

## Preliminary results of monitoring the microbiological quality of the seawater on the project sites in Croatia



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## **Preliminary results of monitoring the microbiological quality of the sea in the ports of Špinut and Strožanac and on the beach in Podstrana**

Monitoring of the microbiological quality of the seawater in the ports of Špinut and Strožanac and on the beach in Podstrana within the project "ECOMAP", from the cross-border cooperation program Italy-Croatia 2014-2020 began in April 2019. The aim of monitoring is the microbiological characterization of the sea to meet the criteria for obtaining/retaining the Blue Flag certificate, international recognition of exceptional cleanliness, quality and tidiness of beaches and ports. Although the microbiological quality of the seawater is not a mandatory criterion for awarding the Blue Flag in ports, but only on beaches, the goal of the "ECOMAP" project is to create conditions for achieving at least good seawater quality in ports, to emphasize their environmental commitment and recognize their efforts in protection and preservation of the marine environment. In the period of April 2019 - March 2020, a total of 11 sampling campaigns were performed in both ports and 15 on the beach in Podstrana to determine indicators of microbiological quality, *Escherichia coli* and intestinal enterococci. Measurements of physical parameters (temperature and salinity of seawater) were also performed. Sampling and testing were performed by the project partner Institute of Oceanography and Fisheries. The research was performed at a total of 9 control points in the area of the port of Špinut (Figure 1), 8 points in the area of the port of Strožanac (Figure 2) and 7 points on the beach in Podstrana (Figure 3). In addition to spatial variability, temporal variability investigations of seawater quality on the beach in Podstrana were performed. For this purpose, sampling was performed 3 times a day, around 10 a.m., 11:30 a.m., and 5:00 p.m., several times during the bathing season. The analyses were performed following standard ISO methods and the data were processed using the methods and criteria for assessing the microbiological quality of the bathing sea, according to the national Regulation on Sea bathing water quality (OG 73/08). Since bathing in ports is prohibited and there are no criteria for the microbiological quality of seawater assessment, data for ports were processed using criteria and methods for assessing the microbiological quality of the bathing seawater.

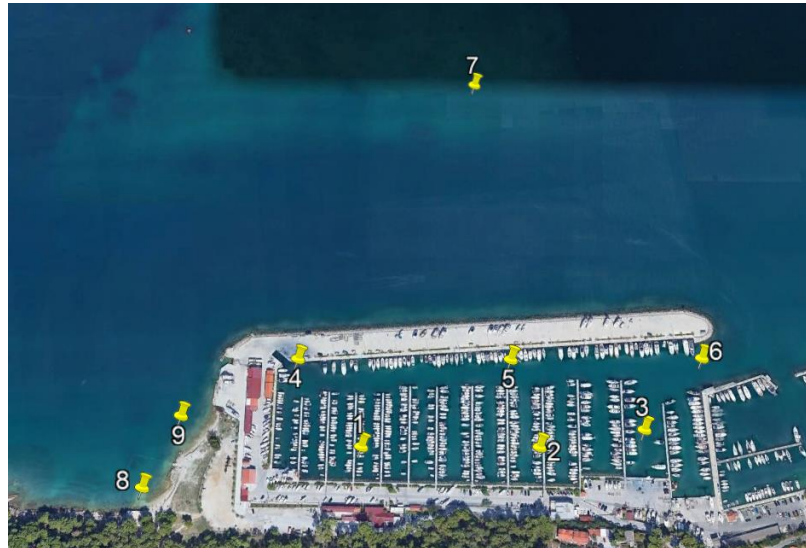


Figure 1. Sampling points for the determination of the microbiological quality of seawater in the port of Špinut

