

Age, growth, reproduction and feed of bottlenose skate, *Rostroraja alba* (Lacepède, 1803) in Saros Bay, the north Aegean Sea

Cigdem Yigin and Ali Ismen

Çanakkale Onsekiz Mart University, Fisheries Faculty, Department of Fishing and Processing Technology, Çanakkale 17100, Turkey [Tel: +902862180018 ext.1564; Fax: +902862180543] email: cyyigin@hotmail.com



INTRODUCTION

The bottlenose skate, *Rostroraja alba* (Figure 1) is a benthic species of sandy and detrital bottoms from coastal waters to the upper slope region between about 40 to 400m (Serena, 2005).

Length-weight relationships, age at maturity, longevity, reproductive age and periodicity, annual rate of population growth and natural mortality are all unknown for this skate although it was studied size at maturity, feeding habits (Bauchot, 1987) and reproduction biology (Serena, 2005).

This study presents significant new information on the maturity, growth and feeding habits of *R. alba* caught in the Saros Bay of the North Aegean Sea.

MATERIAL AND METHODS

A total of 126 specimens of bottlenose skate was collected by using commercial trawls between March 2005 and December 2007 in Saros Bay (Figure 2). Trawling was during daytime and at night at depths ranging from 0 to 500 m. Most individuals were captured at depths of 5-50 and 50-100 m. The trawl was equipped with a 44 mm stretched mesh size net at the cod-end. Trawling lasted 30 min. Trawling speed was 2.5 knots.

Total length (TL) and disc width (DW) were measured to the nearest millimeter and body weight (W) to the nearest gram. Statistical comparison of length-weight and disc width-weight relationships between sexes combined was performed by applying the t-test (Zar, 1999).

Male maturity was defined from the state of development of the mixopterygia (claspers) in relation to the edge of the pelvic fin. Maturity of females was determined monthly by internal examination (Holden and Raitt, 1974). The length at first maturity was obtained using the method described by Avsar 2005.

Age was determined from rings in vertebral centrae using silver nitrate staining method (Kusher et al., 1992; Ismen et al., 2007).

The stomachs were preserved in 4% formaldehyde solution buffered with borax. Identification of ingested prey was carried out systematically. The importance of each prey was determined by calculating the index of relative importance (IRI) (Pinkas et al., 1971).

