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First reported occurrences of the marbled crab, *Pachygrapsus marmoratus* (Crustacea: Brachyura: Grapsoidea) in southern coastal waters of the British Isles

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The occurrence in British coastal waters of the marbled crab *Pachygrapsus marmoratus* is confirmed for the first time. Features are given to enable this crab to be distinguished from native species. Its spread along the French Atlantic coast and introduction into British waters is discussed.

The marbled crab *Pachygrapsus marmoratus* (J.C. Fabricius, 1787) inhabits the intertidal rocky shores of southern Europe. It is reported from the Black Sea, the Mediterranean, the Moroccan Atlantic, the Islands of Canary, Madeira and Azores and from the Atlantic coast of Portugal, Spain and France (d'Udekem d'Acoz, 1999: 255 for details of distribution). It is semi-terrestrial and often present at high densities in regions with high tidal amplitude but also on shores where tides are almost absent, as in the Mediterranean. Despite its abundance the bionomics of shore communities of this species have received detailed studies only recently (Flores & Paula, 2002; Cannicci et al., 2002 and for references).

In its southern regions and where plentiful, *P. marmoratus* is probably the most abundant intertidal crab of rocky shores, although the recently introduced smaller far eastern *Hemigrapsus takanoi* Asakura & Watanabe, 2005 [=*Hemigrapsus penicillatus* (de Haan, 1835) in part] is now found in increasing numbers on Spanish, French, Belgian and Dutch coasts and there is an established population of the related *H. sanguineus* (de Haan, 1835) in the harbour of Le Havre, Normandy (d'Udekem d'Acoz & Faasse, 2002), and the Netherlands (Faasse, 2004; Nijland & Faasse, 2005).

Although Poupin et al., (2005: 25) in their references cite Ingle, (1980: 121) as reporting the marbled crab from the Bristol Channel, this is an error as Ingle listed the Ushant region and that related to the Finistère records. However, there are now two confirmed records of *P. marmoratus* from the southern coastal waters of the British Isles, one from Southampton Water and one from the Teignmouth region. Although an interval of ten years occurred between the first and second finding they are of sufficient importance to allow this species to be added to the British crab faunal list of non-native species (see Ingle, 1980, 1996; Clark, 1986).

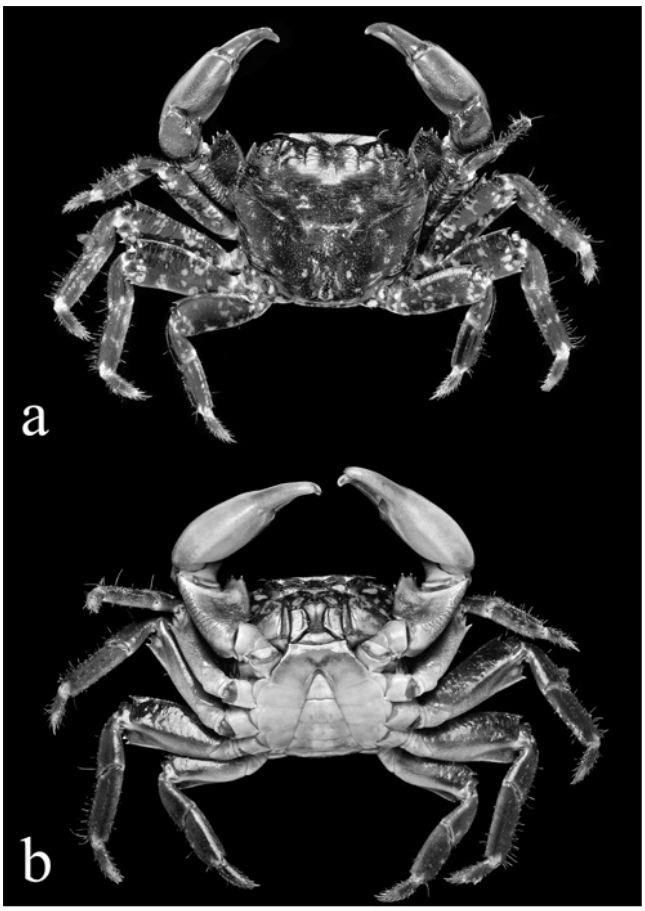

Figure 1. *Pachygrapsus marmoratus* male, Teign estuary (NHM 2005.2092); (a) dorsal view; (b) ventral view; photograph Harry Taylor, NHM Photo Unit.

