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# THE POTENTIAL FOR EXPOSURE OF LOBSTERS TO CREOSOTE DURING COMMERCIAL STORAGE IN THE MARITIME PROVINCES OF CANADA

by

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TABLE OF CONTENTS

## ABSTRACT

McLeese, D. W. 1983. The potential for exposure of lobsters to creosote during commercial storage in the Maritime Provinces of Canada. Can. Tech. Rep. Fish. Aquat. Sci. 1203: iv + 28 p.

Information on the potential for lobsters (Homarus americanus) to be exposed to creosote during commercial storage was obtained by circulating questionnaires. Chemical analyses of hepatopancreas (HP) and tail muscle (TM) tissues from freshly caught lobsters from 19 areas around the Maritime Provinces and samples of lobsters stored in crates, cars and tidal pounds for various periods provided information about the accumulation of polycyclic aromatic hydrocarbons (PAH) in lobsters.

Based on a total of about 42.2 million pounds (M lb) of lobsters landed annually in Canada, it is estimated that 30 M lb (71%) would not be exposed to creosote during commercial storage, 8.5 M lb (20.1%) may be exposed a week or less, and 2.3 M lb (5.4%) may be exposed for 1-2 wk in crates, cars or tanks. About 1.5 M lb (3.5%) may be exposed to creosote for periods of 2-3 mo in tidal pounds.

When exposed to creosote, accumulation of PAH occurs in lobsters held in all types of storage units. However, the main possibility for appreciable accumulation of PAH is among lobsters stored for 2-3 mo in tidal pounds constructed with creosoted materials. The accumulation is greater during summer than during winter storage in the pounds. Generally, fewer lobsters are stored in tidal pounds in summer than in winter.

Key words: Lobster, storage, creosote, polycyclic aromatic hydrocarbons, accumulation

## RÉSUMÉ

McLeese, D. W. 1983. The potential for exposure of lobsters to creosote during commerical storage in the Maritime Provinces of Canada. Can. Tech. Rep. Fish. Aquat. Sci. 1203: iv + 28 p.

Un questionnaire nous a fourni des renseignements sur la possibilité que des homards (Homarus americanus) soient exposés à créosote au cours de l'entreposage commercial. Les données sur l'accumulation, chez ces animaux, d'hydrocarbures aromatiques polycycliques (PAH) ont été obtenues par analyses des tissus de l'hépatopancréas (HP) et due muscle de la queue (TM) prélevés sur des homards fraîchement capturés provenant de 19 arrondissements des Provinces maritimes, et d'échantillons de homards entreposés dans des caisses, des wagons et des étangs à marée pendant diverses périodes.

Sur la base de débarquements annuels d'en iron 42,2 millions de livres (M lb) de homards au Canada, on estime à 30 M lb (71%) la quantité qui ne serait pas exposée à la créosote pendant l'entreposage commercial, 8,5 M lb (20,1%) celle qui pourrait être exposée une semaine ou moins, et 2,3 M lb (5,4%) exposée 1-2 sem dans des caisses, des wagons ou des bassins. Environ 1,5 M lb (3,5%) peuvent être exposées à la créosote pendant des périodes de 2-3 mois dans les étangs à marée.

Il s'accumule des PAH dans des homards exposés à la créosote, quel que soit le type d'unité d'entreposage. Cependant, une accumulation appréciable de PAH est plus probable chez des homards entreposés pendant 2-3 mois dans des étangs à marée construits avec des matériaux créosotés. Dans les étangs, l'accumulation est plus prononcée en été qu'en hiver. En général, le nombre de homards entreposés dans les étangs à marée est plus faible en été qu'en hiver.

## INTRODUCTION

Lobsters (Homarus americanus) held for several months in a large tidal pound were found to have high levels of certain PAH in HP and TM (Dunn and Fee 1979). The source of PAH was believed to be from creosote used as a preservative in wooden parts of the pound, such as pilings and dam facings. Some PAH, for example benzo(a)pyrene, are carcinogenic (National Academy of Science 1972) and may be harmful to humans if present at high levels in food.

The main route for uptake of PAH by lobsters is thought to be from water to gills and from the gills to blood. Blood would transport the PAH to hepatopancreas, muscle and other tissues within the lobster. Because of accumulation and bioconcentration, PAH can be at higher concentrations within lobster tissues than in sea water. Also, PAH in sediment can accumulate in lobsters, provided it is released into the overlying water.

The Department of Fisheries and Oceans has conducted several studies concerned with the occurrence of PAH in lobsters. The studies included sampling of freshly caught lobsters from several areas around the Maritime Provinces, sampling of lobsters after storage in lobster crates, cars, tanks and tidal pounds for various periods, and a laboratory study of uptake and excretion of PAH by lobsters.

The purpose of this report is to present information on the potential for lobsters to be exposed to creosote during short- to long-term commercial storage in lobster crates, cars, tanks and tidal pounds. The basic information about the storage units was obtained from questionnaires circulated to the industry. Appropriate information obtained from the sampling studies on levels of PAH within lobsters is summarized, and the potential for significant contamination of lobsters in commercial storage is assessed.

## MATERIAL AND METHODS

Questionnaires were distributed to District Protection Offices, Department of Fisheries and Oceans, in the Maritime Provinces in January 1982. The questionnaires were for lobster crates (QA), cars (QB), tanks (QC) and tidal pounds (QD). At each office, the forms were copied in suitable numbers for the numbers and types of storage units in the area. The questionnaires and the covering memorandum are shown in Appendix Table I; 274 replies were received between February 25 and October 4, 1982.

Methods for measuring PAH compounds in lobsters HP and TM are described in Uthe et al. (personal communication).

## BACKGROUND INFORMATION

### LEGAL SIZES

Minimum legal sizes for lobsters in Canada range from 63.5-81.0 mm (2 1/2-3 3/16 in.) (1 in. = 25.4 mm) carapace length. Those measuring less than 81 mm are known as "canner-sized" and are processed into fresh, frozen or canned meat soon after they are landed. Those measuring 81 mm and more are "market-sized" and are stored live for a few days to several months until they are marketed.

### LOBSTER LANDINGS

To provide background information on general availability of lobsters, Canadian lobster landings for 1982 are summarized by Province and by time of year when landed (Table 1). The summary was prepared from detailed information on lobster landings by counties and on size distributions of lobsters in total catches from various areas (supplied by the Invertebrate and Marine Plants Division). The size distribution information, not detailed here, was used to estimate proportions of canner- and market-sized lobsters landed in various areas. Depending on the area, market-sized lobsters make up 21-100% of the total landings of legal-sized lobsters.

Lobster landings for Canada for 1981 totaled about 42.2 M lb (19.2 M kg) of which about 20 M lb (9.1 M kg) were canner-sized and the remainder, about 22.3 M lb (10.1 M kg) were market-sized (Table 1). Of the market-sized lobsters, 16.7 M lb (7.6 M kg) were landed in April-July, 1.4 M lb (0.64 M kg) in August-October and about 4.3 M lb (1.9 M kg) were landed in November-December.

### LOBSTER STORAGE

Patterns of storage of live lobsters were discussed in relation to patterns of lobster landings in Canada and in the United States by McLeese and Wilder (1964). In brief, some lobsters caught in late fall (Nov.-Dec.) are stored for later sale in winter or early spring when both U.S. and Canadian lobster landings are at a minimum. Usually, smaller quantities are stored from mid to late spring for later sale in the summer when Canadian landings are low. Lobster crates, cars and tanks are used for short- to moderate-term storage and tidal pounds are used for long-term storage.

## LOBSTER STORAGE UNITS

The distribution of storage units by Province or area, as obtained from the questionnaires, is summarized in Table 2.

### CRATES

Crates are standard size (3 x 2 x 1 ft) (1 ft = 0.3048 m), made of untreated wood (usually spruce) and hold 90-100 lb (41-45 kg) of lobsters. Crates are the initial container used on fishing boats to hold the freshly caught lobsters. At fishing ports fishermen and lobster buyers use floating crates for short-term storage. The crates may be tied together in "strings" and for large operations several hundred crates may be moored together. Sometimes crates are placed within large shallow floating cars for protection or security and for easier access.

Lobsters in crates are exposed to surface waters. If the crates are moored near or against creosoted wharves, there is the possibility that the lobsters will accumulate PAH from the water.

Sixty-nine crate storage units were reported in returned questionnaires (A) (Appendix Table 2). The

information, by size of unit, storage time and moorage location in terms of possible exposure to PAH, is summarized in Table 3 and is reviewed briefly below.

Size: 64 units reported; 25 small units with 8-50 crates; 29 moderate-sized units with 50-500 crates; and 10 large units with 500-2000 crates.

Storage period: 63 reported; 24 units with storage periods of 0.5-1 d; 20 units with storage periods of 2-3 d; and 19 units with storage periods of 1 wk or more.

Moorage sites: 60 reported; 20 units moored in "clean" areas and 40 units moored in areas with creosoted wharves.

CARS

Floating cars, used to store relatively large quantities of lobsters, usually range in size from 15-30 ft long, 10-14 ft wide and 3-8 ft deep. Some cars are divided into escape proof compartments and lobsters are free to move about. Such cars usually are shallow (3-4 ft deep) and lobsters are exposed to surface water. Another type is the trayed car. These cars are relatively deep and each compartment (about 6 ft x 6 ft) is fitted with up to 12 shallow trays which hold the lobsters. A third type of car is large (about 30 x 25 x 3 ft) and is used to hold crated lobsters. About 130 crates in one layer or 260 in two layers are held within each of these cars. All cars and fittings such as trays are constructed of wood and are not creosoted. However, lobsters in cars may be exposed to creosote in the water if the cars are moored near creosoted wharves.

Seventy-four car storage units, mostly single cars, were reported in returned questionnaires (B) (Appendix Table 3). The information in terms of size, storage time and moorage location is summarized in Table 4 and is reviewed briefly below.

Size: 72 units reported; 37 units with 1 car, 18 units with 2 cars; 12 units with 3-5 cars; and 5 large units with 6-10 cars.

Storage period: 61 units reported; 38 units with storage periods of less than 1 wk; 15 units with storage periods of 2-5 wk; and 8 units with storage periods of 6-8 wk.

Moorage sites: 55 units reported; 7 units moored in "clean" areas; 48 units moored near creosoted wharves.

TANKS

Tank storage units for lobsters range in size from small single tanks in retail outlets (stores, restaurants, roadside stands), using artifical sea water or water trucked from the sea, to units with 100 or more tanks located at or near fishing ports. Usually, the latter are supplied with water pumped from the sea. Normally, lobsters are free to wander in the tanks. Occasionally, crated lobsters are placed in the tanks. However, water flow through the crates may be restricted, resulting in rapid depletion of dissolved oxygen and weakening or death of the lobsters.

Tanks are constructed of a variety of materials: wood, wood with fibreglass coating, wood and epoxy paint, fiberglass or concrete. Creosoted materials are not used in any of the tank units. Whether lobster will be exposed to creosote and therefore accumulate PAH depends mainly on whether the water is taken from areas with creosote sources.

A total of 110 tank storage units was reported in the returned questionnaires (C) (Appendix Table 4). Information in terms of size, storage time, water supply and materials used in the units is reported in Table 5 and is reviewed briefly below.

Size: 106 units were reported, with number of tanks in each unit ranging from 1 to more than 100.

Storage time: 92 units reported, with times ranging from less than 1 wk to about 12 wk.

Water supply: 64 units reported; 30 units with artifical sea water or with water trucked from clean areas; and 34 units with water with possible creosote exposure.

Materials: 105 units reported, none with creosoted materials.

