



## South Pacific Regional Fisheries Management Organisation

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**Ecuador 2013 Annual Report**

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The present document contains biological and fishery information of jack mackerel, collected for the small pelagic fish monitoring program of the National Institute of Fisheries in the Ecuadorian purse seine fleet, when this resource is available in Ecuadorians waters.

## 2. FISHING ASPECTS

### 2.1 FISHING EFFORT

Purse seine fleet for small pelagic fishes is formed by ships operating 20 to 22 days in a month, during the period called "oscura" that correspond to new moon; fishing trips are daily and the activity begins from 20h00 to 05h00 hour (Aguilar, 1999).

The fleet at the beginning of the fishery was operating in zones close to the coast, making fishing activity on thread herring and Pacific anchoveta (Arriaga y Pacheco, 1989). For 1971 the fleet was conformed for 48 wooden small ships with 7 tons of capacity; since 1976 is registered and increase in number and size. In 1991, the fleet was conformed for 277 ships approximately, including wooden with few autonomy no refrigeration, and steel ships with refrigeration and autonomy (Aguilar, 1992).

The last years, the fleet in number has a significant decrease, situation related to the decreases in small pelagic fishes catches in Ecuadorian waters, closed processing industries (canned fish and flour fish) and some vessel life-time (González et al, 2008). Until 2012, 77 ships were registered as part of the purse seine small pelagic fish fleet.

National Institute of Fishery in order to study these resources, classified this ships into four different class (Table 1), related to Total Register Tonnage (TRN): Class I belongs to independent fishermen, the activity is close to the coast. The ships class II, III and IV belong to fisheries industries, and catch mackerel, *Etrumeus teres*, *Auxis* spp, jack mackerel and sometimes *Cetengraulis mysticetus* and *Opisthonema* spp.

It must be highlighted when jack mackerel is present in Ecuadorian waters, vessels class III and IV catch these specie (related to the operational activity, 15 miles), while is close to the coast vessels class I and II catch this resource (Table 1, figure 2).

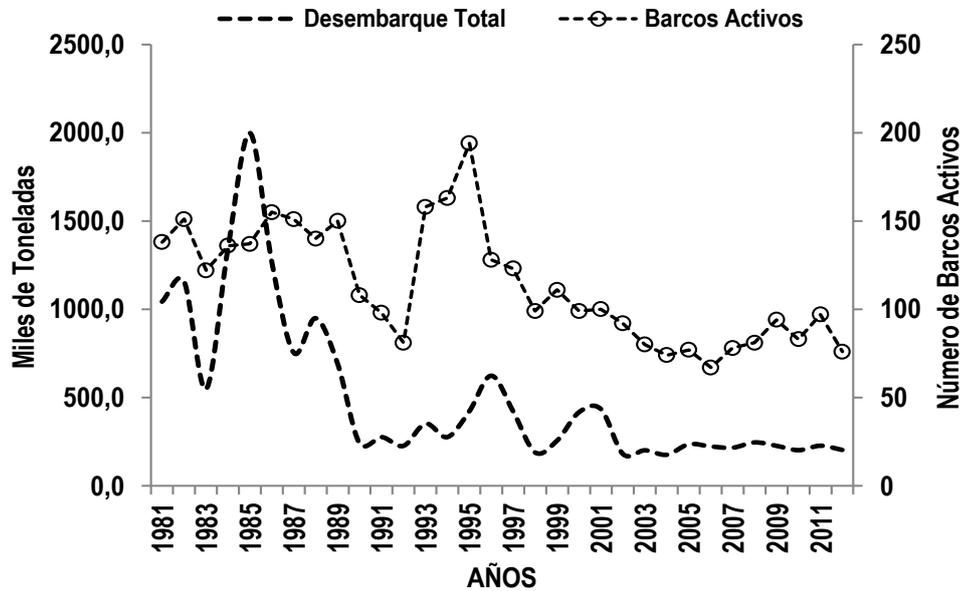
**Table 1.** Purse seine fleet classification and species present in the catch.

CLASS OF VESSEL	Net Registered Tonnage	PRINCIPAL SPECIE	VESSELS REGISTERED 2010	VESSELS REGISTERED 2011	VESSELS REGISTERED 2012
I	1 – 35	Ch – P	41	55	47
II	36 - 70	Ch – P – S – M	24	23	16
III	71 – 105	M-S-J-B-Otr-SR-P-Ch	12	13	10
IV	>106	M-S-J-B-Otr-SR-P-Ch	6	6	4

**S =** *Sardinops sagax*      **M =** *Scomber japonicus*      **SR =** *Etrumeus teres*      **CH =** *Cetengraulis mysticetus*



**P** = *Opisthonema* spp.      **B** = Auxis spp.      **Oth** = Other species      **J** = Jack mackerel



**Figure 2.** Small pelagic fish catch (t) and number of active vessels.

## 2.2 FISHING GEAR

One of the principal components of fishing methodology for small pelagic fishes is the “seine”. This type of gear catches species with 70 meters of depth, and concentrated in compact schools.

