

## AN ANNOTATED LIST OF ALIEN MARINE SPECIES OF THE ISCHIA ISLAND (GULF OF NAPLES)

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This contribution was presented as a poster at the BioMarine Workshop “Management of Bioinvasions in the Mediterranean Sea – a way forward”, held on the island of Ischia on 4-5 May 2016, with the aim of updating the information and providing the workshop’s participants with a list of the alien taxa that have been recorded in the area hosting the meeting.

The island of Ischia, and the nearby islands of Procida and Vivara (Phlaegrean islands), are located on the northern side of the Gulf of Naples, and are included within the Marine Protected Area of the “Regno di Nettuno” (“Neptune’s Realm”) since April 2008 (Gambi *et al.*, 2003).

The Phlaegrean islands are considered a biogeographic boundary which constitutes the distribution limit of most South Mediterranean thermophilous species, since the 14 °C minimum winter surface temperature isotherm (the 14 °C divide) is occurring between Ischia and the Pontine archipelago (e.g., Ventotene island) (Gambi *et al.*, 2009; Gambi, 2014). In the past two decades, due to global warming also acting in the Mediterranean surface waters, we observed a northward shift of the 14°C divide, while the minimum winter isotherm in the area of the Phlaegrean islands is now often rising to the 15°C divide. Therefore this zone is an interesting observatory for the distribution and migratory pattern of thermophilous species both native and introduced/aliens (Gambi, 2014). Occurrence and increase in the abundance of some native Mediterranean warm-species have been documented for this area in some papers (Dappiano and Gambi, 2004; Cigliano *et al.*, 2007; Gambi 2014), as for the coral *Astroides calycularis* (Pallas, 1776), the bryozoan *Calpensia nobilis* (Esper, 1796), and the fishes *Sparisoma cretense* (L., 1758), *Sphoeroides pagygaster* (Müller & Troschel, 1848). and *Sphyraena viridensis* Cuvier, 1829.

As for the alien taxa the annotated list of the species recorded at Ischia is reported in Table 1.

A total of 21 alien species have been documented including 4 macroalgae, 1 sponge, 3 hydrozoans, 7 polychaetes, 2 molluscs, 2 crustaceans, 1 bryozoan and 1 fish. Although some of the listed taxa are occasional and have been recorded in the area only once (e.g., the fish *F. commersonii* or the opisthobranch *B. leachi*), this number of aliens is relatively high, in comparison with areas of larger extension. As an example, 47 taxa are reported from the Central Tyrrhenian Sea and 31 from the Southern Tyrrhenian Sea (see Occhipinti-Ambrogi *et al.*, 2011). The high number of records from Ischia is probably in relation to the large amount of benthic studies issued from the activity of the Stazione Zoologica, especially at the Villa Dohrn-Benthic ecology Center (Ischia), whose investigations around the island dates back to the late 1960s (Gambi, 2014).

Some of the species recorded show an invasive habit, such as *C. cylindracea* and *A. armata*, among the macroalgae, and *B. bairdi*, *P. paucibranchiata*, among the invertebrates. Most of the species have an Indo-Pacific origin and some are migrated from the Red Sea via the Suez Canal (e.g., *B. luctuosum*, *B. leachi*, *F. commersonii*), while *P. magna*, *B. bairdi* and *A. verticillata* have a South Atlantic or Caribbean origin.

Finally, it is interesting to note that various alien species have been recorded from the acidified zones (low and extreme low pH conditions) of the Castello Aragonese CO<sub>2</sub> vents, such as *A. taxiformis*, *C. cylindracea*, *B. bairdi*, *N. infratorquata*, *Mesanthura* sp., *P. gibbesi* (Fig. 1), and thus in agreement with what observed with other “nuisance” species in other CO<sub>2</sub> vent’s systems (Hall-Spencer and Allen, 2015). Several other species were reported inside or in the vicinity of the harbor of Ischia, e.g., *S. comatus*, *B. bairdi*, *P. antennata*, or associated to artificial structures, e.g., *P. magna*, *B. luctuosum*, and *A. verticillata*, thus confirming the general observation that more impacted and low competition habitats are more prone to the colonization/invasion by aliens (Occhipinti-Ambrogi *et al.*, 2011).

