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ABSTRACT: Operators of 4 commercial drift gillnet vessels kept logbooks of their 1991 fishing effort and catch of sockeye *Oncorhynchus nerka*, chum *O. keta*, coho *O. kisutch*, and chinook *O. tshawytscha* salmon in Lynn Canal, Alaska. Mann-Whitney tests were used to determine if catch per unit effort (CPUE) for each species varied significantly by ambient light phase (day vs night). Two definitions of day and night were employed: one relative to sunrise and sunset and another relative to civil twilight. All data were temporally stratified into 3 fishing periods of 5 or 6 weeks each. Logbook fishers caught 7,840 sockeye, 6,330 chum, 3,579 coho, and 187 chinook salmon in 1,060 sets between June 16 and October 2. Chinook salmon were only caught incidental to other species, and 82% were classified as small (≤8 lb) fish. The chinook harvest rate was significantly higher at night than at day, except during the final (fall) strata when very few chinook salmon were caught. During the peak of directed fisheries for sockeye salmon (mid July through August), CPUE for sockeye salmon was highest during the day. During September, CPUE for chum salmon was also higher during the day. Results provide a solid indication that considerable savings in chinook salmon could result from night closures in drift gillnet fisheries of inside marine waters.

INTRODUCTION

Fisheries for chinook salmon *Oncorhynchus tshawytscha* along the west coast of North America are intensively managed to achieve local, regional, national, and international conservation objectives. Night closures of mixed stock gillnet fisheries in Southeast Alaska have occasionally been employed by the Alaska Department of Fish and Game (ADF&G), Commercial Fisheries Management and Development Division (CFMD), to reduce incidental catches of chinook salmon when abundance of immature fish was high or local conservation concerns were great. These closures have been implemented under the belief that catches of chinook salmon are higher at night.

Fishermen have observed that highest catches of immature chinook salmon in Taku Inlet, Alaska, occur at night (Kissner 1977), but studies to evaluate the efficacy of diurnal management tools for Pacific salmon are lacking. Lynch (1991), however, found significantly higher daylight gillnet catch per unit effort (CPUE) for chum salmon *O. keta* in Clarence Strait, Alaska, whereas coho salmon *O. kisutch*, CPUE was unaffected by ambient light phase.

The Chilkat River (Figure 1) in Lynn Canal is the third largest producer of chinook salmon in Southeast Alaska (Pahlke 1995), and the immature fish are known to rear primarily in the inside waters of northern Southeast Alaska (Pahlke et al. 1990; Johnson et al. 1993; Ericksen 1996). In the late 1980s and early 1990s, concerns over chinook salmon returning to this river were high, and local sport and commercial fisheries were restricted to conserve spawners (Johnson et al. 1992). In 1991 we asked selected commercial fishing vessel operators to maintain confidential logbooks of catch and effort data. We used these data to determine (1) effects of ambient light on CPUE for each species, and (2) efficacy of night closures for reducing incidental harvest of chinook salmon in Lynn Canal gillnet fisheries.

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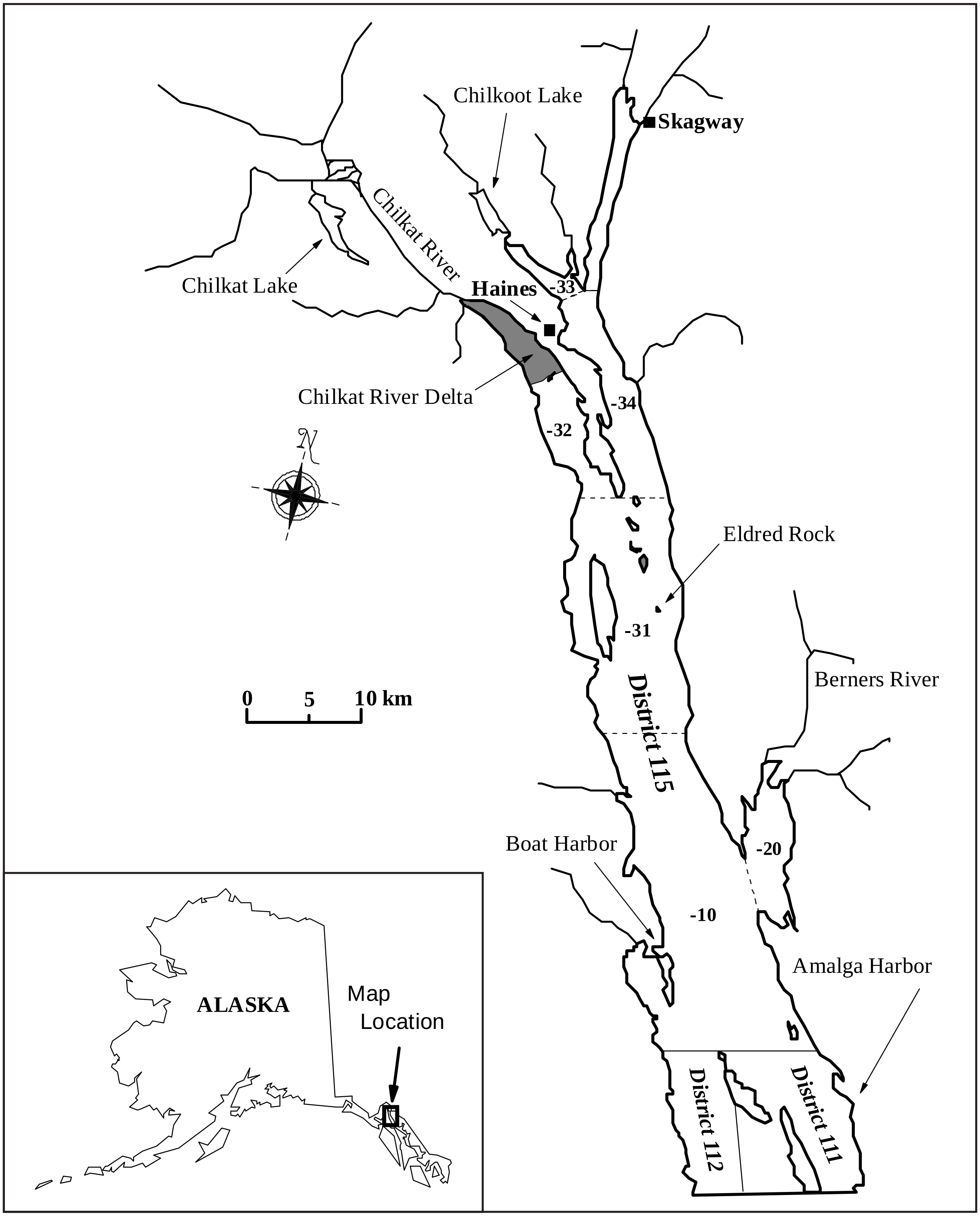

