage of non-significance between distributions. Conversely, in the period from 1988 through 2008 compared with all future year combinations, 15 of 91 (16.5%) possible length-frequency distribution comparisons were not significantly different (Kolmogorov-Smirnov, $p>0.05$, Table 15). In 2008, Inconnu fork length ranged from 515 mm to 977 mm (Figure 18).

Similar to mean age, a significant difference in mean fork length was evident when comparing all years (ANOVA, $df=29$, $p<0.05$), as well as in numerous years when compared pairwise (Bonferonni, $p<0.0017$, Table 16). The general trend in mean fork length also mimicked that of mean age: mean fork length was highest at the onset of the fishery in 1947 (745 mm, Figure 19) and significantly different from most future years when compared pairwise; except, again in 2003, but also in 1977, and 1990 (for 1948) (Table 16). However, while mean age slowly decreased until 1983, mean fork length decreased more rapidly; reaching its lowest point in 1980 (552 mm, Figure 19). Changes in mean fork length were likely influenced by the change in gillnet mesh size used within this period of time (140 mm until 1977, 133 mm thereafter) but it is also likely that high harvests resulted in cropping of larger sized fish. After 1980, mean fork length rose quickly to 675 mm in 1982, but then immediately dropped again in 1983 (569 mm). From there through 1990, mean fork length increased and fluctuated slightly, but was relatively more stable. In 2003, mean fork length peaked again at 732 mm but has dropped in the years to follow, resulting in a mean fork length of 644 mm in 2008 (Figure 19).

In all cases where there was no significant difference in frequency distribution (Kolmogorov-Smirnov, $p>0.05$), there was also no significant difference in mean fork length (Bonferonni, $p>0.0017$). However, in numerous year combinations, a significant difference in distribution was found, but no significant difference in mean fork length was found. This illustrates that while the average size of fish may not show changes, the frequency distribution, and thus the stock size composition, may in fact be changing.

Size-at-Age

Fluctuations in mean fork length over time are seen within each age group (Table 17). In cases where there were enough data to analyse the results statistically (age groups five to 10), the mean fork length was significantly different over time (ANOVA, Table 18). In the previous section of this document, we reported that overall mean fork length was lower in 1979, 1980, and 1981 when compared to most other years. We now see that this is true for each age group individually as well (Figure 20). In fact, when pairwise comparisons between years within individual age groups (ages five to 10) was performed, results showed that the decrease in mean fork length over years within individual age groups was also statistically significant (Bonferonni, $p<0.05$) in almost all cases, although less so in ages nine and 10 where the sample size was smaller (Table 19). Bonferonni pairwise comparisons of mean fork length within each age group (five to 10 years) also showed numerous cases in which the year 2007 was significantly higher than other years. This is interesting since we recorded a significant decrease in mean fork length in 1979-1981, the period immediately after high harvests, while in 2007 mean fork length was in fact significantly higher in age groups five to 10 than most other years, and followed a period of decreased harvest.

Sex Ratio

Documentation on fish gender was initiated in 1976 and assigned visually based on the description provided in Appendix 1. The percentage of Inconnu caught that were female varied annually from 1976 through 2008; however, only in four years (1977, 1979, 1991, 2006) were females more abundant than males (Figure 21). The lowest percentage of females were caught in 1978 (20.7%), while the highest percentages were caught in 1979 (59.7%) and 2006 (60.3%). In 2008, the ratio was 0.59 females.

Maturity Stage

As with fish gender, documentation on sexual maturity stage was also initiated in 1976 and assigned visually based on the description provided in Appendix 1. In both male and female Inconnu, the percentage of mature individuals out-weighed the percentage of immature individuals annually in almost all years data were collected (Figure 22). However, the ratio of mature to immature individuals dropped immediately after the high harvest years (1978 and 1979) in both sexes. Prior to 1979, the percent of mature individuals (male and female) caught ranged from 89% to 100%. Conversely, in 1983, the percent of mature individuals dropped to 18% (females) and 42% (males). This is likely due to the removal of mature individuals in the high harvests of 1977-78 and 1978-79, but may also be influenced by the fact that the offspring from the 1978 spawning event were entering harvestable size in 1983. Thereafter, the percentage of mature individuals improved and remained above 50% in almost all years, although with some annually variation. In 2008, the percent of mature individuals were 61% for females and 67% for males.

CPUE Information

CPUE data were collected beginning in 1976 and was defined as the number of fish caught per hour, per net (50 m long, 2 m deep, 133 mm stretched mesh). The average CPUE in 1976 and 1977 were 12.9 +/- 10.0 and 21.0 +/- 3.4 fish per hour, per net (50 m long, 2 m deep, 133 mm stretched mesh), respectively, (Figure 23). CPUE data were not collected again until 1983, at which time CPUE had dropped to 4.3 +/- 2.0 fish per unit effort. In the years to follow, CPUE had shown periodic signs of improvement (when harvest were lowest), but then declined again (when harvests increased). The highest CPUE recorded after the high harvest period (1978 and 1979) was 6.7 fish per unit effort, found in both 1997 and 1999. These values are 40% lower than the average of 1976 and 1977. This provides further support that it was the Buffalo

River stock of Inconnu which constituted the bulk of the harvest in the west basin. In 2008, the CPUE was 3.1 +/- 1.7 fish per unit effort.

MANAGEMENT RECOMMENDATIONS

Closure Zones

Past and current research programs have led to the prediction that the Buffalo River Inconnu stock is caught mostly in the west basin of GSL, especially along the south shoreline (Areas IW, IE, and III). Concern for the Buffalo River stock was, therefore, addressed through various spatial and temporal closures to the commercial fishery being instituted in the early 1980s by DFO Fisheries and Aquaculture Management (with advice from Science) and expanded thereafter. The goal of the closures was to reduce the number of Inconnu harvested while not significantly hindering the Lake Whitefish commercial fishery.

Historic Closure Zones

In June 1983, concern for the Buffalo River stock led to the first closure zone being instituted by DFO Fisheries and Aquaculture Management; a three kilometer radius around the mouth of the Buffalo River was closed year-round. Unfortunately, this was not effective at halting the decline of this stock and therefore new closure areas were implemented.

By 2001, spring seasonal closures had been expanded to include all of the south shore of GSL from the western edge of the Area IE domestic zone, east to Pine Point, with the addition of a spring closure area to protect the northwest portion of the Slave River delta. The southwest part of Resolution Bay remained open to commercial fishing but the remainder of Resolution Bay was open to domestic fishing only.

Closure zones were updated in 1999 as per variation order 99/00-201(Appendix 2 and 3), in 2001 as per variation order 01/02-204 (Appendix 4 and 5), and in 2005 as per variation order 05/06-208 (Appendix 6 and 7).

In 2008, DFO Fisheries and Aquaculture Management met with DFO Science and asked “What is the recommended maximum commercial quota for Inconnu in the west basin (Areas IW, IE, II and III) on GSL and are there any recommendations as to how this removal level could be partitioned (e.g., by area)?” Upon review of the data, the response by Science (May 2008) was to recommend fishing patterns based on low, moderate, and high risk options:

- Low Risk: Stop all commercial fishing on GSL
- Moderate Risk:
    - Allow commercial fishing to continue but restrict the harvest by closing areas in time and space as follows:
        - Annual closure of Area IE
        - Extend the spring closure period in Area III to all year
        - Expand the size of Area III closure zone (from five kilometers deep to around 10 km) using a latitude reference line
    - Expand Spring Closure Zones
        - Expand the size of Area IE and III spring closure zones (from current five kilometers deep to around 10 km deep) using a latitude reference line.
        - Extend closure period to all year
- High Risk: Continue with status quo on harvest.

It was noted that setting a bycatch quota for Inconnu would likely result in “discarding” or wastage of Inconnu as the quota approached fulfillment. Instead, it was recommended that commercial fishers be asked to attempt to keep Inconnu harvest from the west basin to below

10,000 kg. Upon presentation of closure options to GSL fishers, DFO Fisheries and Aquaculture Management noted that there was significant resistance from commercial fishermen to close all of Area IE. Although DFO Fisheries and Aquaculture Management supported the moderate-risk option, a compromise with commercial fishermen was reached and some modifications were made making it a higher risk to the stock.

The actions taken by DFO Fisheries and Aquaculture Management in 2008, as per variation order 08/09-212 were (Figure 28 and Appendix 8 and 9):

- The area (Zone A) to the north of the Hay River domestic zone and west of 115°20'30" longitude in IE up to the 61st latitude was closed until March 31, 2009
- The area (Zone B) south of the 61st latitude, spanning east from the 115°20'30" longitude to intersect with the west boundary of Area III, was closed through September 30.
- The area (Zone C) in Area III up to 61°03' and 61°07' north latitude lines in two steps, spanning east from the line between IE and III to Pine Point, was closed through July 31, 2008.

In January 2009, data from the 2008 summer fishery were analyzed; this revealed that in the statistical Areas IE, II and III, which had subareas along the south shore closed to fishing, the total catch was successfully reduced (Table 3). However, the improvement was offset by an increased catch in Area IW. The total harvest of Inconnu in the west basin of GSL was not significantly reduced given the harvest in IW. Therefore, Science made the following adjustments to the recommendations:

- Low Risk: Stop all fishing on GSL
- Moderate Risk: Allow commercial fishing to continue but restrict the harvest by extending the closure of the south shore to include the 10 km zone of Area IW. The rationale was that closure to similar zones was effective in the other areas – so the hypothesis that Buffalo River Inconnu used the south shore area of GSL was probably correct. If so then extending the zone westward might reduce Inconnu harvest with minimal interference in the Lake Whitefish fishery.
- High Risk: Continue with status quo on harvest.

The goal to maintain Inconnu harvests below 10,000 kg from the west basin (IE, IW, II and III) would remain. However, a preferred harvest level would be less than 5,000 kg from all sources of fishing mortality. The size of the Inconnu bycatch harvest would remain a performance indicator for the management measures applied.

Subsequently, DFO Fisheries and Aquaculture Management consulted with the Great Slave Lake Advisory Committee (GLSAC) regarding the recommendations made by Science. Fishers indicated that closing the south shore of IW would not benefit the conservation of Buffalo River Inconnu because there were few Inconnu close to shore in that area and that the fish that were present were likely from the Mackenzie River stock. Therefore, no changes to the closure zones were made by DFO Fisheries and Aquaculture Management in 2009.

In recent years, fishing effort in the GSL has been declining due to closures of ports (Table 1), but regulations initiated in 2009 opened the fishery to additional fishers (outside NT). The GSL Advisory Committee approved seven new-entry summer 2009 applications for vessel certificates, three of which were fished.

Current Closure Zones

Harvest data from the summer 2009 GSL fishery were analyzed in March 2010 to review impact of closure zones on the harvest of Inconnu. Harvest of Inconnu increased in all areas of

GSL, except Area II (Table 3). Relating this to Buffalo River Inconnu specifically, harvest in Area IW increased marginally (+383 kg) from 2008, but harvests in Areas IE and III increased more dramatically (+949 kg and +1,383 kg, respectively). The increase in Inconnu harvest may be due to an increase in fishing effort; commercial harvest was opened to fishers from outside the NT and resulted in three additional certificates being awarded in 2009 (accounting for 29,513 kg, 9.6% of the harvest). However, if the increase in Inconnu harvest resulted strictly from fishing effort, it would be expected that the harvest of Lake Whitefish (the target species) would follow the same trend as the Inconnu harvest; this was true for Areas II, III, IV, and V, but not for Areas IW and IE (Table 3). In Area IW, Lake Whitefish harvest decreased 7,896 kg from 2008 catches, but Inconnu harvest increased by 383 kg. In Area IE (which contains the Buffalo River) Lake Whitefish harvest decreased by 27,924 kg yet Inconnu harvest increased by 949 kg. This is alarming for the sustainability of the Buffalo River Inconnu stock.

Upon review of past and current research programs and harvest trends, the following points were summarized for Buffalo River Inconnu:

- Research studies on Inconnu distribution (mark-recapture and the FIHS) in GSL have shown that the south shore of the west basin is an important area for Buffalo River Inconnu.
- Trends in Inconnu biological data show an impact to the stock in high harvest years (especially the late 1970s).
- Trends in CPUE also show a relation to harvest (CPUE increased in lowest harvest years).
- Fishing closures were successful in areas they were applied in 2008.

With these points in mind, Science revised the recommendations for closure zones in GSL and the following options were proposed based on the risk to the Inconnu stock(s):

- Low Risk: close fishery on GSL west basin
- Moderate-Low Risk: close south shore year round and extend closure into Areas IW and V.
- Moderate Risk: close south shore from March 1 to Nov 1 and extend into Areas IW and V (to protect both the spring and fall runs of Inconnu; may be a more sustainable, long-term solution than complete, year-round, closures)
- Moderate-High Risk: current status quo (2008)
- High Risk: old status quo (prior to 2007)

DFO Fisheries and Aquaculture Management reported that it was initiating a log-book program in 2010. This will potentially improve information of the efficiency of closure zones and will be reviewed as the information becomes available.

The potential for fishing effort, and thus harvest of Inconnu, to increase with opening of licenses to out of province fishers, coupled with the continual poor status of the Buffalo River Inconnu stock, demands that continued monitoring of this stock is vital.

A Precautionary Approach Model has also been developed for the Buffalo River Inconnu stock, which places the stock in the Critical Zone. Please refer to Day et al. (2013) for details.

DISCUSSION

FUTURE RESEARCH

Participants of the peer-review Regional Advisory Process (RAP) reviewed the current research program and discussed what research would be beneficial in the future. These included:

1) Fishery-Independent Harvest Study

It was discussed that the 2009 FIHS provided useful information for the assessment of Inconnu in GSL and the research program should continue. However, it was noted that the methodology used in 2009 did not mimic that of the commercial fishery and that the results may not fully represent the potential for Inconnu distribution. Specifically, the FIHS used 3.7 m (12-ft) deep gillnets, while the commercial fishery uses 9.1 m (30-ft) deep gillnets. Also, the FIHS only set one gillnet per set while the commercial fishery sets numerous nets in a gang while fishing. Local fisherman had commented that the use of a single, shallow gillnet would not likely catch many Inconnu. To address this concern, it was recommended that the 2010 FIHS use 9.1 m (30-ft) deep nets and set at least two at a time (one 9.1 m and one 3.7 m to compare with results from 2009). Further discussion from RAP participants suggested that there may be a vertical delineation between Lake Whitefish and Inconnu and perhaps an alternative management action could be to restrict fishing in depth zones rather than geographical area. In response to this, the recommendation was made to mark the 3.7 m gillnet and record which depth range the Lake Whitefish and Inconnu are caught in.

2) Spring sampling at the mouth of Buffalo River

Since 1976, a gillnet research program was run periodically (not annually) in the spring at the mouth of the Buffalo River. This program involved setting gillnets to monitor CPUE as well as lethally sampling fish for biological characteristics. It provided the data required to assess the biological stock status (age and length distributions, growth, etc.) as well as provide reference points for the Precautionary Approach model (CPUE mature females, see Day et al. 2013). This program was considered to be very valuable by the RAP participants, but it is also very expensive to run. Therefore, it was recommended that the program be continued as often as financially feasible, but at least every three years.

3) Genetic stock delineation

Samples required to perform genetic analyses of Inconnu in GSL have been collected in recent years, but a specific research program to use genetics for stock delineation has not been initiated. To do so requires that genetic samples from the ‘pure’ stock of Inconnu in the Buffalo River, and other potential contributing stocks, be collected. It was recommended that this be a high priority for future research.

4) Radio-telemetry

The usefulness in advancing existing information gained by performing a radio-telemetry study of Inconnu in the Buffalo River was discussed. While potential benefits were noted regarding identification of spawning stocks, it was also noted that it is an expensive research program and that devoting financial resources to the FIHS, spring sampling, and genetic stock delineation might be more productive.

CONSIDERATIONS

RAP participants discussed other research avenues, such as stable isotopes, to further increase knowledge and understanding of Inconnu in GSL on a larger (ecosystem) scale, especially due to the recent interest in eco-certification for GSL fisheries.

Numerous comments on potential anthropogenic disturbance, changing environmental conditions, and fish health concerns around the Buffalo River and GSL systems were made during the course of the meeting. These included:

- Potential impacts of the Pine Point Mine on GSL and Buffalo River habitats and fish populations.
- Changing water levels in recent years which may impact the utility/efficiency of closure zones.
- Increasing sewage discharge and potential leaking from waste disposal sites into GSL.
- Recent observations that the condition of Inconnu caught at the mouth of the Buffalo River appears lower compared to Inconnu caught in the Slave River.

SOURCES OF UNCERTAINTY

- It is unknown what the contribution of Buffalo River Inconnu and Slave River Inconnu (and potentially others) are to west basin harvests.
- The harvests from sources other than the commercial fishery (i.e., sport, domestic, subsistence, etc.) are not well known.
- Estimates of recruitment and quantitative documentation of the factors influencing production are unknown.
- The Upper stock reference assumes that carrying capacity is stable.
- Quantitative information on commercial fishing effort is unknown.
- Ecosystem effects on the population dynamics of Buffalo River Inconnu are unknown.
- Locations and characteristics of Inconnu spawning habitat in the Buffalo River are unknown.
- Precision and accuracy of age estimates is questionable because it was performed using scales.

CONCLUSIONS

Inconnu have been caught primarily as bycatch in the Lake Whitefish fishery since 1945, especially in Area IE of the west basin; however, they have been targeted in some years, especially the late 1970s. During this time, commercial harvests and CPUE from the DFO fishery-independent survey at the mouth of the Buffalo River were high. Conversely, in the early 1980s, harvests, CPUE and Inconnu biological characteristics all showed a marked change, for the worse. Further, there is evidence that the 1979 spawners produced a relatively strong cohort of individuals which dominated age and frequency distributions through the late 1980s, whereas the abundance of younger fish was relatively low. This suggests that recruitment failure had occurred after 1978. Since that time, commercial harvest has decreased and remained low. The biological characteristics have shown periods of improvement in years when harvest were lowest, but then worsened again as harvest increased. Currently, harvests of Inconnu remain low due to reduced stocks, non-targeting, implementation of closure zones, and decreased fishing effort. While some of the biological characteristics appear to have stabilized within normal variation, others show cause for concern, and CPUE is still relatively low.

In this document, we have presented a risk-based table of options for the management of closure zones in GSL with the intention to minimize the catch of Inconnu while limiting the impact on the commercial Lake Whitefish fishery.

Results from several mark-recapture studies, as well as the DFO FIHS, suggest that Buffalo River Inconnu are most at risk to harvest in the west basin of GSL, especially along the south shore, and therefore, our recommendations are focused on that area of the lake.

Finally, we provided recommendations for future research programs, as well as potential modifications to current programs, to improve the understanding of many aspects Buffalo River Inconnu. We have also identified potential sources of error in the assessment due to quantitative/statistical issues, as well as information that is currently unknown/limited.

REFERENCES

Alt, K.T. 1988. Biology and management of Inconnu (Stenodus leucichthys) in Alaska. Finnish Fish. Res. 9, p. 127-132.Day, A.C. and G. Low. 1993. The Great Slave Lake commercial inconnu, *Stenodus leucichthys*, fishery. A stock status paper prepared for Arctic Fisheries Scientific Advisory Committee (AFSAC). 22 p. + app.

Blanken, P.D., Rouse, W.R., Culf, A.D., Spence, C., Boudreau, L.D., Jasper, J.N., Kochtubajda, B., Schertzer, W.M., Marsh, P., and Verseghy, D. 2000. Eddy covariance measurements of evaporation from Great Slave Lake, Northwest Territories, Canada. Water Resources Research 36(4): 1069–1077.

Day, A.C., VanGerwen-Toyne, M., and Tallman, R.F. 2013. A risk-based decision-making framework for Buffalo River Inconnu *(Stenodus leucichthys* that incorporates the Precautionary Approach. DFO Can. Sci. Advis. Sec. Res. Doc. 2012/070. iv + 13 p.

DFO. 2013. Assessment of Buffalo River Inconnu, *Stenodus leucichthys*, Great Slave Lake, Northwest Territories, 1945-2009. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2012/045.

Fuller, W.A. 1955. The inconnu (*Stenodus leucichthys mackenziei*) in Great Slave Lake and adjoining waters. J. Fish. Res. Board Can. 12(5): 768-780.

Howland, K.L., Tallman, R.F., and Tonn, W.M. 2000. Migration Patterns of Freshwater and Anadromous Inconnu in the Mackenzie River System. Trans. Amer. Fish. Soc., 129: 41-59.

Howland, K.L., Tonn, W.M., Babaluk, J.A. and Tallman, R.F. 2001. Identification of freshwater and anadromous inconnu in the Mackenzie River system by analysis of otolith strontium. Transactions of the American Fisheries Society 130: 725–741.

Howland, K.L., Gendron, M., Tonn, W.M., and Tallman, R.F. 2004. Age determination of a long-lived coregonid from the Canadian North: comparison of otoliths, fin rays, and scales in Inconnu (*Stenodus leucichthys*). Ann. Zool. Fennici. 41: 205-214.

Keleher, J.J. 1972. Great Slave Lake: effects of exploitation on the salmonid community. J. Fish. Res. Board Canada, 29: 741-753.

Letichevskiy, M.A. 1975. Experimental determination of the abundance of the Caspian Inconnu, *Stenodus leucichthys*, and the effectiveness of hatchery propagation. J. Ichthyol. 15(1): 565-569.

McPhail, J.D. and Lindsey, C.C. 1970. Freshwater fishes of northwestern Canada and Alaska. Bull. Fish. Res. Board Can. 173: 381 p.

Rawson, D.S. 1947. Great Slave Lake. pg 45-68 in Northwest Canadian Fisheries Surveys. Fish. Res. Board Can. Bulletin No. 72.

Rawson, D.S. 1950. The physical limnology of Great Slave Lake. Fish. Res. Board Can. 8: 1-166.

Scott, W.B., and Crossman, E.J. 1973. Freshwater fishes of Canada. Bull. Fish. Res. Board Can. 184: 966 p.

Stewart, D.B. 1999. A review of information on fish stocks and harvests in the South Slave area, Northwest Territories. Can. Manuscr. Rep. Fish. Aquat. Sci. 2493: iv + 65 p.

Yaremchuk, G.C.B., Roberge, M.M., McGowan, D.K., Carder, G.W., Wong, B., and Read, C.J. 1989. Commercial harvests of major fish species from the Northwest Territories, 1945 to 1987. Can. Data. Rep. Fish. Aquat. Sci. 751: iv + 129 p.

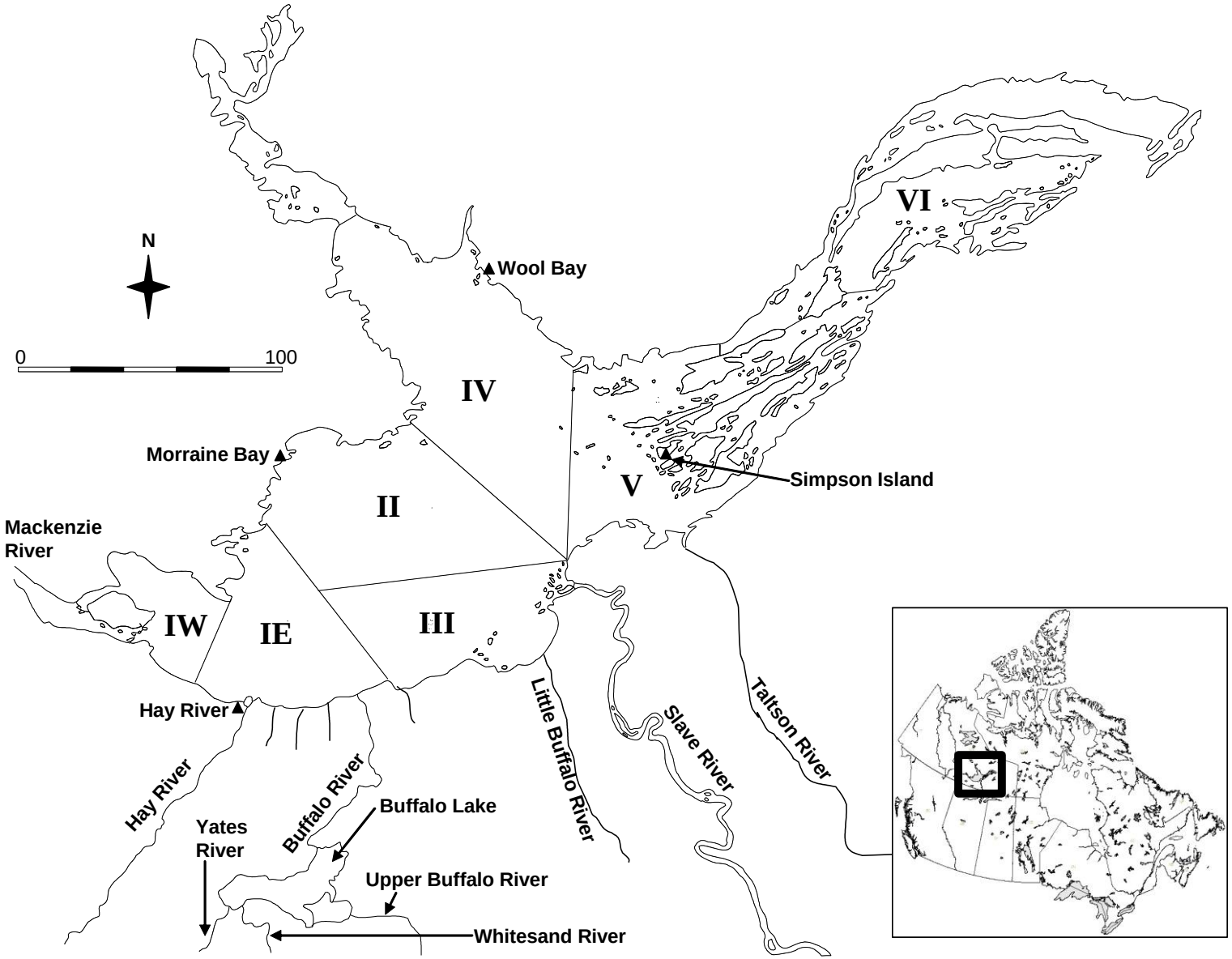


Figure 1. Map of Great Slave Lake showing management areas. Triangles indicate fish plants. Insert shows map of Canada highlighting Great Slave Lake.

