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Composition of the Incidental Kill of Small Cetaceans in the US Purse–Seine Fishery for Tuna in the Eastern Tropical Pacific, 1982 through 1984

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ABSTRACT

Composition of the small cetacean incidental kill by US registered purse–seiners fishing in the eastern tropical Pacific from 1982 to 1984 is reported by area, species, stock, sex, length and reproductive condition. The data were collected by Inter-American Tropical Tuna Commission and National Marine Fisheries Service technicians placed aboard a total of 162 vessel-trips made during these three years. Differences between the data treatment here as opposed to that in two previous papers are discussed.

INTRODUCTION

Several papers describing the small cetacean kill incidental to fishing activities of tuna purse-seiners in the eastern tropical Pacific (ETP) have been published, including Lo, Powers and Wahlen (1982), Perrin and Oliver (1982), Hammond and Tsai (1983), Oliver, Walker and Miller (1983), Smith (1983), Hammond (1984), Hammond and Hall (1985) and Wahlen and Smith (1985). Forthcoming papers include Lo and Smith (1986) and Wahlen (1986).

In this third in a series of papers (Perrin and Oliver, 1982; Oliver *et al.*, 1983), we report the incidental kill of small cetaceans by US registered vessels in the ETP from 1982 to 1984. These kills are classified by area, species, stock, sex, length and reproductive condition. Species represented in this report are: spotted dolphins, *Stenella attenuata*; spinner dolphins, *S. longirostris*; striped dolphins, *S. coeruleoalba*; common dolphins, *Delphinus delphis*; rough-toothed dolphins, *Steno bredanensis*; bottlenose dolphins, *Tursiops truncatus*; and short-finned pilot whales, *Globicephala macrorhynchus*.

DATA

Incidental kill data were collected by Inter-American Tropical Tuna Commission (IATTC) and National Marine Fisheries Service (NMFS) technician-observers placed aboard a sample of US registered tuna purse–seine vessels fishing in the ETP (Lo *et al.*, 1982). However, data collected aboard US registered tuna seiners chartered by non-US companies were not available to us.

Kills by area, species, stock and sex, if determined, were obtained from the 'tally' databases. Length frequencies by sex, and reproductive condition information for females, were obtained from the 'life history' databases containing extensive biological data for those dead animals which were available for 'hands-on' inspection by the technicians. The life history databases thus contain biological data for only a subset of the animals reported as killed in the tally databases, since technicians are unable to physically examine each animal killed. See Perrin and Oliver (1982) for detailed descriptions of data recorded in these databases.

Whereas in the two previous papers in this series, tally data from IATTC technicians were not included, they are included here. As in the previous papers, life history data from both IATTC and NMFS technicians are included.

METHODS

To reduce the size of the report, we have eliminated stratification by month and quarter and have reported kills down to the level of stocks only for spotted and spinner dolphins. We allocated kills of offshore spotted and whitebelly spinner dolphins to geographic stocks as in Perrin and Oliver (1982). Laboratory procedures for processing specimens and determining sexual maturity are referenced in Perrin and Oliver (1982), as is the methodology of the computer programs used to summarize the reproductive condition data.

RESULTS

Kill data from 85 trips in 1982, from 47 trips in 1983, and from 30 trips in 1984 (Table 1) are summarized by year, stock, sex and area for spotted dolphins (Table 2) and spinner dolphins (Tables 3–5), and by year, sex and area

Table 1

Number of fishing trips by US seiners which were observed by IATTC or NMFS technicians, by year and observer type. IATTC and NMFS totals are subdivided according to departure date of trips (previous year, current year). Numbers in parentheses indicate number of trips in which some dolphins were killed

Observer type		1982	1983	1984
IATTC	Previous year	6	7	3
	Current year	40	30	16
	Total	46 (39)	37 (35)	19 (18)
NMFS	Previous year	7	10	0
	Current year	32	0[1]	11
	Total	39 (37)	10 (6)	11 (11)
Total		85 (76)	47 (41)	30 (29)

[1] NMFS technicians were not placed aboard any fishing vessels which departed during 1983 because of a court order forbidding placement of NMFS technicians without a search warrant.

Table 2

Total kill of spotted dolphins by observed US vessels, by year, stock, sex (M = male, F = female), and 5 degree block number. Reported kills of 1 male offshore spotted dolphin of unknown stock and of 59 unidentified spotted dolphins during 1982, and of 1 male coastal spotted dolphin during 1983 are not included. No kills were reported for the coastal stock during 1982 and 1984. T = total

