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Ecosystem goods and services from European protected habitats and species

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Agenda

1. Ecosystem services
2. Classification of marine ecosystem services
3. Identifying MES for MCZ habitats and species
4. Role of ecosystem services in coastal management

1. Ecosystem services

Ecosystem services can be defined in a variety of ways, including:

- "the benefits human populations derive, directly or indirectly, from ecosystem functions" (Costanza *et al* 1997).
- "the benefits people obtain from ecosystems" (MEA 2003).
- "services provided by the natural environment that benefit people" (Defra 2007).
- "the direct and indirect contributions of ecosystems to human well-being" (TEEB 2009).

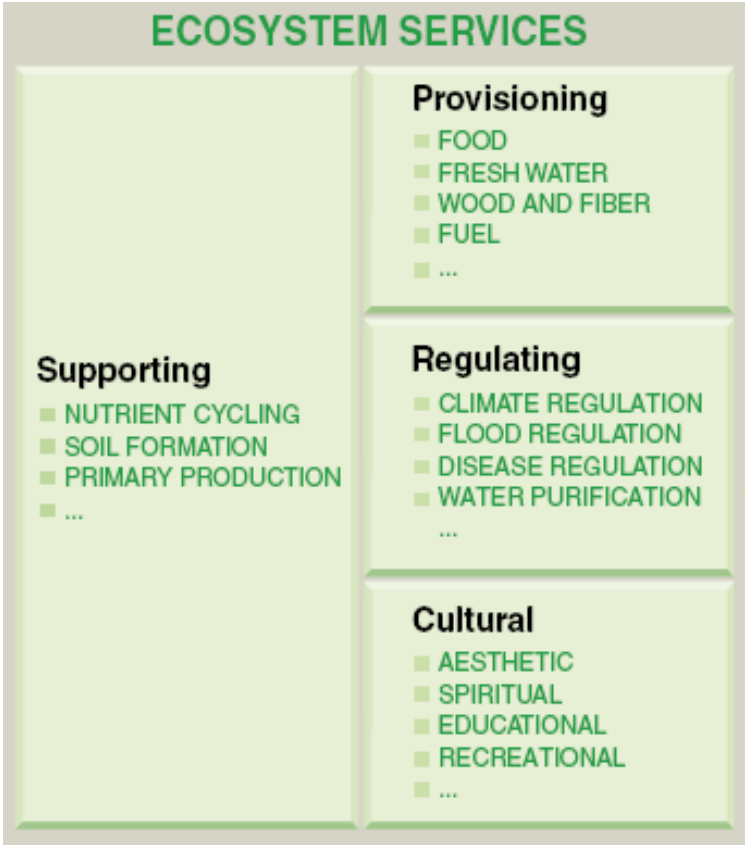
The common emphasis is:

- ***the beneficial role played by ecosystems in enhancing or maintaining aspects of human well being and thereby human society*** e.g. food production, climate regulation, flood protection, pollution sinks, and recreational and aesthetic benefits.

- This information can be used to place an economic value on ecosystems.

2. Classification of ecosystem services

- There are multiple classifications of ecosystem services.
- The most well-known and widely applied classification of ecosystems services was developed by the **Millennium Ecosystem Assessment** (2003).



The MEA mixes ecological processes and services and so risks double counting.

'The Economics of Ecosystems and Biodiversity' (TEEB) project.

- The TEEB (2009) ecosystem service classification distinguishes between **ecological processes** and the **benefits** experienced by humans.

The TEEB (2009) classification has three components:

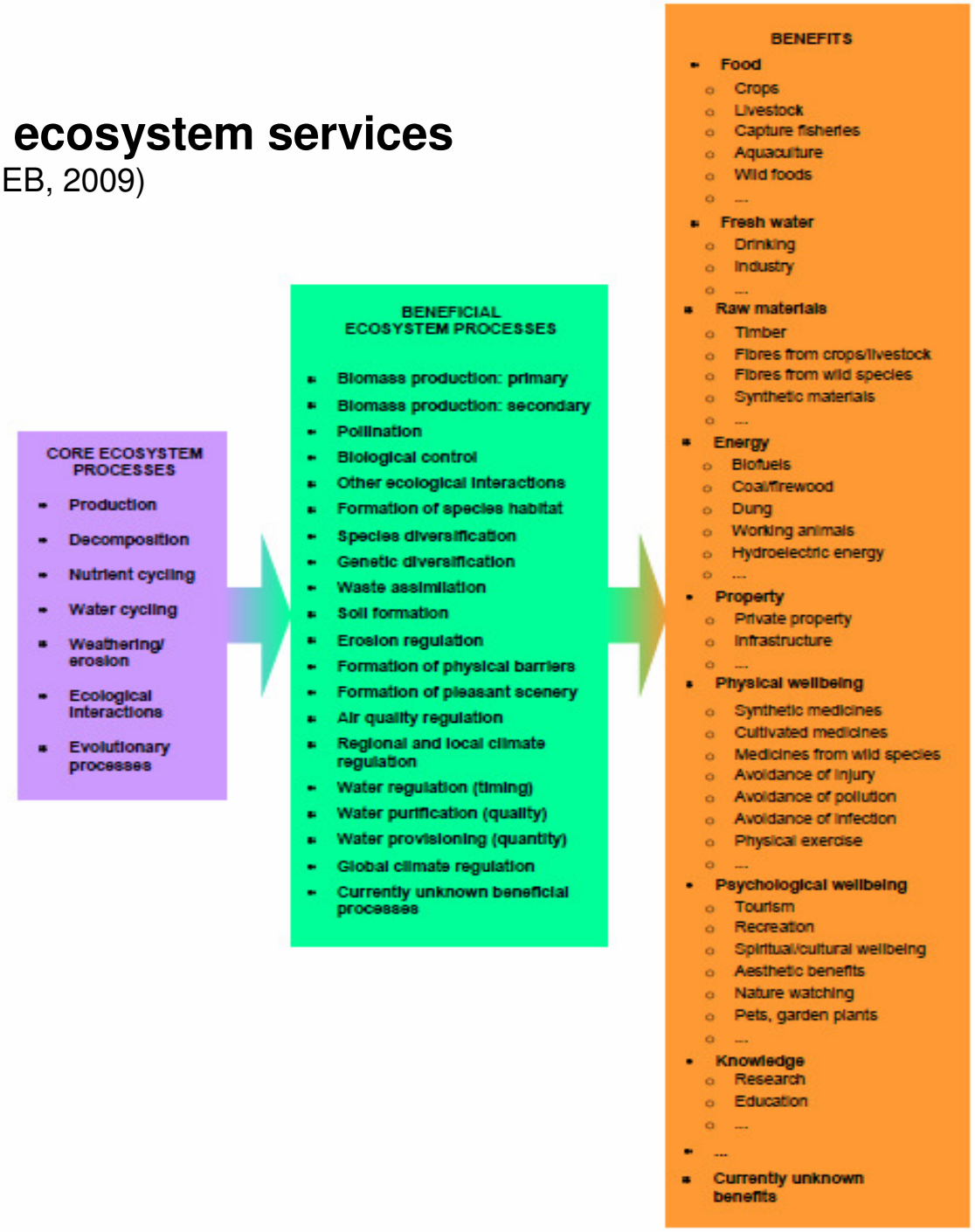
- **Core ecosystem processes:** these describe the basic ecosystem processes supporting ecosystem functions.

