**Kimberly B. Fitzpatrick**

Ph.D. Candidate | Dept. Natural Resources and the Environment, Cornell University

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Education

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| **Ph.D. Candidate in Natural Resources, Cornell University**  Concentrations: Fishery and aquatic science, applied statistics, quantitative ecology  Dissertation Title: *Modeling Predator-Prey Dynamics to Support Fisheries Management*  Advisor: Dr. Suresh Sethi  Expected Graduation: December 2022 | 2017-Present |
| **M.S. in Geography, University of Oklahoma**  Thesis Title: *Return-on-investment frameworks can increase the efficiency of restoration efforts to improve freshwater connectivity*  Advisor: Dr. Thomas Neeson | 2015-2017 |
| **B.S. in Marine Science, Eckerd College**  Concentrations: Biology; Minor: Computer Science  Thesis Title: *Swimming behavior of marine cercariae: effects of gravity and*  *hydrostatic pressure*  Advisor: Dr. Nancy Smith | 2011-2015 |

Employment Record

Graduate Research Assistant Aug 2017 – Present

*New York Cooperative Fish and Wildlife Research Unit, Cornell University 15 hrs / week*

Projects:

* Development of a multispecies statistical catch-at-age model for two recreational fisheries in Lake Ontario and their shared primary prey species (Fitzpatrick et al. 2022)
* Piloting a parentage-based tagging mass marking program ‒ genetically matching hatchery-raised fish back to broodstock parents – for identifying hatchery-raised Chinook Salmon Lake Ontario and informing fisheries management.
* Holistic cost-benefit analysis of mass marking techniques for hatchery-raised Chinook Salmon in Lake Ontario.
* Return-on-investment of monitoring initiatives for improving the multispecies stock assessment model

Graduate Teaching Assistant Aug 2021 – Dec 2021

*Department of Natural Resources and the Environment, Cornell University 15 hrs / week*

NTRES 1101: Understanding Environment and Sustainability

* Prepared weekly lectures (13) for two hour-long discussion sections
* Facilitated scholarly discussions around ecological and social issues with environmental research, policies, and sustainability practices
* Graded weekly (13) written assignments for forty students and provided feedback to improve students’ academic writing skills
* Developed an R Shiny application on the impact of stochasticity on statistical and mathematical models and potential outcomes for fisheries management

Graduate Research Assistant Aug 2015 – May 2017

*Department of Geography and Environmental Sustainability, University of Oklahoma 20 hrs / week*

Projects:

* Aligning dam removals and road culvert upgrades boosts conservation return-on-investment (Fitzpatrick and Neeson 2018)
* Indicator species to guide conservation investments to restore connectivity in Great Lakes tributaries (Fitzpatrick et al. 2021, Neeson et al. 2018)

Ford Apprentice Scholar Summer Internship May 2014 – Aug 2014

*Eckerd College 40 hrs / week*

* Designed experiments on cerceriae behavioral response to geotactic and barokinetic stimuli
* Analysis of videographic data on the vertical movement of cercariae using MaxTRAQ and MaxMATE
* Assisted with daily field survey collections of crab zoea (morning and evening) in response seasonal environmental dynamics
* Field collection and surveys of gastropods in salt marsh habitats

National Science Foundation Research Experience for Undergraduates May 2012 – Aug 2012

*Radford University 40 hrs / week*

* Dissection of amphibian hosts (tadpole stage) including identification and quantification of parasitic infection loads
* Assisted in field work collections and surveys of gastropods and amphibians from freshwater habitats
* Prepared samples for scanning electron microscopy (SEM), clearing and staining, and histology

Marine Science Freshman Researcher Aug 2011 – May 2012

*Eckerd College 4 hrs / week*

* Genetic population analyses on meta-population structure
* Mitochondrial DNA extraction and amplification
* Field collections for three pipefish species and bonnethead sharks in coast marine ecosystems (sein net and gillnet, respectively)

Publications

**Fitzpatrick, K.B.,** Overgaard Therkildsen, N., Marcy-Quay, B., Borchardt-Wier, H.B., Sethi, S.A. Discriminating between natural and stocked recruitment in inland fisheries using parentage-based tagging. *In review at Fisheries Management and Ecology.*

**Fitzpatrick, K.B.**, Weidel, B.C., Connerton, M.J., Lantry, J.R., Holden, J.P., Yuille, M.J., Lantry, B., LaPan, S.R., Rudstam, L.G., Sullivan, P.J., Brenden, T.O., Sethi, S.A. 2022. Balancing prey availability and predator consumption: a multispecies stock assessment for Lake Ontario. Canadian Journal of Fisheries and Aquatic Sciences.

