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10/98

HUDSON RIVER PCBs SITE
REASSESSMENT RI/FS
SCIENTIFIC AND TECHNICAL COMMITTEE
TUESDAY, AUGUST 18, 1998
ALBANY, NEW YORK

MEETING MINUTES

On August 18, 1998, a meeting of the Scientific and Technical Committee (STC) for the Hudson River PCBs Reassessment RI/FS was held in Albany, New York. The purpose of the meeting was to provide STC members with information and an opportunity for questions on the Low Resolution Coring Report (LRC Report). The following STC members were in attendance:

Name	Agency
Doug Tomchuk	U.S. Environmental Protection Agency
Mel Hauptman	U.S. Environmental Protection Agency
Brian Bush	SUNY-Albany
Jay Field	NOAA
John Davis	NYS Dept. Of Law
Bob Dexter	EVS Consultants
Ken Pearsall	USGS
Don Aulenbach	Rensselaer Polytechnic Institute
Jim Bonner	Texas A&M University
G-Yull Rhee	NYS Dept. of Health
Kevin Farley	Manhattan College
Larry Skinner	NYSDEC
John Connolly	QEA
John Sanders	Barnard College
Anne Secord	USFWS
Richard Bopp	Rensselaer Polytechnic Institute
George Putman	SUNY-Albany

Also attending were:

Name	Agency
Claire Hunt	TAMS
Mark Moese	TAMS
Edward Garvey	TAMS
Bob Montione	NYS Dept. Of Health
Leigh Foster	Arbor Hill Environmental Justice
John Santocrose	Audubon Society of NYS/AI
David Adams	Sar. Co EMC - Gov't Liason
Lisa DiPinto	NOAA
Lisa Rosman	NOAA
Mark Behan	GE
Jim Rhea	QEA
John Haggard	GE
Kenneth Fish	GE
Mel Schweiger	GE
Joan Loerhardt	GE
William Ports	NYSDEC
John Butcher (by telephone link)	Tetra Tech

WELCOME AND INTRODUCTION

Doug Tomchuk (USEPA) welcomed everyone who was able to attend the meeting and stated that Bill Nickleson, the normal meeting facilitator, was unable to attend the meeting. Doug went on to state that this meeting will focus on the Low Resolution Coring Report. He further mentioned that the Statement of Work for the Human Health Risk Assessment has been released for public comment and that the Statement of Work for the Ecological Risk Assessment will be released soon. This meetings agenda and revised project schedule were distributed (Attachment A).

PEER REVIEW

Doug Tomchuk further stated that USEPA is committed to an independent peer review for the Hudson River PCBs site Reassessment RI/FS. The Science and Technical Committee does not, under USEPA guidelines constitute an independent peer review committee. The first peer review on the Baseline Modeling Report is scheduled for September 9 and 10, 1998 in Saratoga Springs (see fact sheet and USEPA charge for peer reviewers. Attachment B). Another peer review on all the Phase 2 documents will be scheduled for around September 1999.

A question was raised on whether there would be any mechanism for feedback on the peer review, such as performing additional sampling or data analysis. USEPA responded that they expect to do some revisions but is not anticipating the need for additional sampling due to the current schedule.

Dr. Edward Garvey was then introduced to present the findings of the Low Resolution Coring Report.

LOW RESOLUTION CORING REPORT

A copy of Dr. Edward Garvey's presentation is included as Attachment C.

Once Dr. Garvey was finished Doug Tomchuk introduced Dr. John Connolly to present GE's interpretation of the LRC Report.

PRESENTATION OF GE's INTERPRETATION

A copy of Dr. John Connolly's presentation is included as Attachment D.

DISCUSSION ON LRC

Clarifications to TAMS' presentation were presented as follows. The tentative conclusions of the LRC report are not to be construed as total loss from the system. Some PCBs have been removed by water column transport and flux and some spread out to other sediment areas. The report looked at mass and molar loss. There has been a shift in the type of PCBs present. The percent change on a molar basis indicates that the number of moles present is substantially lower. There is a lot of heterogeneity however, the trends are still valuable. As far as the deposition and burial, the beryllium^{-7} data show that there is no evidence for fast constant rates of burial. Deposition is intermittent and heterogeneous. In regards to matching water column vs. sediment PCB profiles any conclusions here are very dependent on the mechanistic assumptions. TAMS feels that the water column profile does not only match the pore water profile as the source to the river. It does however appear to look like a combination of the pore water profile and a profile consistent with bulk exchange from the sediment.

ISSUES/ACTION ITEMS

John Connolly brought up the fact that a calculation of the PCB molar loss based on the tri and higher homologues following the method in the report would result in an 80% loss in inventory not the 40% inventory loss found in the report. Several participants concurred that there has been loss but the accuracy of the loss estimate in the report is in question. The potential reduction in the tri and higher inventory needs to be included in the report including a detailed discussion on the confidence surrounding the calculated mass estimates. Another question that was raised was the validity of using the geometric mean in place of the arithmetic mean for the analysis. John Connolly also was concerned that since the report is not addressing the loss in a consistent manner, how can the EPA justify an emergency removal.

Kevin Farley asked how do the PCB water concentrations flowing over the Thompson Island Dam relate to the Thompson Island Pool(TIP) inventory? Ed Garvey stated that there is approximately 16 metric tons with a 30% loss over ten years amounting to approximately a 2.5 metric ton loss. Kevin also wanted to know how the mass loadings from the sediments compare to the water concentrations since they do not appear consistent? John Connolly stated that 300 to 500 lbs per year flow over the dam. At issue though, is where the increase at the Thompson Island Dam is coming from and what the relationship is between what is in the pool to what has been coming into the system from upstream.

GE stated that the project must wait and use the quantitative mass balance model to validate the data and conclusions in the LRC report. John Connolly further stated that the model will conform to mass balance requirements, that the LRC report is subject to much uncertainty, and that the model will confirm the conclusions of the LCR report. Bob Dexter responded saying that this assumes that the model will capture everything that is going on. Connolly then stated that we must exercise the model to include what is necessary and that it will give the best understanding of what is happening.

A concern was raised by Richard Bopp dealing with the quantitation of Aroclor 1242 using the peak at relative retention time 28. This peak is generally enhanced with dechlorination. It is not a good peak for quantitating Aroclor 1242. Use of this peak will give you a good approximation of total PCBs but not Aroclor 1242 concentrations. Based on this another issue arose concerned with whether or not there are more moles of PCBs present or less moles of PCB when using a molar weight of 281 and the 1984 data set assuming that the 1984 data had mono and di congeners present in the quantitation. Ed Garvey stated that these issues would be looked into but he thought that there would be less moles present.

Several members were concerned as to how the old method of analysis (i.e, packed column gas chromatography)compare with the new method of quantitation (i.e, capillary column gas chromatography) and would any differences lead to a differing conclusion?

Bob Dexter raised the fact that the LRC Report must clearly state all caveats in the document summary and conclusion. GE was also concerned that the report never addressed uncertainty. The LRC report should include a section similar to a risk assessment discussing the uncertainties associated with the data, data interpretation, models and conclusions.

Jay Field raised concerns about the proper characterization of the near shore sediments since this area has the greatest level of exposure to fish and benthos. He stated that in 1984 the near shore was not sampled much and wanted to know how much it contributed to the inventory. Ed Garvey stated it contributed some but not a lot, because he found that near shore areas were comparable to other areas of fine grained sediment.

Brian Bush requested clarification as to whether the side scan sonar will be used to identify what needs to be removed. Ed Garvey stated that this was not the way it started out but it is the best spatial representation of what will need to be dredged. Brian also asked if one can tell how much is diffusing from the course grained versus fine grained sediments and can we tell what is driving the water concentrations. Ed Garvey replied that the GE float surveys address this issue and that it is the fine grained inventories that are losing inventory. John Bonner asked for clarification on what the inventory is. Ed replied that based on Theissen polygons the analysis yielded 18-19 tons, Kriging yielded 14.5 tons and the side scan sonar with Theissen polygons yielded 8 tons (fine grained) and 6.5 to 7 tons (coarse-grained). He went on to say that based on the LRC report the fine grained inventory declined by 30% and that the coarse-grained inventory appeared to double but that this may be due to the more accurate measurement of the lighter congeners which were not included in earlier analyses. John Bonner suggested doing a back of envelope calculation using the water concentrations. Kevin Farley stated that it would result in approximately 0.25 tons per year or 2.5 tons total loss.

Bob Dexter wanted to know if the report says that there has been an increase in the pool? Ed Garvey said no - there has been a loss in the fine grained inventory. One explanation is the movement of fine grained inventory to the coarse grained inventory. John Connolly stated that the report does not do a bounding calculation of tri vs tri. If one was done you would loose 80% of the PCBs and why was this fact not in the report. G-Yull Rhee wanted to know if the loss in tri and higher was a loss to the system or loss due to dechlorination to mono's and di's? Ed Garvey stated that the 30% of tri and higher moved. Jim Bonner stated that it would be nice to dissect this loss into fractions of dechlorination, transport out of the pool or loss to destruction.

GE representatives questioned why was only the 40% loss number conveyed to the public and not the 5 to 75% confidence limits. Why did we wait until the STC meeting to examine the variance around the data? Ed Garvey stated that the major conclusion of the report is that the system is not stagnant it has changed. GE wanted to know what would EPA do if the loss is only 5% not 40 %?

John Butcher stated that if the LRC Report will form the basis of a decision then there must be an evaluation of the effects of the uncertainty surrounding the reports conclusions on any future decision by USEPA. Doug Tomchuk stated that this analysis would be important for EPAs decision.

One of the STC members questioned that even with the beryllium data the upper 5 inches show low PCBs, and below 5 inches there are higher concentrations. Why doesn't this show burial. Ed Garvey responded that in the high resolution cores the peak concentration is at 15-20 centimeters below the surface where as in the low resolution cores the peak is in the 9 inch top layer. The committee felt that the report should detail the confidence surrounding the estimate for lack of deposition and burial of the PCBs based on the Beryllium analysis.

Kevin Farley asked about sediment transport modeling and what was that showing. Ed Garvey stated that LimnoTech had examined the 100 year flood as an upper bound. Kevin asked what the estimated depth of scour is? Doug Tomchuk stated that he thought it was around 0.5 centimeters but John

Connolly thought it may be 1 to 2 centimeters.

GE was concerned about the statements in the report about the lack of deposition and that the low resolution cores can not give you the resolution necessary for the determination. GE asked what is the confidence in the mass loss? Ed Garvey answered that the purpose of the report was to show/determine change. The conclusion is that the inventories are changing, if we are off by a factor of 2 or 10, there would be little difference. We still have an indication that the inventories have declined and not that they are buried or sequestered.

John Connolly stated that the report should evaluate the uncertainty around the 40% net loss (i.e., the uncertainty of the differences). The analysis performed indicated that there was a change, we can only state that the two populations are different.

ATTACHMENT A

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 2
290 BROADWAY
NEW YORK, NY 10007-1866

HUDSON RIVER PCBs SITE
REASSESSMENT RI/FS
SCIENTIFIC AND TECHNICAL COMMITTEE
TUESDAY, AUGUST 18, 1998
ALBANY, NEW YORK

AGENDA

8:30	Welcome and Introduction	Doug Tomchuk, USEPA
8:45	Peer Review	Doug Tomchuk, USEPA
9:15	Low Resolution Sediment Coring Report	Dr. Ed Garvey, TAMS Consultants
10:30	Break	
10:45	Presentation of GE's Comments	Dr. John Connolly, QEA
11:00	Discussion on LRC	Facilitated by: Doug Tomchuk, USEPA
12:15	Lunch (on your own)	
1:30	Continued Discussion on LRC	
2:45	Break	
3:00	Continued Discussion on LRC	
4:30	Adjourn	

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Hudson River PCBs Site
3/9/98

DOCUMENT	DATE
PHASE 2 REPORTS:	
1- DATABASE REPORT (completed)	NOV 95
2- PRELIMINARY MODEL CALIBRATION (completed)	OCT 96
3- DATA EVALUATION & INTERPRETATION (completed)	FEB 97
3A- Low Resolution Coring Report	JUL 98
Human Health Risk Assmt Scope of Work	JUL 98
CD-ROM Database Reissue	JUL 98
Ecological Risk Assmt Scope of Work	SEPT 98
Feasibility Study Scope of Work	SEPT 98
Responsiveness Summary *DBR, PMCR, DEIR, LRC and HHRA SOW*	DEC 98
4- BASELINE MODELING REPORT	MAY 99
BMR Responsiveness Summary	JAN 00
5- ECOLOGICAL RISK ASSESSMENT	AUG 99
6- HUMAN HEALTH RISK ASSESSMENT	AUG 99
ERA and HHRA Resp. Summary	APR 00
Phase 2 Peer Review Begins	OCT 99
Phase 2 Peer Review Comments Complete	MAR 00
Response to Peer Review Comments	AUG 00
PHASE 3 REPORT	**DEC 00**
PROPOSED PLAN	**DEC 00**
RECORD OF DECISION	**JUN 01**
RESPONSIVENESS SUMMARY	JUN 01

ATTACHMENT B

Hudson River PCBs Site Reassessment RI/FS Peer Review

Region 2 recognizes the need for peer involvement for the Reassessment. The Reassessment is a major scientific effort that has several components which are major scientific and/or technical work products that have not previously been peer reviewed. As defined in the Peer Review Policy, peer involvement is the process whereby Agency staff involve subject-matter experts from outside their program in one or more aspects of the development of work products. Peer involvement takes two general forms:

a. Peer Input: Ongoing iterative discussions during the development of a work product.
b. Peer Review: A documented critical and objective evaluation of a work product.

The key distinctions between peer input and peer review are the independence of the peer reviewers and their level of involvement. The goal of peer review is to obtain an independent, third-party review of a work product from experts who have not substantially contributed to the development of the work product.

Region 2 believes that the Scientific and Technical Committee (STC) established for the Hudson River site satisfies the need for peer involvement. However, the Hudson River STC does not qualify as an appropriate peer review group as most members of the STC are not independent. Therefore, the Region has developed the process outlined below, to conduct the peer review of the Hudson River Reassessment. EPA's Science Policy Council Peer Review Handbook can be accessed via the Internet at: http://www.epa.gov/ordntrnt/ORD/spc/sopmenu.htm

Two Steps - The peer review for the Hudson River PCBs site will be done in two steps.

1) The first peer review will consist of a review of the appropriateness of computer models and their application to the site. Including, the Preliminary Model Calibration Report (PMCR), a revised Scope of Work for the Baseline Modeling Report, and responses to selected public comments on the PMCR.

   EPA released the names of the reviewers on July 1, 1998, and the peer review will occur September 9-10,1998. The panel will consist of 7 reviewers.

2) The second peer review will consist of a review of the following specific aspects of the Phase 2 Reports:
   -Geochemistry (the Data Evaluation and Interpretation Report (DEIR) and the Low Resolution Coring Report (LRC)
   -Baseline Modeling Report (BMR)
   -Ecological Risk Assessment (ERA)
   -Human Health Risk Assessment (HHRA)

   The concurrent review of these reports will allow for interaction of review panels as appropriate. (*E.g.,* discussions between reviewers of the biota uptake models and those reviewing the ecological risk assessment.)

   The second peer review session will be conducted after the release of all Phase 2 Reports (October 1999). Each panel will have 5 to 7 reviewers. We hope to utilize the same reviewers for the BMR review as were used for the PMCR.

Given the controversy surrounding this site, it was decided that it was important to have external peer review, with a discussion session that will be open to public observation.

The peer review is being conducted by an EPA contractor, Eastern Research Group, Inc. (ERG). The contractor will be responsible for hiring all peer reviewers and preparing the comment documents.

The credibility of the peer review lies on the independence of the reviewers. Special emphasis has been placed on identifying peer reviewers that have no conflict of interest.

Peer reviewers will submit their comments on the Reassessment reports prior to the review session, and comments will be distributed to other reviewers and the public.

Public Involvement:
The peer review will be open for public observation.
Observers will me given a limited opportunity in which to comment.
No comments from observers outside of the designated period will be allowed.

PMCR (First) Peer Review Experts:
Ellen Bentzen, Ph.D., Research Scientist, Department of Environmental and Resource Studies, Trent University, Peterborough, Ontario, Canada

Miriam Leah Diamond, Ph.D., Associate Professor, Department of Geography, University of Toronto, Toronto, Ontario, Canada

James W. Gillett, Director, Superfund Basic Research and Education Program and Professor of Ecotoxicology, Cornell University, Ithaca, New York

Gordon Douglas Haffner, Ph.D., Professor, Department of Biological Sciences, University of Windsor, Windsor, Ontario, Canada

Alan W. Maki, Ph.D., Environmental Advisor, Exxon Company, USA, Houston, Texas

Thanos Nicholas Papanicolaou, Ph.D., Assistant Professor, Department of Civil Engineering, Washington State University, Pullman, Washington

Frank Wania, Ph.D., Independent Research Scientist, WECC Wania Environmental Chemists Corp., Toronto, Ontario, Canada

Charge for Peer Review 1

Members of this peer review will be tasked to determine whether the models being used to support the decision-making process for the Reassessment, and the assumptions therein, are appropriate. The peer reviewers will base their assessment on the review the Preliminary Model Calibration Report (PMCR), an updated Technical Scope of Work for the Baseline Modeling Report (Appendix B of the PMCR) and the responses to selected comments received from stakeholders during the public comment period on the PMCR.

In October 1996, EPA released the Preliminary Model Calibration Report (PMCR), which described the models, datasets and assumptions being used as part of the Hudson River PCB Reassessment RI/FS. The PMCR represents the status of the preliminary PCB modeling effort as of Fall 1995. Datasets, database corrections and other pertinent information which became available after October 1995 were not incorporated within the fate and transport modeling presented in the PMCR. The PMCR was an interim document prepared to describe work in progress and was not intended to be a conclusive report. In particular the HUDTOX model presented in the PMCR was not intended to be used as a predictive tool to assess remedial action scenarios. In addition, while time-varying mechanistic models of bioaccumulation will be used along with other models to predict fish body burdens, these models are not described in the PMCR.

The PMCR was not formally peer reviewed at the time of publication, but was distributed to interested parties who were invited to submit comments and questions. Written responses were made to all of these comments and questions. In addition, the work plan contained in Appendix B of the PMCR has been revised to reflect the ongoing work being conducted as part of the Baseline Modeling effort. Results from this effort will be presented in a Baseline Modeling Report that will be formally peer reviewed.

The peer reviewers are requested to determine whether the models being used to support the decision-making process for the Reassessment RI/FS, and the assumptions therein, are appropriate. The peer reviewers are not being asked whether they would conduct the work in the same manner, only whether the work being conducted will yield scientifically credible conclusions.

It is suggested that the reviewer first read the PMCR. The Responses to Comments provides information on the context of the PMCR within the overall modeling effort and additional details beyond the PMCR results. The current work plan as revised in June 1998 reflects the ongoing Baseline Modeling effort and revisions to some of the original modeling tasks proposed in Appendix B of the PMCR. In addition, the USEPA/TAMS Phase 2 database has been considerably revised. New datasets have been added and some earlier datasets have been extensively revised.

The peer reviewers are asked to comment on the following:

A. Is EPA using appropriate models, datasets and assumptions on which to base a scientifically credible decision?

B. Will the models, with the associated datasets and assumptions, be able to answer the following principal study questions as stated in the PMCR:

1. When will PCB levels in the fish population recover to levels meeting human health and ecological risk criteria under No Action?

2. Can remedies other than No Action significantly shorten the time required to achieve acceptable risk levels?

3. Are there contaminated sediments now buried and effectively sequestered from the food chain which are likely to become "reactivated" following a major flood, resulting in an increase in contamination of the fish population?

C. Specific questions:

1. Are the modeling approaches suitable for developing quantitative relationships between external forcing functions (e.g., hydraulic flows, solids and PCB loads, sediment initial conditions, etc.) and PCB concentrations in the water column, sediments and fish? Are the models adequate for discriminating between water-related and sediment-related sources of PCBs?

2. Are the spatial and temporal scales of the modeling approaches adequate to answer the principal study questions? If not, what levels of spatial and temporal resolution are required to answer these questions? What supporting data are required for calibration/ validation of these spatial and temporal scales?

3. It is contemplated that PCB concentrations in fish will be estimated using several modeling approaches: an empirical probabilistic model derived from Hudson River data, a steady state model that takes into account mechanisms of bioaccumulation body burdens, and a time-varying mechanistic model (not included in the PMCR). A bi-variate statistical model may also be used to provide insight into accumulations. This multi-model approach is being contemplated because of the uncertainties associated with any individual model. Is this a reasonable approach or should predictions be made using a single "best" model?

4. Is the level of process resolution[1] in the models adequate to answer the principal study questions? If not, what processes and what levels of resolution are required to answer these questions? What supporting data (such as data to support specifications of a mixed depth layer, solids and scour dynamics, groundwater inflow, etc.) are required for these processes and levels of resolution?

5. The results of the modeling effort will be used, in part, to support human and ecological risk assessments. In your judgment, will the models provide estimates adequate for this purpose?

D. Are there any changes to the work effort outlined in the revised work plan that would significantly improve the outcome?

E. In terms of evaluating the overall and specific effects and behavior of PCBs in the Hudson River, are there any serious flaws in the modeling approach (theory, structure, physical parameters, etc.) that would limit or invalidate any conclusions or further work based upon the results of these models?

Recommendations

Based on your reading and analysis of the information provided, please identify and submit an explanation of your overall recommendation for the modeling effort for the Hudson River PCB Reassessment RI/FS:

1. Acceptable as is
2. Acceptable with minor revision (as indicated)
3. Acceptable with major revision (as outlined)
4. Not acceptable (under any circumstance)

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[1]The "level of process resolution" refers to the theoretical rigor of the equations used to describe the various processes affecting PCB fate and transport such as: settling, resuspension, volatilization, biological activity, partitioning, etc. An example of low process resolution is use of a constant value for the solids resuspension rate. A higher level of process resolution is use of a complex mathematical description of the physics involved in remobilizing bedded sediment particles (such as cohesive forces, bed shear stresses, etc.).

ATTACHMENT C

Low Resolution Sediment Coring Report

Hudson River PCBs Reassessment RI/FS

Ed Garvey

TAMS Consultants, Inc.

TAMS

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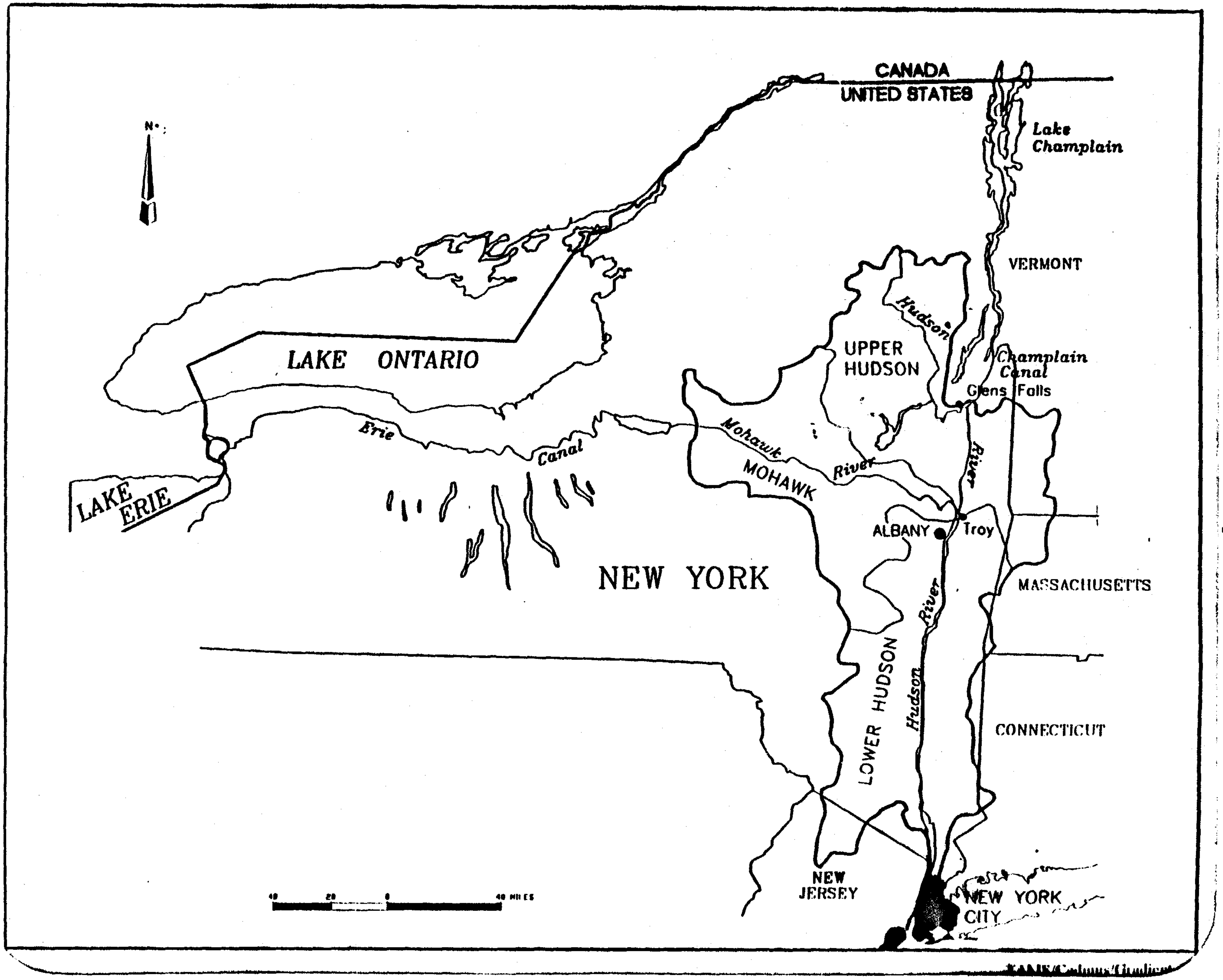
Outline of Presentation

- Introduction and Background
- Program Goals
- Approach
- Comparison to Prior Phase 2 Work
- The PCB Inventory of the TI Pool
- The PCB Inventory Below the TI Dam
- Summary

