ID#
rs-86-015

BIOMONITORING AND ASSESSMENT OF ENVIRONMENTAL CONTAMINANTS IN FISH-EATING BIRDS OF THE UPPER NIAGARA RIVER

a contribution to the

NIAGARA RIVER ENVIRONMENTAL CONTAMINANTS STUDY

U.S. Fish and Wildlife Service
New York Field Office
Cortland, New York 13045

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April 1991

Executive Summary

The Niagara River Environmental Contaminants Study is an ongoing effort by the U.S. Fish and Wildlife Service (Service) emphasizing the use of biological indicators to assess the impacts of environmental contaminants on fish and wildlife resources. Reported here are the results of the wildlife bioindicator portion of the study. The goals of the study were to determine the nature and extent of environmental contaminant burdens in the Common Tern (Sterna hirundo) population of the upper Niagara River area, and to evaluate the potential for negative impacts to that population. Reproductive parameters and contaminant burdens of the upper Niagara River area Common Tern population are compared to the Atlantic coast and lower Great Lakes populations.

Between 1986 and 1988, 62 Common Tern eggs, nine Herring Gull eggs and 17 forage fish samples from the upper Niagara River area were collected and analyzed for organic and elemental residues. The results indicate that organochlorine, heavy metal, and polyaromatic and aliphatic hydrocarbon contamination in upper Niagara River Common Terns is low and does not appear to impair reproduction.

A comparison of the P,P'-DDE:PCBs (polychlorinated biphenyls) ratios for Common Tern and Herring Gull (Larus argentatus) eggs showed them to be nearly the same. Those for Common Tern eggs and forage fish were similar and showed a parallel decline between 1986 and 1988. These comparisons suggest that the concentration of contaminants found in Common Tern eggs reflected local levels rather than contaminant levels on their wintering grounds. Hence, Common Terns were good indicators of upper Niagara River contaminants.

Despite the low levels of contaminants found in the Common Tern eggs and forage fish sampled, the terns experienced poor hatching and fledging success. Predation and poor habitat quality may be the primary factors affecting the breeding success of terns in the upper Niagara River population. However, the high incidence of egg and chick predation and the indirect effects of predation at the tern colonies studied may have masked any observable linkage between poor reproductive performance of Common Terns with local contaminant burdens. Other factors, such as behavioral abnormalities, embryotoxicity, and embryonic mortality that are known to be pollution-induced, should not

be ruled out as having contributed to the poor reproductive success of the Common Terns. In particular, a study should be initiated to investigate parental nest attentiveness, prehatching mortality, and eggshell structure of the Common Terns nesting in the upper Niagara River area to further address the concern over the decline in the population.

ACKNOWLEDGEMENTS

This study was a cooperative effort involving several individuals and organizations. In particular, special thanks go to Gordon Batcheller, Connie Adams and Ken Hotop of the New York State Department of Environmental Conservation, Buffalo, New York for providing logistical support and assistance in the field; Robert E. Ratajczak, Kurt Bogenrider, and Charles Merckel of the State University of New York College at Buffalo, for providing logistical support and assistance in the field; and U.S. Fish and Wildlife Service Volunteer, Michael McMahon for his help in the field and with sample preparations.

In addition, this study would not have been possible without the support and funding provided by the New York Field Office, the Northeast Regional and Washington Offices in the Division of Environmental Contaminants of the U.S. Fish and Wildlife Service. To that end, I thank Leonard P. Corin, Arnie Julin, John T. Hickey, and now retired Field Supervisor Paul Hamilton. Thanks also go to MaryEllen VanDonsel and Megan Patch for their assistance in preparing the manuscript.

Ken Karwowski

TABLE OF CONTENTS

LIST OF TABLES

LIST OF TABLES (Continued)

LIST OF FIGURES

LIST OF APPENDICES

Introduction

Along its route from Lake Erie to Lake Ontario, the Niagara River flows past a complex of steel, petrochemical, and chemical manufacturing industries and urban development. Historically, sources of water for electrical power generation and industrial processes resulted in a high degree of industrialization for the area, particularly in the United States (Niagara River Toxics Committee (NRTC) 1984).

Studies of pollution of the Niagara River have documented serious contaminant problems (Interagency Task Force 1979, Hang and Salvo 1981, County of Erie 1982, Rigg 1982, Vincent and Franzen 1982, NRTC 1984). Over the last several years, these problems have focused media attention on issues such as Love Canal, Occidental Chemical, mirex, dioxins, and fish tumors. What is not so widely known is that the Niagara River supports an exceptional sport fishery and is an important area for waterfowl, colonial nesting birds, and other wildlife resources.

Preliminary studies of contaminated areas in the Niagara River and eastern Lake Erie in the vicinity of Buffalo, New York, have documented high levels of contaminants in Great Lakes and Niagara River fishes. In addition, studies have shown contamination of sediments with various organic compounds and metals including PCBs, polycyclic aromatic hydrocarbons (PAHs), mirex, lead, and mercury.

In 1984, the NRTC identified 35 discharges with significant loadings to the Niagara River. Sixty-one non-point sources were identified as potentially releasing toxics into the river. Pollution levels in sport fish from the Niagara River area have resulted in health advisories by the New York State Department of Health. The recommendation for Cayuga Creek, which flows past the Love Canal-102nd Street Dump Site studied by Hickey et al. in 1986 (1990), is that no fish of any species be eaten. Additionally, the International Joint Commission (IJC) objectives for the protection of fish-consuming birds were exceeded by concentrations of PCBs in young-of-the-year spottail shiners (Notropis hudsonius) from 21 collection sites in the Niagara River (NRTC 1984). The spottail shiner data indicate high levels of contamination from Gill Creek just above Niagara falls at the industrial complex along Buffalo Avenue. In particular, PCBs were found at 21,960 parts per trillion (ppt), benzene hexachloride (BHC) at 265 ppt, and hexachlorobenzene (HCB) at 273 (ppt). The PCB concentrations there are over 200 times that found at most other Niagara River locations. Upstream in the Tonawanda

Creek area, dioxin and dibenzofuran concentrations were reported at 17,670 ppt and 432,000 ppt respectively. These data help explain why Niagara River fish and fish-eating birds are contaminated by high levels of these chemicals (New York State Department of Environmental Conservation 1987).

For the Great Lakes, scientific evidence demonstrates that at least eleven wildlife species have experienced physiological anomalies, reproductive impairments, and/or population declines related to environmental contaminants since the 1960s (Environment Canada 1991). In light of the mounting evidence, there is an emerging pattern suggesting that persistent environmental contaminants are the causative agents affecting the health of those wildlife species.

Wildlife populations in the Niagara River area have not been as well studied, given the relatively high degree of localized contamination in the area, it is likely that wildlife populations are experiencing the same types of impacts as those in the Great Lakes. Several studies of fish-eating birds from the Canadian lower Great Lakes and upper Niagara River have reported organochlorine concentrations in eggs, and correlations of those contaminant levels with reproductive parameters (Gilbertson and Reynolds 1974, Frank et al. 1975, Fox 1976, Gilbertson et al. 1976, Morris et al. 1976, Norstrom et al. 1982, Mineau et al. 1984). Other studies have implicated or suggested environmental contaminants, particularly organochlorine compounds, as the causative agents in the reproductive failure of Herring Gulls, Common Terns, Black-crowned Night- Herons (Nycticorax nycticorax), and Double-crested Cormorants (Phalacrocarax auritus) (Hays and Risebrough 1972, Fox 1976, Morris et al. 1976, Weseloh 1983, Mineau et al. 1984). In addition, an increased incidence of abnormalities among nonpasserines may be related to environmental contamination and seems to be widespread both geographically and taxonomically (Gotchfeld 1975).

In a study of fish-eating birds, Gilbertson et al. (1976) reported Common Terns as having the lowest recorded level of PCB residue in their eggs among several species, but showed the highest incidence of chick deformities. Moreover, Common Tern colonies contained the highest incidence and widest variety of chick abnormalities among the species examined. They also noted that both the incidence of abnormalities and the apparent level of PCB and p,p'-DDE contamination were higher in Common Tern colonies in the lower Great Lakes than those investigated by Hays and Risebrough (1972) on the Atlantic coast. These results

indicate that terns exhibit physiomorphological anomalies with frequencies relative to the degree and nature of localized contamination.

In the U.S. portion of the upper Niagara River, data from censuses of breeding Common Terns conducted between 1983 and 1986 indicated a greater than 24% decline in the population (Batcheller 1986). Although no data about the terns' reproductive parameters or other factors which may have contributed to the population decline were collected, concerns about the potential effects of Niagara River contaminants on the tern population and other wildlife resources arose. In particular, that concern was based on the Common Terns sensitivity to contaminant exposure and the documented contamination of the Niagara River and the terns' forage base, being composed primarily of spottail shiners and other fish species.

To assess the impacts of toxic chemical pollution on the environment, several different groups of scientists in North America are focusing their attention on biological indicators of pollution. Indicators of environmental stress and indicator organisms are being identified and many studies are available where indicators have been successfully used to document the impacts of contaminants. Such studies usually take the form of comparisons between polluted and unpolluted areas where there are known discharges and existing residual pollution in the sediments. From a wildlife standpoint, indicators such as population decrease, effects on reproduction, congenital malformations, behavioral changes, and biochemical changes are being used to document the effects of toxic substances on fish and wildlife resources. These indicators, when accompanied by information on the contaminant levels in whole organisms and tissues, are leading resource managers to address the serious concerns and issues related to toxic chemical pollution in the environment.

To address the concerns about the declining Common Tern population and the potential for negative impacts to other wildlife resources in the Niagara River area related to toxic contaminants, the New York Field Office of the U.S. Fish and Wildlife Service initiated a three year study. The focus of the study was to establish background information on the nature and levels of toxic contaminants of wildlife for the U.S. side of the river, using Common Terns and Herring Gulls as the biological indicators of pollution in the upper Niagara River.

STUDY AREA AND METHODS

Study area

The study area was in the upper Niagara River area of New York State, and encompassed eastern Lake Erie near the terminus of the Buffalo River, and the Tonawanda Channel of the Niagara River to Niagara Falls (Figure 1). A detailed hydrologic and geomorphic description of the area was given by the NRTC (1984). The locations of sampling sites appear in Figure 1. Descriptions of tern nesting sites are given in Appendix A.

Egg collections

A total of 62 Common Tern and nine Herring Gull eggs were collected from randomly selected nests during the summers of 1986, 1987, and 1988. To reduce sampling biases, only the third eggs laid in a clutch incubated less than eight days were collected. Laying sequence was determined by visually comparing eggs in a clutch. The smallest egg was assumed to be the last egg laid. For Common Tern eggs, stage of incubation was estimated by the flotation method described by Hays and LeCroy (1971). The stage of incubation for Herring Gull embryos was estimated by examining embryos after eggs were opened for sample preparation. As eggs were taken from each nest, they were wrapped in aluminum foil, placed in an egg carton, and stored in a cooler packed with "blue ice" until returned to the laboratory. Eggs not processed the same day were refrigerated for no more than three days before they were prepared.

Forage fish collections

To determine the fish species used by Common Terns, dietary data were collected by observing adult terns feeding and chick regurgitations, and by collecting fish dropped in the colonies. Fish species identified as tern forage were collected from areas used by feeding terns with pull seines and hoop nets. Captured fish were emptied directly from the nets into hexane rinsed aluminum foil, wrapped, and stored on ice until processed in the lab. Composite samples of each species were prepared in the laboratory and stored frozen until they were processed by the analytical laboratories.

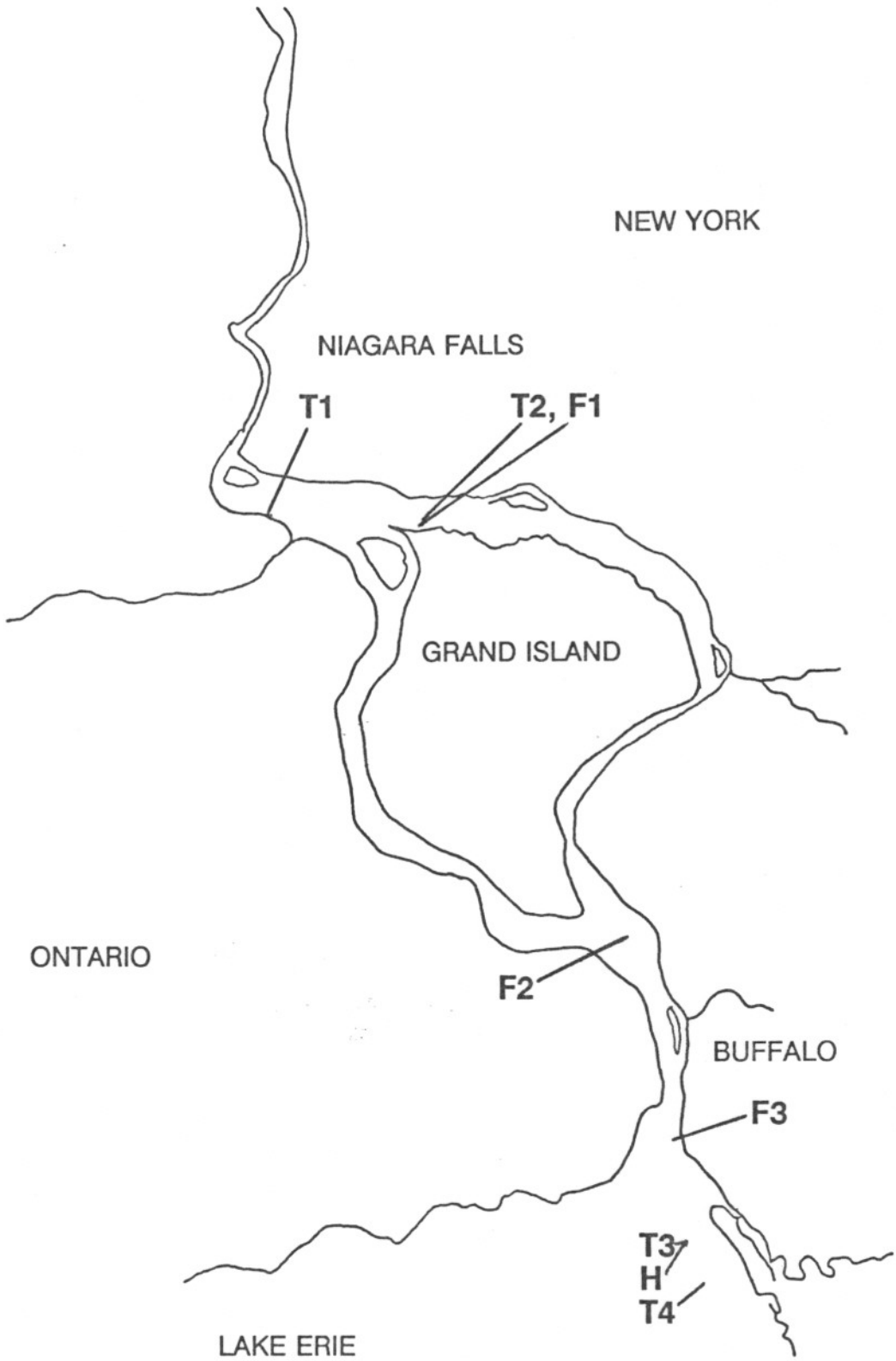

Figure 1. Egg and fish collection sites in the upper Niagara River Study area. Tern egg collection sites: T1 = Tower Island, T2 = Near Crib and Farr Crib, T3 = Donnelly's Pier, T4 = Short Breakwater. Fish collection sites: F1 = East Shore of Grand Island, F2 = Strawberry Island, F3 = Black Rock Canal.

Breeding success of Common Terns

Common Terns breeding in the upper Niagara River area were studied in 1987 and 1988. Between mid-May and mid-July, colony sites were visited every 1-4 days. All nests were marked with a numbered marker, and a detailed chronology was kept for a subsample of randomly selected nests and their contents, until the last egg hatched or the nesting attempt failed. To keep chicks from jumping off colony sites, 30-cm-high, 2.54 cm hexagonal mesh wire fences were erected around study plots prior to the commencement of hatching (Langham 1968, Pearson 1968, Haycock and Threlfall 1975).

For this study hatching success and fledging success were used to measure the relative overall breeding success of the Common Terns nesting in the upper Niagara River area. Hatching success was defined as the number of eggs hatched per egg laid per nest. During the hatching period, chicks were banded within two days of hatching with a Service aluminum leg band. This banding schedule allowed chicks to be identified with a specific nest because they remained in the nest until they were three days old. Chick survival was recorded on each visit by comprehensively searching the colony and recording the band number of each chick encountered. Chicks that were not encountered on a given visit were usually encountered (more than 96%) during the next visit. Unless chicks were found during later visits, they were considered to have been depredated. Chicks alive more than 10 days were considered to have fledged. Information on the history of each chick was collected until the chick died, disappeared, or fledged. Fledging success, like hatching success, was calculated on a per nest basis. Fledging success was defined as the number of chicks fledged per egg hatched per pair.

Sample preparation and analytical procedures

Bird egg and fish sample preparations were conducted as outlined in Appendix B. In 1986, two egg composite samples of Common Tern eggs were submitted to the Weyerhaeuser Analytical and Testing Services (WATS), Weyerhauser Technology Center 2B25, Tacoma, WA 98477, for organochlorine analyses. In 1987 and 1988, two egg composite samples of Common Tern eggs and composite samples of individual species of forage fish were sent to the Mississippi State Chemical Laboratory (MSCL), Box CR, Mississippi State, MS 39762, for organochlorine analyses. In 1987, single egg samples of Herring Gull eggs were sent to MSCL for organochlorine analyses. Analyses for metals and trace substances were all conducted at the Environmental Trace Substances Research Center, Route 3, Columbia, MO 65201. Quality

assurance/quality control (QA/QC) for the analytical techniques used by the contract laboratories were established and overseen by the Service's Patuxent Analytical Control Facility (PACF). Analytical methodologies are summarized in Appendix C.

Statistical methods

Mean contaminant concentrations are reported in parts per million (ppm) wet weight for organic residues and ppm dry weight for elemental residues for each sample when at least half of the samples had detectable levels of contaminants. For this report, a value of one-half the detection limit was assigned to samples in which no residues were detected. Residue concentrations were log transformed before statistical analysis and the retransformed means are presented in the tables. Organochlorine and elemental concentrations in Common Tern eggs collected in 1987 and 1988 were compared between sample sites by T-Test. Means that were not significantly different at $\alpha=0.05$ were pooled for subsequent analyses. Contaminant levels in Common Tern eggs among years were compared by analysis of variance. Multiple comparisons among groups were made by the Bonferroni method.

RESULTS

A total of 31 Common Tern egg, nine Herring Gull egg and 15 forage fish samples were collected for this study. Summary data on egg measurements for tern and gull eggs are listed in Tables 1 and 2 respectively. Data summarizing the forage fish sample measurements are listed in Table 3. The mean percent moisture (± SD) for 1987 and 1988 fish samples was 77.07 (± 1.336), and 76.66 (± 1.514), respectively. The mean percent lipid (± SD) for fish in 1987 was 2.000 (± 0.6905) and 2.168 (± 0.8112) in 1988. Eggshell thickness measurements for Common Terns are summarized in Table 4.

Organochlorine residues

PCBs, p,p'-DDE, and dieldrin were detected in every Common Tern egg in all years (Table 5). Trans-nonachlor was detected in 87% of the eggs. Seven other compounds were detected in two of the three years eggs were collected. With the exception of PCBs and p,p'-DDE, compounds were present at low concentrations, in the range of a few hundredths of a ppm. Maximum concentrations of PCBs and

p,p'-DDE were 8.2 and 1.6 ppm respectively. DDE:PCB ratios for bird eggs and forage fish are summarized in Table 6. Geometric mean concentration and 95% confidence interval of organochlorine residues are summarized in Table 7.

For Herring Gull eggs, oxychlordane, heptachlor epoxide, PCBs, p,p'-DDE, DDD, mirex, and dieldrin were detected in every egg (Table 8). No other organochlorine compounds were detected. Maximum concentrations of PCBs and p,p'-DDE were 14.0 and 2.6 ppm respectively. Other organochlorine compounds were present at lower levels that ranged from a few hundredths to less than three tenths of a ppm.

In forage fish, PCBs and p,p'-DDE were detected in all samples (Table 9). Trans-nonachlor was present in five of the 15 samples in concentrations at, or just above the lower level of detection (0.01 ppm). Dieldrin was detected in only three samples at concentrations equal to 0.01 ppm. No other organochlorine compounds were detected in any of the fish samples. Maximum concentrations of PCBs and p,p'-DDE were 0.34 and 0.05 ppm respectively.

Metals and trace elements

Concentrations of six elemental residues were detected in all Common Tern eggs in all years of the study (Table 10). Aluminum, cadmium, and chromium were detected at low levels in at least one year. Maximum concentrations of mercury, selenium, and copper were 3.78, 3.7, and 3.5 ppm respectively. Lead was detected in less than half of the tern eggs collected in 1987, whereas no lead was detected in eggs in 1986 or 1988. Geometric mean concentrations and 95% confidence intervals of elemental residue concentrations in tern eggs are summarized in Table 11.

Herring Gull eggs had detectable levels of eight elemental residues in over half the eggs sampled in 1987 (Table 12). Maximum concentrations of mercury, selenium, and copper were 0.91, 3.8, and 3.25 ppm respectively. Lead was detected in six of nine eggs sampled, at concentrations ranging from 0.04 to 1.0 ppm.

Forage fish had detectable levels of 11 elemental residues in over half of the samples collected in 1987 and 1988 (Tables 13 and 14). Beryllium was detected at low levels in all fish samples in 1987. In 1988, only two of eight samples had detectable concentrations of beryllium (0.01, 0.03 ppm). Maximum concentrations of mercury, selenium, and copper were 0.23, 3.00, and 4.40 ppm respectively. Nickel was detected in fish collected in both years, with concentrations being significantly higher in 1988. The

maximum concentration of nickel reported in 1988 was 2700 ppm (sample CFO-FF-88-4), followed by 467 ppm for sample CFO-FF-88-8. The concentration of nickel reported for sample CFO-FF-88-4 was considered to be an extraneous value and was not used in calculating the geometric mean or 95% confidence interval (Q=0.83 n=8, Dean and Dixon 1951) for nickel.

Aliphatic and aromatic hydrocarbons

The majority of Common Tern egg samples collected between 1986 and 1988 had concentrations of aliphatic hydrocarbons below the level of detection, or measuring a few hundredths of a ppm (Table 15). The compound, n-heptadecane, was detected in over 77% of the samples and concentrations ranged from below the level of detection to 1.2 ppm. Only two PAHs were detected in the tern eggs sampled between 1986 and 1988. In 1986, no PAHs were present in the samples. In 1987, naphthalene was found in all samples (15) at a maximum concentration of 0.04 ppm, but was not detected in samples collected in 1986 or 1988. Benzo(e)pyrene was the only other PAH detected in the 31 egg samples submitted. The maximum concentration for six of the ten samples was equal to the lowest level of detection (0.01 ppm).

For Herring Gull eggs, aliphatic compounds were detected in less than half of all samples at concentrations below 0.15 ppm. Naphthalene was the only PAH detected, and was present in all gull eggs (n=9) at concentrations between 0.01 and 0.02 ppm.

Forage fish samples had detectable levels of ten aliphatic hydrocarbons. The occurrence and geometric mean concentrations of those compounds are given in Tables 16 and 17 respectively. In 1987, naphtalene was the only PAH detected in more than half of the fish samples at levels equal to 0.01 ppm. In 1988, 1,2-benzanthracene, benzo(e)pyrene, and benzo(g,h,i,)perylene were found in more than half of the samples at concentrations equal to 0.01 ppm.

DISCUSSION AND CONCLUSIONS

Organochlorine, heavy metal, PAH, and aliphatic contamination in upper Niagara River Common Terns is low (highest concentration PCBs = 8.2 ppm, p,p'-DDE = 1.6 ppm) and does not appear to impair their reproduction. This conclusion is consistent with the findings of Custer et al. (1983) and is supported by the same type of evidence. Maximum and mean concentrations of the most prevalent organochlorines in this study, PCBs, p,p'-DDE, and dieldrin, were several times lower than those reported to affect reproduction in Common Terns elsewhere. Mean concentrations of p,p'-DDE and dieldrin declined annually, and were significantly lower in 1988 than in the previous two years of study. A similar trend was also evident for mercury (maximum concentration = 0.64 ppm wet weight), with the mean concentrations being significantly lower in each additional year of study and several times below those known to affect reproduction in birds (Fimrette 1974, Eisler 1987). The high levels of nickel found in the 1988 forage fish samples are not consistent with other data collected by the Service, and may be the result of sample contamination or analytical problems. Mean concentrations of PAHs and aliphatics, when detectable, were usually a few hundredths to a few tenths of a part per million.

Among the organochlorines found in birds' eggs, p,p'-DDE is most often associated with eggshell thinning (e.g. Radcliffe 1967, 1970, Longcore et al., 1971, King et al. 1978, Blus 1982), whereas PCBs are thought not to affect eggshell thickness (Peakall 1975). The mean eggshell thickness of Common Tern eggs collected between 1986 and 1988 were in the range of those measured by Custer et al. (1983) for Atlantic coast Common Terns and by Weseloh et al. (1989) for Common Terns of the Canadian Great Lakes. In addition, neither Custer et al. nor Weseloh et al. found a significant correlation between p,p'-DDE concentrations in Common Tern eggs and eggshell thickness. Common Tern eggshell thickness and structure are not seriously affected until mean p,p'-DDE levels exceed 4 ppm in eggs (Switzer et al. 1973, Fox 1976), however, the maximum concentration of p,p'-DDE detected in this study was 1.6 ppm.

The usefulness of an indicator species in assessing contaminant exposures depends largely upon how well the species reflects the character of local contamination. The ratio of p,p'-DDE to PCBs among Common Tern eggs, Herring Gull eggs, and forage fish collected during this study, suggests that the concentrations of contaminants found in

Common Tern eggs reflected local levels rather than contamination levels obtained on the terns' wintering grounds. Several lines of evidence support this conclusion.

First, the DDE:PCBs ratios for Common Tern and Herring Gull eggs collected in 1987 were nearly the same (0.15 for Common Tern and 0.16 for Herring Gull). Since 1974, Herring Gulls have been used as a primary monitor of organochlorine contaminants for the Great Lakes (Gilbertson 1974, Mineau et al. 1984). On Lake Erie, Herring Gulls are year round residents whose diet is primarily fish (> 94%), and are therefore considered to be good indicators of local contaminant levels (Mineau et al. 1984, Fox et al. 1990). Since the ratio of p,p'-DDE to PCBs for Herring Gull and Common Tern eggs are nearly the same, it appears that the eggs of breeding terns reflect the local contaminant burdens. Secondly, the pattern of contaminant uptake in forage fish collected from the Niagara River should be indicative of local contamination. Between 1986 and 1988, there was a parallel reduction in the DDE:PCBs ratios for Common Tern eggs and fish collected from the Niagara River, evidence that further supports the conclusion that tern eggs reflect local pollution. Finally, several studies (e.g. Ohlendorf et al. 1978, Custer et al. 1983, 1985, Fasola et al. 1987, Weseloh et al. 1989) have attributed organochlorine concentrations in eggs of breeding Common Terns to have been of local origin and not from their wintering grounds. These findings further support our view that the Common Tern was a good monitor of environmental contaminants in the upper Niagara River area.

Despite the low concentration of contaminants found in the bird egg and fish samples from the upper Niagara River, Common Terns experienced poor hatchability and fledging success. Predation of eggs, chicks, and adults, and poor habitat quality may have been the primary factors causing the poor reproductive performance of terns in the upper Niagara River population. Over 49% of the total egg losses in 1987 were due to direct predation (eggs or chicks being eaten) or indirect predation effects (reduced parental attentiveness, eggs cracked from startle flights of incubating adults or abandonment of nests). In 1988, the same pattern of egg depredation accounted for over 60% of all hatching failures. In addition to egg losses resulting from being eaten, many eggs laid directly on smooth or weathered, irregular concrete surfaces were broken or cracked. In 1987 and 1988, over 60% of all nests were located on a concrete substrate, and many of the eggs that failed to hatch had stress cracks in their shells. Given that the majority of the population nests on concrete

substrates and the incidence of predation remains high, continued poor reproductive output could be expected.

Although the evidence collected in this study strongly supports the conclusion that predation was the primary factor in the low hatchability and fledging success of Common Terns in 1987 and 1988, the high incidence of egg and chick predation and associated effects may have masked any observable linkage between poor reproductive performance and local contamination. Since other pollution-induced factors such as gross physiological, behavioral, and histopathological effects that are known to affect the health of fish-eating bird populations (e.g. Gilbertson 1974, Fox et al. 1978, Gilbertson 1983, and Fox and Weseloh 1987) were not examined in this study, but may have had a role in the low reproductive output of the tern population, additional study should be conducted to investigate the low recruitment rate of breeding Common Terns in the upper Niagara River area, and the more subtle effects of contaminant related impacts.

In conclusion, the relatively low level of contaminant burdens observed in this study suggests that the overall exposure of fish-eating water bird populations to toxic contaminants is unlikely to be an important factor in the population dynamics of Common Terns, Herring Gulls, and other fish eating bird populations in the area. However, additional studies may be needed to determine if the poor reproductive performance of Common Terns was the direct result of predation, and that contaminant related factors were not obscured by predation effects. Pollution-induced effects such as behavioral abnormalities, embryotoxicity, teratology, target organ toxicity, or embryonic mortality may be affecting the health of the Common Tern and other wildlife populations in the area, but were not considered in this preliminary study.

LITERATURE CITED

Batcheller, G. Robert presented to the Upper St. Lawrence River Tern Working Group. Mallorytown Landing, Ontario, Canada, September 24, 1986.

Blus, L. J. 1982. Further interpretation of the relation of organochlorine residues in Brown Pelican eggs to reproductive success. Environ. Pollut. (Ser. A) 28:15-33.

County of Erie, Department of Environment and Planning. 1982. Hazardous Waste Inactive Site Survey Phase I - Report.

Custer, T. W., R. M. Erwin, and C. Stafford. 1983. Organochlorine residues in Common Tern eggs from nine Atlantic Coast colonies, 1980. Colonial Waterbirds 6: 197-204.

Eisler, R. 1987. Mercury hazards to fish, wildlife, and invertebrates: a synoptic review. U.S. Fish Wildl. Serv. Biol. Rep. 85(1.10). 90 pp.

Environment Canada. 1991. Toxic Chemicals in the Great Lakes and associated effects. Environment Canada, Communications Directorate Ontario Region, Toronto, Ontario, M4T 1M2. 51 pp.

Fasola, M., I. Vecchio, G. Caccialanza, C. Gandini, and M. Kitsos. 1987. Trends of organochlorine residues in eggs of birds from Italy, 1977 to 1985. Environ. Pollut. 48:25-36.

Fimreite, N. 1971. Effects of dietary methylmercury on Ring-necked Pheasants. Canadian Wildlife Service Occasional Papers No. 9.

Fox, G. A. 1976. Eggshell quality: its ecological and physiological significance in a DDE-contaminated Common Tern population. Wilson Bull. 88:459-477.

Fox, G. A., A. P. Gilman, D. B. Peakall, and F. W. Anderka. 1978. Behavioral abnormalities of nesting Lake Ontario Herring Gulls. J. Wildl. Manage. 42:477-483.

Fox, G. A., L. J. Allan, D. V. Weseloh, and P. Mineau. 1990. The diet of Herring Gulls during the nesting period in Canadian waters of the Great Lakes. Can. J. Zool. 68:1075-1085.

Frank, R., H. E. Holdrinet, and W. A. Rapley. 1975. Residue of organochlorine compound and mercury in birds' eggs from the Niagara Peninsula, Ontario. Arch. Environ. Contam. Toxicol. 3:205-218.

Gilbertson, M. 1974. Pollutants in breeding Herring Gulls in the Lower Great Lakes. Can. Field-Nat. 88:273-280.

Gilbertson, M. 1983. Etiology of chick edema disease in Herring Gulls in the lower Great Lakes. Chemosphere 12:357-370.

Gilbertson, M., and L. M. Reynolds. 1974. DDE and PCB in Canadian birds, 1969 to 1972. Can. Wildl. Serv. Occ. Paper No. 19, 17 pp.

Gilbertson, M., R. D. Morris, and R. A. Hunter. 1976. Abnormal chicks and PCB residue levels in eggs of colonial birds on the lower Great Lakes (1971-1973). Auk 93:434-442.

Gotchfeld, M. 1975. Developmental defects in Common Terns of western Long Island, New York. Auk 92:58-65.

Hang, W. L. T. and J. P. Salvo. 1981. The Ravaged River: Toxic Chemicals in the Niagara. The New York Public Interest Research Group, Inc.

Haycock, K., and W. Threlfall. 1975. The breeding biology of the Herring Gull in Newfoundland. Auk 92:678-697.

Hays, H., and M. LeCroy. 1974. Field Criteria for determining incubation stage in eggs of the Common Tern. Wilson Bull. 83:425-429.

Hays, H., and R. W. Risebrough. 1972. Pollutant concentrations in abnormal young terns from Long Island Sound. Auk 89:19-35.

Hickey, J. T., R. O. Bennett, and C. Merkel. 1990. Biological indicators of environmental contaminants in the Niagara River: histological evaluation of tissues from brown bullheads at the Love Canal - 102nd Street dump site compared to the Black Creek, reference site. U. S. Fish and Wildlife Service, New York Field Office, Cortland, New York. 124 pp.

Interagency Task Force on Hazardous Wastes. 1979. Draft Report on Hazardous Waste Disposal in Erie and Niagara Counties, New York.

King, K. A., E. L. Flickinger, and H. H. Hildebrand. 1978. Shell thinning and pesticides residues in Texas aquatic bird eggs, 1970. Pest. Monit. J. 12:16-21.

Langham, N. 1968. The biology of terns Sterna spp. Unpubl. Ph.D. Dissertation, Univ. Durham, England.

Longcore, J. R., F. B. Samson, and T. W. Whittendale. 1971. DDE thins eggshell and lowers reproductive success of captive Black Ducks. Bull. Environ. Contam. Toxicol. 8: 485-490.

Mineau, P., G. A. Fox, R. J. Norstrom, D. V. Weseloh, D. J. Hallett, and J. A. Ellenton. 1984. Using the Herring Gull to monitor levels and effects of organochlorine contamination in the Canadian Great Lakes. In Toxic Contaminants in the Great Lakes, ed. J.O. Nriagu and M.S. Simmons, Wiley and Sons, New York, pp. 426-52.

Morris, R. D., R. A. Hunter, and J. F. McElman. 1976. Factors affecting the reproductive success of Common Tern (Sterna hirundo) colonies on the lower Great Lakes during the summer of 1972. Can. J. Zool. 54:1850-1862.

Newell, A. J., D. W. Johnson, and L. K. Allen. 1987. Niagara River biota contamination project: fish flesh criteria for piscivorous wildlife. New York State Depart. Environ. Conservation. Tech. Rep. 87-3 Bureau of Environmental Protection. 181 pp.

Norstrom, R. J., D. J. Hallett, F. I. Onuska, and M. E. Comba. 1980. Mirex and its degradation products in Great Lakes Herring Gulls. Environ. Sci. Technol. 14:860-866.

Report of the Niagara River toxics committee, October 1984. 1984. The Niagara River toxics committee. R. J. Collin, U.S. Chairman, New York State Department of Environmental Conservation, Albany, New York.

Ohlendorf, H. M., E. E. Klaas, and T. E. Kaiser. 1978. Environmental pollutants and eggshell thinning in the Black-crowned Night-Heron. In Wading Birds. ed. A. Sprunt, IV, J.C. Ogden and S. Winckler, Natl. Audubon Soc. Res. Rep. No. 7, pp. 63-82.

Peakall, D. B. 1975. PCBs and their environmental effects. CRC Critical Reviews in Environ. Control 5:469-509.

Ratcliffe, D. A. 1967. Decrease in eggshell weight in certain birds of prey. Nature 215:208-210.

Ratcliffe, D. A. 1970. Changes attributable to pesticides in eggshell breakage frequency and eggshell thickness in some British birds. J. Appl. Ecol. 7:67-115.

Reinert, R. E. 1970. Pesticide concentrations in Great Lakes fish. Pest. Monit. J. 3:233-240.

Rigg, K. 1982. Project Pipewatch: Water Pollution and the Permit System in Erie County, New York. Rachel Carson College, State University of New York at Buffalo.

Switzer, B., V. Lewin, and E. H. Wolfe. 1973. DDE and reproductive success in some Alberta Common Terns. Can. J. Zool. 51:1081-1086.

Vincent, J., and A. Frazen. 1982. Overview of Environmental Pollution in the Niagara Frontier, New York. U.S. Environmental Protection Agency.

Weseloh, D. V., S. M. Teeple, and M. Gilbertson. 1983. Double-crested cormorants of the Great Lakes: Egg-laying parameters, reproductive failure, and contaminant residues in eggs, Lake Huron 1972-1973. Can. J. Zool. 61:427-436.

Weseloh, D., T. Custer, and B. M. Braune. 1989. Organochlorine contaminants in Eggs of Common Terns from the Canadian Great Lakes, 1981. Environ. Pollut. 59:141-160.

Table 1. Measurements of Common Tern eggs collected from the upper Niagara River, New York area by year.

	1986 (n=6)	1987 (n=15)	1988 (n=10)
Mean volume (mL) (±SD)	---	19.9 ± 1.400	22.0 ± 1.426
Mean whole egg mass (g)(± SD)	19.3 ± 2.024	20.1 ± 1.386	21.5 ± 1.403
Mean % lipid (± SD)	8.75 ± 0.786	9.37 ± 0.551	10.0 ± 0.675
Mean % moisture (± SD)	77.0 ± 0.689	76.7 ± 0.572	74.9 ± 3.174

Table 2. Measurements of Herring Gull eggs collected from Buffalo Harbor, New York in 1987.

Measurement	Mean ± SD	Sample Size
Whole egg mass (g)	88.05 ± 4.718	9
Length (mm)	73.38 ± 2.749	8
Breadth (mm)	49.81 ± 1.982	8
% Moisture	75.23 ± 1.946	9
% Lipid	8.93 ± 0.9934	9

Table 3. Forage fish species and sample descriptions for fish collected from the upper Niagara River, New York in 1987 and 1988.

Sample I.D.	Species	Sample mass (g)	No. Fish	Sample Location[a]
CFO-FF-87-7	Notropis hudsonius	53.85	22	F3
CFO-FF-87-8	Perca flavescens	49.95	14	F3
CFO-FF-87-9	Notropis atherinoides	81.90	103	F3
CFO-FF-87-10	Notropis hudsonius	57.65	23	F2
CFO-FF-87-11	Fundulus diaphanus	86.55	36	F2
CFO-FF-87-12	Notropis atherinoides	63.00	36	F2
CFO-FF-87-13	Notropis atherinoides	64.45	41	F2
CFO-FF-88-1	Notropis hudsonius	102.45	41	F3
CFO-FF-88-2	Pimephales notatus	103.40	35	F3
CFO-FF-88-3	Notropis hudsonius	101.70	38	F3
CFO-FF-88-4	Notropis hudsonius	100.10	40	F2
CFO-FF-88-5	Notropis hudsonius	101.95	46	F2
CFO-FF-88-6	Pimephales notatus	100.95	35	F2
CFO-FF-88-7	Notropis atherinoides	100.65	75	F1
CFO-FF-88-8	Notropis atherinoides	101.40	75	F1

[a] Sampling sites are indicated in Figure 1.

