INTER-AMERICAN TROPICAL TUNA COMMISSION

90TH MEETING (RESUMED)

La Jolla, California (USA)
12 -14 October 2016

DOCUMENT IATTC-90 INF-B ADDENDUM 1

ADDITIONAL ALTERNATIVE MANAGEMENT MEASURES FOR TROPICAL TUNAS IN THE EASTERN PACIFIC OCEAN

1. EVALUATION OF ADDITIONAL MANAGEMENT PROPOSALS

Various Members have proposed alternatives to the system established in Resolution C-13-01 and its predecessors for managing the fisheries for tropical tunas in the EPO: closures for the purse-seine fisheries and catch limits for the longline fisheries. The staff's analyses of these alternatives are presented below. In some cases, the original proposal has been expanded, where the staff considered that the additional information might be useful for the Commission in taking decisions on these alternatives.

1.1. INDIVIDUAL VESSEL QUOTAS

Individual vessel quotas (IVQs) to reduce the catch of bigeye tuna in the eastern Pacific Ocean (EPO) purse-seine fishery have been discussed previously. Documents SAC-04-11 and IATTC-82 INF-A discuss the numerous logistical issues that have to be addressed before implementing IVQs (*e.g.* transferability of quotas, switching set types, enforcement, monitoring, and species identification).

Four methods were used to calculate IVQs:

1. Each vessel's historical average annual catch during the previous four years, adjusted for any increase (or decrease) in fleet capacity.
2. Total historical catch of a fleet of vessels during the previous four years, distributed among the fleet based on each vessel's capacity.
3. Combination of methods 1 and 2, split 70:30.
4. The average annual allocation, in tons (t) per cubic meter (m^3) of vessel well capacity, that would have yielded the desired catch during the previous four years.

The vessel-specific consequences of the IVQs based on vessel capacity show much more variability than those based on historical catch, with some vessels always having caught more than their IVQ and other vessels always having caught less. A few vessels that catch large amounts of bigeye tuna are much more restricted by the capacity-based IVQs than the catch-based IVQs. Method 4 establishes much less restrictive IVQs, but its success relies on vessels without much historical bigeye catch maintaining the same fishing behavior and not catching their capacity-based IVQ. The other methods are based on the assumption that the vessels will, on average, catch their IVQs. IVQs based on average catch (method 1) might be expected to be caught on average, but IVQs based on capacity (methods 2 and 4) are likely to be under-caught by vessels that historically had low catches of bigeye. Method 2 is likely to be much more restrictive than needed because a large number of vessels would not catch their IVQ, and the resulting catch would be considerably less than the target catch. Method 2 is also very sensitive to which vessels are included in the set of vessels that will have IVQs. Method 4 could be combined with a historical catch based IVQ for an IVQ that is the minimum of the capacity-based IVQ and some scaled value (*e.g.* 120%) of the historical catch. This acts as an additional safeguard against vessels with historically low catches of bigeye targeting bigeye to reach their IVQ, but without being overly restrictive. Method 4 is not appropriate for target species (*e.g*. yellowfin tuna) because it assumes that vessels that did not catch their IVQ in the past do not catch it in the future, but it is likely that vessels will try to maximize their target catch relative to the IVQ. Care needs to be taken when choosing the vessels to use IVQs based on combined yellowfin and bigeye catch, because some vessels with large yellowfin catches get much larger IVQs, and could switch to catching more bigeye.

1.2. 62-DAY CLOSURE FOR ALL VESSELS

The 62-day closure established in Resolution C-13-01 applies to purse-seine vessels of size classes 4-6, with an exception that allows size class 4 vessels (between 182 and 272 t carrying capacity) to make a single fishing trip of up to 30 days duration during a closure. The purse-seine vessels not covered by this measure catch a minor component of the bigeye catch, and the reduction in catch resulting from including these vessels in the closures would be negligible.

The tuna caught by the longline fishery are larger than those caught by the purse-seine fishery, and therefore a reduction in longline catch will not have the same influence on fishing mortality as an equivalent reduction in the purse-seine catch. In addition, the longline fishery is managed based on country-specific catch limits, and the limits are not reached by all countries. Furthermore, the recent increases in fleet capacity, which led the staff to recommend an extension of the purse-seine closure, are due to purse-seine vessels, not longline vessels. As stated in the staff recommendations, the base case *F*multiplier[1] for the purse-seine fishery exceeds 1.0 for both yellowfin and bigeye. However, for illustrative purposes we determine the reduction in longline catch based on a 62-day closure, calculate that as a proportion of the purse-seine catch, and then calculate the equivalent days of purse-seine closure. A 62-day closure of the longline fishery would reduce the total catch of yellowfin and skipjack by less than 0.1% and equates to a negligible number of equivalent days of closure for these species (Table A). However, the reduction in bigeye catch is 10.7% of the purse-seine catch, which is equivalent to about 31 days of purse-seine closure.

