

**Dept of Biology +
Dept of Psychology, Neuroscience, and Behaviour**
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Dr. Andy J. Turko

Research Positions

- 2020- Eastburn Fellow – McMaster University (Drs. Graham Scott and Sigal Balshine)
- Integration of behaviour and physiology to understand how fishes survive challenging environments.
- 2018-2020* ReNewZoo Postdoctoral Fellow – Great Lakes Institute for Environmental Research at the University of Windsor (Dr. Trevor Pitcher) and the Toronto Zoo
- Conservation physiology and reintroduction of endangered fishes in Canada.
 - *NSERC CREATE program to foster collaboration between academics and zoo*
 - *Partnered with Fisheries and Oceans Canada freshwater species at risk network*
 - *Includes 6 months parental leave

Education

- 2018 University of Guelph **PhD**, Integrative Biology *Supervisor: Dr. Patricia Wright*
- 2011 University of Guelph **MSc**, Integrative Biology *Supervisor: Dr. Patricia Wright*
- 2008 University of Guelph **BSc**, Marine and Freshwater Biology (hons) *with distinction*

Peer-Reviewed Publications (527 citations on Google Scholar, h-index = 14)

*Mentored trainees are noted with an * (undergraduate) or † (graduate)*

29. **Turko AJ**, Rossi GS, and Wright PA (2021). More than breathing air: Evolutionary drivers and physiological implications of an amphibious lifestyle in fishes. *Physiology* 36: 307-314. **Invited review**
28. **Turko AJ**, Leclair ATA, Mandrak NE, Drake DAR, Scott GR, and Pitcher TE (2021). Choosing source populations for conservation reintroductions: lessons from variation in thermal tolerance among populations of the imperilled redbreasted sunfish. *Canadian Journal of Fisheries and Aquatic Sciences*. <https://doi.org/10.1139/cjfas-2020-0377>
27. Salena MG, **Turko AJ**, Singh A, Pathak A*, Hughes E, Brenton L, Brown C, and Balshine S (2021). Understanding fish cognition: a review and appraisal of current practices. *Animal Cognition*. 24: 395-406.
26. Tunnah L, Robertson CE, **Turko AJ**, and Wright PA (2021). Acclimation to prolonged aquatic hypercarbia or air enhances hemoglobin- oxygen affinity in an amphibious fish. *Comparative Biochemistry and Physiology A: Molecular and Integrative Physiology* 252: 110848.
25. **Turko AJ**, Nolan CB †, Balshine S, Scott GR, and Pitcher TE (2020). Thermal tolerance depends on age, season, and body condition in imperiled redbreasted sunfish *Clinostomus elongatus*. *Conservation Physiology* 8: 10.1093/conphys/coaa062.
24. Fudge DS, and **Turko AJ** (2020). The best predictions in experimental biology are critical and persuasive. *Journal of Experimental Biology* 223: jeb231894.
23. **Turko AJ**, Cisternino B*, and Wright PA (2020). Calcified gill filaments increase respiratory function in fishes. *Proceedings of the Royal Society B* 287: 20192796.
22. **Turko AJ**, Doherty JE*, Yin-Liao I*, Levesque K, Kruth P*, Holden JM, Earley RL, and Wright PA (2019). Prolonged survival out of water is linked to a slow pace of life in a self-fertilizing amphibious fish. *Journal of Experimental Biology* 222: jeb209270.

