



## RECOVERY POTENTIAL AND POTENTIAL CRITICAL HABITAT FOR THE NOOKSACK DACE (*RHINICHTHYS CATARACTAE* SP.)



Mike Pearson



Credit: Nooksack Dace Recovery Team (2008)

### Context

*The four populations of Nooksack dace in Canadian waters were designated Endangered by COSEWIC in 1996. The status was reconfirmed in 2000 (COSEWIC 2000) and again in 2007 (COSEWIC 2007). Nooksack dace was listed as Endangered (Schedule 1) under the Species at Risk Act (SARA) in 2003. Nooksack dace was designated as Endangered because its populations have small and fragmented distributions (four locations in Canada) and an area of occupancy of less than 20 km<sup>2</sup> with continuing decline in the extent and quality of habitat and number of individuals. The COSEWIC designation reflects a decline in habitat, not in abundance.*

*There are two general kinds of human-caused threat to the Nooksack dace in Canada: actions that alter, destroy or break up habitat, and actions that alter water quality. The threats to dace habitat are the result of more than a century of agricultural, industrial and urban development of the Fraser Valley. Threats to aquatic and riparian habitat include (in order of severity): physical destruction, seasonal low flows, sedimentation and fragmentation. Threats to water quality include toxic chemicals such as pesticides and herbicides, sewage treatment effluent and runoff of urban and industrial wastes. Excess nutrients (manure and inorganic fertilizers) can lead to hypoxia.*

### SUMMARY

- Nooksack dace are found in only four rivers in Canada, all of them in the Fraser Valley; the species is thus restricted to a geographic area where human impacts on dace habitat have been intense for more than a century.

- There are no data or analyses presented for Nooksack dace to counter the original COSEWIC criteria identifying declining habitat quantity and quality as the main factors jeopardizing survival or recovery.
- Nooksack dace is one of many data-poor freshwater fish species that are COSEWIC-designated. The main source of uncertainty is in estimating abundances and capacity of the four populations.
- The stream "reach" is an appropriate assessment scale for Nooksack dace abundance and habitat. Potential critical habitat for Nooksack dace includes reaches in their native creeks that contain or are known to have previously contained more than 10% riffle by length. Riparian habitat is also deemed important for population recovery.
- There is little scope for human-induced mortality or alternative habitat configurations. Permitting of activities that cause incidental mortality or that alter potential critical habitat should consider the consequences for achieving stated recovery goals in a risk management context that considers the high uncertainty in the data.
- Habitat restoration is essential for the survival and recovery of Nooksack dace, but research on the function of potential critical habitat in relation to population survival or recovery is recommended to establish restoration priorities.
- Severe low flow during high water-use periods results in completely dry riffle habitat in some reaches, especially in Bertrand Creek. An immediate mitigation measure would be to reduce drying and its obvious direct impact on survival.

## **BACKGROUND**

Nooksack dace is a small minnow that spends most of its life near the bottom within restricted home ranges, with a strong preference for riffles (areas of faster-moving water). It subsists mainly on aquatic insect larvae, foraging at night. Nooksack dace are found in only four rivers in Canada, all of them in the Fraser Valley: Bertrand, Pepin and Fishtrap Creeks (in the Nooksack River basin), and Brunette River, a tributary of the Fraser.

The Fraser Valley has seen heavy historic pressure on natural ecosystems, first for agriculture, and more recently for industry and urbanization. The course, structure and flow characteristics of many streams have been drastically altered by draining, dredging, building dikes, infilling and channelization for flood control, agricultural drainage, and construction projects. The end result of a hundred years of stream engineering has been the loss of over 80% of foreshore wetlands, marshes and riparian forests in the lower Fraser River. Since the 1960s, commercial farming has amalgamated and intensified, while much of the farmland created during the last hundred years has been converted to commercial and industrial use, or used for housing. Concurrent damage to aquatic ecosystems exceeds even that caused by agriculture, because vegetation is completely eliminated. The Agricultural Land Reserve, created in the 1970s to protect land for agricultural production, has not been entirely successful in preventing this shift in land use.

Nooksack dace habitat continues to be lost to flood control and agricultural drainage projects. The threat appears to be greatest for Fishtrap and Pepin Creeks, although the situation in Brunette River has not been assessed. Riffles and marginal pools are the most affected.

