IOC UNESCO / Leader Task 4.1

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How to cite this factsheet:

PEGASO Consortium. 2013. Water efficiency index. Methodological factsheet in support of comparable measurements and integrated assessment in coastal zones. 5 p. *in* Santoro, F., Lescrauwaet, A.K., Giraud, J.P., Lafitte, A., Pirlet, H., Verleye, T., and Breton, F. (eds.). PEGASO Core Set of Indicators for Integrated Coastal Zone Management. PEGASO Project FP7. www.pegasoproject.eu

INDICATORS FOR INTEGRATED COASTAL ZONE MANAGEMENT (ICZM): *Methodological Factsheets in support of comparable measurements and an integrated assessment in coastal zones*

The **ICZM Protocol for the Mediterranean Sea** (the 'ICZM Protocol'), signed in Madrid on 21 January 2008 and ratified on 24 March 2011, represents a milestone for the implementation of ICZM in the Region and can serve as a blueprint for the implementation of ICZM in other Regional Seas. The **PEGASO project** builds on existing capacities and develops common approaches to support integrated policies for the Mediterranean and Black Sea Basins in ways that are consistent with the ICZM Protocol.

The PEGASO project has developed **a core set of indicators** that are instrumental in measuring the implementation of ICZM policies and programmes. The core set of ICZM indicators addresses the specific requirement of Article 27 of the protocol to *'define coastal management indicators*' and '*establish and maintain up-to-date **assessments of the use and management of coastal zones***'. In doing so, the PEGASO project has widely built on previous and existing indicator sets, developed by different institutions and projects, and which are duly acknowledged (see *'Methodological paper for the selection and application of PEGASO ICZM indicators'* for further reading and background material)

The present Methodological Factsheets is part of a set of 15 factsheets that are made available to end-users. This set of factsheets supports a harmonized approach to calculate ICZM indicators at different spatial scales in the Mediterranean and Black Sea regions

Pegaso ProjectPeople for Ecosystem based Governance
in Assessing Sustainable development of Ocean and coast

Funded by the European Union
under FP7 – ENV.2009.2.2.1.4
Integrated Coastal Zone Management

Specific Programme FP7
Collaborative Projects
Large scale integrating Project

Grant agreement nº: 244170

Name of the Indicator
Water efficiency index

Objective of the indicator
Efforts should be made to stabilize the water demand in the region of interest, aiming at a reduction in the North and controlled increase in the South and East. Measures have to be taken to reduce losses and misuse by defining efficiency targets in all sectors, and through more efficient use of water for irrigation, household consumption and industries, and to satisfy economic and social requirements at lower costs and at lower environmental impact. The water volumes lost and misused over all sectors are such that they artificially increase water demand in Mediterranean countries. Thus, at the scale of Mediterranean catchment areas, the "potential in water savings" have been appraised to be at 24% of the current demands. This indicator measures progress in water savings through demand management, by reducing losses and waste during transport. It covers both total and sectoral water efficiency index (drinking water, agriculture and industry).

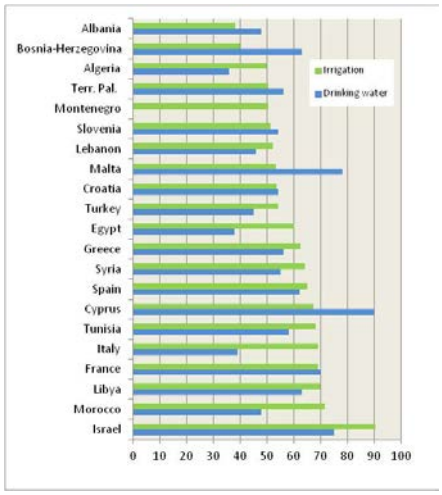
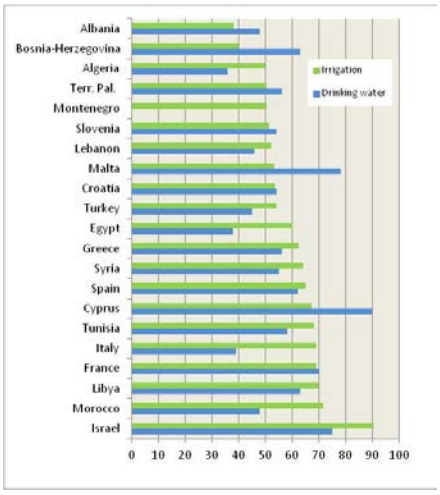
Policy context	
ICZM Policy Objective	To have a balanced use of coastal zone, and avoid urban sprawl
ICZM Protocol Article	Article 9: *Economic activities*
UNEP-MAP Ecological Objective	Objective 7: *Alteration of hydrographic conditions does not adversely affect coastal and marine ecosystems.*
INSPIRE ANNEX I-III Data Theme (34)	Annex III, can be classified under different categories 6 Utility and governmental services 7 Environmental monitoring Facilities 8 Production and industrial facilities 9 Agricultural and aquaculture facilities

CALCULATION OF THE INDICATOR

Spatial consideration	
Coverage	Resolution - Reporting unit(s)
Coastal zone of the Mediterranean Sea Coastal zone of the Black Sea	The data can be reported at different scales or reporting units: - at the scale of individual watersheds - Coastal zone of the Mediterranean and Black Seas: coastal NUTS3 or other relevant spatial reporting units

Temporal consideration	
Period	Resolution (time interval or unit)
Time series should be as long as possible to be able to evaluate to impact of the most important policies related to water use.	Annual data. Measurements should be consistent in reflecting the situation over comparable reference points i.e. 1st of January to 31st of December

