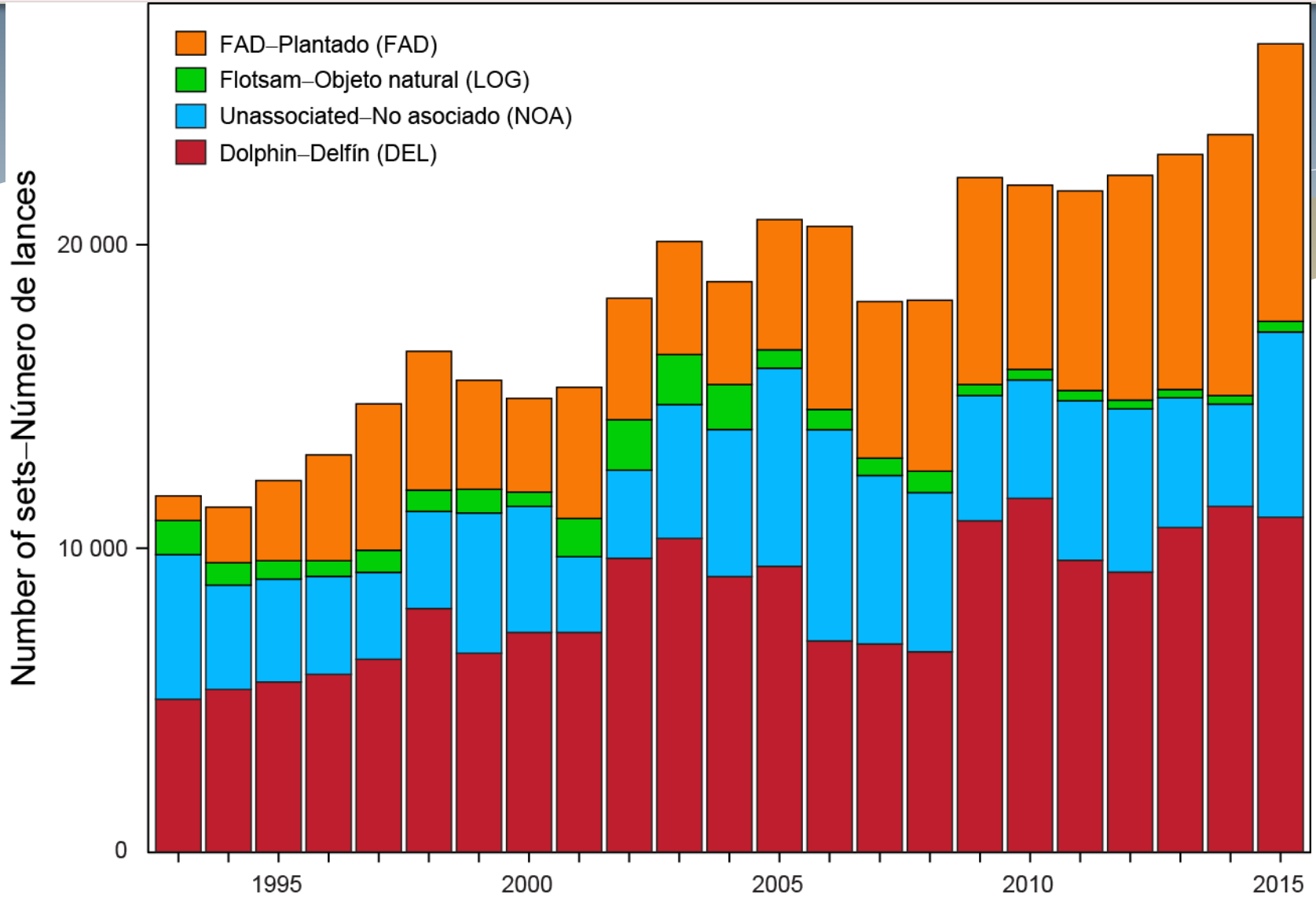
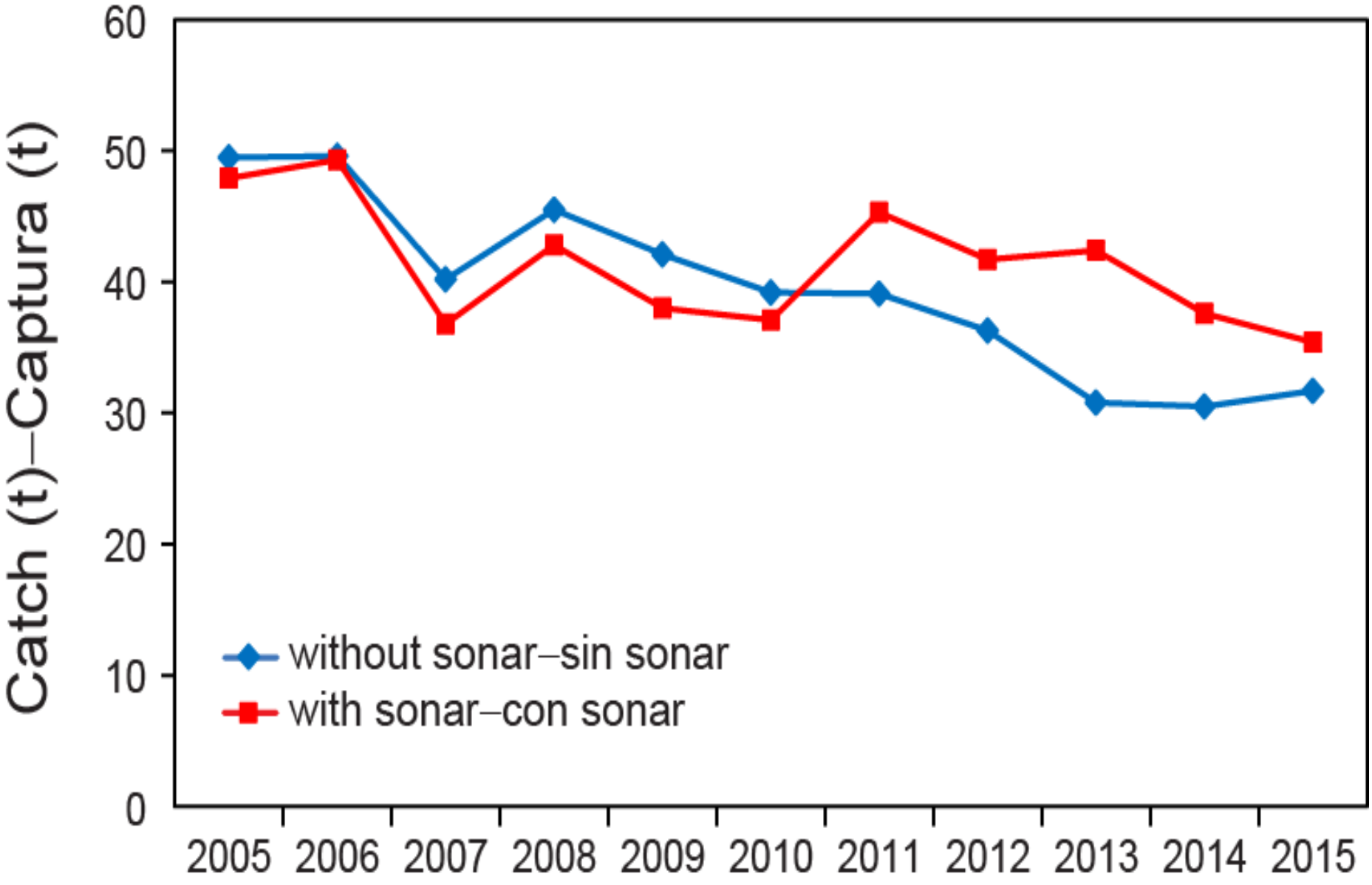
SAC-07-03e The fishery on FADs in the eastern Pacific Ocean

7ª Reunión del Comité Científico Asesor
7th Meeting of the Scientific Advisory Committee

Numbers of sets by type/Numero de lances por tipo



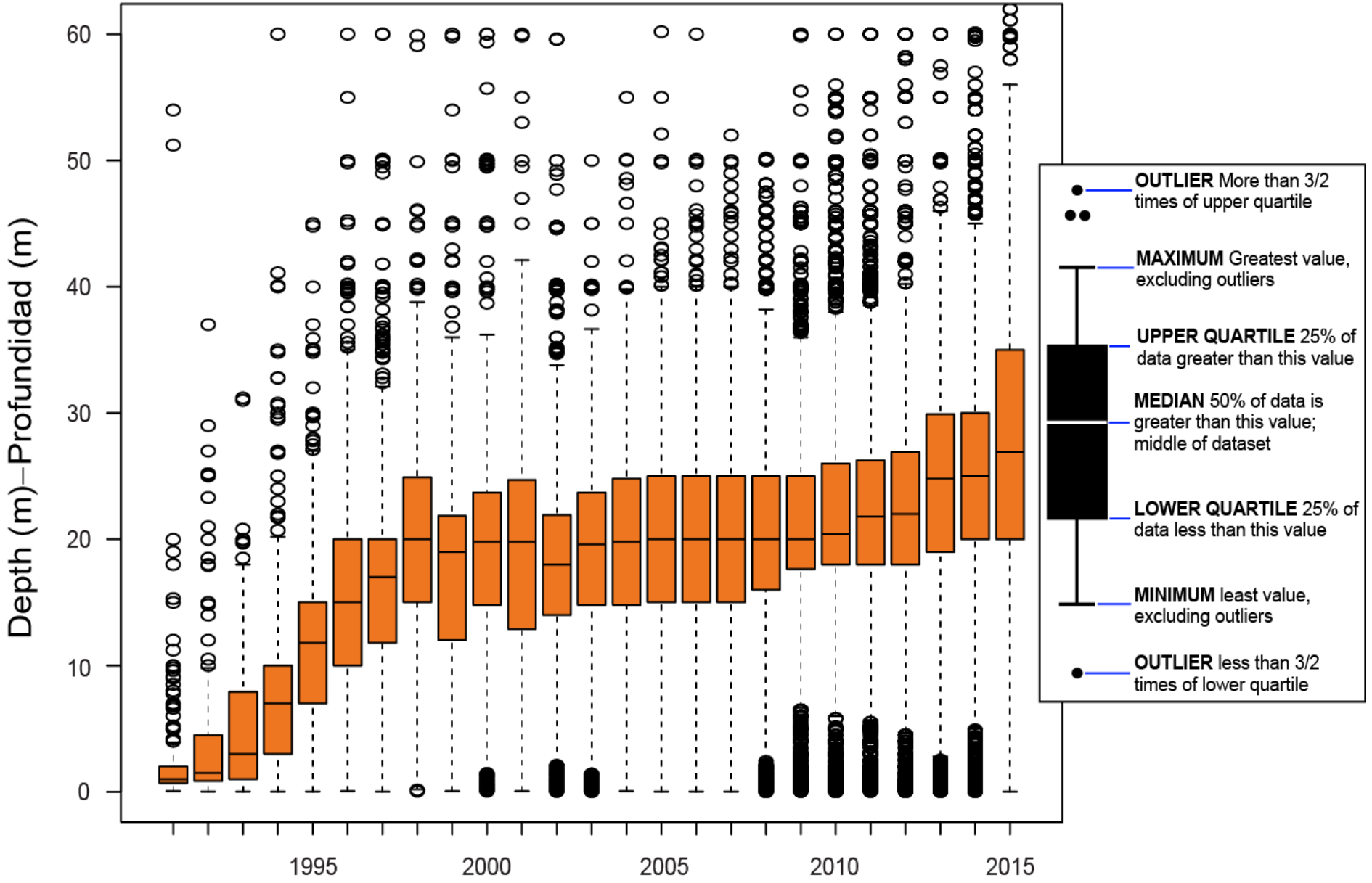
Tuna capture vs echosounder use/captura de atun vs uso de ecosonda



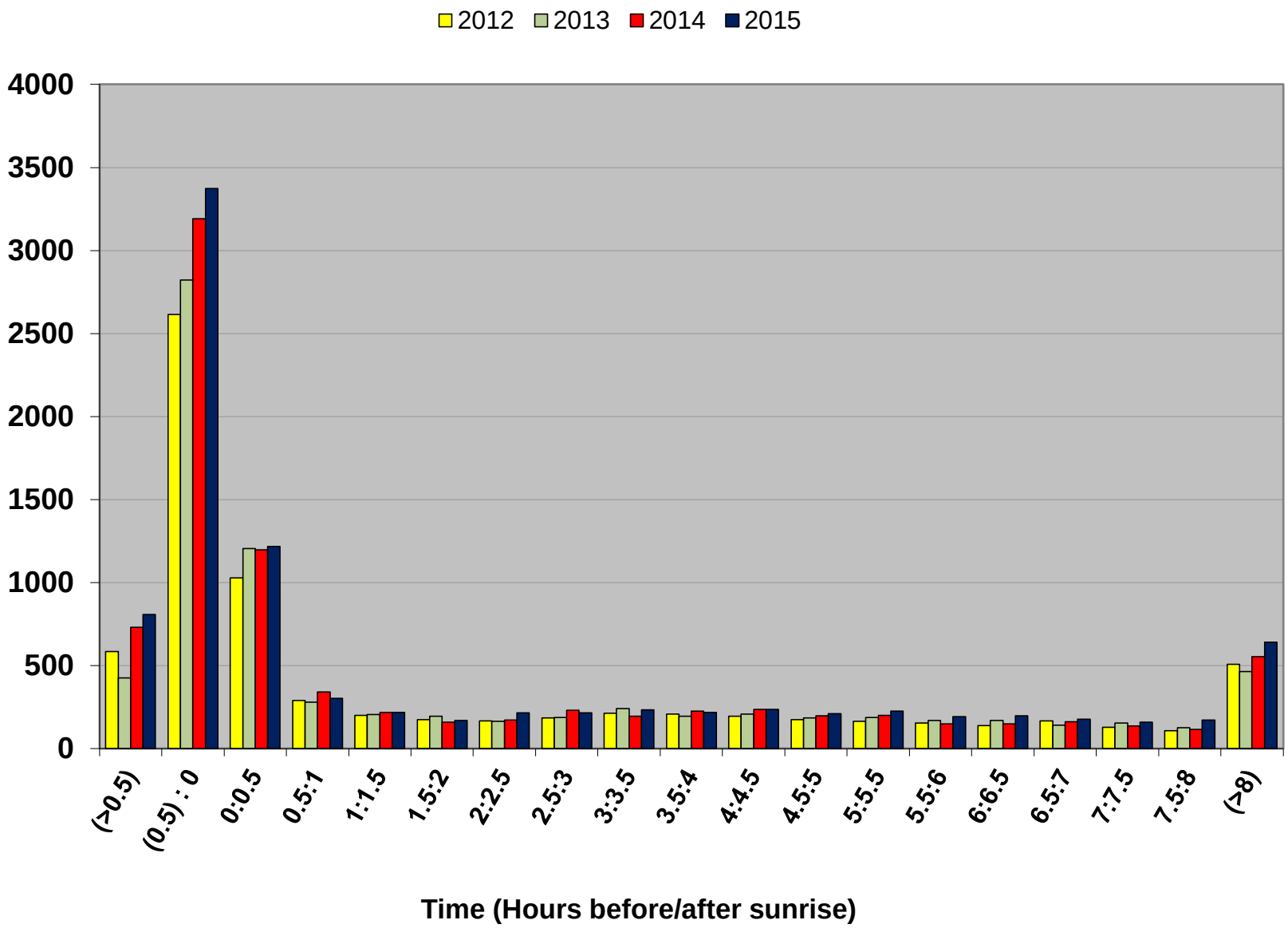
Echosounder use/Uso de ecosondas

		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Without sonar	FAD deployments	87.7	87.8	83.0	79.2	70.8	76.0	74.7	66.9	56.4	37.7	31.1
With sonar	FAD deployments	12.3	12.2	17.0	20.8	29.2	24.0	25.3	33.1	43.6	62.3	68.9