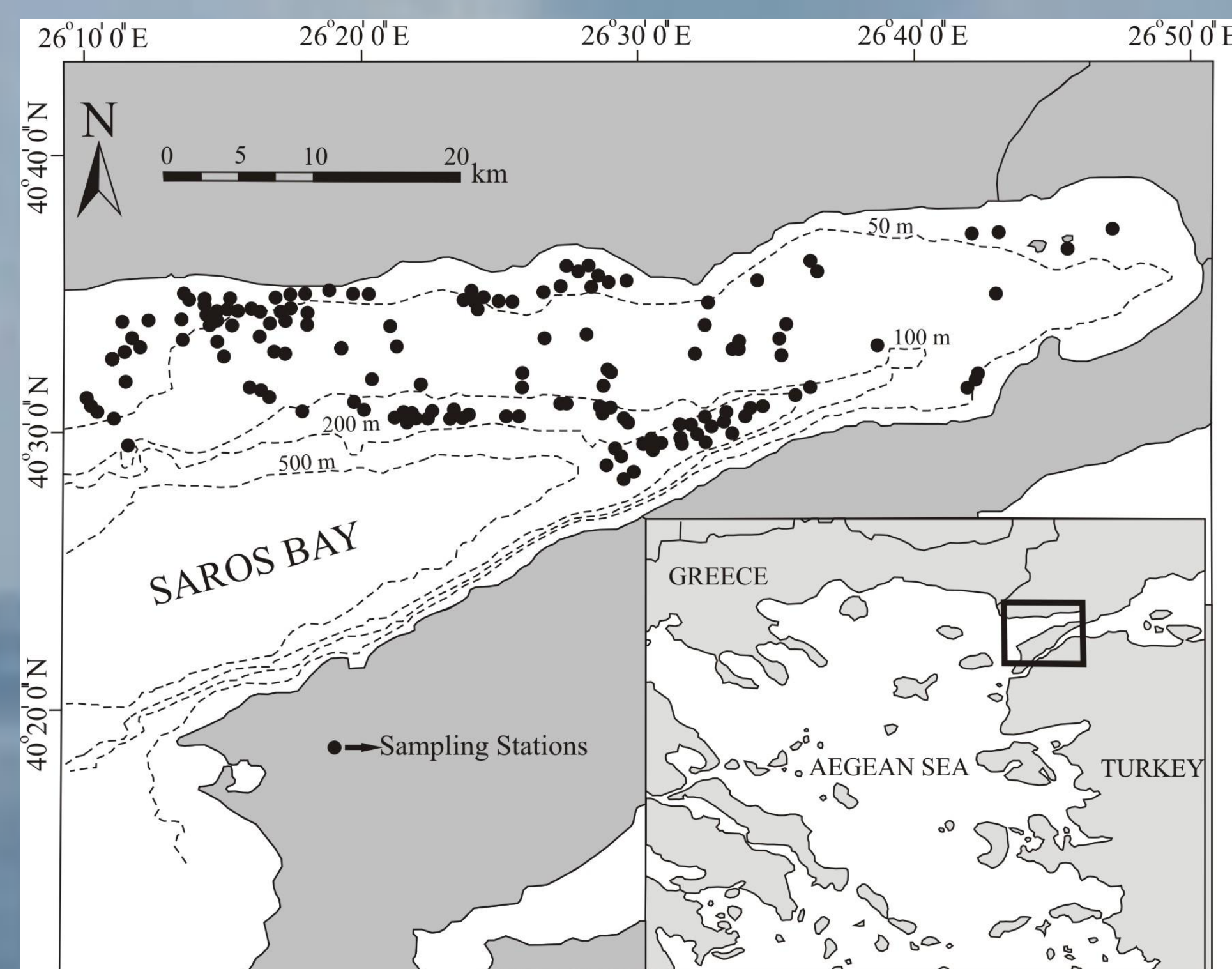


Figure 2- The trawl sampling stations in the Saros Bay, Turkey during surveys March 2005 to December 2007; total numbers of hauls; 237

