

Article

Diversity of Marine and Brackish Macrophytes in the Port-Cros National Park (Provence, France, Mediterranean Sea): Taxa and Research Effort over Space and Time

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Abstract: The terrestrial and marine Port-Cros National (PCNP) was established in 1963; it was then made up only of the Archipelago of Port-Cros. Since 2012, it has been extended to include a vast land and sea area, including not only islands but also part of the mainland, the new PCNP (N-PCNP); the marine core area and the adjacent marine area cover approximately 120,000 ha and extend over 63 km as the crow flies, from east to west. Taxon richness is just one descriptor of biodiversity among others (e.g., functional and ecosystem diversity), and is far from being the most reliable one; however, it deserves to be taken into consideration, provided that certain prerequisites are met, because it constitutes a convenient measure of, e.g., the research effort and the diversity of habitats. The number of reported macrophyte taxa amounts to 502: 73 green algae, 316 red algae, 104 brown algae and 9 magnoliophyta and other taxa. Two new combinations are proposed: *Ericaria brachycarpa* var. *claudiae* and *Gongolaria montagnei* var. *compressa*. This gamma species diversity is far from being exceptionally high, but rather is within the norm for the Mediterranean, if we take into account the size of the area considered. The number of reported taxa per site is highly heterogeneous throughout the N-PCNP area; it is, as expected, correlated with the number of studies per site. The research effort peaked in the 1970–1980s, and then irregularly declined, which may seem surprising in this era of biodiversity launched at the 1992 Rio Summit. The exceptionally extensive database available, covering more than a century, provides the basis for a critical analysis of the concept of biodiversity, as proclaimed by the general public and the ‘greens’, which can be naive or biased, and of the concept of ‘heritage value species’, which the authors of this article consider to be a ‘toxic concept’, as opposed to ‘ordinary biodiversity’, which enables ecosystem functioning. However, this database, straddling both areas highly impacted by humans (coastal development, tourist resorts) and areas that are effectively protected, does not highlight obvious changes over time.

Keywords: brown algae; *Ericaria brachycarpa* var. *claudiae*; *Gongolaria montagnei* var. *compressa*; green algae; macrophytes; national park; Provence; red algae; research effort; seagrasses



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1. Introduction

A checklist of benthic macroalgae of the Gulf of Hyères and Hyères Islands (Porquerolles Island, Port-Cros Archipelago and Le Levant Island; Provence, France, Mediterranean Sea) was published by Belsher et al. [1]. Since then, considerable changes have taken place in the taxonomy of macroalgae, and numerous works have led to the discovery of hitherto unreported taxa.

We define macrophytes as multicellular photosynthetic organisms (MPOs). Here, we include within macrophytes non-cellular taxa, with millions of nuclei within a common cytoplasm, such as *Caulerpa*, and unicellular species forming large colonies, such as *Palmophyllum* and *Chrysoreinhardia*.

Macrophytes do not constitute a taxon but a customary, polyphyletic ensemble. They include some 'green algae' (Chlorobionta), Charophyta, some Magnoliophyta (seagrasses) (Viridiplantae), red algae (Rhodobionta) and brown algae (Phaeophyceae). Green algae, Charophyta, seagrasses and red algae belong to the kingdom Archaeplastida, while brown algae (Phaeophyceae) belong to the kingdom Stramenopiles [2,3].

The Port-Cros National Park (PCNP) (Provence, France, Mediterranean Sea) was established in 1963. It originally encompassed the island of Port-Cros and the nearby island and islets (Bagaud Island, La Gabinière Islet and Le Rascas Islet), i.e., the Port-Cros Archipelago, situated about 8 km off the mainland coast of eastern Provence. In addition to the land areas of the island and islets, the PCNP included a 600 m wide belt of sea, corresponding to ~1300 ha in surface area, surrounding the archipelago. The PCNP is one of the oldest terrestrial and marine national parks in the Mediterranean area [4,5].

Following the reconfiguration of the national parks by the French legislation of 2006, the PCNP engaged, between 2012 and 2016, in a major redefinition and extension of its territory; the new Port-Cros National Park (N-PCNP), established in 2016 (Figure 1), includes the Port-Cros Archipelago and Porquerolles Island as core areas (both terrestrial and marine), a vast adjacent marine area (AMA) including the gulfs of Giens and Hyères and extending seawards to the edge of the continental shelf (118,600 ha), and a discontinuous continental area, the adhesion area (AA) including five municipalities (*communes* in French; Figure 1). The municipalities of the AA have voluntarily joined the N-PCNP through the signing of a charter which defines the objectives of the national park regarding the conservation of the natural and cultural heritage and sustainable development [5,6]. Some other municipalities of the possible adhesion area (PAA) chose not to join the N-PCNP. Only part of the surface area of the municipalities, both those joining and those not joining the N-PCNP, belongs to the PAA (green limits, Figure 1). It is important to note that, whether or not a municipality has joined the park, the marine area located off its coastline does indeed belong to the AMA of the N-PCNP: the AA is therefore discontinuous, while the AMA is continuous. According to French law, the marine area located off the coast of a municipality is not part of the territory of this municipality.

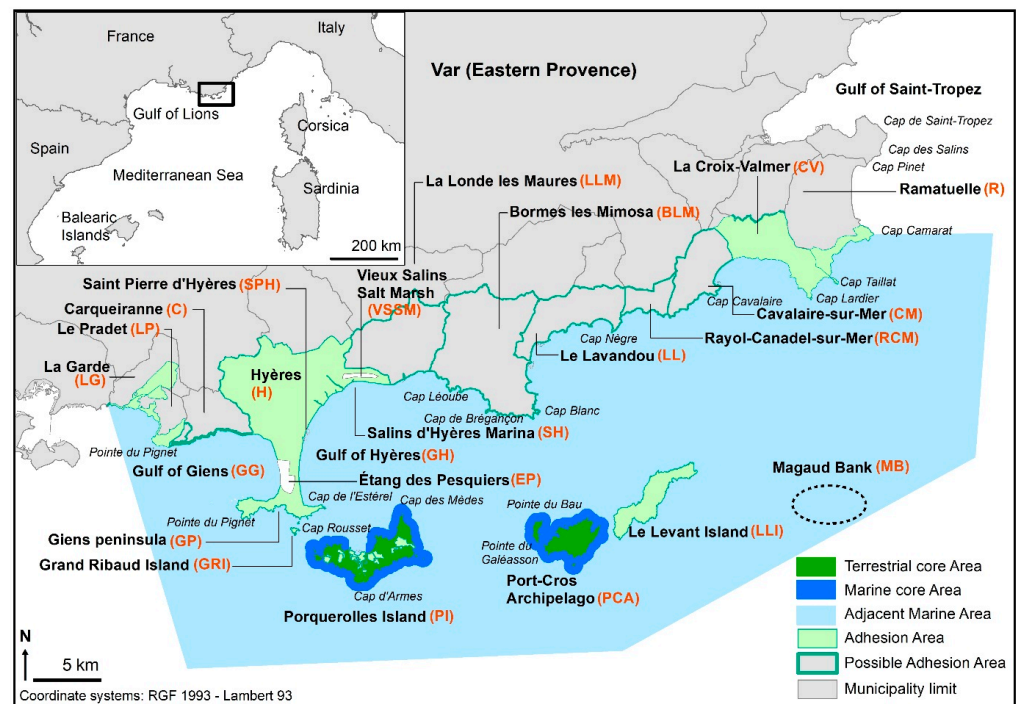


Figure 1. The new Port-Cros National Park (N-PCNP), with terrestrial and marine core areas, the adjacent marine area, the adhesion Area and the abbreviations used (in orange) for the localities and sites taken into consideration.

Some protected areas in the Mediterranean, especially marine protected areas (MPAs), are no more than ‘paper parks’, i.e., fictitious protected areas, or ‘mist parks’, i.e., protected areas intended to fulfill the international commitments of states, often immense, having a real existence (director, premises, officials), but not implementing any real management measures involving, where necessary, constraints for some of the users [7–12]. In contrast with paper parks and mist parks, the PCNP, then the N-PNPC, are true protected areas [5,13]: in particular, since their creation, they have had a scientific council, a scientific strategy, a management plan, a strong scientific research effort based on the close collaboration between park staff and independent academic scientists, and of course the strict application of management measures which constitute constraints for some users whenever necessary [12–16].

2. Materials and Methods

We follow Boudouresque [2] for the taxonomy of higher taxa, Cormaci et al. [17] for Chlorobionta, Cormaci et al. [18–20] and Guiry and Guiry [21] for Rhodobionta and Cormaci et al. [22] for Phaeophyceae. In the few cases where we do not follow the treatment of these authors, we indicate it; we have also taken into account some subsequent articles (e.g., [23]). For each taxon, after the currently accepted name and the order (in parentheses), the names used by the cited authors, if different, are mentioned (in square brackets); such names are followed by correct authorities which could not correspond to those published by authors in the respective articles.

We have examined all of the literature dealing with marine macrophytes of the N-PCNP that we are aware of. This literature has been published in scientific journals (including the PCNP journal, *Scientific Reports of Port-Cros National Park*, 35 volumes of which have been published since its launch in 1975); it also includes unpublished reports (grey literature), kept at the PCNP headquarters (in Hyères-les-Palmiers) and in various libraries, including that of the Macrophyte platform of the MIO (Mediterranean Institute of Oceanography), at Aix-Marseille University [5,16]. Whenever publications clearly constitute duplicates (e.g., a report, a communication at a congress and the corresponding scientific article, or two articles strictly based on the same dataset), for example [24,25], or [26,27], we considered only one of them. Similarly, we did not consider checklists that simply repeat articles cited elsewhere (e.g., [28]). Of course, some duplicates may have escaped our attention, but their effect on the interpretation of the dataset is probably negligible.

Gut contents of herbivorous sea urchins (*Arbacia lixula* (Linnaeus, 1758), *Centrostephanus longispinus* (Philippi, 1845), *Paracentrotus lividus* (Lamarck, 1816) and *Psammechinus microtuberculatus* (Blainville, 1825)) have constituted a valuable source of information [29–32]. Some species were only or mainly recorded through the study of gut contents (e.g., the red alga *Taenioma nanum*).

The starting point of our literature research is 1900. Older records may exist. However, eastern Provence was little frequented by botanists in the 18th and 19th centuries. Moreover, when they exist, records were not accurately localized. In the case of Fucales (brown algae), Aurélie Blanfuné and Thierry Thibaut have explored (as far as N-PCNP is concerned) the literature and the herbaria prior to 1900 [33–35]: the rare records concern the zone outside the N-PNPC, with the exception of *Ericaria crinita* (Porquerolles Island). The oldest records are therefore those of Mouret in 1911 [36]. Marcellin Mouret (1881–1915) was a French soldier and botanist; he was posted to Martinique (French West Indies), Morocco and French Indochina and managed to assemble herbaria completed with notes and drawings, despite his military duties; during World War I, Lieutenant Mouret was wounded in August 1914, then was killed in March 1915 while launching an assault at the head of his company [37].

For each taxon, we have indicated the localities where it was observed from west to east, first for the mainland (La Garde LG through Ramatuelle R), then for the islands (Grand Ribaud Island GRI through Le Levant Island LLI). Magaud bank MB is a former island submerged towards the end of the Holocene transgression (Figure 1). Most localities correspond to a municipality (in French *commune*, the smallest administrative division

in France), with the exception of Hyères (H), a very large *commune*, where a number of particular sites have been distinguished: EP, GP, SPH, SH, VSMM and the islands GRI, PI, PCA and LLI (Figure 1). A few records, without indication of locality, have been labelled ‘NPCNP’.

In order to assess the variations in research effort over space and time, we have considered the number of ‘items’. An item is a record, at a given locality or site (see Figure 1), of a given taxon, by a given author in a given reference (year): item = taxon × locality (or site) × author (reference). Within each group, taxa are listed in alphabetical order.

3. Results

3.1. Green Algae (*Chlorobionta*)

Acetabularia acetabulum (Linnaeus) P.C. Silva (Dasycladales) [*Acetabularia mediterranea* J.V. Lamouroux *nom. illeg.*]. GP [38–41], SPH [42], EP [43,44], SH [45], CM [40], CV [40], PI [38,46,47], PCA [1,32,38,48–56], LLI [38].

Anadyomene stellata (Wulfen in Jacquin) C. Agardh (Cladophorales). CV [40], R [40], PI [46,57], PCA [1,49,51,58,59].

Blastophysa rhizopus Reinke (*incertae sedis*) [*Blastophysa polymorpha* Kjellman]. PCA [1,31,48,50].

Blidingia chadefaudii (J. Feldmann) Bliding (Ulvales). CM [40], PI [46], PCA [1].

Bryopsis corymbosa J. Agardh (Bryopsidales). SPH [60], PCA [49,51].

Bryopsis cupressina J.V. Lamouroux var. *adriatica* (J. Agardh) M.J. Wynne (Bryopsidales) [*Bryopsis adriatica* (J. Agardh) Frauenfeld]. PCA [1,49,61].

Bryopsis duplex De Notaris (Bryopsidales) [as *B. balbisiana* J.V. Lamouroux in [1]]. GP [39], PCA [1,61]. According to Cormaci et al. [17], *B. balbisiana* is a taxon *inquirendum*.

Bryopsis feldmannii Gallardo et G. Furnari (Bryopsidales) [*Bryopsis cupressoides* Kützing non J.V. Lamouroux]. PCA [52], LLI [36,38].

Bryopsis hypnoides J.V. Lamouroux (Bryopsidales) [*Bryopsis monoica* Funk]. GP [41], PCA [1,49,51,61].

Bryopsis muscosa J.V. Lamouroux (Bryopsidales). SPH [42], SH [45,62], PCA [1].

Bryopsis penicillum Meneghini (Bryopsidales). PCA [1].

Bryopsis plumosa (Hudson) C. Agardh (Bryopsidales). C [63], GP [39], SPH [42], PCA [49,59].

Bryopsis secunda J. Agardh (Bryopsidales). C [36], LL [36].

Caulerpa cylindracea Sonder (Bryopsidales) [*Caulerpa racemosa* (Forsskål) J. Agardh var. *cylindracea* (Sonder) Verlaque et al. Misidentified as *Caulerpa racemosa*]. GG [64], GP [41,64], GH [65,66], CM [67], CV [68], R [67,68], PI [47,65,69], PCA [54–56,59,70], LLI [71,72], NPCNP [73].

Caulerpa prolifera (Forsskål) J.V. Lamouroux (Bryopsidales). GH [65], PI [59,65,69,74,75], PCA [75].

Caulerpa taxifolia (Vahl) C. Agardh (Bryopsidales). LG [65,76], LP [65,77–79], GP [41,80], GH [65], LLM [79], CV [68], R [79], PI [47,65,69,79,81], PCA [70,79,82–88], LLI [72,89]. Successfully eradicated from the Port-Cros Archipelago [79,90].

Chaetomorpha ligustica (Kützing) Kützing (Cladophorales) [*Chaetomorpha capillaris* var. *crispa* Feldmann, *C. tortuosa* Kützing *nom. illeg.*]. LP [36], C [36], GP [36,39], CV [40], PCA [1].

Chaetomorpha linum (O.F. Müller) Kützing (Cladophorales) [*Chaetomorpha aerea* (Dillwyn) Kützing]. C [63], GG [38], EP [36,38,43,44], GP [39,41], SPH [42], SH [45], VSSM [43,44], CV [40], R [40], PI [36,38,46], PCA [1,49,51,52].

Cladophora albida (Nees) Kützing (Cladophorales) [*Cladophora refracta* Kützing]. GP [39], BLM [36].

Cladophora coelothrix Kützing (Cladophorales) [*Cladophora repens* Harvey]. GP [39,41], GH [38], PCA [1,49,52].

Cladophora dalmatica Kützing (Cladophorales). GP [39], SPH [60], BLM [36], PCA [49,51].

Cladophora fracta (O.F. Müller ex Vahl) Kützing. LP [36], EP [36,38], VSSM [36].

