

# Nina Overgaard Therkildsen

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## Education

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- Ph.D. in Population Genetics. Section for Population Ecology and Genetics, National Institute of Aquatic Resources (DTU Aqua), Technical University of Denmark, 2012
- M.Sc. in Biology, Section for Ecology and Evolution, University of Copenhagen, Denmark, 2009
- B.A. in Human Ecology, College of the Atlantic, Maine, USA, 2005

## Professional appointments and affiliations

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- Assistant Professor, Department of Natural Resources, Cornell University, 2016 -
- Postdoc, Hopkins Marine Station, Stanford University, USA (advisor: Stephen R. Palumbi), 2013 -
- Postdoc, Section for Population Ecology and Genetics, DTU Aqua, Denmark (advisor: Einar Eg Nielsen), 2012 (four months)
- Affiliated Researcher, Greenland Climate Research Centre, 2010-2014

## Research grants

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- Grant co-written with Stephen R. Palumbi for expanding postdoctoral research project: "High resolution genome changes during evolution in a classic fisheries experiment". National Science Foundation, Division of Ocean Sciences (635,000 USD), 2014-2017
- Two-year postdoc fellowship from the Villum Foundation (Denmark) for research at Stanford University (~250,000 USD), 2013-2014
- Principal Investigator: "Development of genetic tools to separate Greenland's cod stocks". The Commission on Scientific Investigations in Greenland (~40,000 USD), 2012
- Co-Investigator (with PI Einar Eg Nielsen and four other collaborators): "The Atlantic cod in Greenland: past and future under climate change". Greenland Climate Research Center (~430,000 USD), 2010-2014

## Scholarships, awards, and honors

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- Fellow, Stanford Rising Environmental Leaders Program, USA, 2014
- Jorck Foundation Research Award (~35,000 USD), Denmark, 2013
- 1 of 8 winners, PhD Cup (Danish science communication contest broadcast on national TV), 2013
- Young Researcher Award (given to six Ph.D. graduates for outstanding research contributions and potential for future development), Technical University of Denmark, 2012
- Member of the seven-person Scientific Steering Committee for the ICES/PICES Early Career Scientists Conference (108 fully funded participants), Palma de Mallorca, Spain, 23-27 April 2012
- Invited participant, synthesis meeting of the NCEAS Distributed Graduate Seminar on Landscape Genetics. Santa Barbara, California, USA, May 24-28 2010 (~2,000 USD)
- EliteForsk travel grant from the Danish Ministry of Science (~50,000 USD), 2011
- Oticon scholarship to support M.Sc. work (~17,000 USD), Denmark, 2007
- Daniel H. Kane, Jr. Award. "For outstanding work in conservation and environmental law at College of the Atlantic", USA, 2005



- Four-year full Shelby Davis scholarship for College of the Atlantic, Maine, USA, 2001-2005
- Two-year full scholarship for Red Cross Nordic United World College, Norway, 1998-2000

## Research experience

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### **Postdoc, Hopkins Marine Station, Stanford University, USA, 2013-present**

Assembling a reference transcriptome and using low coverage whole genome sequencing to characterize the genomic signature of fisheries-induced evolution in experimental samples of Atlantic silversides (*Menidia menidia*). Advisor: Professor Stephen R. Palumbi

### **Postdoc, Section for Population Ecology and Genetics, DTU Aqua, Denmark, 2012 (four months)**

Developed a molecular tool for assigning Atlantic cod (*Gadus morhua*) to their population of origin and collaborated with resource managers to implement the tool for stock assessment in Greenland. Advisor: Professor Einar Eg Nielsen

### **M.Sc. and Ph.D. Student, Section for Population Ecology and Genetics, DTU Aqua, Denmark, 2007-2012**

Used molecular analysis of historical DNA extracted from archived samples of Atlantic cod (*Gadus morhua*) to study historical demography and identify molecular signatures of natural and human-induced selection in time and space. Primary advisor: Professor Einar Eg Nielsen

