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THE DISCARDS OF ROUNDNOSE GRENADIER IN THE FRENCH FISHERY IN ICES SUBAREAS VI AND VII

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ABSTRACT

The French fishery for roundnose grenadier (*Coryphaenoïdes rupestris)* started in 1989, in the West of Scotland and Ireland. The production of roundnose grenadier in that area is raging from 6 000 tons to 8 000 tons. Landings are sampled since 1990 and discards were studied between 1995 and 1997, by observers onboard of fishing vessels.

Three species are predominant in weigth in the discards : *Deania calceus, Coryphaenoïdes rupestris* and *Alepocephalus bairdii.* In the landings, *Coryphaenoïdes rupestris* is dominant, followed by *Aphanopus carbo*, the two species of siki (*C. Coelolepis* and *C. Squamosus*) and *Hoplosthetus atlanticus.*

An estimate, made for the year 1996, indicates that the total landings for the french fishery West of British Isles and Ireland is close to 13 500 tons instead the total discards are close to 12 000 tons. On this total, roundnose grenadier represents 6 500 tons landed and 2 000 tons discarded.

RESUME

La pêcherie française de grenadier de roche (*Coryphaenoïdes rupestris*) a débuté à l'Ouest de l'Ecosse et de l'Irlande en 1989. La production de grenadier dans cette zone (Sous-Aires CIEM VI et VII) s'établit entre 6 000 et 8 000 tonnes par an. Les débarquements sont échantillonnés par le laboratoire de Lorient depuis 1990 et les rejets ont fait l'objet d'estimation par observateurs embarqués, de 1995 à 1997.

Trois espèces prédominent dans les rejets : *Deania calceus, Coryphaenoïdes rupestris et Alepocephalus bairdii.* Pour les débarquements, il s'agit, dans l'ordre de : *Coryphaenoïdes rupestris, Aphanopus carbo,* des deux espèces de Sikis (*C. coelolepis et C. squamosus)* et d'*Hoplosthetus atlanticus.*

A partir d'extrapolation des données d'observations à la totalité des traits réalisés par la pêcherie française des Sous-Aires CIEM VI et VII on parvient à un total de débarquement voisin de 13 500 tonnes et à un total de rejets de l'ordre de 12 000 tonnes. Sur ce total, le grenadier de roche représente 6 500 tonnes débarquées et 2 000 tonnes de rejetées car ne possédant pas la taille minimum de commercialisation.

***Key - Words** : French Fishery, Coryphaenoïdes rupestris, Landings, Discards, West of Scotland*

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1- INTRODUCTION

The french fishery for roundnose grenadier started in 1989 (Charuau *et al.* 1995). About 60 trawlers from 25 m. to 55 m. long participate in the Fishery. They are from five harbours, the three major ones being Boulogne, Lorient and Concarneau (80 % to 90% of the total production).

After an increase in production, french landings stabilized at about 9000 tons per year. On this total, about 8000 tons are coming from the west of British Isles and Ireland (ICES Subareas VI and VII). Main fishing grounds range from 54° to 59° North, by depth ranging from 800 to 1300 m.

Landings per unit of effort are rather stable in this area, ranging from 60 to 90 Kg per hour of trawling since 1990.

2- SAMPLING OF LANDINGS

The sampling of landings started in 1990, just after the fishery for deep-species begun. The ICES Subareas VI and VII were chosen for management area, because they are well separated from other production areas and they represent the most important area of production.

The same codend is used by all the boats involved in the fishery (100 mm stretched) and only one fishery unit was defined for all french fishing vessels. The fish market of Lorient was chosen for the routine sampling of roundnose grenadier. In this harbour, grenadier is not sorted in commercial categories and only one box (40 to 50 Kg) is measured (preanal length of grenadier to half centimeter below) and otoliths taken on all fish of the box.

Sizes are aggregated on a quaterly basis and then extended, using the length-weigth relationship established by Jensen, 1976 ($W = 1.118\ L^{2.287}$) to the production in live weigth of all ports fishing roundnose grenadier in ICES Subareas VI and VII. All the quarters are summed by year. In table 1, the updated figures for 1996 (preliminary) are presented.

