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AUGUST 1983

SOME DATA ON DOLPHIN MORTALITY IN THE EASTERN TROPICAL PACIFIC TUNA PURSE SEINE FISHERY PRIOR TO 1970

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Nancy C. H. Lo

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U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Southwest Fisheries Center

NOAA Technical Memorandum NMFS

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U.S. DEPARTMENT OF COMMERCE
Malcolm Baldrige, Secretary
National Oceanic and Atmospheric Administration
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National Marine Fisheries Service
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INTRODUCTION

Dolphins of several species have been killed incidentally in the eastern tropical Pacific tuna purse seine fishery since its beginnings in the late 1950's (Perrin 1969, Smith 1983). Data have been collected by a number of individuals and agencies on many aspects of these mortalities, including numbers of dolphins killed and dolphin-release procedures used, but few data are available prior to 1970. As a result, the effect of the fishery on the dolphin populations during that period is uncertain (Smith 1983).

Here, what few data there are available for that period are presented. These data were collected by three individuals on four fishing trips, two in 1964, and one each in 1966 and 1968. Tables of the observations made for each purse seine set are given.

MATERIALS AND METHODS

In 1964 Gerald Lopes, a member of the crew of a 340 ton tuna purse seine vessel, wrote a letter to the State of California, addressed to the Division of Fish and Game, describing his observations during those fishing trips. The vessel fished near Acapulco, Mexico apparently in the first half of the year. His letter is reproduced (retyped from a copy of his original) in Appendix I. He included a table listing the numbers of dolphins killed on several sets.

Lopes noted in his letter that his counts were minimal, "... for the benefit of doubt." He described the procedures used during purse seining for tuna, including the dolphin release procedure termed "backdown" or "backing

down." He indicated the sets in which this release procedure[1] was used. He did not indicate the species of either the tuna caught or the dolphins killed.

In 1979 David Waller wrote a letter to National Marine Fisheries Service, addressed to N. Lo, in response to our inquiry if he had any information about dolphin mortalities during the 1960s. A typed version, from his hand written original letter, is reproduced in Appendix II. Waller accompanied the crew of a 350-ton capacity purse seiner on several fishing trips in the 1960s while he was a graduate student at the University of Wisconsin. He included a hand written table with his letter of 1979, also in Appendix II, giving details of his observations of 46 purse seine sets made during February and March of 1964. He gives numbers of dolphins captured and killed in each net set, classified to species of dolphin (spotted = Stenella attenuata, spinner = S. longirostris), tons of tuna caught, and date of the set, as well as other details of the operations aboard ship. Waller did not indicate the location of the fishing activity, and the data apparently include some sets not involving dolphins (numbers 1, 3, 6, 12, 14, 15, 19, and 20, indicated in the original by a zero crossed with a horizontal line).

In 1966 and 1968 William Perrin, a biologist with the Southwest Fisheries Center, observed dolphin mortalities aboard two fishing trips on different vessels. He recorded extensive data on a variety of aspects of the tuna purse seining process; his records are on file at the Southwest Fisheries Center. Although observing dolphin mortality was not the primary goal of his field work, Perrin recorded data on dolphin mortality.

Perrin's first observations were made aboard a 331-ton capacity tuna purse seine vessel, operating generally in the area 8° to 13°N latitude and 90° to 95°W longitude in July and August 1966. He recorded estimates of the number of dolphins captured in most sets, and of the numbers killed in five sets, when large numbers were killed. He indicated (personal communication) that some dolphins were killed on every set.

Perrin's second obervations were made aboard a 300-ton capacity vessel, operating in the area 7° to 8°N latitude and 90° to 92°W longitude in April 1968. He recorded the number of dolphins killed in all sets involving dolphins and observed one set not involving dolphins. He also recorded the duration of the backdown procedure, when used, as well as the total duration of the set.

RESULTS

Lopes' letter provides data on the number of dolphins killed, tons of tuna caught, and on use of the backdown dolphin-release procedure in 21 dolphin sets in 1964 (Table 1). An average of 61 dolphins was killed per set, with an average catch of 9 tons of tuna. Backdown was used on 81% (17 of 21 sets) of the sets (Table 5).

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[1]For a full description of the "backdown" procedure used by tuna purse seiners to release dolphins while retaining the tuna catch, see Coe and Sousa (1972).

