

## **Andrew R. Munro, PhD**

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### **EDUCATION**

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| <b>PhD in Fish and Wildlife Biology</b> , supporting course area in Statistics<br>Montana State University, Bozeman, Montana    | 2004 |
| <b>MS in Biology</b> , emphasis in Marine and Freshwater Ecology<br>East Stroudsburg University, East Stroudsburg, Pennsylvania | 1995 |
| <b>BS in Biology</b> , concentration in Ecology, Chemistry minor<br>Ursinus College, Collegeville, Pennsylvania                 | 1992 |

### **EMPLOYMENT**

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| <b>Fisheries Scientist, Statewide Salmon Stock Assessment Scientist</b><br>Alaska Department of Fish and Game, Anchorage, Alaska | 2009-present |
| <b>Postdoctoral Research Associate</b><br>University of Adelaide, Adelaide, Australia  | 2007-2009    |
| <b>Australian Research Council Postdoctoral Research Associate</b><br>University of Adelaide, Adelaide, Australia                | 2004-2006    |
| <b>Graduate Research Assistant / Graduate Student</b><br>Montana State University, Bozeman, Montana                              | 1997-2004    |
| <b>Field Scientist / Senior Laboratory Technician</b><br>F.X. Browne, Inc., Marshalls Creek, Pennsylvania                        | 1994-1996    |

### **PROFESSIONAL APPOINTMENTS**

#### *Current*

- Workgroup on Stock Assessment (Chair), NPAFC
- Salmon Stock Composition Workgroup, NPFMC
- Scientific and Technical Committee, AYK-SSI
- Expert Panel on Escapement Quality in the AYK Region, AYK-SSI
- Statewide Escapement Goal Planning Team, ADF&G

#### *Past*

- Expert Panel on the Development and Setting of Escapement Goals in the AYK Region, AYK-SSI
- ADF&G Chinook Salmon Research Team, ADF&G and Governor's Office

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**PUBLICATIONS***Peer Reviewed*

- xman, D.S., K.W. McNeel, and **A.R. Munro**. 2018. Methods used to study the ocean ecology of Pacific salmon and trout: otolith marking. Pages 1000-1019 in R.J. Beamish (ed.). The ocean ecology of Pacific salmon and trout. American Fisheries Society.
- Clark, R.A., D.M. Eggers, **A.R. Munro**, S.J. Fleischman, B.G. Bue, and J.J. Hasbrouck. 2017. An evaluation of the percentile approach for establishing sustainable escapement goals in lieu of stock productivity information. Pages 173-202 in T.J. Quinn II, J.L. Armstrong, M.R. Baker, J.D. Heifetz, and D. Witherell (eds.). Assessing and managing data-limited fish stocks. Alaska Sea Grant, University of Alaska Fairbanks.
- Crook, D.A., D.J. O'Mahony, **B.M. Gillanders**, **A.R. Munro**, A.C. Sanger, S. Thurstan, and L.J. Baumgartner. 2016. Contribution of stocked fish to riverine populations of golden perch (*Macquaria ambigua*) in the Murray–Darling Basin, Australia. *Marine and Freshwater Research* 67:1401-1409.
- Gillanders, B.M., L.M. Wilkinson, **A.R. Munro**, and M.C. deVries. 2013. Statolith chemistry of two life history stages of cuttlefish: effects of temperature and seawater trace element concentration. *Geochimica et Cosmochimica Acta* 101:12-23.
- Gillanders, B.M. and **A.R. Munro**. 2012. Hypersaline waters pose new challenges for reconstructing environmental histories of fish based on otolith chemistry. *Limnology and Oceanography* 57:1136-1148.
- Crook, D.A., D.J. O'Mahony, B.M. Gillanders, **A.R. Munro**, and A.C. Sanger. 2012. Quantitative measurement of calcein fluorescence for non-lethal, field based discrimination of hatchery and wild fish. *American Fisheries Society Symposium* 76:389-396.
- Woodcock, S.H., **A.R. Munro**, D.A. Crook, and B.M. Gillanders. 2012. Incorporation of magnesium into fish otoliths: determining contribution from water and diet. *Geochimica et Cosmochimica Acta* 94:12-21.
- Woodcock, S.H., B.M. Gillanders, **A.R. Munro**, D.A. Crook, and A.C. Sanger. 2011. Determining mark success of 15 combinations of enriched stable isotopes for the batch marking of larval otoliths. *North American Journal of Fisheries Management* 31:843-851.
- Woodcock, S.H., B.M. Gillanders, **A.R. Munro**, F. McGovern, D.A. Crook, and A.C. Sanger. 2011. Using enriched stable isotopes of barium and magnesium to batch mark otoliths of larval golden perch (*Macquaria ambigua*, Richardson). *Ecology of Freshwater Fish* 20:157-165.
- Munro, A.R.**, B.M. Gillanders, S. Thurstan, D.A. Crook, and A.C. Sanger. 2009. Transgenerational marking of freshwater fishes with enriched stable isotopes: a tool for fisheries management and research. *Journal of Fish Biology* 75:668-684.
- Crook, D.A., D.J. O'Mahony, B.M. Gillanders, **A.R. Munro**, A.C. Sanger, and S. Thurstan. 2009. Development and evaluation of methods for osmotic induction marking of golden perch (*Macquaria ambigua*) with calcein and alizarin red S. *North American Journal of Fisheries Management* 29:279-287.
- Munro, A.R.**, B.M. Gillanders, T.S. Elsdon, D.A. Crook, and A.C. Sanger. 2008. Enriched stable isotope marking of juvenile golden perch (*Macquaria ambigua*) otoliths. *Canadian Journal of Fisheries and Aquatic Sciences* 65:276-285.
- Crook, D.A., D.J. O'Mahony, **B.M. Gillanders**, **A.R. Munro**, and A.C. Sanger. 2007. Production of external fluorescent marks on golden perch fingerlings through osmotic induction marking with alizarin red S. *North American Journal of Fisheries Management* 27:670-675.

