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6th Meeting of the Ecosystem Approach Coordination Group

Athens, Greece, 11 September 2017

Agenda item 3: Review of proposed IMAP Common Indicator Guidance Facts Sheets

IMAP Common Indicator Guidance Facts Sheets (Coast and Hydrography)

Note by the Secretariat

1. The 19th Meeting of Contracting Parties (COP 19), held in February 2016, adopted the Integrated Monitoring and Assessment Programme (IMAP) of the Meditrerranean Sea and Coast and Related Assessment Criteria (Decision IG. 22/7), with a list of regionally agreed good environmental status descriptions, common indicators and targets, with principles and clear timeline for its implementation.

2. IMAP, through Decision IG.22/7 lays down the principles for an integrated monitoring, which will, for the first time, monitor biodiversity and non-indigenous species, pollution and marine litter, coast and hydrography in an integrated manner. As such, IMAP aims to facilitate the implementation of article 12 of the Barcelona Convention and several other monitoring related provisions under different Protocols with the main objective to assess GES. Its backbone are the 11 Ecological Objectives and their 27 common indicators as presented in Decision IG. 22/7.

3. The UNEP/MAP Programme of Work (PoW) adopted at COP 19, includes Output 1.4.3 for *the Implementation of IMAP (the EcAp-based integrated monitoring and assessment programme) coordinated, including GES common indicators fact sheets, and supported by a data information centre to be integrated into Info/MAP platform.*

4. In line with the above, guidance factsheets have been developed for each Common Indicator to ensure coherent monitoring, with specific targets defined and agreed in order to deliver the achievement of Good Environmental Status (GES) and as such, provide concrete guidance and references to Contracting Parties to support implementation of their revised national monitoring programmes towards the overall goal of implementing the Ecosystem Approach (EcAp) in the Mediterranean Sea and achieveing GES.

5. In this context, this document outlines the Indicator Guidance Factsheets for the Ecological Objectives Ecological Objectives 7 (Hydrography) and 8 (Coast).

6. The structure of a Common Indicator Factsheets can be summarized looking at the different organization levels of the developed factsheet templates. A common set of relevant policy and science-based information is required on each (ie. Indicator Title, Rational, Policy Context and Targets, Indicator analysis methods and Methodolgy for monitoring (temporal and spatial scope), Contacts and Document Registration). In each, detailed definitions, methodologies, references, gaps, uncertainties, data analysis approaches, basis for aggregation (if applies) and outputs complete the guidance factsheets, as described under, in Table 1.

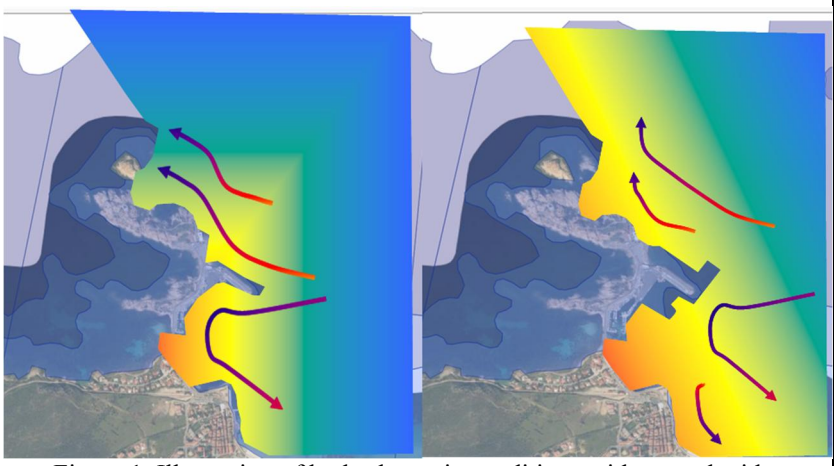
7. The Meeting of the Correspondence Group on Monitoring (CORMON), Coast and Hydrography (Madrid, Spain, 3 March) and the Meeting of the PAP RAC National Focal Points (Split, Croatia, 3 - 4 May 2017) reviewed these factsheets and provided comments and suggestions for their revision. This document reflects comments received in the sessions and after the sessions, as appropriate.

Table 1: Scheme of IMAP Factsheet Template:

Indicator Title			
Relevant GES definition	**Related Operational Objective**	**Proposed Target(s)**	**IMAP Reference No and definition**
Rationale			**Scientific rationale and marine policy context (including relevant references)**
Justification for indicator selection			
Scientific References			
Policy Context and targets			
Policy context description			
Targets			
Policy documents			
Indicator analysis methods			**Agreed scientific methodologies in use, including detailed monitoring requirements**
Indicator Definition			
Methodology for indicator calculation			
Indicator units			
List of Guidance documents and protocols available			
Data Confidence and uncertainties			
Methodology for monitoring, temporal and spatial scope			
Available Methodologies for Monitoring and Monitoring Protocols			
Available data sources			
Spatial scope guidance and selection of monitoring stations			
Temporal Scope guidance			
Data analysis and assessment outputs			**Data reporting, analysis and aggregation (outpout)**
Statistical analysis and basis for aggregation			
Expected assessments outputs			
Known gaps and uncertainties in the Mediterranean			
Contacts and version Date			**Document Registration**
Key contacts within UNEP for further information			
Version No	**Date**	**Author**	

EO7CI15 Ecological Objective 7 Common Indicator 15 Assessment Fact Sheet

Content	Actions	Guidance
General		
Reporter	Underline appropriate	UNEP/MAP/MED POL SPA/RAC REMPEC **PAP/RAC** Plan Bleu (BP)
Geographical scale of the assessment	Select as appropriate	Regional: Mediterranean Sea Eco-regional: NWM (North Western Mediterranean); ADR (Adriatic Sea); CEN (Ionian and Central Mediterranean Seas); AEL (Aegean and Levantine Sea)
Contributing countries	Text	
Core Theme	Select as appropriate	1-Land and Sea Based Pollution 2-Biodiversity and Ecosystems **3-Land and Sea Interaction and Processes**
Ecological Objective	Write the exact text, number	**EO7. Alteration of hydrographical conditions**
IMAP Common Indicator	Write the exact text, number	**CI15. Location and extent of the habitats impacted directly by hydrographic alterations**
Indicator Assessment Factsheet Code	Text	**EO7CI15**
Rationale/Methods		
Background (short)	Text (250 words)	Large-scale coastal and off-shore developments have the potential to alter the hydrographical regime of currents, waves and sediments in marine environment (UNEP/MAP/PAP, 2015). To address these issues, UN Environment/MAP has included the Ecological Objective 7 ("Alteration of hydrographical conditions") into the Integrated Monitoring and Assessment Programme (IMAP) of the Mediterranean Sea and Coast (UNEP(DEPI)/MED IG.22/Inf.7, 2016) . EO7's Common Indicator 15 - 'Location and extent of habitats impacted directly by hydrographic alterations' considers marine habitats which may be affected or disturbed by changes in hydrographic conditions due to new developments. The main target of this indicator is to ensure that all possible mitigation measures are taken into account when planning the construction of new structures, in order to minimize the impact on coastal and

Content	Actions	Guidance
		marine ecosystem and its services, integrity, and cultural/historic assets. The Good Environmental State (GES) regarding EO7 Hydrography is achieved when negative impacts due to new structures are minimal with no influence on the larger scale coastal and marine systems. There are clear links between EO7 and other ecological objectives, especially EO1 (Biodiversity), and these need to be determined on a case-by-case basis.  Figure 1. Illustration of hydrodynamic conditions without and with structure (image provided by O. Brivois)
Background *extended*	Text (no limit), images, tables, references	Ecological Objective 7 is dedicated to assess permanent alterations in the hydrographic conditions due to new developments. By definition the term 'hydrography' is meant to include depth, tidal currents and wave characteristics of marine waters, including the topography and morphology of the seabed. EO7 Common Indicator 15 considers only new developments, since existing structures have already changed the hydrographic conditions and potentially impacted the habitats. Since the baseline conditions before the construction of existing structures are unknown, the monitoring of CI15 for existing structures is not possible. There is a clear link between EO7 and other ecological objectives, especially EO1 (Biodiversity). By definition of functional habitats under EO1, the priority benthic habitats for consideration in EO7 are to be selected. Ultimately, the assessment of impacts, including cumulative impacts, is a cross-cutting issue for EO1 and EO7. The guidance document on how to reflect changes in hydrographical conditions in relevant assessments was prepared in 2015, aiming to define a methodological approach for assessing alterations of hydrographical conditions and the impact this may have on habitats due to permanent constructions and activities on the coast or at sea (UNEP/MAP/PAP, 2015). As for Protocols of the Barcelona Convention relevant for the EO7, the Protocol Concerning Specially Protected Areas and Biological Diversity in the Mediterranean (UNEP/MAP/PAP, 1999) calls to Contracting Parties of the Barcelona Convection for continuous

