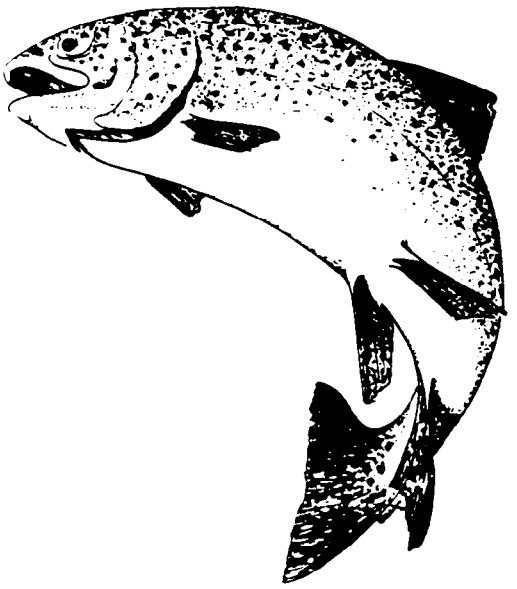
FISHERY MANUSCRIPT NO. 5

SYNOPSIS AND BIBLIOGRAPHY OF LAKE TROUT *(Salvelinus namaycush)* IN ALASKA



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JANUARY 1987

SYNOPSIS AND BIBLIOGRAPHY OF LAKE TROUT *(Salvelinus namaycush)* IN ALASKA[1]

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January 1987

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[1]This investigation was partially financed by the Federal Aid in Sport Fish Restoration Act (16 U.S.C. 777-777K) under Project F-10-2, Job Number T-8-2.

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ABSTRACT

This report reviews literature from studies conducted on lake trout (*Salvelinus namaycush* Walbaum) in Alaska. Lake trout are distributed throughout high elevation lakes of the Brooks Range, the Arctic coastal plain, the upper Tanana, Susitna, and Copper River drainages, and the Kenai Peninsula. Otoliths are preferred over scales for age determination. Lake trout are long-lived with maximum ages in excess of 25 years common and ages in excess of 50 years recorded. Lake trout tend to grow slower, mature at older ages, and reach greater maximum age in Arctic populations than in more southerly Alaskan populations. Age at maturity for southern and interior Alaska lake trout is 7 to 8 years compared with 10 to 20 years in northern Alaska. Additional knowledge of the life history, habitat requirements, and population dynamics of Alaskan lake trout is generally lacking.

Statewide lake trout sport harvests have averaged about 19,000 fish annually since 1977 with more than 50% of the harvest coming from lakes in the Glennallen area and Tanana River drainage. Harvest estimates from almost all accessible lakes are higher than levels recommended to provide sustainable yields. Research with the goal of documenting lake trout abundance and estimating population dynamic rates in Alaska should be conducted and management options to reduce the harvest of lake trout in accessible waters should be considered.

KEY WORDS: lake trout, *Salvelinus namaycush*, review, distribution, age determination, harvest.

INTRODUCTION

This paper reviews literature from studies conducted on lake trout (*Salvelinus namaycush* Walbaum) in Alaska. Redick (1967) reviewed lake trout life history literature and Sonnichsen (ADF&G unpublished) reviewed the literature in a lake trout narrative for Habitat Division's Regional Guides. This paper is an update and continuation of these earlier reports.

This paper does not cover all aspects of the biology of the lake trout from areas outside Alaska. For a recent and thorough review of the species, the reader is directed to Martin and Olver (1980).

DISTRIBUTION

Lake trout are distributed through the high elevation lakes of the Brooks Range, the Arctic coastal plain, the upper Tanana, Susitna and Copper River drainages, Bristol Bay, and the Kenai Peninsula. They are generally absent from the lakes of the North Slope lowlands and the lower Yukon-Kuskokwim River basins (Morrow 1980, McPhail and Lindsey 1970). Lake trout are not found in lakes and streams on the south side of the Alaska Peninsula, in northern Alaskan Peninsula systems south of Mother Goose Lake, and are generally not found in the Wood River System.

Southcentral/Southwestern Region

In southcentral Alaska, lake trout are most widely distributed in the upper Copper and upper Susitna River drainages (Area I)[1] and are present in lakes of the east side of the Susitna River drainage (M). They are found in a few lakes on the west side of Cook Inlet (N) and in some lakes of the Matanuska and Knik River drainages (K). On the Kenai Peninsula (P), lake trout are found in several lakes and streams of the Kenai River system and in the Kasilof River system. In Prince William Sound (J), lake trout are reported in Little Tokun Lake of the Martin River drainage. Lake trout are found in the Naknek, Kvichak and Nushagak River drainages of southwestern Alaska (R,S,T) (Tables 1a-1g).

Arctic-Yukon-Kuskokwim Region

Lake trout are found in many of the lakes and a number of the streams of the Delta and upper Tanana River drainages (U). They are also present in lakes and streams of interior Alaska (V), particularly the upper Kuskokwim and Kuskokwim Bay drainages. They are most frequently associated with deep, oligotrophic lakes in the mountains and are rarely found at lower elevations of the Yukon or Kuskokwim Basins (Redick 1967, Morrow 1980). In northwest Alaska (X), lake trout occur in lakes and streams of the Brooks Range in the Noatak and Kobuk drainages. Lake trout are found in most drainages that flow into the Yukon River from the Brooks Range (Y). Lake trout distribution is primarily restricted to lakes at upper elevations in these drainages. Lake trout are widely distributed on the north slope of the Brooks Range (Z). They occur most frequently in mountain and foothill lakes, but are also found in streams of the Colville, Sagavanirktok, and Canning River drainages. Lake trout are generally not found in the lowland lakes of the Arctic coastal plain, but they are common in central coastal plain lakes between the Ikpikpuk and Colville Rivers (Tables 1h-1l).

LIFE HISTORY

Age Determination

Age determination is always difficult in long-lived, slow growing fish, and lake trout can be particularly difficult (Johnson 1976, Powers 1978, Martin and Olver 1980). Alt (1978) found that otolith and scale ages[2] generally agreed up to age 9 for fish from the Noatak River system. However, for lake trout older than age 9, otolith ages were considerably greater (5 to 10 years older at age 30). McCart et al. (1972) found that

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1 For distribution of lake trout in Alaska, I have followed the geographic divisions used by Mills (1986) for the Statewide Harvest Survey (Figure 1). For the remainder of this paper, each area will be represented by the capital letter designations used by Mills (1986).

2 Otolith age and scale age refers to the number of annuli on each structure.

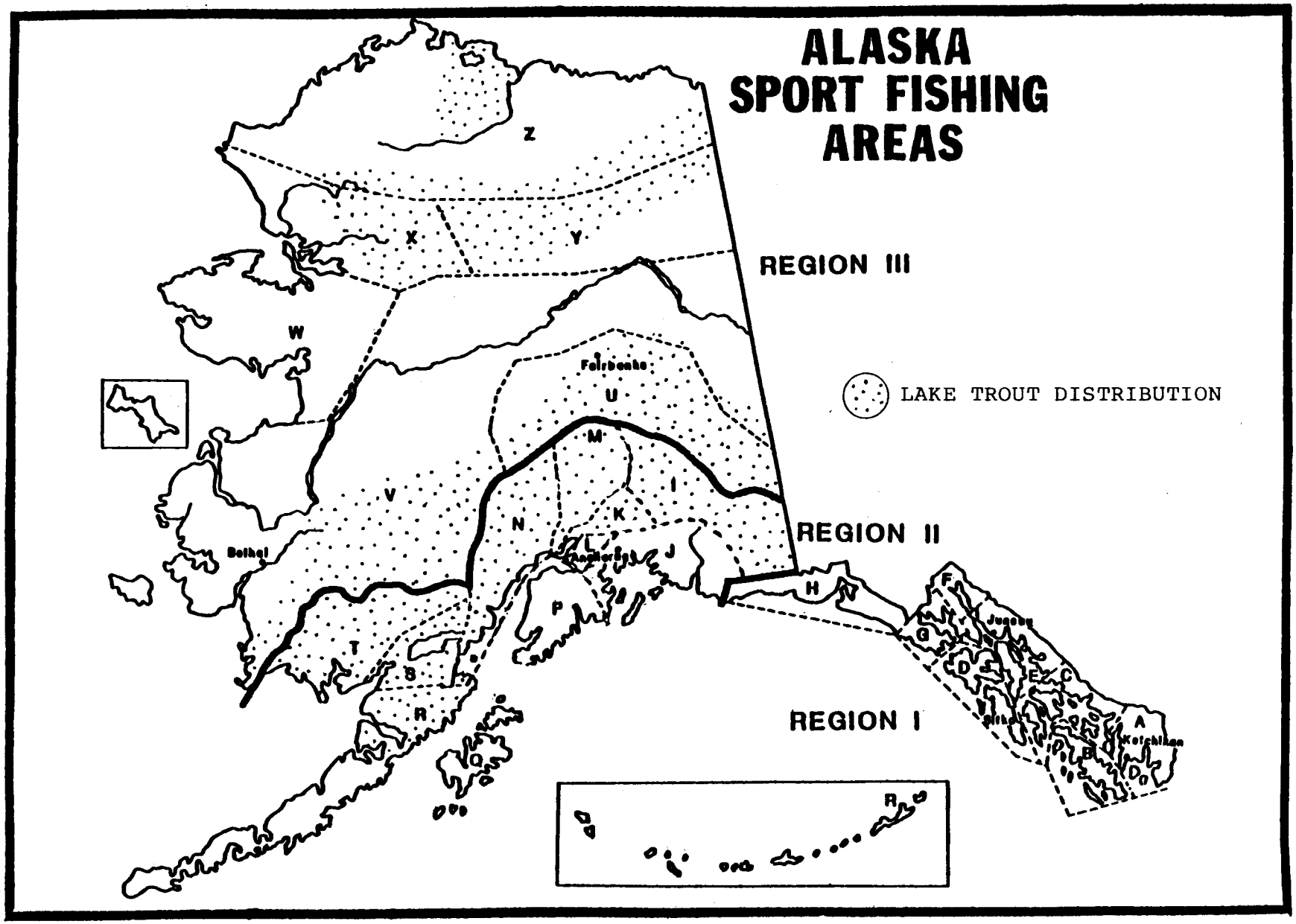

Figure 1. Alaska Sport Fishing Areas.

Table 1a. Lake trout distribution and size composition in Glennallen area, southcentral Alaska. (Area I).

Lake Name	Drainage	Fish Sampled	Length Range (mm)	Length Mean (mm)	Fish/Net Hr *	Author
36-Mile		9	289-592	398	ND	Williams (1966)
Gale		2	720-730	725	ND	Williams (1973)
Grayling		3	368-592	ND	ND	Williams (1971)
Raindrop		11	345-430	403	ND	Williams (1974)
Sally		32	260-490	419	ND	Sautner & Straton (1984)
Sandy					ND	Williams (1967)
Swan		1	...	660	ND	Williams (1966)
Little Twin		1	...	572	ND	Williams (1966)
10-Mile	Copper R.	8	ND	345	ND	Williams (1966)
Andy	Copper R.	45	180-635	338	ND	Williams (1974)
Big Swede	Copper R.	7	229-813	495	ND	Williams (1967)
Boulder	Copper R.	14	185-477	332	ND	Williams (1966)
Caribou	Copper R.	6	483-762	615	ND	Williams (1967)
Copper	Copper R.	22	150-760	446	ND	Williams (1969)
Crosswind	Copper R.	1	...	439	ND	Williams (1966)
Crosswind	Copper R.	2	415-565	ND	ND	Williams (1971)
Crosswind	Copper R.	10	457-909	744	ND	Williams (1965)
Crosswind	Copper R.	11	470-760	555	ND	Williams (1969)
Deep	Copper R.	14	536-721	647	ND	Williams (1968)
Dog	Copper R.	5	368-686	543	ND	Williams (1965)
Hanagita	Copper R.	18	327-673	408	ND	Williams (1964)
High	Copper R.	10	410-560	ND	ND	Williams (1971)
Indian Pass	Copper R.	32	170-415	333	ND	Williams (1974)
Indiana	Copper R.	3	510-600	553	ND	Williams (1968)
Keg	Copper R.	7	445-635	553	0.15	Williams (1976)
Kettle	Copper R.	1	...	575	ND	Williams (1977)
Kettle	Copper R.	2	375-388	365	ND	Williams (1974)
Kettle	Copper R.	1	...	355	ND	Williams (1972)
Kiana	Copper R.	8	390-670	ND	ND	Williams (1971)
Lee's Guide	Copper R.	1	...	690	ND	Williams (1971)
Little Swede	Copper R.	36	254-610	442	ND	Williams (1967)
Lower 12-Mile	Copper R.	ND	ND	ND	ND	Williams (1967)
Mankomen	Copper R.	25	150-820	ND	ND	Williams (1971)
Michigan	Copper R.	1	...	460	ND	Williams (1968)
Mile 36	Copper R.	7	245-620	349	ND	Williams (1972)
Minnesota	Copper R.	6	500-704	610	ND	Williams (1968)
Monsoon	Copper R.	8	200-622	ND	ND	Williams (1970)
Mosouto	Copper R.	18	400-730	569	ND	Williams (1972)
Octopus	Copper R.	1	...	168	ND	Williams (1966)
Octopus	Copper R.	6	420-673	545	0.02	Williams (1982)

(continued)

Table 1a (Cont'd). Lake trout distribution and size composition in Glennallen area, southcentral Alaska. (Area I).

