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Age Distribution of
Chinook Salmon Escapement Samples,
Togiak National Wildlife Refuge, Alaska, 1995

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Togiak National Wildlife Refuge, Southwest
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**Age Distribution of Chinook Salmon Escapement Samples,
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ABSTRACT - Age, sex and length sampling of chinook salmon escapement was conducted by U.S. Fish and Wildlife Service field crews on five rivers within the Togiak National Wildlife Refuge. Scale impressions were used to determine fish ages. Scale samples and lengths were collected from 263 chinook salmon in five rivers within the Togiak Refuge. Six different age designations were determined ranging from age 1.2 to 2.4. Most all fish sampled lived one winter in fresh water (one-check) after hatching. After outmigration, chinook salmon from these systems spent predominantly 4 years in the ocean environment before returning to spawn in their 6th year. Maximum ages observed in all samples were 1.5 and 2.4

Although a relatively small sample size for most systems, this collection of chinook salmon escapement samples provides the second year of published age, sex and length composition data for the Togiak, Goodnews, Kanektok and Arolik River drainages in recent years.

INTRODUCTION

The U.S. Fish and Wildlife Service, Togiak National Wildlife Refuge, has an extensive field program centered around the major waterways of the Refuge. Throughout the ice free season Refuge personnel make an effort to collect biological data from fishes caught by sport fishermen or from spawn out salmon carcasses. Over the past several years a greater emphasis has been placed on the collection of age, sex and length (ASL) data from chinook salmon (*Oncorhynchus tshawytscha*) in the Refuge's three main river systems (Togiak, Kanektok and Goodnews Rivers). Although the Alaska Department of Fish and Game has primary management authority over commercial fisheries activities to ensure an adequate spawning escapement, the U.S. Fish and Wildlife Service works cooperatively with the Department in collecting pertinent data which can assist in better management. In order to monitor long term health of individual salmon runs, forecast future runs, or evaluate escapement goals, it is necessary to sample both the harvest and spawning escapement.

The Department samples commercial catches of chinook, sockeye (*O. nerka*), chum (*O. keta*) and coho (*O. kisutch*) salmon from the three main commercial fishing districts (Quinhagak, Goodnews and Togiak) along the Refuge coastline. Currently the Department only collects escapement samples of sockeye salmon in Togiak Lake, and from four salmon species migrating through the fish weir on the Middle Fork of the Goodnews River. Increasing budget restraints over the last ten years have eliminated all other escapement sampling programs the Department conducted within the Refuge. An increase in the U.S. Fish and Wildlife Service presence on the major waterways due to fisheries inventories and public use management programs has allowed the Service to collect age, sex and length data from chinook salmon in a cost effective manner.

The Togiak National Wildlife Refuge encompasses approximately 4.7 million acres of southwest Alaska (Figure 1). Fourteen drainages ranging in area from 130 km² (50 mi²) to 5,200 km² (2,000 mi²) flow from the Refuge into Bristol and Kuskokwim Bays. Each drainage terminus is located in one of four commercial fishery management districts.

Collection of samples reported here for 1995 are from the Kanektok, Arolik, Goodnews and Togiak River drainages. Samples were gathered on an opportunistic basis and range from the entire river unless specific tributaries are identified. In previous years, scale samples and lengths were collected from 624 chinook salmon in five rivers within the Togiak Refuge in 1994 (Lisac and MacDonald 1995), from 256 chinook salmon from one river in 1993 and from 483 chinook salmon from three rivers in 1992 (unpublished data).

The objectives of this report are to:

1. Document the age, sex and length composition of the escapement component of chinook salmon returns to Refuge rivers targeted by commercial fisheries.
2. Compile this data on an annual basis and make available to resource managers in a standard format archived in the State Research and Technical Services (RTS) system.

METHODS

Refuge personnel participating in other research programs (resident fish or public use surveys) devoted time to the sampling of chinook salmon carcasses encountered along the various rivers (Lisac and MacDonald 1995). The time period between 1 - 20 August has been identified as the most likely time period for chinook salmon carcasses to be available. During annual seasonal safety training and orientation, field crews are taught correct scale and length measurement collection and recording techniques. A target of 460 chinook escapement samples from each drainage is desired (Cindy Anderson, ADFG Commercial Fisheries Biologist, personal communication).

