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E08 Coastal Ecosystems and Landscapes

Common Indicator 16

Length of Mediterranean coastline subject to physical disturbance due to the influence of human-made structures - Israel

IOLR Report H01/2020

Mor Kanari

דו"חות חיא"ל
IOLR REPORTS

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IOLR Report H01/2020

By

Dr. Mor Kanari

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1. Introduction

Common Indicator 16 (CI16 – 'Length of coastline subject to physical disturbance due to the influence of human-made structures') is included in the coast & hydrography cluster under IMAP, the monitoring plan for the Barcelona Convention. Monitoring the indicator and its trend is of paramount importance to preserve habitat, biodiversity and prevent coastal erosion phenomena, as well as for its importance in land-sea interactions. Until now, this indicator has not been systematically monitored in the Mediterranean shorelines. The status assessment of EO8 aims to fill this gap. This report details the methodology and results of CI16 for the Mediterranean coast of Israel and therefore lays the foundation/baseline for monitoring CI16 in the future.

The report includes the methodology for determination of the characteristics of the Israel Mediterranean coastline based on the information standards (Annex 1) and the indicator fact sheet E08 Coastal Ecosystems and Landscapes Common Indicator 16 "Length of coastline subject to physical disturbance due to the influence of human-made structures" (Annex 2).

The results include the two indicator units of CI16, describing the classification of the coastline:

(1) The length of natural and artificial coastline and their percentage form the total length of the coastline.

(2) The type of artificial structures comprising the artificial coastline.

These results are presented in: (a) maps and accompanying tables; (b) GIS layers for each of the above indicator units, as detailed below:

(a) GIS layer '*Artificial_structures*' (polyline, WGS84) with location and extend info of artificial structure type attribute table (CPCODE, ASCODE, ASDES, Year).

(b) GIS layer '*Coastline_AN*' (polyline, WGS84) with artificial / natural coastline type and attribute table (CPCODE, ARTNAT, Year, Ref_Year).

The Mediterranean coastline of Israel

The Mediterranean coast of Israel is the eastern boundary of the Eastern Mediterranean Sea. It extends over 190 km from south to north (Almagor et al., 2000), but measures 212.22 km in the scope of this report, considering its local irregularities in a 10m resolution scale. The coastline itself is comprised mostly of a crystalline sand belt varying in width from several to hundreds of meters. The origin of the sand is the Nile delta fan, transported along the continental shelf and coasts of the Eastern Mediterranean by alongshore currents (and wave induced currents) in a general counter-clockwise movement along the eastern Mediterranean shorelines (Fig. 1). During the Quarternary (2.5 Million years ago until present) this coastline has undergone through sea-level fluctuations (during glacial and interglacial periods) and climatic changes, which have left their geomorphological markers: in places the coast has cliffs of sand dunes which were lithified and turned into sandstone, some of which eroded later into soils (Almagor et al., 2000).

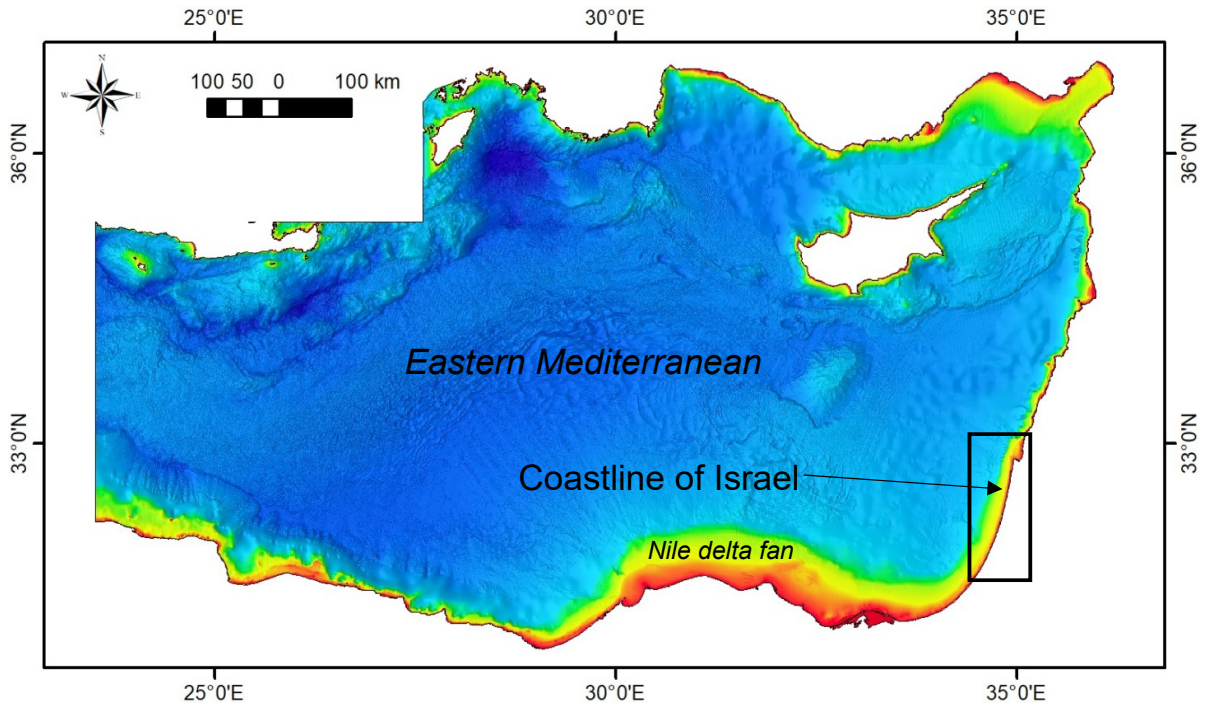

Figure 1: The coastline of Israel in the eastern Mediterranean. The background bathymetric map derived from the EMODnet Bathymetry portal - http://www.emodnet-bathymetry.eu.

