さけ・ます流し網漁業に関連した海産哺乳動物、特にイシイルカに関する1985年調査の概要

Outline of 1985 Research on Marine Mammals, particularly on Dall's Porpoise relating to Salmon Gillnet Fisheries.

１９８５年　９月

September, １９８５

水　　産　　庁

Fisheries Agency of Japan

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1985年のさけ・ます流網漁業に関連した海産哺乳動物の調査研究は、1978年に改定された「北太平洋の公海漁業に関する国際条約」の第10条、同付属書第1節C項及び1984年に改定された日本と合衆国政府間の了解覚書に従って実施された。具体的な調査計画は1985月3月 11日～15日に東京で開かれた海産哺乳動物特別小委員会科学分科会で検討された。1985年5月から9月までに行われた調査研究項目は以下のとおりである。内容の分析は各担当者により現在行われている途中なので、ここではその調査の経過と概要を報告する。

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1. 混獲された海産哺乳動物の統計資料
   1) 母船式さけ・ます流網漁業
   2) 基地式さけ・ます流網漁業
   3) さけ・ます調査船
2. イシイルカの豊度推定のための目視調査
3. イシイルカの生物学的研究のための標本収集
   1) 母船式さけ・ます流網漁業
   2) 基地式さけ・ます流網漁業
   3) さけ・ます調査船
   4) イシイルカ専門調査船
4. イシイルカの音響学的生態調査
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   2) 北海道オホーツク海における実験

注：この文書を引用する場合は下記による。

水産庁 1985. さけ・ます流網漁業に関連した海産哺乳動物、特にイシイルカに関する1985年調査の概要。

① イシイルカ捕獲実験

② 音波に対するイシイルカの反応観察

③ 流網の反射特性の測定

④ 音波に対するサケ・マスの反応観察

5. イシイルカ混獲防止のための改良漁具試験

1) 中空糸付き改良流網

2) 超音波発生器

6. イシイルカの年齢査定ワークショップ

1. 混獲された海産哺乳動物の統計資料

1) 母船式さけ・ます流網漁業

1985年には、4母船とその付属独行船172隻が、さけ・ます流網に混獲された海産哺乳動物に関するデータを収集した。6月～7月の漁期間中に合計164回の船団操業と、延べ7,051回の独航船の操業が行われ、海産哺乳動物2,751頭が混獲された（表1）。その内訳はイシイルカ（すべてイシイルカ型）2,747頭、オットセイ4頭であった。このうち、米国FCZ内でのイシイルカの混獲は2,423頭であった。米国海産哺乳動物視察員（1船団3名ずつ合計12名）は6月中旬～7月下旬にかけて、各々30～37日間船団に滞在した。

2) 基地式さけ・ます流網漁業

1985年の基地式さけ・ます流網漁業の漁期は昨年より1カ月おくれて6月に始まった。1985年6月～7月の漁期間に混獲された海産哺乳動物（すべてイシイルカ）は781頭であった（表2）。

3) さけ・ます調査船

1985年5月～8月の期間、北太平洋の沖合水域において8隻のさけ・ます調査船が活動した。さけ・ます調査船は177°W以西の北西太平洋、155°W線上で45°N～55°Nの北東太平洋及び175°W以西のベーリング海で流網による調査を行った。調査は例年より約20日間おくれの5月上旬に開始され、5月の調査海域はすべて日本の200海里内の北西太平洋であった。さけ・ます調査船は5月3日から7月20日までの間に、258回（総使用反数33,352反）の試験操業を行い、海産哺乳動物42頭を混獲した（表3）。イシイルカは30回、40頭（イシイルカ型20頭、リクゼンイルカ型14頭、型不明6頭）、ネズミイルカは1回、1頭、セミイルカは1回、1頭であった。

