Bycatch management

Objectives:

Avoid extinction

and then ?

Recovery programs? To which levels?

Minimize waste

Reduce incidental mortality

Utilize everything

Maintain ecosystem structure ??

Diversify harvest

Balanced harvesting:

A way to maintain ecosystem sructure

CONSERVATION

Reconsidering the Cons of Selective Fisheries

Balanced fishing across a range of species, stocks, and sizes could mitigate adverse effects and address food security better than increased selectivity.

S. M. Garcia,[1*] J. Kolding,[1,2*] J. Rice,[1,3*] M.-J. Rochet,[4*†] S. Zho
L. Borges,[8] A. Bundy,[9] D. Dunn,[10] E. A. Fulton,[11] M. Hall,[12] M. Hein
A. D. Rijnsdorp,[17] F. Simard,[18] A. D. M. Smith[11]

Concern about the impact of fishing on ecosystems and fisheries production is increasing (*1*, *2*). Strategies to reduce these impacts while addressing the growing need for food security (*3*) include increasing selectivity (*1*, *2*): capturing species, sexes, and sizes in proportions that differ from their occurrence in the ecosystem. Increasing evidence suggests that more selective fishing neither maximizes production nor minimizes impacts (*4*–*7*). Balanced harvesting would more effectively mitigate adverse ecological effects of fishing while supporting sustainable fisheries. This strategy, which challenges present management paradigms, distributes a moderate mortality from fishing across the widest possible range of species, stocks, and sizes in an ecosystem, in proportion to their natural productivity (*8*), so that the relative size and species composition is maintained.

which are not going to be used," i.e., by-catch (*13*). Fisheries worldwide have used species and size limits (*9*, *14*), gear technology (*5*, *15*), and spatial and temporal fishing restrictions (*16*) to reduce fishing impacts while pursuing human benefits.

But selective removals will inevitably alter the composition of a population or community and, consequently, ecosystem structure and biodiversity. Old individuals contribute the most to reproduction (*17*). Even moderate fishing reduces the proportion of

Balanced harvesting … distributes a moderate mortality from fishing across the widest possible range of species, stocks, and sizes in an ecosystem.

large and old fish in a population. Selectively

species and individuals in the North Sea (*22*) (fig. S1). By contrast, in several African small-scale inland fisheries, the fish size spectrum (*23*) has been maintained under intense and diverse fishing activities that cause high mortality with low selectivity (*5*, *24*) (fig. S1).

Results from models suggest that moderating fishing mortality across a wide range of species and sizes maximizes overall catch summed across species while better conserving biodiversity. Multispecies fishery models

show that increased mesh sizes may reduce

- Size selectivity
- Species selectivity

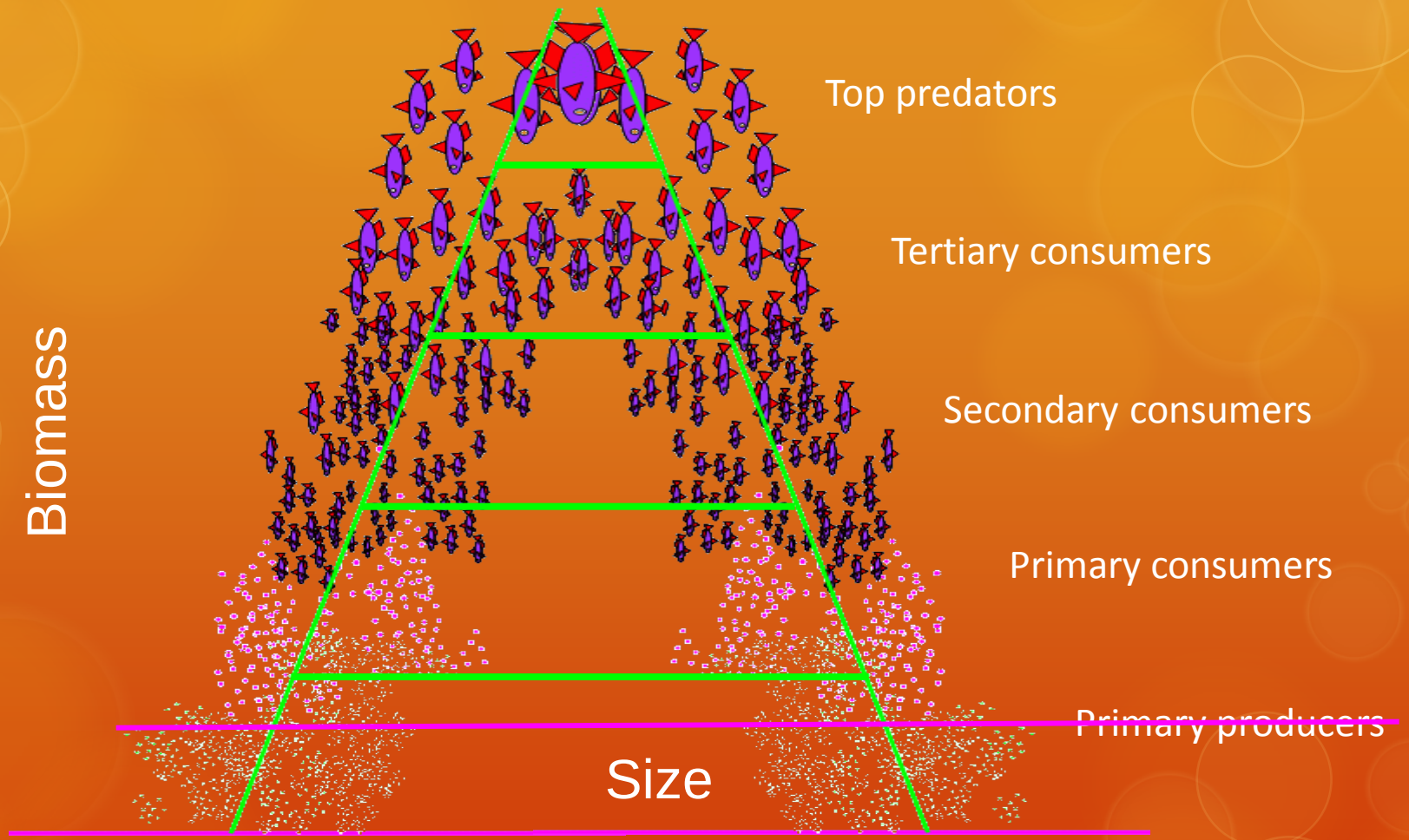
Potential problems ?

Genetic changes (earlier maturity, smaller sizes, etc.)

Reproductive changes: larger individuals major contributions to reproduction, higher quality, etc.

Ecological changes; different size spectrum.

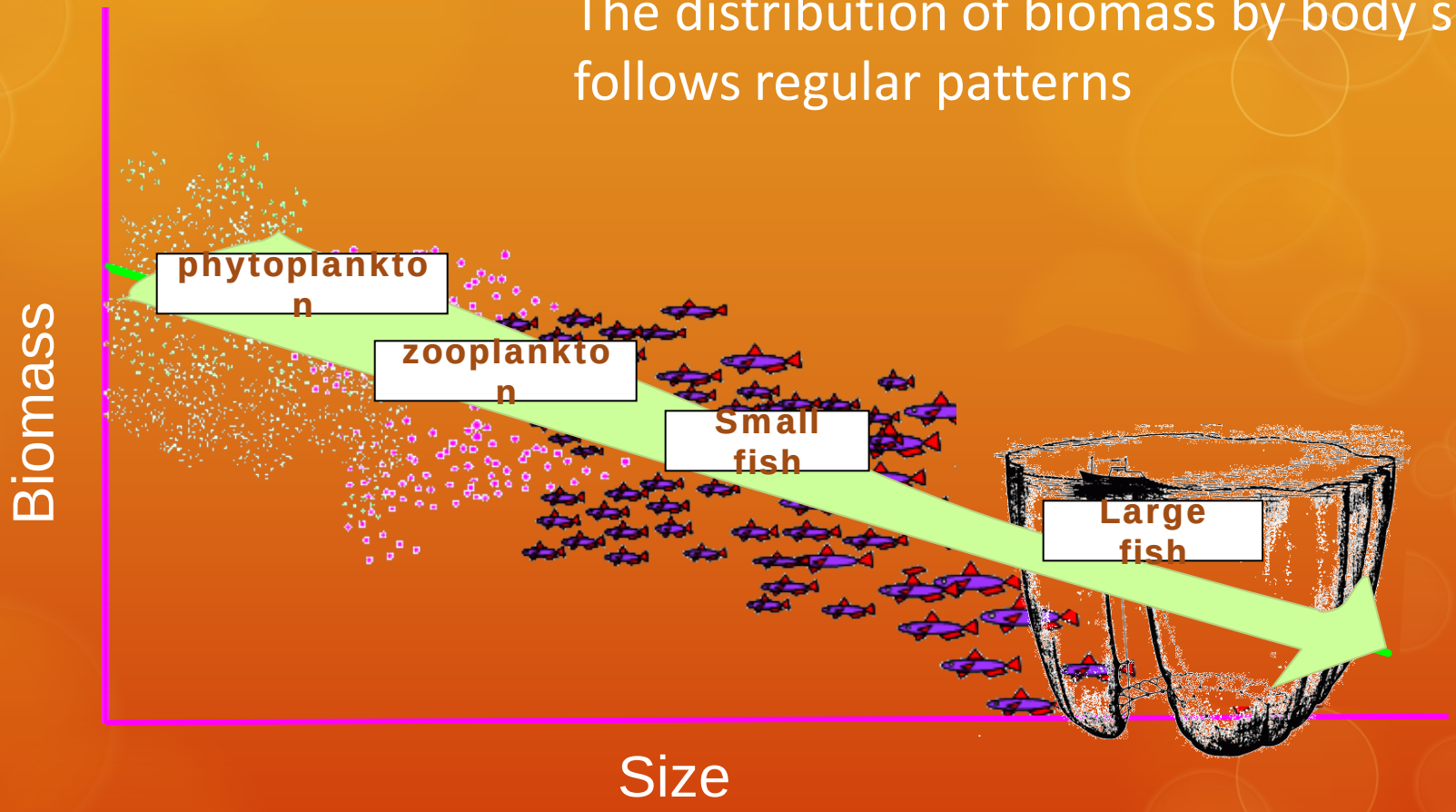
The food web is size structured…



..abundance is inversely correlated with size

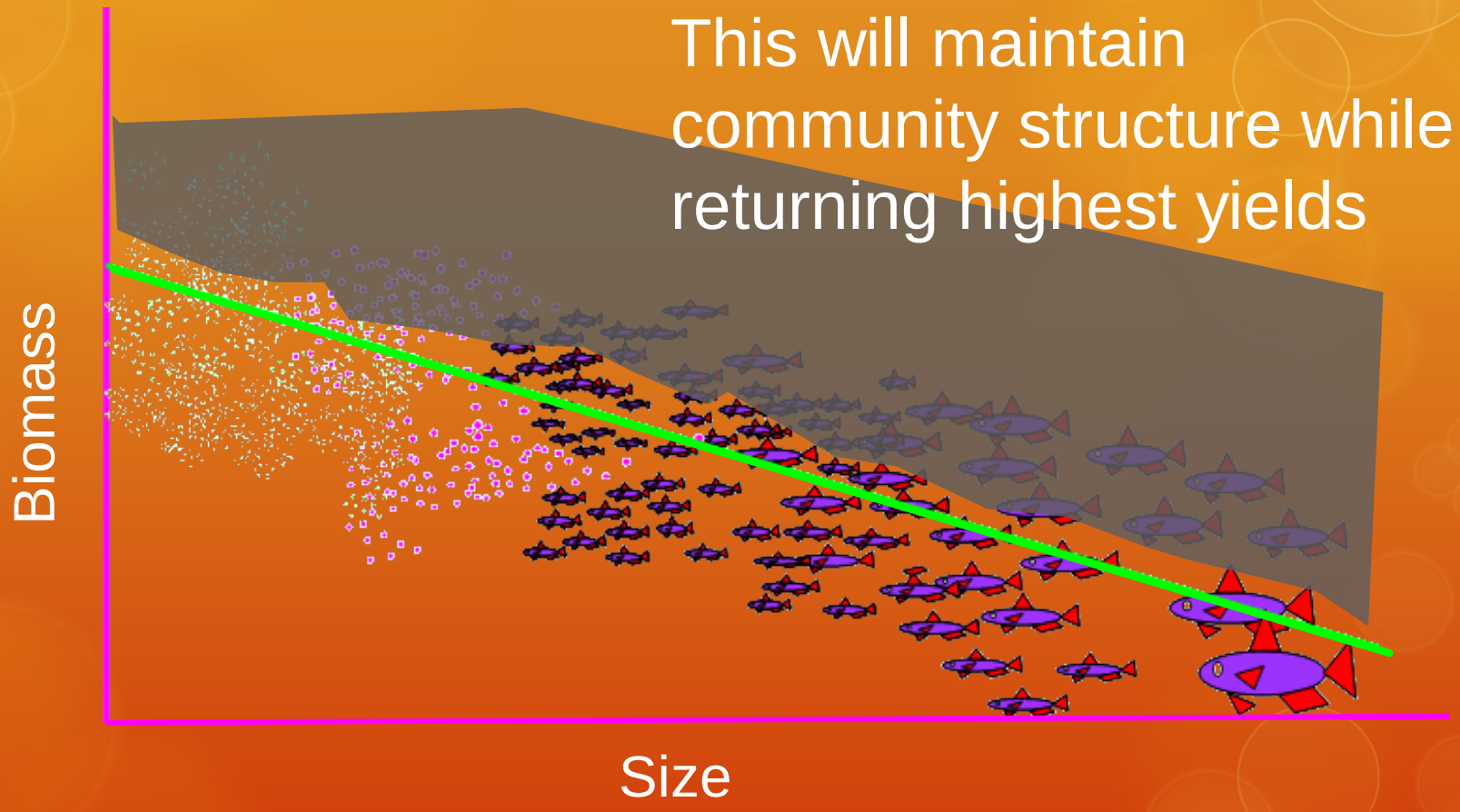
Community size spectrum

The distribution of biomass by body size follows regular patterns



Under conventional selective fishing slope and intercept will change

Balanced harvesting…



This will maintain community structure while returning highest yields

.. is fishing as many sizes and species as possible in proportion to natural productivity

ECOSYSTEM SIMULATIONS SHOW CONSISTENT RESULTS

36 MODELS FROM 30 SYSTEMS

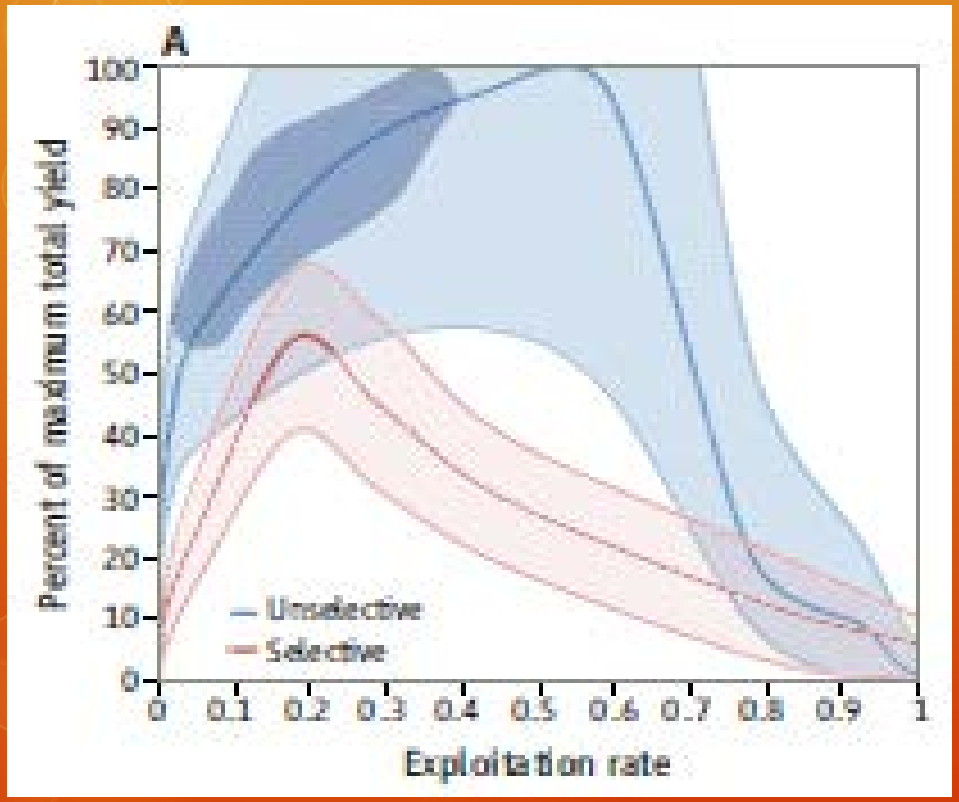
BY BETH FULTON, MARIE-JOELLE ROCHET, ALIDA BUNDY

Ecopath + Ecosym, EwE, Atlantis

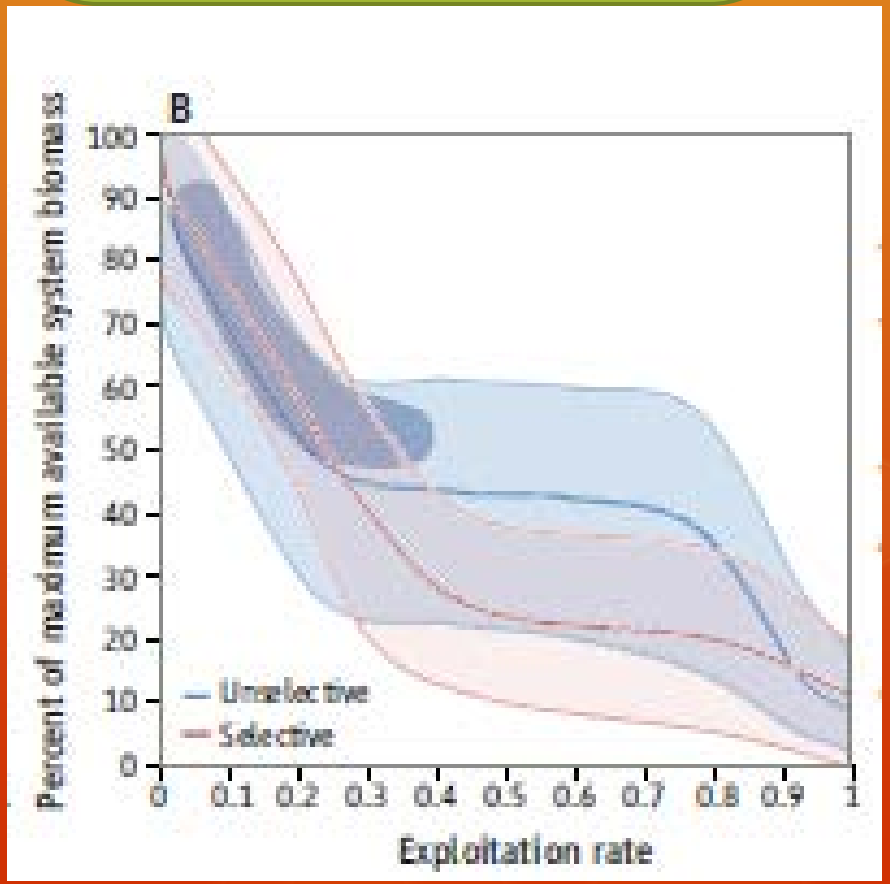
Model Conclusions

"With fishing spread over more groups and sizes, yields are higher and impacts of fishing – such as population extirpations (local extinctions) and biomass depletion- are lower across a broad range of fishing mortalities."

