Guidelines for Conducting Benthic Fish Surveys in Gulf of Riga

Ē. Krūze, I. Putnis

The purpose of the expedition is to conduct surveys of benthic fish and collect biological material, as well as gather information on zooplankton, zoobenthos, and oceanographic data. In the Gulf of Riga, three benthic fish survey trips are conducted each year: in May, August, and October.

Benthic fish surveys in Gulf of Riga and the Irbe Sea Strait are carried out with the assistance of fishing vessels of the MRTK ("Baltica") type. Samples are collected using a bottom trawl with a horizontal opening of 18 meters and a vertical opening of 1.5 meters while moving forward. The mesh size of the net wings is 17 mm, and the mesh size in the cod-end varies from 6 to 8 mm (see Figures 1 and 2). Trawling lasts for 30 minutes, excluding the time for deploying and retrieving the trawl, and the trawling speed is 3 knots. During half an hour, approximately 50,000 square meters of the seabed are sampled. In situations where a large amount of pelagic fish is observed on the echosounder or there are suspicions of trawl snagging, the trawling time is shortened, and the catch is recalculated to a 30-minute equivalent. Fish counts are conducted at different depths at predetermined standard stations or transects in the Irbe Strait and in various parts of the Gulf of Riga: west, east, south, and central. Trawling is also conducted during the night, which is why pelagic fish by-catch measurements are not used in further calculations. The design of the expedition, trawl routes, and the research trawl prototype were established in the 1970s and have remained unchanged since then to ensure that the data obtained each year is comparable.

In one benthic fish survey trip in Gulf of Riga, 10-14 randomly selected trawls are carried out from 30 possible trawling standard stations (see Table 1). The network of stations is spread across the entire Latvian Economic Zone of Gulf of Riga, including coastal territories, to cover all favorable bottom types and depth zones for trawling. The number of trawls conducted, and the selected standard stations mainly depend on weather conditions and the optimal route choice. Additionally, oceanographic stations are sampled in a limited time frame, which is 3 days in May and October and 6 working days in August when oceanographic parameters and zooplankton samples are collected from 5 additional stations in the open Baltic Sea. Depending on the conditions, the expedition leader may make changes to the expedition plan.

For each haul, the following information is documented: Station number, date (dd.mm.yy), depth (m), start and end time of trawling (hh:mm), as well as the starting and ending coordinates of trawling, wind direction (°) and strength (m/s), wave height (m), and the length of the trawl warp (m).

The catch is analyzed immediately after retrieving the trawl. Depending on the size of the catch, either the entire catch or a portion of it is analyzed. If a subsample is taken, the results are recalculated for the entire catch. For each haul, the total mass and the number and mass of fish species in the catch are determined.

Mass measurements are conducted for all benthic fish species in the catch. Biological samples of round goby and eelpout are frozen for further analysis in the laboratory. Freshwater and migratory fish are counted and weighed separately. For pelagic fish species such as three-spined sticklebacks, nine-spined sticklebacks, sprat, herring, and salmon, only the total weight and

quantity in the catch are calculated. The composition of each haul catches and mass measurements of fish species are recorded on a designated form (see Figure 4).

Fish measurements are performed using a caliper. Measurements are made with a resolution of 1 mm. Weights of the catch are determined using marine scales with an accuracy of ± 50 g, and for sorted fish, spring scales with an accuracy of ± 10 g (for 1 kg scales), ± 20 g (for 2.5 kg scales), ± 50 g (for 5 kg scales), and ± 100 g (for 10 kg scales) are used. Small fish are weighed using electronic scales with an accuracy of ± 0.1 g.