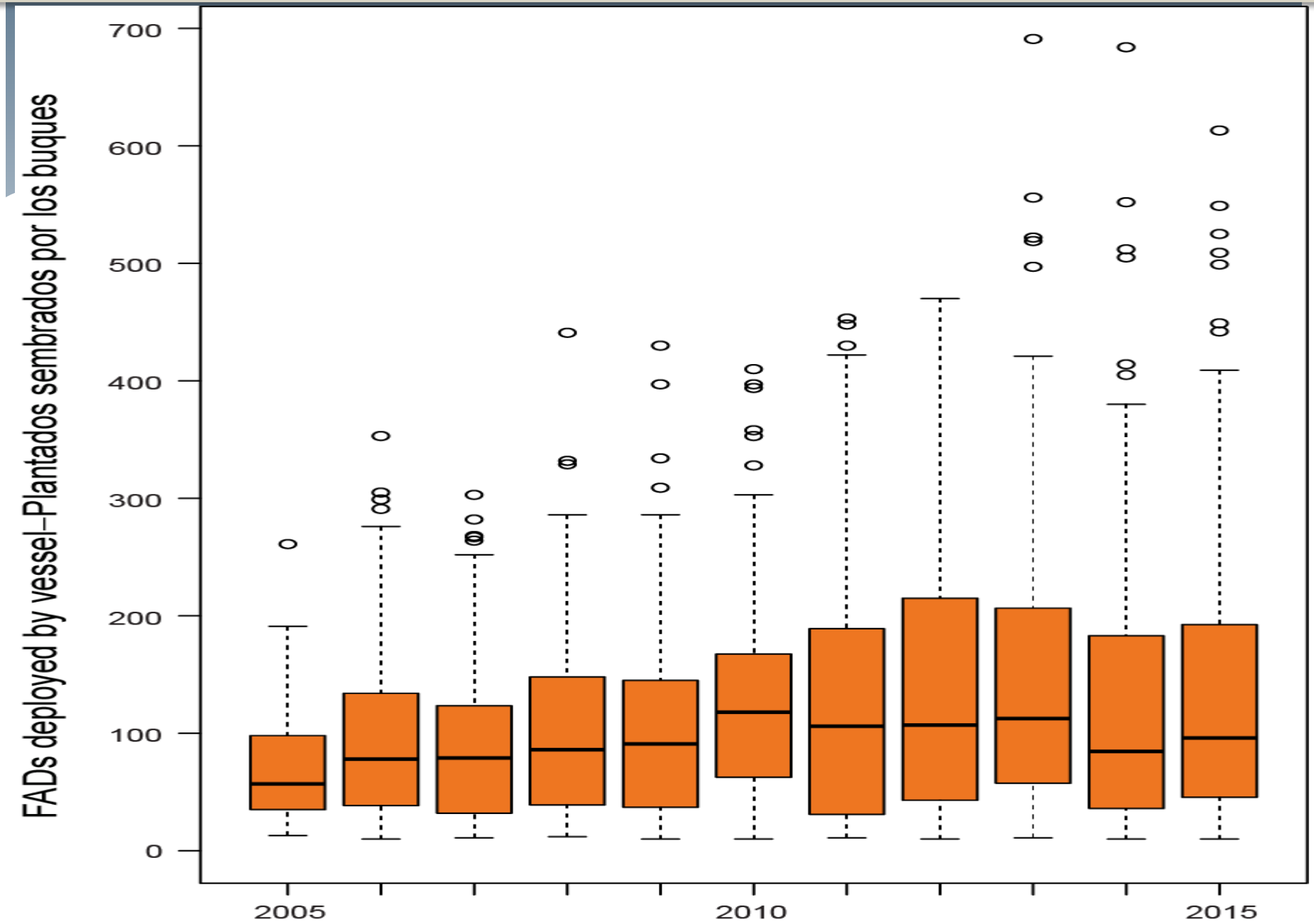
Depth of net under FAD/Profundidad del rabo



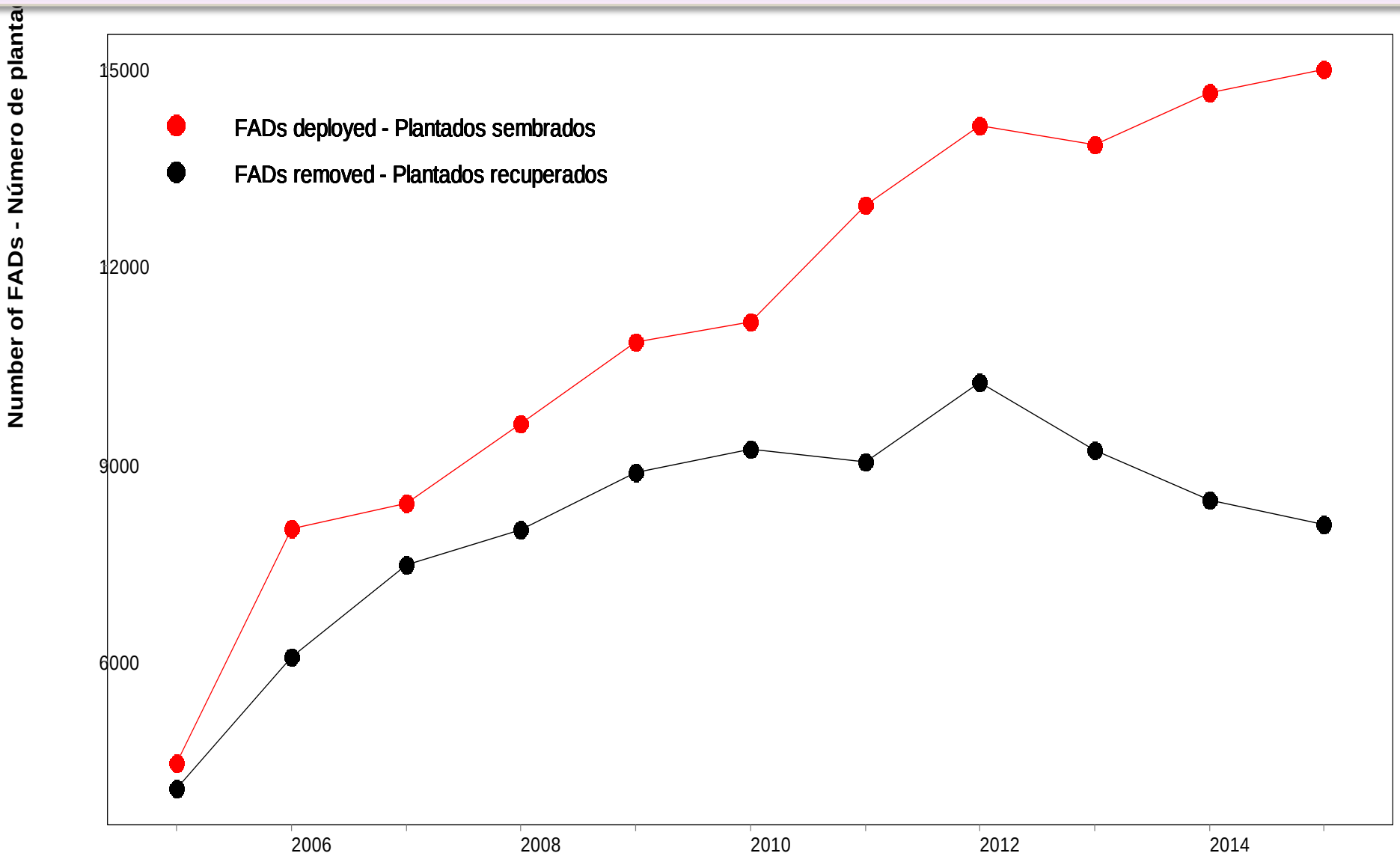
Time of FAD sets/Hora de lances



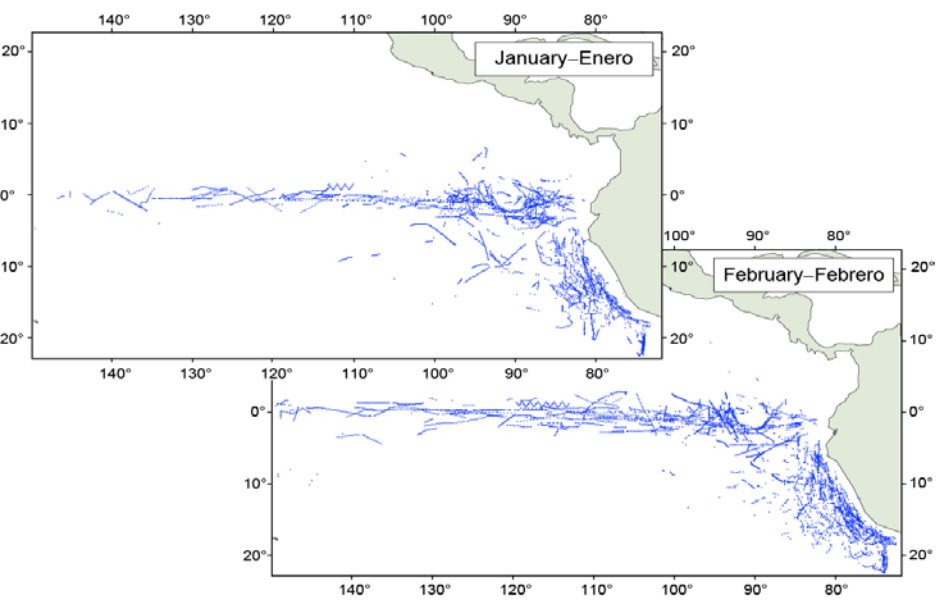
Nr FADs deployed by vessel/no de plantados por barco

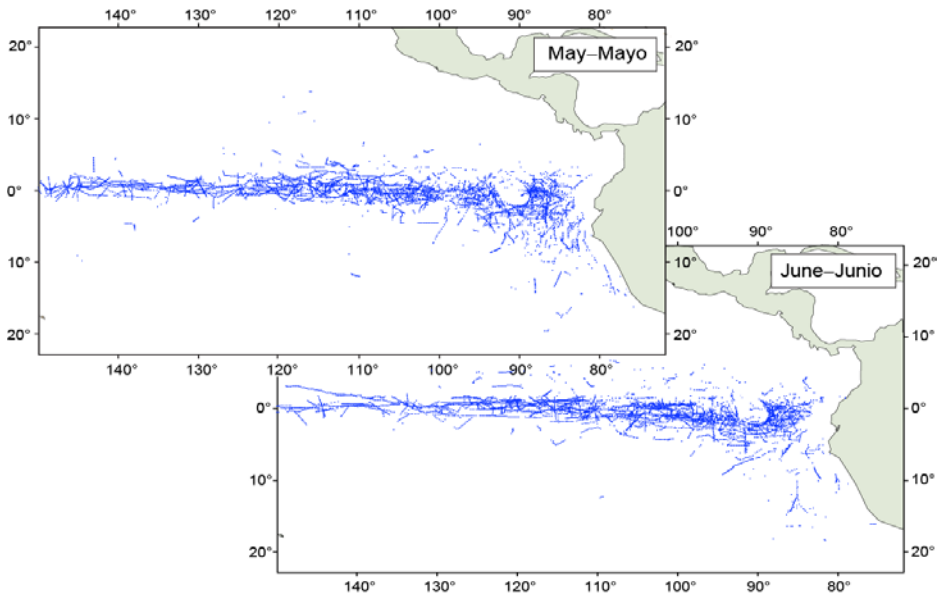


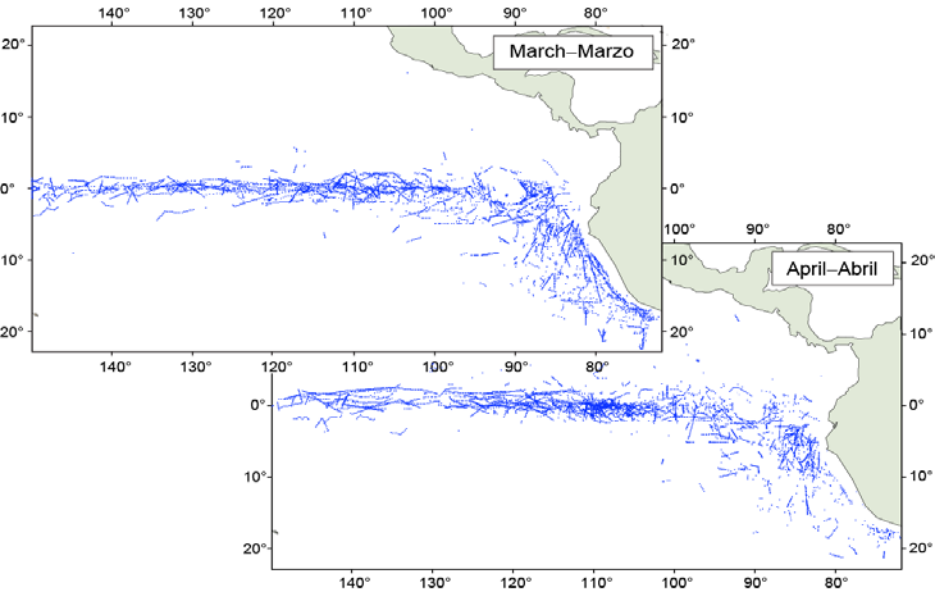
Nr of FADs deployed and recovered/no de plantados y recuperados 2011-15