Table 4. Mean thickness (mm) of Common Tern eggshells by year.

Year	N	$\bar{x}$ ± SD
1986	7	0.198 ± 0.006 A[a]
1987	31	0.208 ± 0.013 AB
1988	19	0.212 ± 0.013 B

[a] Means that do not share the same letter are significantly different from one another, Bonferroni multiple comparison method, $\alpha = 0.05$.

Table 5. Occurrence of organochlorine residues (ppm wet weight) in Common Tern Eggs collected from the upper Niagara River, New York, between 1986 and 1988.

Compound	Number with residues and ranges (in parentheses) 1986 (n=6)	1987 (n=15)	1988 (n=10)
HCB	4 (ND -0.02)	ND	10 (0.01-0.08)
Oxychlordane	6 (0.04-0.08)	ND	10 (0.01-0.03)
Heptachlor epoxide	6 (0.02-0.04)	ND	10 (0.01-0.02)
Cis-chlordane	6 (0.02-0.05)	ND	ND
Cis-nonachlor	6 (0.01-0.02)	ND	8 (ND -0.02)
Trans-nonachlor	6 (0.02-0.04)	13 (ND -0.09)	8 (ND -0.03)
Methoxychlor	6 (0.06-0.14)	NR	NR
PCB	6 (3.4 -5.1)	15 (3.5 -8.2)	10 (3.0 -7.0)
p,p'-DDE	6 (0.82-1.6)	15 (0.43-1.3)	10 (0.40-0.93)
DDT	5 (ND -0.04)	ND	ND
Mirex	ND	12 (ND -0.23)	9 (ND -0.16)
Dieldrin	6 (0.07-0.15)	15 (0.03-0.09)	10 (0.02-0.06)

ND = Not detected
NR = Not reported

Table 6. Comparison of DDE:PCB (ppm, Geometric mean wet weight) ratios among Common Tern eggs, Herring Gull eggs, and forage fish collected from the upper Niagara River, New York, between 1986 and 1987.

Year	Common Tern (n=31)	Herring Gull (n=9)	Forage fish (n=15)
1986	.27	---	---
1987	.15	.16	.22
1988	.13	---	.15

Table 7. Geometric mean concentration (ppm wet weight) and 95% confidence interval of organochlorine residues in eggs of Common Tern collected from the upper Niagara River and Buffalo Harbor, New York, between 1986 and 1988.

	1986 (n=6)		1987 (n=15)		1988 (n=10)	
Compound	Mean	95% C.I.	Mean	95% C.I.	Mean	95% C.I.
HCB	0.01	0.00-0.02	ND	---	0.02	0.01-0.02
Oxychlordane	0.05	0.04-0.07	ND	---	0.02	0.01-0.02
Heptachlor epoxide	0.03	0.02-0.04	ND	---	0.02	0.01-0.02
α-Chlordane	0.02	0.02-0.04	ND	---	ND	---
Cis-nonachlor	0.01	0.01-0.02	ND	---	0.01	0.01-0.01
Trans-nonachlor	0.02	0.01-0.03	0.02	0.01-0.04	0.01	0.01-0.02
Methoxychlor	0.10	0.07-0.13	--	---	--	---
PCB	4.5	3.9 -5.2	5.9	5.1 -6.8	4.3	3.6 -5.1
p,p'-DDE	1.2	0.91-1.6	0.88	0.75-1.0	0.58	0.46-0.71
o,p'-DDT	0.03	0.01-0.06	ND	---	ND	---
Mirex	ND	---	0.03	0.02-0.07	0.04	0.02-0.09
Dieldrin	0.09	0.06-0.12	0.06	0.05-0.07	0.03	0.03-0.04

ND = Not detected

Table 8. Geometric mean concentration (ppm wet weight), 95% confidence interval, and occurrence of organochlorine residues in Herring Gull eggs (N=9) collected from the Buffalo Harbor, New York in 1987.

Compound	Mean	95% C.I.	Number with Residues (Range)
Oxychlordane	0.10	0.07- 0.14	9 (0.07- 0.24)
Heptachlor epoxide	0.08	0.06- 0.10	9 (0.05- 0.13)
PCB	10.	8.9 -12.	9 (8.6 - 14.)
p,p'-DDE	1.6	1.3 - 1.9	9 (1.2 - 2.6)
p,p'-DDD	0.03	0.02- 0.05	9 (0.02- 0.12)
Mirex	0.08	0.06- 0.12	9 (0.05- 0.16)
Dieldrin	0.11	0.08- 0.15	9 (0.07- 0.22)

Table 9. Occurrence of organochlorine and aliphatic compound residues (ppm wet weight) in forage fish collected from the upper Niagara River, New York area in 1987 and 1988.

Compound	Number with residues and ranges (in parentheses) 1987 (n=7)	1988 (n=8)
PCB	7 (0.07-0.13)	8 (0.06-0.44)
p,p'-DDE	7 (0.01-0.03)	8 (0.02-0.05)
n-Dodecane	7 (0.03-0.05)	6 (ND -0.02)
n-Tridecane	6 (ND -0.07)	6 (ND -0.01)
n-Tetradecane	5 (ND -0.10)	7 (ND -0.03)
n-Pentadecane	7 (0.02-0.35)	7 (ND -0.02)
n-Hexadecane	6 (ND -0.23)	8 (0.01-0.28)
n-Heptadecane	7 (0.12-5.2)	8 (0.18-1.2)
Pristane	ND	8 (0.02-0.13)
n-Octadecane	6 (ND -0.31)	8 (0.03-0.08)
Phytane	7 (ND -0.14)	8 (0.02-0.04)
n-Nonadecane	7 (0.03-1.4)	ND
n-Eicosane	ND	8 (0.02-0.04)

ND = Not detected

Table 10. Occurrence of metal and trace element residues (ppm dry weight) in Common Tern eggs collected from the upper Niagara River, New York area between 1986 and 1988.

Element	Number with residues and ranges (in parentheses) 1986 (n=6)	1987 (n=15)	1988 (n=10)
Aluminum	ND	9 (ND - 1.5)	8 (ND - 0.05)
Cadmium	ND	10 (0.03 - 0.40)	7 (ND - 0.05)
Chromium	4 (ND - 0.03)	ND	ND
Copper	6 (2.66- 3.50)	15 (2.52 - 3.08)	10 (2.20 - 3.06)
Iron	6 (109. -138.)	15 (99.1 -140.)	10 (88.4 -130.)
Manganese	6 (1.70- 2.80)	15 (1.50 - 3.76)	10 (1.30 - 2.38)
Mercury	6 (1.40- 2.80)	15 (0.547- 1.30)	10 (0.759- 1.80)
Selenium	6 (3.1 - 3.4)	15 (2.6 - 3.7)	10 (3.0 - 3.6)
Zinc	6 (57.5 - 69.7)	15 (56.8 - 81.0)	10 (52.1 - 65.1)

ND = Not detected

Table 11. Geometric mean concentration (ppm wet weight) and 95% confidence interval of elemental residues in eggs of Common Terns collected from the upper Niagara River and Buffalo Harbor, New York, between 1986 and 1988.

	1986 (n=6)		1987 (n=15)		1988 (n=10)	
Element	Mean	95% C.I.	Mean	95% C.I.	Mean	95% C.I.
Mercury	1.91	1.49- 2.44	0.76	0.67- 0.87	1.24	1.05- 1.46
Selenium	3.2	3.1 - 3.4	3.2	3.0 - 3.4	3.3	3.1 - 3.5
Aluminum	ND	----	0.21	0.07- 0.62	0.03	0.02- 0.04
Chromium	0.06	0.01- 0.48	ND	----	ND	----
Copper	2.92	2.64- 3.23	2.84	2.75- 2.94	2.71	2.52- 2.92
Iron	121.	109. -134.	115.	108. -121.	113.	104. -123.
Mangenese	2.11	1.76- 2.52	2.11	1.84- 2.42	1.82	1.61- 2.07
Zinc	63.1	58.8 - 67.7	68.1	64.8 - 71.5	58.9	55.9 - 62.0
Cadmium	ND	----	0.03	0.02- 0.04	0.03	0.02- 0.04

ND = Not detected

Table 12. Geometric mean concentration (ppm dry weight), 95% confidence interval, and occurrence of elemental residues in Herring Gull eggs collected from the Buffalo Harbor, New York in 1987.

Element	Mean	95% C.I.	Number with residues (range)
Aluminum	1.3	0.88- 1.9	9 (0.50- 2.5)
Copper	2.75	2.46- 3.07	9 (2.15- 3.25)
Iron	104.	93.4 -118.	9 (83.2 -138)
Lead	0.20	0.05- 0.77	6 (ND - 0.90)
Manganese	2.01	1.64- 2.46	9 (1.40- 2.73)
Mercury	0.45	0.32- 0.64	9 (0.24- 0.91)
Selenium	3.1	2.7 - 3.6	9 (2.1 - 3.8)
Zinc	50.8	47.2 - 54.7	9 (40.5 - 57.0)

Table 13. Occurrence of elemental residues (ppm dry weight) in forage fish collected from the upper Niagara River, New York in 1987 and 1988.

Element	Number with residues and range (in parentheses) 1987 (n=7)	1988 (n=8)
Arsenic	6 (ND - 0.53)	8 (0.20- 0.76)
Beryllium	7 (0.02- 0.03)	ND
Cadmium	7 (0.02- 0.42)	8 (0.17- 0.38)
Chromium	7 (0.51- 7.2)	8 (1.6 - 3.8)
Nickel	7 (0.84- 4.1)	8 (14.9 -2700.)
Aluminum	7 (22.0 -370.)	8 (45.8 - 748.)
Copper	7 (2.20- 3.84)	8 (3.26- 4.40)
Iron	7 (56.5 -422.)	8 (96.0 - 629.)
Manganese	7 (10.5 - 35.7)	8 (11.7 - 14.7)
Mercury	7 (0.11- 0.19)	8 (0.01- 0.23)
Selenium	7 (2.0 - 3.0)	8 (2.1 - 2.8)
Zinc	7 (115. -388.)	8 (194. - 331.)

ND = Not detected

Table 14. Geometric mean concentration (ppm dry weight) and 95% confidence interval of elemental residues in forage fish collected from the upper Niagara River, New York in 1987 and 1988.

Element	1987 (n=7)		1988 (n=8)	
	Mean	95% C.I.	Mean	95% C.I.
Arsenic	0.26	0.12- 0.56	0.34	0.23- 0.50
Beryllium	0.02	0.02- 0.03	ND	---
Cadmium	0.26	0.11- 0.41	0.29	0.23- 0.37
Chromium	2.6	2.2 - 3.0	2.7	2.0 - 3.7
Nickel	1.38	0.56- 3.43	36.2	20.3 - 64.4
Aluminum	122.	46.4 -323.	124.	56.3 -274.
Copper	2.69	2.62- 2.76	3.78	3.45- 4.15
Iron	174.	173. -174.	183.	107. -313.
Manganese	16.5	11.5 - 24.5	13.6	12.6 - 14.6
Mercury	0.14	0.12- 0.18	0.10	0.04- 0.21
Selenium	2.6	2.3 - 3.1	2.6	2.4 - 2.8
Zinc	208.	144. -302.	230.1	191. -277.

ND = Not detected

Table 15. Occurrence of aliphatic hydrocarbon residues (ppm wet weight) in Common Tern eggs collected from the upper Niagara River, New York between 1986 and 1988.

Compound	Number with residues and ranges (in parentheses) 1986 (n=6)	1987 (n=15)	1988 (n=10)
n-Dodecane	6 (0.21-0.60)	ND	8 (ND -0.02)
n-Tridecane	ND	ND	8 (ND -0.01)
n-Tetradecane	ND	ND	9 (ND -0.03)
n-Pentadecane	ND	ND	9 (ND -0.03)
n-Hexadecane	ND	9 (ND-0.14)	10 (0.01-0.28)
n-Heptadecane	5 (ND -0.19)	9 (ND-0.23)	10 (0.18-1.2)
Pristane	ND	9 (ND-0.43)	10 (0.02-0.23)
n-Octadecane	ND	9 (ND-0.74)	10 (0.03-0.08)
Phytane	ND	ND	10 (0.02-0.04)
n-Eicosane	ND	ND	10 (0.02-0.04)

ND = Not detected

Table 16. Occurrence of aliphatic hydrocarbons (ppm wet weight) in forage fish collected from the upper Niagara River, New York in 1987 and 1988.

Compound	Number with residues and ranges (in parentheses) 1987 (n=7)	1988 (n=8)
n-Dodecane	7 (0.03-0.05)	8 (0.01- 0.03)
n-Tridecane	6 (ND -0.07)	7 (ND - 0.03)
n-Tetradecane	5 (ND -0.10)	8 (0.03- 0.12)
n-Pentadecane	7 (0.02-0.35)	8 (0.09- 0.95)
n-Hexadecane	6 (ND -0.23)	8 (0.06- 0.24)
n-Heptadecane	7 (0.12-5.2)	8 (1.8 -13)
n-Octadecane	6 (ND -0.31)	8 (0.15- 0.33)
Phytane	6 (ND -0.14)	8 (0.03- 0.15)
n-Nonadecane	7 (0.03-1.4)	8 (0.33- 0.93)
n-Eicosane	1 (ND -0.04)	8 (0.11- 0.39)

ND = Not detected

Table 17. Geometric mean concentration (ppm wet weight) and 95% confidence interval of organochlorine and aliphatic residues in forage fish collected from the upper Niagara River, New York in 1987 and 1988.

Compound	1987 (n=7)		1988 (n=8)	
	Mean	95% C.I.	Mean	95% C.I.
PCBs	0.09	0.08-0.11	0.19	0.11-0.32
p,p'-DDE	0.02	0.01-0.03	0.03	0.02-0.04
n-Dodecane	0.04	0.03-0.04	0.02	0.01-0.03
n-Tridecane	0.02	0.01-0.05	0.01	0.01-0.02
n-Tetradecane	0.02	0.01-0.07	0.05	0.04-0.08
n-Pentadecane	0.14	0.05-0.39	0.33	0.15-0.71
n-Hexadecane	0.07	0.02-0.27	0.12	0.08-0.17
n-Heptadecane	1.4	0.34-6.1	4.2	2.4 -7.2
n-Octadecane	0.10	0.02-0.40	0.20	0.16-0.25
Phytane	0.05	0.02-0.16	0.06	0.03-0.11
n-Nonadecane	0.32	0.08-1.2	0.54	0.39-0.74
n-Eicosane	ND	---	0.19	0.13-0.27

ND = Not detected

APPENDIX A

COMMON TERN COLONY-SITE DESCRIPTIONS

T1 - Tower Island colony site:

Tower Island is a human-made dredge spoil island measuring about 0.4 hectare that is located at the terminus of the Ontario Hydro water control project. Vegetation cover consisted of Poa sp., Coronilla varia, Populus deltoides and Rhus typhina. Other avian species nesting on the site included Larus delewarensis, L. argentatus, and Nycticorax nycticorax (in 1988).

T2 - Near Crib and Far Crib colony sites:

Each site consisted of a cylindrical base about 8 m in diameter, that was constructed of steel sheet piling filled with concrete and dredged river sediment. The cribs supported power line transmission towers. The surfaces consisted of an outer concrete ring, and an inner core of sediment. Both surfaces were approximately level. The height of the concrete surface above water was approximately 3 m. The inner core was approximately 60 cm below the concrete surface. Vegetation cover consisted of Poa sp., Rhus typhina, Vitis labruca, and Solanum dulcamara.

T3 - Donnelly's Pier colony site:

Donnelly's Pier is a concrete breakwater measuring about 5 m wide, 4 m high and 600 m long. The upper surface consisted of weathered concrete which was pitted and had numerous cracks and crevices. Collections of sharp concrete chips, measuring about 0.05 - 2.54 cm, were present in cracks. Vegetation cover occurred in areas where soil had collected in cracks and consisted of Poa sp., Matricaria matricaria, and Solanum dulcamara.

T4 - Short Breakwater colony site:

Short breakwater is a concrete breakwater measuring about 5 m wide, 4 m high and 100 m long. The upper surface consisted of weathered concrete which was pitted and had numerous cracks and crevices. Accumulations of sharp concrete chips measuring about 0.05 - 2.54 cm, were present in cracks. Vegetation cover included Commelina communis, Lepedium virginicum, and Solanum dulcamara.

APPENDIX B

BIRD EGG AND FISH SAMPLE PREPARATION PROTOCOLS

Harvesting egg contents from shells provides critical information about embryo development, and measurements allow for interpretation of analytical results. Think of the process as being performed in three stages, 1) whole egg measurements, 2) egg harvest, and 3) eggshell thickness measurements.

The supplies needed for the procedures include:

1.	WHOLE EGG MEASUREMENTS --	distilled-deionized water, volumeter, egg candler, Kimwipes, laboratory balance (to 0.05 g increments), vernier caliper (graduated to 0.01 mm).
2.	EGG HARVEST --	glass jars of appropriate size (chemically-cleaned and with TFE cap-liners), chemically-rinsed scalpel, lead pencil, and technical pen.
3.	SHELL THICKNESS MEASUREMENTS --	dial micrometer with rounded contacts (graduated to 0.01 mm).

EGG MEASUREMENT PROCEDURE:

1. If possible, eggs should be candled to determine if cracks are present in the shell. Any cracked egg should not be rinsed or immersed in water as this may contaminate the sample.

2. Store eggs in a refrigerator if they cannot be processed immediately after collection. DO NOT FREEZE whole eggs since this will crack the shell.

3. If an egg is not cracked and is dirty (soil, feces) it should be cleaned with a Kimwipe and distilled-deionized water that is at, or near the temperature of the egg.

4. Write the sample ID number on both ends of the eggshell with a dull pencil (both IDs must be legible).

5. Record any remarkable characteristics of the egg (e.g. cracked, dented, discolorations, small in size, etc.).

6. Record the MASS (g) OF THE WHOLE EGG, then measure the LENGTH (mm) and BREADTH (mm) of the egg with calipers at their greatest dimensions. (To obtain an accurate measurement of length, one must

ensure that the caliper jaws are parallel to the longitudinal axis of the egg. For the breadth measurement, the jaws must be held perpendicular to the longitudinal axis of the egg).

7. Determine and record the EGG VOLUME (cm^3), the method of choice will depend on whether the shell is intact or cracked.

   A. INTACT SHELL: For eggs with intact shells, determine the EGG VOLUME using the water displacement technique outlined below.

      Place a volumeter next to and above the pan of a laboratory balance. Set a collection vessel on the balance's pan under the side arm of the volumeter. Next, place a wire loop in the volumeter. Fill the volumeter with distilled-deionized water until it flows freely from the volumeter side arm (REMEMBER, the temperature of the water should be as close to the temperature of the egg as possible). When the water stops flowing, empty the receptacle and return it to the balance pan. Tare the water receptacle. Gently raise the wire loop and place the egg on it. Gently lower the egg until it is completely submersed (lower the egg as quickly as possible without overflowing the volumeter, or breaking the egg). The weight of the displaced water equals the volume (cmm^3) of the egg. Repeat this procedure three (3) times for each egg and report the average value.

   B. CRACKED SHELL: For eggs that are cracked or dented, EGG VOLUME is estimated using the LENGTH and BREADTH measurements and an equation from the published literature (e.g. Westerskov 1950, and Stickel et al. 1973).

EGG HARVEST:

1. For eggs with a strong odor (indicating advanced decomposition of the contents), it is advisable to vent the egg before attempting to open it (explosions are possible). With safety glasses in in place, gently insert a chemically-clean needle into the blunt end of the egg. Use gentle but steady pressure to pierce the shell.

2. Tare a chemically-clean jar and loosen the lid. Rest the egg lengthwise on an appropriate surface (compatible with the analyses requested). Using a sharp scalpel, gently score the egg about its equator. Apply gentle, steady pressure and make several rotations around the egg. Once through the shell, insert the tip of the scalpel blade to cut the membrane and separate the two halves. Cut 1/2 - 2/3 the distance around the egg. Invert the egg while pulling apart the shell halves and pour the contents into the opened jar. If necessary use a chemically clean teflon spatula to scrape any remaining contents into the jar (BE CAREFUL not to tear the shell membrane when using spatula).

3. Record the EGG CONTENTS MASS (g).

4. Visually inspect the egg contents. Record presence or absence of an embryo, estimated age of embryo, abnormalities, etc.

5. Label jar with SAMPLE ID and SAMPLE MASS (place one label on the lid and the other on the jar itself), and immediately store the sample in the freezer.

6. Rinse the interior of the shell halves with tap water being careful not to tear the membrane, or erase the sample IDs. After the shells dry, use a technical pen to remark the shells with their sample IDs. Store the shells in a cool dry place for at least 30 days, or until they have attained a constant mass. (Recycled egg cartons serve as excellent storage containers for egg shells. One tip to ensure that shells do not migrate from their respective compartments, is to place a folded sheet of paper over the shells before closing the carton).

SHELL THICKNESS MEASUREMENT:

1. Determine the EGGSHELL MASS (to nearest 0.001 g) of dried shells.

2. Measure EGGSHELL THICKNESS using a dial micrometer with rounded contacts. Take thickness measurements of each shell-half along the equator at five places. Report the average of all TEN measurements as the final thickness measurement. If the membrane has separated from the shell, take measurements without the membrane but be sure to make note of this on the data sheet.

FORAGE FISH

1. Place fish collected in seine or dip net directly into hexane rinsed aluminum foil. Wrap in waterproof plastic bag and store on cracked ice until sample preparation the same day.

2. Prepare single species composite samples as follows:

    1. Remove fish from foil wrap using chemically clean, stainless steel forceps. Rinse fish with glass distilled water to remove any extraneous materials and place on tared hexane rinsed foil.

    2. Record the number of fish required to obtain a minimum sample mass of 100 g.

    3. Place fish in an appropriately sized, chemically-clean glass jar (with TFE cap-liner). Label, seal lid with teflon tape, enclose in plastic bag, and store frozen until shipped to the analytical laboratory.

    4. Preserve several fish specimens by fixing with 10% formalin and then store them in 70% ethyl alcohol for species identification or confirmation.

APPENDIX C

ANALYTICAL METHODOLOGIES AND RESULTS

1986 ANALYTICAL RESULTS

U. S. FISH AND WILDLIFE SERVICE

PATUXENT ANALYTICAL CONTROL FACILITY

QUALITY ASSURANCE REPORT

RE:# 5151 REGION : 5 REGIONAL ID R5-86-015

THE ANALYSES ON THE ABOVE MENTIONED SAMPLES WERE PERFORMED AT:

WEYERHAEUSER ANALYTICAL AND TESTING SERVICES
WEYERHAEUSER TECHNOLOGY CENTER 2B25
TAKOMA,WASHINGTON 98477

THIS LABORATORY WAS SUBJECTED TO A RIGOROUS EVALUATION PROCESS PRIOR TO THE AWARDING OF IT'S CONTRACT. A PANEL OF FISH AND WILDLIFE SERVICE SCIENTISTS CERTIFIED IT TO BE TECHNICALLY QUALIFIED TO PERFORM THE ANALYSES REPORTED HERE. IN ADDITION WE HAVE CONTINUED TO CLOSELY MONITOR THIS LABORATORY'S PERFORMANCE AND HAVE FOUND THE PRECISION AND ACCURACY OF THEIR WORK REMAINS ACCEPTABLE. WE HAVE GREAT CONFIDENCE IN THE ACCURACY OF THESE DATA.

John F Moore 4-20-88

JOHN F. MOORE

Weyerhaeuser Analytical and Testing Services

Tacoma, Washington 98477

March 23, 1988

ANALYSIS OF CATALOG 340, BATCH R5-86-015
ORGANOCHLORINE PESTICIDE AND AROCHLOR ANALYSIS

NEW YORK STATE TERN AND LOON EGGS

Prepared by:

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NEW YORK STATE TERN AND LOON EGGS
BATCH R5-86-015 CATALOG 340
ORGANOCHLORINE AND AROCHLOR ANALYSIS

SAMPLE PREPARATION AND EXTRACTION

Twenty-five egg samples were analyzed by Patuxent methods. Each of the samples was homogenized in a food blender.

A subsample of the homogenate (5.0 g to 5.1 g), sodium sulfate (heat treated at 550°C), and internal standards were blended in a one-half-pint food blender. This mixture was added to a fiber extraction thimble (pre-extracted with petroleum ether) and extracted with petroleum ether (B&J distilled in glass) for at least 20 hours. The extract was concentrated to 10 mL with a Kuderna-Danish on a steam bath. At this point a 1-mL portion of the sample extract was removed for lipid determination. During the concentration stages, the extract was never allowed to go to dryness.

The 9 mL of extract was exchanged into methylene chloride (Omnisolve distilled in glass) and brought to a 10 mL volume. A volume of extract equivalent to approximately 1 g of sample is loaded into a loop on the GPC unit (ABC model No. 1002A) and injected. The GPC unit transfers the eluted fraction containing the chlorinated organics to an autoconcentrator that concentrates during elution and exchanges the solvent to hexane for a final volume of 10 mL.

The sample is then concentrated to 1 mL by nitrogen blowdown and subjected to alumina micro column cleanup. The alumina (Biorad neutral alumina AG7, 100 to 200 mesh) was ignited at 550°C and then deactivated with distilled water (7% by weight). The analytes were eluted with 10 mL of 4:1 hexane/methylene chloride. The eluent was concentrated to 1 mL for GC capillary analysis.

LIPID AND MOISTURE DETERMINATION

The 1 mL of extract removed before the GPC step was used for lipid determination. The extract was dried at room temperature in tared aluminum pans to constant weight.

For moisture determination, 2 g of the tissue homogenate was placed into a tared aluminum pan and placed in a drying oven (105°C) for at least 48 hours. The weight was recorded after cooling in a desiccator overnight.

INTERNAL STANDARDS

For organochlorine analysis, six chlorinated biphenyl congeners were added before extraction of the sample and served the following purposes:

1. Monitoring sample extract losses due to extraction efficiency, GPC cleanup, or extract transfer.

2. Estimating detection limits.

3. Increasing accuracy of predicted retention times (±0.005 min) for the analytes.

4. Providing backup internal standards in the event of sample matrix interference with the normal quantification internal standard.

Before organochlorine GC analysis, two additional internal standards were added to the sample. These were used for monitoring the instrument's health; e.g., to indicate if there were any problems with the injection of each sample.

GC ANALYSIS

A Hewlett-Packard 5880A GC equipped with dual capillary column/dual ECD detectors was used for the organochlorine and arochlor analysis. The analysis was a single splitless (Grob) injection onto two 30-meter columns (DB-1 and DB-1701) of different polarities. The dual column analysis, besides providing confirmation of the pesticides, checks for coelution of unknowns with each individual pesticide. Because of the high resolving power of the capillary columns, coelution by an unknown on both columns is improbable. Except as explained below, the amount and variance shown on the sample report pages is calculated from the values given by the two GC columns for each compound detected. If the variance was greater than 15% of the mean, it was assumed that coelution was occurring on the column showing the higher amount and only the lower amount is reported. In that case, a variance indicator NA (Not Applicable) is printed in the "Variance" list. Also, if near coelution occurs, where a positive identification on one of the GC columns is not possible, then only the amount given by the GC column that allows positive identification is reported. In this case, the variance indicator NA also is printed. The indicator NA also is used in the "Variance" list in cases where nothing is found above the detection limits on either column where the indicator ND is printed in the "Amount" list.

The temperature program was 50°C for two minutes to 280°C at 3°C/minute and a post-run temperature of 290°C for five minutes. Linear flow rate was 30 cm helium/second.

DATA ANALYSIS

Quantitation was done on the Hewlett-Packard 5880A GC. Due to the narrowness of the capillary peaks, all data were based on peak height, resulting in less biasing due to tailing, near coelution and baseline drift ("Assessment of the Results from Data Processing Systems using a Digital Chromatogram Simulator", R.J. Hunt, Journal of High Resolution Chromatography Communications, Vol. 8, July 1985, pp. 347-355). All data were collected directly from the GC into data bases in an Amiga computer. The data bases, besides providing report generation, allow the monitoring of the standard curves and internal standards over time. The data on the Amiga also were used for pattern recognition in arochlor analysis and to develop the organochlorine pesticide "unknowns" report. Appendices A and B contain the results of the organochlorine-arochlor and "unknowns" analyses, respectively.

BLANKS AND DUPLICATES

The batch size for soxhlet extraction was 12 (11 samples and 1 blank). Two batches went onto the GPC at a time. No analytes were detected in the blank at concentrations greater than 0.5 ppb.

Samples CFO-CT-86-2 and CFO-CT-86-12 were analyzed in duplicate. The results are summarized in the following table:

CFO-CT-86-2
DUPLICATE ANALYSIS

	A	B	MEAN	VAR
OXYCHLORDANE	0.040	0.053	0.046	0.006
C-CHLORDANE	0.037	0.044	0.040	0.004
T-CHLORDANE	0.005	0.010	0.008	0.003
C-NONACHLOR	0.016	0.017	0.017	0.001
T-NONACHLOR	0.047	0.053	0.050	0.003
HEPTACHLOR EPOXIDE	0.027	0.039	0.033	0.006
METHOXYCHLOR	0.077	0.074	0.076	0.002
PP'DDE	1.50	1.70	1.60	0.010
OP'DDT	0.034	0.028	0.031	0.003
DIELDRIN	0.120	0.120	0.120	0.000
HEXACHLOROBENZENE	0.025	0.036	0.031	0.005
AROCHLOR 1260	3.10	3.70	3.40	0.030

CFO-CT-86-12
DUPLICATE ANALYSIS

	A	B	MEAN	VAR
OXYCHLORDANE	0.067	0.070	0.069	0.002
C-CHLORDANE	0.024	0.026	0.025	0.001
T-NONACHLOR	0.016	0.020	0.018	0.002
HEPTACHLOR EPOXIDE	0.032	0.034	0.033	0.002
METHOXYCHLOR	0.110	0.130	0.120	0.010
PP'DDE	1.60	1.70	1.65	0.005
OP'DDT	0.036	0.031	0.034	0.003
DIELDRIN	0.089	0.099	0.094	0.005
HEXACHLOROBENZENE	0.014	0.016	0.015	0.001
AROCHLOR 1260	4.60	5.00	4.80	0.20

GC/MS CONFIRMATION

GC/MS confirmation was done on CFO-CT-86-2 and CFO-CT-86-9; PP'DDE was cofirmed in each sample.

ALKANE AND AROMATIC ANALYSIS

SAMPLE PREPARATION

Sample preparation for the alkanes and aromatics was as follows. Five micrograms deuterium labeled surrogate spikes were added to 5 g of the sample homogenate. There were labeled analogs for each of the polyaromatic hydrocarbons to be analyzed except benzo(e)pyrene and perylene. Aqueous potassium hydroxide (4 N) was added to each of the mixtures and the sample saponified in a steam bath for two hours. The centrifuge tubes were vortex mixed every 40 minutes. The hydrolysates were acidified with hydrochloric acid, the mixture transferred to a separatory funnel and extracted three times with 25 mL methylene chloride each time. The aqueous layer was discarded and the combined organic extract filtered through muffled Na_2SO_4 and rotary-evaporated to several milliliters. One hundred mL petroleum ether and 0.7 mL isooctane was added prior to initial evaporation and the extract again reduced to several milliliters.

The alkanes and aromatics were fractionated on a column of 20 g 2.0% water-deactivated silica gel. Alkanes were eluted with 110 mL petroleum ether. Aromatics were eluted with 100 mL 40% methylene chloride in petroleum ether and an additional 60 mL methylene chloride. Each fraction was concentrated by rotary evaporation followed by nitrogen evaporation. The alkane fraction was evaporated to 1 mL, internal standards added and the extract transferred to a vial in preparation for GC analysis.

The aromatic fraction was concentrated to 10 mL and cleaned by gel permeation chromatography on Bio-Beads SX-3. The collected gel permeation fraction was first rotary-evaporated, then nitrogen-evaporated to 1 mL and finally shaken with aqueous sodium hydroxide. This step removed residual fatty acids. An injection internal standard was added to each extract and it was transferred to a vial in preparation for GC analysis.

ALKANE INTERNAL STANDARDS

Three compounds, n-undecane, n-docosane, and n-triacontane were added to each of the final alkane extracts before GC analysis to serve as quantitation internal standards.

ALKANE GAS CHROMATOGRAPHY

Gas chromatography was done using a 30-M DB-5 capillary column with splitless injection on a Hewlett-Packard 5880A GC with flame ionization. The temperature program was 60°C for three minutes to 310°C at 6°/minute for alkanes and a post run temperature of 320°C for two minutes. Linear flow rate was 30 cm helium/second.

POLYAROMATIC HYDROCARBON INTERNAL STANDARDS

Internal standards for the polyaromatic hydrocarbons were the deuterium labeled compounds added at the saponification stage. The deuterium labeled fluorene has been found to deuterium/hydrogen exchange during base hydrolysis. Thus, D_{10} phenanthrene was used as the internal standard for fluorene.

Use of these internal standards automatically compensates for any losses during sample preparation. An injection internal standard was added to each extract before analysis on the GC/MS and was used to determine if recovery of labeled compounds were within the normal expected range.

POLYAROMATIC HYDROCARBON GAS CHROMATOGRAPHY/MASS SPECTROMETRY

Gas chromatography was done using a 30 M DB-5 capillary column with splitless injection on a Hewlett-Packard 5890 GC in conjunction with a Finnigan-MAT INCOS 50 mass spectrometer. The temperature program was 50°C for two minutes to 320°C at 8°/minute. The mass spectrometer scanned from 35 to 450 m/z in 0.56 seconds at 70 eV.

The target polyaromatic hydrocarbons were purchased from Supelco (Supelpreme) and mixtures of isotope labeled compounds were purchased from MSD Isotopes. Responses of the labeled compounds to 2,2'-difluorobiphenyl internal standard and of the target to the labeled compounds was used to create a polyaromatic hydrocarbon library response list. The response curves for the target polyaromatic hydrocarbons were generated from 1 to 50 ng on column and were linear in this range.

The mass spectrometer was calibrated and an on-going calibration verification standard at either 1 or 2 ng on column injected daily. Compounds were searched for and quantified with "TCA", a program available from Finnigan-MAT for the analysis of target compounds. Mass spectra were examined manually to verify identification.

Results of the alkane and polyaromatic hydrocarbon analyses are contained in Appendices C and D, respectively.

