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Stock Assessment of Burbot in the Tanana and Chena Rivers, 1993

by

Matthew J. Evenson

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ABSTRACT

As part of an ongoing stock assessment program, burbot *lota lota* were sampled in two 24 kilometer river sections, one each in the Tanana and Chena rivers, representing the area where most fishing harvest occurs. These sections have been sampled annually since 1986 and 1988, respectively. A systematic sampling design was used, whereby hoop traps were set and moved daily for a period of four days. Estimates of mean catch per unit effort, mean length, length distributions, and proportions of catch for three size categories were calculated. Estimates for each were within the range of observed values from previous sampling years. Seasonal variations in catch rate and composition was cited as a problem in interpreting these annual estimates. Suggestions for improving the study design to alleviate seasonal catch variability are given.

KEY WORDS: burbot, *Lota lota*, hoop traps, Tanana River, Chena River, catch per unit effort, mean length.

INTRODUCTION

Research concerning burbot *Lota lota* stocks in flowing waters of the Tanana River system has been ongoing since 1983. The objectives of this research program have been to determine biological characteristics such as size, age, and density distributions, identify migratory and reproductive behavior, examine spawning characteristics, monitor harvests, and determine characteristics of the sport fishery. Results of this research have been published in a number of documents (Hallberg 1984 - 1986; Hallberg et al. 1987; Guinn and Hallberg 1990; Evenson 1988-1989, 1990a, 1990b, 1991, 1992, 1993a, 1993b; Evenson and Hansen 1991; Clark et al. 1991; Bernard et al. 1991). Data files concerning Tanana River burbot stock assessment research are archived by the Research and Technical Services of the Alaska Department of Fish and Game, Sport Fish Division. A summary of these data files is shown in Appendix A.

Initially, this research sought to identify individual stocks by identifying movements throughout the system. This was accomplished through a rigorous sampling program which marked and subsequently recaptured burbot in the mainstream Tanana River and in many tributary streams. More recently (Evenson 1993b), radio telemetry was used to monitor seasonal movements and identify spawning concentrations in attempt to refine stock definitions. This information indicated that movements were frequent and extensive throughout the system, and that for management purposes, the entire drainage should be considered a single stock (Evenson 1989 and 1990a).

Assessment of this stock has been accomplished by estimating abundance, relative abundance through mean catch per unit effort (CPUE), and mean length for many sections of river throughout the system using a standardized design. These estimates have been obtained annually or semi-annually for important river sections (areas of large harvest such as the Chena and Tanana rivers near the city of Fairbanks). This assessment has indicated that annual exploitation is low relative to abundance for the entire system. Thus, the stock assessment research has been reduced, and is focused toward those river sections where a substantial harvest occurs.

Since 1986, when extensive stock assessment sampling began, a number of estimates of abundance, CPUE, and mean length have been obtained (Hallberg et al. 1987; Evenson 1988-1989, 1990a, 1991, 1992). This information is summarized by Evenson (1993a). The purpose of this investigation was to continue stock monitoring in the Tanana and Chena rivers near Fairbanks. Specific objectives were to:

1. estimate mean CPUE of burbot for each of three length categories (small: 300-449 mm total length (TL); medium: 450-799 mm TL; and, large: 800 mm TL and larger) in one 24 km section of the Tanana River and in one 24 km section of the Chena River; and,

2. test the hypothesis that the 1993 length distributions of medium-sized burbot in these two river sections are equal to the 1992 length distributions obtained for the same two river sections.

In addition, other statistics regarding length compositions are presented and compared to previous years' data.

STUDY AREA

The Tanana River is of glacial origin flowing over 900 km and draining 115,255 square km. The study area in this investigation included a 24 km section of the Tanana River extending downstream from the confluence of the Chena River, and a 24 km section of the Chena River extending upstream from it's confluence with the Tanana River (Figure 1). These two sections have been sampled annually since 1986 and 1988, respectively, using the same sampling design.

METHODS

Gear Description

Burbot were captured in commercially available hoop traps. Two sizes of traps have been used during the past eight years. The larger of the two traps were used during all years prior to 1988, while the smaller traps were used in all following years. Bernard et al. (1991) provides a comprehensive account of the efficacy of both large and small traps. In general, both sizes are effective at catching burbot greater than 300 mm total length (TL), however burbot do not fully recruit (have the highest probability of capture) to either gear until 450 mm TL. For lengths larger than 800 mm, large traps are more effective than small traps. Small hoop traps were chosen as a sampling gear beginning in 1988 because they are more easily transported, and more traps can be deployed during a sampling day.

Small hoop traps were 3.05 m long with seven 6.35 mm steel hoops (Figure 2). Hoop diameters tapered from 0.61 m at the entrance to 0.46 m at the cod end. Each trap had a double throat (tied to the second and fourth hoops) which narrows to an opening 10 cm in diameter. All netting was knotted nylon woven into 25 mm bar mesh, bound with No. 15 cotton twine, and treated with an asphaltic compound. Each trap was kept stretched with two sections of 19 mm polyvinyl chloride (PVC) pipe attached by snap clips to the end hoops.

Large hoop traps were of similar design, but were 3.66 m long, and had fiberglass hoops with inside diameters tapering from 91 to 69 cm (Figure 2). Throat diameters were 36 cm. Spreader bars made from PVC were also used to keep the traps stretched.

Hoop traps were baited with cut Pacific herring *Clupea harengus* placed in perforated plastic containers. One end of a 5 to 10 m section of polypropylene rope was tied to the cod end of each trap, while the other end was tied off to shore. The traps then fished on the river bottom near shore with the opening facing downstream. An outboard-powered riverboat was used to set, move, and retrieve the traps.