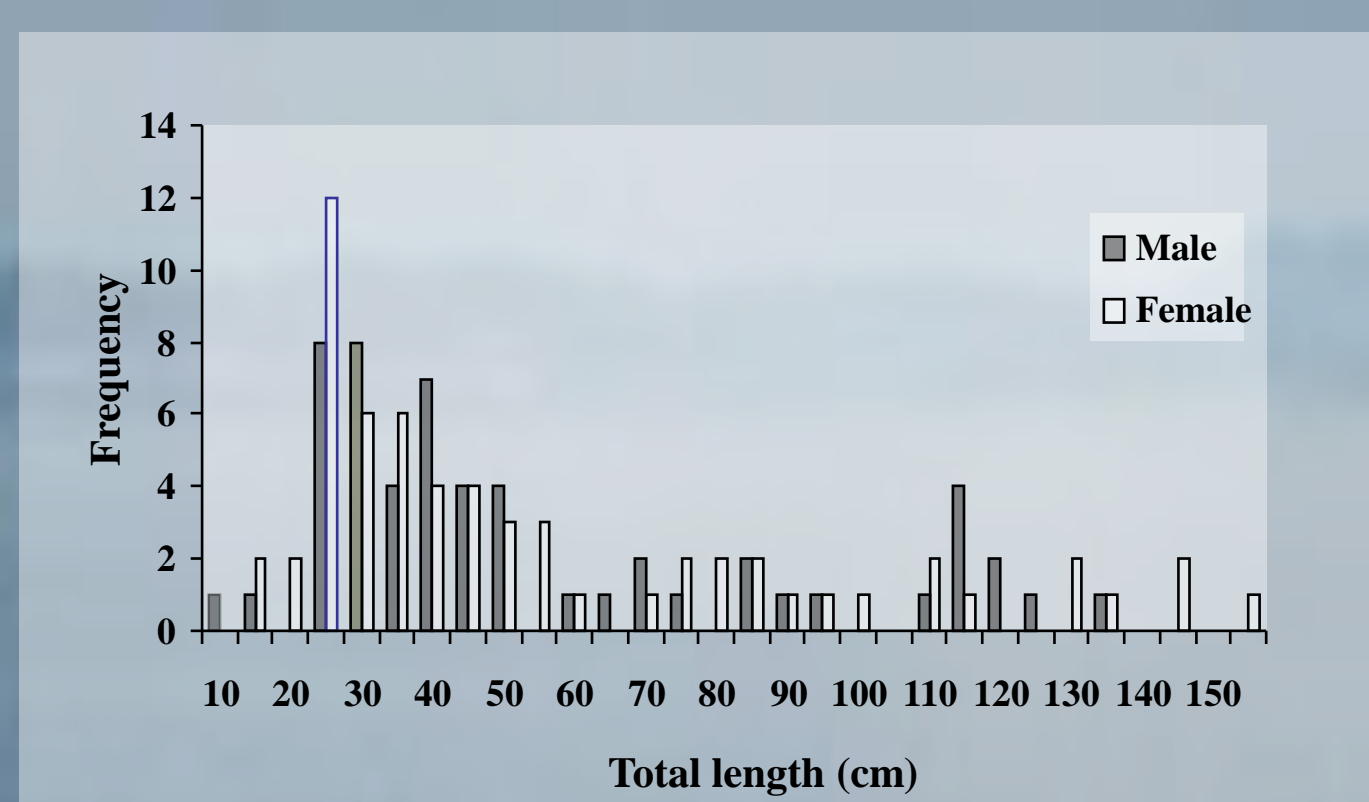


Figure 3- Length-frequency distribution by sex of bottlenose skate.