ORGANOCHLORINES

APPENDIX A

ORGANOCHLORINE AND ARCHLOR ANALYSIS
TERN AND LOON EGGS

CATALOG NO. 340, BATCH R5-86-015

TERN AND LOON EGGS
BATCH R5-86-015 LOT 340
ORGANOCHLORINE PESTICIDE AND AROCHLOR ANALYSIS

Sample Description: CFO-CT-86-11 Weyerhaeuser ID#: 90389

Amount Extracted : 5.00 GRAMS
% Moisture: 76.20%
% Lipid: 9.60%

AMOUNT IN PPM (UG/GRAM) WET WEIGHT

Compound Name	Quantitation limit	Amount	Variance
OXYCHLORDANE	0.005	0.037	0.011
C-CHLORDANE	0.005	0.018	NA
T-CHLORDANE	0.006	ND	NA
C-NONACHLOR	0.003	0.010	0.002
T-NONACHLOR	0.005	0.017	0.000
HEPTACHLOR	0.005	ND	NA
HEPTACHLOR EPOXIDE	0.006	0.026	0.013
METHOXYCHLOR	0.024	0.086	NA
OP'DDE	0.010	ND	NA
PP'DDE	0.008	1.20	0.41
OP'DDD	0.012	ND	NA
PP'DDD	0.012	ND	NA
OP'DDT	0.010	0.035	NA
PP'DDT	0.011	ND	NA
ENDRIN	0.009	ND	NA
DIELDRIN	0.009	0.067	NA
ALDRIN	0.006	ND	NA
ALPHA BHC	0.007	ND	NA
BETA BHC	0.014	ND	NA
GAMMA BHC	0.009	ND	NA
DELTA BHC	0.022	ND	NA
HEXACHLOROBENZENE	0.003	0.014	NA
ENDOSULFAN I	0.007	ND	NA
ENDOSULFAN II	0.008	ND	NA
ENDOSULFAN SULFATE	0.007	ND	NA
MIREX	0.004	ND	NA
DCPA	0.016	ND	NA
DICOFOL	0.015	ND	NA
TETRADIFON	0.039	ND	NA
AROCHLOR 1221	0.500	ND	NA
AROCHLOR 1016	0.050	ND	NA
AROCHLOR 1232	0.050	ND	NA
AROCHLOR 1242	0.050	ND	NA
AROCHLOR 1248	0.050	ND	NA
AROCHLOR 1254	0.050	ND	NA
AROCHLOR 1260	0.050	5.00	1.00
AROCHLOR 1262	0.050	ND	NA
TOXAPHENE	0.500	ND	NA

ND indicates at or below the quantitation limit
NA indicates not applicable

TERN AND LOON EGGS
BATCH R5-86-015 LOT 340
ORGANOCHLORINE PESTICIDE AND AROCHLOR ANALYSIS

Sample Description: CFO-CT-86-12 Weyerhaeuser ID#: 90390

Amount Extracted : 5.00 GRAMS
% Moisture: 77.50%
% Lipid: 8.70%

AMOUNT IN PPM (UG/GRAM) WET WEIGHT

Compound Name	Quantitation limit	Amount	Variance
OXYCHLORDANE	0.005	0.067	0.001
C-CHLORDANE	0.005	0.024	NA
T-CHLORDANE	0.006	ND	NA
C-NONACHLOR	0.003	0.009	NA
T-NONACHLOR	0.005	0.016	0.001
HEPTACHLOR	0.005	ND	NA
HEPTACHLOR EPOXIDE	0.006	0.032	0.008
METHOXYCHLOR	0.024	0.110	NA
OP'DDE	0.010	ND	NA
PP'DDE	0.008	1.60	0.33
OP'DDD	0.012	ND	NA
PP'DDD	0.012	ND	NA
OP'DDT	0.010	0.036	NA
PP'DDT	0.011	ND	NA
ENDRIN	0.009	ND	NA
DIELDRIN	0.008	0.089	NA
ALDRIN	0.006	ND	NA
ALPHA BHC	0.007	ND	NA
BETA BHC	0.014	ND	NA
GAMMA BHC	0.009	ND	NA
DELTA BHC	0.022	ND	NA
HEXACHLOROBENZENE	0.003	0.014	0.006
ENDOSULFAN I	0.007	ND	NA
ENDOSULFAN II	0.008	ND	NA
ENDOSULFAN SULFATE	0.007	ND	NA
MIREX	0.004	ND	NA
DCPA	0.016	ND	NA
DICOFOL	0.015	ND	NA
TETRADIFON	0.039	ND	NA
AROCHLOR 1221	0.500	ND	NA
AROCHLOR 1016	0.050	ND	NA
AROCHLOR 1232	0.050	ND	NA
AROCHLOR 1242	0.050	ND	NA
AROCHLOR 1248	0.050	ND	NA
AROCHLOR 1254	0.050	ND	NA
AROCHLOR 1260	0.050	4.60	0.99
AROCHLOR 1262	0.050	ND	NA
TOXAPHENE	0.500	ND	NA

ND indicates at or below the quantitation limit
NA indicates not applicable

TERN AND LOON EGGS
BATCH R5-86-015 LOT 340
ORGANOCHLORINE PESTICIDE AND AROCHLOR ANALYSIS

Sample Description: CFO-CT-86-12 Weyerhaeuser ID#: 90390
DUPLICATE

Amount Extracted : 5.00 GRAMS
% Moisture: 77.50%
% Lipid: 8.70%

AMOUNT IN PPM (UG/GRAM) WET WEIGHT

Compound Name	Quantitation limit	Amount	Variance
OXYCHLORDANE	0.005	0.070	0.000
C-CHLORDANE	0.005	0.026	NA
T-CHLORDANE	0.005	ND	NA
C-NONACHLOR	0.003	0.008	NA
T-NONACHLOR	0.004	0.020	0.002
HEPTACHLOR	0.004	ND	NA
HEPTACHLOR EPOXIDE	0.006	0.034	0.008
METHOXYCHLOR	0.022	0.130	NA
OP'DDE	0.009	ND	NA
PP'DDE	0.007	1.70	0.32
OP'DDD	0.011	ND	NA
PP'DDD	0.010	ND	NA
OP'DDT	0.009	0.031	NA
PP'DDT	0.010	ND	NA
ENDRIN	0.008	ND	NA
DIELDRIN	0.008	0.099	NA
ALDRIN	0.006	ND	NA
ALPHA BHC	0.007	ND	NA
BETA BHC	0.012	ND	NA
GAMMA BHC	0.008	ND	NA
DELTA BHC	0.020	ND	NA
HEXACHLOROBENZENE	0.003	0.016	0.004
ENDOSULFAN I	0.006	ND	NA
ENDOSULFAN II	0.007	ND	NA
ENDOSULFAN SULFATE	0.006	ND	NA
MIREX	0.004	ND	NA
DCPA	0.014	ND	NA
DICOFOL	0.014	ND	NA
TETRADIFON	0.035	ND	NA
AROCHLOR 1221	0.500	ND	NA
AROCHLOR 1016	0.050	ND	NA
AROCHLOR 1232	0.050	ND	NA
AROCHLOR 1242	0.050	ND	NA
AROCHLOR 1248	0.050	ND	NA
AROCHLOR 1254	0.050	ND	NA
AROCHLOR 1260	0.050	5.00	0.71
AROCHLOR 1262	0.050	ND	NA
TOXAPHENE	0.500	ND	NA

ND indicates at or below the quantitation limit
NA indicates not applicable

TERN AND LOON EGGS
BATCH R5-86-015 LOT 340
ORGANOCHLORINE PESTICIDE AND AROCHLOR ANALYSIS

Sample Description: CFO-CT-86-13 Weyerhaeuser ID#: 90391

Amount Extracted : 5.00 GRAMS
% Moisture: 76.80%
% Lipid: 7.70%

AMOUNT IN PPM (UG/GRAM) WET WEIGHT

Compound Name	Quantitation limit	Amount	Variance
OXYCHLORDANE	0.006	0.039	0.002
C-CHLORDANE	0.005	0.016	NA
T-CHLORDANE	0.006	ND	NA
C-NONACHLOR	0.003	0.013	0.000
T-NONACHLOR	0.005	0.017	0.001
HEPTACHLOR	0.005	ND	NA
HEPTACHLOR EPOXIDE	0.007	0.021	0.005
METHOXYCHLOR	0.025	0.110	NA
OP'DDE	0.010	ND	NA
PP'DDE	0.008	0.820	0.170
OP'DDD	0.013	ND	NA
PP'DDD	0.012	ND	NA
OP'DDT	0.010	0.043	NA
PP'DDT	0.012	ND	NA
ENDRIN	0.009	ND	NA
DIELDRIN	0.009	0.074	NA
ALDRIN	0.007	ND	NA
ALPHA BHC	0.008	ND	NA
BETA BHC	0.014	ND	NA
GAMMA BHC	0.010	ND	NA
DELTA BHC	0.023	ND	NA
HEXACHLOROBENZENE	0.003	0.014	0.005
ENDOSULFAN I	0.007	ND	NA
ENDOSULFAN II	0.009	ND	NA
ENDOSULFAN SULFATE	0.008	ND	NA
MIREX	0.004	ND	NA
DCPA	0.017	ND	NA
DICOFOL	0.016	ND	NA
TETRADIFON	0.041	ND	NA
AROCHLOR 1221	0.500	ND	NA
AROCHLOR 1016	0.050	ND	NA
AROCHLOR 1232	0.050	ND	NA
AROCHLOR 1242	0.050	ND	NA
AROCHLOR 1248	0.050	ND	NA
AROCHLOR 1254	0.050	ND	NA
AROCHLOR 1260	0.050	3.40	0.72
AROCHLOR 1262	0.050	ND	NA
TOXAPHENE	0.500	ND	NA

ND indicates at or below the quantitation limit
NA indicates not applicable

TERN AND LOON EGGS
BATCH R5-86-015 LOT 340
ORGANOCHLORINE PESTICIDE AND AROCHLOR ANALYSIS

Sample Description: CFO-CT-86-14 Weyerhaeuser ID#: 90392

Amount Extracted : 5.00 GRAMS
% Moisture: 76.20%
% Lipid: 9.30%

AMOUNT IN PPM (UG/GRAM) WET WEIGHT

Compound Name	Quantitation limit	Amount	Variance
OXYCHLORDANE	0.007	0.049	0.008
C-CHLORDANE	0.006	0.030	NA
T-CHLORDANE	0.007	ND	NA
C-NONACHLOR	0.004	0.010	NA
T-NONACHLOR	0.006	0.019	0.005
HEPTACHLOR	0.006	ND	NA
HEPTACHLOR EPOXIDE	0.008	0.034	0.010
METHOXYCHLOR	0.030	0.140	NA
OP'DDE	0.012	ND	NA
PP'DDE	0.010	1.40	0.40
OP'DDD	0.015	ND	NA
PP'DDD	0.015	ND	NA
OP'DDT	0.012	0.044	NA
PP'DDT	0.014	ND	NA
ENDRIN	0.011	ND	NA
DIELDRIN	0.011	0.066	NA
ALDRIN	0.008	ND	NA
ALPHA BHC	0.009	ND	NA
BETA BHC	0.017	ND	NA
GAMMA BHC	0.011	ND	NA
DELTA BHC	0.028	ND	NA
HEXACHLOROBENZENE	0.004	ND	NA
ENDOSULFAN I	0.008	ND	NA
ENDOSULFAN II	0.010	ND	NA
ENDOSULFAN SULFATE	0.009	ND	NA
MIREX	0.005	ND	NA
DCPA	0.020	ND	NA
DICOFOL	0.019	ND	NA
TETRADIFON	0.049	ND	NA
AROCHLOR 1221	0.500	ND	NA
AROCHLOR 1016	0.050	ND	NA
AROCHLOR 1232	0.050	ND	NA
AROCHLOR 1242	0.050	ND	NA
AROCHLOR 1248	0.050	ND	NA
AROCHLOR 1254	0.050	ND	NA
AROCHLOR 1260	0.050	5.10	1.30
AROCHLOR 1262	0.050	ND	NA
TOXAPHENE	0.500	ND	NA

ND indicates at or below the quantitation limit
NA indicates not applicable

TERN AND LOON EGGS
BATCH R5-86-015 LOT 340
ORGANOCHLORINE PESTICIDE AND AROCHLOR ANALYSIS

Sample Description: CFO-CT-86-15 Weyerhaeuser ID#: 90393

Amount Extracted : 5.00 GRAMS
% Moisture: 77.50%
% Lipid: 9.70%

AMOUNT IN PPM (UG/GRAM) WET WEIGHT

Compound Name	Quantitation limit	Amount	Variance
OXYCHLORDANE	0.007	0.055	0.007
C-CHLORDANE	0.007	0.022	NA
T-CHLORDANE	0.007	ND	NA
C-NONACHLOR	0.004	0.010	0.000
T-NONACHLOR	0.006	0.017	0.000
HEPTACHLOR	0.007	ND	NA
HEPTACHLOR EPOXIDE	0.008	0.030	0.006
METHOXYCHLOR	0.032	0.094	NA
OP'DDE	0.013	ND	NA
PP'DDE	0.010	1.50	0.31
OP'DDD	0.016	ND	NA
PP'DDD	0.015	ND	NA
OP'DDT	0.013	ND	NA
PP'DDT	0.015	ND	NA
ENDRIN	0.012	ND	NA
DIELDRIN	0.011	0.089	0.011
ALDRIN	0.008	ND	NA
ALPHA BHC	0.010	ND	NA
BETA BHC	0.018	ND	NA
GAMMA BHC	0.012	ND	NA
DELTA BHC	0.029	ND	NA
HEXACHLOROBENZENE	0.004	0.021	0.004
ENDOSULFAN I	0.009	ND	NA
ENDOSULFAN II	0.011	ND	NA
ENDOSULFAN SULFATE	0.009	ND	NA
MIREX	0.005	ND	NA
DCPA	0.021	ND	NA
DICOFOL	0.020	ND	NA
TETRADIFON	0.051	ND	NA
AROCHLOR 1221	0.500	ND	NA
AROCHLOR 1016	0.050	ND	NA
AROCHLOR 1232	0.050	ND	NA
AROCHLOR 1242	0.050	ND	NA
AROCHLOR 1248	0.050	ND	NA
AROCHLOR 1254	0.050	ND	NA
AROCHLOR 1260	0.050	4.40	1.10
AROCHLOR 1262	0.050	ND	NA
TOXAPHENE	0.500	ND	NA

ND indicates at or below the quantitation limit
NA indicates not applicable

TERN AND LOON EGGS
BATCH R5-86-015 LOT 340
ORGANOCHLORINE PESTICIDE AND AROCHLOR ANALYSIS

Sample Description: CFO-CT-86-16 Weyerhaeuser ID#: 90394

Amount Extracted : 5.00 GRAMS
% Moisture: 77.70%
% Lipid: 8.10%

AMOUNT IN PPM (UG/GRAM) WET WEIGHT

Compound Name	Quantitation limit	Amount	Variance
OXYCHLORDANE	0.027	0.081	0.030
C-CHLORDANE	0.026	0.046	NA
T-CHLORDANE	0.028	ND	NA
C-NONACHLOR	0.014	0.020	0.006
T-NONACHLOR	0.025	0.041	0.001
HEPTACHLOR	0.025	ND	NA
HEPTACHLOR EPOXIDE	0.032	0.039	0.017
METHOXYCHLOR	0.123	ND	NA
OP'DDE	0.049	ND	NA
PP'DDE	0.041	0.930	0.210
OP'DDD	0.061	ND	NA
PP'DDD	0.060	ND	NA
OP'DDT	0.050	ND	NA
PP'DDT	0.058	ND	NA
ENDRIN	0.045	ND	NA
DIELDRIN	0.043	0.150	NA
ALDRIN	0.033	ND	NA
ALPHA BHC	0.037	ND	NA
BETA BHC	0.070	ND	NA
GAMMA BHC	0.046	ND	NA
DELTA BHC	0.113	ND	NA
HEXACHLOROBENZENE	0.016	ND	NA
ENDOSULFAN I	0.034	ND	NA
ENDOSULFAN II	0.042	ND	NA
ENDOSULFAN SULFATE	0.036	ND	NA
MIREX	0.021	ND	NA
DCPA	0.081	ND	NA
DICOFOL	0.078	ND	NA
TETRADIFON	0.198	ND	NA
AROCHLOR 1221	0.500	ND	NA
AROCHLOR 1016	0.050	ND	NA
AROCHLOR 1232	0.050	ND	NA
AROCHLOR 1242	0.050	ND	NA
AROCHLOR 1248	0.050	ND	NA
AROCHLOR 1254	0.050	ND	NA
AROCHLOR 1260	0.050	4.70	0.46
AROCHLOR 1262	0.050	ND	NA
TOXAPHENE	0.500	ND	NA

ALIPHATICS

APPENDIX C

ALKANE ANALYSIS
TERN AND LOON EGGS

CATALOG NO. 340, BATCH R5-86-015

TERN AND LOON EGGS
BATCH R5-86-015 LOT 340
ALKANE ANALYSIS

Sample Description: BLANK ANALYSIS Weyerhaeuser ID :BLKA

AMOUNT IN MICROGRAMS

Compound Name	Amount
N-DODECANE	0.50 C
N-TRIDECANE	ND
N-TETRADECANE	ND
OCTYLCYCLOHEXANE	ND
N-PENTADECANE	ND
NONYLCYCLOHEXANE	ND
N-HEXADECANE	ND
N-HEPTADECANE	ND
PRISTANE	ND
N-OCTADECANE	ND
PHYTANE	ND
N-NONADECANE	ND
N-EICOSANE	ND
N-HEINEICOSANE	0.03 C

ND indicates below the quantitation limit, 0.20 ug

C indicates confirmed by gc/ms

TERN AND LOON EGGS
BATCH R5-86-015 LOT 340
ALKANE ANALYSIS

Sample Description: BLANK ANALYSIS Weyerhaeuser ID :BLKB

AMOUNT IN MICROGRAMS

Compound Name	Amount
N-DODECANE	0.29
N-TRIDECANE	ND
N-TETRADECANE	ND
OCTYLCYCLOHEXANE	ND
N-PENTADECANE	ND
NONYLCYCLOHEXANE	ND
N-HEXADECANE	ND
N-HEPTADECANE	ND
PRISTANE	ND
N-OCTADECANE	ND
PHYTANE	ND
N-NONADECANE	ND
N-EICOSANE	0.04
N-HEINEICOSANE	0.18

ND indicates below the quantitation limit, 0.20 ug

TERN AND LOON EGGS
BATCH R5-86-015 LOT 340
ALKANE ANALYSIS

Sample Description: CFO-CT-86-11 Weyerhaeuser ID :90389

Amount Extracted : 5.1 GRAMS
% Moisture: 76.2 %
% Lipid: 4.8 %

AMOUNT IN PPM (UG/GRAM) WET WEIGHT

Compound Name	Amount
N-DODECANE	0.29
N-TRIDECANE	ND
N-TETRADECANE	ND
OCTYLCYCLOHEXANE	ND
N-PENTADECANE	ND
NONYLCYCLOHEXANE	ND
N-HEXADECANE	ND
N-HEPTADECANE	0.19
PRISTANE	ND
N-OCTADECANE	ND
PHYTANE	0.03
N-NONADECANE	ND
N-EICOSANE	ND
N-HEINEICOSANE	ND

ND indicates below the quantitation limit, 0.04 ppm

TERN AND LOON EGGS
BATCH R5-86-015 LOT 340
ALKANE ANALYSIS

Sample Description: CFO-CT-86-12 Weyerhaeuser ID :90390

Amount Extracted : 1.9 GRAMS
% Moisture: 77.6 %
% Lipid: 4.4 %

AMOUNT IN PPM (UG/GRAM) WET WEIGHT

Compound Name	Amount
N-DODECANE	0.60
N-TRIDECANE	ND
N-TETRADECANE	ND
OCTYLCYCLOHEXANE	ND
N-PENTADECANE	ND
NONYLCYCLOHEXANE	ND
N-HEXADECANE	ND
N-HEPTADECANE	ND
PRISTANE	ND
N-OCTADECANE	ND
PHYTANE	ND
N-NONADECANE	ND
N-EICOSANE	ND
N-HEINEICOSANE	ND

ND indicates below the quantitation limit, 0.08 ppm

TERN AND LOON EGGS
BATCH R5-86-015 LOT 340
ALKANE ANALYSIS

Sample Description: CFO-CT-86-13 Weyerhaeuser ID :90391

Amount Extracted : 5.0 GRAMS
% Moisture: 76.8 %
% Lipid: 3.9 %

AMOUNT IN PPM (UG/GRAM) WET WEIGHT

Compound Name	Amount
N-DODECANE	0.21
N-TRIDECANE	ND
N-TETRADECANE	ND
OCTYLCYCLOHEXANE	ND
N-PENTADECANE	ND
NONYLCYCLOHEXANE	ND
N-HEXADECANE	ND
N-HEPTADECANE	0.08
PRISTANE	ND
N-OCTADECANE	ND
PHYTANE	ND
N-NONADECANE	ND
N-EICOSANE	ND
N-HEINEICOSANE	ND

ND indicates below the quantitation limit, 0.04 ppm

TERN AND LOON EGGS
BATCH R5-86-015 LOT 340
ALKANE ANALYSIS

Sample Description: CFO-CT-86-14 Weyerhaeuser ID :90392

Amount Extracted : 5.1 GRAMS
% Moisture: 76.3 %
% Lipid: 4.8 %

AMOUNT IN PPM (UG/GRAM) WET WEIGHT

Compound Name	Amount
N-DODECANE	0.31
N-TRIDECANE	ND
N-TETRADECANE	ND
OCTYLCYCLOHEXANE	ND
N-PENTADECANE	ND
NONYLCYCLOHEXANE	ND
N-HEXADECANE	ND
N-HEPTADECANE	0.08
PRISTANE	ND
N-OCTADECANE	ND
PHYTANE	ND
N-NONADECANE	ND
N-EICOSANE	ND
N-HEINEICOSANE	ND

ND indicates below the quantitation limit, 0.04 ppm

TERN AND LOON EGGS
BATCH R5-86-015 LOT 340
ALKANE ANALYSIS

Sample Description: CFO-CT-86-15 Weyerhaeuser ID :90393

Amount Extracted : 5.1 GRAMS
% Moisture: 77.5 %
% Lipid: 4.9 %

AMOUNT IN PPM (UG/GRAM) WET WEIGHT

Compound Name	Amount
N-DODECANE	0.30
N-TRIDECANE	ND
N-TETRADECANE	ND
OCTYLCYCLOHEXANE	ND
N-PENTADECANE	ND
NONYLCYCLOHEXANE	ND
N-HEXADECANE	ND
N-HEPTADECANE	0.08
PRISTANE	ND
N-OCTADECANE	ND
PHYTANE	ND
N-NONADECANE	ND
N-EICOSANE	ND
N-HEINEICOSANE	ND

ND indicates below the quantitation limit, 0.04 ppm

TERN AND LOON EGGS
BATCH R5-86-015 LOT 340
ALKANE ANALYSIS

Sample Description: CFO-CT-86-16 Weyerhaeuser ID :90394

Amount Extracted : 5.0 GRAMS
% Moisture: 77.7 %
% Lipid: 4.1 %

AMOUNT IN PPM (UG/GRAM) WET WEIGHT

Compound Name	Amount
N-DODECANE	0.25
N-TRIDECANE	ND
N-TETRADECANE	ND
OCTYLCYCLOHEXANE	ND
N-PENTADECANE	ND
NONYLCYCLOHEXANE	ND
N-HEXADECANE	ND
N-HEPTADECANE	0.09
PRISTANE	ND
N-OCTADECANE	ND
PHYTANE	ND
N-NONADECANE	ND
N-EICOSANE	ND
N-HEINEICOSANE	ND

ND indicates below the quantitation limit, 0.04 ppm

POLYAROMATIC HYDROCARBONS

APPENDIX D

POLYAROMATIC HYDROCARBON ANALYSIS
NEW YORK STATE TERN AND LOON EGGS

CATALOG NO. 340 BATCH R5-86-015

FWS TERN AND LOON EGGS
BATCH R5-86-015 LOT 340
ALKANE ANALYSIS

Sample Description: BLANK A

Amount in micrograms

Compound Name	Amount
Naphthalene	BQ
Acenaphthylene	BQ
Acenaphthene	BQ
Fluorene	BQ
Phenanthrene	BQ
Anthracene	BQ
Fluoranthene	BQ
Pyrene	BQ
Benzo(a)anthracene	BQ
Chrysene	BQ
Benzo(b)fluoranthene	BQ
Benzo(k)fluoranthene	BQ
Benzo(a)pyrene	BQ
Benzo(e)pyrene	BQ
Indeno(1,2,3-cd)pyrene	BQ
Dibenz(ah)anthracene	BQ
Benzo(ghi)perylene	BQ

BQ - Below quantitation limit <0.3

FWS TERN AND LOON EGGS
BATCH R5-86-015 LOT 340
POLYAROMATIC HYDROCARBON ANALYSIS

Sample Description: BLANK B

Amount in micrograms

Compound Name	Amount
Naphthalene	BQ
Acenaphthylene	BQ
Acenaphthene	BQ
Fluorene	BQ
Phenanthrene	BQ
Anthracene	BQ
Fluoranthene	BQ
Pyrene	BQ
Benzo(a)anthracene	BQ
Chrysene	BQ
Benzo(b)fluoranthene	BQ
Benzo(k)fluoranthene	BQ
Benzo(a)pyrene	BQ
Benzo(e)pyrene	BQ
Indeno(1,2,3-cd)pyrene	BQ
Dibenz(ah)anthracene	BQ
Benzo(ghi)perylene	BQ

BQ - Below quantitation limit <0.3

FWS TERN AND LOON EGGS
BATCH R5-86-015 LOT 340
POLYAROMATIC HYDROCARBON ANALYSIS

Sample Description: CFO-CT-86-11 Weyerhaeuser ID :90389

Amount Extracted :	5.1 GRAMS
% Moisture:	76.2 %
% Lipid:	4.8 %

Amount in ppm (ug/g) wet weight

Compound Name	Amount
Naphthalene	BQ
Acenaphthylene	BQ
Acenaphthene	BQ
Fluorene	BQ
Phenanthrene	BQ
Anthracene	BQ
Fluoranthene	BQ
Pyrene	BQ
Benzo(a)anthracene	BQ
Chrysene	BQ
Benzo(b)fluoranthene	BQ
Benzo(k)fluoranthene	BQ
Benzo(a)pyrene	BQ
Benzo(e)pyrene	BQ
Indeno(1,2,3-cd)pyrene	BQ
Dibenz(ah)anthracene	BQ
Benzo(ghi)perylene	BQ

BQ - Below quantitation limit <0.060

FWS TERN AND LOON EGGS
BATCH R5-86-015 LOT 340
POLYAROMATIC HYDROCARBON ANALYSIS

Sample Description: CFO-CT-86-12 Weyerhaeuser ID :90390

Amount Extracted :	1.9 GRAMS
% Moisture:	77.6 %
% Lipid:	4.4 %

Amount in ppm (ug/g) wet weight

Compound Name	Amount
Naphthalene	BQ
Acenaphthylene	BQ
Acenaphthene	BQ
Fluorene	BQ
Phenanthrene	1.0
Anthracene	BQ
Fluoranthene	BQ
Pyrene	BQ
Benzo(a)anthracene	BQ
Chrysene	BQ
Benzo(b)fluoranthene	BQ
Benzo(k)fluoranthene	BQ
Benzo(a)pyrene	BQ
Benzo(e)pyrene	BQ
Indeno(1,2,3-cd)pyrene	BQ
Dibenz(ah)anthracene	BQ
Benzo(ghi)perylene	BQ

BQ - Below quantitation limit <0.1

FWS TERN AND LOON EGGS
BATCH R5-86-015 LOT 340
POLYAROMATIC HYDROCARBON ANALYSIS

Sample Description: CFO-CT-86-13 Weyerhaeuser ID :90391

Amount Extracted :	5.0 GRAMS
% Moisture:	76.8 %
% Lipid:	3.9 %

Amount in ppm (ug/g) wet weight

Compound Name	Amount
Naphthalene	BQ
Acenaphthylene	BQ
Acenaphthene	BQ
Fluorene	BQ
Phenanthrene	BQ
Anthracene	BQ
Fluoranthene	BQ
Pyrene	BQ
Benzo(a)anthracene	BQ
Chrysene	BQ
Benzo(b)fluoranthene	BQ
Benzo(k)fluoranthene	BQ
Benzo(a)pyrene	BQ
Benzo(e)pyrene	BQ
Indeno(1,2,3-cd)pyrene	BQ
Dibenz(ah)anthracene	BQ
Benzo(ghi)perylene	BQ

BQ - Below quantitation limit <0.060

FWS TERN AND LOON EGGS
BATCH R5-86-015 LOT 340
POLYAROMATIC HYDROCARBON ANALYSIS

Sample Description: CFO-CT-86-14 Weyerhaeuser ID :90392

Amount Extracted :	5.1 GRAMS
% Moisture:	76.3 %
% Lipid:	4.8 %

Amount in ppm (ug/g) wet weight

Compound Name	Amount
Naphthalene	BQ
Acenaphthylene	BQ
Acenaphthene	BQ
Fluorene	BQ
Phenanthrene	BQ
Anthracene	BQ
Fluoranthene	BQ
Pyrene	BQ
Benzo(a)anthracene	BQ
Chrysene	BQ
Benzo(b)fluoranthene	BQ
Benzo(k)fluoranthene	BQ
Benzo(a)pyrene	BQ
Benzo(e)pyrene	BQ
Indeno(1,2,3-cd)pyrene	BQ
Dibenz(ah)anthracene	BQ
Benzo(ghi)perylene	BQ

BQ - Below quantitation limit <0.060

FWS TERN AND LOON EGGS
BATCH R5-86-015 LOT 340
POLYAROMATIC HYDROCARBON ANALYSIS

Sample Description: CFO-CT-86-15 Weyerhaeuser ID :90393

Amount Extracted : 5.1 GRAMS
% Moisture: 77.5 %
% Lipid: 4.9 %

Amount in ppm (ug/g) wet weight

Compound Name	Amount
Naphthalene	BQ
Acenaphthylene	BQ
Acenaphthene	BQ
Fluorene	BQ
Phenanthrene	BQ
Anthracene	BQ
Fluoranthene	BQ
Pyrene	BQ
Benzo(a)anthracene	BQ
Chrysene	BQ
Benzo(b)fluoranthene	BQ
Benzo(k)fluoranthene	BQ
Benzo(a)pyrene	BQ
Benzo(e)pyrene	BQ
Indeno(1,2,3-cd)pyrene	BQ
Dibenz(ah)anthracene	BQ
Benzo(ghi)perylene	BQ

BQ - Below quantitation limit <0.060

FWS TERN AND LOON EGGS
BATCH R5-86-015 LOT 340
POLYAROMATIC HYDROCARBON ANALYSIS

Sample Description: CFO-CT-86-16 Weyerhaeuser ID :90394

Amount Extracted : 5.0 GRAMS
% Moisture: 77.7 %
% Lipid: 4.1 %
Amount in ppm (ug/g) wet weight

Compound Name	Amount
Naphthalene	BQ
Acenaphthylene	BQ
Acenaphthene	BQ
Fluorene	BQ
Phenanthrene	BQ
Anthracene	BQ
Fluoranthene	BQ
Pyrene	BQ
Benzo(a)anthracene	BQ
Chrysene	BQ
Benzo(b)fluoranthene	BQ
Benzo(k)fluoranthene	BQ
Benzo(a)pyrene	BQ
Benzo(e)pyrene	BQ
Indeno(1,2,3-cd)pyrene	BQ
Dibenz(ah)anthracene	BQ
Benzo(ghi)perylene	BQ

BQ - Below quantitation limit <0.060

ELEMENTAL RESIDUES

U. S. FISH AND WILDLIFE SERVICE

PATUXENT ANALYTICAL CONTROL FACILITY

QUALITY ASSURANCE REPORT

RE:# 5151 REGION : 5 REGIONAL ID R5-86-015

THE ANALYSES ON THE ABOVE MENTIONED SAMPLES WERE PERFORMED AT:

THE ENVIRONMENTAL TRACE SUBSTANCES RESEARCH CENTER
ROUTE 3
COLUMBIA, MISSOURI 65201

THIS LABORATORY WAS SUBJECTED TO A RIGOROUS EVALUATION PROCESS PRIOR TO THE AWARDING OF IT'S CONTRACT. A PANEL OF FISH AND WILDLIFE SERVICE SCIENTISTS CERTIFIED IT TO BE TECHNICALLY QUALIFIED TO PERFORM THE ANALYSES REPORTED HERE. IN ADDITION WE HAVE CONTINUED TO CLOSELY MONITOR THIS LABORATORY'S PERFORMANCE AND HAVE FOUND THE PRECISION AND ACCURACY OF THEIR WORK REMAINS ACCEPTABLE. WE HAVE GREAT CONFIDENCE IN THE ACCURACY OF THESE DATA.

John F Moore 3-30-88
JOHN F. MOORE

UNIVERSITY OF MISSOURI

Environmental Trace Substances Research Center

Route 3 Sinclair Road
Columbia, Missouri 65203
Telephone (314) 882-2151

March 8, 1988

Peter Lowe
U.S. Department of the Interior
Patuxent Wildlife Research Center
Laurel, MD 20708

Dear Peter:

Enclosed are results for Lot 340. This is a group of 24 samples that I wrote to you about on November 11, 1987.

The prices on the purchase orders were last year's prices, not the current prices. However, we only received 24 samples instead of 27. In my previous letter, I indicated if you cancelled the purchase order for $103.00 and we billed you for all 26 samples on the other purchase order, with the exception of one selenium analysis, the total price would be exactly what you would owe us at the current prices.

Your accounting department amended the first purchase order to decrease the total amount by $103.00 instead of cancelling the purchase order that was a total of $103.00. Therefore, I am billing you for 25 samples for everything except As on the first purchase order. Only 24 samples are being billed for As. I am also billing you for the entire $103.00 on the second purchase order.

I am enclosing an itemized list of the work we actually did at the current prices, as well as copies of the two purchase orders and the amendment.

Please sign off on these invoices as they are written. There will be a balance of $14.00 left on the first purchase order which you can cancel out.

If you have any questions, please feel free to call me.

Sincerely,

Lynn A. Hartman

Lynn A. Hartman
Quality Assurance Coordinator

LAH:kas

Enclosures

ETSRC Sample Report

USDI - LOWE Lot 340
B-87110196

Submitter's ID Number	ETSRC ID	Test	Final Concen.	Units of Fin.Conc.	Description
CFO-CT-86-11	7110207	MOIST	76.9	%	TERN EGG
CFO-CT-86-12	7110208	MOIST	77.0	%	TERN EGG
CFO-CT-86-13	7110209	MOIST	76.8	%	TERN EGG
CFO-CT-86-14	7110210	MOIST	75.9	%	TERN EGG
CFO-CT-86-15	7110211	MOIST	78.0	%	TERN EGG
CFO-CT-86-16	7110212	MOIST	77.6	%	TERN EGG

ETSRC Sample Report

USDI - LOWE Lot 340
B-87110196

Submitter's ID Number	ETSRC ID	Test	Final Concen.	Units of Fin.Conc.	Description
CFO-CT-86-11	7110207	AS	<0.2	MCG/G DW	TERN EGG
CFO-CT-86-12	7110208	AS	<0.2	MCG/G DW	TERN EGG
CFO-CT-86-13	7110209	AS	<0.2	MCG/G DW	TERN EGG
CFO-CT-86-14	7110210	AS	<0.2	MCG/G DW	TERN EGG
CFO-CT-86-15	7110211	AS	<0.2	MCG/G DW	TERN EGG
CFO-CT-86-16	7110212	AS	<0.2	MCG/G DW	TERN EGG

ETSRC Quality Control Report -- Duplicates

USDI - LOWE Lot 340
B-87110196

Submitter's ID Number	ETSRC ID	Test	Final Concen.	Units of Fin.Conc.	Description
CFO-CT-86-8	7110204	AS	<0.2	MCG/G DW	TERN EGG
CFO-CT-86-8	7110204D	AS	<0.2	MCG/G DW	TERN EGG
Percent Deviation	0.0				
2 JWM-KK	7110214	AS	<0.2	MCG/G DW	LOON EGG
2 JWM-KK	7110214D	AS	<0.2	MCG/G DW	LOON EGG
Percent Deviation	0.0				

Average Percent Deviations 0.0

ETSRC Quality Control Report -- Spikes

USDI - LOWE Lot 340
B-87110196

Submitter's ID Number	ETSRC ID	Test	Final Concen.	Units of Fin.Conc.	Description
CFO-CT-86-5	7110201	AS	<0.2	MCG/G DW	TERN EGG
CFO-CT-86-5	7110201S	AS	100.	MCG/G DW	TERN EGG
MCG of Spike Added	50.00		Percent Spike Recovery	91.	
1 JWM-KK	7110213	AS	<0.2	MCG/G DW	LOON EGG
1 JWM-KK	7110213S	AS	90.	MCG/G DW	LOON EGG
MCG of Spike Added	50.00		Percent Spike Recovery	94.	

Average Percent Spike Recovery 93.

ETSRC Quality Control Report -- Reference Standards

USDI - LOWE Lot 340
B-87110196

Reference ID Number	ETSRC ID	Test	Final Concen.	Units of Fin.Conc.	Expected Value	Standard Deviation	Description
NRCC TORT1	7110198	AS	20.	MCG/G DW	24.6	1.1	LOBSTER - CA
NBS 1577A	7110222	AS	<0.2	MCG/G DW	0.047	0.006	BOVINE LIVER

ETSRC Sample Report

USDI - LOWE Lot 340
B-87110196

Submitter's ID Number	ETSRC ID	Test	Final Concen.	Units of Fin.Conc.	Description
CFO-CT-86-11	7110207	HG	2.8	MCG/G DW	TERN EGG
CFO-CT-86-12	7110208	HG	1.4	MCG/G DW	TERN EGG
CFO-CT-86-13	7110209	HG	2.0	MCG/G DW	TERN EGG
CFO-CT-86-14	7110210	HG	1.6	MCG/G DW	TERN EGG
CFO-CT-86-15	7110211	HG	1.9	MCG/G DW	TERN EGG
CFO-CT-86-16	7110212	HG	2.0	MCG/G DW	TERN EGG

ETSRC Quality Control Report -- Duplicates

USDI - LOWE Lot 340
B-87110196

Submitter's ID Number	ETSRC ID	Test	Final Concen.	Units of Fin.Conc.	Description
CFO-CT-86-10	7110206	HG	1.7	MCG/G DW	TERN EGG
CFO-CT-86-10	7110206D	HG	1.7	MCG/G DW	TERN EGG
Percent Deviation	0.0				
2 JWM-KK	7110214	HG	4.2	MCG/G DW	LOON EGG
2 JWM-KK	7110214D	HG	4.1	MCG/G DW	LOON EGG
Percent Deviation	2.4				

Average Percent Deviations 1.2

ETSRC Quality Control Report -- Spikes

USDI - LOWE Lot 340
B-87110196

Submitter's ID Number	ETSRC ID	Test	Final Concen.	Units of Fin.Conc.	Description
CFO-CT-86-5	7110201	HG	1.8	MCG/G DW	TERN EGG
CFO-CT-86-5	7110201S	HG	7.5	MCG/G DW	TERN EGG
MCG of Spike Added	1.00		Percent Spike Recovery	105.	
1 JWM-KK	7110213	HG	3.2	MCG/G DW	LOON EGG
1 JWM-KK	7110213S	HG	5.2	MCG/G DW	LOON EGG
MCG of Spike Added	1.00		Percent Spike Recovery	102.	

Average Percent Spike Recovery 103.

ETSRC Quality Control Report -- Reference Standards

USDI - LOWE Lot 340
B-87110196

Reference ID Number	ETSRC ID	Test	Final Concen.	Units of Fin.Conc.	Expected Value	Standard Deviation	Description
NRCC TORT1	7110198	HG	0.30	MCG/G DW	0.33	0.03	LOBSTER - CA
NBS 1577A	7110222	HG	<0.006	MCG/G DW	0.004	0.002	BOVINE LIVER

ETSRC Sample Report

USDI - LOWE Lot. 340
B-87110196

Submitter's ID Number	ETSRC ID	Test	Final Concen.	Units of Fin.Conc.	Description
CFO-CT-86-11	7110207	SE	3.3	MCG/G DW	TERN EGG
CFO-CT-86-12	7110208	SE	3.1	MCG/G DW	TERN EGG
CFO-CT-86-13	7110209	SE	3.3	MCG/G DW	TERN EGG
CFO-CT-86-14	7110210	SE	3.2	MCG/G DW	TERN EGG
CFO-CT-86-15	7110211	SE	3.4	MCG/G DW	TERN EGG
CFO-CT-86-16	7110212	SE	3.2	MCG/G DW	TERN EGG

ETSRC Quality Control Report -- Duplicates

USDI - LOWE Lot. 340
B-87110196

Submitter's ID Number	ETSRC ID	Test	Final Concen.	Units of Fin.Conc.	Description
CFO-CT-86-7	7110203	SE	2.8	MCG/G DW	TERN EGG
CFO-CT-86-7	7110203D	SE	3.1	MCG/G DW	TERN EGG
Percent Deviation	10.2				
2 JWM-KK	7110214	SE	3.4	MCG/G DW	LOON EGG
2 JWM-KK	7110214D	SE	3.3	MCG/G DW	LOON EGG
Percent Deviation	3.0				

Average Percent Deviations 6.6

ETSRC Quality Control Report -- Spikes

USDI - LOWE Lot. 340
B-87110196

Submitter's ID Number	ETSRC ID	Test	Final Concen.	Units of Fin.Conc.	Description
CFO-CT-86-6	7110202	SE	3.1	MCG/G DW	TERN EGG
CFO-CT-86-6	7110202S	SE	130.	MCG/G DW	TERN EGG
MCG of Spike Added	50.00		Percent Spike Recovery	102.	
1 JWM-KK	7110213	SE	2.8	MCG/G DW	LOON EGG
1 JWM-KK	7110213S	SE	110.	MCG/G DW	LOON EGG
MCG of Spike Added	50.00		Percent Spike Recovery	108.	

Average Percent Spike Recovery 105.

ETSRC Quality Control Report -- Reference Standards

USDI - LOWE Lot. 340
B-87110196

Reference ID Number	ETSRC ID	Test	Final Concen.	Units of Fin.Conc.	Expected Value	Standard Deviation	Description
NRCC TORT1	7110198	SE	5.7	MCG/G DW	6.88	0.24	LOBSTER - CA
NBS 1577A	7110222	SE	0.81	MCG/G DW	0.71	0.07	BOVINE LIVER

Environmental Trace Substances Research Center
ICP Scan - Sample Analysis Report
Project: USDI - LOWE Lot 340 Units: MCG/G DRY WEIGHT
Batch #: B-87110196

Customer ID: CFO-CT-86-11
Description: TERN EGG
ETSRC ID: 7110207

Elm	Result	Estimated Sample Detection Limit
AL	<0.4	0.4
BE	<0.01	0.01
CD	<0.04	0.04
CR	0.3	0.1
CU	2.82	0.02
FE	111.	0.1
MN	2.1	0.03
NI	<0.1	0.1
PB	<0.5	0.5
TL	<0.5	0.5
ZN	57.5	0.03

Environmental Trace Substances Research Center
ICP Scan - Sample Analysis Report

Project: USDI - LOWE Lot 340 Units: MCG/G DRY WEIGHT
Batch #: B-87110196

Customer ID: CFO-CT-86-16
Description: TERN EGG
ETSRC ID: 7110212

Elm	Result	Estimated Sample Detection Limit
AL	<0.3	0.3
BE	<0.01	0.01
CD	<0.04	0.04
CR	0.2	0.1
CU	2.90	0.02
FE	109.	0.1
MN	2.2	0.03
NI	<0.1	0.1
PB	<0.5	0.5
		0.4

1987 ANALYTICAL RESULTS

U. S. FISH AND WILDLIFE SERVICE

PATUXENT ANALYTICAL CONTROL FACILITY

QUALITY ASSURANCE REPORT

RE:# 5339 REGION : 5 REGIONAL ID R5-87-007

THE ANALYSES ON THE ABOVE MENTIONED SAMPLES WERE PERFORMED AT:

THE MISSISSIPPI STATE CHEMICAL LABORATORY
BOX CR
MISSISSIPPI STATE, MISSISSIPPI 39762

THIS LABORATORY WAS SUBJECTED TO A RIGOROUS EVALUATION PROCESS PRIOR TO THE AWARDING OF IT'S CONTRACT. A PANEL OF FISH AND WILDLIFE SERVICE SCIENTISTS CERTIFIED IT TO BE TECHNICALLY QUALIFIED TO PERFORM THE ANALYSES REPORTED HERE. IN ADDITION WE HAVE CONTINUED TO CLOSELY MONITOR THIS LABORATORY'S PERFORMANCE AND HAVE FOUND THE PRECISION AND ACCURACY OF THEIR WORK REMAINS ACCEPTABLE. WE HAVE GREAT CONFIDENCE IN THE ACCURACY OF THESE DATA.

