

RAIMOUEST: the French fishery of rays in the Western English Channel (VIIe).

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1. CONTEXT AND OBJECTIVES

Limited knowledge on biology and lack of data on fisheries for most of the ray species lead to significant issues when trying to understand and assess the status of stocks, and establish management measures for sustainable fisheries.

In the Western English Channel (ICES Division VIIe), the principal concerns are for the blonde ray (*Raja brachyura*), the small-eye ray (*Raja microocellata*) and the undulate ray (*Raja undulata*) for which stock status are considered uncertain by ICES. This situation is problematic for fishermen because, classified as 'data-limited stocks', a precautionary margin of -20% is applied to the ICES advice (ICES 2012). This is true for e.g. *R. brachyura* and *R. microocellata* where the stock status relative to candidate reference points for stock size or exploitation are unknown (ICES 2012). The situation is more problematic for *R. undulata* which has been listed as prohibited species by European Union since 2009 despite a recommendation from ICES asking only not to target this species (ICES said: "precautionary approach to the exploitation of these populations and no target fishery").

The landing ban of *R. undulata* has raised misunderstanding for French fishermen's, particularly for those fishing in the normano-breton gulf where this species is abundant. Indeed, *R. undulata* is the main ray species caught in this area and catches are considered stable over time by fishers. This ban generates discards and the majority of the fleet is affected. This situation is even more incomprehensible since ICES stated that "there was no basis in the current or previous ICES advice for the listing of *R. undulata* as a prohibited species".

The lack of data resulting in a poorly known stock status could be explained by two points. Before 2009, *R. undulata* was underrepresented in landings and sales notes because of confusion in the species name (it was confused with the cuckoo ray *Leucoraja naevus*) or registration at higher taxonomic level, i.e. miscellaneous rays and skates. Since 2010, there are no data on landings and sales at auctions because of the ban on landing this species. Also, there is a lack of scientific fishery-independent survey in ICES Division VIIe.

In this context, the RAIMOUEST project has been established as a professional and scientist partnership in order to improve fisheries data on the main ray species caught in the normano-breton gulf (*Raja undulata*, *Raja brachyura*, *Raja microocellata*, *Raja clavata* and *Raja montagui*). The objectives were the identification of fisheries for rays, production of stocks status indicators (catch, landings, Catch Per Unit Effort indices, length distribution, abundance indices of adults and recruits) and the geo-localization of potential areas for spatial protection measures. The aim of RAIMOUEST project is thus to re-evaluate the perception of the state of these stocks, and subsequently, to

propose appropriate and concerted management measures for sustainable exploitation of these resources.

Furthermore RAIMOUEST contributes to the RECOAM project carried out by APECS¹ in Atlantic and English Channel coastal waters on the main ray species (Stéphan *et al.*, 2013). This project focuses on biology (length at maturity in particular), stocks structure (genetic study) and spatial behaviour by tagging.

2. MATERIAL AND METHODS

2.1. Study area

The study is carried out in the normano-breton gulf (Southeast of ICES Division VIIe) with an extension to the North Coast of the Cotentin (in ICES Division VIId) which corresponds to a sector where *Raja undulata* is very abundant in coastal waters (fig. 1).



Figure 1: Map of the study area in the western English Channel

2.2. Data sources

In the RAIMOUEST project, data come from (i.) fishery-dependent data from the SIH² database held at Ifremer and (ii.) local enquiries and sampling at sea aboard professional fishing vessels carried out by the Regional Fishing Committee of Lower Normandy (Comité Régional des Pêches Maritimes de Basse Normandie - CRPM-BN).

¹ Association pour l'étude et la conservation des séliaciens (<http://www.asso-apecs.org/>)

² Système d'Information Halieutique (<http://sih.ifremer.fr/>)

2.2.1. SIH data

The SIH network is based on several key actions for the collection of data. Landings and effort data (logbook), sales at auctions, sampling at sea aboard professional fishing vessels (ObsMer) will be used in this study.

ObsMer (for "Observations en Mer") is the French observation at sea program in application of the Data Collection Framework (EC, 2008). This collection is mandatory for all EC Members States. Ifremer is involved as French technical support, producing methodology, data storage, tools and participating to the exploitation of data. The different steps of the data collection are quality controlled. The quality insurance comprises a sampling plan stratified by fisheries, observer's manual and various documentations to standardize the collection (<http://sih.ifremer.fr/Acquisition-des-donnees/Echantillonnage-des-captures-a-bord-des-navires-de-peche>), software for data entry in the national database, validation tools and output format for exploitation (<http://wwz.ifremer.fr/cost/Cost-Project>).

