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Counsel for Plaintiffs

THE UNITED STATES DISTRICT COURT
FOR THE NORTHERN DISTRICT OF CALIFORNIA

INSTITUTE FOR FISHERIES RESOURCES,
et al.,

Plaintiffs,

v.

STEPHEN HAHN, *et al.*,

Defendants,

and

AQUABOUNTY TECHNOLOGIES, INC.

Intervenor-Defendant.

Case No. 3:16-cv-01574-VC

DECLARATION OF ANNE
KAPUSCINSKI, Ph.D.

Date: August 6, 2020

Time: 10:00 a.m.

Location: Courtroom 4

Judge: Hon. Vince Chhabria

DECLARATION OF ANNE KAPUSCINSKI

I, Anne Kapuscinski, state and declare as follows:

1. I am a fisheries biologist and aquaculture scientist by training and experience. I received my Master of Science in Fisheries, with a minor in Water Resources in 1980 and my Ph.D. in Fisheries in 1984 from Oregon State University; and my research for both degrees addressed salmon aquaculture. Since 2018, I have been a Professor of Environmental Studies and the inaugural Director of the Coastal Science and Policy Program at the University of California, Santa Cruz. Prior to my position at the University of California, I was the Sherman Fairchild Distinguished Professor of Sustainability Science at Dartmouth College for nine years, serving as the Chair of the Environmental Studies Program for five of those years. Prior to Dartmouth College, I was an assistant, associate, and full professor in the Fisheries, Wildlife and Conservation Biology Department, and a Sea Grant Extension Specialist at the University of Minnesota. I have served as a scientific advisor to the U.S. Secretary of Agriculture (under three administrations), U.S. Food and Drug Administration, World Health Organization, and Food and Agriculture Organization of the UN, Global Environment Facility, European Union Food Safety Agency, state of Minnesota, and on four U.S. National Academy of Science committees (with two committees addressing environmental risks of genetically engineered organisms). In 1997, I received an Honor Award from the U.S. Secretary of Agriculture, the USDA highest individual award, in the environment category for promoting sound public policies on biotechnology and fish conservation. I am presently the Chair of the Board of Directors of the Union of Concerned Scientists and member of the California Ocean Protection Council Science Advisory Team.

2. I have co-authored or sole-authored 92 peer-reviewed scientific publications, including as an author, contributor, or editor to 11 peer-reviewed books and monographs, and 27 non-peer-reviewed technical reports on this topic and closely related topics on genetics and

conservation of aquatic biodiversity. Attached to this Declaration, as **Exhibit A**, is a copy of my curriculum vitae.

3. My most recent research has focused on combining microalgae to substitute for fishmeal and fish oil in sustainable feed for aquaculture operations. As most relevant here, I have spent more than two decades studying, developing, and publishing research on science-driven, environmental risk assessment and management methodologies for transgenic fish, and in conducting risk assessment experiments on transgenic fish.

4. Because I am a leading expert in this area, some of my work on this topic is cited in the packet prepared for FDA's Veterinary Medicine Advisory Committee (VMAC) and its consideration of AquaBounty's new animal drug application to produce and market genetically engineered salmon (GE salmon) as food. Some of my work is also cited in the draft and final versions of FDA's Environmental Assessment for the GE salmon.

5. I am also very familiar with FDA's review and approval of the new animal drug application for GE salmon. I followed it closely and participated as much as possible at several points in this review process. I, along with a colleague, Dr. Frederick Sundström, provided written testimony, citing much peer-reviewed scientific literature, to the VMAC committee on September 16, 2010. I also asked to testify orally at the VMAC meeting on September 20, 2010, and provided such testimony. In addition, Dr. Sundström and I provided extensive written comments, again citing many peer-reviewed scientific studies, on FDA's Draft Environmental Assessment on April 19, 2013. I understand that each of these documents is included in the administrative record for FDA's decision provided to the court in this litigation.

6. In preparing this statement, I have reviewed portions of Plaintiffs' Motion for Summary Judgment (dated February 3, 2020), Federal Defendants' Opposition to Plaintiffs' Motion for Summary Judgment and Cross-Motion for Summary Judgment (dated March 6, 2020), and several documents provided to me from the administrative record in *Institute for*

Fisheries Resources, et al. v. Azar, 3:16-cv-01574-VC (N.D. Cal). I have also reviewed my previous testimony and comments from 2010 and 2013 as well as relevant portions of the 2010 VMAC briefing package, and FDA's Final Environmental Assessment for AquAdvantage Salmon and Finding of No Significant Impact (November 12, 2015) and Draft Environmental Assessment for AquAdvantage Salmon and Preliminary Finding of No Significant Impact (May 4, 2012).

7. In both my written and oral submissions throughout FDA's review and evaluation of the GE salmon new animal drug, I highlighted numerous critical factors that FDA needed to evaluate in order to responsibly understand and address the risks that GE salmon posed to the environment, in accordance with my extensive past work in the area. From my review of the parties' filings, I understand that several of these factors are pertinent to this case. These include my comments stressing the need for FDA to complete a comprehensive analysis of both the exposure and the consequences of GE salmon escape (which FDA calls "hazard"), the need for FDA to conduct a failure mode analysis of the containment measures proposed for AquaBounty's broodstock and egg production facility on Prince Edward Island, and the need for FDA to use the most recent and best available environmental risk assessment methodology for GE animals.

8. I have reviewed FDA's statements in its Opposition to Plaintiffs' Motion for Summary Judgment and Cross-Motion for Summary Judgment concerning my 2013 and 2010 comments, which explained in detail what FDA needed to revise in order for the agency's assessment to be scientifically sound and in accord with basic principles of environmental risk assessment for transgenic fish. In each instance, FDA asserts that it addressed the comments or undertook my recommendations for a more complete analysis. In my opinion, FDA's representations that these comments were incorporated is incorrect.

9. For example, on page 27, FDA states that it considered my 2013 comments and Kapuscinski et. al (2007), a peer-reviewed book, regarding risk assessment for transgenic fish. It does not appear that either of these cited pages [cited as FDA-014186 and FDA-022142] address

the comments or the risk assessment elements outlined in Kapuscinski et al. (2007). Both cite to one sentence in that book for the statement that highly domesticated fish may be ill-equipped to mate in the wild but cite this sentence out of context; that is, the book section containing that sentence presents guidance on how to assess whether domesticated fish would mate in the wild and does not make an *a priori* conclusion about this question. Accordingly, my original comments about the need for significant changes to FDA's analysis still stand.

10. On pages 12-13 FDA states that it addressed my previous comments by looking at the consequences if containment measures failed and GE salmon were released into the environment.

11. I have reviewed the cited pages of the Final EA [cited as FDA-022348-51] and they are nearly identical (with minor wording changes that do not change the substance) to the discussion in the draft EA, which Dr. Sundström and I highlighted was “full of scientific inadequacies, omissions, and scientific uncertainties . . . [and which] inappropriately focuses on outdated risk assessment ideas (particularly Kapuscinski and Hallerman 1990, 1991) where it should use updated, state-of-the-art environmental risk assessment methods for genetically modified fish” including numerous methods described in my scientifically peer-reviewed book (Kapuscinski et al. 2007) on environmental risk assessment for transgenic fish. (April 19, 2013 comments on Draft EA, p.2 of 18). It does not appear that FDA altered that discussion, or otherwise addressed those comments on the cited pages. Accordingly my original comments concerning the vital necessity for an analysis that relies on the best available science and methodologies for assessing environmental risk still stand.

12. To state it differently, to provide a complete environmental risk assessment, the Final EA would have had to revise its risk assessment structure to analyze not just risk of escape, but also analyze the possible consequences (which FDA calls “hazard”) if the GE salmon did enter

the wild population and ecosystem. That would have been a fundamental change in the framework FDA undertook. The agency did not make any such fundamental change.

13. Elsewhere, on page 14, FDA states that in response to my comments, it used newer research, including the methods in Kapuscinski et al. (2007) and claims that its risk assessment methods mirror the formal uncertainty analysis recommended in my comments. In those comments on the draft EA, Dr. Sundström and I noted “the 2012 draft EA completely lacks a scientific uncertainty analysis to identify and treat each source of uncertainty.” (April 19, 2013 comments on Draft EA, p.9 of 18).

14. I have reviewed the cited page of the Final EA [cited as FDA-022346] and it is nearly identical (with minor wording changes that do not change the substance) to the discussion in the draft EA. It does not appear that FDA conducted the formal uncertainty analysis or changed or otherwise responded to that comment on the cited page. My original comments concerning the need for uncertainty analysis still stand.

15. Finally, on page 13, FDA states that it did not perform or rely on a failure mode analysis to assess the reliability of the containment measures because the sponsor elected not to and to instead rely on the incorporation of redundancies in the containment.

