さけ・ます標識放流用はえなわ操業における「かえし」の無い釣針使用の効果について

Effect of use of barbless hooks on longline operation for high seas salmon tagging

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要　約

1988年のINPFC年次会議溯河性魚類科学小委員会における勧告に従い、標識放流用はえなわ操業における「かえし」の無い釣針使用の効果を検討する実験操業を行った。

25回のはえなわ操業を合計して、「かえし」の無い釣針及び通常の釣針をそれぞれ18,620本づつ使用し、さけ・ます類をそれぞれ575尾及び751尾漁獲し、312尾及び376尾を放流した。

分散分析により、釣針の「かえし」の有無の効果を比較した。「かえし」の無い釣針を使用すると通常の釣針の場合に比べて漁獲尾数が減少する一方、漁獲した魚のうちの放流可能状態のものの割合には差がなく、結果として使用した1針あたりの放流尾数は減少した。

現時点では、「かえし」の無い釣針の導入のメリットは無いと考えられる。

はじめに

1988年のINPFC年次会議溯河性魚類科学小委員会において、沖合水域での標識放流の有効放流尾数を増大させる調査研究を進める様勧告が出された。この中には、「かえし」のない釣針を使用する事も含まれている。すなわち、魚に与えるダメージを減少させ、漁獲した魚のうち放流可能な状態の個体の割合を高め、放流尾数の増大をはかるものである。一方、釣針に「かえし」が無い場合、餌の脱落、喰い逃げ及び掛かった魚の脱落等により漁獲尾数が減少することも考えられる。

そこで、本年の新りあす丸による調査航海において、はえなわ操業で通常の釣針と「かえし」の無い釣針を併用し、その効果を検討する実験を行った。ここでは、その結果の概要について報告する。

調査方法

1989年6月7～7月7日に北太平洋の北緯43度～46度、東経176度～西経174度の海域において13回の朝はえなわ操業と12回の夕はえなわ操業を行った(図1、表1)。ST.1～12においては

同一地点で朝夕のはえなわ操業を行い、ST.13では朝操業のみ行った。

操業時間帯は、朝操業では投縄開始を日の出の30分前(投縄に約12分を要した)、揚縄開始が日の出後15分になる様に設定し、夕操業では投縄開始を日没45分前、揚縄開始を日没時に設定した。はえなわは通常日本のさけます調査船が使用しているものと同じで、1鉢の長さが148.5m、これに桐浮子が10個及び長さ1mの枝縄が49本付属している。一操業に30鉢あるいは40鉢を用い、49本の全ての釣針の「かえし」をラジオペンチでつぶした鉢と通常の釣針の鉢を交互に連結して使用した。

揚縄時には、1針毎に、さけ・ます類漁獲の有無、揚縄中の脱落、漁獲のなかった釣針の餌の有・無、他魚種及び海鳥の混獲状況及び幹縄・枝縄のもつれを記録した。デッキに上げたさけ・ます類は針を外し標識放流に供するまで、漁獲した針の「かえし」の有無別に2つの水槽に分けて蓄養した。また、釣針が咽の奥にかかっていたり飲み込んでいる場合はテグスを切るだけで釣針は外さなかった。放流時にも漁獲した釣針の「かえし」の有無を記録し、通常の標識付け・放流を行った。

データは各操業別・「かえし」の有無別に以下の集計を行った。

使用針数＝投縄した釣針数（49 × 使用鉢数）

餌無針数＝漁獲が無かった釣針で餌も残っていない釣針数

漁獲尾数＝さけ・ます類の漁獲尾数

脱落尾数＝揚縄中に脱落したさけ・ます類の尾数

放流尾数＝放流したさけ・ます類の尾数

揚縄時にはさけ・ます類各魚種を区別して記録したが、今回の分析では全魚種込みにして扱った。

「かえし」の有無の効果の比較は、操業間の変動を考慮して25回の操業をそれぞれブロックとみなした乱塊法による1因子実験として分散分析を行った。分析には未変換のデータを使用した。