Material examined

Carapace measurements are carapace breadth x length respectively. Abbreviations used: Natural History Museum, London = NHM; registration number = reg.

Female measuring 38.31×34.99 mm., collected at Netley (50°53'N 01°21'W), Southampton Water, Hampshire, by Lee Marshfield, 16 July 1996, identified by Tim Clabon. The specimen (with its moult) was presented by the Portsmouth Sealife Centre, (NHM reg. 1996: 1409). Male measuring 43.26×37.48 mm., found beneath a crab tile in intertidal low water mud with patches of weed 100 m above Shaldon Bridge near Teignmouth, north side of the River Teign estuary (50°32.4'N 03°30.5'W), Devon. It was collected by Peter Full, 10 May 2003 and presented (with its moult) by Douglas Herdson of the National Marine Aquarium, Plymouth, (NHM reg. 2005: 2092; moult 2005: 41).

Species recognition

(Figure 1). Features for distinguishing *Pachygrapsus marmoratus* from native crab species are given by Ingle (1980) and Moyse &

Smaldon (1990); they are summarized as follows: (1) carapace quadrilateral and with conspicuous transverse to obliquely placed carinae; (2) carapace anterior margin with three well developed teeth, including orbital tooth; (3) dorsal surface of carapace and walking legs with fine variegations of deep purple on whitish background to nearly completely black with reduced whitish variegations. There are intergrades of the two extreme colour patterns but on the French Atlantic coast the nearly completely black colour is the most frequent (Dr. d'Udekem d'Acoz, personal communication); (4) claws (chelipeds) naked—without setal mats (mittens) and males without a fleshy protuberance at the base of the propodus.