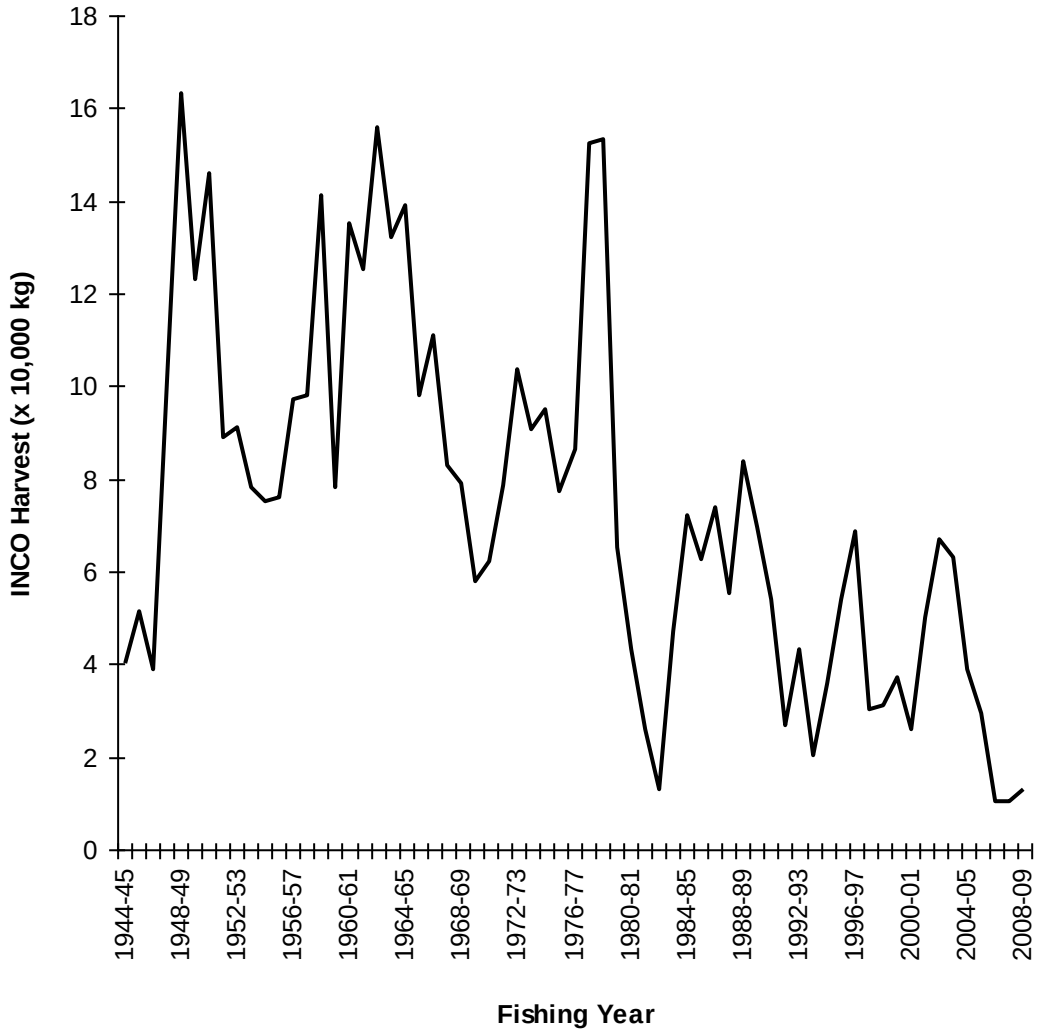


Figure 2. Annual (fishing season) commercial harvest of Inconnu (INCO) in Great Slave Lake from 1944-1945 to 2008-2009.

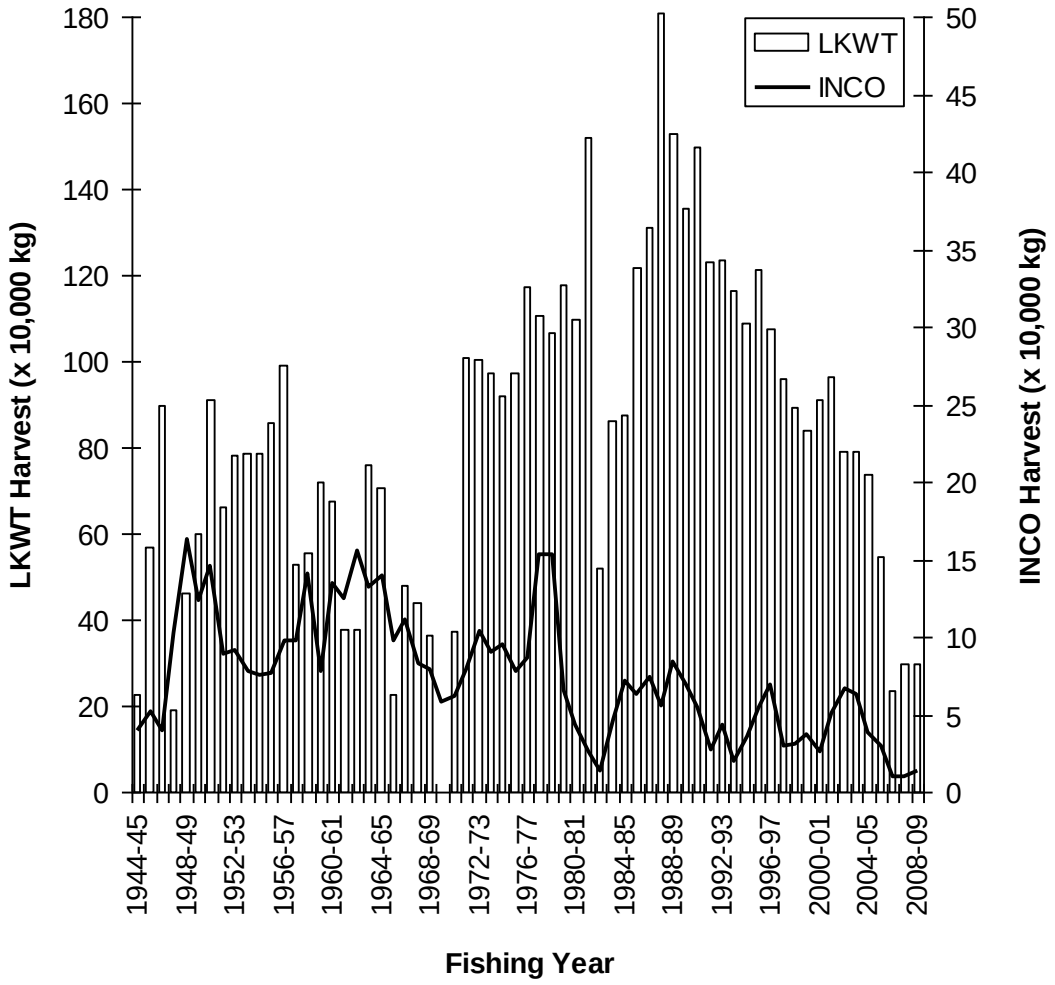


Figure 3. Annual (fishing year) commercial harvest of Inconnu (INCO) and Lake Whitefish (LKWT) in Great Slave Lake from 1944-1945 to 2008-2009.

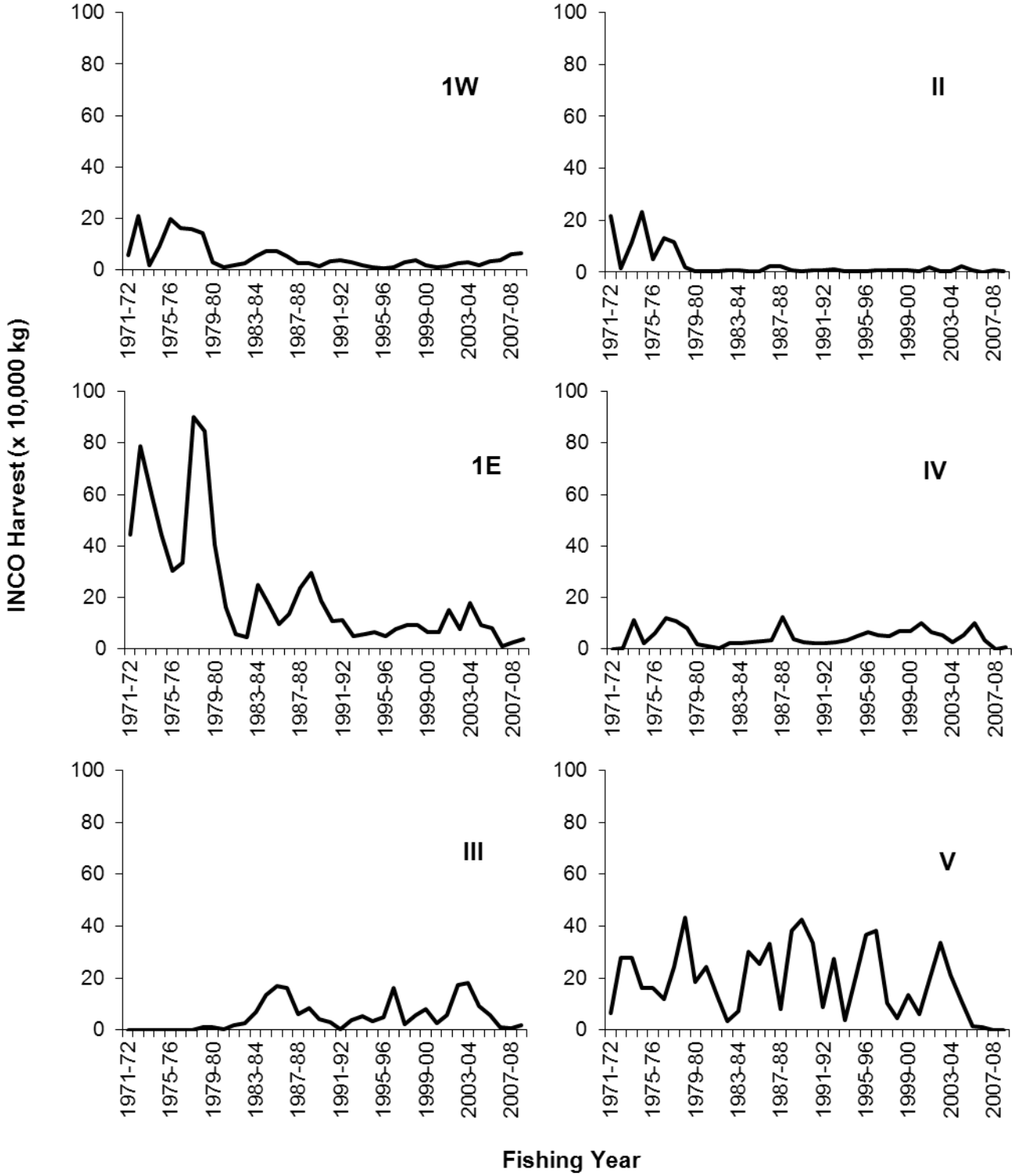


Figure 4. Annual (fishing year) commercial harvest of Inconnu (INCO) in each management area of Great Slave Lake from 1971-1972 to 2008-2009.

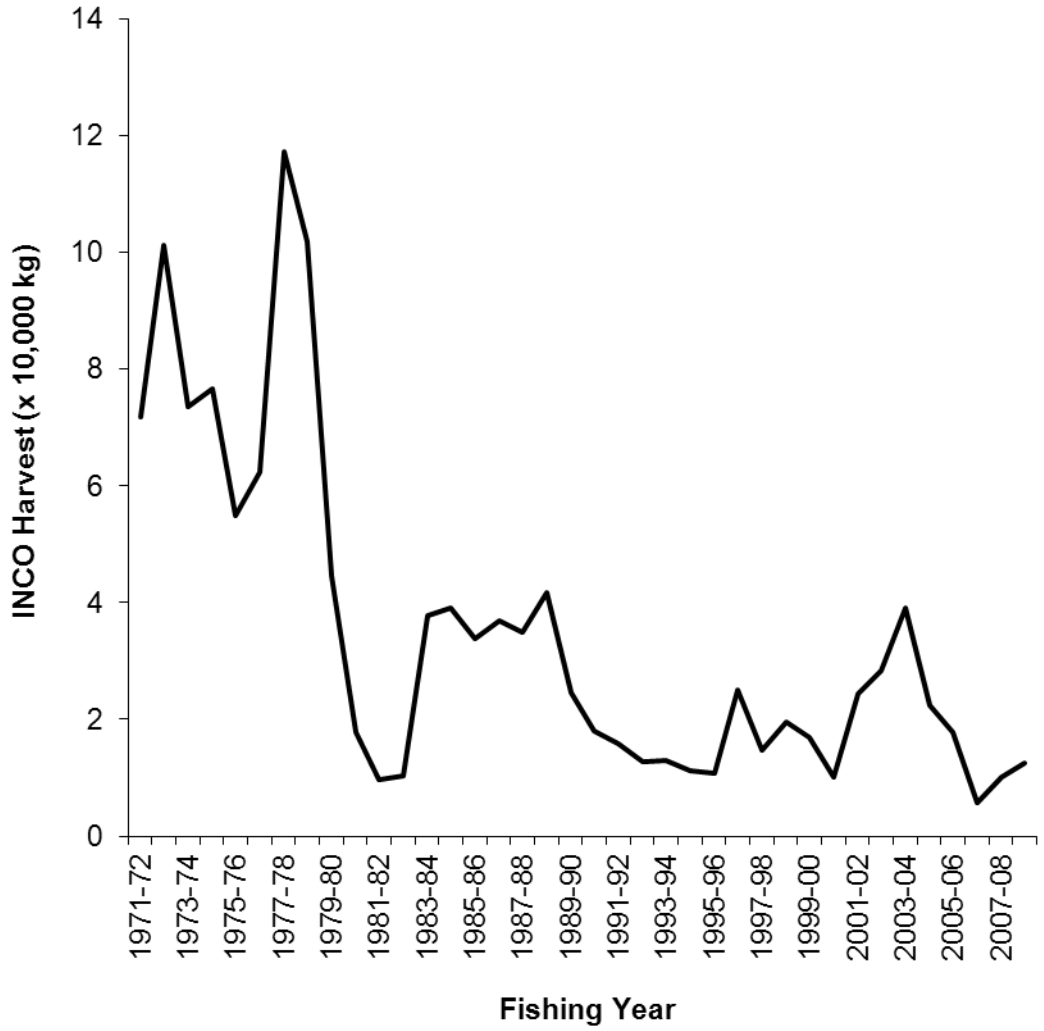


Figure 5. Annual (fishing year) harvest of Inconnu (INCO) in the west basin of Great Slave Lake from 1971-1972 to 2008-2009.

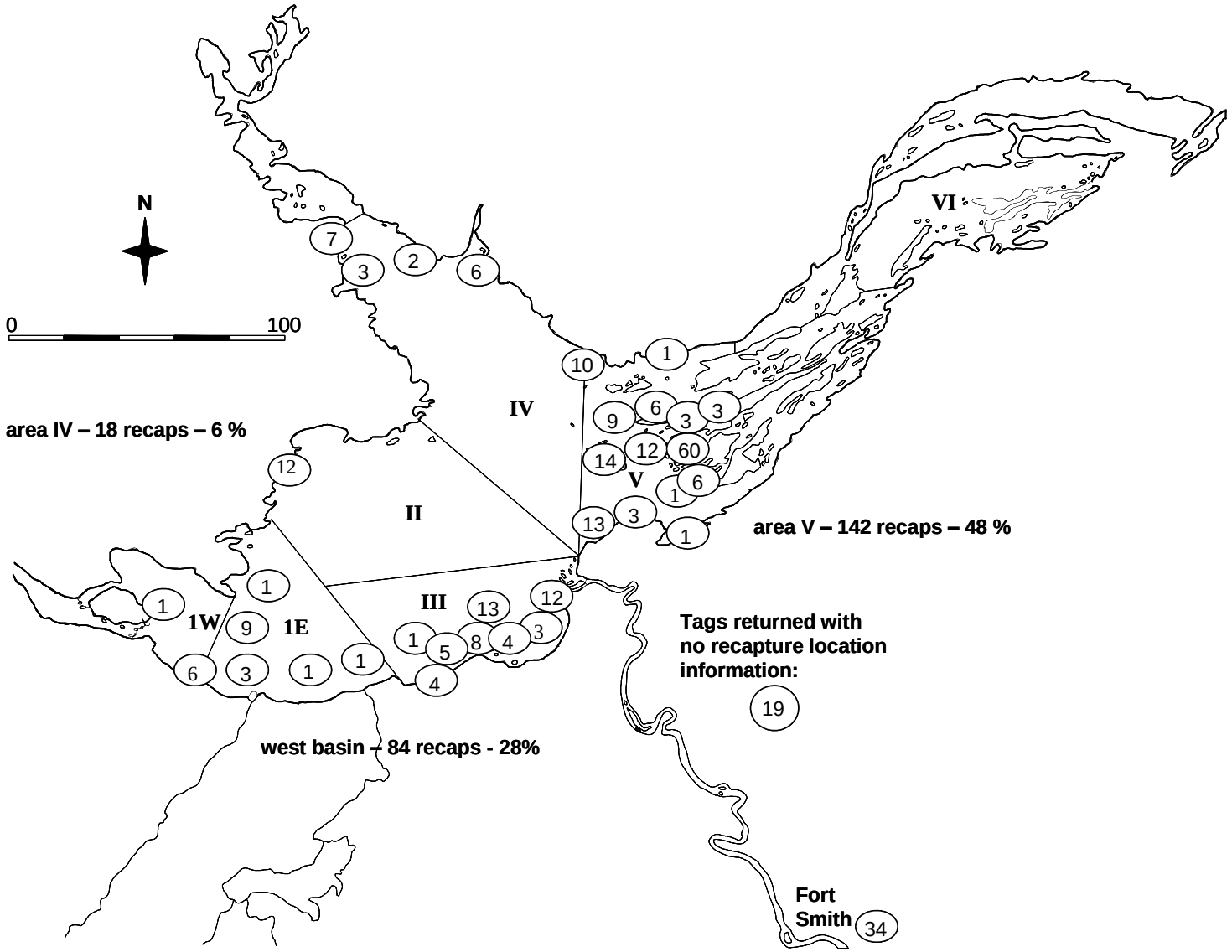


Figure 6. Map of Great Slave Lake showing location of recaptures of Inconnu marked with T-bar tags in the Slave River at Fort Smith.

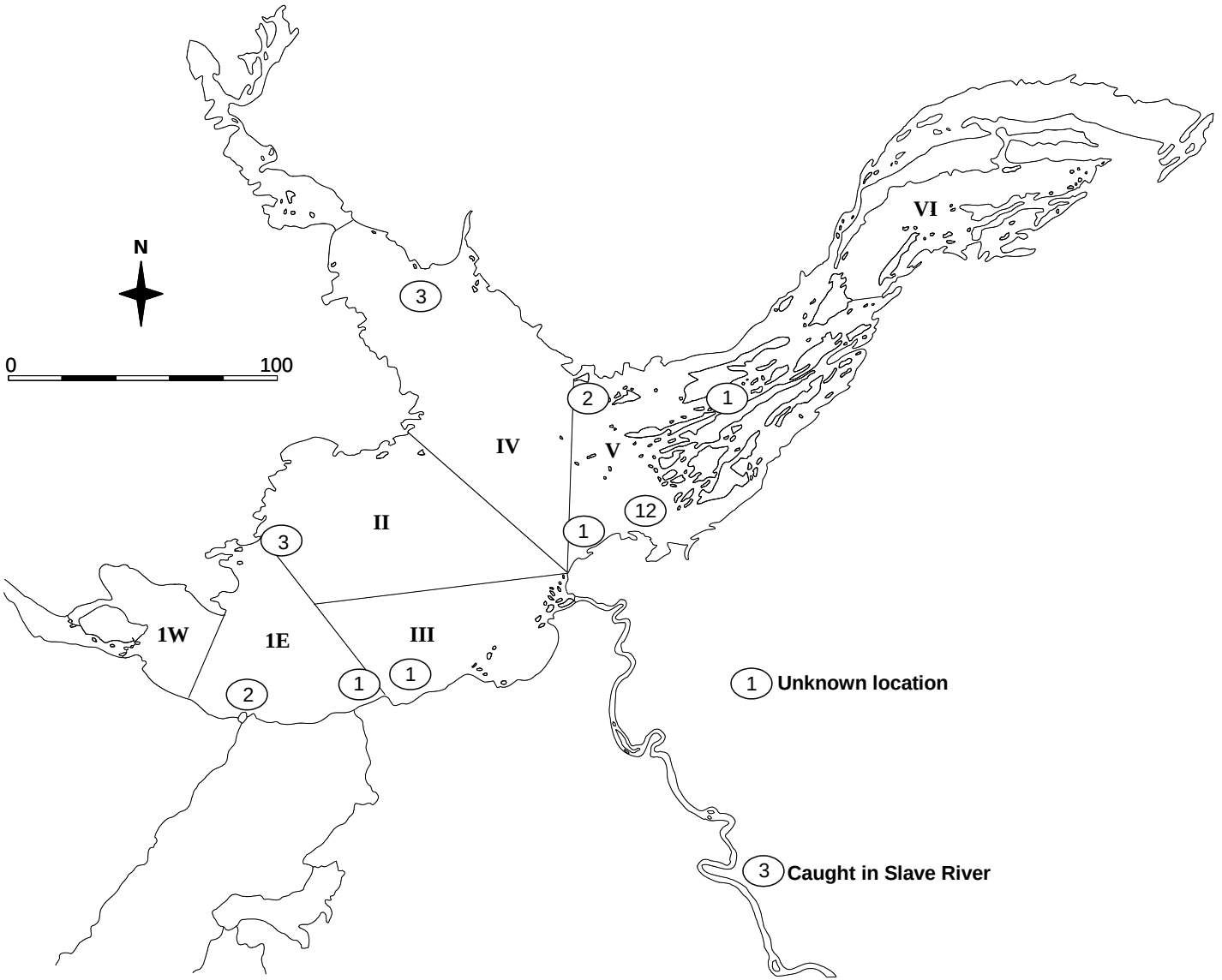


Figure 7. Map of Great Slave Lake showing location of recaptures of Inconnu marked with T-bar tags in the Slave River at Resdelta Channel.

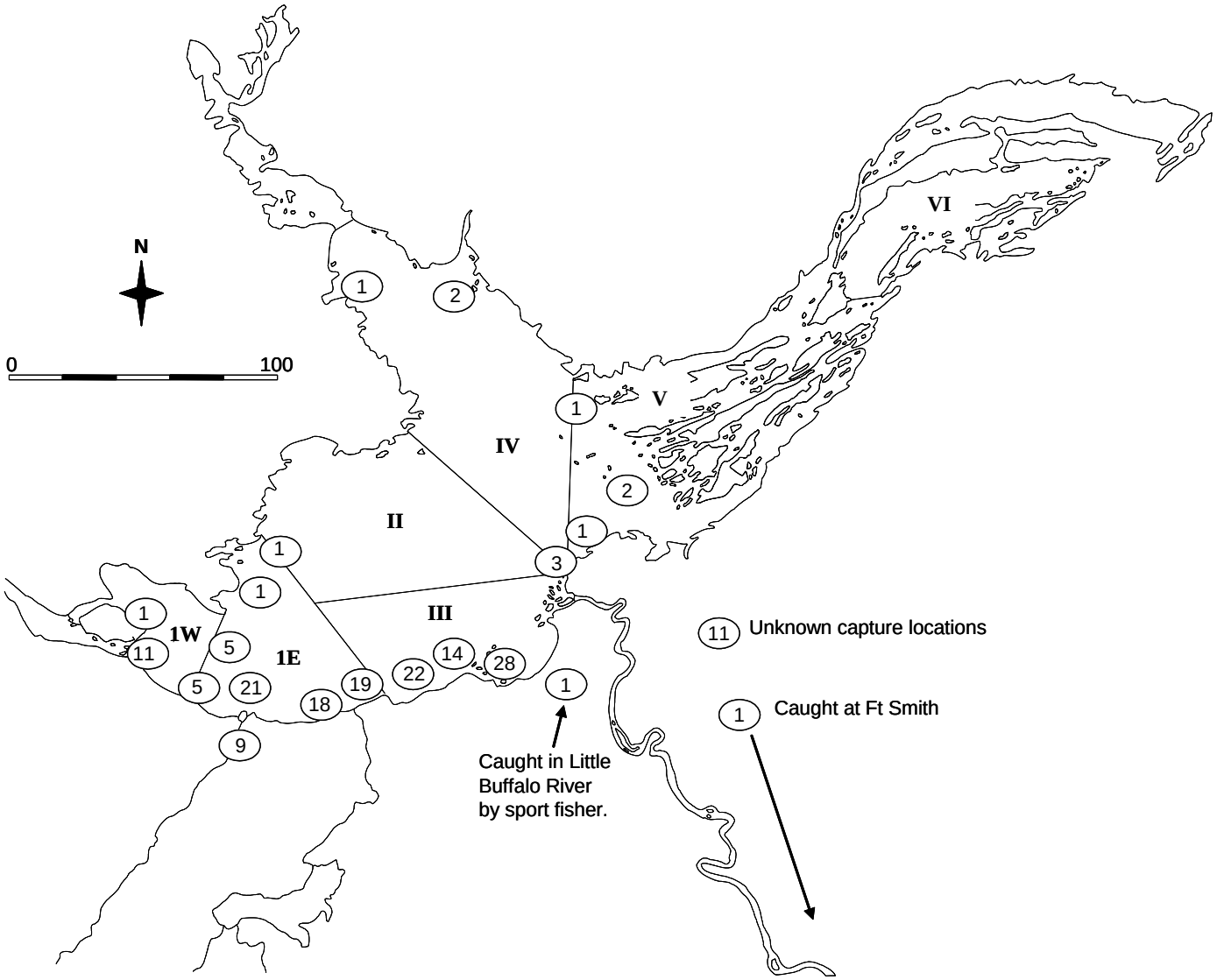


Figure 8. Map of Great Slave Lake showing location of recaptures of Inconnu marked with T-bar tags at the mouth of the Buffalo River.

