Fifteen-spined Stickleback (*Spinachia spinachia* Linnaeus, 1758) in waters off the NW Iberian peninsula, southern limit of its range

A. Fernández-Cordeiro

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*Fifteen-spined Stickleback (*Spinachia spinachia *Linnaeus, 1758) in waters off the NW Iberian peninsula, southern limit of its range.*– Though current distribution maps fail to indicate its presence south of the Bay of Biscay, *Spinachia spinachia* is fairly abundant off the coast of the NW Iberian peninsula, especially in the shallow waters of the southern Galician estuaries (Rías Baixas). This article reviews records of *S. spinachia* in this area and reports new data for the most southern Rías, including certain biological observations and estimates of seasonal variation in abundance based on catches, and indicates that the southern limit of the range of *S. spinachia* is now enlarging.

Key words: *Spinachia spinachia*, Distribution, NW Iberian peninsula.

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A. Fernández-Cordeiro, Consellería de Pesca, Marisqueo e Acuicultura, Rúa Andrés Mellado 15 1º, 36001 Pontevedra, España (Spain).

Introduction

The most characteristic feature of the 1200 km coastline of Galicia (NW Spain) is its numerous deep estuarine inlets, or *rías*, which possess intertidal mudflats at their narrower inland ends and sandy beaches at their broader seaward ends. These inlets do not exceed 60 m in depth, and their numerous secondary bays and coves provide a wide variety of habitats harbouring a correspondingly diverse marine flora and fauna. The high productivity of these waters, which is favoured by the strong tidal influence of the Atlantic (Tenore et al., 1982), has encouraged re-

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search on fishing reserves and on the biology and the population dynamics of fishes and crustaceans of the Galician shelf. The list of accompanying fauna, produced as part of such research, is beginning to provide an accurate picture of the ichthyology of these waters (Alonso Allende et al., 1978; Chesney & Iglesias, 1979; Fernández et al., 1981; Pérez Gandaras et al., 1980).

The presence of the Fifteen-spined Stickleback (*Spinachia spinachia*) in waters off the Iberian peninsula has not been recorded in the field guides of European fishes (Muus & Dahlström, 1974; Bauchot & Pras, 1980), suggesting that the southern limit of this fish is the Bay of Biscay. Recent reviews (Monod, 1979; Banister, 1986) still show the same areas of distribution, indicating that *S. spinachia* is rare to the south of Arcachon (SW France). It is now clear that *S. spinachia* is present in significant numbers in southern localities, such as the Iberian coast (Iglesias, 1981, 1983).

De Buen (1935) was the first to report the presence of *S. spinachia* in Galician waters, though he failed to mention the precise localities at which it had been found. The first to report localities was Lozano y Rey (1947), who asserted that it was present from Nordkapp (Norway) to the Portuguese coast. His collection included specimens from Santander and Marín (fig. 1), although he did not know whether they had been caught in marine waters, terrestrial salt water or fresh water, which is also possible, since elsewhere in Europe *S. spinachia* climbs creeks to spawn in fresh water (Regan, in Lozano y Rey, 1947).

After an interval of 35 years in which little or no research was done on the piscine fauna of the Iberian Atlantic coast, Iglesias (1981, 1983) reported having found *S. spinachia* in samples taken in the years 1975-76, at a depth of 3-5 m over sandy bottoms in the Ría de Arousa and the Ría de Muros e Noia (fig. 1). He failed to find it among the demersal fishes of the Ría de Pontevedra (Iglesias & González-Gurriarán, 1984).

Solorzano et al., (1988) mentioned no further records in his inventory of the fishes of the Galician shores. *Spinachia* has thus not been reported as present in the Ría de Pontevedra or the Ría de Vigo, the southernmost of the Galician Rías, although it has been reported at Bahia de Leixões, near Porto, Portugal (Nobre, 1935, see fig. 1), to the south of Galicia.

In this paper the southern limit of the distribution of *S. spinachia* in South western Europe is revised and certain biological features of this species in the coastal waters of the North West Iberian peninsula are given.

