New species for EU aquaculture

Deliverable Report

Deliverable No:	6.4		**Delivery Month:**	60
Deliverable Title	Establish reliable collection methods and protocols to form new wreckfish broodstocks			
WP No:	6		**WP Lead beneficiary:**	P19. CMRM
WP Title:	Reproduction and Genetics- wreckfish			
Task No:	6.1		**Task Lead beneficiary:**	P19. CMRM
Task Title:	Collect wild fish to establish new broodstocks			
Other beneficiaries:	P8. IEO	P32. MC2		
Status:	Delivered		**Expected month:**	36

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Other Scientists participating: Antonio Vilar (MC2), Blanca Álvarez Blázquez (P8.IEO), Evaristo Pérez (P8.IEO).

Objective: To establish collection methods to form new wreckfish broodstocks.

Description: The deliverable presents:

- Evolution of sales and prices of wreckfish in Galicia.
- Description of methods used to catch wreckfish.
- Information about growth in reared wreckfish.

1.-INTRODUCTION

The wreckfish is a globally distributed, temperate species that inhabits continental coasts and oceanic islands at depths of 100-1000 m (Roberts, 1989), forming three genetically distinct stocks, in the North Atlantic and the Mediterranean Sea, in Brazil and in the South Pacific (Ball *et al.*, 2000). It is a gonochoristic species with no sexual dimorphism and spawns at the continental slope at depths of 300-500 m, with the formation of spawning aggregations (Peres & Klippel, 2003).

Demersal wreckfish individuals inhabit rocky and muddy bottoms, at depths of 40-200 m; however, individuals are frequently found in waters deeper than 300 m, with a maximum recorded depth of 1000 m (Fischer *et al*., 1987). The first part of his life (from hatching to a body length about 60 cm) is pelagic and juveniles live associated with floating objects near the coast.

The fishery of this species has declined in the last years in all geographical areas (Sadovy, 2003):

- ✓ The estimated catch from the USA showed a relatively steady decline from 576, 3 mt (38,205 fish) in 1992 to 71,3 mt (4,958 fish) in 2000 (Sedberry *et al*., 1999, Vaughan *et al*., 2001). This corresponds to a drop of 87%.
- ✓ Annual landings of wreckfish from the Azores (off Portugal) climbed slowly from around 50 to 100 mt in the 1970s and 1980s reached a maximum of 425 mt in 1994. In 1995 the catch dropped rapidly to 246 mt and was down to 139 mt by 1998. Since wreckfish is a capture associated to

a mixed- species demersal fishery which has continued to produce increased landings, it seems the decline reflects decreasing in wreckfish stocks. The decline from 1994 to 1998 was 67% (data from Sedberry *et al.,* 1999, ICES Marine Data Centre, 2001).

- ✓ In Madeira (Portugal) the wreckfish fishery developed slowly with landings rising from 5 mt in 1988 to a peak of 55 mt in 1994. Landings then dropped 51% which is around 27 mt in 1996. For this location the reduction in wreckfish stocks is assumed to be 15%.

Where fisheries have suddenly targeted wreckfish specifically (Brazil, USA, Portugal), the fishery has reached a peak and then it declined for some years (Sadovy, 2003).

In Spain, mainly in Galicia, the wreckfish fishery was very important because its meat is highly appreciated by consumers and reaches a high commercial value. In the last years catches have been very limited and in most of the ports they were accidental catches. There is not a specific fleet for wreckfish fishery.

In Galicia, Vigo and A Coruña are the two main important ports for wreckfish sales. **Fig.1** shows the evolution of wreckfish sales in these ports over the last 10 years. The sales decreased from 60.5 mt (2007) to 10 mt (2017) in A Coruña and from 102 mt (2007) to 10 mt (2017) in Vigo (https://www.pescadegalicia.gal). Most of the catches came from Azores fishery.