### **Visiting Researcher, Hopkins Marine Station, Stanford University, USA, 2011 (six months)**

Developed a statistical method for identifying loci under selection from temporal genetic samples and assisted with preparation of a guide for RNA-Seq data analysis. Host: Professor Stephen R. Palumbi

### **Visiting Researcher, Centre for Geogenetics, University of Copenhagen, Denmark, 2010 (three months)**

Compared DNA extraction methods for degraded DNA and used ancient DNA laboratory facilities for work with historical samples. Host: Professor Thomas J. Gilbert

### **Student Research Assistant, Greenland Institute of Natural Resources, 2007-2009 (~one month each year)**

Participated in research surveys at sea, assisted with species identification, fish and invertebrate sample processing, and data management. Supervisor: Helle Siegstad

### **Student Research Assistant, College of the Atlantic, Maine, USA, 2003-2005**

Assisted with underwater population surveys on the orange-footed sea cucumber, *Cucumaria frondosa*, and developed an overview of emerging fisheries for this species throughout its range. Supervisors: Professors Chris W. Petersen and Helen Hess

### **Research Intern, Mount Desert Island Biological Laboratory, Maine, USA, 2004 (summer)**

Assisted with planning and execution of field and laboratory studies on the reproductive ecology and behavior of the mummichog, *Fundulus heteroclitus*. Supervisor: Professor Chris W. Petersen

### **Research intern, WorldFish Center, Penang, Malaysia, 2003 (summer)**

Responsible for a project on comparing coral reef monitoring protocols. Supervisor: Marco Noordeloos

### **Semester Student, School for Field Studies, Turks and Caicos Islands, 2002 (5 months)**

Assisted with underwater field surveys on coral reefs for a range of research projects. Center Director: Dave Wilson

## Publications

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- Bonanomi, S., Pellissier, L., **Therkildsen, N. O.**, Hedeholm, R. B., Retzel, A., Meldrup, M., Olsen, S. M., Nielsen, A., Pampoulie, C., Hemmer-Hansen, J., Wisz, M. S., Grønkjær, P., Nielsen, E. E. *accepted*. Archived DNA reveals fisheries and climate induced collapse of a major fishery. Nature Scientific Reports