結　果

表2に、操業毎、「かえし」の有無別の集計値を示した。25回の操業による総使用釣針数は「かえし」の無い釣針及び通常の釣針ともにそれぞれ18,620本、さけ・ます類の漁獲尾数はそれぞれ575尾及び751尾、放流尾数はそれぞれ312尾及び376尾であった。全体での漁獲率(漁獲尾数／使用針数）は「かえし」の無い針で1針あたり0.031尾、通常の針で0.040尾であった。また、放流率（放流尾数／使用針数）はそれぞれ1針あたり0.017尾、0.020尾であり、放流可能率（漁獲した魚のうち状態が良く放流できたものの割合、放流尾数／漁獲尾数)は漁獲1尾あたり0.543尾、0.501尾であった。

表3に、漁獲率、放流率及び放流可能率に関する分散分析の結果を示した。「かえし」の有無による差は、漁獲率では分散比15.7715で0.1%水準で有意であり、放流率では分散比5.0321で5%

有意、放流可能率では分散比 0.1188 で有意でなかった。

考　察

「かえし」の無い針の使用の目的は、魚に与えるダメージを減少させ、結果として投入した努力量当たりの有効放流尾数を増大させることであった。しかし、実際には「かえし」の無い釣針を使用すると、漁獲の絶対数が減少する一方、魚へのダメージの減少すなわち漁獲した魚のうち放流可能状態のもの割合の増加が見られず、結果として放流率（努力量当たりの放流尾数）は減少した。

「かえし」の無い釣針で漁獲の絶対数が減少した原因としては、餌の脱落や喰い逃げによる餌付釣針の減少による漁獲努力量の低下、更に一旦掛かった魚の脱落が増加したことが予想される。実際、餌の脱落・喰い逃げを込みにした餌落率（餌落針数／使用針数）は、「かえし」の無い場合の方が有意に高かった（分散比 36.9732、$P < 0.001$）。しかし、揚縄中に観察される脱落（脱落尾数／(漁獲尾数＋脱落尾数)）については、有意な差は見られなかった（分散比 0.0832）。餌落が漁獲に及ぼす影響は、餌落による漁具の有効努力量（餌付釣針数）の時間的変化も考慮して検討する必要があろう。

今回の実験では「かえし」の無い釣針の使用の効果について否定的な結果になったが、色々な海況・漁況条件、使用鉢数、また、漁獲及び放流魚の魚種構成についても細く検討する必要があるかも知れない。

しかし、「かえし」の無い釣針の使用については、船上での準備段階で釣針がカゴからはずれやすい等の取扱い上の問題もあり、現段階では「かえし」の無い釣針の導入のメリットは無いと考えられる。

謝　辞

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参考文献

Zar, J. H. 1984. Biostatistical Analysis. 2nd ed. Prentice-Hall, Inc., Englewood Cliffs, N. J. 718p.

Internatianal North Pacific Fisheries Commission. 1988. Proceedings of the 35th Annual Meeting. Internatianal North Pacific Fisheries Commission, Vancouver, B. C. 326p.

Table 1. Longline operations made during R/V Shin-Riasu maru cruise in 1989

Station No.	Operation No.	Evening or Morning	Date	Position	Effort (Hachi)	Number of salmonids catch	Number of salmonids release
1	1	E	June 7	45° 30N 178° 30E	30	59	34
1	2	M	9	45° 30N 178° 30E	30	95	56
2	3	E	9	45° 30N 179° 30W	30	97	49
2	4	M	10	45° 30N 179° 30W	30	325	172
3	5	E	10	45° 30N 177° 30W	30	49	19
3	6	M	11	45° 30N 177° 30W	30	63	34
4	7	E	11	45° 32N 175° 30W	30	67	29
4	8	M	12	45° 31N 175° 31W	30	128	84
5	9	E	15	44° 30N 177° 30W	30	15	6
5	10	M	16	44° 29N 177° 27W	30	16	6
6	11	E	16	44° 29N 175° 29W	30	49	18
6	12	M	17	44° 32N 175° 30W	30	73	38
7	13	E	18	43° 30N 177° 30W	30	29	17
7	14	M	21	43° 31N 177° 30W	30	18	8
8	15	E	22	43° 29N 175° 30W	30	26	12
8	16	M	23	43° 28N 175° 29W	30	31	16
9	17	E	25	44° 30N 176° 30W	30	24	12
9	18	M	26	44° 29N 176° 30W	30	26	19
10	19	E	27	45° 30N 174° 29W	30	21	4
10	20	M	28	45° 30N 174° 30W	30	41	12
11	21	E	28	45° 30N 175° 30W	30	10	6
11	22	M	29	45° 32N 175° 30W	30	4	1
12	23	E	29	45° 31N 176° 32W	30	14	9
12	24	M	30	45° 33N 176° 31W	30	37	24
13	25	M	July 7	45° 55N 176° 30E	40	9	3
				Total	760	1326	688