Figure 1. Alaska Department of Fish and Game commercial fishing District 115 including Subdistricts 10, 20, and 31 through 34, in Lynn Canal, Southeast Alaska, 1991.

STUDY SITE

Several important drift gillnet fisheries for salmon occur in Lynn Canal (District 115; Figure 1) in northern Southeast Alaska. The largest fishery targets sockeye *O. nerka* salmon returning to Chilkat and Chilkoot Lakes (McPherson 1990). Commercial fishers also target summer runs of chum salmon returning to the Berners and Chilkat Rivers and hatchery chum salmon returning to remote release sites at Boat and Amalga Harbors. During the fall, drift gillnet fishers target fall runs of chum salmon returning to the Chilkat River and coho salmon returning to Berners, Chilkat, and Chilkoot Rivers.

Chinook salmon, mostly immature, are caught incidental to target species in each of these fisheries. These fish are primarily local stocks but include fish originating from a wide geographic area, including infrequent catches of hatchery fish from British Columbia, Washington, and Oregon (CFMD summaries; Orsi and Jaenicke 1996). Fish processors do not consider immature chinook salmon a high-quality product, and exvessel values for these fish are relatively low. Higher prices are paid for large mature chinook salmon, most of which are taken prior to mid July and are believed to be returning to the Chilkat River drainage.

METHODS

Four commercial fishers who expressed interest in chinook salmon conservation agreed to maintain confidential logbooks that we provided. Because high incidental catches of chinook salmon could have prompted additional fisheries restrictions (e.g., time and area closures), we suspected that many commercial fishers would not provide accurate catch information for this species. We believed the selected logbook participants would provide accurate and reliable data because they had often expressed concern for chinook salmon conservation. Each logbook participant recorded the date, area, catch, and beginning and end times of each set to the nearest 5 min. Because immature chinook salmon are generally smaller than mature fish, fishers were also asked to classify them as "large" or "small," depending on whether they appeared to weigh more or less than 8 lb, an average weight for a chinook salmon of about 28 in total length. Each of the 4 participants did not fish during every commercial opening, and 1 participant did not fish the last several weeks of the 1991 season.

Standard commercial drift gillnets were fished by logbook participants in Lynn Canal (District 115; Figure 1). Stretch mesh of gillnets used for sockeye salmon in Lynn Canal is generally 5.25–5.5 in. By regulation, in 1991 these nets could be a maximum of 60 meshes deep and 200 fathoms long, and gillnet web must have met 1 of 2 criteria: (1) consisted of at least 30 filaments of equal diameter, or (2) consisted of at least 6 filaments ≥0.2 mm in diameter. Prior to June 30, a 6.0-in (maximum) mesh restriction was in effect during 1991, but during the fall, fishers usually switched to larger mesh nets as they targeted chum salmon or complied with a 6.25-in minimum mesh restriction normally implemented by emergency order to protect late-run sockeye salmon.

The CPUE (as fish/hour) for each species landed was calculated for each set by dividing catch by the length of time the net was fished. Each CPUE was classified by 2 phases of ambient light: (1) day or night, as defined by the relation to sunrise and sunset (i.e., when the upper edge of the sun's disk is coincident with an ideal horizon), and (2) civil twilight (i.e., when the center of the sun is 6° below an ideal horizon) at the latitude of Eldred Rock (Figure 1). Using sunrise and sunset provided higher sample sizes in the night strata, and repeating the analysis using civil twilight allowed sensitivity to the classification criteria to be determined. Because some sets were not completed within 1 light phase (given the sunrise/set or twilight criteria), they were rejected from the analysis if >10% of the set occurred during the secondary light phase.

