ALASKA DEPARTMENT OF FISH AND GAME
DIVISION OF COMMERCIAL FISHERIES
NEWS RELEASE

Sam Cotten, Commissioner
Forrest Bowers, Acting Director

Contact:
Andy Piston

Phone: (907) 225-9677
Fax: (907) 225-0599

Ketchikan Area Office
2030 Sea Level Drive, Suite 205
Ketchikan, Alaska 99901

Date: November 15, 2018
Time: 1:30 p.m.

2019 NOAA FISHERIES–ALASKA DEPARTMENT OF FISH AND GAME SOUTHEAST ALASKA PINK SALMON HARVEST FORECAST

The Southeast Alaska (SEAK) pink salmon harvest in 2019 is predicted to be in the *weak* range with a point estimate of **18 million fish (80% confidence interval: 15–26 million fish).** The categorical ranges of pink salmon harvest in SEAK were formulated from the 20th, 40th, 60th, and 80th percentiles of historical harvest over the 59-year period 1960–2018:

Category	Range (millions)	Percentile
Poor	Less than 11	Less than 20th
Weak	11 to 19	20th to 40th
Average	19 to 34	40th to 60th
Strong	34 to 50	60th to 80th
Excellent	Greater than 50	Greater than 80th

Forecast Methods:

In past years, NOAA Fisheries, Alaska Fisheries Science Center, Auke Bay Laboratories (NOAA) and the Alaska Department of Fish and Game (ADF&G) produced separate pink salmon harvest forecasts for Southeast Alaska. The two agencies are increasing collaboration in support of NOAA's long-term Southeast Coastal Monitoring Project (SECM) and are combining efforts to produce a joint forecast for 2019. The ADF&G research vessel Medeia was used to conduct the 2018 SECM surveys and ADF&G biologists provided more direct assistance to the sampling effort during the June, July, and August surveys. In the future, we plan to work towards increased coordination between the two agencies and will continue to look for ways to focus and expand the SECM survey to provide a wide variety of information of value to the fishing industry.

The 2019 SEAK pink salmon harvest forecast (Figures 1 and 2) was primarily based on juvenile pink salmon abundance indices collected by the SECM project in northern SEAK inside waters during June and July. These data were obtained from systematic surveys conducted annually in upper Chatham and Icy straits and are highly correlated with the harvest of adult pink salmon in the following year (Wertheimer et al. 2011). The juvenile pink salmon abundance index of 1.23 in 2018 was the third lowest in the 22 years of SECM surveys.

Forecasts were developed using an approach described in Wertheimer et al. (2011). A linear multiple regression model was developed using monthly peak juvenile CPUE (standardized catch based on 20-

minute trawl sets) for the June and July surveys and associated environmental parameters. The model used is:

$$\ln(\text{harvest}) = \alpha + \beta(\ln(\text{CPUE}+1)) + \gamma_1 X_1 + \ldots + \gamma_n X_n + \varepsilon,$$

where γ is the coefficient for environmental covariates X_i (e.g., water temperatures, climate indices, fish size and condition) and ε represents the normally distributed error term. Backward/forward stepwise regression were used for environmental covariate selection and models were ranked via Akaike Information Criterion (AIC) and small sample AIC (AICc). Leave-one-out cross validation (hindcast) and model performance metrics such as Mean and Median Absolute Percentage Error (MAPE, MEAPE) were then used to evaluate forecast accuracy of alternative models. Forecast confidence intervals were developed using a bootstrap approach to sampling the historical series of trawl hauls (sampling with replacement) to estimate annual Peak ln(CPUE+1) for each bootstrap run, and the trawl hauls for the predictor value for each bootstrap run, to generate a series of 10,000 forecast estimates.

Forecast Discussion:

The 2019 harvest forecast of 18 million pink salmon is approximately half of the recent 10-year average harvest of 36 million pink salmon. A harvest near this forecast would be the lowest odd-year harvest since 1987. The 2018 peak June–July juvenile pink salmon index value (1.23) ranked 20th out of the 22 years that SECM information has been collected and pink salmon harvests associated with juvenile indices below a value of 2.0 have ranged from 8 to 37 million fish (mean=20 million fish).