	1982						1983						1984					
5	Northern offshore			Southern offshore			Northern offshore			Southern offshore			Northern offshore			Southern offshore		
block	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T
23	0	0	0	0	1	3	0	0	0	39	22	97	0	0	0	0	0	1
24	0	0	0	14	17	84	0	0	0	9	16	38	0	0	0	26	37	84
25	0	0	0	2	0	2	0	0	0	3	6	24	0	0	0	1	0	3
26	0	0	0	0	0	0	0	0	0	9	13	56	0	0	0	0	0	0
43	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0
44	0	0	0	6	9	23	0	0	0	11	23	73	0	0	0	7	3	55
45	0	0	0	47	75	727	0	0	0	7	12	27	0	0	0	2	6	29
46	0	0	0	22	32	124	0	0	0	40	53	156	0	0	0	0	0	0
47	0	0	0	0	2	14	0	0	0	0	0	0	0	0	0	0	0	0
48	0	0	0	0	1	2	0	0	0	0	0	0	0	0	0	0	0	0
63	8	7	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
64	3	4	7	2	3	11	0	0	3	1	6	35	0	0	0	0	0	0
65	22	20	91	15	26	62	0	0	4	0	0	1	0	0	0	0	0	1
66	12	13	39	5	10	54	1	1	7	14	9	118	0	0	0	0	0	0
67	0	0	0	1	9	30	0	0	0	3	3	16	0	0	0	0	0	0
68	0	0	0	3	8	205	0	0	0	0	0	0	0	0	0	0	0	0
69	0	0	0	16	29	107	0	0	0	0	0	0	0	0	0	0	0	0
70	5	4	48	21	32	104	0	0	0	0	0	0	0	0	0	0	0	0
83	3	12	31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
84	1	2	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
85	23	28	228	0	0	0	0	1	1	0	0	0	0	0	10	0	0	0
86	16	23	75	0	0	0	5	14	49	0	0	0	0	3	5	0	0	0
87	1	4	9	0	0	0	0	0	0	0	0	0	13	21	150	0	0	0
88	0	0	7	0	0	0	3	2	10	0	0	0	9	14	69	0	0	0
89	1	4	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
90	34	64	223	0	0	0	0	1	3	0	0	0	0	0	0	0	0	0
91	38	39	521	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
92	2	4	18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
93	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
103	0	1	17	0	0	0	1	1	3	0	0	0	0	0	0	0	0	0
104	4	7	252	0	0	0	0	1	17	0	0	0	4	5	11	0	0	0
105	42	67	368	0	0	0	13	10	41	0	0	0	0	2	4	0	0	0
106	136	157	753	0	0	0	4	5	17	0	0	0	32	52	139	0	0	0
107	17	22	185	0	0	0	2	1	117	0	0	0	67	95	239	0	0	0
108	6	13	100	0	0	0	0	1	2	0	0	0	18	17	141	0	0	0
109	3	4	16	0	0	0	3	3	7	0	0	0	0	0	0	0	0	0
110	7	14	41	0	0	0	1	0	1	0	0	0	14	20	34	0	0	0
111	20	18	157	0	0	0	0	1	2	0	0	0	28	20	65	0	0	0
112	7	10	105	0	0	0	2	2	5	0	0	0	41	37	147	0	0	0
113	19	14	136	0	0	0	9	7	16	0	0	0	9	7	16	0	0	0
114	40	35	146	0	0	0	8	9	20	0	0	0	20	27	49	0	0	0
115	0	0	0	0	0	0	5	2	9	0	0	0	0	0	0	0	0	0
125	29	27	144	0	0	0	0	0	0	0	0	0	7	12	97	0	0	0
126	13	13	255	0	0	0	0	0	9	0	0	0	0	5	5	0	0	0
127	5	9	77	0	0	0	1	2	4	0	0	0	2	2	20	0	0	0
128	8	14	67	0	0	0	12	24	75	0	0	0	34	30	85	0	0	0
129	32	32	191	0	0	0	10	13	42	0	0	0	2	2	10	0	0	0
130	3	2	7	0	0	0	9	4	22	0	0	0	3	0	3	0	0	0
131	8	3	24	0	0	0	25	20	114	0	0	0	26	40	92	0	0	0
132	0	2	88	0	0	0	5	18	92	0	0	0	50	81	287	0	0	0
133	20	22	122	0	0	0	2	6	39	0	0	0	19	27	272	0	0	0
134	0	1	3	0	0	0	1	0	3	0	0	0	2	7	104	0	0	0
135	1	2	3	0	0	0	1	1	9	0	0	0	0	0	0	0	0	0
146	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
147	11	21	72	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
148	1	1	17	0	0	0	2	6	27	0	0	0	0	0	5	0	0	0
149	0	0	13	0	0	0	1	0	10	0	0	0	0	1	3	0	0	0
151	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0
168	0	0	0	0	0	0	3	1	6	0	0	0	0	0	0	0	0	0
T	601	740	4687	154	254	1556	129	157	789	136	163	641	400	527	2062	36	46	173

Table 3

Total kill of spinner dolphins by observed US vessels during 1982, by stock, sex (M = male, F = female), and 5 degree block number. Reported kill of 39 unidentified spinner dolphins is not included. No kills were reported for the Costa Rican stock

