



Records reveal the vast historical extent of European oyster reef ecosystems

In the format provided by the authors and unedited

Supporting figures:

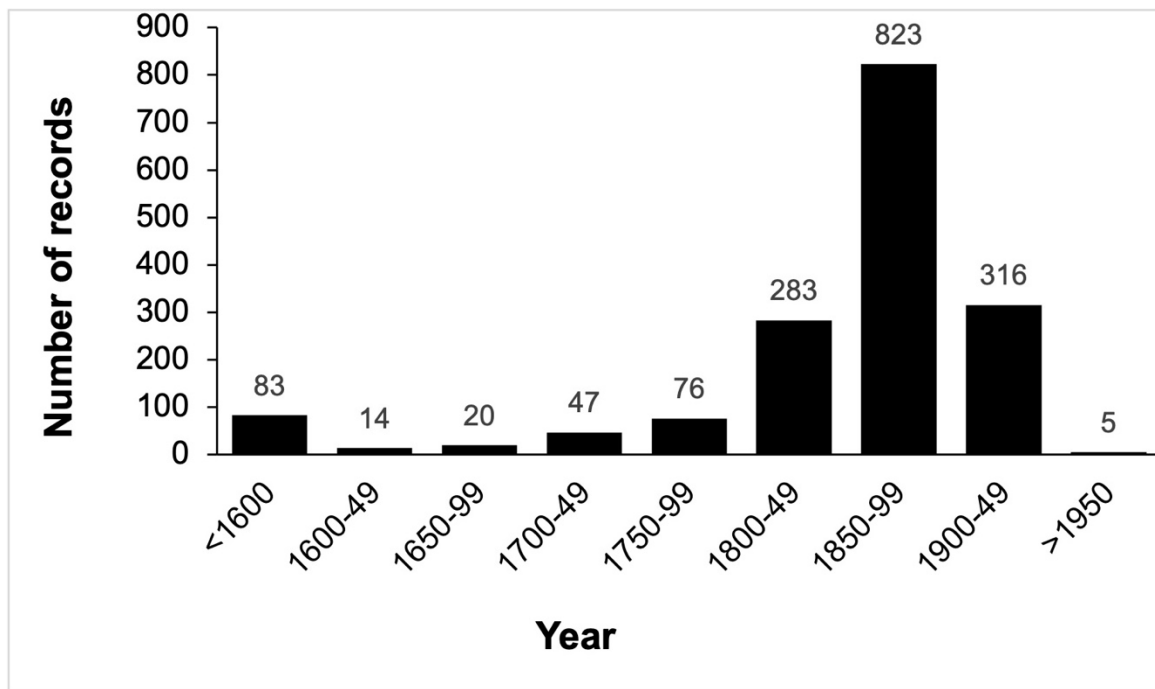


Figure S1. Number and temporal spread of documentary records.

