**UNITED NATIONS
ENVIRONMENT PROGRAMME
MEDITERRANEAN ACTION PLAN**

Science Policy Interface and Ecosystem Approach Coordination Group Joint Meeting on IMAP Scale of Assessment and QSR

Nice, France, 27-28 April 2017

Agenda item 4: Regional Assessment of the Mediterranean Marine and Coastal Environment: the development of the Quality Status Report

Quality Status Report (QSR) Draft Assessment Factsheets on Coast and Hydrography

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Introduction

1.   The Integrated Monitoring and Assessment Programme (IMAP) including 23 Common Indicators and 4 Candidate Common Indicators was adopted at the 19th Meeting of the Parties to the Barcelona Convention (COP 19) in February 2016[1]. The 2017 Quality Status Report (QSR2017) will be the first report on the IMAP-based Ecological Objectives and related common indicators. The UNEP/MAP Programme of Work adopted at COP 19 has a specific Output 1.4.1 "Periodic assessments based on DPSIR approach and published addressing inter alia status quality of marine and coastal environment, interaction between environment and development as well as scenarios and prospective development analysis in the long run. These assessments include climate change-related vulnerabilities and risks on the marine and coastal zone in their analysis, as well as knowledge gaps on marine pollution, ecosystem services, coastal degradation, cumulative impacts and impacts of consumption and production." The specific activity for 2016-2017 is to "Prepare and publish Quality Status Report (QSR) based on MAP EcAp-based EO and related common indicators"

2.   Since the adoption of the IMAP decision at COP19, and given the IMAP implementation is still at an early phase, the approach for the QSR2017 accommodates the short time availably for preparation of this report and data gaps on some of the IMAP indicators, and also considers the approach taken by other Regional Seas (such as OSPAR), and global work such as ongoing work of the Regional Process on a second World Ocean Assessment(s) and the process on implementing the 2030 Agenda, especially in relation to oceans related Sustainable Development Goals (SDGs). As countries are still in the process of revising their national monitoring programmes, it will not be possible to compile a full set of data for all IMAP indicators for the QSR2017. Therefore the approach for the QSR2017 is to use all indicator data available and to complement and address gaps with inputs from numerous sources. In the initial steps additional sources of information are identified and mapped, from other partners, the NAP reports, etc.

3.   The QSR2017 report will be prepared as an online interactive report so that the report can be made widely available, be visually appealing, include graphics and animations (such as time series maps of concentrations), and in addition to the main section, can have links to case studies, from Contracting Parties and also partners), or links to other databases and information sources. A Summary Report will also be prepared and published. The QSR2017 will be presented to 20th Meeting of Contracting Parties to the Barcelona Convention in December 2017, with a recommendation for future assessments.

4.   The current document presents the three indicators for Coast and Hydrography cluster: Common Indicator 15 of the Ecological Objective 7 Hydrography - "Location and extent of the habitats impacted directly by hydrographic alterations"; Common Indicator 16 of the Ecological Objective 8 Coastal Ecosystems and Landscapes – "Length of coastline subject to physical disturbance due to the influence of manmade structures", and Candidate Common Indicator 25 of the EO8 – "Land use Change" The Contracting Parties were encouraged to submit the relevant data to the PAP/RAC. This assessment is based on literature review, recent reports and results from several projects, including EcAp MED II project, and initiatives in the Mediterranean, and data provided.

5.   Contracting Parties and participants to the CORMON on Coast and Hydrography are invited to contribute to this initial draft of the assessment factsheets through the following:

i.   To review and comments for the further revision of the assessment factsheets
ii.   To provide to the PAP/RAC national data and information that can be included in the further revision of the assessment factsheets
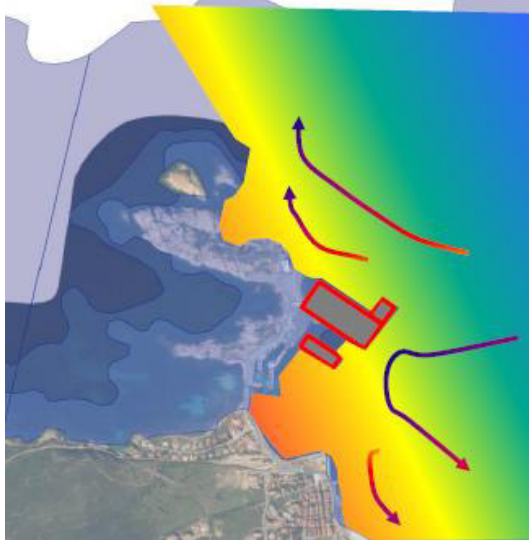
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[1] UNEP(DEPI)/MED IG.22/28. Decision IG.22/7: Integrated Monitoring and Assessment Programme of the Mediterranean Sea and Coast and Related Assessment Criteria

iii. To propose, in addition to the regional level assessment factsheets proposals for case studies at the local, national or regional level for one or more indicator that can also be included in the QSR2017.

