FISHERY RESEARCH

U.S. NAVY ACOUSTIC RESEARCH DETACHMENT KOKANEE SPAWNING HABITAT SURVEY

COMPLETION REPORT
July 1, 2015—August 31, 2015

Prepared by:
Nicholas C. Wahl, Senior Fishery Research Biologist
Andrew M. Dux, Principal Fishery Research Biologist

IDFG Report Number 15-17
September 2015

U.S. NAVY ACOUSTIC RESEARCH DETACHMENT KOKANEE SPAWNING HABITAT SURVEY

Completion Report

July 1, 2015—August 31, 2015

By

Nicholas C. Wahl
Andrew M. Dux

Idaho Department of Fish and Game
600 South Walnut Street
P.O. Box 25
Boise, ID 83707

To

U.S. Department of the Navy
Naval Station Everett
Environmental Division
Public Works Department
2000 W Marine View Dr.
Everett, WA 98207-5001

Cooperative Agreement Number N44255-14-2-0009
CFDA # 12.300

IDFG Report Number 15-17
September 2015

TABLE OF CONTENTS

Page

ABSTRACT....1
INTRODUCTION....2
METHODS....2
RESULTS....3
DISCUSSION....3
RECOMMENDATIONS....3
ACKNOWLEDGEMENTS....5
LITERATURE CITED....6

ABSTRACT

The presence of downwelling currents has been found to contribute to increased egg incubation success for kokanee *Oncorhynchus nerka*, a keystone species in Lake Pend Oreille. Kokanee currently spawn along the shoreline of the U.S. Navy Acoustic Research Detachment (ARD) in Bayview, ID, but we were unsure whether downwelling occurred in these areas. We used a modified piezometer to explore the lakebed between elevations 2,051' and 2,012' in the ARD for the presence of downwelling. We sampled 60 sites and detected downwelling at one site in the southeast corner of the ARD. Although kokanee spawn in the ARD, downwelling does not appear to be an important factor influencing their use of this area for spawning. Therefore, measures to specifically protect downwelling areas are not necessary at the ARD. However, the lakebed along the ARD still provides kokanee spawning habitat and should not be disturbed during the period of kokanee spawning and egg incubation (November through June).

Authors:

Nicholas C. Wahl
Senior Fishery Research Biologist

Andrew M. Dux
Principal Fishery Research Biologist

INTRODUCTION

Kokanee, the landlocked form of Sockeye Salmon *Oncorhynchus nerka*, are a keystone species in the Lake Pend Oreille fish community. They provide an important recreational sport fishery (Maiolie and Elam 1993) and are the primary prey species for predatory salmonids, including ESA-listed Bull Trout *Salvelinus confluentus* (Vidergar 2000; Wahl et al. 2015). From 1972 through 2013, an average of 83% of shoreline-spawning kokanee counted during index surveys was found in the vicinity of Bayview in Scenic Bay (Wahl et al. 2015), and roughly one-fifth of those have been on the U.S. Navy Acoustic Research Detachment (ARD). These counts occur only along index reaches of shoreline rather than the entire lake and do not fully characterize lake-wide spawning distribution of kokanee. However, index counts of shoreline-spawning kokanee have demonstrated that the lakeshore within the ARD provides frequently used spawning habitat.

The southernmost two bays of Lake Pend Oreille, which includes Scenic Bay, have been used by spawning kokanee disproportionately to all other areas within the lake (Wahl et al. 2015). Recently it was found that these bays offer unique habitat characteristics that appear to be preferred by kokanee for spawning (Whitlock 2013). Scenic and Idlewilde bays are the most upstream recharge point for the Spokane Valley-Rathdrum Prairie (SVRP) aquifer (Hsieh et al. 2007). Outflow from Lake Pend Oreille into the SVRP aquifer has been estimated at 50 cubic feet per second (cfs) and may be as high as 200 cfs (Pluhowski and Thomas 1968). This downwelling flow into the SVRP aquifer may provide well-oxygenated water to eggs deposited by kokanee in otherwise less-than-ideal habitat (Hall and Wissmar 2004; Whitlock 2013). Therefore, understanding where downwelling occurs and protecting or enhancing these habitats is desirable to benefit kokanee egg incubation success in Lake Pend Oreille. As such, we conducted a survey to determine if and where downwelling may occur within the ARD.