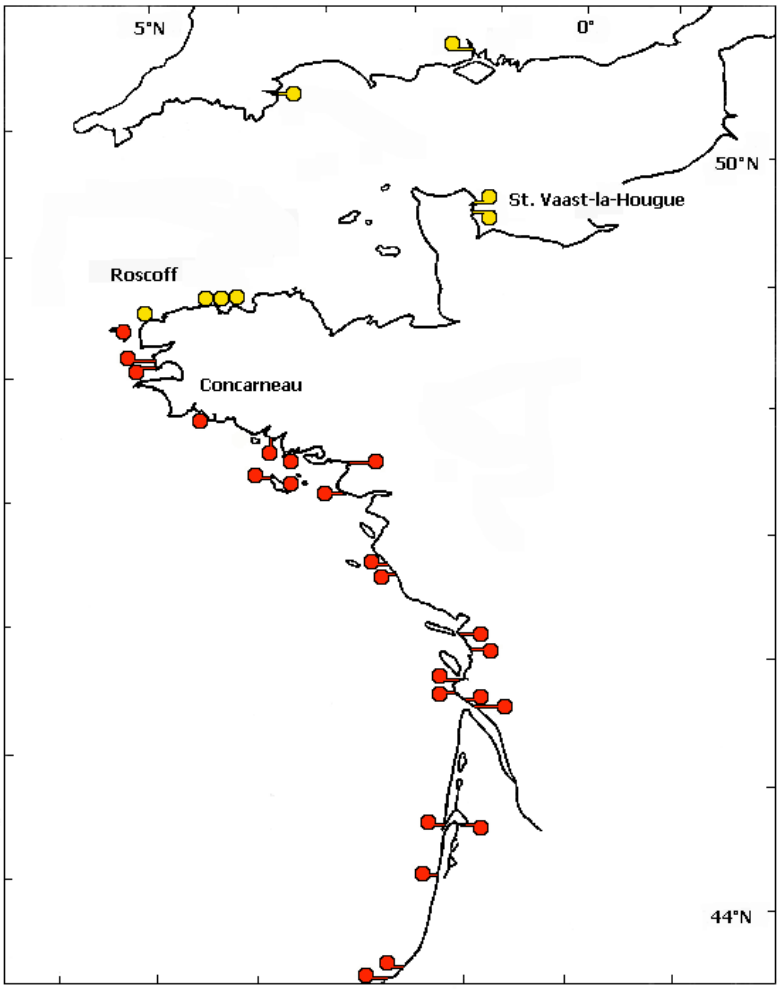

Figure 2. *Pachygrapsus marmoratus*. Reported occurrences on the Atlantic coast of France and southern coast of England. ●, = established fluctuating populations; ●, = introductions by human agencies; (after Crisp & Fischer-Piette, 1959, figure 3 and literature records; see text for details).

French Atlantic coast

The earliest record of *Pachygrapsus. marmoratus* on the northern French Atlantic coast is by H. Milne Edwards (1837) who cited it as '*Grapsus varius*' from Brittany as 'très commun sur les parties rocailleuses de côtes de la Bretage…'. Its distribution on this coast was reviewed by Crisp & Fischer-Piette (1959) who concluded that the region of Concarneau was probably about its normal northerly sustainable limit. During recent years it has been reported further northward in l' Iroise region, but as being somewhat rare (Le Duff, 1999). Southward of Concarneau Crisp & Fischer-Piette (1959) recorded the species from numerous localities. During 1955 they noted its varying abundance according to habitat, and of being particularly abundant at one locality (La Pallice) and, during August 1956, also in the Gironde region, at Pointe de Grave, where some thousands of specimens were reported covering surface walls of jetties and piers. However, these southern populations seemed to have varied. During earlier years Prenant (1939) was not able to find specimens in the Baie de Douarnenez during 1935–1936, but later during the 1950s it was noted by Drach (loc. sit. in Crisp & Fischer-Piette, 1959) on rocks between Morgat and Les Tas de Pois (two locations north of Concarneau) and he also found it particularly abundant at Le Pouldu (south of Concarneau). It was again reported as abundant at two regions just south of Concarneau: at Pointe de Raz in 1987 by Brummer (1989) and reasonably abundant at Le Cabellou in 2003 by Seifert & Rathke, (2003).

It would seem therefore, that *P. marmoratus* continues to be quite common on parts of the south coast of Brittany (Pierre Noël, 2006, personal communication). However, the northward distribution of presumed sustainable populations is less well documented and seems limited to not beyond the 'Iroise' region of Finistère (Le Duff, 1999).

North Finistère records

Crisp & Fischer-Piette (1959) noted that large numbers of *Pachygrapsus marmoratus* had been present at one period in North Finistère, particularly at Roscoff, and that there were also two records from the north side of the Cotentin coast (Normandy). These northerly records are discussed below.

The earliest account of *P. marmoratus* in the North Finistère region seems that by Delage (1881) who listed it as *Grapsus varius*…'sur le sommet des rochers de Tiaoson' (a location just north of Roscoff). Pruvot (1897) also cited this locality and Schlegel (1912) noted a specimen from there but in the collections of the Roscoff Laboratory. He suggested that crabs were occasionally brought to Roscoff from southern regions by boats fishing for spiny lobsters on the coasts of Morocco and Portugal. Later Prenant (1929) inferred that the crab had not become generally known in the Roscoff region until about 1914 and then only from '…exemplaires isolés…' and (citing Schlegel, 1912) as possibly imported by lobster fishermen. He also pointed out that the crab was captured for use

in physiological experiments at the Roscoff laboratory. From 1921 to 1928 Prenant (1929) noted the progressive extension north-eastward of the species at various localities all near Roscoff, and as far north-east as Locquirec. However, the mapped distribution of *P. marmoratus* given by Noël (1993, p.79) shows a record that is much further east than Locquirec and appears to be in the St Malo region. Details of this report have not been confirmed. Also the occurrence at St-Vaast-la-Hougue (Normandy) mentioned below is not included on his map. In 1927 at one location (Lédanet) Prenant noted that crabs were so abundant that they extended into the *Fucus* zone, probably occurring with *Carcinus maenas* and were seen running on the sand around the rocks, but that by 1928 they seemed less plentiful.

