

Identification of keystone species

Milestone M25

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LEAD CONTRACTOR

Hellenic Centre For Marine Research

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1. Introduction

DEVOTES project Milestone 25 concerns the completion of the identification of keystone species, with a list of species to be available on the DEVOTES website. The keystones are collated for different habitats across European regional seas. This milestone is within TASK 6.1.3 Identification of Keystone species and processes. The keystone species have been compiled within the DEVOTES Keystone Species Catalogue and Excel file downloadable from the website. The file is an annex to Deliverable 6.1 *Report on identification of keystone species and processes across regional seas*, which includes a meta-analysis of the catalogue and contextual review. In the following section the structure of the catalogue is explained, but for further detail and clearer comprehensive presentation of results and metadata analysis, the reader is directed to the full Deliverable report:

DEVOTES Keystone Species Catalogue

Smith CJ, Papadopoulou N, Sevastou K, Kiriakopoulou N, et al. (2014). List of available keystone species for possible use in GES assessment of Descriptors 1, 2, 4 and 6 of the MSFD. DEVOTES Project, Deliverable 6.1 "Report on identification of keystone species and processes across regional seas", Annex 2.

www.devotes-project.eu/wp-content/uploads/2014/07/DEVOTES-D6-1-Keystone-Catalogue-v8.xlsx

DEVOTES Deliverable Report on Keystone Species

Smith C, Papadopoulou N, Sevastou K, Franco A, Teixeira H, Piroddi C, Katsanevakis S, Fürhaupter K, Beauchard O, Cochrane S, Ramsvatn S, Feral J-P, Chenuil A, David R, Kiriakopoulou N, Zaiko A, Moncheva S, Stefanova K, Churilova T, Kryvenko O (2014) Report on identification of keystone species and processes across regional seas. Deliverable 6.1, DEVOTES Project. 105 pp + 1 Annex.

www.devotes-project.eu/wp-content/uploads/2014/07/DEVOTES-D6-1-Keystones.pdf

2. Work Completed

The work undertaken consisted of the lead partner, in discussion with other participants, outlining the data to be collated on keystone species. This was followed by the drafting of a template catalogue and guidance for filling in the catalogues (Smith and Papadopoulou, 2014). The template and guidelines were then distributed to the Task partners for filling in their area entries. Replies from 10 participating institutions were collated into one master catalogue by the coordinating partner, with quality control measure to ensure standardised entries, correct entries, non-duplication, etc. The master catalogue was returned to the individual providers for further checks before finalising and undertaking the meta-analysis.

3. Structure of the Catalogue

The data catalogue is a simple Excel file entitled **DEVOTES_613 Keystone Catalogue_v8.xls**

The file consists of 8 separate pages (sheets)

- Sheet 1: Citation Page for the Catalogue and Deliverable
- Sheet 2: Readme: instructions for the data providers of the catalogue
- Sheet 3: Lists: lists and data entry options for preselected categories for various data entry points for each of the keystone entries.
- Sheet 4: Definitions: further definitions for each of the entry columns in the catalogue
- Sheet 5: CATALOGUE: the Keystones Catalogues entries and associated data
- Sheet 6-8: Regional and sub-regional maps for defining geographical entries.

3.1. Catalogue

The CATALOGUE page of the Keystones Catalogue contains the individual keystone entries with single row entries for individual keystone species/groups, with a number of categories of associated information to complete.

3.1.1. Category groups and categories

The entries are broken down into seven broad category groups and then individual categories in single columns. Some categories were for free entries; others were restricted to a specific list (drop down menu).

- Data Input identifier section: to identify who is putting in the data information including institution name and contact
- Keystone: identifying the Keystone by common name, scientific name, keystone type (predator, habitat species, or engineer), biological component group and sub-component group.

- Importance: primary impact (biodiversity reducer or promoter), brief description of importance, size category, abundance category, distribution category, keystone value (if available from Ecopath with Ecosim model).
- Habitat: habitat type, MSFD habitats
- Regions: MSFD Region and sub-region, other subdivision
- More than one entry: indicating if the species/group has more than one entry in the catalogue
- Sources: source of Keystone information (reference, expert knowledge or model) and any bibliographical reference.
- Notes and additional remarks: any particular notes concerning the entry.

3.1.2. Catalogue entries

There are a total of 844 entries in the catalogue with data given for almost every category for each entry. The entries concern a total of 210 distinct species and 19 groups classified by major habitat in the Baltic Sea, North East Atlantic, Mediterranean, Black Sea (EU Regional Seas) and Norwegian Sea (Non-EU Sea). The catalogue also cites 164 references relating to the species. The keystones in the catalogue are sourced from models, by use as indicators, by published work (e.g. on traits and interactions with other species), and by expert opinion based on understanding of systems and roles of species/groups.

4. Report on the Keystone Species

As noted in the introduction, the Smith *et al.* (2014) report contains the meta-analysis of the catalogue, and contextual review. In brief, a total of 74 species were considered to act as keystone predators, 79 as keystone engineers, 66 as keystone habitat forming species, while a few were thought of having multiple roles in their marine ecosystems. Benthic invertebrates accounted for 50% of the reported keystone species/groups, while macroalgae contributed 17% and fish 12%. Angiosperms were consistently put forward as keystone habitat forming and engineering species in all areas. A significant number of keystones were invasive alien species. Only one keystone, the bivalve *Mya arenaria*, was common to all four EU regional seas. The Mediterranean Sea had the largest number of potential keystones (56% of the entries) with the least in the Norwegian Sea. There were very few keystones in deep waters (Bathyal-Abyssal, 200+ m), with most reported in sublittoral shallow and shelf seabeds or for pelagic species in marine waters with few in reduced/variable salinity waters. The gaps in coverage and expertise in the catalogue are analysed at the habitat and regional sea level, within the MSFD

biodiversity component groups and in light of knowledge and outputs from ecosystem models (Ecopath with Ecosim). The understanding of keystones is discussed as to when a species may be a dominant or keystone with respect to the definition term concerning 'disproportionate abundance', how important are the 'disproportionate effects' in relation to habitat formers and engineers, what separates a key predator and key prey for mid-trophic range species and how context dependency makes a species a keystone. Keystone alien invasive species are reviewed and the use of keystone species model outputs investigated. In the penultimate sections of the review the current level of protection on keystone species and the possibilities for a keystone operational metric and their use in management and in Good Environmental Status assessments for the Marine Strategy Framework Directive are discussed. The final section highlights the one keystone species and its interactions not covered in the catalogue but with the greatest impact on almost all marine ecosystems, *Homo sapiens*.

5. References

- Smith C, Papadopoulou KN (2014) Report on identification of keystone species and processes across regional seas: WP6.1.3. How to fill in the Keystone Species Catalogue, analyses and findings to be reported under Deliverable 6.1. Guidance Document. DEVOTES Project. Unpublished Document, 7 pp.
- Smith C, Papadopoulou N, Sevastou K, Franco A, Teixeira H, Piroddi C, Katsanevakis S, Fürhaupter K, Beauchard O, Cochrane S, Ramsvatn S, Feral J-P, Chenuil A, David R, Kiriakopoulou N, Zaiko A, Moncheva S, Stefanova K, Churilova T, Kryvenko O (2014) Report on identification of keystone species and processes across regional seas. Deliverable 6.1, DEVOTES Project. 105 pp + 1 Annex.