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Videoconference, 27 and 30 May 2022

**Agenda Item 6: Initial Marine Environment Assessment for IMAP Common Indicator 21**

**The Initial Results of Marine Environment Assessment for IMAP Common Indicator 21**

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### **Note by the Secretariat**

In line with the Programme of Work 2020-2021 adopted by COP21 (Naples, Italy, December 2019) and the Programme of Work 2022-2022 adopted by COP22 (Antalyia, Turkey, December 2021), as well as the QSR Roadmap implementation (Decision IG.24/4 of COP21), the MED POL Programme has prepared the initial GES assessment for IMAP Common Indicator 21 with a view of providing inputs for preparation of the 2023 MED QSR. This document elaborates the assessment results for the Mediterranean sub-regions respectively the Contracting Parties of the Barcelona Convention for which sufficient data were available both in the IMAP Information System and the State of Bathing Water Quality in 2020 of the European Environment Agency (EEA). The assessment methodology defined in the IMAP Guidance fact sheet for IMAP CI 21 is adjusted to data availability for present assessment. It also includes setting the boundary limit between GES and non-GES status regarding the pathogens in bathing waters.

The present proposal of the initial results of marine environment assessment for IMAP CI 21 is submitted for review and approval of the Meeting of the Ecosystem Approach Correspondence Group on Pollution Monitoring. It is also intended to encourage the Contracting Parties to report sufficient data i.e. 16 data points for 4 consecutive bathing seasons in order to ensure further progress in the preparation of the comprehensive and reliable final assessment input for the preparation of the 2023 MED QSR.

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## **List of Abbreviations / Acronyms**

<b>AEL</b>	Aegean and Levantine Seas Sub-region
<b>ADR</b>	Adriatic Sea Sub-region
<b>BWQ</b>	Bathing Water Quality
<b>CEN</b>	Central Mediterranean Sea Sub-region
<b>CFU</b>	Colony forming units
<b>CI</b>	Common Indicator
<b>CORMON</b>	Correspondence Group on Monitoring
<b>COP</b>	Conference of the Parties
<b>CP</b>	Contracting Party
<b>EEA</b>	European Environmental Agency
<b>E. coli</b>	Escherichia coli
<b>EC</b>	European Commission
<b>EU</b>	European Union
<b>GES</b>	Good Environmental Status
<b>IE</b>	Intestinal enterococci
<b>IMAP</b>	Integrated Monitoring and Assessment Programme of the Mediterranean Sea and Coast and Related Assessment Criteria
<b>Log</b>	Logarithm
<b>MAP</b>	Mediterranean Action Plan
<b>MED</b>	Mediterranean
<b>MED POL</b>	Programme for the Assessment and Control of Marine Pollution in the Mediterranean Sea
<b>QSR</b>	Quality Status Report
<b>UNEP</b>	United Nations Environmental Program
<b>WMS</b>	Western Mediterranean Sea Sub-region
<b>WHO</b>	World Health Organization

## 1. Introduction

1. Updated Guidance Fact sheet for IMAP CI 21<sup>1</sup> was provided in 2019 further to the revised Mediterranean guidelines for bathing waters that was provided in 2007 based on the WHO guidelines for “Safe Recreational Water Environments” and on the EC Directive for “Bathing Waters” (Directive 2006/7/EC)<sup>2</sup>. The latter was made in an effort to provide updated criteria and standards that can be used in the Mediterranean countries and to harmonize their legislation in order to provide homogenous data.

2. The initial target of GES under Common Indicator 21, as stated in the updated IMAP Guidance fact sheet for CI 21 “will be an increasing trend in measurements to test that levels of intestinal enterococci comply with established national or international standards and the methodological approach itself. Particularly, under Decision IG.20/9 and the EU 2006/7 Directive, excellent (95<sup>th</sup> percentile < 100 CFU/100 mL) or good (95<sup>th</sup> percentile < 200 CFU/100 mL) quality categories are set for the “last assessment” which means the last four years”.

3. The COP 17<sup>3</sup> agreed on the threshold values in the Mediterranean region as presented in Table 1. In the present assessment these values are used to set the boundary limit between GES and non-GES status regarding the pathogens in bathing waters. Therefore, the categories A, B and C are proposed to be defined as in GES while category D is proposed to be defined as non-GES for intestinal enterococci (IE) in bathing waters in the Mediterranean.

**Table 1.** Microbial Water Quality Assessment Category based on Intestinal enterococci (cfu/100 mL) in bathing waters in the Mediterranean (Decision IG.20/9).