John F Moore 3-30-88

JOHN F. MOORE

MISSISSIPPI STATE UNIVERSITY
MISSISSIPPI
STATE CHEMICAL LABORATORY
BOX CR - MISSISSIPPI STATE, MISSISSIPPI 39762

March 16, 1988

Mr. Danny Day
Stickel Building/Chemistry
Patuxent Wildlife Research Center
U.S. Fish and Wildlife Service
Route 197
Laurel, MD 20708

Dear Danny:

Enclosed are analytical results for one batch of samples submitted by the U.S. Fish and Wildlife Service (Catalog #5339, Batch #R5-87-007, Order No. 85800-87-12417). The samples were analyzed by Methods 1 & 3.

Please call if you have any questions.

Sincerely,

Larry Lane

Larry G. Lane
Principal Investigator

ORGANOCHLORINES

MISSISSIPPI STATE UNIVERSITY
MISSISSIPPI STATE CHEMICAL LABORATORY
BOX CR
MISSISSIPPI STATE, MS 39762
REPORT FORM
USDI/FWS

SAMPLE TYPE:
Eggs & Fish

CAT NO. 5339
BATCH NO. R5-87-007
ORDER NO. 85800-87-12417

ORGANOCHLORINES

DATE RECEIVED 12/17/87

PARTS PER MILLION AS RECEIVED

CFO-CT-87-X FWS # X=	1	2	3	4	5	6	7
LAB #	744702	744703	744704	744705	744706	744707	744708
MATRIX	Common Tern Egg	Common Tern Egg	Common Tern Egg	Common Tern Egg	Common Tern Egg	Common Tern Egg	Common Tern Egg
COMPOUND							
HCB	ND*	ND	ND	ND	ND	ND	ND
α-BHC	ND	ND	ND	ND	ND	ND	ND
γ-BHC	ND	ND	ND	ND	ND	ND	ND
β-BHC	ND	ND	ND	ND	ND	ND	ND
δ-BHC	ND	ND	ND	ND	ND	ND	ND
Oxychlordane	ND	ND	ND	ND	ND	ND	ND
Hept. Epox.	ND	ND	ND	ND	ND	ND	ND
γ-Chlordane	ND	ND	ND	ND	ND	ND	ND
t-Nonachlor	0.02	0.02	0.02	0.01	0.04	0.04	0.03
Toxaphene	ND	ND	ND	ND	ND	ND	ND
Arochlor 1242	ND	ND	ND	ND	ND	ND	ND
Arochlor 1248	ND	ND	ND	ND	ND	ND	ND
Arochlor 1254	ND	ND	ND	ND	ND	ND	ND
Arochlor 1260	7.6	6.2#	5.3	6.9	8.2	5.9	8.1
o, p'-DDE	ND	ND	ND	ND	ND	ND	ND
α-Chlordane	ND	ND	ND	ND	ND	ND	ND
p, p'-DDE	0.87	1.2#	0.76	0.90	1.3	0.98	1.0
Dieldrin	0.05	0.07	0.04	0.05	0.08	0.06	0.08
o, p'-DDD	ND	ND	ND	ND	ND	ND	ND
Endrin	ND	ND	ND	ND	ND	ND	ND
cis-nonachlor	ND	ND	ND	ND	ND	ND	ND
o, p'-DDT	ND	ND	ND	ND	ND	ND	ND
p, p'-DDD	ND	ND	ND	ND	ND	ND	ND
p, p'-DDT	ND	ND	ND	ND	ND	ND	ND
Mirex	0.09	0.17#	ND	ND	0.04	ND	0.05
WEIGHT (g)	37.0	38.7	35.0	36.0	36.6	38.0	32.2
MOISTURE (%)	77.2	77.3	75.3	77.1	76.8	76.9	77.0
LIPID (%)	8.75	8.60	9.65	9.20	9.00	9.40	8.80

Lower Level of Detection = 0.01 ppm for Tissue, Soil, Etc. LLD = 0.005 for Water
**Spike = ____ ppm for _____
= Confirmed by GC/Mass Spectrometry
*ND = None Detected
***NS = Not Spiked

Signature

MISSISSIPPI STATE UNIVERSITY
MISSISSIPPI STATE CHEMICAL LABORATORY
BOX CR
MISSISSIPPI STATE, MS 39762
REPORT FORM
USDI/FWS

SAMPLE TYPE:
Eggs & Fish

CAT NO. 5339
BATCH NO. R5-87-007
ORDER NO. 85800-87-12417

ORGANOCHLORINES

DATE RECEIVED 12/17/87

PARTS PER MILLION AS RECEIVED

CFO-CT-87-X FWS # X=	8	9	10	11	12	13	14
LAB #	744709	744710	744711	744712	744713	744714	744715
MATRIX	Common Tern Egg	Common Tern Egg	Common Tern Egg	Common Tern Egg	Common Tern Egg	Common Tern Egg	Common Tern Egg
COMPOUND							
HCB	ND*	ND	ND	ND	ND	ND	ND
α-BHC	ND	ND	ND	ND	ND	ND	ND
γ-BHC	ND	ND	ND	ND	ND	ND	ND
β-BHC	ND	ND	ND	ND	ND	ND	ND
δ-BHC	ND	ND	ND	ND	ND	ND	ND
Oxychlordane	ND	ND	ND	ND	ND	ND	ND
Hept. Epox.	ND	ND	ND	ND	ND	ND	ND
γ-Chlordane	ND	ND	ND	ND	ND	ND	ND
t-Nonachlor	0.02	0.10#	0.04	ND	0.03	0.09	0.02
Toxaphene	ND	ND	ND	ND	ND	ND	ND
Arochlor 1242	ND	ND	ND	ND	ND	ND	ND
Arochlor 1248	ND	ND	ND	ND	ND	ND	ND
Arochlor 1254	ND	ND	ND	ND	ND	ND	ND
Arochlor 1260	6.6	6.7#	5.7	4.0	3.5	5.3	7.2
o, p'-DDE	ND	ND	ND	ND	ND	ND	ND
α-Chlordane	ND	ND	ND	ND	ND	ND	ND
p, p'-DDE	1.2	1.1#	0.87	0.59	0.75	0.96	0.77
Dieldrin	0.06	0.09	0.09	0.05	0.07	0.09	0.03
o, p'-DDD	ND	ND	ND	ND	ND	ND	ND
Endrin	ND	ND	ND	ND	ND	ND	ND
cis-nonachlor	ND	ND	ND	ND	ND	ND	ND
o, p'-DDT	ND	ND	ND	ND	ND	ND	ND
p, p'-DDD	ND	ND	ND	ND	ND	ND	ND
p, p'-DDT	ND	ND	ND	ND	ND	ND	ND
Mirex	0.06	0.23#	0.05	0.01	0.06	0.04	0.04
WEIGHT (g)	36.1	36.8	33.8	41.6	37.0	31.5	31.2
MOISTURE (%)	76.3	76.3	77.6	76.0	76.6	76.8	76.4
LIPID (%)	9.80	10.5	9.10	10.4	9.20	9.00	9.85

Lower Level of Detection = 0.01 ppm for Tissue, Soil, Etc. LLD = 0.005 for Water
**Spike = ____ ppm for _____
= Confirmed by GC/Mass Spectrometry
*ND = None Detected
***NS = Not Spiked

Signature Chief Chemist

MISSISSIPPI STATE UNIVERSITY
MISSISSIPPI STATE CHEMICAL LABORATORY
BOX CR
MISSISSIPPI STATE, MS 39762

REPORT FORM
USDI/FWS

SAMPLE TYPE:
Eggs & Fish

CAT NO. 5339
BATCH NO. R5-87-007
ORDER NO. 85800-87-12417

ORGANOCHLORINES

DATE RECEIVED 12/17/87

PARTS PER MILLION AS RECEIVED

CFO-CT-87-X FWS # X=	15	CFO-HG-87-1
LAB #	744716	744728
MATRIX	Common Tern Egg	Herring Gull Egg
COMPOUND		
HCB	ND*	ND
α-BHC	ND	ND
γ-BHC	ND	ND
β-BHC	ND	ND
δ-BHC	ND	ND
Oxychlordane	ND	0.07
Hept. Epox.	ND	0.05
γ-Chlordane	ND	ND
t-Nonachlor	ND	ND
Toxaphene	ND	ND
Arochlor 1242	ND	ND
Arochlor 1248	ND	ND
Arochlor 1254	ND	ND
Arochlor 1260	4.1	9.0
o, p'-DDE	ND	ND
α-Chlordane	ND	ND
p, p'-DDE	0.43	1.3
Dieldrin	0.03	0.10
o, p'-DDD	ND	ND
Endrin	ND	ND
cis-nonachlor	ND	ND
o, p'-DDT	ND	ND
p, p'-DDD	ND	0.02
p, p'-DDT	ND	ND
Mirex	0.04	0.12
WEIGHT (g)	31.8	80.1
MOISTURE (%)	76.3	73.1
LIPID (%)	9.40	9.45

Lower Level of Detection = 0.01 ppm for Tissue, Soil, Etc. LLD = 0.005 for Water
**Spike = ____ ppm for _____
= Confirmed by GC/Mass Spectrometry
*ND = None Detected
***NS = Not Spiked

Jimmie D. Cain
Chief Chemist
Signature

MISSISSIPPI STATE UNIVERSITY
MISSISSIPPI STATE CHEMICAL LABORATORY
BOX CR
MISSISSIPPI STATE, MS 39762

REPORT FORM
USDI/FWS

SAMPLE TYPE:
Eggs & Fish

CAT NO. 5339
BATCH NO. R5-87-007
ORDER NO. 85800-87-12417

ORGANOCHLORINES

DATE RECEIVED 12/17/87

PARTS PER MILLION AS RECEIVED

CFO-HG-87-X FWS # X=	2	3	4	5	6	Duplicate 6	7
LAB #	744729	744730	744731	744732	744733A	744733B	744734
MATRIX	Herring Gull Egg	Herring Gull Egg	Herring Gull Egg	Herring Gull Egg	Herring Gull Egg	Herring Gull Egg	Herring Gull Egg
COMPOUND							
HCB	ND*	ND	ND	ND	ND	ND	ND
α-BHC	ND	ND	ND	ND	ND	ND	ND
ɾ-BHC	ND	ND	ND	ND	ND	ND	ND
ꞵ-BHC	ND	ND	ND	ND	ND	ND	ND
δ-BHC	ND	ND	ND	ND	ND	ND	ND
Oxychlordane	0.13	0.10	0.10	0.24	0.07	0.08	0.11
Hept. Epox.	0.12	0.07	0.09	0.13	0.07	0.08	0.09
ɾ-Chlordane	ND	ND	ND	ND	ND	ND	ND
t-Nonachlor	ND	ND	ND	ND	ND	ND	ND
Toxaphene	ND	ND	ND	ND	ND	ND	ND
Arochlor 1242	ND	ND	ND	ND	ND	ND	ND
Arochlor 1248	ND	ND	ND	ND	ND	ND	ND
Arochlor 1254	ND	ND	ND	ND	ND	ND	ND
Arochlor 1260	14.	9.6	13.	14.	8.6	8.7	11.
o, p'-DDE	ND	ND	ND	ND	ND	ND	ND
α-Chlordane	ND	ND	ND	ND	ND	ND	ND
p, p'-DDE	2.0	1.5	1.8	2.6	1.3	1.3	1.5
Dieldrin	0.13	0.07	0.12	0.22	0.08	0.08	0.19
o, p'-DDD	ND	ND	ND	ND	ND	ND	ND
Endrin	ND	ND	ND	ND	ND	ND	ND
cis-nonachlor	ND	ND	ND	ND	ND	ND	ND
o, p'-DDT	ND	ND	ND	ND	ND	ND	ND
p, p'-DDD	0.04	0.02	0.12	0.05	0.03	0.03	0.03
p, p'-DDT	ND	ND	ND	ND	ND	ND	ND
Mirex	0.08	0.06	0.16	0.14	0.07	0.07	0.06
WEIGHT (g)	84.0	72.7	75.3	68.9	82.4	82.4	76.1
MOISTURE (%)	74.1	76.2	73.7	77.1	78.3	78.1	76.8
LIPID (%)	9.90	9.40	7.75	9.55	7.00	6.70	8.85

Lower Level of Detection = 0.01 ppm for Tissue, Soil, Etc. LLD = 0.005 for Water
**Spike = ___ ppm for _____
= Confirmed by GC/Mass Spectrometry
*ND = None Detected
***NS = Not Spiked

Jeannie De Calvin
Signature Chief Chemist

MISSISSIPPI STATE UNIVERSITY
MISSISSIPPI STATE CHEMICAL LABORATORY
BOX CR
MISSISSIPPI STATE, MS 39762

REPORT FORM
USDI/FWS

SAMPLE TYPE:
Eggs & Fish

CAT NO. 5339
BATCH NO. R5-87-007
ORDER NO. 85800-87-12417

ORGANOCHLORINES

DATE RECEIVED 12/17/87

PARTS PER MILLION AS RECEIVED

FWS #	CFO-HG-87-8	CFO-HG-87-9	7	8	9	10	11
LAB #	744735	744736	744743	744744	744745	744746	744747
MATRIX	Herring Gull Egg	Herring Gull Egg	Forage Fish	Forage Fish	Forage Fish	Forage Fish	Forage Fish
COMPOUND							
HCB	ND*	ND	ND	ND	ND	ND	ND
α-BHC	ND	ND	ND	ND	ND	ND	ND
γ-BHC	ND	ND	ND	ND	ND	ND	ND
β-BHC	ND	ND	ND	ND	ND	ND	ND
δ-BHC	ND	ND	ND	ND	ND	ND	ND
Oxychlordane	0.10	0.07	ND	ND	ND	ND	ND
Hept. Epox.	0.07	0.06	ND	ND	ND	ND	ND
γ-Chlordane	ND	ND	ND	ND	ND	ND	ND
t-Nonachlor	ND	ND	0.01	ND	ND	ND	ND
Toxaphene	ND	ND	ND	ND	ND	ND	ND
Arochlor 1242	ND	ND	ND	ND	ND	ND	ND
Arochlor 1248	ND	ND	ND	ND	ND	ND	ND
Arochlor 1254	ND	ND	ND	ND	ND	ND	ND
Arochlor 1260	8.6	8.7	0.13	0.10	0.07	0.09	0.08
o, p'-DDE	ND	ND	ND	ND	ND	ND	ND
α-Chlordane	ND	ND	0.01	ND	ND	ND	ND
p, p'-DDE	1.3	1.2	0.03	0.01	0.02	0.02	0.02
Dieldrin	0.07	0.07	ND	ND	ND	ND	ND
o, p'-DDD	ND	ND	ND	ND	ND	ND	ND
Endrin	ND	ND	ND	ND	ND	ND	ND
cis-nonachlor	ND	ND	ND	ND	ND	ND	ND
o, p'-DDT	ND	ND	ND	ND	ND	ND	ND
p, p'-DDD	0.04	0.02	ND	ND	ND	ND	ND
p, p'-DDT	ND	ND	ND	ND	ND	ND	ND
Mirex	0.08	0.05	ND	ND	ND	ND	ND
WEIGHT (g)	77.9	65.3	51.3	48.1	74.2	50.8	81.9
MOISTURE (%)	75.2	72.7	76.0	76.5	79.5	78.0	76.0
LIPID (%)	9.10	9.50	2.68	1.02	1.42	2.24	2.00

Lower Level of Detection = 0.01 ppm for Tissue, Soil, Etc. LLD = 0.005 for Water
**Spike = ___ ppm for _____
= Confirmed by GC/Mass Spectrometry
*ND = None Detected
***NS = Not Spiked

Larry Lane
Signature

SAMPLE TYPE:
Eggs & Fish

CAT NO. 5339
BATCH NO. R5-87-007
ORDER NO. 85800-87-12417

MISSISSIPPI STATE UNIVERSITY
MISSISSIPPI STATE CHEMICAL LABORATORY
BOX CR
MISSISSIPPI STATE, MS 39762
REPORT FORM
USDI/FWS

ORGANOCHLORINES

DATE RECEIVED 12/17/87

PARTS PER MILLION AS RECEIVED

CFO-FF-87-X FWS # X=	12
LAB #	744748
MATRIX	Forage Fish
COMPOUND	
HCB	ND
α-BHC	ND
γ-BHC	ND
β-BHC	ND
δ-BHC	ND
Oxychlordane	ND
Hept. Epox.	ND
γ-Chlordane	ND
t-Nonachlor	ND
Toxaphene	ND
Arochlor 1242	ND
Arochlor 1248	ND
Arochlor 1254	ND
Arochlor 1260	0.08
o, p'-DDE	ND
α-Chlordane	ND
p, p'-DDE	0.03
Dieldrin	ND
o, p'-DDD	ND
Endrin	ND
cis-nonachlor	ND
o, p'-DDT	ND
p, p'-DDD	ND
p, p'-DDT	ND
Mirex	ND
WEIGHT (g)	58.7
MOISTURE (%)	76.0
LIPID (%)	2.96

Lower Level of Detection = 0.01 ppm for Tissue, Soil, Etc. LLD = 0.005 for Water
**Spike = ____ ppm for _____
= Confirmed by GC/Mass Spectrometry
*ND = None Detected
***NS = Not Spiked

Larry Lane
Signature

SAMPLE TYPE:
Eggs & Fish

CAT NO. 5339
BATCH NO. R5-87-007
ORDER NO. 85800-87-12417

MISSISSIPPI STATE UNIVERSITY
MISSISSIPPI STATE CHEMICAL LABORATORY
BOX CR
MISSISSIPPI STATE, MS 39762
REPORT FORM
USDI/FWS

ORGANOCHLORINES

DATE RECEIVED 12/17/87

PARTS PER MILLION AS RECEIVED

FWS #	CFO-FF-87-13		Blank	Matrix Blank	Spike**	% Recovery
LAB #	744749		744752	for	744753	
MATRIX	Forage Fish		Reagent	Egg	Egg	
COMPOUND						
HCB	ND*		ND	ND	0.068	68
α-BHC	ND		ND	ND	NS***	
γ-BHC	ND		ND	ND	0.084	84
β-BHC	ND		ND	ND	0.095	95
δ-BHC	ND		ND	ND	NS	
Oxychlordane	ND		ND	ND	0.094	94
Hept. Epox.	ND		ND	ND	0.098	98
γ-Chlordane	ND		ND	ND	NS	
t-Nonachlor	ND		ND	ND	0.093	93
Toxaphene	ND		ND	ND	NS	
Arochlor 1242	ND		ND	ND	NS	
Arochlor 1248	ND		ND	ND	NS	
Arochlor 1254	ND		ND	ND	NS	
Arochlor 1260	0.10		ND	ND	NS	
o, p'-DDE	ND		ND	ND	0.093	93
α-Chlordane	ND		ND	ND	0.096	96
p, p'-DDE	0.03		ND	ND	0.10	100
Dieldrin	ND		ND	ND	0.099	99
o, p'-DDD	ND		ND	ND	NS	
Endrin	ND		ND	ND	0.098	98
cis-nonachlor	ND		ND	ND	0.098	98
o, p'-DDT	ND		ND	ND	0.10	100
p, p'-DDD	ND		ND	ND	0.10	100
p, p'-DDT	ND		ND	ND	0.088	88
Mirex	ND		ND	ND	0.093	93
WEIGHT (g)	61.0		-	-	-	-
MOISTURE (%)	78.5		-	74.0	74.0	-
LIPID (%)	2.22		-	10.7	11.5	-

Lower Level of Detection = 0.01 ppm for Tissue, Soil, Etc. LLD = 0.005 for Water
**Spike = 0.10 ppm for Egg
= Confirmed by GC/Mass Spectrometry
*ND = None Detected
***NS = Not Spiked

Larry Lane
Signature

MISSISSIPPI STATE UNIVERSITY
MISSISSIPPI STATE CHEMICAL LABORATORY
BOX CR
MISSISSIPPI STATE, MS 39762

REPORT FORM
USDI/FWS

SAMPLE TYPE:
Eggs & Fish

CAT NO. 5339
BATCH NO. R5-87-007
ORDER NO. 85800-87-12417

ORGANOCHLORINES

DATE RECEIVED 12/17/87

PARTS PER MILLION AS RECEIVED

FWS #	Blank	Blank	Spike**	% Recovery	Blank	Blank	Matrix Blank
LAB #	744754	744755	744756		744757	744758	for
MATRIX	Reagent	Reagent	Egg		Reagent	Reagent	Fish
COMPOUND							
HCB	ND*	ND	0.067	67	ND	ND	ND
α-BHC	ND	ND	NS***		ND	ND	ND
γ-BHC	ND	ND	0.087	87	ND	ND	ND
β-BHC	ND	ND	0.10	100	ND	ND	ND
δ-BHC	ND	ND	NS		ND	ND	ND
Oxychlordane	ND	ND	0.095	95	ND	ND	ND
Hept. Epox.	ND	ND	0.098	98	ND	ND	ND
γ-Chlordane	ND	ND	NS		ND	ND	ND
t-Nonachlor	ND	ND	0.096	96	ND	ND	ND
Toxaphene	ND	ND	NS		ND	ND	ND
Arochlor 1242	ND	ND	NS		ND	ND	ND
Arochlor 1248	ND	ND	NS		ND	ND	ND
Arochlor 1254	ND	ND	NS		ND	ND	ND
Arochlor 1260	ND	ND	NS		ND	ND	ND
o, p'-DDE	ND	ND	0.094	94	ND	ND	ND
α-Chlordane	ND	ND	0.099	99	ND	ND	ND
p, p'-DDE	ND	ND	0.099	99	ND	ND	0.01
Dieldrin	ND	ND	0.090	90	ND	ND	ND
o, p'-DDD	ND	ND	NS		ND	ND	ND
Endrin	ND	ND	0.098	98	ND	ND	ND
cis-nonachlor	ND	ND	0.10	100	ND	ND	ND
o, p'-DDT	ND	ND	0.10	100	ND	ND	ND
p, p'-DDD	ND	ND	0.10	100	ND	ND	ND
p, p'-DDT	ND	ND	0.089	89	ND	ND	ND
Mirex	ND	ND	0.088	88	ND	ND	ND
WEIGHT (g)	-	-	-	-	-	-	-
MOISTURE (%)	-	-	72.8	-	-	-	77.6
LIPID (%)	-	-	11.7	-	-	-	1.46

Lower Level of Detection = 0.01 ppm for Tissue, Soil, Etc. LLD = 0.005 for Water
**Spike = 0.10 ppm for Egg
= Confirmed by GC/Mass Spectrometry
*ND = None Detected
***NS = Not Spiked

Larry Lane
Signature

MISSISSIPPI STATE UNIVERSITY
MISSISSIPPI STATE CHEMICAL LABORATORY
BOX CR
MISSISSIPPI STATE, MS 39762
REPORT FORM
USDI/FWS

SAMPLE TYPE:
Eggs & Fish

CAT NO. 5339
BATCH NO. R5-87-007
ORDER NO. 85800-87-12417

ORGANOCHLORINES

DATE RECEIVED 12/17/87

PARTS PER MILLION AS RECEIVED

FWS #	Spike**	% Recovery	Blank				
LAB #	744759		744760				
MATRIX	Fish		Reagent				
COMPOUND							
HCB	0.069	69	ND*				
α-BHC	NS***		ND				
γ-BHC	0.095	95	ND				
β-BHC	0.094	94	ND				
δ-BHC	NS		ND				
Oxychlordane	0.090	90	ND				
Hept. Epox.	0.095	95	ND				
γ-Chlordane	NS		ND				
t-Nonachlor	0.088	88	ND				
Toxaphene	NS		ND				
Arochlor 1242	NS		ND				
Arochlor 1248	NS		ND				
Arochlor 1254	NS		ND				
Arochlor 1260	NS		ND				
o, p'-DDE	0.086	86	ND				
α-Chlordane	0.090	90	ND				
p, p'-DDE	0.097	97	ND				
Dieldrin	0.088	88	ND				
o, p'-DDD	NS		ND				
Endrin	0.092	92	ND				
cis-nonachlor	0.092	92	ND				
o, p'-DDT	0.094	94	ND				
p, p'-DDD	0.10	100	ND				
p, p'-DDT	0.082	82	ND				
Mirex	0.086	86	ND				
WEIGHT (g)	-	-	-				
MOISTURE (%)	75.5	-	-				
LIPID (%)	1.60	-	-				

Lower Level of Detection = 0.01 ppm for Tissue, Soil, Etc. LLD = 0.005 for Water
**Spike = 0.10 ppm for Fish
= Confirmed by GC/Mass Spectrometry
*ND = None Detected
***NS = Not Spiked

Larry Lane
Signature

ALIPHATICS

MISSISSIPPI STATE UNIVERSITY
MISSISSIPPI STATE CHEMICAL LABORATORY
BOX CR
MISSISSIPPI STATE, MS 39762

SAMPLE TYPE:
Eggs & Fish

CAT NO. 5339
BATCH NO.R5-87-007
ORDER NO.85800-87-12417

REPORT FORM
USDI/FWS

ALIPHATIC HYDROCARBONS

DATE RECEIVED 12/17/87

PARTS PER MILLION AS RECEIVED

CFO-CT-87-X FWS # X=	1	2	3	4	5	6	7
LAB #	744702	744703	744704	744705	744706	744707	744708
MATRIX	Common Tern Egg	Common Tern Egg	Common Tern Egg	Common Tern Egg	Common Tern Egg	Common Tern Egg	Common Tern Egg
COMPOUND							
n-dodecane	ND*	ND	ND	ND	ND	ND	ND
n-tridecane	ND	ND	ND	ND	ND	ND	ND
n-tetradecane	ND	ND	0.05	ND	0.04	ND	ND
octylcyclohexane	ND	ND	ND	ND	ND	ND	ND
n-pentadecane	ND	ND	ND	ND	ND	ND	ND
nonylcyclohexane	ND	ND	ND	ND	ND	ND	ND
n-hexadecane	ND	0.05	ND	ND	0.07	ND	ND
n-heptadecane	ND	0.13	0.17	ND	0.23	ND	ND
pristane	ND	0.10	0.43	ND	0.08	ND	ND
n-octadecane	ND	ND	ND	ND	0.07	ND	0.05
phytane	ND	ND	ND	ND	ND	ND	ND
n-nonadecane	ND	ND	ND	ND	ND	ND	ND
n-eicosane	ND	ND	ND	ND	ND	ND	ND
WEIGHT (g)	37.0	38.7	35.0	36.0	36.6	38.0	32.2
MOISTURE (%)	77.2	77.3	75.3	77.1	76.8	76.9	77.0
LIPID (%)	8.75	8.60	9.65	9.20	9.00	9.40	8.80

Lower Level of Detection = 0.01 ppm for Tissue, Soil, Sediment, etc.
LLD = 0.005 ppm for Water
*ND = None Detected
**Spike = ____ ppm for _____
***NS = Not Spiked
= Confirmed by GC/Mass Spectrometry

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BOX CR
MISSISSIPPI STATE, MS 39762

SAMPLE TYPE:
Eggs & Fish

CAT NO. 5339
BATCH NO.R5-87-007
ORDER NO.85800-87-12417

REPORT FORM
USDI/FWS

ALIPHATIC HYDROCARBONS

DATE RECEIVED 12/17/87

PARTS PER MILLION AS RECEIVED

CFO-CT-87-X FWS # X=	8	9	10	11	12	13	14
LAB #	744709	744710	744711	744712	744713	744714	744715
MATRIX	Common Tern Egg	Common Tern Egg	Common Tern Egg	Common Tern Egg	Common Tern Egg	Common Tern Egg	Common Tern Egg
COMPOUND							
n-dodecane	ND*	ND	ND	ND	ND	ND	ND
n-tridecane	ND	ND	ND	ND	ND	ND	ND
n-tetradecane	0.09	ND	ND	0.05	0.05	ND	ND
octylcyclohexane	ND	ND	ND	ND	ND	ND	ND
n-pentadecane	0.05	ND	ND	ND	0.05	ND	ND
nonylcyclohexane	ND	ND	ND	ND	ND	ND	ND
n-hexadecane	0.08	0.06	0.05	0.06	0.05	ND	0.07
n-heptadecane	0.22	ND	ND	0.07	0.05	0.11	0.15
pristane	0 12	ND	ND	0.07	0.09	0.35	0.14
n-octadecane	0.12	0.06	0.06	0.11	0.05	0.06	ND
phytane	0.06	ND	ND	ND	ND	ND	ND
n-nonadecane	ND	ND	ND	ND	ND	ND	ND
n-eicosane	ND	ND	ND	ND	ND	ND	ND
WEIGHT (g)	36.1	36.8	33.8	41.6	37.0	31.5	31.2
MOISTURE (%)	76.3	76.3	77.5	76.0	76.6	76.8	76.4
LIPID (%)	9.80	10.5	9.10	10.4	9.20	9.00	9.85

Lower Level of Detection = 0.01 ppm for Tissue, Soil, Sediment, etc.
LLD = 0.005 ppm for Water
*ND = None Detected
**Spike = ____ ppm for _____
***NS = Not Spiked
= Confirmed by GC/Mass Spectrometry

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SAMPLE TYPE:
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ORDER NO.85800-87-12417

REPORT FORM
USDI/FWS

ALIPHATIC HYDROCARBONS

DATE RECEIVED 12/17/87

PARTS PER MILLION AS RECEIVED

CFO-CT-87-X FWS # X=	15	CFO-HG 87-1
LAB #	744716	744728
MATRIX	Common Tern Egg	Herring Gull Egg
COMPOUND		
n-dodecane	ND*	ND
n-tridecane	ND	ND
n-tetradecane	0.04	ND
octylcyclohexane	ND	ND
n-pentadecane	0.12#	ND
nonylcyclohexane	ND	ND
n-hexadecane	0.14#	ND
n-heptadecane	0.08	ND
pristane	0.20#	ND
n-octadecane	0.74#	0.11
phytane	0.05	ND
n-nonadecane	0.09	ND
n-eicosane	ND	ND
WEIGHT (g)	31.8	80.1
MOISTURE (%)	76.3	73.1
LIPID (%)	9.40	9.45

Lower Level of Detection = 0.01 ppm for Tissue, Soil, Sediment, etc.
LLD = 0.005 ppm for Water
*ND = None Detected
**Spike = ____ ppm for _____
***NS = Not Spiked
= Confirmed by GC/Mass Spectrometry

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SAMPLE TYPE:
Eggs & Fish

CAT NO. 5339
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ORDER NO.85800-87-12417

REPORT FORM
USDI/FWS

ALIPHATIC HYDROCARBONS

DATE RECEIVED 12/17/87

PARTS PER MILLION AS RECEIVED

CFO-HG-87-X FWS # X=	2	3	4	5	6	Duplicate 6	7
LAB #	744729	744730	744731	744732	744733A	744733B	744734
MATRIX	Herring Gull Egg	Herring Gull Egg	Herring Gull Egg	Herring Gull Egg	Herring Gull Egg	Herring Gull Egg	Herring Gull Egg
COMPOUND							
n-dodecane	ND*	ND	ND	ND	ND	ND	ND
n-tridecane	ND	ND	ND	ND	ND	ND	ND
n-tetradecane	ND	ND	ND	ND	ND	ND	ND
octylcyclohexane	ND	ND	ND	ND	ND	ND	ND
n-pentadecane	ND	ND	0.05	ND	ND	ND	ND
nonylcyclohexane	ND	ND	ND	ND	ND	ND	ND
n-hexadecane	ND	ND	ND	ND	ND	ND	ND
n-heptadecane	ND	0.12	0.12	0.12	ND	ND	ND
pristane	ND	0.13	ND	0.05	ND	ND	ND
n-octadecane	ND	ND	ND	ND	ND	ND	ND
phytane	ND	ND	ND	ND	ND	ND	ND
n-nonadecane	ND	ND	ND	ND	ND	ND	ND
n-eicosane	ND	0.07	ND	ND	ND	ND	ND
WEIGHT (g)	84.0	72.7	75.3	68.9	82.4	76.1	77.9
MOISTURE (%)	74.1	76.2	73.7	77.1	78.3	78.1	76.8
LIPID (%)	9.90	9.40	7.75	9.55	7.00	6.70	8.85

Lower Level of Detection = 0.01 ppm for Tissue, Soil, Sediment, etc.
LLD = 0.005 ppm for Water
*ND = None Detected
**Spike = ____ ppm for _____
***NS = Not Spiked
= Confirmed by GC/Mass Spectrometry

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Signature

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SAMPLE TYPE:
Eggs & Fish

CAT NO. 5339
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ORDER NO.85800-87-12417

REPORT FORM
USDI/FWS

ALIPHATIC HYDROCARBONS

DATE RECEIVED 12/17/87

PARTS PER MILLION AS RECEIVED

FWS #	CFO-HG-87-8	CFO-HG-87-9
LAB #	744735	744736
MATRIX	Herring Gull Egg	Herring Gull Egg
COMPOUND		
n-dodecane	ND*	ND
n-tridecane	ND	ND
n-tetradecane	ND	ND
octylcyclohexane	ND	ND
n-pentadecane	ND	ND
nonylcyclohexane	ND	ND
n-hexadecane	ND	0.05
n-heptadecane	ND	ND
pristane	ND	ND
n-octadecane	ND	ND
phytane	ND	ND
n-nonadecane	ND	ND
n-eicosane	ND	ND
WEIGHT (g)	65.3	65.3
MOISTURE (%)	75.2	72.7
LIPID (%)	9.10	9.50

Lower Level of Detection = 0.01 ppm for Tissue, Soil, Sediment, etc.
LLD = 0.005 ppm for Water
*ND = None Detected
**Spike = ____ ppm for _____
***NS = Not Spiked
= Confirmed by GC/Mass Spectrometry

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Signature

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SAMPLE TYPE:
Eggs & Fish

CAT NO. 5339
BATCH NO.R5-87-007
ORDER NO.85800-87-12417

REPORT FORM
USDI/FWS

ALIPHATIC HYDROCARBONS

DATE RECEIVED 12/17/87

PARTS PER MILLION AS RECEIVED

CFO-FF-87-X FWS # X=		7	8	9	10	11	Duplicate 11
LAB #		744743	744744	744745	744746	744747A	744747B
MATRIX		Forage Fish	Forage Fish	Forage Fish	Forage Fish	Forage Fish	Forage Fish
COMPOUND							
n-dodecane		0.04	0.03	0.04	0.03	0.04	0.04
n-tridecane		0.06	0.02	0.02	0.03	ND	ND
n-tetradecane		0.09	ND	0.03	0.02	ND	ND
octylcyclohexane		0.02	ND	ND	ND	ND	ND
n-pentadecane		0.35#	0.02	0.15#	0.19	0.08	0.06
nonylcyclohexane		0.02	ND	ND	ND	ND	ND
n-hexadecane		0.22#	0.03	0.18#	0.09	ND	ND
n-heptadecane		5.2#	0.12	2.9#	2.2	0.21	0.21
pristane		ND	ND	ND	ND	ND	ND
n-octadecane		0.22#	0.03	0.22#	0.16	ND	ND
phytane		0.12#	0.02	0.11#	0.05	ND	ND
n-nonadecane		0.67#	0.03	0.33#	0.48	0.07	0.06
n-eicosane		ND	ND	ND	ND	0.04	0.03
WEIGHT (g)		51.3	48.1	74.2	50.8	81.9	81.9
MOISTURE (%)		76.0	76.5	79.5	78.0	76.0	75.5
LIPID (%)		2.68	1.02	1.42	2.24	2.00	1.80

Lower Level of Detection = 0.01 ppm for Tissue, Soil, Sediment, etc.
LLD = 0.005 ppm for Water
*ND = None Detected
**Spike = ____ ppm for _____
***NS = Not Spiked
= Confirmed by GC/Mass Spectrometry

Larry Lane
Signature

MISSISSIPPI STATE UNIVERSITY
MISSISSIPPI STATE CHEMICAL LABORATORY
BOX CR
MISSISSIPPI STATE, MS 39762

SAMPLE TYPE:
Eggs & Fish

CAT NO. 5339
BATCH NO.R5-87-007
ORDER NO.85800-87-12417

REPORT FORM
USDI/FWS

ALIPHATIC HYDROCARBONS

DATE RECEIVED 12/17/87

PARTS PER MILLION AS RECEIVED

FWS #	CFO-FF-87-12	CFO-FF-87-13	Blank	Matrix Blank	Spike**
LAB #	744748	744749	744761	for	744762
MATRIX	Forage Fish	Forage Fish	Reagent	Egg	Egg
COMPOUND					
n-dodecane	0.05	0.03	ND	ND	0.066
n-tridecane	0.07	0.02	ND	ND	0.079
n-tetradecane	0.10#	0.02	ND	ND	0.082
octylcyclohexane	0.03	ND	ND	ND	0.072
n-pentadecane	0.32#	0.20#	ND	ND	0.12
nonylcyclohexane	0.03	ND	ND	ND	0.088
n-hexadecane	0.23#	0.10#	ND	ND	0.10
n-heptadecane	4.7#	3.4#	ND	ND	0.094
pristane	ND*	ND	ND	ND	0.093
n-octadecane	0.31#	0.24#	ND	ND	0.096
phytane	0.14#	0.11#	ND	ND	0.095
n-nonadecane	1.4#	1.1#	ND	ND	0.099
n-eicosane	ND	ND	ND	ND	0.084
WEIGHT (g)	58.7	61.0	-	-	-
MOISTURE (%)	76.0	78.5	-	74.0	73.2
LIPID (%)	2.96	2.22	-	10.7	11.5

Lower Level of Detection = 0.01 ppm for Tissue, Soil, Sediment, etc.
LLD = 0.005 ppm for Water
*ND = None Detected
**Spike = 0.10 ppm for Egg
***NS = Not Spiked
= Confirmed by GC/Mass Spectrometry

Larry Lane
Signature

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MISSISSIPPI STATE CHEMICAL LABORATORY
BOX CR
MISSISSIPPI STATE, MS 39762

SAMPLE TYPE:
Eggs & Fish

CAT NO. 5339
BATCH NO.R5-87-007
ORDER NO.85800-87-12417

REPORT FORM
USDI/FWS

ALIPHATIC HYDROCARBONS

DATE RECEIVED 12/17/87

PARTS PER MILLION AS RECEIVED

FWS #	% Recovery	Blank	Blank	Spike**	% Recovery	Blank	Blank
LAB #		744763	744764	744765		744766	744767
MATRIX		Reagent	Reagent	Egg		Reagent	Reagent
COMPOUND							
n-dodecane	66	ND*	ND	0.077	77	ND	ND
n-tridecane	79	ND	ND	0.080	80	ND	ND
n-tetradecane	82	ND	ND	0.075	75	ND	ND
octylcyclohexane	72	ND	ND	0.063	63	ND	ND
n-pentadecane	120	ND	ND	0.097	97	ND	ND
nonylcyclohexane	88	ND	ND	0.076	76	ND	ND
n-hexadecane	100	ND	ND	0.10	100	ND	ND
n-heptadecane	94	ND	ND	0.099	99	ND	ND
pristane	93	ND	ND	0.092	92	ND	ND
n-octadecane	96	ND	ND	0.10	100	ND	ND
phytane	95	ND	ND	0.081	81	ND	ND
n-nonadecane	99	ND	ND	0.10	100	ND	ND
n-eicosane	84	ND	ND	0.092	92	ND	ND
WEIGHT (g)	-	-	-		-	-	-
MOISTURE (%)	-	-	-	73.4	-	-	-
LIPID (%)	-	-	-	11.7	-	-	-