TIDAL POUNDS

Tidal pounds are large enclosures built in the intertidal zone. Dams retain water during the low-tide period. Water exchange and renewal are limited to the high-tide period of each tidal cycle when the water level is above the top of the dams, about 6 h of every 12.5 h. Lobsters are retained in the same body of water during the remaining 6-6.5 h of the tidal cycle while the outside water level is below the top of the dam. Most tidal pounds are in the Bay of Fundy (Grand Manan, Deer Island, N.B.) and in southwestern Nova Scotia.

Usually lobsters are liberated within the pounds but occasionally crated lobsters may be floated in the pounds for short periods when shipments are received or when lobsters are being collected for shipment. Creosoted material has been used in pilings, sheathing and facing of some pounds, not in others.

All tidal pounds, totaling 21, were reported in returned questionnaires (D) (Appendix Table 5). The information is summarized in terms of size, storage time and possible creosote sources in water or in the pound construction (Table 6) and is reviewed briefly below.

Size: stated capacities of the tidal pounds range from about 50,000-350,000 lb of lobsters (22,700-160,000 kg), with 3 of the 21 pounds having capacities of 250,000-350,000 lb (114,000-160,000 kg).

Storage times: not specified for 11 of the pounds; for the remainder, stated storage time was for about 3 mo, usually in winter. Some of the pounds may be stocked in late spring and the stock retained for 2-3 mo.

Location and materials: three of the 21 pounds are located in areas near creosoted wharves and 4 are reported to have a minor amount of creosoted wood. Based on a survey in 1979, 13 pounds had no creosoted material, 6 had minor amounts and 2 had been made many years ago with creosoted materials.

Depending on several factors, tidal pounds may

not be stocked each winter or summer season or, if stocked, may not contain the maximum amounts of lobsters. For example, at least 5 of 17 pounds in Charlotte Co., N.B., remained empty during the 1981/82 winter period.

## ESTIMATED TOTAL CAPACITIES OF STORAGE UNITS

Storage periods for many of the crate, car and tank units are relatively short. These units can be stocked repeatedly so that annual capacity may be several times greater than the stated single capacity. Generally tidal pounds are stocked in late fall and some may be restocked in late spring. Therefore, the annual capacity for tidal pounds is somewhat less than twice the single capacity.

Estimates of the total capacities for each of the four types of storage units were obtained by summing the information on single and annual capacities provided by the questionnaires. The total single capacity is about 1.3 M lb (0.6 M kg) for crates, 2.5 M lb (1.1 M kg) for cars, 2 M lb (0.9 M kg) for tanks and about 3 M lb (1.4 M kg) for tidal pounds (Table 7).

The total annual capacity is about 7.8 M lb (3.5 M kg) for crates, 4.9 M lb (2.2 M kg) for cars, 22 M lb (10.0 M kg) for tanks and 5.4 M lb (2.3 M kg) for tidal pounds (Table 7).

The reported annual capacity for many of the tank units must have been overstated. The estimated annual capacity for tanks, 22 M lb (10.0 M kg), almost equals the quantity of market-sized lobsters landed annually. The ratio for annual to single capacity is about 11 which is out of line with the ratios for crates (6) cars (2) and tidal pounds (1.6). If the ratio for tanks was about 5 or lower instead of 11, the adjusted figure for annual capacity would be about 10 M lb (4.54 M kg) or less.

The quantities of lobsters that may be exposed to creosote in each type of unit were estimated from information supplied by the questionnaires and summarized in Table 7. The data have been adjusted to include the portion of lobsters in the "unknown" moorage sites or water supply that may be exposed to creosote (Table 8).

In summary, and based on annual landings of 22.4 M lb (10.2 M kg) of market-sized lobsters, the estimated pounds of lobsters stored near creosoted sources on an annual basis are about 3.3 M lb (1.5 M kg) for crates, 3.2 M lb (1.45 M kg) for cars, 4.3 M lb (1.95 M kg) or less for tanks (adjusted value) and 1.5 M lb (0.68 M kg) for tidal pounds, for a grand total of 12.3 M lb (5.6 M kg).

Quantities stored near creosote for less than and for more than 1 wk are listed in Table 8. Quantities stored for more than 1 wk are about 1.0 M lb (.45 M kg) crates, 0.4 M lb (0.18 M kg) cars, 0.9 M lb (0.41 M kg) tanks (adjusted value) and 1.5 M lb (0.68 M kg) for tidal pounds, for a grand total of 3.8 M lb (1.72 M kg) (Table 8). It follows that the total held near creosote for less than 1 wk is about 8.5 M lb (3.86 M kg).

## TRANSFER OF LOBSTERS FROM ONE STORAGE UNIT TO ANOTHER

Information on transfer of lobsters from one type of unit to another or from one location to another was not obtained. The main transfers would be for lobsters in short-term holding, probably in crates, to cars, tanks or tidal pounds for moderate- to long-term storage. The adjusted total annual capacity for the units (28.1 M lb (12.7 M kg), Table 8) exceeds the previously stated annual landings of market-sized lobsters (22.4 M lb (10.1 M kg), Table 1). For example, there were problems associated with estimating the total capacity of tank storage units. In addition, the total annual capacity was estimated by summarizing the capacities of the four types of units and some duplication probably occurred because of transfer of lobsters from one type of unit to another.

Initially some lobsters could be held near creosoted wharves. For example, about 52% of those held in crates may be exposed to creosote before transfer. After transfer to cars, tanks or tidal pounds it would be expected that about 81%, 52% or 38%, respectively, would be exposed again to creosote (Table 8).

## SIGNIFICANCE OF EXPOSURE OF LOBSTERS TO CREOSOTE

Levels of 12 polycyclic aromatic hydrocarbons (PAH) in HP and TM have been determined for lobsters from 19 areas around the Maritime Provinces (data courtesy of J. Uthe and G. Sirota). The information is summarized in Table 9 as minimum level observed and as the three highest values observed. The three highest values are reported because some of the maximum values appeared to be outliers. Examples of possible outliers are compounds Nos. 4, 6, 11 and 12 for HP and 1-4, 8 and 9 for TM, where the differences between the highest and the second highest values are 1.6 x or more.

Seven of the compounds were reported to be carcinogenic, Nos. 5, 6, 7, 8, 9, 10 and 12. (Lo and Sandi 1978).

## STORAGE NEAR CREOSOTED WHARVES

### Crates

Lobsters from five areas were sampled after being held in crates near creosoted wharves for about 1 wk. In addition, freshly caught lobsters from four of the areas serve as direct controls (Table 10). During the 1 wk storage, levels of most PAH in HP and in TM increased. The exception was TM of lobsters held in Charlotte Co., N.B.

Compared with the range of normal values for lobsters from 19 areas (Table 9), lobsters held at Port Mouton, N.S., had three PAH in HP, and lobsters from Chester, N.S., had four PAH in HP that exceeded control values. Lobsters from Glace Bay, N.S., had two PAH in TM and those from Auld's Cove, N.S., had one PAH in TM that exceeded control values (10% of 120 exceeded controls). All seven carcinogenic PAH (Nos. 5-10 and 12), were within the control range except for compound No. 5 in HP of lobsters from Chester, N.S. (1 of 70 exceeded controls).

From this it is concluded that lobsters in

crates near creosoted wharves will accumulate PAH. The degree of accumulation appears to be related to storage time and the holding area, in particular to the extent or freshness of creosoted materials in the wharves.

Tank storage

Lobsters stored for about 1 wk in tanks at Dipper Harbour, N.B., show low values for each of the 12 PAH compounds in HP and in TM (Table 11). There were no creosoted structures nearby and presumably little or no creosote in the water supply. These data probably represent control values for Dipper Harbour and Maces Bay, N.B., lobsters (Table 11).

Crates within floating cars

Results for analyses of samples from lobsters that had been stored in crates within floating cars at Dipper Harbour and Maces Bay, N.B., and Port Mouton, N.S., for 12 h to 2 wk are listed in Table 11. In addition, data for freshly caught lobsters (controls) at Port Mouton, N.S., are listed.

Storage in crates within cars near creosoted wharves at each of the three areas resulted in increases in the levels of six to eight PAH compounds in HP and in three to five PAH compounds in TM.

Compared with the range of normal values (Table 9), PAH levels in HP or TM of lobsters stored for less than 1 wk were within the range of control values (0 of 48 exceeded controls). For those stored for 1 wk or more, two PAH in HP (compounds Nos. 2 and 3) exceeded control values (6 of 72 exceeded controls). All seven carcinogenic PAH in HP and TM were within the range of control values (0 of 70 exceeded controls).

It is concluded that lobsters stored for periods up to 2 wk accumulated PAH, the degree of accumulation being related to the local conditions, as discussed previously for crate storage, and on storage time. None of the carcinogenic PAH in HP or TM exceeded control values, regardless of location or storage time at least up to 2 wk.

Tidal pounds

Results for lobsters stored for 2-3 mo in winter in five tidal pounds are listed in Table 12. The reported amounts of creosoted materials range from little (on floor of sluiceway only) for pounds Nos. 2 and 3, to slightly more (floor of sluiceway, twine, 10 ft (3 m) of fencing) for pound No. 1 and to fairly extensive (originally made with creosoted materials) for pounds Nos. 3 and 4.

Compared with the range of control values (Table 9), lobsters had from three to six PAH in HP and from zero to two PAH in TM with levels above the control values (25 of 120 exceeded controls).

Considering the carcinogenic PAH in HP, only compound No. 5 for lobsters from four of the five pounds and compound No. 8 for lobsters from one pound exceeded the range of control values (5 of 35 exceeded controls). In TM, compound No. 5 for lobsters in one pound exceeded control values (1 of 35 exceeded controls).

Data for lobsters held in a tidal pound for 3 mo in summer and different lobsters for 3 mo in winter are reported by Uthe et al. (personal communication). The pound dates back to the 1950's, and had been constructed originally with creosoted material. After 3 mo storage, levels of PAH in HP were 3-19 times higher in summer than in winter. For the summer storage, all seven carcinogenic PAH in HP and TM exceeded control values.

## CONCLUSIONS

Based on a total of 22.4 M lb (10.2 M kg) (100%) of market-sized lobsters landed annually, it is estimated that 10.1 M lb (4.6 M kg) (45%) would not be exposed to creosote during commercial storage. About 12.3 M lb (5.6 M kg) (55%) could be exposed as follows: less than 1 wk in crates, cars and tanks 8.5 M lb (3.9 M kg) (38%); more than 1 wk in crates, cars and tanks, 2.3 M lb (1.0 M kg) (10%) 2-3 mo in tidal pounds, 1.5 M lb (0.7 M kg) (7%).

In terms of significance of the accumulation of PAH by lobsters, it was concluded that some accumulation would occur in lobsters held for less than 1 wk near creosote wharves in crates, cars and presumably tanks (8.5 M lb) (3.9 M kg) and in such units for periods of 1-2 wk (2.3 M lb) (1.0 M kg). However, few of the 12 PAH (16 of 240 measurements, 6.7%) and practically none of the seven carcinogenic PAH (2 of 140 measurements, 1.4%) would be expected to accumulate to levels exceeding control values.

The main possibility for appreciable contamination of lobsters with PAH remains with lobsters stored for 2-3 mo in tidal pounds containing relatively large amounts of creosoted materials (about 1.5 M lb (0.7 M kg) of lobsters). Under winter conditions, a few of the 12 PAH compounds (25 of 118 measurements, 21.2%), but not many of the seven carcinogenic PAH (6 of 68 measurements, 8.8%) exceeded control values.

Based on previous work with lobster from one creosoted pound (Uthe et al. personal communication), it would be expected that lobsters held for 2 or 3 mo would accumulate higher levels of PAH in summer than in winter. In this tidal pound under winter conditions for 2-3 mo, several of the PAH (avg. 8 of 44 measurements, 33%) and several of the carcinogenic PAH (13 of 24 measurements, 54%) exceeded control values.

