Recovery of Tagged Fish from a Roe Processing Plant — A Pilot Study

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RECOVERY OF TAGGED FISH FROM A ROE PROCESSING PLANT--A PILOT STUDY

by

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ABSTRACT

Hay, D. E., and J. L. Mitchell. 1979. Recovery of tagged fish from a roe processing plant--a pilot study. Fish. Mar. Serv. MS. Rep. 1544: 16 p.

The frequency of tag recovery in a roe processing plant was estimated by experimentally tagging herring as they were unloaded from a packing barge. A total of 298 fish was tagged: 99 in the hold of the barge and 199 on a conveyer belt as they entered the plant. On entering the plant, the fish were first moved to freezing units for temporary storage (up to several weeks) prior to roe extraction. Two hundred and forty-nine tags (83.6%) were recovered during three phases of the processing operation: 58 (19.5%) were recovered prior to freezing; 91 (30.5%) during thawing; the remaining 100 (33.6%) during roe popping. There was no difference in the frequency of recovery between large and small fish. Recovery frequency was not different between fish tagged on the barge and those tagged on the conveyer belt.

Tag recovery frequency in this test probably is higher than that expected during future tagging programs but it is concluded that tag recovery from roe processing operations will be substantial. Recommendations about a reward system and procedures for handling recovered tags are suggested.

RÉSUMÉ

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Pour estimer la fréquence de récupération des marques dans une usine de traitement des oeufs de poisson, on a marqué expérimentalement le hareng au moment où il était débarqué de la barge de transport. Au total, 298 poissons ont été marqués: 99 dans la cale de la barge et 199 sur le tapis roulant au moment de l'entrée dans l'usine. Les poissons ont d'abord été transportés dans les unités de congélation pour être entreposés temporairement (jusqu'à quelques semaines) avant l'extraction des oeufs. Deux cent quarante-neuf marques (83,6%) ont été récuperees pendant les trois phases du traitement: 58 (19,5%) avant la congélation: 91 (30,5%) pendant la décogelation et 100 (33,6%) pendant l'extraction des oeufs. On n'a noté aucune différence dans la frequence de la récupération entre les gros poissons et les petits. Aucune différence non plus entre les poissons marqués dans la barge et les poissons marques sur le tapis roulant.

La fréquence de récupération notée au cours de ce test est probablement plus élevée que celle qu'on peut prévoir pour les programmes de marquage futurs, mais on conclut que les opérations de traitement des oeufs permettront de récupérer une proportion substantielle des marques. On recommande de mettre au point un système de récompenses et des procédures pour la manutention des marques récupérées.

INTRODUCTION

Pacific herring (Clupea harengus pallasi) are widely distributed along the Pacific coast of North America, from southern California to the Bering Sea (Hart 1973). Throughout their range, herring appear to constitute many different populations which differ by migratory habits, spawning locations and morphology (Taylor 1964).

Prior to 1970, most herring were fished by seines for reduction into meal. Large scale tagging programs, conducted during this fishery, used metal tags inserted into the abdominal cavity of fish. The tags were recovered electronically as the fish were processed for meal. Results of these studies provided insight into the distribution, offshore movements and interchange among herring stocks.

Since 1970, herring have been fished mainly for roe, and are taken in the spring by gillnets and seines immediately prior to spawning. Herring are also taken in the fall to produce a fillet for human consumption. This fall fishery, although small, may increase in size in the future. This fishery poses a problem for herring managers because it utilizes the same stocks of fish as the roe fishery and may concentrate, disproportionately, on a stock supporting a subsequent roe fishery. Resolving problems of stock identification and migration routes can be assisted by tagging studies.

In anticipation of future widespread tagging programs, preliminary studies were undertaken to investigate a suitable type of tags and recovery of tags in plants processing food fish (Hay et al. 1979) and tag retention and survival of live captive fish (study in progress). This paper reports on the results of an experiment designed to estimate recovery in a roe processing operation and comment on problems of reward systems for tags.