2. イシイルカの豊度推定のための目視調査

イシイルカ豊度推定のため、1978年以来さけ・ます調査船は航走中に乗組員による海産哺乳動物の目視調査を行っている。この目視調査結果は遠洋水研で分析されている。

1985年には8隻のさけ・ます調査船が5月2日～8月15日に及び1隻のイシイルカ専門調査船

が8月7日～9月12日に調査を行い両者合計して延べ464日、37,321海里にわたって目視調査を行った（表4）。目視調査の行われた海域は、主として177°W以西の北西太平洋と175°W以西のベーリング海であるが、一部その他のベーリング海と北東太平洋も含まれる。

3. イシイルカの生物学的研究のための標本収集

1) 母船式さけ・ます流網漁業

例年と同様、母船に乗船した米国視察員が日本側の協力を得て、独航船が持ち帰ったイシイルカの生物学的計測、解剖、標本採集（歯、臓器等）を行なった。1985年6月～7月の漁期中に母船へ持ち帰ったイシイルカは1,213頭であった（表5）。米国200海里漁業水域外の操業で得られた標本の保存や日本人調査員の活動は例年どおり行なわれた。

2) 基地式さけ・ます流網漁業

基地式流網漁業水域に生息するイシイルカの生物学的情報を得るための努力は昨年に引き続き行なわれた。1985年6月～7月に16頭のイシイルカ（すべてイシイルカ型）が漁船により凍結標本として釧路港に持ち帰られた。これらの標本は、8月上～中旬に現地で解凍され、生物学的計測、頭骨、歯、臓器等の採集が行われた。収集された資料の整理と分析は国立科学博物館が行なっている。

3) さけ・ます調査船

さけ・ます調査船の流網操業で混獲される海産哺乳動物は、船上において生物学的計測、解剖等を行なったり、あるいは冷凍にして基地に持ち帰った後に同様の処理がなされている。

1985年5月～7月の操業期間中、4隻の調査船が合計14隻のイシイルカ（イシイルカ型5頭、リクゼンイルカ型9頭）を冷凍標本としては釧路に持ち帰った。これらの標本は、8月上～中旬に生物学的計測、解剖等の処理がなされた。収集した資料の整理と分析は国立科学博物館が行っている。また、1隻の調査船がセミイルカを1頭混獲した。この標本の処理は北海道大学が行っている。

4) イシイルカ専門調査船

さけ・ます流網漁業に混獲されるイシイルカから得られる情報は、その時空間的な全生活史情報の一部でしかない。イシイルカ専門調査船は1982, 1983年には漁期外の8～9月に、1984年には繁殖期前の5～6月に、いずれも180°付近より以西の北西太平洋において調査し、多くの情報を収集した。

1985年には、専門調査船は漁期外の8～9月に北西太平洋、ベーリング海において海産哺乳動物の目視調査と突きん棒によるイシイルカの捕獲を行なった。

調査期間　1985年8月6日（気仙沼）～9月16日（気仙沼）

調査海域　175°E以西の北西太平洋、173°W以西のベーリング海。ただし、突きん棒による捕獲はベーリング海の公海域、北西太平洋の公海域及び日本の200海里内で行

われた。

調 査 船　第12宝洋丸　全長42 m、299トン（水産庁用船）

航海中、目視調査（目視距離4,210海里）により1,006頭のイシイルカを発見し、また、イシイルカ18頭（イシイルカ型17頭、リクゼンイルカ型1頭）、バンドウイルカ1頭、カマイルカ1頭を捕獲した。捕獲したイシイルカについて、生物学的計測、解剖を行い、歯、血液、筋肉、生殖腺等を採集した。得られた資料は国立科学博物館、北海道大学、愛媛大学、遠洋水研等で分担して分析されている。

4. イシイルカの音響学的生態調査

北洋いるか対策調査グループ（日本大学、鴨川シーワールド水族館、水産工学研究所）はイシイルカの音響学的生態調査を1985年6月～9月に行った。

1）新音波発生装置の効果テスト

20～50 KHzの超音波パルスをランダムに発生する装置を新たに4台試作し、6月11日～7月29日の期間にさけ・ます母船明洋丸船団所属の独航船（第31稲荷丸）の流網に付けて33回の効果テストを行った。

