ENVIRONMENTAL DYNAMICS INC.

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February 21, 2013

EDI Job Number: 12-Y-0450

Assessment and Abandoned Mines
Yukon Government
Box 2703
Whitehorse, YT

Attention: Adrienne Turcotte, Project Officer

Re: Dixon Lake Fish Tissue Analysis Results

In September 2012, EDI Environmental Dynamics Inc. (EDI) reported the capture of Arctic grayling (*Thymallus arcticus*) with unusual prominent dark skin pigmentation from Dixon Lake. Assessment and Abandoned Mines (AAM) subsequently retained EDI to conduct a field program, which included fish tissue and water quality sampling to investigate this further. This letter presents the results of the fish tissue analysis. Field activities and water quality results are summarized in previously submitted EDI technical memos, "Dixon Lake Fish Tissue and Water Quality Project – Field Update" (February 13, 2013) and "Water Quality Sampling Conducted at Dixon Lake" (February 21, 2013).

Three fish were captured during the winter sampling program. One fish exhibited a small amount of dark pigmentation on the lower jaw, which was submitted for analysis to the BC Ministry of Agriculture Animal Health Centre (AHC) laboratory. The AHC final report is attached. To summarize, the black spots on the jaw were symmetrical and considered within the normal variation in skin pigmentation; cell morphology was also normal, indicating there was no cancer within the tissue sample submitted.

The reason for the dark skin pigmentation may be the result of intraspecies variation. Dixon Lake is a small, isolated fish population with presumably limited genetic diversity; hanging culverts at both the mine access road and haul road prevent upstream migration of new fish into the existing population. Additionally, water quality results did not indicate any potential causes for adverse health effects to the fish population. Finally, Dixon Lake is situated upstream of the Faro Mine, outside the zone of influence for contamination concerns.

As fish with prominent dark pigmentation were observed in the fall and fish caught in the winter exhibited little to no dark pigmentation, AAM may wish to consider additional tissue sample collection this summer, for confirmation.

Should you have any questions or concerns, please feel free to contact me via email (mkearns@edynamics.com) or phone (867-393-4882).

Yours truly,

EDI Environmental Dynamics Inc.

Submitted via email

Meighan Kearns, B.Sc., R.P.Bio.
Aquatic Biologist

Attachment: Final Report AHC Case 13-423

BRITISH COLUMBIA
The Best Place on Earth

Ministry of Agriculture

Animal Health Centre

AAVLD - Accredited Laboratory

Ministry of Agriculture
1767 Angus Campbell Road
Abbotsford BC V3G 2M3
Telephone : (604) 556-3003
Facsimile: (604) 556-3010
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Final Report AHC Case: 13-423

Last Updated: 02/08/13 10:53 AM
Pathologist: Gary D. Marty
Received Date: 01/31/13
Collected Date:
Client Ref No:

Veterinarian:
Clinic:
Phone:
Fax:

Submitter: Jody Mackenzie-Grieve
Phone:
Fax:
Owner: Fisheries & Oceans Canada
Phone:
Fax:(867) 393-6737

Animal Data
Species: Arctic Grayling
Breed:
Sex:
Age:
Premise ID:

Case History
Submitted formalized jaw, lower jaw tissue for histology.

Prominent differences in pigmentation were identified in 1/2 to 1/3 of Arctic Grayling (wild) captured from an "un-impacted" isolated late in fall 2012. This sample was obtained in December 2012 (jaw). Contractor identified what appeared to be unexpected pigmentation on the lower jaw of this fish (differences in pigmentation on body not identified in this sample). Would like opinion as to if observation is "normal" or is in response to something else (eg parasite).

Freshwater, Wild.

Final Diagnosis

1. Skin of jaw: abundant dermal melanocytes, focal, bilaterally symmetric (within normal limits; slide 1)

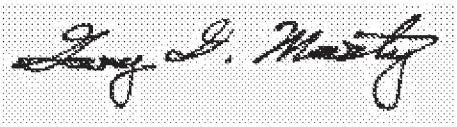
Final Comment: Melanocytes are the cells that produce dark pigment in fish. They are common in many organs, particularly dorsal skin, throughout the body. Their distribution is highly variable within a species, and within an individual fish melanocytes expand and contract to make the fish appear darker or lighter. Because these black spots on the jaw are bilaterally symmetric, and the morphology of the cells is normal (i.e., no evidence of cancer), I consider the spots to be part of the normal variability in skin pigmentation.

Histopathology

A sample of jaw that had been frozen fresh and then preserved in 10% neutral bufferred formalin was received for histopathology. The sample was placed in 10% EDTA solution for mild decalcification over the weekend (4 days). The skin between the medial mandible and lateral dental bone, about 20 mm caudal to the tip of the jaw, has a pair of bilaterally symmetric 5-mm-diameter black spots. The jaw was transected medially and then transversely to produce a cross section of the skin through each of the spots. Additional surface decalcification with 8% formic acid was done on the paraffin block before sectioning.

History of Communication

Date	To	Description
02/08/13 10:53 AM	Fisheries & Oceans Canada - e-mail	bc report sent



Gary D. Marty
D.V.M., Ph.D., Diplomate A.C.V.P.

END OF REPORT