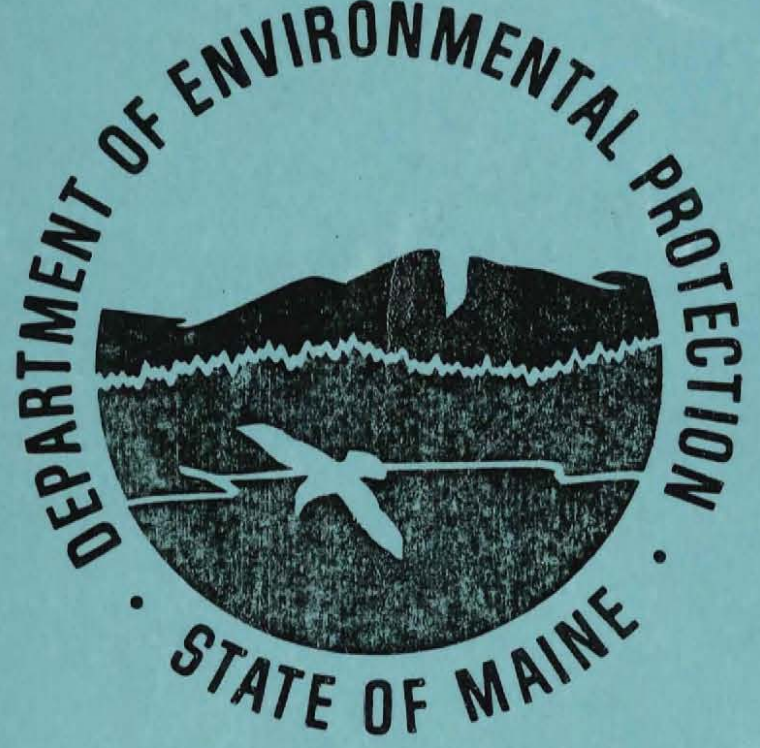
REPORT ON THE

MAINE SARDINE INDUSTRY

AS REQUIRED UNDER

38 MRSA Chapter 3 Section 455



BUREAU OF WATER QUALITY CONTROL

Division of Licensing and Enforcement

March 28,1984

STATE OF MAINE

Department of Environmental Protection

MAIN OFFICE: RAY BUILDING, HOSPITAL STREET, AUGUSTA
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JOSEPH E. BRENNAN
GOVERNOR

HENRY E. WARREN
COMMISSIONER

March 28, 1984

Senator Carroll E. Minkowsky, Chairman
Representative Nathaniel T. Crowley, Chairman
Joint Standing Committee on Marine Resources
State House
Augusta, Maine 04333

Dear Senator Minkowsky and Representative Crowley:

The Department of Environmental Protection respectfully submits this report on the Maine Sardine Industry as required under 38 M.R.S.A., Chapter 3, Section 455(3). Results of the recently completed, two-year, cooperative study concerning sardine processing wastewater are contained in this report.

I would like to thank Jim Warren and Rachel Rosa of the Maine Sardine Council for their assistance throughout the study. I would especially like to thank the managers of each of the 13 packing plants. Their helpfulness and cooperation during the D.E.P.'s 1983 active sampling work was greatly appreciated.

Please feel free to contact me should you have any questions or comments.

Sincerely,

HENRY E. WARREN
Commissioner
Department of Environmental Protection

HEW/KLN/w

Enclosure

REGIONAL OFFICES
• Portland • • Bangor • • Presque Isle •

TABLE OF CONTENTS

1. SUMMARY

As a result of legislation enacted in January of 1982, the Department of Environmental Protection (D.E.P.), in cooperation with the Maine Sardine Industry, was required to conduct a study of the industry's wastewater.

The primary objectives of this study were to intensively monitor sardine processing effluent pollutant levels and to determine best practicable control technology currently available (BPT) for the industry. The Environmental Protection Agency (E.P.A.), the D.E.P. and the sardine industry agreed that the oil and grease content of the effluent would be the parameter most closely examined during the study. Subsequently, the D.E.P., with guidance from the E.P.A. and in cooperation with the industry, developed an effluent sampling program. This program ultimately produced 246 sardine processing and 43 steak processing results for oil and grease concentrations during the 1982 and 1983 packing seasons.

After performing, several statistical analyses on these numbers, the results were applied to the appropriate EPA effluent guideline development formulas. Based on these formulas, the following oil and grease effluent limitation loadings (expressed in pounds of oil and grease discharged per thousand pounds of raw fish processed) for sardine processing wastewater were calculated (see page 7):

DAILY MAXIMUM = 17.34 lbs/1000
30-DAY AVERAGE = 10.06 lbs/1000

The Environmental Protection Agency's current BPT effluent guideline limitation numbers for oil and grease for the Sardine Processing (wet conveyance) subcategory are as follows:

DAILY MAXIMUM = 6.30
30-DAY AVERAGE = 2.80

A wet conveyance plant is defined by the E.P.A. as any sardine processing facility which utilizes wet transportation systems (e.g., flumes) from the fish storage area to the fish processing area. According to this definition, two out of thirteen sardine plants currently employ dry conveyance.

It should be noted that the sardine processing effluent limitation numbers from the two-year study are significantly higher than the E.P.A.'s existing BPT effluent limitation numbers. Because of this, the sardine industry, through the Maine Sardine Council, will petition the E.P.A. to modify their (E.P.A.'s) existing oil and grease effluent guideline numbers for the sardine processing subcategory. The petition will request that the E.P.A. adopt the effluent guideline numbers, that have been developed from the data obtained during the DEP/Industry, two-year study, as the BPT effluent guideline limitation numbers for the sardine processing subcategory. Because of these results, the D.E.P. feels that BPT for the sardine industry should continue to consist of 30 mesh screening, oil and water separators and prudent housekeeping practices. It should also be noted that Maine's thirteen sardine plants are the only facilities in the United States which are in the Sardine Processing subcategory.

There are currently no federal BPT effluent guidelines for herring steak processing. Therefore, the Maine Sardine Council will also petition the EPA to adopt a BPT effluent guideline limitation number for steaking based upon the 43 steak processing sampling results obtained from the two-year study.