Lower Level of Detection = 0.01 ppm for Tissue, Soil, Sediment, etc.
LLD = 0.005 ppm for Water
*ND = None Detected
**Spike = 0.10 ppm for Egg
***NS = Not Spiked
= Confirmed by GC/Mass Spectrometry

Larry Lane
Signature

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MISSISSIPPI STATE CHEMICAL LABORATORY
BOX CR
MISSISSIPPI STATE, MS 39762

SAMPLE TYPE:
Eggs & Fish

CAT NO. 5339
BATCH NO.R5-87-007
ORDER NO.85800-87-12417

REPORT FORM
USDI/FWS

ALIPHATIC HYDROCARBONS

DATE RECEIVED 12/17/87

PARTS PER MILLION AS RECEIVED

FWS #	Matrix Blank	Spike**	% Recovery	Blank			
LAB #	for	744768		744769			
MATRIX	Fish	Fish		Reagent			
COMPOUND							
n-dodecane	ND*	0.073	73	ND			
n-tridecane	ND	0.091	91	ND			
n-tetradecane	ND	0.11	110	ND			
octylcyclohexane	ND	0.093	93	ND			
n-pentadecane	ND	0.097	97	ND			
nonylcyclohexane	ND	0.093	93	ND			
n-hexadecane	0.01	0.099	99	ND			
n-heptadecane	ND	0.088	88	ND			
pristane	0.07	0.11	110	ND			
n-octadecane	ND	0.087	87	ND			
phytane	ND	0.086	86	ND			
n-nonadecane	ND	0.089	89	ND			
n-eicosane	ND	0.10	100	ND			
WEIGHT (g)	-	-	-	-			
MOISTURE (%)	77.6	77.6	-	-			
LIPID (%)	1.46	1.60	-	-			

Lower Level of Detection = 0.01 ppm for Tissue, Soil, Sediment, etc.
LLD = 0.005 ppm for Water
*ND = None Detected
**Spike = 0.10 ppm for Fish
***NS = Not Spiked
= Confirmed by GC/Mass Spectrometry

Larry Lane
Signature

POLYAROMATIC HYDROCARBONS

MISSISSIPPI STATE UNIVERSITY
MISSISSIPPI STATE CHEMICAL LABORATORY
BOX CR
MISSISSIPPI STATE, MS 39762
REPORT FORM
USDI/FWS

SAMPLE TYPE:
Eggs & Fish

CAT NO. 5339
BATCH NO. R5-87-007
ORDER NO. 85800-87-12417

POLYNUCLEAR AROMATIC HYDROCARBONS

DATE RECEIVED 12/17/87

PARTS PER MILLION AS RECEIVED

FWS # CFO-CT-87-X X=	1	2	3	4	5	6	7
LAB #	744702	744703	744704	744705	744706	744707	744708
MATRIX	Common Tern Egg	Common Tern Egg	Common Tern Egg	Common Tern Egg	Common Tern Egg	Common Tern Egg	Common Tern Egg
COMPOUND							
napthalene	0.04	0.02	0.01	0.02	0.02	0.01	0.01
fluorene	ND*	ND	ND	ND	ND	ND	ND
phenanthrene	ND	ND	0.02	ND	ND	ND	ND
anthracene	ND	ND	ND	ND	ND	ND	ND
fluoranthrene	ND	ND	0.01	ND	ND	ND	ND
pyrene	ND	ND	ND	ND	ND	ND	ND
1,2-benzanthracene	ND	ND	ND	ND	ND	ND	ND
chrysene	ND	ND	ND	ND	ND	ND	ND
benzo(b)fluoranthrene	ND	ND	ND	ND	ND	ND	ND
benzo(k)fluoranthrene	ND	ND	ND	ND	ND	ND	ND
benzo(e)pyrene	ND	ND	ND	ND	ND	ND	ND
benzo(a)pyrene	ND	ND	ND	ND	ND	ND	ND
1,2,5,6-dibenzanthracene	ND	ND	ND	ND	ND	ND	ND
benzo(g,h,i)perylene	ND	ND	ND	ND	ND	ND	ND
WEIGHT (g)	37.0	38.7	35.0	36.0	36.6	38.0	32.2
MOISTURE (%)	77.2	77.3	75.3	77.1	76.8	76.9	77.0
LIPID (%)	8.75	8.60	9.65	9.20	9.00	9.40	8.80

Lower Level of Detection = 0.01 ppm for Tissue, Soil, Sediment, etc.
LLD = 0.005 ppm for Water
*ND = None Detected
**Spike = ____ ppm for _____
***NS = Not Spiked
= Confirmed by GC/Mass Spectrometry

Larry Lane
Signature

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REPORT FORM
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SAMPLE TYPE:
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CAT NO. 5339
BATCH NO. R5-87-007
ORDER NO. 85800-87-12417

POLYNUCLEAR AROMATIC HYDROCARBONS

DATE RECEIVED 12/17/87

PARTS PER MILLION AS RECEIVED

CFO-CT-87-X FWS # X=	8	9	10	11	12	13	14
LAB #	744709	744710	744711	744712	744713	744714	744715
MATRIX	Common Tern Egg	Common Tern Egg	Common Tern Egg	Common Tern Egg	Common Tern Egg	Common Tern Egg	Common Tern Egg
COMPOUND							
napthalene	0.03	0.01	0.01	0.01	0.01	0.01	0.01
fluorene	ND*	ND	ND	ND	ND	ND	ND
phenanthrene	ND	ND	ND	ND	ND	ND	ND
anthracene	ND	ND	ND	ND	ND	ND	ND
fluoranthrene	ND	ND	ND	ND	ND	ND	ND
pyrene	ND	ND	ND	ND	ND	ND	ND
1,2-benzanthracene	ND	ND	ND	ND	ND	ND	ND
chrysene	ND	ND	ND	ND	ND	ND	ND
benzo(b)fluoranthrene	ND	ND	ND	ND	ND	ND	ND
benzo(k)fluoranthrene	ND	ND	ND	ND	ND	ND	ND
benzo(e)pyrene	ND	ND	ND	ND	ND	ND	ND
benzo(a)pyrene	ND	ND	ND	ND	ND	ND	ND
1,2,5,6-dibenzanthracene	ND	ND	ND	ND	ND	ND	ND
benzo(g,h,i)perylene	ND	ND	ND	ND	ND	ND	ND
WEIGHT (g)	36.1	36.8	33.8	41.6	37.0	31.5	31.2
MOISTURE (%)	76.3	76.3	77.6	76.0	76.6	76.8	76.4
LIPID (%)	9.80	10.5	9.10	10.4	9.20	9.00	9.85

Lower Level of Detection = 0.01 ppm for Tissue, Soil, Sediment, etc.
LLD = 0.005 ppm for Water
*ND = None Detected
**Spike = ____ ppm for _____
***NS = Not Spiked
= Confirmed by GC/Mass Spectrometry

Larry Lane
Signature

MISSISSIPPI STATE UNIVERSITY
MISSISSIPPI STATE CHEMICAL LABORATORY
BOX CR
MISSISSIPPI STATE, MS 39762

REPORT FORM
USDI/FWS

SAMPLE TYPE:
Eggs & Fish

CAT NO. 5339
TCH NO. RS-87-007
ORDER NO. 85800-87-12417

POLYNUCLEAR AROMATIC HYDROCARBONS

DATE RECEIVED 12/17/87

PARTS PER MILLION AS RECEIVED

FWS # CFO-CT-87-X X=	15	CFO-HG 87-1
LAB #	744716	744728
MATRIX	Common Tern Egg	Herring Gull Egg
COMPOUND		
napthalene	0.01	0.02
fluorene	ND*	ND
phenanthrene	ND	ND
anthracene	ND	ND
fluoranthrene	ND	ND
pyrene	ND	ND
1,2-benzanthracene	ND	ND
chrysene	ND	ND
benzo(b)fluoranthrene	ND	ND
benzo(k)fluoranthrene	ND	ND
benzo(e)pyrene	ND	ND
benzo(a)pyrene	ND	ND
1,2,5,6-dibenzanthracene	ND	ND
benzo(g,h,i)perylene	ND	ND
WEIGHT (g)	31.8	80.1
MOISTURE (%)	76.3	73.1
LIPID (%)	9.40	9.45

wer Level of Detection = 0.01 ppm for Tissue, Soil, Sediment, etc.
LLD = 0.005 ppm for Water
*ND = None Detected
**Spike = ____ ppm for _____
***NS = Not Spiked
= Confirmed by GC/Mass Spectrometry

Larry Lane
Signature

MISSISSIPPI STATE UNIVERSITY
MISSISSIPPI STATE CHEMICAL LABORATORY
BOX CR
MISSISSIPPI STATE, MS 39762
REPORT FORM
USDI/FWS

SAMPLE TYPE:
Eggs & Fish

CAT NO. 5339
BATCH NO. R5-87-007
ORDER NO. 85800-87-12417

POLYNUCLEAR AROMATIC HYDROCARBONS

PARTS PER MILLION AS RECEIVED

DATE RECEIVED 12/17/87

CFO-HG-87-X FWS # X=	2	3	4	5	6	Dupl. 6	7
LAB #	744729	744730	744731	744732	744733A	744733B	744734
MATRIX	Herring Gull Egg	Herring Gull Egg	Herring Gull Egg	Herring Gull Egg	Herring Gull Egg	Herring Gull Egg	Herring Gull Egg
COMPOUND							
napthalene	0.01	0.01	0.01	0.01	0.01	0.01	0.01
fluorene	ND*	ND	ND	ND	ND	ND	ND
phenanthrene	ND	ND	ND	ND	ND	ND	ND
anthracene	ND	ND	ND	ND	ND	ND	ND
fluoranthrene	ND	ND	ND	ND	ND	ND	ND
pyrene	ND	ND	ND	ND	ND	ND	ND
1,2-benzanthracene	ND	ND	ND	ND	ND	ND	ND
chrysene	ND	ND	ND	ND	ND	ND	ND
benzo(b)fluoranthrene	ND	ND	ND	ND	ND	ND	ND
benzo(k)fluoranthrene	ND	ND	ND	ND	ND	ND	ND
benzo(e)pyrene	ND	ND	ND	ND	ND	ND	ND
benzo(a)pyrene	ND	ND	ND	ND	ND	ND	ND
1,2,5,6-dibenzanthracene	ND	ND	ND	ND	ND	ND	ND
benzo(g,h,i)perylene	ND	ND	ND	ND	ND	ND	ND
WEIGHT (g)	84.0	72.7	75.3	68.9	82.4	82.4	76.1
MOISTURE (%)	74.1	76.2	73.7	77.1	78.3	78.1	76.8
LIPID (%)	9.90	9.40	7.75	9.55	7.00	6.70	8.85

Lower Level of Detection = 0.01 ppm for Tissue, Soil, Sediment, etc.
LLD = 0.005 ppm for Water
*ND = None Detected
**Spike = ____ ppm for _____
***NS = Not Spiked
= Confirmed by GC/Mass Spectrometry

Signature

Chief Chemist

MISSISSIPPI STATE UNIVERSITY
MISSISSIPPI STATE CHEMICAL LABORATORY
BOX CR
MISSISSIPPI STATE, MS 39762
REPORT FORM
USDI/FWS

SAMPLE TYPE:
Eggs & Fish

CAT NO. 5339
BATCH NO. R5-87-007
ORDER NO. 85800-87-12417

POLYNUCLEAR AROMATIC HYDROCARBONS

DATE RECEIVED 12/17/87

PARTS PER MILLION AS RECEIVED

FWS #	CFO-HG-87-8	CFO-HG-87-9
LAB #	744735	744736
MATRIX	Herring Gull Egg	Herring Gull Egg
COMPOUND		
napthalene	0.02	0.01
fluorene	ND*	ND
phenanthrene	ND	ND
anthracene	ND	ND
fluoranthrene	ND	ND
pyrene	ND	ND
1,2-benzanthracene	ND	ND
chrysene	ND	ND
benzo(b)fluoranthrene	ND	ND
benzo(k)fluoranthrene	ND	ND
benzo(e)pyrene	ND	ND
benzo(a)pyrene	ND	ND
1,2,5,6-dibenzanthracene	ND	ND
benzo(g,h,i)perylene	ND	ND
WEIGHT (g)	77.9	65.3
MOISTURE (%)	75.2	72.7
LIPID (%)	9.10	9.50

Lower Level of Detection = 0.01 ppm for Tissue, Soil, Sediment, etc.
LLD = 0.005 ppm for Water
*ND = None Detected
**Spike = ____ ppm for _____
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= Confirmed by GC/Mass Spectrometry

Signature Chief Chemist

MISSISSIPPI STATE UNIVERSITY
MISSISSIPPI STATE CHEMICAL LABORATORY
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MISSISSIPPI STATE, MS 39762
REPORT FORM
USDI/FWS

SAMPLE TYPE:
Eggs & Fish

CAT NO. 5339
BATCH NO. RS-87-007
ORDER NO. 85800-87-12417

POLYNUCLEAR AROMATIC HYDROCARBONS

DATE RECEIVED 12/17/87

PARTS PER MILLION AS RECEIVED

FWS # CFO-FF-87-X X=		7	8	9	10	11	Dupl. 11
LAB #		744743	744744	744745	744746	744747A	744747B
MATRIX		Forage Fish	Forage Fish	Forage Fish	Forage Fish	Forage Fish	Forage Fish
COMPOUND							
napthalene		0.01	0.01	0.01	0.01	0.01	0.01
fluorene		ND	ND	ND	ND	ND	ND
phenanthrene		0.03	ND	ND	ND	ND	ND
anthracene		ND	ND	ND	ND	ND	ND
fluoranthrene		0.01	ND	ND	ND	ND	ND
pyrene		0.01	ND	ND	ND	ND	ND
1,2-benzanthracene		ND	ND	ND	ND	ND	ND
chrysene		0.01	ND	ND	ND	ND	ND
benzo(b)fluoranthrene		ND	ND	ND	ND	ND	ND
benzo(k)fluoranthrene		ND	ND	ND	ND	ND	ND
benzo(e)pyrene		ND	ND	ND	ND	ND	ND
benzo(a)pyrene		ND	ND	ND	ND	ND	ND
1.2,5,6-dibenzanthracene		ND	ND	ND	ND	ND	ND
benzo(g,h,i)perylene		ND	ND	ND	ND	ND	ND
WEIGHT (g)		51.3	48.1	74.2	50.8	81.9	81.9
MOISTURE (%)		76.0	76.5	79.5	78.0	76.0	75.5
LIPID (%)		2.68	1.02	1.42	2.24	2.00	1.80

Lower Level of Detection = 0.01 ppm for Tissue, Soil, Sediment, etc.
LD = 0.005 ppm for Water
*ND = None Detected
**Spike = ____ ppm for _____
***NS = Not Spiked
= Confirmed by GC/Mass Spectrometry

Jimmie D. Cain
Chief Chemist
Signature

SAMPLE TYPE:
Eggs & Fish

CAT NO. 5339
BATCH NO. R5-87-007
ORDER NO. 85800-87-12417

MISSISSIPPI STATE UNIVERSITY
MISSISSIPPI STATE CHEMICAL LABORATORY
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MISSISSIPPI STATE, MS 39762
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POLYNUCLEAR AROMATIC HYDROCARBONS

DATE RECEIVED 12/17/87

PARTS PER MILLION AS RECEIVED

FWS #	CFO-FF-87-12	CFO-FF-87-13			Blank	Matrix Blank	Spike**
LAB #	744748	744749			744761	for	744762
MATRIX	Forage Fish	Forage Fish			Reagent	Egg	Egg
COMPOUND							
napthalene	0.01	0.01			ND	ND	0.058
fluorene	0.01	ND*			ND	ND	0.094
phenanthrene	0.05	ND			ND	ND	0.083
anthracene	0.01	ND			ND	ND	0.055
fluoranthrene	0.02	ND			ND	ND	0.079
pyrene	0.02	ND			ND	ND	0.083
1,2-benzanthracene	0.02	ND			ND	ND	0.076
chrysene	0.02	ND			ND	ND	0.079
benzo(b)fluoranthrene	0.02	ND			ND	ND	0.072
benzo(k)fluoranthrene	0.01	ND			ND	ND	0.046
benzo(e)pyrene	0.02	ND			ND	ND	0.085
benzo(a)pyrene	0.02	ND			ND	ND	0.072
1,2,5,6-dibenzanthracene	0.01	ND			ND	ND	0.068
benzo(g,h,i)perylene	0.02	ND			ND	ND	0.076
WEIGHT (g)	58.7	61.0			-	-	-
MOISTURE (%)	76.0	78.5			-	74.0	73.2
LIPID (%)	2.96	2.22			-	10.7	11.5

Lower Level of Detection = 0.01 ppm for Tissue, Soil, Sediment, etc.
LLD = 0.005 ppm for Water
*ND = None Detected
**Spike = 0.10 ppm for Egg
***NS = Not Spiked
= Confirmed by GC/Mass Spectrometry

Signature

Chief Chemist

MISSISSIPPI STATE UNIVERSITY
MISSISSIPPI STATE CHEMICAL LABORATORY
BOX CR
MISSISSIPPI STATE, MS 39762
REPORT FORM
USDI/FWS

SAMPLE TYPE:
Eggs & Fish

CAT NO. 5339
BATCH NO. R5-87-007
ORDER NO. 85800-87-12417

POLYNUCLEAR AROMATIC HYDROCARBONS

DATE RECEIVED 12/17/87

PARTS PER MILLION AS RECEIVED

FWS #	% Recovery	Blank	Blank	Spike**	% Recovery	Blank	Blank
LAB #		744763	744764	744765		744766	744767
MATRIX		Reagent	Reagent	Egg		Reagent	Reagent
COMPOUND							
napthalene	58	ND*	ND	0.044	44	ND	ND
fluorene	94	ND	ND	0.070	70	ND	ND
phenanthrene	83	ND	ND	0.083	83	ND	ND
anthracene	55	ND	ND	0.058	58	ND	ND
fluoranthrene	79	ND	ND	0.085	85	ND	ND
pyrene	83	ND	ND	0.089	89	ND	ND
1,2-benzanthracene	76	ND	ND	0.085	85	ND	ND
chrysene	79	ND	ND	0.086	86	ND	ND
benzo(b)fluoranthrene	72	ND	ND	0.086	86	ND	ND
benzo(k)fluoranthrene	46	ND	ND	0.068	68	ND	ND
benzo(e)pyrene	85	ND	ND	0.094	94	ND	ND
benzo(a)pyrene	72	ND	ND	0.078	78	ND	ND
1,2,5,6-dibenzanthracene	68	ND	ND	0.077	77	ND	ND
benzo(g,h,i)perylene	76	ND	ND	0.088	88	ND	ND
WEIGHT (g)	-	-	-		-	-	-
MOISTURE (%)	-	-	-	73.4	-	-	-
LIPID (%)	-	-	-	11.7	-	-	-

Lower Level of Detection = 0.01 ppm for Tissue, Soil, Sediment, etc.
LLD = 0.005 ppm for Water
*ND = None Detected
**Spike = 0.10 ppm for Egg
***NS = Not Spiked
= Confirmed by GC/Mass Spectrometry

Jerome D. Cain
Signature
Chief Chemist

MISSISSIPPI STATE UNIVERSITY
MISSISSIPPI STATE CHEMICAL LABORATORY
BOX CR
MISSISSIPPI STATE, MS 39762

REPORT FORM
USDI/FWS

SAMPLE TYPE:
Eggs & Fish

CAT NO. 5339
BATCH NO. RS-87-007
ORDER NO. 85800-87-12417

POLYNUCLEAR AROMATIC HYDROCARBONS

DATE RECEIVED 12/17/87

PARTS PER MILLION AS RECEIVED

FWS #	Matrix Blank	Spike**	% Recovery	Blank			
LAB #	for	744768		744769			
MATRIX	Fish	Fish		Reagent			
COMPOUND							
napthalene	ND*	0.057	57	ND			
fluorene	ND	0.088	88	ND			
phenanthrene	ND	0.080	80	ND			
anthracene	ND	0.060	60	ND			
fluoranthrene	ND	0.078	78	ND			
pyrene	ND	0.081	81	ND			
1,2-benzanthracene	ND	0.073	73	ND			
chrysene	ND	0.078	78	ND			
benzo(b)fluoranthrene	ND	0.072	72	ND			
benzo(k)fluoranthrene	ND	0.070	70	ND			
benzo(e)pyrene	ND	0.071	71	ND			
benzo(a)pyrene	ND	0.071	71	ND			
1,2,5,6-dibenzanthracene	ND	0.079	79	ND			
benzo(g,h,i)perylene	ND	0.078	78	ND			
WEIGHT (g)	-	-	-	-			
MOISTURE (%)	77.6	77.6	-	-			
LIPID (%)	1.46	1.60	-	-			

Lower Level of Detection = 0.01 ppm for Tissue, Soil, Sediment, etc.
LLD = 0.005 ppm for Water
*ND = None Detected
**Spike = 0.10 ppm for Fish
***NS = Not Spiked
= Confirmed by GC/Mass Spectrometry

Larry Lane
Signature

JM

U. S. FISH AND WILDLIFE SERVICE

PATUXENT ANALYTICAL CONTROL FACILITY

QUALITY ASSURANCE REPORT

RE:# 5339 REGION : 5 REGIONAL ID R5-87-007

THE ANALYSES ON THE ABOVE MENTIONED SAMPLES WERE PERFORMED AT:

THE ENVIRONMENTAL TRACE SUBSTANCES RESEARCH CENTER
ROUTE 3
COLUMBIA, MISSOURI 65201

THIS LABORATORY WAS SUBJECTED TO A RIGOROUS EVALUATION PROCESS PRIOR TO THE AWARDING OF IT'S CONTRACT. A PANEL OF FISH AND WILDLIFE SERVICE SCIENTISTS CERTIFIED IT TO BE TECHNICALLY QUALIFIED TO PERFORM THE ANALYSES REPORTED HERE. IN ADDITION WE HAVE CONTINUED TO CLOSELY MONITOR THIS LABORATORY'S PERFORMANCE AND HAVE FOUND THE PRECISION AND ACCURACY OF THEIR WORK REMAINS ACCEPTABLE. WE HAVE GREAT CONFIDENCE IN THE ACCURACY OF THESE DATA.

John F Moore 5-10-88
JOHN F. MOORE

ELEMENTAL RESIDUES

UNIVERSITY OF MISSOURI

Environmental Trace Substances Research Center

Route 3 Sinclair Road
Columbia, Missouri 65203
Telephone (314) 882-2151

May 6, 1988

Peter Lowe
U.S. Department of the Interior
Patuxent Wildlife Research Center
Laurel, Maryland 20708

Dear Peter:

Enclosed are data, quality control reports and invoice for Cat. #5339, 5372, and 5377.

Let me know if you have any questions.

Sincerely,

Edward J. Hinderberger

Edward J. Hinderberger, Jr.
Group Leader

EJH:ds

Enclosures

ETSRC Sample Report

USDI - LOWE Cat. 5339
B-88020929

Submitter's ID Number	ETSRC ID	Test	Final Concen.	Units of Fin.Conc.	Description
CFO-CT-87-1	8020930	MOIST	77.1	%	EGGS-TERN
CFO-CT-87-2	8020931	MOIST	77.5	%	EGGS-TERN
CFO-CT-87-3	8020932	MOIST	75.8	%	EGGS-TERN
CFO-CT-87-4	8020933	MOIST	77.5	%	EGGS-TERN
CFO-CT-87-5	8020934	MOIST	77.0	%	EGGS-TERN
CFO-CT-87-6	8020935	MOIST	76.7	%	EGGS-TERN
CFO-CT-87-7	8020936	MOIST	77.5	%	EGGS-TERN
CFO-CT-87-8	8020937	MOIST	76.9	%	EGGS-TERN
CFO-CT-87-9	8020938	MOIST	76.4	%	EGGS-TERN
CFO-CT-87-10	8020939	MOIST	78.3	%	EGGS-TERN
CFO-CT-87-11	8020940	MOIST	76.0	%	EGGS-TERN
CFO-CT-87-12	8020941	MOIST	77.3	%	EGGS-TERN
CFO-CT-87-13	8020942	MOIST	77.5	%	EGGS-TERN
CFO-CT-87-14	8020943	MOIST	77.0	%	EGGS-TERN
CFO-CT-87-15	8020944	MOIST	76.4	%	EGGS-TERN
CFO-HG-87-1	8020960	MOIST	74.7	%	EGGS-HERRING GULL
CFO-HG-87-2	8020961	MOIST	74.6	%	EGGS-HERRING GULL
CFO-HG-87-3	8020962	MOIST	76.2	%	EGGS-HERRING GULL
CFO-HG-87-4	8020963	MOIST	76.9	%	EGGS-HERRING GULL
CFO-HG-87-5	8020964	MOIST	77.1	%	EGGS-HERRING GULL
CFO-HG-87-6	8020965	MOIST	78.0	%	EGGS-HERRING GULL
CFO-HG-87-7	8020969	MOIST	76.8	%	EGGS-HERRING GULL
CFO-CT-87-8	8020970	MOIST	75.5	%	EGGS-HERRING GULL
CFO-HG-87-9	8020971	MOIST	73.7	%	EGGS-HERRING GULL
CFO-FF-87-7	8020982	MOIST	75.3	%	FISH-FORAGE
CFO-FF-87-8	8020983	MOIST	76.9	%	FISH-FORAGE
CFO-FF-87-9	8020984	MOIST	79.3	%	FISH-FORAGE
CFO-FF-87-10	8020985	MOIST	77.6	%	FISH-FORAGE
CFO-FF-87-11	8020986	MOIST	75.6	%	FISH-FORAGE
CFO-FF-87-12	8020987	MOIST	75.9	%	FISH-FORAGE
CFO-FF-87-13	8020988	MOIST	77.1	%	FISH-FORAGE

ETSRC Sample Report

USDI - LOWE Cat. 5339
B-88020929

Submitter's ID Number	ETSRC ID	Test	Final Concen.	Units of Fin.Conc.	Description
CFO-CT-87-1	8020930	AS	<0.1	MCG/G DW	EGGS-TERN
CFO-CT-87-2	8020931	AS	<0.1	MCG/G DW	EGGS-TERN
CFO-CT-87-3	8020932	AS	<0.1	MCG/G DW	EGGS-TERN
CFO-CT-87-4	8020933	AS	<0.1	MCG/G DW	EGGS-TERN
CFO-CT-87-5	8020934	AS	<0.1	MCG/G DW	EGGS-TERN
CFO-CT-87-6	8020935	AS	<0.1	MCG/G DW	EGGS-TERN
CFO-CT-87-7	8020936	AS	<0.1	MCG/G DW	EGGS-TERN
CFO-CT-87-8	8020937	AS	<0.1	MCG/G DW	EGGS-TERN
CFO-CT-87-9	8020938	AS	<0.1	MCG/G DW	EGGS-TERN
CFO-CT-87-10	8020939	AS	<0.1	MCG/G DW	EGGS-TERN
CFO-CT-87-11	8020940	AS	0.1	MCG/G DW	EGGS-TERN
CFO-CT-87-12	8020941	AS	<0.1	MCG/G DW	EGGS-TERN
CFO-CT-87-13	8020942	AS	<0.1	MCG/G DW	EGGS-TERN
CFO-CT-87-14	8020943	AS	<0.1	MCG/G DW	EGGS-TERN
CFO-CT-87-15	8020944	AS	<0.1	MCG/G DW	EGGS-TERN
CFO-HG-87-1	8020960	AS	0.1	MCG/G DW	EGGS-HERRING GULL
CFO-HG-87-2	8020961	AS	<0.1	MCG/G DW	EGGS-HERRING GULL
CFO-HG-87-3	8020962	AS	<0.1	MCG/G DW	EGGS-HERRING GULL
CFO-HG-87-4	8020963	AS	<0.1	MCG/G DW	EGGS-HERRING GULL
CFO-HG-87-5	8020964	AS	<0.1	MCG/G DW	EGGS-HERRING GULL
CFO-HG-87-6	8020965	AS	<0.1	MCG/G DW	EGGS-HERRING GULL
CFO-HG-87-7	8020969	AS	<0.1	MCG/G DW	EGGS-HERRING GULL
CFO-CT-87-8	8020970	AS	<0.1	MCG/G DW	EGGS-HERRING GULL
CFO-HG-87-9	8020971	AS	<0.1	MCG/G DW	EGGS-HERRING GULL
CFO-FF-87-7	8020982	AS	0.47	MCG/G DW	FISH-FORAGE
CFO-FF-87-8	8020983	AS	<0.1	MCG/G DW	FISH-FORAGE
CFO-FF-87-9	8020984	AS	0.41	MCG/G DW	FISH-FORAGE
CFO-FF-87-10	8020985	AS	0.53	MCG/G DW	FISH-FORAGE
CFO-FF-87-11	8020986	AS	0.40	MCG/G DW	FISH-FORAGE
CFO-FF-87-12	8020987	AS	0.2	MCG/G DW	FISH-FORAGE
CFO-FF-87-13	8020988	AS	0.2	MCG/G DW	FISH-FORAGE

ETSRC Quality Control Report -- Duplicates

USDI - LOWE Cat. 5339
B-88020929

Submitter's ID Number	ETSRC ID	Test	Final Concen.	Units of Fin.Conc.	Description
CFO-CT-87-8	8020937	AS	<0.1	MCG/G DW	EGGS-TERN
CFO-CT-87-8	8020937D	AS	<0.1	MCG/G DW	EGGS-TERN
Percent Deviation	0.0				
CFO-CT-87-18	8020950	AS	<0.1	MCG/G DW	EGGS-TERN
CFO-CT-87-18	8020950D	AS	<0.1	MCG/G DW	EGGS-TERN
Percent Deviation	0.0				
CFO-HG-87-2	8020961	AS	<0.1	MCG/G DW	EGGS-HERRING GULL
CFO-HG-87-2	8020961D	AS	<0.1	MCG/G DW	EGGS-HERRING GULL
Percent Deviation	0.0				
CFO-FF-87-3	8020978	AS	0.3	MCG/G DW	FISH-FORAGE
CFO-FF-87-3	8020978D	AS	0.32	MCG/G DW	FISH-FORAGE
Percent Deviation	6.5				
CFO-FF-87-14	8020989	AS	0.2	MCG/G DW	FISH-FORAGE
CFO-FF-87-14	8020989D	AS	0.2	MCG/G DW	FISH-FORAGE
Percent Deviation	0.0				

Average Percent Deviations 1.3

Standard Deviation of % 2.9

ETSRC Quality Control Report -- Spikes

USDI - LOWE Cat. 5339
B-88020929

Submitter's ID Number	ETSRC ID	Test	Final Concen.	Units of Fin.Conc.	Description
CFO-CT-87-1	8020930	AS	<0.1	MCG/G DW	EGGS-TERN
CFO-CT-87-1	8020930S	AS	100.	MCG/G DW	EGGS-TERN
MCG of Spike Added	50.00		Percent Spike Recovery	101.	
CFO-CT-87-12	8020941	AS	<0.1	MCG/G DW	EGGS-TERN
CFO-CT-87-12	8020941S	AS	100.	MCG/G DW	EGGS-TERN
MCG of Spike Added	50.00		Percent Spike Recovery	101.	
CFO-CT-87-23	8020955	AS	<0.1	MCG/G DW	EGGS-TERN
CFO-CT-87-23	8020955S	AS	100.	MCG/G DW	EGGS-TERN
MCG of Spike Added	50.00		Percent Spike Recovery	102.	
CFO-HG-87-7	8020969	AS	<0.1	MCG/G DW	EGGS-HERRING GULL
CFO-HG-87-7	8020969S	AS	97.	MCG/G DW	EGGS-HERRING GULL
MCG of Spike Added	50.00		Percent Spike Recovery	98.	
CFO-FF-87-9	8020984	AS	0.41	MCG/G DW	FISH-FORAGE
CFO-FF-87-9	8020984S	AS	89.	MCG/G DW	FISH-FORAGE
MCG of Spike Added	50.00		Percent Spike Recovery	89.	

Average Percent Spike Recovery 98.

Standard Deviation of Recovery 5.3

ETSRC Quality Control Report -- Reference Standards

USDI - LOWE Cat. 5339
B-88020929

Reference ID Number	ETSRC ID	Test	Final Concen.	Units of Fin.Conc.	Expected Value	Standard Deviation	Description
NRCC DORM1	8020959	AS	21.	MCG/G DW	17.7	2.1	NRCC DOGFISH
NBS 1572	8020972	AS	2.8	MCG/G DW	3.1	0.3	CITRUS LEAVE
NBS 1577A	8020991	AS	<0.1	MCG/G DW	0.047	0.006	BOVINE LIVER

ETSRC Sample Report

USDI - LOWE Cat. 5339
B-88020929

Submitter's ID Number	ETSRC ID	Test	Final Concen.	Units of Fin.Conc.	Description
CFO-CT-87-1	8020930	SE	3.2	MCG/G DW	EGGS-TERN
CFO-CT-87-2	8020931	SE	3.2	MCG/G DW	EGGS-TERN
CFO-CT-87-3	8020932	SE	2.6	MCG/G DW	EGGS-TERN
CFO-CT-87-4	8020933	SE	3.1	MCG/G DW	EGGS-TERN
CFO-CT-87-5	8020934	SE	3.3	MCG/G DW	EGGS-TERN
CFO-CT-87-6	8020935	SE	3.3	MCG/G DW	EGGS-TERN
CFO-CT-87-7	8020936	SE	3.5	MCG/G DW	EGGS-TERN
CFO-CT-87-8	8020937	SE	3.4	MCG/G DW	EGGS-TERN
CFO-CT-87-9	8020938	SE	3.5	MCG/G DW	EGGS-TERN
CFO-CT-87-10	8020939	SE	3.1	MCG/G DW	EGGS-TERN
CFO-CT-87-11	8020940	SE	2.8	MCG/G DW	EGGS-TERN
CFO-CT-87-12	8020941	SE	2.8	MCG/G DW	EGGS-TERN
CFO-CT-87-13	8020942	SE	3.7	MCG/G DW	EGGS-TERN
CFO-CT-87-14	8020943	SE	3.5	MCG/G DW	EGGS-TERN
CFO-CT-87-15	8020944	SE	3.2	MCG/G DW	EGGS-TERN
CFO-HG-87-1	8020960	SE	3.0	MCG/G DW	EGGS-HERRING GULL
CFO-HG-87-2	8020961	SE	2.9	MCG/G DW	EGGS-HERRING GULL
CFO-HG-87-3	8020962	SE	2.8	MCG/G DW	EGGS-HERRING GULL
CFO-HG-87-4	8020963	SE	3.2	MCG/G DW	EGGS-HERRING GULL
CFO-HG-87-5	8020964	SE	3.6	MCG/G DW	EGGS-HERRING GULL
CFO-HG-87-6	8020965	SE	3.5	MCG/G DW	EGGS-HERRING GULL
CFO-HG-87-7	8020969	SE	3.5	MCG/G DW	EGGS-HERRING GULL
CFO-CT-87-8	8020970	SE	3.8	MCG/G DW	EGGS-HERRING GULL
CFO-HG-87-9	8020971	SE	2.1	MCG/G DW	EGGS-HERRING GULL
CFO-FF-87-7	8020982	SE	2.7	MCG/G DW	FISH-FORAGE
CFO-FF-87-8	8020983	SE	2.0	MCG/G DW	FISH-FORAGE
CFO-FF-87-9	8020984	SE	2.8	MCG/G DW	FISH-FORAGE
CFO-FF-87-10	8020985	SE	3.0	MCG/G DW	FISH-FORAGE
CFO-FF-87-11	8020986	SE	2.2	MCG/G DW	FISH-FORAGE
CFO-FF-87-12	8020987	SE	2.8	MCG/G DW	FISH-FORAGE
CFO-FF-87-13	8020988	SE	3.0	MCG/G DW	FISH-FORAGE

ETSRC Quality Control Report -- Duplicates

USDI - LOWE Cat. 5339
B-88020929

Submitter's ID Number	ETSRC ID	Test	Final Concen.	Units of Fin.Conc.	Description
CFO-CT-87-8	8020937	SE	3.4	MCG/G DW	EGGS-TERN
CFO-CT-87-8	8020937D	SE	3.4	MCG/G DW	EGGS-TERN
Percent Deviation		0.0			
CFO-CT-87-18	8020950	SE	3.1	MCG/G DW	EGGS-TERN
CFO-CT-87-18	8020950D	SE	3.2	MCG/G DW	EGGS-TERN
Percent Deviation		3.2			
CFO-HG-87-2	8020961	SE	2.9	MCG/G DW	EGGS-HERRING GULL
CFO-HG-87-2	8020961D	SE	2.9	MCG/G DW	EGGS-HERRING GULL
Percent Deviation		0.0			
CFO-FF-87-3	8020978	SE	2.1	MCG/G DW	FISH-FORAGE
CFO-FF-87-3	8020978D	SE	2.1	MCG/G DW	FISH-FORAGE
Percent Deviation		0.0			
CFO-FF-87-14	8020989	SE	1.7	MCG/G DW	FISH-FORAGE
CFO-FF-87-14	8020989D	SE	1.7	MCG/G DW	FISH-FORAGE
Percent Deviation		0.0			

Average Percent Deviations 0.6

Standard Deviation of % 1.4

ETSRC Quality Control Report -- Spikes

USDI - LOWE Cat. 5339
B-88020929

Submitter's ID Number	ETSRC ID	Test	Final Concen.	Units of Fin.Conc.	Description
CFO-CT-87-1	8020930	SE	3.2	MCG/G DW	EGGS-TERN
CFO-CT-87-1	8020930S	SE	94.	MCG/G DW	EGGS-TERN
MCG of Spike Added	50.00		Percent Spike Recovery	91.	
CFO-CT-87-12	8020941	SE	2.8	MCG/G DW	EGGS-TERN
CFO-CT-87-12	8020941S	SE	93.	MCG/G DW	EGGS-TERN
MCG of Spike Added	50.00		Percent Spike Recovery	91.	
CFO-CT-87-23	8020955	SE	3.3	MCG/G DW	EGGS-TERN
CFO-CT-87-23	8020955S	SE	96.	MCG/G DW	EGGS-TERN
MCG of Spike Added	50.00		Percent Spike Recovery	94.	
CFO-HG-87-7	8020969	SE	3.5	MCG/G DW	EGGS-HERRING GULL
CFO-HG-87-7	8020969S	SE	98.	MCG/G DW	EGGS-HERRING GULL
MCG of Spike Added	50.00		Percent Spike Recovery	96.	
CFO-FF-87-9	8020984	SE	2.8	MCG/G DW	FISH-FORAGE
CFO-FF-87-9	8020984S	SE	93.	MCG/G DW	FISH-FORAGE
MCG of Spike Added	50.00		Percent Spike Recovery	91.	

Average Percent Spike Recovery 92.