Waller's letter provides data on the number of all dolphins captured, the number of dolphins killed by species, and the tons of tuna caught in 38 dolphin sets in 1966 (Table 2). An average of 81 dolphins was captured per set, with 25 being killed, and with an average catch of 7 tons of tuna. No backdown information was recorded (Table 5).

Perrin's records on 28 dolphin sets observed in 1966 give the number of dolphins captured by species and tons of tuna caught (Table 3). While dolphins were killed in all sets involving dolphins, the number killed was recorded for only 5 sets. The duration of the backdown dolphin-release procedure and of the total set is given. An average of 582 dolphins and 12 tons of tuna was captured per set. The mean number of dolphins killed is 250 per set. This is a biased estimate because Perrin recorded data for sets with only large numbers of dolphins killed. The time spent backing down averaged 8 minutes for 14 sets; backing down was used in 90% (18 of 20 sets) of the sets where information is available (Table 5).

Perrin's records for 15 dolphin sets observed in 1968 give total numbers of dolphins captured, numbers of dolphins killed by species, tons of tuna caught, and the use of backdown (Table 4). An average of 402 dolphins was captured and 113 killed per set, with 21 tons of tuna caught. Backdown was used on 92% (11 of 12 sets) of the sets where information is available (Table 5).

For the data collected from these four trips, the mean number of dolphins captured varied markedly from less than 100 to nearly 600, with an overall average of 284 animals (Table 5). The mean number of dolphins killed for sets with a ton or more of tuna[2] (successful) varied from 26 to 250, with an overall mean of 69, and a standard deviation of 87. The highest value is from Perrin's 1966 observations, where only kills for sets with larger mortalities were recorded. If the 1966 observations are excluded, the overall kill-per-set is 56 with a standard deviation of 70. The average tons of tuna caught ranged from 7 to 21 tons for all sets, with an overall average of 11. The standard deviation is 13.

DISCUSSION AND CONCLUSIONS

Available data on numbers of dolphins killed during tuna purse seine net sets in the 1960s are limited to four fishing trips. The data were collected by different investigators and was, in some cases, incomplete. Unfortunately, these data were not collected for years prior to 1964, before new fishing techniques were implemented that were designed to reduce dolphin kills.

The frequency of use of the "backdown" dolphin-release procedure within fishing trips increased over time, but no information is available prior to 1964. The variability of the use of this procedure among vessels cannot be

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[2]The catch of tuna was generally recorded to the nearest ton; a value of zero is assumed to mean that less than 1/2 ton was caught. Other definitions have been used for "successful" sets, where different data recording conventions have been used.

assessed from these data.

Despite the several shortcomings, these data are all that are presently available to us. Some additional data, however, appear to exist. Waller, in his letter (Appendix II), notes that he holds some additional data which "... do not differ much from the trends shown in the enclosed material". Similarly, the Inter-American Tropical Tuna Commission holds data from two fishing trips in that period which include data on numbers of dolphins killed (R. Allen, pers. commun.). Allen noted that his data are not markedly different from those which are reported here but cannot be released at this time because of confidential agreements with the vessels' captains.

LITERATURE CITED

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Perrin, W. F. 1969. Using porpoise to catch tuna. World Fishing, 18(6):42-45.

Smith, T. D. 1983. Changes in size of 3 dolphin populations in the eastern tropical Pacific Fish. Bull. U.S. 81(1):1-14.

Table 1. Number of dolphins killed, number of tons of tuna caught, and the use of "backdown" on 21 purse seine sets involving dolphins, observed by Gerald Lopes in 1964, (Appendix I).

Set number[1]	Number of dolphins killed[2]	Tons of tuna caught	"Backdown" used[3]
1	30	6	Y
2	69	7	N
3	20	15	Y
4	46	7	Y
5	>100[4]	7	N
6	30	1	Y
7	68	4	Y
8	6	2	Y
9	26	7	Y
10	12	6	Y
11	60	0	Y
12	78	23	Y
13	12	3	Y
14	60	5	Y
15	40	4	Y
16	115	5	Y
17	153	60	N
18	76	14	Y
19	18	8	Y
20	60	12	Y
21	150	2	N

[1]Sequence number of sets in letter (Appendix I)

[2]Minimal estimates

[3]Y = yes, N = no

[4]In computing kill rates, e.g. kill/set, the average kill of sets with over 100 kills was used (=139).

Table 2. Numbers of dolphins captured and killed, by species, and tons of tuna caught, during 38 purse seine sets involving dolphins, observed by David Waller in 1964, (Appendix II).