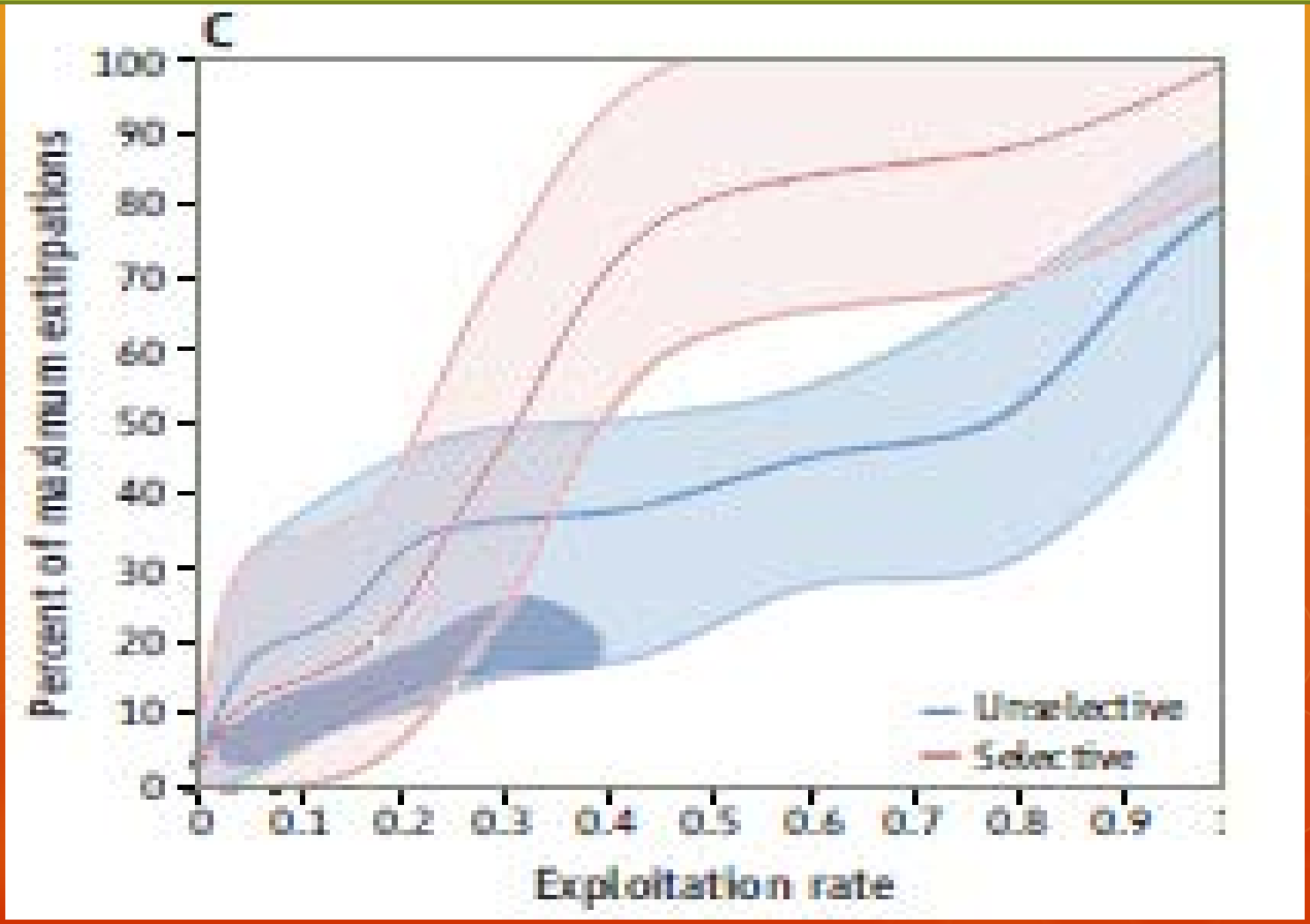
% del maximo rendimiento



% del maximo de la biomasa cosechable del sistema



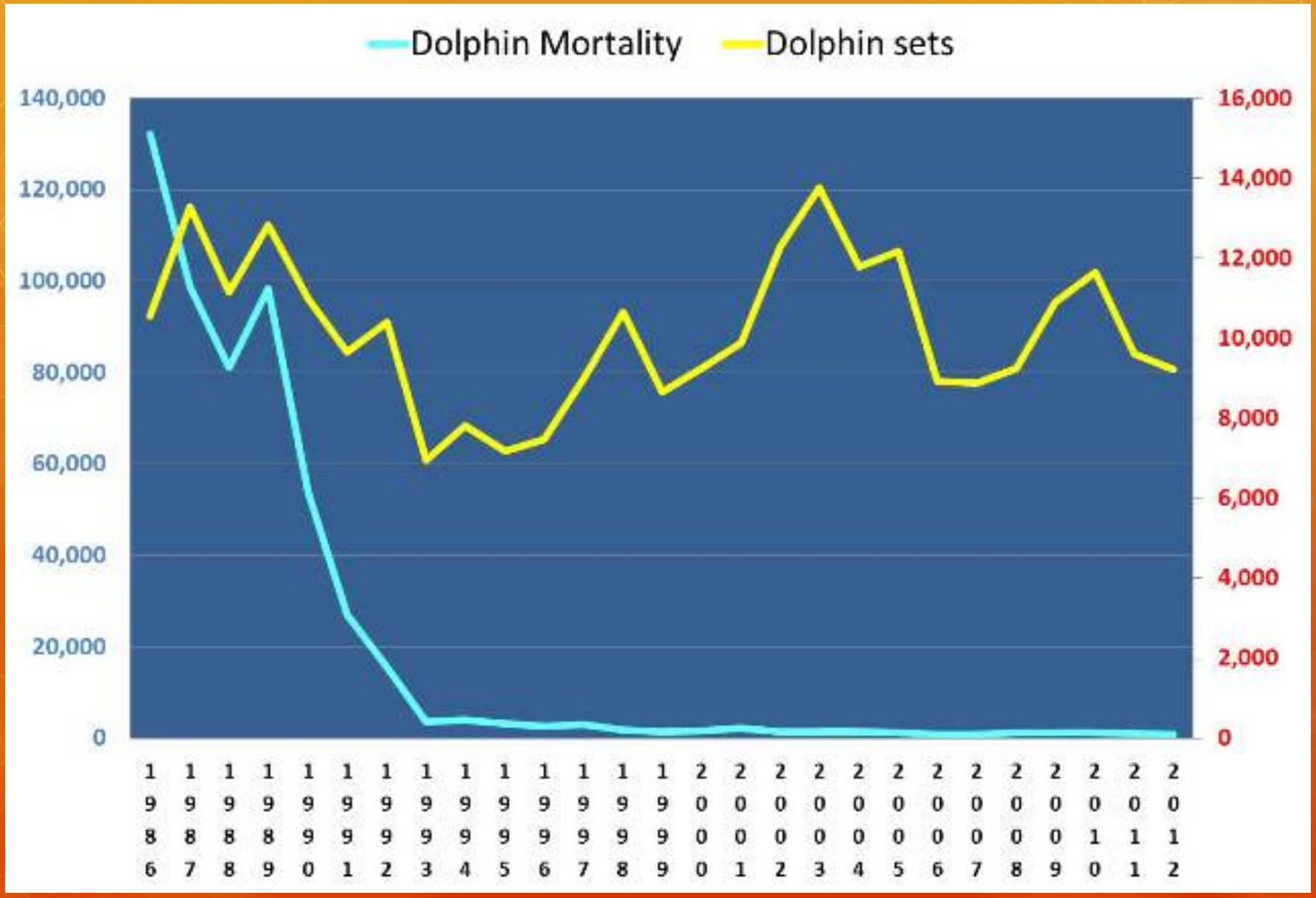
% species or groups that have declined to less than 10% of the unfished level



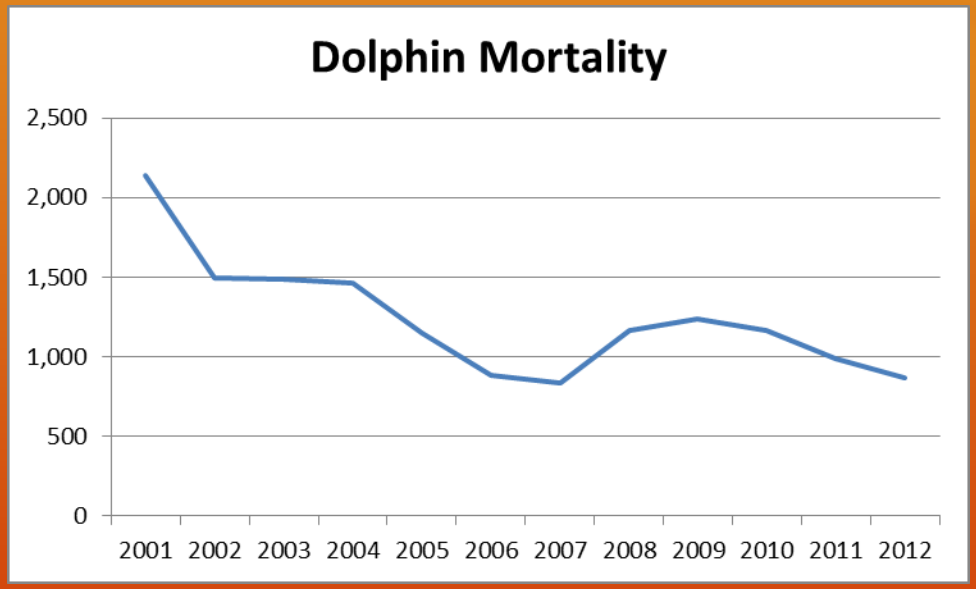
Dolphins

Mortalities of dolphins in 2012, population abundance, and relative mortality

Species and stock	Incidental mortality	Population abundance	Relative mortality (%)	AIDCP Stock Mortality Limit
NE spotted dolphin	151	911,177	0.02	793
W/S spotted dolphin	187	911,830	0.02	881
Eastern spinner dolphin	324	790,613	0.04	655
Whitebelly spinner dolphin	107	711,883	0.02	666
Northern common dolphin	49	449,462	0.01	562
Central common dolphin	4	577,048	<0.01	207
Southern common dolphin	30	1,525,207	<0.01	1,845
Other dolphins	18			
Total	**870**			**5,000**


Dolphin Mortality
Dolphin sets
140,000
120,000
100,000
80,000
60,000
40,000
20,000
0
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012

Recent Trend in Dolphin Mortality 2001-2012



Sea Turtles – Circle hooks


CENDEPESCA
SRP
ARAP
OSPESCA
SVENSKA POSTKOD STIFTELSEN
submon
Mustad
WWF
CIAT
IATTC
USAID
The Ocean Conservancy
WALTON FAMILY FOUNDATION
Kutzari
acorema
IFAW
anpac
APECO
PROFEPA
CPESCA
MAGA
UNIPESCA
INCODER
CVC
CNIP
facimar
ACODIARPE
EPESPO
Bahía Cupica

Fig. 1. Distribution of fishing effort (number of sets) observed by the program between 2004 and 2010 in 1o x 1o grids

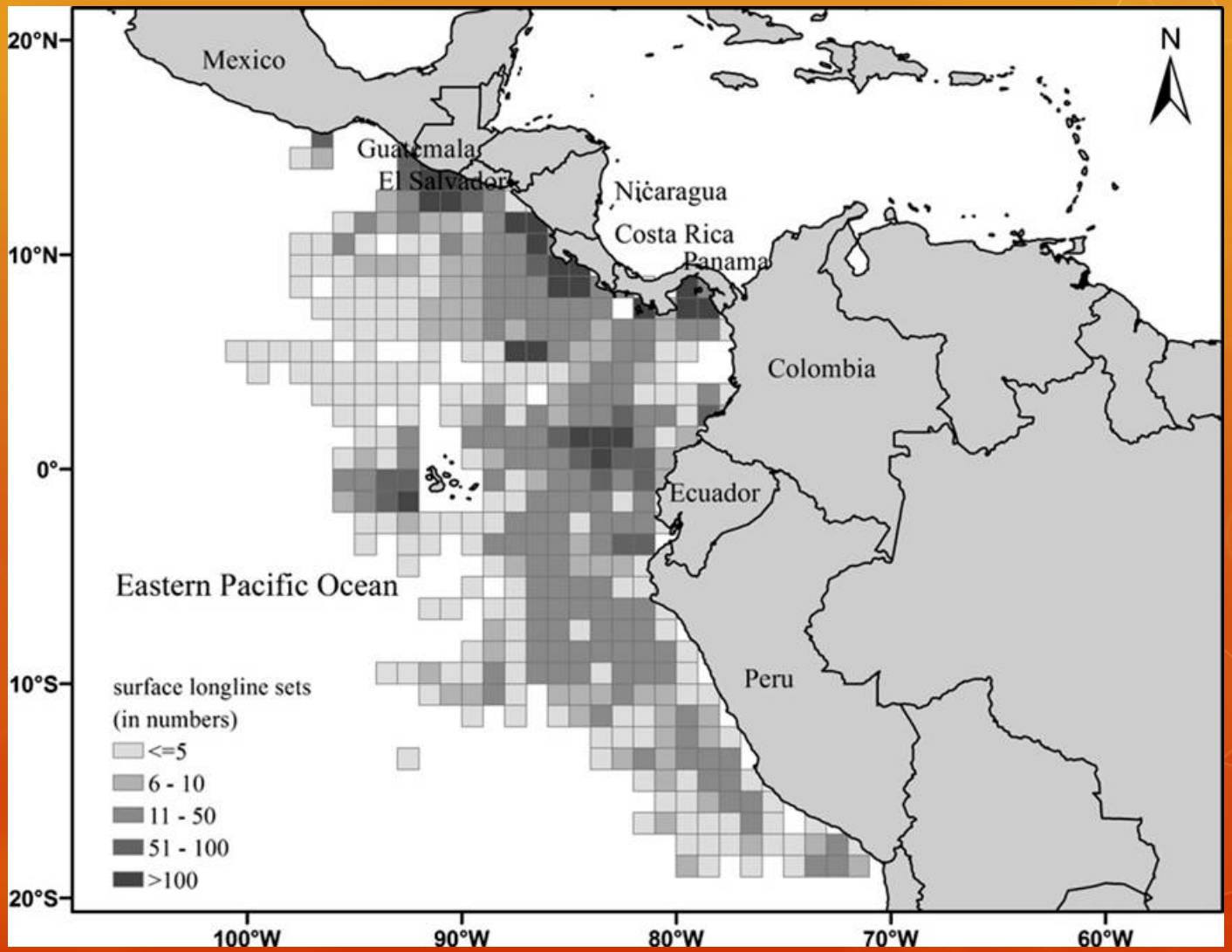
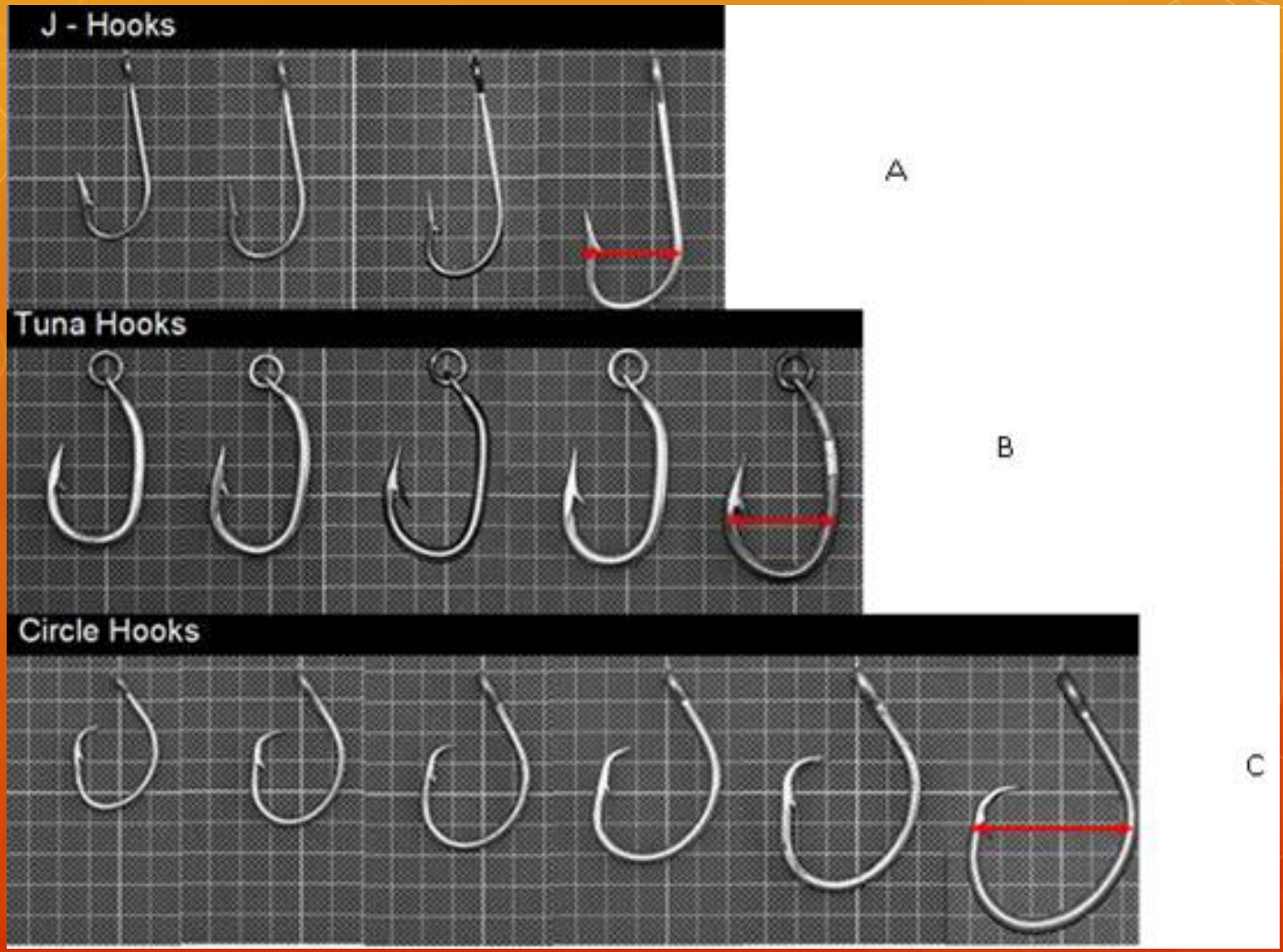


Fig. 1. Main hook shapes and sizes used in the EPO artisanal longline fisheries. **A)** J-hooks; **B)**Tuna-hooks and **C)** circle hooks. Circle hooks vary between 12/0 (left) to 18/0 (right). The arrows indicate the straight total width used for the analysis.



Effects of circle hooks

- **Fewer turtles arrive dead to the boat**
- **Fewer turtles hooked**
- **Fewer turtles deep hooked**

(fewer mortalities to recover hooks)

Sum of all effects wide range 50% - 90%

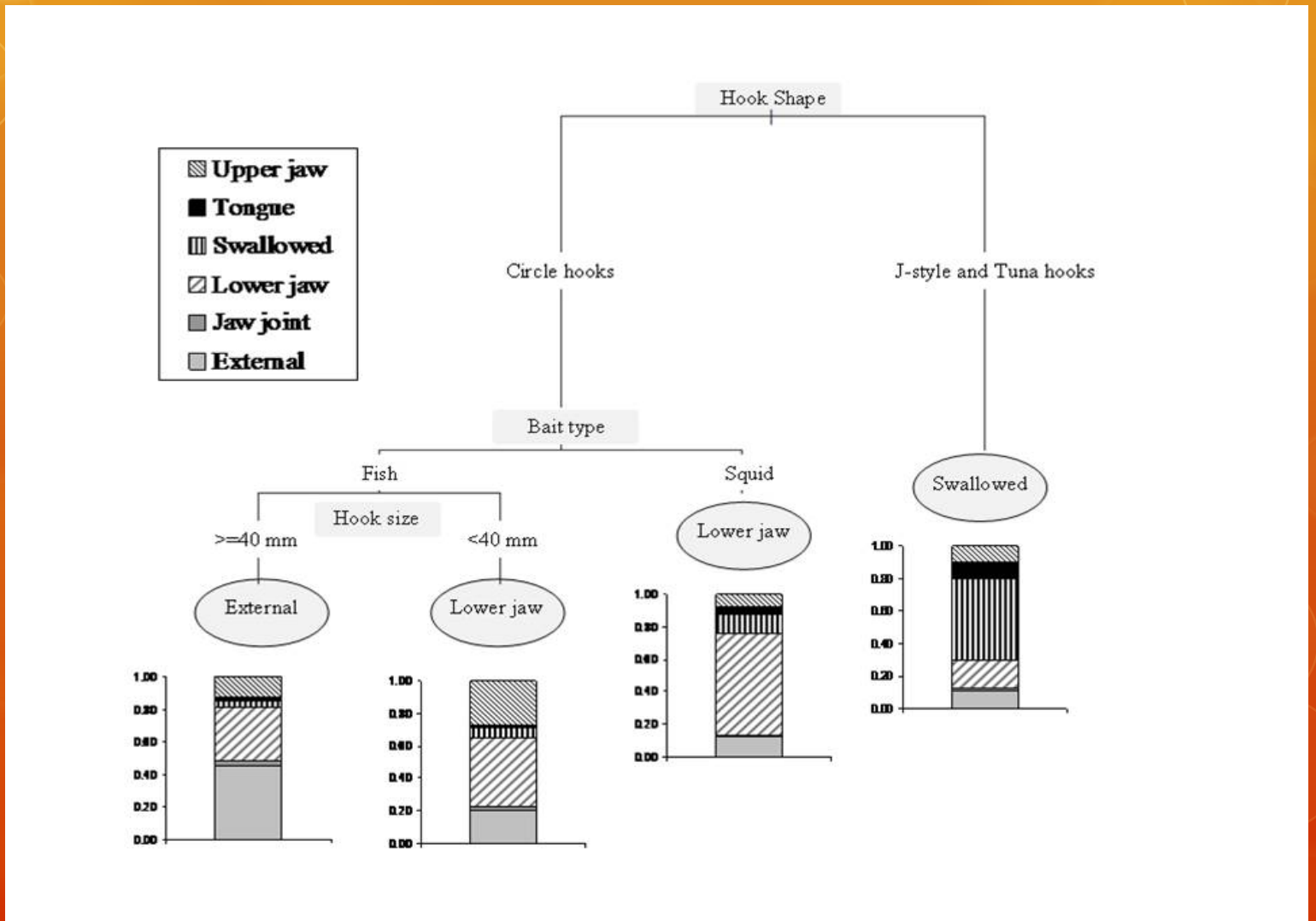
depending on size of circle hook

Estimated coefficients for the Binomial GLMM with its standard error (SE), statistical significance (*p*) and Odds ratio for categorical variables. The intercept for these variables are Jhook
for *Hook shape*, and fish for *Bait type*

	Estimate	SE	P	Odds ratio
Intercept	1.31	0.86	0.129	--
Hook Shape: Circle	-1.80	0.29	**<0.01**	0.17
Hook Shape: Tuna-hook	0.91	0.31	**<0.01**	0.40
Hook Size	2.45	0.77	**<0.01**	--
Bait type: Squid	0.54	0.28	0.05	1.71
CCL*	0.47	0.59	0.43	--

Note: Bold values correspond to p-values that are statistically significant.
*CCL: turtles curve carapace length

Classification tree of olive ridley sea turtles hooking locations. Each node shows the variable used for the splits and in the branches the split criteria. In the leaves or terminal nodes of the tree a bar-plot is showed, with the proportion of hooking locations in each leaf. The category in each terminal node corresponds to the dominant hooking location



TBS fishery EC Specie or group of species	Catch number			CPUE		p
	Tuna hook	Circle hook 16/0		Tuna hook	Circle hook 16/0	
Thunnus albacares	162	298		1.21	2.23	<0.001
Thunnus obesus	101	154		0.75	1.15	0.177
Xiphias gladius	210	223		1.57	1.67	0.814
Coryphaena hippurus	529	529		3.94	3.97	0.917
Istiophorus platypterus	55	62		0.41	0.46	0.628
Makaira indica	58	65		0.43	0.49	0.299
Makaira nigricans	261	273		1.95	2.05	0.464
Tetrapturus audax	117	116		0.87	0.87	0.536
Acanthocybium solandri	18	47		0.13	0.35	0.003
Prionace glauca	287	396		2.14	2.97	<0.001
Alopias pelagicus	592	648		4.41	4.86	0.223
Carcharhinus falciformis	117	171		0.87	1.28	0.019
Carcharhinidae [a]	22	19		0.16	0.14	0.218
Sphyrnidae [a]	34	50		0.25	0.37	0.241
All fishes	2667	3204		20.09	24.37	0.001
Chelonia mydas	24	16		0.18	0.12	0.021
Lepidochelys olivacea	155	63		1.16	0.47	<0.001
All sea turtles	180	83		1.34	0.62	<0.001

[a] grouped into families by low numbers or unidentified species.