Remarks;
E:Evening operation, M:Morning operation

Table 2. Number of hook used, number of hook retrieved with no bait, number of salmonids catch, dropout, and release by barbless and normal hooks operation

Operation No.	Barbless Hook					Normal Hook				
	Number of hook used	Number of hook with no bait	Salmonids			Number of hook	Number of hook with no bait	Salmonids		
			Catch	Dropout	Release			Catch	Dropout	Release
1	735	581	25	1	13	735	444	34	0	21
2	735	481	33	1	21	735	373	62	3	35
3	735	334	46	0	29	735	260	51	0	20
4	735	465	147	0	90	735	462	178	1	82
5	735	199	18	1	8	735	186	31	1	11
6	735	282	25	0	13	735	189	38	0	21
7	735	218	27	1	10	735	193	40	1	19
8	735	352	55	0	37	735	310	73	1	47
9	735	323	7	0	4	735	250	8	1	2
10	735	253	6	0	1	735	212	10	0	5
11	735	300	21	0	7	735	150	28	0	11
12	735	200	31	1	16	735	123	42	0	22
13	735	226	14	1	7	735	174	15	1	10
14	735	345	9	0	5	735	365	9	0	3
15	735	153	7	0	3	735	114	19	0	9
16	735	121	16	0	10	735	78	15	1	6
17	735	230	14	1	4	735	169	10	0	8
18	735	117	11	0	5	735	89	15	0	14
19	735	464	10	0	3	735	451	11	1	1
20	735	282	18	1	8	735	196	23	0	4
21	735	92	3	0	2	735	106	7	0	4
22	735	59	1	0	0	735	42	3	0	1
23	735	78	6	0	5	735	43	8	2	4
24	735	128	18	1	9	735	77	19	0	15
25	980	183	7	1	2	980	109	2	0	1
Total	18620	6466	575	10	312	18620	5165	751	13	376

Table 3. Analysis of variance summary table

3-1 Analysis of variance for catch per number of hook used

Source of variance	Sum of squares	d.f.	Mean squares	F-ratio
Total	9.6231	49		
Barbless or Normal hook	0.1163	1	0.1163	15.7715**
Blocks	9.3298	24	0.3887	52.7118
Remainder	0.0129	24	0.0005	

** P<0.001

3-2 Analysis of variance for release per number of hook used

Source of variance	Sum of squares	d.f.	Mean squares	F-ratio
Total	2.9346	49		
Barbless or Normal hook	0.0153	1	0.0153	5.0321*
Blocks	2.8462	24	0.1186	38.9729
Remainder	0.0730	24	0.0030	

* P<0.05

3-3 Analysis of variance for release per catch

Source of variance	Sum of squares	d.f.	Mean squares	F-ratio
Total	166.4049	49		
Barbless or Normal hook	0.3535	1	0.3535	0.1188
Blocks	94.6669	24	3.9445	1.3262
Remainder	71.3845	24	2.9744	