- Cladophora hutchinsiae* (Dillwyn) Kützing (Cladophorales). LP [36], C [36], GG [38], GP [36,38], SPH [42], PCA [1], LLI [36,38].
- Cladophora laetevirens* (Dillwyn) Kützing (Cladophorales). GP [39,41], SPH [60], PI [46], PCA [1,49].
- Cladophora lehmanniana* (Lindenberg) Kützing (Cladophorales) [*Cladophora utriculosa* Kützing]. GP [41], GH [38], SPH [42,62], SH [45], PCA [1].
- Cladophora prolifera* (Roth) Kützing (Cladophorales). LP [36], C [63], GP [36,38,39,41], SPH [42,60,62], SH [45,62], CM [40], CV [40], PCA [1,30,48,49].
- Cladophora rupestris* (Linnaeus) Kützing (Cladophorales). GP [39,41].
- Cladophora sericea* (Hudson) Kützing (Cladophorales). C [36], SPH [42], BLM [36], PI [46].
- Cladophora vagabunda* (Linnaeus) Hoek (Cladophorales). PCA [1].
- Cladophoropsis membranacea* (Hofman Bang ex C. Agardh) Børgesen (Cladophorales) [Misidentified as *Cladophoropsis modonensis* (Kützing) Reinbold]. PCA [49]. See Cormaci et al. [17] for the confusion with *C. modonensis*.
- Codium bursa* (Linnaeus) C. Agardh. LP [91], C [40], GG [39,92], GP [36,38–41], GH [93], CM [40], CV [40], R [40,94], PI [46,95,96], PCA [1,32,49,51,52,59,97,98], LLI [36,38,72].
- Codium coralloides* (Kützing) P.C. Silva (Bryopsidales). PCA [1,48].
- Codium effusum* (Rafinesque) Delle Chiaje (Bryopsidales). GP [40], CV [40], R [94], PI [46,96], PCA [1,49,54–56].
- Codium fragile* (Suringar) Hariot (Bryopsidales). CV [40], PI [46,99], PCA [1,98].
- Codium vermilara* (Olivieri) Delle Chiaje (Bryopsidales). C [40], GP [40], CV [40], PI [46], PCA [1].
- Dasycladus vermicularis* (Scopoli) Krasser (Dasycladales). LP [36], GP [36,38,39,41], LL [100], CM [40], CV [40,68], PI [46,57], PCA [1,49,51,58].
- Epicladia flustrae* Reinke (Ulvaes) [*Entocladia flustrae* (Reinke) W.R. Taylor]. PCA [61].
- Flabellia petiolata* (Turra) Nizamuddin (Bryopsidales) [*Udotea desfontainii* (J.V. Lamouroux) Decaisne, *U. petiolata* (Turra) Børgesen]. LP [36], C [40,63], GG [39,92], GP [36,39–41], GH [93], SPH [60], CM [40], CV [40], R [40,94,101], PI [46,47,57,59,95,96], PCA [1,29,30,39,48,49,52,54–56,59,61,97,102,103].
- Gomontia polyrhiza* (Lagerheim) Bornet et Flahault (Ulotrionales). PCA [61].
- Halicystis parvula* Schmitz ex Murray (Bryopsidales). As *Derbesia tenuissima* (Moris et De Notaris) P.L. Crouan et H.M. Crouan: GP [41], SPH [42], SH [45,62], CV [40], PCA [49]. As *Halicystis parvula*: GP [39], PCA [1,48,49,61]. *D. tenuissima* is the sporogone of *Halicystis parvula* (the gametogone). Gametogone and sporogone are usually referred to by traditional botanists as gametophyte and sporophyte, respectively (see Boudouresque [2]).
- Halimeda tuna* (Ellis et Solander) J.V. Lamouroux (Bryopsidales). LP [91], C [40], GP [36,38–40], GH [93], LL [36], CM [40], CV [40], R [94,101], PI [46,47,57,59,96], PCA [1,48,49,54,55,59,97], LLI [36,38,56,72].
- Lichaete battersii* (Hoek) M.J. Wynne (Cladophorales) [*Cladophora battersii* Hoek]. PCA [52].
- Lichaete echinus* (Biasoletto) M.J. Wynne (Cladophorales) [*Cladophora echinus* (Biasoletto) Kützing]. GP [41], PCA [1,49,97].
- Lichaete pellucida* Hudson M.J. Wynne (Cladophorales) [*Cladophora pellucida* (Hudson) Kützing]. GP [36,38,39,41,104], BLM [36], PI [46], PCA [1,48,49,59].
- Microdictyon umbilicatum* (Vellay) Zanardini (Cladophorales). PCA (Marc Verlaque, unpublished record, October 2019).
- Ochlochaete hystrix* Thwaites (Ulvaes) [*Ochlochaete ferox* Huber]. PCA [31,52,61].
- Ostreobium quekettii* Bornet et Flahault (Bryopsidales). PCA [61], MB [105].
- Palmophyllum crassum* (Naccari) Rabenhorst (Palmophyllales). GP [39,40,104], CV [40], R [40], PI [59,96], PCA [1,48,54–56,97,102], MB [106].
- Pedobesia simplex* (Meneghini ex Kützing) M.J. Wynne et F. Leliaert (Bryopsidales) [*Derbesia lamourouxii* (J. Agardh) Solier, *Pedobesia lamourouxii* (J. Agardh) Feldmann et al.]. C [36], GG [38], PI [46], PCA [1,30,32,61], LLI [36,38].

- Phaeophila dendroides* (P.L. Crouan et H.M. Crouan) Batters (Ulvales). GP [41], PCA [1,29,31,49,50,52,61,107].
- Pseudobryopsis myura* (J. Agardh) Berthold ex Oltmanns (Bryopsidales). PCA [1].
- Pseudochlorodesmis furcellata* (Zanardini) Børgesen (Bryopsidales). GG [39], GP [39,41], PI [46,96], PCA [1,29,30,48–52,54–56,61,107].
- Rhizoclonium riparium* (Roth) Harvey, *sensu* Leliaert et Boedeker (Cladophorales) [*Lola implexa* (Dillwyn) Hamel, *Rhizoclonium kernerii* Stockmayer, *R. kochianum* Kützing]. PCA [29,30,49,61,97].
- Siphonocladus pusillus* (C. Agardh ex Kützing) Hauck (Cladophorales). PCA [49,52].
- Ulothrix flacca* (Dillwyn) Thuret (Ulotrichales). GP [39].
- Ulva clathrata* (Roth) C. Agardh (Ulvales) [*Enteromorpha clathrata* (Roth) Greville, *E. ramulosa* (J.E. Smith) Carmichael]. GP [36,38], SPH [42,62], LL [36], LLI [36,38].
- Ulva compressa* Linnaeus (Ulvales) [*Enteromorpha compressa* (Linnaeus) Nees]. C [63], GP [39], SPH [42,62], SH [62], PI [46], PCA [1,53,61].
- Ulva intestinalis* Linnaeus (Ulvales) [*Enteromorpha intestinalis* (Linnaeus) Nees]. EP [38], SPH [42,62], SH [62], PI [46], LLI [38].
- Ulva lacinulata* (Kützing) Wittrock (Ulvales) [*Ulva rigida* C. Agardh]. C [63], EP [43,44], GP [39], SPH [42,62], SH [45], VSSM [43,44], PI [46], PCA [1,49,61]. Given the complexity of the taxonomy of the genus *Ulva*, the attribution of the citations under the name of *U. rigida* to *U. lacinulata*, as defined by Hughey et al. [108], is only a hypothesis.
- Ulva lactuca* Linnaeus (Ulvales) [*U. pseudorotundata* Cormaci, G. Furnari et Alongi, *U. rotundata* Bliding *nom. inval.*]. C [63], SPH [42,62], SH [45,62], PI [46], PCA [50,61]. Hughey et al. [108] demonstrated that the type of *U. rotundata* (= *U. pseudorotundata*) should be referred to as *U. lactuca*, a species therefore not to be excluded from the Mediterranean Sea.
- Ulva linza* Linnaeus (Ulvales) [*Enteromorpha linza* (Linnaeus) J. Agardh]. C [63], GH [38,62].
- Ulva polyclada* Kraft (Ulvales) [*Enteromorpha multiramosa* Bliding]. GP [41], PCA [49]. See Cormaci et al. [17] for synonymy.
- Ulva prolifera* O.F. Müller (Ulvales) [*Enteromorpha prolifera* O.F. Müller] J. Agardh]. PCA [61].
- Ulvella inflata* (Ercegović) R. Nielsen, C.J. O’Kelly et B. Wysor (Ulvales) [*Pseudodictyon inflatum* Ercegović, *Acrochaete inflata* (Ercegović) Gallardo et al.]. GP [41], PCA [29,52].
- Ulvella lens* P.L. Crouan et H.M. Crouan (Ulvales). PCA [49].
- Ulvella leptochaete* (Huber) R. Nielsen, C.J. O’Kelly et B. Wysor (Ulvales) [*Ectochaete leptochaete* (Huber) Wille]. GP [41], PCA [49].
- Ulvella major* (J. Feldmann) Cormaci, Furnari et Alongi (Ulvales) [*Endoderma majus* J. Feldmann]. PCA [1,49,97]. According to Guiry and Guiry [21], this taxon requires further investigation.
- Ulvella scutata* (Reinke) R. Nielsen, C.J. O’Kelly et B. Wysor (Ulvales) [*Pringsheimiella scutata* (Reinke) Marchewianka]. GP [41], PCA [1,29,30,48,52,107].
- Ulvella setchellii* P.J.L. Dangeard (Ulvales). PCA [1,49,51].
- Ulvella viridis* (Reinke) R. Nielsen, C.J. O’Kelly et B. Wysor (Ulvales) [*Entocladia viridis* Reinke, *Endoderma viride* (Reinke) De Toni, *Phaeophila viridis* (Reinke) Burrows]. GP [39,41], PCA [29,31,48,49,51,52,61].
- Umbraulva dangeardii* Wynne et G. Furnari (Ulvales). GH [67].
- Valonia macrophysa* Kützing (Cladophorales). GH [93], R [94], PCA [1,39,48,61,97,102,107], NPCNP [73].
- Valonia utricularis* (Roth) C. Agardh (Cladophorales). GG [39], GP [36,38,39,41,104], CM [40], CV [40], R [40], PI [46], PCA [1,49,52,107], LLI [36,38].

3.2. Charophyta, Streptobionta

- Lamprothamnium papulosum* (K. Wallroth) J. Groves. EP [43,44].

3.3. Seagrasses (Magnoliophyta, Streptobionta)

Althenia filiformis Petit. VSSM [109].

Cymodocea nodosa (Ucria) Ascherson. C [40], GG [39,64,92,100,109,110], GP [39,40,64,80,109], GH [109], BLM [109], LL [100,109], CM [111], CV [40,68,109], R [101], PI [57,80,95,109], PCA [53,58,64,100,109,112–116], LLI [71,72,89]. The near disappearance of *C. nodosa* in the lagoon located behind the barrier reef of *Posidonia oceanica* in the Bay of Port-Cros was noted in 1997 by Meinesz et al. [116]; in 2002, they transplanted cuttings from another site at Port-Cros Island, the Bay of Port-Man; the operation was not successful [116].

Posidonia oceanica (Linnaeus) Delile. LG [27,117], LP [27,91,117,118], C [27,40,117,118], GG [27,39,92,100,110,117–119], GP [39,40,64,80,104,117,120], SPH [60], SH [64], GH [27,66,117,118,120], LLM [27,117,120], BLM [27,64,117], LL [27,64,100,117], RCM [27,117], CM [27,40,111,121], CV [27,40,64,68,94,117], R [27,68,94,101,111,117], GRI [117], PI [27,47,57,80,95,100,117,118,122,123], PCA [27,30–32,53,58,64,98,100,113,115,117,124–130], LLI [27,71,72,89,100,117].

Ruppia maritima Linnaeus [*Ruppia cirrhosa* (Petagna) Grande, as *R. spiralis* Linnaeus ex Dumortier (a misidentification for *R. cirrhosa*)]. EP [43,44,109,131], VSSM (43,44,109,131).

Stuckenia pectinata (Linnaeus) Börner [*Potamogeton pectinatus* Linnaeus)]. EP [109], VSSM [109].

Zostera noltei Hornemann [*Nanozostera noltei* (Hornemann) Tomlinson et Posluszny]. GG [100,109], GP [109], VSSM [44], LLM [109], BLM [109], CV [109], PI [80,109], PCA [58,61,98,109,112,113,115], LLI [89]; not found by [72]. The disappearance of *Z. noltei* in the lagoon located behind the barrier reef of *Posidonia oceanica* in the Bay of Port-Cros was noted in 1997 by Meinesz et al. [116]. It also disappeared from the Port-Man Bay [53].

3.4. Red Algae (Rhodobionta, Kingdom Archaeplastida)

Acrochaetium microscopicum (Nägeli ex Kützing) Nägeli (Acrochaetiales) [*Acrochaetium crassipes* Børgesen) Børgesen]. GP [39], PCA [1,49,51,61].

Acrochaetium molinieri Coppejans et Boudouresque (Acrochaetiales). PCA [58,61,132].

Acrochaetium subpinnatum Bornet ex Hamel (Acrochaetiales). GP [39].

Acrochaetium trifilum (Buffham) Batters (Acrochaetiales). GP [39]. We follow Guiry and Guiry [21] in distinguishing this taxon.

Acrodiscus vidovichii (Meneghini) Zanardini (Halymeniales). CV [68], R [68], PI [96], PCA [1,48,49,102].

Acrosorium ciliolatum (Harvey) Kylin (Ceramiales) [*Acrosorium venulosum* (Zanardini) Kylin]. R [101], PCA [1,29,48,49,51,97].

Acrosymphyton purpuriferum (J. Agardh) G. Sjöstedt (Acrosymphytales). PCA [1,48,49,59].

Acrothamnion preissii (Sonder) E.M. Wollaston (Ceramiales). GP [41], CM [133], R [40,68,101,134], PCA [54,55], LLI [72,133], NPCNP [73].

Agissea harveyana (P.L. Crouan et H.M. Crouan ex J. Agardh) Pestana, Lyra, Cassano et Nunes (Peyssonneliales) [*Peyssonnelia harveyana* P.L. Crouan et H.M. Crouan ex J. Agardh]. GP [41], GH [93], PCA [1,48,49,97,135], NPCNP [73].

Agissea inamoena (Pilger) Pestana, Lyra, Cassano et Nunes (Peyssonneliales) [*Peyssonnelia inamoena* Pilger]. PCA [1,97,135].

Agissea orientalis (Weber van Bosse) Pestana, Lyra, Cassano et Nunes (Peyssonneliales) [*Peyssonnelia orientalis* (Weber van Bosse) Cormaci et G. Furnari]. CV [40], PCA [49,51,97].

Agissea stoechas (Boudouresque et Denizot) Pestana, Lyra, Cassano et Nunes (Peyssonneliales) [*Peyssonnelia stoechas* Boudouresque et Denizot]. PCA [58,97,135].

Aglaothamnion caudatum (J. Agardh) G. Feldmann (Ceramiales) [*Callithamnion caudatum* J. Agardh]. PCA [1], LLI [36,38].

Aglaothamnion cordatum (Børgesen) Feldmann-Mazoyer (Ceramiales) [*Aglaothamnion neglectum* Feldmann-Mazoyer]. PCA [49].

Aglaothamnion tenuissimum (Bonnemaison) Feldmann-Mazoyer (Ceramiales) [*Aglaothamnion furcellariae* (J. Agardh) Feldmann-Mazoyer]. GG [39], GP [39,41], CV [40], PCA [1,48,49,51,107].

- Aglaothamnion tripinnatum* (C. Agardh) Feldmann Mazoyer (Ceramiales). GP [39], PCA [1,48].
- Alsidium helminthochorton* (Schwendimann) Kützing (Ceramiales). GP [39].
- Amphiroa beauvoisii* J.V. Lamouroux (Corallinales). PCA [1].
- Amphiroa cryptarthrodia* Zanardini (Corallinales). GP [39], CM [40], CV [40], PI [46], PCA [1,31,32,39,48,49].
- Amphiroa rigida* J.V. Lamouroux (Corallinales). C [40], GG [38], GP [39–41], BLM [36], CM [40], CV [40], R [40], PI [46,95], PCA [1,32,49,136], LLI [36,38].
- Anotrichium barbata* (C. Agardh) Nägeli (Ceramiales) [*Griffithsia barbata* C. Agardh]. GG [39], GP [39], PCA [1,49,51,137].
- Anotrichium furcellatum* (J. Agardh) Baldock (Ceramiales) [*Griffithsia furcellata* J. Agardh, *Neomonospora furcellata* (J. Agardh) Feldmann-Mazoyer et Meslin]. C [63], GP [41], SPH [42,62], SH [45], PCA [1,61]. According to Verlaque et al. [138], possible confusion with the non-native *Anotrichium okamurae* Baldock.
- Anotrichium tenue* (C. Agardh) Nägeli (Ceramiales) [*Griffithsia tenuis* C. Agardh]. PCA [49,51,52,137]. According to Verlaque et al. [138], possible confusion with the non-native *Anotrichium okamurae*, they suggest to maintain as a distinct species from *A. tenue* notwithstanding the opposite opinion of Kim and Lee [139].
- Antithamnion amphigeneum* A.J.K. Millar (Ceramiales). PCA [133].
- Antithamnion cruciatum* (C. Agardh) Nägeli (Ceramiales) [var. *cruciatum*, var. *profundum* Feldmann-Mazoyer and f. *radicans* Feldmann Mazoyer nom. illeg.]. C [63], GG [39], GP [36,38,39,41], SH [45], BLM [36], CV [40], R [40], PI [46], PCA [1,29,39,48–52,61,97,107,140].
- Antithamnion heterocladum* Funk (Ceramiales). GP [39,141], PCA [1,29,49,51,58,61,107,140].
- Antithamnion piliferum* Cormaci et G. Furnari (Ceramiales). PCA [133].
- Antithamnion tenuissimum* (Hauck) Schiffner (Ceramiales). PCA [1,29,39,48,52,61,97].
- Antithamnionella elegans* (Berthold) J.H. Price et D.M. John (Ceramiales). PCA [1].
- Apoglossum ruscifolium* (Turner) J. Agardh (Ceramiales). GG [39], GP [36,38,39], PI [46], PCA [1,29,39,48,49,51,52,97,107], LLI [36,38].
- Asparagopsis armata* Harvey (Bonnemaisoniales). As *Asparagopsis armata*: GP [39], CV [40]. As *Falkenbergia rufolanosa* (Harvey) F. Schmitz: LP [91], C [40,63], GG [39], GP [39–41], SPH [42,60], CM [40], R [40], PI [46,142], PCA [1,29–31,39,48,49,52,61,97,107,136]. *F. rufolanosa* is the sporogene of *A. armata* (gametogene).
- Balliella cladoderma* (Zanardini) Athanasiadis (Ceramiales) [*Antithamnion cladoderma* (Zanardini) Hauck]. PCA [1,48,58].
- Bangia fuscopurpurea* (Dillwyn) Lyngbye (Bangiales) [*Bangia lutea* J. Agardh]. LP [36], C [36], GP [36], SPH [42,62], LL [36]. This ‘species’ seems to constitute a complex of cryptic species pending taxonomic reassessment [18,143].
- Bonnemaisonia asparagoides* (Woodward) C. Agardh (Bonnemaisoniales). As *B. asparagoides*: GP [39], PCA [1,49,59]. As *Hymenoclonium serpens* (P.L. Crouan et H.M. Crouan) Batters: PCA [1,48,49,51]. *H. serpens* is the sporogene of *B. asparagoides* (gametogene).
- Bornetia secundiflora* (J. Agardh) Thuret (Ceramiales). GP [36,38], CV [40], PCA [1,49].
- Botryocladia botryoides* (Wulfen) Feldmann (Rhodymeniales) [*Chrysomenia uvaria* J. Agardh]. GP [36,38,39,104], BLM [36], PI [46], PCA [1,48,49,51,97], LLI [36,38].
- Calliblepharis ciliata* (Hudson) Kützing (Gigartinales). PCA [97].
- Calliblepharis jubata* (Goodenough et Woodward) Kützing (Gigartinales). PCA [133].
- Callithamniella tingitana* (Schousboe ex Bornet) Feldmann-Mazoyer (Ceramiales). PCA [1,58,61].
- Callithamnion corymbosum* (I.E. Smith) Lyngbye (Ceramiales). GP [39], PCA [29,49,51,52].
- Callithamnion granulatum* (Ducluzeau) C. Agardh (Ceramiales) [*Callithamnion grande* J. Agardh]. GP [39], SPH [42], CM [40], CV [40], PI [36,38,46], PCA [1,36,38], LLI [36,38].
- Callithamnion tetragonum* (Stackhouse) S.F. Gray (Ceramiales). SPH [42], SH [45], PCA [1].
- Calosiphonia vermicularis* (J. Agardh) F. Schmitz (Gigartinales). PCA [1,48].

