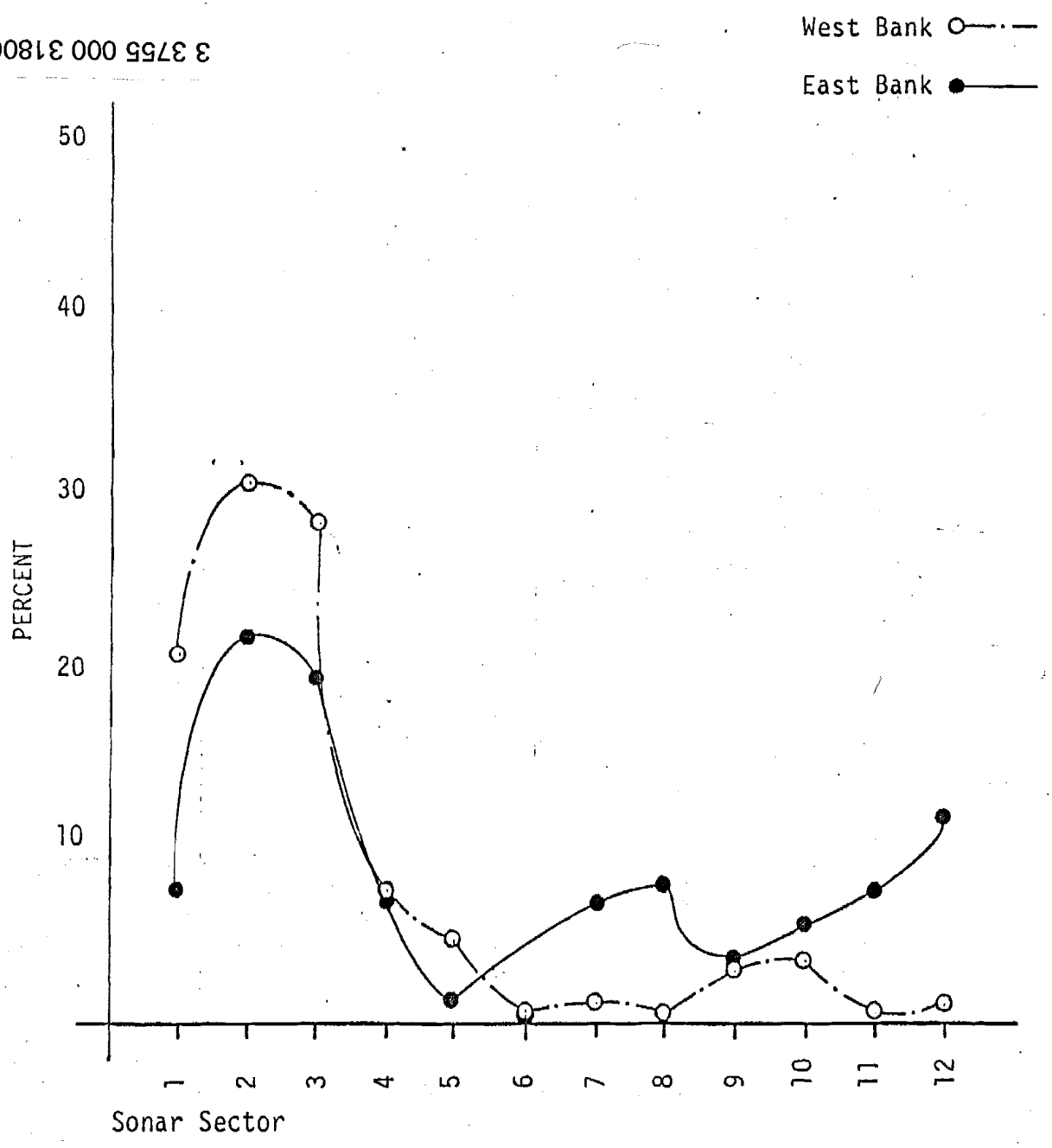
SUSITNA RIVER HYDRO STUDIES REWRITE

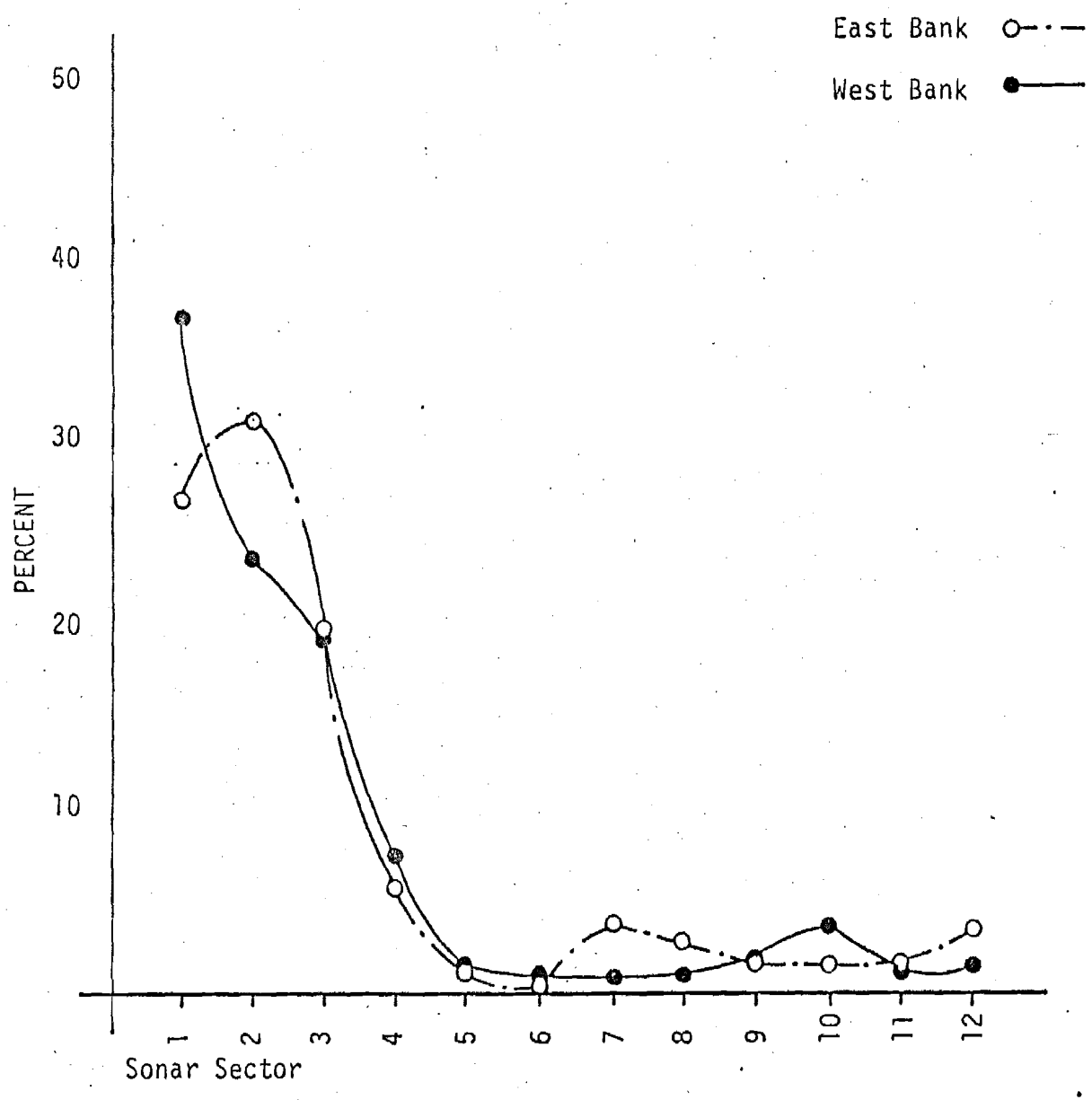
Background Information

Several basic assumptions made in the development of the original Susitna Hydroelectric Anadromous Adult Scope of Work may, in view of recent data analysis, be questionable. Two areas of major concern which may result in misleading data are assumptions relative to the capabilities of the side scan sonar and the application of mark-recapture techniques for enumeration of salmon spawning populations. An underlying principal in the original design of the adult salmon program was that comparative analysis of fish abundance between sonar sites could be made. Onsite counts could then be compared, and estimates of between site and main tributary spawning populations made. This is technically incorrect for most Susitna stocks. The complexity of the Susitna system (glacial, fluctuating water levels, multiple channels, wide cross section, and behavior pattern of salmon species) render sonar counts as indices of run strength rather than absolute counts. Data from three years of side scan sonar use (1978-1980) support the concept that sonar counts are useable only as run strength indices for chum, coho, and king salmon. These same data indicate that counts attributed to sockeye and pink salmon may be reasonable estimations of spawning population sizes.

