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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
1986年調査の概要

Outline of 1986 Research on Marine Mammals,
particularly on Dall's Porpoise relating
to Salmon Gillnet Fisheries.

1986年 9月
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水産庁，1986．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1986年の調査概要．11頁．（第33回INPFC定例年次会議提出文書．1986年10月．米国，アンカレッジ市）．水産庁．日本．〒100千代田区霞ヶ関2-1-1．

さけ・ます流網漁業に関連した海産哺乳動物、
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水 産 庁

1986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条及び1984年に改定された日本と合衆国間の了解覚書に従って実施された。具体的な調査計画は1986年3月10日～14日に東京で開かれた海産哺乳動物特別委員会科学分科会で検討された。1986年4月から10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

1986年には、4母船とその付属独航船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月上旬～7月中旬(昨年は7月下旬)の漁期間中に合計136回(同じく164回)の船団操業と、延べ5,854回(同じく7,051回)の独航船の操業が行われ、海産哺乳動物1,857頭(同じく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)1,856頭、オットセイ1頭であった。表2には1981～1986年の米国FCZ、南公海及び北公海におけるイシイルカの混獲頭数を示した。1986年のイシイルカの混獲頭数は米国FCZ内で1,607(昨年は2,423頭)、南公海で35頭(同じく28頭)及び北公海で214頭(296頭)と米国FCZ内での混獲頭数が昨年より大きく減少した。米国海産哺乳動物視察員(1船団3名づつ合計12名)は6月中旬～7月中旬にかけて、各々28～29日間船団に滞在した(表6)。

2) 基地式さけ・ます流網漁業

1986年の基地式さけ・ます流網漁業は6月上旬～7月上旬(昨年は7月中旬)の漁期間中に1,436,000反(同じく2,442,000反)を使用し、404頭(同じく781頭)の海産哺乳動物(すべてイシイルカ)を混獲した(表3)。

3) さけ・ます調査船

8隻のさけ・ます調査船は1986年4～5月に日本の200海里内及び6月～8月に北太平洋沖合水域において活動した。さけ・ます調査船は177°W以西の北西北太平洋及び174°E～166°Wのベーリング海で流網及び延縄による調査を行った。さけ・ます調査船は4月20日～8月^{6日}までの間に、262回、総使用反数26,019反(昨年は258回、33,352反)の試験操業を行い、海産哺乳動物35頭(同じく41頭)を混獲した(表4)。イシイルカは21回、24頭(イシイルカ型15頭、リクゼンイルカ型3頭、型不明イシイルカ6頭)、ネズミイルカ2回、2頭、オットセイ5回、7頭、アカボウクジラ1回、1頭であった。リクゼンイルカ型はすべて日本の200海里内で混獲された。

2. イシイルカの豊度推定のための目視調査

イシイルカの豊度推定のため、さけ・ます調査船及びイシイルカ専門調査船は航走中に乗組員及び専門調査員による海産哺乳動物の目視調査を行った。この目視調査結果は遠洋水研で分析されている。

1986年には8隻のさけ・ます調査船が4月19日～8月18日、及び1隻のイシイルカ専門調査

船が8月9日～10月5日に、両者合計して延べ460日、42,000海里にわたり目視調査を行った(表5)。目視調査の行われた海域は主として177°W以西の北太平洋と174°E～165°Wのベーリング海であるが、一部北東北太平洋も含まれる。

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

母船に乗船した米国視察員は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)を行った。1986年には米国FCZ内から794頭、南公海から15頭及び北公海から96頭、合計905頭のイシイルカが母船に持ち帰られた(表6)。

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、基地式漁船に混獲したイシイルカ標本の収集が行われた。1986年6月29日～7月5日に混獲されたイシイルカ15頭(イシイルカ型11頭、リクゼンイルカ型4頭)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月中旬～下旬に現地で解凍され、生物学的計測、頭骨、歯、生殖腺、その他の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た海産哺乳動物は、船上において生物学的計測、解剖等を行ったり、あるいは冷凍にして基地に持ち帰った後、同様の処理がなされる。