Set number[1]	Number of Dolphins				Tons of tuna caught
	Captured[2]	Killed			
		spotted	spinner	total	
2	500	150	0	150	33
4	30	19	0	19	7
5	300	41	0	41	5
7	75	26	0	26	7
8	50	38	0	38	6
9	40	11	0	11	1
10	100	45	14	59	10
11	25	2	0	2	0
13	50	37	0	37	15
16	65	14	0	14	13
17	50	10	0	10	10
18	20	13	0	13	4
21	7	4	0	4	7
22	60	3	24	27	1
23	150	20	8	28	7
24	30	23	0	23	6
25	80	14	0	14	5
26	50	3	3	6	1
27	40	6	20	26	0
28	40	20	0	20	7
29	100	24	0	24	6
30	140	68	14	82	19
31	50	16	0	16	3
32	80	6	0	6	1
33	65	23	5	28	3
34	40	7	0	7	2
35	90	7	0	7	3
36	225	30	0	30	8
37	40	2	0	2	2
38	160	36	33	69	31
39	80	20	7	27	4
40	50	25	0	25	10
41	50	10	0	10	1
42	65	7	5	12	4
43	30	5	0	5	16
44	20	2	0	2	1
45	20	1	0	1	0
46	25	16	0	16	5

[1]Sequence number given in letter (Appendix II), with sets not involving dolphins omitted.
[2]Only total indicated.

Table 3. Number of dolphins captured and number killed, tons of fish caught, and the duration of the set and of the "backdown" procedure on 28 purse seine sets involving dolphins, observed by William Perrin in 1966, (Appendix III and field notes).

Set number[1]	Number of Dolphins Captured			Killed	Tuna Caught	Durations (min)	
	spotted	spinner	total	total	(tons)	Backdown	Set
2	-[2]	-	-	+[3]	0	-	-
3	-	-	-	+	10	-	95
4	-	0	-	+	4	-	54
5	-	-	-	+	5	-	103
6	-	-	-	+	3	10	95
7	250	750	1000	300	10	9	119
8	-	-	-	+	40	11	90
9	900	100	1000	+	13	11	131
10	250	250	500	300	7	8	154
11	375	125	500	+	70	9	90
12	665	35	700	+	22	-	140
13	-	-	50	+	2	0[4]	100
14	450	150	600	150	16	-	127
15	-	-	1000	350	40	+[3]	144
16	270	30	300	+	8	9	97
17	750	250	1000	+	8	10	175
18	750	250	1000	+	13	+	-
19	150	350	500	150	6	+	122
20	-	-	100	+	3	6	100
21	375	125	500	+	5	+	113
22	-	-	300	+	-	8	104
23	140	10	150	+	5	5	-
24	200	0	200	+	6	5	90
25	350	0	350	+	11	-	68
26	400	0	400	+	11	6	122
27	495	55	550	+	14	6	117
28	1100	0	1100	+	52	0	412
29	1000	0	1000	+	33	-	240

[1]Sets not involving dolphins omitted; sequence number as per field data.

[2]- = no observation recorded

[3]+ = greater than zero, but amount not recorded

[4]0 = backdown procedure not used

Table 4. Number of dolphins captured and number killed, tons of fish caught, and use of "backdown" dolphin release procedure, on 15 purse seine sets involving dolphins, as observed by William Perrin in 1968, (Appendix IV and field notes).

Set number[1]	Number of dolphins				Tuna Caught (tons)	Backdown used
	Captured	Killed				
		spotted	spinner	total		
1	270	1	0	1	0	-
2	500	55	78	133	6	Y[3]
3	- [2]	4	3	7	0	-
4	-	33	1	34	9	-
5	300	31	9	40	10	Y
6	800	310	75	385	35	Y
7	-	268	0	268	45	Y
8	125	92	0	92	60	N
9	600	185	0	185	50	Y
10	400	39	20	59	35	Y
11	-	34	0	34	10	Y
12	-	48	0	48	2	Y
13	250	34	0	34	15	Y
14	350	0	109	109	5	Y
15	425	239	33	272	30	Y

[1]Sequence number in field data notes
[2]- = No observation recorded
[3]Y = yes; N = no

Table 5. Mean (M), standard deviations (SD) and number of set (N) for the total number of dolphins captured and killed, and the total tons of tuna caught in purse seine sets involving dolphins observed during four fishing trips in the 1960s. Mean numbers of dolphins killed are given for sets with >0 ton tuna (termed successful) and 0 ton tuna caught, (termed unsuccessful); the proportions (P) of all sets during which the backdown dolphin-release procedure was used are also given.

