Dr. Lisa Nadine Saba Shama
Alfred-Wegener-Institut Helmholtz-Zentrum für Polar- und Meeresforschung
Wadden Sea Station Sylt, 25992 List, Germany
Phone: + 49 (0)4651 956 4204 ; Fax: + 49 (0)4651 956 200
E-mail: Lisa.Shama@awi.de

RESEARCH STATEMENT

I am an evolutionary ecologist with interests and experience in aquatic ecology, evolutionary biology, population genetics, quantitative genetics, epigenetics and non-genetic inheritance, using insects and fish as model systems. My research focuses on evolutionary potential, adaptive responses to rapid environmental change, the underlying mechanisms, and implications for population persistence.

ACADEMIC EDUCATION

2002-2006 **Doctor of Science ETH Zürich**, Department of Aquatic Ecology, EAWAG/ETH Zürich, *'Population persistence in temporary streams: plasticity and gene flow in an alpine caddisfly'*, under the supervision of PD Dr. Christopher Robinson.

1999-2002 **Master of Science**, Department of Biology, University of Victoria, Canada, *'Functional redundancy of stream insect detritivores: an experimental test'*, under the supervision of Dr. Richard Ring (UVic) and Dr. John Richardson (UBC).

1995-1998 Post-undergraduate studies (part-time), Department of Biology, University of Victoria. Study areas: entomology, invertebrate adaptations, phycology, and ecological statistical methods.

1989-1994 **Bachelor of Science Honours**, Department of Biology, Queen's University, Kingston, Canada. Study areas: ecology and evolutionary biology. Honours project: *'Reverse plumage dimorphism in polyandrous shorebirds'*, under the supervision of Dr. Raleigh Robertson.

RESEARCH ACTIVITIES

2018-present Senior Scientist: Coastal Ecology Section, AWI Wadden Sea Station – Sylt, Germany. *Non-genetic sources of phenotypic variation and adaptive potential of coastal populations.*

2016-2017 Postdoc (100%): Section of Coastal Ecology, AWI Wadden Sea Station – Sylt, Germany. *Genetic and non-genetic responses to rapid climate change in marine stickleback and implications for ecosystem function.*

2013-2015 Postdoc (50%): Section of Coastal Ecology, AWI Wadden Sea Station – Sylt, Germany. *Evolutionary potential and transgenerational plasticity of marine stickleback.*

2010-2012 Postdoc (50%): Evolutionary Ecology of Fishes, GEOMAR, Kiel, Germany. *Evolutionary genetics of pathogen resistance in coastal ecosystems.*

2009 Postdoc (50%): Dept. of Experimental Ecology, ETH Zürich, Switzerland. *Marker development of MHC class IIB genes and metagenomics of European plaice.*

2008-2009 Postdoc (50%): Dept. of Aquatic Ecology, EAWAG, Zürich Switzerland. *Distribution, reproductive mode and clonal diversity of Dahlica triquetrella (Lepidoptera; Psychidae).*

2007-2008 Postdoc (100%): Laboratory of Aquatic Ecology and Evolutionary Biology, Leuven Belgium. *Intraspecific temperature related latitudinal variation and evolutionary potential of growth rates using the damselfly Ishnura elegans as a model system.*

2002-2006 PhD: Dept. of Aquatic Ecology, EAWAG, Zürich Switzerland. *Population persistence in temporary streams: plasticity and gene flow in an alpine caddisfly.*

1999-2002 Masters: Dept. of Biology, University of Victoria, Victoria Canada. *Functional redundancy in stream detritivores: an experimental test.*

1996-1997 Research Assistant: Aqua-Tex Scientific Consulting Ltd. Victoria Canada. Field sampling of freshwater, benthic macroinvertebrates, riparian habitat characterization, taxonomic identification of invertebrate specimens, analysing data, writing final reports, and presenting technical information to senior biologists and government officials.

TEACHING AND MENTORING

2020-2023 PhD committee (Sarah Kempf, AWI) "Adaptive potential of the Arctic keystone species Polar cod in a changing ocean: linking transcriptomic plasticity and epigenetic patterns to species performance in specific life stages and populations".