- Hemmer-Hansen, J., **Therkildsen, N. O.**, and Pujolar, J. M. 2014. Population genomics of marine fishes: next generation prospects and challenges. *The Biological Bulletin* 227:117-132.
- Bonanomi, S., **Therkildsen, N. O.**, Hedeholm, R. B., Hemmer-Hansen, J., and Nielsen, E. E. 2014. The use of archived tags in retrospective genetic analysis of fish. *Molecular Ecology Resources* 14:616-621.
- Hemmer-Hansen, J., **Therkildsen, N. O.**, Meldrup, D. and Nielsen, E. E. 2014. Conserving marine biodiversity: insights from life-history trait candidate genes in Atlantic cod (*Gadus morhua*). *Conservation Genetics* 15:213-228.
- Laugen, A. T., Engelhard, G. H., Whitlock, R., Arlinghaus, R., Dankel, D. J., Dunlop, E. S., [...], **Therkildsen, N. O.**, et al. 2014. Evolutionary impact assessment: accounting for evolutionary consequences of fishing in an ecosystem approach to fisheries management. *Fish and Fisheries* 15:65-96.
- Heino, M., Baulier, L., Boukal, D. S., Ernande, B., Johnston, F. D., Mollet, M., [...], **Therkildsen, N. O.** et al. 2013. Can fisheries-induced evolution shift reference points for fisheries management? *ICES Journal of Marine Science* 70:707-721.
- Hemmer-Hansen, J., Nielsen, E. E., **Therkildsen, N. O.**, Taylor, M. I., Ogden, R., Geffen, A., Bekkevold, D., Helyar, D., Pampoulie, C., Johansen, T., FishPopTrace Consortium, and Carvalho, G. R. 2013. A genomic island linked to ecotype divergence in Atlantic cod. *Molecular Ecology* 22: 2653-2667.
- **Therkildsen, N. O.**, Hemmer-Hansen, J., Hedeholm, R. B., Wisz, M., Pampoulie, C., Meldrup, D., Bonanomi, S., Retzel, A., Olsen, M. A., and Nielsen, E. E. 2013. Spatiotemporal SNP analysis reveals pronounced biocomplexity at the northern range margin of Atlantic cod *Gadus morhua*. *Evolutionary Applications* 6:690-705.
- **Therkildsen, N. O.**, Hemmer-Hansen, J., Als, T. D., Swain, D. P., Morgan, J., Trippel, E., Meldrup, D., and Nielsen, E. E. 2013. Microevolution in time and space: SNP analysis of historical DNA reveals dynamic signatures of selection in Atlantic cod. *Molecular Ecology* 22:2424-2440.
- Bothwell, H., Bisbing, S., **Therkildsen, N. O.**, Crawford, L., Alvarez, N., Holderegger, R., and Manel, S. 2013. Identifying genetic signatures of selection in a non-model species, alpine gentian (*Gentiana nivalis* L.), using a landscape genetic approach. *Conservation Genetics* 14:467-481.
- De Wit, P., Pespeni, M. H., Ladner, J. T., Barshis, D. J., Seneca, S., Jaris, H., **Therkildsen, N. O.**, Morikawa, M., and Palumbi, S. R. 2012. The Simple Fool's Guide to RNA-Seq: Gene expression and SNP data analysis in the age of high-throughput sequencing. *Molecular Ecology Resources* 12:1058-1067
- Behrens, J. W., Gräns, A., **Therkildsen, N. O.**, Neuenfeldt, S., and Axelsson, M. 2012. Correlations between hemoglobin type and temperature preference of juvenile Atlantic cod *Gadus morhua*. *Journal of Experimental Marine Biology and Ecology* 413: 71-77
- **Therkildsen, N. O.**, Nielsen, E. E., Swain, D. P., and Pedersen, J. S. 2010 Effective population size and temporal genetic stability in Atlantic cod (*Gadus morhua*) in the southern Gulf of St. Lawrence. *Canadian Journal of Fisheries and Aquatic Sciences* 67: 1585-1595
- **Therkildsen, N. O.**, Nielsen, E. E., Hüsey, K., Meldrup, M., and Geffen, A. J. 2010. Does DNA extraction affect the physical and chemical composition of historical cod (*Gadus morhua*) otoliths? *ICES Journal of Marine Science* 67:1251-1259
- **Therkildsen, N. O.** 2007. Small versus large-scale fishing operations in New England, USA. *Fisheries Research* 83:285-296
- **Therkildsen, N. O.** and Petersen, C. W. 2006. A review of the emerging fisheries for the sea cucumber *Cucumaria frondosa*: biology, policy, and future prospects. *Beche-de-Mer Information Bulletin* 23:16-25



## Invited talks

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- “Tracking genomic changes during rapid life history evolution in a non-model species with population-level whole genome sequencing”. Gordon Conference on Ecological and Evolutionary Genomics. Biddeford, Maine, USA. July 12-17 2015
- “Cryptic distribution shifts and genomic signatures of fisheries-induced evolution: insights from temporal genomic analyses of archived fish samples. Geomar, Kiel, Germany. October 23 2014 (host Thorsten Reusch)
- “Historical DNA reveals dynamic patterns of recent microevolution in overfished populations of Atlantic cod”. Department of Bioscience - Genetics, Ecology and Evolution, University of Aarhus, Denmark. December 13 2013 (host Michael Møller Hansen)
- “Historical DNA reveals dynamic patterns of recent microevolution in overfished populations of Atlantic cod”. Rapid Evolution and Sustainability Workshop. Columbus Ohio, USA. October 7-11 2013
- “Genetic tools for detecting population structure and monitoring past and present distribution patterns in marine fish: examples from Atlantic cod”. Young Scientists Symposium: Exchanging knowledge on novel approaches to studying marine organisms and ecosystems. Nagasaki University, Japan. July 23-24 2013 (host Yuuki Kawabata)
- “DNA from archived otoliths reveals cryptic distribution shifts and signatures of ongoing adaptation in Atlantic cod”. NOAA Southwest Fisheries Science Center, Santa Cruz, CA, USA. July 2 2013 (host Stephen Munch)