Standard age, sex and length (ASL) sampling as outlined in Clutter and Whitesel (1956) are followed. Lengths are measured from mid-eye to fork of tail and recorded to the nearest millimeter. Scales are collected on gum cards or in coin envelopes with the data being directly recorded on ADFG Standard Age Weight Length Form (V1.1) mark-sense data forms or transferred from coin envelopes at a later date (ADFG 1990). Data forms are sent to ADFG Research and Technical Services (RTS) for optical scanning. Each data set is assigned a file number which corresponds to the State fisheries management area, the species sampled, and the year of collection. Electronic data files on diskette and a hard copy are returned from RTS to this station. Frequency reports are generated which tally data by field and allow data validation and editing using WordPerfect software (Heineman 1989a). Once corrections and age

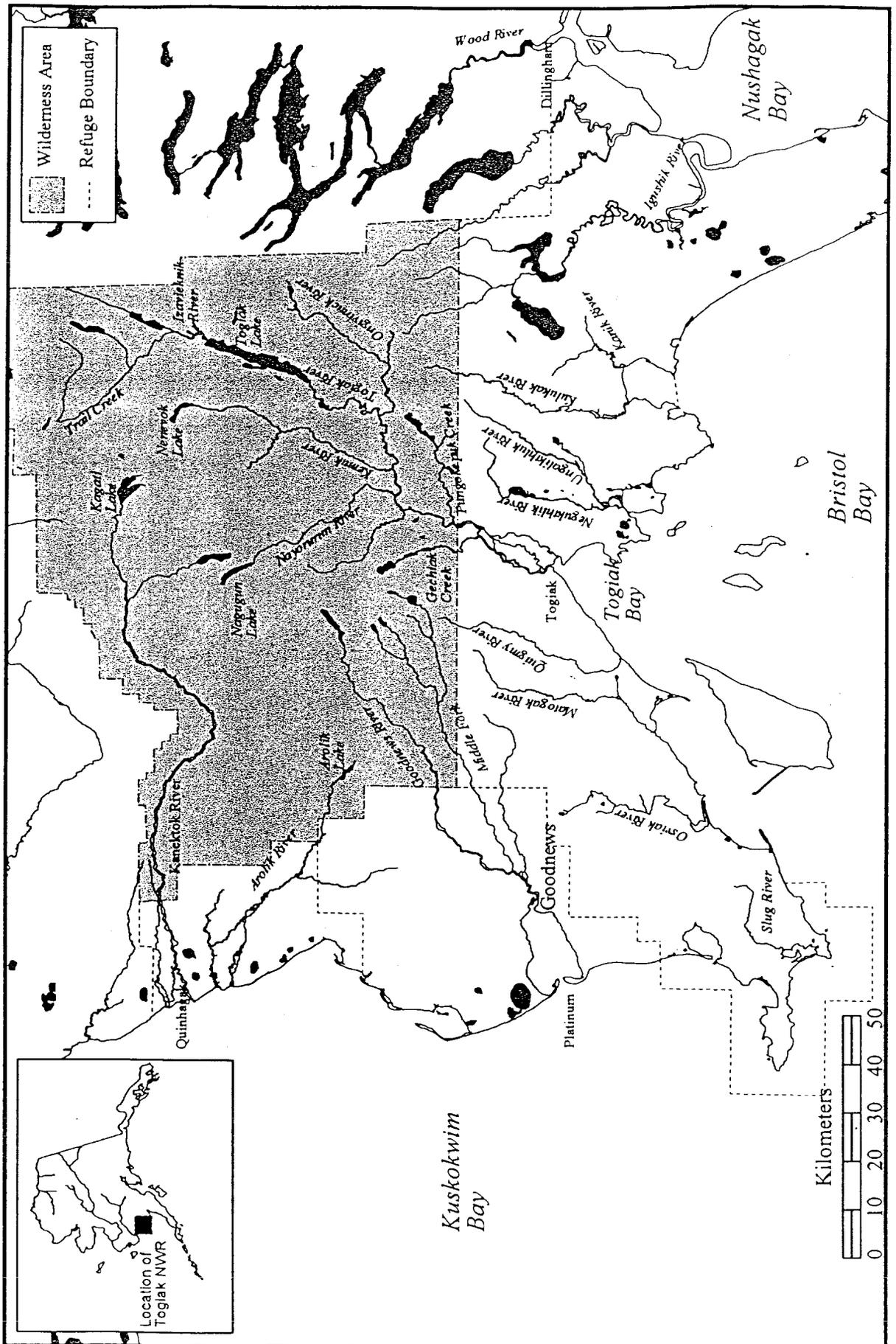


Figure 1. Togiak National Wildlife Refuge.

determinations are entered in the electronic file, copies of the file are sent to RTS and the local ADFG office for archiving.