日本の視察員が記録したデータを現在整理中である。

2）北海道オホーツク海における実験

8月26日～9月2日の期間に、昨年と同じく北海道斜里町宇登呂近辺のオホーツク海で以下の4実験を行った。

① イシイルカ捕獲実験

従来の捕獲道具を用いて船に付くイシイルカを捕獲しようとしたが、船に付くイシイルカ群が少なく、成功しなかった。

② 音波に対するイシイルカの反応観察

海面に浮いて遊んでいるイシイルカに接近し、音を出す時と出さない時の反応を観察した。使用した音は24 KHzの超音波パルス、20～50 KHzのランダムに発生した超音波パルス、シャチの鳴音の3種類である。超音波パルスには水飛沫を上げて逃げたが、今回のシャチの鳴音に対しては、音を出さないで船が接近する時と同じで顕著な逃避反応はみられなかった。

③ 流網の反射特性の測定

実際の海に流網3反を投網し、143 KHzの超音波パルスを発射して流網全体からの反射波を測定し、流網の総合反射特性を調べた。

④ 音波に対するサケ・マスの反応観察

小さないけすに入れたカラフトマス14尾とシロザケ1尾に対して300～1,000 Hzの低周波音波及び20～20 KHzと143 KHzの超音波パルスを発射してその反応行動を観察したが、いずれに対しても無反応であった。

5. イシイルカ混獲防止のための改良漁具試験

母船式さけ・ます流網漁業は、米国200海里漁業水域内における海産哺乳動物の混獲頭数を規制されており、さらに年々改良漁具の使用増大が義務付けられている。1985年においては、全独航船の50％が中空糸網を使用し、その他音響発生器によるイシイルカ混獲防除試験も継続した。

1) 中空糸付き改良流網

1985年には、網の中央部に3本の中空糸を設置した改良流網（AT—1）を各船団20隻、網上部に3本の中空糸を設置した改良流網（AT—3）を各船団2隻、計88隻が使用して操業を行った。これらの改良流網の操業回数（3,608回）は全操業回数の51％をしめた。このうち、AT—1の操業回数は3,280回、AT—3の操業回数は328回であった（表6）。

中空糸船（AT—1）と一般網船の全期間、全海域における操業回数当たりの平均混獲頭数（CPUE）をみると、中空糸船で0.358、一般網船で0.445であった。一般網船のCPUEを100とした場合、中空糸船のそれは80となった。また、これらの平均CPUEを統計的に検定した結果、1％の危険率で有意差が認められた。中空糸流網の操業結果の詳細な分析はM. M. チームにより、行われている。

2) 超音波発生器による防除試験

適当な周波数の超音波を発射することにより、流網の存在をイルカに予知させることを目的とした混獲防止の研究も続けられている。1985年には次の3種の超音波発生器を流網に取付けて実験を行った（表6）。

① 145 KHz単純型音波発生器（SG—2）

イシイルカのクリックの145 KHzを、1,000倍のパルス幅（50 ms）で発生させる装置である。各船団1隻がこの装置を5台ずつ流網に取付けて、合計164回の操業を行った。

② 145 KHz イルカ型音波発生器（SG—3）

イシイルカのエコロケーションに近い超音波パルスを発生させる装置である。各船団1隻がこの装置を5台ずつ流網に取付けて、合計164回の操業を行った。

③ 新音波発生装置（SG—4）

4の1）に述べたので省略する。

①、②の超音波発生器付流網の操業結果の分析はM. M. チームにより行われている。

6. イシイルカの年齢査定ワークショップ

イシイルカの年齢査定において、1984年に行われた標本交換による比較により、

(1) 若齢個体の年齢の解釈の違い

(2) 高齢個体の年齢査定の研究者間のばらつき

(3) 標本調製法あるいは産地による読みの違い

の3問題を解決するため年齢査定ワークショップが開催された。

期　間　1985年7月15日～18日

場　所　シアトル市、米国海産哺乳動物研究所

出席者　日本：粕谷俊雄（遠洋水研）、宮崎信之（国立科学博物館）

米国：L。Jones，M。Gosho，A。Walman，D。Rice （海産哺乳動物研究所）

米国研究者により配付されたデータ未知のイシイルカの歯30頭分を、粕谷、宮崎、Goshoの3名があらかじめ調製して持参し、Jonesを除く5名が査定した。結果が不一致の標本についてはその理由を討議し、次の結論を得た。