The minimum levels of the 12 PAH in freshly caught lobsters from 19 areas ranged from ND to 19 ng/g wet weight in HP and from ND to 1.2 ng/g in TM (Table 9). However, the maximum levels ranged from 18-1720 ng/g in HP and from 2.6-140 ng/g in TM. In other words, there is a wide variation in PAH levels in freshly caught lobsters from different areas. Therefore, a wide variation in PAH levels among lobsters placed in tidal pounds would be expected whether the lobsters were freshly caught or had been stored temporarily in other storage units. Consequently, if elevated levels of PAH are found in lobsters sampled after storage in tidal pounds, it is impossible to judge accurately whether the accumulation is related to the condition of the lobsters as received or to conditions in the tidal pound. Repeated sampling, after further storage is required to assess whether conditions in a pound actually contribute to the accumulation of PAH in the lobsters.

Subject to the above reservation, it is concluded that the potential for significant contamination of lobsters with PAH is limited to long-term storage in one or two of the tidal pounds, particularly during summer.

## SUMMARY AND RECOMMENDATIONS

Of 10.2 M kg of market-sized lobsters landed yearly in Canada, about 45% (4.6 M kg) are stored in crates (1.3 M kg), cars (0.3 M kg), tanks (1.8 M kg) and tidal pounds (1.1 M kg) where there is no exposure to creosote.

About 48% (4.9 M kg) of the lobsters are stored for periods of a few hours to about 2 wk in crates (1.5 M kg), cars (1.4 M kg), and tanks (1.9 M kg) where there is the possibility of exposure to creosote. The crates and cars are moored in areas with creosoted wharves or the tanks are where the water inlets are near such structures. In such units, contamination of the lobsters with PAH does not seem to be severe, partly because of the relatively short storage times. In our sampling of lobsters, few of the 12 PAH (6.7% of the measurements) and practically none of the seven carcinogenic PAH (1.4% of the measurements) exceeded the range of control values. These units are widespread both in terms of location and in time of year when used (various legal fishing seasons). Recommendations for these storage units are: (1) to keep the storage times for lobsters at a minimum, and (2) possible to move the units, or to extend the water intakes for tanks, further from the creosoted structures. The latter should reduce the possibility of contamination of the lobsters because of dilution, and the consequent lowering of concentrations of PAH in the water.

About 6.7% (0.7 M kg) of the lobsters are stored for 2.3 mo in tidal pounds where creosoted materials have been used. Contamination of the lobsters with PAH is less during winter than during summer storage. Most, but not all, storage of lobsters in tidal pounds occurs during winter. From our sampling, contamination of the lobsters with PAH seems to be similar whether the tidal pounds have relatively little creosoted material (mainly on floor of sluiceways) or considerably more creosoted material was used many years ago. After about 2 mo storage in winter, several of the 12 PAH in lobsters (21.2% of the measurement) and several of the seven carcinogenic PAH (8.8% of the measurements) exceeded the ranges of control values. It is likely that higher percentages of the PAH measurements would exceed control values with longer storage in winter or with similar or longer storage in summer. Consequently, recommendations for the few pounds with creosoted materials are (1) keep storage times in winter and particularly in summer as short as possible; (2) avoid long-term storage in summer; (3) repairs or replacements to be made with non-creosoted materials.

It is not certain whether PAH in the sediments of the tidal pounds contribute to contamination of the lobsters. If so, some of the sediment could be removed during routine maintenance when the tidal pounds are not stocked with lobsters.

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Table 1. Summary of lobster landings in Canada for 1982 by area and by season.

| Province / County | Lobster district | Size limit canner market | Annual[a] landings 1981 (M lb) | Estimated market-sized (%) | (M lb) | Estimated landings of markets by season (M lb)[b] Spring | Summer / Fall | Winter |
|---|---|---|---|---|---|---|---|---|
| Nova Scotia | | | | | | | | |
| Victoria | 6B | C | 1.3 | 61 | 0.79 | 0.79 | | |
| Inverness | 7B | C | 1.7 | 29 | 0.49 | 0.49 | | |
| Cape Breton | 6B | C | 1.4 | 61 | 0.85 | 0.85 | | |
| Richmond | 6A | M | 0.16 | 100 | 0.16 | 0.16 | | |
| Pictou | 7B | C | 1.3 | 37 | 0.48 | 0.48 | | |
| Antigonish | 7B | C | 1.1 | 37 | 0.41 | 0.41 | | |
| Guysborough | 5 | M | 0.19 | 100 | 0.19 | 0.19 | | |
| Halifax | 5 | M | 0.13 | 100 | 0.13 | 0.13 | | |
| Lunenburg | 5 | M | 0.06 | 100 | 0.06 | 0.03 | | 0.03 |
| Queens | 4 | M | 0.26 | 100 | 0.26 | 0.13 | | 0.13 |
| Shelburne | 4 | M | 3.0 | 100 | 3.0 | 1.5 | | 1.5 |
| Yarmouth | 4 | M | 2.8 | 100 | 2.8 | 1.4 | | 1.4 |
| Digby | 4 | M | 0.7 | 100 | 0.7 | 0.03 | | 0.04 |
| Annapolis | 3 | M | 0.08 | 100 | 0.08 | 0.04 | | 0.04 |
| Kings | 3 | M | 0.02 | 100 | 0.02 | 0.01 | | 0.01 |
| Harts | 3 | M | 0 | 100 | 0 | 0 | | 0 |
| Colchester | 7B,3 | C,M | 0.03 | 100/37 | 0.01 | 0.015 | | 0.015 |
| Cumberland | 8,7B,3 | C,M | 0.2 | 100/37 | 0.07 | 0.04 | | 0.03 |
| N.S. total | | | 14.4 | | 10.5 | 6.7 | 0 | 3.9 |
| New Brunswick | | | | | | | | |
| Albert | 3 | M | 0.06 | 100 | 1.06 | 0.03 | | 0.03 |
| Saint John | 1 | M | 0.16 | 100 | 0.16 | 0.08 | | 0.08 |
| Charlotte | 1,2 | M | 0.66 | 100 | 0.66 | 0.33 | | 0.33 |
| Restigouche | 7C | C | 0.16 | 21 | 0.03 | 0.03 | | |
| Gloucester | 7C | C | 2.7 | 21 | 0.57 | 0.57 | | |
| Northumberland | 7C | C | 1.0 | 21 | 0.21 | 0.21 | | |
| Kent | 8 | C | 3.0 | 21 | 0.63 | | 0.63 | |
| Westmorland | 8 | C | 1.4 | 21 | 0.29 | | 0.29 | |
| N.B. total | | | 9.1 | | 2.6 | 1.25 | 0.92 | 0.44 |
| Prince Edward Island | | | | | | | | |
| Prince | 8,7B | C | 5.1 | 19 | 0.97 | 0.5 | 0.47 | |
| Queens | 7B | C | 1.5 | 19 | 0.28 | 0.28 | | |
| Kings | 7B | C | 5.1 | 19 | 0.97 | 0.97 | | |
| P.E.I. total | | | 11.7 | | 2.2 | 1.75 | 0.47 | 0 |
| Quebec | 9,10 | C | 3.0 | 100 | 3.0 | 3.0 | | |
| Newfoundland | 11-14 | M | 4.0 | 100 | 4.0 | 4.0 | | |
| Canada Total | | | 42.2 | | 22.3 | 16.7 | 1.4 | 4.3 |

[a] 2.205 lb = 1 kg.

[b] Spring season - April - July
Summer season - August - October
Winter season - Mainly November and December - portion landed in spring has been transferred to the spring landings.

Table 2. Distribution of lobster storage units, by province and area as determined from questionnaires.

| Province or Area | Number of storage units | | | | |
|---|---|---|---|---|---|
| | Crates | Cars | Tanks | Tidal pounds | Total |
| N.B. | | | | | |
| Bay of Fundy | 12 | 12 | 15 | 18 | 57 |
| Northumberland Strait | 20 | 15 | 34 | 0 | 69 |
| N.S. | | | | | |
| Bay of Fundy | 7 | 27 | 7 | 1 | 42 |
| Northumberland Strait | 1 | - | 10 | 0 | 11 |
| Eastern Coast | 10 | 15 | 9 | 2 | 36 |
| Cape Breton | 6 | 1 | 11 | 0 | 18 |
| P.E.I. | 4 | 2 | 15 | 0 | 21 |
| Que. | | | | | |
| Gaspé | 1 | 2 | 2 | 0 | 5 |
| Magdalen Is. | 0 | 0 | 4 | 0 | 4 |
| Nfld. | 8 | 0 | 3 | 0 | 11 |
| Totals | 69 | 74 | 110 | 21 | 274 |

Table 3. Summary of crate units by size (a), storage time (b) and moorage location (c).

| (a) Size (No. crates/unit) | No. units | (b) Storage time | No. units | (c) Moorage | No. units |
|---|---|---|---|---|---|
| Not specified | 5 | Not specified | 6 | Not specified | 9 |
| 10-50 crates | 25 | 0.5-1 d | 24 | Not put in water | 6 |
| 51-100 " | 4 | 2-3 d | 20 | Assoc. with tidal pounds | 6 |
| 101-200 " | 6 | 1 wk | 7 | Clean area | 8 |
| 201-300 " | 2 | 1-4 wk | 8 | Near creosote sources | 40 |
| 301-400 " | 10 | 4+ wk | 4 | | |
| 401-500 " | 7 | | | | |
| 501-2,000 " | 10 | | | | |
| Total | 69 | Total | 69 | Total | 69 |

Table 4. Summary of car units by size (a), storage time (b) and location (c).

| (a) Size (No. crates/unit) | No. units | (b) Storage time | No. units | (c) Moorage | No. units |
|---|---|---|---|---|---|
| Not specified | 2 | Not specified | 13 | Not specified | 19 |
| 1 car | 37 | Less than 1 wk | 38 | Clean area | 7 |
| 2 cars | 18 | 2-5 wk | 15 | Near creosote source | 48 |
| 3 " | 6 | 6-8 wk | 8 | | |
| 4 " | 3 | | | | |
| 5 " | 3 | | | | |
| 6-10 cars | 5 | | | | |
| Total | 74 | Total | 74 | Total | 74 |

Table 5. Summary of tank units by size (a), storage time (b), water supply (c) and materials (d).

| (a) Size No. tanks/unit | No. units | (b) Storage time | No. units | (c) Water supply | No. units | (d) Materials | No units |
|---|---|---|---|---|---|---|---|
| Not specified | 6 | Not specified | 18 | Not specified | 46 | Not specified | 5 |
| 1-5 | 39 | 1-5 d | 46 | Art. seawater | 11 | Fiberglass | 62 |
| 6-10 | 22 | 1-2 wk | 30 | Trucked, clean area | 19 | Wood, epoxy/pentox | 4 |
| 11-20 | 14 | 3-12 wk | 16 | Possible creosote | 34 | Wood, untreated | 32 |
| 21-40 | 15 | | | | | Concrete | 7 |
| 61-100 | 9 | | | | | | |
| 101-200 | 5 | | | | | | |
| Total | 110 | Total | 110 | Total | 110 | Total | 110 |

Table 6. Summary of tidal pounds by size (a), water supply (b) and materials (c) (storage time about 3 mo in winter and in summer).

| (a) Size Capacity in '000 lb Lobsters/Unit | No. units | (b) Water supply | No. units | (c) Materials | No. units | (c[a]) Materials | No. units |
|---|---|---|---|---|---|---|---|
| Not specified | 1 | No creosote | 17 | Untreated wood | 19 | Untreated wood | 12 |
| 50-100 | 8 | Creosote wharf nearby | 4 | Creosoted wood | 2 | Minor creosote | 5 |
| 100-200 | 9 | | | | | Moderate creosote | 2 |
| 200-300 | 2 | | | | | Old, wood creosoted | 2 |
| 300+ | 1 | | | | | | |
| Totals | 21 | | 21 | | 21 | | 21 |

a) from previous survey - minor creosote - on floor of sluiceway
moderate creosote - on sluiceway, gates, some of sheathing
old, creosoted - built many years ago with creosoted materials