Because Nooksack dace are concentrated in small sections of the total stream area, the "reach concept" is important in describing their potential critical habitat. The scale of habitat ranges from very large (watershed) to very small (microhabitat). The reach scale is midway along this continuum. A reach is a section of river that contains smaller habitat features like riffles and pools. For Nooksack dace, a reach will be in the high hundreds to the low thousands of metres long. The reach scale is appropriate for defining critical habitat for Nooksack dace because it contains the riffle features important to the species and is large enough to account for any seasonal shifts in their location.

The Nooksack Dace Recovery Team defined potential critical habitat for Nooksack dace as "reaches in their native creeks that contain or are known to have previously contained more than 10% riffle by length." The 10% riffle threshold, while a judgment based on limited data, was chosen in order to exclude small, isolated riffles assumed to play no functional role in dace persistence. Within these reaches, the definition includes "all aquatic habitat and riparian reserve strips of native vegetation on both banks for the entire length of the reach." Riparian habitat (the land adjacent to the stream) is included in critical habitat because it is needed to protect the integrity of aquatic habitat for many fish species. The geographic location of the habitat proposed as critical is contained in the Recovery Strategy (Pearson 2007; Pearson et al. 2008).

## ANALYSIS

Nooksack dace is one of many data-poor freshwater fish species that are COSEWIC-designated. Nooksack dace populations are restricted to a geographic area where human impacts on habitat have been considerable for more than a century. For such species, the sources of human-caused harm are clear and long-standing, but the best way to deal with their effects is complicated by large gaps in our knowledge of the basic biology of the species.

Population sizes for Bertrand, Pepin and Fishtrap Creeks have been estimated using an indirect process based on three kinds of information: the catch per unit effort (CPUE) derived from trapping experiments; the amount of potential habitat in each stream; and the estimated density of dace in "high quality habitat." The CPUE data are based on 24h fish-trap sets in 72 reaches of the three creeks. Methods for obtaining the amount of suitable habitat are not clearly described in the literature. The density of dace in high quality habitat is based on measurements in only one creek (Bertrand); neither the number of sites sampled nor how they were selected are clearly described in the literature. CPUE estimates in Pepin and Fishtrap Creeks in fact indicate much lower densities (COSEWIC 2007); the value of 1.9 adult fish/m<sup>2</sup> was nevertheless chosen by the recovery team as appropriately conservative.

The maximum sustainable mortality by any population ideally provides decision makers with a benchmark that's useful for adjudicating proposed activities that can remove fish either directly (by killing them) or indirectly (by affecting habitat or water quality). Such estimates are highly uncertain for the four Nooksack dace populations in Canada because the data are very limited. There is, however, consensus that the maximum population size that can be achieved in the habitat presently available for the three Nooksack River tributaries is close to the minimum viable population sizes commonly accepted as generic for vertebrates (2,000 – 10,000 mature individuals). The fact that there are four separate Nooksack dace populations in Canada at least potentially reduces the risk of species extirpation from random environmental or demographic effects. Only 34% of the channel length in the Brunette River identified as potential critical habitat is actually occupied by dace. In those areas that are occupied, density is only 0.5 adult fish/m<sup>2</sup>. Further research is recommended to determine why so little of the available habitat in

Brunette River is occupied. The GIS assessment of the amount of potential critical habitat and the reach locations in Pearson (2007) identify the distribution of critical habitat.

### **Sources of uncertainties**

The main sources of uncertainty are in the estimates of abundance and habitat capacity. Like many such estimates for species with no commercial importance, the abundances for Nooksack dace are extrapolations based on limited data sets, none of which were gathered for population estimation. Nooksack dace are hard to sample: minnow traps are inefficient, electrofishing must be done with great care to avoid damaging fish, and kick seines only work if the substrate is not too large.

The same uncertainties apply to the population targets, because they are obtained by multiplying estimates of suitable habitat by estimates of dace density believed to be supported by such habitat. These targets are not minimum viable populations (MVPs), because there are insufficient demographic data to determine such a benchmark. By definition, these target abundances assume that all habitat with high potential productivity will be occupied by Nooksack dace. The population in Bertrand Creek thus appears to be healthy. To achieve the target abundances for Pepin and Fishtrap Creeks, riffle areas that are currently degraded and unoccupied will need to be remediated. Brunette River, with its large areas of unoccupied habitat, does not fit this pattern, and further research is recommended to determine the cause of its apparently low population.