## Selected contributed conference presentations

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- **Therkildsen, N. O.**, Munch, S. B., Conover, D. O., and Palumbi, S. R. 2015. A Comprehensive Exome Scan for Signatures of Rapid Fisheries-Induced Evolution. Talk presented at the 145th Annual Meeting of the American Fisheries Society, August 16-20 2015, Portland, Oregon, USA
- **Therkildsen, N. O.**, Munch, S. B., Conover, D. O., and Palumbi, S. R. 2015. Tracking genomic changes during rapid life history evolution. Talk presented at the Congress of the European Society for Evolutionary Biology, August 10-14 2015, Lausanne, Switzerland
- **Therkildsen, N. O.**, Munch, S. B., Conover, D. O., and Palumbi, S. R. 2014. Genomic signatures of selection in a classic fisheries experiment. Talk presented at the Western Society of Naturalists. November 13-16 2014, Tacoma, WA, USA
- **Therkildsen, N. O.**, Munch, S. B., Conover, D. O., and Palumbi, S. R. 2014. Genomic signatures of selection in a classic fisheries experiment. Talk presented at the Evolution meeting. June 20-24 2014, Raleigh, North Carolina, USA
- **Therkildsen, N. O.**, Hemmer-Hansen, J., Hedeholm, R. B., Wisz, M., Pampoulie, C., Meldrup, D., Bonanomi, S., Retzel, A., Olsen, M. A., Nielsen, E. E. 2013. Spatiotemporal SNP analysis reveals cryptic distribution shifts and signs of ongoing adaptation at the northern range margin for Atlantic cod. Talk presented at the Evolution meeting. June 21-26 2013. Snowbird, Utah, USA
- **Therkildsen, N. O.**, Hemmer-Hansen, J., and Nielsen, E. E. 2011. Historical DNA reveals signatures of recent fisheries- or climate-induced evolution in Atlantic cod, *Gadus morhua*. Poster presented at the Gordon Research Conference on Ecological & Evolutionary Genomics. July 10-15, 2011, Biddeford, Maine, USA
- **Therkildsen, N. O.**, Hemmer-Hansen, J., and Nielsen, E. E. 2011. Klimaændringer og tidlig genetisk variation i torsk (*Gadus morhua*). 16. Danske Havforsker møde, January 18-20 2011, Fuglsøcentret, Denmark [**best student talk award**]
- **Therkildsen, N. O.**, Hemmer-Hansen, J. and Nielsen, E. E. 2010. Using historical DNA to study fisheries-induced genetic change in commercial fish stocks. Talk presented at the Oceans Past III Conference: Stories



from the sea - history of marine animal populations and their exploitation. November 18-20 2010, Dublin, Ireland

- **Therkildsen, N. O.**, Hemmer-Hansen, J. and Nielsen, E. E. 2010. Using historical DNA to study fisheries-induced genetic change in Atlantic cod (*Gadus morhua*). Talk presented at the ICES Annual Science Conference. September 20-24 2010, Nantes, France
- **Therkildsen, N. O.**, Hemmer-Hansen, J. and Nielsen, E. E. 2010. Using the candidate gene approach to study fisheries-induced evolution. Poster presented at the conference Evolutionary Potential in Natural Populations. April 11-14 2010, Sandbjerg, Danmark
- **Therkildsen, N. O.**, Nielsen, E. E., Swain, D. P, and Pedersen, J. S. 2009. Effective population size and temporal genetic stability in Atlantic cod (*Gadus morhua*) in the southern Gulf of St. Lawrence. Poster presented at the ESF Conservation Genetics Conference: Integrating Population Genetics and Conservation Biology. May 23-26 2009, Trondheim, Norway [**voted among the top three student posters**]

