INTER-AMERICAN TROPICAL TUNA COMMISSION
COMISIÓN INTERAMERICANA DEL ATÚN TROPICAL

WORKING GROUP TO REVIEW STOCK ASSESSMENTS

7TH MEETING

LA JOLLA, CALIFORNIA (USA)
15-19 MAY 2006

DOCUMENT SAR-7-12a

CATCH LIMITS FOR INDIVIDUAL PURSE-SEINE VESSELS TO REDUCE FISHING MORTALITY OF BIGEYE TUNA IN THE EASTERN PACIFIC OCEAN

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1. INTRODUCTION

Harley *et al*. (2004) provided a rationale for individual purse-seine vessel catch limits for bigeye tuna (BET) in the eastern Pacific Ocean. We update their analysis using data for 2004 and provide additional information. Readers are directed to Harley *et al*. (2004) for further discussion.

2. METHODS

The analysis is based on trip records held in the IATTC database. Data for each vessel are summed to provide total catch of bigeye, yellowfin, and skipjack for each year for each vessel. Two analyses are carried out. The number of vessels in the databases each year ranges from 212 to 223. Of these approximately 100 are authorized and equipped to fish for yellowfin tuna associated with dolphins and catch almost no bigeye tuna.

The first analysis orders the data by descending catch of bigeye, to determine the number of vessels that capture the majority of bigeye catch.

The second analysis investigates individual vessel catch limits by assuming that catch occurs at a constant rate throughout the year and that each vessel stops fishing as soon as it reaches its bigeye catch limit.

3. RESULTS

The majority of bigeye is caught by a small number of vessels (Figure 1). These vessels capture a lesser proportion of the total catches of yellowfin and skipjack (Figure 2). During 1999-2005, between 11 and 15 vessels captured 50% of the bigeye catch, but only about 5% of the yellowfin catch and 18-32% of the skipjack catch (Table 1). Between 23 and 30 vessels captured 75% of the bigeye catch, but only about 10% of the yellowfin catch and 32-50% of the skipjack catch. Many of these vessels frequently caught a large proportion of the bigeye catch (Table 2).

The individual-vessel bigeye catch limits required to reduce the catch to 30% and 50% of the levels in each year are about 660-930 and 350-520 t, respectively, except for 2000, which would have required much higher limits (Tables 3a and 3b). These limits would have affected 16-26 and 30-40 vessels, respectively, and would have resulted in a reduction of about 7-10% and 15-20%, respectively, of the total tuna catch if the vessels took no action to reduce the proportion of bigeye in their catches. Figure 3 provides information, based on the 2004 and 2005 data, about the predicted effect of the size of the vessel limit on the bigeye catch, the number of vessels that would have been affected and the reduction in total tuna catch, again assuming that vessels take no action to reduce the proportion of bigeye in their catches.