By about the 1930s the species had all but disappeared from the North Finistère region. Only one specimen was found at Trémazan in 1933 by Fischer-Piette (Crisp & Fisher-Piette, 1959). As far as we are aware the crab has never been reported in recent years as far north as this location and not beyond the 'Iroise' region of Finistère.

Normandy Records

There are two published occurrences of *Pachygrapsus marmoratus* from the north Cotentin coast, Normandy, and both are probably introductions by human intervention. The earliest, by Anthony (1909), pertains to a specimen cited as '*Grapsus marmoratus*' collected at Saint-Vaast-la-Hougue. Fauvel (1929) however, stated that this specimen had been collected from an oyster bed where a vessel had discharged its catch of young oysters originating from a region south of Brittany and suggested that it had been imported. Many years later, in 1991, a single specimen was again reported from a locality near to Saint-Vaast-la-Hougue (l'île de Tatihou) and collected in March of that year (Vincent & Le Granche, 1996). No additional crabs were found despite further searching by these authors throughout the following months in both localities. Unfortunately this specimen is no longer extant. Poupin et al. (2005) did not rule out the possibility that this may have been a specimen of the non-native *Hemigrapsus sanguineus* several of which were found at Saint-Vaast-la-Hougue by Pierre Noël in 2004 who did not find there any specimens of *P. marmoratus*.

Remarks

Crisp & Fischer Piette (1959) suggested that Concarneau or just beyond forms 'la frontière normale de l'espèce'. However, northward of that region, *P. marmoratus* seems able to maintain populations as far north as the 'Iroise' region of mid-Finistère (Le Duff, 1999), although perhaps in smaller and greater fluctuating numbers than those noted in southern regions of Brittany. This northerly limit of penetration perhaps is maintained by a combination of ongoing circumstances, including repeated introductions by human agencies, by discrete breeding communities enhanced by some larval recruitment from the south in years when conditions are favourable, and also some limited migration northward of juveniles and adults.

Some of these features may have favoured the establishment of the temporary large populations that occurred in the Roscoff region (and just beyond) for about ten years during the previous century but that later declined and were then reported as having totally disappeared.

This event could well have been realized by repeated introductions from the south via maritime traffic. It is of interest that Prenant (1929) remarked on its use by the Roscoff Laboratory and there may have been a reasonable demand for study specimens supplied by fishermen some of which could have escaped or were locally discarded. Establishment would have been also enhanced if a significant number of crabs were ovigerous females. Mouchet (1931), studying specimens at Roscoff, noted the crabs were very large, very black and were nearly all females. It is probable that the large populations attained over that period were sustained by local larval recruitment rather than by any southern migrations. Crisp & Fischer-Piette (1959) questioned whether or not the region from Concarneau to Locquirec was experiencing more 'southerly' conditions than normal during the years when the crab was so abundant in North Finistère. Such conditions certainly would have favoured larval recruitment and settlement. However, the larvae of *P. marmoratus* remains unrecorded from the Channel region, (Martin, 2001) and temperatures below which the crab is unable to breed have not been reported. As far as is known the species has not re-appeared in this most northern part of Finistère and thus the 'Iroise' region seems at present its current northerly limit (Le Duff, 1999).

Similar to other grapsids, *P. marmoratus* undergoes a brief development and grows quickly, often reaching maturity in less than one year after development. Studies of populations on the Portuguese coast revealed that 'young-of-the-year' juveniles recruited after the main settlement season in September–October were able to reproduce by May of the following year (Flores & Paula, 2002). This important feature would contribute to an ability to become quickly established in favourable environmental conditions. However, there are many inter-related factors affecting successful megalopal settlement of *P. marmoratus* as noted by Flores et al. (2002).