5°	Eastern			Northern whitebelly			Southern whitebelly		
block	M	F	Total	M	F	Total	M	F	Total
23	0	0	0	0	0	0	0	1	2
24	0	0	0	0	0	0	2	2	6
25	0	0	0	0	0	0	2	2	10
44	0	0	0	0	0	0	1	2	28
45	0	0	0	0	0	0	28	31	410
46	0	0	0	0	0	0	5	4	19
64	0	0	0	0	0	0	4	3	104
65	0	0	0	0	0	0	6	4	17
66	0	0	0	0	0	0	5	5	64
67	0	0	0	0	0	0	0	0	4
68	0	0	0	0	0	0	1	2	44
69	0	0	0	0	0	0	1	4	7
70	0	0	0	0	0	0	1	1	11
85	0	0	0	6	12	30	0	0	0
86	0	0	0	0	1	2	0	0	0
87	0	0	0	9	3	14	0	0	0
88	0	0	0	1	1	4	0	0	0
89	0	0	0	2	1	8	0	0	0
90	0	0	0	10	9	25	0	0	0
91	0	0	0	1	2	84	0	0	0
103	0	0	4	0	0	1	0	0	0
104	0	0	0	1	3	9	0	0	0
105	1	1	2	1	5	17	0	0	0
106	0	0	0	0	2	8	0	0	0
107	0	1	3	12	4	24	0	0	0
108	0	0	0	2	2	38	0	0	0
109	1	0	1	0	0	4	0	0	0
110	0	0	5	3	0	4	0	0	0
111	0	0	0	5	7	35	0	0	0
112	0	0	1	1	3	7	0	0	0
113	0	0	0	2	7	56	0	0	0
114	0	0	0	11	10	64	0	0	0
115	0	0	0	0	0	19	0	0	0
125	22	21	86	0	0	0	0	0	0
126	9	13	123	0	0	274	0	0	0
127	5	17	41	0	0	4	0	0	0
128	3	5	23	0	0	2	0	0	0
129	42	28	313	0	0	7	0	0	0
130	0	1	1	0	1	1	0	0	0
131	0	0	0	12	18	42	0	0	0
132	16	0	82	1	0	10	0	0	0
133	15	12	62	1	4	7	0	0	0
134	0	0	0	0	1	2	0	0	0
135	0	0	0	14	12	26	0	0	0
147	11	4	50	0	0	0	0	0	0
148	0	0	0	0	0	1	0	0	0
149	2	7	24	0	0	0	0	0	0
Total	127	110	821	95	108	829	56	61	726

for common dolphins and striped dolphins (Table 6). Kill data are also presented by year, sex and area for rough-toothed and bottlenose dolphins (Table 7), and by year and area for unidentified dolphins (Table 8). In Tables 2–7, which were derived from the tally databases, the stock or species totals may be larger than the sum over sex because the sex of some animals in the tally databases was not determined. The unidentified dolphins (Table 8) were probably spotted or spinner dolphins which were not seen closely enough for identification.

Length frequencies for sexed animals are tabulated by year and stock for spotted dolphins (Table 9), spinner dolphins (Table 10), and by year for common, striped, rough-toothed and bottlenose dolphins (Table 11). The length frequency totals (Tables 9–11) are less than or equal to the kill by sex and area totals (Tables 2–7) because lengths were obtained from the life history databases, which contain data for only a subset of the animals in the tally databases.

Perrin, Scott, Walker and Cass (1985) reviewed all body length data for specimens collected through 1981. Some of the male northern offshore spotted dolphin specimens collected after 1981 were quite large (Table 9); however, all lengths were within the range of body lengths observed by Perrin *et al.* (1985) except the 250 cm specimen recorded in 1982. The male eastern spinner dolphin in the 60–64 cm length category (Table 10) may have been an aborted fetus rather than a neonate.

Female reproductive condition results are reported by year and stock for spotted dolphins (Table 12), spinner dolphins (Table 13), and by year for common and striped dolphins (Table 14). From 1982 to 1984, no sexually mature specimens of rough-toothed or bottlenose dolphins, or of short-finned pilot whales were collected. Finally, the geographical distribution of kills is presented in Figs 1–3.

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Table 4

Total kill of spinner dolphins by observed US vessels during 1983, by stock, sex (M = male, F = female), and 5 degree block number. Reported kill of one unidentified spinner dolphin is not included. No kills were reported for the Costa Rican stock

5°	Eastern			Northern whitebelly			Southern whitebelly		
block	M	F	Total	M	F	Total	M	F	Total
23	0	0	0	0	0	0	0	2	4
24	0	0	0	0	0	0	1	0	12
25	0	0	0	0	0	0	11	11	99
26	0	0	0	0	0	0	1	1	3
44	0	0	0	0	0	0	11	19	59
45	0	0	0	0	0	0	5	3	17
46	0	0	0	0	0	0	1	4	7
64	0	0	0	0	0	0	7	6	36
65	0	0	0	0	0	0	1	3	6
66	0	0	0	0	0	0	6	6	32
67	0	0	0	0	0	0	1	0	2
86	0	0	0	0	1	3	0	0	0
88	0	0	0	0	0	1	0	0	0
90	0	1	1	0	0	0	0	0	0
105	1	0	2	0	0	0	0	0	0
107	0	0	0	0	0	3	0	0	0
110	0	0	2	0	0	1	0	0	0
111	0	0	0	0	0	1	0	0	0
112	0	0	0	2	0	2	0	0	0
114	0	0	0	1	0	1	0	0	0
115	0	0	0	1	1	2	0	0	0
126	0	0	55	0	0	0	0	0	0
128	2	4	40	6	8	14	0	0	0
129	10	9	28	0	0	0	0	0	0
130	4	3	14	0	1	3	0	0	0
131	8	9	61	3	0	10	0	0	0
132	0	0	0	15	21	445	0	0	0
133	0	1	4	35	53	400	0	0	0
135	0	0	0	10	5	23	0	0	0
148	2	2	7	0	0	0	0	0	0
149	1	1	2	0	0	1	0	0	0
151	0	0	0	3	2	26	0	0	0
Total	28	30	216	76	92	936	45	55	277