Content	Actions	Guidance
		monitoring of ecological processes, population dynamics, landscapes, as well as the impacts of human activities (Article 7b). In addition, it calls to Parties to evaluate and take into consideration the possible direct or indirect, immediate or long-term impacts, including the cumulative impact of the projects and activities, on protected areas, species and their habitats (Article 17). Another Protocol of the Barcelona Convention, the Protocol on the Integrated Coastal Zone Management in the Mediterranean (UNEP/MAP/PAP, 2008), in its Article 9, calls for Parties to minimize negative impacts on coastal ecosystems, landscapes and geomorphology, coming from infrastructure, energy facilities, ports and maritime works and structures; or where appropriate to compensate these impacts by non-financial measures. In addition, the Article 9 demands maritime activities to be conducted "in such a manner as to ensure the preservation of coastal ecosystems in conformity with the rules, standards and procedures of the relevant international conventions".
Assessment methods	Text (200-300 words), images, formulae, URLs	In brief, the methodology to assess the indicator can be divided in three main steps: (i) Baseline hydrographical conditions characterisation (Monitoring and modelling of actual conditions without structure); (ii) Assessment of hydrographical alterations induced by new structure (comparing baseline conditions and with structure conditions, using modelling tools); and (iii) Assessment of habitats impacted directly by hydrographic alterations (by crossing hydrographical alterations and habitat maps). Among hydrographical conditions, at least waves and currents changes should be assessed, with changes in sediment transport processes and turbidity in case of sandy sites, and salinity and/or temperature changes in case of structures that involve water discharge, water extraction or changes in fresh water movements. The monitoring should focus on habitats of interest around new permanent constructions (lasting more than 10 years). At first, the spatial scale (in cross-shore and long-shore directions) to be used should be about 10 to 50 times the characteristic length of the structure, and should be enlarged depending on the first results obtained for this area. To correctly assess changes in time on habitats induced by constructions, the monitoring should be performed: before construction (baseline conditions); during construction; and after construction - short term changes 0 to 5 years after (at least yearly up to 5 years), midterm changes 5 to 10 years after (at least biennium to 10 years), and long-term changes (10 to15 years after construction).
Results		

Content	Actions	Guidance
Key findings	Text (maximum 100 words)	There was no systematic monitoring on Common Indicator 15 on regional level until now. At the moment, the only experience of examining the hydrographic alterations was in EU countries sharing Mediterranean waters, due to their obligation to report it as part of Descriptor 7 of the Marine Strategy Framework Directive (MSFD). However, these results end with 2012 and are not fully in line with the Indicator Guidance Fact Sheet for the CI15. Therefore, there is a clear knowledge gap on implementation of this indicator in Mediterranean, and strong effort to reduce these gaps needs to be made in national monitoring of CI15 according to developed national IMAPs.
Key assessment	Text (500 words), images	Since there was no systematic monitoring on this particular indicator on regional level until now, examples of intersection of modeled area of hydrographic alterations with habitat area were not found. The methodology applied in some partial examples consisted mostly in measurement of trends for certain hydrographic parameters (temperature, salinity, waves, currents, marine acidification etc.) and limited, mostly qualitative, analysis on impacts on habitats at a national level. The data presented in the *Extended* section are mainly from the EU countries. It needs to be highlighted that the information presented here is extracted from technical assessment of the European Commission of submissions on Descriptor 7 by the EU countries. This information end up with 2012 and are not fully in line with the Indicator Guidance Fact Sheet for the CI15. There are some partial information which are more in line with CI15 Guidelines fact sheets, but these surveys were done on much local scale and are presented as case studies (namely, LNG terminal in Monfalcone Port, Italy; and container terminal Haifa Bay in Israel)
Key assessment (extended) Assessment, including extended descriptions of the quality status (including trends)	Text(no limit), figures, tables	A brief overview of initial assessments of the current environmental status of marine waters belonging to Mediterranean-based EU countries has been summarized here. It needs to be highlighted that the information presented here is extracted from technical assessment of the European Commission of submissions on Descriptor 7 by the EU countries. This information end up with 2012 and are not fully in line with the Indicator Guidance Fact Sheet for the CI15. Nearly all of the EU Member States focused on coastal zones in their report, with most Member States (e.g. France, Greece, Italy Spain) expressed the readiness to address the existing knowledge gaps. Many countries have focused on specific hydrographic parameteres, most of them on temperature and salinity (e.g. Croatia, Cyprus,

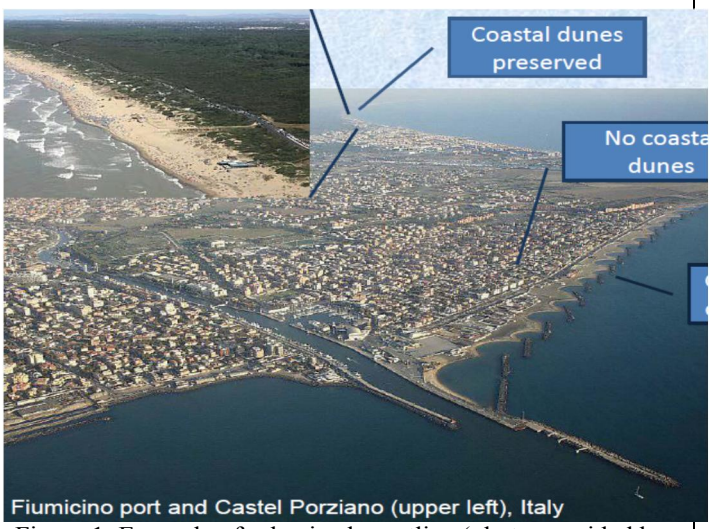
Content	Actions	Guidance
		Italy), while some countries also assessed other parameters such as wave/current regime (e.g. Malta, France) and marine acidification (e.g. Cyprus, Greece) The proportion of the assessment area affected by hydrological processes was reported for some countries (Cyprus, Greece, Italy, Slovenia, Spain) although numbers quite varied due to the different methodologies used. Some countries indicated different drivers behind pressures on hydrographic conditions (France, Greece, Malta, Slovenia). Some countries also estimated the impact of hydrographic alterations on marine habitats, such as Cyprus (impacts on macroalgae), Greece (impacts on seabed habitats), and Malta (impacts on algae and seagrass).
Conclusions		
Conclusions (brief)	Text (200 words)	The EO7 Common Indicator 15 reflects location and extent of the habitats impacted directly by hydrographic alterations due to new coastal structures. The big issue on deriving concluding remarks for this indicator on regional level is that the national monitoring programmes are currently being developed for most Mediterranean countries. Therefore, assessment results on this indicator (as proposed in indicator guidance fact sheet) were not found on national, nor regional level. The findings here were mostly based on literature review of technical assessments on EU countries' reports on hydrographic alterations. However, these reports mainly focus on measurement of trends for certain hydrographic parameters, which is not completely in line with requirement for common Indicator 15. However, measurement of baseline hydrographic conditions can serve as a baseline for more detailed assessments in the future. Two local scale projects are presented as case studies namely, LNG terminal in Monfalcone Port, Italy; and container terminal Haifa Bay in Israel.
Conclusions (extended)	Text (no limit)	/
Key messages	Text (3-6 sentences or maximum 200 words)	• The EO7 Common Indicator 15 considers marine habitats which may be affected or disturbed by changes in hydrographic conditions (currents, waves, suspended sediment loads) due to new coastal structures; • There is a clear link between EO7 and other ecological objectives, especially EO1 (Biodiversity); • The national monitoring in Mediterranean countries regarding EO7 has not been initiated yet, or it is just being initiated; • There is no sufficient data to derive conclusions/observe trends on Common Indicator 15 on regional, sub-regional or even national level;