2. Methods and dataset

2.1 The reference coastline

In order to maintain the official form of the reference coastline and repeatability of the methodology for monitoring the indicator in the future, the reference coastline used is the official statutory coastline of Israel as determined and published by the Survey of Israel. It is also the coastline defined in the Coastal Environment Preservation Law (2004) of Israel, which states that the sea and the shore are considered a public resource comprising one integral unit, to be preserved and protected from damage. This line was defined at 0.75 m elevation above the Israel zero-level datum, which was measured and published by the Survey of Israel in 2005. In some parts, due to limitations of confidentiality (where military installations are located) the official line is not public. In these places – the exact location of the line was determined using digitization of an orthophoto of the coastline from 2019 provided by the Survey of Israel.

2.2 Determination of the extent of artificial structures

The intersection of artificial coastline structures with the reference coastline was determined as follows: A utility layer of the natural/artificial coastline of Israel (digitized from orthophotos by the Survey of Israel in 2019 and included in the governmental geographic database) was used to locate the vertex points between natural and artificial coastlines. The intersection or projection of these vertex points with the reference coastline were used to define the segments of artificial structures on the reference coastline.

Since the reference coastline is defined by law at 0.75m above the Israel zero-level datum, in many cases it does not intersect with the digitized artificial structures coastline (which are at sea level elevation). In these cases, the artificial digitized coastline and the reference coastline do not intersect. To resolve that in these

locations, the digitized artificial structures were projected onto the reference line in one of two methods: (1) In a straight line perpendicular to the coast line strike (this is the default methodology). See Fig. 2 for example. (2) Where drawing a perpendicular line to the reference coastline is not applicable: in a straight line striking due East (azimuth 090 degrees) from the artificial structure. See Fig. 3 for example.

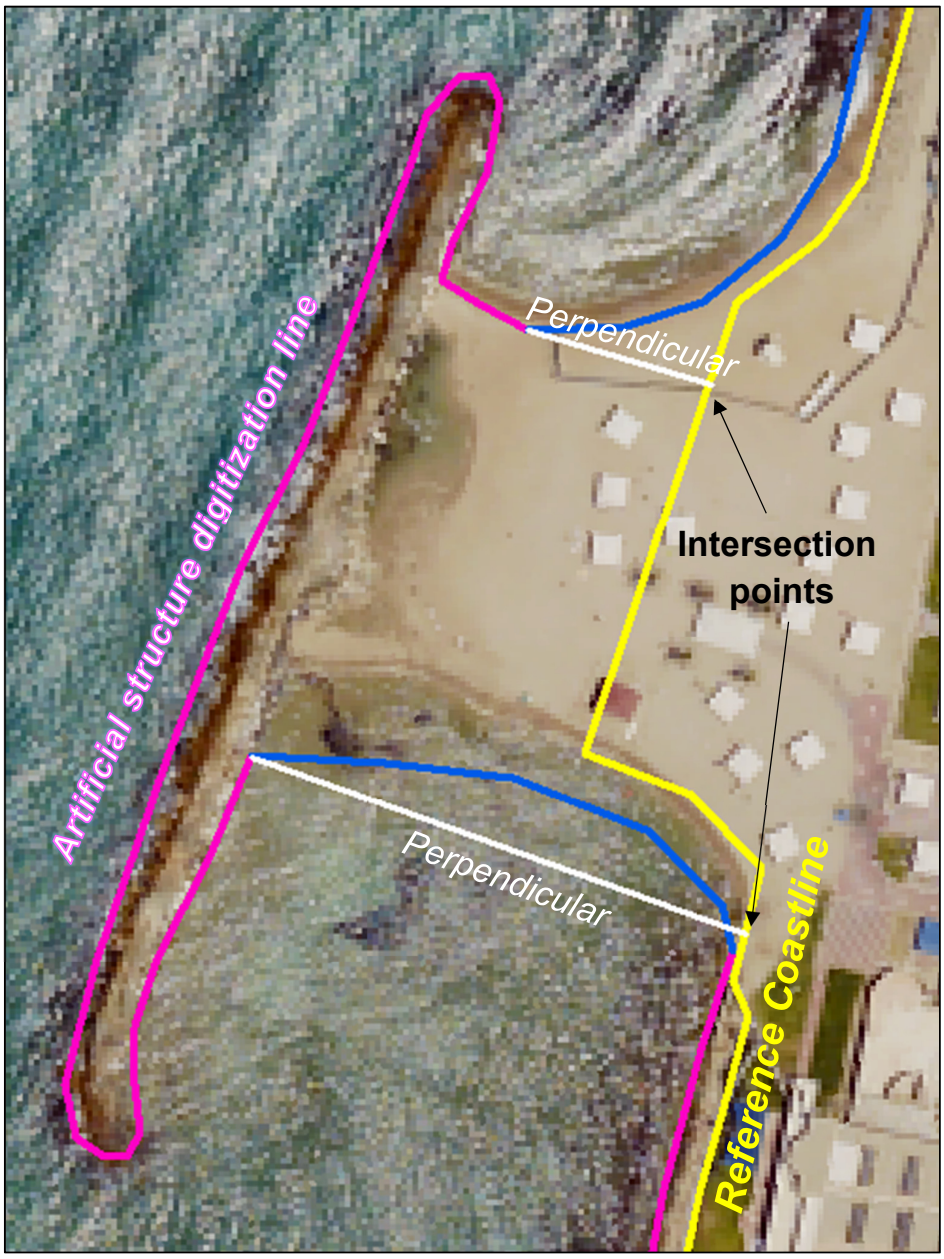

Figure 2: Projection of the 2019 digitized artificial structure coastline intersection onto the reference coastline (yellow). Default methodology: The intersection is determined using a perpendicular to the reference coastline from the end of the artificial structure (final artificial segment on the reference line determined between the points marked as 'Intersection points'). Pink line: 2019 digitized coastline-artificial; blue line: 2019 digitized coastline-natural.