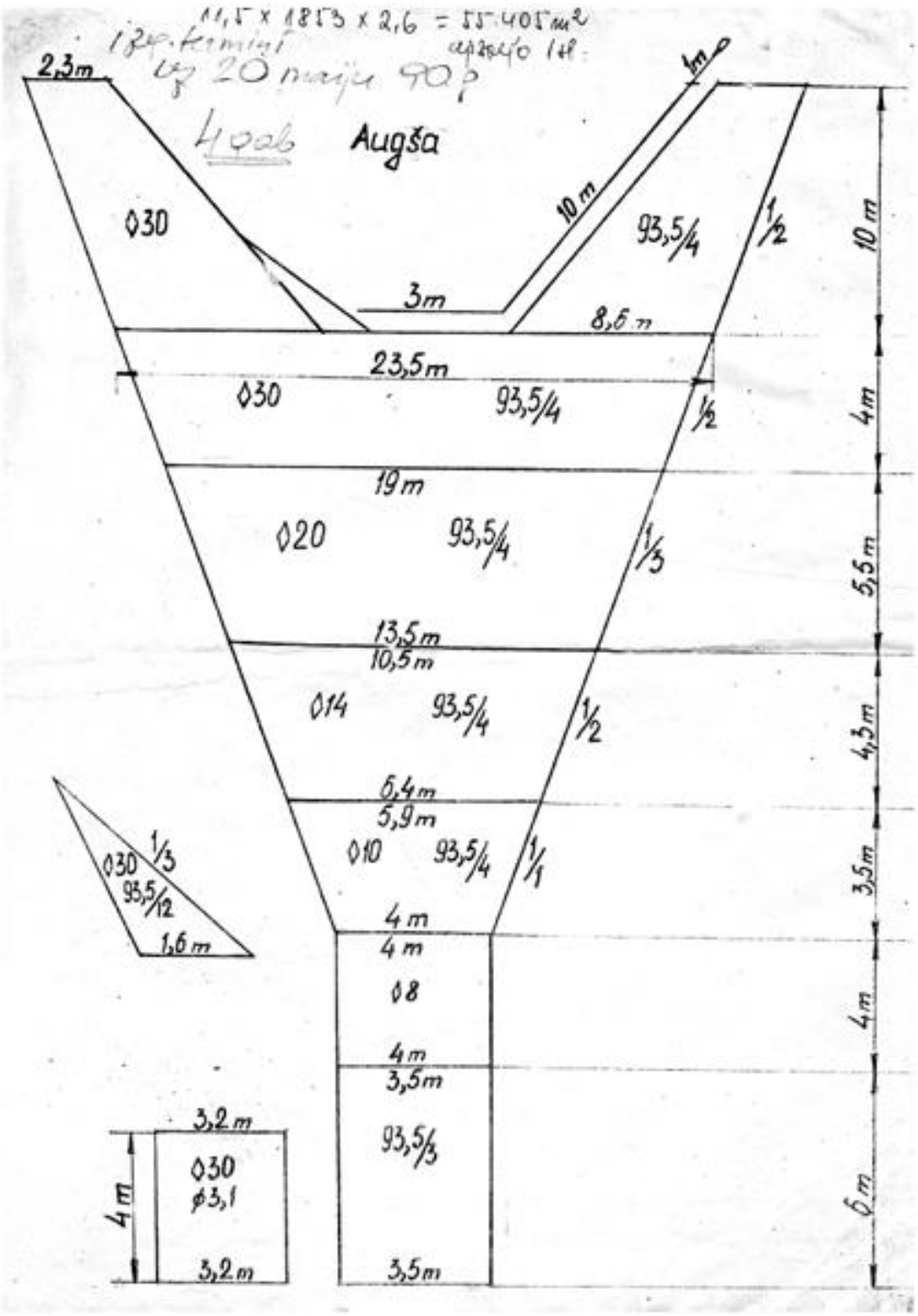

Figure 1. Surface schematic of the research trawl.