Material and methods

Specimens of *S. spinachia* were taken between October 1987 and May 1989, at frequencies of up to one per month, from the mixed rocky and sandy-bottomed intertidal and sublitoral zones at several localities on the southern Galician Rías Baixas. Four beach areas (Lapamán Beach in the Ría de Pontevedra and Os Alemáns, O Canaval and Alcabre beaches in the Ría de Vigo) located in the middle section of the ría, where neither oceanic nor estuarine influence is very marked, were sampled. A fifth beach site, Cabo Estai, in the seaward section of the Ría de Vigo where the influence of the Atlantic is greater, did not produce specimens. The location of all five beaches is close to 42°15'N and 8°46'W (fig. 1).

Each month, sampling was carried out during the week of lowest low-tides (range from 0.02 to 0.80 m according to the Tides Year-book of the Instituto Hidrográfico de la Marina: years 1987, 1988 and 1989). All samples were taken in the morning (6:00 to 12:00 a.m.), except those from O Canaval Beach samples, which were taken both in the morning and in the evening of the same day (20:00 to 24:00 p.m.)

Samples were taken at a depth of 1-1.5 m at low tide, using two forms of shrimp-fishing tackle: a hand-net (ganapán) for daytime sampling, and a trawl for evening sampling. The trawl, drawn by a single person, consisted of a 144 x 66 cm metal frame as its mouth bearing a 197 cm long seine of 11 mm mesh. The hand-net consisted of a hoop 50 cm in diameter with a metal handle bearing a 130 cm long seine of 13 mm mesh.

Specimens caught between October 1987 and April 1988 were preserved in 75% alcohol after being measured and weighed; those caught subsequently were returned live to the sea.

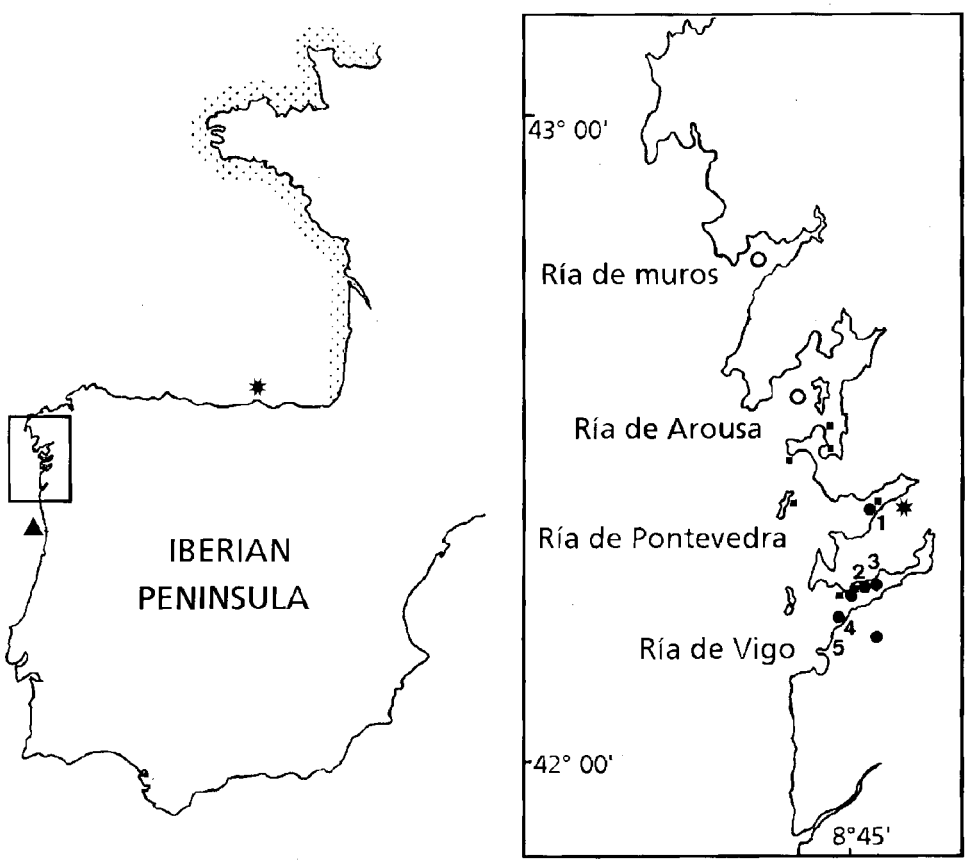

Fig. 1. Present distribution of *S. spinachia*: South distributional limit (BANISTER, 1986); ▲ NOBRE (1935); ✱ LOZANO (1947); O IGLESIAS (1981, 1983); ■ Own records, sights; ● Own records, captures; 1. Lapamán Beach (Bueu); 2. Alemans Beach (Cangas); 3. O Canaval Beach (Cangas); 4. Alcabre Beach (Vigo); 5. Cabo Estai Beach (Vigo).