(1) 年齢以外の歯の特徴を参照することにより正しい年齢査定が行えること。個体の生物学的情報は参照すべきでないこと。

(2) 高齢個体については、上の方法では年輪と偽年輪の識別が不可能な個体が若干あり、高齢群の年齢組成に不正確さを残すこと。

(3) 最適な処理が行われれば手法による差は無い。連続切片法は最適な切片を査定時に選択できる長所があるが、最適脱灰時間の決定に困難が伴うこと。

なお、ワークショップの報告書は1986年3月までに完成の予定。

Table 1. Number of incidental take of marine mammals, catcher boat operations and gillnet used by mothership salmon driftnet fishery during 1978 to 1985.

Year	Total number of catcher boat operation	Total number of gillnet used (in tans)	Total number of incidental take	Break down by species				
				Dall's porpoise	PP	OO	CU	EJ
1978	8,284	2,721,113	505	495	1	1	6	-
1979	8,611	2,798,022	688	682	3	-	3	-
1980	9,551	3,145,913	1,004	1,004	4	-	-	-
1981	8,811	2,902,231	1,370	1,361	-	-	9	-
1982	8,957	2,942,443	3,199	3,190	-	-	8	1
1983	8,967	2,954,989	2,990	2,986	-	-	4	-
1984	8,333	2,739,857	2,675	2,670	-	-	5	-
1985[a]	7,051	2,322,160	2,751	2,747	-	-	4	-

a: Preliminary
PP: Harbour porpoise
OO: Killer whale
CU: Northern fur seal
EJ: Steller sea lion

Table 2. Number of incidental take of marine mammals and gillnet used by land-based salmon driftnet fishery during 1978 to 1985.

Year	Total number of gillnet used (in tans)	Dall's porpoise	Northern right whale dorphin
1978	3,371,736	303	-
1979	3,218,490	127	-
1980	3,144,187	139	-
1981	3,233,925	696	-
1982	2,961,730	1,641	-
1983	3,113,681	1,291	-
1984	2,823,704	812	1
1985[a]	2,442,430	781	-

a: Preliminary

Table 3. Number of incidental take of marine mammals, gillnet operations and gillnet used by salmon research vessels during 1978 to 1985.

Year	Number of total operation	Number of gillnet used (in tans)	Marine mammals incidentaly taken								
			Dall's porpoise Total	PT	PP	LO	LB	UD	CU	US	RS
1978	355	44,622	27(22)[b]	-	-	-	-	-	1(1)	2(2)	-
1979	268	34,615	20(16)	-	-	1(1)	-	-	17(12)	-	-
1980	276	38,080	56(27)	1(1)	1(1)	-	3(1)	3(2)	19(10)	-	-
1981	287	40,739	21(15)	1(1)	-	-	3(2)	-	15(13)	-	-
1982	317	40,262	48(37)	2(2)	-	-	-	-	15(11)	-	-
1983	321	39,730	31(26)	-	-	-	-	-	2(2)	-	-
1984	351	44,579	41(32)	-	1(1)	1(1)	3(1)	-	6(6)	-	1(1)
1985[a]	258	33,352	40(27)	14(12)	1(1)	-	1(1)	-	-	-	-

a: Preliminary
b: The figures in parrentheses indicate the number of operations when marine mammals were taken.

PT: Truei type
PP: Harbour porpoise
LO: Pacific whiteside dorphin
LB: Northern right whale dorphin
UD: Unidentified porpoise
CU: Northern fur seal
US: Unidentified seal
RS: Ringed seal

Table 4. Sighting survey of marine mammals conducted by salmon research vessels during 1978 to 1985.