The dimensions for this gear can vary, in accordance to the size vessel (Castro 2010):

### Vessels Class I – II

Length	220 – 450 bz
Depth	20 – 60 bz
Mesh size in cabecero	5/8” – 1 1/8” inch

### Vessels Class III – IV

Length	330 - 450 bz
Depth	40 - 60 bz
Mesh size in cabecero	3/4” – 1 1/8” inch

According to Ministerial Agreement 047 (April 9, 2010), it was established that “Fishery of small pelagic fishes as mackerel (*Scomber japonicus*), thread herring (*Opisthonema* spp.), jack mackerel (*Trachurus murphyi*), pacific anchoveta (*Cetengraulis mysticetus*);



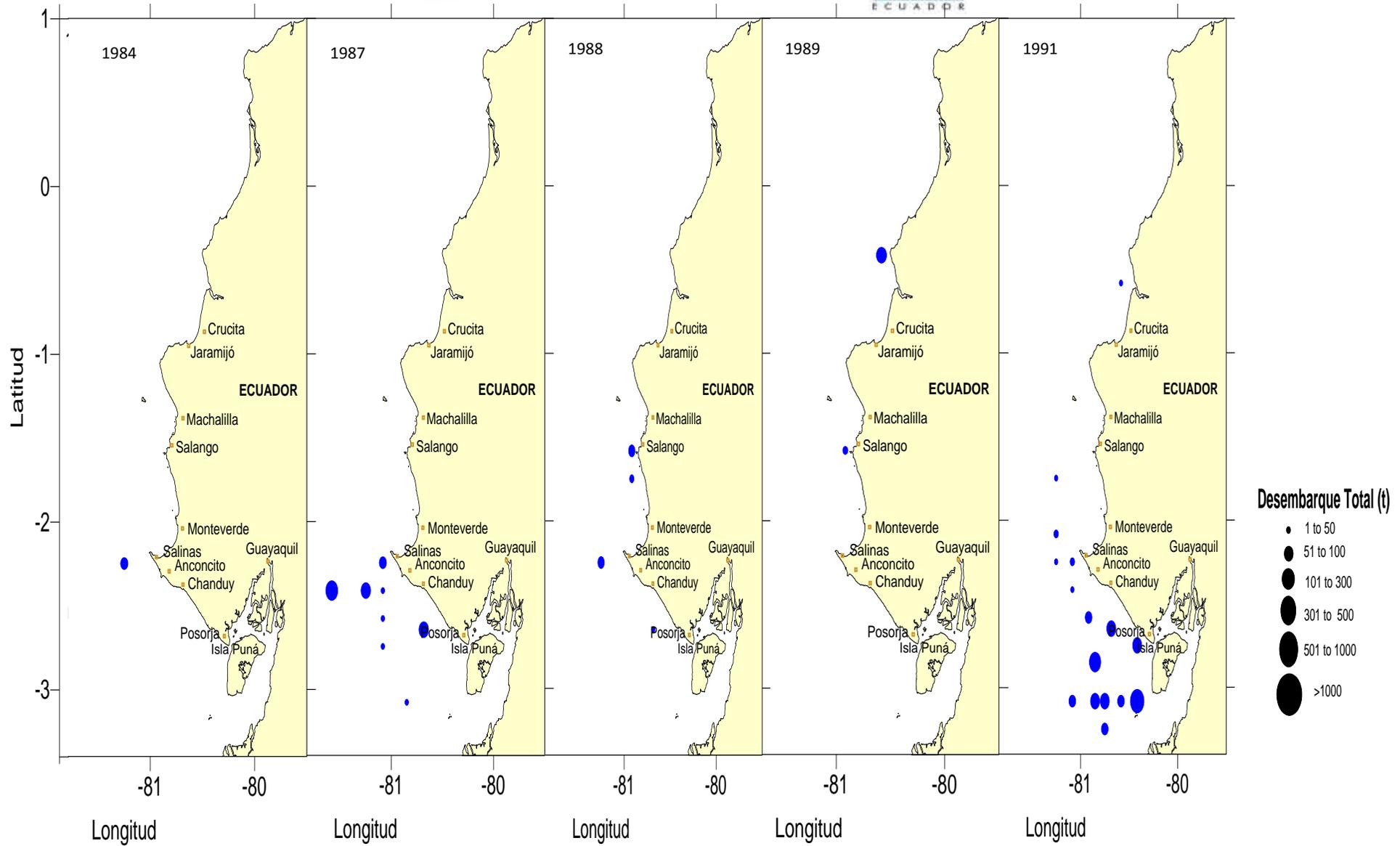
frigate tuna (*Auxis* spp.) and similar, must be done with seines and mesh size not less than 1 1/8" inch. (González 2012).