Table 7. Summary of storage units in terms of quantities of lobster held in relation to possible exposure to creosote (1 lb = 0.454 kg).

| Possible exposure to creosote | No. units | Quantities stocked: Single capacity ('000 lb) | Quantities stocked: Annual capacity ('000 lb) | Ratio Annual/Single |
|---|---|---|---|---|
| A Crates | | | | |
| No exposure | 11 | 339 | 2,384 | 7 |
| Assoc. with tidal pds. | 6 | 270 | 370 | 1.4 |
| In trucks or buildings | 6 | 33 | 855 | 2.6 |
| Unknown | 12 | 48 | 199 | 4.1 |
| Near creosoted wharves[a,b] | 34 (41) | 612 (641) | 3,998 (4,117) | 6.5 (6.4) |
| Total | 69 | 1,302 | 7,836 | 6 |
| [a]In brackets, incorporates 34/57th (60%) of unknowns. | | | | |
| [b]Estimated poundage stored near creosote for more than 1 wk | | | | |
| (54% of single, 30.3% of annual) | | 346 | 1,247 | 3.6 |
| B Cars | | | | |
| No exposure | 6 | 109 | 704 | 6.5 |
| Unknown | 14 | 1,136 | 1,803 | 1.6 |
| Near creosoted wharves[a,b] | 54 (74) | 1,200 (2,222) | 2,415 (4,038) | 2.0 (1.8) |
| Total | 74 | 2,445 | 4,922 | 2.0 |
| [a]In brackets, incorporates 54/60th (90%) of unknowns. | | | | |
| [b]Estimated poundage stored near creosote for more than 1 week | | | | |
| (23.5% of single, 13.7% of annual) | | 522 | 553 | 1.1 |
| C Tanks | | | | |
| No exposure, Art. seawater | 17 | 18 | 268 | 14.8 |
| No exposure, clean | 11 | 443 | 2,240 | 5 |
| Unknown water supply | 53 | 1,017 | 13,057 (5,085) | 12.8 (5) |
| Near creosoted wharves [a,b] | 29 | 570 | 6,843 (2,850) | 12.0 (5) |
| Total | 110 | 2,048 | 22,408 (10,443) | 11 (5) |
| [a]Near creosote wharves, adjusted to incorporate 29/57th (51%) of unknowns. | | | | |
| | 56 | 1,098 | 13,502 (5,443) | 12.3 (5) |
| [b]Estimated poundage stored near creosote for more than 1 wk | | | | |
| (51% single, 22% annual) | | 560 | 2,970 (1,197) | 5.3 (5) |

Table 7. continued

| Possible exposure to creosote | No. units | Quantities stocked: Single capacity ('000 lb) | Quantities stocked: Annual capacity ('000 lb) | Ratio Annual/Single |
|---|---|---|---|---|
| D Tidal pounds | | | | |
| No exposure | 12 | 1,642 | 3,080 | 1.9 |
| Minor amount of creosote[a,b] | 5 | 495 | 640 | 1.3 |
| Creosoted materials[a,b] | 4 | 890 | 1,250 | 1.4 |
| Total | 21 | 3,027 | 4,970 | 1.6 |
| [a]Near creosote | 9 | 1,385 | 1,890 | 1.4 |
| [b]Storage near creosote for more than 1 wk (3 mo) | | 1,385 | 1,890 | 1.4 |

Table 8. Summary of poundage of lobsters exposed to creosote during commercial storage (poundage expressed as million lb and 1 M lb = 0.454 M kg).

| Storage unit | Poundage: Annual capacity | | Poundage: No exposure to creosote | | Poundage: Stored near creosote source | | Poundage: Stored near creosote source <1 wk | | Poundage: Stored near creosote source >1 wk | |
|---|---|---|---|---|---|---|---|---|---|---|
| Crate | | 7.8 | | 3.7 | | 4.1 | | 2.9 | | 1.2 |
| Car | | 4.9 | | 0.9 | | 4.0 | | 3.5 | | 0.5 |
| Tank[a] | (22.4) | 10.4 | (8.9) | 5.0 | (13.5) | 5.4 | (10.6) | 4.2 | (2.9) | 1.2 |
| Tidal Pound | | 5.0 | | 3.1 | | 1.9 | | 0 | | 1.9 |
| Totals | (40.1) | 28.1 | (16.6) | 12.7 | (23.5) | 15.4 | (17) | 10.6 | (6.5) | 4.8 |
| Adjusted totals[b] | | 22.4 (100%) | | 10.1 (45%) | | 12.3 (55%) | | 8.5 (38%) | | 3.8 (17%) |

[a]Quantity for tanks, in brackets, probably overestimated.

[b]Totals adjusted on basis that 22.4 M lb landed (Table 1) are 80% of 28.1.

Table 9. Range of values for 12 PAH in lobsters from 19 areas in the Maritime Provinces based on values for freshly caught lobster - minimum values and the 3 highest values reported (ng/g wet weight, ppb).

| Compound No. | Name | Minimum | 3 highest values (1) | (2) | (3) |
|---|---|---|---|---|---|
| | **Hepatopancreas** | | | | |
| 1 | Phenanthrene | T | 620 | 1000 | 1450 |
| 2 | Fluoranthene | 19 | 460 | 470 | 500 |
| 3 | Pyrene | ND | 197 | 198 | 245 |
| 4 | Triphenylene | ND | 442 | 650 | 1720 |
| 5 (C) | Benzo(a)anthracene | 3 | 575 | 640 | 720 |
| 6 (C) | Chrysene | T | 237 | 360 | 1000 |
| 7 (C) | Benzo(e)pyrene | 5.6 | 220 | 435 | 577 |
| 8 (C) | Benzo(b)fluoranthene | 2 | 56 | 60 | 78 |
| 9 (C) | Benzo(k)fluoranthene | T | 11 | 15 | 18 |
| 10 (C) | Benzo(a)pyrene | T | 20 | 23 | 30 |
| 11 | Benzo(ghi)perylene | 1.3 | 24 | 71 | 113 |
| 12 (C) | Indeno-(1,2,3-cd)pyrene | 0.7 | 41 | 47 | 74 |
| | **Tail Muscle** | | | | |
| 1 | | ND | 20 | 24 | 130 |
| 2 | | 1.2 | 32 | 38 | 102 |
| 3 | | ND | 10 | 25 | 103 |
| 4 | | ND | 37 | 44 | 100 |
| 5 (C) | | ND | 17 | 125 | 140 |
| 6 (C) | | ND | 7 | 12 | 16 |
| 7 (C) | | ND | 9 | 22 | 30 |
| 8 (C) | | ND | 1.6 | 5.6 | 9 |
| 9 (C) | | T | 0.4 | 1.6 | 2.6 |
| 10 (C) | | ND | 0.6 | 2 | 2.7 |
| 11 | | ND | 2.6 | 2.8 | 3 |
| 12 (C) | | ND | 3 | 3.7 | 4 |

ND = not detected, T = trace (C) = carcinogenic PAH.

Table 10. PAH levels in freshly caught lobsters and those held in crates near creosoted wharves for about 1 wk (concentration in ng/g wet weight, ppb).

| Compound | Port Mouton, N.S. Fresh | Port Mouton, N.S. Held | Glace Bay, N.S. Fresh | Glace Bay, N.S. Held | Chester, N.S. Fresh | Chester, N.S. Held | Char. Co., N.B. Fresh | Char. Co., N.B. Held | Auld's Cove, N.S. Held |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Hepatopancreas | | | | | |
| 1 | 220 | 1830[a] | 160 | 654[b] | 28 | 1800[a] | 17 | 143 | 565 |
| 2 | 120 | 374 | 159 | 308 | 197 | 995[a] | 19 | 126 | 175 |
| 3 | 47 | 626[a] | 44 | 168 | ND | 1125[a] | TR | 27 | 85 |
| 4 | 111 | 1008[b] | 72 | 427 | TR | 835[b] | ND | 66 | 316 |
| 5 (C) | 60 | 730[a] | 77 | 217 | 7 | 1430[a] | 2 | 150 | 274 |
| 6 (C) | 5.9 | 11 | 5 | 16 | 2 | 197[b] | 1 | 14 | TR |
| 7 (C) | 17 | 46 | 16 | 41 | 7 | 322[b] | 1.7 | 10 | 96 |
| 8 (C) | 10 | 19 | 9 | 29 | 4 | 57[b] | 1.7 | 13 | 23 |
| 9 (C) | 2.5 | 3.7 | 2.3 | 7 | 1.2 | 16[b] | TR | 1.5 | 7.9 |
| 10 (C) | 2.0 | 2.6 | 2.0 | 8 | 1.0 | 23[b] | TR | 2 | 11 |
| 11 | 2.9 | 0 | 3.1 | 6 | 2.6 | 19 | 1.6 | 5 | 6.2 |
| 12 (C) | 1.6 | 0 | 2.3 | 4 | 3.2 | 25 | 0.7 | 2.6 | 2 |
| | | | | Tail Muscle | | | | | |
| 1 | 11 | 26[b] | 38 | 141[a] | 3.5 | 12[b] | TR | TR | 54[b] |
| 2 | 5.0 | 69[b] | 20 | 32[b] | 1.3 | 44[b] | 2 | 7 | 11 |
| 3 | 0 | 28[b] | 11 | 15[b] | ND | 13[b] | ND | ND | TR |
| 4 | TR | 47[b] | 29 | 55[b] | ND | TR[b] | ND | ND | 120[a] |
| 5 (C) | 2.7 | 47[b] | 11 | 49[b] | ND | 21[b] | ND | 2 | 28[b] |
| 6 (C) | 0 | TR | TR | TR[b] | ND | 1.6 | ND | ND | TR[b] |
| 7 (C) | 0 | 7.5[b] | 3 | 23[b] | ND | 4 | ND | ND | 14[b] |
| 8 (C) | 0.5 | 1.6[b] | 0.6 | 1.1[b] | ND | 1 | TR | TR | 0.6[b] |
| 9 (C) | 0.05 | 0.5[b] | 0.7 | 0.6[b] | TR | TR | TR | TR | 0.6[b] |
| 10 (C) | 0.08 | 0.1 | 1 | 0.8[b] | ND | TR | TR | TR | 0.5 |
| 11 | 0 | 0 | 0.8 | 5[a] | ND | 0.8 | ND | 0.2 | 1.5 |
| 12 (C) | 0 | 0 | 0.8 | TR | 0.1 | 0.2 | ND | 0.2 | 0.6 |

C = Carcinogenic PAH
ND = Not detected, TR = trace
[a]indicates value exceeds range for freshly caught lobsters
[b]indicates value within maximum of range for freshly caught lobsters

Table 11. Examples of PAH levels in lobsters from tank storage with no creosote and from car storage (crates in cars) near creosoted wharves for various times (concentration in ng/g wet weight, ppb).