Year	Number of research vessels	Period of survey	Accumulated days sighted	Accumulated distance sighted (N.M.)
1978	9	May 10 - Sept.14	563	36,505
1979	9	May 10 - Aug. 11	533	42,969
1980	9	Apr.21 - Aug. 13	548	44,744
1981	9	Apr.23 - Aug. 16	639	46,232
1982	10[b]	Apr.24 - Sept.19	653	49,830
1983	10[b]	Apr.20 - Sept.10	608	43,116
1984	11[c]	Apr.20 - Aug. 21	588	50,614
1985[a]	9[b]	May. 2 - Sept.12	462	37,321

a: Preliminary
b: Including dedicated vessel for Dall's porpoise research
c: b + Wakashio maru

Table 5. Number of marine mammals brought back to motherships for biological samplings and periods during U.S. scientific observers on board in 1985.

Name of motherships	Period during U.S. scientific observers on board motherships		Number of marine mammals brought back to motherships	
Kizan maru	June 13 - July 10 July 15 - July 30	(37 days)	Dall's porpoise	396
Meiyo maru	June 14 - July 8 July 16 - July 29	(32 days)	Dall's porpoise	245
Nojima maru	June 14 - July 6 July 15 - July 28	(30 days)	Dall's porpoise	264
Jinyo maru	June 14 - July 2 July 12 - July 27	(30 days)	Dall's porpoise	308
Total		129 days		1,213

Table 6. Number of Dall's porpoise incidentally taken by catcher boats with air-tube threads, with sound generators and ordinary catcher boats in 1985 fishing season.

Catcher boats	Gears	Number of sets	Incidental take
Catcher boats with air-tube threads	AT-1	3,280	1,173
	AT-3	328	116
Catcher boats with sound generators	SG-2	164	69
	SG-3	164	66
	SG-4	41	13
Catcher boats	Ordinary net	2,080	926
Scout boats	Ordinary net	994	384
Total		7,051	2,747

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Fisheries Agency of Japan

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Research on marine mammals was conducted in 1984 in accordance with Article 10 of the International Convention for the High Seas Fisheries of the North Pacific Ocean, as amended in 1978, paragraph 1(c) of the Annex to the Convention and the Memorandum of Understanding between the Governments of Japan and the United States amended in 1984. In addition, the research plan was presented and reviewed at the Meeting of the Scientific Sub-Committee of the Ad Hoc Committee on Marine Mammals, INPFC, held in Tokyo during 1985 March 11 to 15. The items of research conducted during 1985 May to September were as follows. Since some analyses are still underway, an outline only is reported.

Outline of research

1. Collection of statistical data on incidentally taken marine mammals in the following operations--

   (1) Mothership salmon driftnet fishery
   (2) Landbased salmon driftnet fishery
   (3) Salmon research vessels

2. Sighting survey for estimating abundance of Dall's porpoise

3. Sampling for biological studies of Dall's porpoise in the following operations--

   (1) Mothership salmon driftnet fishery
   (2) Landbased salmon driftnet fishery
   (3) Salmon research vessels
   (4) Dedicated vessel for Dall's porpoise research

4. Acoustic studies on Dall's porpoise

   (1) Test of the effect of the newly designed sound generator

(2) Experiments in the Sea of Okhotsk coast of Hokkaido

(i) Experiment to capture Dall's porpoise

(ii) Observation of response of Dall's porpoise to sound waves

(iii) Measurement of reflection characteristics of driftnets

(iv) Observation of response of salmon to sound waves

5. Gear modification experiments for the purpose of reduction or elimination of incidental take of Dall's porpoise

(1) Gillnets modified with air-tube threads

(2) Supersonic wave generators

6. Age determination workshop for Dall's porpoise

1. Statistics on incidentally taken marine mammals

(1) Mothership salmon driftnet fishery

In 1985 four motherships and a total of 172 catcher boats attached to those motherships collected data on marine mammals incidentally taken by salmon gillnets. A total of 164 fleet operations and 7,051 gillnet operations by catcher boats were conducted during June to July. A total of 2,751 marine mammals (2,747 Dall's porpoise (dalli-type only) and four northern fur seals) were incidentally taken (Table 1). Of the 2,747 Dall's porpoise, 2,423 were taken in the U.S. FCZ. U.S. marine mammal observers (a total of 12; 3 for each fleet) were accommodated by the fleets for 30 to 37 days from mid-June to late July.