TABLE A. Longline catches of tropical tunas in the EPO, by species, 2000-2015. The data have not been adjusted to the species composition estimate. *: data missing or not available (from IATTC Fishery Status Report 14, Table A-2a).

Longline	YFT	SKJ	BET
2000	23,855	68	47,605
2001	29,608	1,214	68,755
2002	25,531	261	74,424
2003	25,174	634	59,776
2004	18,779	713	43,483
2005	11,946	231	40,694
2006	10,210	224	31,770
2007	8,067	238	29,876
2008	9,820	1,185	26,208
2009	10,444	1,584	31,422
2010	8,339	1,815	37,090
2011	8,048	1,384	32,317
2012	12,954	2,381	36,167
2013	11,416	2,024	36,204
2014	8,522	239	35,096
2015	*	*	38,245
Avg. 2013-2015	9,969	1,132	36,515

[1] *F* multiplier = F_{MSY} (the fishing mortality that will produce the maximum sustainable yield) divided by $F_{current}$ (the average fishing mortality for the three most recent years). An *F* multiplier of 1.0 means that $F_{current} = F_{MSY}$; if it is below 1.0, fishing mortality is excessive ($F_{current} > F_{MSY}$).

1.3. LIMITING THE NUMBER OF SETS

The number of floating-object sets could be limited to the recent three-year average (12,181) in order to offset any increase in sets, and thus the catch of bigeye, resulting from the 25,000 m^3 increase in purse-seine capacity (Table B). Similarly, the number of dolphin-associated sets could be limited to the recent three-year average (10,667) to reduce the catch of yellowfin. However, limiting a single set type to recent levels may not be sufficient, because bigeye and yellowfin are also caught in the other set types, particularly yellowfin in floating-object and unassociated sets (Table C). The sets by set type could be applied as IVQs based on the historical number of sets for each vessel.

TABLE B. Number of floating-object and dolphin-associated sets, by vessel size category, 2000-2015. (from IATTC Fishery Status Report 14, Table A-7)

	Floating object			Dolphin		
	≤363 t	>363 t	Total	≤363 t	>363 t	Total
2000	508	3,713	4,221	0	9,235	9,235
2001	827	5,674	6,501	0	9,876	9,876
2002	867	5,771	6,638	0	12,290	12,290
2003	706	5,457	6,163	0	13,760	13,760
2004	615	4,986	5,601	0	11,783	11,783
2005	639	4,992	5,631	0	12,173	12,173
2006	1,158	6,862	8,020	0	8,923	8,923
2007	1,384	5,857	7,241	0	8,871	8,871
2008	1,819	6,655	8,474	0	9,246	9,246
2009	1,821	7,077	8,898	0	10,910	10,910
2010	1,788	6,399	8,187	0	11,645	11,645
2011	2,538	6,921	9,459	0	9,604	9,604
2012	3,067	7,610	10,677	0	9,220	9,220
2013	3,081	8,038	11,119	0	10,736	10,736
2014	3,858	8,777	12,635	0	11,382	11,382
2015	3,403	9,385	12,788	0	11,020	11,020
2013-2015	3,447	8,733	12,181	0	10,667	10,667

1.4. CATCH QUOTAS BY SET TYPE

Data on average catches by all purse-seine vessels, by set type and species, during 2013-2015 (Table C) can be used to calculate species quotas by set type. However, if monitoring of the quotas is based on observer data, which are not adjusted for species composition sampling, quotas would have to be based on data in the IATTC catch and effort (CAE) database. Quotas by set type are difficult to enforce because many vessels use multiple set types, and the proportion of unassociated sets varies considerably over time.

TABLE C. Retained purse-seine catches of yellowfin, skipjack, and bigeye tuna, in metric tons, by set type, 2013-2015. The data in the upper panel, from IATTC Fishery Status Report 14, Table A-7, have been adjusted to the species composition estimate; those in the lower panel, from the IATTC CAE database, have not.

