SOA 2007-11

Priest Rapids Coordinating Committee
Statement of Agreement (SOA)
Use of an Ultrasonic Device to reduce or eliminate algal growth at a Wanapum right-bank video fish count window

Submitted to Priest Rapids Coordinating Committee: March 20, 2007
Approved by Priest Rapids Coordinating Committee: March 28, 2007

Statement of Agreement (SOA)

The PRCC agrees with Grant PUD's recommendation to install an ultrasound device at the right-bank video fish count (VFC) window during the 2007 fish passage season. If logistics will not allow installation prior to April 1, 2007, Grant PUD will install the ultrasonic device in November 2007 during the scheduled maintenance outage. The goal is to assess device performance at reducing or eliminating algal growth on the count window, as well as observe if the ultrasound device inhibits fish passage. If it is determined that the device is restricting or deterring upstream movement of resident or anadromous fish the device will be immediately shut off.

Background

Currently, the VFC windows at the Wanapum and Priest Rapids dams are cleaned (brushed) manually. During late spring and summer, windows are typically brushed several times over the course of a week due to algal buildup. To facilitate cleaning Grant PUD proposes to install an ultrasound device at the Wanapum Dam right-bank VFC window during the 2007 fish passage season.

The ultrasound device stops algae growth by producing vibrations at frequencies alternating between 20,000–45,000 Hz. These frequencies match the critical resonance frequency of algae gas vacuoles and membrane structures of algae, some bacteria, and some fungi, thereby destroying cell structures, which results in the lose of the alga's ability to maintain buoyancy. Roaming algae types do not have gas vesicles, but are damaged by a separation of their inner cell wall (plasmalemma) from their outer cell wall. This disrupts their ability to get nutrients, and maintain turgor (internal) pressure.

Frequencies $\geq$20,000Hz are well outside of the hearing/detection ranges of most fish species studied (Fay and Popper 1999). However, the American shad (*Alosa sapidissima*) can hear ultrasonic sound due to a modified swim bladder that extends up into its ear. American shad can detect sounds from 100–180,000Hz, with two regions of best sensitivity, one from 200–800 Hz and the other from 25,000–150,000Hz (Mann et al. 1997). Carlson (1994) reported that American shad avoided sound in the 100,000–150,000Hz with peak avoidance occurring at 130,000Hz (outside the 20,000–45,000Hz range).

Research states that suckers species (*Catastomus* sp.) likely have the next best hearing of any species in the Columbia River system. Longnose suckers (*Catastomus catastomus*) can hear within the frequency range of 100–1,600Hz (Mann et al. 2007). Canadian fishes, such as trout perches (*Percopsis omiscomaycus*), nine-spine stickleback (*Pungitius pungitius*), spoon head sculpin (*Cottus ricei*), burbot (*Lota lota*), and broad whitefish (*Coregonus nasus*) detected frequencies <400Hz (Mann et al. 2007). It is likely that following fish species: sand roller (*Percopsis transmontana*), several sculpin species (*Cottus* sp.), lake whitefish (*Coregonus clupeaformis*), and mountain whitefish (*Prosopium williamsoni*) have the same ability to detect frequencies <400Hz, as they are very similar to those listed above.

Cartilaginous fishes generally have a pair of ducts (called spiracles in sturgeon) that connects the inner ears to the out environment, such as white sturgeon (*Acipenser transmontanus*). In general, the hearing of cartilaginous fishes is restricted to frequencies <40Hz (Moyle and Cech 2004). Lamprey have two canals that enter the inner ear; however, these canals serve as a balance function (Moyle and Cech 2004).