21. Rossi GS, Tunnah L, Martin KE, **Turko AJ**, Taylor DS, Currie S, and Wright PA (2019). Mangrove fishes rely on emersion behavior and physiological tolerance to persist in sulphidic environments. *Physiological and Biochemical Zoology* 92: 316-325.
20. **Turko AJ**, Maini P*, Wright PA, and Standen EM (2019). Gill remodelling during terrestrial acclimation in the amphibious fish *Polypterus senegalus*. *Journal of Morphology* 280: 329-338.
19. Livingston MD*, Bhargav V*, **Turko AJ**, Wilson JM, and Wright PA (2018). Widespread use of emersion and cutaneous ammonia excretion in Aplocheiloid killifishes. *Proceedings of the Royal Society B* 285: 20181496. **Featured by Outside JEB**
18. **Turko AJ**, Tatarenkov A, Currie S, Earley RL, Platek A*, Taylor DS, and Wright PA (2018). Emersion behaviour underlies variation in aquatic respiratory function in the amphibious fish *Kryptolebias marmoratus*. *Journal of Experimental Biology* 221: jeb.168039.
17. Rossi GS, **Turko AJ**, and Wright PA (2018). Oxygen drives skeletal muscle remodeling in an amphibious fish out of water. *Journal of Experimental Biology* jeb.180257.
16. Sutton AO*, **Turko AJ**, McLaughlin RL, and Wright PA (2018). Behavioural and physiological responses of an amphibious, euryhaline mangrove fish to acute salinity exposure. *Copeia* 106: 305-311.
15. **Turko AJ**, Kultz D, Fudge D, Croll RP, Smith FM, Stoyek MR, and Wright PA (2017). Skeletal stiffening in an amphibious fish out of water is a response to increased body weight. *Journal of Experimental Biology* 220, 3621-3631. **Featured by Inside JEB**
14. Heffell Q, **Turko AJ**, and Wright PA (2017). Skin water permeability and skin thickness are plastic in the amphibious mangrove rivulus *Kryptolebias marmoratus* out of water. *Journal of Comparative Physiology and Biochemistry B* 188: 305-314.
13. Platek A*, **Turko AJ**, Donini A, Kelly S, and Wright PA (2017). Environmental calcium regulates gill remodeling in a euryhaline teleost fish. *Journal of Experimental Zoology A* 327:139-142.
12. Blewett TA, Simon RA*, **Turko AJ**, and Wright PA (2017). Copper alters hypoxia sensitivity and the behavioural emersion response in the amphibious fish *Kryptolebias marmoratus*. *Aquatic Toxicology* 189: 25-30.
11. Brunt EM*, **Turko AJ**, Scott GR, and Wright PA (2016). Amphibious fish jump better on land after acclimation to a terrestrial environment. *Journal of Experimental Biology* 219: 3204-3207.
10. Wright PA, and **Turko AJ** (2016). Amphibious fishes: evolution and phenotypic plasticity. *Journal of Experimental Biology* 219: 2245-2259. **Invited review**
9. Regan MD, **Turko AJ**, Heras J, Andersen MK, Lefevre S, Wang T, Bayley M, Brauner CJ, Huong DTT, Phuong NT, and Nilsson GE (2016). Ambient CO₂, fish behaviour and altered GABAergic neurotransmission: exploring the mechanism of CO₂-induced behaviour by taking a hypercapnia dweller down to low CO₂ levels. *Journal of Experimental Biology* 219: 109-118. **Featured by Inside JEB**
8. **Turko AJ**, and Wright PA (2015). Evolution, ecology and physiology of amphibious killifishes (Cyprinodontiformes). *Journal of Fish Biology* 87:815-835. **Invited review**
7. Wells MW*, **Turko AJ**, and Wright PA (2015). Fish embryos on land: Terrestrial embryo deposition lowers oxygen uptake without altering growth or survival in the amphibious fish *Kryptolebias marmoratus*. *Journal of Experimental Biology* 218: 3249-3256. **Featured by Inside JEB**
6. Gibson DJ*, Sylvester EVA*, **Turko AJ**, Tattersall GJ, and Wright PA (2015). Out of the frying pan into the air – emersion behaviour and evaporative heat loss in an amphibious mangrove fish (*Kryptolebias marmoratus*). *Biology Letters* doi: 10.1098/rsbl.2015.0689 **Featured by National Geographic, ScienceNOW, IFL Science, & many others**
5. Robertson CE, **Turko AJ**, Jonz MG, and Wright PA (2015). Hypercapnia and low pH induce neuroepithelial cell proliferation and emersion behaviour in the amphibious fish *Kryptolebias marmoratus*. *Journal of Experimental Biology* 218:2987-2990.
4. **Turko AJ**, Robertson CE, Bianchini K, Freeman M*, and Wright PA (2014). The amphibious fish *Kryptolebias marmoratus* uses different strategies to maintain oxygen delivery during aquatic hypoxia and air exposure. *Journal of Experimental Biology* 217:3988-3995.
3. Johnson AC*, **Turko AJ**, Klaiman JM, Johnston EF, and Gillis TE (2014). Cold acclimation alters the connective tissue content of the zebrafish (*Danio rerio*) heart. *Journal of Experimental Biology* 217:1868-1875.

2. **Turko AJ**, Cooper CA, and Wright PA (2012). Gill remodelling during terrestrial acclimation reduces aquatic respiratory function of the amphibious fish *Kryptolebias marmoratus*. *Journal of Experimental Biology* 215:3973-3980.
1. **Turko AJ**, Earley RL, and Wright PA (2011). Behaviour drives morphology: voluntary emersion patterns shape gill structure in genetically identical mangrove rivulus. *Animal Behaviour* 82:39-47.

Submitted manuscripts

- **Turko AJ**, Rossi GS, Blewett TA, Currie S, Taylor DS, Wright PA, and Standen EM. (submitted). Context-dependent relationships between athletic performance and body composition in the amphibious fish *Kryptolebias marmoratus*. JEXBIO/2021/243372
- **Turko AJ**, Rossi GS. (submitted). Habitat choice promotes and constrains phenotypic plasticity. RSBL-2021-0468

Awards and Recognition

Research Grants

- 2020 E.B. Eastburn Fellowship, McMaster University. Awarded to study habitat choice and physiological performance of endangered fishes Highly competitive - only one PDF awarded every 2 years, open to applicants from science, engineering, and medicine. (24 months, \$90,000)
- 2018 ReNewZoo postdoctoral fellowship. Awarded to study environmental threats and reintroduction of endangered fishes. Highly competitive - only one PDF awarded in entire NSERC CREATE grant. (18 months, \$67,500)
- 2016 *Jumping killifish: traits that enhance performance out of water*. *Journal of Experimental Biology Travelling Fellowship*, Company of Biologists (£2500)

Scientific Awards

- 2019 CAGS/Proquest-UMI Distinguished Dissertation Award Finalist (#1 at University of Guelph) Best Poster Award, McMaster Water Week (\$250)
- 2018 William S. Hoar Award, best student talk, Canadian Society of Zoologists (\$500)
- 2016 Best student presentation (3rd place), 12th International Congress on the Biology of Fish (\$300)
- 2015 Department of Integrative Biology Distinguished Student Speaker Award (\$300)

Major Scholarships

- 2016 Ontario Graduate Scholarship (\$15,000)
- 2013 NSERC Alexander Graham Bell Canada Graduate Scholarship (\$105,000)
Department of Integrative Biology PhD Award (\$100,000; declined)
Ontario Graduate Scholarship (\$15,000; declined)
- 2010 Ontario Graduate Scholarship (\$15,000)

Scholarly Support

- 2019 Early Career Award from the Canadian Conference for Fisheries Research (\$250)
- 2016 Society for Experimental Biology/Company of Biologists Travel Grant (£300)
- 2014 American Physiological Society, graduate course at Can Tho University, Vietnam (\$750)
- 2013 Canadian Society of Zoologists CPB Travel Research Grant (\$500)
- 2004 University of Guelph Undergraduate Entrance Scholarship (\$2000)