16. In previous comments to the VMAC and on the draft EA, Dr. Sundström and I stressed that a failure mode analysis of the “multiple confinement measures for AAS is needed to substantiate their reliability.” As stated in our comments, a failure mode analysis should be as quantitative as possible and, at a minimum, present a fault-tree analysis; and should consider how unfolding climate change might alter the frequency and severity of storm events might challenge multiple confinement measures. It is especially important to conduct a reliable failure mode analysis because this first EA for AAS sets the precedent, at least sets the floor, for future approvals of commercial production of GE fish which, as stated on page 1 of my 2013 comments, “may involve larger-scale or less confined commercial production, or involve fish expressing more

ecologically disruptive engineered traits.” (April 19, 2013 comments on Draft EA, p.1 of 18).

FDA’s assertion is not a response to this major oversight and those original comments still stand.

Pursuant to 28 U.S.C. § 1746, I declare under penalty of perjury that the foregoing is true and correct to the best of my knowledge.

Executed this 30th day of April, 2020 in Santa Cruz, California

Anne R. Kapuscinski

Anne R. Kapuscinski

EXHIBIT A

KAPUSCINSKI, ANNE R. D. – CURRICULUM VITAE

UC Santa Cruz | Coastal Science Campus | 115 McAllister Way | Santa Cruz, CA 95060
Email: akapusci@ucsc.edu Webpage: <https://csp.ucsc.edu/staff/> Lab: <https://kapsar.sites.ucsc.edu/>

Education

Oregon State University, Ph.D., 1984, Fisheries (genetics)
Oregon State University, M.S., 1980, Fisheries (aquaculture), Water Resources (minor)
Swarthmore College, B.A., 1976, Biology (Semester at Pomona College)

Positions

University of California, Santa Cruz

Director of Coastal Science and Policy Program, July 2018 –
Professor of Environmental Studies, Environmental Studies Dept., July 2018 –

Dartmouth College

Sherman Fairchild Distinguished Professor of Sustainability Science, Environmental Studies Program, since 2009
Chair of Environmental Studies Program, July 2011 – June 2014

University of Minnesota – Departmental and Graduate Faculty Appointments

Professor (Fisheries, Conservation Biology) 1994-2009
Associate Professor 1989-1994, Assistant Professor 1984-1989
Sea Grant Extension Specialist (Aquaculture and Biotechnology) 1984-2009
Graduate Faculty Member: Fisheries; Conservation Biology
Affiliate Graduate Faculty Member: Science, Technology and Environmental Policy; Public Policy; Public Affairs; Urban and Regional Planning

University of Minnesota – Interdisciplinary and University-wide Programs

Founding Fellow, Institute on the Environment, 2007-2009
Chair, Sustainability Studies Minor Curriculum Committee, 2005-2009
Co-Leader, Ecosystem Science and Sustainability Initiative, 2004-2009
Director, Institute for Social, Economic, and Ecological Sustainability (ISEES), 1996-2009
Associate Director, MacArthur Interdisciplinary Program on Global Change, Sustainability, and Justice, 1995-2004

University of California, Berkeley

Visiting Scholar (Sabbatical Leave) at Energy and Resources Group, 1998-1999
Ph.D. committees of three students in Energy & Resources and one in Geography, 1998-2002

Oregon State University

Fish Genetics Research Assistant / Aquaculture Instructor, 1981-1984
Project leader, experimental chum salmon hatchery and Aquaculture Instructor 1980-1983
Aquaculture Instructor/Project Leader, 1980-1981
Salmon Culture Research Assistant, 1977-1980

Weyerhaeuser Company - Aquaculture Research Technician, 1976-1977

Honors

Ocean Award 2019, Innovation Category, Boat International & Blue Marine Foundation - 2019
Rachel Carson Environmental Award, Natural Products Association –national award to an individual who has made outstanding contributions to protection of the environment, 2014
Distinguished Service Award, Society for Conservation Biology – global award for extraordinary contributions to biotechnology policy and conservation genetics, conservation of aquatic biodiversity, and interdisciplinary analysis of sustainability issues, 2008
Star Faculty Award, College of Food, Agriculture and Natural Resource Sciences, University of Minnesota, 2007
Distinguished Graduate, Oregon State University Dept. of Fisheries & Wildlife, 2003
Pew Fellow in Marine Conservation - world's pre-eminent marine conservation award, 2001
Honor Award from U.S. Secretary of Agriculture - USDA highest individual award, environment category, for promoting sound public policies on biotechnology and fish conservation, 1997
Finalist, Transactions of the American Fisheries Society Best Paper Award, 1995
Walter Jones Memorial Fisheries Development Award, Oregon State University, 1984
Sea Grant Association National Student Award - for published article based on M.S. thesis, 1983

Awards for Scientific Presentations

Sea Grant Award for Fisheries Science, to advisee, MN Chapter, American Fisheries Society, 2007
Best Student Paper Award to my advisee, MN Chapter, American Fisheries Society, 2006
Best Paper Award, MN Chapter, American Fisheries Society, 1996
Best Student Paper Award to my advisee, American Fisheries Society, 1996
Best Poster Award, International Association for the Study of Common Property, 1995
Best Paper Award, North Central Division of the American Fisheries Society, 1992

Teaching

Interdisciplinary Curriculum Development – Dartmouth College

Ecology, Evolution, Ecosystems and Society (EEES) Graduate Program – on faculty team that developed the proposal and curriculum, including a sustainability track. Began fall 2016.
Undergraduate Sustainability Track –led collaborative development of new sustainability minor (2009-2010); main student advisor and chair of sustainability curriculum working group, since fall 2010.
Environment and Society: Towards Sustainability? – fully revised a prior course (Environment and Society, ENVS 3) to focus on sustainability challenges; taught by natural scientist (Kapuscinski) and social scientist (Sneddon) 2010-2013; taught by Kapuscinski since 2014.
Getting to a Low Carbon Society – developed new first-year seminar in 2014.

Interdisciplinary Curriculum Development –University of Minnesota

Sustainability Studies Minor www.sustainability.umn.edu (undergraduate, campus-wide), led development and approval process for new curriculum, established fall 2006
Sustainable People, Sustainable Planet, core course for Sustainability Studies Minor, input and review of syllabus, 2005-2006
Sustainable Communities, core course for Sustainability Studies Minor, led syllabus development 2006-2007 and lead co-instructor in 2008 and 2009

Risk Analysis of Introduced Species and Genotypes Minor (graduate) <http://ISG-IGERT.umn.edu>, review of entire curriculum, co-developed syllabus for team-taught course, led proposal for problem-solving course, since 2006

Regular Courses since 2008

Hacking for Oceans – lean design methods (graduate & undergraduate), UCSC, since 2020
Adaptation and Planning (graduate), Coastal Science and Policy program, UCSC, since 2019
Capstone Planning Seminar (graduate) Coastal Science and Policy program, UCSC, since 2019
Getting to a Low Carbon Society (undergraduate), Dartmouth College, since 2015
Environment and Society: Towards Sustainability? (undergraduate), Dartmouth College, since 2010
Sustainable Communities (undergraduate) – systems thinking approach to a complex sustainability problem, using UMN Twin Cities campus as the focal community
Sustainable Aquaculture (graduate/senior) – integrated framework to address production technology, socio-economic, environmental, and policy aspects of aquaculture
Ecological Risk Analysis of Introduced Species and Genotypes (graduate) – led cooperative learning teaching team for module on critique of prevailing ecological risk analysis using real cases.

Examples of Occasional Courses

Sustainable Development, Global Justice, and the Environment; Colloquium on Social, Economic, and Ecological Sustainability; Population Growth, Consumption Patterns, and Sustainability; Creature Features: Wildlife and Film (a freshman seminar); Dam the Dams: Social and Ecological Consequences of Large-Scale Dam Projects; Environmental Education for Teachers: Biotechnology Issues; Genetics in Fisheries and Aquaculture; Graduate Seminar on Social and Environmental Effects of Biotechnology (UC Berkeley); Problem Solving in Fisheries and Wildlife.

Guest lectures in Courses

UCSC: History of Aquaculture, Aquaculture and Coastal Governance, Integrated Aquaculture-Agriculture

Dartmouth: Environmental Science, Science for Sustainable Systems, Ecological Agriculture, Fundamentals of Ecology, Marine Policy; *Dartmouth Tuck School of Business*: Sustainable Business.

University of Minnesota: International Natural Resources and Sustainable Development; Population, Environment and Sustainability; Approaches to Knowledge and Truth: Ways of Knowing; Conservation Biology; Ethics and Values in Natural Resources; Social Uses of Biology; Introduction to Fisheries, Wildlife and Conservation Biology.

