

## **Moritz Sebastian Schmid, PhD**

Date of birth: 1987/02/16

Hatfield Marine Science Center  
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Oceanographer, ecologist and biogeographer with a wide range in modelling skills including automatic species identification from imagery using machine learning, and spatially explicit species distribution modelling under current as well as future climate conditions.

### **HIGHER EDUCATION**

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#### **09/2012 – 06/2017 Ph.D. in Oceanography**

Université Laval, Québec City, Canada

Thesis title: The race for lipids: ontogeny of the fine-scale vertical co-distribution of Arctic calanoid copepods and their phytoplankton food as elucidated by an imaging profiler.

Supervisors: Prof. Louis Fortier and Prof. Marcel Babin (Université Laval)

#### **04/2010 – 05/2012 Integrated bi-national M.Sc. of International Nature Conservation**

University of Alaska Fairbanks, Fairbanks, USA; Lincoln University, Lincoln, New Zealand; Göttingen University, Göttingen, Germany

Thesis title: Model-predicting the effect of freshwater inflow on saltwater layers, migration and life history of zooplankton in the Arctic Ocean: Towards scenarios and future trends.

Supervisors: Prof. Falk Huettmann (University of Alaska Fairbanks) and Prof. Michael Mühlenberg (Göttingen University)

**10/2007 – 04/2010 B.Sc. in Biology**

Göttingen University, Göttingen, Germany

Thesis title: Analysis of the feeding ecology of the red kite (*Milvus milvus*) by prey-delivery videography.

Supervisors: Prof. Mark Maraun and Dr. Eckhard Gottschalk  
(Göttingen University)

## PEER REVIEWED PUBLICATIONS

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Huettmann, F., Craig, E.H., Herrick, K.A., Baltensperger, A.P., Humphries, G.R.W., Lieske, D., Miller, K., Mullet, T.C., Opper, S., Resendiz, C., Rutzen, I., **Schmid, M.S.**, Suwal, M.K., Young, B. (in press): Use of machine learning (ML) for predicting and analyzing ecological and 'location only' data: an overview of applications and an outlook. In: Huettmann, F., et al. (eds.) Machine Learning. Springer, New York.

Lieske, D.J., Mahoney, M., **Schmid, M.S.** (in press): Ensembles of ensembles: combining the predictions from multiple machine learning methods. In: Huettmann, F., et al. (eds.) Machine Learning. Springer, New York.

Grigor, J.J., **Schmid, M.S.**, Caouette, M., St-Onge, V., Barthélémy, R., (in review): Arrow worms: tigers or sheep of the zooplankton? Signals of carnivory and omnivory in two Arctic chaetognath species. Peerj.

**Schmid, M.S.**, Maps, F., Fortier, L. (2018): Lipid load triggers migration to diapause in Arctic *Calanus* copepods—insights from underwater imaging. Journal of Plankton Research, 40:311-325. <https://doi.org/10.1093/plankt/fby012>.

Grigor J.J., **Schmid, M.S.**, Fortier, L. (2017) Growth and reproduction of the chaetognaths *Eukrohnia hamata* and *Parasagitta elegans* in the Canadian Arctic Ocean: Capital breeding versus income breeding. Journal of Plankton Research, 39:910-929. <https://doi.org/10.1093/plankt/fbx045>.

**Schmid, M.S.**, Aubry, C., Grigor, J., Fortier, L. (2016): The LOKI underwater imaging system and an automatic identification model for the detection of zooplankton taxa in the Arctic Ocean. Methods in Oceanography 15-16:129-160. <http://dx.doi.org/10.1016/j.mio.2016.03.003>.

Kooi, M., Reisser, J., Slat, B., Ferrari, F., **Schmid, M.S.**, Cunsolo, S., Brambini, R., Noble, K., Sirks, L-A., Linders, T.E.W., Schoeneich-Argent, R., Koelmans, A.A. (2016): In Depth: correcting plastic sea surface measurements for vertical mixing. Scientific Reports 6, 33882. <http://dx.doi.org/10.1038/srep33882>.