- Carradoriella elongata* (Hudson) Savoie et G.W. Saunders (Ceramiales) [*Polysiphonia elongata* (Hudson) Sprengel]. PCA [1,29,48,49,51,52].
- Ceramium bertholdii* Funk (Ceramiales). R [101], PCA [1,29,48].
- Ceramium ciliatum* (Ellis) Ducluzeau var. *ciliatum* (Ceramiales). C [63], GP [39,41], SPH [42,60], SH [45,62], CV [40], R [40], PI [46], PCA [1,30–32,49,50,52,61,107].
- Ceramium ciliatum* var. *robustum* (J. Agardh) Mazoyer (Ceramiales). GP [39], PCA [1,49,51].
- Ceramium cimbricum* H.E. Petersen f. *cimbricum* (Ceramiales) [*Ceramium fastigiatum* Harvey nom. illeg.]. GP [41], CV [40], PCA [29,51,52].
- Ceramium circinatum* (Kützing) J. Agardh (Ceramiales). GP [39,41], PCA [1,49,51,52,140].
- Ceramium codii* (H. Richards) Mazoyer (Ceramiales). GG [39], GP [39], R [101], PI [46], PCA [1,39,48,49,51,52,61,97], NPCNP [73].
- Ceramium comptum* Børgesen (Ceramiales). PCA [107].
- Ceramium diaphanum* (Lightfoot) Roth (Ceramiales) [incl. *C. tenuissimum* Roth] J. Agardh nom. illeg.]. GG [39], GP [39,41], SPH [60], LL [36], CV [40], R [40], PCA [1,29,32,49–52,61,107].
- Ceramium echionotum* J. Agardh (Ceramiales). LP [36], C [63], GP [39,41], SPH [42,60], SH [45], BLM [36], CV [40], PCA [1,49,52,61,107], LLI [36,38].
- Ceramium giacconei* Cormaci et G. Furnari (Ceramiales) [Misidentified as *Ceramium cingulatum* Weber van Bosse]. PCA [49,51,52,144].
- Ceramium siliquosum* (Kützing) Maggs et Hommersand var. *lophophorum* (Feldmann-Mazoyer) Serio (Ceramiales) [*Ceramium diaphanum* var. *lophophorum* Feldmann-Mazoyer]. PCA [1,39,48].
- Ceramium siliquosum* var. *zostericola* (Feldmann-Mazoyer) G. Furnari (Ceramiales) [*Ceramium diaphanum* var. *zostericola* (Thuret) Feldmann-Mazoyer]. PCA [1].
- Ceramium tenerrimum* (G. Martens) Okamura (Ceramiales). C [63], GP [39], PCA [1,29].
- Ceramium brevizonatum* H.E. Petersen (Ceramiales) [*C. tenerrimum* (G. Martens) Okamura var. *brevizonatum* (H.E. Petersen) Mazoyer]. PCA [49,51].
- Ceramium virgatum* Roth [*C. rubrum* auctorum] (Ceramiales). GP [39], SPH [60], LL [36], CV [40], R [40], PI [46], PCA [1,49].
- Champia parvula* (C. Agardh) Harvey (Rhodymeniales). GP [39,41], SPH [60], PCA [59].
- Chondracanthus acicularis* (Roth) Fredericq (Gigartinales) [*Gigartina acicularis* (Roth) J.V. Lamouroux]. C [63], GP [39,41], SH [45], PI [38,46], PCA [1,38,59,61], LLI [38].
- Chondria capillaris* (Hudson) M.J. Wynne (Ceramiales) [*Chondria tenuissima* C. Agardh nom. illeg.]. GG [39], GP [36,38,41], CV [40], PCA [1,48–51,97].
- Chondria curvilineata* F.S. Collins et Hervey (Ceramiales). GP [41], PCA [52].
- Chondria dasyphylla* (Woodward) C. Agardh (Ceramiales). GP [36,38,39], BLM [36], PCA [1,29,48–52].
- Chondria mairei* G. Feldmann (Ceramiales). GG [145], GP [39,145], PCA [1,49,51,58,61,145].
- Chondria mediterranea* (Kützing) M.J. Wynne (Ceramiales) [*Chondria boryana* (De Notaris) De Toni nom. illeg.]. C [63], GP [39], SPH [42,62], SH [45], PCA [49]. We follow the taxonomic treatment of Wynne [146].
- Chondrymenia lobata* (Meneghini) Zanardini (Gigartinales). PCA [1,39,48,58,147].
- Choreonema thuretii* (Bornet) F. Schmitz (Hapalidiales). GP [39].
- Chroodactylon ornatum* (C. Agardh) Basson (Stylonematales). GP [41], PCA [49,51,107].
- Chrysymenia ventricosa* (J.V. Lamouroux) J. Agardh (Rhodymeniales). GP [39], PI [59,96], PCA [1,59], LLI [72].
- Chylocladia verticillata* (Lightfoot) Bliding (Rhodymeniales) [*Chylocladia bistratosa* (Goodenough et Woodward) Ercegović, *C. kaliformis* Harvey, *C. squarrosa* (Kützing) Thuret]. LP [36], C [63], GG [39], GP [36,38,39,41], SPH [42], BLM [36], R [40], PCA [1,29,49,51,52,59].
- Colaconema codicola* (Børgesen) Stegenga, J.J. Bolton et R.J. Anderson (Colaconematales) [misidentified as *Rhodothamniella codii* (Hamel) J. Feldmann = *Colaconema caespitosum* (J. Agardh) Jackelman, Stegenga et J.J. Bolton]. CV [40], PI [46], PCA [1].
- Colaconema corymbiferum* (Thuret) Alongi, Cormaci et G. Furnari (Colaconematales) [*Acrochaetium corymbiferum* (Thuret) Batters]. GP [36,38], PCA [1].

- Colaconema daviesii* (Dillwyn) Stegenga (Colaconematales) [*Acrochaetium daviesii* (Dillwyn) Nägeli]. GG [39], GP [39], PCA [1,29,49,51,52,61].
- Colaconema nemalii* (De Notaris ex Dufour) Stegenga (Colaconematales) [*Acrochaetium nemalii* 'nemalionis' (De Notaris ex Dufour) Børgesen]. GP [39], PCA [1].
- Colaconema savianum* (Meneghini) R. Nielsen (Colaconematales) [*Acrochaetium savianum* (Meneghini) Nägeli]. PCA [30,48].
- Compsothamnion thuioides* (J.E. Smith) Nägeli (Ceramiales). GG [39], PCA [49,61].
- Contarinia peyssonneliiformis* Zanardini (Gigartinales) [*Rhizophyllis codii* Feldmann]. GP [39,41], PCA [1,49,97].
- Contarinia squamariae* (Meneghini) Denizot (Gigartinales) [*Rhizophyllis squamariae* Meneghini) Kützing]. PCA [1,39,48,49,97].
- Corallina officinalis* Linnaeus (Corallinales). R [94].
- Corallophila cinnabarina* (Grateloup ex Bory) R.E. Norris (Ceramiales) [*Centroceras cinnabarinum* (Grateloup ex Bory) J. Agardh]. CV [40]. PCA [49,51].
- Croisetia requienii* (J. Agardh) M.J. Wynne (Gigartinales) [*Kallymenia requienii* (J. Agardh) J. Agardh]. C [36], R [101], PI [96], PCA [1,48,49,59,97], LLI [72].
- Crouania attenuata* (C. Agardh) J. Agardh (Ceramiales) [including f. *bispora* PL. et H.M. Crouan) Hauck]. GG [39], GP [36,38,39], CV [40], PCA [1,29,39,49,51,52,61,97,107].
- Crouania ischiana* (Funk) C.F. Boudouresque et M.M. Perret-Boudouresque (Ceramiales) [*Pseudocrouania ischiana* Funk]. PCA [29,49,52,58].
- Cruoria cruoriiiformis* (P.L. Crouan et H.M. Crouan) Denizot (Gigartinales). PCA [1,48].
- Cryptonemia palmetta* (S.G. Gmelin) Woelkerling, G. Furnari, Cormaci et McNeill (Halymeniales) [*Cryptonemia lomation* (Bertoloni) J. Agardh]. GP [39,41], PI [59], PCA [1,49,59,97], NPCNP [73].
- Cryptonemia tuniformis* (A. Bertoloni) Zanardini (Halymeniales). PCA [97], MB [105,106].
- Cryptopleura ramosa* (Hudson) L. Newton (Ceramiales) [*Acrosorium uncinatum* (Turner) Kylin, *Nitophyllum laceratum* (S.G. Gmelin) Greville]. GG [39], GP [36,39], SPH [42], CV [40], PI [38], PCA [1,29,38,39,48], LLI [38].
- Dasya baillouviana* (S.G. Gmelin) Montagne (Ceramiales) [*Dasya pedicellata* (C. Agardh) C. Agardh]. GP [39], PCA [1,49–51,97].
- Dasya corymbifera* J. Agardh (Ceramiales). C [63], GG [39], GP [39], PCA [1,29,39,49,51,52].
- Dasya hutchinsiae* Harvey (Ceramiales) [*Dasya arbuscula sensu* Harvey, non (Dillwyn) C. Agardh]. GP [36,38,41], R [40], PCA [52,61], LLI [36,38].
- Dasya ocellata* (Grateloup) Harvey (Ceramiales) [*Dasya simpliciuscula* C. Agardh nom. illeg.]. GP [36,39,41], SPH [42,60], CV [40], PCA [1,29,48–52,61,107].
- Dasya rigidula* (Kützing) Ardissonne (Ceramiales). GP [39,41], R [40], PCA [1,31,49,51,52,61,97,148].
- Dermocorynus dichotomus* (J. Agardh) Gargiulo, Morabito et Manghisi (Halymeniales) [*Grateloupia dichotoma* J. Agardh]. C [36], GP [38,39], CM [40], PCA [1], LLI [36].
- Dermocorynus horridus* (J. Agardh) Gargiulo, Morabito et Manghisi (Halymeniales) [*Grateloupia filicina* f. *horrida* (Kützing) Børgesen]. C [36], GG [38], SH [45], CM [40], PI [59], PCA [1,59], LLI [36,38].
- Digenea simplex* (Wulfen) C. Agardh (Ceramiales). C [40], GP [40], CM [40], CV [40,68].
- Dipterosiphonia rigens* (C. Agardh) Falkenberg (Ceramiales). GG [39], GP [39], PCA [1,32,48,49,51,52,107].
- Dudresnaya verticillata* (Withering) Le Jolis (Gigartinales). R [101], PCA [49,59,97].
- Ellisolandia elongata* (Ellis et Solander) K. Hind et G.W. Saunders (Corallinales) [*Corallina elongata* Ellis et Solander, *C. mediterranea* Areschoug]. LP [91], C [36,40,63], GG [38], GP [36,38–41], SPH [60], SH [45], BLM [36], CM [40], CV [40], R [40], PI [46,99], PCA [1,31,32,48–51,53,136].
- Erythrocladia polystromatica* P.J.L. Dangeard (Erythropeltales). PCA [1,49].
- Erythrocytis montagnei* (Derbès et Solier) P.C. Silva (Ceramiales) [*Ricardia montagnei* Desbès et Solier]. GP [39], R [40], PCA [1,49,51,136].
- Erythroglossum balearicum* J. Agardh ex Kylin (Ceramiales). PCA [1,48].

- Erythroglossum sandrianum* (Kützing) Kylin (Ceramiales). GP [39], SPH [60], PCA [1,48,49,51,97].
- Erythrotrichia carnea* (Dillwyn) J. Agardh (Erythropeltales) [*Erythrotrichia ceramicola* (Lyngbye) Kützing]. GP [36,38,41], PCA [1,29,49–52,107]. This ‘species’ probably constitutes a complex of cryptic species and genera, not yet formally proposed, pending further molecular studies [18,149].
- Erythrotrichia rosea* P.J.L. Dangeard (Erythropeltales). PCA [52]. According to Cormaci et al. [18], *nomen invalidum*.
- Erythrotrichia simplex* P.J.L. Dangeard (Erythropeltales). GP [41]. According to Cormaci et al. [18], this is an invalid name.
- Eupogodon planus* (J. Agardh) Kützing (Ceramiales) [*Dasyopsis plana* (C. Agardh) Zanardini ex Falkenberg]. GG [39], PCA [1,39,48,49,51,52,97,148], NPCNP [73].
- Eupogodon spinellus* (C. Agardh) Kützing (Ceramiales) [*Dasyopsis cervicornis* (J. Agardh) Schmitz]. PCA [1,39,48,49,51,52,97]. We follow Jong [150] in maintaining the distinction between *E. spinellus* and *E. planus*.
- Feldmannophycus rayssiae* (J. Feldmann et G. Feldmann) H. Augier et Boudouresque (Gigartinales). GP [39,41], PCA [1,39,48,49,58,97,151].
- Felicinia marginata* (Roussel) Manghisi, Le Gall, Ribera, Gargiulo et Morabito (Halymeniales) [*Aeodes marginata* (Roussel) F. Schmitz]. PCA [148].
- Felicinia spathulata* (J. Agardh) Le Gall et Vergés (Gigartinales) [*Kallymenia spathulata* (J. Agardh) Codomier ex P.G. Parkinson]. CV [40], PCA [97].
- Furcellaria lumbricalis* (Hudson) J.V. Lamouroux (Gigartinales). PCA [59].
- Gaillona hookeri* (Dillwyn) Athanasiadis (Ceramiales) [*Aglaothamnion brodiei* (Harvey) Feldmann-Mazoyer]. GP [39].
- Gaillona scopulorum* (C. Agardh) Athanasiadis (Ceramiales) [*Aglaothamnion scopulorum* (C. Agardh) Feldmann-Mazoyer; misidentified as *Callithamnion roseum* (Roth) Lyngbye = *Gaillona rosea* (Roth) Athanasiadis]. GP [36,38], SPH [60], LLI [38].
- Gastroclonium clavatum* (Roth) Ardissonne (Rhodymeniales) [*Chylocladia mediterranea* J. Agardh]. GP [36,38,39], SPH [42], SH [45,62], BLM [36], CV [40], PI [46], PCA [1,61].
- Gayliella mazoyerae* T.O. Cho, Fredericq et Hommersand (Ceramiales) [*Ceramium byssoideum* Harvey *nom illeg.*, *C. gracillimum* var. *byssoideum* Mazoyer]. C [63], GG [39], GP [39], SPH [42], SH [45,62], CV [40], PCA [1,31,48–52,61,107].
- Gayliella taylorii* (E.Y. Dawson) T.P. Choo et S.M. Boo (Ceramiales) [*Ceramium taylorii* E.Y. Dawson]. PCA [49].
- Gelidiella lubrica* (Kützing) J. Feldmann et G. Hamel (Gelidiales). GP [39,41], SPH [60].
- Gelidium crinale* (Turner) Gaillon (Gelidiales). GP [39,41], SPH [42,60], SH [45], CV [40], PCA [1,32,49,50].
- Gelidium minusculum* (Weber van Bosse) R.E. Norris (Gelidiales) [*Gelidium pusillum* var. *minusculum* Weber van Bosse]. PCA [49].
- Gelidium pulchellum* (Turner) Kützing (Gelidiales). PCA [1,32,49].
- Gelidium pusillum* (Stackhouse) Le Jolis (Gelidiales). C [36], GP [39], PCA [52,61].
- Gelidium spathulatum* (Kützing) Bornet (Gelidiales). C [63], SPH [42,62], SH [45].
- Gelidium spinosum* (S.G. Gmelin) P.C. Silva var. *spinosum* (Gelidiales) [*Gelidium latifolium* var. *latifolium* (Greville) Bornet and var. *luxurians* (P.L. Crouan et H.M. Crouan) J. Feldmann et Hamel *comb. inval.*]. SPH [42], CV [40], PCA [1,49,51].
- Gelidium spinosum* var. *hystrix* (J. Agardh) G. Furnari (Gelidiales) [*Gelidium latifolium* var. *hystrix* (J. Agardh) J. Feldmann et Hamel *comb. inval.* and *nom. illeg.*]. CV [40], PCA [1].
- Gloiocladia furcata* (C. Agardh) J. Agardh (Rhodymeniales). PCA [1,29,30,48,49,59,97,107].
- Gloiocladia repens* (C. Agardh) N. Sánchez et Rodríguez-Prieto (Rhodymeniales) [*Fauchea repens* (C. Agardh) Montagne et Bory]. PI [96], PCA [54–56,59], LLI [72], MB [106].
- Goniotrichopsis sublittoralis* G.M. Smith (Stylonematales). GP [41,133].
- Gracilaria bursa-pastoris* (S.G. Gmelin) P.C. Silva (Gracilariales). GP [41], PCA [97].
- Gracilaria corallicola* Zanardini (Gracilariales). R [101], MB [106].
- Gracilaria dura* (C. Agardh) J. Agardh (Gracilariales). PCA [102], NPCNP [73].