“Decision making” matrix on the adoption of circle hooks

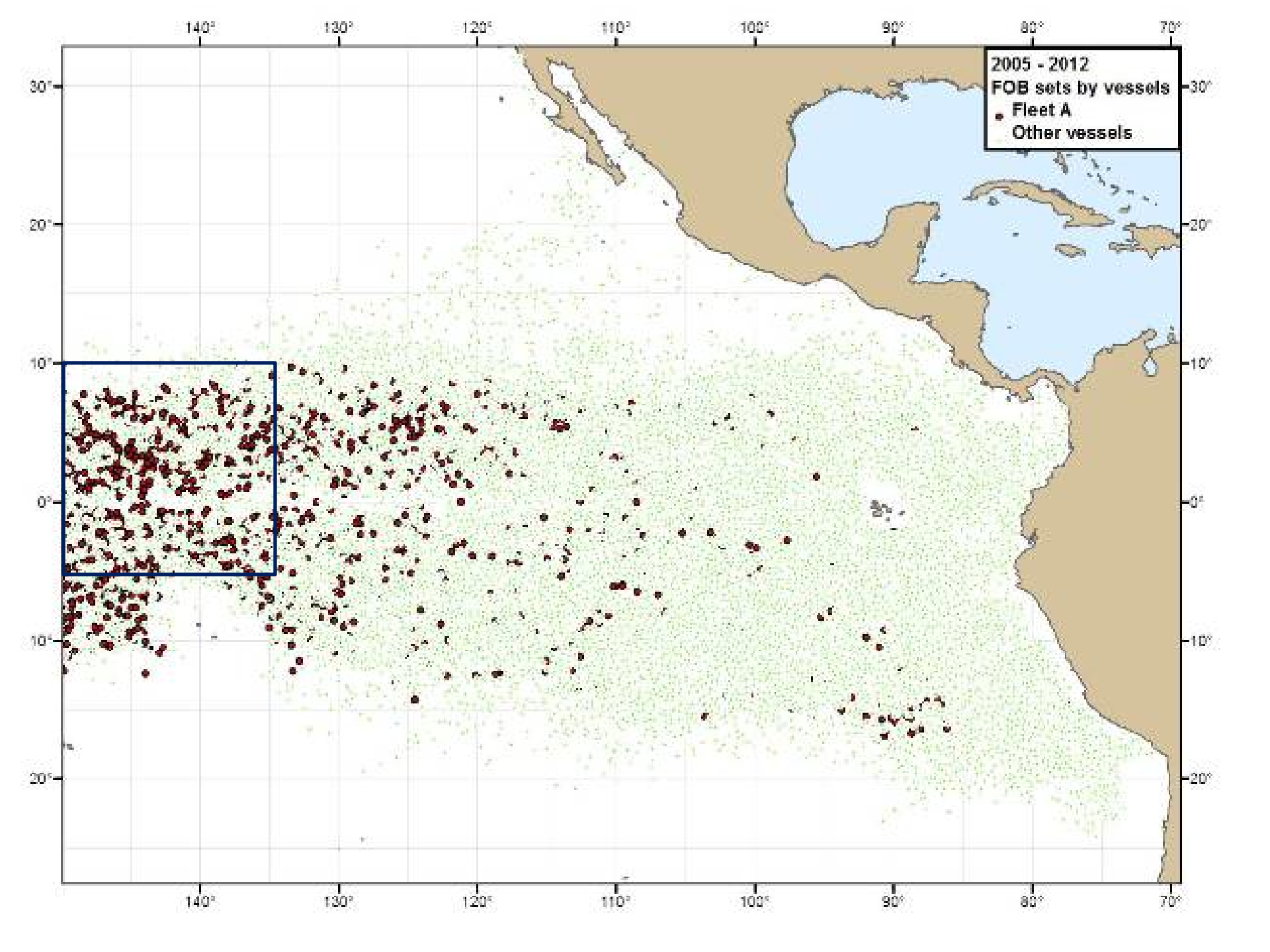
	Catch higher	Catch same	Catch lower
Sea Turtle Bycatch higher			
ST Bycatch same			
ST bycatch lower	Easy to sell, but ???	Easy choice	Hard sell

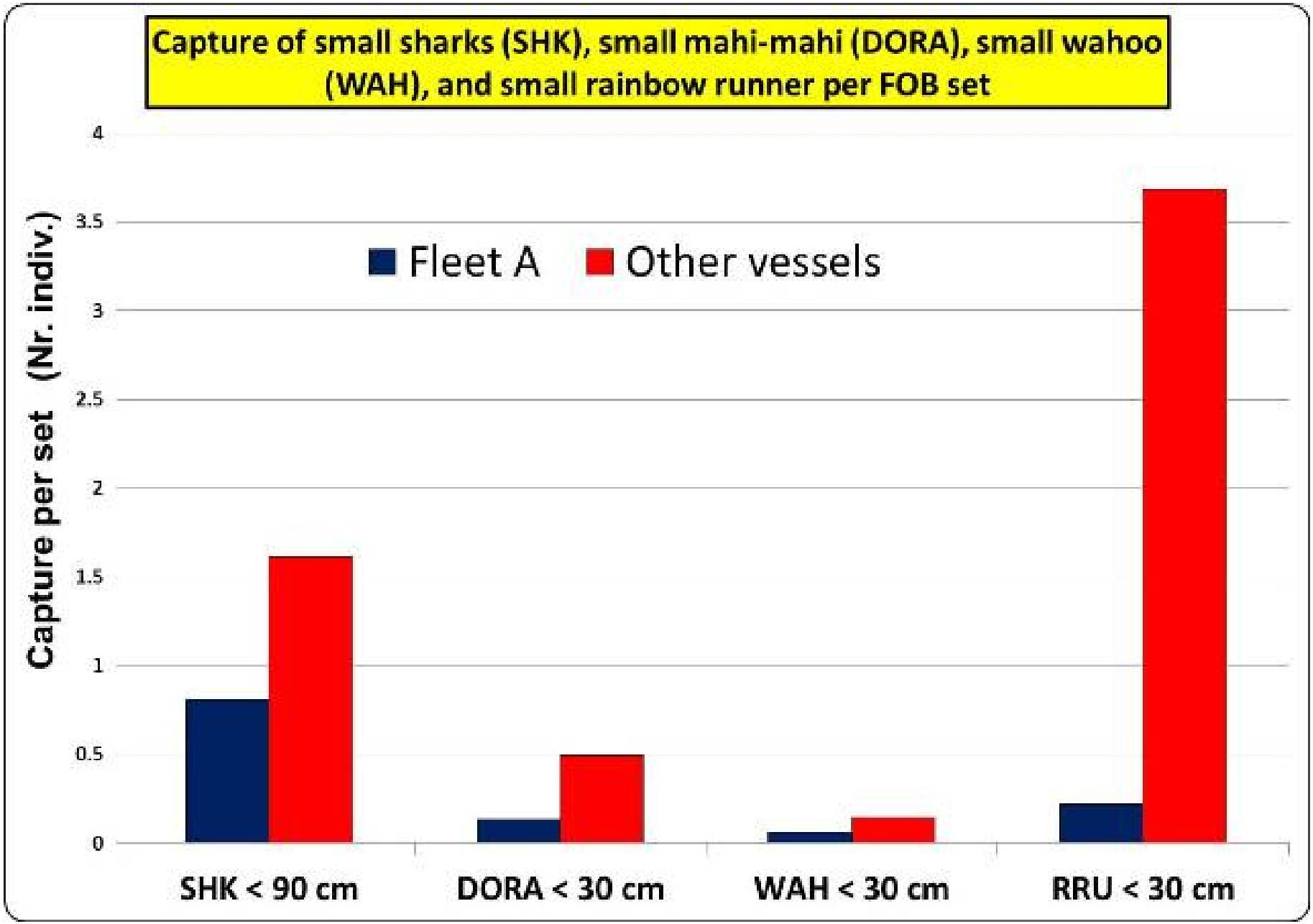
	Bycatch B higher	Bycatch B same	Bycatch B lower
ST Bycatch higher			??????
ST Bycatch same			??????
ST Bycatch lower	??????	Easy choice	Easy choice

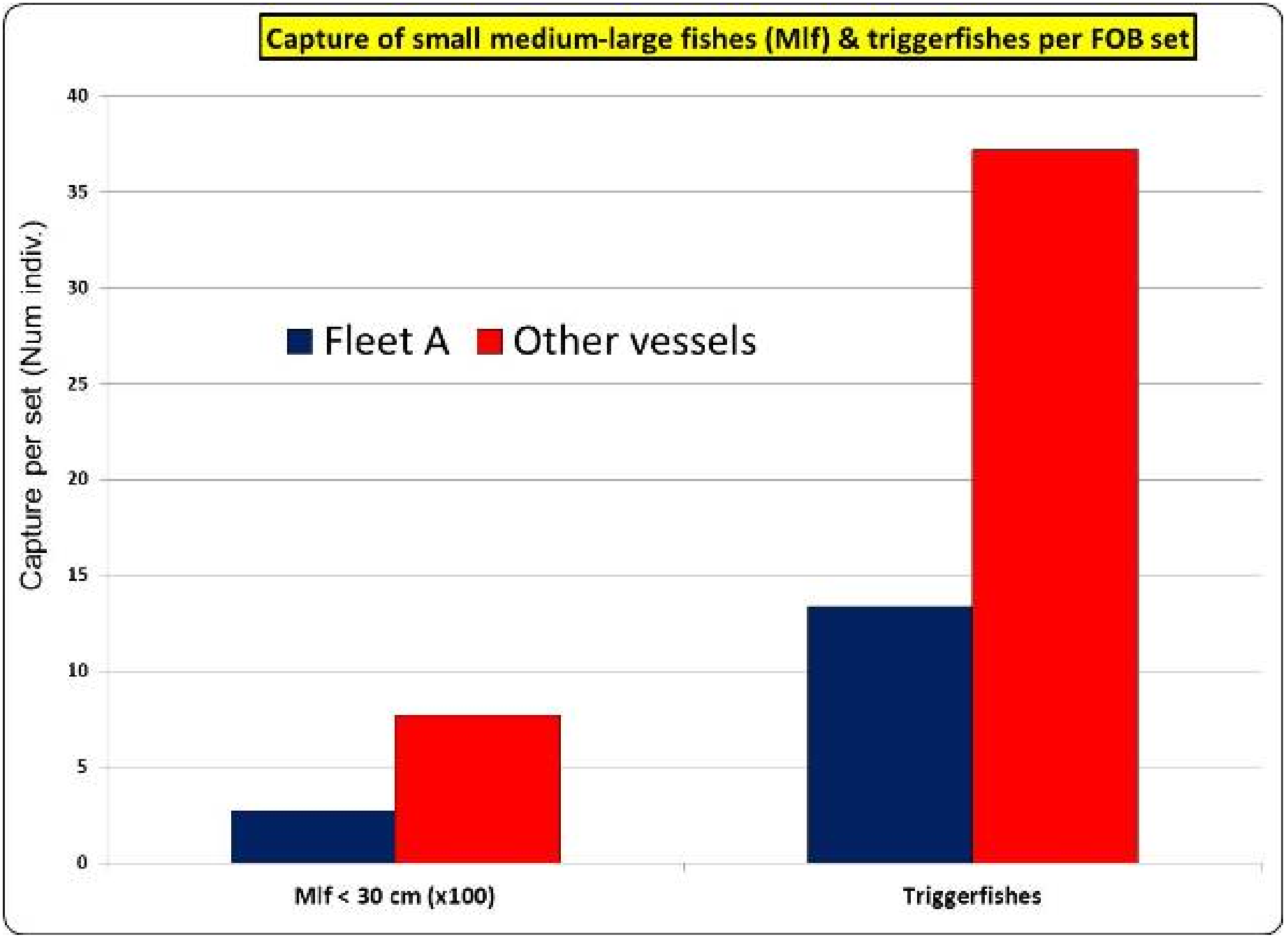
Can large mesh sections in the seine help reduce bycatches ?

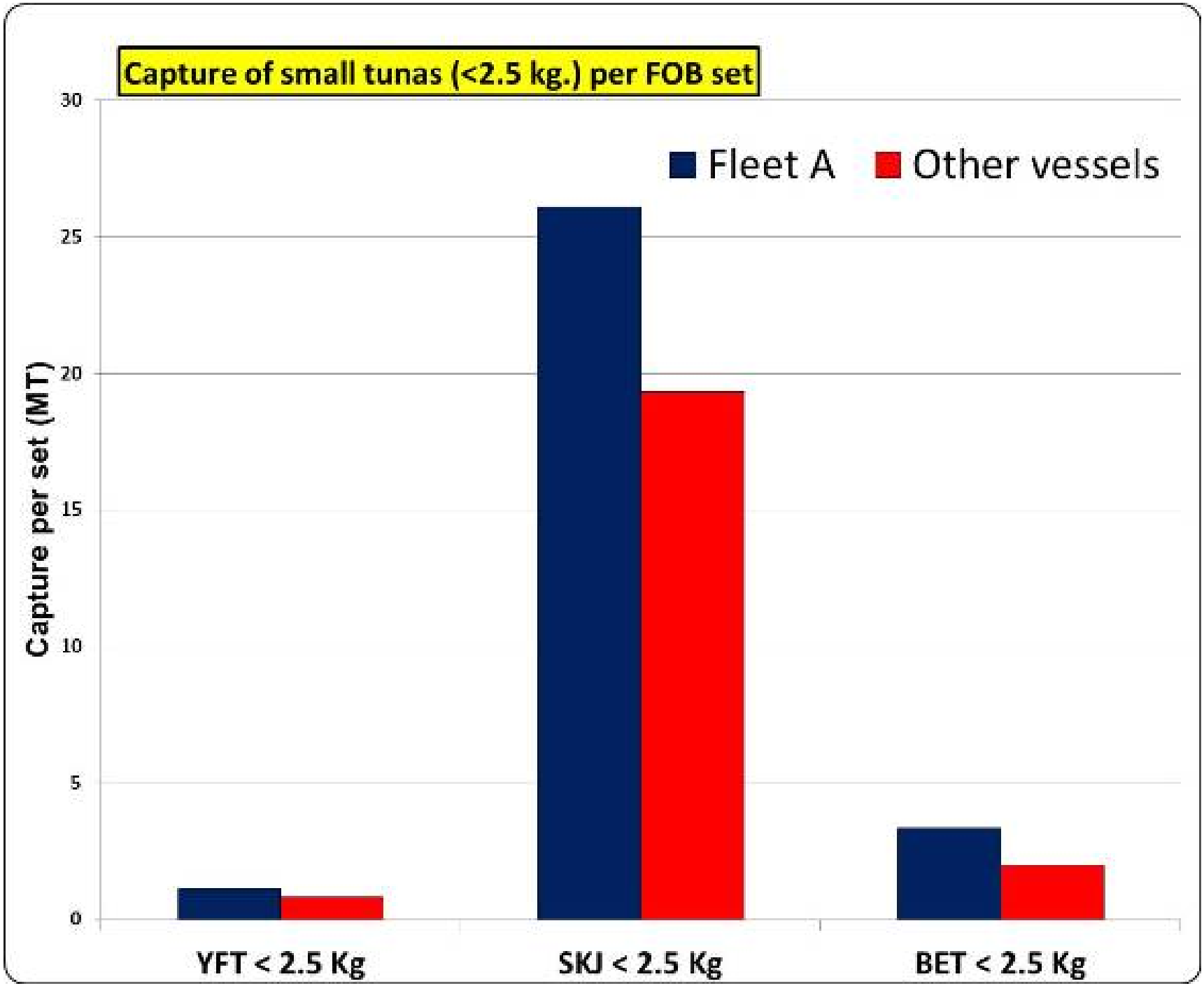
Preliminary look at catches and bycatches in sets on floating objects made by fleet A (large mesh net), and the rest of the fleet vessels. 2005 - 2012

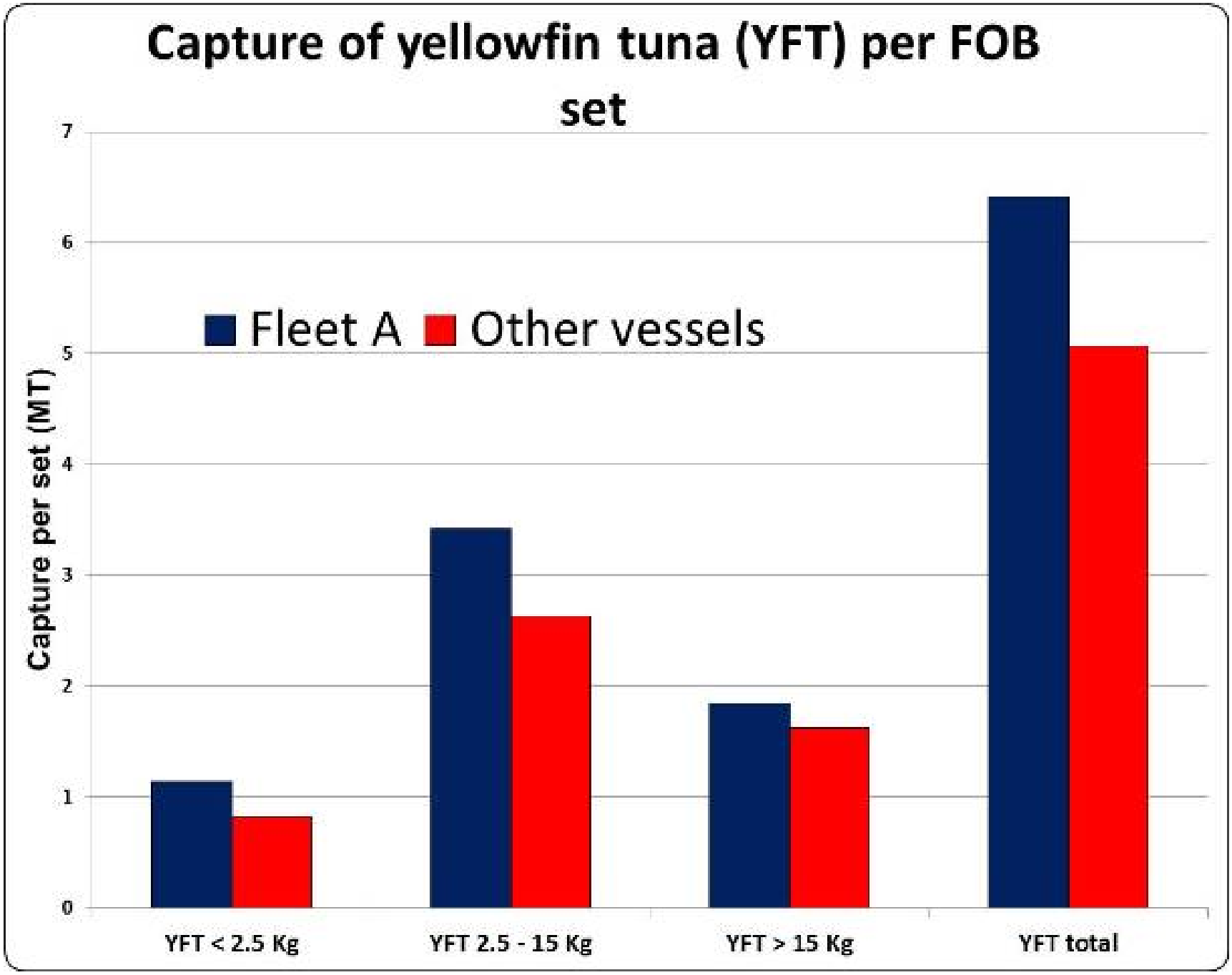
Area: 10ºN - 5ºS 135ºW - 150ºW.

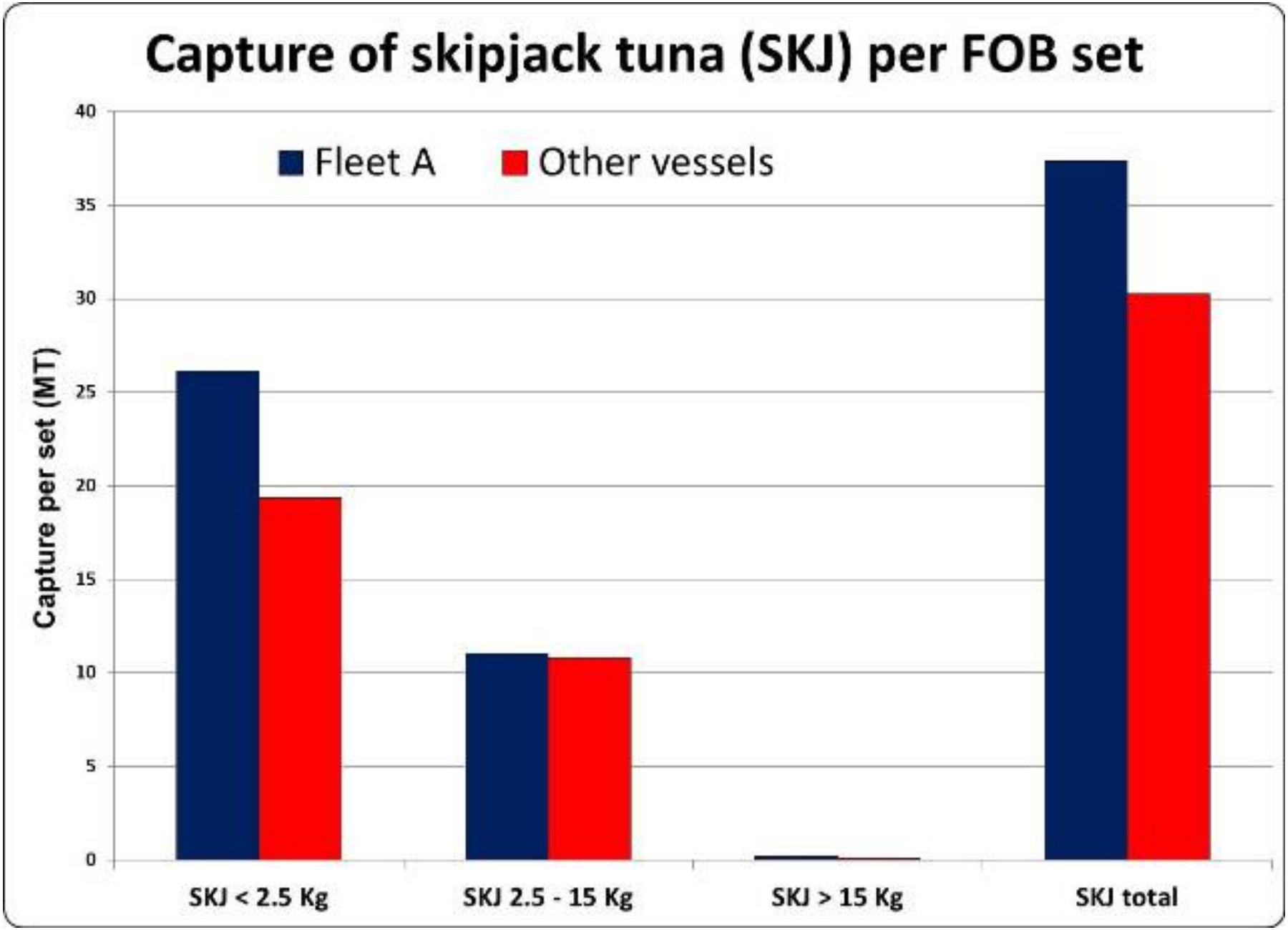

2005 - 2012
FOB sets by vessels
Fleet A
Other vessels
140°
130°
120°
110°
100°
90°
80°
70°
30°
20°
10°
0°
10°
20°