2019-2022 PhD committee (Aruna Shankregowda, Nord University, Norway) "Genetic and non-genetic adaptation in stickleback fishes".

2017-2020 PhD committee (Daniel Liesner, AWI) "Impact of temperature within and across generations on populations and life cycle stages of kelps".

2019 Co-supervision of Master´s Thesis project (Neal Scheraga, Universtity of Algarve) entitled "(Epi)genetic diversity of oceanic stickleback populations along a temperate to arctic latitudinal gradient".

2019 Co-supervision of Bachelor Thesis project (Carl Bukowski, FU Berlin) entitled "Transgenerational plasticity and eco-evolutionary dynamics".

2016 Co-supervision of Master´s Thesis project (Sylvia Wanzenböck, University of Vienna) entitled "Assortative mating by plate morph and thermal acclimation history in marine sticklebacks".

2016 Co-supervision of Master´s Thesis project (Lukas Fuxjäger, University of Vienna) entitled "Adaptive significance of transgenerational plasticity in the wild".

2008 Co-supervision of Master's Thesis project (Karen Kubow, Department of Aquatic Ecology, EAWAG/ETHZ) entitled "Shifting genetic structure of an alpine caddisfly in response to environmental change".

2002-2006 Teaching Assistant, Department of Aquatic Ecology, EAWAG/ETHZ. I taught undergraduate and diploma students aquatic and terrestrial ecosystem field sampling techniques, aquatic invertebrate taxonomy and ecology, basic statistics, and laboratory methods of ecological genetics.

1997-2002 Laboratory Instructor/Teaching Assistant, Department of Biology, University of Victoria. I taught undergraduate students the laboratory component of several full-semester courses: Biol.313 (Economic Entomology), Biol.215 (Ecology), and Biol.210 (Diversity). I also gave lectures to senior undergraduate and graduate students in Biol.412 (Advanced Entomology).

PUBLICATIONS

26. **Shama LNS**, Donelson JM, Eirin-Lopez JM and Ravasi T (2022) Editorial: Adaptation and phenotypic plasticity to climate change. (Special Issue: Adaptation and phenotypic plasticity to climate change) *Frontiers in Marine Science* 9:893117 doi: 10.3389/fmars.2022.893117