Because time required to set and pull the gillnets was not recorded, estimated CPUE may have been biased somewhat low. Because this bias could influence the statistical tests if the distribution of gillnet set times varied by ambient light phase, times required to set and pull comparable drift gillnets were estimated from the salmon catch data presented in Appendices C and D in Lynch (1991). Thus, the average time required to set a 200-fathom net was estimated at 6.6 min, and pull time was estimated from a linear regression: 8.2 + (1.32)(catch). These relations were used to estimate *true fishing times* (Van Alen 1981) for Lynn Canal logbook fishers: fishing time = total time - (0.5)(6.6 + pull time). This conversion produced a set of adjusted CPUEs. Because some of the logbook fishers may have consciously adjusted set and pull times to reflect the true fishing time, the adjusted CPUEs might have been biased somewhat high. Thus, we only used adjusted CPUEs to determine sensitivity of our analysis to uncertainties of set and pull times.

We used 3 temporal strata (weeks 25–29 or June 16 to July 16, weeks 30–35 or July 21 to August 28, and weeks 36–40 or September 1 to October 2) to summarize the logbook CPUE data and to estimate effects

Table 1. Catch and effort statistics by logbook fishers by period and ambient light phase in Lynn Canal, Alaska, 1991.

	Nr Fish Caught					Nr	Observed		Adjusted	
Strata	Sockeye	Chum	Coho	All Chinook	Small Chinook	Gillnet Sets	Total Net h	Median h/set	Total Net h	Median h/set
Ambient Light Boundaries at Sunrise/Sunset										
Weeks 25–29										
Day	1,012	2,311	17	67	59	263	338.8	1.25	269.5	0.97
Night	152	341	2	27	25	43	80.5	1.83	69.3	1.54
Reject	128	274	2	20	19	33	74.8	2.00	nc	nc
Weeks 30–35										
Day	4,742	756	55	23	19	384	497.8	1.21	392.2	0.91
Night	718	106	24	24	17	70	163.4	2.00	145.2	1.77
Reject	568	97	14	12	8	48	113.2	2.00	nc	nc
Weeks 36–40										
Day	345	1,525	1,721	5	3	131	205.9	1.50	150.4	1.09
Night	118	358	817	4	2	48	138.4	2.50	118.2	1.97
Reject	57	562	927	5	2	40	104.2	2.42	nc	nc
Total	7,840	6,330	3,579	187	154	1,060	1,716.9			
Ambient Light Boundaries at Twilight										
Weeks 25–29										
Day	1,099	2,471	19	80	71	289	375.2	1.25	299.6	0.98
Night	58	114	0	11	10	16	23.4	1.63	19.4	1.36
Reject	135	341	2	23	22	34	95.5	2.50	nc	nc
Weeks 30–35										
Day	4,948	812	65	23	19	408	534.6	1.25	423.1	0.94
Night	541	80	20	15	10	50	114.1	2.00	100.8	1.82
Reject	539	67	8	21	15	44	125.7	2.63	nc	nc
Weeks 36–40										
Day	369	1,627	1,946	5	3	146	230.5	1.50	169.3	1.09
Night	95	258	631	4	2	40	115.6	2.50	99.8	2.07
Reject	56	560	888	5	2	33	102.4	2.75	nc	nc
Total	7,840	6,330	3,579	187	154	1,060	1,716.9			

nc = not calculated

of ambient light phases by species. These strata reflected commercial fishing patterns (i.e., emphasis on particular species over time) and different fisheries in Lynn Canal. Temporal stratification also reduced potential bias due to changes in the species composition of the catch. For instance, it takes more time to pick 100 dark chum salmon out of a gillnet than 100 bright sockeye salmon.

In 1991, drift gillnet fishing in District 115 began in week 25 with a 3-d opening in Subdistricts 10 and 31. The fishery was opened and closed based on run size, so time and area available to commercial fishers varied from week to week. Fishers targeted chum and sockeye salmon during the first temporal stratum. Sockeye salmon predominated the catch during the second stratum, as did chum and coho salmon during the third stratum. Subdistricts 33 and 34 were opened for fishing during statistical weeks 31–38, usually 3–4 d/week. Subdistrict 31 was closed after week 39, and 10 was closed after week 41.

Median and mean CPUE and notched box plots (Chambers et al. 1983) of CPUE were employed to characterize the data and graphically display the CPUEs. However, because of high incidence of sets taking no chinook or coho salmon (CPUE = 0) and because box plots do not illustrate these data effectively, we did not use box plots for these species.

