PIMSD/ISB

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

OCT 15 1987

OFFICE OF
PESTICIDES AND TOXIC SUBSTANCES

Memorandum

Subject: Evaluation of Fish Residue Data for Chlordane, Mirex, DDT, Heptachlor and Aldrin/Dieldrin.
No MRID Number
No Accession Number
RCB Nos. 2430 - 2453, 2381 - 84, 2379, 2848

From: Michael S. Metzger, Chemist
Residue Chemistry Branch
Hazard Evaluation Division (TS-769C)

Michael S. Metzger

Thru: Edward Zager, Section Head, SRS 2
Residue Chemistry Branch
Hazard Evaluation Division (TS-769C)

E Zager

To: Ferial S. Bishop, Chief
Registration Support and
Emergency Response Branch
Registration Division (TS-767C)

Introduction

Th Registration Division of the Office of Pesticide Programs (OPP) has asked EPA Regional Offices, state agencies and other federal agencies to provide OPP with fish residue monitoring data for the following pesticides:

Aldrin/Dieldrin
Chlordane
DDT
Heptachlor
Mirex

Many of these organizations responded by providing OPP with fish residue data in a variety of formats (e.g. summary tables, individual raw data sheets, etc.). RCB has been asked to review these data as part of the fish action levels reevaluation project for these pesticides.

These data come from a variety of sources which utilized different analytical methods, sampling schemes, sample preparation techniques, QA/QC procedures and data reporting

methods. Additionally, the particular analytical methods used in most of these studies were not identified. For these reasons, a sound statistical analysis of these data which would provide conclusive relationships among residue level and fish species, location, aquatic environment, time, etc., cannot be performed.

However, RCB has attempted to identify potential trends in these data which might give some indication of where greater fish residues might be expected to be found. Before proceeding, however, we will point out some of the sources of uncertainty which arise from the use of these incongruous data sets.

## Residue Variation with Data Source

RCB previously recommended fish action levels for these chemicals based solely on FDA surveillance monitoring data for FY 1985 and FY 1986 (M. Metzger, 3/25/87). It was assumed that these data were collected utilizing a sampling scheme in which residue levels in fish tissue were representative of residues likely to be found in the entire national fish population (fish utilized for human consumption or as animal feed). Additionally, the sampling schemes, sample preparation techniques, analytical methods, QA/QC procedures and data reporting were assumed to be consistent from year to year.

The current data set utilized by RCB contains these FDA data as well as data from numerous other sources. Therefore, the data are not nationally randomized for residues likely to be found in fish tissues. Parameters such as analytical methodology, sampling schemes, use of composite vs. individual fish samples, etc., become variables which cannot be isolated; and therefore, the causes of residue level variations cannot easily be assigned to a particular variable. Rather, it must be stated that these variations in residue levels may be due to one or more factors which may be reflective of the sampling and analytical methodologies used as well as the actual variations in the residue levels.

We have compared the FDA data to all other data ("non-FDA data") to estimate the differences in averages between these data sets. These comparisons will not provide conclusive information regarding the causes of these differences, nor will they allow estimation of differences among FDA data and data from individual non-FDA studies.

## Residue Variation with Species

The fish species analyzed in these studies were divided into 4 groups based on their feeding habits so that residue level variation with feeding habits could be identified. The four groups are "High(er) level predators", "low(er) level

predators/bottom-feeders", "neither or unknown" (e.g. "caviar") and "shellfish". High(er) and low(er) level predators refers to higher or lower level positions in the food chain. Both fresh water and salt water species are included in each group. Additionally, data analyses were performed utilizing or excluding individual fish species. Bluefish were isolated for statistical analysis because a large number of bluefish were analyzed relative to the total number of fish analyzed. Separate statistical analyses of bluefish and non-bluefish would allow determination of how the large number of bluefish samples biased the results. American eels were analyzed separately since this species of fish differs significantly from most other species sampled.

When examining the data subsets broken down in this manner, it must be remembered that other, non-isolable variables (other than feeding habits) may be causing the differences seen. The most likely reasons for the observed residue variations with species are the following:

(1) actual differences in residues in different kinds of fish due to different feeding habits;

(2) differences in residues due to a greater number of fresh water species (containing higher residues than salt water species) in a particular data subset;

(3) differences in residues due to a greater number of fish from a particular data subset being taken from a more highly contaminated (or less contaminated) location;

(4) differences in analytical method (recoveries), sampling techniques, data reporting (were reported data corrected for recovery?);

(5) differences in residues due to a greater number of high or low residue species in a specific data subset;

(6) different studies monitoring for all or only part of the residue of concern for a particular chemical.

Reasons other than those listed are possible. In a well designed sampling scheme, these factors would be controlled so that only the single variable to be examined would be a factor contributing to observed residue variations. However, in this data set, any individual factor or combination of the factors above could cause the observed residue variations.

Residue Variation with Aquatic Environment (Fresh vs. Salt Water Fish)

Fish were also divided according to whether they lived in "Brackish or salt water", "fresh water", "either" or "unknown or not applicable" (e.g. "caviar"). Fish such as bass or trout could be of either fresh or salt water varieties and were classified as "either" since, in many cases, the aquatic environment or sampling location was not specified.

When examining the data broken down by aquatic environment, factors similar to those discussed for "residue variation with species" must be considered. In addition to (3), (4), (5) and (6) discussed there, the following factors could be responsible for apparent residue variations with aquatic environment:

(7) actual differences in residues in fish from different aquatic environments due to the aquatic environment;

(8) differences in residues due to a greater number of high level predators or low level predators/bottom-feeders in a particular data subset.

Residue Variation with Time

Data for all divisions by species, location, etc. were examined for samples collected in 1985, 1986 and for combined 1985 + 1986 data sets. This was done in order to estimate residue decline from 1985 to 1986. Changes in average residues seen from year to year could be due to actual residue variation due to time. Additionally, factors previously discussed in (2), (3), (4), (5), (6) and (8) could be entirely or partially responsible for the observed residue variation.

Residue Variation with Location

Data from the various locations from which samples were obtained were examined separately to determine if there are specific locations which have higher or lower residues of particular pesticides than other locations. Residue variations observed could be due to actual variations in residues due to location, or they could be due to (2), (3), (4), (5), (6) or (8) discussed earlier.

Statistical Analysis

The data set utilized for statistical analysis is composed of studies performed for a variety of purposes utilizing various analytical and sampling methods, sample preparation techniques,

QA/QC procedures and data reporting methods. For these reasons, the data are not random or representative of the total U.S. fish population, and results of the statistical analyses must be viewed keeping in mind all of the possible variables which could cause the residue variations observed. RCB cannot attribute observed residue variations to any single factor such as location or species; rather, the residue variation could be due to any of the numerous variables which are not held constant for a particular data subset.

In order to examine these data, residue values and other important parameters (e.g. location, year, species, etc.) were entered into a dBase III Plus data base file. Average residues as well as 95% confidence limits (assuming a normal distribution) were calculated using a dBase III Plus program. Each residue value and the number of times it appeared in a data subset were calculated and printed out for each data set.

Information for tolerance limit calculations for 95% confidence and 95% population coverage was provided by Richard A. Levy (Leader, Biostatistics Team, Toxicology Branch, HED). Mr. Levy provided a 70-page computer print-out which allowed RCB to calculate the appropriate tolerance limits for a data set containing a specific number of values. One-sided statistical tolerance limits calculated for the various data subsets furnish limits below which we confidently (i.e. 95% confidence) expect to find a prescribed proportion of individual items (i.e. 95% population coverage) of the population. These calculations assumed no distribution in determining the tolerance limits. The reader is refered to the following for more information regarding this statistical method:

> Wilks, S.S., Statistical Prediction with Special Reference to the Problem of Tolerance Limits, Princeton University, Princeton, N.J.
>
> Wilks, S.S., Determination of Sample Sizes for Setting Tolerance Limits, Princeton University, Princeton, N.J.

## CHLORDANE

### Chlordane Residue Variation with Data Source, FDA vs. Other Data

Chlordane residue variation with data source is shown in Figure 2. In all cases, the data from sources other than the FDA show average residue values greater than or equal to the average residue values for FDA data. This is primarily due to

the large number of non-FDA samples from Regions 5 and 7 which have greater average residues (particularly Region 7) than those of the entire data set.

## Chlordane Residue Variation with Species

Chlordane residue variation with fish species is shown in Figure 3. No consistent year to year trend is seen showing higher residues in either high level predators or low level predators/bottom-feeding fish. However, low level predators/bottom feeders in Regions 5 and 7 tend to have significantly higher residues than the average national residues for all fish.

American eels, bluefish and non-shellfish have average residues very similar to the national average for all fish. Shellfish show significantly lower residues than other fish (residues in shellfish were non-detectable in most cases).

## Chlordane Residue Variation with Aquatic Environment

Chlordane residue variation with aquatic environment (water type, fresh vs. salt water species) is shown in Figure 1. For the entire data set, fresh water fish have higher average residues than salt water fish. This trend is also seen for low level predators/bottom-feeding species but is reversed for high level predators in which the fresh water species have slightly lower residues.

## Chlordane Residue Variation with Time

Chlordane residue variation with time is shown in Figure 5. No consistent residue decline is seen in the various data subsets analyzed. The FDA data shows a slight decline in residues from 1985 to 1986. All other data sets have increases in residues from 1985 to 1986, some significant. The reasons for these trends could be numerous, as described in the Introduction.

## Chlordane Residue Variation with Location

Chlordane residue variation with location is shown in Figure 4. Region 7 has significantly higher residues than any other location (greater than 2X the average residue for all locations). Regions 2 and 5 show slightly higher residues than the average residues for all locations, whereas all other locations show significantly lower residues. This trend corresponds very well with the source of the data: Regions 2, 5 and 7 data are primarily non-FDA data, whereas the data from the other locations are almost exclusively FDA data. Additionally, the data from Regions 2, 5 and 7 are primarily for fresh water fish, whereas the data from the other locations are for both fresh and salt water fish.

## Clordane: Other Considerations

Table 1 shows averages and tolerance limits (95% confidence, 95% population coverage, no distribution assumed) for selected data subsets. RCB's previous action level for chlordane was 0.3 ppm (M. Metzger, 3/25/87). This recommendation was based on FDA surveillance monitoring data only.

Utilizing 95% confidence and 95% coverage of the fish population, and utilizing the entire data set presently available to RCB, we estimate that residues of chlordane and its metabolites are not likely to exceed 0.4 ppm nationally with local areas of possibly higher concentration found in Region 5 (Great Lakes, maximum residue = 0.5 ppm) and Region 7 (Mississippi and Missouri Rivers and several fresh water lakes; maximum residue = 2.0 ppm).

Table 1: Chlordane Summary Statistics

| Year | Region | Water Type | Fish Type | FDA Data | Number of Samples | Average Residue (ppm) | Tolerance Limit (ppm) |
|---|---|---|---|---|---|---|---|
| 1985 | All | All | All | FDA | 936 | 0.088 | 0.240 |
| | All | All | All | All | 2156 | 0.121 | 0.335 |
| 1986 | All | All | All | FDA | 588 | 0.068 | 0.245 |
| | All | All | All | All | 863 | 0.134 | 0.539 |
| 85 + | Reg 5 | All | All | All | 480 | 0.145 | 0.450 |
| 86 | Reg 7 | All | All | All | 172 | 0.301 | 1.926 |
| | Reg 2 | All | All | All | 1758 | 0.133 | 0.368 |
| | All | All | All | FDA | 1525 | 0.080 | 0.235 |
| | All | All | All | All | 3020 | 0.125 | 0.372 |

## MIREX

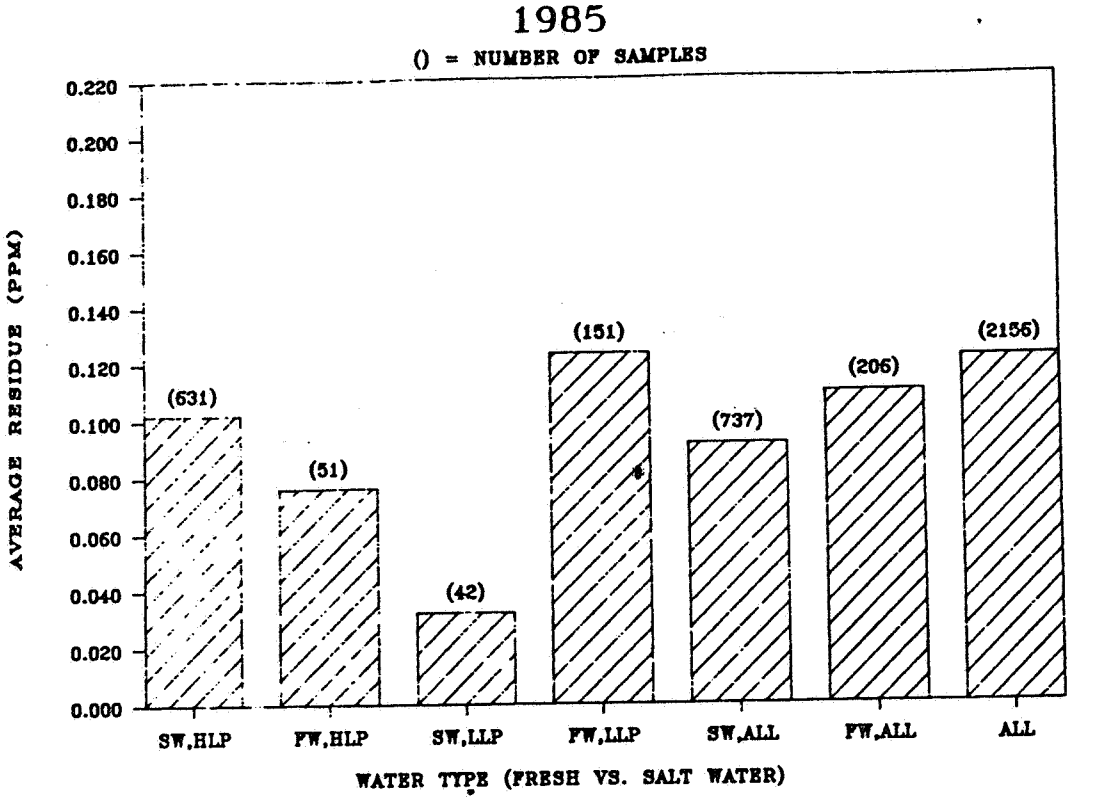
### Mirex Residue Variation with Data Source, FDA vs. Other Data

Mirex residue variation with data source is shown in Figure 7. No mirex residues were found in fish by the FDA for 1985 or 1986. In non-FDA data, mirex residues were found exclusively in Lake Ontario and the Saint Lawrence River in NY (Region 2) in 1985 only (1 detectable residue found in 1986). The difference between the FDA data and the other data could be due to FDA's not obtaining samples from the contaminated NY water bodies.

### Mirex Residue Variation with Species

Mirex residue variation with species is shown in Figure 8. Since detectable residues were found primarily only in 1985, species variation can be observed only for 1^85 data. However,

Figure 1:
CHLORDANE: Residue Variation with Water Type (Salt vs. Fresh Water)



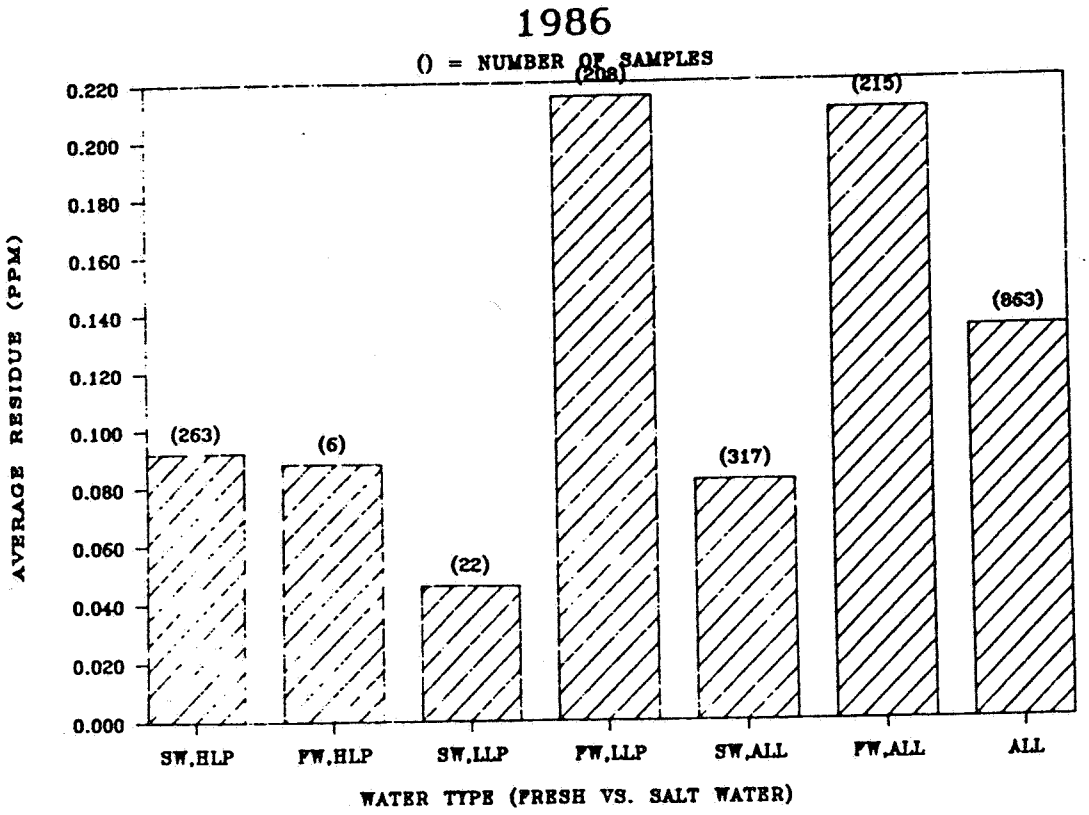
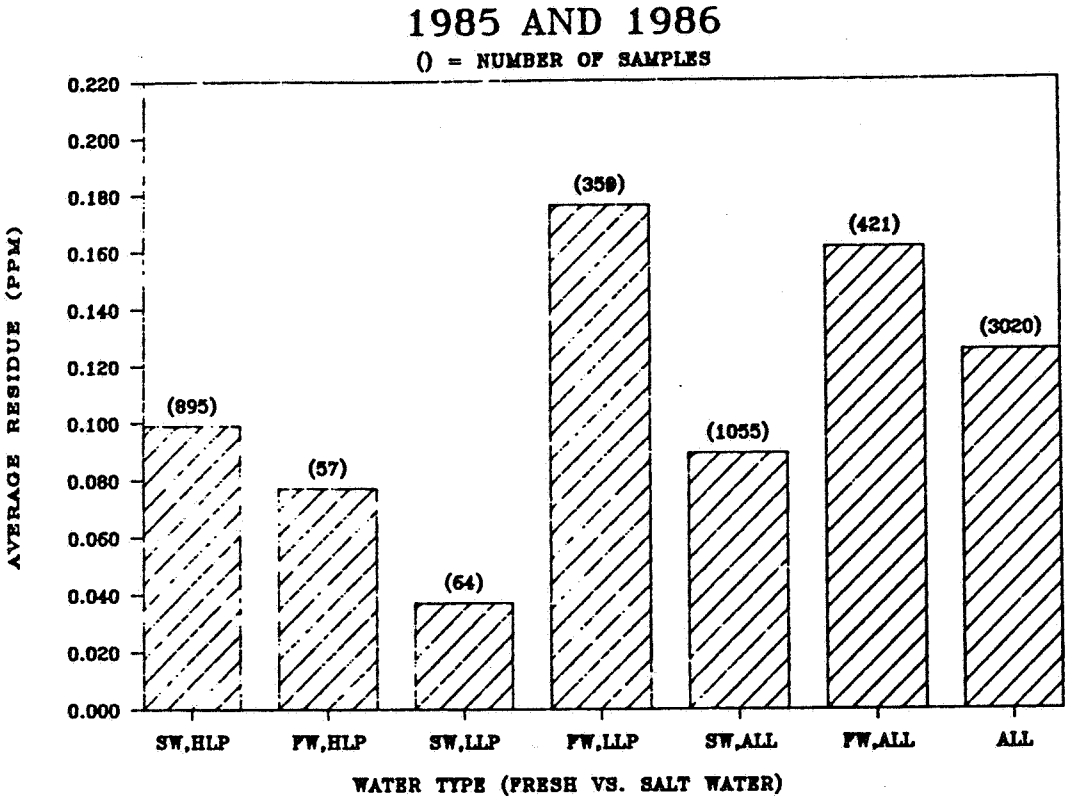
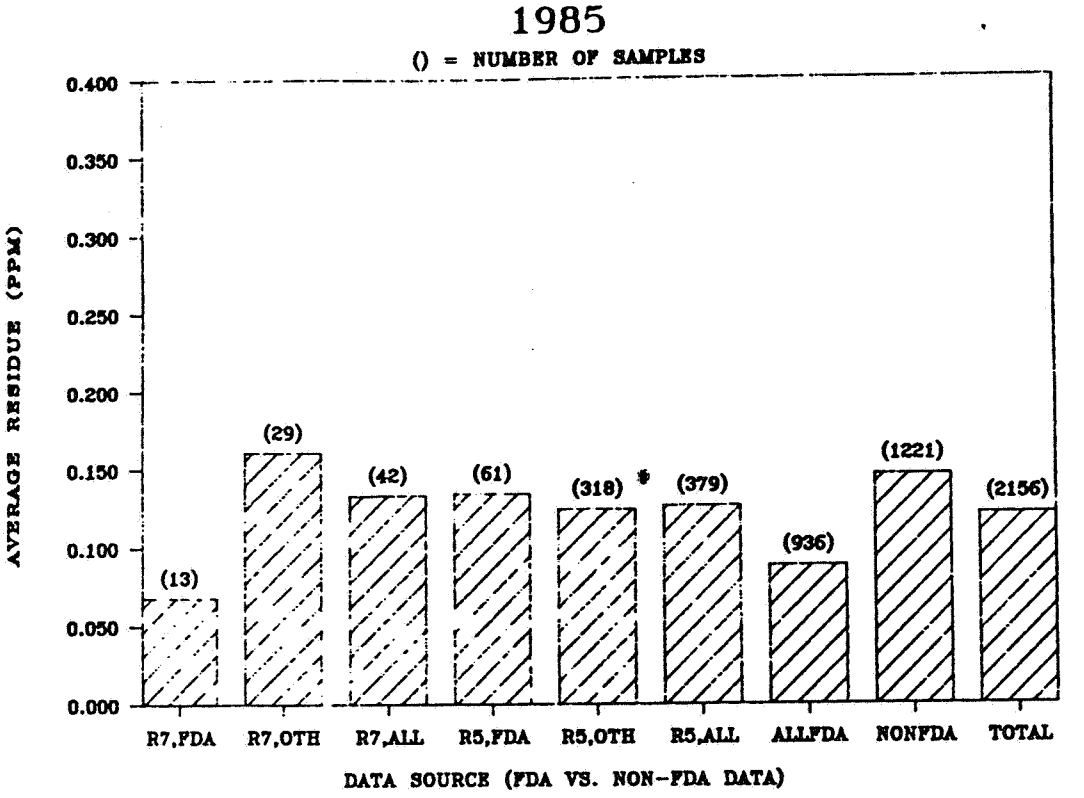



Figure 1 (cont.):
CHLORDANE: Residue Variation with Water Type (Salt vs. Fresh Water)




SW = Salt Water Fish
HLP = High level predatory fish
FW = Fresh water fish
LLP = Low level predatory / bottom-feeding fish
All = All high level predatory and low level predatory / bottom-feeding fish

Figure 2:
CHLORDANE: Residue Variation with Data Source (FDA vs. Non-FDA data)



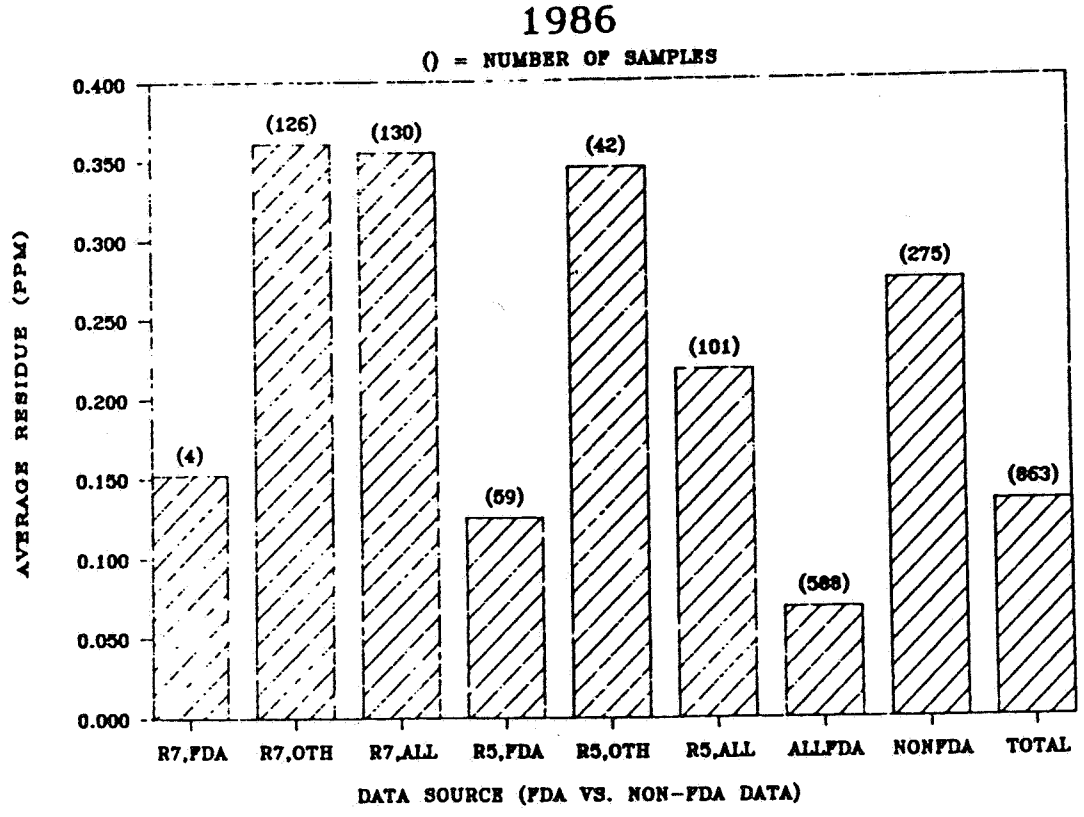
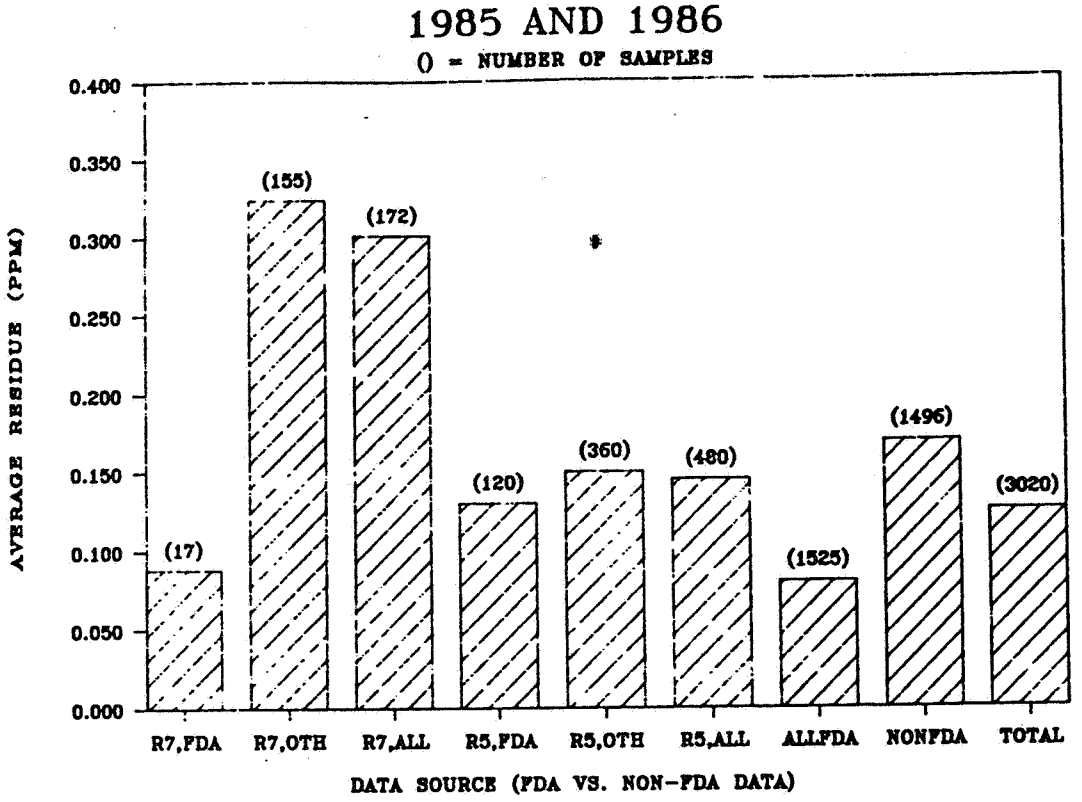
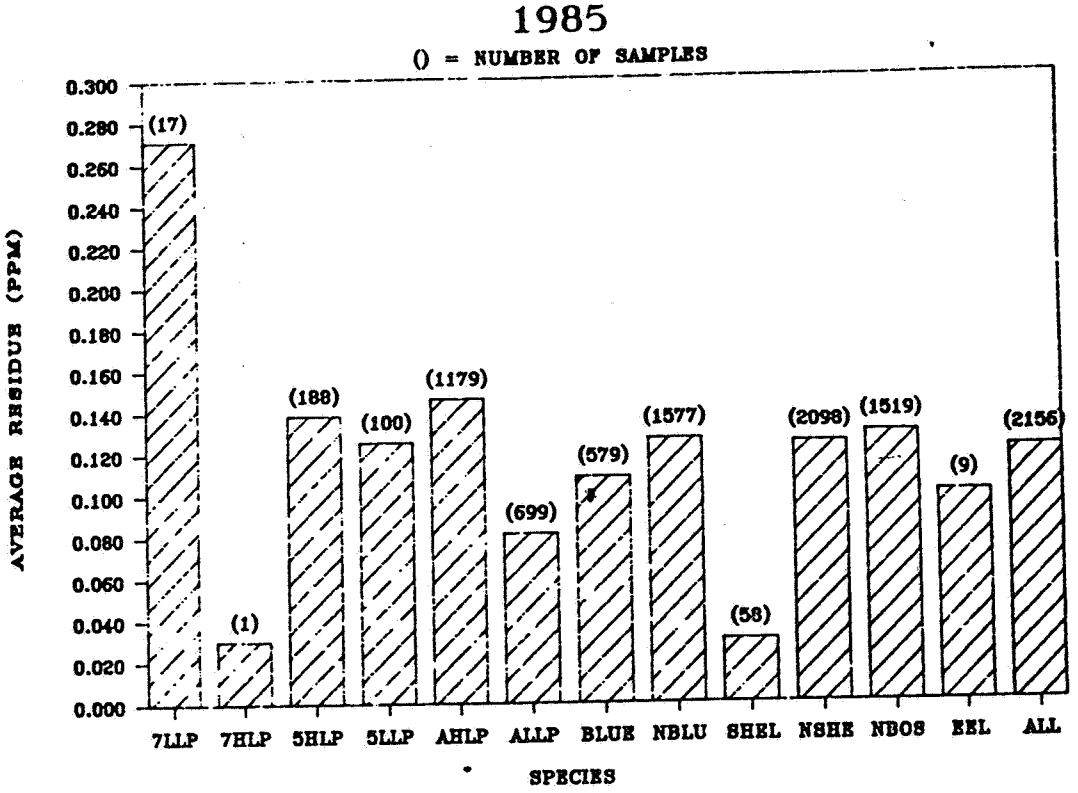



Figure 2 (Cont.):
CHLORDANE: Residue Variation with Data Source (FDA vs. Non-FDA data)




R7 = EPA Region 7
R5 = EPA Region 5
FDA = FDA data only
OTH = All data other than FDA data
ALL = All FDA data and other (non-FDA) data
ALLFDA = FDA data from all locations
NONFDA = All data other than FDA data from all locations
TOTAL = All data