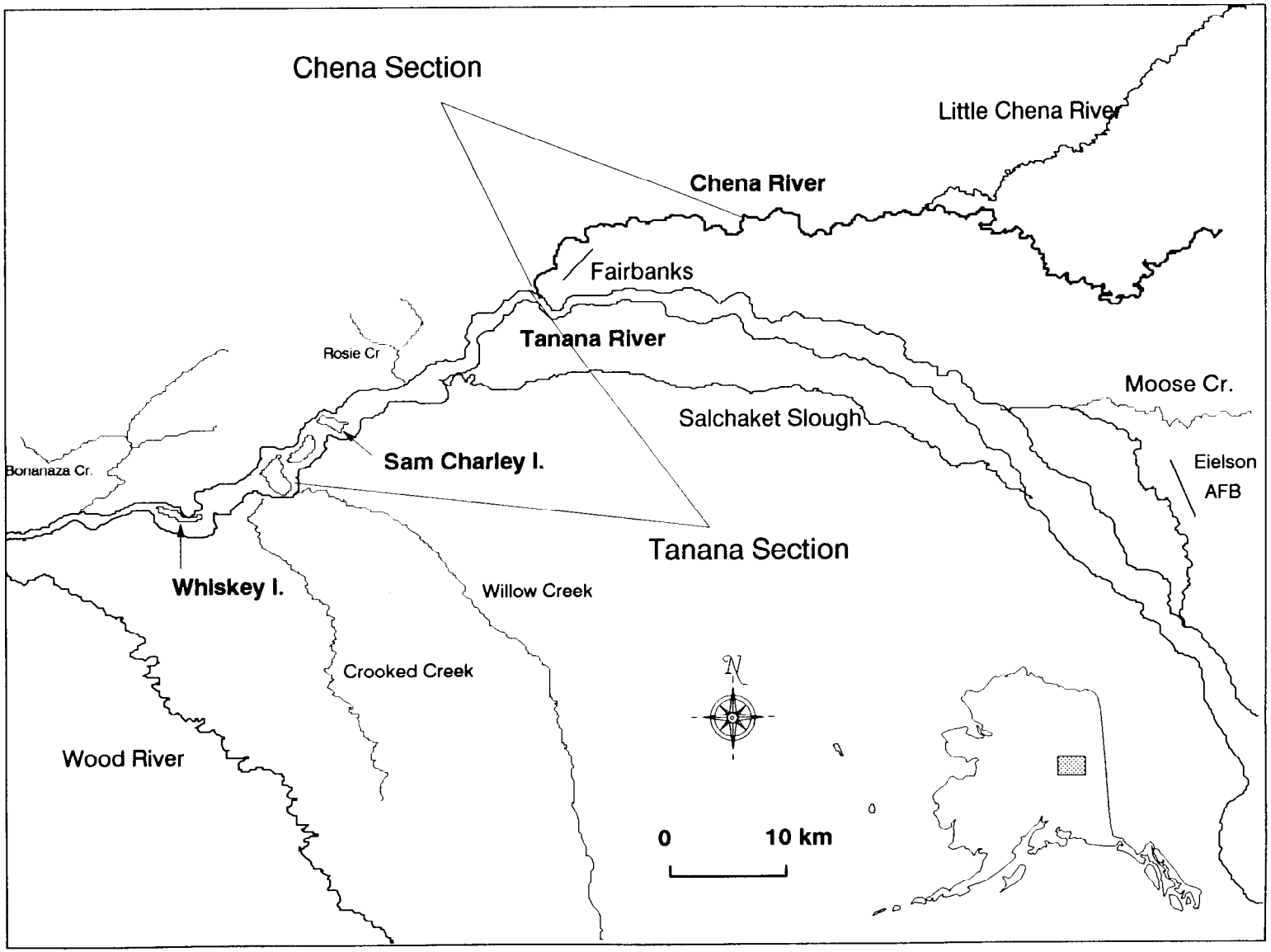

Figure 1. Map of the Tanana River drainage showing sample sections during 1993.

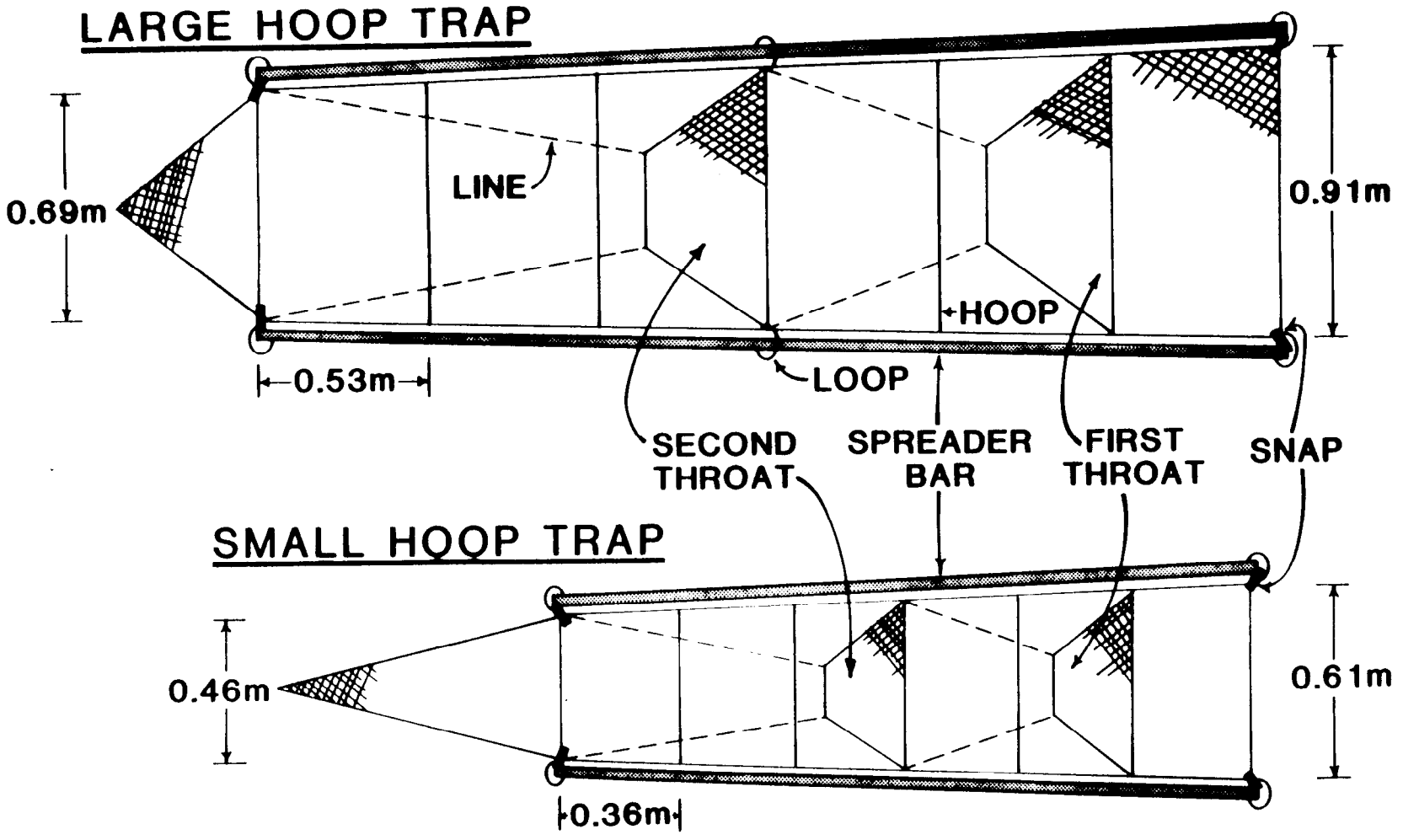

Figure 2. Diagrams of large and small hoop traps used to catch burbot in flowing waters of the Tanana River drainage.