The Maine Sardine Council and the D.E.P. have, together, scrutinized both the sardine data and steak data obtained from the two-year study. It is the D.E.P.'s intention to support the study data that was used to develop the recommended BPT effluent guideline limitation numbers. Therefore, the D.E.P. supports the Maine Sardine Council in its petition to modify the existing federal oil and grease effluent guidelines for the sardine industry. It is our understanding that the Maine Sardine Council, a state agency, will be the primary petitioner and will be assisted in all phases of the petition presentation by the D.E.P.

Should problems occur concerning water quality (floating scum, foam, solids, etc.) and/or license conditions (discharges in excess of license limitations) it is the intention of the D.E.P. to initially work with each sardine plant to obtain voluntary solutions to these problems. Throughout the two-year study, the D.E.P. and the industry have maintained a high level of cooperation. Provided this effort is continued in the coming years, the D.E.P. should not have any difficulty obtaining voluntary solutions to potential water quality and license limitation problems.

2. INTRODUCTION

2.1 Background

In 1980, the D.E.P. proposed to reduce the allowable oil and grease concentration from 300 mg/l on each sardine plant's waste discharge license. This proposed reduction was in response to complaints received by the D.E.P. concerning the floating scum and foam problem caused by sardine plant discharges.

The D.E.P. believed that this reduction in the allowable concentration of oil and grease would prevent the formation of floating scum and foam. At the same time, however, the sardine industry was extremely concerned about the costs of the additional treatment needed to achieve a reduced level of oil and grease.

As a result of these issues, in January of 1982, emergency legislation was passed requiring the evaluation and development of both effluent guidelines and control technologies for the treatment of sardine processing wastewater. Such legislation (38 M.R.S.A., Chapter 3 Section 455) required that a study of the Maine Sardine industry's wastewater discharges be conducted by the Commissioner of the Department of Environmental Protection in cooperation with the sardine industry. In the spring of 1982, interim waste discharge licenses were issued to all the sardine plants with the condition that the findings of the study be incorporated into the licenses at the conclusion of the study. The D.E.P. granted licenses to all the plants because it was shown that each plant treated its wastewater through the use of screens, oil and water separators and "good housekeeping" practices. The legislation required that a report of the study be submitted to the Legislature by January 15, 1984. However, because of problems encountered with the Environmental Protection Agency in Washington, D.C., it became impossible to complete a study report, prior to January 15, which contained conclusive findings and recommendations for the legislatuare to consider. Therefore, upon the request of the Maine Sardine Council and the D.E.P., the Legislature extended the final report deadline to April 11, 1984.

2.2 Objectives

The Legislature outlined the following objectives of the study:

1. Initiation of a program to ensure quality control of industry monitoring data;

2. Consideration of other data necessary to establish effluent standards;

3. Consideration of current or proposed federal categorization and effluent limitations for the sardine industry and their relation to practices in Maine; and

4. Determination of best practicable control technology currently available for the sardine industry, including the performance and availability of control technology, the economic impact of the implementation of this technology and any other issues deemed relevant.

3. PROCEDURES

During the first year of the study the D.E.P. established an industry-wide, standardized program for collecting sardine effluent data in an accurate, consistent and practical fashion. Beginning on August 1, 1982, effluent data for the 1982 processing season was obtained by each of the 13 sardine plants using this standardized program. The program was continued by both the industry and D.E.P. throughout the 1983 processing season. The D.E.P. reviewed the program with each plant prior to the beginning of the season. The program consisted of three standardized procedures: 1) sampling; 2) laboratory analysis; and 3) reporting of data.

3.1 Sampling

During the 1982 and 1983 packing season each sardine plant took samples of their effluent for determination of oil and grease content and total suspended solids. All the plants were shown the standard way of collecting, containing and preserving their effluent samples. They were also asked to sample one day out of every five operating days. On the sample day they were to take five, evenly spaced, grab samples during packing and clean-up. It was agreed that samples would be consistently taken at designated locations in each plant. The sampling procedures were periodically reviewed by the E.P.A.'s Region I office in Boston.

3.2 Laboratory Analysis

For the purposes of this study, the sardine industry felt that the E.P.A.'s approved Standard Method of analyzing for oil and grease content was too time consuming and expensive. The D.E.P.. therefore developed a slightly modified version of the Standard Method which has proved to be quicker, less expensive and essentially just as accurate as the Standard Method. Our modified method was approved by the E.P.A.'s laboratory headquarters in Cincinnati, Ohio in March 1983.

During the 1982 and 1983 processing seasons there were three commercial labs doing the total suspended solids and oil and grease analysis for the sardine packers. They were: National Sea Products lab in Rockland, Belfast Technical Services Laboratory in Belfast; and the University of Maine at Machias lab in Machias. Samples obtained by the D.E.P. staff during the 1983 packing season were analyzed by the D.E.P. lab in Augusta. Cooperation from all the labs was extremely good as was the reliability of their results.

In an attempt to check the reliability of their analytical work, the labs were asked to analyze quality control check samples on two separate occasions during the 1983 packing season. This work yielded satisfactory results.

3.3 Reporting of Data

The D.E.P. developed and distributed monitoring and sampling forms which standardized the procedure for compiling and documenting the effluent data from each plant. Beginning in August, 1982 and at the end of each operating month during the 1982 and 1983 processing seasons, each packing plant submitted the following information:

1. Copies of the daily sampling sheets;

2. Copies of the lab reports with analysis results;

3. A copy of the monthly report of overboard screened effluent; and

4. The discharge monitoring report forms which are sent to the plants by mail. These are computer forms which must be filled out in accordance with their waste discharge license.

This information included such items as sample bottle number, time sample taken, total gallons of effluent discharged, suspended solids concentration, oil and grease concentration, amount of raw fish processed, duration of operation, species processed, type of process (fillets, steaks, whole fish, etc.) and special remarks (such as size or fattiness of fish, breakdown in machinery, brine tank holding time , etc.). From this information, we could calculate pounds of oil and grease per thousand pounds of live weight of fish processed, also known as "the oil and grease number." The importance of this calculation is obvious since the oil and grease number is the primary figure that we are concerned with in this study. This information also helped us to see if all the packing plants were following the same standard procedures, thereby ensuring quality control of industry monitoring data. The data enabled us to discover any relationships or trends that might exist between oil and grease concentrations and various processing practices, e.g., frequency of pumping, size of fish processed, use of saltwater or freshwater in the plant, effects of suspended solids on wastewater discharges.

