



CRUISE REPORT



R/V Aranda

Cruise 07/2021

COMBINE 3, leg II 10.8.2021 – 13.8.2021

This report is based on preliminary data and is subject to changes.

COMBINE 3 leg 2 2/7

Objectives of the cruise

The objectives of the cruise were:

1) Monitoring of the Gulf of Finland. Measured parameters were temperature, salinity, oxygen, oil, nutrients, pH, chlorophyll a, secchi depth, phytoplankton, zooplankton, benthic animals, phycotoxins, hazardous substances from the sediments.

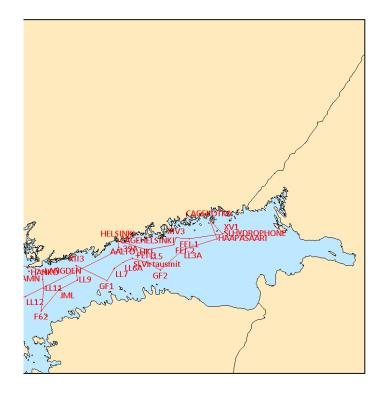
2) Further, a mussel cage was lifted up for later biomarker and hazardous substance analysis, a hydrophone was planned to be lifted up, and a wave buoy was lifted up for maintenance work and put back to sea. In addition, video footage and interviews were planned with two separate film crews and zooplankton was collected for further metabolism analysis by Novia researchers.

Table 1 The scientific crew

Name	On board	Organization
Maiju Lehtiniemi	1013.8.2021	SYKE
Heini Jalli	1013.8.2021	IL
Pia Varmanen	1013.8.2021	SYKE
Ilkka Lastumäki	1013.8.2021	SYKE
Tanja Kinnunen	1013.8.2021	SYKE
Pekka Kosloff	1013.8.2021	SYKE
Sami Pusa	1013.8.2021	SYKE
Outi Setälä	1013.8.2021	SYKE
Tarja Katajisto	1013.8.2021	SYKE
Jere Riikonen	1013.8.2021	SYKE
Mira Granlund	1013.8.2021	SYKE
Juha Flinkman	1013.8.2021	SYKE
Henry Vallius	1013.8.2021	GTK
Mikko Kinnunen	1013.8.2021	GTK
Joakim Pusenius	1013.8.2021	Freelance photographer
Juha Portaankorva	1013.8.2021	YLE
Turkka Korkiamäki	1013.8.2021	YLE
Lisa Naeve	1013.8.2021	Novia
Ella Weissenberg	1013.8.2021	Novia
Antti Räike	1013.8.2021	SYKE
Raisa Turja	1013.8.2021	SYKE

Cruise Route

COMBINE3 leg II covered the Gulf of Finland. The cruise started in Hanko and ended in Helsinki. Cruise lasted 4 days. During the cruise 23 sampling or maintenance stations were covered (see Annex 2. of the stations below).



Cruise route

Observations

In 2021, oxygen levels in the open sea areas of the Gulf of Finland were worse than in summer 2020, but still better than in 2019. Similarly, phosphorus concentrations on the seafloor were higher than in 2020 but mostly lower than in 2019.

Concentrations of biologically available phosphorus and nitrogen measured in the central part of the Gulf of Finland in August were the highest in the history of the 50 years of monitoring (seen e.g. in the phospate figure (Annex 1.) on station LL7 below). The high concentrations are likely explained by water flowing from the main basin of the Baltic Sea trapped in the Gulf of Finland, to which nutrients released from the seafloor have accumulated.

