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Recovery of External Anchor Tags During Processing of Food Herring in British Columbia

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RECOVERY OF EXTERNAL ANCHOR TAGS
DURING PROCESSING OF FOOD HERRING IN
BRITISH COLUMBIA.

by

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ABSTRACT

Haegele, C. W. 1982. Recovery of external anchor tags during processing of food herring in British Columbia. Can. MS Rep. Fish. Aquat. Sci. No. 1669: iii + 14 p.

Experiments were conducted during the 1981 herring food fishery in the Strait of Georgia to determine recovery rates for external anchor tags in processing plants and to determine whether some tags are lost during the transfer of catches. Tag recovery rates were estimated at 35% for the fishery but were as high as 76% for individual trials and 68% for processing plants. There were indications that 25% of tags may be lost during the loading of the catch by pumps. The bulk of the recoveries were made during the sorting of the catch.

Key words: External tags, tag recovery, Pacific herring.

RÉSUMÉ

Haegele, C. W. 1982. Recovery of external anchor tags during processing of food herring in British Columbia. Can. MS Rep. Fish. Aquat. Sci. No. 1669: iii + 14 p.

Au cours de la saison 1981 de pêche du hareng de consommation dans le détroit de Géorgie, on a mené des expériences afin de déterminer le taux de récupération des étiquettes à ancrage dans les usines de traitement et la possibilité de perte des étiquettes au cours du transfert des prises. Le taux de récupération des étiquettes au cours de cette pêche a été évalué à 35%, mais s'élevait jusqu'à 76% pour des essais individuels et 68% pour les usines de traitement. Certains indices portent à croire que 25% des étiquettes sont perdues au cours du chargement des prises à l'aide de pompes. La majeure partie des étiquettes ont été récupérées au cours du triage des prises.

Mots-clés: étiquettes, récupération des étiquettes, hareng du Pacifique.

INTRODUCTION

Herring have been tagged in British Columbia with external anchor tags since the fall of 1979. The objectives of this tagging program are to determine the discreteness and migratory movements of herring stocks. To fulfill these objectives, tags have to be returned in sufficient numbers for valid conclusions to be drawn. However, tag returns have been below projections and there are several potential causes for this shortfall (Haegele et al. 1982). This study was conducted to examine two of these: (1) tag shedding resulting from the transfer of the catch by pumping and other handling, and (2) a low rate of retrieval and reporting by processing plant workers of tags in the food herring catch.

There are two studies that have addressed, partially, each of these topics. Hay and Mitchell (1979) introduced dead tagged herring into the hold of a barge from which the catch was pumped to a conveyor belt, where additional tagged fish were introduced. Tag recovery rates during the processing for roe extraction were 85.8% for both taggings. In the other study (Hay et al. 1979) live fish were tagged and released into holding ponds, from which, after 3 to 5 days after tagging, the fish were removed by pump and brailer for shipment and processing. The tag recovery rate in this study was 33%.

METHODS

Herring were tagged with fluorescent orange Floy anchor tags (FD-68BC) as described in Haegele (1981) and with Floy lock-on tags (FT-4) inserted through the dorsal musculature behind the dorsal fin. The lock-on tags were 9 cm long and fashioned from the same material as the anchor tags. Lock-on tags were used as controls since, theoretically, they would not be dislodged during the handling of the catch. All tags were individually numbered for identification. Tags were recovered by processing plant workers who then forwarded them to a PBS Technical representative who visited the plants during processing, or to a contact person (generally a supervisor) who turned them over to a technical representative from PBS, or directly to PBS in postage pre-paid envelopes. A \$2.00 reward was paid to the finder for each tag returned.

TAG LOSS EXPERIMENT

The tag loss experiment was conducted to determine whether the transfer of the catch by pumps causes tags to be dislodged from the fish.

Tagged fish were introduced into the catch in the seine, the hold, and after unloading to determine in which catch handling procedure tag loss may occur.