Each plant's data has been carefully scrutinized for accuracy by both the Maine Sardine Council and the D.E.P.

Essentially all of the D.E.P.'s work throughout the two-year study was done in consultation with the Maine Sardine Council. During the past two packing seasons, frequent meetings were held with the Council and the Sardine Wastewater Committee to keep the industry informed of the D.E.P.'s progress and to get feedback and comments from the industry.

4. RESULTS AND DISCUSSION

From August 1, 1982 to October 31, 1983, 246 verifiable sardine processing wastewater samples were analyzed for oil and grease content. Fifty of these samples were obtained by the D.E.P. staff during the 1983 packing season. More important than the actual results, however, was the fact that the Department had the opportunity to observe the operation of each sardine plant during a typical packing day. While at the plant the staff was able to note the following:

1) the characteristics of the fish being processed (size, fattiness, amount of waste, etc.);

2) the condition and effectiveness of the screens and oil/water separators;

3) the plant's effort at "good housekeeping"; and

4) the condition of the receiving water around the outfall.

These observations assisted us in determining the effects of sardine processing wastewater on water quality.

After each of the 246 sardine sampling results was scrutinized, they were grouped and then analyzed statistically to determine whether or not there was any significant difference between the groups. The results were grouped as follows:

1) results from 1982 vs. results from 1983

2) results from industry vs. results from D.E.P.

3) results from dry conveyance plants vs. results from other than dry conveyance plants (wet conveyance)

4) results from plants using DAF vs. plants not using DAF (DAF = Dissolved Air Flotation)

5) results from plants discharging to a POTW vs. results from plants not discharging to a POTW.

It should be noted that DAF is treatment used in addition to screens, oil and water separators and good housekeeping practices. Also, five plants discharge the underflow from their oil and water separators to the local POTW (Publicly Owned Treatment Works, i.e., sewerage treatment plant).

It was found that in <u>all</u> pairings there was no statistical significant difference between the groups. According to statistical principles, significant differences are based strictly upon probability and chance. A complete explanation of this concept is beyond the scope of this report. Therefore, <u>all</u> the numbers were used in generating one sardine processing effluent guideline limitation number for the sardine industry.

4.1 Effluent Guideline Development Formulas

Based on the individual plant data contained in Appendix A, the following E.P.A. formulas were used to develop the industry's recommended effluent guideline limitation numbers. These are the same formulas that were used by the E.P.A. in the mid-1970's to develop the original effluent guidelines for the sardine industry. However, it should be noted that the 30 day average is based upon a sampling frequency of 2 samples/month; n = 2 (see Appendix B)*. Prior to their utilization, the formulas were reviewed with guidance from E.P.A.'s Region I office in Boston and their Effluent Guidelines Division in Washington, D.C. The formulas are as follows:

I. Log-Normal Formulas For The Subcategory Mean And Standard Deviation (From Page 279 of September, 1975 Seafood Development Document)

$$\ln \mu_S = \frac{\sum_{i=1}^{N} \left(\frac{n_i}{\ln\left(\frac{\sigma_i^2}{\mu_i^2}+1\right)} \right) \left(\ln \mu_i - \frac{1}{2} \ln\left(\frac{\sigma_i^2}{\mu_i^2}+1\right) \right)}{\sum_{i=1}^{N} \frac{n_i}{\ln\left(\frac{\sigma_i^2}{\mu_i^2}+1\right)}} = 0.9956$$

$$\ln \sigma_S = \left[\frac{\sum_{i=1}^{N} (n_i - 1) \ln\left(\frac{\sigma_i^2}{\mu_i^2}+1\right)}{\sum_{i=1}^{N} (n_i - 1)} \right]^{1/2} = 0.7972$$

Where $\ln \mu_S$ and $\ln \sigma_S$ are the parameter log-normal mean and standard deviation respectively; N is the total number of plants samples; n_i is the number of parameter samples of plant i; and μ_i and σ_i are the parameter mean and standard deviation of plant i.

II. Daily Maximum And Maximum 30 Day Average Formulas Based on Log-Normal Summary Data (From Page 376 of September, 1975 Seafood Development Document)

$$\text{Daily Maximum} = e^{\ln \mu_S + Z \ln \sigma_S + \ln R}$$

$$= e^{0.9956 + 1.8575 + 0}$$

$$= \underline{17.34} \text{ lbs } 0\text{i}\text{l}\text{&}\text{G}/1000 \text{ lbs. fish processed}$$

$$\text{Maximum 30-Day Avg.} = e^{\ln \mu_S + \frac{1}{\sqrt{n}} Z \ln \sigma_S + \ln R}$$

$$= e^{0.9956 + 1.3134 + 0}$$

$$= \underline{10.06} \text{ lbs } 0\text{i}\text{l}\text{&}\text{G}/1000 \text{ lbs fish processed}$$

Where $\ln \mu_S$ and $\ln \sigma_S$ are the log-normal subcategory mean and standard deviation, respectively; R is the percent of the pollutant parameter remaining after treatment (100%); Z is a constant set equal to 2.33 corresponding to the upper 99 percent confidence interval; and n is an assumed sampling frequency of 9 samples per month.

*The D.E.P. and the industry, together sampled approximately two times per month over the last two processing seasons. However, the E.P.A. has advised that for initial comparative review purposes a sample frequency of nine will be used regardless of how many times per month we actually sampled during the study. The 30 day average number based upon nine samples per month is much lower (more stringent) than the 30 day average number based on two samples per month. The sardine industry cannot accept the former as they feel that they will be in violation of the 30 day average a large percentage of the time based on the results of the last two years of sampling.

4.2 Water Quality

During the 1983 packing season, the D.E.P. staff observed at least one occurrence of floating scum or foam at 9 out of the 13 (approximately 70%) packing plants. Throughout the past packing season, there has been only one active complaint concerning the discharge from a sardine plant. This involves the Stinson Canning Company plant in Belfast which is located to the north and uptide from the Belfast Boatyard. The owner of the boatyard claims that the discharge from the plant contains greasy, stringy, scum which coats the hulls and mooring lines of the boats anchored at his boatyard.

Based upon our observations and sampling results from the 1983 season, it appears that the following three factors exert the most influence over whether or not sardine plant discharges result in floating scum or foam on the surface of the receiving water:

1) location of the outfall - generally, the greater the depth of water over the outfall the lesser the chance of foam or scum reaching the surface of the receiving water.

