AYK REGION
NS/K STOCK SEP.
REPORT # 3

KWINIUK RIVER COUNTING TOWER PROJECT

1966

(From AYK Area 1966 Annual Management Report)

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KWINIUK RIVER TOWER COUNTING PROJECT, 1966

INTRODUCTION

In 1966 the Kwiniuk River tower counting project was continued for the second year. The primary objective of the project is to evaluate the accuracy of aerial surveys of spawning salmon by comparing aerial counts to tower counts. Secondary objectives of the project were to determine the timing and magnitude of the escapement by use of a counting tower; to evaluate the operational use of the tower; to observe behavior of migrating salmon and attempt to relate movements of fish with environmental factors; and to periodically sample the salmon runs for size, sex, age, predator and net marks, and fecundity.

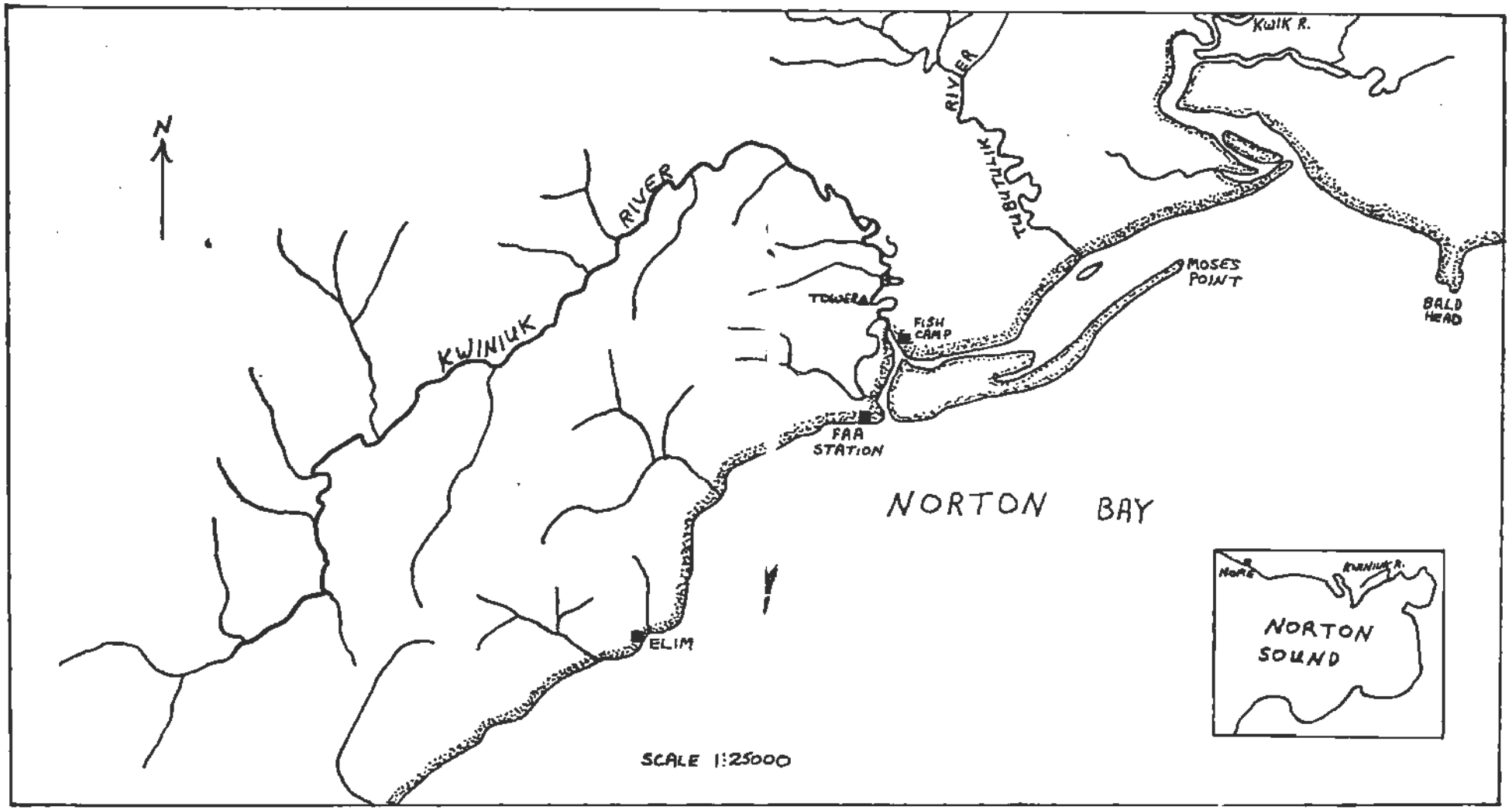
METHODS AND MATERIALS

The counting tower was located at the same site as in 1965, about five miles above the mouth of the river. A map of the Kwiniuk River system is presented in Figure 12 . A beach seine was not used in 1966 to divert salmon from using a secondary channel formed by a sand bar opposite the tower site. The net was ineffective in 1965 and in addition, salmon using this channel could be counted from the tower. A detailed description of the tower site and equipment was presented in the 1965 Annual Report.

On June 16 the counting tower was erected. Three crew members made hourly counts (24 hours per day) during the salmon runs. Each crew member counted for two 4-hour shifts daily. If counts were missing for a time interval, the numbers of salmon were determined by averaging the counts preceding and following that period. Salmon moving downstream past the

FIGURE 12

KWINIUK RIVER SYSTEM MAP



tower were subtracted from the total count. In addition to the hourly counts, 10-minute counts were made each hour to determine if a reliable seasonal estimate of the salmon escapements could be obtained by counting for shorter intervals.

Climatological and Stream Observations: Daily water temperatures and river depths were measured by the tower crew. The FAA station at Moses Point provided data on air temperatures, precipitation, and wind direction and velocity. Precipitation during the period the tower was in operation totaled 3.39 inches. Daily maximum air temperatures ranged from 47°F. to 78°F. and minimum temperatures from 33°F. to 61°F. The mean water temperature was 50.6°F. with a maximum of 59°F. and a minimum of 44°F. Winds at the tower site averaged 13 miles per hour and usually from a south-southeast direction. A tidal influence of about one foot occurred at the tower site.