We used nonparametric Mann-Whitney tests (Conover 1980) to test for significant differences (α = 0.10) in CPUE during light and dark light phases. Following Lynch (1991), we selected this level because it minimizes the chance of accepting the null hypothesis (no differences in CPUE by light phase) when differences exist. We agree with Lynch that this error is more serious than rejecting the null hypothesis when it is true. The Mann-Whitney test was applied to the raw CPUE data and the adjusted CPUE data to determine sensitivity to the time required to set and pull the gillnets. Statistical tests were completed in SYSTAT (Wilkinson 1990).

Pie charts were used to compare, by species and subdistrict, the 1991 logbook catches with District 115 harvests reported in fish-processor receipts. Commercial harvest and other fishery statistics were obtained from CFMD database files.

RESULTS

Lynn Canal drift gillnet fisheries opened June 16 and closed October 8 during 1991. Subdistrict 32 (Figure 1) was closed all year to protect mature chinook salmon returning to the Chilkat River and to provide extra protection to poor returns of Chilkat Lake sockeye salmon. Summer chum salmon were unusually abundant in 1991; fall fisheries were directed primarily at coho salmon because they were abundant, whereas fall-run chum salmon were not. The total 1991 reported commercial drift gillnet harvest in District 115, as determined from fish-processor sales receipts, was 745 chinook, 307,811 sockeye, 210,189 chum, and 128,365 coho salmon.

In District 115, logbook catches between June 16 and October 2, 1991, included 187 chinook, 7,840 sockeye, 6,330 chum, and 3,579 coho salmon from 1,060 sets totaling 1,717 h (Table 1). Most of the sockeye salmon were taken midseason and most of the coho salmon at season's end (Table 1). Chum salmon catches were high early but continued late in the year. Logbook and District 115 drift gillnet catch proportions of target species were similar: sockeye salmon 44 vs 48%, chum salmon 35 vs 32%, and coho salmon 20 vs 20%. Spatial distribution of the catch by species was reasonably similar between the logbook and District 115 data (Figure 2).

In contrast to the similar catch proportions reported for target species, logbook and District 115 catch proportions for chinook salmon in 1991 were 1.04 vs 0.12%, respectively. Logbook vs District 115 temporal proportions of chinook salmon catch were, however, similar: 61 vs 68% for the first stratum and 32 vs 28% for the second stratum. About 0.18% (33 fish) of logbook total salmon catch of all species were composed of large chinook salmon, and 0.86% (154 fish) were small. Thus, logbooks indicated that 82% of chinook salmon caught were small fish (≤8 lb).

Gillnet sets tended to be longer at night than day (Table 1; Figure 3). The shortest set was 0.17 h and the longest 9.25 h. Defining ambient light phases relative to sunrise and sunset yielded 778 day sets, 161 night sets, and 121 sets rejected because time overlap across ambient light phases was ≥10% (Table 1). Defining ambient light phases relative to civil twilight yielded more sets during the day and fewer sets at night (Table 1). Because gillnet sets tended to be shorter during daytime, adjusting logbook fishing effort for time spent setting and pulling nets reduced total and median effort/set more for day sets than for night sets (Table 1).

Logbook fishers' CPUE for chinook salmon was highest early in the season; CPUEs were greatest in mid season for sockeye salmon and in late season for

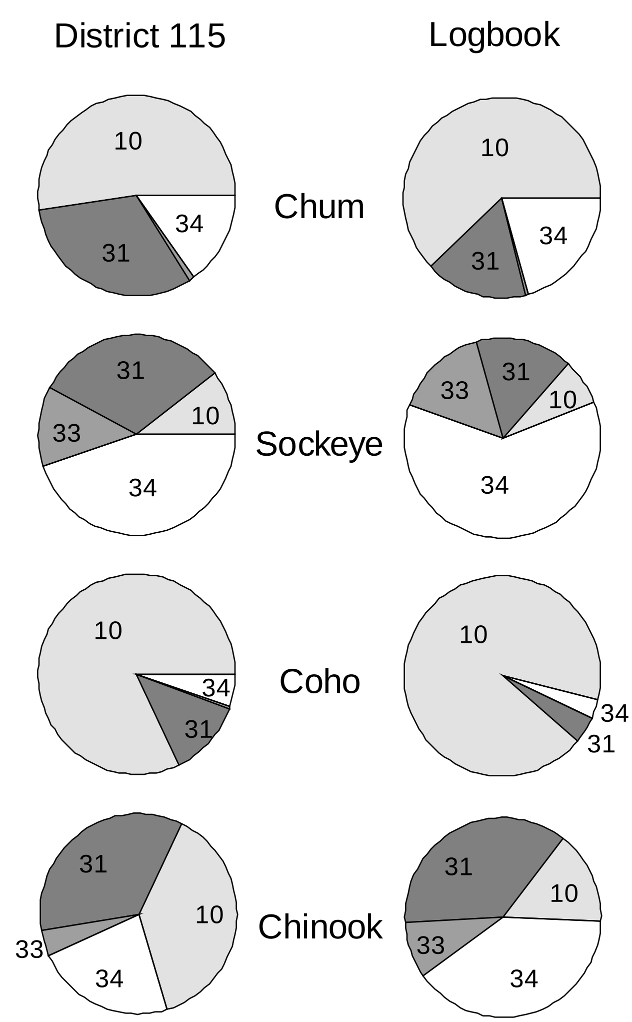

Figure 2. Distributions of chum, sockeye, coho, and chinook salmon drift gillnet catches in 1991 by Subdistrict (10, 31, 33, 34) for all District 115 and for logbook fishers.