Study Design

Sampling events lasted five days and four nights. A systematic sampling design was used in which traps were set along both shores at near equal intervals beginning at the most downstream end of the section and progressing to the most upstream end of the section. Two crews were used to sample each of the two sections. Each crew worked opposite sides of the river. Traps were set at a density of three traps per kilometer per day. All traps were fished for approximately 24 hours, were rebaited, and were moved to a slightly upstream area (approximately 0.25 km depending upon the availability of suitable setting locations). All trap locations were marked on 1:63,360 USGS maps and were recorded to the nearest kilometer. All burbot captured were measured for total length (TL) to the nearest millimeter, and were tagged using individually numbered Floy (FD-67 T-bar) internal anchor tags. All fish were released at the capture site.

Data Analysis

Due to the size selectivity of hoop traps described above, estimates of mean CPUE and length composition statistics described below are given for three length strata: "small" (300-449 mm TL) "medium" (450-799 mm TL) and "large" (≥800 mm TL).

Catch per Unit Effort:

Mean CPUE for each river section and its associated variance were calculated from the number of burbot caught per net-night for all traps set during each sampling period based upon the following equations from Wolter (1984):

$$\overline{CPUE_c} = \bar{X}_c + t^{-1} \sum_{h=1}^{t} X_{ch}; \quad (1)$$

$$V[\overline{CPUE_c}] = \frac{\sum_{h=2}^{t} [X_{ch} - X_{ch-1}]^2}{2t[t-1]} \quad (2)$$

where:

X_{ch} = catch of burbot of size class c in hoop trap h (where h=1 to t with h=1 the most downstream set and h=t the most upstream); and,

t = the total number of hoop traps in a river section.

All estimates of mean CPUE are given in units of number of burbot per net per overnight set, or burbot per net-night (bb/nn).

Length Composition:

Length compositions of burbot sampled in these two sections were examined using three methods. Mean lengths and proportions of total catch for each of the three size categories were calculated. In addition, cumulative length distributions for various sampling years were compared.

Mean length and its associated variance were also calculated for three length categories as:

$$\bar{l}_a = \sum_{b=1}^{n} \frac{l_{ab}}{n_a}; \tag{3}$$

$$V[\bar{l}_a] = \sum_{b=1}^{n} \frac{(l_{ab} - \bar{l}_a)^2}{n_a(n_a-1)} \tag{4}$$

where:

l_{ab} = length of burbot b in length category a; and,

n_a = number of samples in length category a.

All estimates of mean length are expressed to the nearest millimeter of total length (TL).

Proportions of total catch for each length category and associated variances were calculated as:

$$\hat{p}_z = n_z/n; \text{ and,} \tag{5}$$

$$V(\hat{p}_z) = \hat{p}_z(1-\hat{p}_z)/(n-1) \tag{6}$$

where:

$\hat{p}_z$ = the estimated proportion of burbot in category z;

n_z = the number of burbot in category z; and,

n = the total number of burbot in the sample.

Cumulative length distributions generated from annual sampling events in each section were tested for homogeneity using a k-sample Anderson-Darling test (abbreviated A-D below) using a modified version[2] of the program ADK2.EXE (Scholz and Stephens 1987) to calculate the test statistic.

Similarly, cumulative length distributions from each section for sampling years 1992 and 1993 were compared using a Kolmogorov-Smirnov two sample goodness of fit test (abbreviated K-S below).

RESULTS

A total of 266 and 150 burbot larger than 300 mm TL were caught in the Tanana River and Chena River sections, respectively, during 1993 with 257 net-nights of effort. Estimates of mean CPUE in the Tanana River Section were 0.32 bb/nn (SE = 0.04) for small burbot, 0.67 bb/nn (SE = 0.05) for medium burbot, and 0.02 bb/nn (SE < 0.01) for large burbot. Estimates of mean CPUE in the Chena River section were 0.08 bb/nn (SE = 0.01) for small burbot, and 0.49 bb/nn (SE = 0.09) for medium burbot. No large burbot were caught.

A summary of annual CPUE estimates for these two sections is shown in Table 1. In general, the CPUE estimates observed this year are all within the range of estimates from previous years.

Estimates of mean length for burbot sampled from the Tanana River section were 375 mm TL (SE = 5) for small burbot, 552 mm TL (SE = 6) for medium burbot, and 841 mm TL (SE = 14) for large burbot. Estimates of mean length for burbot sampled from the Chena River section were 371 mm TL (SE = 11) for small burbot and 565 mm TL (SE = 7) for medium burbot. No large burbot were captured in the Chena River section.

A summary of annual mean length estimates for these two sections is shown in Table 2. Mean lengths for medium burbot observed this year were within the range of estimates from previous years. However, mean lengths of small and large burbot were smaller than those observed during previous years.

Comparisons of cumulative length frequency distributions between 1992 and 1993 (Figure 3) revealed that Tanana River distributions were significantly different (K-S test, dn = 0.20, P < 0.01), while 1992 and 1993 Chena River distributions were similar (K-S test, dn = 0.11, P = 0.33).

Comparisons among cumulative length frequency distributions for all sample years since 1988 (small traps were used during all years) indicated that distributions were not homogeneous in either section (A-D tests, Takn = 50.98, P < 0.01 for the Tanana River section and Takn = 11.44, P < 0.01 for the Chena River section). Examination of the plotted distributions (Figure 3) revealed that in both sections, there was no consistent trend for either increasing or decreasing distributions over time.