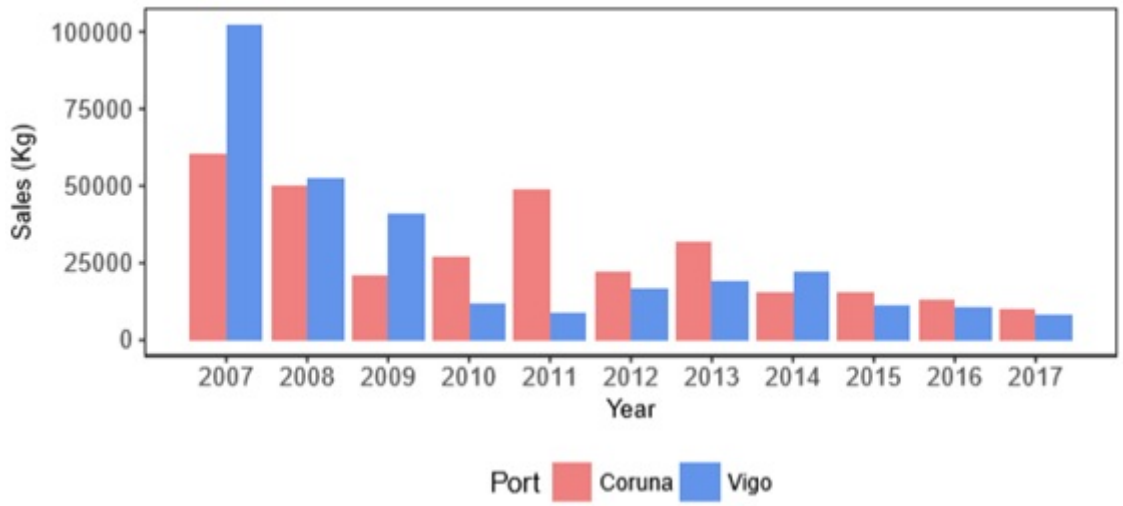

Figure 1. Evolution of sales in A Coruña and Vigo ports (2007-2017).

The decline in catches has been accompanied by a considerable increased in wreckfish price, which fluctuated between 13 and 22 €/kg over the 10 years of analysis (**Fig. 2**).

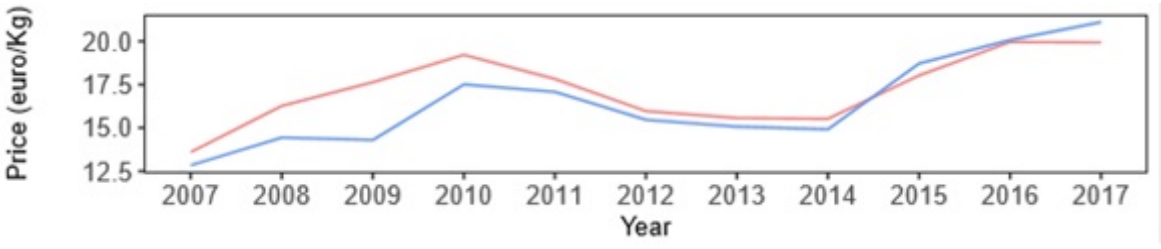

Figure 2. Evolution of wreckfish price in Galicia (2007-2017).

Catching methods

There are two main methods used to catch wreckfish: by a net (similar purse seine) that surrounds a floating object for juveniles (weight < 3kg) and by hook and long-line (**Fig.3**) for adults (weight > 3kg). The fishing season of wreckfish is between April and July.

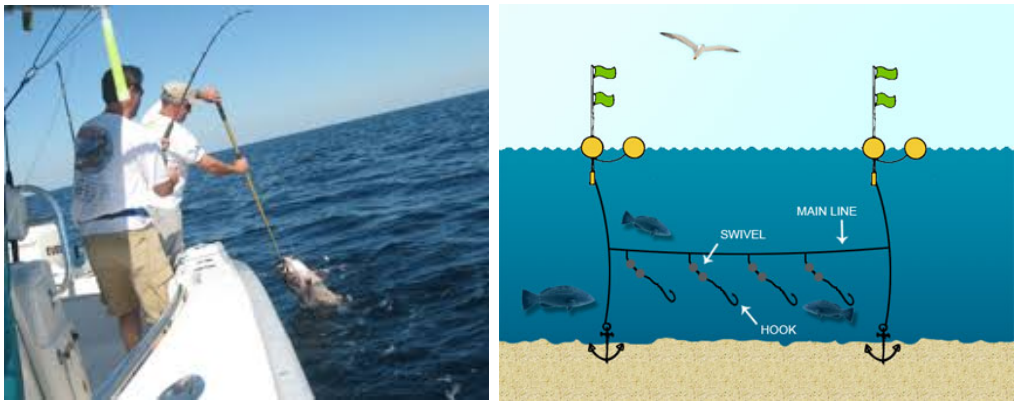

Figure 3. Fishing with hook (left) and with demersal long line (right).