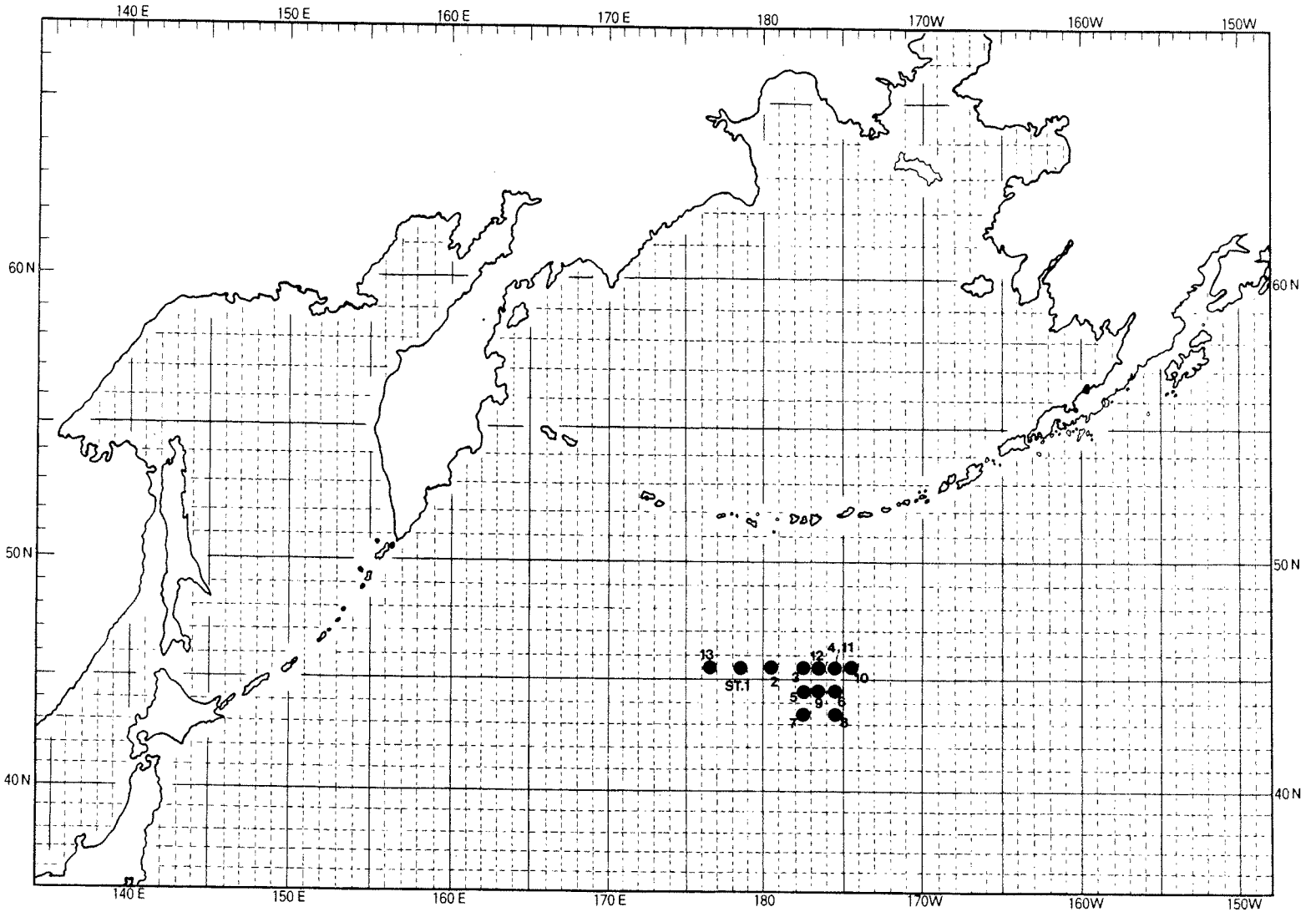

Fig. 1 Circle and number attached show position and number of station operated

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TRANSLATION

EFFECT OF USE OF BARBLESS HOOKS ON LONGLINE OPERATION FOR HIGH SEAS SALMON TAGGING

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Introduction

At the 1988 INPFC Annual Meeting, the Salmon Sub-Committee recommended that the research should be conducted to increase the number of salmon effectively released in offshore tagging experiments. The study of the effect of the use of barbless hooks was included in that recommendation. The objective of this study was to reduce hooking damage to fish, increase proportion of fish suitable for tagging and increase the number of fish released. On the other hand, use of barbless hooks may reduce the number of fish caught because the bait drops off, or was stolen and because fish that are caught may escape.

For this reason, the effect of using barbless hooks during the longline operation was examined this year on board Shin riasu maru by using barbless and regular hooks. This report outlines the results of the study.

Survey methods

Thirteen morning longline operations and 12 evening operations were conducted at waters 43°-46°N and 176°E-174°W from June 7 to July 7 in 1989 (Fig. 1 and Table 1). Morning and evening longline operations were conducted at Stations 1-12, whereas only a morning operation was conducted at Station 13.