Content	Actions	Guidance
		• CI 15 is a complex indicator, requires many parameters which should be collected regularly at a more detailed scale (case by case), the modeling is expensive; baseline conditions need to be surveyed first.
Knowledge gaps (brief)	Text (100 words)	There is a significant knowledge gaps on implementation of the Common Indicator 15. It is a complex and only introduced indicator. The knowledge gaps are mainly related to insufficient surveys and monitoring of this indicator on all geographical levels. Assessments that estimate the extent of hydrographic alterations (knowing conditions before and after construction) and its intersection with marine habitats are currently rare in the Mediterranean, except for some local studies of EIA/SEA. Instead, only trends of some hydrographic parameters are known, mostly unable to be connected to anthropogenic drivers and, more often, impacts by changes of these parameters are either not assessed or assessed in limited/qualitative way.
Knowledge gaps (extended)	Text (no limit)	Like everywhere, there is certainly a lack of hydrographic data in the Mediterranean Sea (bathymetric data, seafloor topography, current velocity, wave exposure, turbidity, salinity, temperature, etc.), which is one of the main problems to implement this indicator, in particular to define the base-line conditions. To identify these gaps, a clear inventory of existing and available data in Mediterranean Sea should be done. Although certain data can be collected from regional models (bathymetry, hydrodynamics, salinity, temperature), these would have too coarse resolution and would need to be refined close to the location of the new structure. In case of no sufficient data, the use of assessment methods needing less data (empirical formulae, expert judgment, comparison with similar sites) should be considered, as well as acquisition/monitoring of missing data, promoting regional cooperation. Other difficulties come from the use of numerical model to assess hydrographic alterations before the structure is built. These tools need many data (bathymetry, offshore hydrodynamics data, field data) and can be costly and time-consuming. Moreover, the use of these tools needs some experience and some knowledge about the processes and theories involved. The link to EO1 is so essential, as map of benthic habitats in the zone of interest (broad habitat types and/or particular sensitive habitats) is required. Therefore, identifying the priority benthic habitats for consideration in EO7 together assessment of impacts, including cumulative impacts, is a cross-cutting issue of high priority for EO1 and EO7. In addition, effort needs to be given to detect the cause-consequence relationship between hydrographic alterations due to new structures and habitat deterioration. Especially, since marine habitats can deteriorate for many different reasons. That is

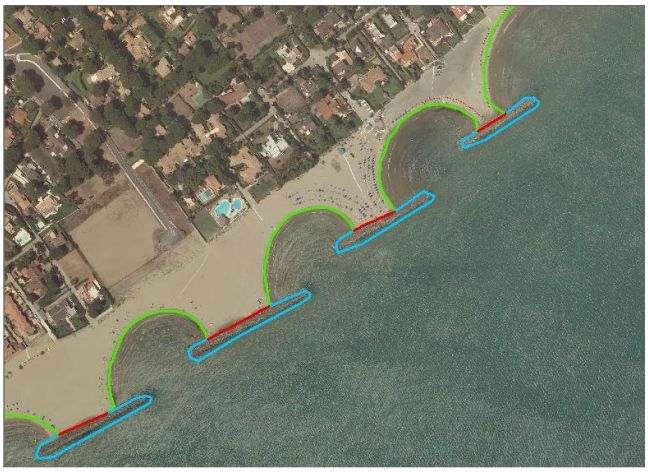
Content	Actions	Guidance
		why the knowledge on baseline conditions (i.e. conditions before construction) is essential to establishing such cause-consequence relationship. To conclude, such an integrated assessment of impacts calls for additional research efforts on habitat modeling, pressure mapping and cumulative impacts, along with monitoring of potentially affected areas.
List of references	Text	UNEP/MAP/PAP (1999) Protocol Concerning Specially Protected Areas and Biological Diversity in the Mediterranean - http://www.rac-spa.org/sites/default/files/protocole_aspdb/protocol_eng.pdf UNEP/MAP/PAP (2008) Protocol on the ICZM in the Mediterranean, Split, Priority Actions Programme, 2008. http://www.pap-thecoastcentre.org/pdfs/Protocol_publikacija_May09.pdf UNEP/MAP/PAP (2015). Guidance document on how to reflect changes in hydrographical conditions in relevant assessment (prepared by Spiteri, C.). Priority Actions Programme. Split, 2015. UNEP(DEPI)/MED IG.22/Inf.7 (2016). Draft Integrated Monitoring and Assessment Guidance UNEP(DEPI)/MED WG.433/1 (2017) PAP/RAC Meeting of the Ecosystem Approach Correspondence Group on Monitoring (CORMON) on Coast and Hydrography – Working Document *Information used in "Key assessment" chapter:* For Cyprus, France , Greece, Italy, Slovenia and Spain: Article 12 Technical Assessments of the MSFD 2012 obligations (2014) For Croatia: Institute for Oceanography and Fisgeries (2014) Skup značajki dobrog stanja okoliša za morske vode pod suverenitetom republike hrvatske i skup ciljeva u zaštiti morskog okoliša i s njima povezanih pokazatelja (in Croatian) For Malta: Interference with Hydrological Processes (2013), retreived from http://rod.eionet.europa.eu, on 22 February, 2017

EO8CI16 Common Indicator 16 Ecological Objective 8Assessment Fact Sheet

Content	Actions	Guidance
General		
Reporter	Underline appropriate	UNEP/MAP/MED POL SPA/RAC REMPEC **PAP/RAC** Plan Bleu (BP)
Geographical scale of the assessment	Select as appropriate	Regional: Mediterranean Sea Eco-regional: NWM (North Western Mediterranean); ADR (Adriatic Sea); CEN (Ionian and Central Mediterranean Seas); AEL (Aegean and Levantine Sea) Sub-regional: National: France, Italy, Montenegro
Contributing countries	Text	**France, Italy, Montenegro**
Core Theme	Select as appropiate	1-Land and Sea Based Pollution 2-Biodiversity and Ecosystems **3-Land and Sea Interaction and Processes**
Ecological Objective	Write the exact text, number	**EO8. Coastal Ecosystems and Landscapes**
IMAP Common Indicator	Write the exact text, number	**CI16. Length of coastline subject to physical disturbance due to the influence of manmade structures**
Indicator Assessment Factsheet Code	Text	**EO8CI16**
Rationale/Methods		
Background (short)	Text (250 words)	The Mediterranean coastline is approximately 46000 km long, with around 40% of the coastal zone being under some form of artificial land cover (Plan Bleu, 2005). Mediterranean coastal areas are threatened by development that modifies the coastline through the construction of buildings and infrastructure needed to sustain residential, tourism, commercial, transport and other activities. This kind of development can cause irreversible damage to landscapes; habitats and biodiversity; and shoreline configuration. This EO does not have a precedent in other regional ecosystem approach initiatives, such as Helcom or OSPAR, neither in Marine Strategy Framework Directive.

Content	Actions	Guidance
		The MAP emphasizes the integrated nature of the coastal zone, particularly through consideration of marine and terrestrial parts as its constituent elements required by the ICZM Protocol. The aim of monitoring the EO8 common indicator 16 "Length of coastline subject to physical disturbance due to the influence of manmade structures" is twofold: to quantify the rate and the spatial distribution of the Mediterranean coastline artificialisation; and to provide a better understanding of the impact of those structures to the shoreline dynamics. GES for Common Indicator 16 can be achieved by minimizing physical disturbance to coastal areas close to the shoreline induced by human activities. Definition of targets, measures and interpretation of results regarding this common indicator is left to the countries, due to strong socio-economic, historic and cultural dimensions in addition to specific geomorphological and geographical conditions.  Figure 1. Example of urbanized coastline (photo provided by G.Giorgi)
Background *extended*	Text (no limit), images, tables, references	The land, inter-tidal zone and near-shore estuarine and marine waters in Mediterranean are increasingly altered by the loss and fragmentation of natural habitats and by the proliferation of a variety of built structures, such as ports, marinas, breakwaters, seawalls, jetties and pilings. These coastal manmade infrastructures cause irreversible damage to landscapes, losses in habitat and biodiversity, and strongly influence the configuration of the shoreline. Indeed, physical disturbance in particular in sandy coasts due to the development of artificial structures in the coastal fringe can disrupt the sediment transport, reduce the ability of the shoreline to respond to natural forcing