Teaching and Mentorship

Philosophy Synopsis

My goal as a teacher and mentor is to facilitate experiential learning opportunities that are active, collaborative, and engaging. I believe students learn best by doing, and therefore strive to provide a learning environment that allows students to become deeply engaged with their topic of study. Students are required to actively participate in the learning process, and my role is to both challenge and provide support as needed, encouraging students to ask and answer to their own questions and therefore gain a deep understanding of the topic at hand. I have found this active learning style to work well for a range of

situations, from large first-year introductory classes, to smaller, specialized upper-year courses, to one-on-one mentorship of senior undergraduates conducting independent research projects. I am also committed to continual improvement of my teaching skills via self-reflection, feedback from students and peers, and engagement with the scholarly literature. In this sense my teaching gives me my own form of the experiential learning opportunities I provide for my students in the classroom, and I endeavour to learn as much from these situations as my students do.

Course Instructor

- 2019 Investigative Marine Biology Laboratory, Shoals Marine Laboratory (Cornell BIOSM 1500; University of New Hampshire MEFB 403)
- **Instructor of record**
 - Students learn the scientific method by conducting research projects in the field
- 2018 Investigative Marine Biology Laboratory, Shoals Marine Laboratory (Cornell BIOSM 1500; University of New Hampshire MEFB 403)
- **Instructor of record;** co-taught with Douglas Fudge, Chapman University
 - Students learn the scientific method by conducting research projects in the field

Invited Guest Lecturer

- 2021 Comparative Physiology (BIOL385), Chapman University
Adaptational Physiology (BIO4010), University of Guelph
- 2020 Adaptations to Extreme Environments (BIOL4318), Carleton University
Topics in Physiology (BIO3ZZ3), McMaster University
Special Topics in Animal Behaviour (PSYCH 4R03), McMaster University
- 2019 Environmental Physiology (BIO4X03), McMaster University
Field Biology (BIO-333), Redeemer University College
- 2018 Environmental Physiology (BIO4X03), McMaster University
- 2017 Integrative Vertebrate Biology (ZOO4910), University of Guelph
- 2016 Integrative Vertebrate Biology (ZOO4910), University of Guelph
- 2015 Integrative Vertebrate Biology (ZOO4910), University of Guelph
Humans in the Natural World (BIOL1500), University of Guelph
Topics in Physiology (BIO3ZZ3), McMaster University
- 2013 Integrative Vertebrate Biology (ZOO4910), University of Guelph

Graduate Teaching Assistant

- 2015 Investigative Marine Biology Laboratory (BIOSM1500/MEFB403), Shoals Marine Laboratory
- 2010-2013 Biology of Fishes (ZOO4330), University of Guelph
- 2009-2011 Vertebrate Structure and Function (ZOO2090), University of Guelph

Mentorship

- 2021 **Susan Procopio.** Metabolic constraints or tissue tradeoffs: an intraspecific investigation of the mechanisms permitting brain size divergence in Pumpkinseed sunfish (*Lepomis gibbosus*). MSc committee member, University of Guelph.
Madison Dugdale. Suspended sediment, schooling behaviour, and swimming performance of redbreasted dace. MSc student, co-supervised with Trevor Pitcher, University of Windsor.
Jessica Qiu. Leadership and habitat selection in schools of redbreasted dace. BSc honours research project. Co-supervised with Sigal Balshine, McMaster University.
Andre Morin. Territory quality and thresholds of thermal avoidance behaviour in an African cichlid. BSc honours research project. Co-supervised with Sigal Balshine, McMaster University.
- 2020 **Colleen Dowling.** Demography and fecundity of wild redbreasted dace. BSc honours thesis project. Co-supervised with Sigal Balshine, McMaster University.