		Number of Dolphins												Tons of Fish Caught						
		Captured			Killed in sets which were successful			Killed in sets which were unsuccessful			All sets			Successful sets			All sets			
Year	Observer	M	SD	N	M	SD	N	M	SD	N	M	SD	N	M	SD	N	M	SD	N	P
1964	Lopes	-	-	-	60[1]	47	20	60	-	1	60	45	21	10	13	20	9	13	21	.81
1964	Waller	81	91	38	26	28	35	10	14	3	25	28	38	8	8	35	7	8	38	-
1966	Perrin	582	342	22	250	93	5	-	-	-	250	94	5	12	12	26	12	12	27	.90
1968	Perrin	402	193	10	130	114	13	4	4	2	113	114	15	24	19	13	21	20	15	.92
All		284	313	70	69	87	73	16	24	6	65	85	79	12	13	94	11	13	101	.87
All (excluding 1966 data)					56	70	68													

[1]Assuming actual number killed in set 5 equals average of all sets with over 100 killed (139), 56 if set 5 is excluded.

APPENDIX I.

Letter from Gerald H. Lopes to Department of Conservation, Division of Fish and Game, Sacramento, California dated June 8, 1964. Portion unclear is marked by *.

Rt. 1, Box 64
Patterson, Calif.
June 8, 1964

Dept. of Conservation
Division of Fish and Game
Sacramento, Calif.

Dear Sirs:

I have just recently completed two trips aboard one of San Diego's famed commercial tuna boats. Our first trip lasted forty-four days, and the second thirty-four. The grounds we fished were about 200 miles off the coast of Acupulco. At this time of year the weather there is very warm and pleasant with the water ranging over 80 degrees.

The trip did much for me as far as nourishing my physical aspects. It also gave me much "food for thought."

To start with, the ship "Concho" which I was aboard was a sleek 118 foot purse seiner equipped with a net 485* fathoms long and 46* fathoms deep. The boat has thirteen refrigerated "wells" with capacities ranging from 15 to 40 tons each. With a full load she is supposed to carry 340 tons of fish, though the two trips only totaled 318 on our first and 308* on the other.

When working in lower murky waters (around Chile and Peru), I am told that all of the sets are made directly on schools of running tuna. But while working in clear waters, such as the fishing grounds off Acupulco, the boats practically always act on schools of porpoise which the majority of the time have tuna that school directly below them for some unknown reason. On our two trips we had a total of 110 sets. Of these only four were on school fish.

Upon approaching one of these schools a person usually notices a large "spot" of birds. As you get closer, you can see porpoise, fish and birds in one big "feeding frenzy." The boat will run with them for awhile to check if there is enough fish with the porpoise to make it worth while for a "set."

When it is determined a set is feasible, the ship stops and lowers its two outboard powered speedboats. Once the speedboats or "pongas" (as they are called) are in the water the ship again gets underway. The pongas run with the ship as it circles the school, each time tightening the circle until it gets into position to make the set. When the word is given, the seven ton skiff hauled on the rear of the ship is "cut loose" taking one end of the net and begins towing (or rather holding the net) as the ship encircles the school. At the same time the skiff is turned loose, the two pongas are given commands by radio head sets. One ponga goes to the stern and back around the wake, while the other goes ahead and forward of the boat. The idea is to get all the porpoise into the net, as the tuna will stay right with them. Many times, if just several of the porpoise escape, the whole school of tuna will go with them.

With the circle completed, the ship will meet the skiff and pick up the end of the net. From here the net will be pursed. This is done by a "purse line." A cable threaded through rings attached to the bottom of the net. When the cable is all brought in, the rings and the bottom of the net are all brought on deck. From here there is not a chance of the fish (or porpoise) to escape.

From here the net is begun to be brought in. This is done by means of a large "power block." The power block, attached to a boom, reels the net in and enables it to be stacked on board again. Usually before the net is half way in porpoise begin to appear, wrapped or tangled in the net. These are taken out on board and thrown over the other side. Most are cut and bleeding from the punishment of the net, many are already dead from drowning.

Usually when the net is about half way in, it is tied up. The ship is then put in reverse. This is known as backing down. This causes the net to float towards the bow where the corks sink at the center of the net and enable most of the porpoise to "go cut over the corks" without the fish escaping. But there is always that ten or fifteen percent that can't find their way out.