Catch Sampling: The commercial and subsistence fishery near the mouth of the river were sampled seven times during the season. A total of 479 chums and 120 pink samples were collected for age, sex, and size information. Also 3 chum and 20 pink ovary samples were taken. Results are discussed under "Norton Sound Catch Sampling" and "Salmon Fecundity Studies".

Aerial Surveys: Aerial surveys were made in single engine planes, Cessna-180 and Super Cub with two different experienced pilots. Flights were made from both upstream and downstream directions over the river. Two management biologists made the aerial surveys, in contrast to only a single observer in 1965. Most of the surveys were flown without prior knowledge of the accumulative tower counts. Based on cloudiness, stream turbidity, winds, distance covered, each survey was rated as either

"poor, fair or good".

RESULTS

Estimation of Escapements from Tower Counts: Kwiniuk River salmon escapements are presented in Table 43 . An estimated escapement of 32,786 chums; 10,629 pinks; and 7 kings was recorded during the period June 19 to July 28, 1966. In addition, subsistence fishermen caught 396 chums and 235 pinks above the tower. The tower counts continued past the peak of the salmon migrations until it was indicated that the runs were nearly completed. In 1965 counting terminated prematurely (July 19) and as a result, some chum salmon and a substantial number of pink salmon were probably not counted.

On June 19 chums were first observed when 24 fish passed the tower. The first major peak in the chum run was observed on July 1 when 3,548 fish were counted. A second major peak occurred on July 12 as 4,998 chums were counted. During the period June 19 to July 28, the average daily count was 830 chums. In Figure 13 the daily counts of chum salmon passing the tower in 1965 and 1966 are graphed to show the fluctuations in the seasonal migration. It is interesting to note the similarity in run timing during both years. The chum salmon runs peaked during the same periods in 1965 and 1966.