METHODS AND MATERIALS

TAGGING AND HANDLING OF FISH

On March 29, 1979, 298 orange fabric tags were applied to herring at the B.C. Packers plant in Steveston, B.C. The herring were unloaded from B.C. Packers barge No. 17, carrying 262 tons. The tags were 38 mm long and were inserted into the left side of the fish, immediately below the dorsal fin. The legend on each tag included a tag number, the word "Reward" and research agency: "Pac. Biol. Station, Nanaimo, B.C."

Ninety-nine fish were randomly chosen, and tagged in the hold of the barge, before they were pumped through a 10-inch wet pump to a conveyer belt. The remainder of the fish were tagged on the conveyer belt. Two groups of fish were tagged on the belt: a random sample of 99, and a sample of 100 small fish that were deliberately selected to compare tag retention and recovery between large and small specimens.

From the conveyer belt, which was about 50 m long, the fish entered the plant and dropped into totes in which they were weighed (Fig. 1). The totes were then transported to a plate freezer where the fish were frozen into 50 lb. blocks. The fish were spread thinly in each block making tag recovery more likely at this point than during previous handling. After about 80 minutes in the plate freezer, the blocks of fish were frozen. The blocks were then stacked on pallets and transferred to a freezer storage unit for about one week. The frozen blocks of fish were taken by fork lift to automatic thawing machines where each block was placed on a conveyer belt. Steam and hot water quickly thawed the fish. From the thawing conveyer, the fish were placed in totes, carried to automatic washers for rinsing, and then dropped onto conveyer belts and carried to the popping line. At this point, nearly every fish was individually handled as they were broken open for examination and roe extraction.

TAG RECOVERY AND REWARD

The recovery location, date and tag number were recorded for each recovered tag. A reward of $1.00 was offered for each tag, and plant personnel were informed of the presence of tags by a poster displayed in the plant. Representatives from the Dept. of Fisheries and Oceans collected the tags, and received frequent assistance from plant personnel.

RESULTS

Of the 298 tags used, 249 (83.6%) were recovered. There is no obvious difference in the recovery frequency according to the location of tag application (barge or conveyer belt--Table 1) or by fish size.

The number of tags recovered in each area of the plant can be estimated as a percentage of the total number of tags entering each area. Of the 298 tags which entered the plant 58 (23.3%) were recovered in the plate freezer. Of an estimated 240 tagged fish remaining, 91 (37.9%) were found during the thawing process. Of an estimated 149 tagged fish which were routed to the roe popping lines, 100 (67.1%) were recovered (Table 1). Calculated in this way, tag recovery is much higher during roe popping than in other locations. The fate of the tags not recovered is not certain, but it is likely that some were found but not turned in.

The date and location of each tag recovery is listed in the Appendix.

DISCUSSION

RATE OF TAG RECOVERY

This study demonstrates that substantial tag returns can be expected from tagged fish entering a roe processing plant. The actual rate or frequency of recovery determined in this study is subject to several sorts of bias, and the rate of recovery in this study is probably higher than would be expected for fish tagged alive at sea. The most significant difference is that in this study the tagged fish were much more concentrated than would be expected during a normal tagging study. Two hundred and ninety-eight tags released among 260 tons represents about one tagged fish for every 5,000 to 8,000 untagged fish (assuming 3 to 4 fish per pound). Under the likely circumstances of any future tagging studies, the frequency of tagged fish would be much lower. Because of this relatively high frequency of tagged fish, the processing plant staff were especially aware of their presence and may have been extraordinarily diligent about recovering them.

RECOMMENDATIONS FOR ENHANCING TAG RECOVERY

Although the rate of recovered tags was high, a few problems occurred in the retrieval of tags. Some plant employees remained unaware of the tagging experiment and inadvertently pocketed the tags for several days before giving them to Fisheries representatives. In other instances tags were given to foremen who forgot the names of the original finders. These cases do not seriously affect the interpretation of the results of this study but a continuation of problems like these could jeopardize the quality of information retrieved in a large scale tagging study. To reduce these problems we submit the following recommendations:

(1) personnel responsible for tag recovery in plants should have some kind of highly visible distinctive identification (hat, jacket, etc.) so that plant workers, particularly those on the roe processing lines, would know to whom they should give recovered tags.