1986年4月～7月の操業期間中、2隻の調査船が合計10頭のイシイルカ(イシイルカ型7頭、リクゼンイルカ型3頭)及びネズミイルカ1頭を冷凍標本として釧路に持ち帰った。これらの標本は8月中～下旬に現地において生物学的計測、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。

4) イシイルカ専門調査船

イシイルカ専門調査船は1982、1983年に漁期外の8～9月に、1984年に繁殖期前の5～6月に、いずれも180°以西の北西北太平洋で、及び1985年に漁期外の8～9月に北西北太平洋とベーリング海において調査し、多くの情報を得た。

1986年には、専門調査船は漁期外の8～10月に北西北太平洋及びアラスカ湾を含む北東北太平洋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った。

特に、この調査は従来調査努力が不十分であった北東北太平洋を主な目的海域とした。

調査期間 1986年8月9日(気仙沼)～10月5日(気仙沼) ただし、補給のため合衆国シアトル市に9月2日～6日(現地時間)に寄港した。

調査海域 40°～50°Nの北西北太平洋及び45°～55°Nの北東北太平洋。

調査船 第12宝洋丸 全長42m、299トン(水産庁用船)

得られた資料は国立科学博物館、北海道大学、遠洋水研、鯨類研究所、愛媛大学等で分担して分析される予定である。

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、水産工学研究所）はイシイルカの音響学的生態調査を1986年2月と6月～9月に行った。この調査結果の分析は水工研により行われる。

1) 新音波発生装置の効果テスト

昨年試作し、実験を行った20～50 KHzの超音波パルスをランダムに発生する新方式音波発生装置3台を野島丸船団所属の独航船1隻（第~~53~~⁵³長久丸）の流網（中空糸流網）に取付けた。1986年6月～7月のさけ・ます操業期間中に34回の操業を行い、混獲されたイシイルカの頭数、羅網部位を調べ、混獲防止の効果进行调查した（表7）。

2) 捕獲イルカの音響学的調査

a ハンドウイルカ

1986年2月にハンドウイルカ3頭を捕獲し、狭い入江を網で区切って蓄養し、対網行動を4日間にわたり連続して目視とビデオカメラにより観察した。

b イシイルカ

1986年9月にイシイルカ1頭を旋網により捕獲し、蓄養しながら、超音波パルス、物体等に対する反応、流網に対する行動の調査及びクリックスの録音を行った。

c ネズミイルカ

イシイルカと同じ属のイルカであるネズミイルカを用い、水族館の水槽でクリックスの録音、各種の刺激に対する反応の観察等を分析する。

5. イシイルカの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。1986年においては、全独航船の81%が中空糸網及びマルチフィラメント網及び音響発生器付中空糸網によるイシイルカ混獲防止試験を行った。

1) 中空糸付き改良漁具

1986年には、網の中央部に3本の中空糸を設置した改良流網を各船団30～31隻（先航船を含む）、計123隻が使用して操業を行った。この改良漁具の操業回数（4,188回）は全操業回数の72%をしめた（表7）。

先航船以外の中空糸網船（AT-1）と一般網船の全期間、全海域における操業回数当りの平均混獲頭数（CPUE）をみると、中空糸網船で0.31、一般網船で0.39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79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。中空糸網船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) マルチフィラメント付改良流網

流網の中央部に3本のマルチフィラメントを設置した改良流網(MT-1)を各船団2隻、計8隻が使用して、合計272回(全操業回数の5%)の操業を行った(表7)。MT-1船の操業回数当りの混獲頭数(CPUE)は0.28であり、一般網船のそれを100とした場合、MT-1船のそれは72となった。この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。

3) 超音波発生器による混獲防止試験

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。1986年には次の3種の超音波発生器を中空糸流網に取付けて実験を行った(表7)。昨年までは超音波発生器は一般流網に取付けられた点が異なっている。

a 145KHz 単純型音波発生器(SG-2)

イシイルカのクリックの145KHzを1,000倍のパルス幅(50ms)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、計136回(全操業回数の2%)の操業を行った(表7)。

b 145KHz 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136回(全操業回数の2%)の操業を行った(表7)。

c 新音波発生器(SG-4)

