

The lesser amberjack *Seriola fasciata* (Perciformes: Carangidae) in the Mediterranean: A recent colonist?

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ABSTRACT. - From 1994 to 2002, 80 lesser amberjacks, *Seriola fasciata* (Bloch, 1793), were caught in Sicilian waters. Their identification was confirmed by morphometric and meristic features measured on some preserved specimens. Juvenile specimens were observed under fish aggregating devices (FADs) located in Sardinia and Sicily during surveys carried out between 2001 and 2002. This species was previously recorded in the Mediterranean Sea as rare and considered a new Atlantic immigrant but the frequent catches and the continuous observations under FADs lead us to suppose that it is not as sporadic as the literature reports. The analysis of 14 stomach contents suggests *S. fasciata* to be an active predator of fish and crustaceans. The high frequency of records over the years, the large range of sizes recorded and the wide Mediterranean distribution of *S. fasciata*, suggests the establishment of a stable population in Sicilian seas as well as in the western Mediterranean. *S. fasciata* is here recorded for the first time in Sardinian waters.

RÉSUMÉ. - La sériole babiane *Seriola fasciata* (Perciformes: Carangidae) est-elle une récente colonisatrice en Méditerranée ?

Entre 1994 et 2002, 80 sérioles babilanes, *Seriola fasciata* (Bloch, 1793), ont été pêchées autour de la Sicile. Leur identification a été confirmée par les caractéristiques morphométriques et méristiques de quelques spécimens conservés. Des juvéniles ont été observés sous des dispositifs de concentration de poissons (DCP) positionnés en Sardaigne et en Sicile pendant des campagnes effectuées en 2001 et 2002. Cette espèce a été précédemment signalée en Méditerranée comme rare et considérée comme un nouvel immigrant de l'Atlantique, mais les fréquentes captures et observations sous les DCP nous font supposer qu'elle n'est pas aussi sporadique que la littérature le rapporte. L'analyse de 14 contenus stomacaux suggère que *S. fasciata* est un prédateur actif de poissons et de crustacés. La haute fréquence de captures au cours des années, la grande gamme de tailles enregistrée et la large répartition de *S. fasciata* en Méditerranée suggèrent l'établissement d'une population stable dans les eaux de la Sicile ainsi que dans le reste de la Méditerranée occidentale. *S. fasciata* est ici signalée pour la première fois dans les eaux de la Sardaigne.

Key words. - Carangidae - *Seriola fasciata* - *Seriola dumerili* - MED - Sicily - Sardinia - Diet - Immigration - FADs.

In recent years, the number of alien fish species migrating to the Mediterranean Sea from the Atlantic Ocean through the Strait of Gibraltar has been rapidly increasing. Imports via Gibraltar would be supported by an increase in water flux through the strait and hydroclimatic modifications, such as temperature increase, which would favour the settlement of species of subtropical and tropical affinity (Andaloro and Rinaldi, 1998; Quignard and Tomasini, 2000). Among these Atlantic immigrants, the carangid *Seriola fasciata* (Bloch, 1793) was signalled, in the Mediterranean, as a rare species. It was recorded for the first time in 1989 in the Balearic Islands (Massutí and Stefanescu, 1993) and fished again in 1993 in the same area (Riera *et al.*, 1995). It was successively recorded in the Ionian and southern Tyrrhenian

Sea (Costa, 1999; Andaloro *et al.*, 2002, 2003), along the north coast of the western basin, in the Gulf of Lion (Quignard and Tomasini, 2000), in the Gulf of Gabes (Bradai, 2000), in the East Tunisian coast near Monastir (Bradai, pers. comm., 2002) and in Maltese waters (Mark Gatt, pers. comm., 1999). Conversely, this species has not been recorded yet from the eastern Mediterranean.

S. fasciata is a subtropical fish distributed in the eastern Atlantic in Madeira, where it is locally abundant; in the western Atlantic, it is recorded from the Gulf of Mexico, Cuba, Puerto Rico and Bermuda. Juveniles are epipelagic under floating objects in oceanic or offshore neritic waters; larger juveniles are benthopelagic in shelf waters, adults apparently are found near the bottom. *S. fasciata* feeds on squids and

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fishes (Fischer *et al.*, 1981; Smith-Vaniz, 1986).