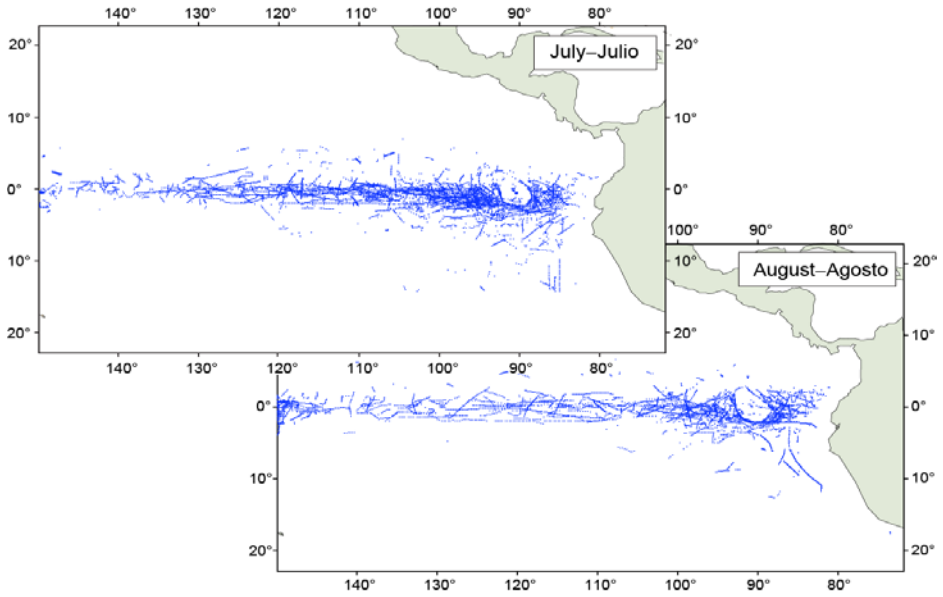


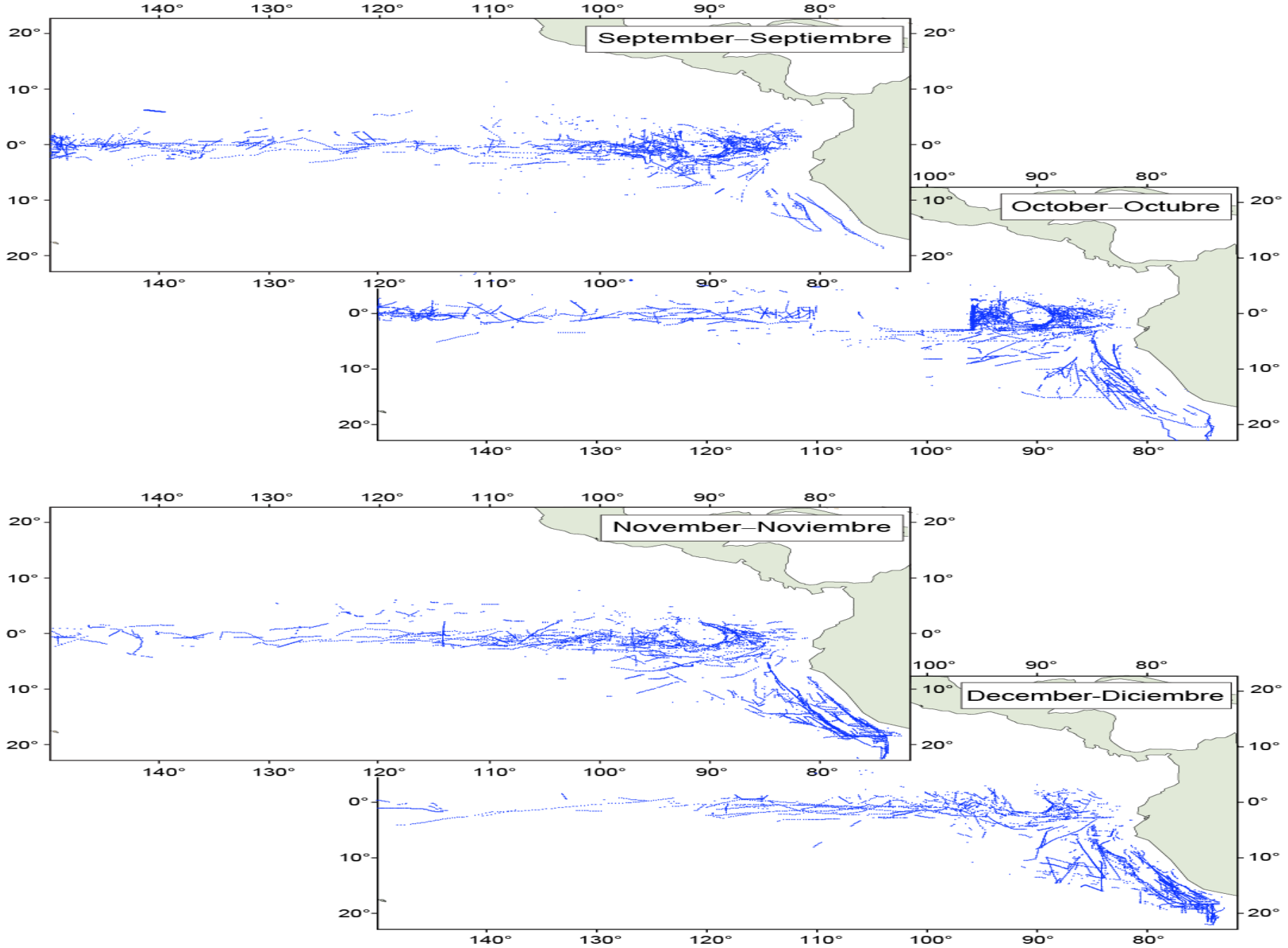
Locations of deployment by month/lugares de plantado por mes
2011 - 2015



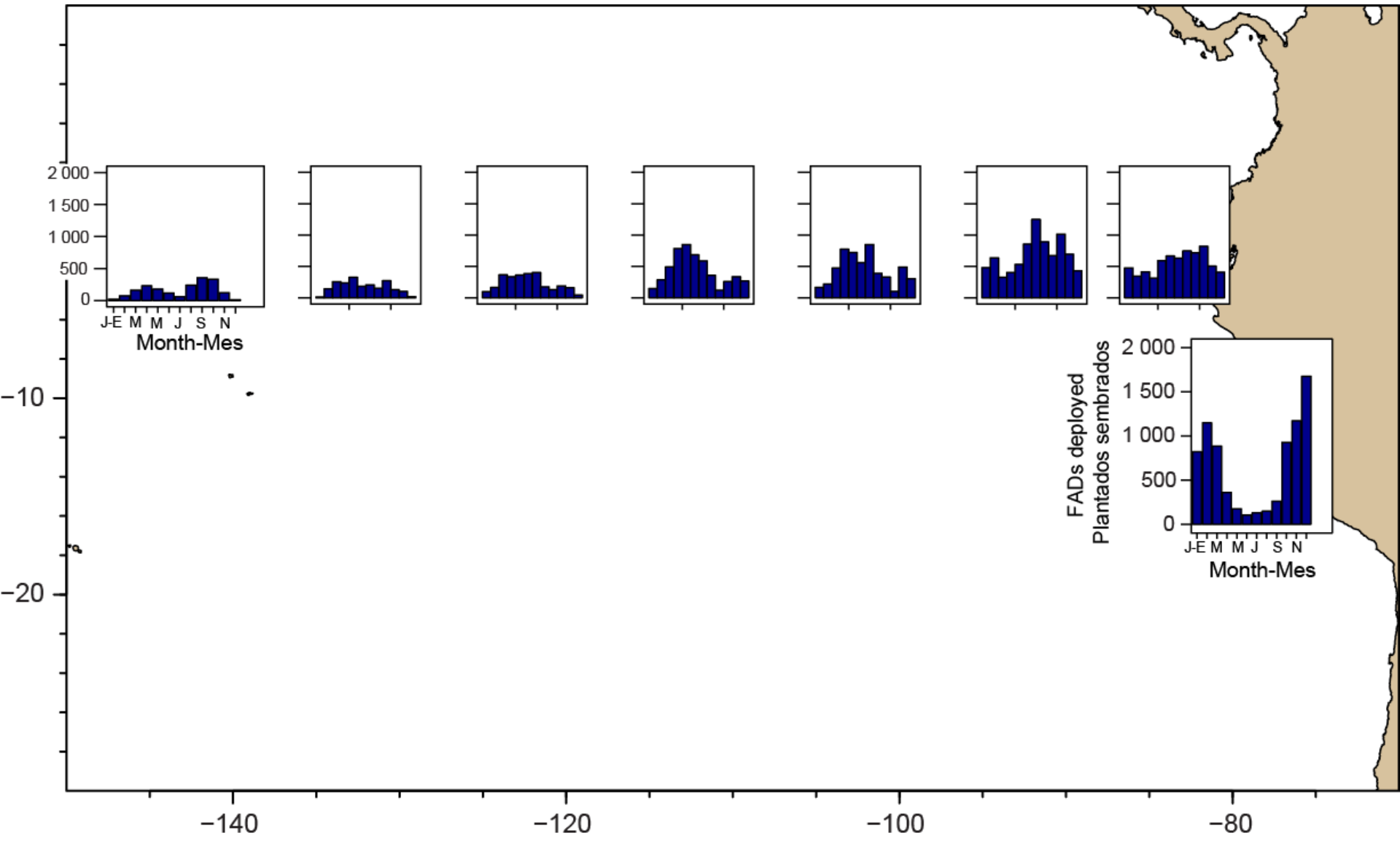




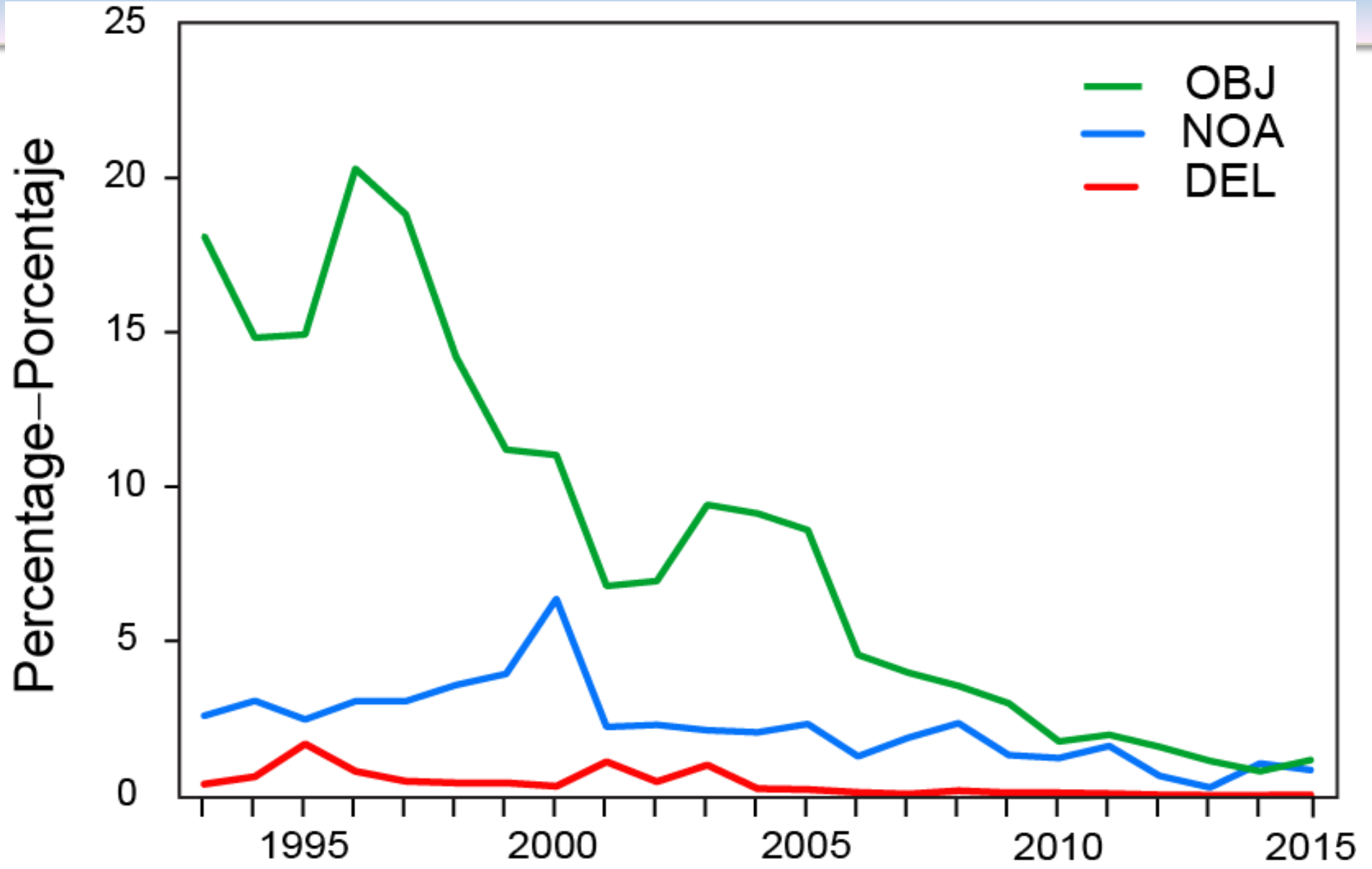



September–Septiembre
October–Octubre
November–Noviembre
December-Diciembre
140°
130°
120°
110°
100°
90°
80°
20°
10°
0°

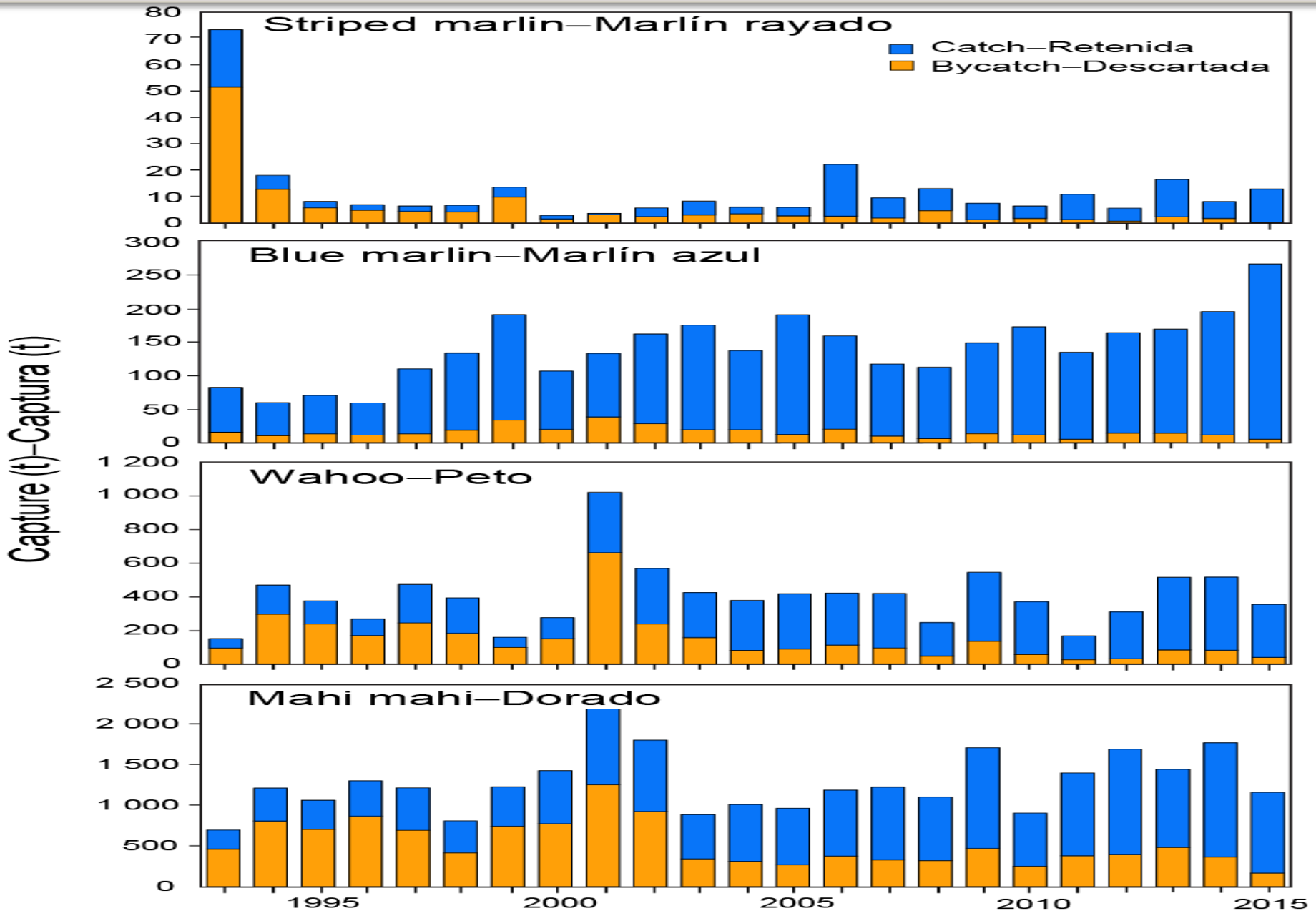
Seasonal distribution of deployments/Distribucion estacional de plantados