2) dilution ability of the receiving waters - generally, the swifter the tide or current of the receiving water, the lesser the chance of foam or scum reaching the surface of the receiving water.

3) discharge flow - generally, the greater the discharge flow, the greater the possibility of foam or scum reaching the surface of the receiving water.

Given the fact that all sardine plant wastewater discharges contain some level of oil and grease, it appears that these three factors, individually or in combination, exert the most influence over the presence or absence of floating scum or foam on the receiving water.

4.3 Dissolved Air Flotation (DAF)

During the 1983 processing season, three sardine plants employed additional wastewater treatment in the form of dissolved air flotation (DAF). However, these systems were occasionally operated as simple gravity separators rather than dissolved air units. Regardless of their mode of operation, these systems did not produce an effluent with oil and grease levels consistently lower than those plants with conventional treatment. In addition to this, the use of these systems did not necessarily prevent occurrences of floating scum or foam.

However, due to the large amounts of sludge generated from these D.A.F. systems, it is evident that they have been successful in removing significant quantities of scum and solids from sardine processing wastewater.

The use of DAF can be quite costly. There are three major costs associated with the use of DAF as a means of treating sardine wastewater. They are:

1) purchase and installation

2) operation and maintenance of the system

3) sludge disposal at an acceptable site

4.4 D.E.P.'s Study Costs

The following is a breakdown of the costs incurred by the D.E.P. during the study period from January 15, 1982 to March 28, 1984:

-Automobile costs = $ 1,700.00
-Personnel costs = $38,400.00
-Lodging and meals costs = $550.00
-Sampling and laboratory equipment costs = $415.00

TOTAL COSTS = $41,065.00

5. CONCLUSIONS AND RECOMMENDATIONS

The following conclusions and recommendations can be made based on the results of the D.E.P./Industry two-year study.

5.1 Dissolved Air Flotation

Based on its inconclusive past performance and potentially high costs of purchase, installation, operation, maintenance and sludge disposal, dissolved air flotation, as a means of treating sardine wastewater, should not be an industry-wide requirement. However, given financial capability and prudent operation and maintenance, it is believed that DAF may be an effective and economical long term solution to resolving, both water quality problems and problems involving discharges in excess of license limitations.

5.2 Water Quality

High levels of oil and grease in sardine wastewater effluent do not necessarily result in floating scum or foam on the receiving water. On the other hand, low levels of oil and grease in the effluent do not necessarily mean that there won't be floating scum or foam on the receiving water. Possible solutions to this water quality problem are:

1) reduce in-plant water usage and subsequent discharge as much as possible;

2) improve efforts at prudent operation and maintenance of screens, oil and water separators and DAF units (if applicable);

3) initiate more prudent "housekeeping" techniques; and

4) relocate and secure the discharge pipe outfall in deeper water with greater mixing action.

However, at those sardine plants which regularly experience water quality problems, additional wastewater treatment may be necessary.

5.3 Best Practicable Treatment (BPT)

Best practicable control technology currently available for the sardine processing subcategory should consist of the following:

1) prudent housekeeping and management practices and efficient operation of all pollution control technology;

2) screening of all process wastewaters except retort water by means of a 30 mesh screen; and

3) separation of oil from steam box cook water by means of a gravity oil separator.

In conclusion, the results of the two-year study have yielded BPT effluent guideline limitation numbers for sardine processing with the following values:

DAILY MAXIMUM = 17.34 lbs/1000
30-DAY AVERAGE = 10.06 lbs/1000

From August 1, 1982 to October 31, 1983, 43 verifiable steak processing wastewater samples were analyzed for oil and grease content. There was shown to be a statistically significant difference between those results from dry conveyance plants and those from other than dry conveyance (wet) plants. As previously mentioned, significant differences are based strictly upon probability and chance. Using the E.P.A.'s effluent guideline development formulas the following results were obtained:

All Plants	Dry Conveyance Plants	Wet Conveyance Plants
DAILY MAXIMUM = 39.16	DAILY MAXIMUM = 26.20	DAILY MAXIMUM = 40.77
30-DAY AVERAGE = 29.92	30-DAY AVERAGE = 16.94	30-DAY AVERAGE = 29.12

The Maine Sardine Council intends to petition the E.P.A. to adopt these numbers as the BPT numbers for the sardine processing subcategory. The D.E.P. supports the data from the study used in developing these numbers. The Department feels that these numbers are representative of BPT for the sardine industry and should be promulgated as such. It is our understanding that the Maine Sardine Council, a state agency, will be the primary petitioner and will be assisted in all phases of the petition presentation by the D.E.P.

APPENDIX A

INDIVIDUAL PLANT DATA

SARDINE PROCESSING
OIL AND GREASE EFFLUENT DATA

COMPANY

1. BOOTH FISHERIES, LUBEC

DATE	lbs/1000	mg/1	FLOW(MGD)	TONS PROCESSED	HOURS PACKED
08-02-82	2.30	202	.07730	28.0	9.0
08-09-82	4.30	365	.11340	40.0	9.0
08-23-82	6.90	679	.11520	47.0	9.0
08-25-82	1.90	163	.13660	49.0	9.0
08-31-82	5.90	636	.104500	47.0	9.0
09-07-82	7.67	647	.11680	41.1	9.0
09-13-82	2.90	266	.13210	50.0	9.5
09-20-82	7.56	709	.11070	43.3	8.0
09-27-82	3.25	162	.10660	22.2	9.0
10-04-82	1.80	160	.06290	23.3	7.0
10-11-82	1.36	117	.08540	30.5	7.0
06-08-83	1.33	76	.08580	20.5	6.5
07-11-83	3.09	190	.08020	20.6	7.0
07-26-83	1.70	142	.03020	10.6	3.0
08-11-83	3.00	296	.14310	58.3	7.5
08-17-83	2.30	188	.06500	22.2	5.5
09-06-83	5.40	472	.09290	33.9	6.5
09-13-83	3.80	523	.011020	63.9	8.5
10-01-83	4.61	402	.06110	22.2	4.5
10-04-83	5.76	773	.09930	55.6	8.0
10-11-83	1.46	169	.08030	38.9	7.0
10-18-83	2.94	226	.12140	38.9	8.5
09-06-**	19.40	1700	.09200	33.9	6.5
10-05-**	5.22	710	.09700	55.0	7.5
10-27-**	5.94	750	.10150	57.8	9.0