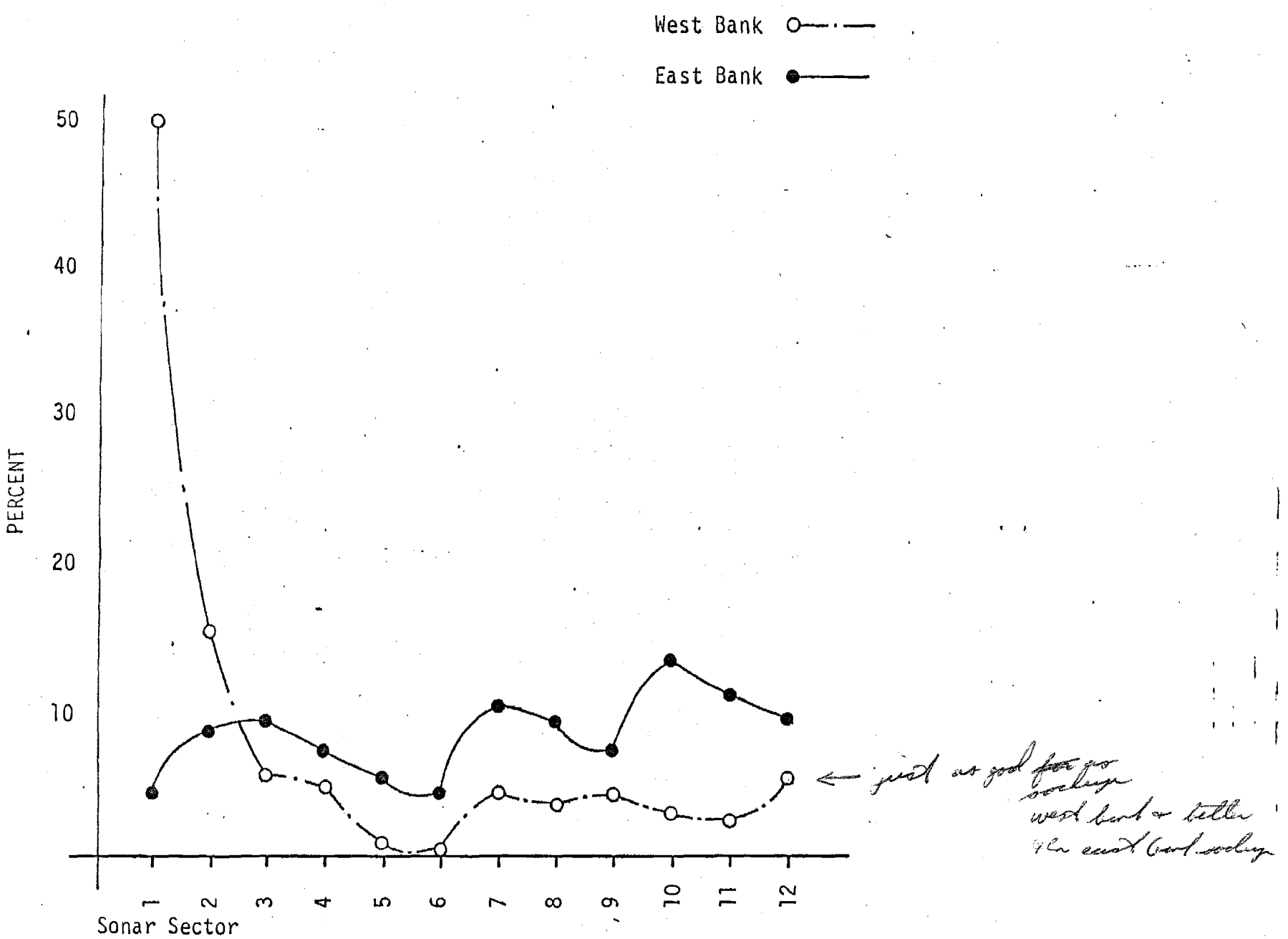
Figures 1 and 2 show the horizontal distribution for sockeyes and pinks along the sonar substrate in 1980. It is clear that both species tend to use the bank in upstream movement in the Susitna River. Conversely, Figure 3 shows chum movement in 1979 to be more evenly distributed along the substrate. This is an indication that chum counts are minimum numbers and that an unknown component of the chum escapement is probably moving outside the 60 foot range of the side scan sonar.



SUSITNA RIVER SOCKEYE SALMON
SECTOR DISTRIBUTION



SUSITNA PINK SALMON
SECTOR DISTRIBUTION



SUSITNA RIVER CHUM
Sector passage

← just as good for ~~for~~ sockeye
west bank + better
than east bank sockeye

Fish targets attributed to coho salmon have not been plotted in a similar manner because in both 1979 and 1980 there were not time periods in which coho counts represented more than a small portion of the total salmon run, and therefore coho horizontal distribution was masked by that of other more numberous salmon species. However, other evidence exists which supports the idea of offshore movement or fishwheel avoidance by coho salmon. The attached memo (Appendix I) from Dave Watsjold (Sport Fish Division, Palmer) indicates that if Commercial Fisheries Division escapement totals for coho in 1979 are considered absolute counts, approximately 46% of the run was harvested by sport fishermen above Susitna Station. As he pointed out, this figure is unrealistic in view of the fact that only a small portion of the Susitna river tributaries are accessible to fishermen and most of these are on the east side of the mainstem Susitna (data from 1979 and 1980 suggest that most of the coho may migrate up the Yentna River). Although 1980 sport fish harvest data are not yet completely tabulated, Sport Fish Division personnel in Palmer feel that the harvest may exceed 1979 by 2-3 times, indicating the same or greater percent of run harvested by fisherman in 1980 if sonar counts attributed to coho salmon are considered to be absolute counts. Kenai River coho catch and escapement totals demonstrate the error in assuming coho counts are absolute. In 1980, the harvest exceeded 6,000 while fish targets attributed to coho at the sonar site were less than 8,000.

In 1978 a special appropriation was made available to the Division of Commercial Fisheries to use side scan sonar to enumerate king salmon in the Susitna River. The data indicate offshore movement by larger and older king salmon. Fish targets attributed to king salmon numbered approximately 43,000 at Susitna Station while Sport Fish Division aerial surveys produced an estimated escapement of 74,000 for the Susitna drainage. Age information

from 1978 also indicate that larger kings move in mid-river. Susitna Station fishwheel catches yielded 48% four year old and 30% five year old kings. Sport Fish Division data from the Deshka River (where roughly half of the total Susitna River kings were counted) shows that the two most numerous age classes were five and six year old with 42% and 38% of the fish sampled, respectively.

The above data on chum, coho, and king salmon clearly shows that the assumption that counts for specific mainstem and tributary salmon spawning populations can be arrived at by subtraction of counts between the sonar sites is invalid. Counts at each sonar site will represent only the minimum number of these species which pass the site, and will not represent total population counts, or indicate the extent of mainstem spawning. In the case of sockeye and pink salmon, counts may be close representations of the actual spawning populations, but still do not indicate the degree of mainstem spawning.

The existing Susitna River Hydroelectric Project scope of work also outlines the use of a mark-recapture program to enumerate salmon above the Sunshine sonar site. The basis of the program is that tag recoveries will give salmon population estimates for the Susitna River above Talkeetna (to Devil Canyon), which can then be subtracted from Sunshine sonar counts to get the numbers of salmon going up the Chulitna and Talkeetna Rivers. This program, however, is based on several questionable assumptions about mark-recapture programs, mainstem spawning, and the ability to use sonar counts as absolute estimates.