Figure 3:
CHLORDANE: Residue Variation with Species of Fish



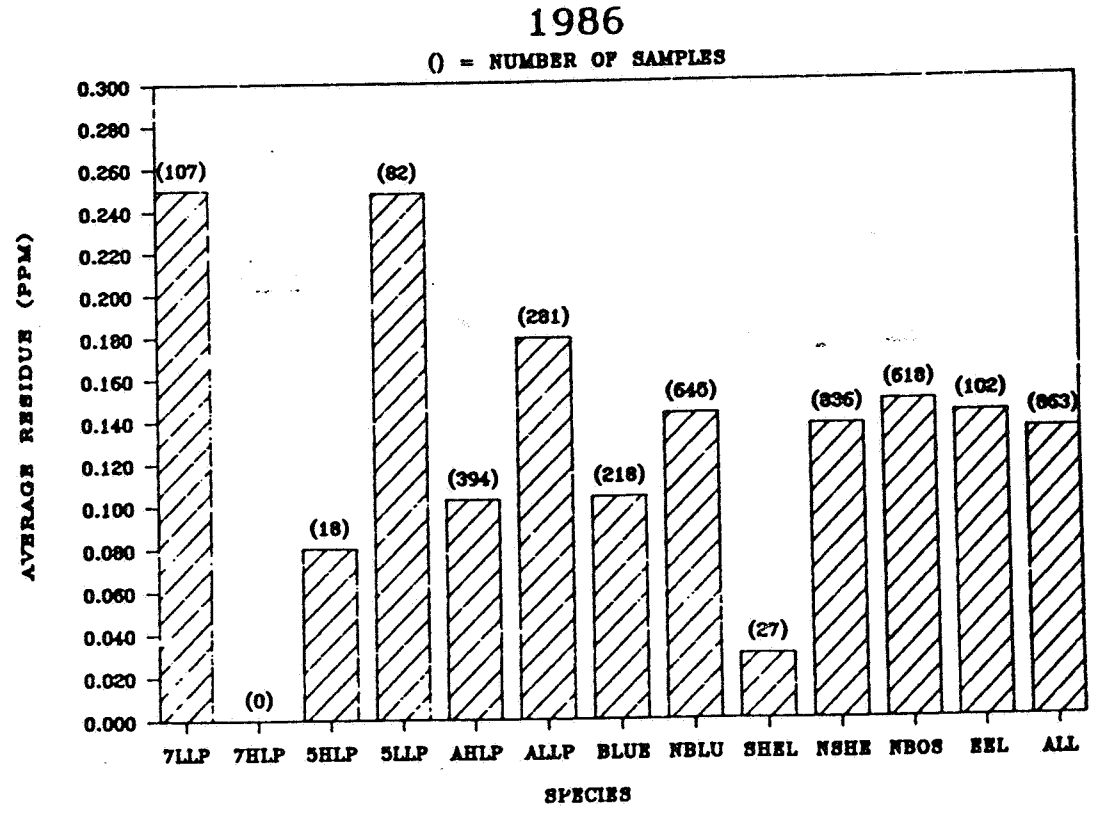
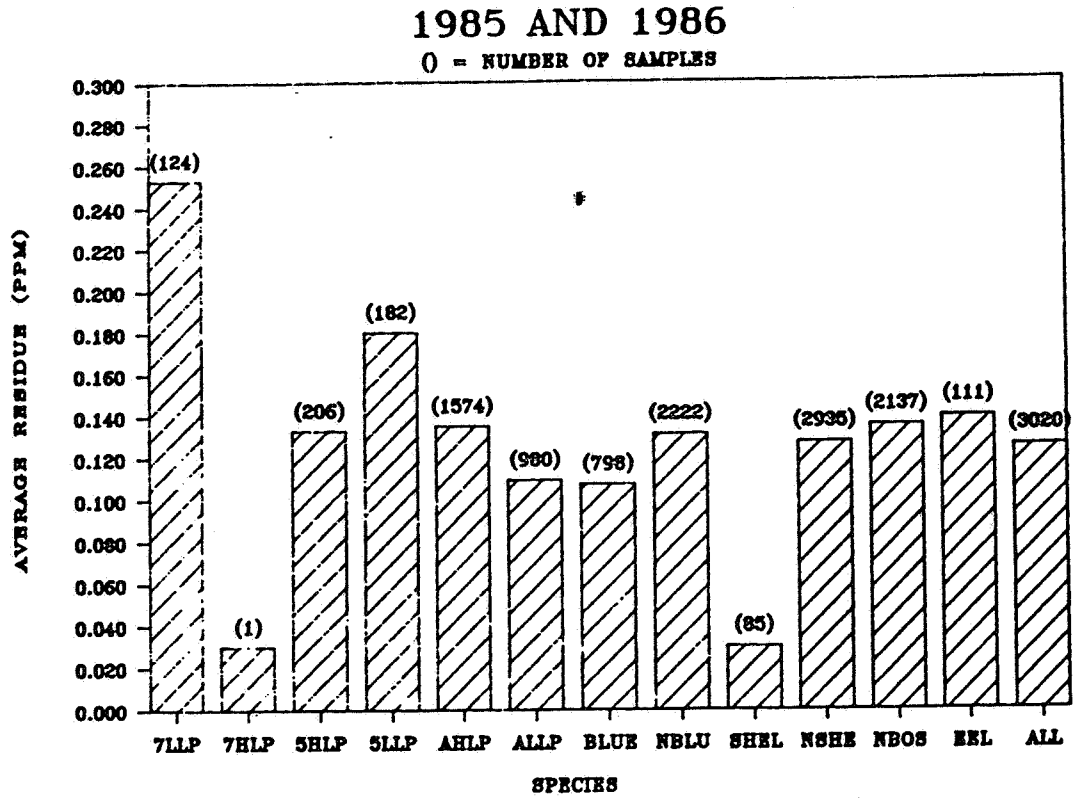
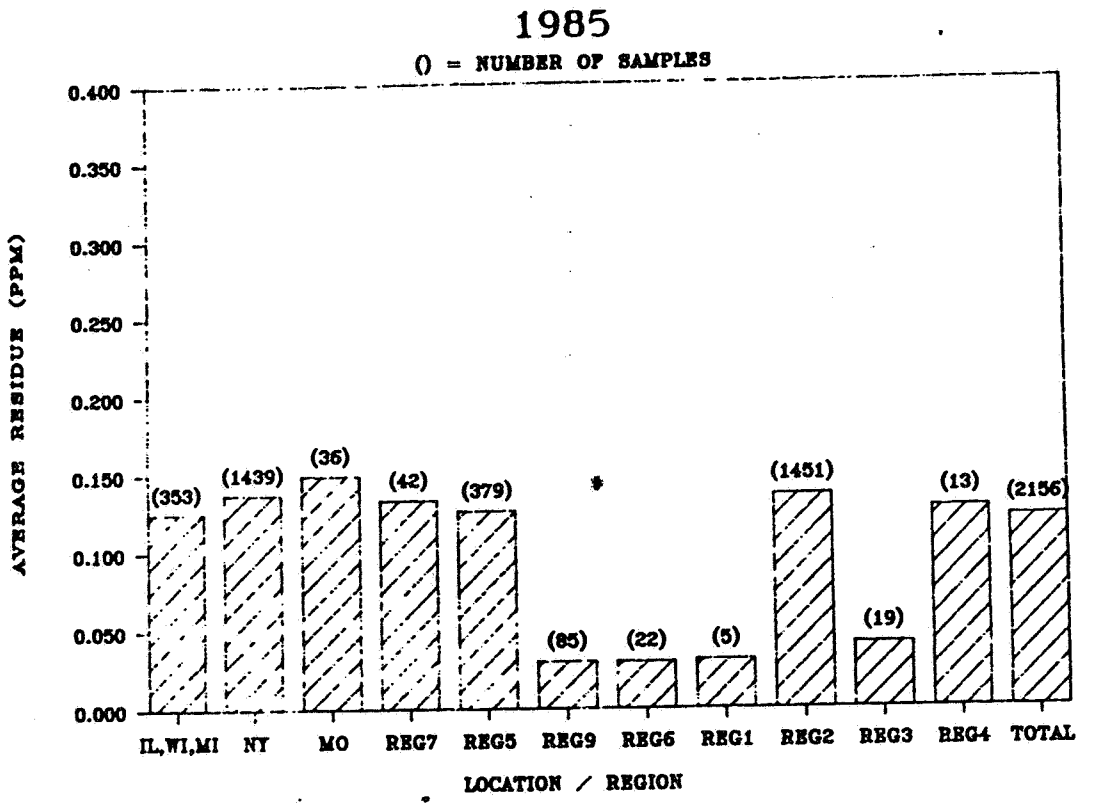



Figure 3 (Cont.):
CHLORDANE: Residue Variation with Species of Fish




7LLP = EPA Region 7, low level predatory and bottom-feeding fish
7HLP = EPA Region 7, high level predatory fish
5HLP = EPA Region 5, high level predatory fish
5LLP = EPA Region 5, low level predatory and bottom-feeding fish
AHLP = High level predators, all locations
ALLP = Low level predators, all locations
BLUE = Bluefish
NBLU = All fish except Bluefish
SHEL = Shellfish
NSHE = All fish except shellfish
NBOS = All fish except Bluefish and shellfish
EEL = American Eels
ALL = All fish

Figure 4:
CHLORDANE: Residue Variation with Location / Region



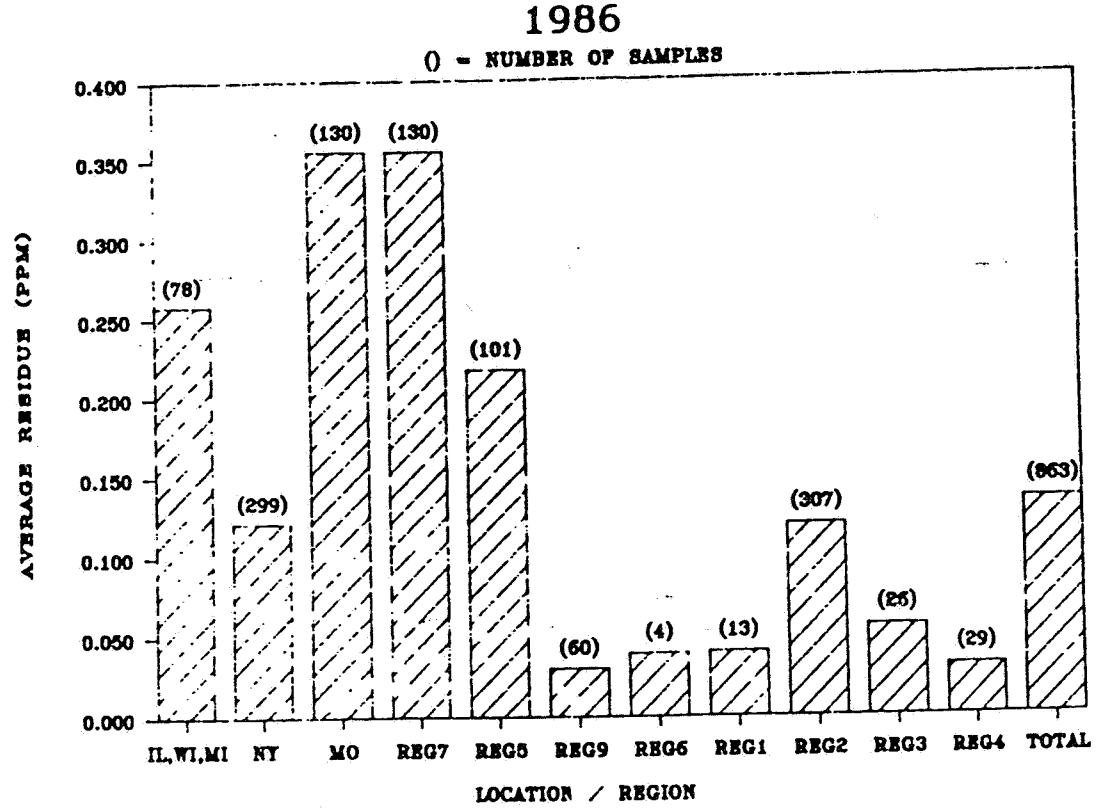
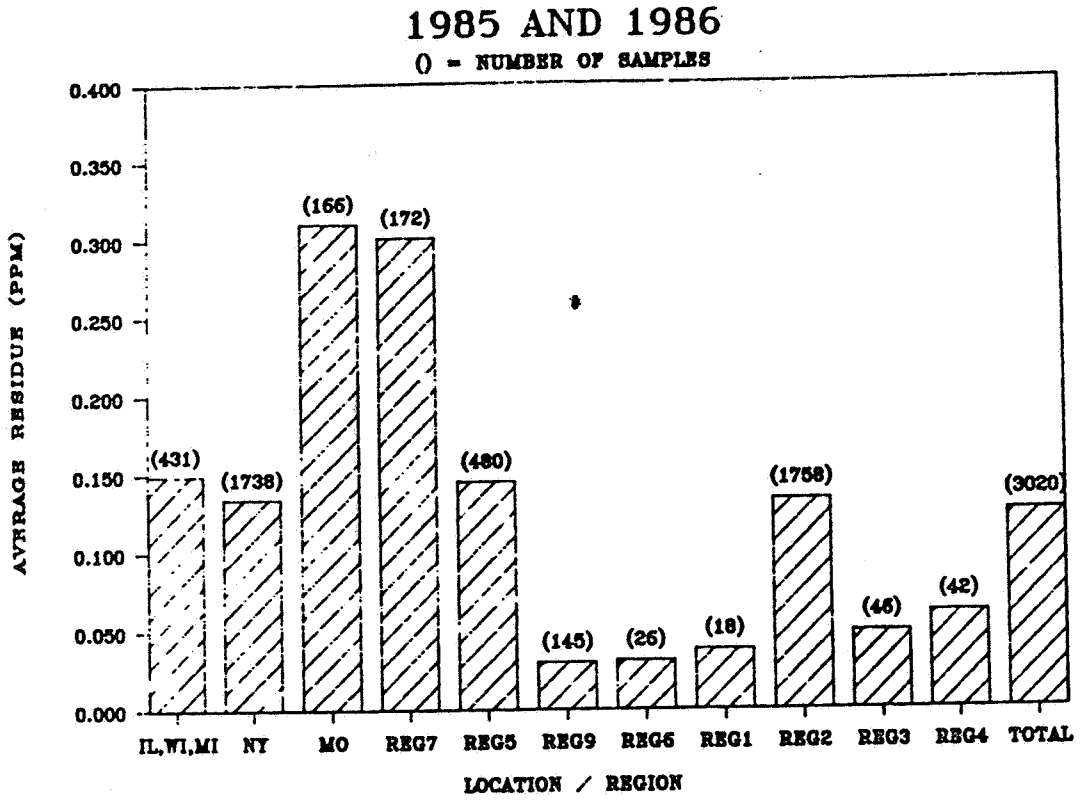
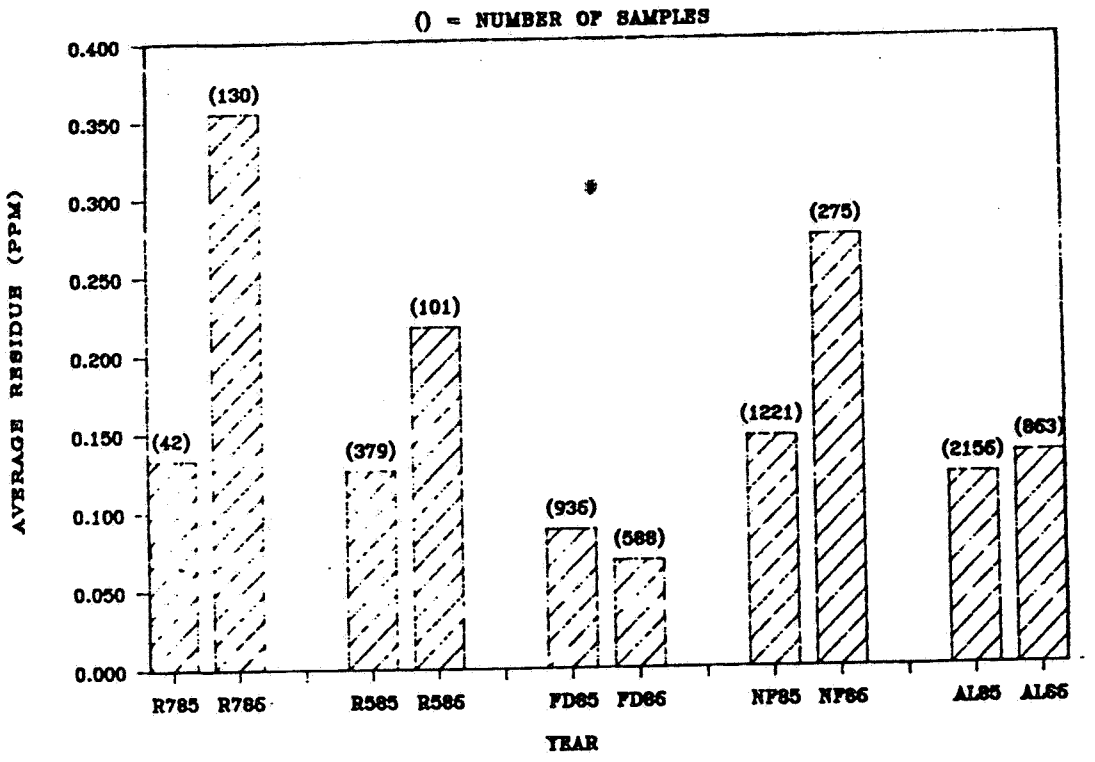



Figure 4 (Cont.):
CHLORDANE: Residue Variation with Location / Region




IL,WI,MI = Illinois, Wisconsin and Michigan
NY = New York
MO = Missouri
REGX = EPA Region X
TOTAL = Combined data from all locations

Figure 5:
CHLORDANE: Residue Variation with Time




R785 = EPA Region 7 data, 1985
R786 = EPA Region 7 data, 1986
R585 = EPA Region 5 data, 1985
R586 = EPA Region 5 data, 1986
FD85 = FDA data, 1985
FD86 = FDA data, 1986
NF85 = All data except FDA data, 1985
NF86 = All data except FDA data, 1986
AL85 = All data, 1985
AL86 = All data, 1986

since most of the samples were obtained from NY and were primarily high level predators (trout), comparison of mirex residues based on fish species is impossible.

## Mirex Residue Variation with Aquatic Environment

Mirex residue variation with aquatic environment (water type, fresh vs. salt water) is shown in Figure 6. All of the NY data were for bass and trout. These were not included under either the fresh water or salt water categories since different species of these fish could be either fresh or salt water fish, and since in many cases, whether the fish were fresh or salt water was not specified. Therefore, we are unable to identify trends in mirex residue concentration for fresh vs. salt water fish.

The 1985 and combined 1985 + 1986 data sets show higher average residue values for all fish than for individual subsets. This is due to detectable mirex residues only being found in species not fitting into any of the fish type categories shown in the graph.

## Residue Variation with Time

Mirex residue variation with time is shown in Figure 10. Most of the samples from NY were obtained in 1985 except for American eels in which mirex residues were not found. Therefore, mirex residue variation with time cannot be estimated using these data.

## Mirex Residue Variation with Location

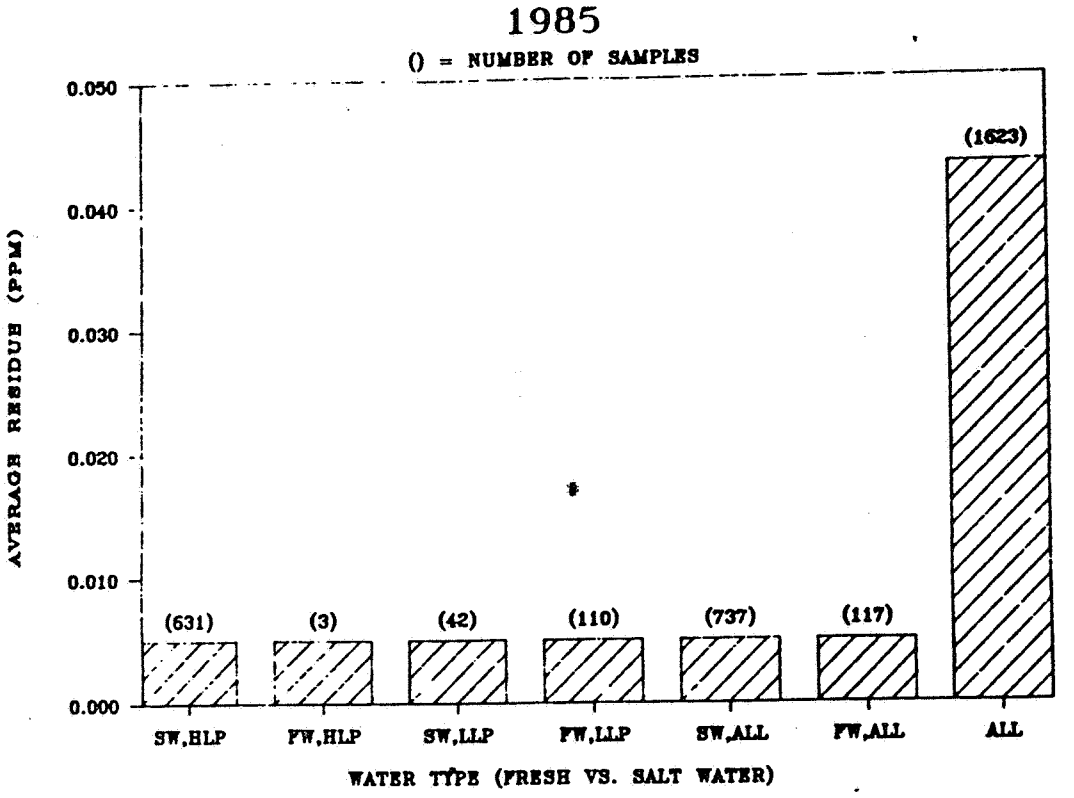
Mirex residue variation with location is shown in Figure 9. Detectable residues of mirex were found only in 1985 in NY (Region 2) in Lake Ontario and in the Saint Lawrence River, and only in samples analyzed in programs monitored by the state of NY. All other laboratories and locations monitoring for residues of mirex showed no detectable residues.

## Mirex: Other Considerations

Table 2 shows averages and tolerance limits (95% confidence, 95% coverage of the population, no distribution assumed) for selected data subsets. RCB previously recommended that no replacement action level be set for residues of mirex in fish since no mirex residues were found in fish by the FDA (M. Metzger, 3/25/87).

Utilizing 95% confidence with 95% coverage of the population and utilizing the data set currently available to RCB, we estimate that mirex residues are not likely to exceed 0.3 ppm nationally and 0.4 ppm in Region 2 (NY). Residues found in fish from most locations would be considerably less than these values.

Figure 6:
MIREX: Residue Variation with Water Type (Salt vs. Fresh Water)



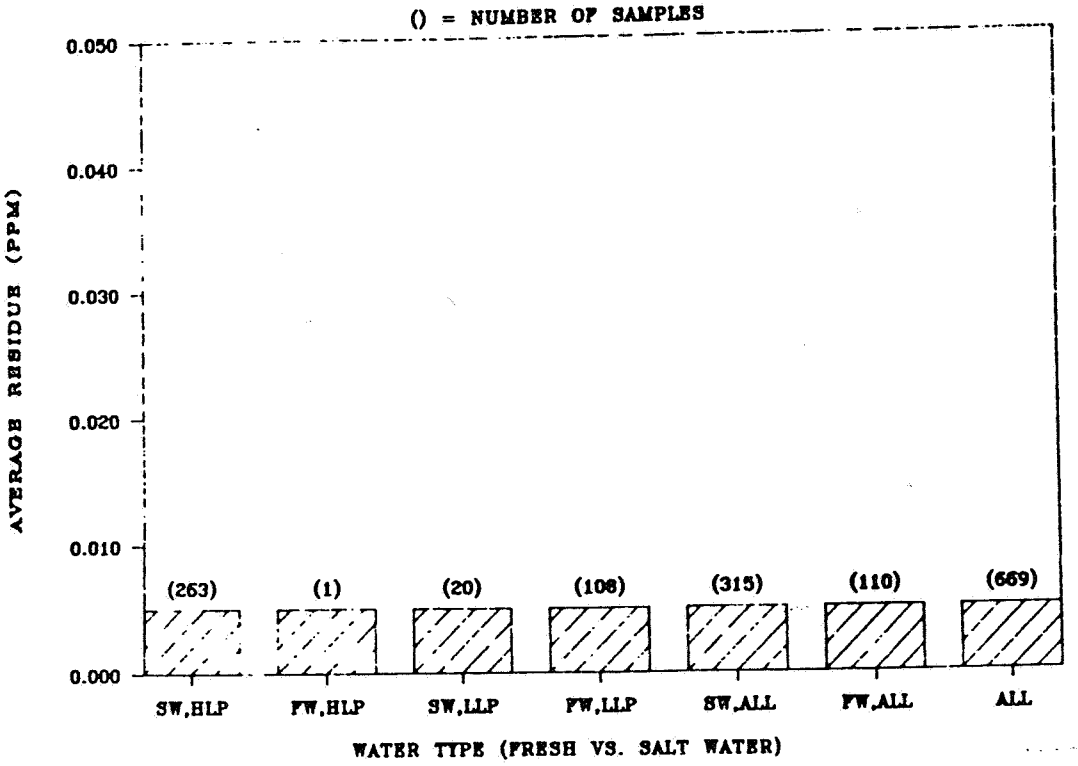
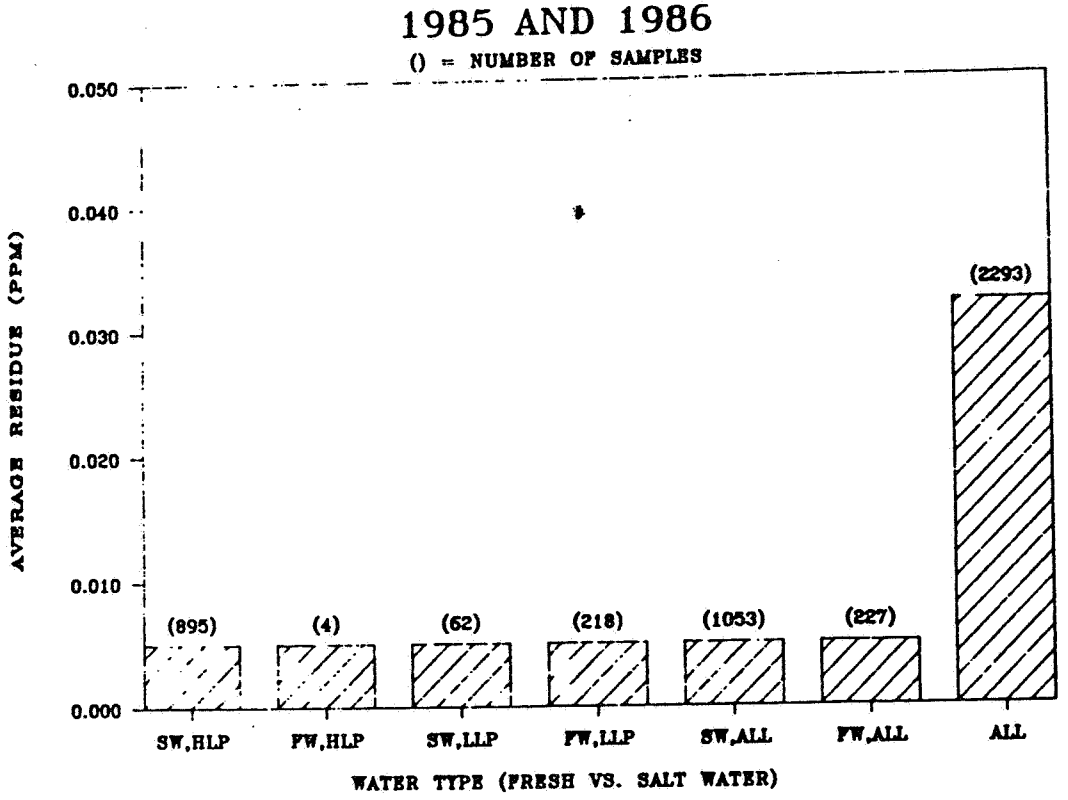
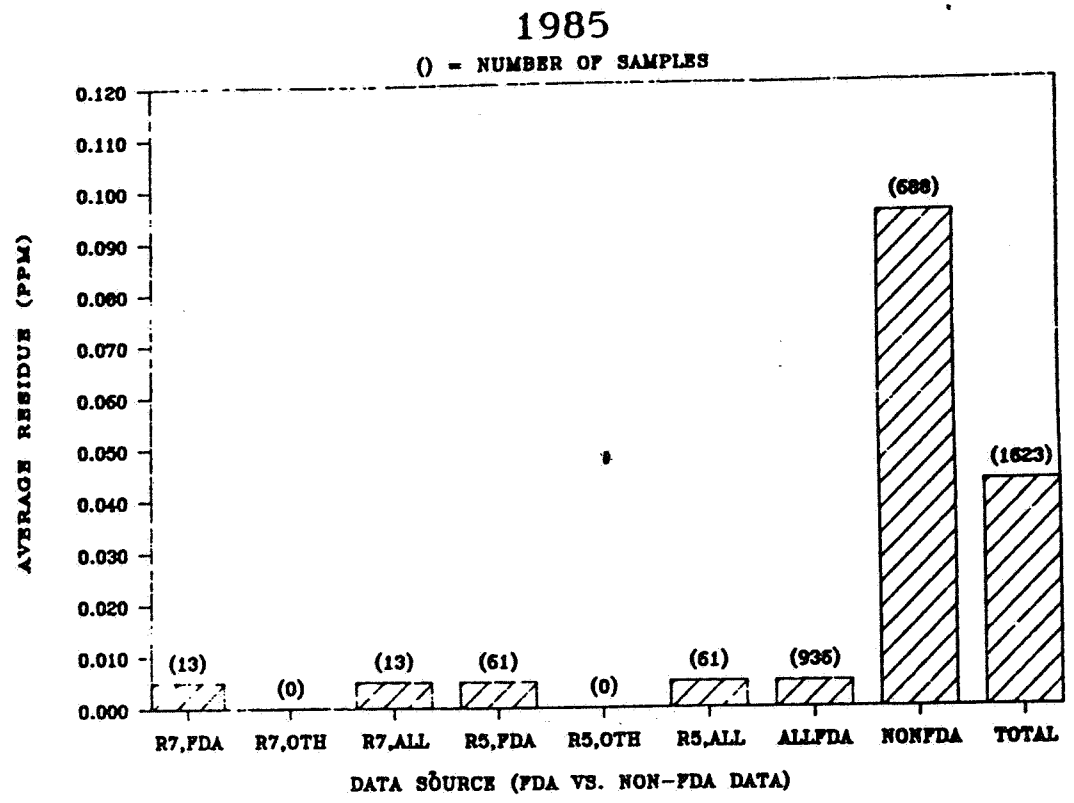



Figure 6 (Cont.):
MIREX: Residue Variation with Water Type (Salt vs. Fresh Water)




SW = Salt Water Fish
HLP = High level predatory fish
FW = Fresh water fish
LLP = Low level predatory / bottom-feeding fish
All = All high level predatory and low level predatory / bottom-feeding fish

Figure 7:
MIREX: Residue Variation with Data Source (FDA vs. Non-FDA data)



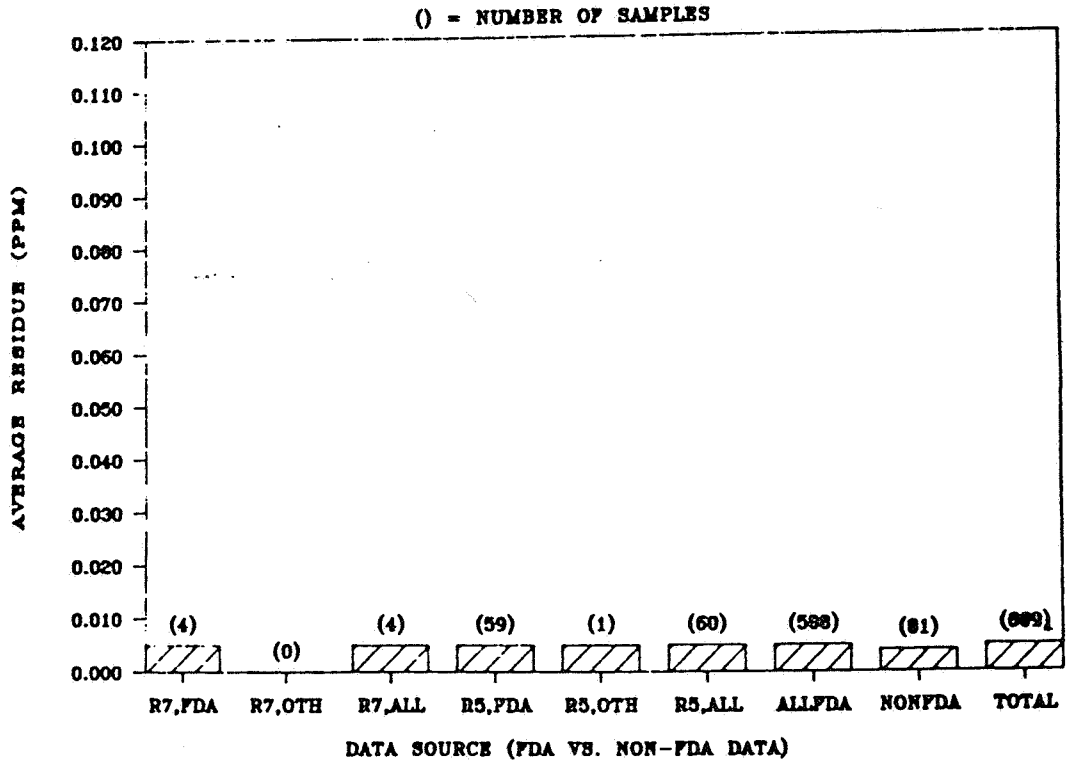
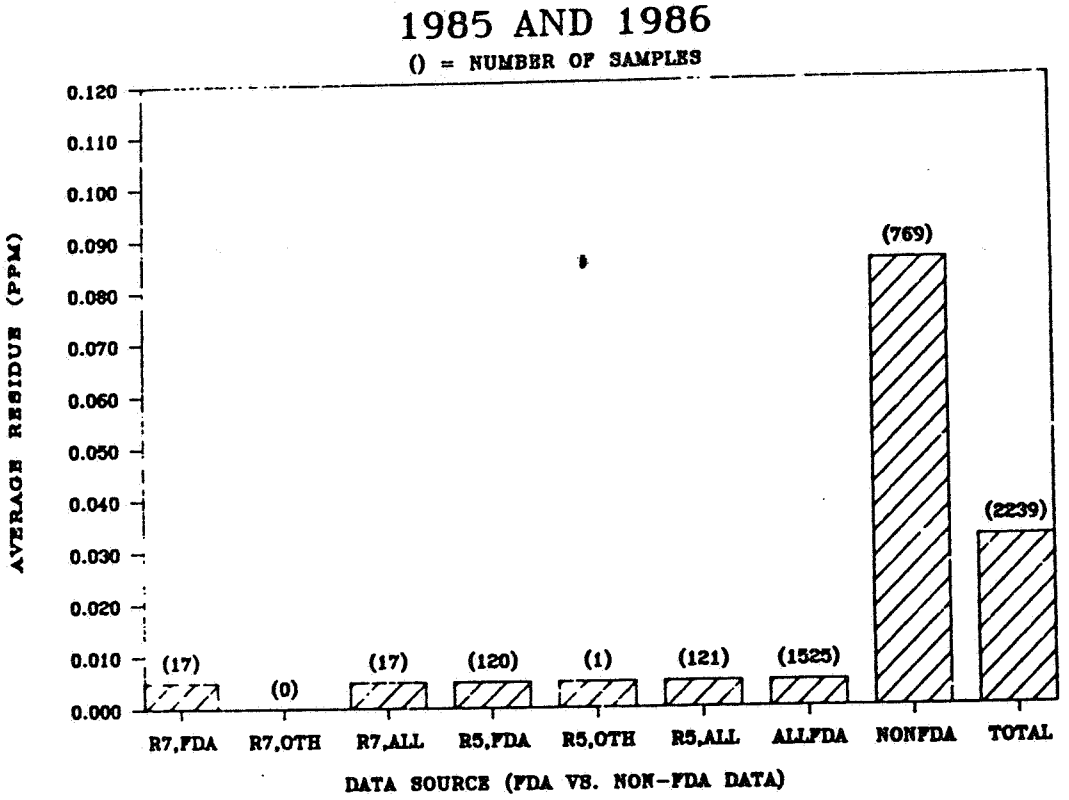



Figure 7 (Cont.):
MIREX: Residue Variation with Data Source (FDA vs. Non-FDA data)




R7 = EPA Region 7
R5 = EPA Region 5
FDA = FDA data only
OTH = All data other than FDA data
ALL = All FDA data and other (non-FDA) data
ALLFDA = FDA data from all locations
NONFDA = All data other than FDA data from all locations
TOTAL = All data