| Compound | Tanks no creosote | Dipper Harbour, N.B. Crates in car(12 hr) | Dipper Harbour, N.B. Crates in car(1 wk) | Maces Bay, N.B. Crates in car(2-3 d) | Maces Bay, N.B. Crates in car(2 wk) | Port Mouton, N.S. Freshly caught | Port Mouton, N.S. Crates in car(7-10 d) |
|---|---|---|---|---|---|---|---|
| **Hepatopancreas** | | | | | | | |
| 1 | 22 | 187 | 399 | 171 | 1155[b] | ND | 998 |
| 2 | 168 | 372 | 730[a] | 350 | 1380[a] | 200 | 1790[a] |
| 3 | 35 | 187 | 407[a] | 163 | 1105[a] | 7 | 1375[a] |
| 4 | ND | 320 | 50 | TR | 840[b] | TR | 244 |
| 5 | ND | 73 | 200 | 108 | 550 | 6 | 363 |
| 6 | ND | ND | 22 | TR | 84 | ND | 34 |
| 7 | ND | ND | ND | ND | ND | ND | ND |
| 8 | 24 | 17 | 21 | 21 | 31 | 10 | 13 |
| 9 | 5.2 | 3.6 | 4.1 | 4 | 6.7 | 3.8 | 2.7 |
| 10 | 7 | 3.4 | 5.2 | 4.5 | 7.6 | 3.7 | 2.5 |
| 11 | 20 | 4 | ND | 6.4 | 3.1 | ND | ND |
| 12 | 16 | 11 | 6 | 14.6 | 8 | ND | ND |
| **Tail muscle** | | | | | | | |
| 1 | ND | ND | 26 | TR[b] | 50 | ND | 49[b] |
| 2 | TR | 9 | 14 | 30[b] | 32[b] | 3 | 46[b] |
| 3 | ND | ND | 5 | TR | 18[b] | ND | 29[b] |
| 4 | ND | ND | ND | ND | ND | ND | ND |
| 5 | ND | ND | TR | ND | 5.2 | ND | 15 |
| 6 | ND | ND | ND | ND | ND | ND | ND |
| 7 | ND | ND | ND | ND[b] | ND | ND | ND |
| 8 | 0.5 | 0.45 | 0.5 | 2.3[b] | 0.8 | ND | TR |
| 9 | 4 | TR | 0.1 | 0.3 | 0.2 | TR | TR |
| 10 | 0.15 | TR | 0.15 | 0.4 | 0.3 | TR | ND |
| 11 | 2.5 | ND | ND | ND | ND | TR | ND |
| 12 | 0.05 | TR | ND | ND | ND | TR | ND |

[a]indicates value exceeds control range (Table 9)
[b]indicates value within maximum of control range (Values 1-3, Table 9)

Table 12. PAH levels in lobsters held in tidal pounds for 2-3 mo in winter (concentration in ng/g wet weight, ppb).

| Compound | Pound #1 | Pound #2 | Pound #3 | Pound #4 | Pound #5 |
|---|---|---|---|---|---|
| | | Hepatopancreas | | | |
| 1 | 1833[a] | 609 | 1240[b] | 2810[a] | 1350[b] |
| 2 | 2570[a] | 1000[a] | 1605[a] | 2875[a] | 3180[a] |
| 3 | 1766[a] | 452[a] | 1375[a] | 2830[a] | 592[a] |
| 4 | 1870[a] | 1860[a] | 1370[b] | 2620[a] | 1950[a] |
| 5 | 2263[a] | 308 | 2410[a] | 3175[a] | 1685[a] |
| 6 | 176 | 37 | 120 | 94 | 210 |
| 7 | 261[b] | 77 | 286 | 257[b] | 420[b] |
| 8 | 84[a] | 21 | 78[b] | 69[b] | 79[b] |
| 9 | 21[b] | 5.1 | 30[b] | 18[b] | 18[b] |
| 10 | 23[b] | 5.4 | 27[b] | 20 | 13 |
| 11 | 20[b] | 13[b] | 28[b] | 24[b] | 40[b] |
| 12 | 28 | 8 | 26 | 20 | - |
| | | Tail Muscle | | | |
| 1 | 32[b] | 69[b] | 85[b] | 110[b] | 45[b] |
| 2 | 106[a] | 22 | 100[b] | 116[a] | 127[a] |
| 3 | 49[b] | 75[b] | 77[b] | 97[b] | 17[b] |
| 4 | 45[b] | 45[b] | 43[b] | 46[b] | 50[b] |
| 5 | 141[a] | 10 | 37[b] | 41[b] | 48[b] |
| 6 | 6.7 | 4 | 5 | 4.9 | 5 |
| 7 | 3.2 | 7.3 | 11[b] | 10[b] | 13[b] |
| 8 | 3.7[b] | 1.1 | 2.7[b] | 1.9[b] | 4[b] |
| 9 | 0.8[b] | 0.2 | 0.6[b] | 0.4 | 0.7[b] |
| 10 | 1.2[b] | 0.6 | 1.5[b] | 1.0[b] | 0.1 |
| 11 | 0.8 | 1.4 | 2.3 | 1.7 | 1.7 |
| 12 | 1.2 | 0.7 | 1.5 | 1.0 | - |

Pound #1 Sluiceway, twine and 10 ft (3 m) of fencing are creosoted.
" #2 Floor of sluiceway creosoted.
" #3 " " " "
" #4 Old parts creosoted, dating back to 1950's, repairs with untreated wood.
" #5 Old parts creosoted, " " " ".

[a]indicates value exceeds control range (Table 9)
[b]indicates value within maximum of control range (Values 1-3, Table 9)

Appendix Table 1.

LOBSTER IMPOUNDMENT QUESTIONNAIRE

There is growing concern that lobsters take up and store chemical compounds called polycyclic aromatic hydrocarbons (PAH in short) in the hepatopancreas (tomally) and in the meat. PAH's are formed when fossil fuels burn, and they are present in creosote. Some PAH's are carcinogenic; consequently, they are potentially dangerous to people.

We are working on the problem to learn more about the PAH content of freshly caught lobsters from "clean" areas and from "dirty" areas such as in or near industrialized harbours. It is also possible that some storage units add to the PAH load in stored lobsters either because creosoted wood has been used or because the units may be moored near wharves that are made of creosoted lumber.

The attached questions are to obtain information about lobster storage units (type, materials, when and how many lobsters held) and to obtain information on the location of storage units (nearness to wharves, creosoted or not, or near other sources of contaminants) in New Brunswick, Prince Edward Island, and Nova Scotia.

Lobster storage units are of four main types:

A - crates, holding 90-100 lb - Questionnaire A
B - floating cars, compartment or trayed - Questionnaire B
C - tanks - Questionnaire C
D - tidal pounds - Questionnaire D

Please complete the questionnaire or questionnaires that are suitable for each lobster storage operation in your area.

If there are any questions about the forms, please contact Mr. Paul Sutherland, Halifax, N.S. (426-2683) or Dr. D. W. McLeese, Biological Station, St. Andrews, N.B. (529-8854).

It is hoped the forms can be completed by the end of February 1982. Completed forms are to be returned to Mr. Paul Sutherland, Assistant Director, Field Services Branch, Department of Fisheries and Oceans, P. O. Box 550, Halifax, N.S., B3J 2S7.

(1A) LOBSTER IMPOUNDMENT QUESTIONNAIRE - A - CRATE STORAGE

Name of person completing form: _____

Address: _____

Phone number: _____ Date _____

Name of establishment _____

Location (address) _____

_____ Fisheries District _____

Licenced (out of season storage) _____

Not licenced (in season storage only) _____

Number of crates _____ Other storage units? cars ____, tanks ____,

tidal pounds ____

Capacity of crate storage unit

Estimated capacity at one time _____ lb of lobsters

Estimated capacity per year _____ lb of lobsters

Average storage time per lot of lobsters, days ____, weeks ____,

months ____

Storage period or periods From _____ to _____ _____ lb of lobsters held

_____ to _____ _____ lb of lobsters held

_____ to _____ _____ lb of lobsters held

Construction materials used in crates - probably spruce wood _____. If wood is treated, please specify treatment or preservative: creosote_____, tar _____, other _____.

Remarks (for example, treated how often)

General location of crate storage unit

Remarks (Example (a)) - crates are moored in strings near a wharf. Wharf constructed with treated wood - please specify treatment.

(Example (b)) - Is there a potential source of contamination in the area such as fish plants, or other industrial activity?

(1B) LOBSTER IMPOUNDMENT QUESTIONNAIRE - B - CAR STORAGE

Name of person completing form: _____

Address: _____

Phone no.: _____ Date: _____

Name of establishment _____

Location (address) _____

_____ Fisheries District _____

Licenced (out of season storage) _____

Not licenced (in season storage only) _____

Number of cars _____ Other storage units? cars ____, tanks_____,
tidal pounds _____

Size of each car: length _____ ft, width _____, depth _____ ft

Specify if cars divided into compartments: number/car _____, compartment size L _____ ft, W _____ ft or fitted with trays: number trays/ car _____, tray size L ____ ft, W _____ ft, Depth _____

Capacity of car storage unit

Estimated capacity at one time _____ number of cars _____, ____ lbs of lobsters

Estimated capacity per year _____ _____ lbs of lobsters

Average storage time per lot of lobsters, days _____, weeks _____, months ____

Storage periods from _____ to _____ _____ lb of lobsters held

from _____ to _____ _____ lb of lobsters held

from _____ to _____ _____ lb of lobsters held

Construction materials used in cars _____

wood _____ untreated _____ treated _____

If wood is treated, please specify treatment or preservative:

creosote _____ , tar _____, other _____.

Remarks (for example treated how often?)

General location of car storage unit.

Remarks (example (a)) - cars are moored near or against a wharf constructed of treated wood - please specify treatment.

(example (b))- Is there a potential source of contamination in the area such as fish plants or other industrial industry?

(1C) LOBSTER IMPOUNDMENT QUESTIONNAIRE - C - TANK STORAGE

Name of person completing form: _____

Address _____

Phone no.: _____ Date: _____

Name of establishment _____

Location (address) _____

_____ Fisheries District _____

Licenced (out of season storage) _____

Not licenced (in season storage only) _____

Number of tanks _____ Other storage units - crates _____ , cars _____

tidal pound _____

Size of tanks: length _____ , width _____, depth _____

Arrangement: single tanks _____, stacked 2 or 3 high _____

Is tank a self-contained commercially manufactured unit for retail sales?

_____ yes, _____ no

Estimated capacity at one time _____ lb of lobsters

Estimated capacity per year _____ lb of lobsters

Average storage time per lot of lobsters days ____, weeks ____, months ____

Storage period or periods From _____ to _____, _____ lb of lobsters held

From _____ to _____, _____ lb of lobsters held

From _____ to _____, _____ lb of lobsters held

Construction materials used in tanks - (if not commercially manufactured):

wood _____, fibreglass _____, plexiglass _____, other _____

If wood, please specify if treated with wood preservative: creosote _____,

tar _____, other _____.

Remarks (for example treated how often) -

General location of tank storage unit.

In retail store - not near sea _____ uses artificial sea water _____

In building near sea _____ water pumped from sea _____

On wharf (open to weather) _____ water pumped from sea _____

Other remarks (example (a)) - tanks are situated near a wharf constructed with _____ treated wood, please specify treatment.

(example (b)) - Is there a potential source of contamination in the area such as fish plants or other industrial activity?

(1D) LOBSTER IMPOUNDMENT QUESTIONNAIRE - D - TIDAL POUND STORGE

Name of person completing form: _____

Address _____

Phone no. _____ Date: _____

Name of establishment _____

Location (address) _____

_____ Fisheries District _____

Other storage units: crates _____, cars _____, tanks _____

Size of tidal pound

Overall size: length _____, width _____; Total area _____ sq ft

Number of compartments _____

Size of compartments: length _____, width _____.

Remarks about arrangement of compartments (or rough drawing)

Description of dam - Example, around 3 sides or cove dammed off (on rough drawing above)

Dam height (depth of retained water) _____ ft

Depth of water over dam at spring (highest) tides _____ ft, at neap (lowest) tides _____ ft

Length of stagnant period (a) when water (tide) below top of dam _____ hr

(b) when water (tide) is below foot of dam _____ hr

Stocking or capacity of tidal pound

Estimated capacity at one time _____ lb of lobsters

Estimated capacity per year _____ lb of lobsters

Average storage time per lot of lobsters days ____, weeks ____, months ____

Storage periods - from _____ to _____, ____ lb of lobsters held (approx. dates)

from _____ to _____, ____ lb of lobsters held

from _____ to _____, ____ lb of lobsters held

Construction materials used in tidal pound - If any wood is treated with preservative, please specify type - creosote _____, tar _____, other _____. How often is wood, etc. treated.