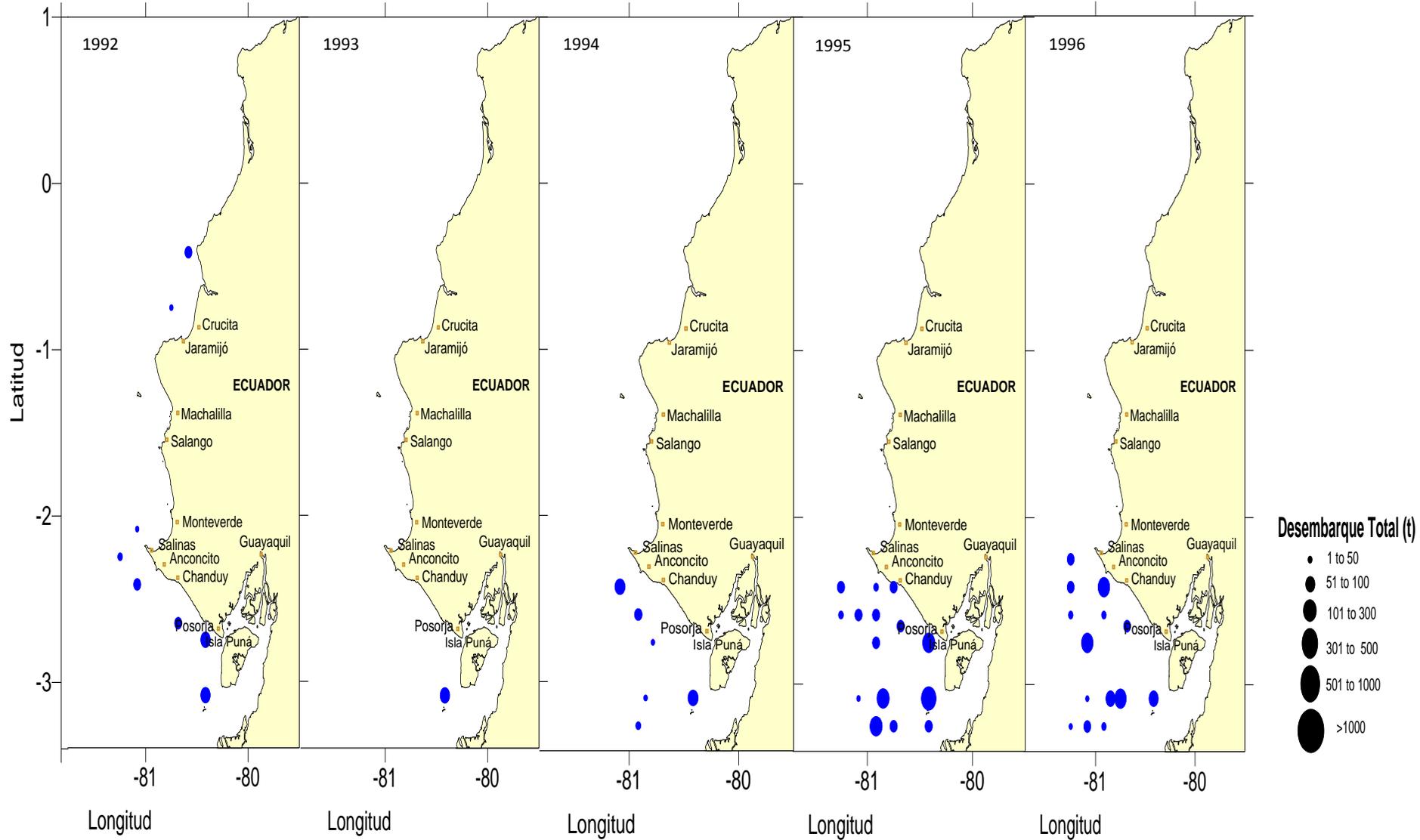
### 2.3 FISHING ZONES

The principal fishing zones with the higher concentrations of Jack mackerel, when is available in Ecuadorian waters, correspond to the Gulf of Guayaquil and around Peninsula de Santa Elena.

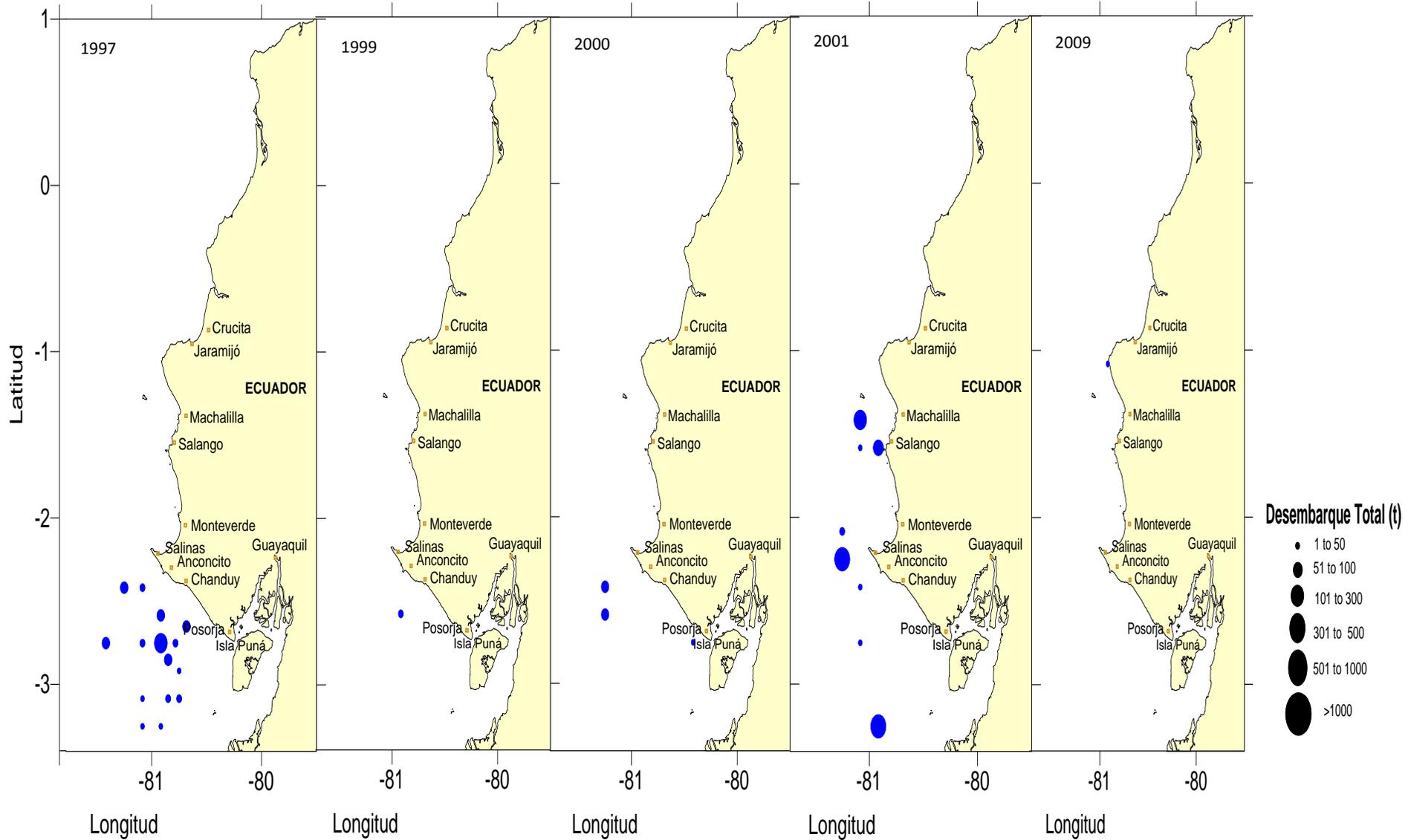
Catch information is recorded in the national institute of fisheries data base since 1984; during 1991, 1995 - 1996 were registered catches in the internal part of Gulf of Guayaquil; being around Santa Clara Island 1 600 t reported in both periods. In 2001 were reported catches in front of Manabi Coast, and south of Isla de la Plata.