This first reported sporadic occurrence of the marbled Crab on the southern Channel coast of the British Isles would seem a further example of introduction by human agencies, perhaps by shipping traffic (see Gollasch, 2002). The western warmer part of the Channel (Crisp & Southward, 1958) may be favourable from time to time for temporarily sustaining sporadic introductions of these more southern species as noted by Southward & Southward (1977, 1988) for the hermit crab *Clibanarius erythropus*.

At least six crab species have been introduced into the British Isles by human agencies (Ingle, 1980, 1996; Clark, 1986). As far as is known only two of these have become established here: the dwarf crab *Rhithropanopeus harrisii* (Gould, 1841) an American Atlantic species (Eno et al., 1997), and the mitten crab *Eriocheir sinensis* (H. Milne Edwards, 1853), originating from the Far East (Clark et al., 1998; Rainbow et.al., 2003). All were probably introduced by shipping traffic.

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REFERENCES

Anthony, R., 1909. Le laboratoire maritime du Muséum d'Histoire Naturelle (Saint-Vaast-la-Hougue) pendant l'année 1908. *Annales des Sciences Naturelles, Zoologie*, **10**, 199–254.

Asakura A. & Watanabe S., 2005. *Hemigrapsus takanoi*, new species, a sibling species of the common Japanese intertidal crab *H. penicillatus* (Decapoda: Brachyura: Grapsoidea). *Journal of Crustacean Biology*, **25**, 279–292.

Brummer, T. von, 1989. *Pachygrapsus marmoratus* und *Clibanarius erythropus* an der französischen Atlantikküste. *Die Aquarien-und Terrarienzeitschrift*, **42**, 161–162.

Cannicci, S., Gomei, M., Boddi, B. & Vannini, M., 2002. Feeding habits and natural diet of the intertidal crab *Pachygrapsus marmoratus*: opportunistic browser or selective feeder? *Estuarine, Coastal and Shelf Science*, **54**, 983–1001.

Clark, P.F., 1986. *North-east Atlantic crabs; and atlas of distribution.* Ross-on-Wye: Marine Conservation Society.

Clark, P.F., Rainbow, P.S., Robbins, S.M., Smith, B., Yeomans, W.E., Thomas, M. & Dobson, G., 1998. The alien Chinese mitten crab, *Eriocheir sinensis* (Crustacea: Decapoda: Brachyura), in the Thames catchment. *Journal of the Marine Biological Association of the United Kingdom*, **78**, 1215–1221.

Crisp, D.J. & Fischer-Piette, E., 1959. Répartition des principales espèces intercotidales de la côte Atlantique Française en 1954–1955. *Annales de l'Institut Océanographique*, **36**, 275–388.

Crisp, D.J. & Southward, A.J., 1958. The distribution of intertidal organisms along the coast of the English Channel. *Journal of the Marine Biological Association of the United Kingdom*, **37**, 157–208.

Delage, Y., 1881. Contribution a l'étude de l'appareil circulatoire des Crustacés Édriophthalmes marins. *Archives de Zoologie Expérimentale et Générale*, **9**, 1–172.

Duff, M. Le., 1999. *Environnmement Naturel de l'Iroise. Bilan des Connaissances et Intérêt Patrimonial*. Vol. 1. Université de Bretagne Occidentale. Ministère de l'Aménegement du Territoire et de l'Environnement, 21pp.

Eno, N.C., Clark, R.A. & Sanderson, W.G., 1997. *Non-native marine species in British waters: a review and directory*. Peterborough: Joint Nature Conservation Committee.

Fabricius, J.C., 1787. *Mantissa Insectorum, sistens corum species nuper detectas: adjectis characteribus genericis, differentiis specificis, emendationibus, observationibus. Hafniæ*, **1**, xx + 348 p.

Faasse, M., 2004. Opmars van de blaasjeskrab (*Hemigrapsus sanguineus* de Haan, 1835) in Nederland [range extension of the Asian shore crab (*Hemigrapsus sanguineus* de Haan, 1835) in the Netherlands]. *Het Zeepaard*, **64**(5), 143–144.