Capture of small sharks (SHK), small mahi-mahi (DORA), small wahoo (WAH), and small rainbow runner per FOB set
Capture per set (Nr. indiv.)
4
3.5
3
2.5
2
1.5
1
0.5
0
Fleet A
Other vessels
SHK < 90 cm
DORA < 30 cm
WAH < 30 cm
RRU < 30 cm

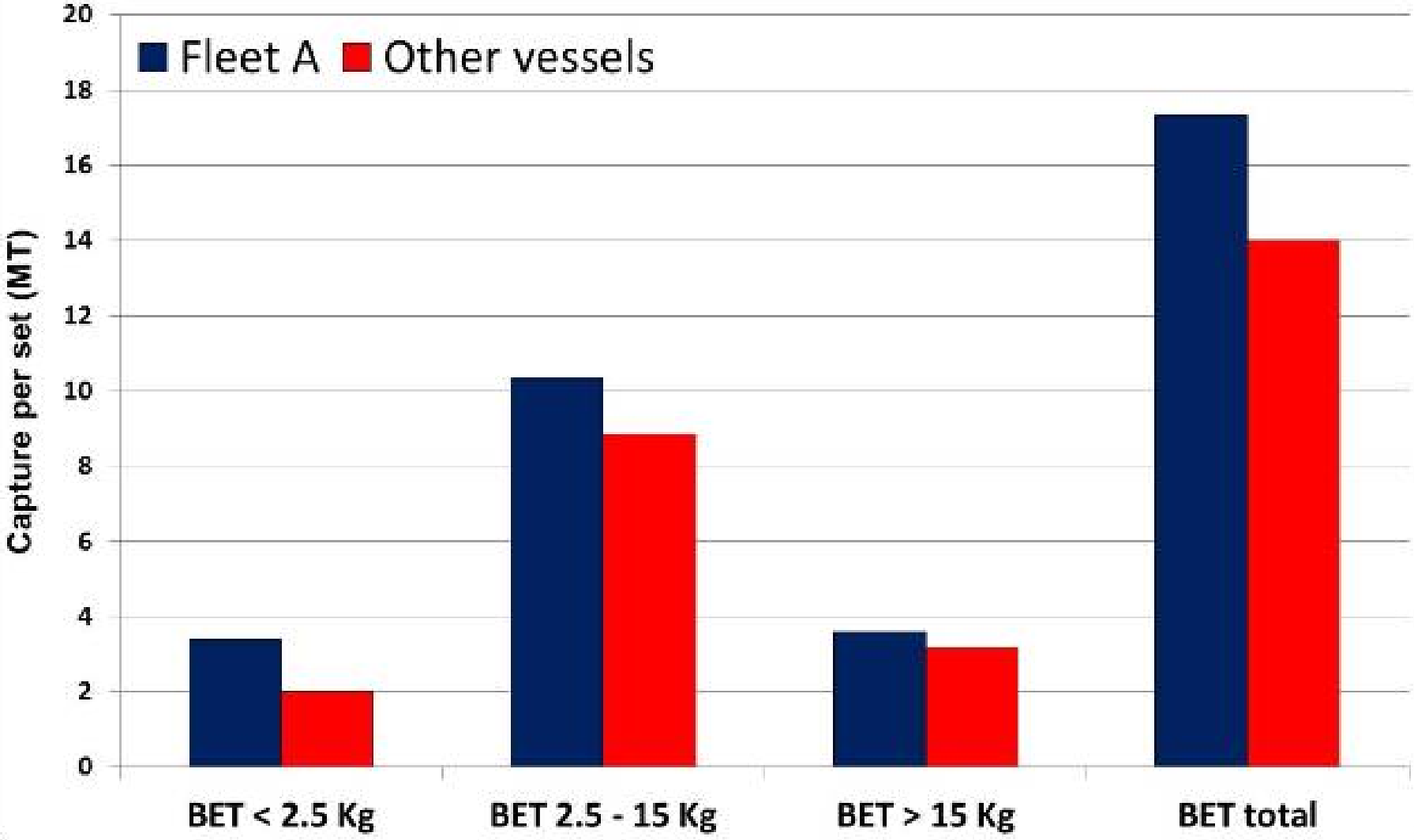

Capture of small medium-large fishes (Mlf) & triggerfishes per FOB set
Capture per set (Num indiv.)
40
35
30
25
20
15
10
5
0
Fleet A
Other vessels
Mlf < 30 cm (x100)
Triggerfishes

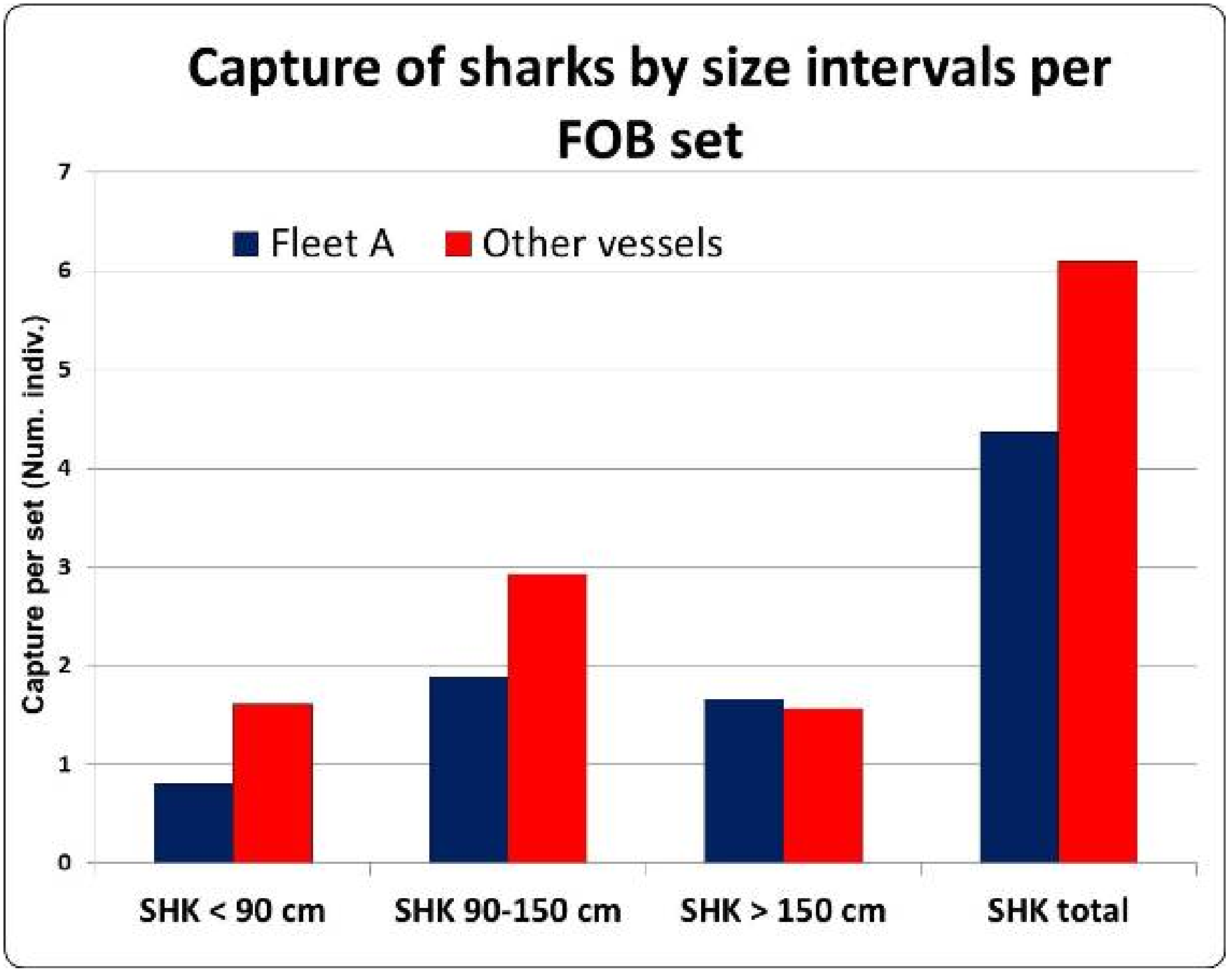

Capture of small tunas (<2.5 kg.) per FOB set
Fleet A
Other vessels
Capture per set (MT)
30
25
20
15
10
5
0
YFT < 2.5 Kg
SKJ < 2.5 Kg
BET < 2.5 Kg

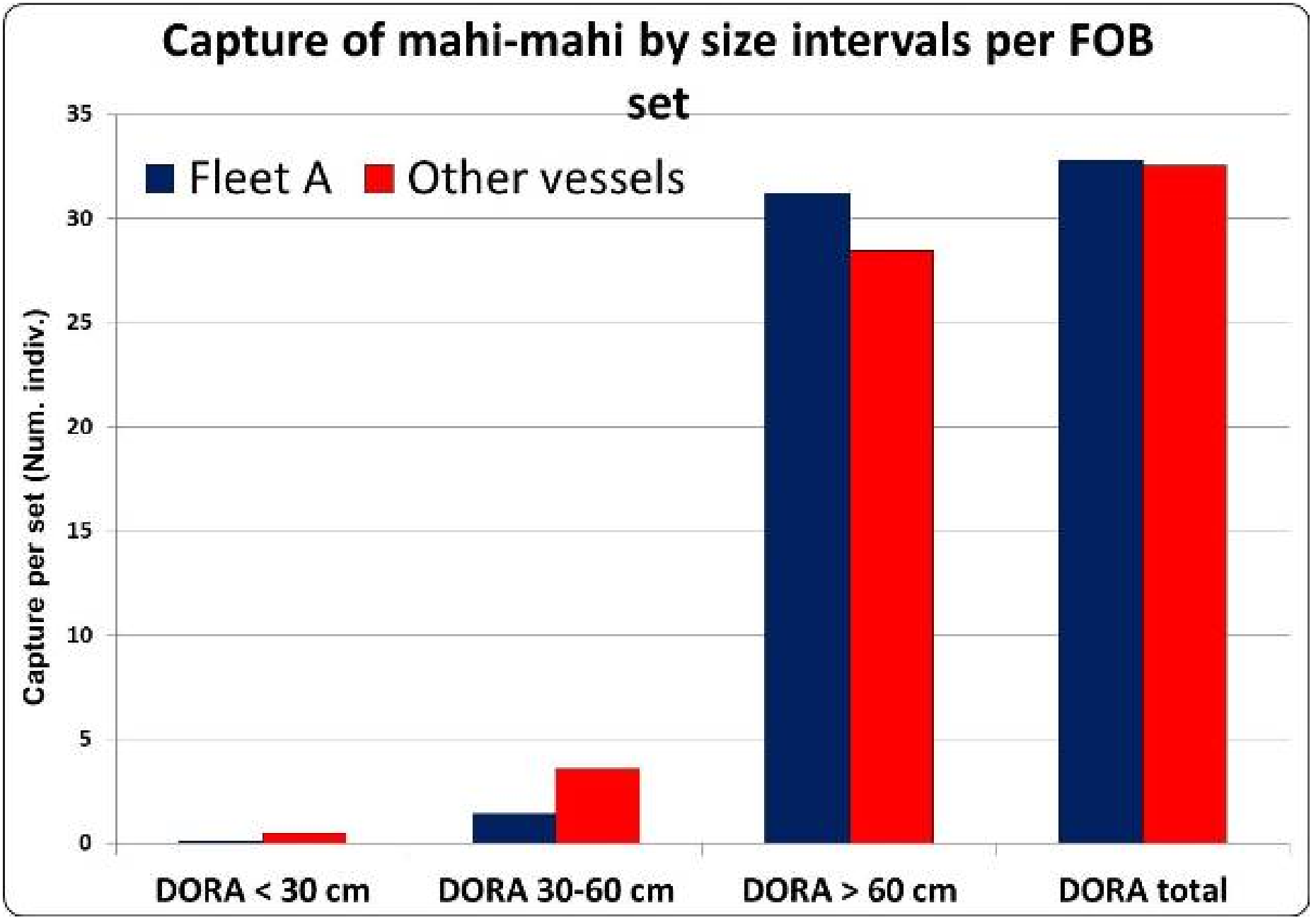

Capture of yellowfin tuna (YFT) per FOB set
Capture per set (MT)
0
1
2
3
4
5
6
7
Fleet A
Other vessels
YFT < 2.5 Kg
YFT 2.5 - 15 Kg
YFT > 15 Kg
YFT total

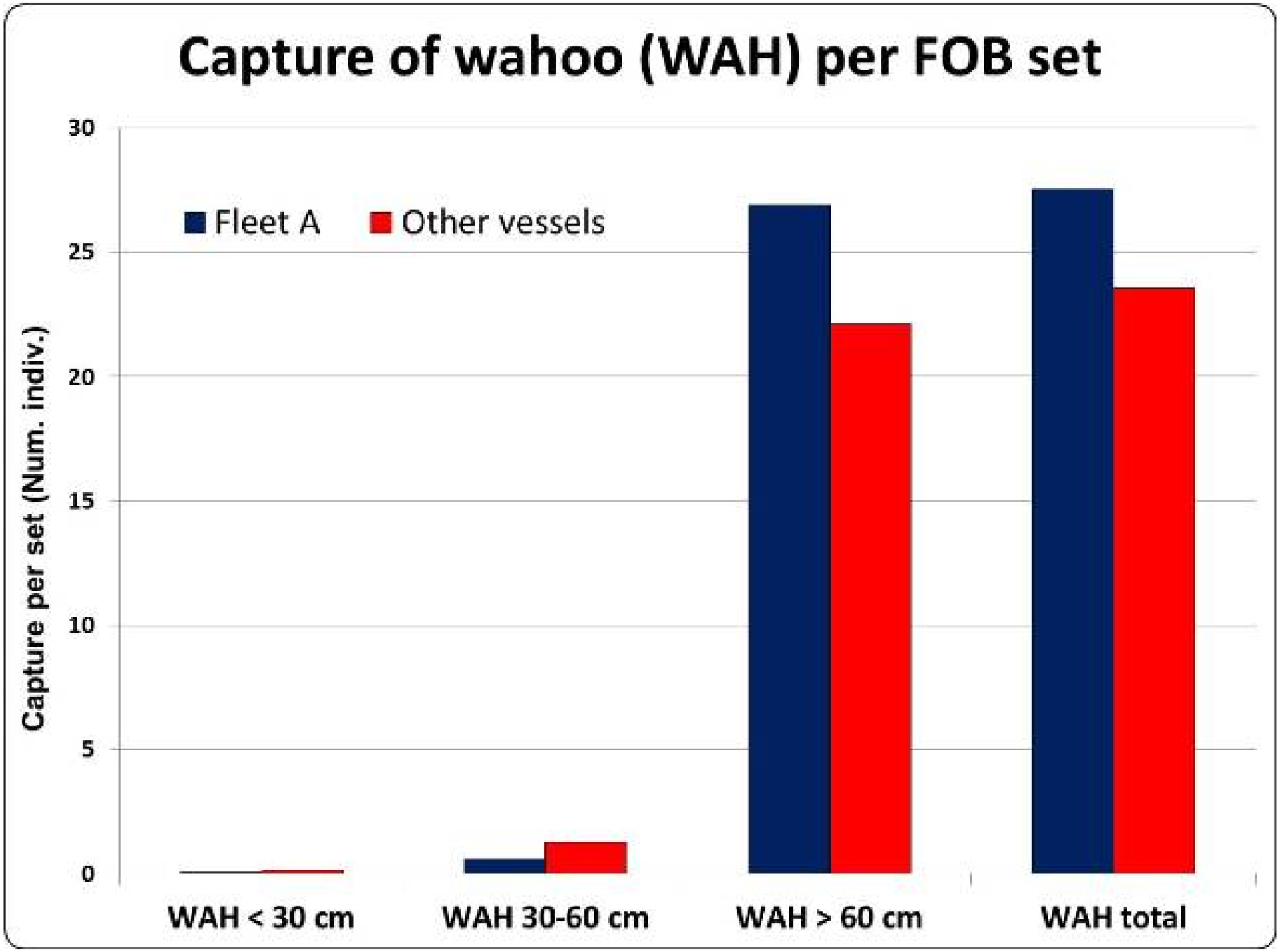

Capture of skipjack tuna (SKJ) per FOB set
Fleet A
Other vessels
Capture per set (MT)
40
35
30
25
20
15
10
5
0
SKJ < 2.5 Kg
SKJ 2.5 - 15 Kg
SKJ > 15 Kg
SKJ total

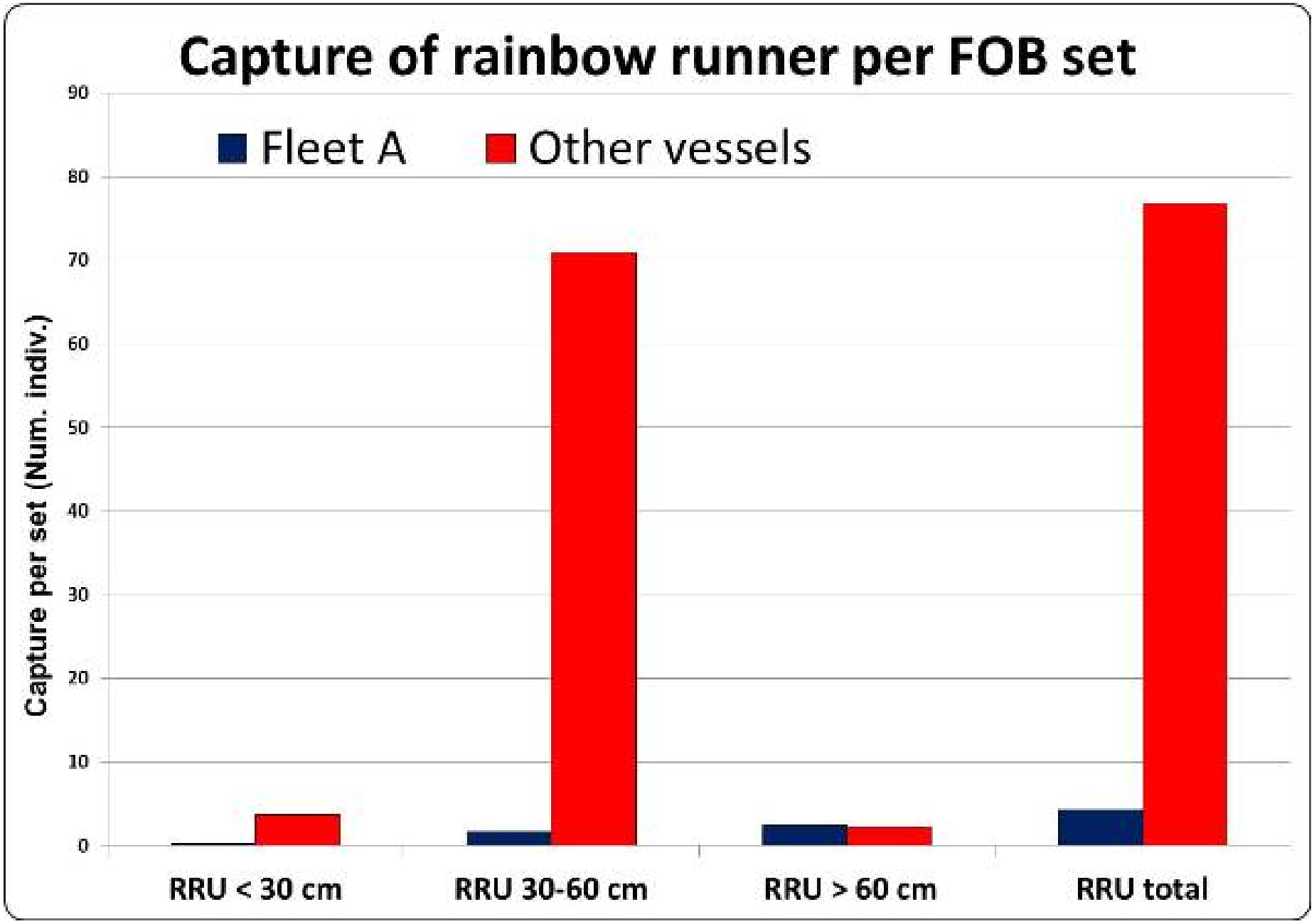
Capture of bigeye tuna (BET) per FOB set




Capture of sharks by size intervals per FOB set
Fleet A
Other vessels
Capture per set (Num. indiv.)
0
1
2
3
4
5
6
7
SHK < 90 cm
SHK 90-150 cm
SHK > 150 cm
SHK total


Capture of mahi-mahi by size intervals per FOB set
Fleet A
Other vessels
Capture per set (Num. indiv.)
35
30
25
20
15
10
5
0
DORA < 30 cm
DORA 30-60 cm
DORA > 60 cm
DORA total


Capture of wahoo (WAH) per FOB set
Capture per set (Num. indiv.)
30
25
20
15
10
5
0
Fleet A
Other vessels
WAH < 30 cm
WAH 30-60 cm
WAH > 60 cm
WAH total


Capture of rainbow runner per FOB set
Fleet A
Other vessels
Capture per set (Num. indiv.)
90
80
70
60
50
40
30
20
10
0
RRU < 30 cm
RRU 30-60 cm
RRU > 60 cm
RRU total