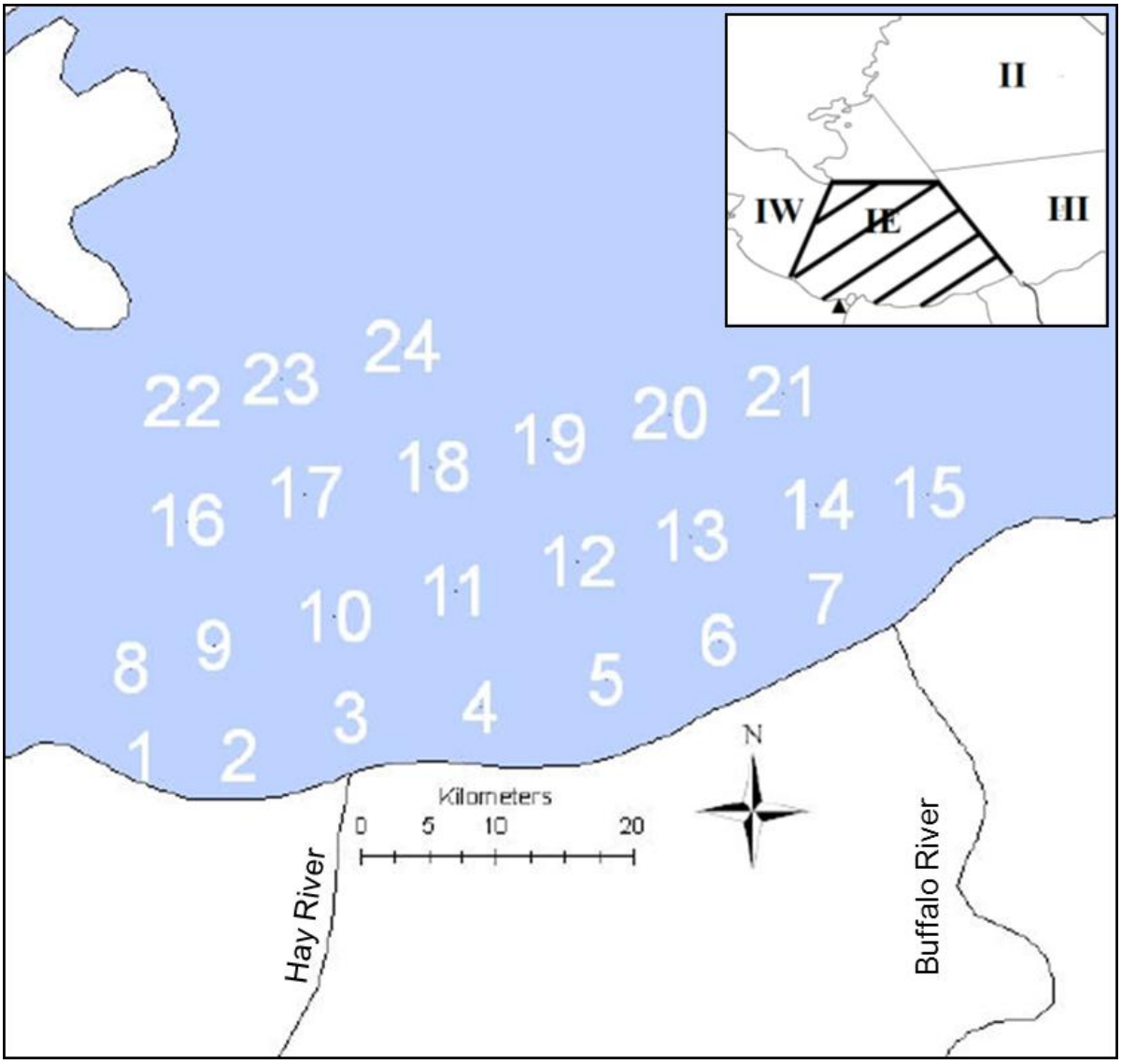


Figure 9. Map of Great Slave Lake Area IE, showing the grids used in the 2009 Fishery-Independent Harvest Study. Numbers are grid IDs. Insert map shows Great Slave Lake Area IE highlighting the study area.

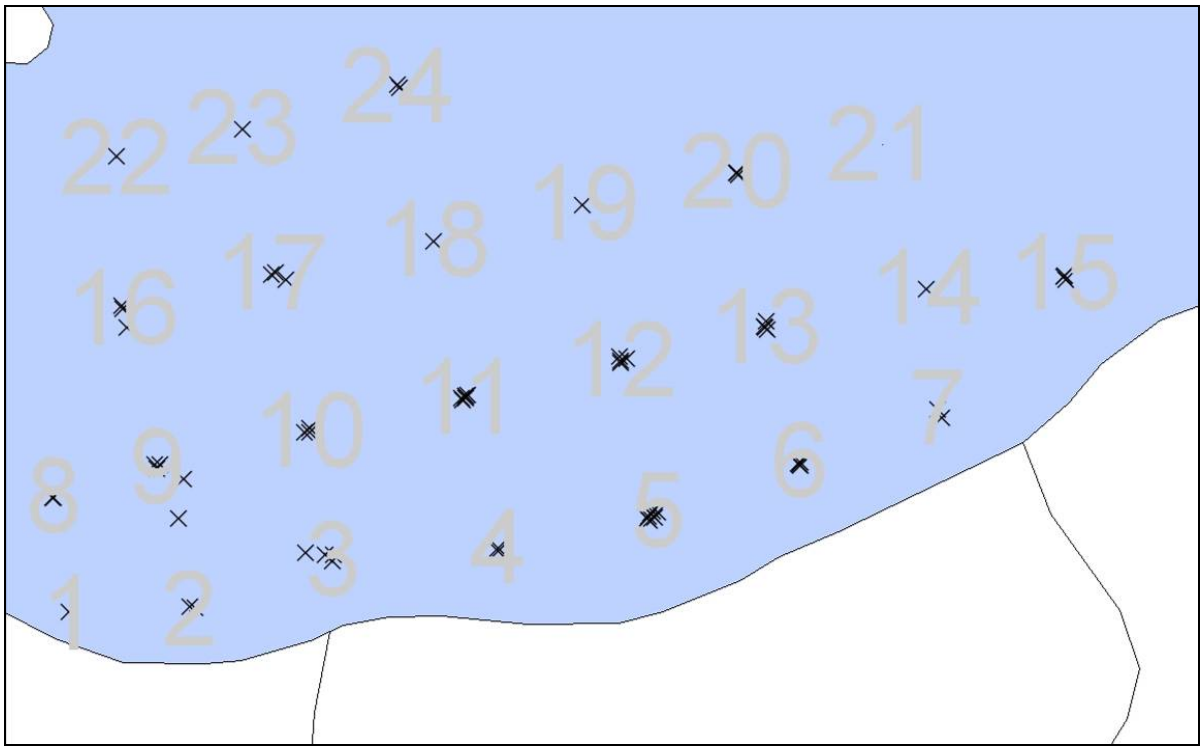


Figure 10. Map of Great Slave Lake Area IE showing the location of sites sampled during 2009 Fishery-Independent Harvest Study.

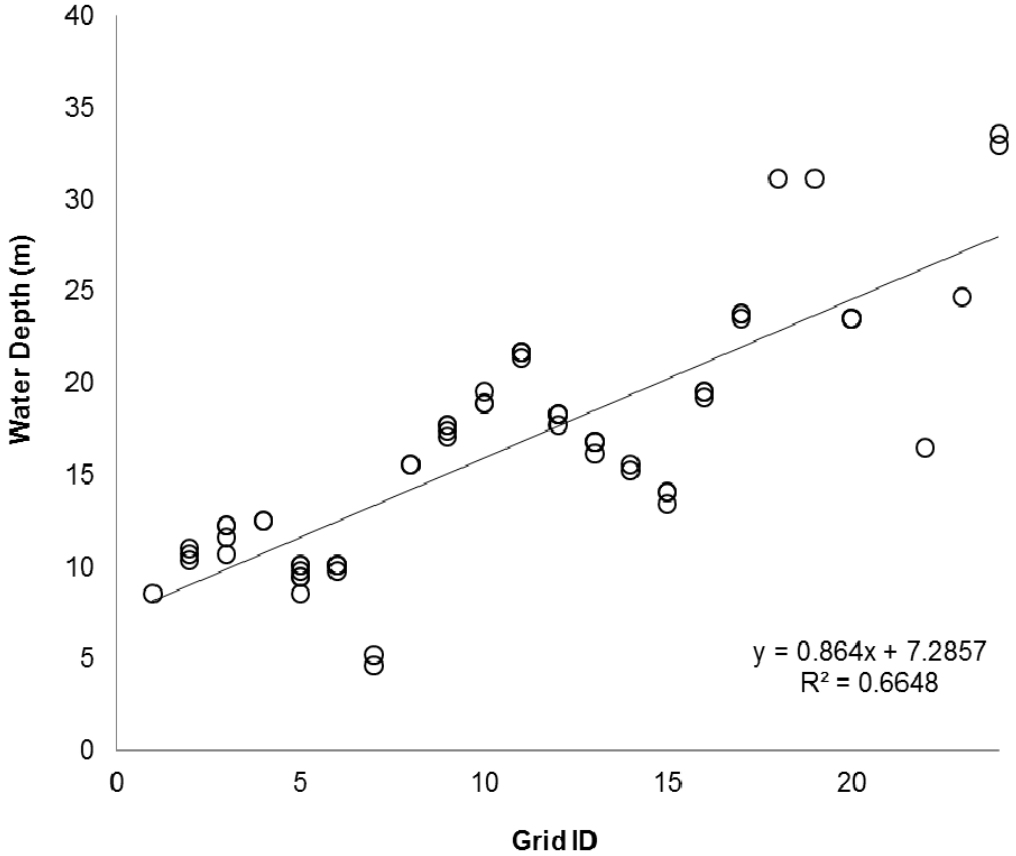


Figure 11. Correlation between water depth and grid ID at sites sampled during the 2009 Fishery-Independent Harvest Study.

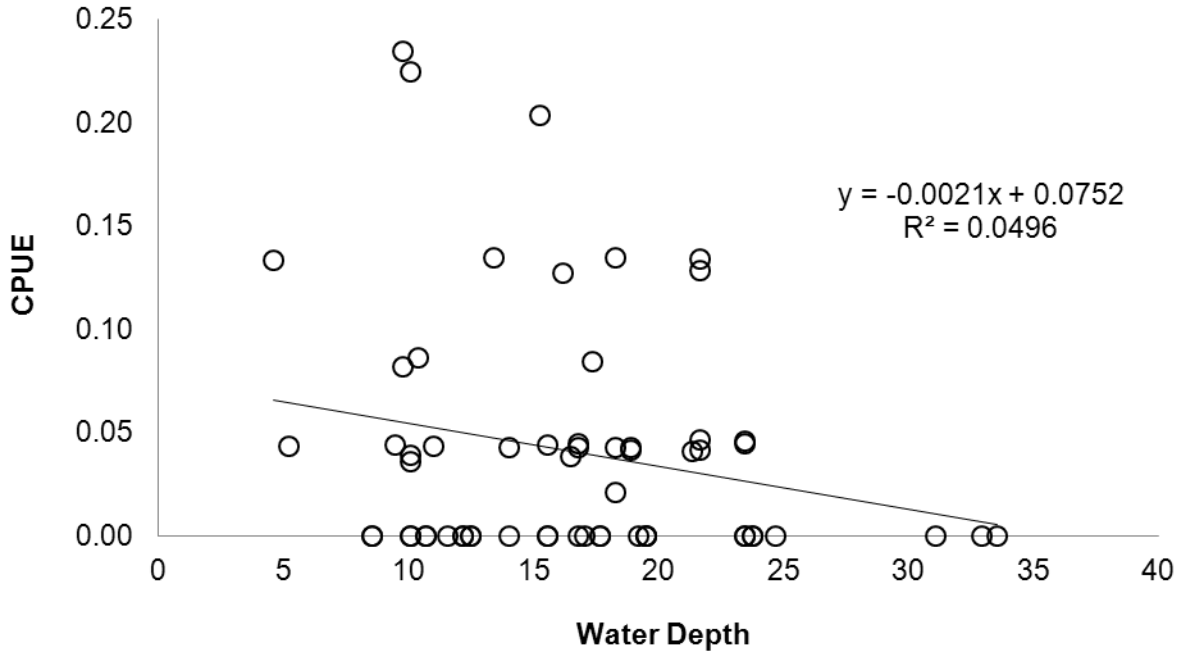


Figure 12. Correlation of Inconnu catch-per-unit-effort (CPUE) on water depth for sites sampled during the 2009 Fishery-Independent Harvest Study.

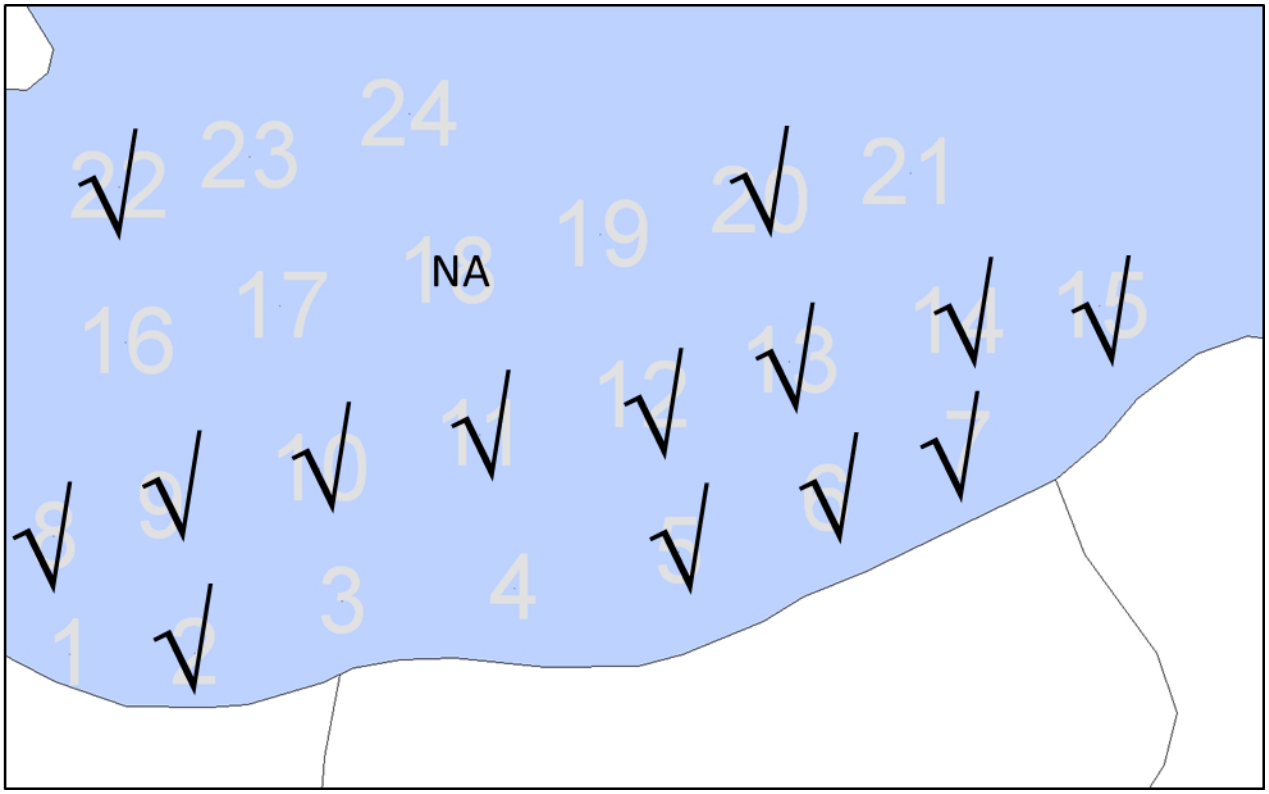


Figure 13. Map of Great Slave Lake Area IE showing the grids Inconnu were caught in during the 2009 Fishery-Independent Harvest Study.

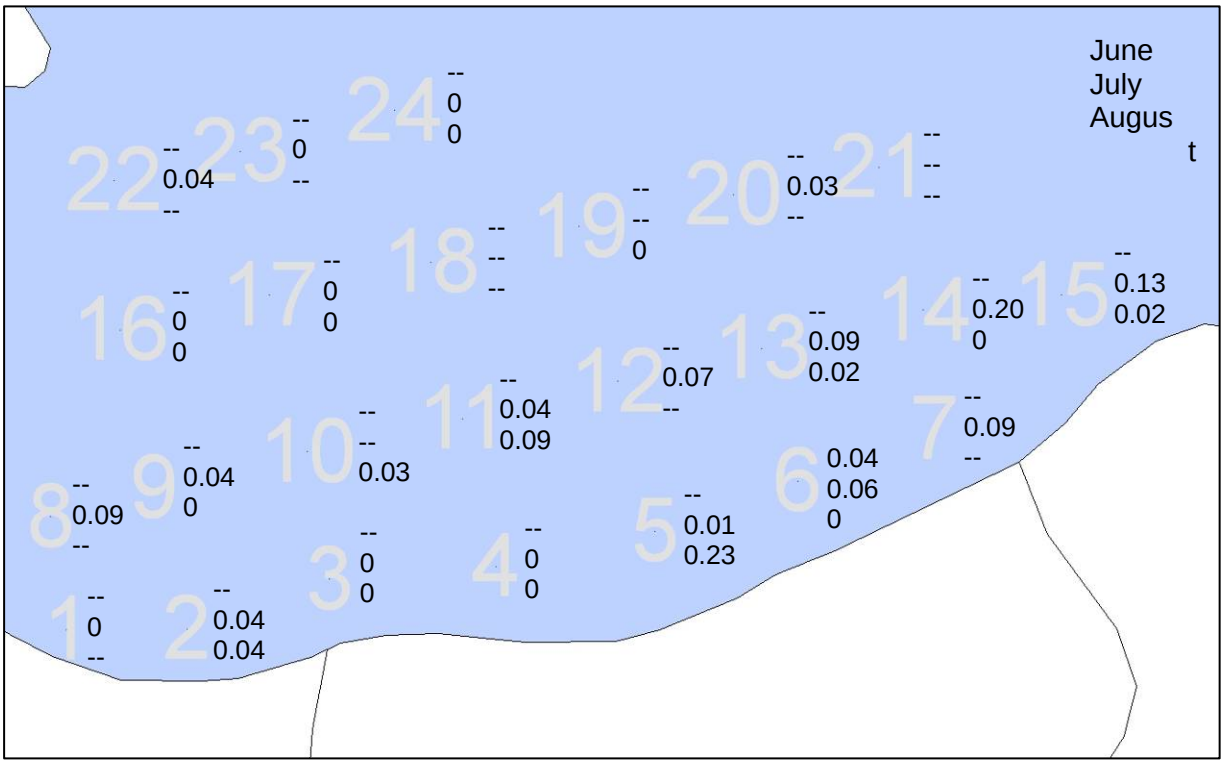


Figure 14. Map of Great Slave Lake Area IE showing mean monthly catch-per-unit-effort for Inconnu caught during the 2009 Fishery-Independent Harvest Study (Note: Inconnu were caught in grid 21 but the data were incomplete and therefore CPUE could not be calculated).

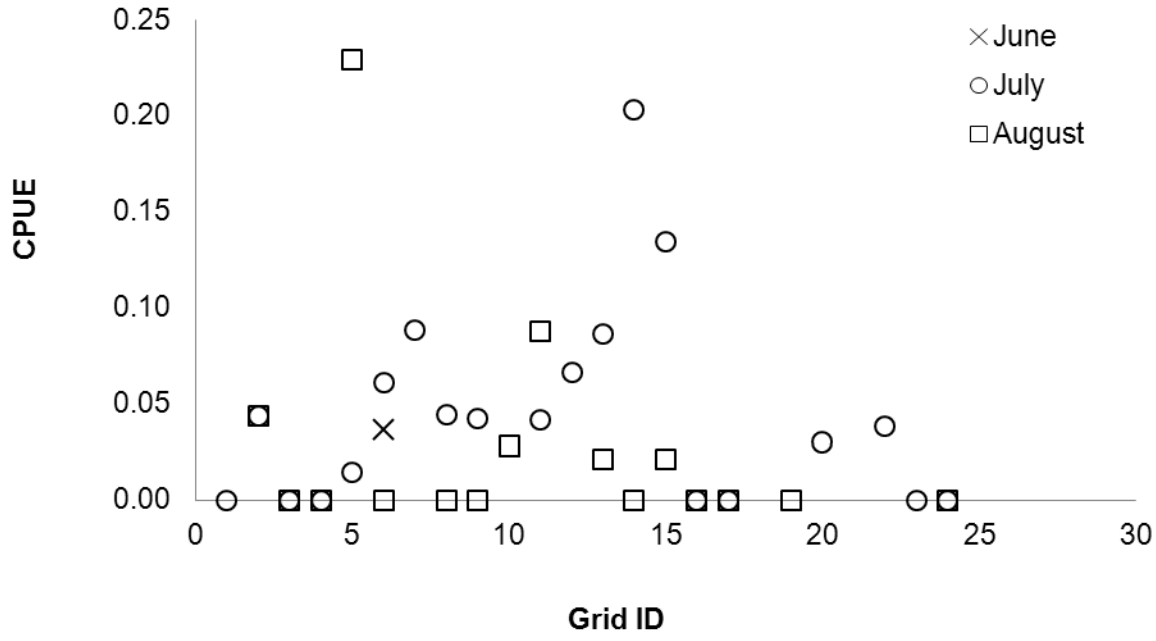


Figure 15. Correlation of Inconnu mean monthly catch-per-unit-effort (CPUE) on grid ID for the 2009 Fishery-Independent Harvest Study.

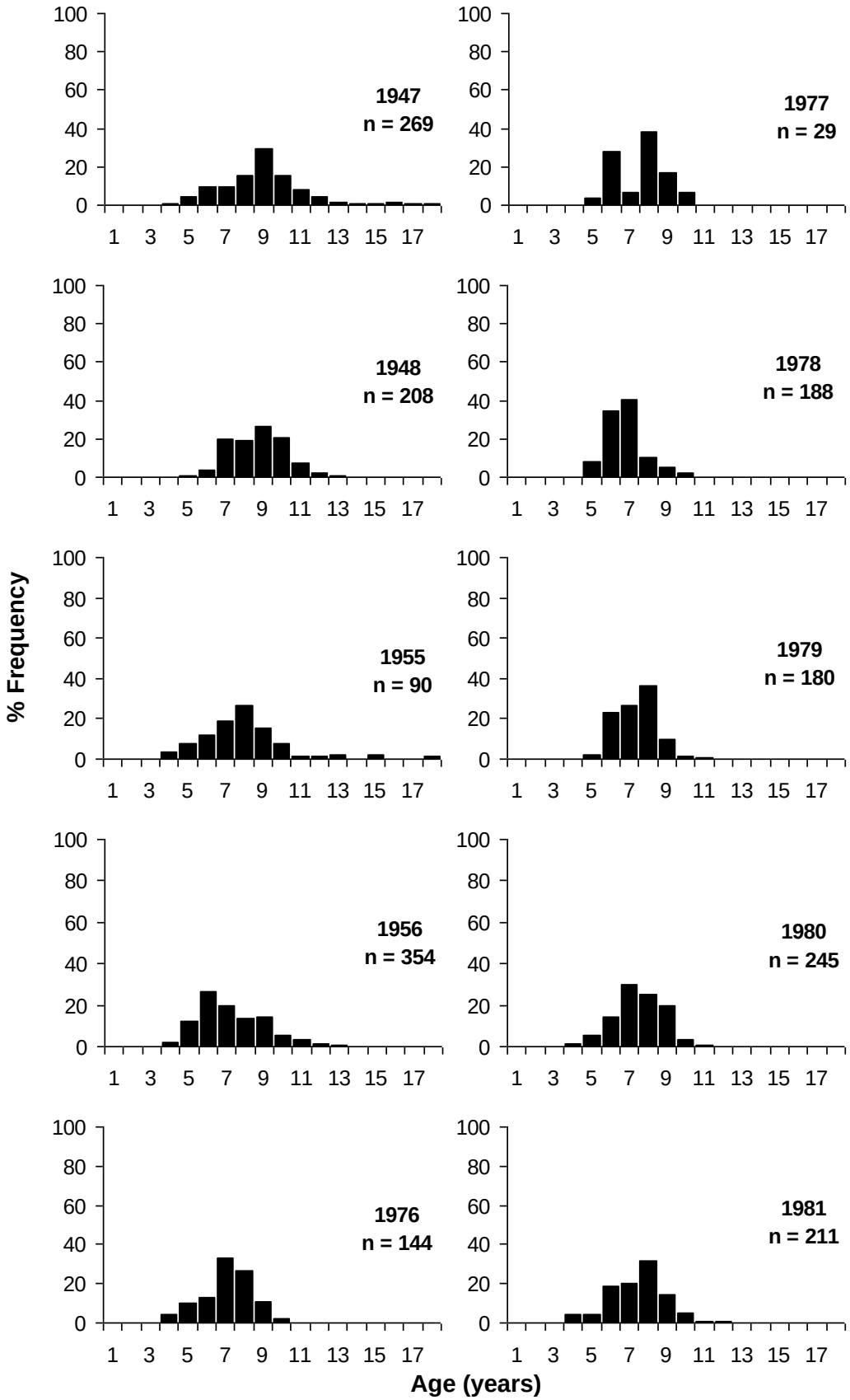


Figure 16. Age-frequency distribution for Inconnu caught at the mouth of the Buffalo River in Great Slave Lake from 1947 to 2008.

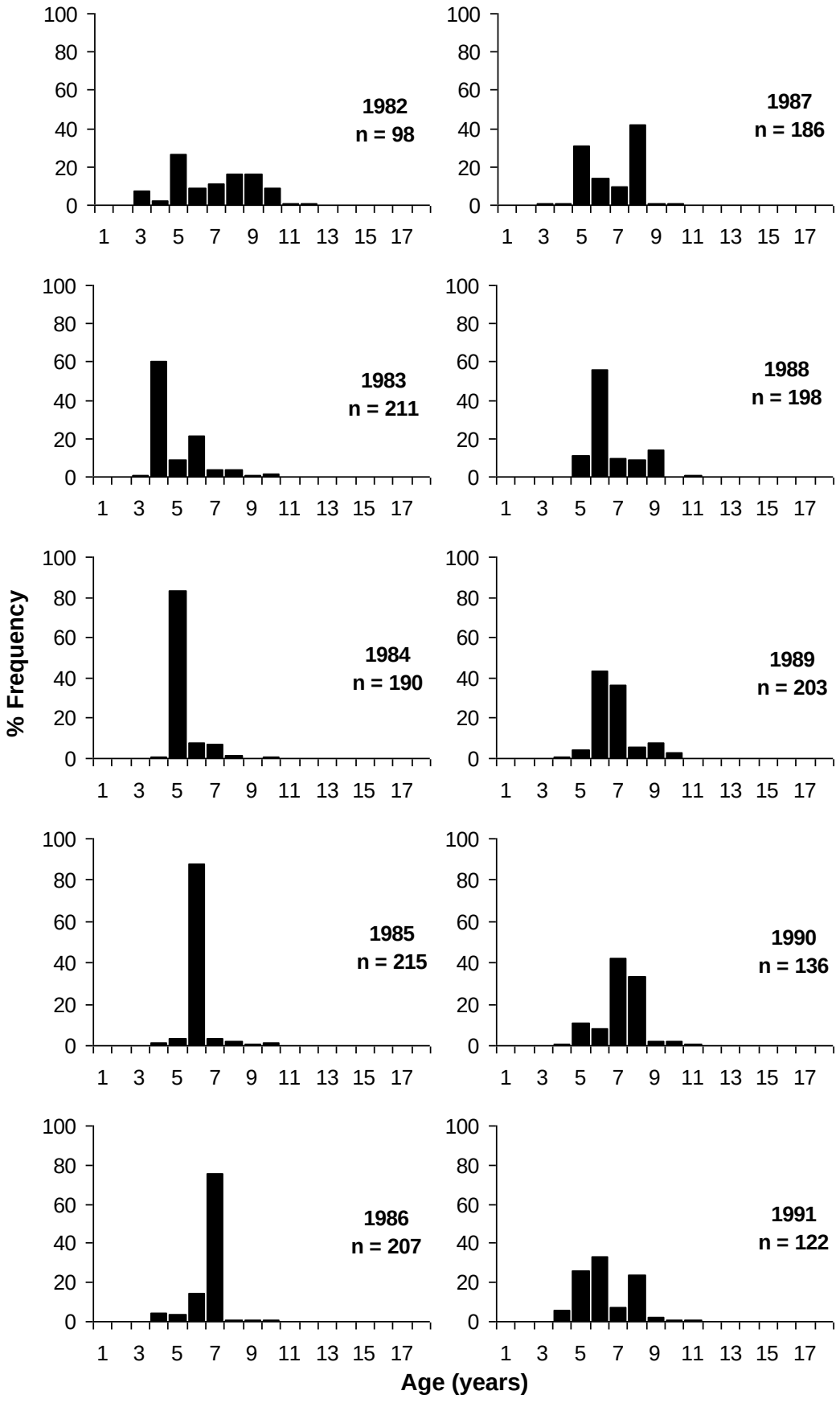


Figure 16. continued.