Content	Actions	Guidance
		factors, and fragment the coastal space. The modification of emerged beach and elimination of dune system contribute to coastal erosion phenomena by lessening the beach resilience to sea storms. Coastal defence infrastructures have been implemented to solve the problem together with beach nourishment, but preserving the natural shoreline system with adequate sediment transport from river has proved to be the best solution. Around 40% of Mediterranean coastal zone is already under some form of artificial land cover. This share is expected to grow, especially since urban population in Mediterranean coasts is expected to grow to 90 million in 2025, compared to 70 million in 2000 (Plan Bleu, 2005). In addition, importance of tourism in these areas should be considered as well, since tourists can double the number of permanent dwellers in peak periods in some areas. That is why construction of holiday homes is one of the important drivers of land consumption. In Mediterranean, the linear nature of coastal urbanization and the speed of the phenomenon is significant (Plan Bleu, 2005). The consequence of the growth in population growth, infrastructure and facilities results in increase in artificial land cover in the coastal zone. Monitoring the length of coastline subject to physical disturbance due to the influence of manmade structures and its trend is therefore of paramount importance, in order to preserve habitat, biodiversity and prevent coastal erosion phenomena. Also, access to the coast, beaches, visual qualities of coastal landscapes, decreasing potentials for other users to develop, such as tourism etc. are important elements to take into account. The EO8 also reflects the aim of the Barcelona Convention to include coastal areas in the assessment, which became a legal obligation upon the entry into force of its Protocol on Integrated Coastal Zone in the Mediterranean (ICZM Protocol). In the Article 16 of the Protocol, the Contracting Parties are required to “set out an agreed reference format and process to collect appropriate data in national inventories“ regarding the state and evolution of coastal zones.
Assessment methods	Text (200-300 words), images,	Monitoring of the EO8 Common Indicator 16 focuses on measuring the length of artificial coastline and its share in

Content	Actions	Guidance
	formulae, URLs	total county's coastline, on a proper geographical scale. An example of artificial vs. natural coastline can be seen in example on breakwaters in Figure 2.  Figure 2. Image showing coastal defence structure (blue), artificial coastline (red) and natural coastline (green) (image provided by G.Giorgi) The monitoring of this Common Indicator entails an inventory of: (i) the length and location of manmade coastline (hard coastal defence structures, ports, marinas. Soft techniques e.g. beach nourishment are not included. (ii) land claim, i.e. the surface area reclaimed from the 1980's onward (ha); and (iii) the Impervious surface in the coastal fringe (100m from the coastline). With regard to the coastline to be considered: the fixed reference official coastline as defined by responsible Contracting Party should be available throughout monitoring (initial, and all consequent monitoring should use the same official coastline). The optimal resolution should be 5 m or 1: 2000 spatial scale. The monitoring should be done every 6 years, and so every CP should fix a reference year in the time interval 2000-2012 in order to eliminate the bias due to old or past manmade infrastructures and coastal processes such as coastal erosion. The length of artificial coastline should be calculated as the sum of segments on reference coastline identified as the intersection of polylines representing manmade structures with reference coastline ignoring polylines representing manmade structures with no intersection

Content	Actions	Guidance
		with reference coastline. The minimum distance between coastal defence structures should be set to 10 m in order to classify such segments as natural, i.e. if the distance between two adjacent coastal defence structures is less than 10 m, all the segment including both coastal defence structures is classified as artificial.
Results		
Key findings	Text (maximum 100 words)	Until now there has been no systematic monitoring in Mediterranean regarding the EO8 Common Indicator. The only country that has implemented the monitoring of this indicator on a national level, at the moment, is Italy. There were also assessments on national level in France and Montenegro, but these assessments, although quite similar, do not fully resemble the implementation of the EO8 indicator, since they pre-date it. However, they still provide a deep insight on the state of Montenegrin and French coastlines regarding length of artificialized coastline.

<table>
<tr><th>Content</th><th>Actions</th><th>Guidance</th></tr>
<tr><td>Key assessment</td><td>Text (500 words), images</td><td>Here, the results for three contributing countries are presented: Italy, Montenegro and France
Italy, for now, is the only country to implement the monitoring of the EO8 common indicator 16 on a national level. Almost 16 % of the coastline was classified as built-up in 2006, with strong regional (sub-national) differences, for example between Continental Italy (20.5%) and Sardinia (4.5%). The share of built-up coastline slightly increased in 2012 in the whole country (+0.36%), again with higher increase in Continental Italy (+0.51%) than in Sardinia (0.06%).

In Montenegro, the assessment in 2013 showed around 32% of built-up coastline on national level with notable differences between coastal counties (e.g. 11.6% in Ulcinj County and 40.4% in Tivat County).

The rate of artificalization of the whole of the French Mediterranean coast is around 11 %, with wide differences apparent from region to region: from around 89 % for the coast of the Principality of Monaco to around 2 % for the coast of Corse du Sud (MEDAM Project).

It is important to note that in Montenegro and France the inventories of length of built-up coastline took place before the implementation of national Integrated Monitoring Assessment Programmes. However, methodology for delineating built-up coastline is quite similar to IMAP’s monitoring guidelines.</td></tr>
<tr><td>Key assessment (extended) Assessment, including extended descriptions of the quality status (including trends)</td><td>Text(no limit), figures, tables</td><td>The assessment results for Italy on the length of artificialized coastline are summarized in Table 2.

Table 2. Length of built-up coastline in Italy in 2006 (provided by Project EcAp-ICZM Italian Ministry of Environment/ISPRA)

<table>
<tr><th></th><th colspan="3">LENGTH (KM)
2006</th><th colspan="2">PERCENTAGE
2006</th><th colspan="2">PERCENTAGE
2012</th></tr>
<tr><td></td><td>total</td><td>natural</td><td>artificial</td><td>natural</td><td>artificial</td><td>natural</td><td>artificial</td></tr>
<tr><td>ITALY – continental</td><td>3844.985</td><td>3058.103</td><td>786.882</td><td>79.53</td><td>20.47</td><td>79.02</td><td>20.98</td></tr>
<tr><td>SICILIY</td><td>1177.769</td><td>1003.140</td><td>174.629</td><td>85.17</td><td>14.83</td><td>85.01</td><td>14.99</td></tr>
</table></td></tr>
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Content	Actions	Guidance

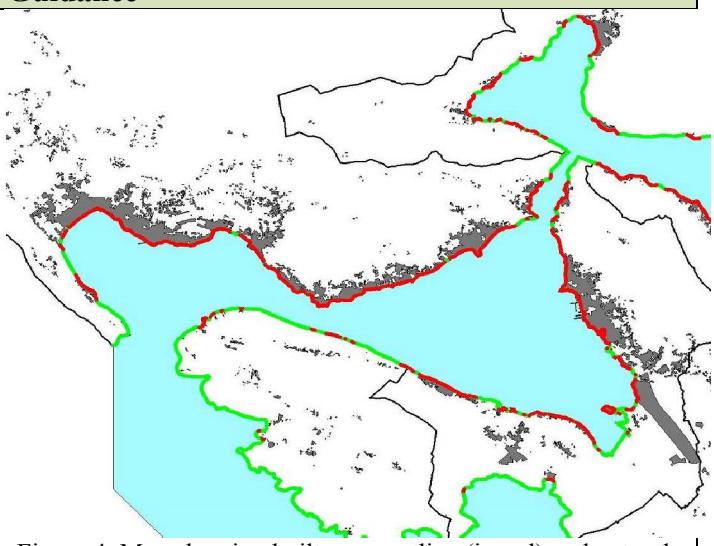
SARDINIA	1512.145	1444.395	67.749	95.52	4.48	95.46	4.54		+0.06%
TOTAL	6535.899	5505.638	1029.261	**84.25**	**15.75**	**83.89**	**16.11**		**+0.36 %**

The total length in Table 2 is referred to a reference coastline for year 2006, and does not include islands except Sardinia and Sicily. Built-up coastline includes coastal defense structures, ports and marinas. The spatial extension of impervious surfaces on land side has not been considered in the calculation of the length of built-up coastline. The above results show that meaningful trends as for ex. 2012 over 2006 or 2018 over 2012, have to be calculated considering Sardinia and Sicily separated by the continental part of Italy as they both have share percentage completely different from each other and from the continental part. The high level of artificialisation in Sicily is mainly due to little ports and marinas for touristic and fishery activities that have been built or expanded in the last 30-20 years.

In Montenegro, the built-up assessment of coastal zone was carried out within the frame of Coastal Area Management Program (CAMP), which served as a basis for Spatial plan for six coastal counties and latter National strategy for integrated coastal zone management for Montenegro. The length of built-up coastline in Montenegro was assessed for each of the six coastal counties (Table 3). The indicator was calculated by overlapping the built-up areas with generalized coastline to get the share of the built-up coastline in the whole coastline. The coastline was generalized in order to avoid unrealistic length of anthropogenic coastline (e.g. to avoid undulations by marinas, ports, were groins, etc.). The built-up coastline is shown in Figure 4.