- Avani Pathak.** The effects of social context on thermal preference of fish. BSc honours thesis project. Co-supervised with Sigal Balshine, McMaster University.
- Angela Tobia.** Thermal plasticity of swimming performance in the endangered redbside dace. BSc honours thesis project. Co-supervised with Graham Scott, McMaster University.
- 2019 **Alyssa Faiczak.** Thermal preference of endangered redbside dace (*Clinostomus elongatus*). BSc honours thesis project. Co-supervised with Sigal Balshine, McMaster University. Thesis resulted in a manuscript in preparation.
- Serena Gaffan.** Swimming performance of redbside dace (*Clinostomus elongatus*). BSc honours thesis project. Co-supervised with Trevor Pitcher, University of Windsor. Thesis resulted in a manuscript in preparation.
- Colby Nolan.** Thermal tolerance of wild redbside dace (*Clinostomus elongatus*) and their sperm. MSc candidate. Co-supervised with Trevor Pitcher, University of Windsor. Research substantially contributed to a publication (Turko et al. 2020 Cons Physiol 8: 10.1093/conphys/coaa062)
- Macaila Wagner.** Environmental cues for gill remodelling in an amphibious fish. Experiential learning undergraduate internship program. Co-supervised with Patricia Wright, University of Guelph.
- 2018 **Liam Tigert.** Positive feedback drives terrestriality of an amphibious fish. BSc honours thesis project. Co-supervised with Patricia Wright, University of Guelph. Thesis resulted in a manuscript in preparation.
- Priyam Maini.** Plasticity of gill morphology and collagen density of *Polypterus senegalus* after short- and moderate-term terrestriality. BSc honours thesis project. Co-supervised with Emily Standen, University of Ottawa. Thesis substantially contributed to a publication (Turko et al. 2019 J Morph 280: 329-338).
- Bianca Cisternino.** Gill filament calcification of Cyprinodontiform fishes. Undergraduate volunteer, University of Guelph. Substantial contribution to a submitted manuscript (Turko et al. 2020 Proc R Soc B 287: 20192796).
- 2017 **Michael Livingston.** Widespread use of cutaneous ammonia excretion in Aplocheiloid killifishes. BSc honours thesis project. Co-supervised with Patricia Wright, University of Guelph. Thesis resulted in a publication (Livingston et al. 2018 Proc R Soc B, 20181496).
- Vikram Bhargav.** Emersion behaviour of Aplocheiloid killifishes. BSc honours research project. Co-supervised with Patricia Wright, University of Guelph. Research substantially contributed to a publication (Livingston et al. 2018 Proc R Soc B, 20181496).
- 2016 **Robyn Simon.** Copper alters hypoxia sensitivity and the behavioural emersion response in the amphibious fish *Kryptolebias marmoratus*. BSc honours research project. Co-supervised with Tamzin Blewett, Wilfrid Laurier University, and Patricia Wright, University of Guelph. Research substantially contributed to a publication (Blewett et al. 2017 Aquat Toxicol 189: 25-30).
- 2015 **Emily Brunt.** Amphibious fish jump better on land after acclimation to a terrestrial environment. BSc honours thesis project. Co-supervised with Patricia Wright, University of Guelph. Thesis resulted in a publication (Brunt et al. 2016 J Exp Biol 219: 3204-3207).
- 2014 **Justine Doherty.** Physiological and behavioural traits influencing emersion tolerance in mangrove rivulus. BSc honours thesis project. Co-supervised with Patricia Wright, University of Guelph. Thesis substantially contributed to a manuscript in prep.
- Alexis Platek.** Effects of environmental calcium on gill remodeling in *Kryptolebias marmoratus*. BSc honours thesis project. Co-supervised with Patricia Wright, University of Guelph. Thesis resulted in a publication (Platek et al. 2017 J Exp Zool A 327: 139-142) and substantially contributed to another study (Turko et al. 2018 J Exp Biol jeb.168039.)
- 2013 **Amy Johnson.** Connective tissue remodelling of the zebrafish heart in response to thermal acclimation. BSc honours thesis project. Co-supervised with Todd Gillis, University of Guelph. Thesis resulted in a publication (Johnson et al. 2014 J Exp Biol 217: 1868-1875).

Alex Sutton. Behavioural and physiological responses of an amphibious, euryhaline mangrove fish to acute salinity exposure. BSc honours thesis project. Co-supervised with Patricia Wright, University of Guelph. Thesis resulted in a publication (Sutton et al. 2018 Copeia 106: 305-311).

- 2012 **Michael Wells.** Terrestrial embryo deposition and metabolism in the amphibious fish *Kryptolebias marmoratus*. BSc honours thesis project. Co-supervised with Patricia Wright, University of Guelph. Thesis resulted in a publication (Wells et al. 2015 J Exp Biol 218: 3249-3256).

Presentations

Invited Academic Seminars

- 2021 *Feedback among phenotypically plastic behavioural, physiological, and morphological traits in amphibious fish moving between water and land.* Invited talk for the Society of Experimental Biology special symposium “The physiology behind phenotypic plasticity in rapidly changing environments”, part of the annual conference.
- 2020 *Thermal physiology of redbreasted dace.* Credit Valley Conservation Authority, Mississauga, ON.
Integrating behaviour and physiology to understand how amphibious fish survive in extreme environments. Department of Biological Sciences, University of Alberta, Edmonton, AB.
Feedback among phenotypically plastic behavioural, physiological, and morphological traits in amphibious fish moving between water and land. Invited talk for the Society of Experimental Biology special symposium “The physiology behind phenotypic plasticity in rapidly changing environments”, Prague, Czech Republic. *Cancelled due to COVID-19.*
Integrating habitat preferences and physiological tolerances to conserve the endangered redbreasted dace. Ecology and Evolutionary Biology seminar series, McMaster University, Hamilton, ON.
- 2019 *Conservation physiology of endangered Canadian stream fishes.* Department of Integrative Biology comparative physiology seminar series, University of Guelph, Guelph, ON.
- 2017 *Fish out of water: Evolution and physiology of amphibious killifishes.* Department of Biology, University of Waterloo, Waterloo ON
- 2015 *Fish out of water: Phylogenetic relationships and physiological consequences of amphibious life histories.* Department of Integrative Biology, University of Guelph, Guelph ON. Recipient of the “Distinguished Student Speaker” award.
- 2015 *Amphibious astronauts: Gill remodelling in response to altered body weight in the mangrove rivulus.* Vox Physiologica seminar series, McMaster University, Hamilton ON.

Conference Presentations - mentored trainees are noted with an * (undergraduate) or † (graduate)

- 2021 **Turko AJ**, Faiczak A*, Scott GR, and Balshine S. Thermal preference and aerobic performance of the endangered redbreasted dace. Talk given as part of the Ecological and Evolutionary Ethology of Fishes virtual conference, July 12-14, 2021.
Turko AJ, Faiczak A*, Balshine S, and Scott GR. Thermal preference and aerobic performance of the endangered redbreasted dace. Talk given as part of the Canadian Society of Zoologists virtual annual meeting, May 10-21, 2021. **President’s award finalist, best postdoc presentation.**
Turko AJ, Rossi GS, Blewett TA., Currie S, Taylor DS, Wright PA, and Standen EM. Context-dependent relationships between athletic performance and body composition in the amphibious fish *Kryptolebias marmoratus*. Talk given as part of the Canadian Society of Zoologists virtual annual meeting, May 10-21, 2021.
 Pathak A*, **Turko AJ**, and Balshine S. Should I stay or should I go? Consensus and leadership in thermal decision. Talk given as part of the Ontario Ecology, Ethology, and Evolution Colloquium, May 13-14, 2021.