Table 1 - (*) = invasive	
Alien species/origin	Notes and references
(*) <i>Caulerpa cylindracea</i> (Sonder) Verlaque, Huisman & Boudouresque (Chlorophyceae) (Indo-Pacific)	Recorded since 2000 in various areas off Ischia (Buia <i>et al.</i> , 2003 indicated as <i>Caulerpa racemosa</i> var. <i>cylindracea</i> ) is highly invasive especially in summer and autumn. It occurs also on the CO <sub>2</sub> vents off the Castello Aragonese (Hall-Spencer <i>et al.</i> , 2008) although not all years (Gambi M.C. pers. observ.).
(*) <i>Asparagopsis taxiformis</i> (Delile) Trevisan de Saint-Leon (Rhodophyceae) (Indo-Pacific)	Recorded in 2000 off Ischia and Procida (Flagella <i>et al.</i> , 2003; D'Archino <i>et al.</i> , 2003 in Gambi <i>et al.</i> , 2003) and confirmed to belong to <i>A. taxiformis</i> by genetic analysis by Andreakis <i>et al.</i> (2004). At present, it is very abundant/invasive in spring also in the north acidified area of the Castello Aragonese CO <sub>2</sub> vents, both on bare rock and among <i>Posidonia</i> shoots (Gambi M.C. person. observ.).
<i>Acrothamnion preissii</i> (Sonder) E.M. Wollaston (Rhodophyceae) (Indo-Pacific)	Recorded in June 2015 in shallow rocky reefs (10 m depth) off Ischia (Ballesteros E., Teixido N. & Gambi M.C., unpublished data).
<i>Womersleyella setacea</i> (Hollenberg) R.E. Norris (Rhodophyceae) (Indo-Pacific)	Recorded in June 2015 in shallow rocky reefs (10 m depth) off Ischia (Ballesteros E., Teixido N. & Gambi M.C., unpublished data).
<i>Paraleucilla magna</i> Klatau <i>et al.</i> , 2004 (Porifera) (South Atlantic, Brazil)	Recorded in 2014 on artificial barriers and structures around the coast of Ischia (Grech <i>et al.</i> , 2015).
<i>Filellum serratum</i> (Clark, 1879) (Hydrozoa) (Circumtropical)	Reported around Ischia in Stechow (1923). The species has been included although its records is relatively old respect to the criteria adopted in recent alien species check-list (e.g., Occhipinti-Ambrogi <i>et al.</i> , 2011; GSA-SIBM, 2016)
<i>Clytia linearis</i> (Thorneley, 1900) (Hydrozoa) (Circumtropical)	Recorded as epiphytic on <i>Posidonia oceanica</i> by Boero (1981a, 1981b).
<i>Cirrholovenia tetranema</i> Kramp, 1959 (Hydrozoa) (Indo-Pacific)	Recorded by Brinckmann (1965).
(*) <i>Pseudopolydora paucibranchiata</i> Okuda, 1937 (Polychaeta, Spionidae) (Indo-Pacific)	Recorded in July 2014 in the soft bottoms of the harbor of Ischia, but present in the harbor since 1977 (identified as <i>Polydora antennata</i> in Fresi <i>et al.</i> , 1983, 1984). The present record represents the first in the Western Mediterranean (Radashkevsky V., Giangrande A. & Gambi M.C. unpublished data).
<i>Lysidice collaris</i> Grube, 1870 (Polychaeta, Eunicidae) (Red Sea, lessepsian)	Species borer of <i>Posidonia oceanica</i> seagrass sheaths, recorded in Ischia since 1995 (Guidetti <i>et al.</i> , 1997).
<i>Streblosoma comatus</i> (Grube, 1859) (Polychaeta, Terebellidae) (Indo-Pacific)	Reported as <i>Streblosoma hesslei</i> in the harbor of Ischia in 1977 (Giangrande <i>et al.</i> , 1981).
<i>Branchiomma luctuosum</i> (Grube, 1869) (Polychaeta, Sabellidae) (Red Sea, lessepsian)	Recorded in Ischia in 1982 on a <i>Cymodocea nodosa</i> meadow (Sordino and Gambi, 1992) and in artificial moorings (Gambi M.C., pers. observ.); it seems no more present in this area (Gambi M.C. pers. observ.).
(*) <i>Branchiomma bairdi</i> (McIntosh, 1885) (Polychaeta, Sabellidae) (Caribbean Sea)	Recorded in July 2012 inside the marinas of Lacco Ameno, Casamicciola and Ischia. It occurs also in the acidified areas of the south side CO <sub>2</sub> vents of the Castello (Arias <i>et al.</i> , 2013), where is now becoming invasive (Gambi M.C. pers. observ.).
<i>Novafabricia infratorquata</i> (Fitzhugh, 1973) (Polychaeta, Fabriciidae) (Caribbean Sea)	Recorded in rocky vegetated reef of the low pH area of the Castello CO <sub>2</sub> vent's system in 2008 (Giangrande <i>et al.</i> , 2014)

