Methods for Collecting and Processing Oceanographic and Meteorological Data

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Localization of Oceanographic Observations

Oceanographic (hydrological) observations at the BIOR Fish Resources Research Department are conducted within the economic zone of the Republic of Latvia, specifically in the Gulf of Riga and the open part of the Baltic Sea (see Figures 1 and 2).

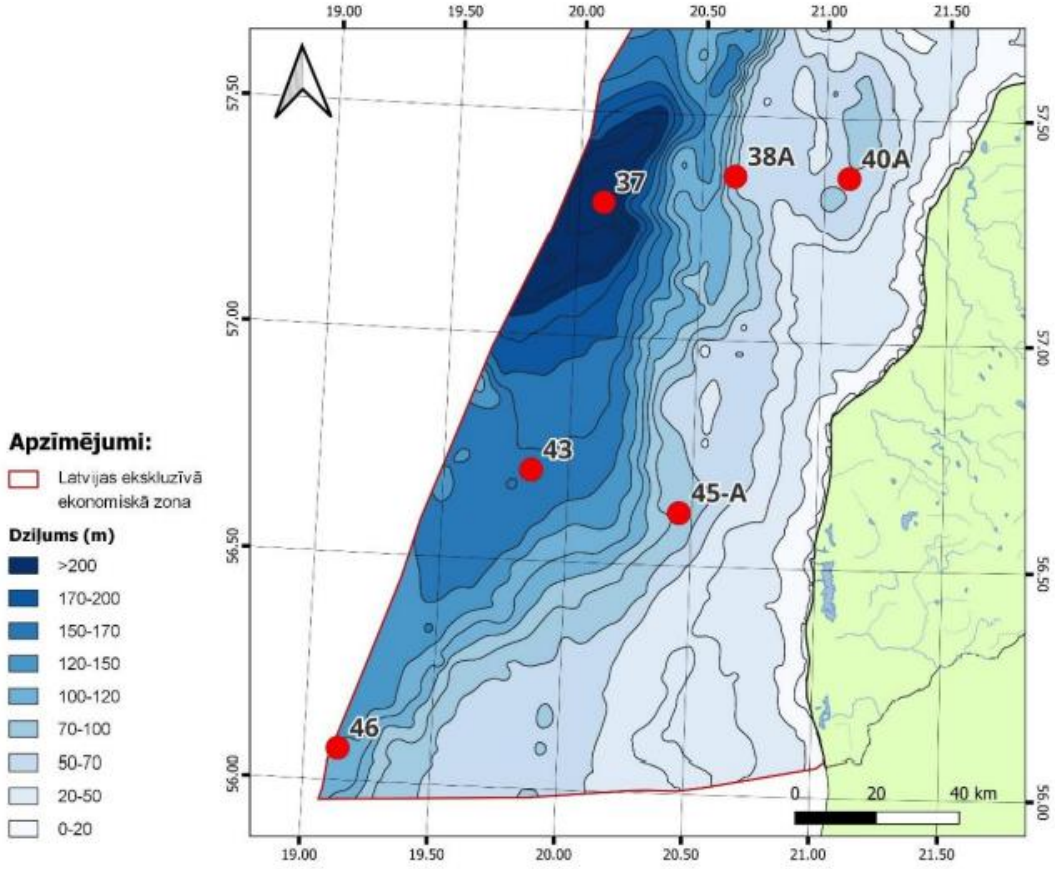

Figure 1. Localization of Oceanographic Observation Stations in the Open Part of the Baltic Sea.

Coastal stations in the Gulf of Riga are defined as those located within the buffer zone of the 6000 m coastline, and the furthest line coincides with an approximate 22 m isobath. All Gulf of Riga stations are classified into the following regions: northeastern (NE, stations 159, 158), eastern (E, stations 160, 161, 121V), southeastern (SE, stations 162A, 163), southern (S, stations 165, 101A, 167, 169), southwestern (SW, stations 170, 171, 172B), western (W, stations 172, 173, 174), and Irbe Strait (IS, 113) regions (see Figure 2).