4.の1)に述べたので省略する。

a、b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。

4) 調査船による混獲防止器具の効果試験

水産庁用船黒森丸(¹⁶⁰150トン)が1986年6月2日(岩手県山田)~6月22日(釧路)に流網に混獲防止用器具(エアークラップ、ロープ等)を取付け、海産哺乳動物の混獲調査を行った。また、音響発生器の実験やイルカの鳴音の録音等も行った。これら実験の分析は水工研・日本大学により行われている。

Table 1. Number of incidental take of marine mammals, catcher boat operations and gillnets used by mothership salmon driftnet fishery during 1978 to 1986.

| Year | Total number of catcher boat operation | Total number of gillnets 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 | 497 | 1 | 1 | 6 | - |
| 1979 | 8,611 | 2,798,022 | 688 | 682 | 3 | - | 3 | - |
| 1980 | 9,551 | 3,145,913 | 1,004 | 1,000 | 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 | 2,953,699 | 2,990 | 2,986 | - | - | 4 | - |
| 1984 | 8,333 | 2,739,857 | 2,675 | 2,670 | - | - | 5 | - |
| 1985 | 7,051 | 2,322,160 | 2,751 | 2,747 | - | - | 4 | - |
| 1986 ^a | 5,854 | 1,929,626 | 1,857 | 1,856 | - | - | 1 | - |

a: Preliminary

PP: Harbour porpoise
OO: Killer whale

CU: Northern fur seal
EJ: Steller sea lion

Table 2. Number of incidental take of Dall's porpoise number of sets of gillnets in US FCZ, southern and northern parts of open sea, 1981-1986.

| Year | US FCZ | | Southern part of open sea | | Northern part of open sea | | Total | |
|-------------------|-------------|-------------|---------------------------|-------------|---------------------------|-------------|-------------|-------------|
| | No. of sets | No. of take | No. of sets | No. of take | No. of sets | No. of take | No. of sets | No. of take |
| 1981 | 6,150 | 1,137 | - | - | 2,661* | 224* | 8,811 | 1,361 |
| 1982 | 6,271 | 2,389 | 1,207 | 208 | 1,479 | 593 | 8,957 | 3,190 |
| 1983 | 6,217 | 2,399 | 1,329 | 136 | 1,421 | 451 | 8,967 | 2,986 |
| 1984 | 5,694 | 2,129 | 1,329 | 176 | 1,310 | 365 | 8,333 | 2,670 |
| 1985 | 5,672 | 2,423 | 407 | 28 | 972 | 296 | 7,051 | 2,747 |
| 1986 ^a | 4,660 | 1,607 | 332 | 35 | 862 | 214 | 5,854 | 1,856 |

* Including southern part of open sea.

a: Preliminary

Table 3. Number of incidental take of marine mammals and gillnet used by land based salmon driftnet fishery, 1978-1986.

| Year | Total number of gillnets 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 | 2,442,430 | 781 | - |
| 1986 ^a | 1,436,175 | 404 | - |

a: Preliminary

Table 4. Number of incidental take of marine mammals, gillnets operations and gillnets used by salmon research vessels, 1978-1986.

| Year | Number of total operation | Number of gillnets used (in tans) | Dall's porpoise | | | | | | | | | |
|--------------------|---------------------------|-----------------------------------|---------------------|--------|------|------|------|------|--------|------|------|------|
| | | | (PT) | PP | LO | LB | UD | CU | US | RS | ZX | |
| 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 | 57(26) | 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 | 39(31) | - | 1(1) | 1(1) | 3(1) | - | 6(6) | - | 1(1) | - |
| 1985 [*] | 258 | 33,352 | 39(26) | 14(12) | 1(1) | - | 1(1) | - | - | - | - | - |
| 1986 ^{a*} | 262 | 26,019 | 24(21) | 3(3) | 2(2) | - | - | 1(1) | 7(5) | - | - | 1(1) |

*: Including Japanese FCZ.

a: Preliminary

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

PT: Truei type

PP: Harbour porpoise

LO: Pacific whiteside dorphin

LB: Nothern right whaie dorphin

CU: Northern fur seal

RS: Ringed seal

ZX: Goosebeak whale

UD: Unidentified porpoise

US: Unidentified seal

Table 5. Sighting survey of marine mammals conducted by salmon research vessels, 1978-1986.

| Year | Number of research vessels | Periods 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 [*] | 9 ^b | May. 2 - Sept.12 | 462 | 37,614 |
| 1986 ^{a*} | 9 ^b | Apr.19 - Oct. 5 | 460 | 42,000 |

a: Preliminary

b: Including dedicated vessel for Dall's porpoise research

c: b + Wakashio maru

*: Sighting surveys were conducted only in Japanese FCZ during April to May, 1985 and 1986.