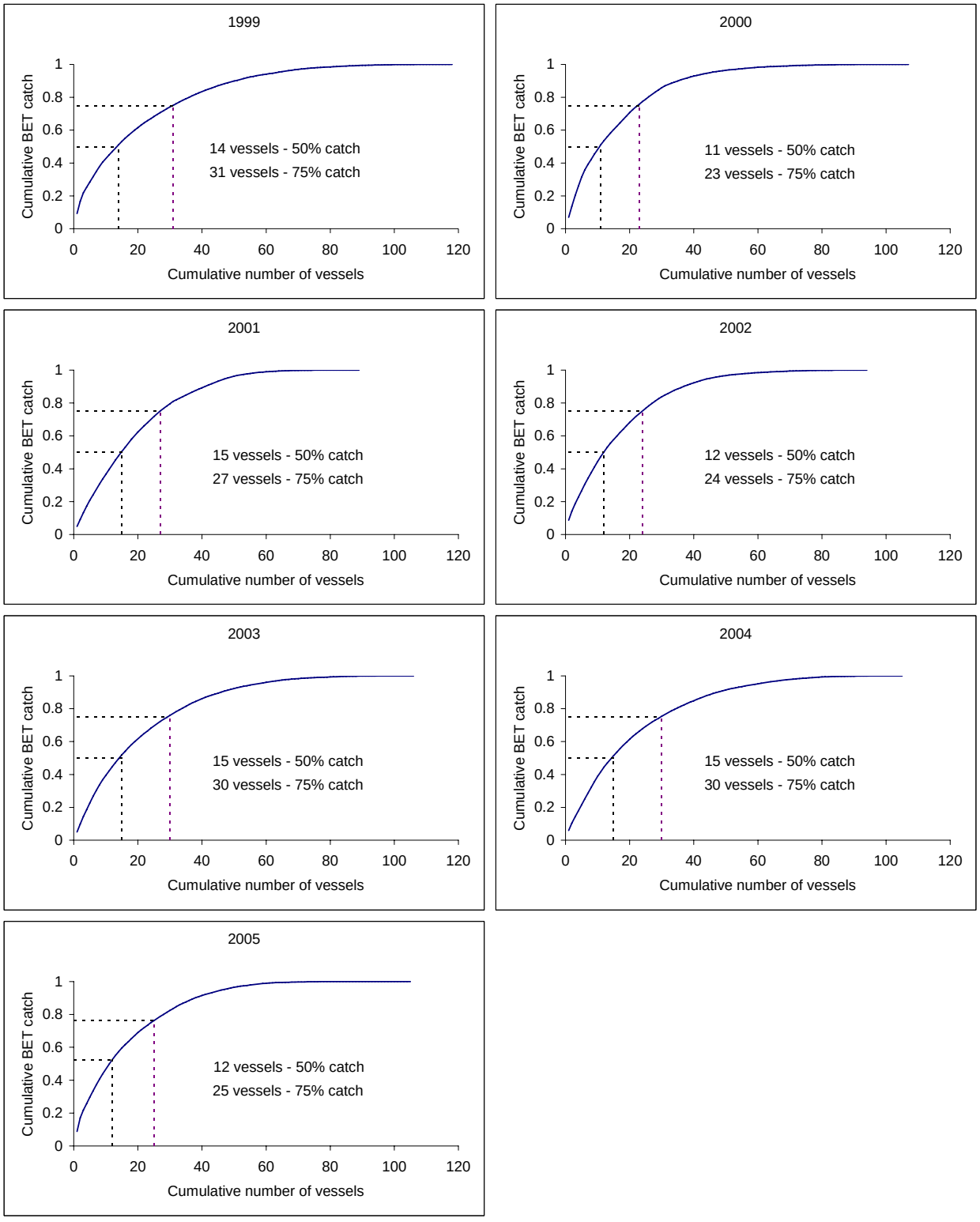

FIGURE 1. Cumulative catch of bigeye as a proportion of the total catch plotted against the cumulative number of vessels required to produce the catch. The vessels are ordered by decreasing amount of bigeye catch.