	Dolphin			Floating object			Unassociated		
	YFT	SKJ	BET	YFT	SKJ	BET	YFT	SKJ	BET
Adjusted									
2013	157,432	4,272	0	35,089	194,372	48,337	25,666	79,916	1,150
2014	168,209	4,436	3	45,476	199,488	59,803	20,288	57,654	647
2015	160,901	5,651	2	43,152	205,976	61,277	41,130	117,653	1,950
2013-2015	162,181	4,786	2	41,239	199,945	56,472	29,028	85,074	1,249
Unadjusted									
2013	159,155	4,222	0	35,474	192,136	52,712	25,947	78,985	1,254
2014	172,914	4,447	3	46,751	200,013	54,574	20,856	57,796	590
2015	161,668	5,517	2	43,531	201,472	65,420	41,394	114,881	2,082
2013-2015	164,579	4,729	2	41,919	197,874	57,569	29,399	83,888	1,309

1.5. EXTENDING THE *CORRALITO* IN SPACE AND TIME

The high-seas closure established in paragraph 5 of Resolution C-13-01 applies to the area from 96°W to 110°W between 4°N and 3°S (the "*corralito*") during 29 September-29 October. Several analyses, based on data for 2012-2015, were conducted to evaluate the impact of closing a spatial extension of the *corralito* for and additional 1 to 5 months during February-June, when no other conservation measures are in place. For this analysis, the northern and southern boundaries of the extended *corralito* were set at 5°N and 5°S, respectively, and the western boundary was moved westward, from 110°W to 150°W, in 5° increments.

The equivalent days of closure for bigeye increases linearly as the western boundary moves west, but the magnitude differs among months (Table D, Figure A). May and June reach about 12 equivalent days at 150°W, and a closure from February to June out to 110°W is equal to about 11 equivalent days, neither of which is enough to compensate for the increase in fishing capacity. Therefore, the closure has to be extended both westward and for more than one month. For example, closures during February-April out to 145°W, February-June out to 120°W, March-May out to 130°W, or May-June out to 135°W, are all worth about 17 days of equivalent closure.

The spatial closures have a much smaller impact on the catches of yellowfin and skipjack.

TABLE D. Effect, in equivalent days of closure, of closing the *corralito* for additional months and extending its western boundary.

	YFT					SKJ					BET				
°W	Feb	Mar	Apr	May	Jun	Feb	Mar	Apr	May	Jun	Feb	Mar	Apr	May	Jun
110	-0.1	-0.2	-0.4	-0.5	-1.0	-0.5	-0.9	-0.8	-0.6	0.9	2.0	1.6	2.7	2.4	2.5
115	-0.1	-0.2	-0.5	-0.7	-1.3	-0.7	-1.1	-1.0	-0.8	1.2	2.3	2.0	2.7	3.4	4.2
120	-0.2	-0.1	-0.5	-0.5	-1.5	-0.8	-1.3	-1.0	-0.8	1.3	2.7	2.5	4.3	4.1	5.8
125	-0.2	0.1	-0.4	-0.2	-1.6	-0.8	-1.4	-1.2	-0.9	1.3	2.8	3.1	5.4	5.3	6.6
130	-0.2	0.2	-0.4	0.5	-1.6	-0.8	-1.5	-1.3	-0.7	1.4	2.9	3.7	6.0	7.5	8.0
135	-0.2	0.2	-0.3	1.0	-1.5	-0.9	-1.6	-1.2	-0.5	1.9	3.2	4.0	6.8	8.3	10.2
140	-0.2	0.1	-0.3	1.2	-1.4	-0.8	-1.6	-1.0	-0.4	2.1	3.2	4.3	7.3	9.3	11.1
145	-0.2	0.2	-0.2	1.3	-1.4	-0.7	-1.6	-0.8	-0.1	2.4	3.4	4.6	9.0	10.7	11.8
150	-0.2	0.2	-0.1	1.5	-1.3	-0.6	-1.5	-0.7	0.3	3.0	4.7	5.2	9.8	12.1	12.5

	BET				
°W	Feb	Feb-Mar	Feb-Apr	Feb-May	Feb-Jun
110	2.0	3.6	6.3	8.7	11.2
115	2.3	4.3	7.0	10.4	14.6
120	2.7	5.2	9.5	13.7	19.5
125	2.8	5.9	11.2	16.5	23.1
130	2.9	6.6	12.5	20.1	28.0
135	3.2	7.2	14.0	22.4	32.6
140	3.2	7.5	14.7	24.0	35.1
145	3.4	8.1	17.0	27.8	39.5
150	4.7	9.9	19.7	31.8	44.3