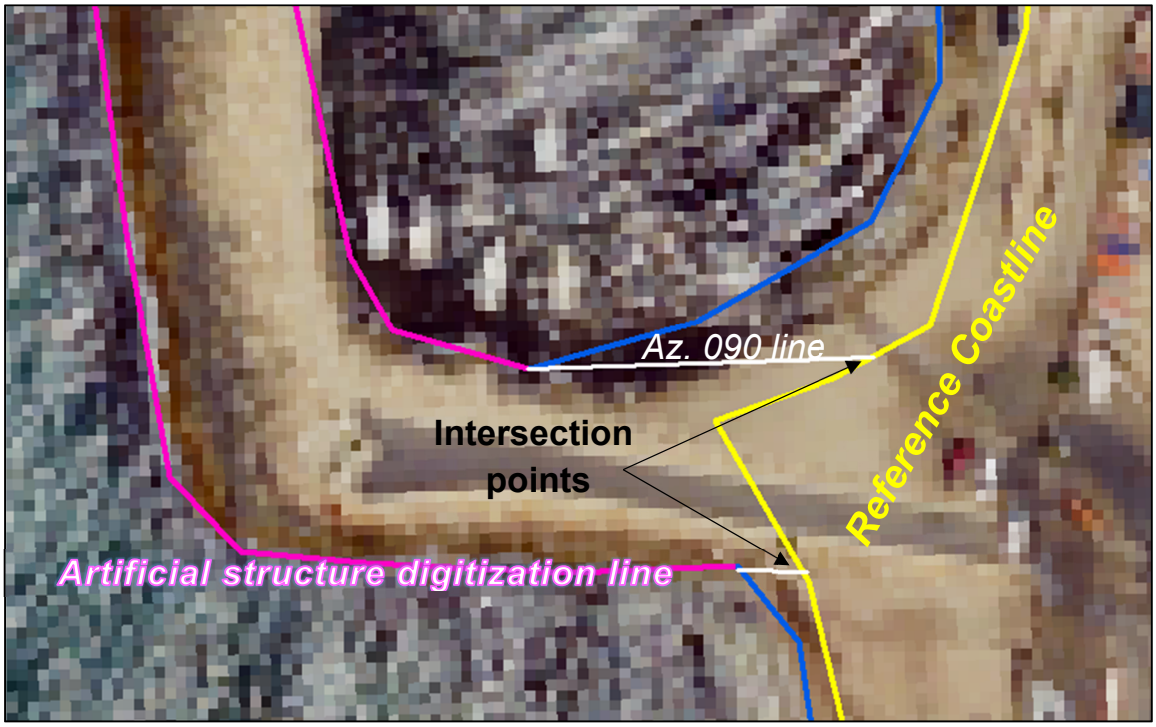

Figure 3: Projection of the 2019 digitized artificial structure coastline intersection onto the reference coastline (yellow). Alternative methodology (when the default perpendicular line is not applicable): The intersection is determined using a line in azimuth 090 degrees to the reference coastline, from the end of the artificial structure (final artificial segment on the reference line determined between the points marked as 'Intersection points'). Pink line: 2019 digitized coastline-artificial; blue line: 2019 digitized coastline-natural.

2.3 Length of the artificial coastline

The length of artificial coastline has been calculated as the sum of segments on the reference coastline identified as the intersection of polylines representing human-made structures with reference coastline, ignoring polylines representing human-made structures with no intersection with the reference coastline (with the exception detailed in section 2.2 above: human-made structures which clearly intersect with the coastline but not intersect with the 0.75m line, were projected onto the reference coastline).

The minimum distance between coastal artificial structures is set to 10 m in order to classify such segments as natural, i.e. if the distance between two adjacent coastal defense structures is less than 10 m, all the segment including both coastal defense structures is classified as artificial.

Length calculations were performed in the Israel Transverse Mercator grid (ITM) as provided by the Survey of Israel. The polyline shape files were then projected to geographic coordinates (degrees decimal WGS84) in order to comply with the Information Standards for the Common Indicator 16.

2.4 GIS layers attribute tables

The attribute tables of the GIS layers, which accompany this report, are in accordance with the detailed 'Information standards for the Common Indicator 16' as appears in Annex 1):

1. CPCODE (two letter code of country): IL
2. ART_NAT (code for type of coastline segment):
   - 0 – Natural coastline
   - 1 – Artificial structure coastline
3. ASCODE (Code for type of artificial structure classification):
   - 1 – Breakwaters
   - 2 – Seawaters / revetments / sea dikes
   - 3 – Groins
   - 4 – Jetties
   - 5 – River mouth structures
   - 12 – Ports and Marinas
4. ASDES (description of artificial infrastructure): dock, quay, sea front etc.
5. YEAR (Year in which the information layer was produced) – 2019.
6. REF_YEAR (Year in which the reference coastline used to represent natural and artificial segments was produced) – 2005.
7. LENGTH (Length of the coastline segment in km) – This field was calculated using ArcGIS.

3. Results

Results of the coastline classification analysis according to the indicator guidance factsheet for EO8 and CI16 are reported here and added as an integral part to this report in two shape-files (SHP) containing the digital data (*Coastline_AN* and *Artificial_Structures* SHP files). The digital data are also uploaded to the INFO/RAC IMAP Info System.

3.1 Length of coastline types

The total length of the entire coastline of Israel is 212.220 km.

The length of the natural coastline of Israel is 172.147 km, which is 81.1% of the total; the length of the artificial structure coastline is 40.073 km, which is 18.9% of the total (Fig. 4; Table 1).