Standard Deviation of Recovery 2.3

ETSRC Quality Control Report -- Reference Standards

USDI - LOWE Cat. 5339
B-88020929

Reference ID Number	ETSRC ID	Test	Final Concen.	Units of Fin.Conc.	Expected Value	Standard Deviation	Description
NRCC DORM1	8020959	SE	1.5	MCG/G DW	1.62	0.12	NRCC DOGFISH
NBS 1572	8020972	SE	<0.2	MCG/G DW	0.025	NO CERT	CITRUS LEAVE
NBS 1577A	8020991	SE	0.71	MCG/G DW	0.71	0.07	BOVINE LIVER

ETSRC Sample Report

USDI - LOWE Cat. 5339
B-88020929

Submitter's ID Number	ETSRC ID	Test	Final Concen.	Units of Fin.Conc.	Description
CFO-CT-87-1	8020930	HG	0.669	MCG/G DW	EGGS-TERN
CFO-CT-87-2	8020931	HG	0.701	MCG/G DW	EGGS-TERN
CFO-CT-87-3	8020932	HG	0.694	MCG/G DW	EGGS-TERN
CFO-CT-87-4	8020933	HG	0.926	MCG/G DW	EGGS-TERN
CFO-CT-87-5	8020934	HG	1.3	MCG/G DW	EGGS-TERN
CFO-CT-87-6	8020935	HG	0.783	MCG/G DW	EGGS-TERN
CFO-CT-87-7	8020936	HG	0.852	MCG/G DW	EGGS-TERN
CFO-CT-87-8	8020937	HG	0.874	MCG/G DW	EGGS-TERN
CFO-CT-87-9	8020938	HG	0.598	MCG/G DW	EGGS-TERN
CFO-CT-87-10	8020939	HG	0.862	MCG/G DW	EGGS-TERN
CFO-CT-87-11	8020940	HG	0.638	MCG/G DW	EGGS-TERN
CFO-CT-87-12	8020941	HG	0.567	MCG/G DW	EGGS-TERN
CFO-CT-87-13	8020942	HG	0.755	MCG/G DW	EGGS-TERN
CFO-CT-87-14	8020943	HG	0.949	MCG/G DW	EGGS-TERN
CFO-CT-87-15	8020944	HG	0.547	MCG/G DW	EGGS-TERN
CFO-HG-87-1	8020960	HG	0.33	MCG/G DW	EGGS-HERRING GULL
CFO-HG-87-2	8020961	HG	0.605	MCG/G DW	EGGS-HERRING GULL
CFO-HG-87-3	8020962	HG	0.38	MCG/G DW	EGGS-HERRING GULL
CFO-HG-87-4	8020963	HG	0.674	MCG/G DW	EGGS-HERRING GULL
CFO-HG-87-5	8020964	HG	0.909	MCG/G DW	EGGS-HERRING GULL
CFO-HG-87-6	8020965	HG	0.658	MCG/G DW	EGGS-HERRING GULL
CFO-HG-87-7	8020969	HG	0.32	MCG/G DW	EGGS-HERRING GULL
CFO-CT-87-8	8020970	HG	0.32	MCG/G DW	EGGS-HERRING GULL
CFO-HG-87-9	8020971	HG	0.24	MCG/G DW	EGGS-HERRING GULL
CFO-FF-87-7	8020982	HG	0.19	MCG/G DW	FISH-FORAGE
CFO-FF-87-8	8020983	HG	0.19	MCG/G DW	FISH-FORAGE
CFO-FF-87-9	8020984	HG	0.11	MCG/G DW	FISH-FORAGE
CFO-FF-87-10	8020985	HG	0.12	MCG/G DW	FISH-FORAGE
CFO-FF-87-11	8020986	HG	0.16	MCG/G DW	FISH-FORAGE
CFO-FF-87-12	8020987	HG	0.12	MCG/G DW	FISH-FORAGE
CFO-FF-87-13	8020988	HG	0.15	MCG/G DW	FISH-FORAGE

ETSRC Quality Control Report -- Duplicates

USDI - LOWE Cat. 5339
B-88020929

Submitter's ID Number	ETSRC ID	Test	Final Concen.	Units of Fin.Conc.	Description
CFO-CT-87-8	8020937	HG	0.886	MCG/G DW	EGGS-TERN
CFO-CT-87-8	8020937D	HG	0.862	MCG/G DW	EGGS-TERN
Percent Deviation	2.7				
CFO-CT-87-18	8020950	HG	1.3	MCG/G DW	EGGS-TERN
CFO-CT-87-18	8020950D	HG	1.3	MCG/G DW	EGGS-TERN
Percent Deviation	0.0				
CFO-HG-87-2	8020961	HG	0.607	MCG/G DW	EGGS-HERRING GULL
CFO-HG-87-2	8020961D	HG	0.602	MCG/G DW	EGGS-HERRING GULL
Percent Deviation	0.8				
CFO-FF-87-3	8020978	HG	0.18	MCG/G DW	FISH-FORAGE
CFO-FF-87-3	8020978D	HG	0.17	MCG/G DW	FISH-FORAGE
Percent Deviation	5.7				
CFO-FF-87-14	8020989	HG	0.18	MCG/G DW	FISH-FORAGE
CFO-FF-87-14	8020989D	HG	0.18	MCG/G DW	FISH-FORAGE
Percent Deviation	0.0				

Average Percent Deviations 1.9

Standard Deviation of % 2.4

ETSRC Quality Control Report -- Spikes

USDI - LOWE Cat. 5339
B-88020929

Submitter's ID Number	ETSRC ID	Test	Final Concen.	Units of Fin.Conc.	Description
CFO-CT-87-1	8020930	HG	0.669	MCG/G DW	EGGS-TERN
CFO-CT-87-1	8020930S	HG	4.6	MCG/G DW	EGGS-TERN
MCG of Spike Added	1.00		Percent Spike Recovery	101.	
CFO-CT-87-12	8020941	HG	0.567	MCG/G DW	EGGS-TERN
CFO-CT-87-12	8020941S	HG	4.5	MCG/G DW	EGGS-TERN
MCG of Spike Added	1.00		Percent Spike Recovery	101.	
CFO-CT-87-23	8020955	HG	1.5	MCG/G DW	EGGS-TERN
CFO-CT-87-23	8020955S	HG	5.28	MCG/G DW	EGGS-TERN
MCG of Spike Added	1.00		Percent Spike Recovery	98.	
CFO-HG-87-7	8020969	HG	0.32	MCG/G DW	EGGS-HERRING GULL
CFO-HG-87-7	8020969S	HG	2.4	MCG/G DW	EGGS-HERRING GULL
MCG of Spike Added	1.00		Percent Spike Recovery	106.	
CFO-FF-87-9	8020984	HG	0.11	MCG/G DW	FISH-FORAGE
CFO-FF-87-9	8020984S	HG	2.2	MCG/G DW	FISH-FORAGE
MCG of Spike Added	1.00		Percent Spike Recovery	107.	

Average Percent Spike Recovery 102.

Standard Deviation of Recovery 3.7

ETSRC Quality Control Report -- Reference Standards

USDI - LOWE Cat. 5339
B-88020929

Reference ID Number	ETSRC ID	Test	Final Concen.	Units of Fin.Conc.	Expected Value	Standard Deviation	Description
NRCC DORM1	8020959	HG	0.767	MCG/G DW	0.798	0.074	NRCC DOGFISH
NBS 1572	8020972	HG	0.11	MCG/G DW	0.08	0.02	CITRUS LEAVE
NBS 1577A	8020991	HG	0.005	MCG/G DW	0.004	0.002	BOVINE LIVER

Quality Control Report
Environmental Trace Substances Research Center
ICP Scan - Sample Analysis Report
Project: USDI - LOWE Cat. 5339 Units: MCG/G DRY WEIGHT
Batch #: B-88020929

Customer ID: CFO-CT-87-8
Description: EGGS-TERN
ETSRC ID: 8020937

Elm	Result	Duplicate	% Deviation	Estimated Sample Detection Limit
AL	<0.3	<0.3	0.0	0.3
BE	<0.009	<0.009	0.0	0.009
CD	0.04	0.04	0.0	0.03
CR	<0.1	0.1	***	0.1
CU	3.03	3.03	0.0	0.02
FE	117.	117.	0.0	0.1
MN	2.63	2.63	0.0	0.02
NI	0.2	<0.2	***	0.2
PB	1.	1.	0.0	0.4
TL	<0.6	<0.6	0.0	0.6
ZN	63.7	64.1	0.6	0.02

Average % Deviation 0.1

Customer ID: CFO-CT-87-18
Description: EGGS-TERN
ETSRC ID: 8020950

Elm	Result	Duplicate	% Deviation	Estimated Sample Detection Limit
AL	1.	1.3	26.1	0.4
BE	<0.01	<0.01	0.0	0.01
CD	0.04	0.03	28.6	0.03
CR	<0.1	0.3	***	0.1
CU	2.35	2.32	1.3	0.02
FE	91.2	92.7	1.6	0.1
MN	2.1	2.0	4.9	0.02
NI	<0.2	0.2	***	0.2
PB	0.6	<0.5	***	0.5
TL	<0.6	<0.6	0.0	0.6
ZN	71.7	73.2	2.1	0.03

Average % Deviation 8.1

Quality Control Report
Environmental Trace Substances Research Center
ICP Scan - Sample Analysis Report
Project: USDI - LOWE Cat. 5339 Units: MCG/G DRY WEIGHT
Batch #: B-88020929

Customer ID: CFO-HG-87-2
Description: EGGS-HERRING GULL
ETSRC ID: 8020961

Elm	Result	Duplicate	% Deviation	Estimated Sample Detection Limit
AL	1.9	2.3	19.0	0.3
BE	<0.009	<0.009	0.0	0.009
CD	<0.03	0.03	***	0.03
CR	<0.1	<0.1	0.0	0.1
CU	2.75	2.75	0.0	0.02
FE	138.	138.	0.0	0.1
MN	2.71	2.75	1.5	0.02
NI	<0.2	<0.2	0.0	0.2
PB	0.5	0.7	33.3	0.4
TL	<0.6	<0.6	0.0	0.6
ZN	56.7	57.3	1.1	0.03

Average % Deviation 5.5

Quality Control Report
Environmental Trace Substances Research Center
ICP Scan - Sample Analysis Report
Project: USDI - LOWE Cat. 5339 Units: MCG/G DRY WEIGHT
Batch #: B-88020929

Customer ID: CFO-FF-87-3
Description: FISH-FORAGE
ETSRC ID: 8020978

Elm	Result	Duplicate	% Deviation	Estimated Sample Detection Limit
AL	24.	25.	4.1	0.4
BE	<0.01	<0.01	0.0	0.01
CD	0.1	0.08	22.2	0.04
CR	0.3	0.44	37.8	0.1
CU	2.2	2.2	0.0	0.02
FE	67.6	66.9	1.0	0.1
MN	8.63	8.77	1.6	0.02
NI	0.2	0.2	0.0	0.2
PB	<0.5	<0.5	0.0	0.5
TL	<0.6	<0.6	0.0	0.6
ZN	207.	204.	1.5	0.02

Average % Deviation 6.2

Customer ID: CFO-FF-87-14
Description: FISH-FORAGE
ETSRC ID: 8020989

Elm	Result	Duplicate	% Deviation	Estimated Sample Detection Limit
AL	85.2	87.3	2.4	0.4
BE	0.03	0.02	40.0	0.01
CD	0.07	<0.04	***	0.04
CR	1.2	1.1	8.7	0.1
CU	3.70	3.66	1.1	0.03
FE	86.6	85.1	1.7	0.1
MN	7.73	7.68	0.6	0.03
NI	0.67	0.5	29.1	0.2
PB	<0.5	<0.5	0.0	0.5
TL	<0.6	<0.7	0.0	0.7
ZN	97.0	95.8	1.2	0.03

Average % Deviation 8.5

Quality Control Report
Environmental Trace Substances Research Center
ICP Scan - Sample Analysis Report
Project: USDI - LOWE Cat. 5339 Units: MCG/G DRY WEIGHT
Batch #: B-88020929

Customer ID: CFO-CT-87-1
Description: EGGS-TERN
ETSRC ID: 8020930

Elm	Result	MCG Added	Spiked Sample	% Recovery	Estimated Sample Detection Limit
AL	1.5	100.0	208.	104.	0.4
BE	<0.01	5.0	10.3	104.	0.01
CD	0.04	10.0	20.1	101.	0.04
CR	<0.1	50.0	99.9	100.	0.1
CU	2.67	100.0	208.	103.	0.02
FE	106.	1000.0	2100.	100.	0.1
MN	2.1	50.0	101.	99.	0.03
NI	0.3	50.0	102.	102.	0.2
PB	<0.5	50.0	102.	103.	0.5
TL	<0.6	50.0	101.	102.	0.7
ZN	71.6	200.0	488.	105.	0.06

Average % Recovery 102.

- Not Spiked
* Possibly Not Spiked - Not in Average
*** Spike Too Low

Customer ID: CFO-CT-87-12
Description: EGGS-TERN
ETSRC ID: 8020941

Elm	Result	MCG Added	Spiked Sample	% Recovery	Estimated Sample Detection Limit
AL	1.2	100.0	210.	105.	0.4
BE	<0.009	5.0	10.4	104.	0.01
CD	<0.03	10.0	20.1	101.	0.04
CR	<0.1	50.0	100.	100.	0.1
CU	3.08	100.0	212.	105.	0.02
FE	128.	1000.0	2130.	101.	0.1
MN	3.76	50.0	103.	100.	0.03
NI	<0.2	50.0	102.	102.	0.2
PB	1.	50.0	103.	102.	0.5
TL	<0.6	50.0	103.	103.	0.7
ZN	74.9	200.0	494.	105.	0.06

Average % Recovery 103.

- Not Spiked
* Possibly Not Spiked - Not in Average
*** Spike Too Low

Quality Control Report
Environmental Trace Substances Research Center
ICP Scan - Sample Analysis Report
Project: USDI - LOWE Cat. 5339 Units: MCG/G DRY WEIGHT
Batch #: B-88020929

Customer ID: CFO-CT-87-23
Description: EGGS-TERN
ETSRC ID: 8020955

Elm	Result	MCG Added	Spiked Sample	% Recovery	Estimated Sample Detection Limit
AL	9.2	100.0	218.	106.	0.4
BE	<0.009	5.0	10.5	106.	0.01
CD	0.03	10.0	20.2	102.	0.04
CR	<0.1	50.0	100.	101.	0.1
CU	2.58	100.0	211.	106.	0.02
FE	106.	1000.0	2130.	103.	0.1
MN	2.26	50.0	101.	100.	0.03
NI	<0.2	50.0	102.	103.	0.2
PB	<0.5	50.0	104.	105.	0.5
TL	<0.6	50.0	99.2	101.	0.7
ZN	70.3	200.0	495.	108.	0.06

Average % Recovery 104.

\- Not Spiked
* Possibly Not Spiked - Not in Average
*** Spike Too Low

Quality Control Report
Environmental Trace Substances Research Center
ICP Scan - Sample Analysis Report
Project: USDI - LOWE Cat. 5339 Units: MCG/G DRY WEIGHT
Batch #: B-88020929

Customer ID: CFO-HG-87-7
Description: EGGS-HERRING GULL
ETSRC ID: 8020969

Elm	Result	MCG Added	Spiked Sample	% Recovery	Estimated Sample Detection Limit
AL	2.1	100.0	209.	105.	0.3
BE	<0.01	5.0	10.3	104.	0.01
CD	<0.03	10.0	20.7	105.	0.04
CR	<0.1	50.0	103.	104.	0.1
CU	3.05	100.0	209.	104.	0.02
FE	100.	1000.0	2140.	103.	0.1
MN	1.8	50.0	104.	103.	0.03
NI	<0.2	50.0	102.	103.	0.2
PB	<0.4	50.0	103.	104.	0.5
TL	<0.5	50.0	102.	103.	0.6
ZN	40.5	200.0	454.	105.	0.06

Average % Recovery 104.

- Not Spiked
* Possibly Not Spiked - Not in Average
*** Spike Too Low

Customer ID: CFO-FF-87-9
Description: FISH-FORAGE
ETSRC ID: 8020984

Elm	Result	MCG Added	Spiked Sample	% Recovery	Estimated Sample Detection Limit
AL	278.	100.0	473.	98.	0.4
BE	0.03	5.0	10.5	105.	0.01
CD	0.42	10.0	20.8	103.	0.05
CR	4.5	50.0	98.3	94.	0.1
CU	2.6	100.0	214.	106.	0.03
FE	283.	1000.0	2230.	98.	0.1
MN	21.5	50.0	117.	96.	0.04
NI	2.1	50.0	99.0	97.	0.2
PB	0.8	50.0	101.	101.	0.5
TL	<0.7	50.0	102.	103.	0.7
ZN	388.	200.0	790.	101.	0.06

Average % Recovery 100.

- Not Spiked
* Possibly Not Spiked - Not in Average
*** Spike Too Low

Quality Control Report
Environmental Trace Substances Research Center
ICP Scan - Sample Analysis Report
Project: USDI - LOWE Cat. 5339 Units: MCG/G DRY WEIGHT
Batch #: B-88020929

Customer ID: NRCC DORM1
Description: NRCC DOGFISH MUSCLE
ETSRC ID: 8020959

Elm	Result	Expected Value	+/- STD.DEV.	Estimated Sample Detection Limit
AL	11.			0.3
BE	<0.009			0.009
CD	0.12	0.086	0.012	0.03
CR	3.5	3.60	0.40	0.1
CU	4.69	5.22	0.33	0.02
FE	73.1	63.6	5.3	0.1
MN	1.3	1.32	0.26	0.02
NI	1.3	1.20	0.30	0.2
PB	1.	0.40	0.12	0.4
TL	<0.6			0.6
ZN	19.4	21.3	1.0	0.03

Quality Control Report
Environmental Trace Substances Research Center
ICP Scan - Sample Analysis Report
Project: USDI - LOWE Cat. 5339 Units: MCG/G DRY WEIGHT
Batch #: B-88020929

Customer ID: NBS 1572
Description: CITRUS LEAVES
ETSRC ID: 8020972

Elm	Result	Expected Value	+/- STD.DEV.	Estimated Sample Detection Limit
AL	65.0	92.	15.	0.3
BE	<0.01			0.01
CD	0.04	0.03	0.01	0.03
CR	0.62	0.8	0.2	0.1
CU	15.5	16.5	1.0	0.02
FE	80.6	90.	10.	0.1
MN	22.1	23.	2.	0.02
NI	0.63	0.6	0.3	0.2
PB	14.	13.3	2.4	0.4
TL	<0.5	<0.01	NO CERT	0.5
ZN	28.3	29.	2.	0.03

Customer ID: NBS 1577A
Description: BOVINE LIVER
ETSRC ID: 8020991

Elm	Result	Expected Value	+/- STD.DEV.	Estimated Sample Detection Limit
AL	0.7	2.	NO CERT	0.3
BE	0.01			0.01
CD	0.40	0.44	0.06	0.04
CR	0.3			0.1
CU	139.	158.	7.	0.02
FE	169.	194.	20.	0.1
MN	9.19	9.9	0.8	0.02
NI	0.4			0.2
PB	<0.4	0.135	0.015	0.4
TL	<0.5	0.003	NO CERT	0.5
ZN	115.	123.	8.	0.06

Environmental Trace Substances Research Center
ICP Scan - Sample Analysis Report
Project: USDI - LOWE Cat. 5339 Units: MCG/G DRY WEIGHT
Batch #: B-88020929

Customer ID: CFO-CT-87-1
Description: EGGS-TERN
ETSRC ID: 8020930

Elm	Result	Estimated Sample Detection Limit
AL	1.5	0.4
BE	<0.01	0.01
CD	0.04	0.03
CR	<0.1	0.1
CU	2.67	0.02
FE	106.	0.1
MN	2.1	0.02
NI	0.3	0.2
PB	<0.5	0.5
TL	<0.6	0.6
ZN	71.6	0.03

Customer ID: CFO-CT-87-2
Description: EGGS-TERN
ETSRC ID: 8020931

Elm	Result	Estimated Sample Detection Limit
AL	1.1	0.3
BE	<0.009	0.009
CD	0.04	0.03
CR	<0.1	0.1
CU	2.94	0.02
FE	114.	0.1
MN	2.43	0.02
NI	<0.2	0.2
PB	<0.4	0.4
TL	<0.6	0.6
ZN	81.0	0.03

Environmental Trace Substances Research Center
ICP Scan - Sample Analysis Report
Project: USDI - LOWE Cat. 5339 Units: MCG/G DRY WEIGHT
Batch #: B-88020929

Customer ID: CFO-CT-87-3
Description: EGGS-TERN
ETSRC ID: 8020932

Elm	Result	Estimated Sample Detection Limit
AL	<0.3	0.3
BE	<0.009	0.009
CD	0.05	0.03
CR	<0.1	0.1
CU	2.58	0.02
FE	101.	0.1
MN	1.5	0.02
NI	<0.2	0.2
PB	0.4	0.4
TL	<0.6	0.6
ZN	56.8	0.02

Customer ID: CFO-CT-87-4
Description: EGGS-TERN
ETSRC ID: 8020933

Elm	Result	Estimated Sample Detection Limit
AL	<0.3	0.3
BE	<0.009	0.009
CD	0.04	0.03
CR	<0.1	0.1
CU	3.00	0.02
FE	126.	0.1
MN	1.8	0.02
NI	0.2	0.2
PB	<0.4	0.4
TL	<0.6	0.6
ZN	72.6	0.03

Environmental Trace Substances Research Center
ICP Scan - Sample Analysis Report
Project: USDI - LOWE Cat. 5339 Units: MCG/G DRY WEIGHT
Batch #: B-88020929

Customer ID: CFO-CT-87-5
Description: EGGS-TERN
ETSRC ID: 8020934

Elm	Result	Estimated Sample Detection Limit
AL	0.6	0.3
BE	<0.009	0.009
CD	<0.03	0.03
CR	<0.1	0.1
CU	2.85	0.02
FE	100.	0.1
MN	1.9	0.02
NI	<0.2	0.2
PB	0.4	0.4
TL	<0.6	0.6
ZN	68.0	0.02

Customer ID: CFO-CT-87-6
Description: EGGS-TERN
ETSRC ID: 8020935

Elm	Result	Estimated Sample Detection Limit
AL	0.7	0.3
BE	<0.009	0.009
CD	0.04	0.03
CR	3.5	0.1
CU	2.73	0.02
FE	126.	0.1
MN	2.54	0.02
NI	1.7	0.2
PB	<0.4	0.4
TL	<0.6	0.6
ZN	70.8	0.03

Environmental Trace Substances Research Center
ICP Scan - Sample Analysis Report
Project: USDI - LOWE Cat. 5339 Units: MCG/G DRY WEIGHT
Batch #: B-88020929

Customer ID: CFO-CT-87-7
Description: EGGS-TERN
ETSRC ID: 8020936

Elm	Result	Estimated Sample Detection Limit
AL	<0.3	0.3
BE	<0.009	0.009
CD	0.04	0.03
CR	<0.1	0.1
CU	2.79	0.02
FE	109.	0.1
MN	2.0	0.02
NI	<0.2	0.2
PB	<0.4	0.4
TL	<0.6	0.6
ZN	61.2	0.03

Customer ID: CFO-CT-87-8
Description: EGGS-TERN
ETSRC ID: 8020937

Elm	Result	Estimated Sample Detection Limit
AL	<0.3	0.3
BE	<0.009	0.009
CD	0.04	0.03
CR	<0.1	0.1
CU	3.03	0.02
FE	117.	0.1
MN	2.63	0.02
NI	0.2	0.2
PB	1.	0.4
TL	<0.6	0.6
ZN	63.9	0.02

Environmental Trace Substances Research Center
ICP Scan - Sample Analysis Report
Project: USDI - LOWE Cat. 5339 Units: MCG/G DRY WEIGHT
Batch #: B-88020929

Customer ID: CFO-CT-87-9
Description: EGGS-TERN
ETSRC ID: 8020938

Elm	Result	Estimated Sample Detection Limit
AL	0.8	0.3
BE	<0.009	0.009
CD	0.04	0.03
CR	0.1	0.1
CU	3.07	0.02
FE	128.	0.1
MN	2.0	0.02
NI	0.2	0.2
PB	<0.4	0.4
TL	<0.6	0.6
ZN	61.4	0.03

Customer ID: CFO-CT-87-10
Description: EGGS-TERN
ETSRC ID: 8020939

Elm	Result	Estimated Sample Detection Limit
AL	1.5	0.3
BE	<0.009	0.009
CD	<0.03	0.03
CR	<0.1	0.1
CU	2.52	0.02
FE	118.	0.1
MN	2.82	0.02
NI	<0.2	0.2
PB	<0.4	0.4
TL	<0.5	0.5
ZN	67.9	0.02

Environmental Trace Substances Research Center
ICP Scan - Sample Analysis Report
Project: USDI - LOWE Cat. 5339 Units: MCG/G DRY WEIGHT
Batch #: B-88020929

Customer ID: CFO-CT-87-11
Description: EGGS-TERN
ETSRC ID: 8020940

Elm	Result	Estimated Sample Detection Limit
AL	1.	0.3
BE	<0.009	0.009
CD	0.03	0.03
CR	<0.1	0.1
CU	2.85	0.02
FE	102.	0.1
MN	2.1	0.02
NI	<0.2	0.2
PB	0.5	0.4
TL	<0.6	0.6
ZN	66.7	0.03

Customer ID: CFO-CT-87-12
Description: EGGS-TERN
ETSRC ID: 8020941

Elm	Result	Estimated Sample Detection Limit
AL	1.2	0.3
BE	<0.009	0.009
CD	<0.03	0.03
CR	<0.1	0.1
CU	3.08	0.02
FE	128.	0.1
MN	3.76	0.02
NI	<0.2	0.2
PB	1.	0.4
TL	<0.6	0.6
ZN	74.9	0.03

Environmental Trace Substances Research Center
ICP Scan - Sample Analysis Report
Project: USDI - LOWE Cat. 5339 Units: MCG/G DRY WEIGHT
Batch #: B-88020929

Customer ID: CFO-CT-87-13
Description: EGGS-TERN
ETSRC ID: 8020942

Elm	Result	Estimated Sample Detection Limit
AL	0.9	0.3
BE	<0.009	0.009
CD	0.03	0.03
CR	<0.1	0.1
CU	2.86	0.02
FE	99.1	0.1
MN	1.8	0.02
NI	<0.2	0.2
PB	0.6	0.4
TL	<0.6	0.6
ZN	73.5	0.02

Customer ID: CFO-CT-87-14
Description: EGGS-TERN
ETSRC ID: 8020943

Elm	Result	Estimated Sample Detection Limit
AL	<0.4	0.4
BE	<0.01	0.01
CD	<0.03	0.03
CR	<0.1	0.1
CU	3.05	0.02
FE	140.	0.1
MN	1.8	0.02
NI	<0.2	0.2
PB	<0.5	0.5
TL	<0.6	0.6
ZN	66.3	0.03

Environmental Trace Substances Research Center
ICP Scan - Sample Analysis Report
Project: USDI - LOWE Cat. 5339 Units: MCG/G DRY WEIGHT
Batch #: B-88020929

Customer ID: CFO-CT-87-15
Description: EGGS-TERN
ETSRC ID: 8020944

Elm	Result	Estimated Sample Detection Limit
AL	<0.4	0.4
BE	<0.01	0.01
CD	<0.03	0.03
CR	<0.1	0.1
CU	2.73	0.02
FE	112.	0.1
MN	1.5	0.02
NI	0.2	0.2
PB	0.5	0.5
TL	<0.6	0.6
ZN	69.5	0.03

Environmental Trace Substances Research Center
ICP Scan - Sample Analysis Report
Project: USDI - LOWE Cat. 5339 Units: MCG/G DRY WEIGHT
Batch #: B-88020929

Customer ID: CFO-HG-87-1
Description: EGGS-HERRING GULL
ETSRC ID: 8020960

Elm	Result	Estimated Sample Detection Limit
AL	1.	0.4
BE	<0.01	0.01
CD	0.03	0.03
CR	<0.1	0.1
CU	3.25	0.02
FE	105.	0.1
MN	1.6	0.02
NI	0.2	0.2
PB	0.5	0.5
TL	<0.6	0.6
ZN	54.2	0.03

Customer ID: CFO-HG-87-2
Description: EGGS-HERRING GULL
ETSRC ID: 8020961

Elm	Result	Estimated Sample Detection Limit
AL	2.1	0.3
BE	<0.009	0.009
CD	<0.03	0.03
CR	<0.1	0.1
CU	2.75	0.02
FE	138.	0.1
MN	2.73	0.02
NI	<0.2	0.2
PB	0.6	0.4
TL	<0.6	0.6
ZN	57.0	0.03

Environmental Trace Substances Research Center
ICP Scan - Sample Analysis Report
Project: USDI - LOWE Cat. 5339 Units: MCG/G DRY WEIGHT
Batch #: B-88020929

Customer ID: CFO-HG-87-3
Description: EGGS-HERRING GULL
ETSRC ID: 8020962

Elm	Result	Estimated Sample Detection Limit
AL	2.5	0.3
BE	<0.009	0.009
CD	<0.03	0.03
CR	<0.1	0.1
CU	2.35	0.02
FE	101.	0.1
MN	1.6	0.02
NI	<0.2	0.2
PB	0.9	0.4
TL	<0.6	0.6
ZN	52.4	0.02

Customer ID: CFO-HG-87-4
Description: EGGS-HERRING GULL
ETSRC ID: 8020963

Elm	Result	Estimated Sample Detection Limit
AL	1.1	0.3
BE	<0.009	0.009
CD	0.03	0.03
CR	<0.1	0.1
CU	2.83	0.02
FE	101.	0.1
MN	1.8	0.02
NI	<0.2	0.2
PB	<0.4	0.4
TL	<0.6	0.6
ZN	50.2	0.02

Environmental Trace Substances Research Center
ICP Scan - Sample Analysis Report
Project: USDI - LOWE Cat. 5339 Units: MCG/G DRY WEIGHT
Batch #: B-88020929

Customer ID: CFO-HG-87-5
Description: EGGS-HERRING GULL
ETSRC ID: 8020964

Elm	Result	Estimated Sample Detection Limit
AL	0.9	0.3
BE	<0.009	0.009
CD	0.03	0.03
CR	<0.1	0.1
CU	2.44	0.02
FE	98.0	0.1
MN	1.4	0.02
NI	<0.2	0.2
PB	<0.4	0.4
TL	<0.6	0.6
ZN	49.9	0.02

Customer ID: CFO-HG-87-6
Description: EGGS-HERRING GULL
ETSRC ID: 8020965

Elm	Result	Estimated Sample Detection Limit
AL	1.7	0.3
BE	<0.009	0.009
CD	<0.03	0.03
CR	0.1	0.1
CU	2.15	0.02
FE	83.2	0.1
MN	2.67	0.02
NI	<0.2	0.2
PB	0.6	0.4
TL	<0.6	0.6
ZN	52.3	0.02

Environmental Trace Substances Research Center
ICP Scan - Sample Analysis Report
Project: USDI - LOWE Cat. 5339 Units: MCG/G DRY WEIGHT
Batch #: B-88020929

Customer ID: CFO-HG-87-9
Description: EGGS-HERRING GULL
ETSRC ID: 8020971

Elm	Result	Estimated Sample Detection Limit
AL	1.2	0.3
BE	<0.01	0.01
CD	<0.03	0.03
CR	<0.1	0.1
CU	3.02	0.02
FE	131.	0.1
MN	2.71	0.02
NI	<0.2	0.2
PB	0.7	0.4
TL	<0.5	0.5
ZN	51.5	0.02

Environmental Trace Substances Research Center
ICP Scan - Sample Analysis Report
Project: USDI - LOWE Cat. 5339 Units: MCG/G DRY WEIGHT
Batch #: B-88020929

Customer ID: CFO-HG-87-7
Description: EGGS-HERRING GULL
ETSRC ID: 8020969

Elm	Result	Estimated Sample Detection Limit
AL	2.1	0.3
BE	<0.01	0.01
CD	<0.03	0.03
CR	<0.1	0.1
CU	3.05	0.02
FE	100.	0.1
MN	1.8	0.02
NI	<0.2	0.2
PB	<0.4	0.4
TL	<0.5	0.5
ZN	40.5	0.02

Customer ID: CFO-CT-87-8
Description: EGGS-HERRING GULL
ETSRC ID: 8020970

Elm	Result	Estimated Sample Detection Limit
AL	0.5	0.3
BE	<0.01	0.01
CD	<0.03	0.03
CR	<0.1	0.1
CU	3.11	0.02
FE	98.1	0.1
MN	2.39	0.02
NI	0.2	0.2
PB	0.6	0.5
TL	<0.6	0.6
ZN	50.6	0.02

Environmental Trace Substances Research Center
ICP Scan - Sample Analysis Report
Project: USDI - LOWE Cat. 5339 Units: MCG/G DRY WEIGHT
Batch #: B-88020929

Customer ID: CFO-FF-87-7
Description: FISH-FORAGE
ETSRC ID: 8020982

Elm	Result	Estimated Sample Detection Limit
AL	370.	0.3
BE	0.02	0.01
CD	0.26	0.04
CR	1.0	0.1
CU	3.84	0.02
FE	422.	0.1
MN	15.4	0.03
NI	0.84	0.2
PB	<0.5	0.5
TL	<0.6	0.6
ZN	230.	0.02

Environmental Trace Substances Research Center
ICP Scan - Sample Analysis Report
Project: USDI - LOWE Cat. 5339 Units: MCG/G DRY WEIGHT
Batch #: B-88020929

Customer ID: CFO-FF-87-8
Description: FISH-FORAGE
ETSRC ID: 8020983

Elm	Result	Estimated Sample Detection Limit
AL	236.	0.4
BE	0.03	0.01
CD	0.17	0.05
CR	7.2	0.1
CU	2.2	0.03
FE	349.	0.1
MN	17.8	0.03
NI	4.1	0.2
PB	<0.6	0.6
TL	<0.7	0.7
ZN	115.	0.03

Customer ID: CFO-FF-87-9
Description: FISH-FORAGE
ETSRC ID: 8020984

Elm	Result	Estimated Sample Detection Limit
AL	278.	0.4
BE	0.03	0.01
CD	0.42	0.04
CR	4.5	0.1
CU	2.6	0.03
FE	283.	0.1
MN	21.5	0.03
NI	2.1	0.2
PB	0.8	0.6
TL	<0.7	0.7
ZN	388.	0.03

Environmental Trace Substances Research Center
ICP Scan - Sample Analysis Report
Project: USDI - LOWE Cat. 5339 Units: MCG/G DRY WEIGHT
Batch #: B-88020929

Customer ID: CFO-FF-87-10
Description: FISH-FORAGE
ETSRC ID: 8020985

Elm	Result	Estimated Sample Detection Limit
AL	164.	0.4
BE	0.02	0.01
CD	0.28	0.04
CR	4.5	0.1
CU	2.56	0.02
FE	181.	0.1
MN	14.1	0.02
NI	2.3	0.2
PB	<0.5	0.5
TL	<0.6	0.6
ZN	197.	0.02

Customer ID: CFO-FF-87-11
Description: FISH-FORAGE
ETSRC ID: 8020986

Elm	Result	Estimated Sample Detection Limit
AL	116.	0.4
BE	0.02	0.01
CD	0.15	0.04
CR	3.5	0.1
CU	2.80	0.02
FE	155.	0.1
MN	35.7	0.02
NI	2.1	0.2
PB	<0.5	0.5
TL	<0.6	0.6
ZN	138.	0.02

Environmental Trace Substances Research Center
ICP Scan - Sample Analysis Report
Project: USDI - LOWE Cat. 5339 Units: MCG/G DRY WEIGHT
Batch #: B-88020929

Customer ID: CFO-FF-87-12
Description: FISH-FORAGE
ETSRC ID: 8020987

Elm	Result	Estimated Sample Detection Limit
AL	40.8	0.3
BE	0.02	0.01
CD	0.27	0.03
CR	3.5	0.1
CU	2.44	0.02
FE	74.8	0.1
MN	10.6	0.02
NI	1.4	0.2
PB	<0.5	0.5
TL	<0.6	0.6
ZN	240.	0.02

Customer ID: CFO-FF-87-13
Description: FISH-FORAGE
ETSRC ID: 8020988

Elm	Result	Estimated Sample Detection Limit
AL	22.	0.4
BE	0.02	0.01
CD	0.36	0.04
CR	0.51	0.1
CU	2.57	0.02
FE	56.5	0.1
MN	10.5	0.02
NI	0.2	0.2
PB	<0.5	0.5
TL	<0.6	0.6
ZN	255.	0.02

1988 ANALYTICAL RESULTS

U. S. FISH AND WILDLIFE SERVICE

PATUXENT ANALYTICAL CONTROL FACILITY

QUALITY ASSURANCE REPORT

RE:# 5550 REGION : 5 REGIONAL ID 88-5-081

THE ANALYSES ON THE ABOVE MENTIONED SAMPLES WERE PERFORMED AT:

THE MISSISSIPPI STATE CHEMICAL LABORATORY
BOX CR
MISSISSIPPI STATE, MISSISSIPPI 39762

THIS LABORATORY WAS SUBJECTED TO A RIGOROUS EVALUATION PROCESS PRIOR TO THE AWARDING OF IT'S CONTRACT. A PANEL OF FISH AND WILDLIFE SERVICE SCIENTISTS CERTIFIED IT TO BE TECHNICALLY QUALIFIED TO PERFORM THE ANALYSES REPORTED HERE. IN ADDITION WE HAVE CONTINUED TO CLOSELY MONITOR THIS LABORATORY'S PERFORMANCE AND HAVE FOUND THE PRECISION AND ACCURACY OF THEIR WORK REMAINS ACCEPTABLE. WE HAVE GREAT CONFIDENCE IN THE ACCURACY OF THESE DATA.

John F. Moore 1-31-89

JOHN F. MOORE

MISSISSIPPI STATE UNIVERSITY
MISSISSIPPI
STATE CHEMICAL LABORATORY
BOX CR - MISSISSIPPI STATE, MISSISSIPPI 39762

January 27, 1989

Mr. John Moore
Stickel Building/Chemistry
Patuxent Wildlife Research Center
U.S. Fish and Wildlife Service
Route 197
Laurel, MD 20708

Dear John:

Enclosed is the amended analytical report of organochlorine results for Catalog #5550, Batch #88-5-081.

Please call if you have any questions.

Sincerely,

Larry Lane

Larry G. Lane
Principal Investigator

Method 1. Analysis For Organochlorine Pesticides and PCBs In Animal and Plant Tissue.

Ten gram tissue samples are thoroughly mixed with anhydrous sodium sulfate and soxhlet extracted with hexane for seven hours. The extract is concentrated by rotary evaporation; transferred to a tared test tube, and further concentrated to dryness for lipid determination. The weighed lipid sample is dissolved in petroleum ether and extracted four times wth acetonitrile saturated with petroleum ether. Residues are partitioned into petroleum ether which is washed, concentrated, and transferred to a glass chromatographic column containing 20 grams of Florisil. The column is eluted with 200 ml 6% diethyl ether/94% petroleum ether (Fraction I) followed by 200 ml 15% diethyl ether/85% petroleum ether (Fration II). Fraction II is concentrated to appropriate volume for quantification of residues by packed column electron capture gas chromatography. Fraction I is concentrated and transferred to a Silicic acid chromtographic column for additional cleanup required for separation of PCBs from other organochlorines. Three fractions are eluted from the Silicic acid column. Each is concentrated to appropriate volume for quantification of residues by packed or megabore column, electron capture gas chromatography. PCBs are found in Fraction II.

