

Fisheries Data Series 95-4

**Age Distribution of
Chinook Salmon Escapement Samples,
Togiak National Wildlife Refuge, Alaska, 1994.**

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Age Distribution of Chinook Salmon (Oncorhynchus tshawytscha) Escapement Samples, Togiak National Wildlife Refuge, Alaska, 1994.

Abstract.- Age, sex and length sampling of chinook salmon escapement was conducted by U.S. Fish and Wildlife 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 624 chinook salmon in five rivers within the Togiak Refuge. Nine different age designations were determined ranging from age 1.1 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 3 or 4 years in the ocean environment before returning to spawn in their 5th or 6th year, respectively. 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 only age and sex composition for the Togiak, Kanektok and Arolik Rivers 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 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 USFWS 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 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 USFWS presence on the major waterways due to fisheries inventory 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 (Fig. 1). Fourteen drainages ranging in area from 130 km² (50mi²) to 5,200 km² (2,000mi²) 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 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.

The objectives of this report are to:

1. Document the age and sex 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 Service (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. 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 form 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 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 Rife 1994). All scales are aged using a Canon PC 70M microfiche copier with a forty-power (40x) lens via

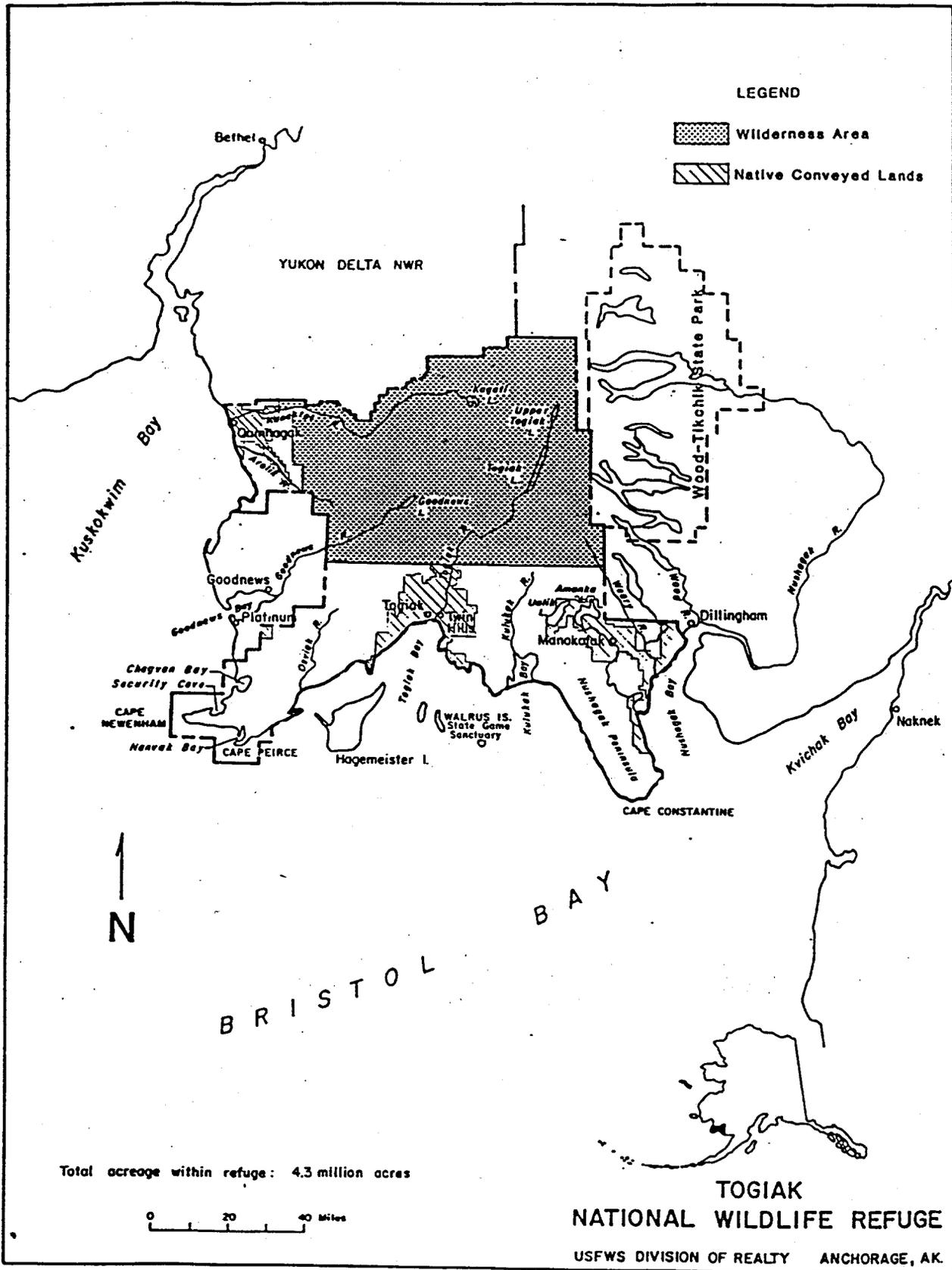


Figure 1. Togiak National Wildlife Refuge

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 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 ADFG 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 and lengths were collected from 624 chinook salmon in five rivers within the Togiak Refuge. Most samples were collected from the Kanektok River (365) and only 18 were collected from Gechiak Creek, a tributary to the Togiak River. Of all samples, 430 ages were determined. The rest (194) were regenerated or unreadable scales. Refuge River Rangers collected all samples from the Kanektok, Goodnews and mainstem Togiak River. Refuge fisheries personnel collected all samples from the Arolik River and Gechiak Creek.

