New records of non-indigenous fishes (Perciformes and Tetraodontiformes) from the Canary Islands (north-eastern Atlantic)

by

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ABSTRACT. – We report the collection of specimens of Paranthias furcifer (Serranidae), Abudefduf hoefleri (Pomacentridae), Acanthurus bahianus, A. chirurgus, A. coeruleus (Acanthuridae), and Cantherhines pullus (Monacanthidae) as first records for these tropical and subtropical species from the Canary Islands (north-eastern Atlantic). Most of these records coincide with the presence of oil platforms towards and within the Port of Las Palmas. Regarding the management of the arrival of warm-affinity fish species, it would be necessary to implement control and monitoring measures to avoid they become invaders, displacing indigenous species and changing the ecosystems.

RÉSUMÉ. - Premier signalement d’espèces non-indigènes (Perciformes et Tetraodontiformes) aux îles Canaries (Atlantique nord-est).

La capture de spécimens de Paranthias furcifer (Serranidae), Abudefduf hoefleri (Pomacentridae), Acanthurus bahianus, A. chirurgus, A. coeruleus (Acanthuridae) et Cantherhines pullus (Monacanthidae) représente le premier signalement pour ces six espèces tropicales et subtropicales aux îles Canaries (Atlantique nord-est). Les zones autochtones de ces espèces coïncident avec les zones d’origine et l’arrivée de plates-formes pétrolières au Port de Las Palmas. Le contrôle et le suivi de l’introduction d’espèces ayant des affinités avec les eaux chaudes devraient être mis en œuvre pour éviter qu’elles deviennent invasives, déplaçant les espèces indigènes et modifiant les écosystèmes.

Many authors have postulated on a tropicalization process of fish assemblages in temperate biogeographic transition zones, including the Macaronesian region and some parts of the Mediterranean Sea (Brito et al., 2005; Wirtz et al., 2008; Afonso et al., 2013; Horta Costa et al., 2014), associated with global warming in many cases (Brito et al., 2005; Perry et al., 2005; Occhipinti-Ambrogi, 2007). A recent review by Vergés et al. (2014) accounts for this topic in temperate marine ecosystems, emphasizing that climate-driven changes in biotic interactions can profoundly alter ecological communities, particularly when they impact foundation species.

During the last thirty years, ichthyologists have reported the presence (and sometimes establishment) of non-indigenous marine fish species around the Canary Islands (Fig. 1), generally arriving from subtropical and tropical nearby areas (i.e. the north-western African coasts and the Cape Verde Islands) (e.g. Brito, 1991; Brito et al., 2002, 2005). Within the Macaronesian archipelagos, this phenomenon has also been reported at Madeira (e.g. Wirtz et al., 2008) and Azores (e.g. Afonso et al., 2013).

Early examples of these findings from the Canaries include Lutjanus goreensis (Valenciennes, 1830) (Lutjanidae) (González and Santana, 1986), Corningus spinosus Agassiz, 1831 (Holocentridae) (Lozano and Brito, 1989), Epinephelus itajara (Lichtenstein, 1822) (Serranidae), Argyrosomus regius (Asso, 1801) (Sciaenidae), Dentex canariensis Steindachner, 1881, Pagrus africanus Akazaki, 1962 (Sparidae), Trachurus trecae Cadenat, 1950 (Carangidae), Chaetodon hoefleri Steindachner, 1881, Prognathodes marcellae (Poll, 1950) (Chaetodontidae), Abudefduf saxatilis (Linnaeus, 1758) (Pomacentridae), Acanthurus monroviae Steindachner, 1876 (Acanthuridae), Aulurus monoceros (Linnaeus, 1758) (Monacanthidae), Ocrynopsis unicolor (Geoffroy Saint-Hilaire, 1817), Scomberomorus tritor (Cuvier, 1832) (Scombridae) (Brito, 1991), Dentex angolensis Poll & Maul, 1953 (Sparidae) (Rico et al., 1995) or Holocentrus adsceni...
sionis (Osbeck, 1765) (Holocentridae) (Castro-Hernández and Martín-Gutiérrez, 2000). Many other records of subtropical and tropical fish species in waters of the Canary Islands were compiled by Brito et al. (2002), for instance Rhincodon typus Smith, 1828 (Rhincodontidae), Grammonus longhursti (Cohen, 1964) (Bythitidae), Antennarius striatus (Shaw, 1794) (Antennariidae), Myripristis jacobus Cuvier, 1829 (Holocentridae), Epinephelus caninus (Valenciennes, 1843) (Serranidae), Priacanthus arenatus Cuvier, 1829 (Priacanthidae), Caranx hippos Linnaeus, 1766, C. latus Agassiz, 1831, C. Iugubris Poey, 1860, Decapterus punctatus (Cuvier, 1829), Elagatis bipinnulata (Quoy & Gaimard, 1825), Selene dorsalis (Gill, 1863), Seriola carpenteri Mather, 1971 (Carangidae), Erythrocles monodi Poll & Cadenat, 1954 (Emmelichthyidae), Lobotes surinamensis (Bloch, 1790) (Lobotidae), Mullolidichthys martinicus (Cuvier, 1819) (Mullidae), Microlipophrys velifer (Norman, 1935) (Blenniidae), Gnatholepis thompsoni Jordan, 1904 (Gobiidae), Ballistes punctatus Gmelin, 1789, Canthidermis sufflamen (Mitchill, 1815), Melichthys niger (Bloch, 1786) (Balistidae), Chilomycterus reticulatus (Linnaeus, 1758) or Diodon hystrix Linnaeus, 1758 (Diodontidae). In recent years, other subtropical and tropical fish species have been reported from the Canaries, including Cephalopholis tae- niops (Valenciennes, 1828) (Serranidae) (Brito et al., 2011), Echidopsis punctifer (Kaup, 1859) (Ophichthidae), Hyleleurochilus sp. (Blenniidae) (Espino et al., 2014), and Lutjanus dentatus (Duméril, 1861) (Lutjanidae) (García-Mederos and Tuset, 2014).