Former Regular Courses

Biosafety Science and Policy (graduate/senior) – environmental and food safety assessment and management of genetically modified organisms, national and international policy arenas

Conservation Biology (graduate) – principles from natural and social sciences and policy, local to international case studies

Aquaculture (graduate/senior) – chemical, biological, engineering, financial, and regulatory principles and practices

Scientific and Professional Memberships

American Association for the Advancement of Science:

Nominating committee, Section on Agriculture, Food & Renewable Resources, member, 2000-2004; chair 2003-2004

American Fisheries Society (AFS): Distinguished Service Award Committee, 1999-2000; Task Force on Human Use of Fish and Other Aquatic Animals, 1996-1997; Co-chair, AFS North Central Technical Committee on Fish Genetics, 1989-1991; Coordinator and co-author, AFS position statement on transgenic fish, 1989-1990; Nominating Committee, Genetics Section, 1987; and Chair 1988-1990; Advisor to Long Range Planning Committee, 1987

Society for Conservation Biology:

Distinguished Service Awards Committee, 2008-2010; Scientific Committee, since 2008

Ecological Society of America; World Aquaculture Society; Science Network of UCS

Appointments – Inter-governmental and International

Term Appointments

- North America Member, UN Food and Agriculture Organization (FAO), Committee on Fisheries, Advisory Group on Aquatic Genetic Resources and Technologies. 2015-2019
- Chair, Scientific Advisory Committee, WorldFish Center of the Consultative Group on International Agriculture Research (CGIAR) 2007-2011
- Board of Trustees, WorldFish Center, 2004-2007
- Global Environmental Facility (GEF), Scientific and Technical Advisory Panel, 2002-2006
- Consultative Group on International Agriculture Research (CGIAR), Study Panel on Safe Use of Gene Technology and Its Product, 2003-2004
- UNEP/GEF Project on National Biosafety Frameworks, Steering Committee, 2002-2006
- Great Lakes Fishery Commission, Board of Technical Experts, 1994–1999

One-time Appointments

- UN Framework Convention on Climate Change, member of observer-status delegation of the Union of Concerned Scientists to COP21, Paris, France. 2015.
- UN, Food and Agriculture Organization (FAO), partner in High Impact Opportunity Initiative, Assessment of Sustainability of Integrated Food Energy Systems. Since 2013
- European Union, European Food Safety Agency, Working Group on Genetically Modified Fish, April 2010-May 2013.
- European Union, European Food Safety Agency, workshop to review draft report on risk assessment of genetically modified fish. 2010
- UN, Food and Agriculture Organization (FAO) and World Health Organization (WHO), Chair of Expert Consultation on Safety Assessment of Foods Derived from Recombinant-DNA Animals, 2007
- UN, FAO, Fisheries Division & Commission on Genetic Resources for Food and Agriculture, Consultation on Status and Trends in Aquatic Genetic Resources: a Basis for International Policy, 2006
- Cartagena Protocol on Biosafety, Secretariat of the Convention on Biological Diversity, Ad-Hoc Technical Expert Group on Risk Assessment, 2005
- Government of Canada, Experts Meeting on Assessment of Environmental and Indirect Human Health Effects of Genetically Modified Aquatic Organisms, 2004

- UN FAO and WHO, *Rapporteur* of Expert Consultation on Safety Assessment of Genetically Modified Animals including Fish, 2003
- UN, FAO & WorldFish Center, Expert Consultations on environmental biosafety of aquatic biotechnology and sustainable use of aquatic genetic resources, 2003, 2002, 1998
- USDA Delegation to People's Republic of China, Aquacultural and Marine Biotechnology in China, 1995
- U.S. Delegation to Organization for Economic Cooperation and Development, Workshop on Aquatic Biotechnology, 1993
- UN, FAO, Expert Consultation on Utilization and Conservation of Genetic Resources of Aquatic Organisms, 1992

Appointments – Federal and State Government

- California Ocean Protection Council, Science Advisory Team, since 2019
- National Academies of Science, Engineering and Medicine, *Chair* of Committee on Strengthening Sustainability in Higher Education, since 2018
- National Research Council, *Chair* of Committee on Research on Impacts of Genetically Engineered Organisms on Terrestrial and Aquatic Wildlife and Habitats, 2007-2008
- National Research Council, Committee on Atlantic Salmon of Maine, 2001-2004
- National Research Council, Committee on Bioconfinement of Genetically Engineered Organisms, 2002-2004
- FDA, Food Safety Advisory Committee, Biotechnology Subcommittee, 2002-2005
- USDA Advisory Committees to the Secretary:
 - Advisory Committee on Agricultural Biotechnology, 2000-2002
 - Agricultural Biotechnology Advisory Committee (ABRAC), 1992-1996
 - Vice-Chair of ABRAC, 1995-1996
- State of Maine & Trout Unlimited, Review of hatcheries for Atlantic salmon restoration, 1999
- MN Dept of Natural Resources, Review finalists for Director of Division of Fish & Wildlife, 1999
- MN Dept. of Natural Resources, Citizens Advisory Committee on the Future of Minnesota's Fishing, Hunting, and Trapping Heritage, 1997-1998
- National Research Council, Committee on Protection and Management of Pacific Northwest Anadromous Salmonids, 1992-1995
- Office of Technology Assessment, U.S. Congress, Advisory Panel on Aquaculture, (expert on biotechnology in aquaculture and policy implications) 1993-1995
- Long-term Fitness Task Team (addressed genetic conservation in hatchery programs to rebuild Pacific salmon populations), Yakima Klickitat Fisheries Program, 1992-1994
- Chair, MN Governor's Task Force on Aquaculture, 1987
- Chair, MN Governor's Aquaculture Advisory Committee, 1988-1990
- Coordinator, Aquaculture Discharge Workgroup, Minnesota Dept. of Agriculture, 1989-1990
- MN Environmental Quality Board, Advisory Committee on Genetic Engineering, 1988-1994
- North Central Regional Aquaculture Center of USDA, Research Technical Committee Chair, 1988-1992; Board of Directors, *ex officio* 1988-1992; Executive Committee of Technical Committee, 1995-1996
- Chair, Steering Committee of NCA-23 Subgroup on Aquaculture, led preparation of proposal to Congress to establish North Central Regional Aquaculture Center, 1986-1987

Appointments – Public Interest Organizations and Philanthropic Foundations

- Union of Concerned Scientists, Chair of Board of Directors, since October 2015:
Governance, Finance, and Investment committees (*ex officio*); Strategic Team; Kendall Fellows Advisory Committee; Diversity, Equity, Inclusivity Task Force; Executive Committee (chair)
- Union of Concerned Scientists, Member of Board since 2002; Search Committee for President, Aug 2013-Feb 2014; UCS Food and Environment Scientific Advisory Committee, 2001
- Seafood Watch Advisory Board, Monterey Bay Aquarium, 2006-2009
- Marine Stewardship Council, Senior Advisors Board / Standards Council, 1999 - 2001
- Habitat Productions. Scientific advisor for TV documentaries “Empty Oceans, Empty Nets” and “Farming the Seas”, 1998-2004

Grants Since 1995 (*interdisciplinary, # lead or co-PI on multi-investigator grant)

- # “Converting under-utilized microalgal co-products into value-added ingredients for fish-free aquafeed for rainbow trout.”, \$78,000, California Sea Grant. 2020-2021.
- “Repass-Rodgers Fellowship on California Salmon Restoration Policy.” Donor gift for Coastal Science and Policy program. 2020-2022.
- *# “Economic and environmental sustainability decision-support tool for fish-free aquafeed,” \$244,416, Sea Grant 2019 National Aquaculture Initiative, 2019-2021.
- *# "Inclusive Training of Rising Leaders in Coastal Sustainability," \$200,000. Wells Fargo Foundation. 2019-2020.
- # “Development of cost-viable and fishmeal- and fish oil-free feeds for Nile tilapia (*Oreochromis niloticus*) using microalgal cells and co-products,” \$500,000, USDA Animal Health and Production and Animal Products program, 2016-2018
- # Donor gift for sustainable aquaculture research at Dartmouth, \$500,000. Received 2015.
- #Life-cycle environmental benefits and financial resilience of integrated food-energy systems: closing the loop on nutrients, water and energy. \$496,000, USDA Agriculture Systems and Technology program, 2015-2018
- Restoration of Atlantic salmon and their ecosystem services to Lake Champlain by restoring their river imprinting. Environmental Protection Agency STAR Fellowship to my PhD advisee, Marcus Welker, 2012-2015
- # Genetic biocontrol of invasive fish and mollusks, \$75,000. Great Lakes Protection Fund, 2009-10
- *#Engaging sustainability science and design in participatory land use planning and implementation, \$100,000, Institute on the Environment (UMN), 2008-2009
- *#Sustainability Science Forum, \$20,210, Consortium on Law and Values in Health, Environment & the Life Sciences (UMN), 2008-2009
- *#Integrative Graduate Education and Research Training Program: Risk analysis of introduced species and genotypes, \$2.9 million, National Science Foundation, 2007-2012
- #Aquaculture best management practices for Minnesota, \$100,000, Minnesota Dept of Natural Resources, 2008-2009
- *#Conference on genetic biocontrol of invasive fish species, \$10,000, USDA, 2008-2010
- *#Minnesota statewide conservation and preservation plan, \$300,000, Legislative and Citizens’ Commission on Minnesota Resources, 2007-2008
- *#Predicting invasive potential of exotic species. Minnesota Futures, Office of the Vice President for Research (UMN) \$25,000, 2007-2008
- *#Initiative on Ecosystem Science and Sustainability, \$900,000, Archibald Bush Foundation, 2004-2009