Figure 8:
MIREX: Residue Variation with Species of Fish

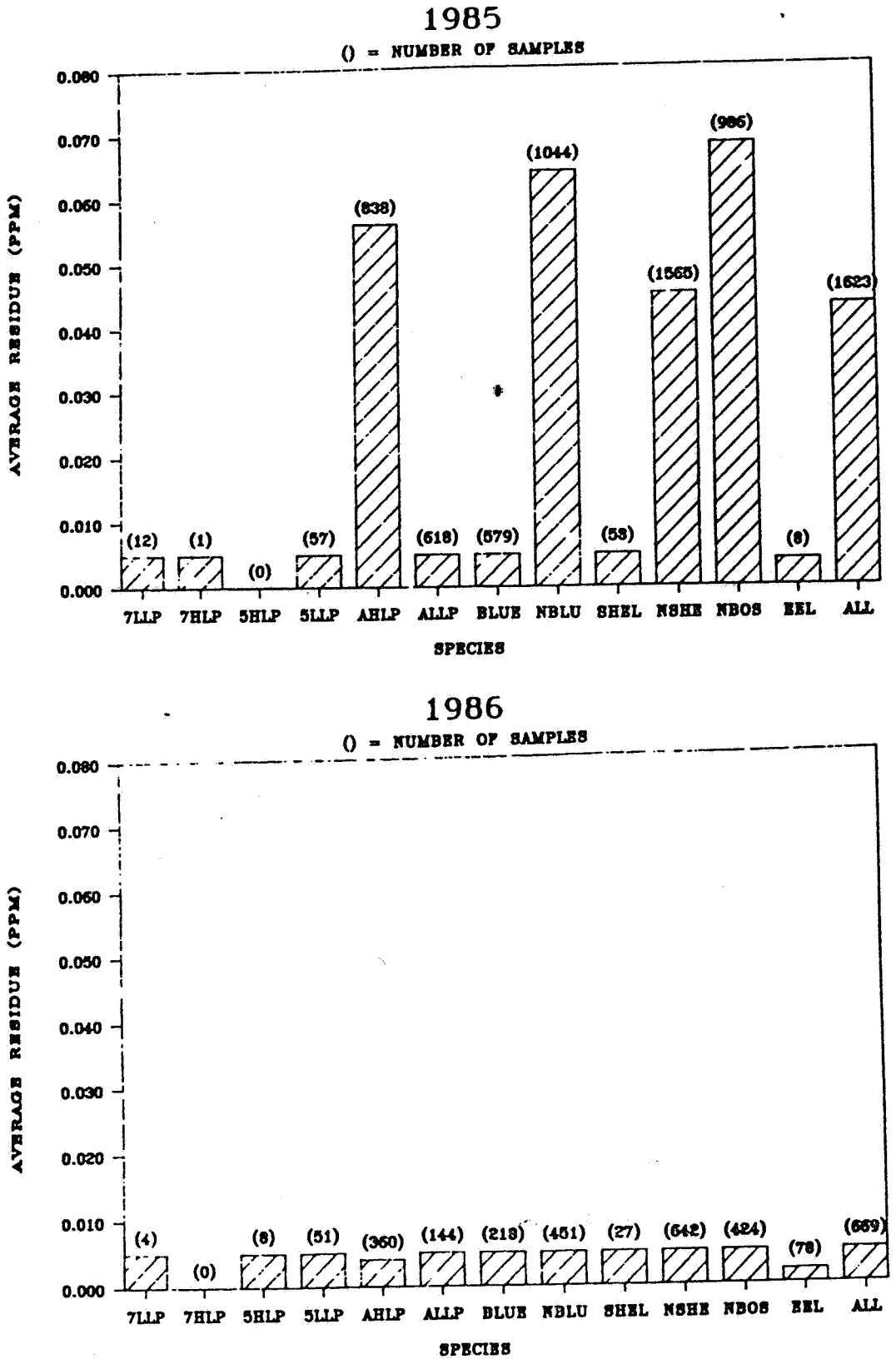
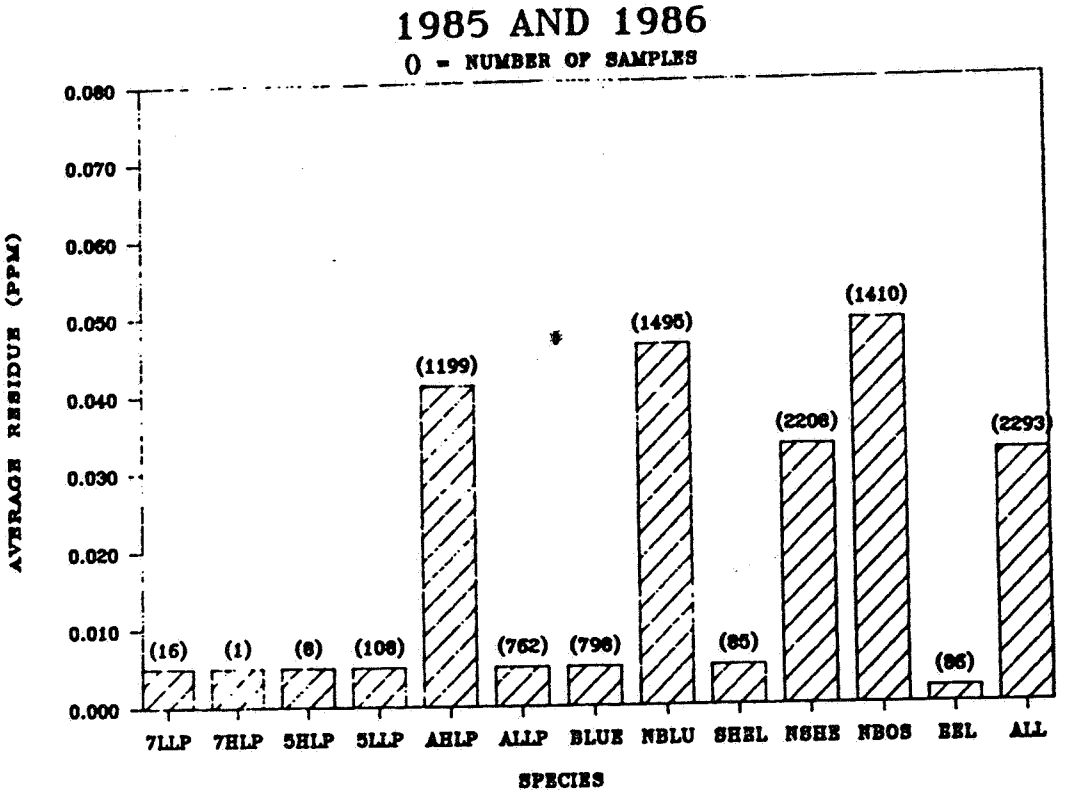
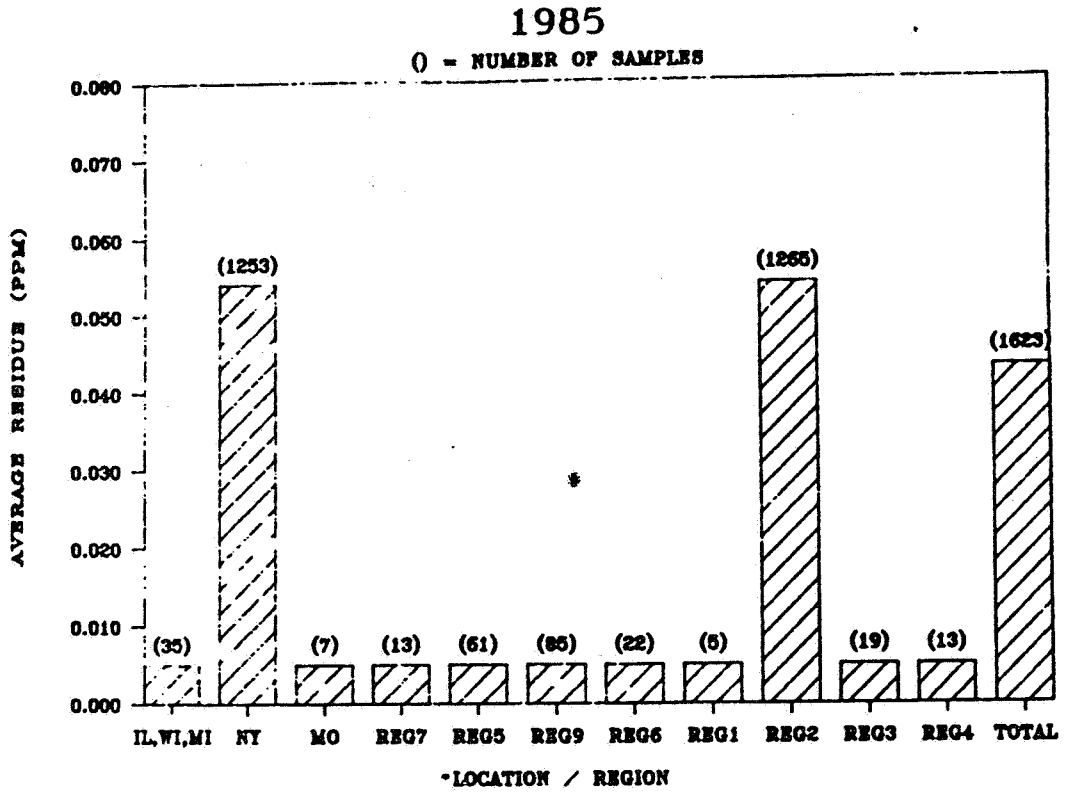


Figure 8 (Cont.):
MIREX: Residue Variation with Species of Fish




7LLP = EPA Region 7, low level predatory and bottom-feeding fish
7HLP = EPA Region 7, high level predatory fish
5HLP = EPA Region 5, high level predatory fish
5LLP = EPA Region 5, low level predatory and bottom-feeding fish
AHLP = High level predators, all locations
ALLP = Low level predators, all locations
BLUE = Bluefish
NBLU = All fish except Bluefish
SHEL = Shellfish
NSHE = All fish except shellfish
NBOS = All fish except Bluefish and shellfish
EEL = American Eels
ALL = All fish

Figure 9:
MIREX: Residue Variation with Location / Region



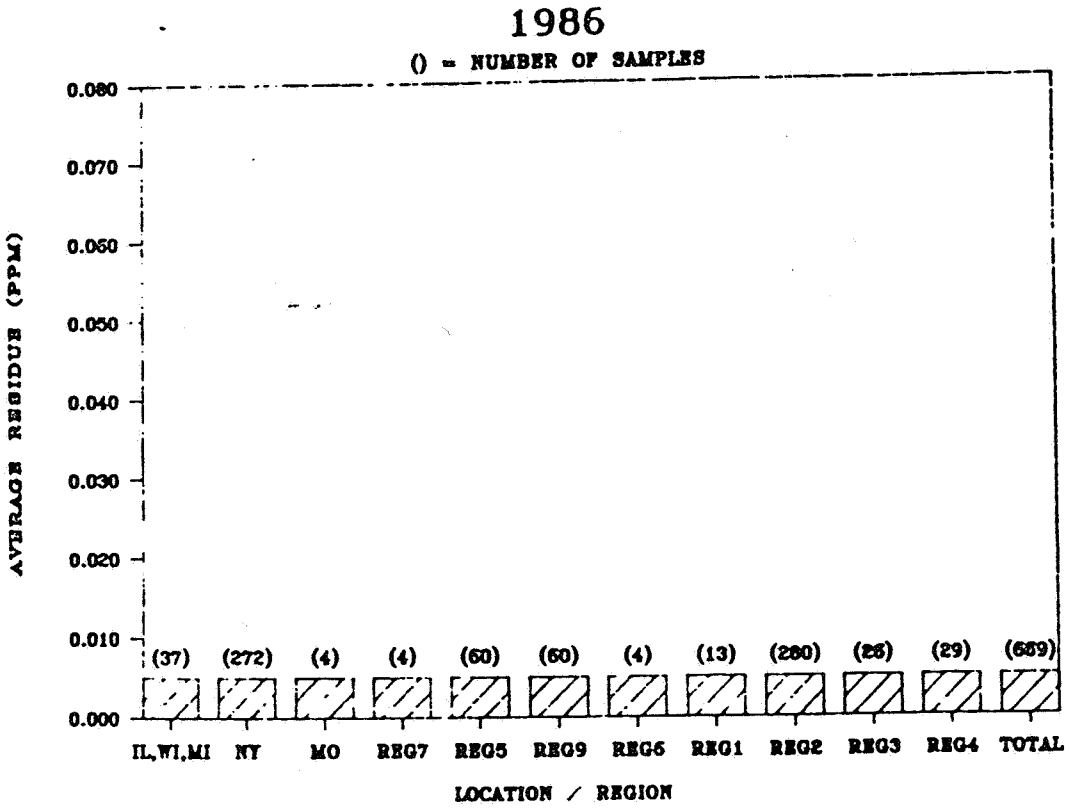
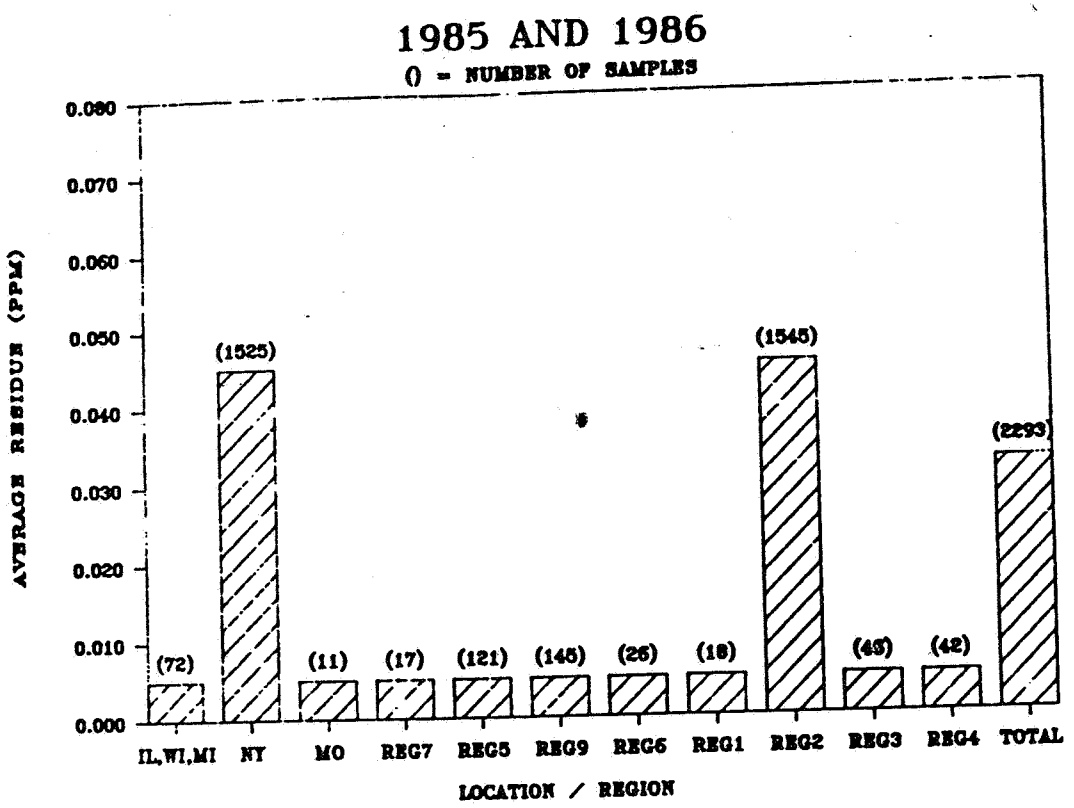
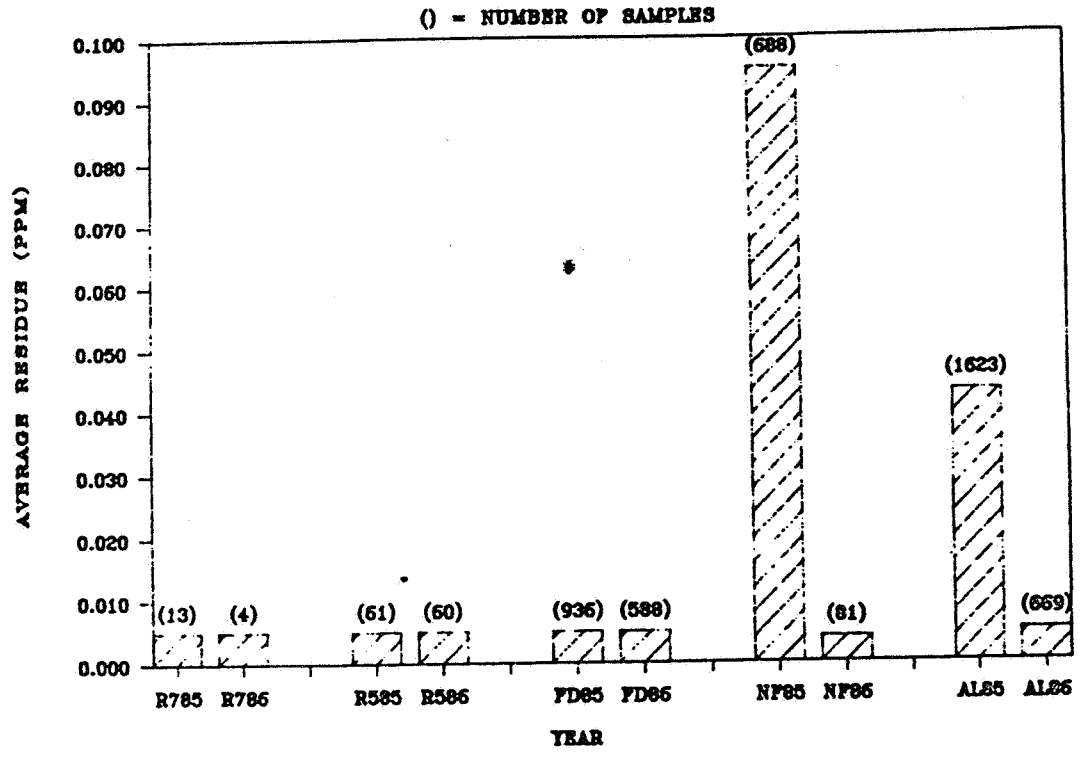



Figure 9 (Cont.):
MIREX: Residue Variation with Location / Region




IL,WI,MI = Illinois, Wisconsin and Michigan
NY = New York
MO = Missouri
REGX = EPA Region X
TOTAL = Combined data from all locations

Figure 10:
MIREX: Residue Variation with Time




R785 = EPA Region 7 data, 1985
R786 = EPA Region 7 data, 1986
R585 = EPA Region 5 data, 1985
R586 = EPA Region 5 data, 1986
FD85 = FDA data, 1985
FD86 = FDA data, 1986
NF85 = All data except FDA data, 1985
NF86 = All data except FDA data, 1986
AL85 = All data, 1985
AL86 = All data, 1986

Table 2: Mirex Summary Statistics

| Year | Region | Water Type | Fish Type | FDA | Number of Samples | Average (ppm) | Tolerance Limit (ppm) |
|---|---|---|---|---|---|---|---|
| 1985 | All | All | All | FDA | 936 | 0.005 | 0.005 |
| | All | All | All | All | 1623 | 0.043 | 0.351 |
| 1986 | All | All | All | FDA | 588 | 0.005 | 0.005 |
| | All | All | All | All | 81 | 0.004 | 0.108 |
| 85 + | Reg 5 | All | All | All | 121 | 0.005 | 0.005 |
| 86 | Reg 7 | All | All | All | 17 | 0.005 | 0.005 |
| | Reg 2 | All | All | All | 1545 | 0.045 | 0.355 |
| | All | All | All | FDA | 1525 | 0.005 | 0.005 |
| | All | All | All | All | 2293 | 0.032 | 0.252 |

## HEPTACHLOR

### Heptachlor Residue Variation with Data Source, FDA vs. Other Data

Heptachlor residue variation with data source is shown in Figure 12. For combined 1985 + 1986 data, the average for the FDA data is greater than that for the non-FDA data (difference = 0.007 ppm). This trend is consistent for both years, and is also seen in the Region 5 data subset (difference = 0.021 ppm for combined 1985 + 1986 data). The opposite trend, but of smaller magnitude (i.e. averages for non-FDA data greater than those for FDA data), is seen for the Region 7 data.

### Heptachlor Residue Variation with Species

Heptachlor residue variation with species is shown in Figure 13. Since most of the samples analyzed for heptachlor from all locations and species showed no detectable residues, trends in residue variation cannot be seen for most species. It can be seen, however, that low level predators/bottom-feeding species from Region 5 had higher average residues than those for the entire data set. The apparent lower average residues for American eels is due to a lower limit of detection for the analytical method used to determine residues in this species.

### Heptachlor Residue Variation with Aquatic Environment

Heptachlor residue variation with aquatic environment (water type, fresh vs. salt water) is shown in Figure 11. Low level predators/bottom-feeding species and the entire data set show higher average residues for fresh water species than for salt water fish. High level predators show the opposite trend with salt water species having higher residues than fresh water fish. These trends are consistent over both years.

## Heptachlor Residue Variation with Time

Heptachlor residue variation with time is shown in Figure 15. In all cases shown, an apparent increase in the average residues is seen going from 1985 to 1986. The possible reasons for this trend are numerous and cannot be determined from the available data.

## Heptachlor Residue Variation with Location

Heptachlor residue variation with location is shown in Figure 14. For all locations analyzed other than Region 5, the average residues found are approximately equal to the national average.

Heptachlor residues from Region 5, particularly in samples from the Great Lakes, are significantly higher than the national average (difference = 0.008 ppm for combined 1985 + 1986 data; difference = 0.019 ppm for IL,MI,WI, 1986).

## Heptachlor: Other Considerations

Table 3 shows the average residues and the tolerance limits (utilizing 95% confidence, 95% coverage of the fish population, no distribution assumed) for select data subsets. RCB previously recommended an action level for combined residues of heptachlor and heptachlor epoxide of 0.02 ppm based on FDA surveillance monitoring data for FY 1985 and FY 1986 (M. Metzger, 3/25/87).

Utilizing 95% confidence and 95% population coverage and using the entire data set currently available to RCB, we estimate that heptachlor residues are not likely to exceed 0.02 ppm nationally, and 0.1 ppm in Regions 5 and 7. Residues would likely be less than these values in most locations.

Table 3: Heptachlor Summary Statistics

| Year | Region | Water Type | Fish Type | FDA | Number of Samples | Average (ppm) | Tolerance Limit (ppm) |
|---|---|---|---|---|---|---|---|
| 1985 | All | All | All | FDA | 936 | 0.011 | 0.015 |
| | All | All | All | All | 1503 | 0.010 | 0.013 |
| 1986 | All | All | All | FDA | 588 | 0.012 | 0.025 |
| | All | All | All | All | 801 | 0.011 | 0.035 |
| 85 + | Reg 5 | All | All | All | 210 | 0.019 | 0.085 |
| 86 | Reg 7 | All | All | All | 147 | 0.010 | 0.086 |
| | Reg 2 | All | All | All | 1338 | 0.008 | 0.010 |
| | All | All | All | FDA | 1525 | 0.012 | 0.015 |
| | All | All | All | All | 2305 | 0.010 | 0.015 |

Figure 11:
HEPTACHLOR: Residue Variation with Water Type (Salt vs. Fresh Water)

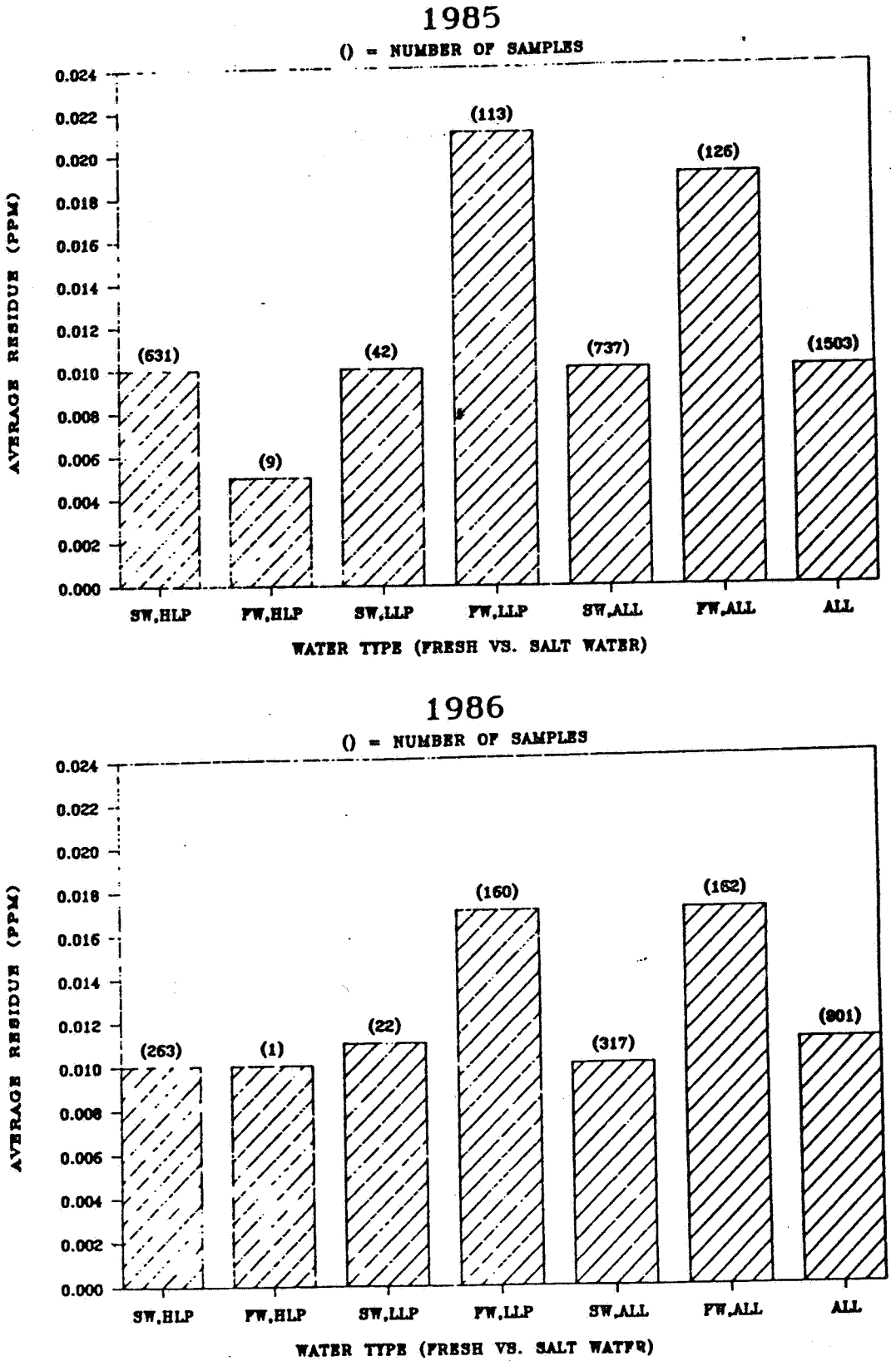
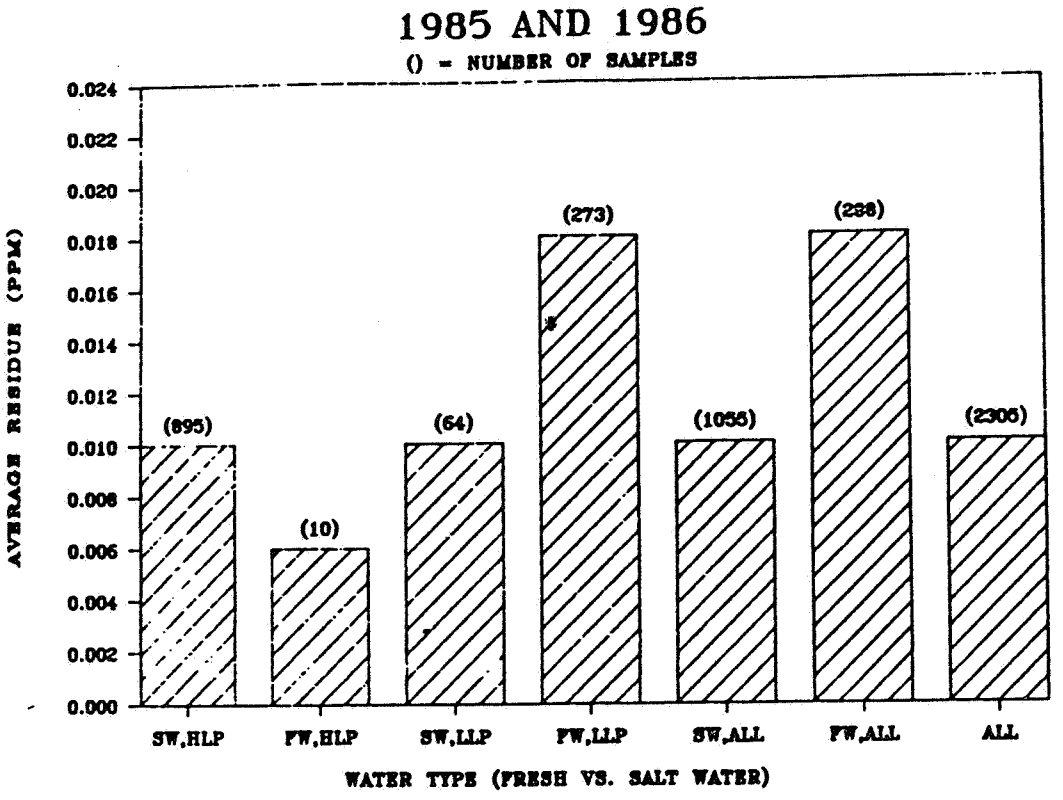
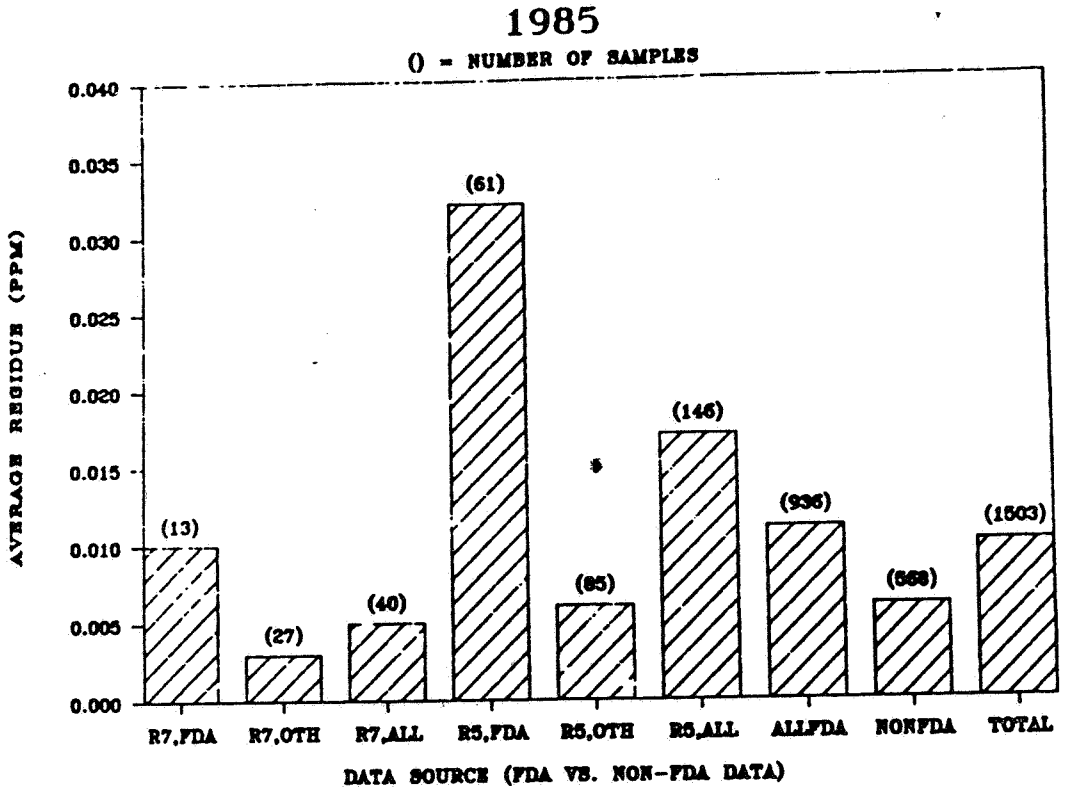


Figure 11 (Cont.):
HEPTACHLOR: Residue Variation with Water Type (Salt vs. Fresh Water)




SW = Salt Water Fish
HLP = High level predatory fish
FW = Fresh water fish
LLP = Low level predatory / bottom-feeding fish
All = All high level predatory and low level predatory / bottom-feeding fish

Figure 12:
HEPTACHLOR: Residue Variation with Data Source (FDA vs. Non-FDA data)