The net is then untied and the stacking continues. Now there are both fish and porpoise coming up the net. By this time (perhaps 1 hour) you notice only an occasional porpoise that is still alive. The net is brought in as far as possible until all fish and porpoise are in a "sack." The skiff then arrives at the edge of the sack and the corks are tied to it.

If there are still an abundance of porpoise in the net, several men will crawl into the net and take them out. By this time, perhaps only five out of fifteen still remain alive.

On the trips 110 sets were made. Sometimes we missed porpoise and all. Sometimes we just got porpoise. Other than school fish, whenever we got fish, we always had porpoise. This leaves me with grave concern. Will this cause depletion or perhaps an extinction of porpoise? Is there anything that can be done about it?

I have mentioned it to many of the men aboard the "Concho," even the skipper. Most of them say that it is a shame, the slaughter that is going on. Others shrug it off, as if to say "it's a living."

I have tried to get an estimate on the kill of porpoise on several sets. I would have gotten more, but my work kept me from keeping track. The tonnage here is pretty accurate, but the porpoise count is less for the benefit of doubt.

6 tons of tuna w/backdown-- 30 porpoise killed
7 tons of tuna w/o backdown-- 69 porpoise killed
15 tons of tuna w/backdown-- 20 porpoise killed
7 tons of tuna w/backdown-- 46 porpoise killed
7 tons of tuna w/o backdown-- over 100 porpoise killed

1	ton of tuna	w/backdown-- 30 porpoise killed
4	tons of tuna	w/backdown-- 68 porpoise killed
2	tons of tuna	w/backdown-- 6 porpoise killed
7	tons of tuna	w/backdown-- 26 porpoise killed
6	tons of tuna	w/backdown-- 12 porpoise killed
0	tons of tuna	w/backdown-- 60 porpoise killed
23	tons of tuna	w/backdown-- 78 porpoise killed
3	tons of tuna	w/backdown-- 12 porpoise killed
5	tons of tuna	w/backdown-- 60 porpoise killed
4	tons of tuna	w/backdown-- 40 porpoise killed
5	tons of tuna	w/backdown-- 115 porpoise killed
60	tons of tuna	w/o backdown-- 153 porpoise killed
14	tons of tuna	w/backdown-- 76 porpoise killed
8	tons of tuna	w/backdown-- 18 porpoise killed
12	tons of tuna	w/backdown-- 60 porpoise killed
2	tons of tuna	w/o backdown-- 150 porpoise killed

You'll notice that I have noted some with backdown and some without. Porpoise will not go out of the net after dark and sometimes the skipper got lazy, I guess. These 21 sets totaling 198 tons, killed 1229 porpoise (at least). That comes to over six porpoise per ton. Six times 300 is 1,800 porpoise. There are thirteen other boats just in this same company. By the time each boat makes just one trip the porpoise population drops 25,200. Quite an unbelievable figure. How long can this go on? Perhaps a new net or a modification to the ones they are now using is the solution.

Another situation which brought question to my mind was the legal size of the fish taken. Using a net which can cover a diameter of almost a quarter of a mile, how can a person determine the size of fish it will yield?

Yellowfin tuna are found in the fishing grounds off Acupulco. But many times skipjack, a smaller tuna, are found in the schools with them. To be legal, skipjack must weigh at least 4 pounds (or so I've been told). During our trips we must have thrown overboard several tons. I also saw several large yellowfin thrown overboard because they were too large. What good can a dead fish be at the bottom of the sea? Is it fish and game laws or just because the canneries would rather not take the trouble to process them?

These are questions that bear looking into. In my concern with this subject, I would be more than happy to help you in anyway you may see fit.

I may be reached through mail at Rt. 1, Box 64, Patterson, California, or by telephone at TYler 2-3944.

Thank you,

s/Gerald H. Lopes

Gerald H. Lopes

APPENDIX II.

Letter from David W. Waller to Nancy C.H. Lo, Southwest Fisheries Center, dated June 25, 1979.

Laredo, Texas

Monday 25 June 1979

Dr. Nancy C. H. Lo, Leader
Quantitative Analysis Task Group
National Marine Fisheries Service
Southwest Fisheries Service
La Jolla, California 92038

Dear Dr. Lo:

I am enclosing copies of some of my records of the first 1964 excursion of the Independence which I observed on board. They cover the period February-March and include detail reports on the first 24 of all 56 sets made, and a summary sheet which shows abstracted data from the first 46 of the 56 sets.