Wreckfish captures

Year 2014

Two fishes with a body weight of 2 kg each on 12/6/2014 and 1 fish weighing 1.5 kg on 26/08/2014 were captured using a hand net since these fish are usually found below floating objects. The fishing area was located to 5 miles West of Corrubedo Cape, A Coruña (**Fig. 4**). The individuals were transported by boat, in tanks with flow-through water, until the facilities from the O Grove Aquarium (Pontevedra), where the fish were maintained in quarantine until weaning to inert food. Morphometric measurements were taken and samples of the fin were taken for future genetic identification.

Figure 4. Capture zone (Spain) (A), Hand net "salabre" used to capture juveniles (B), Quarantine tank (C).

Years 2015-2016

During 2015 (on 7 and 14 of August) two wreckfish individuals were captured using a hand net in a fishing area located 5 miles West of Corrubedo Cape, A Coruña. Fishes were transported by sea on a ship with flow-through water until O Grove Aquarium facilities, where the fish were transferred to a

quarantine tank. A sample from the fin was also taken for genetic analysis. These fishes were transported to IEO facilities in Vigo in March 2016. These two juveniles (4.86 and 0.94 kg in body weight) will be maintained separated from the existent stock at the IEO until they become adults. Simultaneously, we are following the growth and development of the three juvenile specimens captured during 2014, two held at the IEO **(Fig. 5**), and the third at the O Grove Aquarium.

Figure 5. Wreckfish captured in 2015 in the fishing area 5 miles to the West of Corrubedo Cape, A Coruña.

Year 2017

As discussed above, the decline in wreckfish catches in Galicia makes it difficult to obtain fish to increase the wreckfish broodstocks. Despite all the efforts made to contact Galician fishermen, in this period only one fish was caught on 9/07/2017 (body weight 4 kg and size 55 cm). The fish was punctured to empty the air from the coelomic cavity and it was introduced into a quarantine tank (0_2 95%, Salinity = 35 ppt, pH = 7.84 and T^a = 17.2ºC) in the A Coruña Aquarium Finisterrae (AF) facilities. Anti-inflammatory treatment was administrated for shock, with considerable improvements on physical condition of the fish. However, after few days, the fish experienced a sudden deterioration of health status losing buoyancy, and eventually died on 20/7/2017. The necropsy (**Fig.6**) showed numerous skin alterations, especially on the left side of the body that had a deep corneal ulcer. Other alterations included: loss of scales, fraying fins and hemorrhages in multiple locations (from the middle to caudal parts of the body, in the ventral side and in the jaw). Gills had normal coloration without parasites.

Figure 6. Details of the necropsy of wild wreckfish caught in 2017.

Fish death is mainly due to barotrauma, an overexpansion of the swimming bladder gas. When a fish is lifted to the surface too fast, gas expands and produces an explosion of the swim bladder wall, producing hemorrhage and collapse of internal organs, ultimately leading to death. Short lift must be carried out, even with decompression stops and giving the fish time to evacuate the gas.

In order to prevent death associated to capturing, the following protocol was established. Once the hook has been bitten, the fishing line needs to be lifted as soon as possible. The fishing line is lifted slowly, according to wreck deep and excel decompression tables (estimated according to swim bladder volume and fishing deep). Once the surface, the fish is collected from the water with help of a non-abrasive mesh stretcher. The fish is then transferred into a tank with water and an anaesthetic agent. Once individuals are under sedation it is proceeded to hook extraction. Finally, the fish is transferred to a new tank with oxygen and clear water. Upon arrival at the harbour, the fishes are transferred to a truck equipped with a tank provided with oxygen. After that, the individuals are moved to the facilities and maintained in quarantine.