- *#The future of energy and Minnesota's water resources. \$270,000, Legislative and Citizens Commission on Minnesota Resources, 2008-2010.
- *Course on population and the environment, \$20,000, Minneapolis Foundation, 2003-2004
- *Genetic methods of biological control of non-native fish in the Gila River system, U.S. Geological Survey, Fish and Wildlife Service, \$89,142, 2003-2005
- *Oxfam America, report on international agricultural biotechnology, \$10,000, 2003
- Reproductive success and survival comparisons of hatchery and wild Lake Superior steelhead, Sea Grant, \$67,612 (+\$29,000 for graduate student), 2003-2006
- *#Thailand transgenic fish and biodiversity program: Risk assessment research and capacity building, U.S. Agency for International Development, \$425,000, 2001-2007
- *Organic Aquaculture Practices and Policy, Packard Foundation, \$145,000, 2001-2004
- *Safety First Initiative: Industry-wide Safety Program for GMOs in Agriculture, Pew Initiative on Food and Biotechnology \$113,000, 2001-2002
- *Transgenic Fish: status of development, issues and options for U.S. policy, Pew Initiative on Food and Biotechnology, \$15,000, 2001
- *Safety first: Active governance of GMOs for environment and human health worldwide, Workshop support from various U of MN units, \$50,000, 2000
- Transgenic fish: testing models to assess risk, USDA, \$150,000, 2000-2004
- *#Minnesota-Stanford-Wisconsin Consortium: Changes in global society, MacArthur Foundation, \$950,000, 2000-2004
- Genetic analysis of coaster brook trout populations, Minnesota Sea Grant, \$60,427, 2000-2002
- *National workshop on organic aquaculture standards, Packard Foundation / USDA, Agricultural Marketing Service / U of MN Extension Service, \$50,000 / \$10,000 / \$15,500, 2000
- *Population, environment and sustainability, Minneapolis Foundation, \$18,800, 2000
- *Environmental assessment tool for private aquaculture in the Great Lakes Basin, Great Lakes Fishery Commission, \$22,575, 2000 -2001
- *#Institute for Social, Economic, and Ecological Sustainability, U of MN. \$65,000, 1996-2000
- Assessment of genetic population structure in yellow perch, Great Lakes Fishery Commission, \$30,000, 1999-2000
- *Environmental sustainability and livelihoods in South Africa, Human Sciences Research Council, Republic of South Africa, \$7,000, 1998-2000
- Genetic markers to identify declining populations of Great Lakes yellow perch, Great Lakes Fishery Commission, \$40,000, 1998-1999
- Genetic effects of hatchery rainbow trout on naturalized steelhead populations based on diagnostic DNA markers. Minnesota Sea Grant, \$156,655, 1998-2001
- *Learning to engage citizens in development of sustainable futures for the Upper Mississippi River, \$34,010, Northwest Area Foundation, 1998
- *#Minnesota-Stanford-Wisconsin Consortium: World society on the eve of the twenty-first century, \$944,000, MacArthur Foundation, 1997-1999
- Diagnostic genetic markers for fisheries at the species and subspecies level. Minnesota Dept of Natural Resources (managed by Post-doc, Loren Miller), \$40,000, 1998-2000
- *Model management program for oversight of private aquaculture in the Great Lakes Basin, Great Lakes Fishery Commission, \$40,000, 1997-1999
- Improved decisions for walleye stocking, Legislative Commission on Minnesota Resources, \$200,000, 1997-1999

Minnesota rare mussel conservation and the fish connection, Legislative Commission on Minnesota Resources, \$91,000, 1997-1999

*#Institute for Social, Economic, and Ecological Sustainability, University of Minnesota Graduate School, \$150,000, 1996-1999

Temporal trends in genetic diversity in fish populations and implications for sustainability, Minnesota Sea Grant, \$86,579, 1996-1998

Outreach publications on genetic guidelines for fish hatcheries and for fisheries management \$19,175, Minnesota Sea Grant, 1995-1996

Grants and Contracts 1984-1994

44 grants awarded totaling over \$5.1 million from Sea Grant, Great Lakes Fishery Commission, Leech Lake Indian Reservation, Legislative Commission on Minnesota Resources, Minneapolis Foundation, Minnesota DNR, University of MN Graduate School, Early Stage Technology Development Fund, Project MINNEMAC, USDA, Greater Minnesota Corporation, Sport Fishing Institute Fund, Red Lakes Band of Chippewa Indians Fisheries Department, National Institutes of Health, Bonneville Power Administration, Human Sciences Research Council (South Africa), MacArthur Foundation, Joyce Foundation, and Northwest Area Foundation

International Presentations in Policy Settings (invited)

Government of Mexico, CONABIO (inter-ministerial), First international workshop on the environmental risk evaluation of genetically modified (GM) fish in Mexico. Presented “Environmental risk assessment for transgenic fish” and “Gene flow assessment of transgenic fish,” 2015

UN Food and Agriculture Organization, Technical consultation on assessing sustainability and scalability of integrated food-energy systems (IFES), presentation on research by Dartmouth Team IFES, 2013

Transgenic salmon: myths and realities, Workshop of salmon industry of Chile, presentation on environmental risk assessment, 2010

10th Asian Pacific Economic Forum (APEC), Workshop on Research, Development, and Extension on Agricultural Biotechnology (RDEAB), presentation on transgenic fish: global status and regulation (delivered by co-author W. Senanan), 2006

Norway/UN Conference on Technology Transfer and Capacity Building, presentation and panel discussion on gene technology and biosafety in a development perspective, 2003

First Meeting of Global Consultative Process on an International Assessment of the Role of Agricultural Science and Technology in Reducing Hunger, Improving Livelihoods and Stimulating Economic Growth, Convened by the World Bank, Dublin, Ireland, 2002

Convention on Biological Diversity, Open-Ended Expert Meeting on Capacity Building for Cartagena Protocol on Biosafety, Havana, plenary presentation, 2001

Government of Chile & Universidad de Chile, National Conference on Genetically Modified Organism, plenary talks on assessing the biosafety of genetically modified organisms and on intellectual property issues, 2000

International Joint Commission, Great Lakes Water Quality Board, presented an environmental assessment tool for private aquaculture in the Great Lakes basin, 1999

Great Lakes Fishery Commission, demonstrated aquaculture environmental assessment tool, 1998

Government of India, Workshop on Biosafety and Conservation of Biodiversity, 1997

Government of Thailand and Kasetsart University, Biosafety in Aquatic Biotechnology, 1997

United Nations, Convention on Biological Diversity, Negotiations of the Biosafety Protocol, workshops and statements to delegates on biosafety assessment, 1996, 1997, 1999

National Presentations in Policy Settings (invited)

Technical Presentations

National Academy of Science Committee on Future Biotechnology Products and Opportunities to Enhance Capabilities of the Biotechnology Regulatory System. Presented “Genetically engineered fish and ecological risk assessment science.” 2016

USDA, briefing to Under Secretary of Agriculture. Agroecology research needs. 2015

Whole Foods Market Seafood Standards Meeting. A sustainability matrix for evaluating aquaculture operations, Whole Foods headquarters, Austin TX 2007

Invasive Species Advisory Committee (US federal interagency body). Genetic methods for biological control of invasive species (presenter T. Patronski), Washington D.C., 2006

Aquatic Nuisance Species Task Force (US federal interagency body). Genetics as a biocontrol strategy (presenter L. Riley), Virginia, 2006

National Academy of Science, lead presenter at public and web-cast briefing to release report on biological confinement of genetically engineered organisms, 2004

U.S. Dept of Agriculture and National Academy of Science, Co-presenter of report on biological confinement of genetically engineered organisms to USDA sponsor, 2004

U.S. Fish and Wildlife Service and U.S. Geological Survey, Workshop on Future Environmental Challenges, Plenary presentation on biotechnology, 2004

National Research Council, Standing Committee on Biotechnology, Food, Fiber and the Environment, presented on issues regarding aquatic GMOs, 2000

National Research Council, Standing Committee on Biotechnology, Food, Fiber and the Environment, Workshop on Monitoring GMOs, presented on adaptive management as a framework for ecological monitoring of GMOs, 2000