ObsMer data includes the characteristics of the fishing operations (gear, location, fishing effort) and sampling of the catches (species and weight exhaustively; number of individuals, length size and sex from sampling). Data are available at a national level from 2003 onwards, but the sampling effort is more intensive since 2009. A meta-analysis of these data demonstrated the importance of Rays in the normano-breton gulf (Tétard A. *et al.*, 2013).

The location of the sampling (all métiers) in the normano-breton gulf in 2012 is presented figure 2. Each point corresponds to a fishing operation, each colour to a trip (colours are recycled).

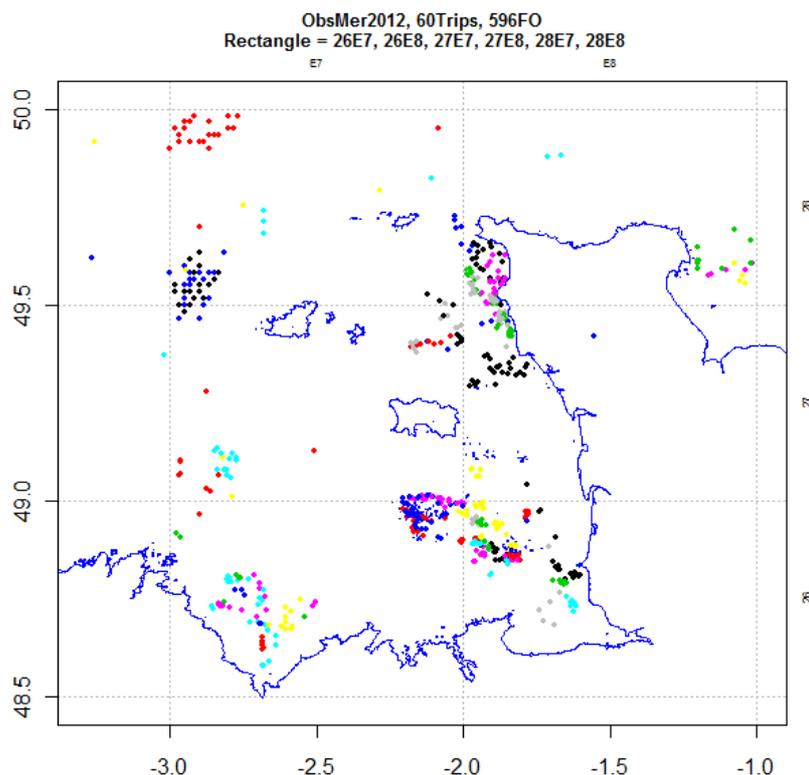


Figure 2 : Fishing operation sampling in the normano-breton gulf in 2012 through ObsMer

2.2.2. Data collection through RAIMOUEST

Inquiries

Vessels from Basse-Normandie, Brittany and Jersey identified as catching or having caught rays in the normano-breton gulf will be inquired in order to characterize:

- ray species caught,
- fishing strategy, season and target species associated to catches of rays,
- rays fishing areas by month and métier as well as the proportion of each ray species in the total catch of ray by area,
- seasonality and spatial distribution of mating, spawning and nursery area,
- annual ray landings by species and contribution to the annual total sales in weight and values,
- changes in fishing strategy and economic impact induced by the landing ban of *R. undulata*.

Sampling at sea aboard professional fishing vessels

24 additional sampling at sea aboard professional fishing vessels are scheduled, with the objective of increasing the observed proportion of fishing activities that catch rays. This additional sampling was carried under ObsMer protocol and could be used to supplement ObsMer data. It started in September 2012 and will run until December 2013.

Experimental fishing

In response to *R. undulata* landing ban, areas where this species is most abundant have no longer been fished and fishing methods targeting this species have been abandoned. In order to collect data on these areas and fishing activities, experimental fishing trips targeting *R. undulata* will be carried out.

2.3. RAIMOUEST plan of analyzes

2.3.1. Ray fisheries

A description of the socio economic status of ray fisheries in the normano-breton gulf was carried out with a particular focus on the contribution of *R. undulata* and *R. brachyura* to these fisheries.

Fleet Characteristics

Description of the ray fisheries fleet (number and average vessels characteristics for each métier) and its evolution using SIH and CRPBN fleet database.

Fishing strategies

Description of ray fishing strategies per métier including seasonality, targeted or bycatch fishery, proportion of rays in the catch and mean contributions to sales revenues in total and by species, target species associated to catch of rays will be assessed using inquiries.