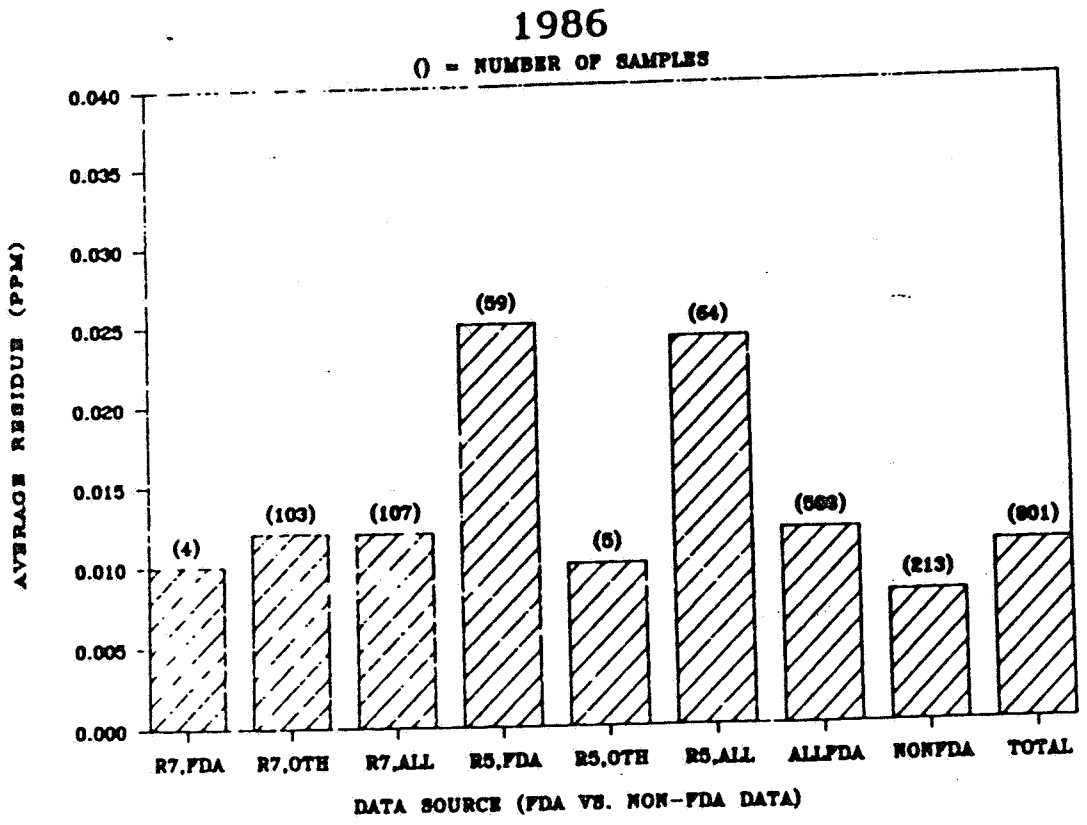
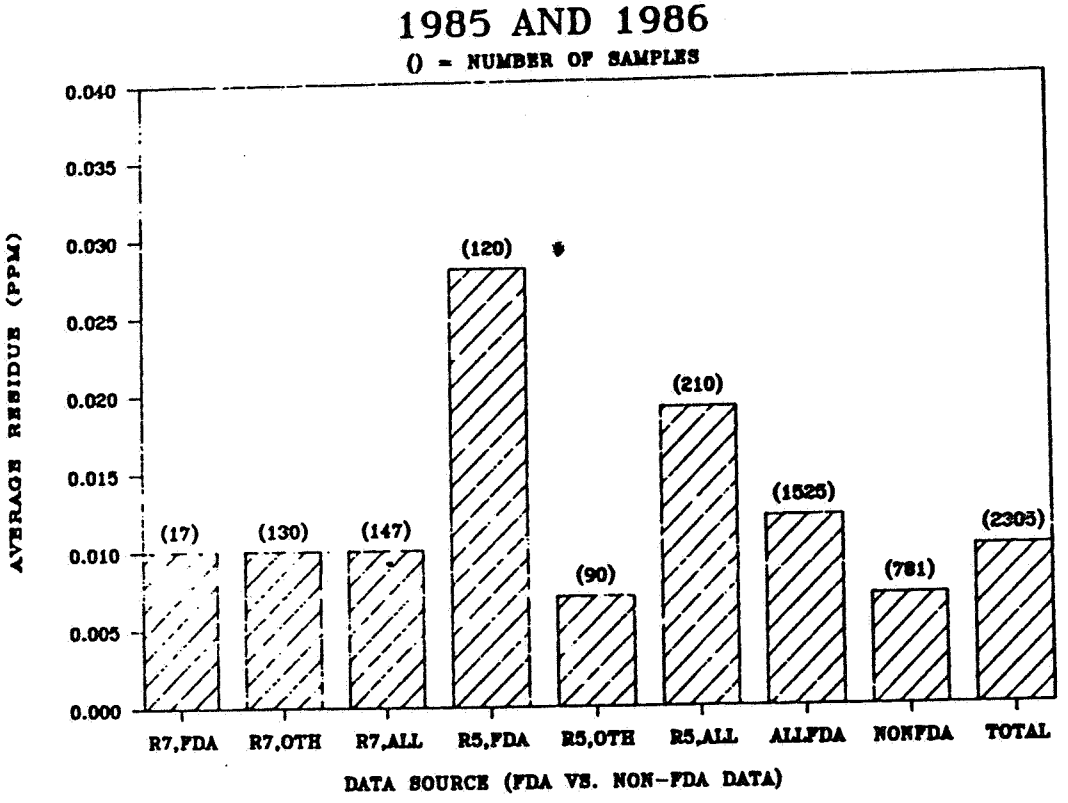



Figure 12 (Cont.):
HEPTACHLOR: Residue Variation with Data Source (FDA vs. Non-FDA data)




R7 = EPA Region 7
R5 = EPA Region 5
FDA = FDA data only
OTH = All data other than FDA data
ALL = All FDA data and other (non-FDA) data
ALLFDA = FDA data from all locations
NONFDA = All data other than FDA data from all locations
TOTAL = All data

Figure 13:
HEPTACHLOR: Residue Variation with Species of Fish

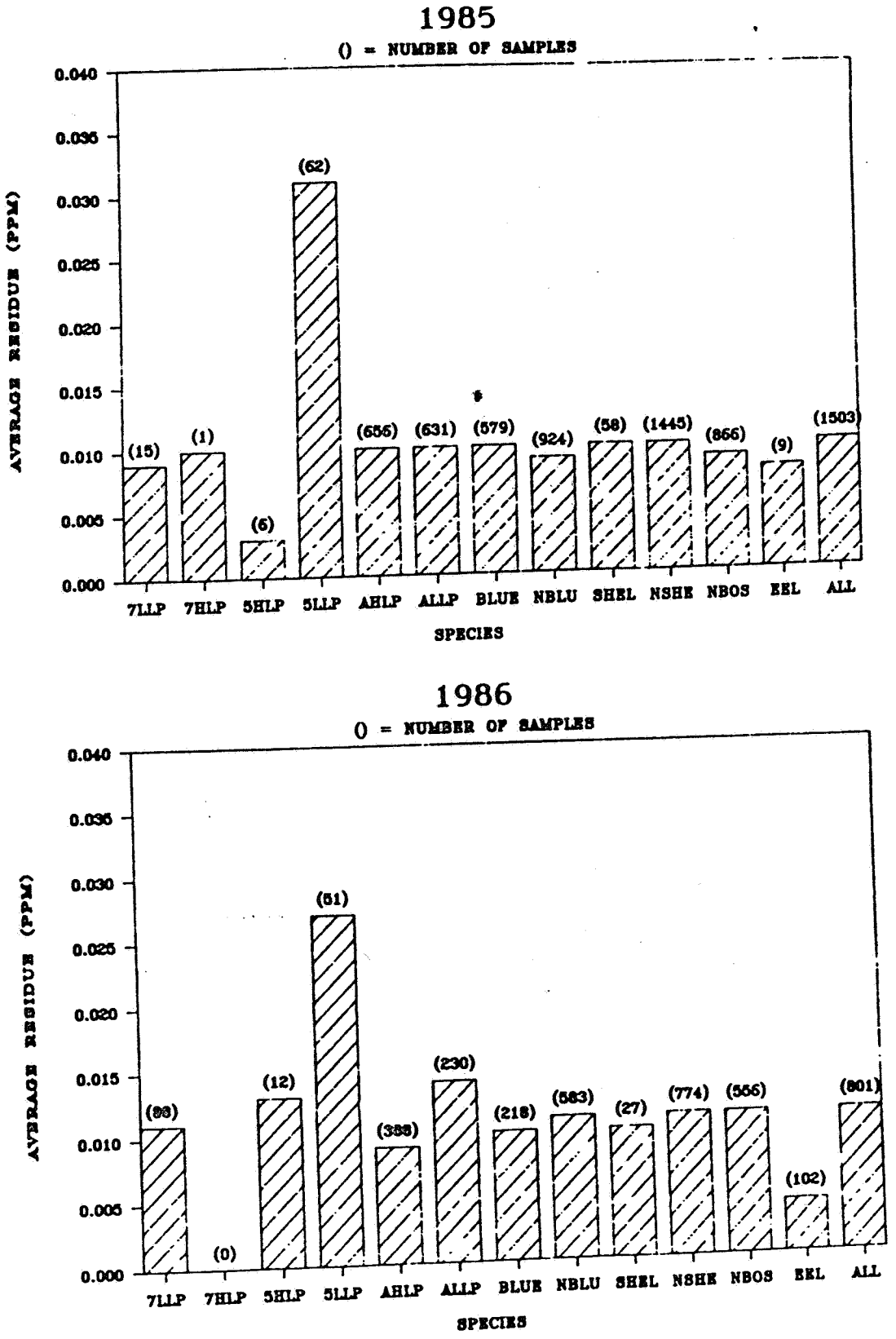
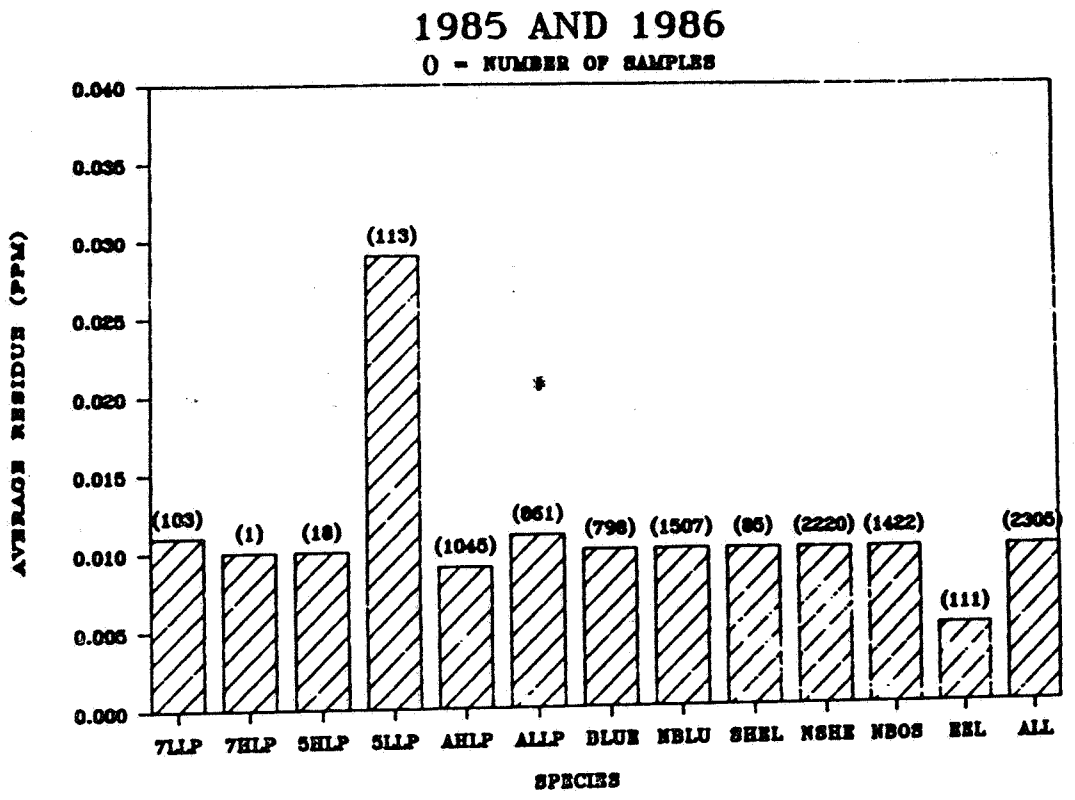
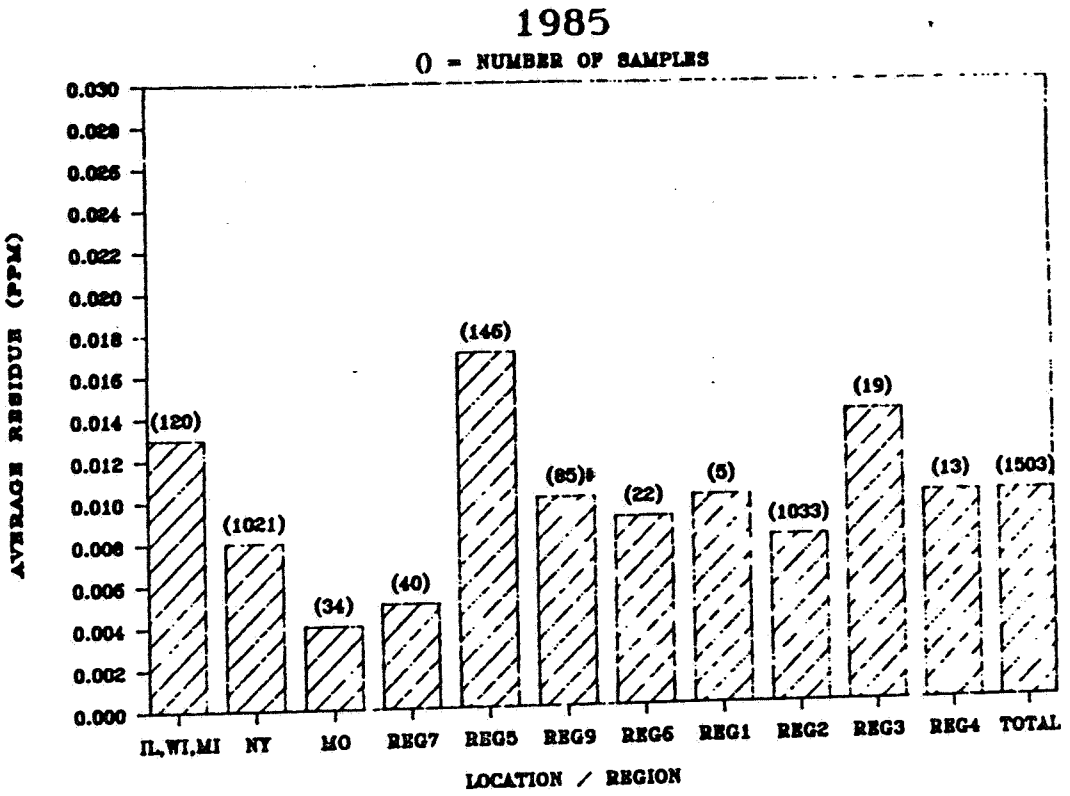


Figure 13 (Cont.):
HEPTACHLOR: Residue Variation with Species of Fish




7LLP = EPA Region 7, low level predatory and bottom-feeding fish
7HLP = EPA Region 7, high level predatory fish
5HLP = EPA Region 5, high level predatory fish
5LLP = EPA Region 5, low level predatory and bottom-feeding fish
AHLP = High level predators, all locations
ALLP = Low level predators, all locations
BLUE = Bluefish
NBLU = All fish except Bluefish
SHEL = Shellfish
NSHE = All fish except shellfish
NBOS = All fish except Bluefish and shellfish
EEL = American Eels
ALL = All fish

Figure 14:
HEPTACHLOR: Residue Variation with Location / Region



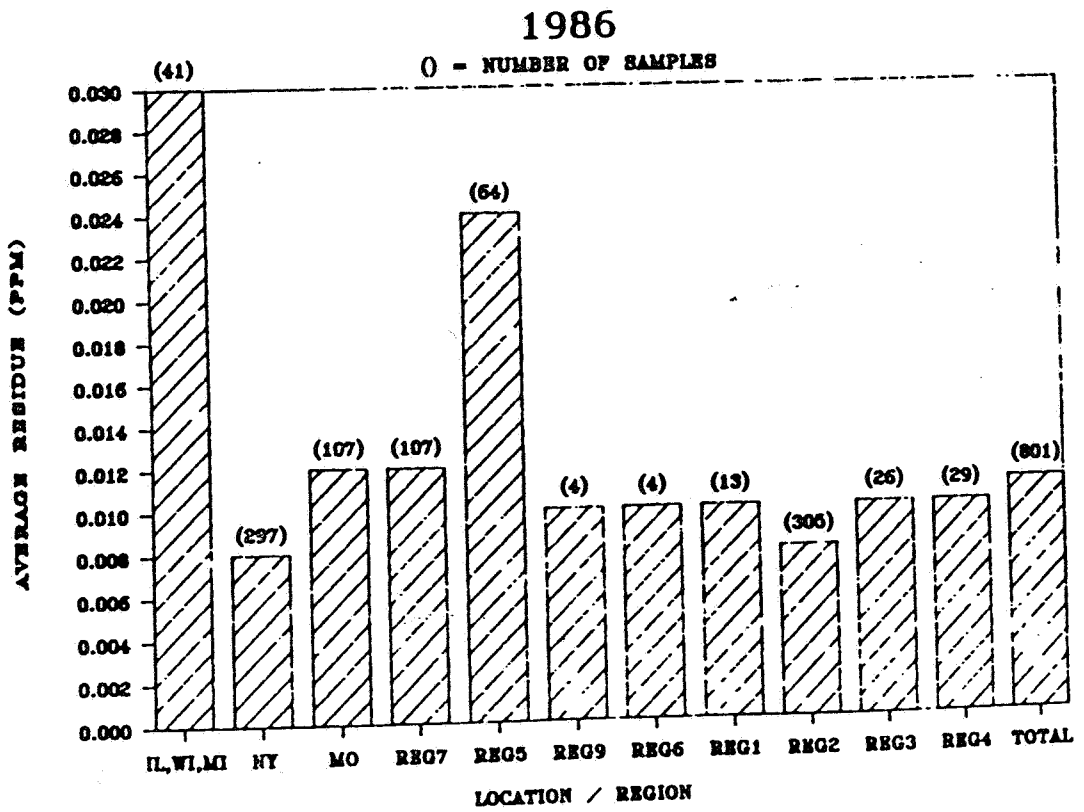
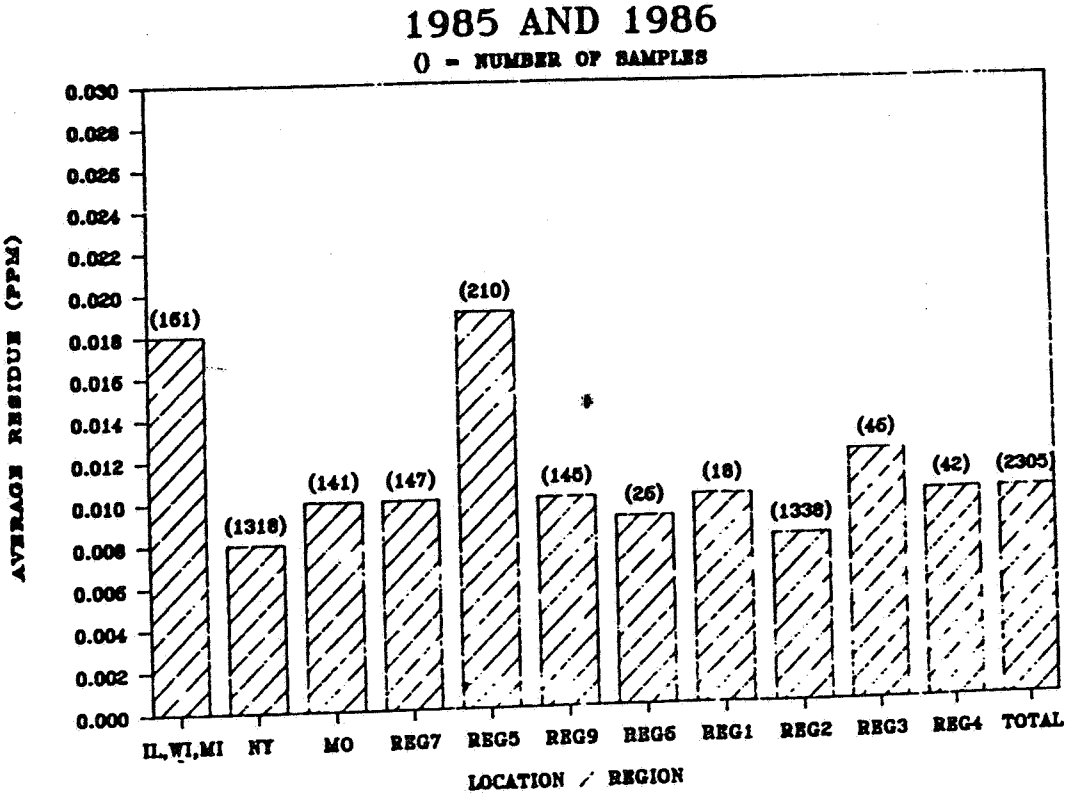
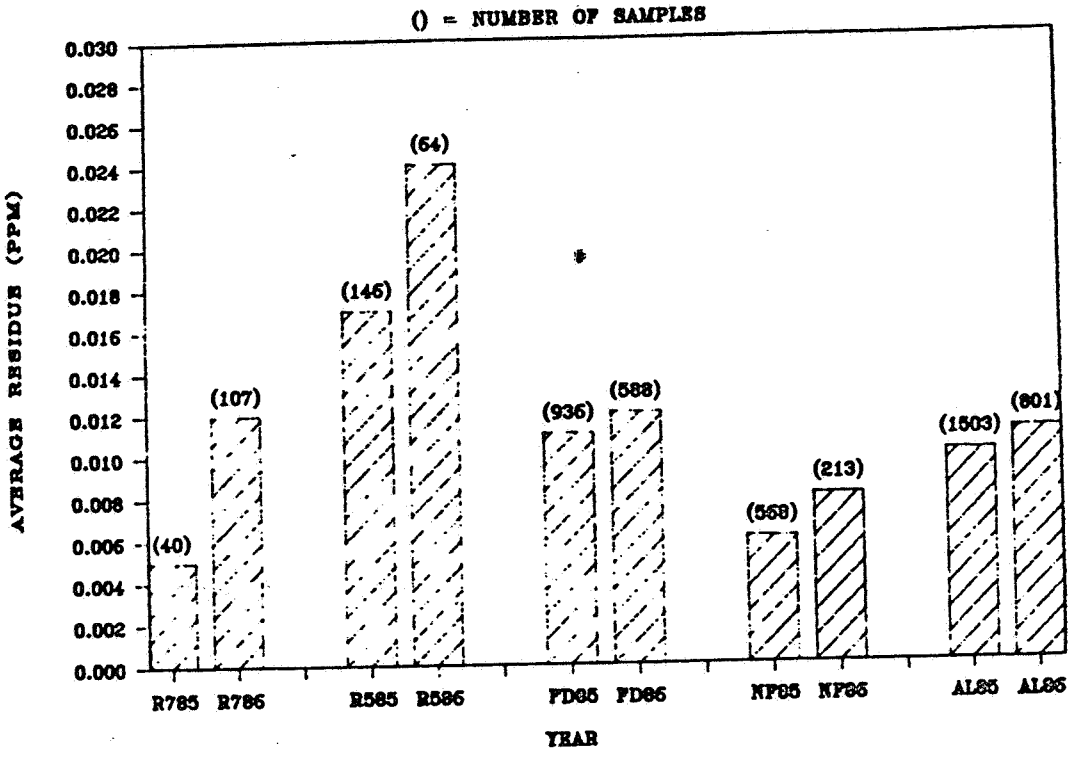



Figure 14 (Cont.):
HEPTACHLOR: Residue Variation with Location / Region




IL,WI,MI = Illinois, Wisconsin and Michigan
NY = New York
MO = Missouri
REGX = EPA Region X
TOTAL = Combined data from all locations

Figure 15:
HEPTACHLOR: Residue Variation with Time




R785 = EPA Region 7 data, 1985
R786 = EPA Region 7 data, 1986
R585 = EPA Region 5 data, 1985
R586 = EPA Region 5 data, 1986
FD85 = FDA data, 1985
FD86 = FDA data, 1986
NF85 = All data except FDA data, 1985
NF86 = All data except FDA data, 1986
AL85 = All data, 1985
AL86 = All data, 1986

## DDT

### DDT Residue Variation with Data Source, FDA vs. Other Data

DDT residue variation with data source is shown in Figure 17. For the entire data set, the average for the FDA data is lower than that for the other data by 0.2 ppm. For the two Regional subsets analyzed, the average of the FDA data from Region 7 is larger than that for other data by approximately 0.2 ppm, and the average of the FDA data from Region 5 is smaller than that for the other data by 0.91 ppm (combined 1985 + 1986 data). These trends are also reflected in the data sets for individual years. These trends could be due, in part, to the greater percentage of fresh water fish (which have higher average residues than salt water fish) in the non-FDA data.

### DDT Residue Variation with Species

DDT residue variation with species is shown in Figure 18. Virtually no difference is seen between average residues found in high level predators and low level predators/bottom-feeders. Bluefish and American eels have average residues less than the average residues for all species, while shellfish show practically no DDT residue accumulation at all. Fish species other than bluefish, shellfish and American eels have average residues greater than average residues for all species. Major trends seen in the combined 1985 + 1986 data set are also seen in data sets for individual years.

### DDT Residue Variation with Aquatic Environment

DDT residue variation with aquatic environment (water type, fresh vs. salt water) is shown in Figure 16. For low level predators/bottom-feeders and for the entire data set, fresh water fish have significantly higher residues than salt water fish. This trend is seen in both 1985 and 1986. For high level predators, a consistent year to year trend is seen in which salt water fish have slightly higher residues than fresh water fish.

### DDT Residue Variation with Time

DDT residue variation with time is shown in Figure 20. Most data sets analyzed show a significant decrease in residues going from 1985 to 1986.

### DDT Residue Variation with Location

DDT residue variation with location is shown in Figure 19. The average residues for Region 4 for 1985 and for combined 1985 + 1986 are 15.334 ppm and 5.522 ppm respectively. These residues are much higher than average residues for other

locations due to some unusually large values in the data subsets for Region 4 including one of 122.2 ppm, and because of the small size of the data subsets. Because of this small size, we cannot conclude that these large average residues are the average residues likely to be found in fish from Region 4. However, since the trend is seen for both 1985 and 1986 data, we can conclude that Region 4 appears to have significantly higher DDT residues than other locations.

Average residues from Region 5 (particularly in samples from the Great Lakes) have significantly higher values than the average from all locations (difference = 0.47 ppm for IL,MI,WI, combined 1985 + 1986 data). Average residues in NY are approximately equal to the average residues for all locations. Average residues from Regions 1, 3, 6, 9 and 7 (MO) are lower than the national average. These trends are consistent from year to year although the magnitude of the average residues vary.

DDT: Other Considerations

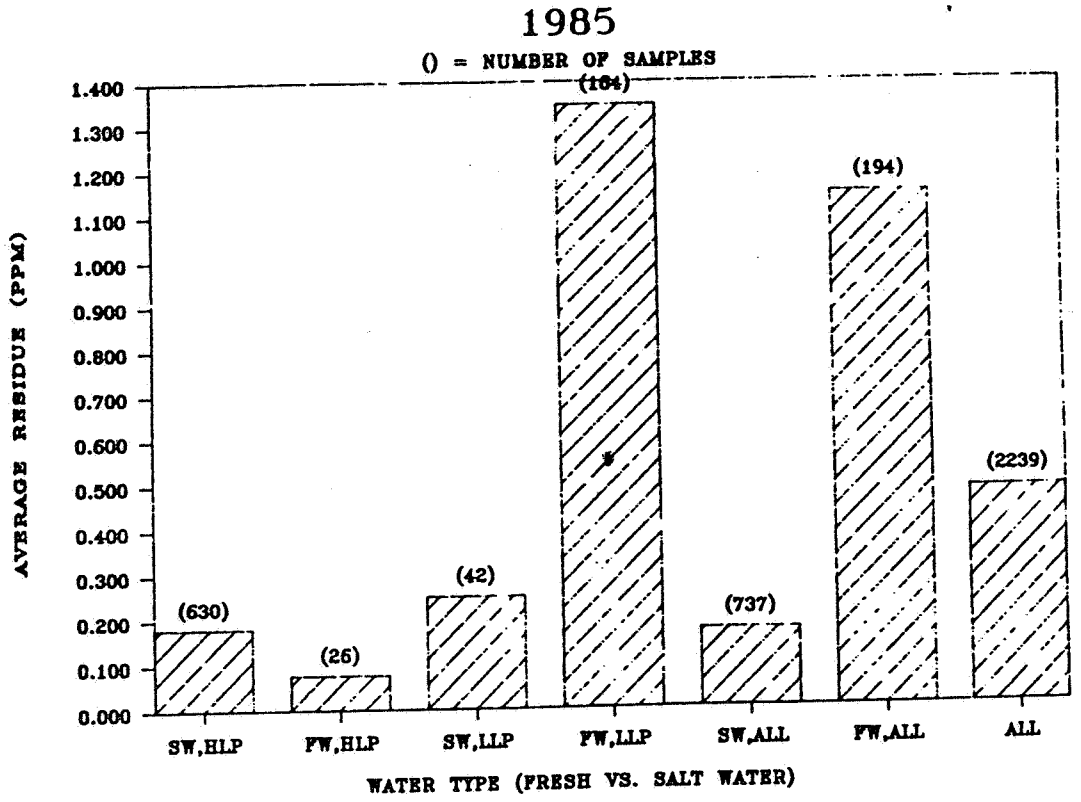
Table 4 shows the average residues and the tolerance limits (utilizing 95% confidence, 95% population coverage, no distribution assumed) for select data subsets for DDT. RCB's previous action level recommendation for residues of DDT and its metabolites in fish was 1 ppm based only on FDA surveillance monitoring data from FY 1985 and FY 1986.

Utilizing 95% confidence with 95% coverage of the fish population, and utilizing the entire data set currently available to RCB, we estimate that it is unlikely that combined residues of DDT and its metabolites would exceed 10 ppm in Region 5, and 2 ppm nationally. Residues found in most locations would likely be lower than these values.

Table 4: DDT Summary Statistics

| Year | Region | Water Type | Fish Type | FDA | Number of Samples | Average Residue (ppm) | Tolerance Limit (ppm) |
|---|---|---|---|---|---|---|---|
| 1985 | All | All | All | FDA | 936 | 0.379 | 0.615 |
| | All | All | All | All | 2239 | 0.482 | 1.525 |
| 1986 | All | All | All | FDA | 588 | 0.181 | 0.650 |
| | All | All | All | All | 803 | 0.178 | 0.650 |
| 85 + 86 | Reg 5 | All | All | All | 245 | 0.730 | 8.794 |
| | Reg 7 | All | All | All | 147 | 0.053 | 0.415 |
| | Reg 2 | All | All | All | 2041 | 0.366 | 1.413 |
| | All | All | All | FDA | 1525 | 0.302 | 0.575 |
| | All | All | All | All | 3043 | 0.402 | 1.326 |

Figure 16:
DDT: Residue Variation with Water Type (Salt vs. Fresh Water)



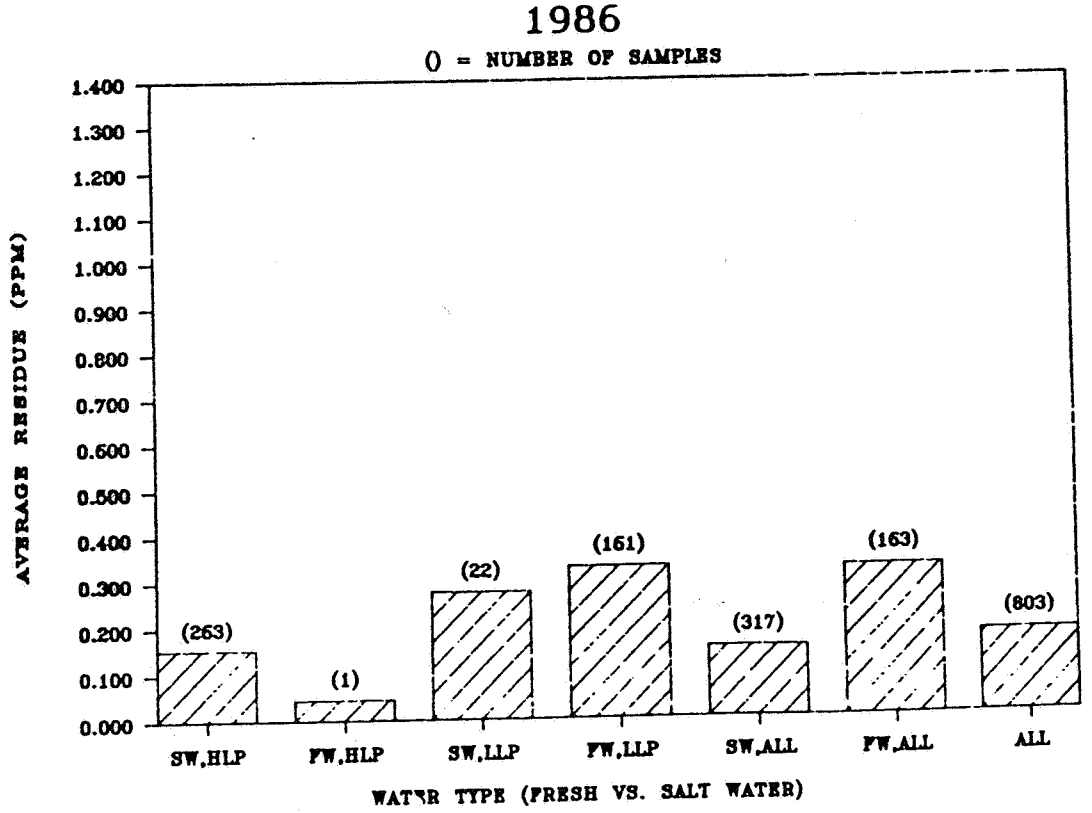
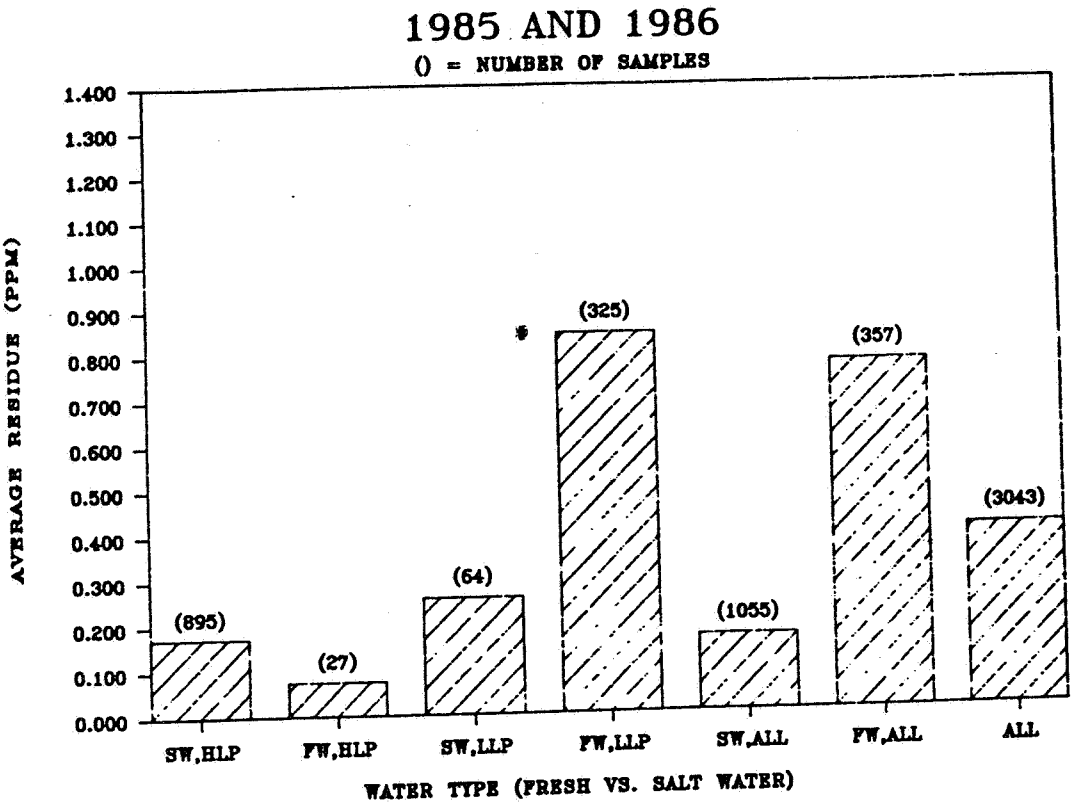
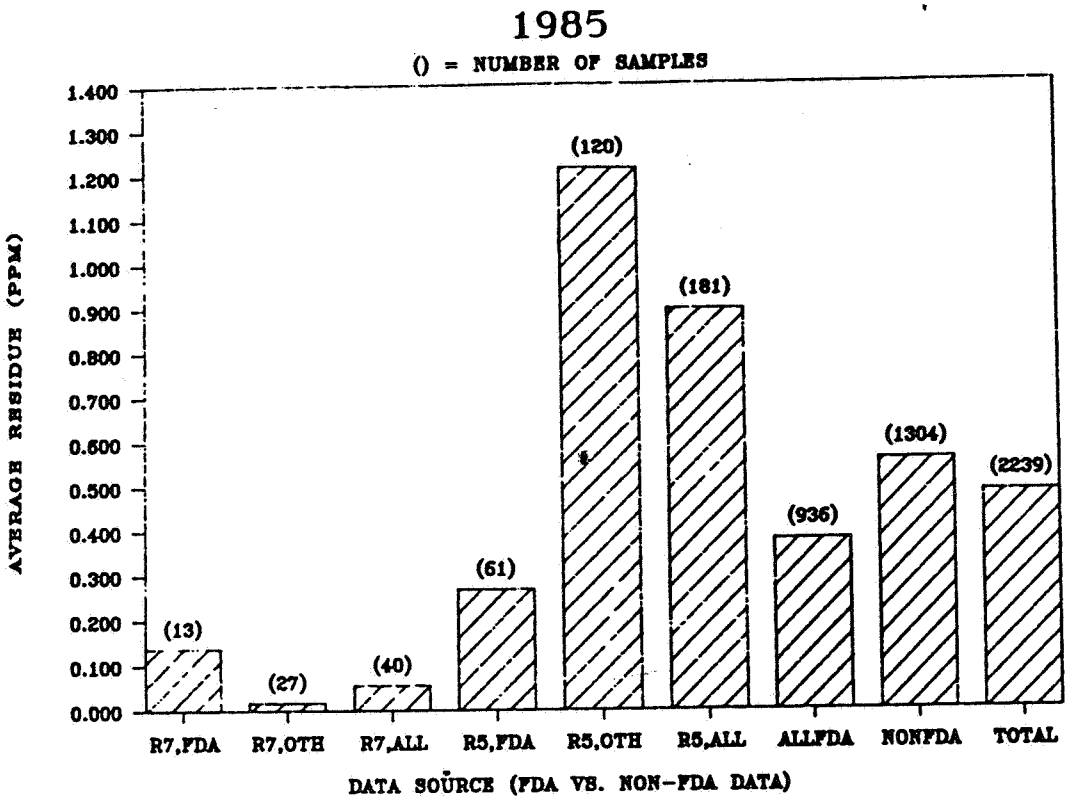