TAMS


CANADA
UNITED STATES
Lake Champlain
N
VERMONT
LAKE ONTARIO
UPPER HUDSON
Hudson
Champlain Canal
Glens Falls
Erie Canal
Mohawk River
MOHAWK
River
LAKE ERIE
ALBANY
Troy
NEW YORK
MASSACHUSETTS
LOWER HUDSON
Hudson River
CONNECTICUT
NEW JERSEY
NEW YORK CITY
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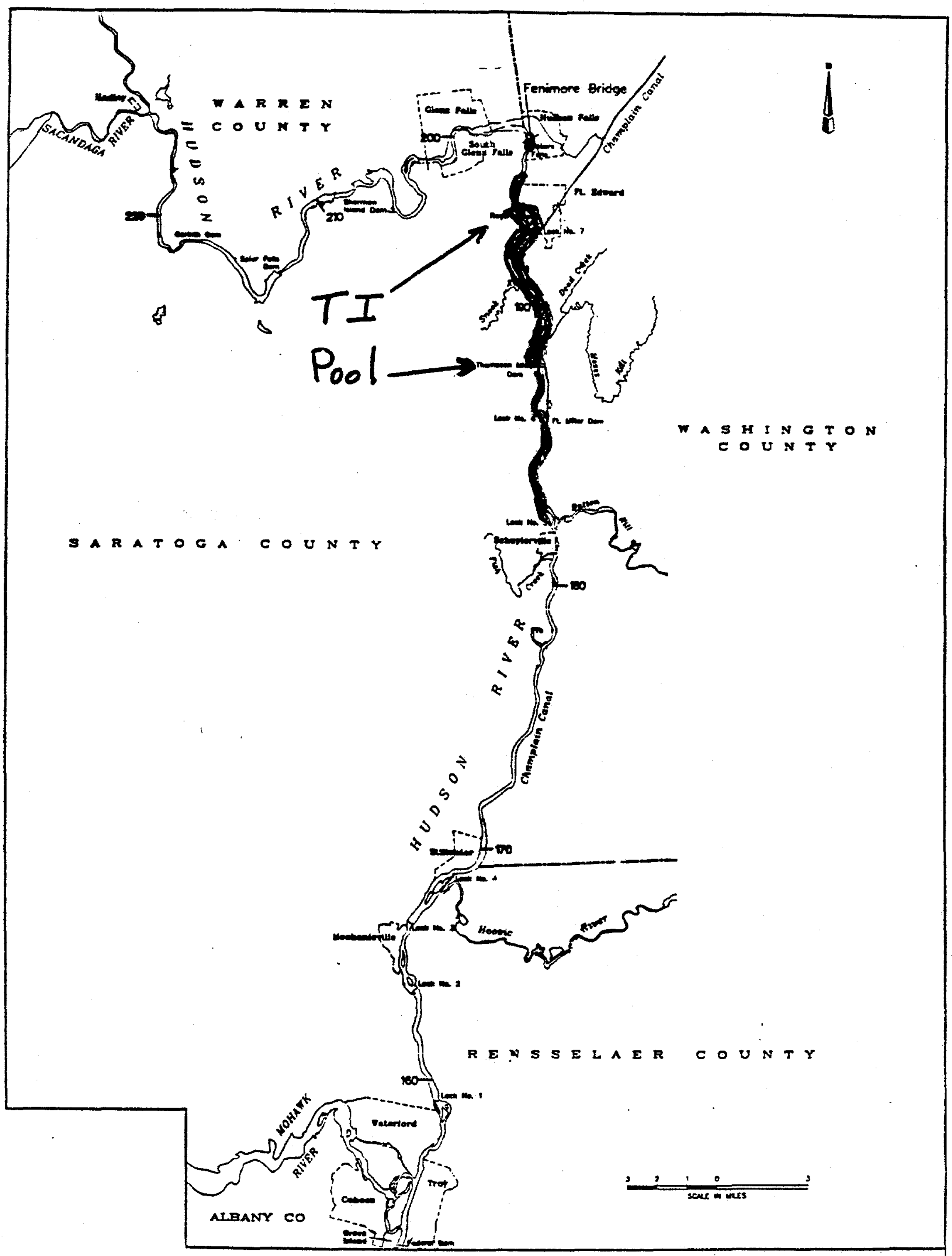


Geophysical Survey Area

TAMS/Cadmus/Gradient

Program Goals

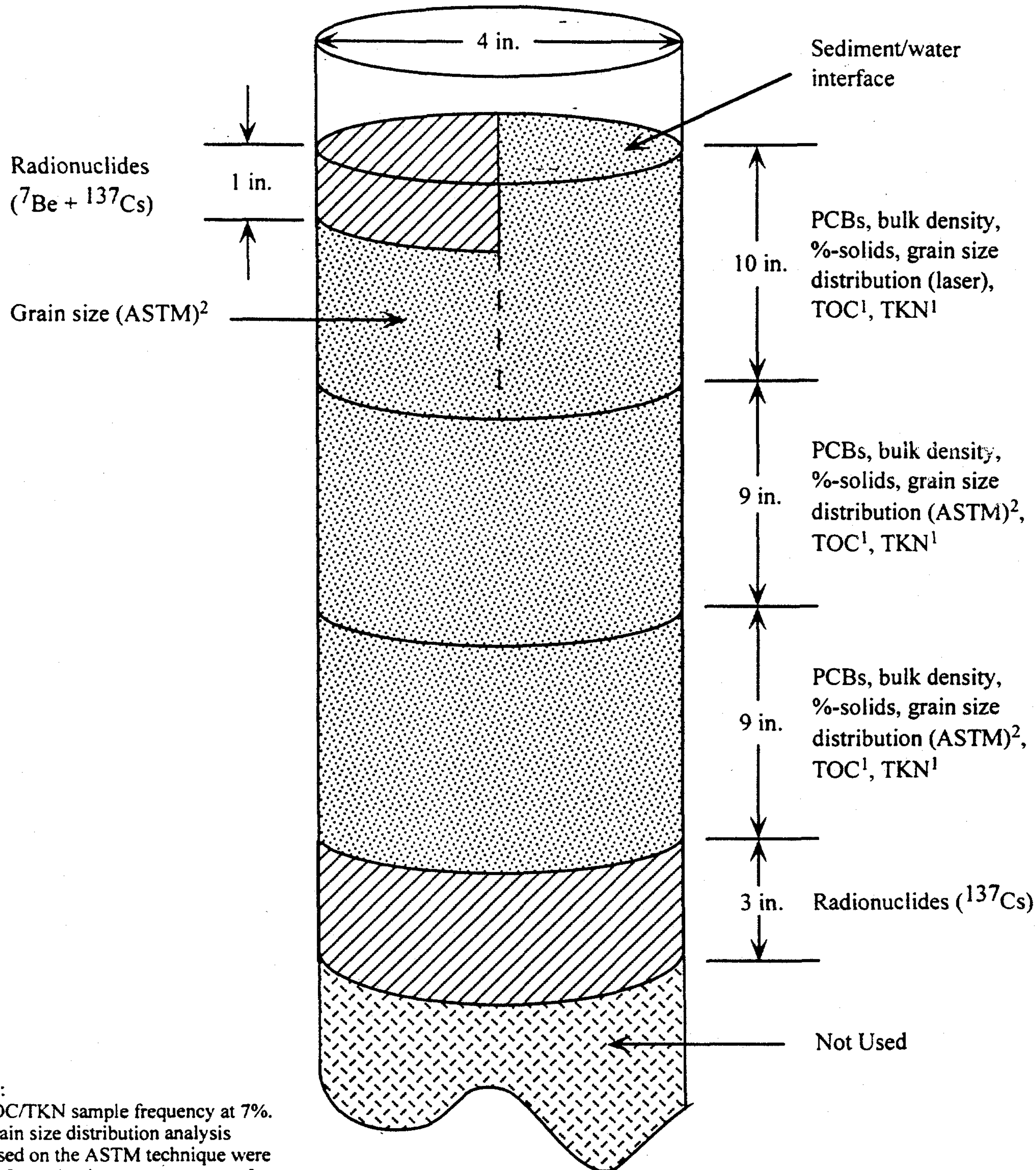
- Obtain new estimates of sediment PCB inventories at a number of locations in the TI Pool to compare against the existing 1984 NYSDEC data set

- Refine the PCB mass estimates for a limited number of hot spots locations below the TI Dam relative to the 1977 NYSDEC survey

Approach

- Obtain sediment cores of sufficient depth to capture the entire section of post-1954 deposition at each location.
- In the TI Pool, reoccupy NYSDEC sampling sites in homogeneous zones for direct 1984 to 1994 comparison.
- Below the TI Dam, survey several hot spots with locations selected to provide a current, area-based inventory.

TAMS



Notes:
1. TOC/TKN sample frequency at 7%.
2. Grain size distribution analysis based on the ASTM technique were performed at least once per core for approximately 68% of the cores collected.
3. The segment thicknesses shown are median values for four segment cores.

Legend:
TOC - Total Organic Carbon Analysis
TKN - Total Kjeldahl Nitrogen Analysis

Source: TAMS/Gradient Database, Release 3.5

TAMS

Figure 2-3
Low Resolution Sediment Core Preparation

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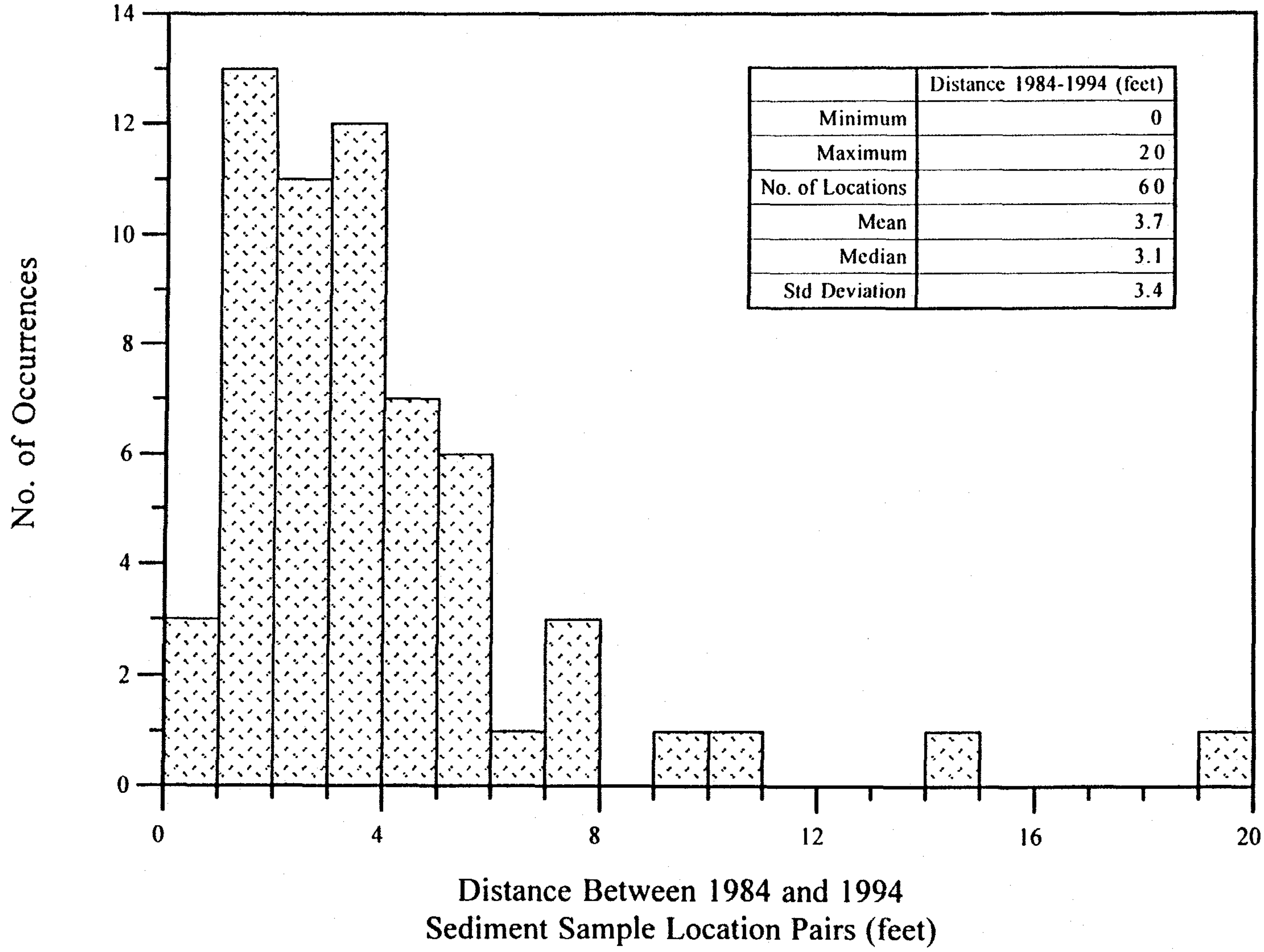


Source: TAMS/Gradient Database, Release 3.5

TAMS

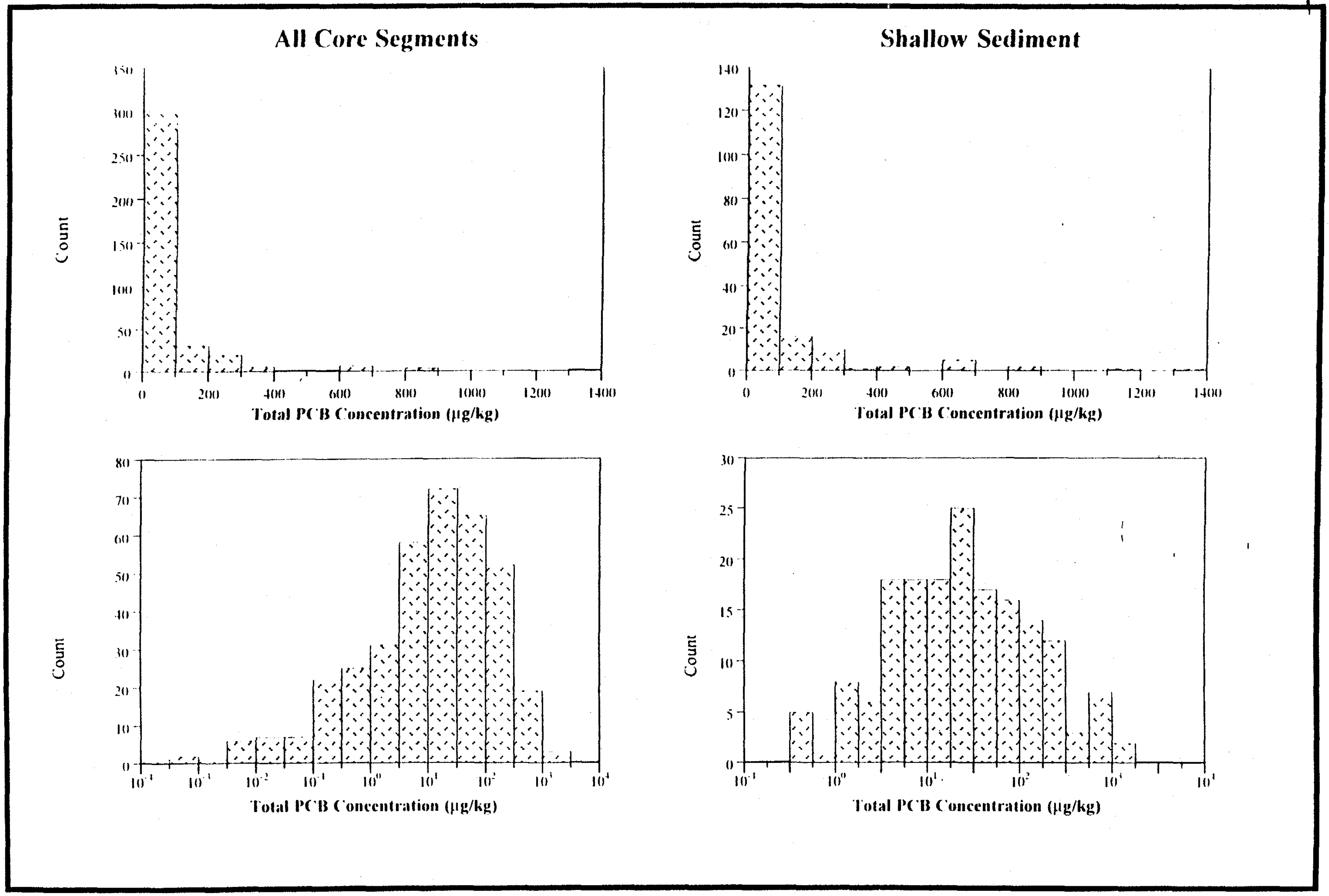
Figure 2-1
Distance Between 1984 and 1994 Sediment Sample Locations

Analytical Approach

- Monitor PCB congeners to estimate inventory and confirm high resolution core results.

- Utilize radionuclides to establish post-1954 deposition and current depositional environment.

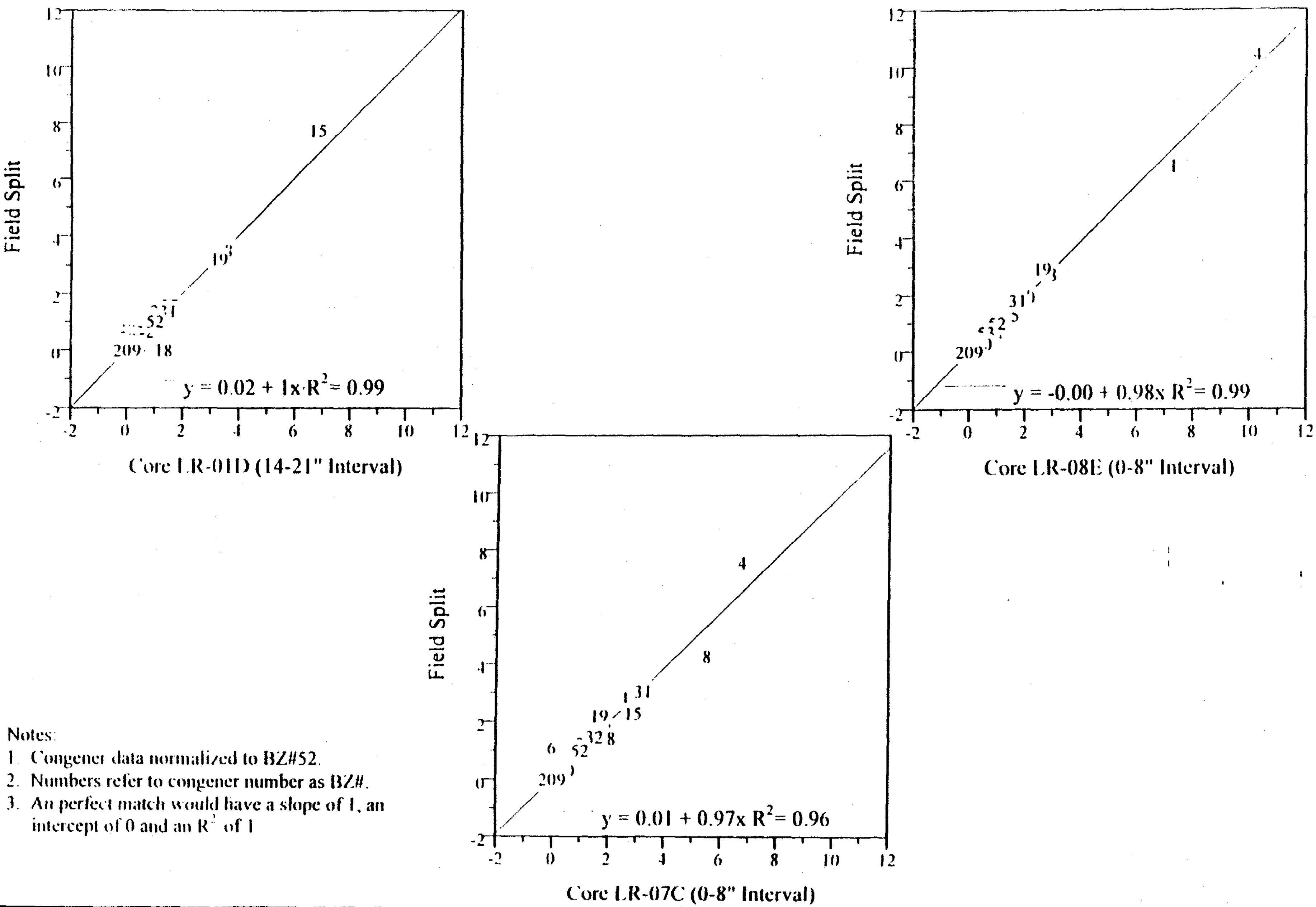
- Measure sediment properties for correlation analysis with PCBs and Side-Scan Sonar as well as for engineering analysis.



Source: TAMS/Gradient Database, Release 3.5

TAMS

Figure 2-4
Distribution of Total PCB Concentrations in Low Resolution Sediment Core Samples



Notes:
1. Congener data normalized to BZ#52.
2. Numbers refer to congener number as BZ#.
3. An perfect match would have a slope of 1, an intercept of 0 and an R^2 of 1

Source: TAMS/Gradient Database, Release 3.5

TAMS

Figure 2-5
Example Regressions for Low Resolution Sediment Core Field Split Pairs

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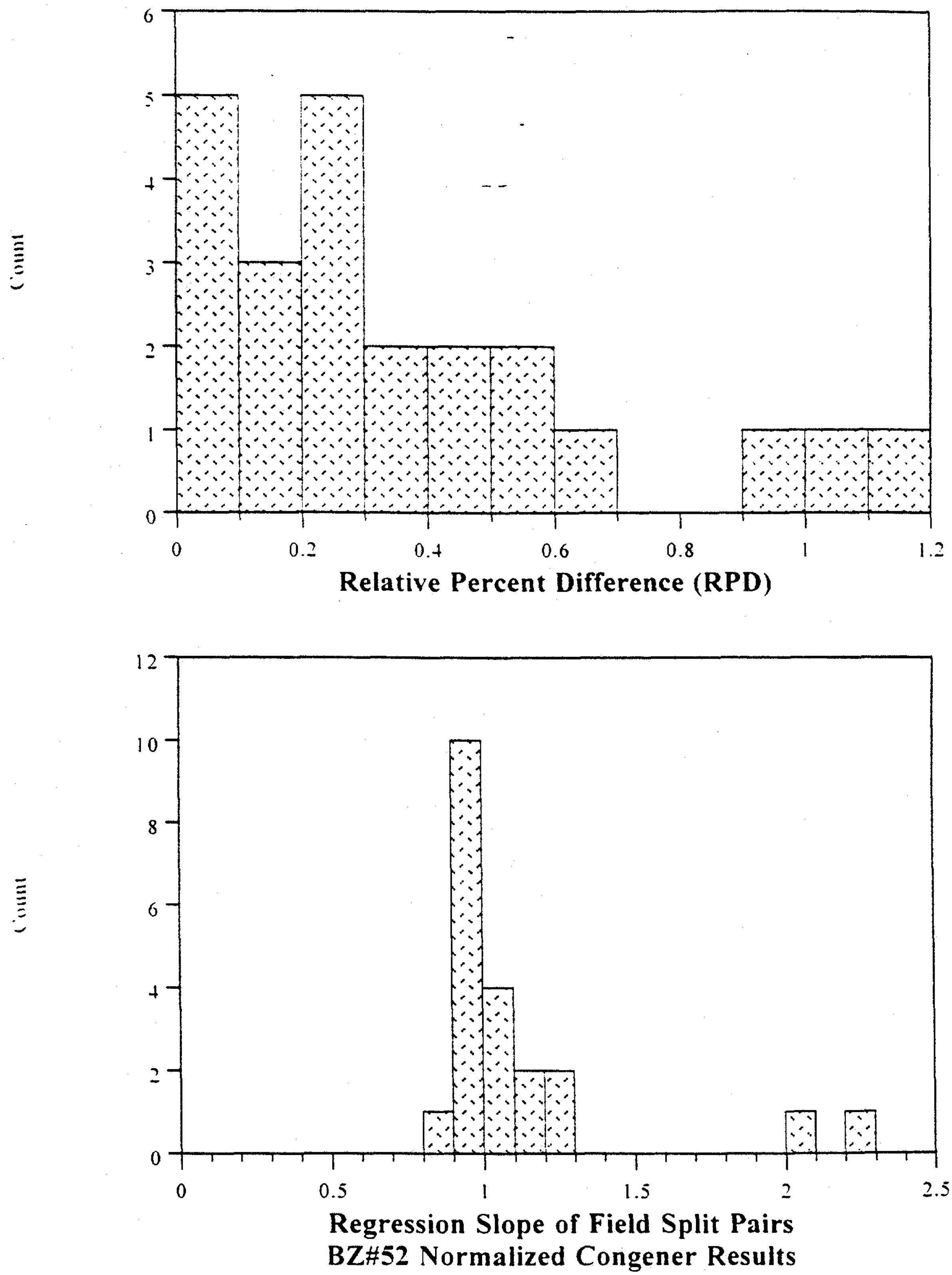

Source: TAMS Gradient Database, Release 3.5

TAMS

Figure 2-6
Precision in Total PCB Concentration for Low Resolution Core Field Splits

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Comparison to Prior Work

- Confirm relationships found among total PCBs, degree of dechlorination (ΔMW), and dechlorination products (MDPR).

- Confirm relationships among total PCBs, side-scan sonar results and sediment properties.