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[2] The program ADK2.EXE was modified from the original by Allen Bingham, Alaska Department of Fish and Game, Anchorage, AK.

Table 1. Catch per unit effort (CPUE) estimates of burbot sampled in sections of the Tanana and Chena rivers, 1986-1993.

Sampling Dates	Year	River km Sampled	Trap Size	Net Nights	Small (300-449 mm TL) Catch	CPUE	SE	Medium (450-799 mm TL) Catch	CPUE	SE	Large (≥800 mm TL) Catch	CPUE	SE	Medium + Large (≥450 mm TL) Catch	CPUE	SE
Tanana River																
07/29-08/02	1986[a]	334-352	Large	99	51	0.52	NA	94	0.95	NA	7	0.07	NA	101	1.02	NA
08/11-08/15	1986[a]	334-352	Large	128	42	0.33	NA	57	0.45	NA	3	0.02	NA	60	0.47	NA
07/22-07/25	1987[a]	339-354	Large	77	22	0.29	0.02	41	0.53	NA	6	0.08	NA	47	0.61	0.09
07/28-07/31	1987[a]	339-354	Large	106	70	0.66	0.10	73	0.69	NA	6	0.06	NA	79	0.75	0.09
08/04-08/07	1987[a]	339-354	Large	79	24	0.30	0.08	45	0.57	NA	2	0.03	NA	47	0.59	0.10
08/18-08/21	1987[a]	339-354	Large	183	46	0.25	0.05	178	0.97	NA	14	0.08	NA	192	1.05	0.11
07/06-07/09	1988	312-376	Small	268	159	0.59	0.05	144	0.54	NA	1	<0.01	NA	145	0.54	0.05
06/13-06/16	1989	317-374	Small	237	137	0.58	0.06	125	0.53	NA	6	0.03	NA	131	0.55	0.05
08/14-08/16	1990	344-376	Small	90	44	0.49	0.10	96	1.07	NA	4	0.04	NA	100	1.11	0.12
07/11-07/17	1991	336-360	Small	310	97	0.31	0.04	247	0.80	0.07	3	0.01	0.01	250	0.81	0.07
08/24-08/28	1992	336-360	Small	277	57	0.21	0.03	266	0.96	0.08	16	0.06	0.01	282	1.02	0.08
06/08-06/11	1993	336-360	Small	257	85	0.32	0.04	175	0.67	0.05	6	0.02	<0.01	181	0.70	0.05
Chena River																
09/07-09/09	1988	0-24	Small	88	23	0.32	0.08	65	0.90	0.13	0	0	0	65	0.90	0.13
06/27-06/30	1989	0-40	Small	120	30	0.25	0.06	74	0.62	NA[b]	1	0.01	NA	75	0.63	0.09
06/12-06/15	1990[a]	0-24	Small	232	14	0.06	0.02	16	0.07	NA	0	0	0	16	0.07	0.02
08/21-08/24	1990[a]	0-24	Small	204	41	0.20	0.04	82	0.40	NA	1	<0.01	NA	83	0.41	0.06
08/27-08/31	1990[a]	0-24	Small	203	59	0.29	0.04	204	1.00	NA	1	<0.01	NA	205	1.01	0.11
09/06-09/07	1990[a]	0-24	Small	73	26	0.36	0.03	90	1.23	NA	0	0	0	90	1.23	0.09
09/27-09/28	1990[a]	0-24	Small	80	9	0.11	0.03	66	0.83	NA	2	0.03	NA	68	0.85	0.05
08/27-08/30	1991[a]	0-24	Small	268	35	0.13	0.03	218	0.81	0.09	0	0	0	218	0.81	0.09
09/04-09/07	1991[a]	0-24	Small	248	28	0.11	0.03	171	0.69	0.08	3	0.01	<0.01	174	0.70	0.08
08/31-09/04	1992	0-24	Small	272	19	0.07	0.02	111	0.41	0.05	1	<0.01	<0.01	112	0.41	0.05
08/17-08/20	1993	0-24	Small	257	23	0.08	0.01	127	0.49	0.09	0	0	0	127	0.49	0.09

[a] Data used as part of a mark-recapture experiment to estimate abundance.
[b] Data is not available for this estimate.

Table 2. Mean length estimates of burbot sampled in sections of the Tanana and Chena rivers, 1986-1993.

Sampling Dates	Year	River km Sampled	Hoop Trap Size	Length Range (mm TL)	Small (300-449 mm TL)			Medium (450-799 mm TL)			Large (≥800 mm TL)			Medium + Large (≥450 mm TL)		
					Catch	Mean	SE	Catch	Mean	SE	Catch	Mean	SE	Catch	Mean	SE
Tanana River																
07/29-08/02	1986	334-352	Large	260-863	51	382	6	94	552	8	7	839	9	101	572	10
08/11-08/15	1986	334-352	Large	266-905	42	379	7	57	556	14	3	846	29	60	570	13
07/22-07/25	1987	339-354	Large	315-1,025	22	400	7	41	544	12	6	888	41	47	588	21
07/28-07/31	1987	339-354	Large	304-1,079	70	396	5	73	552	9	6	885	45	79	578	13
08/04-08/07	1987	339-354	Large	308-1,028	24	399	7	45	569	12	2	937	92	47	584	16
08/18-08/21	1987	339-354	Large	311-1,000	46	411	4	178	570	7	14	882	17	192	593	9
07/06-07/09	1988	312-376	Small	235-855	159	388	3	144	520	5	1	855	ID[a]	145	523	5
06/13-06/16	1989	317-374	Small	278-895	137	381	4	125	535	6	6	849	13	131	549	8
08/14-08/16	1990	344-376	Small	300-900	44	393	6	96	540	8	4	856	23	100	553	8
07/11-07/17	1991	336-360	Small	238-922	97	386	5	247	530	4	3	893	19	250	534	4
08/24-08/28	1992	336-360	Small	277-1,040	57	398	6	266	557	5	16	864	16	282	574	6
06/08-06/11	1993	336-360	Small	280-902	86	375	5	174	552	6	6	841	14	180	562	7
Chena River																
09/07-09/09	1988	0-24	Small	306-754	23	394	8	65	557	8	0	ID	ID	65	557	8
06/27-06/30	1989	0-40	Small	295-802	30	366	6	74	568	10	1	802	ID	75	571	10
06/12-06/15	1990	0-24	Small	265-600	14	375	14	16	510	12	0	ID	ID	16	510	12
08/21-08/24	1990	0-24	Small	302-873	41	400	7	82	540	8	1	873	ID	83	544	8
08/27-08/31	1990	0-24	Small	294-852	59	409	5	204	555	5	1	852	ID	205	556	5
09/06-09/07	1990	0-24	Small	316-762	26	391	9	90	554	7	0	ID	ID	90	554	7
09/27-09/28	1990	0-24	Small	315-905	9	381	18	66	554	9	2	888	18	68	564	9
08/27-08/30	1991	0-24	Small	288-785	35	385	8	218	562	5	0	ID	ID	218	562	5
09/04-09/07	1991	0-24	Small	295-895	28	382	9	171	565	5	3	850	27	174	569	5
08/31-09/04	1992	0-24	Small	307-843	19	388	10	111	575	7	1	843	ID	112	577	7
08/17-08/20	1993	0-24	Small	295-760	23	371	11	126	565	7	0	ID	ID	126	565	7