Figure 16 (Cont.):
DDT: Residue Variation with Water Type (Salt vs. Fresh Water)




SW = Salt Water Fish
HLP = High level predatory fish
FW = Fresh water fish
LLP = Low level predatory / bottom-feeding fish
All = All high level predatory and low level predatory / bottom-feeding fish

Figure 17:
DDT: Residue Variation with Data Source (FDA vs. Non-FDA data)



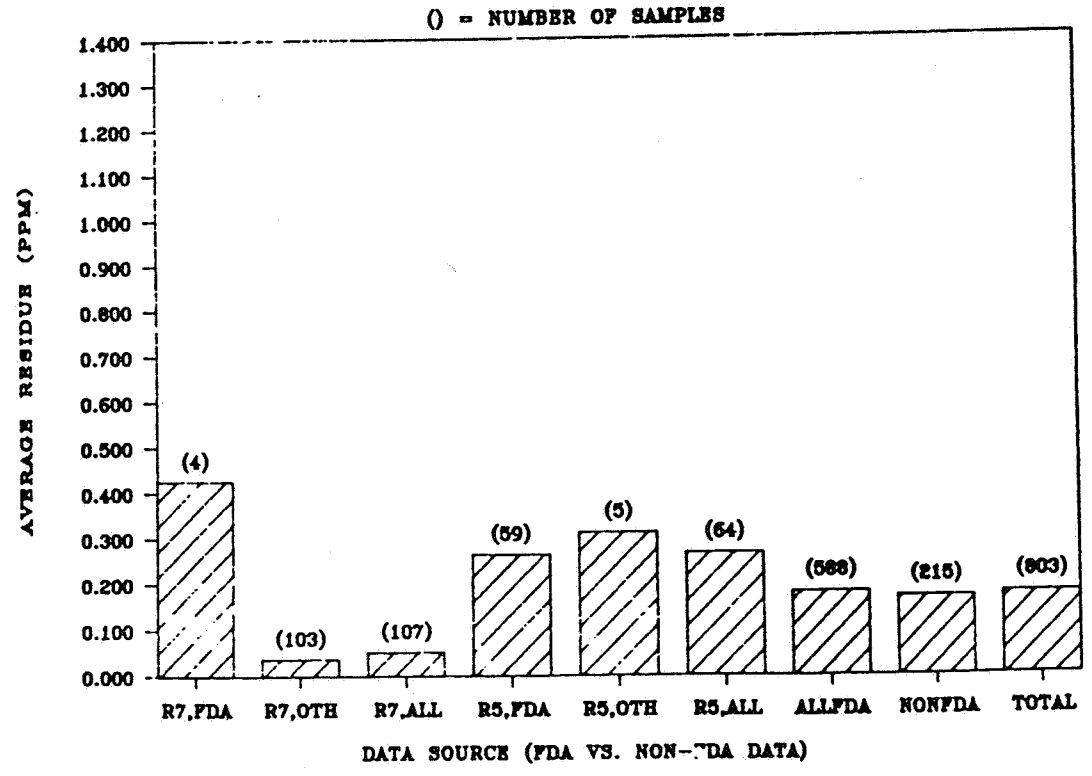
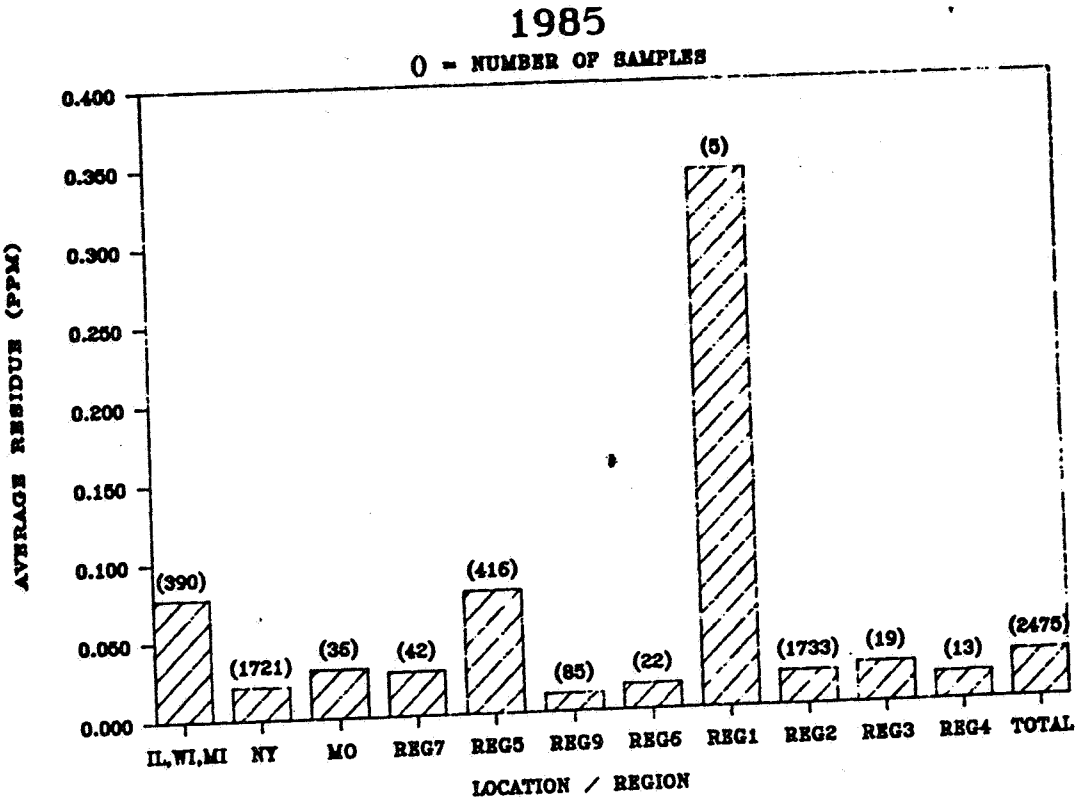



Figure 24:
ALDRIN/DIELDRIN: Residue Variation with Location / Region



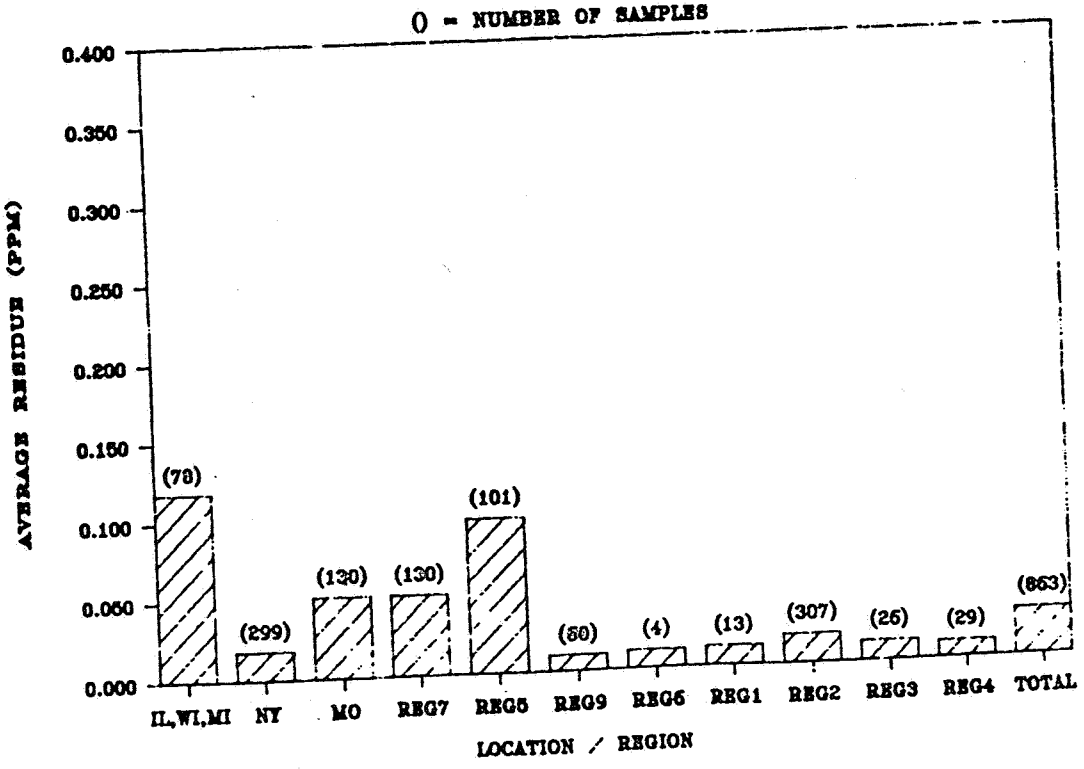
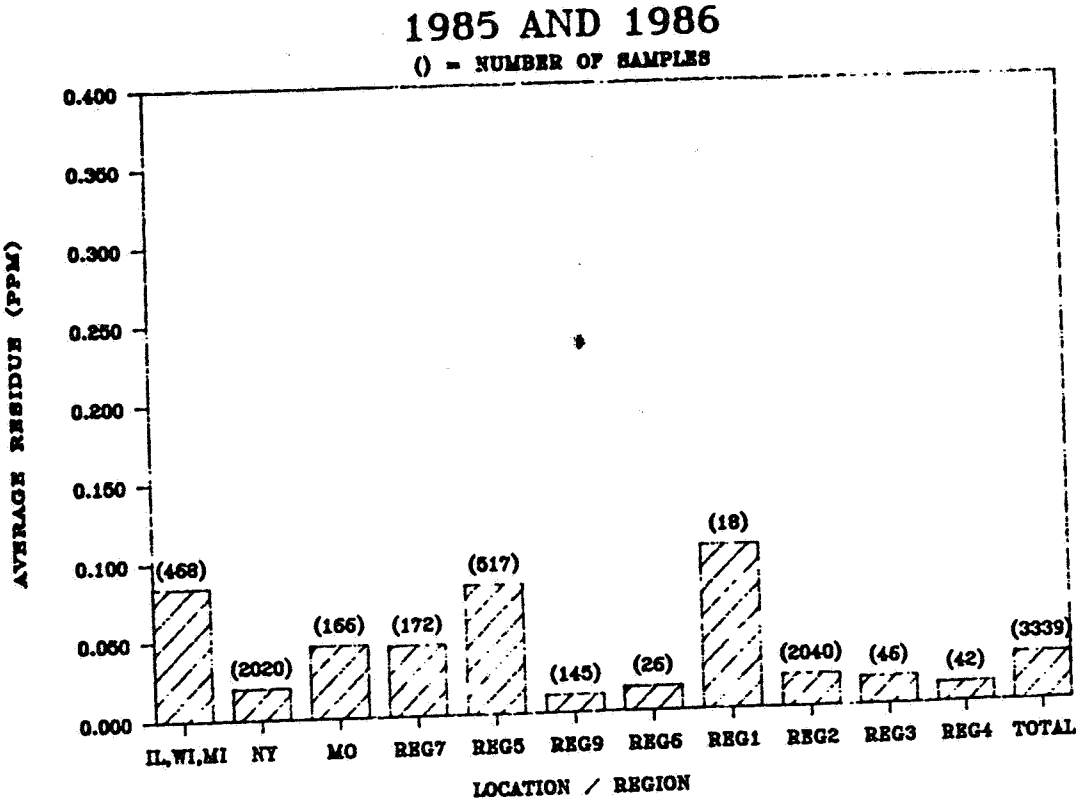
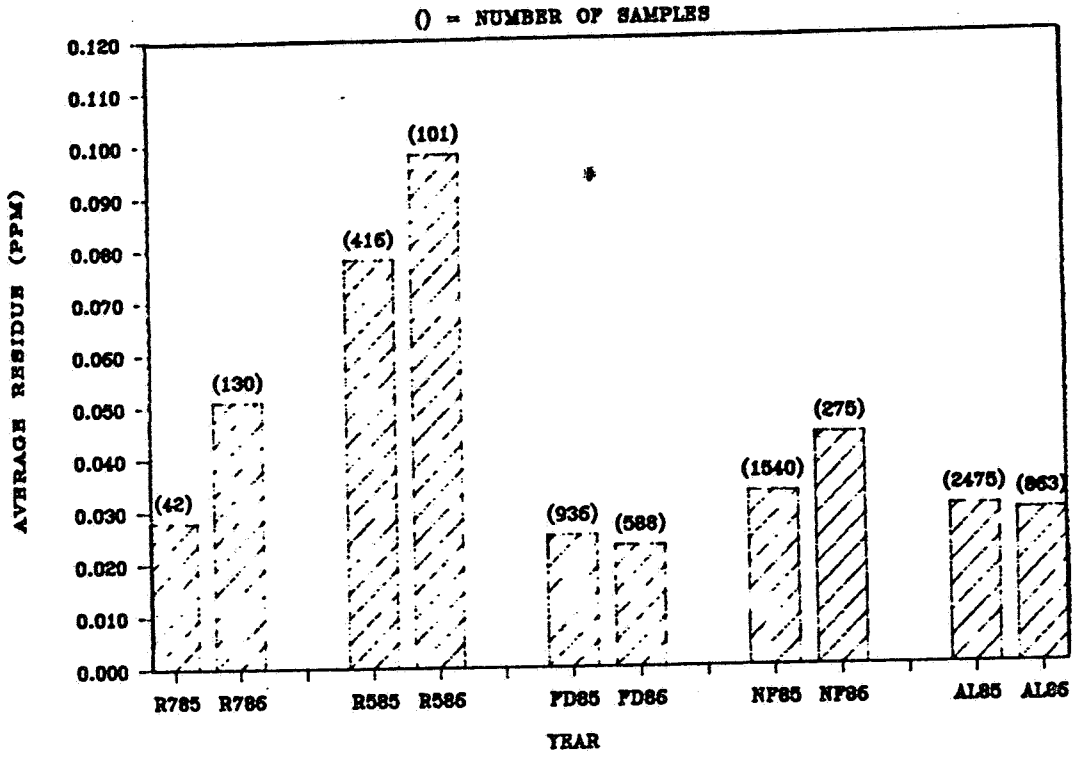



Figure 24 (Cont.):
ALDRIN/DIELDRIN: Residue Variation with Location / Region




IL,WI,MI = Illinois, Wisconsin and Michigan
NY = New York
MO = Missouri
REGX = EPA Region X
TOTAL = Combined data from all locations

Figure 25:
ALDRIN/DIELDRIN: Residue Variation with Time




R785 = EPA Region 7 data, 1985
R786 = EPA Region 7 data, 1986
R585 = EPA Region 5 data, 1985
R586 = EPA Region 5 data, 1986
FD85 = FDA data, 1985
FD86 = FDA data, 1986
NF85 = All data except FDA data, 1985
NF86 = All data except FDA data, 1986
AL85 = All data, 1985
AL86 = All data, 1986

Conclusions

(1) The data set examined in this review includes numerous studies from various sources. The studies were performed for many purposes and utilized different analytical methods, sampling schemes, sample preparation techniques, QA/QC procedures and data reporting methods. Therefore, it is difficult to isolate single variables as causes for fish residue variations. Examination of these data and the conclusions below must be made keeping these factors in mind.

(2) Neither the FDA data nor the non-FDA data have consistently greater average residues for all 5 of the subject chemicals. For chlordane and mirex, the FDA data have smaller average residues than non-FDA data. For aldrin/dieldrin, DDT and heptachlor, either the FDA data or the non-FDA data may show higher average residues depending on which data subset is being examined.

(3) Several trends are seen in residue variation with species for the 5 chemicals.

(3a) For all 5 pesticides, shellfish have much smaller average residues than non-shellfish. Very few detectable residues of any of these pesticides were found in the 85 shellfish samples analyzed.

(3b) American eels have consistently lower average residues of all pesticides except chlordane than the average residues for all fish for each pesticide. This is most likely due to the reported lower limit of detection for the analytical method used to measure residues in American eels than analytical methods used to measure residues in other fish.

(3c) Average residues in Bluefish are less than or equal to the average residues for all fish for all pesticides.

(3d) For all chemicals except chlordane and mirex, low level predators/bottom feeders have slightly lower average residues than high level predators. This trend is reversed for chlordane. Mirex was found in only 1 Region (NY). Since primarily only samples of high level predators were obtained from this location, residue variation cannot be determined for mirex.

(4) For all chemicals in which detectable residues were found in both salt and fresh water fish (i.e. all except mirex for which only fresh water fish samples showed detectable

residues), the entire data set and low level predators/bottom feeding species showed higher average residues in fresh water fish than in salt water fish, and for high level predators, salt water fish showed higher average residues.

(5) Of the 5 pesticides examined, only DDT showed a decrease in average residues from 1985 to 1986 for most data subsets examined. For the other chemicals, there is an apparent increase in residues in going from 1985 to 1986. A number of possible reasons are described in this review for this unexpected apparent increase in residues.

(6) The following Table shows locations in which particular residues were found in fish at significantly higher values than the average residue values for all locations.

| Pesticide | Location | Average Residue of Subset (ppm) | Average Residues in all Samples (ppm) | Residue Difference |
|---|---|---|---|---|
| Chlordane | Region 7 | 0.301 | 0.125 | 0.176 |
| Mirex | Region 2 | 0.045 | 0.032 | 0.013 |
| Heptachlor | Region 5 | 0.019 | 0.010 | 0.009 |
| DDT | Region 5 | 0.730 | 0.402 | 0.328 |
| | Region 4* | 5.522 | 0.402 | 5.120 |
| Aldrin/ dieldrin | Region 5 | 0.082 | 0.030 | 0.052 |
| | Region 1* | 0.104 | 0.030 | 0.074 |

*These average residue values do not likely represent average residues likely to be found due to the small number of samples involved and some inordinately high residue values found in the data subsets.

(7) The following Table lists current action levels, previously recommended action levels and maximum residues likely to be found in various locations assuming 95% confidence and 95% coverage of the fish population. It should be kept in mind that these values are calculated using data subsets in which location is not the only possible variable causing the observed residue level variation. Most locations would have considerably lower fish residues than those shown below (Table on next page).

| Chemical | Location | Maximum Likely Residue (ppm) | Current Action Level (ppm) | Previously Recommended Action Level (ppm) |
|---|---|---|---|---|
| Chlordane | All | 0.4 | 0.3 | 0.3 |
| | Reg 5 | 0.5 | | |
| | Reg 7 | 2.0 | | |
| Mirex | All | 0.3 | 0.1 | None |
| | Reg 2 | 0.4 | | |
| Heptachlor | All | 0.02 | 0.3 | 0.02 |
| | Reg 5 | 0.1 | | |
| | Reg 7 | 0.1 | | |
| DDT | All | 2.0 | 5 | 1 |
| | Reg 5 | 10.0 | | |
| Aldrin/ Dieldrin | All | 0.2 | 0.3 | 0.1 |
| | Reg 5 | 0.4 | | |
| | Reg 7 | 0.4 | | |

Recommendations

The data examined by RCB in this review are incongruous data sets due to the numerous purposes for which the data were monitored, the various sampling schemes and analytical methods used, the various data reporting formats, etc. Additionally, the information RCB has about these studies, other than the actual residue values, is minimal. Although each individual study may be adequate for the purposes for which it was performed, utilization of the results of these studies as a whole to determine maximum likely residues to be found in the edible portion of fish on a national basis is tenuous at best. Therefore, we recommend that only the FDA surveillance monitoring data be used for this purpose since these data are the most representative, randomized, appropriately weighted and consistent data set currently available.

Alternatively, we would recommend that a fish residue monitoring program be designed and implemented for the specific purpose of dietary exposure assessment.

Attachments to S.F., Reviewer, Theodore M. Farber (TOX, TS-769C), Amy Rispin (SIS, TS-769C)
cc: DDT, Chlordane, Mirex, Heptachlor, Aldrin/dieldrin, Fish, S.F., R.F., Circu, M. Metzger, PMSD/ISB, Theodore M. Farber (TOX, TS-769C), Amy Rispin (SIS, TS-769C)
RDI:E.Zager:EZ:10/13/87
TS-769C:RCB:M.Metzger:MM:Rm803a:CM#2:10/13/87

# Appendix I

## Sources of Data Used in Statistical Calculations

Data Sources


(1) Missouri Department of Health, Health Advisory Issued for Missouri and Mississippi Rivers, News Release, 2/11/87, plus related attachments.

(2) Missouri Department of Health, Health Advisory Issued for Wilson Creek and James River, News Release, 9/18/86, plus related attachments.

(3) Missouri Department of Health, Health Advisory continued for Meramec River, News Release, 6/9/86, plus related attachments.

(4) Ronald Crunkilton, Missouri Department of Conservation, Fish and Wildlife Research Center, Chlorinated Hydrocarbon Pesticides and PCBs in Lake of the Ozarks Fish, June, 1985.

(5) Fish Contamination Monitoring Program, 1986 Annual Report, Michigan Department of Natural Resources, Nov., 1986.

(6) Microcontaminants in Lake Michigan, Lake Superior, Green Bay and Their Tributaries Since 1983, computer printout, Wisconsin Department of Natural Resources, March 2, 1987.

(7) Microcontaminants in Inland Waters of Wisconsin Since 1983, Wisconsin Department of Natural Resources, computer printout, March 2, 1987.

(8) Microcontaminants in Whole Fish Samples from Wisconsin Waters Since 1978, computer printout, Wisconsin Department of Natural Resources, March 4, 1987.

(9) EPA/FDA Great Lakes Fish Monitoring Survey for FY 1986, raw data sheets and summary tables.

(10) FDA Surveillance Monitoring Data, Domestic Samples for FY 1985 and FY 1986, provided to OPP by Mr. Ellis L. Gunderson, Division of Contaminants Chemistry, Center for Food Safety and Applied Nutrition, FDA.

(11) Max A. Anderson, Region 5 Fish Tissue Report, U.S. Environmental Protection Agency, Sept., 1986.

(12) Bioaccumulation Monitoring Guidance: Selection of Target Species and Review of Available Bioaccumulation Data, Office of Marine and Estuarine Protection, U.S. Environmental Protection Agency, Prepared by Tetra Tech, Inc., Sept., 1985.

(13) Report of the Analysis of Fishes Collected During 1985 from the Ambient Fish Tissue Monitoring Program Sites in Iowa, U.S. Environmental Protection Agency, Region VII, not dated.

(14) Final report of an Intensive Water Quality Survey of the Lake of the Woods and the Lagoon in Swope Park, Kansas City, Missouri, U.S. Environmental Protection Agency, Region 7, July 1985, plus related attachments.

(15) Computer printout, 1985 data from NY, Lake Ontario, trout.

(16) Computer printout, 1985 data from NY, Long Island Ponds.

(17) Computer printout, 1985 data from NY, Lake Ontario, Lake trout.

(18) Computed printout, 1985 data from NY, Keuka Lake, Lake trout.

(19) Computer printout, 1985 data from NY, Cayuga Lake, Lake trout.

(20) Computed printout, data from NY, Saint Lawrence River.

(21) Computer printout, data from NY, Fulton Chain Lakes.

(22) Computer printout, 1985 data from NY, Onondaga lake.

(23) Computer printout, data from NY, Lake Ontario.

(24) Computer printout, Statewide toxic substances monitoring program.

(25) Computer printout, data from NY, Organochlorines and Hg in Striped Bass from the Marine district, 1985.

# Appendix II

## Tabular Summary of Statistical Calculations

CHLORDANE, 1985

*See notes at end of Appendix II for guide to abbreviations.

| Region | Water Type | Fish Type | FDA | # of Smpls | Avg. (ppm) | Max. Res. (ppm) | 95% Conf. Limit (Normal Dist.) | 95% Conf. 95% Cov. (ppm) |
|---|---|---|---|---|---|---|---|---|
| IL,WI,MI | All | All | All | 353 | 0.125 | 0.99 | 0.310 | 0.383 |
| NY | All | All | All | 1439 | 0.137 | 25.14 | 1.312 | 0.357 |
| MO | All | All | All | 36 | 0.149 | 2.96 | 1.023 | 0.788 |
| Reg 7 | All | All | All | 42 | 0.133 | 2.96 | 0.945 | 0.788 |
| Reg 7 | All | LLP | All | 17 | 0.271 | 2.96 | 1.506 | 0.788 |
| Reg 7 | All | All | FDA | 13 | 0.068 | 0.041 | 0.296 | 0.041 |
| Reg 7 | All | All | NoFDA | 29 | 0.161 | 2.96 | 1.123 | 0.788 |
| Reg 7 | All | HLP | All | 1 | 0.030 | 0.030 | - | - |
| Reg 5 | All | HLP | All | 188 | 0.138 | 0.99 | 0.343 | 0.470 |
| Reg 5 | All | LLP | All | 100 | 0.125 | 0.47 | 0.302 | 0.415 |
| Reg 5 | All | All | FDA | 61 | 0.134 | 0.415 | 0.330 | 0.415 |
| Reg 5 | All | All | NoFDA | 318 | 0.124 | 0.99 | 0.304 | 0.380 |
| Reg 5 | All | All | All | 379 | 0.126 | 0.99 | 0.308 | 0.380 |
| Reg 9 | All | All | All | 85 | 0.030 | 0.030 | 0.030 | 0.030 |
| Reg 6 | All | All | All | 22 | 0.030 | 0.050 | 0.039 | 0.050 |
| Reg 1 | All | All | All | 5 | 0.031 | 0.035 | 0.035 | 0.035 |
| Reg 2 | All | All | All | 1451 | 0.136 | 25.14 | 1.306 | 0.369 |
| Reg 3 | All | All | All | 19 | 0.041 | 0.115 | 0.085 | 0.115 |
| Reg 4 | All | All | All | 13 | 0.127 | 0.96 | 0.561 | 0.960 |
| All | Salt | HLP | All | 631 | 0.102 | 1.005 | 0.234 | 0.220 |
| All | Salt | LLP | All | 42 | 0.032 | 0.110 | 0.053 | 0.110 |
| All | Salt | All | All | 737 | 0.091 | 1.005 | 0.222 | 0.210 |
| All | Fresh | HLP | All | 51 | 0.076 | 0.386 | 0.188 | 0.386 |
| All | Fresh | LLP | All | 151 | 0.123 | 2.960 | 0.593 | 0.788 |
| All | Fresh | All | All | 206 | 0.109 | 2.960 | 0.518 | 0.470 |
| All | All | HLP | All | 1179 | 0.146 | 25.14 | 1.439 | 0.369 |
| All | All | LLP | All | 699 | 0.081 | 2.960 | 0.327 | 0.261 |
| All | All | Bluefi | All | 579 | 0.108 | 1.005 | 0.241 | 0.240 |
| All | All | No Blfi | All | 1577 | 0.126 | 25.14 | 1.259 | 0.385 |
| All | All | Shellfi | All | 58 | 0.030 | 0.035 | 0.031 | 0.035 |
| All | All | No shel | All | 2098 | 0.124 | 25.14 | 1.109 | 0.340 |
| All | All | No Bf,S | All | 1519 | 0.129 | 25.14 | 1.284 | 0.390 |
| All | All | Eel | All | 9 | 0.100 | 0.205 | 0.238 | 0.205 |
| All | All | All | FDA | 936 | 0.088 | 1.005 | 0.233 | 0.240 |
| All | All | All | NoFDA | 1221 | 0.146 | 25.14 | 1.43 | 0.415 |
| All | All | All | All | 2156 | 0.121 | 25.14 | 1.093 | 0.335 |

CHLORDANE, 1986
*See notes at end of Appendix II for guide to abbreviations.

| Region | Water Type | Fish Type | FDA | # of Smpls | Avg. (ppm) | Max. Res. (ppm) | 95% Conf. Limit. (Normal Dist.) | 95% Conf. 95% Cov. (ppm) |
|---|---|---|---|---|---|---|---|---|
| IL,WI,MI | All | All | All | 78 | 0.258 | 2.69 | 1.011 | 2.690 |
| NY | All | All | All | 299 | 0.121 | 0.995 | 0.310 | 0.370 |
| MO | All | All | All | 130 | 0.355 | 6.735 | 1.586 | 1.926 |
| Reg 7 | All | All | All | 130 | 0.355 | 6.735 | 1.586 | 1.926 |
| Reg 7 | All | LLP | All | 107 | 0.250 | 2.045 | 0.829 | 1.389 |
| Reg 7 | All | All | FDA | 4 | 0.152 | 0.520 | 0.525 | 0.520 |
| Reg 7 | All | All | NoFDA | 126 | 0.361 | 6.735 | 1.609 | 1.926 |
| Reg 7 | All | HLP | All | 0 | | | | |
| Reg 5 | All | HLP | All | 18 | 0.080 | 0.100 | 0.108 | 0.100 |
| Reg 5 | All | LLP | All | 82 | 0.248 | 2.69 | 0.986 | 2.690 |
| Reg 5 | All | All | FDA | 59 | 0.125 | 0.450 | 0.286 | 0.450 |
| Reg 5 | All | All | NoFDA | 42 | 0.345 | 2.69 | 1.333 | 2.690 |
| Reg 5 | All | All | All | 101 | 0.217 | 2.69 | 0.893 | 1.871 |
| Reg 9 | All | All | All | 60 | 0.030 | 0.030 | 0.030 | 0.030 |
| Reg 6 | All | All | All | 4 | 0.039 | 0.055 | 0.056 | 0.050 |
| Reg 1 | All | All | All | 13 | 0.040 | 0.070 | 0.064 | 0.070 |
| Reg 2 | All | All | All | 307 | 0.119 | 0.995 | 0.307 | 0.370 |
| Reg 3 | All | All | All | 26 | 0.056 | 0.185 | 0.126 | 0.185 |
| Reg 4 | All | All | All | 29 | 0.031 | 0.045 | 0.036 | 0.045 |
| All | Salt | HLP | All | 263 | 0.092 | 0.995 | 0.264 | 0.300 |
| All | Salt | LLP | All | 22 | 0.046 | 0.264 | 0.138 | 0.264 |
| All | Salt | All | All | 317 | 0.082 | 0.995 | 0.245 | 0.280 |
| All | Fresh | HLP | All | 6 | 0.088 | 0.100 | 0.134 | 0.100 |
| All | Fresh | LLP | All | 208 | 0.215 | 2.690 | 0.837 | 1.330 |
| All | Fresh | All | All | 215 | 0.210 | 2.690 | 0.824 | 1.330 |
| All | All | HLP | All | 394 | 0.103 | 0.995 | 0.278 | 0.343 |
| All | All | LLP | All | 281 | 0.179 | 2.690 | 0.743 | 0.961 |
| All | All | Bluefi | All | 218 | 0.104 | 0.995 | 0.285 | 0.340 |
| All | All | No Blfi | All | 645 | 0.143 | 6.735 | 0.800 | 0.745 |
| All | All | Shellfi | All | 27 | 0.030 | 0.030 | 0.030 | 0.030 |
| All | All | No shel | All | 836 | 0.137 | 6.735 | 0.721 | 0.548 |
| All | All | No Bf,S | All | 618 | 0.148 | 6.735 | 0.818 | 0.777 |
| All | All | Eel | All | 102 | 0.142 | 0.514 | 0.329 | 0.513 |
| All | All | All | FDA | 588 | 0.068 | 0.995 | 0.212 | 0.245 |
| All | All | All | NoFDA | 275 | 0.273 | 6.735 | 1.227 | 1.609 |
| All | All | All | All | 863 | 0.134 | 6.735 | 0.710 | 0.539 |

CHLORDANE, 1985 + 1986
*See notes at end of Appendix II for guide to abbreviations.

