BioInvasions Records (2013) Volume 2, Issue 4: 311–315
doi: http://dx.doi.org/10.3391/bir.2013.2.4.08

Open Access

Rapid Communication

Discovery of an alien crab, *Scylla serrata* (Forsskål, 1775) (Crustacea: Decapoda: Portunidae), from the Caribbean coast of Colombia

Rafael Lemaitre[1]*, Néstor H. Campos[2], Efraín A. Viloria Maestre[3] and Amanda M. Windsor[1]

1 *Department of Invertebrate Zoology, National Museum of Natural History, Smithsonian Institution, 4210 Silver Hill Road, Suitland, MD 20746 USA*
2 *Sede Caribe, Universidad Nacional de Colombia, c/o INVEMAR, Calle 25 # 2 - 55, Rodadero sur, Playa Salguero, Santa Marta, Colombia*
3 *Efraín A. Viloria Maestre, Programa Valoración y Aprovechamiento de Recursos Marinos, INVEMAR, Calle 25 # 2 - 55, Rodadero sur, Playa Salguero, Santa Marta, Colombia*

E-mail: lemaitrr@si.edu (RL), nhcamposc@unal.edu.co (NHC), efrain.viloria@invemar.org.co (EAVM), windsora@si.edu (AMW)

**Corresponding author*

Received: 13 September 2013 / Accepted: 14 November 2013 / Published online: 19 November 2013

Handling editor: Vadim Panov

Abstract

A specimen of the swimming crab *Scylla serrata*, a species native to the tropical Indo-West and South Pacific, is reported from Cartagena Bay, Colombia, in the southern Caribbean. It is the third alien decapod crustacean documented from the Caribbean coast of Colombia. Analyses of genetic sequences points to a northern Indian Ocean origin of this specimen. Presence of this specimen is considered an isolated case, most likely kept alive for human consumption on board ship and discarded in the Bay.

Key words: *Scylla serrata*; "giant mud crab"; alien marine species; Crustacea; Brachyura; Indo-West Pacific; western Atlantic; southern Caribbean; Colombia

Introduction

The "giant mud crab" *Scylla serrata* (Forsskål, 1775) is perhaps the largest member of the family Portunidae with a maximum carapace width of 280 mm, and a weight of 3.5 kg (Ng 1998; Poore 2004). This commercially important species, also known by other common names such as "mangrove crab", "muddie" or "Shri Lanka crab" (Davie 2002; Ng et al. 2008a,b), is native to the Indo-West and South Pacific Oceans, from South Africa and the Red Sea to Tahiti, and from Japan to northern and eastern Australia (Keenan et al. 1998; Brockerhoff and McLay 2011). The reported depth range is intertidal to 7 m (Poore 2004), but specimens are known to occur to depths of 60 m, and 3 to 95 km offshore in shrimp fishing grounds (e.g., Hill 1974, 1994; Knuckey 1996). An ovigerous specimen in the National Museum of Natural History, Smithsonian Institution (USNM 127095), was collected in the Bay of Bengal, Indian Ocean, from a depth of 82 m.

This giant mud crab was intentionally introduced to the Hawaiian Islands between 1926 and 1935, where it is now commercially fished (Carlton and Eldredge 2009; Brockerhoff and McLay 2011). In the western Atlantic, attempts to introduce it to Florida's Gulf Coast failed (Park 1969, Masterson 1999; Fofonoff et al. 2003). Two specimens of *S. serrata* recorded off São Paulo and Rio de Janeiro, Brazil, are thought to have arrived in ballast water or as adults carried live for human consumption (Melo 1983; Tavares and Mendonça 2011). This species has failed to establish along the Brazilian coast (Junqueira et al. 2009; Tavares and Mendonça 2011; Tavares 2011).

The capture of *Scylla serrata* in Cartagena Bay, in the Caribbean coast of Colombia, is reported and relevant information about the geographical setting and its biology is briefly summarized.