**Fitzpatrick, K.B.**, Moody, A.T., Milt, A., Herbert, M.E, Khoury, M., Yacobson, E., Ross, J.A., Doran, P.J., Ferris, M.C., McIntyre, P.B., Neeson, T.M. 2021. Can indicator species guide conservation investments to restore connectivity in Great Lakes tributaries? Biodiversity and Conservation. 30: 165-182. <https://doi.org/10.1007/s10531-020-02084-5>

Andres, K.J., Sethi, S.A., Dusky, E., Lepak, J.M., Rice, A.N., Estabrook, B.J., **Fitzpatrick, K.B.**, George, E., Marcy-Quay, B., Paufve, M.R., Perkins, K., Scofield, A.E. 2020. Seasonal habitat use indicates that depth may mediate the potential for invasive round goby impacts in inland lakes. Freshwater Biology. 65(8): 1337-1347. <https://doi.org/10.1111/fwb.13502>

Neeson, T.M., Doran, P.J., Ferris, M.C., **Fitzpatrick, K.B.**, Herbert, M., Khoury, M., Moody, A.T., Ross, J., Yacobson, E., McIntyre, P.B. 2018. Conserving rare species can have high opportunity costs for common species. Global Change Biology. 24(8): 3862-3872. <https://doi.org/10.1111/gcb.14162>

**Fitzpatrick, K.B.**, Neeson, T.M. 2018. Aligning dam removals and road culvert upgrades boosts conservation return-on-investment. Ecological Modelling. 368: 198-204. <https://doi.org/10.1016/j.ecolmodel.2017.11.018>

**Fitzpatrick, K.B.**, Smith, N.F., Cohen, J.H. 2016. Swimming behavior of marine cercariae: effects of gravity and hydrostatic pressure. Journal of Experimental Marine Biology and Ecology. 476: 8-14. <https://doi.org/10.1016/j.jembe.2015.12.002>

Presentations

**Fitzpatrick, K.B.,** Overgaard Therkildsen, N., Marcy-Quay, B., Borchardt-Wier, H.B., Sethi, S.A. 2022. Parentage-Based Tagging to Support the Conservation and Management of Inland Fish Populations. Joint Aquatic Sciences Meeting. May 19.

**Fitzpatrick, K.B.** 2022. Modeling Predator-Prey Dynamics to Support Fisheries Management. Cornell Unviersity Department of Natural Resources and the Environment Seminar Series. April 19. Recording: <https://vod.video.cornell.edu/media/Clip+of+DNRE+Seminar+Kimberly+Fitzpatrick%2A/1_tqh9pu2r>

**Fitzpatrick, K.B.,** Connerton, M.J., Yuille, M.J., Overgaard Therkildsen, N., Sethi, S.A. 2021. Minimizing cost and uncertainty: assessing marking techniques to distinguish stocked and wild fish. International Association of Great Lakes Research. May 17-21.

**Fitzpatrick, K.B.,** Weidel, B.C., Connerton, M.J., Lantry, J.R., Holden, J.P., Yuille, M.J., Lantry, B., LaPan, S.R., Rudstam, L.G., Sullivan, P.J., Brenden, T.O., Sethi, S.A. 2021. Predator-prey population dynamics modeling for Chinook salmon and alewife in Lake Ontario. New York Chapter of the American Fisheries Society Annual Meeting. Feb. 6.