| Region | Water Type | Fish Type | FDA | # of Smpls | Avg. (ppm) | Max. Res. (ppm) | 95% Conf. Limit (Normal Dist.) | 95% Conf. 95% Cov. (ppm) |
|---|---|---|---|---|---|---|---|---|
| IL,WI,MI | All | All | All | 431 | 0.149 | 2.690 | 0.521 | 0.470 |
| NY | All | All | All | 1738 | 0.134 | 25.14 | 1.206 | 0.368 |
| MO | All | All | All | 166 | 0.310 | 6.735 | 1.483 | 1.926 |
| Reg 7 | All | All | All | 172 | 0.301 | 6.735 | 1.456 | 1.926 |
| Reg 7 | All | LLP | All | 124 | 0.253 | 2.96 | 0.959 | 1.389 |
| Reg 7 | All | All | FDA | 17 | 0.088 | 0.52 | 0.364 | 0.520 |
| Reg 7 | All | All | NoFDA | 155 | 0.324 | 6.735 | 1.531 | 1.926 |
| Reg 7 | All | HLP | All | 1 | 0.030 | 0.030 | | |
| Reg 5 | All | HLP | All | 206 | 0.133 | 0.990 | 0.331 | 0.470 |
| Reg 5 | All | LLP | All | 182 | 0.180 | 2.690 | 0.704 | 0.882 |
| Reg 5 | All | All | FDA | 120 | 0.130 | 0.450 | 0.309 | 0.415 |
| Reg 5 | All | All | NoFDA | 360 | 0.150 | 2.690 | 0.547 | 0.538 |
| Reg 5 | All | All | All | 480 | 0.145 | 2.690 | 0.501 | 0.450 |
| Reg 9 | All | All | All | 145 | 0.030 | 0.030 | 0.030 | 0.030 |
| Reg 6 | All | All | All | 26 | 0.031 | 0.055 | 0.043 | 0.055 |
| Reg 1 | All | All | All | 18 | 0.038 | 0.070 | 0.059 | 0.070 |
| Reg 2 | All | All | All | 1758 | 0.133 | 25.14 | 1.199 | 0.368 |
| Reg 3 | All | All | All | 46 | 0.049 | 0.185 | 0.111 | 0.185 |
| Reg 4 | All | All | All | 42 | 0.161 | 0.960 | 0.314 | 0.960 |
| All | Salt | HLP | All | 895 | 0.099 | 1.005 | 0.244 | 0.250 |
| All | Salt | LLP | All | 64 | 0.037 | 0.264 | 0.095 | 0.264 |
| All | Salt | All | All | 1055 | 0.089 | 1.005 | 0.230 | 0.230 |
| All | Fresh | HLP | All | 57 | 0.077 | 0.386 | 0.185 | 0.386 |
| All | Fresh | LLP | All | 359 | 0.176 | 2.96 | 0.745 | 0.882 |
| All | Fresh | All | All | 421 | 0.161 | 2.96 | 0.692 | 0.777 |
| All | All | HLP | All | 1574 | 0.135 | 25.14 | 1.258 | 0.343 |
| All | All | LLP | All | 980 | 0.109 | 2.96 | 0.484 | 0.455 |
| All | All | Bluefi | All | 798 | 0.107 | 1.005 | 0.255 | 0.250 |
| All | All | No Blfi | All | 2222 | 0.131 | 25.14 | 1.150 | 0.423 |
| All | All | Shellfi | All | 85 | 0.030 | 0.035 | 0.031 | 0.030 |
| All | All | No shel | All | 2935 | 0.127 | 25.14 | 1.017 | 0.376 |
| All | All | No Bf,S | All | 2137 | 0.135 | 25.14 | 1.173 | 0.435 |
| All | All | Eel | All | 111 | 0.139 | 0.514 | 0.323 | 0.513 |
| All | All | All | FDA | 1525 | 0.080 | 1.005 | 0.226 | 0.235 |
| All | All | All | NoFDA | 1496 | 0.169 | 25.14 | 1.402 | 0.539 |
| All | All | All | All | 3020 | 0.125 | 25.14 | 1.002 | 0.372 |

MIREX, 1986
*See notes at end of Appendix II for guide to abbreviations.

| Region | Water Type | Fish Type | FDA | # of Smpls | Avg. (ppm) | Max. Res. (ppm) | 95% Conf. Limit (Normal Dist.) | 95% Conf. 95% Cov. (ppm) |
|---|---|---|---|---|---|---|---|---|
| IL,WI,MI | All | All | All | 37 | 0.005 | 0.005 | 0.005 | 0.005 |
| NY | All | All | All | 272 | 0.005 | 0.108 | 0.016 | 0.005 |
| MO | All | All | All | 4 | 0.005 | 0.005 | 0.005 | 0.005 |
| Reg 7 | All | All | All | 4 | 0.005 | 0.005 | 0.005 | 0.005 |
| Reg 7 | All | LLP | All | 4 | 0.005 | 0.005 | 0.005 | 0.005 |
| Reg 7 | All | All | FDA | 4 | 0.005 | 0.005 | 0.005 | 0.005 |
| Reg 7 | All | All | NoFDA | 0 | 0.005 | 0.005 | 0.005 | 0.005 |
| Reg 7 | All | HLP | All | 0 | 0.005 | 0.005 | 0.005 | 0.005 |
| Reg 5 | All | HLP | All | 8 | 0.005 | 0.005 | 0.005 | 0.005 |
| Reg 5 | All | LLP | All | 51 | 0.005 | 0.005 | 0.005 | 0.005 |
| Reg 5 | All | All | FDA | 59 | 0.005 | 0.005 | 0.005 | 0.005 |
| Reg 5 | All | All | NoFDA | 1 | 0.005 | 0.005 | 0.005 | 0.005 |
| Reg 5 | All | All | All | 60 | 0.005 | 0.005 | 0.005 | 0.005 |
| Reg 9 | All | All | All | 60 | 0.005 | 0.005 | 0.005 | 0.005 |
| Reg 6 | All | All | All | 4 | 0.005 | 0.005 | 0.005 | 0.005 |
| Reg 1 | All | All | All | 13 | 0.005 | 0.005 | 0.005 | 0.005 |
| Reg 2 | All | All | All | 280 | 0.005 | 0.108 | 0.016 | 0.005 |
| Reg 3 | All | All | All | 26 | 0.005 | 0.005 | 0.005 | 0.005 |
| Reg 4 | All | All | All | 29 | 0.005 | 0.005 | 0.005 | 0.005 |
| All | Salt | HLP | All | 263 | 0.005 | 0.005 | 0.005 | 0.005 |
| All | Salt | LLP | All | 20 | 0.005 | 0.005 | 0.005 | 0.005 |
| All | Salt | All | All | 315 | 0.005 | 0.005 | 0.005 | 0.005 |
| All | Fresh | HLP | All | 1 | 0.005 | 0.008 | 0.006 | 0.006 |
| All | Fresh | LLP | All | 108 | 0.005 | 0.008 | 0.006 | 0.006 |
| All | Fresh | All | All | 110 | 0.004 | 0.005 | 0.007 | 0.005 |
| All | All | HLP | All | 360 | 0.005 | 0.008 | 0.006 | 0.005 |
| All | All | LLP | All | 144 | 0.005 | 0.005 | 0.005 | 0.005 |
| All | All | Bluefi | All | 218 | 0.005 | 0.108 | 0.014 | 0.005 |
| All | All | No Blfi | All | 451 | 0.005 | 0.005 | 0.005 | 0.005 |
| All | All | Shellfi | All | 27 | 0.005 | 0.108 | 0.012 | 0.005 |
| All | All | No shel | All | 642 | 0.005 | 0.108 | 0.014 | 0.005 |
| All | All | No Bf,S | All | 424 | 0.002 | 0.005 | 0.005 | 0.005 |
| All | All | Eel | All | 78 | 0.005 | 0.005 | 0.005 | 0.005 |
| All | All | All | FDA | 588 | 0.004 | 0.108 | 0.024 | 0.108 |
| All | All | All | NoFDA | 81 | 0.005 | 0.108 | 0.012 | 0.005 |
| All | All | All | All | 669 | | | | |

MIREX, 1985
*See notes at end of Appendix II for guide to abbreviations.

| Region | Water Type | Fish Type | FDA | # of Smpls | Avg. (ppm) | Max. Res. (ppm) | 95% Conf. Limit (Normal Dist.) | 95% Conf. 95% Cov. (ppm) |
|---|---|---|---|---|---|---|---|---|
| IL,WI,MI | All | All | All | 35 | 0.005 | 0.005 | 0.005 | 0.005 |
| NY | All | All | All | 1253 | 0.054 | 0.902 | 0.299 | 0.411 |
| MO | All | All | All | 7 | 0.005 | 0.005 | 0.005 | 0.005 |
| Reg 7 | All | All | All | 13 | 0.005 | 0.005 | 0.005 | 0.005 |
| Reg 7 | All | LLP | All | 12 | 0.005 | 0.005 | 0.005 | 0.005 |
| Reg 7 | All | All | FDA | 13 | 0.005 | 0.005 | 0.005 | 0.005 |
| Reg 7 | All | All | NoFDA | 0 | | | | |
| Reg 7 | All | HLP | All | 1 | 0.005 | 0.005 | | |
| Reg 5 | All | HLP | All | 0 | | | | |
| Reg 5 | All | LLP | All | 57 | 0.005 | 0.005 | 0.005 | 0.005 |
| Reg 5 | All | All | FDA | 61 | 0.005 | 0.005 | 0.005 | 0.005 |
| Reg 5 | All | All | NoFDA | 0 | | | | |
| Reg 5 | All | All | All | 61 | 0.005 | 0.005 | 0.005 | 0.005 |
| Reg 9 | All | All | All | 85 | 0.005 | 0.005 | 0.005 | 0.005 |
| Reg 6 | All | All | All | 22 | 0.005 | 0.005 | 0.005 | 0.005 |
| Reg 1 | All | All | All | 5 | 0.005 | 0.005 | 0.005 | 0.005 |
| Reg 2 | All | All | All | 1265 | 0.054 | 0.902 | 0.297 | 0.409 |
| Reg 3 | All | All | All | 19 | 0.005 | 0.005 | 0.005 | 0.005 |
| Reg 4 | All | All | All | 13 | 0.005 | 0.005 | 0.005 | 0.005 |
| All | Salt | HLP | All | 631 | 0.005 | 0.005 | 0.005 | 0.005 |
| All | Salt | LLP | All | 42 | 0.005 | 0.005 | 0.005 | 0.005 |
| All | Salt | All | All | 737 | 0.005 | 0.005 | 0.005 | 0.005 |
| All | Fresh | HLP | All | 3 | 0.005 | 0.005 | 0.005 | 0.005 |
| All | Fresh | LLP | All | 110 | 0.005 | 0.005 | 0.005 | 0.005 |
| All | Fresh | All | All | 117 | 0.005 | 0.005 | 0.005 | 0.005 |
| All | All | HLP | All | 838 | 0.056 | 0.902 | 0.290 | 0.409 |
| All | All | LLP | All | 618 | 0.005 | 0.005 | 0.005 | 0.005 |
| All | All | Bluefi | All | 579 | 0.005 | 0.005 | 0.005 | 0.005 |
| All | All | No Blfi | All | 1044 | 0.064 | 0.902 | 0.329 | 0.454 |
| All | All | Shellfi | All | 58 | 0.005 | 0.005 | 0.005 | 0.005 |
| All | All | No shel | All | 1565 | 0.045 | 0.902 | 0.266 | 0.355 |
| All | All | No Bf,S | All | 986 | 0.068 | 0.902 | 0.339 | 0.483 |
| All | All | Eel | All | 8 | 0.004 | 0.005 | 0.007 | 0.005 |
| All | All | All | FDA | 936 | 0.005 | 0.005 | 0.005 | 0.005 |
| All | All | All | NoFDA | 688 | 0.095 | 0.902 | 0.407 | 0.586 |
| All | All | All | All | 1625 | 0.043 | 0.902 | 0.261 | 0.351 |

MIREX, 1985 + 1986
*See notes at end of Appendix II for guide to abbreviations.

| Region | Water Type | Fish Type | FDA | # of Smpls | Avg. (ppm) | Max. Res. (ppm) | 95% Conf. Limit (Normal Dist.) | 95% Conf. 95% Cov. (ppm) |
|---|---|---|---|---|---|---|---|---|
| IL,WI,MI | All | All | All | 72 | 0.005 | 0.005 | 0.005 | 0.005 |
| NY | All | All | All | 1525 | 0.045 | 0.902 | 0.270 | 0.355 |
| MO | All | All | All | 11 | 0.005 | 0.005 | 0.005 | 0.005 |
| Reg 7 | All | All | All | 17 | 0.005 | 0.005 | 0.005 | 0.005 |
| Reg 7 | All | LLP | All | 16 | 0.005 | 0.005 | 0.005 | 0.005 |
| Reg 7 | All | All | FDA | 17 | 0.005 | 0.005 | 0.005 | 0.005 |
| Reg 7 | All | All | NoFDA | 0 | 0.005 | 0.005 | 0.005 | 0.005 |
| Reg 7 | All | HLP | All | 1 | 0.005 | 0.005 | 0.005 | 0.005 |
| Reg 5 | All | HLP | All | 8 | 0.005 | 0.005 | 0.005 | 0.005 |
| Reg 5 | All | LLP | All | 105 | 0.005 | 0.005 | 0.005 | 0.005 |
| Reg 5 | All | All | FDA | 120 * | 0.005 | 0.005 | 0.005 | 0.005 |
| Reg 5 | All | All | NoFDA | 1 | 0.005 | 0.005 | 0.005 | 0.005 |
| Reg 5 | All | All | All | 121 | 0.005 | 0.005 | 0.005 | 0.005 |
| Reg 9 | All | All | All | 145 | 0.005 | 0.005 | 0.005 | 0.005 |
| Reg 6 | All | All | All | 26 | 0.005 | 0.005 | 0.005 | 0.005 |
| Reg 1 | All | All | All | 18 | 0.005 | 0.005 | 0.005 | 0.005 |
| Reg 2 | All | All | All | 1545 | 0.045 | 0.902 | 0.268 | 0.355 |
| Reg 3 | All | All | All | 46 | 0.005 | 0.005 | 0.005 | 0.005 |
| Reg 4 | All | All | All | 42 | 0.005 | 0.005 | 0.005 | 0.005 |
| All | Salt | HLP | All | 895 | 0.005 | 0.005 | 0.005 | 0.005 |
| All | Salt | LLP | All | 62 | 0.005 | 0.005 | 0.005 | 0.005 |
| All | Salt | All | All | 1053 | 0.005 | 0.005 | 0.005 | 0.005 |
| All | Fresh | HLP | All | 4 | 0.005 | 0.008 | 0.006 | 0.005 |
| All | Fresh | LLP | All | 218 | 0.005 | 0.008 | 0.006 | 0.005 |
| All | Fresh | All | All | 227 | 0.041 | 0.902 | 0.241 | 0.323 |
| All | All | HLP | All | 1199 | 0.005 | 0.008 | 0.005 | 0.005 |
| All | All | LLP | All | 762 | 0.005 | 0.005 | 0.005 | 0.005 |
| All | All | Bluefi | All | 798 | 0.046 | 0.902 | 0.272 | 0.364 |
| All | All | No Blfi | All | 1495 | 0.005 | 0.005 | 0.005 | 0.005 |
| All | All | Shellfi | All | 85 | 0.033 | 0.902 | 0.222 | 0.269 |
| All | All | No shel | All | 2208 | 0.049 | 0.902 | 0.281 | 0.404 |
| All | All | No Bf,S | All | 1410 | 0.002 | 0.005 | 0.005 | 0.005 |
| All | All | Eel | All | 86 | 0.005 | 0.005 | 0.005 | 0.005 |
| All | All | All | FDA | 1525 | 0.085 | 0.902 | 0.385 | 0.541 |
| All | All | All | NoFDA | 769 | 0.032 | 0.902 | 0.218 | 0.252 |
| All | All | All | All | 2293 | | | | |

DDT, 1985
*See notes at end of Appendix II for guide to abbreviations.

| Region | Water Type | Fish Type | FDA | # of Smpls | Avg. (ppm) | Max. Res. (ppm) | 95% Conf. Limit (Normal Dist.) | 95% Conf. 95% Cov. (ppm) |
|---|---|---|---|---|---|---|---|---|
| IL,WI,MI | All | All | All | 155 | 1.004 | 18.65 | 5.560 | 10.367 |
| NY | All | All | All | 1722 | 0.395 | 12.96 | 1.901 | 1.594 |
| MO | All | All | All | 34 | 0.049 | 0.625 | 0.263 | 0.625 |
| Reg 7 | All | All | All | 40 | 0.056 | 0.625 | 0.276 | 0.625 |
| Reg 7 | All | LLP | All | 15 | 0.119 | 0.625 | 0.446 | 0.625 |
| Reg 7 | All | All | FDA | 13 | 0.138 | 0.625 | 0.478 | 0.625 |
| Reg 7 | All | All | NoFDA | 27 | 0.017 | 0.108 | 0.053 | 0.108 |
| Reg 7 | All | HLP | All | 1 | 0.005 | 0.005 | | |
| Reg 5 | All | HLP | All | 26 | 0.283 | 0.757 | 0.642 | 0.757 |
| Reg 5 | All | LLP | All | 67 | 0.261 | 0.740 | 0.660 | 0.740 |
| Reg 5 | All | All | FDA | 61 | 0.262 | 0.740 | 0.674 | 0.740 |
| Reg 5 | All | All | NoFDA | 120 | 1.212 | 18.65 | 6.326 | 14.024 |
| Reg 5 | All | All | All | 181 | 0.894 | 18.65 | 5.138 | 9.397 |
| Reg 9 | All | All | All | 85 | 0.309 | 8.700 | 2.007 | 8.700 |
| Reg 6 | All | All | All | 22 | 0.138 | 0.735 | 0.444 | 0.735 |
| Reg 1 | All | All | All | 5 | 0.062 | 0.075 | 0.093 | 0.735 |
| Reg 2 | All | All | All | 1734 | 0.393 | 12.96 | 1.895 | 1.525 |
| Reg 3 | All | All | All | 19 | 0.058 | 0.205 | 0.138 | 0.205 |
| Reg 4 | All | All | All | 13 | 15.33 | 122.2 | 70.84 | 122.2 |
| All | Salt | HLP | All | 631 | 0.181 | 8.700 | 0.818 | 0.465 |
| All | Salt | LLP | All | 42 | 0.250 | 1.460 | 0.922 | 1.460 |
| All | Salt | All | All | 737 | 0.173 | 8.700 | 0.789 | 0.485 |
| All | Fresh | HLP | All | 26 | 0.076 | 0.757 | 0.334 | 0.757 |
| All | Fresh | LLP | All | 164 | 1.348 | 122.2 | 18.56 | 12.929 |
| All | Fresh | All | All | 194 | 1.150 | 122.2 | 16.99 | 7.550 |
| All | All | HLP | All | 1133 | 0.461 | 12.96 | 2.295 | 1.917 |
| All | All | LLP | All | 800 | 0.440 | 122.2 | 8.282 | 0.752 |
| All | All | Bluefi | All | 579 | 0.173 | 0.755 | 0.389 | 0.455 |
| All | All | No Blfi | All | 1660 | 0.590 | 122.2 | 6.415 | 2.017 |
| All | All | Shellfi | All | 58 | 0.040 | 0.465 | 0.141 | 0.465 |
| All | All | No shel | All | 2181 | 0.494 | 122.2 | 5.586 | 1.594 |
| All | All | No Bf,S | All | 1602 | 0.610 | 122.2 | 6.536 | 2.153 |
| All | All | Eel | All | 9 | 0.228 | 0.453 | 0.444 | 0.453 |
| All | All | All | FDA | 936 | 0.379 | 122.2 | 7.646 | 0.615 |
| All | All | All | NoFDA | 1304 | 0.556 | 18.65 | 2.889 | 2.238 |
| All | All | All | All | 2239 | 0.482 | 122.2 | 5.509 | 1.525 |

DDT, 1986
*See notes at end of Appendix II for guide to abbreviations.

| Region | Water Type | Fish Type | FDA | # of Smpls | Avg. (ppm) | Max. Res. (ppm) | 95% Conf. Limit (Normal Dist.) | 95% Conf. 95% Cov. (ppm) |
|---|---|---|---|---|---|---|---|---|
| IL,WI,MI | All | All | All | 41 | 0.324 | 0.805 | 0.702 | 0.805 |
| NY | All | All | All | 299 | 0.215 | 4.035 | 0.709 | 0.697 |
| MO | All | All | All | 107 | 0.052 | 1.150 | 0.269 | 0.335 |
| Reg 7 | All | All | All | 107 | 0.052 | 1.150 | 0.269 | 0.335 |
| Reg 7 | All | LLP | All | 88 | 0.044 | 1.150 | 0.266 | 1.150 |
| Reg 7 | All | All | FDA | 4 | 0.425 | 1.150 | 1.183 | 1.150 |
| Reg 7 | All | All | NoFDA | 103 | 0.037 | 0.319 | 0.134 | 0.301 |
| Reg 7 | All | HLP | All | 0 | | | | |
| Reg 5 | All | HLP | All | 12 | 0.279 | 0.390 | 0.426 | 0.390 |
| Reg 5 | All | LLP | All | 51 | 0.269 | 0.805 | 0.668 | 0.805 |
| Reg 5 | All | All | FDA | 59 | 0.264 | 0.805 | 0.643 | 0.805 |
| Reg 5 | All | All | NoFDA | 5 | 0.312 | 0.390 | 0.391 | 0.390 |
| Reg 5 | All | All | All | 64 | 0.267 | 0.805 | 0.633 | 0.805 |
| Reg 9 | All | All | All | 60 | 0.199 | 2.795 | 0.890 | 2.795 |
| Reg 6 | All | All | All | 4 | 0.050 | 0.085 | 0.086 | 0.085 |
| Reg 1 | All | All | All | 13 | 0.095 | 0.240 | 0.193 | 0.240 |
| Reg 2 | All | All | All | 307 | 0.213 | 4.035 | 0.702 | 0.697 |
| Reg 3 | All | All | All | 26 | 0.123 | 0.430 | 0.296 | 0.430 |
| Reg 4 | All | All | All | 29 | 1.123 | 9.230 | 4.351 | 9.230 |
| All | Salt | HLP | All | 263 | 0.154 | 4.035 | 0.623 | 0.425 |
| All | Salt | LLP | All | 22 | 0.278 | 2.795 | 1.358 | 2.795 |
| All | Salt | All | All | 317 | 0.152 | 4.035 | 0.672 | 0.430 |
| All | Fresh | HLP | All | 1 | 0.045 | 0.045 | | |
| All | Fresh | LLP | All | 161 | 0.330 | 9.230 | 1.884 | 2.700 |
| All | Fresh | All | All | 163 | 0.326 | 9.230 | 1.873 | 2.700 |
| All | All | HLP | All | 388 | 0.189 | 4.035 | 0.631 | 0.628 |
| All | All | LLP | All | 231 | 0.266 | 9.230 | 1.626 | 2.030 |
| All | All | Bluefi | All | 218 | 0.164 | 4.035 | 0.660 | 0.415 |
| All | All | No Blfi | All | 585 | 0.183 | 9.230 | 1.076 | 0.760 |
| All | All | Shellfi | All | 27 | 0.041 | 0.095 | 0.076 | 0.095 |
| All | All | No shel | All | 776 | 0.183 | 9.230 | 1.000 | 0.655 |
| All | All | No Bf,S | All | 558 | 0.190 | 9.230 | 1.103 | 0.776 |
| All | All | Eel | All | 102 | 0.283 | 0.889 | 0.642 | 0.855 |
| All | All | All | FDA | 588 | 0.181 | 9.230 | 1.094 | 0.650 |
| All | All | All | NoFDA | 215 | 0.170 | 1.413 | 0.540 | 0.713 |
| All | All | All | All | 803 | 0.178 | 9.230 | 0.983 | 0.650 |

DDT, 1985 + 1986
*See notes at end of Appendix II for guide to abbreviations.

| Region | Water Type | Fish Type | FDA | # of Smpls | Avg. (ppm) | Max. Res. (ppm) | 95% Conf. Limit (Normal Dist.) | 95% Conf. 95% Cov. (ppm) |
|---|---|---|---|---|---|---|---|---|
| IL,WI,MI | All | All | All | 196 | 0.862 | 18.65 | 4.946 | 9.397 |
| NY | All | All | All | 2021 | 0.368 | 12.96 | 1.776 | 1.425 |
| MO | All | All | All | 141 | 0.051 | 1.15 | 0.267 | 0.415 |
| Reg 7 | All | All | All | 147 | 0.053 | 1.15 | 0.271 | 0.415 |
| Reg 7 | All | LLP | All | 103 | 0.055 | 1.15 | 0.299 | 0.625 |
| Reg 7 | All | All | FDA | 17 | 0.206 | 1.15 | 0.724 | 1.150 |
| Reg 7 | All | All | NoFDA | 130 | 0.033 | 0.319 | 0.122 | 0.267 |
| Reg 7 | All | HLP | All | 1 | 0.005 | 0.005 | | |
| Reg 5 | All | HLP | All | 38 | 0.282 | 0.757 | 0.590 | 0.757 |
| Reg 5 | All | LLP | All | 118 | 0.265 | 0.805 | 0.663 | 0.740 |
| Reg 5 | All | All | FDA | 120 | 0.266 | 0.805 | 0.659 | 0.740 |
| Reg 5 | All | All | NoFDA | 125 | 1.176 | 18.65 | 6.196 | 12.26 |
| Reg 5 | All | All | All | 245 | 0.730 | 18.65 | 4.414 | 8.794 |
| Reg 9 | All | All | All | 145 | 0.264 | 8.700 | 1.641 | 1.460 |
| Reg 6 | All | All | All | 26 | 0.125 | 0.735 | 0.412 | 0.735 |
| Reg 1 | All | All | All | 18 | 0.086 | 0.240 | 0.174 | 0.240 |
| Reg 2 | All | All | All | 2041 | 0.366 | 12.96 | 1.768 | 1.413 |
| Reg 3 | All | All | All | 46 | 0.096 | 0.430 | 0.246 | 0.430 |
| Reg 4 | All | All | All | 42 | 5.522 | 122.2 | 38.59 | 122.2 |
| All | Salt | HLP | All | 895 | 0.173 | 8.700 | 0.765 | 0.445 |
| All | Salt | LLP | All | 64 | 0.259 | 2.795 | 1.095 | 2.795 |
| All | Salt | All | All | 1055 | 0.167 | 8.700 | 0.755 | 0.445 |
| All | Fresh | HLP | All | 27 | 0.075 | 0.757 | 0.328 | 0.757 |
| All | Fresh | LLP | All | 325 | 0.843 | 122.2 | 13.15 | 3.700 |
| All | Fresh | All | All | 357 | 0.774 | 122.2 | 12.52 | 3.030 |
| All | All | HLP | All | 1522 | 0.391 | 12.96 | 2.003 | 1.611 |
| All | All | LLP | All | 1031 | 0.401 | 122.2 | 7.340 | 0.826 |
| All | All | Bluefi | All | 798 | 0.171 | 4.035 | 0.489 | 0.425 |
| All | All | No Blfi | All | 2245 | 0.484 | 122.2 | 5.523 | 1.658 |
| All | All | Shellfi | All | 85 | 0.041 | 0.465 | 0.126 | 0.465 |
| All | All | No shel | All | 2958 | 0.412 | 122.2 | 4.811 | 1.353 |
| All | All | No Bf,S | All | 2160 | 0.502 | 122.2 | 5.636 | 1.676 |
| All | All | Eel | All | 111 | 0.278 | 0.889 | 0.629 | 0.855 |
| All | All | All | FDA | 1525 | 0.302 | 122.2 | 6.026 | 0.575 |
| All | All | All | NoFDA | 1519 | 0.502 | 18.65 | 2.680 | 1.917 |
| All | All | All | All | 3043 | 0.402 | 122.2 | 4.740 | 1.326 |

HEPTACHLOR, 1985

*See notes at end of Appendix II for guide to abbreviations.

| Region | Water Type | Fish Type | FDA | # of Smpls | Avg. (ppm) | Max. Res. (ppm) | 95% Conf. Limit (Normal Dist.) | 95% Conf. 95% Cov. (ppm) |
|---|---|---|---|---|---|---|---|---|
| IL,WI,MI | All | All | All | 120 | 0.013 | 0.095 | 0.049 | 0.095 |
| NY | All | All | All | 1021 | 0.008 | 0.048 | 0.014 | 0.010 |
| MO | All | All | All | 34 | 0.004 | 0.041 | 0.018 | 0.041 |
| Reg 7 | All | All | All | 40 | 0.005 | 0.041 | 0.018 | 0.041 |
| Reg 7 | All | LLP | All | 15 | 0.009 | 0.015 | 0.014 | 0.015 |
| Reg 7 | All | All | FDA | 13 | 0.010 | 0.015 | 0.013 | 0.015 |
| Reg 7 | All | All | NoFDA | 27 | 0.003 | 0.041 | 0.016 | 0.041 |
| Reg 7 | All | HLP | All | 1 | 0.010 | 0.010 | | |
| Reg 5 | All | HLP | All | 6 | 0.003 | 0.009 | 0.008 | 0.008 |
| Reg 5 | All | LLP | All | 62 | 0.031 | 0.095 | 0.081 | 0.095 |
| Reg 5 | All | All | FDA | 61 | 0.032 | 0.095 | 0.081 | 0.095 |
| Reg 5 | All | All | NoFDA | 85 | 0.006 | 0.026 | 0.017 | 0.026 |
| Reg 5 | All | All | All | 146 | 0.017 | 0.095 | 0.057 | 0.095 |
| Reg 9 | All | All | All | 85 | 0.010 | 0.010 | 0.010 | 0.010 |
| Reg 6 | All | All | All | 22 | 0.009 | 0.010 | 0.012 | 0.010 |
| Reg 1 | All | All | All | 5 | 0.010 | 0.010 | 0.010 | 0.010 |
| Reg 2 | All | All | All | 1033 | 0.008 | 0.048 | 0.014 | 0.010 |
| Reg 3 | All | All | All | 19 | 0.014 | 0.045 | 0.033 | 0.045 |
| Reg 4 | All | All | All | 13 | 0.010 | 0.010 | 0.010 | 0.010 |
| All | Salt | HLP | All | 631 | 0.010 | 0.010 | 0.010 | 0.010 |
| All | Salt | LLP | All | 42 | 0.010 | 0.010 | 0.010 | 0.010 |
| All | Salt | All | All | 737 | 0.010 | 0.010 | 0.010 | 0.010 |
| All | Fresh | HLP | All | 9 | 0.005 | 0.010 | 0.012 | 0.010 |
| All | Fresh | LLP | All | 113 | 0.021 | 0.095 | 0.060 | 0.085 |
| All | Fresh | All | All | 126 | 0.019 | 0.095 | 0.058 | 0.085 |
| All | All | HLP | All | 656 | 0.010 | 0.010 | 0.012 | 0.010 |
| All | All | LLP | All | 631 | 0.010 | 0.095 | 0.031 | 0.045 |
| All | All | Bluefi | All | 579 | 0.010 | 0.010 | 0.010 | 0.010 |
| All | All | No Blfi | All | 924 | 0.009 | 0.095 | 0.027 | 0.041 |
| All | All | Shellfi | All | 58 | 0.010 | 0.010 | 0.010 | 0.010 |
| All | All | No shel | All | 1445 | 0.010 | 0.095 | 0.024 | 0.015 |
| All | All | No Bf,S | All | 866 | 0.009 | 0.095 | 0.028 | 0.025 |
| All | All | Eel | All | 9 | 0.008 | 0.010 | 0.014 | 0.010 |
| All | All | All* | FDA | 936 | 0.011 | 0.095 | 0.027 | 0.015 |
| All | All | All | NoFDA | 568 | 0.006 | 0.048 | 0.014 | 0.015 |
| All | All | All | All | 1503 | 0.010 | 0.095 | 0.024 | 0.013 |

HEPTACHLOR, 1986
*See notes at end of Appendix II for guide to abbreviations.

| Region | Water Type | Fish Type | FDA | # of Smpls | Avg. (ppm) | Max. Res. (ppm) | 95% Conf. Limit (Normal Dist.) | 95% Conf. 95% Cov. (ppm) |
|---|---|---|---|---|---|---|---|---|
| IL,WI,MI | All | All | All | 41 | 0.030 | 0.075 | 0.068 | 0.075 |
| NY | All | All | All | 297 | 0.008 | 0.045 | 0.015 | 0.010 |
| MO | All | All | All | 107 | 0.012 | 0.097 | 0.047 | 0.091 |
| Reg 7 | All | All | All | 107 | 0.012 | 0.097 | 0.047 | 0.091 |
| Reg 7 | All | LLP | All | 88 | 0.011 | 0.097 | 0.041 | 0.097 |
| Reg 7 | All | All | FDA | 4 | 0.010 | 0.010 | 0.010 | 0.010 |
| Reg 7 | All | All | NoFDA | 103 | 0.012 | 0.097 | 0.048 | 0.091 |
| Reg 7 | All | HLP | All | 0 | | | | |
| Reg 5 | All | HLP | All | 12 | 0.013 | 0.015 | 0.017 | 0.015 |
| Reg 5 | All | LLP | All | 51 | 0.027 | 0.075 | 0.062 | 0.075 |
| Reg 5 | All | All | FDA | 59 | 0.025 | 0.075 | 0.059 | 0.075 |
| Reg 5 | All | All | NoFDA | 5 | 0.010 | 0.010 | 0.010 | 0.010 |
| Reg 5 | All | All | All | 64 | 0.024 | 0.075 | 0.057 | 0.075 |
| Reg 9 | All | All | All | 4 | 0.010 | 0.010 | 0.010 | 0.010 |
| Reg 6 | All | All | All | 4 | 0.010 | 0.010 | 0.010 | 0.010 |
| Reg 1 | All | All | All | 13 | 0.010 | 0.010 | 0.010 | 0.010 |
| Reg 2 | All | All | All | 305 | 0.008 | 0.045 | 0.015 | 0.010 |
| Reg 3 | All | All | All | 26 | 0.010 | 0.015 | 0.013 | 0.015 |
| Reg 4 | All | All | All | 29 | 0.010 | 0.010 | 0.010 | 0.010 |
| All | Salt | HLP | All | 263 | 0.010 | 0.011 | 0.011 | 0.010 |
| All | Salt | LLP | All | 22 | 0.011 | 0.028 | 0.017 | 0.028 |
| All | Salt | All | All | 317 | 0.010 | 0.028 | 0.012 | 0.010 |
| All | Fresh | HLP | All | 1 | 0.010 | 0.010 | | |
| All | Fresh | LLP | All | 160 | 0.017 | 0.097 | 0.049 | 0.075 |
| All | Fresh | All | All | 162 | 0.017 | 0.097 | 0.049 | 0.075 |
| All | All | HLP | All | 388 | 0.009 | 0.015 | 0.014 | 0.011 |
| All | All | LLP | All | 230 | 0.014 | 0.097 | 0.042 | 0.065 |
| All | All | Bluefi | All | 218 | 0.010 | 0.015 | 0.011 | 0.010 |
| All | All | No Blfi | All | 583 | 0.011 | 0.097 | 0.032 | 0.045 |
| All | All | Shellfi | All | 27 | 0.010 | 0.010 | 0.010 | 0.010 |
| All | All | No shel | All | 774 | 0.011 | 0.097 | 0.029 | 0.035 |
| All | All | No Bf,S | All | 556 | 0.011 | 0.097 | 0.033 | 0.045 |
| All | All | Eel | All | 102 | 0.004 | 0.015 | 0.010 | 0.013 |
| All | All | All | FDA | 588 | 0.012 | 0.075 | 0.025 | 0.025 |
| All | All | All | NoFDA | 213 | 0.008 | 0.097 | 0.034 | 0.059 |
| All | All | All | All | 801 | 0.011 | 0.097 | 0.029 | 0.035 |

HEPTACHLOR, 1985 + 1986
*See notes at end of Appendix II for guide to abbreviations.

