

Composition of the 1991 Incidental Kill of Small Cetaceans in the Eastern Tropical Pacific US Tuna Fishery and Two California Gillnet Fisheries

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ABSTRACT

Data are presented for the observed incidental kill of small cetaceans on 40 US tuna purse-seine vessel-trips and 794 California gillnet vessel-trips. This is the first complete year (1991) that data were collected by observers for California gillnet fisheries. There were 1,002 cetaceans killed incidentally in the US tuna fishery and 69 cetaceans killed incidentally in the California gillnet fisheries sampled. The observed incidental kills are summarized and reported here by geographic area, species, stock and sex. Where life history data were collected, the summary also includes a length distribution for each species and sex, as well as the reproductive condition for the females collected.

KEYWORDS: EASTERN TROPICAL PACIFIC; NORTH PACIFIC; SPOTTED DOLPHIN; SPINNER DOLPHIN; COMMON DOLPHIN; RIGHT WHALE DOLPHIN; WHITE-SIDED DOLPHIN; DALLS PORPOISE; FISHERIES; INCIDENTAL CAPTURE; MORTALITY; GROWTH/LENGTH DISTRIBUTION.

INTRODUCTION

The National Marine Fisheries Service (NMFS) places biological technicians (observers) aboard US tuna purse-seine vessels and California gillnet vessels to monitor the incidental kill of marine mammals and other protected marine vertebrates. These monitoring programs provide estimates of mortality and reproductive rates which are used to assess the effects of the fisheries on populations of small cetaceans and pinnipeds. The purpose of this report is to document the observed incidental mortality of small cetaceans and the collection of life history data subsampled from the kill by US-registered tuna purse-seine vessels and California gillnet vessels between 1 January and 31 December 1991.

US tuna fishery

The NMFS has monitored the incidental kill of small cetaceans by the US tuna purse-seine fishery in the eastern tropical Pacific (ETP) since 1968 with the Inter-American Tropical Tuna Commission (IATTC) beginning a complementary program for the international fleet in 1979. Since 1989, the aim has been for complete coverage of the US fleet by fisheries observers. Prior to 1989, 30% observer coverage of the fleet was targeted (Lo *et al.*, 1982). The species most frequently killed as a result of tuna purse-seine fishing operations are the pantropical spotted dolphin (*Stenella attenuata*), spinner dolphin (*S. longirostris*) and common dolphin (*Delphinus delphis*). Several other species of small cetaceans are also killed in relatively low numbers. The composition of the US kill of small cetaceans has been documented since 1979 in a series of reports (Perrin and Oliver, 1982; Oliver *et al.*, 1983; Wahlen *et al.*, 1986; 1987; 1988; Chivers *et al.*, 1989; 1990; Hohn *et al.*, 1991; Peltier *et al.*, 1992), and the non-US kill has also been documented since 1979 by the IATTC (Hammond and Hall, 1985; Hall and Boyer, 1986; 1987; 1988; 1989; 1990; 1992).

California gillnet fisheries

In July 1990, the NMFS in conjunction with the California Department of Fish and Game (CDFG), initiated a three year program to assess mortality and collect life history data from all species that are killed incidentally in two of the gillnet fisheries operating off the coast of California. The targeted observer coverage for these fisheries is 20% of all vessels trips (Lennert *et al.*, 1993). The two California gillnet (CAGN) fisheries sampled are the set-net fishery targeted for halibut (*Paralichthys californicus*) and Pacific angel shark (*Squatina californica*), and the drift-net fishery targeted for common thresher shark (*Alopias vulpinus*), short-finned mako shark (*Isurus paucus*) and swordfish (*Xiphias gladius*) (Herrick and Hanan, 1988). The non-target species observed killed in the two CAGN fisheries include cetaceans, pinnipeds [California sea lions (*Zalophus californianus*), harbor seals (*Phoca vitulina*), elephant seals (*Mirounga angustirostris*)], sea otters (*Enhydra lutris*) and several species of seabirds and turtles. The species of cetacean most frequently killed is the common dolphin. Mortality observed in this fishery has been reported by several authors (Diamond and Hanan, 1986; Hanan *et al.*, 1986; 1987; 1988; Herrick and Hanan, 1988; Hanan and Diamond, 1989; Perkins *et al.*, 1992a; b; Barlow *et al.*, 1993; Lennert *et al.*, 1993). This report summarizes only the observed incidental kill of small cetaceans.