Parameter(s)	
(i)	Water use efficiency indices by sector (drinking water, water for irrigation purposes and industrial water use) (see definition below for different sectors). In general, the efficiency indexes measure the quantity of water effectively utilized versus the quantity of water produced and transported
(ii)	Total physical efficiency index of water consumption defined as the sum of the sectoral water use, weighted by the share of sectoral requirements (drinking water, irrigation and industry), over total demand (see step 4 below)

Calculation method		
	Steps	Products
1	**Drinking Water Efficiency** This is the share of drinking water produced, distributed[1], and paid by consumers. $E_{pot} = V_1 / V_2$ - V_1 = drinking water volume invoiced and paid by consumer - V_2 = total drinking water volume produced and distributed The indicator measures both the physical efficiency of drinking water distribution networks (loss rates or yield) and economic efficiency, e.g., the capacity of network managers to cover costs through consumer payments.	 Example of the water use efficiency in two sectors (drinking water andirrigation) (%)
2	**Irrigation Water Efficiency** The physical efficiency of irrigation water is the product of "network for irrigation water transport and distribution" efficiency by plot efficiency: $E_{irr} = E_1 \times E_2$ - E_1: efficiency of irrigation water transport and distribution networks, upstream from agricultural plots, measured as the ratio between water volumes actually distributed to plots and the total volume of water for irrigation, upstream of networks, including losses in networks; - E_2: plot irrigation efficiency is defined as the sum of efficiencies (per plot) of all irrigation methods (surface irrigation, sprinkler irrigation, micro-irrigation, others), weighted by the respective proportions of all local methods and estimated as the ratio between water volumes actually consumed by plants and volumes delivered to plots. E2 = $\sum_1^n \frac{Sm \times Em}{S}$	 Example of the water use efficiency in two sectors (drinking water andirrigation) (%)

[1] *In the sense of networks upstream from losses.*

	- n : number of irrigation methods used - S_m: surfaces irrigated using method: m - E_m: method efficiency: m - S: total local irrigated surface according different methods	
3	**Industrial Water Efficiency** The volume of recycled industrial water (recycling index) $E_{ind} = V_1 / V_2$ - V_1 = Recycled water volumes - V_2 = Gross volume consumed for industrial processes which is equal to the volume entering the industrial plant for the first time + the recycled volume.	
4	**Total Efficiency** Total physical efficiency of water consumption is defined as the sum of used water quantity ratios per sector (demand-losses) over sector demand, weighted by the share of sectoral requirements (drinking water, irrigation and industry) $E = \frac{(Epot \times Dpot + Eirr \times Dirr + Eind \times Dind)}{D}$ Water demand is defined as the sum of water volumes dedicated to satisfying needs (excluding "green" water and "virtual" water), including volumes lost in production, transport and consumption. This corresponds to the sum of water volumes abstracted, non-traditional water production (desalination and imports), and water reuse, minus export volumes.	
Caution for use:	In some cases, due to the diversity in data sources for one country, or due to heterogeneous definitions, total water demand can be different from the sum of demand in various sectors. The economic efficiency of drinking water is dependent on invoicing modes (subscription, meters) and meter malfunction can yield biased results.	

Current monitoring	Data sources
Plan Bleu studies FAO Aquastat has data since 1960 for some countries	FAO-Aquastat Plan Bleu

Assessment context	
Use of the indicator in previous assessments/initiatives	Plan Bleu report / Mediterranean Strategy for Sustainable Development (MSSD)
DPSIR framework	Response
Link to anthropogenic pressure	

Sustainability target or threshold	To achieve the 2025 physical efficiency levels recommended by the alternative scenario of the Plan Bleu: - Drinking water in communities: restore levels of distribution losses to 15%; - Industry recycling generalized at 50%; - Irrigation: restore levels of transport losses to 10% and maintain high physical efficiency at 80%. Or, as an alternative, to achieve national total physical efficiency objectives.
Link with other assessment tools	This indicator has to be used and interpreted in conjunction with 'water demand', see e.g. the MSSD indicator on water demand 'WAT_P02'.
Example of integrated assessment	UNEP-MAP Plan Bleu: State of the environment and development in the Mediterranean 2009

Scope for future improvements

In many areas, in particular the areas with important seasonality or peaks in tourism, it may be relevant to collect data for different seasons or over peak periods (e.g. during summer).

Data Harmonization

In order to build a common, regional view for a particular indicator, it is crucial to harmonize the data in terms of e.g. concepts, definitions, reporting units, colour codes, value class boundaries and scoring methods. For this purpose, the PEGASO consortium has developed 'Guidelines for Data Harmonization' which are available from the 'Products' section on the PEGASO project website www.pegasoproject.eu. Although agreements may exist related to the presentation of certain indicators that are legally embedded, this may be less evident for indicators which are not (yet) used as an instrument within a policy context or within a region where the policy is not applicable. The PEGASO consortium encourages contributing partners, stakeholders and end-users to consult the 'Guidelines for Data Harmonization' document, and to actively engage in this process.

Indicator references (i.e. UNEP, EEA, …)

Plan Bleu - MSSD priority indicator WAT_P01

Eurostat:

http://epp.eurostat.ec.europa.eu/portal/page?_pageid=1996,45323734&_dad=portal&_schema=PORTAL&screen=welcomeref&open=/&product=EU_MASTER_environment&depth=2

Yearly data, Online data limited to EU and accessing countries, National scope only

FAO-Aquastat

http://www.fao.org/ag/agl/aglw/aquastat/dbase/index.stm: Data from 1960 till 2005 (not for all the countries). List of indicators available online. National scope only