(2) tag recovery envelopes should be printed so that, as tags are returned, the appropriate recovery information could be recorded on the outside of the envelope. Such a system would promote uniformity in the detail of recovery information among different plants. The appropriate information would include:

(i) date of recovery;
(ii) recovery location: plant;
area of plant;
(iii) lot number: packing plants often use distinct 'lot numbers' to distinguish among catches being unloaded from different vessels.
(iv) name, address and telephone number of finder.

Accurate records of this information, particularly tracing the name of the vessel from which the tag was recovered, will be vital to the success of any future tagging programs. This information would be pursued by Fisheries representatives on receipt of the envelopes.

To facilitate tag recovery during any future tagging study, representatives should make frequent visits to plants during the roe processing season and some jobs might be dedicated solely to the task of tag recovery.

Posters announcing a herring tagging program should be distributed to processing plants and fisheries offices.

The role of company participation and assistance in tag recovery will probably vary among firms. It is clear, however, that the handling systems vary considerably and the efficiency of tag returns will probably vary considerably and recovery systems might have to be developed and modified to suit individual plants.

REWARD SYSTEMS

The incentive of $1.00 per tag return proved useful during this study, and would be advantageous in any future studies. A problem with the reward systems, however, is the potentially laborious administration associated with payment. The use of an envelope system for tag storage and information recording would assist in the preparation of cheques for payment. Ideally any rewards should be paid as soon as possible, preferably on the spot. Alternately, some of the larger firms would probably be willing to assist the program by paying the reward directly and then being reimbursed by the department. Another possibility could involve a lottery system as an incentive for tag returns.

ACKNOWLEDGMENTS

Dr. A. S. Hourston suggested this tag recovery experiment and reviewed the manuscript. R. D. Humphreys, L. Webb and D. Chalmers assisted in the application of tags and provided suggestions concerning tag recovery procedures. Robin Garriok recovered the tags in the plant. We are grateful to Mr. D. Petrie, Manager of the B.C. Packers plant in Steveston, and many employees in the plant for their helpful cooperation during the study.

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Taylor, F. H. C. 1964. Life history and present status of British Columbia herring stocks. Fish. Res. Board. Can. Bull. 143: 81 p.

Table 1. Efficiency of tag recovery in different areas of the processing plant.

		Recovery Area			
		Plate Freezer	Thawing Process	Popping Lines	Total All Areas
Sample tagged in Barge hold:	no. entering area	99	77	56	99
	no. recovered	22	21	42	85
	% recovery	22.2%	27.3%	75%	85.8%
Sample tagged on Conveyer -random size	no. enter area	99	75	36	99
	no. recovered	24	39	22	85
	% recovery	24.2%	52.0%	61.1%	85.8%
Sample tagged on Conveyer -small size sample	no. entering area	100	88	57	100
	no. recovered	12	31	36	79
	% recovered	12%	35.2%	63.2%	79%
All samples	no. entering area	298	240	149	298
	no. recovered	58	91	100	249
	% recovered	23.3%	37.9%	67.1%	83.6%