Pilings - Wood untreated or treated

Dam sheathing - wood untreated _____ or treated _____

Fencing above dam - wood _____, netting _____ treated _____

Sluiceway/gates - size _____, treated _____

Other remarks: (example (a)) - situated open-shore location or in a cove?

(example (b)) - Is there a potential source of contamination in the area - such as creosoted wharf, fish plant or other industrial activity?

Appendix Table 2. Summary of information about crate storage units (69).

| Key no. | Area | No. crates | Storage time | Dates | Capacity Single | Capacity Annual (1000 lb) | Remarks |
|---|---|---|---|---|---|---|---|
| New Brunswick | | | | | | | |
| 1 | Grand Manan | 300 | 2d | Nov-June | 20 | 20 | Near cr. wharf |
| 2 | " | 300 | " | " | 30 | 30 | Tidal pd. area |
| 3 | " | 300 | " | " | " | " | " " " |
| 4 | " | 300 | " | " | " | " | " " " |
| 5 | " | 400 | " | " | " | " | Cr. wharf |
| 6 | " | 300 | 3d | " | " | " | Tidal Pd. area |
| 7 | " | 300 | 2d | " | " | " | Cr. wharf |
| 8 | " | 300 | " | " | " | " | " " |
| 25 | Deer Island | 500 | 3wk | Dec-Jan | 50 | 50 | Tidal Pd. area |
| 28 | " | - | 4-5 mo | Nov-Mar | 100 | 200 | Clean area |
| 29 | " | 70 | 2mo | Apr-Dec | 12 | 80 | In car, creosote wharf |
| 32 | Alma | - | 10d | - | - | - | - |
| 66 | Escuminac | 20 | 0.5d | - | 2 | - | Wharf, boats |
| 67 | " | 20 | 0.5d | - | 2 | - | " |
| 70 | Pt. Sapin | 15 | 0.5d | - | 10 | 10 | Clean area |
| 75 | Buctouche | 20 | 1d | Aug-Oct | 2 | 70 | Cr. wharf |
| 76 | " | 15 | 1d | " | 1.5 | 4.5 | " |
| 77 | " | 10 | 1d | " | 1 | 27 | " |
| 90 | Cape Bald | 20 | 0.5d | " | 2 | 85 | Iced truck |
| 91 | Little Cape | 24 | 0.5d | " | 2.5 | 90 | " |
| 94 | Amos Pt. | 8 | 0.5d | Aug-Sept | 0.7 | 24 | Cr. wharf |
| 95 | Murray Cor. | 6 | 0.5d | " | 0.6 | 22 | " |
| 96 | " | 9 | 0.5d | " | 0.8 | 35 | " |
| 97 | Cape Tormentine | 10 | 0.5d | " | 0.9 | 30 | " |
| 98 | " | 10 | 0.5d | " | - | - | " |
| 99 | Little Cape | 18 | 0.5d | " | 1.6 | 60 | Iced truck |
| 193 | Shippegan | 500 | 2d | May-June | 10 | 400 | Cr. wharf |
| 199 | " | 800 | - | " | - | 425 | " |
| 200 | Stonehaven | 25 | 1wk | " | 2 | 75 | " |
| 202 | Bathurst | - | 1d | - | - | - | In truck |
| 204 | Nigadoo | 100 | 1d | May-Oct | 10 | 100 | - |
| 224 | Neguac | 9 | 1d | - | 0.6 | 32 | - |

Appendix Table 2 (continued)

| Key no. | Area | No. crates | Storage time | Dates | Capacity Single/Annual (1000 lb) | | Remarks |
|---|---|---|---|---|---|---|---|
| **Nova Scotia** | | | | | | | |
| 34 | Cape Breton | 100 | 1d | May-July | 10 | - | Cr. Wharf |
| 35 | " | 500 | 2d | " | 10 | 200 | " |
| 36 | " | 500 | 1d | " | 10 | - | " |
| 37 | " | 100 | 1d | " | 10 | - | " |
| 39 | " | 500 | 1wk | " | 50 | 200 | Concrete wharf |
| 43 | " | 200 | 1d | " | 20 | 20 | - |
| 52 | Chester | - | - | - | - | - | - |
| 92 | Pt. Howe | 8 | 2d | Aug-Sept | 0.7 | 25 | Cr. Wharf |
| 93 | Halifax | 10 | 2d | " | 0.9 | 28 | " |
| 120 | Pt. Mouton | 150 | - | Apr-Oct Nov.Jan | 14 | 26 | " |
| 123 | Metaghan | 288 | 1wk | - | 29 | 150 | " (in car) |
| 124 | " | 384 | 2d | - | - | - | " (in car) |
| 126 | Shelburne | 20 | 1-4wk | Dec | 2 | 2 | Clean area |
| 128 | Metaghan | 35 | 10d | " | 35 | 35 | Wharf (in car) |
| 132 | Anna. Co. | 80 | 3d | Mar-Dec | 7 | 20 | In truck |
| 140 | Yarmouth Bar | 1000 | 1-7d | Dec-May | 50 | 400 | Cr. wharf |
| 141 | " | 250 | 2wk | " | 25 | 200 | Untreated wharf |
| 167 | Jones Harbour | 50 | 3wk | Dec | 5 | 6 | Cr. wharf |
| 168 | Lockeport | 1000 | 5wk | " | 100 | 100 | " |
| 170 | Shelburne Harbour | 20 | 3wk | " | 1 | 2 | - |
| 171 | Lockeport | 2000 | 2wk | Nov-Mar May-Aug | 100 | 200 | Tidal Pd.(clean) |
| 172 | Shelburne | 20 | 6wk | Dec-Jan | 2 | 2 | Near wharf |
| 189 | Clark's Harbour | 500 | 2d | May-June | 10 | 400 | Cr. wharf |
| 211 | Pictou | 100 | 1d | " | 10 | 500 | " |
| **Prince Edward Island** | | | | | | | |
| 110 | Beach Pt. | 300 | 1-5d | May-June | 12 | 400 | In building, |
| 111 | Murray Harbour | 200 | 1d | " | 15 | 250 | " |
| 116a | Tignish | - | - | - | - | - | - |
| 116b | " | - | - | - | - | - | - |
| **Newfoundland** | | | | | | | |
| 225 | Cow Hd. | 350 | 4d | May-July | 60 | 200 | Cr. wharf |
| 226 | Picadilly | 500 | 1wk | Apr-July | 30 | 125 | " |
| 227 | " | 630 | 1wk | " | 30 | 200 | " |
| 229 | Stephenville | 100 | - | " | 10 | 25 | In trucks? |
| 230 | Benoits Cove | 2000 | 1wk | " | 72 | 250 | Cr. wharf |
| 233 | Port-au-Choux | unlimited | 3-5 | - | 50 | 350 | Untreated wharf |
| 234 | " | " | 3-4d | - | 30 | 200 | " |
| 235 | " | " | 3-5d | - | 50 | 200 | " |
| **Quebec** | | | | | | | |
| 241 | Magdalen Is. | 1500 | 3d | May-July | - | 1000 | 1000 ft from cr. wharf |

Appendix Table 3. Summary of information about car storage units (74).

| Key no. | Area | No. cars | Size L/W/D (ft) | Storage Time | Storage Dates | Capacity Single (1000 lb) | Capacity Annual (1000 lb) | Remarks |
|---|---|---|---|---|---|---|---|---|
| **New Brunswick** | | | | | | | | |
| 1 | Grand Manan | 1 | 32/18/3 | 2d-1wk | Seasonal | 18 | 18 | Cr Wharf |
| 5 | " | 2 | " | 2d | " | 18 | 18 | " |
| 6 | " | 1 | " | 2d | " | 14 | 14 | " |
| 7 | " | 1 | " | 2d | " | 18 | 18 | " |
| 8 | " | 1 | 40/18/3 | 2d | Nov-June | 22 | - | " |
| 9 | Maces Bay | 1 | 28/14/3.5 | 2wk | Nov-Jan | - | 8 | " |
| 10 | " | 1 | " | 2wk | Nov-Jan Apr-June | - | 8.5 | " |
| 11 | " | 1 | " | - | - | 3 | 27 | " |
| 17 | Dipper Harbour | 1 | 28/18/10 | 1-7d | Yearly | 12 | 40 | " |
| 18 | " | 1 | 28/18/6 | 2-7d | - | - | - | " |
| 24 | Campobello | 1 | 14/14/4 | 2.5mo | June-Sept | 2 | 5 | " |
| 29 | Deer Island | 1 | 20/14/2.5 | 1.5mo | Apr-Dec | 7 | 40 | " |
| 82 | Cape Bald | 3 | 16/10/3 | 1wk | May-June Aug-Sept | 3 | 80 | " |
| 196 | Caraquet | 1 | 24/12/4 | 3wk | May-June | 2 | 5 | Marina wharf |
| 197 | Grande Anse | 1 | " | 2-3wk | - | 10 | 110 | - |
| 198 | Caraquet | 1 | 22/15/4 | - | - | - | 152 | Clean area |
| 214 | " | 1 | 22/16/3 cpts | 3d | - | 4 | 170 | Wharf (Green) |
| 215 | Shippegan | 5 | " | 1d | - | 15 | 250 | Cr. wharf |
| 217 | " | 1 | 16/16/3 cpts | 2d | - | 3 | 10 | " |
| 218 | Blue Cove | 1 | 26/12/3 | - | May | 6 | 80 | " |
| 220 | Grande Anse | 1 | 24/12/3 cpts | 3-4d | - | 10 | 100 | " |
| 221 | Anse Blue | 1 | 24/10/3 | - | May | 5 | 50 | " |
| 224 | Caraquet | 1 | 22/18/4 (6 cpts) | 2d | - | 60 | 200 | " |
| 227 | Miscou | 3 | 20/14/3 | 2-3d | - | - | - | Clean area |
| 228 | " | 1 | 16/12/3 (4 cpts) | 2d | - | 4 | 173 | - |
| 229 | " | 2 | 20/16/3 (6 cpts) | 2d | - | - | 770 | Wharf |
| 230 | " | 2 | 20/16/3 (6 cpts) | - | - | 8 | 750 | " |
| **Nova Scotia** | | | | | | | | |
| 44 | Cape Breton | 1 | 16/8/4 | 2wk | May-Oct | 0.6 | 2 | Clean area |
| 121 | Wood Harbour | 2 | 30/20/4 | 2mo | - | 8 | 8 (crates) | Cr. wharf |
| 122 | Metaghan | 1 | 32/20/5 | 1wk | - | 29 | 150 " | " |
| 124 | " | 2 | 50/18/5 | 2d | - | 77 | 150 " | " |
| 125 | " | 1 | 40/20/4 | 1wk | - | 2 | 80 " | " |
| 127 | " | 1 | 30/20/7 | 1wk | - | 26 | 26 " | " |
| 129 | Tiverton | 1 | 30/20/4 | 3wk | Dec-Mar | 10 | 60 " | Old wharf |
| 139 | Yarmouth Harbour | 10 | 30/10/4 | 2mo | Dec-Aug | 30 | 400 | New wharf, some cr |
| 145 | Tusket Is. | 3 | 30/26/4 | 3d | Dec-Jan | 180 | - (crates) | - |
| 146 | Harris Is. | 1 | 28/24/4 | 2d | Dec | 12 | - " | - |
| 147 | John's Is. | 3 | 32/24/4 | 1mo | " | 48 | - " | - |
| 148 | Pinkney's Pt. | 1 | 28/24/4 | 2d | " | 12 | - " | Cr. wharf |
| 149 | YarCo (Sluice Pt) | 1 | 30/24/4 | 3d | " | 18 | - " | " |
| 150 | " (L.Surette Is) | 1 | 28/20/4 | 3d | " | 10 | - " | " |