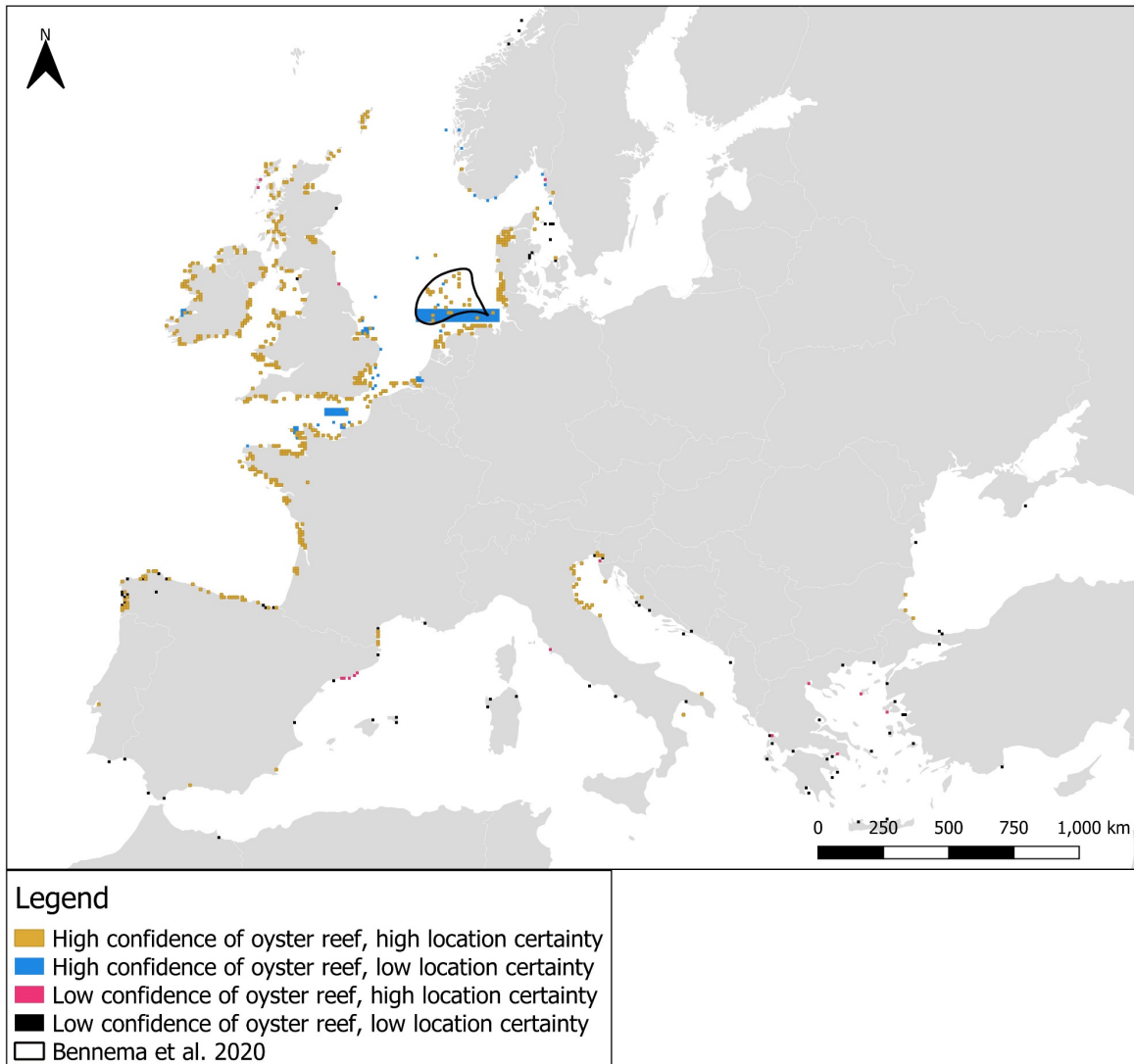


Figure S2: Locations across Europe where oyster reef presence was assigned from historical sources, identified to 10km² grids, with associated confidence levels that biogenic reef habitat once formed. Base map: European Environment Agency (2017).