Ecological Objective EO7. Alteration of hydrographical conditions

EO7: Common Indicator 15. Location and extent of the habitats impacted directly by hydrographic alterations

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: Please, provide appropriate information
Contributing countries	Text	**EU countries surrounding Med (Croatia, Cyprus, France, Greece, Italy, Malta, Slovenia, Spain)**
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 developments have the potential to alter the hydrographical regime of currents, waves and sediments in near-shore waters, either at broad scale or through acting cumulatively with other developments. Ecological Objective 7 ("Alteration of hydrographical conditions") addresses these issues through an agreed common indicator 15 - 'Location and extent of habitats impacted directly by hydrographic alterations'. This indicator considers marine habitats which may be affected or disturbed by changes in hydrographic

Content	Actions	Guidance
		conditions (currents, waves, suspended sediment loads, temperature, salinity) due to new large-scale 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 coastal structures, in order to minimize the impact on coastal and marine ecosystem and its services integrity, and cultural/historic assets. 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. The definition of functional habitats under EO1 could help identify the priority benthic habitats for consideration in EO7. There is a strong rationale in international legislation for monitoring this indicator, such as the UNEP/MAP Decision IG.22/7 on Integrated Monitoring and Assessment Programme (IMAP) of the Mediterranean Sea and Coast, adopted at COP in 2016, which includes EO7 Hydrography. In addition, some Protocols of the Barcelona Convention (such as the SPA/BD protocol and the ICZM Protocol) are relevant to EO7, as well as the Marine Strategy Framework Directive (MSFD 2008/56/EC). Figure 1. Illustration of hydrodynamic conditions with structure (image provided by O. Brivois)
Background *extended*	Text (no limit), images, tables, references	
Assessment methods	Text (200-300 words), images, formulae, URLs	Methodology for measurement of the Common Indicator 15 encompasses elaboration on: (i) Mapping of area where human activities may cause permanent alterations of hydrographical conditions (using i.e. existing EIA, SEA and MSP); (ii) Mapping of habitats of interest in this area of hydrographical changes; and (iii) Intersection of the spatial map of areas of hydrographical changes with spatial maps of habitats to determine the areas of individual habitat types that can be

Content	Actions	Guidance
		impacted directly by hydrographical changes. A methodological approach of how to reflect the objectives of the Hydrography Common Indicator in the main steps undertaken in an EIA (and SEA) procedure can be seen in Figure 2. Figure 2. Methodological approach of how to integrate the EIA/SEA process with the implementation of EO7 (from UNEP/MAP/PAP, 2015) 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 (see *Key assessment* chapter) 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 obtained ends with 2012.
Results		
Key findings	Text (maximum 100 words)	Since the monitoring of many non-EU countries on EO7 Hydrography has not been initiated yet, the only experience of examining the hydrographic alterations is those dealing with the Descriptor 7 in EU countries sharing Mediterranean waters. As required by the Marine Strategy Framework Directive (MSFD), the Member States of the European Union were due to submit to the European Commission by 15 October 2012 their reports on: (i) initial assessment of the current environmental status of their marine waters (Art. 8 MSFD); (ii) determination of what Good Environmental Status (GES) for the marine waters of relevant marine regions and sub-regions (Art. 9 MSFD); and identification of environmental targets and associated indicators to guide progress towards achieving GES by 2020 (Art. 10 MSFD). Here, a brief overview of experiences of EU countries belonging to the Mediterranean basin has been summarized, with particular focus on the initial assessment of the current environmental status of their marine waters (see *Key*