[a] Insufficient data.

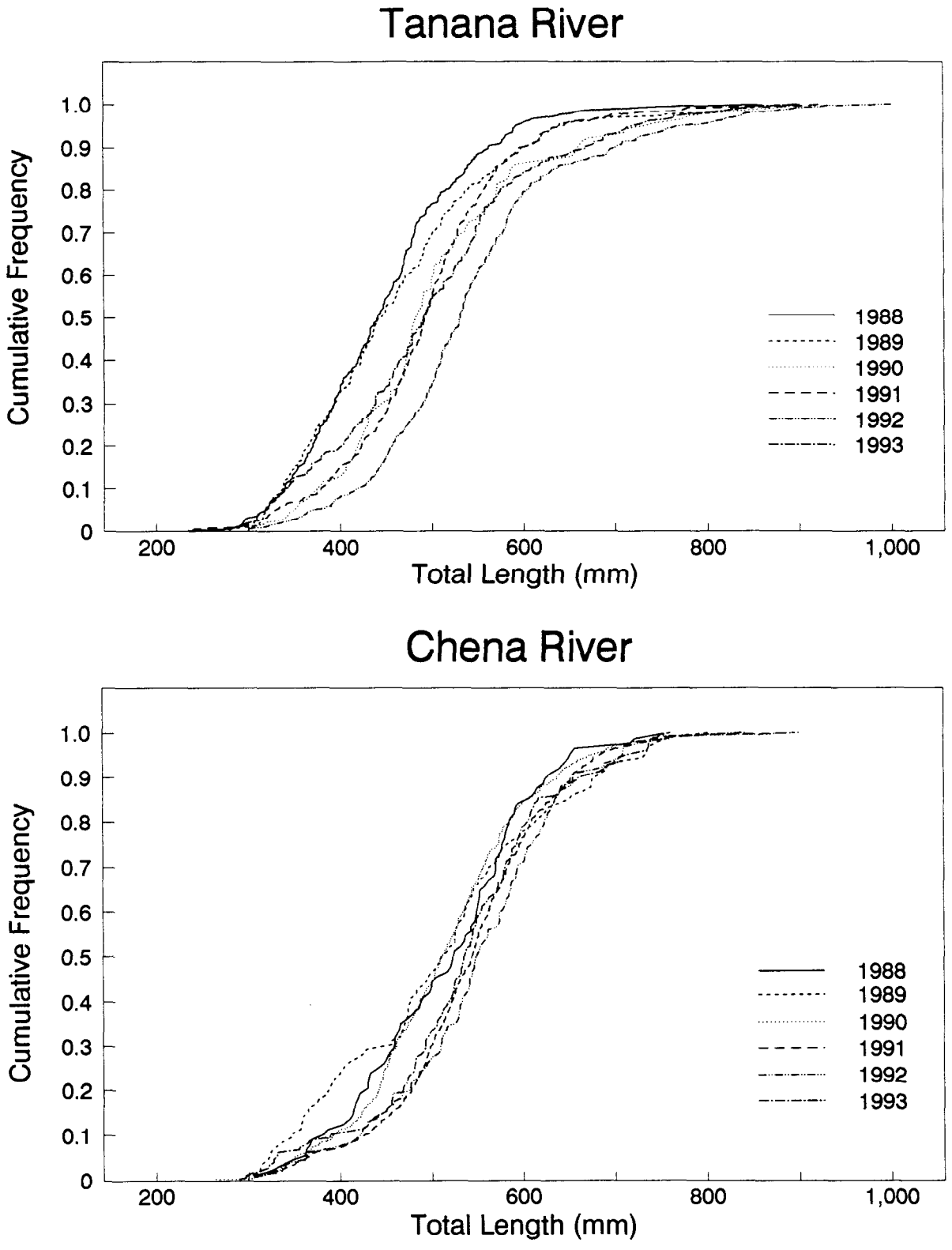

Figure 3. Cumulative length frequency distributions of burbot sampled in the Tanana and Chena rivers, 1988-1993.

Due to size selectivity of the hoop traps, proportions of total catch attributed to each of the three size categories do not represent true population proportions, but do provide a means of comparison. Large burbot are caught in low proportions in both sections (less than 5%), but are slightly more predominant in the Tanana River section than in the Chena River section (Figures 4 and 5). There are no apparent trends over time in proportions of large burbot in either section. A general upward trend in proportion of medium burbot in recent years and a corresponding downward trend in small burbot was apparent in both sections.

DISCUSSION

Accurate stock assessment of burbot in this system is difficult for a number of reasons. First, because it is so large, only a small portion can be sampled during the open water period. Second, information from tag recoveries and from radio telemetry investigations have indicated that there is substantial interchange among burbot in river sections over the span of one year or more (Evenson 1990a, 1993b). Third, there is no reliable method for ageing burbot which does not require sacrificing the animal. Also, there are seasonal fluctuations in both catch rates and in size composition of sampled catches, and for this reason, stock assessment through annual monitoring of mean CPUE and size compositions in index sections can be difficult.

Obtaining estimates of abundance in index sections, while a more accurate method of stock assessment, has met with limited success in past investigations. Due to the low probability of capture using hoop traps, abundance estimates require substantial effort (twice as much as is needed to estimate mean CPUE) and in the past have been marginally precise (relative precision of seven estimates has ranged between 58%-87%; Evenson 1993a).