The other information is available, but I did not have a chance to complete the records to send to you before leaving for my current work with a group of KSU students in our Mexican, Field Biology course. In fact, I'm sending these from our campground at Laredo. We enter Mexico tomorrow for a two-week excursion.

I will prepare the rest of the records to send to you after July 20. The data do not differ much from the trends shown in the enclosed materials. This will just have to do for now.

Hasta la regressa,

David W. Waller
Assistant Professor

ADDITIONAL NOTES
106 = Total Encounters of $\bar{c}$ Porpoises
56 = Total Number of Sets

Date		Set	Tuna	Spot	Mortality Spin	Mortality Spot	Spin	Tags	Cum. tuna	Cum. porp	Well
Feb	20	1	0		0		0	0			
	22	2	33-.5	(500)	0	150	0	0	33.5	150	P-5,S-5
	22	3	0		0		0	0	33.5	150	S-5
	22	4	7	30	0	19	0	1	40.5	169	S-5
	26	5	5	300	0	41	0	15	45.5	210	S-5,S6
	27	6	0		0		0	0			
	28	7	7	75	0	26	0	0	52.5	236	S-6
	28	8	6	50	0	38	0	0	58.5	274	S-6
	28	9	1	40	0	11	0	4	59.5	285	S-6, P-6
Mar	1	10	10		(100)	45	14	0	69.5	344	P-6
	3	11	0	20	5	2	0	5	69.5	346	
	3	12	0		0		0	0			
	4	13	15	50	0	37	0	3	89.5	383	P-6, P-4
	4	14	0		0		0	0			
	4	15	0		0		0	0			
	6	16	13	65	0	14	0	0	97.5	397	P-4, S4
	6	17	9.5	50	0	10	0	2	107.	407	P-4, S4
	6	18	3.5	20	0	13	0	0	110.5	420	P-4, S4
	7	19	0		0		0	0			
	8	20	0		0		0	0			
	8	21	6.5	7	0	4	0	0	117.	424	S-4, S3
	8	22	.5	30	30	3	24	0	117.5	451	S-4, S3
	9	23	7-.25	140	10	20	8	3	124.75	479	S3
	9	24	6	30	0	23	0	4	130.75	502	S3
	10	25	5	80	0	14	0	4	136.75	516	S3
	10	26	.75	10	40	3	3	2	137.5	522	S3
	10	27	0	20	20	(6)	(20)	0	137.5	548	
	11	28	7	40	0	20	0	8	144.5	568	S3, P3
	12	29	6	100	0	24	0	0	150.5	592	P3
	12	30	19	120	20	68	14	0	169.5	674	P3
	12	31	2.5	50	0	16	0	0	172.	690	P3
	13	32	1	80	0	6	0	8	173.	696	P3, P2
	13	33	3	50	15	23	5	0	176.	724	P3, P2
	14	34	1.5	40	0	7	0	2	177.5	731	P2
	14	35	2.5	80	(10)	7	0	1	180.	738	P2
	15	36	8	225	0	30	0	1	188.	768	P2
	16	37	1.5	40	0	2	0	1	189.5	770	P2, S2
	16	38	30.5	125	35	36	33	0	210.	839	P2, S2
	18	39	4	50	30	20	7	8	214.	866	S2, P1
	19	40	10	50	0	25	0	6	224.	891	P1
	20	41	1	50	0	10	0	6	225.	901	P1, S1
	20	42	3.5-1.5	40	25	7	5	2	230.	913	P1, S1
	20	43	16	30	0	5	0	3	246.	918	P1, S1
	21	44	1	20	0	2	0	3	247.	920	S1
	21	45	0	20	0	1	0	5	247.	921	
	22	46	5	25	0	16	0	8	252.	937	S1

M/V U.S. 14 tons Y.F. - on spotters

APPENDIX III.

Memorandum from William F. Perrin to Acting Laboratory Director, Tuna Resources Laboratory, dated September 8, 1966.

Acting Laboratory Director,
Tuna Resources Laboratory, La Jolla, Calif.

September 8, 1966

W. F. Perrin, Biological Technician (Fish.)

Cruise on M/V Conte Blanco

Introduction: The following is a brief summary of my activities aboard the purse seiner Conte Blanco on a cruise from 10 July to 11 August 1966. Fishing operations were carried out along the coast of Mexico south to the Gulf of Tehuantepec and in an area centered on 10° north latitude and 90° west longitude.