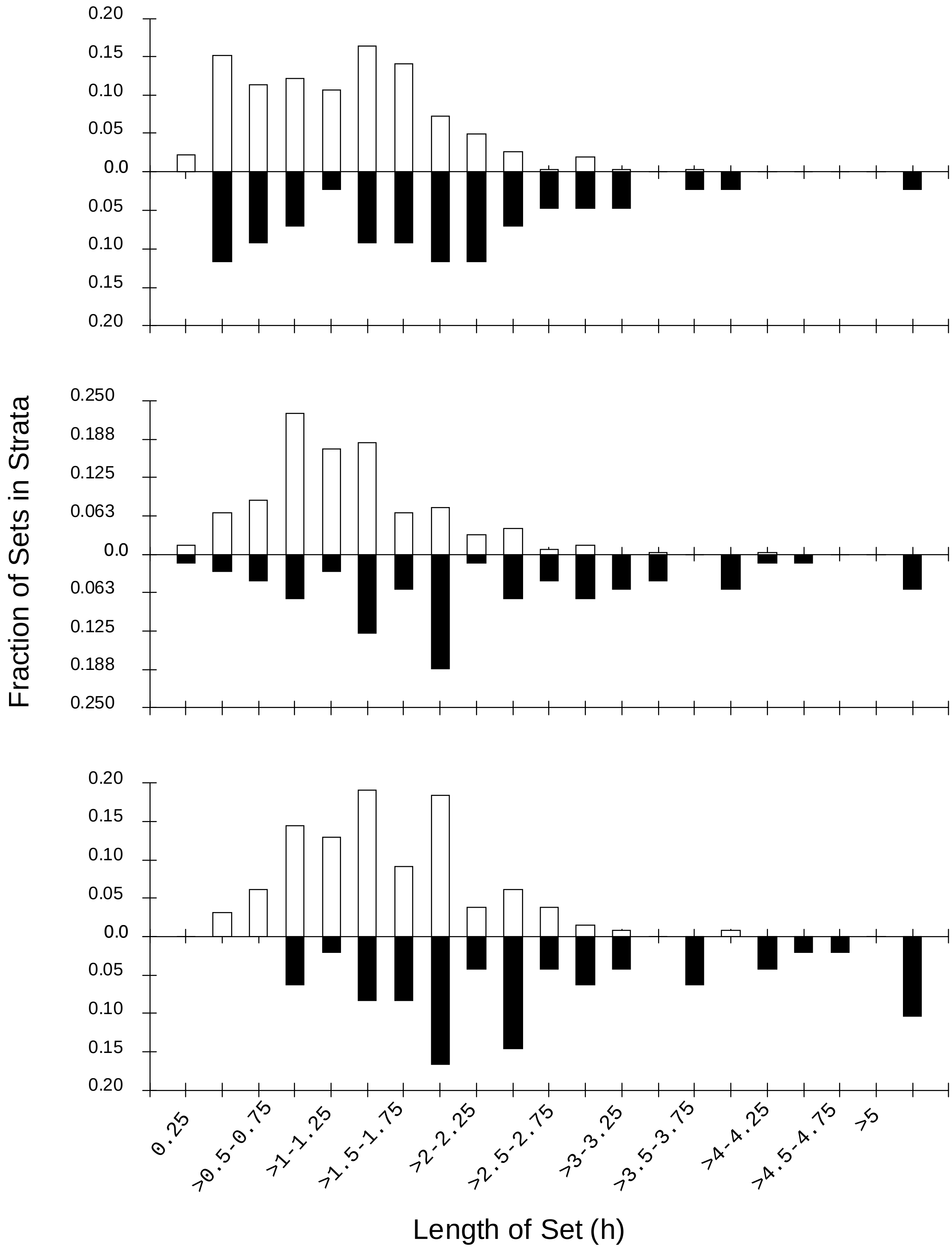

Figure 3. Distribution of logbook fishers drift gillnet set times by ambient light phase and temporal period (weeks 25–29 above, weeks 30–35 center, and weeks 36–40 below) using sunrise/sunset to distinguish light phases. Day sets are above and night sets below each horizontal axis.

Table 2. Median and mean logbook fishers' CPUE for sockeye, coho, chum, and chinook salmon by temporal strata and ambient light phase. Day and night are the ambient light periods bounded by either sunrise and sunset, or early and late twilight.