Humphries, G.R.W., Flemming, S.A., Hammer, S., Hirata, K., Kappes, M.A., Kappes, P., Magnúsdóttir, E., Major, H., Mcduie, F., McOmber, K., Orben, R.A., **Schmid, M.S.**, Wille, M. (2016) Bridging the gap from student to senior scientist: recommendations for engaging early career scientists in professional biological societies. *Marine Ornithology* 44: 157–166.

Huettmann, F., **Schmid, M.S.**, Humphries, G.R.W. (2015): A first overview of open access digital data for the Ross Sea: complexities, ethics, and management opportunities. *Hydrobiologia* 761:97–119, <http://dx.doi.org/10.1007/s10750-015-2520-x>.

Huettmann, F. and **Schmid, M.S.** (2015): A short introduction to tropical land- and seascapes and their wildlife conservation management. In: Huettmann, F. (ed.) *Central American Biodiversity: Conservation, Ecology, and a Sustainable Future*. Springer, New York, pp 1-23, [http://dx.doi.org/10.1007/978-1-4939-2208-6\\_1](http://dx.doi.org/10.1007/978-1-4939-2208-6_1).

**Schmid, M.S.**, Baltensperger, A.P, Grigor, J., Huettmann, F. (2015): Assessments of carbon stock hotspots in Nicaragua and Costa Rica. In: Huettmann, F. (ed.) *Central American Biodiversity: Conservation, Ecology, and a Sustainable Future*. Springer, New York, pp 677-701, [http://dx.doi.org/10.1007/978-1-4939-2208-6\\_30](http://dx.doi.org/10.1007/978-1-4939-2208-6_30).

Huettmann, F. and **Schmid, M.S.** (2014): Climate change and predictions of pelagic biodiversity components. In: De Broyer, C., et al. (eds.) *Biogeographic Atlas of the Southern Ocean*. Scientific Committee on Antarctic Research, Cambridge, pp. 390-396.

Huettmann, F. and **Schmid, M.S.** (2014): Climate change in the Arctic. In: Hund, A. (ed.) *Antarctica and the Arctic Circle: A Geographic Encyclopedia of the Earth's Polar Regions*. Vol I. ABC-Clio, Santa Barbara, pp. 189-193.

Roelofs, M., **Schmid, M.S.**, Zuijderwijk, R. (2014): Chapter 6.3 Zooplankton. In: Slat, B., et al. (eds.) *How the Oceans can clean themselves. A feasibility study*. The Ocean Cleanup, Delft, pp. 320-327.

Huettmann, F. and **Schmid, M.S.** (2014): Publicly available open access data and machine learning model-predictions applied with open source Geographic Information Systems (GIS) for the entire Antarctic Ocean: A first meta-analysis and synthesis from 53 charismatic species. In: Veress, B. and Szigethy, J. (eds.) *Horizons in Earth Science Research*. Volume 11. Nova Science Publishers, New York, pp. 23-33.

Baltensperger, A.P., Mullet, T., **Schmid, M.S.**, Humphries, G.R.W., Kövér, L., Huettmann, F. (2013): Seasonal observations and machine-learning-based spatial model predictions for the common raven (*Corvus corax*) in the urban, sub-arctic environment of Fairbanks, Alaska. *Polar Biology* 36:1587–1599, <http://dx.doi.org/10.1007/s00300-013-1376-7>.

Cohen-Rengifo, M., Crafton, R.E., Hassenrück, C., Jankowska, E., Koenigstein, S., Sandersfeld, T., **Schmid, M.S.**, Schmidt, M., Simpson, R., Sheward, R.M. (2013): Module 1: marine ecosystems and climate change. In: Dummermuth, A. and Grosfeld, K. (eds.) *Climate change in the marine realm: an international summer school in the framework of the European Campus of*

Excellence. Reports on polar and marine research 662, Alfred Wegener Institute for Polar and Marine Research, Bremerhaven, pp. 2-20, hdl:10013/epic.41554, <http://epic.awi.de/33026/>.