There are seven assumptions which must hold true for accurate population estimates using any mark-recapture technique. These are listed below, accompanied by data from the literature detailing how assumptions were tested in other salmon mark-recapture programs, and the effect on population

estimates in the event that assumptions are not met. Existing data from Susitna River studies are also included where possible to document problems which could occur in meeeing the stated assumptions.

1. Loss by natural mortality or emigration is proportionally the same for marked and unmarked fish.

   The net effect of a loss of marked fish relative to unmarked fish is an overestimation of the total population. Schaefer (1951) documents previous work which found that gill nets are biased toward externally tagged fish. He also suggests (and cites other authors) that fish already stressed (in his work this was indicated by gill net marks) are more susceptable to mortality after handling in the tagging process. Although difficult to assess, the stress affect on salmon could be significant in the Susitna River due to the high percentage of fish with recorded damge by nets, predators, and parasites. Data from 1974, 1975, and 1977 (ADF&G, 1977) baseline Susitna River work indicate that loss by emigration could be a significant factor in developing population estimates for that portion of the river above the Talkeetna River-Chulitna River confluence. These studies found that a portion of the fish tagged on the Susitna River above Talkeetna were later recovered in other downstream tributaries. Conclusions in these reports suggested the confluence may be a milling area, however the possibility exists that the 'drop out' phenomena could be a reaction to the tagging process. In either case, the consistant appearance of numerous tagged fish below the tagging sites is an indication that population estimates may be biased if the behavior is not true for the unmarked population of salmon. Schaefer also concluded that even if the ratio of marked fish to total fish is

assumed to be the same at the mark and recapture sites, the estimate of the size of the population is correct only for the time (and place if migration occurs) of marking. This is true especially for situations where marks are put on salmon at a distance from the recapture area and an unknown rate of mortality (or migration up tributaries or into side sloughs) equal on both marked and unmarked fish reduces the population enroute to the area where recapture sampling is done. In such a case the population estimate is correct for the locality of marking only. In the Susitna River this would mean that a mark-recapture program where fish were tagged at the Sunshine site would yield an estimate of the size of the run which passed the Sunshine site only (where sonar counts are also being conducted).

2. Marks are not lost during the experiment.

   None of the literature reviewed or previous Susitna work indicates a problem with tag loss.

3. Marks are recognized and reported on recovery.

   This is not a potential problem because recaptures in the upper Susitna River will be made by project personnel. The project does not rely on tag return from the sport or commercial fishery, a source of error in many studies.

4. Marked fish are as likely to be caught as unmarked fish.

   In order for population estimates to be valid using standard statistical approaches, the ratio of marked fish to the entire population must remain constant during recapture. This assumes that the recovery method does not discriminate against either marked or unmarked fish. Ricker (1978) documents known cases where fish behavior and cathability can be altered by fish

handling, which may reduce the number of recaptures of tagged fish. Conversely the high visibility of tags on live fish may increase their chances of being counted in water conditions where unmarked fish are marginally visible. In any event, Schaefer (1951) demonstrated that the use of periodic spawning ground surveys for counting tagged and untagged fish was not sufficient to assume equal catchability of the marked and unmarked fish when sites were long distances apart. Work compiled and edited by Ulland (1977) found that the assumption is most valid (error reduced) when relatively large numbers of recaptures can be made in a relatively short period of time.

5. Marked fish mix randomly with unmarked fish, or fishing effort is proportional to the density of fish in different parts of the body of water.

Although random mixing of marked and unmarked fish is difficult to assess, Schaefer (1951) found that there was not full mixing of sockeye even when all fish were equally susceptible to capture and recovery. As noted previously, evidence exists from earlier Susitna River work that kings, chums, and cohos are undercounted because of offshore movement or fishwheel avoidance. Without any means of assessing the magnitude of the runs of these species which are not captured by fishwheels it may be impossible to determine the degree of mixing, or to assume that fishing effort is proportional to fish density in the river.

Recapture methods concentrate on four major tributaries and the mainstem sloughs in between. It can be assumed from the literature that mixing has not been totally random, however no means exists to assess the degree of error which may result in

population estimates. Limiting of recapture sampling to side sloughs and tributaries within a relatively small section of the upper Susitna River leaves researchers without any means of determining if effort is proportional to fish densities in different parts of the river. In fact, a major portion of the river and within the river has been left out of the recapture sampling effort indicating that unless the unsampled portions of the river contain no fish, population estimates will be in error.

6. A negligible amount of recruitment occurs during the period between marking and recapture.

Potential sources of error in population estimates exist in the current study plan because there is no way to assess recruitment in the recapture areas. Fish which move outside the fishwheels in the lower river may move into sloughs and tributaries where they are countable in recovery sampling only. As stated previously emigration may occur after tagging, giving a form of reverse recruitment which could affect estimates. Lastly, limiting the area of recapture sampling offers numerous combinations of tagged and untagged fish movements and spawning area selections which could result in recruitment in recovery sampling. Because of the limitations of the existing program, and the complexity and enormity of the spawning area in the upper Susitna it will be extremely difficult if not impossible to assess the affect of recruitment on population estimates.

7. The product of the number of fish originally captured and marked, and the number of fish in the recapture sample examined for marks

must exceed the product of the size of the population at the time of release of marked fish times four.

