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ALASKA DEPARTMENT OF FISH AND GAME

DIVISION OF SPORT FISH

MEMORANDUM

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SUBJECT: 2010 and 2011 late run Kenai River Chinook salmon run strength and escapement

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This memo summarizes the department's current knowledge regarding the inriver run strength of late run Kenai River Chinook salmon in 2010 and 2011. It also provides 2010 and 2011 escapement estimates, properly converted to the currency of target strength based (TS-based) sonar estimates, for comparison with the sustainable escapement goal (SEG; 17,800 - 35,700).

Background

The current escapement goal is based on TS-based sonar and mark-recapture estimates initiated in the late 1980s. The original goal, developed in 1989, set a minimum escapement of 15,500 and an optimum of 22,300 (McBride et al. 1989). The goal was revised to a range of 17,800 to 35,700 in 1999 (Fried 1999) by multiplying the optimum goal of 22,300 by 0.8 and 1.6 as recommended in Eggers (1993) for development of escapement goal ranges for Pacific salmon. The escapement goal range of 17,800 to 35,700 was recently corroborated with a stock-recruit analysis using data through 2006 (McKinley and Fleischman 2010).

With few exceptions, achievement of the goal has been evaluated using TS-based sonar to estimate inriver run size, then subtracting sport fishing mortality upstream of the sonar site to estimate escapement. In the 1990s, experiments indicated TS was a poor predictor of fish size and thus a poor discriminator of sockeye from Chinook salmon (Burwen and Fleischman 1998), resulting in estimates of

Chinook salmon abundance that were biased high (Hammarstrom and Hasbrouck 1998, 1999). Results of these studies led the department to begin developing alternative indices of abundance (discussed below) for assessing inriver run strength and making inseason management decisions (Eskelin and Miller 2010). During the 2010 field season, DIDSON imaging sonar was deployed on a limited basis, and the department committed to developing a new assessment system based on DIDSON estimates of inriver passage.

In 2011 the department revised the escapement goal from a biological escapement goal (BEG) to a sustainable escapement goal (SEG) because of the uncertainty in the estimates of escapement and lack of stock-specific information in the commercial harvest. In addition, the department informed the public it would discontinue use of TS-based estimates of inriver run in favor of five abundance indices (described below), and would also continue development of the new DIDSON-based assessment.

Run strength

The 2010 and 2011 late runs of Kenai River Chinook salmon were below average based on the following five inseason indices: echo length standard deviation based (ELSD-based) split beam sonar estimates, net-apportioned split-beam sonar estimates, catch per unit effort (CPUE) of gillnets drifted at the sonar site, CPUE of sport anglers interviewed in the lower river creel survey, and the harvest of Chinook salmon in the eastside set-net fishery (ESSN). See Eskelin and Miller (2010) for descriptions of these indices. All indices point to a general decline in run strength since 2003 or 2004 (Figure 1). Scatter plots of the indices (Figure 2) show positive linear relationships among all pairs of variables. This is consistent with the assumption that each is a consistent and corroborative measure of relative Chinook salmon abundance. All five indices were below average in 2010 and 2011, and in many cases they were at or near historical lows (Figures 1 and 2).

Escapement

As mentioned above, the escapement has historically been estimated from TS-based inriver abundance estimates. Until recently, TS-based estimates of inriver run had a positive relationship with the other indices of abundance (Figure 2; top row of matrix), although the relationships are not as strong as the relationships among the other five indices. In 2010, the TS-based sonar estimate was very high (50,400), whereas the other indices were near historic lows (Figures 1 and 2). Because the TS-based estimate was abnormally high in 2010, and it was not produced at all in 2011, the inriver run size and the escapement could not be estimated in the usual way in either of these two years.

At the February 2011 Board of Fisheries meeting, the department stated that ELSD-based estimates, along with other indicators of abundance, would be used to estimate escapement and evaluate whether the SEG had been met. ELSD is a better predictor of fish size and ELSD-based estimates are regarded as being more reliable than TS-based estimates (Eskelin and Miller 2010). However, new technical problems with the ELSD-based estimates surfaced in 2010 and the problems persisted in 2011. Direct use of ELSD-based estimates to evaluate achievement of the SEG is no longer recommended.