Table 5

Total kill of spinner dolphins by observed US vessels during 1984, by stock, sex (M = male, F = female), and 5 degree block number. Reported kill of 176 unidentified spinner dolphins is not included. No kills were reported for the Costa Rican stock

5°	Eastern			Northern whitebelly			Southern whitebelly		
block	M	F	Total	M	F	Total	M	F	Total
23	0	0	0	0	0	0	0	0	2
24	0	0	0	0	0	0	26	26	74
44	0	0	0	0	0	0	9	2	13
45	0	0	0	0	0	0	0	1	16
65	0	0	0	0	0	0	0	0	4
85	0	0	0	1	0	38	0	0	0
86	0	0	0	0	1	1	0	0	0
87	0	0	0	4	5	122	0	0	0
88	0	0	0	3	1	8	0	0	0
89	0	0	0	0	0	3	0	0	0
106	0	0	0	0	1	1	0	0	0
107	0	0	0	25	15	56	0	0	0
108	4	5	9	6	5	51	0	0	0
110	0	0	0	33	29	62	0	0	0
111	0	0	0	9	13	36	0	0	0
112	0	0	0	5	7	30	0	0	0
113	0	0	0	1	3	4	0	0	0
114	0	0	0	4	12	25	0	0	0
125	43	14	442	0	0	0	0	0	0
126	1	2	3	0	0	0	0	0	0
127	2	3	6	1	3	6	0	0	0
128	43	32	193	33	22	55	0	0	0
129	1	0	2	0	1	1	0	0	0
131	7	9	37	1	2	6	0	0	0
132	1	0	1	6	4	14	0	0	0
133	0	0	1	0	0	0	0	0	0
134	0	0	0	0	0	96	0	0	0
148	2	0	8	0	0	5	0	0	0
Total	104	65	702	132	124	615	35	29	109

Table 6

Total kill of common and striped dolphins by observed US vessels, by year, sex (M = male, F = female), and 5 degree block number. T = total

	1982						1983						1984					
5°	Common			Striped			Common			Striped			Common			Striped		
block	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T
24	0	0	0	4	1	179	0	0	0	0	0	1	1	0	1	0	0	0
44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
45	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
103	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
104	1	5	7	0	0	0	3	4	19	0	0	0	0	0	0	0	0	0
105	11	29	128	0	0	0	1	5	14	0	0	0	0	0	0	0	0	0
106	2	7	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
111	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
113	0	0	0	1	2	10	0	0	0	0	0	0	0	0	0	0	0	0
125	0	0	0	0	0	0	3	2	8	0	0	0	4	7	743	4	5	9
128	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
148	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
149	2	2	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
169	0	0	0	0	0	0	9	16	25	0	0	0	0	0	0	0	0	0
170	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
189	0	0	71	0	0	0	18	13	33	0	0	0	0	0	0	0	0	0
Total	16	43	227	5	3	190	34	40	99	0	0	1	5	7	744	4	5	10

Table 7

Total kill of rough-toothed and bottlenose dolphins by observed US vessels, by year, sex (M = male, F = female), and 5 degree block number. Reported kills of 36 rough-toothed dolphins (2 males, 6 females, 28 sex undetermined) at an unknown position and of 2 short-finned pilot whales of undetermined sex during 1982 are not included. No kills were reported for rough-toothed or bottlenose dolphins, or for short-finned pilot whales during 1984

	1982						1983					
5°	Rough-toothed			Bottlenose			Rough-toothed			Bottlenose		
block	M	F	Total	M	F	Total	M	F	Total	M	F	Total
105	0	0	0	0	0	0	0	0	0	1	0	1
107	0	0	0	1	0	1	0	0	0	0	0	0
111	0	0	1	0	0	0	0	0	0	0	0	0
125	0	1	1	0	0	1	0	0	0	0	0	0
127	0	0	0	0	0	0	0	0	0	2	0	2
128	0	0	0	0	1	2	0	0	0	0	0	0
130	0	0	0	0	0	0	0	1	1	0	0	0
170	0	0	0	0	0	1	0	0	0	0	0	0
Total	0	1	2	1	1	5	0	1	1	3	0	3

Table 8

Total kill of unidentified dolphins by observed US vessels, by year and 5 degree block number. Sex was not determined for these animals