Expert Testimony

U.S. Congress, Senate Commerce Committee, invited staff briefing on GM fish, 2011

Food and Drug Administration, Veterinary Medicine Advisory Committee, comments on environmental assessment and briefing packet for transgenic AquAdvantage salmon, 2010

Minnesota Legislature, House Committee on Environment and Natural Resources Finance, invited presentation on MN 2050 scenarios research, 2009

Minnesota Environmental Quality Board (commissioners of state agencies and citizen representatives) and Legislative and Citizens Commission on Minnesota Resources, eight briefings on statewide conservation and preservation plan, 2007-2008

U.S. Congress, Briefings on GMOs for members of the Senate and House of Representatives, 2000

Minnesota Administrative Law Hearing, Comments on Proposed Rules of the State Dept. of Agriculture Governing Genetically Engineered Organisms, 1995

U.S. Congress, House Committee on Merchant Marine and Fisheries, Subcommittee on Environment and Natural Resources, role of hatcheries in restoration of naturally-spawning populations of salmon, 1993

Minnesota Environmental Quality Board, five testimonies, 1991-1992

Minnesota Legislature, eight testimonies to Environment or Agriculture Committees, 1987-1994

Symposia and Workshops Organized

Chinese Mariculture 2030: Steps Towards Greater Sustainability. Pew Marine Fellows Program Meeting, 2019.

Opportunities and challenges of integrated food energy systems. National Council on Science and the Environment Conference, Washington, DC. 2016

Changing climate, changing minds. Dartmouth College, 2016

Who is responsible for climate change? Dartmouth College, 2015

Sustainability Solutions Café, interactive discussion series at Dartmouth College, since 2012

Association for the Advancement of Sustainability in Higher Education (AASHE). Designing sustainability curricula to foster a diverse generation of leaders. Co-organizer, 2010

International symposium on genetic biocontrol of invasive fish, Chair of steering committee, 2008-2010

Strategic leadership for a sustainable Minnesota: scenario exploration and the statewide conservation plan, Monticello MN, 2008

Predicting invasive potential of exotic species, involved citizens, legislators, federal and state agencies, and scientists from USA and Europe, Minneapolis, MN, 2008

Assessing ecological impacts of tilapia in Thailand: farm escapes, transgenics and genetically improved strains, Bangkok, Thailand, 2007

Methodologies for Environmental Risk Assessment of Transgenic Fish, book-drafting workshop (40 co-authors from 19 countries), WorldFish Center, Penang, Malaysia, 2005

Joint WorldFish Center and University of Minnesota workshops on Environmental Effects of Aquatic Alien Species (involved U.S. scientists, government and private sector to develop collaborative projects), February and November, 2005

Reconciling Fisheries with Conservation through Stock Enhancement (co-chair), 4th World Fisheries Congress, Vancouver, Canada, 2004

Biosafety Science of Genetically Engineered Organisms, an international workshop with participants from eight countries, convened by U of MN and Burapha Univ., Chonburi, Thailand, 2003

Meeting of Safety First Initiative Executive Advisory Board and Steering Committee convened at University of Minnesota, 2002

Safety First: Active Governance of Genetic Engineering for Environment and Human Health Worldwide. International Workshop convened at University of Minnesota, 2001

Workshop on Organic Aquaculture Standards, International workshop convened at University of Minnesota, 2000

Symposium on Assessing and Managing Risks Posed by Genetically Modified Organisms, Annual Meeting of the American Fisheries Society, 1996

Symposium on Genetically Modified Organisms and Wild Marine Populations, International Marine Biotechnology Conference (Norway), 1994

Workshop on Performance Standards for Environmentally Safe Research with Genetically Modified Fish and Shellfish, (100 attendees from U.S. & abroad), 1993

Symposium on Columbia Basin Salmon and Steelhead, Annual AFS Meeting, 1991

Symposium on Conservation of Fisheries Genetic Resources, Annual AFS Meeting, 1990

Aquaculture Symposium, Midwest Fish & Wildlife Conference, 1989

Fisheries Genetics Workshop for Midwest Fish and Wildlife Conference, 1987

Symposia and Workshops Organized by Staff I Supervised

Conversations on Sustainability, on topics ranging from climate change to sustainable cities, six public conversations 2006-2008

Minnesota 2050: Pathway to a Sustainable Future (under the Ecosystem Science and Sustainability Initiative), 12 regional workshops on scenario development and leadership insights, 2007-2008

Journalist Workshops on Sustainability Issues: Feeding Ourselves in the Future - Science and Policy of Food 2006; Water in the 21st Century - Our Most Precious Resource 2007

Society for Conservation Biology Annual Meeting, Symposium on Biotechnology and Biodiversity, New York, 2004

International Organic Aquaculture Workshop and Organic Seafood Tasting Tour: Low-Food-Chain Candidate Species, Organized by ISEES (I served on steering committee), Minneapolis, 2003

Campus Sustainability Summit, University of Minnesota, Minneapolis, 2003

Creature Features: A Day of Wildlife in Film and Video. Film festival co-organized by ISEES and Bell Museum of Natural History, Minneapolis, 2003

Passport to the Earth Summit 2002: Exploring Sustainable Development, nine public lectures and panel discussions, University of Minnesota, Minneapolis and St. Paul, 2002

Presentations to General Audiences (invited)

Moderator and Speaker, "Climate Justice: Linking Science to Just Action", UCSC Climate Conference, April 11, 2019

Science Pub speaker, "Science and Policy", Lebanon, NH, March 29, 2018

Hanover Conservancy, "Stand up for Science" April 1, 2017

Link Environmental Awareness Lecture and Food Day Lecture at Dartmouth, Onstage conversation with Michael Pollan, "Changing the US Food System One Meal at a Time" Oct /24, 2016

Hanover Rotary Club, "Microalgae-based fish feeds for sustainable aquaculture" Dec 11, 2013

Greenways: Coming Home symposium, panel on "A Deeper Shade of Green: Sustainability at Dartmouth." April 6, 2013

ILEAD at Dartmouth, "Sustainability: linking science with practice in the Upper Valley" 2011

Swarthmore College, Inauguration of President Rebecca Chopp, panel on Sustainable Living, 2010

End of the Line, Hopkins Center Films, Hanover, NH, panel discussion with audience, 2010.

Union of Concerned Scientists 40th Anniversary Science Symposium, panel on sustainable agriculture, "Sustainability science," 2009

Food, Inc., Hopkins Center Films, Hanover, NH, panel discussion with audience 2009

Conversations on Sustainability, "Food in our future," 2008

Great Conversations (TV and public audience series), "Biotechnology and the environment" University of Minnesota, 2003

American Museum of Natural History, "Can biotechnology save the world's species?" Public lecture and panel discussion, NY City, 2001

Swarthmore College, Alumni reunion plenary speech, "Now more than ever: liberal arts vision in a high tech world", 2001

Gene Media Forum, panel for mass media reporters, GMOs in the pipeline, NY City, 2001

Swarthmore College, A closer look at the future of science: panel discussion, 2000

The Keystone Center, Biotechnology Forum, Atlanta, Georgia, plenary presentation on transgenic fish, 1988

Workshops and Conferences (invited)

- Dartmouth and University of New Hampshire Retreat to explore joint research consortium on sustainability science, 2014
- Assessing the sustainability and scalability of integrated food-energy systems. UN Food and Agriculture Organization technical consultation, led Dartmouth delegation, 2013
- Renewable energy and society, Matariki Network of Universities Workshop, led Dartmouth delegation and presented “An integrated approach to sustainability in higher education: the Dartmouth experience,” 2010
- Adaptive Management Network, presented on genetically engineered organisms, 2001
- Union of Concerned Scientists, Annual Board of Directors Meeting, presented on environmental issues posed by transgenic fish, 2001
- International Joint Commission, Water quality issues posed by aquaculture development in the Great Lakes, 1999
- Simon Fraser University, Aquaculture and the Protection of Wild Salmon, presented on biosafety assessment of transgenic salmon, 1999
- Pew Charitable Trusts, Consultation on aquaculture environmental issues, 1998
- National Research Council, Board on Sustainable Development, Workshop on Food Security, 1997
- MacArthur Foundation, Institutional Grants of the Peace and International Cooperation Program, 1995
- North Carolina Biotechnology Center, Forum on The Brave New World of Animal Biotechnology: Can Ethics Meet Reality?, panel discussion leader and respondent in session on transgenic fish, 1995
- Synthesis team leader, Northwest Power Planning Council Genetics Workshop: Sustainability of Anadromous Salmon and Trout Populations, 1991
- Northwest Power Planning Council, workshop on genetic production principles for Columbia River Basin fisheries management, 1989
- Rapporteur, National Aquaculture Forum (USDA and Sea Grant), 1987
- Aquaculture Genetics and Breeding: Research Priorities Workshop (USDA), 1986
- Rapporteur, Genetics Work Group of Enhancement Planning Team (Columbia River), 1984