Nine different age designations were determined from all samples collected (1.1, 1.2, 1.3, 1.4, 1.5, 2.1, 2.2, 2.3, 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 3 or 4 years in the ocean environment before returning to spawn in their 5th or 6th year, respectively. Maximum ages observed in all samples were 1.5 and 2.4 except for the Gechiak Creek sample (n=18) where 1.5 age fish were absent.

Between 8 - 16, August 365 chinook salmon escapement samples were collected from the Kanektok River. Of these, 243 were successfully aged (Table 1). Ages 1.3 and 1.4 predominated the sample accounting for 43.6% (106) and 30.0% (73) respectively. One-check fish accounted for 82.7% of the aged fish. Of the 348 fish with a recorded sex determination 205 (58.9%) were males, 143 (41.1%) were females. An additional 17 fish had no sex determination recorded.

Between 22 - 24 August, 45 chinook salmon escapement samples were collected from the Arolik River. Of these 28 were successfully aged (Table 2). Age 1.3 accounted for 50% (14) of the sample. One-check fish accounted for 92.9% of this small sample. Of the 45 fish sampled 25

(55.6%) were females.

Between 8 - 16 August, 88 chinook salmon escapement samples were collected from the North Fork of the Goodnews River. Of these, 66 were successfully aged (Table 3). Ages 1.3 and 1.4 predominated, accounting for 39.4% (26) and 36.4% (24), respectively. One-check fish accounted for 97.0% of the sample. Of the 88 fish sampled 50 (56.8%) were females.

Between 22 - 23 August, 108 chinook salmon escapement samples were collected from the Togiak River. Of these, 77 were successfully aged (Table 4). Ages 1.3 and 1.4 predominated, accounting for 44.2% (34) and 32.5% (25), respectively. One-check fish accounted for 97.4% of the sample. Of the 108 fish sampled 70 (64.8%) were females.

Between 30 August and 2 September, 18 chinook salmon escapement samples were collected from Gechiak Creek. Of these, 16 were successfully aged (Table 5). Age 1.3 accounted for 50% (8) of the sample. One-check fish accounted for 87.5% of this small sample. Of the 18 fish sampled 10 (55.6%) were females.

Discussion and Recommendations

Sample sizes ($n=18$ to 365) were less than the desired goal (460) for all rivers. Run timing and water levels can severely affect the availability of salmon carcasses for sampling. In 1994 water levels increased in mid-August hampering field crews' efforts to collect escapement samples. In addition, 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 only age and sex composition for the Togiak, Kanektok and Arolik Rivers in recent years. ADFG 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 USFWS from the Kanektok, Togiak and Goodnews Rivers between 1991 and 1994. Continuation of this sampling effort is dependant on Togiak Refuge public use survey programs. Efforts should be made to continue this data base, and achieve a sample size of 460 fish, which may become increasingly useful in managing the commercial fisheries and insuring adequate spawning escapements.