The capture of adults (>3 Kg) becomes difficult because the ascent to the surface must be done very slowly to avoid problems of decompression and the death of the fish. The juvenile specimens captured during 2014 and 2015 have been maintained as follows. Four were held at the IEO (three of them died) and the fifth at the O Grove Aquarium facilities. Initial weight and length of fishes from the IEO were 6.05 kg and 73 cm, 11.25 kg and 79 cm, 10.58 kg and 77 cm, 2 kg and 46 cm and 3.99 kg and 83 cm from O Grove Aquarium. At present the fish that survived in the IEO facilities has 8.25 kg of weight and 77 cm of size.

Furthermore, wreckfish from O Grove Aquarium were monitored until April 2017, 7 fish: 2 females, 3 males and 1 undetermined and 1 immature. The average weight of the 6 mature fish was 13.39 ± 1.40 kg, the standard and total length were 76.33±3.67 cm and 88.17±4.17 cm. The immature fish had 3.99 kg and 73 and 83 cm of standard and total length respectively. On 10/7/2017, 29/8/2017 and 19/09/ 2017, 3 fish died in O Grove Aquarium: 2 females (weight 12.5 and 11.6 kg) and 1 male (weight 8.8 kg). All of them have a big amount of perivisceral fat (%) particularly around the viscera. Some samples of liver, kidney, brain and spleen were sent to the Ictiopathology Department of the University of Santiago to perform bacteriological and virological analysis. No viral infection was detected. For bacterial infection testing, the results were positives for *Vibrio sp.* but this was clearly not the cause of the fishes' death.

Because of the big amount of fat found in these specimens we thought they could have a problem with the food supplied and we recommended a change of the diet.

Year 2018

Three new wreckfish juveniles from Mediterranean Sea (43º10'N-05º36'E, France) were obtained from Flying Sharks (company) and moved to the IEO facilities in August 2018. During this time, they were sampled twice and the resulting weight and length are shown in **Fig.7**. The initial weights were 351.5, 351.8 and 609 g, with lengths of 32.5, 33.5 and 36 cm respectively. During two months in captivity two juveniles have doubled their weight, while the another one achieved a weight of 1 Kg. Natural photoperiod and thermoperiod were maintained, with a mean sea water temperature between 15.4ºC and 19ºC and the ingestion rate was around 1%. FCR and SGR were 0.7 and 1% respectively. Fish were fed three times a week with a food based in a dry commercial pellet (SPAROS).

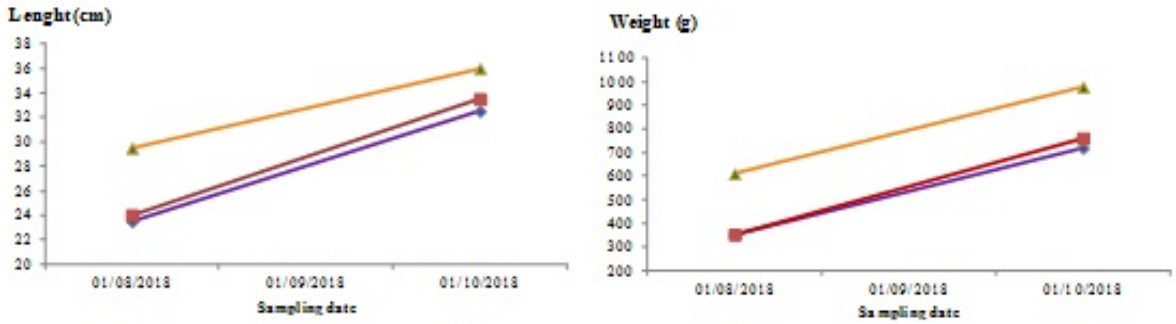

Figure 7. Length and weight of wreckfish juveniles in captivity and captured in Mediterranean Sea in August 2018.

Growth of the wreckfish in captivity

Experiments of on growing of wild fish show that wreckfish has a very good growth. In the IGAFA facilities (CMRM) 12 fish with an initial weight of 1.72 kg reached 4.8 kg after 283 days, (**Fig. 8**) (Rodriguez *et al*., 2014).