- **Beneficial ecosystem processes:** these are the specific ecosystem processes that directly underpin benefits to people.

- **Beneficial ecosystem services:** these are the products of ecosystem processes that directly impact human wellbeing.

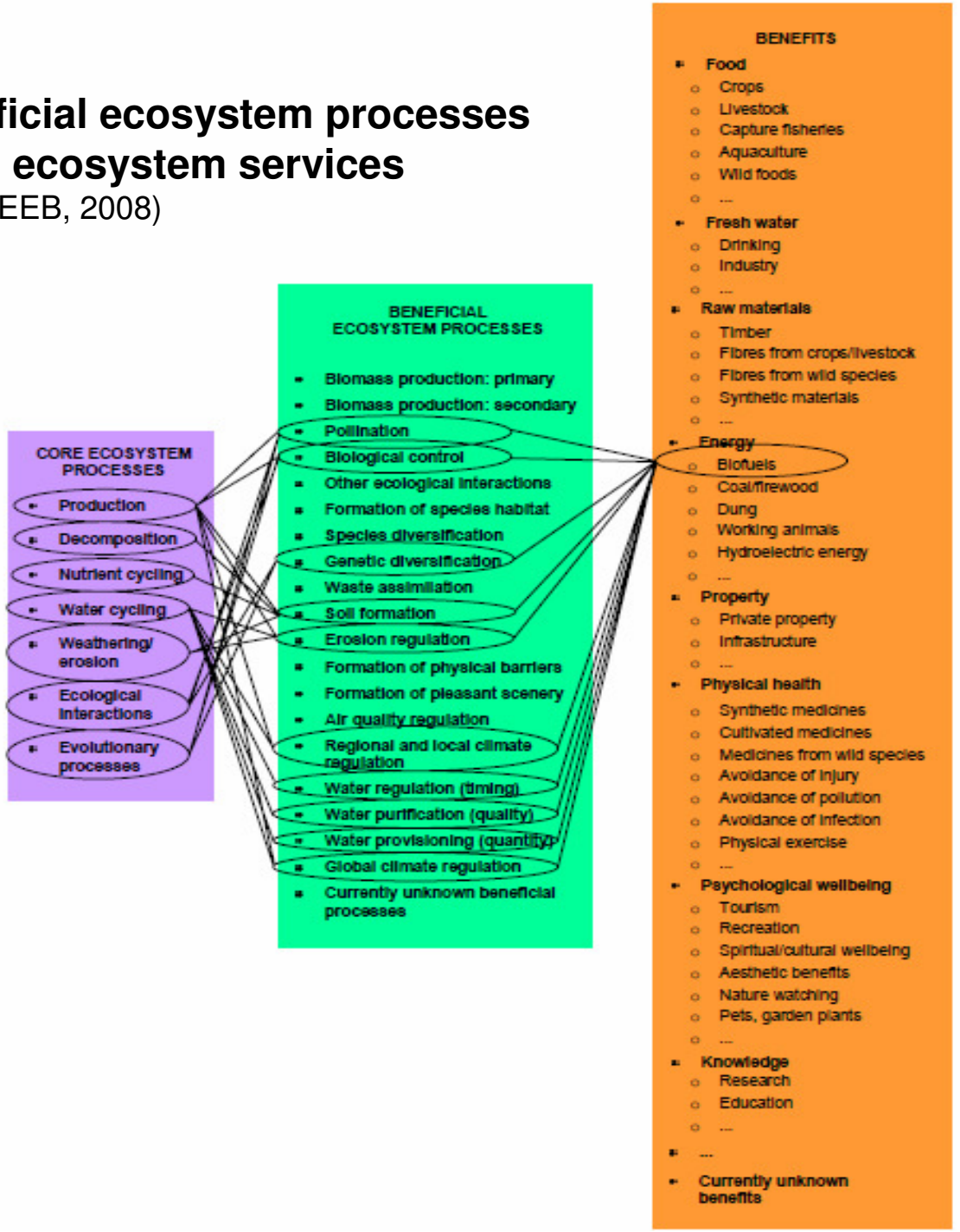
Classification of ecosystem services

(TEEB, 2009)



Links between beneficial ecosystem processes and beneficial ecosystem services

(TEEB, 2008)



3. Ecosystem services from European protected habitats and species

This work was undertaken as part of a project funded by Natural England, completed in partnership with ABPmer.