**Fitzpatrick, K.B.,** Weidel, B.C., Connerton, M.J., Lantry, J.R., Holden, J.P., Yuille, M.J., Lantry, B., LaPan, S.R., Rudstam, L.G., Sullivan, P.J., Brenden, T.O., Sethi, S.A. 2020. Balancing Predator Consumption and Prey Availability in an Intensively Managed Fishery: A Multispecies Statistical Catch-at-Age Model for Lake Ontario. American Fisheries Society Annual Meeting. Sept. 14.

**Fitzpatrick, K.B.,** Weidel, B.C., Connerton, M.J., Lantry, J.R., Holden, J.P., Yuille, M.J., Lantry, B., LaPan, S.R., Rudstam, L.G., Sullivan, P.J., Brenden, T.O., Sethi, S.A. (invited). Predator-prey modeling for Lake Ontario. Lake Ontario Lake Committee Meeting. March 2020 (canceled due to pandemic).

**Fitzpatrick, K.B.,** Weidel, B.C., Connerton, M.J., Lantry, J.R., Holden, J.P., Yuille, M.J., Lantry, B., LaPan, S.R., Rudstam, L.G., Sullivan, P.J., Brenden, T.O., Sethi, S.A. 2020. Predator-prey population dynamics modeling for chinook salmon and alewife in Lake Ontario. New York Chapter of the American Fisheries Society Meeting. Feb. 6

**Fitzpatrick, K.B.,** Weidel, B.C., Connerton, M.J., Lantry, J.R., Holden, J.P., Yuille, M.J., Lantry, B., LaPan, S.R., Rudstam, L.G., Sullivan, P.J., Brenden, T.O., Sethi, S.A. 2019 (invited). Predator-prey population dynamics in LakeOntario. NYS Department of Environmental Conservation Great Lakes Fisheries Section Meeting. July 24.

**Fitzpatrick, K.B.,** Weidel, B.C., Connerton, M.J., Lantry, J.R., Holden, J.P., Yuille, M.J., LaPan, S.R., Rudstam, L.G., Sullivan, P.J., Brenden, T.O., Sethi, S.A. 2019. Predator-prey population dynamics modeling for Chinook Salmon and Alewife in Lake Ontario. International Association of Great Lakes Research. June 12.

**Fitzpatrick, K.B.,** Brenden, T.O., LaPan, S.R., Rudstam, L.G., Sullivan, P.J., Weidel, B.C., Sethi, S.A. 2019. Modeling Chinook salmon population dynamics in Lake Ontario. (poster) New York Chapter and Northeastern Division of the American Fisheries Society Meeting. Feb. 7.

**Fitzpatrick, K.B.** and Sethi, S.A. 2018. Predator‐prey population dynamics model for Lake Ontario salmon management. New York Chapter of the American Fisheries Society Meeting. (poster) Feb. 8.

**Fitzpatrick, K.B.** and Sethi, S.A. 2017. Predator-prey population dynamics model for Chinook Salmon management.Lake Ontario Technical Committee Meeting. Nov. 27-28.

**Fitzpatrick, K.B.**, Moody, A.T., Milt, A., Herbert, M.E, Khoury, M., Yacobson, E., Ross, J.A., Doran, P.J., Ferris, M.C., McIntyre, P.B., Neeson, T.M. 2017. Can indicator species guide conservation investments to restore connectivity in Great Lakes tributaries? Midwest Fish and Wildlife Conference. Feb. 5-8.

**Fitzpatrick, K.B.,** Smith, N., Cohen, J. 2015. Swimming behavior of marine cercariae: Effects of gravity and hydrostatic pressure. The Ecological Society of America. Aug. 12.

**Fitzpatrick, K.B.,** Smith, N., Cohen, J. 2014. Facilitating Host Contact: Can Marine Cercariae Use Gravity To Find Their Next Host? SigmaXi Annual Meeting (poster) Nov. 7-9.

Michael, C., Bennett, J., Carter, J., **Fitzpatrick, K.B.,** Flight, C., O’Brien, C., Petrilla, C., Ramirez, H., Mack, K., Szelistowski. W.A. 2012. Genetic Structure of Chain Pipefish *Syngnathus louisianae* and Dusky Pipefish *Syngnathus floridae* populations in Florida. Florida Chapter of the American Fisheries Society Annual Meeting. (poster) Feb. 21-23.