The extremely low juvenile abundance index in 2018 was unexpected given that pink salmon escapements in 2017 were generally good and escapement goals were met in all three subregions of SEAK. This indicates that brood year 2017 pink salmon likely experienced poor freshwater and/or early marine survival. The Auke Creek Research Station in Juneau, Alaska contains a permanent fish counting structure that allows for near-complete sampling of upstream and downstream migrating salmon, including pink salmon adults and fry. The escapement of 10,711 pink salmon at Auke Creek in 2017 produced only 31,540 outmigrating fry in spring 2018. The fry-per-spawner ratio of 2.94 was the second lowest on record and well below the long-term average for the odd-year brood at 13.42 fry per spawner (Figure 3). In addition, the midpoint date of pink salmon fry outmigration at Auke Creek in 2018 (April 20) was four days later than the historical average (April 16) and nine days later than the average migration midpoint date of the last five odd-year brood fry (April 11). The overall midpoint date of pink salmon fry outmigration at Auke Creek has shifted earlier over time at a rate of almost a half day per year, but this year's later timing likely reflects below average temperatures in the Juneau area from February through March. The juvenile pink salmon caught in the 2018 SECM survey trawls were also the smallest (in length) in the 22-year time series (Figure 4), which may be related to the later emergence timing and possibly poor nearshore marine conditions in the spring.

One potential source of uncertainty regarding the 2019 pink salmon return is the anomalously warm sea surface temperatures in the Gulf of Alaska. The warm temperatures that persisted throughout the Gulf of Alaska from fall 2013 through much of 2016 (Bond et al. 2015; Di Lorenzo and Mantua 2016) have returned in 2018. Pink salmon that went to sea from 2014 to 2016 returned in numbers below expectation and below recent odd- and even-year averages. Although sea surface temperatures moderated in the Gulf of Alaska in 2017, effects on the Gulf ecosystem likely persisted and pink salmon that went to sea in 2017 and returned in 2018 also experienced reduced survival. The return of anomalously warm sea surface temperatures in the Gulf of Alaska may have a negative impact on the survival of pink salmon. Although the weak harvest forecast in 2019 is consistent with poor survival, the impact of Gulf of Alaska temperatures is unknown and adds uncertainty to the forecast.

The department will manage the 2019 commercial purse seine fisheries *inseason* based on the strength of salmon runs. Aerial escapement surveys and fishery performance data will continue, as always, to be essential in making inseason management decisions.

Literature Cited:

Bond, N. A., M. F. Cronin, H. Freeland, and N. Mantua. 2015. Causes and impacts of the 2014 anomaly in the NE Pacific. Geophysical Research Letters 42: 3414–3420.

Di Lorenzo, E. and N. Mantua. 2016. Multi-year persistence of the 2014/15 North Pacific marine heatwave. Nature Climate Change 6:1042.

Wertheimer, A. C., J. A. Orsi, E. A. Fergusson, and M. V. Sturdevant. 2011. Forecasting pink salmon harvest in Southeast Alaska from juvenile salmon abundance and associated environmental parameters: 2010 returns and 2011 forecast (NPAFC Doc. 1343) Auke Bay Lab., Alaska Fish. Sci. Cen., Nat. Mar. Fish. Serv., NOAA, 17109 Point Lena Loop Road, Juneau, AK 99801-8626, USA, 20 p.; http://www.npafc.org/new/pub_documents.html.