		CPUE (fish/h)				
		Sockeye	Coho	Chum	All Chinook	Small Chinook
Ambient Light Boundaries at Sunrise/Sunset						
Weeks 25–29						
Day:	Median	1.710	0	4.000	0	0
	Mean	3.838	0.044	7.124	0.296	0.250
Night:	Median	1.120	0	4.000	0	0
	Mean	2.804	0.023	4.500	0.469	0.436
Weeks 30–35						
Day:	Mean	6.000	0	0.460	0	0
	Median	11.328	0.121	1.976	0.045	0.039
Night:	Mean	3.910	0	0	0	0
	Mean	5.277	0.356	0.882	0.151	0.089
Weeks 36-40						
Day:	Median	0.340	5.250	4.800	0	0
	Mean	2.045	8.439	8.133	0.025	0.015
Night:	Median	0.245	4.690	1.365	0	0
	Mean	1.428	6.216	3.161	0.041	0.023
Ambient Light Boundaries at Twilight						
Weeks 25–29						
Day:	Median	1.710	0	4.000	0	0
	Mean	3.749	0.043	6.864	0.304	0.259
Night:	Median	1.520	0	4.285	0	0
	Mean	3.951	0	4.922	0.730	0.689
Weeks 30–35						
Day:	Median	6.000	0	0.460	0	0
	Mean	11.018	0.124	1.932	0.042	0.037
Night:	Median	4.000	0	0	0	0
	Mean	5.340	0.455	0.985	0.134	0.063
Weeks 36–40						
Day:	Median	0	5.250	4.500	0	0
	Mean	1.989	8.500	7.703	0.022	0.013
Night:	Median	0.245	4.370	1.115	0	0
	Mean	1.311	5.676	2.758	0.049	0.028

coho salmon (Table 2). Mean CPUEs for chum salmon were similar at the season's beginning and end. Using both sunrise/sunset and civil twilight to define ambient light strata, we found significantly higher night CPUE ($P<0.1$; Table 3) for chinook salmon in weeks 25–29 and weeks 30–35 and higher day CPUE for sockeye salmon in weeks 30–35 and for chum salmon in weeks 36–40. Diurnal patterns in the CPUE for sockeye and chum salmon are reflected in box plots (Figure 4; plots for twilight data are excluded for brevity). Diurnal patterns in the CPUE for chinook salmon were illustrated by tabulating their frequencies of occurrence (Table 4), which are noticeably divergent at low values (especially 0). Diurnal patterns were not detected for coho salmon.

Mann-Whitney statistics based on CPUE adjusted for estimated set and pull times (Table 5) were practically identical to those based on observed CPUE for chinook and sockeye salmon (Table 3). However, for chum and coho salmon a few significant differences, not detected with observed CPUE, were found using adjusted CPUE. For chum salmon, a significantly higher day CPUE during weeks 30–35 was found using sunrise/set data. During the final stratum (weeks

Table 3. Mann-Whitney probabilities of equal day/night CPUE for logbook fishers for sockeye, coho, chum, chinook, and small chinook salmon by period and day/night classifier.

	Probability of Equal Day/Night CPUE				
Weeks	Sockeye	Coho	Chum	All Chinook	Small Chinook
Sunrise/Sunset					
25–29	0.151	0.828	0.336	0.008*	0.001*
30–35	0.003*	0.419	0.121	0.000*	0.004*
36–40	0.887	0.293	0.000*	0.340	0.508
Twilight					
25–29	0.706	0.931	0.954	0.055*	0.035*
30–35	0.023*	0.402	0.276	0.000*	0.039*
36–40	0.994	0.183	0.000*	0.168	0.315

* Significant at $\alpha = 0.1$.

36–40), we found significantly higher day CPUE for coho salmon using both sunrise/set and twilight data.

DISCUSSION

Results from the logbook program indicate incidental catch rates for chinook salmon in Lynn Canal drift gillnet fisheries increase at night. Also, between mid July and late August catch rates increase for sockeye salmon during daylight. Similarly, we found catch rates for chum salmon in September increase during daylight, a result also reported in upper Clarence Strait (Lynch 1991) during a similar period (mid August to mid September). These results were robust to arbitrary definitions of *day* and *night* and to our difficulty in estimating, because of set- and pull-time variations, true fishing time. The lack of a significant result for chinook salmon during the fall stratum is not surprising given the low catch (14 fish) during that period.

Other significant results determined using adjusted CPUE are inconsistent with results based on observed CPUE. However, the significant results for chum salmon during weeks 30–35 may not be surprising, given the significant results for weeks 36–40 and the low *P* value (0.121) in the unadjusted data. The adjusted catch rates for coho salmon, however, increased at day during the fall stratum (September) when they were the target species. This result was not confirmed, using either observed or adjusted CPUE, for any other time stratum. In addition, Lynch (1991) did not find a diurnal pattern for adult coho salmon.

Fishing practices could have influenced the CPUE data collected in this study. For example, some fishers may not work as hard or effectively at night, which could lower sockeye salmon CPUE at night. Planned experiments to remove or minimize this type of influence and allow CPUE to be cast as an index of abundance might not account for differences in net avoidance between day and night. Also, obtaining an adequate sample size for incidentally caught chinook salmon could be difficult, as found in this study and discussed in Orsi and Wertheimer (1995) and Candy et al. (1996). Regardless of any experimental short-

Table 4. Percent frequency of CPUE for chinook salmon as reported by logbook fishers, by CPUE category, temporal strata, and ambient light phase as defined by sunrise and sunset.