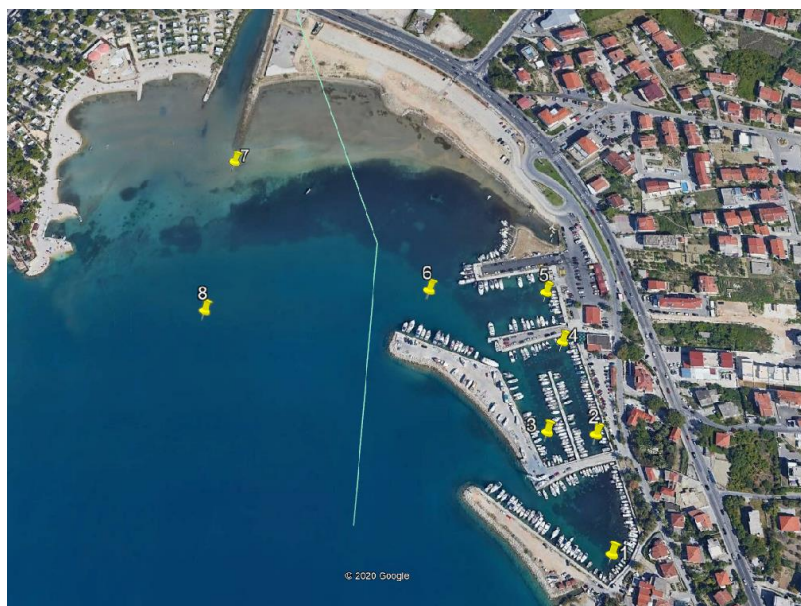


Figure 2. Sampling points for the determination of the microbiological quality of seawater in the port of Strožanac



Figure 3. Sampling points for the determination of the microbiological quality of seawater on the beach in Podstrana

In the mentioned period of research, the microbiological quality of the sea in the port of Špinut was excellent at 4 control points and good at two points. The negative effect of the port on the microbiological quality of the sea on the neighbouring beach (Prva Voda) was not determined since both points on the beach were of excellent quality (Figure 4).

The seawater quality in the area of the port of Strožanac was good at 4 and sufficient at 3 control points. At one control point, sea quality was unsatisfactory (Figure 5). If only data from the bathing season period are considered, 6 points were of excellent quality, 1 good and 1 sufficient (Figure 6). Preliminary results indicate the seasonal character of microbiological marine pollution in the area of the port of Strožanac.

The microbiological quality of the sea on the beach in Podstrana was excellent at 6 points and good at one point (Figure 7). If only data from the period of the bathing season are considered, when according to the Regulation on Sea bathing water quality is officially monitored, the quality of the sea was excellent at all control points (Figure 8). No significant temporal variations in quality were found, meaning the sea was of excellent quality during the morning and afternoon hours.