It is also noteworthy that some of these non-native species have been found in port waters (mainly in the Port of Las Palmas, Gran Canaria Island, and in the Port of Santa Cruz de Tenerife, Tenerife Island) or in their vicinity (Fig. 1). Some examples are Cephalopholis nigr (Günther, 1859), Epinephelus costae (Steindachner, 1878) (Serranidae) (Brito, 1991), Chaetodon sanctaeheleene Günther, 1868 (Chaetodontidae) (Brito and Falcón, 1996) or Monodactylus sebæ (Cuvier, 1829) (Monodactylidae) (Brito et al., 2002).

Out of these fish species having warm water affinity, at least Caranx crysos (Mitchill, 1815), Decapterus maccarellus (Cuvier, 1833) (Carangidae), Lutjanus gorensis (Brito et al., 2002), Diodon eydouxii Brisout de Barneville, 1846 (Diodontidae) (Brito et al., 2005), Gnatholepis thompsoni, Chilomycterus reticulatus (Espino et al., 2014), Canthidermis sufflamen and Abudedefduf saxatilis (author obs.) seem to have currently well-established populations around the Canary Islands.

The presence of non-native marine fish species in biogeographical regions well separated from their donor regions has been related with the natural population extensions, in many cases associated with climate change (e.g. Brito et al., 2005; Perry et al., 2005; Occhipinti-Ambrogi, 2007). In response to warmer conditions, marine fishes tend to shift their distributions to higher latitudes (Perry et al., 2005; Spencer 2008; Nye et al., 2009; Lucey and Nye, 2010; Horta Costa et al., 2014). However, in the case of human-caused factors, the arrival areas are linked to transport vectors (shipping) of non-native fish species (e.g. Vitousek et al., 1997). In the context of the Canary Islands, the transport vector has been mainly associated with ballast waters [Brito et al. (2011), C. taeniops] and, to a lesser extent, with aquarium trade [Brito et al. (2002), Pomacanthus maculosus (Forsskal, 1775) (Pomacanthidae)]. However, Pajuelo et al. (unpubl. data) have video-recorded, for the first time from the Canaries, that oil platforms are an important vector for the translocation and introduction of non-native species.

Once verified that, in the last five years, oil rigs operating in West Africa and South America have increasingly consolidated the Port of Las Palmas as the most important base for oil platforms in the north-eastern Atlantic, a network of volunteer observers has reported sightings and/or catches of non-indigenous species. Following this strategy, useful information was gathered and several specimens of different non-native species were collected and taxonomically identified.