Although the number of tagged fish recaptured can be low (if the number of fish originally captured and marked divided by the size of the population at the time of release of marked fish is small, statistical bias can be ignored if the number of recaptures exceeds four) a fairly large number of fish must be tagged at the lower site and captured at the upper site to give valid estimates. For example: if 100,000 pinks are suspected to enter the upper Susitna River above Talkeetna, then 500 fish would need to be marked and 200 examined for marks. Any combination of multipliers of marked fish and fish examined for marks which yields a product greater than 100,000 would be a sufficient sample size. If, however, precise estimates of spawning populations are required, much larger sample sizes will be needed.

Robson and Regier (1964) developed charts which give the minimum sample sizes for marked fish and total recaptures (marked plus unmarked) necessary when an estimate of the total population is known. Using these charts and preliminary estimates of the run sizes into the Susitna River above the Yentna River confluence it is possible to develop sample sizes which would be needed for a statistically unbiased population estimate (with a 95 percent confidence that errors will not exceed 10 percent).

Case 1. All Fish passing the Susitna-Yentna confluence will also pass the Sunshine Site.

Species	Year	Estimate of Population Size	Number Marked	Number Examined For Marks
Chum	1981	50,000	2,000	5,000
Chum	1982	70,000	4,000	6,000
Coho	1981	20,000	2,000	3,000
Coho	1982	30,000	2,000	4,000
Sockeye	1981	70,000	4,000	6,000
Sockeye	1982	65,000	4,000	6,000
Pink	1981	100,000	5,000	7,000
Pink	1982	1,500,000	11,000	12,000

Using these data and Susitna River fishwheel capture totals from 1978-1980 it appears that as many as 10 fishwheels would be necessary to tag enough fish. If only 10% of the estimated 1981 and 1982 runs were to reach the Sushine Site it would still be necessary to run three or four wheels to tag the minimum number of chum salmon (the species thought to be least catchable by fishwheels).

The problems discussed above indicate that the mark-recapture program as it now exists has the potential to give misleading information about the spawning salmon populations above the Sunshine sonar site. The numbers generated could easily under or over estimate the upper Susitna salmon escapement (Talkeetna to Devil Canyon) which when subtracted from Sunshine Sonar counts, which are assumed to be absolute, will also give misleading results about the suspected escapements into the Chulitna and Talkeetna Rivers.

With the existing program problems in mind, several different approaches to obtaining appropriate data about each salmon species

are discussed below. As background some basic information which is known or suspected about the run tendencies of each species in the Susitna River are pointed out, the questions which need to be addressed by the program are listed, and programs are presented by species which are felt to be the best means of answering the questions within the time, economic, and technical limitations that currently exist.

REVISED PROGRAM

The following section presents a revised anadromous adult program designed to meet, where possible, the objectives stated in the existing scope of work. Each salmon species is treated individually in terms of sampling methods and the degree of success which might be achieved with the revised program. Selection of methods and evaluation of program success incorporate run expectation data and professional judgements expressed in Appendix II.

OBJECTIVES

The objectives stated in the existing scope of work are broken down into three main study areas, and are the same for all species within each area. All of the objectives, however can be condensed into five basic objectives which apply to all species as follows:

1. Escapement data by species in total and for each study area of the river from Susitna Station to Devil Canyon;
2. Differentiation of the Susitna River and Yentna River contributions to the total escapement;
3. Run timing into each study area of the Susitna River;
4. The degree of mainstem spawning in the designated study areas of the river, and
5. Differentiation of Chulitna, Susitna, and Talkeetna River stocks.

Individual programs are discussed for each objective by species in the following section.

Sockeye

1. Side scan sonar counters will be placed in the Susitna River at Susitna Station, the Yentna River, the Susitna River at Sunshine, and in the Susitna River above Talkeetna. The counters should provide acceptable estimates of sockeye escapement at the respective sites. It is likely

that sockeye (and pink) will be the only species for which the 'subtraction' method of obtaining counts between sonar counters is valid.

2. A fin and tail clipping program will be used at Susitna Station to determine if east bank sockeye go up the Yentna River, or west bank sockeye move up the Susitna River past the confluence. Clipped fish recoveries which indicate cross over will not provide absolute counts of the number of fish, but may indicate the degree in a broad sense (i.e. minimal versus significant). If cross over does not occur it can be assumed that Susitna Station west bank sockeye counts are fish migrating up the Yentna River. Yentna sonar sockeye counts can then be compared to Susitna Station west bank counts to determine if the 'subtraction' method is feasible.

3. Run timing data will be compiled from fishwheel captures at all sites.

4. Aerial surveys will be conducted of the known clear water sockeye spawning areas of the Susitna River above the confluence with the Yentna River. Surveys will be conducted a minimum of three times to determine peak abundance of sockeye. Aerial counts can be compared to sonar counts to give an estimate of the maximum number of potential mainstem spawners. It should be stressed, however, that surveys of this type usually do not account for one hundred percent of the spawning population. Previous surveys from the Susitna Basin have enumerated from 10% to 30% of the estimated sockeye escapements. Increased survey time, increased number of survey areas, and complete surveys of existing spawning grounds (fixed boundaries exist in each established survey area which limit the area of survey for year to year consistnecy) will undoubtedly increase the number of tributary spawners accounted for.

However, because of the enormity of the area and number of tributaries in which small sockeye runs exist, it is doubtful that any amount of effort will successfully enumerate all sockeye spawning in tributaries.

5. In the case of sockeye (and pink) salmon, placement of sonar above and below the confluence of the Susitna, Talkeetna, and Chulitna Rivers should give some idea of the magnitude of the Talkeetna River-Chulitna River run. Aerial surveys may help determine how this component breaks down within the two rivers.