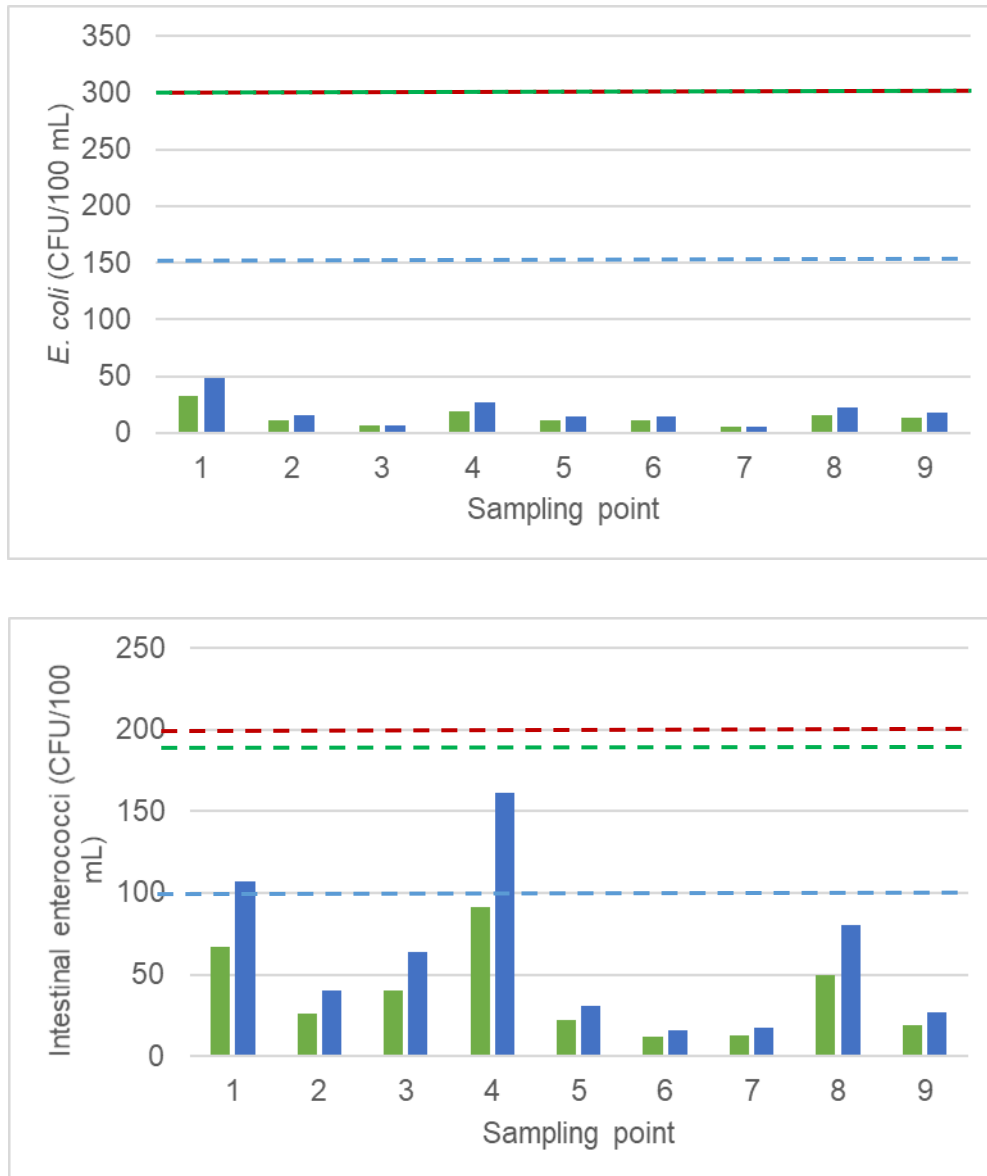


Figure 4. Seawater quality in the port of Špinut for the period of April 2019 - March 2020.

Upper limits for seawater quality categories:

----- excellent\*, - - - - good\*, - . . . . sufficient\*\*

\* based on 95<sup>th</sup> percentile (blue bars)

\*\* based on 90<sup>th</sup> percentile (green bars)

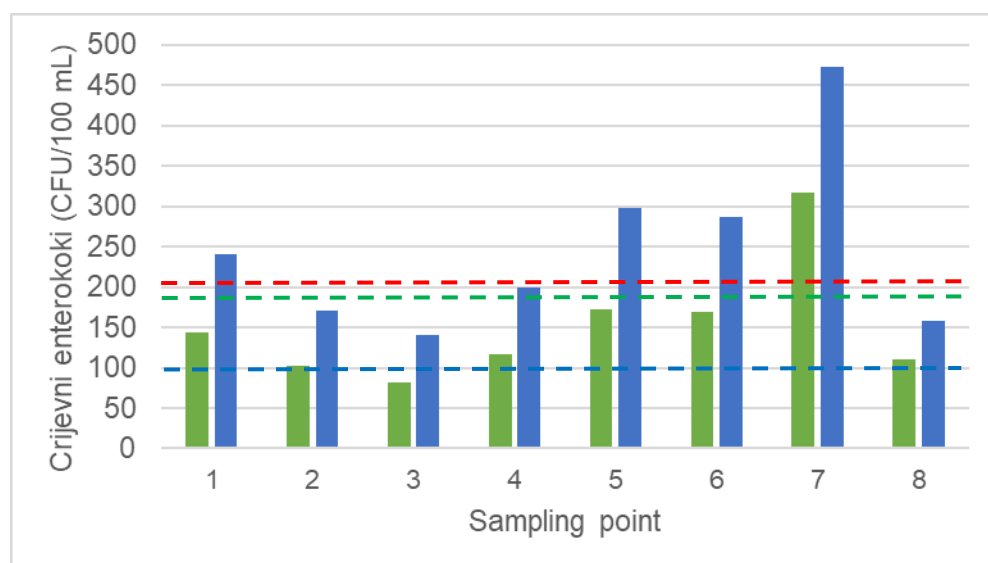
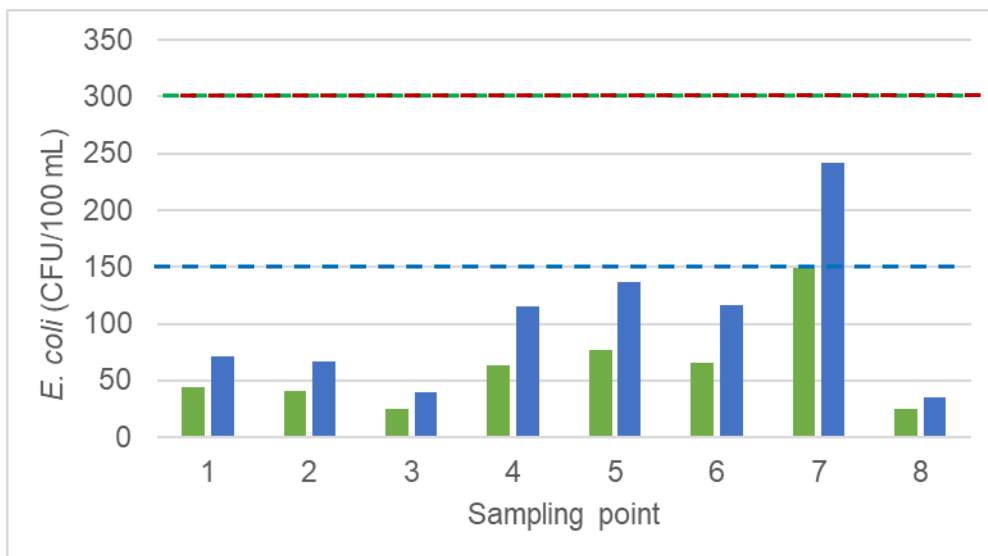


