



# CRUISE REPORT



*R/V Aranda*

Cruise 8/2019

C4 2019

*24 – 30 April 2019*

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

## C4 2019

Cruise number 8 / 2019, date 24-30.4.2019

Chief scientist Mika Raateoja

### Description of the cruise

This cruise was part of HELCOM/COMBINE monitoring program, combined with enhanced environmental monitoring of Gulf of Finland. This cruise the Northern Baltic Proper, western and central Gulf of Finland, the Archipelago Sea, and the Bothnian Sea.

Monitoring parameters include:

- the hydrographic description of the water column (density, temperature, salinity)
- water transparency
- water chemistry (nutrients, pH, dissolved O<sub>2</sub>)
- the parameters of biogenic origin (Chl *a*, *in vivo* fluorescence of Chl *a* as well as the taxonomic distribution and biomass of phytoplankton and mesozooplankton)

Also

- SMHI's wavebuoy was deployed in Finngrundet
- Attempts were made to service IL's wavebuoy in the Bothnian Sea
- 4 m<sup>3</sup> of seawater was taken for Viikki's laboratories

### Observations

All in all, the cruise probing the phytoplankton vernal bloom should be two weeks earlier in the year than now carried out. The waning of the vernal bloom was evidenced by the increase in Secchi-depth. Stations LL11 and JML are relatively close to each other. JML had Secchi 3.5 m on the 25<sup>th</sup> while LL11 had twice that on the 29<sup>th</sup> day. Additionally, the Bothnian Sea leg could cover only the southernmost area.

#### *The Gulf of Finland and the northern Baltic Proper*

This part is based on the results acquired early in the cruise, and not on the last stations of the cruise almost a week later.

Seasonal thermocline was about to be formed in the area. The depth and the extent of the faint thermocline varied considerably being affected by the current fields, but in general, it was more developed in the Baltic Proper while in the Gulf there was merely warmer water restricted to the near-surface layer. The timing of the development was early for the season probably due to atypically warm and calm weather in the middle-April.

There was no clear halocline in the Gulf. Rather, salinity increased steadily with depth, and the most at 40-60 m interval. In the Proper, halocline located at 60-70 m, and at 50-60 m at the entrance to the Gulf.

Oxygen was exhausted at 60-70 m in the Gulf and hydrogen sulphide was there from 70 m downwards.

The formation of the seasonal thermocline was still on-going which was apparent in the inorganic nutrient patterns. Nitrate was depleted in the surface, but only in the upper 10-20 m in the Gulf and in the upper 30-40 m in the Proper. Phosphate levels did not drastically decrease towards to the surface, but rather, steadily throughout the water column. In the Gulf, surface values were 0.15-0.25  $\mu\text{mol/l}$ .

The vernal phytoplankton bloom was just passing its peak in the eastern part of the area, as indicated by huge biomasses in the density gradients, and already declining in the western Gulf. We had not any Chl a measurements ready during the cruise, but CTD-fluorescence levels were high in the Finnish coastal area, still inclined elsewhere in the Gulf, and clearly lower in the Proper.

Secchi-depth in the Gulf was 3.0-3.5 m while in the Proper it was 5.0-6.0 m.

#### *The Bothnian Sea*

The seasonal thermocline was in the beginning phases and had started to form only in the coastal areas while the wintertime condition applied in the offshore.

The faint halocline (0.5-0.7 g/kg) was found at 50-80 m in the deep offshore stations while the Finnish coastal area exhibited almost uniform salinity in the vertical. The Swedish coastal area had somewhat (about 0.2 g/kg) fresher water layer in the uppermost 10-20 m probably due to the southbound current from the Bothnian Bay.

No oxygen deficiency was observed in the area. Oxygen concentration did decrease in the halocline but still never fell below 6 ml/l.

Nitrate was exhausted in the upper 10-20 m while phosphate was present in finite concentrations (about 0.1  $\mu\text{mol/l}$ ) suggesting that vernal phytoplankton bloom is at or has reached its maximum. Again, we had not any Chl a measurements ready during the cruise but at least with CTD-fluorescence this could not be seen. The readings were inclined in the upper 20-30 m but the level was low equalling the Baltic Proper where the bloom was already over.

Secchi-depth in the Bothnian Sea was 5.0-6.0 m.