Table 3. Length of built-up coastline in Montenegro (provided by G. Berlengi)

County	Natural coastline (km)	Built-up coastline (km)	
Bar	23.615	12.549	
Budva	24.505	7.305	
Herceg Novi	32.883	19.715	
Kotor	39.596	23.819	
Tivat	19.008	12.885	
Ulcinj	32.158	4.236	
Total	**171.764**	**80.509**	

Content	Actions	Guidance
		 Figure 4. Map showing built-up coastline (in red) and natural coastline (in green) in Montenegro (provided by G. Berlengi) In France, the MEDAM inventory (i.e. database) was established as a project that monitors the sources of artificial and development pressure on the French Mediterranean Coast, entailing features such as: the total length of coastline; coastline 'artificialised' by reclamation; rate of 'artificialisation' of coastline (linear), etc. The rate of artificalisation of the whole of the French Mediterranean coast, according to MEDAM, is 11.1 %, with wide differences apparent from region to region: from the 88.96 % for the coast of the Principality of Monaco to the 2.08 % for the coast of Corse du Sud. The total area reclaimed from 0 to -50m is around 5 240 ha for France and 78 ha for Monaco. This covers around 977 reclamation developments bigger than 100 ha (developments of harbors, groins, landfills, etc.) for France and 9 for Monaco. In 1960-1985 period, the number of reclamations from the sea tripled along the French Mediterranean, followed by a distinct slow-down of these redevelopments between 1985 and 2010. The slowing down was to a large extent the result of enforcement of an Act (arrêté) that banned the destruction of marine phanerogams (*Posidonia oceanica* and *Cymodocea nodosa*) (Arrêté of 19 July 1988).
Conclusions		
Conclusions (brief)	Text (200 words)	The inclusion of the EO8 Common Indicator aims to fill the gap of not having systematic monitoring in Mediterranean regarding the physical disturbance of coastline due to the influence of manmade structures. On the other hand, it offers very few examples to follow, especially since this indicator has no precedents in regional ecosystem approach initiatives, such as Helcom

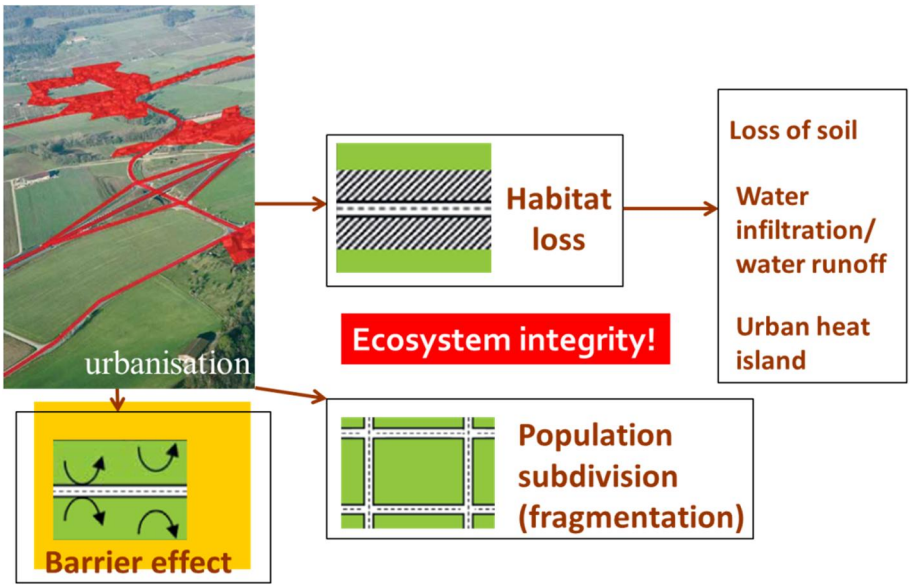
Content	Actions	Guidance
		or OSPAR, neither in Marine Strategy Framework Directive. Some countries, such as Italy, France and Montenegro, have developed the inventories of the share of their urbanized coastline, while some countries of South and East Mediterranean are starting to do so in frame of the EcAp MED II project.
Conclusions (extended)	Text (no limit)	
Key messages	Text (3-6 sentences or maximum 200 words)	• Mediterranean coastal areas are threatened by intensive construction of buildings and other infrastructure that can impact landscapes, habitats and biodiversity; • There was no systematic monitoring in Mediterranean regarding coastal artificialization by now; • The only country that has implemented the monitoring of the EO8 common indicator on a national level by this moment is Italy, with Montenegro and France performing similar inventories; • Targets, GES thresholds, measures and interpretation of results regarding this indicator should be left to the countries due to strong nation-specific socio-economic, historic and cultural dimensions and geographical conditions • The national reporting on state and evolution of coastal zones is required by the ICZM Protocol
Knowledge gaps (brief)	Text (100 words)	It is difficult to point out the knowledge gaps in this phase since there are so few examples of implementation of the EO8 Common Indicator. However, there are some "known" knowledge gaps that could hinder successful implementation of this indicator. These refer to: the choice of a reference coastline; natural variability and anthropogenic changes in coastline; spatial resolution of maps/satellite imagery; availability of maps/images; interpretation capacity, etc.
Knowledge gaps (extended)	Text (no limit)	There are several knowledge gaps that could impair successful implementation of the EO8 Common Indicator 16. First, it is a choice of a fixed reference coastline that each CP should select in order to assure comparability of

Content	Actions	Guidance
		results between successive reporting exercises. Unfortunately, it is not unusual to find out that more than one 'official' coastline exists for the same CP produced with different technological techniques. Plus, coastlines change due to coastal erosion, sea level rise and morphological modifications. In addition, if spatial resolution is too low or time period is too long, manmade structures could be poorly identified or completely missed with heavy consequences on the calculation of length of artificial coastline. The availability of satellite imagery of high resolution could also be a challenge, since these images could be costly. In addition, interpretation of these images requires certain knowledge and experience. In this case, some training and capacity building of national experts is essential.
List of references	Text	Berlengi, G. (2013) Primjena odabranih indikatora za praćenje i ocjenjivanje održivosti prostornog razvoja obalnog područja Crne Gore (in Montenegrin) Boak, E,, H,& Turner I,, L, (2005), Shoreline definition and detection: a review, Journal of Coastal Research 21(4), 688-703, Deichmann, U,, Ehrlich, E,, Small, E,, and Zeug, G, (2011), Using high resolution satellite data for the identification of urban natural disaster risk (GFDRR (Global Facility for Disaster Reduction and Recovery)), Markandya, A,, Arnold, S,, Cassinelli, M,, and Taylor, T, (2008), Protecting coastal zones in the Mediterranean: an economic and regulatory analysis, J, Coast, Conserv, 12, 145–159, McLachlan, A,, Brown, A,C,, 2006, The Ecology of Sandy Shores, Academic Press, Burlington, MA, USA, 373 pp MEDAM - French Mediterranean coasts inventory and impact of reclamations from the sea http://www.medam.info/index.php/en/ Özhan, E, (2002), Coastal erosion management in the Mediterranean: an overview (Split: UNEP/MAP/PAP), Plan Bleu (2005): Benoit G. and A. Comeau (eds.), "A Sustainable Future for the Mediterranean", The Blue Plan's Environment & Development Outlook, Earthscan, 2005. Rochette, J,,Puy-Montbrun, G,, Wemaëre, M,, and Billé, R, (2010), Coastal setback zones in the Mediterranean: a