Content	Actions	Guidance
		assessment chapter).
Key assessment	Text (500 words), images	All Member States of the European Union have carried out an initial assessment for Descriptor 7 – Hydrographic conditions, and submitted their assessments to European Commission in 2012. The main sources of the information here were the technical assessments of Member States' obligations towards MSFD, from 2014, ordered by the European Commission. In some countries, the impacts of altered hydrographical conditions are assessed as a part of Environmental Impact Assessment (EIA) for certain coastal structures (e.g. Israel). Nearly all of the 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. Some countries have focused solely on some specific parameteres, such as temperature and salinity (e.g. Cyprus and Italy). In Cyprus, thermal regimes related to power generation capacity and estimates of cooling water usage for the main power plants of were covered. The current and projected (2020) volume of freshwater generation by desalination was considered, with a limited assessment on the impacts on macroalgae (based on literature from 1999). In Italy, the Gulf of Taranto and the coast of Lazio were both found to be affected by the elevated temperatures. For both areas there was no sufficient data to identify activities that cause these elevated temperatures. Italy is currently in the process of developing national environmental impact assessment for new coastal structures with most significant estimated impacts on marine environment. In particular, in the Port of Monfalcone (Northern Adriatic Sea) a monitoring campaign for currents, sediment deposition, physico-chemical parameters as temperature, salinity and nutrients has been carried on in order to calibrate/validate a 3D Hydrological modelling (TELEMAC-3D) coupled to DELWAQ water quality models. In this area a storage, regasification and distribution terminal of LNG is planned and an EIA procedure is on-going. In Croatia, the assessment from 2012 hydrographic parameters (temperature, salinity, transparency and sea level) has shown no visible impacts on ecosystem lasting for more than 10 years. The proportion of the assessment area reported as affected by hydrological processes varied significantly between countries: from less than 1% (Cyprus and Spain), 1-5% in Italy, 5-25% in Slovenia, to 75-100% in Greece. However, in Greece the high percentage was justified by the fact that climate change-related changes were also taken into account. Some countries indicated the drivers behind pressures on hydrographic conditions. For example Greece identified industry, agriculture and forestry as causes of pressures on features, habitats and species groups. Malta attributed temperature anomalies (and related increase in epiphytic growth and regression in the *Posidonia* extent), reduced oxygen levels, high levels of chlorophyll *a* and occasional water turbidity, to discharge of cooling waters from the power stations at Marsa and Delimara. Changes in salinity were mainly associated with the brine discharges of three desalination plants and by tourist resorts. Changes in currents, wave action and sediment transport are considered as result of dredging activities (mainly restricted to harbor areas), installation of offshore structures (mainly related to aquaculture) and construction works affecting the coastline (mostly marinas, ports and harbours. In France, the changes in thermal regime were associated with releases by thermal plants, and urban and industrial water releases, mainly in the Gulf of Fos. However, the thermal releases from power plants were characterized as having very limited influence in space (about 1 km), causing no known ecological impacts. As for the modification of the current regime n French Mediterranean, the impact of human activities (various constructions: dikes, oyster tables, turbines, etc.) remains limited to the local level (considering currents only, not the sediment transport). Coastal developments

Content	Actions	Guidance
		(harbors or protections against coastal hazards) were found to be spatially limited to few hundred meters/few kilometers, so the orders of magnitude were very low, although with changes of sediment transport are notable in Languedoc-Roussillon area.
Key assessment (extended) Assessment, including extended descriptions of the quality status (including trends)	Text(no limit), figures, tables	
Conclusions		
Conclusions (brief)	Text (200 words)	The EO7 Common Indicator 15 reflects location and extent of the habitats impacted directly by hydrographic alterations. This indicator should indicate the area/habitat and the proportion of the total area/habitat where alterations of hydrographical conditions are expected to occur (estimations by modelling or semi-quantitative estimation). The big issue on deriving concluding remarks for this indicator on regional level is that the monitoring programmes for its surveillance are currently being developed for most Mediterranean countries. There are no practical good examples for its implementation, except for some experiences from implementation of Descriptor 7 by the EU Member States.
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); - There is a clear link between EO7 and other ecological objectives, especially EO1 (Biodiversity); - EU countries submitted their first initial assessments regarding Descriptor 7 in 2012, which was revised by European Commission in 2014; - The monitoring of many non-EU countries on EO7 Hydrography has not been initiated yet, or it is just being initiated, except for countries where EIA is required for the new structures, such as in Israel.
Knowledge gaps (brief)	Text (100 words)	The knowledge gaps that pose an obstacle of drawing conclusion on Common Indicator 15 on regional level are mainly related to insufficient surveys and monitoring of state of marine environment regarding this indicator. The methodological gaps are related to the definition of types and dimensions of new structures to be taken into account; gaps related to the complex information needs to define the base-line conditions; and the spatial and temporal scales of assessment as well as. The habitat maps to be considered will be provided from the EO1 indicator. Assessments that estimate the extent of hydrographic alterations (knowing

