State of Washington
DEPARTMENT OF FISHERIES
Coastal Lab
331 State Highway 12
Montesano, Washington 98563
March 6, 1986

TO: Dick Stone

FROM: Rick Brix

SUBJECT: WILLAPA BAY-CHINOOK ESCAPEMENTS GOALS AND ESTIMATES:

While I no longer remember how I got started, the recent re-working of the Willapa Bay chinook escapement data is nearing completion. Basicly two tasks were undertaken: 1) recalculate escapement goals in order to utilize new information and standardize the technique with that used in Grays Harbor, and, 2) recalculate historic Willapa chinook escapement (since the estmate themselves are based on a percent of goal statistics). The purpose of this memo is to document the rationale and methodologies used throughout these processes.

I. Revisions to Escapement Goals.

The need to revised Willapa Bay chinook escapement goals was pointed to from primarily three areas. First, the methodology utilized was signifiantly different from that in Grays Harbor. Willapa Bay escapement goals were developed and calculated prior to those of Grays Harbor and at the time of their development two seperate statistics were utilized. In streams/stream sections where more than 1000 yd2 spawning area per mile of length was available, the goal was calculated using 48 fish/mile as the desired peak count density (48 f/m x miles = #fish), otherwise the goal was estimated by dividing the yd2 of spawning area by 20.91 yd2/spawning pair (Engineers Hand Book). Summing the results of these calculations for each system gives the stream goal. Grays Harbor goals on the other hand were calculated by simply multipling the number of available miles of use by 36 f/m (the desired peak count density). The revised Willapa goals use this same statistic throughout.

A second area indicating revision that of goals was appropriate resulted from information gained from direct observations of the quality and quanity of spawning area in the mainstem North River. A boat survey of the lower twenty five miles resulted in the conclusion that there was, for all practical purposes, no spawning area in this section. This section had previously been considered the primary spawning section. Additional spot checks along the mainstem North River area have been made and no adequate spawning area has been located. Similar observations were made in Smith Creek. The effect of these observations were the elimmination of mainstem North River as potential spawning area and a reduction of two miles of use in Smith Creek.

Finally, estimates of escapements did not appear consistant with our knowledge and perceptions of productivity. The methodology utilized to estimate escapements resulted in placing what seemed to be excessive numbers of fish in marginal areas. Additionally it seemed to over-estimate (based on observations and perceptions) the relative importantance of strictly wild production, particularly in the North Bay.

As a result of this I have re-evaluated and propose to revise the Willapa Bay chinook escapement goals. These revised goals are presented in Table 1 along with their historical counterpart.

Table 1. Historical and Proposed Willapa Bay Chinook Escapement Goals.

Area	Historical	Proposed
North River	2211	695
Smith Creek	768	296
Willapa River	2093	1181
Palix River	130	104
Nemah River	545	224
Naselle River	2008	1547
Bear River	369	306

II. Revisions to Historic Escapement Estimates

The revision of the wild escapement goals necessites revision of the total Willapa Bay chinook data base and particularly the historical estimate of escapement. Using the revised goals I've recalculated most of the Willapa Bay wild chinook escapements. (Table 2.) With only a few noteable exceptions the methodology follows closely that used historically. Generally the peak count fish per mile is calculated for each index stream. This value is then divided by 36 f/m (the peak count goal) to obtain an % of goal . Using this figure as a multiplier for the appropriate system goal an estimate is calculated. Listed below are the index streams/areas and the corresponding stream/stream section to which the "% goal statistic is applied".

Index Stream/Section	Stream or Stream Section % Goal Statistic Appied
Fall River	-North River System
Clear Water Creek	-Smith Creek System
Willapa River	-Willapa mainstem below Forks Creek (river mile 29.0-30.5)
Trap Creek	-Trap Creek
S.F. Willapa	-Willapa River above Forks Cr. 1/ SF Willapa and all tribs All other major Willapa R tribs Palix River
North Nemah	-Nemah River system
Mainstem Naselle	-Naselle and Bear River systems

1/In addition to the number estimated by using the S. Fork survey data 5% of each years hatchery escapement was added to account in some fashion for fish straying from Forks Cr. and the Willapa Hatchery. (SF % goal x Willapa goal above Forks Cr. +.05 x Hatchery Esc) = Willapa escapement above Forks Cr.)

Unfortunately chinook spawner surveys in South Bay tributaries ended in 1979. This resulted from the policy decision for hatchery management of chinook and coho in Willapa and the need to increase and intensify survey efforts in Grays Harbor which is managed for natural production.

As a result an alternative estimator needed to be developed for South Bay tributaries. Within the data base (1968-1979) there are six years where there is sufficiant information to generate escapement estimates using spawner survey data for the total bay. These data points include estimates to the Nemah system. In reviewing the way the Nemah escapements were developed a number of errors both proceedurally and conceptually were noted. First, the chinook "index" is located on the N. Nemah from the hatchery rack downstream .5 miles. Obviously this section is very highly influenced by hatchery production. In expanding this survey data to the total system no adjustment was made for areas not so strongly influenced by the hatchery. This accounts for a very signifiant error. The second major error, more conceptual in nature was in the interpretation of what was seen in the Nemah index. Were or are the fish observed in this index going to spawn or are they just in transport to the hatchery. If just in transport to the hatchery then they'll be counted at the hatchery rack and should not also be counted as "natural" spawners. Currently, the perceptions are that the vast majority of these fish are in transport to the Nemah Hatchery and the "natural" spawning portion is relativity insignificant. Therefore, for the purposes of rebuilding the data base, it was felt that the Nemah system escapements are small enough to be consisdered insignifiant and were removed.