YEAR	1990	1991	1992	1993	1994	1995	1996*
LANDINGS Tons	5944	8159	8019	8169	8525	7602	6799
LANDINGS Thousand ind.	5368	7419	7817	8790	9200	9098	7540
MEAN WEIGTH Kg	1.108	1.099	1.026	0.929	0.927	0.834	0.898
MEAN SIZE LPA cm	20.975	20.533	20.154	18.562	18.456	17.100	18.251
ST. ERROR LPA cm	0.726	0.681	0.644	0.624	0.617	0.585	0.612

* preliminary

Table 1- Main biological characteristics of the French landings of roundnose grenadier from ICES Areas VI and VII.

A diminution of mean size and weigth is noted from 1990 to 1995 and then a small increase for 1996. This is the normal evolution of a fishery beginning on a virgin stock. The mean weigth is close to 1 Kg per fish and the mean size to 20 cm (Lpa) in the landings.

3 - SAMPLING OF DISCARDS

Discards are sampled once per quarter, during 15 days trips on board fishing vessels of Concarneau harbour. Because the fishing trips are not only targetting to deep-sea species catch, but also to the demersal fish of the shelf (saithe, cod, whiting...), the number of tows sampled per quarter is generally low. The table 2 represents the sampling scheme and the mean tow duration (time elapsed between the onset and the reset of the trawl on the bottom).

A total of 55 tows were sampled (ranging from 1 to 11 per trip) from december 1995 to August 1997. The duration of the tows are comprised between 3h31 to 4h20 (mean duration of 3h57).

The sampling area is distributed from 57° N to 59° N and 9° W to 15° W, for a depth ranging from 875 m to 1300 m. When the fishing vessel attains this area, the tows are sampled randomely.

Year	MONTH	TOWS Sampled	Duration of tows	Mean duration
1995	December	7	28h00	4h00
1996	March	5	19h30	3h55
1996	June	7	27h50	3h58
1996	September	10	40h35	4h04
1996	December	7	27h45	3h59
1997	February	1	4h00	4h00
1997	May	11	38h45	3h31
1997	August	7	30h25	4h20
TOTAL		55	216h45	3h57

Table 2 - Sampling Scheme for Discard Study

4- ESTIMATES OF TOTAL DISCARDS AND LANDINGS

The number of discard by species is presented in annex1 (1996). Three species are predominant in the discards : *Deania calceus,Coryphaenoïdes rupestris* and *Alepocephalus bairdii*. On these three species only the second is landed. In the landings this species is dominant, followed by *Aphanopus carbo*, the two species of siki (*C. coelolepis* and *C. squamosus)* and *Hoplostethus atlanticus*. Total discards and landings for the period strechtching from december 1995 to August 1997 are presented in table 3.

The ratio of total discards on total landings in the tows sampled is close of one. Moreover, the ratio of roundnose grenadier discarded on grenadier caugth is of 24 %. the ratio of grenadier discarded on grenadier landed is close of 30 % in weigth.

On the total, 10 species are landed and about 50 are discarded but, for the latter, only 10 species are regularly discarded.

For the year 1996, each quarter was considered as a stratum and the total directed effort on deep species (Biseau, 1996; Dupouy, 1997) was used for expanding the mean weigth and number of grenadier per tow, assuming that each tow has a duration of 4 hours. The main assumption is based on the randomly selection of tows sampled in the totality of the tows realised by the french fleet of trawlers directed on deep-sea species. The results are presented in the table 4, calculated by the swept area method, using the duration of the tows sampled

and the directed effort on deep-sea species by quarter as an indicator of the ratio for expanding the mean weigth per tow. The calculation of standard deviation is given by Cochran (1977) and by Grosslein and Laurec (1982).

DATE	WEIGTH OF DISCARDS (kg)	WEIGTH OF LANDING (kg)	DISCARDS OF GRENADIER Kg	LANDING OF GRENADIER Kg	% GRENADIER DISCARDED
December 1995	780	983	157	375	30.0
March 1996	1115	954	194	390	19.4
June 1996	408	467	29	100	36.4
September 1996	867	616	85	296	22.3
December 1996	476	765	113	517	17.9
February1997	47	500	9	100	8.3
May1997	752	509	51	232	18.0
August1997	678	422	85	336	20.2
Total 1995-1997	5123	5216	723	2346	23.6

Table 3 - Evaluation of total discards and discards of Roundnose Grenadier.