Lake Name	Drainage	Fish Sampled	Length Range (mm)	Length Mean (mm)	Fish/Net Hr *	Author
Paxson	Copper R.	ND	ND	ND	ND	Van Wyhe & Peck
Summit	Copper R.	4	295-710	447	ND	Thomas & Namtvedt (1970)
Summit	Copper R.	4	356-470	401	ND	Williams (1967)
Suslota	Copper R.	1	...	140	ND	Williams (1974)
Tanada	Copper R.	5	249-686	533	ND	Williams (1966)
Tazlina	Copper R.	10	366-495	406	ND	Williams (1965)
Wisconsin	Copper R.	8	325-760	538	ND	Williams (1968)
Tokun	Martin	4	450-695	540	ND	Williams (1974)
Beaver	Susitna R.	6	295-780	ND	ND	Thomas & Namtvedt (1970)
Beaver	Susitna R.	9	572-737	675	ND	Williams (1965)
Clarence	Susitna R.	25	212-720	425	0.81	Williams (1978)
Crater	Susitna R.	12	390-550	ND	ND	Williams (1971)
Curtis	Susitna R.	2	520-670	ND	ND	Williams (1971)
Deadman	Susitna R.	32	285-795	525	ND	Sautner & Straton (1984)
Little Louise	Susitna R.	1		585	0.02	Williams (1982)
Louise	Susitna R.	33	384-914	591	ND	Williams (1964)
Louise	Susitna R.	5	415-610	498	0.06	Williams (1978)
Louise	Susitna R.	9	490-810	617	0.01	Williams (1978)
Louise (east #1)	Susitna R.	9	420-700	ND	ND	Williams (1983)
Susitna	Susitna R.	131	251-920	ND	ND	Williams (1966)
Susitna	Susitna R.	88	173-909	ND	ND	Williams (1967)

* Fish caught/hour in an experimental gill net.

NOTE: all lengths are fork lengths unless otherwise noted.

Table 1b. Lake trout distribution, Knik Arm drainages, southcentral Alaska. (Area K).

Area K Knik Arm Drainage:

Lake Name	Drainage	Fish Sampled	Length Range (mm)	Length Mean (mm)	Weight Range (g)	Weight Mean (g)	Fish/Net Hr *	Author
Big	Susitna	ND	ND	ND	ND	ND	ND	Mills (1984)
Nancy	Susitna	ND	ND	ND	ND	ND	ND	Mills (1984)
Byers	Susitna	ND	ND	ND	ND	ND	ND	Sonnichsen (1985)
Lucy	Susitna	ND	ND	ND	ND	ND	ND	Sonnichsen (1985)

* Fish caught/hour in an experimental gill net.

Table 1c. Lake trout distribution and size composition in the east Susitna drainage, southcentral Alaska. (Area M)

Lake Name	Drainage	Fish Sampled	Length Range (mm)	Length Mean (mm)	Fish/Net Hr *	Author
Clarence	Susitna R.	9	356-510	455	1.44	McGinnis (1965)
Stephen	Susitna R.	15	203-510	412	0.44	McGinnis (1965)
Butte	Susitna R.	ND	ND	ND	ND	ADF&G (1978)

* Fish caught/hour in an experimental gill net.

Table 1d. Lake trout distribution and size composition in west side Cook Inlet, southcentral Alaska. (Area N).

Lake Name	Drainage	Fish Sampled	Length Range (mm)	Length Mean (mm)	Fish/Net Hr *	Author
Crescent	Crescent R.	29	200-555	ND	ND	Russell (1980)
Chakachamna	McArthur R.	33	125-524	ND	ND	Russell (1980)
Chelatna	Susitna R.	24	305-457	363	0.84	McGinnis (1965)
Deadman	Susitna R.	8	254-500	467	ND	McGinnis (1966)
Shell	Susitna R.	4	ND	577	ND	McGinnis (1966)

* Fish caught/hour in an experimental gill net.

Table 1e. Lake trout distribution and size composition, Kenai Peninsula, southcentral Alaska. (Area P)

Lake Name	Drainage	Fish Sampled	Length Range (mm)	Length Mean (mm)	Weight Range (g)	Weight Mean (g)	Fish/Net Hr *	Author
Tustumena	Kasilof R.	ND	ND	ND	ND	ND	ND	ADF&G (1978)
Skilak	Kenai R.	156	233-497	345	ND	461	ND	Engel (1970)
Hidden	Kenai R.	ND	ND	ND	ND	ND	ND	ADF&G (1978)
Juneau	Kenai R.	ND	ND	ND	ND	ND	ND	ADF&G (1978)
Upper Trail	Kenai R.	ND	ND	ND	ND	ND	ND	ADF&G (1978)
Lower Trail	Kenai R.	ND	ND	ND	ND	ND	ND	ADF&G (1978)
Trout	Kenai R.	ND	ND	ND	ND	ND	ND	ADF&G (1978)
Swan	Kenai R.	29	200-555	ND	ND	ND	ND	ADF&G (1978)

* Fish caught/hour in an experimental gill net.

Table 1f. Lake trout distribution and size composition, Kvichak Drainage, southwestern Alaska. (Area S)

Lake Name	Fish Sampled	Length Range (mm)	Length Mean (mm)	Weight Range (g)	Weight Mean (g)	Fish/Net Hr *	Author
Hudson	7	ND	ND	ND	ND	ND	Russell (1980)
Kijik	5	ND	ND	ND	ND	ND	Russell (1980)
Kontrashibuna	71	150-485	ND	ND	ND	ND	Russell (1980)
Lachbuna	24	200-679	ND	ND	ND	ND	Russell (1980)
Lk Clark	47	258-781	ND	ND	ND	ND	Russell (1980)
Portage	29	168-542	ND	ND	ND	ND	Russell (1980)
Iliamna	25	215-660	490	863-1,816	1,044	ND	Metsker (1967)
Iliamna	3	500-635	571	953-1,090	1,453	ND	Metsker (1967)

* Fish caught/hour in an experimental gill net.

Table 1g. Lake trout distribution and size composition, Nushugak Area southwestern Alaska. (Area T)

Lake Name	Drainage	Fish Sampled	Length Range (mm)	Length Mean (mm)	Weight Total (lbs)	Author
Tikchik	Nuyakuk	86	ND	ND	ND	Redick (1967)
Tikchik	Nuyakuk	ND	ND	ND	ND	Yanagawa (1967)
		582* (Spring 1966)	ND	ND	2,689	
		710* (Fall 1966)	ND	ND	3,523	
		210* (Spring 1967)	ND	ND	1,055	
Chauekuktult	Nuyakuk	ND	ND	ND	ND	Yanagawa (1967)
Nuyakak	Nuyakuk	ND	ND	ND	ND	Yanagawa (1967)
Tikchik	Nuyakuk	ND	ND	ND	ND	Burgner et al (1965)
Fish Trap	Nushagak R.	8	ND	ND	ND	Russell (1980)
Snipe	Nushagak R.	6	ND	ND	ND	Russell (1980)
Turquoise	Nushagak R.	46	41-430	ND	ND	Russell (1980)
Twin Lakes	Nushagak R.	62	241-461	ND	ND	Russell (1980)

* Data retrieved from commercial fishery data.

Table 1h. Lake trout distribution and size composition, Tanana River drainage, Arctic-Yukon-Kuskokwim. (Area U)

Lake Name	Drainage	Fish Sampled	Length Range (mm)	Length Mean (mm)	Weight Range (g)	Weight Mean (g)	Fish/Net Hr *	Author
16.8	Delta R.	17	254-414	348	ND	ND	0.94	Peckham (1976)
16.8	Delta R.	14	274-500	350	ND	ND	0.29	Williams (1966)
Boulder	Delta R.	75	376-813	ND	508-6,265	ND	ND	Heckart (1964)
Fielding	Delta R.	5	450-690	530	ND	ND	ND	Peckham (1972)
Fielding	Delta R.	13	410-840	573	650-9,200	3,200	ND	Peckham (1983)
Fielding	Delta R.	16	358-680	472	ND	ND	ND	Heckart (1965)
Glacier	Delta R.	21	274-647	ND	ND	ND	0.55	Peckham (1975)
Glacier	Delta R.	21	274-645	432	ND	ND	0.55	Peckham (1976)
Glacier	Delta R.	26	236-541	399	ND	ND	.01	Williams (1972)
Landmark Gap	Delta R.	34	274-571	399	ND	ND	0.94	Peckham (1976)
Seven Mile	Delta R.	28	290-470	408	ND	ND	ND	Williams (1976)
Seven Mile	Delta R.	52	287-475	381	ND	ND	ND	Williams (1966)
Seven Mile	Delta R.	254	183-457	345	ND	ND	1.76	Peckham (1976)
Seven Mile	Delta R.	31	400-455	430	ND	ND	ND	Williams (1974)
Tangle (Long)	Delta R.	3	203-417	300	ND	ND	ND	Heckart (1965)
Tangle (Round)	Delta R.	14	226-417	315	ND	ND	ND	Heckart (1965)
Tangle (Upper)	Delta R.	4	246-554	398	ND	ND	ND	Heckart (1965)
Tangle (L. Lock)	Delta R.	26	299-470	368	ND	ND	0.61	Peckham (1976)
Two-Bit	Delta R.	79	179-437	ND	27-908	ND	ND	Heckart (1964)
Two-Bit	Delta R.	59	120-420	341	ND	ND	2.68	Peckham (1975)
Harding	Tanana R.	6	393-821	691	ND	ND	ND	Peckham (1971)
Harding	Tanana R.	4	533-686	633	ND	ND	ND	Spetz (1969)
Harding	Tanana R.	5	478-767	650	ND	ND	ND	Heckart (1965)
Harding	Tanana R.	1	...	540	ND	ND	ND	Peckham (1972)
Monte	Tanana R.	17	262-396	359	ND	ND	ND	Heckert & Roguski (1966)
Monte	Tanana R.	50	220-422	371	ND	ND	ND	Heckart (1964)
Beaver	White R.	6	330-775	472	681-6,129	2,270	0.08	Pearse (1975)
Ptarmigan	White R.	12	355-813	533	345-6,492	2,247	0.05	Pearse (1975)
Rock	White R.	9	381-470	424	499-1,180	813	0.28	Pearse (1975)

* Fish caught/hour in an experimental gill net.

Table 1i. Lake trout distribution and size composition, interior Alaska, Arctic-Yukon-Kuskokwim. (Area V)

Lake Name	Drainage	Fish Sampled	Length Range (mm)	Length Mean (mm)	Weight Range (g)	Weight Mean (g)	Fish/Net Hr	Author
	KUSKOKWIM BAY							
Asriguat		1	ND	ND	ND	ND	ND	Alt (1977)
Canyon		30	277-485	437	250-1,250	927	0.02	Alt (1977)
Goodnews		7	432-576	517	1,200-2,600	1,835	0.15	Alt (1977)
N. Middle Fk		24	405-533	461	1,000-2,275	1,177	0.05	Alt (1977)
S. Middle Fk		15	387-773	487	600-6,500	1,613	0.31	Alt (1977)
Kukaktlim		1	ND	ND	ND	ND	0.04	Alt (1977)
Kagati		4	357-521	454	450-1,650	1,000	0.08	Alt (1977)
Kanuktik		18	367-730	465	500-5,700	1,398	0.38	Alt (1977)
Klak		4	425-523	458	1,050-1,800	1,360	0.08	Alt (1977)
Ohnlik		9	400-447	415	750-1,200	872	0.38	Alt (1977)
Arolik		38	359-735	425	500-6,100	1,150	0.04	Alt (1977)
	KUSKOKWIM R.							
Aniak	Aniak R.	21	275-590	454	275-2,250	1,116	0.22	Alt (1977)
Kisaralik	Kisaralik R.	8	465-700	498	1,000-3,900	1,550	0.08	Alt (1977)
Kisaralik #2	Kisaralik R.	17	219-860	495	250-12,040	2,186	0.24	Alt (1977)
Telaquana	Stoney R.	20	408-536	ND	ND	ND	ND	Russell (1980)
Two Lakes	Stoney R.	3	ND	ND	ND	ND	ND	Russell (1980)

* Fish caught/hour in an experimental gill net.