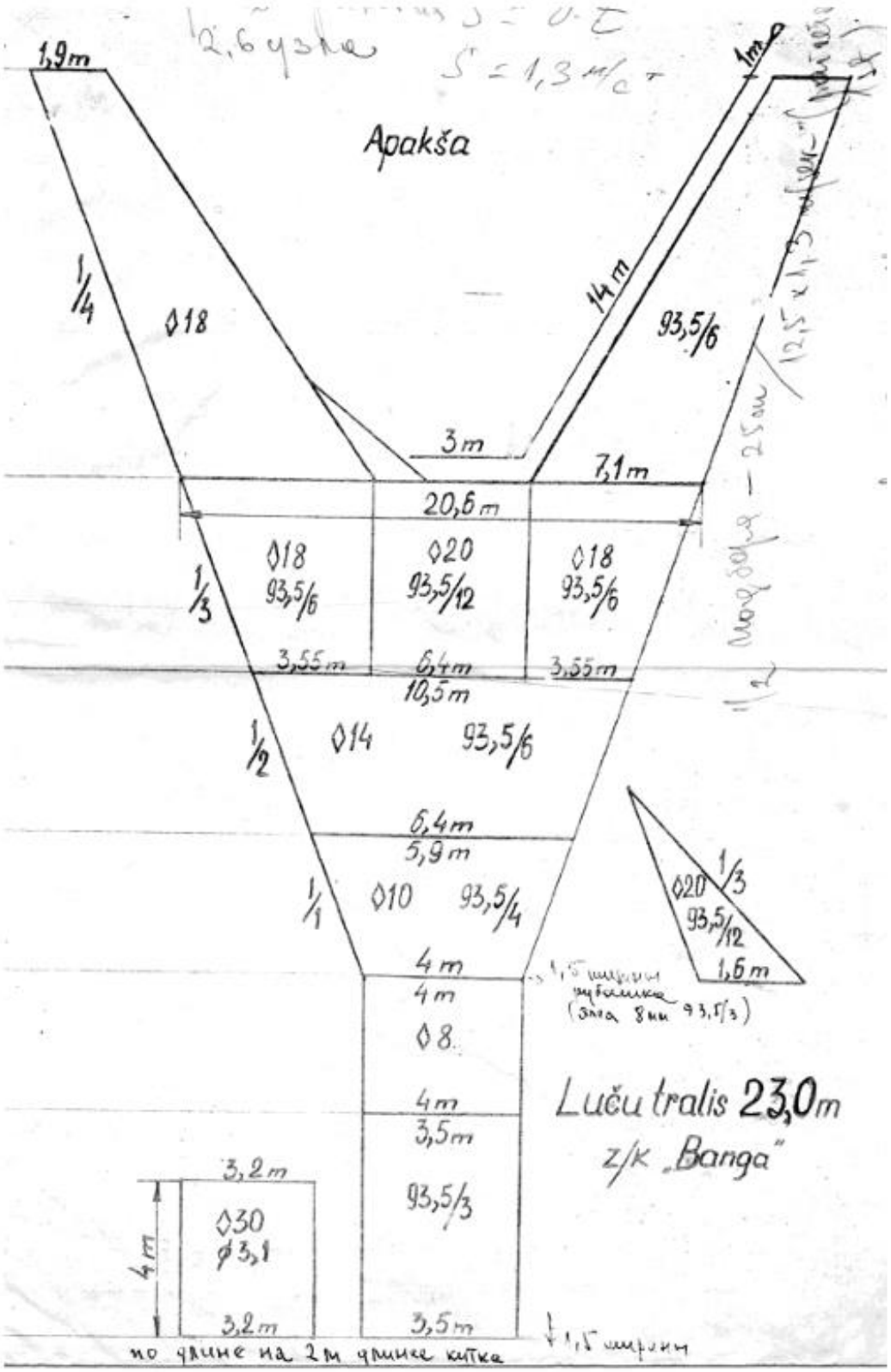

Figure 2. Bottom view schematic of the research trawl

Figure 3. Trawl data sheet for Gulf of Riga benthic fish survey.

	Rīgas līča reisa Loma apraksta blanka								
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Table 1. List of standard stations for benthic fish surveys in Gulf of Riga with coordinates.

Nr.	Kv.	Dziļums	N	E	Lat dec	Long dec	Nosaukums
1	184	30	57450	24100	57.75	24.1667	Salacgrīva (159)
2	190	27	57470	24100	57.78333	24.1667	Salacgrīva
3	197	43	57415	23520	57.69167	23.8667	Salacgrīva 40 (107)
4	212	55	57372	23370	57.62	23.6167	Centrs 50 (121)
5	206	45	57260	23450	57.43333	23.75	Centrs
6	193	43	57170	23540	57.28333	23.9	Gauja 40 (119)
7	187	26	57358	24065	57.59667	24.1083	Skulte (137A)
8	187	40	57210	24050	57.35	24.0833	Gauja 30
9	187	13	57113	24180	57.18833	24.3	Gauja 10
10	201	10	57014	23578	57.02333	23.9633	Lielupe 10
11	201	22	57030	23507	57.05	23.845	Lielupe 20
12	208	30	57035	23425	57.05833	23.7083	Lielupe 30
13	208	38	57082	23430	57.13667	23.7167	Lielupe 40 (102A)
14	221	41	57195	23229	57.325	23.3817	Mērsrags 40 (135)
15	252	20	57263	23020	57.465	23.0333	Mērsrags 20 Z
16	251	41	57333	23013	57.555	23.0217	Roja 40 (142)
17	265	28	57336	22501	57.56	22.835	Roja 30 (142-A)
18	277	19	57371	22432	57.61833	22.72	Roja 20
19	285	15	57410	22378	57.68333	22.63	Melnsils 15 (174)
20	285	12	57461	22312	57.76833	22.52	Irbe 12
21	295	22	57458	22424	57.76333	22.7067	Irbe 20 (113)
22	276	30	57479	22470	57.79833	22.7833	Kolka (111)
23	252	15	57255	23035	57.425	23.0583	Mersrags 15
24	238	15	57127	23157	57.21167	23.2617	Bērzciems
25	223	15	57030	23244	57.05	23.4067	Plieņciems
26	238	13	57199	23131	57.33167	23.2183	Mērsrags 10 D
27	305	10	57430	22186	57.71667	22.31	Mazirbe 10
28	285	18	57487	22363	57.81167	22.605	Kolkas bāka
29	214	42	57100	23395	57.16667	23.6583	Centrs 102A
30	305	28	57500	22246	57.83333	22.41	Irbe 28 (114-A)