Pinks

1. See sockeye number one.
2. See sockeye number two.
3. See sockeye number three.
4. A survey of historical data will be undertaken to determine if an aerial program such as the one presently proposed for sockeye can be accomplished. As with sockeye, spawning ground survey totals can be compared to sonar counts to estimate the maximum number of mainstem spawners. In addition, two ground survey crews will be placed on the mainstem Susitna River for the purpose of identifying spawning areas in mainstem channels, sloughs, backwaters and other areas where pinks have been observed spawning in past years. With experience these crews may be able to give reliable estimates on the number of spawners in each mainstem area examined which when totaled will represent a rough estimate of the mainstem spawning population which might be impacted by the proposed Hydroelectric project.
5. See sockeye number five. Ground survey crews will not be working the Talkeetna and Chulitna Rviers where it is suspected that some pink spawning will occur.

of the escapement will go up the Susitna River past the Yentna River; and 4) inability to predict the effects of the fishery on the returning population may increase or decrease the escapement. Based on these assumptions and recognizing that any estimates of return will be very rough, the sockeye run into the Susitna River above the Yentna River may approach 70,000 in 1981 and 65,000 in 1982.

Pinks

1. If the same assumptions about bank movement related to direction of travel at the Susitna River-Yentna River confluence are true, an average of 69.5% of the pink run will continue up the Susitna River (68% in 1979 and 71% in 1980).
2. Aerial surveys enumerate pinks incidentally to sockeye and as such, tributaries known for large pink spawning populations are not necessarily surveyed. In 1980 pinks were counted in large numbers in tributaries entering the Susitna above the Yentna in Chunilna Creek tributaries only (the Chinulna enters the Talkeetna River). Visual observations by sonar crews in 1980 found large numbers of pinks spawning in every slough or backwater investigated in the vicinity of Susitna Station. It is felt that at least in even year escapements, a large part of the run spawns in or near the mainstem river.
3. Surveys in 1977 enumerated 6,600 pinks (of the 1.5 million estimated escapement) in the area above the three river confluence (Talkeetna River, Chulitna River and Susitna River) to Devil Canyon. In 1975, 291 of the estimated 546,000 escapement were enumerated in the same area.
4. The 50% point of the pink run past Susitna Station historically occurs around the end of the third week of July in odd years and the end of July in even years. Data from upper Susitna Studies conducted in 1974

and 1975 indicates a peak in pink catches in the first two weeks of August.

5. Predictions are based on these assumptions: 1) the number of fish returning to the river per parent year spawner was 1:1 in even years and a range of .08-2.7:1 in odd years based on escapements at Susitna Station from 1978 to 1980; 2) 70% of the total pink escapement continues up the Susitna River past the Yentna; and 3) inability to predict the effect of the fishery on the run may influence escapements. Based on these assumptions and recognizing that run predictions are very rough, the Susitna crews above Susitna Station may be dealing with pink run sizes in the Susitna above the Yentna of 70,000 to 236,000 in 1981 and 1.5 million in 1982.

Chum

1. If the assumption that bank selection indicates direction of travel at the Susitna Rivers confluence, 82.5% of the chums are moving up the Susitna above the Yentna. It should be noted, however, that because of potential midriver movement by this species, the percentage attributed to each river may not be close to actual escapements. That is, the figure represents the percentage of chums catchable by a fishwheel only.
2. Spawning ground surveys rarely account for more than a few chums in any clearwater area, although occasional reports of large numbers exist in the historical records (in 1953 10,000 chums were spotted off the mouth of Chunilna Creek, a tributary of the Talkeetna River). Susitna Hydro surveys accounted for approximately 3,100 chums in 1974 and 2,300 in 1977 (of a total escapement estimated at 105,000 by Susitna Station) in the Susitna River above the confluence at Talkeetna. It is suspected that chums can and do spawn in the bottom conditions of the mainstem

river. Most of the chums observed in the 1974, 1975, and 1977 Susitna Hydro studies were found spawning in side sloughs of the upper Susitna.

3. The 50% point of chum fishwheel catches at Susitna Station usually occurs around the last week of July although the date fluctuates from year to year and may be as late as mid-August (August 14 in 1979). Chum captures in upper Susitna fishwheels peak during the period of August 11-17 in 1974, 1975, and 1977 studies.

4. Predictions of 1981 and 1982 chum escapements are based on the following assumptions: 1) totals are based on recent sonar counts which are thought to be minimum escapement totals, 2) the return is primarily 4 year old fish; 3) the number of fish returning to the river per parent year spawner has averaged .6 for 1975 and 1976 parent years returning in 1979 and 1980; 4) 82.5% of the returning chum go up the Susitna River above the Yentna; and 5) inability to accurately enumerate the run may result in extremely low estimates of run strength (this is probably true for 1979 and 1980 escapement estimates, which also affects the return per spawner ratio). Based on these assumptions and recognizing that confidence in the above numbers is much less than for sockeye and pinks the minimum chum escapement into the Susitna above the Yentna may approach 50,000 in 1981 and 70,000 in 1982.

Coho

1. If the same assumptions above bank movement related to direction of travel at the Susitna River-Yentna River confluence are true for coho as sockeye, roughly one-third of the coho entering the Susitna River will continue above the confluence with the Yentna River. As with chums, however, lack of reliable sonar counts greatly decreases the degree of confidence in this figure.