Regarding the time period for operation, time of setting longline was set at 30 minutes before sun rise (about 12 minutes was necessary for setting) and time of hauling was set at 15 minutes after sun rise for the morning operation. For the evening operation, the time of setting longline was set at 45 minutes before sun set and time of hauling was set at sun set. The longline used for this study was the same gear as that normally used by the Japanese salmon research vessels; the length of one hachi was 148.5m with 10 floats and 49 gangions of 1m long. Thirty to 40 hachi were used for one operation. A hachi of which all barbs of 49 regular hooks were crushed by radio pliers and a hachi with regular hooks were alternately linked for operation.

At the time of hauling, the catch of salmon, drop-out of salmon during a haul, condition of bait on hooks that caught no fish, entanglement of other fish species and seabirds and entanglement of groundline and gangions were recorded by hachi. Salmon caught were kept in two tanks, one for those caught by barbless hooks and one for regular hooks before they were tagged and released. In case of deep hooking at the throat or if the hook was swallowed, the hook was not removed but the line was cut. At the time of release, salmon caught by the barbless hooks and those caught by the regular hooks were recorded and released with a normal tag.

The following data were collected by operation and by barbless and regular hooks:

Number of hooks used = number of hooks set (49 x number of hachi used)

Number of hooks without bait = number of hooks that did not catch any fish and lost bait
Number of fish caught = number of salmon caught
Number of fish dropped out = number of salmon dropped out during a haul
Number of fish released = number of salmon released

Each species of salmon was recorded at time of hauling, however data for all species were combined in this analysis.

The comparison of effectiveness between barbless and regular hooks was conducted by analysis of variance, which was conducted as single-factor experiment by randomized block design which assumed each of 25 operations as a block as a result of taking fluctuations of each operation into consideration. The data which were not transformed were used for the analysis.

Results

Table 2 shows data by operation and by barbless and regular hooks. In 25 operations, a total of 18,620 barbless hooks and a total of 18,620 regular hooks were used. A total of 575 salmon were caught by barbless hooks and 312 were released, and 751 salmon were caught by regular hooks and 376 were released. The overall catch rate (number of fish caught/number of hooks used) was 0.031 fish per barbless hook and 0.040 fish per regular hook. The overall release rates (number of fish released/number of hooks used) was 0.017 for barbless and 0.020 for regular hooks, and the overall suitability (proportion of fish in good condition for release to total catch, number of fish released/number of fish caught) was 0.543 for barbless and 0.501 for regular hooks.

Table 3 shows the results of analysis of variance on catch rate, release rate and suitability. For the difference between barbless hooks and regular hooks, the ratio of variance for catch rate was 15.7715 and was significant at the level of 0.1%, that for release rate was 5.0321 and was significant at the level of 5%. However, the difference between hook types, the ratio of variance for suitability was 0.1188 and was not significant.

Discussion

The purpose of using barbless hooks was to reduce damage to fish and as a result increase the number of fish released per unit effort. However, the number of fish caught using barbless hooks was actually less and did not produce a decrease of damage to fish, e.g. an increase in the proportion of fish suitable for tagging. As a result, the release rate (number of fish released per unit effort) declined.

The reason for the lower number of fish caught by barbless hooks may be due to the drop-out of bait, increase of bait stolen, reduction of effort caused by fewer numbers of hooks with bait. Furthermore, increase of drop-out of fish once caught was also expected. Actually, the bait drop-out rate (number of hooks bait dropped out/number of hooks used) which took drop- out and stolen bait into consideration was significantly higher for barbless hook (variance ratio 36.9732, $P<0.001$). However, for drop-out observed during hauls (number of fish dropped out / (number of fish caught + number of fish dropped out)), there was no significant difference (variance ratio 0.0832). Effect of drop-out of bait to catch should be studied with time-dependent change of effective amount of effort (number of hooks with bait) of gear by drop-out of bait into consideration.

Although the effect of using barbless hooks in this study did not produce the expected result, it may be necessary to consider in detail the oceanographic and fishing conditions, number of hooks used and species composition of fish caught and released to detect any difference with regular hooks. However, the use of barbless hooks has a some handling disadvantages because hooks easily fall off the basket at time of preparation on board the vessel, etc., and at present, there may be no merit of introducing barbless hooks to longline operations.

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The author expressed gratitude to Captain Yoshitsune Muraki of the Shin riasu maru and his crew for their cooperation in the survey.

Reference, Tables 1 to 3 and Fig. 1 are in English in the Japanese document.