- Pathak A*, **Turko AJ**, and Balshine S. Should I stay or should I go? Individual vs. group thermal decision making in redbside dace (*Clinostomus elongatus*). Talk given as part of Rice Lake Comparative Physiology and Biochemistry Workshop, February 19-20, 2021. **Runner up, best undergraduate presentation.**
- Winslow V*, Mehdi H, **Turko AJ**, and Balshine S. Does thermal tolerance vary between male reproductive tactics in the invasive round goby (*Neogobius melanostomus*)? Talk given as part of Rice Lake Comparative Physiology and Biochemistry Workshop, February 19-20, 2021.
- Turko AJ**, Faiczak A*, Pitcher TE, Balshine S, and Scott GR. Do fish choose temperatures that optimize performance? Comparing thermal preference and aerobic scope in the endangered redbside dace *Clinostomus elongatus*. Poster given as part of Rice Lake Comparative Physiology and Biochemistry Workshop, February 19-20, 2021.
- Thorstensen MJ, **Turko AJ**, Pitcher TE, and Jeffries KM. Differential gene expression and exon usage in heat-stressed redbside dace. Talk given as part of the Canadian Conference For Fisheries Research, February 15-19, 2021.
- 2020 **Turko AJ**, Faiczak A*, Pitcher TE, Scott GR, and Balshine S. Thermal preference of endangered redbside dace *Clinostomus elongatus* depends on age, acclimation temperature, and individual differences in metabolic rate. Talk submitted as part of the Canadian Society of Zoologists annual meeting, *cancelled due to COVID-19*.
- 2019 **Turko AJ**, Nolan CB[†], Balshine S, Scott GR, and Pitcher TE. Thermal tolerance depends on age, condition, and season in endangered redbside dace *Clinostomus elongatus*. Talk presented as part of the Canadian Freshwater Species at Risk Network annual symposium, Burlington, ON, November 13-14, 2019.
- Turko AJ**, Nolan CB[†], Balshine S, Scott GR, and Pitcher TE. Thermal tolerance depends on age, condition, and season in endangered redbside dace *Clinostomus elongatus*. Poster presented as part of McMaster Water Week, Hamilton, ON, October 28-November 1, 2019. **(Best Poster Award, \$250)**
- Turko AJ**, Nolan CB[†], Balshine S, Scott GR, and Pitcher TE. Thermal tolerance depends on age, condition, and season in endangered redbside dace *Clinostomus elongatus*. Poster presented as part of the Canada's Accredited Zoos and Aquariums annual meeting, Calgary, AB, September 24-27, 2019.
- Turko AJ**, Nolan CB[†], Balshine S, Scott GR, and Pitcher TE. Seasonal variation in thermal tolerance and energy allocation of endangered Redside Dace *Clinostomus elongatus* in the wild. Talk presented as part of the Canadian Society of Zoologists annual meeting, Windsor, ON, May 13-17, 2019.
- Tunnah L, Robertson CE, **Turko AJ**, and Wright PA. Amphibious fish maintain blood O₂ transport during air-exposure despite whole-body CO₂ accumulation. Poster presented as part of the Canadian Society of Zoologists annual meeting, Windsor, ON, May 13-17, 2019.
- Standen EM, and **Turko AJ**. The art of unsticking: The biomechanics of terrestrial adhesion in an amphibious fish *Kryptolebias marmoratus*. Talk presented as part of the Society for Integrative and Comparative Biology annual meeting, Tampa, FL, USA, January 3-7, 2019.
- Turko AJ**, and Wright PA. Gill filament calcification: a mechanism to enhance fish respiratory function? Talk presented as part of the Canadian Conference for Fisheries Research, London, ON, January 3-6, 2019.
- Turko AJ**, Nolan CB[†], and Picher TE. Thermal tolerance across age, sex, and season in endangered redbside dace *Clinostomus elongatus*. Poster presented as part of the Canadian Conference for Fisheries Research, London, ON, January 3-6, 2019.
- 2018 **Turko AJ**, Nolan CB[†], and Pitcher TE. Conservation physiology of endangered redbside dace *Clinostomus elongatus* in Ontario. Poster presented as part of the Canadian Accredited Zoos and Aquariums annual meeting, Cambridge, ON, September 11-14, 2018.