Distribución actual conocida de S. spinachia: *Límite de distribución meridional (BANISTER, 1986); ▲ NOBRE(1935); ✱ LOZANO (1947); O IGLESIAS (1981, 1983); ■ Citas propias, ejemplares observados; ● Citas propias, capturas; 1. Praia de Lapamán (Bueu); 2. Praia de Alemans (Cangas); 3. Praia de O Canaval (Cangas); 4. Praia de Alcabre (Vigo); 5. Praia de Cabo Estai (Vigo).*

Results

Table 1 lists the catches obtained during the study period at each of the beaches sampled in the Ría de Pontevedra and the Ría de Vigo (fig. 1). No specimens were found at the most exposed beach site of Cabo Estai between December and March, the best period for finding the Fifteen-spined Stickleback.

At the other four, semi-exposed, beach sites, specimens were caught at the moment of maximum low tide, in the sublittoral fringe, mainly in the sometimes overlapping *Saccorhiza bulbosa* and kelp (*Laminaria ochroleuca* and *L. hyperborea*) zones, and also to a lesser extent, at higher

Table 1. Monthly distribution of captures in each locality: n. Number of samples; (+) Samples with trawl net; * Fishes captured in two samples; - Months without samples.
*Distribución mensual de las capturas en cada localidad: n. Número de muestras; (+) Muestras con arrastre; * Peces capturados en dos muestras; - Meses sin muestras.*

	Beach (Locality)						
	Lapamán (Bueu)	Alemáns (Cangas)	O Canaval (Cangas)		Alcabre (Vigo)	Cabo Estai (Vigo)	
(n)	Day (24)	Day (23)	Day (26)	Night (27)	Day (20)	Day (4)	Tot.(124)
1987							
October	-	0	0	0	-	-	0
November	-	-	4	29*	-	-	33
December	1	-	9	15	-	-	25
1988							
January	0	-	1	33	-	0	34
February	1	2	2	7	-	0	12
March	0	0	0	2	-	0	2
April	0	1	0	0	1	-	2
May to October	0	0	0	0	0	0	0
November	0	1	1	0	0	-	2
December	0	0	0	4	0	-	4
1989							
January	0	0	0	12	0	-	12
February	0	0	0	2	0	-	2
March	0	0	0	8	0	-	8
April to October	0	0	0	0	0	-	0
November	0	0	0	10	0	-	10
Total	2	4	17	122	1	0	146

levels including the *Bifurcaria* sp. zone (where *Cystoseira baccata* is also abundant), the *Fucus* spp. zone and, more rarely, the Ulva rigida zone. The floristic composition of the intertidal algal communities of the Galician Rías Bajas is similar to that observed along the coast of Brittany, France (Niell, 1978). For more details of the seaweed zones of the rías see Seoane Camba (1957, 1960), Seoane Camba & Campo Sancho (1968) and Niell (1979).

Most specimens were caught on O Canaval, the most sheltered of the beaches studied, where the bottom, though predominantly sandy, also has more or less muddy areas supporting *Zostera marina* and *Z. noltii*, which in some places formed a dense monospecific carpet.

Specimens were also caught, without systematic sampling, in the harbour at Punta Balea.

