

PRESEASON REPORT II

APPENDIX D

SACRAMENTO RIVER FALL CHINOOK HARVEST MODEL (SHM)

The model previously used by the STT to forecast the impacts of ocean and river fisheries on SRFC escapement has a number of significant limitations: (1) It is not a dynamic model, (2) it is not based directly on SRFC fishery impact data, (3) it does not directly account for north of Point Arena ocean fishery impacts, and river fishery impacts (although SRFC escapement implicitly depends on these impacts), and (4) it is incapable of modeling the effect of variation in management measures for the ocean fishery north of Point Arena, and for the river fishery. SRFC have not been a constraining stock for fishery management for the past 15 years and this model, despite its limitations, was sufficient for management purposes. However, the 2008 SRFC stock status demanded development of a more refined harvest model in order to meet current management needs. In response, a new "Sacramento Harvest Model" (SHM) was developed to rectify all but the first limitation listed above. The SHM is described below.

Given the SRFC ocean harvest $H_o(x)$ for all time/area fisheries (x) for the September – August period and the SI (APPENDIX C), define the SRFC ocean harvest rate index as $h_o(x) = H_o(x) / SI$. Summing these quantities across all time/area fisheries gives the overall harvest and harvest rate index for the September - August period: $H_o = \sum H_o(x)$ and $h_o = \sum h_o(x)$, respectively. By definition of the SI , the SRFC spawning escapement assuming an unrestricted river fishery is

$$E_u = SI - H_o = SI(1 - h_o).$$

This escapement thus results from a river run size of

$$R = E_u / (1 - h_{r,u}) = SI(1 - h_o) / (1 - h_{r,u}),$$

where $h_{r,u}$ is the unrestricted river harvest rate. For a restricted river fishery with harvest rate h_r , the SRFC escapement would thus be

$$E = R(1 - h_r) = SI(1 - h_o)(1 - h_r) / (1 - h_{r,u}).$$

If fishery impacts are not equal to fishery harvest, for example with non-retention fisheries, the above formula for E would apply with the impact rate i_o substituted for h_o , and i_r substituted for h_r :

$$E = SI(1 - i_o)(1 - i_r) / (1 - h_{r,u}).$$

Forecasting the SRFC escapement E thus requires forecasts of the components SI , i_o , and i_r , along with an estimate of $h_{r,u}$. The component SI is forecast as described in APPENDIX C. The component $i_o = \sum i_o(x)$, and the $i_o(x)$ quantities are forecast as follows. For seasonal retention fisheries $i_o(x) = h_o(x)$, and $h_o(x)$ is modeled as a linear function of the expected effort, $f(x)$.

A ratio estimator was used to fit these time/area fishery-specific relationships to the historical $(h_o(x), f(x))$ data, 1986-forward, with the historical $h_o(x) = H_o(x) / SI$ estimated based on SRFC coded-wire tag recoveries as described in APPENDIX C. These data and fitted relations are depicted for the January - August period in Figure D-1 for the commercial fishery and Figure D-2 for the recreational fishery. For the previous September - December (fall) fishery period, since these fisheries have occurred prior to model application, $H_o(x)$ is estimated directly from the observed coded-wire tag recoveries for that period. The forecast effort $f(x)$ is provided by the KOHM effort submodel and is a linear function of the number of days open. For a quota fishery, the harvest rate index is forecast as $h_o(x) = Q(x)\pi(x) / SI$, where $Q(x)$ is the quota and $\pi(x)$ is the proportion of SRFC expected in the catch. In the case of non-retention fisheries, $i_o(x)$ is forecast as $h_o(x)s_o(x)$, where $h_o(x)$ is the expected harvest rate were it a retention fishery, and $s_o(x)$ is the hook-and-release mortality rate. The time/area fishery-specific ocean harvests and impacts are forecast as the respective harvest and impact rate index forecasts multiplied by the forecast SI .

For a retention river fishery $i_r = h_r$, and h_r is forecast as Q_r / R for quota-restricted fishery, and as $h_{r,u}$ for an unrestricted fishery. The quantity $h_{r,u}$ was estimated to be 0.1449 based on the available river fishery harvest survey data, as shown in Figure D-3. For a non-retention river fishery, i_r is forecast as $h_r s_r$, where h_r is the expected harvest rate were it a retention fishery, and s_r is the hook-and-release mortality rate (0.10). The river fishery harvest and impacts are forecast as the respective harvest and impact rate forecasts multiplied by the forecast river run size.