(2) Landbased salmon driftnet fishery

In 1985 the fishing season for the landbased salmon driftnet fishery opened one month later than in the previous year. The number of

marine mammals incidentally taken by this fishery during 1985 June to July was 781 (Dall's porpoise only) (Table 2).

(3) Salmon research vessels

During 1985 May to August, eight salmon research vessels were engaged in the survey in offshore waters of the North Pacific Ocean. These vessels conducted driftnet surveys in the northwestern Pacific west of 177°W, in the northeastern Pacific between 45° to 55°N along 155°W, and in the Bering Sea west of 175°W. The survey was initiated in early May, 20 days later than in previous years, and in May was conducted in the northwestern Pacific in the Japanese 200 mile zone. The salmon research vessels conducted a total of 258 experimental operations (the total number of driftnets used was 33,352 tans) during May 3 to July 20 and took 42 marine mammals incidentally (Table 3). Of those, 40 Dall's porpoise (20 dalli-type, 14 truei-type, and 6 type-unknown) were taken in 30 operations and one Harbor porpoise and one Northern right whale dolphin were taken.

2. Sighting survey for estimating abundance of Dall's porpoise

For estimating abundance of Dall's porpoise, sighting surveys were conducted by crews of salmon research vessels during the cruises. The results are being analyzed at the Far Seas Fisheries Research Laboratory.

Eight salmon research vessels (from May 2 to August 15) and one dedicated research vessel (from August 6 to September 15) conducted sighting surveys for a total of 464 days (37,321 miles) in 1985 (Table 4). The areas surveyed were mainly the northwestern Pacific west of 177°W and the Bering Sea west of 175°W. Effort was also expended in other areas of the Bering Sea and the northeastern Pacific.

3. Sampling for biological studies of Dall's porpoise

(1) Mothership salmon driftnet fishery

As in previous years, the U.S. observers who were on board each mothership conducted biological measurement and dissection and collected samples such as teeth and internal organs of Dall's porpoise brought back by the catcher boats in cooperation with Japan. During the fishing periods in June and July, 1,213 Dall's porpoise were brought back to the motherships (Table 5). Preservation of samples obtained outside the U.S. 200 mile zone and the sampling activities of Japanese research personnel were the same as in previous years.

(2) Landbased salmon driftnet fishery

Effort to obtain biological information on Dall's porpoise found in the landbased salmon driftnet fishing areas was expended as in the previous year. During 1985 June to July, 16 frozen Dall's porpoise (dalli-type only) were brought back to Kushiro. These samples were thawed at Kushiro, biological measurements were made, and skulls, teeth and internal organs were collected during early to mid-August. Collected samples are being sorted and analyzed at the National Science Museum, Japan.

(3) Salmon research vessels

In relation to marine mammals taken incidentally by driftnet operations of the salmon research vessels, biological measurements, dissection, etc. were conducted on board the vessels or at their mother ports after unloading and thawing.

During the survey period, 1985 May to July, four research vessels brought back a total of 14 Dall's porpoise (5 dalli-type and 9 truei-type) as frozen samples to Kushiro. These specimens were

measured and sampled when dissected during early to mid-August. Samples collected are being sorted and analyzed at the National Science Museum, Japan. In addition, one research vessel captured one Northern right whale dolphin incidentally and processing of this specimen is being done at Hokkaido University.