	Weeks 25–29		Weeks 30–35		Weeks 36–40	
CPUE Category	Day	Night	Day	Night	Day*	Night
0	82.5	62.8	94.0	80.0	97.0	94.0
0.00–0.25	0.0	0.0	0.0	0.0	0.0	0.0
0.26–0.50	1.9	11.6	2.0	9.0	1.0	2.0
0.51–0.75	2.7	2.3	2.0	6.0	1.0	2.0
0.76–1.00	1.9	7.0	2.0	1.0	1.0	0.0
1.01–1.25	1.1	0.0	0.0	0.0	0.0	2.0
1.26–1.50	3.0	11.6	0.0	3.0	1.0	0.0
1.51–1.75	0.8	0.0	0.0	1.0	0.0	0.0
>1.75	6.1	4.7	0.0	0.0	0.0	0.0

* Total exceeds 100% due to rounding.

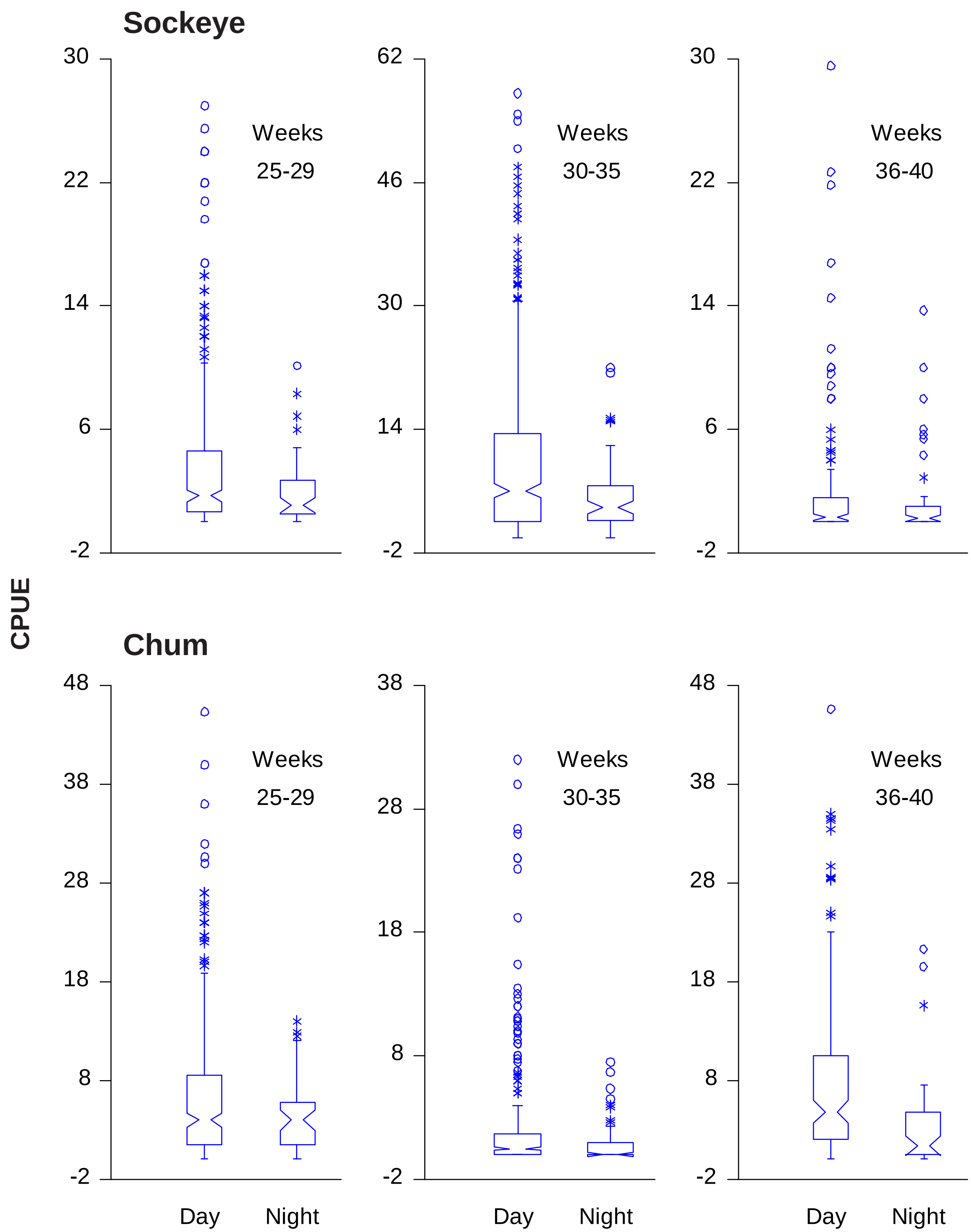

Figure 4. Notched box plots of logbook fishers' observed CPUE of chum and sockeye salmon by fishing period and ambient light phase as defined by sunrise and sunset. The box is defined by the first and third quartiles of the data; i.e., Q(.25) and Q(.75), respectively. The origin of the notch is the sample median and the edges of the notch estimate a confidence interval for the median; if notches on 2 neighboring boxes overlap, there is about 95% confidence the medians are equal (Chambers et al. 1983). Vertical lines (whiskers) extend 1.5 · [Q(.75) - Q(.25)] beyond the box, showing elongation of the tails of the distribution. Data outside the whiskers are plotted as individual points (circles and stars).