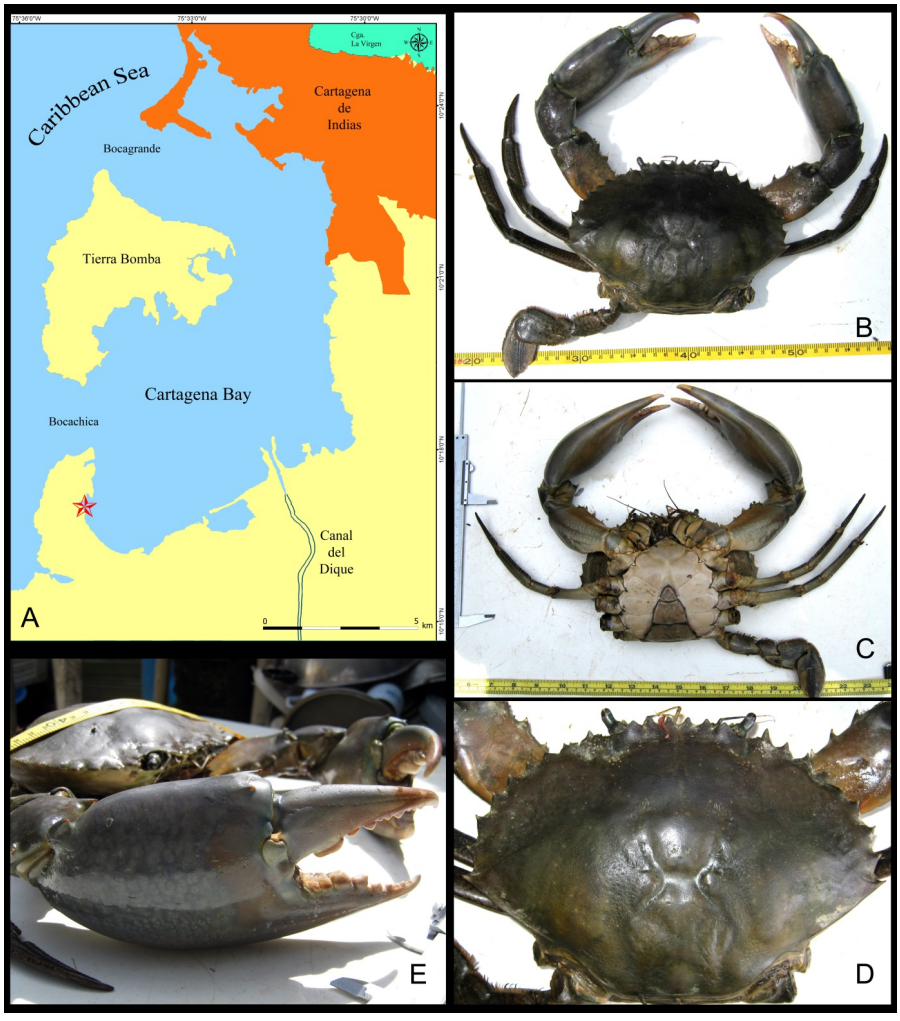

Figure 1. Locality (A) and views of the specimen of *Scylla serrata* (Forsskål, 1775) (B-E) captured in Cartagena Bay, Colombia. A, map (red star is capture location); B, dorsal view; C, ventral view; D, carapace, dorsal view; E, chelipeds and anterofrontal carapace, laterodorsal view. (B-E, male, 20.75 cm carapace width, 13.20 cm carapace length, INV-CRU-8280). Photographs courtesy of Elkin Pardo.

Results and discussion

Capture and environmental setting

On April 27, 2013, Mr. P. Berrío captured a large, unfamiliar, swimming crab in his gillnet on the southwestern portion of Cartagena Bay (Figure 1A) at a depth of 6.5 m. The crab was given to Mr. E. Berrío, a field aid working for the "Instituto de Investigaciones Marinas y Costeras" (INVEMAR). The specimen (Figure 1B–E), identified as *Scylla serrata*, measured 20.75 cm in carapace width, 13.20 cm in carapace length, and weighed 2 kg. It is deposited in the collections of Museo de Historia Natural Marina de Colombia (INV-CRU-8280), INVEMAR.

Cartagena Bay is considered an estuary strongly affected by freshwater outflow and sediments from Canal del Dique, a man-made canal forced into the Bay since 1933. Outside the Bay, salinities vary from 35.7 to 35.9. Salinity inside the Bay depends upon whether it is the rainy or dry season and ranges from 3.1 to 36.1 and occasionally drop to 0 at the mouth of the Canal del Dique. Surface water temperatures range between 27 and 31°C (Vivas-Aguas et al. 2010). Two faunistic reports of decapod crustaceans from the Caribbean coast of Colombia have been published (Campos et al. 2003, 2005), and one on decapod larvae (Medellín-Mora et al. 2009), but no detailed taxonomic studies exist of the crustacean fauna from Cartagena Bay and vicinity except for Lemaitre's (1981) study of the shallow-water brachyuran crabs, where he reported the presence of 96 species, none of which were alien species.