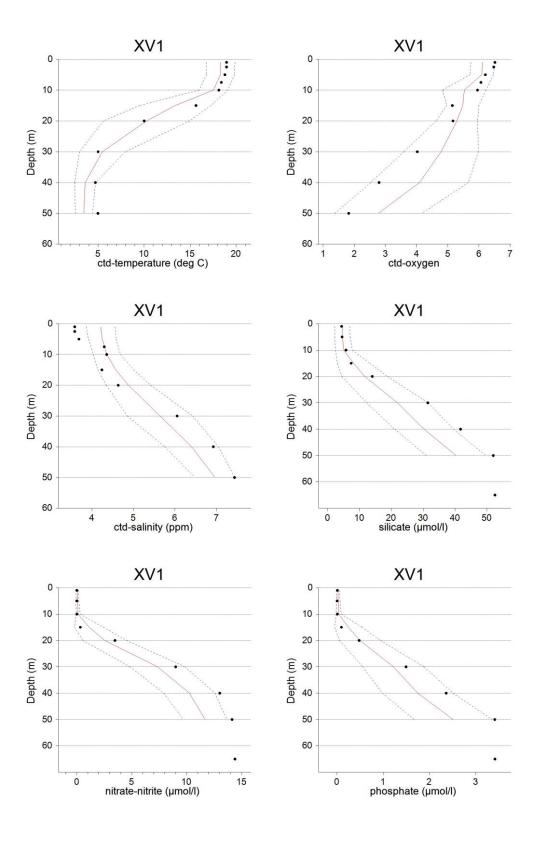
Conclusions

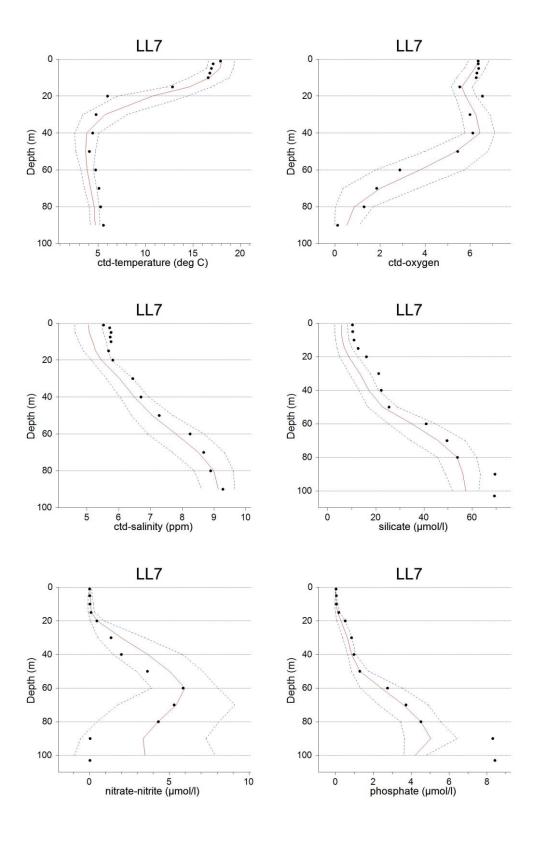
Between 2014 and 2016, several pulses of salty water flowed into the Baltic Sea from the North Sea. The detrimental effects of salty, oxygen-deficient and nutrient-rich water displaced by the salt pulses were evident in the oxygen situation in the Gulf of Finland in August 2019. This is still visible in the Gulf of Finland as low oxygen concentrations in the deeper areas in the middle of the Gulf.

Phosphorus load into the Gulf of Finland has decreased by about 60 % since 2000. Despite this, concentrations of chlorophyll a in the eastern Gulf of Finland, indicating the amount of algae, are

unchanged from the early 1990s. At the same time as load has decreased, the halocline of the main basin of the Baltic Sea has increased in elevation, and large amounts of phosphorus have flowed into the Gulf of Finland with deep water from the main basin. The decrease in phosphorus load may partly explain the reversal of eutrophication in the eastern Gulf of Finland, where, in fact, the effects of the large emission reductions in Russia should be first observed.

Annex 1. Selected variables at the stations XV1 and LL7. Mean (red solid line) and standard deviation (blue dotted lines) represent the data collected at the same time of season since the year 2000.





Annex 2. List of sampled stations of the cruise

INDEX	STATION	latitude	longitude	depth	DATE	time	ctd	На	ОХ	nu	ph	ZO	be	chl	oil	tox	secchi
HANKO	HANKO	59.82323	22.94817	5.5 5.11	2021-08-10	15:57											
2021010349	LANGDEN	59.77682	23.26297	57	2021-08-10	17:56	Х	Х	Х	Х	Х	Х		Х			Х
2021010350	AMN	59.69052	23.25735	55	2021-08-10	21:03	Х	Х	Х	Х				Х			
2021010351	LL11	59.58342	23.29673	68	2021-08-10	22:40	Х	Х	Х	Х				Х			
2021010352	F62	59.33357	23.26357	97	2021-08-11	01:46	Х	Х	Х	Х				Х			
2021010353	JML	59.58187	23.62682	80	2021-08-11	05:23	Х	Х	Х	Х				Х			Х
2021010354	LL9	59.70020	24.03015	67	2021-08-11	08:00	Х	Х	Х	Х	Х	Х		Х			Х
2021010355	XII3	59.86418	23.98592	36	2021-08-11	11:07	Х	Х	Х	Х				Х			Х
2021010356	GF1	59.70500	24.68217	84	2021-08-11	14:38	Х	Х	Х	Х	Х	Х		Х			Х
2021010357	LL7	59.84653	24.83773	104	2021-08-11	18:54	Х	Х	Х	Х	Х	Х		Х	Х		
2021010358	LL6A	59.91685	25.03010	73	2021-08-11	22:25	Х	Х	Х	Х				Х			
2021010359	SLVirtausmit	59.96625	25.22740		2021-08-12	00:39											
2021010360	AALTO_HKI	59.96660	25.22892	62	2021-08-12	00:47	Х										
2021010361	LL5	59.91685	25.59702	69	2021-08-12	03:51	Х	Х	Х	Х				Х			Х
2021010362	GF2	59.83852	25.85687	85	2021-08-12	06:13	Х	Х	Х	Х							Х
2021010363	LL3A	60.06712	26.34662	69	2021-08-12	09:58	Х	Х	Х	Х	Х	Х		Х	Х		Х
2021010364	HAAPASAARI	60.19322	27.11583	62	2021-08-12	14:19	Х	Х	Х	Х				Х			Х
2021010365	CAGEKOTKA	60.40130	26.95308	21	2021-08-12	17:24	Х										
2021010366	XV1	60.24995	27.24705	66	2021-08-12	20:23	Х	Х	Х	Х	Х	Х		Х			
2021010367	SLHYDROPHONE	60.24870	27.24763	67	2021-08-13	00:04	Х										
2021010368	FEI-1	60.19368	26.49767	49	2021-08-13	04:20	Х	Х	Х	Х				Х			Х
2021010369	XIV3	60.20320	26.19283	78	2021-08-13	06:44	Х	Х	Х	Х				Х			Х
2021010370	FEI-2	60.12483	26.14838	42	2021-08-13	08:39	Х	Х	Х	Х				Х			х
2021010371	FEI-3	60.06735	25.54382	54	2021-08-13	11:56	Х	Х	Х	Х				Х			Х
HELSINKI	HELSINKI	60.16180	24.90158		2021-08-13	15:44											

Parameters: ox = oxygen, nu = nutrients, ph = phytoplankton, zo = zooplankton, be = benthos, chl = chlorophyll a, oil = dissolved oil, tox = phytotoxins.