2. Sport Fish Biologist feel based on experience that mainstem spawning by coho salmon is negligible. No hard evidence to support this exists. Aerial surveys rarely account for more than a few coho in clear water tributareis, coho are the most difficult salmon species to enumerate on spawning ground. The literature suggest that coho tend to spawn in smaller clearwater creeks and rivers and are not known to use substrates such as those typical of the mainstem Susitna River and its larger tributaries.

3. Almost nothing is known about coho distribution either above the Talkeetna River-Chulitna River confluence or in the mainstem between Talkeetna and the mouth of the Susitna.

4. A 50% date for fishweel captures of August 15 in the Susitna River above Talkeetna was established by the 1974 and 1975 studies, however, this figure is based on a very small sample size. Fifty percent of the cohos were captured in fishwheels at Susitna Station around August 1 in 1979 and 1980. As with chum, these dates have varied by as much as two weeks in previous years.

5. Predictions of coho run strength in 1981 and 1982 are very rough because the run strengths from previous years are probably low, giving a low ratio of the number of fish returning to the river per parent year spawner. The assumptions are: 1) the run is primarily four year old fish; 2) the return per spawner ratio used is 1:1 although the yearly ratio for 1979 and 1980 differs by nearly 100% and 3) the Susitna River contribution above the Yentna River confluence averaged 33% although as explained above this figure represents a comparison of fishwheel captures only and may not reflect the actual contribution of each river system. If these assumptions are close, then the number of fish sampleable by current

techniques and entering the Susitna River above the Yentna may approach 20,000 in 1981 and 30,000 in 1982.

King

Sport Fish input?

APPENDIX II

RUN EXPECTATIONS

Based on previous experience on the Susitna River and analysis of 1978 through 1980 Susitna Station sonar and fishwheel data, certain characteristics of each salmon species run can be described which have been used in program redesign. Using these previous data and the assumptions contained in the text for each species below, it is possible to give some information about what answers might be expected and what information in unknown about the questions posed in the scope of work objectives.

Sockeye

1. Because of the location of the sonar counters at Susitna Station just below and across from the Yentna River-Susitna River confluence, it is thought that most salmon following the west bank are going up the Yentna River and those on the east bank continuing up the Susitna River. Some unpublished data exist in support of this speculation in the form of informal work done in 1978, as well as the 1977 tagging studies. No fish captured and marked in east bank wheels in 1977 were later captured in wheels located on the Yentna or Skwentna Rivers. In 1978, field crews tail-punched sockeye in east bank wheels to determine if crossover to the west bank was occurring, but of the fish marked only one was later found in west bank wheels. The evidence is far from conclusive, but indicates that bank choice may determine the direction of travel at the Yentna River-Susitna River confluence. Although no work of this nature has been attempted for other salmon species it is assumed for purposes of discussing relative magnitude of run up each river (Susitna and Yentna), that the same pattern hold true for pink, chum and coho. In 1979 and 1980 west bank sonar counts contributed 79% and 82% of the

sockeye total respectively. The assumption that these fish went up the Yentna River is somewhat supported by aerial surveys which enumerated 91% (1979) and 93% (1980) of all Susitna drainage sockeye spawners seen in surveys in Yentna River tributaries.

2. Aerial surveys accounted for 27% of the west bank sockeye counts and 10% of the east bank sockeye in 15 known clear water tributary spawning areas in 1980. These numbers may have been higher except for economic constraints on survey time (particularly on the Susitna River above the Yentna confluence), and limiting of counts to established index areas. Nothing is known of sockeye mainstem spawning in the Susitna drainage although it is thought that bottom conditions (primarily shifting sand and silt) are not condusive to or preferred by sockeye for spawning.
3. Baseline studies in 1974 and 1975 counted very few sockeye in the Susitna River above Talkeetna. In 1974, 336 sockeye were seen in surveys, and in 1975 when 108,000 sockeye were estimated to have passed Susitna Station, 103 were counted in the upper river. Of the 238,000 sockeye estimated at Susitna Station in 1977, ground surveys enumerated 661 in the Susitna River above Talkeetna.
4. The date on which 50% of the sockeye run passed Susitna Station in 1978-1980 was July 18-20. Fishwheels on the upper Susitna River above Talkeetna captured 50% of the total sockeye catch on August 5, 1975 and 75% by August 16, in 1974.
5. Predicting returning spawning populations in difficult at best, but numbers are generated here based on the following assumptions: 1) The return will be approximately one-half 4 year and 5 year old adults; 2) the number of fish returning to the river per parent year spawner is 2 to 1 based on 1980 returns from 1975 and 1976 parent years; 3) 20%

Chum

1. Chum salmon (and coho) will be the hardest species to obtain accurate escapement counts for. As discussed previously, sonar counters are not usable for absolute counts, and since most of this species are suspected to be mainstem spawners, spawning ground surveys of clearwater streams will probably not enumerate a substantial number. It is possible that the majority of the Susitna River chum run continues up the mainstem above the Yentna River to spawn, but very little data exists that documents where or how many. Ground survey crews will be used to document those areas along the entire river where chums are found, and various sampling methods will be used to obtain rough estimates of the numbers of spawners in each area. This program is viewed as a preliminary approach which may reveal areas where a significant amount of spawning occurs that may be worthy of a concentrated enumeration effort in future years. It is doubtful if the technology exists to enumerate chums which spawn primarily in the glacial mainstem areas. This approach, however, coupled with habitat flow work may roughly estimate the number of spawners which may no longer have access to side sloughs when flow levels are reduced.

