

Alatna River Inconnu Population Structure

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BRIAN MCKENNA

*Tanana Chiefs Conference, Wildlife & Parks Department, 201 First Avenue, Fairbanks, Alaska
99701.*

RANDY BROWN

*U.S. Fish & Wildlife Service, Fairbanks Fish and Wildlife Field Office, 101 12th Avenue, Room
110, Fairbanks, Alaska 99701.*

AARON DUPUIS

*Alaska Department of Fish and Game, Soldotna Area Office, 43961 Kalifornsky Beach Road,
Suite B, Soldotna, Alaska 99669.*

JEFFERY OLSEN

*U.S. Fish & Wildlife Service, Conservation Genetics Laboratory, 1011 East Tudor Road,
Anchorage, Alaska 99503.*

Abstract

The Tanana Chiefs Conference Fisheries program conducted a population structure study on Inconnu spawning in the Alatna River. Assistance was provided by the Tribes of Alatna and Allakaket, and by the U.S. Fish and Wildlife Service's Fairbanks Field Office. The goals of this study were to 1) collect 200 tissue samples from Inconnu spawning in the Alatna River for population specific genetics baseline development, and 2) describe the demographic composition (age, sex, length, and gonadosomatic index) of the Alatna River Inconnu population. Samples (N=200) were collected from the spawning grounds in the Alatna River between September 2012 and September 2014. Age, sex, lengths, and weights were recorded and analyzed. The female proportion of the Alatna River Inconnu population was 28% (N=56). The overall age structure ranged from 5 to 25 years, with males averaging 8.8 years, and females averaging 10.4 years of age. Lengths and weights also varied between sex, and female Inconnu were longer and heavier on average than male Inconnu. The overall length and weight structures ranged from 50.5 to 92.3 cm and 2050 to 8700 g, respectively. Male Inconnu had an average length of 66.3 cm and an average weight of 3398 g. Female Inconnu had an average length of 74.5 cm, and an average weight of 5357 g. The gonadosomatic index for female Inconnu averaged 20.8%. Genetic tissue samples were collected from all 200 Inconnu, and were stored with the U.S. Fish and Wildlife Service – Conservation Genetics Laboratory for later analyses.

Introduction

Inconnu *Stenodus leucichthys*, a large, long-lived, piscivorous whitefish, are known to spawn in the Yukon, Koyukuk, Innoko, Sulukna, and Tanana River drainages, and engage in sometimes long migrations from summer feeding areas to these spawning locations (Brown and Burr 2012). Due to their wide geographic distribution, Inconnu are routinely targeted by subsistence, personal use, and sport fisheries throughout the Yukon River drainage.

Within the Koyukuk River drainage, Inconnu are an important source of non-salmon fish protein which local communities rely upon to meet their subsistence needs (Andersen et al. 2004). Local residents rely heavily on whitefish which are taken in currently unmonitored fisheries (Andersen et al. 2004; Brown et al. 2012). Whitefishes have historically been an important source of food for residents in the Koyukuk River Drainage, and Inconnu represent an important component of this subsistence harvest (Andersen et al. 2004). There are no estimates for harvests of Inconnu on the Alatna River, but estimates from subsistence surveys suggest that Inconnu constitute 19% of the total non-salmon subsistence harvest in the Koyukuk River drainage. Subsistence users from Allakaket and Alatna routinely harvest Inconnu from the Alatna River by beach seining in the fall (Andersen et al. 2004). Approximately 73% of the households in Allakaket utilize Inconnu to meet subsistence needs. These fisheries are currently unmonitored.