- Munro, A.R.**, T.E. McMahon, and J.R. Ruzycki. 2005. Use of natural chemical markers to identify the origin and timing of exotic species introductions: lake trout in Yellowstone Lake. *Canadian Journal of Fisheries and Aquatic Sciences* 62:79-87.
- Munro, A.R.**, T.E. McMahon, S.A. Leathe, and G. Liknes. 2003. Evaluation of batch marking small rainbow trout with coded wire tags. *North American Journal of Fisheries Management* 23:600-604.
- Munro, A.R.**, T.L. Baker, W.L. McKibbin, T. Strakosh, and C. Robinson. 2000. Safety in fisheries work: can we afford not to be prepared? *Fisheries* 25(8):36-37.

### Reports (selected)

- Brenner, R.E., **A.R. Munro**, and J.C. Shriver, editors. 2018. Run forecasts and harvest projections for 2018 Alaska salmon fisheries and review of the 2017 season. Alaska Department of Fish and Game, Special Publication No. 18-09, Anchorage, AK. (*Annual report. 2014-present, sole or co-editor*)
- Evenson, D.F., C. Habicht, M. Stopha, **A.R. Munro**, T.R. Meyers, and W.D. Templin. 2018. Salmon hatcheries in Alaska? A review of the implementation of plans, permits, and policies designed to provide protection for wild stocks. Alaska Department of Fish and Game, Special Publication No. 18-12, Anchorage, AK.
- Irvine, J.R., **A.R. Munro**, W. Templin, M. Thiess, S. Grant, and E. Neatherlin. 2018. Status overview for Pacific salmon populations in the eastern North Pacific Ocean. Pages 1-7 in J. Park and S. Taylor (eds.) First NPAFC-IYS workshop on Pacific salmon production in a changing climate. NPAFC Technical Report 11.
- Munro, A.R.** 2018. Summary of Pacific salmon escapement goals in Alaska with a review of escapements from 2009 to 2017. Alaska Department of Fish and Game, Fishery Manuscript Series No. 18-04, Anchorage, AK. (*Annual report. 2010-present, primary or sole author*)
- Guyon, J.R., C.M. Guthrie III, **A.R. Munro**, J. Jasper, and W.D. Templin. 2015. Genetic stock composition analysis of the Chinook salmon bycatch in the Gulf of Alaska walleye pollock (*Gadus chalcogrammus*) trawl fisheries, 2013. NOAA Technical Memorandum NMFS-AFSC-291.
- Volk, E.C., and **A.R. Munro**. 2015. Pacific salmon escapement estimation methods and data for Alaska. NPAFC Doc. 1588.
- Clark, R.A., D.M. Eggers, **A.R. Munro**, S.J. Fleischman, B.G. Bue, and J.J. Hasbrouck. 2014. An evaluation of the percentile approach for establishing Sustainable Escapement Goals in lieu of stock productivity information. Alaska Department of Fish and Game, Fishery Manuscript No. 14-06, Anchorage, AK.
- Guyon, J.R., C.M. Guthrie III, **A.R. Munro**, J. Jasper, and W.D. Templin. 2014. Extension of genetic stock composition analysis to the Chinook salmon bycatch in the Gulf of Alaska walleye pollock (*Gadus chalcogrammus*) trawl fisheries, 2012. NOAA Technical Memorandum NMFS-AFSC-285.
- ADF&G Chinook Salmon Research Team. 2013. Chinook salmon stock assessment and research plan, 2013. Alaska Department of Fish and Game, Special Publication No. 13-01, Anchorage, AK.
- Dann, T.H., C. Habicht, S.D.R. Olive, H.L. Liller, E.K.C. Fox, J.R. Jasper, **A.R. Munro**, M.J. Witteveen, T.T. Baker, K.G. Howard, E.C. Volk, and W.D. Templin. 2012. Stock composition of sockeye salmon harvests in fisheries of the Western Alaska Salmon Stock Identification Program (WASSIP), 2006-2008. Alaska Department of Fish and Game, Special Publication No. 12-22, Anchorage, AK.
- Eggers, D.M., **A.R. Munro**, and E.C. Volk. 2012. Estimating escapement of Western Alaskan sockeye salmon for Western Alaska Salmon Stock Identification Program reporting groups, 2006 to 2008. Alaska Department of Fish and Game, Special Publication No. 12-15, Anchorage, AK.