For 2011 fishing zones were reported in front of Province of Manabi, being this around Península de Santa Elena where were registered the higher concentrations of jack mackerel (figure 3).





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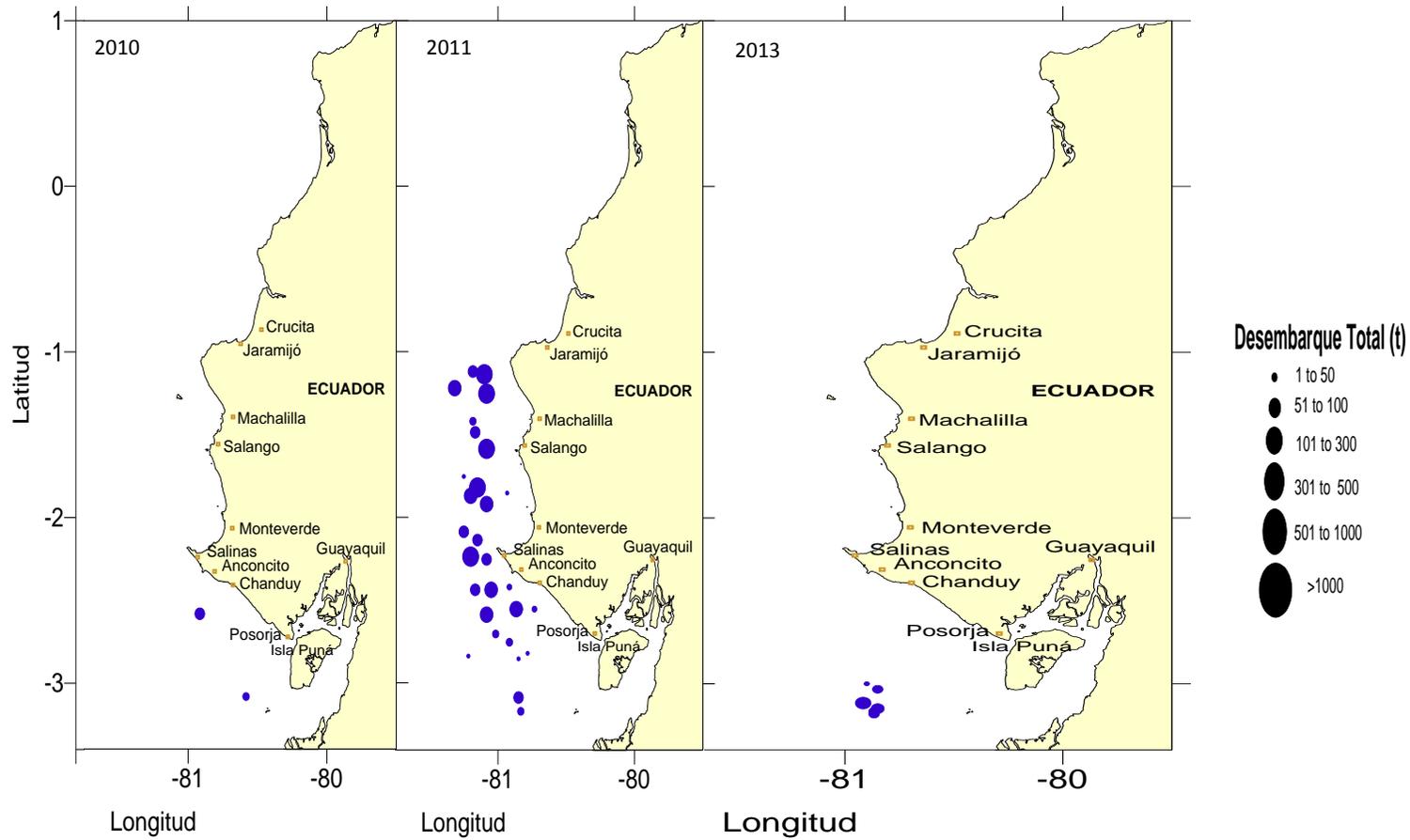