Table 5. Mann-Whitney probabilities of equal day/night CPUE for logbook fishers, adjusted for times to set and pull the net, for sockeye, coho, chum, chinook, and small chinook salmon by period and day/night classifier.

	Probability of Equal Day/Night CPUE				
Weeks	Sockeye	Coho	Chum	All Chinook	Small Chinook
Sunrise/Sunset					
25–29	0.133	0.821	0.279	0.009*	0.001*
30–35	0.002*	0.434	0.081*	0.000*	0.005*
36–40	0.702	0.093*	0.000*	0.340	0.508
Twilight					
25–29	0.713	0.335	0.937	0.060*	0.036*
30–35	0.015*	0.414	0.217	0.000*	0.039*
36–40	0.833	0.054*	0.000*	0.168	0.315

* Significant at $\alpha = 0.1$.

coming, we believe the logbook data reflect the commercial fishing activity in Lynn Canal in 1991 because we found no evidence that logbook participants fished substantially different from other fishery participants.

Because CPUE for other species was not affected or increased during ylight, we also believe the observed diurnal increase in CPUE for chinook salmon at night provides compelling possibilities for reducing incidental harvests of chinook salmon in some drift gillnet fisheries. One caveat is the majority (82%) of chinook salmon caught in this study were small, and probably immature. Thus diurnal patterns observed in this study might not hold for large, mature fish, although some small fish sampled mid June to mid July may have been age-1.1 (jack) or age-1.2 chinook salmon returning to the Chilkat River (Johnson et al. 1992).

The diurnal migration patterns for Pacific salmon may depend on many factors, including maturity, food, environment, and distance from natal rivers (Ogura and Ishida 1992; Ogura 1994). Similarly, diurnal patterns may be related to the changing lengths of daylight (from 21.1 h in week 25 to 12.9 h in week 40 in this study). For chinook salmon in Southeast Alaska, vertical distributions have been shown to depend on age and length (older/longer fish are deeper), season (progressively deeper: May, September, February), the thermocline and halocline (generally below both, but even deeper in winter), and changes in vertical location of important forage fish (Orsi and Wertheimer 1995) and prey such as euphausiids (APPRISE Staff 1988). Such factors might also explain the low catch and absence of a detectable diurnal migration pattern for chinook salmon during the last stratum. Also, the lower autumn catch rates may, in large part, be due to the larger gillnet mesh sizes used during this period.

Lack of consistent diurnal patterns between temporal strata in our data for sockeye, chum, and coho salmon may be related to fishing practices, as well as biotic and abiotic factors. Lynch (1991) found that chum salmon catch rates between sunset and evening astronomical twilight were intermediate between those during full daylight and full darkness. For coho salmon, no consistent diel pattern has been observed (Godfrey et al. 1975; Lynch 1991; Ogura and Ishida 1992).

The large differences between the species catch proportions for chinook salmon by logbook (1.04%) vs harvests by all District 115 fishers (0.12%) is not believed to cast doubt on the validity of the logbook data. Rather, the disparity can be attributed to different fishing practices, to nonretention of chinook salmon, to the incidental harvests not being sold and reported, and to combinations of these factors. Although we did not find significant differences in fishing practices between the 2 groups, nonretention and nonreporting are likely possibilities. That is, under state regulations chinook salmon caught in the Lynn Canal gillnet fishery may be discarded or used for personal consumption. Also, the high proportion of small chinook salmon in the incidental catch (82%) and their low commercial value contribute to both the nonretention and personal consumption of the fish. Unbiased estimation of the magnitude of this unenumerated catch and harvest was outside the scope of our research.

The potential efficacy of night closures in the Lynn Canal drift gillnet fishery in 1991 was estimated using the logbook catch and effort data found in Table 1. Had managers, without reducing the total catch of sockeye salmon, employed night closures in the first 2 strata, when bycatch was greatest, the fishery would have been open 432.6 h (sunrise to sunset) during weeks 25–29 and 632.8 h during weeks 30–36, or 16% fewer overall hours than occurred with nights open. Although catches of sockeye salmon would have been unchanged, catch by logbook fishers for the 2 periods combined would have been altered by +0.7% for chum (26 fish), -20% for coho (-22 fish), and -34% for chinook (-58 fish) salmon. Logbook fishers landed only 2.6% of the District 115 sockeye harvest, 2.8% of the coho harvest, and 3.0% of the chum harvest. We could not reliably expand the logbook chinook catches (187 fish) to estimate the total number of chinook salmon that would have been caught and conserved if night closures had been in place because the study was not designed for this purpose. However, the logbook catch data provide a solid indication that considerable savings in chinook salmon could result from night closures.

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