

## Curriculum vitae with track record

### PERSONAL INFORMATION

Family name, First name: Bechmann, Renée Katrin

Date of birth: 15.05.1965

Sex: Female

Nationality: Norwegian

Researcher unique identifier(s):

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### KEY QUALIFICATIONS

I am a marine biologist, and my main area of research is experimental marine ecotoxicology. I have led a series of projects investigating the effects of pollution, ocean acidification and climate change by performing exposure experiments studying a broad range of effect parameters in fish and invertebrates, including northern shrimp, *Pandalus borealis*, a keystone species in the marine ecosystem.

### EDUCATION

*PhD (Dr. scient.)*. Disputation date: 23.10.1997. "Responses to toxic stress: life tables and reproductive parameters". Dept. of Marine Chemistry and Marine Zoology, Institute of Biology, University of Oslo, Norway. Main supervisor: John S. Gray. External supervisor: Jens Skei (NIVA).

*MSc/Cand. scient.* Dept. of Marine Chemistry and Marine Zoology, Institute of Biology, University of Oslo, Norway. Main subject candidate thesis: "Evaluering av subletale og akutte effekter av kobber på *Tisbe furcata* (Baird) (Copepoda) ved bruk av livstabeller og  $LC_{50}$ -tester". Cand. scient. thesis, University of Oslo, Norway, 1990. Supervisors: John S. Gray (main supervisor), Nils-Christian Stenseth and Jørgen Stenersen.

### CURRENT AND PREVIOUS POSITIONS

*2018-present* Current position: Senior Research Scientist (Forsker II) in the Ocean & Environment department of NORCE (Norwegian Research Centre AS), Stavanger, Norway. IRIS and several other institutes merged to NORCE in 2018.

*1997 – 2018* Senior Research Scientist in the Environment department of IRIS (International Research Institute of Stavanger AS, Norway).

*1991 – 1996* PhD fellowship at Dept. of Marine Chemistry and Marine Zoology, Institute of Biology, University of Oslo, Norway.

*1990 – 1991* Research assistant NIVA.

### TEACHING ACTIVITIES and SUPERVISION OF GRADUATE STUDENTS AND RESEARCH FELLOWS

As part of my PhD, I assisted in field courses (biology/marine biology) and gave lectures (marine biology/systematics). Dept. of Marine Chemistry and Marine Zoology, Institute of Biology, University of Oslo, Norway. Supervision of one PhD (Maj Arnberg, University of Plymouth, Marine Biology and Ecology Research Centre, Plymouth, England) and one MSc (Linda Bærheim, University of Stavanger, Faculty of Science and Technology Department of Mathematics and Natural Sciences).

## ORGANISATION OF SCIENTIFIC MEETINGS

As part of RCN project #267746 PestPuls I initiated and organized a workshop in 2017 including scientists, industry and management, 38 participants. Title: “*Are crustaceans living near aquaculture plants affected by the use of chemicals against salmon lice?*”. I also wrote a summary report from the workshop.

## PROJECT MANAGEMENT EXPERIENCE (project manager role only)

- 2021 Oksygenering av Hafrsfjord - En mulighetsanalyse. Miljødirektoratet.
- 2017-2019 PestPuls - Effects of pulsed exposures to combinations of pesticides used as anti-parasitic medicines in aquaculture. Funding: Research Council of Norway, MARINFORSK #267746.
- 2014-2016 FLUCLIM – Effects of diflubenzuron on Northern shrimps (*Pandalus borealis*) at ambient and future climate conditions. Funding: Research Council of Norway, HAVKYST #234407.
- 2014-2016 SeaSens - Seasonal variation in the Sensitivity of krill to oil. Funding: Research Council of Norway, HAVKYST #234291.
- 2012-2014 OAPPI - Effects of Ocean Acidification on Predator-Prey interaction (OAPPI). Funding: Research Council of Norway, HAVKYST #215589.
- 2009-2014 Combined effects of ocean acidification, climate change and oil related discharges. Funding: Research Council of Norway, NORKLIMA #200800.
- 2008 BioSea II – phase 2. Effects of oil on shrimp larvae. Part 2. Funding: TOTAL E&P Norge AS and ENI Norge.
- 2006-2008 Drilling mud follow up study - Input data and validation experiments for ERMS. Funding: Research Council of Norway, HAVKYST, project no. 173418.
- 2006-2008 ISP – Histology and genotoxicity. Funding: IRIS/RCN: Internal Strategy Program.
- 2006 BioSea II – Phase 1. Effects of produced water on wolffish larvae. Funding: TOTAL E&P. Norge AS and ENI Norge.
- 2004-2005 Impacts of drilling mud discharges on water column organism and filter feeding bivalves. Funding: Research Council of Norway, PROOF #159183. Stig Westerlund was project leader towards RCN, I was project leader towards IRIS.
- 2002- 2003 DREAM validation. Funding: TOTAL E&P Norge AS.