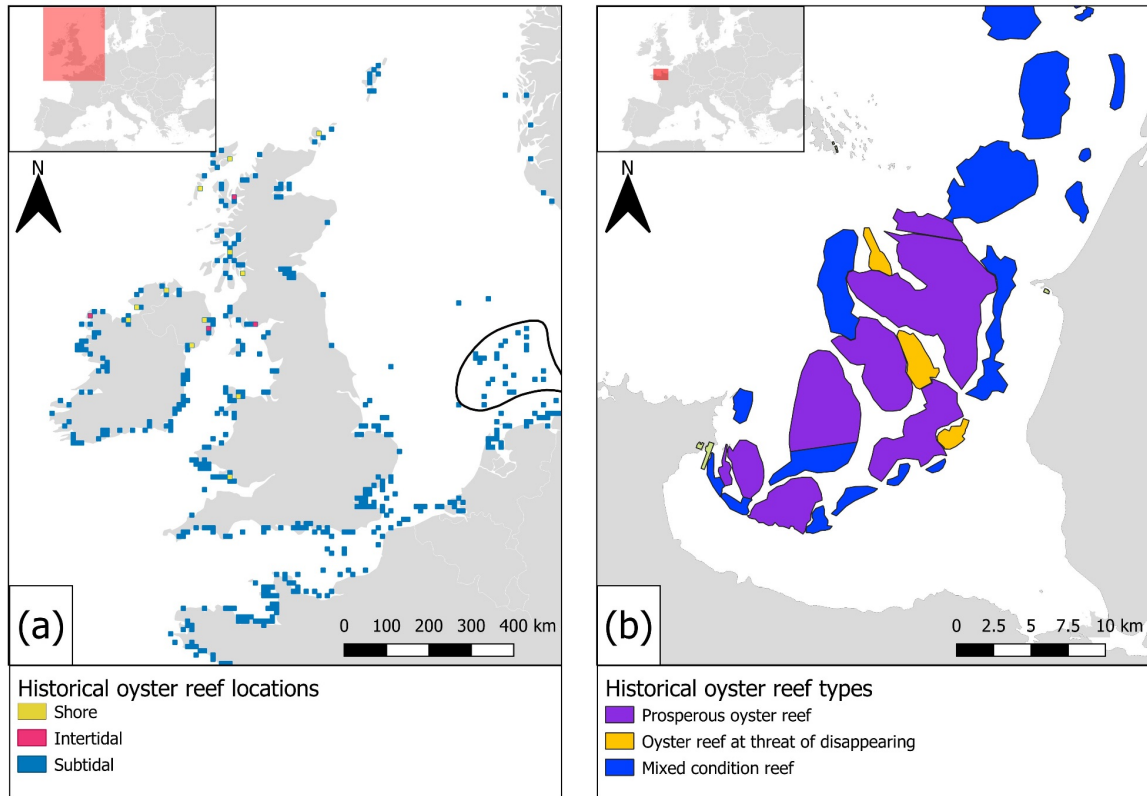


Figure S3. (a) Intertidal, shore and subtidal records of oyster reef habitat. (b) Example of oyster habitat mapped in the Bay of Cancale (Joubin and Guérin-Ganivet 2009, originally published 1910), detailing the extent and positioning of prosperous, threatened and mixed condition oyster habitat along the coast of France. Base map: European Environment Agency (2017).

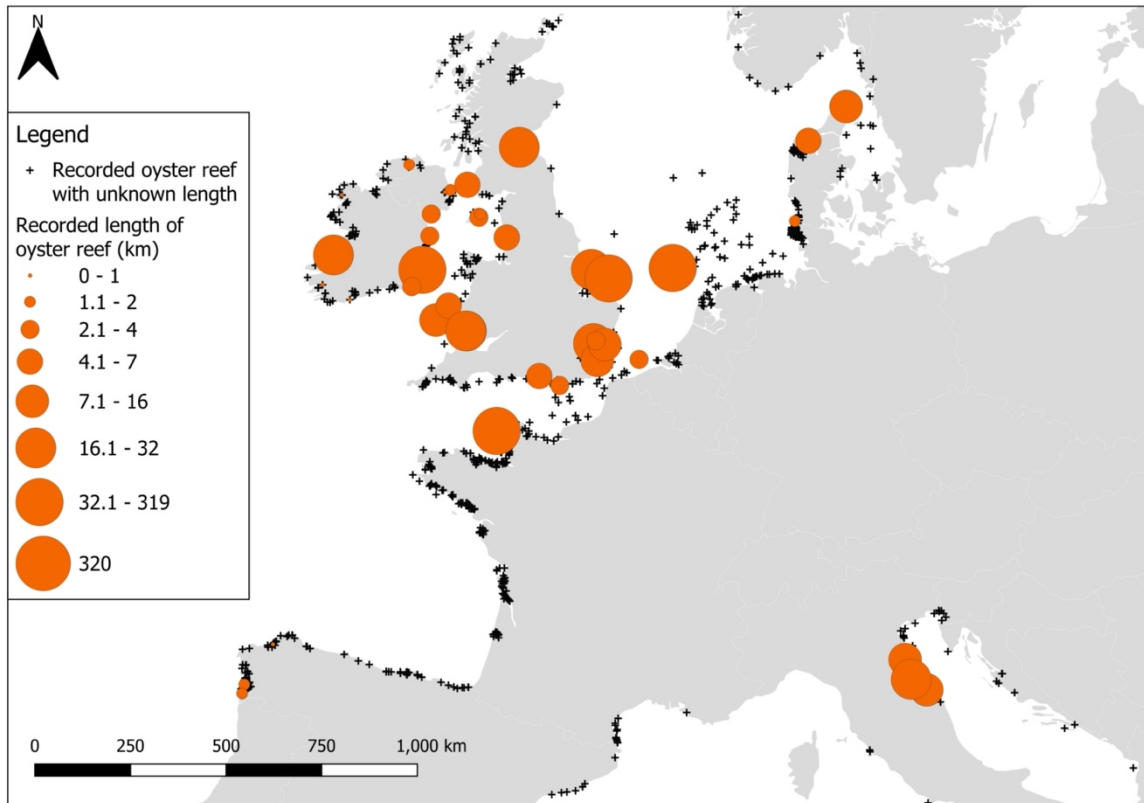


Figure S4. Recorded length (km, orange circles) of described oyster reefs. The crosses indicate records of reefs of unknown length. Base map: European Environment Agency (2017).