On November 17, during the first 1981 food fishery opening in the Strait of Georgia, tagged fish were introduced into a seine set made by the WINDWARD STAR and estimated to contain 50 tons of herring. This catch was loaded into three vessels by wet pump. The portion of the catch loaded into the hold of the WINDWARD STAR was salted with additional tagged fish. The catch, after it was unloaded by wet pump at the NSPL¹ plant, was further salted with tagged herring introduced into the unloading hopper. The WINDWARD CLOUD unloaded an estimated 25 tons between 1630 and 2000 PST on November 17, the MARY ROBERTA unloaded an estimated 20 tons between 2000 and 2400 PST on November 17, and the WINDWARD STAR unloaded an estimated 20 tons between 1230 and 1400 PST on November 18. Most of the fish were processed at the NSPL plant while portions were trucked to other plants (SCEL, TOEL and WPFL) for processing.

On November 23, during the first part of the second 1981 food fishery opening, tagged fish were introduced into a seine set of approximately 10 tons made by the TAASKA. This catch was pumped into the hold of the CAPE CAUTION, which already contained an estimated three tons of herring. Tagged fish were introduced into the hold as fish were being loaded. This vessel unloaded an estimated 20 tons at the CFCL plant, where the fish were pumped into the flooded well of a barge from where a bucket conveyor removed the fish for further processing. Tagged fish were introduced into the well and onto the bucket conveyor.

TAG RECOVERY EXPERIMENT

The tag recovery experiment was conducted to determine the rate of retrieval and reporting of tags in the catch and tagged fish were introduced into the catch in the seines.

On November 24, during the second food fishery, tagged fish were introduced into seine catches made by 11 vessels². However, there were 12 separate trials because one set was salted with tagged fish twice. Most of the catches exceeded the 25 ton load limit permitted for transport and an estimated 22 vessels participated in the transport of the catches salted with tagged fish.

During the last 1981 food fishery opening of November 30 in the Strait of Georgia, the seine catches made by 22 vessels were salted with tagged herring prior to loading of the catches. Twenty-six vessels were

¹For full names and addresses of processing plants, referred to by a four letter code, refer to Appendix Table 1.

²Appendix Table 2 lists all vessels identified as catching or transporting fish from tag-salted catches from these and the November 30 trials.

identified in the handling of these catches, only 5 of which were also involved in the November 24 trials.

RESULTS AND DISCUSSION

TAG LOSS EXPERIMENT

The results from the November 17 tag loss trial on the catch made by the WINDWARD STAR were inconclusive, mainly because only 3.0% and 12.0% of tags introduced into the unloading hopper for the loads delivered by the WINDWARD CLOUD and MARY ROBERTA were recovered (Table 1). The reasons for these low recoveries may be that:

1. these were the first two loads delivered from the WINDWARD STAR catch and plant workers were not looking for tags with any effort;
2. some of the handling and processing was done outdoors and unsettled weather caused plant workers to seek shelter;
3. the unloading was done in the late afternoon (1630PST) to late evening (2400PST) when lighting was poor; and
4. some, perhaps the bulk, of the two loads was transferred to another plant (SCEL) for further processing -- 80% of the 15 recovered tags from the two hopper taggings were recovered at the SCEL plant -- and there was no PBS contact person at the SCEL plant.

The results from the WINDWARD STAR load were different; 69.0% of anchor tags from the hold were recovered and 72.0% of anchor tags from the unloading hopper were recovered, indicating that there was no tag loss as a result of unloading by pump. These recovery rates cannot be compared to the 34.0% recovery rate for the seine tags because the catch was transported by all three vessels and the proportion of the tags from the seine going to individual loads was not known and may have differed from the weight ratio of the loads, which was approximately 1:1:1. The results from the lock-on tags were similarly confounded.

The November 23 trial made on the catch of the TAASKA was more straight forward (Table 2). All lock-on tags from the seine and the hold were recovered, which was expected, since pumping or other handling of the catch should not have dislodged these tags, provided plant workers showed good acuity and diligence in seeing and turning in tags. For the anchor tags, 57.6% of the seine tags were recovered, compared to 81.8% of the hold tags. This would have been evidence that some of the anchor tags are lost as a result of loading the catch with a pump. Unfortunately, only 74.7% of the tags from the unloading barge were recovered. This latter rate should have been as high or higher than the recovery rate for the hold tags and the only reasonable explanation for this not being so is that a worker at the unloading

facility was, part way through unloading, discouraged from retrieving tags introduced during this part of the operation while, initially, he retrieved tags introduced prior to and during the unloading operation.

A total of 415 tags were recovered from the tag loss trials. Table 3 lists, in sequence, the operations or activities associated with the processing of the catch and the number of tags recovered at each of these stages. The majority of the tags were recovered during the unloading and culling (34.5%) and the sorting (37.8%) of the catch.