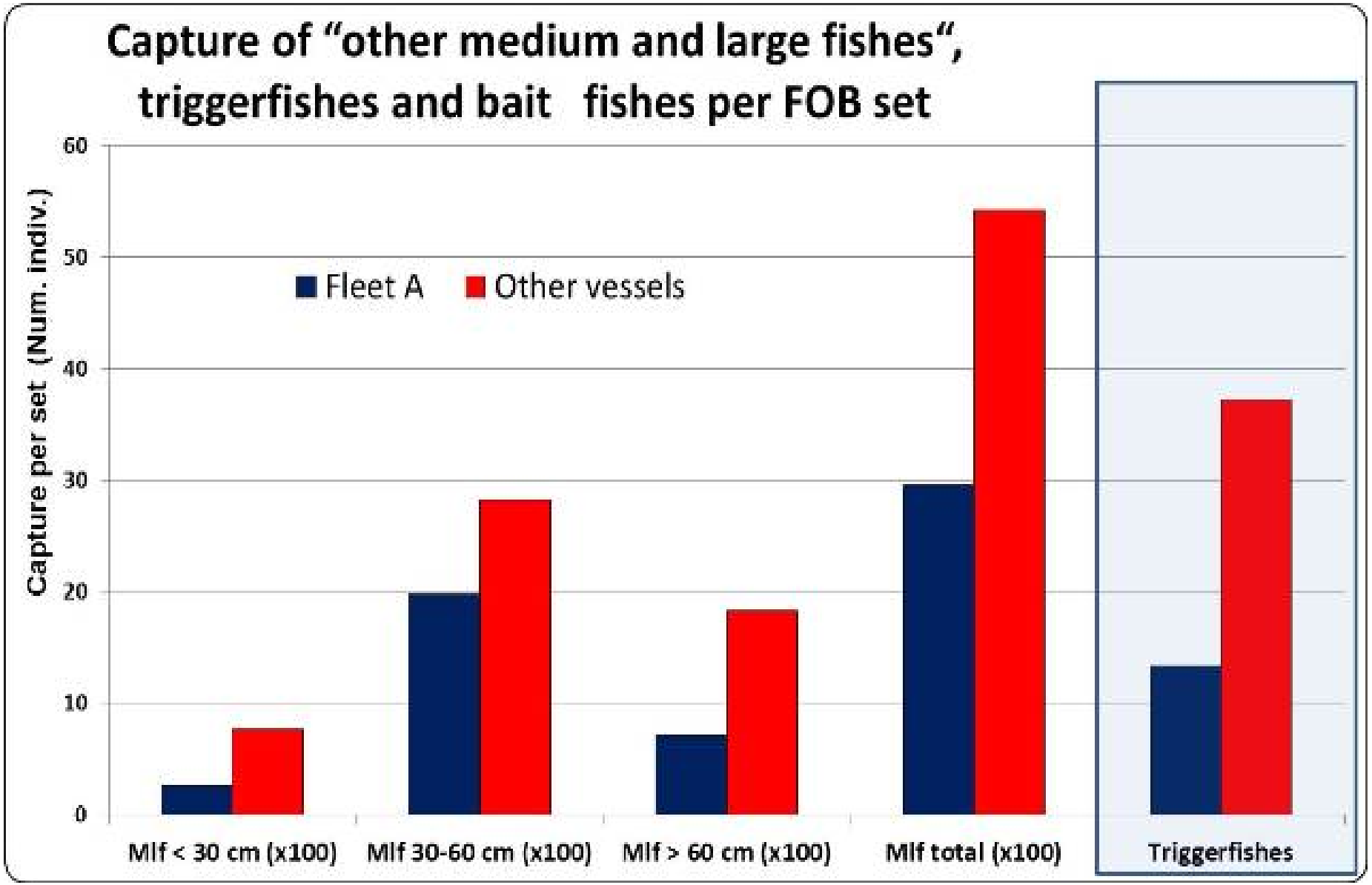
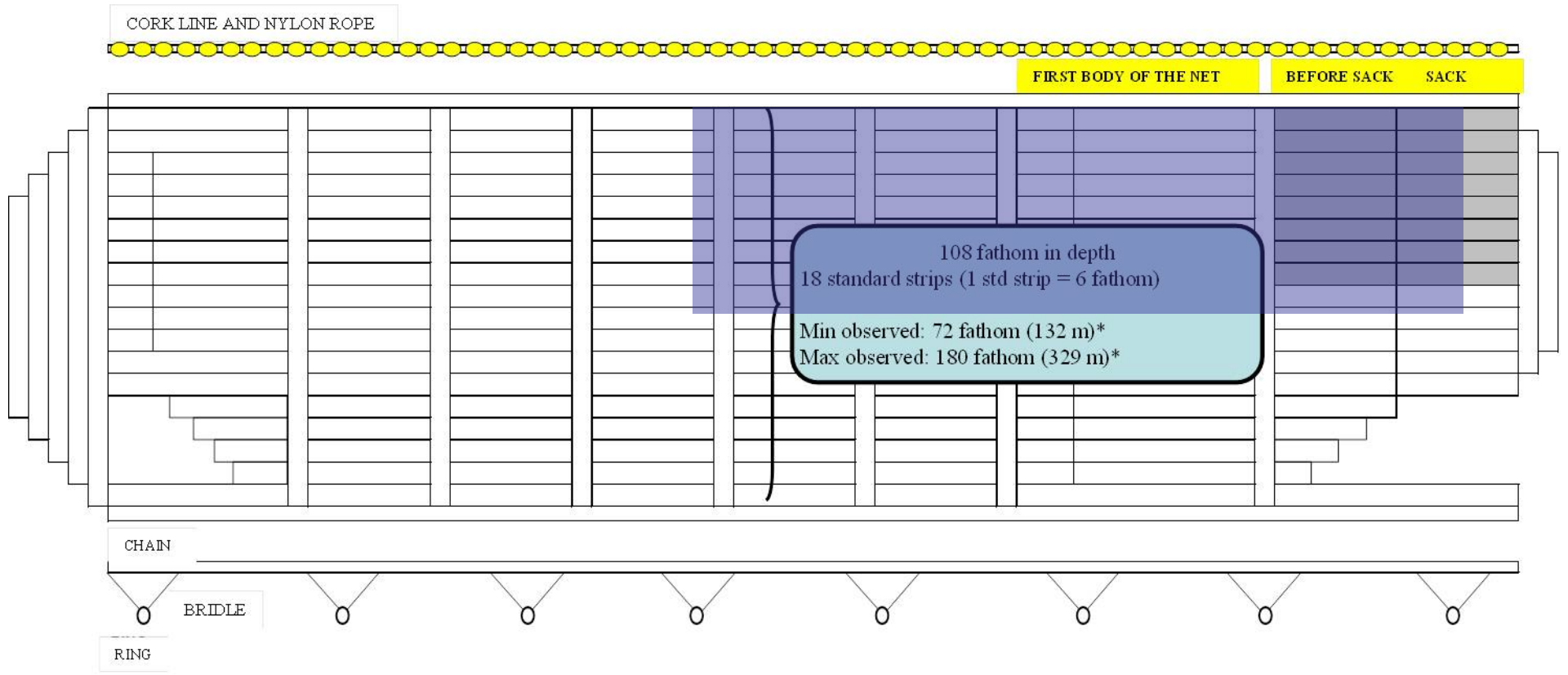

Capture of "other medium and large fishes", triggerfishes and bait fishes per FOB set
Capture per set (Num. indiv.)
60
50
40
30
20
10
0
Fleet A
Other vessels
Mlf < 30 cm (x100)
Mlf 30-60 cm (x100)
Mlf > 60 cm (x100)
Mlf total (x100)
Triggerfishes

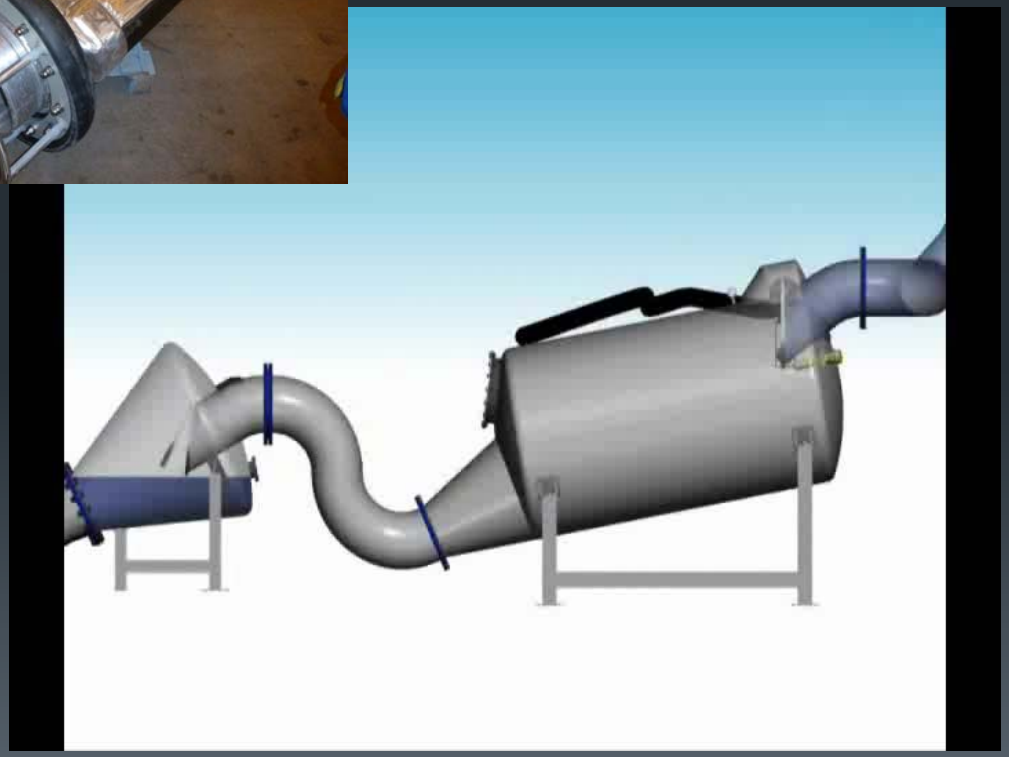
FIGURE 2

Purse seine net design (typical EPO net)



*For vessels that made 50% or more FO sets during 2004-2008 - EPO

Pumps for selectivity



Manta rays

Species	Disk width sexual maturity		Maximum DW	
	Males	Females	Males	Females
Manta birostris (a)	3.6 m	4 m	4.9 m	4.1 m
Mobula japanica (a)	2 m	< 1 m.	2.4 m	2.8 m
M. japanica (b)	2.1 m	≈ 2.1 m	2.4 m	2.3 m
Mobula tarapacana (a)	2.5 m	3.0 m	3.7 m	
Mobula thurstoni (a)	1.5 m		1.8 m	1.7 m
M. thurstoni (b)			1.8 m	1.8 m
M. munkiana (b)			0.9 m	1.1 m
Manta alfredi (c)	> 3 m.	≈ 4 m		
M. alfredi (d)	3.4 m	2.7 m	3.0 m	3.6 m

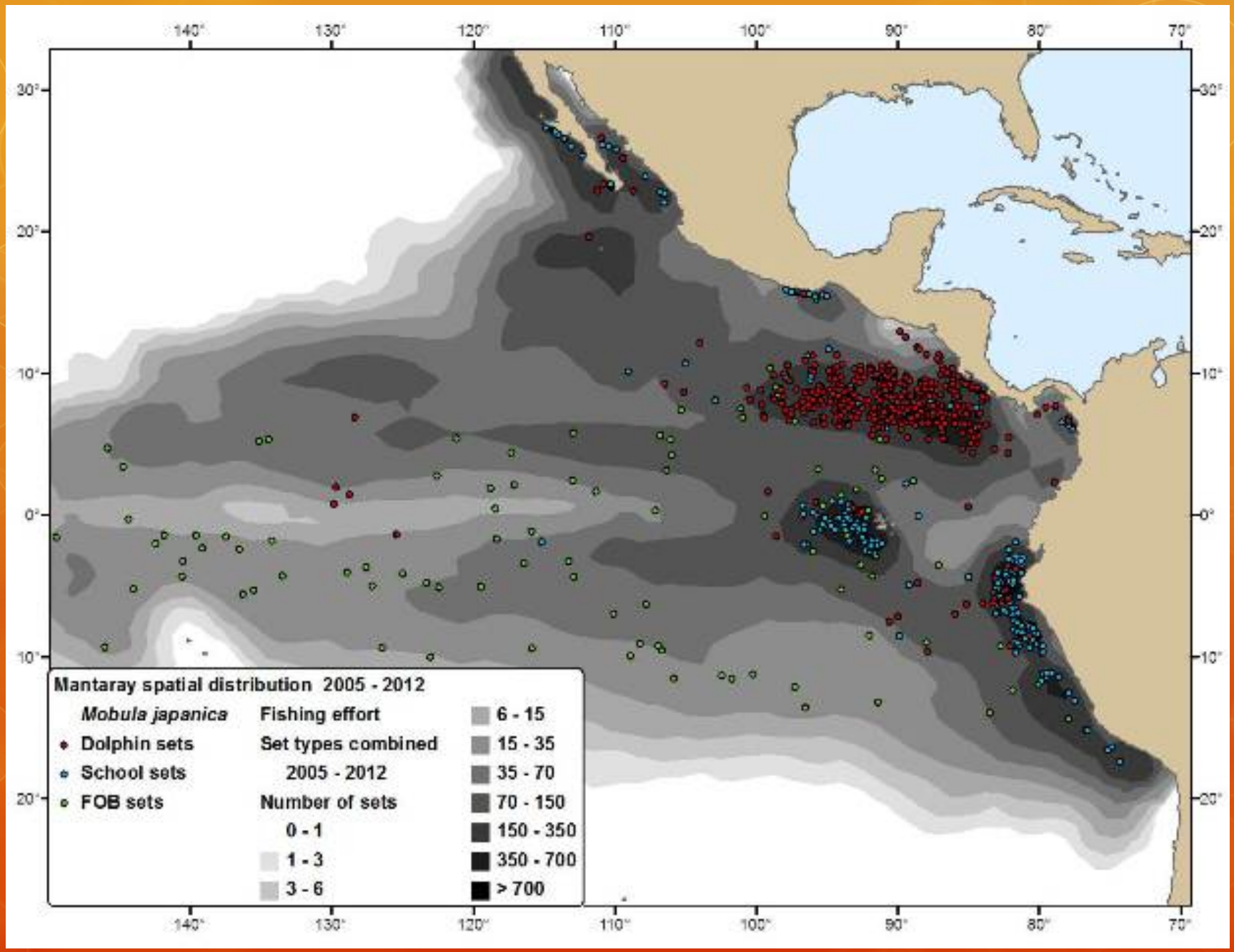
One pup every 1 – 3 years

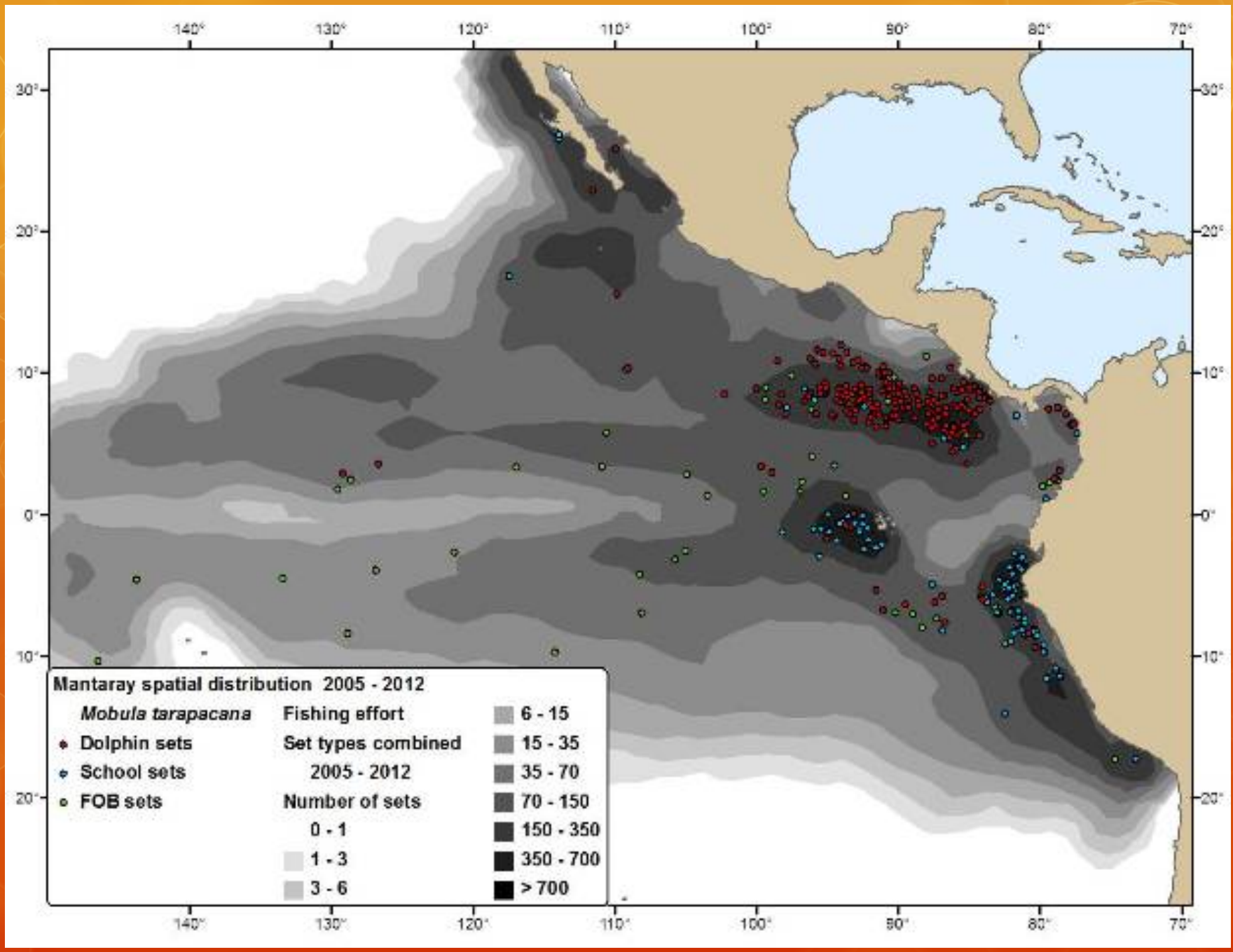
Gestation 12 months

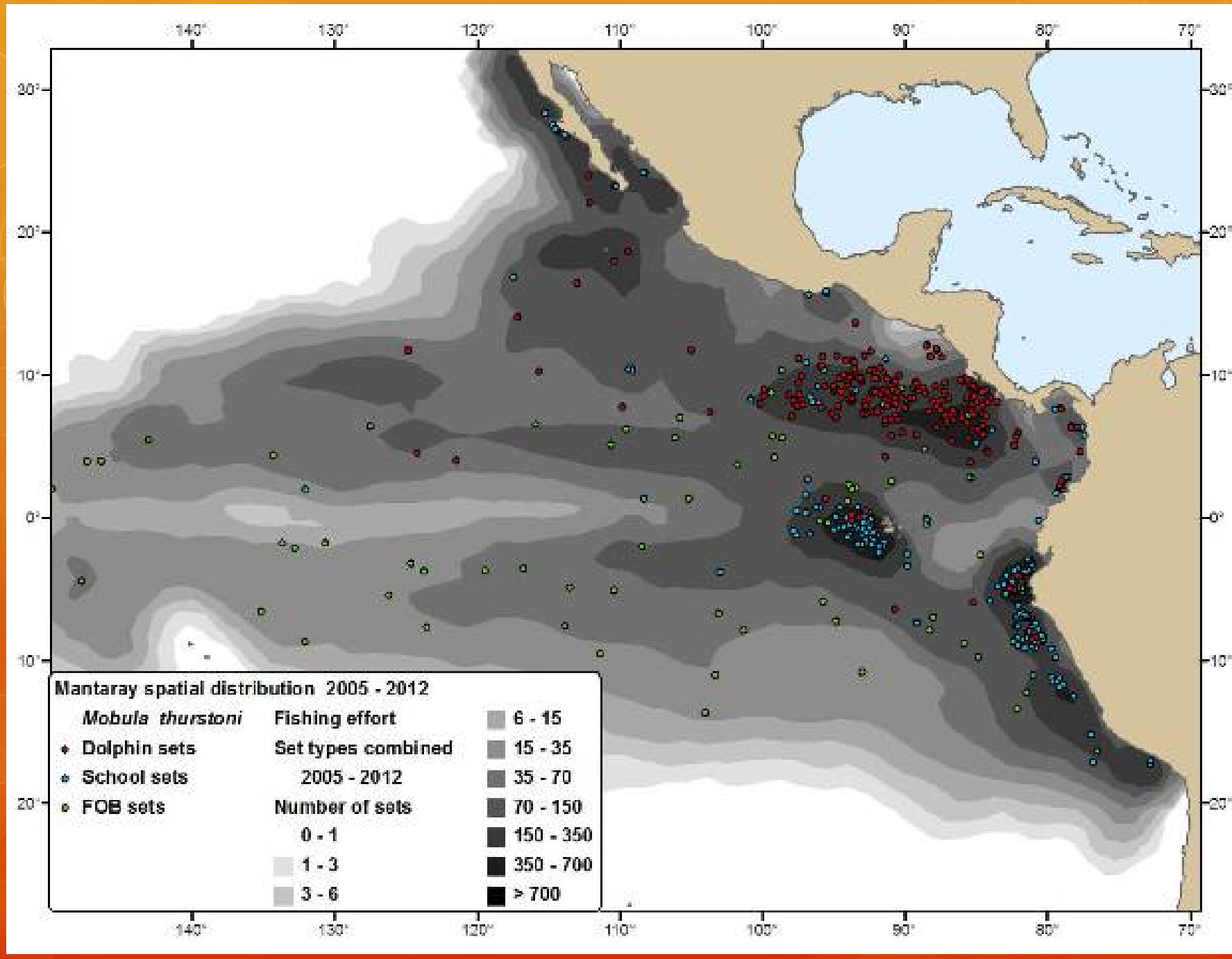
Sexual maturity 3 – 6 years

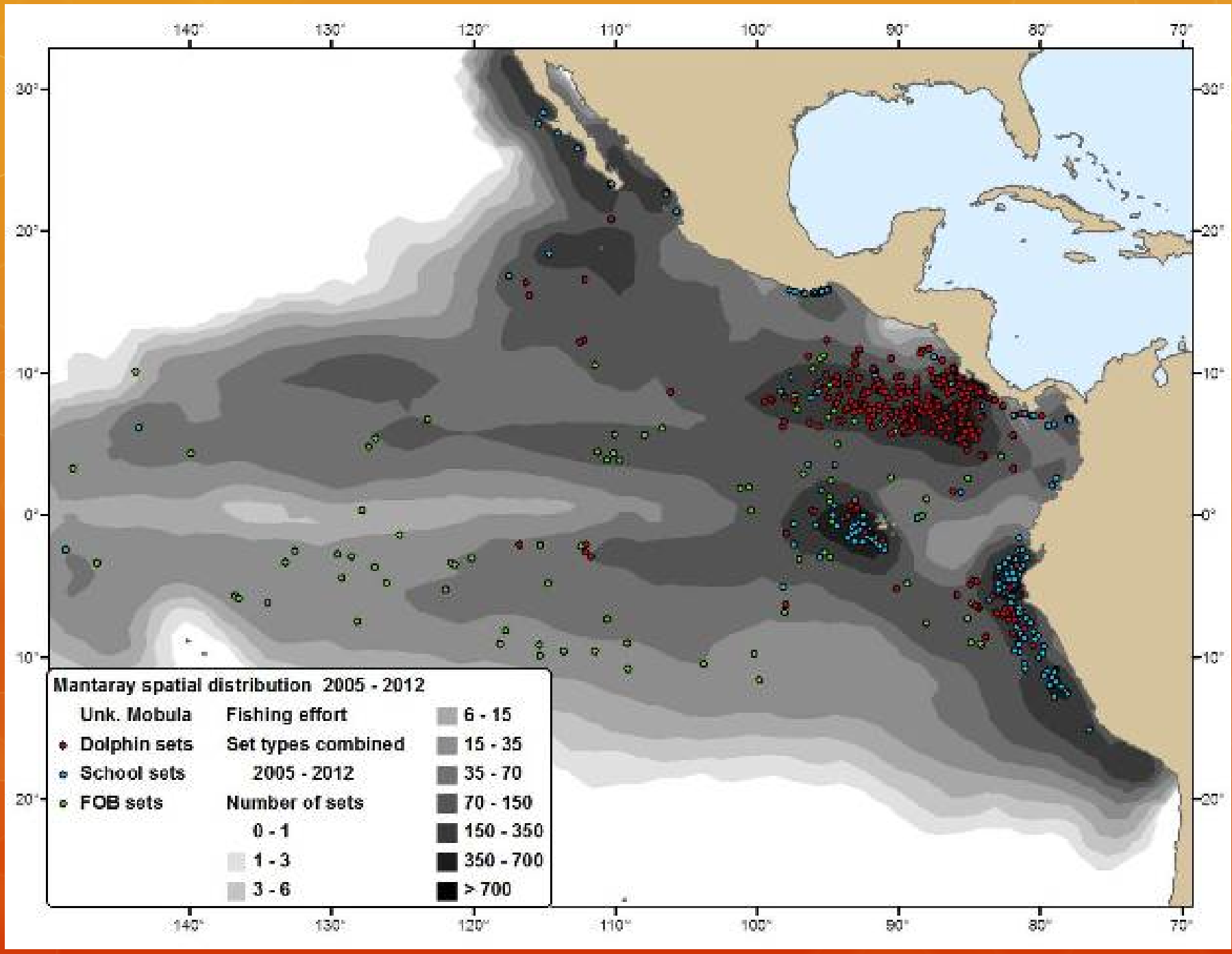
Size at sexual maturity 2m – 4 m disc width