To alleviate problems associated with seasonal fluctuations in catch rates, I recommend sampling be conducted during similar times each year in a given section, and conducted over a longer time period than has been the case in the past (typically one week). As an illustration, I present results from sampling conducted in the Chena River section during 1990 and 1991. During 1990, this section was sampled during four different periods between 21 August and 28 September as part of a mark-recapture experiment to estimate abundance (Table 1). During these sampling events, there was a three-fold difference in extreme mean CPUE estimates for medium burbot (0.40 and 1.23). During 1991, two sampling events were conducted in the same river section between 27 August and 7 September, again as part of mark-recapture experiment to estimate abundance. Mean CPUE estimates for medium burbot were 0.81 and 0.69 for the two sampling events. Estimates of abundance during each of these years were nearly identical (1,752 burbot greater than 450 mm TL in 1990 and 1,704 burbot in 1991) Combining mean CPUE estimates for all sampling events during each year (four events over a five week period in 1990 and two events over a two week period in 1991) shows that CPUE estimates are similar (0.79 for 1990 and 0.75 for 1991).

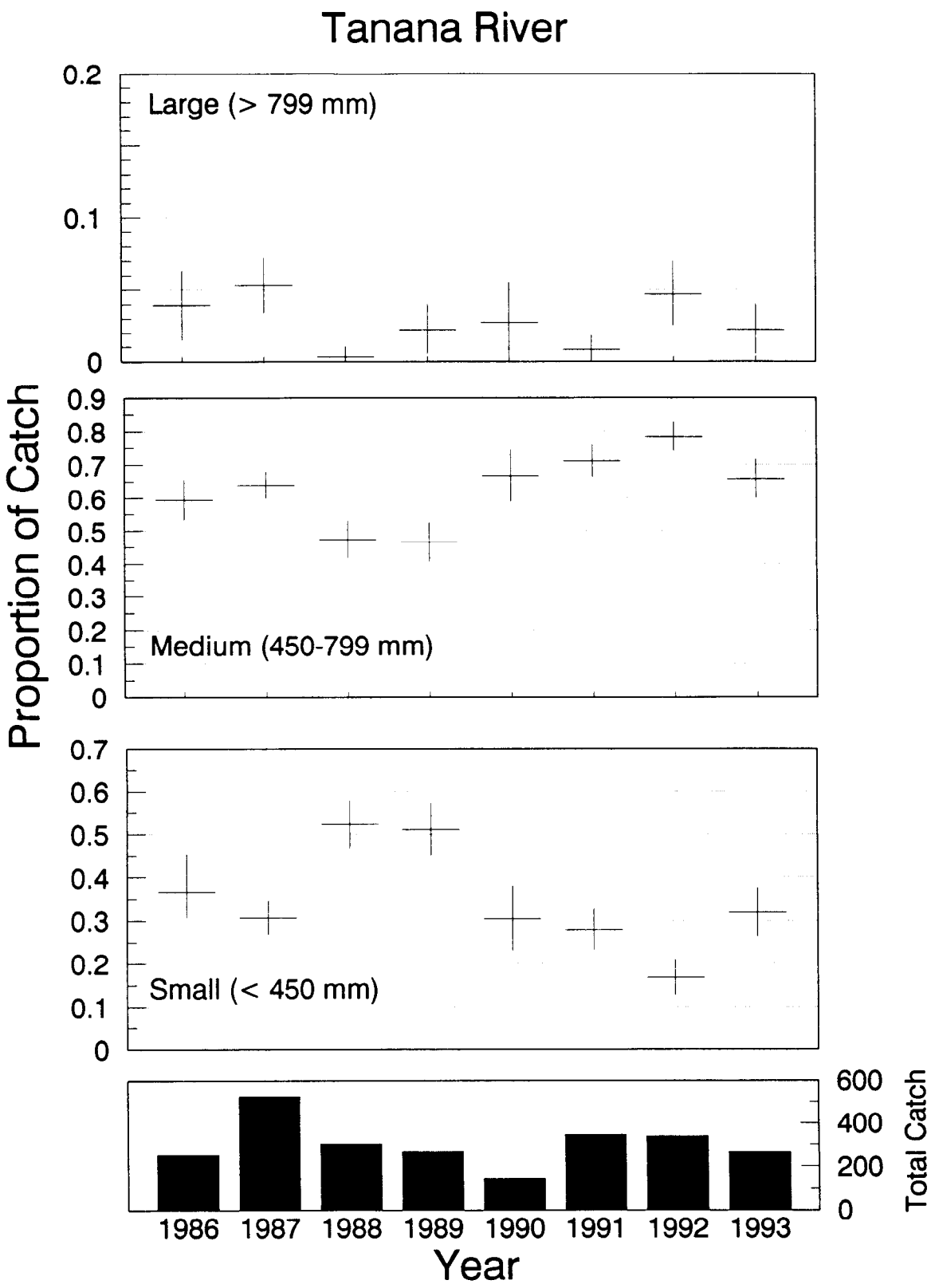

Figure 4. Proportions of large, medium, and small burbot captured in a section of the Tanana River, 1986-1993.