MEAN = 4.47

STANDARD DEVIATION = 3.69

NUMBER OF SAMPLES = 25

** = DEP SAMPLE POINT, 1983

SARDINE PROCESSING
OIL AND GREASE EFFLUENT DATA

COMPANY

2. JASPER WYMAN, MILBRIDGE

DATE	lbs/1000	mg/l	FLOW(MGD)	TONS PROCESSED	HOURS PACKED
08-16-82	.34	28	.02400	8.2	8.0
08-31-82	3.20	219	.02150	6.2	8.0
09-13-82	1.70	240	.01357	8.0	8.0
09-27-82	2.90	290	.02889	12.3	8.0
10-18-82	.67	91	.02169	12.2	8.0
10-25-82	2.40	307	.02251	12.2	8.0
08-15-83	.14	158	.00244	11.6	8.0
08-17-83	.12	148	.00263	13.4	8.0
10-19-83	.48	38	.00880	2.9	4.0
08-16-**	.33	310	.00250	9.8	7.0
08-24-**	.16	160	.00185	7.9	6.0
10-04-**	6.95	670	.02750	11.0	8.5
10-24-**	1.30	210	.02312	15.6	8.0

MEAN = 1.82

STANDARD DEVIATION = 2.11

NUMBER OF SAMPLES = 15

** = DEP SAMPLE POINT, 1983

SARDINE PROCESSING
OIL AND GREASE EFFLUENT DATA

COMPANY

3. L. RAY PACKING, MILBRIDGE

DATE	lbs/1000	mg/l	FLOW(MGD)	TONS PROCESSED	HOURS PACKED
08-16-82	.32	29	.06800	26.0	8.5
08-30-82	3.50	422	.07000	35.0	8.5
09-07-82	3.40	409	.07000	35.0	8.5
09-13-82	2.70	316	.07000	34.0	8.5
09-22-82	1.50	123	.06000	20.0	7.5
09-28-82	2.95	323	.07000	32.0	8.5
10-11-82	1.99	164	.07000	24.0	8.5
10-18-82	2.30	188	.07600	26.0	9.5
10-25-82	1.96	183	.07200	28.0	9.0
08-01-83	1.60	254	.05300	35.0	10.0
08-24-83	1.60	304	.04400	36.0	9.0
10-10-83	1.64	197	.04800	24.0	7.0
10-20-83	.86	54	.03800	10.0	10.0
10-24-83	1.76	182	.05800	25.0	12.0
08-24-**	2.50	480	.04400	36.0	9.0
10-04-**	1.28	160	.04800	25.0	9.0
10-20-**	.32	20	.03800	10.0	10.0
10-24-**	4.80	500	.05800	25.0	12.0

MEAN = 2.05

STANDARD DEVIATION = 1.14

NUMBER OF SAMPLES = 18

** = DEP SAMPLE POINT, 1983

SARDINE PROCESSING
OIL AND GREASE EFFLUENT DATA

COMPANY

4. MACHIASPORT PACKING, MACHIASPORT

DATE	lbs/1000	mg/l	FLOW(MGD)	TONS PROCESSED	HOURS PACKED
08-16-82	.26	21	.07300	25.0	8.2
08-23-82	.44	41	.07200	28.0	8.0
08-27-82	1.70	151	.07000	26.0	7.7
08-31-82	2.02	167	.08100	28.0	9.0
09-01-82	2.40	252	.08100	35.0	9.0
09-16-82	2.43	201	.05800	20.0	6.5
09-22-82	2.60	293	.06900	32.0	7.5
09-27-82	.48	42	.07600	28.0	8.5
10-06-82	2.26	190	.06000	21.0	6.5
10-13-82	3.04	263	.05000	18.0	5.5
10-28-82	1.80	160	.08100	30.0	9.0
11-02-82	2.40	204	.07700	27.0	8.5
08-11-83	6.40	521	.08500	29.0	7.0
08-23-83	3.40	297	.09500	35.0	9.0
10-04-83	2.40	144	.10000	25.0	8.0
10-12-83	1.84	120	.12500	34.0	11.0
10-20-83	2.29	65	.11000	13.0	10.0
10-27-83	2.12	118	.12500	29.0	11.0
08-23-**	4.90	430	.09500	35.0	9.0
09-30-**	2.00	110	.11500	27.0	9.0
10-17-**	2.46	150	.11000	28.0	8.5

MEAN = 2.36

STANDARD DEVIATION = 1.37

NUMBER OF SAMPLES = 21

** = DEP SAMPLE POINT, 1983

SARDINE PROCESSING
OIL AND GREASE EFFLUENT DATA

COMPANY

5. NORTH LUBEC CANNING AND MANUFACTURING, ROCKLAND

DATE	lbs/1000	mg/l	FLOW(MGD)	TONS PROCESSED	HOURS PACKED
09-14-83	1.20	105	.08317	30.6	0.0
09-20-83	.60	74	.08992	44.1	0.0
09-30-83	1.00	62	.10228	26.3	0.0
10-03-83	.61	29	.08325	16.5	0.0
10-11-83	.33	22	.08100	22.7	0.0
10-20-83	.20	13	.07537	20.8	0.0
07-27-**	1.70	170	.08190	35.0	0.0
08-10-**	4.86	440	.08100	30.6	0.0
08-22-**	.24	20	.08212	28.8	0.0
08-30-**	1.63	100	.09112	23.3	0.0
09-09-**	1.00	90	.08430	30.6	0.0
09-20-**	.60	70	.08992	44.1	0.0
10-03-**	.84	40	.08325	16.5	0.0
10-11-**	.45	30	.08100	22.7	0.0
10-21-**	.39	20	.08550	18.4	0.0