TAG RECOVERY EXPERIMENT

Tags were recovered from 32 of the 34 trials conducted on November 24 and 30 (Table 4). In two of the trials (A2 and B5), fish were loaded by brailer, the other catches were loaded by pump. The recovery rates for the brailer trials were 59.0% in a plant where the recovery rate for 4 trials was also 59.0% and 56.0% in a plant where the recovery rate was 44.8% for 5 trials. The results from the trials with the brailer were, thus, considered not sufficiently different from the trials where pumps were used and were included in subsequent analyses. Overall recovery for the 849 tags placed was 35.7%³. Deleting the two trials for which there were no recoveries, the overall recovery rate for 799 tags placed was 37.9%. Because the fish from the two trials for which there was no recovery may not have entered a processing plant or have been processed for bait with little or no handling, these two trials have not been included in further analysis.

There were recoveries from 13 processing plants, or combination of plants, with tags from between 1 to 5 trials ($Av=2.46$, $SD=1.20$) being handled by individual plants. The av recovery rate ($\pm 1SD$) for plants was 34.6 (± 20.0)% and recovery rates for plants ranged from 6.0% (AERT) to 66.7% (QFCL).

The av recovery rate ($\pm 1SD$) for all trials was 37.1 (± 22.3)%. However, the av recovery rate for the twelve November 24 trials was 31.9 (± 22.2)% and for the twenty November 30 trials was 40.2 (± 22.3)%. Although the recovery rates were not significantly different ($P \approx 0.30$), the difference may be real and have been the result of (1) plant workers being more aware of tags and more diligent in turning them in during the last fishery than the preceding one, and (2) estimated catches for trials in the November 30 fishery being smaller ($rg = 2$ to 80 tons, $Av = 19.9$ tons, $SD = 19.1$ tons) than for the November 24 trials ($rg = 5$ to 100 tons, $Av = 57.3$ tons, $SD = 30.4$ tons), which was significantly different ($P < 0.001$).

³An additional five tags (from trials B5, B7, B14 and B15) were returned by plant workers in the spring of 1982, during processing of the 1982 roe fishery catch. Since these tags would probably not have been turned in had there been no subsequent roe fishery, they were not included.

To determine whether the catch size, and hence tag frequency, which ranged from 0.25 to 12.5 tags per ton for the 32 trials, affected tag recovery, recovery rates for catches \leq 25 tons were compared to tag recovery rates for catches $>$ 25 tons. There were 14 catches of $>$ 25 tons for which tag frequency (\pm 1SD) was 0.49 (\pm 0.24) tags per ton and the av recovery rate (\pm 1SD) was 40.5 (\pm 24.5)%, and 18 catches \leq 25 tons for which tag frequency was 3.16 (\pm 2.74) tags per ton and the av recovery rate was 34.4 (\pm 20.7)%. The difference in the recovery rates was not significantly different ($P \approx 0.40$) while the tag frequency rate was significantly different ($P < 0.005$). Hence, in the range of tag frequency encountered, it did not affect tag recovery rates.

The number of tags recovered, in the tag recovery trials, during the various stages in the handling and processing of the catch are shown in Table 5. Of the 303 tags returned, such information was available for 192 tag returns. As for the tag loss trials, the largest number of tags were retrieved by workers on the sorting operation (45.8% of tags with known recovery location). A substantial number of tags were also recovered during unloading (21.9%) and packing (19.8%).

CONCLUSIONS

The tag recovery rate for herring catches processed for food is expected to be about 35% of tagged fish in the catch. The various estimates from the trials were 35.7% recovery of all tags placed, 37.9% recovery of tags placed in trials for which there was any recovery, 37.1% av recovery for all trials with returns, and 34.6% av recovery for plants. This estimate is similar to the 33% recovery rate obtained by Hay et al. (1979), during a single trial and under different fish handling procedures. However, recovery rates ranged from 0.0% to 76.0% for individual trials and from 6.0% to 66.7% for processing plants. This range in recovery rates would indicate that the physical conditions (e.g. lighting, layout) within plants and worker attitude towards the return of tags was the major reason for less than optimal tag returns of about 70% (three trials exceeded 70% recovery and one plant approached 70% recovery).