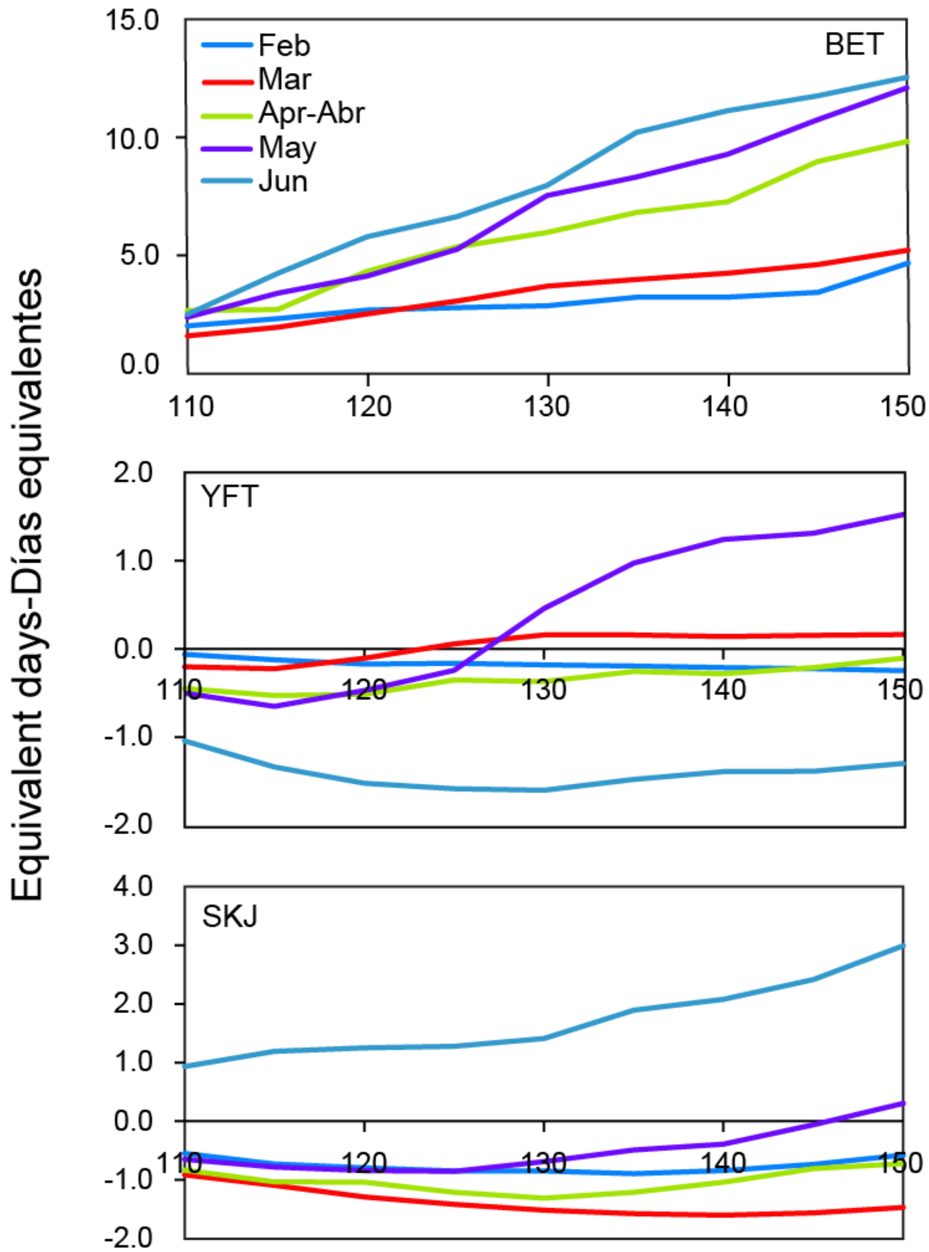

FIGURE A. Effect, in equivalent days of closure, of extending the closure of the *corralito* in both space (westward, to between 110° and 150°W) and time (an additional month between February and June, when no other closures are in effect), by species. Note that the y-axis scale is different for each species.