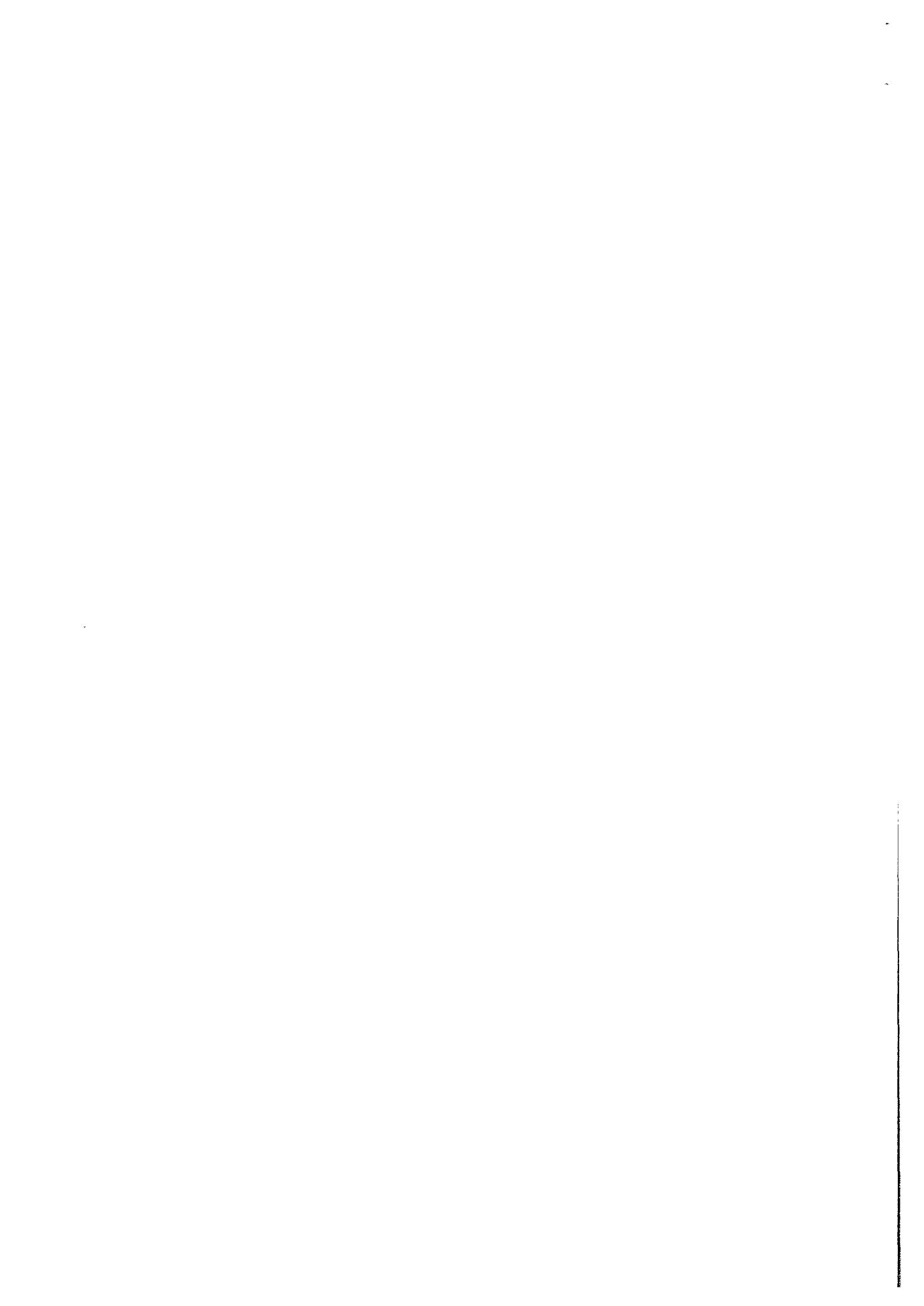
Table 6. Number of marine mammals brought back to motherships for biological samplings and periods during U. S. scientific observers on board in 1986.