Acetate impressions are made of scales using a hydraulic press (Dery 1983 and Riffe 1994). All scales are aged using a Canon PC 70M microfiche copier with a forty-power (40x) lens via methods outlined in Mosher (1969) and Lux (undated). Ages are reported using the European system of age designation. The number of winters the fish spent in fresh water (not counting the winter the egg was in the gravel) is shown as an Arabic numeral followed by a dot, then the number of winters the fish spent in the ocean. Therefore, a salmon of age 1.3 spent 1 winter in fresh water after hatching and 3 winters in the ocean; the fish is four years old and is in its fifth year (Mosher 1969). The scale reader makes three independent age determinations for each scale sample. The mean modal age is then reported as suggested by Coggins (1994). Samples with no modal age are treated as unreadable.

Completed data sets are then analyzed using the crosstabulation program BBX, developed by the Alaska Department of Fish and Game's Research and Technical Services (Heineman 1989b). The BBX program produces unweighted estimates of mean length and percentage by age group, and the associated standard error estimates following procedures outlined by Sokal and Rohlf (1981, Boxes 4.2 and 7.1, pages 56 and 139) (Riffe 1994). Summary tables produced by the BBX program are then imported into word processing software and presented here as Tables 1-5.

RESULTS

Scale samples, sex determinations, and lengths were collected from 263 chinook salmon in five rivers within the Togiak National Wildlife Refuge. Most samples were collected from the Kanektok River (150), followed by the North Fork of the Goodnews River (89), Arolik River (17), Gechiak Creek (5) and Pungokepek Creek (2). Of all samples, 213 ages were determined. The rest (50) were regenerated or unreadable scales. Refuge River Rangers collected all samples from the Kanektok and Goodnews Rivers. Refuge fisheries personnel collected all samples from the Arolik River, Gechiak Creek and Pungokepek Creek.

Six different age designations were determined from all samples collected (1.2, 1.3, 1.4, 1.5, 2.2 and 2.4). Most all fish sampled lived one winter in fresh water (one-check) after hatching. After outmigration, chinook salmon from these systems spent predominantly 4 years in the ocean environment before returning to spawn in their 6th year.

Between 28 July and 15 August, 150 chinook salmon escapement samples were collected from the Kanektok River. Of these, 121 were successfully aged (Table 1). Age 1.4 predominated the sample accounting for 84.3% (102) of this sample. One-check fish accounted for 98.3% of the aged fish. Of the 150 fish with a recorded sex determination 71 (47.1%) were males and 79 (52.9%) were females.

Between 20 - 23 July, 17 chinook salmon escapement samples were collected from the Arolik River. Of these, 13 were successfully aged (Table 2). Age 1.4 accounted for 92.3% (12) of the sample. One-check fish accounted for all fish in this small sample. Of the 17 fish sampled, 9 (46.2%) were females and 8 (53.8%) were males.

Between 16 July and 26 August, 89 chinook salmon escapement samples were collected from the North Fork of the Goodnews River. Of these, 73 were successfully aged (Table 3). Age 1.4 predominated, accounting for 78.1% (57) of the samples. One-check fish accounted for all of the sample. Of the 89 fish sampled, 43 (47.9%) were females and 45 (50.7%) were males. For one fish, sex was not recorded.

On 24 August, 2 chinook salmon escapement samples were collected from Pungokepuk Creek. Of these, both were successfully aged (Table 4). One fish was age 1.3 and one was age 1.4, representing 50% for each age group. One-check fish accounted for all of the sample. Of these 2 fish sampled, one was a male and one was a female.

Between 13 - 15 August, 5 chinook salmon escapement samples were collected from Gechiak Creek. Of these, 4 were successfully aged (Table 5). Age 1.4 accounted for 75% (3) of the sample. One-check fish accounted for 75% of this small sample. Of the 5 fish sampled 2 (40%) were females and 3 (60%) were males.

