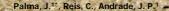
# IMPACT OF BIVALVE DREDGE FISHING ON FLATFISH SPECIES IN THE SOUTH COAST OF PORTUGAL (ALGARVE)





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## INTRODUCTION

The passage of a bivalve dredge, as any other type of trawl, across the seabed leads to direct mortality and/or indirect mortality of both commercial and non-commercial species. Although this type of gear is specially designed to catch bivalves some amounts of fish, and benthic invertebrates are also caught.

Presently the dredge fleet catches a high variety of species, being the most important the clam (*Spisula solida*), the razor clam (*Pharus legumen*), the striped venus (*Chamelea gallina*), and donax clam (*Donax trunculus*).

The by-catch of this bivalve fishery, especially of the discarded fish species, was not been quantified. This study intends to give a first estimate of the impact on fish caused by bivalve dredging in the South coast of Portugal.

### RESULTS

A total of 87 surveys were conducted throughout the sampling period; 55 were targeted for *Donnax trunculus*, 20 for *Spisula solida*, 9 for *Chamelea gallina* and 3 for *Pharus legumen*.

A total of 12 surveys were conducted for abundance estimates.

Abundance composition, by-catch composition and number of collected specimens for 100 kg of bivalve are presented in Tables I, II, and III, respectively.

Table 1 - Abundance composition from surveys data. Sampled area ±26.000 m<sup>2</sup>.

ALCONOMIC AND ALCONOMIC PROPERTY.	Contraction of the local division of the loc	a construction of the	200 A. C. MARCON	· Lotte warden	and the second
A REAL PROPERTY OF	N	Lenght Range	Av. Length	Av. Weight	% •
THE REPORT OF A	11 A A	(cm)	± sd (g)	± sd (g)	undersized
Arnoglossus thori	242	2,8-23,2	9,2±2,66	9,73±10,46	Sec. 1 Sec. 1
Bothus podas	155	3,2-23,2	8,63±3,14	10,59±11,33	-1.4
Psetta maxima	1	CH. COLLENS	32.1	165.2	0
Scophthalmus rhombus	23	5,8-23,1	15,47±4,85	55,6±45,71	100
Dicologoglossa cuneata	8	7,2-17,3	12,31±3,05	12,86±8,78	75
Microchirus boscanion	21	4-7,7	5,89±0,83	2,79±3,01	C. Calar
Solea lascaris	97	4,4-25	12,37±4,73	30,75±35,99	98.97
Solea senegalensis	30/1/2		26.5	47	0
Non flatfish	2760 (27 sp.)	Ser land	an here all	A SALE TO A S	the second second
Conholonode	120 (4 cm)	a series and the	And the second sec	Contraction of the second	CONTRACTOR OF STREET

12	Sampling area	
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## MATERIAL AND METHODS

Data collection of the dredge fishery was undertaken between 27<sup>th</sup> November 2000 and 28<sup>th</sup> February 2002 and was based on information gathered directly on the fishing surveys made on board of commercial dredge vessels. Operational parameters such as towing speed and duration were maintained exactly as the commercial fleet usually operates.

Individuals were identified, weighed (to the nearest 0.4 g) and measured (to the nearest lower 0.1 cm). Species were sorted, counted and the individual weight was recorded.

The percentage of each species in the total bycatch and number of fish under the minimum legal catch size (%US) was calculated.

Abundance analysis was performed in the same area were the commercial fleet operate. Surveys were performed during the summer of 2001, using two different fishing gears, the beach seine and the beam trawl. Biological information of the specimens collected in this experiment was conducted in the same way as described above for the surveys data.

Table II - By-catch composition from su	urveys data. N - number	sd - standard	deviation