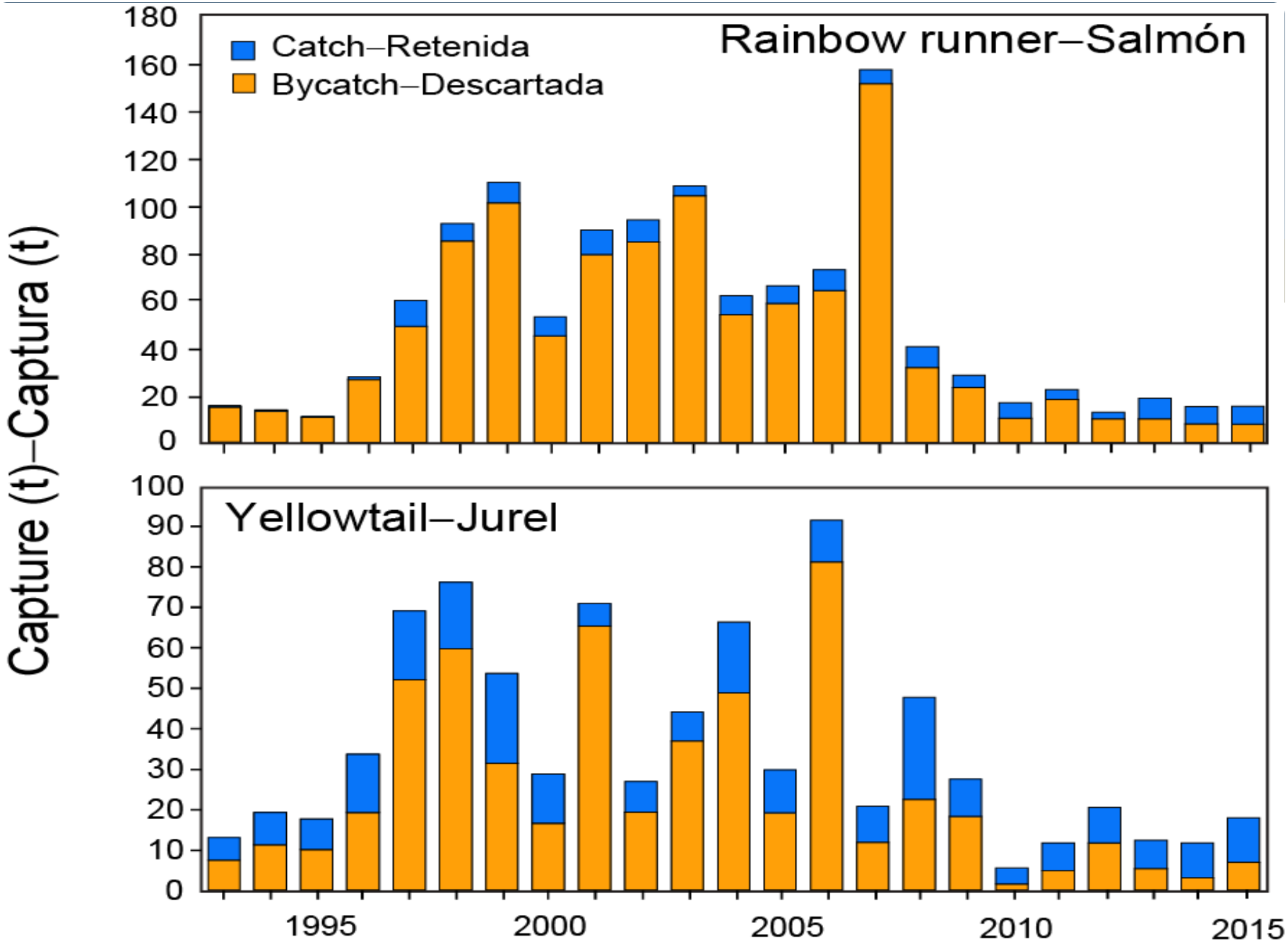


Tuna discards by set type 1993-2015

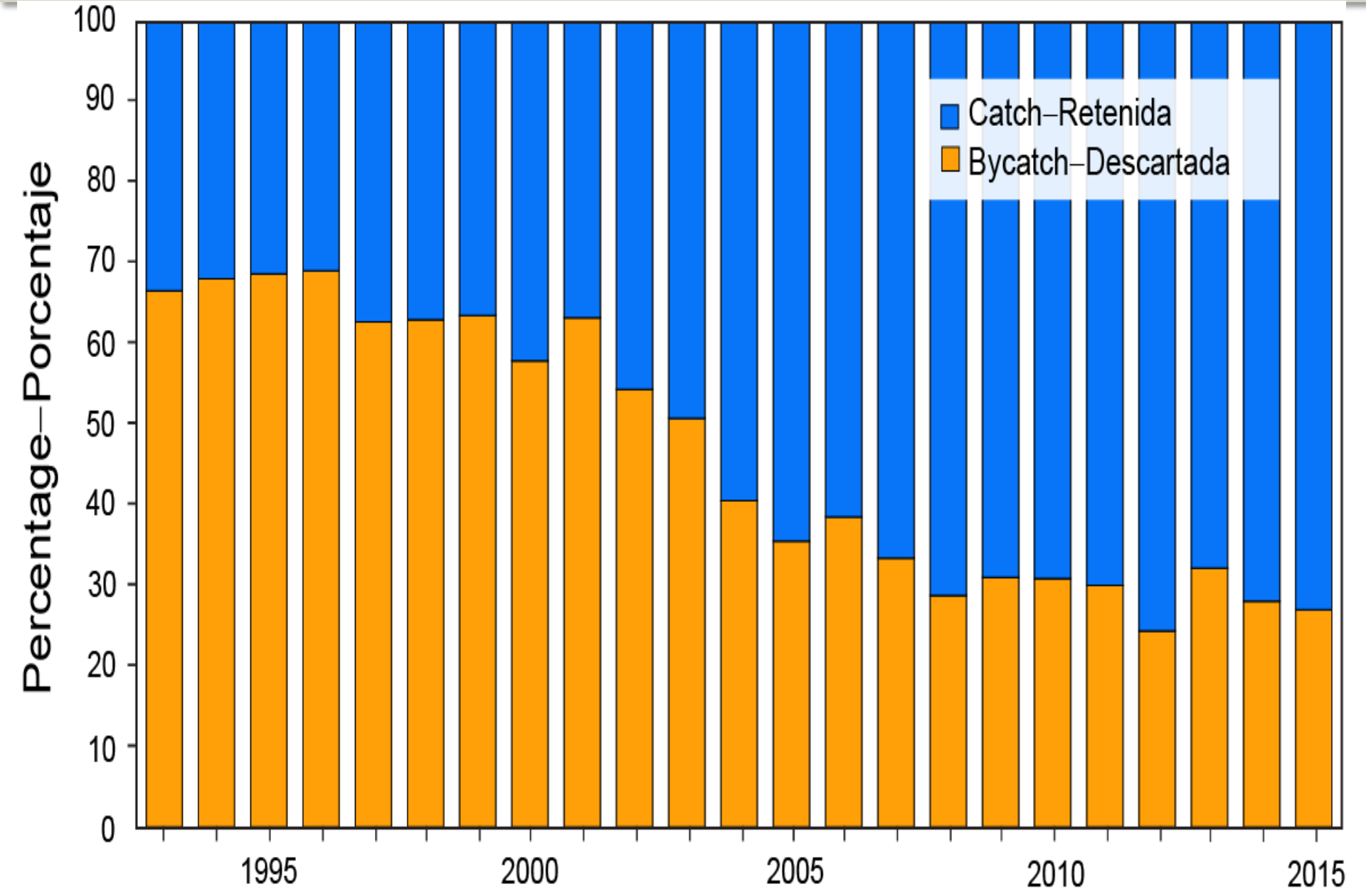


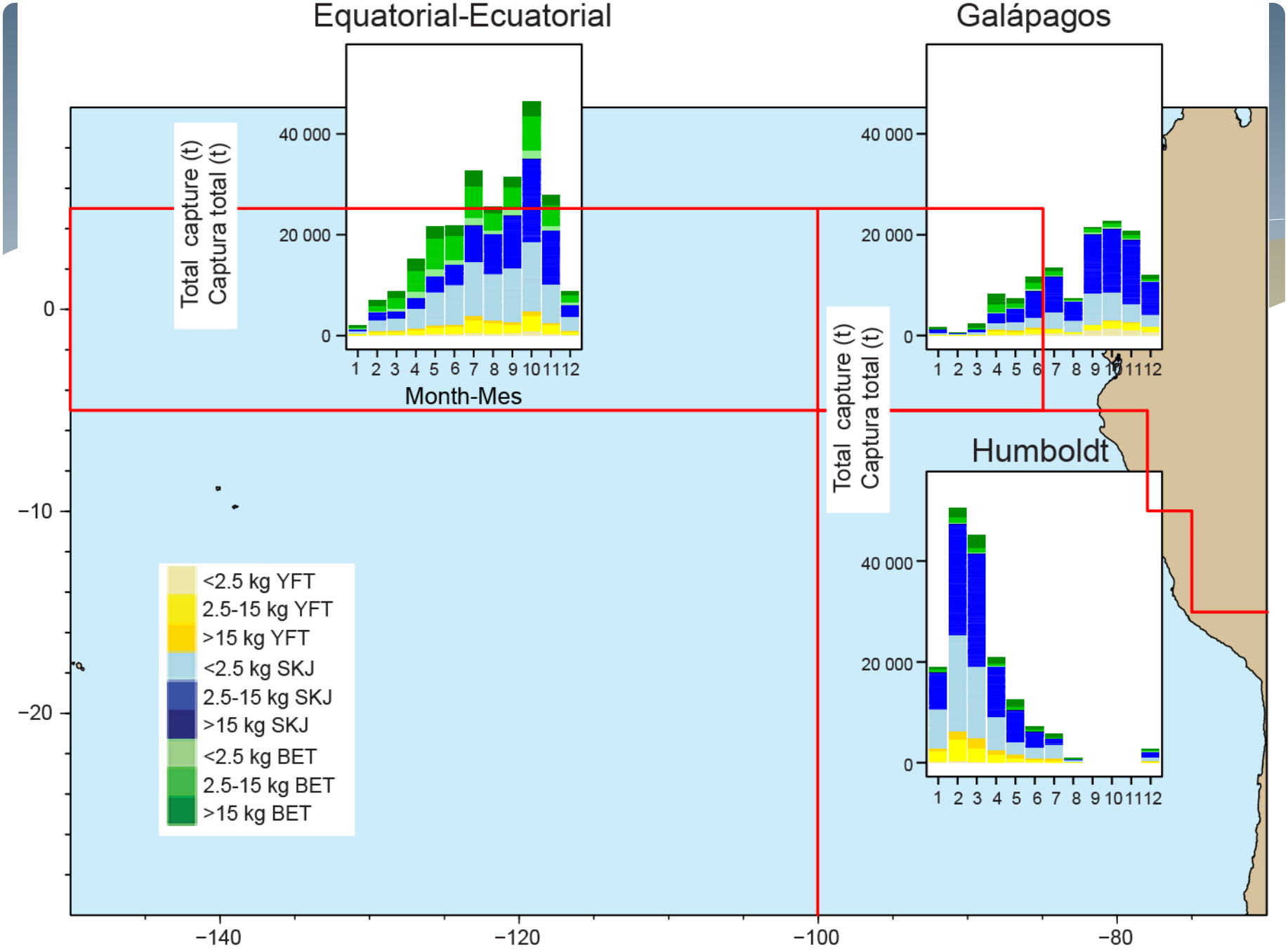
CAPTURE utilization/Utilizacion de la captura

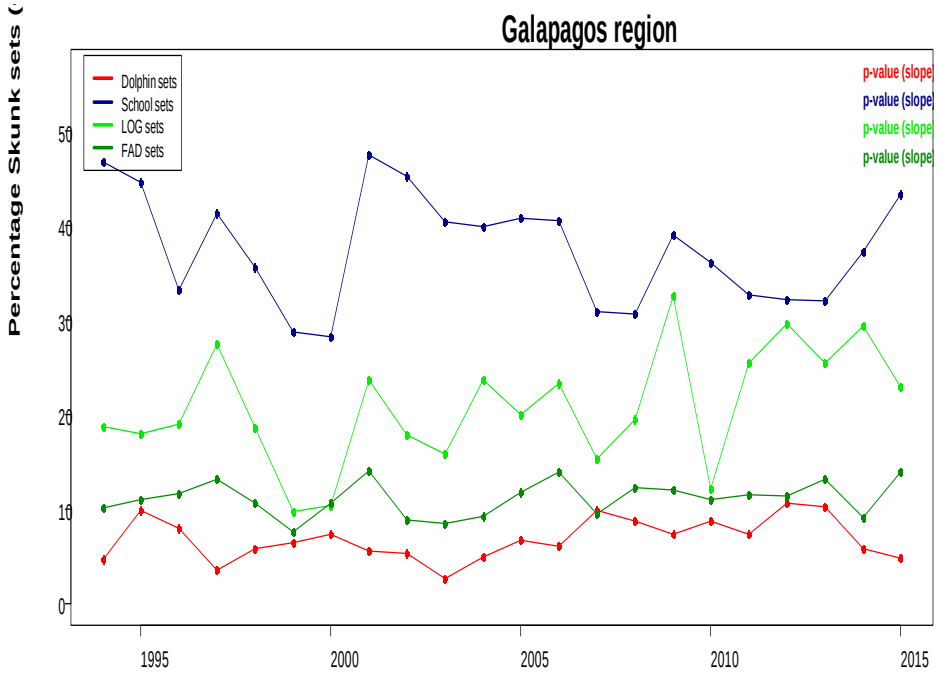


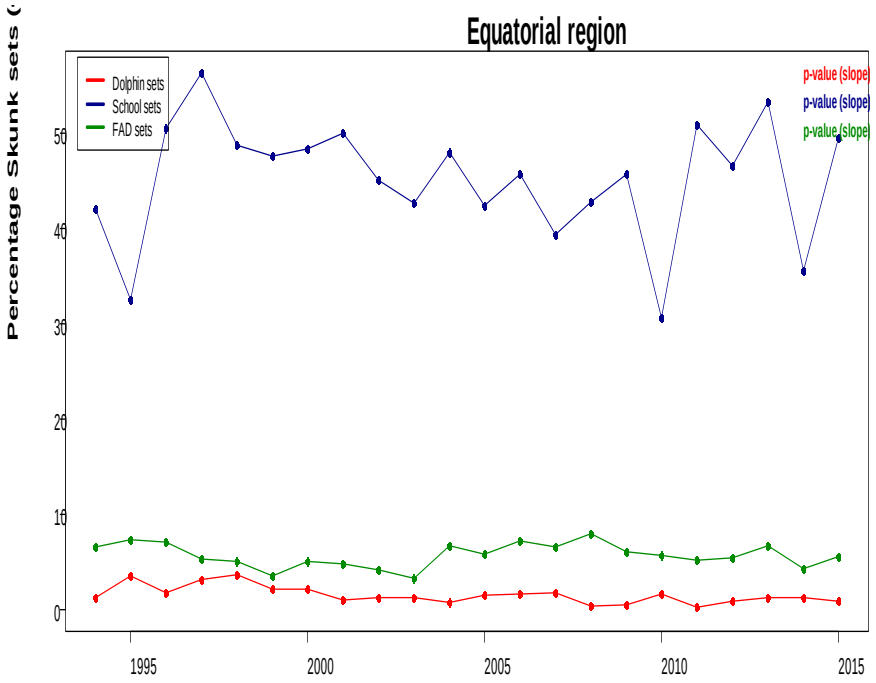

Capture (t)–Captura (t)
Catch–Retenida
Bycatch–Descartada
Rainbow runner–Salmón
Yellowtail–Jurel
180
160
140
120
100
80
60
40
20
0
100
90
80
70
60
50
40
30
20
10
0
1995
2000
2005
2010
2015