- Eggers, D.M., **A.R. Munro**, and E.C. Volk. 2012. Estimating escapement of Western Alaskan chum salmon for Western Alaska Salmon Stock Identification Program reporting groups, 2007 to 2009. Alaska Department of Fish and Game, Special Publication No. 12-21, Anchorage, AK.
- Habicht, C., **A.R. Munro**, and W.D. Templin. 2012. Western Alaska Salmon Stock Identification Program Technical Document 26: Reporting measures of central tendency. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 5J12-26, Anchorage, AK.
- Habicht, C., **A.R. Munro**, T.H. Dann, D.M. Eggers, W.D. Templin, M.J. Witteveen, T.T. Baker, K.G. Howard, J.R. Jasper, S.D.R. Olive, H.L. Liller, E.L. Chenoweth, and E.C. Volk. 2012. Harvest and harvest rates of sockeye salmon stocks in fisheries of the Western Alaska Salmon Stock Identification Program (WASSIP), 2006-2008. Alaska Department of Fish and Game, Special Publication No. 12-24, Anchorage, AK.
- Jasper, J.R., C. Habicht, **A.R. Munro**, and W.D. Templin. 2012. Western Alaska Salmon Stock Identification Project Technical Document 7: Regional allocation model. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 5J12-12, Anchorage, AK.
- Munro, A.R.**, C. Habicht, T.H. Dann, D.M. Eggers, W.D. Templin, M.J. Witteveen, T.T. Baker, K.G. Howard, J.R. Jasper, S.D. Rogers Olive, H.L. Liller, E.L. Chenoweth, and E.C. Volk. 2012. Harvest and harvest rates of chum salmon stocks in fisheries of the Western Alaska Salmon Stock Identification Program (WASSIP), 2007-2009. Alaska Department of Fish and Game, Special Publication No. 12-25, Anchorage, AK.
- Templin, W.D., N.A. DeCovich, S.D. Rogers Olive, H.L. Liller, E.K.C. Fox, J.R. Jasper, M.J. Witteveen, T.T. Baker, K.G. Howard, **A.R. Munro**, E.C. Volk, and C. Habicht. 2012. Stock composition of chum salmon harvests in fisheries of the Western Alaska Salmon Stock Identification Program (WASSIP), 2007-2009. Alaska Department of Fish and Game, Special Publication No. 12-23, Anchorage.
- Jones, M., E. Volk, M. Adkison, B. Bue, S. Fleischman, **A. Munro**, and M. Catalano. 2011. Management strategies for AYK salmon stocks: accounting for uncertainty. AYK-SSI Final Report of an Expert Panel, Project 902, Anchorage, AK.
- Brookes, J.D. and 33 co-authors. 2009. An ecosystem assessment framework to guide management of the Coorong. Final Report of the CLLAMMecology Research Cluster. CSIRO: Water for a Healthy Country National Research Flagship, Canberra, ACT.
- Gillanders, B.M. and **A.R. Munro**. 2009. Relations between water chemistry, otolith chemistry and salinity of a hypersaline system: implications for determining past environmental history of fish. CSIRO: Water for a Healthy Country National Research Flagship, Canberra, ACT.
- Crook, D.A., **A.R. Munro**, B.M. Gillanders, A.C. Sanger, D. Mahony, and S. Thurstan. 2006. Improved methodologies for discriminating stocked and wild fish – Final report. Murray Darling Basin Commission Publication No. 38/06, Canberra, ACT.
- Gillanders, B.M., T.S. Elsdon, and **A.R. Munro**. 2006. Impacts of native fish stocking on fish within the Murray-Darling Basin. Murray-Darling Basin Commission Native Fish Strategy MD239, Canberra, ACT.
- Crook, D.A., **A.R. Munro**, B.M. Gillanders, A.C. Sanger, S. Thurstan, and J. Macdonald. 2005. Review of existing and proposed methodologies for discriminating hatchery and wild-bred fish. Murray-Darling Basin Commission, Native Fish Strategy R5003, Canberra, ACT.
- McMahon, T.E., **A.R. Munro**, A.V. Zale, S.A. Leathe, and G. Liknes. 2002. Interaction of life history, fish size, and infection risk on population-level effects of whirling disease on Missouri River rainbow trout. Final Report to: National Partnership on the Management of Wild and Native Coldwater Fisheries, Bozeman, MT.