| Name of motherships | Period during U.S. scientific observers on board motherships | Number of marine mammals brought back to motherships |
|---------------------|--|--|
| <u>Kizan maru</u> | June 11 - June 29 (29 days) | Dall's porpoise 240 |
| | July 6 - July 15 | |
| <u>Meiyo maru</u> | June 11 - July 5 (29 days) | Dall's porpoise 251 |
| | July 13 - July 16 | |
| <u>Nojima maru</u> | June 11 - July 3 (29 days) | Dall's porpoise 241 |
| | July 10 - July 15 | |
| <u>Jinyo maru</u> | June 11 - June 28 (28 days) | Dall's porpoise 173 |
| | July 6 - July 15 | |
| Total | 115 days | 905 |

Table 7. Number of Dall's porpoise incidentally taken by catcher boats with air-tube threads, with multifilament threads, with sound generators and ordinary catcher boats in 1986 fishing season.

| Catcher boats | Gears* | Number of sets | Incidental take |
|--|--------------|----------------|-----------------|
| Catcher boats with air-tube threads | AT-1 | 3,366 | 1,041 |
| Scout boats with air-tube threads | AT-1 | 822 | 227 |
| Catcher boats with multifilament threads | MT-1 | 272 | 76 |
| Catcher boats with sound generators | SG-2+AT-1 | 136 | 43 |
| | SG-3+AT-1 | 136 | 39 |
| | SG-4+AT-1 | 34 | 8 |
| Catcher boats | Ordinary net | 1,088 | 422 |
| Total | | 5,854 | 1,856 |

*: See text.



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TRANSLATION

OUTLINE OF 1986 RESEARCH ON MARINE MAMMALS,
PARTICULARLY DALL'S PORPOISE RELATING TO SALMON GILLNET FISHERIES

Fisheries Agency of Japan

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Research on marine mammals was conducted in 1986 in accordance with Article 10 of the International Convention for the High Seas Fisheries of the North Pacific Ocean, as amended in 1978, 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 1986 March 10 to 14. The details of research conducted during 1986 April to October are 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) Acoustic study on captive porpoise

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) Gillnets modified with multi-filament threads
 - (3) Supersonic wave generators
 - (4) Tests of effect of accessories attached to gillnets to avoid the incidental take of marine mammals by a research vessel

1. Statistics on incidentally taken marine mammals

- (1) Mothership salmon driftnet fishery

In 1986 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 136 (164 in 1985, hereinafter figures in parentheses are those for 1985) fleet operations and 5,854 (7,051) gillnet operations by catcher boats were conducted during early June to mid-July (early June to late July in 1985). A total of 1,857 (2,751) marine mammals (1,856 Dall's porpoise (dalli-type only) and one northern fur seal) were incidentally taken (Table 1). Table 2 shows numbers of Dall's porpoise incidentally taken within the U.S. Fishery Conservation Zone (FCZ) in the high seas portions of the fishing area in the North Pacific south of the U.S. FCZ and in the high seas portions of the Bering Sea north of the U.S. FCZ in the years 1981 to 1986. In 1986, a total of 1,607 (2,423) Dall's porpoise were incidentally taken in the U.S. FCZ, 35 (28) in the southern high seas areas and 214 (296) in the northern areas; the number of Dall's porpoise incidentally taken in the U.S. FCZ decreased significantly.

A total of 12 U.S. marine mammal observers (three for each fleet) were accommodated by the fleets for 28 to 29 days during mid-June to mid-July (Table 6).