## COMMISSIONS OF TRUST

I have participated in the evaluation committee for three PhDs as second opponent:

- 2002 Magnus Breitholtz, University of Stockholm, Sweden.
- 2008 Liv-Guri Faksness, University Centre in Svalbard/University of Bergen, Norway.
- 2019 Brabro Taraldset Haugland, University of Oslo, Norway

## MAJOR COLLABORATIONS in projects funded by the Research Council of Norway

- *Effects of antiparasitic chemicals used in aquaculture*: Les Burrige (Burrige Consulting Inc., Canada).
- *Gene expression*: Paul Seear (University of Leicester, UK).
- *Chemical analyses*: Alfhild Kringstad, Thomas Rundberget, Katherine Langford (NIVA, Norway).
- *Modelling*: Tjalling Jager (DEBtox Research, the Netherlands), Jannicke Moe and Dag Ø. Hjermann (NIVA, Norway).

- *Combined effects of global and local stressors*: Piero Calosi (Université du Québec à Rimouski, Canada), Sam Dupont (University of Gothenburg, Sweden) and John I. Spicer (University of Plymouth, UK).
- *Ocean acidification effects, sea urchin larvae*: Sam Dupont (University of Gothenburg, Sweden).
- *Krill*: Geraint Tarling (British Antarctic Survey, UK).
- *Predator-prey interaction for echinoderms*: Chris Harley (University of British Columbia, Canada) and Nils T. Hagen (Nord University, Norway)
- *Histopathology*: David Lowe (Plymouth University, UK).
- *Biomarkers of oxidative stress*: Grete Jonsson (Stavanger University Hospital, Norway).

## Track record

### 1. The total number of publications during the career

Total number of publications: 28 international peer-reviewed journal papers, > 40 presentations at national and international scientific conferences and meetings, media coverage of projects that I have been manager for > 50 (including TV, radio, newspaper and magazine interviews), > 30 scientific reports and conference proceedings.

### 2. Selected ten publications from last ten years

Bamber, S., J. T. Rundberget, A. Kringstad and R. K. Bechmann. 2021. Effects of simulated environmental discharges of the salmon lice pesticides deltamethrin and azamethiphos on the swimming behaviour and survival of adult Northern shrimp (*Pandalus borealis*). *Aquatic Toxicology* 240: 105966. <https://doi.org/10.1016/j.aquatox.2021.105966>.

Keitel-Gröner, F., S. Bamber, R. K. Bechmann, E. Lyng, A. Gomiero, V. Tronci, N. Gharbi, F. Engen, I. C. Taban and T. Baussant. 2021. Effects of chronic exposure to the water-soluble fraction of crude oil and in situ burn residue of oil on egg-bearing Northern shrimp (*Pandalus borealis*). *Ecotoxicology and Environmental Safety* 228: 113013. <https://doi.org/10.1016/j.ecoenv.2021.113013>.

Keitel-Gröner, F., R. K. Bechmann, F. Engen, E. Lyng, I. C. Taban and T. Baussant. 2021. Effects of crude oil and field-generated burned oil residue on Northern shrimp (*Pandalus borealis*) larvae. *Marine Environmental Research* 168: 105314. <https://doi.org/10.1016/j.marenvres.2021.105314>.

Bechmann, R.K., M., Arnberg, S. Bamber, E. Lyng, S. Westerlund, J. T. Rundberget, Al Kringstad, P. J. Seear, Burrige, L. E. 2020. Effects of exposing shrimp larvae (*Pandalus borealis*) to aquaculture pesticides at field relevant concentrations, with and without food limitation. *Aquatic Toxicology*. 222: 105453. <https://doi.org/10.1016/j.aquatox.2020.105453>.