As observed in table 4, the total landing of deep sea species by french trawlers, for the year 1996, is estimated to 13352 tons and the total weigth of discards is 11921 tons. the coefficient of variation is respectively of 9 % and 20 %. that is to say that the estimation of landings is more precise that this of discards.

The ratio of total discards to total landings is 90 % in weigth. One can consider that for a ton of fish landed, there is a ton of fish discarded, all species taken into account.

Year 1996	Number of tows sampled	Directed effort (hours)	Estimated Discards (tons)	Standard deviation (tons)	Estimated Landings (tons)	Standard Deviation (tons)
Quarter 1	5	13375	3824	1684	3272	514
Quarter 2	7	17008	1750	498	2004	397
Quarter 3	10	25405	3720	1422	3854	663
Quarter 4	7	21718	2627	731	4221	653
TOTAL	**29**	**77506**	**11921**	**2375**	**13352**	**1135**

Table 4 - Estimated weigth of total discards and landings, expanded to the french fishery in ICES subareas VI and VII, for the year 1996

5 - ESTIMATES OF LANDINGS AND DISCARDS OF ROUNDNOSE GRENADIER

The same method as for the total landings and discards estimates was used for estimating landings and discards of roundnose grenadier, for the year 1996. The results are presented in the following tables (table 5 for the weigth and table 6 for the number of individuals)

Year 1996	Number of tows sampled	Directed effort (hours)	Estimated Discards (tons)	Standard deviation (tons)	Estimated Landings (tons)	Standard Deviation (tons)
Quarter 1	5	13375	665	216	1338	339
Quarter 2	7	17008	126	37	433	154
Quarter 3	10	25405	533	156	1855	582
Quarter 4	7	21718	619	230	2832	612
TOTAL	**29**	**77506**	**1943**	**354**	**6458**	**923**

Table 5 - Estimated weigth of Roundnose grenadier discarded and landed, expanded to the french fishery in ICES subareas VI and VII, for the year 1996

Year 1996	Number of tows sampled	Directed effort (hours)	Estimated Discards (Thousand)	Standard deviation (Thousand)	Estimated Landings (Thousand)	Standard Deviation (Thousand)
Quarter 1	5	13375	1474	482	1606	408
Quarter 2	7	17008	282	80	520	185
Quarter 3	10	25405	1467	508	2269	695
Quarter 4	7	21718	1715	570	3396	733
TOTAL	**29**	**77506**	**4938**	**906**	**7791**	**1105**

Table 6 - Estimated number of Roundnose grenadier discarded and landed, expanded to the french fishery in ICES subareas VI and VII, for the year 1996

If we compare the estimated landings (6458 tons) with the true landings obtained by the auction hall (6799 tons in table 1), the difference is of minor importance (5% only). This small discrepancy is probably related to the definition of directed effort, which takes only in account the tows were more than 10 % of landings are constitued of grenadier. That definition seems however quite good because the difference between the two sources of landings is very small.

On the same point of view, the mean weigth per individual in the landings is estimated to 829 grams, compared to the 898 grams for 1996 (table 1), calculated for the landings sampled on the fish market in the harbour of Lorient, the difference is of minor importance (8 %).

The coefficient of variation, of the estimated landings in weigth and number is 14 %. For the discards in weigth and number, this coefficient is of 18 %.

The ratio of discards in weigth, to the landings is 30 % . This result is the same as for the global period of sampling (December 1995 to August 1997; see table 3). So the year 1996 could be considered as representative of the whole period of sampling. The ratio of number discarded to number landed is close to 60 % and the mean weigth per individual in the discards is of 393 grams, which represents about half the mean weigth in the landings.

The landings per unit of effort for roundnose grenadier, is of 83 Kg/hour, after estimates of landings on the boats sampled. This value is very close to those given for the previous years (see section 1), by direct calculation. One can consider that the boats used for sampling landings and discards are representative of the whole french fleet.

If we compare the total catch of roundnose grenadier (landings + discards) in number and in weigth, from tables 5 and 6, with the total estimate of abundance and biomass made by

Gordon and Hunter (1994), this ratio is less that 1 % per year in both cases. After Dupouy and Lorance (1998) the ratio would be of 3% . So, it seems that fishing is moderate on this stock.