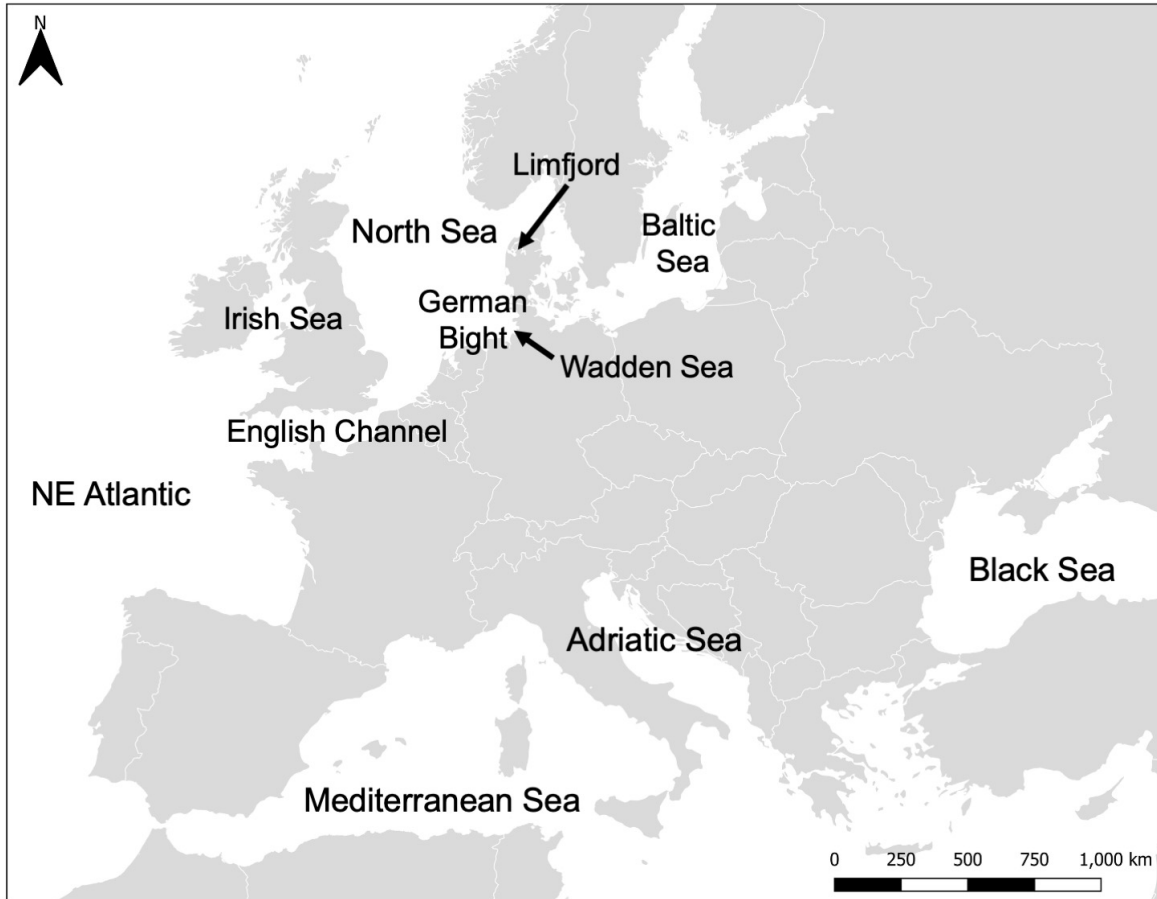


Figure S5. The locations of seas and sea basins referred to in the manuscript. Base map: European Environment Agency (2017).

Supporting tables:

Table S1. Species historically associated with oyster beds. Includes IUCN Species Redlist Classification and population trend as reported by the IUCN in the IUCN Red List (<https://www.iucnredlist.org/>), accessed 16th May 2024. No reported classification indicates the species is not yet assessed. Data sourced from: Beckmann (1800); Ellis J (1754); Eyton TC (1858); Henke D (1743); Krøyer H (1837); Martin WCL (1850); Möbius KA (1877); Möbius KA (1893); Pennant T (1776); Smellie W (1790); von Hamm W (1881); Wilmsen FP (1831).