As a further contribution to the knowledge of biological invaders, we report observations and data about the presence of *S. fasciata* in Sicilian and Sardinian waters.

MATERIAL AND METHODS

Specimens of *Seriola fasciata* were collected in Sicilian waters since November 1994 with purse seine, trolling line and trammel net. Some of them represent the by-catch of greater amberjack *Seriola dumerili* (Risso, 1810); other specimens were collected under fish aggregating devices (FADs) as a by-catch of dolphinfish fishery. Most specimens were caught in the day-time except one caught with trammel net.

Visual censuses beneath experimental FADs were carried out by scuba divers in the Gulf of Castellammare (38°03'N-38°05'N, 12°56'E-12°58'E) from July 2001 to June 2002. Three sites distant 1.3 km (0.7 nautical miles), 2.8 km (1.5 nautical miles) and 5.6 km (3 nautical miles) from the coast, at depths of 25, 50, 100 m respectively, were visited from 10:00 a.m. to 03:00 p.m. with a fortnightly frequency; in January and February no observations were made because of the bad weather. A similar census was carried out in western Sardinia (Sardinia Sea), north to the Oristano Gulf (40°04'N-40°06'N, 08°16'E-08°20'E), from May to October 2001 and from August to September 2002. 12 FADs distant about 5.6 km (3 nautical miles) to 11.1 km (6 nautical miles) from the coast, at depths ranging from 80 m to 100 m, were visited from 09:00 a.m. to 04:00 p.m.

In order to avoid a mistaken identification with *S. dumerili*, the identification of *S. fasciata* juveniles (Fig. 1) was based on the following combined features: stocky body against slender body of *S. dumerili*, according to Cervigón (1993); 7 distinct vertical dark body bars against 5 for *S. dumerili* (Fischer *et al.*, 1981); grey-yellowish against intense yellow body colour of *S. dumerili*; grey pectoral, pelvic and caudal fins against intense yellow fins of *S. dumerili*; different sizes at time of sampling: *S. dumerili* settles FADs



Figure 1. - *Seriola dumerili* (above) and *S. fasciata* (below) caught off Lampedusa Island. [*Seriola dumerili* (en haut) et *S. fasciata* (en bas) capturées au large de l'île Lampedusa.]

in July at about 70 mm TL, reaching sizes from 200 to 350 mm TL in November whilst *S. fasciata* of about 70 mm TL appears in November (D'Anna *et al.* 1999; Andaloro *et al.* 2002).

Morphometric and meristic characteristics for 9 individuals from Lampedusa Island, preserved at the ICRAM laboratory of Palermo, were recorded according to Fisher *et al.* (1987). Stomach contents of 13 specimens from Lampedusa Island and 1 from Capo d'Orlando were analysed. When possible, macroscopic observation of gonads was made in order to define the maturity stage.

RESULTS

A total of 80 specimens ranging from 84 to 335 mm TL were collected. The fishing gear, time and site of capture, the number of specimens collected and their minimum and maximum TL are reported in table I. Figure 2 resumes our records of *Seriola fasciata* in Italian seas.

The specimens caught by purse seine in Lampedusa Island were always found together with specimens of *S. dumerili*. Particularly, in July 2001, *S. fasciata* was caught together with a size-homogeneous group of 70 *S. dumerili* averaging 400 mm TL. In June 2002, it was caught together with 62 *S. dumerili* ranging from 380 to 440 mm TL, and 58 *Caranx crysos* (Mitchill, 1815) averaging 450 mm TL; actually, about 15 specimens were sighted inside the purse seine before hoisting the gear on board, but most of them escaped during fishing operations.