## **AWARDS AND HONORS**

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- 11/2016** John W. Davies Memorial Award from the Society of Naval Architects and Marine Engineers, Arctic Section (SNAME AS)
- 06/2016** Foundation Richard-Bernard Award for excellence in doctoral studies
- 11/2014** Award for best presentation at the Québec-Océan Conference 2014 in Rivière-du-Loup (Canada). Title: Automated zooplankton identification for Baffin Bay and adjacent waters
- 01/2013** Award for best poster at the Arctic Frontiers Conference 2013 in Tromsø (Norway). Title: In situ imaging of mesozooplankton in order to assess fine scale spatiotemporal variability

## **GRANTS, FELLOWSHIPS AND SCHOLARSHIPS**

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- 01/2017** Fellowship from the Research Council of Norway to attend Emerging Leaders 2017 in conjunction with the Arctic Frontiers conference 2017, Tromsø (Norway).
- 11/2012 – 11/2014** Scholarship of Excellence in Scientific Leadership and Sustainable Development, Université Laval, Québec City (Canada).
- 09/2012** Grant from the Mercator Foundation to attend the international summer school on Climate Change in the Marine Realm at University of Bremen, Bremen (Germany).
- 08/2012 – 08/2015** Takuvik doctoral scholarship, Université Laval, Québec City (Canada).
- 01/2012** Grant from the NSF Office of Polar Programs for the IPY 2012 conference in Montreal (Canada).
- 12/2011** Association of Polar Early Career Scientists (APECS) grant to attend IPY 2012 conference in Montreal (Canada).
- 10/2011 – 04/2012** Otto Bayer Fellowship from the Bayer Foundation for studies at the University of Alaska Fairbanks, Fairbanks (USA).

- 09/2011** PROMOS stipend from the German Academic Exchange Service for studies at the University of Alaska Fairbanks, Fairbanks (USA).
- 02/2011 – 06/2011** ISAP fellowship from the German Academic Exchange Service for studies at Lincoln University, Lincoln (New Zealand).
- 09/2010** Travel grant from the German Academic Exchange Service for studies at the University of Alaska Fairbanks, Fairbanks (USA).

## CONFERENCE ACTIVITY

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### a) Invited oral presentations:

**Schmid, M.S.** (2017): Underwater imaging, automatic identification, and ecology of plankton with a focus on the Arctic ecosystem. NOAA PMEL, EcoFOCI seminar series, Seattle (USA), Oct 2017.

**Schmid, M.S.**, Aubry, C., Grigor, J., Fortier, L. (2014): Zooplankton imaging with the Lightframe On-sight Keyspecies Investigation (LOKI) system. 5ème Rencontre des Technologies Marines, Réseau National Technologies Marines et la Direction Technique de l'INSU, Benodet (France), Nov 2014.

### b) Conference organized:

Co-organizer for the Colloque Biologie at Université Laval, 2015.

### c) Selected oral presentations:

**Schmid, M.S.**, Robinson, K.L., Luo, J.Y., Cowen, R.K., Sponaugle, S. (2018): Fine-scale spatio-temporal distribution of plankton across a mesoscale eddy - insights from underwater imaging. Ocean Sciences, Oregon Convention Center, Portland (USA), Feb 2018.

**Schmid, M.S.** and Fortier, L. (2017): Lipid load triggers migration to diapause in Arctic *Calanus* copepods—insights from underwater imaging. Arctic Frontiers, University of Tromsø, Tromsø (Norway), Jan 2017.

Grigor, J., **Schmid, M.S.**, Aubry, C., Fortier, L. (2015): Small is just as important: using multiple techniques to reveal the ecologies of Arctic plankton. Colloque Biologie, Université Laval, Québec City (Canada), Mar 2015, (1<sup>st</sup> and 2<sup>nd</sup> author presented).

**Schmid, M.S.**, Aubry, C., Grigor, J., Fortier, L. (2015): Automatic zooplankton species identification for the greater North Water Polynya region. APECS Online Conference – New perspectives in the Polar Sciences, Mar 2015.