Kwiniuk River chum salmon tower counts in 1966 (33,182) and 1965 (32,861) were similar. The size of the run (commercial catch and escapement) in 1966 was slightly greater than the 1965 run, since an unknown portion of the run was harvested by the commercial fishery. However, the greater proportion of sub-district Z-3 commercial catch consisted of Tubutulik River chums, since during most of the season the fishery

TABLE 43

KWINIUK RIVER DAILY SALMON ESCAPEMENTS
JUNE 19 - JULY 28, 1966

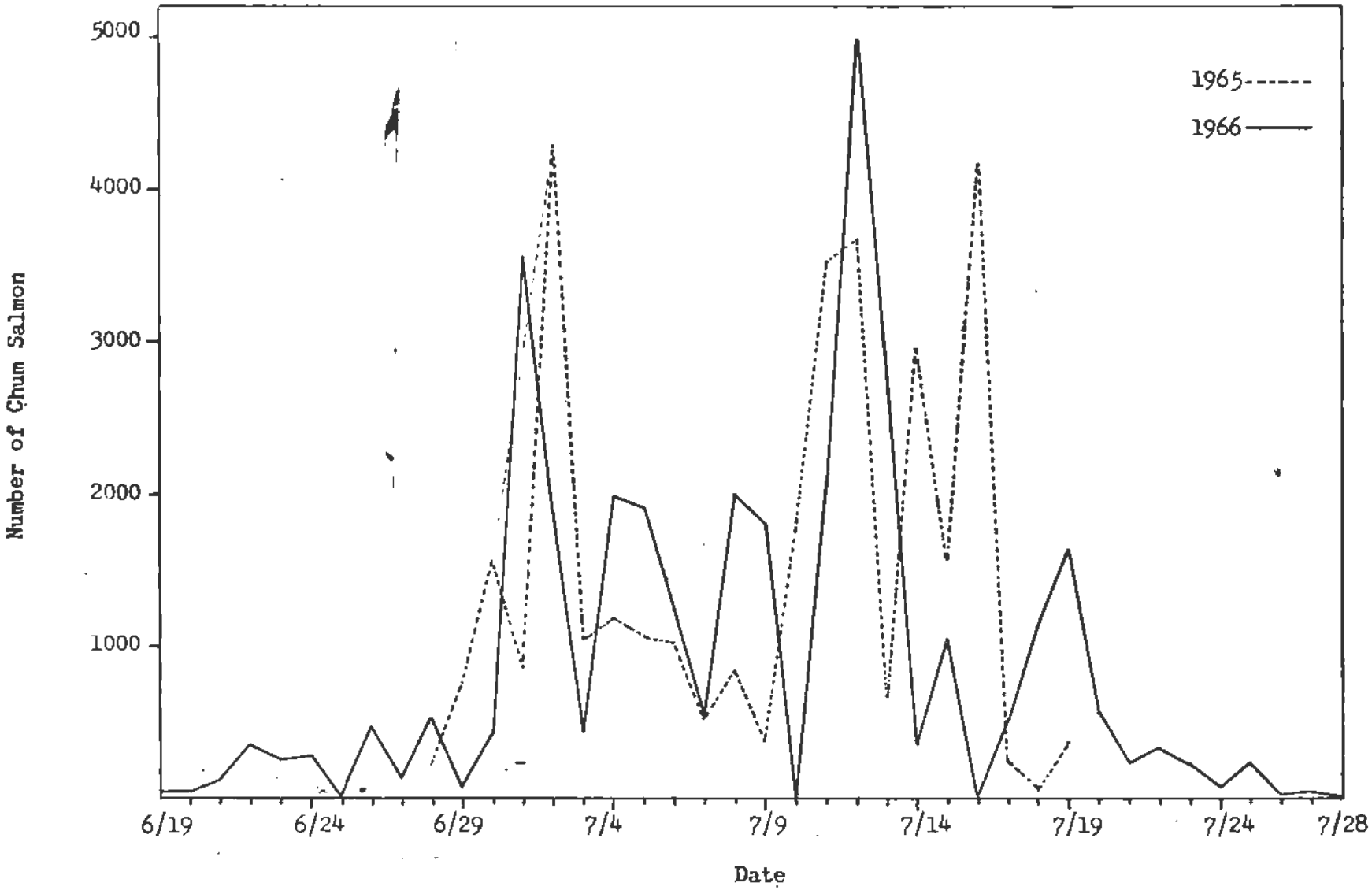
Date	Chums	Pinks	Kings
6/19	24		
6/20	26		
6/21	108		
6/22	348		
6/23	253		
6/24	289		
6/25	-451*		
6/26	463		
6/27	129		
6/28	508		
6/29	71		1
6/30	412		
7/1	3,548		1
7/2	1,891	11	
7/3	435	18	
7/4	1,996	288	
7/5	1,908	200	
7/6	1,226	16	
7/7	519	35	1
7/8	2,000	39	
7/9	1,800	66	2
7/10	-31*	10	
7/11	2,079	39	
7/12	4,998	36	
7/13	2,676	59	
7/14	354	81	
7/15	1,025	307	
7/16	-268*	-197*	-1
7/17	508	198	1
7/18	1,121	565	
7/19	1,619	1,498	1
7/20	570	625	
7/21	244	296	
7/22	325	1,368	
7/23	215	1,219	
7/24	92	1,066	
7/25	107	2,172	
7/26	16	676	
7/27	31	107	1
7/28	-2*	66	
Total Tower Count:	33,182	10,864	7
Caught Above Tower by Subsistence Fishermen:	396	235	0
ESCAPEMENT:	32,786	10,629	7