Appendix Table 3 (continued)

| Key no. | Area | No. cars | Size L/W/D (ft) | Storage Time | Storage Dates | Capacity Single (1000 lb) | Capacity Annual (1000 lb) | Remarks |
|---|---|---|---|---|---|---|---|---|
| 151 | " (Morris Is) | 1 | 30/24/4 | 2d | " | 12 | - | " |
| 152 | " (Pickney's Pt) | 2 | 30/24/5 | 3d | " | 40 | - | " |
| 153 | " Deep Cove | 2 | 32/26/6 | 2-5wk | " | 48 | - | " |
| 154 | " L. Wedgeport | 4 | 28/24/4 | 2-5wk | " | 36 | - | " Cr. wharf |
| 155 | " Tusket Is. | 2 | 32/24/6 | 2-5wk | " | 88 | - | " - |
| 156 | " Ellenwood Is. | 3 | 32/28/6 | 2-5wk | " | 50 | - | " - |
| 157 | " Argyle | 2 | 30/16/4 | - | " | 39 | - | " Cr. wharf |
| 158 | " L.River Har. | 2 | 30/24/4 | 2-5wk | " | 36 | - | " " |
| 159 | " E. Pubnico | 1 | 32/26/6 | - | " | 40 | - | " " |
| 161 | " L. Wedgeport | 2 | 28/24/4 | 2-5wk | - | 12 | - | " - |
| 162 | " Pickney's Pt | 2 | 30/20/4 | 2-5d | - | 30 | - | " Cr. wharf |
| 163 | L.W. Pubnico | 5 | 45/15/5 | 1-6wk | - | 150 | - | " " |
| 164 | " | 1 | 40/20/6 | - | Dec | 18 | - | " " |
| 165 | " | 2 | 45/20/4 | 2-5d | " | 42 | - | " - |
| 166 | " | 3 | 45/20/4 | 2-5d | " | 610 | - | " - |
| 169 | Lockeport | 1 | 40/20/5 | - | " | 95 | - | " Cr. wharf |
| 175 | West Hd. | 8 | 30/18/3 | 1-2mo | Dec-June | 24 | - | - |
| 179 | Wood Harbour | 2 | 30/18/3 | - | " | 10 | - | Cr. wharf |
| 180 | Swims Pt. | - | - | - | Yearly | - | 180 | " |
| 182 | Wood Harbour | 1 | 30/18/3 | - | - | - | - | " |
| 183 | Shag Harbour | 5 | - | 1wk | - | 25 | - | " |
| 184 | Newellton | 4 | 38/18/3 | 2d | - | 20 | 100 | " |
| 185 | " | 2 | 30/18/3 | 2d | Dec-Feb | 8 | 50 | " |
| 186 | Shag Harbour | 1 | 30/18/3 | 6wk | Dec-May | 4 | 8 | " |
| 187 | Wood Harbour | 2 | 30/18/3 | 6wk | " | 8 | 16 | " |
| 188 | Cape Is. | 1 | 30/18/3 | 6wk | " | 4 | 8 | " |
| 190 | West Hd. | 2 | 30/18/3 | 2d | Dec-April | 8 | 100 | " |
| 191 | Clark's Harbour | 4 | 30/18/3 | 2-6d | Dec-June | - | - | " |
| 192 | Swims Pt. | 6 | 30/18/3 | 3-6d | Dec-May | 24 | 30 | Clean area |
| Prince Edward Island | | | | | | | | |
| 116 | Gaspereau | 3 | 25/15/3 | 5d | May-June | 75 | 200 | Cr. wharf |
| 117 | Red Hd. | 5 | 15/9/3 | 10d | May-June | 7 | 150 | " |
| Quebec | | | | | | | | |
| 240 | Magdalen Is. | 9 | 12/8/10 | 3d | May-July | 65 | 1000 | near wharf |
| 242 | " | 6 | 15/10/8 | 6d | May-July | 65 | 350 | untreated wharf |

Appendix Table 4. Summary of information about tank storage units (110).

| Key no. | Area | No. tanks | Size L/W/D (ft) | Storage Time | Storage Dates | Storage or retail | Capacity* Single (1000 lb) | Capacity* Annual (1000 lb) | Ratio Annual/ Single | Remarks Water Supply | Remarks Creosote |
|---|---|---|---|---|---|---|---|---|---|---|---|
| New Brunswick | | | | | | | | | | | |
| 6 | Grand Manan | 1 | 10/4/4 | 2d | Seasonal | R | 0.5 | - | - | Artificial SW | 0 |
| 7 | " | 1 | 10/4/4 | 1wk | " | R | 0.5 | - | - | Pumped | - |
| 12 | Back Bay | 4 | 8/4/1.3 | 2wk | Aug-Oct | R | 0.7 | 9 | 12.8 | - | - |
| 13 | " | 3 | 13/5/1.5 | 5wk | Apr-Sept | R | 0.9 | 15 | 16.7 | Trucked | - |
| 15 | Saint John | 2 | 8/4/2 | 2wk | Yearly | R | 0.5 | - | - | Artificial SW | 0 |
| 15a | " | 1 | 9/3/2.5 | 2wk | " | R | 0.3 | - | - | " | 0 |
| 16 | " | 1 | 6/2.5/2.5 | 2wk | " | R | 0.2 | - | - | " | 0 |
| 17 | " | 6 | 10/5/2 | 2wk | - | R | 0.8 | 4 | 10 | Trucked | - |
| 20 | St. Stephen | 1 | 8/4/2 | 3d | Mar-Dec | R | 0.3 | - | - | " | - |
| 17a | Dipper Harbour | 11 | 6/10/3 | 3mo | - | S | 0.8(9) | 40 | 4.4 | Pumped | Cr. wharf |
| 21 | St. Andrews | 4 | 8/4/2 | 2d | June-Sept | R | 0.5 | 5 | 10 | " | " |
| 22 | " | 2 | 8/2.5/1.5 | 1wk | Yearly | R | 0.3 | 3 | 10 | " | " |
| 25 | Deer Island | 36 | 10/3/2 | 2wk | " | S | 72 | 700 | 9.7 | " | - |
| 29 | " | 9 | 8/4/1.3 | 2wk | Apr-Dec | S | 4.5 | 40 | 8.9 | " | - |
| 33 | Alma | 25 | 3/4/1 | 1mo | Apr-Dec | S | 30 | 50 | 1.7 | " | - |
| 68 | Beach R. | 1 | 8/5/2.5 | 4d | May-Oct | R | 0.2 | 5 | 25 | " | - |
| 69 | Escuminac | 1 | 8/5/1.5 | 2d | May-Oct | R | 0.2 | 40 | 200 | Trucked | - |
| 71 | Kouchibouguac | 4 | " | 1d | May-Sept | R | 1 | 64 | 64 | Pumped | - |
| 72 | Richibucto | 9 | 13/6/1.5 | 2d | May-Oct | S | 0.5(5) | 175 | 35 | " | Cr. wharf |
| 73 | Cape Lumiere | 75 | 12/4/1.5 | 2d | May-Oct | S | -(75) | 2,500 | (33) | " | - |
| 74 | Coté Ste Anne | 6 | 10/61/- | 5d | " | S | 3.5 | 60(270) | 17(77) | " | - |
| 78 | Cocagne | 6 | 10/4/1.5 | 5d | " | S | 12 | 175 | 14.6 | " | Old wharf |
| 79 | " | 120 | 14/6/1.5 | 5d | " | S | 130 | 1,250 | 9.6 | " | " |
| 80 | Buctouche | 4 | 10/4/1.5 | 5d | " | R | 4 | 25 | 6.3 | Trucked | - |
| 81 | " | 6 | 16/6/2 | 4d | " | S+R | - | - | - | Pumped | No wharf |
| 83 | Pt. du Chene | 9 | 8/4/1 | 2d | " | S+R | 3 | 50 | 16.7 | " | Cr. wharf |
| 84 | Shediac | 4 | 10/5/1 | 1wk | May-Dec | R | 1.2 | 75 | 62.5 | Artifical SW | 0 |
| 85 | Cape Bald | 36 | 10/5/1.5 | 2d | May-Oct | S | 1(36) | 1,000 | (28) | Pumped | - |
| 86 | Shediac | 144 | 19/5/2 | 1wk | Yearly | S | -(140) | 4,000 | (29) | " | - |
| 87 | Cape Bald | 10 | 11/5/1.5 | 2d | May-Oct | S | 5 | 100 | 20 | " | - |
| 88 | Robichaud | 36 | - | - | " | - | 1(36) | 63 | (1.7) | - | - |
| 89 | Pt. du Clare | - | - | - | - | - | - | - | - | - | - |
| 100 | Cp. Tormentine | 1 | 8/3/1.5 | 10d | May-Oct | R | 0.2 | 5 | 25 | Artifical SW | 0 |
| 101 | Murray Cor. | 10 | 8/4/1.5 | 1wk | " | - | -(10) | 20 | (2) | Pumped | Cr. wharf |
| 195 | Anse Blue | 4 | 18/15/3 | 3wk | May-Dec | S | 8.5 | 25 | 2.9 | " | - |
| 199 | Darlington | 5 | 12/5/1.2 | 3d | Apr-Sept | R | 0.4 | 10 | 25 | " | Wharf |
| 201 | Stonehaven | 2 | 10/5/1.5 | 1wk | May-June | S | 1.5 | 25 | 16.7 | " | Cr. wharf |
| 203 | Nigadoo | 5 | 10/6/2 | 5d | May-Oct | S | 0.7 | 30 | 42.8 | " | - |
| 205 | Petit Rocher | 40 | 12/7/1.5 | 2mo | May-June | S | 40 | 300 | 7.5 | " | - |
| 206 | " | 40 | - | - | - | - | -(40) | - | - | " | - |
| 207 | Tetegooch Hill | 1 | 8/2.5/1 | - | - | R | - | - | - | Artificial SW | 0 |
| 208 | St. Louis de Kent | 4 | 5/4/1.2 | - | May-Oct | R | 0.4 | 20 | 50 | Trucked | Wharf |
| 209 | Escuminiac | 3 | 4.6/10/1.3 | - | " | - | 1.5 | 50 | 33 | " | " |