Computer Software Skills

Mathematical and statistical model development, data analyses, and programing: R, AD Model Builder (ADMB), Java, Python.

Spatial analyses and GIS: ArcGIS

Parentage Analysis: Cervus, Colony, CKMRsim (R package)

Microsoft Office: Microsoft Excel, Microsoft Word, Microsoft Powerpoint

Coursework using: QGIS, GRASS, Git and Github, SQL, WinBUGS, Program Mark, website development languages (html, css, php, MySQL, JavaScript)

Teaching Experience

Teaching Assistant: Cornell University, Understanding Environment and Sustainability – Fall 2021

Teaching Assistant: Eckerd College, Marine Invertebrate Biology – Fall 2014

Research Grants

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| Parentage based tagging for Lake Ontario salmon management, $70,000, PIs: S.A. Sethi (Cornell) and N. Overgaard Therkildsen (Cornell). CI: K.B. Fizpatrick. NY Department of Environmental Conservation grant. | 2022 |
| Monitoring against runaway wild production: Genetics provides a cost efficient and reliable tool for identifying hatchery versus wild Chinook Salmon in the Great Lakes, $15,000, Co-PIs: S.A. Sethi (Cornell) and N. Overgaard Therkildsen (Cornell), AI: K.B. Fitzpatrick (Cornell). NY Sea Grant grant. | 2019-2020 |

Awards and Honors

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| Charles Standley Memorial Award for Outstanding Publication by a Graduate Student, Dept. of Geography and Environmental Sustainability, University of Oklahoma. | 2018 |
| Phi Beta Kappa National Honor’s Society, Eckerd College | 2015 |
| Sigma Xi Honor’s Society, Associate Member, Eckerd College | 2015 |
| Eckerd College Ford Apprentice Scholar Program | 2013-2015 |
| Women Diver’s Hall of Fame Undergraduate Scholarship in Marine Conservation | 2014 |
| Florida Zeta Chapter of Phi Beta Kappa Peter Pav Freshmen Scholar Award | 2012 |

Service

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| Lake Ontario Technical Committee Member, Predator-Prey Working Group | 2018-Present |
| Cornell University DNRE DEI Advisory Council Charter Working Group Member | 2020 |
| Cornell University DNR Graduate Student Assembly, President | 2019-2020 |
| Cornell University DNR Graduate Student Assembly, Treasurer | 2018-2019 |
| Kieckhefer/Mellon Funds Evaluation Committee | 2019 |
| Cornell University American Fisheries Society Panel on Graduate School Advice | 2019 |
| University of Oklahoma Association of Geography Graduate Students, VP | 2016-2017 |
| Eckerd College Natural Science Collegium Student Representative | 2013-2015 |
| Eckerd College Academic Honor Council Member | 2012-2015 |
| Eckerd College Search and Rescue (participated in 200+ emergency responses) | 2011-2015 |

*Society Memberships*

American Fisheries Soceity, New York Chapter of the American Fisheries Society, Society for Freshwater Science, SigmaXi, Phi Beta Kappa

Professional References

Dr. Suresh A. Sethi (PhD Advisor)

Associate Professor and Assistant Unit Leader

New York Cooperative Fish and Wildlife Research Unit

Cornell University - Deperatment of Natural Resources and the Environment

Email: [suresh.sethi@cornell.edu](mailto:suresh.sethi@cornell.edu)

Phone: (607) 255-7273

Dr. Patrick J. Sullivan

Emeritus Professor

Cornell University - Deperatment of Natural Resources and the Environment

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Phone: (607) 379-1311

Dr. Lars G. Rudstam

Professor and Director for the Cornell Biological Field Station

Cornell University - Deperatment of Natural Resources and the Environment

Email: [lgr1@cornell.edu](mailto:lgr1@cornell.edu)

Phone: (607) 255-1555

Dr. Brian C. Weidel

Research Fishery Biologist

Lake Ontario Biological Station

United States Geological Survey Great Lake Science Center

Email: [bweidel@usgs.gov](mailto:bweidel@usgs.gov)