TITLE:

Description of the ecosystem services provided by broad-scale habitats and features of conservation importance that are likely to be protected by Marine Protected Areas in the Marine Conservation Zone Project area.

The MPA network includes:

- Special Areas of Conservation
- Special Protection Areas
- Sites of Special Scientific Interest
- Ramsar sites
- Marine Conservation Zones

Method

The review is focused upon marine species and habitats collectively known as '**marine features**'.

Broad-scale habitats to be protected within MPAs of the MCZ Project area

High energy intertidal rock
Moderate energy intertidal rock
Low energy intertidal rock
Intertidal coarse sediment
Intertidal sand and muddy sand
Intertidal mud
Intertidal mixed sediments
Coastal saltmarshes and saline reedbeds
Intertidal sediments dominated by aquatic angiosperms
Intertidal biogenic reefs
High energy infralittoral rock
Moderate energy infralittoral rock
Low energy infralittoral rock
High energy circalittoral rock
Moderate energy circalittoral rock
Low energy circalittoral rock
Subtidal coarse sediment
Subtidal sand
Subtidal mud
Subtidal mixed sediments
Subtidal macrophyte-dominated sediment
Subtidal biogenic reefs
Deep-sea bed

Marine habitats listed in Annex I the EC Habitats Directive not listed elsewhere

Saline lagoons
Submarine Structures made by leaking gases
Submerged or partially submerged sea caves

Habitats of conservation importance to be protected within MPAs of the MCZ Project area

Blue mussel beds
Cold-water coral reefs
Coral Gardens
Deep-sea sponge aggregations
Estuarine rocky habitats
File shell beds
Fragile sponge and anthozoan communities on subtidal rocky habitats
Intertidal underboulder communities
Littoral chalk communities
Maerl beds
Modiolus modiolus beds
Mud habitats in deep water
Sea-pen and burrowing megafauna communities
Ostrea edulis beds
Peat and clay exposures
Sabellaria alveolata reefs
Sabellaria spinulosa reefs
Seagrass beds
Sheltered muddy gravels
Subtidal chalk
Subtidal sands and gravels
Tide-swept channels

Low or limited mobility species of conservation importance to be protected within the MCZ Project area

Anotrichium barbatum	Bearded Red Seaweed
Cruoria cruoriaeformis	Red seaweed
Dermocorynus montagnei	Red seaweed
Lithothamnion corallioides	Coral Maërl
Padina pavonica	Peacock's tail
Phymatolithon calcareum	Common Maërl
Alkmaria romijni	Tentacled Lagoon-Worm
Armandia cirrhosa	Lagoon Sandworm
Gobius cobitis	Giant Goby
Gobius couchi	Couch's goby
Hippocampus guttulatus	Long snouted seahorse
Hippocampus hippocampus	Short snouted seahorse
Osmerus eperlanus	Smelt
Anguilla anguilla	European eel
Victorella pavida	Trembling sea mat
Amphianthus dohrnii	Sea-fan Anemone
Edwardsia timida	Timid Burrowing Anemone
Eunicella verrucosa	Pink Sea-fan
Funiculina quadrangularis	Tall sea pen
Haliclystus auricular	Stalked jellyfish
Leptopsammia pruvoti	Sunset Cup Coral
Lucernariopsis campanulata	Stalked jellyfish
Lucernariopsis cruxmelitensis	Stalked jellyfish
Nematostella vectensis	Starlet sea anemone
Gammarus insensibilis	Lagoon sand shrimp
Gitanopsis bispinosa	Amphipod Shrimp
Mitella pollicipes	Gooseneck Barnacle
Palinurus elephas	Spiny lobster
Arctica islandica	Ocean quahog
Atrina fragilis	Fan Mussel
Caecum armoricum	Defolin's Lagoon Snail
Ostrea edulis	Native Oyster
Paludinella littorina	Sea snail
Tenellia adspersa	Lagoon sea slug
Raja undulata	Undulate ray