Instead, we have developed an estimator that combines information from all five indices, properly converted to the currency of the TS-based estimates, with which to evaluate achievement of the current escapement goal. We simultaneously considered the positive relationships between TS-based estimates and the other five indices (top row of Figure 2) in a statistical model[1], which provided sufficient information to predict what the TS-based abundance estimate would have been in 2010 and 2011. The expected[2] TS-based estimates of Chinook salmon passing the sonar site are 33,600 in 2010 (95% credible interval CI 20,200-56,100) and 36,000 in 2011 (CI: 22,400-58,200). After subtracting estimates of harvest and mortality above the sonar (7,026 in 2010; 6,240 in 2011), the corresponding estimates of escapement are 26,600 in 2010 (CI: 13,100 - 49,100) and 29,800 in 2011 (CI: 16,100 - 51,900). Although the point estimates are within the escapement goal in both cases, considering the uncertainty in the predicted TS-based estimates, there is a probability of 12% (2010) and 4% (2011) that the TS-based estimate would have led to an escapement estimate less than the goal (17,800) in those years.

2012 and Beyond

The indices of abundance described above are largely in agreement and provide valuable information for inseason monitoring of run strength. We recommend that they continue to be monitored and used as they were in 2011.

Analysis of historical data and comparison with new DIDSON-based estimates is ongoing. The approach used above to predict the missing 2010 and 2011 TS-based estimates may also be used to produce historical estimates of abundance in the currency of DIDSON-based estimates. This will be valuable in two ways:

1. It will provide a context for the DIDSON estimates and allow them to be considered along with other indices when monitoring run strength during the season, beginning in 2012.
2. Reconstructing historical abundance is the first step toward developing a new escapement goal based on DIDSON numbers.

Cc: Robert Begich, Tom Vania, Jim Hasbrouck, Bob Clark

[1] A state-space model considering process and observation error was fitted to the data using Bayesian statistical methods. Such methods allow for consideration of multiple sources of information, and a more complete assessment of uncertainty than most other methods.

[2] Means of the posterior probability distribution are reported here as a point estimates.

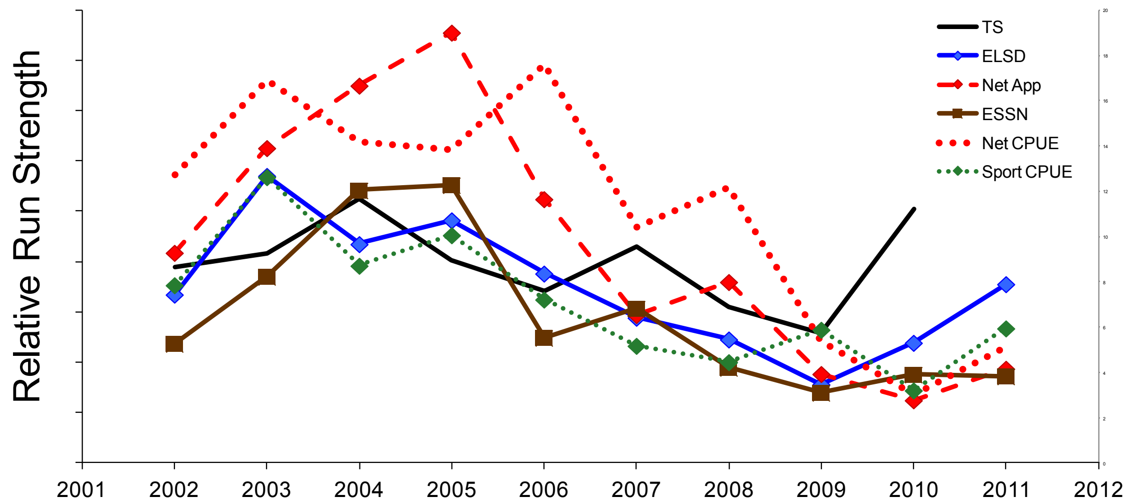

Figure 1.- Relative value of key Kenai River Chinook salmon abundance indices, late run 2002-2011. TS = TS-based split beam sonar estimates; ELSD = ELSD-based split beam sonar estimates; Net App = net apportioned split beam sonar estimates; Net CPUE = inriver netting catch rate index; Sport CPUE= lower river sport fishery catch rate index; ESSN = east side set net commercial fishery catch index. Absolute values not shown.