1.6. LIMIT THE NUMBER OF FADs DEPLOYED

This option cannot be analyzed with the information available; more comprehensive data on FADs, including unique identification, is required. The number of FADs or all floating objects used could possibly be limited in various ways (number of FADs carried on the vessel, number of FADs deployed, or number of floating objects a vessel has in the water at any given time, for instance), but it is very difficult to evaluate how effective these measures would be in reducing fishing mortality. The number of FADs deployed varies widely among vessels (Figure B), and there is no clear relationship between the number of FADs deployed and the number of floating-object sets made (Figure C). Very few vessels make more than 500 FAD deployments within a year (Figure B). but without a unique identification system for FADs, it is impossible to know whether a FAD has been deployed more than once. Also, if a vessel attaches a locator beacon to a floating object, the object then 'belongs' to the vessel, but the event will not necessarily be recorded as a 'deployment', and the object's performance in terms of attracting tunas would be impossible to predict.

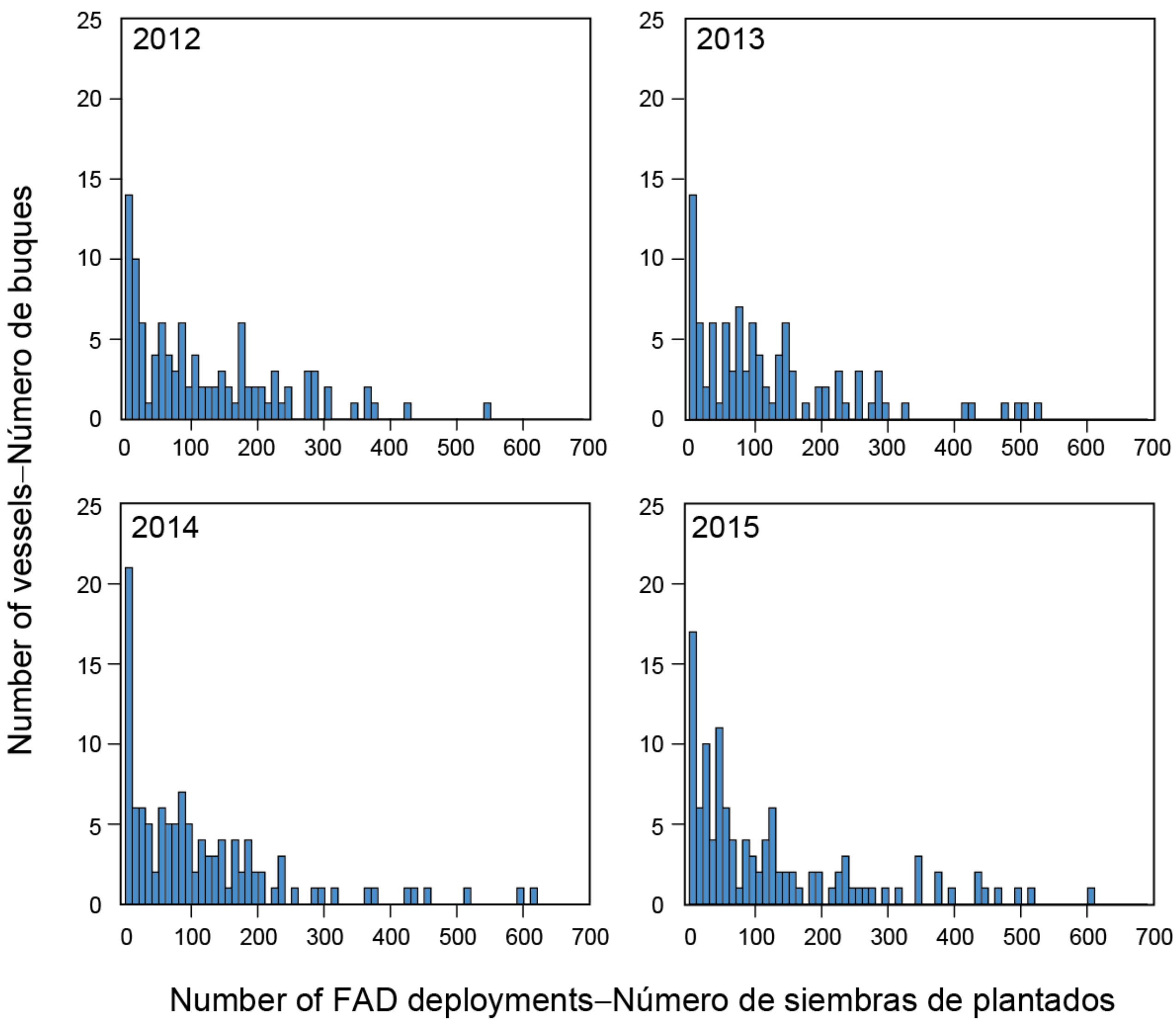

FIGURE B. Frequency distribution of numbers of vessels relative to the number of FAD deployments in the EPO, 2012-2015. Includes only size class-6 vessels that deployed at least one FAD.