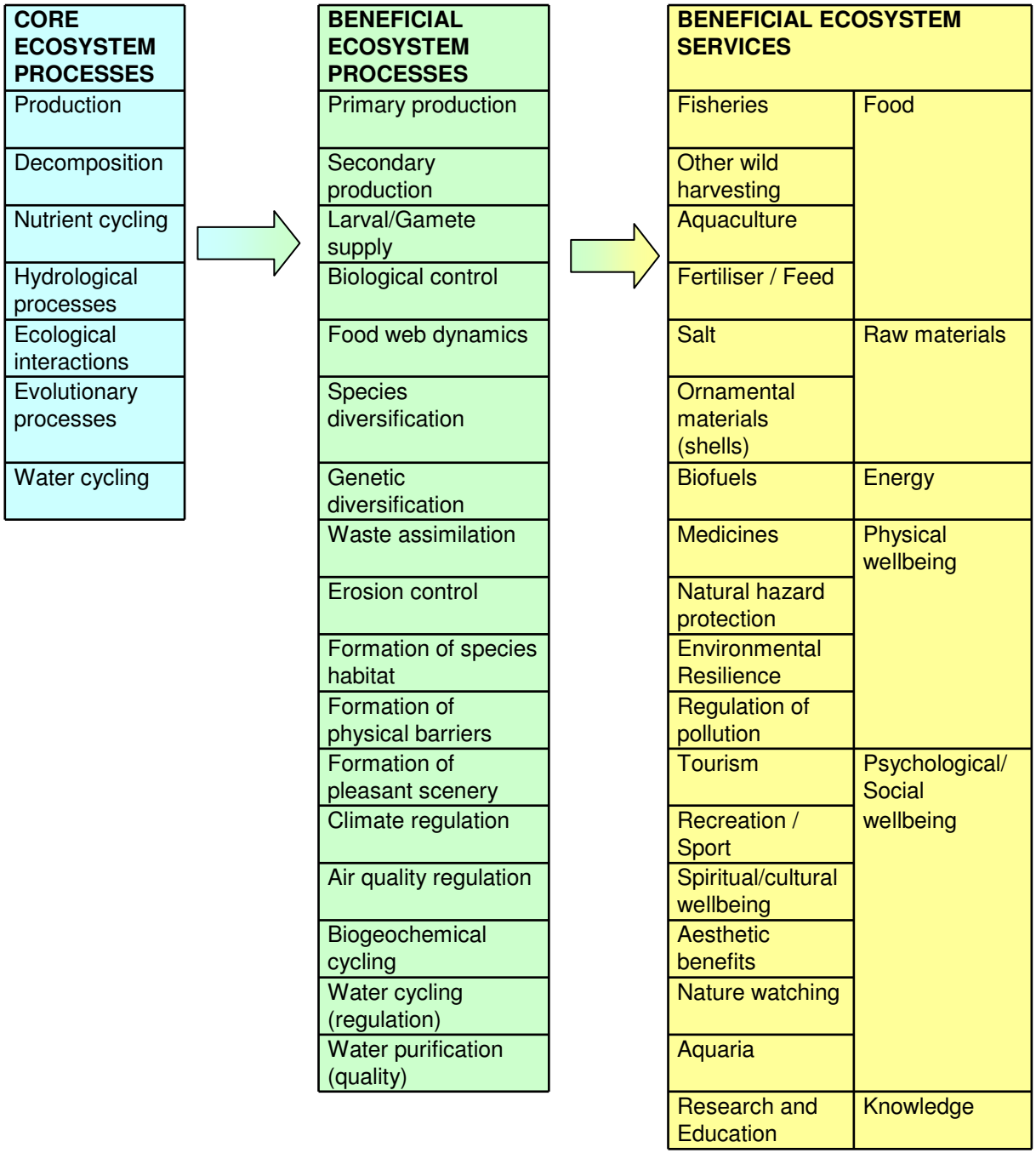
Method

The review is focused upon marine species and habitats collectively known as '**marine features**'.

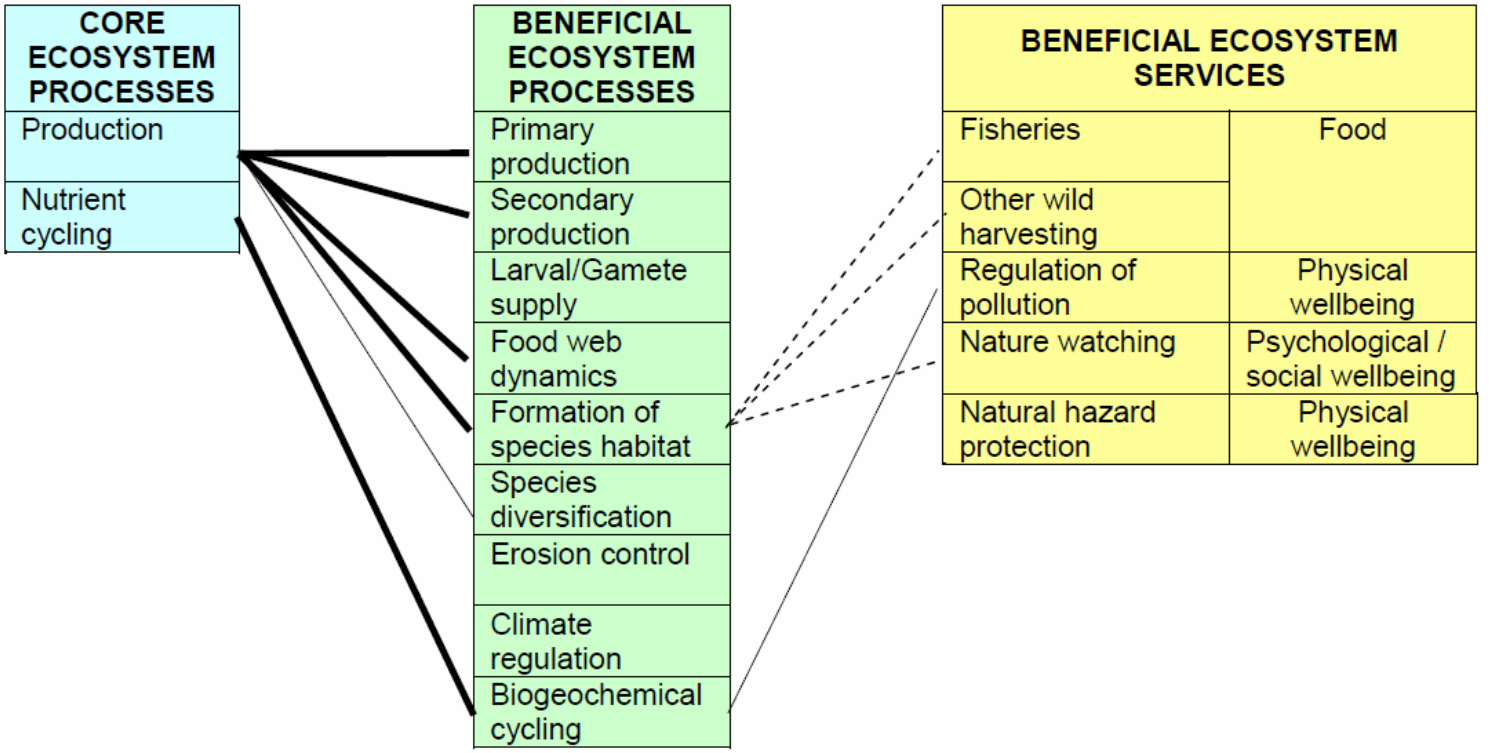
A specific classification of marine ecosystem services was developed based on the TEEB classification.