**Schmid, M.S.**, Aubry, C., Grigor, J., Fortier, L. (2014): Automated zooplankton identification for Baffin Bay and adjacent waters – combining in-situ imaging, machine learning and taxonomy to gain insights into the fine-scale dynamics of zooplankton. Arctic Change, Ottawa Convention Centre, Ottawa (Canada), Dec 2014.

**Schmid, M.S.**, Aubry, C., Grigor, J., Fortier, L. (2014): Automated zooplankton identification for Baffin Bay and adjacent waters. Québec-Océan Annual Meeting, Hôtel Universel, Rivière-du-Loup (Canada), Nov 2014.

**Schmid, M.S.**, Aubry, C., Grigor, J., Fortier, L. (2013): New perspectives in zooplankton sampling: use of in situ optical imaging to profile the vertical distributions of taxa. APECS webinar series. Eastern Arctic Research Webinar, Apr 2013.

**Schmid, M.S.**, Aubry, C., Grigor, J., Fortier, L. (2013): In situ imaging of mesozooplankton in order to assess fine scale spatiotemporal variability. Colloque Biologie, Université Laval, Québec City (Canada), Mar 2013.

**Schmid, M.S.**, Aubry, C., Grigor, J., Fortier, L. (2012): Assessing spatiotemporal variability in the mesozooplankton using a newly developed plankton imaging system - first experiences from the BaySys 2012 expedition in Hudson Bay. ArcticNet Annual Conference, The Westin Bayshore, Vancouver (Canada), Dec 2012.

**Schmid, M.S.**, Huettmann, F., Polyakov, I. (2012): Model-predicting the effect of freshwater inflow on migration and life history of zooplankton in the Arctic Ocean: towards scenarios and future trends. Midnight Sun Science Symposium, University of Alaska Fairbanks, Fairbanks (USA), Mar 2012.

**Schmid, M.S.**, Huettmann, F., Polyakov, I. (2011): Model-predicting the effect of freshwater inflow on migration and life history of zooplankton in the Arctic Ocean. An overview of my M.Sc. thesis. Life Science Seminar Series, University of Alaska Fairbanks, Fairbanks (USA), Dec 2011.

#### **d) Selected poster presentations:**

**Schmid, M.S.**, Aubry, C., Grigor, J., Fortier, L. (2014): Automated zooplankton identification for Baffin Bay and adjacent waters – combining in-situ imaging, machine learning and taxonomy to gain insights into the fine-scale dynamics of zooplankton. Arctic Change, Ottawa Convention Centre, Ottawa (Canada), Dec 2014.

**Schmid, M.S.**, Aubry, C., Grigor, J., Fortier, L. (2013): In-situ imaging of Arctic plankton: automated taxonomic classification using machine learning algorithms. ArcticNet Annual Conference, World Trade and Convention Centre, Halifax (Canada), Dec 2013.

**Schmid, M.S.**, Aubry, C., Grigor, J., Fortier, L. (2013): In-situ imaging of Arctic zooplankton. Québec-Océan Annual Meeting, Hôtel Universel, Rivière-du-Loup (Canada), Nov 2013.

**Schmid, M.S.**, Aubry, C., Grigor, J., Fortier, L. (2013): In situ imaging of mesozooplankton in order to assess fine scale spatiotemporal variability: experiences from the BaySys 2012 expedition in Hudson Bay. Arctic Frontiers Conference 2013, University of Tromsø (Norway), Jan 2013.

**Schmid, M.S.**, Aubry, C., Grigor, J., Fortier, L. (2012): Assessing spatiotemporal variability in the mesozooplankton using a newly developed plankton imaging system - first experiences from the BaySys 2012 expedition in Hudson Bay. Québec-Océan Annual Meeting, Omni Mont-Royal Hotel, Montreal (Canada), Nov 2012.

**Schmid, M.S.**, Huettmann, F., Polyakov, I. (2012): Model-predicting the effect of freshwater inflow on saltwater layers, migration and life history of zooplankton in the Arctic Ocean: towards scenarios and future trends. International Polar Year Conference 2012, Montreal (Canada), Apr 2012.