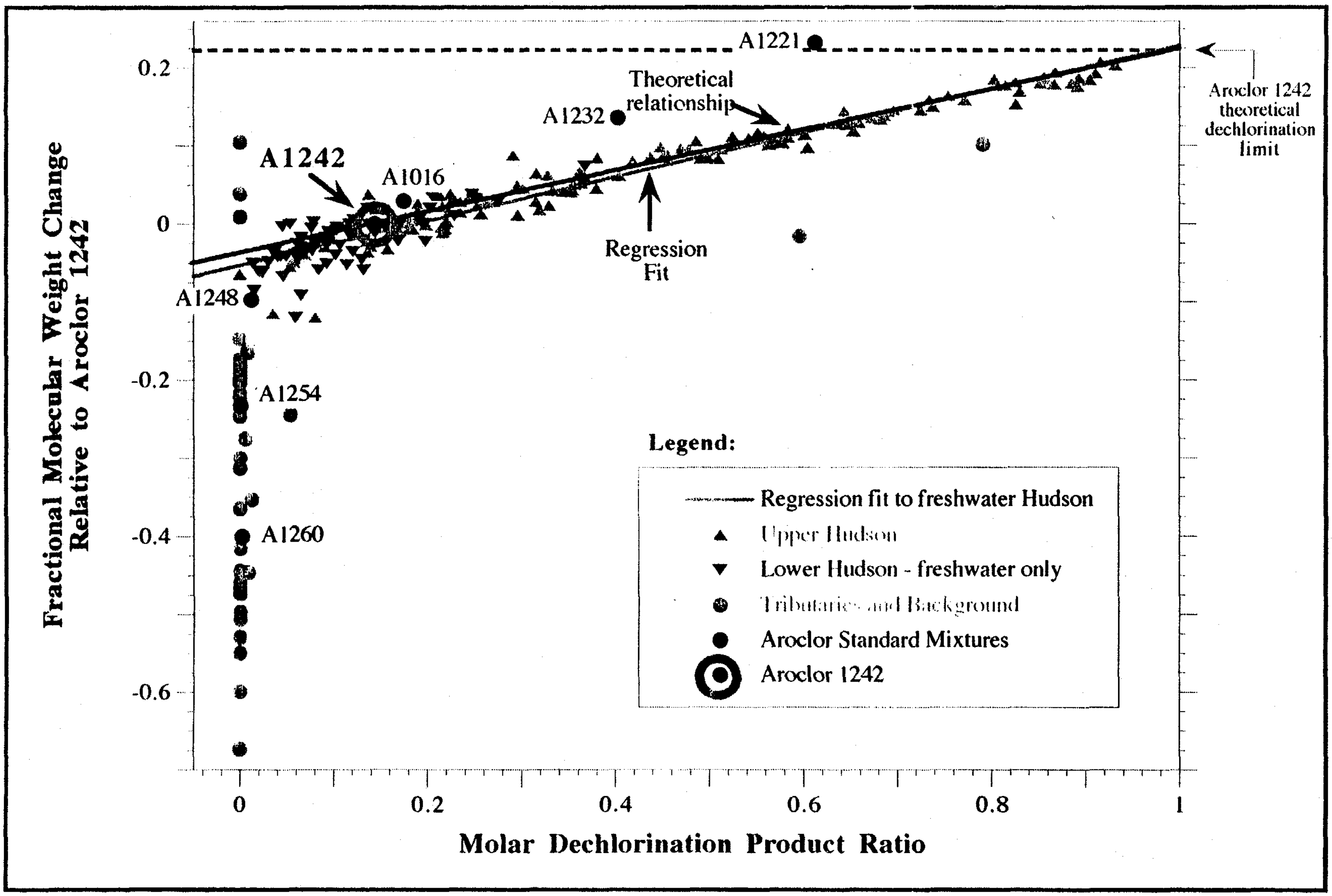
PCB MEASURES

- Change in Molecular Weight

$$\Delta MW = \frac{MW_{sample} - MW_{A1242}}{MW_{A1242}}$$

- Molar Dechlorination Product Ratio

$$MDPR = \frac{\sum_{i=1, 4, 8, 10, 19} [BZ\ \#i]}{\sum_{j=l}^{126} [BZ\ \#j]}$$



TAMS/Cadmus/Gradient

Comparison Between the Molar Dechlorination Product Ratio and the Fractional Change in Molecular Weight for All Post-1954 Freshwater Sediments

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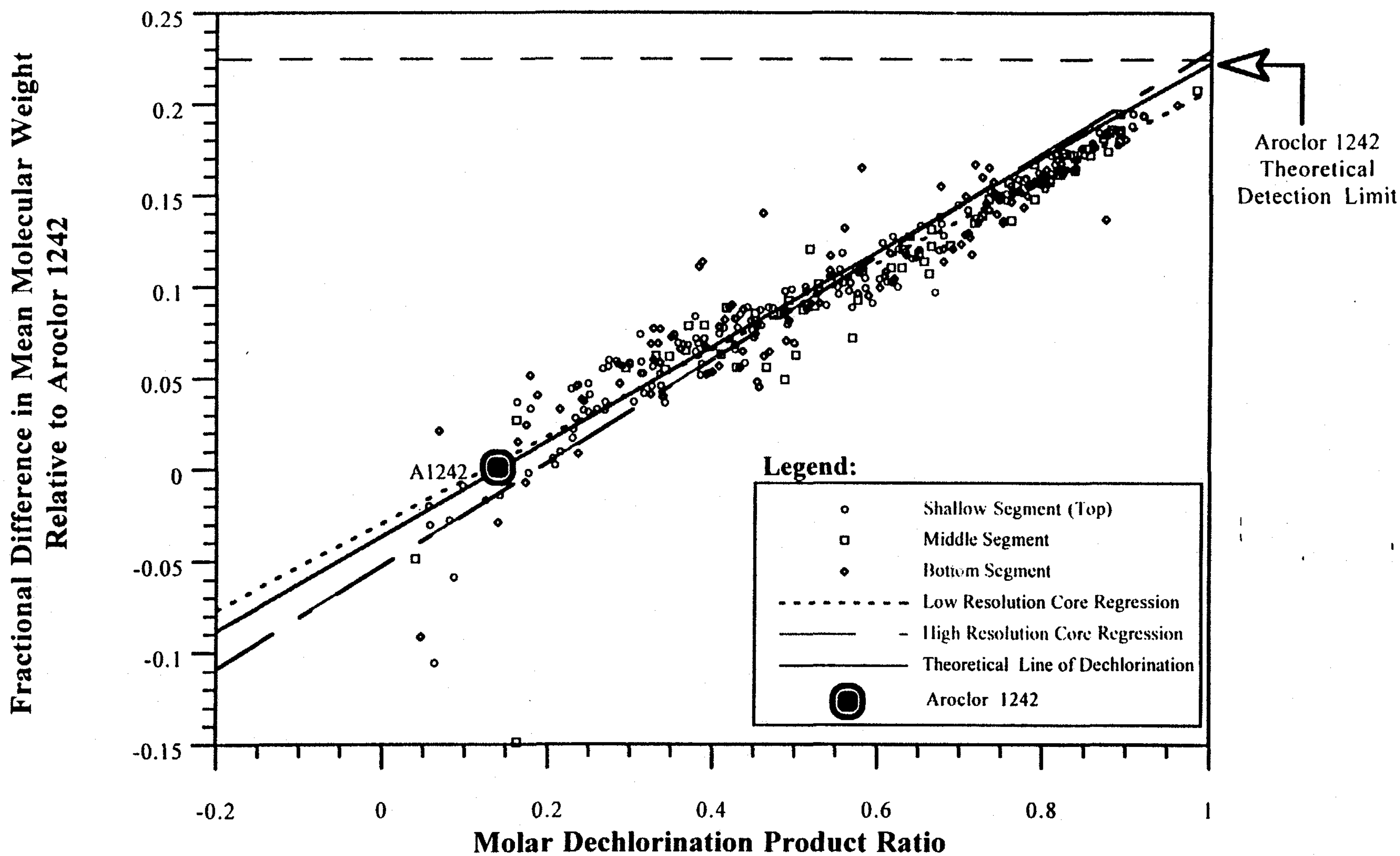

Notes:

1. Plot excludes sediment samples less than 100 µg/kg (ppb).
2. The High Resolution regression line is ΔMW = -0.0523+ 0.282*MDPR R^2= 0.94. The Low Resolution regression line is ΔMW = -0.0295+ 0.238*MDPR R^2= 0.90.

Source: TAMS/Gradient Database, Release 3.5

TAMS

Figure 3-1
Molar Dechlorination Product Ratio vs Fractional Difference in Mean Molecular Weight Relative to Aroclor 1242 for All Low Resolution Sediment Core Results

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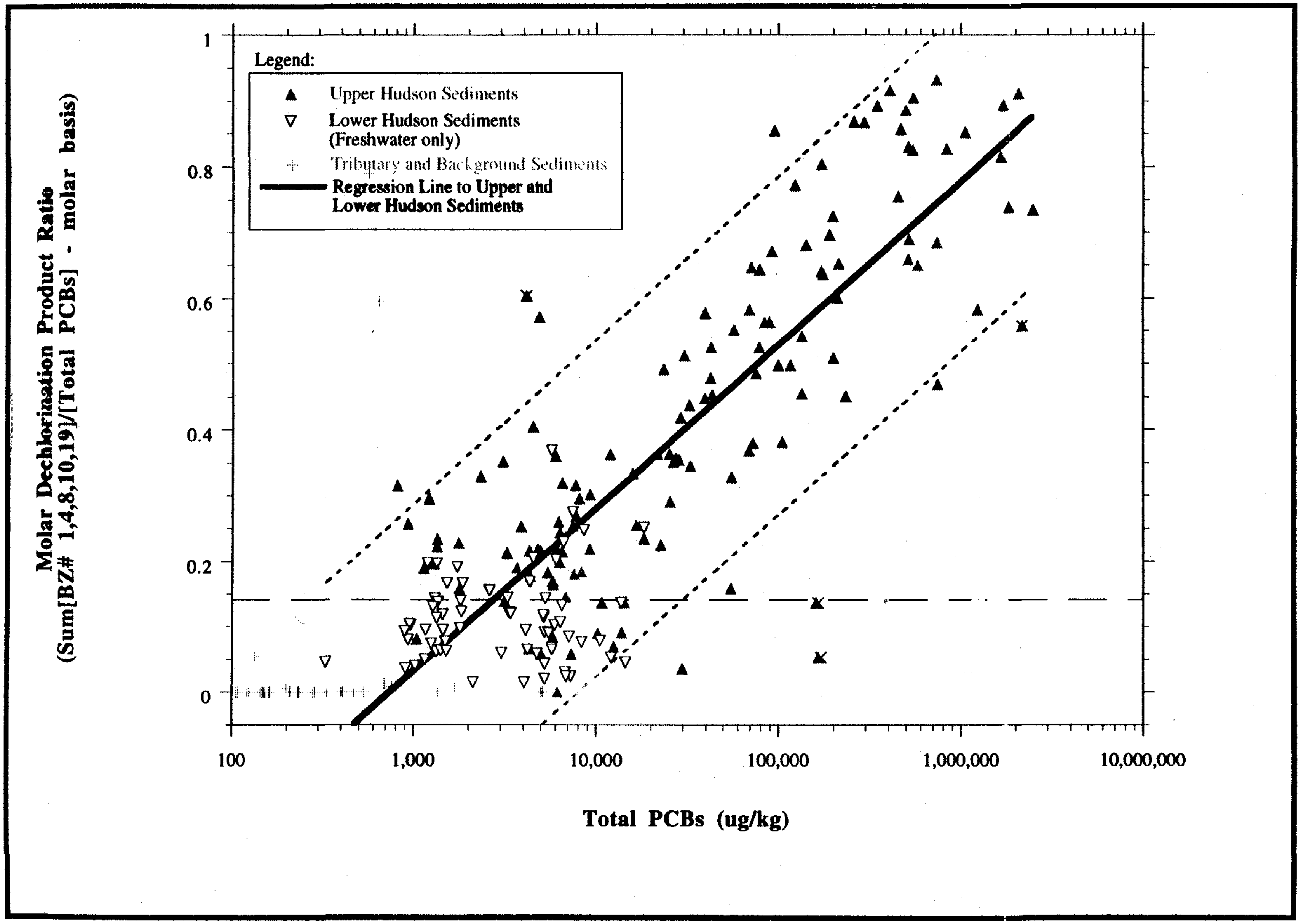
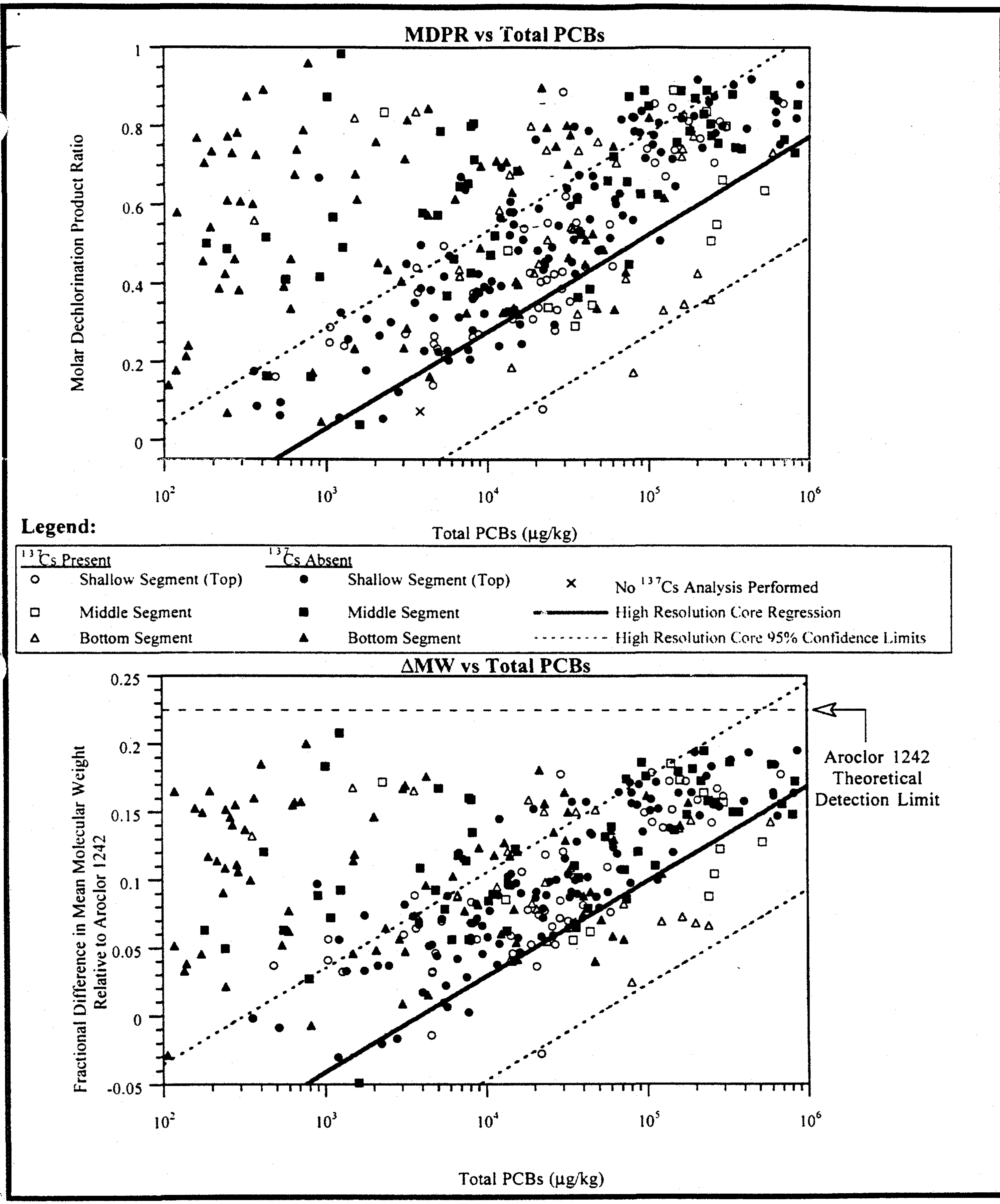


TAMS/Cadmus/Gradient

Molar Dechlorination Product Ratio vs. Total PCB Concentration in Post-1954 Sediments from the Freshwater Hudson River

10.9943

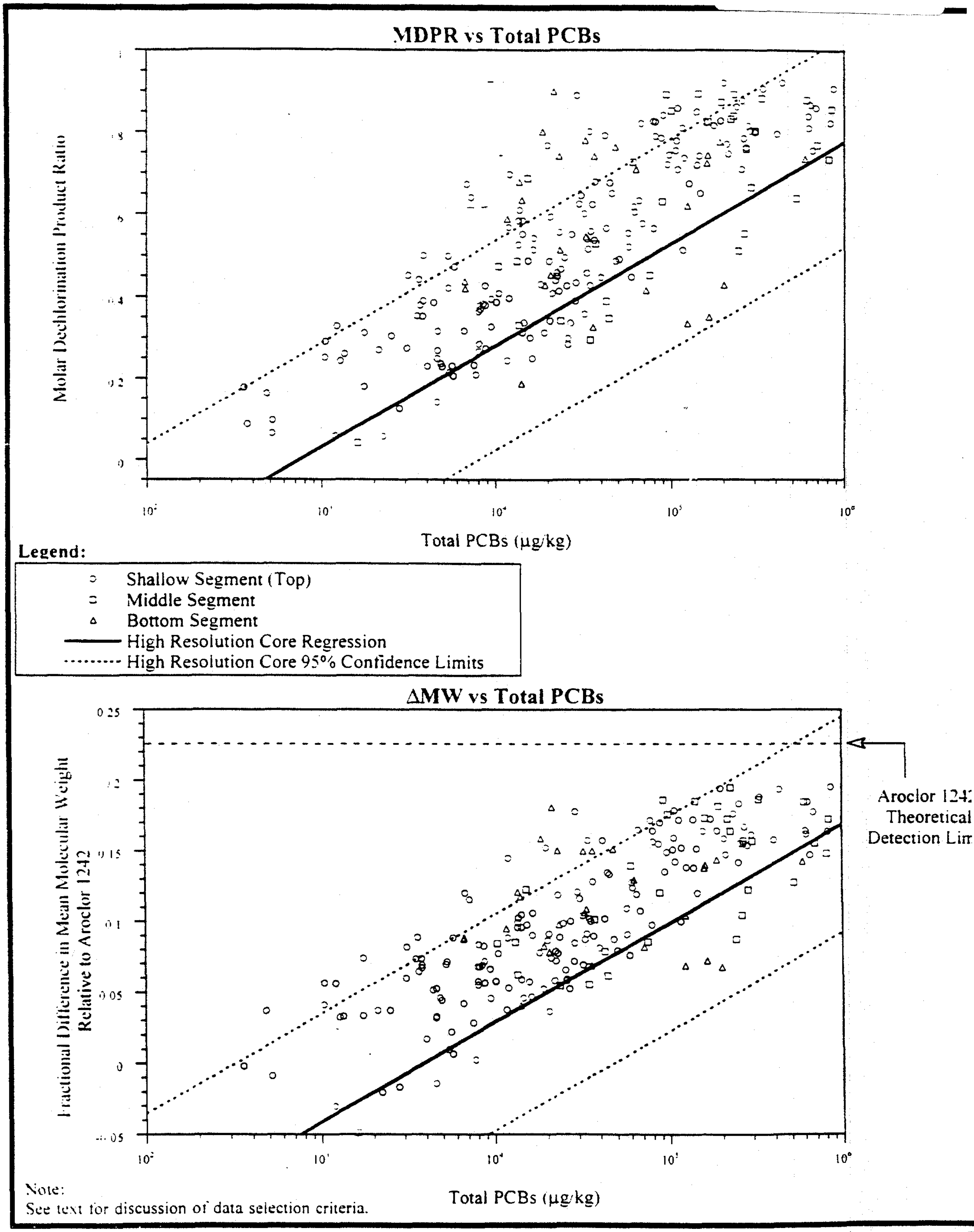


Source: TAMS/Gradient Database, Release 3.5

TAMS

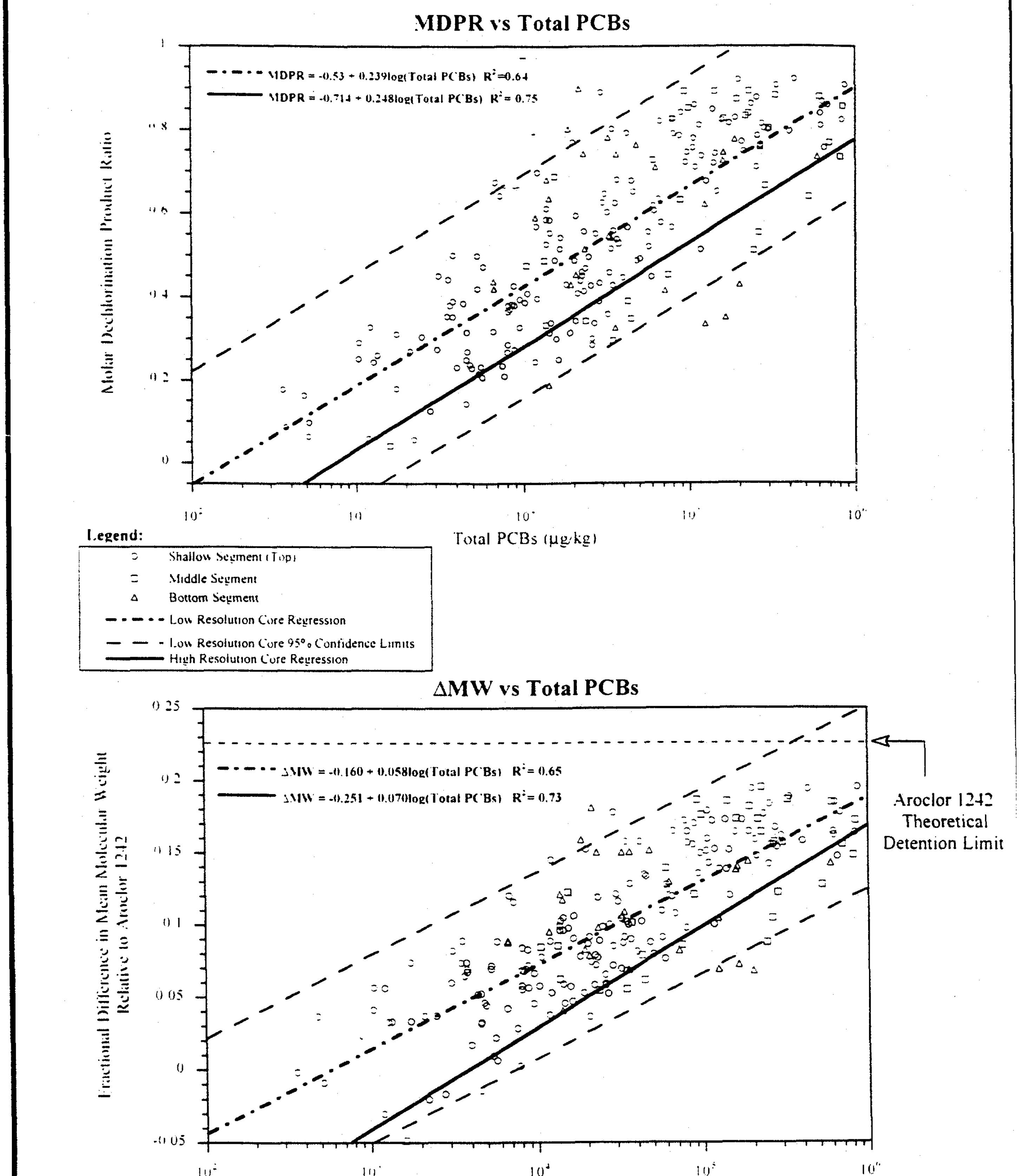
Figure 3-3
Total PCB Concentration vs MDPR and Δ MW
Showing Cores with and without ^{137}Cs Present

10.9944



Source: TAMS/Gradient Database, Release 3.5

Figure 3-8
Examination of the Relationship of MDPR and ΔMW to Total PCBs for Selected Low Resolution Sediment Core Results

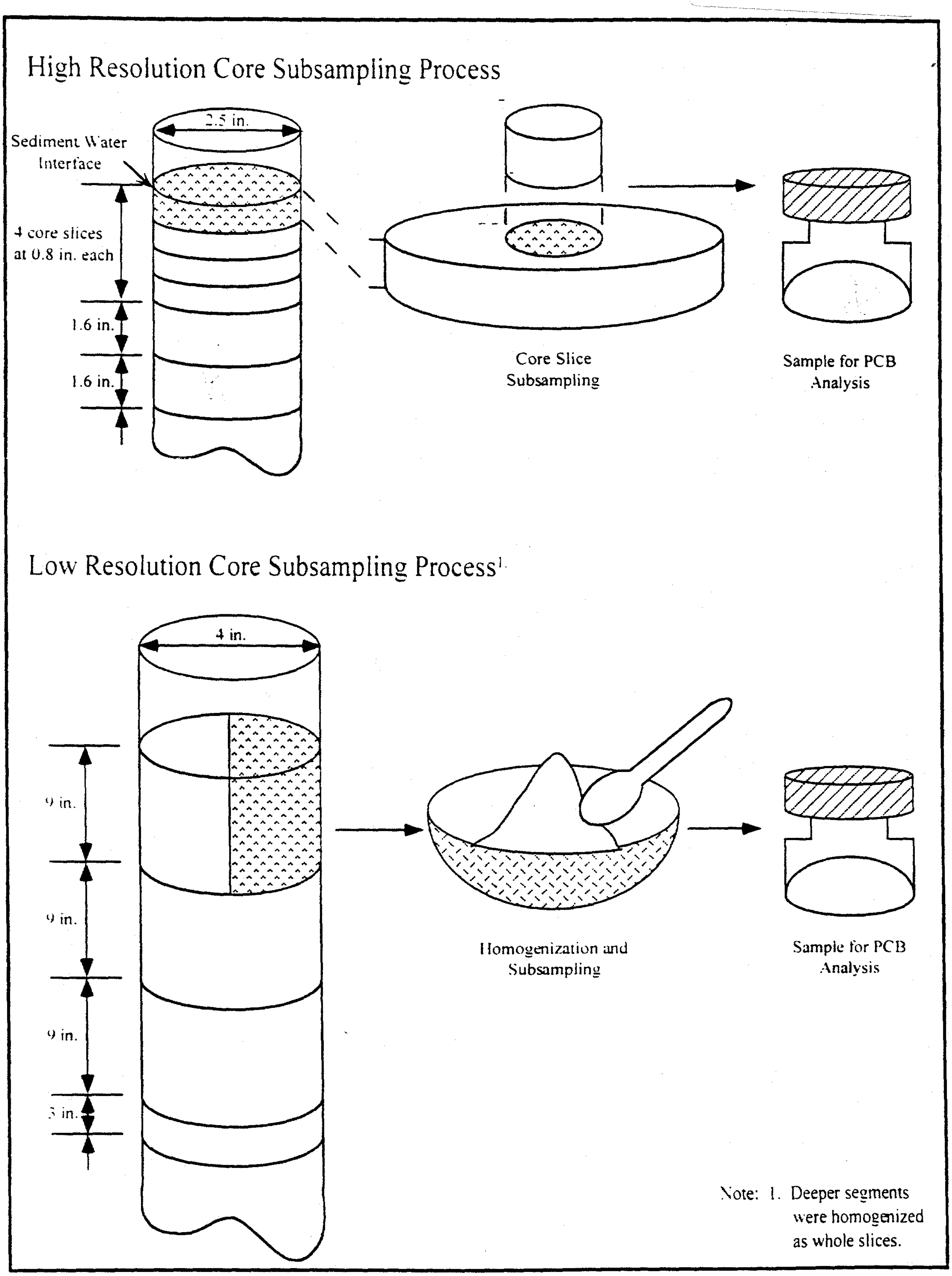


Note:
See text for discussion of data selection criteria.