This action - pulling Nemah, resulted in increasing the number of years where we had sufficiently complete data to estimate escapements to eight, 1972-1979. A simple regression analysis, of these eight data points using WDF's prime minitab facility compared total bay wild spawners vs total Willapa River wild spawners. The result was an r2 of .375. The analysis indicated that the 1974 data point had a large influence. This particular data point includes a very large escapement estimate for the Naselle River. While this estimate was based on good index information. 1974 was a low flow year and an inordinate porportion of spawning occurred within the index resulting in an inflated escapement estimate. Removing this data point from the analysis the r2 = .709 adjusted for degress of freedom. The regression equation is:

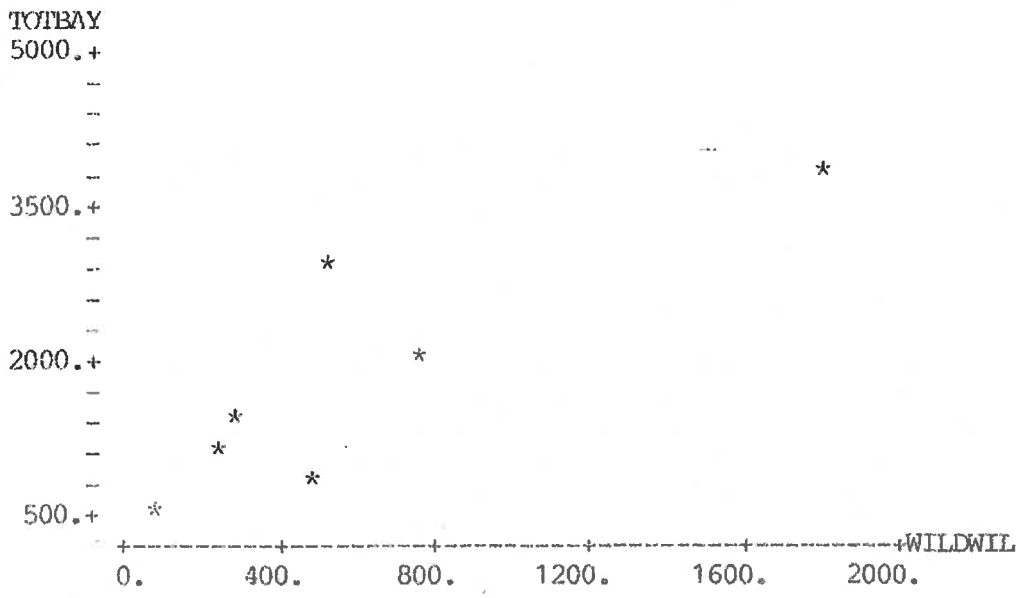
Total Bay Wild = 791 + 1.80 (Wild Willapa)

Details of the analysis as well as the plot are included. This relationship is signifiant at the α=.05 level. Since this appears to be a reasonably good relationship I've used it to fill in the missing data points.

South Bay = Total Bay - North Bay

The proposed revised escapement data base is presented in Table 2.

As a result of all these numerical manipulations I've got it into my head that we need to change the way we spend our effort on chinook spawner surveys in Willapa. The feeling I have from going thru these exercises is that we'd probably generate better estimate if our survey efforts were invested in the Willapa, and Naselle, drainages. Approximately 75% of the total natural spawning population in Willapa Bay is located in these two streams. Given the limited manpower we have, I would suggest we emphasize on these streams even to the point of sacrificing chinook data from other Willapa streams. As I see it six "index" areas could go a long way to giving us a more realistic picture of Willapa Bay escapements. These six, include the Willapa mainstem (above and below the mouth of Forks Cr), our regular Trap Cr index, the current SF index, and indexes above and below the hatchery on the Naselle. Precise locations have yet to be determined.

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MTB > REGR C3 1 C2

THE REGRESSION EQUATION IS
TOTBAY = 791 + 1.80 WILDWIL

                                    ST. DEV.     T-RATIO =
COLUMN       COEFFICIENT           OF COEF.     COEF/S.D.
                   790.6               358.5          2.21
WILDWIL          1.7989              0.4547          3.96

" = 636.7

R-SQUARED = 75.8 PERCENT
R-SQUARED = 70.9 PERCENT, ADJUSTED FOR D.F.

ANALYSIS OF VARIANCE

 DUE TO      DF           SS         MS=SS/DF
REGRESSION    1      6344648          6344648
RESIDUAL      5      2026848           405370
TOTAL         6      8371496

Continue? Y
                         Y    PRED. Y   ST.DEV.
 ROW   WILDWIL     TOTBAY      VALUE   PRED. Y  RESIDUAL     ST.RES.
   6      1783       3884       3998       596      -114      -0.51 X

X DENOTES AN OBS. WHOSE X VALUE GIVES IT LARGE INFLUENCE.

DURBIN-WATSON STATISTIC = 3.09

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