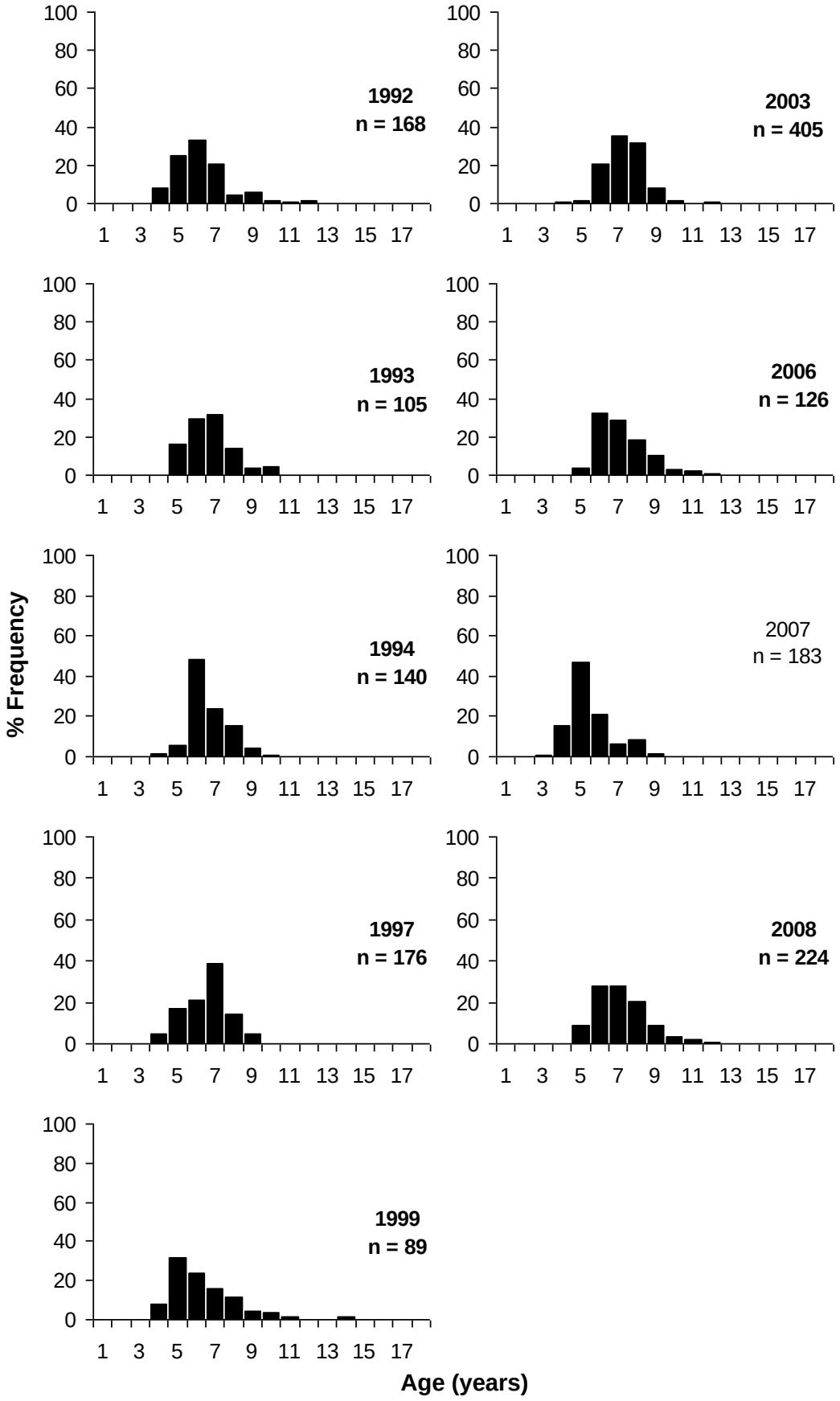


Figure 16. continued.

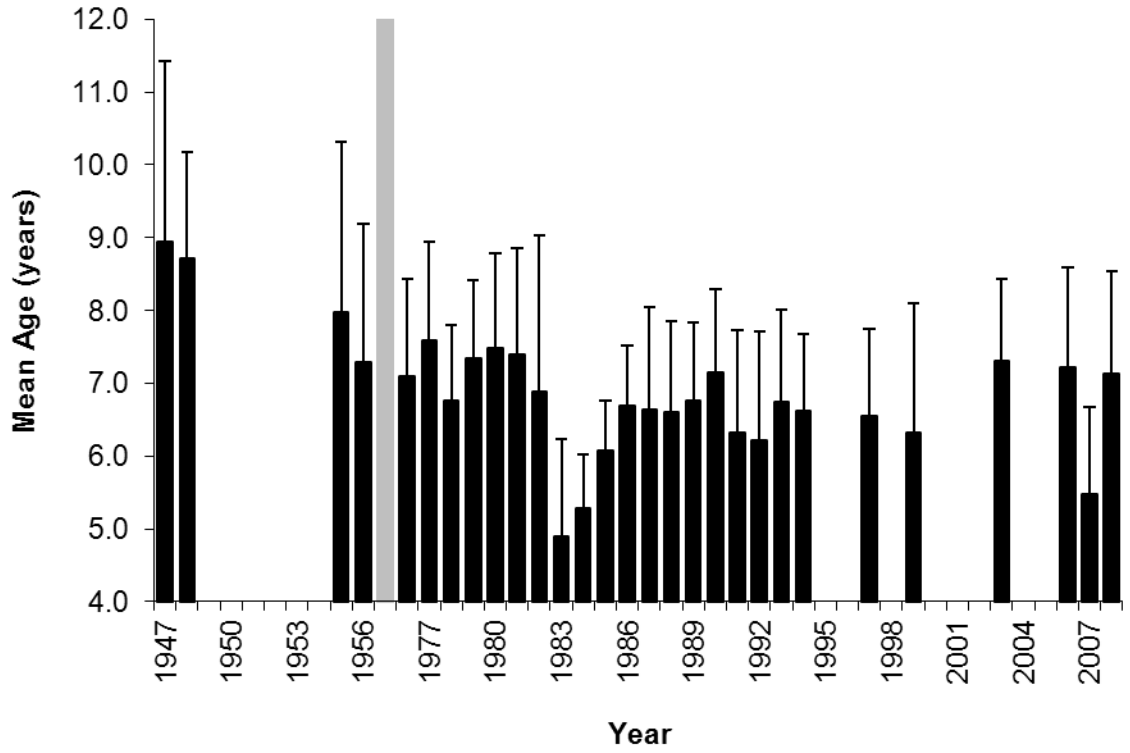


Figure 17. Mean age of Inconnu caught at the mouth of the Buffalo River in Great Slave Lake from 1947 to 2008 (n = 5,324). Error bars indicate 1 standard deviation. Note, no data were collected from 1957 to 1976 (solid grey bar); therefore, those years have been omitted from the graph to reduce space requirements.

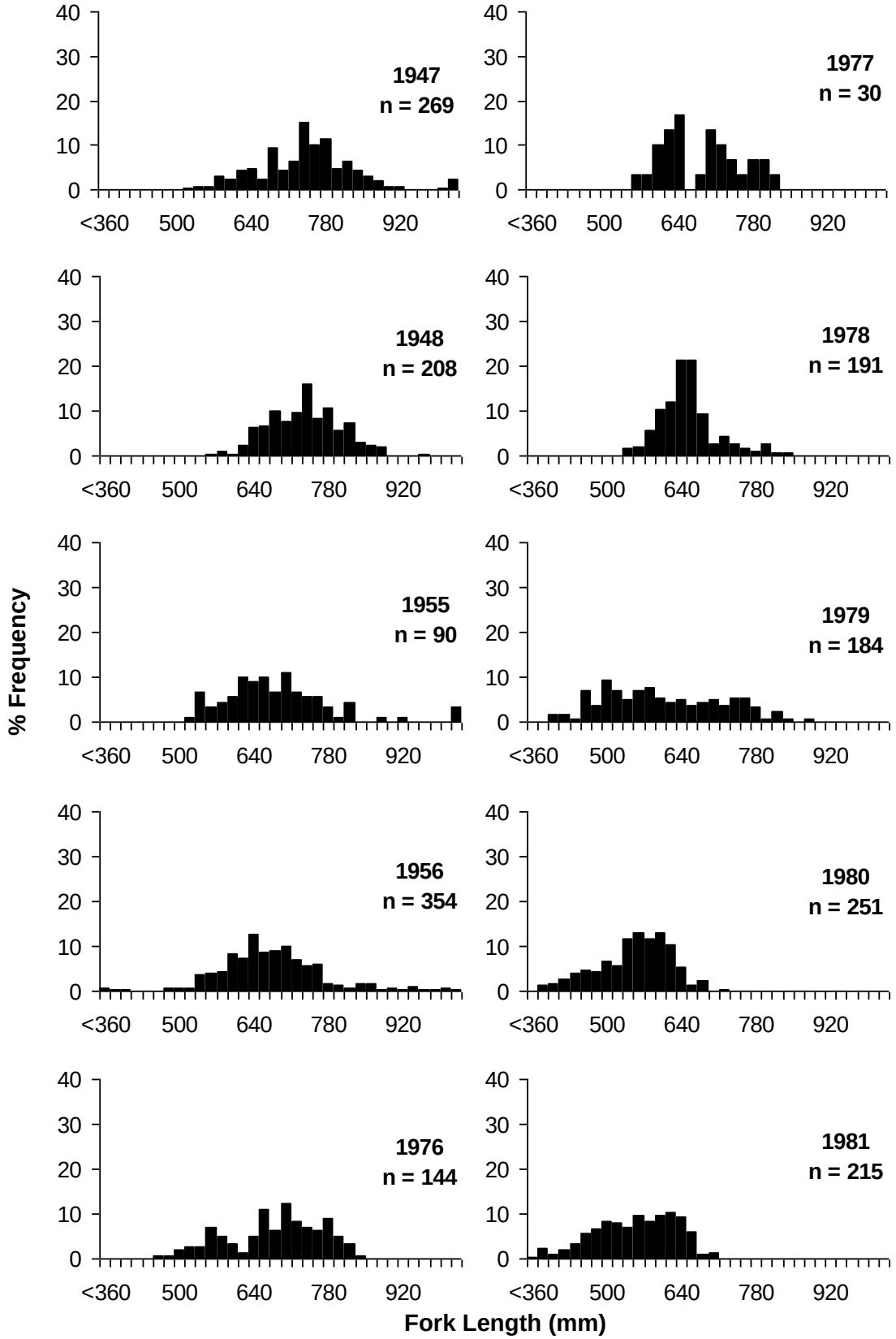


Figure 18. Fork length-percent frequency distribution for Inconnu caught at the mouth of the Buffalo River in Great Slave Lake from 1947 to 2008.

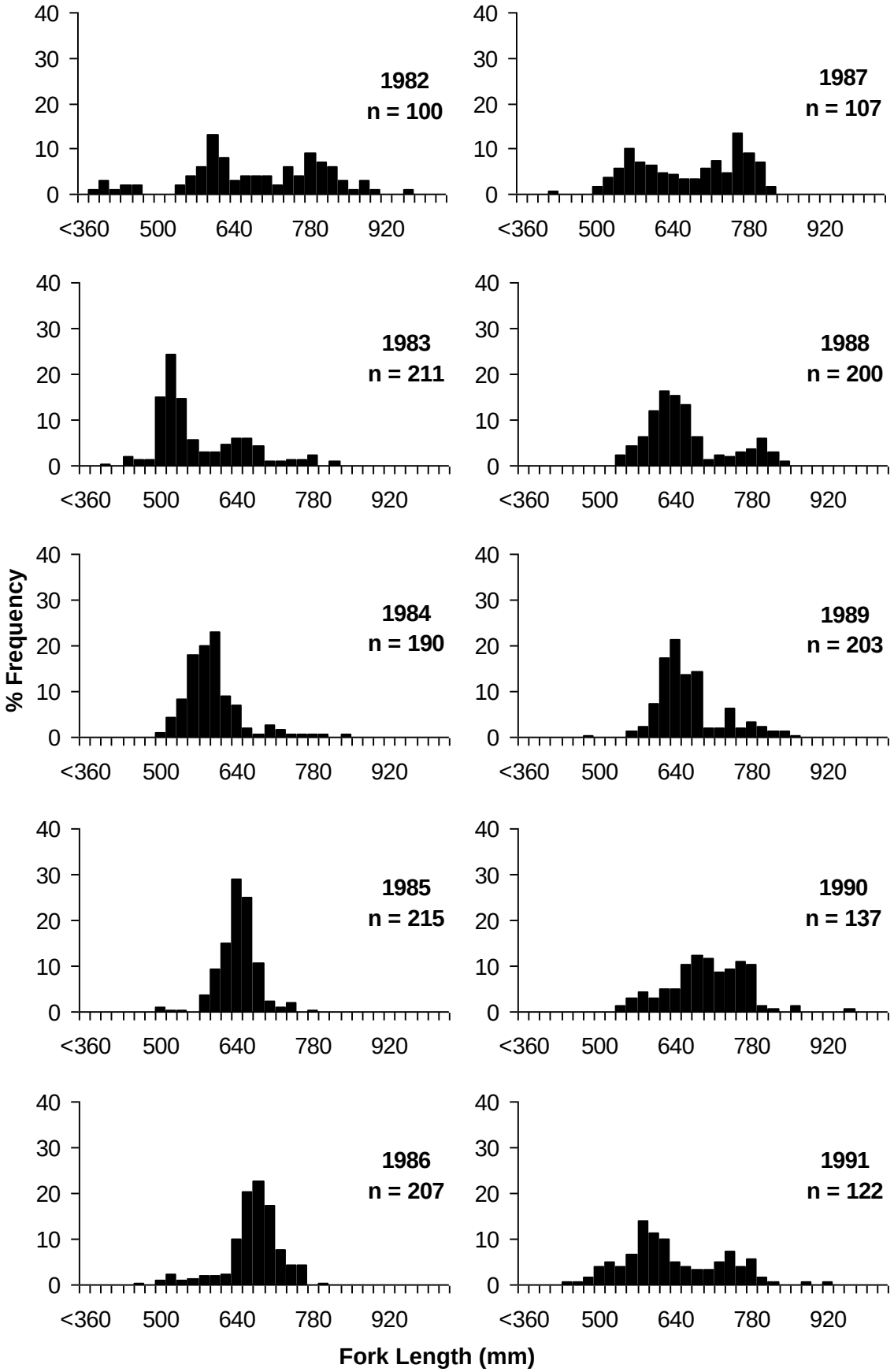


Figure 18. continued.

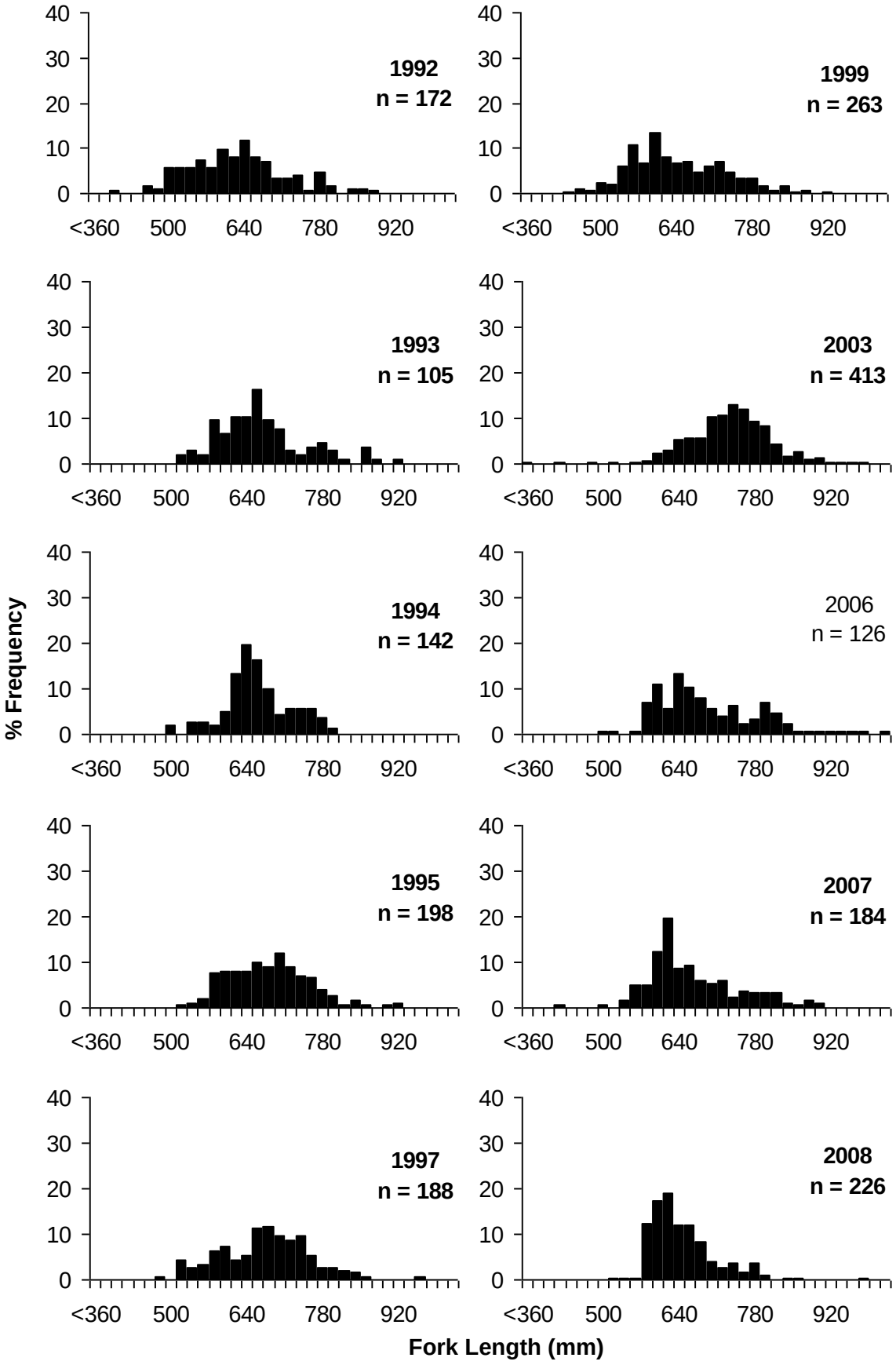


Figure 18. continued.

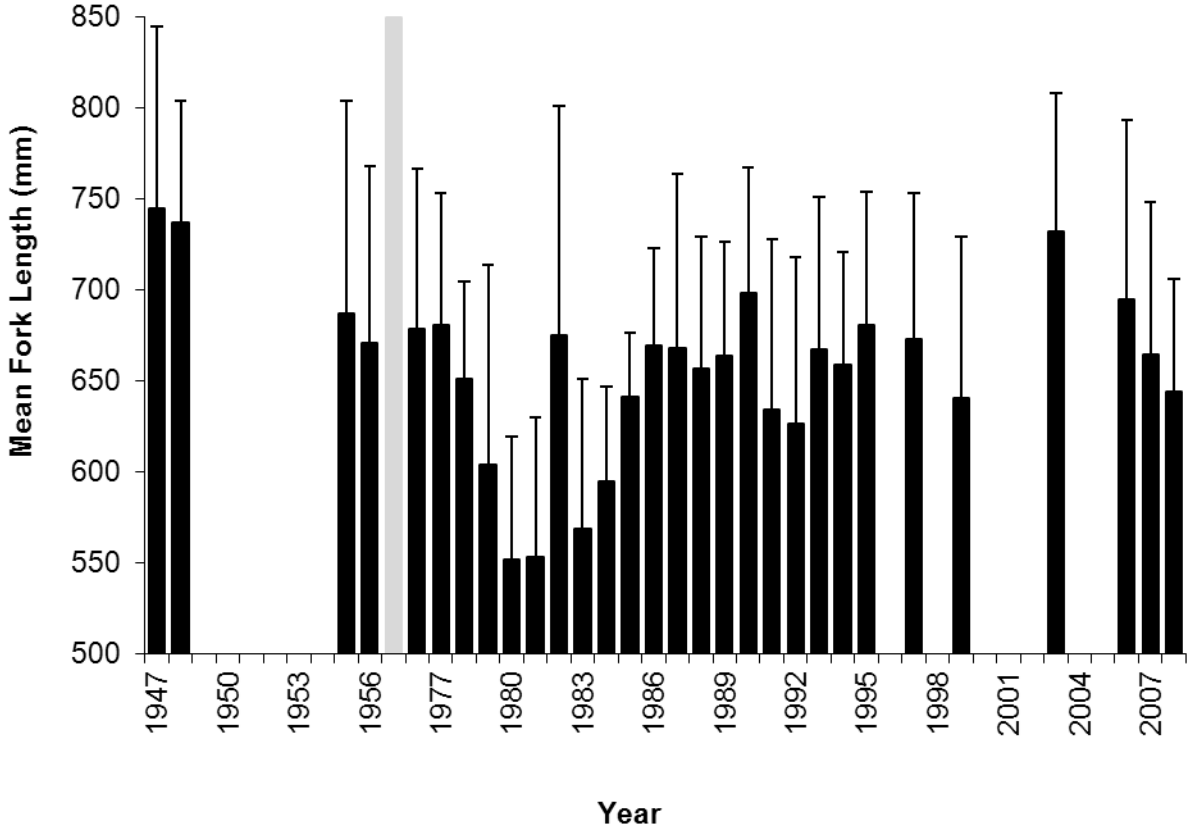


Figure 19. Mean fork length (mm) of Inconnu caught at the mouth of the Buffalo River in Great Slave Lake from 1947 to 2008 (n = 5,725). Error bars indicate 1 standard deviation. Note, no data were collected from 1957 to 1976 (solid grey bar); therefore, those years have been omitted from the graph to reduce space requirements.

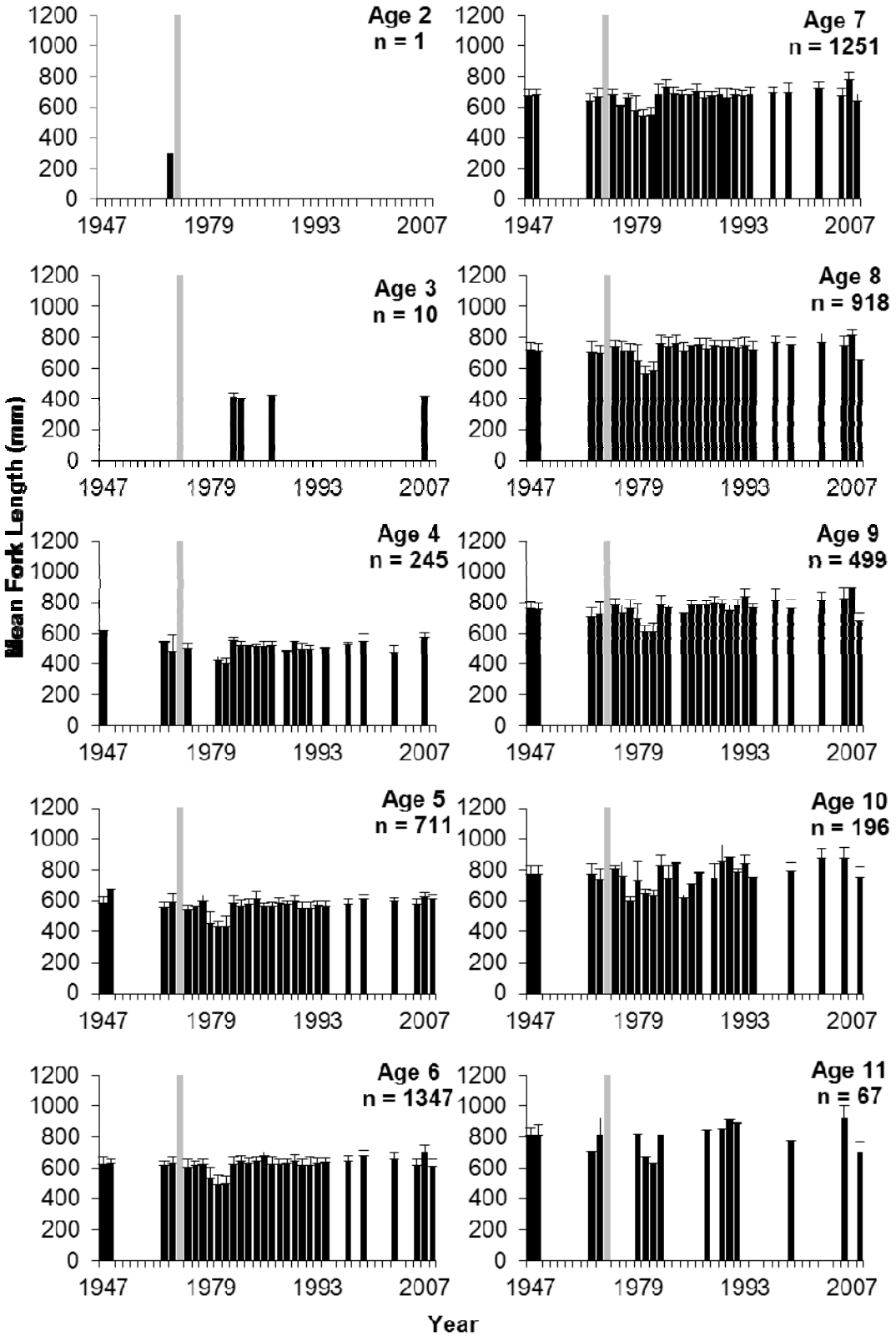


Figure 20. Mean fork length for each age class of Inconnu caught at the mouth of the Buffalo River in Great Slave Lake from 1947 to 2008. Note, no data were collected from 1957 to 1976 (solid grey bar); therefore, those years have been omitted from the graph to reduce space requirements.