2008 Preseason Forecast h.SRFC versus Effort – Commercial

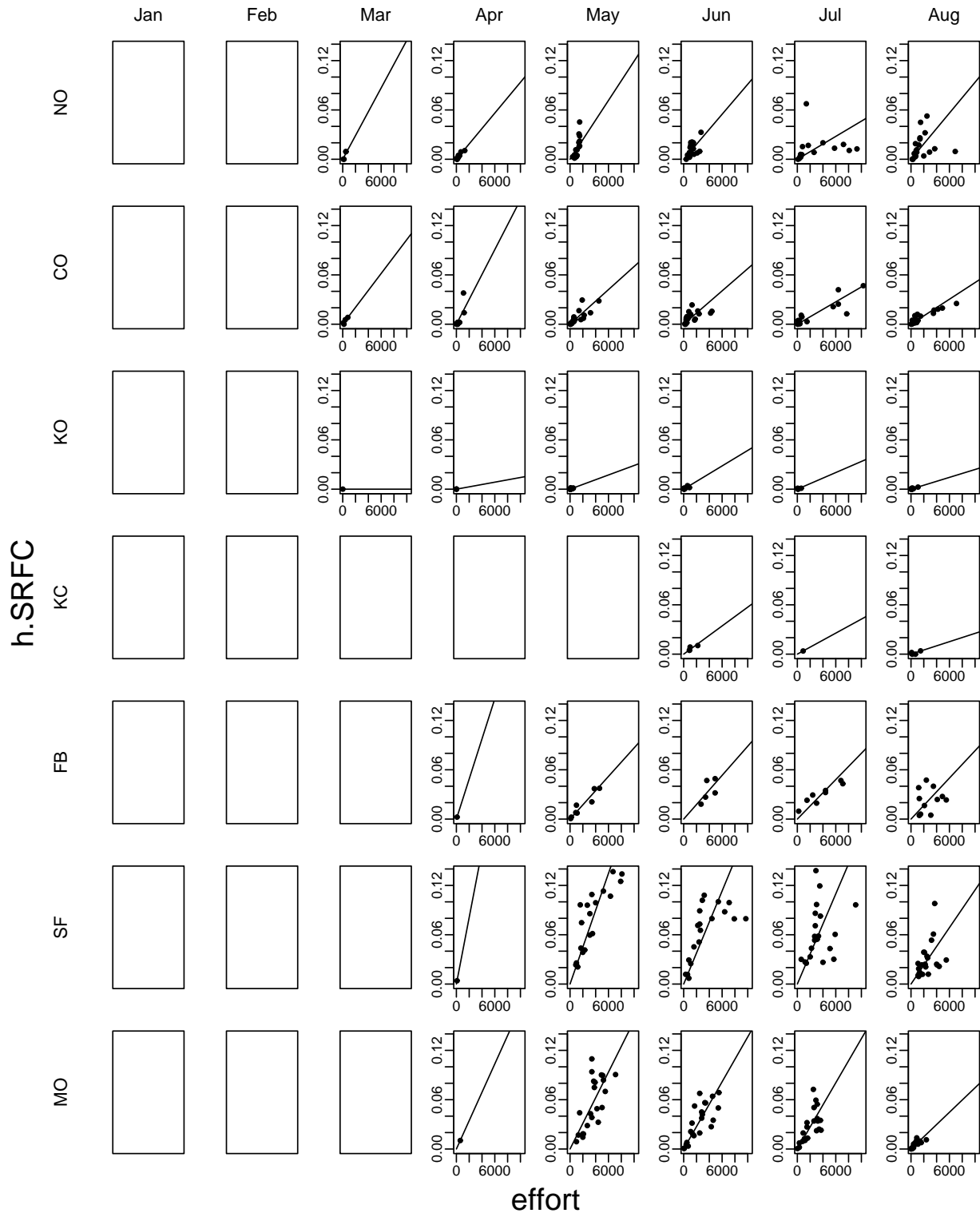


FIGURE D-1 SRFC ocean commercial harvest rate index versus effort for each month/port-area. The dots are the historical data, 1986 forward, and the line depicts the ratio estimator predictor.

2008 Preseason Forecast h.SRFC versus Effort – Recreational



FIGURE D-2 SRFC ocean recreational harvest rate index versus effort for each month/port-area. The dots are the historical data, 1986 forward, and the line depicts the ratio estimator predictor.