Fauvel, P., 1929. Sur la presence du crabe *Pachygrapsus marmoratus* à Saint-Vaast-la-Hougue. *Bulletin du Laboratoire Maritime du Muséum d'Histoire Naturelle de Saint-Servan*, **4**, 3.

Fischer-Piette, T., 1932. Répartition des principales espèces fixées sur les rochers battus des côtes et des îles de la Manche, de Lannion à Fécamp. *Annales de l'Institut Océanographique*, **12**, 105–213.

Flores, A.A.V., Cruz, J. & Paula, J., 2002. Temporal and spatial patterns of settlement of brachyuran crab megalopae at a rocky coast in Central Portugal. *Marine Ecology Progress Series*, **229**, 207–220.

Flores, A.A.V. & Paula, J., 2002. Population dynamics of the shore crab *Pachygrapsus marmoratus* (Brachyura: Grapsidae) in the central Portuguese coast. *Journal of the Marine Biological Association of the United Kingdom*, **82**, 229–241.

Gollasch, S., 2002. The importance of ship hull fouling as a vector of species introductions into the North Sea. *Biofouling*, **18**, 105–121.

Gould, A.A., 1841. *Crustacea. Report on the Invertebrata of Massachusetts, comprising the Mollusca, Crustacea, Annelida, and Radiata*. Cambridge, Massachusetts: Folsom, Wells, and Thurston, pp. 321–341.

Haan, W. de, 1835. Crustacea. Fauna Japonica, sive Descriptio animalium, quae in itinere per Japoniam, jussu et auspiciis superiorum, qui summum in India Batava imperium tenent, suscepto, annis 1823–1830 collegit, notis, observationibus et adumbrationibus illustravit P.F. de Siebold. Conjunctis studiis C.J. Temminck et H. Schlegel pro Vertebratis atque W. de Haan pro Invertebratis elaborata Regis aupicus edita. I.P.F. v. Siebold. Leiden, Lugundi Batavorum. **Decas II**, 25–64, pls 9, 15, 17, C, D. (For dates see Sherborn & Jentink, 1895; Holthuis, 1953 and Holthuis & T. Sakai, 1970).

Holthuis, L.B., 1953. On the dates of publication of W. De Haan's volume on the Crustacea of P.F. Von Siebold's "Fauna Japonica." *Journal of the Society for the Bibliography of Natural History*, **3**, 36–47.

Holthuis, L.B. & Sakai, T., 1970. Ph.F. Von Siebold and Fauna Japonica. A history of early Japanese Zoology. Tokyo, Academic Press of Japan. i–xviii + part I, 1–132, (in English) + part II, 207–323, (in Japanese) + plates I–XXXII.

Ingle, R.W., 1980. *British crabs*. British Museum (Natural History) & Oxford University Press.

Ingle, R.W., 1996. Shallow-water crabs. *Synopsis of the British Fauna (New Series)* **25**, 1–243. 2nd edn. Published for The Linnean Society of London and The Estuarine and Coastal Sciences Association by Field Studies Council, Shrewsbury.

Martin, J., 2001. *Les larves de crustacés decapods de côtes françaises de la Manche. Identification, période, abondance*. Brest: IFREMER.

Milne Edwards, H., 1837. *Histoire Naturelle des Crustacés, comprenant l'anatomie, la physiologie et la classification de ces animaux*, Paris, 2, 532pp.

Milne Edwards, H., 1853. Mémoires sur la famille des Ocypodiens suite. *Annales des Sciences Naturelles Série 3* (Zoologie), **20**, 163–228.

Mouchet, S., 1931. Spermatophores des Crustacés Décapodes Anomoures et Brachyoures et castration parasitaire chez quelques Pagures. *Annales Station Océanographique de Salammbô*, **VI**, 1–203.

Moyse, J. & Smaldon, G., 1990. 10. Crustacea III: Malacostraca Eucarida. In *Introduction and protozoans to arthropods. Handbook of the marine fauna of north-west Europe* (ed P.J. Hayward and J.S. Ryland), pp. 489–552. Oxford.