## Skills

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- Extensive molecular laboratory experience including DNA and RNA purification, microsatellite and SNP genotyping, and preparation of libraries for ddRAD-seq, RNA-seq and full genome sequencing
- Independently developed/adapted bioinformatic pipelines for analysis of RAD-seq data, de novo transcriptome assembly, and whole genome sequence data from non-model species using command line tools along with custom shell and python scripting
- Broad knowledge of population genetic analysis and general data analysis in R
- PADI Divemaster and extensive scientific diving experience

## Academic service

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- Co-organizer of a Software Carpentry Workshop. Stanford University, Summer 2015
- Peer-reviewer for the following journals: Molecular Ecology, Molecular Ecology Research, Conservation Genetics, Conservation Biology, BMC Genetics, Journal of Experimental Marine Biology and Ecology, Fisheries Research, Oceanologia, PeerJ, Journal of Fish Biology
- Initiator for establishment of a clean-lab dedicated to historical DNA work at the Section for Population Ecology and –Genetics, DTU Aqua, Silkeborg, Denmark
- Co-organizer of a two-day seminar on presentation skills for Ph.D. students. DTU Aqua, Charlottenlund, Denmark, January 13-14 2010
- Participant in the ICES Working Group on the Application of Genetics in Fisheries and Mariculture. Meeting in Cork, Ireland, May 5-7 2010
- Participant in the ICES Study Group on Fisheries-induced Adaptive Change. Meetings in Copenhagen January 21-25 2008 and April 1-3 2009

## Teaching experience

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- Guest lecturer. Marine conservation. California State University, Monterey Bay, February 2015
- Teaching assistant and guest lecturer. SNP analysis workshop, Hopkins Marine Station, Stanford University, June 6-11 2013
- Guest lecturer. Summer intern workshop. Hopkins Marine Station, Stanford University. July 2013



- One week intensive pedagogy course (“Teaching and learning”), DTU, November 2012
- Guest lecturer. Genetic methods in aquaculture. DTU Aqua, Denmark. January 2011
- Guest lecturer. Introduction to the fisheries component of DTU’s Masters program in Aquatic Science and Technology, Denmark. November 2010

### Media coverage of research (selected)

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- En torsk er ikke bare en torsk. Information (Danish national newspaper), May 8 2013 <http://www.information.dk/459827>
- Contestant in the PhD Cup (Danish science communication contest broadcast on national TV (DR2, Danish Broadcast Corporation), May 20 2013 <http://www.dr.dk/tv/se/ph-d-cup-2013/ph-d-cup-2013-det-danske-hjernemesterskab/>
- DNA analyser afslører torskens udvikling gennem 1900 tallet. Dr.dk (Danish Broadcast Corporation), May 8 2013 <http://www.dr.dk/Nyheder/Viden/phdcup/2013/05/08140122.htm>
- DNA test rewrites history of Greenland cod. ScienceNordic (Scandinavian popular science website), March 30 2013 <http://sciencenordic.com/dna-test-rewrites-history-greenland-cod>
- DNA-test omskriver torskens grønlandshistorie. Videnskab.dk (Danish popular science website). February 3, 2013 <http://tinyurl.com/q2wqzzq>
- Forsker i torskens DNA. Knr.gl (Greenland’s Broadcasting Corporation), October 30 2012. <http://www.knr.gl/da/nyheder/forsker-i-torskens-dna>
- DNA-test omskriver torskens grønlandshistorie. Polarfronten (Magazine on polar research), issue 3 2012, p.4-5 <http://www.e-pages.dk/polarfronten/7/4>
- Dansk forsker følger evolution 'tæt på live' over kun 15 generationer torsk. Ingeniøren (Danish national newspaper), August 28 2012 <http://ing.dk/artikel/dansk-forsker-folger-evolution-taet-pa-live-over-kun-15-generationer-torsk-131534>