(4) Dedicated vessel for Dall's porpoise research

Information obtained from Dall's porpoise taken incidentally by the salmon driftnet fisheries is limited to only a part of the spatio-temporal whole life history of Dall's porpoise. The vessel dedicated to Dall's porpoise research conducted operations in the northwestern Pacific west of around 180° during August to September (after the commercial fishing period) in 1982 and 1983 and during May to June (before the breeding season) for 1984, and collected much information.

In 1985, this vessel conducted a sighting survey of marine mammals and captured Dall's porpoise with harpoons in the northwestern Pacific and Bering Sea during August to September (after the commercial fishing period) as follows--

Period 1985 August 6 (departed from Kesen-numa) to September 16 (returned in Kesen-numa)

Area the northwestern Pacific west of 175°E and the Bering Sea west of 173°W (harpoon operations were conducted in high seas areas of the Bering Sea outside the 200 mile zones in the northwestern Pacific outside the 200 mile zones, and in the Japanese 200 mile zone).

The research vessel was the Hoyo maru No. 12, 42 m length and 299 GRT (chartered by the Fisheries Agency of Japan).

During the cruise 1,006 Dall's porpoise were sighted (sighting distance 4,210 miles) and 19 Dall's porpoise (18 dalli-type and 1 truei-type) and one Bottlenose dolphin were captured. For the Dall's porpoise taken, biological measurements were taken, specimens were dissected, and samples such as teeth, blood, muscle, and reproductive organs were collected.

Analyses of data and material obtained are underway at the National Science Museum, Hokkaido University, Ehime University, Far Seas Fisheries Research Laboratory, etc. for each aspect of studies.

4. Acoustic studies of Dall's porpoise

The research group, which consisted of members from Nihon University, Kamogawa Sea World (aquarium), and the National Research Institute of Fishery Engineering, conducted acoustic studies of Dall's porpoise during 1985 June to September.

(1) Test of the effect of the newly designed sound generator

Four sound generators which were designed to emit random supersonic pulses of 20 kHz to 50 kHz were developed. Thirty-three operations with driftnets equipped with those four generators were conducted by the catcher boat (Inari maru No. 31) attached to the mothership Meiyo maru during 1985 June 11 to July 29 to test their effect. The data recorded by a Japanese observer are being analyzed.

(2) Experiments in the Sea of Okhotsk coast of Hokkaido

During 1985 August 26 to September 2, in the Sea of Okhotsk foreshore in the vicinity of Utoro, Shari town, Hokkaido, as in the previous year the following four types of experiments were conducted--

(i) Experiment to capture Dall's porpoise

Capture of Dall's porpoise attracted to vessels was attempted with the same gears as in previous years but resulted in no capture because of the small number of schools attracted to the vessel.

(ii) Observation of response of Dall's porpoise to sound waves

For Dall's porpoise found resting and rolling slowly at the surface while the vessel was approaching them, their responses to the following situations were observed--the vessel emitted (1) supersonic pulses of 24 kHz, (2) randomly generated supersonic pulses of 20 to 50 kHz, (3) vocalizations of clicks of killer whales and (4) no sound signals. While to the supersonic pulses they swam away splashing, to the vocalizations of clicks used in this experiment they showed no notable avoidance or escapement behavior, the same as for no sound signal situation.

(iii) Measurement of reflectivity of driftnets

Three tans of driftnet were set at sea and supersonic pulses of 143 kHz were emitted towards them. Reflection was measured to examine the overall reflection characteristics of the driftnet.

(iv) Observations of response of salmon to sound waves

Low frequency sound waves (300 to 1,000 Hz) and supersonic pulses of 20 kHz to 50 kHz or 143 kHz were emitted toward captive pink salmon (14) and one chum salmon to observe their responses. They did not show any significant response.

5. Gear modification experiments for the purpose of reduction or elimination of incidental take of Dall's porpoise

The incidental take of marine mammals by the mothership salmon driftnet fishery in the U.S. 200 mile fishing zone has been regulated and use of modified gear is required with an increasing percentage stipulated year by year. In 1985, 50% of all catcher boats used air-tube thread gillnets. Experiments to avoid the incidental take of marine mammals by using sound generators were also continued.