Taxonomy and ecology

There are four known species of *Scylla*, all with a natural distribution in the tropical regions of the Indo-West and South Pacific Oceans (Keenan et al. 1998). *Scylla serrata* can be recognized from other congeners primarily by the larger development and height of the four frontal lobes relative to the frontal width of the carapace, the narrow anterolateral carapace spines with outer margins concave, and well developed spines on the outer surface of the cheliped carpus and palm (Figure 1B-E). Modern diagnoses, color patterns, keys for identifications, summaries of taxonomy and distributions, biological information, and fisheries of *Scylla* species, can be found in Keenan et al. (1998), Ng (1998), Davie (2002), Poore (2004), and Ng et al. (2008a).

Scylla serrata is inhabits estuaries, mangrove swamps and sheltered bays where it is known to dig deep burrows in shallow to intertidal waters. It can be found in nearly fresh waters, although prefers salinities ≥ 34 in offshore waters (Keenan et al. 1998). It remains buried during the day, and emerges at night to feed on a diet of mollusks, crustaceans, other small invertebrates, and rarely plant materials and fish (Ng 1998; Fratini and Vannini 2002; Fofonoff et al. 2003; FAO 2013). *Scylla serrata* is considered to be a highly aggressive species (Motoh 1980). Most of its life cycle is spent in coastal waters but after mating, females migrate to the open sea where eggs hatch and larvae are released to spend three or four weeks in the plankton before adopting a benthic existence (Hill 1994; Knuckey 1996; Fratini and Vannini 2002). The larvae do not tolerate temperatures below 12°C or salinities below 17.5 (Hill 1974).

Origin, possible vectors, and significance

To establish the origin of our specimen, tissue was removed for molecular analysis. The cytochrome oxidase subunit I (COI) barcode region (658 bp) was sequenced and deposited in GenBank under accession number KF827821. A BLAST® search of existing sequences revealed a 100% match to four sequences of *Scylla serrata* (KC200562, JN085428, JN085429, JN805434) from two unpublished studies originating in India. Our sequence was also a match to the COI barcode region of an unpublished mitochondrial genome of *S. serrata* from Thailand (FJ827758). While the precise collection localities of the specimens in GenBank cannot be confirmed, this evidence points to a northern Indian Ocean origin of our specimen.

The means of arrival of the specimen of *Scylla serrata* to Cartagena Bay can only be speculated upon. Introduction of crab species is most commonly attributed to larvae or juveniles transported in ship ballast water or on hull fouling (Brockerhoff and McLay 2011). In the absence of long-term monitoring studies, it is not possible to conclude in our case that larvae or juveniles of this species may have been discharged into the Bay or nearby offshore. As our specimen appears to be an isolated case, it seems unlikely that it arrived as larva or juvenile and then grew to such large size and weight. The large mariculture operations that exist south of the Bay do not culture *S. serrata*, and furthermore they are far removed and not directly connected to the Bay, so that vector is discounted. A more plausible explanation is that the specimen was kept live aboard ship for human consumption, and intentionally or unintentionally discarded near the entrance channel to the Bay where it was then collected by the fisherman. This method of introduction of alien species, is increasingly being reported (e.g., Abelló and Hispano 2006; Stebbing et al. 2012). Although a high volume of shipping does not necessarily translate to a higher rate of invasions (Ruiz et al. 2013), it is significant to note that Cartagena Bay receives heavy commercial and passenger cruise ship traffic originating from numerous ports in the Atlantic and Pacific, with 13,700 ships entering the Bay during the 5-year period of 2006–2010 (Cañón Paez et al. 2010). The irresponsible practice of discarding living organisms that are carried on board ships for human consumption should be a concern to local authorities, as it could lead to establishment of alien populations.

Scylla serrata is the third Indo Pacific decapod introduced in the Caribbean coast of Colombia. *Charybdis hellerii* (A. Milne-Edwards, 1867) was recorded from Portete Bay, Guajira (Campos and Türkay 1989), and *Penaeus monodon* Fabricius, 1798, found on the Guajira coast and Ciénaga Grande de Santa Marta (Álvarez-León and Gutiérrez-Bonilla 2007; Gómez-Lemos and Campos 2008; EAVM, pers. obs.). The former presumably arrived in ship ballast water or hull fouling, whereas the latter was released, intentionally or not, by the local mariculture industry. Both species are considered locally established (RL, pers. obs.).