A literature review was undertaken for each marine feature to identify:

- Beneficial ecosystem processes
- Beneficial ecosystem services

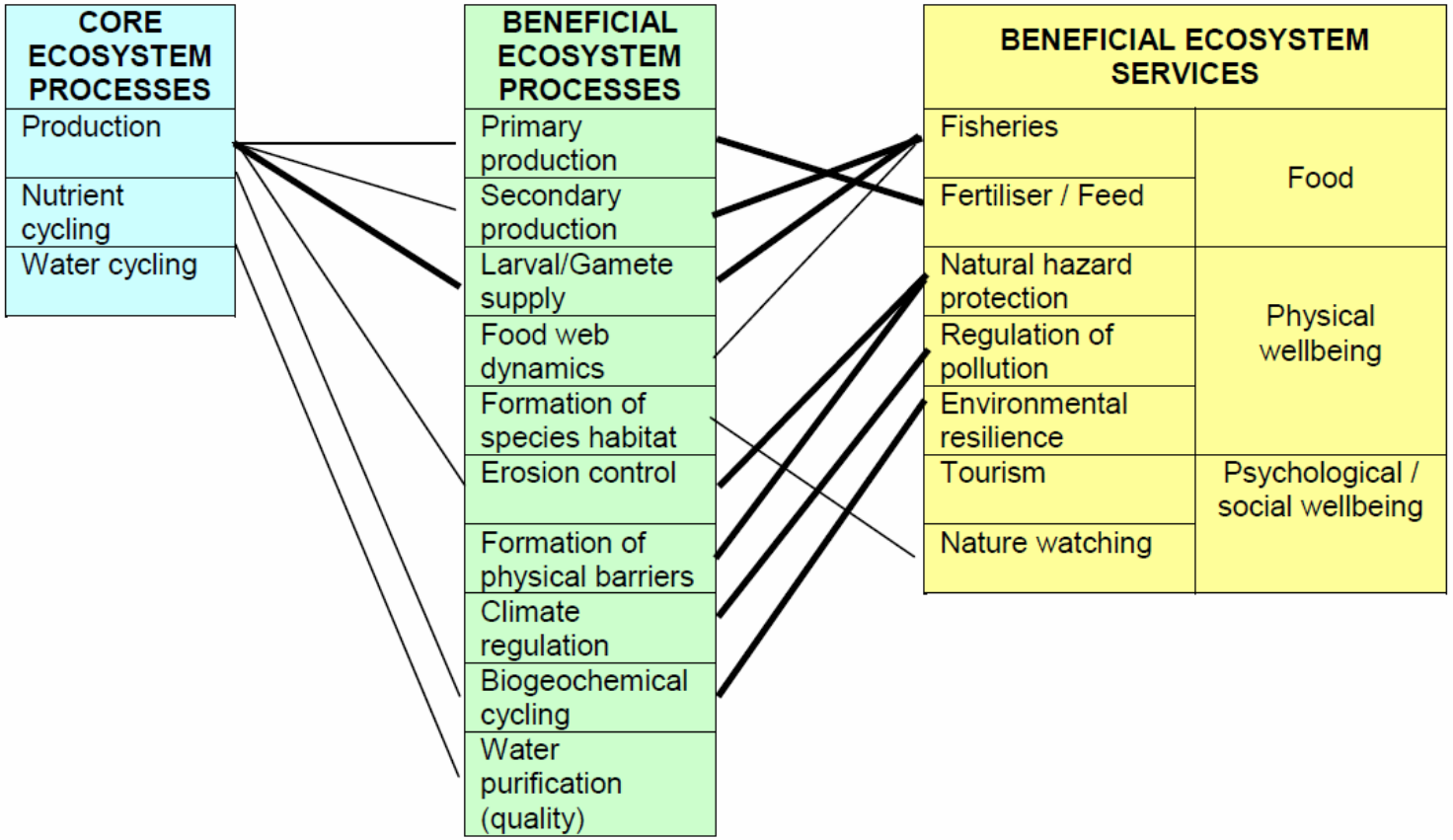

CORE ECOSYSTEM PROCESSES
Production
Decomposition
Nutrient cycling
Hydrological processes
Ecological interactions
Evolutionary processes
Water cycling
BENEFICIAL ECOSYSTEM PROCESSES
Primary production
Secondary production
Larval/Gamete supply
Biological control
Food web dynamics
Species diversification
Genetic diversification
Waste assimilation
Erosion control
Formation of species habitat
Formation of physical barriers
Formation of pleasant scenery
Climate regulation
Air quality regulation
Biogeochemical cycling
Water cycling (regulation)
Water purification (quality)
BENEFICIAL ECOSYSTEM SERVICES
Fisheries
Food
Other wild harvesting
Aquaculture
Fertiliser / Feed
Salt
Raw materials
Ornamental materials (shells)
Biofuels
Energy
Medicines
Physical wellbeing
Natural hazard protection
Environmental Resilience
Regulation of pollution
Tourism
Psychological/ Social wellbeing
Recreation / Sport
Spiritual/cultural wellbeing
Aesthetic benefits
Nature watching
Aquaria
Research and Education
Knowledge

Intertidal mud



Solid line: indicates evidence is UK related, feature specific and peer reviewed
Thin line: indicates UK related but grey literature
Dashed line: indicates overseas papers or expert evidence