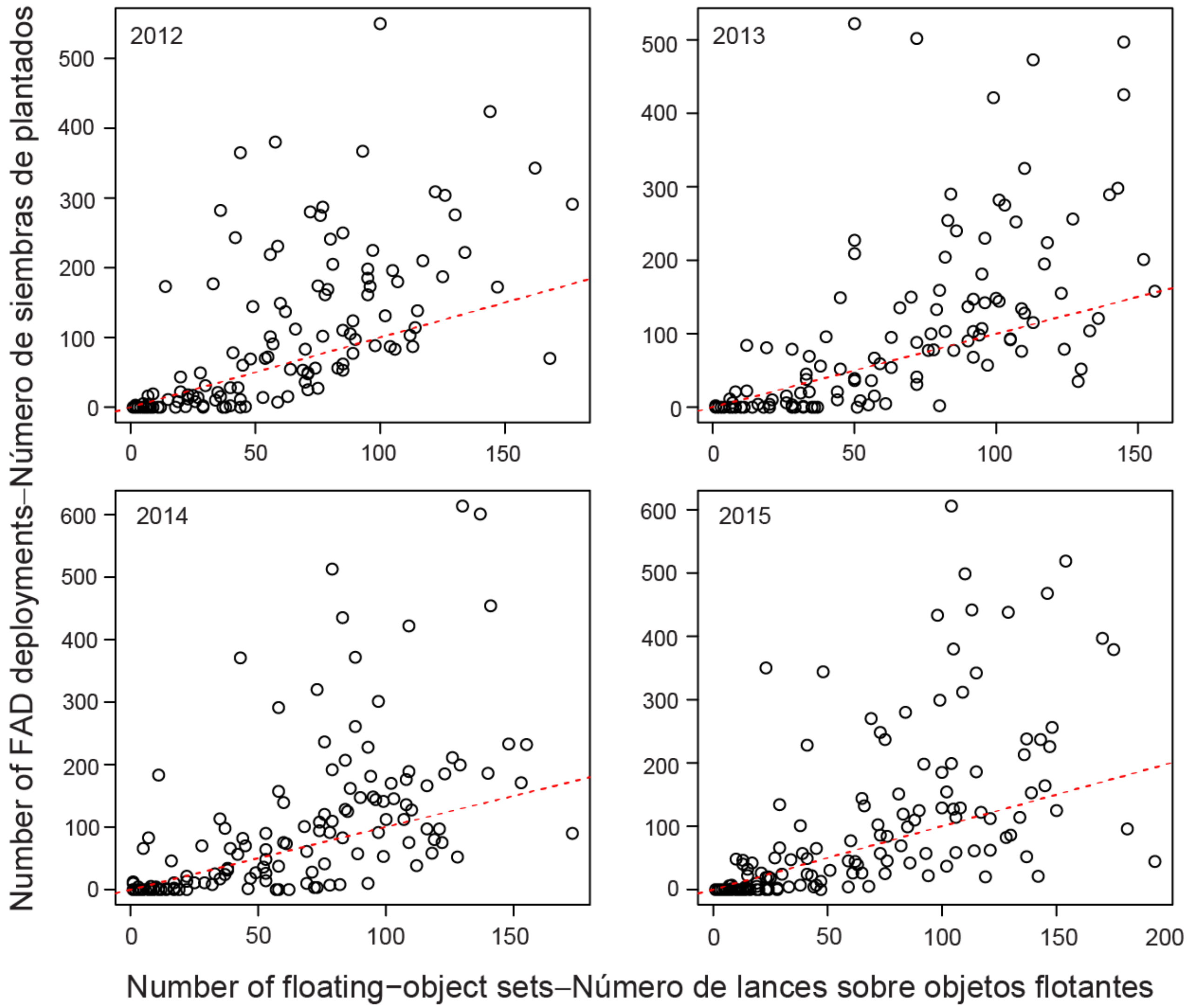

FIGURE C. Number of FAD deployments *versus* number of floating-object sets in the EPO, by vessel, 2012-2015. Includes only size class 6 vessels. The red dashed line is the one-to-one line.