<i>Spirorbis marioni</i> Caullery & Mesnil, 1897 (Polychaeta, Serpulidae) (Indo-Pacific)	Recorded in 2008 on artificial settlement structures off the Castello Aragonese area at Ischia but in areas with normal pH conditions (Cigliano <i>et al.</i> , 2010).
<i>Percnon gibbesi</i> (H. Milne Edwards, 1853) (Crustacea Decapoda) (Atlantic and Pacific)	Visually observed since 2004 in several intertidal/upper subtidal areas of Ischia (Lorenti M., Zupo V., Gambi M.C. pers. observ., Dappiano and Gambi, 2004). A few juveniles, identified as <i>P. cf. gibbesi</i> , have been collected in the <i>Posidonia oceanica</i> meadow off the Castello d'Ischia in 2011 (Garrard <i>et al.</i> , 2014).
<i>Mesanthura</i> sp. (Crustacea, Isopoda) (Indo-Pacific?)	A species showing the traits of an alien, likely conspecific with <i>M. romulea</i> Poore & Lew Ton, 1986 (Indo-Pacific) (Lorenti <i>et al.</i> , 2009). Found on the rocky reefs off the Castello Aragonese at Ischia (Kroeker <i>et al.</i> , 2011).
<i>Bursatella leachi</i> De Blainville, 1817 (Mollusca Opisthobranchia) (Red Sea, lessepsian)	Recorded at Ischia in 1986 (Russo, 1987) in a <i>Cymodocea nodosa</i> meadow. Never recorded after.
<i>Polycerella emertoni</i> Verrill, 1881 (Mollusca Opisthobranchia) Amphi-Atlantic species	Recorded as <i>Polycerella recondita</i> Schmekel, 1965 by Schmekel (1968) in the Cartaromana Bay at Ischia (2-10 m depth). Never reported after.
(* <i>Amathia (Zooetryon) verticillata</i> (Delle Chiaje, 1822) (Bryozoa) (Caribbean Sea)	Observed in 2000 as epiphytic on <i>Cymodocea nodosa</i> and some macroalgae and gorgonians (Gambi M.C., pers. observ.), and in more recent years (2013-2014) in artificial reefs off Ischia (Grech <i>et al.</i> , 2015).
<i>Fistularia commersonii</i> Rueppel, 1838 (Osteichthyes) (Red Sea, lessepsian)	Recorded at Ischia (Sant' Angelo cliff, 14 m depth) in November 2014 (Tiberti <i>et al.</i> , 2015)

Fig. 1 - Some of the alien species recorded along the coast of Ischia: top left) *Caulerpa cylindracea* settled among Posidonia at the Castello south side low pH zone (3 m depth, Photo: Iacono B.); top right) *Asparagopsis taxiformis* settled on bare rocks at the Castello north side low pH zone (3 m depth, Photo: Gambi M.C.); Center left) *Brachiomma bairdi* settled at the Castello south side low pH zone (1m depth, Photo: Vassallo P.); center right) *Mesanthura* sp. (Photo: Lorenti M.); bottom) *Fistularia commersonii* at San Angelo cliff (Ischia, 14 m depth) (Photo: Renella G.).



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