Bechmann, R.K., M., Arnberg, Gomiero, A., Westerlund, S., Lyng, E., Berry, M., Thorleifur Agustsson, T., Jager, T., Burrige, L. E. 2019. Gill damage and delayed mortality of Northern shrimp (*Pandalus borealis*) after short time exposure to anti-parasitic veterinary medicine containing hydrogen peroxide. *Ecotoxicology and Environmental Safety*. 180: 473-482. <https://doi.org/10.1016/j.ecoenv.2019.05.045>

Bechmann, R.K., Lyng, E., Westerlund, S., Bamber, S., Berry, M., Arnberg, M., Kringstad, A., Calosi, P., Seear P.J. 2018. Early life stages of Northern shrimp (*Pandalus borealis*) are sensitive to fish feed containing the anti-parasitic drug diflubenzuron. *Aquatic Toxicology*. 198: 82-91. <https://doi.org/10.1016/j.aquatox.2018.02.021>

Arnberg, M., Calosi, P., Spicer, J.I., Taban, I.C., Bamber, S.D., Westerlund, S., Vingen, S., Baussant, T., Bechmann, R.K., Dupont, S. 2018. Effects of oil and global environmental drivers on two keystone marine invertebrates. *Scientific Reports*. 8: 17380. <https://doi:10.1038/s41598-018-35623-w>

Bechmann, R. K., Lyng, E., Berry M., Kringstad, A, Westerlund, S. 2017. Exposing Northern shrimp (*Pandalus borealis*) to fish feed containing the antiparasitic drug diflubenzuron caused high mortality

during molting. *Journal of Toxicology and Environmental Health A*. 80: 941-953. DOI: [10.1080/15287394.2017.1352213](https://doi.org/10.1080/15287394.2017.1352213)

Arnberg, M., Moodley, L., Dunaevskaya, E., Ramanand, S., Ingvarsdóttir, A., Nilsen, M., Ravagnan, E., Westerlund, S., Sanni, S., Tarling, G.A., Bechmann, R.K. 2017. Effects of chronic crude oil exposure on early developmental stages of the Northern krill (*Meganyctiphanes norvegica*). *Journal of Toxicology and Environmental Health Part A*. 80: 916-931. <https://doi.org/10.1080/15287394.2017.1352204>

Arnberg, M., P. Calosi, Spicer, J. I., Tandberg, A. H. S., Nilsen, M., Westerlund, S., Bechmann, R.K. 2013. Elevated temperature elicits greater effects than decreased pH on the development, feeding and metabolism of northern shrimp (*Pandalus borealis*) larvae. *Marine Biology*. 160(8): 2037-2048. <https://doi.org/10.1007/s00227-012-2072-9>

#### Other publications from the last ten years

Keitel-Gröner, F., M. Arnberg, R.K. Bechmann, E. Lyng, T. Baussant. 2020. Dispersant application increases adverse long-term effects of oil on shrimp larvae (*Pandalus borealis*) after a six hour exposure. *Marine Pollution Bulletin*, 151: 110892. <https://doi.org/10.1016/j.marpolbul.2020.110892>.

Moe, J. S., D. Ø. Hjermann; E. Ravagnan; R. K. Bechmann. 2019. Effects of an aquaculture pesticide (diflubenzuron) on non-target shrimp populations: extrapolation from laboratory experiments to the risk of population decline. *Ecological Modelling*, 413: 108833. <https://doi.org/10.1016/j.ecolmodel.2019.108833>.

Arnberg, M., Keitel-Gröner, F., Westerlund, S., Ramanand, S., Bechmann, R. K., Baussant, T. 2019. Exposure to chemically-dispersed oil is more harmful to early developmental stages of the Northern shrimp *Pandalus borealis* than mechanically-dispersed oil. *Marine Pollution Bulletin* 145: 409–417. <https://doi.org/10.1016/j.marpolbul.2019.06.039>.