Background

The Alatna River is the only documented spawning tributary for Inconnu in the Koyukuk River drainage and is thought to be the second largest spawning stock for Inconnu in the Yukon River system (Brown and Burr 2012). Despite the obvious importance of the Alatna River spawning population, there is currently no biological information available describing the age, sex, and length structure, and there have been no genetic collections for baseline development. Development of genetic baselines from known spawning stocks and the collection of stock and sex specific age and length data were cited as high priorities for Inconnu throughout Alaska (Brown et al. 2012). Genetic baseline samples have been collected from the Yukon Flats, Sulukna River, and Innoko River populations and samples from the Alatna River will be extremely useful in the future determination of stock compositions of Inconnu taken in mixed-stock subsistence fisheries in the Yukon River drainage. Information describing the maturity of whitefishes is also important when describing the demography of a population. The gonadosomatic index (GSI) can be used to assess the maturity of whitefishes (Dupuis and Sutton 2011). In addition, sex-specific age and length data can be used to monitor responses to changes in future management decisions and harvest activities. Given the importance of the Alatna River spawning stock to local subsistence fisheries and its contribution to the Yukon River system, the data collected from this project will be invaluable for future management of this fishery.

Information describing the demographics of the Alatna River Inconnu population will be crucial when developing future management plans and evaluating impacts of harvest at the population level. Age, sex, and length distributions have been described for several populations of Inconnu and other whitefishes in Alaska (e.g., Alt 1987; Brown 2004; Brown 2006; Harper et al. 2007; Edenfield 2009), and is often the first step taken by researchers when beginning to understand a fish population. For example, Brown (2006) began a multi-year investigation into the humpback whitefish *Coregonus pidschian* population of the upper Tanana River with systematic sampling

designed to describe the demographics of the population. Additionally, information on the maturity of Inconnu can be used to assess whether or not fish sampled in a particular season and habitat are in spawning condition (Brown 2000). Because there is essentially no monitoring of Inconnu harvests in the Yukon River drainage (Brown et al. 2012), these descriptions of population structure are important for monitoring the effects of harvests on individual stocks. Establishing sex specific length-weight and length-age distributions will be important to assess the impacts of future harvests as these distributions can change if the exploitation level changes (Brown et al. 2012).

The development of genetics baselines for known populations of Inconnu in the Yukon River drainage was listed as a priority in the Strategic Plan for Research of Whitefish Species (Brown et al. 2012). Genetic samples have previously been collected from spawning populations in the Yukon River main stem and the Innoko and Sulukna rivers, and additional samples are needed from spawning populations in the Tanana and Alatna rivers (Brown et al. 2012). Establishing genetic baselines for stocks of Inconnu in the Yukon River drainage will help to identify the relative contribution of each stock in mixed-stock fisheries.

The goals of this project were to collect genetic tissue samples and demographic information from Inconnu in the Alatna River. This project provided the samples necessary to add the Alatna River population to the genetic baseline samples already collected in the Yukon River drainage, and described the demographics of the Alatna River Inconnu which can be used by managers in the future to monitor harvests, and their impacts to this population.

Objectives:

- 1) Collect 200 tissue samples from Inconnu spawning in the Alatna River for population specific genetics baseline development.
- 2) Describe the demographic composition (age, sex, length, gonadosomatic index) of the Alatna River Inconnu population.

Study Area

This study occurred on the Alatna River (Figure 1), which is located within the Gates of the Arctic National Park, and is a federally designated Wild and Scenic River. The Alatna River is important to the life cycle of Yukon River drainage Inconnu which support traditional fisheries (Andersen et al. 2004). The Alatna River is a swift flowing river with a substrate of gravel and sand, and is a major tributary to the Koyukuk River. Fish were collected in the spawning area described by Brown (2009) and Brown and Burr (2012).

Methods

To address study objective 1 (tissue collection), tissue samples were collected from 200 Inconnu in the Alatna River. To address study objective 2 (demographic composition), fish used for tissue collection were sexed by cutting, measured for length, weighed, and their otoliths were removed for ageing. To obtain the gonadosomatic index, females' ovaries were removed and weighed separately. Stomach contents were analyzed for all 200 Inconnu. Additionally, local

fishers participated in the collection and sampling processes, and helped to distribute the harvested Inconnu within the communities of Allakaket and Alatna for customary and traditional use.