25. Wanzenböck S, Fuxjäger L, Ringler E, Ahnelt H and **Shama LNS** (2022) Temperature-dependent reproductive success of stickleback lateral plate morphs: implications for population polymorphism and range shifts under ocean warming. (Special Issue: Adaptation and phenotypic plasticity to climate change) *Frontiers in Marine Science* 9:759450 doi: 10.3389/fmars.2022.759450
24. Fellous A, Wegner KM, John U, Mark FC and **Shama LNS** (2022): Windows of opportunity: ocean warming shapes temperature-sensitive epigenetic reprogramming and gene expression across gametogenesis and embryogenesis in marine stickleback. *Global Change Biology* 28: 54-71. doi.org/10.1111/gcb.15942
23. Adrian-Kalchhauser I, Sultan SE, **Shama LNS**, Spence-Jones H, Tiso S, Keller Valsecchi CI and Weissing FJ (2021) Inherited gene regulation unifies molecular approaches to non-genetic inheritance: Response to Edelaar et al. *Trends in Ecology and Evolution* 36: 477. doi.org/10.1016/j.tree.2021.03.004
22. Adrian-Kalchhauser I, Sultan SE, **Shama LNS**, Spence-Jones H, Tiso S, Keller Valsecchi CI and Weissing FJ (2020) Understanding non-genetic inheritance: Insights from molecular-evolutionary crosstalk. *Trends in Ecology and Evolution* 35: 1078-1089. doi.org/10.1016/j.tree.2020.08.011
21. Liesner D, **Shama LNS**, Diehl N, Valentin K and Bartsch I. (2020) Thermal plasticity of the kelp *Laminaria digitata* (Phaeophyceae) across life cycle stages reveals the importance of cold seasons for marine forests. *Frontiers in Marine Science* 7: 456. doi: 10.3389/fmars.2020.00456
20. Fellous A and **Shama LNS** (2019) Genome survey of chromatin-modifying enzymes in threespine stickleback: a crucial epigenetic toolkit for adaptation? (Special issue: Marine Environmental Epigenetics) *Frontiers in Marine Science* 6: 721. doi.org/10.3389/fmars.2019.00721
19. Feis ME, Goedknegt MA, Arzul I, Chenuil A, den Boon O, Gottschalck L, Kondo Y, Ohtsuka S, **Shama LNS**, Thieltges DW, Wegner KM and Luttikhuizen PC (2019). Global invasion genetics of two parasitic copepods infecting marine bivalves. *Scientific Reports* 9: 12730. doi.org/10.1038/s41598-019-48928-1
18. Fuxjager L, Wanzenböck S, Ringler E, Wegner KM, Ahnelt H and **Shama LNS** (2019) Within-generation and transgenerational plasticity of mate choice in oceanic stickleback under climate change. *Philosophical Transactions of the Royal Society* **374:** 20180183.
17. Donelson JM, Salinas S, Munday PM and **Shama LNS** (2018) Transgenerational plasticity and climate change experiments: where do we go from here? *Global Change Biology* **24:** 13-34.
16. **Shama LNS** (2017) The mean and variance of climate change in the oceans: hidden evolutionary potential under stochastic environmental variability in marine sticklebacks. *Scientific Reports* **7:** 8889.
15. **Shama LNS**, Mark FC, Strobel A, Lokmer, A, John, U and Wegner KM (2016) Transgenerational effects persist down the maternal line in marine sticklebacks: gene expression matches physiology in a warming ocean. *Evolutionary Applications* **9:** 1096-1111.
14. **Shama LNS** (2015) Bet-hedging in a warming ocean: predictability of maternal environment shapes offspring size variation in marine sticklebacks. *Global Change Biology* **21:** 4387-4400.
13. **Shama LNS** & Wegner KM (2014) Grandparental effects in marine sticklebacks: transgenerational plasticity across multiple generations. *Journal of Evolutionary Biology* **27**: 2297-2307.
12. **Shama LNS**, Strobel A, Mark FC and Wegner KM (2014) Transgenerational plasticity in marine sticklebacks: maternal effects mediate impacts of a warming ocean. *Functional Ecology* **28**: 1482-1493.

11. Schade FM, **Shama LNS** and Wegner KM (2014) Impact of thermal stress on evolutionary trajectories of pathogen resistance in three-spined stickleback (Gasterosteus aculeatus). *BMC Evolutionary Biology* **14**: 164.
10. Ramler D, Mitteroecker P, **Shama LNS**, Wegner KM & Ahnelt H (2014) Non-linear effects of temperature on body form and developmental canalization in the threespine stickleback. *Journal of Evolutionary Biology* **27:** 497-507.
9. Elzinga JA, Jokela J and **Shama LNS** (2013) Large variation in mitochondrial DNA of sexual and parthenogenetic Dahlica triquetrella (Lepidoptera: Psychidae) shows multiple origins of parthenogenesis. *BMC Evolutionary Biology* **13:** 90.
8. Wegner KM, **Shama LNS**, Kellnreiter F & Pockberger M (2012) Diversity of immune genes and associated microbes of European plaice *Pleuronectes platessa* in the Sylt-Romo bight. *Estuarine Coastal and Shelf Science* **108**: 87-96.
7. **Shama LNS**, Kubow KB, Jokela J and Robinson CT (2011) Bottlenecks drive temporal and spatial genetic responses in alpine caddisfly metapopulations. *BMC Evolutionary Biology* **11:** 278.
6. **Shama LNS**, Campero-Paz M, Wegner KM, De Block M and Stoks R. (2011) Latitudinal and voltinism compensation shape thermal reaction norms for growth rate. *Molecular Ecology* **20:** 2929-2941.
5. Robinson CT, Jolidon C and **Shama LNS** (2011) Scales of patchiness in the response of lotic macroinvertebrates to disturbance in a regulated river. *Journal of the North American Benthological Society* **30(2)**: 374-385.
4. Kubow KB, Jokela J, **Shama LNS** and Robinson CT (2010) Spatial scaling in the phylogeography of an alpine caddisfly, *Allogamus uncatus*, within the central European Alps. *Journal of the North American Benthological Society* **29(3)**: 1089-1099.
3. **Shama LNS** and Robinson CT (2009) Microgeographic life history variation in an alpine caddisfly: plasticity in response to seasonal time constraints. *Freshwater Biology* **54**: 150-164.
2. **Shama LNS**, Kubow KB and Robinson CT (2009) Ten polymorphic microsatellite loci isolated from the alpine caddisfly *Allogamus uncatus* Brauer (Trichoptera: Limnephilidae). *Molecular Ecology Resources* **9**: 285-287.
1. **Shama LNS** and Robinson CT (2006) Sex-specific life history responses to seasonal time constraints in an alpine caddisfly. *Evolutionary Ecology Research* **8**: 169-180.