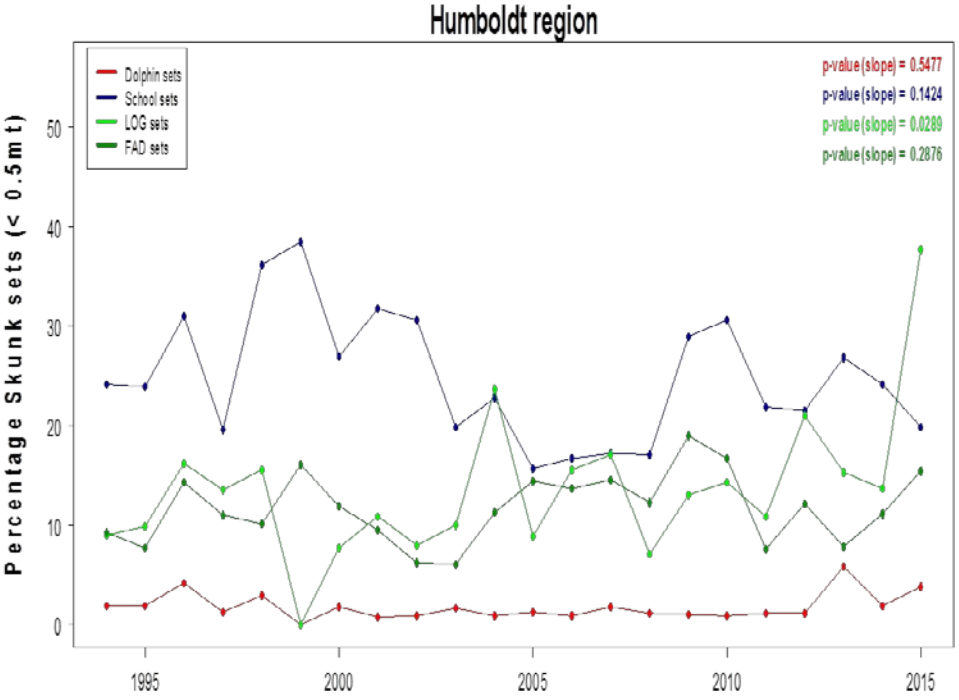
Capture utilization/Utilizacion de la captura



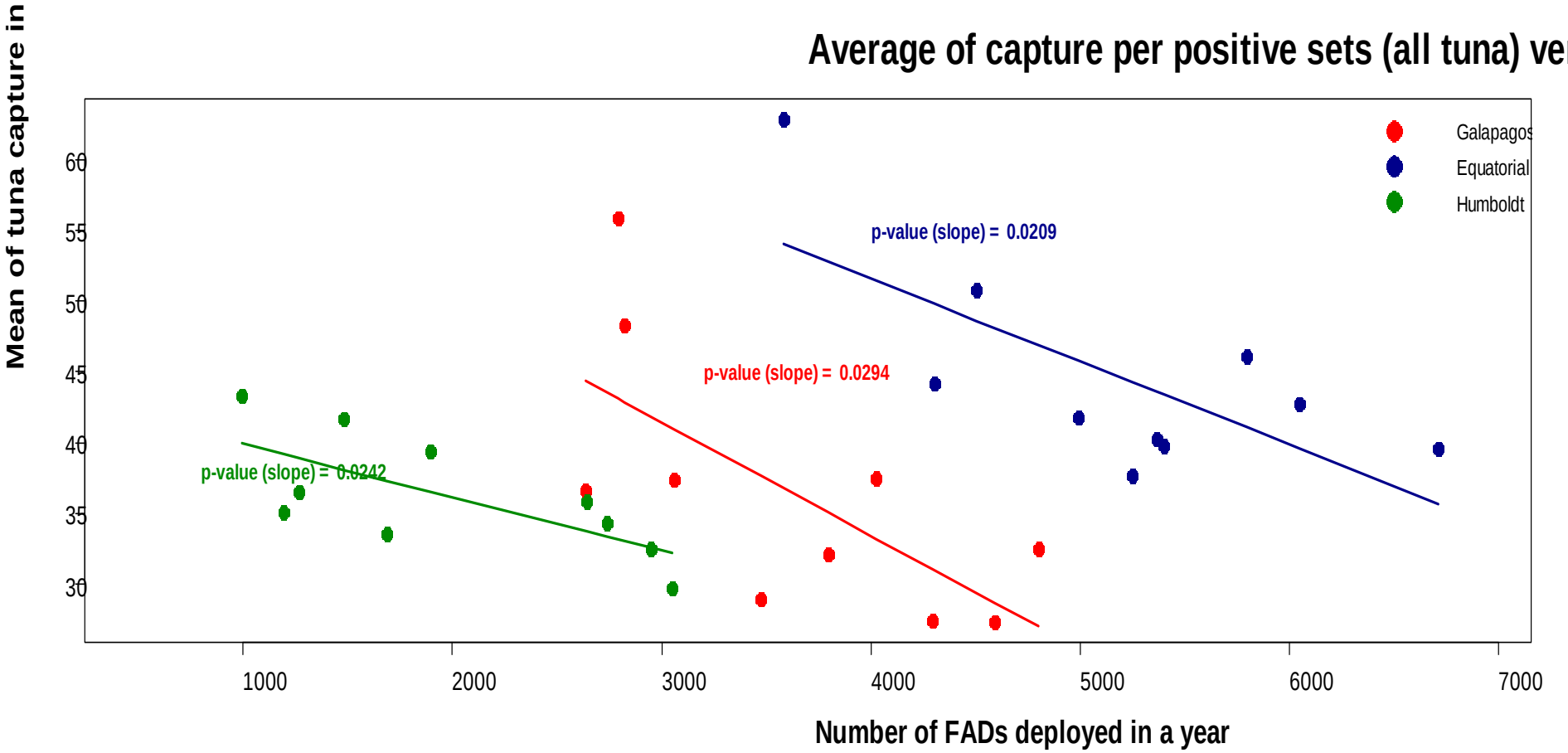

Equatorial-Ecuatorial
Galápagos
Humboldt
Total capture (t)
Captura total (t)
40 000
20 000
0
1 2 3 4 5 6 7 8 9 10 11 12
Month-Mes
<2.5 kg YFT
2.5-15 kg YFT
>15 kg YFT
<2.5 kg SKJ
2.5-15 kg SKJ
>15 kg SKJ
<2.5 kg BET
2.5-15 kg BET
>15 kg BET
0
−10
−20
−140
−120
−100
−80



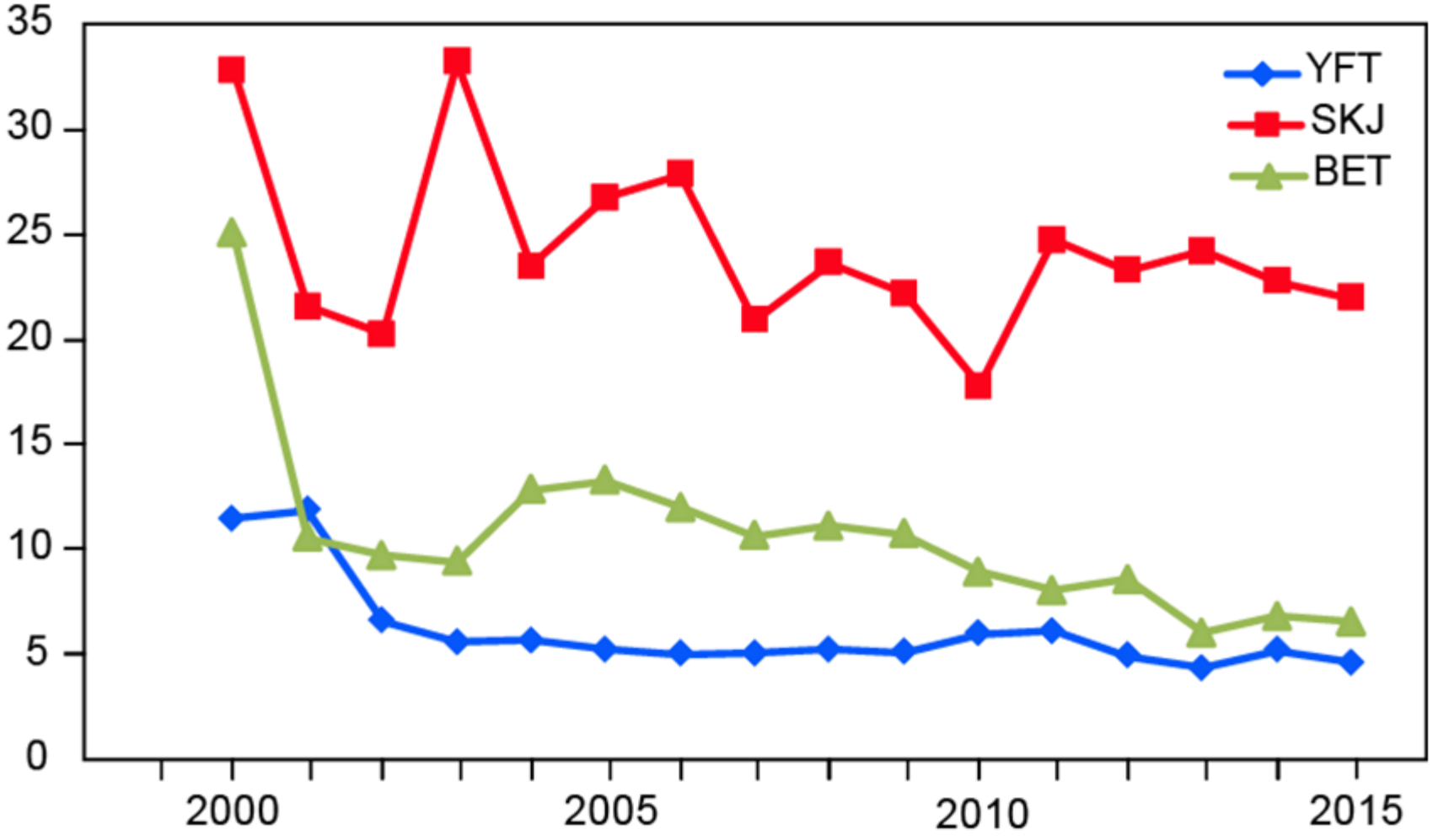




No clear trends in the % of skunk sets but there are regional differences


Average of capture per positive sets (all tuna) ver
Mean of tuna capture in
Number of FADs deployed in a year
Galapagos
Equatorial
Humboldt
p-value (slope) = 0.0209
p-value (slope) = 0.0294
p-value (slope) = 0.0242
60
55
50
45
40
35
30
1000
2000
3000
4000
5000
6000
7000

Catch per set by species
(NOT only positive sets; NOT regionalized)



Hypotheses for the decline in CPPS

CPPS is NOT a measure of CPUE in the traditional sense that is used as an index of abundance.
It is mostly an "ecological index" perhaps related to prey abundance, productivity, etc., or it could be a measure of the "encounter rate" between tuna schools and FADs.

a) With many FADs in an area, there are many "attractors" for the tuna schools. In the past, perhaps 2,3 or more schools converged in the same FAD. Now, fewer schools per FAD are the norm.

b) Schools are smaller because of ecological or environmental changes (e.g. prey abundance, thermocline depth, etc.)

c) FADs are set on sooner than in the past, so schools don't have time to accumulate.

d) Smaller schools reflect lower abundance of one or more species

Assumption

Most of the school is caught in the set

Uncertainties:

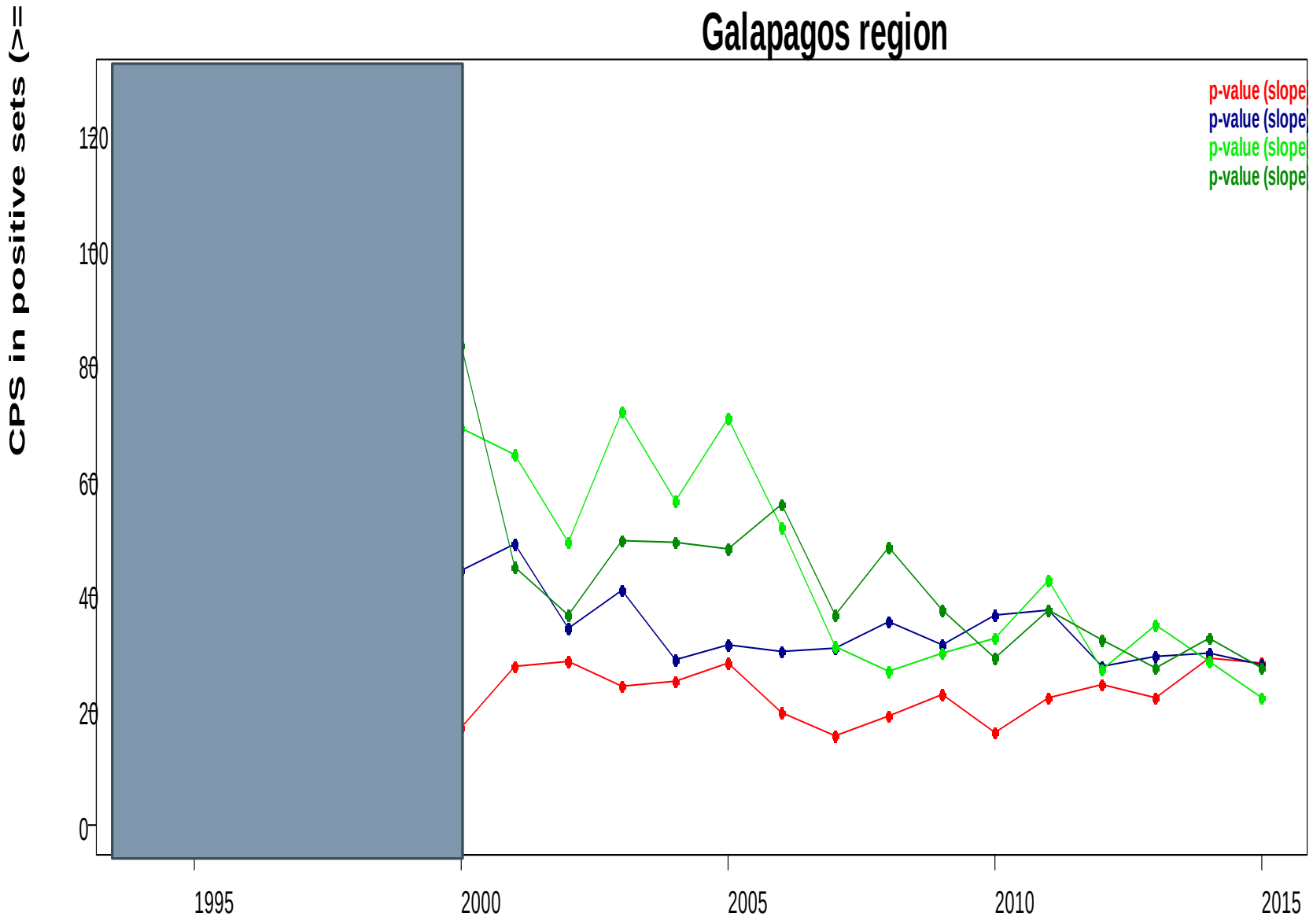
Are there many pure schools that only merge under the FADs?