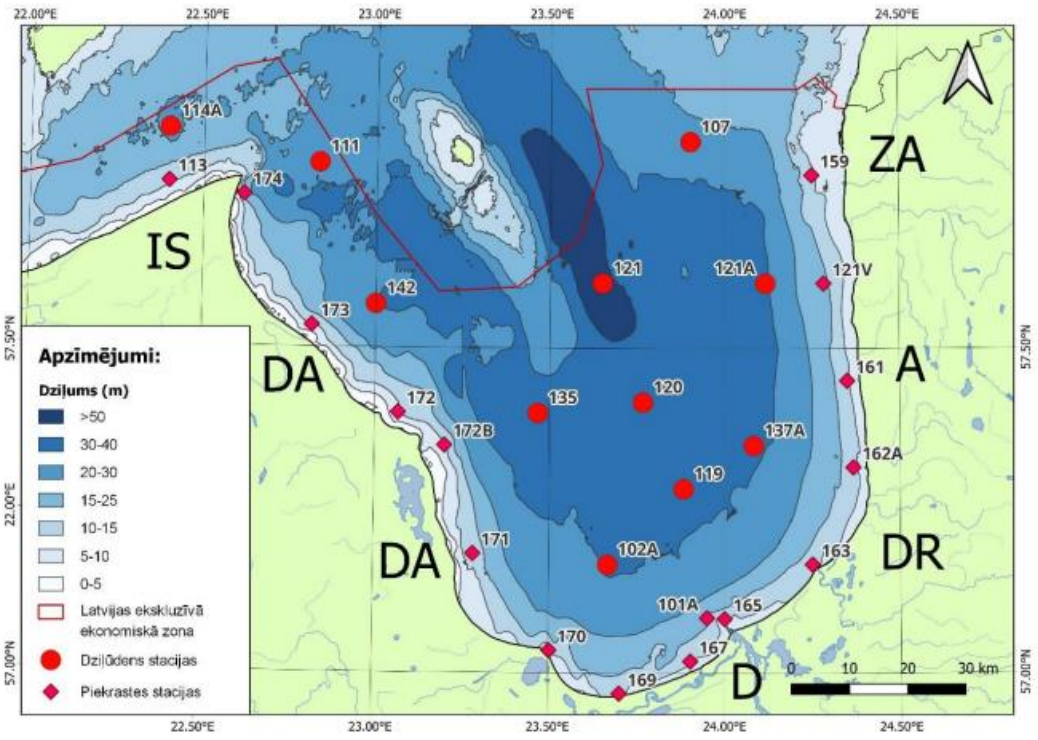

Figure 2. Localization of oceanographic observation stations in the Gulf of Riga

Table 1. Numbers, coordinates, average depth, and location of coastal observation (oceanographic) stations within the exclusive economic zone of the Republic of Latvia.

Rīgas jūras līča stacijas						
Stacija	LAT	LON	Latitude	Longitude	h,m	Komentāri
101A	57.09	23.94	57° 05' 07.000"	23° 56' 06.000"	23.6	
102A	57.17	23.67	57° 10' 00.000"	23° 40' 00.000"	39.6	Engure
103	57.17	23.92	57° 10' 04.000"	23° 55' 08.000"	36.7	
107	57.82	23.9	57° 49' 04.000"	23° 54' 08.000"	33.4	
111	57.78	22.83	57° 47' 01.000"	22° 50' 02.000"	30.1	
113	57.75	22.39	57° 45' 02.000"	22° 23' 06.000"	13.2	Saunags
114A	57.83	22.4	57° 50' 02.000"	22° 24' 01.000"	29.5	Irbes šaurums
119	57.28	23.87	57° 17' 05.000"	23° 52' 07.000"	42.4	
120	57.42	23.77	57° 25' 04.000"	23° 46' 03.000"	44.1	
121	57.59	23.64	57° 35' 08.000"	23° 38' 09.000"	52.4	
121A	57.6	24.12	57° 36' 00.000"	24° 07' 00.000"	41.9	
121V	57.6	24.27	57° 36' 00.000"	24° 16' 09.000"	22.1	Vitrupe
135	57.39	23.47	57° 23' 09.000"	23° 28' 01.000"	43.5	
137A	57.35	24.07	57° 21' 00.000"	24° 04' 09.000"	41.2	
142	57.57	22.99	57° 34' 00.000"	22° 59' 09.000"	40.1	
159	57.75	24.25	57° 45' 09.000"	24° 15' 00.000"	12.2	Salacgriva
162A	57.32	24.35	57° 19' 01.000"	24° 21' 07.000"	13.9	Pabaži

163	57.17	24.24	57° 10' 02.000"	24° 14' 09.000"	14	Gauja
165	57.08	24	57° 05' 00.000"	24° 00' 00.000"	13.6	Daugavgriva
167	57.02	23.9	57° 01' 05.000"	23° 54' 09.000"	13.8	Lielupe
170	57.03	23.5	57° 02' 05.000"	23° 30' 05.000"	14.6	Ragaciems
171	57.17	23.28	57° 10' 02.000"	23° 17' 05.000"	14.2	
172	57.4	23.05	57° 24' 03.000"	23° 03' 07.000"	12.3	Mersrags-Z
172B	57.35	23.2	57° 21' 01.000"	23° 12' 01.000"	13.2	Mersrags-D
173	57.53	22.8	57° 32' 00.000"	22° 48' 09.000"	11	Roja
174	57.73	22.62	57° 44' 00.000"	22° 37' 01.000"	15.8	Kolka
Baltijas jūras atklātās daļas stacijas						
37	57.3	20.1	57° 18' 00.000"	20° 06' 00.000"	238	
43	56.7	20.1	56° 42' 00.000"	19° 51' 00.000"	158	
46	56.07	19.13	56° 04' 00.000"	19° 08' 00.000"	121	
40-A	57.37	21.1	57° 22' 07.000"	21° 06' 00.000"	65	Ventspils
45-A	56.62	20.45	56° 37' 00.000"	20° 27' 00.000"	75	Liepāja

In the Gulf of Riga and the open part of the Baltic Sea, hydrological observations until October 2021 were conducted using the "SBE 19plus" probe, and later the "SBE 19plus V2" probe was used. Temperature, salinity, and oxygen concentration were measured at a 1-second interval. The observations were carried out by lowering the probe with a hydraulic winch every 10 meters in the open part of the Baltic Sea and every 5 meters at the respective stations in the Gulf of Riga (see Figures 1 and 2).