- Gracilariopsis longissima* (S.G. Gmelin) Steentoft, L.M. Irvine *et* Farnham (Gracilariales) [*Gracilaria confervoides* Greville, *G. verrucosa* (Hudson) Papenfuss *nom. rej.*]. EP [38].
- Griffithsia genovefae* J. Feldmann (Ceramiales). PCA [1,97].
- Griffithsia opuntioides* J. Agardh (Ceramiales). PCA [1,52].
- Griffithsia phyllamphora* J. Agardh (Ceramiales). CV [40], PCA [1].
- Griffithsia schousboei* Montagne (Ceramiales). PCA [1,48,49,51,61,107].
- Gulsonia nodulosa* (Ercegović) Feldmann *et* G. Feldmann (Ceramiales). PI [96], PCA [49].
- Gymnogongrus crenulatus* (Turner) J. Agardh (Gigartinales) [*Gymnogongrus norvegicus* (Gunnerus) J. Agardh]. PCA [1,58,152]. The conspecificity of *G. norvegicus* with *G. crenulatus* is questionable: see Cormaci *et al.* [19].
- Gymnogongrus griffithsiae* (Turner) Martius (Gigartinales). GP [39], SH [45,62], LLI [36,38].
- Gymnothamnion elegans* (Schousboe *ex* C. Agardh) J. Agardh (Ceramiales). GP [39], PCA [1,61].
- Halopithys incurva* (Hudson) Batters (Ceramiales) [*Halopithys pinastroides* (Stackhouse) Kützing]. GG [38,39], GP [36,38,39,41], CM [40], CV [40], R [40].
- Halurus flosculosus* (J. Ellis) Maggs *et* Hommersand *var. flosculosus* (Ceramiales) [*Griffithsia flosculosa* (J. Ellis) Batters; possibly misidentified as *G. sphaerica* Schousboe *ex* C. Agardh = *H. flosculosus var. sphaericus* (Schousboe *ex* C. Agardh) Gomez Garreta *et al.*,]. GG [39], GP [39], CV [40], PCA [1,107], LLI [36,38].
- Halurus flosculosus var. irregularis* (C. Agardh) Gómez Garreta, Gallardo, Ribera, M. Cormaci, G. Furnari, Giaccone *et* Boudouresque (Ceramiales) [*Griffithsia flosculosa var. irregularis* (C. Agardh) Feldmann-Mazoyer]. PCA [49,51].
- Halydictyon mirabile* Zanardini (Ceramiales). GP [39,41], PCA [1,29,39,48,49,51,52,107,153].
- Halymenia elongata* C. Agardh (Halymeniales) [*Halymenia trigona* (Clemente) C. Agardh *sensu* Codomier]. CV [68], R [68], PI [59], PCA [59].
- Halymenia floresii* (Clemente) C. Agardh (Halymeniales). PI [96], PCA [59].
- Haraldia lenormandii* (Derbès *et* Solier) J. Feldmann (Ceramiales). PCA [29,49,51,97,148].
- Herposiphonia secunda* (C. Agardh) Ambronn (Ceramiales) [*Polysiphonia secunda* (C. Agardh) Zanardini]. GG [39], GP [36,38,39,41], SPH [60], CV [40], PI [46], PCA [1,30,31,48,49,51,52,61,97], LLI [36,38].
- Herposiphonia tenella* (C. Agardh) Ambronn (Ceramiales). C [63], GP [39], SPH [42], SH [45,62], CV [40], R [40], PCA [1,31,49,50,61].
- Heterosiphonia crispella* (C. Agardh) M.J. Wynne (Ceramiales) [*Heterosiphonia wurdemanii* (Bailey *ex* Harvey) Falkenberg]. GP [39], SPH [42], SH [45], PCA [1,31,49,51,52].
- Hildenbrandia prototypus* Nardo (Hildenbrandiales) [*Hildenbrandia rosea* Kützing]. GP [39], PI [36,38]. In the opinion of Cormaci *et al.* [18], this species should be considered as a *taxon inquirendum*.
- Hydrolithon boreale* (Foslie) Y.M. Chamberlain (Corallinales) [*Fosliella farinosa var. solmsiana* (Falkenberg) Foslie, *F. ischiensis* Coppejans *nom nudum*]. GP [154], PCA [1,48–51]. See Cormaci *et al.* [18] for taxonomic treatment of *Fosliella ischiensis*.
- Hydrolithon farinosum* (J.V. Lamouroux) Penrose *et* Y.M. Chamberlain *var. farinosum* (Corallinales) [*Fosliella farinosa* (J.V. Lamouroux) Howe, *Melobesia farinosa* J.V. Lamouroux]. GG [38,39], GP [36,38,39], CV [40], R [40], PCA [1,29–32,48–52,61,97,107].
- Hydrolithon farinosum var. chalicodictyum* (W.R. Tylor) Serio (Corallinales). PCA [31,49,51].
- Hypnea musciformis* (Wulfen) J.V. Lamouroux (Gigartinales). C [63], GP [36,38], CV [40], PCA [59].
- Hypoglossum hypoglossoides* (Stackhouse) Collins *et* Hervey (Ceramiales) [*Delesseria hypoglossum* (Woodward) J.V. Lamouroux, *Hypoglossum woodwardii* Kützing]. LP [36], GG [39], GP [36,38,39], LL [36], PI [46], PCA [1,29,39,48,49,51,52].
- Irvinea boergesenii* (Feldmann) R.J. Wilkes, L.M. McIvor *et* M.D. Guiry (Rhodymeniales) [*Botryocladia boergesenii* Feldmann]. GG [39], GP [39], CV [40], PI [59], PCA [1,29,39,48,49,51,52,59,61,97].
- Janczewskia verruciformis* Solms-Laubach (Ceramiales). PCA [49].
- Jania longifurca* Zanardini *ex* Zanardini (Corallinales). GP [39].

- Jania pedunculata* J.V. Lamouroux var. *adhaerens* (J.V. Lamouroux) A.S. Harvey, Woelkerling et Reviere (Corallinales). GP [41], PCA [52], NPCNP [73].
- Jania rubens* (Linnaeus) J.V. Lamouroux var. *rubens* (Corallinales). C [40,63], GG [38,39], GP [36,38–40,104], SPH [42], CM [40], CV [40], R [40], GRI [38,155], PI [38,46,95], PCA [1,31,32,48,49,52,59,97].
- Jania rubens* var. *corniculata* (Linnaeus) Yendo (Corallinales) [*Jania corniculata* (Linnaeus) J.V. Lamouroux]. C [36,63], GG [36,38,39], GP [38,39,41], SPH [42,60], SH [45], PCA [1,49,51].
- Jania virgata* (Zanardini) Montagne (Corallinales) [*Corallina granifera* J. Ellis et Solander]. GP [39], SPH [60], CM [40], CV [40], R [40], PCA [1,31,32,49,52,61,97,107].
- Kallymenia feldmannii* Codomier in Woelkerling et al., (Gigartinales). PI [47], PCA [59].
- Kallymenia patens* (J. Agardh) Codomier ex P.G. Parkinson (Gigartinales). CV [40], PI [59], PCA [59].
- Kallymenia reniformis* (Turner) J. Agardh (Gigartinales) [*Neurocaulon reniforme* (Turner) Zanardini]. GP [39], PCA [48,97], MB [106].
- Laurencia chondrioides* Børgesen (Ceramiales). PI [133,156].
- Laurencia microcladia* Kützing (Ceramiales). GP [41], CV [40], R [40], PCA [29,31,32,50,52].
- Laurencia obtusa* (Hudson) J.V. Lamouroux (Ceramiales). GG [38,39], GP [36,39,104], CM [40], CV [40], PI [46,95], PCA [1,39,48–50,52,61,97,136], LLI [36,38].
- Lejolisia mediterranea* Bornet (Ceramiales). GP [39], PCA [1,48,49,51,52,140].
- Leptofauchea coralligena* Rodríguez-Prieto et De Clerck (Rhodymeniales). NPCNP [73].
- Liagora distenta* (Mertens ex Roth) J.V. Lamouroux (Nemaliales). CM [40], CV [40], PI [38], PCA [1,59].
- Liagora viscida* (Forsskål) C. Agardh (Nemaliales). C [36], GG [38], GP [39], BLM [36], CM [40], CV [40], R [40], PI [46,47,95], PCA [1,32,49,50,59], LLI [36,38].
- Lithophyllum byssoides* (Lamarck) Foslie (Corallinales) [*Lithophyllum tortuosum* (Esper) Foslie sensu Hamel et Lemoine, *L. lichenoides* Philippi, erroneously as *Tenarea tortuosa* (Esper) Me. Lemoine]. GP [38–40,154,157,158], CM [40], CV [40,68,159], R [40,68,101,159], GRI [155,160], PI [46,47,123,160–162], PCA [1,53,59,102,158,161–169], LLI [72,158,161,162].
- Lithophyllum corallinae* (P.L. Crouan et H.M. Crouan) Heydrich (Corallinales) [*Dermatolithon pustulatum* var. *corallinae* (P.L. Crouan et H.M. Crouan) Foslie ex Ercegović comb. inval.]. PCA [1]. See Cormaci et al. [18].
- Lithophyllum cystoseirae* (Hauck) Heydrich (Corallinales) [*Dermatolithon cystoseirae* (Hauck) Huvé]. PCA [1,48].
- Lithophyllum incrustans* Philippi (Corallinales). C [40], GP [39,40,157], CM [40], CV [40], R [40], PI [46,47], PCA [1,136], LLI [72].
- Lithophyllum papillosum* (Zanardini ex Hauck) Foslie (Corallinales) [*Goniolithon papillosum*]. PCA [1,58,163].
- Lithophyllum pustulatum* (J.V. Lamouroux) Foslie (Corallinales) [*Dermatolithon hapalidioides* var. *hapalidioides* (P.L. Crouan et H.M. Crouan) Foslie and var. *confine* (P.L. Crouan et H.M. Crouan) Foslie, *D. litorale* (Suneson et Me. Lemoine, *D. pustulatum* (J.V. Lamouroux) Foslie]. GP [39], PCA [1,48,61].
- Lithophyllum racemus* (Lamarck) Foslie (Corallinales). GH [93], PCA [102].
- Lithophyllum stictiforme* (Areschoug) Hauck (Corallinales) [*Lithophyllum cabiochiaie* Boudouresque et Verlaque) Athanasiadis, *Pseudolithophyllum expansum* (Philippi) Me. Lemoine sensu Hamel et Lemoine]. GP [38,104], CM [40], CV [40], R [40,94], PI [96,154], PCA [39,54–56,154], LLI [154], NPCNP [73].
- Lithothamnion corallioides* (P.L. Crouan et H.M. Crouan) P.L. Crouan et H.M. Crouan (Corallinales) [*Lithothamnium solutum* (Foslie) Foslie, *Mesophyllum corallioides* (P.L. Crouan et H.M. Crouan) Me. Lemoine comb. inval.]. GG [110], GH [93], CV [68], R [68,94,101], PI [96], PCA [97,102], LLI [72], MB [105], NPCNP [73].
- Lithothamnion minervae* Basso (Corallinales). PI [96], NPCNP [73].
- Lithothamnion valens* Foslie (Corallinales). R [94], PI [96], MB [106].
- Lomentaria articulata* (Hudson) Lyngbye var. *articulata* (Rhodymeniales). PCA [1,58,59], LLI [36,38].

- Lomentaria articulata* var. *linearis* Zanardini (Rhodymeniales) [*Lomentaria linearis* Zanardini] Zanardini]. PCA [97].
- Lomentaria chylocladiella* Funk (Rhodymeniales). GP [41], PCA [29,49,51,52].
- Lomentaria clavellosa* (Lightfoot ex Turner) Gaillon var. *clavellosa* (Rhodymeniales). GP [41], SPH [42], PCA [1,30,61,148].
- Lomentaria claviformis* Ercegović (Rhodymeniales). PCA [107].
- Lomentaria ercegovicii* M. Verlaque, Boudouresque, Meinesz, Giraud et Marcot-Coqueugniot (Rhodymeniales). PCA [51].
- Lomentaria pennata* Coppejans *nomen nudum* (Rhodymeniales). PCA [49]. Name invalidly published.
- Lomentaria verticillata* Funk (Rhodymeniales). PCA [29,49,58,61].
- Lophocladia lallemandii* (Montagne) F. Schmitz (Ceramiales). PCA [170].
- Lophosiphonia cristata* Falkenberg (Ceramiales). GP [41], PCA [31,49–52,58,132].
- Lophosiphonia obscura* (C. Agardh) Falkenberg (Ceramiales) [*Lophosiphonia subadunca* (Kützing) Falkenberg, *Polysiphonia obscura* (C. Agardh) J. Agardh, *P. subtilis* De Notaris]. GP [36,38,41], VSSM [43,44], PCA [31,49–52], LLI [36]. Guiry and Guiry [21] consider *P. subtilis* as a distinct species.
- Melanothamnus harveyi* (J.W. Bailey) Díaz-Tapia et Maggs (Ceramiales) [*Neosiphonia harveyi* (J. Bailey) M.S. Kim, H.G. Choi, Guiry et G.W. Sanders, *Polysiphonia harveyi* J.W. Bailey, *P. mottei* Lauret]. GP [41].
- Melobesia membranacea* (Esper) J.V. Lamouroux (Corallinales) [*Epilithon membranaceum* (Esper) Heydrich, *Lithothamnion membranaceum* (Esper) Foslie]. GP [36,38,154], PCA [1,56,61].
- Meredithia microphylla* (J. Agardh) J. Agardh (Gigartinales) [*Kallymenia microphylla* J. Agardh]. As *M. microphylla*: GP [38,39], PCA [1,48,49,59,97]. As *Rhodochorton hauckii* (Schiffner) Hamel: PCA [30,52]. *R. hauckii* could be a stage in the life history of *M. microphylla* (gametogene) (see Cormaci et al. [18]).
- Mesophyllum alternans* (Foslie) Cabioch et M.L. Mendoza (Corallinales). R [101], PI [96], PCA [54–56].
- Mesophyllum expansum* (Philippi) Cabioch et M.L. Mendoza (Corallinales). R [68], PI [47], PCA [55,56].
- Mesophyllum lichenoides* (J. Ellis) Me. Lemoine (Corallinales) [*Lithothamnium lichenoides* (J. Ellis) Foslie]. GP [36,38–40,104,154], GH [93], CM [40], CV [40], R [94], PCA [1,39,48,49], MB [106].
- Mesophyllum philippii* (Foslie) W.H. Adey (Corallinales) [*Lithothamnium philippii* Foslie]. PCA [1,48], MB [106]. See Cormaci et al. [18] for discussion regarding the identity of this species.
- Metacallophyllis laciniata* (Hudson) A. Vergés et Le Gall (Gigartinales) [*Callophyllis laciniata* (Hudson) Kützing]. PCA [59].
- Metapeyssonnelia feldmannii* Boudouresque, Coppejans et Marcot (Peyssonneliales). PCA [171].
- Microcladia glandulosa* (Solander ex Turner) Greville (Ceramiales). C [63], PCA [1].
- Millerella albertanoae* (A. Bottalico, G.H. Boo, C. Russo, S.M. Boo et C. Perrone) G.H. Boo et A. Bottalico (Gelidiales) [erroneously as *Gelidiella ramellosa* (Kützing) Feldmann et Hamel]. GP [39,141], PCA [1]. *Gelidiella ramellosa* (= *Huismaniella ramellosa* (Kützing) G.H. Boo et S.M. Boo) does not occur in the Mediterranean Sea [19].
- Millerella pannosa* (J. Feldmann) G.H. Boo et L. Le Gall (Gelidiales) [*Gelidiella pannosa* (J. Feldmann) J. Feldmann et Hamel, *G. tenuissima* J. Feldmann et Hamel *nom. illeg.*]. GP [39,172,173], PCA [49,51,52,61].
- Monosporus pedicellatus* (J.E. Smith) Solier var. *pedicellatus* (Ceramiales) [*Corynospora pedicellata* (J.E. Smith) J. Agardh, *Neomonospora pedicellata* (J.E. Smith) Feldmann-Mazoyer et Meslin]. GP [39,41], PCA [1,29,49,51,52,107].
- Monosporus pedicellatus* var. *tenuis* (Feldmann-Mazoyer) Huisman et Kraft (Ceramiales) [*Corynospora pedicellata* var. *tenuis* Feldmann-Mazoyer]. PCA [49,51].

Myriogramme distromatica Rodriguez *ex* Boudouresque (Ceramiales). CV [40], PCA [1,49]. See Boudouresque [174] for taxonomy.

Myriogramme minuta Kylin (Ceramiales) [*Drachiella minuta* (Kylin) Maggs *et* Hommersand, *Myriogramme gaiolae* (Funk) Funk]. GP [39], PCA [1,48,52,61].

Myriogramme unistromatica Coppejans *nomen nudum* (Ceramiales). PCA [49]. Name invalidly published.

Naccaria wiggii (Turner) Endlicher *ex* J. Agardh (Atractophorales). PCA [59].

Nemalion lubricum Duby (Nemaliales) [misidentified as *Nemalion helmintoides* (Velley) Batters]. GP [39,104], R [40], PI [38,46], PCA [1,38,163], LLI [38].

Neogoniolithon brassica-florida (Harvey) Setchell *et* L.R. Mason (Corallinales) [*Neogoniolithon notarissii* (Dufour) Me. Lemoine]. GP [39,41,154], CM [40], GRI [155], PI [46,96,123], PCA [1,50,163].

Neogoniolithon mamillosum (Hauck) Setchell *et* Mason (Corallinales). GP [154], CV [68], R [68]. Cormaci *et al.* [18] consider this taxon as a *species inquirenda*.

Nesoia latifolia (P.L. Crouan *et* H.L. Crouan *ex* Kützing) H.W. Lee *et* M.S. Kim (Halymeniales) [*Halymenia latifolia* P.L. Crouan *et* H.L. Crouan *ex* Kützing]. PI [59], PCA [1,48,59,97].

Neurocaulon foliosum (Meneghini) Zanardini *ex* Kützing (Gigartinales). PCA [1,97], MB [106,175].

Nitophyllum micropunctatum Funk (Ceramiales). PCA [49].

Nitophyllum punctatum (Stackhouse) Greville (Ceramiales). GG [39], GP [39], PI [46], PCA [1,29,39,49,51,52,61,107,136].

Nitophyllum tristromaticum J.J. Rodriguez *y* Feminias *ex* Mazza (Ceramiales). PCA [1].

Olokunia atropurpurea (P.L. Crouan *et* H.L. Crouan) Pestana, Nunes, Cassano *et* Lyra (Peyssonneliales) [*Peyssonnelia atropurpurea* P.L. Crouan *et* H.L. Crouan]. LP [36], C [36], GG [38], GP [36,38], CM [40], PCA [1]-but see [48,49,176].

Osmundaria volubilis (Linnaeus) R.E. Norris (Ceramiales) [*Vidalia volubilis* (Linnaeus) J. Agardh]. GG [38], GP [36,38], GH [93], R [68,94,101], GRI [38], PCA [1,97,102,103,148,177], LLI [36,38,72].

Osmundea pelagosae (Schiffner) K.W. Nam (Ceramiales) [*Laurencia pelagosae* (Schiffner) Ercegović]. PCA [1,48,49,97,102], NPCNP [73].

Osmundea truncata (Kützing *emend.* Furnari *et* Serio) K.W. Nam *et* Maggs (Ceramiales) [Misidentified as *Laurencia pinnatifida* (Hudson) J.V. Lamouroux = *Osmundea pinnatifida* (Hudson) Stackhouse]. C [36], GG [38,39], GP [39,41], BLM [36], CV [40], R [40], PI [46,47], PCA [1,31,32,49,50,52,61], LLI [36,38]. We follow the taxonomic treatment of Furnari and Serio [178].