Fishing area mapping

The fishing activity in number of vessels per métier will be mapped at the resolution of 1x1 nautical mille square represented by vessels frequentation map using inquiries. The proportion of ray species in the ray catch will be mapped per métier at the same resolution.

*Impact induced by the ban of *R. undulata* landings*

The vessels impacted (ray fishery abandoned or decreased) will be identified and the loss of revenues for these vessels will be estimated using inquiries data.

Discards of *R. undulata* since the ban will be estimated using inquiries and ObsMer data.

2.3.2. Stocks status indicators

The R-package COST was developed as a common "open source" tool (COST) for assessing the accuracy of the biological data and parameters estimates collected for stock assessment purposes within the framework of the Data Collection Framework.

All available on-board observations from both the standard DCF sampling and RAIMOUEST were used to derive stock status indicators. It allows to raise observed discards and catches to the total fishing activities and to estimate length distribution per strata (time, space and technical).

Several raising methods (by trips, by fishing operations, by an auxiliary variable, by fishing days) can be used and the results be compared.

2.3.3. Experimental fishing

To consider the bias resulting from the disappearance of the fishing activities targeting *R. undulata* since 2009 and the sharp reduction of other fishing activities catching rays, CPUEs will be assessed using experimental fishing data.

2.3.4. Research of potential areas for spatial protection measures

The mating, spawning and nursery area identified by inquiries or by on-board observations will be mapped and could be used to propose management measures.

3. PRELIMINARY RESULTS

3.1. Ray fisheries

61 % of the currently active fleet from Lower Normandy (coastline from Granville to Cherbourg) catches or have caught rays in the normano-breton gulf. The distribution of the Lower Normandy's vessels is presented figure 3. Vessels from each port along the coast are concerned. All the fishermen who have ever been inquired yet indicated that *R. undulata* is the main ray species caught in this area (approximately 75 % of the ray catch) and *R. brachyura* the second (approximately 20 % of the ray catch). The rays are caught by both active gear (trawling in particular and dredging) and by passive gear (large mesh gillnet or long-line).

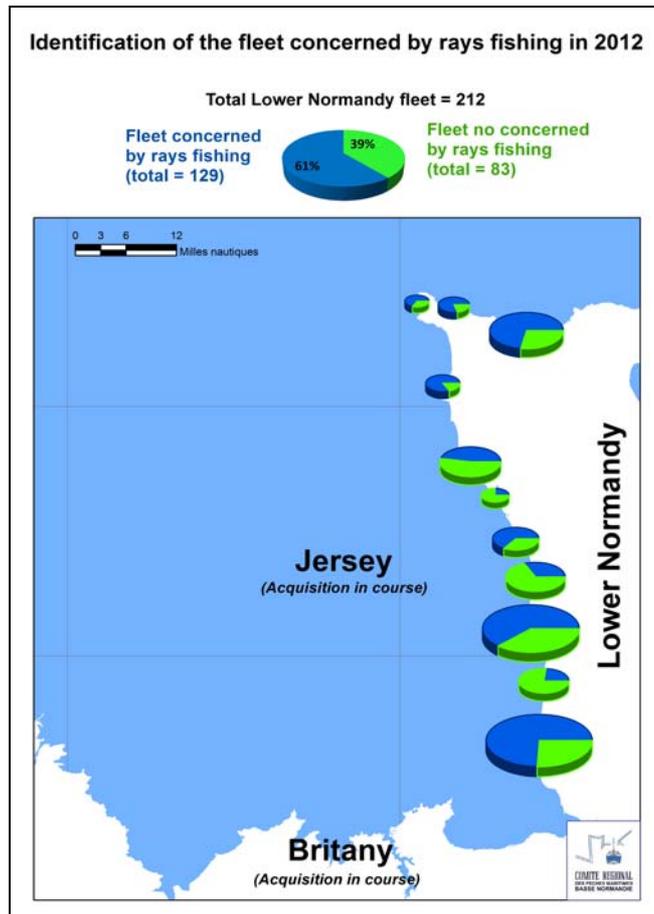


Figure 3 : Identification of the fleet concerned by rays fishing in the normano-breton gulf in 2012

3.2. Stock status indicators

Landings

The French total landings of rays in ICES Division VIIe are more or less stable from 2000 to 2005 and decrease after (Fig. 4). Years 2009 and 2010 mark a decreasing step certainly in relation with the *R. undulata* ban.