Table 1j. Lake trout distribution and size composition, northwest Alaska, Arctic-Yukon-Kuskokwim. (Area X)

Lake Name	Drainage	Fish Sampled	Length Range (mm)	Length Mean (mm)	Weight Range (g)	Weight Mean (g)	Fish/Net Hr *	Author
Minakakosa	Kobuk	3	508-660	588	ND	ND	ND	Roguski (1968)
Selby	Kobuk	3	530-686	585	ND	ND	ND	Roguski (1968)
Walker	Kobuk	15	165-838	523	ND	ND	ND	Roguski (1968)
Feniak	Noatak R.	10	390-780	558	ND	ND	ND	Alt (1978)
Matcharak	Noatak R.	4	480-570	535	ND	ND	ND	Alt (1978)
Kikitaliorak	Noatak R.	4	390-558	474	ND	ND	ND	Alt (1978)
Kiingyak	Noatak R.	2	565-590	577	ND	ND	ND	Alt (1978)
Desperation	Noatak R.	2	480-485	483	ND	ND	ND	Alt (1978)
Kipmuk	Noatak R.	1	...	512	ND	ND	ND	Alt (1978)
Inyorurak Pass	Noatak R.	ND	ND	ND	ND	ND	ND	Bendock (1978)
Kikitaliorak	Noatak R.	ND	ND	ND	ND	ND	ND	Bendock (1978)
Burial	Noatak R.	ND	ND	ND	ND	ND	ND	DeCicco pers comm

* Fish caught/hour in an experimental gill net.

Table 1k. Lake trout distribution and size composition, south slope Brooks Range, Arctic-Yukon-Kuskokwim. (Area Y)

Lake Name	Drainage	Fish Sampled	Length Range (mm)	Length Mean (mm)	Weight Range (g)	Weight Mean (g)	Fish/Net Hr *	Author
Helpmejack	Alatna R.	2	610-648	629	ND	ND	ND	Roguski (1968)
Helpmejack	Alatna R.	1	...	600	...	2,780	ND	Pearse (1978)
Iniakuk	Alatna R.	3	360-655	497	460-3,200	1,578	ND	Pearse (1978)
Iniakuk	Alatna R.	1	...	575	...	...	ND	Roguski (1968)
Ackerman	Chandalar R.	12	100-560	438	680-1,920	981	ND	Pearse (1978)
Ackerman	Chandalar R.	5	399-450	419	ND	ND	0.01	Kramer (1976)
Chandalar	Chandalar R.	5	442-617	531	910-2,160	ND	0.13	Roguski (1968)
Chandalar	Chandalar R.	8	274-500	386	113-1,362	545	0.08	Kramer (1976)
Chandalar	Chandalar R.	1	...	236	...	...	ND	Kramer (1976)
Chandalar	Chandalar R.	4	510-541	530	1,135-1,476	1,317	0.18	Kramer (1976)
Chandalar	Chandalar R.	24	235-702	481	220-3,700	1,210	ND	Pearse (1978)
Squaw	Chandalar R.	1	...	515	...	1,332	ND	Pearse (1978)
Squaw	Chandalar R.	3	457-597	533	765-1,900	1,380	ND	Roguski (1968)
Big	Koyukuk R.	1	...	325	...	908	0.02	Kramer (1976)
Big	Koyukuk R.	4	326-720	589	907-4,300	2,914	ND	Pearse (1978)
Twin	Koyukuk R.	18	315-820	505	340-7,031	1,903	ND	Pearse (1978)
Twin	Koyukuk R.	6	399-828	566	635-7,037	2,542	0.12	Kramer (1976)
Wild	Koyukuk R.	6	440-720	595	900-3,750	2,480	ND	Pearse (1978)
Wild	Koyukuk R.	4	419-686	519	ND	ND	ND	Roguski (1968)
Old John	Sheenjek R.	11	375-1,041	636	460-12,268	4,199	ND	Pearse (1978)
Old John	Sheenjek R.	75	114-903	ND	ND	ND	ND	Craig & Wells (1975)
Agiak	John R.	6	500-580	536	1,300-2,200	1,733	ND	Bendock & Burr (1985)

* Fish caught/hour in an experimental gill net.

Table 1L. Lake trout distribution and size composition, north slope Brooks Range, Arctic-Yukon-Kuskokwim. (Area Z)

Lake Name	Drainage	Fish Sampled	Length Range (mm)	Length Mean (mm)	Weight Range (g)	Weight Mean (g)	Fish/Net Hr *	Author
CL-M-11	Anaktuvuk R.	ND	ND	ND				Bendock & Burr unpubl.
Irgnyivik	Anaktuvuk R.	19	282-757	ND	200,6,200			Bendock (1982)
Nanushuk	Anaktuvuk R.	ND	ND	ND				Bendock & Burr unpubl.
Natvakruak	Anaktuvuk R.	6	272-652	ND	180-3,600			Bendock (1982)
Shainin	Anaktuvuk R.	14	255-758	468	168-4,000	1,318		Furniss (1974)
Shainin	Anaktuvuk R.	11	457-800	604	820-6,010	2,590		Roguski (1968)
Shainin	Anaktuvuk R.	26	345-726	ND	ND			Bendock (1979)
Sitchiak	Anaktuvuk R.	ND	ND	ND	ND			Bendock & Burr unpubl.
Tulugak	Anaktuvuk R.	7	440-810	553	900-6,400	2,529		Bendock (1982)
"Lower Anayak"	Anaktuvuk R.	9	251-865	ND	120-8,500			Bendock (1982)
---	Anaktuvuk R.	1	...	400	...	740		Bendock & Burr unpubl.
MT-C-3	Canning R.	ND	ND	ND	ND			Bendock & Burr unpubl.
MT-C-4	Canning R.	ND	ND	ND	ND			Bendock & Burr unpubl.
Amiloyak	Chandler R.	ND	ND	ND	ND			Bendock & Burr unpubl.
Chandler	Chandler R.	78	375-927	528	506-12,474	1,754		Furniss (1974)
Chandler	Chandler R.	5	442-617	531	910-2,160			Roguski (1968)
Chandler	Chandler R.	35	55-984	ND	30,10,050			Bendock & Burr unpubl.
Fish (CL-M-3)	Chandler R.	ND	ND	ND	ND			Bendock & Burr unpubl.
Little Chandler	Chandler R.	ND	ND	ND	ND			Bendock & Burr unpubl.
White	Chandler R.	ND	ND	ND	ND			Bendock & Burr unpubl.
---	Chandler R.	ND	ND	ND	ND			Bendock (1979)
TA-C-35	Chipp R.	2	522-550	ND	1,800-2,450			Bendock & Burr unpubl.
TA-C-9	Chipp R.	ND	ND	ND	ND			Bendock & Burr unpulb.
---	Colville R.	14	385-768	ND	560-4,350			Bendock (1979)
Betty	Etivluk R.	9	489-662	ND	1,450-2,850			Bendock (1979)
Etivluk	Etivluk R.	18	405-774	ND	620-4,500			Bendock (1979)

(Continued)

Table 1L (Cont'd). Lake trout distribution and size composition, north slope Brooks Range, Arctic-Yukon-Kuskokwim. (Area Z)

Lake Name	Drainage	Fish Sampled	Length Range (mm)	Length Mean (mm)	Weight Range (g)	Weight Mean (g)	Fish/Net Hr *	Author
Tukuto	Etivluk R.	7	515-610	ND	1,700-2,500	ND	ND	Bendock (1979)
"Nigu" (HP-F-11)	Etivluk R.	4	415-460	ND	700-1,100	ND	ND	Bendock & Burr unpubl.
---	Etivluk R.	ND	ND	ND	ND	ND	ND	Bendock (1979)
HB-C-25 (C-119)	Fish Cr.	3	487-908	656	1,400-9,300	4,400	ND	Bendock & Burr (1984a, b)
HB-C-3 (C-67)	Fish Cr.	ND	ND	ND	ND	ND	ND	Bendock & Burr unpubl.
IR-C-7 (C-52)	Fish Cr.	9	500-725	567	1,400-4,600	2,144	ND	Bendock & Burr (1984a, b)
IR-C-13 (C-116)	Ikpikpuk R.	6	447-814	547	1,100-7,000	2,375	ND	Bendock & Burr (1984a, b)
IR-C-14 (C-117)	Ikpikpuk R.	5	510-745	649	1,900-5,100	ND	ND	Bendock & Burr (1984a, b)
IR-C-15 (C-126)	Ikpikpuk R.	2	546-585	566	2,000-2,400	2,200	ND	Bendock & Burr (1984a, b)
IR-C-2	Ikpikpuk R.	ND	ND	ND	ND	ND	ND	Bendock & Burr unpubl.
IR-C-3	Ikpikpuk R.	ND	ND	ND	ND	ND	ND	Bendock & Burr (1984a, b)
TA-C-13	Ikpikpuk R.	ND	ND	ND	ND	ND	ND	Bendock & Burr (1984a, b)
TA-C-14	Ikpikpuk R.	ND	ND	ND	ND	ND	ND	Bendock & Burr (1984a, b)
TA-C-15	Ikpikpuk R.	ND	ND	ND	ND	ND	ND	Bendock & Burr (1984a, b)
TA-C-16	Ikpikpuk R.	ND	ND	ND	ND	ND	ND	Bendock & Burr (1984a, b)
TA-C-17	Ikpikpuk R.	ND	ND	ND	ND	ND	ND	Bendock & Burr (1984a, b)
TA-C-18 (C-40)	Ikpikpuk R.	2	594-615	605	2,900-3,200	3,050	ND	Bendock & Burr (1984a, b)
TA-C-19 (C-41)	Ikpikpuk R.	3	497-531	517	1,600-1,800	1,733	ND	Bendock & Burr (1984a, b)
TA-C-20 (C-50)	Ikpikpuk R.	1	...	630	...	3,500	ND	Bendock & Burr (1984a, b)
TA-C-22 (C-59)	Ikpikpuk R.	4	370-647	557	580-4,000	2,845	ND	Bendock & Burr (1984a, b)
TA-C-23 (C-120)	Ikpikpuk R.	5	640-717	685	3,600-6,000	4,520	ND	Bendock & Burr (1984a, b)
TA-C-25 (C-122)	Ikpikpuk R.	12	480-592	530	1,400-2,800	1,879	ND	Bendock & Burr (1984a, b)
TA-C-27 (C-124)	Ikpikpuk R.	4	476-550	527	1,400-2,400	2,025	ND	Bendock & Burr (1984a, b)
TA-C-28 (C-125)	Ikpikpuk R.	1	...	697	...	5,200	ND	Bendock & Burr (1984a, b)
TA-C-3	Ikpikpuk R.	ND	ND	ND	ND	ND	ND	Bendock & Burr unpubl.
Teshekpuk	Ikpikpuk R.	24	442-892	733	1,050-9,000	5,327	ND	Bendock & Burr (1984a, b)

(Continued)

Table 1L (Cont'd). Lake trout distribution and size composition, north slope Brooks Range, Arctic-Yukon-Kuskokwim. (Area Z)

Lake Name	Drainage	Fish Sampled	Length Range (mm)	Length Mean (mm)	Weight Range (g)	Weight Mean (g)	Fish/Net Hr *	Author
Itgaknit	Itkillik R.	23	275-573	ND	200-2,316	ND	ND	Bendock & Burr unpubl.
Itkillik	Itkillik R.	39	325-777	464	362-1,364	1,118	ND	Furniss (1974)
Itkillik	Itkillik R.	203	247-852	ND	ND	ND	ND	McCart, Craig & Bain (1971)
Itkillik	Itkillik R.	6	390-452	420	ND	ND	ND	Winslow & Roguski (1970)
PS-M-19 (M-60)	Itkillik R.	ND	ND	ND	ND	ND	ND	Bendock & Burr unpubl.
HB-C-23 (C-57)	Kalikpik R.	1	...	890	...	9,700	ND	Bendock & Burr (1984a, b)
HB-C-24 (C-58)	Kalikpik R.	2	662-765	714	3,900-4,550	4,225	ND	Bendock & Burr (1984a, b)
Imiaknikpak	Killik R.	ND	ND	ND	ND	ND	ND	Bendock & Burr unpubl.
---	Killik R.	ND	ND	ND	ND	ND	ND	Bendock (1979)
Toolik	Kuparuk R.	26	115-475	363	20-1,110	583	ND	Bendock & Burr unpubl.
N. Itgaknit	Kuparuk R.	19	275-500	ND	ND	ND	ND	Bendock (1980)
"Kuparuk"	Kuparuk R.	12	295-455	ND	250-693	ND	ND	Alt & Furnis (1976)
Cascade	Kurupa R.	10	155-495	ND	50-1,100	ND	ND	Bendock & Burr unpubl.
Kurupa	Kurupa R.	26	65-788	ND	-5,500	ND	ND	Bendock & Burr unpubl.
Okpilik	Okpilik R.	ND	ND	ND	ND	ND	ND	Bendock & Burr unpubl.
Peters	Sadlerochit R.	ND	ND	ND	ND	ND	ND	Bendock & Burr unpubl.
Schraders	Sadlerochit R.	ND	ND	ND	ND	ND	ND	Bendock & Burr unpubl.
Campsite	Sagavanirktok R.	9	155-760	465	30-6,000	1,711	ND	Bendock (1980)
"Island"	Sagavanirktok R.	1	...	600	...	2,700	ND	Bendock & Burr unpubl.
Campsite	Sagavanirktok R.	68	136-753	ND	ND	ND	ND	McCart, Craig & Bain (1971)
Elusive	Sagavanirktok R.	19	246-797	536	126-7,500	2,248	ND	Bendock & Burr (1985)
Elusive	Sagavanirktok R.	49	318-867	510	359-7,954	1,685	ND	Furniss (1974)
Elusive	Sagavanirktok R.	1	...	450	ND	ND	ND	Winslow & Roguski (1970)
Galbraith	Sagavanirktok R.	23	120-755	ND	20-4,400	ND	ND	Bendock & Burr unpubl.
PS-M-17 (M-37)	Sagavanirktok R.	ND	ND	ND	ND	ND	ND	Bendock & Burr unpubl.