Osmundea verlaquei Furnari (Ceramiales) [misidentified as *Laurencia undulata* Yamada = *Chondrophyucus undulatus* (Yamada) Garbary *et* J. Harper]. C [63], GP [39], PI [46], PCA [1]. We follow the taxonomic treatment of Cormaci *et al.* [179].

Palisada thuyoides (Kützing) Cassano, Senties, Gil-Rodríguez *et* M.T. Fujii (Ceramiales) [*Laurencia paniculata* (C. Agardh) J. Agardh *nom. illeg.*]. CV [40].

Parviphycus antipae (M. Celan) B. Santelices (Gelidiales) [*Gelidiella antipae* 'antipai' M. Celan]. PCA [1,48,58,180]. According to Cormaci *et al.* [19], *P. antipae* probably belongs to the genus *Millerella*; however, pending molecular studies carried out on type material, the transfer has not been completed.

Peyssonnelia armorica (P.L. Crouan *et* H.M. Crouan) Weber van Bosse (Peyssonneliales). PCA [49].

Peyssonnelia bornetii Boudouresque *et* Denizot (Peyssonneliales). GP [40], CM [40], CV [40], R [40], PCA [1,30,31,49,51,52,58,61,135,181].

Peyssonnelia crispata Boudouresque *et* Denizot (Peyssonneliales). PCA [1,58,97,135,176].

Peyssonnelia dubyi P.L. Crouan *et* H.M. Crouan (Peyssonneliales). GP [41], PCA [30,49,52,61].

Peyssonnelia heteromorpha (Zanardini) Athanasiadis (Peyssonneliales) [*Peyssonnelia polymorpha* F. Schmitz]. GP [39], PCA [1,39,48,49,102,135], MB [106]. Records of [102] and [106] could be based on misidentifications of *P. rosa-marina*.

- Peyssonnelia rosa-marina* Boudouresque et Denizot (Peyssonneliales). GP [41], GH [93]-misidentified as *P. polymorpha*, CV [40,68], R [40,68,94]-misidentified as *P. polymorpha*, PI [46], PCA [1,49,58,97,135,148,177,181], NPCNP [73].
- Peyssonnelia rubra* (Greville) J. Agardh (Peyssonneliales). GG [92], GP [39,41], CV [40], R [94], PCA [1,39,48,49,51,97,106,107,148], NPCNP [73].
- Peyssonnelia squamaria* (S.G. Gmelin) Decaisne ex J. Agardh (Peyssonneliales). LP [36], GG [39], GP [36,38–41], CM [40], CV [40], R [40,94], PI [46], PCA [1,48,49,51,61,97], NPCNP [73].
- Phrix spatulata* (E.Y. Dawson) M.J. Wynne, M. Kamiya et J.A. West (Ceramiales) [*Apoglossum gregarium* (E.Y. Dawson) M.J. Wynne]. GP [41].
- Phyllophora crispa* (Hudson) P.S. Dixon (Gigartinales) [*Phyllophora nervosa* (A.P. de Candolle) Greville]. LP [36], GP [36,38–40,104], CM [40], CV [40,68], R [40,68], PI [46,59,96], PCA [1,48,49,59,97], LLI [72].
- Phyllophora sicula* (Kützing) Guiry et L.M. Irvine (Gigartinales) [*Phyllophora palmettoides* J. Agardh]. PI [38], PCA [38], LLI [38].
- Phymatolithon calcareum* (Pallas) W.H. Adey et McKibbin ex Woelkerling et L.M. Irvine (Corallinales) [*Lithothamnium calcareum* (Pallas) Areschoug]. LP [36], GP [36,38,154], GH [93], R [94], PCA [97,102], MB [105].
- Phymatolithon lenormandii* (Areschoug) W.H. Adey (Corallinales) [*Lithothamnium lenormandii* (Areschoug) Foslie]. GP [39], R [94], PCA [1].
- Platoma cyclocolpum* (Montagne) Schmitz (Nemastomatales). PCA [59].
- Pleonosporium borneri* (J.E. Smith) Nägeli (Ceramiales). GG [39], GP [39,41], PCA [1,29,107].
- Plocamium cartilagineum* (Linnaeus) P.S. Dixon (Plocamiales) [*Plocamium coccineum* Lyngbye nom. illeg., *P. vulgare* J.V. Lamouroux nom. illeg., *P. cartilagineum* var. *uncinatum* (C. Agardh) Guiry ex Benhissoune et al.]. GG [39,92], GP [39,104], H [36], GH [38], SPH [42,60], SH [45], BLM [36], R [40], PI [46], PCA [1,29,31,39,48,49,51,52,61,97,107].
- Pneophyllum confervicola* (Kützing) Y.M. Chamberlain (Corallinales) [*Fosliella minutula* (Foslie) Ganesan]. PCA [29,49–52,61].
- Pneophyllum fragile* Kützing (Corallinales) [*Fosliella lejolisii* (Rosanoff) Howe]. GG [39], GP [39], CV [40], R [40,94], PCA [29,49,52,61,107].
- Polysiphonia atlantica* Kapraun et J.N. Morris (Ceramiales) [*Polysiphonia macrocarpa* Harvey nom. illeg.]. GP [41].
- Polysiphonia bififormis* Zanardini (Ceramiales). PCA [97].
- Polysiphonia deusta* (Roth) Sprengel (Ceramiales). LP [36], GH [38], BLM [36], CM [36].
- Polysiphonia flexella* (C. Agardh) J. Agardh (Ceramiales). GP [39].
- Polysiphonia flocculosa* (C. Agardh) Endlicher (Ceramiales). R [40], PI [46].
- Polysiphonia opaca* (C. Agardh) Moris et De Notaris (Ceramiales). GG [39], GP [39,41], SPH [42], R [40], PI [38], PCA [1,38,49–52], LLI [38].
- Polysiphonia pulvinata* (Roth) Sprengel (Ceramiales). EP [36,38].
- Polysiphonia sanguinea* (C. Agardh) Zanardini (Ceramiales). EP [38].
- Polysiphonia scopulorum* Harvey (Ceramiales) [*Lophosiphonia scopulorum* (Harvey) Womersley]. GP [41], SPH [60], PCA [31,52]. Some records of *P. scopulorum* may represent misidentification for *Polysiphonia atlantica* [138].
- Polysiphonia sertularioides* (Grateloup) J. Agardh (Ceramiales) [*Neosiphonia sertularioides* (Grateloup) K.W. Nam et P.J. Kang]. GP [39,104], PCA [1,50]. According to Díaz-Tapia et al. [182] it is doubtful if the genus *Neosiphonia* is a distinct genus; the correct name of *P. sertularioides* is currently unclear.
- Predaea ollivieri* J. Feldmann (Nemastomatales). PCA [1,59].
- Pterocladia capillacea* (S.G. Gmelin) Santelices et Hommersand (Gelidiales) [*Pterocladia pinnata* (Hudson) Papenfuss, *P. capillacea* (S.G. Gmelin) Bornet]. C [63], SH [45], CV [40], PCA [1].
- Pterocladia melanoidea* (Schousboe ex Bornet) Santelices et Hommersand (Gelidiales) [*Gelidium melanoideum* Schousboe ex Bornet]. SPH [60], PCA [1].
- Pterothamnion crispum* (Ducluzeau) Nägeli (Ceramiales) [*Antithamnion plumula* var. *bebbii* (Reinsch) J. Feldmann and var. *crispum* (Ducluzeau) Hauck, *Platythamnion plumula* var.

- bebbii* (Reinsch) J. Feldmann]. GP [39,41], SPH [42,62], SH [45], PCA [1,39,48,49,51,61,97,148], NPCNP [73].
- Pterothamnion plumula* (I. Ellis) Nägeli (Ceramiliales) [*Antithamnion plumula* (I. Ellis) Thuret, *Platythamnion plumula* (I. Ellis) Boudouresque, Belsher et Marcot-Coqueugnot comb. inval.]. C [63], R [40], PCA [1,29,30,39,48,49,52,61,107].
- Ptilothamnion pluma* (Dillwyn) Thuret (Ceramiliales) [*Spermothamnion barbatum* (C. Agardh) Bornet]. GG [39], GP [39], PCA [1,29,30,39,48,49,51,107].
- Pyropia elongata* (Kylin) Neefus et J. Brodie (Bangiales) [misidentified as *Porphyra leucosticta* Thuret]. C [63], SPH [42]. See Cormaci et al. [18] for nomenclatural comments.
- Radicilingua reptans* (Kylin) Papenfuss (Ceramiliales). PCA [1,49,51,58,183].
- Radicilingua thysanorhizans* (Holmes) Papenfuss (Ceramiliales). PCA [1,48,97].
- Rhodophyllis bifida* (J.V. Lamouroux) Kützing (Gigartinales) [misidentified as *R. divaricata* (Stackhouse) Papenfuss, *R. appendiculata* J. Agardh]. GP [39,41], SPH [60], SH [45], CV [40], PCA [1,29,30,48,49,51,52,61,107]. See Woelkerling et al. [184] for taxonomic treatment.
- Rhodophyllis strafforelloi* Ardissonne (Gigartinales). PCA [1,48].
- Rhodymenia ardissonnei* (Kuntze) Feldmann (Rhodymeniales). C [63], GG [39], GP [39,41], SH [45,62], PI [46], PCA [1,32,39,48,52,59,61,97,136].
- Rissoella verruculosa* (A. Bertoloni) J. Agardh (Gigartinales). LP [91], C [63], GP [39,104,157], CM [40], CV [40,68], R [40,68], PI [38,46,47], PCA [1,38,59,102,163,166–169,185]. LLI [38,72].
- Rodriguezella pinnata* (Kützing) F. Schmitz ex Falkenberg (Ceramiliales). PCA [1,48,97].
- Rodriguezella strafforelloi* F. Schmitz ex J.J. Rodriguez (Ceramiliales). R [94], PCA [1,48,97,102].
- Rytiphlaea tinctoria* (Clemente) C. Agardh (Ceramiliales). GG [39], GP [36,38,39,41], BLM [36], PCA [49,97,102,177].
- Sahlingia subintegra* (Rosenvinge) Kornmann (Erythropeltidales) [*Erythrocladia subintegra* Rosenvinge]. GP [39], PCA [1,49,51].
- Schmitziella endophloea* Bornet et Batters (Gigartinales). GP [36,154].
- Schottera nicaeensis* (J.V. Lamouroux ex Duby) Guiry et Hollenberg (Gigartinales) [*Petroglossum nicaeense* (J.V. Lamouroux ex Duby) Schotter]. C [63], GP [39,104], SH [45], CM [40], CV [40], R [40], PCA [1,59].
- Scinaia complanata* (Collins) Cotton (Nemaliales). PI [59].
- Scinaia furcellata* (Turner) J. Agardh (Nemaliales). PCA [59].
- Scinaia interrupta* (A.P. De Candolle) Wynne (Nemaliales). PCA [59].
- Sebdenia dichotoma* Berthold (Sebdeniales). R [101], PI [47,59,96], PCA [59,97], LLI [72].
- Sebdenia monardiana* (Montagne) Berthold (Sebdeniales). PI [96].
- Sebdenia rodrigueziana* (J. Feldmann) Athanasiadis (Sebdeniales) [*Halymenia rodrigueziana* J. Feldmann]. PI [59], PCA [1,49,59].
- Seirospora apiculata* (Meneghini) G. Feldmann-Mazoyer (Ceramiliales). PCA [1,39,48].
- Seirospora interrupta* (J.E. Smith) F. Schmitz (Ceramiliales). GP [39].
- Seirospora sphaerospora* Feldmann (Ceramiliales). GG [39].
- Spermothamnion flabellatum* Bornet f. *disporum* Feldmann-Mazoyer (Ceramiliales). GP [39,41], PCA [49].
- Spermothamnion irregulare* (J. Agardh) Ardissonne (Ceramiliales) [*Callithamnion irregulare* J. Agardh]. GP [36,41].
- Spermothamnion johannis* G. Feldmann-Mazoyer (Ceramiliales). PCA [1,48,49,51,97,140].
- Spermothamnion repens* (Dillwyn) Magnus var *repens* (Ceramiliales). GP [39,41], PCA [1,29,30,49,52,61,107].
- Spermothamnion repens* var. *variabile* (C. Agardh) Feldmann-Mazoyer (Ceramiliales). PCA [51].
- Sphaerococcus coronopifolius* Stackhouse (Gigartinales). As *Haematocelis fissurata* P.L. Crouan et H.M. Crouan [*Ethelia fissurata* (P.L. Crouan et H.M. Crouan) Denizot]: PCA [1,48,58]. As *S. coronopifolius*: C [40], GP [36,38–41], CM [40], CV [40], R [40], GRI [38], PI [59,96], PCA [1,49,56,59,97,102]. *Haematocelis* is the sporogone of *Sphaerococcus* (gametogone).
- Sphaerococcus rhizophylloides* J.J. Rodríguez y Feminias (Gigartinales). PCA [102,186], LLI [186].

- Sphondylothamnion multifidum* (Hudson) Nägeli f. *multifidum* (Ceramiales). GP [36,38,41], BLM [36], PCA [49].
- Sphondylothamnion multifidum* f. *distichum* G. Feldmann-Mazoyer (Ceramiales). GP [39], PCA [1,48,49].
- Spongites fruticosus* Kützing (Corallinales) [*Lithothamnium fruticosum* (Kützing) Foslie]. GH [93], R [94], PCA [102], NPCNP [73].
- Spyridia filamentosa* (Wulfen) Harvey (Ceramiales). GG [39], GP [39,41], CV [40], PCA [1,31,48,49,51,52,97,107].
- Stylonema alsidii* (Zanardini) K.M. Drew (Stylonematales) [*Goniotrichum alsidii* (Zanardini) Howe]. GP [39,41], PCA [1,29,31,49,50,52,61,97,107].
- Stylonema cornu-cervi* Reinsch (Stylonematales) [*Goniotrichum cornu-cervi* (Reinsch) Hauck]. GP [41], PCA [1,29,48,49,51,52,61].
- Symphycladiella parasitica* (Hudson) D. Bustamante, B.Y. Won, S.C. Lindstrom et T.O. Cho (Ceramiales) [*Pterosiphonia parasitica* (Hudson) Falkenberg]. SPH [60].
- Symphycladiella spinifera* (Kützing) Bustamante, B.Y. Won, S.C. Lindstrom et T.O. Cho (Ceramiales) [*Pterosiphonia spinifera* (Kützing) Ardré]. PCA [61].
- Taenioma nanum* (Kützing) Papenfuss (Ceramiales). PCA [31,50].
- Tricleocarpa fragilis* (Linnaeus) Huisman et R.A. Townsend (Nemaliales) [*Galaxaura oblongata* (J. Ellis et Solander) J.V. Lamouroux]. CV [40,68], R [68], PI [96], PCA [1,59], NPCNP [73].
- Verlaquea lacerata* (Feldmann) L. Le Gall et Vergés (Gigartinales) [*Kallymenia lacerata* Feldmann]. PI [96], PCA [1,59].
- Vertebrata byssoides* (Goodenough et Woodward) Kuntze (Ceramiales) [*Brongniartella byssoides* (Goodenough et Woodward) F. Schmitz]. PCA [97,148], NPCNP [73].
- Vertebrata fruticulosa* (Wulfen) Kuntze (Ceramiales) [*Boergeseniella fruticulosa* (Wulfen) Kylin, *Polysiphonia fruticulosa* (Wulfen) Sprengel]. C [63], GP [39,41], PI [38], PCA [1,31,38,49–52], LLI [38].
- Vertebrata furcellata* (C. Agardh) Kuntze (Ceramiales) [*Polysiphonia furcellata* (C. Agardh) Harvey]. GP [41], SPH [60], PCA [49,51,52].
- Vertebrata reptabunda* (Suhr) Díaz-Tapia et Maggs (Ceramiales) [*Polysiphonia reptabunda* Suhr]. GP [39].
- Vertebrata subulifera* (C. Agardh) Kuntze (Ceramiales) [*Polysiphonia subulifera* (C. Agardh) Harvey]. PCA [1,48,49,51,52,97], NPCNP [73].
- Vertebrata tripinnata* (J. Agardh) Kuntze (Ceramiales) [*Polysiphonia tripinnata* J. Agardh]. R [40], PCA [50,52].
- Vickersia baccata* (J. Agardh) Karsakoff (Ceramiales). GP [39], PCA [1,51].
- Womersleyella setacea* (Hollenberg) R.E. Norris (Ceramiales). GG [92], GP [41], CV [68], R [68,101], PI [47,96], PCA [54–56], LLI [72], NPCNP [73].
- Wrangelia penicillata* (C. Agardh) C. Agardh (Ceramiales). GP [40], CM [40], CV [40], R [40], PI [46], PCA [1,48,49,51,97,136].
- Wurdemannia miniata* (Sprengel) Feldmann et Hamel (Gigartinales). PCA [30,49].
- Xiphosiphonia ardreana* (Maggs et Hommersand) Savoie et G.W. Saunders (Ceramiales) [*Pterosiphonia ardreana* Maggs et Hommersand]. GP [41].
- Xiphosiphonia pennata* (C. Agardh) Savoie et G.W. Saunders (Ceramiales) [*Pterosiphonia pennata* (C. Agardh) Sauvageau]. GG [39], SPH [42], SH [45].
- Xiphosiphonia pinnulata* (Kützing) Savoie et G.W. Saunders (Ceramiales) [*Pterosiphonia pinnulata* (Kützing) Maggs et Hommersand]. GP [41].
- 3.5. Brown Algae (*Phaeophyceae*, Kingdom *Stramenopiles*)
- Acinetospora crinita* (Carmichael) Sauvageau (Ectocarpales). GP [41], SPH [60], PCA [50,52].
- Arthrocladia villosa* (Hudson) Duby (Desmarestiales). R [101], PI [96], PCA [1,59,97], NPCNP [73].
- Asperococcus bullosus* J.V. Lamouroux (Ectocarpales) [including f. *profundus* Feldmann]. GP [36,38], R [101], BLM [36], PI [59], PCA [1,48,49,59,97], LLI [36,38].