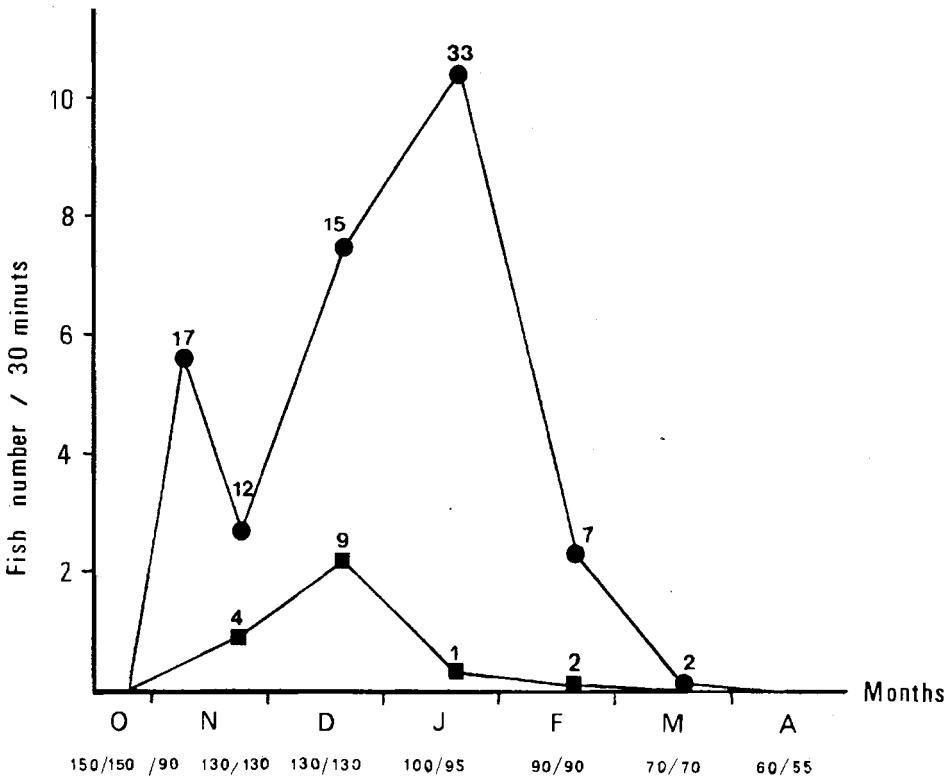

Fig. 2. Monthly average of fishes captured in a 30 minute period at O Canaval Beach (October 1987 to April 1988) and real number of fishes captured: ■ by day, ● by night. The figure below the x-axis indicates the time spent sampling, in minutes, during the day and the evening (day/night).

Valor medio mensual del número de peces capturados en un período de 30 minutos en Praia de O Canaval (octubre 1987 a abril 1988) y número real de peces capturados: ■ de día, ● de noche. Bajo el eje x se indican los minutos de muestreo durante el día y durante la noche (día/noche).

S. spinachia was sighted, but not caught, at seven further localities (fig. 1). From north to south, these sites include O Grove harbour, Punta Abelleira coast and the estuarine area of Ensenada do Grove (in the Ría de Arousa), the east coast of the Ons Islands and Praia do Santo (in the Ría de Pontevedra), and the beaches of Cangas and Areamilla (on the north bank of the Ría de Vigo.

The first catches were made in November, and numbers increased until January, after which they dwindled (fig. 2). In April, *Spinachia* was caught rarely or not at all, and from May to October no specimens were caught. The catch at O Canaval Beach between November 1987 and March 1988 was 16 individuals during daytime sampling periods totalling 520 minutes of fishing ($\bar{x}$ = 0.92 fishes/30 minutes), and 86

during evening sampling totalling 605 minutes ($\bar{x}$ = 4.26 fishes/30 minutes), giving a total of 102 specimens.

The greater abundance in evening samples may have been due, among other causes, to the differences in sampling site and fishing tackle; daytime sampling took place in the most rocky areas, whereas evening sampling was carried out with a larger net chiefly on sandy beach.

The winter catches of 1988-89 were fewer than those of 1987-88 (table 1), especially at O Canaval Beach (where 102 specimens were caught in 1987-88 and only 27 in 1988-89).

Discussion

S. spinachia inhabits weedy, shallow coastal waters (BANISTER, 1986; POTTS et al., 1988), preferring the seaweed zone and avoiding exposed locations (KRUUK et al., 1988). In the Ría de Muros e Noia and the Ría de Arousa (NW Iberian peninsula) it lives on sandy bottoms at a depth of 3-5 m (IGLESIAS, 1981, 1983). It may also be common beneath mussel-farming rafts (RODRÍGUEZ SOLORZANO et al., 1983), although according to LOZANO Y REY (1947) it is found chiefly among *Fucus*. In the Ría de Pontevedra and Ría de Vigo, it prefers sheltered beaches, living at similar depths over muddy, sandy or rocky bottoms with beds of *Zostera* and Seaweed. No specimens of *Spinachia* have been found in the deep water of the rías (IGLESIAS & GONZÁLEZ-GURRIARÁN, 1984). In this work we did find it occasionally in exposed locations.