Source: LAMS Gradient Database, Release 3.5

TAM

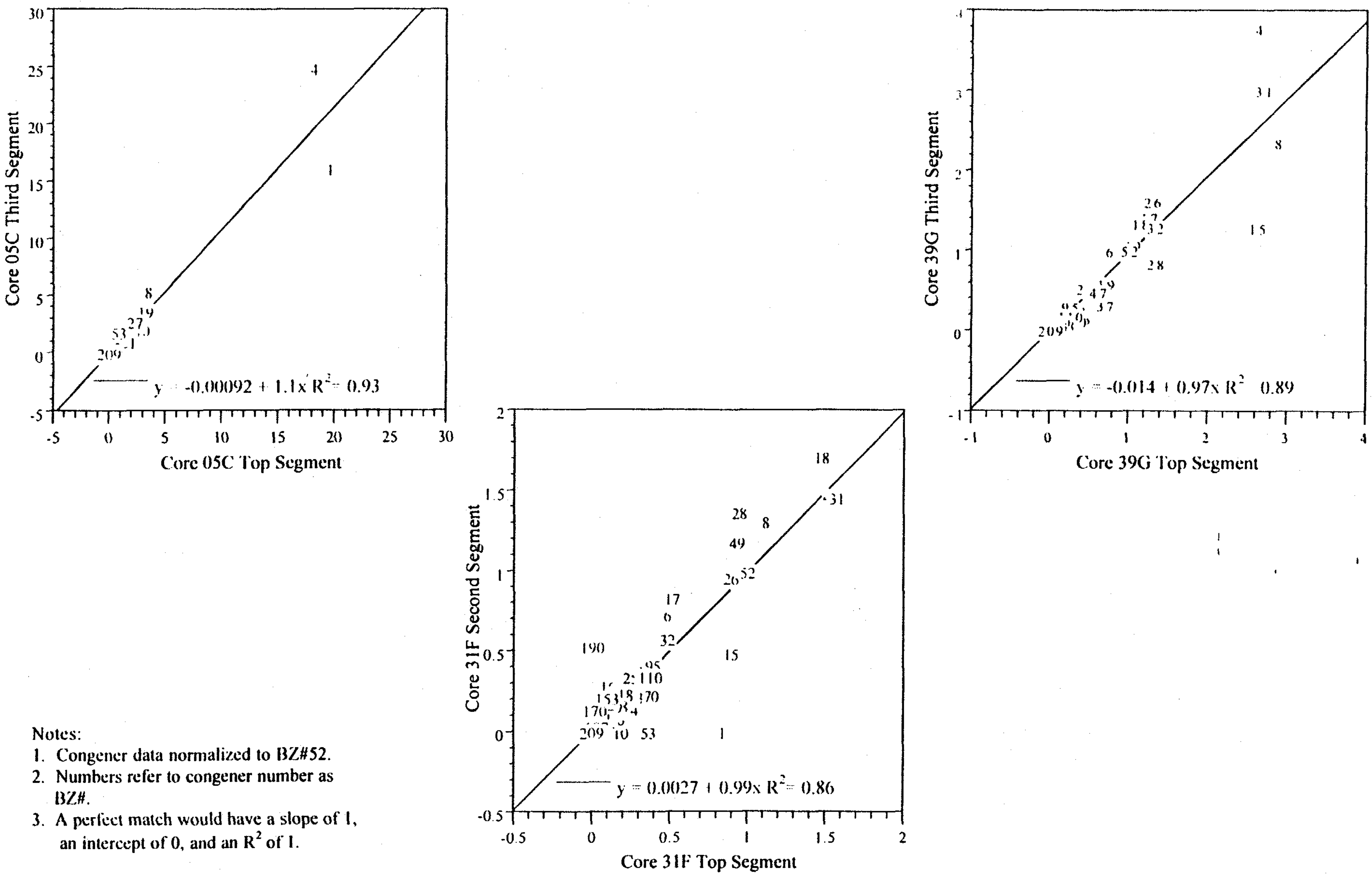
Figure 3-9
Comparison of Low Resolution Core and High Resolution Core Regressions for MDPR and ΔMW vs Total PCBs



Source: TAMS Gradient Database, Release 3.5

TAMS

Figure 3-6
Comparison of the Low Resolution Core and High Resolution Core Subsampling Processes



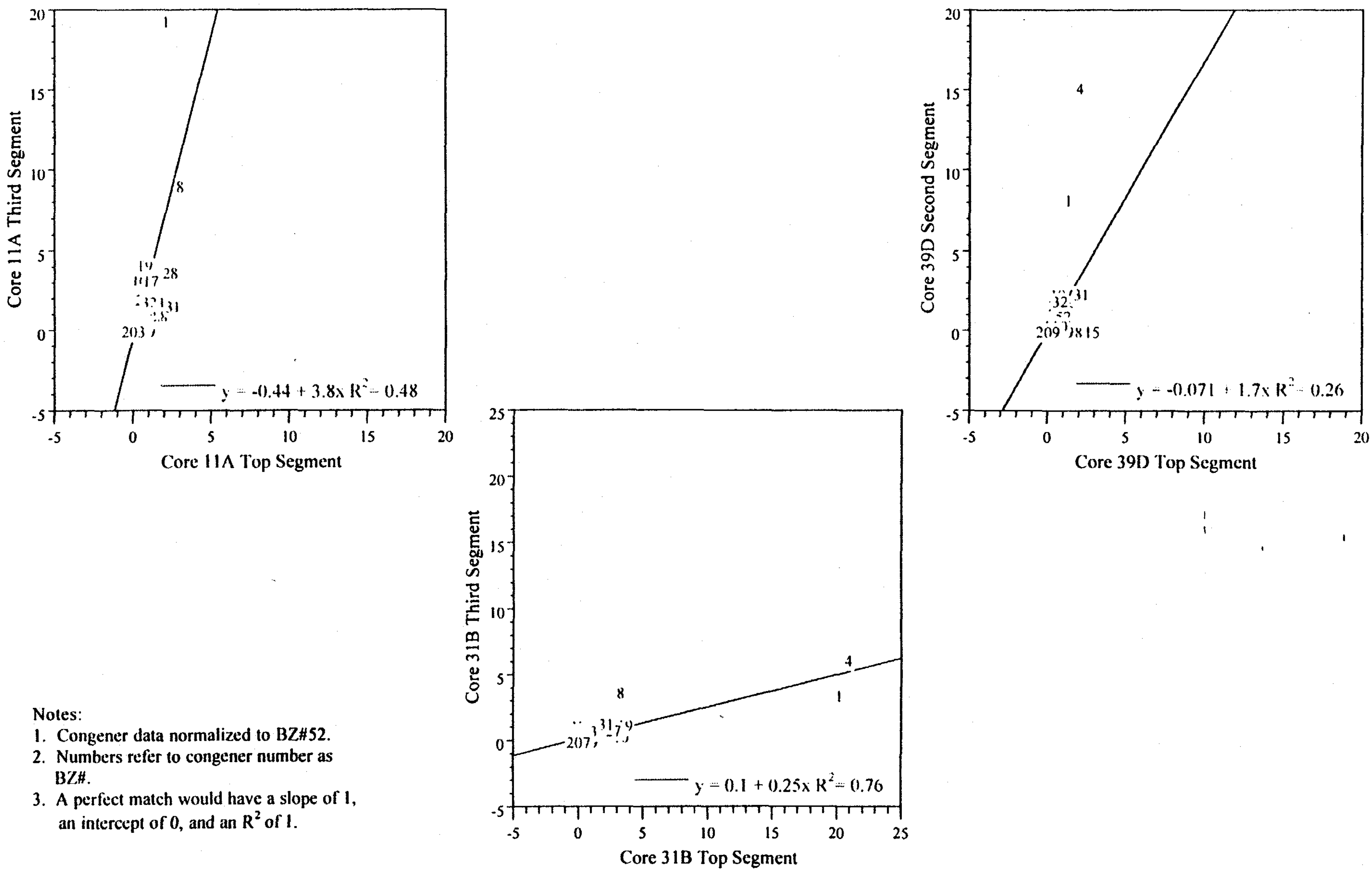
Notes:
1. Congener data normalized to BZ#52.
2. Numbers refer to congener number as BZ#.
3. A perfect match would have a slope of 1, an intercept of 0, and an R^2 of 1.

Source: TAMS/Gradient Database, Release 3.5

TAMS

Figure 3-4
Congener Pattern Comparison Between Upper and Lower Segments on Potentially Cross-Contaminated Cores

10.9948



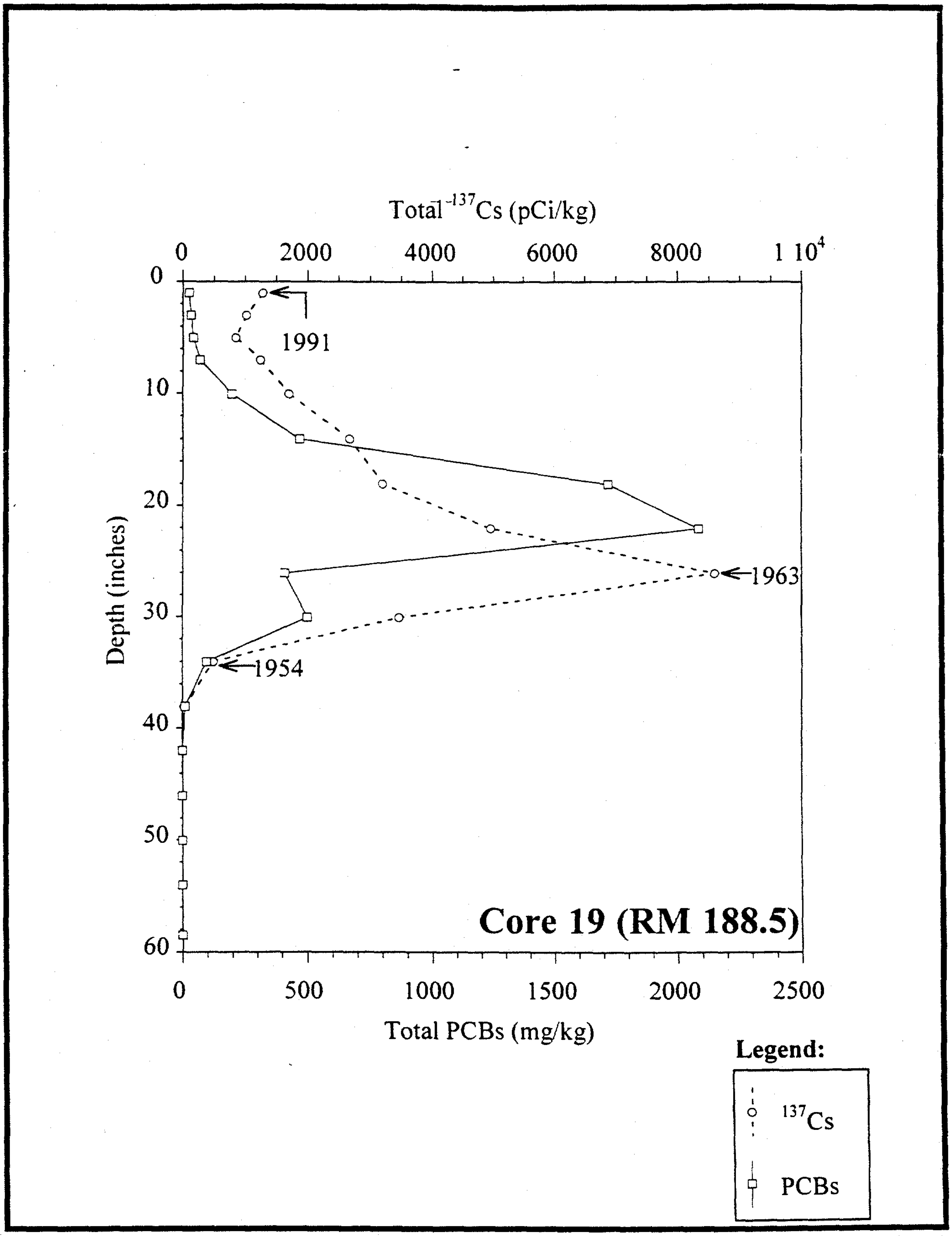
Notes:
1. Congener data normalized to BZ#52.
2. Numbers refer to congener number as BZ#.
3. A perfect match would have a slope of 1, an intercept of 0, and an R^2 of 1.

Source: TAMS/Gradient Database, Release 3.5

TAMS

Figure 3-5
Congener Pattern Comparison Between Upper and Lower Segments on Cores without Cross-Contamination

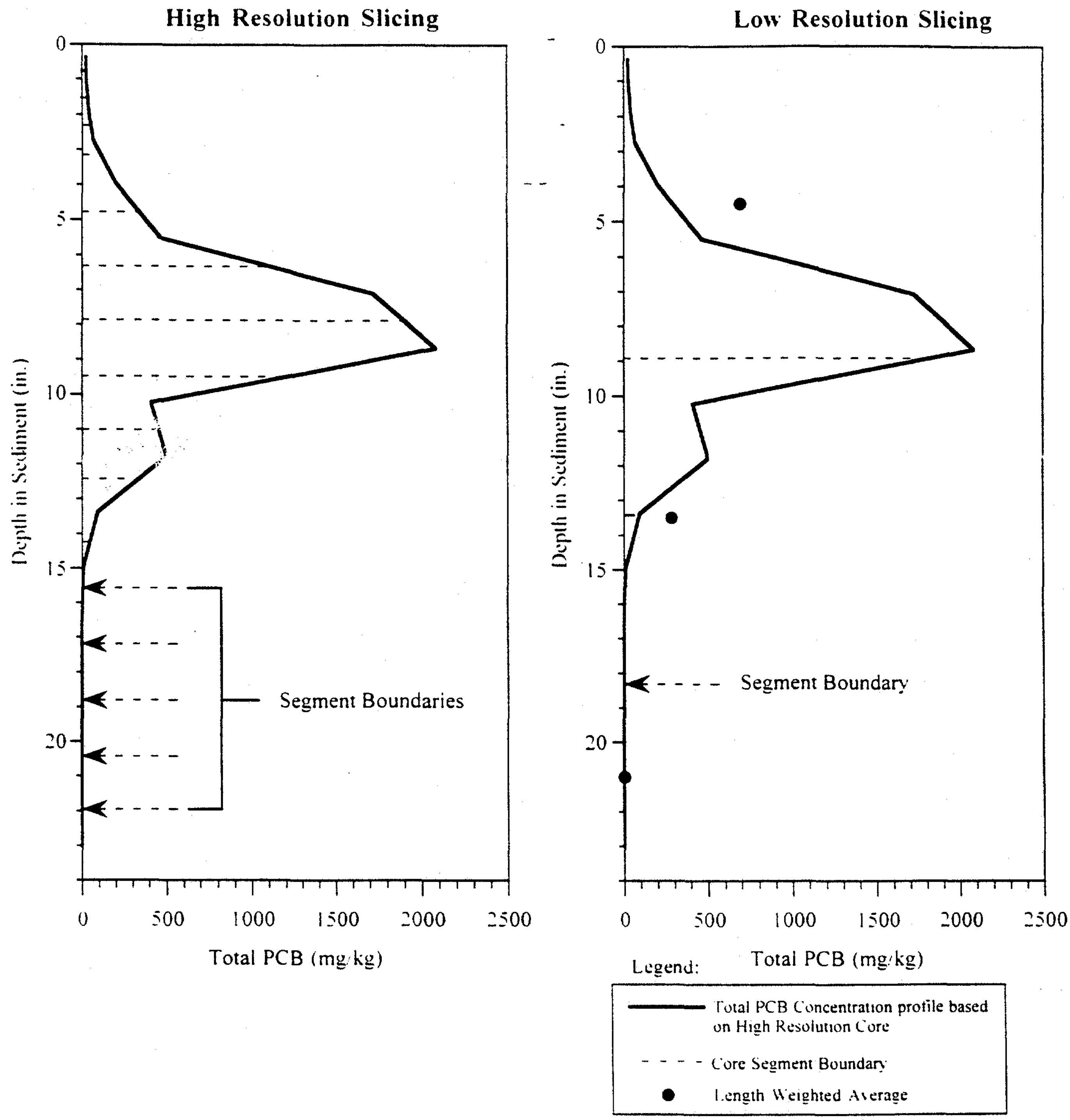
10.9949



Source: TAMS/Gradient Database, Release 3.5

TAMS

Figure 4-2
High Resolution Core 19 from the TI Pool



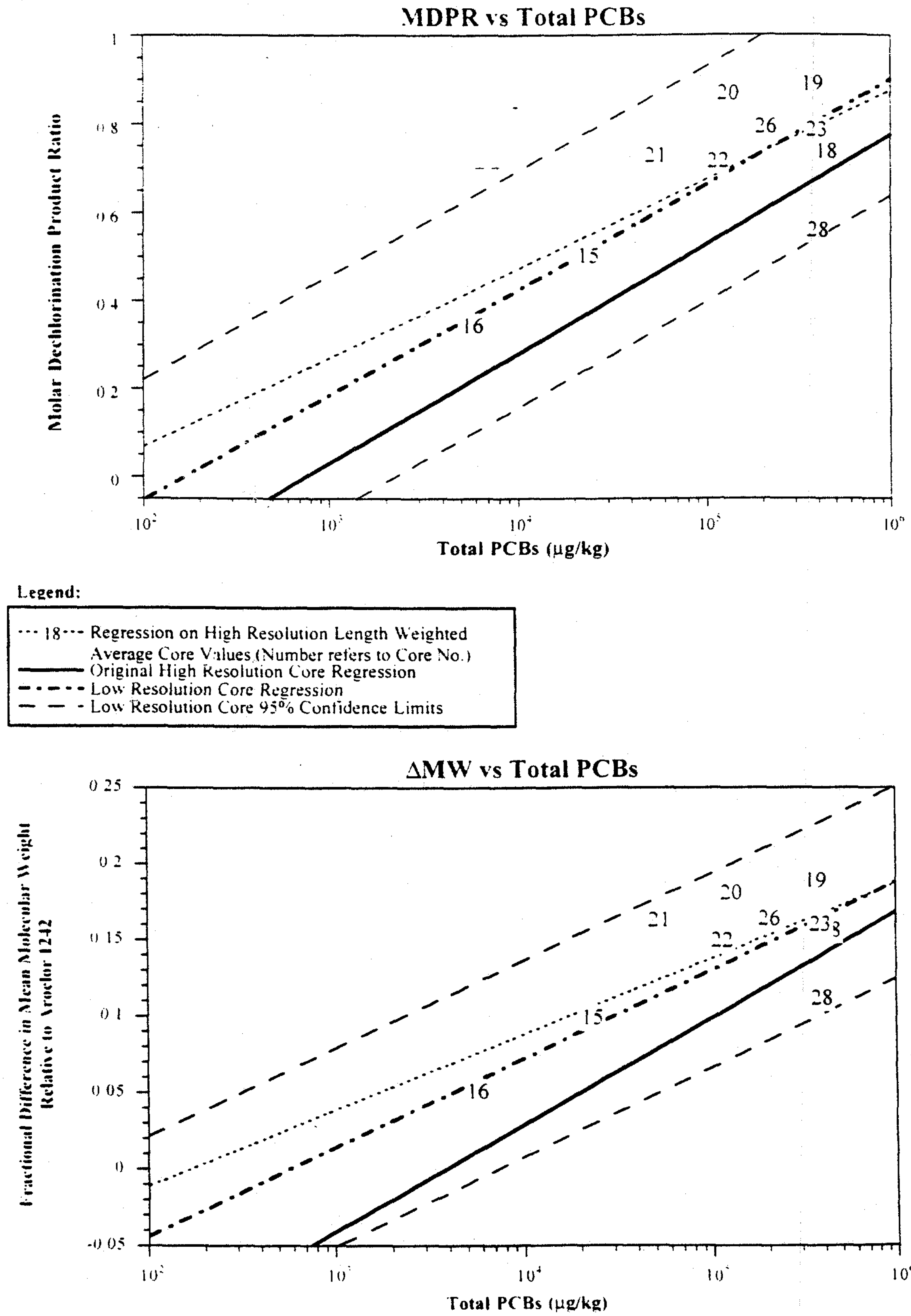
High Resolution Core Samples[1]	MDPR	ΔMW	Total PCBs (ppm)
Minimum	0.0000	-0.0916	0.01
Maximum	0.9156	0.2074	2082.93

Length Weighted Averages	MDPR	ΔMW	Total PCBs (ppm)
0-9"	0.8799	0.1860	693
9-18"	0.9002	0.1922	282
>18"	0.0000	-0.0568	0.02
Full Core	0.8828	0.1871	512

Note:
1. ^{137}Cs Bearing slices only

Source: TAMS Gradient Database, Release 3.5

Figure 3-10
Comparison of the Low Resolution Core and High Resolution Core Slicing Techniques on Measured Sample Values for High Resolution Core 19

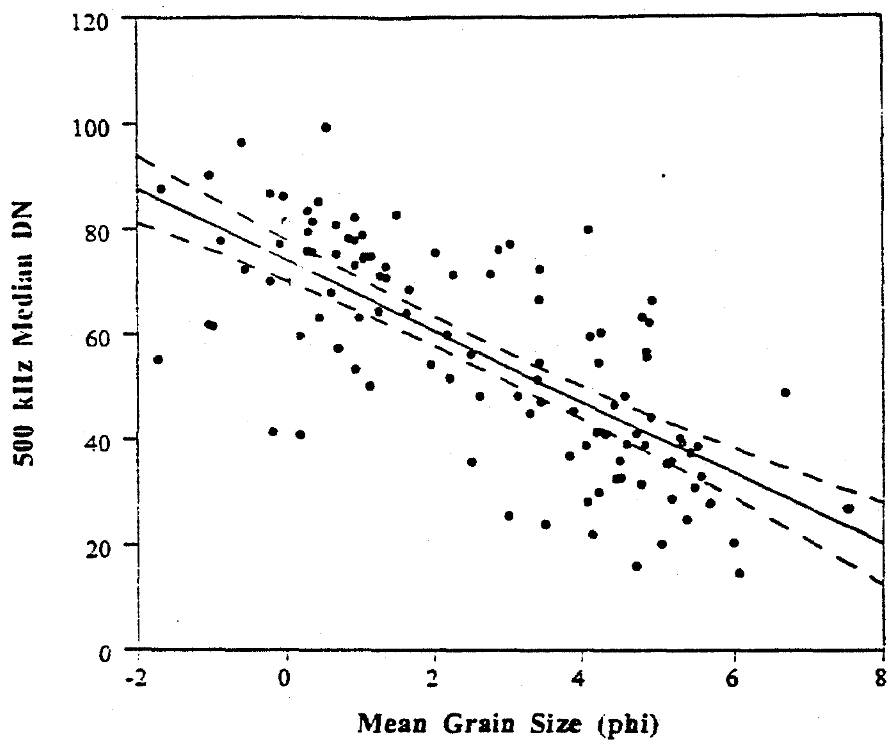


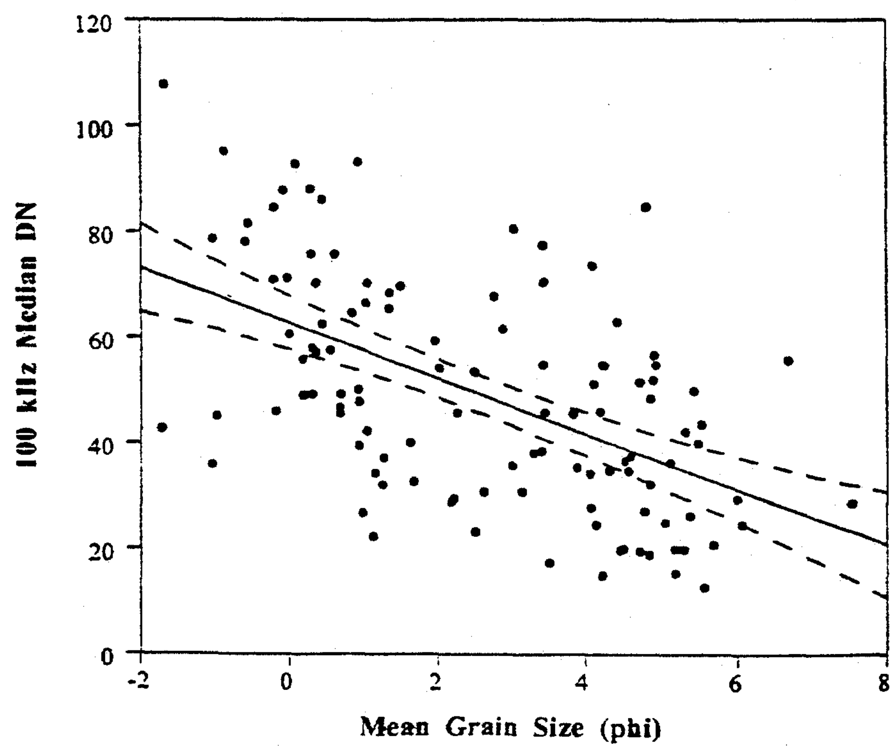
Source: TAMS Gradient Database, Release 3.5

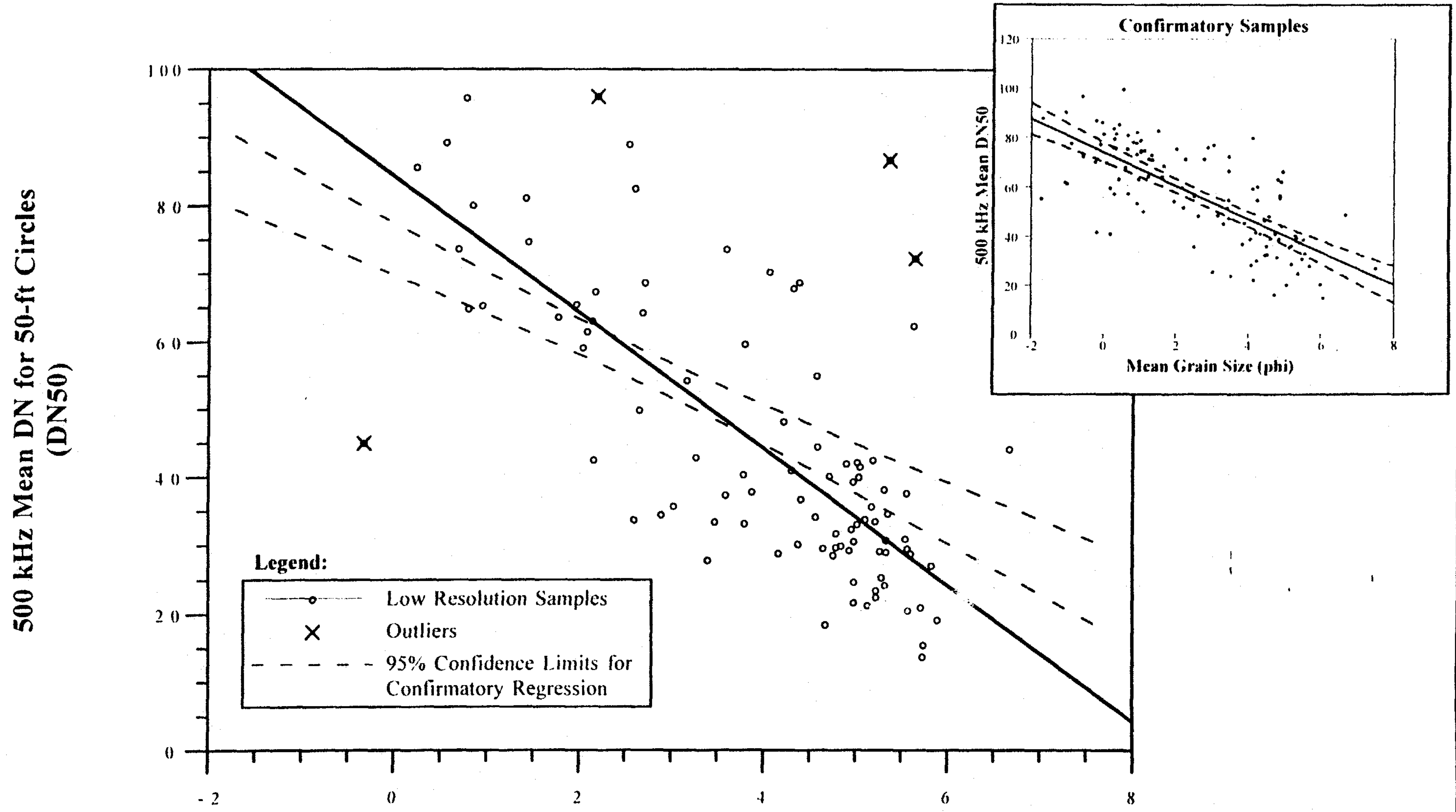
Figure 3-12

Comparison of Calculated Results for High Resolution Cores with the Low Resolution Core Regression Lines for ΔMW and MDPR vs Total PCBs

Calibration Plots of DN vs. Grain-Size







Notes:

a. phi = Log[grain size (mm)] / Log[2]

b. The regression line for the confirmatory samples is Mean DN50 = 76 - 6.9*Mean Phi $R^2 = 0.54$.