* Fish moved downstream past tower.

FIGURE 13

DAILY COUNTS OF CHUM SALMON PASSING

KWINIUK RIVER COUNTING TOWER, 1965 - 1966



was concentrated inside the Moses Point spit.

Pink salmon were first observed on July 2 when 11 fish were counted. The pinks first peaked on July 19 (1,498 fish) and during the period July 22-25 with an average daily count of 1,456 noted. After July 25 the pink counts declined rapidly. During the period July 19 to July 28 pinks were more numerous than chums. In Figure 14 daily counts of pinks are compared for the years 1965 and 1966.

Pink salmon appeared to be more abundant in 1965 since large numbers of fish were probably still moving upstream past the tower site when the project terminated. A total of 8,668 pinks were estimated to have passed the tower as of July 19, 1965, the last day of counting. A total of 10,864 were counted in 1966 during the entire season. It is believed that very few Kwiniuk River pinks were taken by the commercial fishery in 1966, since nearly all gear was located near the mouth of the Tubutulik River.

Observations of Salmon Behavior: The daily timing of chum and pink salmon past the tower in 1966 was similar to the pattern noted in 1965. In Figure 15 the daily timing of migrating chum salmon in 1965 and 1966 is compared. In 1966 salmon moved upstream primarily during the hours 1600 to 0300 versus 1400 to 0200 hours in 1965.

In 1966 there were several instances of downstream migration. A total seasonal count of 752 chums and 197 pinks was observed moving downstream in 1966, a considerable increase over that observed in 1965. It appears that downstream movements of salmon in 1966 may be associated with changes in stream discharge resulting from heavy rainfall. The majority of the downstream migrations occurred during or following