2. Because of the difficulty in enumerating chums, differentiation of Susitna River and Yentna River stocks will be accomplished only in the form of minimum counts at the Yentna and Sunshine sonar sites. Although east bank Susitna Station sonar counts attributed to chum are thought to be migrating up the Susitna River past the Yentna River confluence, without accurate counts at any point in either river it will be impossible to enumerate the percent of the total chum escapement contributed by either river.

3. Run timing data will be compiled from fishwheel captures at all sites.
4. See chum number one.
5. See chum number two. Minimum chum escapement totals will be obtained for the Susitna River above Talkeetna using sonar counts and ground surveys. No estimates of chums migrating into the Chulitna and Talkeetna Rivers will be made.

Coho

1. Sonar counters will provide a minimum estimate of coho passing each site. Ground survey crews will report numbers of coho observed or captured however since coho are not normally found spawning in the conditions which exist in the mainstem Susitna River it is expected that ground crews will not locate large numbers of coho. Apparently, coho are found in nearly every clear body of water, regardless of size, in the Susitna drainage, which makes large scale tributary survey efforts of questionable value.
2. See chum number two.
3. Run timing data will be compiled from fishwheel captures at all sites.
4. It is felt that mainstem coho spawning is negligable, however, no data exists to support this contention. Ground survey crews will enumerate coho found in mainstem areas.
5. See chum number five.

King

1. Intensive aerial surveys will be conducted on known king salmon spawning tributaries. This is an ongoing program developed by Sport Fish Division to estimate total king salmon return to the Susitna Basin.
2. See king number one.
3. See king number one.

4. Aerial surveys are conducted on clear water tributaries only. No attempt will be made to estimate the degree of mainstem spawning of kings (if any) due to the glacial nature of the mainstem Susitna River and it's main tributaries.

5. See king numbers one and four.

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MEMORANDUM State of Alaska

TO:
Bruce King
Commercial Fish Division
ADF&G, Soldotna

DATE: November 4, 1980

FILE NO:

TELEPHONE NO: 745-3178

SUBJECT: Coho Data

FROM: D.W.
David Watsjold
Sport Fish Division
ADF&G, Palmer

Your memo was referred to me since I do all the anadromous fish work in the valley. We do not monitor coho escapements in very many streams due to the inaccessibility and large numbers of coho systems that exist in Upper Cook Inlet. We do attempt to make escapement counts on a small number of streams and we only count certain sections of these streams. Unfortunately the last two years have been extremely wet and complete counts have not been possible on some of the streams. The following are those streams on which we have some coho data:

	1975	1976	1977	1978	1979	1980
Wasilla Creek	207	313	*	150	248	*
Cottonwood Creek	236	204	117	264	*	870
Birch Creek	92	27	96	103	120	121
Question Creek	111	126	87	45	384	321
Fish Creek (Weir)	1,601	765	930	3,121	2,511	8,832

* All or part of index areas not countable.

Birch and Question Creeks are the only two streams that are tributaries of the Susitna River while the remaining streams flow directly into Cook Inlet.

Fish Creek and Cottonwood Creek are the largest coho systems that are monitored on a regular basis. The 1980 escapements on these streams were the highest recorded since Statehood. We do not census anglers on any of the east side Susitna River tributaries, but we are in close contact with the sport fisheries that occur on all east side tributaries and streams flowing directly into Knik Arm. I can safely say that in my eleven years of close association with the sport fisheries in this area that the excellent coho salmon fishing experienced in 1980 was unequalled in the previous ten years. The apparently large number of coho available in 1980 was not restricted to just several areas but was widespread throughout all the Upper Cook Inlet drainages.

Based on the 1979 sport fish catch estimates for the Susitna River, Larry Engel and I believe that the estimate of 37,000 is well below the actual escapement level of the Susitna River. We have received the preliminary sport fish catch estimates from the 1979 Statewide harvest study. In 1979 the coho catch estimate for Susitna River tributaries was 17,000. If the Susitna River coho escapement was indeed in the range of 37,000 that would mean the sport fishery would have harvested 46% of the escapement. This is not very likely in this system where the majority of coho stream are not even fished because of their remoteness. Even in the most ideal situations on our roadside stream systems we seldom see harvest levels that reach this magnitude

We also feel that the 1980 escapement level of 43,000 is also a very conservative figure. The 1980 escapement in the Susitna River drainage could easily be twice the

1979 figure given the fact that in Cottonwood and Fish Creeks the 1980 escapement was 3.5 times the 1979 escapement level. The sport fisheries also indicate a considerably greater abundance of coho in 1980 than what occurred in 1979. When the 1980 Statewide harvest study is completed sometime next summer I am confident that it will show a very significant increase in the coho harvest in all areas of Upper Cook Inlet.

We have just bits and pieces when it comes to length-weight averages and age classes. Several years ago we collected length-weight data from Wasilla Creek, Fish Creek and Little Susitna River. Wasilla and Fish Creeks coho are representative of the size coho that are generally available in Upper Cook Inlet. These coho average 58-60 centimeters fork length or 53-55 centimeters mideye to fork and 4.6 to 4.9 lbs. The Little Susitna River coho have always been unique in that they are larger than normal coho for this area. They average 67 centimeters (fork length), 60 centimeters (mideye to fork) and 7.9 lbs.

The majority of coho salmon that have been aged from various systems in the area have been Age 2.1.

I hope this information assists you in some manner. Unfortunately we don't have much information on coho at this time. If you have any questions regarding anything that I have stated please contact me.