METHODS

US tuna fishery

Data are collected by NMFS and IATTC observers aboard US-registered tuna purse-seine vessels in the ETP. For each set made, the observers record the species, stock and sex of cetaceans involved along with the geographic location of the school and a tally of individual animals killed. Life history data (e.g. specimen length and reproductive condition) are collected from those animals that are brought aboard with the tuna and, therefore, represent a subset of the incidental kill that is tallied.

Procedures for the collection of life history data have been described by Perrin *et al.* (1976). While the procedures for collecting the life history data have not changed, additional materials are now collected (i.e. adrenal glands and biopsy sample). An example of the most recent life history form can be found in Hohn *et al.* (1991), and the data elements are described in Oliver (1991).

Life history and tally data are summarized for all vessel trips between 1 January and 31 December 1991. The number of cetaceans observed killed are summed by 5° block for each species, stock and sex to show the geographic distribution of observed sets (for a complete map of blocks for the ETP, see Perrin and Oliver, 1982). The life history data collected are presented as length frequency distributions for each species and sex, and for females, the life history data are further summarized by reproductive condition (e.g. whether sexually mature, pregnant or lactating). Tally and life history data are also stratified by stock for the pantropical spotted dolphin (northern and southern) and for the spinner dolphin (eastern and whitebelly) (Perrin *et al.*, 1985). We have combined the northern and southern stocks of whitebelly spinner dolphins in accordance with the most recent spinner dolphin stock descriptions given in Perrin *et al.* (1991).

California gillnet fisheries

NMFS biological technicians are placed on selected California drift- and set-net vessels (Perkins *et al.*, 1992b; Lennert *et al.*, 1993). The observers tally the number and species of cetaceans observed entangled in the nets by geographic location, and life history data are collected from the animals when possible. The procedures for collecting life history data are essentially the same as for the ETP cetacean species, although a few modifications were made to the life history form (Hohn *et al.*, 1991) for the collection of data for pinnipeds (Winchell, 1990). Modifications to the data form include the addition of fields to note whether the total body length measurement was curvilinear, to record flipper length and to note if a skin sample was collected. Because animals cannot always be brought aboard the vessels, the definition of life history data collection also includes cases where only geographic location, species and a skin sample are collected. Otherwise, geographic location, species, sex and length constitute the collection of baseline life history data, as is the case for the ETP observer program.

We have summarized the tally and life history data for small cetaceans collected from all observed vessel-trips made by observers between 1 January and 31 December 1991. The life history data are presented as length frequency distributions for each cetacean species by sex, also presented are data collected on the reproductive condition of females.

RESULTS

US tuna fishery

For the third consecutive year, there was 100% observer coverage on all US tuna purse-seine vessels with fishing permits. There was a total of 40 tuna purse-seine trips reported and observed in the ETP during 1991, 16 of which (40%), reported cetacean kill. The observed incidental kill of 1,002 small cetaceans was composed of 634 pantropical spotted dolphins, 271 spinner dolphins, 93 common dolphins and 4 dolphins unidentified to species.

Fig. 1 shows the geographic distribution of purse-seine sets with observed kill. The totals for each 5° square block are summed by species, stock and sex (Table 1). Life history data were collected from 263 of the animals killed on 11 of the 16 trips with observed cetacean kill. These data included total body length measurement for 149 females and 114 males (Table 2) and reproductive condition for 106 of the females (Table 3).

California gillnet fisheries

In 1991, there were an estimated 4,752 days fished in the drift-net fishery and 7,089 days fished in the set-net fishery. There were 88 drift-net trips accounting for 470 days of fishing observed during the year, and 706 set-net trips were observed, which corresponds to the same number of fishing days. In both fisheries, the observer coverage accounted for 10% of the total number of fishing days reported. Cetaceans were incidentally killed on 34 of the 88 observed drift-net trips and on only four of the 706 observed set-net trips. A total of 64 cetaceans were observed killed on drift-net trips: 44 common dolphins, 7 northern right-whale dolphins (*Lissodelphis borealis*), 5 Pacific white-sided dolphins (*Lagenorhynchus obliquidens*), 5 Risso's dolphins (*Grampus griseus*), 2 Dall's porpoise (*Phocoenoides dalli*) and one unidentified cetacean. In the set-net fishery, five harbor porpoise (*Phocoena phocoena*) were observed killed. In the drift-net fishery, 34 of the 35 trips observed that reported cetacean kill also collected life history data. Life history data were collected from one harbour porpoise on a set-net trip. We have plotted (Fig. 2) the geographic positions of sets in which cetaceans were observed killed but no life history data were collected and those sets with life history data collected for the two fisheries observed. Life history data were collected from 54 of the 69 animals observed killed in both fisheries, including a measure of total body length for 17 females and 26 males (Table 2), reproductive condition for 14 of the females (Table 3) and skin samples for 12 specimens (5 females, 5 males, and 2 of unknown sex).