(Continued)

Table 1L (Cont'd). Lake trout distribution and size composition, north slope Brooks Range, Arctic-Yukon-Kuskokwim. (Area Z)

Lake Name	Drainage	Fish Sampled	Length Range (mm)	Length Mean (mm)	Weight Range (g)	Weight Mean (g)	Fish/Net Hr *	Author
PS-M-24 (M-72)	Sagavanirktok R.	2	232-362	297	140-500	320	ND	Bendock & Burr (1984)
PS-M-25 (M-73)	Sagavanirktok R.	4	330-3,100	420	330-3,100	1,089	ND	Bendock & Burr (1984)
PS-M-26 (M-74)	Sagavanirktok R.	5	375-469	407	500-940	693	ND	Bendock & Burr (1984)
PS-M-29 (M-77)	Sagavanirktok R.	3	387-765	514	600-6,500	2,566	ND	Bendock & Burr (1984)
SA-F-4	Sagavanirktok R.	ND	ND	ND	ND	ND	ND	Bendock & Burr unpubl.
Wahoo	Sagavanirktok R.	ND	ND	ND	ND	ND	ND	Bendock & Burr unpubl.
"Tea" (PS-M-14)	Sagavanirktok R.	ND	ND	ND	ND	ND	ND	Bendock & Burr unpubl.

* Fish caught/hour in an experimental gill net.

beyond age 5, otolith ages exceeded those determined from scales for lake trout from Itkillik Lake on the North Slope[1]. These authors feel that ages determined from otoliths are probably conservative.

Age and Growth

There can be considerable variability in the growth of lake trout of the same year class within a population and between populations, particularly in older age classes (Table 2). In Arctic populations, lake trout tend to grow slower and may reach a greater age than in the more southerly Alaskan populations. However, ages from the southern populations were generally determined from scales, while those from Arctic populations were determined from otoliths. The differences are amplified because growth rates determined from otoliths are lower than those determined from scales. McCart et al. (1972) compared growth of lake trout from Campsite Lake and Itkillik Lake from the North Slope (Area Z) with Great Bear Lake in Canada and with Summit Lake (Area I) in interior Alaska. They found lake trout from Campsite Lake grew slower than those in Great Bear Lake (Figure 2a). Growth of young lake trout from Itkillik Lake was faster than that in Campsite or Great Bear Lake. However, growth of older lake trout was slower in Itkillik than in the other lakes. McCart et al. (1972) tempered their comparisons by noting that:

1. The samples from the North Slope localities were small;

2. The selectivities of the sampling methods were not known; and

3. Growth rates from the Great Bear and Summit lake populations were determined by the scale method and thus, ages may have been underestimated.

Craig and Wells (1975) found that growth of lake trout from Old John Lake (Area Y) was slower than that observed in more southerly latitudes, but faster than in Itkillik Lake north of the Brooks Range (Figure 2b). Growth rate of lake trout from Old John Lake was similar to that of the Great Bear Lake population. Alt (1977) concluded from scale ages that growth of lake trout in the Kuskokwim drainage is generally slower than that reported for other waters in interior Alaska and in Great Slave Lake in Canada, but is more rapid than growth of lake trout in lakes of the Brooks Range and in Great Bear Lake, Canada (Figure 2c).

Little is known of the growth of young lake trout (less than age 8) in Alaska. Alt (1977) captured only two lake trout younger than age 8 from lakes in the Kuskokwim drainage. In another study on Old John Lake, only a single lake trout younger than age 8 was captured and that fish was found in the stomach of a larger lake trout (Craig and Wells 1975). Studies of other populations of lake trout in Alaska have also obtained little information on young fish (Table 2). Although the cause for poor representation of the younger age classes is not known, possibilities

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[1] Dubois and Legeux (1968) feel that after age 4, otoliths provide a more accurate estimate of age for lake trout from Quebec.

Table 2. Lake trout age and length data from Alaskan lakes.

Lake	Drainage	Author	Age and Length At Capture (Sample Sizes): 1	2	3	4	5
Helpmejack (s)	Alatna	Roguski (1968)	...	...	...	...	...
Irgnyivik (o) n=19	Anaktuvuk	Bendock (1982)	...	...	...	...	...
Shainin (o) n=14	Anaktuvuk	Furniss (1974)	...	...	...	...	...
Shainin (o) n=16	Anaktuvuk	Bendock (1979)	...	...	...	...	...
Shainin (s) n=11	Anaktuvuk	Roguski (1968)	...	...	...	...	...
Ackerman (o) n=11	Chandalar	Pearse (1978)	119*	161*	195*	226*	252*
Chandalar (o) n=20	Chandalar	Pearse (1978)	128*	182*	236*	271*	307*
Chandalar (s) n=5	Chandalar	Roguski (1968)	...	...	...	...	...
Chandler (o) n=35	Chandler	Bendock (1979)	55 (1)	...	...	...	249 (2)
Chandler (o) n=67	Chandler	Furniss (1974)	...	...	...	...	...
Paxson (s) n=101	Copper	Van Wyhe & Peck (1968)	64*	122*	180*	236*	290*
Summit (s) n=106	Copper	Van Wyhe & Peck (1968)	56*	102*	155*	213*	267*
Etivluk (o) n=18	Etivluk	Bendock (1979)	...	...	...	...	...
Teshshekpuk (o) n=24	Ikpikpuk	Bendock & Burr (1984)	...	...	...	...	...
TA-C-25 (o) n=12	Ikpikpuk	Bendock & Burr (1984)	...	...	...	...	...
Itkillik (o) n=28	Itkillik	Furniss (1974)	...	...	...	...	...
Itkillik (o) n=87	Itkillik	McCart et al. (1972)	...	...	...	...	320 (1)
Itkillik (s)	Itkillik	Winslow & Roguski (1970)	...	...	...	...	...
Itkillik (s) n=116	Itkillik	McCart et al. (1972)	...	...	...	...	...
Minskakoss (s)	Kobuk	Roguski (1968)	...	...	...	...	...
Selby (s)	Kobuk	Roguski (1968)	...	...	...	...	...
Walker (s) n=12	Kobuk	Roguski (1968)	...	...	...	...	377 (2)
South Twin (o) n=13	Koyukuk	Pearse (1978)	123*	170*	208*	241*	268*
Wild (s) n=3	Koyukuk	Roguski (1968)	...	...	...	...	...
Kuparuk (o) n=6	Kuparuk	Alt & Furniss (1976)	...	...	...	...	...
Toolik (o) n=25	Kuparuk	Pearse (1978)	93*	133*	159*	187*	213*
Kurupa (o) n=24	Kurupa	Bendock & Burr unpubl.	65 (1)	95 (1)	130 (1)	137 (1)	165 (1)
Aniak (s) n=25	Kuskokwim	Alt (1977)	...	...	...	...	290 (2)
Arolik (s) n=39	Kuskokwim	Alt (1977)	...	...	...	...	...
Canyon (s) n=32	Kuskokwim	Alt (1977)	...	...	...	...	...
Goodnews (s) n=24	Kuskokwim	Alt (1977)	...	...	...	...	...
Kanuktik (s) n=20	Kuskokwim	Alt (1977)	...	...	...	...	...
Kisarolik #2 (s) n=20	Kuskokwim	Alt (1977)	...	...	...	...	...
Kisarolik (s) n=21	Kuskokwim	Alt (1977)	...	...	...	...	...
N. Middle Fk. (s) n=17	Kuskokwim	Alt (1977)	...	...	...	...	...
Ohnlik (s) n=9	Kuskokwim	Alt (1977)	...	...	...	...	...
S. Middle Fk. (s) n=24	Kuskokwim	Alt (1977)	...	...	...	...	...
Desperation (s) n=2	Noatak	Alt (1978)	...	...	...	...	...
Feniak (s) n=10	Noatak	Alt (1978)	...	...	...	...	...
Kiingyak (s) n=2	Noatak	Alt (1978)	...	...	...	...	...
Kikitaliorak (s) n=4	Noatak	Alt (1978)	...	...	...	...	...
Kipmuk (s) n=1	Noatak	Alt (1978)	...	...	...	...	...
Metcharak (s) n=4	Noatak	Alt (1978)	...	...	...	...	...
Campsite (o) n=68	Sagavanirktok	McCart et al. (1972)	...	...	136 (4)	151 (1)	183 (4)
Elusive (o) n=44	Sagavanirktok	Furniss (1974)	...	...	...	...	...
Elusive (s)	Sagavanirktok	Winslow & Roguski (1970)	...	...	...	...	...
Galbrath (o) n=22	Sagavanirktok	Pearse (1978)	131*	187*	243*	280*	336*
Old John (o) n=75.	Sheenjek	Craig & Wells (1975)	...	114 (1)	...	...	
Deadman (s) n=4	Susitna	Sautner & Straton (1984)	...	...	...	..	...
Susitna (s) n=78	Susitna	Williams (1967)	...	...	173 (1)	...	345 (4)
Susitna (s) n=131	Susitna	Williams (1966)	...	...	...	251 (1)	348 (4)
Boulder (s) n=5	Tanana	Heckert (1965)	...	...	...	...	...
Fielding (o) n=28	Tanana	Peckham (1983)	...	...	...	...	...
Two Bit (s) N=9	Tanana	Heckert (1964)	...	...	...	...	...

-Continued-

Table 2. Lake trout age and length data from Alaskan lakes (continued).