3.2 Length of artificial infrastructure types

The extent and lengths of the different classified types of artificial structures, categorized into the following categories, are detailed in Fig. 5 and Table 2. The most dominant type is 'Ports and Marinas (type 12; 78.0%). The rest in order of length are: Seawaters / revetments / sea dikes (type 2; 20.2%), Breakwaters (type 1; 1.5%), Groins (type 3; 0.2%) and Jetties (type 4; 0.1%).

Most of the Ports and Marinas coastline length (19.700 km out of 30.966) are the two large ports of Haifa in the north and Ashdod in the south. Included is the ancient Roman port of Caesarea, a national park and archaeological site (0.74 km, 2.4% of all Ports and Marinas). Most of the Seawaters/revetments/sea dike coastline length are in the cities of Akko, Haifa, Tel-Aviv-Yafo and Ashkelon, where either old city wall fortifications (Akko; 1.9 km, 23.4% of all seawater/revetments) or modern sea walls and revetments (Haifa, Tel-Aviv-Yafo, Ashkelon) were constructed along the coastline. Most of the Breakwaters (type 1) and Jetties (type 4) are included in the count of the Ports and Marinas (type 12) as they are located within them, so their intersection onto the reference coastline falls within the segments classified as Ports and Marinas. The reported 1.5% (0.611 km) of Breakwaters are the ones located outside ports and marinas.

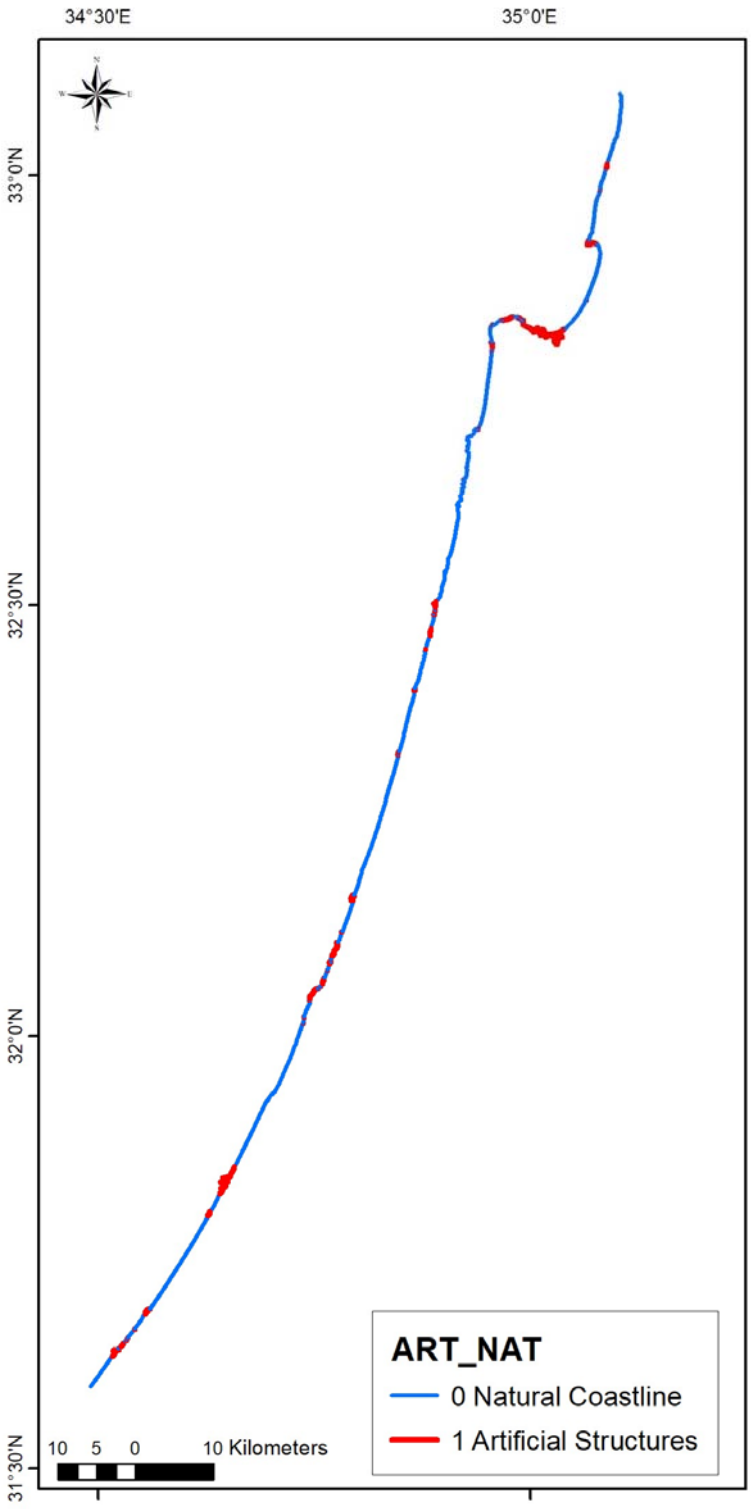

Figure 4: GIS layer *Coastline_AN* detailing the types of coastline: artificial structures (red) and natural coastline (blue).

Table 1 details the length in km and the percentage of each coastline type.