The trials made to determine whether the handling of the catch results in tag loss were confounded with irregularities in catch handling and opportunities for tag recovery but indications are that pumping of the catch during loading may result in 25% tag loss (TAASKA trials). Furthermore, during none of the recovery trials did returns exceed 76%.

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Table 1. Tagging and tag recovery data for November 17 tag loss trial (est. 50 ton set by WINDWARD STAR).

Tagging location	Tag type	Tags placed	Plant	Tags recovered	% recovery
WS - seine	anchor	97	NSPL	31	34.0
			SCEL	1	
			TOEL	1	
	lock-on	24	NSPL	6	37.5
			WPFL	1	
			UK	2	
WS - hold	anchor	100	NSPL	69	69.0
	lock-on	25	NSPL	20	84.0
			WPFL	1	
WC - hopper	anchor	100	NSPL	2	3.0
			SCEL	1	
MR - hopper	anchor	100	NSPL	1	12.0
			SCEL	11	
WS - hopper	anchor	75	NSPL	54	72.0

Table 2. Tagging and tag recovery data for November 23 tag loss trial (est. 10 ton set by TAASKA).

Tagging location	Tag type	Tags placed	Plant	Tags recovered	% recovery
TA - seine	anchor	99	CFCL	57	57.6
	lock-on	10	CFCL	10	100.0
CC - hold	anchor	99	CFCL	81	81.8
	lock-on	10	CFCL	10	100.0
CC - barge	anchor	75	CFCL	56	74.7

Table 3. Number of tag recoveries by in-plant location for November 17 and 23 tag loss trials.

Trial date	Plant	Activity						
		Unknown, other	Unloading, culling	Tote filling	Tote tipping	Sorting	Packing	Freezing
Nov. 17	UK	2	-	-	-	-	-	-
	NSPL	-	-	-	26	157	-	-
	SCEL	-	-	-	-	-	2	11
	TOEL	-	-	-	-	-	1	-
	WPFL	2	-	-	-	-	-	-
Nov. 23	CFCL	-	143	49	22	-	-	-

Table 4. Tagging and tag recovery data for November 24 (A) and 30 (B) tag recovery trials.

Plant(s)	Trial No.	Tons in set	Method of transfer	Tags placed	Tags recovered	% recovery	
						Trial	Plant
AERT	A 4 ^a	25	Pump	25	1	4.0	6.0
AERT	A 9 ^a	15	Pump	25	2	9.0	
BCPL	A12	50	Pump	25	6	24.0	59.0
BCPL	A 2	35	Brailer	25	17	59.0	
BCPL	B16	30	Pump	25	19	75.0	
BCPL	B17	2	Pump	25	17	59.0	
CFCL	A 6	100	Pump	25	12	48.0	44.8
CFCL	B 6	15	Pump	25	13	52.0	
CFCL	B 5	15	Brailer	25	14	56.0	
CFCL	B 7	15	Pump	25	7	28.0	
CFCL	B14	27	Pump	25	10	40.0	
CPCL	A 3	80	Pump	24	2	8.3	9.5
CPCL, UK	A 5	80	Pump	25	3	12.0	
CPCL, TOEL	B20	5	Pump	25	2	8.0	
JSMR, JSMF, FJFC	B 4	18	Pump	25	12	48.0	41.3
JSMR, JSMF, UK	A 1	77	Pump	25	8	32.0	
JSMR, JSMF, FJFC	B15	15	Pump	25	11	44.0	
MIFL	B22	5	Pump	25	11	44.0	44.0
NSPL	A 8	5	Pump	25	16	54.0	54.0
OCFL	A10	75	Pump	25	8	32.0	30.0
OCFL, NSPL	A11	75	Pump	25	7	29.0	
PRFR, PRFC	B 8	23	Pump	25	6	24.0	14.0
PRFR	B12	80	Pump	25	1	4.0	
QFCL	A 7	70	Pump	25	18	72.0	66.7
QFCL	B 2	10	Pump	25	13	52.0	
QFCL	B13	30	Pump	25	19	76.0	
SCEL	B11	17	Pump	25	1	4.0	26.0
SCEL, SFCL	B21	5	Pump	25	12	48.0	
SPET, QFCL	B 3	10	Pump	25	14	56.0	42.7
SPET, QFCL	B 1	50	Pump	25	14	56.0	
SPET, UK	B18	15	Pump	25	4	16.0	

Table 4. (cont'd)

Plant(s)	Trial No.	Tons in set	Method of transfer	Tags placed	Tags recovered	% recovery Trial	% recovery Plant
TOEL	B10	7	Pump	25	3	12.0	12.0
-	B 9	15	Pump	25	0	0.0	
-	B19	2	Pump	25	0	0.0	

^aSame catch but loading to another vessel during second trial.