6- LENGTH DISTRIBUTION OF DISCARDS AND LANDINGS OF GRENADIER

For each tow sampled, the content of one to two boxes of 40 kgs of landings was measured to the half centimeter below (Lpa) and for discards half to one box per tow was measured. For the whole period from December 1995 to August 1997, all the tows sampled were added, after expansion to the total weigth of landings and discards in the trip surveyed.

The results for *Coryphaenoïdes rupestris* are presented in Figure 1. For roundnose grenadier, Lpa ranges from 15 to 26 cm for landings, and discards from 4 to 16 cm. The sex ratio is of 2.7 males for a female. Most of females are comprised between 16 and 26 cm. This pattern suggest an hermaphrodism occuring for this species, or a differential distribution between young males and females.

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	Marc				May-				Septe				Dece			
NUMBER	Landi		Disca		Landi		Disca		Landi		Disca		Landi		Disca	
	mean	SD	mean	SD	mean	SD	mean	SD	mean	SD	mean	SD	mean	SD	mean	SD
Alepocephalus bairdii			162	329.5			84	93.4			213	216.9			169	188.1
Alepocephalus rostratus			4	4.3			6	7.2			16	18.8			1	
Antimora rostrata															1	
Aphanopus carbo	313	335.9			108	135.9	4		71	61.3			117	99.1		
Apristurus maderensis			3	0.0			2	1.2			4	2.7			8	7.6
Argentina silus																
Argyropelecus sp.															1	
Bathygadus melanobranchus																
Bathypterois dubuis											3	0.7				
Borostomias sp.																
Centrocymnus crepidater			1				7	4.9			3	2.1			8	6.6
Coelorhynchus occa			69	79.9			29	47.5			8	7.4			28	3.5
Coryphaenoides guentheri																
Coryphaenoides rupestris	468	273.0	430	321.6	120	114.9	65	49.9	362	346.0	234	252.8	620	357.3	313	277.9
Cottunculus thomsonii			4	2.1			1	0.0			4	3.0			2	1.2
Dalatias licha											1	0.0			1	
Deania calceus			64	99.9			16	16.4			11	13.0			20	16.4
Epigonus telescopus																
Etmopterus princeps											2					
Etmopterus spinax																
Gaidropsarus vulgaris															4	1.2
Glyptocephalus cynoglossus			2	0.0											21	24.3
Halargyreus johnsonii			6	8.9			22	43.5			3	4.0			5	0.6
Harriotta raleighana															2	
Helicolenus dactylopterus															14	15.6
Hexanchus griseus															1	
Hoplostethus atlanticus	18	35.1			19	30.6			33	36.7						
Hydrolagus affinis			26	17.3			2	1.6			9	7.3			24	17.0
Hydrolagus mirabilis															13	10.7
Lepidion eques			180	124.2			32	27.2			37	21.2			106	74.9
Lophius piscatorius																
Molva dipterygia	4	5.4			2	2.9			4	6.3			15	8.2	4	4.9
Molva molva			1													
Mora moro	19	42.0	5	0.7			1	0.0								
Neocyttus helgae							1				5	4.8			2	0.0
Nesarchius nasutus																
Nezumia aequalis			20				1				3	0.0			3	2.3
Notacanthus bonapartei																
Notacanthus chemnitzii			1								2	1.2			3	
Oxynotus paradoxus							1				1					
Phycis blennoides											1				3	
Pseudotriakis microdon											1					
Ray			2				3	1.2			4	3.5			6	3.8
Rhinochimaera atlantica			4				1				3	1.3			3	
Rouleina sp																
Sebastes mentella																
Siki	32	17.5	49	93.7	37	30.8	2	2.1	28	20.1	8	13.2	15	9.3	5	4.6
Spectrunculus grandis			1													
Synaphobranchus kaupi											1	0.0				
Trachyrhynchus murrayi			95	143.7			130	137.7			94	64.3			138	178.6
Trachyscorpia cristulata echina									1	1.3						
Xenodermichthys copei																

Annex 1 - Species composition of landings and discards in number per tow for the year 1996