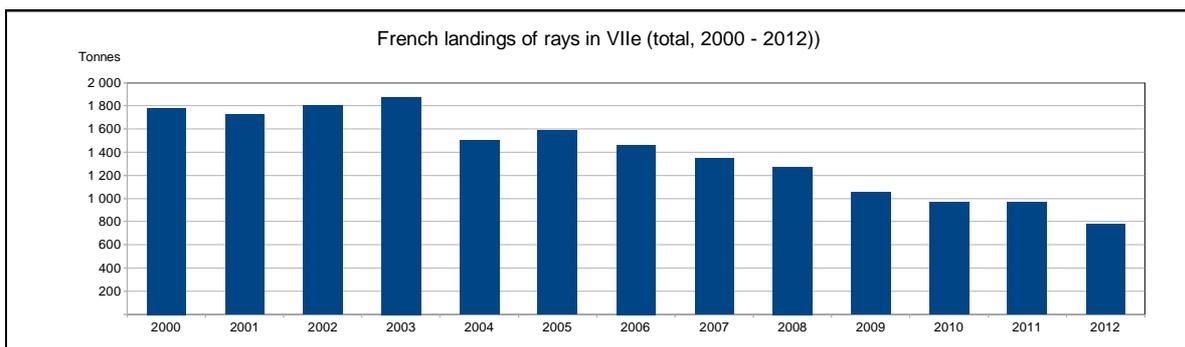


Figure 4 : Total French landings of rays in ICES Division VIIe from 2000 to 2012.

The situation of the main species (fig.5) shows a very important various group (RAJ) from 2000 to 2008, it decreases sharply in 2009 with the *R. undulata* ban and the enforcement to distinguish the ray species in the log book and auction sales. This confirms that *R. undulata*, one of the main species, was present in the landings before 2009 but not recorded at a taxonomic level. The decrease of 300 tonnes in the landings from 2008 to 2010 can be analysed as the loss of *R. undulata* despite of changing of fishing practise. Confusions between French common name of *R. undulata* and *L. naevus* have also certainly contributed to mask the reality of the landings of *R. undulata*. Confusions between *R. brachyura* and *R. montagui* are also noticed.

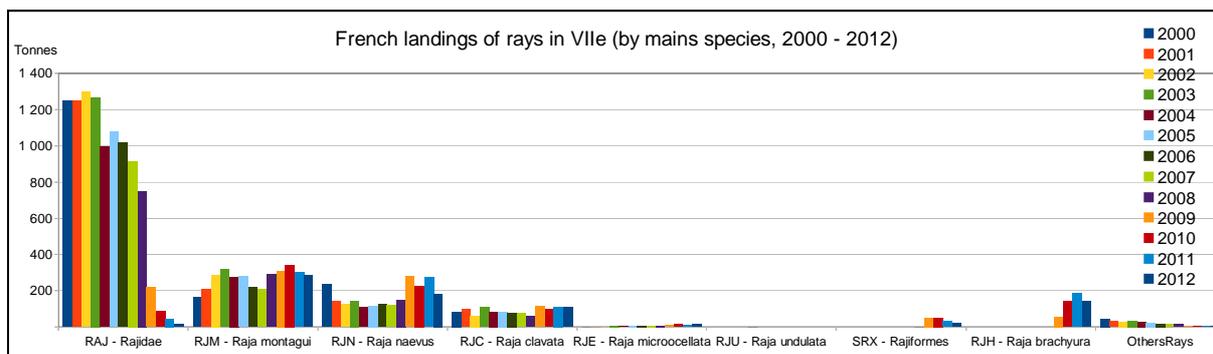


Figure 5 : French landings of the main rays in ICES Division VIIe from 2000 to 2012

Discards estimate

Preliminary results concerning *R.undulata* in ICES Division VIIe using ObsMer sampling in 2012 are presented in table 1. For this area and period 162 trips are available, 42 trips caught *R. undulata* with a total catch of 1.6 tonnes. The distribution of these catches is 61.0 % for bottom otter trawling, 29.7 % for netting and 9.3 % for beam trawling.