FIGURE 14

DAILY COUNTS OF PINK SALMON PASSING
KWINIUK RIVER COUNTING TOWER, 1965 - 1966

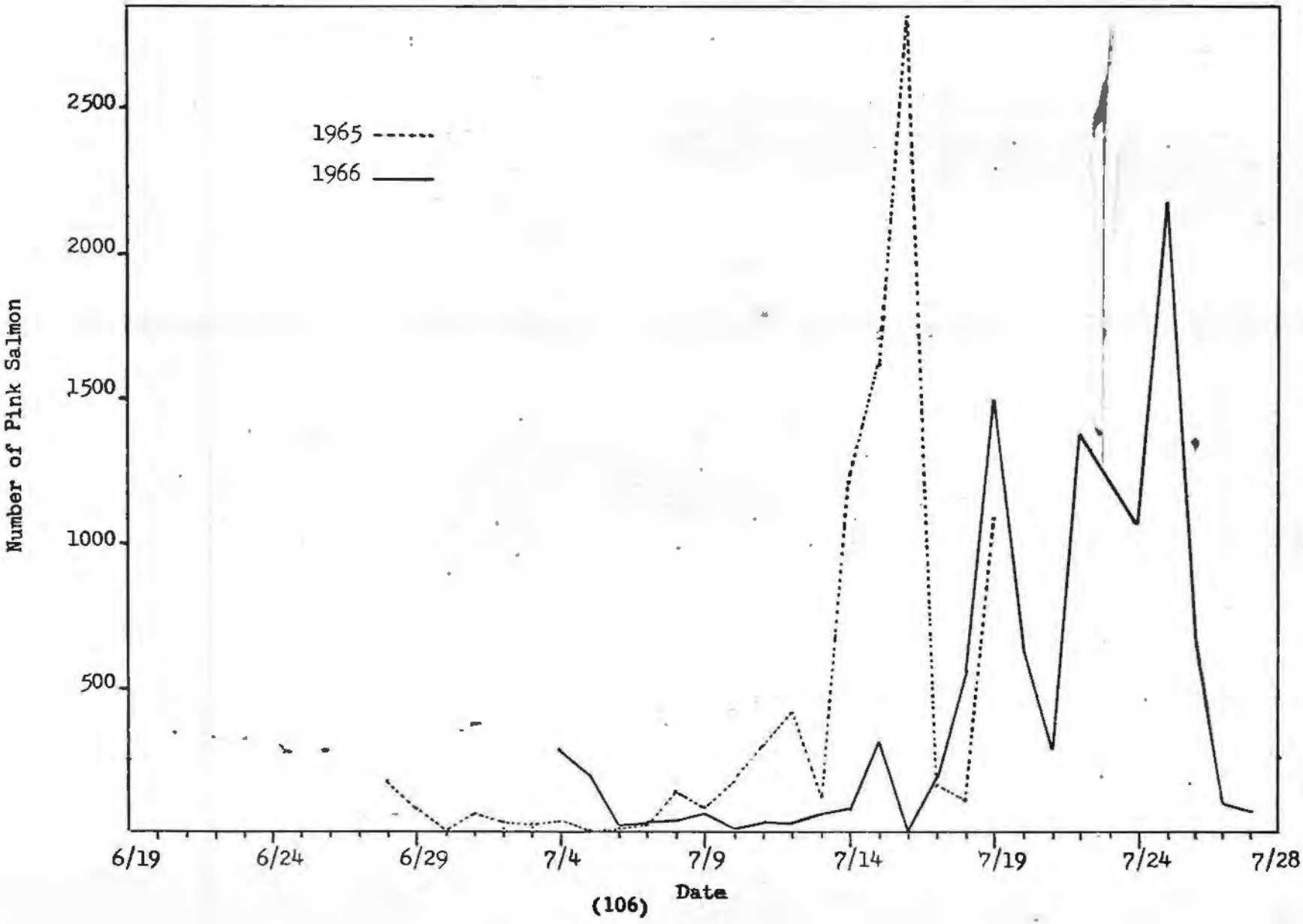
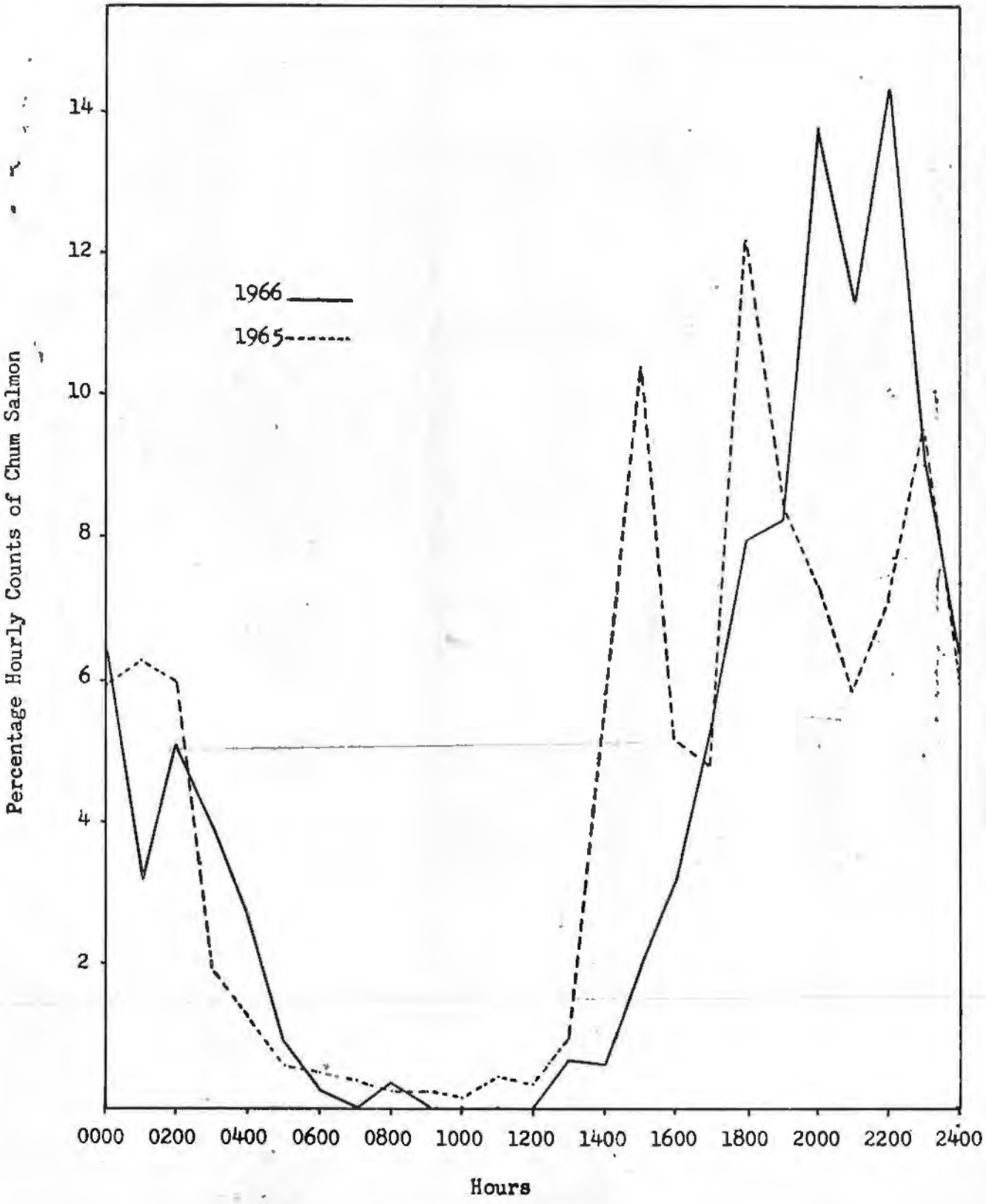