The present paper describes the records, for the first time, of six teleost fishes from the Canary Islands: Paranthias furci fer (Valenciennes, 1828) (Serranidae), Abudedefduf hoefleri (Steindachner, 1881) (Pomacentridae), Acanthurus bahianus Castelnau, 1855, Acanthurus chirurgus (Bloch, 1787), Acanthurus coeruleus Bloch & Schneider, 1801 (Acanthuridae), and Cantherhines pullus (Ranzani, 1842) (Monacanthidae) (Fig. 2). Moreover, the presence of five tropical or subtropical non-native fish species previously recorded from the
Canaries is confirmed: Holocentrus adscensionis (Holocentridae), Cephalopholis taeniops (Serranidae), Prognathodes marcellae (Chaetodontidae), Abudelfaf saxatilis (Pomacentridae), and Acanthus monroviae (Acanthuridae) (Fig. 2). Biogeographical data on these species have been gathered and they are provided herein.

**MATERIAL AND METHODS**

Volunteer observers (SCUBA divers, professional and recreational fishermen) reported sightings and/or catches of non-native fish species along the north, east, and south-east coasts of Gran Canaria (Fig. 1). The number of sightings/catches and the total number of individuals are given for each non-indigenous fish species. For each fish (observed or caught), collection information (locality, coordinates, date, depth, type of substratum, among others) was recorded.

Most non-native specimens collected by spearfishing or professional fishing gear were examined at the laboratory for taxonomic identification and determination of sex and maturity condition. Just two specimens of two non-indigenous species were identified from photographs of freshly caught animals; in these cases, the size of specimens was indirectly estimated. Meristic and morphometric measurements (in mm) were made following Hubbs and Lagler (1958): TL, total length and SL, standard length.

This study follows the best practices approach to overcoming unverified and unverifiable “first records”, as proposed by Bello et al. (2014). Voucher specimens were deposited in the collections of the Tenerife Museum of Natural History (TFMC, Spain) and the Funchal Natural History Museum (MMF, Portugal). Muscle tissue samples taken from each specimen, as well as some voucher specimens, were stored at ICCM (Initiative for Marine Science Collections, in English) from the Department of Biology of the University of Las Palmas de Gran Canaria.

The systematic arrangement of the present account of species followed Nelson (2006), and their taxonomical status was assigned according to Eschmeyer and Fong (2015) and Froese and Pauly (2015).

**RESULTS**

**Holocentrus adscensionis** (Osbeck, 1765), squirrelfish

*Material examined.* – ICCM399, one resting male, 219 mm TL, 167 mm SL, off La Laja Beach, 28°03’N 15°25’W, 15–24 m, 15 Feb. 2015, rocks with sand (Fig. 2A).

*Sightings and catches.* – Once, n = 1, same locality (Fig. 3).

*Remarks.* – A tropical and subtropical reef-associated species, living from the shoreline to 180 m of depth (Smith, 1997), usually at 8-30 m (Wyatt, 1983). It occurs in shallow coral reefs as well as deeper offshore waters (Woods and Greenfield, 1978). A nocturnal species, hiding in deep crevices or under coral ledges during the day; at night, it usually moves over sand and seagrass beds, taking mainly crabs and other small crustaceans (Greenfield, 1981). Maximum length published is 610 mm TL. An amphiplantic species. In the West Atlantic, it ranges from North Carolina, USA and Bermuda to Brazil (Woods and Greenfield, 1978; Robins and Ray, 1986; Greenfield, 2003). In the mid-Atlantic: St. Paul’s Rocks, Ascension and St. Helena Islands (Wirtz et al., 2007). In the East Atlantic, it is known from Annobón Island (Wirtz et al., 2007) and São Tomé Island (Osório, 1898; Afonso et al., 1999; Wirtz et al., 2007), and from Gabon to Angola (Greenfield, 1981); absent from the Cape Verde Islands (Wirtz et al., 2013; Hanel and John, 2015).

*H. adscensionis* was first reported from the Canaries by Castro-Hernández and Martín-Gutiérrez (2000) based on one individual caught off Castillo del Romeral, south-eastern coast of Gran Canaria. Brito et al. (2002) reported on a total of nine individuals all collected at the eastern coast of Gran Canaria. One more individual was sighted and photographed alive off Punta de La Sal, eastern coast of Gran Canaria (Espino et al., 2014). Another individual (220 mm TL, 168 mm SL) caught at the Port of Santa Cruz de Tenerife (rocky breakwater, 20-30 m) in October 2014 was identified by the second author and deposited as a museum voucher (TFMCBM-VP/1949).

**Cephalopholis taeniops** (Valenciennes, 1828), African hind or blue-spotted seabass

*Material examined.* – ICCM404, one resting male, 390 mm TL, 325 mm SL, off Baja de Melénara (Melénara reef), 27°59’N 15°22’W, 15-24 m, 15 Oct. 2014, rocks with sand (Fig. 2B).