Nijland, R. & Faasse, M., 2005. Meer vindplaatsen van de blaasjeskrab *Hemigrapsus sanguineus* (de Haan, 1835) in Nederland [More localities for the Asian shore crab *Hemigrapsus sanguineus* (de Haan, 1835) in the Netherlands]. *Het Zeepaard*, **65**(5), 151–152.

Noël, P., 1993. *Atlas des Crustacés Décapodes de France (espèces marines et d'eaux saumâtres)-état d'avancement au 28/06/93-Paris*, S.F.F. et B.I.M.M/M.N.H.N., C.S.P., Min. Env.: 99p.

Poupin, J., Davie, P.J.F. & Cexus, J.-C., 2005. A revision of the genus *Pachygrapsus* Randall, 1840 (Crustacea: Decapoda: Brachyura, Grapsidae), with special reference to the Southwest Pacific species. *Zootaxa*, **1015**, 1–66.

Prenant, M., 1929. Sur l'extension actuelle de *Pachygrapsus marmoratus* (Fabr.). *Bulletin du Laboratoire Maritime du Muséum d'Histoire Naturelle de Saint-Servan*, **4**, 3–4.

Prenant, M., 1939. Études de bionomie intercotidale. La baie de Douarnenez et ses abords. *Bulletin Biologique de la France et de la Belgique*, **73**, 451–476.

Pruvot, G., 1897. Essai sur les fonds et la faune de la manche occidentale (Côtes de Bretage) compares a ceux du golfe du Lion. *Archives de Zoologie Expérimentale et Général* (3), **5**, 511–664.

Rainbow, P., Robbins, R. & Clark, P., 2003. Alien invaders: Chinese mitten crabs in the Thames and spreading. *Biologist. Journal of the Institute of Biology*, **50**, 227–230.

Schlegel, C., 1912. Recherches faunistiques sur les Crustacés decapods Brachyoures de la region de Roscoff. *Mémoires de la Société Zoologique de France*, (1911), 24, 133–179, 247.

Seifert, A. & Rathke, J., 2003. Habitatspräferenzen von *Carcinus maenas*, *Pachygrapsus marmoratus* und *Xantho pilipes* am Strand von Le Cabellou (Bretagne). Meeresbiologisches Praktikum Concarneau. Frei Universität Berlin. Systematik und Evolution der Tierre, pp. 1–6.

Sherborn, C.D. & Jentink, J.A., 1895. On the dates of the Parts of Siebold's 'Fauna Japonica' and Giebel's 'Allgemeine Zoologie' (first edition). *Proceedings of the Zoological Society of London,* 1895, 149–150.

Southward, A.J. & Southward, E.C., 1977. Distribution and ecology of the hermit crab *Clibanarius erythropus* in the western Channel. *Journal of the Marine Biological Association of the United Kingdom*, **57**, 441–452.

Southward, A.J. & Southward, E.C., 1988. Disappearance of the warm-water hermit crab *Clibanarius erythropus* from south-west Britain. *Journal of the Marine Biological Association of the United Kingdom*, **68**, 409–412.

Udekem d'Acoz, C. d', 1999. Inventaire et distribution des crustacés decapods de l'Atlantique nord-oriental, de la Méditerranée et des eaux continentals adjacentes au nord de 25°N. *Patrimoines Naturels* (M.N.H.N./S.P.N.), 40, 383p.

Udekem d'Acoz, C. d' & Faasse, M.A., 2002. De huidige status van *Hemigrapsus sanguineus* (de Haan, 1835) en *H. penicillatus* (de Haan, 1835) in de noordelijke Atlantische Oceaan, in het bijzonder in Nederland, met opmerkingen over hun biologie (Crustacea, Decapoda, Brachyura). *Het Zeepaard*, **62**, 101–115.

Vincent, Th. & Le Granche, Ph., 1996. Observation d'un Crabe Marbré *Pachygrapsus marmoratus* (Fabricius, 1787) en 1991 dans Le Cotentin, (Normandie, France). *Annales de l'Institut Océanographique*, **72**, 173–178.

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