- Rossi GS, Tunnah L, Martin KE, **Turko AJ**, Taylor DS, Currie S, and Wright PA. Mangrove fishes rely on emersion behaviour and physiological tolerance to persist in sulfidic environments. Poster presented as part of the Canadian Society for Ecology and Evolution annual meeting, Guelph, ON, July 17-21, 2018.
- Wright PA, Tigert L*, and **Turko AJ**. Pros and cons of staying put or escaping poor environmental conditions in amphibious fishes. Talk presented as part of the International Congress on the Biology of Fishes, Calgary, AB, July 15-19, 2018.
- Raby GD, **Turko AJ**, Mokhdad A, Clark TD, Pitcher TE, and Fisk AT. Allometry of thermal tolerance and metabolic performance in Chinook salmon. Talk presented as part of the Society for Experimental Biology Annual Main Meeting, Florence, Italy, July 3-6, 2018.
- Turko AJ**, and Wright PA. Gill filament calcification: an adaptation for improved respiratory function in hypoxia tolerant fishes? Talk presented as part of the Canadian Society of Zoologists annual meeting, St. John's, NL, May 7-11, 2018. (**W.S. Hoar Award for best student presentation, \$500**)
- Rossi GS, **Turko AJ**, and Wright PA. Oxygen drives skeletal muscle remodelling in an amphibious fish out of water. Talk presented as part of the Canadian Society of Zoologists annual meeting, St. John's, NL, May 7-11, 2018.
- Standen EM, **Turko AJ**, Currie S, Blewett T, Taylor DS, Rossi GS, and Wright PA. Surface tension, muscle mass and emersion performance in the mangrove rivulus (*Kryptolebias marmoratus*). Talk presented as part of the Canadian Society of Zoologists annual meeting, St. John's, NL, May 7-11, 2018.
- 2017 Blewett T, Standen E, **Turko AJ**, Currie S, Taylor S, Snihur K, Simon R, Von Gunten K, Alessi D, and Wright PA. Copper alters hypoxia sensitivity, performance and the behavioural emersion response in the amphibious fish *Kryptolebias marmoratus*. Talk presented as part of the Society of Environmental Toxicology and Chemistry North America annual meeting, Minneapolis, MN, USA, Nov 12-16, 2017.
- Turko AJ**, Wright P, Currie S, Blewett T, Taylor DS, Rossi G, and Standen EM. Athletes vs Parents: life history tradeoffs in an amphibious mangrove fish. Talk presented as part of the Canadian Society of Zoologists annual meeting, Winnipeg, MB, May 15-19, 2017.
- Wright P, Bhargav V*, Livingston M*, and **Turko AJ**. Both behavioural and physiological traits suggest amphibiousness may be ancestral in Aplocheilod killifishes. Talk presented as part of the Canadian Society of Zoologists annual meeting, Winnipeg, MB, May 15-19, 2017.
- Currie S, Burnett M, Kane C, Blewett T, Standen E, Taylor DS, **Turko AJ**, and Wright PA. Sensory cues for recognition in a wild, amphibious mangrove fish, *Kryptolebias marmoratus*. Talk presented as part of the Canadian Society of Zoologists annual meeting, Winnipeg, MB, May 15-19, 2017.
- Turko AJ**, and Wright PA. Calcified gill filaments in amphibious fishes: an adaptation for terrestrial life? Talk given as part of the University of Guelph Graduate Student Symposium, Guelph, ON, April 27, 2017.
- Turko AJ**, and Wright PA. Gill filament calcification: an adaptation for terrestrial life in amphibious fishes? Poster given as part of Rice Lake Comparative Physiology and Biochemistry Workshop, Keene, ON, January 27-29, 2017.
- 2016 **Turko AJ**, Doherty J*, Anderson C, Earley RL, Kruth P*, Levesque KD, Yin-Liao I*, and Wright PA. Survival of the slowest: Can plasticity in metabolism and life history traits explain why some amphibious fish can survive out of water longer than others? Talk presented as part of the 12th International Congress on the Biology of Fish, San Marcos, TX, USA, June 12-16, 2016. (**2nd runner up, best student presentation, \$300**)
- Turko AJ**, Currie S, Earley RL, Platek A*, Tatarenkov A, Taylor DS, and Wright PA. Behaviour not genetics explains differences in hypoxia tolerance in the selfing fish *Kryptolebias marmoratus* in

- the wild. Talk presented as part of the Canadian Society of Zoologists annual meeting, London, ON, May 9-13, 2016.
- Turko AJ**, Levesque KD, Blanchard TS, Leinonen A, and Wright PA. A low-cost, modular, and highly configurable 3D printed system for building metabolic rate chambers for air or water. Poster presented as part of the Canadian Society of Zoologists annual meeting, London, ON, May 9-13, 2016.
- Blanchard TS, **Turko AJ**, and Wright PA. A new twist to an old method- Measuring the critical oxygen tension (P_{crit}) in air. Poster presented as part of the Canadian Society of Zoologists annual meeting, London, ON, May 9-13, 2016.
- Turko AJ**, Tatarenkov A, Currie S, Earley R, Taylor DS, Platek A*, and Wright PA. Causes of intraspecific variation in the hypoxia tolerance of wild mangrove rivulus, *Kryptolebias marmoratus*. Talk given as part of Rice Lake Comparative Physiology and Biochemistry Workshop, Keene, ON, January 29-31, 2016.
- Brunt E*, **Turko AJ**, Scott GR, and Wright PA. Amphibious fish jump better on land when acclimated to a terrestrial environment.” Talk given as part of Rice Lake Comparative Physiology and Biochemistry Workshop, Keene, ON, January 29-31, 2016.
- 2015 **Turko AJ**, Croll R, Fudge DS, Kültz D, Smith F, Stoyek M, and Wright PA. Aquatic-terrestrial transitions in amphibious fishes mimic astronauts returning to earth. Talk presented as part of the Canadian Society of Zoologists annual meeting, Calgary, AB, May 25-29, 2015.
- Turko AJ**, Currie S, Earley R, Taylor DS, and Wright PA. Trade-offs between metabolic rate, habitat, and contest performance in wild mangrove rivulus, *Kryptolebias marmoratus*. Talk and poster given as part of Rice Lake Comparative Physiology and Biochemistry Workshop, Keene, ON, January 30-February 1, 2015.
- Brunt E*, **Turko AJ**, and Wright PA. Piscine track and field- skeletal muscle remodeling in an amphibious fish. Poster given as part of Rice Lake Comparative Physiology and Biochemistry Workshop, Keene, ON, January 30-February 1, 2015.
- 2014 **Turko AJ**, Croll R, Fudge DS, Kültz D, Smith F, Stoyek M, and Wright PA Amphibious astronauts: Gill remodelling in response to altered body weight in the mangrove rivulus. Talk given as part of International Congress on the Biology of Fish, Edinburgh, UK, August 3-7, 2014.
- Robertson C, **Turko AJ**, Jonz M, and Wright PA. CO₂ accumulation during air exposure reduces mangrove rivulus hemoglobin-O₂ binding affinity via expression of embryonic-like hemoglobin isoforms. Talk presented as part of the Canadian Society of Zoologists annual meeting, Montreal, QC, May 25-29, 2014.
- Gibson D*, Sylvester E*, **Turko AJ**, Tattersall G, and Wright PA. Out of the frying pan into the air - emersion behaviour and evaporative heat loss in an amphibious mangrove fish (*Kryptolebias marmoratus*). Talk presented as part of the Canadian Society of Zoologists annual meeting, Montreal, QC, May 25-29, 2014.
- Turko AJ**, Croll R, Fudge DS, Kültz D, Smith F, Stoyek M, and Wright PA. Amphibious astronauts: tissue remodelling in response to altered body weight in the mangrove rivulus. Poster given as part of Rice Lake Comparative Physiology and Biochemistry Workshop, Keene, ON, January 31-February 2, 2014.
- Doherty J*, **Turko AJ**, and Wright PA. Physiological and behavioural traits influencing emersion tolerance in the mangrove rivulus. Talk given as part of Rice Lake Comparative Physiology and Biochemistry Workshop, Keene, ON, January 31-February 2, 2014.
- Platek A*, **Turko AJ**, and Wright PA. Effects of environmental calcium on gill remodeling in *Kryptolebias marmoratus*. Poster given as part of Rice Lake Comparative Physiology and Biochemistry Workshop, Keene, ON, January 31-February 2, 2014.