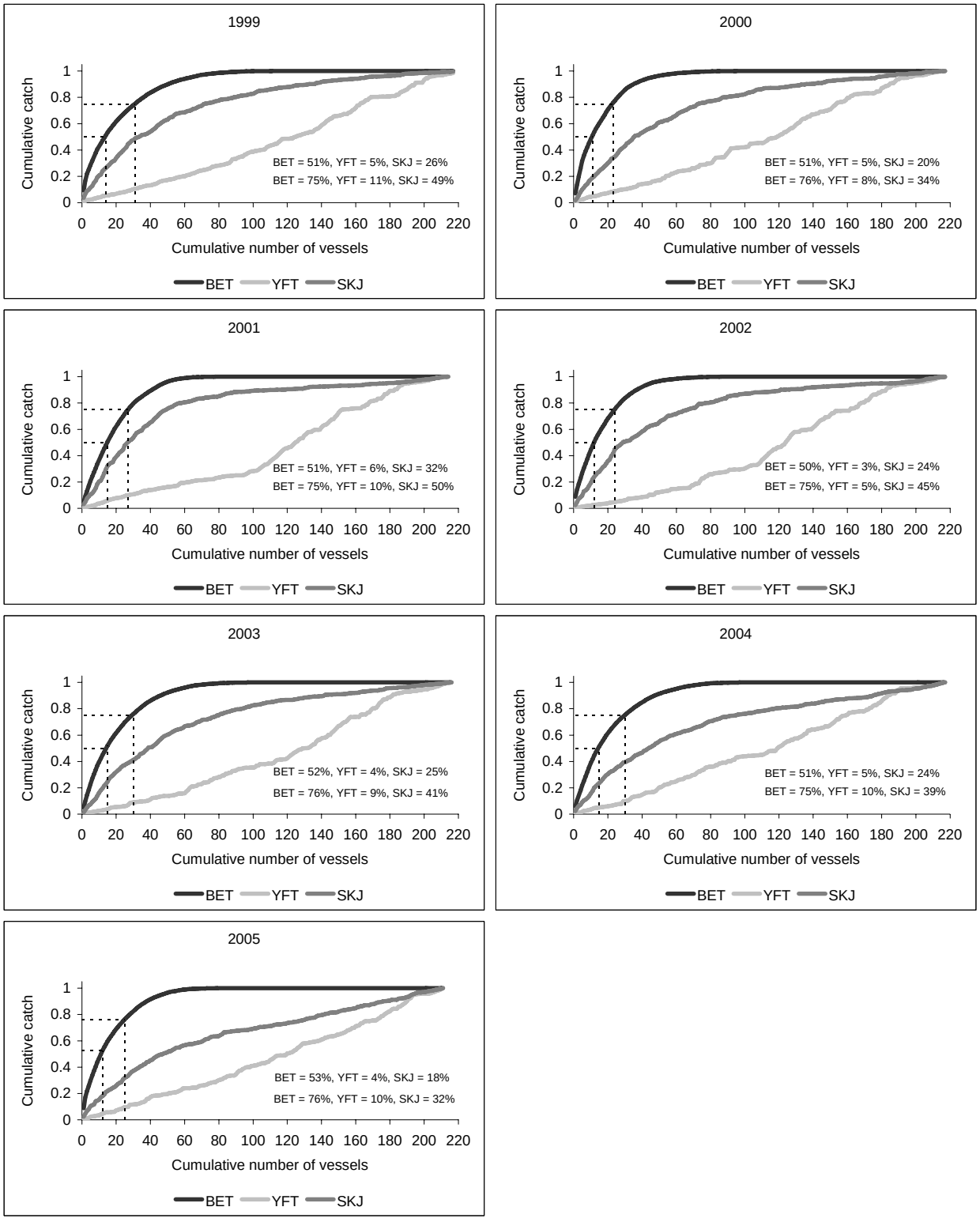

FIGURE 2. Cumulative catch of bigeye, yellowfin, and skipjack as a proportion of the total catch of that species plotted against the cumulative number of vessels required to produce the catch. The vessels are ordered by decreasing amount of bigeye catch.