The Vessel: The Conte Blanco is a 117 ft. purse seiner with a capacity of 331 tons. She carries a 525 x 42 fathom net and is equipped with four "porpoise chaser" skiffs in addition to the large seine skiff.

Set Logs: A standard set log sheet was completed for each set. A total of 29 sets were made of which 28, all made on porpoise, were successful, yielding a mean catch of approximately 11 tons per set. The largest haul was 55 tons and the smallest 250 lbs.

Bathykmographs: Four BKG's were taken on the cruise. One was lost on set #2; two more were lost on set #3. The remaining instrument was lost on set #20. A total of 14 usable traces were obtained.

Blood Samples: A total of 155 yellowfin and 30 skipjack blood samples were taken, from 8 hauls. The samples were centrifuged and the serum frozen and retained until return to San Diego where it was turned over to Izadore Barrett of the IATTC.

Sharks: Two net-eater sharks (C. malpeloensis) were tagged and released. The captain ordered a hault put to tagging operations when a crewman was severely bitten on the hand. Twelve net-eaters were measured and sexed. Nine individuals were examined for stomach contents. One large manta ray was measured, tagged and released. A whale shark was sighted and photographed.

Weather: A total of 39 standard international weather reports were compiled and logged. Of these, 25 were successfully transmitted to the weather observer in San Francisco thru KMl. A continuous barograph record of pressure was kept.

Stomach samples: Yellowfin stomach samples were taken on three hauls. A total of 75, about 25 per haul, were taken.

Net Data: The history of and peculiarities of operation and construction of the seine on the Conte Blanco were investigated and recorded. A scale diagram of the net is being prepared.

Photos: 150 black and white and 75 color photos were taken of fishing operations. In addition, 350 feet of 16 mm movie film was exposed.

Suggestions: It is suggested that the following items of equipment be taken along on future cruises:

1. More film: Film is cheap compared to manhour expense and takes up little room. Good shots are often missed because of a reluctance to use up the film too rapidly.

2. Polaroid filters: This item is essential if good results are to be obtained when shooting down into the water.

3. High-powered binoculars: for better observation of behavior of birds, fish and cetaceans.

4. Spare literature, reprints, etc. to give to interested crew members.

Species Encountered: The following species were observed in the net hauls:

Elasmobranchs:
Net-eater shark Carcharhinus malpeloensis
Manta, Manta sp.
Hammerhead, Sphyrna zygaena
Blue shark, Prionace glauca

Teleosts:
Yellowfin tuna, Thunnus albacares
Skipjack, Euthynnus pelamis
Bullet mackerel, Auxis sp.
Black skipjack, Euthynnus lineatus
Swordfish, Xiphias gladius
Remoras, Remora remora
Phtheirichthys lineatus
Ribbonfish, Zu cristatus
Unidentified carangid
Unidentified hemiramphid
Spotted dolphin, Stenella graffmani
"spinner" dolphin, Stenella microps and/or longirostris
Pacific bottlenose dolphin, Tursiops sp.

Reptiles: Green turtle, Chelonia agassizii
Yellow-bellied Seasnake, Palamis platurus

In addition the following animals were sighted and are considered of sufficient importance to be mentioned:

Whale shark, Rhincodon typus, (photographed)
Baird's dolphin, Delphinus bairdii
Killer whale, Orcinus orca

William F. Perrin

WFP:md

Admin
Chron
W. F. Perrin

SET	POSITION W	POSITION N	DATE	SPIN	SPOT	SER	YELLOWFIN
1	114:30	26:52	7-11	0	0	-	0
2	107:35	21:35	7-14	X	X	X	1/8
3	101:10	17:10	7-16	X	X	X	10
4	98:35	16:02	7-17	0	X	X	2 1/2 Y, 1/2 SK
5	98:27	16:03	7-17	X	X	-	5
6	93:13	12:50	7-19	4/5	1/5	X	3
7	92:51	12:17	7-19	750 (300 Killed)	250	X	10
8	92:21	12:13	7-20	X	X	-	4
9	92:29	12:01	7-20	100	900	-	13
10	92:15	11:38	7-20	250 (300 Killed)	250	X	7 (+10 lb SK)
11	92:00	11:07	7-21	125	375	X	7 (+10 lb SK)
12	92:30	11:29	7-21	35	665	-	22 (+10 lb SK)
13	91:20	11:33	7-21	X	X(most)	-	2
14	91:00	11:08	7-22	150 (150 Spin Killed)	450	-	16 (+50 lb SK)
15	90:55	10:51	7-22	1000 (300-400 Killed)		-	40 (+200 lb SK)
16	91:08	10:40	7-23	30	270	X	8 (+100 lb SK)
17	90:48	10:30	7-23	250	750	-	8 (+200 lb SK)
18	90:48	10:24	7-24	250	750	-	13
19	91:54	10:00	7-25	350 (150 Killed)	150	-	6
20	91:57	10:03	7-25	100 Total		-	2 1/2
21	91:02	9:00	7-27	125	375	-	5
22	90:30	8:50	7-27	300 Total		-	(-)
23	90:30	8:40	7-27	10	140	-	5
24	91:40	9:12	7-28	0	200	-	6 (+6 lb SK)
25	91:36	9:20	7-28	0	350	-	11
26	91:28	9:14	7-29	0	400	-	11
27	91:30	9:27	7-29	55	495	-	14 (+5 lb SK)
28	89:04	8:20	8-1	0	1200	-	52
29	88:48	8:31	8-2	0	1000	-	33