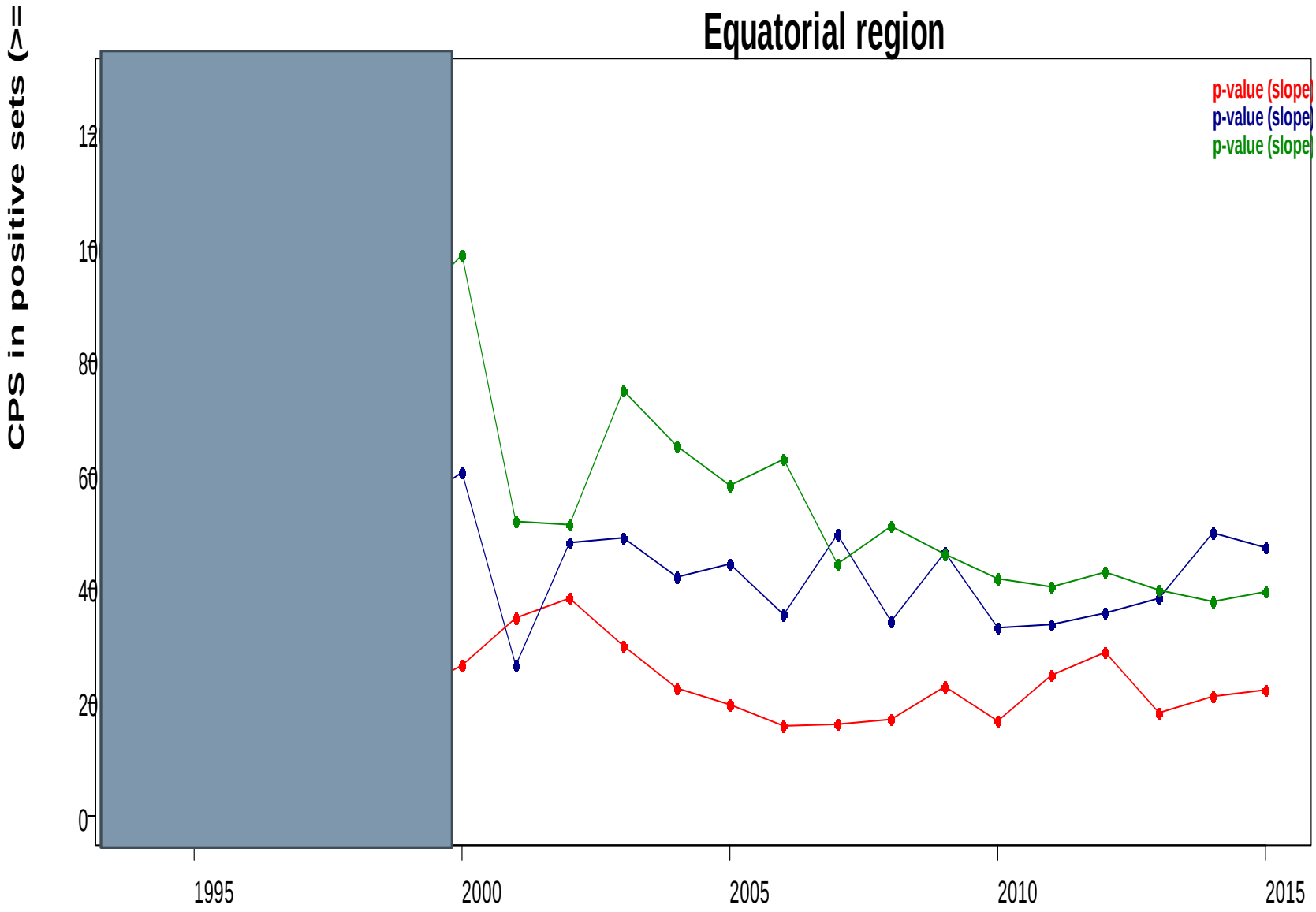
Or

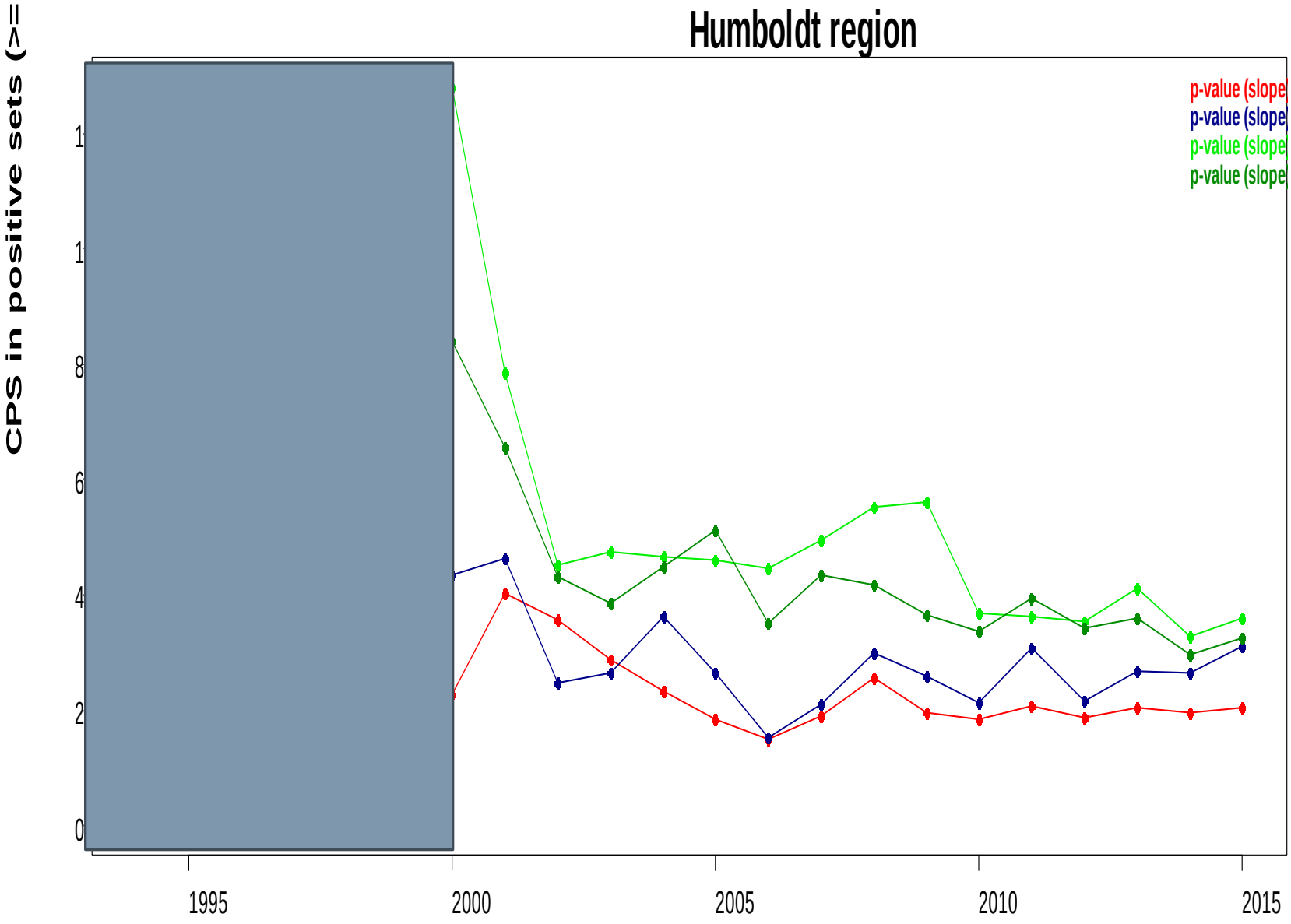
Are there many mixed schools that join the FAD as a group?

Or

Which is the balance of the previous two options?

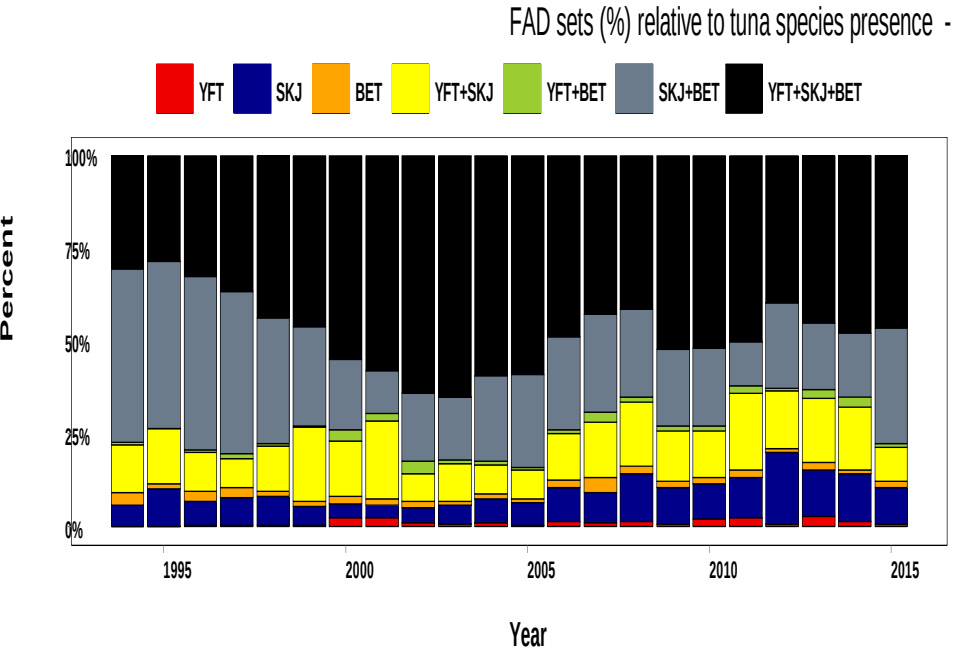

Galapagos region
CPS in positive sets (>=
p-value (slope)
p-value (slope)
p-value (slope)
p-value (slope)
0
20
40
60
80
100
120
1995
2000
2005
2010
2015

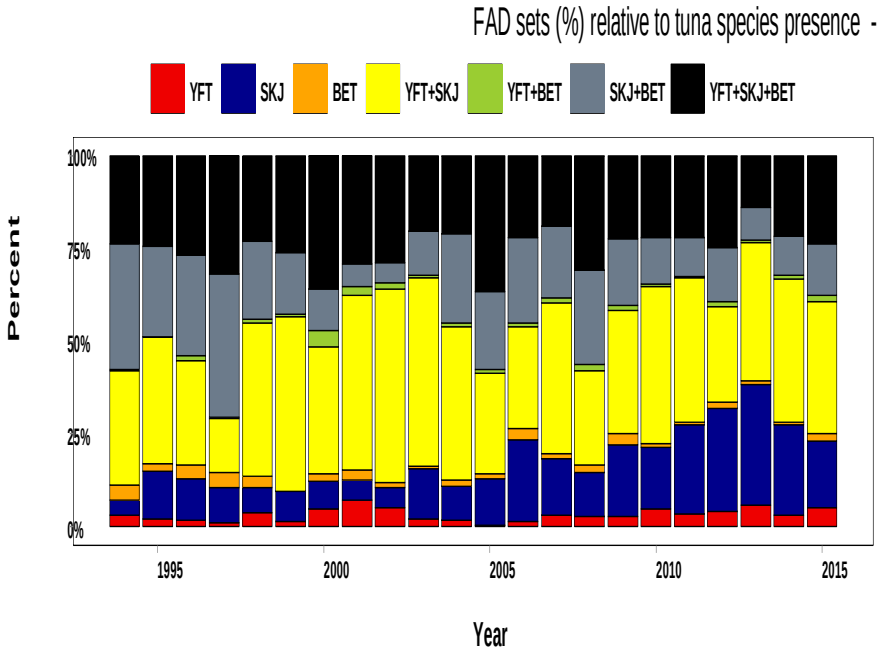

Equatorial region
CPS in positive sets (>=
p-value (slope)
p-value (slope)
p-value (slope)
0
20
40
60
80
100
120
1995
2000
2005
2010
2015

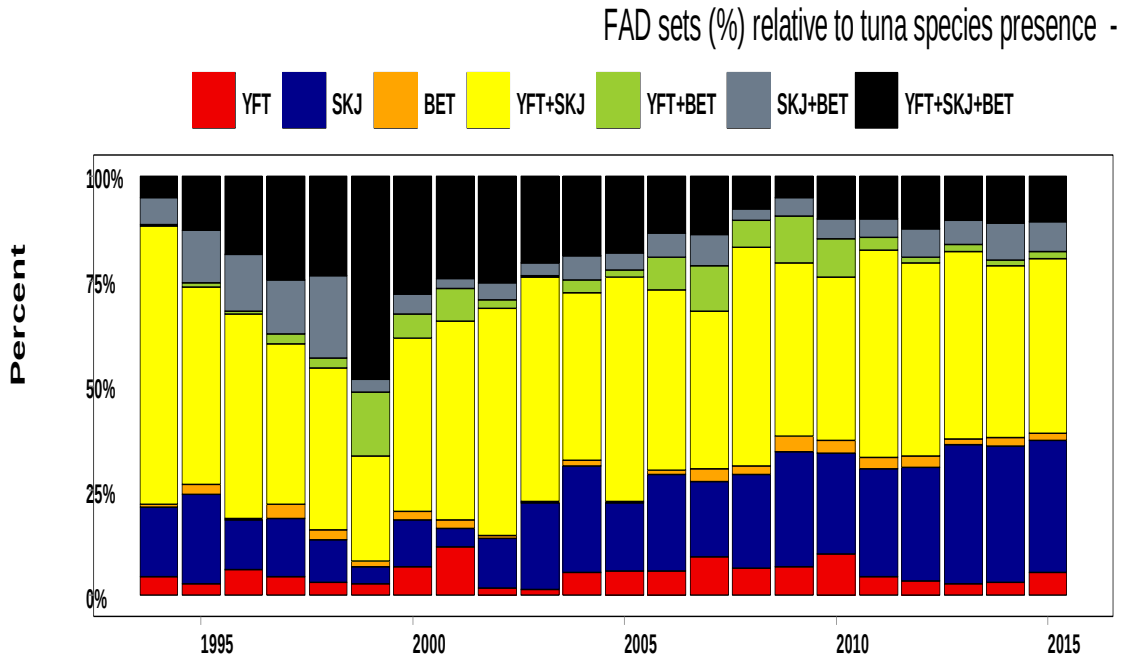

Humboldt region
CPS in positive sets (>=
p-value (slope
p-value (slope
p-value (slope
p-value (slope
0
2
4
6
8
1
1
1995
2000
2005
2010
2015