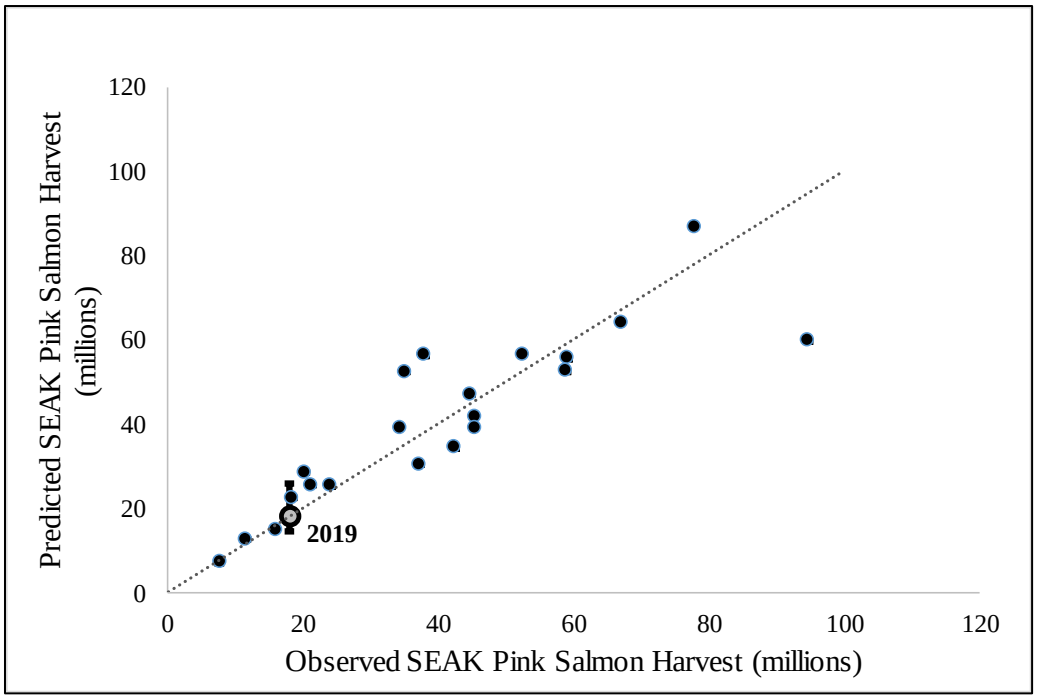

Figure 1. Forecast model fit (hindcasts) for total Southeast Alaska (SEAK) pink salmon harvest, 1998–2018. The 2019 forecast is shown as a gray circle and the 80% forecast range is shown as a black bar. The dotted line represents a one-to-one line and circles above the line represent hindcasts that would have been over the actual harvest and circles below the line represent hindcasts that would have been below the actual harvest.

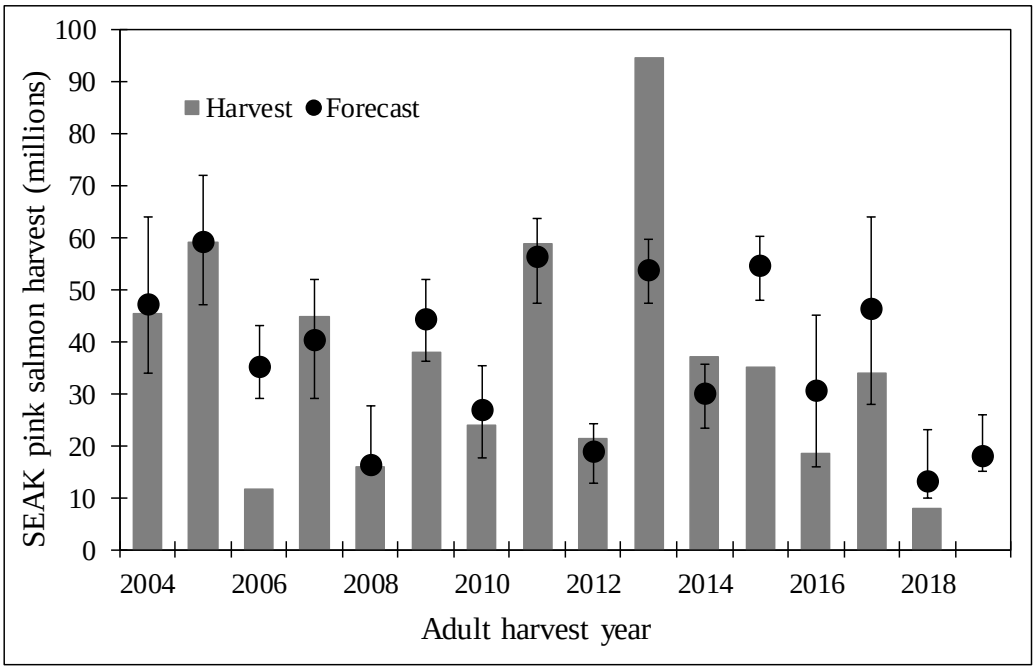

Figure 2. Annual harvests of pink salmon in SEAK compared to the actual preseason harvest forecasts, 2004–2019. The error bars represent the 80% confidence intervals of the forecasts.