The second second second	and the second se	The state of the state of the	Length	Av. Lengui	Av. weight	%
The state of the state of		State of the state	range (cm)	± sd (g)	± sd (g)	undersized
Sector And	Scophthalmus rhombus	4	21.7-29.7	- 24.7±3.5	170.8±83.7	100
	Dicologoglossa cuneata	20	9.8-23.8	16.2±4.1	46.0±33.9	40
	Solea lascaris	4	18,6-26.2	22.5±3.6	94.3±44.1	50
c. gattina	Solea senegalensis	19	24.0-49.0	31.2±5.3	295.4±149.1	0
90	Synaptura lusitanica	12	21.4-45.0	30.7±5.8	272.3±180.3	R Landon
the set of the	Microchirus boscanion	Con Pages	Second State	6.6	3	Contraction of the second
100 A 100	Non flatfish	333 (12 sp.)	Top of the second	and the second		Colling Street
Sector and	Cephalopods	155 (2 sp.)	MATTER A	A. 1. 2. 2. 2. 3	COLUMN STREET	Charles .
and the second second	Scophthalmus rhombus	88	3,5-34,5	22,52±4,9	154,73±88,1	95.40
PERSONAL STREET	Psetta maxima	11	13,5-33,7	23,18±7,1	294,17±273,1	81.82
D. trunculus	Dicologoglossa cuneata	19	13,4-25,4	18,11±3,5	47,59±31,2	5.26
cult	Solea lascaris	203	12,7-30,6	22,34±3,1	105,6±50,7	68.97
un	Solea senegalensis	9	17,1-43	31,28±8	330,98±240	44.44
Carl Carl	Solea vulgaris	12	21-22,1	21,55±0,8	79,15±10,8	100
	Synaptura lusitanica	10	22,3-38,3	27,02±4,6	113,44±55,6	
A	Non flatfish	1772 (22 sp.)	Anna 1997 - San	Carl Contra	Lint a line	S
Section Sec.	Cephalopods	158 (2 sp.)	and a state of the	100 C		
20	Bothus podas	- 1 A	and the second	11.6	13.4	Sec. 22.
ume	Solea lascaris	4	20.3-26.1	23.2±2.4	103.3±35.7	75
169	Non flatfish	52 (3 sp.)		PAG STATIS	and the second second	- All - and
p. legumen	Cephalopods	4 (1 sp.)	2.2	A HAR	and the second	a. Directo
States and a state	Psetta maxima	2	23.2-30.1	26.7±8.8	421.2±288.6	50
2 Production of	Scophthalmus rhombus	13	14.2-39.6	21.4±8.11	144.5±195.9	84.6
C. C.A.	Dicologoglossa cuneata	32	10.4-37.8	21.5±5.8	92.9±79.1	15.6
lide	Solea lascaris	27	20.2-35.7	25.0±2.8	149.4±57	37
S. solida	Solea senegalensis	28	13.6-38.0	28.3±5.7	226.7±101.1	0
2-2-4-20	Synaptura lusitanica	26	25.7-54.6	32.3±5.9	373.3±198.1	7.1
A REAL PROPERTY	Non flatfish	251 (20 sp.)	AMA ANA ANA	Charles and	CONTRACTOR	A LANG
COLOR SHOW	Conhalanade	215 (2 cp.)	Service and	and the second	Car Barry Conner	Mar and 1

and the second second second second second	Chamelea gallina				Apple 1	Donax trunculus					Pharus legumen					Spisula solida				
Constant for the second second	Winter	Spring	Summer	Autum	Total	Winter	Spring	Summer.	Autum	n Total	Winter	Spring S	Summe	rAutumr	Total	Winter	Spring	Summer	Autum	n Tot
Bivalve (in Kg)	書からない	169	631	150	950	. 3660	436	40	4391-	8527	260	90	ALC: N	1. N. A.	350	State Sel	3621	370	1000	399
By-catch (n° ind.)	ALC: NO	108	372	84	564	813	129	59	1420	2421	9	52	-	1.00	61	Sec.	685	. 77	135 30	78
latfish (n° ind.)	2.4	6	45	17	68	145	15	23	216	399	3	1	100	S. Salar	4	5223	117	37	54.57	15
Ion flatfish fish (n° ind.)	10000	83	209	50	342	610	107	18.	1116	1851	+ 4	49	1000	1111	53	ALC: NO	254	25	12.1	27
ephalopods (n° ind.)	Carlos and	19	118	17	154	58	7*	18	88	171	2	2	Carlo -		4	1000	314	15	1000	3
y-catch (n° ind./100Kg of bivalve)	2.00	63.9	59	56	59.4	22.2	29.6	147.5	32.3	28.4	3.5	57.8	123	Service of the	17.4	Sec.	18.9	20.8	1.10	19
latfish (n° ind./100Kg of bivalve)	1.12	3.6	7.1	11.3	7.2	4.0	3.4	57.5	4.9	4.7	1.2	1.1	1000	12	1.1	1. 1. 1.	3.2	10	See.	3
on flatfish fish (n° ind./100Kg of bivalve	1000	49.1	33.1	33.3	- 36	16.7	24.5	45	25.4	21.7	1.5	•54.4	1000	Contraction of the	15.1	1000	1.7.5	6.8	23.00	10.00
Cephalopods (n° ind./100kg of bivalve)	Stands.	11.2	18.7	11.3	16.2	1.6	1.6	45	2	12	0.8	2.2	Sec. 1	R)	1.1	1200	8.7	4.1	152.5	8

- not regulated by the portuguese law

#### DISCUSSION

The information collected during the surveys reflects the information gathered during the abundance analysis. Within the flatfish group, some species seem to have the ability to avoid the dredge gear. Species like *B. podas, A. thori*, and *M. boscanion*, which occur in the sampled areas, were never captured (exception for one *A. thori* and one *M. boscanion*). The same occurred with the smaller specimens of the remaining collected species. Thus, when under sized specimens were captured they were juveniles near their first maturation.