Taxonomic classification (Phylum, Class, Species)	IUCN Species Redlist Classification
Annelida	
Polychaeta	
<i>Amphictene auricoma</i> (O.F. Müller, 1776)	
<i>Arenicola marina</i> (Linnaeus, 1758)	
<i>Branchiomma bombyx</i> (Dalyell, 1853)	
<i>Bylgides sarsi</i> (Kinberg in Malmgren, 1866)	
<i>Dodecaceria concharum</i> Örsted, 1843	
<i>Eulalia viridis</i> (Linnaeus, 1767)	
<i>Lanice conchilega</i> (Pallas, 1766)	
<i>Lepidonotus squamatus</i> (Linnaeus, 1758)	
<i>Neoamphitrite figulus</i> (Dalyell, 1853)	
<i>Nephtys caeca</i> (Fabricius, 1780)	
<i>Nereis noctiluca</i> Linnaeus, 1761	
<i>Nereis pelagica</i> Linnaeus, 1758	
<i>Nicolea zostericola</i> Örsted, 1844	
<i>Pherusa plumosa</i> (Müller, 1776)	
<i>Phyllodoce maculata</i> (Linnaeus, 1767)	
<i>Sabellaria alveolata</i> (Linnaeus, 1767)	
<i>Sabellaria spinulosa</i> (Leuckart, 1849)	
<i>Scoloplos armiger</i> (Müller, 1776)	
<i>Spirobranchus triqueter</i> (Linnaeus, 1758)	
<i>Sthenelais boa</i> (Johnston, 1833)	
<i>Thelepus cincinnatus</i> (Fabricius, 1780)	
Arthropoda	
Copepoda	
<i>Centropages hamatus</i> (Lilljeborg, 1853)	
<i>Paracalanus parvus</i> (Claus, 1863)	
<i>Temora longicornis</i> (Müller O.F., 1785)	
Malacostraca	
<i>Abludomelita obtusata</i> (Montagu, 1813)	
<i>Aega psora</i> (Linnaeus, 1758)	
<i>Ampelisca brevicornis</i> (Costa, 1853)	

Ampelisca tenuicornis Liljeborg, 1856
Aora gracilis (Spence Bate, 1857)
Athanas nitescens (Leach, 1814 [in Leach, 1813-1815])
Bathyporeia pilosa Lindström, 1855
Cancer pagurus Linnaeus, 1758
Caprella linearis (Linnaeus, 1767)
Carcinus maenas (Linnaeus, 1758)
Corystes cassivelaunus (Pennant, 1777)
Crangon allmanni Kinahan, 1860
Crangon crangon (Linnaeus, 1758)
Dexamine spinosa (Montagu, 1813)
Diastylis rathkei (Krøyer, 1841)
Diastylis spinulosa Heller, 1875
Ebalia cranchii Leach, 1817 [in Leach, 1815-1875]
Galathea intermedia Lilljeborg, 1851
Galathea strigosa (Linnaeus, 1761)
Gammaropsis nitida (Stimpson, 1853)
Gammarus locusta (Linnaeus, 1758)
Gastrosaccus sanctus (Van Beneden, 1861)
Homarus gammarus (Linnaeus, 1758) LC Stable
Hyas araneus (Linnaeus, 1758)
Hyas coarctatus Leach, 1815 [in Leach, 1815-1875]
Idotea balthica (Pallas, 1772)
Iphimedia obesa Rathke, 1843
Janira maculosa Leach, 1814
Liocarcinus holsatus (JC Fabricius, 1798)
Macropodia rostrata (Linnaeus, 1761)
Metalpheus rostratipes (Pocock, 1890)
Nebalia biipes (Fabricius, 1780)
Pagurus bernhardus (Linnaeus, 1758)
Palaemon adpersus Rathke, 1836
Pandalus montagui Leach, 1814 [in Leach, 1813-1815]
Phoxocephalus holbolli (Krøyer, 1842)
Pisidia longicornis (Linnaeus, 1767)
Processa edulis (Risso, 1816)

Pycnogonida

Callipallene brevirostris (Johnston, 1837)
Pycnogonum litorale (Strøm, 1762)