Lake	Drainage	Author	Age and Length At Capture (Sample Sizes): 6	7	8	9	10
Helpmejack (s)	Alatna	Roguski (1968)	...	...	...	629 (2)	...
Irgnyivik (o) n=19	Anaktuvuk	Bendock (1982)	...	282 (1)	311 (2)	...	...
Shainin (o) n=14	Anaktuvuk	Furniss (1974)	255(1)	...	...	369 (3)	...
Shainin (o) n=16	Anaktuvuk	Bendock (1979)	...	...	...	...	373 (2)
Shainin (s) n=11	Anaktuvuk	Roguski (1968)	457(1)	481 (2)	520 (1)	553 (2)	658 (1)
Ackerman (o) n=11	Chandalar	Pearse (1978)	282*	308*	329*	351*	365*
Chandalar (o) n=20	Chandalar	Pearse (1978)	343*	379*	397*	415*	451*
Chandalar (s) n=5	Chandalar	Roguski (1968)	...	458 (2)	533 (1)	604 (2)	...
Chandler (o) n=35	Chandler	Bendock (1979)	273(1)	...	320 (1)	305 (1)	396 (1)
Chandler (o) n=67	Chandler	Furniss (1974)	...	...	...	...	...
Paxson (s) n=101	Copper	Van Wyhe & Peck (1968)	363*	429*	493*	511*	594*
Summit (s) n=106	Copper	Van Wyhe & Peck (1968)	320*	370*	411*	455*	490*
Etivluk (o) n=18	Etivluk	Bendock (1979)	...	405 (1)	...	...	...
Teshshekpuk (o) n=24	Ikpikpuk	Bendock & Burr (1984)	...	472 (3)	500 (1)	555 (2)	...
TA-C-25 (o) n=12	Ikpikpuk	Bendock & Burr (1984)	...	...	...	...	496 (1)
Itkillik (o) n=28	Itkillik	Furniss (1974)	...	328 (1)	361 (4)	381 (4)	389 (1)
Itkillik (o) n=87	Itkillik	McCart et al. (1972)	247(1)	348 (1)	344 (3)	359 (3)	379 (4)
Itkillik (s)	Itkillik	Winslow & Roguski (1970)	...	...	402 (3)	433 (2)	452 (1)
Itkillik (s) n=116	Itkillik	McCart et al. (1972)	...	284 (2)	364 (2)	379 (7)	412 (14)
Minskakoss (s)	Kobuk	Roguski (1968)	...	597 (1)	...	...	660 (1)
Selby (s)	Kobuk	Roguski (1968)	...	535 (2)	...	686 (1)	...
Walker (s) n=12	Kobuk	Roguski (1968)	...	495 (1)	515 (4)	533 (1)	640 (1)
South Twin (o) n=13	Koyukuk	Pearse (1978)	290*	316*	339*	358*	344*
Wild (s) n=3	Koyukuk	Roguski (1968)	428(2)	...	...	523 (1)	686 (1)
Kuparuk (o) n=6	Kuparuk	Alt & Furniss (1976)	...	...	...	...	295 (1)
Toolik (o) n=25	Kuparuk	Pearse (1978)	236*	257*	270*	287*	304*
Kurupa (o) n=24	Kurupa	Bendock & Burr unpubl.	227(1)	...	403 (1)	250 (2)	278 (1)
Aniak (s) n=25	Kuskokwim	Alt (1977)	...	...	410 (1)	416 (3)	436 (6)
Arolik (s) n=39	Kuskokwim	Alt (1977)	...	...	384 (1)	377 (5)	395 (6)
Canyon (s) n=32	Kuskokwim	Alt (1977)	277(1)	318 (1)	312 (1)	413 (2)	431 (5)
Goodnews (s) n=24	Kuskokwim	Alt (1977)	...	...	420 (2)	466 (2)	470 (3)
Kanuktik (s) n=20	Kuskokwim	Alt (1977)	...	...	369 (2)	404 (4)	424 (6)
Kisarolik #2 (s) n=20	Kuskokwim	Alt (1977)	219(1)	...	380 (1)	415 (1)	445 (2)
Kisarolik (s) n=21	Kuskokwim	Alt (1977)	...	...	...	...	...
N. Middle Fk. (s) n=17	Kuskokwim	Alt (1977)	...	...	...	405 (1)	449 (6)
Ohnlik (s) n=9	Kuskokwim	Alt (1977)	...	...	404 (3)	417 (3)	424 (3)
S. Middle Fk. (s) n=24	Kuskokwim	Alt (1977)	...	...	404 (1)	432 (4)	472 (6)
Desperation (s) n=2	Noatak	Alt (1978)	...	...	480	485	...
Feniak (s) n=10	Noatak	Alt (1978)	...	...	...	390	...
Kiingyak (s) n=2	Noatak	Alt (1978)	...	...	...	...	...
Kikitaliorak (s) n=4	Noatak	Alt (1978)	...	...	...	390	...
Kipmuk (s) n=1	Noatak	Alt (1978)	...	...	...	...	...
Metcharak (s) n=4	Noatak	Alt (1978)	...	...	...	...	...
Campsite (o) n=68	Sagavanirktok	McCart et al. (1972)	...	232 (3)	...	336 (1)	261 (1)
Elusive (o) n=44	Sagavanirktok	Furniss (1974)	...	341 (3)	395 (3)	365 (4)	...
Elusive (s)	Sagavanirktok	Winslow & Roguski (1970)	...	...	...	...	450 (1)
Galbrath (o) n=22	Sagavanirktok	Pearse (1978)	376*	410*	429*	466*	484*
Old John (o) n=75	Sheenjek	Craig & Wells (1975)	...	...	339 (3)	348 (5)	364 (2)
Deadman (s) n=4	Susitna	Sautner & Straton (1984)	...	...	...	...	...
Susitna (s) n=78	Susitna	Williams (1967)	439(6)	490 (4)	506 (4)	579 (14)	612 (5)
Susitna (s) n=131	Susitna	Williams (1966)	411(8)	457 (10)	493 (11)	582 (12)	643 (16)
Boulder (s) n=5	Tanana	Heckert (1965)	...	...	...	...	...
Fielding (o) n=28	Tanana	Peckham (1983)	352(4)	419 (2)	445 (6)	502 (6)	...
Two Bit (s) N=9	Tanana	Heckert (1964)	...	361 (2)	...	...	366 (1)

-Continued-

Table 2. Lake trout age and length data from Alaskan lakes (continued).

Lake	Drainage	Author	Age and Length At Capture (Sample Sizes): 11	12	13	14	15
Helpmejack (s)	Alatna	Roguski (1968)	...	...	...	...	...
Irgnyivik (o) n=19	Anaktuvuk	Bendock (1982)	...	381 (2)	...	...	...
Shainin (o) n=14	Anaktuvuk	Furniss (1974)	...	456 (2)	642 (1)	469 (3)	490 (3)
Shainin (o) n=16	Anaktuvuk	Bendock (1979)	405(3)	382 (1)	412 (1)	449 (2)	...
Shainin (s) n=11	Anaktuvuk	Roguski (1968)	715(3)	...	800 (1)	...	...
Ackerman (o) n=11	Chandalar	Pearse (1978)	381*	391*	408*	419*	428*
Chandalar (o) n=20	Chandalar	Pearse (1978)	469*	487*	505*	505*	523*
Chandalar (s) n=5	Chandalar	Roguski (1968)	...	...	...	...	...
Chandler (o) n=35	Chandler	Bendock (1979)	376(2)	391 (2)	532 (3)	425 (1)	...
Chandler (o) n=67	Chandler	Furniss (1974)	...	520 (1)	432 (3)	426 (9)	447 (15)
Paxson (s) n=101	Copper	Van Wyhe & Peck (1968)	635*	737*	780*	...	...
Summit (s) n=106	Copper	Van Wyhe & Peck (1968)	549*	612*	709*	813*	...
Etiyluk (o) n=18	Etivluk	Bendock (1979)	...	407 (1)	...	430 (1)	464 (1)
Teshshekpuk (o) n=24	Ikpikpuk	Bendock & Burr (1984)	...	...	...	...	...
TA-C-25 (o) n=12	Ikpikpuk	Bendock & Burr (1984)	480(1)	...	...	...	...
Itkillik (o) n=28	Itkillik	Furniss (1974)	437(2)	...	451 (4)	449 (1)	445 (1)
Itkillik (o) n=87	Itkillik	McCart et al. (1972)	413(7)	418 (5)	404 (3)	434 (9)	461 (8)
Itkillik (s)	Itkillik	Winslow & Roguski (1970)	...	...	...	...	...
Itkillik (s) n=116	Itkillik	McCart et al. (1972)	430(29)	435 (17)	459 (19)	505 (11)	478 (6)
Minskakoss (s)	Kobuk	Roguski (1968)	...	...	...	...	...
Selby (s)	Kobuk	Roguski (1968)	...	...	...	...	...
Walker (s) n=12	Kobuk	Roguski (1968)	711(2)	...	838 (1)	...	...
South Twin (o) n=13	Koyukuk	Pearse (1978)	358*	406*	417*	429*	447*
Wild (s) n=3	Koyukuk	Roguski (1968)	...	...	...	...	...
Kuparuk (o) n=6	Kuparuk	Alt & Furniss (1976)	335(1)	...	...	370 (1)	...
Toolik (o) n=25	Kuparuk	Pearse (1978)	314*	327*	338*	349*	361*
Kurupa (o) n=24	Kurupa	Bendock & Burr unpubl.	...	...	...	...	...
Aniak (s) n=25	Kuskokwim	Alt (1977)	457(5)	483 (3)	530 (2)	558 (2)	590 (1)
Arolik (s) n=39	Kuskokwim	Alt (1977)	409(13)	423(9)	465 (2)	...	...
Canyon (s) n=32	Kuskokwim	Alt (1977)	462(12)	456 (9)	425 (1)	...	...
Goodnews (s) n=24	Kuskokwim	Alt (1977)	506(9)	549 (7)	576 (1)	...	...
Kanuktik (s) n=20	Kuskokwim	Alt (1977)	461(4)	509 (1)	533 (1)	...	...
Kisarolik #2 (s) n=20	Kuskokwim	Alt (1977)	453(9)	...	510 (3)	...	...
Kisarolik (s) n=21	Kuskokwim	Alt (1977)	476(4)	481 (11)	500 (3)	530 (2)	...
N. Middle Fk. (s) n=17	Kuskokwim	Alt (1977)	473(9)	...	533 (1)	...	...
Ohnlik (s) n=9	Kuskokwim	Alt (1977)	...	...	...	...	...
S. Middle Fk. (s) n=24	Kuskokwim	Alt (1977)	511(8)	529 (2)	550 (1)	...	...
Desperation (s) n=2	Noatak	Alt (1978)	...	...	...	...	...
Feniak (s) n=10	Noatak	Alt (1978)	...	550	539	450	547
Kiingyak (s) n=2	Noatak	Alt (1978)	590	565	...	...	...
Kikitaliorak (s) n=4	Noatak	Alt (1978)	...	...	558	...	...
Kipmuk (s) n=1	Noatak	Alt (1978)	512	...	...	...	...
Metcharak (s) n=4	Noatak	Alt (1978)	500	480	592	570	...
Campsite (o) n=68	Sagavanirktok	McCart et al. (1972)	344(3)	...	373 (4)	378 (4)	381 (6)
Elusive (o) n=44	Sagavanirktok	Furniss (1974)	492(3)	466 (2)	480 (4)	538 (2)	497 (4)
Elusive (s)	Sagavanirktok	Winslow & Roguski (1970)	...	...	...	...	...
Galbrath (o) n=22	Sagavanirktok	Pearse (1978)	484*	521*	540*	559*	562*
Old John (o) n=75	Sheenjek	Craig & Wells (1975)	377(13)	375 (10)	420 (9)	409 (7)	409 (3)
Deadman (s) n=4	Susitna	Sautner & Straton (1984)	...	...	...	...	500 (1)
Susitna (s) n=78	Susitna	Williams (1967)	729(6)	744 (7)	754 (10)	798 (17)	841 (6)
Susitna (s) n=131	Susitna	Williams (1966)	744(10)	759 (19)	772 (16)	795 (12)	853 (2)
Boulder (s) n=5	Tanana	Heckert (1965)	...	...	...	...	...
Fielding (o) n=28	Tanana	Peckham (1983)	...	641 (1)	...	...	...
Two Bit (s) N=9	Tanana	Heckert (1964)	...	368 (1)	406 (2)	415 (2)	...

-Continued-

Table 2. Lake trout age and length data from Alaskan lakes (continued).

Lake	Drainage	Author	Age and Length At Capture (Sample Sizes): 16	17	18	19	20
Helpmejack (s)	Alatna	Roguski (1968)	...	...	...	...	...
Irgnyivik (o) n=19	Anaktuvuk	Bendock (1982)	365(1)	401 (1)	426 (4)	433 (1)	422 (1)
Shainin (o) n=14	Anaktuvuk	Furniss (1974)	...	...	...	...	...
Shainin (o) n=16	Anaktuvuk	Bendock (1979)	440(1)	...	470 (1)	467 (1)	493 (1)
Shainin (s) n=11	Anaktuvuk	Roguski (1968)	...	...	...	...	...
Ackerman (o) n=11	Chandalar	Pearse (1978)	431*	434*	449*	471*	479*
Chandalar (o) n=20	Chandalar	Pearse (1978)	523*	523*	505*	559*	505*
Chandalar (s) n=5	Chandalar	Roguski (1968)	...	...	...	...	...
Chandler (o) n=35	Chandler	Bendock (1979)	476(1)	444 (2)	510 (3)	471 (1)	498 (2)
Chandler (o) n=67	Chandler	Furniss (1974)	464(5)	509 (4)	470 (6)	460 (2)	---------
Paxson (s) n=101	Copper	Van Wyhe & Peck (1968)	...	...	...	...	...
Summit (s) n=106	Copper	Van Wyhe & Peck (1968)	...	...	...	...	...
Etivluk (o) n=18	Etivluk	Bendock (1979)	585(2)	533 (2)	...	494 (1)	...
Teshshekpuk (o) n=24	Ikpikpuk	Bendock & Burr (1984)	...	...	...	...	...
TA-C-25 (o) n=12	Ikpikpuk	Bendock & Burr (1984)	...	525 (3)	...	532 (1)	519 (2)
Itkillik (o) n=28	Itkillik	Furniss (1974)	496(2)	492 (4)	494 (2)	...	610 (6)-
Itkillik (o) n=87	Itkillik	McCart et al. (1972)	458(7)	456 (9)	468 (5)	439 (3)	478 (1)
Itkillik (s)	Itkillik	Winslow & Roguski (1970)	...	...	...	...	...
Itkillik (s) n=116	Itkillik	McCart et al. (1972)	530(2)	...	639 (2)	809 (3)	706 (1)
Minskakoss (s)	Kobuk	Roguski (1968)	...	...	...	...	...
Selby (s)	Kobuk	Roguski (1968)	...	...	...	...	...
Walker (s) n=12	Kobuk	Roguski (1968)	...	...	...	...	...
South Twin (o) n=13	Koyukuk	Pearse (1978)	460*	469*	476*	494*	497*
Wild (s) n=3	Koyukuk	Roguski (1968)	...	...	...	...	...
Kuparuk (o) n=6	Kuparuk	Alt & Furniss (1976)	356(1)	...	384 (1)	...	...
Toolik (o) n=25	Kuparuk	Pearse (1978)	372*	376*	379*	391*	402*
Kurupa (o) n=24	Kurupa	Bendock & Burr unpubl.	...	...	...	...	...
Aniak (s) n=25	Kuskokwim	Alt (1977)	...	...	...	...	...
Arolik (s) n=39	Kuskokwim	Alt (1977)	540(1)	...	...	705 (1)	735 (1)
Canyon (s) n=32	Kuskokwim	Alt (1977)	...	...	...	...	...
Goodnews (s) n=24	Kuskokwim	Alt (1977)	...	...	...	...	...
Kanuktik (s) n=20	Kuskokwim	Alt (1977)	705(1)	...	...	730 (1)	...
Kisarolik #2 (s) n=20	Kuskokwim	Alt (1977)	...	...	725 (1)	...	...
Kisarolik (s) n=21	Kuskokwim	Alt (1977)	...	...	700 (1)	...	...
N. Middle Fk. (s) n=17	Kuskokwim	Alt (1977)	...	...	...	...	...
Ohnlik (s) n=9	Kuskokwim	Alt (1977)	...	...	...	...	...
S. Middle Fk. (s) n=24	Kuskokwim	Alt (1977)	640(1)	...	773 (1)	...	...
Desperation (s) n=2	Noatak	Alt (1978)	...	...	...	...	...
Feniak (s) n=10	Noatak	Alt (1978)	...	...	...	651	780
Kiingyak (s) n=2	Noatak	Alt (1978)	...	...	...	...	...
Kikitaliorak (s) n=4	Noatak	Alt (1978)	...	...	...	...	...
Kipmuk (s) n=1	Noatak	Alt (1978)	...	...	...	...	...
Metcharak (s) n=4	Noatak	Alt (1978)	...	...	...	...	...
Campsite (o) n=68	Sagavanirktok	McCart et al. (1972)	428(9)	384 (5)	398 (2)	428 (7)	496 (4)
Elusive (o) n=44	Sagavanirktok	Furniss (1974)	540(4)	...	480 (1)	586 (1)	--735 (4)-
Elusive (s)	Sagavanirktok	Winslow & Roguski (1970)	...	...	...	...	...
Galbrath (o) n=22	Sagavanirktok	Pearse (1978)	586*	607*	670*	...	...
Old John (o) n=75	Sheenjek	Craig & Wells (1975)	418(4)	492 (5)	634 (3)	...	...
Deadman (s) n=4	Susitna	Sautner & Straton (1984)	...	...	...	...	...
Susitna (s) n=78	Susitna	Williams (1967)	887(4)	...	...	...	...
Susitna (s) n=131	Susitna	Williams (1966)	856(4)	940 (2)	825 (2)	864 (1)	919 (1)
Boulder (s) n=5	Tanana	Heckert (1965)	420(2)	498 (2)	533 (1)	...	...
Fielding (o) n=28	Tanana	Peckham (1983)	478(1)	...	...	...	...
Two Bit (s) N=9	Tanana	Heckert (1964)	437(1)	...	...	...	...