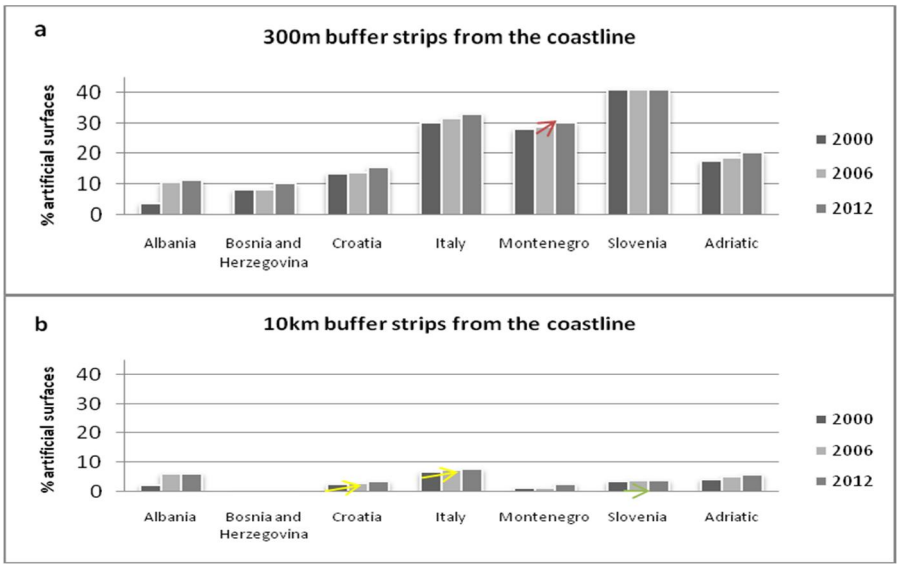
Content	Actions	Guidance
		study on Article 8-2 of the Mediterranean ICZM Protocol, n°05/10 December 2010, IDDRI Sanò, M,, Jiménez, J,A,, Medina, R,, Stanica, A,, Sanchez-Arcilla, A,, and Trumbic, I, (2011), The role of coastal setbacks in the context of coastal erosion and climate change, Ocean Coast,Manag, 54, 943–950, UNEP/MAP/PAP (2001), White paper: coastal zone management in the Mediterranean, (Split), UNEP/MAP (2013), Approaches for definition of Good Environmental Status (GES) and setting targets for the Ecological Objective (EO) 7 "Hydrography" and EO8 "Coastal ecosystems and landscape" in the framework of the Ecosystem Approach, UNEP(DEPI)/MED IG.22. UNEP(DEPI)/MED IG.22/Inf.7 (2016). Draft Integrated Monitoring and Assessment Guidance UNEP(DEPI)/MED WG.433/1 (2017) PAP/RAC Meeting of the Ecosystem Approach Correspondence Group on Monitoring (CORMON) on Coast and Hydrography – Working Document

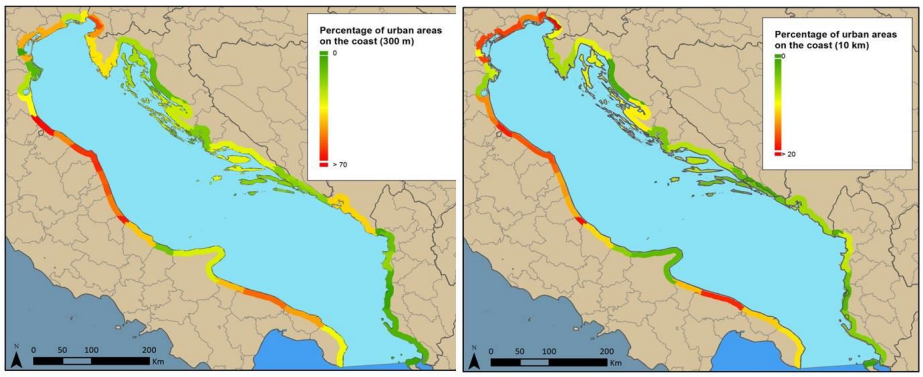
EO8CCI25. Candidate Common Indicator 25 Ecological Objective 8 Assessment Fact Sheet

Content	Actions	Guidance
Reporter	Underline appropriate	UNEP/MAP/MED POL SPA/RAC REMPEC **PAP/RAC** Plan Bleu (BP)
Geographical scale of the assessment	Select as appropriate	Regional: Mediterranean Sea Eco-regional: NWM (North Western Mediterranean); **ADR (Adriatic Sea)**; CEN (Ionian and Central Mediterranean Seas); AEL (Aegean and Levantine Sea) Sub-regional: Please, provide appropriate information
Contributing countries	Text	
Core Theme	Select as appropiate	1-Land and Sea Based Pollution 2-Biodiversity and Ecosystems **3-Land and Sea Interaction and Processes**
Ecological Objective	Write the exact text, number	**EO8. Coastal Ecosystems and Landscapes**
IMAP Common Indicator	Write the exact text, number	**CCI25. Land use change**
Indicator Assessment Factsheet Code	Text	**EO8CCI25**
Rationale/Methods		
Background (short)	Text (250 words)	Identifying and understanding the processes of land use change is especially relevant for critical and vulnerable areas such as coastal zones, where several competitive uses are pressing. In this context, the urbanization is the most dramatic change given the (almost) irreversibility of the process. The accumulated impacts of urbanization, such as habitat loss and fragmentation, highly compromise ecosystem integrity. The severity of the problem in Mediterranean coasts was recognized by UN Environment/MAP, and the indicator for Land use change was included in the Integrated Monitoring and Assessment Programme of the Mediterranean Sea and Coast and Related Assessment Criteria (IMAP) as a Candidate common indicator 25.

		The definition of Good Environmental State (GES) for the Land use change calls for linear coastal development to be minimised, with perpendicular development being in balance with integrity and diversity of coastal ecosystems and landscapes. Some general targets for this indicator include: no further construction within the setback zone; change of coastal land use structure - dominance of urban land use reversed; and keeping, and increasing, where needed, landscape diversity. The interpretation of targets, and setting the measures to achieve them, should be left to the countries due to the strong socio-economic, historic and cultural dimensions, and specific geomorphological and geographical conditions in each country.  Figure 1. Overview of major impacts of land take on ecosystem integrity
Background *extended*	Text (no limit), images, tables, references	Some projections indicate that the number of urban dwellers in Mediterranean coastal cities could increase to 90 million in 2025, compared to 70 million in 2000, mainly in southern and eastern shores (Plan Bleu, 2005). Together with construction of holiday homes, this increase of urban coastal population is one of the main drivers of land consumption. An EcAp pilot project on further testing this indicator took place in the Adriatic to assess its feasibility on the sub-regional level, following the 2013 CORMON Coast and Hydrography recommendation. This was done within the framework of an EU funded project on the "Implementation of the Ecosystem Approach in the Mediterranean (also known as EcAp-MED I project 2012-2015)". The Protocol on the ICZM in the Mediterranean identifies the need of balanced use of coastal zones in several articles (Articles 5, 6 and 8). In addition, the EU's Habitats Directive (92/43/EEC), Birds Directive (2009/147/EC), as well as Convention of Biological Diversity (CBD) can also be relevant for policy context regarding land use change. Given the particularities and complexity of the terrestrial systems, to which the land use change indicator mainly refers, the GES for land use cannot be defined by a single value or threshold and needs to take a different approach. The indicator, complemented with the local/regional knowledge, is well suited to assist spatial planning when defining objectives and

		measures. In other words, given the relevance of the socio-economic, historic and cultural dimensions, in addition to specific geographical conditions, local experts will provide the needed input in support to achieving GES. Assessing the trends in different areas over a certain period is useful to identify certain areas with higher degradation that would require specific actions or the efficiency of the implementation of planning policies. Evaluation of different land use change parameters (such as: the area of built-up land in coastal zone as a proportion of the total area in the same unit, or as a proportion of the area of built-up land in the wider coastal unit; land take as % initial urban area on the coastal zone, etc.) can identify: (i) where pressures are higher (by amount of change and by pace of the process); (ii) spatial trends (along the coast and landwards); and (iii) areas for priority action. However, responsible (national) institutions are necessary to correctly interpret these processes and to understand the drivers behind them.
Assessment methods	Text (200-300 words), images, formulae, URLs	Methodology for calculation of the EO8 Land use change CCI 25 comprises of: (i) **data compilation**, i.e. mapping five land cover classes (artificial surfaces; agricultural; forests and semi-natural lands; wetlands; and water bodies) from digital remotely sensed data through the process of a supervised digital image classification, and (ii) **data processing**, i.e. extracting statistics of different parameters once adapted to 1ha grid. The parameters calculated for the Land use change indicator are: • Area of built-up land in coastal zone as a proportion of the total area in the same unit • Area of built-up land in coastal units as a proportion of the area of built-up land in the wider coastal unit • Land take as % initial urban area on the coastal zone • Change of forest and semi-natural areas • Change of wetlands The spatial scale of monitoring includes the coastal zone as defined by the CPs. The analytical units are 300m belt from the coastline, as well as 1km and 10km when appropriate.
Results		
Key findings	Text (maximum 100 words)	At this stage there is no comprehensive study on land use change in Mediterranean coastal zones. Therefore, the results on monitoring the EO8 CCI25 Land use change indicator in the Adriatic region, from the pilot study of the 2012-2015 EcAp MED project (UNEP/MAP/PAP, 2015), are used here to demonstrate what has been done in the Mediterranean area at this sub-regional scale. This pilot study was successful in indicating the coastal areas that either already have high degree of urbanization or are experiencing rapid land take. In addition, the areas and amount of natural systems lost (e.g. amount of forest converted to artificial land) were also uncovered.