Recent Invited Presentations at Scientific Meetings

International Meetings

- International Symposium on Genetic Biocontrol of Invasive Fish, “Early steps in ecological risk assessment for genetic biocontrol: hazards, harms and assessment endpoints”, 2010
- Society for Conservation Biology, “Being a conservation biologist in the policy arena”, 2008
- VI Latin-American and Caribbean Meeting on Agricultural Biotechnology: REDBIO 2007, “Methodologies for environmental risk assessment of genetically modified fish”
- World Aquaculture Society, “Methodologies for environmental risk assessment and management of transgenic fish” and “Assessing ecological risk of non-native Nile tilapia aquaculture escapees to native heterospecifics” (presenter A. Cooper) 2007
- 9th International Symposium on Biosafety of Genetically Modified Organisms, “Methods to address uncertainty in risk assessment of genetically modified organisms” (presenter K. Hayes) 2006
- Fourth World Fisheries Congress, Vancouver B.C, Session on Reconciling Fisheries with Conservation through Stock Enhancement, “What makes fishery enhancements responsible?” 2004

- Society for Conservation Biology Annual Meeting, Symposium on Biotechnology and Biodiversity, “Environmental risk assessment and management of genetically engineered organisms: insights from transgenic fish” 2004
- Society for Conservation Biology Annual Meeting, “Conservation biology at the biotechnology-biodiversity interface: the case of aquatic genetically modified organisms” (presenter E. Pullins) 2003
- Society for Conservation Biology Annual Meeting, “Demographic and genetic estimates of effective population size reveals genetic compensation in steelhead trout” (presenter W. Ardren) 2003
- Bordeaux Aquaculture Conference in France, “Genetic and ecological effects of aquaculture” and panel discussion 2002
- Annual Pew Marine Conservation Fellows Meeting, “A new governance for marine GMOs” 2001
- International Marine Biotechnology Congress, Symposium on Genetically Engineered Fish of the Scientific Committee on Problems of the Environment (SCOPE), “A safety first approach to assessing and managing environmental risks of transgenic fish” 2000
- World Aquaculture Society, Biotechnology Symposium, “Performance standards for safely conducting research with genetically modified fish and shellfish” (presenter E. Hallerman) 1997
- World Fisheries Congress, Athens Greece, “A common conservation ethic: communicating the way towards conservation of aquatic biodiversity” 1992

National and State Meetings

- National Academies of Sciences, Engineering and Medicine, introduction speaker and moderator at workshop with three invited panels on “Strengthening sustainability curricula and programs in higher education”, at UC Santa Cruz, 2020.
- National Academies of Sciences, Engineering and Medicine, introduction speaker and moderator at participatory workshop on “Strengthening sustainability curricula and programs in higher education”, at National Academy of Sciences, Washington, D.C., 2019.
- National Academies of Science, Engineering and Medicine, introduction speaker and moderator at participatory workshop on “Strengthening sustainability curricula and programs in higher education”, at Mitchell Foundation, Austin, TX, 2018.
- MIT Water Summit 2017: Water Food Nexus, Speaker on Aquaculture Panel, 2017.
- USDA, Agricultural Systems and Technology Program, Biological Engineering Project Directors Workshop, “Life-cycle environmental benefits and financial resilience of integrated food-energy systems: closing the loop on nutrients, water and energy.” 2015.
- National Science Foundation Research Coordination Network, Scenarios to Solutions workshop. Invited talk “Lessons from the Minnesota 2050 project” 2014
- AAAS (American Association for the Advancement of Science), Gordon Conference on Science and Technology Policy: Systems Approaches to Research and Practice. Talk on “Integrated food energy systems and sustainability transitions” 2014
- AAAS, “Shared learning systems for sustainability” in symposium, Roles of Knowledge Institutions in Sustainability 2013
- AAAS, Discussant at symposium, Transformative Research Beyond Scenario Studies 2010
- AAAS, Discussion Leader in Sustainability Science Forum: core competencies in sustainability 2010
- Institute on the Environment, U of MN, Environment Roundtable: Adaptation Strategies for Climate Change (with Steve Pacala, Princeton University) 2008

- Minnesota Chapters of the American Fisheries Society and Society for Conservation Biology, Joint Annual Meeting, plenary talk “Genetically engineered fish: A 21st century challenge” 2004
- Sea Grant Program Assessment Team, Duluth, MN, “Effects of hatchery rainbow trout by naturalized steelhead trout hybridization on fitness in Lake Superior streams” 2003
- USDA Workshop: Future Directions and Research Priorities for the USDA Biotechnology Risk Assessment Research Grants Program, “How proposals can address the risk assessment process” 2003
- National Agricultural Biotechnology Council Conference: Foods for Health, Minneapolis, dinner plenary “The Safety First initiative” 2002
- American Fisheries Society Annual Meeting, “A Safety First approach to governing marine GMOs” 2002
- American Society of Agronomy, Public Science, World Trade and Biotechnology: Issues for Young Professionals in the Natural Sciences, “A Safety First approach to biotechnology” 2000
- Midwest Fish and Wildlife Conference, “Biosafety assessment of genetically engineered organisms intended for aquaculture” 2000
- AFS Annual Meeting, Symposium on Environment and Aquaculture, “Environmental consequence of large-scale aquaculture of genetically engineered organisms” 1999
- AFS Annual Meeting, Symposium on Hybridization in Fishes, “Socio-genetic analysis of fish hybridizations: impacts of hybrid catfish (*Clarias macrocephalus* x *C. gariepinus*) farming in central Thailand on native fish genepools and local farmers' livelihoods” (presenter W. Senanan) 1999
- Ecological Society of America, Symposium on Theoretical and Practical Considerations for Assessing Ecological and Human Health Effects of Genetically Engineered Organisms, “Controversies in designing useful ecological assessments of genetically engineered organisms” 1999
- Ecological Society of America, Symposium on Fisheries Restoration, “Hatcheries: experimental systems in an adaptive learning context” 1997
- AFS Annual Meeting, “Genetic conservation and sustainability of salmonine artificial propagation in the Great Lakes” 1996
- AFS Annual Meeting, “Genetic conservation guidelines for Pacific salmon hatchery programs” 1995
- Pacific Salmon and their Ecosystems: Status and Future Options. Seattle, WA, presented “Reweaving Pacific salmon and their ecosystems: what threads can artificial propagation contribute?” 1994

Recent Submitted Presentations at Scientific and Professional Meetings

International

- Resilience 2011, panel chair and presenter, “Methodologies for building adaptive capacity through shared learning among scientists, stakeholders and practitioners,” 2011
- Society for Conservation Biology Meeting, “Does participatory risk analysis promote social learning about biodiversity conservation?” (presenter G. Dana), 2009
- Resilience 2008, International Science and Policy Conference, Stockholm, Sweden, “Integrating stakeholder scenarios with trends science to increase adaptive capacity” (Kapusinski et al., presenter L. Schmitt-Olabisi), 2008
- 14th International Conference on Aquatic Invasive Species, “Diet overlap between alien fish species, Nile tilapia (*Oreochromis niloticus*), and native cyprinid fish species (*Cyprinidae*) in natural aquatic environments in Thailand” (presenter W. Senanan), 2006

- Fish Biology Congress, Symposium on Genetically Modified Fish, “Testing gene flow from growth-enhanced transgenic medaka (*Oryzias latipes*) in confined experimental systems” (presenter K. Paulson), 2006
- Fish Biology Congress, Symposium on Genetically Modified Fish, “Assessing ecological risk of transgenic tilapia to heterospecifics” (presenter A. Cooper), 2006
- MN Chapter, American Fisheries Society, Annual Meeting, “One year of parental hatchery experience reduces success of steelhead fry stocked into their naturalized environment” (presenter D. Caroffino), 2006
- BioThailand (biotechnology conference), “Ecological risk assessment of genetically engineered tilapia, *Oreochromis niloticus*” (presenter W. Senanan), 2005
- Desert Fishes Council, “Genetic methods for biological control of non-native fishes in the Gila River Basin: technical, environmental, regulatory and other considerations” (presenter P. Barrett), 2005