Coastal saltmarshes and saline reedbeds



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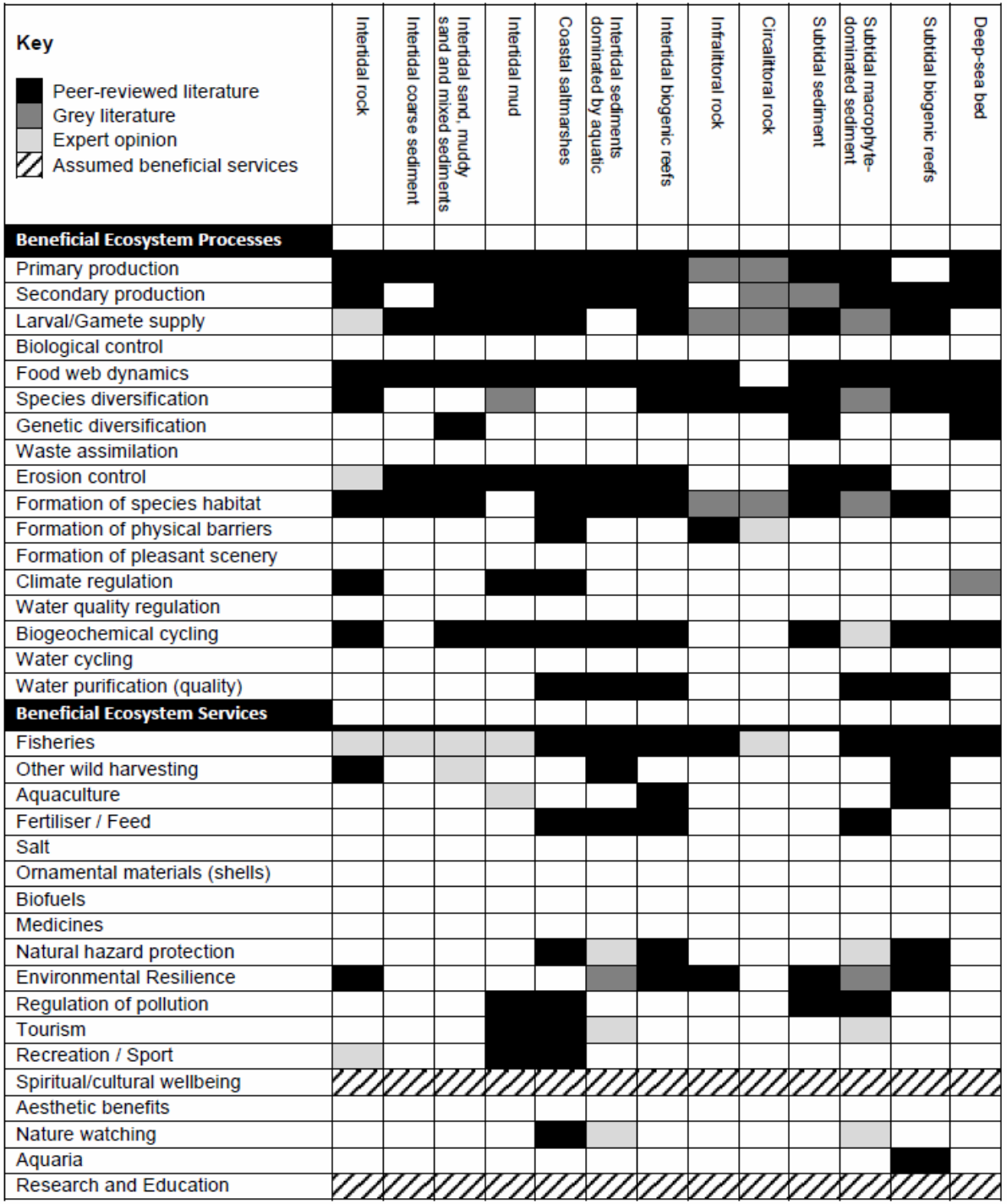