Longevity > 14 yrs – 27 yrs


140°
130°
120°
110°
100°
90°
80°
70°
30°
20°
10°
0°
10°
20°
Mantaray spatial distribution 2005 - 2012
Mobula japanica
Dolphin sets
School sets
FOB sets
Fishing effort
Set types combined
2005 - 2012
Number of sets
0 - 1
1 - 3
3 - 6
6 - 15
15 - 35
35 - 70
70 - 150
150 - 350
350 - 700
> 700


Mantaray spatial distribution 2005 - 2012
Mobula tarapacana
Dolphin sets
School sets
FOB sets
Fishing effort
Set types combined
2005 - 2012
Number of sets
0 - 1
1 - 3
3 - 6
6 - 15
15 - 35
35 - 70
70 - 150
150 - 350
350 - 700
> 700
140°
130°
120°
110°
100°
90°
80°
70°
30°
20°
10°
0°
10°
20°


140°
130°
120°
110°
100°
90°
80°
70°
30°
20°
10°
0°
10°
20°
Mantaray spatial distribution 2005 - 2012
Mobula thurstoni
Dolphin sets
School sets
FOB sets
Fishing effort
Set types combined
2005 - 2012
Number of sets
0 - 1
1 - 3
3 - 6
6 - 15
15 - 35
35 - 70
70 - 150
150 - 350
350 - 700
> 700

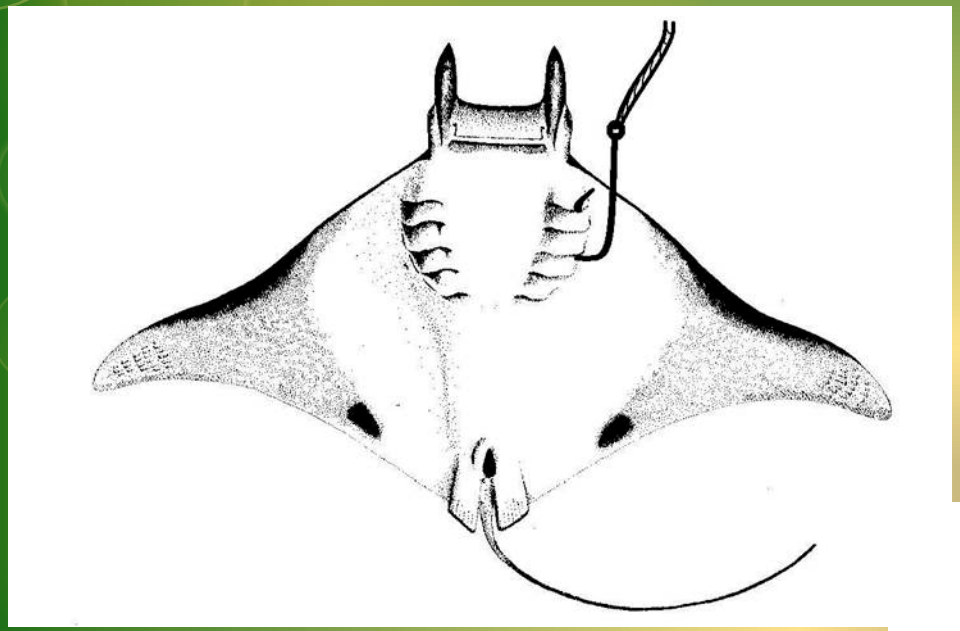

140°
130°
120°
110°
100°
90°
80°
70°
30°
20°
10°
0°
10°
20°
Mantaray spatial distribution 2005 - 2012
Unk. Mobula
Dolphin sets
School sets
FOB sets
Fishing effort
Set types combined
2005 - 2012
Number of sets
0 - 1
1 - 3
3 - 6
6 - 15
15 - 35
35 - 70
70 - 150
150 - 350
350 - 700
> 700

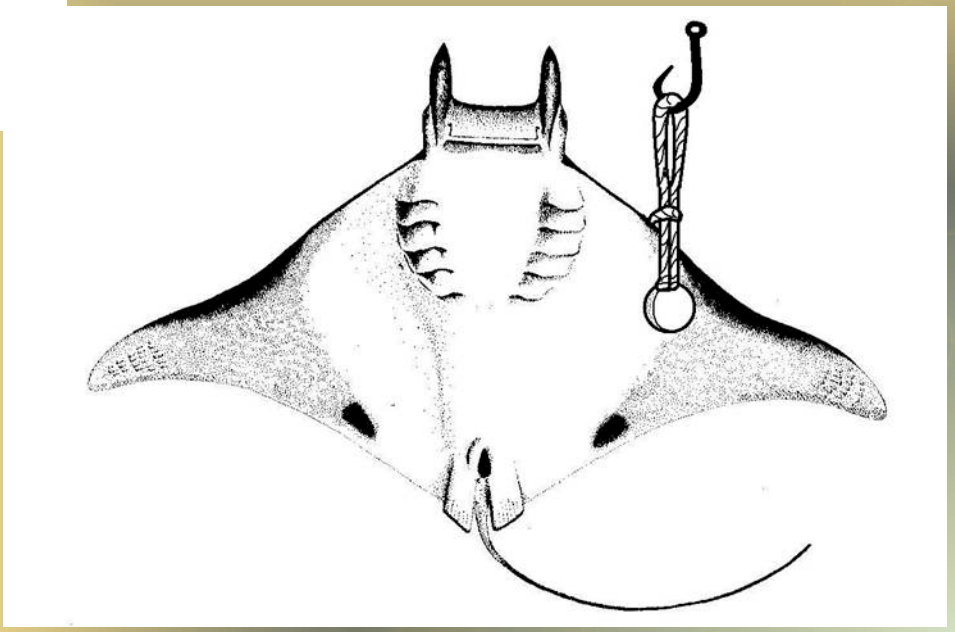
Mantas and devil rays bycatch (1993 - 2011)

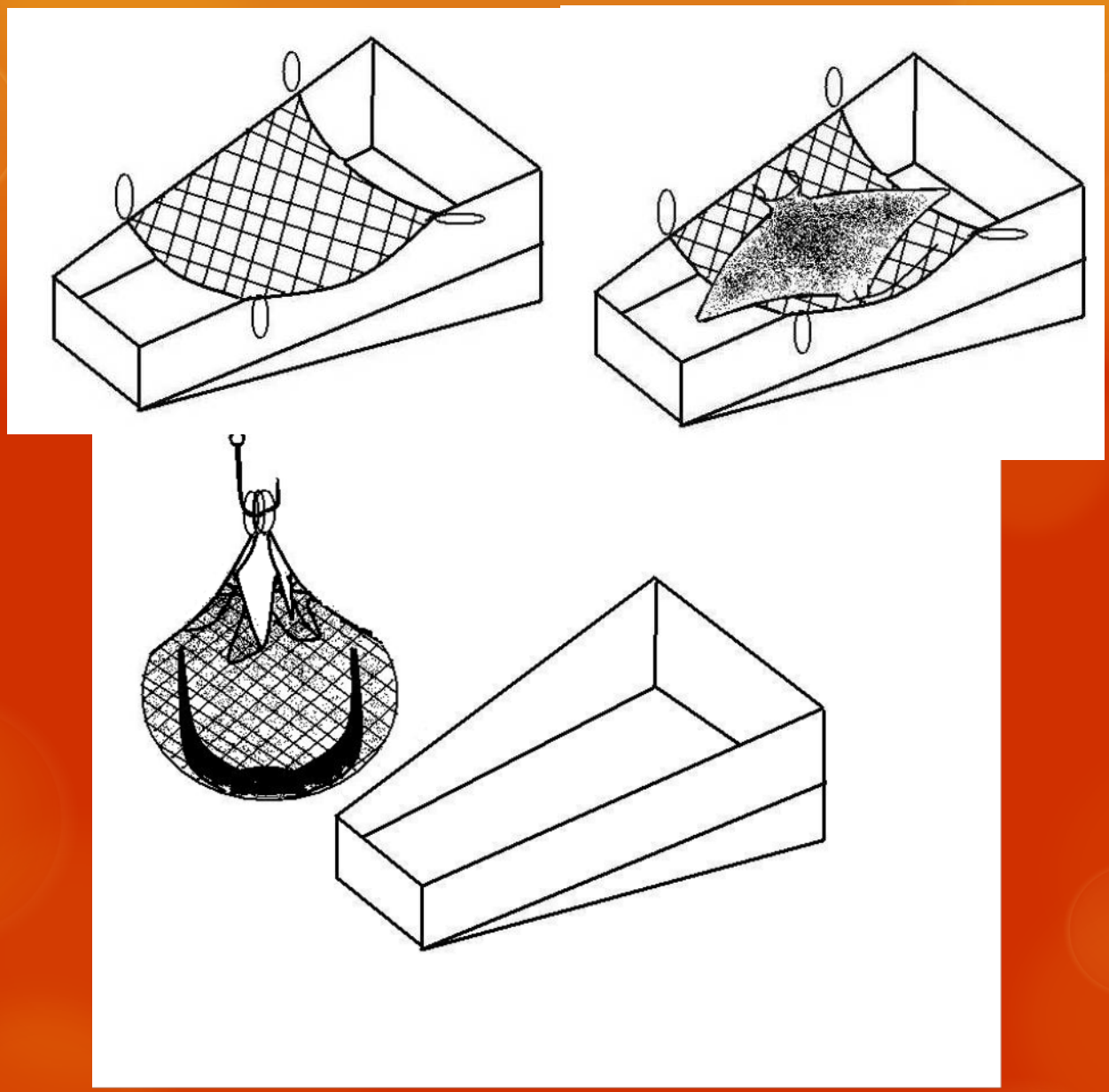
	Avg all years	1993	1994	1995	1996	1997	1998	1999	2000	2001
Giant manta	103	0	1	1	0	2	99	74	15	14
Spinetail manta	171	0	0	0	0	0	0	0	0	26
Chilean devil ray	65	0	0	0	0	0	0	0	0	4
Smoothtail manta	330	0	3	0	0	0	8	3	257	290
Munk's devil ray	38	0	0	0	0	0	0	0	0	3
Unid Manta/devil rays	2109	6531	1689	2817	1850	1229	4453	2112	3126	787
Total	**2816**	**6531**	**1693**	**2818**	**1850**	**1231**	**4560**	**2189**	**3398**	**1123**

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Giant manta	13	14	64	69	286	30	82	18	1169	15
Spinetail manta	111	96	89	253	679	383	364	316	659	274
Chilean devil ray	29	8	33	124	102	116	316	213	167	115
Smoothtail manta	2143	885	523	291	629	183	190	146	294	430
Munk's devil ray	14	68	32	35	96	55	171	60	82	98
Unid Manta/devil rays	2760	2040	1361	2237	1662	1460	339	491	2643	480
Total	**5069**	**3111**	**2102**	**3010**	**3454**	**2227**	**1463**	**1244**	**5014**	**1412**

Release methods







Better techniques ??

Whale sharks

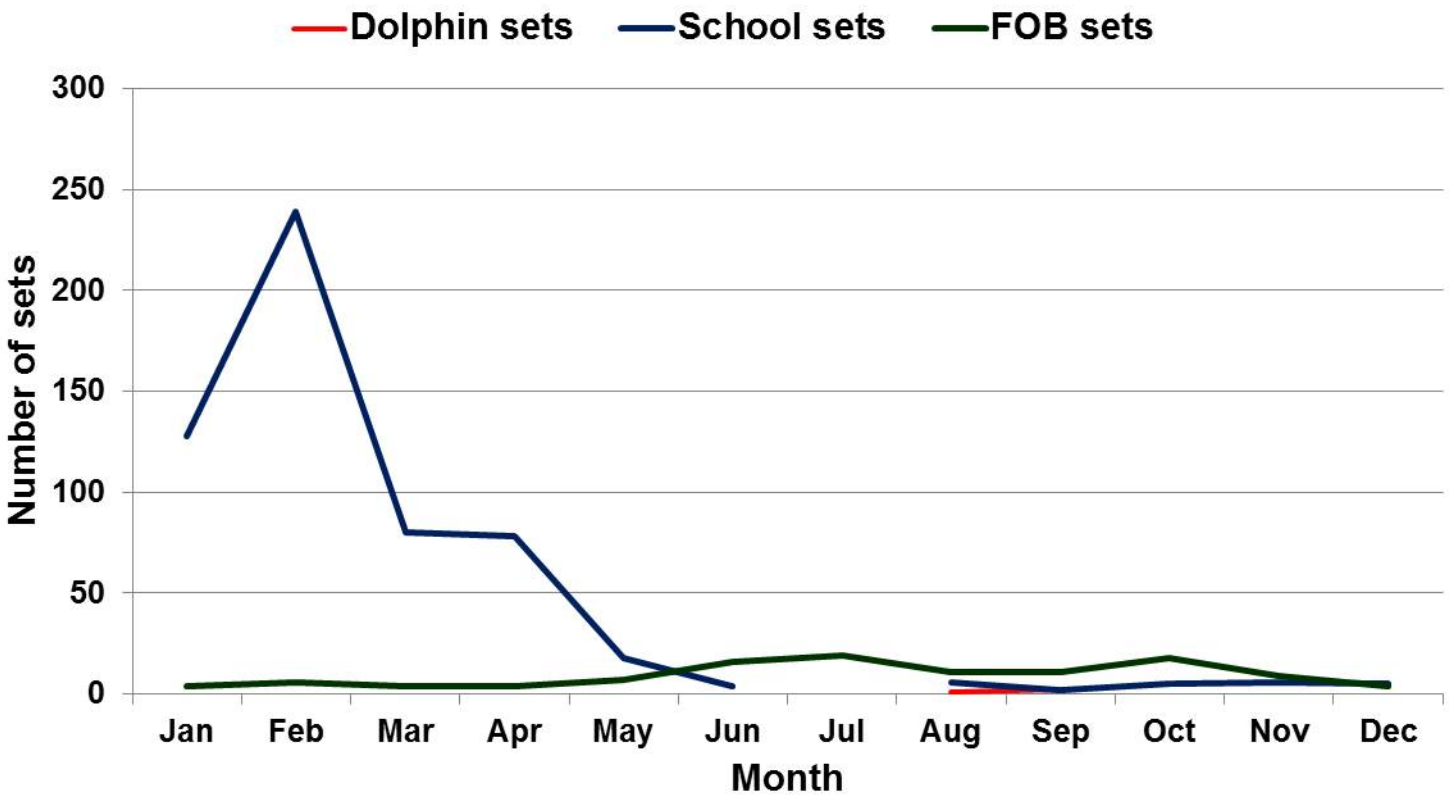
Number of sets by year with presence of whale sharks

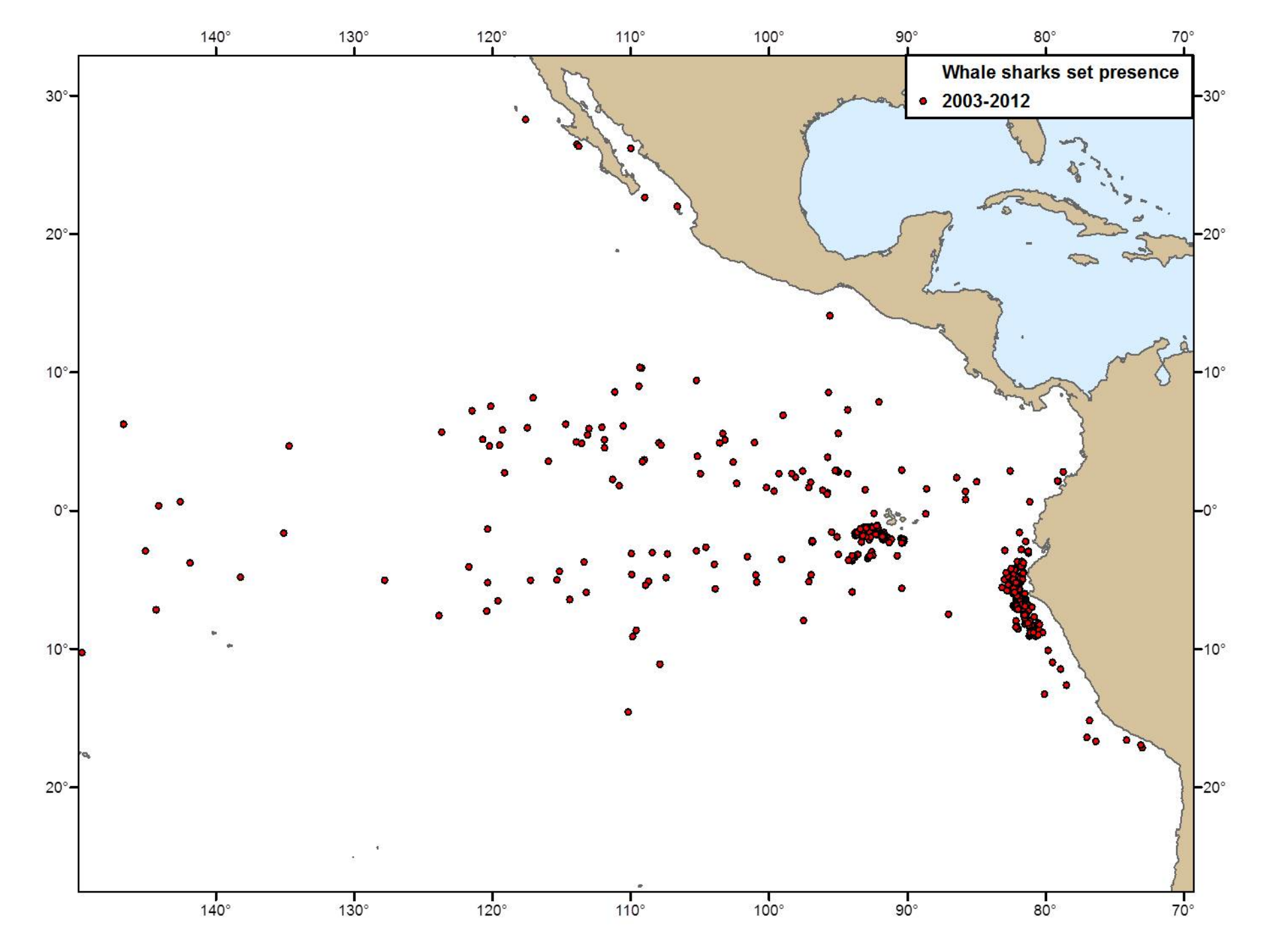
Year	Number of sets
2003	35
2004	40
2005	23
2006	268
2007	61
2008	121
2009	25
2010	38
2011	22
2012	60

Number of whale sharks grouped by quarter and by size

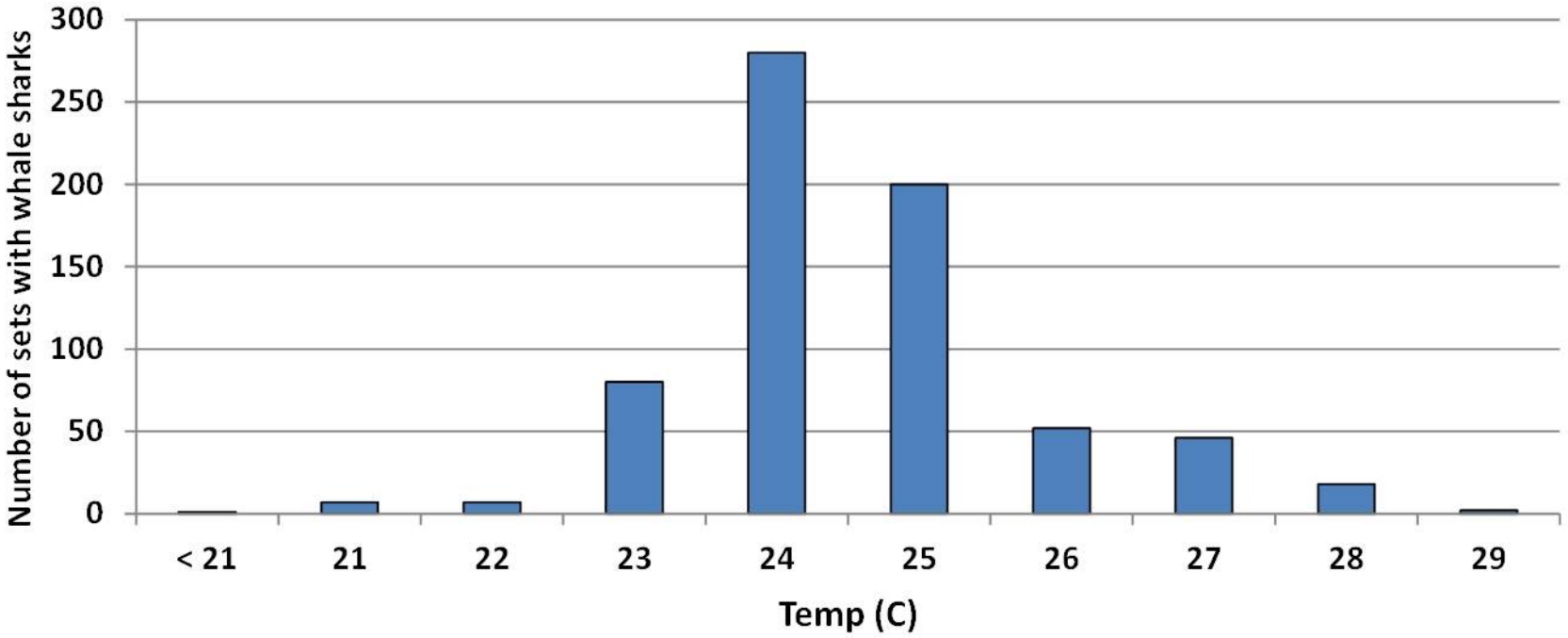
Quarter	<= 2 m	2.1 - 5 m	5.1 - 9 m	> 9 m
1	4	31	170	245
2	2	28	31	41
3	6	16	23	14
4	4	9	16	10