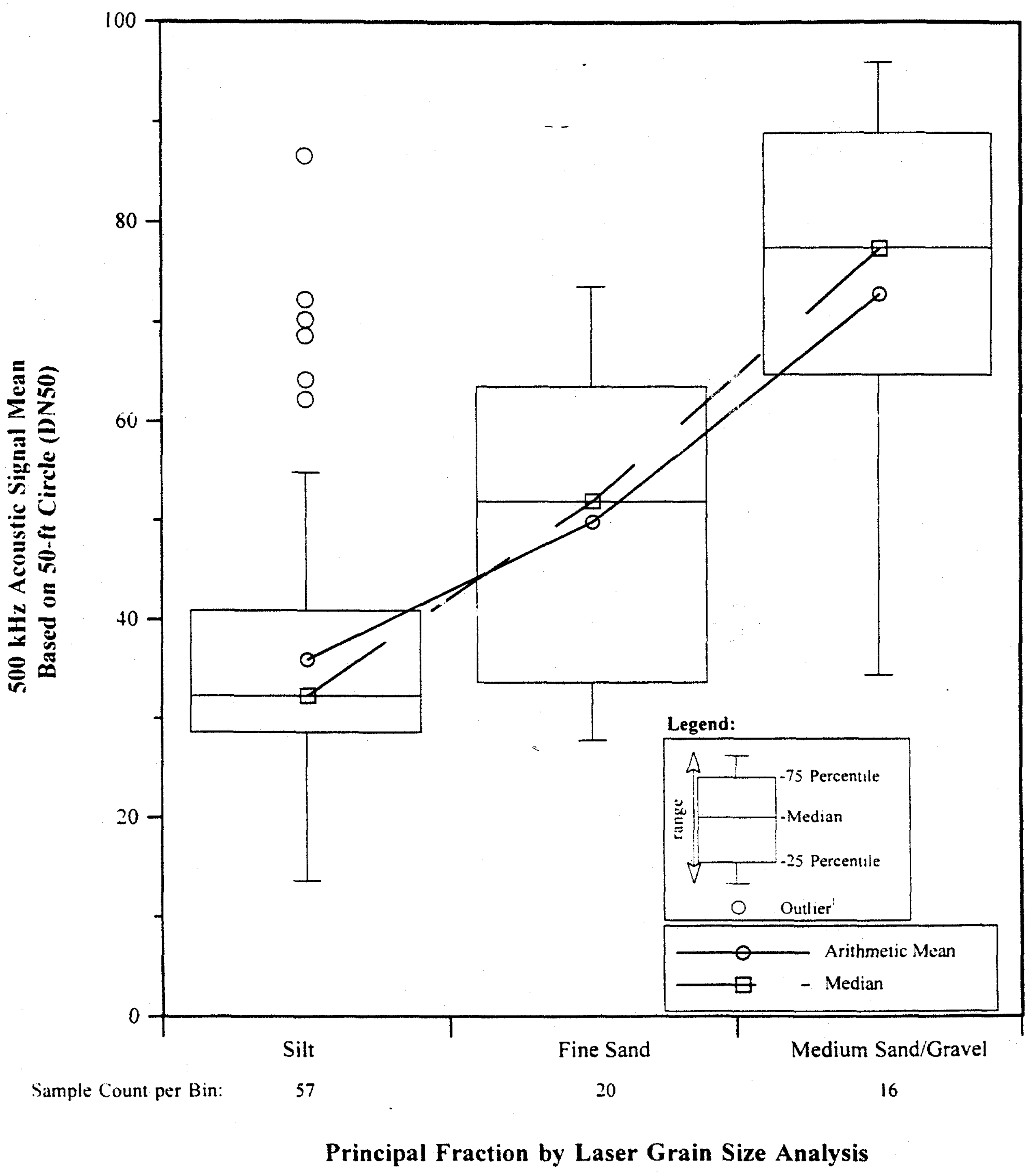
For the low resolution core samples the regression line is Mean DN50 = 84 - 10*Mean Phi $R^2 = 0.61$.

Source: TAMS/Gradient Database, Release 3.5

TAMS

Figure 3-29

Comparison of the Regression Lines for the Confirmatory and Low Resolution Core Results against the DN50 for the 500 kHz Side-Scan Sonar Images



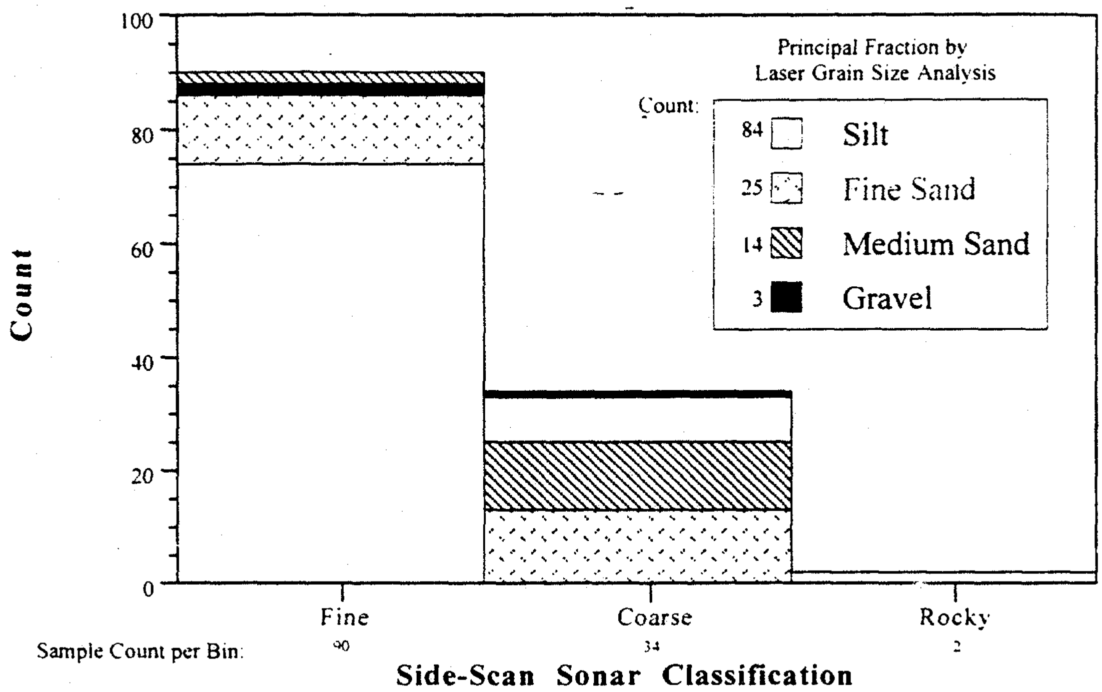
Note 1) See text for discussion

Source: TAMS/Gradient Database. Release 3.5

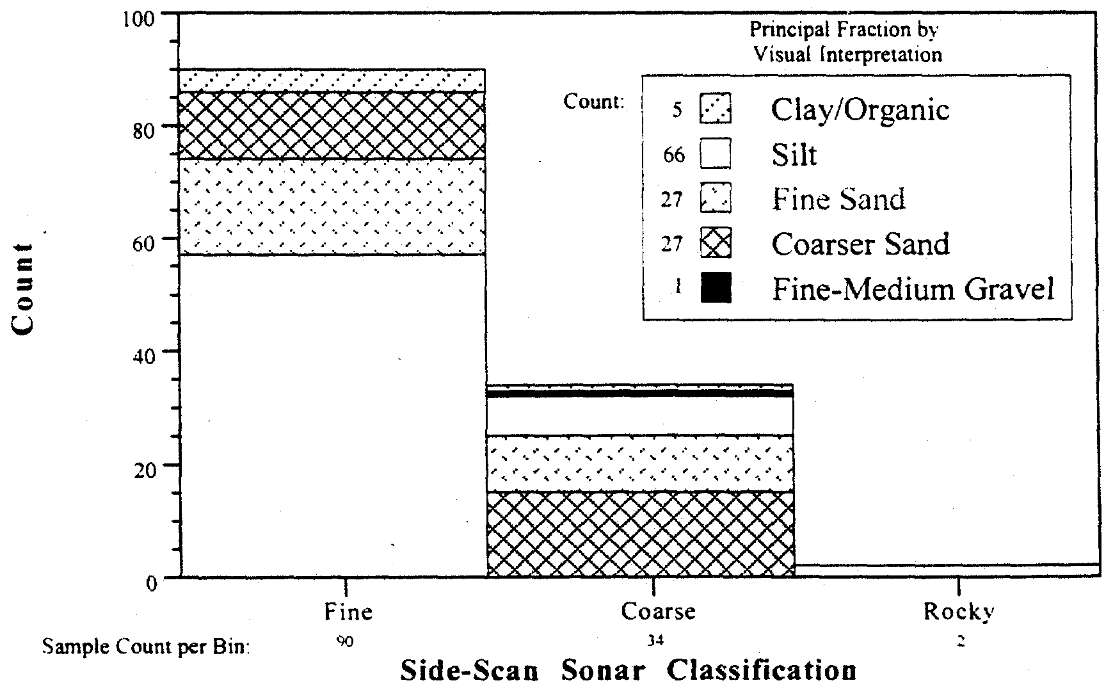
TAMS

Figure 3-28
Acoustic Signal Mean (DN50) Based on 50-ft Circles Grouped by Laser Analysis Principal Fraction

Principal Sediment Fraction by Laser Grain Size Analysis vs Side-Scan Sonar Classification



Principal Sediment Fraction by Visual Inspection vs Side-Scan Sonar Classification

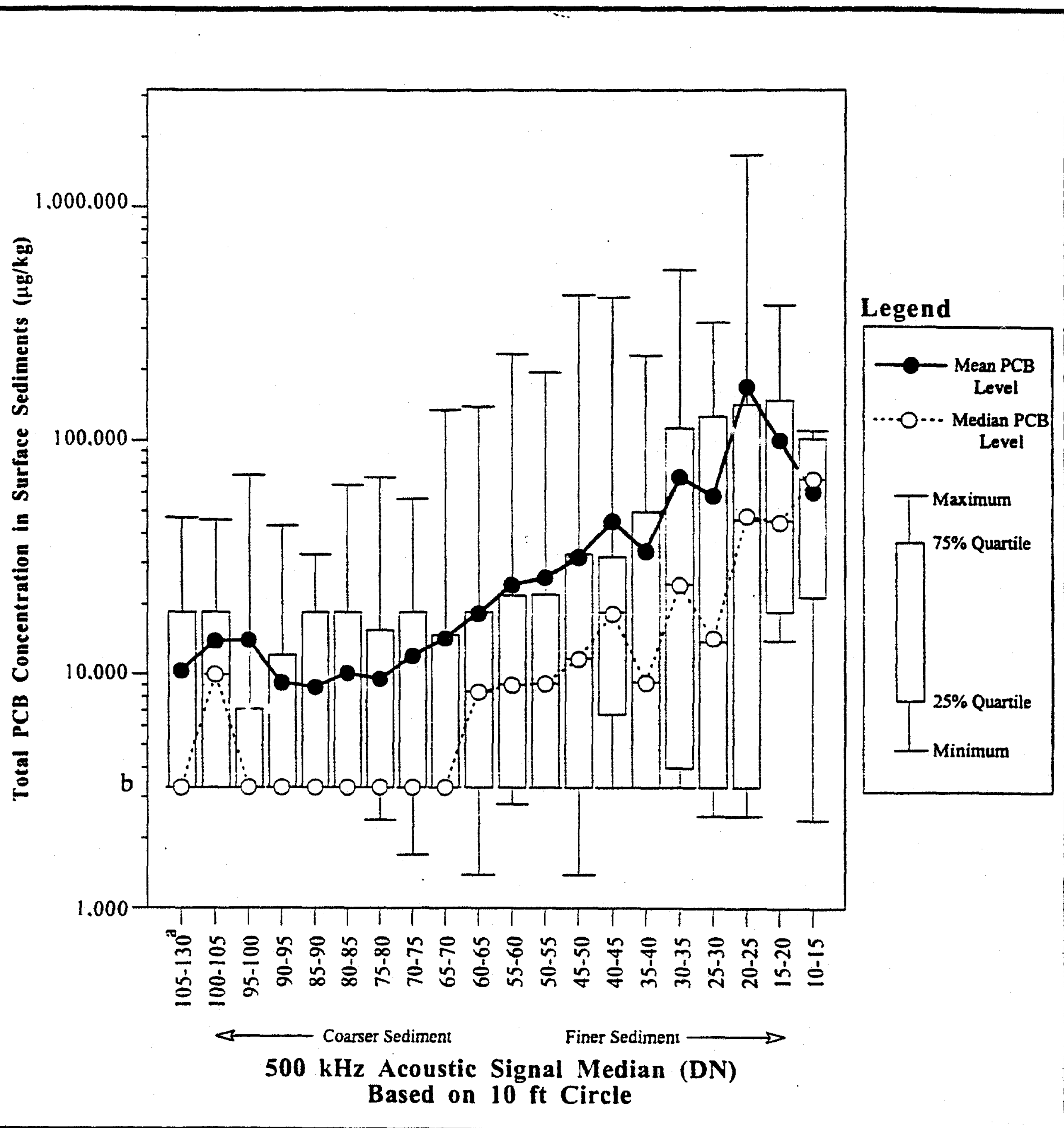


Source: TAMS/Gradient Database. Release 3.5

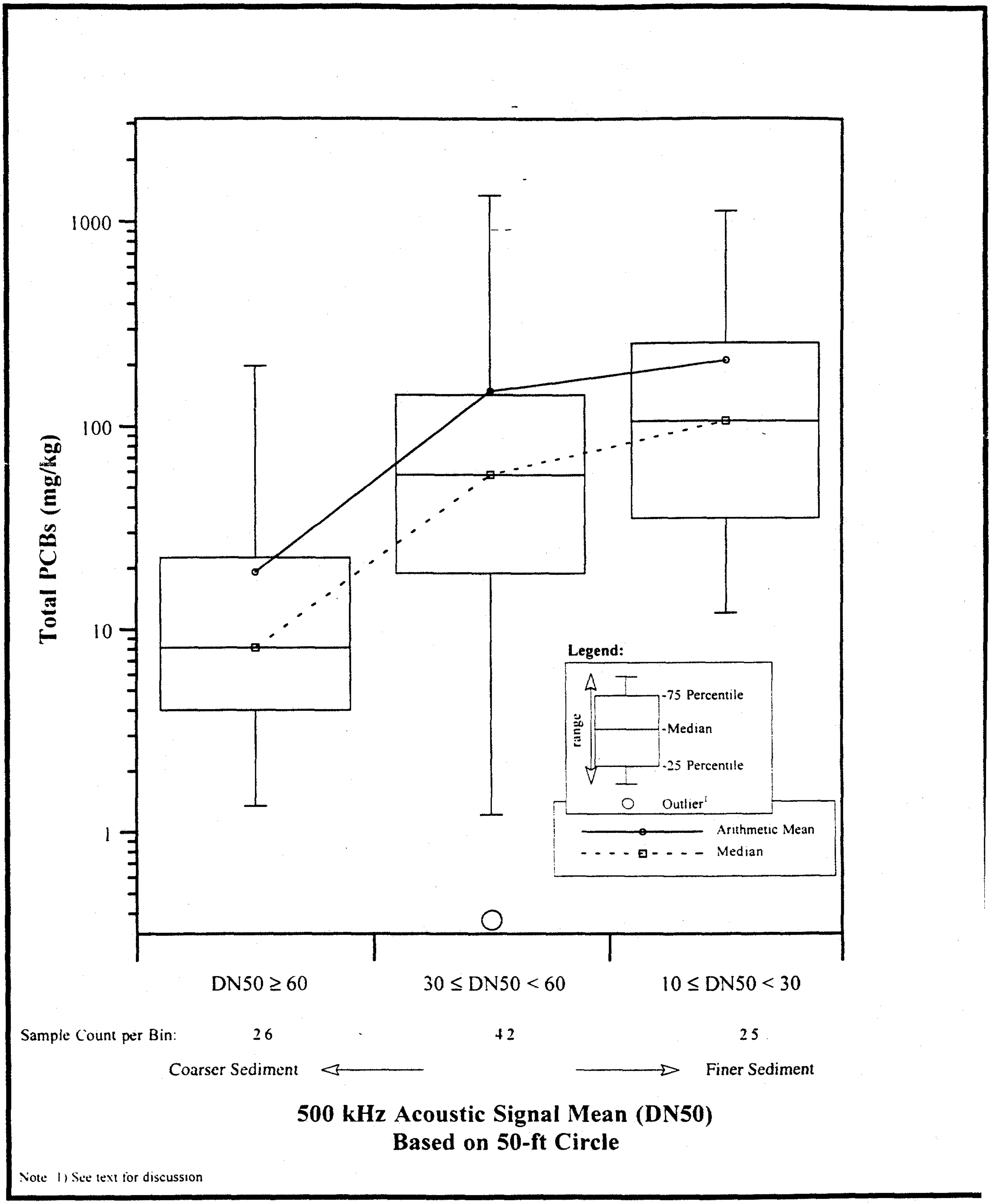
TAMS

Figure 3-27
Classification of Sediment Samples
Comparison of Visual and Analytical Techniques to the Interpretation of the Side-Scan Sonar Images

Comparison of 500 kHz Acoustic Signal and 1984 NYSDEC PCB Levels in Surface Sediments



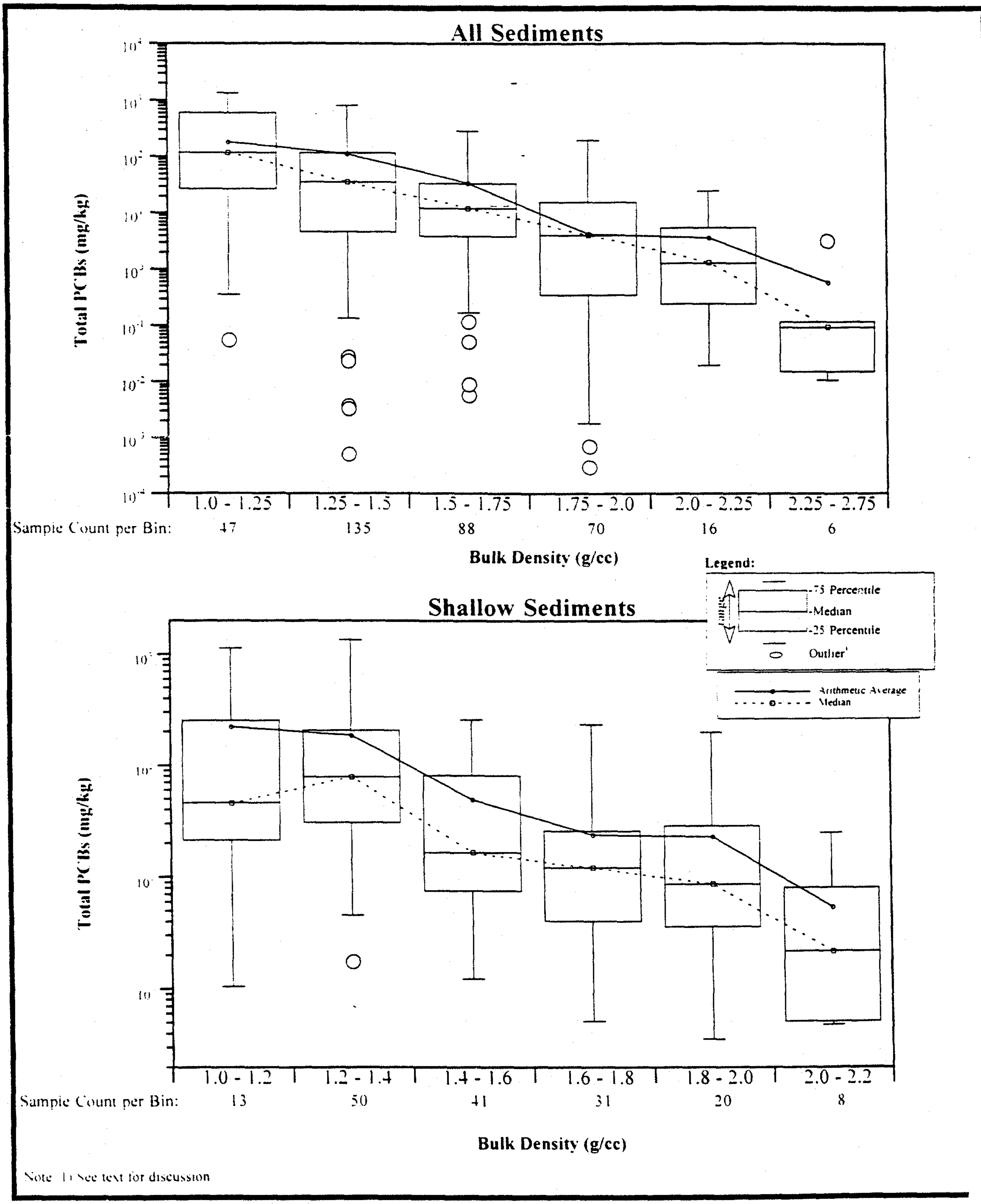
TAMS/Cadmus/Gradient



Source: TAMS/Gradient Database, Release 3.5

TAMS

Figure 3-30
Comparison of 500 kHz Acoustic Signal (DN50) and Low Resolution Core PCB Levels in Shallow Sediments

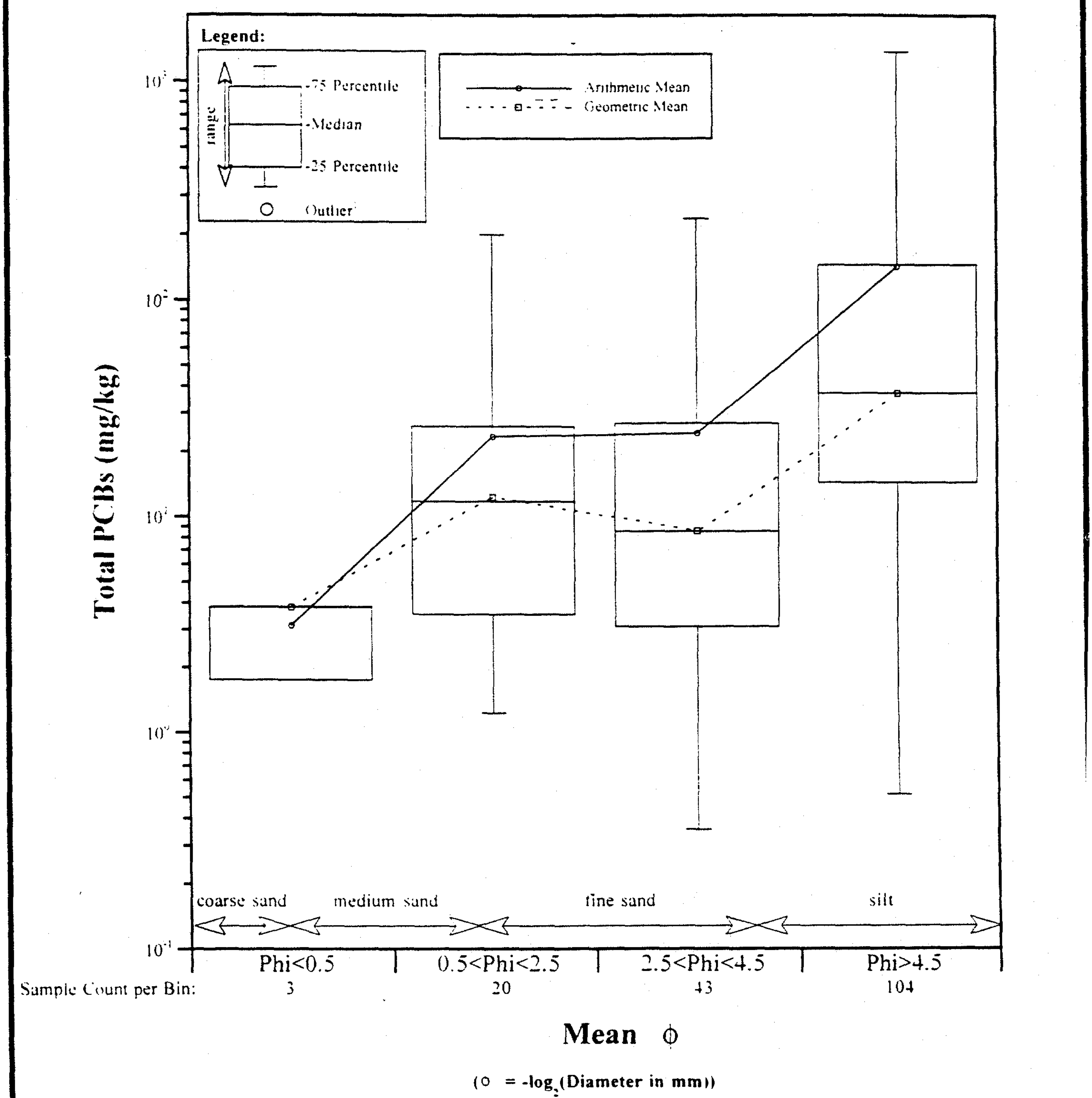


Source: TAMS Gradient Database, Release 3.5

TA

Figure 3-13
Total PCBs Grouped by Bulk Density

10.9959



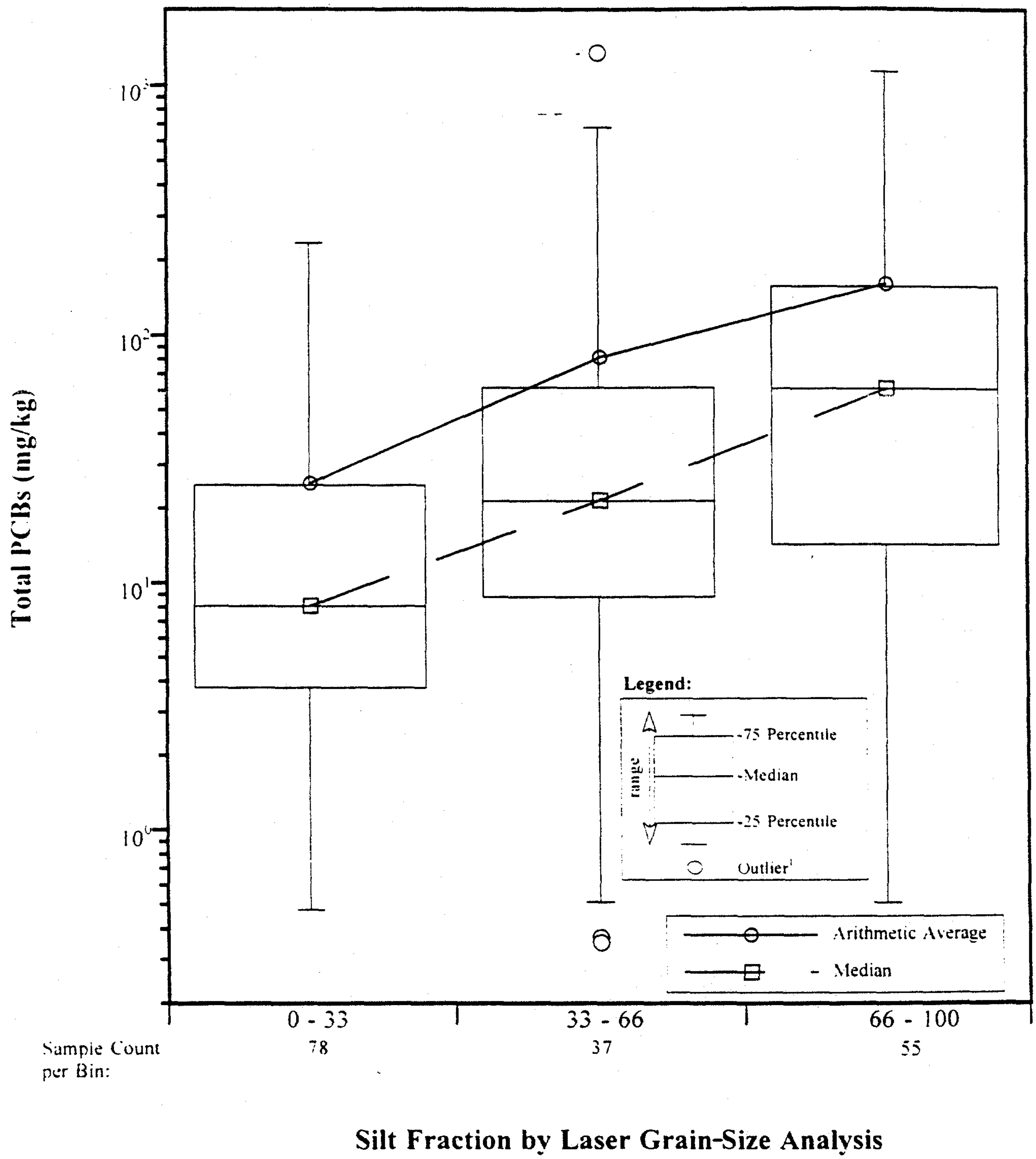
Note: 1) See text for discussion

Source: TAMS/Gradient Database, Release 3.5

TAMS

Figure 3-20
Total PCBs Grouped by Mean ϕ (Phi) in Shallow Sediments

10.9960



Note: 1) See text for discussion

Source: TAMS/Gradient Database, Release 3.5

TA

Figure 3-19
Total PCBs Grouped by Silt Fraction in Shallow Sediments

TI Pool Inventory

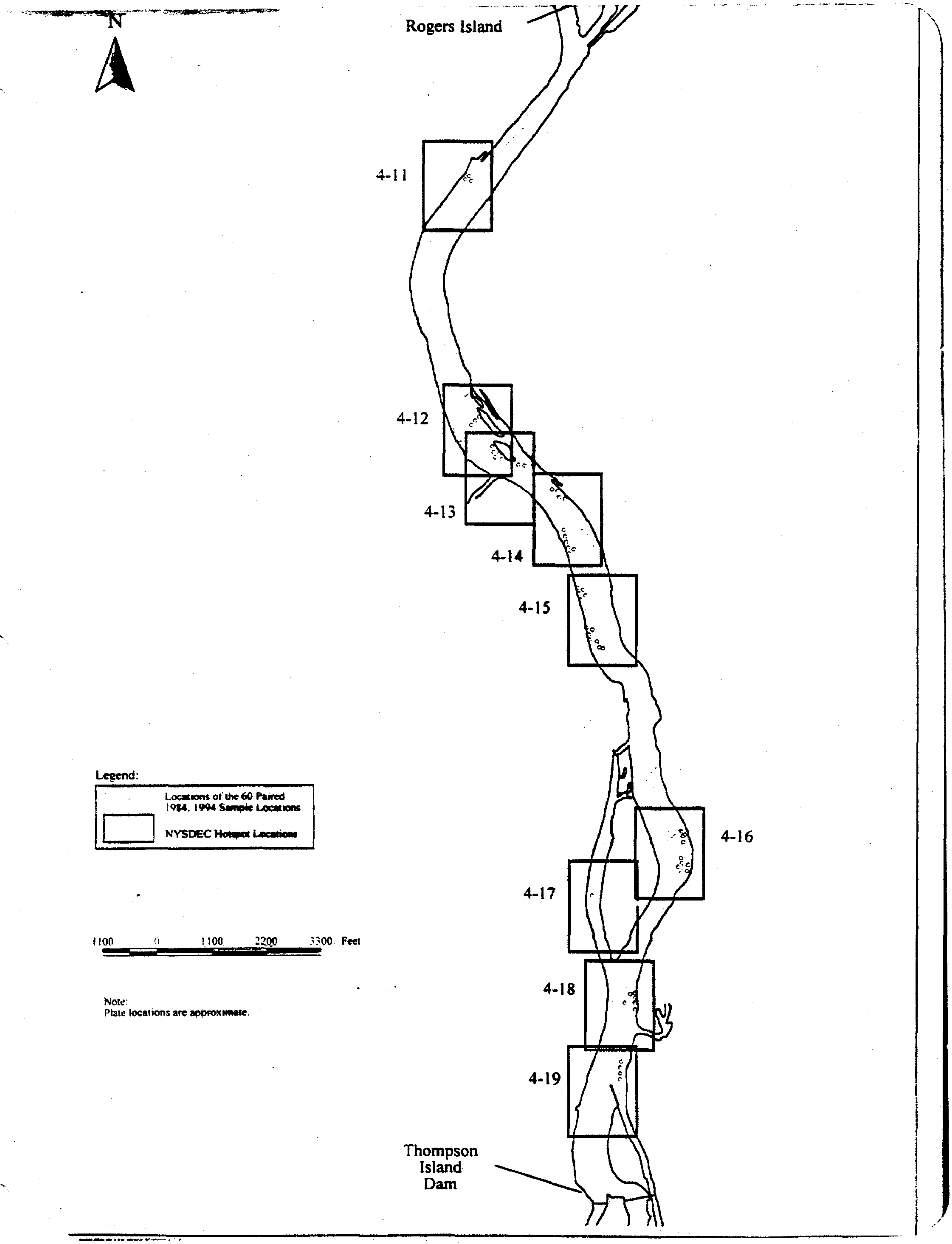
- Comparison of 1984 and 1994 core profiles
- Comparison of mean 1984 and 1994 sediment inventories based on trichloro & higher congeners