5° block	1982	1983	1984	5° block	1982	1983	1984
24	0	0	4	112	4	1	0
45	3	0	0	113	5	0	0
64	15	0	0	126	1	0	0
66	10	0	0	127	1	0	0
67	0	1	0	128	3	3	5
68	1	0	0	129	43	0	0
83	10	0	0	130	0	1	0
85	3	0	0	132	24	15	0
91	51	0	0	133	23	3	0
92	1	0	0	147	5	0	0
105	2	0	0	148	0	8	1
106	12	0	0	151	0	4	0
111	2	0	2	Total	219	36	12

Table 9

Length frequencies of spotted dolphins killed by observed US vessels, by year, stock, and sex (M = male, F = female). Reported kill during 1983 of one 214–219 cm male belonging to the coastal stock is not included. No kills were reported for the coastal stock during 1982 and 1984

Length (cm)	1982 Northern offshore M	1982 Northern offshore F	1982 Southern offshore M	1982 Southern offshore F	1983 Northern offshore M	1983 Northern offshore F	1983 Southern offshore M	1983 Southern offshore F	1984 Northern offshore M	1984 Northern offshore F	1984 Southern offshore M	1984 Southern offshore F
0–74	0	0	0	0	0	0	0	0	0	0	0	0
75–79	1	0	0	0	0	0	0	0	0	0	0	0
80–84	3	4	0	0	0	0	0	0	0	1	1	2
85–89	4	1	0	0	2	0	1	2	2	1	4	5
90–94	2	5	0	0	0	0	1	1	4	6	2	1
95–99	2	4	0	1	0	0	1	1	1	1	0	0
100–104	2	6	0	0	0	2	0	0	1	4	0	0
105–109	3	3	0	0	0	0	0	1	3	0	0	0
110–114	2	2	0	0	0	1	0	0	4	1	0	0
115–119	8	7	3	0	0	1	0	0	1	1	0	0
120–124	7	15	1	1	2	1	1	1	3	3	0	0
125–129	5	6	3	1	1	1	0	0	1	1	0	0
130–134	5	7	0	1	0	1	1	0	3	2	0	1
135–139	5	6	1	1	1	1	1	0	4	7	2	0
140–144	9	6	1	1	1	0	0	0	6	6	0	0
145–149	6	13	4	1	3	2	0	3	6	12	0	0
150–154	19	14	3	2	4	5	3	2	9	9	1	0
155–159	21	16	11	5	8	6	1	0	16	13	0	0
160–164	18	28	7	10	8	12	2	11	18	17	2	1
165–169	24	29	10	11	9	13	4	4	14	22	5	3
170–174	32	32	9	16	9	7	9	3	25	27	4	3
175–179	31	38	9	21	10	12	4	10	20	44	2	4
180–184	23	66	5	32	10	7	4	15	17	47	4	7
185–189	29	86	11	37	5	23	5	17	29	63	1	4
190–194	28	85	9	33	17	22	5	22	29	49	1	7
195–199	47	59	12	13	8	18	6	9	31	36	3	6
200–204	43	26	9	2	6	2	10	4	17	18	1	1
205–209	33	10	5	1	4	0	6	0	20	4	1	0
210–214	19	4	4	0	6	0	2	0	9	3	1	0
215–219	8	0	3	0	2	0	1	0	6	1	1	0
220–224	7	0	0	0	0	0	0	0	2	0	0	0
225–229	1	0	0	0	0	0	0	0	0	0	0	0
230–234	0	0	0	0	0	0	0	0	1	0	0	0
235–249	0	0	0	0	0	0	0	0	0	0	0	0
250–254	1	0	0	0	0	0	0	0	0	0	0	0
255–	0	0	0	0	0	0	0	0	0	0	0	0
Total	448	578	120	190	116	137	68	106	302	399	36	45

Table 10

Length frequencies of spinner dolphins killed by observed US vessels, by year, stock (E = eastern, NWB = northern whitebelly, SWB = southern whitebelly) and sex (M = male, F = female). Reported kills of 12 unidentified spinners during 1982, 1 unidentified spinner during 1983, and 70 unidentified spinners during 1984 are not included. No kills were reported for the Costa Rican stock during 1982–84