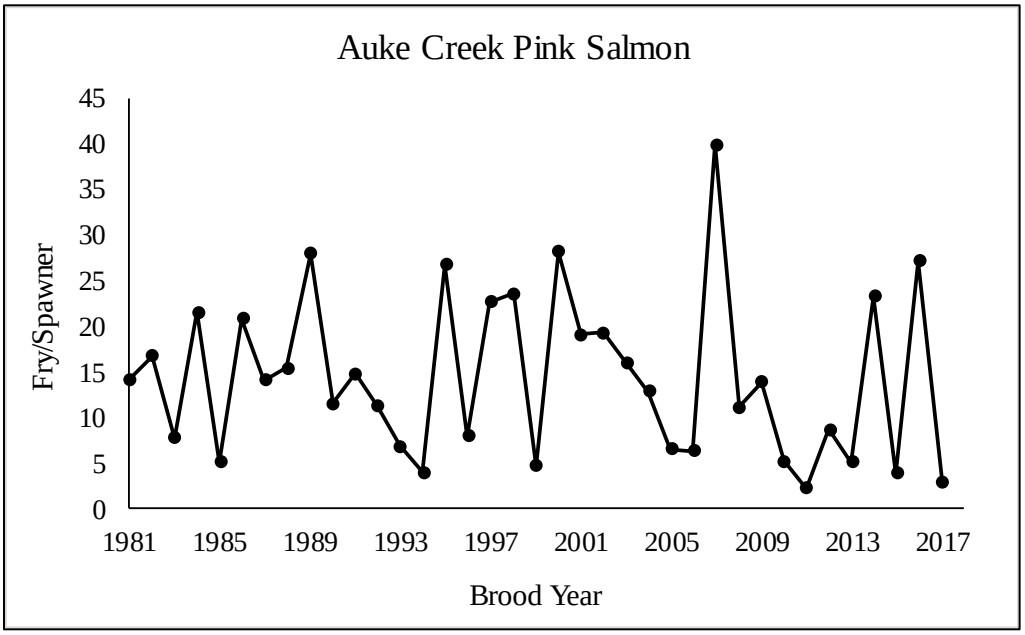

Figure 3. Average number of pink salmon fry produced per spawner at Auke Creek, 1981–2017 brood years.

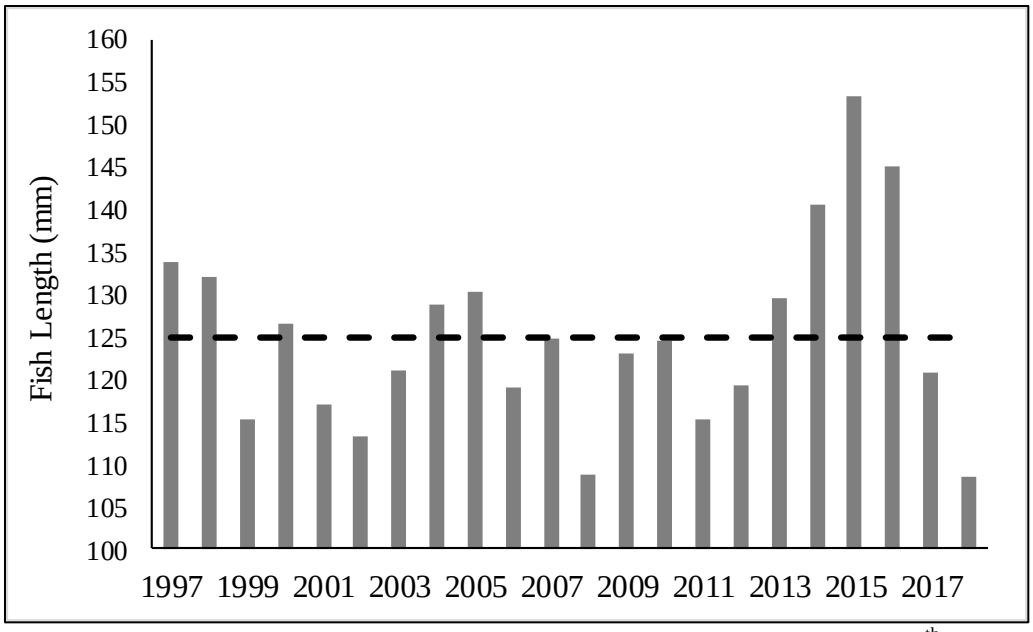

Figure 4. Average snout-to-fork length of juvenile pink salmon, standardized to July 24th, captured during trawl surveys in upper Chatham and Icy straits, 1997–2018. The dashed line represents the 1997–2018 average length.

Andy Piston, Steve Heinl, Sara Miller, and Rich Brenner, Alaska Department of Fish and Game
Jim Murphy, Jordan Watson, Andy Gray, and Emily Fergusson, NOAA, Auke Bay Lab, Alaska Fisheries Science Center

News releases web site: *http://www.adfg.alaska.gov/index.cfm?adfg=cfnews.main*.

Office	*Ketchikan*	*Petersburg*	*Wrangell*	*Sitka*	*Juneau*	*Haines*	*Hoonah*	*Yakutat*
ADF&G	*225-5195*	*772-3801*	*874-3822*	*747-6688*	*465-4250*	*766-2830*		*784-3255*
AWT	*225-5111*	*772-3983*	*874-3215*	*747-3254*	*465-4000*		*945-3620*	