DISCUSSION

US tuna fishery

The observed incidental kill during 1991 is down markedly from the two preceding years that also had 100% observer coverage. The observed incidental kill of 1,002 cetaceans in 1991 compares to a kill of 12,548 and 5,083 cetaceans for 1989 and 1990, respectively (Hohn *et al.*, 1991; Peltier *et al.*, 1992). Correspondingly, the total number of trips and the number of trips with observed kill were also down markedly in 1991. Only 40% of all observed trips ($n = 40$) reported cetacean kill in 1991, whereas 88% of the trips ($n = 123$) in 1989 reported kill, and in 1990, 64% of the trips ($n = 107$) reported kill. The decline in the incidental kill of small cetaceans in the ETP may be attributed to the reduction of the US tuna purse-seine fleet that followed the US tuna canneries' decision in April 1990 to not buy tuna caught in conjunction with dolphins. Currently, only seven tuna purse-seine vessels remain in the US fleet: a reduction from 31 vessels in 1989 and 17 vessels in 1990 (R. Rasmussen, SWFSC, pers. comm.).

The life history data collected in 1991 account for 26% of the total observed kill and compares to average collection rates for the periods 1979–80 and 1981–87, of 43% and 20%, respectively. The collection rates for life history data in 1991 are not statistically different (chi-square, $\alpha = 0.05$) from those for 1989 (24%) and 1990 (26%) when observer coverage was also 100%. The fraction of the kill collected

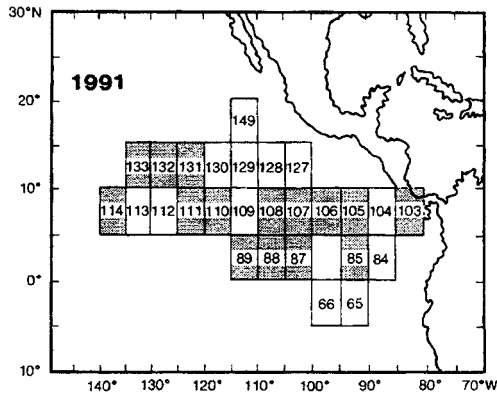


Fig. 1. Geographic distribution of the observed incidental kill of small cetaceans in the ETP for 40 trips by US-registered vessels during 1991. The data are summarized by 5° square areas. The stippled blocks indicate areas where both a tally of the observed kill and life history data were collected; numbered blocks without shading are regions where only tally data were collected.

with life history data complete with reproductive information for females is 11%, significantly more than was collected in 1989 and 1990 (chi square, $p < 0.005$). In 1989, 7% of the life history data collected included reproductive data, and in 1990, 8% of the sample was represented by reproductive data (Chivers *et al.*, 1990; Hohn *et al.*, 1991; Peltier *et al.*, 1992). This compares to an average longterm

collection rate of 12% and 6% for the periods 1979–80 and 1981–87, respectively. The data show that 51% of the cetaceans collected were sexually immature, with 69% of the common dolphins that had reproductive data collected having the highest percentage. This is a higher proportion, but not significantly different (chi square, $\alpha = 0.05$) than in recent years (43% and 42% for 1989 and 1990, respectively).

California gillnet fisheries

This report documents the data collected during the first complete calendar year in which the CAGN observer program was operating. During 1991, 69 cetaceans were reported killed compared to 19 cetaceans during the first six months of the program, July–December 1990 (Lennert *et al.*, 1993). Cetacean kill was reported on 40% of the observed drift-net trips, while less than 1% of the set-net trips reported cetacean kill. Although observer coverage is targeted for 20% of days fished, only 10% were observed in 1991. This is more than were observed between July and December 1990 when observer coverage of the fisheries was 4% for the drift-net fishery and 5% for the set-net fishery (Lennert *et al.*, 1993).

Life history data collected from these fisheries accounted for 78% of the observed cetacean kill, with 20% of the observed kill including data on reproductive condition for females. Because of small sample sizes, we are not yet able to estimate population parameters for the species incidentally killed in the fisheries, but 71% of all the cetaceans with reproductive data collected were sexually mature.

Table 1

Total observed kill of dolphins from the ETP by geographic location (5° square block) and sex. Pantropical spotted dolphins (*Stenella attenuata*) and spinner dolphins (*S. longirostris*) are separated by stock. The total for each stock includes dolphins of unknown sex. Four dolphins unidentified to species were not included in the table. All were of unknown sex. No kill was reported for coastal spotted or Costa Rican spinner dolphins.