Thecostraca

Balanus balanus (Linnaeus, 1758)
Balanus crenatus Bruguière, 1789
Sacculina carcini Thompson, 1836
Verruca stroemia (O.F. Müller, 1776)

Bryozoa

Gymnolaemata

- Alcyonidioides mytili* (Dalyell, 1848)
- Alcyonidium gelatinosum* (Linnaeus, 1761)
- Alcyonidium parasiticum* (Fleming, 1828)
- Alcyonium digitatum* Linnaeus, 1758
- Caberea ellisii* (Fleming, 1814)
- Crisularia plumosa* (Pallas, 1766)
- Electra pilosa* (Linnaeus, 1767)
- Scrupocellaria scrupea* Busk, 1851

Stenolaemata

- Hornera lichenoides* (Linnaeus, 1758)
- Stigmatoechos violacea* (M.Sars, 1863)

Chaetognatha

Sagittoidea

- Sagitta bipunctata* Quoy & Gaimard, 1827

Chordata

Appendicularia

- Oikopleura (Vexillaria) dioica* Fol, 1872

Ascidiacea

- Styela rustica* Linnaeus, 1767

Aves

- Haematopus ostralegus* Linnaeus, 1758 NT Decreasing

Chondrostei

- Acipenser sturio* Linnaeus, 1758 CR Decreasing

Elasmobranchii

- Dasyatis pastinaca* (Linnaeus, 1758) VU Decreasing
- Myliobatis aquila* (Linnaeus, 1758) CR Decreasing
- Raja clavata* Linnaeus, 1758 NT Decreasing

Mammalia

- Phoca vitulina* Linnaeus, 1758 LC Unknown

Teleostei

- Agonus cataphractus* (Linnaeus, 1758) LC Increasing
- Balistes vetula* Linnaeus, 1758 NT Decreasing
- Carapus acus* (Brünnich, 1768) LC Unknown
- Hippocampus hippocampus* (Linnaeus, 1758) DD
- Limanda limanda* (Linnaeus, 1758) LC Increasing
- Ophidion* spp. LC/DD
- Pholis gunnellus* (Linnaeus, 1758)
- Pleuronectes platessa* Linnaeus, 1758 LC Increasing
- Pomatoschistus minutus* (Pallas, 1770) LC Stable
- Syngnathus acus* Linnaeus, 1758 LC Unknown

Cnidaria

Anthozoa

- Alcyonium gelatinosum*

Metridium senile (Linnaeus, 1761)
Sagartia viduata (Müller, 1778)
Urticina crassicornis (Müller, 1776)

Asciacea

Molgula sp.

Hydrozoa

Calycella syringa (Linnaeus, 1767)
Clytia hemisphaerica (Linnaeus, 1767)
Dynamena pumila (Linnaeus, 1758)
Ectopleura larynx (Ellis & Solander, 1786)
Eudendrium arbuscula Wright, 1859
Eudendrium rameum (Pallas, 1766)
Gonothyrea loveni (Allman, 1859)
Halecium halecinum (Linnaeus, 1758)
Halecium tenellum Hincks, 1861
Hydractinia echinata (Fleming, 1828)
Hydrallmania falcata (Linnaeus, 1758)
Laomedea flexuosa Alder, 1857
Leuckartiara octona (Fleming, 1823)
Obelia dichotoma (Linnaeus, 1758)
Opercularella lacerata (Johnston, 1847)
Podocoryna carnea M. Sars, 1846
Rhizocaulus verticillatus (Linnaeus, 1758)
Sertularella polyzonias (Linnaeus, 1758)
Sertularia argentea Linnaeus, 1758
Thuiaria thuja (Linnaeus, 1758)
Tubularia indivisa Linnaeus, 1758

Ctenophora

Tentaculata

Pleurobrachia pileus (O. F. Müller, 1776)

Echinodermata

Asteroidea

Asterias rubens Linnaeus, 1758
Astropecten irregularis (Pennant, 1777)
Crossaster papposus (Linnaeus, 1767)
Pontaster tenuispinus (Düben & Koren, 1846)

Echinoidea

Echinocardium cordatum (Pennant, 1777)
Echinocardium flavescens (O.F. Müller, 1776)
Echinus esculentus Linnaeus, 1758
Psammechinus miliaris (P.L.S. Müller, 1771)