IN PREPARATION

Bukowski C, Fritscher D, Leubner, N, and **Shama LNS** (*in prep*) Within- and across generation plasticity effects on eco-evolutionary dynamics in subtidal communities.

Fellous A, Wegner KM, John U, Mark FC and **Shama LNS** (*in prep*) Whole genome methylation responses to ocean warming across gametogenesis and embryogenesis in marine stickleback

NON-REFEREED publications

Shama LNS (2007) *Population persistence in temporary streams: plasticity and gene flow in an alpine caddisfly*. PhD thesis # 16959 ETH Zürich, Switzerland.

Shama LNS (2002) *Functional redundancy of congeneric stream insect detritivores: an experimental test.* MSc. thesis, University of Victoria, Victoria, Canada.

Barraclough C.L, Lucey WP, LaCas BD, **Shama LNS**, and Hunchuk JMD (1997) *Forest Renewal B.C. operational inventory of water quality, toxics and water quantity for Squamish and*

Lillooet drainages. Final report. Prepared by Aqua-Tex Scientific Consulting Ltd. and LaCas Consultants Inc. for the B.C. Ministry of Environment, Lands and Parks.

COMPETITIVE RESEARCH FUNDING and AWARDS

2020	AWI (Alfred Wegener Institute) INSPIRES project for "Do you remember? Epigenetic and ecological memory to climate variability and extremes". 300 000€
2019	Norwegian Ministry of Education and Research / Nord University for project "Genetic and non-genetic adaptation in stickleback fishes". 270 000 NOK
2017	AWI (Alfred Wegener Institute) Strategy Funds Initiative for project "Coping with climate change via epigenetics: linking methylomes, transgenerational plasticity and eco-evolutionary dynamics in North and Arctic Sea stickleback populations". 313 000€
2015	Best Young Researcher Presentation ASLO 2015 Session: "Evolutionary effects of ocean warming and acidification". 500€
2012	Volkswagen Stiftung Grant for Symposium "Evolutionary potential in marine populations workshop". 14 500€
2012	EUR-OCEANS Consortium Foresight Workshop Grant for "Evolutionary potential in marine populations workshop". 14 500€
2007-2008	SNF (Swiss National Science Foundation) Postdoctoral Fellowship "Evolutionary and functional ecology of thermal reaction norms of growth rates across a latitudinal gradient". 39 000 CHF
2004	Boesel-Sanderson Endowment Award for Research in Natural History, North American Benthological Society (NABS). 600 USD
2004	Swiss Zoological Society International Conference Travel Award. 2000 CHF
2001	NABS Endowment Research Award (MSc). 500 USD
2001	NABS Conservation and Environmental Issues Award. 500 USD
2001	NABS Student Travel Award (Basic Research). 500 USD
2000-2002	President's Research Scholarship, University of Victoria. 4000 CDN
1999-2001	NSERC (Natural Science and Engineering Research Council of Canada) Industrial Postgraduate Scholarship. 30 000 CDN

SCIENTIFIC SOCIETY AFFILIATIONS

1. American Society of Limnology and Oceanography (ASLO). 2011-present: Member
2. European Society for Evolutionary Biology (ESEB). 2009-present: Member
3. North American Benthological Society (NABS). 2003-2004 President of the Graduate Resources Committee (GRC), 2004-2005 GRC Representative to the Executive Committee, 2003-present Journal Referee for JNABS / Freshwater Science, 2000-2009: Member.
4. Swiss Zoological Society. 2003-2010: Member.