5° block	Northern offshore spotted			Southern offshore spotted			Eastern spinner			Whitebelly spinner			Common		
	M	F	Total	M	F	Total	M	F	Total	M	F	Total	M	F	Total
65	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0
66	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0
84	3	3	24	0	0	0	0	0	0	0	0	0	0	0	0
85	19	11	53	0	0	0	0	0	0	1	0	2	0	0	0
87	3	1	32	0	0	0	0	0	0	0	0	0	0	0	0
88	7	2	40	0	0	0	0	0	0	1	2	41	0	0	0
89	5	4	15	0	0	0	0	0	0	0	0	0	0	0	0
103	0	0	0	0	0	0	0	0	0	0	0	0	16	14	55
104	0	0	6	0	0	0	0	0	0	0	0	0	0	1	6
105	0	0	0	0	0	0	0	0	0	1	0	1	10	20	32
106	1	11	35	0	0	0	6	3	9	0	0	8	0	0	0
107	8	10	58	0	0	0	4	6	17	1	0	5	0	0	0
108	29	38	108	0	0	0	3	8	17	26	21	63	0	0	0
109	2	6	8	0	0	0	0	2	3	0	0	0	0	0	0
110	16	34	84	0	0	0	4	0	4	6	15	24	0	0	0
111	1	3	5	0	0	0	0	0	0	2	3	5	0	0	0
112	5	9	14	0	0	0	0	0	0	1	2	3	0	0	0
113	0	0	43	0	0	0	0	0	0	0	0	5	0	0	0
114	1	8	14	0	0	0	0	0	0	1	6	10	0	0	0
127	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
128	0	0	1	0	0	0	0	0	0	7	0	0	0	0	0
129	4	2	7	0	0	0	4	3	12	0	0	0	0	0	0
130	1	1	3	0	0	0	0	0	0	0	0	0	0	0	0
131	22	23	52	0	0	0	9	5	18	0	0	0	0	0	0
132	3	3	13	0	0	0	0	0	0	5	4	9	0	0	0
133	0	2	8	0	0	0	0	0	0	3	3	7	0	0	0
149	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0
Total	130	171	629	0	0	5	30	27	87	49	56	184	26	35	93

Table 2
Length frequencies for all cetaceans with life history collected from the
ETP US tuna fishery and two CAGN fisheries.

Length(cm)	Eastern Tropical Pacific cetaceans								California Temperate cetaceans							
	Northern offshore spotted		Eastern spinner		Whitebelly spinner		Common		Northern right-whale dolphin		Pacific white-sided		Common		Dall's porpoise	
	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F
0- 74	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0
75- 79	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
80- 84	0	0	0	0	4	1	0	0	0	0	0	0	0	0	0	0
85- 89	0	0	0	0	1	3	0	0	0	0	0	0	0	0	0	0
90- 94	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
95- 99	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
100-104	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0
105-109	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
110-114	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
115-119	0	0	0	1	0	0	0	0	0	0	0	0	0	1	1	0
120-124	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
125-129	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
130-134	0	0	0	0	1	1	1	1	0	0	0	0	0	0	0	0
135-139	2	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0
140-144	1	4	0	0	0	1	1	0	0	0	0	0	0	0	0	0
145-149	1	1	0	1	2	1	0	1	0	0	0	0	0	0	0	0
150-154	3	3	1	0	0	1	0	1	0	0	0	0	0	1	1	0
155-159	2	6	1	0	0	1	1	2	0	0	0	0	1	0	0	0
160-164	7	4	2	0	2	3	0	1	0	0	0	0	0	1	0	0
165-169	7	9	0	2	1	5	3	0	0	0	0	0	0	1	1	0
170-174	5	8	1	0	4	6	0	4	0	0	0	0	4	0	0	0
175-179	5	6	2	1	1	1	1	2	0	0	0	1	2	2	0	0
180-184	6	8	1	0	1	1	1	3	0	0	1	0	2	2	0	0
185-189	4	16	2	0	1	0	5	1	0	0	1	0	4	2	0	0
190-194	4	11	1	0	0	0	0	1	0	1	0	1	1	0	0	0
195-199	6	5	0	0	0	0	2	5	0	0	0	0	4	0	0	0
200-204	3	2	0	0	0	0	0	0	0	1	0	0	1	0	0	0
205-209	2	0	0	0	0	0	1	1	0	0	0	1	1	0	0	0
210-214	2	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0
215-219	1	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0
220-224	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
225-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	65	90	12	5	19	31	18	23	0	4	2	3	23	10	1	0

Table 3

Reproductive condition of female cetaceans with life history collected from the ETP US tuna fishery and two CAGN fisheries. Percentages include females without reproductive information available. 'Maturity undetermined' indicates that only minimum life history data were collected.