METHODS

The ARD is located in the southwest corner of Scenic Bay on Lake Pend Oreille in northern Idaho (Figure 1). Downwelling exploration occurred within the boundary of the ARD below the winter lake surface elevation (2,051 feet) and extended to a depth of 50’ (2,012 foot elevation). Sampling occurred along transects at approximately 50 foot intervals with each transect approximately 50 feet apart. Areas under work barges and sheds were excluded from exploration for security reasons. Sampling sites were marked with buoys and georeferenced using a handheld GPS. Sampling occurred during July 29-31, 2015.

We used a modified piezometer consisting of a hollow aluminum rod and clear vinyl tubing to detect the presence of downwelling (Whitlock 2013). Two divers inserted the aluminum rod into the substrate at each site to a depth of approximately six inches. The tubing was then attached to the top of the rod. A third diver remained on the surface to measure the water level in the tubing in relation to the lake surface. Measurements had to be at least one centimeter of difference to qualify as upwelling or downwelling; measurements below this value could be caused by factors other than intra-gravel flow such as wave action. Water displacement in the tube below the lake surface indicated the presence of downwelling (Baxter et al. 2003; Whitlock 2013). This process was repeated at all sites. High levels of silt prevented to probe from working effectively, and sites with silt substrate were not sampled for the presence of downwelling.

In addition to detecting the presence of downwelling, a second objective was to visually categorize habitat conditions as they relate to kokanee spawning. To do this, divers visually

determined if substrate was primarily silt, gravel, or cobbles that were too large for kokanee to move for spawning.

RESULTS

A total of 60 sites were identified to assess the presence of downwelling, 47 of which were sampled with the probe. The remaining 13 sites had high levels of silt that prohibited use of the probe. Of the sites sampled, downwelling was documented at one site near the southeast corner of the ARD (Figure 2).

The habitat was dominated by gravel and silt substrates. Cobble was observed in very few areas, and where it was observed, other substrates were dominant. Throughout the ARD, substrates above the 2021 foot elevation were dominated by gravels appropriately sized for kokanee spawning. Deeper elevations appeared to be depositional areas with silt substrates (Figure 2).

DISCUSSION

Downwelling was only detected at one site and appeared to be an uncommon lake bed habitat feature in the ARD. It is possible that downwelling occurred in other areas and was not detected, but sampling was intensive enough to characterize the general distribution of any downwelling that was present. Additionally, the technique used to detect downwelling was not quantitative. Therefore, we do not know the rate of water exchange from Lake Pend Oreille, through the gravel substrate, and into the SVRP aquifer at the site where downwelling was detected.

In 2013, downwelling was detected near the 2051 foot elevation along the southern shore of Scenic Bay west of the ARD, but was not detected along the western shore to the north of the ARD (Whitlock 2013). The ARD appears to lie along the northern boundary of where water discharges from Lake Pend Oreille into the SVRP aquifer (Hsieh et al. 2007).

The probability of buried kokanee eggs surviving to the pre-emergent stage was over three times higher at sites that had downwelling (Whitlock 2013). However, downwelling alone does not determine successful egg incubation. Egg boxes buried in some areas without downwelling also had survival over 50%, but no eggs survived when minimum dissolved oxygen levels fell below 4.0 mg/L (Whitlock 2013).

Historically, spawning kokanee have been documented along most of the ARD shoreline (Figure 3). Although downwelling was not present along most of this shoreline, suitable clean gravel substrate was observed by the divers and likely provides the best spawning habitat within the ARD.