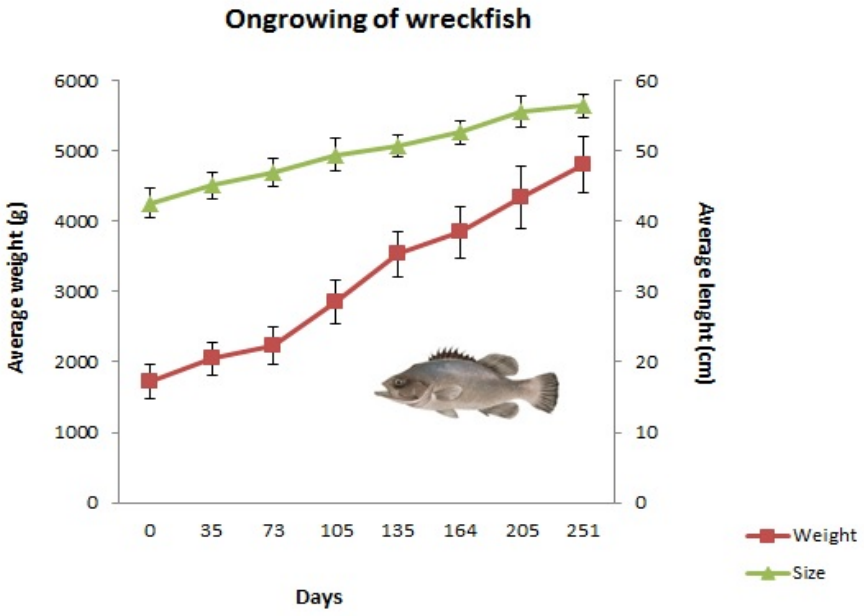

Figure 8. Growth of the wild individuals (n=12) in IGAFA.

The experiment was conducted at the experimental facilities of IGAFA in a 40 m^3 rectangular tank. Fishes were initially fed with semi-moisture feed and a few days later this was replaced by extruded turbot dry feed (Skretting, Norway) with a size of 22 mm and they were fed until they were sated. Samplings of weight and size were taken regularly and the following growth rates were calculated: condition factor (CF), feed conversion ratio (FCR) and specific growth rate (SGR). The condition factor varied between 2.17 and 2.70 and the average value was 2.44. Despite of the fact that no specific dry feed was used, feed conversion ratios were good with an average value of 1.42 during the experiment reaching the worst values when the temperature was 18ºC. The average specific growth rate (SGR) was 0.41 (**Table I**).

Table I. CF: Condition factor; FCR: Feed conversion ratio; SGR: Specific growth rate.

DAY	AVERAGE WEIGHT (g)	AVERAGE LENGTH (cm)	CF	FCR	SGR	TEMPERATURE ºC
0	1722	42.50	2.24			
35	2044	45.08	2.23	1.39	0.49	15.60
73	2228	46.83	2.17	1.99	0.13	18.20
104	2846	49.41	2.36	1.22	0.78	16.51
134	3535	50.75	2.70	0.90	0.73	15.59
163	3841	52.58	2.62	1.59	0.29	15.90
205	4342	55,.50	2.54	1.30	0.30	14.97
252	4801	56.33	2.68	1.54	0.23	13.14
AVERAGE			**2.44**	**1.42**	**0.41**	

In 2014, a wreckfish fry was produced at the hatchery of Isidro de la Cal facilities in Valdoviño (A Coruña). This specimen was later transferred to the Aquarium Finisterrae (AF) in A Coruña for its control and maintenance. Size and weight were measured periodically. The grow curve was elaborated (**Fig. 9**), the fish reached 5 kg at three years of life, 8 kg in four years and 11.5 kg in 62 months and these data confirm those obtained with wild specimens.

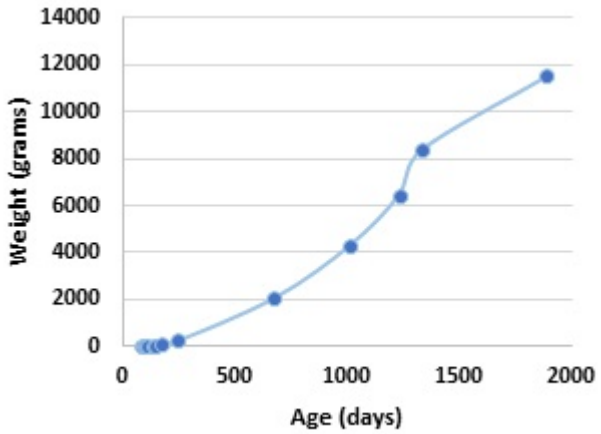

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Figure 9. Growth of one individual from Isidro 1952, maintained in MC2 facilities.