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Table 2. Lake trout age and length data from Alaskan lakes (continued).

Lake	Drainage	Author	Age and Length At Capture (Sample Sizes): 21-25	26-30	31-35	36-40	40 +
Helpmejack (s)	Alatna	Roguski (1968)	...	...	...	...	...
Irgnyivik (o) n=19	Anaktuvuk	Bendock (1982)	456(2)	...	632 (2)	...	...
Shainin (o) n=14	Anaktuvuk	Furniss (1974)	758(1)	...	...	...	...
Shainin (o) n=16	Anaktuvuk	Bendock (1979)	526(2)	620 (1)	...	...	...
Shainin (s) n=11	Anaktuvuk	Roguski (1968)	...	...	...	...	...
Ackerman (o) n=11	Chandalar	Pearse (1978)	486*---?	...	...	...	...
Chandalar (o) n=20	Chandalar	Pearse (1978)	523*	...	...	...	...
Chandalar (s) n=5	Chandalar	Roguski (1968)	...	...	...	...	...
Chandler (o) n=35	Chandler	Bendock (1979)	509(3)	658 (4)	805 (1)	755 (2)	984 (1)
Chandler (o) n=67	Chandler	Furniss (1974)	--------627 (22)----------				...
Paxson (s) n=101	Copper	Van Wyhe & Peck (1968)	...	...	...	...	...
Summit (s) n=106	Copper	Van Wyhe & Peck (1968)	...	...	...	...	...
Etivluk (o) n=18	Etivluk	Bendock (1979)	584(4)	618 (1)	584 (3)	...	...
Teshshekpuk (o) n=24	Ikpikpuk	Bendock & Burr (1984)	...	820 (3)	...	825 (3)	837 (7)
TA-C-25 (o) n=12	Ikpikpuk	Bendock & Burr (1984)	...	...	561 (4)	...	...
Itkillik (o) n=28	Itkillik	Furniss (1974)	...	...	...	...	...
Itkillik (o) n=87	Itkillik	McCart et al. (1972)	481(14)	637 (3)	...	...	...
Itkillik (s)	Itkillik	Winslow & Roguski (1970)	...	...	...	...	...
Itkillik (s) n=116	Itkillik	McCart et al. (1972)	800(1)	...	...	...	...
Minskakoss (s)	Kobuk	Roguski (1968)	...	...	...	...	...
Selby (s)	Kobuk	Roguski (1968)	...	...	...	...	...
Walker (s) n=12	Kobuk	Roguski (1968)	...	...	...	...	...
South Twin (o) n=13	Koyukuk	Pearse (1978)	572*	...	...	...	...
Wild (s) n=3	Koyukuk	Roguski (1968)	...	...	...	...	...
Kuparuk (o) n=6	Kuparuk	Alt & Furniss (1976)	391(6)	455 (1)	...	...	...
Toolik (o) n=25	Kuparuk	Pearse (1978)	453*	...	...	...	...
Kurupa (o) n=24	Kurupa	Bendock & Burr unpubl.	670(4)	677 (5)	732 (1)	727 (2)	720 (2)
Aniak (s) n=25	Kuskokwim	Alt (1977)	...	...	...	...	...
Arolik (s) n=39	Kuskokwim	Alt (1977)	...	...	...	...	...
Canyon (s) n=32	Kuskokwim	Alt (1977)	...	...	...	...	...
Goodnews (s) n=24	Kuskokwim	Alt (1977)	...	...	...	...	...
Kanuktik (s) n=20	Kuskokwim	Alt (1977)	...	...	...	...	...
Kisarolik #2 (s) n=20	Kuskokwim	Alt (1977)	820(1)	860 (1)	...	...	...
Kisarolik (s) n=21	Kuskokwim	Alt (1977)	...	...	...	...	...
N. Middle Fk. (s) n=17	Kuskokwim	Alt (1977)	...	...	...	...	...
Ohnlik (s) n=9	Kuskokwim	Alt (1977)	...	...	...	...	...
S. Middle Fk. (s) n=24	Kuskokwim	Alt (1977)	...	...	...	...	...
Desperation (s) n=2	Noatak	Alt (1978)	...	...	...	...	...
Feniak (s) n=10	Noatak	Alt (1978)	...	...	...	...	...
Kiingyak (s) n=2	Noatak	Alt (1978)	...	...	...	...	...
Kikitaliorak (s) n=4	Noatak	Alt (1978)	...	...	...	...	...
Kipmuk (s) n=1	Noatak	Alt (1978)	...	...	...	...	...
Metcharak (s) n=4	Noatak	Alt (1978)	...	...	...	...	...
Campsite (o) n=68	Sagavanirktok	McCart et al. (1972)	538(9)	385 (1)	...	...	...
Elusive (o) n=44	Sagavanirktok	Furniss (1974)	-------?...		...	...	...
Elusive (s)	Sagavanirktok	Winslow & Roguski (1970)	...	...	...	...	...
Galbrath (o) n=22	Sagavanirktok	Pearse (1978)	...	...	...	...	...
Old John (o) n=75	Sheenjek	Craig & Wells (1975)	722(2)	731 (3)	826 (2)	882 (1)	892 (2)
Deadman (s) n=4	Susitna	Sautner & Straton (1984)	583(2)	685 (1)	...	...	...
Susitna (s) n=78	Susitna	Williams (1967)	...	...	...	...	...
Susitna (s) n=131	Susitna	Williams (1966)	...	...	...	...	...
Boulder (s) n=5	Tanana	Heckert (1965)	...	...	...	...	...
Fielding (o) n=28	Tanana	Peckham (1983)	...	...	...	...	...
Two Bit (s) N=9	Tanana	Heckert (1964)	...	...	...	...	...

(o) Fish aged with otolith
(s) Fish aged with scales
* lengths calculated

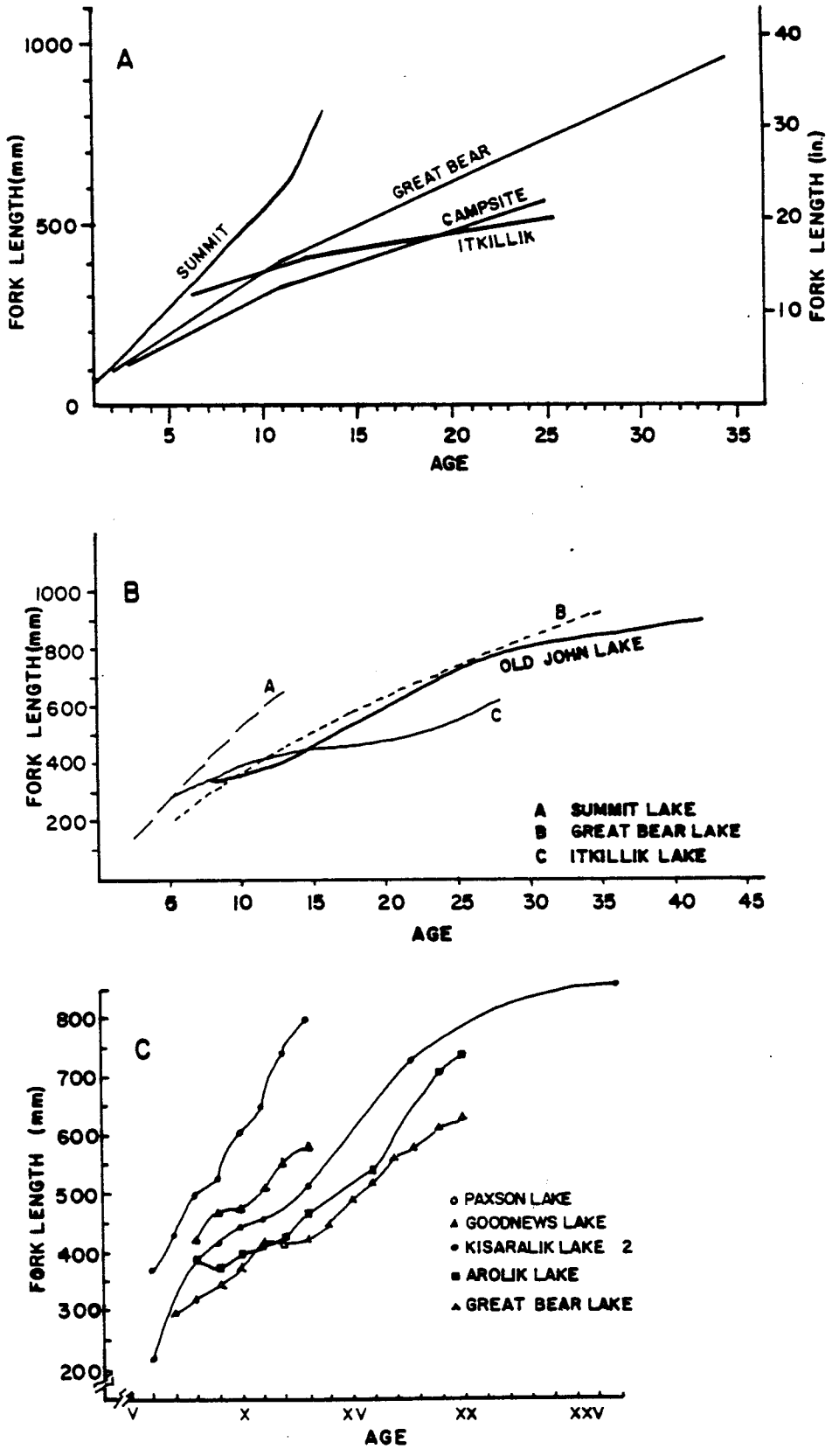

Figure 2. Growth of lake trout from various Alaskan lakes and Great Bear Lake in Canada. A-Campsite and Itkillik Lakes from the North Slope Brooks Range (AREA Z) and Summit Lake in the Alaska Range (AREA I) (McCart et al. 1972). B-Old John Lake from the South slope Brooks Range (AREA Y) (Craig and Wells 1975). C-Goodnews, Arolik, and Kisaralik Lakes from the Kuskokwim drainage (AREA I) and Paxson Lake in the Alaska Range (AREA I) (Alt 1977).

include: (1) sampling procedures which are biased toward larger sizes of fish; (2) young lake trout utilize areas which are not sampled; or (3) a combination of these factors.