Category	A	B	C	D
Limit values	<100*	101-200*	185**	>185**(1)
Water Quality	Excellent	Good	Sufficient	Poor/Immediate Action

\*Based on the 95<sup>th</sup> percentile; \*\* Based on the 90<sup>th</sup> percentile;

- <sup>(1)</sup>For single sample appropriate action is recommended to be carried out once the count for IE exceeds 500 cfu/100 mL;
- For classification purposes at least 12 sample results are needed spread over 3-4 bathing seasons;
- Reference method of analysis: ISO 7899-2 based on membrane filtration technique or any other approved technique;
- Transitional period 4 years (starting by 1st January 2012).

4. For the indicator calculation, the IMAP Guidance fact sheet for CI 21 provides the methodology that has been proposed by Directive 2006/7/EC with the specification as explained here below.

5. Based upon percentile evaluation of the log<sub>10</sub> normal probability density function of microbiological data acquired from the particular bathing water, the 90<sup>th</sup> and 95<sup>th</sup> percentile values are derived as follows<sup>4</sup>:

- i. Take the log<sub>10</sub> value of all bacterial enumerations in the data sequence to be evaluated; If a zero value is obtained, take the log<sub>10</sub> value of the minimum detection limit of the analytical method used instead;

<sup>1</sup> UNEP/MED WG473/7 Annex I

<sup>2</sup> IMAP Guidance Fact Sheet for IMAP CI 21 (UNEP/MED WG.473/7)

<sup>3</sup> Decision IG.20/9 Criteria and Standards for bathing waters quality in the framework of the implementation of Article 7 of the LBS Protocol, COP 17, Paris, 2012 (UNEP/MAP, 2012)

<sup>4</sup> UNEP/MED WG473/7 Annex I

- ii. Calculate the arithmetic mean of the log<sub>10</sub> values ( $\mu$ );
  - iii. Calculate the standard deviation of the log<sub>10</sub> values ( $\sigma$ );
6. The upper 90-percentile point of the data probability density function is derived from the following equation: upper 90-percentile = antilog ( $\mu + 1,282 \sigma$ ).
7. The upper 95-percentile point of the data probability density function is derived from the following equation: upper 95-percentile = antilog ( $\mu + 1,65 \sigma$ ).
8. It should also be noted that IMAP Guidance fact sheet for CI 21 sets the minimum sampling frequency i.e. at least one per month and not less than four in a bathing period, including an initial one prior to the start of the bathing period.

## 2. The assessment related to IMAP CI 21 provided in the MED QSR 2017 (<https://www.medqsr.org/background-ci21>)

9. The previously explained assessment methodology of IMAP CI 21 was considered for application during the preparation of the 2017 Mediterranean Quality Status Report (2017 MED QSR). At that time, no sufficient updated datasets were available, therefore the assessment was undertaken based on the assessment report from the European Environment Agency (EEA) on Bathing Water Quality (from 2015) that was then integrated with the assessment of monitoring data reported from Tunisia to MEDPOL (2014).

10. In the 2017 MED QSR, it was recommended to prepare the future assessments of IMAP CI 21 based on the statistics from datasets submitted by national authorities or/and the corresponding agencies. However, up to the end of March 2022, only a few data sets were reported to the IMAP-IS. Those are presented in Table 2.

**Table 2.** Available data for IMAP CI 21 in IMAP-IS starting from 2015.

Source	IMAP file	Country	Sub-region	Year
IMAP-IS	403	Morocco	WMS	2018
IMAP-IS	404	Morocco	WMS	2019
IMAP-IS	547-551	Spain	WMS	2017-2021
IMAP-IS	262	Bosnia-Herzegovina	ADR	2015-2020
IMAP-IS	385	Croatia	ADR	2016-2020
IMAP-IS	#	Montenegro	ADR	2017-2021
IMAP-IS	146	Slovenia	ADR	2019
IMAP-IS	440	Slovenia	ADR	2020
IMAP-IS	490*	Malta	CEN	2016-2020
IMAP-IS	147	Lebanon	AEL	2019

# Reported directly to MEDPOL, still to be uploaded in the IMAP-IS, \*data available in draft status

### 3. Location of sampling stations

11. Given lack of data reported by the CPs prevents implementation of the recommendations of COP 19, the input for the 2023 Mediterranean Quality Status Report (2023 MED QSR) related to the assessment of IMAP CI 21 was performed using the approach applied for the 2017 MED QSR. Namely, it combines the assessment results as presented in the assessment report<sup>5</sup> from the European Environment Agency (EEA) on the State of Bathing Water Quality in 2020<sup>6</sup> and the assessment of monitoring data reported for IMAP CI 21 from Morocco, Bosnia-Herzegovina, Montenegro and Lebanon (Table 3).