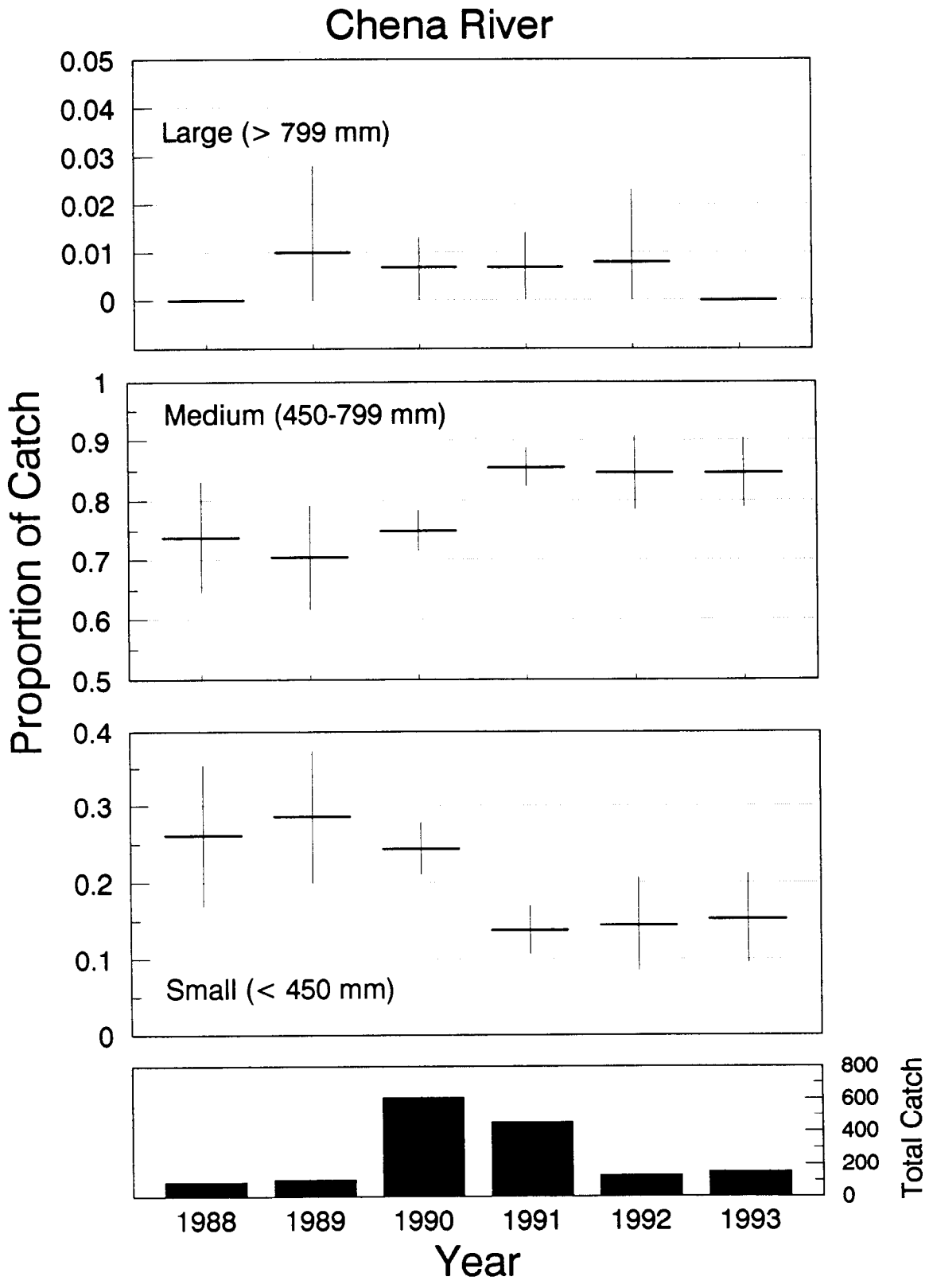

Figure 5. Proportions of large, medium, and small burbot captured in a section of the Chena River, 1988-1993.

Length compositions from sampled catches can also vary substantially over a short period of time, but seem to be seasonally less variable than CPUE estimates. Length frequency distributions from sampling events in the Chena River section (same as described above) during 1990 were significantly heterogeneous (A-D test, Takn = 3.80, P = 0.005), while distributions from 1991 in the same section were similar (K-S test, dn = 0.06, P = 0.89; Figure 6). By sampling for a period longer than one week, as is the standard design, it is likely that a more representative estimate of length composition will be obtained.

Given the variability in CPUE and length compositions that can occur over a short period of time, the fact that annual length distributions and mean CPUE estimates have varied somewhat substantially since 1986 in these two sections (Table 1, Figure 3) is not particularly alarming in regard to exploitation of the stock.

The presence of large burbot in a sampled area (especially in areas of this study where substantial fishing harvest occurs) is a good indicator that stocks are not being over exploited. However, small hoop traps are not efficient at catching large burbot. In order to accurately estimate proportions of large burbot, larger samples than have been obtained in the past need to be collected. Large hoop traps, which are more efficient at catching large burbot, but more difficult to set should be considered for use. Set lines are also effective at catching large burbot. Monitoring the set line harvest may also provide a means for estimating proportions of large burbot.

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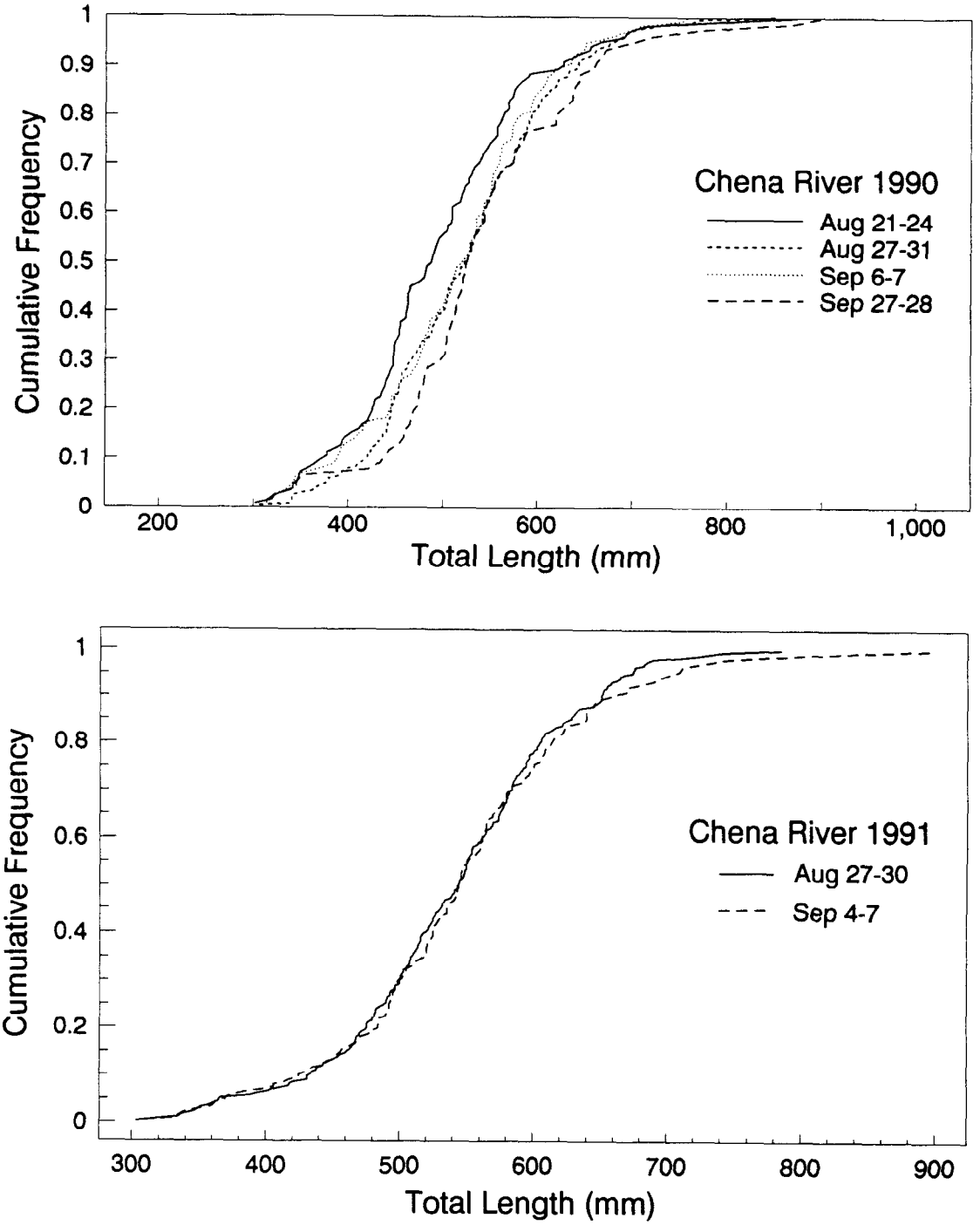