Table 5. Number of tag recoveries by in-plant location for November 24 and 30 tag recovery trials.

Plant	Activity							Total for plant
	Unknown, other	Unloading	Tote filling	Sorting	Packing	Weighing	Freezing	
UK	5	-	-	-	-	-	-	5
AERT	3	-	-	-	-	-	-	3
BCPL	34	5	-	3	1	11	5	59
CFCL	19	31	3	3	-	-	-	56
CPCL	1	-	-	-	3	-	1	5
FJFC	6	-	-	-	-	-	-	6
JSMF	3	-	-	-	-	-	-	3
JSMR	21	-	-	-	-	-	-	21
MIFL	5	-	-	-	3	-	3	11
NSPL	1	-	-	-	16	-	-	17
OCFL	-	-	-	14	-	-	-	14
PRFC	-	2	-	-	-	-	-	2
PRFR	1	4	-	-	-	-	-	5
OFCL	-	-	-	54	-	-	-	54
SCEL	-	-	-	-	9	-	1	10
SFCL	-	-	-	-	3	-	-	3
SPET	11	-	-	14	-	-	-	25
TOEL	1	-	-	-	3	-	-	4
All plants	111	42	3	88	38	11	10	303

Appendix Table 1. List of processing plants that participated in tagging trials.

AERT	Aero Trading, 8592 Fraser Street, Vancouver.
BCPL	B.C. Packers Ltd., 4300 Moncton Street, Richmond.
CFCL	Canadian Fishing Co. Ltd., Gore Avenue, Vancouver.
CPCL	Cassiar Packing Co. Ltd., 13140 Rice Mill Road, Richmond.
FJFC	Fjord Fishing Co., 228 East Esplanade Street, North Vancouver.
JSMF	J.S. McMillan Fisheries Ltd., 2199 Commissioner Street, Vancouver.
JSMR	J.S. McMillan Fisheries Ltd., 237 Cow Bay Road, Prince Rupert.
MIFL	Millerd Fisheries Ltd., 20 Orwell Drive, North Vancouver.
NSPL	North Sea Products Ltd., 1670 E. Kent Avenue, Vancouver.
OCFL	Ocean Fisheries Ltd., 2145 Commissioner Street, Vancouver.
PRFC	Prince Rupert Fisherman's Co-op, 2851 Commissioner Street, Vancouver.
PRFR	Prince Rupert Fisherman's Co-op, P.O. Box 520, Prince Rupert.
QFCL	Quality Fish Co. Ltd., 1350 E. Kent Avenue, Vancouver.
SCEL	Scanner Enterprises Ltd., 8305 - 128th Street, Surrey.
SFCL	Shearer Fish Co. Ltd., 9500 Alaska Way, Delta.
SPET	Spetifore, 6001 - 60th Avenue, Delta.
TOEL	Tonquin Enterprises Ltd., 2145 Commissioner Street, Vancouver.
WPFL	Westpine Fisheries Ltd., 8383 Crompton Road, Vancouver.

Appendix Table 2. List of identified vessels that participated in tagging trials.

ANDONIS
ALASKA QUEEN II
ANTE B
B C SAFARI
BERNICE C
BLIGH ISLAND
BOLD CONTENDER
BOLD PERFORMANCE
BRAVADO
C VENTURE NO. 1
CAAMANO SOUND
CAPE CAUTION
DUAL VENTURE
FISHER LASSIE II
FRANCISCAN NO. 1
HARBOUR PROVIDER
HEATHER RAE
KARA-MATT
KWAWKEWLTH PRODUCER
MAPLE RIDGE
MARY ROBERTA
NIKRAM
OCEAN AGGRESSOR
OCEAN CAVALIER
OCEAN DESTINY
OSPREY NO. 1
PACIFIC CHALLENGER
PACIFIC HARVESTER
PACIFIC JOYE
PACIFIC QUEST
PACIFIC RAIDER
PACIFIC ROVER
PROGRESSOR
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