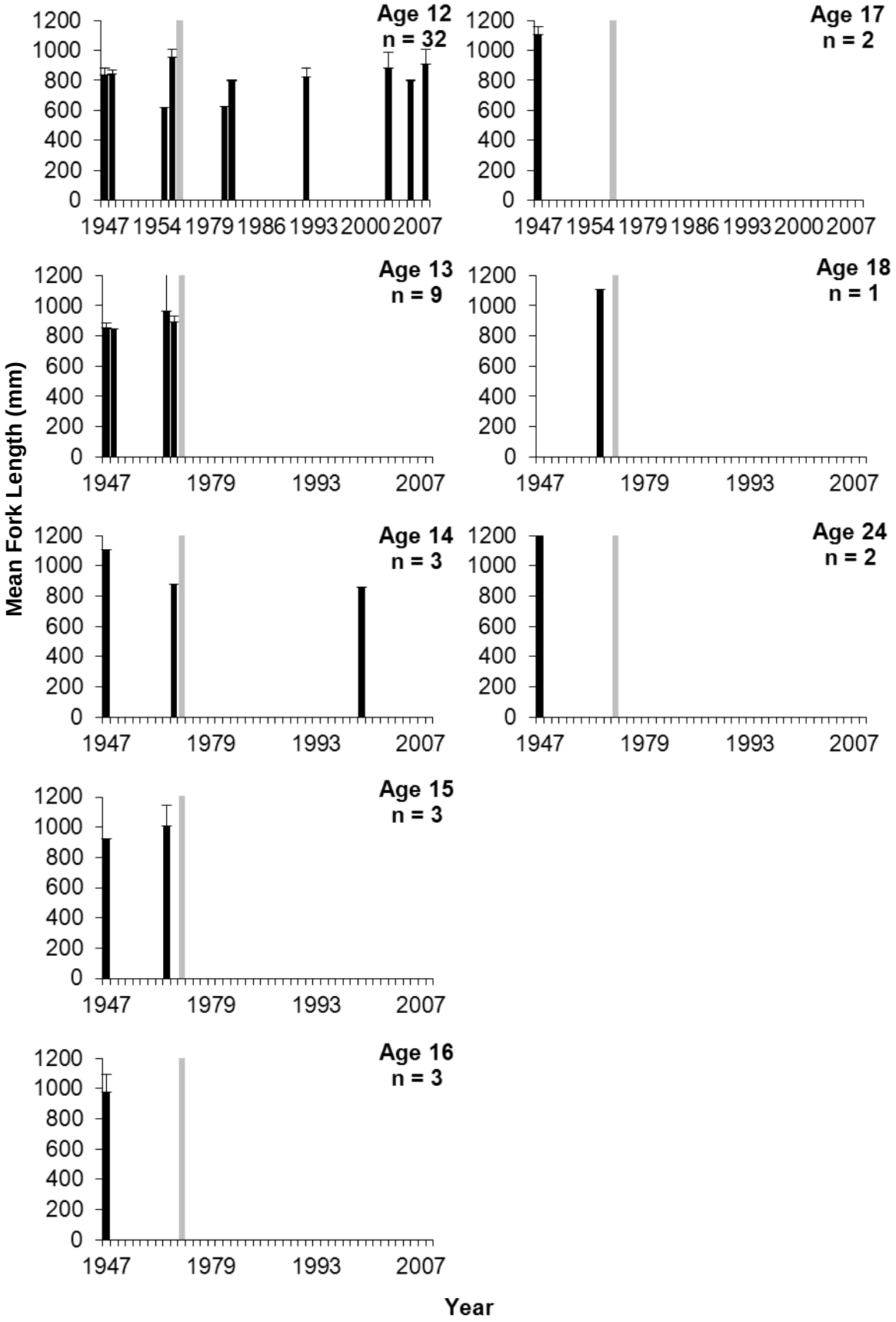


Figure 20. continued.

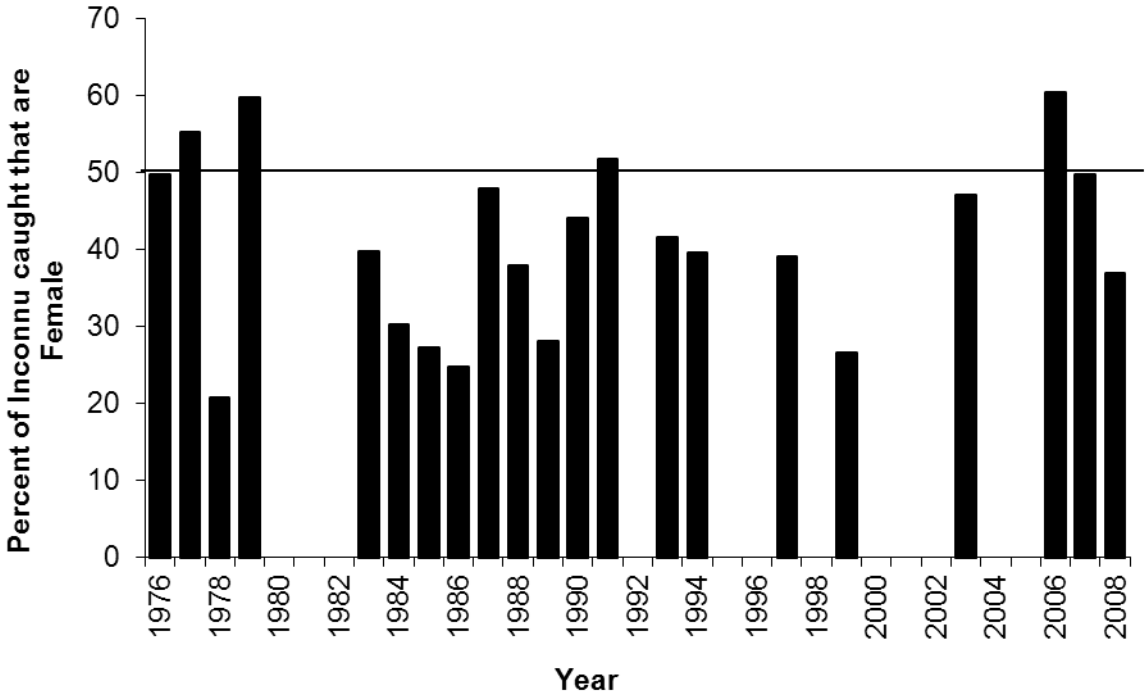


Figure 21. Percent of Inconnu caught at the mouth of the Buffalo River in Great Slave Lake from 1976 to 2008 (n = 3,193) that are female. Horizontal line marks 50%.

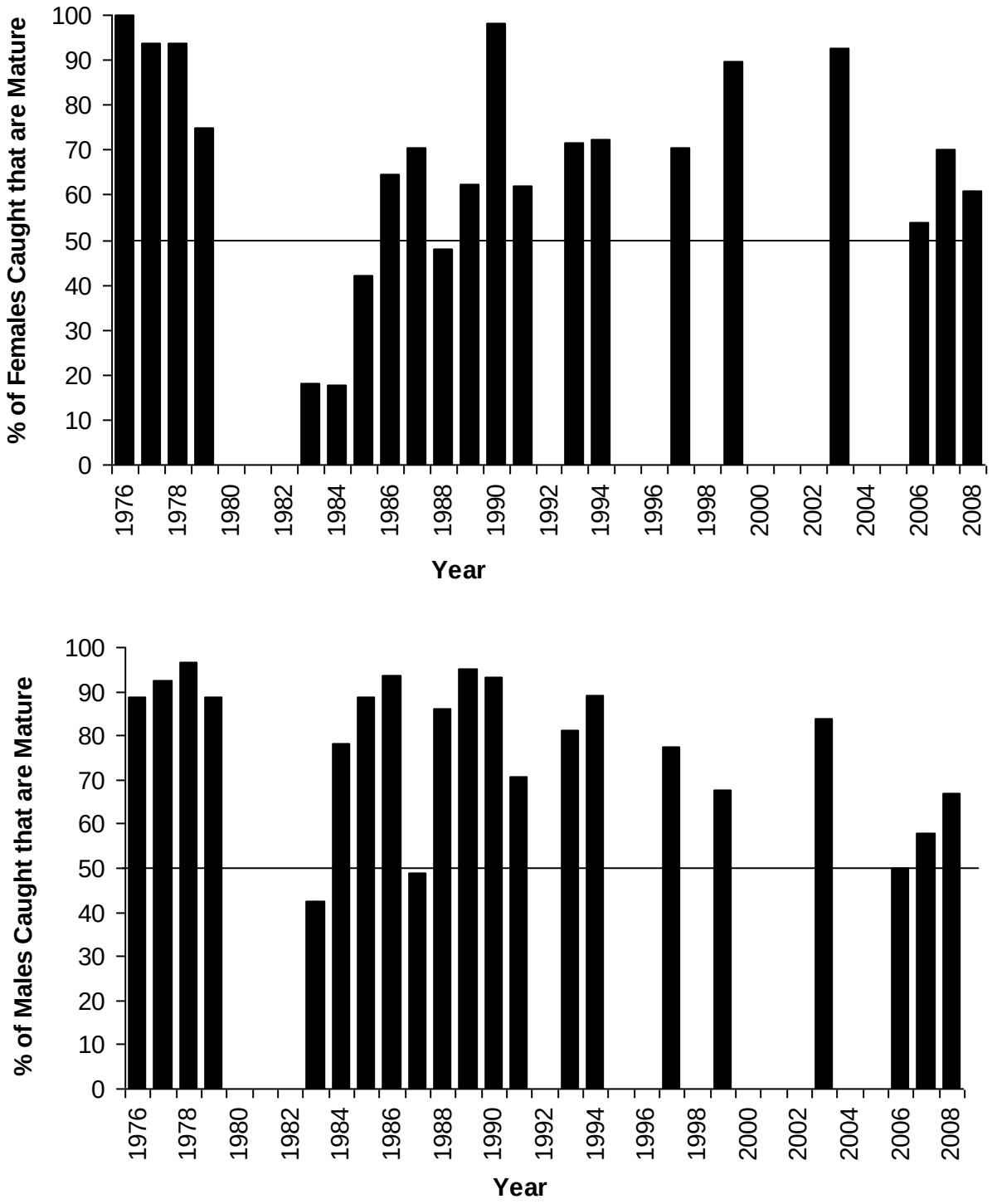


Figure 22. Percent of mature individuals for female and male Inconnu caught at the mouth of the Buffalo River in Great Slave Lake from 1976 to 2008 (n = 3,193). Horizontal lines mark 50%.

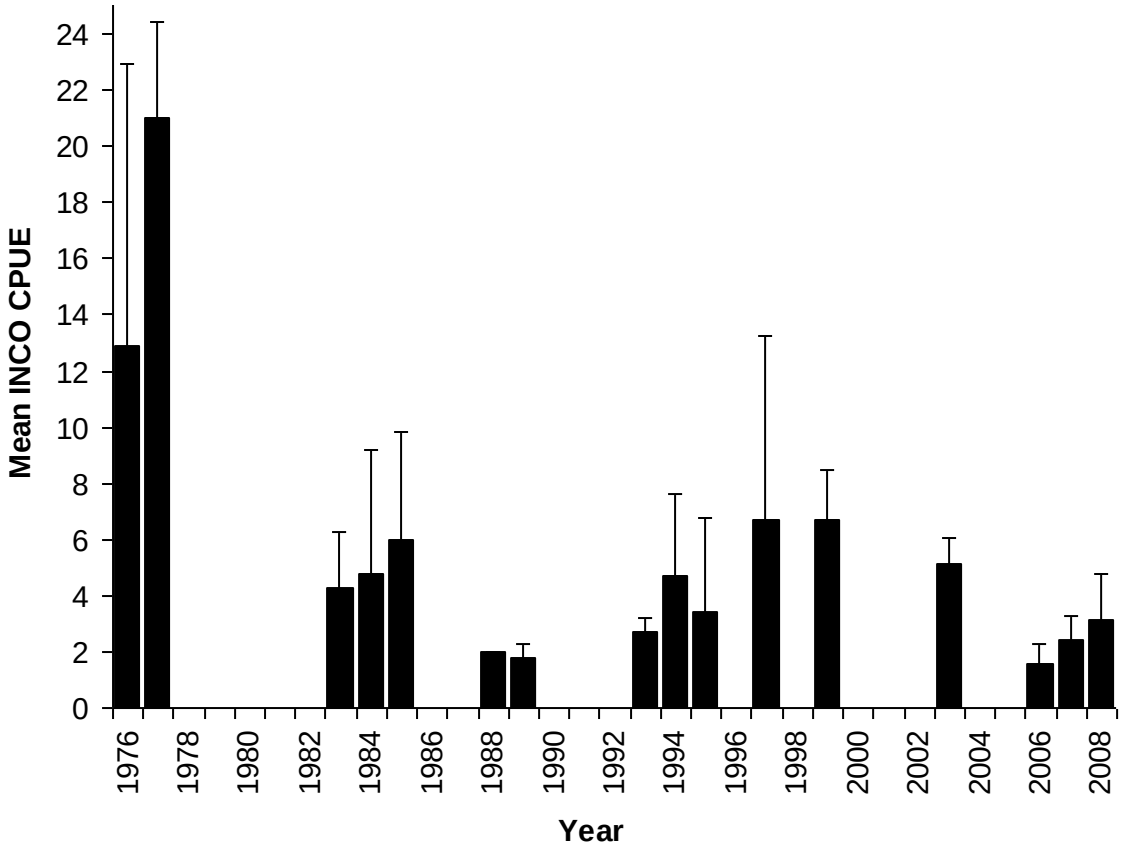


Figure 23. Mean CPUE for all sex and maturity stages of Inconnu caught in 50 m of gillnet (2 m deep) per hour (+/- 1 Standard Deviation) set at the mouth of the Buffalo River, GSL

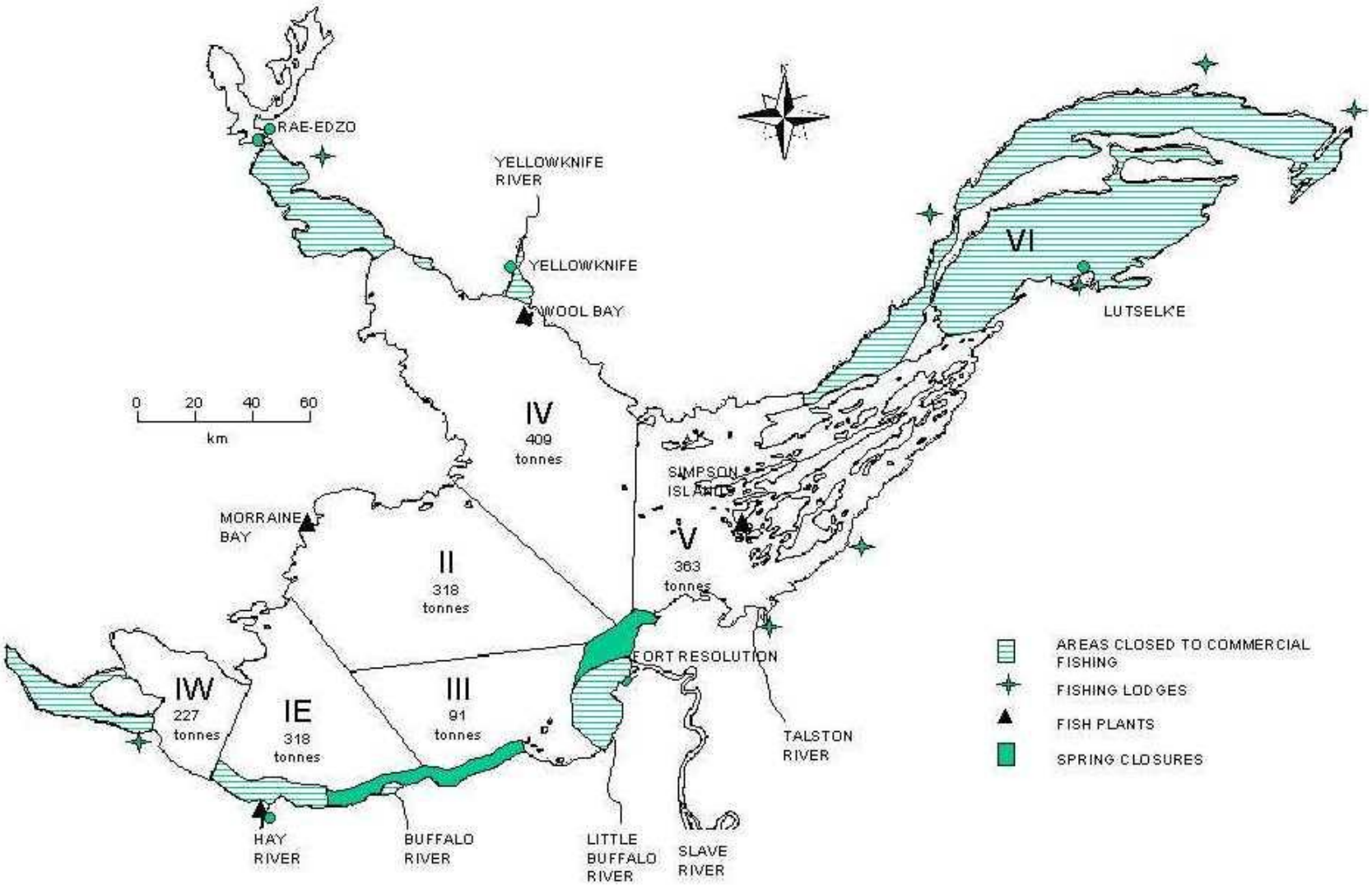


Figure 24. Map of Great Slave Lake showing areas closed to commercial fishing in the fishing season 2007-2008 (unchanged in 2008-2009).

Table 1. List of fish processing plants on Great Slave Lake indicating the year they originally opened and closed.

Fish Plant	Year Open	Year Closed
Simpson Islands	1967 or earlier	1991
Moraine Bay	1967 or earlier	2005
Wool Bay	1967 or earlier	2008
Hay River	1967 or earlier	open only in summer since 2007

Table 2. Lake Whitefish quota for each management area of Great Slave Lake (Note: quota includes Lake Whitefish only for all areas except Area V which includes Lake Whitefish and Lake Trout combined).

Year[1]	IW	IE	II	III	IV	V
1975-76	227,273	318,181	681,819	0	622,727	325,000
1976-77	227,273	318,181	318,181	0	409,091	272,729
1977-78	227,273	318,181	318,181	0	409,091	272,729
1978-79	227,273	318,181	318,181	45,455	409,091	295,455
1979-80	227,273	318,181	318,181	45,455	409,091	363,637
1980-81	227,300	318,200	318,200	45,500	409,100	363,600
1981-82	227,300	318,200	318,200	79,500	409,100	363,600
1982-83	227,300	318,200	318,200	45,500	409,100	363,600
1983-84	227,300	318,200	318,200	45,500	409,100	363,600
1984-85	227,300	318,200	318,200	45,500	409,100	363,600
1985-86	227,300	318,200	318,200	70,000	409,100	363,600
1986-87	227,300	318,200	318,200	45,500	409,100	363,600
1987-88	227,300	318,200	318,200	45,500	409,100	363,600
1988-89	227,300	318,200	318,200	45,500	409,100	363,600
1989-90	227,300	318,200	318,200	45,500	409,100	363,600
1990-91	227,300	318,200	318,200	91,000	409,100	363,600
1991-92	227,300	318,200	318,200	91,000	409,100	363,600
1992-93	227,300	318,200	318,200	91,000	409,100	363,600
1993-94	227,300	318,200	318,200	91,000	409,100	363,600
1994-95	227,300	318,200	318,200	91,000	409,100	363,600
1995-96	227,300	318,200	318,200	91,000	409,100	363,600
1996-97	227,300	318,200	318,200	91,000	409,100	363,600
1997-98	227,300	318,200	318,200	91,000	409,100	363,600
1998-99	227,300	318,200	318,200	91,000	409,100	363,600
1999-00	227,300	318,200	318,200	91,000	409,100	363,600
2000-01	227,300	318,200	318,200	91,000	409,100	363,600
2001-02	227,300	318,200	318,200	91,000	409,100	363,600
2002-03	227,300	318,200	318,200	91,000	409,100	363,600
2003-04	227,300	318,200	318,200	91,000	409,100	363,600
2004-05	227,300	318,200	318,200	91,000	409,100	363,600
2005-06	227,300	318,200	318,200	91,000	409,100	363,600
2006-07	227,300	318,200	318,200	91,000	409,100	363,600
2007-08	227,300	318,200	318,200	91,000	409,100	363,600
2008-09	227,300	318,200	318,200	91,000	409,100	363,600

Table 3. Commercial harvest of Inconnu in Great Slave Lake by management area, pooled west basin, and total harvest for each fishing year (November 1 of one year to October 31 of the next year) from 1944-1945 to 2008-2009.

Year	IW	IE	II	III	IV	V	West Basin	Total
1944-45	NA	NA	NA	NA	NA	NA	NA	40,000
1945-46	NA	NA	NA	NA	NA	NA	NA	51,364
1946-47	NA	NA	NA	NA	NA	NA	NA	39,000
1947-48	NA	NA	NA	NA	NA	NA	NA	102,000
1948-49	NA	NA	NA	NA	NA	NA	NA	163,000
1949-50	NA	NA	NA	NA	NA	NA	NA	123,000
1950-51	NA	NA	NA	NA	NA	NA	NA	146,000
1951-52	NA	NA	NA	NA	NA	NA	NA	89,000
1952-53	NA	NA	NA	NA	NA	NA	NA	91,000
1953-54	NA	NA	NA	NA	NA	NA	NA	78,000
1954-55	NA	NA	NA	NA	NA	NA	NA	75,000
1955-56	NA	NA	NA	NA	NA	NA	NA	76,000
1956-57	NA	NA	NA	NA	NA	NA	NA	97,000
1957-58	NA	NA	NA	NA	NA	NA	NA	98,000
1958-59	NA	NA	NA	NA	NA	NA	NA	141,000
1959-60	NA	NA	NA	NA	NA	NA	NA	78,000
1960-61	NA	NA	NA	NA	NA	NA	NA	135,000
1961-62	NA	NA	NA	NA	NA	NA	NA	125,000
1962-63	NA	NA	NA	NA	NA	NA	NA	156,000
1963-64	NA	NA	NA	NA	NA	NA	NA	132,000
1964-65	NA	NA	NA	NA	NA	NA	NA	139,000
1965-66	NA	NA	NA	NA	NA	NA	NA	98,000
1966-67	NA	NA	NA	NA	NA	NA	NA	111,000
1967-68	NA	NA	NA	NA	NA	NA	NA	83,000
1968-69	NA	NA	NA	NA	NA	NA	NA	79,000
1969-70	NA	NA	NA	NA	NA	NA	NA	58,000
1970-71	NA	NA	NA	NA	NA	NA	NA	62,000
1971-72	5,757	44,442	21,653	0	21	6,612	71,852	78,485
1972-73	21,097	78,647	1,562	0	297	27,821	101,306	103,461
1973-74	1,832	60,221	11,581	0	11,246	27,932	73,634	90,717
1974-75	9,156	44,455	22,993	0	2,037	16,230	76,604	94,867
1975-76	19,705	30,196	5,042	0	6,132	16,117	54,943	77,188
1976-77	16,062	33,347	13,006	0	11,863	12,108	62,415	86,382
1977-78	15,915	90,020	11,421	0	10,944	24,221	117,356	152,516
1978-79	14,188	84,790	1,780	1,183	8,209	43,270	101,941	153,415
1979-80	2,848	40,446	372	1,007	1,626	18,687	44,673	64,984
1980-81	1,034	16,203	439	189	1,165	24,269	17,865	43,291
1981-82	1,602	5,773	182	2,013	296	13,082	9,570	25,945
1982-83	2,451	4,446	546	2,837	2,381	3,430	10,280	13,094
1983-84	5,431	24,788	516	7,019	2,154	7,102	37,754	47,010
1984-85	7,272	17,949	216	13,589	2,768	30,192	39,026	71,986
1985-86	7,270	9,456	302	16,820	2,946	25,626	33,848	62,420

Table 3. continued.

Year	IW	IE	II	III	IV	V	West Basin	Total
1986-87	5,144	13,391	2,082	16,287	3,444	33,365	36,904	73,713
1987-88	2,463	23,796	2,333	6,281	12,255	8,234	34,873	55,362
1988-89	2,760	29,540	712	8,644	3,829	38,247	41,656	83,732
1989-90	1,230	18,507	514	4,324	2,466	42,433	24,575	69,474
1990-91	3,333	10,722	732	3,133	2,355	33,651	17,920	53,926
1991-92	3,602	11,140	841	315	2,179	8,711	15,898	26,788
1992-93	2,855	5,099	1,121	3,785	2,645	27,529	12,860	43,034
1993-94	1,683	5,686	293	5,259	3,404	3,966	12,921	20,291
1994-95	1,043	6,623	385	3,254	4,992	19,463	11,305	35,760
1995-96	488	5,035	380	4,945	6,368	36,562	10,848	53,778
1996-97	887	7,507	720	16,026	5,398	38,232	25,140	68,770
1997-98	2,870	9,100	539	2,114	4,997	10,520	14,623	30,140
1998-99	3,841	9,287	643	5,697	7,039	4,749	19,468	31,256
1999-00	1,806	6,550	571	7,955	6,838	13,570	16,882	37,290
2000-01	1,150	6,342	136	2,526	9,891	6,010	10,154	26,055
2001-02	1,438	15,221	1,885	5,752	6,486	19,331	24,296	50,113
2002-03	2,698	7,673	456	17,531	5,176	33,485	28,358	67,019
2003-04	2,960	17,638	369	18,180	2,639	21,165	39,147	62,951
2004-05	1,677	9,289	2,193	9,322	5,156	11,129	22,481	38,766
2005-06	3,314	7,974	669	5,815	10,024	1,357	17,772	29,153
2006-07	3,765	1,080	0	937	3,316	1,195	5,782	10,293
2007-08	6,221	2,705	590	640	0	0	10,156	10,156
2008-09	6,604	3,654	226	2,023	579	55	12,507	13,141

Table 4. Summary of Inconnu marked with T-bar anchor tags in the Slave River at Fort Smith and subsequently recaptured from 1995 through 1999.

Year	# Marked	# Returned	% Returned
1995	346	105	30
1996	219	60	27
1997	124	29	23
1998	343	58	17
1999	364	59	16
Total	1396	311	

Table 5. Number of Inconnu recaptured in each management area of Great Slave Lake which were marked in the Slave River at Fort Smith.

Location of Recapture	# Returned	% Returned
IE	15	5
IW	7	2
II	12	4
III	50	16
IV	18	6
V	142	46
unknown	33	11
Slave River	34	11
Total	311	

Table 6. Number of Inconnu recaptured in each management area of Great Slave Lake which were marked at Resdelta Channel.

Location of Recapture	# Returned	% Returned
IE	3	10
IW	0	0
II	3	10
III	1	3
IV	3	10
V	16	53
unknown	1	3
Slave River	3	10
Total	30	

Table 7. Summary of Inconnu marked with T-bar anchor tags at the mouth of the Buffalo River from 1995 to 2008.

Year tagged	Month tagged	Tag ID	Tag color	# tagged
1995	June 5-11	SR 1001 - SR 1163	Yellow	150
1997	June 1-5	HGF 2801 - HGF 2900	Orange	100
1999	June 1-3	FT 0001 - FT 0165	White	154
2000	June 8-9	FT 0201 - FT 0301	White	91
2003	May 30 - June 9	HGF 0551 - HGF 0726	Orange	174
2006	May. 30	HGF 0751 - HGF 0755	?	5
2007	May 26-31	HGF 0802 - HGF 0912	?	100
2008	May 25 - June 3	MC 0101 - MC 0300 BO 4300 - BO 4354	?	255
Total				*1029*

Table 8. Number of Inconnu recaptured in each management area of Great Slave Lake and other locations which were marked at the mouth of the Buffalo River.

Recapture Area	# Returned
IE	70
IW	12
III	64
IV	3
V	7
Little Buffalo R	1
Slave R	1
Hay R	9
Unknown	11
Total	*178*

Table 9. Location of girds and the number of net-sets for the 2009 Fishery-Independent Harvest Study.