Figure 3. Spatial Distribution of jack mackerel in Ecuadorian waters.



## 2.4 LANDINGS

In Ecuadorian waters, first reports of this specie were identified for Massay (1983); afterwards, in 1984 and 1990, has been reported variables catches (September - October), located in the southern of Gulf of Guayaquil (Aguilar 1992); the landings were associated to secondary species in the small pelagic fishery.

During 1990 jack mackerel represented 2% (4 144 t) of the total landings of small pelagic fish, showing a gradual monthly increase, reaching in 1991 a total of 45 313 t (16%); fishing records of this species were variable in subsequent years, reporting in 1995 up to 174 393 t (45%).

Since 1996 the mackerel catch levels showed a gradual decline, reaching in 2000 a 2% of the total catch made by the purse seine fleet. In 2001 there was a sharp increase in landings of this species, recording 134 011 t, approximately.

During the period 2002 - 2009, the availability of this resource was minimal, reporting catches isolated in 2002, 2007 and 2009 (604 t, 927 t and 1 935 t, respectively).

From the last week of December 2010 were reported catches of jack mackerel off the coast of Ecuador, the same corresponded the 25% of total landings (4 613 t), later during the first quarter of 2011 records landing of the fleet were mostly represented by this resource, accumulating a total of 69 153 t, then disappearing in landings of small pelagic fishes, until August 2012 where there were 104 t. By 2013 there were 2 448 t during the month of January, while for August were 20 t (Table 2, Figure 4).

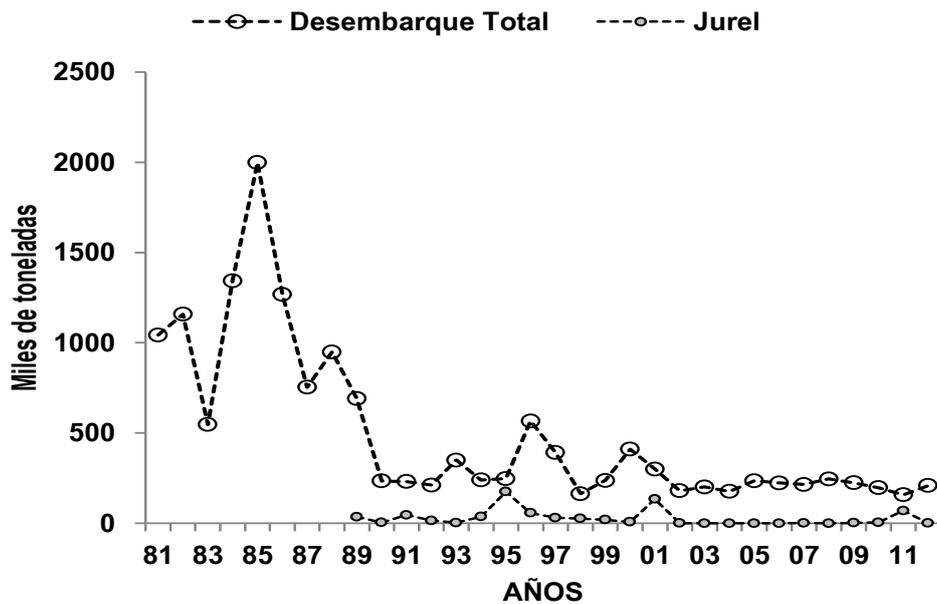
**Table 2.** Historical catches (t) of Jack mackerel in Ecuadorian Waters

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
<b>January</b>	850	26	79	19	3665	8928	850	0	11151	0	40530
<b>February</b>	1139	0	109	876	602	1584	0	0	6377	27	20559
<b>March</b>	0	0	0	9245	21681	8887	161	0	374	68	17685
<b>April</b>	0	0	0	7260	23522	12113	14409	17	611	150	16268
<b>May</b>	8214	0	28	4801	35302	8280	5707	0	157	0	15319
<b>June</b>	1686	247	0	17	11517	3200	9039	1066	26	0	23305
<b>July</b>	10383	193	0	6	8097	6784	0	3589	10	10	345
<b>August</b>	4425	501	0	6	4948	1142	128	13586	0	0	0
<b>September</b>	13556		86	9350	14263	2793	8	1767	349	0	0
<b>October</b>	1799	7510	1028	1162	7658	2232	0	24	17	1307	0
<b>November</b>	3261	4415	1343	12	11676	263	0	544	0	2296	0
<b>December</b>	0	2130	0	3821	31462	576	0	5307	0	3263	0
<b>TOTAL</b>	45313	15022	2673	36575	174393	56782	30302	25900	19072	7121	134011