Method 3. Analysis For Aliphatic and Polynuclear Aromatic Hydrocarbons In Animal and Plant Tissue.

A sample of appropriate size (i.e. 15 grams animal or plant tissue, 2 grams adipose, 5 grams eggs) is digested in 6N aqueous potassium hydroxide for 24 hours at 35°C. Cool digestate thoroughly in an ice bath and carefully neutralize with glacial acetic acid. Extract the neutralized reaction mixture three times with methylene chloride; concentrate the combined extracts to near dryness and reconstitute in petroleum ether for transfer to a 20 gram 1% deactivated silica gel column, topped wth 5 grams neutral alumina. Aliphatic and polynuclear aromatic hydrocarbon residues are separated by eluting aliphatics from the column with 100 ml petroleum ether (Fraction I) followed by elution of aromatics using first, 100 ml 40% methylene chloride/60% petroleum ether, then 50 ml methylene chloride (Combined eluates, Fraction II). If needed, Fraction I containing aliphatics is subjected to additional cleanup by concentration and transfer to a deactivated (2% water) Florisil column. Aliphatic residues are eluted from the Florisil column using 200 ml 6% diethyl ether/94% petroleum ether. The eluate is concentrated to appropriate volume for quantification by capillary column, flame ionization gas chromatography. The silica gel Fraction II containing aromatic hydrocarbons is concentrated, reconstituted in methylene chloride, and subjected to gel permeation chromatographic (GPC) cleanup prior to quantification by capillary, flame ionization gas chromatography and fluorescence HPLC.

Method 5. Analysis For Aliphatic and Polynuclear Aromatic Hydrocarbons and Organochlorine Pesticides In Water.

A 500 milliliter water sample is extracted four times by shaking with 50 milliliter portions of methylene chloride. The four extracts are combined and concentrated by Kuderna-Danish to near dryness, then reconstituted in 5 milliliters petroleum ether. An appropriate aliquot is removed for organochlorine and PCB analysis and transferred to a 20 gram Florisil column. The column is eluted with 200 ml 6% diethyl ether/94% petroleum ether (Fraction I) followed by 200 ml 15% diethyl ether/85% petroleum ether (Fraction II). Fraction II is concentrated to appropriate volume for quantification of residues by packed column electron capture gas chromatography. Fraction I is concentrated and transferred to a Silicic acid chromtographic column for additional cleanup required for separation of PCBs from other organochlorines. Three fractions are eluted from the Silicic acid column. Each is concentrated to appropriate volume for quantification of residues by packed or megabore column, electron capture gas chroamtograpy. PCBs are found in Fraction II. The remainder of the petroleum ether from the above methylene chloride extraction is transferred to a 20 gram 1% deactivated silica gel column, topped with 5 grams neutral alumina. Aliphatic and polynuclear aromatic hydrocarbon residues are separated by eluting aliphatics from the column with 100 ml petroleum ether (Fraction I) followed by elution of aromatics using first, 100 ml 40% methylene chloride/60% petroleum ether then 50ml methylene chloride (combined eluates, Fraction II). If needed, Fracton I containing aliphatics is subjected to additional cleanup by concentration and transfer to a deactivated (2% water) Florisil column. Aliphatic residues are eluted from the Florisil column using 200 ml 6% diethyl ether/94% petroleum ether. The eluate is concentrated to appropriate volume for quantification by capillary column, flame ionization gas chromatography. The silica gel Fraction II containing aromatic hydrocarbons is concentrated, reconstituted in methylene chloride, and subjected to gel permeation chromatographic (GPC) cleanup prior to quantification by capillary, flame ionizaton gas chromatography and fluorescence HPLC.

Elution Profiles for Florisil, Silica Gel and Silicic Acid Column Separations

A. Florisil Column:

1. Fraction I (6% ethyl ether with 2% ethanol, 94% petroleum ether)
   HCB, alpha-BHC, beta-BHC, gamma-BHC, delta-BHC, oxychlordane, heptachlor epoxide, gamma-chlordane, trans-nonachlor, toxaphene, PCB's, o,p'-DDE, alpha-Chlordane, p,p'-DDE, o,p'-DDT, cis-nonachlor, o,p'-DDT, p,p'-DDD, p,p'-DDT, mirex, dicofol, endosulfan I (Split with FII).
2. Fraction II - (15% ethyl ether with 2% ethanol, 85% petroleum ether)
   dieldrin, endrin, dacthal, endosulfan I (split with FI), endosulfan II (split with FIII), endosulfan sulfate (split with FIII).
3. Fraction III - (50% ethyl ether with 2% ethanol, 50% petroleum ether)
   endosulfan II (split with FII), endosulfan sulfate (split with FII), malathion.

7-31-87

B. Florisil Mini-Column:

1. Fraction I - (12 ml hexane followed by 12 ml 1% methanol in hexane)

HCB, gamma-BHC (25%), alpha-BHC (splits with FII), trans-nonachlor, o,p'-DDE, p,p'-DDE, o,p'-DDD, p,p'-DDD (splits with FII), o,p'-DDT, p,p'-DDT, mirex, cis-nonachlor, cis-chlordane, trans-chlordane, PCB's

2. Fraction II - (24 ml 1% methanol in hexane)

gamma BHC (75%), beta-BHC, alpha-BHC (splits with FI), delta-BHC, oxychlordane, heptachlor epoxide, toxaphene, dicofol, dacthal.

C. Silica Gel:

1. SG Fraction I - (100 ml petroleum ether)

n-dodecane, n-tridecane, n-tetradecane, octylcyclohexane, n-pentadecane, nonylcyclohexane, n-hexadecane, n-heptadecane, pristane, n-octadecane, phytane, n-nonadecane, n-eicosane.

2. SG Fraction II (100 ml 40% methylene chloride in petroleum ether followed by 50 ml methlene chloride)

naphthalene, fluorene, phenanthrene, anthracene, fluoranthrene, pyrene, 1,2-benzanthracene, chrysene, benzo [b] fluoranthrene, benzo [k] fluoranthrene, benzo [e] pyrene, benzo [a] pyrene, 1,2:5,6-dibenzanthracene, benzo [g,h,i] perylene.

D. Silicic Acid:

1. SA Fraction I (20 ml petroleum ether)
HCB, mirex

2. SA Fraction II (100 ml petroleum ether)

PCB's, p,p'-DDE (splits with SA III)

3. SA Fraction III (20 mls·mixed solvent: 1% acetonitrile, 80 % methylene chloride, 19 % hexane)

alpha-BHC, beta BHC, gamma-BHC, delta-BHC, oxychlordane, hextachlor epoxide, gamma-chlordane, trans-nonachlor, toxaphene, o,p'-DDE, alpha-chlordane, p,p'-DDE (splits with SA II), o,p'-DDT, cis-nonachlor, o,p'-DDT, p,p'-DDD, p,p'-DDT, dicofol.

ORGANOCHLORINES

SAMPLE TYPE:Bird Egg, Fish, and Water

CAT NO. 5550
BATCH NO. 88-5-081
ORDER NO. 30072

MISSISSIPPI STATE UNIVERSITY
MISSISSIPPI STATE CHEMICAL LABORATORY
BOX CR
MISSISSIPPI STATE, MS 39762
REPORT FORM
USDI/FWS

ORGANOCHLORINES

DATE RECEIVED 08/12/88

PARTS PER MILLION AS RECEIVED (WET WT)

FWS #	CFO-CT 88-1	CFO-CT 88-2	CFO-CT 88-3	CFO-CT 88-4	CFO-CT 88-5	CFO-CT 88-6	CFO-CT 88-7
LAB #	756321	756322	756323	756324	756325	756326	756327
MATRIX	Common Tern Egg	Common Tern Egg	Common Tern Egg	Common Tern Egg	Common Tern Egg	Common Tern Egg	Common Tern Egg
COMPOUND							
HCB	0.01	0.01	0.01	0.01	0.01	0.01	0.01
α-BHC	ND	ND	ND	ND	ND	ND	ND
γ-BHC	ND	ND	ND	ND	ND	ND	ND
β-BHC	ND	ND	ND	ND	ND	ND	ND
δ-BHC	ND	ND	ND	ND	ND	ND	ND
Oxychlordane	0.03	0.02	0.02	0.02	0.02	0.02	0.02
Hept. Epox.	0.02	0.02	0.02	0.01	0.02	0.02	0.02
γ-Chlordane	ND	ND	ND	ND	ND	ND	ND
t-Nonachlor	0.01	0.03	0.02	0.01	0.02	ND	0.02
Toxaphene	ND	ND	ND	ND	ND	ND	ND
Arochlor 1242	ND	ND	ND	ND	ND	ND	ND
Arochlor 1248	ND	ND	ND	ND	ND	ND	ND
Arochlor 1254	1.4	1.4	0.61	0.62	1.3	1.6#	0.69
Arochlor 1260	5.6	3.2	2.7	2.4	3.7	2.5#	3.0
o, p'-DDE	ND	ND	ND	ND	ND	ND	ND
α-Chlordane	ND	ND	ND	ND	ND	ND	ND
p, p'-DDE	0.93	0.68	0.35	0.40	0.58	0.59#	0.77
Dieldrin	0.03	0.05	0.03	0.03	0.06	0.03	0.04
o, p'-DDD	ND	ND	ND	ND	ND	ND	ND
Endrin	ND	ND	ND	ND	ND	ND	ND
cis-nonachlor	0.01	0.02	ND	ND	0.02	0.01	0.01
o, p'-DDT	ND	ND	ND	ND	ND	ND	ND
p, p'-DDD	0.02	0.01	0.01	0.01	0.02	0.01	0.02
p, p'-DDT	ND	ND	ND	ND	ND	ND	ND
Mirex	0.01	0.02	0.14	ND	0.07	0.14#	0.02
WEIGHT (g)	37.0	39.0	35.0	38.1	40.5	36.5	36.1
MOISTURE (%)	75.5	76.5	75.3	76.9	76.8	71.0	76.6
LIPID (%)	10.2	9.56	10.9	10.6	10.6	10.1	9.70

Lower Level of Detection = 0.01 ppm for Tissue, Soil, etc.; 0.05 for Toxaphene and PCBs.
For Water, LLD = 0.005 ppm for OCs, Tox, PCBs.
**Spike = ppm for
= Confirmed by GC/Mass Spectrometry
*ND = None Detected
***NS = Not Spiked

Larry Lane
Signature

SAMPLE TYPE:Bird Egg, Fish, and Water

CAT NO. 5550
BATCH NO. 88-5-081
ORDER NO. 30072

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ORGANOCHLORINES

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PARTS PER MILLION AS RECEIVED (WET WT)

FWS #	CFO-CT 88-8	CFO-CT 88-9	CFO-CT 88-10
LAB #	756328	756329	756330
MATRIX	Common Tern Egg	Common Tern Egg	Common Tern Egg
COMPOUND			
HCB	0.02	0.03	0.08
α-BHC	ND*	ND	ND
ɾ-BHC	ND	ND	ND
ꞵ-BHC	ND	ND	ND
δ-BHC	ND	ND	ND
Oxychlordane	0.01	0.02	0.02
Hept. Epox.	0.01	0.02	0.01
ɾ-Chlordane	ND	ND	ND
t-Nonachlor	0.01	0.02	ND
Toxaphene	ND	ND	ND
Arochlor 1242	ND	ND	ND
Arochlor 1248	ND	ND	ND
Arochlor 1254	1.2	1.9	0.98#
Arochlor 1260	3.0	3.3	2.7#
o, p'-DDE	ND	ND	ND
α-Chlordane	ND	ND	ND
p, p'-DDE	0.55	0.68	0.46#
Dieldrin	0.02	0.05	0.02
o, p'-DDD	ND	ND	ND
Endrin	ND	ND	ND
cis-nonachlor	0.01	0.01	ND
o, p'-DDT	ND	ND	ND
p, p'-DDD	0.01	0.01	0.01
p, p'-DDT	ND	ND	ND
Mirex	0.04	0.06	0.16#
WEIGHT (g)	41.0	37.9	35.8
MOISTURE (%)	67.5	77.2	76.8
LIPID (%)	8.50	10.2	10.1

Lower Level of Detection = 0.01 ppm for Tissue, Soil, etc.; 0.05 for Toxaphene and PCBs.
For Water, LLD = 0.005 ppm for OCs, Tox, PCBs.
**Spike = ppm for
= Confirmed by GC/Mass Spectrometry
*ND = None Detected
***NS = Not Spiked

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Signature

SAMPLE TYPE:Bird Egg, Fish, and Water

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ORGANOCHLORINES

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PARTS PER MILLION AS RECEIVED (WET WT)

FWS #	CFO-FF 88-1	CFO-FF 88-2	CFO-FF 88-3	CFO-FF 88-4	CFO-FF 88-5	CFO-FF 88-6	CFO-FF 88-7
LAB #	756341	756342	756343	756344	756345	756346	756347
MATRIX	Forage Fish	Forage Fish	Forage Fish	Forage Fish	Forage Fish	Forage Fish	Forage Fish
COMPOUND							
HCB	ND*	ND	ND	ND	ND	ND	ND
α-BHC	ND	ND	ND	ND	ND	ND	ND
r-BHC	ND	ND	ND	ND	ND	ND	ND
β-BHC	ND	ND	ND	ND	ND	ND	ND
δ-BHC	ND	ND	ND	ND	ND	ND	ND
Oxychlordane	ND	ND	ND	ND	ND	ND	ND
Hept. Epox.	ND	ND	ND	ND	ND	ND	ND
r-Chlordane	ND	ND	ND	ND	ND	ND	ND
t-Nonachlor	0.01	0.02	0.01	0.01	ND	ND	ND
Toxaphene	ND	ND	ND	ND	ND	ND	ND
Arochlor 1242	ND	ND	ND	ND	ND	ND	ND
Arochlor 1248	ND	ND	ND	ND	ND	ND	ND
Arochlor 1254	0.07	0.23	0.10	0.10	0.06	0.21	0.21
Arochlor 1260	0.08	0.11	ND	0.05	ND	0.13	0.10
o, p'-DDE	ND	ND	ND	ND	ND	ND	ND
α-Chlordane	ND	ND	ND	ND	ND	ND	ND
p, p'-DDE	0.05	0.03	0.02	0.02	0.02	0.04	0.04
Dieldrin	ND	0.01	ND	ND	ND	0.01	ND
o, p'-DDD	ND	ND	ND	ND	ND	ND	ND
Endrin	ND	ND	ND	ND	ND	ND	ND
cis-nonachlor	ND	ND	ND	ND	ND	ND	ND
o, p'-DDT	ND	ND	ND	ND	ND	ND	ND
p, p'-DDD	ND	ND	ND	ND	ND	ND	ND
p, p'-DDT	ND	ND	ND	ND	ND	ND	ND
Mirex	ND	ND	ND	ND	ND	ND	ND
WEIGHT (g)	96.5	99.0	91.7	90.0	87.5	85.5	89.2
MOISTURE (%)	77.3	74.7	78.7	77.7	76.9	74.2	77.3
LIPID (%)	1.55	3.14	1.40	1.66	1.65	3.61	1.96

Lower Level of Detection = 0.01 ppm for Tissue, Soil, etc.; 0.05 for Toxaphene and PCBs.
For Water, LLD = 0.005 ppm for OCs, Tox, PCBs.
**Spike = ppm for
= Confirmed by GC/Mass Spectrometry
*ND = None Detected
***NS = Not Spiked

Larry Lane
Signature

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SAMPLE TYPE:Bird Egg, Fish, and Water

CAT NO. 5550
BATCH NO. 88-5-081
ORDER NO. 30072

ORGANOCHLORINES

DATE RECEIVED 08/12/88

PARTS PER MILLION AS RECEIVED (WET WT)

FWS #	CFO-FF 88-8
LAB #	756348
MATRIX	Forage Fish
COMPOUND	
HCB	ND*
α-BHC	ND
γ-BHC	ND
β-BHC	ND
δ-BHC	ND
Oxychlordane	ND
Hept. Epox.	ND
γ-Chlordane	ND
t-Nonachlor	ND
Toxaphene	ND
Arochlor 1242	ND
Arochlor 1248	ND
Arochlor 1254	0.12
Arochlor 1260	0.11
o, p'-DDE	ND
α-Chlordane	ND
p, p'-DDE	0.04
Dieldrin	0.01
o, p'-DDD	ND
Endrin	ND
cis-nonachlor	ND
o, p'-DDT	ND
p, p'-DDD	ND
p, p'-DDT	ND
Mirex	ND
WEIGHT (g)	94.7
MOISTURE (%)	76.5
LIPID (%)	2.37

Lower Level of Detection = 0.01 ppm for Tissue, Soil, etc.; 0.05 for Toxaphene and PCBs.
For Water, LLD = 0.005 ppm for OCs, Tox, PCBs.
**Spike = ppm for
= Confirmed by GC/Mass Spectrometry
*ND = None Detected
***NS = Not Spiked

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Signature

ALIPHATICS

MISSISSIPPI STATE UNIVERSITY
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BOX CR
MISSISSIPPI STATE, MS 39762

SAMPLE TYPE:Bird Egg, Fish, and Water

CAT NO. 5550
BATCH NO. 88-5-081
ORDER NO. 85800-88-30072

REPORT FORM
USDI/FWS

ALIPHATIC HYDROCARBONS

DATE RECEIVED 08/12/88

PARTS PER MILLION AS RECEIVED (WET WT)

FWS #	CFO-CT -88-1	CFO-CT -88-2	CFO-CT -88-3	CFO-CT -88-4	CFO-CT -88-5	CFO-CT -88-6	CFO-CT -88-7
LAB #	756321	756322	756323	756324	756325	756326	756327
MATRIX	Common Tern Egg	Common Tern Egg	Common Tern Egg	Common Tern Egg	Common Tern Egg	Common Tern Egg	Common Tern Egg
COMPOUND							
n-dodecane	ND*	0.01	ND	0.01	0.01	0.02	0.01
n-tridecane	ND	0.01	0.01	ND	0.01	0.01	0.01
n-tetradecane	ND	0.02	0.02	0.03	0.02	0.03	0.03
octylcyclohexane	ND	ND	ND	ND	ND	ND	ND
n-pentadecane	0.01	0.02	0.02	0.01	0.01	0.03	0.02
nonylcyclohexane	ND	ND	ND	ND	ND	ND	ND
n-hexadecane	0.03	0.01	0.02	0.04	0.03	0.05	0.05
n-heptadecane	0.46	0.41	0.35	0.31	0.36	0.24	0.39
pristane	0.04	0.09	0.06	0.13	0.06	0.07	0.23
n-octadecane	0.07	0.03	0.05	0.06	0.06	0.07	0.07
phytane	0.03	0.03	0.03	0.02	0.04	0.03	0.04
n-nonadecane	0.02	ND	ND	ND	ND	ND	ND
n-eicosane	0.04	0.03	0.02	0.02	0.02	0.03	0.04
WEIGHT (g)	37.0	39.0	35.0	38.1	40.5	36.5	36.1
MOISTURE (%)	75.5	76.5	75.3	76.9	76.8	71.0	76.6
LIPID (%)	10.2	9.56	10.9	8.70	10.6	10.1	9.70

Lower Level of Detection = 0.01 ppm for Tissue, Soil, Sediment, etc.
LLD = 0.005 ppm for Water
*ND = None Detected
**Spike = ____ ppm for _____
***NS = Not Spiked
= Confirmed by GC/Mass Spectrometry

Signature

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MISSISSIPPI STATE, MS 39762

SAMPLE TYPE:Bird Egg, Fish, and Water

CAT NO. 5550
BATCH NO. 88-5-081
ORDER NO. 85800-88-30072

REPORT FORM
USDI/FWS

ALIPHATIC HYDROCARBONS

DATE RECEIVED 08/12/88

PARTS PER MILLION AS RECEIVED (WET WT)

FWS #	CFO-CT -88-8	CFO-CT -88-9	CFO-CT -88-10
LAB #	756328	756329	756330
MATRIX	Common Tern Egg	Common Tern Egg	Common Tern Egg
COMPOUND			
n-dodecane	0.02	0.01	0.02
n-tridecane	0.01	0.01	0.01
n-tetradecane	0.03	0.02	0.03
octylcyclohexane	ND*	ND	ND
n-pentadecane	ND	0.02	0.02
nonylcyclohexane	ND	ND	ND
n-hexadecane	0.04	0.28	0.05
n-heptadecane	0.25	0.18	1.2
pristane	0.09	0.06	0.02
n-octadecane	0.04	0.05	0.08
phytane	0.02	0.02	0.03
n-nonadecane	ND	ND	ND
n-eicosane	0.03	0.03	0.04
WEIGHT (g)	41.0	37.9	35.8
MOISTURE (%)	67.5	77.2	76.8
LIPID (%)	8.50	10.2	10.1

Lower Level of Detection = 0.01 ppm for Tissue, Soil, Sediment, etc.
LLD = 0.005 ppm for Water
*ND = None Detected
**Spike = ____ ppm for _____
***NS = Not Spiked
= Confirmed by GC/Mass Spectrometry

Jeanine DeCaen
Signature

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SAMPLE TYPE:Bird Egg, Fish, and Water

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ALIPHATIC HYDROCARBONS

DATE RECEIVED 08/12/88

PARTS PER MILLION AS RECEIVED (WET WT)

FWS #	CFO-FF -88-1	CFO-FF -88-2	CFO-FF -88-3	CFO-FF -88-4	CFO-FF -88-5	CFO-FF -88-6	CFO-FF -88-7
LAB #	756341	756342	756343	756344	756345	756346	756347
MATRIX	Forage Fish	Forage Fish	Forage Fish	Forage Fish	Forage Fish	Forage Fish	Forage Fish
COMPOUND							
n-dodecane	0.02	0.03	0.03	0.02	0.02	0.02	0.01
n-tridecane	0.02	0.01	0.02	0.01	ND	0.03	0.02
n-tetradecane	0.07	0.07	0.06	0.03	0.03	0.12#	0.04
octylcyclohexane	ND*	ND	ND	ND	ND	ND	ND
n-pentadecane	0.30#	0.42#	0.24	0.09	0.09	0.95#	0.76#
nonylcyclohexane	ND	ND	ND	ND	ND	ND	ND
n-hexadecane	0.14#	0.12#	0.09	0.06	0.07	0.24#	0.14#
n-heptadecane	2.2#	7.6#	1.8	2.9	2.8	13.#	4.9#
pristane	ND	ND	ND	ND	ND	ND	ND
n-octadecane	0.19#	0.15#	0.16	0.18	0.18	0.20#	0.31#
phytane	0.03	0.07	0.05	0.03	0.03	0.11#	0.14#
n-nonadecane	0.57#	0.46#	0.42	0.93	0.96	0.33#	0.49#
n-eicosane	0.19#	0.13#	0.11	0.38	0.39	0.15#	0.16#
WEIGHT (g)	96.5	99.0	91.7	90.0	87.5	85.5	89.2
MOISTURE (%)	77.3	74.7	78.7	77.7	76.9	74.2	77.3
LIPID (%)	1.55	3.14	1.40	1.66	1.65	3.61	1.96

Lower Level of Detection = 0.01 ppm for Tissue, Soil, Sediment, etc.
LLD = 0.005 ppm for Water
*ND = None Detected
**Spike = ____ ppm for _____
***NS = Not Spiked
= Confirmed by GC/Mass Spectrometry

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MISSISSIPPI STATE, MS 39762

SAMPLE TYPE:Bird Egg, Fish, and Water

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ALIPHATIC HYDROCARBONS

DATE RECEIVED 08/12/88

PARTS PER MILLION AS RECEIVED (WET WT)

FWS #	CFO-FF -88-8
LAB #	756348
MATRIX	Forage Fish
COMPOUND	
n-dodecane	0.01
n-tridecane	0.01
n-tetradecane	0.05
octylcyclohexane	ND*
n-pentadecane	0.81#
nonylcyclohexane	ND
n-hexadecane	0.16#
n-heptadecane	6.4#
pristane	ND
n-octadecane	0.33#
phytane	0.15#
n-nonadecane	0.46#
n-eicosane	0.16#
WEIGHT (g)	94.7
MOISTURE (%)	76.5
LIPID (%)	2.37

Lower Level of Detection = 0.01 ppm for Tissue, Soil, Sediment, etc.
LLD = 0.005 ppm for Water
*ND = None Detected
**Spike = ____ ppm for _____
***NS = Not Spiked
= Confirmed by GC/Mass Spectrometry

Jimmie D. Cain
Signature

POLYAROMATIC HYDROCARBONS

SAMPLE TYPE:Egg,Fish, Water

CAT NO. 5550
BATCH NO. 88-5-081
ORDER NO. 85800-88-30072

MISSISSIPPI STATE UNIVERSITY
MISSISSIPPI STATE CHEMICAL LABORATORY
BOX CR
MISSISSIPPI STATE, MS 39762
REPORT FORM
USDI/FWS

POLYNUCLEAR AROMATIC HYDROCARBONS

DATE RECEIVED 08/12/88

PARTS PER MILLION AS RECEIVED (WET WT)

FWS #	CFO-CT -88-1	CFO-CT -88-2	CFO-CT -88-3	CFO-CT -88-4	CFO-CT -88-5	CFO-CT -88-6	CFO-CT -88-7
LAB #	756321	756322	756323	756324	756325	756326	756327
MATRIX	Common Tern Egg	Common Tern Egg	Common Tern Egg	Common Tern Egg	Common Tern Egg	Common Tern Egg	Common Tern Egg
COMPOUND							
napthalene	ND*	ND	ND	ND	ND	ND	ND
fluorene	ND	ND	ND	ND	ND	ND	ND
phenanthrene	ND	ND	ND	ND	ND	ND	ND
anthracene	ND	ND	ND	ND	ND	ND	ND
fluoranthrene	0.01	ND	ND	ND	ND	ND	ND
pyrene	ND	0.01	0.01	0.01	ND	ND	ND
1,2-benzanthracene	ND	ND	ND	0.01	0.01	ND	ND
chrysene	ND	ND	ND	ND	ND	ND	0.01
benzo(b)fluoranthrene	ND	ND	ND	ND	ND	ND	ND
benzo(k)fluoranthrene	ND	ND	ND	ND	ND	ND	ND
benzo(e)pyrene	0.01	0.01	ND	0.01	ND	ND	ND
benzo(a)pyrene	ND	ND	ND	ND	ND	ND	ND
1,2,5,6-dibenzanthracene	ND	ND	ND	ND	ND	ND	ND
benzo(g,h,i)perylene	ND	ND	ND	ND	ND	ND	ND
WEIGHT (g)	37.0	39.0	35.0	38.1	40.5	36.5	36.1
MOISTURE (%)	75.5	76.5	75.3	76.9	76.8	71.0	76.6
LIPID (%)	10.2	9.56	10.9	8.70	10.6	10.1	9.70

Lower Level of Detection = 0.01 ppm for Tissue, Soil, Sediment, etc.
LLD = 0.005 ppm for Water
*ND = None Detected
**Spike = ____ ppm for _____
***NS = Not Spiked
= Confirmed by GC/Mass Spectrometry

Signature

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MISSISSIPPI STATE CHEMICAL LABORATORY
BOX CR
MISSISSIPPI STATE, MS 39762

REPORT FORM
USDI/FWS

SAMPLE TYPE:Egg,Fish, Water

CAT NO. 5550
BATCH NO. 88-5-081
ORDER NO. 85800-88-30072

POLYNUCLEAR AROMATIC HYDROCARBONS

DATE RECEIVED 08/12/88

PARTS PER MILLION AS RECEIVED (WET WT)

FWS #	CFO-FF -88-8
LAB #	756348
MATRIX	Forage Fish
COMPOUND	
napthalene	ND*
fluorene	ND
phenanthrene	ND
anthracene	ND
fluoranthrene	ND
pyrene	0.01
1,2-benzanthracene	0.01
chrysene	ND
benzo(b)fluoranthrene	ND
benzo(k)fluoranthrene	ND
benzo(e)pyrene	0.01
benzo(a)pyrene	ND
1,2,5,6-dibenzanthracene	ND
benzo(g,h,i)perylene	0.01
WEIGHT (g)	94.7
MOISTURE (%)	76.5
LIPID (%)	2.37

Lower Level of Detection = 0.01 ppm for Tissue, Soil, Sediment, etc.
LLD = 0.005 ppm for Water
*ND = None Detected
**Spike = ____ ppm for _____
***NS = Not Spiked
= Confirmed by GC/Mass Spectrometry

Jeannie D. Cain
Signature

MISSISSIPPI STATE UNIVERSITY
MISSISSIPPI STATE CHEMICAL LABORATORY
BOX CR
MISSISSIPPI STATE, MS 39762

REPORT FORM
USDI/FWS

SAMPLE TYPE:Egg,Fish, Water

CAT NO. 5550
BATCH NO. 88-5-081
ORDER NO. 85800-88-30072

POLYNUCLEAR AROMATIC HYDROCARBONS

DATE RECEIVED 08/12/88

PARTS PER MILLION AS RECEIVED (WET WT)

FWS #	CFO-FF -88-1	CFO-FF -88-2	CFO-FF -88-3	CFO-FF -88-4	CFO-FF -88-5	CFO-FF -88-6	CFO-CT -88-7
LAB #	756341	756342	756343	756344	756345	756346	756347
MATRIX	Forage Fish	Forage Fish	Forage Fish	Forage Fish	Forage Fish	Forage Fish	Forage Fish
COMPOUND							
napthalene	ND*	0.01	ND	ND	ND	0.01	ND
fluorene	ND	ND	ND	ND	ND	ND	ND
phenanthrene	ND	0.01	ND	ND	ND	ND	ND
anthracene	ND	0.01	ND	ND	ND	ND	ND
fluoranthrene	0.01	ND	ND	ND	ND	ND	ND
pyrene	0.01	0.01	ND	ND	ND	0.01	0.01
1,2-benzanthracene	0.01	ND	0.01	ND	0.01	ND	0.01
chrysene	ND	ND	ND	0.01	0.01	ND	ND
benzo(b)fluoranthrene	ND	ND	ND	ND	ND	0.01	ND
benzo(k)fluoranthrene	ND	ND	ND	ND	ND	ND	ND
benzo(e)pyrene	0.01	0.01	0.01	0.01	ND	0.01	0.01
benzo(a)pyrene	ND	ND	ND	ND	ND	ND	ND
1,2,5,6-dibenzanthracene	ND	0.01	ND	ND	ND	ND	ND
benzo(g,h,i)perylene	0.01	0.01	0.01	ND	ND	0.01	ND
WEIGHT (g)	96.5	99.0	91.7	90.0	87.5	85.5	89.2
MOISTURE (%)	77.3	74.7	78.7	77.7	76.9	74.2	77.3
LIPID (%)	1.55	3.14	1.40	1.66	1.65	3.61	1.96

Lower Level of Detection = 0.01 ppm for Tissue, Soil, Sediment, etc.
LLD = 0.005 ppm for Water
*ND = None Detected
**Spike = ____ ppm for _____
***NS = Not Spiked
= Confirmed by GC/Mass Spectrometry

Signature

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BOX CR
MISSISSIPPI STATE, MS 39762

REPORT FORM
USDI/FWS

SAMPLE TYPE:Egg,Fish, Water

CAT NO. 5550
BATCH NO. 88-5-081
ORDER NO. 85800-88-30072

POLYNUCLEAR AROMATIC HYDROCARBONS

DATE RECEIVED 08/12/88

PARTS PER MILLION AS RECEIVED (WET WT)

FWS #	CFO-CT -88-8	CFO-CT -88-9	CFO-CT -88-10
LAB #	756328	756329	756330
MATRIX	Common Tern Egg	Common Tern Egg	Common Tern Egg
COMPOUND			
napthalene	0.01	0.01	ND
fluorene	ND*	ND	ND
phenanthrene	ND	ND	ND
anthracene	ND	ND	ND
fluoranthrene	ND	ND	ND
pyrene	ND	0.01	0.01
1,2-benzanthracene	ND	ND	0.01
chrysene	ND	0.01	ND
benzo(b)fluoranthrene	ND	ND	ND
benzo(k)fluoranthrene	ND	ND	ND
benzo(e)pyrene	0.01	0.01	0.01
benzo(a)pyrene	ND	ND	ND
1,2,5,6-dibenzanthracene	ND	ND	ND
benzo(g,h,i)perylene	ND	ND	0.01
WEIGHT (g)	41.0	37.9	35.8
MOISTURE (%)	67.5	77.2	76.8
LIPID (%)	8.50	10.2	10.1

Lower Level of Detection = 0.01 ppm for Tissue, Soil, Sediment, etc.
LLD = 0.005 ppm for Water
*ND = None Detected
**Spike = ____ ppm for _____
***NS = Not Spiked
= Confirmed by GC/Mass Spectrometry

Francis D. Cain
Signature

MISSISSIPPI STATE UNIVERSITY
MISSISSIPPI STATE CHEMICAL LABORATORY
BOX CR
MISSISSIPPI STATE, MS 39762

REPORT FORM
USDI/FWS

SAMPLE TYPE:Egg,Fish, Water

CAT NO. 5550
BATCH NO. 88-5-081
ORDER NO. 85800-88-30072

POLYNUCLEAR AROMATIC HYDROCARBONS

DATE RECEIVED 08/12/88

PARTS PER MILLION AS RECEIVED (WET WT)

FWS #	Matrix Blank	Spike**	% Recovery	Blank	Blank	Matrix Blank	Spike
LAB #	for	756388		756389	756390	for	756391
MATRIX	Egg	Egg		Reagent	Reagent	Fish	Fish
COMPOUND							
napthalene	ND*	0.070	70	ND	ND	ND	0.056
fluorene	ND	0.089	89	ND	ND	ND	0.088
phenanthrene	ND	0.095	95	ND	ND	ND	0.093
anthracene	ND	0.094	94	ND	ND	ND	0.089
fluoranthrene	ND	0.085	85	ND	ND	ND	0.083
pyrene	ND	0.088	88	ND	ND	ND	0.095
1,2-benzanthracene	ND	0.082	82	ND	ND	ND	0.085
chrysene	ND	0.099	99	ND	ND	ND	0.098
benzo(b)fluoranthrene	ND	0.059	59	ND	ND	ND	0.072
benzo(k)fluoranthrene	ND	0.056	56	ND	ND	ND	0.051
benzo(e)pyrene	ND	0.089	89	ND	ND	ND	0.097
benzo(a)pyrene	ND	0.079	79	ND	ND	ND	0.053
1,2,5,6-dibenzanthracene	ND	0.089	89	ND	ND	ND	0.089
benzo(g,h,i)perylene	ND	0.076	76	ND	ND	ND	0.086
WEIGHT (g)	-	-	-	-	-	-	-
MOISTURE (%)	74.0	68.9	-	-	-	80.4	84.5
LIPID (%)	-	-	-	-	-	-	-

Lower Level of Detection = 0.01 ppm for Tissue, Soil, Sediment, etc.
*ND = None Detected
**Spike = 0.10 ppm for Egg and Fish
***NS = Not Spiked
= Confirmed by GC/Mass Spectrometry

Signature

ELEMENTAL RESIDUES

UNIVERSITY OF MISSOURI

Environmental Trace Substances Research Center

Route 3
Columbia, Missouri 65203
Telephone (314) 882-2151

May 11, 1989

Gregory Smith
U.S. Department of the Interior
Patuxent Wildlife Research Center
Laurel, Maryland 20708

Dear Dr. Smith:

Enclosed are data, quality control reports, procedures and invoice for Cat. 5550.

Let me know if you have any questions.

Sincerely,

Edward J. Hinderberger

Edward J. Hinderberger, Jr.
Group Leader

EJH:kb

Enclosures

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% MOISTURE

For animal tissue and sediments of sufficient size, moisture was determined by placing a weighed aliquot of the sample in a Fisher Isotemp oven and drying at 103-105 C. The dried sample was then weighed and the data entered into a computer program to generate the % moisture and final report.

Plants, and samples too small for oven dried moisture determination had the % moisture calculated from the moisture lost during the freeze-drying in the Labcono Freeze-Dryer 8. The data was entered into a computer program to generate a % moisture and final report.

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HOMOGENIZATION

Large tissue samples, such as whole fish, were first run through a meat grinder one or more times depending on the size of the sample. An aliquot of the ground sample was weighed and frozen. For smaller tissue samples and plant samples the entire sample was weighed and then frozen. For sediments, the sample was mixed and an aliquot weighed and frozen. The frozen samples were placed in a Labcono Freeze Dryer 8 until the moisture had been removed. The dry samples were then weighed and further homogenized using a blender, or Spex Industries, Inc. Model 8000 mixer/mill with tungsten-carbide vial and balls.

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NITRIC - PERCHOLORIC DIGESTION - (I.C.P.)

Approximately 0.5 g. of sample was weighed into a freshly cleaned 100 ml. quartz Kjeldahl flask. (Samples containing a high percent of silica and sediment samples were digested in 100 ml. teflon beakers.) For water samples, 50 ml. of sample was measured into a teflon beaker. Slowly 15 ml. of concentrated sub-boiled HNO_3 and 2.5 ml. of concentrated sub-boiled $HClO_4$ were added. Foaming may occur with some samples. If the foaming started to become excessive, the container was cooled in a beaker of cold water. After the initial reaction had subsided, the sample was placed on low heat until the evolution of dark red fumes had ceased. Gradually, the heat was increased until the HNO_3 began refluxing, samples were allowed to reflux overnight. (This decreased the chance for charring during the reaction with $HClO_4$.) After the refluxing, the heat was gradually increased until the HNO_3 had been driven off, and the reaction with $HClO_4$ had occured. When dense white fumes from the $HClO_4$ were evident, the samples were removed from the heat and allowed to cool. Two ml. of concentrated sub-boiled HCl was added. The flasks were replaced on the heat and warmed until the containers were hot to the touch or started to boil. They were removed from the heat, and 5-10 ml. of deionized water was added. Samples were allowed to cool. They were then diluted using deionized water in a 50 ml. volumetric flask and transferred to a clean, labeled, 2 oz. polyethylene bottle.

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NITRIC REFLUX DIGESTION FOR MERCURY

Approximately 0.5 g. of sample was weighed into a freshly cleaned 50 ml. round bottom flask with 24/40 ground glass neck. For waters, 10 ml. of sample was measured into the flask. Five ml. of concentrated sub-boiled HNO_3 was added and the flask was placed under a 12 inch water cooled condenser with water running through the condenser. The heat was turned up to allow the HNO_3 to reflux no more than 1/3 the height of the columns. Samples were allowed to reflux for two hours. Then the heat was turned off and the samples allowed to cool. The condensers were rinsed with 1% v/v HCl and the flasks removed. The samples were diluted with 1% v/v HCl in a 50 ml. volumetric flask and then transferred to a clean, labeled, 2 oz. flint glass bottle.

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NITRIC - PERCHOLORIC DIGESTION - (ARSENIC)

Approximately 0.5 g. of sample was weighed into a freshly cleaned 100 ml. Kjeldahl flask. (Samples containing a high percent of silica and sediment samples were digested in 100 ml. teflon beakers.) For water samples, 50 ml. of sample was measured into a teflon beaker. Slowly 15 ml. of concentrated sub-boiled HNO_3 and 2.5 ml. of concentrated sub-boiled $HClO_4$ were added. Foaming may occur with some samples. If the foaming started to become excessive, the container was cooled in a beaker of cold water. After the initial reaction had subsided, the sample was placed on low heat until the evolution of dark red fumes had ceased. Gradually, the heat was increased until the HNO_3 had been driven off, and the reaction with $HClO_4$ had occured. After this reaction, the samples were heated approximately 5 minutes, after dense white fumes from the $HClO_4$ were evident. The samples were removed from the heat and allowed to cool. Samples were diluted using deionized water in 50 ml. volumetric flasks and transferred to clean, labeled, 2 oz. polyethylene bottles.