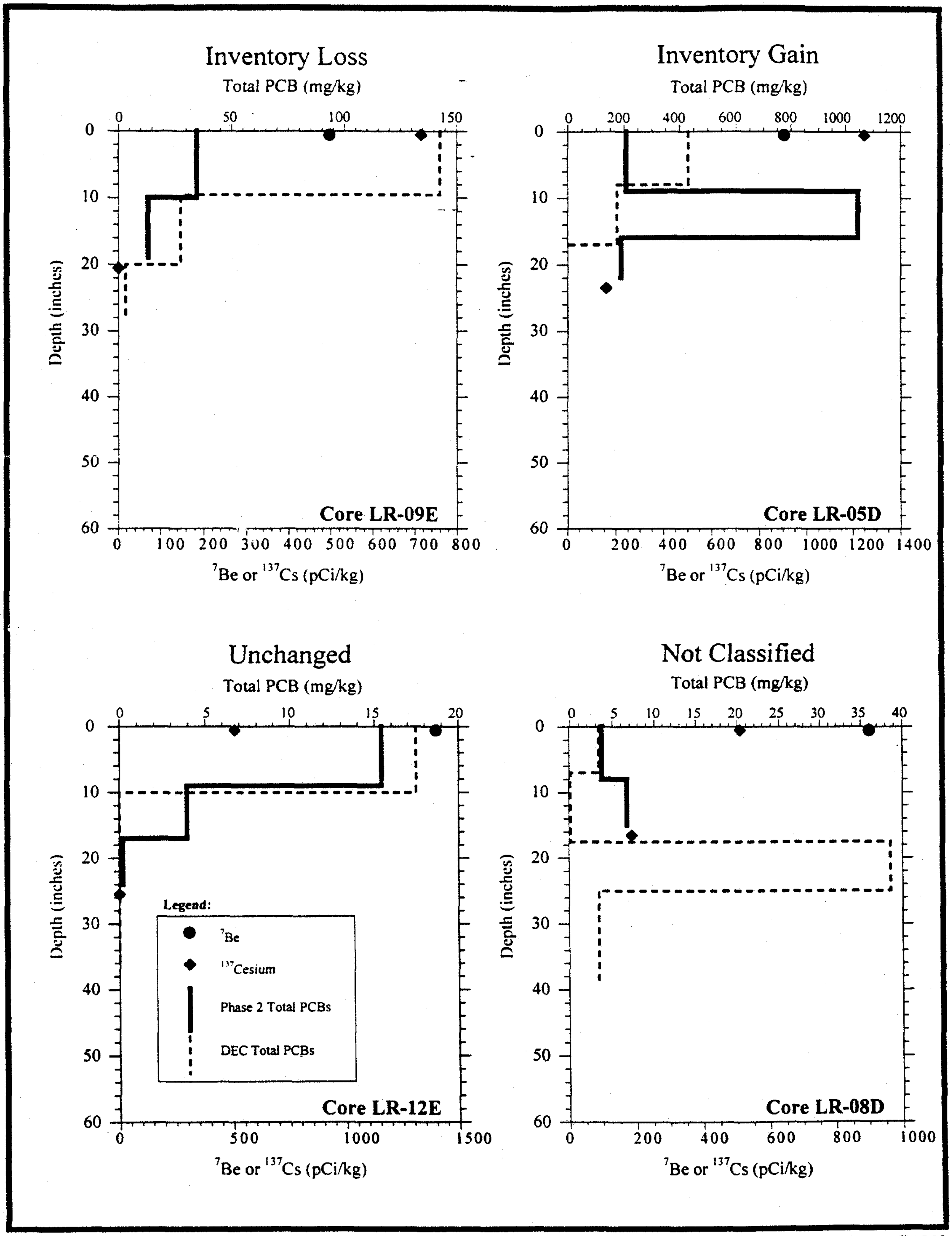
$$1994\ MPA_{3+} - 1984\ MPA_{3+}$$

- Examination of the fractional change in inventory on a mass and molar basis

$$\Delta_m = \frac{1994 \text{ Total Moles} - 1984 \text{ Tri+ Moles}}{1984 \text{ Tri+ Moles}}$$

$$\Delta_{PCB} = \frac{1994\ MPA - 1984\ MPA_{3+}}{1984\ MPA_{3+}}$$

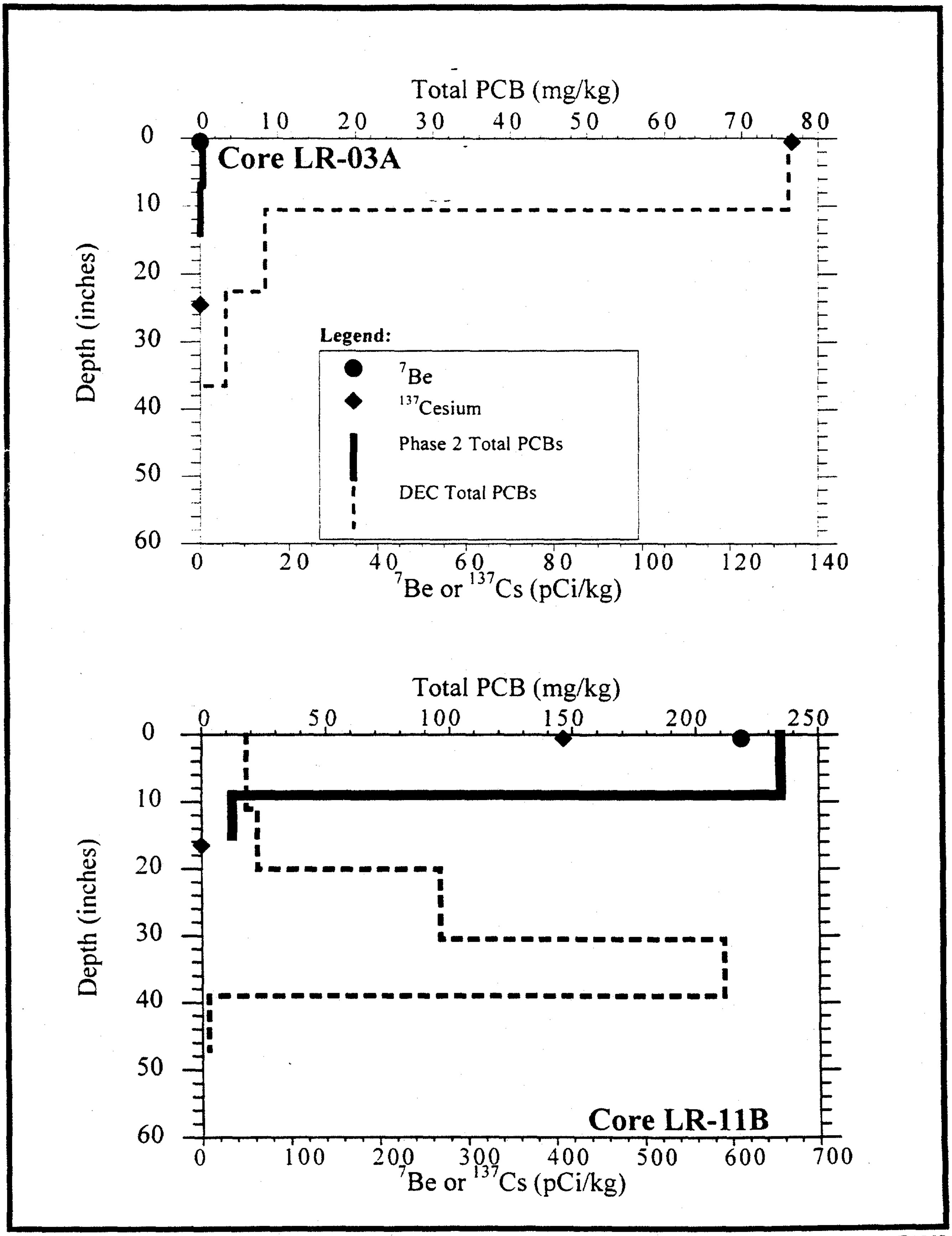

N
Rogers Island
4-11
4-12
4-13
4-14
4-15
4-16
4-17
4-18
4-19
Thompson
Island
Dam
Legend:
Locations of the 60 Paired
1984, 1994 Sample Locations
NYSDEC Hotspot Locations
1100 0 1100 2200 3300 Feet
Note:
Plate locations are approximate.



Source: TAMS/Gradient Database, Release 3.5

TAMS

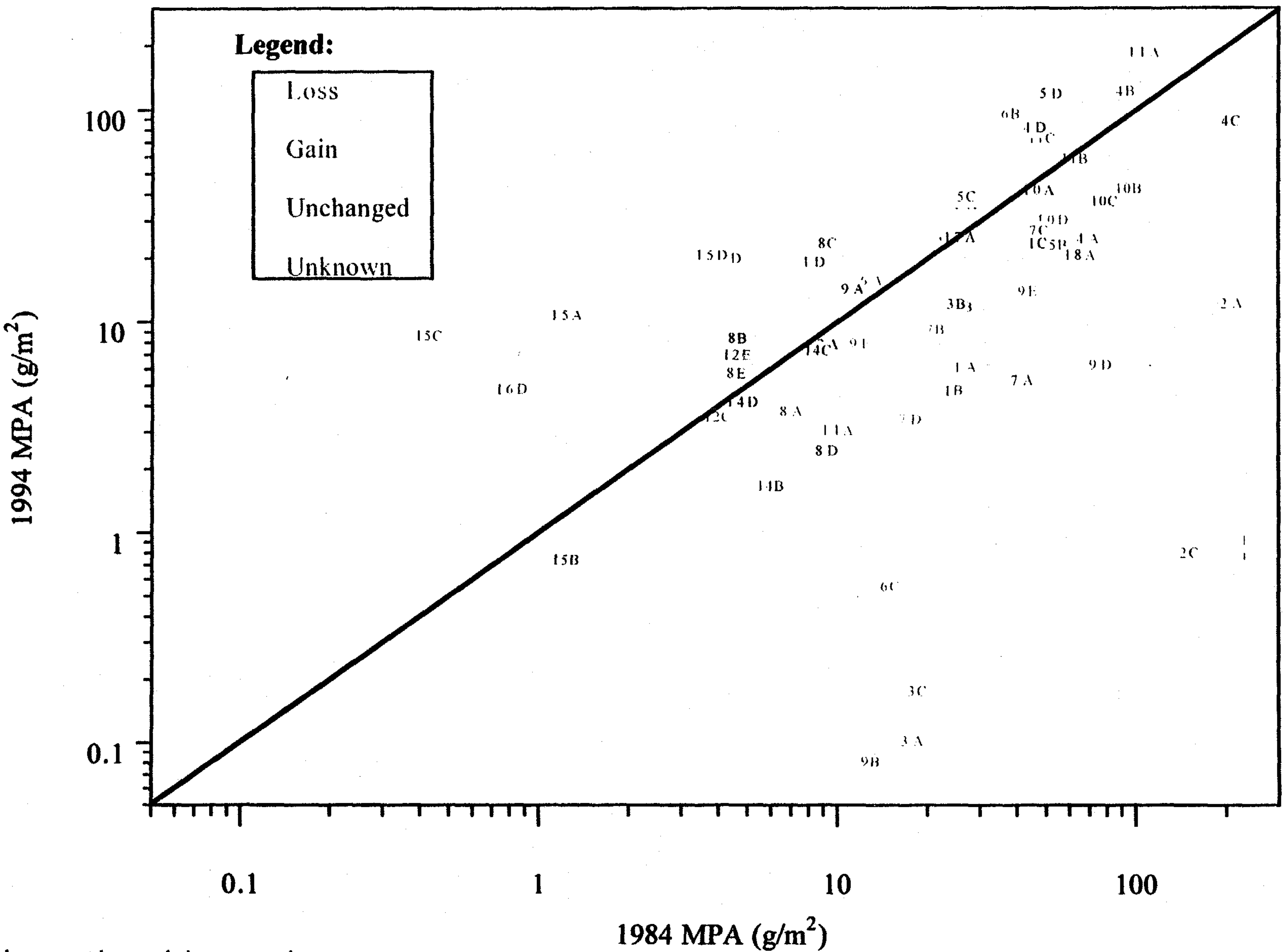
Figure 4-1
Typical Low Resolution Core Profiles for the TI Pool and Their Classification



Source: TAMS/Gradient Database, Release 3.5

TAMS

Figure 4-3
Core Locations Exhibiting Sediment Scour

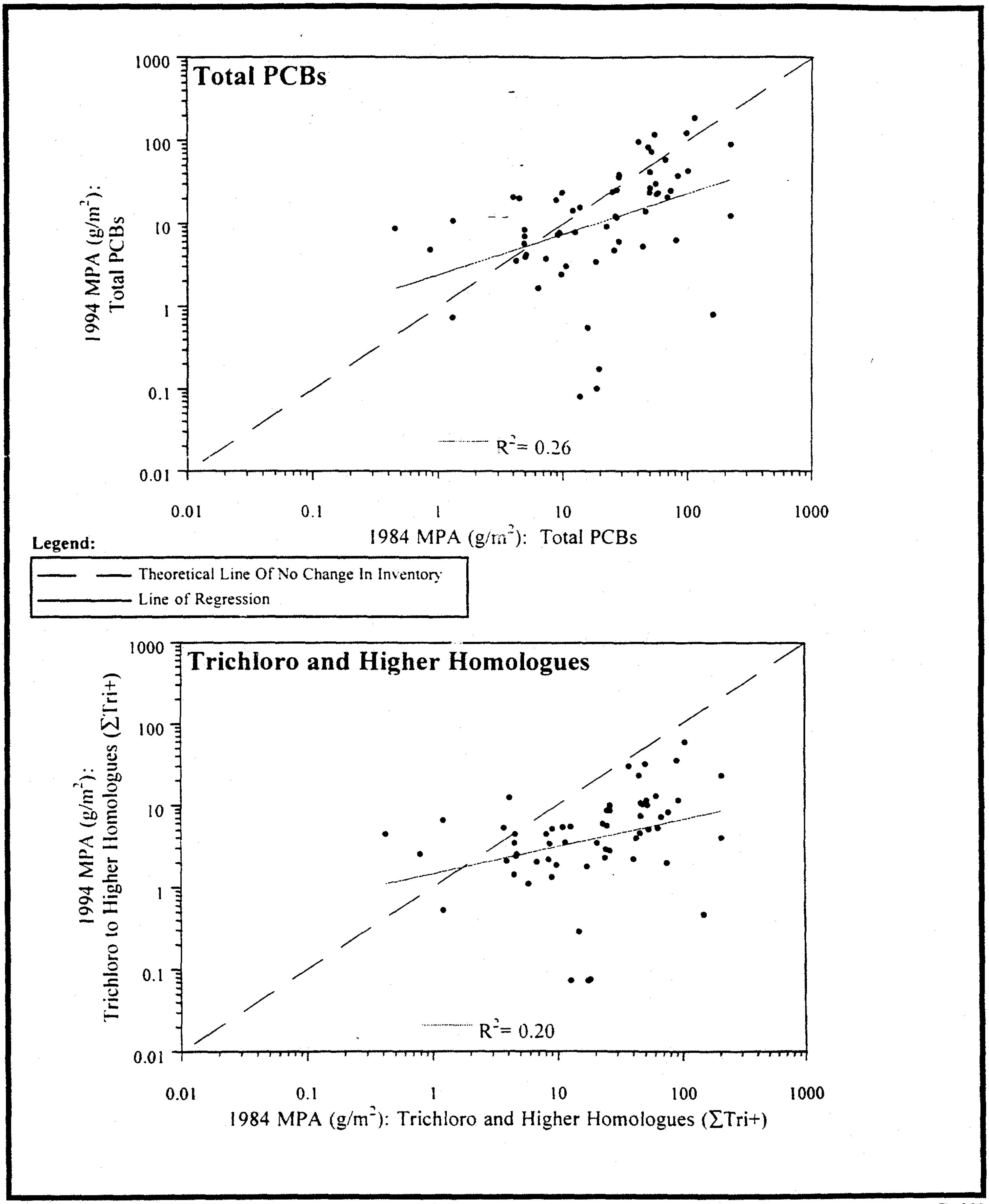


Note:
Data labels represent low resolution core numbers.

Source: TAMS/Gradient Database, Release 3.5

TAMS

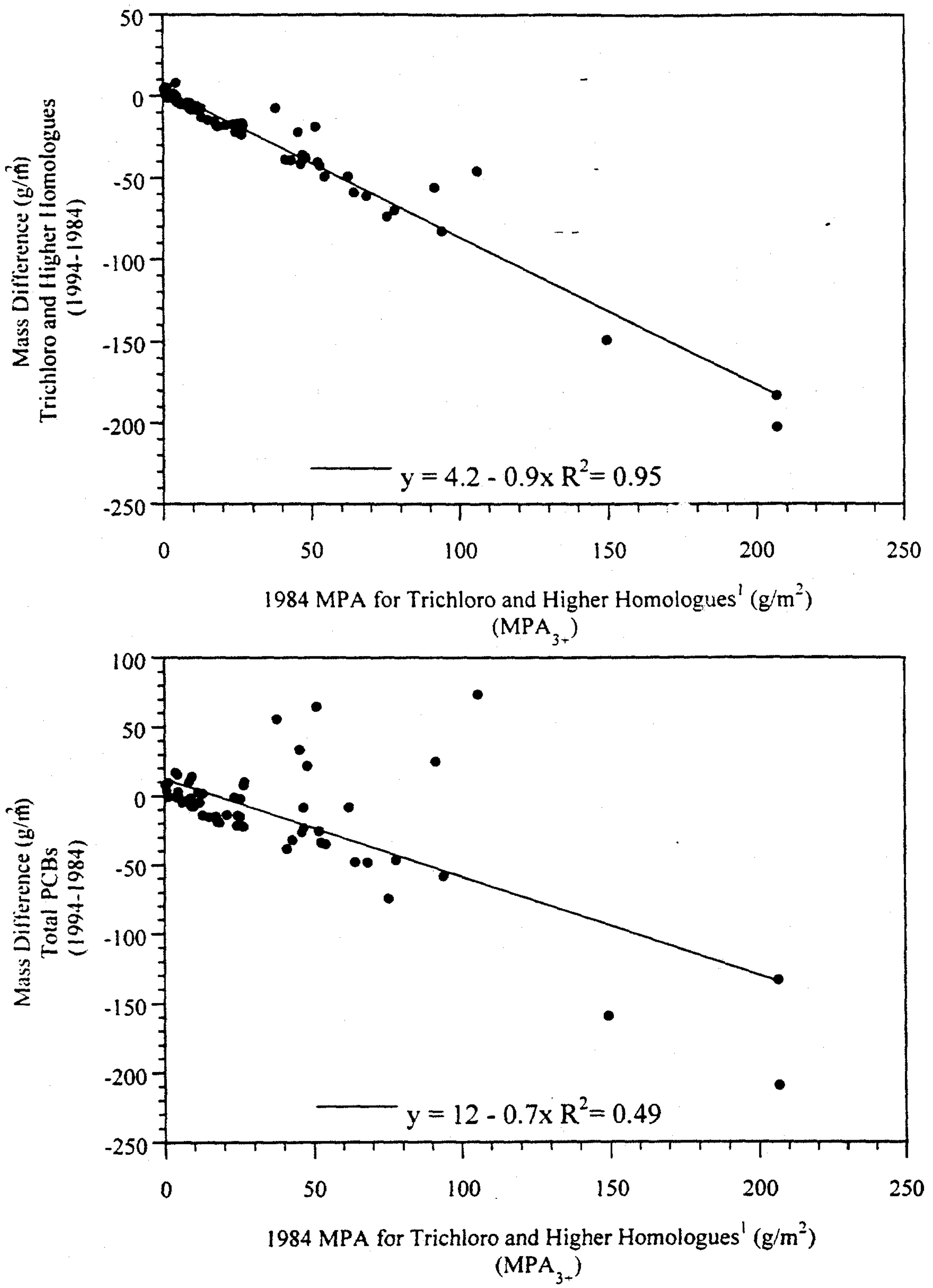
Figure 4-4
Comparison Between 1984 and 1994 MPA for Total PCBs Showing Core Classications



Source: TAMS/Gradient Database. Release 3.5

TAMS

Figure 4-5
Relationship Between 1984 and 1994 Sediment Inventories (MPA) for Total PCBs and Trichloro and Higher Homologues



Note:
1. See text for definition.

