

## Report for the year 2020 and future activities

### **SOLAS Finland**

**compiled by: Lauri Laakso / Finnish Meteorological Institute,**

**reporting for**

- **Finnish Meteorological Institute (FMI) (Jukka-Pekka Jalkanen, Risto Makkonen, Lauri Laakso)**
- **Finnish Environment Institute (SYKE) (Jukka Seppälä)**
- **University of Helsinki (UH) (Joanna Norkko)**
- **University of Turku (UT) : nothing to report**
- **Åbo Akademi University (ÅA): nothing to report**
- **Geological Survey of Finland (GTK) (Joonas Virtasalo)**
- **Natural Resources Institute Finland (LUKE): nothing to report**

*This report has two parts:*

**- Part 1:** reporting of activities in the period of January 2020 - Jan/Feb 2021

**- Part 2:** reporting on planned activities for 2021 and 2022.

*The information provided will be used for reporting, fundraising, networking, strategic development and updating of the live web-based implementation plan. As much as possible, please indicate the specific SOLAS 2015-2025 Science Plan Themes addressed by each activity or specify an overlap between Themes or Cross-Cutting Themes.*

- 1 Greenhouse gases and the oceans;
- 2 Air-sea interfaces and fluxes of mass and energy;
- 3 Atmospheric deposition and ocean biogeochemistry;
- 4 Interconnections between aerosols, clouds, and marine ecosystems;
- 5 Ocean biogeochemical control on atmospheric chemistry;

Integrated studies of high sensitivity systems;  
Environmental impacts of geoengineering;  
Science and society.

**IMPORTANT:** This report should reflect the efforts of the SOLAS community in the entire country you are representing (all universities, institutes, lab, units, groups, cities).

**First things first...Please tell us what the IPO may do to help you in your current and future SOLAS activities. ?**

- Lobby for funding in suitable international organizations including EU.
- Provide feedback on work plan of relevant funding instruments, like Horizon, BANOS, CEF etc.
- Promote the uptake of results and data in e.g., Copernicus marine and atmospheric services

**PART 1 - Activities from January 2020 to Jan/Feb 2021**

**1. Scientific highlight**

Describe one scientific highlight with a title, text (**max. 300 words**), a figure with legend and full references. Please focus on a result that would not have happened without SOLAS, and we are most interested in results of international collaborations. (If you wish to include more than one highlight, feel free to do so).

**Theme #3**

Cyanobacteria are an important part of phytoplankton communities, however, they are also known for forming massive blooms with potentially deleterious effects on recreational use, human and animal health, and ecosystem functioning. Emerging high-frequency imaging flow cytometry applications, such as Imaging FlowCytobot (IFCB), are crucial in furthering our understanding of the factors driving bloom dynamics, since these applications provide community composition information at frequencies impossible to attain using conventional monitoring methods. In our study, we demonstrate how using a high-frequency imaging flow cytometry application - together with continuous in-situ observations of atmospheric and marine variables - can help understand the development of cyanobacteria summer blooms.

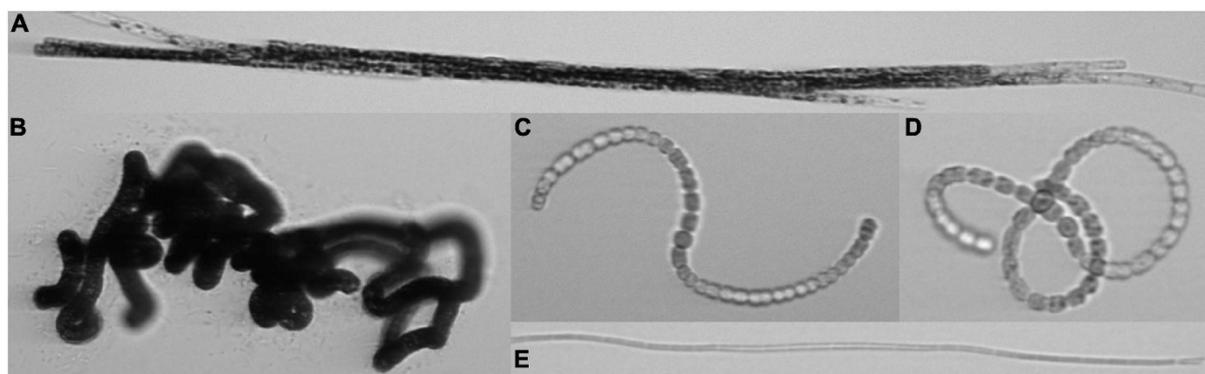


Figure: Common filamentous cyanobacteria from the Baltic Sea captured with an Imaging FlowCytobot. *Aphanizomenon flosaquae* (A) (filament width ca. 5  $\mu\text{m}$ ), *Nodularia spumigena* (B) (filament width ca. 8–10  $\mu\text{m}$ ), *Dolichospermum* spp. (C) (representing the group “straight,” i.e., not forming closed loops), (D) (representing the group “coiled,” i.e., forming closed loops) (filament width ca. 5–7  $\mu\text{m}$ ), Oscillatoriales (E) (filament width ca. 1.5–2  $\mu\text{m}$ )