| Region | Water Type | Fish Type | FDA | # of Smpls | Avg. (ppm) | Max. Res. (ppm) | 95% Conf. Limit (Normal Dist.) | 95% Conf. 95% Cov. (ppm) |
|---|---|---|---|---|---|---|---|---|
| IL,WI,MI | All | All | All | 161 | 0.018 | 0.095 | 0.056 | 0.085 |
| NY | All | All | All | 1318 | 0.008 | 0.048 | 0.014 | 0.010 |
| MO | All | All | All | 141 | 0.010 | 0.097 | 0.042 | 0.086 |
| Reg 7 | All | All | All | 147 | 0.010 | 0.097 | 0.041 | 0.086 |
| Reg 7 | All | LLP | All | 103 | 0.011 | 0.097 | 0.039 | 0.086 |
| Reg 7 | All | All | FDA | 17 | 0.010 | 0.015 | 0.012 | 0.015 |
| Reg 7 | All | All | NoFDA | 130 | 0.010 | 0.097 | 0.043 | 0.086 |
| Reg 7 | All | HLP | All | 1 | 0.010 | 0.010 | | |
| Reg 5 | All | HLP | All | 18 | 0.010 | 0.015 | 0.019 | 0.015 |
| Reg 5 | All | LLP | All | 113 | 0.029 | 0.095 | 0.073 | 0.095 |
| Reg 5 | All | All | FDA | 120 | 0.028 | 0.095 | 0.071 | 0.095 |
| Reg 5 | All | All | NoFDA | 90 | 0.007 | 0.026 | 0.017 | 0.026 |
| Reg 5 | All | All | All | 210 | 0.019 | 0.095 | 0.057 | 0.085 |
| Reg 9 | All | All | All | 145 | 0.010 | 0.010 | 0.010 | 0.010 |
| Reg 6 | All | All | All | 26 | 0.009 | 0.010 | 0.012 | 0.010 |
| Reg 1 | All | All | All | 18 | 0.010 | 0.010 | 0.010 | 0.010 |
| Reg 2 | All | All | All | 1338 | 0.008 | 0.048 | 0.014 | 0.010 |
| Reg 3 | All | All | All | 46 | 0.012 | 0.045 | 0.024 | 0.045 |
| Reg 4 | All | All | All | 42 | 0.010 | 0.010 | 0.010 | 0.010 |
| All | Salt | HLP | All | 895 | 0.010 | 0.015 | 0.010 | 0.010 |
| All | Salt | LLP | All | 64 | 0.010 | 0.028 | 0.014 | 0.028 |
| All | Salt | All | All | 1055 | 0.010 | 0.028 | 0.011 | 0.010 |
| All | Fresh | HLP | All | 10 | 0.006 | 0.010 | 0.013 | 0.010 |
| All | Fresh | LLP | All | 273 | 0.018 | 0.097 | 0.054 | 0.075 |
| All | Fresh | All | All | 288 | 0.018 | 0.097 | 0.053 | 0.075 |
| All | All | HLP | All | 1045 | 0.009 | 0.015 | 0.013 | 0.010 |
| All | All | LLP | All | 861 | 0.011 | 0.097 | 0.034 | 0.048 |
| All | All | Bluefi | All | 798 | 0.010 | 0.015 | 0.010 | 0.010 |
| All | All | No Blfi | All | 1507 | 0.010 | 0.097 | 0.029 | 0.029 |
| All | All | Shellfi | All | 85 | 0.010 | 0.010 | 0.010 | 0.010 |
| All | All | No shel | All | 2220 | 0.010 | 0.097 | 0.026 | 0.015 |
| All | All | No Bf,S | All | 1422 | 0.010 | 0.097 | 0.030 | 0.035 |
| All | All | Eel | All | 111 | 0.005 | 0.015 | 0.010 | 0.013 |
| All | All | All | FDA | 1525 | 0.012 | 0.095 | 0.027 | 0.015 |
| All | All | All | NoFDA | 781 | 0.007 | 0.097 | 0.022 | 0.020 |
| All | All | All | All | 2305 | 0.010 | 0.097 | 0.026 | 0.015 |

ALDRIN/DIELDRIN, 1985
*See notes at end of Appendix II for guide to abbreviations.

| Region | Water Type | Fish Type | FDA | # of Smpls | Avg. (ppm) | Max. Res. (ppm) | 95% Conf. Limit (Normal Dist.) | 95% Conf. 95% Cov. (ppm) |
|---|---|---|---|---|---|---|---|---|
| IL,WI,MI | All | All | All | 390 | 0.077 | 1.165 | 0.275 | 0.325 |
| NY | All | All | All | 1721 | 0.021 | 0.343 | 0.076 | 0.098 |
| MO | All | All | All | 36 | 0.031 | 0.503 | 0.184 | 0.503 |
| Reg 7 | All | All | All | 42 | 0.028 | 0.503 | 0.170 | 0.503 |
| Reg 7 | All | LLP | All | 17 | 0.060 | 0.503 | 0.271 | 0.503 |
| Reg 7 | All | All | FDA | 13 | 0.027 | 0.145 | 0.090 | 0.145 |
| Reg 7 | All | All | NoFDA | 29 | 0.029 | 0.503 | 0.194 | 0.503 |
| Reg 7 | All | HLP | All | 1 | 0.010 | 0.010 | | |
| Reg 5 | All | HLP | All | 190 | 0.067 | 0.550 | 0.197 | 0.200 |
| Reg 5 | All | LLP | All | 125 | 0.141 | 1.165 | 0.421 | 0.515 |
| Reg 5 | All | All | FDA | 61 | 0.159 | 1.165 | 0.477 | 1.165 |
| Reg 5 | All | All | NoFDA | 355 | 0.064 | 0.700 | 0.217 | 0.260 |
| Reg 5 | All | All | All | 416 | 0.078 | 1.165 | 0.273 | 0.325 |
| Reg 9 | All | All | All | 85 | 0.011 | 0.075 | 0.024 | 0.085 |
| Reg 6 | All | All | All | 22 | 0.016 | 0.055 | 0.036 | 0.055 |
| Reg 1 | All | All | All | 5 | 0.343 | 1.664 | 1.502 | 1.664 |
| Reg 2 | All | All | All | 1733 | 0.021 | 0.343 | 0.076 | 0.098 |
| Reg 3 | All | All | All | 19 | 0.025 | 0.125 | 0.086 | 0.125 |
| Reg 4 | All | All | All | 13 | 0.017 | 0.025 | 0.027 | 0.025 |
| All | Salt | HLP | All | 631 | 0.014 | 0.045 | 0.019 | 0.015 |
| All | Salt | LLP | All | 42 | 0.013 | 0.075 | 0.032 | 0.075 |
| All | Salt | All | All | 737 | 0.016 | 1.664 | 0.123 | 0.015 |
| All | Fresh | HLP | All | 50 | 0.014 | 0.150 | 0.061 | 0.150 |
| All | Fresh | LLP | All | 214 | 0.085 | 1.165 | 0.320 | 0.355 |
| All | Fresh | All | All | 268 | 0.070 | 1.165 | 0.288 | 0.335 |
| All | All | HLP | All | 1296 | 0.030 | 0.550 | 0.105 | 0.130 |
| All | All | LLP | All | 860 | 0.031 | 1.165 | 0.172 | 0.225 |
| All | All | Bluefi | All | 579 | 0.015 | 0.045 | 0.018 | 0.015 |
| All | All | No Blfi | All | 1896 | 0.035 | 1.664 | 0.168 | 0.170 |
| All | All | Shellfi | All | 58 | 0.039 | 1.664 | 0.417 | 1.664 |
| All | All | No shel | All | 2417 | 0.030 | 1.165 | 0.133 | 0.150 |
| All | All | No Bf,S | All | 1838 | 0.035 | 1.165 | 0.152 | 0.170 |
| All | All | Eel | All | 9 | 0.015 | 0.025 | 0.030 | 0.025 |
| All | All | All | FDA | 936 | 0.025 | 1.664 | 0.165 | 0.115 |
| All | All | All | NoFDA | 1540 | 0.033 | 0.700 | 0.134 | 0.160 |
| All | All | All | All | 2475 | 0.030 | 1.664 | 0.147 | 0.150 |

ALDRIN/DIELDRIN, 1986

*See notes at end of Appendix II for guide to abbreviations.

| Region | Water Type | Fish Type | FDA | # of Smpls | Avg. (ppm) | Max. Res. (ppm) | 95% Conf. Limit (Normal Dist.) | 95% Conf. 95% Cov. (ppm) |
|---|---|---|---|---|---|---|---|---|
| IL,WI,MI | All | All | All | 78 | 0.118 | 0.480 | 0.324 | 0.480 |
| NY | All | All | All | 299 | 0.018 | 0.205 | 0.047 | 0.055 |
| MO | All | All | All | 130 | 0.051 | 0.578 | 0.221 | 0.367 |
| Reg 7 | All | All | All | 130 | 0.051 | 0.578 | 0.221 | 0.367 |
| Reg 7 | All | LLP | All | 107 | 0.037 | 0.578 | 0.164 | 0.293 |
| Reg 7 | All | All | FDA | 4 | 0.050 | 0.065 | 0.086 | 0.065 |
| Reg 7 | All | All | NoFDA | 126 | 0.051 | 0.578 | 0.224 | 0.367 |
| Reg 7 | All | HLP | All | 0 | | | | |
| Reg 5 | All | HLP | All | 18 | 0.026 | 0.050 | 0.048 | 0.050 |
| Reg 5 | All | LLP | All | 82 | 0.115 | 0.480 | 0.318 | 0.480 |
| Reg 5 | All | All | FDA | 59 | 0.107 | 0.335 | 0.281 | 0.281 |
| Reg 5 | All | All | NoFDA | 42 | 0.086 | 0.480 | 0.302 | 0.480 |
| Reg 5 | All | All | All | 101 | 0.098 | 0.480 | 0.291 | 0.470 |
| Reg 9 | All | All | All | 60 | 0.010 | 0.010 | 0.010 | 0.010 |
| Reg 6 | All | All | All | 4 | 0.011 | 0.015 | 0.015 | 0.015 |
| Reg 1 | All | All | All | 13 | 0.012 | 0.015 | 0.016 | 0.015 |
| Reg 2 | All | All | All | 307 | 0.018 | 0.205 | 0.046 | 0.055 |
| Reg 3 | All | All | All | 26 | 0.012 | 0.015 | 0.016 | 0.015 |
| Reg 4 | All | All | All | 29 | 0.010 | 0.010 | 0.010 | 0.010 |
| All | Salt | HLP | All | 263 | 0.015 | 0.205 | 0.039 | 0.035 |
| All | Salt | LLP | All | 22 | 0.015 | 0.098 | 0.048 | 0.098 |
| All | Salt | All | All | 317 | 0.015 | 0.205 | 0.038 | 0.035 |
| All | Fresh | HLP | All | 6 | 0.010 | 0.010 | 0.010 | 0.010 |
| All | Fresh | LLP | All | 208 | 0.065 | 0.578 | 0.237 | 0.320 |
| All | Fresh | All | All | 215 | 0.063 | 0.578 | 0.233 | 0.320 |
| All | All | HLP | All | 394 | 0.017 | 0.205 | 0.042 | 0.043 |
| All | All | LLP | All | 281 | 0.051 | 0.578 | 0.206 | 0.295 |
| All | All | Bluefi | All | 218 | 0.016 | 0.205 | 0.042 | 0.035 |
| All | All | No Blfi | All | 645 | 0.034 | 0.578 | 0.156 | 0.235 |
| All | All | Shellfi | All | 27 | 0.010 | 0.015 | 0.012 | 0.015 |
| All | All | No shel | All | 836 | 0.030 | 0.578 | 0.139 | 0.195 |
| All | All | No Bf,S | All | 618 | 0.035 | 0.578 | 0.159 | 0.235 |
| All | All | Eel | All | 102 | 0.020 | 0.070 | 0.047 | 0.061 |
| All | All | All | FDA | 588 | 0.023 | 0.335 | 0.099 | 0.165 |
| All | All | All | NoFDA | 275 | 0.044 | 0.578 | 0.195 | 0.340 |
| All | All | All | All | 863 | 0.029 | 0.578 | 0.137 | 0.194 |

ALDRIN/DIELDRIN, 1985 + 1986
*See notes at end of Appendix II for guide to abbreviations.

| Region | Water Type | Fish Type | FDA | # of Smpls | Avg. (ppm) | Max. Res. (ppm) | 95% Conf. Limit (Normal Dist.) | 95% Conf. 95% Cov. (ppm) |
|---|---|---|---|---|---|---|---|---|
| IL,WI,MI | All | All | All | 468 | 0.084 | 1.165 | 0.285 | 0.335 |
| NY | All | All | All | 2020 | 0.020 | 0.343 | 0.073 | 0.092 |
| MO | All | All | All | 166 | 0.046 | 0.578 | 0.214 | 0.367 |
| Reg 7 | All | All | All | 172 | 0.045 | 0.578 | 0.210 | 0.367 |
| Reg 7 | All | LLP | All | 124 | 0.040 | 0.578 | 0.183 | 0.201 |
| Reg 7 | All | All | FDA | 17 | 0.033 | 0.145 | 0.093 | 0.145 |
| Reg 7 | All | All | NoFDA | 155 | 0.047 | 0.578 | 0.219 | 0.367 |
| Reg 7 | All | HLP | All | 1 | 0.010 | 0.010 | | |
| Reg 5 | All | HLP | All | 208 | 0.064 | 0.550 | 0.189 | 0.190 |
| Reg 5 | All | LLP | All | 207 | 0.131 | 1.165 | 0.384 | 0.480 |
| Reg 5 | All | All | FDA | 120 | 0.133 | 1.165 | 0.395 | 0.515 |
| Reg 5 | All | All | NoFDA | 397 | 0.067 | 0.700 | 0.227 | 0.280 |
| Reg 5 | All | All | All | 517 | 0.082 | 1.165 | 0.277 | 0.325 |
| Reg 9 | All | All | All | 145 | 0.011 | 0.075 | 0.021 | 0.015 |
| Reg 6 | All | All | All | 26 | 0.015 | 0.055 | 0.034 | 0.055 |
| Reg 1 | All | All | All | 18 | 0.104 | 1.664 | 0.768 | 1.664 |
| Reg 2 | All | All | All | 2040 | 0.020 | 0.343 | 0.072 | 0.092 |
| Reg 3 | All | All | All | 46 | 0.017 | 0.125 | 0.058 | 0.125 |
| Reg 4 | All | All | All | 42 | 0.012 | 0.025 | 0.020 | 0.025 |
| All | Salt | HLP | All | 895 | 0.015 | 0.205 | 0.028 | 0.015 |
| All | Salt | LLP | All | 64 | 0.014 | 0.098 | 0.038 | 0.098 |
| All | Salt | All | All | 1055 | 0.016 | 1.664 | 0.106 | 0.015 |
| All | Fresh | HLP | All | 56 | 0.014 | 0.150 | 0.058 | 0.150 |
| All | Fresh | LLP | All | 422 | 0.075 | 1.165 | 0.282 | 0.325 |
| All | Fresh | All | All | 483 | 0.067 | 1.165 | 0.265 | 0.320 |
| All | All | HLP | All | 1691 | 0.027 | 0.550 | 0.094 | 0.112 |
| All | All | LLP | All | 1141 | 0.036 | 1.165 | 0.181 | 0.235 |
| All | All | Bluefi | All | 798 | 0.015 | 0.205 | 0.029 | 0.015 |
| All | All | No Blfi | All | 2541 | 0.035 | 1.664 | 0.165 | 0.175 |
| All | All | Shellfi | All | 85 | 0.030 | 1.664 | 0.343 | 1.664 |
| All | All | No shel | All | 3254 | 0.030 | 1.165 | 0.135 | 0.153 |
| All | All | No Bf,S | All | 2456 | 0.035 | 1.165 | 0.154 | 0.177 |
| All | All | Eel | All | 111 | 0.020 | 0.070 | 0.046 | 0.061 |
| All | All | All | FDA | 1525 | 0.024 | 1.664 | 0.144 | 0.105 |
| All | All | All | NoFDA | 1815 | 0.035 | 0.700 | 0.145 | 0.166 |
| All | All | All | All | 3339 | 0.030 | 1.664 | 0.145 | 0.150 |

## List of Abbreviations

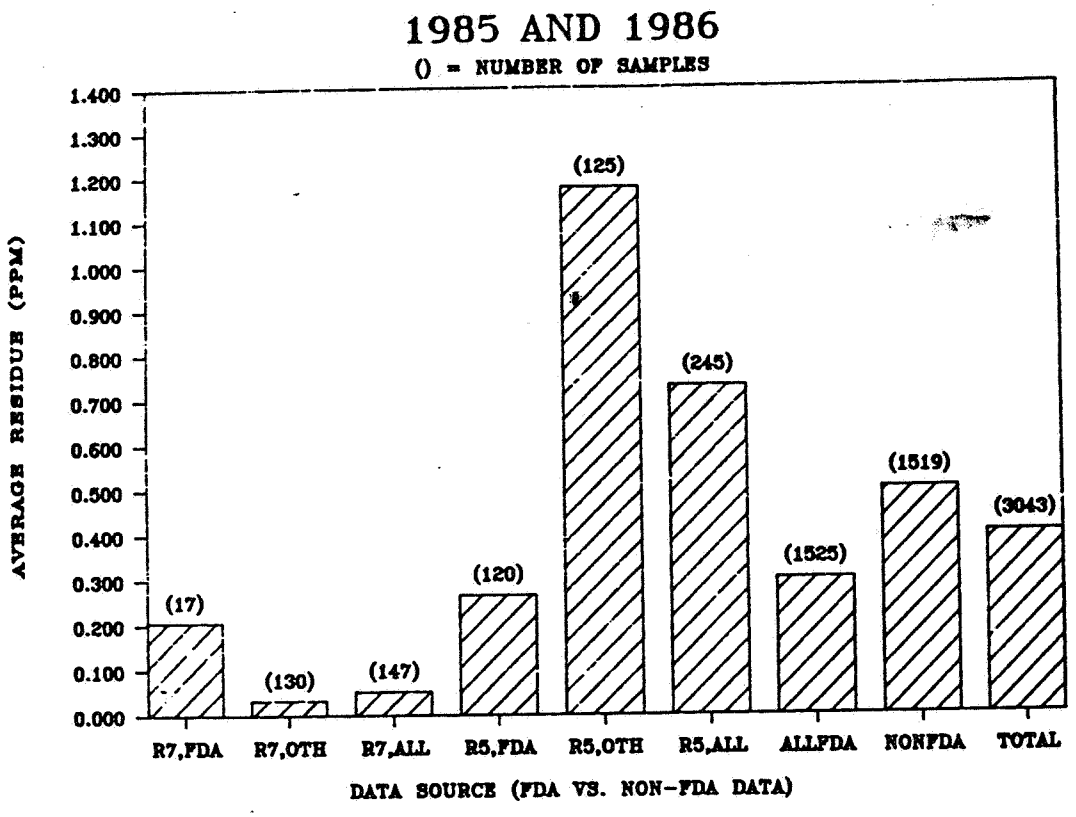
### Abbreviations within Tables

| | | |
|---|---|---|
| All | = | All locations, both fresh and salt water, all fish species or both FDA and non-FDA data |
| IL,WI,MI | = | Illinois, Wisconsin and Michigan data |
| NY | = | New York |
| MO | = | Missouri |
| Reg X | = | EPA Region X |
| Salt | = | Salt water fish |
| Fresh | = | Fresh water fish |
| HLP | = | High level predatory species |
| LLP | = | Low level predatory species / bottom feeding species |
| Bluefi | = | Bluefish |
| No Blfi | = | All fish except Bluefish |
| Shellfi | = | Shellfish |
| No Shel | = | All fish except shellfish |
| No Bf,S | = | All fish except Bluefish and shellfish |
| Eel | = | American Eel |
| FDA | = | FDA data only |
| NoFDA | = | All data except FDA data |

### Column Headings

| | | |
|---|---|---|
| Water type | = | Either fresh or salt water fish |
| Fish type | = | Species and/or category of fish by feeding habits |
| FDA | = | Data source (FDA or other data) |
| # of Smpls | = | Number of samples |
| Avg. | = | Average residue (ppm) |
| Max. Res. | = | Maximum residue (ppm) |
| 95% Conf. Limit (Normal Distribution) | = | 95% upper confidence limit assuming the data are normally distributed |
| 95% Conf. 95% Cov. | = | Tolerance limit utilizing 95% confidence, 95% population coverage (no distribution assumed) |

Figure 17 (Cont.):
DDT: Residue Variation with Data Source (FDA vs. Non-FDA data)




R7 = EPA Region 7
R5 = EPA Region 5
FDA = FDA data only
OTH = All data other than FDA data
ALL = All FDA data and other (non-FDA) data
ALLFDA = FDA data from all locations
NONFDA = All data other than FDA data from all locations
TOTAL = All data

Figure 18:
DDT: Residue Variation with Species of Fish

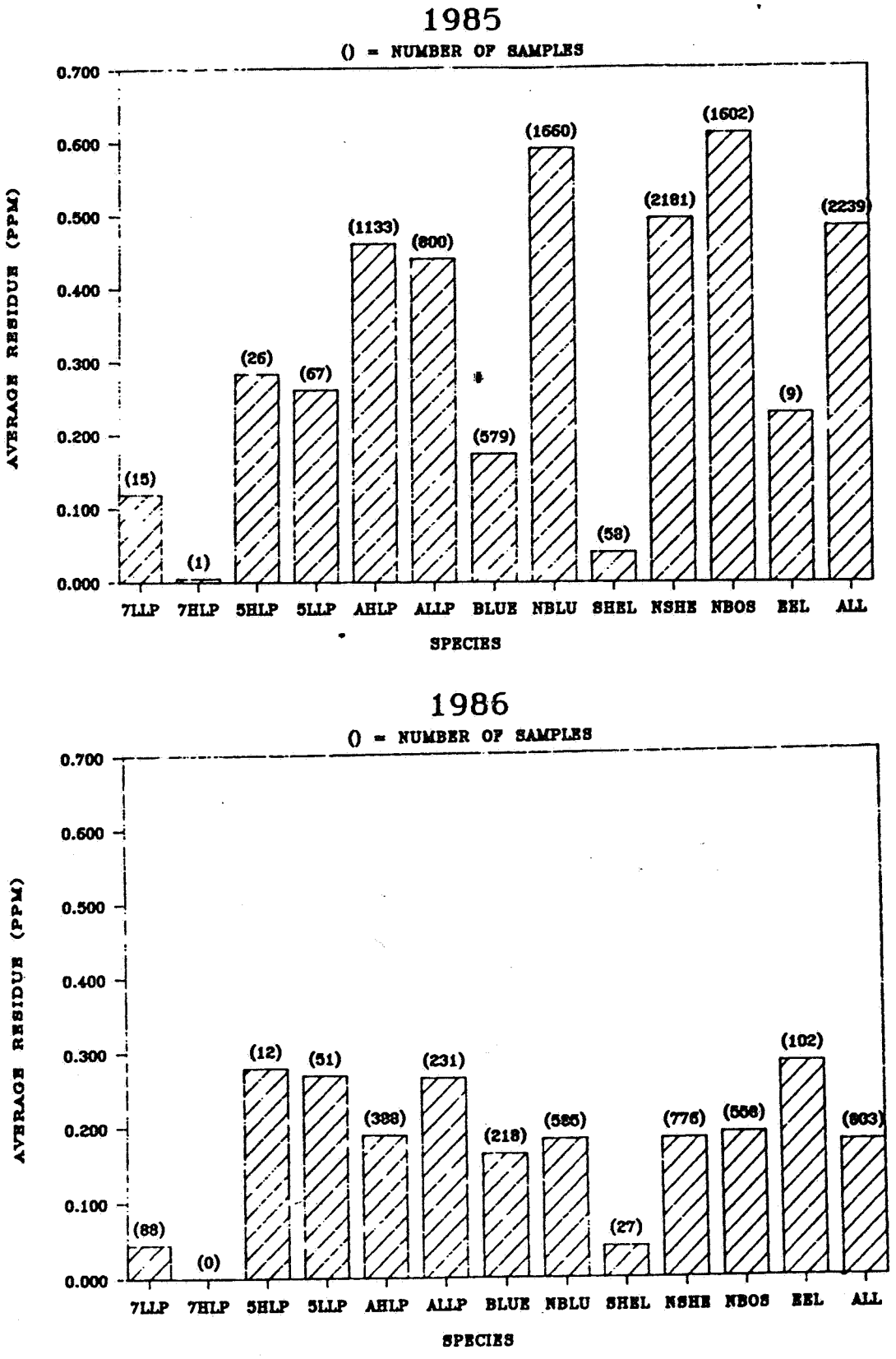
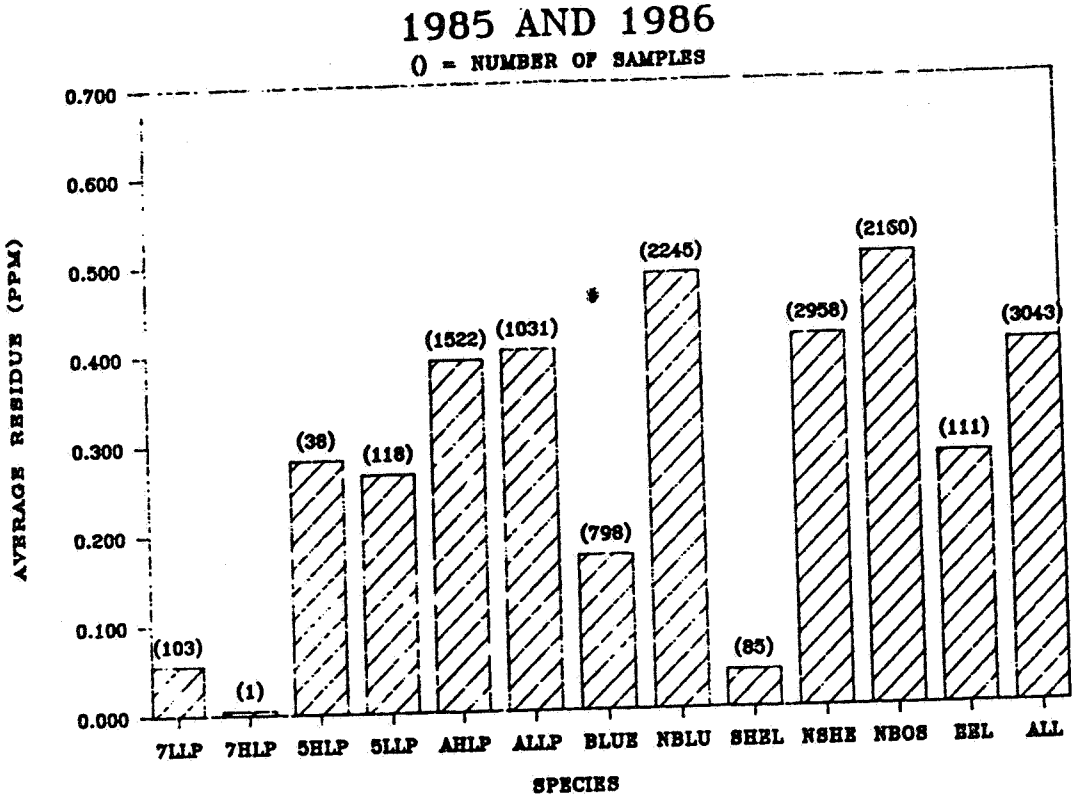
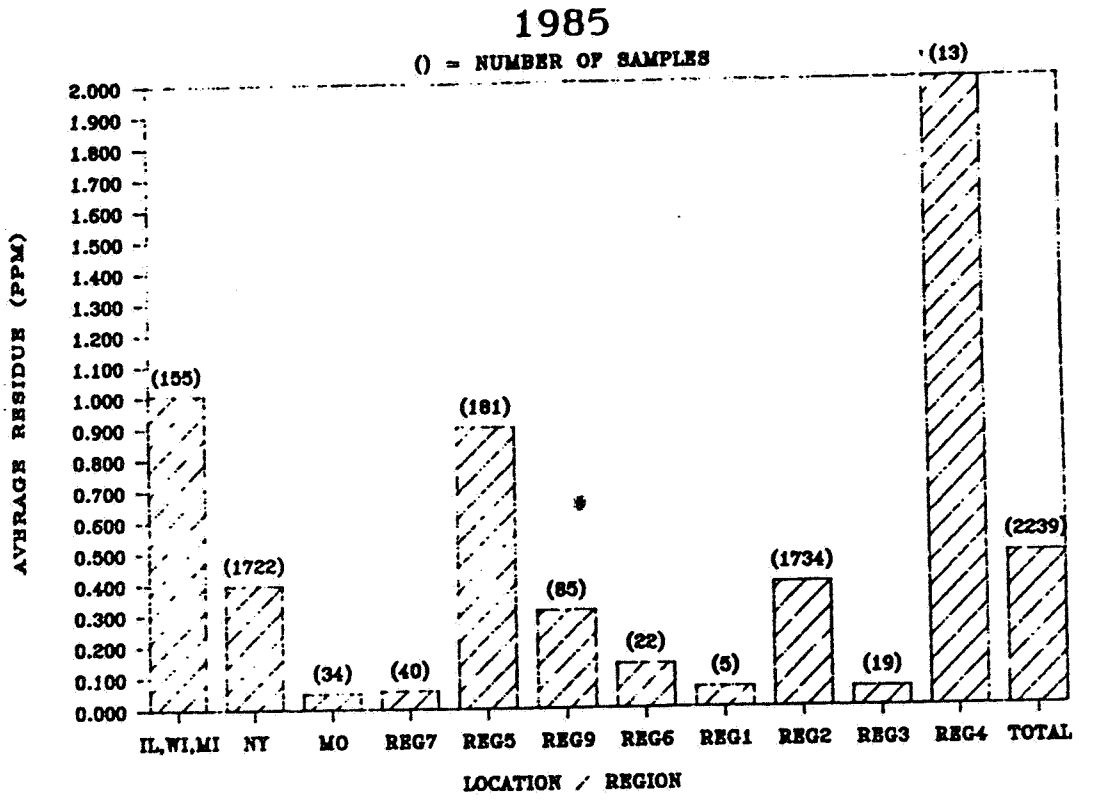


Figure 18 (Cont.):
DDT: Residue Variation with Species of Fish




7LLP = EPA Region 7, low level predatory and bottom-feeding fish
7HLP = EPA Region 7, high level predatory fish
5HLP = EPA Region 5, high level predatory fish
5LLP = EPA Region 5, low level predatory and bottom-feeding fish
AHLP = High level predators, all locations
ALLP = Low level predators, all locations
BLUE = Bluefish
NBLU = All fish except Bluefish
SHEL = Shellfish
NSHE = All fish except shellfish
NBOS = All fish except Bluefish and shellfish
EEL = American Eels
ALL = All fish

Figure 19:
DDT: Residue Variation with Location / Region



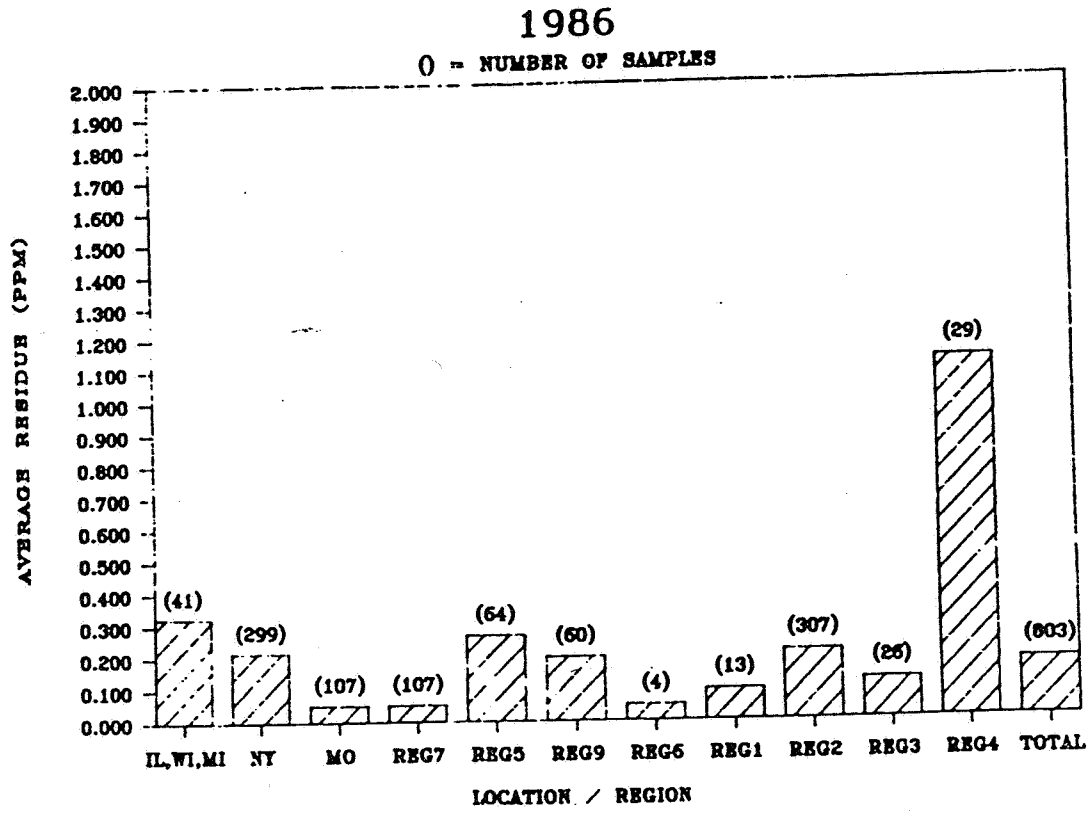
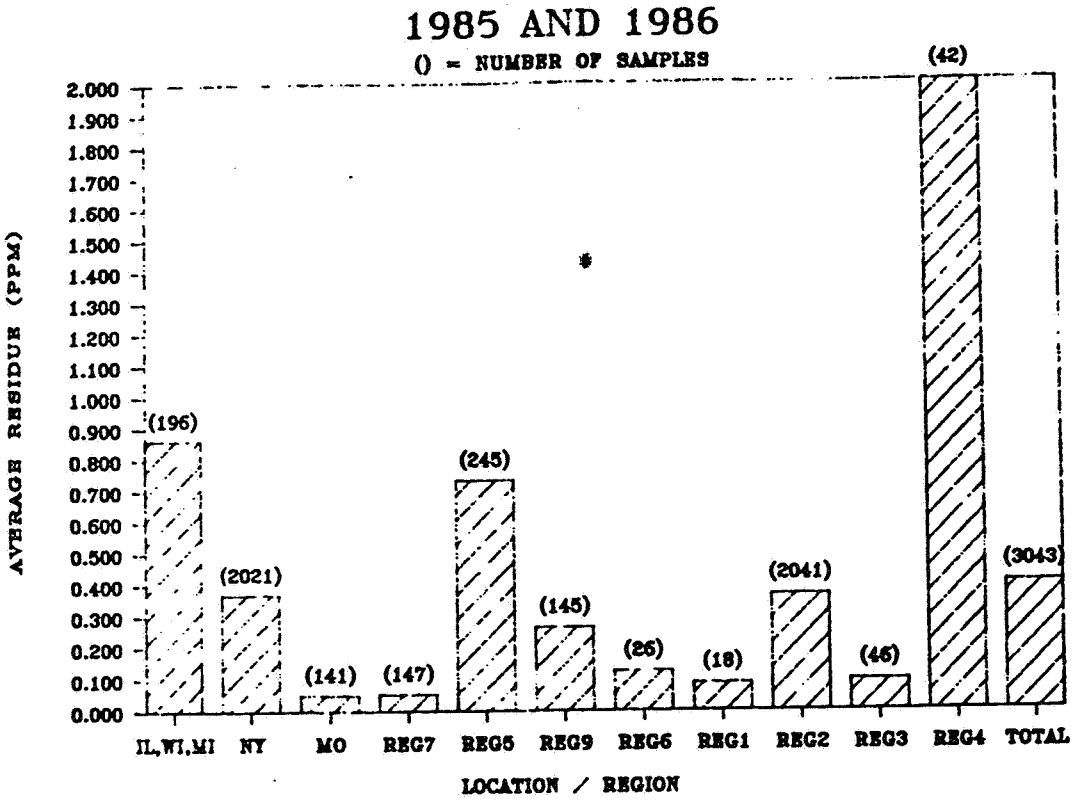
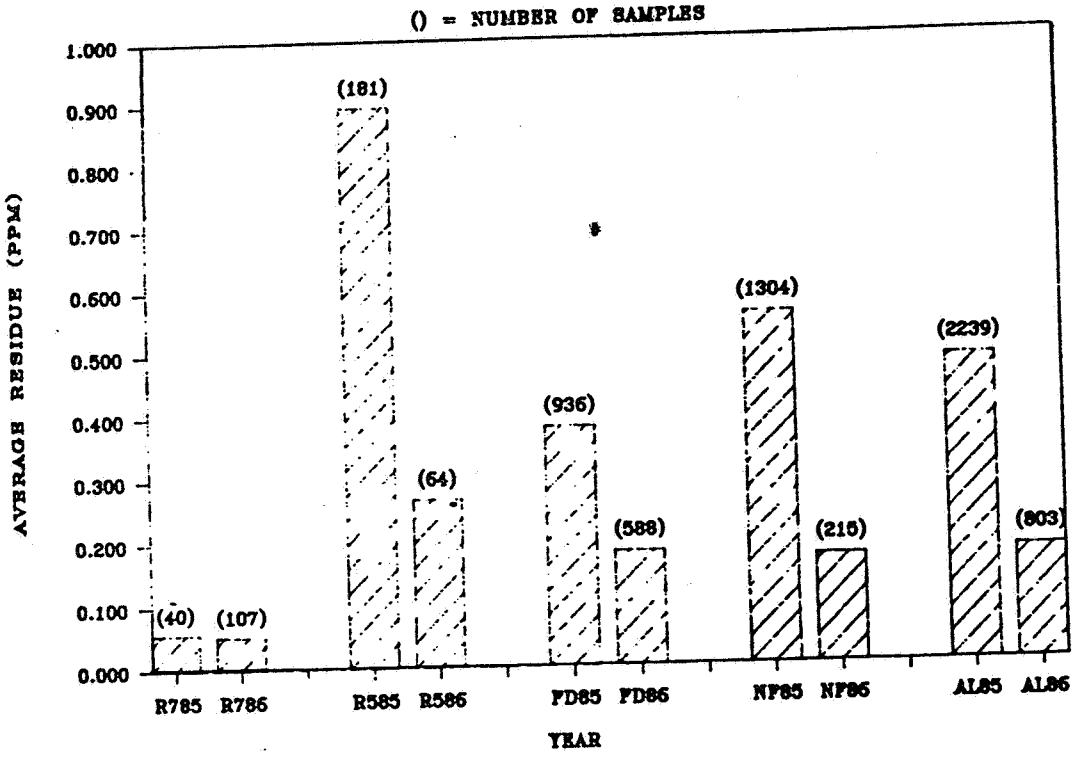



Figure 19 (Cont.):
DDT: Residue Variation with Location / Region




IL,WI,MI = Illinois, Wisconsin and Michigan
NY = New York
MO = Missouri
REGX = EPA Region X
TOTAL = Combined data from all locations

Figure 20:
DDT: Residue Variation with Time




R785 = EPA Region 7 data, 1985
R786 = EPA Region 7 data, 1986
R585 = EPA Region 5 data, 1985
R586 = EPA Region 5 data, 1986
FD85 = FDA data, 1985
FD86 = FDA data, 1986
NF85 = All data except FDA data, 1985
NF86 = All data except FDA data, 1986
AL85 = All data, 1985
AL86 = All data, 1986

## ALDRIN/DIELDRIN

### Aldrin/Dieldrin Residue Variation with Data Source

Aldrin/Dieldrin residue variation with data source is shown in Figure 22. The variation in residues found for the entire data set and both years is minimal (0.010 ppm). The variation is greater in 1986 (0.021 ppm) than in 1985 (0.008 ppm). For the entire data set, the average of the FDA data is lower than that of other data for both years.