National and State

- AAAS Annual Meeting, speaker and organizer of panel “Strengthening sustainability programs and curricula in higher education, Seattle, WA 2020.
- F3 Meeting of the Anthropocene Institute, “Towards sustainable aquafeeds: fish-free feed for trout and tilapia,” presented by collaborator Pallab Sarker, 2019.
- World Aquaculture Society, “Towards sustainable, fish-free aquafeeds: Evaluating microalgal co-product for replacing fishmeal in diets for Nile tilapia (*Oreochromis niloticus*),” presented by USDA grant lead PI, Pallab Sarker, 2018.
- Science in Support of Sustainable Communities, ISIE conference, “Policy and decision making at the nexus: an assessment of integrated food-energy systems”, presented by co-PI Mike Gerst, 2017.
- Algae Biomass Summit, “Towards sustainable aquafeeds: Evaluating three marine microalgae for replacement of fish oil and fishmeal in aquaculture diets for Nile tilapia (*Oreochromis niloticus*) and rainbow trout (*Oncorhynchus mykiss*)” presented by co-PI, Pallab Sarker, 2015
- American Fisheries Society Annual Meeting, “Synthesis of social considerations and ecological dynamics to inform the management process of a Dominican coral-reef fishery” presented by PhD advisee Tyler Pavlowich, 2015
- National Science Foundation IGERT conference, “Stakeholder involvement in environmental risk: assessing impacts of genetically modified maize on South African biodiversity, poster led by IGERT PhD trainee, Genya Dana, 2009
- Association for the Advancement of Sustainability in Higher Education, “Bridging the disciplinary divide: tackling the challenge of educating for sustainability at the University of Minnesota”, 2008
- Association for the Advancement of Sustainability in Higher Education, “Sustainability science at a land grant institution: linking community visioning and scientific analysis” (K. Johnson, presenter) 2008
- American Fisheries Society, “Assessing ecological risk of a non-native fish and transgenic fish to heterospecifics using integrated habitat, diet, and competitive behavioral studies” (A. Cooper presenter), 2007
- Annual Meeting of the Minnesota Chapter of the AFS, “Use of scanning electron microscopy for identifying juvenile mussels” (awarded Best Poster, 1 of 8 authors), 2002
- American Museum of Natural History, “Policy for sustaining seascapes needs to address marine GMOs” Poster session at Sustaining Seascapes Symposium, 2002

American Fisheries Society, Parentage Assignment Using DNA microsatellite markers to evaluate performance differences between two populations of stocked walleye, 1999
American Fisheries Society, “Inheritance of 12 microsatellite loci in *Oncorhynchus mykiss*” 1999
Annual Meeting of the Minnesota Chapter of the AFS, “Hosts and host attracting behaviors of five upper Mississippi River mussels” (awarded Best Poster, 1 of 11 authors), 1999
Coastwide Salmonid Genetics Meeting, “Effective number of breeders in a steelhead trout population based on DNA polymorphisms: implications for conservation and restoration” 1999
Society of Ichthyologists and Herpetologists, “Population structure of northern pike in North America and Europe using microsatellite polymorphisms” 1997
Annual Meeting of AFS, “Effective population size of a northern pike population based on microsatellite markers” 1996
Annual Meeting of AFS, “Can genetic conservation and hatchery programs coexist in salmonid fisheries management?” 1993

Invited Seminars

UC Santa Cruz, Environmental Studies Dept., “Towards sustainable aquaculture via redesign of aquafeeds” 2017
UC Santa Cruz, Coastal Campus, “Vision for graduate leadership at the science and practice interface: the coastal science and policy graduate program” 2017
Dartmouth College, Faculty Lightning Round (for prospective students and parents), “Anchovies, algae, and aquaculture: what’s the connection?” 2017
Dartmouth College, Freshmen Orientation, Summer Reading book lecture, “Strange no more: engaging *Strange As This Weather Has Been* through the liberal arts” 2012
Hubbard Brook Research Foundation, Board of Directors, Sustainability science research and education at Dartmouth College, Hanover, NH 2010
Union of Concerned Scientists, Board of Directors, Sustainability science and launching research in the Connecticut River watershed, Cambridge, MA 2010
Pontificia Universidad Catolica de Valparaíso, Chile, “Methodologies for environmental risk assessment and management of genetically modified and invasive aquatic organisms” 2007
Shanghai Fisheries University, “Methodologies for biosafety assessment and management of transgenic fish” 2006
Sarah Lawrence College, “Pursuing science’s new social contract: salmon, biotechnology and the Safety First initiative”, part of Colloquium Series, *The Politics of Food*, 2003
Center for Genetic Engineering and Biotechnology, Cuba, “Methods for environmental safety assessment of transgenic fish” 2001
Millennium Science Initiative, Santiago, Chile, “Biosafety of genetically modified organisms: scientific principles and methods” 2000
Minnesota Fish and Wildlife Employees Association, “What every natural resource professional should know about genetically engineered organisms” 2000
Universidad Austral de Chile, “Biosafety assessment of marine genetically modified organisms” 2000
Universidad Catolica de Valparaiso, Chile, “Genetic engineering of marine organisms and assessment of ecological effects” 2000
Jawaharlal Nehru University, New Delhi, India, “Biosafety assessment in agriculture, with focus on aquatic biotechnology” 1997
Gustavus Adolphus College, Minnesota, “Genetics and hatcheries in salmon conservation” 1994

Oregon State University, Water Resources Graduate Program, Seminar Series on Salmon and the Columbia River: The Recovery Puzzle, “Hatcheries: a piece of the puzzle?” 1993
Audubon Society, Fish: Native, Introduced and Genetically Engineered, “Implications of introductions of transgenic fish into natural ecosystems” 1992
20 additional seminars at universities, research institutes, government agencies and other organizations 1984-2001

Presentations to Multi-Stakeholder Audiences (invited)

Plate of the Union Marquee Event, “The impact of our food policies,” Londonderry, NH, Sept. 8, 2016.
Sustainable Foods Institute, speaker in panel on sustainable seafood, Monterey Bay Aquarium, 2007
Seafood Summit, Beyond U.S. fisheries: sustainable seafood meets the realities of the international marketplace, Jacksonville, Florida, 2007
MN Sea Grant External Program Assessment Team, presentations and host of teleconference with stakeholders, on governance of marine genetically engineered organisms (including Safety First initiative) and on sustainable aquaculture, 2003
Minnesota Sustainable Communities Network Conference, Relating to a globalizing world, led a group discussion, 2002
SeaWeb, Workshop on Salmon Aquaculture, presentations on organic aquaculture and on transgenic fish, Washington DC., 2001
University of Minnesota Sesquicentennial Public Conference, Governing GMOs, panel presentation and discussion on assessing environmental and evolutionary impacts, 2001
Missouri Aquaculture Association Annual Meeting, “Risk assessment and management of aquatic biotechnology” 1997
Extension's Role in Biotechnology Education, convened at Iowa State University, “Assessing and managing risks posed by genetically modified fish and shellfish” 1996

Trainings on Biotechnology and the Environment († organized entire training)

Mass Media Fellowship Workshop on Genomics, University of Minnesota, “Biosafety science and case study of transgenic fish”, lecture and discussion, 2001
International Centre for Genetic Engineering and Biotechnology, Italy, International Training Workshop for Government Delegates on Biosafety and Risk Assessment of GMOs, “*The Manual for Assessing Ecological and Human Health Effects of Genetically Engineered Organisms*: design principles and demonstration with a case study of transgenic fish” 2000
† Genetics in Fisheries Management Short Course, MT Chapter, American Fisheries Society, 1997
† Fisheries Genetics Continuing Education Course, and presented “Aquatic biotechnology”, MN Chapter, American Fisheries Society, 1995
† Workshop on Environmental Review of Releases of Genetically Engineered Organisms for State of Minnesota Agencies, 1994

Reviews for Scientific Journals, Funders, Government, Universities, and NGOs

Editorial and Major Reviewer Positions

Editor in Chief (inaugural), [Sustainability Transitions](#) domain of [Elementa: Science of the Anthropocene](#) – open-access, non-profit, refereed online journal, since fall 2012
National Science Foundation, Food Energy Water Systems grant proposal panel - 2016
Guest Editor, issue on genetic biocontrol of invasive fish, *Biological Invasions*, 2010-2014

Book series Co-Editor for CABI Publishing, Environmental Risk Assessment of Genetically Modified Organisms, 2003-2008
Editorial Board, *Environmental Biosafety Research*, 2002-2012
USDA Review Panel, Animal Genome and Genetic Mechanisms, NRI Grants Program, 2002
Editorial Board, *Conservation Ecology* (on-line journal of Ecol. Soc. of America), 1998-2003
National Sea Grant Review Panel, Marine Biotechnology Policy, 1994.]
Aquaculture Grant Review Panel, USDA's SBIR Program, 1990
Associate Editor, *Transactions of the American Fisheries Society*, 1989-1990
Book Reviewer, American Fisheries Society, 1988
North Central Regional Aquaculture Center Board of Directors, Grant Reviews, 1988-1992
USDA Review Panel, Aquaculture Special Research Grants Program, 1987-1990

Short-term External Reviews

Sustainability Institute, University of New Hampshire, 2015
Department of Environmental Studies, Emory University, 2013
Minneapolis Foundation, roundtable on priority environmental issues, 2001
Archibald Bush Foundation, Environmental Roundtable, 2000
Peer Review Forum on salmon survival, Tuolumne River Technical Committee, California, 1998
Bonneville Power Administration, reviews of various hatchery issues, 1990-1996
Auburn Univ. Site Visit Team, USDA Office of Agricultural Biotechnology, 1989
Northwest Power Planning Council, Draft Hatchery Production Principles, 1989
Federal Environmental Assessments, Office of Agricultural Biotechnology, USDA, 1988, 1990

External Reviews of Proposals & Nominations - Since 1985

Audubon Society, Binational Agricultural Research and Development Fund, Educational Research Foundation, Great Lakes Fishery Commission, Greater Minnesota Corp., MacArthur Foundation, Menominee Indian Tribe of Wisconsin, MN Dept. of Natural Resources Natural Heritage Program, National Coastal Research Institute, National Marine Fisheries Service, National Sea Grant, National Science Foundation, Natural Resources Research Institute (U of MN), North Central Regional Aquaculture Center (USDA), Pew Fellows Program in Marine Conservation, Small Business Innovative Research Program (USDA), Western Regional Aquaculture Center (USDA), National Research Initiative (USDA), Agricultural Research Service (USDA), USDA NIFA.