The period during which *Spinachia* was found in the Rías of Pontevedra and Vigo essentially coincides with that reported by IGLESIAS (1981) for the Ría de Arousa (October-May, maximum in January-February), and differs from that reported for the Shetland Islands (U.K.), where maximum catches are obtained in spring, between February and May (KRUUK et al., 1988).

Elsewhere in Europe, males build nests in late winter and early spring (POTTS et al., 1988), especially in April-June (BANISTER, 1986), although the post-April presence of *Spinachia* implied by April nesting has not been recorded in our sampled beaches. The presence in March of fishes with swollen bellies, presumably females with eggs, suggests that spawning also takes place at this time in Galicia. We have no information concerning the fate of fry between hatching and the following November, when only specimens measuring at least 65 mm were caught.

In view of the unsociable habit of *Spinachia* (LOZANO Y REY, 1947), which tends to live singly or in pairs (BANISTER, 1986), the capture of as many as 102 specimens at a single beach (O Canaval) in the autumn-winter of 1987-88 (139 in the whole studied period) suggests that the large scale population density in the Rías Bajas of Galicia must be high, at least at favourable locations.

The fact that catches in the winter of 1988-89 were fewer than in 1987-88 (table 1) at O Canaval Beach, may have been due to overfishing at these sites during the previous year. This hypothesis, which is supported by a recovery in numbers in November 1989 (in 1988-89 we returned all catches to the sea), implies that *S. spinachia* populations in this area are highly vulnerable.

The population appears to be subject to the more or less regular annual fluctuations, as reported by KRUUK et al. (1988), except that, in Galicia, the population peak comes in winter rather than spring.

These data show that *S. spinachia* is widespread in the southern rías of Galicia, and that the southern limit of its range in Europe is no further north than these rías. It may also exist further south, in waters of Portugal, since NOBRE (1935) records a specimen from near Porto, in Bahia de Leixões. The Science Museum of the University of Porto also has a specimen collected from the mouth of the Douro (Foz do Douro, December 1938). The fact that there is a vernacular name for this species in Portuguese, Esganagata (NOBRE, 1935) also suggests that *Spinachia spinachia* was more widely spread, historically.

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informed me of two new localities of *Spinachia* in the Ría de Arousa, and Juan Pino of the presence of the species in the Ons Islands (Ría de Pontevedra).

Resumen

*El Espinosillo (*Spinachia spinachia *Linnaeus, 1758) en aguas del NO de la península ibérica, límite meridional de su distribución*

Pese a que los mapas de distribución actuales no indican la presencia de *Spinachia spinachia* más al sur del golfo de Vizcaya, éste resulta común en aguas costeras del NO de la península ibérica, especialmente en aguas someras de las Rías Bajas gallegas. En el presente artículo se revisan los registros de *S. spinachia* en la costa atlántica de la península ibérica, recogiéndose 12 nuevas localidades dentro de las tres rías más meridionales de Galicia (fig. 1).

Las primeras capturas se realizan en noviembre (generalmente especímenes pequeños, 65-115 mm), siendo más abundante durante el mes de enero (fig. 2), a diferencia del máximo poblacional que en localidades más septentrionales se presenta en primavera. Durante dos años consecutivos, no se pescaron ejemplares en los meses de mayo a octubre (tabla 1). La captura de 102 ejemplares en una misma localidad (Praia do Canaval) en otoño-invierno de 1987-88 sugiere que su densidad de población en las Rias Bajas de Galicia debe ser alta, por lo menos en aquellas localidades favorables.

Se amplía el área de distribución conocida para esta especie. *S. spinachia* se encueantra ámpliamente distribuida por las rías más meridionales de Galicia, por lo que éste debe ser, como mínimo su límite meridional en Europa, si bien también existen citas más al sur, en los alrededores de Oporto, en aguas de Portugal.

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