DISCUSSION AND RECOMMENDATIONS

Sample sizes ($n = 2$ to 150) were less than the desired goal of 460 for all rivers. Run timing and water levels can severely affect the availability of salmon carcasses for sampling. In addition, the short, frequent fisheries sampling trips in different locations reduce the time on a river to collect samples and regular field crew responsibilities may restrict their time commitment to this sampling effort. Work schedules for field crews need to be flexible enough for them to concentrate on escapement sampling when carcasses are most plentiful. Carcass availability (accumulation in shallow water) can generally be expected to begin in early August and peak after mid-August for most western Alaska rivers.

Although a relatively small sample size for most systems, this collection of chinook salmon escapement samples provides the second year of published age, sex and length composition data for the Togiak River drainage, Kanektok, Goodnews and Arolik Rivers in recent years. The Alaska Department of Fish and Game currently collects chinook escapement samples from the Middle Fork of the Goodnews River, and sporadically from the Togiak River. Samples have been collected by the U.S. Fish and Wildlife Service from the Kanektok, Togiak and Goodnews Rivers between 1992 and 1995.

The range of ages for 1995 Togiak Refuge chinook salmon (1.2 to 2.4) was similar to 1994 fish (1.1 to 2.4) (Lisac and MacDonald 1995). A shift in the number of fish at each age was evident

between the two years. In 1994 the majority of fish were ages 1.3 (188 fish, 43.7%) and 1.4 (128 fish, 29.8%), while in 1995 only a few chinook salmon were age 1.3 (19 fish, 8.9%) and the majority were age 1.4 (175 fish, 82.2%). Relative to this shift is the fact that far fewer chinook salmon were sampled in 1995 (263 fish, 213 aged) than in 1994 (624 fish, 430 aged). If a larger sample size was acquired, perhaps similar trends in the data could have been seen. In addition, unpublished data from 1992 and 1993 show a similar range of ages (1.1 to 2.4 in 1992 and 1.2 to 2.4 in 1993). The majority of the chinook salmon sampled were age 1.4 in 1992 (207 fish, 49.4%) and 1993 (120 fish, 52.2%). Sample sizes in these two years were 419 aged fish in 1992 and 230 aged fish in 1993.

The ratio of males to females was approximately 50% for 1994 and 1995. In 1994 there were 210 males (50.1%) and 209 females (49.9%). In 1995 there were 128 males (48.9%) and 134 females (51.1%). In 1992 there were 250 males (60.4%) and 164 females (39.6%). In 1993 there were 126 males (54.8%) and 104 females (45.2%).

Efforts should be made to continue this data base and to achieve the desired sample size of 460 fish as this data may become increasingly useful in managing the commercial fisheries and insuring adequate spawning escapements. Continuation of this sampling effort is dependent on Togiak Refuge public use survey programs for the Kanektok, Goodnews, and Togiak Rivers and on fishery surveys throughout the Refuge.

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Table 1. Mean lengths (mm) of chinook salmon by sex and age group from escapement samples collected from the Kanektok River, 1995.

	Age Group						TOTAL
	UNKNOWN	1.2	1.3	1.4	1.5	2.4	
FEMALES							
N (Known Age)	15	2	3	54	3	2	79
Percent		1.7	2.5	44.6	2.5	1.7	52.9
Std Err		1.16	1.42	4.54	1.42	1.16	4.56
Mean Ln	843	581	911	882	874	851	867
Std Err	24.86	38.00	19.78	7.61	5.24	19.00	8.95
N	15	2	3	54	3	2	79
MALES							
N (Known Age)	14	3	6	48			71
Percent		2.5	5.0	39.7			47.1
Std Err		1.42	1.98	4.47			4.56
Mean Ln	841	550	700	913			866
Std Err	45.82	16.95	20.15	9.34			15.36
N	14	3	6	48			71
ALL SAMPLES							
N (Known Age)	29	5	9	102	3	2	150
Percent		4.1	7.4	84.3	2.5	1.7	100.0
Std Err		1.82	2.40	3.32	1.42	1.16	
Mean Ln	842	562	771	897	874	851	866
Std Err	25.11	17.02	37.93	6.13	5.24	19.00	8.63
N	29	5	9	102	3	2	150

Table 2. Mean lengths (mm) of chinook salmon by sex and age group from escapement samples collected from the Arolik River, 1995.