(1) Gillnets modified with air-tube threads

In 1985, two types of modified gillnets were used. One type had three air-tube threads woven into the central part of the gillnet (AT-1) and the other had the same three threads woven into the upper part of the gillnet (AT-3). Twenty catcher boats operated with the former and two with the latter for each fleet. The total number of catcher boats which used the modified gillnets amounted to 88 for the four fleets.

A total of 3,608 operations with these modified gillnets accounted for 51% of total mothership salmon fishing operations. Out of 3,608 operations, 3,280 were with AT-1 modified gillnets and 328 were with AT-3 (Table 6).

Average incidental take per operation (CPUE) for the entire fishing period and area was 0.358 for the modified gillnets with air-tube threads (AT-1) and 0.445 for the standard gillnets. If the CPUE for the standards gillnets is considered as 100, that for the modified air-tube gillnets was 80. In addition, the statistical test of these average CPUEs showed a significant difference (probability of type I error less than 1%). Detailed analyses of the results of operations with the air-tube modified gillnets are being conducted by the Marine Mammal Project Team.

(2) Experiments to avoid incidental take using supersonic generators

Studies to avoid the incidental take, aimed at alerting porpoise to the existence of salmon gillnets by generating supersonic waves with proper frequencies, were conducted as in the previous year. In 1985, experiments with the following three supersonic generators attached to the salmon gillnets were conducted (Table 6)--

(i) Simple mode sound generators (145 kHz) (SG-1)

This type generates supersonic pulses with a frequency of 145 kHz the same as the clicks of the Dall's porpoise and 1,000 times greater pulse width (50 milliseconds) than clicks of the Dall's porpoise. One catcher boat of each fleet used a set of salmon gillnets equipped with five generators and a total of 164 operations was conducted.

(ii) Dolphin mode sound generators (145 kHz) (SG-3)

This type emits supersonic waves similar to those used in echo location by Dall's porpoise. One catcher boat of each fleet conducted operations with a set of salmon gillnets equipped with five generators. A total of 164 such operations was conducted.

(iii) Newly designed sound generator See 4-(1)

Analyses of results from gillnets equipped with sound generators SG-1 and SG-3 during operations are underway by the Marine Mammal Project Team.

6. Age determination workshop for Dall's porpoise

In relation to age determination of Dall's porpoise an age determination workshop was held to discuss and solve (1) discrepancies in interpretation of ages for young porpoise, (2) variance of age determinations for older porpoise among the scientists, and (3) differences derived from techniques for preparation of samples at laboratories where samples were prepared based on the comparison of results from samples exchanged in 1984.

Period	1985 July 15 to 18
Location	National Marine Mammal Laboratory of the United States, Seattle
Participants	Japan: Toshio Kasuya (Far Seas Fisheries Research Laboratory), Nobuyuki Miyazaki (National Science Museum) United States: L. Jones, M. Gosho, A. Walman, D. Rice (Marine Mammal Laboratory)

Teeth sampled from thirty Dall's porpoise for which biological information was not divulged which had been distributed by U.S. scientists were prepared and brought to the workshop by Kasuya, Miyazaki, and Gosho individually were examined by all participants except for Jones. Regarding the samples for which results of age determination showed discrepancies, the possible reasons were discussed and the following conclusions were reached--

(1) More accurate age determination is possible by referring to characteristics of teeth other than those used in relation to age. Biological information on individuals should not be referred to.

(2) Regarding older porpoise, the distinguishment between true age rings and false age indications is impossible for some samples based on the above mentioned methods and inaccuracy remains in age compositions of older age groups.

(3) For the most adequately processed samples no discrepancy occurs among methods. A continuous section method has merit in that the most adequate sections can be selected at time of age determination but is there is some difficulty in determining the most adequate decalcification time.

The report of this workshop will be completed by 1986 March.

TABLES 1 TO 6 ARE IN ENGLISH IN THE JAPANESE DOCUMENT