Acknowledgements

The collection of scales from decaying chinook salmon was due to the efforts of Robert Doyle, Alex Wheeler, Patrick Chubb, Jennifer Culbertson, W. Stevens Harper, Eloise Tavares, John Moran, and the authors.

Table 1. Mean lengths (mm) of chinook salmon by sex and age group from escapement samples collected from the Kanektok River, 1994.

	Age Group								TOTAL	
	UNKNOWN	1.2	1.3	1.4	1.5	2.1	2.2	2.3		2.4
UNKNOWN										
n (Known Age)		1	5	4					1	11
Percent		0.4	2.1	1.6					0.4	4.5
Std Err		0.41	0.91	0.82					0.41	1.34
Mean Ln	790	725	858	806					821	813
Std Err	29.25		28.77	9.23						15.18
Sample Size	5	1	5	4					1	16
Mean Wt										
Std Err										
Sample Size	0	0	0	0					0	0
FEMALES										
n (Known Age)		2	24	44	3	1		6	18	98
Percent		0.8	9.9	18.1	1.2	0.4		2.5	7.4	40.3
Std Err		0.58	1.92	2.48	0.71	0.41		1.00	1.68	3.15
Mean Ln	849	797	828	851	857	595		857	854	845
Std Err	7.84	2.50	11.96	6.52	8.33			12.49	6.78	4.32
Sample Size	46	2	24	44	3	1		6	18	144
Mean Wt										
Std Err										
Sample Size	0	0	0	0	0	0		0	0	0
MALES										
n (Known Age)		16	77	25		1	1	5	9	134
Percent		6.6	31.7	10.3		0.4	0.4	2.1	3.7	55.1
Std Err		1.59	2.99	1.95		0.41	0.41	0.91	1.21	3.20
Mean Ln	823	742	770	877		550	780	867	852	804
Std Err	13.18	25.53	8.51	14.49				18.28	35.48	7.05
Sample Size	71	16	77	25		1	1	5	9	205
Mean Wt										
Std Err										
Sample Size	0	0	0	0		0	0	0	0	0
ALL SAMPLES										
n (Known Age)		19	106	73	3	2	1	11	28	243
Percent		7.8	43.6	30.0	1.2	0.8	0.4	4.5	11.5	100.0
Std Err		1.73	3.19	2.95	0.71	0.58	0.41	1.34	2.05	
Mean Ln	832	747	787	857	857	572	780	861	852	821
Std Err	8.37	21.79	7.39	6.60	8.33	22.50		10.29	11.83	4.47
Sample Size	122	19	106	73	3	2	1	11	28	365
Mean Wt										
Std Err										
Sample Size	0	0	0	0	0	0	0	0	0	0

Table 2. Mean lengths (mm) of chinook salmon by sex and age group from escapement samples collected from the Arolik River, 1994.

	Age Group						TOTAL	
	UNKNOWN	1.2	1.3	1.4	1.5	2.2		2.4
FEMALES								
n (Known Age)		5	8	3	1	1	1	19
Percent		17.9	28.6	10.7	3.6	3.6	3.6	67.9
Std Err		7.37	8.69	5.95	3.57	3.57	3.57	8.99
Mean Ln	792	750	797	855	840	905	855	802
Std Err	31.51	52.39	21.59	16.07				15.81
Sample Size	6	5	8	3	1	1	1	25
Mean Wt								
Std Err								
Sample Size	0	0	0	0	0	0	0	0
MALES								
n (Known Age)		2	6	1				9
Percent		7.1	21.4	3.6				32.1
Std Err		4.96	7.90	3.57				8.99
Mean Ln	794	795	852	900				817
Std Err	29.97	35.00	13.21					18.30
Sample Size	11	2	6	1				20
Mean Wt								
Std Err								
Sample Size	0	0	0	0				0
ALL SAMPLES								
n (Known Age)		7	14	4	1	1	1	28
Percent		25.0	50.0	14.3	3.6	3.6	3.6	100.0
Std Err		8.33	9.62	6.73	3.57	3.57	3.57	
Mean Ln	793	763	821	866	840	905	855	808
Std Err	21.74	37.87	15.08	15.99				11.89
Sample Size	17	7	14	4	1	1	1	45
Mean Wt								
Std Err								
Sample Size	0	0	0	0	0	0	0	0

Table 3. Mean lengths (mm) of chinook salmon by sex and age group from escapement samples collected from the Goodnews River, 1994.