**Table 3.** Details of data on CI 21 available from IMAP\_IS used in this assessment

Source	IMAP file	Country	Sub-region	Year	Number stations	Number of data points per station
IMAP-IS	403-404	Morocco	WMS	2018-2019	130	10*
IMAP-IS	262	Bosnia-Herzegovina	ADR	2017-2020	3	9,10,13
IMAP-IS	#	Montenegro	ADR	2017-2020	23	30-39
IMAP-IS	147	Lebanon	AEL	2019	62	1-3

# Reported directly to MEDPOL, still to be uploaded in the IMAP-IS, \*9 stations with less than 10 data points.

12. The methodology used in the EEA 2020 assessment of the state of bathing water quality was as defined in the EU 2006/7 Directive and in IMAP decision IG.20/9, i.e. the classification of the bathing waters was provided according to the 90<sup>th</sup> or 95<sup>th</sup> percentile of the log<sub>10</sub> normal probability density function of microbiological data. The number of data points for each location was at least 16, over 4 bathing seasons<sup>7</sup>, at least 4 for each bathing season. It should be mentioned that the EU 2006/7 Directive defines two indicators: Intestinal enterococci (IE) (cfu/100 ml) and Escherichia coli (E. coli) (cfu/100 ml). Therefore, the classification of the bathing waters is based on the combination of both microbiological parameters, classifying the stations based on the worse status between the two criteria<sup>8</sup>. For example, if status for IE is excellent but for E. coli the status is poor, the station is classified as poor.

13. The same methodology used in the EEA 2020 of the state of bathing water quality was applied to the data set from Montenegro, using just intestinal enterococci as indicator.

14. This methodology could not be applied to data from Morocco, Bosnia-Herzegovina and Lebanon because 16 data points for 4 consecutive bathing seasons were not available (Table 3). Therefore, for these 3 CPs, the classification was based on the geometric mean calculated for each location. The geometric mean was chosen because it reduces the effect of outliers on the mean and is not influenced by skewed distribution as the arithmetic mean. Table 4 compares between the two methodologies.

<sup>5</sup> <https://www.eea.europa.eu/themes/water/europes-seas-and-coasts/assessments/state-of-bathing-water/state-of-bathing-waters-in-2020>

<sup>6</sup> The updated IMAP Guidance fact sheet for CI 21 provided in 2019 mentions the EEA as an available data source for some Mediterranean countries European and non-European.

<sup>7</sup> Exceptions are outlined in Directive 2006/7/EC and in Decision IG.20/9. Shortly, bathing water quality assessments may be carried out on the basis of three bathing seasons if the bathing water is newly identified or any changes have occurred that are likely to affect the classification of the bathing water. Sets of bathing water data used to carry out bathing water quality assessments shall always comprise at least 16 samples. Only 12 samples may be used to assess bathing water quality in special circumstances when the bathing season does not exceed 8 weeks or location is situated in a region subject to special geographical constraints (Annex IV, paragraph 2).

<sup>8</sup> EEA Guidelines for the assessment under the Bathing Water Directive Prepared by: ETC/ICM (Lidija Globevnik, Luka Snoj, Gašper Šubelj), October 2021