NT

Holothuroidea

Paraleptopentacta elongata (Düben & Koren, 1846)

Ophiuroidea

Amphipholis squamata (Delle Chiaje, 1828)
Amphiura filiformis (O.F. Müller, 1776)
Ophiothrix fragilis (Abildgaard in O.F. Müller, 1789)
Ophiura albida Forbes, 1839
Ophiura sarsii Lütken, 1855

Entoprocta

Pedicellina cernua (Pallas, 1774)
Pedicellina nutans Dalyell, 1848

Foraminifera

Globothalamea

Ammonia beccarii (Linnaeus, 1758)
Elphidium striatopunctatum (Fichtel & Moll, 1798)
Haynesina depressula (Walker & Jacob, 1798)
Protoglobulimina pupoides (d'Orbigny, 1846)
Riminopsis asterizans (Fichtel & Moll, 1798)

Nodosariata

Fissurina marginata (Montagu, 1803)
Reusoolina laevis (Montagu, 1803)

Mollusca

Bivalvia

Abra alba (W. Wood, 1802)
Anomia ephippium Linnaeus, 1758
Cerastoderma edule (Linnaeus, 1758)
Chamelea gallina (Linnaeus, 1758)
Ensis ensis (Linnaeus, 1758)
Heteranomia squamula (Linnaeus, 1758)
Hiatella rugosa (Linnaeus, 1767)
Macoma balthica (Linnaeus, 1758)
Mimachlamys varia (Linnaeus, 1758)
Modiolus modiolus (Linnaeus, 1758)
Mya arenaria Linnaeus, 1758
Mya truncata Linnaeus, 1758
Mysia undata (Pennant, 1777)
Mytilus edulis Linnaeus, 1758
Nucula nucleus (Linnaeus, 1758)
Parvicardium pinnulatum (Conrad, 1831)
Pecten maximus (Linnaeus, 1758)
Phaxas pellucidus (Pennant, 1777)
Tellimya ferruginosa (Montagu, 1808)
Varicorbula gibba (Olivi, 1792)
Venerupis corrugata (Gmelin, 1791)

Gastropoda

Acanthodoris pilosa (Abildgaard [in Müller], 1789)
Ancula gibbosa (Risso, 1818)

Buccinum undatum Linnaeus, 1758
Coryphella verrucosa (M. Sars, 1829)
Dendronotus frondosus (Ascanius, 1774)
Duvaucelia plebeia (G. Johnston, 1828)
Euspira nitida (Donovan, 1803)
Littorina littorea (Linnaeus, 1758)
Littorina obtusata (Linnaeus, 1758)
Neptunea antiqua (Linnaeus, 1758)
Nucella lapillus (Linnaeus, 1758)
Ocenebra erinaceus (Linnaeus, 1758)
Polycera quadrilineata (O. F. Müller, 1776)
Propebela turricula (Montagu, 1803)
Tritia reticulata (Linnaeus, 1758)
Tritonia hombergii Cuvier, 1803
Turritella unguolina (Linnaeus, 1758)

Polyplacophora

Lepidochitona cinerea (Linnaeus, 1767)

Platyhelminthes

Eurylepta cornuta (Müller OF, 1776)

Porifera

Demospongiae

Cliona celata Grant, 1826

Halichondria (Halichondria) panicea (Pallas, 1766)

Grand Total

Table S2: Trophic guild classifications and associated definitions as assigned to each species associated with *O. edulis* habitat using published descriptions from WoRMs and MarLIN databases.

Trophic guild	Definition
Primary producer	Photosynthetic marine plants and algae
Deposit feeder	Moves in or on sediment digesting sediment and/or eating food on or in. Includes detritivores (dead bacteria and plants) for this purpose
Filter feeder	Suspension feeder that pumps water
Suspension feeder	Removes particles from water column via capture (active)
Parasite	An organism that obtains food and other requirements from a host organism. The host does not benefit from the association and may be harmed by it
Herbivore	Eats plants or algae via grazing or biting
Omnivore	Predator/grazer that eats animals and plants or algae (included scavengers- consuming carcasses of dead animals) for this purpose)
Carnivore	Predator that consumes primarily animals

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Statistical Source Data:

For Figures S1-S3, Statistical Source Data is as per Figure 1 in the main manuscript.
For Figure S4, Statistical Source Data is as per Figure 2 in the main manuscript.