The spread of marine alien species is considered one of the most significant global modifiers of biodiversity of the oceans, and brachyuran crabs in particular, are a major component of bioinvasions (Cohen and Carlton 1998; Ruiz et al. 2000; Galil et al. 2002; Galil, 2007, 2009; Brockerhoff and McLay 2011). Yet, many tropical coastal areas with high density of maritime traffic remain poorly studied, making timely detection of alien species difficult or unlikely. Given the recent exponential increase in traffic of commercial and tourist ships to major ports of the Caribbean coast of Colombia (Cañón Paez et al. 2010), it is likely that more than just the three alien species currently known from this coast (i.e., *Charybdis helleri*, *Scylla serrata*, *Penaeus monodon*) are present. Along the coast of Brazil alone, for example, 13 marine alien decapod species have been documented so far, five of which, all brachyurans, have become established (Tavares and Mendonça 2011). Only with careful field surveys of this important Bay will it be possible to first detect and then study the extent of ecological impacts from any alien species that arrives and becomes established. Ecological impacts of *S. serrata*, if it were to become established, to the local environment or fisheries are difficult to predict. Based on what is known about the life cycle and behavior of this crab species, it would seem appropriate to consider not just monitoring Cartagena Bay, but also nearby offshore oceanic areas where females theoretically would need to migrate and release their eggs.

Acknowledgements

We thank the project CORMAGDALENA and INVEMAR for funding field work and laboratory support. Capture information was supplied by "LabSIS-INVEMAR 2013, Proyecto Evaluación de la pesca artesanal antes, durante y después del proyecto de actividades de mantenimiento y relimpia del canal del Dique, en el área de influencia de la bahía de Cartagena, Bolívar. Convenio: 1-0008-2012-INVEMAR-CORMAGDALENA". For their help in obtaining information about shipping and port statistics, we thank our colleagues: G R Navas and A. Bermúdez, from Facultad de Ciencias Exactas Universidad de Cartagena; LJA Silva and GT Herazo, from Centro de Investigaciones Oceano-gráficas e Hidrográficas del Caribe, MinDefensa-Dirección General Marítima; and Cpt. JCR Cubaque, Capitán de Puerto de Cartagena. R. Gulledge assisted in the electronic preparation of Figure 1. This is contribution 388 from Centro de Estudios en Ciencias del Mar, CECIMAR, Universidad Nacional de Colombia, Sede Caribe. We thank PF Clark and two anonymous reviewers for their helpful comments to improve the manuscript.

References

Abelló P, Hispano C (2006) The capture of the Indo-Pacific crab *Charybdis feriata* (Linnaeus, 1758) (Brachyura: Portunidae) in the Mediterranean Sea. *Aquatic Invasions* 1: 13–16, http://dx.doi.org/10.3391/ai.2006.1.1.4

Álvarez-León R, Gutiérrez-Bonilla FdeP (2007) Situación de los invertebrados acuáticos introducidos y transplantados en Colombia: antecedentes, efectos y perspectivas. *Revista de la Academia Colombiana de Ciencias* 31: 557–574

Brockerhoof A, McLay C (2011) Human-mediated spread of alien crabs. In: Galil BS, Clark PF, Carlton JT (eds), In the wrong place – alien marine crustaceans: distribution, biology and impacts. Invading Nature. Springer, New York, pp 27–106, http://dx.doi.org/10.1007/978-94-007-0591-3_2

Campos NH, Türkay M (1989) On a record of *Charybdis helleri* from the Caribbean coast of Colombia. *Senckenbergiana Maritima* 20: 119–123

Campos NH, Lemaitre R, Navas GR (2003) La fauna de crustáceos decápodos de la costa Caribe colombiana: Un aporte al conocimiento de la biodiversidad en Colombia. In: El Mundo marino en Colombia: Investigación y desarrollo de territorios olvidados. Red de estudios del mundo marino REMAR, Universidad Nacional de Colombia, Bogotá, pp 114–184

Campos CNH, Navas SGR, Bermúdez TA, Cruz CN (2005) Monografías de Fauna de Colombia. 2. Los crustáceos decápodos de la franja superior del talud continental (300–500 m) del mar Caribe colombiano. Universidad Nacional de Colombia, Facultad de Ciencias, Instituto de Ciencias Naturales, 272 pp