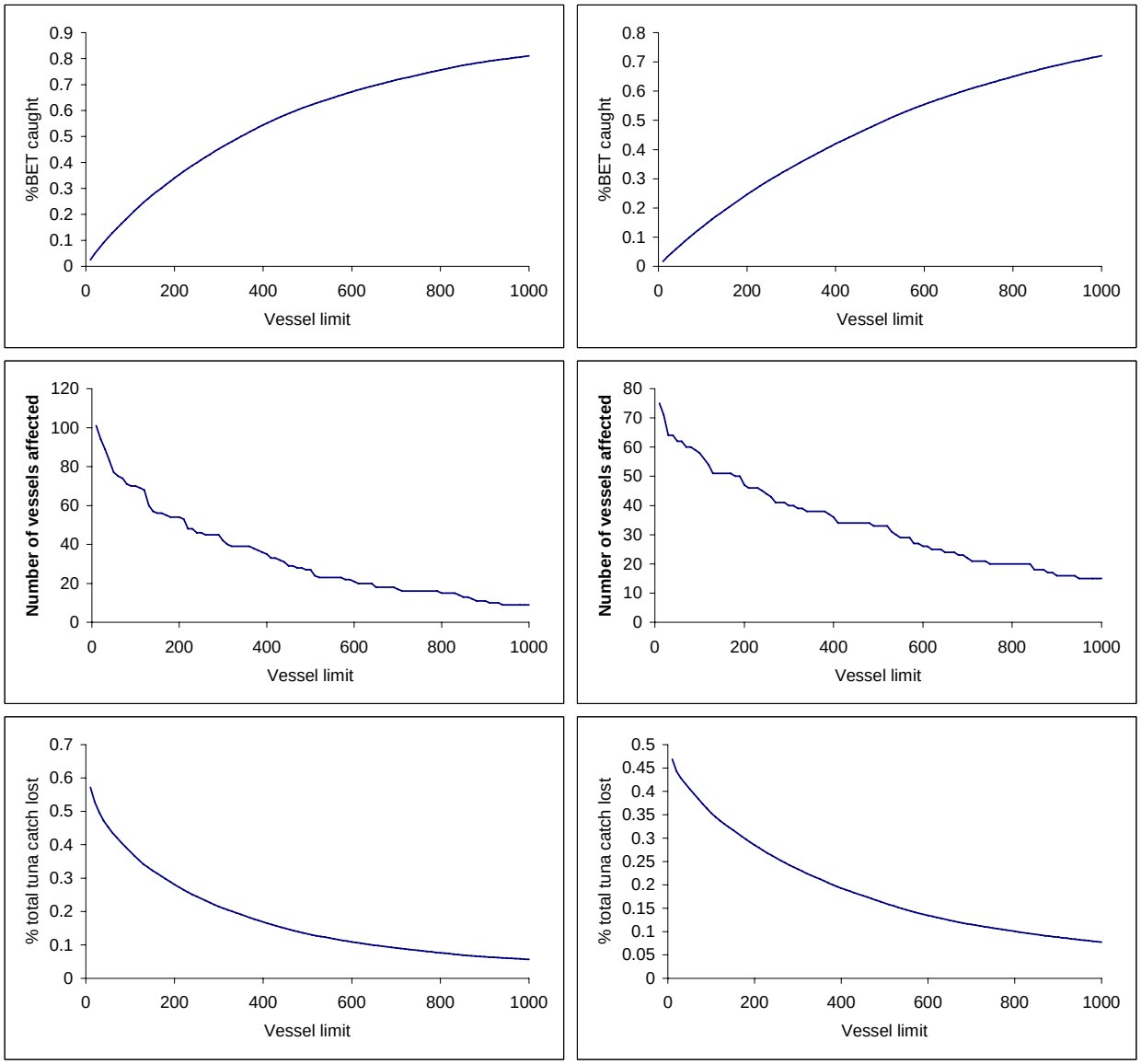

FIGURE 3. Percentage of bigeye caught, number of vessels affected, and percentage of total tuna catch lost based on different vessel bigeye catch limits using the 2004 (left) and 2005 (right) data.

TABLE 1. Number of vessels that collectively took 50% and 75% of the total bigeye catch based on the top bigeye catching vessels in each year, 1999-2005. %BET, %YFT, and %SKJ, indicate the percentage of the total catch for that species caught by those vessels.

	50% of the BET catch				75% of the BET catch			
	Vessels	**%BET**	**%YFT**	**%SKJ**	**Vessels**	**%BET**	**%YFT**	**%SKJ**
1999	14	51	5	26	31	75	11	49
2000	11	51	5	20	23	76	8	34
2001	15	51	6	32	27	75	10	50
2002	12	50	3	24	24	75	5	45
2003	15	52	4	25	30	76	9	41
2004	15	51	5	24	30	75	10	39
2005	12	53	4	18	25	76	10	32

TABLE 2. Ranking, by bigeye catch, of the vessels that collectively took 50% of the total bigeye catch. A blank means either the vessel did not operate in that year or it was not one of the vessels that took 50% of the bigeye catch.

	Rank within vessels that took 50% of the catch of BET									
Vessel	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**Number of years**	**Average annual total tuna catch**	**Average annual % BET**
1						13		1	3961	0.21
2	10							1	3434	0.22
3	6							1	3557	0.14
4				5				1	4499	0.24
5					15			1	4630	0.19
6	7	9		7				3	6859	0.17
7						4		1	4730	0.21
8	8				11	8	10	4	4998	0.26
9	4	10	5	2	9		4	6	5770	0.30
10			8		13	11	5	4	6101	0.18
11			11	4	5	7	6	5	3190	0.46
12	14							1	3256	0.14
13	12		12	8	7	3		5	6637	0.22
14			7		1	15	7	4	4678	0.32
15					14			1	3004	0.22
16	5				12			2	4254	0.24
17	3	6	13					3	7122	0.17
18			10	9				2	5135	0.19
19	1	1	9	11	10	2	1	7	10020	0.27
20	9	7	15		6	12		5	7153	0.20
21	2	3						2	7777	0.23
22			6					1	5116	0.16
23		11	14	10		6	11	5	5833	0.21
24	11	5		12	4	9	8	6	5973	0.29
25		8	2					2	4315	0.23
26		2						1	5463	0.20
27	13	4	1	6	2	1	2	7	8744	0.28
28							12	1	2732	0.21
29						14	9	2	3577	0.27
30			3	3	3	10	3	5	7661	0.26
31			4	1				2	7405	0.20
32					8	5		2	5966	0.25

TABLE 3a. Individual vessel bigeye catch limits required to reduce the total bigeye catch to 50% of the catch in that year. "Vessels" is the number of vessels affected by the limit. "Lost catch %" is the percentage reduction of the total catch of tuna (bigeye, yellowfin, and skipjack) if the vessel was to stop all fishing immediately upon reaching its bigeye catch limit.

	Limit	Vessels	Lost catch %
1999	350	39	0.19
2000	889	30	0.17
2001	474	31	0.16
2002	459	30	0.12
2003	416	38	0.16
2004	454	37	0.17
2005	520	33	0.16

TABLE 3b. Individual vessel bigeye catch limits required to reduce the total bigeye catch to 30% of the catch in that year. "Vessels" is the number of vessels affected by the limit. "Lost catch %" is the percentage reduction of the total catch of tuna (bigeye, yellowfin, and skipjack) if the vessel was to stop all fishing immediately upon reaching its bigeye catch limit .

	Limit	Vessels	Lost catch %
1999	660	18	0.10
2000	1520	19	0.09
2001	790	26	0.09
2002	780	20	0.07
2003	730	22	0.08
2004	820	23	0.10
2005	930	16	0.08