REVIEWER & EDITORIAL SERVICE

Journals: Ecology Letters, Global Change Biology, Evolutionary Applications, Functional Ecology, Molecular Ecology, Journal of Animal Ecology, Journal of Thermal Biology, Scientific Reports, Frontiers in Marine Science, Ecography, Oecologia, Axios, Ecological Entomology, Freshwater Science (JNABS), Aquatic Sciences.
Grants: NERC (Natural Environment Research Council, UK), NSF (National Science Foundation, USA), COFUND, FR (EU Bienvenüe Project), MCID University of Bern, CH

Editorial Board Member: Scientific Reports, Frontiers in Marine Science (Special Issue: Adaptation and Phenotypic Plasticity to Climate Change)

CONFERENCE PRESENTATIONS (selected)

2019 *Epigenetic reprogramming during gametogenesis and embryogenesis of threespine stickleback: windows for adaptation to climate change?* (invited talk) Causes and Consequences of Inclusive Inheritance, Plön, Germany

2019 *Epigenetic reprogramming during gametogenesis and embryogenesis of threespine stickleback: windows for adaptation to climate change?* (Poster). ESEB (European Society for Evolutionary Biology) Turku, Finland.

2018 *Coping with ocean climate change via epigenetics in marine stickleback* (**invited speaker**). Gordon Research Conference: Ocean Global Change Biology, Waterville NH, USA

2018 *Coping with ocean climate change: transgenerational plasticity, bet-hedging and cryptic genetic variation in marine stickleback* (**invited speaker**). Marine Evolution Conference, Strömstad, Sweden

2017 *Coping with ocean climate change: transgenerational plasticity, bet-hedging and cryptic genetic variation in marine sticklebacks.* ESEB (European Society for Evolutionary Biology) Groningen, Netherlands.

2015 *Acute vs. developmental acclimation shapes parental and grandparental effects of ocean warming on marine sticklebacks.* ASLO (American Society of Limnology and Oceanography) Granada, Spain

2013 *Transgenerational plasticity in marine sticklebacks: maternal effects mediate impacts of a warming ocean* (Poster). ESEB (European Society for Evolutionary Biology) Lisbon, Portugal

2012 *Transgenerational plasticity in marine sticklebacks: maternal thermal environment matters most* (Poster). Evolutionary Potential in Marine Populations Workshop, Sylt Germany.

2011 *Evolutionary potential and thermal reaction norms of marine host-par*asite *interactions* (Poster). ASLO (American Society of Limnology and Oceanography) Puerto Rico

2010 *Latitudinal and voltinism compensation shape thermal reaction norms for growth rate.* Evolutionary Potential in Natural Populations Workshop, Sandbjerg, Denmark.

2009 *Phenotypic and genetic responses to environmental change in an alpine caddisfly metapopulation* (Poster). ESEB (European Society for Evolutionary Biology) Torino, Italy

2006 *Contrasting patterns of divergence in quantitative traits and neutral DNA markers in an alpine caddisfly.* NABS (North American Benthological Society) Alaska, USA

2005 *Microgeographic life history variation in an alpine caddisfly: local adaptation or phenotypic plasticity?* SEFS 4 (Symposium for European Freshwater Sciences) Krakow, Poland

2005 *Glacier retreat = temporary streams = species extinction?* (Poster) 6th Swiss Global Change Day, Bern, Switzerland

2005 *Sex-specific life history responses to seasonal time constraints in an alpine caddisfly,* (Poster) 4th International Symposium on Ecological Genetics, Antwerp Belgium

2004 *Does lake order influence lotic macroinvertebrate community composition in a high alpine stream/lake network?* Interdisciplinary Mountain Research - Young Scientists Conference, Stelvio National Park, Sudtirol

2004 *Life history plasticity of an alpine caddisfly: environmental cues signaling an approaching time horizon.* NABS, Vancouver, Canada

2003 *Adaptations to alpine temporary streams: Life history plasticity, dispersal and population genetic structure of the alpine caddisfly Allogamus uncatus (Brauer).* 9th Meeting of PhD Students in Evolutionary Biology, Fiesch, Switzerland