Oceanographic observations are conducted according to the Institute's methodology for oceanographic and meteorological data collection and processing. Measurements are taken using the "SBE 19plus" probe, which is lowered to the seabed at standard stations. Temperature, salinity, and oxygen concentration must be measured at 1-second intervals. Hydro-meteorological parameters are obtained using the following instruments: wind direction - based on the ship's compass, wind speed - with an anemometer MC-13. Visual assessments are made for water transparency using a Secchi disk and water color using an SCV scale. Oceanographic observations are conducted at specified standard stations (Figure 4) and before trawling operations commence.

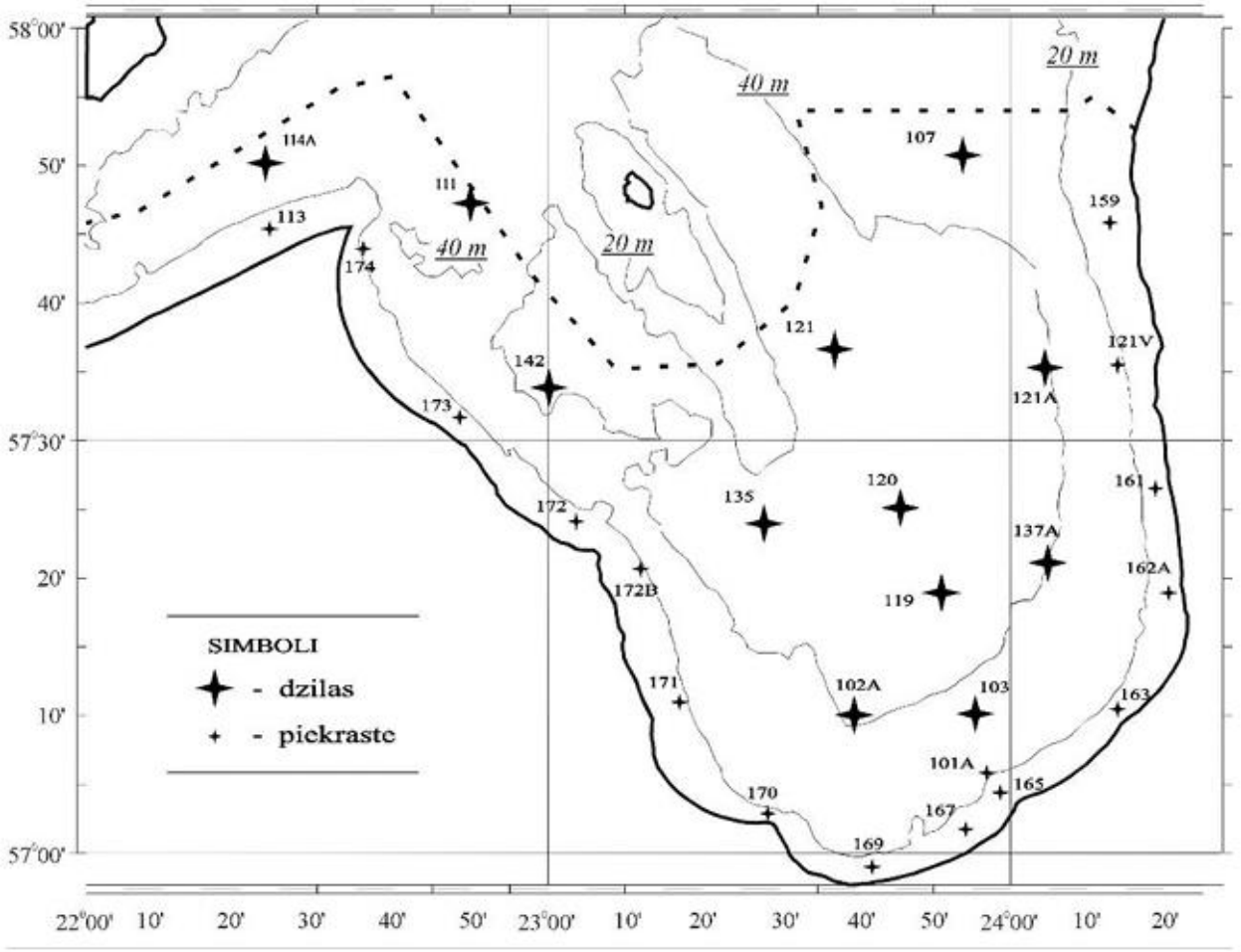

Figure 4. Localization of oceanographic observation stations in Gulf of Riga and its coastal area.