Figure 5. Seawater quality in the port of Strožanac for the period of April 2019 - March 2020.

Upper limits for seawater quality categories:

- - - - - excellent\*, - - - - - good\*, - - - - - sufficient\*\*

\* based on 95<sup>th</sup> percentile (blue bars)

\*\* based on 90<sup>th</sup> percentile (green bars)

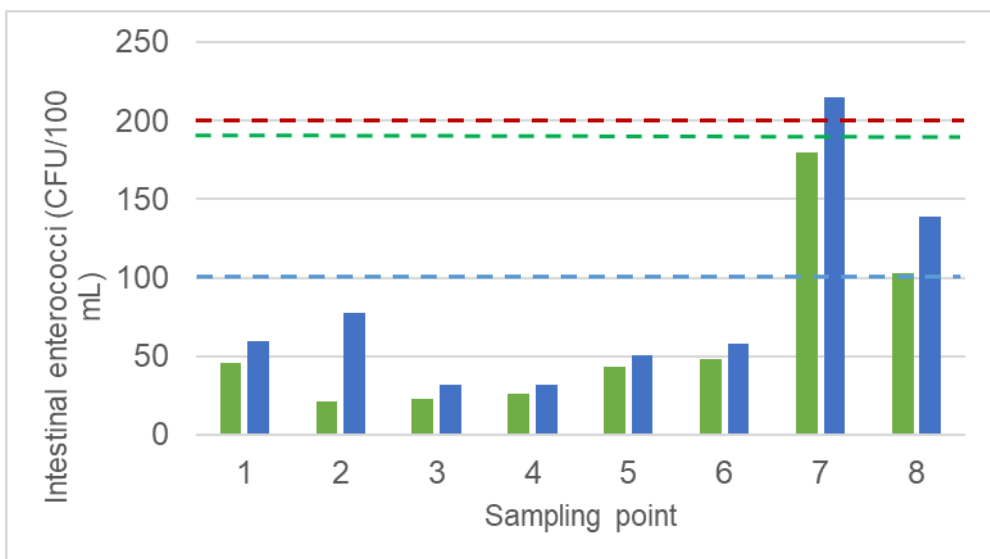
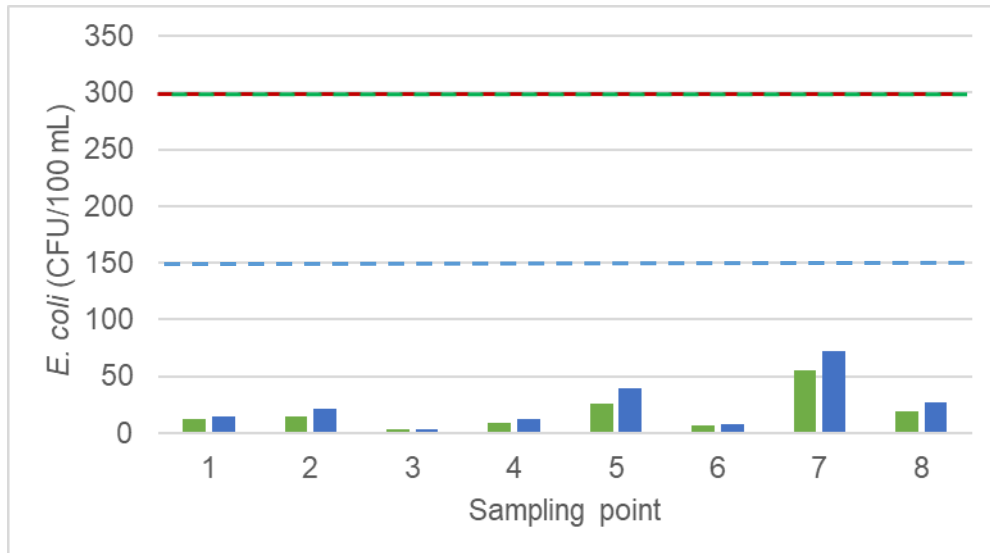


Figure 6. Seawater quality in the port of Strožanac in the bathing season 2019.