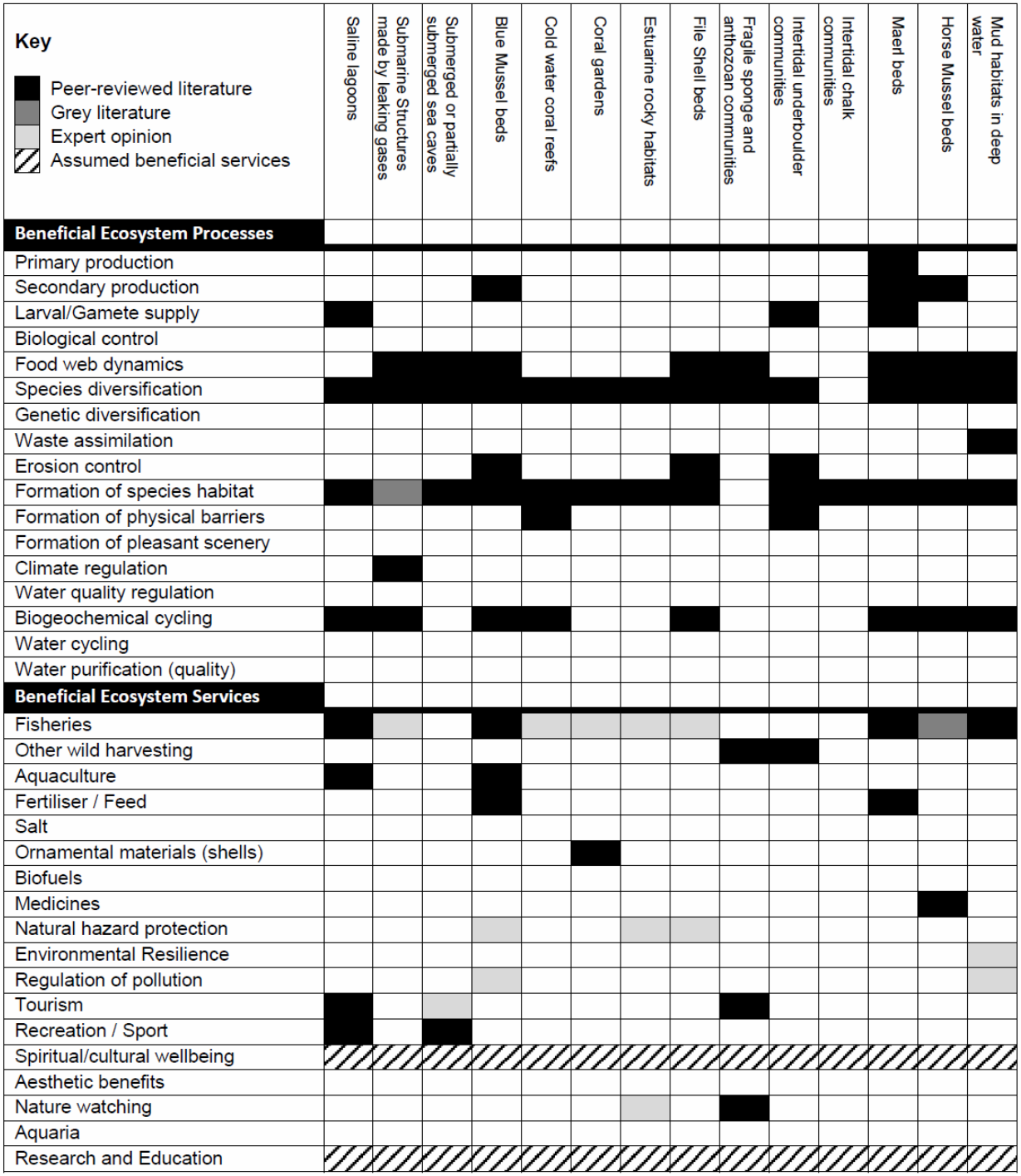
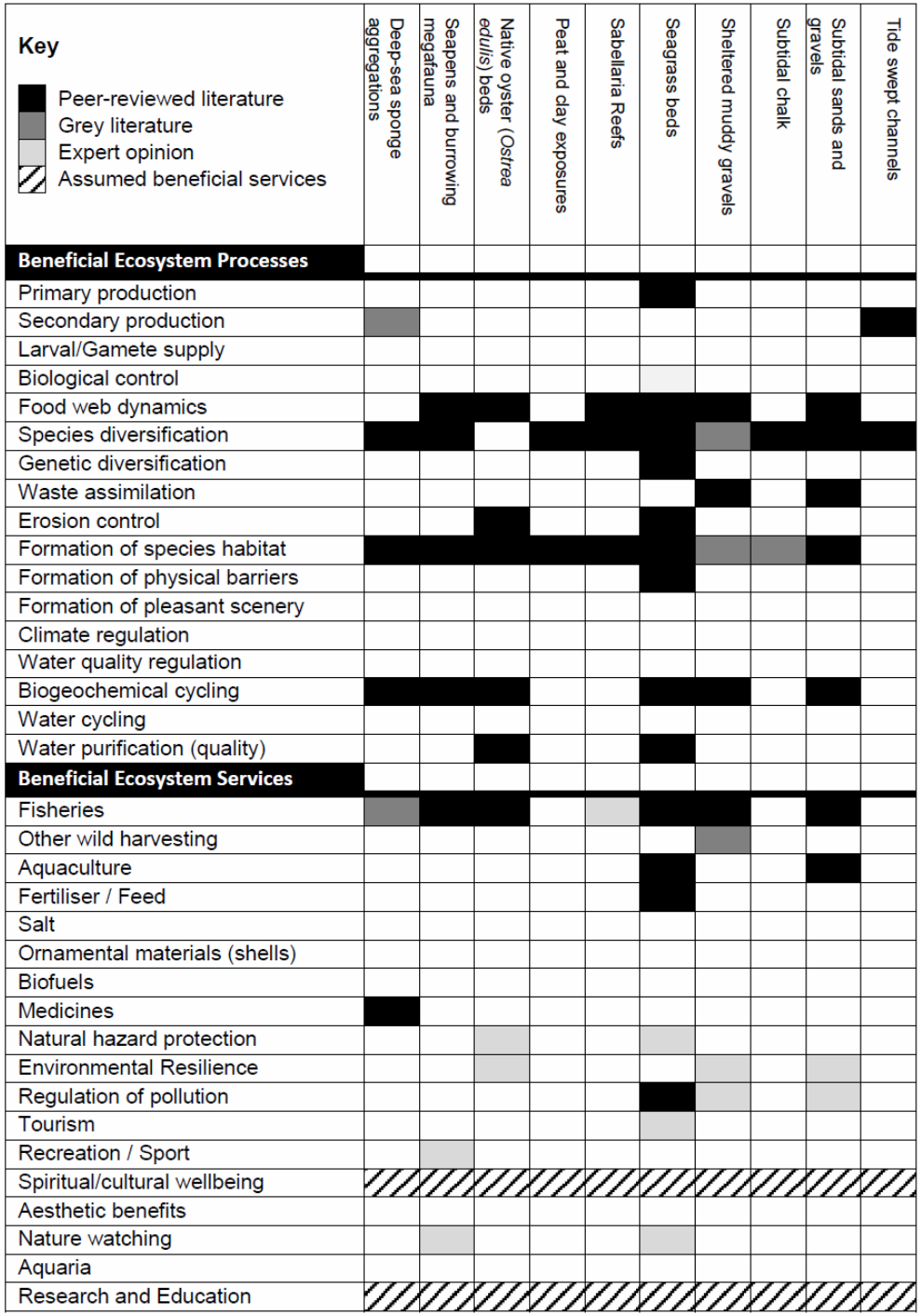
Broadscale Habitats