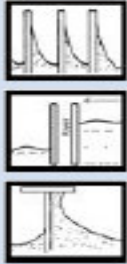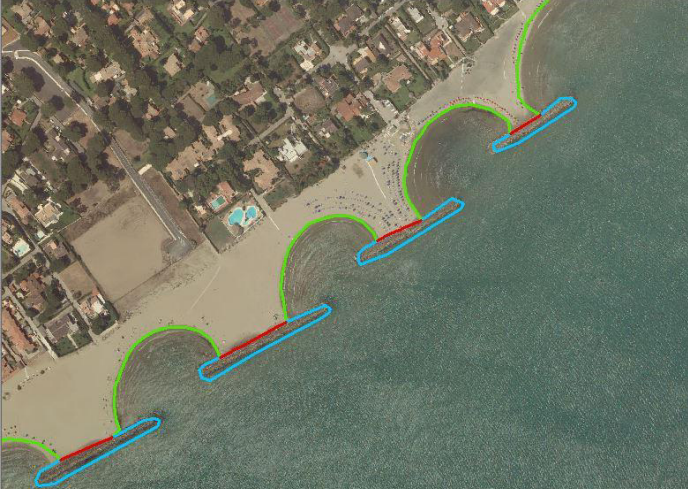| Content	Actions	Guidance
		conditions before and after construction) and its intersection with marine habitats are extremely rare in the Mediterranean, except for some local studies of EIA/SEA. Instead, only trends of some hydrographic parameters are known, mostly unable to be connected to anthropogenic 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)	
List of references	Text	EC JRC (2015). Review of Commission Decision 2010/477/EU concerning MSFD criteria for assessing good environmental status Descriptor 7: Permanent alteration of hydrographical conditions does not adversely affect marine ecosystems

EMEC Ltd (2005).Environmental impact assessment (EIA) guidance for developers at the European Marine Energy Centre.

OSPAR Commission (2012). MSFD Advice document on Good environmental status - Descriptor 7: Hydrographical conditions. A living document - Version 17 January 2012.

OSPAR Commission (2013).Report of the EIHA Common Indicator Workshop.

Royal Haskoning DHV (2012).Environmental Impact Assessment (EIA) and Appropriate Assessment (AA) Evaluation of assessment tools and methods. Lot 2: Analysis of case studies of port development projects in European estuaries. Tidal Rover Development (TIDE) Interreg IVB

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. 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

For MSFD Descriptor 7:

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 |

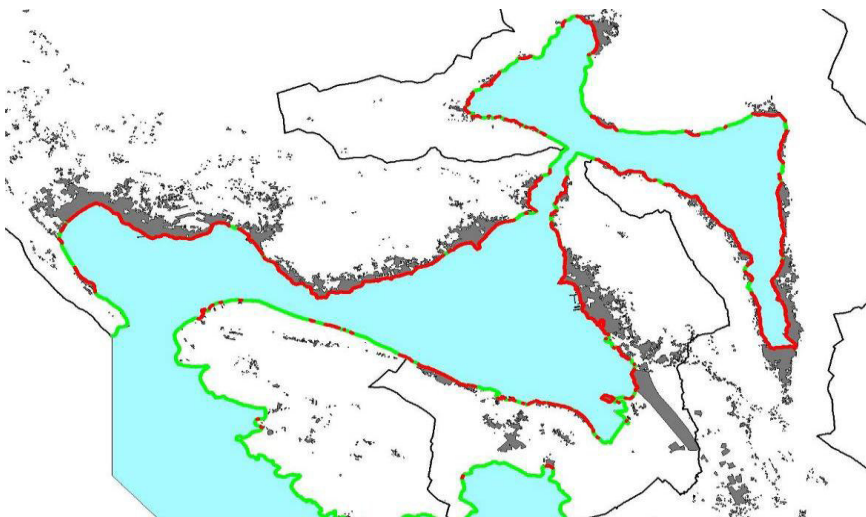**Ecological Objective EO8. Coastal Ecosystems and Landscapes**

EO8: Common Indicator 16. Length of coastline subject to physical disturbance due to the influence of manmade structures

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: Please, provide appropriate information
Contributing countries	Text	**Italy, Montenegro, France**
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	**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)	Mediterranean coastal areas are threatened by coastal development that modifies the coastline through the construction of buildings and infrastructure needed to sustain residential, tourism, commercial, and transport activities. The Mediterranean coastline is approximately 46000 km long, with around 40% of the total coastal zone estimated to be under some form of artificial land cover (Plan Bleu, 2005). Coastal manmade infrastructures cause irreversible damage to landscapes; habitats and biodiversity; and shoreline configuration by disrupting the sediment transport. UN Environment/MAP decided to tackle these issues by including the Ecological Objective focusing specifically on the coast - EO8 "Coastal