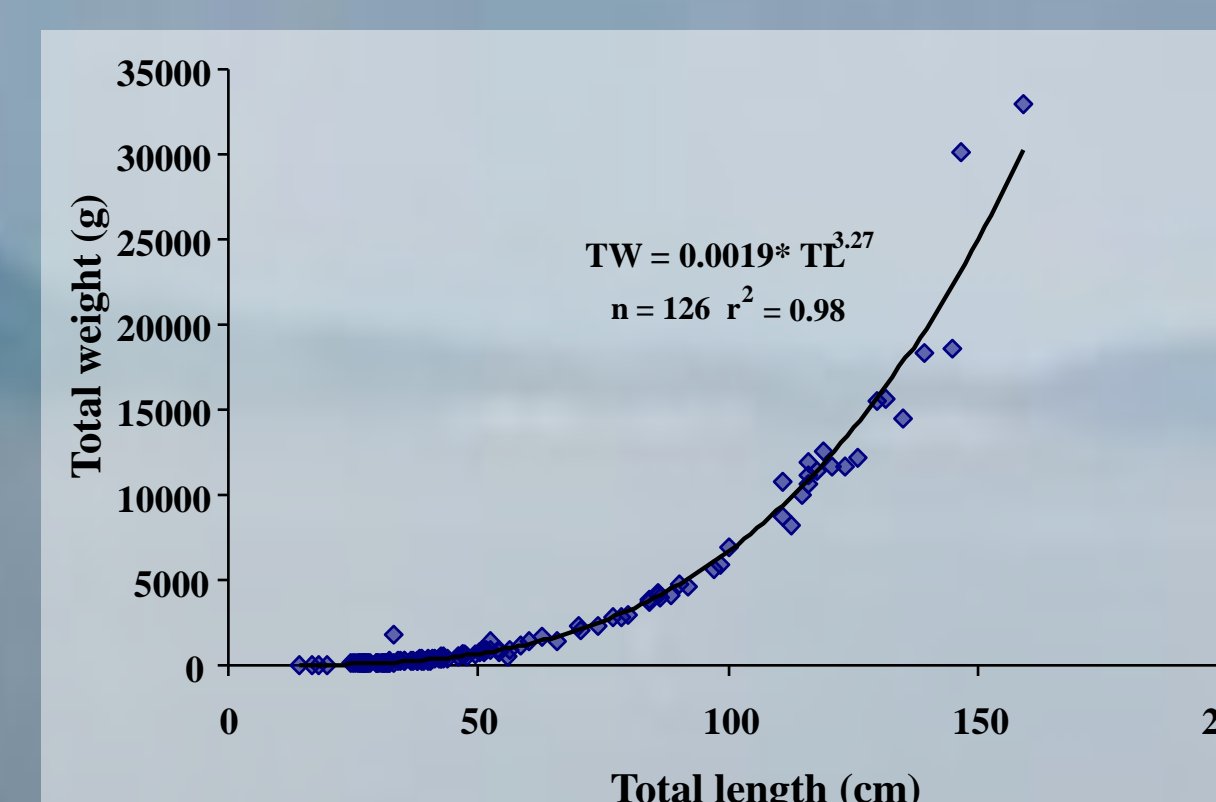
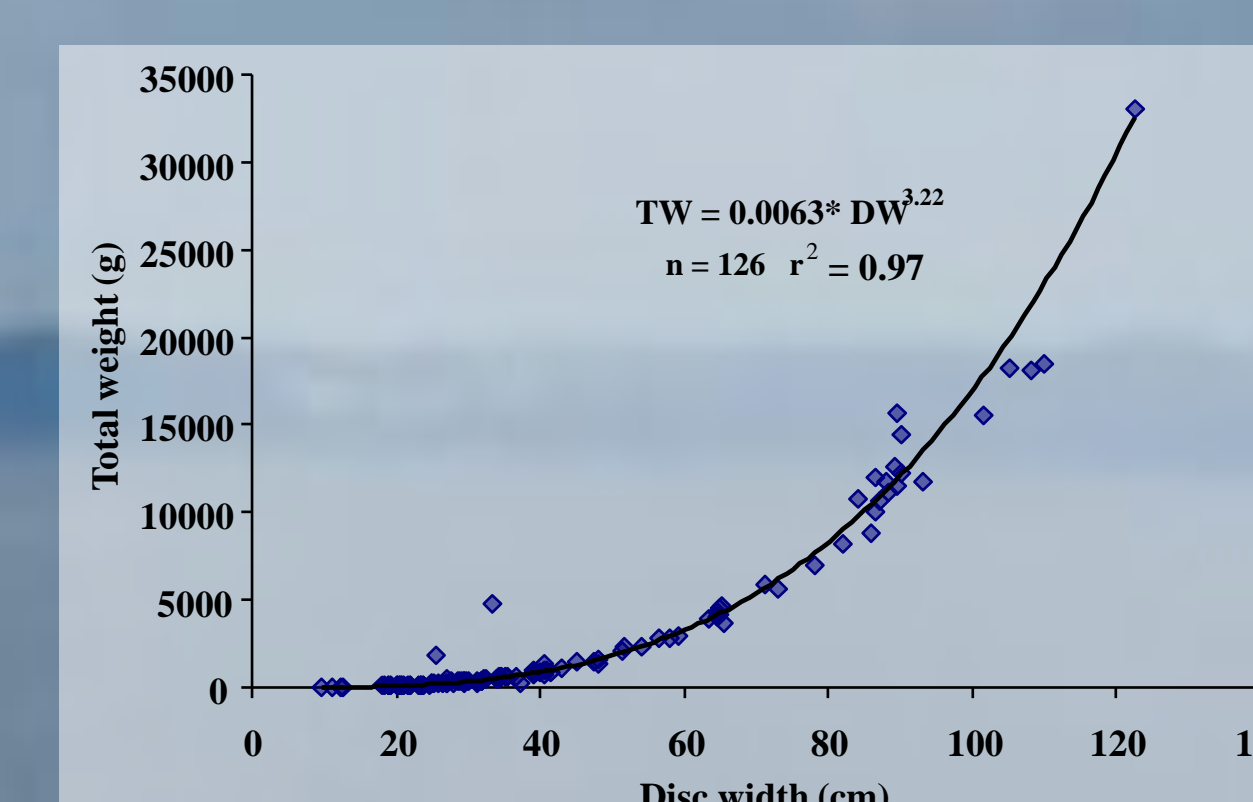


Figure 4- Total length-Total weight and Disc width-Total weight (g) relationships for combined sexes of *R. alba*



AGE AND GROWTH

Table 1. The mean length (cm) at each age group of bottlenose skate

Age	N	Range (cm)	Mean length (cm)
0	1	14.0	14.0 (±0.000)
1	4	16.8-24.6	19.9 (±1.710)
2	36	24.8-35.2	29.3 (±0.469)
3	20	35.4-44.0	39.9 (±0.539)
4	18	45.9-56.5	50.1 (±0.732)
5	4	56.0-63.0	59.4 (±1.480)
6	4	65.8-74.0	70.1 (±1.680)
7	8	77.0-88.5	83.9 (±1.410)
8	2	90.5-92.0	91.3 (±0.750)
9	3	97.1-100.0	98.5 (±0.839)
10	9	111.0-121.0	115.9 (±1.110)