Zooplankton and hydrological samples are collected at oceanographic observation standard stations (Tables 2 and 3). The collection of zooplankton samples follows the Institute's methodology for zooplankton collection, analysis, and data processing. Samples are collected using a D-net (with an upper ring diameter of 37 cm and a middle ring diameter of 50 cm) with a filtering mesh size of 160 micrometers. Samples are filtered and preserved in ethanol.

In the Gulf of Riga, zooplankton samples are collected in May, August, and October in two water layers: throughout the entire water column from the seafloor to the water surface and in the upper 0-20 m water layer. In shallow stations (with a depth of approximately 20 m), samples are collected only in the entire water column. In the open Baltic Sea area, zooplankton samples are taken in the 0-100 m layer and the upper 0-50 m water layer.

Table 2. Coordinates of oceanographic observation stations in Gulf of Riga.

Stacijas nr.	LAT	LON	Latitude	Longitude	h,m	Komentāri
101A	57.08528	23.935	57° 05' 07.000"	23° 56' 06.000"	23.6	
102A	57.16667	23.66667	57° 10' 00.000"	23° 40' 00.000"	39.6	Engure
103	57.16778	23.91889	57° 10' 04.000"	23° 55' 08.000"	36.7	
107	57.81778	23.90222	57° 49' 04.000"	23° 54' 08.000"	33.4	
111	57.78361	22.83389	57° 47' 01.000"	22° 50' 02.000"	30.1	
113	57.75056	22.385	57° 45' 02.000"	22° 23' 06.000"	13.2	Saunags
114A	57.83389	22.40028	57° 50' 02.000"	22° 24' 01.000"	29.5	Irbes_šaurums
119	57.28472	23.86861	57° 17' 05.000"	23° 52' 07.000"	42.4	
120	57.41778	23.7675	57° 25' 04.000"	23° 46' 03.000"	44.1	
121	57.58556	23.63583	57° 35' 08.000"	23° 38' 09.000"	52.4	
121A	57.6	24.11667	57° 36' 00.000"	24° 07' 00.000"	41.9	
121V	57.6	24.26917	57° 36' 00.000"	24° 16' 09.000"	22.1	Vitrupe
135	57.38583	23.46694	57° 23' 09.000"	23° 28' 01.000"	43.5	
137A	57.35	24.06917	57° 21' 00.000"	24° 04' 09.000"	41.2	
142	57.56667	22.98583	57° 34' 00.000"	22° 59' 09.000"	40.1	
159	57.7525	24.25	57° 45' 09.000"	24° 15' 00.000"	12.2	Salacgriva
162A	57.31694	24.35194	57° 19' 01.000"	24° 21' 07.000"	13.9	Pabaži
163	57.16722	24.23583	57° 10' 02.000"	24° 14' 09.000"	14	Gauja
165	57.08333	24	57° 05' 00.000"	24° 00' 00.000"	13.6	Daugavgriva
167	57.01806	23.9025	57° 01' 05.000"	23° 54' 09.000"	13.8	Lielupe
170	57.03472	23.50139	57° 02' 05.000"	23° 30' 05.000"	14.6	Ragaciems
171	57.16722	23.28472	57° 10' 02.000"	23° 17' 05.000"	14.2	
172	57.40083	23.05194	57° 24' 03.000"	23° 03' 07.000"	12.3	Mersrags-Z
172B	57.35028	23.20028	57° 21' 01.000"	23° 12' 01.000"	13.2	Mersrags-D
173	57.53333	22.8025	57° 32' 00.000"	22° 48' 09.000"	11	Roja
174	57.73333	22.61694	57° 44' 00.000"	22° 37' 01.000"	15.8	Kolka

Table 3. Coordinates of hydrological stations in the open part of the Baltic Sea.

Stacijas nr.	LAT	LON	Latitude	Longitude	h,m	Komentāri
37	57.30	20.10	57° 18' 00.000"	20° 06' 00.000"	238	
43	56.70	20.10	56° 42' 00.000"	19° 51' 00.000"	158	
46	56.07	19.13	56° 04' 00.000"	19° 08' 00.000"	121	
40A	57.37	21.10	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