MEAN = 1.04

STANDARD DEVIATION = 1.15

NUMBER OF SAMPLES = 15

** = DEP SAMPLE POINT, 1983

SARDINE PROCESSING
OIL AND GREASE EFFLUENT DATA

COMPANY

6. R.J. PEACOCK, LUBEC

DATE	lbs/1000	mg/l	FLOW(MGD)	TONS PROCESSED	HOURS PACKED
08-23-82	3.30	143	.13090	23.8	8.0
08-31-82	11.20	454	.13050	21.9	8.0
09-08-82	1.60	128	.06680	22.3	8.0
09-28-82	7.17	313	.13620	24.8	7.5
10-13-82	1.38	53	.15490	24.8	5.5
08-15-83	1.97	65	.21770	30.0	6.5
08-25-83	13.30	272	.13250	11.3	3.5
10-05-**	7.60	320	.18550	32.5	7.0
10-06-**	12.50	470	.11950	18.7	2.5
10-27-**	9.60	430	.23430	43.7	8.5

MEAN = 6.96

STANDARD DEVIATION = 4.65

NUMBER OF SAMPLES = 10

** = DEP SAMPLE POINT, 1983

SARDINE PROCESSING
OIL AND GREASE EFFLUENT DATA

COMPANY

7. PORT CLYDE FOODS, INC., EASTPORT

DATE	lbs/1000	mg/l	FLOW(MGD)	TONS PROCESSED	HOURS PACKED
08-11-83	1.70	68	.18495	31.2	4.7
08-22-83	2.90	139	.24845	49.6	7.0
08-29-83	3.80	171	.23510	44.7	7.0
09-07-83	5.00	280	.28280	65.5	8.0
09-16-83	8.60	403	.20025	39.2	6.0
09-21-83	1.70	148	.11340	41.0	6.0
09-29-83	3.50	179	.24018	51.4	9.0
10-08-83	4.53	179	.15990	26.3	6.7
10-12-83	2.09	130	.21510	55.7	7.7
10-21-83	5.35	216	.19645	33.0	6.0
09-07-**	11.30	630	.28280	65.5	8.0
09-29-**	2.10	110	.24018	51.5	9.0
10-12-**	3.06	190	.21510	55.7	7.7

MEAN = 4.28

STANDARD DEVIATION = 2.84

NUMBER OF SAMPLES = 13

** = DEP SAMPLE POINT, 1983

SARDINE PROCESSING
OIL AND GREASE EFFLUENT DATA

COMPANY

8. PORT CLYDE FOODS, INC., STONINGTON

DATE	lbs/1000	mg/l	FLOW(MGD)	TONS PROCESSED	HOURS PACKED
08-26-82	29.10	1099	.28776	45.3	8.8
09-01-82	54.60	2820	.22050	47.5	10.7
09-08-82	19.60	798	.27840	47.3	11.8
09-17-82	10.90	397	.26380	40.0	10.0
09-23-82	13.20	640	.25160	51.0	11.0
09-30-82	6.70	293	.25520	46.5	11.2
10-06-82	25.20	690	.27900	31.9	11.2
10-20-82	22.77	785	.19200	27.6	4.7
10-27-82	5.40	224	.24000	41.7	10.0
03-18-83	6.25	129	.22500	19.4	8.0
03-24-83	1.90	54	.22400	27.0	8.0
06-23-83	1.86	29	.30700	20.0	10.5
08-16-83	3.70	286	.19100	62.0	10.0
08-25-83	1.60	91	.20900	51.0	9.0
03-31-83	7.10	181	.29300	31.0	8.0
09-12-83	6.80	322	.19880	39.0	8.0
09-27-83	1.18	44	.25100	39.0	10.0
10-05-83	3.94	164	.25320	44.0	8.0
10-12-83	4.27	160	.26880	42.0	7.0
10-19-83	3.34	175	.24290	53.0	10.0
10-26-83	22.01	266	.13890	7.0	7.0
08-08-**	6.00	390	.15400	42.0	8.0
08-16-**	2.30	180	.19100	62.0	10.0
08-23-**	5.40	600	.10100	47.0	9.0
09-07-**	6.30	370	.23500	58.0	10.0
09-15-**	6.50	350	.28330	64.0	10.0
09-29-**	2.60	140	.15000	34.0	7.0

MEAN = 10.25

STANDARD DEVIATION = 11.67

NUMBER OF SAMPLES = 28

** = DEP SAMPLE POINT, 1983

SARDINE PROCESSING
OIL AND GREASE EFFLUENT DATA

COMPANY

9. PORT CLYDE FOODS, INC., ROCKLAND

DATE	lbs/1000	mg/l	FLOW(MGD)	TONS PROCESSED	HOURS PACKED
08-11-83	4.70	167	.29520	43.5	4.0
09-06-83	1.70	174	.13860	58.0	3.7
09-13-83	3.80	392	.22522	97.0	6.7
09-14-83	1.90	162	.19057	67.0	5.2
10-24-83	2.70	104	.22385	36.0	6.5
10-25-83	1.10	48	.21526	38.0	6.2
10-27-83	1.20	84	.21701	62.0	6.7
10-28-83	1.70	156	.18788	71.0	5.2
08-22-**	4.60	200	.29151	52.0	5.0
08-30-**	2.70	130	.38376	78.0	7.0
09-13-**	2.00	210	.22522	52.5	4.5
09-27-**	1.20	100	.22546	82.0	6.7
10-07-**	1.00	90	.19847	76.0	5.5
10-11-**	1.40	120	.22059	77.0	6.7
10-21-**	.80	60	.19888	59.0	5.7

MEAN = 2.17

STANDARD DEVIATION = 1.28

NUMBER OF SAMPLES = 15

** = DEP SAMPLE POINT, 1983

SARDINE PROCESSING
OIL AND GREASE EFFLUENT DATA

COMPANY

10. STINSON CANNING CO., BATH

DATE	lbs/1000	mg/l	FLOW(MGD)	TONS PROCESSED	HOURS PACKED
09-23-82	14.70	809	.06160	14.1	7.0
09-27-82	5.20	174	.19500	27.0	10.5
10-18-82	35.34	3020	.08900	32.0	8.0
03-15-83	8.00	447	.07320	17.0	8.0
10-03-83	10.60	288	.21200	24.0	7.5
10-12-83	6.28	167	.22560	25.0	8.0
10-21-83	.94	18	.22560	18.0	8.0
10-27-83	.35	224	.22560	61.0	8.0
07-18-**	.50	140	.02110	24.5	6.5
10-12-**	6.02	160	.22560	25.0	8.0