Content	Actions	Guidance
		ecosystems and landscape" in its ecosystem approach. This EO does not have a precedent in other regional ecosystem approach initiatives, such as Helcom or OSPAR, neither in Marine Strategy Framework Directive. The EO8 emphasizes the integrated nature of the coastal zone, particularly through consideration of marine and terrestrial parts as its constituent elements. The aim of monitoring the EO8 common indicator "Length of coastline subject to physical disturbance due to the influence of manmade structures" is twofold: (i) to quantify the rate and the spatial distribution of the Mediterranean coastline artificialitsation and (ii) to provide a better understanding of the impact of those structures to the shoreline dynamics. It has an operational target on impact, thus it is associated to concrete implementation measures related to specific human activities (i.e. appropriate management measures) to minimize negative impacts. Definition of the targets, measures and interpretation of results regarding the EO8 common indicator, are 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	
Assessment methods	Text (200-300 words), images, formulae, URLs	The monitoring of the EO8 Common Indicator entails an inventory of: (i) the length and location of manmade coastline: hard coastal defence structures, ports, marinas, etc (see Figure 2). 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).

Content	Actions	Guidance

Figure 2. Hard coastal defence structures, modified from the EUROSION Shoreline Management Guide, EU, 2004. Taken from IMAP guidelines, page 134, Table 1.

Monitoring of this indicator focuses on measuring the length of artificial coastline and its share in 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 3.

Figure 3. Image showing coastal defence structure (blue), artificial coastline (red) and natural coastline (green) (image provided by G.Giorgi)

Content	Actions	Guidance
		Space and airborne earth observation systems are the most suitable tool to conduct the monitoring strategy of the EO8 common indicator, i.e. very high resolution (VHR) satellite imagery, aerial photographs, laser scanners etc. Statistics is then extracted via identification techniques and procedures used through GIS tools.
Results		
Key findings	Text (maximum 100 words)	The only country that has implemented the monitoring of this indicator on a national level, at the moment, is Italy. 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. This assessment does not fully resemble the implementation of the EO8 indicator, since it pre-dates it, but it is quite similar to it, and serves to provide deep insight on the state of Montenegrin coastline regarding built-up areas. . Similar inventory of artificial coastline was made for French Mediterranean coast within the MEDAM project.
		The countries eligible for the EcAp MED II project (Algeria, Egypt, Israel, Lebanon, Libya, Morocco and Tunisia) are currently developing their national monitoring programs, which include the monitoring of the EO8 common indicator.
Key assessment	Text (500 words), images	Until now there has been no systematic monitoring in Mediterranean regarding the EO8 Common Indicator, in particular not quantitatively based monitoring or any major attempt to homogenously characterize coastal ecosystems on a wider Mediterranean basis. There are some estimations, however, based on data from night-time light radiation survey. According to these about 40% of the total Mediterranean coastal zone is under some form of artificial land cover. There are large differences between countries, ranging from 7% in Albania to practically 100% in several other countries (Lebanon, Israel, the Palestinian Territories, Malta, Monaco and Slovenia).
		As for the more detailed assessment in Montenegro, the length of built-up coastline was assessed for six coastal counties (Table 1). 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 groynes, etc.). The built-up coastline is shown in Figure 4.

Content	Actions	Guidance

Table 1. Length of built-up coastline in Montenegro (provided by G. Berlengi)

County	Natural coastline (m)	Built-up coastline (m)	Total (m)	Share (built-up/total) (%)
Bar	23,615	12,549	36,164	34.7
Budva	24,505	7,305	31,810	23.0
Herceg Novi	32,883	19,715	52,597	37.5
Kotor	39,596	23,819	63,415	37.6
Tivat	19,008	12,885	31,893	40.4
Ulcinj	32,158	4,236	36,393	11.6
Total	171,764	80,509	252,273	31.9

Figure 4. Map showing built-up coastline (in red) and natural coastline (in green) in Montenegro (provided by G. Berlengi)

The assessment results for Italy on the length of artificialized coastline are summarized in the following table for 2006:

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

Macroregions	Natural coastline (Km)	Built-up coastline (Km)	Total (Km)	Share (built-up/total) (%)
ITALY - continental	3058.103	786.882	3844.985	20.47
SICILIY	1003.140	174.629	1177.769	14.83
SARDENIA	1444.395	67.749	1512.145	4.48
TOTAL	5505.638	1029.261	6535.899	15.75

The total length is referred to a reference coastline for year 2006 which does not include islands except Sardinia and Sicily .Built-up coastline includes

Content	Actions	Guidance
		coastal defense structures, ports and marinas. The spatial extension of impervious surfaces on land side have 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 artificialization 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 France, the MEDAM inventory was established as a project that monitors (through a database) the sources of artificial and development pressure on the French Mediterranean Coast, entailing features such as: the total length of coastline; coastline 'artificialized' by reclamation; rate of 'artificialization' of coastline (linear), etc. The methodology does not exactly follow the one of CI16, since the database is being updated for decades now.