	Age Group								
	UNKNOWN	1.1	1.2	1.3	1.4	1.5	2.3	2.4	TOTAL
FEMALES									
n (Known Age)			2	12	18	3			35
Percent			3.0	18.2	27.3	4.5			53.0
Std Err			2.13	4.78	5.52	2.58			6.19
Mean Ln	856		817	788	852	860			837
Std Err	18.21		2.50	17.52	12.27	7.64			8.93
Sample Size	14		2	12	18	3			49
Mean Wt									
Std Err									
Sample Size	0		0	0	0	0			0
MALES									
n (Known Age)		1	7	14	6	1	1	1	31
Percent		1.5	10.6	21.2	9.1	1.5	1.5	1.5	47.0
Std Err		1.52	3.82	5.07	3.57	1.52	1.52	1.52	6.19
Mean Ln	826	540	686	795	920	935	920	940	804
Std Err	41.03		26.35	23.00	32.20				19.40
Sample Size	7	1	7	14	6	1	1	1	38
Mean Wt									
Std Err									
Sample Size	0	0	0	0	0	0	0	0	0
ALL SAMPLES									
n (Known Age)		1	9	26	24	4	1	1	66
Percent		1.5	13.6	39.4	36.4	6.1	1.5	1.5	100.0
Std Err		1.52	4.26	6.06	5.97	2.96	1.52	1.52	
Mean Ln	846	540	715	792	869	879	920	940	822
Std Err	17.96		27.94	14.53	13.34	19.51			9.94
Sample Size	21	1	9	26	24	4	1	1	87
Mean Wt									
Std Err									
Sample Size	0	0	0	0	0	0	0	0	0

Table 4. Mean lengths (mm) of chinook salmon by sex and age group from escapement samples collected from the Togiak River, 1994.

	Age Group							TOTAL	
	UNKNOWN	1.1	1.2	1.3	1.4	1.5	2.3		2.4
FEMALES									
n (Known Age)			4	20	19	3	1	1	48
Percent			5.2	26.0	24.7	3.9	1.3	1.3	62.3
Std Err			2.55	5.03	4.95	2.22	1.30	1.30	5.56
Mean Ln	871		780	843	858	880	910	855	855
Std Err	11.47		35.59	12.84	15.31	39.69			7.40
Sample Size	22		4	20	19	3	1	1	70
Mean Wt									
Std Err									
Sample Size	0		0	0	0	0	0	0	0
MALES									
n (Known Age)		4	5	14	6				29
Percent		5.2	6.5	18.2	7.8				37.7
Std Err		2.55	2.83	4.42	3.07				5.56
Mean Ln	711	547	704	779	842				739
Std Err	34.27	23.94	67.70	21.19	27.83				19.49
Sample Size	9	4	5	14	6				38
Mean Wt									
Std Err									
Sample Size	0	0	0	0	0				0
ALL SAMPLES									
n (Known Age)		4	9	34	25	3	1	1	77
Percent		5.2	11.7	44.2	32.5	3.9	1.3	1.3	100.0
Std Err		2.55	3.69	5.70	5.37	2.22	1.30	1.30	
Mean Ln	825	547	738	817	854	880	910	855	814
Std Err	18.23	23.94	40.77	12.60	13.21	39.69			9.90
Sample Size	31	4	9	34	25	3	1	1	108
Mean Wt									
Std Err									
Sample Size	0	0	0	0	0	0	0	0	0

Table 5. Mean lengths (mm) of chinook salmon by sex and age group from escapement samples collected from Gechiak Creek, 1994.