This is in contrast to Region 5 data in which the average for the FDA data is higher than that of the other data by a significant amount (difference = 0.020-0.094 ppm for different years). Region 7 data shows a maximum difference in average residues of 0.014 ppm for the combined 1985 + 1986 data with the FDA data lower.

### Aldrin/Dieldrin Residue Variation with Species

Aldrin/dieldrin residue variation with fish species is shown in Figure 23. Bluefish, shellfish and American eels have average residues less than or equal to the mean for all species. Low level predators/bottom-feeding species have higher average residues than high level predators, a trend which is particularly evident in data from Region 5. These trends are found in both 1985 and 1986 data.

### Aldrin/Dieldrin Residue Variation with Aquatic Environment

Aldrin/dieldrin residue variation with aquatic environment (water type, fresh vs. salt water) is shown in Figure 21. Fresh water species are seen to have significantly higher residues than salt water species in most instances. The exception is high level predators which have approximately equal average residues for salt water and fresh water fish. These trends are consistent from year to year.

### Aldrin/Dieldrin Residue Variation with Time

Aldrin/dieldrin residue variation with time is shown in Figure 25. The average residue level in fish for 1986 was greater than for 1985 for Region 5, Region 7 and non-FDA data. Average residues for the entire data set and for FDA data showed slight decreases from 1985 to 1986.

## Aldrin/Dieldrin Residue Variation with Location

Aldrin/dieldrin residue variation with location is shown in Figure 24. Initial inspection of this graph suggests that Region 1 has much higher average residues than other locations. However, only a minimal number of samples were obtained from Region 1 (18), and 1 sample with an unusually high residue value accounted for this high average residue.

Regions 7 and 5, particularly Region 5, show higher average residues than other locations. Most of the samples taken from these two Regions were fresh water fish which generally have higher residues than the salt water fish taken from many of the other locations. However, samples taken from Region 2 (primarily NY) were also mostly fresh water fish but showed lower average residues than most other locations.

## Aldrin/Dieldrin: Other Considerations

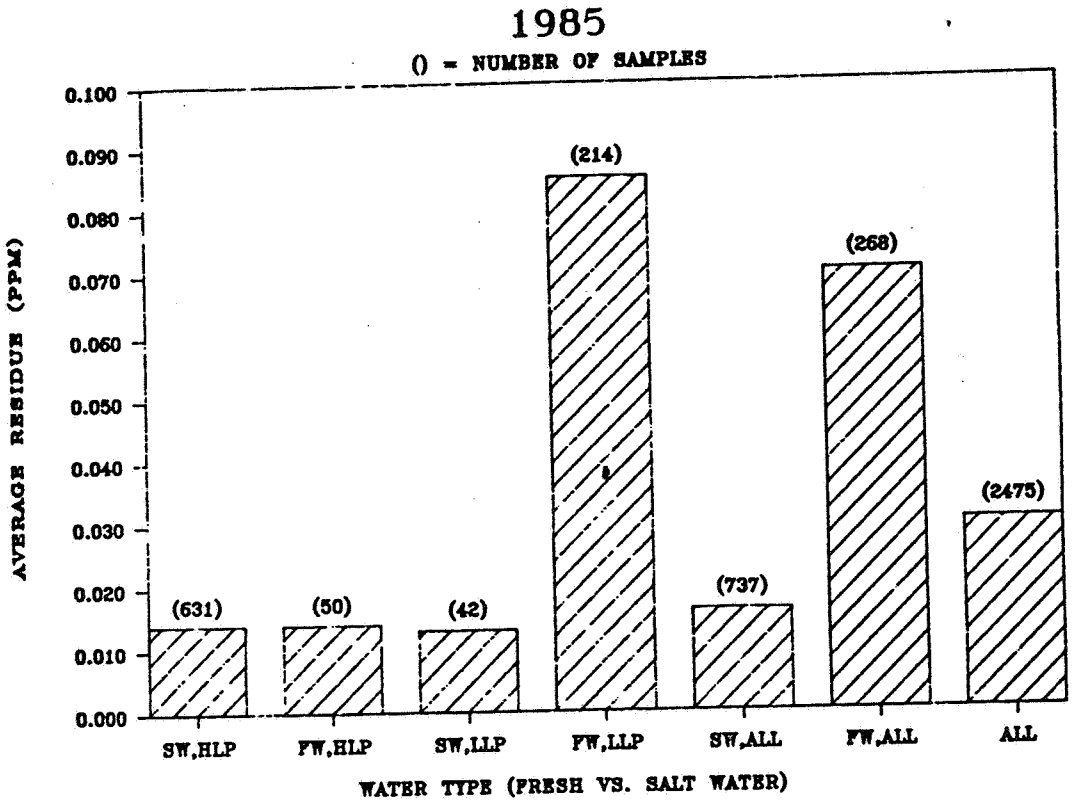
Table 5 shows the average values and tolerance limits (95% confidence, 95% coverage, no distribution assumed) for select data subsets. Our previous action level recommendation for aldrin/dieldrin of 0.1 ppm (M. Metzger, 3/25/87) was based on FDA surveillance monitoring data only.

Utilizing 95% confidence with 95% coverage of the fish population, and utilizing the entire data set currently available to RCB, we estimate that aldrin/dieldrin residues would not exceed 0.2 ppm on a national basis and 0.4 ppm in Regions 5 and 7 assuming 95% confidence and 95% coverage of the fish population.

Table 5: Aldrin/Dieldrin Summary Statistics

| Year | Region | Water Type | Fish Type | FDA? | Number of Samples | Average Residue (ppm) | Tolerance Limit (ppm) |
|---|---|---|---|---|---|---|---|
| 1985 | All | All | All | FDA | 936 | 0.025 | 0.115 |
| | All | All | All | All | 2475 | 0.030 | 0.150 |
| 1986 | All | All | All | FDA | 588 | 0.023 | 0.165 |
| | All | All | All | All | 863 | 0.029 | 0.194 |
| 85 + 86 | Reg 5 | All | All | All | 517 | 0.082 | 0.325 |
| | Reg 7 | All | All | All | 172 | 0.045 | 0.367 |
| | Reg 2 | All | All | All | 2040 | 0.020 | 0.092 |
| | All | All | All | FDA | 1525 | 0.024 | 0.105 |
| | All | All | All | All | 3339 | 0.030 | 0.150 |

Figure 21:
ALDRIN/DIELDRIN: Residue Variation with Water Type (Salt vs. Fresh Water)



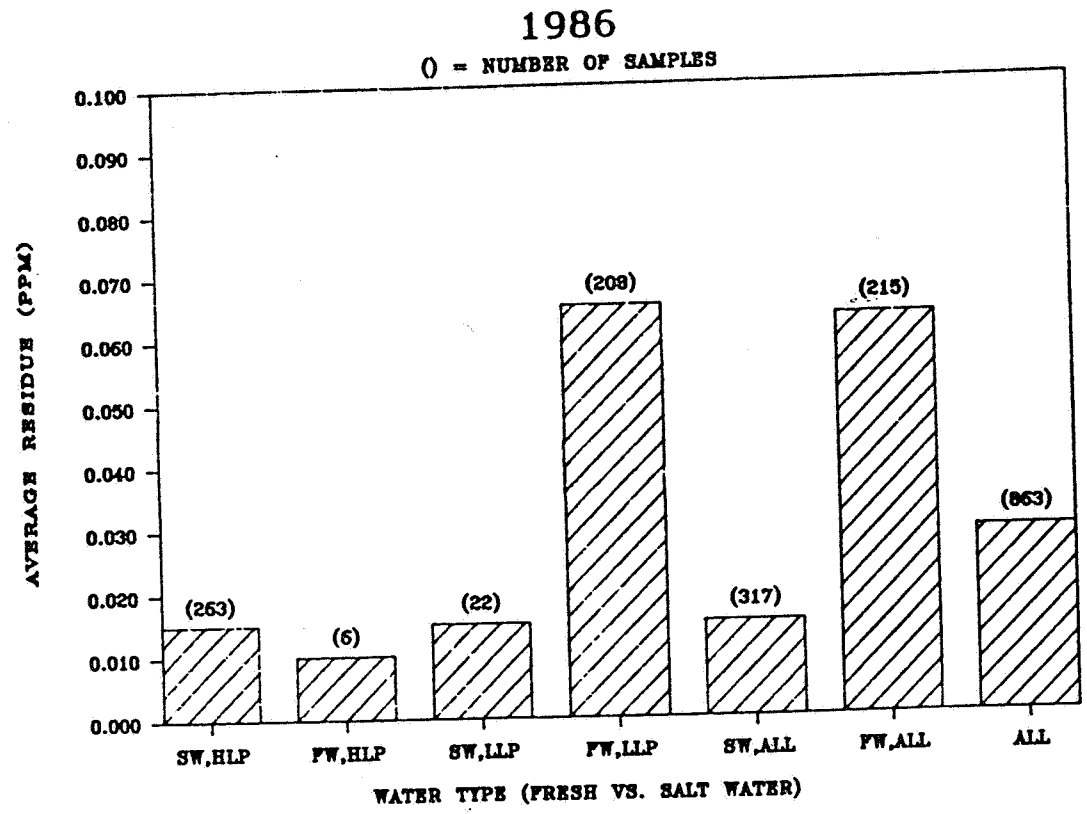
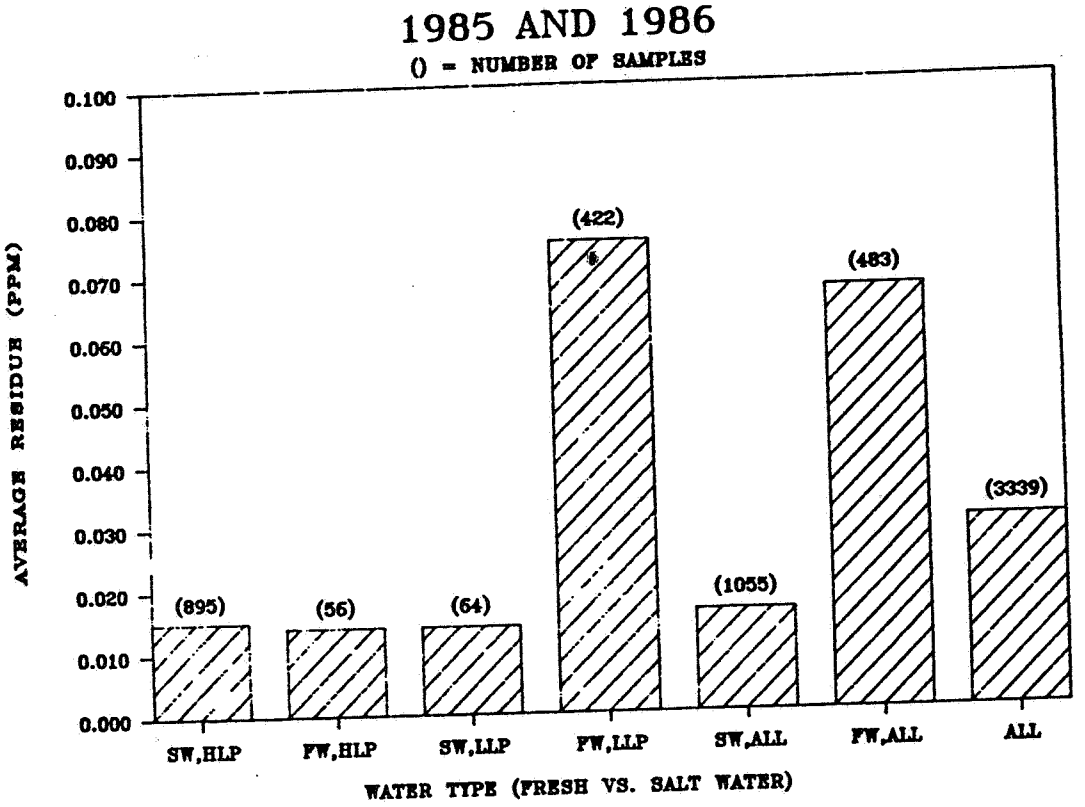
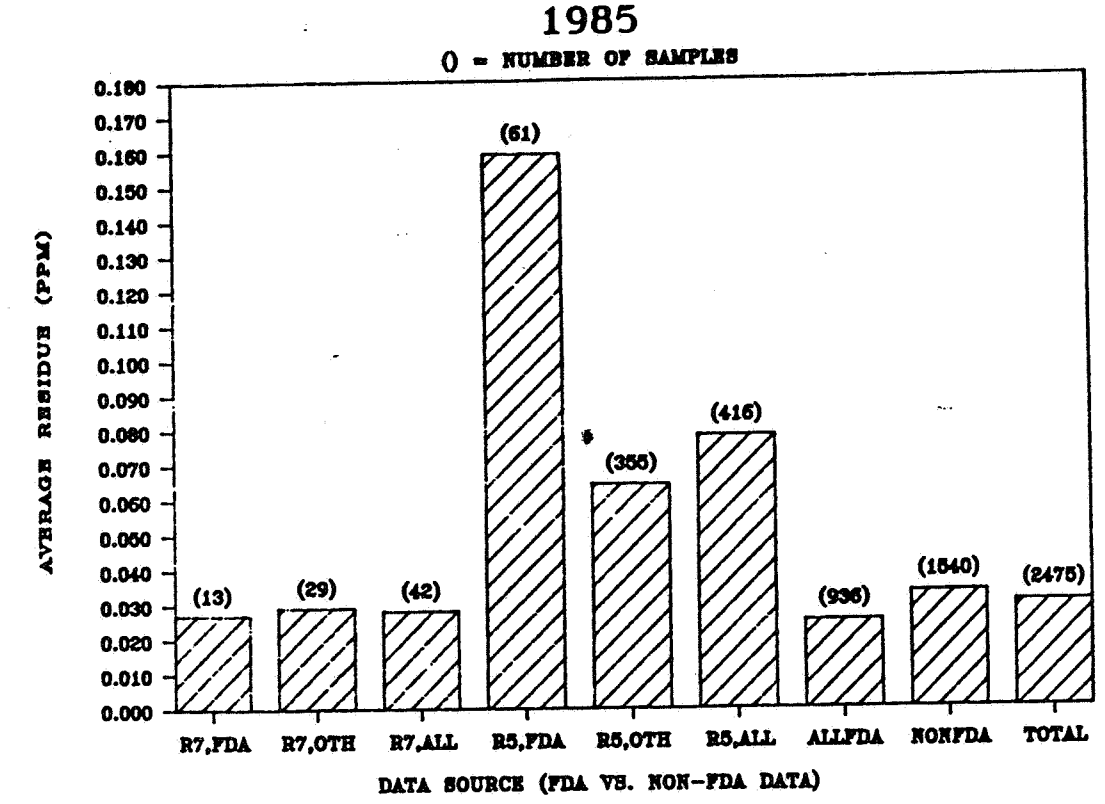



Figure 21 (Cont.):
ALDRIN/DIELDRIN: Residue Variation with Water Type (Salt vs. Fresh Water)




SW = Salt Water Fish
HLP = High level predatory fish
FW = Fresh water fish
LLP = Low level predatory / bottom-feeding fish
All = All high level predatory and low level predatory / bottom-feeding fish

Figure 22:
ALDRIN/DIELDRIN: Residue Variation with Data Source (FDA vs. Non-FDA data)



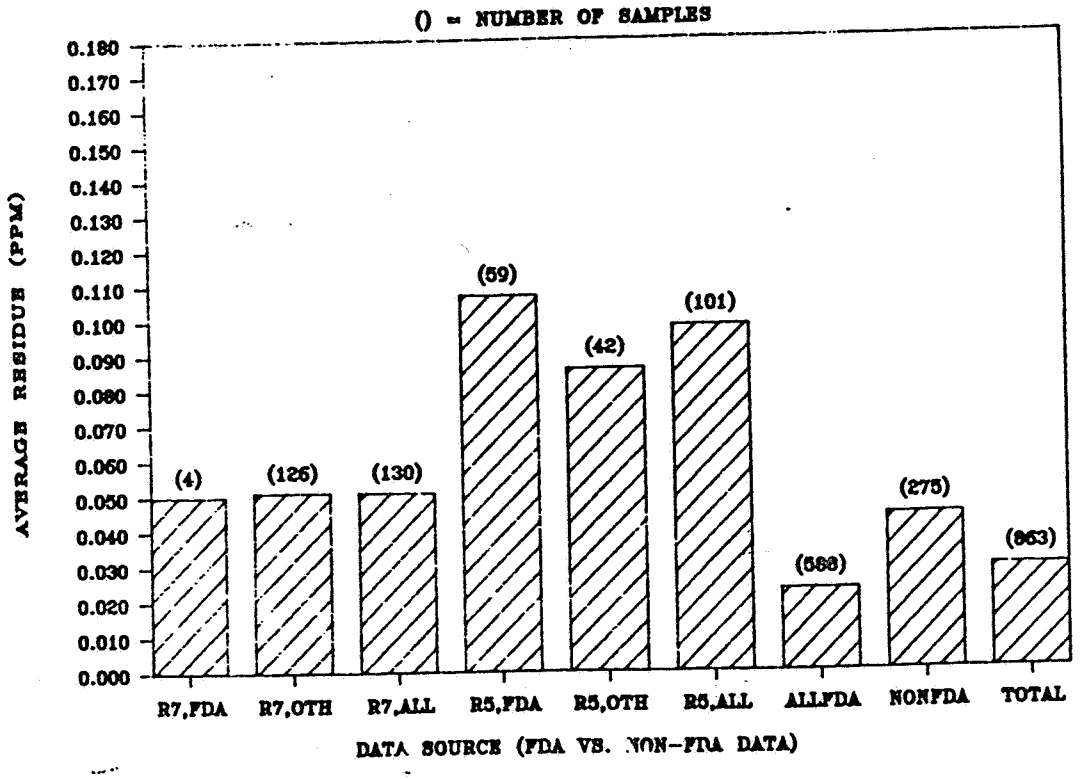
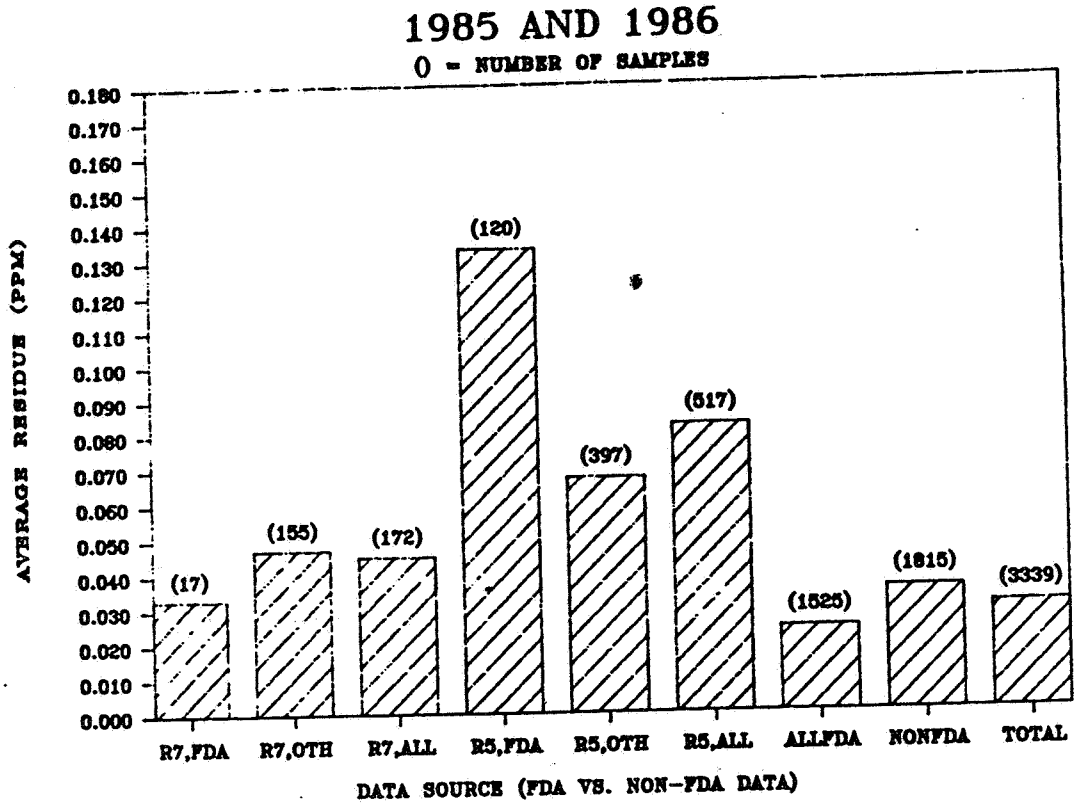
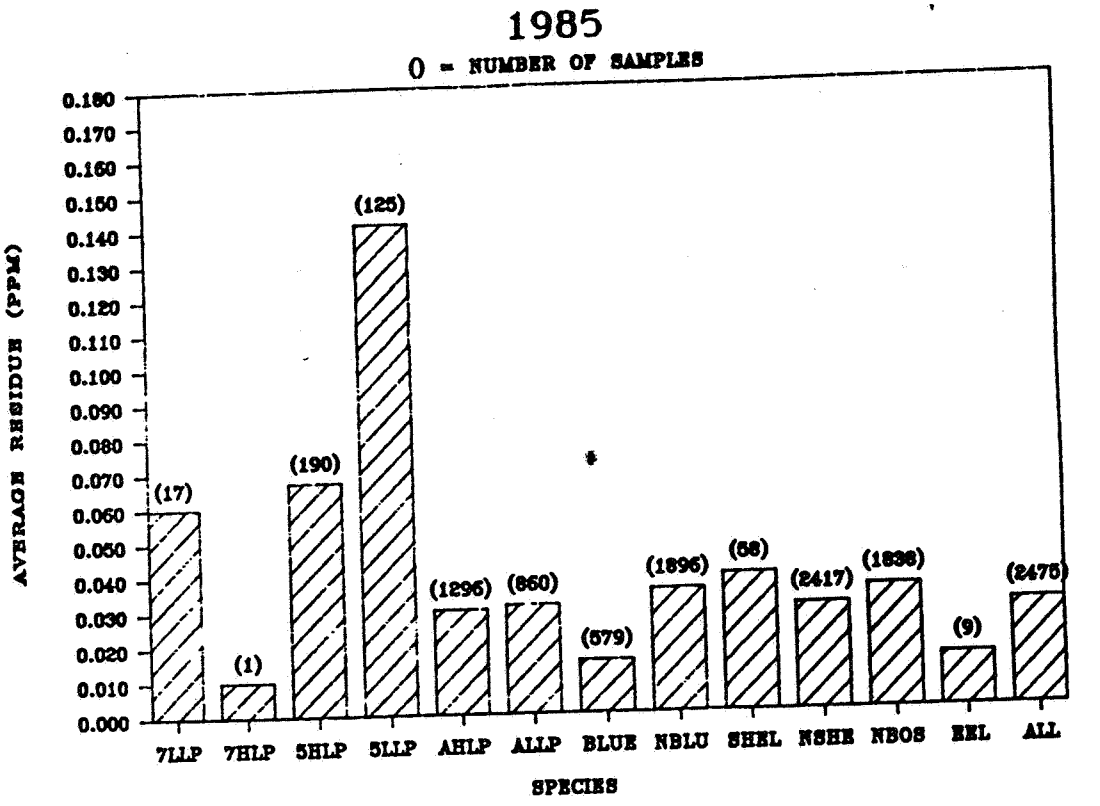



Figure 22 (Cont.): ALDRIN/DIELDRIN: Residue Variation with Data Source (FDA vs. Non-FDA data)




R7 = EPA Region 7
R5 = EPA Region 5
FDA = FDA data only
OTH = All data other than FDA data
ALL = All FDA data and other (non-FDA) data
ALLFDA = FDA data from all locations
NONFDA = All data other than FDA data from all locations
TOTAL = All data

Figure 23:
ALDRIN/DIELDRIN: Residue Variation with Species of Fish



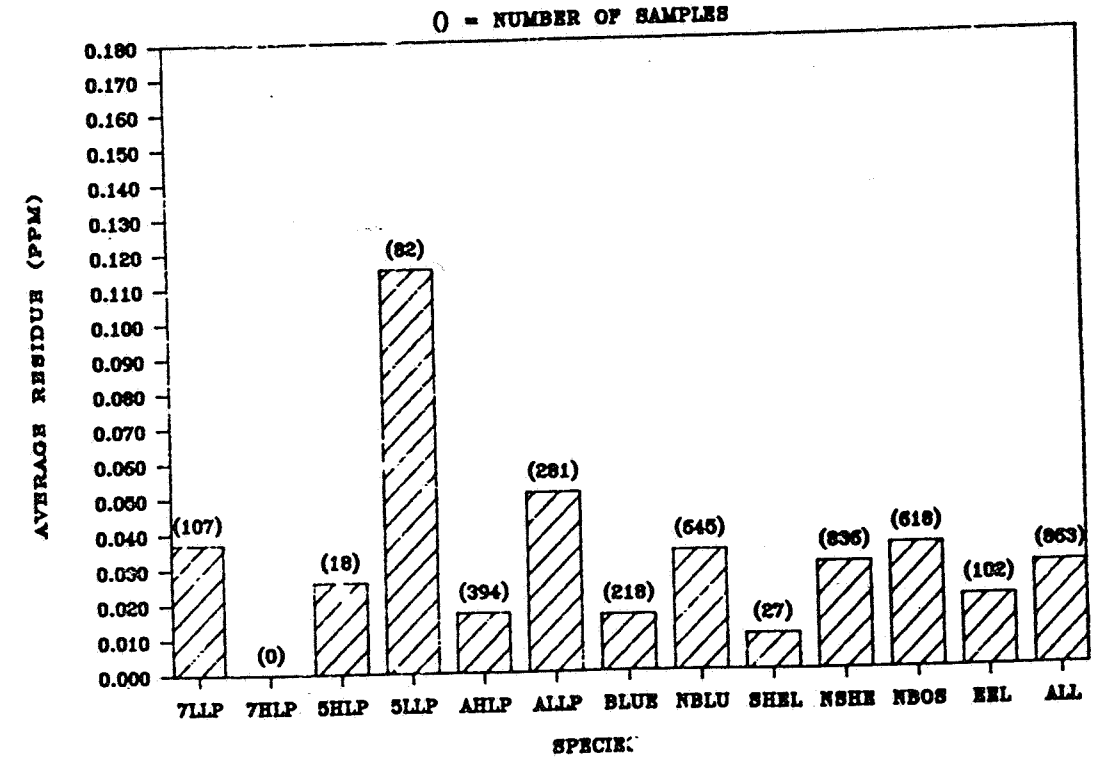
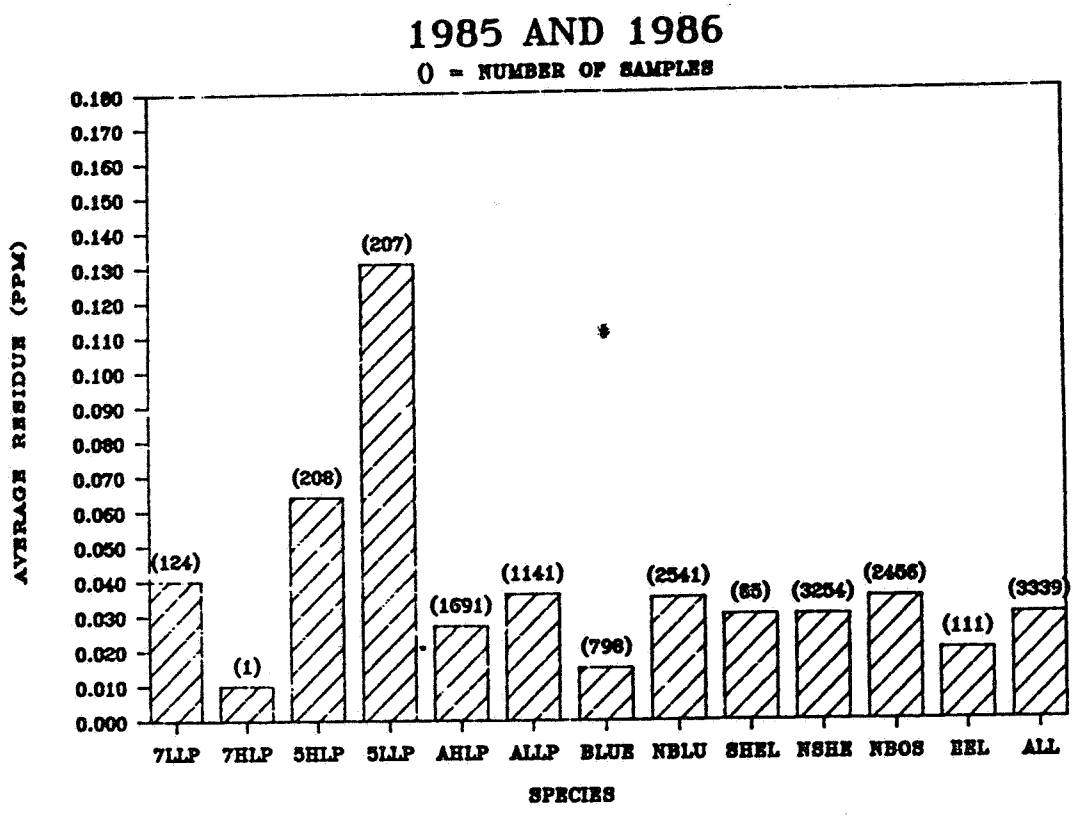



Figure 23 (Cont.):
ALDRIN/DIELDRIN: Residue Variation with Species of Fish




7LLP = EPA Region 7, low level predatory and bottom-feeding fish
7HLP = EPA Region 7, high level predatory fish
5HLP = EPA Region 5, high level predatory fish
5LLP = EPA Region 5, low level predatory and bottom-feeding fish
AHLP = High level predators, all locations
ALLP = Low level predators, all locations
BLUE = Bluefish
NBLU = All fish except Bluefish
SHEL = Shellfish
NSHE = All fish except shellfish
NBOS = All fish except Bluefish and shellfish
EEL = American Eels
ALL = All fish