Table 1 Type of coastline	Length (km)	Percentage (%)
Natural	172.147	81.1%
Artificial	40.073	18.9%
Total	**212.220**	**100.0%**

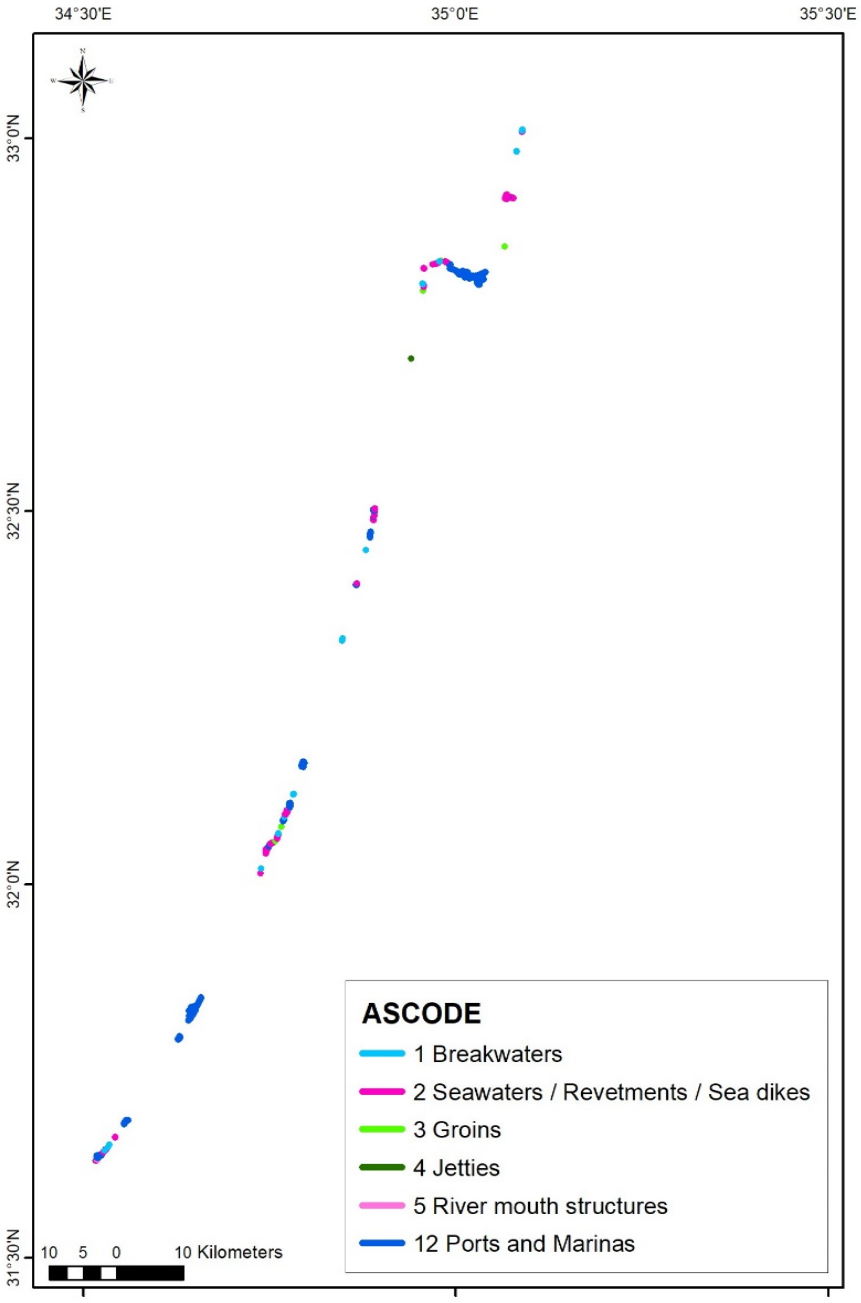

Figure 5: GIS layer *Artificial_structures* detailing the types of artificial structures on the coastline (see legend).

Table 2 details the length in km and the percentage of each infrastructure type.

Table 2 AS Code	Type of artificial infrastructure	Length (km)	Percentage (%)
1	Breakwaters	0.611	1.5%
2	Seawaters / Revetments / Sea dike	8.089	20.2%
3	Groins	0.089	0.2%
4	Jetties	0.025	0.1%
5	River mouth structures	0.0	0.0%
12	Ports and Marinas	32.258	78.0%
	Total	**40.073**	**100.0%**

4. Conclusion and recommendations

The total length of the coastline of Israel is 212.22 km. The length of the natural coastline of Israel is 172.147 km, which is 81.1% of the total; the length of the artificial structure coastline is 40.073 km, which is 18.9% of the total.

The extent and lengths of the different classified types of artificial structures, is dominated by 'Ports and Marinas (type 12; 78.0%). The rest in order of length are Seawaters / revetments / sea dikes (type 2; 20.2%), Breakwaters (type 1; 1.5%), Groins (type 3; 0.2%) and Jetties (type 4; 0.1%).

The digital data SHP files that are an integral part of this report are uploaded to the INFO/RAC IMAP Info System. They detail the length of natural/artificial coastline and the spatial distribution of types of artificial structures with their required attribute tables.

This is the first time this indicator is monitored in Israel, hence it provides a benchmark for systematic monitoring of CI16 in the future.

Notes regarding future development of Common Indicator 16

During the analysis and writing of the report, the following subjects were encountered and required attention and decision-making. It is suggested that these will be addressed in future development of the methodology or guidance documents for Common Indicator 16:

(1) How to relate to archaeological remains: old fortification walls, ancient ports etc. Currently, they are classified as part of other infrastructure types (for example: ancient city wall fortifications as revetments; ancient harbor as ports and marinas).

(2) How to include marine artificial structures which do not reach the coastline and therefore their lines do not intersect with the reference coastline – so they are not accounted for in this methodology. However, they appear to have human-made impact on the coastline and advised to be addressed in the frame of Common Indicator 16 guidelines (see Annex 3 for an example).

(3) Some artificial structures (e.g. breakwaters and groins) cause accumulation/erosion changes in their adjacent coastline surrounding (depending on the currents that transport the sediment around them). These changes are not accounted for as they are classified as natural coastline segments. It is advised to relate to such occurrences in the future development of the Common Indicator 16 guidelines.

Acknowledgements

Crucial contribution of spatial data of the natural and artificial coastline, as well as information and consulting regarding the methodology and technical aspects of classification were provided by the kind help of Limor Gur-Aryeh (Survey of Israel) and Maayan Haim (Marine Enviromental Protection Division, Israel Ministry of Environmental Protection). Their help is greatly appreciated.