Length (cm)	1982 E M	1982 E F	1982 NWB M	1982 NWB F	1982 SWB M	1982 SWB F	1983 E M	1983 E F	1983 NWB M	1983 NWB F	1983 SWB M	1983 SWB F	1984 E M	1984 E F	1984 NWB M	1984 NWB F	1984 SWB M	1984 SWB F
0–59	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
60–64	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
65–74	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
75–79	0	0	0	1	0	0	0	0	1	0	1	0	0	0	1	0	0	0
80–84	0	0	0	1	0	0	0	0	2	2	0	0	0	0	0	0	0	0
85–89	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	1
90–94	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0
95–99	0	0	0	1	0	0	0	0	0	0	0	0	1	0	1	2	0	0
100–104	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
105–109	1	1	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0
110–114	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
115–119	1	1	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0
120–124	0	3	1	0	0	0	0	1	0	0	0	0	0	1	1	1	0	0
125–129	0	1	0	3	1	0	1	0	2	0	0	0	0	0	0	1	0	0
130–134	0	0	3	0	1	0	0	0	0	0	0	0	1	1	0	0	0	0
135–139	1	1	1	0	1	1	1	0	0	1	0	0	0	1	1	0	0	0
140–144	1	0	1	4	0	0	0	1	0	1	0	0	0	4	4	0	0	0
145–149	2	3	3	2	0	1	0	3	4	2	1	0	0	1	1	0	0	0
150–154	5	4	2	2	0	3	1	1	2	4	2	2	1	1	5	6	1	0
155–159	3	5	6	9	1	2	2	2	6	3	0	0	2	6	5	3	0	0
160–164	8	8	5	11	2	3	4	3	5	5	1	2	4	2	10	8	4	3
165–169	9	15	9	6	4	7	2	3	4	8	2	2	4	7	11	15	3	0
170–174	8	15	8	14	3	9	1	2	5	13	0	3	7	4	11	12	3	2
175–179	11	4	4	16	15	9	3	4	8	17	2	11	7	3	7	15	2	5
180–184	5	5	10	8	13	10	4	2	8	10	5	15	2	1	9	11	7	8
185–189	2	1	11	8	11	9	0	0	6	6	15	8	4	2	6	5	7	3
190–194	0	0	5	7	11	2	0	0	2	0	6	3	4	1	2	5	6	6
195–199	0	0	6	0	5	2	0	0	0	0	2	1	0	0	1	0	1	0
200–204	0	0	1	0	1	1	0	0	0	0	1	0	0	0	0	0	1	1
205–209	0	0	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
210–214	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
215–	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	58	67	77	96	70	60	19	23	55	72	38	47	39	36	78	87	35	29

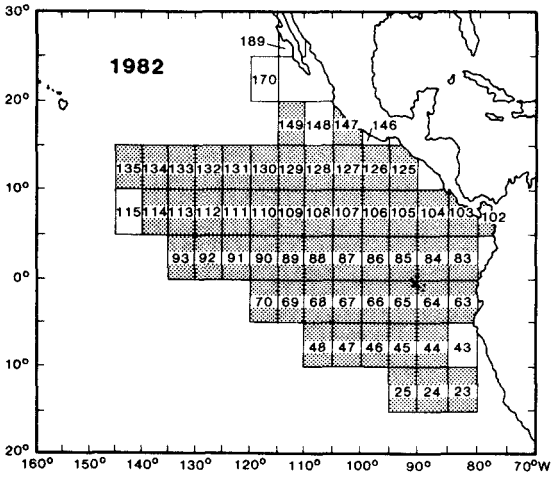

Fig 1. Five-degree blocks in the eastern tropical Pacific Ocean in which dolphins were killed during fishing operations of US vessels in 1982. Numbered blocks without shading indicate areas in which tally data only were collected. Numbered blocks with shading indicate areas in which no dolphin kills were recorded.

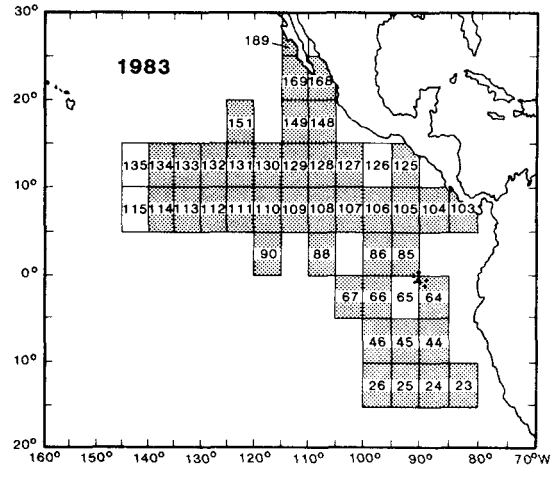

Fig. 2. Five-degree blocks in the eastern tropical Pacific Ocean in which dolphins were killed during fishing operations of US vessels in 1983, with block numbering and shading conventions as in Fig. 1.

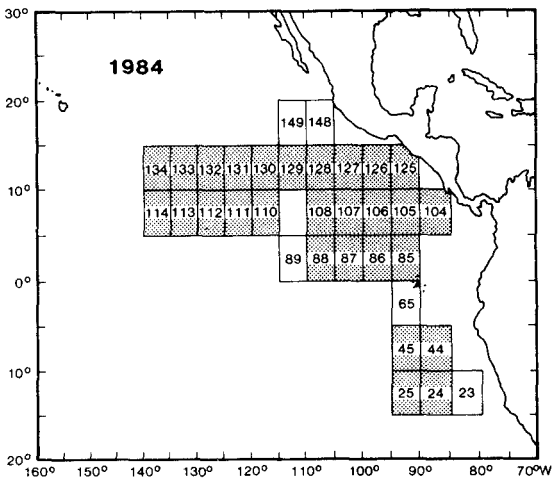

Fig. 3. Five-degree blocks in the eastern tropical Pacific Ocean in which dolphins were killed during fishing operations of US vessels in 1984, with block numbering and shading conventions as in Fig. 1.