**Schmid, M.S.** and Huettmann, F. (2011): Model-predicting thick epiphyte layers and related parameters on Haida Gwaii (Queen Charlotte Islands, Canada) in order to assess habitat suitability for marbled murrelets and to address climate change questions. US Regional Association of the International Association for Landscape Ecology, Portland Hilton, Portland (USA), Apr 2011.

## **WORKSHOPS AND SUMMER SCHOOLS**

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### **a) Attended:**

**01/2013**                      Young Scientists Forum on soft skills in the sciences, including writing of grant applications, Tromsø (Norway).

**09/2012**                      Summer school on Climate Change in the Marine Realm, Alfred-Wegener-Institute (AWI) and University of Bremen (Germany).

### **b) Contributed:**

**12/2012**                      Arctic Safety Workshop presentation part 5) Glaciology, Avalanches and Safety in an Arctic Environment. ArcticNet student day, The Westin Bayshore, Vancouver (Canada), Dec 2012.

## TEACHING EXPERIENCE

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- 05/2018** Guest lecturer in BI-450: Marine Biology and Ecology, Oregon State University
- 03/2018** Guest lecturer in Interdisciplinary Science 1, New technologies in oceanography. School for Science and Math, Vanderbilt University, Nashville, TN
- 03/2017** Guest lecturer in Interdisciplinary Science 1, Climate change and plastic in the ocean. School for Science and Math, Vanderbilt University, Nashville, TN
- 06/2015 – 04/2016** Co-Supervising the biology/oceanography honors thesis of Kevin Gonthier.
- 01/2015 – 04/2016** Co-Supervising the biology/oceanography honors thesis of Claudie Lachance.
- 10/2011 – 01/2012** Teaching assistant in tropical rainforest ecology, climate change and geographical information systems (GIS) in Nicaragua at the Ometepe field station of the Maderas Rainforest Conservancy.

## OTHER RESEARCH EXPERIENCE

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- 12/2013 – 08/2016** Data analyst for The Ocean Cleanup, modeling vertical distribution of plastic in the ocean.
- 12/2011 – 01/2012** Assessing above and below ground biomass in the UN-REDD (Reducing Emissions from Deforestation) framework, Nicaragua. Contracted by the Maderas Rainforest Conservancy.
- 01/2009 – 07/2009** Research assistant at the Max-Planck-Institute (MPI) for Biophysical Chemistry, Göttingen (Germany). Bioinformatics division. Genetics of the circadian rhythm.

## SERVICE TO PROFESSION

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Reviewer for 1) Earth System Science Data Discussions, 2) Marine Biology Research, and 3) International Journal of Biodiversity and Conservation.



## UNIVERSITY SERVICE

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10/2014 – 12/2016 Student representative of the PhD program in oceanography at Université Laval.

## COMMUNITY INVOLVEMENT

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**04/2018** Marine Science Day, an open house at the Hatfield Marine Science Center. Discussing marine science and technology with the public.

**04/2017** Marine Science Day, an open house at the Hatfield Marine Science Center. Discussing marine science and technology with the public.

**04/2017** Judge at the Oregon Regional MATE ROV Competition.

**04/2015** Judge at the Québec regional science fair.

**12/2014 – 12/2016** Member of the ArcticNet Student Association outreach team.

**12/2014** Presentation to and hands on experience for school children as part of the Canada science day at the National Museum in Ottawa. The Arctic Ocean, key species identification and climate change.

**03/2014** Blogging on science topics such as zooplankton and climate change. <http://blog.scienceborealis.ca/arctic-zooplankton-and-climate-change/>

**08/2012** Participant in a discussion round with German Chancellor Dr. Angela Merkel on marine protected areas as part of her visit to Dalhousie University to foster German-Canadian collaboration.

**08/2012 – 06/2015** Board member of the Canadian National Committee of the Association of Polar Early Career Scientists (APECS).