5. References

Almagor, G., D. Gill, and I. Perath (2000), Marine sand resources offshore Israel, Marine Georesources and Geotechnology, 18(1-42).

EMODnet Bathymetry portal - http://www.emodnet-bathymetry.eu.

6. Annexes

Annex 1: Information standards for Common Indicator 16 'Length of coastline subject to physical disturbance due to the influence of human-made structures'

Data standards for the common indicator 16

GIS Information Standards:

Artificial structures

- Artificial / natural coastline

Name of the GIS layer: Artificial_structures

GIS layer type: polyline

eographical Reference Systems: WGS 84 degree decimal

Content	**Description**
Ecological Objective	**EO8. Coastal ecosystem and landscape**
IMAP Common Indicator	**CI16. Length of coastline subject to physical disturbance due to the influence of human-made structures**
Parameter	**Location and extend of artificial structures**
Attribute table	Specify the following information in the attribute table associated with the GIS information layer: • CPCODE: Two-letter code of Country • ASCODE: Mandatory. Integer. Code of type of artificial infrastructure. The following code list should be used: ○ 1 Breakwaters ○ 2 Seawater/Revetements/Sea dike ○ 3 Groins ○ 4 Jetties ○ 5 River mouth structures ○ 12 Port and marinas ○ 21 Land reclamation • ASDES: Optional. Text. Description of type of artificial infrastructures • Municipal: Optional. Text. Name of municipality or local administrative region where the polygon of impervious surface is located • Year: Mandatory. Text. Year of production of the information layer
Variables	Border on the sea side of coastal artificial structures
Spatial resolution	10 mt or higher as produced by photo digitalization or CAD (Computer Aided Design) software

Content	Description
Ecological Objective	**EO8. Coastal ecosystem and landscape**
IMAP Common Indicator	**CI16. Length of coastline subject to physical disturbance due to the influence of human-made structures**
Vertical coverage	1 level at sea surface
Coordinate Reference System	WGS 84 or ETRS 89 decimal degrees
Temporal coverage	Every 6 years
Data format	GIS Layer: polyline or polygon

Content	Description
Ecological Objective	**EO8. Coastal ecosystem and landscape**
IMAP Common Indicator	**CI16. Length of coastline subject to physical disturbance due to the influence of human-made structures**
Parameter	**Artificial/Natural coastline**

Attribute table	Specify the following information in the attribute table associated with the GIS information layer:
	• CPCODE: Two-letter code of Country
	• ART_NAT: Mandatory. Integer. Code for type of segment of coastline. Use the following code list:
	  ○ 0 Natural coastline
	  ○ 1 Artificial coastline
	• Municipal: Optional. Text. Name of municipality or local administrative region where the polygon/polyline of segment of coastline is located
	• Year: Mandatory. Text. Year of production of the information layer
	• Ref_Year: Mandatory. Year of the reference coastline used to represent natural and artificial segments

Variables	Segment of artificial/natural of coastline
Spatial resolution	10 mt or higher as produced by photo digitalization and interpretation
Vertical coverage	1 level at sea surface
Coordinate Reference System	WGS 84 or ETRS 89 decimal degrees
Temporal coverage	Every 6 years
Data format	GIS Layer: polyline

Annex 2

Indicator guidance factsheet for EO8 Coastal Ecosystems and Landscapes Common Indicator 16 "Length of coastline subject to physical disturbance due to the influence of human-made structures"

Ecological Objective 8: The natural dynamics of coastal areas are maintained and coastal ecosystems and landscapes are preserved

Indicator Title*	Length of coastline subject to physical disturbance due to the influence of human-made structures	
Relevant GES definition	**Related Operational Objective**	**Proposed Target(s)**
Physical disturbance to coastal areas induced by human activities should be minimized.	The natural dynamics of coastal areas are maintained and coastal ecosystems and landscapes are preserved.	Negative impacts of human activities on coastal areas are minimized through appropriate management measures.
The CORMON on coast and hydrography meeting (21-22 May 2019, Rome) agreed that the GES, targets and measures cannot be expressed quantitatively (as a threshold value) but due to country specific circumstances (socio-economic, cultural, historical) should be defined by the countries themselves. In doing so the CPs should take their spatial development and planning policies into account, as well as the legal obligations of the Barcelona Convention, in particular the ICZM Protocol. The above GES definition and Proposed target(s) are just examples.		
Rationale		
Justification for indicator selection Mediterranean coastal areas are particularity threatened by coastal development that modifies the coastline through the construction of buildings and infrastructure needed to sustain residential, commercial, transport and tourist activities. The land, intertidal zone and near-shore estuarine and marine waters 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 human-made infrastructures cause irreversible damage to landscapes, losses in habitat and biodiversity, and strong influence on the configuration of the shoreline. Indeed, physical disturbance 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 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. Monitoring the length of coastline subject to physical disturbance due to the influence of human-made structures and its trend is of paramount importance to preserve habitat, biodiversity and prevent coastal erosion phenomena, as well as for its importance in land-sea interactions. Until now there has not been systematic monitoring in Mediterranean regarding this, in particular not quantitatively based		

Indicator Title*	Length of coastline subject to physical disturbance due to the influence of human-made structures

monitoring or any major attempt to homogenously characterize coastal ecosystems on a wider Mediterranean basis. The status assessment of EO8 aims to fill this gap.

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Policy Context and targets

Policy context description

ICZM Protocol (Article 8, point 3):

Indicator Title*	Length of coastline subject to physical disturbance due to the influence of human-made structures

The Parties shall also endeavour to ensure that their national legal instruments include criteria for sustainable use of the coastal zone. Such criteria, taking into account specific local conditions, shall include, inter alia, the following:

(a) identifying and delimiting, outside protected areas, open areas in which urban development and other activities are restricted or, where necessary, prohibited;

(b) limiting the linear extension of urban development and the creation of new transport infrastructure along the coast;

(c) ensuring that environmental concerns are integrated into the rules for the management and use of the public maritime domain;

(d) providing for freedom of access by the public to the sea and along the shore;

(e) restricting or, where necessary, prohibiting the movement and parking of land vehicles, as well as the movement and anchoring of marine vessels, in fragile natural areas on land or at sea, including beaches and dunes.

