DEPARTMENT OF THE INTERIOR
U.S. FISH AND WILDLIFE SERVICE
REGION 1

Interim Report

CA-Impacts to Humboldt Bay NWR From Forestry and Dairy Activities in the Salmon Creek Watershed

Study ID: 200010006.2
1261-1N52

John Henderson
Fish and Wildlife Biologist
U.S. Fish and Wildlife Service
Sacramento Fish and Wildlife Office

Sacramento, CA
June 1, 2001

Background

The Humboldt Bay National Wildlife Refuge occupies portions of estuarine bottomlands around Humboldt Bay, in Humboldt County on the north coast of California. The freshwater creeks, brackish water sloughs, saltwater marshes and mud flats found on the Refuge provide habitats for 110 species of birds, 110 species of fish, 30 species of mammals, and many unique floral species found in and around the bay. The Salmon Creek Unit (Refuge), located on South Humboldt Bay, is named for Salmon Creek, which drains a 23.5 square mile watershed managed primarily for timber production and livestock grazing. Located within the upper watershed of Salmon Creek, 11 miles east of Humboldt Bay, is the Headwaters Forest Preserve (Headwaters), an old-growth redwood forest preserved through the efforts of many governmental and non-governmental organizations including the U.S. Fish and Wildlife Service (Service). Approximately 1 mile of Salmon Creek courses through the Refuge before meeting Hookton Slough, a tidal arm of South Humboldt Bay.

Agricultural activities (primarily forestry, dairies, and cattle ranches) within the Salmon Creek watershed contribute contaminants to Salmon Creek. The levels of contaminants in Salmon Creek have been high enough to make the creek a highly turbid and foul-smelling public nuisance during summer low flow periods. A former Refuge Manager also observed that the creek water was often white in color. In past years, it is suspected that the poor water quality in Salmon Creek resulted in the deaths of juvenile salmonids found in the creek during the summer months.

Fish monitoring conducted by the Service between 1989 and 1991 documented coho (*Oncorhynchus kisutch*), chinook (*Oncorhynchus tshawytscha*) and steelhead (*Salmo gairdneri*) salmon in Salmon Creek. Because salmonid outmigrants have been documented leaving Salmon Creek, this creek is recognized as critical habitat for coho salmon, a federally listed species. In 1997, the California Department of Fish and Game (CDFG) directed a stream inventory of Salmon Creek from Hookton Slough to approximately 10 miles upstream. Twenty-five sites were electrofished on 4 days in September 1997 by the CDFG and no coho salmon were observed. The CDFG inventory concentrated on channel form and habitat type and, except for water temperature, did not report water-quality parameters.

Water quality in Salmon Creek is related to land uses in the upper and lower watershed. Timber production and harvesting activities in the upper watershed is the suspected primary source of suspended sediment and elevated turbidity in Salmon Creek and secondary sources of nitrogen, phosphorus, and pesticides. Erosion of logging roads, clearcuts and channel disturbances would be the primary sources of suspended sediment, elevated turbidity, and nutrients mobilized from disturbed top soil.

Agricultural activities in the lower watershed are the suspected primary source of nitrogen (especially ammonia), phosphorus, color, bacteria, pesticides, and pharmaceuticals. Loss of

streambank vegetation due to unrestricted grazing and channelization in the lower watershed may be a secondary source of suspended sediment and turbidity which may adversely affect the habitat quality of Salmon Creek. The contaminants introduced to Salmon Creek in the lower watershed are suspected of having a high biochemical oxygen demand (BOD) leading to episodes of depressed dissolved oxygen. At least one dairy operation was (now closed) situated close enough to Salmon Creek that solid and liquid wastes from the milking parlor could directly enter the creek.

This interim report covers the data collected to date for this investigation, and briefly discusses the results of the investigation.

Data Collected

Datasonde-3 (DS-3) multi-parameter data logging water quality instruments were deployed in Salmon Creek at the Refuge beginning June 15, 2000, and in Salmon Creek at the Headwaters, Alicia Pass site beginning July 22, 2000. Water quality monitoring at the Alicia Pass was discontinued on September 21 due to low water levels in Salmon Creek. Water quality monitoring began at the Salmon Pass site on October 4. Nineteen weeks of water-quality data have been collected at the Refuge and 12 weeks of water-quality data collected at the Headwaters. Temperature, dissolved oxygen (DO), specific conductivity (SC), and pH were the main parameters measured at 30-minute intervals during the DS-3 deployment periods. At the refuge site 58,000 data points were recorded and at the Headwaters 33,000 data points were recorded.