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
<b>January</b>	0	0	0	0	0	0	0	286	0	53763	0	2448
<b>February</b>	0	0	0	0	0	0	0	356	0	15272	0	9
<b>March</b>	0	0	0	0	0	0	0	132	0	73	0	0
<b>April</b>	0	0	0	0	0	0	0	925	0	45	0	0



May	0	0	0	0	0	0	0	5	0	0	0	0
June	0	0	0	0	0	0	0	0	0	0	0	0
July	0	0	0	0	0	0	0	6	0	0	0	0
August	0	0	0	0	0	927	0	144	0	0	104	20
September	0	0	0	0	0	0	0	63	0	0	0	0
October	397	0	0	0	0	0	0	0	0	0	0	0
November	0	0	0	0	0	0	0	18	0	0	0	0
December	207	0	0	0	0	0	0	0	4613	0	0	0
<b>TOTAL</b>	<b>604</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>927</b>	<b>0</b>	<b>1935</b>	<b>4613</b>	<b>69153</b>	<b>104</b>	<b>2477</b>

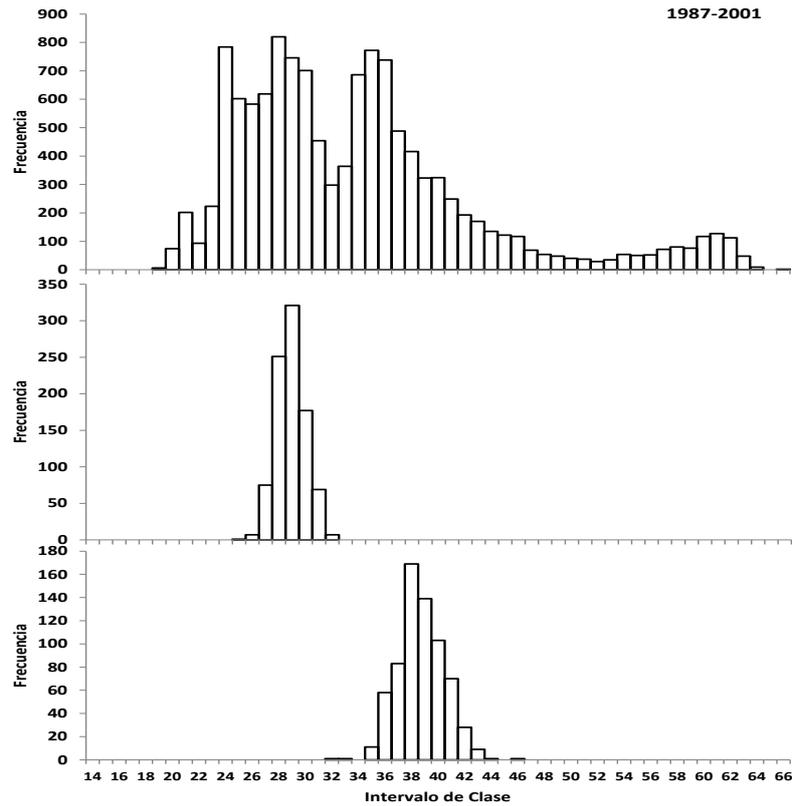


**Figure 4.** Total annual landing (t) of small pelagic fishes versus jack mackerel.

### 3. BIOLOGICAL ASPECTS

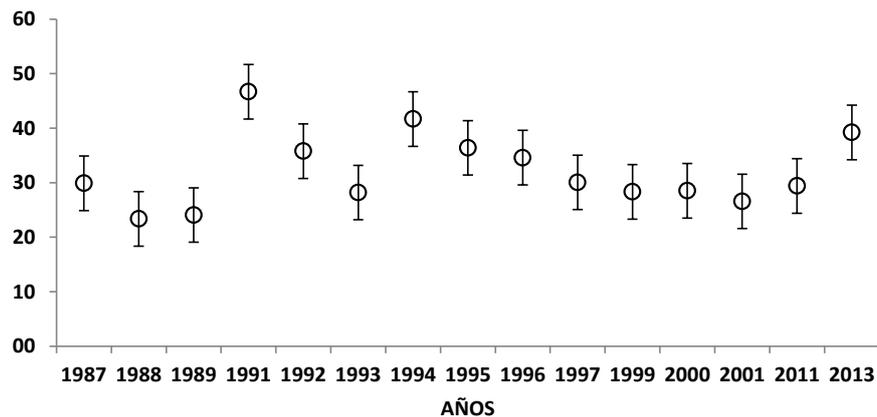
#### 3.1 SIZE STRUCTURE

The size structure of mackerel caught by the Ecuadorian fleet of small pelagic fish can be described in two phases or periods: 1) the composition for the years 1987 to 2001 ranged between 19 and 66 cm TL, mostly represented by individuals between 24 and 36 cm TL (65.8%), 2) in 2011, the structure was composed of organisms between 25 and 32 cm TL, made up largely of individuals between 28 and 29 cm TL (63%), and 3) for the 2013 the size range was between 32 and 46 cm TL, with greater presence of organisms between 38 and 40 cm TL (61%) (Figure 5).