*Sightings and catches.* – Twice, n = 3: Melénara reef, 15-24 m, rocks with sand; off the Port of Agaete, 28°06’N 15°42’W, 20-30 m, rocks with sand (Fig. 3).

*Remarks.* – A demersal species, found on shallow tropical rocky reefs and sandy bottoms up to 200 m depth in the eastern Atlantic from the Western Sahara to Angola, including Cape Verde and São Tomé and Príncipe Islands (Rocha et al., 2008; Craig et al., 2011; Tariche et al., 2014). This is a large-sized carnivorous species (Tariche 2002; Brito et al., 2011). Maximum length published is 700 mm TL.

*C. taeniops* was first reported from the Canaries by Brito et al. (2011) based on one individual caught at the Port of Las Palmas.

**Paranthias furcifer** (Valenciennes, 1828), creole-fish

*Material examined.* – MMF44365, one post-spawning male, 340 mm TL, 264 mm SL, old dike of Arinaga, 27°51’N 15°23’W, 6-8 m, 16 Apr. 2015, rocky substrate (Fig. 2C).
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MMF44490, one post-spawning male, 352 mm TL, 279 mm SL, dike Reina Sofía, 28°07’N 15°24’W, 15 m over a bottom of 24 m of depth, 11 May 2015, rocks.

Sightings and catches. – Four times, n = 27: dike Reina Sofía, 12-15 m over a bottom of 21 m of depth, rocky breakwater; off La Isleta, 28°10’N 15°24’W, 19–20 m, rocks; old dike of arinaga, 6-8 m, rocky substrate (Fig. 3).

Remarks. – A tropical and subtropical reef-associated species (Heemstra and Randall, 1993), living between 8 and 100 m of depth (Lieske and Myers, 1994), usually at 10-66 m (Randall, 1996). Inhabits coral reefs and hard bottom areas. Observed in feeding aggregations above reefs. Feeds mainly in midwater on zooplankton (copepods, pelagic tunicates, shrimps and shrimp larvae) (Heemstra and Randall, 1993; Lieske and Myers, 1994). Paranthias Guichenot, 1868 is a unique genus of groupers that have a small mouth [with a more protrusable upper jaw than in other groupers], small teeth, numerous [long] gill rakers, fusiform body, and deeply forked caudal fin – all representing departures from the typical grouper morphology, and all specializations for feeding in mid-water on zooplankton (Randall, 1967). Paranthias feed mainly on small planktonic animals that are picked individually from the water, and their shortened snout (compared to other groupers), which facilitates close-range binocular vision, is thus another specialization for this type of plankton feeding (Heemstra and Randall, 1993). Maximum length published is 300 mm SL. It seems to be primarily a western Atlantic species, distributed from Bermuda and south Florida, USA to São Paulo, Brazil (Heemstra and Randall, 1993). In the mid-Atlantic: Ascension Island (Cadenat and Marchal, 1963; Wirtz et al., 2014). In the East Atlantic: known from the Gulf of Guinea islands of Annobón, São

Figure 2. - Non-native species introduced to the Canaries. A: Holocentrus ascensionis; B: Cephalopholis taeniops; C: Paranthias furcifer; D: Prognathodes marcellae; E: Abudelfuf saxatilis; F: Abudelfuf hoefleri; G: Acanthurus bahianus; H: Acanthurus coeruleus; I: Acanthurus chirurgus; J: Acanthurus monroviae; K: Cantherhines pullus. Scale bars = 5 cm.
Tomé and Príncipe (Osório, 1893; Wirtz et al., 2007) and Bioko (Wirtz et al., 2007).
This is the first record for *P. furcifer* from the Canary Islands.

**Prognathodes marcellae** (Poll, 1950), French butterflyfish

*Material examined.* – No voucher specimens. One individual caught on a fish-trap and photographed, and then identified by the authors. An adult, approximately 97 mm TL, off El Burrero Beach, 27°54′N 15°23′W, 40–50 m, 16 Aug. 2014, sand (Fig. 2D).

*Sightings and catches.* – Twice, *n* = 2: off El Burrero Beach, 40–50 m, sand; Baja de Gando (= Gando reef), 27°56′N 15°21′W, 23 m, rocks (Fig. 3).