Figure 6. Cumulative length frequency distributions of burbot sampled in the Chena River during four events in 1990 (top) and two events during 1991 (bottom).

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APPENDIX A

Appendix A. Data files regarding Tanana River burbot stock assessment archived by the Research and Technical Services of the Alaska Department of Fish and Game-Sport Fish Division.

Data File	River (River Kilometer)
1986	
U0275BTA.DTA	Tanana River (98-116)
U0275CTA.DTA	Tanana River (247-265)
U0275DTA.DTA	Tanana River (265-284)
U0275ETA.DTA	Tanana River (334-352)
U0275ETB.DTA	Tanana River (334-352)
U0275ETC.DTA	Tanana River (334-352)
U0275FTA.DTA	Tanana River (356-377)
U0275ITA.DTA	Tanana River (523-532)
U0275JTA.DTA	Tanana River (553-564)
U0275KTA.DTA	Tanana River (578-584)
U0275LTA.DTA	Tanana River (608-619)
U0275MTA.DTA	Tanana River (705-721)
U0275NTA.DTA	Tanana River (890-903)
U0275NTB.DTA	Tanana River (890-903)
1987	
U0275BBA.DTA	Tanana River (102-112)
U0275BTA.DTA	Tanana River (270-285)
U0275CBA.DTA	Tanana River (339-354)
U0275DBA.DTA	Tanana River (339-354)
U0275EBA.DTA	Tanana River (339-354)
U0275EBB.DTA	Tanana River (339-354)
U0275EBC.DTA	Tanana River (339-354)
U0275FBA.DTA	Tanana River (360-378)
U0275GBA.DTA	Tanana River (430-442)
U0275HBA.DTA	Tanana River (498-510)
U0275IBA.DTA	Tanana River (520-536)
U0275JBA.DTA	Tanana River (553-571)
U0275KBA.DTA	Tanana River (578-594)
U0275LBA.DTA	Tanana River (606-619)
U0275MBA.DTA	Tanana River (806-829)
U0275NBA.DTA	Tanana River (842-853)
U0275NBB.DTA	Tanana River (894-915)
1988	
U275DLA8.DTA	Tanana River (526-592)
U275ELA8.DTA	Tanana River (656-720)
U275FLA8.DTA	Tanana River (784-848)
U275ALA8.DTA	Tanana River (48-112)
U275BLA8.DTA	Tanana River (160-216)
U275CLA8.DTA	Tanana River (312-376)
U0020LA8.DTA	Chena River (0-24)
U0040LA8.DTA	Chatanika River (0-5)

-continued-

Data File	River (River Kilometer)
	1988 (Continued)
U2780LA8.DTA	Tatalina River (0-5)
U2860LA8.DTA	Tolovana River (37-78)
U386ALA8.DTA	Yukon River (22-0)[a]
U386BLA8.DTA	Yukon River (0-56)[b]
	1989
U2750LA9.DTA	Tanana River (0-54)
U275ALA9.DTA	Tanana River (154-160)
U275BLA9.DTA	Tanana River (317-374)
U275CLA9.DTA	Tanana River (418-474)
U275DLA9.DTA	Tanana River (632-662)
U275ELA9.DTA	Tanana River (714-766)
U275FLA9.DTA	Tanana River (896-902)
U0020LA1.DTA	Chena River (0-40)
U286ALA9.DTA	Tolovana River (0-43)
U008ALA9.DTA	Goodpaster River (0-18)
U143ALA9.DTA	Kantishna River (0-43)
U200ALA9.DTA	Chisana River (0-38)
U243ALA9.DTA	Nabesna River (0-9)
Y103BLA9.DTA	Yukon River (242-203)[a]
	1990
U0020HA0.DTA	Chena River (0-24)
U0020HB0.DTA	Chena River (0-24)
U0020HC0.DTA	Chena River (0-24)
U0020HD0.DTA	Chena River (0-24)
U0020HE0.DTA	Chena River (0-24)
U2750HA0.DTA	Tanana River (344-376)
U2750HB0.DTA	Tanana River (888-904)
U2750HC0.DTA	Tanana River (888-904)
	1991
U0020HA1.DTA	Chena River (0-24)
U2470HA1.DTA	Nenana River (0-24)
U2750HA1.DTA	Tanana River (336-360)
U2860HA1.DTA	Tanana River (0-48)
U2860HB1.DTA	Tanana River (0-48)
Y2480HA1.DTA	Tanana River (0-24)[a]
	1992
U0020HA2.DTA	Chena River (0-24)
U2750HA2.DTA	Tanana River (336-360)
	1993
U0210HA3.DTA	Chena River (0-24)
U2750HA3.DTA	Tanana River (336-360)

[a] Measured in kilometers downstream from the Dalton Highway Bridge
[b] Measured in kilometers upstream from the Dalton Highway Bridge