Habitats of Conservation Importance



Habitats of conservation importance (continued)



Species of conservation importance

Key

- Peer-reviewed literature
- Grey literature
- Expert opinion
- Assumed beneficial services

	Sea-fan anemone *Amphianthus dohrnii*	Stalked jellyfish *Haliclystus auricula*	Stalked jellyfish *Lucernariopsis*	Stalked jellyfish *Lucernariopsis*	Starlet sea anemone *Nematostella vectensis*	Sunset cup coral *Leptopsammia pruvoti*	Timid burrowing anemone *Edwardsia timida*	Lagoon sandworm *Armandia cirrhosa*	Tentacled lagoon-worm *Alkmaria romijni*	Amphipod shrimp *Gitanopsis bispinosa*	Gooseneck barnacle *Mitella policipes*	Lagoon sand shrimp *Gammarus insensibilis*	Spiny lobster *Palinurus elephas*	Defolin's lagoon snail *Caecum armoricum*
Beneficial Ecosystem Processes														
Primary production														
Secondary production											■			
Larval/Gamete supply														
Biological control														
Food web dynamics					■						■			
Species diversification														
Genetic diversification														
Waste assimilation														
Erosion control														
Formation of species habitat						■					■			
Formation of physical barriers														
Formation of pleasant scenery														
Climate regulation														
Water quality regulation														
Biogeochemical cycling														
Water cycling														
Water purification (quality)														
Beneficial Ecosystem Services														
Fisheries													■	
Other wild harvesting														
Aquaculture														
Fertiliser / Feed														
Salt														
Ornamental materials (shells)														
Biofuels														
Medicines														
Natural hazard protection														
Environmental Resilience														
Regulation of pollution														
Tourism														
Recreation / Sport						■								
Spiritual/cultural wellbeing														
Aesthetic benefits														
Nature watching						■								
Aquaria														
Research and Education														

Species of conservation importance (continued)

Key Peer-reviewed literature Grey literature Expert opinion Assumed beneficial services	Fan mussel *Atrina pectinata*	Lagoon sea slug *Tenellia adspersa*	Ocean quahog *Arctica islandica*	Pink Sea-fan *Eunicella verrucosa*	Tall sea pen *Funiculina quadrangularis*	Couch's goby *Gobius couchi*	European eel *Anguilla anguilla*	Giant goby *Gobius cobitis*	Long snouted seahorse *Hippocampus guttulatus*	Short snouted seahorse *Hippocampus*	Smelt *Osmerus eperlanus*	Undulate ray *Raja undulata*	Bearded red seaweed *Anotrichium barbatum*	Burgundy maërl paint seaweed *Cruoria*
Beneficial Ecosystem Processes														
Primary production														
Secondary production			■				■		▒	▒				
Larval/Gamete supply							■		▒	▒				
Biological control														
Food web dynamics			■			■	■	■	■	■	■	■		
Species diversification	▒													
Genetic diversification														
Waste assimilation														
Erosion control														
Formation of species habitat	■													
Formation of physical barriers														
Formation of pleasant scenery														
Climate regulation														
Water quality regulation														
Biogeochemical cycling														
Water cycling														
Water purification (quality)														
Beneficial Ecosystem Services														
Fisheries	■		■				■		▒	▒	■	■		
Other wild harvesting														
Aquaculture														
Fertiliser / Feed														
Salt														
Ornamental materials (shells)	■													
Biofuels														
Medicines														
Natural hazard protection														
Environmental Resilience								■						
Regulation of pollution														
Tourism														
Recreation / Sport											■			
Spiritual/cultural wellbeing	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨
Aesthetic benefits														
Nature watching						▒		▒	▒	▒				
Aquaria														
Research and Education	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨

Species of conservation importance (continued)

Key Peer-reviewed literature Grey literature Expert opinion Assumed beneficial services	Common maërl *Phymatolithon calcareum*	Coral maërl *Lithothamnion coralloides*	Grateloup's little-lobed weed *Grateloupia montagnei*	Peacock's tail *Padina pavonica*
Beneficial Ecosystem Processes				
Primary production				
Secondary production				
Larval/Gamete supply				
Biological control				
Food web dynamics				
Species diversification				
Genetic diversification				
Waste assimilation				
Erosion control				
Formation of species habitat				
Formation of physical barriers				
Formation of pleasant scenery				
Climate regulation				Peer-reviewed literature
Water quality regulation				
Biogeochemical cycling				
Water cycling				
Water purification (quality)				
Beneficial Ecosystem Services				
Fisheries				
Other wild harvesting				
Aquaculture				Expert opinion
Fertiliser / Feed				Expert opinion
Salt				
Ornamental materials (shells)				
Biofuels				
Medicines				Expert opinion
Natural hazard protection				
Environmental Resilience				
Regulation of pollution				
Tourism				
Recreation / Sport				
Spiritual/cultural wellbeing	Assumed beneficial services	Assumed beneficial services	Assumed beneficial services	Assumed beneficial services
Aesthetic benefits				
Nature watching				
Aquaria				
Research and Education	Assumed beneficial services	Assumed beneficial services	Assumed beneficial services	Assumed beneficial services

Key findings:

- The **evidence base is inconsistent** as some marine features offer relatively strong conclusions whereas others have little or no evidence.

- The **evidence base for ecosystems was stronger than for species**.

- For **marine species, the evidence base for beneficial ecosystem processes and services was very limited**.

- There was **more evidence for beneficial ecosystem processes** than beneficial ecosystem services.

- **Commercial fisheries** are the beneficial ecosystem service with the strongest evidence base.

NOTE: *Insufficient evidence should not be equated with insignificant ecosystem value, therefore a precautionary view of is needed.*

4. The potential role of ecosystem services in the management of coastal and marine space

Marine ecosystem services can help to:

- Connect socio-economic choice with ecological well-being.
- Connect ecological management to socio-economic priorities.
- Provide a driver for stakeholder involvement.
- Facilitate the choice between competing management options.
- Understand the implications of ecosystem change on humans.
- Can be used to identify triggers for management intervention.

Full report will be available from NE.