- Asperococcus ensiformis* (Delle Chiaje) M.J. Wynne (Ectocarpales) [*Asperococcus compressus* Griffiths ex W.J. Hooker, *Haloglossum compressum* (Griffiths ex W.J. Hooker) Hamel]. GP [36,38], PCA [49].
- Carpomitra costata* (Stackhouse) Batters var. *costata* (Sporochnales). PI [59], PCA [59,97].
- Choristocarpus tenellus* Zanardini (Discosporangiales). PCA [49,51,58,187].
- Cladosiphon cylindricus* (Sauvageau) Kylin (Ectocarpales) [*Castagnea cylindrica* Sauvageau]. GG [39], GP [39], PCA [1,29,49,51,107].
- Cladosiphon irregularis* (Sauvageau) Kylin (Ectocarpales) [*Castagnea irregularis* Sauvageau]. GG [39], PCA [1,48,49,51,107].
- Cladosiphon mediterraneus* Kützing (Ectocarpales) [*Castagnea mediterranea* (Kützing) Hauck]. GP [39].
- Cladosiphon zosterae* (J. Agardh) Kylin (Ectocarpales) [*Myriocladia zosterae* J. Agardh]. GP [36], BLM [36]. Regarded as introduced from the Atlantic Ocean in coastal lagoons harbouring shellfish aquaculture [138].
- Cladostephus hirsutus* (Linnaeus) Boudouresque et Perret-Boudouresque ex Heesch, Rindi, Guiry et Nelson. (Sphacelariales) [Misidentified as *Cladostephus spongiosus* (Hudson) C. Agardh and *C. verticillatus* (Lightfoot) Lyngbye nom. illeg.]. C [40], GP [36,38,39,41], SPH [60], SH [45], BLM [36], CM [40], CV [40], R [40], PI [46,96], PCA [1,49,51,53,59]. For taxonomic treatment, see Heesch et al. [188].
- Colpomenia peregrina* Sauvageau (Ectocarpales). PCA [49,51,59,61].
- Colpomenia sinuosa* (Mertens ex Roth) Derbès et Solier (Ectocarpales). C [63], GP [36,38,39], SPH [42,60], CM [40], CV [40], PI [46,59], PCA [1,32,49,50,53,59,61].
- Cutleria adspersa* (Roth) De Notaris (Tilopteridales). As *C. adspersa*: PI [59], PCA [1,49,59]. As *Aglaozonia melanoidea* Sauvageau: PCA [1]. *A. melanoidea* is the sporogene of *C. adspersa* (gametogene).
- Cutleria chilosa* (Falkenberg) P.C. Silva (Tilopteridales) [*Cutleria monoica* Ollivier]. As *Cutleria monoica*: PCA [49,51]. As *Aglaozonia chilosa* Falkenberg: PCA [1,48,49,51,97,107], NPCNP [73]. *Aglaozonia chilosa* is the sporogene of *Cutleria chilosa* (gametogene).
- Cutleria multifida* (Turner) Greville (Tilopteridales). As *C. multifida*: PI [46], PCA [49,51,59,61]. As *Aglaozonia parvula* (Greville) Zanardini: GP [39,41], SPH [60], PCA [31,49,50,52,61]. *A. parvula* is the sporogene of *C. multifida* (gametogene).
- Cystoseira compressa* (Esper) Gerloff et Nizamuddin var. *compressa* (Fuciales) [*Cystoseira abrotanifolia* (Linnaeus) C. Agardh, *C. fimbriata* Bory]. C [63], GP [39,104], SPH [42,62], SH [45,62], CM [40], CV [40,68,159], R [40,68,159], PI [38,46,47], PCA [1,24,31,32,49,53,59,136,166–169,189], LLI [72].
- Cystoseira compressa* subsp. *pustulata* (Ercegović) Verlaque (Fuciales) [*Cystoseira compressa* var. *pustulata* (Ercegović ex Verlaque nom. inval.]. CV [159], R [159], PCA [24,189].
- Cystoseira foeniculacea* (Linnaeus) Greville f. *foeniculacea* (Fuciales) [*Cystoseira discors* (Linnaeus) C. Agardh, *C. ercegovicii* Giaccone]. LP [36], GP [39], GH [38], SH [45,62], CV [68,159], R [68,159], PI [38,46], PCA [1,24,189].
- Cystoseira foeniculacea* f. *latiramosa* (Ercegović) Gómez Garreta, Barceló, Ribera et Rull Lluch (Fuciales). LLI [72].
- Desmotrichum tenuissimum* (C. Agardh) Athanasiadis (Ectocarpales) [*Desmotrichum undulatum* (J. Agardh) Reinke]. PCA [61].
- Dictyopteris polypodioides* (A.P. De Candolle) J.V. Lamouroux (Dictyotales) [*Dictyopteris membranacea* Batters]. LP [91], C [40,63], GG [38,39], GP [36,38,39,41,104], SH [45], BLM [36], CM [40], CV [40], R [40,101], PI [46,59,96], PCA [1,39,48,49,52,59,61,97], LLI [72].
- Dictyota dichotoma* (Hudson) J.V. Lamouroux var. *dichotoma* (Dictyotales). LP [91], C [63], GG [39], GP [36,38,39], BLM [36], GRI [38], SH [45,62], PI [46], PCA [1,39,48–50,52,61,97,98], NPCNP [73].
- Dictyota dichotoma* var. *intricata* (C. Agardh) Greville (Dictyotales) [*Dictyota dichotoma* var. *implexa* (Desfontaines) S.F. Gray, *D. implexa* (Desfontaines) J.V. Lamouroux]. C [63], GP [39], PI [46], PCA [1,61], NPCNP [73].

Dictyota fasciola (Roth) J.V. Lamouroux var. *fasciola* (Dictyotales) [*Dilophus fasciola* (Roth) Howe]. C [40], GG [39,41], GP [39,40,104], SPH [60], CM [40], CV [40], PI [46], PCA [1,48–50,53,61].

Dictyota fasciola var. *repens* (J. Agardh) Ardissonne (Dictyotales) [*Dilophus repens* (J. Agardh) J. Agardh]. GP [39], CV [40], R [40], PCA [1,49,50,136].

Dictyota linearis (C. Agardh) Greville (Dictyotales). GP [36,41], BLM [36], CV [40], PCA [1,29,31,48,49,51,52,97,107]. We follow the taxonomic treatment of Cormaci et al. [22] in recognizing *D. linearis* as a distinct species.

Dictyota mediterranea (Schiffner) G. Furnari (Dictyotales) [*Dilophus mediterraneus*]. PCA [51,52].

Dictyota spiralis Montagne (Dictyotales) [*Dilophus ligulatus* (Kützing) Feldmann, *D. spiralis* (Montagne) Hamel]. C [63], PI [46].

Dilophus linearis Coppejans *nomen nudum* (Dictyotales). PCA [49]. Name invalidly published.

Discosporangium mesarthrocarpum (Meneghini) Hauck (Discosporangiales). CV [40], PCA [1,49,51,58,97].

Ectocarpus siliculosus (Dillwyn) Lyngbye (Ectocarpales) [*Ectocarpus confervoides* Le Jolis]. GG [39], PCA [52].

Elachista intermedia P.L. Crouan et H.M. Crouan (Ectocarpales). PCA [1,49,51].

Elachista stellaris J.E. Areschoug (Ectocarpales). PCA [1,48].

Ericaria amentacea (C. Agardh) Molinari Novoa et Guiry (Fuciales) [*Cystoseira amentacea* var. *stricta* Montagne, *C. stricta* (Montagne) Sauvageau]. LP [33,91], C [33,36,63], GG [38,92], GP [33,36,39,40,104,157], LLM [33], LL [33], RCM [33], CM [33,40], CV [33,40,68], R [33,40,68,101], GRI [38], PI [33,46,47,123], PCA [1,24,32,33,59,136,166–169,189], LLI [33,72].

Ericaria brachycarpa (J. Agardh) Molinari Novoa et Guiry var. *brachycarpa* (Fuciales) [*Cystoseira balearica* Sauvageau, *C. brachycarpa* J. Agardh, *C. caespitosa* Sauvageau]. CM [40], CV [40,68,159], R [68,159], PCA [1,24,31,32,49,50,53,189,190].

Ericaria brachycarpa var. *claudiae* (Giaccone) comb. nov. (Fuciales) [*Cystoseira balearica* var. *claudiae* Giaccone]. CV [159], R [159]. We propose here the new combination, to date not proposed; basonym *Cystoseira balearica* Sauvageau var. *claudiae* Giaccone in Amico et al. [191] (1986: 906; Figures 22–23; *Bol. Acc. Gioenia Sci. Nat.*, 18(326), 887–986; dated '1985'); Latin diagnosis in Cinelli et al. [192] (1976: 161; *Mem. Biol. Mar. Oceanogr.*, N.S., 6(5), 141–174).

Ericaria crinita (Duby) Molinari Novoa et Guiry (Fuciales) [*Cystoseira crinita* Duby]. LP [34,91], C [34], GP [34,39,104], BLM [34], LL [34], RCM [34], CM [34], CV [68,159], R [34,68,159], PI [38,46], PCA [1,24,53,189], LLI [34,72].

Ericaria funkii (Schiffner ex Gerloff et Nizamuddin) Molinari Novoa et Guiry (Fuciales) [*Cystoseira funkii* Schiffner ex Gerloff et Nizamuddin]. R [68,101], PI [96], PCA [24,54,56,189,193].

Ericaria zosteroides (C. Agardh) Molinari Novoa et Guiry (Fuciales) [*Cystoseira opuntioides* Bory ex Montagne, *C. zosteroides* C. Agardh]. R [68,101], PI [47,96], PCA [24,49,54,56,59,102,189,193], LLI [72], MB [106].

Eudesme virescens (Carmichael ex Berkeley) J. Agardh (Chordariales). PCA [59].

Feldmannia irregularis (Kützing) Hamel (Ectocarpales). GP [39], PCA [49,51].

Feldmannia mitchelliae (Harvey) H.S. Kim (Ectocarpales) [*Giffordia mitchelliae* (Harvey) Hamel, *Hincksia mitchelliae* (Harvey) P.C. Silva]. GP [39], PCA [61].

Feldmannia padinae (Buffham) Hamel (Ectocarpales). PCA [49,52].

Feldmannia paradoxa (Montagne) Hamel var. *paradoxa* (Ectocarpales) [*Feldmannia globifera* (Kützing) Hamel]. GP [39], CV [40], PCA [49,52].

Feldmannia paradoxa (Montagne) Hamel var. *donatiae* (Ercegović) M.J. Wynne (Ectocarpales) [*Ectocarpus caespitulus* J. Agardh, *Feldmannia caespitula* (J. Agardh) Knoepffler-Péguy]. GP [36,38], PI [46], PCA [1,31,49,51,194].

Giraudya sphaclarioides Derbès et Solier (Ectocarpales). GG [39], GP [39], CV [40], PCA [1,29,32,48,49,51,52,61,107].

- Gongolaria barbata* (Stackhouse) Kuntze (Fucales) [*Cystoseira barbata* (Stackhouse) C. Agardh, incl. var. *barbata* and var. *hoppei* (C. Agardh) J. Agardh]. LP [36], CV [159], R [159], PI [38], PCA [24,189], LLI [36].
- Gongolaria elegans* (Sauvageau) Molinari Novoa et Guiry (Fucales) [*Cystoseira elegans* Sauvageau]. CV [159], R [159], PCA [24,189].
- Gongolaria montagnei* (C. Agardh) Kuntze var. *montagnei* (Fucales) [*Cystoseira spinosa* Sauvageau]. GP [104], CV [159], R [101], PI [47], PCA [1,24,48,97,102,189].
- Gongolaria montagnei* var. *compressa* (Ercegović) comb. nov. (Fucales) [*Cystoseira spinosa* var. *compressa* (Ercegović) Cormaci, G. Furnari, Giaccone, Scammacca et Serio]. CV [68], R [68], PCA [24,189], LLI [72]. We propose here the new combination, to date not proposed; basonym *Cystoseira adriatica* Sauvageau var. *compressa* Ercegović (Ercegović, 1952 [195]. 'Jadranske Cistozire. Njihova morfologija, ekologija i razvitak'. Sur les cystoseira adriatiques. Leur morphologie, écologie et evolution. Flora et flora adriatica, volumen II. Institut za Oceanografiju i Ribarstvo FNR Jugoslavije, Split), diagnosis page 107, figure plate 9.
- Gongolaria montagnei* var. *tenuior* (Ercegović) Molinari Novoa et Guiry (Fucales) [*Cystoseira jabukae* Ercegović, *C. spinosa* var. *tenuior* (Ercegović) Cormaci, G. Furnari, Giaccone, Scammacca et Serio]. CV [159], R [159], PI [96], PCA [24,189], LLI [72].
- Gongolaria sauvageauana* (Hamel) Molinari Novoa et Guiry (Fucales) [*Cystoseira sauvageauana* Hamel]. GRI [38], PCA [24,189].
- Halopteris filicina* (Grateloup) Kützing (Sphacelariales). C [36], GG [38], GP [36,38,39,41], SPH [60], BLM [36], CV [40], R [40], PI [96], PCA [1,29,30,39,48,49,51,59,61,97,102,107], MB [106,175], NPCNP [73].
- Halopteris scoparia* (Linnaeus) Sauvageau (Sphacelariales) [*Stypocaulon scoparium* (Linnaeus) Kützing]. C [40,63], GP [39–41,104], SPH [42,60,62], SH [45,62], CM [40], CV [40], R [40], GRI [38], PI [46,59,99], PCA [1,31,32,49,51–53,59,61,98].
- Hapalospongidion macrocarpum* (Feldmann) León-Álvarez et González-González (Ralfsiales) [*Mesospora macrocarpa* (J. Feldmann) Hartog, *M. mediterranea* Feldmann]. GP [39,104], PCA [31,50].
- Herponema valianthei* (Bornet) Hamel (Ectocarpales). GP [39].
- Hincksia granulosa* (J.E. Smith) P.C. Silva (Ectocarpales) [*Ectocarpus granulosa* (J.E. Smith) C. Agardh]. C [36].
- Hincksia ovata* (Kjellman) P.C. Silva (Ectocarpales) [*Giffordia intermedia* (Rosenvinge) Lund]. PCA [49].
- Hincksia sandriana* (Zanardini) P.C. Silva (Ectocarpales) [*Giffordia sandriana* (Zanardini) Hamel]. PCA [1,48,49].
- Hydroclathrus clathratus* (Bory ex C. Agardh) M. Howe (Ectocarpales). PCA [59].
- Kuckuckia spinosa* (Kützing) Kornmann (Ectocarpales). GP [41], PCA [30,49,51,52,61].
- Kuetzingiella battersii* (Bornet) Kornmann (Ectocarpales). PCA [52].
- Laminaria rodriguezii* Bornet (Laminariales). R [101,196], PCA [106], LLI [175], MB [106,175,196].
- Leathesia mucosa* J. Feldmann var. *condensata* J. Feldmann (Ectocarpales). PI [59], PCA [1,59].
- Lobophora variegata* (J.V. Lamouroux) Womersley ex E.C. Oliveira (Dictyotales) [*Pocockiella variegata* (J.V. Lamouroux) Papenfuss]. PCA [1,49,51].
- Mesogloia leveillei* (J. Agardh) Meneghini (Ectocarpales) [*Liebmannia leveillei* J. Agardh]. GP [39], PCA [32].
- Mesogloia vermiculata* (J.E. Smith) S.F. Gray (Ectocarpales). PCA [49].
- Myriactula gracilis* van der Ben (Ectocarpales). PCA [1,29,48].
- Myriactula stellulata* (Harvey) Levring (Ectocarpales). PCA [49,51,52], NPCNP [73].
- Myrionema conchicola* (J. Feldmann) Boudouresque (Ectocarpales) [misidentified as *Myrionema magnusii* (Sauvageau Loiseaux nom. inval.]. CV [40], PCA [52]. See Cormaci et al. [22] for taxonomic features.
- Myrionema hemisphaericum* Sauvageau (Ectocarpales). PCA [49,51].