FIGURE 15

TIMING OF DAILY MOVEMENTS OF CHUM SALMON PASSING
KWINIUK RIVER COUNTING TOWER, 1965 - 1966



periods of precipitation. Other factors probably influence downstream migration also.

Estimate of Total Escapements by 10-Minute Counts: Counting for shorter time periods was conducted in 1965 to determine if a reduction in counting time would be feasible for reliably estimating the total hourly migration. It was indicated that 10, 20, or 30 minute counts will not provide reasonable hourly estimates and hence daily totals (See 1965 Annual Report). Therefore, it was necessary to continue the hourly counts in 1966 so that accurate daily escapements could be obtained.

In addition to the hour counts made in 1966, 10-minute counts were taken each hour for the purpose of estimating the total seasonal escapement of pinks and chums. To determine if 10-minute counts would provide a reasonably accurate estimate of the total escapement, the relative error of the two estimates was computed. The relative error is the difference between the total expanded 10-minute counts and the total seasonal escapement based on actual hour counts divided by the sum of the total hour counts. Results are summarized below:

	Total Actual Hour Counts	Total Expanded 10-minute Counts	Relative Error
Chums	27,261	29,692	+ 8.92%
Pinks	10,138	10,770	+ 6.23%

Thus, 10-minute counts will provide a reasonable estimate of seasonal escapement. However, hour counts are required to obtain accurate daily estimates of salmon escapements for the purpose of evaluating aerial surveys.