**03/2012** Judging at the Interior Alaska Science Fair.

**02/2011 - present** Aiding website coordinator for [www.seabirds.net](http://www.seabirds.net), in charge of research spotlights.

## OTHER PUBLICATIONS

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### a) Software:

**Schmid, M.S.**, Aubry, C., Grigor, J., Fortier, L. (2015): ZOOMIE v1.0 (Zooplankton Multiple Image Exclusion). <https://dx.doi.org/10.5281/zenodo.17928>.

### b) Data and Code:

**Schmid, M.S.**, Aubry, C., Grigor, J., Fortier, L. (2016): Data and R script for publication: The LOKI underwater imaging system and an automatic identification model for the detection of zooplankton taxa in the Arctic Ocean. doi:10.1016/j.mio.2016.03.003, <https://zenodo.org/record/54762>.

Lieske, D.J., Mahoney, M., **Schmid, M.S.** (2015): R-code for publication: “Ensembles of ensembles: combining the predictions from multiple machine learning methods”. doi:10.5281/zenodo.45784, <https://zenodo.org/record/45784?ln=en>.

**Schmid, M.S.** (2012): One hundred seventy environmental GIS data layers for the circumpolar Arctic Ocean region. M.Sc. thesis data. International Arctic Research Center, University of Alaska Fairbanks, [goo.gl/MQs7dc](http://goo.gl/MQs7dc).

## CERTIFICATES

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- 1) R Programming, Coursera, taught by Roger Peng et al., Johns Hopkins University
- 2) Machine learning, Coursera, taught by Andrew NG, Stanford University
- 3) Introduction to interactive programming in Python (part 1), Coursera, taught by Joe Warren et al., Rice University
- 4) Introduction to interactive programming in Python (part 2), Coursera, taught by Joe Warren et al., Rice University
- 5) Advanced Open Water Diver, PADI

## LANGUAGE SKILLS

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**German:**  
mother tongue

**English:**  
excellent written  
and oral command

**French:**  
good written and  
oral command

**Spanish:**  
basic written and  
oral command

## PROFESSIONAL MEMBERSHIPS

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The Oceanography Society, Association of Polar Early Career Scientists (APECS)

## RESEARCH CRUISES

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- 07/2018** Cruise coordinator for the 2<sup>nd</sup> research cruise of the NSF-funded MEsoZooplankton trophodynamics in the CALifornia Current (MEZCAL) project onboard R/V Sally Ride. Sampling with a towed underwater imager and a coupled MOCNESS.
- 02/2018** Cruise coordinator for the 1<sup>st</sup> research cruise of the NSF-funded MEsoZooplankton trophodynamics in the CALifornia Current (MEZCAL) project onboard R/V Sikuliaq. Sampling with a towed underwater imager and a coupled MOCNESS.
- 2014** ArcticNet cruise onboard the NGCC Amundsen in Baffin Bay, the Northwest Passage, Amundsen Gulf and Beaufort Sea. Sampling for zooplankton and fish larvae using different gear (e.g. multinet samplers, oblique tows and LOKI in-situ zooplankton camera system).
- 2014** SUBICE cruise onboard USCGC Healy in the Chukchi Sea. Sampling for zooplankton using the LOKI in-situ zooplankton camera system and the Underwater Vision Profiler (UVP 5).
- 2013** ArcticNet cruise onboard the NGCC Amundsen in Baffin Bay and the Northwest Passage. Sampling for zooplankton and fish larvae using different gear (e.g. multinet samplers, oblique tows and LOKI in-situ zooplankton camera system).
- 2012** BaySys cruise onboard the NGCC Pierre Radisson in Hudson Bay. Sampling for zooplankton and fish larvae using different gear (e.g. multinet samplers, oblique tows and LOKI in-situ zooplankton camera system).
- 2011** Seward Line research cruise onboard the M/V Tiglax in the Gulf of Alaska, USA. General zooplankton sampling.
- 2008** Expedition 309 onboard the Fishery Research Vessel Walther Herwig III. Sampling for fish larvae and identification of abnormalities in their development, North Sea, Germany.

## REFERENCES

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