- Myrionema liechtensternii* Hauck (Ectocarpales). PCA [49,51,58,197].
- Myrionema orbiculare* J. Agardh (Ectocarpales) [*Ascocyclus orbicularis* (J. Agardh) Kjellman]. GG [39], GP [39,41], PCA [1,29,30,32,48,61,107].
- Myrionema strangulans* Greville (Ectocarpales). GP [39], PCA [61].
- Myriotrichia claviformis* 'clavaeformis' Harvey (Ectocarpales). PCA [32,52].
- Nemacystus flexuosus* (J. Agardh) Kylin var. *giraudyi* (J. Agardh) Y.S.D.M. De Jong (Ectocarpales) [*Nemacystus ramulosus* Derbès et Solier]. GP [41]. PCA [1,32,49,51].
- Nemoderma tingitanum* Schousboe ex Bornet (Nemodermatales). GP [39], CM [40], PCA [31,32].
- Nereia filiformis* (J. Agardh) Zanardini (Sporochnales). GP [36,38,39,41], CV [68], R [68], PI [96], PCA [1,48,49,59,61,97,106], LLI [72].
- Padina pavonica* (Linnaeus) J.V. Lamouroux (Dictyotales) [*Padina pavonia* J.V. Lamouroux]. LP [91], GG [38,39], GP [38,39,41,104], SPH [42], SH [45], CM [40], CV [40], R [40,94,101], PI [38,46,47,59,96], PCA [1,29,31,32,38,49–53,59,61,98], LLI [38].
- Petalonia fascia* (O.F. Müller) Kuntze (Ectocarpales). C [63].
- Phyllariopsis brevipes* (C. Agardh) E.C. Henry et G.R. South (Tilopteridales) [*Phyllaria reniformis* (J.V. Lamouroux ex J. Agardh) Rostafinsky ex Bornet]. R [68,101], PI [47,59,96], PCA [1,59], LLI [72].
- Pseudolithoderma adriaticum* (Hauck) Verlaque (Ralfsiales) [*Lithoderma adriaticum* Hauck]. GG [92], GP [39,41], PCA [1,31,49,51,52].
- Pseudoralfsia verrucosa* (Areschoug) Parente, Fletcher et G.W. Saunders (Ralfsiales) [*Ralfsia verrucosa* (Areschoug) Areschoug]. LP [36], GP [36,38–41,104], BLM [36], CM [40], CV [40], R [40], PCA [1,49].
- Sargassum acinarium* (Linnaeus) Setchell (Fucales). C [35], GP [35], PI [35], PCA [Feldmann 1929 in [24,35,189]], LLI [35].
- Sargassum vulgare* C. Agardh *nom. illeg. f. vulgare* (Fucales). LP [36], GP [35,36,38], BLM [35,36], CV [35], R [68,159], PI [35,38,47], PCA [1,24,35,49,51,59,189], LLI [35,36,38,72].
- Sargassum vulgare f. diversifolium* Grunow (Fucales). PI [47,96].
- Sauvageaugloia divaricata* (Clemente) Cremades (Ectocarpales) [*Sauvageaugloia griffithsiana* (Greville ex W.J. Hooker) Hamel ex Kylin, *Mesogloia griffithsiana* Greville ex W.J. Hooker]. GP [39], PI [198], PCA [198], LLI [198].
- Scytosiphon lomentaria* (Lyngbye) Link (Ectocarpales). C [63], GP [39], GH [198], SPH [42], SH [45], PI [38], PCA [1,38], LLI [38].
- Spatoglossum solieri* (Chauvin ex Montagne) Kützing (Dictyotales). PCA [56,59], LLI [72].
- Spermatochnus paradoxus* (Roth) Kützing (Ectocarpales). PCA [48,52,97].
- Sphacelaria cirrosa* (Roth) C. Agardh (Sphacelariales) [incl. *f. mediterranea* Sauvageau; *S. hystrix* Suhr ex Reinke]. GG [39], GP [39,41,198], SPH [60], R [40], PI [46], PCA [1,29–32,39,48–52,61,97,107,136], NPCNP [73].
- Sphacelaria fusca* (Hudson) S.F. Gray (Sphacelariales). CV [40], PCA [1,49,51,52].
- Sphacelaria plumula* Zanardini (Sphacelariales). GP [41], PCA [1,48,49,51], NPCNP [73].
- Sphacelaria rigidula* Kützing (Sphacelariales) [*Sphacelaria furcigera* Kützing]. GP [39,41], SPH [2,60], PCA [49,51].
- Sphacelaria tribuloides* Meneghini (Sphacelariales). GP [39,41,198], SPH [42], SH [45], PCA [31,32,49,50].
- Sporochnus pedunculatus* (Hudson) C. Agardh (Sporochnales). GG [110], PCA [1,59], NPCNP [73].
- Stictyosiphon soriferus* (Reinke) Rosenvinge (Ectocarpales). PCA [50].
- Stilophora tenella* (Esper) P.C. Silva (Ectocarpales) [*Stilophora rhizodes* (Turner) J. Agardh *nom. illeg.*, incl. *var. adriatica* J. Agardh]. GP [41], PCA [1,49,51,52].
- Strepsithalia liagorae* Sauvageau (Ectocarpales). PCA [49].
- Taonia atomaria* (Woodward) J. Agardh (Dictyotales). GG [39], GP [36,38,39], CM [40], CV [40], PI [46], PCA [1,49].

Zanardinia typus (Nardo) P.C. Silva (Tilopteridales) [*Zanardinia collaris* P.L. Crouan et H.M. Crouan, *Z. prototypus* (Nardo) Nardo]. LP [36], GP [39,41], CM [40], CV [40], R [94], PI [59,96], PCA [1,39,48,49,59,97,102], LLI [36,38,72].

Zonaria tournefortii (J.V. Lamouroux) Montagne (Dictyotales). PI [59,96], PCA [1,59,97], LLI [72].

Zosterocarpus oedogonium (Meneghini) Bornet (Ectocarpales). PCA [1,48,97].

3.6. Pelagophyceae (Kingdom Stramenopiles)

Nematochryopsis marina (J. Feldmann) C. Billard [*Tribonema marinum* Feldmann]. GP [41].

3.7. Prymnesophyceae (Kingdom Haptobionta)

Chrysoreinhardia giraudyi (Derbès et Solier) C. Billard [*Phaeocystis giraudyi* Derbès et Solier]. GP [41], PCA [29,50].

3.8. Taxa Inquirenda

Acrochaetium mediterraneum (Levring) Athanasiadis (Acrochaetiales). GP [39], PCA [61]. See Cormaci et al. [18].

Ectocarpus brachiatus (C. Agardh) J. Agardh (Ectocarpales). VSSM [36].

Fosliella zonalis (P.L. Crouan et H.M. Crouan) J. Feldmann (Corallinales). PCA [50]. See Cormaci et al. [18] for taxonomic discussion.

Lithophyllum lobatum Lemoine (Corallinales). PCA [1,48]. See Cormaci et al. [18] for taxonomic discussion.

Polysiphonia havanensis Montagne (Ceramiales). PCA [52]. *P. havanensis* Montagne, a taxon of uncertain status, is different from *P. havanensis sensu* Børgesen, which is known from eastern Atlantic (Azores, Madeira, Canary Islands) and Mediterranean Morocco [199].

Polysiphonia spinella C. Agardh (Ceramiales). PI [38], PCA [38], LLI [38].

Porphyra laciniata auctorum (Bangiales). GP [36,38], LL [36]. The type specimen of *Porphyra laciniata* (Lightfoot) C. Agardh actually belongs to the genus *ErythroGLOSSUM* (in [18]); it is difficult to resituate in the current taxonomy the old records of *P. laciniata*.

Sargassum flavifolium Kützing (Fucales). LLI [35]. According to Aouissi et al. [200], the presence of this species in the Mediterranean requires confirmation.

3.9. Taxa Excludenda

Acrochaetium lenormandii (Suhr ex Kützing) Nägeli (Acrochaetiales). PCA [49]. See Cormaci et al. [18] for taxonomic treatment.

Atractophora hypnoides P.L. Crouan et H.M. Crouan (Atractophorales). PCA [59]. The occurrence of this Atlantic species at Port-Cros is doubtful.

Ceramium rosenvingei Petersen (Ceramiales) [*Ceramium rubrum* var. *decurrens* J. Agardh]. C [36], GP [36], LLI [36].

Codium adhaerens C. Agardh (Codiales). GP [36]. See Cormaci et al. [17] for nomenclatural comments.

Cordylecladia erecta (Greville) J. Agardh (Gracilariales). GP [39], SPH [60]. A possible confusion with *C. guiryi* described from Sicily by Gargiulo et al. [201] and recorded at Marseilles by Klein and Verlaque [133].

Derbesia marina (Lyngbye) Solier (Bryopsidales). GP [36,38], LLI [36,38]. *D. marina* is the sporogone of *Halicystis ovalis* (Lyngbye) Areschoug (the gametogone). According to Gallardo et al. [202], all Mediterranean records of this species are misidentifications for *D. tenuissima* (Moris et De Notaris) P.L. Crouan et H.M. Crouan and *H. parvula* F. Schmitz.

Dictyosiphon foeniculaceus (Hudson) Greville (Ectocarpales). PCA [48].

Gayliella flaccida (Harvey ex Kützing) T.O. Cho et L. McIvor (Ceramiales) [*Ceramium flaccidum* (Harvey ex Kützing) Ardissonne]. GP [41], PCA [32]. Occurrence in the Mediterranean should be confirmed.

Leptosiphonia fibrata (C. Agardh) A.M. Savoie et G.W. Saunders (Ceramiales) [*Polysiphonia fibrata* (Dillwynn) Harvey]. LL [36].

Porphyra umbilicalis Kützting (Bangiales). GP [39]. We follow Cormaci et al. [18].

Tricleocarpa cylindrica (J. Ellis et Solander) Huisman et Borowitzka (Nemaliales). PI [59]. According to Cormaci et al. [18], the occurrence of this pantropical species in the Mediterranean Sea should be confirmed.

4. Discussion

4.1. How Many Taxa?

In 1976, Belsher et al. [1] listed 335 taxa and stadia (life stages) of green, red and brown macroalgae for the Gulf of Hyères and Hyères islands, including the Port-Cros Archipelago, the latter then constituting the Port-Cros National Park (PCNP). The present updated checklist identifies 502 taxa, on a slightly different scale, that of the N-PCNP, from La Garde to Ramatuelle (eastern Provence) (Figure 1), and a slightly different taxonomic format, macrophytes (including seagrasses) instead of macroalgae. As far as the Port-Cros Archipelago is concerned, the number of recorded taxa was 285 in 1976 [1], 284 in 1981 [58], 353 in 1985 [28] and 441 (present study).

Such gamma species diversity (see [203] for the concept of diversity) is not low, but far from particularly high: it falls just within the norm for a size-diversity relationship in the Mediterranean (Table 1). In addition, the research effort in the AMA of the N-PCNP has been particularly strong (see Section 4.3), which would imply that exceptionally high numbers of taxa might be expected. This may disappoint those who, on the basis of an old conception of biodiversity (see e.g., [5] for criticism), believe that a national park necessarily harbours high gamma species diversity, and that only high species diversity deserves to be protected. For the tiny Isole dei Ciclopi (Sicily) and the Principality of Monaco (French Riviera), 380 and 365 taxa and stages have been reported, respectively (Table 1). Overall, the number of taxa reported from the N-PCNP represents 40 to 55% of the Mediterranean epsilon diversity (Table 2).

Table 1. Epsilon taxon diversity of macrophytes in a number of Mediterranean areas. The maximum distance (as the crow flies) between the outer limits of the area was used as a proxy for its size. Note that the research effort differs between areas.

Area	Size	Number of Taxa	Reference
Thau Lagoon (Occitania, France)	SW–NE: ~20 km	222 ^a 179 ^b	Boudouresque et al. [204]
Maltese Islands	W–E: ~41 km	223 ^c	Cormaci et al. [205]
Maddalena Peninsula (Sicily)	~9 km	229 ^c	Cormaci and Furnari [206]
Venice Lagoon (northern Adriatic, Italy)	SW–NE: ~50 km	277 ^c	Sfriso and Curiel [207]
Isole dei Ciclopi (Catania, Sicily)	W–E: ~0.1 km	380 ^{c,d}	Giaccone and Pizzuto [208]
Principality of Monaco (French Riviera)	SW–NE: ~3 km	381	Verlaque and Bernard [209]
Balearic Islands	SW–NE: 290 km	420 ^c	Ribera Siguan and Gómez-Garreta [210]
Aeolian Islands (Tyrrhenian Sea, Italy)	W–E: ~80 km	441 ^d	Giaccone et al. [211]
Scàndula Nature Reserve area (Galeria-Ghjiurulatu, Corsica)	NW–SE and W–E: ~18 km	454	Verlaque [212]
Study area: AMA of the N-PCNP	W–E: ~63 km	502	This study
French Catalonia	N–S: ~46 km	540	Boudouresque et al. [213]
Iblea area (SE Sicily)	N–S and W–E: ~170 km	573 ^d	Giaccone and Di Martino [214]

^a Cumulative census dating back to the 19th century. ^b Thorough exploration of the lagoon since 1994. ^c Magnoliophyta not taken into account by the authors. ^d Cyanobacteria removed.

Table 2. Number of taxa at the scale of the study area and of the whole Mediterranean Sea. Note that the accepted taxa generally follow the treatment of Cormaci et al. (2012, 2014, 2017, 2020, 2021), but sometimes other authors, such as Guiry and Guiry (2022), are followed: see text in Section 3 for details.

Taxa	Number of Taxa in the N-PCNP	Number of Taxa in the Mediterranean Sea (Reference)
Green algae (Chlorobionta, kingdom Archaeplastida)	73	214 (Gallardo et al. [202]) 176 (Cormaci et al. [17])
Red algae (Rhodobionta other than Ceramiales, kingdom Archaeplastida)	166	352 (Cormaci et al. [18–20])
Red algae (Ceramiales, Rhodobionta, kingdom Archaeplastida)	150	271 (Gómez Garreta et al. [215])
Brown algae (Phaeophyceae, kingdom Stramenopiles)	104	265 (Ribera et al. [216]) 270 (Cormaci et al. [22])

A higher number of species was reported from Giens Peninsula, Porquerolles Island and the Port-Cros Archipelago than in other, less explored (see below) localities and sites. Some large species, easy to identify and therefore unlikely to be missed, have been only found at mainland localities and sites, but not at Porquerolles Island, Port-Cros Archipelago and Le Levant Island: *Alsidium helminthochorton*, *Digenea simplex*, *Halopithys incurva* and the gametogene of *Asparagopsis armata*; a lower mean sea surface temperature, at offshore islands than at mainland areas, may account for these observations. Other large species, some of them of cold affinities, such as *Calliblepharis ciliata*, *C. jubata*, *Gymnogongrus crenulatus*, *Lomentaria articulata* and *Spatoglossum solieri*, were only reported from offshore islands.

The increase over time in the cumulative number of taxa presents two major phases: the foundational work of Mouret [36] in 1911 and the bulk of taxonomic and ecological studies of the 1970–1980s (e.g., [1,39,49,51]) (Figure 2).

It is worth underlining that such a cumulative checklist, although useful and even essential for management purposes, must be handled with caution. For some civil servants of state agencies (e.g., in France the Ministry of the Environment and the *Service Patrimoine* of the Muséum National d’Histoire Naturelle), the production of these inventories sometimes constitutes in a way a goal in itself, and the paradigm of biodiversity, whereas it is rather a caricature of the concept of biodiversity, and the opposite of an ecosystem-based approach to biodiversity. Biodiversity is a multidimensional concept, encompassing levels of complexity from within species to across ecosystems: evolutionary scale (from genes to species and kingdoms); functional scale; organizational scale (from patches to landscapes/seascapes); spatial scale; and heterogeneity scale [203,217–219]. This naive approach to biodiversity, this race for the maximum number of species (‘my list of species is longer than yours!’) can have several perverse effects: (i) It can divert a disproportionate amount of human and financial resources for the production of lists of species whose value is more arithmetical than ecological, although they are obviously necessary. (ii) It helps to ‘deify’ the number of species, whereas it is just one descriptor of biodiversity among others, and this descriptor is far from being the most relevant, in contrast with functional diversity and ecosystem diversity. (iii) It contributes to the general public’s belief that the greater the number of species in an area, the more this area deserves protection. (iv) It equates species that are important because of their rarity, or the role they play in ecosystems, or which are abundant, with species that occur incidentally, are sometimes observed only once, and are therefore without ecological and biogeographical significance. (v) It underestimates ‘ordinary biodiversity’, which might be seen as ‘the biodiversity of the people’, that ensures the functioning of ecosystems throughout the year, in favor of biodiversity that is in a way ‘aristocratic’, qualified as ‘heritage value species’. The term ‘heritage value species’ is very vague and even fuzzy: it covers truly rare and/or threatened species, attractive and human-friendly species, species supported by taxonomic lobbies (e.g., bird, bat and

sea mammal lobbies), and legitimately protected species together with not legitimately protected species, species that are just protected thanks to taxonomic lobbies.

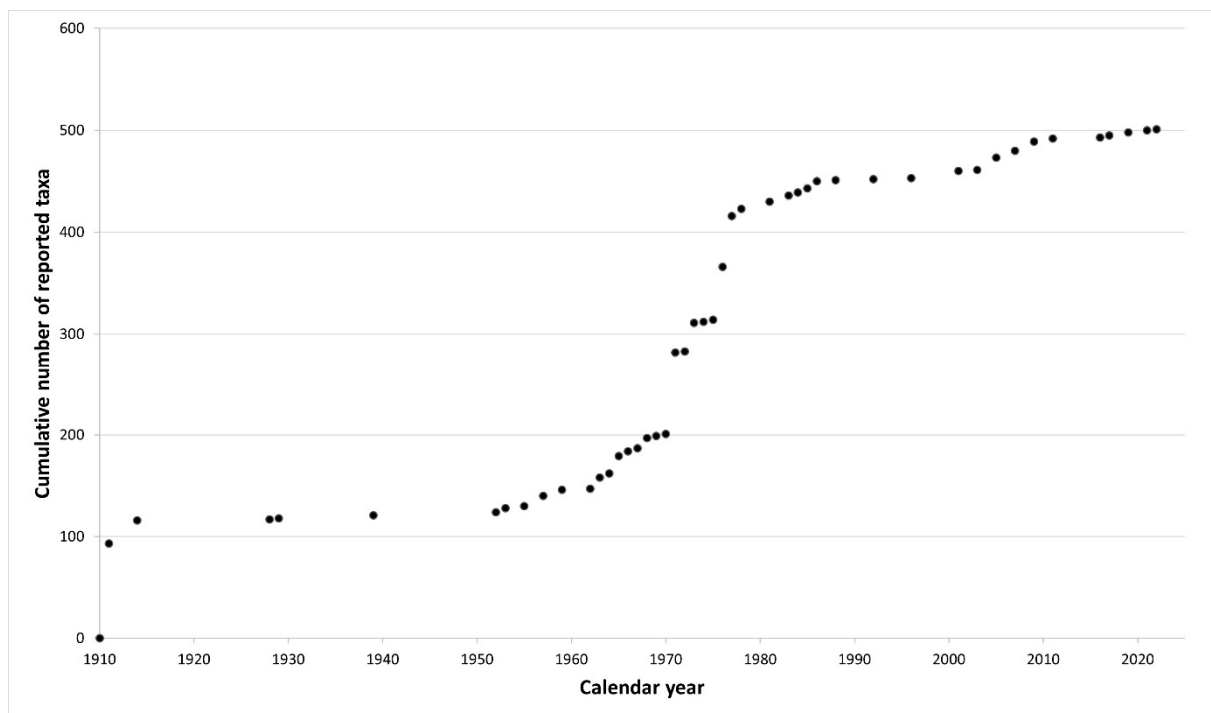


Figure 2. Cumulative number of reported taxa of macrophytes over time, in the N-PCNP, since the early 20th century.

Of course, the species gamma diversity may be underestimated in the framework of the present study. On the one hand, taxonomic expertise and research effort have declined over time (see below). On the other hand, partly following from the first point, species newly described elsewhere in the Mediterranean were not searched for in the N-PCNP. For example, *Dictyopteris lucida* M.A. Ribera Siguán, A. Gómez Garreta, Pérez Ruzafa, Barceló Martí *et* Rull Lluch, previously confused with *D. polypodioides* [220], *Lithophyllum pseudoracemus* Caragnano, Rodondi *et* Rindi, previously confused with *L. racemus* [221] and the cryptic species hitherto confused as *Padina pavonica* [222].

4.2. How Many Introduced Species?

Introduced species are recognized worldwide as a major threat to biodiversity [223–225]. The Mediterranean Sea is the area most hit worldwide by introduced species [138,226–228].