Fish Capture (or Sample Collections)

Fish capture and sampling activities were contracted to Paige Drobny (dba Spearfish Inc.) and local subsistence fishermen (Jared Sam and Stanley Ned). Sampling took place within the known spawning area of Alatna River inconnu. The furthest upstream sample site was located at 66.773390° N. Latitude, -153.482420° W. Longitude, and the furthest downstream sample site was located at 66.762300° N. Latitude, -153.447190° W. Longitude (Figure 1).

Fish were captured in 2012 and 2014 using a combination of hook and line, drift gillnets, and beach seining. Rod and reel produced no fish, as the river was murky and didn't allow for sight snagging techniques to be utilized. Beach seining and drift gillnetting (6" mesh) were conducted in cooperation with the subsistence fishermen.

All captured inconnu were measured for fork length (FL) to the nearest 1 mm and weighed wet (WW) to the nearest 0.1 gram. Sex was determined in the field through gross examination. The stomach was removed and examined for contents to determine if active feeding was occurring. Otoliths were removed and placed in sample vials for later age analysis. Tissue samples were collected from the pectoral fin and placed in sample vials filled with silica beads and shipped to the USFWS laboratory for later genetic analyses. The gonads of female fish were removed and weighed wet to the nearest 0.1 g.

Laboratory analysis

Sagittal otoliths were extracted for aging. One otolith from each fish was sectioned in the transverse plane through the core and mounted on a glass slide with thermoplastic glue (Secor et al. 1992). Each section was approximately 200 µm thick, which permitted growth increments to be viewed with transmitted light. Fish age was determined based on the descriptions and illustrations in Howland et al. (2004). The youngest mature fish for each sex was considered to be a good estimate of the minimum age of maturity. Basic aging statistics are presented and age distributions of male and female fish are illustrated with histograms.

Data analyses

To describe the demographics of the Alatna River Inconnu population, descriptive statistics (Table 1) were produced using R statistical software, and were used to describe the relationships between age, length, and weight. Excel was used to create a scatter plot (Figure 2) to illustrate the relationship between lengths and weights for male and female inconnu, and to create a clustered column (Figure 3) to illustrate the age distribution for male and female inconnu. The gonadosomatic index (Table 2) for female fish was determined as:

$$\text{GSI} = (\text{total ovary weight/wet weight}) \times 100.$$

Results and Discussion

Sample Collections:

Sampling was scheduled to occur during the month of September, 2012. This project was originally designed to be a one year project. However, high water occurred during the sampling event in 2012 allowing for only two Inconnu to be collected and sampled. The high water delayed sampling until the following year, 2013. The sampling was scheduled to resume in September of 2013. However, early winter conditions led to ice formation in the Alatna River, and the project was again delayed. In September 2014, weather and river conditions allowed for a successful sampling event, which occurred between September 15 and 22, 2014.

Of the three gear types utilized for collections of Inconnu, 6" drift gillnetting was the most effective producing 196 of the 200 captured fish. The 196 Inconnu were captured in 33 drifts, averaging 5.94 Inconnu per drift. Beach seining was relatively ineffective, producing only 4 fish. In total, 200 Inconnu were captured and sampled; 198 in 2014, and 2 in 2012. True catch per unit effort (CPUE) was not quantified for any of the gear types as this was not an objective of this project.

Demographic Composition

The female proportion of the Alatna River Inconnu population was 28% (N=56). Inconnu ages ranged from 5 to 25 years, and varied among male and female Inconnu. Male Inconnu ages ranged from 5 to 25 years, with an average of 8.8 years (N=144), while female Inconnu ages ranged from 7 to 22 years, with an average age of 10.4 years (N=56) (Table 1, Figure 2). Lengths and weights also varied between sex, and female Inconnu were longer and heavier on average than male Inconnu. Male Inconnu average length was 66.3 cm, with a range from 50.5 to 78.4 cm. Female Inconnu average length was 74.5 cm and ranged from 66.3 to 92.3 cm (Table 1, Figure 4) Male Inconnu average weight was 3398 g, with a range from 2050 to 6050 g, while female Inconnu average weight was 5357 g, with a range from 3600 to 8700 g (Table 1, Figure 4). Female Inconnu gonadosomatic index averaged 20.8%, with a range from 15.9 to 27.1%, which indicates that all were preparing to spawn (Table 2; Brown et al. 2012).