MEAN = 8.79

STANDARD DEVIATION = 10.39

NUMBER OF SAMPLES = 10

** = DEP SAMPLE POINT, 1983

SARDINE PROCESSING
OIL AND GREASE EFFLUENT DATA

COMPANY

11. STINSON CANNING CO., BELFAST

DATE	lbs/1000	mg/l	FLOW(MGD)	TONS PROCESSED	HOURS PACKED
08-24-82	27.20	1357	.13000	27.0	6.5
09-02-82	2.20	788	.04950	73.0	9.5
09-07-82	1.10	486	.04160	76.0	8.0
09-15-82	4.60	1386	.04420	55.0	8.5
09-22-82	1.90	417	.04680	43.0	9.0
09-27-82	1.70	549	.04030	55.0	7.7
10-13-82	9.53	369	.13624	22.0	7.7
10-20-82	15.40	395	.11223	12.0	5.5
10-25-82	2.54	173	.18633	53.0	9.5
11-15-82	3.40	204	.18700	47.2	9.2
11-29-82	4.40	191	.14800	27.0	7.5
02-14-83	5.20	221	.13620	24.0	7.7
03-02-83	12.10	660	.12100	27.5	7.0
03-15-83	9.80	464	.12400	24.5	8.0
03-27-83	5.75	295	.12850	27.5	9.5
09-02-83	12.60	927	.12020	37.0	4.3
09-30-83	13.90	980	.17624	52.0	6.7
10-05-83	2.37	83	.21800	32.0	8.5
10-13-83	7.97	470	.13420	33.0	5.0
10-26-83	6.31	158	.21060	22.0	8.2
09-30-**	15.60	1100	.17624	52.0	6.7
10-13-**	8.82	520	.13420	33.0	5.0

MEAN = 7.93

STANDARD DEVIATION = 6.33

NUMBER OF SAMPLES = 22

** = DEP SAMPLE POINT, 1983

SARDINE PROCESSING
OIL AND GREASE EFFLUENT DATA

COMPANY

12. STINSON CANNING CO., PROSPECT HARBOR

DATE	lbs/1000	mg/l	FLOW(MGD)	TONS PROCESSED	HOURS PACKED
08-27-82	7.90	226	.36000	43.0	7.5
08-30-82	7.00	213	.38400	49.0	8.0
09-09-82	4.60	158	.38200	55.0	8.0
09-14-82	1.76	79	.22400	42.0	5.5
09-27-82	.92	24	.22000	24.0	4.7
09-30-82	3.80	132	.41000	60.0	8.5
10-01-82	.64	24	.09600	15.0	2.5
10-08-82	1.35	69	.21500	46.0	4.5
10-13-82	3.90	111	.43200	51.0	9.0
10-21-82	3.30	129	.37200	61.0	7.7
11-12-82	1.15	42	.27000	41.0	5.2
11-18-82	8.60	273	.20500	27.0	4.2
02-28-83	9.60	124	.44700	24.0	9.2
03-15-83	6.20	269	.23625	43.0	6.7
03-23-83	34.73	1745	.21000	44.0	6.0
05-14-83	44.70	1823	.16450	28.0	6.5
06-27-83	1.72	72	.21200	37.0	8.5
07-06-83	.22	12	.22000	51.0	9.2
07-21-83	1.20	107	.15000	55.0	6.5
08-23-83	.65	82	.14400	76.0	8.0
09-13-83	1.70	86	.27700	60.0	8.0
09-20-83	4.10	138	.28000	39.0	7.7
09-29-83	1.00	61	.28600	70.0	7.7
10-07-83	9.90	827	.12900	45.0	7.2
10-13-83	.30	33	.13200	62.0	7.7
10-21-83	.58	50	.11700	42.0	6.5
10-28-83	.74	79	.02700	12.0	1.5
07-21-**	2.05	180	.15000	55.0	6.5
09-06-**	8.00	440	.28700	66.0	8.5
09-20-**	5.70	190	.28000	39.0	8.5
10-13-**	.80	90	.13200	62.0	7.7

MEAN = 5.77

STANDARD DEVIATION = 9.63

NUMBER OF SAMPLES = 31

** = DEP SAMPLE POINT, 1983

SARDINE PROCESSING
OIL AND GREASE EFFLUENT DATA

COMPANY

13. STINSON CANNING CO., SOUTHWEST HARBOR

DATE	lbs/1000	mg/l	FLOW(MGD)	TONS PROCESSED	HOURS PACKED
08-27-82	3.67	135	.13020	20.0	6.0
08-30-82	3.90	148	.19200	30.0	9.0
09-03-82	2.90	86	.16560	20.8	6.0
09-09-82	3.30	101	.20160	25.7	8.0
09-16-82	2.80	101	.21360	32.0	8.5
09-29-82	4.80	151	.15840	21.0	4.0
10-01-82	3.12	100	.18720	25.0	5.2
10-05-82	4.28	150	.23280	34.0	7.5
10-15-82	1.49	70	.12720	25.0	5.2
10-25-82	1.24	72	.14400	35.0	8.7
11-02-82	.66	39	.17520	43.0	7.5
11-08-82	.74	39	.07680	17.0	4.2
11-19-82	.36	14	.14100	23.0	4.7
06-14-83	.80	42	.07040	15.0	6.0
06-23-83	.50	19	.08640	13.0	7.0
07-05-83	1.27	34	.09840	11.0	6.0
08-02-83	3.80	96	.24960	26.0	8.2
10-07-83	1.76	56	.22560	30.0	6.5
10-18-83	2.47	68	.21840	25.0	8.0
10-25-83	.33	8	.11560	11.0	5.5
10-27-83	3.00	131	.24720	45.0	8.0
08-02-**	3.60	90	.24960	26.0	8.2
09-08-**	8.60	220	.24240	26.0	8.0

MEAN = 2.58

STANDARD DEVIATION = 1.91

NUMBER OF SAMPLES = 23

** = DEP SAMPLE POINT, 1983

STEAK PROCESSING
OIL AND GREASE EFFLUENT DATA

COMPANY

1. PORT CLYDE FOODS, INC., STONINGTON

DATE	lbs/1000	mg/l	FLOW(MGD)	TONS PROCESSED	HOURS PACKED
08-04-82	26.30	867	.32046	44.1	9.8
11-04-82	11.30	230	.25050	21.2	7.0
07-22-83	15.00	302	.22600	19.0	5.0
08-03-83	20.30	574	.24600	29.0	10.0
08-10-83	35.60	528	.42000	26.0	6.0
07-13-83	9.30	744	.06600	22.0	4.0
08-01-**	25.80	900	.22700	33.0	10.0