Two to four specimens, estimated to be from 70 to 170 mm TL, were recorded beneath FADs during visual censuses in the Gulf of Castellammare, in November and December 2001. These specimens were observed beneath

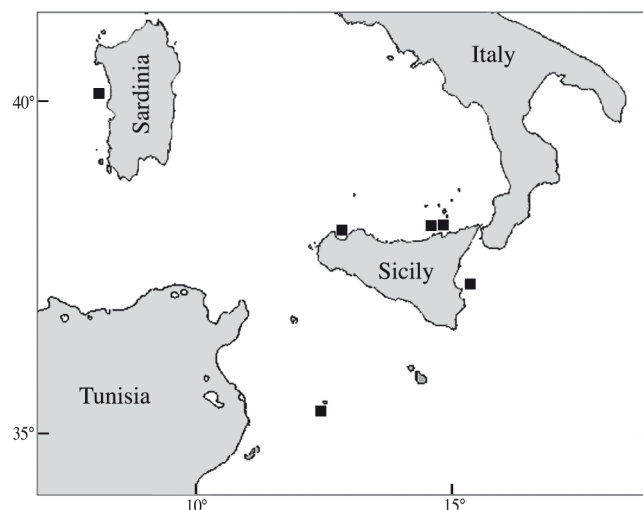


Figure 2. - Map of the study area with indicated (■) the sites of records of *Seriola fasciata*. [Carte de la zone étudiée indiquant les signalements de *Seriola fasciata* (■).]

Table I. - Date, site of capture, fishing gear, number of specimens (N), minimum and maximum total length (TL), average weight (W) of *Seriola fasciata* in the Sicilian waters. [Date, lieu de la capture, engin de pêche, nombre de spécimens (N), longueur totale minimum et maximum (TL), poids moyen (W) de *Seriola fasciata* dans les eaux siciliennes.]

Date	Area	Geographic coordinates	Fishing gear	N	TL (mm)	W (g)
Nov. 1994	S.Agata di Militello	38°07'N; 14°13'E	Purse seine (FADs)	2	160-167	
Jun. 1995	Lampedusa Island	35°22'888''N; 13°27'534''E	Purse seine	21	223-320	
Jul. 1995	Lampedusa Island	35°20'350''N; 12°10'121''E	Trolling line	12	262-320	
Oct. 1995	Lampedusa Island	35°20'350''N; 12°10'121''E	Trolling line	1	357	
Jun. 1997	Lampedusa Island	35°26'398''N; 12°49'092''E	Purse seine	9	215-335	322
Oct. 1997	Siracusa	36°55'N; 15°30'E	Purse seine (FADs)	1	131	
Aug. 1998	Castellamare del Golfo	38°06'N; 12°59'E	Purse seine (FADs)	2	166-206	
Oct. 1998	Capo d'Orlando	38°13'N; 14°42'E	Purse seine (FADs)	1	84	
Nov. 1998	S.Agata di Militello	38°12'N; 14°27'E	Purse seine (FADs)	2	150-185	
May 1999	Lampedusa Island	35°26'398''N; 12°49'092''E	Purse seine	8	260-365	344
Oct. 1999	Capo d'Orlando	38°13'N; 14°45'E	Purse seine (FADs)	1	108	
Jan. 2000	Capo d'Orlando	38°12'N; 14°43'E	Trammel net	1	229	176
Jul. 2001	Lampedusa Island	35°51'954''N; 11°58'040''E	Purse seine	15	280-300	350
Jun. 2002	Lampedusa Island	35°26'398''N; 12°49'092''E	Purse seine	4	272-300	356

FADs located 5.55 km (3 nautical miles) from the coast with the only exception of one individual of 90 mm TL, recorded at 2.77 km (1.5 nautical miles) from the coast. In Sardinian waters, no record was noticed in 2001, while 1 to 2 specimens were recorded in September 2002 (Tab. II).

Morphometric and meristic characteristics for the individuals from Lampedusa Island (Tab. III) correspond as well as those reported in the literature for this species (Fischer *et al.*, 1981; Golani *et al.*, 2002). In particular, soft anal fin base was contained 1.6 to 2.1 times in the second dorsal fin base, the second dorsal fin lobe was contained 5.6 to 7.1 times in the fork length. Meristic features were: D1, VIII; D2, I+28-31; A, II+I+18-20; P, I+19; V, I+5; GR 24-25.

All the specimens collected exhibited a well defined colour pattern, grey-yellowish with irregular dark body bars more evident in the smallest individuals.