	Age Group			TOTAL
	UNKNOWN	1.3	1.4	
FEMALES				
N (Known Age)	3		6	9
Percent			46.2	46.2
Std Err			14.39	14.39
Mean Ln	912		905	907
Std Err	14.24		9.04	7.22
N	3		6	9
MALES				
N (Known Age)	1	1	6	8
Percent		7.7	46.2	53.8
Std Err		7.69	14.39	14.39
Mean Ln	850	855	937	916
Std Err			20.88	20.58
N	1	1	6	8
ALL SAMPLES				
N (Known Age)	4	1	12	17
Percent		7.7	92.3	100.0
Std Err		7.69	7.69	
Mean Ln	896	855	921	911
Std Err	18.41		11.85	10.11
N	4	1	12	17

Table 3. Mean lengths (mm) of chinook salmon by sex and age group from escapement samples collected from the Goodnews River, 1995.

		Age Group					
		UNKNOWN	1.2	1.3	1.4	1.5	TOTAL
FEMALES							
N (Known Age)	8	2	2	30	1		43
Percent		2.7	2.7	41.1	1.4		47.9
Std Err		1.92	1.92	5.80	1.37		5.89
Mean Ln	841	739	864	869	967		860
Std Err	19.03	80.50	38.00	8.25			8.84
N	8	2	2	30	1		43
MALES							
N (Known Age)	8	5	6	26			45
Percent		6.8	8.2	35.6			50.7
Std Err		2.98	3.24	5.64			5.89
Mean Ln	784	661	713	927			844
Std Err	29.66	25.19	28.13	10.90			18.01
N	8	5	6	26			45
ALL SAMPLES							
N (Known Age)	16	7	8	57	1		89
Percent		9.6	11.0	78.1	1.4		100.0
Std Err		3.47	3.68	4.88	1.37		
Mean Ln	813	684	751	896	967		852
Std Err	18.52	28.62	32.98	7.60			10.04
N	16	7	8	57	1		89

Table 4. Mean lengths (mm) of chinook salmon by sex and age group from escapement samples collected from Pungokepuk Creek, 1995.

	Age Group		TOTAL
	1.3	1.4	
FEMALES			
N (Known Age)		1	1
Percent		50.0	50.0
Std Err		50.00	50.00
Mean Ln		880	880
Std Err			
N		1	1
MALES			
N (Known Age)	1		1
Percent	50.0		50.0
Std Err	50.00		50.00
Mean Ln	655		655
Std Err			
N	1		1
ALL SAMPLES			
N (Known Age)	1	1	2
Percent	50.0	50.0	100.0
Std Err	50.00	50.00	
Mean Ln	655	880	767
Std Err			112.50
N	1	1	2

Table 5. Mean lengths (mm) of chinook salmon by sex and age group from escapement samples collected from Gechiak Creek, 1995.

	Age Group			TOTAL
	UNKNOWN	1.4	2.2	
FEMALES				
N (Known Age)		2		2
Percent		50.0		50.0
Std Err		28.87		28.87
Mean Ln		905		905
Std Err		20.00		20.00
N		2		2
MALES				
N (Known Age)	1	1	1	3
Percent		25.0	25.0	50.0
Std Err		25.00	25.00	28.87
Mean Ln	580	945	545	690
Std Err				127.90
N	1	1	1	3
ALL SAMPLES				
N (Known Age)	1	3	1	5
Percent		75.0	25.0	100.0
Std Err		25.00	25.00	
Mean Ln	580	918	545	776
Std Err		17.64		87.87
N	1	3	1	5

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APPENDIX

Appendix Table A1. Sample location, size and data file name for chinook salmon escapement samples collected and analyzed by Togiak NWR, 1995.

<u>River</u>	<u>Number of Fish</u>		<u>RTS Data File Number</u>
	<u>Sampled</u>	<u>Aged</u>	
Arolik River	17	13	V0880BA5.dta
Gechiak Creek	5	4	T1400BA5.dta
Goodnews River, North Fork	89	73	V0040BA5.dta
Kanektok River	150	121	V0030BA5.dta
Pungokepuk Creek	2	2	T1320BA5.dta