**Figure 5.** Size structure of Jack mackerel in Ecuadorian waters.

Figure 6 shows the average catch size for the period under review, highlighting the years 1991, 1994 and 2013 with the highest recorded values (46.7, 41.7 and 39.2 cm TL, respectively).



**Figure 6.** Average catch size of Jack mackerel registered in Ecuadorian waters.

In general, due to the sporadic presence of the resource in Ecuadorian waters, it is not possible to define clear trends from the available size structure, or capable of displaying the entry of recruitments or track cohort, and project on the stock structure.

Additionally, as an exercise it was used data of size composition and were admitted in an integrated model called statistical of capture at size (MECCT), modified by Canales et al (2011) and codified in ADBM (Automatic Difference Model Builder), considering the assumptions necessary to run the model, it was used as seed values, the studies reported in the literature and reports both Peru and Chile. The parameters obtained were  $L_{\infty} = 61.88$ ,  $K = 0.178$  y  $L_0 = 19.94$  (figure 7).

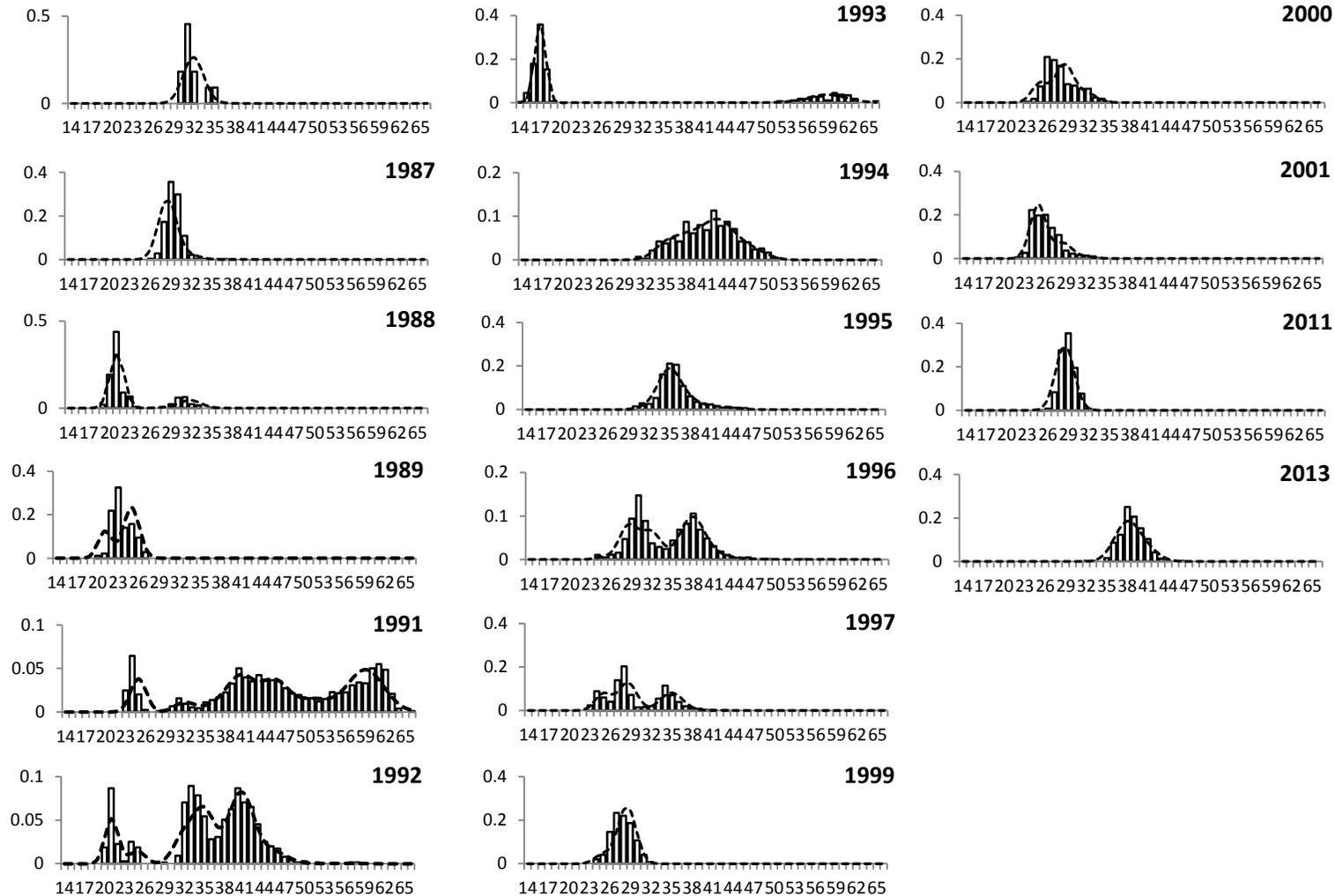
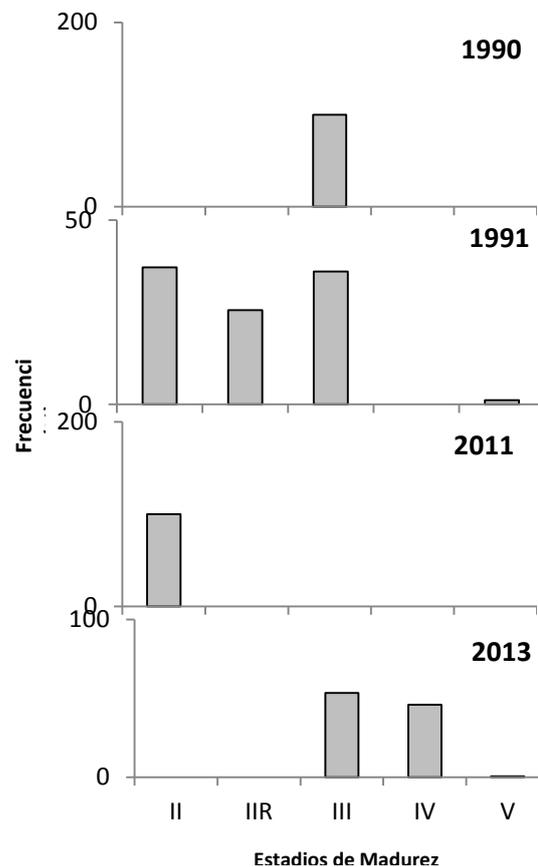