Citation: Kraft, K., Seppälä, J., Hällfors, H., Suikkanen, S., Ylöstalo, P., Anglès, S., Kielosto, S., Kuosa, H., Laakso, L., Honkanen, M., Lehtinen, S., Oja, J., Tamminen, T., Application of IFCB High-Frequency Imaging-in-Flow Cytometry to Investigate Bloom-Forming Filamentous Cyanobacteria in the Baltic Sea, <https://www.frontiersin.org/article/10.3389/fmars.2021.594144>, Frontiers in Marine Science, 2021

**2. Activities/main accomplishments in 2020 (e.g., projects; field campaigns; workshops and conferences; model and data intercomparisons; capacity building; international collaborations; contributions to int. assessments such as IPCC; collaborations with social**

sciences, humanities, medicine, economics and/or arts; interactions with policy makers, companies, and/or journalists and media).

FMI

- H2020/SCIPPER - Shipping Contributions to Inland Pollution-Push for the Enforcement of Regulations, continuation, Aristotle Univ Thessaloniki coordinates **#Science and society**
- H2020/AIRCOAT - Air Induced friction Reducing ship COATING, continuation, Fraunhofer institute (CML) coordinates **#Science and society**
- ShipNOEm – Annual reporting of Baltic Sea ship emissions to air, water and underwater noise; annual submission to HELCOM Maritime group by Finland, national funding, ongoing **#Science and society**
- Copernicus Atmospheric Monitoring Services (CAMS81), Annual emission reporting for air emissions from ships in EU and global scale, continuation **#Science and society**
- Contribution to the first European Maritime Transport Environmental Report (EMTER), assisting European Maritime Safety Agency and European Environment Agency **#Science and society**
- Participation to International Maritime Organization meetings (Marine Environment Protection Committee; Intersessional Working Group to Reduce GHG emissions from ships) as part of national delegations. **#Science and society**
- Participation in the work of Task Force for Emission Inventories and Projections (TFEIP; part of Convention for Long-Range Transport for Atmospheric Pollution) **#Science and society**
- Participation in the work for national plan for sea area governance (MSFD requirement), especially in underwater noise **#Science and society**
- Membership in the ICES WGSHP group **#Science and society**
- Introduction of FMI ship emissions work to OSPAR MIME group **#Science and society**
- Support for national HELCOM delegation to revise the Baltic Sea Action Plan **#Science and society**
- Participation in the national task force for planning low carbon transport **#Science and society**
- Participation in Policy Area SHIP work supporting the EU strategy for the Baltic Sea Region **#Science and society**

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**3. Top 5 publications in 2020 (only PUBLISHED articles) and if any, weblinks to models, datasets, products, etc.**

FMI

- Johansson, L., Fridell, E., Jalkanen, J.-P., Ytreberg, E., Maljutenko, I., Eriksson, K. M., Roth, E. and Fischer, V., "On the modelling of pleasure boat activities and emissions at the Baltic Sea", *Ocean Sci.*, 16, 1143–1163, <https://doi.org/10.5194/os-16-1143-2020>, 2020 **#Science and society**
- Jan Eiof Jonson, Michael Gauss, Michael Schulz, Jukka-Pekka Jalkanen, and Hilde Fagerli, "Effects of global ship emissions on European air pollution levels", *Atmos. Chem. Phys.*, 20, 11399–11422, <https://doi.org/10.5194/acp-20-11399-2020>, 2020 **#Science and society**
- Rafael A.O. Nunes, Maria C. M. Alvim-Ferraz, Fernando G. Martins, Fatima Calderay-Cayetano, Vanessa Durán-Grados, Juan Moreno-Gutiérrez, Jukka-Pekka Jalkanen, Hanna Hannuniemi, and Sofia I. V. Sousa, Shipping emissions in the Iberian Peninsula and its impacts on air quality, *Atmos. Chem. Phys.*, 20, 9473–9489, 2020, <https://doi.org/10.5194/acp-20-9473-2020> **#Science and society**
- Ytreberg, E., Eriksson, M., Maljutenko, I., Jalkanen, J.-P., Johansson, L., Hassellöv, I.-M., & Granhag, L. (2020). Environmental impacts of grey water discharge from ships in the Baltic Sea. *Marine Pollution Bulletin*, 152(January), 110891. <https://doi.org/10.1016/J.MARPOLBUL.2020.110891> **#Science and society**
- Karl, M., Pirjola, L., Karppinen, A., Jalkanen, J. P., Ramacher, M. O. P., & Kukkonen, J. (2020). Modeling of the Concentrations of Ultrafine Particles in the Plumes of Ships in the Vicinity of Major Harbors. *International Journal of Environmental Research and Public Health*, 17(3), 1–24. <https://doi.org/10.3390/ijerph17030777> **#Science and society**
- Björkqvist, J.-V., Vähä-Piikkiö, O., Alari, V., Kuznetsova, A., and Tuomi, L., 2020: WAM, SWAN and WAVEWATCH III in the Finnish archipelago – the effect of spectral performance on bulk wave parameters, *J. Oper. Oceanogr.*, 13, 55–70, DOI: 10.1080/1755876X.2019.1633236 **Theme #2**