- Munro, A.R.**, T.E. McMahon, and B.E. Rieman. 2001. Microchemical analysis of otoliths to determine life history patterns in interior salmonids using secondary ion mass spectrometry. Final Report. USDA, Forest Service, Rocky Mountain Research Station, Boise, ID.
- McMahon, T.E., S.A. Leathe, G. Liknes, E.R. Vincent, **A.R. Munro**, and A.V. Zale. 2001. Relation of life history type to whirling disease susceptibility in Missouri River rainbow trout. Final Report. National Partnership on Management of Wild and Native Coldwater Fisheries, Bozeman, MT.
- Munro, A.R.**, T.E. McMahon, and B.E. Rieman. 1998. Review of current approaches for chemically analyzing the calcified structures in fish. USDA Forest Service, Rocky Mountain Research Station, Boise, ID.

### Dissertation and Thesis

- Munro, A.R.** 2004. Identification of life-history variation in salmonids using otolith microchemistry and scale patterns: implications for illegal introductions and for whirling disease in Missouri River rainbow trout. PhD Dissertation, Montana State University, Bozeman, MT.
- Munro, A.R.** 1995. Comparison of ageing techniques and growth estimates as applied to the fish of Lake Laura, Pennsylvania. MS Thesis, East Stroudsburg University, East Stroudsburg, PA.

### GRANTS

- Arctic-Yukon-Kuskokwim Sustainable Salmon Initiative Priority #8 Escapement Goal Expert Panel Phase 2. Arctic-Yukon-Kuskokwim Sustainable Salmon Initiative. 2011. M. Jones, M. Catalano, E. Volk, S. Fleischman, **A. Munro**, B. Bue, and M. Adkison. \$159,139
- Methods of discriminating hatchery fish and outcomes of stocking in the Murray-Darling Basin. Murray-Darling Basin Commission, Native Fish Strategy. 2007. D.A. Crook, B.M. Gillanders, **A.R. Munro**, A.C. Sanger, L. Baumgartner, and S. Thurstan. \$62,800
- Impacts of native fish stocking on fish within the Murray-Darling Basin. Murray-Darling Basin Commission, Native Fish Strategy. 2005. B.M. Gillanders, T.S. Elsdon, and **A.R. Munro**. \$29,900
- Improved methodology for discrimination of stocked and wild fish. Murray-Darling Basin Commission, Strategic Investigations and Education Funding Program. 2004. D.A. Crook, **A.R. Munro**, B.M. Gillanders, A.C. Sanger, and S. Thurstan. \$149,700
- Factors affecting the relative abundance of migratory and resident life history forms among bull trout populations. Avista Utilities and US Fish and Wildlife Service. 2001. T.E. McMahon, and **A.R. Munro**. \$87,000
- Interaction of life history, fish size, and infection risk on population-level effects of whirling disease on Missouri River rainbow trout. National Partnership on the Management of Wild and Native Coldwater Fisheries. 2001. T.E. McMahon, **A.R. Munro**, A.V. Zale, S.A. Leathe, and G. Liknes. \$127,000
- Epidemiology of whirling disease in the Missouri River ecosystem. National Partnership on Management of Wild and Native Coldwater Fisheries. 2000. T.E. McMahon, A.V. Zale, **A.R. Munro**, S.A. Leathe, and G. Liknes. \$168,000
- Identification of the source population of lake trout in Yellowstone Lake using otolith microchemistry. National Park Service, Yellowstone National Park. **A.R. Munro**, T.E. McMahon, and J. Ruzycski. \$7,000
- Relation of life history type to whirling disease susceptibility in Missouri River rainbow trout. National Partnership on Management of Wild and Native Coldwater Fisheries. 1999. T.E. McMahon, B.L. Kerans, A.V. Zale, E.R. Vincent, S.A. Leathe, **A.R. Munro**, and J.B. Munro. \$43,000
- Microchemical analysis of otoliths and scales to determine life-history patterns of interior salmonids using secondary ion mass spectrometry: phase two. USDA Forest Service, Rocky Mountain Research Station. 1998. **A.R. Munro**, T.E. McMahon, and B.E. Rieman. \$10,600