Moodley, L., Arnberg, M., Sears, P., Dunaevskaya, E., Nilsen, M., Westerlund, S., Sanni, S., Tarling, G.A., Bechmann, R.K. 2017. Effects of low crude oil chronic exposure on the northern krill (*Meganyctiphanes norvegica*). *Journal of Experimental Marine Biology and Ecology*. 500:120-131 <https://doi.org/10.1016/j.jembe.2017.07.003>

Baussant, T., M. Ortiz-Zarragoitia, M.P. Cajaraville, R.K. Bechmann, I.C. Taban, S. Sanni. 2011. Effects of chronic exposure to dispersed oil on selected reproductive processes in adult blue mussels (*Mytilus edulis*) and the consequences for the early life stages of their larvae. *Marine Pollution Bulletin*. 62:1437–1445 <https://doi.org/10.1016/j.marpolbul.2011.04.029>

Bechmann, R.K., Taban, I.C, Westerlund, S., Godal, B.F., Arnberg, M., Vingen, S., Ingvarsdottir, A., Baussant, T., 2011. Effects of ocean acidification on early life stages of shrimp (*Pandalus borealis*) and mussel (*Mytilus edulis*). *Journal of Toxicology and Environmental Health-Part A-Current Issues*. 74: 424-38. <https://doi.org/10.1080/15287394.2011.550460>

Aarab, N., Godal, B. F., Bechmann, R. K. 2011. Seasonal variation of histopathological and histochemical markers of PAH exposure in blue mussel (*Mytilus edulis* L.). *Marine Environmental Research*. 71: 213-217. <https://doi.org/10.1016/j.marenvres.2011.01.005>

#### Relevant recent reports

Bechmann, R. K. 2022. Er fjordforbedring en god ide for Hafrsfjord? Rapport 1-2022 NORCE Klima og miljø. Stavanger, Norway, 53 pp. ISBN 978-82-8408-193-9. Oppdragsgiver: Miljødirektoratet.

Bechmann, R. K. 2018. Mulige miljøeffekter av offshore-oppdrett (skrevet på oppdrag fra Miljødirektoratet). IRIS RAPPORT – 2018/302. Stavanger, Norway, International Research Institute of Stavanger (IRIS): 37 pp. ISBN 978-82-490-0922-0.

## Conferences and meetings 2010-2020

Bechmann *et al.* *Environmental effects of chemicals used against salmon lice - Results from RCN#267746 PestPuls and RCN #234407 FluClim*. I presented results from these projects at the following meetings: HAVBRUK 2020 video conference (2020), Aquaculture Europe 19 (Berlin), AquaNor (Trondheim), Fylkesmannen i Rogaland, Gjesteforedrag på UiO (2019). Hardangerfjordseminaret; Fylkesmannen i Rogaland; STRANDBÚNAÐUR 2018, Reykjavík; Norsk Kjemisk Selskap - Landsmøtet i kjemi; Forskningsrådets havforskningskonferanse; International Coldwater Prawn Forum (ICWPF) Industry Meeting in London, meeting in Tromsø («Hvordan sikre bedre kunnskap og innsikt omkring miljøeffekter av lusebehandling innenfor oppdrett»); Plastikk Fantastisk – konferanse om marin forsøpling (2018); “No blue, no green – seminar on ocean preservation”, arranged by the University of Stavanger when Sylvia Earle received the Rachel Carson prize (2017); Keynote presentation at the 6th Norwegian Environmental Toxicology Symposium (NETS); presentation at the Nor-Fishing conference; and at “Seminar om legemidler mot lakselus og miljøpåvirkning” (2016). Presentations at Fylkeskommunal lærersamling, UiS; at a meeting arranged by the Environment Agency in The Faroe Island, Tórshavn; at «Krabbe og skalldyrkonferansen», at RCN Havet og kystens avslutningskonferanse, Midnatsol (2015). Presentation at 5th NETS and at Hardangerfjordseminaret (2014).

Bechmann *et al.* *Combined effects of ocean acidification and other anthropogenic stressors - Results from RCN #200800 Combined effects and RCN #215589 OAPPI*. I presented results from these projects at the following meetings: Peter Wall International Roundtable, University of British Columbia; the Arctic Ocean Acidification – International Conference, Bergen; Forskningsrådets klimakonferanse; Tekna Biotech group Temakveld “Havet som matfat”, Stavanger (2013); 4th NETS; Peismøte, Miljøverndepartementet (2012); 2011 ASLO Aquatic Sciences Meeting in San Juan, Puerto Rico (2011); lunch seminar at CICERO Senter for klimaforskning; 3rd NETS and a poster at SETAC-Europe in Seville (2010).