Records of lake trout older than 25 years are not unusual, particularly when otoliths are used for aging (Table 2). The Alaska state record lake trout is 21.4 kg from Clarence Lake in the Susitna drainage (Area M). Alt (1977) caught a 12.0 kg lake trout with a fork length of 860 mm and a scale age of 27 years from Kisaralik Lake (Area V). A 984 mm, 10.1 kg male lake trout from Chandler Lake (Area Z) was aged at 42 years using otoliths (Bendock 1979). Fish aged in excess of 50 years by the otolith method were captured from two lakes on the Arctic coastal plain (Teshekpuk and IR-C-13 Lakes, Area Z) (Bendock and Burr 1984a,b). Other maximum ages reported in the literature are age 62, Kaminuriak Lake, Northwest Territories (NWT) (Bond 1975); age 53, Great Bear Lake, NWT; and age 30, Great Slave Lake, NWT (Falk et al. 1974).

Reproduction

Lake trout are primarily lacustrine spawners and rarely spawn in streams. Williams (1966) reports that spawning began in Susitna Lake on 18 September at water temperatures of 49-50°F, concurrent with fall turnover. In Paxson and Summit Lakes in the Alaska Range, lake trout spawn in mid to late September (Van Whye & Peck 1968). On the North Slope, McCart et al. (1972) found the first ripe females in Campsite Lake on 2 September. All of the fish they captured in Itkillik Lake on 6 September were ripe or spent. Lake trout captured from Amiloyak Lake on 4 September, 1985 were not yet ripe (Bendock and Burr unpubl); 16 days later the lake was completely ice covered. The spawning season may be as short as 7 days in small shallow lakes and may extend to more than a month in large lakes (Redick 1967).

Lake trout do not excavate a redd but instead broadcast eggs and milt over the spawning bed. Typical spawning habitat is cobble, rubble, boulders or "honey comb" rock with abundant interstitial spaces (Eschmeyer 1964, Martin and Olver 1980). However, in some Alaskan lakes containing spawning lake trout, little or no "typical" spawning habitat exists. Alt (1978) found little or no rock or gravel substrate in landlocked lakes containing lake trout populations in the Noatak River drainage. Lakes in the central portion of the Arctic coastal plain that have spawning lake trout have only sand and silt bottoms (Bendock and Burr 1984a,b).

Age at Maturity: Lake trout populations from southern and interior Alaska appear to spawn at an earlier age than populations in northern Alaska. Van Whye and Peck (1968) reported that lake trout first spawn in Paxson and Summit Lakes (Area I) at age 7 and 8 (scale age), respectively. Most lake trout from Paxson Lake were mature after reaching 450 mm. Many of the trout from Summit Lake were immature at 500 mm but by 550 mm all were mature. Based on a limited sample, lake trout in Harding Lake (Area U) first spawn at an otolith age of 7-8 and a length of 600 mm (Doxey 1984). Age at maturity for Susitna Lake (Area I) lake trout is 7-9 years (scale age). All fish over 560 mm were mature (Williams 1967). Age at maturity for Kuskokwim Bay lake trout (Area V) is generally reached at 430-440 mm

and age 9-10 (scale age). Most fish were mature by age 12 (Alt 1977). Lake trout from Old John Lake (Area Y) first matured at age 10 (otolith age) (350 mm) and all were mature by age 15 (445 mm) (Craig and Wells 1975).

On the north slope of the Brooks Range, male lake trout first matured at age 11 (otolith age) from Itkillik and Campsite Lakes. Fork length of first maturity for males was 400 mm from Itkillik Lake and 345 mm from Campsite Lake (Area Z). The youngest mature female from Itkillik Lake was age 14 (430 mm) and from Campsite Lake age 13 (370 mm) (McCart et al. 1972). Age of first maturity (otoliths) for Chandler Lake (Area Z) lake trout was 13 years at fork lengths of 430 to 500 mm (Furniss 1974). Age at maturity for lake trout from 16 North Slope mountain lakes (Area Z) ranged from 9 to 20 years (otoliths) with an average of 12 years (Table 3a). Lengths at maturity ranged from 308 mm to 526 mm (mean = 428 mm), with males maturing at younger ages and smaller size than females (Bendock and Burr unpublished). Lake trout from Teshekpuk Lake on the Arctic coastal plain matured at age 8-9 (otoliths) and 500 to 560 mm. Samples from lake trout populations of other lakes on the Arctic coastal plain ranged from 9-25 years in age of first maturity and averaged 12.4 years (Table 3b). Corresponding lengths were 458 mm to 605 mm, with a mean of 522 mm.

Frequency of Spawning: Mature lake trout do not necessarily spawn every year.[1] Inspection of gonads was sufficient to classify mature fish into spawners and non-spawners for Paxson and Summit Lakes (Van Whye and Peck 1968), but not for Itkillik and Campsite Lakes (McCart et al. 1972), Old John Lake (Craig and Wells 1975), or lakes on the Arctic coastal plain (Bendock 1982). Without the retention of fully developed eggs from a previous spawning in samples taken from the latter set of lakes, the authors could not confidently distinguish between mature non-spawners and immature fish with smaller, developing eggs (1.0 to 2.0 mm in diameter). Alt (1977) estimates that 53% of mature lake trout from the Kuskokwim River watershed were non-consecutive spawners.

Fecundity: The fecundity of lake trout has been reported for populations from five Alaskan lakes (Table 4). Egg counts ranged from 274 to 13,000 eggs/female. These counts lie within ranges reported from populations from other areas (Martin and Olver 1980).

Food Habits

Lake trout are opportunistic feeders and feed on a wide variety of organisms including insects, mollusks, crustaceans, fish and rodents (Table 5). Juvenile lake trout feed on small crustaceans, insect larvae and small fish. As lake trout grow, they generally switch from invertebrates to a primarily piscivorous diet in waters containing forage fish. Sculpins (*Cottus* sp.), least ciscoes (*Coregonus sardinella* Valenciennes), humpback whitefish (*Coregonus pidschian* Gmelin), and round whitefish (*Prosopium*

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[1] Lake trout in Great Bear Lake (Miller and Kennedy 1948) and in Great Slave Lake (Kennedy 1954) spawn once every two or three years.

Table 3a. Age and length at maturity of lake trout from 16 North Slope mountain lakes. (Area Z)

Lake	Sample Size	Youngest Mature LT	Length at Capture (mm)
Amiloyak	30	12	423
Betty	9	10	489
Cascade	10	20	460
Elusive	19	9	308
Etivluk	18	16	494
Galbraith	23	9	475
Irgnyivik	19	12	371
Itgaknit	23	11	430
Kurupa	26	13	526
Lower Anayak	9	12	358
Natvakrurak	6	14	355
Nigu	4	10	425
Shainin	26	10	400
Toolik	26	12	375
Tukuto	7	13	515
Tulugak	7	9	440

Table 3b. Age and length at maturity of lake trout from nine North Slope Coastal Plain lakes. (AREA Z)

Lake	Sample Size	Youngest Mature LT	Length at Capture mm
IR-C-7	9	11	500
TA-C-22	4	25	605
IR-C-13	6	9	458
IR-C-14	5	8	510
HB-C-25	3	11	572
TA-C-25	12	10	496
TA-C-27	4	16	536
IR-C-15	2	10	546
C-141	2	12	479

Table 4. Lake trout fecundity from five Alaskan lakes.

Location	Sample Size	Eggs/Female		Fork Length		Author
		Mean	Range	Mean	Range	
Susitna Lk	17	7,600	ND	800	698-990	Williams 1966
Old John Lk	4	6,633	1,230-13,000	ND	345-770	Craig & Wells 1975
Iikillik Lk	21	2,514	1,011-10,623	514	423-821	McCart et al 1972
Campsite Lk	10	1,710	274-10,824	412	353-753	McCart et al 1972
Chandler Lk	8	3,117	1,088-6,371	585	420-748	Furniss 1974

Table 5. Food habits of lake trout in Alaska.

Location	% Empty	Food Items Declining Freq. Of Occurrence	Author
Skilak Lake	27	Fish	Engles (1970)
Paxson/Summit Lakes	ND	400 mm: Snails, Insects 400 mm: Fish (Red Salmon Fry)	Van Wyhe & Peck (1968)
Harding Lake	57	Fish	Doxey Unpubl.
Kuskokwim Lakes	19	Fish, Insects	Alt (1977)
Noatak Lakes	ND	Snails, Insects, Fish	Alt (1978)
Old John Lake	35	Snails, Fish, Insects	Craig & Wells (1978)
Colville R. Drang. Lks	51	Fish, Snails, Insects, Voles	Bendock (1979)
Coastal Plain Lks	ND	Fish, Snails, Crustaceans	Bendock & Burr (1984)
Teshekpuk Lake	50	Fish, Crustaceans	Bendock & Burr (1984)
Campsite Lake	32	Insects, Snails, Fish	McCart et al (1972)
Elusive	4	Insects, Crustaceans, Fish	Furniss (1974)
Itkillik Lake	6	Snails, Insects, Fish	McCart et al (1972)
Chandler Lake	7	Insects, Fish	Furniss (1974)

cylindraceum Pallas) are the preferred prey species, but grayling (*Thymalus arcticus* Pallas), pike (*Esox lucius* Linnaeus), burbot (*Lota lota* Linnaeus), and lake trout have also been found in lake trout stomachs.

Lake Trout in Rivers

Little is known about the use of streams by lake trout. During lake and stream surveys for the Arctic Gas Pipeline, McCart et al. (1972) found lake trout in the outlets of Itkillik and Tee Lakes, Oksrokovik Creek, and the Atigun River. Bendock (1979), during summer lake and stream surveys on the North Slope, found lake trout in the Colville River, its tributaries (the Anaktuvuk, Chandler, Ikagiak, Etivluk, and Killik Rivers) and in the Sagavanirktok River. During winter under-ice test netting, adult lake trout were captured in the central portion of the Colville River and in the Anaktuvuk River (Bendock 1980, 1982). Alt & DeCicco (ADF&G, unpublished) have found lake trout in northwestern Alaskan rivers including the Kobuk, Noatak, Nimiuktuk and Cutler Rivers.

A few instances of river spawning by lake trout have been reported in the literature for areas outside of Alaska (Dymond 1926; Loftus 1958; Paterson 1968; Seguin and Roussel 1968). In every case spawning was limited to outlets or tributaries to lakes. No cases of river spawning by lake trout in Alaska have yet been recorded.

FISHERIES AND MANAGEMENT

Sport Harvest

In Alaska, sport fishing angling effort and harvest for lake trout during the open water period is concentrated in spring and late fall, with sharply reduced effort and catches during July and August (Redick 1967). In winter, ice fishing for lake trout is particularly popular in lakes of interior Alaska and of the upper Susitna and upper Copper River drainages. Limited creel census information is available from Lake Louise in the Susitna drainage (Williams 1965), the Tangle Lakes in the Delta River (Roguski 1969) and from Fielding Lake (Peckham 1983). Most information is from the open-water period and little to no information is available on harvest levels by ice fishermen. The only continuous data come from the Sport Fish Division Statewide Harvest Postal Survey (Mills 1986). This survey indicates that statewide harvest has ranged between 18,000 and 20,000 lake trout annually (Table 6). More than 50% of this harvest comes from the Glennallen area and the Tanana River drainage.

Commercial Harvest

In the 1960's, four lake systems in the Bristol Bay area had experimental commercial fisheries (Nelson 1969, Metsker 1967, Yanagawa 1967). In three of these systems, lake trout were an important component of the catch.

1. Lake Iliamna - Lake Clark:
   During the spring and fall in 1964, 9,000 fish totaling 28,000 lbs. were harvested. Primary species were: humpback whitefish, least cisco, Arctic cisco (*Coregonus atumnalis*

Table 6. Estimated lake trout harvest by area, 1980-1985 (Mills 1986).

	1980	1981	1982	1983	1984	1985
Statewide	18,041	18,316	20,550	19,984	16,925	18,663
South Central	14,469	14,081	14,596	14,166	11,595	13,119
I Glennallen	8,067	8,337	8,699	7,215	6,311	8,755
Rivers (All)				335	136	1,097
Lakes Louise, Susitna, Tyone	ND	ND	ND	3,210	2,668	2,341
Louise	ND	ND	ND	ND	ND	2,018
Susitna	ND	ND	ND	ND	ND	650
Lakes Summit, Paxson	ND	ND	ND	2,623	1,368	2,323
Summit	ND	ND	ND	ND	581	520
Paxson	ND	ND	ND	ND	787	1,803
Crosswind Lake	ND	ND	ND	388	ND	832
Other Lakes	ND	ND	ND	659	2,139	1,699
K Knik Arm Drainage	2,118	1,791	1,058	1,279	1,919	277
Little Susitna River	ND	ND	ND	31	ND	17
Big Lake	ND	ND	ND	441	798	156
Nancy Lake Recreation Area	ND	ND	ND	304	549	104
Other Lakes	ND	ND	ND	503	572	ND
M East Susitna Drainage	267	287	335	1,404	362	17
Streams	ND	ND	ND	63	25	ND
Lakes	ND	ND	ND	1,341	337	17
N West Side Cook Inlet W. Susitna Drng	448	297	167	849	562	328
Streams	ND	ND	ND	10	125	121
Shell Lake	ND	ND	ND	409	½	ND
Other Lakes	ND	ND	ND	430	437	207
P Kenai Peninsula	3,569	3,369	4,337	3,419	2,441	2,724
Kenai R. System (Includes Lake)	ND	ND	ND	650	535	ND
Hidden Lake	ND	ND	ND	1,437	1,047	1,405
Other Lakes	ND	ND	ND	1,332	809	295
Other Rivers	ND	ND	ND	ND	50	35

Continued

Table 6. (Cont'd) Estimated lake trout harvest by area, 1980-1985 (Mills 1986).