Reproductive condition	Eastern Tropical Pacific cetaceans								California Temperate cetaceans					
	Northern offshore spotted		Eastern spinner		Whitebelly spinner		Common		Northern right-whale dolphin		Pacific white-sided		Common	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Maturity undetermined	29	32.2	1	20.0	13	41.9	0	0.0	1	20.0	0	0.0	5	41.7
Sexually immature	28	31.1	2	40.0	8	25.8	16	69.6	0	0.0	1	33.3	3	25.0
Sexually mature:														
Condition undetermined	0	0.0	0	0.0	0	0.0	1	4.3	0	0.0	0	0.0	2	16.7
Pregnant only	6	6.7	0	0.0	0	0.0	0	0.0	0	0.0	2	66.7	0	0.0
Pregnant and lactating	7	7.8	0	0.0	0	0.0	2	8.7	0	0.0	0	0.0	1	8.3
Lactating only	11	12.2	1	20.0	6	19.4	2	8.7	1	20.0	0	0.0	0	0.0
Resting with a corpus luteum	2	2.2	1	20.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Resting without a corpus luteum	6	6.7	0	0.0	3	9.7	2	8.7	3	60.0	0	0.0	1	8.3
Post reproductive	1	1.1	0	0.0	1	3.2	0	0.0	0	0.0	0	0.0	0	0.0
Total	90	100.0	5	100.0	31	100.0	23	100.0	5	100.0	3	100.0	12	100.0

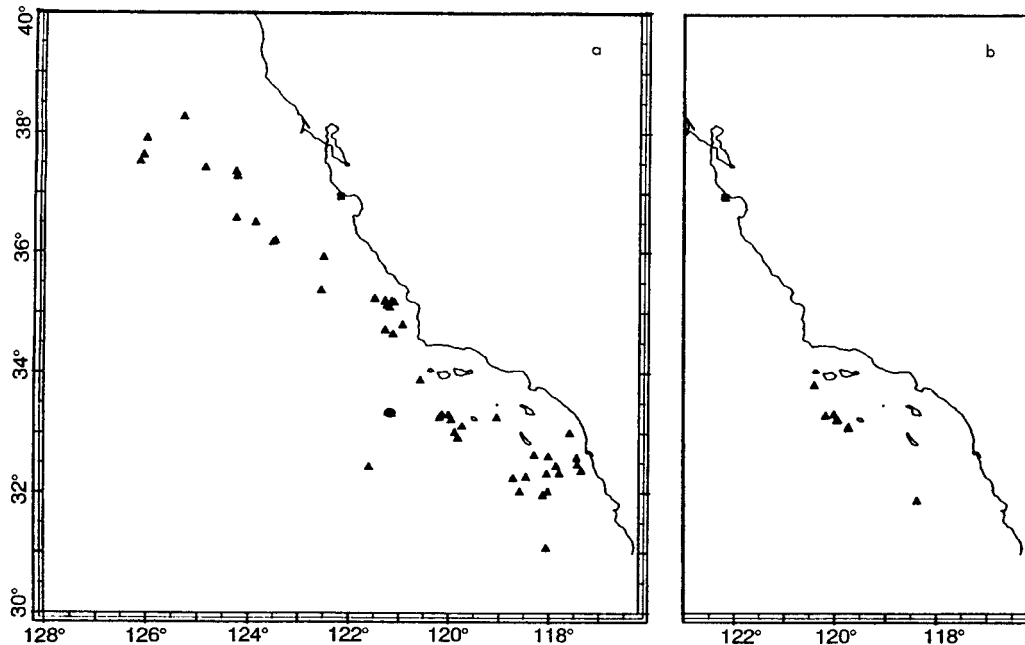


Fig. 2. (a) Geographic distribution of sets having incidental kill of cetaceans for which tally and life history data were collected in the drift-net fishery. Each square represents at least one cetacean but no more than three. No life history data were collected on set-net trips. (b) Geographic distribution of the tally of the observed incidental kill of small cetaceans from the two CAGN fisheries for which no life history data were collected. Each symbol represents one net-set with a maximum of three animals observed killed per symbol. The squares represent tally from the drift-net fishery and the triangles represent tally from the set-net fishery.

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