Phone: (315) 343-3951

Research Statement

Kimberly B. Fitzpatrick

I develop quantitative tools that combine multiple types of models and data sources to understand drivers of population dynamics and support fisheries management. I believe that my statistical and mathematical skillset combined with my background in ecology and fisheries science could support the objectives of the Resource, Ecology, and Fisheries Management division of the Alaska Fisheries Science Center to improve stock assessments and support ecosystem-based management in the North Pacific and adjacent seas. My current research involves three intersecting themes: (1) incorporating ecological dynamics into fisheries models, (2) risk-assessment and projections of future fishery sustainability, (3) resource-efficient management and monitoring. My quantitative skills and interests are centered on population dynamics models, including catch-at-age models; however, I use a variety of techniques and analyses (e.g. individual-based models, bioenergetics, genetics) to best represent underlying ecological processes and management actions.

*Incorporating ecological dynamics into fisheries models*

There is growing awareness that incorporating ecosystem interactions directly into fisheries assessment models may improve estimates of species dynamics and predictions of future sustainability by incorporating the impact of ecological interactions on fishery productivity and sustainability. The success of these models across a variety of ecosystems, including for North Pacific and Bering Sea fisheries (Hollowed et al. 2000, Jurado-Molina et al. 2005), has demonstrated that multispecies models show great promise in supporting fisheries management in ecosystems that are dominated by strong ecological interactions. In the Laurentian Great Lakes, culturally and economically important recreational salmonine fisheries are known to be dependent on the continued availability of their primary prey item. Fisheries managers have sought to balance predation pressure from stocked and naturally reproduced salmonine populations with fluctuating prey availability by adjusting the number of fish stocked in response to shifts in prey biomass. As single species models fail to capture the trophic interactions that underlie management decision making for these fisheries, my research has focused on the development of multispecies tools that capture the trophic interactions that underlie fishery sustainability and management decision-making in the Laurentian Great Lakes.

In collaboration with regional managers and biologists, I developed a novel multispecies statistical catch-at-age model for two recreational fisheries (Chinook Salmon and Lake Trout) and their shared primary prey item (Alewife) in Lake Ontario (Fitzpatrick et al. 2022). The model includes three population dynamics models linked together by predation and bioenergetics sub-models. Thus, the model is able to jointly estimate the dynamics of all three species and the amount of predation pressure on the prey population. As a member of the Lake Ontario Technical Committee, I have annually updated the stock assessment model and presented the results to the Lake Ontario Committee (the regional section of the [Great Lakes Fishery Committee](http://www.glfc.org/lake-ontario-committee.php)) to help inform ongoing predator-prey management in Lake Ontario.

*Risk-assessment and projections of future fishery sustainability*

Fisheries with tight linkages to other species through predator-prey or other trophic dynamics, multispecies analyses can provide critical insight into how management decisions and species interactions can influence future fishery sustainability. I am collaborating with Lake Ontario manages and biologists to use the multispecies model to develop short-term forecasts of predator-prey dynamics in response to varying ecological dynamics and management actions (predator stocking). I develop the statistical simulations to examine if changes in hatchery augmentation of the Chinook Salmon population could offset the impact of increased natural Chinook Salmon recruitment on the available prey fish biomass (Fitzpatrick et al. 2022). I found that changes in stocking practices alone would be unable to substantially reduce prey mortality to reduce the probability of declines in prey fish biomass. Additionally, after recent variability in prey recruitment regimes, I added in simulations to examine how the temporal variability in strong prey recruitment years could substantially lower the sustainability of the salmon and trout fisheries. These forecasts serve dual purposes of supporting current stocking decisions and highlighting data needs to informing future management decision making. I found that greater understanding of drivers Alewife and Chinook Salmon recruitment, including potential predation interactions between age-0 alewife and age-0 salmon, could improve our predictions of future predator-prey dynamics.

*Resource-efficient management and monitoring programs*

Limited financial and personnel resources are a reality for management and conservation interests, thus investment into one program often comes at the cost of other potential management and monitoring efforts. Optimizing the resource-efficiency of management and monitoring programs by incorporating relevant ecological data has been a central theme throughout my graduate research.