Key assessment	Text (500 words), images	The pilot study on land use change in the Adriatic region (UNEP/MAP/PAP, 2015) revealed that the urbanization within the 300m from the coastline in the Adriatic region has moved from Albania, having high increase of built-up area in 2000-2006 period, to Bosnia and Herzegovina, Croatia and Montenegro having higher increase of built-up area in the 2006-2012 period. (Figure 2a). Italy and Slovenia had a steady behavior over the whole period. As for the 10 km buffer (Figure 2b), Croatia and Italy had important increases of urban areas (10 to 25%) in some coastal spots during the 2000-2006 period, which extended also in the 2006-12 period. Bosnia and Herzegovina and Montenegro again had a higher increase in the 2006-12 period.  Figure 3. The share of artificial areas in total areathrough the 2000-2012 period: for 300m buffer strip (a) and 10 km buffer strip (b) There were no significant differences on the behavior of the land taken by the urbanization process between the two periods. The only difference was the intensity between land uses in the first 300 meters. In 2000-2006 period the forest land use class was more affected by the expansion of artificial surfaces, while in 2006-2012 more than 50% of the land take of the first 300 meters occurs in pastures and mixed agricultural areas instead of forest surfaces.
Key assessment (extended) Assessment, including extended descriptions of the quality status	Text(no limit), figures, tables	The extended results on monitoring of the EO8 CCI25 Land use change indicator in the Adriatic region are presented here (from the pilot study of the 2012-2015 EcAp MED project). **Parameter 1: Reference to initial state: % built-up on the coastal zone as a proportion of the total area in the same unit (year 2000):** As for the percentage of built-up area in coastal zone in year 2000 (see Figure 4), around 6 % of the coastal zone was urbanized on the Adriatic region **within the 10km belt from the coastline**. There was no

(including trends)		homogenous distribution of built-up areas along the coast, which is logical considering the diverse topography and history of the region. The less urbanized coast is found in some parts of Croatia and Bosnia and Herzegovina, while Italy had urban spots where the percentage of built-up goes up to 20% of the coastal zone. As for the **300m-wide belt from the coastline[1], t**he share of the built-up area was about 18% (around three times of the built-up observed on the complete coastal area within 10 km from the coastline). The urbanization in this part of the coast is characterized by a linear urban development following the coastline which implies the disruption of the land-sea interactions. Moreover, these developments are also at higher risk of coastal floods. The results also showed that, not only the distance from the coastline, but also elevation played an important role in urbanization patterns. More precisely, the degree of urbanization was found to be relatively high at low elevation.  Figure 4. Share of built-up area in the first 10 km of the coast (left) and share of built-up in the first 300 m (right) in 2000 in the Adriatic region **Parameter 2: Area of built-up land in coastal units as a proportion of the area of built-up land in the wider coastal unit** This parameter illustrates (see Fig. 5) to what extent built‑up areas are concentrated on the coast for a given administrative area. The higher the value, the higher the concentration of urban areas along the coast, which may integrate two components: - Availability of space for development. This is the case of some parts of the Eastern Adriatic coast, with high share of urban on the first 10km of the coastal zone. Here, the topography is a major constrain for urban development landwards; and - Economic activities on the coast as a major driver for development. This would be the case in some regions in Italy where not topographic constrain was observed.

[1] the 300m wide coastal strip is proposed as relevant representation of the coastal setback (also considering the resolution issues)

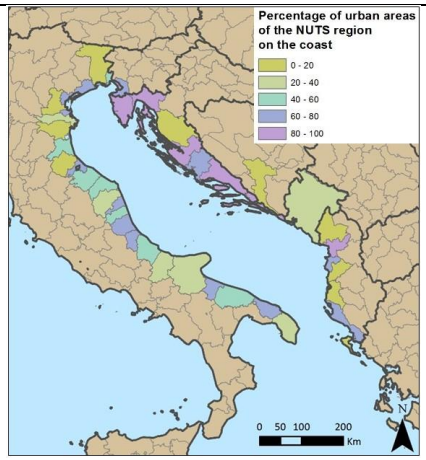


Figure 5:Built-up in the 0-10 km coastal strip versus the entire administrative area (2000).

Parameter 3: Land take as % initial urban area on the coastal zone

a) Land take (2000-2006)

Within the first 10 km of the coast the land take rate could be in general considered medium to high for the 2000-32006 period: most of the areas are on the range of 5-10 % increase, with a clear hot spot on Albania (Figure 6, left). The situation slightly improves within the first 300 m (Figure 5, right): the rate of development is below 1% in most areas with some hot spots still found in Albania. There is a general trend of increased land take rates as we move far from the coastline. This is due to the fact that considerable part of the setback zone is already constructed, reaching high values in certain areas.

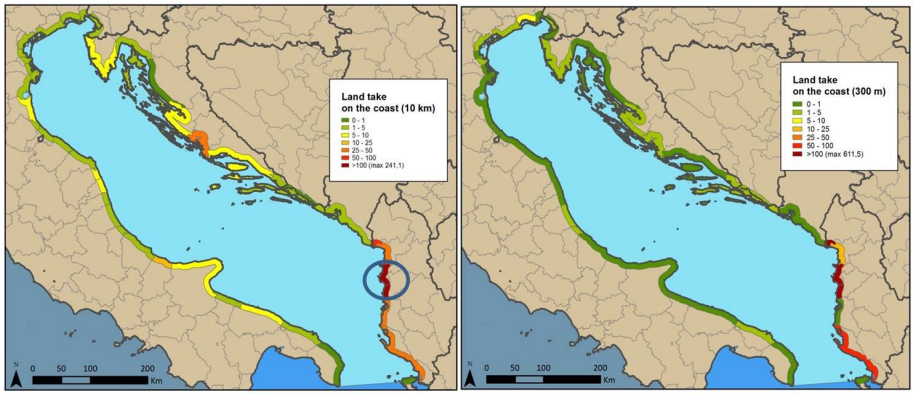


Figure 6. Land take as percentage of initial urban area on the coastal zone (2000-2006) on the 10 km buffer (left) and 300 m buffer (right). Part of Albanian coast is encircled

b) Land take (2006-2012)

The process of urbanization in the Adriatic region for the 2006-2012 period has taken place at an average rate of 3084 ha/year on the first 10 km of the coast, significantly lower compared to the land take of 4600 ha/year in the previous period (2000-2006). This decrease is largely explained by the stabilization of Albania's hotspot detected in the previous period. In the 2006-2012 period the new land take has relocated to other coastal regions: especially in Croatia and Italy (Figure 7, left), but also in Montenegro and

Bosnia Herzegovina. This pattern is valid for both 300 m and 10 km buffers. However, new urbanized areas tend to concentrate in the first 300 m buffer in contrast with the previous period when urbanization concentrated on the 1-10 km buffer (Figure 7, right).

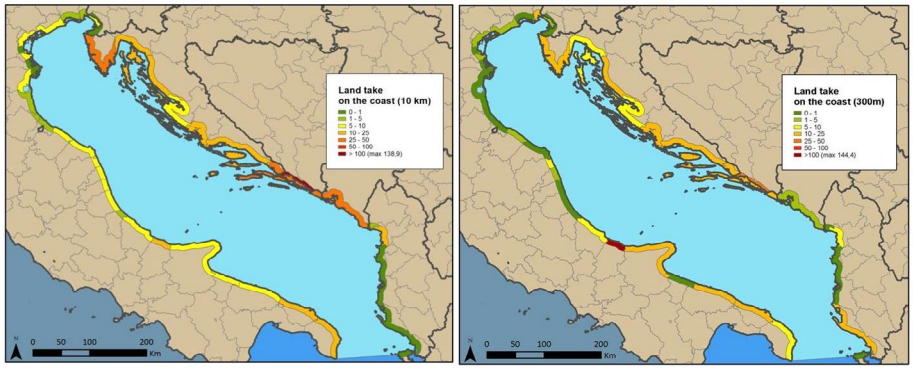


Figure 7. Land take as percentage of initial urban area on the coastal zone (2006-2012) on the 10 km buffer (left) and 300 m buffer (right).

Parameter 4: Change of forest and semi-natural areas

This is a critical aspect to better understand the potential impacts of the observed urbanisation patterns in the Adriatic coastal region. Almost 75% of the urbanisation process in the first 10km from the coastline took place on pastures and agricultural areas (see Figure 8).

While forest losses decreases as we move away from the coastline, pastures is by far the land use class more affected by the expansion of urbanization farther away from the coastline.