Stomachs examined belonged to 13 individuals from Lampedusa Island, ranging from 215 to 335 mm TL, and to one specimen from Capo d'Orlando measuring 229 mm TL. Nearly all the prey items were in an advanced state of digestion, and therefore difficult to identify. In the fish from Lampedusa Island we found Teleostei in seven stomachs; Crustacea in four stomachs (Amphipoda Hyperiidea, unidentified Amphipoda, the Mysidacea *Eucopia cf. unguiculata*, unidentified Crustacea); Mollusca in one stomach (Cephalopoda Ommastrephidae); Nematoda (parasite) in one stomach; mucous in three stomachs. Only one stomach from a specimen measuring 272 mm TL was found empty. In the specimen from Capo d'Orlando we only found Crustacea as prey.

DISCUSSION

In literature, the presence of *S. fasciata* is considered sporadic in the Mediterranean. After the three specimens recorded from the Balearic Islands, little information is known about this species, mostly based on personal observations not supported by scientific validations. Sicilian fishermen operating with FADs fishery and with *S. dumerili* fishery, recently reported infrequent captures of specimens morphologically featuring *S. fasciata*. Costa (1999) reported one specimen of 170 mm TL, caught by purse seine in the

Ionian Sea in 1993, and one of 145 mm TL, in the southern Tyrrhenian Sea in 1994, attributing their presence to the tropicalisation phenomenon observed in the Mediterranean in the last decades (Andaloro and Rinaldi, 1998). These specimens, smaller than 200 mm FL, are juveniles of *S. fasciata* (Golani *et al.*, 2002), as well as two specimens caught under FADs in the southern Tyrrhenian Sea (Andaloro *et al.*, 2002) and those recorded from Tunisia (Bradai, 2000). Otherwise, the specimens caught at Lampedusa Island ranged from 215 to 365 mm TL, sizes at which most of them are considered adults (Fischer *et al.*, 1981). The simultaneous presence of specimens of such different lengths, belonging to at least two size classes, let us suppose that they are attrib-

Table II. - Date, number of specimens (N), estimated total length (TL) of *Seriola fasciata* recorded beneath FADs during visual census in the Gulf of Castellammare and in the Sardinian waters. [Date, nombre de spécimens (N) et longueur totale estimée (TL) de *Seriola fasciata* repérées sous FADs pendant un comptage visuel dans le golfe de Castellammare et dans les eaux sardes.]

Date	N	Estimated TL (mm)	Site
15 Nov. 2001	2	70; 90	Gulf of Castellammare
27 Nov. 2001	4	80; 90; 110; 130	Gulf of Castellammare
21 Dec. 2001	3	70; 170; 170	Gulf of Castellammare
17 Sep. 2002	1	170	Western Sardinia
23 Sep. 2002	2	40; 170	Western Sardinia

unable to differ ages. According to Cervigón (1993), who reports a minimum size at maturity of 380 mm TL for this species in western central Atlantic, the specimens recorded in the Mediterranean would be immature. However, the wide Mediterranean distribution of *S. fasciata*, from the Balearic

Islands to Malta waters, the high frequency of records over the years and the large range of sizes recorded, suggests the establishment of a stable population in the study area as well as in the western Mediterranean sea, according to the provisions of Riera *et al.* (1995).

Stomach contents of the specimens examined suggest *S. fasciata* to be an active predator of fish and crustaceans, some of them pelagic such as hyperiids. A similar diet was observed in *S. dumerili* juveniles from 200 to 240 mm SL caught in the same area; this species spends the early stages of its life in offshore waters and later moves towards the coasts (Pipitone and Andaloro, 1995). Our data on *S. fasciata* could suggest a similar behaviour, as the specimens recorded beneath FADs did not exceed 206 mm TL while the bigger specimens recorded were caught in coastal areas or in proximity of shoals. The visual observations also confirmed the presence of the sole early stages beneath FADs. The bigger individuals, collected with purse seine, were always caught

Table III. - Morphometric and meristic data from 9 specimens of *Seriola fasciata* from Lampedusa Island. Lengths in millimetres. [Données morphométriques et méristiques pour 9 spécimens de *Seriola fasciata* de l'île Lampedusa. Longueurs en millimètres.]