The width between bars on the Donax dredge and the Spisula/Chamelea dredge is also an important factor for the retention of smaller specimens of flatfish species. In the case of the Spisula/Chamelea dredge, the width between bars is larger, fact that increases the flatfish probability to escape. This is the direct cause for the significant differences existing between lengths of *S. lascaris* and *S. lusitanica* captured with the two different gears.

Although the capture of undersized fish, the length composition of the capture is quite different from the faunal composition of the surveyed areas, which is a clear indicator of the good performance of the dredge gears. Due to the gear characteristics presently used, it is almost impossible to reduce the number of captured flatfishes without reduce the bivalve dredge efficiency.

Although the moderate impact on the flatfish species, the bivalve dredge fisheries should be considered in the management and conservation studies of fish stocks.

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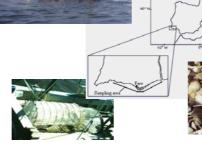
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> Individuals were identified, weighed (to the nearest 0.1 g) and measured (to the nearest lower 0.1 cm). Species were sorted, counted and the individual weight was recorded.

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Scophthalmus rhombus	23	5,8-23,1	15,47±4,85	55,6±45,71	100
Dicologoglossa cuneata	8	7,2-17,3	12,31±3,05	12,86±8,78	75
Microchirus boscanion	21	4-7,7	5,89±0,83	2,79±3,01	*
Solea lascaris	97	4,4-25	12,37±4,73	30,75±35,99	98.97
Solea senegalensis	1	-	26.5	47	0
Non flatfish	2760 (27 sp.)	-	-	-	-
Cephalopods	120 (4 sp.)	-	-	-	-

		N	Length	Av. Length	Av. Weight	%
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0	Microchirus boscanion	1	-	6.6	3	*
	Non flatfish	333 (12 sp.)	-	-	-	-
	Cephalopods	155 (2 sp.)	-	-	-	-
	Scophthalmus rhombus	88	3,5-34,5	22,52±4,9	154,73±88,1	95.40
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. cum	Solea senegalensis	9	17,1-43	31,28±8	330,98±240	44.44
0. <sup>N</sup>	Solea vulgaris	2	21-22,1	21,55±0,8	79,15±10,8	100
v	Synaptura lusitanica	10	22,3-38,3	27,02±4,6	113,44±55,6	*
	Non flatfish	1772 (22 sp.)	-	-	-	-
	Cephalopods	158 (2 sp.)				-
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2	Synaptura lusitanica	26	25.7-54.6	32.3±5.9	373.3±198.1	7.1
	Non flatfish	251 (20 sp.)	-	-	-	-
	Cephalopods	315 (2 sp.)	-	-	-	-
* - not regulated by t	he portuguese law					

	Chamelea gallina						Donax trunculus					Pha	rus legum	Spisula solida						
	Winter	Spring	Summer	Autum	n Total	Winter	Spring	Summer	Autum	n Total	Winter	Spring	Summer A	lutum	n Total	Winter	Spring	Summer	Autum	n Tota
Bivalve (in Kg)	-	169	631	150	950	3660	436	40	4391	8527	260	90	-	-	350	-	3621	370	-	3991
By-catch (nº ind.)	-	108	372	84	564	813	129	59	1420	2421	9	52	-	-	61	-	685	77	-	762
Flatfish (n° ind.)	-	6	45	17	68	145	15	23	216	399	3	1	-	-	4	-	117	37	-	154
Non flatfish fish (n° ind.)	-	83	209	50	342	610	107	18	1116	1851	4	49	-	-	53	-	254	25	-	279
Cephalopods (n° ind.)	-	19	118	17	154	58	7	18	88	171	2	2	-	-	4	-	314	15	-	329
By-catch (n° ind./100Kg of bivalve)	-	63.9	59	56	59.4	22.2	29.6	147.5	32.3	28.4	3.5	57.8	-	-	17.4	-	18.9	20.8	-	19.1
Flatfish (n° ind./100Kg of bivalve)	-	3.6	7.1	11.3	7.2	4.0	3.4	57.5	4.9	4.7	1.2	1.1	-	-	1.1	-	3.2	10	-	3.9
Non flatfish fish (n° ind./100Kg of bivalve	e -	49.1	33.1	33.3	36	16.7	24.5	45	25.4	21.7	1.5	54.4	-	-	15.1	-	7	6.8	-	7
Cephalopods (nº ind./100Kg of bivalve)	-	11.2	18.7	11.3	16.2	1.6	1.6	45	2	2	0.8	2.2	-	-	1.1	-	8.7	4.1	-	8.2

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