Currently, I evaluate cost-efficient new data streams that could increase the accuracy of the multispecies stock assessment model and provide additional support for management decision making with agency and Cornell University collaborators. I am evaluating the relative costs, benefits, and tradeoffs associated with the six mass marking techniques that have been implemented for Lake Ontario Chinook Salmon in the past twenty years, including parentage-based tagging. I led the pilot analysis of parentage-based tagging – genetically matching hatchery-raised offspring to their broodstock parents – in Lake Ontario and found that parentage-based tagging could be both a highly accurate and resource-efficient monitoring program for Chinook Salmon (Fitzpatrick et al. *in review*). Understanding the relative abundance of hatchery-raised and naturally reproduced Chinook Salmon in Lake Ontario has been highlighted as a key data need by managers and regional scientists and this review will be a holistic evaluation of the resource-efficiency of these different mass marking techniques.

Additional, while at the University of Oklahoma, my research evaluated the use of return-on-investment frameworks to guide freshwater connectivity restoration efforts. I created individual-based model to demonstrate how spatial optimization could maximize conservation outcomes for both stream-resident and migratory fisheries (Fitzpatrick and Neeson, 2018) and, in collaboration with researchers from The Nature Conservancy and the University of Wisconsin-Madison, evaluated how indicator species could help guide restoration efforts in Great Lakes tributaries (Fitzpatrick et al. 2021, Neeson et al. 2018).

*Future Directions*

I am excited about the possibilities of continuing my research on integrating ecological dynamics into population dynamics models and stock assessments with the purpose of supporting fisheries management. Similar to the objectives of the Resource Ecology and Fisheries Management Division, I will continue to use innovative and cutting-edge techniques to find resource-efficient solutions to management data needs and improve our understanding of current and future fisheries dynamics.

References:

**Fitzpatrick, K.B.,** Overgaard Therkildsen, N., Marcy-Quay, B., Borchardt-Wier, H.B., Sethi, S.A. Discriminating between natural and stocked recruitment in inland fisheries using parentage-based tagging. *In review at Fisheries Management and Ecology.*

**Fitzpatrick, K.B.**, Weidel, B.C., Connerton, M.J., Lantry, J.R., Holden, J.P., Yuille, M.J., Lantry, B., LaPan, S.R., Rudstam, L.G., Sullivan, P.J., Brenden, T.O., Sethi, S.A. 2022. Balancing prey availability and predator consumption: a multispecies stock assessment for Lake Ontario. Canadian Journal of Fisheries and Aquatic Sciences.

**Fitzpatrick, K.B.**, Moody, A.T., Milt, A., Herbert, M.E, Khoury, M., Yacobson, E., Ross, J.A., Doran, P.J., Ferris, M.C., McIntyre, P.B., Neeson, T.M. 2021. Can indicator species guide conservation investments to restore connectivity in Great Lakes tributaries? Biodiversity and Conservation. 30: 165-182. <https://doi.org/10.1007/s10531-020-02084-5>

**Fitzpatrick, K.B.**, Neeson, T.M. 2018. Aligning dam removals and road culvert upgrades boosts conservation return-on-investment. Ecological Modelling. 368: 198-204. <https://doi.org/10.1016/j.ecolmodel.2017.11.018>

Hollowed, A. B., Ianelli, J., and Livingston, P. 2000. Including predation mortality in stock assessments: a case study for Gulf of Alaska walleye pollock. ICES Journal of Marine Science. 57 (2): 279-293.

Jurado-Molina, J. Livingston, P.A., Ianelli, J. 2005. Incorporating predation interactions in a statistical catch-at-age model for a predator–prey system in the eastern Bering Sea. Canadian Journal of Fisheries and Aquatic Sciences. 62: 1865-1873.

Neeson, T.M., Doran, P.J., Ferris, M.C., **Fitzpatrick, K.B.**, Herbert, M., Khoury, M., Moody, A.T., Ross, J., Yacobson, E., McIntyre, P.B. 2018. Conserving rare species can have high opportunity costs for common species. Global Change Biology. 24(8): 3862-3872. <https://doi.org/10.1111/gcb.14162>