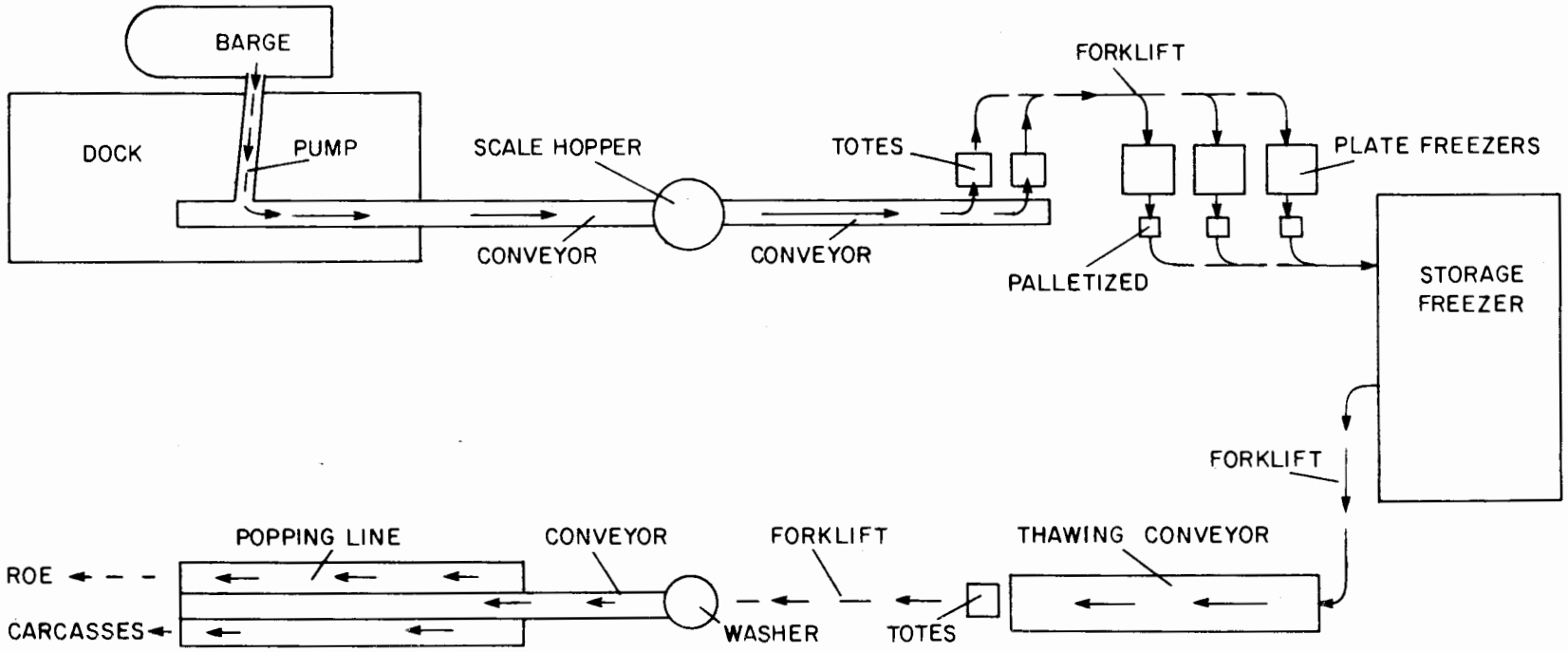

Fig. 1. Diagram showing the sequence of handling procedures for roe herring in the B.C. Packers' plant in Steveston.

Appendix Table 1A. Tag number, plant recovery area and recovery date of herring tagged in the hold of a barge at B.C. Packers, Steveston B.C., March 29, 1979.

Tag No.	Area received	Date received
A00001	Taken as a sample tag	
A00002		
A00003	Plate freezer	March 30, 1979
A00004	Popping line	April 11, 1979
A00005	Popping line	April 11, 1979
A00006	Popping line	April 11, 1979
A00007	Thawing totes	April 9, 1979
A00008	Plate freezer	March 30, 1979
A00009	Popping line	April 11, 1979
A00010	Popping line	April 11, 1979
A00011	Popping line	April 11, 1979
A00012	Popping line	April 11, 1979
A00013	Popping line	April 11, 1979
A00014	Popping line	April 10, 1979
A00015	Popping line	April 10, 1979
A00016		
A00017	Thawing tank	April 6, 1979
A00018	Popping line	April 10, 1979
A00019		
A00020		
A00021	Thawing Tank	April 11, 1979
A00022	Thawing tank	April 10, 1979
A00023	Thawing totes	April 9, 1979
A00024		
A00025	Plate freezer	April 2, 1979
A00026	Thawing tank	April 6, 1979
A00027	Thawing totes	April 9, 1979
A00028	Thawing tank	April 6, 1979
A00029	Thawing totes	April 9, 1979
A00030	Thawing totes	April 9, 1979
A00031	Popping tank	April 11, 1979
A00032	Popping tank	April 10, 1979
A00033	Popping tank	April 11, 1979
A00034		
A00035	Thawing tank	April 20, 1979
A00036	Plate freezer	March 30, 1979
A00037	Popping line	April 20, 1979
A00038	Plate freezer	March 30, 1979
A00039	Popping line	April 20, 1979
A00040	Plate freezer	March 30, 1979