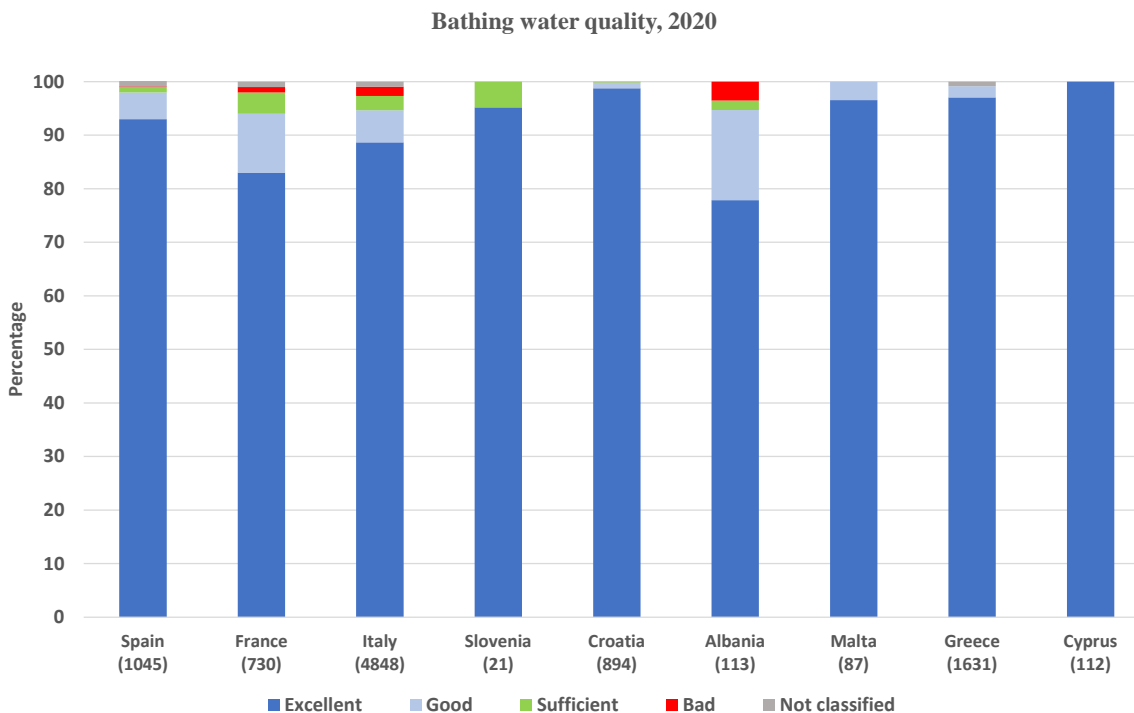
**Table 4:** Comparison between the methodology used by the EEA and the methodology used in present document for the assessment of Bathing waters quality (CI-21)

Assessment methodology	EEA	Present assessment of IMAP CI 21*
Assessment Category	Based on Intestinal enterococci and Escherichia coli (cfu/100 mL)	Based on Intestinal enterococci (cfu/100 mL)
Number of data points	At least 16	Less than 16, depending on the CP*
Number of monitoring years	4	Less than 4, depending on the CP*
Classification of station	percentile evaluation of the log10 normal probability density function	Geometric mean

\* Morocco, Bosnia-Herzegovina and Lebanon. Montenegro was classified using the same methodology as the EEA, therefore 16 data points over 4 consecutive bathing seasons, however using just Intestinal enterococci values and by applying percentile evaluation of the log10 normal probability density function.

#### 4. The assessment findings related to IMAP CI 21 and Discussion

15. The results of the assessment of the state of bathing water quality for Mediterranean countries, EU Member States and Albania are presented in Figure 1. Most (>90%) of the bathing waters in all countries were in the excellent and good GES classifications. A small percentage of bathing waters were classified as poor D category: 0.1% in Spain, 1% in France, 1.7% in Italy and 3.5% in Albania.

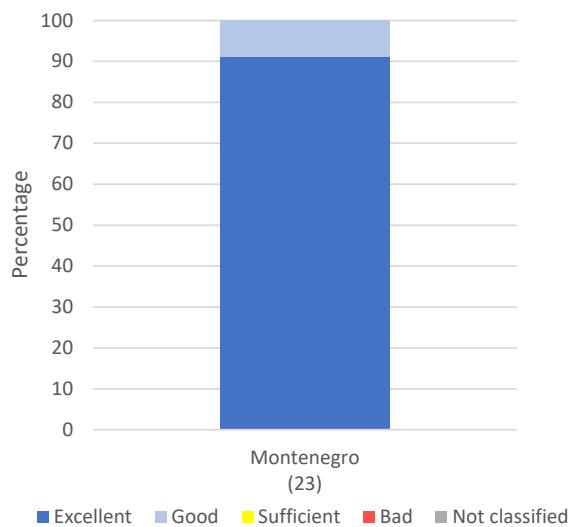




**Figure 1:** Percentages of the bathing water quality assessment with respect to IMAP CI 21 in 2020 for some Contracting Parties of the Barcelona Convention. (Source: EEA, 2020). In parenthesis, number of stations.

16. The results of the assessment of the status of bathing water quality for Montenegro and for Morocco, Bosnia-Herzegovina and Lebanon performed with data available from IMAP-IS are presented in Figures 2 and 3, respectively.

17. **Montenegro:** Data were available for 23 stations for the years 2017-2020 (Table 3). As explained, bathing waters quality in Montenegro was classified using the same methodology as the EEA, at least 16 data points over 4 seasons, however using just Intestinal enterococci values and by applying percentile evaluation of the log10 normal probability density function. Four stations had data available for only 3 bathing seasons, but they were classified in the same way, based on the exceptions outlined in Directive 2006/7/EC and in Decision IG.20/9. Out of the 23 available stations, 21 were classified as excellent category and 2 as good category.