Targets

Negative impacts of human activities on coastal areas are minimized through appropriate management measures.

Additional country-specific criteria should be taken into account for definition of targets, measures and interpretation of results regarding this indicator due to strong socio-economic, historic and cultural dimensions in addition to characteristic geomorphological and geographical conditions in each respective country (reflected in policy documents, strategies and other country-specific documents). Interpretation of results should be left to the countries taking above criteria into account.

Policy documents

Protocol on the ICZM in the Mediterranean - http://www.pap-thecoastcentre.org/pdfs/Protocol_publikacija_May09.pdf

Indicator analysis methods

Indicator Definition

The monitoring aim of the EO8 common indicator is twofold: (i) to quantify the rate and the spatial distribution of the Mediterranean coastline artificialisation 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 and to inform about progress towards GES.

Methodology for indicator calculation

Indicator Title*	Length of coastline subject to physical disturbance due to the influence of human-made structures

The monitoring of this Common Indicator entails an inventory of the length and location of human-made coastline (hard coastal defence structures, ports, marinas (see Figure 1). Soft techniques e.g. beach nourishment are not included.

With regard to the coastline to be considered: the fixed reference official coastline as defined by responsible Contracting Party should be considered. The optimal resolution should be 5 m or 1: 2000 spatial scale.

Once a proper geographic scale has been established, monitoring should focus, in particular, on the location, the spatial extent and the types of coastal structures taking into account the minimum coastal length that can be classified as artificial or natural.

The identification procedure of human-made structures should be carried on based on typical situations added to the indicator guidance factsheet, including the minimum size (length, width of human-made structures) to be taken into account.

As monitoring should be done every 6 years, every CP should fix a reference year in the time interval 2000-2012 in order to eliminate the bias due to old or past human-made infrastructures.

Positioning/Orientation respect to the shore	Type of structure	Action and purposes
Not connected to shore parallel or fish tail 	Breakwaters	Reduce the intensity of wave forces in inshore waters creating a low-energy zone behind the structure. Used for protecting ports, and as coastal defences.
Onshore parallel on open coasts 	Seawalls Bulkheads	Reduce the impact of waves on shore; used as a tool against coastal erosion and as a constituent of ports, docks and marinas.
	Revetments	A revetment is a facing of erosion resistant material, such as stone, geotextiles or concrete. Sloped structures which break up or absorb the energy of the waves used to reduce the landward migration of the beach due to coastal erosion. It is built to protect a scarp, embankment, or other shoreline feature against erosion.
	Sea dike	Large land-based sloped structures used to prevent overtopping during high tide and storm events. Instead of providing protection against wave action, sea dikes fix the land-sea boundary in place to prevent inland flooding.
Connected to shore perpendicular 	Groins	Reduce along-shore transport of sediments; used in coastal defence schemes, often in association with breakwaters.
	Jetties	Reduce wave- and tide-generated currents; used for developing, ports, harbours, marinas and as constituents of coastal defence schemes.
	Groins (composite)	Reduce along-shore transport of sediments; used in coastal defence schemes. Used to avoid the formation of stationary eddies.

Indicator Title*	Length of coastline subject to physical disturbance due to the influence of human-made structures

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

Indicator units

- Km of artificial coastline and % of total length of coastline.
- Percentage (%) of natural coastline on the total coastline length.

The length of artificial coastline should be calculated as the sum of segments on reference coastline identified as the intersection of polylines representing human-made structures with reference coastline ignoring polylines representing human-made structures with no intersection 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.

List of Guidance documents and protocols available

Monitoring and assessment methodological guidance on EO8: coastal ecosystems and landscapes (within IMAP guidelines)

EUROSION Shoreline Management Guide (European Commission and Directorate General Environment, 2004, Annex 2)

Data Confidence and uncertainties

Regarding data confidence, both geographic scale and resolution of images have to be properly selected depending on type and density of coastal human-made structures. A specific cost/benefit analysis has to be carried on to choose the right balance among resolution, an acceptable level of uncertainties and the necessity to assure comparability of results at Mediterranean level.

Methodology for monitoring, temporal and spatial scope

Available Methodologies for Monitoring and Monitoring Protocols

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. Beyond earth observation data, identification techniques and procedures used through GIS tools also have to be described

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Available data sources

CORINE land cover, national spatial plans, World Imagery Basemap feature (in ArcGIS 10.1), Landsat satellite imagery, Google earth, aerial photographs surveys.

Spatial scope guidance and selection of monitoring stations

The exact territorial extent of the monitoring should be presented.
The optimum spatial scale for a proper identification of human-made structures should be 5 m by satellite imagery or aerial photographs.

Temporal Scope guidance

Monitoring human-made structures data should be updated at least every 6 years, while shoreline survey of sandy coastline under anthropogenic pressure should be, if possible, repeated annually (at the same time of the year)

Data analysis and assessment outputs

Statistical analysis and basis for aggregation

The total length of coastline estimated as being subjected to physical disturbance due to the influence of human-made structures should be summed. In addition, the share of this coastline in total country's coastline should be determined. If an official coastline is available, i.e. an institutional body provides a GIS polyline, then such coastline can be used to "project" the identified human-made structures in order to classify parts of the coastline as being subjected to physical disturbance due to the influence of human-made structures. Geographic scale of maps and cartography used to identify human-made structures could be different but not too much form the ones used for the official coastline. In case if such official coastline is not available or its geographic scale is too coarse with respect to one needed to properly identify human-made structures, then coastline will be defined by the same maps/cartography used for human-made structures identification.