In the N-PCNP area, the number of introduced macrophyte species is relatively low: only 18 species, namely *Caulerpa cylindracea*, *C. taxifolia*, *Codium fragile* (Chlorobionta), *Acrothamnion preissii*, *Antithamnion amphigeneum*, *Antithamnionella elegans*, *Asparagopsis armata*, *Chondria curvilineata*, *Colaconema codicola*, *Goniotrichopsis sublittoralis*, *Lophocladia lallemandii*, *Malanothamnus harveyi*, *Phrix spatulata*, *Polysiphonia atlantica*, *Womersleyella setacea* (Rhodobionta), *Colpomenia peregrina*, *Cutleria multifida* and *Desmotrichum tenuissima* (Phaeophyceae). These 18 species are to be compared with the 117 non-indigenous species recorded in the Mediterranean Sea [138].

In the middle of the 20th century, Elton (ecological resistance theory—ERT) [229] claimed that low species diversity and disturbance favored biological invasions. As a matter of fact, ERT is today widely challenged. At least in the marine realm, species richness usually enhances biological invasions (ecological acceptance hypothesis—EAH) [230–232]. In fact, the probability of introduction does not depend upon species richness and disturbances, but on the presence of a vector, e.g., a harbour or aquaculture facilities; for

this reason, the N-PCNP is less affected by introduced species than, e.g., the Calanques National Park (western Provence), adjacent to the port of Marseilles, and Thau Lagoon in Occitania, a major shellfish aquaculture area [40,204,233]. As already pointed out by a host of authors (e.g., [234–238]), invasive species do not respect the boundaries of marine protected areas (MPAs).

Four introduced species are invasive in the N-PCNP: *Caulerpa taxifolia*, *C. cylindracea*, *Acrothamnion preissii* and *Womersleyella setacea* [55,239]. *Caulerpa taxifolia*, present at Port-Cros Island since 1994 [82–84], has been successfully eradicated [90].

4.3. The Research Effort over Space and Time

The different parts of the adjacent marine area (AMA) of the N-PCNP have been studied very heterogeneously: from 3 to 94 documents per site (Figure 3). The fact that the size of the sites (surface area, length of coastline) is very heterogeneous does not in itself explain the differences in the number of taxa per site (from 2–La Garde to 441–Port-Cros Archipelago). As intuitively expected, there is a significant correlation ($r = 0.69$, $p < 0.001$) between the number of references (a clue for research effort) and the cumulative number of reported taxa (Figure 4).

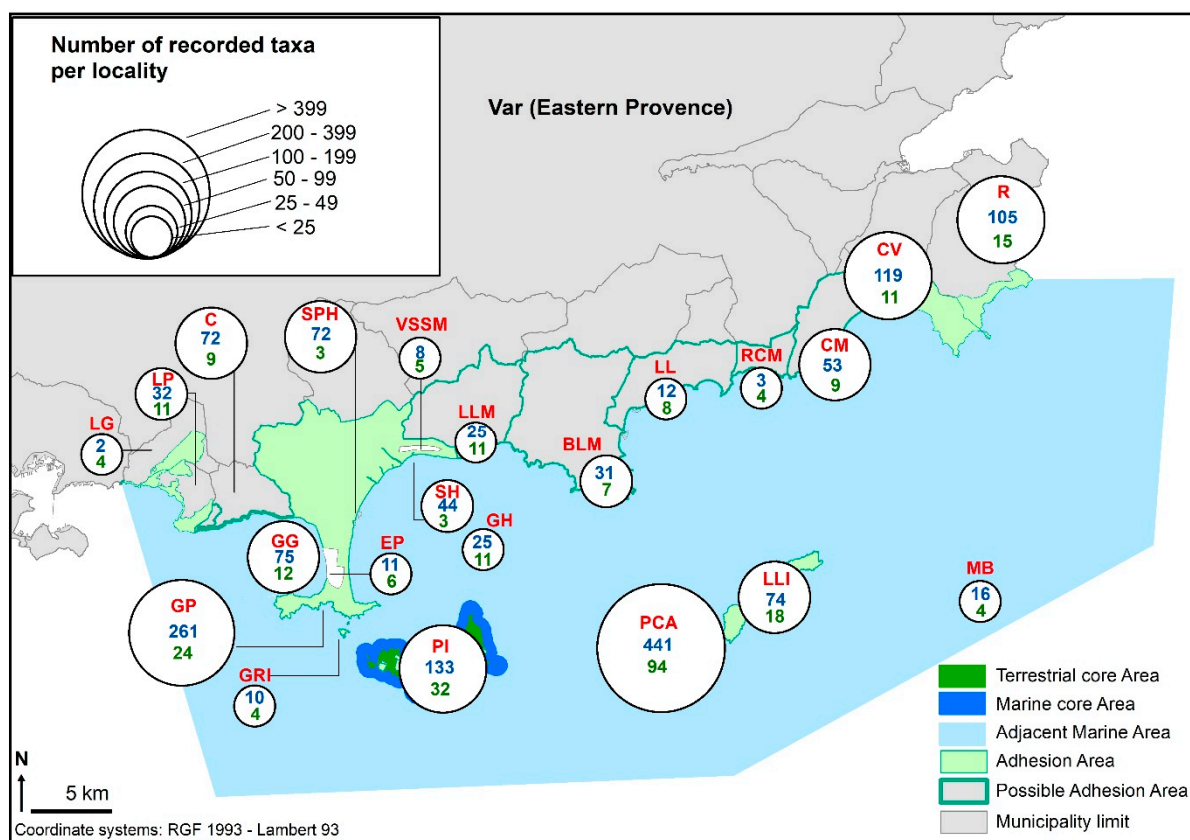


Figure 3. Number of reported taxa (in blue) and literature documents (in green) per locality and site (in red).

The fact that the archipelago of Port-Cros (PCA) has been, by far, the site which benefited from the most important research effort, is unsurprising: it was the initial site of the Port-Cros National Park (PCNP) and, since 2012, is one of the two core areas of the N-PCNP. It is widely accepted that we only effectively protect what we know well [6,14,16,240]. Unfortunately, the other side of the coin is that ‘ordinary biodiversity’, as pointed out above, has been neglected. We are witnessing a kind of opposition between the biodiversity of most of the territory, poorly known and which would not interest scientists and managers (which of course is not really the case), and the biodiversity of the core area of

the PCNP, supposedly more central and worthy of interest: plebeian versus aristocratic, deluxe, biodiversity?

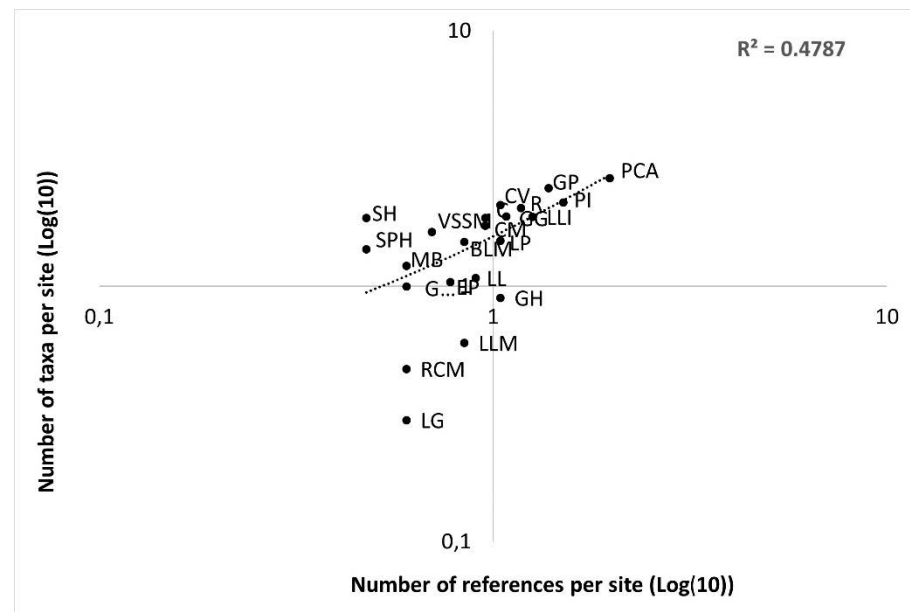


Figure 4. Log-Log correlation between the number of reported taxa and the number of references per site.

The number of items (i.e., reporting of a taxon, at a given site, by a given reference) peaked in the 1970–1980s, then declined in the 1990s, before a partial recovery in the 2000s (Figure 5). The extinction of taxonomists, in the age of biodiversity, is a recurring topic in the literature (e.g., [241,242]). This extinction of taxonomists constitutes a paradox, insofar as the general public believes that, since 1992 and the Rio summit, taxonomy has won acclaim and has expanded in a significant way. In fact, according to many authors, the biodiversity concept has been stolen by molecular biologists, by taxonomic lobbies, by ‘green’ activists with no real interest in scientific ecology and by often whimsical database manipulators [243–245]. The result is that there are fewer and fewer taxonomists able to put a name to a taxon, and more and more ‘parasitic researchers’, unable to distinguish a mouse from an elephant (in the absence of a genetic analysis; of course an exaggeration!), but experts in modelling, based upon doubtful databases and interpretations dating back to the prehistory of ecology [242]. In the study area, the decline in the taxonomic research effort, from the 1970–1980s, is obvious (Figure 5).

The heterogeneity of scientific exploration also concerns habitats. Intertidal habitats have long been favored by scientists. Since the advent of scuba diving, the opposite has happened. The relative scarcity of reports of intertidal species, probably present everywhere, such as *Pyropia elongata*, *Nemoderma tingitanum* and *Pseudoralgsia verrucosa*, can be explained in this way.

The scientific strategy of the Port-Cros National Park [14] explicitly involved plans to explore the new territories of the N-PCNP, those of its vast AMA. For the moment, this is far from being achieved (Figure 3). In the 2000s, as part of the establishment of Natura 2000 areas programmed by the European ‘Habitat Directive’ of 1992, studies were carried out [47,68,72]. However, they were unfortunately based on minimalist lists of protected species, on the ‘toxic’ concept of heritage value species and on the doctrine of the French Ministry of the Environment [10,246,247].

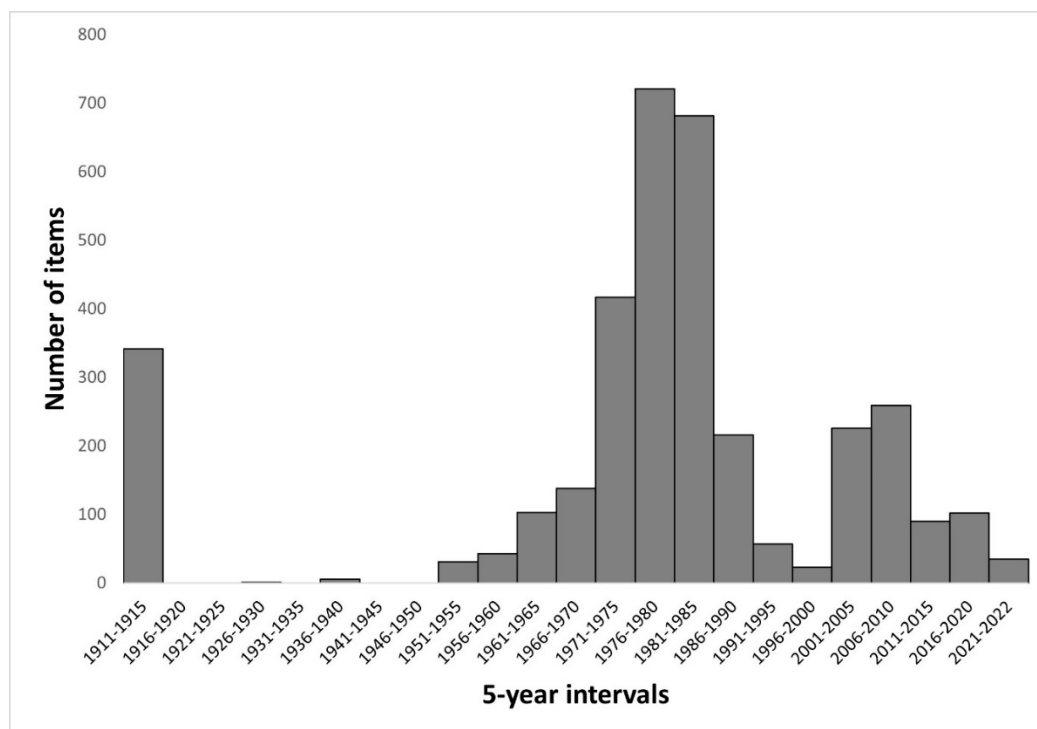


Figure 5. A clue to research efforts: number of items (i.e., reporting of a taxon, in a given site, by a given reference) per 5-year interval.

4.4. Are Some Taxa Locally Extinct?

The year of the last sighting of a taxon in the study area can date back from a few years to more than a century (Table 3). Overall, 50% of the taxa have not been reported for 30 years and almost 10% for more than 50 years (Table 3). Could we consider that the latter are locally extinct? In some cases, we can suspect errors of identification, e.g., *Polysiphonia deusta* and *Phyllophora sicula*, only reported by Mouret in 1911 [36], and *Corallina officinalis*, only reported by Fredj in 1964 [94], who was not known as a phycologist. However, this is not the case with, e.g., *Alsidium helminthochorton*, *Gelidium spathulatum*, *Gymnogongrus griffithsiae*, *Hildenbrandia prototypus*, *Lithophyllum racemus*, *Pyropia elongata*, *Sphaerococcus rhizophylloides* and *Petalonia fascia*, large and well-characterized species which are not prone to misidentification.

For a number of ‘missing’ species, the lack of recent investigations, perhaps also the decline in the taxonomic expertise, may account for the absence of sightings. This is not the case with some Fucales of the genera *Cystoseira*, *Ericaria*, *Gongolaria* and *Sargassum*, for which the identification expertise is fortunately not lost (e.g., [25,33–35,189]).

4.5. Are There Clues to Climate Warming?

Species, on the basis of their presence or absence, and the spread of their range area, are the best biological indicators of the current warming [248–251]. This contrasts with inter-annual fluctuations of physical parameters, so sharply that contemporaries of the Late Bronze Age (LBA; ~1000 BCE), the Dark Age Cold Period and the Fall of the Roman Empire (DACP; ~500 CE) and the Little Ice Age (LIA; ~1800 CE) never perceived that civilization was sinking into a climatic episode rather than into changes triggered by the decadence of morals or the errors of the politicians of the time [252–255].

Table 3. Year of the last record for the 502 taxa reported from the N-PCNP.

Year	Number of Taxa	Cumulated Number of Taxa	Cumulated Percentage
2022	4	4	<1%
2021	6	10	2%
2020	4	14	3%
2019	31	45	9%
2017	1	46	9%
2016	18	64	13%
2011	23	87	17%
2009	56	143	28%
2007	8	151	30%
2005	82	233	46%
2001	2	235	47%
1992	9	244	49%
1988	11	255	51%
1987	11	266	53%
1986	35	301	60%
1985	28	329	66%
1984	8	337	67%
1983	32	369	74%
1981	17	386	77%
1980	3	389	77%
1978	13	402	80%
1977	33	435	87%
1976	30	465	93%
1971	18	483	96%
1970	1	484	96%
1968	4	488	97%
1966	2	490	98%
1964	1	491	98%
1963	1	492	98%
1953	1	493	98%
1914	6	499	99%
1911	3	502	100%

A number of macrophyte species are regarded as thermophilous. As a result, they are expected to spread northwards in the Mediterranean Sea. In the N-PCNP area, the year of first report of thermophilous macrophytes is 1911 (*Dasycladus vermicularis*, *Hypnea musciformis* and *Rytiphlaea tinctoria*), 1953 (*Caulerpa prolifera*), 1971 (*Spyridia filamentosa*), 1976 (*Anadyomene stellata* and *Lobophora variegata*), 1977 (*Cladophoropsis membranacea*), 1987 (*Taenioma nanum*), 2009 (*Hydrochlathrus clathratus*), 2019 (*Microdictyon umbilicatum*) and 2022 (*Lophocladia lallemandii*).

It is worth noting that two invasive species, initially regarded as of tropical origin, *Caulerpa taxifolia* and *C. cylindracea*, subsequently proved to originate from temperate southern Australia [256–260].

Overall, the increase in the presence of thermophilous species is not obvious. The possible increase in their abundance would be of more significance, but no data are available. This reinforces the perception of a stronger impact of global warming on the human target than on the biodiversity target (see, e.g., [11,225]).

At the same time, have species of cold affinity disappeared? The only species which seems to offer an affirmative answer to this question is the brown alga *Scytosiphon lomentaria*, never sighted since the years 1960–1970.

5. Conclusions

The diversity of macrophytes within the new Port-Cros National Park (N-PCNP) is not exceptionally high. However, this observation must be put in the light of the very patchy knowledge of the territory: the research effort has mainly focused on the Port-Cros

Archipelago, the original area of the Port-Cros National Park (PCNP), founded in 1963. This diversity is known through two highpoints of research effort: the early 20th century and the 1960–1970s. Since then, the research effort has declined: contrary to popular belief, in the midst of the current so-called era of biodiversity launched by the 1992 Rio Summit, knowledge of biodiversity has not increased and may even have declined.

It should also be stressed that species diversity (how many species?), often idolized by political ecologists (successors of the prehistory of ecology), taxonomic lobbies, the general public and managers, is a very poor indicator of biodiversity. The concept of biodiversity is actually very different from, and much broader than, species richness.

Heritage value species, sometimes regarded as the paradigm of biodiversity, constitute a vague and fuzzy concept, a kind of aristocratic concept as opposed to the ordinary diversity that keeps the ecosystems of the real world functioning.

However, although the inventory of species is a poor descriptor of biodiversity, it is an essential prerequisite for the study of human impact, global change and in particular the impact of climate change.

The database that we present here is unique because it concerns an area (i) in part strongly impacted by humans, mainland Provence, strongly urbanized and with world-famous tourist resorts, and (ii) in part efficiently protected since the middle of the 20th century, the offshore islands bordering the Gulf of Hyères. However, it does not offer the means to highlight an obvious change in the flora over time, in relation with, e.g., urbanization, tourism and warming, either because it is not suited to a study of that kind, or because the change is (for the moment) more tenuous than is generally thought.

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