SYKE

- Kraft, K., Seppälä, J., Hällfors, H., Suikkanen, S., Ylöstalo, P., Anglès, S., Kielosto, S., Kuosa, H., Laakso, L., Honkanen, M., Lehtinen, S., Oja, J., Tamminen, T., Application of IFCB High-Frequency Imaging-in-Flow Cytometry to Investigate Bloom-Forming Filamentous Cyanobacteria in the Baltic Sea, <https://www.frontiersin.org/article/10.3389/fmars.2021.594144>, *Frontiers in Marine Science*, 2021 **Theme #3**

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- Broman E, Sun XL, Stranne C, Salgado MG, Bonaglia S, Geibel M, Jakobsson M, Norkko A, Humborg C, Nascimento FJA (2020) Low abundance of methanotrophs in sediments of shallow boreal coastal zones with high water methane concentrations. *Frontiers in Microbiology* 11:1536 **Theme #1**
- Hellemann D, Tallberg P, Aalto SL, Bartoli M, Hietanen S (2020) Seasonal cycle of benthic denitrification and DNRA in the aphotic coastal zone, northern Baltic Sea. *Marine Ecology Progress Series* 637:15-28 **Theme #1**
- Myllykangas JP, Rissanen AJ, Hietanen S, Jilbert T (2020) Influence of electron acceptor availability and microbial community structure on sedimentary methane oxidation in a boreal estuary. *Biogeochemistry* 148:291-309 **Theme #1**

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- Virtasalo, J.J., Österholm, P., Kotilainen, A.T. & Åström, M.E. 2020: Enrichment of trace metals from acid sulphate soils in sediments of the Kvarken Archipelago, eastern Gulf of Bothnia, Baltic Sea. *Biogeosciences* 7, 6097–6113. **Theme #1**
- Harazim, D., Virtasalo, J.J., Denommee, K.C., Thiemeyer, N., Lahaye, Y. & Whitehouse, M.J. 2020: Exceptional sulfur and iron isotope enrichment in millimetre-sized, early Palaeozoic animal burrows. *Scientific Reports* 10, 20270. **Theme #1**
- Åström, M.E., Yu, C., Virtasalo, J.J., Österholm, P., Peltola, P., Burton, E.D., Hogmalm, J.K. & Ojala, A.E.K. 2020: Extensive accumulation of rare earth elements in estuarine sediments affected by leaching of acid sulfate soils. *Boreal Environment Research* 25, 105–120. **Theme #1**
- Jokinen, S., Koho, K., Virtasalo, J.J. & Jilbert, T. 2020: Depth and intensity of the sulfate-methane transition zone control sedimentary molybdenum and uranium sequestration in a eutrophic low-salinity setting. *Applied Geochemistry* 122, 104767. **Theme #1**

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**4. Did you engage any stakeholders/societal partners/external research users in order to co-produce knowledge in 2020? If yes, who? How did you engage?**

FMI

- FMI signed cooperation agreement with European Maritime Safety Agency, to facilitate the EMTER reporting **#Science and society**
- Support for SWAM in ship emission reporting **#Science and society**
- ARPA FVG cooperation within EMERGE project to include Northern Adriatic Sea as an area for air/water pollution studies **#Science and society**
- Data submission to JRC to support their work on EDGAR emission inventories **#Science and society**
- Review for the Fourth IMO GHG study; UNEP Emissions gap report **#Science and society**

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## PART 2 - Planned activities for 2021 and 2022

### 1. Planned major national and international field studies and collaborative laboratory and modelling studies (incl. all information possible, dates, locations, teams, work, etc.).