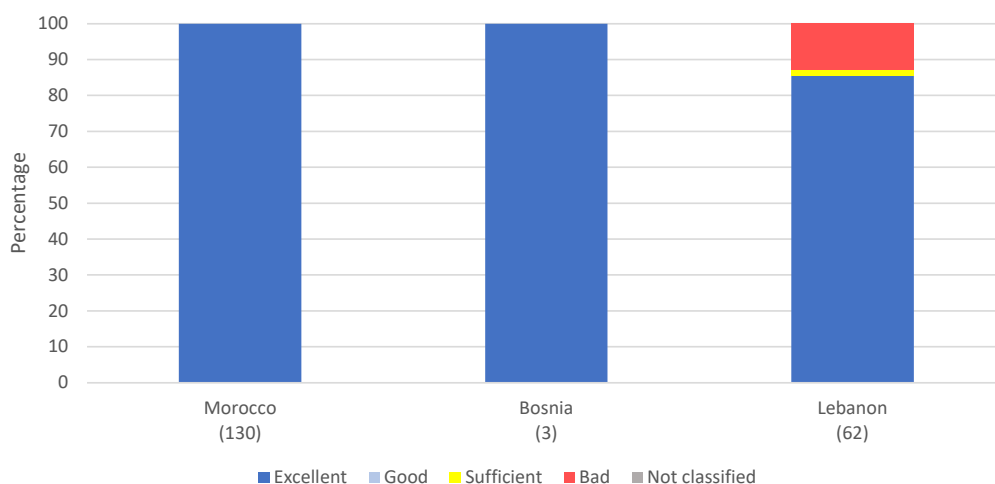


**Figure 2:** Percentages of the bathing water quality assessment with respect to IMAP CI 21 in 2020 for Montenegro (Source IMAP InfoSystem). In parenthesis, number of stations.

18. **Morocco:** Data were available for 130 stations for the years 2018-2019 (Table 3). All of the stations were classified as excellent category.

19. **Bosnia-Herzegovina:** Data was available for 3 stations for the years 2017-2019 (Table 3). All 3 available stations were classified as excellent category.

20. **Lebanon:** Data was available for 62 stations for 2019 (Table 3). Out of the 62 available stations, 53 stations (85%) were classified as excellent category, 1 station (2%) as sufficient category and 8 stations (13%) as bad category. It should be mentioned that 4 out of the 8 bad category stations had only one data point.



**Figure 3:** Percentages of the bathing water quality assessment categories with respect to IAMP CI 21 for Morocco, Bosnia-Herzegovina, and Lebanon. (Source: IMAP InfoSystem). In parenthesis, number of stations.

## 5. The key findings

21. In line with the findings on the status of bathing water, as provided above in Section 4, based on the available data, the Mediterranean bathing waters can be classified in GES (excellent, good and sufficient status) whereby percentage are higher than 87% for the CPs for which the assessment was undertaken. The confidence of this evaluation is high for areas with sufficient data points and bathing seasons and less so for areas with less data. Some areas of the Mediterranean could not be assessed given no data were reported.

22. The sub-regions with good representation were Adriatic Sea Sub-region (ADR) with data from all the Adriatic countries (partial data for Bosnia-Herzegovina); and the Western Mediterranean Sea Sub-region (WMS) (with data from Morocco (partial), Spain, France and Italy). The Central Mediterranean Sea Sub-region (CEN) had data from Italy, Malta and Greece, while the Aegean and Levantine Seas (AEL) sub-region had data from Greece, Cyprus and Lebanon (partial).

23. Most of the data were available through EEA and not through IMAP IS. It must be noted that the lack of data reporting for IMAP CI 21 into IMAP IS is a key obstacle to undertaking related assessments for the preparation of the 2023 MED QSR. The evaluation of the state of the Mediterranean bathing waters should be improved by reporting additional data from the sub-regions/ areas with low quantity of data or no data reported. Therefore, the present assessment findings call on CPs to report monitoring data related to IMAP CI 21 so that they can be taken into account, especially in the case of the countries that have established monitoring programs for CI 21 and regularly implement them.

24. It also must be noted that sufficient data reporting i.e., 16 data points for 4 consecutive bathing seasons would allow the application of uniform assessment methodology across the Mediterranean, therefore increasing the comparability and consistency of the assessment findings.

25. Compared to the 2017 MED QSR, the current assessment includes four CPs instead of one CP along with the CPs assessed within the EEA 2020 assessment of the state of bathing water quality. However, lack of data reporting to IMAP IS implies the use of different assessment approaches that may bring certain discrepancy. Although the present situation is better than in 2017, more data must be reported by the CPs in order to provide comparable and consistent assessment findings.

**Annex I**  
**References**

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