RECOMMENDATIONS

Suitable kokanee spawning substrate was documented above the 2021 foot elevation; substrate below this depth was dominated by high levels of silt. Although much of this area did not have downwelling, efforts should be taken to avoid disturbing the substrate during kokanee spawning and egg incubation (November through June). Additionally, divers documented large

amounts of trash on the lakebed, especially near docks and work barges. Removing this trash may improve access to the existing spawning habitat by kokanee and reduce habitat for potential kokanee predators such as Smallmouth Bass *Micropterus dolomieu*.

ACKNOWLEDGEMENTS

Many people contributed to making this project possible. IDFG Fisheries technicians Joe Buchanan, Bill Ament, and Bill Harryman helped to collect the data, and Matt Corsi reviewed an earlier draft of this report. Additional technical advisement was provided by Tom Tupper, Jim Baxter, and Steve Armstrong at the ARD. The U.S. Navy provided funding for this project.

LITERATURE CITED

Baxter, C., F. R. Hauer, and W. W. Woessner. 2003. Measuring groundwater-stream water exchange: new techniques for installing minipiezometers and estimating hydraulic conductivity. Transactions of the American Fisheries Society 132: 493-502.

Hall, J. L. and R. C. Wissmar. 2004. Habitat factors affecting sockeye salmon redd site selection in off-channel ponds of a river floodplain. Transactions of the American Fisheries Society 133: 1480-1496.

Hsieh, P.A., Barber, M.E., Contor, B.A., Hossain, M.A., Johnson, G.S., Jones, J.L., and Wylie, A.H. 2007. Ground-water flow model for the Spokane Valley-Rathdrum Prairie Aquifer, Spokane County, Washington, and Bonner and Kootenai Counties, Idaho. U.S. Geological Survey Scientific Investigations Report. 2007-5044.

Maiolie, M. A., and S. Elam. 1993. Influence of lake elevation on availability of kokanee spawning gravels in Lake Pend Oreille, Idaho, in Dworshak Dam impacts assessment and fisheries investigations. Idaho Department of Fish and Game, Annual Report to Bonneville Power Administration, Contract DE-AI79-87BP35167, Project 87-99. Portland, Oregon.

Pluhowski, E. J. and C. A. Thomas. 1968. A water-balance equation for the Rathdrum Prairie ground-water reservoir, near Spokane, Washington. U.S. Geological Survey Professional Paper 600-D: 75-78.

Vidergar, D. T. 2000. Population estimates, food habits and estimates of consumption of selected predatory fishes in Lake Pend Oreille, Idaho. Master's thesis. University of Idaho, Moscow.

Wahl, N.C., A. M. Dux, W. J. Ament, and W. H. Harryman. 2015. Lake Pend Oreille Research, 2013. Idaho Department of Fish and Game, Annual Report to Bonneville Power Administration, Contract Numbers 57288 and 60656, Portland, Oregon.

Whitlock, S. L. 2013. Kokanee spawning ecology and recruitment response to water level management in Lake Pend Oreille, Idaho. Master's thesis. University of Idaho, Moscow.

Figure 1. Map of Lake Pend Oreille in Idaho. The star on the southern end of Lake Pend Oreille indicates the location of the U.S. Navy Acoustic Research Detachment in Bayview, ID.