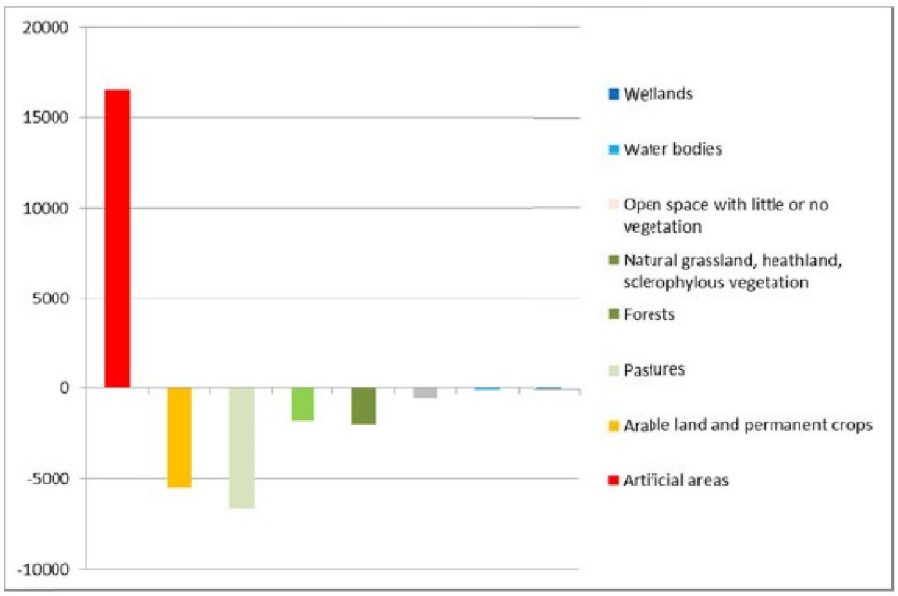


Figure 8. Net change in land use 2000-06 (ha) on the 10 km coastal zone

Parameter 5: Change of wetlands

It should be noted that the accuracy of wetland change assessment is influenced by the 25 ha mapping limit of the Corine land cover (CLC) database. Many wetlands and their related changes are smaller in size, and the total coverage of coastal wetlands is likely to be underestimated.

		National and local assessments with refiner data are needed to calculate this parameter. This parameter reflects: - an increase of wetlands (gain of wetland area) due to recovery actions; - a decrease of wetlands area: land loss still continues to be the most pervasive threat to coastal wetlands and salt marshes. Thus, this parameter is of paramount importance to detect urban sprawl without planning with an ecosystem perspective; and - maintenance of wetlands area: in this case, it is recommended to analyse if built-up surface is expanding surrounding the wetland area. It could indicate habitat degradation and/or habitat fragmentation of this fragile coastal ecosystem.
Conclusions		
Conclusions (brief)	Text (200 words)	The land use change indicator does not provide the exact threshold and place where to revert particular land use changes. However, it provides boundary conditions that reflect the most extreme situations where habitat loss is most dramatic –and consequently biodiversity and other related services strongly affected. There was no systematic monitoring on land use change in Meditaerranean coastal zones up till now. On sub-regional level, the monitoring on the land use change indicator was carried out in the Adriatic region, within the first phase of the EcAp MED project (2012-2015). This pilot study revealed many useful insights that can be relevant to successful monitoring of the indicator elsewhere. The monitoring was successful in indicating the areas having either already high degree of urbanization or rapid land take. However, the interpretation of results, i.e. the drivers behind built-up increase in certain areas is left to the countries, since there are the strong socio-economic, historic and cultural dimensions in addition to specific geomorphological and geographical conditions in each country for such phenomena. In 2017 Correspondence Group on Monitoring (CORMON) meeting on Coast and Hydrography in Madrid and at the PAP/RAC National FPs meeting in May in Split, participants welcomed the inclusion of the CCI25 on the list of candidate indicators as it seemed very relevant, innovative and mature enough, and proposed its further development.
Conclusions (extended)	Text (no limit)	/
Key messages	Text (3-6 sentences or maximum 200 words)	• Identifying and understanding the processes of land use change is especially relevant for critical and vulnerable areas such as coastal zones; • There was no systematic monitoring on land use change in coastal zones on Mediterranean level ; • On sub-regional level the pilot study of the 2012-2015 EcAp MED project tested the monitoring of the EO8 Land use change indicator in the Adriatic region;

		• Potential inclusion of the CCI25 on the list of candidate indicators was welcomed during 2017 CORMON Coast and Hydrography meeting and at PAP/RAC NFPs meeting.
Knowledge gaps (brief)	Text (100 words)	Although the monitoring of the land use change indicator in the Adriatic region has proven as quite successful, there are still some uncertainties and knowledge gaps that need to be addressed. For example, the definition of GES for land use change cannot be defined simply by a single value or threshold, given the particularities and complexity of terrestrial systems. Other issue is the definition of reporting units, since division of sub-units is very much subjected to the specific topographic, historical and socio-economic conditions. The relevance of data can also be an issue: the limitations of remote sensing data are often related to resolution of maps and imagery that sometimes, if not of high quality, could omit important elements for the analysis. In addition, availability of high quality data to perform the assessment can also be an issue. Also, the people interpreting the data would need to have certain level of knowledge, i.e. skills in working with specialized software.
Knowledge gaps (extended)	Text (no limit)	
List of references	Text	UNEP/MAP/PAP (2015) Pilot project in the Adriatic on testing the candidate common indicator 'Land use change' in the Mediterranean, by: Anna Marín. Raquel Ubach. and Jaume Fons-Esteve. Coordinated by: Marko Prem, PAP/RAC. URL: http://www.pap-thecoastcentre.org/pdfs/Pilot%20Adriatic_Final_Sep2015.pdf UNEP(DEPI)/MED WG.433/1 (2017) PAP/RAC Meeting of the Ecosystem Approach Correspondence Group on Monitoring (CORMON) on Coast and Hydrography – Working Document *Land use change and related impacts:* • Bajocco, S., De Angelis, A., Perini, L., Ferrara, A. i Salvati, L., 2012, 'The Impact of Land Use/Land Cover Changes on Land Degradation Dynamics: A Mediterranean Case Study', *Environmental Management*, 49(5), p.980-989. • Dale,V. H. , Brown, S. , Haeuber, R. A. , Hobbs, N. T. , Huntly, N. , Naiman, R. J. , Riebsame, W. E. , Turner, M. G. and Valone, T. J., 2000. Ecological principles and guidelines for managing the use of land. *Ecological Applications* 10:639–670. • Gibbs, H. K., Helkowski, J. H., Holloway, T., Howard, E. A., Kucharik, C. J., Monfreda,

		C., Patz, J. A., Prentice, I. C., Ramankutty, N., Snyder, P. K., Foley, J. A., DeFries, R., Asner, G. P., Barford, C., Bonan, G., Carpenter, S. R., Chapin, F. S., Coe, M. T. i Daily, G. C., 2005. Global Consequences of Land Use. *Science*, 309(5734), p.570-574. • Haines-Young, R., 2009, 'Land use and biodiversity relationships', *Land Use Policy*, 26, p.S178-S186. <u>*Methodology to compute land use change indicator:*</u> • Breton, F., Ivanov, E., Morisseau, F., Nowell, M. 2014. *D4.2 Report, accompanying database and supporting materials on LEAC Methodology and how to apply it in CASES*. PEGASO 06/Deliverable. URL: http://www.pegasoproject.eu/images/stories/WP4/D4.2%20LEAC_UAB_140401.pdf • EEA, 2006. The changing faces of Europe's coastal areas, EEA report. European Environment Agency ; Office for Official Publications of the European Communities, Copenhagen, Denmark : Luxembourg. • Feranec, J., Jaffrain, G., Soukup, T. and Hazeu, G., 2010, 'Determining changes and flows in European landscapes 1990–2000 using CORINE land cover data', *Applied Geography*, 30(1), p.19-35. • V. Perdigao i S. Christensen, 2000, *The LACOAST atlas: Land cover changes in European coastal zones*, Joint Research Centre, Milan. • Serra, P, Pons, X., Saurí D. 2008. Land-cover and land-use change in a Mediterranean landscape: A spatial analysis of driving forces integrating biophysical and human factors. *Applied Geography*, 28(3): 189-209. • Weber, J.-L., 2007, 'Implementation of land and ecosystem accounts at the European Environment Agency', *Ecological Economics*, 61(4), p.695-707. • EC - DG.ENV, 2013. Mapping and assessment of ecosystems and their services an analytical framework for ecosystem assessments under action 5 of the EU biodiversity strategy to 2020: discussion paper - final, April 2013. Publications Office, Luxembourg. URL: http://ec.europa.eu/environment/nature/knowledg

		e/ecosystem_assessment/pdf/MAESWorkingPape r2013.pdf