	1980	1981	1982	1983	1984	1985
South Western	1,283	1,414	827	1,724	1,706	5,870
R Naknek R. Drainage, Ak Peninsula	422	681	241	355	654	450
Rivers	ND	ND	ND	198	322	208
Naknek Lake	ND	ND	ND	157	337	121
Other Lakes	ND	ND	ND	ND	ND	121
S Kvichak R. Drainage	413	453	545	367	898	5,333
Rivers	ND	ND	ND	42	112	15
Lake Clark Area	ND	ND	ND	273	789	59
Other Lakes	ND	ND	ND	52	0	459
T Nushagak Area	448	280	41	1,322	149	87
Nushagak R. System	ND	ND	ND	ND	25	ND
Wood R. Lake System	ND	ND	ND	42	0	ND
Tikchik-Nuyakuk Lake System	ND	ND	ND	21	87	58
Other Lakes	ND	ND	ND	1,259	25	ND
Other Streams	ND	ND	ND	ND	12	29
Arctic-Yukon-Kuskokwim	2,289	2,821	5,127	4,094	3,624	5,544
U Tanana River Drainage	1,264	1,721	3,104	2,937	2,104	3,174
Streams	ND	ND	ND	188	546	ND
Fielding Lake	ND	ND	ND	294	169	347
Tangle Lakes	ND	ND	ND	2,088	636	2,376
Other Lakes	ND	ND	ND	367	753	226
V Interior Alaska	267	117	503	419	662	34
Streams	ND	ND	ND	ND	195	17
Lakes	ND	ND	ND	419	467	17

Continued

Table 6. (Cont'd) Estimated lake trout harvest by area, 1980-1985 (Mills 1986).

	1980	1981	1982	1983	1984	1985
Arctic-Yukon-Kuskokwim	17	216	168	223	338	144
X Northwest Alaska	ND	ND	ND	19	67	48
Streams	ND	ND	ND	204	273	96
Lakes	362	313	723	148	39	485
Y South Slope Brooks Range	ND	ND	ND	ND	ND	260
Lakes	ND	ND	ND	ND	ND	225
Streams	379	454	629	367	481	1,707
Z North Slope Brooks Range	ND	ND	ND	231	ND	ND
Streams	ND	ND	ND	136	481	1,707
Lakes						

Pallas) (60%), lake trout (15%) and Arctic char (*Salvelinus alpinus* Linnaeus) (25%). Value to 15 fishermen was estimated at $5,600.

2. Naknek Lake:
A single commercial fisherman fished the portion of Naknek Lake outside of Katmai National Monument from May to November, 1967. The catch of 700 fish (3,800) lbs consisted primarily of lake trout (32%) and whitefish species (47%).

3. Tikchik Lakes:
The commercial fishery in the Tikchik Lakes harvested 4,900 fish (23,000 lbs) from April 1966 to March 1967. Composition of the catch was 62% whitefish species, 30% lake trout and 8% pike, char and burbot. From data collected before and after the fishery on the Tikchik Lakes system, the Alaska Department of Fish and Game concluded that there were no significant changes in abundance of lake trout or species composition that were attributable to the commercial fishery (Nelson 1969).

The establishment of commercial freshwater fisheries in the Bristol Bay area were marginal ventures due to serious problems related to transportation and marketing. In addition, there is the question of the ability of the lake systems to produce substantial yields over a long time period. Hence, there is presently no viable commercial freshwater fishery in the area (Nelson 1969).

Management

Regulations: Sport harvest regulations for lake trout in Alaska are summarized in Table 7. For the most part these regulations have remained unchanged since statehood.

Transplants: Stocking lake trout as adults, juveniles, or eyed eggs was attempted in Harding Lake near Fairbanks, and Upper Summit Lake on the Kenai Peninsula prior to statehood. The first recorded introduction of lake trout into Harding Lake was in 1939 and 1940 when the U.S. Fish and Wildlife Service introduced "about a dozen" from an unknown source (Metsker 1963). As of 1963, the population was small and did not support a fishery. In 1963, 252 lake trout (FL range 173-813 mm) were transplanted from Two Bit and Boulder Lakes in the Alaska Range. The transplant was considered successful, as lake trout in good condition were captured in spawning condition in shoal areas in 1964 (Heckart 1965). During June 1965, an additional 235 adult lake trout (FL range 254-508 mm, scale age range 8-10 yrs) were transplanted from Monte Lake (179 acres) located in the Robertson River drainage (upper Tanana River) of the Alaska Range.[1] In December 1965, 88,000 eyed lake trout eggs from Susitna Lake

[1] At the time of transplant, lake trout was the only species captured in Monte Lake.

Table 7. Current lake trout bag and possession limits (ADF&G 1986).

Area	Bag Limit	Possession Limit	Size Limit
Upper Copper/upper Susitna	2	2	20 inches or more
	10	10	less than 20 inches
Prince William Sound	3*	6*	20 inches or more
	15*	30*	less than 20 inches
Kenai Peninsula	2	2	20 inches or more
	10	10	less than 20 inches
Susitna/West Cook inlet	2	2	20 inches or more
	10	10	less than 20 inches
Alaska Peninsula	10	10	no size limit
Bristol Bay	10	10	no size limit
Alaska Peninsula	10	10	no size limit
Arctic-Yukon-Kuskokwim	3*	6*	20 inches or more
(except Tanana drainage)	15*	15*	less than 20 inches
Tanana River Drainage	2	2	20 inches or more
	10	10	less than 20 inches

* A combination of grayling, Arctic char and lake trout

(Williams 1966) were stocked into Harding Lake (Heckart and Roguski 1966).[1]

Information on lake trout gill netted in Harding Lake in 1978, 1979, 1984, and 1985 are listed in Table 8. Growth has been good and the presence of young lake trout in these samples indicates that some spawning has occurred in the lake. The lake trout population is apparently still small since very few lake trout enter the sport fishery or are caught during ADF&G test netting (Mike Doxey, ADF&G biologist, pers. comm.).

In 1969, 204 lake trout were transplanted from Skilak Lake to upper Summit Lake in the Kenai River system (Engel 1970). A sample of 156 lake trout from Skilak Lake had mean lengths of 336.3 mm for males (range = 270-444 mm), and 355 mm for females (range = 233-497 mm). Upper Summit Lake is a 258 acre oligotrophic lake with an abundant population of "dwarf sized" Dolly Varden (mean length of males x=165 mm, and females x=159 mm) as forage.

Non-Lethal Capture Methods

Small mesh gill nets are the most often used gear type for live-capturing lake trout. Williams (1966), capturing lake trout for an egg take in Susitna Lake, preferred a "tooth net" (1" bar mesh) because of the much lower mortality. However, he noted that the incidental whitefish catch was very high. Variable mesh gill nets were used for capturing lake trout for transplanting from Monte Lake to Harding Lake (Heckart & Roguski 1966). These nets required checking every 1 to 2 hours to minimize mortality. In lakes with whitefish or other similar size fish, variable mesh nets present the same problems as the tooth nets. During summer surveys in Kuskokwim drainage lakes, Alt (1977) found that floating gill nets generally caught more lake trout than sinking gill nets, although all lake trout greater than 1,500 g were captured in sinking nets.

Hoop nets or fyke nets have been suggested for non-lethal capture of lake trout but have generally not worked well in practice, although Williams (1966) believed that they could be effective at capturing lake trout if used with appropriate leads and wings. In approximately 1,000 net-days of fishing hoop nets, only a single lake trout was captured in Fielding Lake (Gary Pearse and John Clark, ADF&G, pers. comm.).

SCUBA was used for observing and locating spawning lake trout in Susitna Lake by Williams (1966) who found it to be a very useful tool when water turbidity was low.

Hook and line capture has often been used for capturing lake trout for egg takes, transplants, and Floy tagging (Heckart and Roguski 1966, Williams 1966, Alt 1967, Bendock and Burr unpublished). In certain circumstances this can be a very efficient capture method, particularly when experienced

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[1] About 20 percent of these eggs were already in the alevin stage. Of the 88,000 eggs planted, 15 percent were not viable, so that an estimated 75,000 eggs hatched.

Table 8. Age and length at capture of transplanted lake trout from Harding Lake (Doxey 82, 83, 84 & unpubl.).

Date		Length and age at capture														
		2	3	4	5	6	7	8	9	11	12	19	20-24	25-29	30-34	35+
1978	x	...	...	...	...	...	...	...	...	...	...	813	823	832	846	762
	range	...	...	...	...	...	...	...	...	...	...	...	...	775-914	749-927	...
	n=	...	...	...	...	...	...	...	...	...	...	1	1	7	4	1
1979	x	110	262	...	...	629	599	...	...	...	...	...	...	...	...	...
	range	...	...	...	...	...	585-616	...	...	...	...	...	...	...	...	...
	n=	1	1	...	...	1	3	...	...	...	...	...	...	...	...	...
1984	x	...	298	316	...	487	...	617	...	738	...	...	...	730	...	...
	range	...	268-347	293-340	...	...	...	589-636	...	...	...	...	...	...	...	...
	n=	...	3	2	...	1	...	3	...	1	...	...	...	1	...	...
1985	x	...	...	...	454	451	...	...	746	...	770	...	...	...	...	...
	range	...	...	...	367-533	...	...	...	...	...	...	...	...	...	...	...
	n=	...	...	...	3	1	...	...	1	...	1	...	...	...	...	...

anglers are available. Set lines can also be a successful sampling tool, but since mortality is often high, they require very close monitoring.

Given the wide dispersal habits of lake trout, Williams (1966) notes that "a considerable amount of gill netting and/or trapping is required to secure adequate numbers of fish for an egg take, age and growth tagging studies, or population estimates.

INFORMATION GAPS

Most quantitative information on lake trout comes from Canada and the Great Lakes region. With the exception of the large lakes in the Northwest Territory, lake trout populations outside Alaska encounter markedly different climatic conditions from Alaskan populations. To more effectively manage lake trout fisheries and protect critical habitat we must obtain a great deal more quantitative information in the following areas.

Distribution

Knowledge of the distribution of lake trout in Alaska is reasonably complete except for the Seward Peninsula and the western part of the North Slope.

Life History

Information on the early life history of lake trout in Alaska is almost entirely lacking. Nothing is known about migrations, habitat requirements, sources of mortality, and factors that influence year-class strength.

Habitat Requirements

In the Arctic, where many lakes and streams freeze to the bottom in winter, overwintering habitat is extremely limited. In rivers, fish become concentrated in small, open-water areas and isolated pockets of water under the ice (Bendock and Burr 1984a). In lakes, fish are concentrated in the lake basin. These overwintering areas are critical and disturbance in or near them would be detrimental to resident lake trout populations. Our present understanding of habitat requirements is incomplete and mapping of critical areas could be improved to ensure that adequate protection is provided.

Population Dynamics

There are no quantitative data available on abundance, standing crop or complete age structure (all ages) of a lake trout population in Alaska. Information on size and sex composition is also very limited. Estimates of population dynamic rates such as recruitment, natural mortality, and growth are not presently available.

Present levels of harvest are not accurately known, nor are sustainable harvest levels known for Alaskan populations. Since lake trout are slow-growing, late-maturing fish, they are very susceptible to overfishing

(Martin and Olver 1980). Healey (1978) suggests that lake trout stocks are likely to be overfished if annual harvest exceeds 0.5 kg per ha. Considering Alaska lake trout life history features and environmental conditions, it seems likely that sustainable yield of Alaskan stocks may be less.

Using harvest figures from Mills (1986) and based on average size of fish in samples taken from these lakes, the level of harvest in kilograms per hectare for the few Alaskan lakes for which an estimate of lake trout harvest is available was estimated (Table 9). In every case, the estimates of yield are near or greater than the 0.5 kg/ha limit suggested by Healey (1978). For the Tangle Lakes system the estimated harvest is over four times the recommended limit. This illustrates a need to quantify life history features and population dynamics of lake trout in Alaska and develop managment options to reduce the harvest of lake trout in accessible waters.

Table 9. Estimated harvest of lake trout from nine Alaska lakes.

Lake	Area (ha)	Estimated kg/fish	Estimated Harvest *	kg/year	kg/ha
Louise	6,000	3	2,018	6,054	1.0
Susitna	2,600	3	650	1,950	0.7
Summit	1,650	1.6	520	832	0.5
Paxson	1,575	1.7	1,803	3,065	1.9
Crosswind	2,600	2.3	832	1,914	0.7
Shell	1,200	2.3	400	920	0.8
Hidden	1,000	0.6	1,405	843	0.8
Fielding	675	1.8	347	625	0.9
Tangles	725	0.7	2376	1,663	2.3

* Mills 1986.

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