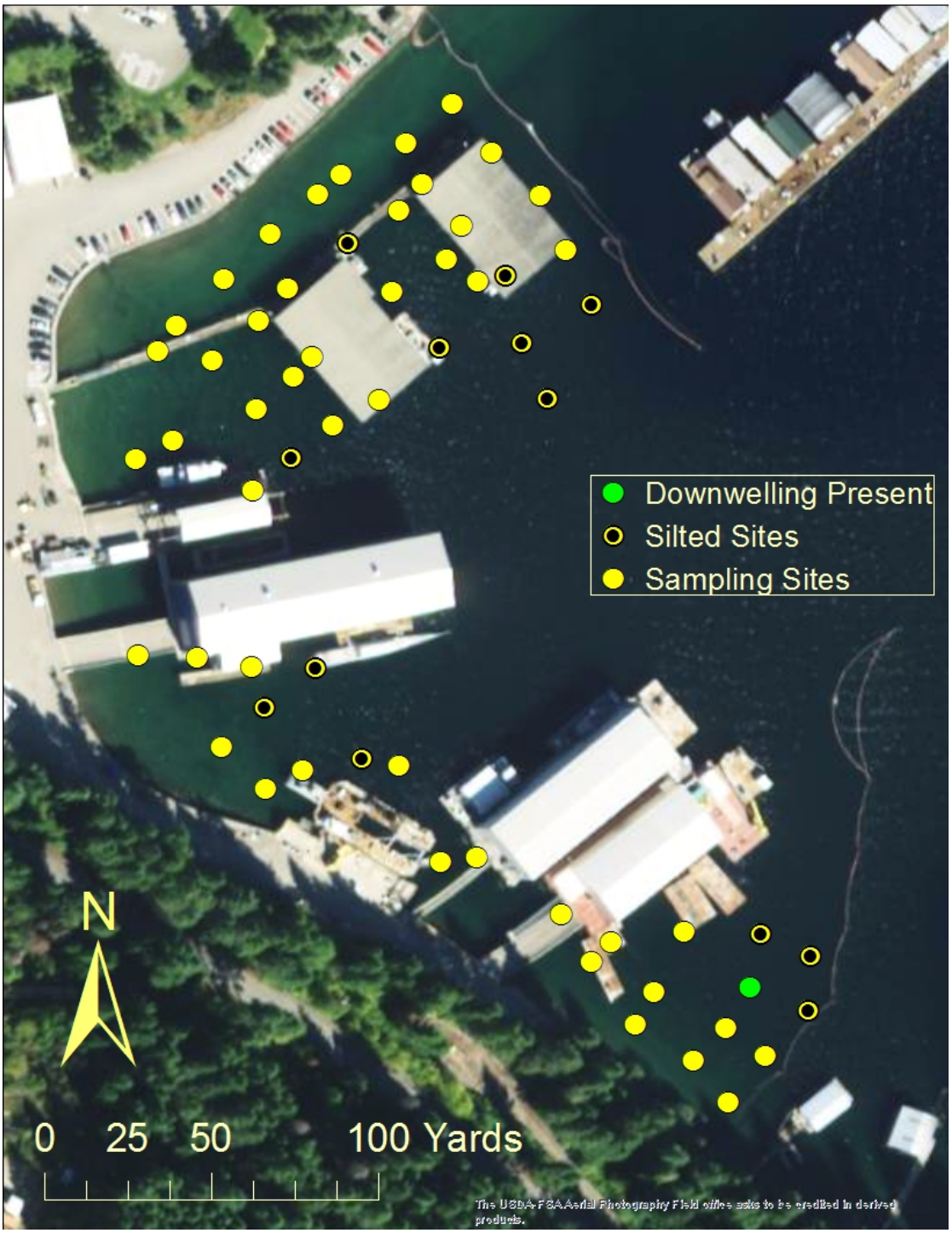

Figure 2. Sites sampled within the wetted area of U.S. Navy Acoustic Research Detachment for the presence of downwelling. A total of 61 sites was sampled with downwelling detected at one site. “Silted sites” had high levels of fine sediments that prohibited the probe from working properly. All other sampling sites were dominated by gravel substrate.

Figure 3. Areas of visually verified kokanee spawning (red polygons) on the U.S. Navy Acoustic Research Detachment base during 1996 to 2014.

Prepared by:

Nicholas C. Wahl
Senior Fishery Research Biologist

Andrew M. Dux
Principal Fishery Research Biologist

Approved by:

IDAHO DEPARTMENT OF FISH AND GAME

Daniel J. Schill
Fisheries Research Manager

James P. Fredericks, Chief
Bureau of Fisheries