**Remarks.** – A tropical reef-associated species, living from 12 to 140 m of depth (Maugé, 1990). Most specimens were collected on soft bottoms (Maugé, 1990). Oviparous; form pairs during breeding (Breder and Rosen, 1966). No information exists on its feeding habits in literature. Maximum length published is 116 mm TL (Reiner, 2005). An eastern Atlantic species, known from Senegal and Cape Verde Islands (Maugé, 1990; Brito et al., 1999; Wirtz et al., 2013; Hanel and John, 2015) to Angola (Bianchi, 1986), including the Gulf of Guinea islands of São Tomé and Rolas where is common at 5–20 m (Wirtz et al., 2007).

*P. marcellae* was first reported from the Canaries by Brito (1991), as a demersal littoral species on rocky bottom, based on one individual caught in the South of Tenerife Island.
Abudefduf hoefleri (Steindachner, 1881), African sergeant

Material examined. – MMF44366, one resting female, 228 mm TL, 173 mm SL, dike Reina Sofía, 28°07’N 15°24’W, 18-19 m over a bottom of 21 m of depth, 21 Mar. 2015, rocky breakwater (Fig. 2E). Four maturing males, off San Cristóbal, 28°04’N 15°24’W, 18 m, 24 Apr. 2015, rocks with sand: MMF44375, 219 mm TL, 155 mm SL; MMF44376, 220 mm TL, 155 mm SL; ICCM405, 193 mm TL, 138 mm SL; ICCM406, 195 mm TL, 144 mm SL.

Sightings and catches. – Three times, n > 100: dike Reina Sofía, 21 m, rocky breakwater; off San Cristóbal, 18 m, rocks with sand (Fig. 3).

Remarks. – A tropical reef-associated species (Allen, 1991). A littoral species that inhabits rocky reefs (Lloris and Rucabado, 1990). Oviparous, distinct pairing during breeding; eggs are demersal and adhere to the substrate; males guard and aerate the eggs (Breder and Rosen, 1966). No information exists on its feeding habits in literature. Maximum length published is 200 mm TL. An eastern Atlantic species, known from Senegal and Cape Verde Islands (Edwards, 1986; Wirtz et al., 2013; Hanel and John, 2015) to Benin, including São Tomé Island and Ilheu das Rolas (Osório, 1891; Lloris and Rucabado, 1990; Wirtz et al., 2007).

This is the first record for A. hoefleri from the Canary Islands.

Abudefduf saxatilis (Linnaeus, 1758), sergeant-major

Material examined. – ICCM400, one resting male, 125 mm TL, 98 mm SL, off La Laja Beach, 28°03’N 15°25’W, 15-24 m, rocks with sand (Fig. 2F).

Sightings and catches. – Twenty times, n > 310: dike Reina Sofía, 12 m over a bottom of 21 m of depth, rocky breakwater; off La Garita Beach, 28°00’N 15°22’W, 15-24 m, rocks with sand; off Las Canteras Beach’s sedimentary reef, 28°09’N 15°28’W, 6-7 m, large rocks with sand; off Baja de Melenara (= Melenara reef), 15-24 m, rocks with sand; off Risco Verde, 27°51’N 15°23’W, 5-8 m, vertical cliff; off El Cabrón Beach, 27°52’N 15°23’W, 8-10 m, vertical cliff; off the Port of Sardina del Norte, 28°09’N 15°41’W, 5-8 m, sand with rocks; around the Kalais (33 m, sand) and Arona (27-30 m, sand), shipwrecks, in the Bay of Las Palmas near the Port of Las Palmas; Baja de Jinamar (= Jinámar reef), 28°02’0’N 15°22’W, an isolated rocky outcrop (an urchin-grazed barren) 1.5 km away from the coast at ca. 39 m of depth (Fig. 3).

Remarks. – A subtropical benthopelagic reef-associated species (Allen, 1991), living from the shoreline to 20 m of depth (Feitoza et al., 2003). Juveniles are common in tidal pools, while adults are found over shallow reef tops. Adults frequently form large feeding aggregations of up to several hundred individuals. Food items include algae, small crustaceans and fish, and various invertebrate larvae (Emery, 1978). Adult males adopt a bluish ground colour when guarding eggs. Oviparous, distinct pairing during breeding; eggs are demersal and adhere to the substrate (Breder and Rosen, 1966). Maximum length published is 229 mm TL (Claro, 1994). It seems to be primarily an amphio-Atlantic species. West Atlantic: from Canada (Scott and Scott, 1988) to Uruguay, abundant on Caribbean reefs (Allen, 1991). In the mid-Atlantic: Ascension Island (Cadenat and Marchal, 1963; Wirtz et al., 2014). East Atlantic: from Senegal south to Angola, including the Cape Verde Islands (Franca and Vasconcelos, 1962; Wirtz et al., 2013; Hanel and John, 2015), São Tomé and Príncipe Islands (Osório, 1891; Afonso et al., 1999; Wirtz et al., 2007), Bioko Island, Annobón Island and other offshore islands (Wirtz et al., 2007). Also reported at Madeira (Freitas and Araújo, 2006; Wirtz et al., 2008) and Malta, central Mediterranean (Deidun and Castriota, 2014). Foster and Willan (1979) reported this species from the western Pacific (Solomon Islands), based on the observation of a couple of individuals adopted by a semi-submersible exploratory drilling platform in coastal waters of the Solomon Islands.