Appendix Table 4 (continued)

| Key no. | Area | No. tanks | Size L/W/D (ft) | Storage Time | Storage Dates | Storage or retail | Capacity* Single (1000 lb) | Capacity* Annual (1000 lb) | Ratio Annual/ Single | Remarks Water Supply | Remarks Creosote |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 210 | St. Edward de Kent | 9 | 4.6/10/1.3 | 3d | " | - | -(9) | 500 | (55) | Pumped | Cr. wharf |
| 215 | Shippegan | 9 | 12/8/2 | 2d | - | - | 9 | 500 | 55 | - | - |
| 219 | Anse Blue | 4 | 13-/8/10/2.5 | 4-5d | May | - | 6 | 60 | 10 | - | - |
| 222 | Darlington | 6 | 12/5/1.6 | 3d | " | R | 2 | 50 | 30 | - | Wharf |
| 223 | Shippegan | 3 | 20/16/3 | 3d | " | S | 30(3) | 250 | (83) | - | Cr. wharf |
| 225 | Caraquet | 6 | 10/5/2 | 2d | May-June | - | 6 | 60 | 10 | Artificial SW | 0 |
| 226 | " | 2 | 20/8/2 | 7d | May | - | 3 | 60 | 20 | Pumped | - |
| Nova Scotia | | | | | | | | | | | |
| 38 | Glace Bay | 6 | 8/4/2 | 1wk | Yearly | S/R | 2 | 25 | 12.5 | Pumped | - |
| 40 | " | 12 | " | 1wk | " | S/R | 4 | 50 | 12.5 | " | - |
| 41 | Petit de Grat | 8 | " | 3wk | May-Sept | S/R | 10 | 50 | 5 | " | - |
| 42 | " | 1 | 20/20/3 | 1wk | May-Aug | S/R | 1 | 15 | 15 | - | - |
| 45 | N. Sydney | 1 | 5/4/1 | 4wk | May-Dec | R | 0.5 | 15 | 30 | Artificial SW | 0 |
| 46 | Wreck Cove | - | 8/4/2 | 1wk | July-Oct | R | 0.5 | 3 | 6 | " | 0 |
| 47 | Indian Br. | 1 | 40/10/2.5 | 1wk | May-Aug | S/R | 2.5 | 7 | 2.8 | Pumped | - |
| 48 | South Haven | 1 | 8/4/1 | 1wk | May-Oct | R | 0.5 | 3 | 6 | " | - |
| 49 | Louisbourg | 1 | 10/6/1.5 | 2wk | July-Oct | R | 0.5 | 2 | 4 | - | - |
| 50 | Louisbourg | 6 | 15/5/1.5 | 3wk | May-Sept | R | 5 | 5 | 1 | - | - |
| 51 | Main a Dieu | 28 | 10/5/1.3 | 1wk | May-July | S | 20 | 20 | 1 | Pumped | - |
| 52 | Chester | 10 | 8/4/1.5 | 1wk | May-Jan | S | 1.5 | 40 | 26.6 | " | Cr. wharf |
| 53 | Lunenburg Co. | 11 | 12/5/1.5 | 3mo | Yearly | R | 5 | - | - | " | - |
| 54 | Antigonish | 2 | 10/5/1.3 | 3d | May-July | R | 2 | 6 | 3 | Artifical SW | 0 |
| 55 | Aulds Cove | 28 | 8/4/15 | 3d | Yearly | S | 1.2(28) | 300 | (11) | Pumped | - |
| 56 | " | 98 | 10/6/1.3 | 4-5d | May-July | S | -(95) | 300 | (3) | " | - |
| 57 | Antigonish Co. | 6 | 10/5/1.3 | 1wk | " | S | 0.8(5) | 20 | (4) | Pumped | - |
| 58 | Arisaig | 26 | 8/4/2 | 1d | May-June | S | - | 50 | (2) | " | - |
| 59 | Antigonish Co. | 3 | 12/4/2 | 4d | " | S | - | 30 | - | " | - |
| 60 | " | 14 | " | 4d | " | S | 1.5(14) | 30 | (2) | " | - |
| 61 | Guysborough Co. | 2 | 8/7/1.5 | 3wk | - | R | 0.5 | 2 | 2 | " | - |
| 62 | Murphys Cove | 12 | 4/4/5 | 2mo | Apr-Aug | - | 1.2 | 5 | 4.2 | " | - |
| 63 | Lawler Pt. | 24 | 12/6/1.5 | 5wk | Apr-Oct | S | -(24) | 75 | (3) | " | - |
| 64 | River John | 6 | 8/4/1 | 4d | May-Dec | - | - | 20 | - | Artificial SW | 0 |
| 65 | Pictou | 21 | " | 4d | " | S | 4 | 100 | (100)25 | Pumped | - |
| 130 | Centreville | 167 | 12/6/1 | 10d | Yearly | S | 125 | 300 | 2.4 | " | Clean |
| 131 | Westport | 108 | 15/5/2.5 | 3wk | " | S | 50 | 200 | 4 | " | " |
| 133 | Annapolis Co. | 2 | 16/4/1.5 | 3d | Mar-Dec | S | 2.5 | 50 | 20 | " | " |
| 134 | Digby | 18 | 12/8/2 | 3wk | May-Dec | S | -(18) | 50 | (2.7) | " | " |
| 142 | Town Pt. | 4 | 5/4/1.2 | 6wk | Yearly | S | 70(4) | 175 | (43) | " | " |
| 143 | Yarmouth Bar | 8 | 10/6/1.5 | 2wk | Dec-Jan | S | 7 | 165 | 23.6 | " | " |
| 160 | Yarmouth Co. | 30 | 10/6/2 | 5d | - | S | 30 | - | - | " | Cr. wharf |
| 173 | Shelburne Co. | 160 | - | 3wk | Nov-Jan | S | 100 | 200 | 2 | " | Clean |
| 176 | West Hd. | 84 | 8/5/12 | 6wk | Dec-June | S | -(84) | 100 | 1.2 | " | - |
| 178 | Wood Harbour | 15 | 12/8/2.5 | 6wk | " | S | 20 | 200 | 10 | " | Wharf |
| 181 | Swim Pt. | 115 | 12/5/1.5 | 8wk | Yearly | S | 90 | 1,500 | 167 | " | Cr. wharf |

Appendix Table 4 (continued)

| Key no. | Area | No. tanks | Size L/W/D (ft) | Storage Time | Storage Dates | Storage or retail | Capacity* Single (1000 lb) | Capacity* Annual (1000 lb) | Ratio Annual/ Single | Remarks Water Supply | Remarks Creosote |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Prince Edward Island** | | | | | | | | | | | |
| 102 | Northport | 16 | 12/10/1.5 | 1wk | May-Oct | - | -(16) | 20 | (1.3) | Pumped | - |
| 103 | Bloomfield | 21 | 10/5/1.3 | 3d | Aug-Oct | S | 21 | 300 | 14.3 | " | - |
| 104 | Souris | 100 | 4/4/2 | 2d | May-June | S | 100 | 500 | 5 | " | Cr. wharf |
| 105 | Summerside | - | - | - | May-Oct | S | - | - | - | " | " |
| 106 | Kensington | 9 | 10/4/1.5 | 3d | June-Aug | S | 14 | 20 | 1.4 | " | " |
| 107 | Summerside | 18 | - | - | May-Oct | S | 10 | - | - | " | " |
| 108 | Borden | - | - | - | Aug-Oct | S | - | - | - | " | " |
| 109 | Beach Pt. | 88 | 8/4/1 | 4d | May-July | S | 35 | 300 | 8.6 | " | - |
| 112 | Murray Harbour | 72 | 12/5/1 | 10d | May-June | S | 35 | 100 | 2.9 | " | Clean area |
| 113 | Georgetown | 20 | 10/6/1.5 | 1wk | " | S | 14 | 120 | 8.6 | " | - |
| 114 | " | 3 | 10/5/1.5 | 1wk | May-Sept | S/R | 3.5 | 8 | 2.3 | " | - |
| 115 | " | 63 | 8/4/1.5 | 1d | May-June | S | 60 | 1,000 | 16.7 | " | Cr. wharf |
| 118 | Redhead | 18 | 12/5/1.2 | 2d | " | S | 14 | 300 | 21.4 | " | wharf |
| 212 | Kensington | 22 | 12/5/1.5 | 2d | - | S | 10 | 350 | 35 | " | Cr. wharf |
| 213 | Beach Pt. | 14 | 4.7/8/1.5 | 1-5d | May-June | - | 70(14) | 500+ | (36) | " | - |
| **Quebec** | | | | | | | | | | | |
| 236 | Gaspé | 20 | 18/8/3 | 1-2wk | May-Aug | - | 2(20) | 500 | (25) | Pumped | - |
| 237 | " | 26 | 10/5/2 | 1d | May-June | - | 16(26) | 260 | (10) | " | - |
| 238 | " | 12 | 10/6/1.5 | 3d | " | - | 2(12) | 100 | (8) | " | - |
| 239 | " | - | 10/12/1.5 | 2d | " | - | 2 | 150 | 75 | " | - |
| 240 | Magdalen Is. | 21 | 4.6/10/1.3 | 2d | May-July | - | 20 | 100 | 5 | " | Cr. wharf |
| 243 | " | 72 | 12/6/1 | 6d | " | - | 60 | 400 | 6.7 | " | Clean area |
| **Newfoundland** | | | | | | | | | | | |
| 228 | St. Theresse | 3 | - | - | - | - | 9 | 55 | 6.1 | - | - |
| 231 | Codroy | 5 | 15/9/3 | 4d | Apr-July | - | 18 | 200 | 11.1 | - | Cr. wharf |
| 232 | Port aux Basques | 1 | - | 3d | " | - | 23 | 300 | 13 | - | Clean area |

* Where single capacity was not listed, or was listed for 1 tank only, quantity of lobsters is adjusted to about 1000 lbs/tank in brackets.

Appendix Table 5. Summary of information about tidal pound storage units (21).

| Key no. | Location | Size LxW (ft) | Area ('000 sq ft) | Comparts. no. | Storage time | Capacity Single (1000 lb) | Capacity Annual (1000 lb) | Remarks |
|---|---|---|---|---|---|---|---|---|
| **New Brunswick** | | | | | | | | |
| 1 | Woodwards C. G.M. | 300/180 | 54 | 1 | 3mo | 90 | 150 | No creosote,* |
| 2 | Thoroughfare G.M. | 350/100 | 100 | 1 | " | 125 | 225 | Untreated wood |
| 3 | Ross Is. G.M. | 575/300 | 173 | 1 | " | 250 | 400 | " "* |
| 4 | Thoroughfare G.M. | 300/100 | 30 | 1 | " | 50 | 85 | " " |
| 5 | Woodwards C. G.M. | 180/60 | 10 | 1 | " | 60 | 100 | " " |
| 6 | " | 300/140 | 42 | 2 | - | - | - | " "* |
| 7 | Thoroughfare G.M. | 410/225 | 93 | 1 | - | 150 | - | " "* |
| 8 | " | 440/220 | 97 | 2 | 3mo | 200 | 0 | Creosote? |
| 14 | Back Bay | 600/250 | 150 | 3 | - | 250 | 500 | No creosote |
| 19 | Dipper Harbour | 70/60 | 4 | 1 | 1mo+ | 200 | - | " ", Near wharf |
| 23 | Campobello | 600/200 | 120 | 1 | 4-8mo | 125 | 200 | " " |
| 25 | Fairhaven D.I. | 400/500 | 150 | 2 | 3mo | 200 | 400 | Creosote* |
| 26 | Kalmus Cr. D.I. | 1000/200 | 200 | 2(3) | " | 350 | 500 | Some creosoted lumber* |
| 27 | Lambert's C. D.I. | 725/300 | 218 | 3 | 7mo | 200 | 400 | untreated wood |
| 28a | Leonardville D.I. | 400/- | - | 1 | 5mo | 65 | 110 | Sluiceway(4x4') creosoted |
| 28b | " | 325/200 | 65 | 1 | 5mo | 80 | 130 | " " " |
| 30 | " | 250/125 | 31 | 1 | 3mo | 58 | 100 | Untreated wood, cr. wharf |
| 31 | Chocolate C. D.I. | 320/250 | 80 | 1 | 3mo | 84 | 160 | " " |
| **Nova Scotia** | | | | | | | | |
| 144 | Fourchu, Yar. Co. | 455/125 | 57 | 2 | 3 mo | 200 | 750 | untreated wood |
| 174 | Hawk, Shel. Co. | 500/525 | 262 | 4 | 3.5mo | 200 | 450 | " " |
| 177 | Woods Harbour, Shel. Co. | 600/300 | 180 | 1 | 4mo | 90 | 110 | " " |

* Additional information re creosote from a 1979 survey.
#1 Untreated wood except old parts creosoted, dating back to 1954.
#3 Floor of sluiceway, gates and sheathing creosoted wood.
#6,#7 Floor of sluiceway creosoted.
#25 Sluiceway, twine, 10' of fencing creosoted.
#26 Old creosote, built in late 1940's and early 1950's.