Upper limits for seawater quality categories:

- - - - - excellent\*, - - - - - good\*, - - - - - sufficient\*\*

\* based on 95<sup>th</sup> percentile (blue bars)

\*\* based on 90<sup>th</sup> percentile (green bars)

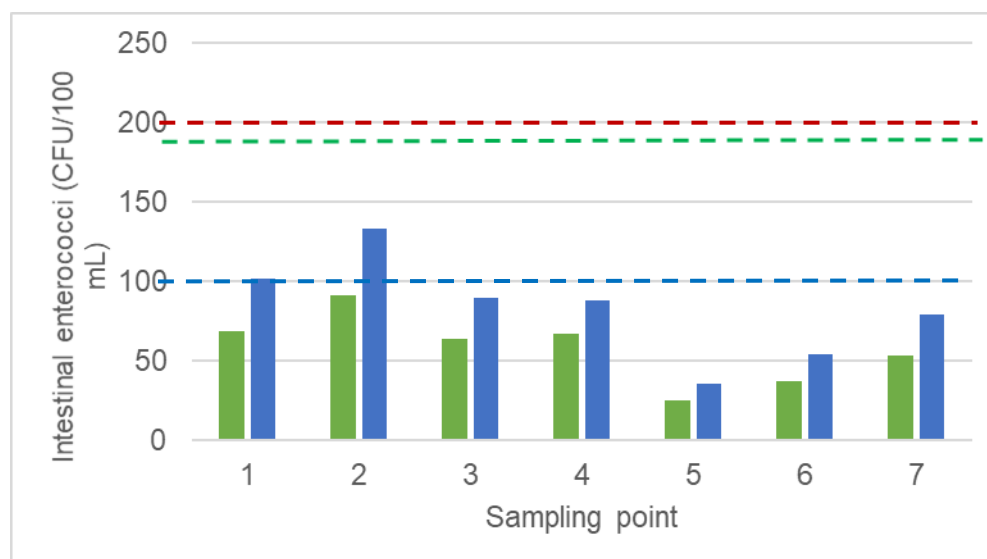
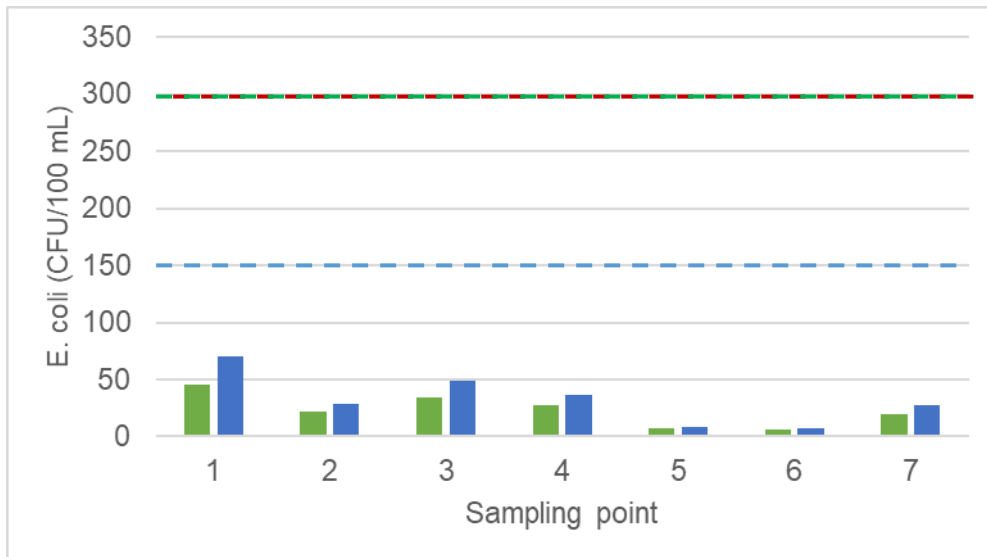


Figure 7. Seawater quality on the beach in Podstrana in the period of April 2019 - March 2020.