- 2013 **Turko AJ**, Robertson C, Bianchini K, Freeman M*, and Wright PA. The amphibious fish *Kryptolebias marmoratus* uses alternate strategies to maintain oxygen delivery during hypoxia and air exposure. Talk presented as part of the Canadian Society of Zoologists annual meeting, Guelph, ON, May 13-17, 2013.
- Hull M*, Robertson C, **Turko AJ**, and Wright PA. To leap or not to leap? Emergence behaviour in response to acute salinity change in the amphibious mangrove rivulus *Kryptolebias marmoratus*. Poster given as part of the Canadian Society of Zoologists annual meeting, Guelph, ON, May 13-17, 2013.
- Turko AJ**, Robertson C, Bianchini K, and Wright PA. The amphibious fish *Kryptolebias marmoratus* uses alternate strategies to maintain oxygen delivery during hypoxia and air exposure. Talk presented as part of the University of Guelph Graduate Student Symposium, Guelph, ON, April 25, 2013.
- Turko AJ**, Haddad O, Kultz D, and Wright PA. Changes in gill structure and blood flow during air exposure in the amphibious fish *Kryptolebias marmoratus*. Poster given as part of Rice Lake Comparative Physiology and Biochemistry Workshop, Keene, ON, February 1-3, 2013.
- Wells M, **Turko AJ**, and Wright PA. How to avoid eating your kids: mangrove rivulus can discriminate between kin and non-kin. Talk given as part of Rice Lake Comparative Physiology and Biochemistry Workshop, Keene, ON, February 1-3, 2013.
- Sutton A*, **Turko AJ**, and Wright PA. Behavioural changes with osmotic shock in a euryhaline mangrove fish. Talk given as part of Rice Lake Comparative Physiology and Biochemistry Workshop, Keene, ON, February 1-3, 2013.
- 2012 Wright PA, Kultz D, and **Turko AJ**. Reversible gill plasticity – A response to extreme environments. Talk presented as part of the International Congress on the Biology of Fish, Madison, WI, USA, July 15-19, 2012.
- Turko AJ**, and Wright PA. Structural changes to the gills of the amphibious mangrove rivulus during air exposure. Talk presented as part of the University of Guelph Graduate Student Symposium, Guelph, ON, April 30, 2012.
- Turko AJ**, Cooper CA, and Wright PA. Gill remodelling reduces the aquatic respiratory function of *Kryptolebias marmoratus*. Talk presented as part of the Society for Integrative and Comparative Biology annual meeting, Charleston, SC, USA, Jan 3-7, 2012.
- Wells M*, **Turko AJ**, and Wright PA. Terrestrial embryonic development in the mangrove rivulus. Poster presented as part of the Society for Integrative and Comparative Biology annual meeting, Charleston, SC, USA, Jan 3-7, 2012.
- 2011 **Turko AJ**, Cooper CA, and Wright PA. Does gill plasticity affect the respiratory function of mangrove rivulus? Talk presented as part of the Canadian Society of Zoologists annual meeting, Ottawa, ON, May 16-20, 2011.
- Turko AJ**, Cooper CA, and Wright PA. Ventilatory responses of the mangrove killifish to acute hypoxia. Talk presented as part of the University of Guelph Graduate Student Symposium, Guelph, ON, April 26, 2011.
- Turko AJ**, Cooper CA, and Wright PA. Ventilatory response of the mangrove rivulus to acute hypoxia. Talk given as part of Rice Lake Comparative Physiology and Biochemistry Workshop, Keene, ON, February 4-6, 2011.
- Wells M*, **Turko AJ**, and Wright PA. The impact of environmental extremes on early development in mangrove rivulus. Talk given as part of Rice Lake Comparative Physiology and Biochemistry Workshop, Keene, ON, February 4-6, 2011.
- Dickson L, Cooper C, **Turko AJ**, and Wright PA. Impact of gill remodeling on branchial vs cutaneous ammonia excretion. Poster given as part of Rice Lake Comparative Physiology and Biochemistry Workshop, Keene, ON, February 4-6, 2011.