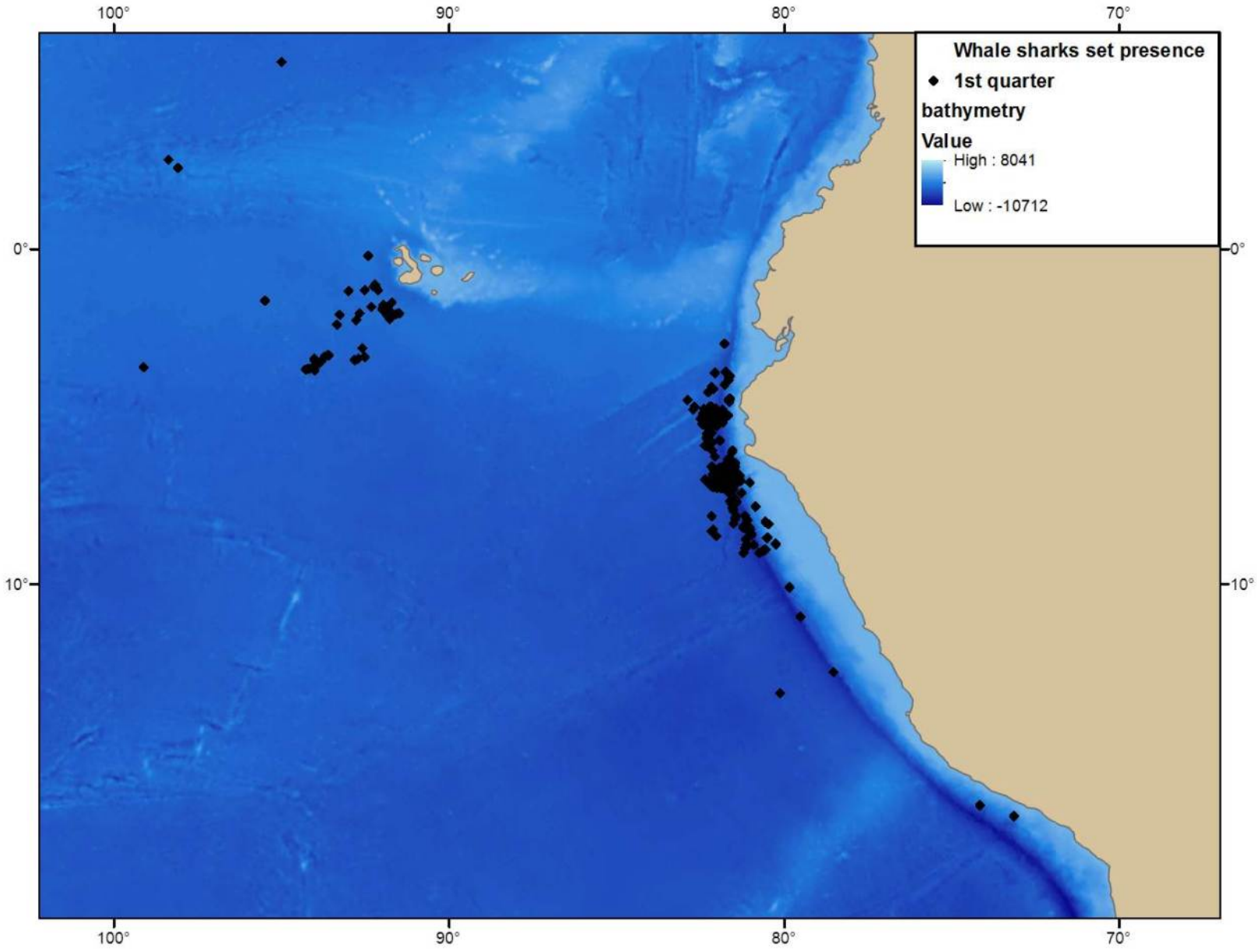
Number of sets with whale sharks by month (2003 – 2012)

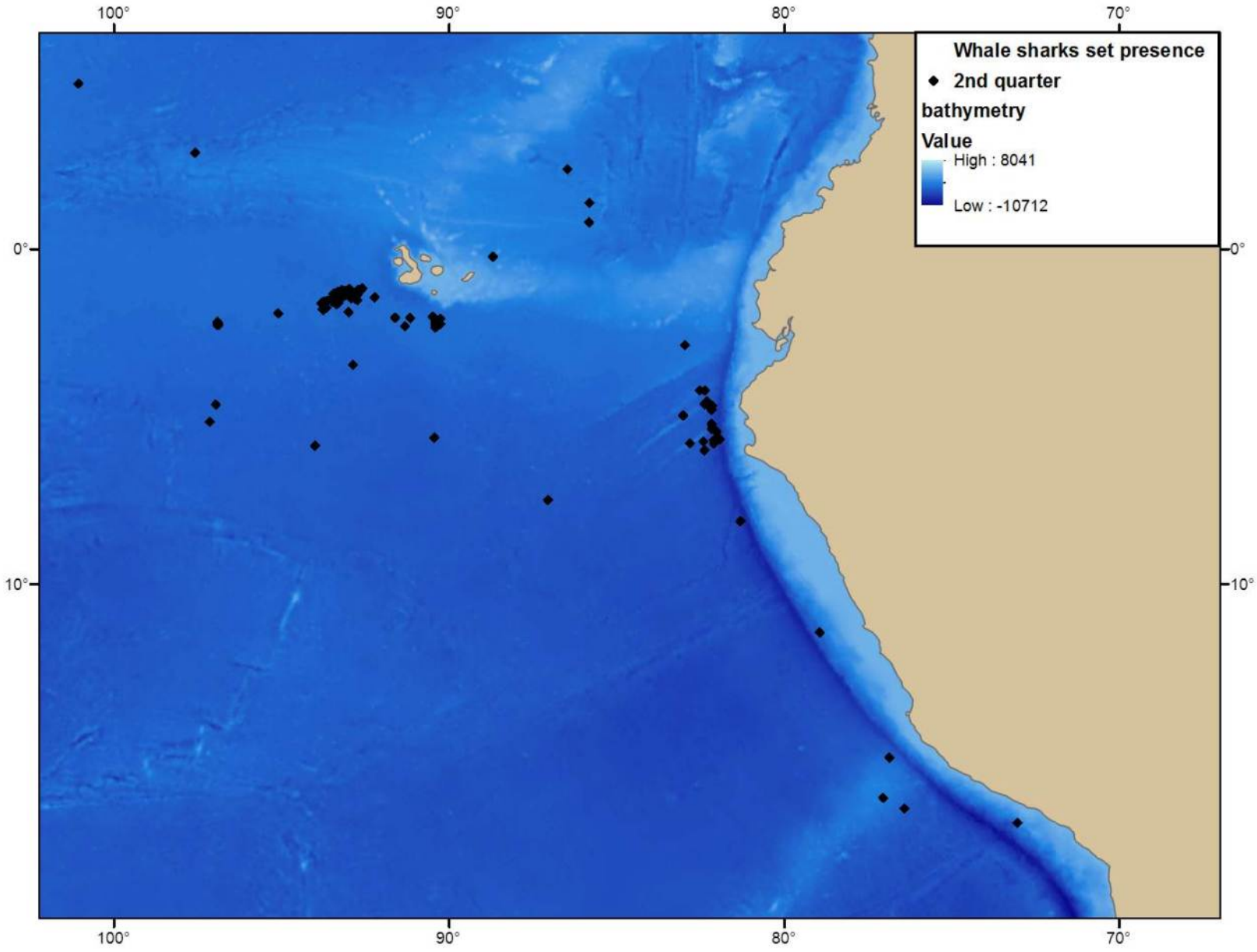


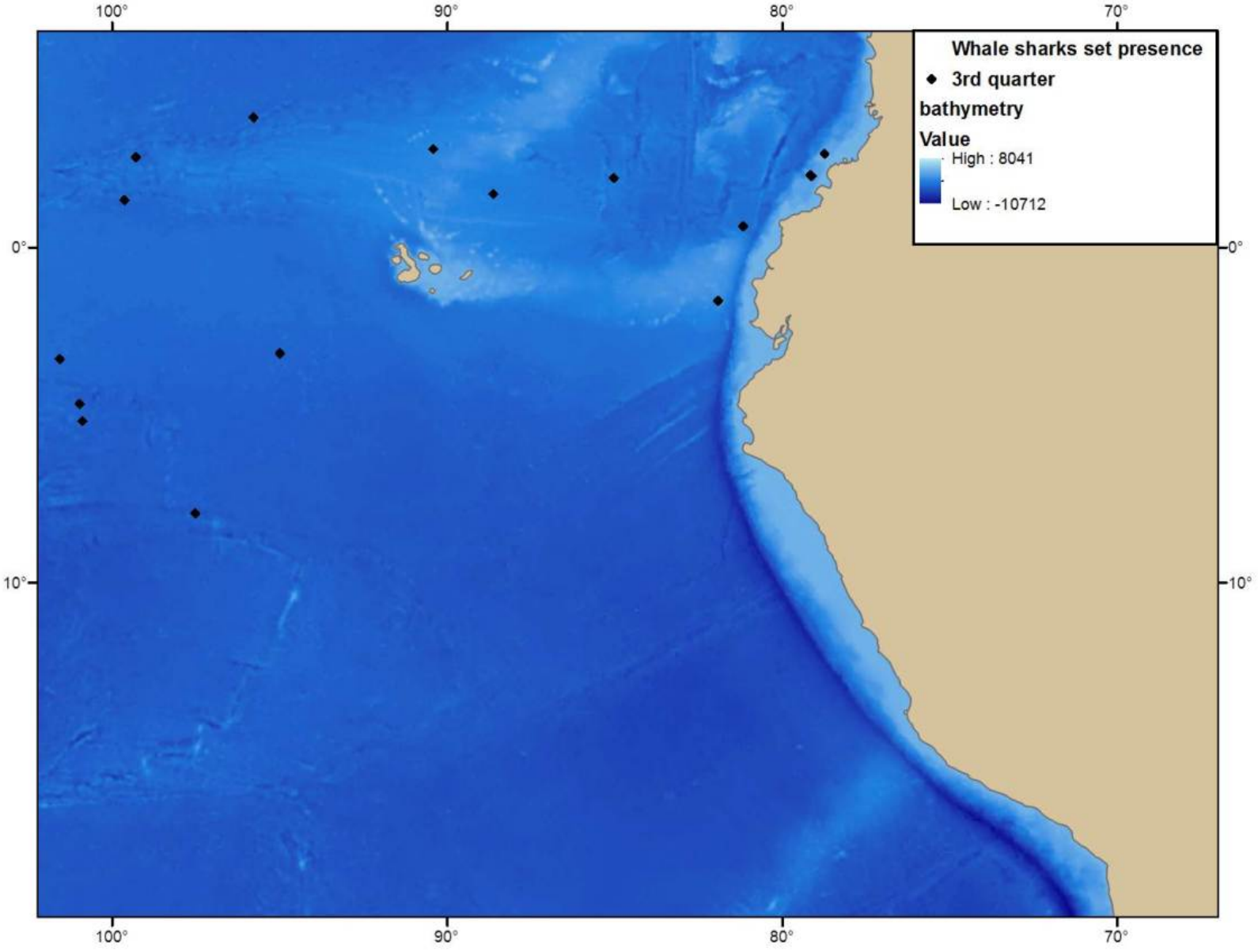

Whale sharks set presence
2003-2012
140°
130°
120°
110°
100°
90°
80°
70°
30°
20°
10°
0°
10°
20°

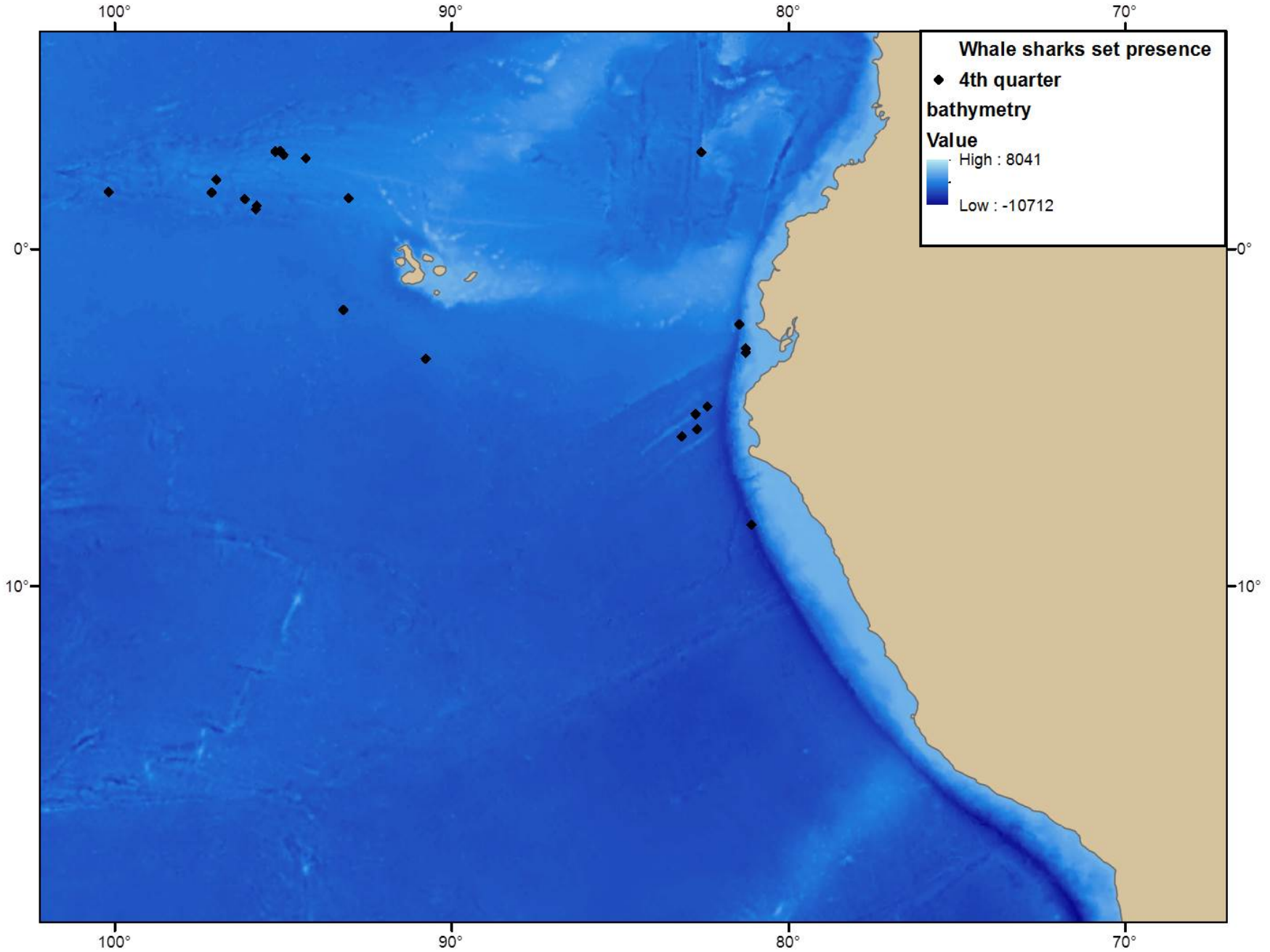
Sets with presence of whale sharks grouped by sea surface temperature (ºC)

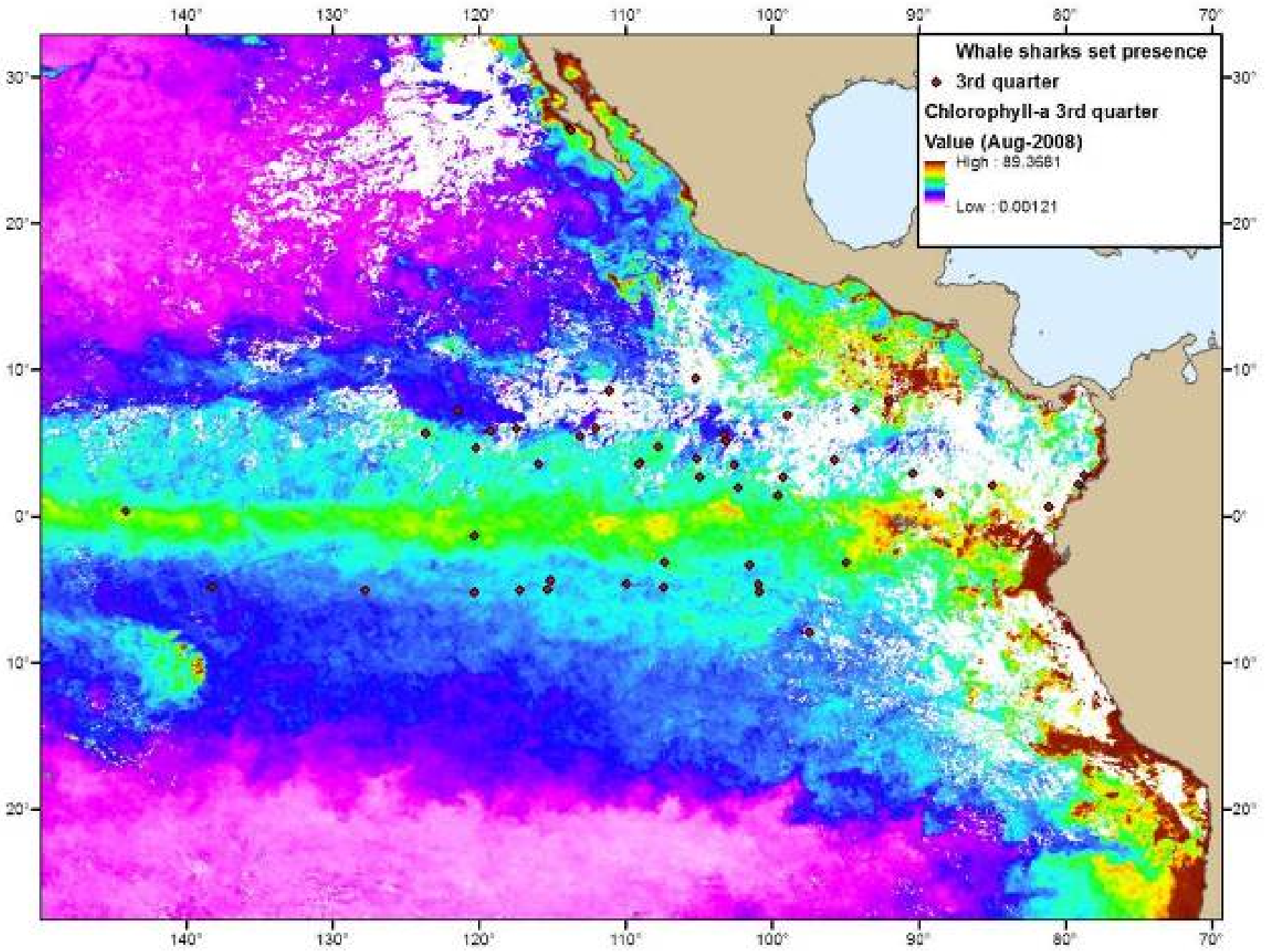


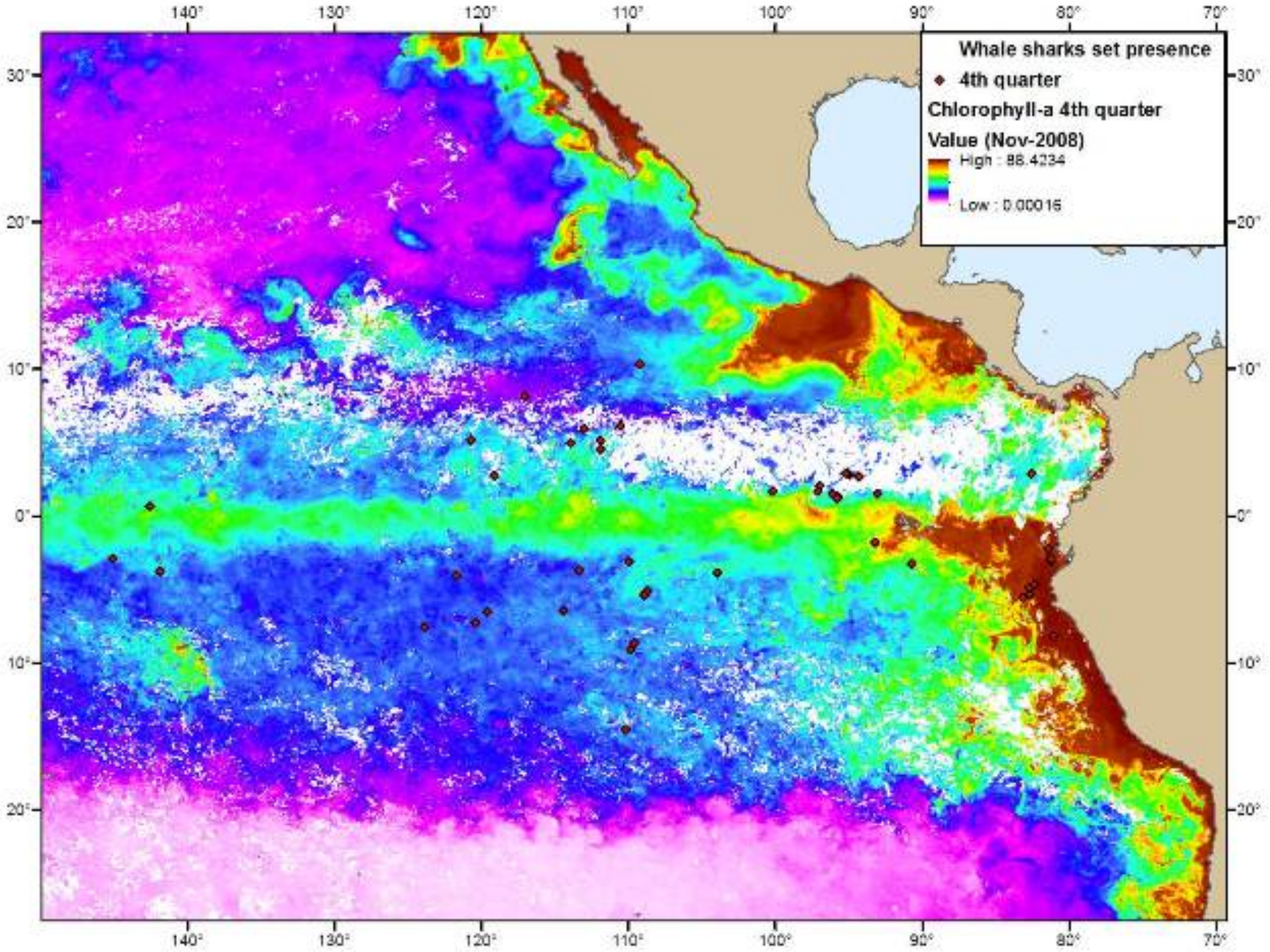

100°
90°
80°
70°
0°
10°
Whale sharks set presence
1st quarter
bathymetry
Value
High : 8041
Low : -10712