FMI

- Atmospheric Composition and Radiative forcing changes due to UN International Ship Emissions regulations (ACRUISE), **#Science and society, Theme #3**

GTK

- Joonas Virtasalo will participate in the IODP Expedition 386 "Japan Trench Paleoseismology" in October-November 2021. **Theme #1**
- Joonas Virtasalo will participate in the Aranda MAAMERI cruise, 30 Aug to 3 Sep 2021 to the southern Gulf of Bothnia and western Gulf of Finland. **Theme #1**

SYKE

- Field campaigns at Utö Atmospheric and Marine Research Station **Theme #3**

### 2. Events like conferences, workshops, meetings, summer schools, capacity building etc. (incl. all information possible).

All activities with physical meetings mainly on hold due to the COVID-19 situation.

FMI

- Copernicus Policy workshop **#Science and society**
- IMO ISWG GHG7 **#Science and society**
- IMO MEPC75 **#Science and society**
- HELCOM Maritime **#Science and society**
- Air Quality 2020 conference, keynote lecture **#Science and society**
- Invited talk at Navigate trade fair **#Science and society**

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GTK

- GTK (Joonas Virtasalo) will co-organize an IODP Magellan workshop titled "Mechanisms of Rifting of Large Continental Blocks", 1 to 3 December 2021 at GTK Espoo. **Theme #1**

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### 3. Funded national and international projects/activities underway.

All partners (FMI, SYKE, UH, UT, ÅA, GTK, LUKE):

- Finnish Marine Research Infrastructure (FINMARI) **Themes #1, 2, 3, 4, 5**

FMI

- Global modeling study of underwater noise, submitted for publication, dataset available through Zenodo **#Science and society**
- FMI-coordinated CriceS consortium secured funding from H2020. The CRiceS project, or Climate relevant interactions and feedbacks: the key role of sea ice and snow in the polar and global climate system, will contribute to a more precise understanding of the ocean-ice-snow-atmosphere system to deliver improved models that describe polar and global climate. The 4-year project starts in September 2021. **Themes #2, #4**
- H2020: JERICO-S3, H2020 JERICO-DS: developing coordinated coastal observing system for European coastal waters **Themes #1, #2, #3, #4, #5, #Science and society**
- Enabling forecasts on radar performance in marine environment, Academy of Finland (2020-23) **# Science and Society**
- H2020/EMERGE - Evaluation, control and Mitigation of the EnviRonmental impacts of shippinG Emissions, project started 02/2020, 7.5 million EUR, FMI coordinates **#Science and society**
- Participation on ICOS-OTC carbonate system instrument intercomparison exercise, delayd from 2020 to 2021 due to COVID-19, Belgium **Theme #1**

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- Centre for Coastal Ecosystem and Climate Change Research (CoastClim), 5-year project funded by the Jane and Aatos Erkko Foundation, starting in September 2021. Joining marine ecology and biogeochemistry, with atmospheric sciences, greenhouse gases and aerosols (University of Helsinki and Stockholm University) to investigate the links between coastal biodiversity and climate change. More funding will be applied for to include also marine physics, modelling etc. **Themes #1, #4**

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- Academy of Finland Project: FERMAID - Ferromanganese Concretion-Archives of Ecosystem Variability, Climate Forcing and Anthropogenic Impact on the Baltic Sea (1.9.2020 – 31.8.2024, PI: Joonas Virtasalo, 540 k€). **Theme #1**

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**4. Plans / ideas for future national or international projects, programmes, proposals, etc. (please indicate the funding agencies and potential submission dates).**

FMI

- JERICO ESFRI application, coordinated by IFREMER, France, submitted in 2020, results in 2021. Finland (FMI and SYKE) full partner in the application. **Themes #1, #2, #3, #4, #5, #Science and society**

SYKE

- JERICO ESFRI application, coordinated by IFREMER, France, submitted in 2020, results in 2021. Finland (FMI and SYKE) full partner in the application **Themes #1, #2, #3, #4, #5, #Science and society**

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**5. Engagements with other international projects, organisations, programmes, etc.**

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- ACRUISE (UK Science foundation), Emissip (Portuguese national project)
- ICOS-ERIC, ACTRIS-ERIC

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- GTK (Joonas Virtasalo) is the Finnish national delegate in ESSAC, the European branch of IODP. **Theme #1**

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**Comments**

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