Genetic Baseline

Genetic samples were collected from all 200 captured Inconnu. The Alatna River Inconnu tissue samples were archived along with the tissue samples from the Innoko, Suluka, and Yukon River populations. These samples will be analyzed at a later date in order to develop genetic baselines for these individual Inconnu populations.

Stomach Content Analyses

All 200 Inconnu stomachs observed were empty. This suggests that the Alatna River Inconnu population was not actively feeding during their spawning timeframe.

Acknowledgements

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Table 1. — Descriptive statistics illustrating age, length, and weight structures for the Alatna River Inconnu population.

Descriptive Statistics: Fork length (cm), Age, Weight (g)									
Variable	Sex	Total		Mean	SE Mean	Minimum	Median	Maximum	
		Count	N*						
Fork length (cm)	Female	56	0	74.53	0.65	66.30	73.90	92.30	
	Male	144	0	66.31	0.36	50.50	66.50	78.40	
Age	Female	56	0	10.43	0.40	7.00	9.50	22.00	
	Male	144	2	8.82	0.20	5.00	8.50	25.00	
Weight (g)	Female	56	0	5357.0	145.0	3600.0	5000.0	8700.0	
	Male	144	0	3398.3	52.7	2050.0	3375.0	6050.0	

*This indicates the number of missing samples.

Table 2. — Descriptive statistics illustrating the gonadosomatic index (GSI) for female Inconnu in the Alatna River population.

Descriptive Statistics: Gonadosomatic Index (GSI) for Female Inconnu									
Variable	Sex	Total		Mean	SE Mean	Minimum	Median	Maximum	
		Count	N*						
GSI	Female	56	0	20.79%	0.003	15.85%	20.88%	27.14%	