Cañón Paez ML, López Osorio R, Arregoces Silva LJ (2010) Informe valoración rápida. Componente técnico para la gestión del agua de lastre en Colombia. Dirección General Marítima, Centro de Investigaciones Oceanográficas e Hidrográficas del Caribe, 109 pp

Carlton JT, Eldredge LG (2009) Marine bioinvasions of Hawai'i. The introduced and cryptogenic marine and estuarine animals and plants of the Hawaiian Archipelago. Bishop Museum Bulletin in Cultural and Environmental Studies 4, Bishop Museum Press, Honolulu, 202 pp

Cohen AN, Carlton JT (1998) Accelerated invasion rate in a highly invaded estuary. *Science* 279: 555–558, http://dx.doi.org/10.1126/science.279.5350.555

Davie PJF (2002) Crustacea: Malacostraca Eucarida (part 2) Decapoda-Anomura, Brachyura. *Zoological Catalogue of Australia* 19.3B: i–xiv, 1–641

Fabricius JC (1798) *Supplementum Entomologiae Systematicae*. Hafniae, 572 pp

FAO [Food and Agriculture Organization of the United Nations] (2013) Fisheries and Aquaculture Fact Sheets. Species Fact Sheets *Scylla serrata*. http://www.fao.org/fishery/species/2637/en (Accessed 12 September 2013)

Fofonoff PW, Ruiz GM, Steves B, Carlton JT (2003) National Exotic Marine and Estuarine Species Information System. http://invasions.si.edu/nemesis/ (Accessed 12 September 2013)

Forsskål P (1775) *Descriptiones Animalium Avium, Amphibiorum, Piscium, Insectorum, Vermium; quae in Itinere orientali observavit. Petrus Forskål. Post Mortem Auctoris editit Carsten Niebuhr. Adjuncta est materia Medica Kahirina*. Hauniae, Heineck et Faber, http://dx.doi.org/10.5962/bhl.title.2154

Fratini S, Vannini M (2002) Genetic differentiation in the mud crab *Scylla serrata* (Decapoda: Portunidae) within the Indian Ocean. *Journal of Experimental Marine Biology and Ecology* 272: 103–116, http://dx.doi.org/10.1016/S0022-0981(02)00052-7

Galil BS (2007) Loss or gain? Invasive aliens and biodiversity in the Mediterranean Sea. *Marine Pollution Bulletin* 55: 314–322, http://dx.doi.org/10.1016/j.marpolbul.2006.11.008

Galil BS (2009) Tacking stock: inventory of alien species in the Mediterranean Sea. *Biological Invasions* 11: 359–372, http://dx.doi.org/10.1007/s10530-008-9253-y

Galil BS, Froglia C, Noël P (2002) CIESM atlas of exotic species in the Mediterranean. CIESM Publisher, Monaco, 192 pp

Gómez-Lemos LA, Campos NH (2008) Presencia *de Penaeus monodon* Fabricius (Crustacea: Decapoda: Penaeidae) en aguas de la Guajira colombiana. *Boletín de Investigaciones Marinas y Costeras* 37: 221–225

Hill BJ (1974) Salinity and temperature tolerance of zoeae of the portunid crab *Scylla serrata*. *Marine Biology* 25: 21–24, http://dx.doi.org/10.1007/BF00395104

Hill BJ (1994) Offshore spawning by the portunid crab *Scylla serrata* (Crustacea: Decapoda). *Marine Biology* 120: 379–384, http://dx.doi.org/10.1007/BF00680211

Junqueira AOR, Tavares MDS, Schaeffer-Novelli Y, Radashevsky VI, Cirelli JO, Julio LM, Romagnoli FC, Santos KC, Ferreira-Silva MAG (2009) Zoobentos. In: Lopes RM, Coradin L., Pombo VB, Cunha DR (eds), Informe sobre as espécies exótica invasoras marinhas do Brasil. Ministerio do Meio Ambiente, Brasilia, pp 145–371

Keenan CP, Davie PJF, Mann DL (1998) A revision of the genus *Scylla* De Haan, 1833 (Crustacea: Decapoda: Brachyura: Portunidae). *The Raffles Bulletin of Zoology* 46: 217–245