Appendix Table 1A (cont'd)

Tag No.	Area received	Date received
A00041	Plate freezer	April 2, 1979
A00042	Plate freezer	April 2, 1979
A00043	Popping line	April 20, 1979
A00044	Plate freezer	April 2, 1979
A00045	Plate freezer	April 2, 1979
A00046	Plate freezer	April 2, 1979
A00047	Plate freezer	April 2, 1979
A00048		
A00049	Popping line	April 23, 1979
A00050	Popping line	April 23, 1979
A00051	Popping line	April 11, 1979
A00052	Popping line	April 20, 1979
A00053	Popping line	April 20, 1979
A00054	Popping line	April 20, 1979
A00055	Plate freezer	April 2, 1979
A00056	Popping line	April 10, 1979
A00057	Popping line	April 20, 1979
A00058	Popping line	April 10, 1979
A00059	Thawing totes	April 9, 1979
A00060	Plate freezer	March 30, 1979
A00061	Popping line	April 20, 1979
A00062	Thawing tank	April 10, 1979
A00063	Popping line	April 9, 1979
A00064	Thawing tank	April 6, 1979
A00065	Thawing tank	April 23, 1979
A00066	Popping line	April 9, 1979
A00067	Popping line	April 10, 1979
A00068	Popping line	April 20, 1979
A00069	Plate freezer	March 30, 1979
A00070	Thawing tank	April 6, 1979
A00071		
A00072		
A00073	Thawing tank	April 10, 1979
A00074		
A00075	Popping line	April 23, 1979
A00076	Plate freezer	March 30, 1979
A00077	Popping line	April 23, 1979
A00078		
A00079	Thawing tank	April 10, 1979
A00080	Plate freezer	March 30, 1979

Appendix Table 1A (cont'd)

Tag No.	Area received	Date received
A00081	Popping line	April 20, 1979
A00082	Popping line	April 23, 1979
A00083	Thawing tank	April 6, 1979
A00084		
A00085	Popping line	April 23, 1979
A00086	Popping line	April 10, 1979
A00087	Plate freezer	April 2, 1979
A00088	Plate freezer	April 2, 1979
A00089	Popping line	April 10, 1979
A00090		
A00091	Thawing line	April 6, 1979
A00092	Thawing tank	April 10, 1979
A00093	Popping line	April 10, 1979
A00094	Plate freezer	March 30, 1979
A00095		
A00096	Popping line	April 20, 1979
A00097	Popping line	April 20, 1979
A00098	Popping line	April 10, 1979
A00099	Plate freezer	April 2, 1979
A00100	Plate freezer	March 30, 1979

Appendix Table 1B. Tag number, plant recovery area and recovery date of a random size sample of herring tagged on the conveyer belt entering B.C. Packers, Steveston B.C., March 29, 1979.