A. saxatilis was first reported from the Canaries by Brito (1991, as A. marginatus) based on one individual caught at the Port of Santa Cruz de Tenerife. Brito et al. (2002) reported on one more individual sighted in a beach near that port.

Acanthus bahianus Castelnau, 1855, ocean surgeon

Material examined. – MMF44367, one resting female, 168 mm TL, 131 mm SL, El Altillo, 28°11’N 15°33’W, 4 m, 8 Aug. 2014, reef platform (Fig. 2G).

Sightings and catches. – Once, n = 1, same locality (Fig. 3).

Remarks. – A tropical reef-associated species (Robins and Ray, 1986), living from 2 (Baensch and Debelius, 1997) to 40 m of depth (Desoutter, 1990), usually at 2-25 m, between 21 and 25°C (Baensch and Debelius, 1997). Inhabitats shallow bottoms with coral or rocky formations (Cervigón, 1994). Usually occurs in groups of five or more individuals. Mainly diurnal. Feeds on algae (Robins and Ray, 1986). Maximum length published is 381 mm SL (Humann, 1994). An amphio-Atlantic species. West Atlantic: Massachusetts, USA and Bermuda southward to southern Brazil (Froese and Pauly, 2015, Anderson et al., 2015). In the mid-Atlantic: Ascension (Cadenat and Marchal, 1963; Wirtz et al., 2014) and St. Helena Islands (Desoutter, 1990). East Atlantic: off Angola (Smith, 1997).

This is the first record for A. bahianus from the Canary Islands.

Acanthus chirurgus (Bloch, 1787), doctorfish

Material examined. – MMF44368, one mature female, 307 mm TL, 244 mm SL, dike Reina Sofía, 28°07’N
Acanthurus coeruleus Bloch & Schneider, 1801, blue tang surgeonfish

**Material examined.** – Two specimens, dike Reina Sofía, 28°07’N 15°24’W, rocky breakwater: MMF44369, one maturing female, 237 mm TL, 188 mm SL, 18-19 m over a bottom of 21 m of depth, 21 Mar. 2015, rocky breakwater (Fig. 2H).

**Sightings and catches.** – Twice, n = 2, same locality (Fig. 3).

**Remarks.** – A tropical reef-associated species, living from 2 to 40 m of depth (Desoutter, 1990), usually at 20-25°C (Baensch and Debelius, 1997). Inhabits coral reefs, inshore grassy or rocky areas. Forms small groups (Coupl et al., 1992). Mainly diurnal. Feeds entirely on algae (Böhlke and Chaplin, 1993). Maximum length published is 390 mm TL (Figueiredo and Menezes, 2000).

This is the first record for *A. coeruleus* from the Canary Islands.

Acanthurus monroviae Steindachner, 1876, Monrovia doctorfish

**Material examined.** – Four specimens, dike Reina Sofía, 28°07’N 15°24’W, 21 m, 21 Mar. 2015, rocky breakwater: MMF44370, one immature female, 251 mm TL, 195 mm SL (Fig. 2J); MMF44371, one immature male, 242 mm TL, 184 mm SL; TFMCBM-VP/1950, one immature female, 235 mm TL, 176 mm SL; TFMCBM-VP/1951, one immature male, 228 mm TL, 174 mm SL. Two specimens, off La Isleta, 28°10’N 15°24’W, 20 m, rocks: ICCM402, one unsexed adult, 350 mm TL, 239 mm SL, 13 Jul. 2013; ICCM403, one spawning male, 392 mm TL, 286 mm SL, 18 Apr. 2015.

**Sightings and catches.** – Three times, n = 5: dike Reina Sofía, 21 m, rocky breakwater; off La Isleta, 19-37 m, rocks (Fig. 3).