Expected assessments outputs

The total length of coastline influenced by human-made structures and the share of this coastline in total country's coastal length should be provided on a map showing the coastline subject to physical disturbance due to human-made structures (artificial segments) in red line and the rest (natural segments) in green line.

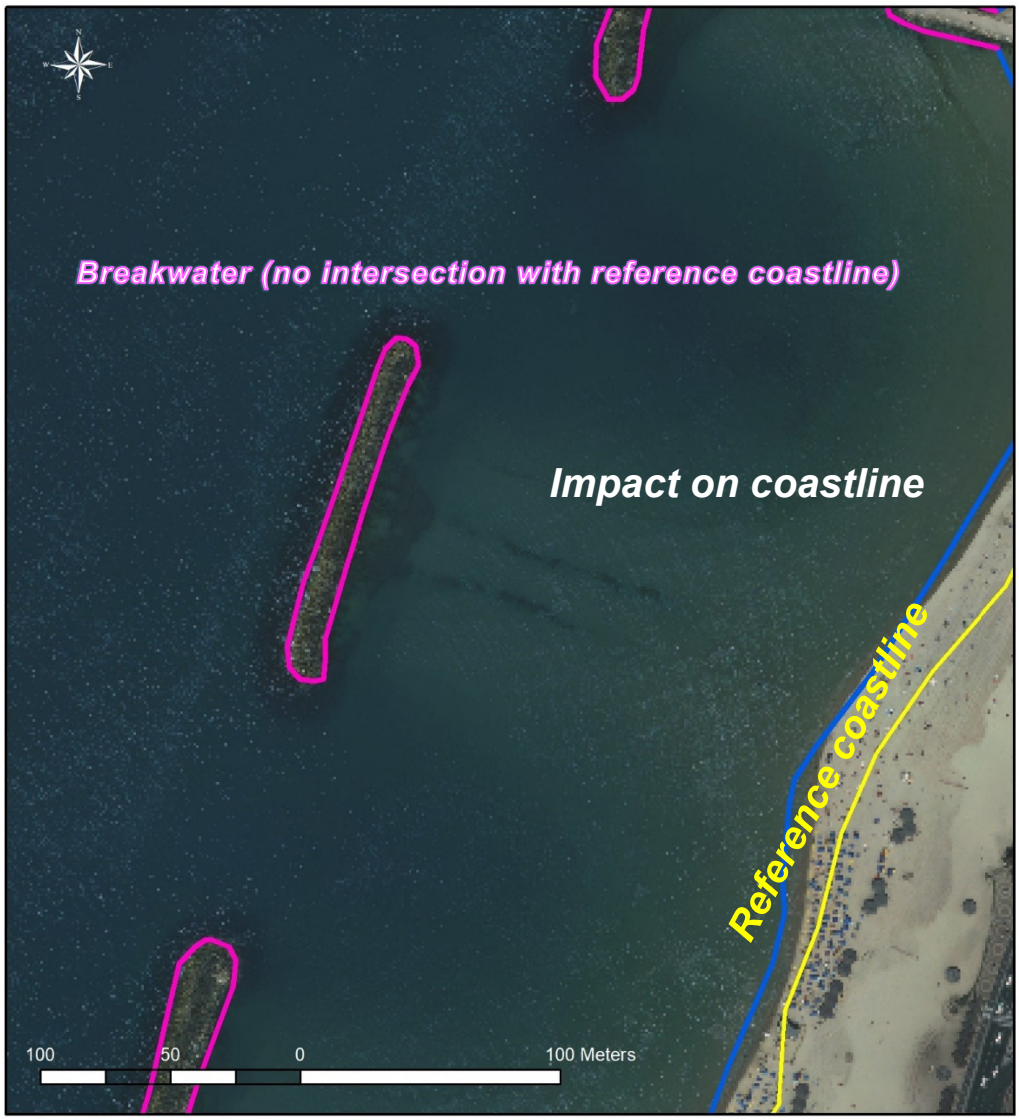
The assessment output should be reported as a common shape file format with GRS as WGS84.

Indicator Title*	Length of coastline subject to physical disturbance due to the influence of human-made structures
Shape file with other GRS will also be accepted if provided with a complete .prj file that allows GRS transformations by standard GIS tools.	
Known gaps and uncertainties in the Mediterranean In order to implement EO8 indicator with an acceptable level of accuracy, recent data sources with proper spatial resolution and complete coastline coverage should be used jointly with adequate GIS tools and expert team. Capacity building can be readily assessed for each CP as such resources are generally available for the Mediterranean Region also taking into account the increasing efforts on satellite imagery products (ESA Sentinels constellation). So, once a common framework of data sources, GIS procedures and way of representing the output of EO8 indicator are agreed, a common implementation work for all CPs could be in principle settle down.	
Contacts and version Date	
Key contacts within UNEP/MAP for further information	

Version No	**Date**	**Author**
V.1	27/6/16	PAP/RAC & Giordano Giorgi
V.2	27/7/16	Giordano Giorgi
v.3	23 March 2018	PAP/RAC

* The CORMON on coast and hydrography meeting (21-22 May 2019, Rome) indorsed the change of the term ‘human-made structures’ with the term ‘human made structures’ to respect the gender-neutrality. This change is pending EcAp Coordination Group and COP decision.

<u>Annex 3</u>: Example for marine human-made infrastructures which do not intersect the coastline but have an impact on the coastal environment



Example of human-made marine breakwater not intersecting the coastline and therefore not classified as artificial coastline. The coastline is classified as natural, yet an impact on the characteristics of the coastal area exists: for example differences in erosion / deposition patterns on south and north sides of the structure. Such structures are currently unaccounted for and it is advised to be addressed in the frame of Common Indicator 16. Pink line: 2019 digitized coastline-artificial; blue line: 2019 digitized coastline-natural; yellow line: reference coastline.