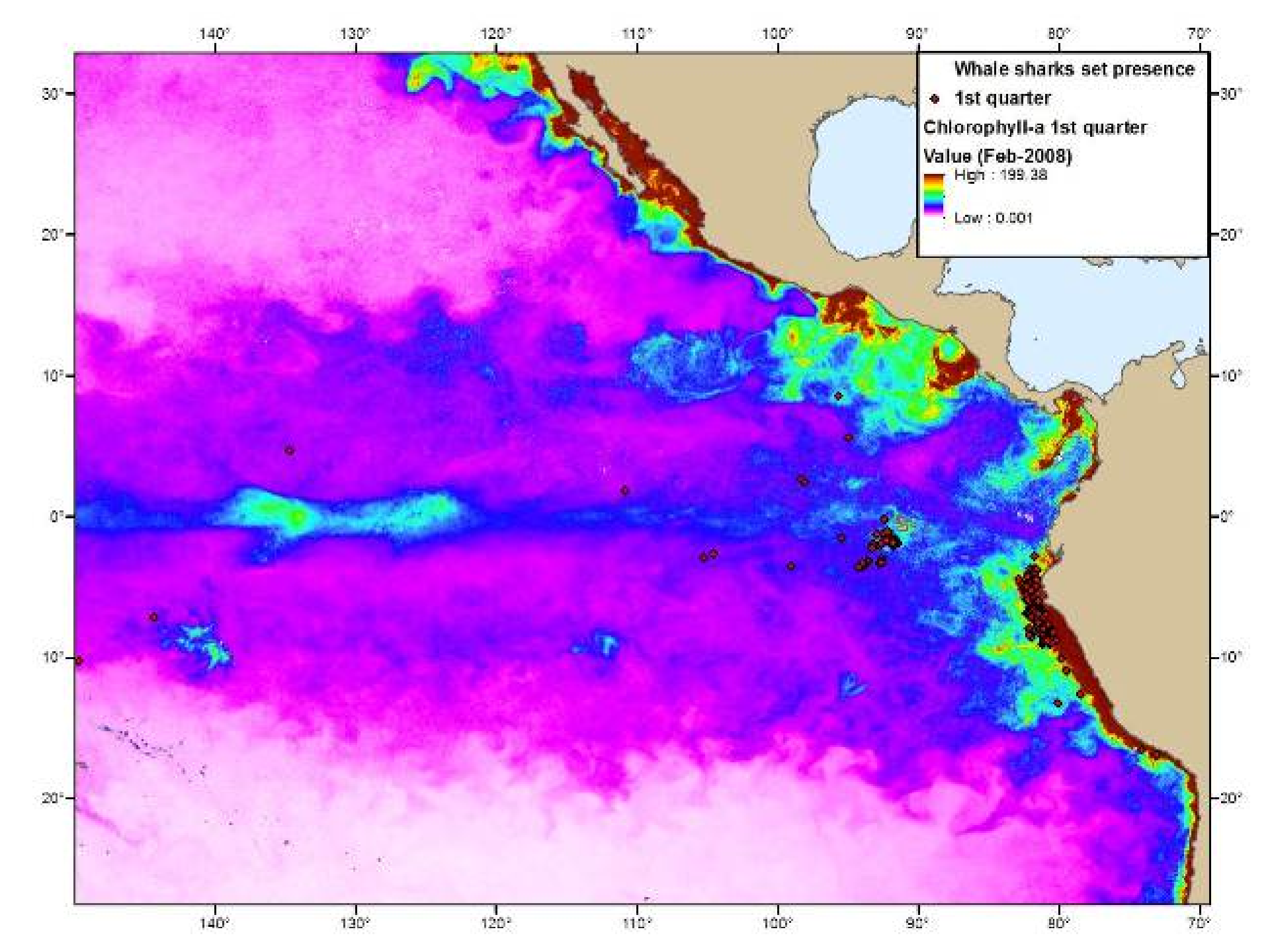

100°
90°
80°
70°
0°
10°
Whale sharks set presence
2nd quarter
bathymetry
Value
High : 8041
Low : -10712

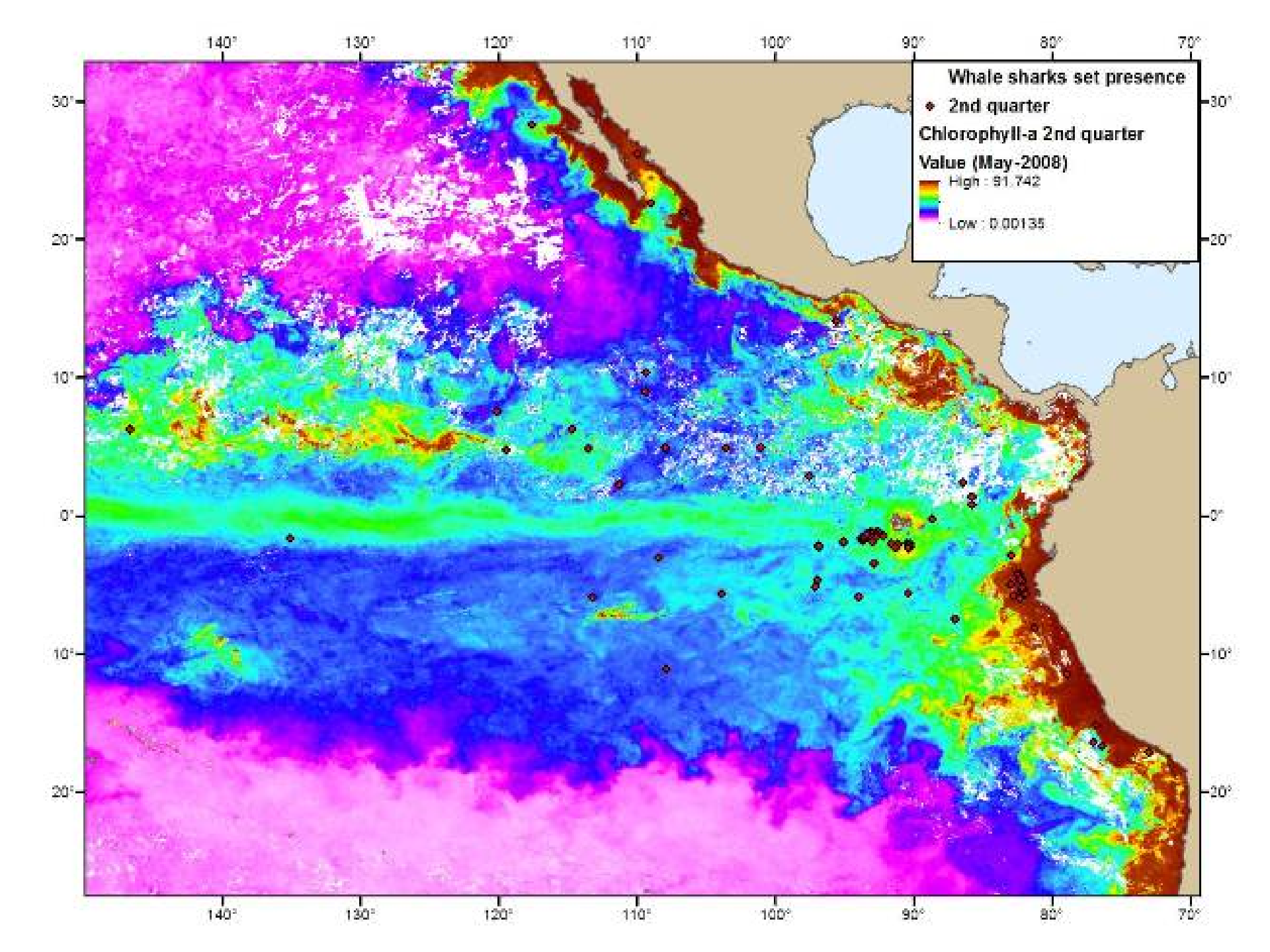

100°
90°
80°
70°
0°
10°
Whale sharks set presence
3rd quarter
bathymetry
Value
High : 8041
Low : -10712


100°
90°
80°
70°
0°
10°
Whale sharks set presence
4th quarter
bathymetry
Value
High : 8041
Low : -10712


Whale sharks set presence
3rd quarter
Chlorophyll-a 3rd quarter
Value (Aug-2008)
High : 89.3681
Low : 0.00121
140°
130°
120°
110°
100°
90°
80°
70°
30°
20°
10°
0°
10°
20°


Whale sharks set presence
4th quarter
Chlorophyll-a 4th quarter
Value (Nov-2008)
High : 88.4234
Low : 0.00016
140°
130°
120°
110°
100°
90°
80°
70°
30°
20°
10°
0°
10°
20°


Whale sharks set presence
1st quarter
Chlorophyll-a 1st quarter
Value (Feb-2008)
High : 199.38
Low : 0.001
140°
130°
120°
110°
100°
90°
80°
70°
30°
20°
10°
0°
10°
20°


Whale sharks set presence
2nd quarter
Chlorophyll-a 2nd quarter
Value (May-2008)
High : 91.742
Low : 0.00135
140°
130°
120°
110°
100°
90°
80°
70°
30°
20°
10°
0°
10°
20°

ALL SPECIES AND FLEETS COVERED BY THE ANTIGUA CONVENTION

1. report to the IATTC implementation of all the relevant IPOA, National Plans of Action for reducing incidental catches of the different groups.

2. try to minimize the incidental capture and mortality of all species and individuals that are not to be retained. Train crews to recognize the priority species, and the correct handling techniques

3. try to maximize the utilization of all species and individuals of fishes and invertebrates retained in the net that cannot be released with a high chance of survival

4. avoid operations in areas where large concentrations of non-target species are present, especially those most vulnerable to fisheries induced mortality

6. report to the IATTC all catches and bycatches of the species relevant to the Commission according to the Antigua Convention. The collection of biological data critical to assess the status of those populations such as length, sex, weight, age, reproductive status, etc. should also be implemented, and the results reported to the Commission.

7. adequate training for identifying species (Observers, port samplers, etc.).

8. observer programs in fisheries covered by the Antigua Convention

ACTION ITEMS FOR SHARKS AND MANTA RAYS

9. Sharks of the species *Carcharhinus falciformis*, and *C. longimanus*, all species of the Genus Sphyrna, and manta rays of the Genera Manta and Mobula, captured in fisheries not targeting them, should be released alive, and as soon as they are encountered in the course of fishing operations in order to maximize their chances of survival. Finning is not allowed, and when a shark is retained, the fins should remain attached,

10. Shark and Manta Ray Workshop to identify procedures for the safe handling and release of sharks and rays to maximize their chances of survival, while also accounting for the safety of the crew.

11. Crews should receive training for the safe handling and release of live sharks, and manta rays.

12. “*Shark and manta ray Research Fund*” to support mitigation research,

13. experiments to estimate the survival of sharks and manta rays released from all gear with significant captures

14. statistically designed sampling programs to collect standardized catch and effort data, as well as to conduct biological sampling of sharks and manta rays captured in fisheries covered by the Antigua Convention or landed in their ports.

PURSE SEINES

15. All sets on floating objects of any kind in the area north of 8 degrees North should be suspended until the Scientific Advisory Committee determines that the silky shark population is showing solid evidence to be recovering from the recent declines. [In this area 5% of the tuna catches result in 30% of the silky shark bycatches.

16. The webbing used under FADs should be prohibited and subsequently replaced by non-entangling materials and structures no later than January 1st, 2014.

17. Sets on whale sharks, should be avoided, and when an accidental capture happens, a mechanism to release whale sharks alive should be identified as the best practice.

18. If large aggregations of sharks or manta rays are detected before a set is made, they should be cut out of the set, or the set should not be made.

19. During the setting, the floating object should be towed out of the net by a speed boat, trying to attract the sharks out of the net.

20. Experiments to identify and develop means of attracting the sharks out of the area to be encircled, or out of the net, at any stage previous to sacking up should be carried out as soon as possible.

LONGLINES

21. Wire leaders should not be used as terminal gear in longline fisheries targeting tunas or billfishes beginning on January 1st, 2014.

22.research to identify means of reducing non-target catches of sharks in longline fisheries

23. monitoring programs, including through implementation of Resolution C-11-08, in order to study incidental catches of sharks and to identify possible mitigation strategies

ACTION ITEMS for SEA TURTLES
Purse seiners

24. A speedboat with a crew person should be placed in the area where the net ascends to the power block to release turtles entangled in the net.

25. Sea turtles encountered entangled in the webbing hanging under FADs shall be released by the crew of the seiner, regardless of the origin of the FAD.

26. Sea turtles that were inadvertently brought to the deck should be released as soon as possible, following the best practices available. If they were comatose, they should be allowed to recover before release.

Longliners

27. All longliners longer than 20 m shall carry the following equipment on board to facilitate the release of sea turtles:

a) A dipnet to lift the turtles to the deck of the boat.

b) Two types of dehookers (V-shaped and pig-tailed)

c) A line cutter

d) A mouth-opener

28. Adopt circle hooks when they have no adverse effects on the catches, or experiment with other types of hooks and baits when the adverse effects prevented their adoption.

29. Train the longline crews in the Best Practices to release sea turtles

30. economic incentives for mitigation

31. For lines manufactured with floating materials (e.g. polypropylene), replace section connecting the float to the mainline with nylon monofilament or other non-buoyant materials, and add the necessary weight to sink the line in the vicinity of the floats to prevent entanglements.

32. Avoid setting in the proximity of sea turtle nesting beaches during the nesting season. The map attached shows the main nesting beaches and seasons

ACTION ITEMS FOR SEA BIRDS
Longliners

33. longline vessels of more than 20 meters length overall that use hydraulic, mechanical, or electrical systems north of 23°N and south of 30°S, plus the area bounded by the coastline at 2°N, west to 2°N-95°W, south to 15°S-95°W, east to 15°S-85°W, and south to 30°S (Fig. 1) to use at least two of the mitigation measures listed below (Table 1

Table 1. Mitigation measures

Mitigation	Description	Specification
Night setting with minimum deck lighting	No setting between nautical dawn and before nautical dusk. Deck lighting to be kept to a minimum.	Nautical dusk and nautical dawn are defined as set out in the Nautical Almanac tables for relevant latitude, local time and date. Minimum deck lighting should not breach minimum standards for safety and navigation.
Bird-scaring lines (Tori lines)	Bird-scaring lines shall be deployed during the entire longline setting to deter birds from approaching the branch line.	For vessels greater than or equal to 35 m: • Deploy at least 1 bird-scaring line. Where practical, vessels are encouraged to use a second tori pole and bird scaring line at times of high bird abundance or activity; both tori lines should be deployed simultaneously, one on each side of the line being set. • Aerial extent of bird-scaring lines must be greater than or equal to 100 m. • Long streamers of sufficient length to reach the sea surface in calm conditions must be used. • Long streamers must be at intervals of no more than 5m. For vessels less than 35 m: • Deploy at least 1 bird-scaring line. • Aerial extent must be greater than or equal to 75 m. • Long and/or short (but greater than 1 m in length) streamers must be used and placed at intervals as follows: - Short: intervals of no more than 2 m. - Long: intervals of no more than 5 m for the first 55 m of bird scaring line. Additional design and deployment guidelines for bird-scaring lines are provided in Annex 1 of this Resolution.
Line weighting	Line weights to be deployed on the snood prior to setting.	• Greater than a total of 45 g attached within 1 m of the hook or; • Greater than a total of 60 g attached within 3.5 m of the hook

34. voluntarily employ at least one of the mitigation measures included in Table 1 if they have experienced seabird interactions during their fishing activities.

35. research to further develop and refine methods for mitigating seabird bycatch,

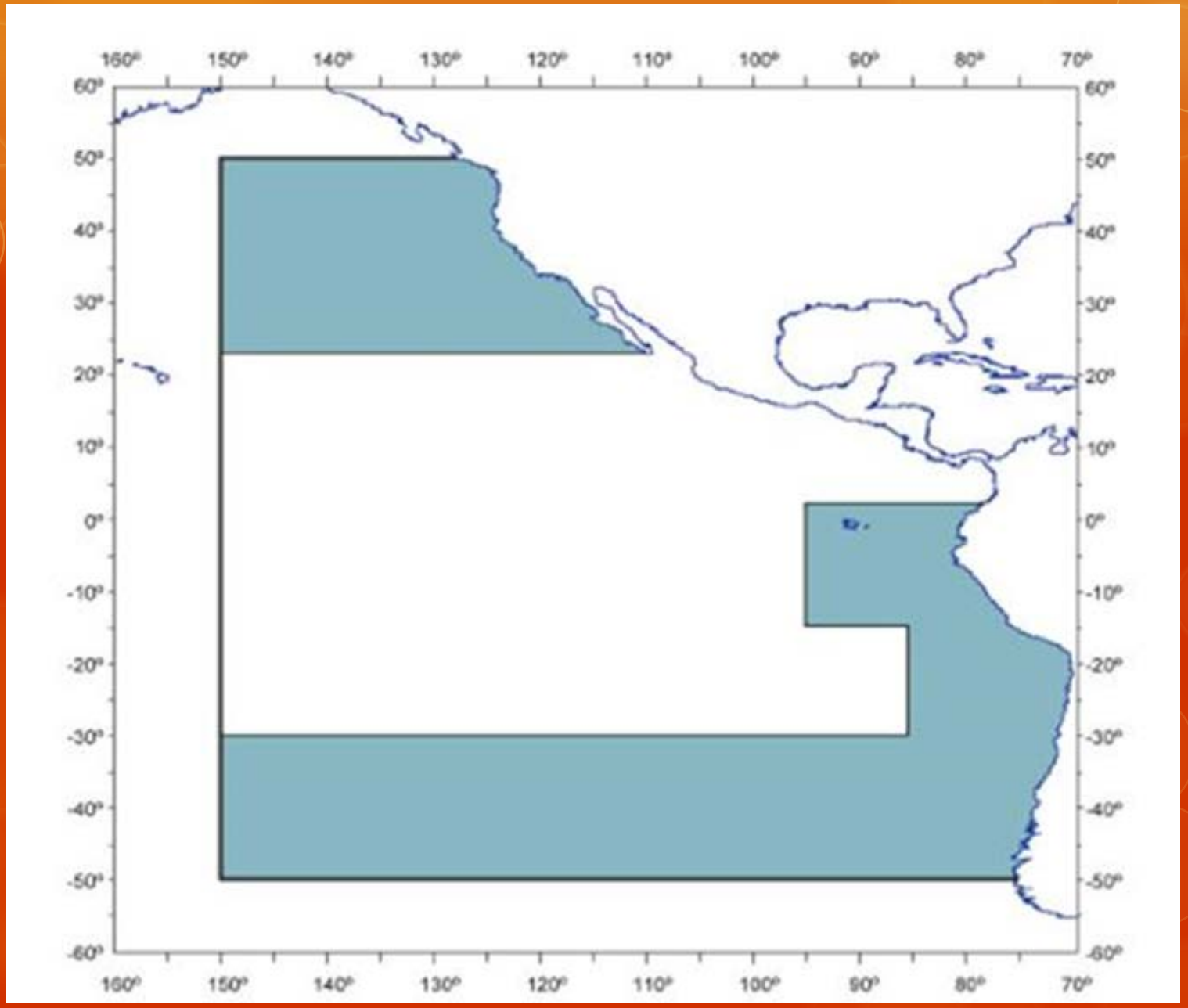
36. inform the IATTC annually of the mitigation measures that their flag vessels plan to employ in the implementation of this resolution.

37. seabirds captured alive during longline fishing operations are released alive and in the best condition possible

38. implementation of this resolution no later than ..... for their longline vessels equal to or greater than 24 meters in length overall, and no later than ..... for their longline vessels of 20 m - 24 m in length overall.

Vessels propelled by outboard motors are not subject to this resolution

Fig. 1: Areas to implement mitigation measures



ANNEX 2

Guidelines from OPAGAC and ANABAC to release whale sharks from purse seines:

"Whale Sharks

Concerning whale sharks we are aware about the great difficulty of their release, concluding that the maneuver currently applied is the most appropriate and the only practical thing to do once a whale shark is caught. The specific protocol is as follows:

The crews should take all possible measures to avoid, by all means, mortality of whale sharks. If a whale shark is found encircled in the set, the net should be carefully pulled up to confine it in a small area of the bag. At this time, depending on the circumstances of the sea as well as the animal's behavior and always preserving the safety of the crew, the following measures might be taken:

A) When the whale shark floats on the surface

A.1. – The crew must carefully pull the net to approach the whale shark to the nearest corkline. The net should always be pulled from the animal's tail side and below the ventral side, trying to make the fish slide towards the corkline.

A.2. - If it is a small-sized shark (less than 2m long) it can be directly scooped out and released using the dip net.

A.3. - Free the corkline to facilitate the exit of the whale shark, sinking the corkline.

A.4. - Wait for the whale shark to swim out of the net by its own means.

A.5. - Collection of the catch will only take place once the shark is freed from the net.

B) When the whale shark does not appear on the surface.

The loading of the catch can be carried on until the shark appears on the surface. At that time the loading shall be suspended and procedure explained in Section A) above should be followed.

C) When the whale shark pushes the net with his head before lowering the corkline.

There are occasions on which the shark pushes the net attempting to escape, before the corkline can be brought down and it becomes difficult to push it back in order to lower the corkline. In this case the corkline should be lowered from the ship using poles or rods so the animal can free its head over the corkline.

D) In case the shark is trapped in the bag with the head towards the stern of the boat

The operation to try to free the animal over the corkline becomes more difficult, therefore a more effective maneuver, once the shark is in the bag, will be to locate the net's joint nearest to the head of the animal, proceeding to cut a couple of fathoms of the seam of the joint providing a window for the shark to get out lowering the drapes a bit until sinking that window.

Regardless of the circumstances and the actions undertaken, after the animal's release the crew will check whether it behaves normally and record the operation in the logbook. In case any unusual behavior is perceived, it will also be noted in the logbook."