Table 2. The von Bertalanffy growth parameters for the bottlenose skate

Sex	L _∞ (cm)	K (year ⁻¹)	t ₀ (year)
Males	339	0.04	-0.28
Females	306	0.04	-0.31
Combined	311	0.04	-0.25

REPRODUCTION

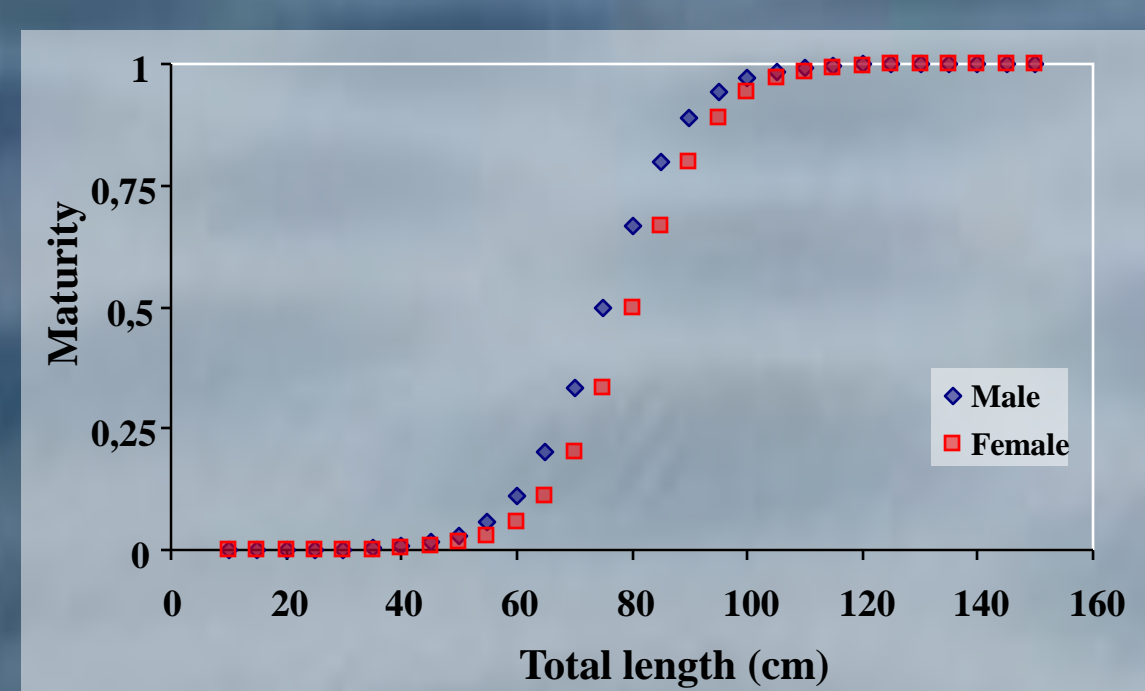


Figure 6- Length at first maturity of male and female *Rostroraja alba*

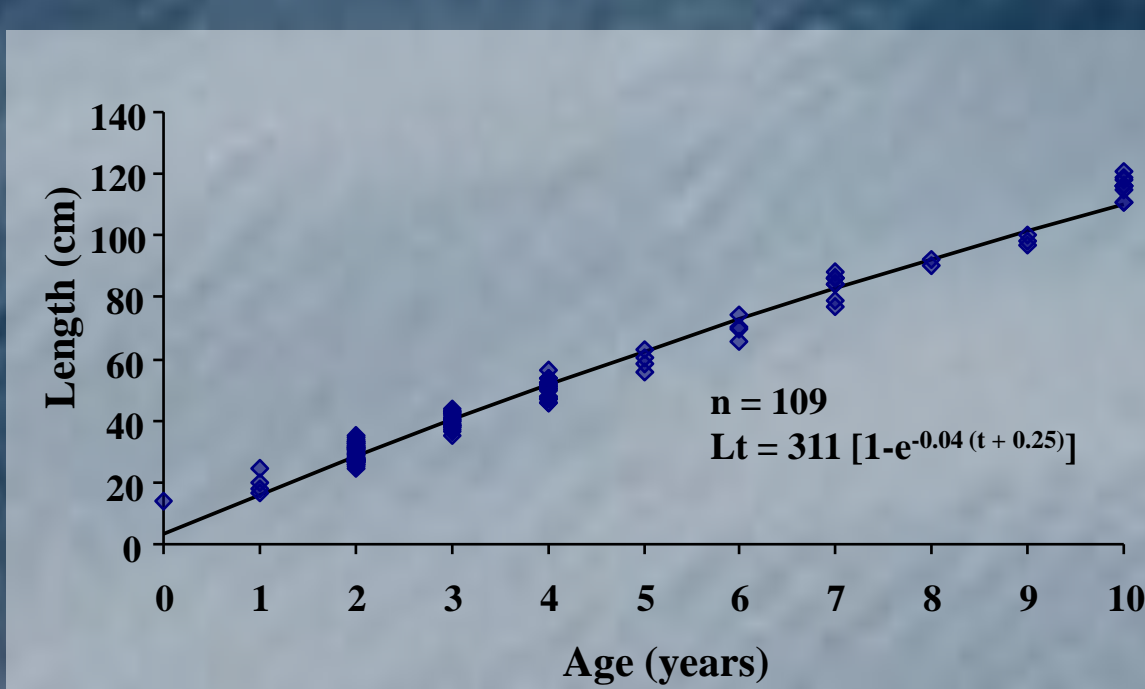


Figure 5- von Bertalanffy growth curve in length of bottlenose skate from Saros Bay.



Figure 1- Photograph of *Rostroraja alba*.

RESULTS AND DISCUSSION

Of the 126 specimens measured, 67 were females (53%) and 59 males (47%). Females TL ranged from 18.1 to 159 cm (DW 12.4-122.5cm) and males TL from 14 to 135 cm (DW 9.5-90 cm) (Figure 3). The calculated parameters of TL-W and DW-W relationships for sexes combined were presented in Figure 4. The exponent *b* demonstrated allometric growth.

The sample consisted of individuals ranging from age 0 to 10. Treatment by silver nitrate resulted in better visibility of the rings of 109 individuals. The number of individuals and length interval at age data according to sexes combined are in Table 1. To study growth in length, the data set of 109 individuals was used to calculate von Bertalanffy growth parameters, which are shown for male, female and combined in Table 2. When mean length observed at each age is compared with that obtained from the theoretical growth curve (Figure 5), a close similarity of both data sets is evident.

A total of 92 (58 males and 34 females) bottlenose skate was sexed. Of these, 43 males and 28 females were immature; 15 males and 6 females were mature. Examination of maturity stages indicated that length at 50% maturity was about 75 cm TL for males and 80 cm TL for females (Figure 6).

Stomach contents from 55 individuals were examined. Of the 55 stomachs examined, 37 (67%) were full and 18 (33%) empty. A total of 62 prey individuals was identified (Table 3). Seasonal changes in the diet followed the same pattern during both years, Pisces were the most important prey groups in all seasons (Figure 7). Index of relative importance of pisces are 75.2% and constituted 53.2% of the total prey number.

The results obtained in this study are useful to fishery scientists because the data were sampled from a relatively undisturbed area. Length-weight relationships, age/size and growth for *Rostroraja alba* were not yet available in Fishbase (Froese and Pauly, 2009) and hence these results contribute to our knowledge and to the implementation of basic management measures to ensure the sustainability of catches of this species.

ACKNOWLEDGEMENTS

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FEEDING

Table 3. Values for percentage by number (%N), weight (%W), occurrence (%F) and index of relative importance (IRI and %IRI) for prey items observed in stomachs (n=37) of bottlenose skates (*R. alba*), Saros Bay