Knuckey IA (1996) Maturity in male mud crabs, *Scylla serrata*, and the use of mating scars as a functional indicator. *Journal of Crustacean Biology* 16: 487–495, http://dx.doi.org/10.2307/1548738

Lemaitre R (1981) Shallow-water crabs (Decapoda, Brachyura) collected in the southern Caribbean near Cartagena, Colombia. *Bulletin of Marine Science* 31: 234–266

Masterson J (1999) The Indian River Lagoon Species Inventory: *Scylla serrata*. http://www.sms.si.edu/irlspec/Scylla_serrata.htm (Accessed 12 September 2013)

Medellín-Mora J, Campos NH, Franco-Herrera A, Jaimes JC (2009) Taxonomía de larvas zoea de crustáceos decápodos del área nororiental del mar caribe colombiano. *Boletín de Investigaciones Marinas y Costeras* 38: 55–73

Melo GAS (1983) A ocorrênciano no litoral brasileiro de um Portunidae (Crustacea: Decapoda: Brachyura), originário do Indo-Pacífico. *Revista Brasileira de Zoología* 1: 159–167

Milne-Edwards A (1867) Descriptions de quelques espèces nouvelles de Crustacés Brachyoures. *Annales de la Societé Entomologique de France* (série 4) 7: 263–288

Motoh H (1980) Edible crustaceans in the Philippines, 11th in a series. *Asian Aquaculture* 2: 5

Ng PKL (1998) Crabs. In: Carpenter KE, Niem VH (eds), FAO species identification guide for fishery purposes. The living marine resources of the Western Central Pacific. Vol. 2: cephalopods, crustaceans, holothuroideans and sharks. Rome, pp 1045–1155

Ng PKL, Guinot D, Davie PJF (2008a) Systema brachyurorum: Part 1. An annotated checklist of extant brachyuran crabs of the world. *The Raffles Bulletin of Zoology,* suppl. 17: 1–286

Ng PKL, Keng WL, Lim KKP (eds) (2008b) Private lives. An exposé of Singapore's mangroves. Kepmedia International Pte Ltd, Singapore, 249 pp

Park JR (1969) A preliminary study of portunid crabs in Biscayne Bay. *Quarterly Journal of the Florida Academy of Sciences* 32: 12–20

Poore GCB (2004) Marine decapod Crustacea of southern Australia, guide to identification. CSIRO Publishing, Collingwood, Australia, 574 pp

Ruiz GM, Fofonoff PW, Carlton JT, Wonham MJ, Hines AH (2000) Invasion of coastal marine communities in North America: apparent patterns, processes, and biases. *Annual Review of Ecology and Systematics* 31: 481–531, http://dx.doi.org/10.1146/annurev.ecolsys.31.1.481

Ruiz GM, Fofonoff PW, Ashton G, Minton MS, Miller AW (2013) Geographic variation in marine invasions among large estuaries: effects of ships and time. *Ecological Applications* 23: 311–320, http://dx.doi.org/10.1890/11-1660.1

Stebbing P, Johnson P, Delahunty A, Clark PF, McCollin T, Hale C, Clark S (2012) Reports of American lobsters, *Homarus americanus* (H. Milne Edwards, 1837), in British waters. *BioInvasions Records* 1: 17–23, http://dx.doi.org/10.3391/bir.2012.1.1.04

Tavares M (2011) Alien decapod crustaceans in the Southwestern Atlantic Ocean. In: Galil BS, Clark PF, Carlton JT (eds), In the wrong place – alien marine crustaceans: distribution, biology and impacts. Invading Nature. Springer, New York, pp 251–267, http://dx.doi.org/10.1007/978-94-007-0591-3_7

Tavares M, Mendonça Jr. JB (2011) The occurrence of the Indo-Pacific swimming crab *Scylla serrata* (Forskål, 1775) in the Southwestern Atlantic (Crustacea: Brachyura: Portunidae). *Aquatic Invasions* 6 (Suppl. 1): S49–S51, http://dx.doi.org/10.3391/ai.2011.6.S1.011

Vivas-Aguas L, Tosic M, Sánchez J, Narváez S, Cadavid B, Bautista P, Betancourt J, Parra L J, Echeverri L, Espinosa L (2010) Diagnóstico y evaluación de la calidad ambiental marina en el Caribe y Pacífico colombiano. Red de vigilancia para la conservación y protección de las aguas marinas y costeras de Colombia-REDCAM. Informe técnico 2010. INVEMAR. Santa Marta, 208 pp