Upper limits for seawater quality categories:

----- excellent\*, ----- good\*, ----- sufficient\*\*

\* based on 95th percentile (blue bars)

\*\* based on 90th percentile (green bars)



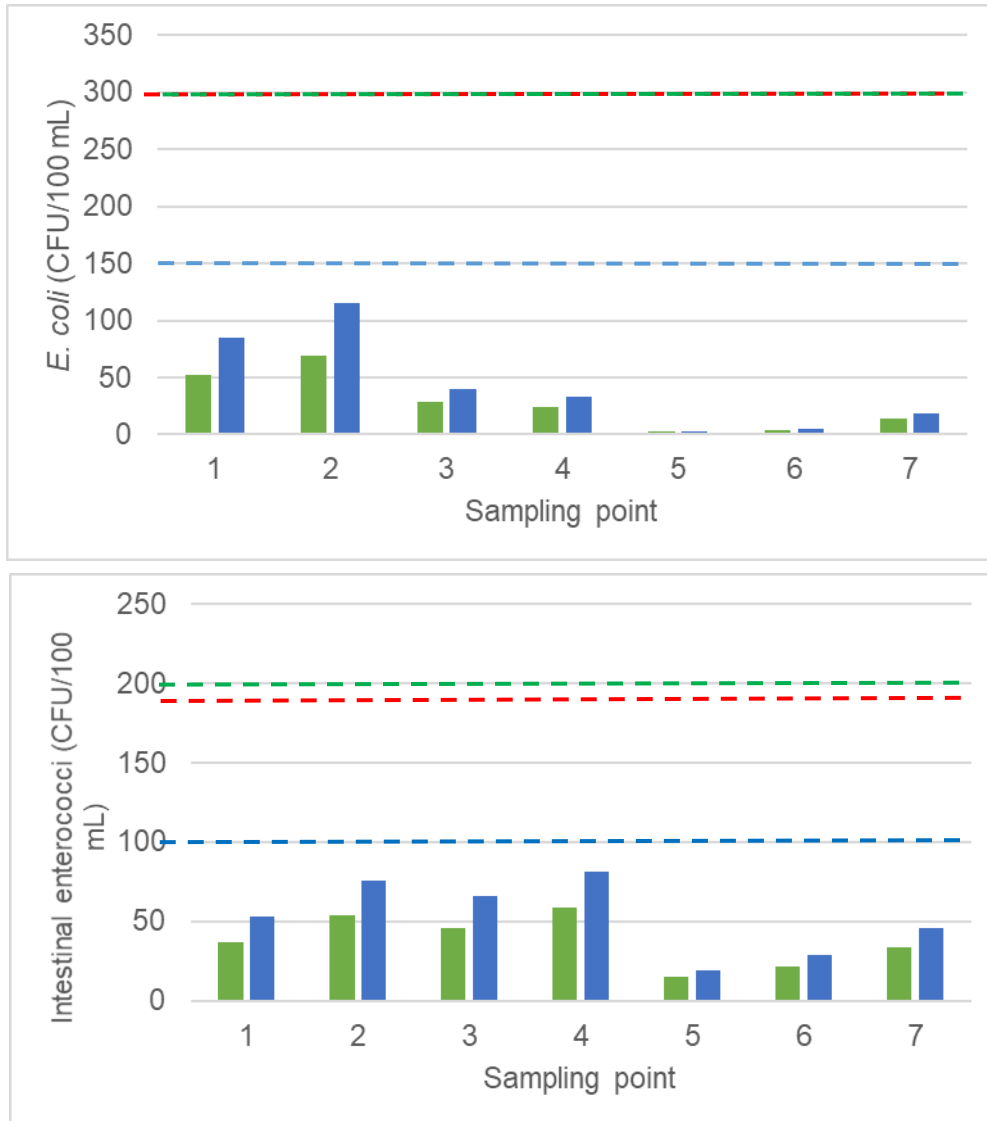


Figure 8. Seawater quality on the beach in Podstrana in the bathing season 2019

Upper limits for seawater quality categories:

- - - - - excellent\*, - - - - - good\*, - . - . - . sufficient\*\*

\* based on 95<sup>th</sup> percentile (blue bars)

\*\* based on 90<sup>th</sup> percentile (green bars)