Figura 7. Size structure of Jack mackerel, using model MECCT (líneas).



### 3.2 SEXUAL MATURITY

The analysis of the variation of gonadal development recorded for females, in the different years in which samples were obtained, presents individuals at different stages of maturity, was observed during the years 1990, 1991 and 2013 the presence of mature organism (stages III and IV), while for the year 2011 all captured individuals were found in stage II (figure 8).

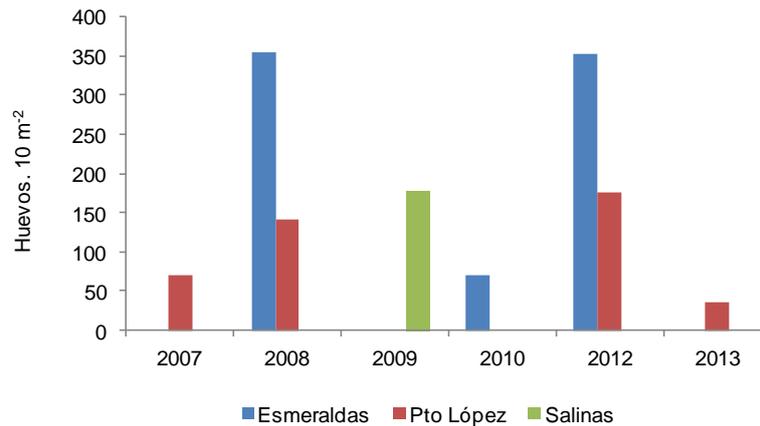


**Figure 8.** Sexual maturity of jack mackerel (females).

### 3.3 EGGS AND LARVAE

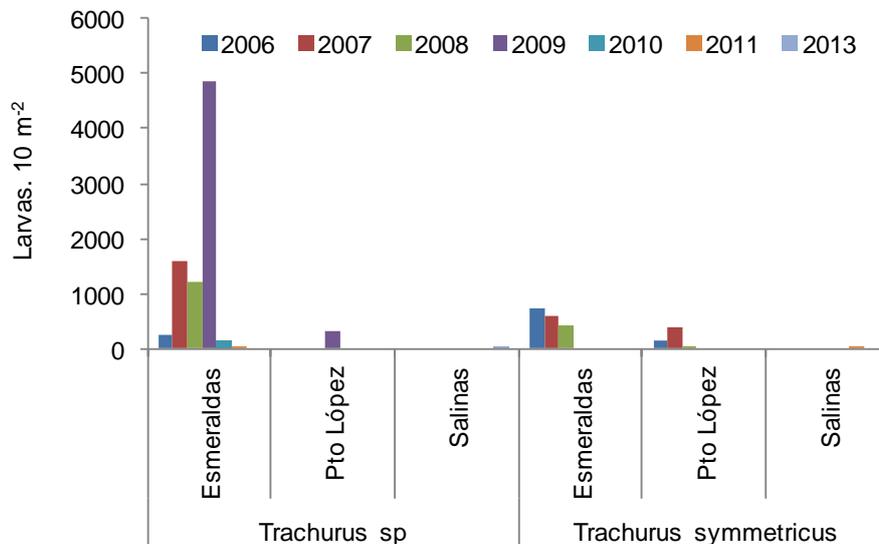
From the results of the fixed stations of Esmeraldas, Puerto Lopez and Salinas from 2006 to May 2013, it was identified five species of Carangidae family, including *Trachurus symmetricus*, and *Trachurus* sp, commercially important species, known as jack mackerel.

For the first stage (eggs) were identified *Trachurus* sp., being more abundant in the Esmeraldas area during 2008 and 2012, while for the Salinas zone only recorded in 2009, for the Puerto López zone is presented more often this species in the egg stage (Figure 9).



**Figura 9.** Abundance of eggs of *Trachurus* sp., during 2006 - 2013

But for fish larvae were identified *Trachurus* sp, and *Trachurus symmetricus* who recorded their highest abundance in the Esmeraldas descending in Puerto Lopez and being almost absent in Salinas. The highest density of these organisms was recorded in 2009, a year which was considered as the second warmest year globally according to NASA by Agency EFE - 21/01/2010 (Figure 10)



**Figure 10.** Abundance of larvae of *Trachurus* sp., and *Trachurus symmetricus* during 2006 – 2013.



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