SRFC River Fishery

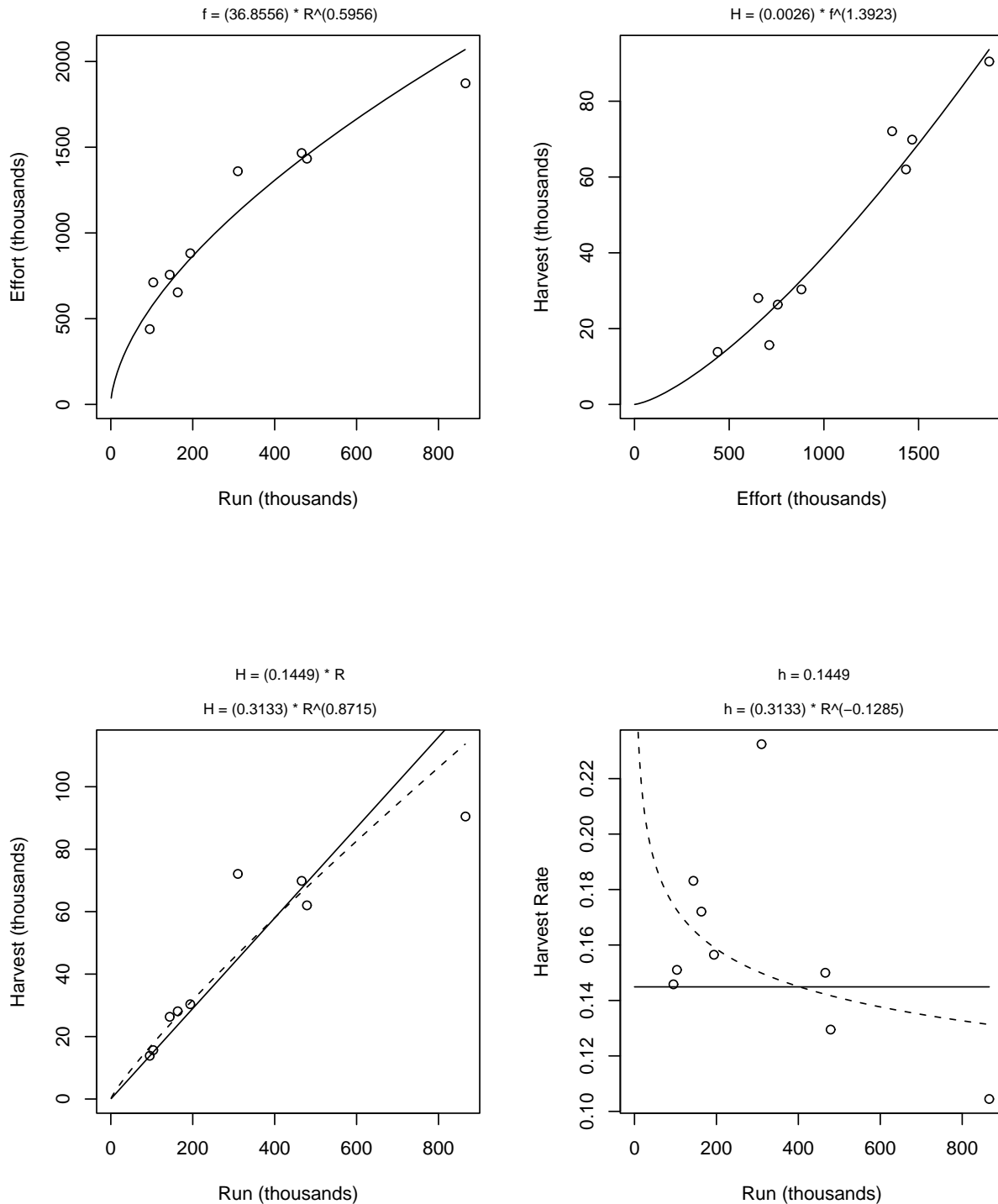


FIGURE D-3 SRFC river fishery available survey data. Top-left panel: effort versus run size; top-right panel: harvest versus effort; bottom-left panel: harvest versus run size; bottom-right panel: harvest rate versus run size. Solid line in bottom-left panel depicts the ratio estimator fit with slope 0.1449, and this value was considered the best estimate of the average unrestricted river fishery harvest rate. The ratio estimator is depicted in the bottom-right panel as a solid horizontal line with intercept 0.1449.