(2) Landbased salmon driftnet fishery

In 1986, the landbased salmon driftnet fishery operated with a total of 1,436,000 (2,442,000) tans of gillnet and took incidentally a total of 404 (781) marine mammals (Dall's porpoise only) during the fishing season from early June to early July (early June to mid-July in 1985) (Table 3).

(3) Salmon research vessels

In 1986, eight salmon research vessels were engaged in the survey in Japan's 200 mile zone from April to May and in offshore waters in the North Pacific from June to August. These vessels conducted driftnet surveys in the northwestern Pacific west of 177°W in the Bering Sea between 174°E and 166°W. The salmon research vessels conducted a total of 262 experimental operations with a total of 26,019 tans of drift gillnets (258 operations, 33,352 tans) during April 20 to August 1 and took 35 (41) marine mammals incidentally (Table 4). Of those, 24 Dall's porpoise (15 dalli-type, 3 truei-type, and 6 type unidentified) were taken in 21 operations, 2 Harbor porpoise in 2, 7 northern fur seals in 5, and 1 Cuvier's beaked whale. All truei-type Dall's porpoise were taken in Japan's 200 mile zone.

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

For estimating abundance of Dall's porpoise, sighting surveys were conducted by crew members and investigators on board the salmon research vessels and one dedicated research vessel during the cruises. The results are being analyzed at the Far Seas Fisheries Research Laboratory.

Eight salmon research vessels from April 19 to August 18 and one dedicated research vessel from August 9 to October 5 conducted sighting surveys for a total of 460 days (42,000 miles) in 1986

(Table 5). The areas surveyed were mainly the northwestern Pacific west of 177°W and the Bering Sea between 174°E and 165°W. Effort was also expended in part of the northeastern Pacific.

3. Sampling for biological studies of Dall's porpoise

(1) Mothership salmon driftnet fishery

The U.S. observers who were on board each mothership conducted biological measurements 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. In 1986, a total of 905 Dall's porpoise were brought back to the motherships; 794 from the U.S. FCZ and 15 and 96 from the high seas portions south and north of the U.S. FCZ, respectively.

(2) Landbased salmon driftnet fishery

Effort to collect Dall's porpoise taken incidentally in the landbased salmon driftnet fishery was expended to obtain biological information on Dall's porpoise found in the area of operations of this fishery. During 1986 June 29 to July 5, 15 frozen Dall's porpoise (11 dalli-type and 4 truei-type) were brought back to Kushiro. These samples were thawed at Kushiro, biological measurements were made, and skulls, teeth, reproductive organs, and other internal organs were collected during mid to late August. Collected samples are being sorted and analyzed at the National Science Museum, Japan.

(3) Salmon research vessels

For marine mammals taken incidentally by driftnet operations of the salmon research vessels, biological measurements, dissection, etc. were conducted on board the vessels or at Kushiro after unloading and thawing.

During the survey period, 1986 April to July, two research vessels brought back a total of 10 Dall's porpoise (7 dalli-type and 3 truei-type) and one Harbor porpoise as frozen samples to Kushiro. These specimens were measured and sampled when dissected during mid to late August. Samples collected are being sorted and analyzed at the National Science Museum, Japan.

(4) Dedicated vessel for Dall's porpoise research

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 in the northwestern Pacific and Bering Sea during August to September (after the commercial fishing period) in 1985; and collected much information.

In 1986, this vessel conducted a sighting survey of marine mammals and captured Dall's porpoise with harpoons in the northwestern Pacific and in the northeastern Pacific including the Gulf of Alaska during August to October (after the commercial fishing period) as follows--

In particular, the main survey area was the northeastern Pacific where the research effort has been inadequate in the past.

| | |
|--------|---|
| Period | 1986 August 9 (departed from Kesen-numa) to October 5 (returned to Kesen-numa) with entry into Seattle for refueling during September 2 to 6 (local time) |
| Area | the northwestern Pacific between 45° and 50°N and the northeastern Pacific between 45° and 55°N |
| Vessel | <u>Hoyo maru No. 12</u> , 42 m length and 299 GRT (chartered by the Fisheries Agency of Japan) |

Responsibility for analyses of data and materials obtained will be shared among the following research bodies; the National Science Museum, Hokkaido University, Far Seas Fisheries Research Laboratory, Whales Research Institute, Ehime University, etc.