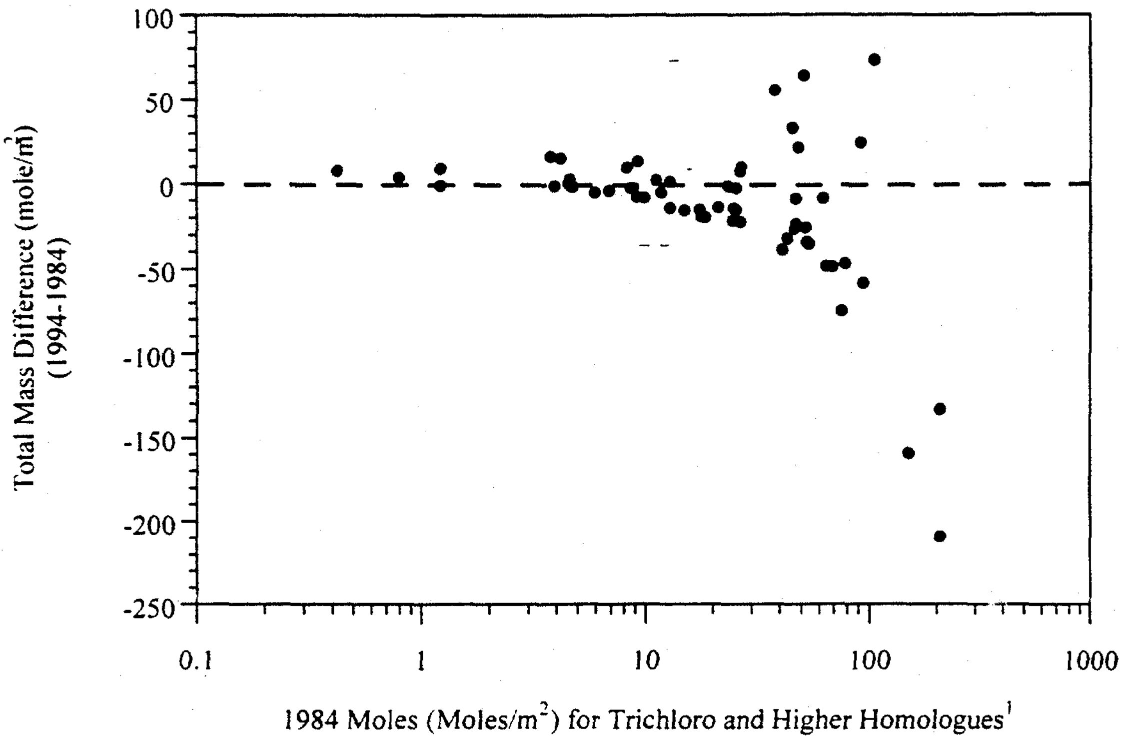
Source: TAMS/Gradient Database. Release 3.5

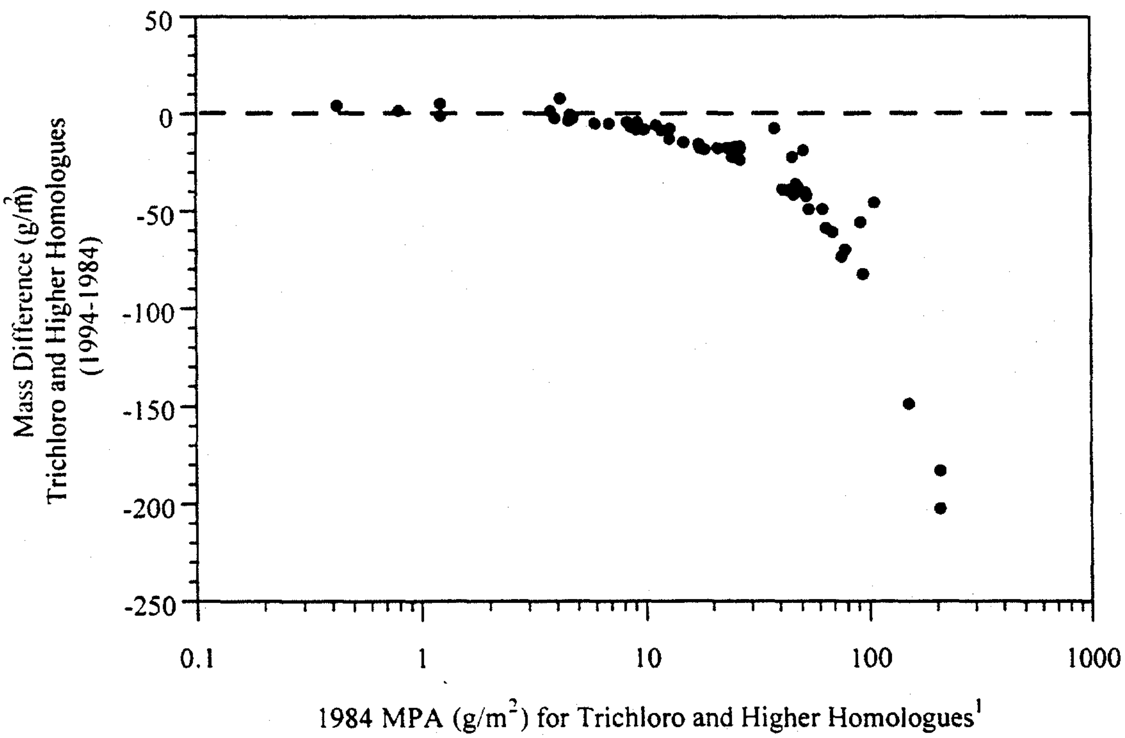
TAMS

Figure 4-6

Relationship Between the 1984 $\sum$Tri+ Mass Per Unit Area (MPA_{3+}) and the Change in Sediment PCB Inventory for the TI Pool

10.9968



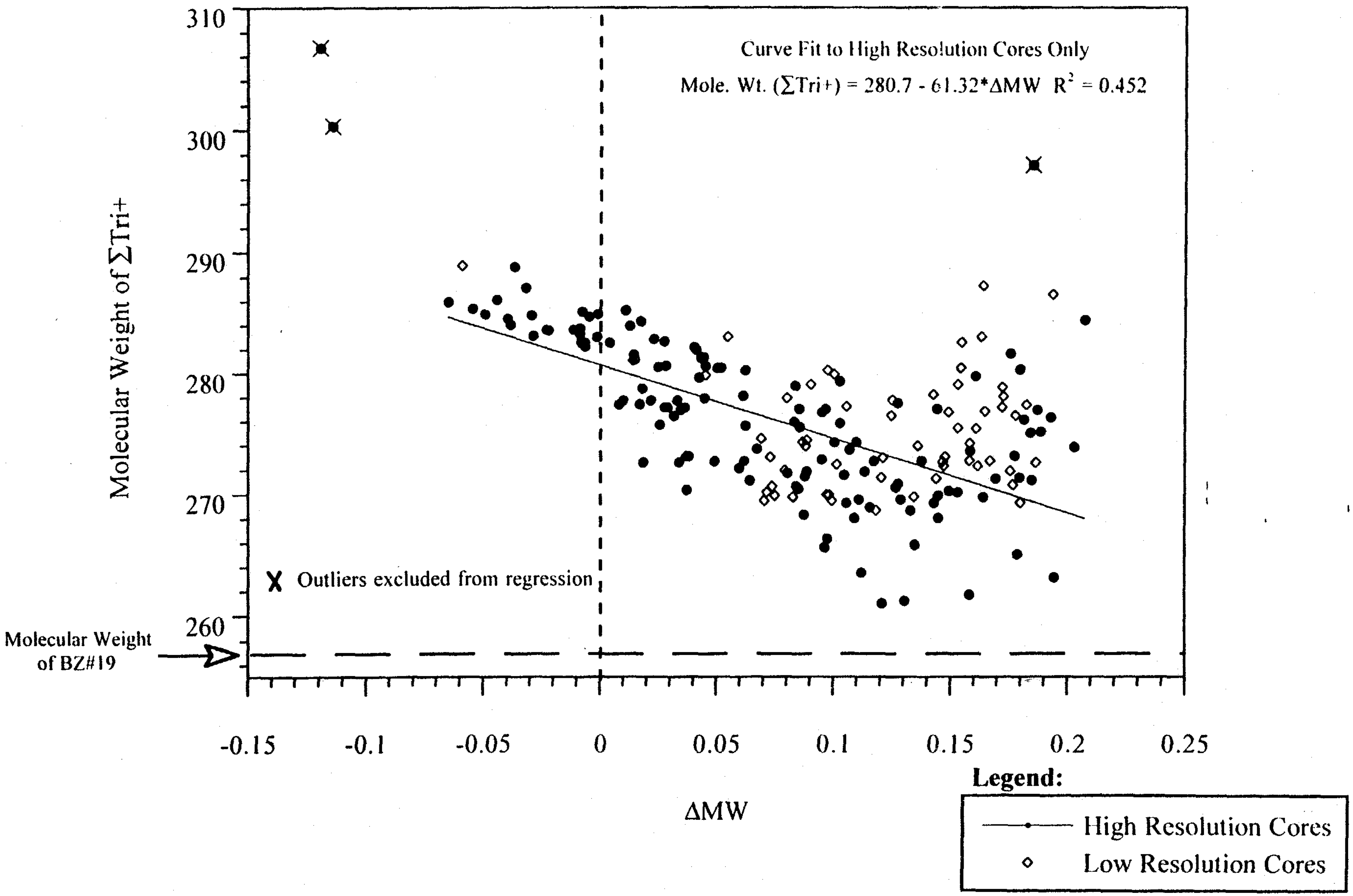


Note:
1. See text for definition.

Source: TAMS/Gradient Database, Release 3.5

TAMS

Figure 4-7
1984 Trichloro and Higher Homologues as MPA vs Mass Difference and Mole Difference Relative to 1994 - Log Scale



Source: TAMS/Gradient Database, Release 3.5

TAMS

Figure 4-8
Determination of the Molecular Weight of the Trichloro and Higher Homologues (ΣTri+) at the Time of Deposition

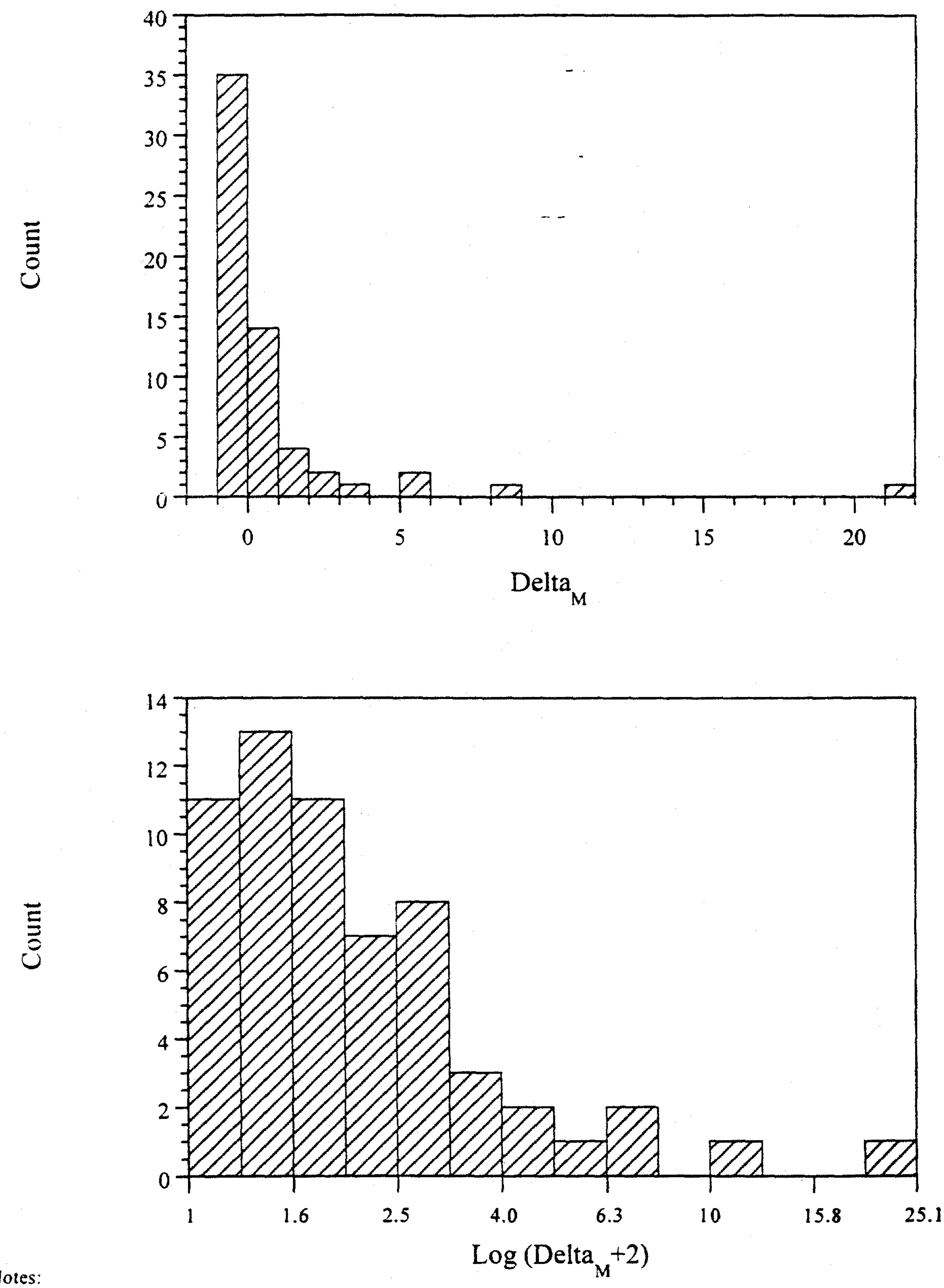
Note:
1. Mole Difference = 1984 Moles $_{Tn+}$ - (1994 Moles $_{Tn+}$ + BZ 1,4,8,10,19)

Source: TAMS/Gradient Database, Release 3.5

TAM

Figure 4-9

Distribution of Mass Difference (g/m^2) and Mole Difference ($mole/m^2$) between 1984 and 1994

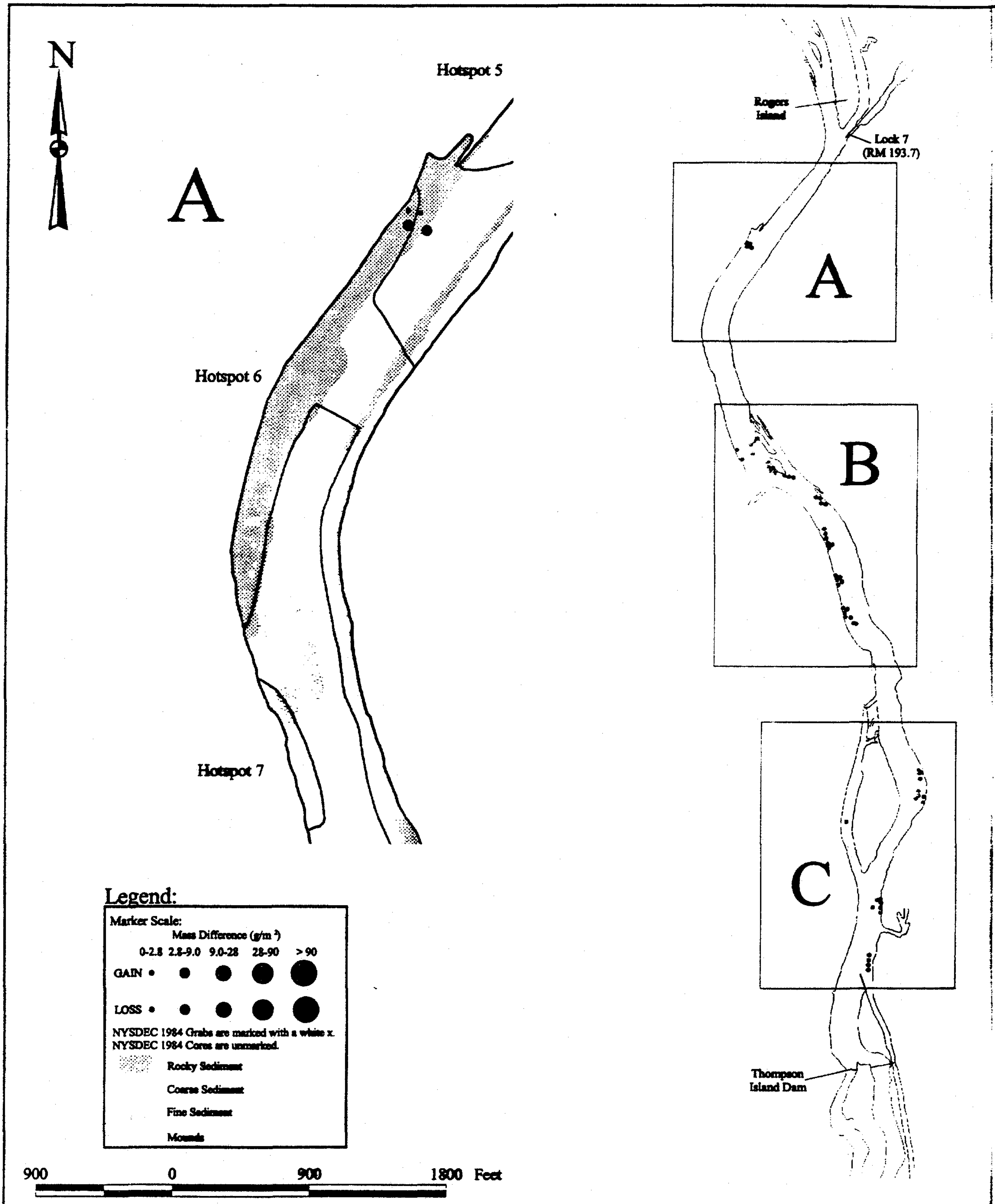


Notes:
1. See text for definition of $Delta_M$
2. The value of 2 is added to $Delta_M$ prior to taking the logarithm of the value in order to translate the distribution away from zero and negative numbers which do not have defined logarithm values.

Source: TAMS/Gradient Database, Release 3.5

TA!

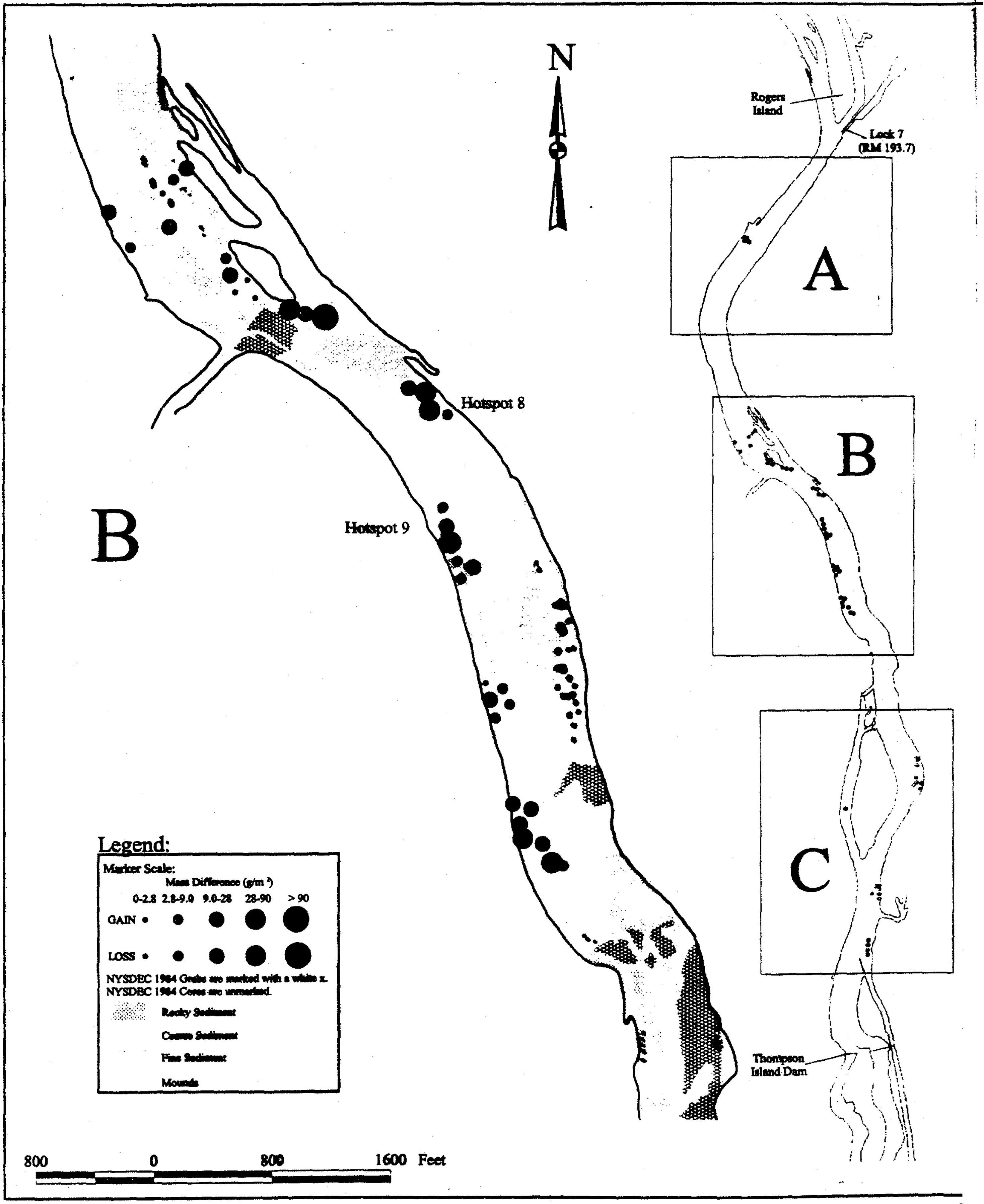
Figure 4-10
Distribution of the Percent Change in PCB Molar Inventory ($Delta_M$)



Hudson River Database Release 3.5

TAMS

1984 to 1994 Change in Sediment Inventory Exclusive of Dechlorination



1984 to 1994 Change in Sediment Inventory Exclusive of Dechlorination

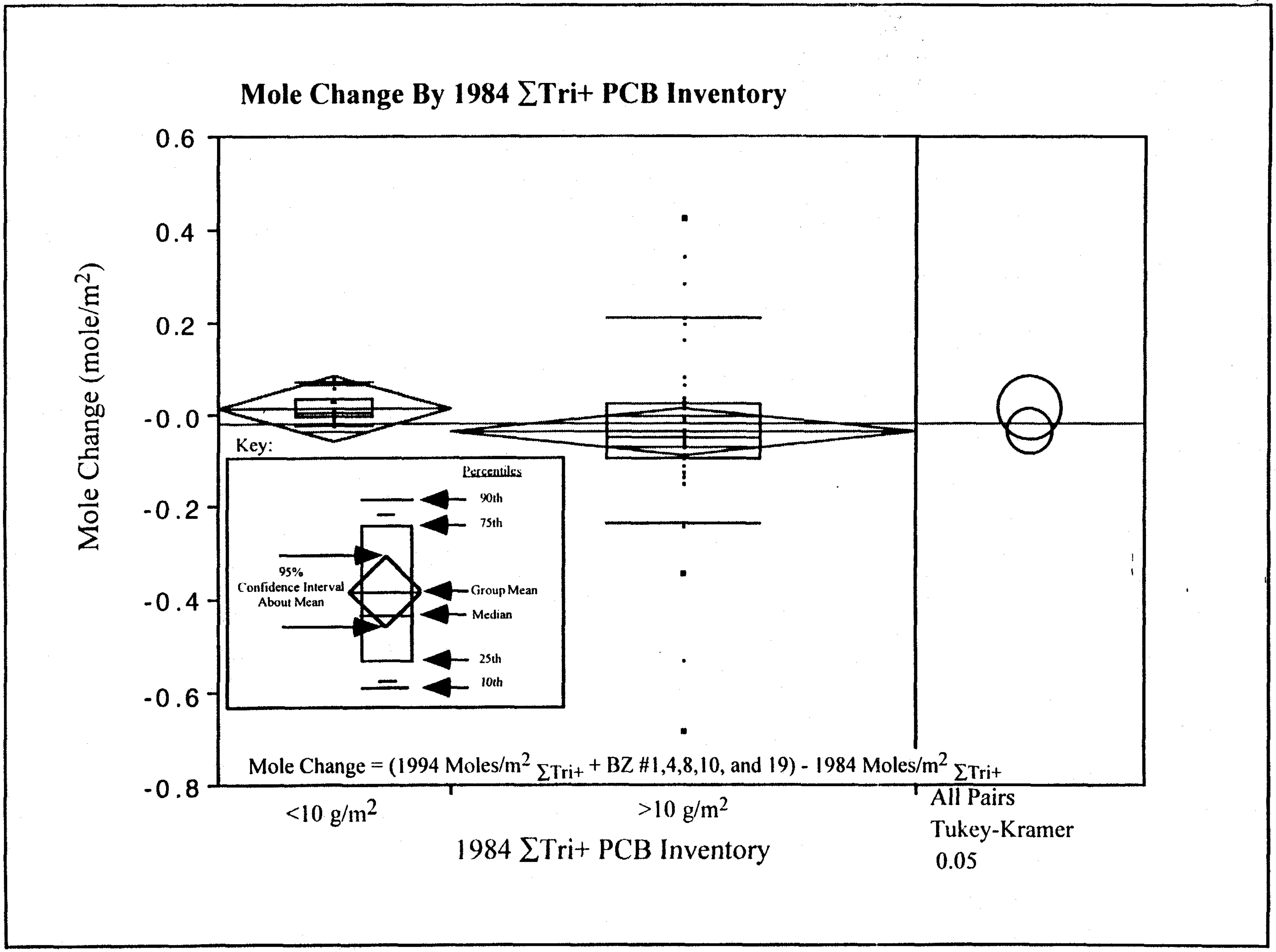


Figure 4-11
Change in (Moles/m^2) by 1984 ∑Tri+ PCB Inventory

10.9975

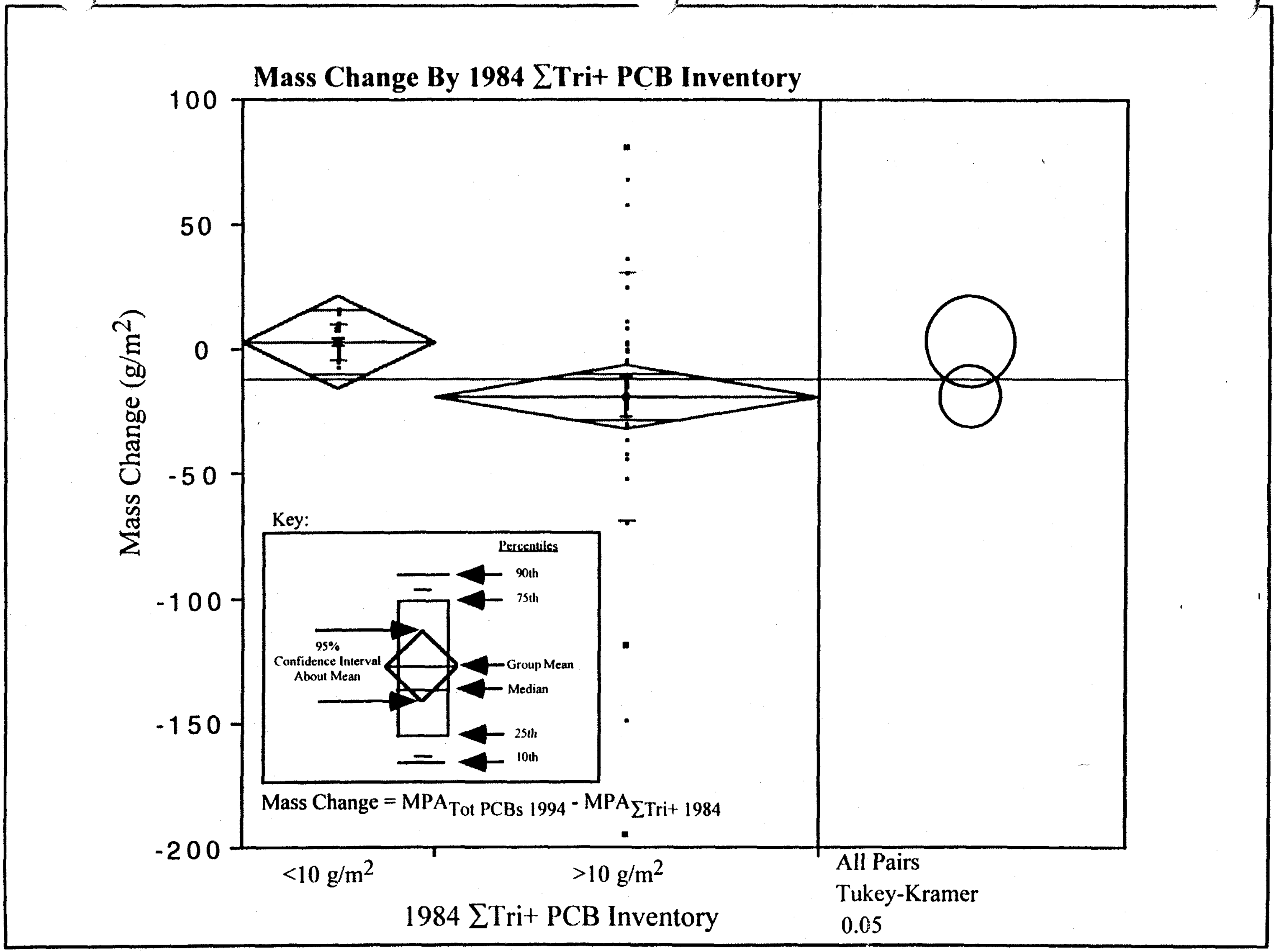
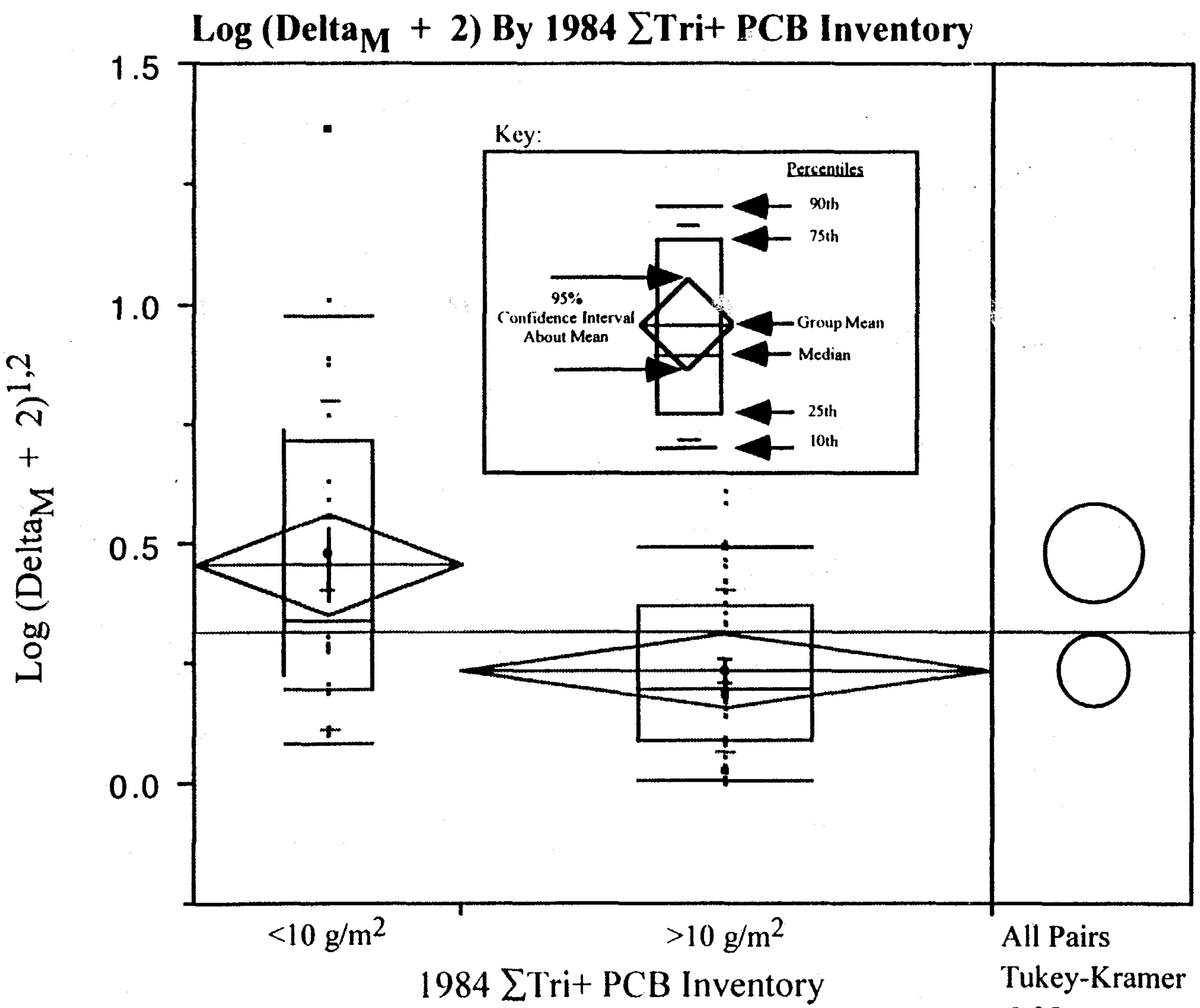