**Remarks.** – A tropical demersal species, living from 5 to 200 m of depth (Desoutter, 1990), usually at 5-40 m, between 20 and 25°C (Baensch and Debelius, 1997). Found on rocky and coral bottoms (Schneider, 1990). It is also a brackish coastal species found in the mouth of rivers and lagoons (Desoutter, 1990). Feeds on zooplankton, phytoplankton and detritus (Diouf, 1996). Maximum length published is 450 mm SL (Randall, 1981). It is firstly an eastern Atlantic species: from Portugal (Costa and Gonçalves, 2013, at 38.43°N in December 2007) and Morocco to Angola, including the Cape Verdes (Franca and Vasconcelos, 1962; Wirtz et al., 2013; Hanel and John, 2015) and São Tomé Island (Osório, 1891; Afonso et al., 1999; Wirtz et al., 2004). Recently reported from the West Atlantic: Brazil (Luiz-Júnior et al., 2004).

*A. monroviae* was first reported from the Canaries by Brito (1991) based on five individuals caught at the Port of Santa Cruz de Tenerife. Brito et al. (2002) reported on several sightings and another four individuals caught in Gran Canaria. One more observation was reported off El Cabrón Beach in August 2014 by Espino et al. (2014).

Cantherhines pullus (Ranzani, 1842), orange-spotted filefish

**Material examined.** – No voucher specimens. One individual caught on a fish trap and photographed, and then identified by an expert. An adult, approximately 114 mm TL, off Castillo del Romeral, 27°47’N 15°27’W, 18-30 m, 14 Jan. 2015, rocks (Fig. 2K).

**Sightings and catches.** – Once, n = 1, same locality (Fig. 3).

**Remarks.** – A subtropical reef-associated species, living from 3 to 50 m of depth (Harmelin-Vivien and Quéro, 1990), usually at 3-20 m (Gasparini and Floeter, 2001). Found in shallow water and around coral and rocky reefs (Tyler, 1978). Usually remains near the bottom, hiding among gorgonians and branching coral (Lieske and Myers, 1994).
Feeds on bottom growth, primarily sponges and algae, but stomachs often contain tunicates, bryozoans and other sessile benthic invertebrates (Böhle and Chaplin, 1993). Young are pelagic and highly important food items in the diet of large predatory fishes such as tunas and billfishes (Tyler, 1978). Maximum length published is 200 mm TL (Robins and Ray, 1986). An amphi-Atlantic species. West Atlantic: known from Massachusetts, USA and Bermuda to southeastern Brazil (Harmelin-Vivien and Quéro, 1990), including Trindade Island (Gasparini and Floeter, 2001). East Atlantic: off some Gulf of Guinea islands (Harmelin-Vivien and Quéro, 1990), São Tomé and Príncipe (Osório, 1891; Afonso et al., 1999; Wirtz et al., 2007) and Annobón (Wirtz et al., 2007). Absent from the Cape Verde Islands (Wirtz et al., 2013).

This is the first record for *C. pullus* from the Canary Islands.

**DISCUSSION**

Pajuelo et al. (unpubl. data) have observed that the appearance of these tropical and subtropical fish species in waters of Gran Canaria Island is related to the heavy overseas traffic of oil platforms, with destination towards the Port of Las Palmas (docked). This also includes the adjacent Bay of Las Palmas (anchor area) and the auxiliary (when overbooking) Port of Arinaga (docked) located 16 nm down south on the east coast of the island. Importantly, all specimens identified in this work were caught inside port waters, in the pathway to the Port of Arinaga (eastern corridor of the island) or in adjacent waters to the main ports. *H. adscensionis* has been caught in the adjacent waters of the Bay of Las Palmas, but also in the Port of Santa Cruz de Tenerife, which also provides mooring for oil rigs. *C. taeniops* has been collected in the above mentioned pathway and it was also previously reported (Brito et al., 2011) from the Port of Las Palmas. *P. furcifer* has been captured in the Port of Las Palmas, and also in adjacent waters of these two ports. *P. marcellae* has been sighted at two localities in the eastern insular corridor between the two mentioned ports (Las Palmas and Arinaga). *A. hofleri* has been caught in the Port of Las Palmas and fished off the Bay of Las Palmas. *A. saxatilis* has been fished in the adjacent waters of the Bay of Las Palmas, but has also been sighted in port waters and from several localities north- and southward from the Port of Las Palmas. *A. bahianus* has been captured in waters northward from the Port of Las Palmas. Both *A. chirurgus* and *A. coeruleus* have been caught inside the main port. *A. monroviae* has been captured in port waters, and also in adjacent waters to the North and South. Finally, *C. pullus* has been fished in the eastern pathway, slightly southward from the Port of Arinaga. So, proximity to the Port of Las Palmas is the key.