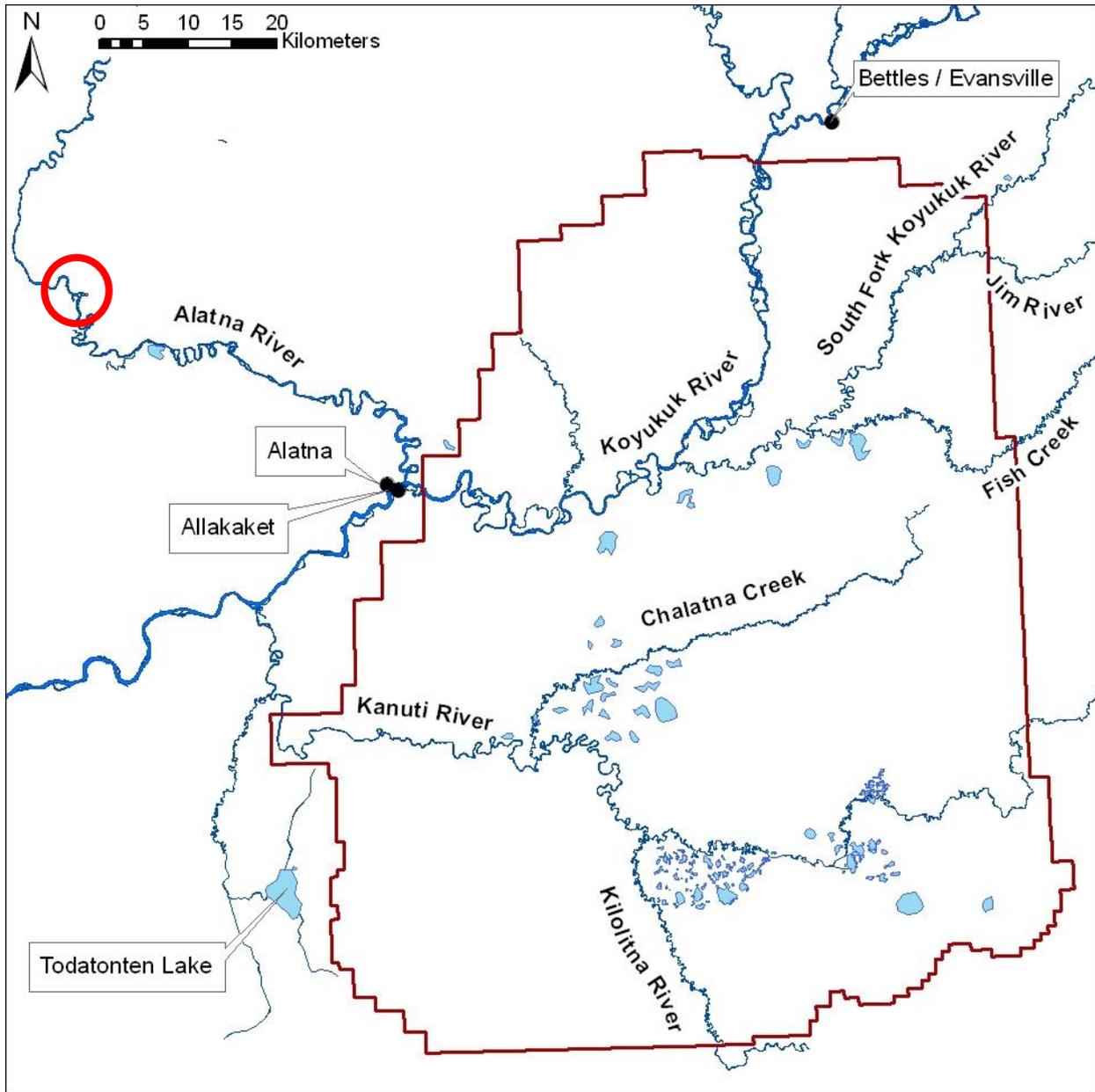


Figure 1. — Map of the upper Koyukuk River drainage showing the Alatna River and the local communities of Alatna and Allakaket (map courtesy of R. Brown, USFWS). The red circle denotes the sampling area; the furthest upstream sample site was located at 66.773390° , -153.482420° , and the furthest downstream sample site was located at 66.762300° , -153.447190° .

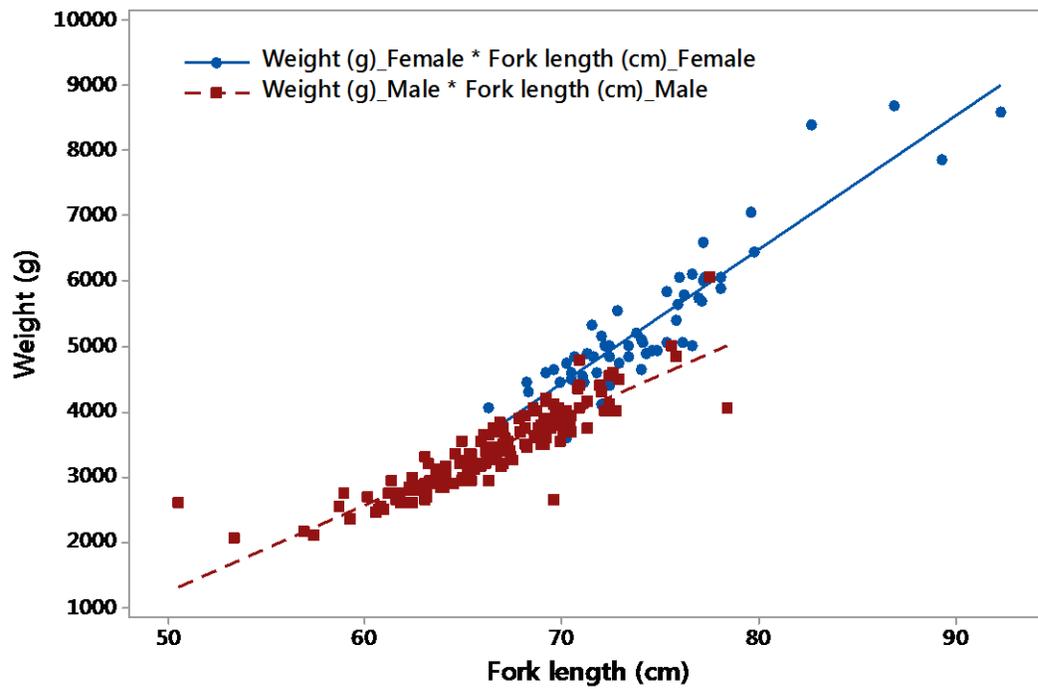


Figure 2. — Weight and length relationships for female and male Inconnu in the Alatna River population.