Tag No.	Area received	Date received
A00101	Popping line	April 10, 1979
A00102	Popping line	April 10, 1979
A00103	Plate freezer	March 30, 1979
A00104	Thawing tank	April 6, 1979
A00105	Thawing tank	April 7, 1979
A00106	Plate freezer	March 30, 1979
A00107		
A00108	Plate freezer	April 2, 1979
A00109	Popping line	April 20, 1979
A00110	Plate freezer	March 30, 1979
A00111	Popping line	April 20, 1979
A00112	Popping line	April 20, 1979
A00113	Thawing tank	April 6, 1979
A00114		
A00115	Popping line	April 11, 1979
A00116	Thawing tank	April 6, 1979
A00117	Thawing tank	April 6, 1979
A00118	Thawing tank	April 6, 1979
A00119	Thawing totes	April 9, 1979
A00120	Plate freezer	April 2, 1979
A00121	Plate freezer	April 2, 1979
A00122	Popping line	April 11, 1979
A00123	Thawing tank	April 6, 1979
A00124	Plate freezer	April 2, 1979
A00125	Thawing tank	April 6, 1979
A00126	Popping line	April 11, 1979
A00127	Plate freezer	March 30, 1979
A00128	Plate freezer	March 30, 1979
A00129	Plate freezer	March 30, 1979
A00130	Popping line	April 10, 1979
A00131		
A00132	Popping line	April 10, 1979
A00133	Plate freezer	March 30, 1979
A00134		
A00135	Popping line	April 20, 1979
A00136		
A00137	Thawing tank	April 6, 1979
A00138		
A00139	Thawing totes	April 9, 1979
A00140	Plate freezer	April 2, 1979

Appendix Table 1B (cont'd)

Tag No.	Area received	Date received
A00141	Thawing totes	April 9, 1979
A00142		
A00143	Thawing totes	April 9, 1979
A00144	Thawing tank	April 6, 1979
A00145	Thawing tank	April 6, 1979
A00146		
A00147	Thawing tank	April 6, 1979
A00148	Thawing tank	April 6, 1979
A00149	Thawing totes	April 9, 1979
A00150	Popping line	April 10, 1979
A00151	Popping line	April 11, 1979
A00152	Plate freezer	March 30, 1979
A00153	Thawing tank	April 10, 1979
A00154	Thawing tank	April 6, 1979
A00155	Thawing totes	April 9, 1979
A00156	Thawing tank	April 10, 1979
A00157	Thawing tank	April 10, 1979
A00158		
A00159	Thawing tank	April 10, 1979
A00160	Thawing tank	April 10, 1979
A00161		
A00162	Thawing tank	April 6, 1979
A00163	Popping line	April 10, 1979
A00164	Plate freezer	April 2, 1979
A00165	Popping line	April 10, 1979
A00166	Thawing tank	April 6, 1979
A00167	Thawing tank	April 10, 1979
A00168	Popping line	April 10, 1979
A00169	Popping line	April 20, 1979
A00170	Popping line	April 20, 1979
A00171		
A00172	Thawing tank	April 10, 1979
A00173	Plate freezer	March 30, 1979
A00174	Plate freezer	March 30, 1979
A00175	Thawing tank	April 6, 1979
A00176	Plate freezer	March 30, 1979
A00177	Thawing tank	April 10, 1979
A00178	Plate freezer	March 30, 1979
A00179	Thawing tank	April 10, 1979
A00180	Thawing tank	April 10, 1979

Appendix Table 1B (cont'd)

Tag No.	Area received	Date received
A00181		
A00182	Thawing totes	April 9, 1979
A00183	R E T U R N E D U N U S E D	
A00184	Plate freezer	April 2, 1979
A00185		
A00186	Popping line	April 9, 1979
A00187		
A00188	Popping line	April 10, 1979
A00189	Thawing tank	April 10, 1979
A00190	Thawing tank	April 10, 1979
A00191	Plate freezer	March 30, 1979
A00192	Plate freezer	April 2, 1979
A00193	Plate freezer	March 30, 1979
A00194	Plate freezer	March 30, 1979
A00195	Plate freezer	March 30, 1979
A00196	Thawing tank	April 23, 1979
A00197	Popping line	April 10, 1979
A00198	Thawing tank	April 6, 1979
A00199	Popping line	April 20, 1979
A00200	Thawing tank	April 6, 1979

Appendix Table 1C. Tag number, plant recovery area and recovery date of a sample of small herring tagged on the conveyer belt entering B.C. Packers. Steveston B.C., March 29, 1979.