Sample code	Sflc9	Sflc2	Sflc4	Sflc6	Sflc8	Sflc5	Sflc1	Sflc7	Sflc3
Total length	215.0	250.0	260.0	260.0	270.0	280.0	280.0	315.0	335.0
Fork length	195.0	220.0	220.0	220.0	235.0	240.0	250.0	270.0	290.0
Standard length	185.0	210.0	210.0	210.0	220.0	230.0	240.0	255.0	280.0
Peduncle length	165.0	195.0	195.0	195.0	210.0	205.0	215.0	235.0	255.0
Body depth	75.0	75.0	75.0	80.0	75.0	80.0	85.0	90.0	100.0
Caudal-peduncle length	20.0	19.4	27.0	23.6	24.8	20.7	22.3	27.0	30.2
Predorsal distance	50.0	65.0	65.0	70.0	75.0	80.0	75.0	85.0	85.0
Head length	52.7	64.5	63.0	64.5	63.5	67.8	69.5	74.9	78.2
Eye diameter	11.0	13.7	15.0	13.9	13.7	16.3	14.5	18.0	17.8
Preorbital distance	19.5	24.0	23.5	25.7	23.9	23.2	25.1	26.2	30.2
Postorbital distance	24.8	29.1	28.6	31.1	28.0	27.6	32.5	34.0	33.8
Preopercular distance	9.1	11.6	12.2	12.4	11.9	10.2	14.5	14.2	17.3
Preanal distance	100.0	115.0	115.0	110.0	120.0	125.0	130.0	140.0	150.0
Base of 1 st dorsal fin	19.0	20.5	20.5	19.0	17.2	23.3	23.8	18.9	27.0
Base of 2 nd dorsal fin	81.0	93.2	99.0	105.7	94.5	103.0	100.0	116.0	130.0
Base of anal fin	52.0	54.9	50.5	51.5	60.5	63.0	58.3	69.7	67.5
Pectoral fin	28.5	32.1	32.0	31.5	33.0	38.3	37.2	39.6	44.5
Pelvic fin	41.7	41.0	44.9	44.5	43.5	48.5	48.5	53.2	53.6
2 nd dorsal fin lobe	32.7	31.4	31.1	39.5	34.5	38.5	38.0	42.9	44.3
Upper jaw	22.3	26.7	26.7	27.9	27.0	28.0	30.3	32.1	34.0
Fin rays									
1 st dorsal	VIII	VIII	VIII	VIII	VIII	VIII	VIII	VIII	VIII
2 nd dorsal	I, 28	I, 28	I, 28	I, 28	I, 30	I, 28	I, 31	I, 30	I, 29
Pectoral	I, 19	I, 19	I, 19	I, 19	I, 19	I, 19	I, 19	I, 19	I, 19
Pelvic	I, 5	I, 5	I, 5	I, 5	I, 5	I, 5	I, 5	I, 5	I, 5
Anal	II+I, 18	II+I, 20	II+I, 19	II+I, 20	II+I, 19	II+I, 19	II+I, 18	II+I, 18	II+I, 18
Gill rakers	8+16	8+17	8+16	8+17	8+16	8+16	8+17	8+16	8+17

in groups and often together with other carangid fishes, suggesting shoaling behaviour at least in this phase of their life, as the other congeneric species.

Our data support the idea that this species is not sporadic in the Mediterranean. We consider it as a recent colonist, according to the Joint Nature Conservation Committee classification (Eno *et al.*, 1997), that is “a species which, without any human intervention, has extended its natural geographical range in recent times and which has established new self-maintaining and self-regenerating populations in the wild”. Recent records of *S. fasciata* early stages, however, could be related to the increasing use of FADs for dolphinfish fishery, recorded in the last years in the study area, from 6,000 structures in 1990 to 19,000 structures in 1999 (Morales-Nin *et al.*, 2000). Long-term studies of fish community associated with FADs, in fact, confirm that they may affect the distribution, feeding and survival of young fish, providing adequate conditions for recruitment (Deudero *et al.*, 1999). The positioning of experimental FADs in Sardinian waters actually allowed us to record *S. fasciata* in an area where it was not previously observed. Incoming researches on FADs ecological role will clarify if the increasing use of these devices favours the success of *S. fasciata* in the study area, as already observed for other FADs associated species (Andaloro *et al.*, 2002).

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