Table 11

Length frequencies of common, striped, rough-toothed, and bottlenose dolphins killed by observed US vessels, by year and sex (M = male, F = female). Reported kills of 1 female bottlenose dolphin (220–224 cm) during 1982 and 1 female rough-toothed dolphin (210–214 cm) during 1983 are not included. No kills were reported of striped dolphins during 1983, and no kills were reported of rough-toothed or bottlenose dolphins during 1984

	1982						1983				1984			
	Common		Striped		Rough-Toothed		Common		Bottlenose		Common		Striped	
Length (cm)	M	F	M	F	M	F	M	F	M	F	M	F	M	F
0–89	0	0	0	0	0	0	0	0	0	0	0	0	0	0
90–94	0	1	0	0	0	0	1	0	0	0	0	0	0	0
95–99	1	0	0	0	0	0	0	0	0	0	0	0	0	0
100–119	0	0	0	0	0	0	0	0	0	0	0	0	0	0
120–124	0	0	0	0	0	0	0	0	0	0	0	0	0	1
125–129	0	0	0	0	0	1	0	0	0	0	0	0	0	0
130–134	0	0	0	0	0	0	0	0	0	0	0	0	0	0
135–139	0	1	0	0	0	0	0	0	0	0	0	0	1	0
140–144	1	0	0	0	0	0	0	0	0	0	0	0	0	0
145–149	1	0	0	0	0	0	1	1	0	0	0	0	0	0
150–154	0	0	0	0	0	0	0	1	0	0	0	0	1	0
155–159	1	1	0	0	0	0	0	0	0	0	0	0	0	0
160–164	0	2	0	0	0	0	0	1	0	0	0	0	0	0
165–169	0	1	1	0	0	0	0	1	0	0	0	0	0	1
170–174	0	0	0	1	0	1	1	3	0	0	0	0	0	0
175–179	1	1	0	0	0	0	2	0	0	0	0	0	0	1
180–184	0	3	0	0	0	0	3	3	0	0	0	0	0	0
185–189	1	6	0	0	0	1	1	2	0	0	0	0	1	0
190–194	1	8	0	0	0	0	2	1	0	0	1	0	0	0
195–199	0	8	0	0	0	0	1	4	0	0	0	0	0	1
200–204	1	4	1	0	0	1	0	5	0	0	0	1	1	0
205–209	3	5	0	1	0	0	2	4	0	0	0	0	0	1
210–214	2	1	0	0	0	1	3	2	0	0	1	0	0	0
215–219	2	0	2	0	0	1	3	2	0	0	0	0	0	0
220–224	1	0	0	0	1	1	3	3	0	0	0	0	0	0
225–229	0	0	0	0	1	0	4	1	0	0	0	0	0	0
230–234	0	0	0	0	0	0	3	0	0	0	0	0	0	0
235–239	0	0	0	0	0	1	0	0	0	0	0	0	0	0
240–249	0	0	0	0	0	0	0	0	0	0	0	0	0	0
250–254	0	0	0	0	0	0	0	0	1	0	0	0	0	0
255–259	0	0	0	0	0	0	0	0	0	0	0	0	0	0
260–264	0	0	0	0	0	0	0	0	1	0	0	0	0	0
265–269	0	0	0	0	0	0	0	0	1	0	0	0	0	0
270–	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	16	42	4	2	2	8	30	34	3	0	2	1	4	5

Table 12

Reproductive condition of female spotted dolphins killed by observed US vessels, by year and stock. Both sample sizes (N) and percentages (%) are indicated. Reproductive condition information was not obtained for any animals belonging to the coastal stock. U = Maturity undetermined; I = Sexually immature; MU = Sexually mature, condition undetermined; P = Pregnant only; PL = Pregnant and lactating; L = Lactating only; RCL = 'Resting' with corpus luteum; R = 'Resting' without corpus luteum; PR = Post-reproductive

	1982				1983				1984			
	Northern offshore		Southern offshore		Northern offshore		Southern offshore		Northern offshore		Southern offshore	
	N	%	N	%	N	%	N	%	N	%	N	%
U	336	57.9	78	41.1	62	45.3	69	65.1	230	57.6	40	88.9
I	90	15.5	44	23.2	38	27.7	15	14.2	81	20.3	1	2.2
MU	0	0.0	1	0.5	0	0.0	0	0.0	1	0.3	0	0.0
P	39	6.7	15	7.9	10	7.3	4	3.8	31	7.8	2	4.4
PL	9	1.6	5	2.6	4	2.9	0	0.0	2	0.5	0	0.0
L	77	13.3	30	15.8	21	15.3	6	5.7	38	9.5	1	2.2
RCL	4	0.7	3	1.6	0	0.0	2	1.9	4	1.0	0	0.0
R	23	4.0	13	6.8	2	1.5	10	9.4	11	2.8	1	2.2
PR	2	0.3	1	0.5	0	0.0	0	0.0	1	0.3	0	0.0
Total	580	100.0	190	100.0	137	100.0	106	100.0	399	100.0	45	100.0

Table 13

Reproductive condition of female spinner dolphins killed by observed US vessels, by year and stock. Both sample sizes (N) and percentages (%) are indicated. Reproductive condition information was not obtained for any animals belonging to the Costa Rican stock. During 1983, none of the 23 eastern spinner, 72 northern whitebelly, or 47 southern whitebelly specimens was sexually mature. Abbreviations as for Table 12