The rate of artificalization 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.

The progression of the number of reclamations from the sea along the French Mediterranean shows a period of tripling of reclamations between 1960 and 1985, and then a distinct slowing down of these redevelopments between 1985 and 2010. This slowing down is to a large extent the result of an Act (arrêté) banning the destruction of marine phanerogams (Posidonia oceanica and Cymodocea nodosa). (Arrêté of 19 July 1988). |
| Key assessment (extended) Assessment, including extended descriptions of the quality status (including trends) | Text(no limit), figures, tables | |
| **Conclusions** | | |
| Conclusions (brief) | Text (200 words) | The inclusion of the EO8 Common Indicator "in the EcAp process 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 or OSPAR, neither in Marine Strategy Framework Directive,

Some countries, such as Italy 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. These countries are: Algeria, Egypt, Israel, Lebanon, Libya, Morocco and Tunisia. |
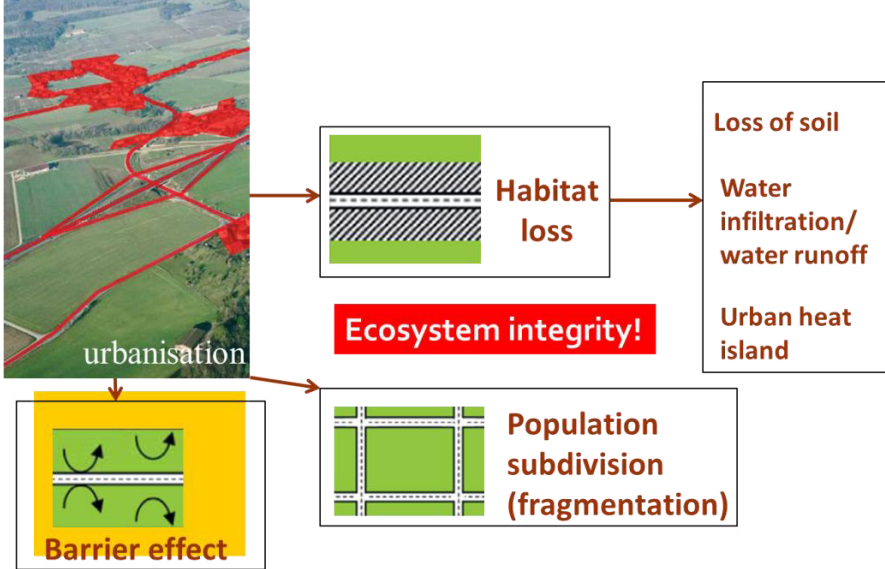| Conclusions (extended) | Text (no limit) | |

Content	Actions	Guidance
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; • The EO8 does not have a precedent in other regional ecosystem approach initiatives, such as Helcom or OSPAR, neither in Marine Strategy Framework Directive; • 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; • Algeria, Egypt, Israel, Lebanon, Libya, Morocco and Tunisia are starting to implement the monitoring of the EO8 common indicator in the frame of EcAp MED II project.
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. First, it is a choice of a fixed reference coastline that each CP should select in order to assure comparability of 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 old, manmade structures could be poorly identified or completely missed with heavy consequences on the calculation of length of artificial coastline.
Knowledge gaps (extended)	Text (no limit)	
List of references	Text	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)), European commission and Directorate General Environment (2004a), Living with coastal erosion in Europe: Sediment and Space for Sustainability, A guide to coastal erosion management practices in Europe (The Netherlands: Eurosion project), European commission and Directorate General Environment (2004b), Living with coastal erosion in Europe: Sediment and space for sustainability, Guidelines for incorporating coastal erosion issues into Environmental Assessment (EA) procedures (The Netherlands: Eurosion project), Markandya, A,, Arnold, S,, Cassinelli, M,, and Taylor, T, (2008), Protecting coastal zones in the Mediterranean: an economic and regulatory analysis, J,