Manuscript Reviews

Journals - Aquaculture, BioScience, Bulletin of Marine Science, Canadian Journal of Fisheries & Aquatic Sciences, Canadian Journal of Zoology, Conservation Biology, Ecology, Ecological Applications, Ecology and Society, Fish and Fisheries (Blackwell Scientific), Fisheries, Journal of Heredity, Industrial Biotechnology, Invasion Biology, Journal of Responsible Innovation, Lake and Reservoir Management, Marine Ecology Progress, Nature Biotechnology, North American Journal of Fisheries Management, PLOS One, Proceedings of the National Academy of Science, Progressive Fish Culturist, Science, Transactions of the American Fisheries Society, Transgenic Research

Books – Engineering Trouble: Biotechnology and its Discontents (several chapters) for U.C. Berkeley Press

Organizations - Binational Agricultural Research and Development Fund, Ecological Society of America, Environmental Defense, Millennium Ecosystem Assessment, Union of Concerned Scientists, U.S. Congress Office of Technology Assessment, World Wildlife Fund & Monterey Bay Aquarium

Campus Activities and Committees

UC Santa Cruz

Institute of Marine Sciences, Strategy Advisory Committee, 2020 -
Coastal Science and Policy Program, chair of Admissions, Executive, and Core Faculty Committees, 2018-

Keeley Coastal Scholarship Selection Committee, member, 2019

Personnel Committee, Environmental Studies Department, 2019 -

Dartmouth College

Sustainability Food Working Group, Co-Chair, 2017-2018

Member, Sustainability Task Force, Member, 2016-2017

Graduate Program in Ecology, Evolution, Ecosystems and Society, Faculty Member since 2015

Energy Systems Faculty Search Committee, Member, Thayer School of Engineering, 2015

Committee on Priorities, Member 2014-2015

Curriculum Review Committee, Member 2012-2014

President Search Committee, Member 2012

Council of Interdisciplinary Programs, Science Division Council, Committee of Chairs, 2011-14

Energy Faculty Search Committee, Member, Thayer School of Engineering 2010-2011

Sustainability Steering Committee Member and Co-Chair of Learning and Culture Working Group, 2011-2012

Cross-departmental team to develop undergraduate sustainability curriculum, Chair, 2009-2010

Sustainability Office Director Search Committee, Member, 2010

Sustainable Living Center, Advisory Committee, Member, since 2010

Resource Working Group, Member, 2009-2011

1984 -1991 (University of Minnesota): Five faculty position search committees, two center director search committees, and 24 additional committees at department, college, or university level

Departmental Committees (University of Minnesota)

New Faculty Positions 2007-2008; Social 2003-2006; Chair, Faculty Search in Biotechnology and the Environment 2002-2003; Long Range Planning and Space; Department Head Search 2000-2001; Chair, Kolshorn Endowed Lecture 1999; Member, Kolshorn Lecture 2000; Co-chair Seminar 1994-1995; Chair, Fisheries Faculty Position Search 1992; Promotion and Tenure 1989-2009

College Committees (University of Minnesota)

Environmental Sciences, Policy and Management Faculty 2006-2009; Dean Search 2002; Promotion and Tenure 2005, 2001, 2000, 1998, 1997, 1995 (Chair), 1994, 1992; Chair, Human Dimensions Position Evaluation 1997; Natural Resources and Environmental Studies Faculty 1990-2006; Dean's Review 1996; Curriculum 1995

University-level Committees (University of Minnesota)

Sustainability Goals and Outcomes Committee (advisory to the President), 2008-2009
Sustainability Education and Outreach Work Team Co-Chair, 2008-2009
Institute on the Environment, Governance Committee & Associate Director Search Committee, 2007-2008
Admissions Committee Chair, IGERT Traineeships in Risk Analysis of Introduced Species and Genotypes, 2007-2009
Institute on the Environment Blueprint Committee, 2006
Strategic Repositioning Task Force (on merger of two colleges), 2005-2006
Water Resources Center, Advisory Committee, 2001-2009
University Commission on Environmental Science and Policy, 2000-2002
Geography Department Faculty Search Committee, 1997
Rosemount Landscape and Community Development Task Force, 1997-1998
Minnesota Institute for Sustainable Agriculture, Joint Seminar, 1996-1998
Urban and Regional Planning Graduate Program Task Force, 1996-1997
MacArthur Interdisciplinary Program on Global Change, Sustainability, and Justice
Scholarship Selection 2000-2005; Scholarship Screening 1999; African Dissertator's Workshop, 1997-98; Doctoral Dissertation Grants, 1996-97; Executive Advisory Committee, 1996-2005; Field Work Grants, 1995; Sustainable Societies Initiative (chair), 1995; Steering, since 1994; Winter '95 Workshop Planning, 1994-1995
Conservation Biology Graduate Program
Doctoral Preliminary Exam Committee, 2005; Curriculum Review for Merger Proposal, 2001; Curriculum Committee Chair, 1995-98; Curriculum, 1993-94; Advisory Committee on Environmental Courses 1992; Admissions, 1990-1992, 1995.
Sustainability Studies Undergraduate Minor
Chair, Curriculum Committee 2008 – June 2009

Consulting

Tesco Fresh and Easy, advice on assessment of sustainable aquaculture products, 2007-2008
Headwaters Group, advice on evaluation of grant programs in marine conservation, 2007
Millennium Science Initiative, Government of Chile, reviewer of biotechnology research, 2000
Montgomery Watson, genetics advisor for design of salmon hatchery audits, 1996
Bonneville Power Administration, fish genetics advisor, 1991-1992, 1994
Northwest Power Planning Council, evaluation of genetic policies of fisheries agencies in the Columbia River Basin; review of genetic conservation planning documents, 1990-1992
Pacific Aqua Foods, Ltd., Vancouver, B.C., Canada, developed chinook salmon selective breeding program and provided advice for its implementation, 1988
Wisconsin DNR Salmonid Broodstock Committee, provided advice on incorporation of genetic principles into broodstock development for hatchery stocking programs, 1988

Publications

Peer-reviewed Articles (# for articles with leading lab's senior author listed last)

Sarker P.K., **Kapuscinski, A.R.** Vandenberg G.W., Proulx E., Sitek A.J. (2020). Towards sustainable and ocean-friendly aquafeeds: Evaluating a fish-free feed for rainbow trout

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Students, Post-docs, and Other Research Staff Supervised

University of California, Santa Cruz

- 1 Graduate Program Administrator
- 1 PhD student (major advisor) in Environmental Studies
- Coastal Science and Policy Program: 5 MS student (capstone faculty advisor) and 13 MS students capstone design advisor

Dartmouth College

- 1 senior research associate in sustainable fish nutrition; 2 research assistant professors (integrated food energy systems, sustainable aquafeeds); 1 senior research associate in integrated food energy systems and editing management of Sustainability Transitions domain of *Elementa*
- Ph.D. students: 2 in Ecology and Evolutionary Biology (EEES focus).
- 34 undergraduate researchers (most won college-level scholarships), advised 4 seniors on thesis research, currently advising 3 seniors on thesis research
- 8 post-baccalaureate research assistants

University of Minnesota

- Ph.D. and M.S. students: Major advisor of 13 in Fisheries, major co-advisor of 2 in Fisheries, major advisor of 8 and major co-advisor of 2 students in Conservation Biology, major co-advisor of 1 in Energy and Resources (U.C. Berkeley)
- 16 undergraduate students in Undergraduate Research Programs
- 7 high school students in summer or academic year research
- 7 Research Associates (6 at post-doctorate level)
- 7 Research Technicians or Research Assistants (who are not my major advisees)
- 4 Office and Research Assistants at ISEES