Grid ID	Coordinates		# Sets	% of sets
1	60°53.495'	116°03.450'	1	1.5%
2	60°52.750'	115°55.500'	3	4.6%
3	60°53.333'	115°45.600'	4	6.2%
4	60°52.585'	115°35.200'	2	3.1%
5	60°52.500'	115°25.000'	7	10.8%
6	60°53.000'	115°14.790'	4	6.2%
7	60°53.800'	115°05.000'	2	3.1%
8	60°57.200'	116°02.800'	2	3.1%
9	60°57.500'	115°55.600'	4	6.2%
10	60°57.500'	115°45.500'	3	4.6%
11	60°57.500'	115°35.000'	5	7.7%
12	60°57.500'	115°24.700'	4	6.2%
13	60°57.500'	115°15.000'	4	6.2%
14	60°57.500'	115°04.300'	2	3.1%
15	60°57.000'	114°55.300'	3	4.6%
16	61°02.500'	115°55.700'	3	4.6%
17	61°02.500'	115°45.500'	3	4.6%
18	61°02.500'	115°35.000'	1	1.5%
19	61°02.500'	115°25.000'	1	1.5%
20	61°02.500'	115°14.500'	3	4.6%
21	61°02.250'	115°05.000'	0	0.0%
22	61°07.250'	115°54.300'	1	1.5%
23	61°07.500'	115°45.500'	1	1.5%
24	61°07.500'	115°35.000'	2	3.1%
Total			*65*	100.0%

Table 10. Species composition and relative abundance caught during the 2009 Fishery-Independent Harvest Study.

SPP	Total	%
Lake Whitefish	1046	42.8
Burbot	591	24.2
Longnose Sucker	475	19.5
Cisco	200	8.2
Inconnu	77	3.2
Lake Trout	46	1.9
Northern Pike	6	0.2
Yellow Walleye	1	0.0
Total	*2442*	*100.0*

Table 11. Total number, relative abundance, and catch-per-unit-effort (CPUE) for Inconnu (INCO) caught by date and grid location during the 2009 Fishery-Independent Harvest Study.

Date	Grid ID	Set Duration (hr)	# INCO	# Other SPP	% INCO	INCO CPUE
28-Jun-09	6	91.3	13	315	4.0	0.04*
1-Jul-09	3	24.4	0	230	0.0	0.00
3-Jul-09	13	22.5	1	31	3.1	0.04
3-Jul-09	15	22.3	3	26	10.3	0.13
4-Jul-09	5	23.2	0	10	0.0	0.00
4-Jul-09	16	16.3	0	24	0.0	0.00
5-Jul-09	23	23.2	0	33	0.0	0.00
5-Jul-09	7	23.0	1	11	8.3	0.04
6-Jul-09	9	23.8	2	9	18.2	0.08
6-Jul-09	2	23.3	2	17	10.5	0.09
7-Jul-09	8	22.8	1	9	10.0	0.04
7-Jul-09	3	21.8	0	29	0.0	0.00
8-Jul-09	12	23.4	1	22	4.3	0.04
8-Jul-09	7	22.5	3	8	27.3	0.13
10-Jul-09	22	26.3	1	37	2.6	0.04
10-Jul-09	20	21.8	1	22	4.3	0.05
16-Jul-09	12	48.1	1	28	3.4	0.02
16-Jul-09	11	48.1	2	24	7.7	0.04
18-Jul-09	24	24.2	0	62	0.0	0.00
18-Jul-09	14	24.6	5	80	5.9	0.20
19-Jul-09	12	NA	0	16	0.0	NA
19-Jul-09	5	NA	1	6	14.3	NA
21-Jul-09	2	23.0	0	14	0.0	0.00
21-Jul-09	5	22.9	1	10	9.1	0.04
22-Jul-09	6	24.5	2	10	16.7	0.08
22-Jul-09	13	23.6	3	19	13.6	0.13
23-Jul-09	12	22.3	3	23	11.5	0.13
23-Jul-09	17	20.3	0	20	0.0	0.00
24-Jul-09	20	24.0	0	21	0.0	0.00
24-Jul-09	1	23.8	0	12	0.0	0.00
28-Jul-09	20	22.4	1	26	3.7	0.04
28-Jul-09	4	20.8	0	35	0.0	0.00
29-Jul-09	18	22.9	0	0	NA	0.00
29-Jul-09	5	26.9	0	0	NA	0.00
30-Jul-09	6	25.6	1	31	3.1	0.04
30-Jul-09	5	24.2	0	24	0.0	0.00
31-Jul-09	9	20.0	0	14	0.0	0.00
31-Jul-09	3	20.1	0	64	0.0	0.00
4-Aug-09	11	21.5	1	31	3.1	0.05
4-Aug-09	3	19.4	0	78	0.0	0.00
5-Aug-09	16	25.3	0	37	0.0	0.00
5-Aug-09	11	22.4	3	26	10.3	0.13

*4 nets were used in this set. This was accounted for in CPUE calculation. All subsequent sets used one net.

Table 11. continued.

Date	Grid ID	Set Duration (hr)	# INCO	# Other SPP	% INCO	INCO CPUE
6-Aug-09	16	22.3	0	33	0.0	0.00
6-Aug-09	2	23.3	1	32	3.0	0.04
9-Aug-09	4	70.4	0	38	0.0	0.00
9-Aug-09	15	70.5	0	89	0.0	0.00
11-Aug-09	11	23.4	3	27	10.0	0.13
11-Aug-09	14	23.4	0	30	0.0	0.00
13-Aug-09	17	46.5	0	32	0.0	0.00
13-Aug-09	10	45.5	0	22	0.0	0.00
14-Aug-09	6	95.2	0	30	0.0	0.00
20-Aug-09	24	94.5	0	76	0.0	0.00
19-Aug-09	8	46.7	0	24	0.0	0.00
19-Aug-09	10	47.2	2	51	3.8	0.04
20-Aug-09	9	27.5	0	22	0.0	0.00
20-Aug-09	11	24.7	1	59	1.7	0.04
24-Aug-09	19	94.8	0	61	0.0	0.00
24-Aug-09	17	93.9	0	47	0.0	0.00
27-Aug-09	9	25.5	0	21	0.0	0.00
28-Aug-09	13	46.7	2	24	7.7	0.04
29-Aug-09	10	24.3	1	23	4.2	0.04
29-Aug-09	13	24.1	0	12	0.0	0.00
30-Aug-09	5	26.8	6	25	19.4	0.22
30-Aug-09	15	23.5	1	18	5.3	0.04
31-Aug-09	5	21.3	5	25	16.7	0.23
Total		*2,074.6*	*75*	*2,365*	*3.2*	*0.04*

Table 12. Water depth and number of Inconnu (INCO) caught during the 2009 Fishery-Independent Harvest Study.

Grid ID	Date Net Checked	Lat d°mm.mmm	Long d°mm.mmm	Depth of water (m)	# INCO
7	8-Jul-09	60°53.474	115°05.212	4.6	3
7	5-Jul-09	60°53.768	115°05.356	5.2	1
5	4-Jul-09	60°52.579	115°24.520	8.5	0
1	24-Jul-09	60°53.530	116°03.172	8.5	0
5	21-Jul-09	60°52.387	115°25.181	9.4	1
5	19-Jul-09	60°52.456	115°24.822	9.4	1
5	29-Jul-09	60°52.511	115°25.193	9.8	na
5	31-Aug-09	60°52.631	115°24.820	9.8	5
6	22-Jul-09	60°53.047	115°14.884	9.8	2
5	30-Jul-09	60°52.472	115°25.293	10.1	0
5	30-Aug-09	60°52.607	115°24.972	10.1	6
6	14-Aug-09	60°53.027	115°14.857	10.1	0
6	30-Jul-09	60°53.098	115°14.939	10.1	1
6	28-Jun-09	60°53.122	115°14.777	10.1	13
2	6-Jul-09	60°55.667	115°54.972	10.4	2
2	21-Jul-09	60°52.804	115°55.155	10.7	0
3	1-Jul-09	60°53.327	115°45.786	10.7	0
2	6-Aug-09	60°52.884	115°55.448	11.0	1
3	4-Aug-09	60°53.487	115°45.621	11.6	0
3	31-Jul-09	60°53.545	115°46.181	12.2	0
3	7-Jul-09	60°53.764	115°47.384	12.2	0
4	28-Jul-09	60°52.512	115°35.090	12.5	0
4	9-Aug-09	60°52.550	115°35.268	12.5	0
15	3-Jul-09	60°56.812	114°55.354	13.4	3
15	9-Aug-09	60°56.936	114°55.497	14.0	0
15	30-Aug-09	60°56.974	114°55.414	14.0	1
14	18-Jul-09	60°57.532	115°04.341	15.2	5
8	7-Jul-09	60°57.131	116°02.633	15.5	1
8	19-Aug-09	60°57.133	116°02.659	15.5	0
14	11-Aug-09	60°57.458	115°35.083	15.5	0
13	22-Jul-09	60°57.415	115°15.009	16.2	3
22	10-Jul-09	61°07.213	115°53.934	16.5	1
13	28-Aug-09	60°57.476	115°15.106	16.8	2
13	29-Aug-09	60°57.520	115°15.123	16.8	0
13	3-Jul-09	60°57.667	115°14.940	16.8	1
9	31-Jul-09	60°56.826	115°54.104	17.1	0
9	6-Jul-09	60°57.337	115°55.684	17.4	2
9	27-Aug-09	60°57.447	115°55.428	17.7	0
9	20-Aug-09	60°57.480	115°55.729	17.7	0
12	19-Jul-09	60°57.510	115°24.310	17.7	0

Table 12. continued.

Grid ID	Date Net Checked	Lat d°mm.mmm	Long d°mm.mmm	Depth of water (m)	# INCO
12	23-Jul-09	60°57.404	115°24.750	18.3	3
12	8-Jul-09	60°57.473	115°24.726	18.3	1
12	16-Jul-09	60°57.609	115°24.761	18.3	1
10	29-Aug-09	60°57.426	115°45.433	18.9	1
10	19-Aug-09	60°57.439	115°45.788	18.9	2
16	6-Aug-09	61°02.588	115°55.674	19.2	0
10	13-Aug-09	60°57.542	115°45.372	19.5	0
16	4-Jul-09	61°01.878	115°55.616	19.5	0
16	5-Aug-09	61°02.461	115°55.617	19.5	0
11	20-Aug-09	60°57.393	115°35.096	21.3	1
11	5-Aug-09	60°57.366	115°35.312	21.6	3
11	4-Aug-09	60°57.429	115°35.330	21.6	1
11	11-Aug-09	60°57.457	115°35.082	21.6	3
11	16-Jul-09	60°57.481	115°34.881	21.6	2
20	24-Jul-09	61°02.372	115°14.631	23.5	0
20	10-Jul-09	61°02.434	115°14.653	23.5	1
20	28-Jul-09	61°02.446	115°14.681	23.5	1
17	24-Aug-09	61°02.532	115°45.660	23.5	0
17	23-Jul-09	61°02.280	115°44.844	23.8	0
17	13-Aug-09	61°02.558	115°45.382	23.8	0
23	5-Jul-09	61°07.187	115°45.500	24.7	0
18	29-Jul-09	61°02.447	115°34.891	31.1	na
19	24-Aug-09	61°02.531	115°24.973	31.1	0
24	20-Aug-09	61°07.496	115°35.022	32.9	0
24	18-Jul-09	61°07.397	115°34.909	33.5	0

Table 13. Results of pairwise Kolmogorov-Smirnov tests comparing age-frequency distributions of Inconnu caught at the mouth of the Buffalo River from 1947 to 2008. Black cells indicate a statistically significant difference (df=28, p<0.05) was found.

X	1947	1948	1955	1956	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1997	1999	2003	2006	2007	2008
1947	x	0.199																											
1948	x	x																											
1955	x	x	x			0.995			0.332	0.440																			
1956	x	x	x	x		0.113																					0.222		
1976	x	x	x	x	x	0.151		0.212	0.258	0.125									0.738							0.103	0.502		0.332
1977	x	x	x	x	x	x		0.653	0.736	0.953									0.113							0.211	0.050		
1978	x	x	x	x	x	x	x											0.947				0.736	0.114	0.063					
1979	x	x	x	x	x	x	x	x	0.093	0.435									0.461							0.826	0.160		
1980	x	x	x	x	x	x	x	x	x	0.679																			
1981	x	x	x	x	x	x	x	x	x	x																0.123			
1982	x	x	x	x	x	x	x	x	x	x	x																		
1983	x	x	x	x	x	x	x	x	x	x	x	x																	
1984	x	x	x	x	x	x	x	x	x	x	x	x	x																
1985	x	x	x	x	x	x	x	x	x	x	x	x	x	x															
1986	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x														
1987	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x													
1988	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x						0.218						
1989	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x				0.277	0.657						
1990	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x							0.297			
1991	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	0.107				0.935				
1992	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x				0.872				
1993	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	0.564	0.989			0.338		
1994	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	0.070					
1997	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x					
1999	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x				0.298
2003	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x			
2006	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		
2007	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
2008	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x

Table 14. Results of pairwise Bonferroni tests comparing mean age of Inconnu caught at the mouth of the Buffalo River from 1947 to 2008. Black cells indicate a statistically significant difference (df=28, p<0.0018) was found.

X	1947	1948	1955	1956	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1997	1999	2003	2006	2007	2008
1947	x	1.0000																											
1948	x	x			0.0212																								
1955	x	x	x	0.0246	0.0020	1.0000		0.2392	1.0000	0.5234									0.0082							0.0304	0.0475		
1956	x	x	x	x	1.0000	1.0000	0.0092	1.0000	1.0000	1.0000	1.0000							0.0054	1.0000			0.1742				1.0000	1.0000		1.0000
1976	x	x	x	x	x	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000				1.0000	1.0000	0.5538	1.0000	1.0000	0.0033		1.0000	1.0000	0.2111	0.0215	1.0000	1.0000		1.0000
1977	x	x	x	x	x	x	1.0000	1.0000	1.0000	1.0000	1.0000				0.6095	0.3278	0.1877	1.0000	1.0000	0.0060		1.0000	0.3377	0.0986	0.0127	1.0000	1.0000		1.0000
1978	x	x	x	x	x	x	x	0.0312		0.0028	1.0000				1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.1496	1.0000	1.0000	1.0000	1.0000	0.0032	1.0000		1.0000
1979	x	x	x	x	x	x	x	x	1.0000	1.0000	1.0000				0.0033			0.0218	1.0000			0.2448	0.0028			1.0000	1.0000		1.0000
1980	x	x	x	x	x	x	x	x	x	1.0000	0.1652								1.0000			0.0028				1.0000	1.0000		1.0000
1981	x	x	x	x	x	x	x	x	x	x	1.0000								1.0000			0.0482				1.0000	1.0000		1.0000
1982	x	x	x	x	x	x	x	x	x	x	x				1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0838	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000		1.0000
1983	x	x	x	x	x	x	x	x	x	x	x	x	1.0000															0.0150	
1984	x	x	x	x	x	x	x	x	x	x	x	x	x															1.0000	
1985	x	x	x	x	x	x	x	x	x	x	x	x	x	x	0.0031	0.0309	0.0734			1.0000	1.0000	0.0332	0.1692	0.4808	1.0000			0.0107	
1986	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	1.0000	1.0000	1.0000	1.0000	1.0000	0.4926	1.0000	1.0000	1.0000	1.0000		0.4785		0.5335
1987	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	1.0000	1.0000	0.6026	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000		0.1760		0.1750
1988	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	1.0000	0.2153	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000		0.0581		0.0459
1989	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	1.0000	1.0000	0.1222	1.0000	1.0000	1.0000	1.0000		1.0000		1.0000
1990	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x			1.0000	0.8245	0.0797	0.0085	1.0000	1.0000		1.0000
1991	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	1.0000	1.0000	1.0000	1.0000	1.0000				
1992	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	1.0000	1.0000	1.0000	1.0000				
1993	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	1.0000	1.0000	1.0000	0.0937	1.0000		1.0000
1994	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	1.0000	1.0000		0.2618		0.3143
1997	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	1.0000		0.0208		0.0149
1999	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		0.0024		0.0021
2003	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	1.0000		1.0000
2006	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		1.0000
2007	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
2008	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x

Table 15. Results of pairwise Kolmogorov-Smirnov tests comparing fork length-frequency distributions of Inconnu caught at the mouth of the Buffalo River from 1947 to 2008. Black cells indicate a statistically significant difference (df=29, p<0.05) was found.

X	1947	1948	1955	1956	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1997	1999	2003	2006	2007	2008
1947	x	0.404																									0.053			
1948	x	x																									0.808			
1955	x	x	x	0.812	0.259	0.868					0.092					0.087						0.202		0.597	0.852			0.608	0.111	
1956	x	x	x	x		0.657																0.289		0.248	0.149					
1976	x	x	x	x	x	0.503													0.100					0.095	0.170			0.154		
1977	x	x	x	x	x	x					0.174								0.082			0.151	0.072	0.873	0.776			0.685	0.170	
1978	x	x	x	x	x	x	x							0.073			0.175	0.144				0.057	0.183							
1979	x	x	x	x	x	x	x	x																						
1980	x	x	x	x	x	x	x	x	x	0.104																				
1981	x	x	x	x	x	x	x	x	x	x																				
1982	x	x	x	x	x	x	x	x	x	x	x					0.133												0.061		
1983	x	x	x	x	x	x	x	x	x	x	x	x																		
1984	x	x	x	x	x	x	x	x	x	x	x	x	x																	
1985	x	x	x	x	x	x	x	x	x	x	x	x	x	x																
1986	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x															
1987	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x														
1988	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x					0.063	0.057						0.379	0.165
1989	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x				0.172	0.807							
1990	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x											
1991	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	0.534					0.495				
1992	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x					0.250				
1993	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	0.337					0.107	0.348	
1994	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x							
1995	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	0.541			0.052		
1997	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x			0.052		
1999	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x				
2003	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x			
2006	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		
2007	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
2008	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x

Table 16. Results of pairwise Bonferroni tests comparing mean fork length of Inconnu caught at the mouth of the Buffalo River from 1947 to 2008. Black cells indicate a statistically significant difference (df=29, p<0.0017) was found.

X	1947	1948	1955	1956	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1997	1999	2003	2006	2007	2008
1947	x	1.0000				0.0156																					1.0000			
1948	x	x				0.1556													0.0055								1.0000			
1955	x	x	x	1.0000	1.0000	1.0000	0.1722				1.0000			0.0026	1.0000	1.0000	1.0000	1.0000	1.0000			1.0000	1.0000	1.0000	1.0000			1.0000	1.0000	0.0079
1956	x	x	x	x	1.0000	1.0000	1.0000				1.0000			0.0119	1.0000	1.0000	1.0000	1.0000	0.3301	0.0063		1.0000	1.0000	1.0000	1.0000			1.0000	1.0000	0.0488
1976	x	x	x	x	x	1.0000	0.7129				1.0000			0.0076	1.0000	1.0000	1.0000	1.0000	1.0000	0.0028		1.0000	1.0000	1.0000	1.0000	0.0018		1.0000	1.0000	0.0252
1977	x	x	x	x	x	x	1.0000				1.0000			1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.3210	1.0000	1.0000	1.0000	1.0000	1.0000	0.3223	1.0000	1.0000	1.0000
1978	x	x	x	x	x	x	x				1.0000			1.0000	1.0000	1.0000	1.0000	1.0000		1.0000	1.0000	1.0000	1.0000	0.1192	1.0000	1.0000			1.0000	1.0000
1979	x	x	x	x	x	x	x	x				0.0091	1.0000							0.5303	1.0000									
1980	x	x	x	x	x	x	x	x	x	1.0000		1.0000																		
1981	x	x	x	x	x	x	x	x	x	x		1.0000																		
1982	x	x	x	x	x	x	x	x	x	x	x			0.2331	1.0000	1.0000	1.0000	1.0000	1.0000	0.0650		1.0000	1.0000	1.0000	1.0000	0.0966		1.0000	1.0000	0.5814
1983	x	x	x	x	x	x	x	x	x	x	x	x	0.5425																	
1984	x	x	x	x	x	x	x	x	x	x	x	x	x							0.0131	0.0796									
1985	x	x	x	x	x	x	x	x	x	x	x	x	x	x	0.1425	0.3853	1.0000	1.0000		1.0000	1.0000	1.0000	1.0000		0.0410	1.0000			1.0000	1.0000
1986	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	1.0000	1.0000	1.0000	0.6110	0.0464		1.0000	1.0000	1.0000	1.0000	0.0380		1.0000	1.0000	0.4434
1987	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	1.0000	1.0000	0.4475	0.1136		1.0000	1.0000	1.0000	1.0000	0.1236		1.0000	1.0000	1.0000
1988	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	1.0000		1.0000	0.1682	1.0000	1.0000	1.0000	1.0000	1.0000		0.0136	1.0000	1.0000
1989	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	0.0612	0.4900	0.0034	1.0000	1.0000	1.0000	1.0000	0.6831		0.3580	1.0000	1.0000
1990	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x			1.0000	0.0209	1.0000	1.0000		0.0084	1.0000	0.0942	
1991	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	1.0000	0.7687	1.0000		0.0145	1.0000			0.5459	1.0000
1992	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	0.0188	0.1981			1.0000			0.0047	1.0000
1993	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	1.0000	1.0000	1.0000	1.0000		1.0000	1.0000	1.0000
1994	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	1.0000	1.0000	1.0000		0.1197	1.0000	1.0000
1995	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	1.0000			1.0000	1.0000	
1997	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	0.0099		1.0000	1.0000	0.1342
1999	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x			0.8133	1.0000
2003	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	0.0024		
2006	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	0.5021	
2007	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	1.0000
2008	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x

Table 17. Sample size, mean, and standard deviation (SD) of fork length at age from 1947 to 2008.

	2			3			4			5			6			7			8			9			10		
	n	*Mean*	*SD*	*n*	*Mean*	*SD*	*n*	*Mean*	*SD*	*n*	*Mean*	*SD*	*n*	*Mean*	*SD*	*n*	*Mean*	*SD*	*n*	*Mean*	*SD*	*n*	*Mean*	*SD*	*n*	*Mean*	*SD*
1947	0	na	na	0	na	na	1	616	na	11	585	35	26	623	43	26	675	41	41	722	48	79	761	45	41	772	56
1948	0	na	na	0	na	na	0	na	na	1	673	na	8	631	28	41	676	42	39	710	50	55	757	40	43	776	49
1955	0	na	na	0	na	na	3	540	8	7	561	27	11	619	21	17	641	51	24	703	67	14	712	57	7	771	69
1956	1	300	na	0	na	na	8	483	107	43	593	55	93	628	42	69	665	57	47	694	54	51	725	80	19	736	68
1976	0	na	na	0	na	na	6	502	30	14	549	23	19	603	51	48	676	39	38	741	36	16	784	40	3	804	25
1977	0	na	na	0	na	na	0	na	na	1	563	na	8	618	22	2	608	3	11	718	52	5	736	43	2	763	90
1978	0	na	na	0	na	na	0	na	na	15	599	36	65	624	30	76	656	33	19	711	48	9	760	61	4	599	27
1979	0	na	na	0	na	na	0	na	na	4	456	77	42	530	76	48	578	91	65	652	100	18	698	93	2	728	134
1980	0	na	na	0	na	na	3	421	23	13	434	33	35	494	55	74	541	41	62	567	51	48	610	36	9	648	27
1981	0	na	na	0	na	na	9	405	31	9	432	70	40	502	39	43	544	53	67	586	57	31	613	50	10	632	40
1982	0	na	na	7	416	28	2	555	21	26	583	47	9	625	44	11	683	63	16	761	49	16	790	57	9	827	72
1983	0	na	na	1	400	na	127	517	25	18	568	34	45	643	34	7	729	44	8	744	56	2	771	12	3	738	88
1984	0	na	na	0	na	na	1	517	na	158	580	30	14	630	34	13	693	39	3	761	52	0	na	na	1	842	na
1985	0	na	na	0	na	na	3	511	15	8	612	48	188	642	27	8	677	31	4	706	58	1	733	na	3	618	19
1986	0	na	na	0	na	na	9	516	30	7	567	16	30	675	28	157	680	37	1	750	na	2	784	30	1	706	na
1987	0	na	na	1	426	na	2	519	26	58	563	29	26	625	45	18	702	46	78	755	37	2	778	6	1	783	na
1988	0	na	na	0	na	na	0	na	na	22	583	31	111	627	29	19	659	45	18	731	61	27	785	27	0	na	na
1989	0	na	na	0	na	na	1	483	na	8	578	21	88	630	23	74	670	34	12	745	36	15	801	36	5	750	86
1990	0	na	na	0	na	na	1	546	na	15	597	35	11	641	39	57	685	39	45	744	39	3	795	26	3	862	98
1991	0	na	na	0	na	na	7	495	36	32	556	37	40	616	42	9	661	66	29	742	40	3	749	33	1	882	na
1992	0	na	na	0	na	na	13	497	22	42	554	39	56	617	51	34	678	39	8	733	63	10	780	39	2	785	19
1993	0	na	na	0	na	na	0	na	na	17	569	26	31	628	34	33	671	36	15	750	51	4	837	44	5	842	54
1994	0	na	na	0	na	na	2	497	7	8	566	28	68	634	26	33	683	44	22	723	50	6	768	23	1	753	na
1997	0	na	na	0	na	na	8	523	17	30	577	31	37	641	33	68	700	32	25	765	40	8	810	75	0	na	na
1999	0	na	na	0	na	na	7	544	52	28	608	38	21	675	39	14	697	60	10	754	43	4	764	52	3	792	50
2003	0	na	na	0	na	na	4	475	41	5	595	20	82	656	38	143	726	37	127	770	57	34	815	50	7	877	58
2006	0	na	na	0	na	na	0	na	na	5	576	33	41	620	37	36	674	50	23	746	60	13	827	68	4	879	64
2007	0	na	na	1	422	na	28	578	28	86	627	28	39	705	40	11	779	48	15	813	38	3	891	8	0	na	na
2008	0	na	na	0	na	na	0	na	na	20	611	33	63	612	42	62	641	45	46	656	56	20	684	52	7	755	63

Table 17. continued.