Class	Species	%N	%W	%F	IRI	%IRI
Nematoda	Nematod (unidentified)	4.80	0.002	5.40	25.93	0.61
	<i>Eleuthero moschata</i>	3.20	28.93	5.40	173.52	4.07
Cephalopoda	<i>Loligo</i> sp.	1.60	1.89	2.70	9.41	0.22
	<i>Sepia</i> sp.	1.60	0.09	2.70	4.57	0.11
Crustacea	<i>Isope</i>	1.60	0.001	2.70	4.32	0.10
	<i>Dekapoda</i>	1.60	0.03	2.70	4.41	0.10
	<i>Natantia</i>	6.50	0.97	2.70	20.16	0.47
	<i>Meaganus</i> sp.	1.60	0.02	2.70	4.32	0.10
	<i>Parapenaeus longirostris</i>	1.60	0.50	2.70	5.66	0.13
	<i>Processa macrophthalmia</i>	1.60	0.02	2.70	4.37	0.10
	<i>Natantia</i> (unidentified)	1.60	0.02	2.70	4.32	0.10
	<i>Solea</i> sp.	1.60	2.49	2.70	11.05	0.26
Pisces	<i>Merluccius merluccius</i>	3.20	11.45	5.40	79.13	1.85
	<i>Trachinus draco</i>	4.80	9.39	2.70	38.32	0.90
	<i>Mullus barbatus barbatus</i>	8.10	6.36	10.80	156.13	3.66
	<i>Pisces</i> (unidentified)	35.50	24.68	48.60	2924.90	68.53
	<i>Pisces</i> (unidentified)	1.60	0.05	2.70	4.44	0.10
Algae		17.7	13.14	29.7	79.285	18.57
Other						

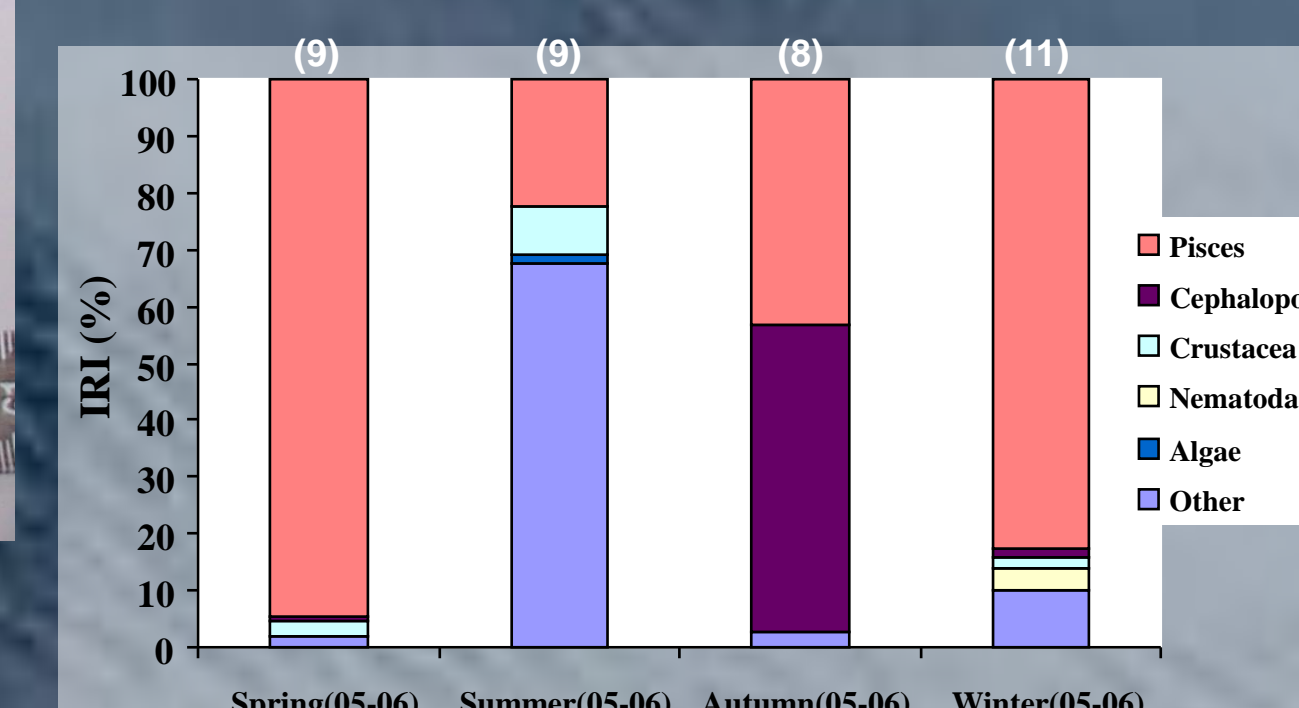


Figure 7- Seasonal variation of the stomach contents of *R. alba* (number in brackets is of stomachs analyzed)