APPENDIX IV.

Memorandum from William F. Perrin to Director Fishery-Oceanography Center, dated May 13, 1968.

File: 3201.3

TO: Director
Fishery-Oceanography Center

DATE: May 13, 1968

FROM: Fishery Biologist (General)
Operations Research Program

SUBJECT: CRUISE REPORT - M/V Carol Virginia (commercial tuna seiner)

Vessel: M/V Carol Virginia (commercial tuna seiner)
Personnel: William F. Perrin
Duration: 1 April 1968 to 29 April 1968

Fishing operations were carried out mostly in the area of 7 and 8°N latitude and 90 and 92°W longitude, 300-400 miles offshore.

Data and specimens were gathered for the following areas of research:

1. Variation in rostrum length in Stenella longirostris from the Eastern Central Pacific, and the taxonomic status of Stenella microps.

2. Comparative feeding habits of yellowfin tuna (Thunnus albacares) and porpoise (Stenella graffmani and S. longirostris) in mixed-species schools.

3. Intra-and interschool morphometric variation in the Eastern Pacific spotted porpoise (Stenella graffmani).

4. The ontogeny of color pattern in the Eastern Pacific spotted porpoise (Stenella graffmani).

5. Color pattern and sexual dimorphism in Stenella longirostris from the Eastern Central Pacific.

6. Interschool differences in the distribution and abundance of internal parasites in two schools of the Eastern Pacific spotted porpoise (Stenella graffmani).

7. Predation by the tuna fishery on two species of porpoise (Stenella longirostris and S. graffmani) in the Eastern Central Pacific.

8. Occurrence of suckerfish (Remorz remora) on the Eastern Pacific spotted porpoise (Stenella graffmani).

9. Behavior of porpoise (Stenella longirostris and S. graffmani) before and during a tuna seine set.

10. Sex and size structures of schools of the Eastern Pacific spotted porpoise (Stenella graffmani).

11. The "porpoise factor" in tuna seining.

12. Preliminary investigation of serum and eye protein polymorphisms in the Eastern Pacific sotted porpoise.

Sixty-six specimens of the Eastern Pacific spotted porpoise, (Stenella graffmani), from 2 schools, were brought back in the fish wells and placed in cold storage. After being processed for the above areas of investigation this material will be placed in the new cetacean depository at the U. S. National Museum.

The cruise can be considered to have been successful, due primarily to extensive and freely-given cooperation by the owners, captain and crew of the vessel.

William F. Perrin

Table 1. Mortality of porpoise during tuna-seining operations in the eastern tropical Pacific. Results of 15 net-sets made during April 1968.

Set no.	Yellowfin tuna (tons)	Spotters (*Stenella graffmani*) (no.)	Spinners (*S. longirostris*) (no.)	Estimate of proportion of school killed (%)
1	0	1	0	<1
2	6	55	78	35
3	0	4	3	<5
4	9	33	1	15
5	10	31	9	15
6	35	310	75	25
7	45	268	0	25
8	60	92	0	10
9	50	185	0	30
10	35	39	20	15
11	10	34	0	20
12	2	48	0	15
13	15	34	0	10
14	5	0	109	20
15	30	239	33	50
Total	312	1359	338	Average=19.4%

Total = 1697 porpoise

$$\frac{1697 \text{ porpoise}}{312 \text{ tons of YF}} = 5.45 \text{ porpoise per ton}$$

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32 "NMFS guidelines on economic valuation of marine recreational fishing"
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