	11			12			13			14			15			16			17			18			24		
	n	*Mean*	*SD*	*n*	*Mean*	*SD*	*n*	*Mean*	*SD*	*n*	*Mean*	*SD*	*n*	*Mean*	*SD*	*n*	*Mean*	*SD*	*n*	*Mean*	*SD*	*n*	*Mean*	*SD*	*n*	*Mean*	*SD*
1947	21	804	52	11	838	42	3	855	29	1	1105	na	1	921	na	3	978	117	2	1105	54	0	na	na	2	1204	40
1948	16	808	70	4	843	23	1	845	na	0	na	na	0	na	na	0	na	na	0	na	na	0	na	na	0	na	na
1955	1	708	na	1	620	na	2	961	327	0	na	na	2	1008	137	0	na	na	0	na	na	1	1105	na	0	na	na
1956	13	813	108	6	954	55	3	890	39	1	876	na	0	na	na	0	na	na	0	na	na	0	na	na	0	na	na
1976	0	na	na	0	na	na	0	na	na	0	na	na	0	na	na	0	na	na	0	na	na	0	na	na	0	na	na
1977	0	na	na	0	na	na	0	na	na	0	na	na	0	na	na	0	na	na	0	na	na	0	na	na	0	na	na
1978	0	na	na	0	na	na	0	na	na	0	na	na	0	na	na	0	na	na	0	na	na	0	na	na	0	na	na
1979	1	820	na	0	na	na	0	na	na	0	na	na	0	na	na	0	na	na	0	na	na	0	na	na	0	na	na
1980	1	670	na	0	na	na	0	na	na	0	na	na	0	na	na	0	na	na	0	na	na	0	na	na	0	na	na
1981	1	630	na	1	626	na	0	na	na	0	na	na	0	na	na	0	na	na	0	na	na	0	na	na	0	na	na
1982	1	810	na	1	800	na	0	na	na	0	na	na	0	na	na	0	na	na	0	na	na	0	na	na	0	na	na
1983	0	na	na	0	na	na	0	na	na	0	na	na	0	na	na	0	na	na	0	na	na	0	na	na	0	na	na
1984	0	na	na	0	na	na	0	na	na	0	na	na	0	na	na	0	na	na	0	na	na	0	na	na	0	na	na
1985	0	na	na	0	na	na	0	na	na	0	na	na	0	na	na	0	na	na	0	na	na	0	na	na	0	na	na
1986	0	na	na	0	na	na	0	na	na	0	na	na	0	na	na	0	na	na	0	na	na	0	na	na	0	na	na
1987	0	na	na	0	na	na	0	na	na	0	na	na	0	na	na	0	na	na	0	na	na	0	na	na	0	na	na
1988	1	847	na	0	na	na	0	na	na	0	na	na	0	na	na	0	na	na	0	na	na	0	na	na	0	na	na
1989	0	na	na	0	na	na	0	na	na	0	na	na	0	na	na	0	na	na	0	na	na	0	na	na	0	na	na
1990	1	853	na	0	na	na	0	na	na	0	na	na	0	na	na	0	na	na	0	na	na	0	na	na	0	na	na
1991	1	910	na	0	na	na	0	na	na	0	na	na	0	na	na	0	na	na	0	na	na	0	na	na	0	na	na
1992	1	888	na	2	824	55	0	na	na	0	na	na	0	na	na	0	na	na	0	na	na	0	na	na	0	na	na
1993	0	na	na	0	na	na	0	na	na	0	na	na	0	na	na	0	na	na	0	na	na	0	na	na	0	na	na
1994	0	na	na	0	na	na	0	na	na	0	na	na	0	na	na	0	na	na	0	na	na	0	na	na	0	na	na
1997	0	na	na	0	na	na	0	na	na	0	na	na	0	na	na	0	na	na	0	na	na	0	na	na	0	na	na
1999	1	775	na	0	na	na	0	na	na	1	857	na	0	na	na	0	na	na	0	na	na	0	na	na	0	na	na
2003	0	na	na	3	884	104	0	na	na	0	na	na	0	na	na	0	na	na	0	na	na	0	na	na	0	na	na
2006	3	922	78	1	800	na	0	na	na	0	na	na	0	na	na	0	na	na	0	na	na	0	na	na	0	na	na
2007	0	na	na	0	na	na	0	na	na	0	na	na	0	na	na	0	na	na	0	na	na	0	na	na	0	na	na
2008	4	700	69	2	906	100	0	na	na	0	na	na	0	na	na	0	na	na	0	na	na	0	na	na	0	na	na

Table 18. Results from ANOVA tests for difference in mean fork length at ages five through 10 for Inconnu caught at the mouth of the Buffalo River from 1947 to 2008.

Age	n	df	F	p
5	711	26	27.5	<0.000
6	1347	28	54.3	<0.000
7	1251	28	55.9	<0.000
8	918	27	45.7	<0.000
9	499	26	29.6	<0.000
10	196	20	11.12	<0.000

Table 19a. Results of Bonferroni pairwise tests for differences in mean fork length at age five (top right, df=26, α=0.0018) and six (bottom left, df=28, α=0.0017) for Inconnu caught at the mouth of the Buffalo River from 1947 to 2008. Comparisons that are significantly different are shaded in black.

X	1947	1948	1955	1956	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1997	1999	2003	2006	2007	2008
1947	x	x	1.0000	1.0000	1.0000	x	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0732	1.0000
1948	1.0000	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
1955	1.0000	1.0000	x	1.0000	1.0000	x	1.0000	0.0008	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.5015	1.0000	1.0000	0.0007	0.4288
1956	1.0000	1.0000	1.0000	x	0.0155	x	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0068	1.0000	1.0000	1.0000	0.0017	0.0001	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0001	1.0000
1976	1.0000	1.0000	1.0000	1.0000	x	x	0.0520	0.0013	0.0000	0.0000	1.0000	1.0000	0.5650	0.0219	1.0000	1.0000	1.0000	1.0000	0.0761	1.0000	1.0000	1.0000	1.0000	1.0000	0.0001	1.0000	1.0000	0.0000	0.0002
1977	1.0000	1.0000	1.0000	1.0000	1.0000	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
1978	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	x	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.1634	1.0000	1.0000	1.0000	0.0333	0.0100	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
1979	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	x	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0002	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001	0.0000	0.0000	0.0000	0.0001	0.0000	0.0000
1980	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0121	x	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1981	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.3193	1.0000	x	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1982	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	x	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.3346	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	1.0000
1983	1.0000	1.0000	1.0000	1.0000	0.0468	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	x	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0656	1.0000	1.0000	0.0000	0.0762
1984	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	x	1.0000	1.0000	0.5950	1.0000	1.0000	1.0000	0.1299	0.0098	1.0000	1.0000	1.0000	0.0341	1.0000	1.0000	0.0000	0.0833
1985	1.0000	1.0000	1.0000	1.0000	0.0092	1.0000	0.3190	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	x	1.0000	0.0896	1.0000	1.0000	1.0000	0.0210	0.0090	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
1986	0.0001	1.0000	0.0091	0.0000	0.0000	0.0629	0.0000	0.0000	0.0000	0.0000	0.1944	0.1414	0.0848	0.0034	x	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0052	1.0000
1987	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	0.0003	x	1.0000	1.0000	0.2573	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	1.0000	1.0000	0.0000	0.0001
1988	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.2918	0.0000	1.0000	x	1.0000	1.0000	1.0000	0.6599	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0001	1.0000
1989	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	0.0000	1.0000	1.0000	x	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0623	1.0000
1990	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	x	0.0530	0.0167	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.9493	1.0000
1991	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	0.3285	1.0000	0.0282	0.0000	1.0000	1.0000	1.0000	1.0000	x	1.0000	1.0000	1.0000	1.0000	0.0000	1.0000	1.0000	0.0000	0.0000
1992	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	0.2269	1.0000	0.0068	0.0000	1.0000	1.0000	1.0000	1.0000	1.0000	x	1.0000	1.0000	1.0000	0.0000	1.0000	1.0000	0.0000	0.0000
1993	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	0.0006	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	x	1.0000	1.0000	0.1005	1.0000	1.0000	0.0000	0.1110
1994	1.0000	1.0000	1.0000	1.0000	0.7163	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	0.0003	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	x	1.0000	1.0000	1.0000	1.0000	0.0012	0.8889
1997	1.0000	1.0000	1.0000	1.0000	0.1548	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	0.1084	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	x	0.3123	1.0000	1.0000	0.0000	0.3677
1999	0.0011	1.0000	0.0284	0.0002	0.0000	0.1350	0.0000	0.0000	0.0000	0.0000	0.3997	0.6970	0.2390	0.0722	1.0000	0.0027	0.0000	0.0006	1.0000	0.0000	0.0000	0.0065	0.0072	0.5107	x	1.0000	1.0000	1.0000	1.0000
2003	0.0320	1.0000	0.7982	0.0005	0.0000	1.0000	0.0001	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0844	0.0000	0.0033	1.0000	0.0000	0.0000	0.2042	0.1466	1.0000	1.0000	x	1.0000	1.0000	1.0000
2006	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.2524	0.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0002	x	0.6434	1.0000
2007	0.0000	0.0002	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.3864	0.0000	0.0000	0.0000	0.0003	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	x	1.0000
2008	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	0.0074	1.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.2807	0.0617	0.0000	0.0000	1.0000	0.0000	x

Table 19b. Results of Bonferroni pairwise tests for differences in mean fork length at age seven (top right, df=28, α=0.0017) and eight (bottom left df=27, α=0.0018) for Inconnu caught at the mouth of the Buffalo River from 1947 to 2008. Comparisons that are significantly different are shaded in black.

X	1947	1948	1955	1956	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1997	1999	2003	2006	2007	2008
1947	x	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	1.0000	0.0000	0.4575
1948	1.0000	x	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	1.0000	0.0000	0.0451
1955	1.0000	1.0000	x	1.0000	1.0000	1.0000	1.0000	0.0002	0.0000	0.0000	1.0000	0.0045	0.7097	1.0000	0.2671	0.0264	1.0000	1.0000	0.1785	1.0000	1.0000	1.0000	0.7505	0.0006	0.2007	0.0000	1.0000	0.0000	1.0000
1956	1.0000	1.0000	1.0000	x	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	0.1203	1.0000	1.0000	1.0000	0.8945	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0031	1.0000	0.0000	1.0000	0.0000	0.6769
1976	1.0000	1.0000	1.0000	0.0405	x	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	1.0000	0.0000	0.0137
1977	1.0000	1.0000	1.0000	1.0000	1.0000	x	1.0000	1.0000	1.0000	1.0000	1.0000	0.2795	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0868	1.0000	0.0003	1.0000
1978	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	x	0.0000	0.0000	0.0000	1.0000	0.0143	1.0000	1.0000	0.0649	0.0479	1.0000	1.0000	0.1332	1.0000	1.0000	1.0000	1.0000	0.0000	0.6653	0.0000	1.0000	0.0000	1.0000
1979	0.0000	0.0001	0.0443	0.0276	0.0000	0.1074	0.0200	x	0.0044	0.1424	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1980	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	x	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1981	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	x	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1982	1.0000	0.7262	0.4520	0.0120	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	x	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.9237	1.0000	0.0002	1.0000
1983	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0041	0.0000	0.0000	1.0000	x	1.0000	1.0000	1.0000	1.0000	0.1440	0.2914	1.0000	0.9008	1.0000	0.6716	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0003
1984	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.3317	0.0000	0.0000	1.0000	1.0000	x	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0010	0.0581
1985	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0006	0.0111	1.0000	1.0000	1.0000	x	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0004	1.0000
1986	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	1.0000	0.0000	0.0000
1987	0.6239	0.0138	0.0235	0.0000	1.0000	1.0000	0.6553	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	x	x	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0025	0.0002
1988	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	x	1.0000	x	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.1850	1.0000	0.0000	1.0000	0.0000	1.0000
1989	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	x	1.0000	1.0000	x	1.0000	1.0000	1.0000	1.0000	1.0000	0.0289	1.0000	0.0000	1.0000	0.0000	0.0683
1990	1.0000	1.0000	1.0000	0.0086	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	x	1.0000	1.0000	1.0000	x	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	1.0000	0.0000	0.0000
1991	1.0000	1.0000	1.0000	0.1178	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	x	1.0000	1.0000	1.0000	1.0000	x	1.0000	1.0000	1.0000	1.0000	1.0000	0.0093	1.0000	0.0000	1.0000
1992	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0391	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	x	1.0000	1.0000	1.0000	1.0000	1.0000	x	1.0000	1.0000	1.0000	1.0000	0.0000	1.0000	0.0000	0.0398
1993	1.0000	1.0000	1.0000	0.2632	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	x	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	x	1.0000	1.0000	1.0000	0.0000	1.0000	0.0000	0.6793
1994	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0001	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	x	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	x	1.0000	1.0000	0.0003	1.0000	0.0000	0.0057
1997	0.8703	0.0523	0.0441	0.0001	1.0000	1.0000	0.5580	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	x	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	x	1.0000	0.0289	1.0000	0.0000	0.0000
1999	1.0000	1.0000	1.0000	0.7516	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	x	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	x	1.0000	1.0000	0.0024	0.0079
2003	0.0005	0.0000	0.0000	0.0000	1.0000	1.0000	0.0057	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	x	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.1038	1.0000	1.0000	x	0.0000	0.0563	0.0000
2006	1.0000	1.0000	1.0000	0.1068	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	x	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	x	0.0000	0.1596
2007	0.0000	0.0000	0.0000	0.0000	0.0098	0.0067	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.2376	x	0.0926	0.0099	0.6477	0.0114	0.0223	0.3939	0.7723	0.0006	1.0000	1.0000	1.0000	0.1054	x	0.0000
2008	0.0000	0.0035	0.3125	0.3850	0.0000	0.3759	0.1297	1.0000	0.0000	0.0000	0.0000	0.0157	0.5854	1.0000	x	0.0000	0.0006	0.0003	0.0000	0.0000	0.1233	0.0000	0.0014	0.0000	0.0002	0.0000	0.0000	0.0000	x

Table 19c. Results of Bonferroni pairwise tests for differences in mean fork length at age nine (top right, df=27, α=0.0018) and 10 (bottom left, df=23, α=0.0021) for Inconnu caught at the mouth of the Buffalo River from 1947 to 2008. Comparisons that are significantly different are shaded in black.

X	1947	1948	1955	1956	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1997	1999	2003	2006	2007	2008
1947	x	1.0000	0.5212	0.0711	1.0000	1.0000	1.0000	0.0019	0.0000	0.0000	1.0000	1.0000	x	x	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0003	0.0097	0.0111	0.0000
1948	1.0000	x	1.0000	0.7868	1.0000	1.0000	1.0000	0.0141	0.0000	0.0000	1.0000	1.0000	x	x	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0002	0.0058	0.0074	0.0001
1955	1.0000	1.0000	x	1.0000	0.0721	1.0000	1.0000	1.0000	0.0000	0.0000	0.0204	1.0000	x	x	1.0000	1.0000	0.0110	0.0025	1.0000	1.0000	0.6495	0.0114	1.0000	0.0108	1.0000	0.0000	0.0000	0.0001	1.0000
1956	1.0000	1.0000	1.0000	x	0.0400	1.0000	1.0000	1.0000	0.0000	0.0000	0.0075	1.0000	x	x	1.0000	1.0000	0.0010	0.0005	1.0000	1.0000	0.9554	0.0177	1.0000	0.0096	1.0000	0.0000	0.0000	0.0001	1.0000
1976	1.0000	1.0000	1.0000	1.0000	x	1.0000	1.0000	0.0008	0.0000	0.0000	1.0000	1.0000	x	x	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.4715	0.0000
1977	1.0000	1.0000	1.0000	1.0000	1.0000	x	1.0000	1.0000	0.0002	0.0006	1.0000	1.0000	x	x	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.6463	0.3478	0.0221	1.0000
1978	0.0000	0.0000	0.0008	0.0054	0.0014	0.2672	x	1.0000	0.0000	0.0000	1.0000	1.0000	x	x	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0781	0.1283
1979	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	x	0.0000	0.0000	0.0002	1.0000	x	x	1.0000	1.0000	0.0000	0.0000	1.0000	1.0000	0.0277	0.0008	1.0000	0.0002	1.0000	0.0000	0.0000	0.0000	1.0000
1980	0.0000	0.0000	0.0075	0.0468	0.0166	1.0000	1.0000	1.0000	x	1.0000	0.0000	0.0103	x	x	0.0021	0.0046	0.0000	0.0000	0.0000	0.0039	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001
1981	0.0000	0.0000	0.0005	0.0016	0.0024	0.8354	1.0000	1.0000	1.0000	x	0.0000	0.0169	x	x	0.0037	0.0078	0.0000	0.0000	0.0000	0.0078	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0010
1982	1.0000	1.0000	1.0000	0.0284	1.0000	1.0000	0.0000	1.0000	0.0000	0.0000	x	1.0000	x	x	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.8691	0.0000
1983	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.3821	1.0000	1.0000	1.0000	1.0000	x	x	x	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
1984	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
1985	0.0033	0.0019	0.0354	0.2586	0.0254	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	1.0000	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
1986	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
1987	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
1988	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.3528	0.0000
1989	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0282	1.0000	0.3782	0.0539	1.0000	1.0000	x	0.4354	x	x	x	x	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000
1990	1.0000	1.0000	1.0000	0.1247	1.0000	1.0000	0.0000	1.0000	0.0000	0.0000	1.0000	1.0000	x	0.0001	x	x	x	1.0000	x	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.2515
1991	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.3759	1.0000
1992	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0575	1.0000	0.6006	0.1697	1.0000	1.0000	x	0.3972	x	x	x	1.0000	1.0000	x	x	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.5255	0.0012
1993	1.0000	1.0000	1.0000	0.0734	1.0000	1.0000	0.0000	1.0000	0.0000	0.0000	1.0000	1.0000	x	0.0001	x	x	x	1.0000	1.0000	x	1.0000	x	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0001
1994	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	1.0000	1.0000	1.0000	1.0000	0.3553	0.2569
1997	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	1.0000	1.0000	1.0000	1.0000	0.0000
1999	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0043	1.0000	0.0521	0.0086	1.0000	1.0000	x	0.0639	x	x	x	1.0000	1.0000	x	1.0000	1.0000	x	x	x	1.0000	1.0000	0.5773	1.0000
2003	0.0033	0.0067	0.1686	0.0000	1.0000	1.0000	0.0000	0.3189	0.0000	0.0000	1.0000	0.1368	x	0.0000	x	x	x	0.0511	1.0000	x	1.0000	1.0000	x	x	1.0000	x	1.0000	1.0000	0.0000
2006	0.1102	0.1793	0.7318	0.0027	1.0000	1.0000	0.0000	0.6087	0.0000	0.0000	1.0000	0.3660	x	0.0000	x	x	x	0.2304	1.0000	x	1.0000	1.0000	x	x	1.0000	1.0000	x	1.0000	0.0000
2007	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	0.0000
2008	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0054	1.0000	0.0630	0.0052	1.0000	1.0000	x	0.1523	x	x	x	1.0000	1.0000	x	1.0000	1.0000	x	x	1.0000	0.0254	0.1713	x	x

APPENDICES

Appendix 1. Description of gonads used during visual inspection to determine gender and sexual maturity stage for Inconnu caught at the mouth of the Buffalo River.

Maturity Code	Maturity Stage	SEX	Description
0	unknown (virgin)	unknown	cannot be sexed, gonads long or short and thin, transparent or translucent
1	immature	Female	ovaries granular in texture, hard and triangular in shape, up to full length of body cavity, membrane firm
2	mature	Female	current year spawner, ovary fills body cavity, eggs near full size but not loose, not expelled by pressure
3	ripe	Female	ovaries greatly extended and fill body cavity, eggs full size and transparent, expelled by slight pressure
4	spent	Female	spawning complete, ovaries ruptured and flaccid, seed eggs visible, some retained eggs in body cavity
5	resting	Female	ovarity 40-50% of body cavity, membrane thin, loose, and semi-transparent, healed from spawning
6	immature	Male	testes long and thin, tubular and scalloped shape, up to full body length, putty-like firmness
7	mature	Male	current year spawner, testes large and lobate, white to purplish in color, centers may be fluid, milt not expelled with pressure
8	ripe	Male	testes full size, white and lobate, milt expelled by slight pressure
9	spent	Male	spawning complete, testes flaccid with some milt, blood vessels obvious, testes violet-pink in color
10	resting	Male	testes tubular, less lobate, healed from spawning, no fluid in center, usually full length, mottled and purplish in color
11	unknown (non-virgin)	unknown	resting fish, has spawned but gonads regenerated, sexing not possible

Appendix 2. Variation Order 99/00-201 describing spatial and temporal areas closed to commercial fishing in Great Slave Lake in 1999-2000. 'Zones' correspond to map in Appendix 3.

FISHERIES ACT

Central and Arctic Region Variation Order No. 99/00-201

The Regional Director General of the Department of Fisheries and Oceans for the Central and Arctic Region pursuant to subsection 6(1) of the Fishery (General) Regulations, hereby makes the annexed Order varying the close time(s) and/or quota(s) for commercial fishing in certain waters of the Northwest Territories as set out in the Schedule to this Order.

Original signed

April 6, 1999

R. J. Pierce
Director General
Central and Arctic Region
Winnipeg Manitoba

Date

Short Title

1. This Order may be cited as the Central and Arctic Region Variation Order No. 99/00-201

ORDER VARYING THE CLOSE TIMES FOR COMMERCIAL FISHING IN CERTAIN WATERS OF THE NORTHWEST TERRITORIES

Variation

2. The close time for commercial fishing in certain waters as set out in Column IV of each item in Schedule V to the Northwest Territories Fishery Regulations is hereby varied to that set out in Column IV of that item in the Schedule attached to this Order.

Coming into Force

3. This Order shall come into force on April 6, 1999 and remain in force as set out in the Schedule attached to this Order, until March 31, 2000, at which time the close time and quota shall revert to that set out for that item in Schedule V to the Northwest Territories Fishery Regulations.

SCHEDULE
(Schedule V)

CLOSE TIMES

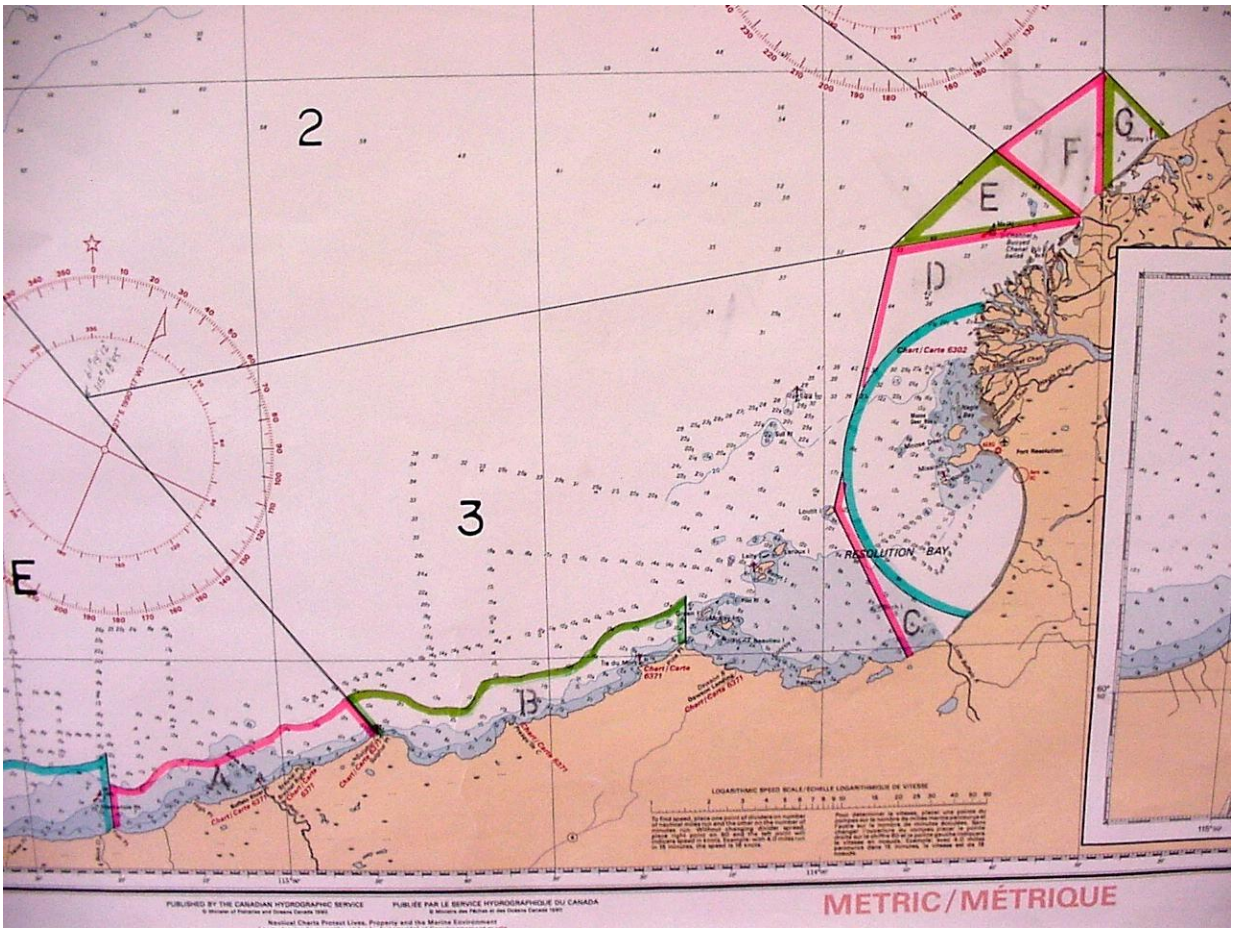
Item	Column I Waters	Column IV Close Times
Region II - Slave Mackenzie		
13	That portion of Area I (East) of Great Slave Lake within 4.8 km (2.6 nautical miles) of the shore beginning at 60°53' north latitude and 115°20'30" west longitude on a line drawn 360° true from Fish Point in 60°50'25" north latitude and 115°20'15" west longitude and a point intersecting the easterly boundary of Area I (East) in 60°57'45" north latitude.	April 6, 1999 to June 21, 1999 Zone 'A' in Appendix 3.
14	That portion of Area II of Great Slave Lake Area beginning at the north shore of the north branch of the Jean River at its confluence with Great Slave Lake, then westerly along the northern boundary of Area III to a point at 61°21'10" north latitude and 113°53'00" west longitude, then northeasterly to a point at 61°25'45" north latitude and 113°42'00" west longitude then south along a straight line to the north shore of the north branch of the Jean River at its confluence with Great Slave Lake.	April 6, 1999 to June 30, 1999 Zone 'E' in Appendix 3.
15	That portion of Area III of Great Slave Lake lying east of a line drawn from a point intersecting the boundary of the Fort Resolution Domestic Fishing Zone at 61°10'25" north latitude and 113°58'45" west longitude to a point intersecting the southerly boundary of Area II at 61°21'10" north latitude and 113°53'00" west longitude.	April 6, 1999 to June 30, 1999 Zone 'D' in Appendix 3.

SCHEDULE
(Schedule V)

CLOSE TIMES

Item	Column I Waters	Column IV Close Times
15	That portion of Area III of Great Slave Lake lying east of a line drawn from a point on the mainland at 60°59'20" north latitude and 113°50'45" west longitude to the most easterly tip of Birch Island, thence to the most easterly tip of Loutit Island, and thence in a northeasterly direction to a point intersecting the boundary of the Fort Resolution Domestic Fishing Zone at 61°10'25" north latitude and 113°58'45" west longitude.	April 6, 1999 to March 31, 2000 Zone 'C' in Appendix 3.
15	That portion of Area III of Great Slave Lake within 4.8 km (2.6 nautical miles) of the shore between a point intersecting the easterly boundary of Area I East at 60°57'45" north latitude and a line drawn 360° true from Pine Point at 61°00'45" north latitude and 114°15'30" west longitude.	April 6, 1999 to June 21, 1999 Zone 'B' in Appendix 3.
16	That portion of Area IV of Great Slave Lake lying south of a line drawn from the east boundary of Area II at 61°25'45" north latitude and 113°42'00" west longitude, to the west boundary of Area V at 61°30'00" north latitude and 113°30'00" west longitude.	April 6, 1999 to June 30, 1999 Zone 'F' in Appendix 3.
17	That portion of Area V of Great Slave Lake Area lying south and west of a line drawn from the west boundary of said area at 61°30'00" north latitude and 113°30'00" west longitude, to a point on the mainland 2 km (1.1 nautical miles) south and east of Stony Island at 62°26'40" north latitude and 113°21'48" west longitude.	April 6, 1999 to June 30, 1999 Zone 'G' in Appendix 3.