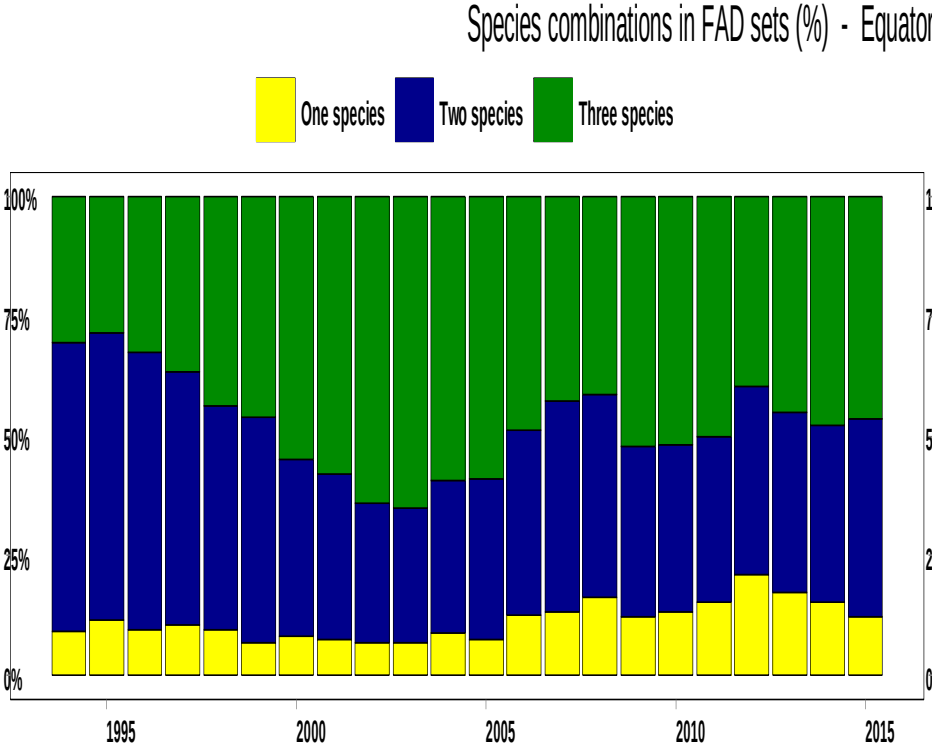
* **Exploring a) the increase in the number of FADs results in lower CPPS**

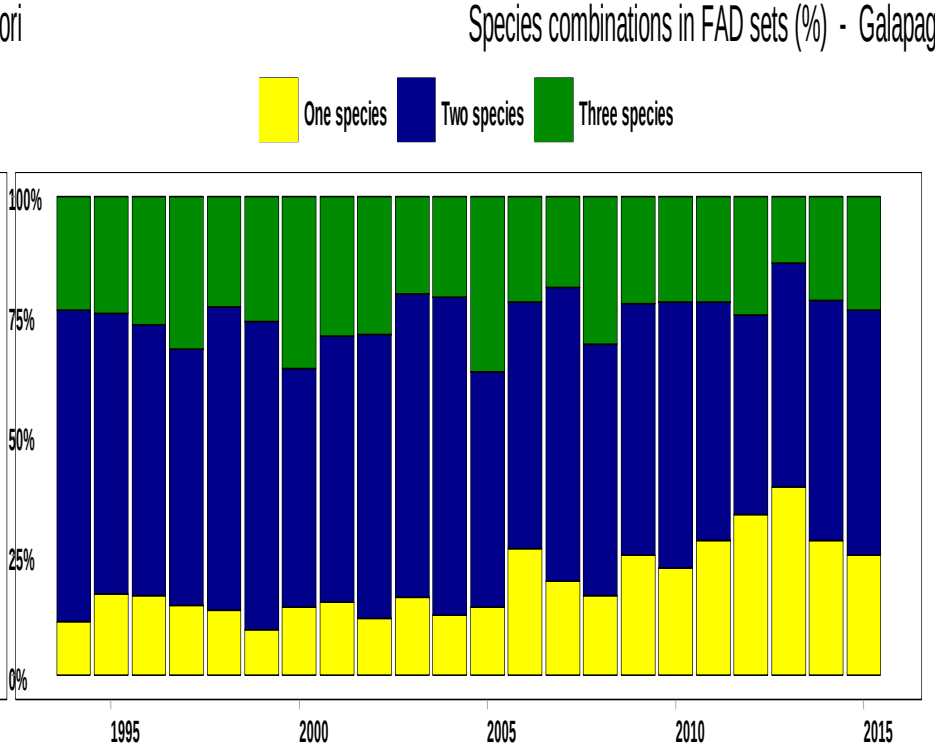
* **If there are fewer schools under the FADs, the schools captured may have fewer species and/or fewer size classes present.**

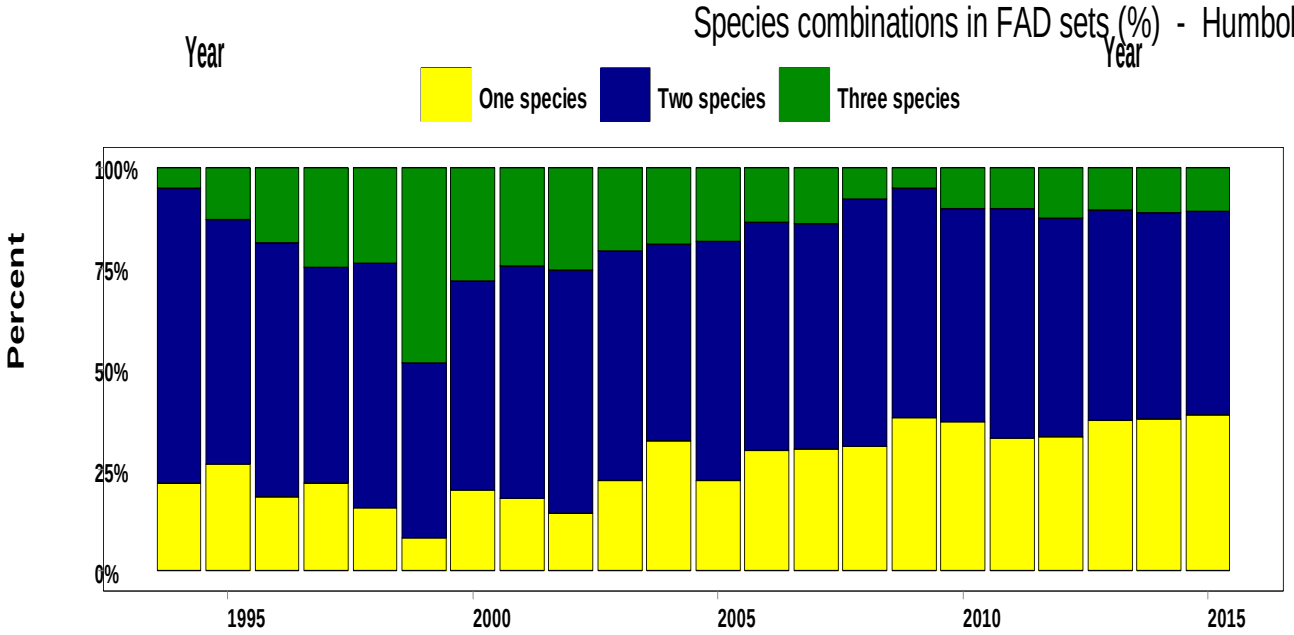

FAD sets (%) relative to tuna species presence -
YFT
SKJ
BET
YFT+SKJ
YFT+BET
SKJ+BET
YFT+SKJ+BET
Percent
100%
75%
50%
25%
0%
1995
2000
2005
2010
2015
Year


FAD sets (%) relative to tuna species presence -
YFT
SKJ
BET
YFT+SKJ
YFT+BET
SKJ+BET
YFT+SKJ+BET
Percent
100%
75%
50%
25%
0%
1995
2000
2005
2010
2015
Year


FAD sets (%) relative to tuna species presence -
YFT
SKJ
BET
YFT+SKJ
YFT+BET
SKJ+BET
YFT+SKJ+BET
Percent
100%
75%
50%
25%
0%
1995
2000
2005
2010
2015

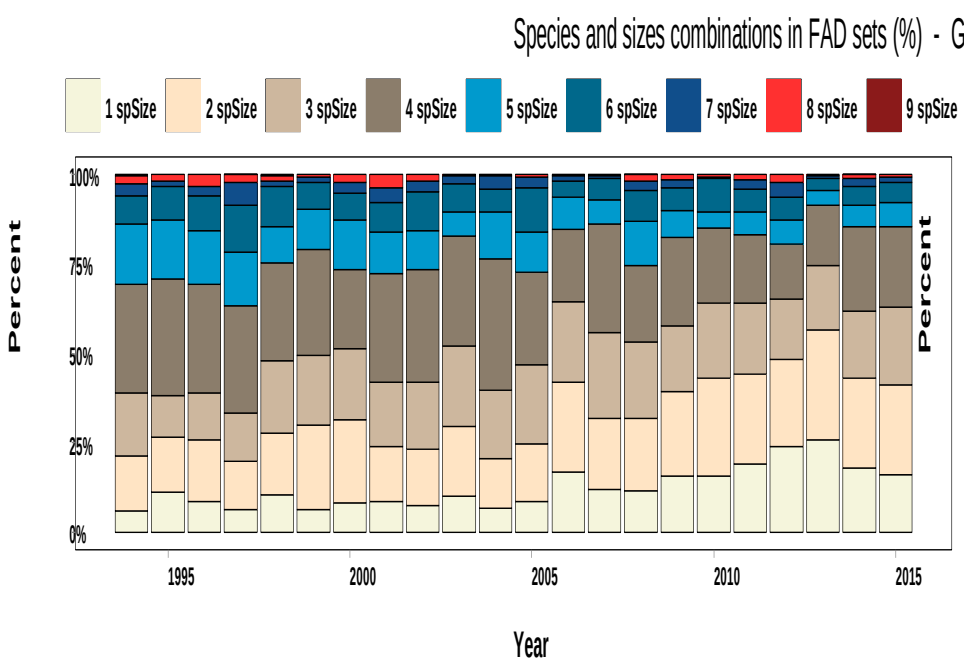

Species combinations in FAD sets (%) - Equatori
One species
Two species
Three species
100%
75%
50%
25%
0%
1995
2000
2005
2010
2015
Year

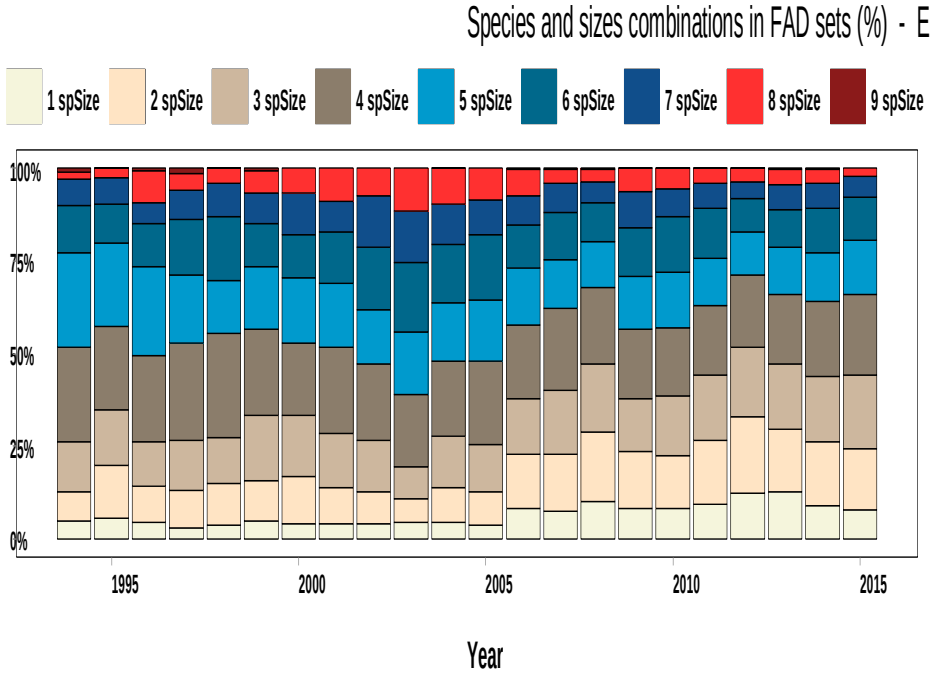

Species combinations in FAD sets (%) - Galapag
One species
Two species
Three species
100%
75%
50%
25%
0%
1995
2000
2005
2010
2015
Year

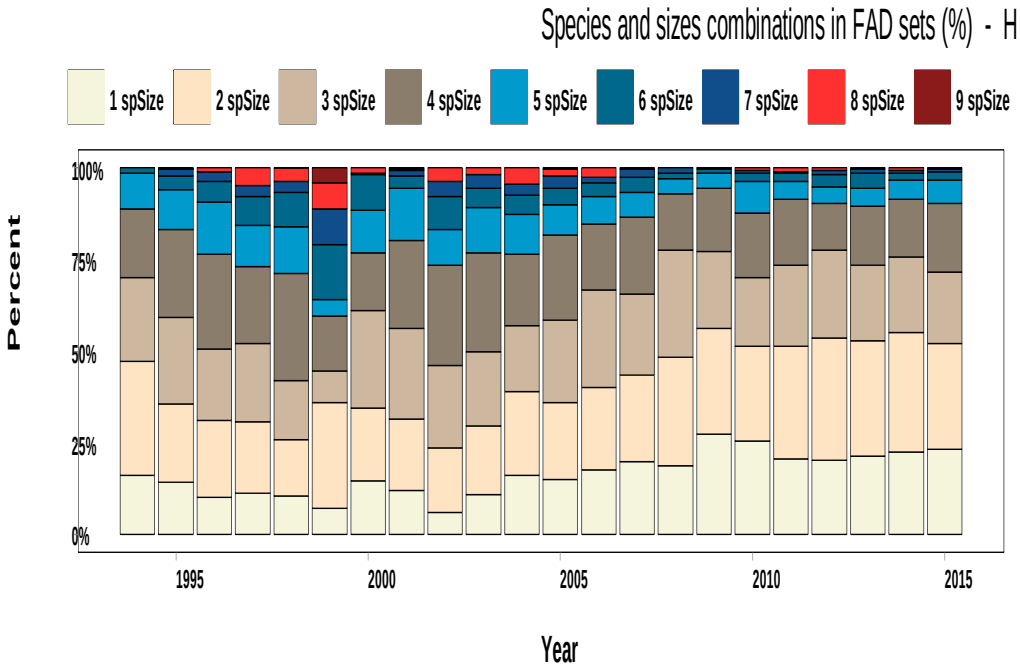

Species combinations in FAD sets (%) - Humbol
One species
Two species
Three species
Percent
100%
75%
50%
25%
0%
1995
2000
2005
2010
2015
Year