We choose to raise the data by fishing days, which seems the more accurate method after exploratory analysis. The estimation of discards is around 750 tonnes and the main contributing métiers are bottom trawling (98 %), beam trawling (1 %) and netting (0.4 %). The very low contribution of the netting is a cause of concern. For this métier, the CVs are very high and contribution is much less important than in the samplings.

time	space	technical	value	cv	inf	sup
2012 - 1	VIIe	FPO CRU	0	NaN		
2012 - 1	VIIe	GNS DEF		NaN		
2012 - 1	VIIe	GNS SPF	NA	NA	NA	NA
2012 - 1	VIIe	GTR CEF	NA	NA	NA	NA
2012 - 1	VIIe	GTR CRU		NaN		
2012 - 1	VIIe	GTR DEF	523	10.47		11 258
2012 - 1	VIIe	LLS DEF		NaN		
2012 - 1	VIIe	OTB DEF	339 809	.16	234 692	444 926
2012 - 1	VIIe	PTM DEF		NaN		
2012 - 1	VIIe	TBB DEF	6 057	.17	4 002	8 112
2012 - 1	VIIe	all	346 389			
2012 - 2	VIIe	FPO CEF	NA	NA	NA	NA
2012 - 2	VIIe	FPO CRU		NaN		
2012 - 2	VIIe	GNS DEF	447	7.78		7 272
2012 - 2	VIIe	GTR CRU		NaN		
2012 - 2	VIIe	GTR DEF	1 578	14.19		45 470
2012 - 2	VIIe	LLS DEF		NaN		
2012 - 2	VIIe	MIS DES	NA	NA	NA	NA
2012 - 2	VIIe	OTB CEF	NA	NA	NA	NA
2012 - 2	VIIe	OTB DEF	681	.66		1 565
2012 - 2	VIIe	OTT CEF	NA	NA	NA	NA
2012 - 2	VIIe	all	2 707			
2012 - 3	VIIe	FPO CRU		NaN		
2012 - 3	VIIe	GNS CRU	17	45.04		1 526
2012 - 3	VIIe	GNS DEF	0	NaN		
2012 - 3	VIIe	GTR CRU		NaN		
2012 - 3	VIIe	GTR DEF	24	20.69		983
2012 - 3	VIIe	LLS DEF		NaN		
2012 - 3	VIIe	MIS DES	NA	NA	NA	NA
2012 - 3	VIIe	OTB CEF	NA	NA	NA	NA
2012 - 3	VIIe	OTB DEF	122 552	.21	71 790	173 313
2012 - 3	VIIe	OTM SPF		NaN		
2012 - 3	VIIe	OTT CEF	NA	NA	NA	NA
2012 - 3	VIIe	SDN DEF	NA	NA	NA	NA
2012 - 3	VIIe	TBB DEF	4 535	.72		10 968
2012 - 3	VIIe	all	127 128			
2012 - 4	VIIe	FPO CRU	0	NaN		
2012 - 4	VIIe	GNS CRU	0	NaN		
2012 - 4	VIIe	GNS DEF		NaN		
2012 - 4	VIIe	GNS SPF	NA	NA	NA	NA
2012 - 4	VIIe	GTR CRU	134	.00	134	134