MEAN = 20.51

STANDARD DEVIATION = 9.40

NUMBER OF SAMPLES = 7

** = DEP SAMPLE POINT, 1983

STEAK PROCESSING
OIL AND GREASE EFFLUENT DATA

COMPANY

2. PORT CLYDE FOODS, INC., ROCKLAND

DATE	lbs/1000	mg/l	FLOW(MGD)	TONS PROCESSED	HOURS PACKED
08-02-**	17.60	530	.34362	43.0	5.0
08-12-**	8.80	410	.31410	61.0	5.0

MEAN = 13.20

STANDARD DEVIATION = 6.22

NUMBER OF SAMPLES = 2

** = DEP SAMPLE POINT, 1983

STEAK PROCESSING
OIL AND GREASE EFFLUENT DATA

COMPANY

3. STINSON CANNING CO., BATH

DATE	lbs/1000	mg/l	FLOW(MGD)	TONS PROCESSED	HOURS PACKED
08-26-82	11.25	791	.06818	20.0	3.7
10-07-82	1.54	234	.14000	89.0	8.0
10-21-82	9.80	664	.08550	24.0	5.2
12-02-82	.54	126	.22700	22.0	8.0
02-08-83	11.60	434	.11530	18.0	6.2
08-17-83	18.50	809	.26830	49.0	8.0
08-03-**	15.00	730	.25180	24.0	8.0

MEAN = 9.75

STANDARD DEVIATION = 6.61

NUMBER OF SAMPLES = 7

** = DEP SAMPLE POINT, 1983

STEAK PROCESSING
OIL AND GREASE EFFLUENT DATA

COMPANY

4. STINSON CANNING CO., BELFAST

DATE	lbs/1000	mg/l	FLOW(MGD)	TONS PROCESSED	HOURS PACKED
08-06-82	11.00	705	.12000	32.0	6.0
08-11-82	2.00	105	.06500	14.0	3.5
08-17-82	31.80	1880	.15000	37.0	7.5
11-02-82	2.50	188	.19500	62.0	10.5
07-13-83	13.90	1602	.10800	52.0	9.0
07-27-83	9.00	1292	.08700	52.0	7.2
08-01-**	15.20	1100	.18200	55.0	7.0
08-04-83	14.60	1019	.21020	61.0	8.2
08-10-83	17.40	983	.22100	52.0	8.5
08-17-83	10.60	674	.21000	56.0	8.2
08-30-**	12.40	1200	.09170	37.0	3.5
07-13-**	4.00	460	.10800	52.0	9.0
08-08-**	14.10	930	.15600	43.0	6.0
08-17-**	15.70	1000	.21020	56.0	8.2

MEAN = 12.44

STANDARD DEVIATION = 7.46
NUMBER OF SAMPLES = 14

** = DEP SAMPLE POINT, 1983

STEAK PROCESSING
OIL AND GREASE EFFLUENT DATA

COMPANY

5. STINSON CANNING CO., PROSPECT HARBOR

DATE	lbs/1000	mg/l	FLOW(MGD)	TONS PROCESSED	HOURS PACKED
08-03-83	2.71	303	.09450	44.0	5.2
07-14-83	2.80	342	.07800	40.0	3.2
07-28-83	13.84	1130	.13800	47.0	0.0
08-19-83	3.70	457	.08550	44.0	4.7
07-28-**	6.12	500	.13800	47.0	0.0
08-04-**	2.30	240	.14400	63.0	8.0
08-18-**	3.40	390	.09900	47.0	5.2
09-12-**	8.10	410	.22300	47.0	7.2

MEAN = 5.37

STANDARD DEVIATION = 3.96
NUMBER OF SAMPLES = 8

** = DEP SAMPLE POINT, 1983

STEAK PROCESSING
OIL AND GREASE EFFLUENT DATA

COMPANY

6. STINSON CANNING CO., SOUTHWEST HARBOR

DATE	lbs/1000	mg/l	FLOW(MGD)	TONS PROCESSED	HOURS PACKED
08-10-83	15.30	214	.42720	25.0	8.2
08-17-83	17.40	367	.43200	38.0	9.0
07-26-**	5.83	150	.24240	25.0	8.0
08-10-**	13.50	190	.42720	25.0	8.2
08-17-**	10.40	220	.43200	38.0	9.0

MEAN = 12.49

STANDARD DEVIATION = 4.52
NUMBER OF SAMPLES = 5

** = DEP SAMPLE POINT, 1983

APPENDIX B

SARDINE AND STEAK PROCESSING SAMPLING FREQUENCY

SAMPLING FREQUENCY

STEAKS ONLY

Total Number of Operating Days (O.D.) = 144

Total Number of Operating Months (O.M.) = 32

O.D./OM = Avg. Number Of Operating Days Per Operating Month

= 144/32 = 4.50 O.D./OM

Total Number Of Operating Days (O.D.) = 144

Total Number of samples (S) = 43

O.D./S = 144/43 = 3.35 (1 Sample Every 3.35 Operating Days)

AVG. Number Of Samples/Operating Month = AVG #OD/OM X Sample/O.D.

= 4.50 O.D./OM . X 1 Sample/3.35 O.D.s

= 1.34 Samples/Operating Month*

* For licensing requirements, 1.35 should be rounded to the next highest whole integer, i.e., "2".

SAMPLING FREQUENCY

SARDINES ONLY

Total Number of Operating Days (O.D.) = 1048

Total Number of Operating Months (O.M.) = 197

O.D./OM = Avg. Number Of Operating Days Per Operating Month

= 1048/197 = 5.32 O.D./OM

Total Number Of Operating Days (O.D.) = 1048

Total Number of samples (S) = 246

O.D./S = 1048/246 = 4.26 (1 Sample Every 4.26 Operating Days)

AVG. Number Of Samples/Operating Month = AVG #OD/OM X Sample/O.D.

= 5.32 O.D./OM X 1 Sample/4.26 O.D.s

= 1.25 Samples/Operating Month*

* For licensing requirements, 1.25 should be rounded to the next highest whole integer, i.e., "2".