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NITRIC - PERCHOLORIC DIGESTION - (SELENIUM)

Approximately 0.5 g. of sample was weighed into a freshly cleaned 100 ml. quartz Kjeldahl flask. (Samples containing a high percent of silica and sediment samples were digested in 100 ml. teflon breakers.) For water samples, 50 ml. of sample was measured into a teflon beaker. Slowly 15 ml. of concentrated sub-boiled HNO_3 and 2.5 ml. of concentrated sub-boiled $HClO_4$ were added. Foaming may occur with some samples. If the foaming started to become excessive, the container was cooled in a beaker of cold water. After the initial reaction had subsided, the sample was placed on low heat until the evolution of dark red fumes had ceased. Gradually, the heat was increased until the HNO_3 began refluxing, samples were allowed to reflux overnight. (This decreased the chance for charring during the reaction with $HClO_4$.) After the refluxing, the heat was gradually increased until the HNO_3 had been driven off, and the reaction with $HClO_4$ had occured. When dense white fumes from the $HClO_4$ were evident, the samples were removed from the heat and allowed to cool. Two ml. of concentrated sub-boiled HCl was added. The flasks were replaced on the heat and warmed until the containers were hot to the touch or started to boil. They were removed from the heat, and 5-10 ml. of deionized water was added. Samples were allowed to cool. They were then diluted using deionized water in a 50 ml. volumetric flask and transferred to a clean, labeled, 2 oz. polyethylene bottle.

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Columbia, Missouri 65203
Telephone (314) 882-2151

ARSENIC AND SELENIUM BY HYDRIDE

The Varian VGA-76 hydride generation accessory was mounted on either a Perkin-Elmer Model 603 AA or Model 3030 (B) AA. Electrodeless Discharge lamps (EDL) were used. The instrument and EDL settings were taken from the instrument manuals. The burner mount for a Perkin-Elmer Model 10 Hydride generator was modified slightly to hold the Varian quartz cell. The cell was aligned in the light path of the burner chamber and a very lean flame was used for heating the cell. The two stock solutions were 50% v/v sub-boiled HCl and 0.6% $NaBH_4$ in 0.5% NaOH for Selenium and concentrated sub-boiled HCL and 1% $NaBH_4$ in 0.5% NaOH for Arsenic. Samples were diluted in 10% v/v sub-boiled HCl. Standards were prepared by dilution of Fisher 1000 ppm stock in 10% v/v sub-boiled HCl in the range of 0 to 20 PPB. The instrument was standardized to read directly in PPB using S1 = 5.00 and S2 = 20.00. After standardization, the standardization was checked by reading other standards such as 2.00, 10.00 and 15.00 PPB and an instrumental quality control sample with a known value. If the standards and quality control were acceptable, the detection limit was determined by reading the zero standard 10 times and twice the standard deviation of the mean was used as the detection limit. Samples were analyzed by taking an integrated reading for 3 seconds after the plateau was reached for the sample. This occured approximately 45 seconds after the sample tube was placed in the sample. Standardization was checked every 8-15 samples and approximately 10% of the samples were checked by the method of additions to monitor matrix effects. Matrix effects were usually not significant with the VGA-76. The data was corrected for drift of the standard curve and entered into the AA calculation program. This program corrected for blank, dilution, sample weight, sample volume and recorded the data in the LIMS database for report generation.

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Environmental Trace Substances Research Center

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INDUCTIVELY COUPLED PLASMA (ICP)

The instrument used for ICP analysis was a Jarrell-Ash Model 1100 Mark III with 40 analytical channels, controlled by a Digital Equipment Company (DEC) 11/23+ computer with two RL02 disk drives, DEC VT100 terminal, and DEC LA120 decwriter III. The instrument was standardized with a series of seven standards containing 36 elements. After the standardization, the detection limit was determined by taking ten integrations of the zero standard; three times the standard deviation of the mean was used as the detection limit. Instrumental quality control samples were then analyzed to check the ICP operation. If the values were acceptable, the samples were then analyzed. Standards were run every 10-15 samples to check for drift. If the drift was more than 5%, the instrument was restandardized. After the analysis was completed, the data was transferred to the Perkin-Elmer LIMS 2000 computer for calculation. The final detection limit for each element was further increased by 4% of the magnitude of the spectral interferences from the other elements. The data was checked before calculation to correct for possible errors in sample number, weight, volumes and dilution. The data was calculated using the ICP calculation program written by ETSRC computer staff, which corrected for blanks, standard drift, spectral interferences, sample weight, sample volume, and dilution. After the quality control was reviewed, a final report was generated using a Hewlett-Packard laser jet printer.

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MERCURY - COLD VAPOR ATOMIC ABSORPTION

Equipment used for Cold Vapor Atomic Absorption include: Perkin-Elmer Model 403 AA; Perkin-Elmer Model 056 recorder; Technicon Sampler I; Technicon Pump II; a glass cell with quartz windows and capillary tube for entry and exit of the mercury vapor; and a liquid-gas separator. The samples were placed in 4 ml. sample cups at least 3/4 full. The samples were mixed with hydroxylamine for preliminary reduction, then stannous chloride for reduction to the mercury vapor. The vapor was separated from the liquid and passed through the cell mounted in the light path of the burner compartment. The peaks were recorded and the peak heights measured. The standardization was done with at least 5 standards in the range of 0 to 10 ppb. The correlation coefficient was usually 0.9999 or better and must have been at least 0.999 to have been acceptable. A standard was run every 8-10 samples to check for drift in the standardization. This was usually less than 5%. Standards were preserved with 10% v/v HNO_3, 1% v/v HCl and 0.05% w/v K2Cr207. The solution concentrations were calculated and the data entered into the AA calculation program which corrected for blank, dilution, sample weight, sample volume and entered the data into the LIMS system for report generation.

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Route 3
Columbia, Missouri 65203
Telephone (314) 882-2151

ARSENIC IN FISH AND MARINE SAMPLES BY HYDRIDE

The Perkin-Elmer MHS-1 hydride generation accessory was mounted on either a Perkin-Elmer Model 603 AA or Model 3030(B) AA. An Electrodeless Discharge Lamp (EDL) was used. The instrument and EDL settings were taken from the instrument manuals. The cell was aligned in the light path of the burner chamber and a very lean flame used for heating the cell. The standard curve was run and a quality control sample of known concentration to check the standard curve. Blanks and samples are run by diluting an aliquot of the digested sample to 10 ml. with 4% v/v HClO4. The amount of sample used varied with the Arsenic concentration. Samples were analyzed using the Method of Standard Additions. The peaks from the recorder tracing were measured with a ruler and the slope and intercept calulated on a calculator. The data was entered into the AA calculation program. This program corrected for the blank, dilution factors, sample weight, sample volume and recorded the data in the LIMS database for report generation.

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PRECONCENTRATION OF ICP - PH 6

A 30 g. sample of the digestate for I.C.P. was weighed into a 50 ml. screw top centrifuge tube. One ml. of 2000 ppm Indium and 1 ml. of 10% ammonium acetate buffer were added and the pH adjusted to 6.5 with high purity NH_4OH from Seastar. One ml. of a 10% DDTC was added and the caps screwed on and mixed by turning end over end 6 times slowly. After mixing, the tubes were centrifuged in an I.E.C. refrigerated centrifuge at 20 C for 15 minutes at 15,000 RPM. The liquid was then decanted from the precipitate and 0.3 ml. of high purity HNO_3 from Seastar was added. The Tubes were heated in a water bath at 95 C to dissolve the preicipitate and diluted to 3 ml. with deionized water.

For samples high in Caclium and Phosphate a pH of 6.0 was used to reduce the precipitation of $Ca_3(PO4)2$.

U. S. FISH AND WILDLIFE SERVICE
PATUXENT ANALYTICAL CONTROL FACILITY

QUALITY ASSURANCE REPORT

RE:5550 REGION: 5 REGIONAL ID: 88-5-081

THE ANALYSES ON THE ABOVE MENTIONED SAMPLES WERE PERFORMED AT:

THE ENVIRONMENTAL TRACE SUBSTANCES RESEARCH CENTER
ROUTE 3
COLUMBIA, MISSOURI 65201

AFTER A THOROUGH REVIEW OF THE REPORTS ISSUED BY THE LABORATORY, I REPORT THE FOLLOWING OBSERVATIONS AND CONCLUSIONS:

THE ACCURACY, AS MEASURED BY SPIKE RECOVERY AND REFERENCE MATERIAL ANALYSIS, WAS ACCEPTABLE FOR ALL ANALYTES. AVERAGE RECOVERY FOR SPIKED SAMPLE ANALYSES IS GIVEN IN TABLE 1.

THE PRECISION, AS MEASURED BY DUPLICATE SAMPLE ANALYSIS, WAS ACCEPTABLE FOR ALL ANALYTES. AN ESTIMATE OF THE 95 % CONFIDENCE INTERVAL FOR THE METHODS USED IN THESE ANALYSES IS GIVEN IN TABLE 2.

John F Moore 9-14-89

JOHN F. MOORE DATE

TABLE 1: AVERAGE RECOVERY OF SPIKED ANALYTE FROM TISSUES ANALYZED BY THE ENVIRONMENTAL TRACE SUBSTANCES RESEARCH CENTER

	AVERAGE	STANDARD DEVIATION	NUMBER
ATOMIC ABSORPTION ANALYSES			
Arsenic	100	5.9	136
Selenium	95	3.4	153
Mercury	105	4.4	127
ICP ANALYSES(NO PRECON)			
Aluminum	103	5.3	98
Beryllium	102	5.9	111
Cadmium	102	4.6	111
Chromium	100	5.2	111
Copper	106	4.3	111
Iron	103	5.6	102
Lead	103	5.6	111
Manganese	101	4.8	101
Nickel	102	5.3	111
Zinc	105	6.2	110
Boron	91	6.1	110
Barium	102	4.1	99
Magnesium	101	6.2	98
Molybdenum	101	6.2	111
Silver	94	14.	111
Strontium	103	3.9	82
Thallium	99	3.0	111
Vanadium	104	5.2	110
Arsenic	101	11.	111
Selenium	104	7.7	111
PRECON ICP ANALYSES			
Aluminum	104	3.5	44
Beryllium	104	4.1	48
Cadmium	101	5.3	90
Chromium	99	7.2	48
Copper	103	4.1	90
Iron	103	7.6	87
Lead	99	5.4	90
Manganese	99	5.1	46
Nickel	101	4.8	90
Zinc	102	5.2	89
Molybdenum	102	4.4	42
Thallium	99	4.0	90
Vanadium	100	6.3	42
Selenium	98	6.4	37

TABLE 2: ESTIMATED 95 % CONFIDENCE INTERVAL FOR TISSUE ANALYSES PERFORMED BY THE ENVIRONMENTAL TRACE SUBSTANCES RESEARCH CENTER

SAMPLE CONCENTRATION*	± CONFIDENCE INTERVAL AS % OF SAMPLE CONCENTRATION 2-10 LOD	>10 LOD
ATOMIC ABSORPTION ANALYSES	20	5
Arsenic	INS	10
Selenium	INS	5
Mercury	INS	5
ICP ANALYSES(NO PRECON)	20	5
Aluminum	INS	15
Beryllium	INS	INS
Cadmium	INS	INS
Chromium	INS	INS
Copper	10	5
Iron	INS	5
Lead	INS	INS
Manganese	INS	5
Nickel	INS	INS
Zinc	INS	5
Boron	20	INS
Barium	50	10
Magnesium	INS	5
Molybdenum	INS	INS
Silver	INS	INS
Strontium	15	10
Thallium	INS	INS
Vanadium	30	10
Arsenic	INS	INS
Selenium	INS	INS
PRECON ICP ANALYSES	40	10
Aluminum	INS	15
Beryllium	INS	35
Cadmium	INS	INS
Chromium	INS	INS
Copper	INS	10
Iron	INS	10
Lead	INS	INS
Manganese	INS	10
Nickel	45	30
Zinc	INS	5
Molybdenum	INS	5
Thallium	INS	INS
Vanadium	INS	INS
Selenium	15	5

* FOR ANY CONCENTRATION LESS THAN 2 LOD, THE 95 % CONFIDENCE INTERVAL IS ESTIMATED AT ± 2 LOD.

LOD= LIMIT OF DETECTION

INS=INSUFFICIENT DATA TO CALCULATE ON AN INDIVIDUAL ANALYTE BASIS

ETSRC Sample Report

U.S.D.I. - Cat.5550
B-88110710

Submitter's ID Number	ETSRC ID	Test	Final Concen.	Units of Fin.Conc.	Description
CFO-CT-88-1	8110711	MOIST	76.0	%	COMMON TERN EGG
CFO-CT-88-2	8110712	MOIST	76.8	%	COMMON TERN EGG
CFO-CT-88-3	8110713	MOIST	76.6	%	COMMON TERN EGG
CFO-CT-88-4	8110714	MOIST	77.5	%	COMMON TERN EGG
CFO-CT-88-5	8110715	MOIST	77.4	%	COMMON TERN EGG
CFO-CT-88-6	8110716	MOIST	77.8	%	COMMON TERN EGG
CFO-CT-88-7	8110717	MOIST	77.4	%	COMMON TERN EGG
CFO-CT-88-8	8110718	MOIST	78.1	%	COMMON TERN EGG
CFO-CT-88-9	8110719	MOIST	76.8	%	COMMON TERN EGG
CFO-CT-88-10	8110720	MOIST	77.1	%	COMMON TERN EGG
CFO-FF-88-1	8110734	MOIST	77.7	%	FORAGE FISH
CFO-FF-88-2	8110735	MOIST	74.7	%	FORAGE FISH
CFO-FF-88-3	8110737	MOIST	78.0	%	FORAGE FISH
CFO-FF-88-4	8110738	MOIST	77.4	%	FORAGE FISH
CFO-FF-88-5	8110739	MOIST	76.5	%	FORAGE FISH
CFO-FF-88-6	8110740	MOIST	74.6	%	FORAGE FISH
CFO-FF-88-7	8110741	MOIST	77.1	%	FORAGE FISH
CFO-FF-88-8	8110742	MOIST	77.6	%	FORAGE FISH

ETSRC Quality Control Report -- Duplicates

USDI - Cat. 5550
B-88110710

Submitter's ID Number	ETSRC ID	Test	Final Concen.	Units of Fin.Conc.	Description
CFO-CT-88-8	8110718	AS	<0.1	MCG/G DW	COMMON TERN EGG
CFO-CT-88-8	8110718D	AS	<0.1	MCG/G DW	COMMON TERN EGG
Percent Deviation	0.0				
CFO-FF-88-5	8110739	AS	0.30	MCG/G DW	FORAGE FISH
CFO-FF-88-5	8110739D	AS	0.30	MCG/G DW	FORAGE FISH
Percent Deviation	0.0				
CFO-FF-88-12	8110746	AS	<0.1	MCG/G DW	FORAGE FISH
CFO-FF-88-12	8110746D	AS	<0.1	MCG/G DW	FORAGE FISH
Percent Deviation	0.0				

Average Percent Deviations 0.0

Standard Deviation of % 0.0

ETSRC Quality Control Report -- Spikes

USDI - Cat. 5550
B-88110710

Submitter's ID Number	ETSRC ID	Test	Final Concen.	Units of Fin.Conc.	Description
CFO-CT-88-5	8110715	AS	<0.1	MCG/G DW	COMMON TERN EGG
CFO-CT-88-5	8110715S	AS	100.	MCG/G DW	COMMON TERN EGG
MCG of Spike Added	50.00		Percent Spike Recovery	101.	
CFO-CT-88-19	8110729	AS	0.2	MCG/G DW	COMMON TERN EGG
CFO-CT-88-19	8110729S	AS	97.	MCG/G DW	COMMON TERN EGG
MCG of Spike Added	50.00		Percent Spike Recovery	99.	
CFO-FF-88-8	8110742	AS	0.39	MCG/G DW	FORAGE FISH
CFO-FF-88-8	8110742S	AS	110.	MCG/G DW	FORAGE FISH
MCG of Spike Added	50.00		Percent Spike Recovery	111.	
CFO-FF-88-15	8110750	AS	0.31	MCG/G DW	FORAGE FISH
CFO-FF-88-15	8110750S	AS	92.	MCG/G DW	FORAGE FISH
MCG of Spike Added	50.00		Percent Spike Recovery	92.	

Average Percent Spike Recovery 101.

Standard Deviation of Recovery 7.9

ETSRC Quality Control Report -- Reference Standards

USDI - Cat. 5550
B-88110710

Reference ID Number	ETSRC ID	Test	Final Concen.	Units of Fin.Conc.	Expected Value	Standard Deviation	Description
NRCC DORM1	8110736	AS	18.	MCG/G DW	17.7	2.1	NRCC DOGFISH
NRCC DOLT1	8110747	AS	8.0	MCG/G DW	10.1	1.4	NRCC DOGFISH

ETSRC Quality Control Report -- Blanks

USDI - Cat. 5550
B-88110710

Submitter's ID Number	ETSRC ID	Test	Final Concen.	Units of Fin.Conc.	Description
BLANK 1	8110710	AS	<0.05	MCG	BLANK 1
BLANK 2	8110733	AS	<0.05	MCG	BLANK 2

ETSRC Sample Report

USDI - Cat. 5550
B-88110710

Submitter's ID Number	ETSRC ID	Test	Final Concen.	Units of Fin.Conc.	Description
CFO-CT-88-1	8110711	AS	<0.1	MCG/G DW	COMMON TERN EGG
CFO-CT-88-2	8110712	AS	<0.1	MCG/G DW	COMMON TERN EGG
CFO-CT-88-3	8110713	AS	<0.1	MCG/G DW	COMMON TERN EGG
CFO-CT-88-4	8110714	AS	<0.1	MCG/G DW	COMMON TERN EGG
CFO-CT-88-5	8110715	AS	<0.1	MCG/G DW	COMMON TERN EGG
CFO-CT-88-6	8110716	AS	<0.1	MCG/G DW	COMMON TERN EGG
CFO-CT-88-7	8110717	AS	<0.1	MCG/G DW	COMMON TERN EGG
CFO-CT-88-8	8110718	AS	<0.1	MCG/G DW	COMMON TERN EGG
CFO-CT-88-9	8110719	AS	<0.1	MCG/G DW	COMMON TERN EGG
CFO-CT-88-10	8110720	AS	<0.1	MCG/G DW	COMMON TERN EGG
CFO-FF-88-1	8110734	AS	0.2	MCG/G DW	FORAGE FISH
CFO-FF-88-2	8110735	AS	0.49	MCG/G DW	FORAGE FISH
CFO-FF-88-3	8110737	AS	0.3	MCG/G DW	FORAGE FISH
CFO-FF-88-4	8110738	AS	0.2	MCG/G DW	FORAGE FISH
CFO-FF-88-5	8110739	AS	0.30	MCG/G DW	FORAGE FISH
CFO-FF-88-6	8110740	AS	0.76	MCG/G DW	FORAGE FISH
CFO-FF-88-7	8110741	AS	0.37	MCG/G DW	FORAGE FISH
CFO-FF-88-8	8110742	AS	0.39	MCG/G DW	FORAGE FISH

ETSRC Quality Control Report -- Duplicates

USDI - Cat. 5550
B-88110710

Submitter's ID Number	ETSRC ID	Test	Final Concen.	Units of Fin.Conc.	Description
CFO-CT-88-8	8110718	SE	3.5	MCG/G DW	COMMON TERN EGG
CFO-CT-88-8	8110718D	SE	3.5	MCG/G DW	COMMON TERN EGG
Percent Deviation	0.0				
CFO-FF-88-5	8110739	SE	2.5	MCG/G DW	FORAGE FISH
CFO-FF-88-5	8110739D	SE	2.5	MCG/G DW	FORAGE FISH
Percent Deviation	0.0				
CFO-FF-88-12	8110746	SE	1.7	MCG/G DW	FORAGE FISH
CFO-FF-88-12	8110746D	SE	1.7	MCG/G DW	FORAGE FISH
Percent Deviation	0.0				

Average Percent Deviations 0.0

Standard Deviation of % 0.0

ETSRC Quality Control Report -- Spikes

USDI - Cat. 5550
B-88110710

Submitter's ID Number	ETSRC ID	Test	Final Concen.	Units of Fin.Conc.	Description
CFO-CT-88-5	8110715	SE	3.1	MCG/G DW	COMMON TERN EGG
CFO-CT-88-5	8110715S	SE	98.	MCG/G DW	COMMON TERN EGG
MCG of Spike Added	50.00		Percent Spike Recovery	97.	
CFO-CT-88-19	8110729	SE	3.3	MCG/G DW	COMMON TERN EGG
CFO-CT-88-19	8110729S	SE	100.	MCG/G DW	COMMON TERN EGG
MCG of Spike Added	50.00		Percent Spike Recovery	97.	
CFO-FF-88-8	8110742	SE	2.8	MCG/G DW	FORAGE FISH
CFO-FF-88-8	8110742S	SE	98.	MCG/G DW	FORAGE FISH
MCG of Spike Added	50.00		Percent Spike Recovery	96.	
CFO-FF-88-15	8110750	SE	2.3	MCG/G DW	FORAGE FISH
CFO-FF-88-15	8110750S	SE	95.	MCG/G DW	FORAGE FISH
MCG of Spike Added	50.00		Percent Spike Recovery	96.	

Average Percent Spike Recovery 96.

Standard Deviation of Recovery 0.6

ETSRC Quality Control Report -- Reference Standards

USDI - Cat. 5550
B-88110710

Reference ID Number	ETSRC ID	Test	Final Ccncen.	Units of Fin.Conc.	Expected Value	Standard Deviation	Description
NRCC DORM1	8110736	SE	1.5	MCG/G DW	1.62	0.12	NRCC DOGFISH
NRCC DOLT1	8110747	SE	6.4	MCG/G DW	7.34	0.42	NRCC DOGFISH

ETSRC Quality Control Report -- Blanks

USDI - Cat. 5550
B-88110710

Submitter's ID Number	ETSRC ID	Test	Final Concen.	Units of Fin.Conc.	Description
BLANK 1	8110710	SE	<0.09	MCG	BLANK 1
BLANK 2	8110733	SE	<0.09	MCG	BLANK 2

ETSRC Sample Report

USDI - Cat. 5550
B-88110710

Submitter's ID Number	ETSRC ID	Test	Final Concen.	Units of Fin.Conc.	Description
CFO-CT-88-1	8110711	SE	3.0	MCG/G DW	COMMON TERN EGG
CFO-CT-88-2	8110712	SE	3.0	MCG/G DW	COMMON TERN EGG
CFO-CT-88-3	8110713	SE	3.6	MCG/G DW	COMMON TERN EGG
CFO-CT-88-4	8110714	SE	3.5	MCG/G DW	COMMON TERN EGG
CFO-CT-88-5	8110715	SE	3.1	MCG/G DW	COMMON TERN EGG
CFO-CT-88-6	8110716	SE	3.1	MCG/G DW	COMMON TERN EGG
CFO-CT-88-7	8110717	SE	3.5	MCG/G DW	COMMON TERN EGG
CFO-CT-88-8	8110718	SE	3.5	MCG/G DW	COMMON TERN EGG
CFO-CT-88-9	8110719	SE	3.5	MCG/G DW	COMMON TERN EGG
CFO-CT-88-10	8110720	SE	3.6	MCG/G DW	COMMON TERN EGG
CFO-FF-88-1	8110734	SE	2.6	MCG/G DW	FORAGE FISH
CFO-FF-88-2	8110735	SE	2.4	MCG/G DW	FORAGE FISH
CFO-FF-88-3	8110737	SE	2.7	MCG/G DW	FORAGE FISH
CFO-FF-88-4	8110738	SE	2.7	MCG/G DW	FORAGE FISH
CFO-FF-88-5	8110739	SE	2.5	MCG/G DW	FORAGE FISH
CFO-FF-88-6	8110740	SE	2.1	MCG/G DW	FORAGE FISH
CFO-FF-88-7	8110741	SE	2.8	MCG/G DW	FORAGE FISH
CFO-FF-88-8	8110742	SE	2.8	MCG/G DW	FORAGE FISH

ETSRC Quality Control Report -- Duplicates

USDI - Cat. 5550
B-88110710

Submitter's ID Number	ETSRC ID	Test	Final Concen.	Units of Fin.Conc.	Description
CFO-CT-88-4	8110714	HG	1.1	MCG/G DW	COMMON TERN EGG
CFO-CT-88-4	8110714D	HG	1.2	MCG/G DW	COMMON TERN EGG
Percent Deviation			8.7		
CFO-CT-88-8	8110718	HG	1.6	MCG/G DW	COMMON TERN EGG
CFO-CT-88-8	8110718D	HG	1.6	MCG/G DW	COMMON TERN EGG
Percent Deviation			0.0		
CFO-FF-88-5	8110739	HG	0.099	MCG/G DW	FORAGE FISH
CFO-FF-88-5	8110739D	HG	0.098	MCG/G DW	FORAGE FISH
Percent Deviation			1.0		
CFO-FF-88-12	8110746	HG	0.24	MCG/G DW	FORAGE FISH
CFO-FF-88-12	8110746D	HG	0.24	MCG/G DW	FORAGE FISH
Percent Deviation			0.0		

Average Percent Deviations 2.4

Standard Deviation of % 4.2

ETSRC Quality Control Report -- Spikes

USDI - Cat. 5550
B-88110710

Submitter's ID Number	ETSRC ID	Test	Final Concen.	Units of Fin.Conc.	Description
CFO-CT-88-5	8110715	HG	1.2	MCG/G DW	COMMON TERN EGG
CFO-CT-88-5	8110715S	HG	3.2	MCG/G DW	COMMON TERN EGG
MCG of Spike Added	1.00		Percent Spike Recovery	101.	
CFO-CT-88-19	8110729	HG	1.3	MCG/G DW	COMMON TERN EGG
CFO-CT-88-19	8110729S	HG	3.3	MCG/G DW	COMMON TERN EGG
MCG of Spike Added	1.00		Percent Spike Recovery	100.	
CFO-FF-88-8	8110742	HG	0.13	MCG/G DW	FORAGE FISH
CFO-FF-88-8	8110742S	HG	2.11	MCG/G DW	FORAGE FISH
MCG of Spike Added	1.00		Percent Spike Recovery	99.	
CFO-FF-88-15	8110750	HG	0.29	MCG/G DW	FORAGE FISH
CFO-FF-88-15	8110750S	HG	2.29	MCG/G DW	FORAGE FISH
MCG of Spike Added	1.00		Percent Spike Recovery	101.	

Average Percent Spike Recovery 100.

Standard Deviation of Recovery 0.8

ETSRC Quality Control Report -- Reference Standards

USDI - Cat. 5550
B-88110710

Reference ID Number	ETSRC ID	Test	Final Concen.	Units of Fin.Conc.	Expected Value	Standard Deviation	Description
NRCC DORM1	8110736	HG	0.799	MCG/G DW	0.798	0.074	NRCC DOGFISH

ETSRC Quality Control Report -- Blanks

USDI - Cat. 5550
B-88110710

Submitter's ID Number	ETSRC ID	Test	Final Concen.	Units of Fin.Conc.	Description
BLANK 1	8110710	HG	0.012	MCG	BLANK 1
BLANK 2	8110733	HG	0.010	MCG	BLANK 2

ETSRC Sample Report

USDI - Cat. 5550
B-88110710

Submitter's ID Number	ETSRC ID	Test	Final Concen.	Units of Fin.Conc.	Description
CFO-CT-88-1	8110711	HG	1.4	MCG/G DW	COMMON TERN EGG
CFO-CT-88-2	8110712	HG	1.2	MCG/G DW	COMMON TERN EGG
CFO-CT-88-3	8110713	HG	0.759	MCG/G DW	COMMON TERN EGG
CFO-CT-88-4	8110714	HG	1.2	MCG/G DW	COMMON TERN EGG
CFO-CT-88-5	8110715	HG	1.2	MCG/G DW	COMMON TERN EGG
CFO-CT-88-6	8110716	HG	1.2	MCG/G DW	COMMON TERN EGG
CFO-CT-88-7	8110717	HG	1.1	MCG/G DW	COMMON TERN EGG
CFO-CT-88-8	8110718	HG	1.6	MCG/G DW	COMMON TERN EGG
CFO-CT-88-9	8110719	HG	1.2	MCG/G DW	COMMON TERN EGG
CFO-CT-88-10	8110720	HG	1.8	MCG/G DW	COMMON TERN EGG
CFO-FF-88-1	8110734	HG	0.12	MCG/G DW	FORAGE FISH
CFO-FF-88-2	8110735	HG	0.23	MCG/G DW	FORAGE FISH
CFO-FF-88-3	8110737	HG	0.14	MCG/G DW	FORAGE FISH
CFO-FF-88-4	8110738	HG	0.11	MCG/G DW	FORAGE FISH
CFO-FF-88-5	8110739	HG	0.099	MCG/G DW	FORAGE FISH
CFO-FF-88-6	8110740	HG	0.11	MCG/G DW	FORAGE FISH
CFO-FF-88-7	8110741	HG	0.12	MCG/G DW	FORAGE FISH
CFO-FF-88-8	8110742	HG	0.13	MCG/G DW	FORAGE FISH

Environmental Trace Substances Research Center
ICP Scan - Sample Analysis Report
Project: USDI - Cat. 5550 Units: MCG/G DRY WEIGHT
Batch #: B-88110710

Customer ID: CFO-CT-88-1
Description: COMMON TERN EGG
ETSRC ID: 8110711

Elm	Result	Estimated Sample Detection Limit
AL	<0.3	0.3
BE	<0.01	0.01
CD	0.04	0.04
CR	<0.1	0.1
CU	2.20	0.02
FE	88.4	0.1
MN	1.3	0.02
NI	0.3	0.2
PB	<0.5	0.5
TL	<0.5	0.5
ZN	52.1	0.03

Customer ID: CFO-CT-88-2
Description: COMMON TERN EGG
ETSRC ID: 8110712

Elm	Result	Estimated Sample Detection Limit
AL	0.4	0.3
BE	<0.01	0.01
CD	<0.03	0.03
CR	0.3	0.1
CU	2.74	0.02
FE	105.	0.1
MN	2.1	0.02
NI	0.3	0.2
PB	<0.4	0.4
TL	<0.5	0.5
ZN	64.8	0.02

Environmental Trace Substances Research Center
ICP Scan - Sample Analysis Report
Project: USDI - Cat. 5550 Units: MCG/G DRY WEIGHT
Batch #: B-88110710

Customer ID: CFO-CT-88-3
Description: COMMON TERN EGG
ETSRC ID: 8110713

Elm	Result	Estimated Sample Detection Limit
AL	0.4	0.3
BE	<0.01	0.01
CD	<0.03	0.03
CR	0.1	0.1
CU	3.06	0.02
FE	123.	0.1
MN	2.0	0.02
NI	<0.2	0.2
PB	<0.4	0.4
TL	<0.5	0.5
ZN	62.1	0.02

Customer ID: CFO-CT-88-4
Description: COMMON TERN EGG
ETSRC ID: 8110714

Elm	Result	Estimated Sample Detection Limit
AL	0.5	0.3
BE	<0.01	0.01
CD	0.04	0.04
CR	<0.1	0.1
CU	3.02	0.02
FE	120.	0.1
MN	1.6	0.02
NI	<0.2	0.2
PB	<0.5	0.5
TL	<0.5	0.5
ZN	60.8	0.03

Environmental Trace Substances Research Center
ICP Scan - Sample Analysis Report

Project: USDI - Cat. 5550 Units: MCG/G DRY WEIGHT

Batch #: B-88110710

Customer ID: CFO-CT-88-5
Description: COMMON TERN EGG
ETSRC ID: 8110715

Elm	Result	Estimated Sample Detection Limit
AL	<0.3	0.3
BE	<0.01	0.01
CD	0.04	0.03
CR	0.2	0.1
CU	2.60	0.02
FE	109.	0.1
MN	1.7	0.02
NI	<0.2	0.2
PB	<0.5	0.5
TL	<0.5	0.5
ZN	61.2	0.02

Customer ID: CFO-CT-88-6
Description: COMMON TERN EGG
ETSRC ID: 8110716

Elm	Result	Estimated Sample Detection Limit
AL	0.4	0.3
BE	<0.01	0.01
CD	0.04	0.03
CR	<0.1	0.1
CU	2.56	0.02
FE	124.	0.1
MN	1.9	0.02
NI	0.2	0.2
PB	<0.4	0.4
TL	0.6	0.5
ZN	65.1	0.02

Environmental Trace Substances Research Center
ICP Scan - Sample Analysis Report
Project: USDI - Cat. 5550 Units: MCG/G DRY WEIGHT
Batch #: B-88110710

Customer ID: CFO-CT-88-7
Description: COMMON TERN EGG
ETSRC ID: 8110717

Elm	Result	Estimated Sample Detection Limit
AL	0.5	0.3
BE	<0.01	0.01
CD	0.03	0.03
CR	<0.1	0.1
CU	2.98	0.02
FE	124.	0.1
MN	1.9	0.02
NI	<0.2	0.2
PB	<0.5	0.5
TL	<0.5	0.5
ZN	54.6	0.02

Customer ID: CFO-CT-88-8
Description: COMMON TERN EGG
ETSRC ID: 8110718

Elm	Result	Estimated Sample Detection Limit
AL	<0.3	0.3
BE	<0.01	0.01
CD	<0.03	0.03
CR	<0.1	0.1
CU	2.55	0.02
FE	109.	0.1
MN	2.0	0.02
NI	<0.2	0.2
PB	<0.4	0.4
TL	<0.5	0.5
ZN	55.7	0.02

Environmental Trace Substances Research Center
ICP Scan - Sample Analysis Report
Project: USDI - Cat. 5550 Units: MCG/G DRY WEIGHT
Batch #: B-88110710

Customer ID: CFO-CT-88-9
Description: COMMON TERN EGG
ETSRC ID: 8110719

Elm	Result	Estimated Sample Detection Limit
AL	0.5	0.3
BE	<0.01	0.01
CD	0.05	0.03
CR	0.1	0.1
CU	2.73	0.02
FE	104.	0.1
MN	1.6	0.02
NI	<0.2	0.2
PB	<0.5	0.5
TL	<0.5	0.5
ZN	56.6	0.02

Customer ID: CFO-CT-88-10
Description: COMMON TERN EGG
ETSRC ID: 8110720

Elm	Result	Estimated Sample Detection Limit
AL	0.3	0.3
BE	<0.01	0.01
CD	0.04	0.03
CR	<0.1	0.1
CU	2.81	0.02
FE	130.	0.1
MN	2.38	0.02
NI	<0.2	0.2
PB	<0.4	0.4
TL	<0.5	0.5
ZN	57.8	0.02

Environmental Trace Substances Research Center
ICP Scan - Sample Analysis Report
Project: USDI - Cat. 5550 Units: MCG/G DRY WEIGHT
Batch #: B-88110710

Customer ID: CFO-FF-88-1
Description: FORAGE FISH
ETSRC ID: 8110734

Elm	Result	Estimated Sample Detection Limit
AL	61.0	0.4
BE	<0.01	0.01
CD	0.38	0.04
CR	1.6	0.1
CU	3.91	0.02
FE	115.	0.1
MN	11.7	0.03
NI	19.	0.2
PB	<0.5	0.5
TL	<0.6	0.6
ZN	200.	0.03

Customer ID: CFO-FF-88-2
Description: FORAGE FISH
ETSRC ID: 8110735

Elm	Result	Estimated Sample Detection Limit
AL	241.	0.3
BE	<0.01	0.01
CD	0.26	0.03
CR	3.2	0.1
CU	4.31	0.02
FE	305.	0.1
MN	14.7	0.02
NI	52.7	0.2
PB	<0.5	0.5
TL	<0.6	0.6
ZN	228.	0.03

Environmental Trace Substances Research Center
ICP Scan - Sample Analysis Report

Project: USDI - Cat. 5550 Units: MCG/G DRY WEIGHT

Batch #: B-88110710

Customer ID: CFO-FF-88-3
Description: FORAGE FISH
ETSRC ID: 8110737

Elm	Result	Estimated Sample Detection Limit
AL	76.3	0.4
BE	<0.01	0.01
CD	0.37	0.04
CR	1.7	0.1
CU	3.26	0.02
FE	118.	0.1
MN	11.9	0.03
NI	52.8	0.2
PB	<0.5	0.5
TL	<0.7	0.7
ZN	216.	0.03

Customer ID: CFO-FF-88-4
Description: FORAGE FISH
ETSRC ID: 8110738

Elm	Result	Estimated Sample Detection Limit
AL	169.	0.4
BE	<0.01	0.01
CD	0.27	0.05
CR	3.5	0.1
CU	3.49	0.03
FE	221.	0.1
MN	13.5	0.03
NI	2700. ——	0.2
PB	<0.5	0.5
TL	23.	7.
ZN	194.	0.03

Spike Recovery
Not a valid Spike

Environmental Trace Substances Research Center
ICP Scan - Sample Analysis Report

Project: USDI - Cat. 5550 Units: MCG/G DRY WEIGHT

Batch #: B-88110710

Customer ID: CFO-FF-88-5
Description: FORAGE FISH
ETSRC ID: 8110739

Elm	Result	Estimated Sample Detection Limit
AL	160.	0.4
BE	0.01	0.01
CD	0.23	0.04
CR	2.9	0.1
CU	3.37	0.02
FE	202.	0.1
MN	14.2	0.03
NI	14.9	0.2
PB	<0.5	0.5
TL	<0.6	0.6
ZN	197.	0.03

Customer ID: CFO-FF-88-6
Description: FORAGE FISH
ETSRC ID: 8110740

Elm	Result	Estimated Sample Detection Limit
AL	748.	0.3
BE	0.03	0.01
CD	0.17	0.04
CR	4.3	0.1
CU	4.40	0.02
FE	629.	0.1
MN	13.7	0.03
NI	19.	0.2
PB	<0.5	0.5
TL	<0.6	0.6
ZN	198.	0.03

Environmental Trace Substances Research Center
ICP Scan - Sample Analysis Report
Project: USDI - Cat. 5550 Units: MCG/G DRY WEIGHT
Batch #: B-88110710

Customer ID: CFO-FF-88-7
Description: FORAGE FISH
ETSRC ID: 8110741

Elm	Result	Estimated Sample Detection Limit
AL	45.8	0.4
BE	<0.01	0.01
CD	0.33	0.04
CR	3.8	0.1
CU	3.85	0.02
FE	96.0	0.1
MN	14.6	0.02
NI	29.3	0.2
PB	<0.5	0.5
TL	<0.6	0.6
ZN	320.	0.03

Customer ID: CFO-FF-88-8
Description: FORAGE FISH
ETSRC ID: 8110742

Elm	Result	Estimated Sample Detection Limit
AL	54.7	0.4
BE	<0.01	0.01
CD	0.38	0.04
CR	2.3	0.1
CU	3.84	0.02
FE	114.	0.1
MN	14.4	0.02
NI	467.	0.2
PB	<0.5	0.5
TL	3.	2.
ZN	331.	0.03