	1982						1984					
	Eastern		Northern whitebelly		Southern whitebelly		Eastern		Northern whitebelly		Southern whitebelly	
	N	%	N	%	N	%	N	%	N	%	N	%
U	45	67.2	65	71.4	56	91.8	27	45.8	63	72.4	27	93.1
I	15	22.4	17	18.7	2	3.3	21	35.6	11	12.6	0	0.0
MU	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
P	1	1.5	1	1.1	0	0.0	3	5.1	1	1.1	0	0.0
PL	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
L	6	9.0	3	3.3	2	3.3	6	10.2	9	10.3	2	6.9
RCL	0	0.0	0	0.0	1	1.6	0	0.0	1	1.1	0	0.0
R	0	0.0	5	5.5	0	0.0	2	3.4	2	2.3	0	0.0
PR	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Total	67	100.0	91	100.0	61	100.0	59	100.0	87	100.0	29	100.0

Table 14

Reproductive condition of female common and striped dolphins killed by observed US vessels, by year. Both sample sizes (N) and percentages (%) are indicated. During 1983, none of the 34 common dolphin specimens was sexually mature, and no reproductive condition information was obtained for striped dolphins. During 1984, no reproductive condition information was obtained for common dolphins

	1982				1984	
	Common		Striped		Striped	
	N	%	N	%	N	%
M	28	66.7	0	0.0	1	20.0
I	7	16.7	1	50.0	2	40.0
MU	0	0.0	0	0.0	0	0.0
P	1	2.4	1	50.0	1	20.0
PL	1	2.4	0	0.0	0	0.0
L	4	9.5	0	0.0	1	20.0
RCL	1	2.4	0	0.0	0	0.0
R	0	0.0	0	0.0	0	0.0
PR	0	0.0	0	0.0	0	0.0
Total	42	100.0	2	100.0	5	100.0

DISCUSSION

There are two differences between the data treatment here compared to that in the two previous papers in this series. Firstly, as noted above, tally data from IATTC technicians were not included in other papers. Inclusion of tally data from IATTC technicians allowed us to obtain sex breakdown for a larger proportion of animals than possible from the life history data. Secondly, results for common and striped dolphins are reported as species totals here rather than as separate subtotals for each geographic stock.

The unusually small number of common dolphins which were sexed out of the total kill of 744 in 1984 (Table 6), is correct as reported. Nearly all of these animals were killed in one haul of the purse-seine net, making it impossible to examine more than a very small fraction of the dead animals.

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REFERENCES

Hammond, P. S. 1984. Dolphin mortality incidental to purse-seining for tunas in the eastern tropical Pacific, 1982. *Rep. int. Whal. Commn* 34: 539–41.

Hammond, P. S. and Hall, M. A. 1985. Dolphin mortality incidental to purse-seining for tunas in the eastern tropical Pacific inflicted by the US fleet in 1983 and non-US fleet in 1979–83. *Rep. int. Whal. Commn* 35: 431–3.

Hammond, P. S. and Tsai, K.-T. 1983. Dolphin mortality incidental to purse-seining for tunas in the eastern Pacific Ocean, 1979–81. *Rep. int. Whal. Commn* 33: 589–97.

Lo, N. C. H., Powers, J. E. and Wahlen, B. E. 1982. Estimating and monitoring incidental dolphin mortality in the eastern tropical Pacific tuna purse seine fishery. *Fish. Bull., US* 80(2): 396–401.

Lo, N. C. H. and Smith, T. D. 1986. Incidental mortality of dolphins in the eastern tropical Pacific 1959–1972. *Fish. Bull., US* 84(1).

Oliver, C. W., Walker, G. J. and Miller, R. B. 1983. Time/area distribution and composition of the incidental kill of small cetaceans in the US purse-seine fishery for tuna in the eastern tropical Pacific during 1981. *Rep. int. Whal. Commn* 33: 603–15.

Perrin, W. F. and Oliver, C. W. 1982. Time/area distribution and composition of the incidental kill of dolphins and small whales in the US purse-seine fishery for tuna in the eastern tropical Pacific, 1979–80. *Rep. int. Whal. Commn* 32: 429–44.

Perrin, W. F., Scott, M. D., Walker, G. J. and Cass, V. L. 1985. Review of geographical stocks of tropical dolphins (*Stenella* spp. and *Delphinus delphis*) in the eastern Pacific US Dep. Commer., NOAA Tech. Rep. NMFS 28, 28 pp.

Smith, T. D. 1983. Changes in size of three dolphin (*Stenella* spp.) populations in the eastern tropical Pacific. *Fish. Bull.*, US 83(1): 1–13.

Wahlen, B. E. 1986. Incidental dolphin mortality in the eastern tropical Pacific tuna fishery, 1973 through 1978. *Fish. Bull.*, US 84(3).

Wahlen, B. E. and Smith, T. D. 1985. Observer effect on incidental dolphin mortality in the eastern tropical Pacific tuna fishery. *Fish Bull.*, US 83(4): 521–30.