Operations with the SBE 19plus Probe:

Before and after each station:

1. Remove the protective tube from the pump openings.
2. Attach the probe to the cable, ensuring secure connection.
3. Turn on the probe (switch in the ON position).
4. Submerge the probe into the water so that the entire housing is submerged.
5. Hold (wait) the probe at sea level for at least 30 seconds.
6. Immerse the probe at an approximate rate of 0.5 - 1.0 m/s.
7. Monitor the depth based on markings on the cable or by other reliable means.
8. Stop the probe descent every 5 meters (in the Gulf of Riga) or every 10 meters (in the Baltic Sea).
9. Hold (wait) the probe at the respective depth for at least 20 seconds.
10. Terminate the probe descent as close to the seabed as possible.
11. Retrieve the probe at maximum speed.
12. Turn off the probe (switch in the OFF position).

13. Check if the lower opening of the probe is contaminated with sediments. If contaminated, rinse the probe with preferably clean drinking water using the upper opening.
14. Place the protective tube on the lower pump opening.
15. Pour a small amount of water into the protective tube, ensuring contact with the connection area.
16. Put the protective tube on the upper pump opening.

Regarding the holding (waiting) of the probe,

The response time (inertia) of the sensors, as indicated in the instructions, is typically around 0.1 - 0.5 seconds, which means a very short time for the true parameter value to be established. However, this time applies only to individual isolated sensors.

In real life, all sensors are mounted inside the probe's casing, and this factor significantly affects the response time. There are two reasons for this:

1. Water supply to the sensors is provided by a pump, and it takes some time for the water to reach the sensor.
2. The probe has a certain mass, approximately up to 5 kg, and it has a known thermal inertia. As a result, the true temperature is recorded with a slight delay.

Oceanographic and hydrometeorological observations in the Gulf of Riga and the open part of the Baltic Sea.

Hydrological observations in the Gulf of Riga and the open part of the Baltic Sea were conducted until October 2021 using the SBE 19plus probe, and later the SBE 19plus V2 probe. Temperature, salinity, and dissolved oxygen concentration were measured at 1-second intervals. The observations involved lowering the probe using a hydraulic winch every 10 meters in the open Baltic Sea and every 5 meters at the respective stations in the Gulf of Riga (see Figures 1 and 2). The data obtained with the probe were also corrected using classical oceanographic observation methods, such as temperature determination with reversing thermometers, water sampling with bathometers, salinity determination using conductivity, and dissolved oxygen determination using the Winkler method.

Hydrometeorological parameters were obtained using the following instruments: wind direction - using a ship's compass, wind speed - with an MC-13 anemometer. Visual assessments were made for water transparency using a Seki disk and water colour using the ŠCV scale. Some regularly observed hydrometeorological parameters were obtained from the internet, such as air temperature and wind parameters. River discharge data were obtained from the Latvian

Environment, Geology, and Meteorology Centre (LVĢMC) website: Daugava River - Pļaviņas Hydroelectric Power Station, Lielupe River, Gauja River, Salaca River.

In the meteorological description, wind direction sectors are defined as follows: northern sector (northwest, north, and northeast winds), north-eastern sector (north, northeast, and east winds), eastern sector (northeast, east, and southeast winds), south-eastern sector (east, southeast, and south winds), southern sector (southeast, south, and southwest winds), southwestern sector (south, southwest, and west winds), western sector (southwest, west, and northwest winds), north-western sector (west, northwest, and north winds).

To characterize the hydrological regime of the Riga Bay, average water temperature, salinity, and oxygen concentration values are used for the entire bay (0-50 m), as well as for the surface layer (0-10 m) and deep layer (30-50 m). These values are compared to the norms (long-term values).

The boundary between the deep and coastal zones is assumed to be approximately at 22 m isobath. The coastal zone is divided into the following regions: north-eastern (NE, stations 159, 158), eastern (E, stations 160, 161, 121V), south-eastern (SE, stations 162A, 163, 163B), southern (S, stations 165, 101A, 167, 167B, 169), southwestern (SW, stations 170, 171, 172B), western (W, stations 172, 173, 174), and Irbe Strait (IS, 113) regions (refer to Figure 2).

For the open Baltic Sea waters, the hydrological regime is characterized by average water temperature, salinity, and oxygen concentration values in the surface layer (0-20 m), the active intermediate layer (46 stations - 70-90 m, 43 and 37 stations - 100-130 m), as well as the deep layer (46 stations - 100-120 m, 43 stations - 130-150 m, 37 stations - 200-230 m; refer to Figure 1).