Tag No.	Area received	Date received
A00201	Popping line	April 11, 1979
A00202	Thawing tank	April 6, 1979
A00203	Thawing tank	April 6, 1979
A00204	Popping line	April 10, 1979
A00205	Plate freezer	April 2, 1979
A00206	Thawing tank	April 6, 1979
A00207	Popping line	April 20, 1979
A00208	Popping line	April 20, 1979
A00209	Plate freezer	March 30, 1979
A00210	Thawing tank	April 23, 1979
A00211	Popping line	April 23, 1979
A00212		
A00213		
A00214	Popping line	April 20, 1979
A00215	Plate freezer	April 2, 1979
A00216		
A00217	Thawing tank	April 6, 1979
A00218	Popping line	April 10, 1979
A00219		
A00220	Thawing totes	April 9, 1979
A00221		
A00222	Thawing totes	April 9, 1979
A00223		
A00224	Thawing totes	April 9, 1979
A00225	Popping line	April 10, 1979
A00226	Thawing tank	April 6, 1979
A00227	Thawing tank	April 10, 1979
A00228	Thawing totes	April 9, 1979
A00229	Thawing totes	April 9, 1979
A00230	Thawing totes	April 9, 1979
A00231	Thawing totes	April 9, 1979
A00232	Thawing totes	April 9, 1979
A00233	Thawing totes	April 9, 1979
A00234	Thawing totes	April 9, 1979
A00235	Thawing tank	April 6, 1979
A00236	Popping line	April 11, 1979
A00237	Popping line	April 11, 1979
A00238		
A00239	Thawing tank	April 10, 1979
A00240		

Appendix Table 1C (cont'd)

Tag No.	Area received	Date received
A00241	Thawing tank	April 6, 1979
A00242	Thawing tank	April 6, 1979
A00243		
A00244		
A00245	Popping line	April 23, 1979
A00246	Popping line	April 20, 1979
A00247		
A00248	Popping line	April 23, 1979
A00249	Popping line	April 20, 1979
A00250	Popping line	April 23, 1979
A00251		
A00252		
A00253		
A00254		
A00255	Thawing totes	April 9, 1979
A00256	Popping line	April 10, 1979
A00257		
A00258	Thawing tank	April 6, 1979
A00259	Popping line	April 11, 1979
A00260	Thawing tank	April 6, 1979
A00261	Popping line	April 11, 1979
A00262	Plate freezer	March 30, 1979
A00263		
A00264	Popping line	April 20, 1979
A00265		
A00266	Popping line	April 23, 1979
A00267	Popping line	April 23, 1979
A00268	Plate freezer	April 2, 1979
A00269	Popping line	April 23, 1979
A00270	Popping line	April 23, 1979
A00271	Popping line	April 20, 1979
A00272	Plate freezer	March 30, 1979
A00273		
A00274	Thawing totes	April 9, 1979
A00275	Thawing totes	April 9, 1979
A00276	Plate freezer	March 30, 1979
A00277	Plate freezer	March 30, 1979
A00278	Plate freezer	March 30, 1979
A00279	Popping line	April 20, 1979
A00280	Thawing tank	April 6, 1979

Appendix Table 1C (cont'd)

Tag No.	Area received	Date received
A00281	Popping line	April 11, 1979
A00282		
A00283	Thawing tank	April 10, 1979
A00284	Thawing totes	April 9, 1979
A00285	Popping line	April 11, 1979
A00286	Thawing tank	April 10, 1979
A00287	Thawing tank	April 10, 1979
A00288		
A00289	Plate freezer	April 2, 1979
A00290	Popping line	April 11, 1979
A00291	Popping line	April 9, 1979
A00292	Popping line	April 20, 1979
A00293	Plate freezer	March 30, 1979
A00294	Popping line	April 20, 1979
A00295	Popping line	April 23, 1979
A00296	Plate freezer	March 30, 1979
A00297	Popping line	April 10, 1979
A00298	Popping line	April 10, 1979
A00299	Popping line	April 11, 1979
A00300	Popping line	April 11, 1979