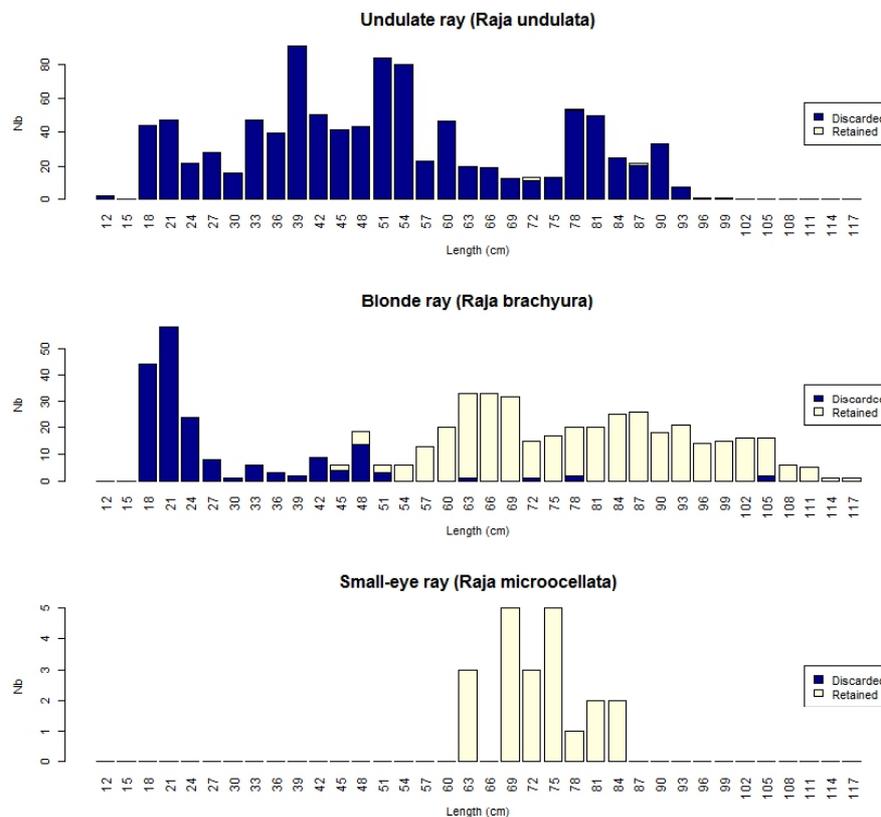
2012 - 4	Ville	GTR	DEF	0	NaN			
2012 - 4	Ville	LLS	DEF		NaN			
2012 - 4	Ville	OTB	CEP	NA	NA	NA	NA	
2012 - 4	Ville	OTB	DEF	274 018	.44	36 954	511 081	
2012 - 4	Ville	OTT	DEF		NaN			
2012 - 4	Ville	SDN	DEF	NA	NA	NA	NA	
2012 - 4	Ville		all	274 152				
2012 - Tot	Ville	FPO	CEP	NA				
2012 - Tot	Ville	FPO	CRU	0				
2012 - Tot	Ville	GNS	CRU	17				
2012 - Tot	Ville	GNS	DEF	447				
2012 - Tot	Ville	GNS	SPF	NA				
2012 - Tot	Ville	GTR	CEP	NA				
2012 - Tot	Ville	GTR	CRU	134				
2012 - Tot	Ville	GTR	DEF	2 125				
2012 - Tot	Ville	LLS	DEF	0				
2012 - Tot	Ville	MIS	DES	NA				
2012 - Tot	Ville	OTB	CEP	NA				
2012 - Tot	Ville	OTB	DEF	737 060				
2012 - Tot	Ville	OTM	SPF	0				
2012 - Tot	Ville	OTT	CEP	NA				
2012 - Tot	Ville	OTT	DEF	0				
2012 - Tot	Ville	PTM	DEF	0				
2012 - Tot	Ville	SDN	DEF	NA				
2012 - Tot	Ville	TBB	DEF	10 592				
2012 - Tot	Ville		all	750 375				

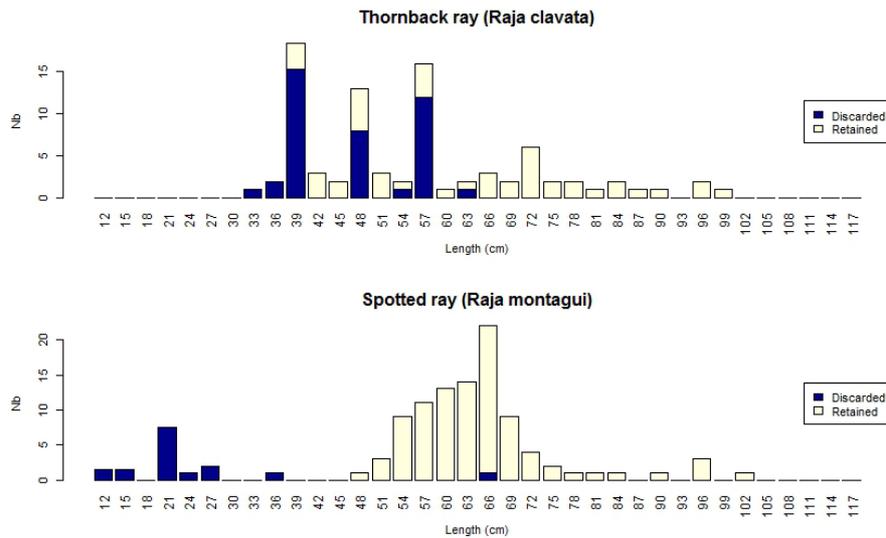
Table 1: Estimation of *R. undulata* discards in 2012 from COST-analysis. Values (Kg) are presented by season and by metier with the corresponding coefficient of variation (cv), inferior and superior limits. Total estimations were added.

We tried another estimation using the raising by trips. The estimation of discards is 379 tonnes that seems less realistic, trawling represents 87 % and netting 13 %, which is more in agreement with the distribution in the sampling data.

More work is necessary to improve the evaluation; a solution may be to evaluate separately and with different raising methods, active gears and static gears.

Length structure raised to sampled trips





Acknowledgements

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