Figure 1 and Figure 2 are graphical presentations of dissolved oxygen from the Refuge dataset and the Headwaters dataset respectively. The data is presented as draft data because probe drift, which is caused by probe fouling and DS-3 electronic circuit fluctuations, has not been fully evaluated and a possible correction applied to the datasets. However, probe drift is only a factor during individual deployment periods and introduces a error that varies in magnitude during the deployment period. DS-3 maintenance and calibration results in accurate data at the beginning of each deployment period. Therefore, the un-corrected datasets can provide information on the megatrends in Salmon Creek water quality. The X-axis on the Refuge graph shows time beginning on June 15, 2000, at 7:30 p.m. and ending November 11, 2000, at 12:00 p.m. The Headwaters data begins at July 22, 2000, at 7:30 p.m. and the last data point graphed is for November 7, 2000 at 12:00 p.m. The Y-axis on each graph shows dissolved oxygen in milligrams per liter.

Three water sampling events have been conducted on Salmon Creek- two dry season sampling events and one wet season event. Water samples from Salmon Creek were collected from three to four sites each event. Water samples were analyzed for Biochemical Oxygen Demand-5-day test (BOD-5), total suspended solids (TSS) and ammonia at a City of Eureka, water-quality laboratory near the study area. Table 1, shows the results for the three water sampling events

which occurred on September 20 (and 21), October 4 and October 30, 2000.

Discussion

The dairy operation adjacent to the Refuge which, at various times in the past, was introducing cow feces and urine directly to Salmon Creek upstream of the Refuge ceased operations at some point during the winter of 1999-2000. Dairy operations are regulated and inspected by the State of California, Regional Water Quality Control Boards (RWQCB). After an inspection by North Coast RWQCB staff it became evident that the necessary improvements to the dairy facilities, which would bring the operation into compliance with State regulations, would not be economically feasible. The Refuge in currently working to acquire the dairy property and pastureland.

All data collected for this study has been collected after the dairy adjacent to the Refuge was closed. However, there may be residual effects to Salmon Creek water quality due to contaminants from the dairy and continuing effects from the other contaminant sources in the watershed (other dairies and forestry).

The DS-3 data shows that DO in the Headwaters remained high during the monitoring period generally above 60 percent of saturation at the Alicia Pass site and above 90 percent at the Salmon Pass site. The magnitude of the DO probe drift error for DS-3s deployed in the Headwaters was approximately 25 percent at the Alicia Pass site and DO probe drift was approximately 5 percent at the Salmon Pass site. The effect of a film that developed over the surface of the DO probe membrane at the Alicia Pass site can be clearly seen in Figure 2 where the DO line trends downward and then abruptly rises at the beginning of a new deployment period.

The DO at the Refuge location in June was around 80 percent of saturation and followed a steady decline dropping below 50 percent of saturation after August 13 and remained at or below 30 percent of saturation from September 2 through October 21. Dissolved oxygen was consistently below 3 mg/L from September 14 through October 21 at the Refuge. After the first major rainstorm, at the end of October, DO returned to levels above 70 percent of saturation (around 7 to 8 mg/L).

Water samples were collected from a total of four locations on Salmon Creek and from one location on Little Salmon Creek. The results for BOD-5, total suspended solids and ammonia are entered in Table 1. Water-quality parameters (Temperature, DO, SC and pH) entered in Table 1 are from the DS-3 generated datasets for Sites 1, 4, and 5 while the water-quality parameter data for Sites 2 and 3 are spot measurements taken at the time the water samples were collected.

The data in Table 1 generally shows that water quality in Salmon Creek decreases from the Headwaters to the Refuge. However, the low DO levels at the Refuge are not explained by the dry season BOD-5 (Site 1 on Table 1) values in Salmon Creek water samples. Ammonia was not detected in any water sample collected from Salmon Creek. Total suspended solids increased dramatically in the October 30 water samples after a heavy 2 day rainstorm. The highest levels of both BOD-5 and TSS were in water samples collected from Little Salmon Creek which drains a sub-watershed of the Salmon Creek watershed.

The other three DS-3 measured water-quality parameters, temperature, SC and pH, will be discussed in the final report.