Aerial Surveys: A total of seven aerial surveys were made of the Kwiniuk River from the period June 30 to July 23, 1966. The surveys were flown during good weather and when stream flows were normal. In Table 44 comparative tower counts and aerial survey estimates of salmon escapements

TABLE 44

COMPARATIVE TOWER COUNTS AND AERIAL SURVEY COUNTS OF SALMON ESCAPEMENTS
KWINIUK RIVER, 1966

Date	Tower Count	Aerial Count [1]	Percent Tower Count Estimated by Aerial Count	Survey Rating	Remarks
June 30	1,842 chums 0 pinks	0 chums 0 pinks	0.0% -	Fair	Migrating salmon.
July 1	2,444 chums 0 pinks	585 chums 0 pinks	23.9% -	Fair	Migrating salmon. Very windy and could not survey all bends.
July 2	6,381 chums 0 pinks	2,390 chums 0 pinks	37.5% -	Good	Migrating salmon. A few bends above tower not surveyed.
July 5	8,152 chums 317 pinks	4,448 chums 100 pinks	54.6% 31.5%	Fair-Good	Majority migrating salmon, some spawners noted.
July 21	31,873 chums 3,641 pinks 35,514 chums & pinks	- - 17,160 chums & pinks [2]	- - 48.3%	Good	Majority spawning. Some migrating salmon in lower river.
July 23	32,861 chums 5,816 pinks 38,677 chums & pinks	24,497 chums & pinks [2]	74.5%	Good	Majority spawning except some migrating salmon in lower river.
	6 kings	6 kings	100.0%		

1) Salmon counted above tower.
2) Majority chums.

are listed. An aerial survey flown on July 19 was not included in the Table since only one half of the river was surveyed. The surveys were made during all phases of the salmon runs from the early migrating schools to the onset of peak spawning activity. Best results were obtained when aerial counts were made during the latter period. The final survey on July 23 estimated 24,497 chums and pinks or 74.5% of the tower count recorded the same day. All surveys underestimated the actual numbers of salmon in the river.

DISCUSSION

In this section factors affecting the differences between the aerial survey estimates and the tower count (true population) will be briefly discussed. Aerial counts of salmon should be regarded as an index of relative abundance and not as a total count. If aerial survey procedures are standardized and environmental conditions do not vary much, then estimates of salmon escapements (indices) made at the same stage of the run can be compared from year to year. The high count or estimate of salmon escapements, usually made at the peak of spawning, is considered as the best index of the total escapement. Most aerial surveys by management biologists are made near the peak of spawning to obtain escapement indices of major salmon streams.

In general, most aerial surveys will underestimate the actual counts of fish due to the following factors: stream conditions (turbidity and deep pools), weather, wide variations in distribution and density of salmon scattered over distant areas of the stream and its tributaries, and the continuous changing population of spawners.

Successive Kwiniuk River aerial survey estimates did not provide reliable indices of salmon abundance since the proportion of the true

population estimated varied considerably. The wide differences between the aerial estimates can be attributed to the lack of standardized aerial survey procedures: 1) two different observers made surveys, 2) two different types of aircraft used (minimum speeds and maneuverability differ considerably) and 3) surveys flown at different stages of the salmon runs (i.e. migrating vs. spawning salmon). The lack of standardized methods resulted from unavailability of the same type of aircraft and time and personnel considerations.

All aerial counts underestimated the actual number of salmon in the river as recorded by the tower counts. Estimates were lowest when surveys were flown during the early portion of the run which consisted of nearly all migrating salmon. Schools of migrating salmon are often observed resting in pools and accordingly, it is difficult to make reasonably accurate estimates. The best estimate of the actual salmon population was a survey made near the peak of spawning when most of the salmon were distributed over the shallow riffle areas and hence, were easily visible.

Although considerably more aerial surveys of the Kwiniuk River were made in 1966, it would be desirable to have additional surveys made during 1967. If feasible, several surveys, using the same observer and and type of aircraft, should be conducted immediately prior to the peak of spawning since the high count or estimate is usually regarded as the best index of the total number of salmon entering the stream. These aerial estimates would be more meaningful than several surveys conducted during the entire salmon runs. Only by using standardized aerial survey procedures under optimum conditions and just prior to heavy spawning activity, can a proper evaluation of aerial estimates of salmon escapements be obtained.