## Cruise personnel

Mika Raateoja	SYKE	24.-30.4.2019
Susanna Hyvärinen	SYKE	24.-30.4.2019
Panu Hänninen	SYKE	24.-30.4.2019
Heini Jalli	IL	24.-30.4.2019
Pekka Kosloff	IL	24.-30.4.2019
Pia Varmanen	SYKE	24.-30.4.2019
Ilkka Lastumäki	SYKE	24.-30.4.2019
Jan-Erik Bruun	SYKE	24.-30.4.2019
Jere Riikonen	SYKE	24.-30.4.2019

INDEX	STATION	LAT	LON	TIME (UTC)	SECCHI	HYDROGRAPHY	CHEMISTRY	CHL	ZPL	KPL
0228	39A	60°04.01'	24°58.81'	24.4.2019 07:59	(x)	X	X	X		
0229	XIV3	60°12.19'	26°11.57'	24.4.2019 12:00	(x)	X	X	X		
0230	LL3A	60°04.03'	26°20.80'	24.4.2019 14:00	(x)	X	X	X	X	X
0231	XV1	60°15.00'	27°14.82'	24.4.2019 18:15	(x)	X	X	X	X	X
0232	GF2	59°50.31'	25°51.41'	24.4.2019 23:45	(x)	X	X	X		
0233	LL5	59°55.01'	25°35.82'	25.4.2019 02:15	(x)	X	X	X		
0234	LL6A	59°55.01'	25°01.81'	25.4.2019 05:02	(x)	X	X	X		
0235	LL7	59°50.79'	24°50.27'	25.4.2019 06:47	(x)	X	X	X	X	X
0236	GF1	59°42.30'	24°40.93'	25.4.2019 10:00	(x)	X	X	X	X	X
0237	LL9	59°42.01'	24°01.81'	25.4.2019 13:15	(x)	X	X	X	X	X
0238	JML	59°34.91'	23°37.61'	25.4.2019 15:48	(x)	X	X	X		
0239	F62	59°20.01'	23°15.81'	25.4.2019 18:10	(x)	X	X	X		
0240	LL15	59°11.00'	21°44.81'	25.4.2019 22:55	(x)	X	X	X		
0241	LL17	59°02.00'	21°04.77'	26.4.2019 02:15	(x)	X	X	X	X	X
0242	TROSKAH	59°39.60'	19°53.00'	26.4.2019 09:08	(x)	X	X	X		
0243	F69	59°47.00'	19°55.80'	26.4.2019 10:40	(x)	X	X	X		
0244	F64	60°11.34'	19°08.55'	26.4.2019 14:55	(x)	X	X	X	X	X
0245	F33	60°31.99'	18°56.26'	26.4.2019 19:19	(x)	X	X	X		
0246	FINNGRUNDET	60°54.00'	18°36.56'	26.4.2019 22:21						
0247	SR3	61°11.00'	18°13.80'	27.4.2019 00:58	(x)	X	X	X		
0248	SR1A	61°14.00'	17°39.79'	27.4.2019 03:49	(x)	X	X	X		

0249	MS2	62°07.00'	17°50.78'	27.4.2019 08:45	(x)	X	X	X		
0250	MS3	62°08.07'	18°09.78'	27.4.2019 10:37	(x)	X	X	X		
0251	MS6	61°59.02'	19°09.81'	27.4.2019 13:53	(x)	X	X	X		
0252	F26	61°59.01'	20°03.78'	27.4.2019 16:50	(x)	X	X	X		
0253	AALTO_SM	61°48.09'	20°14.11'	27.4.2019 19:00						
0254	MS9	61°46.01'	20°31.83'	27.4.2019 20:41	(x)	X	X	X		
0255	SR8	61°07.59'	20°55.80'	28.4.2019 01:05	(x)	X	X	X		
0256	SR7	61°05.01'	20°35.79'	28.4.2019 02:56	(x)	X	X	X		
0257	SS29	61°06.50'	20°16.00'	28.4.2019 04:48	(x)	X	X	X		
0258	SR5	61°05.00'	19°34.78'	28.4.2019 07:32	(x)	X	X	X	X	X
0259	IU1	60°46.01'	20°50.80'	28.4.2019 12:46	(x)	X	X	X		
0260	IU3	60°20.00'	21°06.80'	28.4.2019 15:50	(x)	X	X	X		
0261	IU5	60°03.49'	21°11.90'	28.4.2019 18:25	(x)	X	X	X		
0262	IU7	59°48.91'	21°20.20'	28.4.2019 21:39	(x)	X	X	X	X	X
0263	LL12	59°29.01'	22°53.81'	29.4.2019 05:11	(x)	X	X	X	X	X
0264	LL11	59°35.01'	23°17.81'	29.4.2019 7:51	(x)	X	X	X		
0265	AMN	59°41.43'	23°15.43'	29.4.2019 09:46	(x)	X	X	X		
0266	LANGDEN	59°46.36'	23°15.59'	29.4.2019 11:17	(x)	X	X	X	X	X
0267	XII3	59°52.01'	23°58.81'	29.4.2019 14:38	(x)	X	X	X		