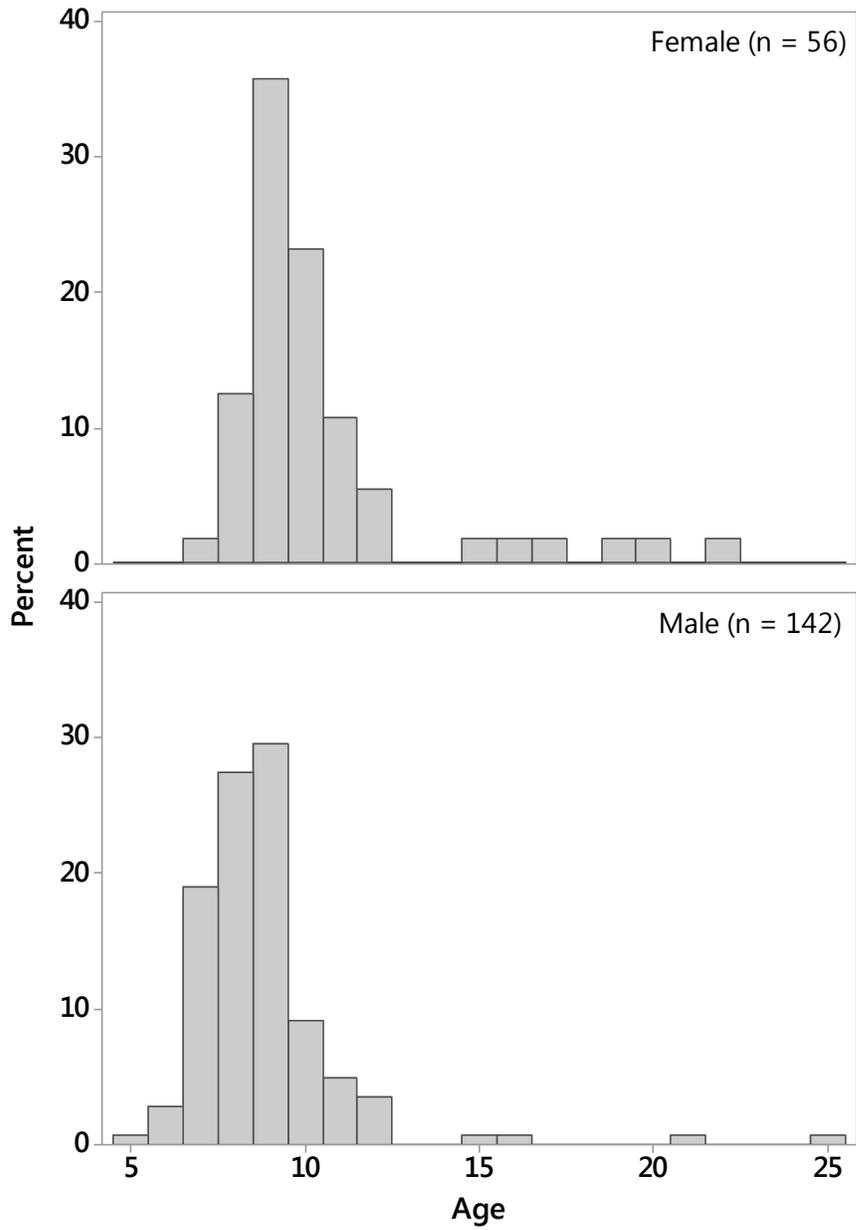


Figure 3. — Age distributions for female and male Inconnu from the Alatna River population.

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