Content	Actions	Guidance
		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 study on Article 8-2 of the Mediterranean ICZM Protocol, n°05/10 December 2010, IDDRI
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Ecological Objective EO8. Coastal Ecosystems and Landscapes

EO8: Candidate Common Indicator 25. Land use change

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: Please, provide appropriate information
Contributing countries	Text	**Italy, Slovenia, Croatia, Bosnia and Herzegovina, Montenegro, Albania**
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	**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)	A specific candidate common indicator for the Mediterranean region addressing land use change (Candidate common indicator 25) was included in the Decision IG.22/7 on Integrated Monitoring and Assessment Programme (IMAP) of the Mediterranean Sea and Coast. 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 urbanization, or land take, is the most dramatic change given the (almost) irreversibility of the process.

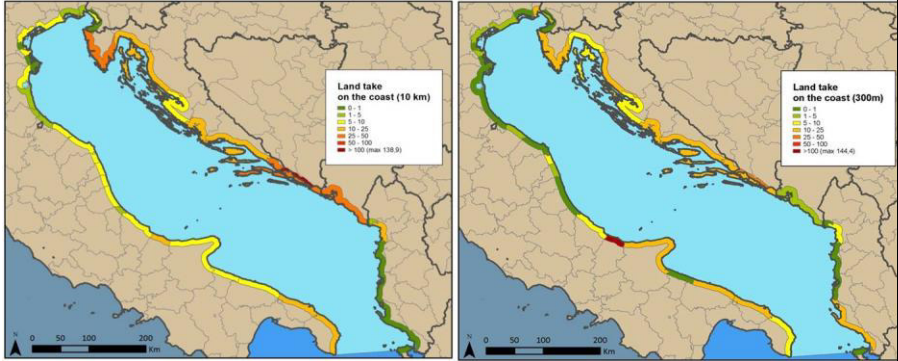| Content	Actions	Guidance
		The accumulated impacts of urbanization highly compromise ecosystem integrity. Since impacts are dependent on the scale and pace of changes it is important to consider these aspects when monitoring land use changes. The main associated impacts are: **habitat loss** with the associated impact on related ecosystem functions like C sequestration, regulation of water cycle, or biomass production; and **fragmentation**, i.e. the division of natural habitats in smaller parcels contributes to the isolation of number of species and also compromises its viability. There are some general targets for this indicator: (i) No further construction within the setback zone; (ii) Change of coastal land use structure, dominance of urban land use reversed; and (iii) Keep, and increase, where needed, landscape diversity. Figure 1. Overview of major impacts of land take on ecosystem integrity
Background *extended*	Text (no limit), images, tables, references	
Assessment methods	Text (200-300 words), images, formulae, URLs	Different parameters (Table 1) can be considered for evaluation of indicator on land use change. The combined analysis of these parameters entails an inventory of the urbanization pressures on coastal ecosystems. In practice the parameters 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. Table 1. Description of the parameters calculated for the indicator Land use change