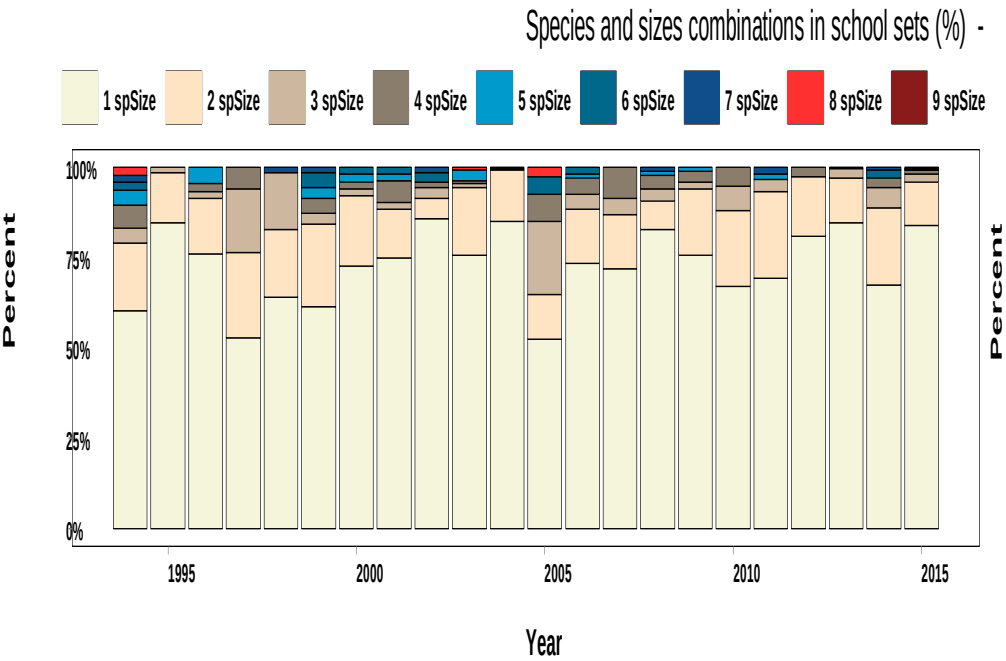
If there are fewer schools, there may be fewer combinations of species and sizes in the sets:

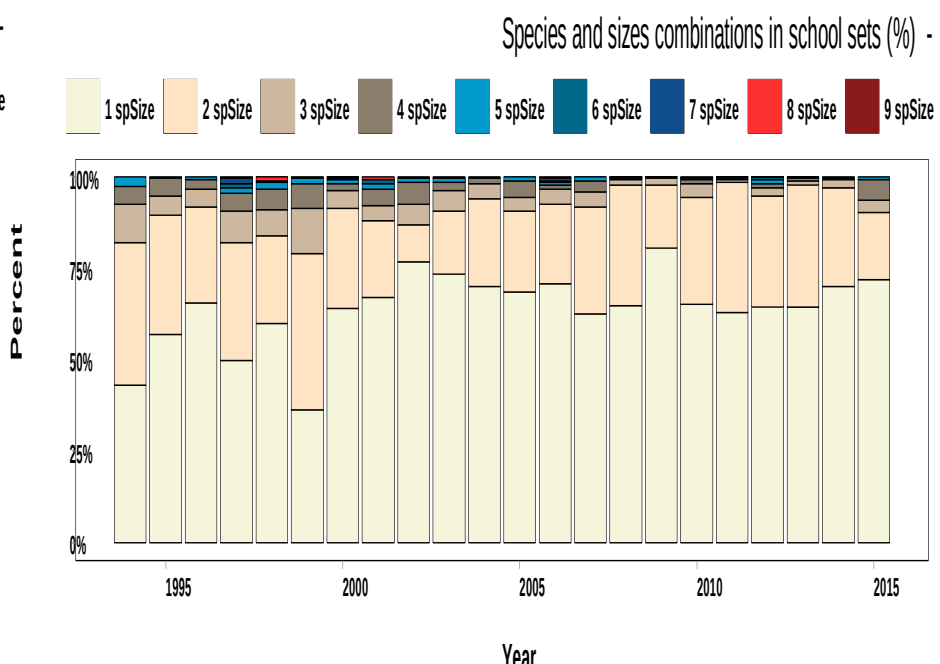
We have 3 species and 3 size categories (not great for SJ), so a set may yield from 1 to 9 classes (speciesxsize)


Species and sizes combinations in FAD sets (%) - G
1 spSize
2 spSize
3 spSize
4 spSize
5 spSize
6 spSize
7 spSize
8 spSize
9 spSize
Percent
100%
75%
50%
25%
0%
1995
2000
2005
2010
2015
Year

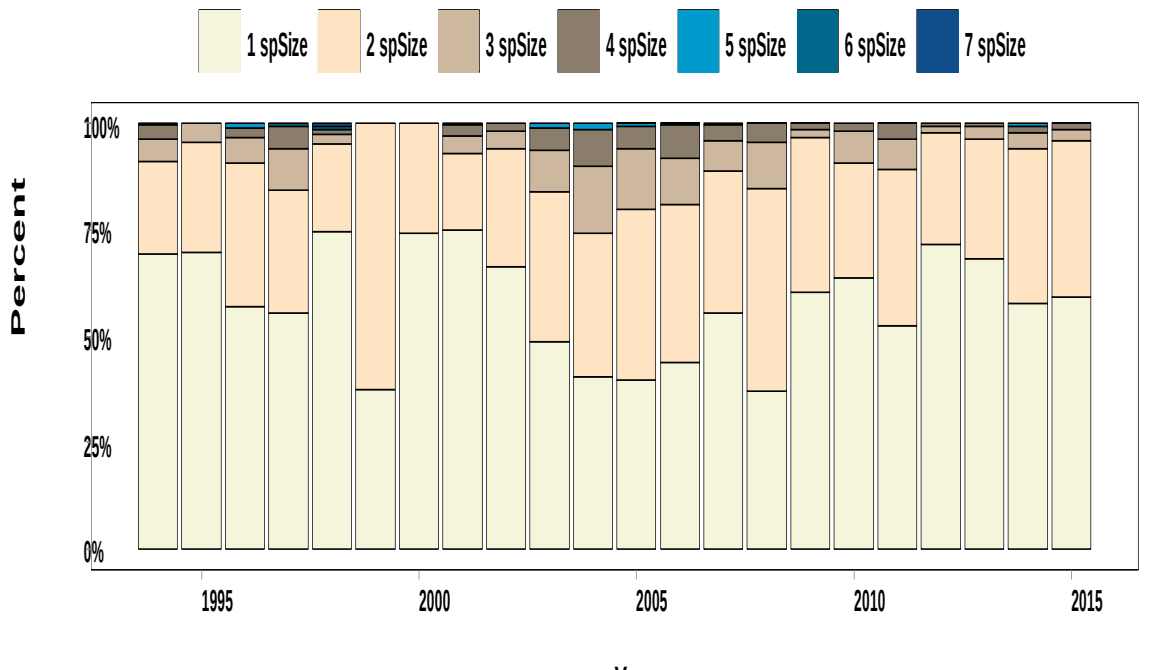

Species and sizes combinations in FAD sets (%) - E
1 spSize
2 spSize
3 spSize
4 spSize
5 spSize
6 spSize
7 spSize
8 spSize
9 spSize
100%
75%
50%
25%
0%
1995
2000
2005
2010
2015
Year


Species and sizes combinations in FAD sets (%) - H
1 spSize
2 spSize
3 spSize
4 spSize
5 spSize
6 spSize
7 spSize
8 spSize
9 spSize
Percent
100%
75%
50%
25%
0%
1995
2000
2005
2010
2015
Year



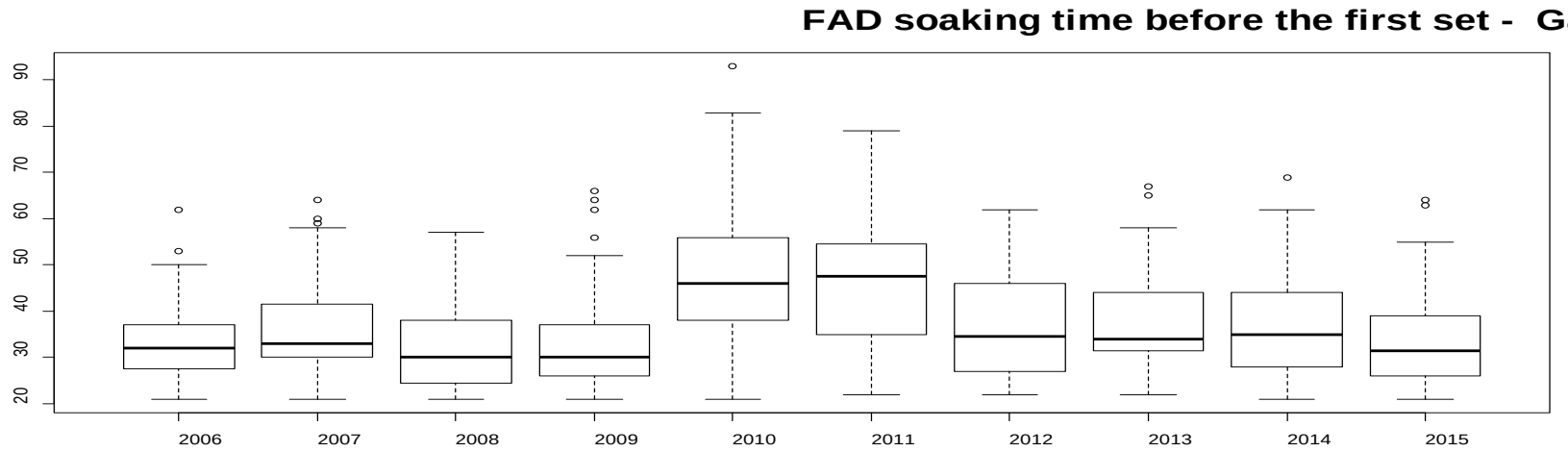


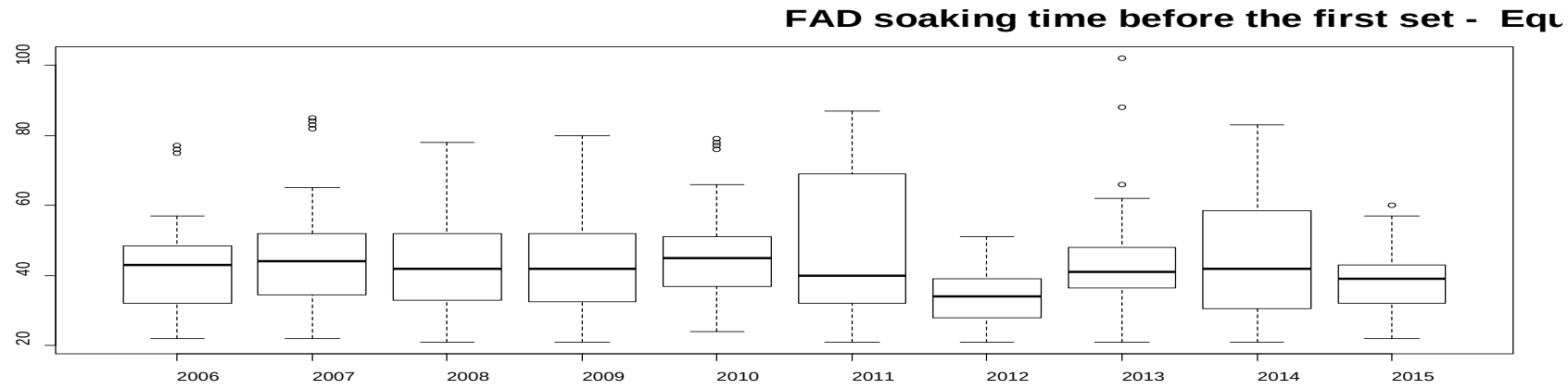
Simplification of schools

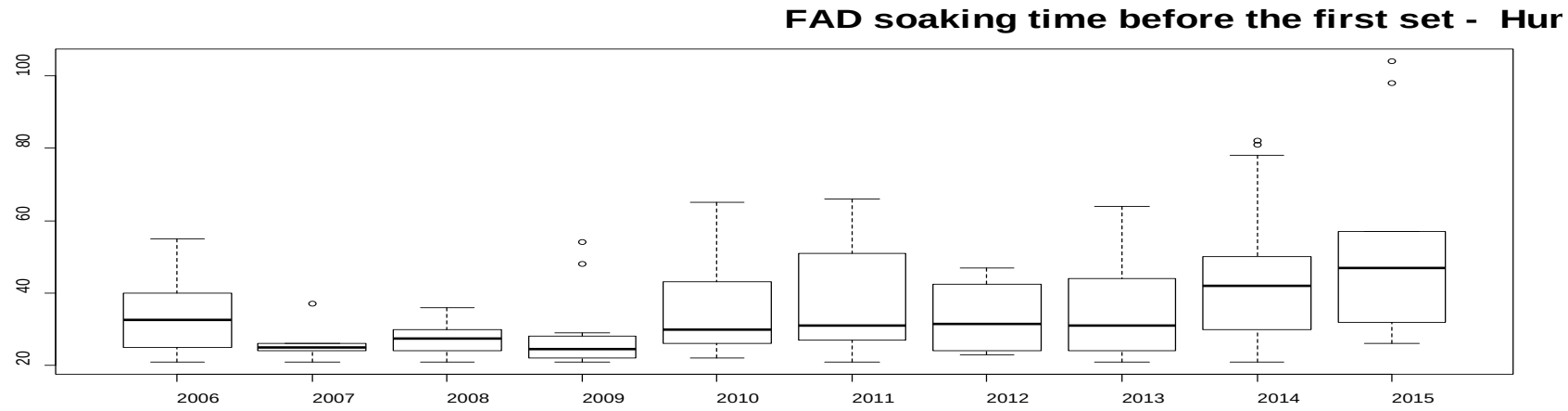


Exploring b)

Shorter soak times reduce the probability of accumulation of more schools


FAD soaking time before the first set - Gal
20
30
40
50
60
70
80
90
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015


FAD soaking time before the first set - Equ
20
40
60
80
100
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015


FAD soaking time before the first set - Hur
20
40
60
80
100
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015

Hypotheses for the decline in CPPS:

Not conclusive evidence for any of them; a comprehensive model is needed

a) High density of FADs competing for schools

Some supporting evidence of school "simplification" but there are alternative explanations (e.g. one species declining, etc.)

b) Schools are smaller because of ecological or environmental changes (e.g. prey abundance, thermocline depth, etc.)

Not explored yet

c) FADs are set on sooner after planting than in the past, so schools don't have time to accumulate.

Some support with regional differences

d) Smaller schools reflect lower abundance of one or more species

Simplification of schools, and lower CPPS could be the result of abundance changes.