- 2010 **Turko AJ**, and Wright PA. What causes mangrove killifish to emerge? Talk given as part of Rice Lake Comparative Physiology and Biochemistry Workshop, Keene, ON, February 5-7, 2010.
- 2008 **Turko AJ**, and Wright PA. Mangrove killifish exhibit distinct personalities and gill characteristics. Poster presented as part of the Ecological and Evolutionary Ethology of Fishes biennial conference, Boston, Mass., USA, June 29-July 3, 2008.
- Turko AJ**, and Wright PA. Mangrove killifish (*Kryptolebias marmoratus*) individuals exhibit distinct emersion patterns and associated morphological characters. Presentation given as part of Ontario Biology Day, Guelph, ON, March 29-30, 2008.

Science Communication and Public Outreach

- 2019-2020 Contributor to Outside JEB, a featured section of the Journal of Experimental Biology (JEB) where I write lay summaries of exciting primary research papers
- 2018-2019 Contributor to preLights, a platform where I write short highlights of the best preprints in biology. Supported by the Company of Biologists. Profile at <https://prelights.biologists.com/profiles/aturko/>.

Non-Academic Publications

- **Turko AJ**. (2020). A mucous house built for feeding. *Outside JEB*. Journal of Experimental Biology 223: jeb214544.
- **Turko AJ**. (2020). A radical cost to thermal flexibility. *Outside JEB*. Journal of Experimental Biology 223: jeb.214387.
- **Turko AJ**. (2020). Bright-eyed fish light up their predators. *Outside JEB*. Journal of Experimental Biology 223: jeb.214247.
- **Turko AJ**. (2020). Electric fish turn down the power. *Outside JEB*. Journal of Experimental Biology 223: jeb.211375.
- **Turko AJ**. (2019). Fungused frogs fail to fix fast fluid flux. *Outside JEB*. Journal of Experimental Biology 222: jeb193086.
- **Turko AJ**. (2019). Deep breathing in tired trout. *Outside JEB*. Journal of Experimental Biology 222: jeb192906.
- **Turko AJ**. (2019). Bigger brains in trickier habitats. *Outside JEB*. Journal of Experimental Biology 222: jeb192591.
- **Turko AJ**. (2013). Guppies reproduce from beyond the grave. *Outside JEB*. Journal of Experimental Biology 216: iv.
- **Turko AJ**. (2010). What's so special about the mangrove killifish? Practical Fishkeeping Magazine.

Public Outreach Seminars

- 2020 Conservation and captive breeding of endangered native fishes. Public lecture presented to the St. Catherines & Area Aquarium Society, a group of aquarium fish hobbyists. December 7, 2020.
- Redside dace: The most spectacular fish you've never heard of! Public lecture presented to the Kitchener and Waterloo Aquarium Society, a group of aquarium fish hobbyists. February 4, 2020.
- 2019 Doom, gloom, and a bit of hope: Conservation and captive breeding of endangered Canadian freshwater fishes. Keynote lecture to be given as part of the Canadian Association of Aquarium Clubs (CAOAC) annual meeting, Burlington, ON. May 18, 2019.
- 2018 From the tropics to Toronto: Understanding the adaptations of some extreme fishes and what we can do to conserve them in the wild. Public lecture presented to the Peel Region Aquarium Club, a group of aquarium fish hobbyists. November 21, 2018.
- 2017 So you want to start an aquarium? Aqualab experts Mike Davies and Andy Turko show you how. University of Guelph undergraduate mentoring seminar. Presented with M. Davies, February 3, 2017.

- 2016 Fish out of water: The amphibious killifishes. Public lecture presented to the Hamilton and District Aquarium Society, a group of aquarium fish hobbyists. February 2, 2016.
Ugly brown fish with superpowers. Public lecture presented to the Kitchener and Waterloo Aquarium Society, a group of aquarium fish hobbyists. February 2, 2016.
- 2015 The mangrove rivulus and other amphibious killifishes. Public lecture presented to the Peel Region Aquarium Club, a group of aquarium fish hobbyists. February 18, 2015.
A walk on the wild side: The biology of mangrove forests. Public lecture presented to Nature Guelph, a group of naturalists and citizen scientists. February 12, 2015.
- 2014 The amphibious mangrove rivulus. Keynote lecture presented at the Southern Ontario Killifish Society annual show and auction. June 22, 2014.

Service

- 2019-present Member of the Redside Dace Implementation Team, a mix of government and academic scientists who discuss approaches to implement the provincial recovery strategy of this endangered species.
- 2020-2021 Postdoc representative on the Equity, Diversity, and Inclusion committee of the Canadian Society of Zoologists
- 2020-2021 Canadian Society of Zoologists local organizing committee, McMaster - I organized a plenary symposium *Integrating organismal function with behaviour to understand how animals cope in a changing world*
- 2013-2018 Graduate student representative, Integrative Biology Departmental Council, University of Guelph
- 2014-2016 Integrative Biology Graduate Student Council, University of Guelph
- 2013 Canadian Society of Zoologists local organizing committee, University of Guelph

Journal Reviewer

Comparative Physiology and Biochemistry A
Comparative Physiology and Biochemistry D
Conservation Physiology
Environmental Biology of Fishes
Functional Ecology
Journal of Experimental Biology
Journal of Experimental Zoology A
Journal of Fish Biology
Journal of Great Lakes Research
Journal of Morphology
Marine Biology
Physiology and Behaviour
The Anatomical Record
Zoological Journal of the Linnean Society

Professional Memberships

American Association for the Advancement of Science
Canadian Society of Zoologists
Society for Experimental Biology