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 in February and during June to September in 1986. Analyses of the results will be conducted by the National Research Institute of Fishery Engineering.

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

One catcher boat (Chokyu maru No. 53) attached to the mothership Nojima maru used a set of the air-tube thread gillnets equipped with three newly designed sound generators which emit random supersonic pulses of 20 kHz to 50 kHz. These generators were manufactured and also tested in actual commercial operations in the previous year. Thirty-four operations with gillnets equipped with those generators were conducted during 1986 June to July and the following were examined; number of Dall's porpoise taken incidentally, location of the net where entanglement occurred, and effect in reducing or eliminating the incidental take (Table 7).

(2) Acoustic study on captive porpoise

(a) Bottlenose dolphin

Three bottlenose dolphins were captured alive in 1986 February and held in a narrow cove. Their behavior to nets was observed with the naked eye and by a video camera system for four consecutive days.

(b) Dall's porpoise

One Dall's porpoise was captured by purse seine in 1986 September. While feeding, responses to supersonic pulses, obstacles, etc. and behavior to driftnets were examined and its clicks were recorded.

(c) Harbor porpoise

Using Harbor porpoise, belonging to the same genus as Dall's porpoise, recording of clicks and observation of responses to various stimuli will be conducted in a water tank installed in an aquarium and the results will be analyzed.

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 1986, 81% of all catcher boats used the following gears as experiments to avoid or reduce the incidental take of marine mammals; gillnets modified with air-tube threads or multi-filament threads, including air-tube thread gillnets equipped with sound generators.

(1) Gillnets modified with air-tube threads

In 1986, a total of 123 catcher boats (30 to 31 for each fleet including scout boats) conducted commercial operations using gillnets modified with three air-tube threads woven into the central part of the nets. A total of 4,188 operations with this type of modified gear accounted for 72% of the total gillnet operations (Table 7).

Average incidental take per operation (CPUE) for the entire period and area was 0.31 for the air-tube thread gillnets excluding those used by the scout boats (AT-1) and 0.39 for standard gillnets. If the CPUE for the standard gillnets is considered as 100, that for the air-tube gillnets was 79. In addition, the statistical test of these average CPUEs showed a significant difference (level of significance: 0.01). Detailed analyses of the results of operations with the air-tube modified gillnets are being conducted by the Marine Mammal Project Team.

(2) Gillnets modified with multi-filament threads

In 1986, a total of eight catcher boats (two for each fleet) used gillnets modified with three multi-filament threads woven into the central part of the nets (MT-1) and conducted a total of 272 operations (5% of the total gillnet operations) (Table 7). Average incidental take per operation was 0.28 for the multi-filament modified gillnets and represented 72 when CPUE for the standard gillnets was considered as 100. Analyses of the results of operations with the multi-filament modified gillnets are being analyzed by the Marine Mammal Project Team.

(3) 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 previous years. In 1986, experiments with the following three supersonic generators attached to the air-tube modified gillnets were conducted (Table 7). In previous years, the supersonic generators were attached to the standard gillnets.

(a) Simple mode sound generators (145 kHz) (SG-2)

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 136 operations (2% of total operations) was conducted (Table 7).

(b) 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 136 such operations (2% of total operations) was conducted (Table 7).

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

Analyses of results from gillnets equipped with sound generators SG-2 and SG-3 during operations are underway by the Marine Mammal Project Team.

(4) Test of the effect of accessories attached to gillnets to avoid the incidental take of marine mammals by a research vessel

The Kuromori maru No. 38 (160 GT, chartered by the Fisheries Agency of Japan) conducted investigations on the incidental take of marine mammals using gillnets equipped with accessories such as a blister plastic packaging material, rope, etc., experiments with sound

generators, and recording of the clicks of porpoise during 1986 June 2 (departed from Yamada, Iwate Prefecture) to June 22 (entered Kushiro). Analyses of these studies are being conducted by the National Research Institute of Fishery Engineering and Nihon University.

TABLES 1 TO 7 ARE IN ENGLISH IN THE JAPANESE DOCUMENT