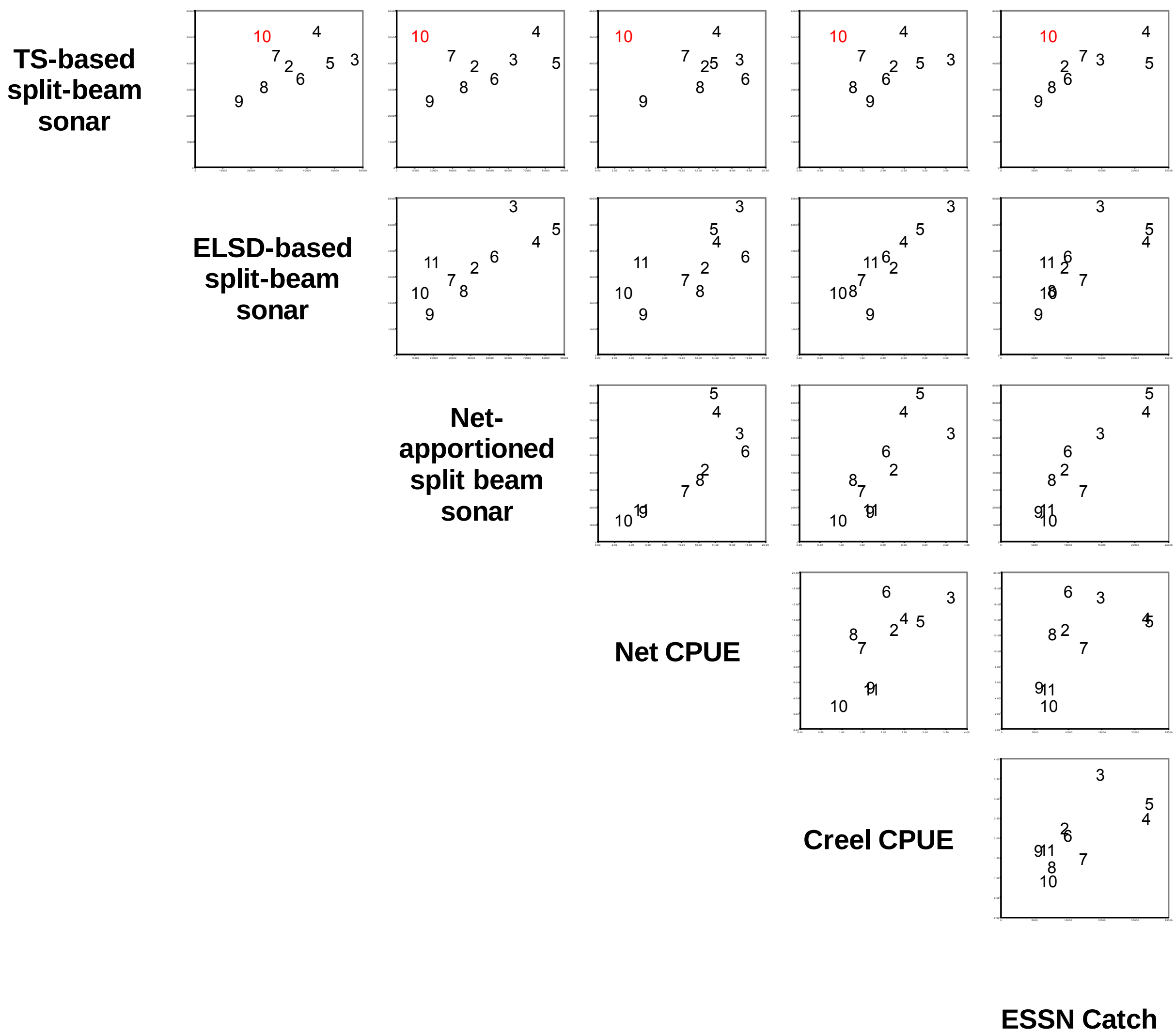

Figure 2.- XY scatter plots of late-run Kenai River Chinook salmon abundance indices 2002-2011. Data labels in plots refer to year.

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