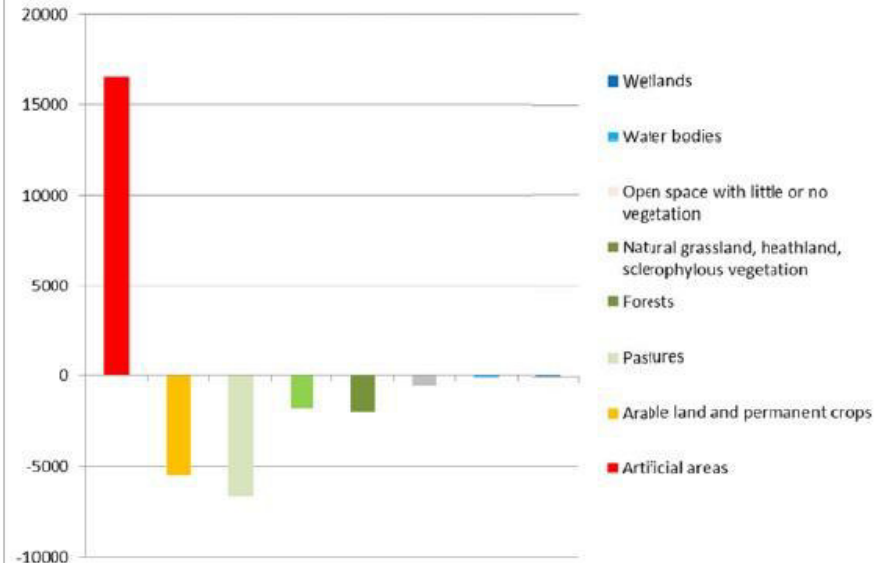| Content	Actions	Guidance				
		Parameter	*Units*	*Data required*	*Reporting units*	*Meaning*
		Area of built-up land in coastal zone as a proportion of the total area in the same unit	% of artificial areas	Artificial surfaces at a single time shot	Coastal zone as defined by the country Also coastal strips (<300m*, 300m-1km, 1-10 km).	State of urban areas at a particular time. This is used as a baseline, i.e. initial condition for the analysis of changes.
		Area of built-up land in coastal units as a proportion of the area of built-up land in the wider coastal unit	% of artificial areas	Artificial surfaces at a single time shot	Narrower coastal strips within the wider ones (or even within the whole coastal unit).	This parameter shows to what extent the process of urbanization has been more intense on the coast than on the inland. It also reflects the relevance of economic activities on the coast as a driver of urban development.
		Land take as % initial urban area on the coastal zone	% of increase of urban areas	Artificial surfaces at t_0 and t_1	Coastal zone as defined by the country. Also coastal strips (<300m*, 300m-1km, 1-10 km)	Intensity of the process of urbanization in a given period of time.
		Change of forest and semi-natural areas	% of change of forest and semi-natural areas	Forest and semi-natural land at t_0 and t_1	Coastal zone as defined by the country. Also coastal strips (<300m*, 300m-1km, 1-10 km)	This parameter would reflect to what extent management is leading to an increase, maintenance or decrease of forest and semi-natural areas. This represents the land cover closer to "natural land" excluding wetlands (specific indicator).
		Change of wetlands	% of change of wetlands	Wetlands at t_0 and t_1	Coastal zone as defined by the country. Also coastal strips (<300m*, 300m-1km, 1-10 km	This parameter will indicate how effective is the protection of wetlands, in terms of coverage. The indicator could reflect and increase, maintenance or a decrease of wetlands.
		*the 300m wide coastal strip is proposed as relevant representation of the coastal setback (also considering the resolution issues). Further division landwards is very much subjected to the specific topographic, historical and socio-economic conditions.				

Content	Actions	Guidance
		Methodology for calculation of the EO8 Candidate common indicator Land use change consists of: (i) **data compilation**, i.e. mapping the land cover classes 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 (e.g. percentage of built-up area in coastal zone; area of built-up land in coastal units as a proportion of the area of built-up land in the wider reference region; land take as % of initial urban area on the coastal zone, etc.) once adapted to 1ha grid.
Results		
Key findings	Text (maximum 100 words)	The countries eligible for the EcAp MED II project (Algeria, Egypt, Israel, Lebanon, Libya, Morocco and Tunisia) are currently developing their national monitoring programs, which includes the monitoring of the Land use change candidate common indicator. Since that work is ongoing, 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) are used to demonstrate what has been done in the Mediterranean area. The pilot study covered changes in land use of Albania, Bosnia and Herzegovina, Croatia, Italy, Montenegro, and Slovenia, countries surrounding the Adriatic region - one of four sub-regions of the Mediterranean basin.
Key assessment	Text (500 words), images	The Pilot projecton the Land use change indicator in the Adriatic region 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. In brief, 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.

Content	Actions	Guidance
		Figure 3. The share of artificial areas in total area through 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 is the land use class 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 (including trends)	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 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[2], 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.

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

Content	Actions	Guidance

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.

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

Content	Actions	Guidance
		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) <u>Land take (2006-2012)</u> 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.

Content	Actions	Guidance
		  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. The monitoring on the land use change indicator in the Adriatic region, within the first phase of the EcAp MED project (2012-2015), revealed many useful insights that can be relevant to successful monitoring of the indicator elsewhere (i.e. in the eligible countries within the second project's phase). 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.

Content	Actions	Guidance
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; - The pilot study of the 2012-2015 EcAp MED project tested the monitoring of the EO8 Land use change indicator in the Adriatic region; - The pilot study demonstrated different trends of land use change in different countries when considering the proximity of the coast and time period (see points below); - Within 300m from the coastline in 2000-2012 increase of built-up area moved from Albania in the first period to Bosnia and Herzegovina, Croatia and Montenegro in the second, with Italy and Slovenia having a steady behavior over both periods. - Within 10 km from the coastline, Croatia and Italy showed high increases of urban areas for the whole 2000-2012 period, while Bosnia and Herzegovina and Montenegro had a higher increase in the second period.
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
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:*

Content	Actions	Guidance
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		t/pdf/MAESWorkingPaper2013.pdf