The fast growth has a great importance because the fish can reach commercial size (over 8 kg) before reaching sexual maturity without loss of growth (**Figs. 8 and 9**). The lengths and weights at which 50% of females and males matured were 944 and 808 mm total length, and 14.4 and 11.2 kg, respectively (Wakefield et al, 2013). With the data from the wreckfish of IGAFA and when the sex of each specimen was identified, growth differences according to gender were found. The first data for a long period of growth (from 6.2 kg to 15.5 kg) were obtained for wreckfish in captivity. It has been demonstrated that growth is strongly influenced by sex and female wreckfish are significantly heavier than males (**Fig. 10**), as it was observed in many other marine fish species (Rodriguez *et al*, 2017). These fish were fed during 2014 with Vitalis Repro/Vitalis Cal from Skretting, as it was said above. The food was changed

at the end of this year, because of the fish had a big amount of fat. During 2015 and 2016 they were fed with squid and in 2017 by a mixture of hake and squid (half and half).

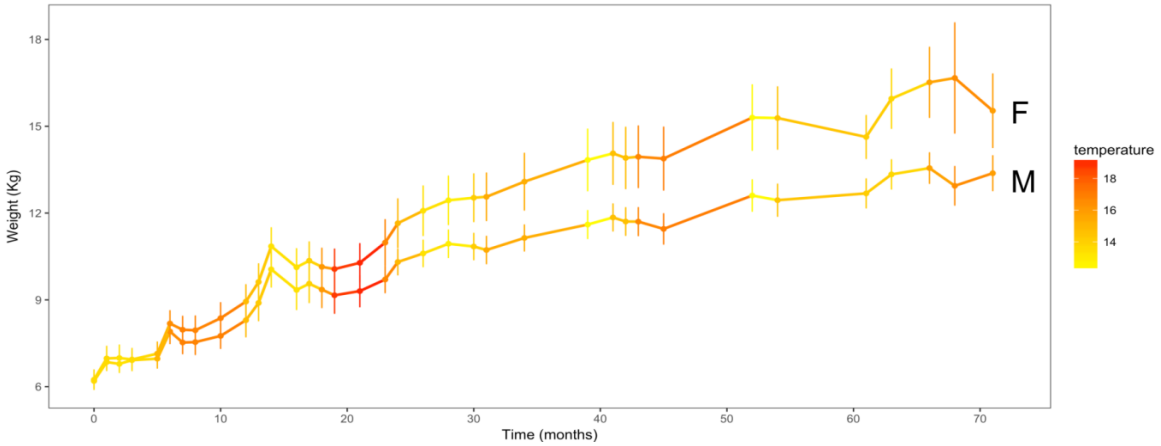

Figure 10. Evolution of wreckfish weight over 72 month period. The curves represent the average weight of female (F) and male (M) at each time. The line color represents the temperature measured at each time point**.**

4.-CONCLUSIONS

Wreckfish is one of the most interesting new species for aquaculture, due to high market price. In Galicia the price of wreckfish has recently increased from 13 to 22 euros, with a paralell decline of catches. This species exhibits a fast growth, reaching the commercial size of 5 kg in three years and 8 kg in four years. Its long juvenile stage is a great advantage from the aquaculture viewpoint, allowing for commercialization before sexual maturity, and thus avoiding problems linked to maturation, such as reduction in growth, or loss of flesh quality and organoleptic properties. It has been demonstrated that growth is strongly influence by sex and that female wreckfish are significantly heavier than males, as observed in many other marine fish species. Wreckfish acclimatizes easily to captivity and, despite its large size, no mortalities have been reported due to handling. It accepts inert food easily, being a very voracious carnivore.

The sharp drop in catches determined that the fulfillment of one of the objectives of the project that it was to obtain wild fish to increase wreckfish broodstocks of the different facilities involved in the project was very reduced, despite the efforts to contact with a large number of fishermen in different ports of Galicia.

This objective can be improved in the coming years with the results obtained from the larval culture in 2018 with the obtention of 25 juveniles of wreckfish, since in the future they can help to increase the number of individuals in the different wreckfish broodstock.

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