Appendix 3. Map of southern Great Slave Lake showing areas closed to commercial fishing in 1999-2000. Letters correspond to area closures as described in Appendix 2.



Appendix 4. Variation Order 01/02-204 describing spatial and temporal areas closed to commercial fishing in Great Slave Lake in 2001-2002. 'Zones' correspond to map in Appendix 5.

FISHERIES ACT

Central and Arctic Region Variation Order No. 01/02-204

The Regional Director General of the Department of Fisheries and Oceans for the Central and Arctic Region pursuant to subsection 6(1) of the Fishery (General) Regulations, hereby makes the annexed Order varying the close time(s) and/or quota(s) for commercial fishing in certain waters of the Northwest Territories as set out in the Schedule to this Order.

R. J. Pierce
Director General
Central and Arctic Region
Winnipeg Manitoba

28 May '01
Date

Short Title

1. This Order may be cited as the Central and Arctic Region Variation Order No. 01/02-204

ORDER VARYING THE CLOSE TIMES FOR COMMERCIAL FISHING IN CERTAIN WATERS OF THE NORTHWEST TERRITORIES

Variation

2. The close time for commercial fishing in certain waters as set out in Column IV of each item in Schedule V to the Northwest Territories Fishery Regulations is hereby varied to that set out in Column IV of that item in the Schedule attached to this Order.

Coming into Force

3. This Order shall come into force on May 28, 2001 and remain in force as set out in the Schedule attached to this Order, until March 31, 2002, at which time the close time and quota shall revert to that set out for that item in Schedule V to the Northwest Territories Fishery Regulations.

SCHEDULE
(Schedule V)

CLOSE TIMES

Item	Column I Waters	Column IV Close Times
Region II - Slave Mackenzie		
13	That portion of Area I (East) of Great Slave Lake within 4.8 km (2.6 nautical miles) of the shore beginning at 60°53' north latitude and 115°20'30" west longitude on a line drawn 360° true from Fish Point in 60°50'25" north latitude and 115°20'15" west longitude and a point intersecting the easterly boundary of Area I (East) in 60°57'45" north latitude.	May 28, 2001 to June 21, 2001 Zone 'A' in Appendix 5.
14	That portion of Area II of Great Slave Lake Area beginning at the north shore of the north branch of the Jean River at its confluence with Great Slave Lake, then westerly along the northern boundary of Area III to a point at 61°21'10" north latitude and 113°53'00" west longitude, then northeasterly to a point at 61°25'45" north latitude and 113°42'00" west longitude then south along a straight line to the north shore of the north branch of the Jean River at its confluence with Great Slave Lake.	May 28, 2001 to June 30, 2001 Zone 'E' in Appendix 5.
15	That portion of Area III of Great Slave Lake lying east of a line drawn from a point intersecting the boundary of the Fort Resolution Domestic Fishing Zone at 61°10'25" north latitude and 113°58'45" west longitude to a point intersecting the southerly boundary of Area II at 61°21'10" north latitude and 113°53'00" west longitude.	May 28, 2001 to June 30, 2001 Zone 'D' in Appendix 5.

SCHEDULE
(Schedule V)

CLOSE TIMES

Item	Column I Waters	Column IV Close Times
15	That portion of Area III of Great Slave Lake lying east of a line drawn from a point on the mainland at 60°59'20" north latitude and 113°50'45" west longitude to the most easterly tip of Birch Island, thence to the most easterly tip of Loutit Island, and thence in a northeasterly direction to a point intersecting the boundary of the Fort Resolution Domestic Fishing Zone at 61°10'25" north latitude and 113°58'45" west longitude.	May 28, 2001 to March 31, 2002 Zone 'C' in Appendix 5.
15	That portion of Area III of Great Slave Lake within 4.8 km (2.6 nautical miles) of the shore between a point intersecting the easterly boundary of Area I East at 60°57'45" north latitude and a line drawn 360° true from Pine Point at 61°00'45" north latitude and 114°15'30" west longitude.	May 28, 2001 to June 21, 2001 Zone 'B' in Appendix 5.
16	That portion of Area IV of Great Slave Lake lying south of a line drawn from the east boundary of Area II at 61°25'45" north latitude and 113°42'00" west longitude, to the west boundary of Area V at 61°30'00" north latitude and 113°30'00" west longitude.	May 28, 2001 to June 30, 2001 Zone 'F' in Appendix 5.
17	That portion of Area V of Great Slave Lake Area lying south and west of a line drawn from the west boundary of said area at 61°30'00" north latitude and 113°30'00" west longitude, to a point on the mainland 2 km (1.1 nautical miles) south and east of Stony Island at 62°26'40" north latitude and 113°21'48" west longitude.	May 28, 2001 to June 30, 2001 Zone 'G' in Appendix 5.
17	That portion of Area V of Great Slave Lake lying within three km (1.6 nautical miles) from the shore between lines drawn due North at points 61.8 ° 27'30"N and112.8° 53'00"W and 61.8° 30'30"N and 112.8 ° 34'00"W.	May 28, 2001 to March 31, 2002 Zone highlighted in the bottom map in Appendix 5.

Explanatory Note:

This Order maintains the Buffalo River, Slave River, Little Buffalo River closed areas and creates the Talston River closed area as recommended by the Great Slave Lake Advisory Committee.

Commercial fishing is not permitted in the closed areas of:
Buffalo River from May 28 to June 21, 2001,
Slave River from May 28, 2001 to June 30, 2001.
Little Buffalo River and Talston River from May 28, 2001 to March 31, 2002.

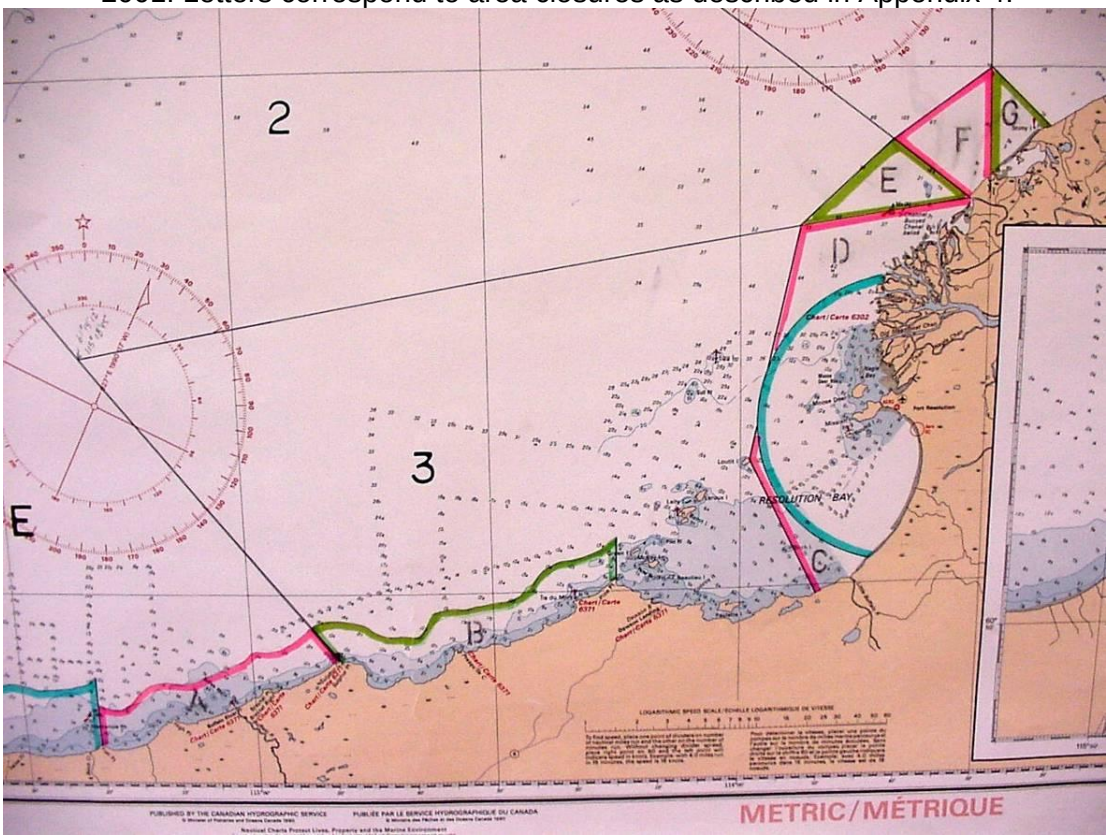
Consult the nearest office of the Department of Fisheries and Oceans for more information.

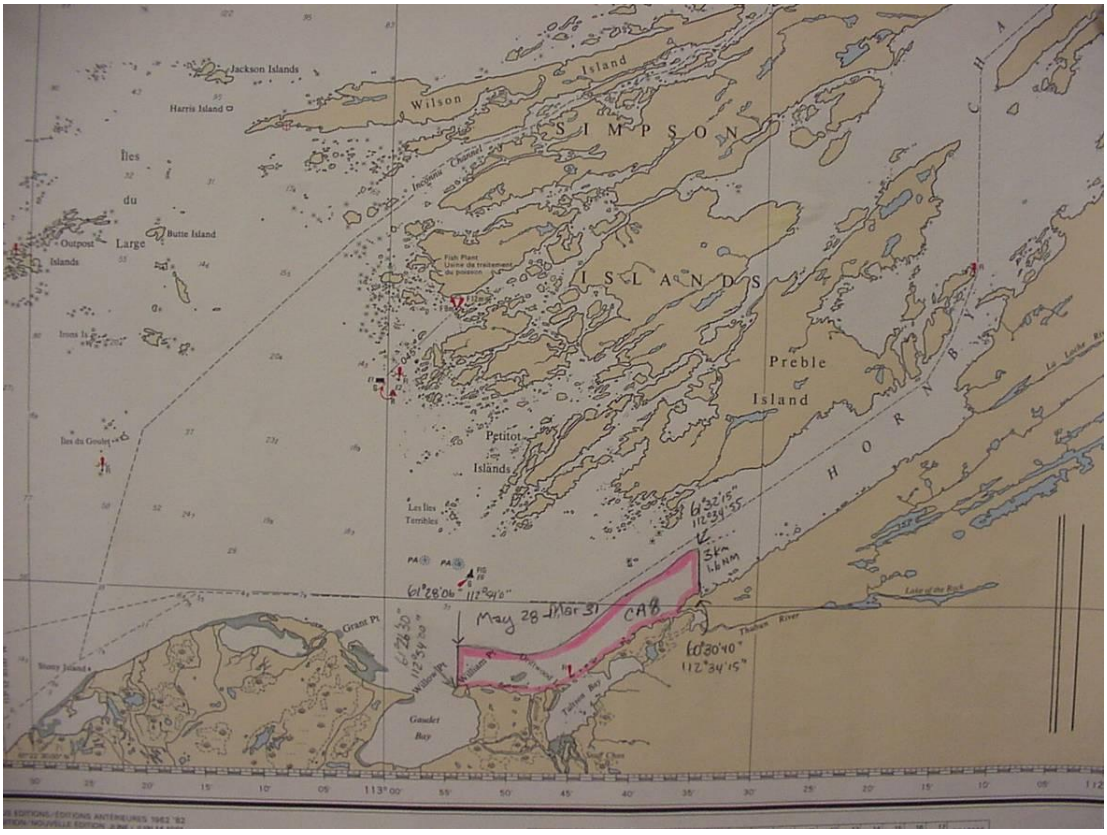
The Fort Resolution Domestic Fishing Zone remains in effect.

The Hay River Domestic Fishing Zone remains in effect.

The Buffalo River commercial closure remains in effect.

Appendix 5. Map of southern Great Slave Lake showing areas closed to commercial fishing in 2001. Letters correspond to area closures as described in Appendix 4.





Appendix 6. Variation Order 05/06-208 describing spatial and temporal areas closed to commercial fishing in Great Slave Lake in 2005-2006. 'Zones' correspond to map in Appendix 7.

Fisheries and Oceans Canada | Pêches et Océans Canada

FISHERIES ACT

Central and Arctic Region Variation Order No. **05/06-208**

The Regional Director General of the Department of Fisheries and Oceans for the Central and Arctic Region, pursuant to subsection 6(1) of the Fishery (General) Regulations, hereby makes the annexed Order varying the closed times for commercial fishing in certain waters of Great Slave Lake in the Northwest Territories as set out in the Schedule to this Order.

_____ _____

J. Cooley
A/Regional Director General
Central and Arctic Region

Date

Short Title

1. This Order may be cited as the Central and Arctic Region **Variation Order No. 05/06-208**

ORDER VARYING THE CLOSED TIMES FOR COMMERCIAL FISHING IN CERTAIN WATERS OF GREAT SLAVE LAKE IN THE NORTHWEST TERRITORIES

Variation

2. The closed times for commercial fishing in certain waters of Great Slave Lake as set out in column IV of each item in Schedule V to the Northwest Territories Fishery Regulations is hereby varied to that set out in Column IV of that item in the Schedule attached to this Order.

Coming into Force

3. This Order shall come into force on May 13, 2005 and remain in force as set out in the Schedule attached to this Order until March 31, 2006, at which time the close time shall revert to that set out for that item in Schedule V of the Northwest Territories Fishery Regulations.

Variation Order

SCHEDULE
(Schedule V)

CLOSED TIMES

Item	Column I Waters	Column IV Closed Times
13	That portion of Area 1(East) lying south of a line drawn 4.8 km from the mainland starting at a point 360° true from Fish Point to a point where it intersects with eastern boundary of Area 1 (East).	May 28 to June 21, 2005 Zone 'A' in Appendix 7.
14	That portion of Area II south and east of a straight line drawn from a point at 61°21′10″N, 113°52′50″ in the north boundary of Area III to a point at 61°26′00″N 113°41′30″W intersecting the north boundary of Area II.	May 28 to June 30, 2005 Zone 'E' in Appendix 7.
15	That portion of Area III lying east of a straight line drawn from a point intersecting the boundary of the Fort Resolution Domestic Fishing Zone at 61°13′21″ N, 113°56′35″W, northerly to a point intersecting The southern boundary of Area II at 61°21′10″N, 113°52′50″W.	May 28 to June 30, 2005 Zone 'D' in Appendix 7.
15	That portion of Area III lying east of a straight line drawn from a point on the mainland at 60°59′28″N, 113°50′42″W to a point at the eastern tip of Loutit Island at 61°07′37″N, 113°59′00″, then in a straight line to a point at 61°09′36N, 113°58′00″W intersecting the Fort Resolution Domestic Fishing Zone.	May 28, 2005 to March 31, 2006 Zone 'C' in Appendix 7.
15	That portion of Area III within 4.8 km of the mainland between a point intersecting the eastern boundary of Area I (East) and a straight line drawn 360° true from Pine Point at 61°00′44″N, 114°15′00″W.	May 28 to June 30, 2005 Zone 'B' in Appendix 7.
16	That portion of Area IV lying south of a straight line drawn from the east boundary of Area II at 61°26′00″N, 113°41′30″W to a point intersecting the western boundary of Area V at 61°30′00″N, 113°30′00″W.	May 28 to June 30, 2005 Zone 'F' in Appendix 7.

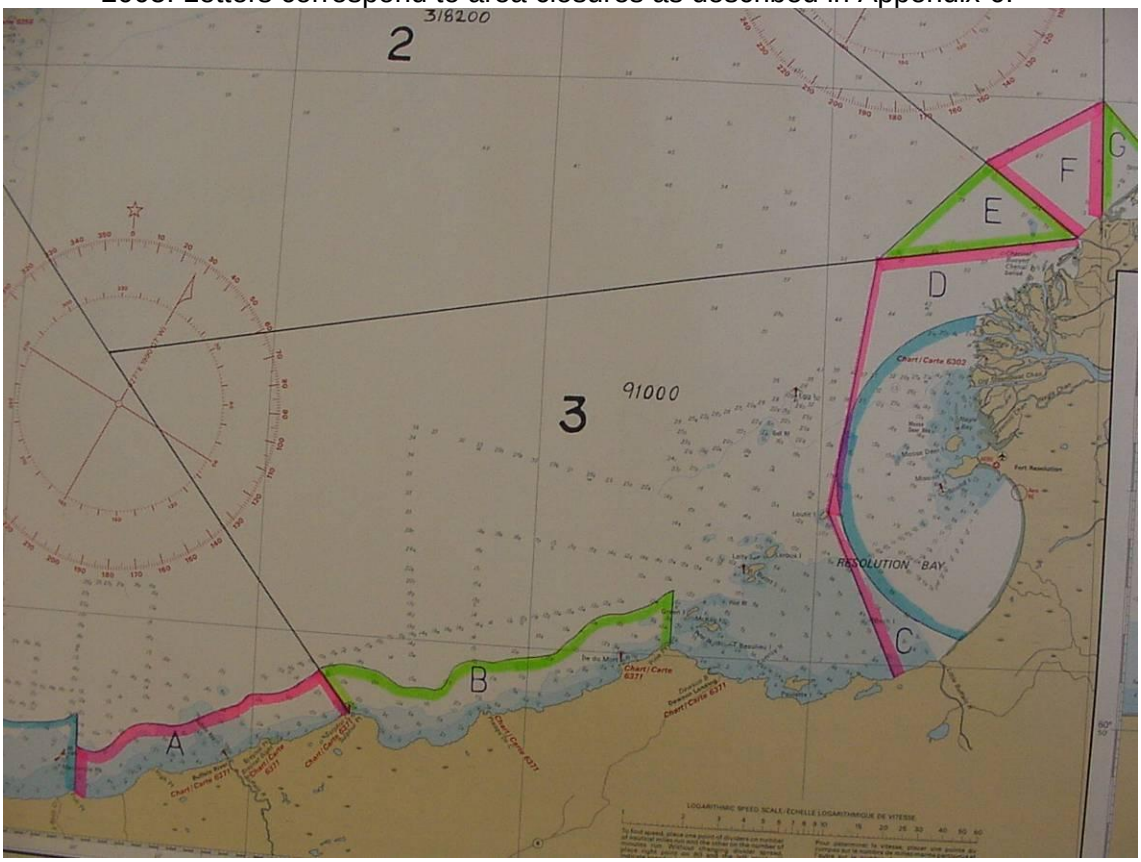
Variation Order

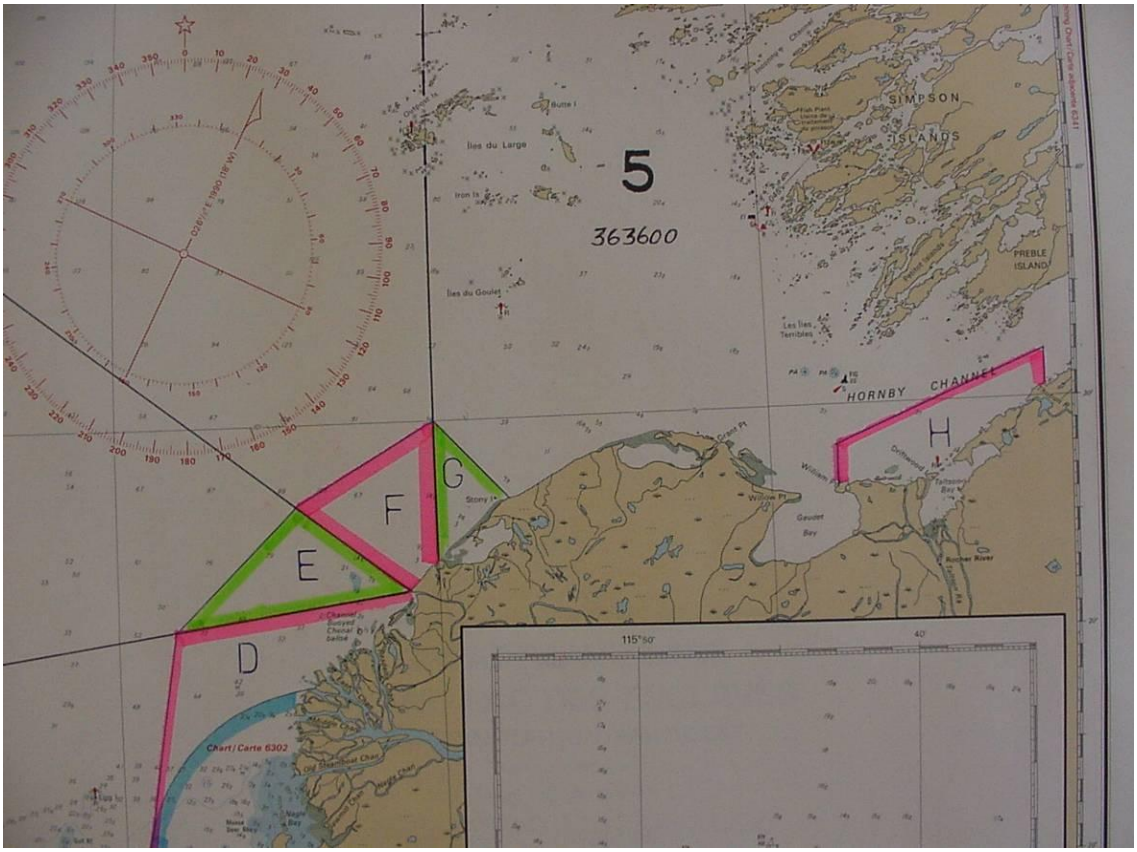
SCHEDULE
(Schedule V)

CLOSED TIMES

Item	Column I Waters	Column IV Closed Times
17	That portion of Area V lying south and west of a straight line drawn from a point at 61°30′00″N, 113°30′00″W in the eastern boundary of Area IV to a point at 61°26′41″N, 113°22′50″W on the mainland.	May 28 to June 30, 2005 Zone 'G' in Appendix 7.
17	That portion of Area V enclosed by the mainland and straight lines joining the following points in the order in which they are listed; 61°26′35N, 112°54′00″W; 61°28′12″N, 112°54′00″W; 61°32′09″N, 112°34′30″W; 61°30′40″N, 112°34′30″W.	May 28, 2005 to March 31, 2006 Zone 'H' in Appendix 7.

Appendix 7. Map of southern Great Slave Lake showing areas closed to commercial fishing in 2005. Letters correspond to area closures as described in Appendix 6.





Appendix 8. Variation Order 08/09-212 describing spatial and temporal areas closed to commercial fishing in Great Slave Lake in 2008-09. 'Zones' correspond to map in Appendix 9.

Fisheries and Oceans Canada / Pêches et Océans Canada

FISHERIES ACT

Central and Arctic Region Variation Order No. 08/09-212

The Regional Director General of the Department of Fisheries and Oceans for the Central and Arctic Region **hereby revokes Variation Order 2007/2008-211** and, pursuant to subsection 6(1) of the Fishery (General) Regulations, hereby makes the annexed Order varying the closed times for commercial fishing in certain waters of Great Slave Lake in the Northwest Territories as set out in the Schedule to this Order.

R. Lambe
Director General
Central and Arctic Region
Fisheries and Oceans Canada

Date

Short Title

1. This Order may be cited as the Central and Arctic Region **Variation Order No. 08/09-212**

ORDER VARYING THE CLOSED TIMES FOR COMMERCIAL FISHING IN CERTAIN WATERS OF GREAT SLAVE LAKE IN THE NORTHWEST TERRITORIES

Variation

2. The closed times for commercial fishing in certain waters of Great Slave Lake as set out in column IV of each item in Schedule V to the Northwest Territories Fishery Regulations is hereby varied to that set out in Column IV of that item in the Schedule attached to this Order.

Coming into Force

3. This Order shall come into force on June 18, 2008 and remain in force as set out in the Schedule attached to this Order until March 31, 2009, at which time the close time shall revert to that set out for that item in Schedule V of the Northwest Territories Fishery Regulations.

Variation Order

SCHEDULE
(Schedule V)

CLOSED TIMES

Item	Column I Waters	Column IV Closed Times
13	That portion of Area 1(East) lying south of the 61st parallel (excluding the Hay River Domestic Zone) and west of a straight line drawn from Fish Point 360° true, at longitude 115°20'30" to a point where it intersects the 61st parallel.	June 18, 2008 to March 31, 2009 Zone 'H' in Appendix 9.
13	That portion of Area 1 (East) lying south of the 61st parallel and east of a straight line drawn from Fish Point 360° true, at longitude 115°20'30" to a point where it intersects the 61st parallel.	June 18 to July 31, 2008 Zone 'A' in Appendix 9.
14	That portion of Area II south and east of a straight line drawn from a point at 61°21'10"N, 113°52'50" in the north boundary of Area III to a point at 61°26'00"N 113°41'30"W intersecting the north boundary of Area II.	June 18 to June 30, 2008 Zone 'B' in Appendix 9.
15	That portion of Area III lying east of a straight line drawn from a point intersecting the boundary of the Fort Resolution Domestic Fishing Zone at 61°13'21" N, 113°56'35"W, northerly to a point intersecting The southern boundary of Area II at 61°21'10"N, 113°52'50"W.	June 18 to June 30, 2008 Zone 'F' in Appendix 9.
15	That portion of Area III lying east of a straight line drawn from a point on the mainland at 60°59'28"N, 113°50'42"W to a point at the eastern tip of Loutit Island at 61°07'37"N, 113°59'00", then in a straight line to a point at 61°09'36N, 113°58'00"W intersecting the Fort Resolution Domestic Fishing Zone.	June 18, 2008 to March 31, 2009 Zone 'E' in Appendix 9.
15	That portion of Area III contained by straight lines drawn from the east boundary of Area 1 (East) at 61°03'00"N, 115°00'45"W to 61°03'00"N, 114°30'00"W then to 61°07'00"N, 114°30'00"W; then to 61°07'00"N, 114°15'00"W then to the shore at Pine Point at 61°00'44"N, 114°15'00"W.	June 18 to July 31, 2009 Zone 'D' in Appendix 9.

Variation Order

SCHEDULE
(Schedule V)

CLOSED TIMES

Item	Column I Waters	Column IV Closed Times
16	That portion of Area IV lying south of a straight line drawn from the east boundary of Area II at 61°26′00″N, 113°41′30″W to a point intersecting the western boundary of Area V at 61°30′00″N, 113°30′00″W.	June 18 to June 30, 2008 Zone 'G' in Appendix 9.
17	That portion of Area V lying south and west of a straight line drawn from a point at 61°30′00″N, 113°30′00″W in the eastern boundary of Area IV to a point at 61°26′41″N, 113°22′50″W on the mainland.	June 18 to June 30, 2008 Zone 'H' in Appendix 9.
17	That portion of Area V enclosed by the mainland and straight lines joining the following points in the order in which they are listed; 61°26′35N, 112°54′00″W; 61°28′12″N, 112°54′00″W; 60°32′09″N, 112°34′30″W; 61°30′40″N, 112°34′30″W.	June 18, 2008 to March 31, 2009 Zone 'I' in Appendix 9.

Appendix 9. Map of southern Great Slave Lake showing areas closed to commercial fishing in 2008. Letters correspond to area closures as described in Appendix 8.