## **CONCLUSIONS AND ADVICE**

- There are no data or analyses presented for Nooksack dace to counter the original COSEWIC criteria identifying declining habitat quantity and quality as the main factors jeopardizing survival or recovery. There remains considerable uncertainty, however, regarding population abundance, habitat capacity and recovery goals, including population targets.
- A guideline for minimum viable population size for each population is likely several thousand mature individuals (Reed et al. 2003). This range, referenced in conservation literature, is considered adequate to maintain genetic diversity and to buffer independent populations from random variations in survival, and thus to maintain long-term viability.
- The actual “currency” of recovery should be in measurable units of potential critical habitat coupled with relative estimates of abundance based on an acceptable sampling protocol. Population performance measures should be reviewed and numerical targets will need to be re-evaluated in the future. Riparian habitat should be included in the definition of critical habitat, because of its potential importance the recovery of the species.
- The stream “reach” is an appropriate assessment scale for species abundance and habitat. Homogeneous habitat features (e.g., riffles, pools and riparian habitat) are easy to identify, and the fragmentary and shifting nature of habitats is accommodated at this scale. Potential critical habitat for Nooksack dace includes reaches in their native creeks that contain or are known to have previously contained more than 10% riffle by length.
- There is little scope for human-induced mortality or alternative habitat configurations. Permitting of activities that cause incidental mortality or that alter potential critical habitat

should consider the consequences for achieving stated recovery goals in a risk management context that considers the high uncertainty in the data.

- Habitat restoration is essential for the survival and recovery of Nooksack dace, but research on function of potential critical habitat in relation to population survival or recovery is recommended to establish restoration priorities. This research should identify performance indicators for potential critical habitat and populations.
- Severe low flow during high water-use periods results in completely dry riffle habitat in some reaches, especially in Bertrand Creek. An immediate mitigation measure would be to reduce drying and its obvious direct impact on survival.

## SOURCES OF INFORMATION

DFO, 2007. Proceedings of the PSARC review on the recovery potential assessment for Nooksack Dace and potential critical habitat for Nooksack Dace and Salish Sucker, October 25, 2007. DFO Can. Sci. Advis. Sec. Proceed. Ser. 2007/041.

Harvey, B. 2008. Recovery potential assessment for the Nooksack Dace (*Rhinichthys cataractae*) Working Paper, DFO Can. Sci. Advis. Sec. Res. Doc. 2007/075.

Pearson, M. 2007. An Assessment of Potential Critical Habitat for Nooksack Dace (*Rhinichthys cataractae*) and Salish Sucker (*Catostomus* sp.). DFO Can. Sci. Advis. Sec. Res. Doc. 2007/058.

Pearson, M.P., T. Hatfield, J.D. McPhail, J.S. Richardson, J.S. Rosenfeld, H. Schreier, D. Reed, M.J., O'Grady, J.J., Brook, B.W., Ballou, J.D., and Frankham, R. 2003. Estimates of minimum viable population sizes for vertebrates, and factors influencing those estimates. *Biol. Conserv.* 113: 23-34.

Schluter, D.J. Sneep, M. Stejpovic, E.B. Taylor, and P.M. Wood. 2008. Recovery Strategy for the Nooksack Dace (*Rhinichthys cataractae*) in Canada. Species at Risk Act Recovery Strategy Series, Fisheries and Oceans Canada, Vancouver. vi + 29 pp.

**FOR MORE INFORMATION**

Contact: Neil Schubert  
Fisheries and Oceans Canada  
Burnaby, B.C.

Tel: (604) 666-8452  
Fax: (604) 666-1995  
E-Mail: Neil.Schubert@dfo-mpo.gc.ca

or

Contact: Alan Cass  
Fisheries and Oceans Canada  
3190 Hammond Bay Rd.,  
Nanaimo, B.C. V9R 5K6

Tel: (250) 756-7142  
Fax: (250) 756-7209  
E-Mail: Alan.Cass@dfo-mpo.gc.ca

This report is available from the:

Centre for Science Advice (CSA)  
Pacific Region  
Fisheries and Oceans Canada  
Pacific Biological Station  
3190 Hammond Bay Road  
Nanaimo, BC V9T 6N7

Telephone: (250) 756-7208  
Fax: (250) 756-7209  
E-Mail: psarc@dfo-mpo.gc.ca  
Internet address: [www.dfo-mpo.gc.ca/csas](http://www.dfo-mpo.gc.ca/csas)

ISSN 1480-4913 (Printed)  
© Her Majesty the Queen in Right of Canada, 2008

*La version française est disponible à l'adresse ci-dessus.*

**CORRECT CITATION FOR THIS PUBLICATION**

DFO. 2008. Recovery Potential and Potential Critical Habitat for the Nooksack Dace (*Rhinichthys cataractae* sp.). DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2008/031.