	Age Group					TOTAL
	UNKNOWN	1.2	1.3	1.4	2.4	
FEMALES						
n (Known Age)		1	5	2	1	9
Percent		6.3	31.3	12.5	6.3	56.3
Std Err		6.25	11.97	8.54	6.25	12.81
Mean Ln	610	830	828	872	905	823
Std Err			30.44	17.50		29.12
Sample Size	1	1	5	2	1	10
Mean Wt						
Std Err						
Sample Size	0	0	0	0	0	0
MALES						
n (Known Age)		3	3		1	7
Percent		18.8	18.8		6.3	43.8
Std Err		10.08	10.08		6.25	12.81
Mean Ln	910	548	718		985	712
Std Err		77.15	89.27			70.43
Sample Size	1	3	3		1	8
Mean Wt						
Std Err						
Sample Size	0	0	0		0	0
ALL SAMPLES						
n (Known Age)		4	8	2	2	16
Percent		25.0	50.0	12.5	12.5	100.0
Std Err		11.18	12.91	8.54	8.54	
Mean Ln	760	619	787	872	945	774
Std Err	150.00	89.08	39.84	17.50	40.00	36.56
Sample Size	2	4	8	2	2	18
Mean Wt						
Std Err						
Sample Size	0	0	0	0	0	0

References

- ADFG (Alaska Department of Fish and Game). 1990. Instructions for using sport fish creel survey and biological mark-sense forms, 1990. Division of Sport Fish, Research and Technical Services. Anchorage.
- Clutter, R. I. and L. E. Whitesel. 1956. Collection and interpretation of sockeye salmon scales. International Pacific Salmon Fishery Commission, Bulletin 9. 159pp.
- Coggins, L.G. 1994. Precision of ages estimated from scales for rainbow trout in Bristol Bay, Alaska. Alaska Department of Fish and Game, Fisheries Data Series No. 94-26.
- Dery, L.M. 1983. Use of laminated plastic to impress fish scales. *Progressive Fish Culture*, 45(2), April 1983. Pages 87-88.
- Heineman, G. M. 1989a. Instructions for using sport fish mark sense diskettes 1989. Alaska Department of Fish and Game, Division of Sport Fish, Research and Technical Services. Anchorage.
- _____. 1989b. BBX computer program for analysis of biological samples. Revised 3/13/89. Alaska Department of Fish and Game, Division of Sport Fish, Research and Technical Services. Anchorage.
- _____. 1989c. BBX crosstabulation system for Bristol Bay historic rainbow trout data. Alaska Department of Fish and Game, Division of Sport Fish, Research and Technical Services. Anchorage.
- Lux, F.E. undated. Age Determination of Fishes (Revised). U.S. Department of Commerce. NOAA, National Marine Fisheries Service. Fishery Leaflet 637. Revision of Lux, Fred E. Age Determination of Fishes, USFWS, Fishery Leaflet No. 488.
- Minard, R. E. 1992. Updated Summary of effort and harvest statistics for major sport fisheries in Southwestern Alaska. Alaska Department of Fish and Game, Division of Sport Fish. Interdepartmental report unpublished November 17, 1992.
- Mosher, K.H. 1969. Identification of Pacific salmon and steelhead trout by scale characteristics. USDOI, U.S. Fish and Wildlife Service, Bureau of Commercial Fisheries, XF WC-A 317 1-17 (1969).
- Riffe, R. 1994. Pressing Scales. An internal memo describing the performance and procedures of using the hydraulic press for creating acetate scale impressions. Alaska Department of Fish and Game, Dillingham, Alaska. Dated January 14, 1994.

Appendix Table A1. Sample location, size and data file name for chinook salmon escapement samples collected and analyzed by Togiak NWR, 1994.

<u>River</u>	<u>Number of Fish</u>		<u>RTS Data File Number</u>
	<u>Sampled</u>	<u>Aged</u>	
Arolik River - chinook escapement	45	28	V0880BA4.dta
Gechiak Cr. - chinook escapement	18	16	T1400BA4.dta
Goodnews R. NF - chinook escapement	88	66	V0040BA4.dta
Kanektok R. - chinook escapement	365	243	V0030BC4.dta
Togiak R. - chinook escapement	108	77	T0060BA4.dta