Moreover, *H. adscensionis*, *P. furcifer*, *Abudefduf saxatilis*, *Acanthurus bahianus*, *A. chirurgus*, *A. coeruleus*, and *C. pullus* have been observed associated with oil platforms off the southern coast of Brazil (Barreiros et al., 1998; Ferreira et al., 2006; Anderson et al., 2015).

The introduced species in waters of the Canaries reported herein exhibit various feeding habits, including herbivorous, planktivorous, planktivorous-detritivore, omnivorous or carnivorous/predator fishes.

*A. saxatilis* seems to have a stable population around Gran Canaria Island. Two adult males of *A. saxatilis* were observed and photographed at Jinámar reef in October 2014 (with a sea temperature of 23.5°C) exhibiting the typical dark bluish pattern which is an evidence of reproduction activity of this guarder nester species (Breder and Rosen, 1966). So, this species seems to be well suited to conditions in the Canaries. The reasons why *A. saxatilis* has recently become abundant in the Canaries may be that it has occupied vacant niches that have opened from the effects of extirpation of predators by overfishing on local fish species; it also presents low mortality and has no efficient competitors (Moyle, 1985; Liao et al., 2010). However, because *A. saxatilis* is larger than native pomacentrids (*Similiparuma lurida* (Cuvier, 1830)), interspecific competition between this species and native pomacentrids is expected as a result of the territorial behaviour. Robertson (1996) demonstrated that interspecific competition controls abundance and habitat use by territorial Caribbean damselfishes. *A. saxatilis* has also been reported at Madeira (Freitas and Araújo, 2006; Wirtz et al., 2008), and more recently from the central Mediterranean (Deidun and Castriota, 2014, Malta, 6-7 individuals). This species is included in the 2015 FAO Database on Introductions of Aquatic Species (DIAS) from the Red Sea to Italy, and therefore considered as an alien/invasive species by FishBase (Froese and Pauly, 2015). The remaining ten tropical or subtropical non-indigenous species recorded here were accounted by sporadic findings. *A. monroviae* currently inhabits Tenerife and Gran Canaria islands. This species has been included in the CIESM Atlas of Exotic Species in the Mediterranean: first recorded from southern Spain (Crespo et al., 1987, Almería); later from Israel (Golani and Sonin, 1996); several specimens have been sighted and photographed off the Mediterranean coast of Algeria in late 2001 and August 2002 (Hamida et al., 2004); more recently, it has been recorded along the coasts of Tunisia (last update of the species sheet: November 2013). Besides, this species is included in the IABIN Brazil catalogue of invasive species, and therefore considered as an alien/invasive species by FishBase (Froese and Pauly, 2015).

*C. taeniops* has been included in the CIESM Atlas of Exotic Species in the Mediterranean: Malta, Lampedusa Island, Libya (Ben Abdallah et al., 2007; Guidetti et al.,...
 Introduced outside of their native distribution area is able to thrive and invade new habitats. Regarding the management of this large arrival of fish species, it would be necessary to implement control and monitoring measures to avoid these species become invaders, displacing indigenous species and changing the ecosystems. In this regard, authors have recently applied for one research project to the Spanish Government in order to study this topic. The proposal has been supported by the Port of Las Palmas Authority.

Acknowledgements. – Many thanks are due to the renowned ichthyologists Dr John E. (Jack) Randall (Bernice P. Bishop Museum, Honolulu, Hawai‘i, USA) (Monacanthidae) and Dr Gerald R. Allen (Western Australian Museum, Department of Fishes, Perth, Australia) (Pomacentridae) for helping us in the identification of the tropical non-indigenous species. Authors are indebted to the observers and collaborators Adexe, Daniel, Domingo, Fernando, Fran, Jonathan and Maite, as well as to E. Faber, B. Ramírez, and E. Vera. Our gratitude is also extended to Dr Fátima Hernández and Alejandro Vera from the TFMC and to Dr Manuel Biscoito from the MMF for accepting our vouchers. Special thanks are due to Captain Ignacio Soler (Simrad Marine Electronics, Spain) and Oliver González (MET Engineering and Consulting, Las Palmas de Gran Canaria) for useful comments on oil platforms. Finally, thanks to Mrs. Tucson for reviewing the English.

REFERENCES


Fishes introduced to the Canaries