Figure 4-12
Change in Mass per Unit Area (MPA) by 1984 ΣTri+ PCB Inventory

10.9976

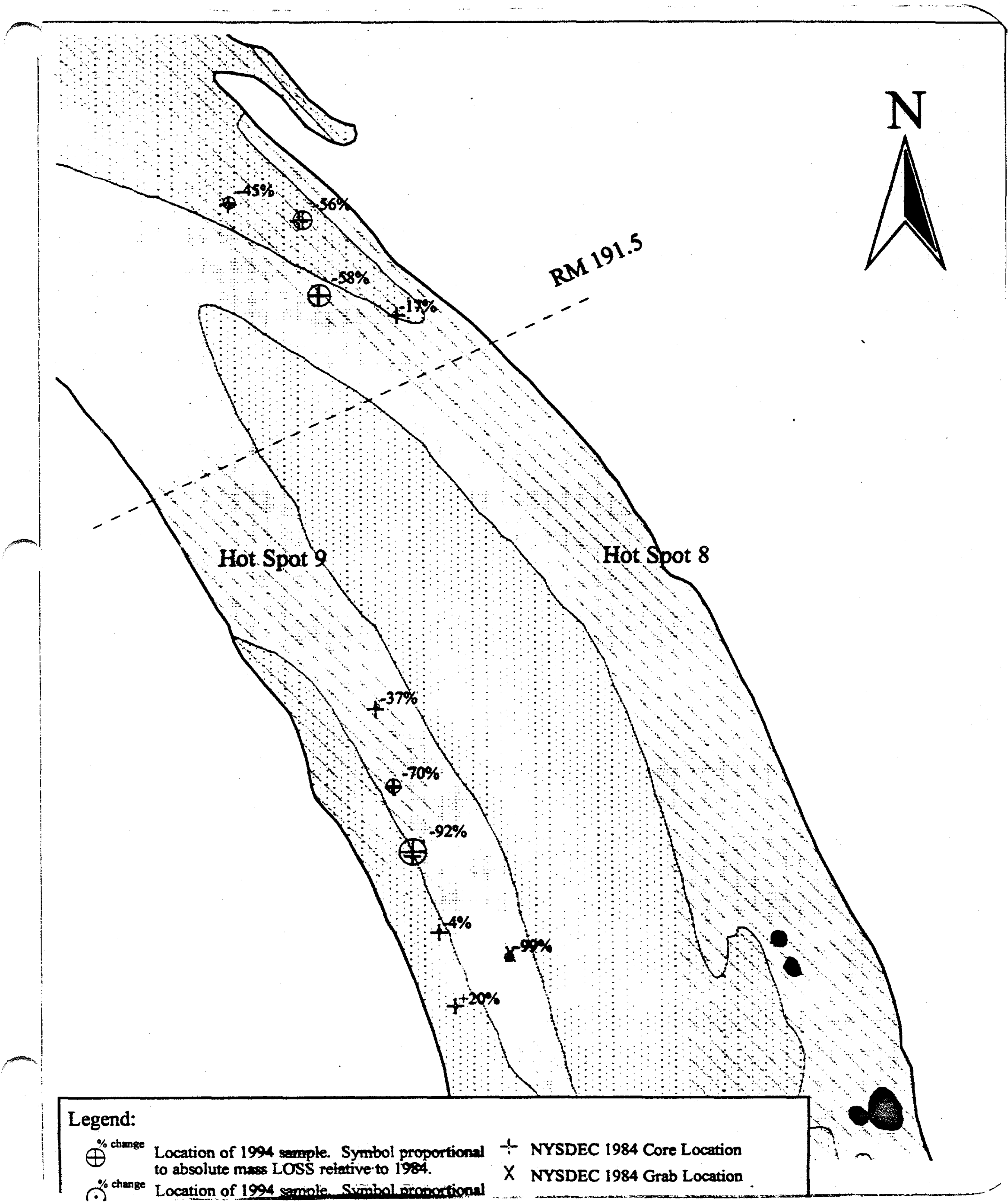


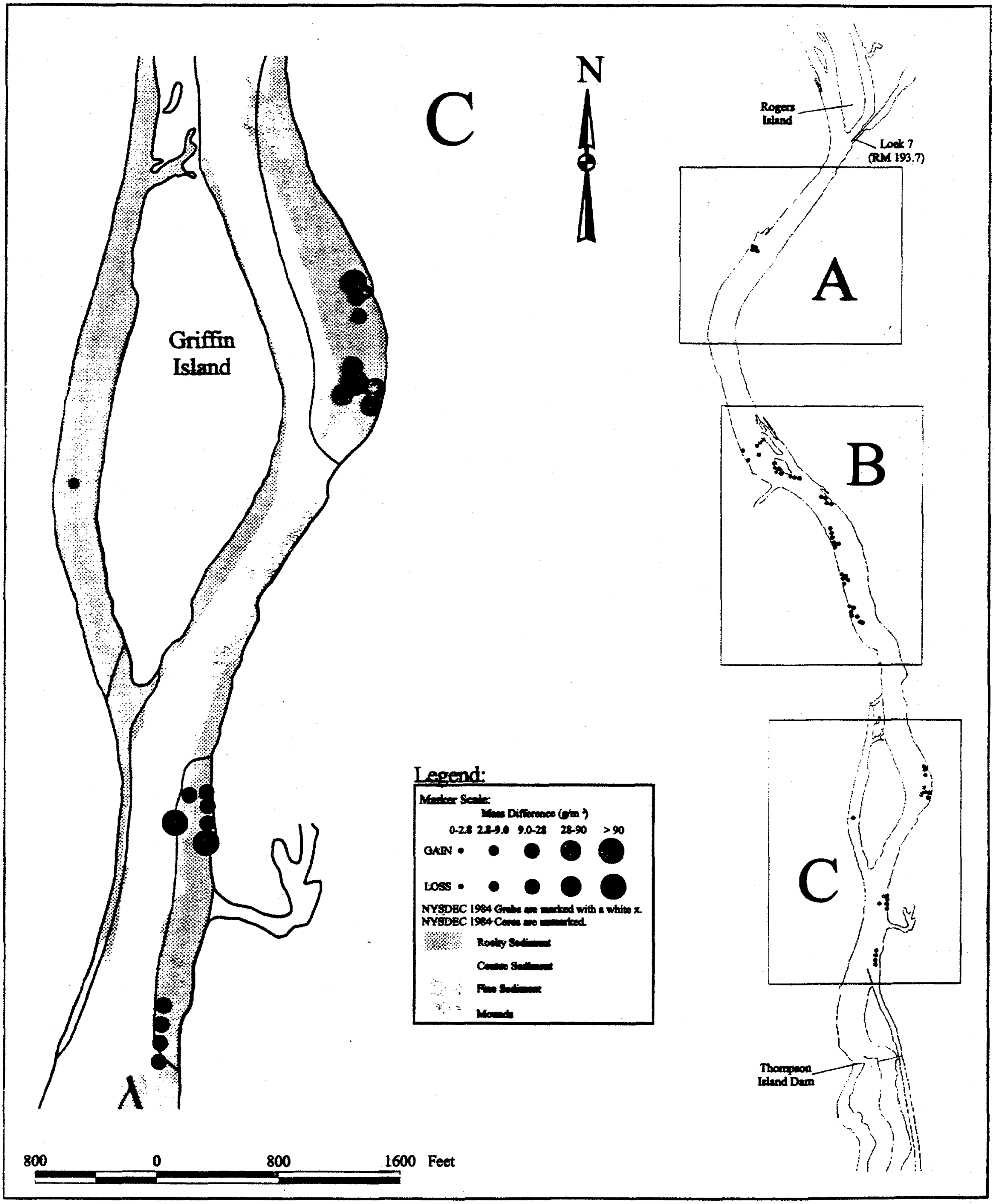
Notes:

1. See text for definition of Delta$_M$.
2. The value 2 is added to Delta$_M$ prior to taking the logarithm of the value in order to translate the distribution away from zero and negative numbers which do not have defined logarithmic values.

Figure 4-13
Percent Change in PCB Molar Inventory (Delta$_M$) by 1984 ΣTri + PCB Inventory

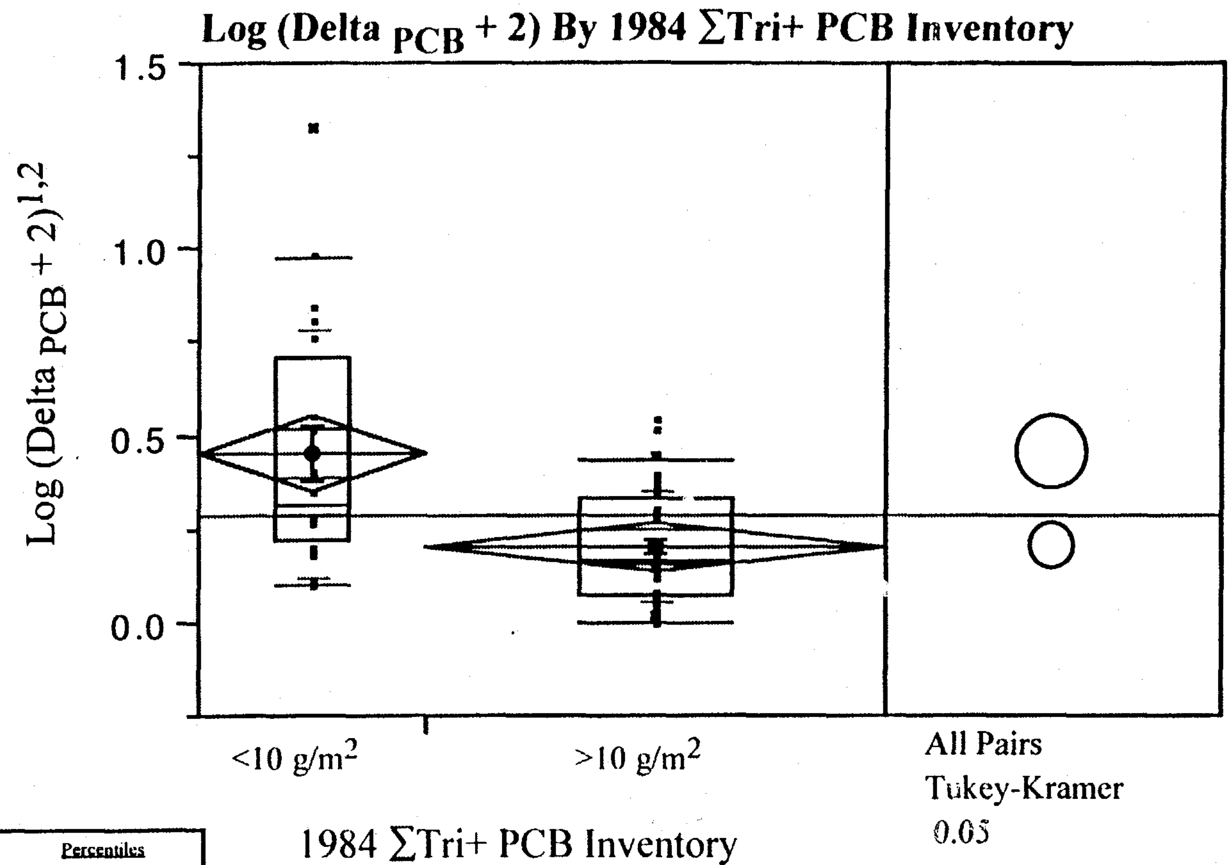
10.9977


N
RM 191.5
-45%
-56%
-58%
-17%
Hot Spot 9
Hot Spot 8
-37%
-70%
-92%
-4%
-99%
+20%
Legend:
% change
Location of 1994 sample. Symbol proportional to absolute mass LOSS relative to 1984.
% change
Location of 1994 sample. Symbol proportional
NYSDEC 1984 Core Location
NYSDEC 1984 Grab Location

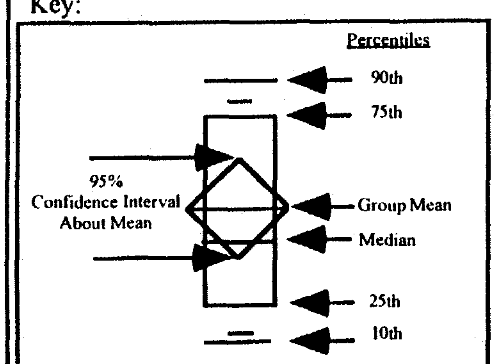


TAMS

1984 to 1994 Change in Sediment Inventory Exclusive of Dechlorination



Key:

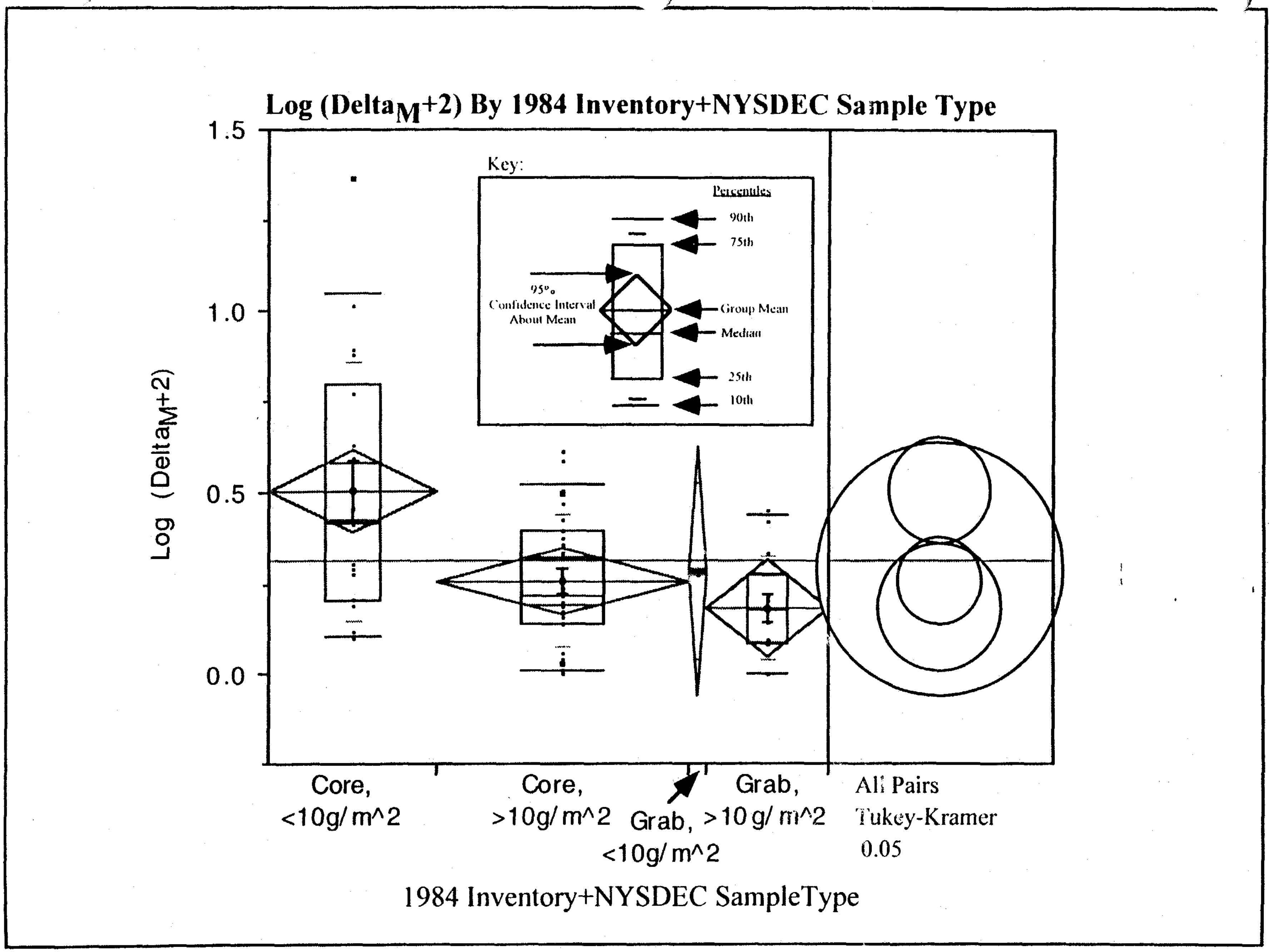


Notes:

1. See text for definition of $Delta_{PCB}$.
2. The value 2 is added to $Delta_{PCB}$ prior to taking the logarithm of the value in order to translate the distribution away from zero and negative numbers which do not have defined logarithmic values.

Figure 4-14
Percent Mass Change ($Delta_{PCB}$) by 1984 ΣTri+ PCB Inventory

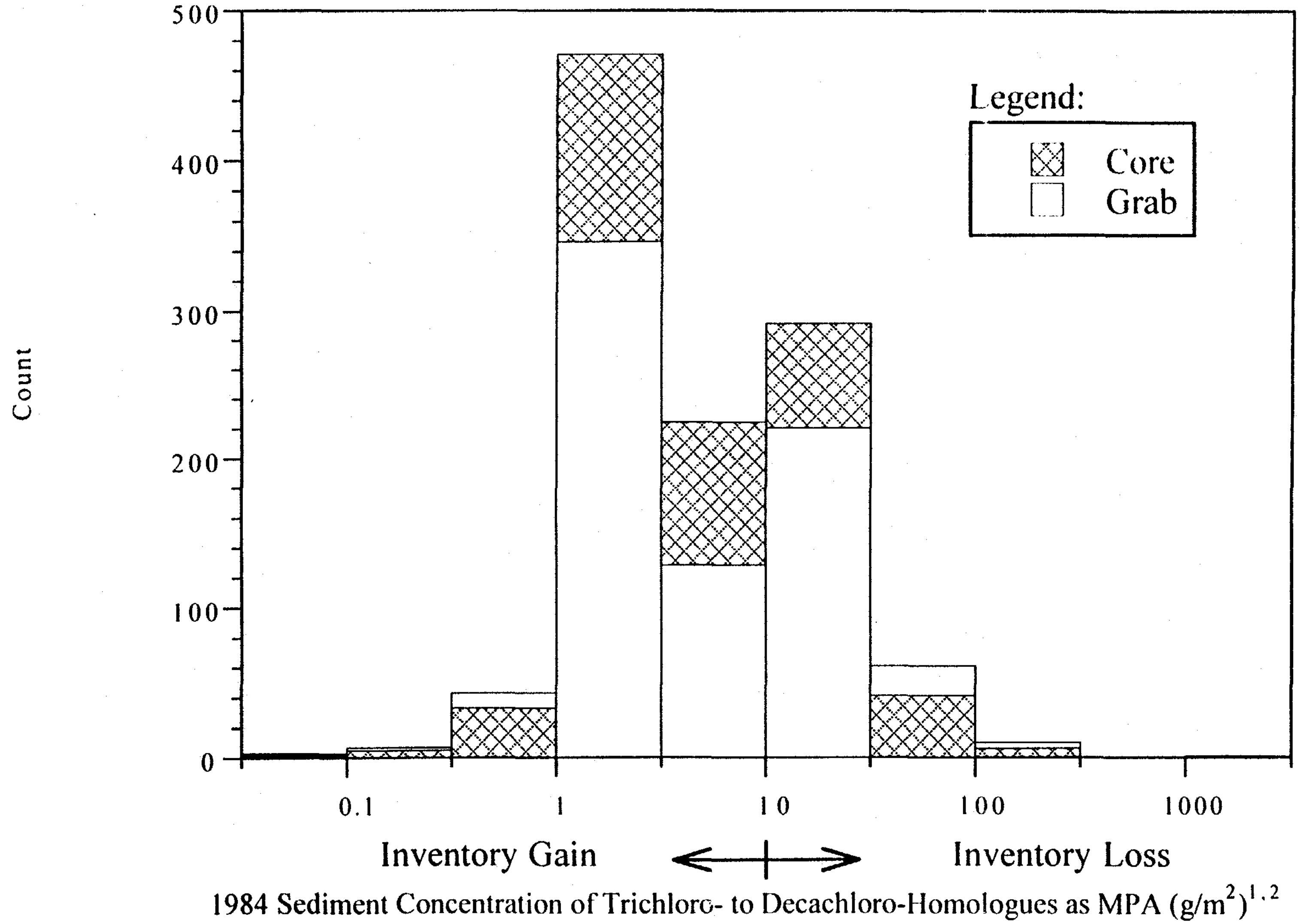
10.9980



10.9981

Figure 4-15

Statistical Analysis of Delta$_M$ as a Function of 1984 Sediment ΣTri+ Inventory and NYSDEC Sample Type



Notes:
1. Based on Brown, et al 1988.
2. Original 1984 PCB concentrations were converted to the sum of trichloro- to decachloro homologues by multiplying by a factor of 0.934. See text for discussion.

Source: TAMS/Gradient Database, Release 3.5

TAMS

10.9982

Figure 4-16
Implications of the Inventory Change Analysis for the 1984 TI Pool Inventory

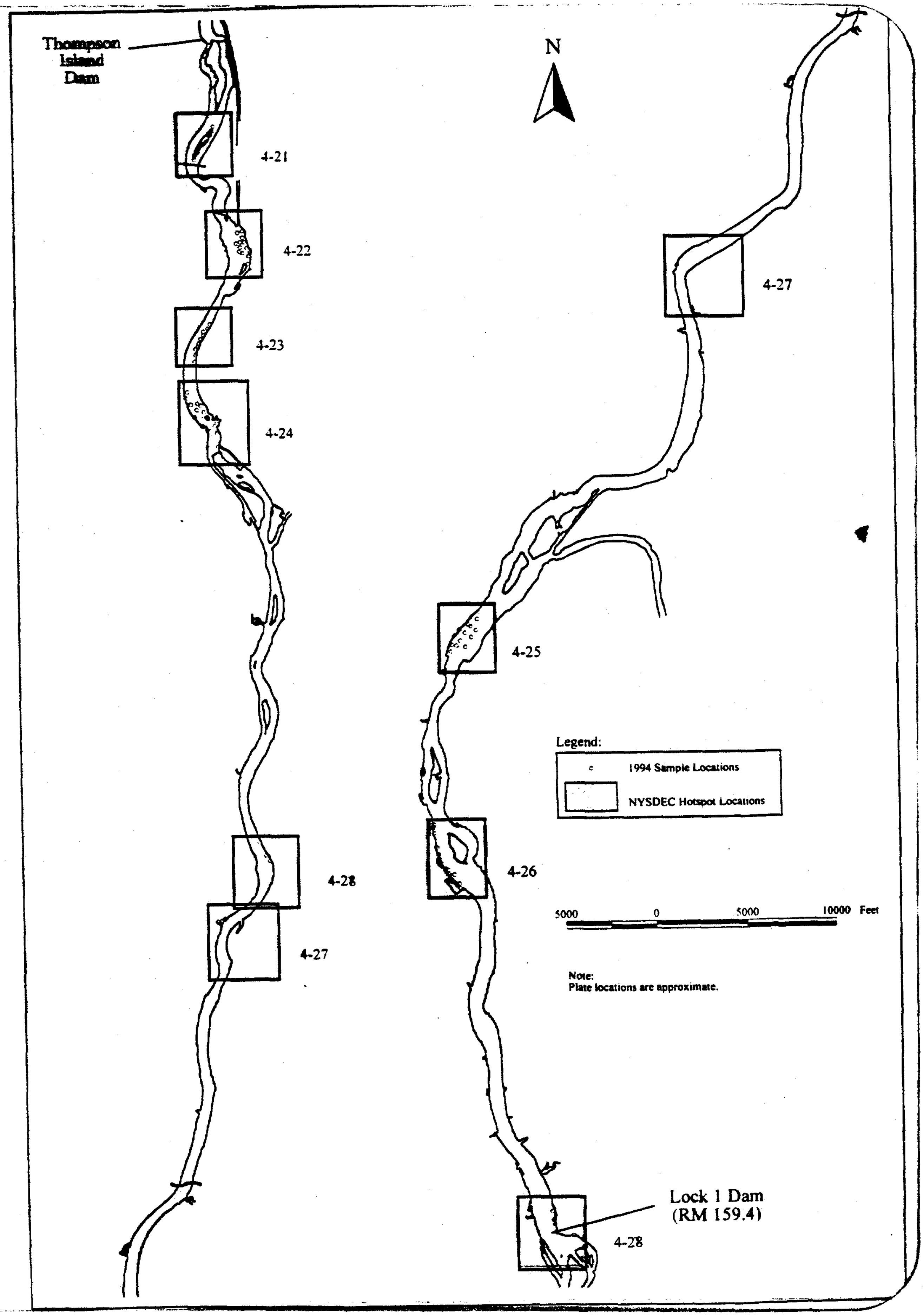
Inventory Below TI Dam

- Comparison of sediment characterizations
- Comparison of mean 1976-78 and 1994 sediment inventories based on total PCBs, revised density (SSW)
- Examination of both LWA and MPA estimates on a *hot spot* area basis
- Examination of the fractional change in PCB inventory on a mass basis for entire *hot spot* area

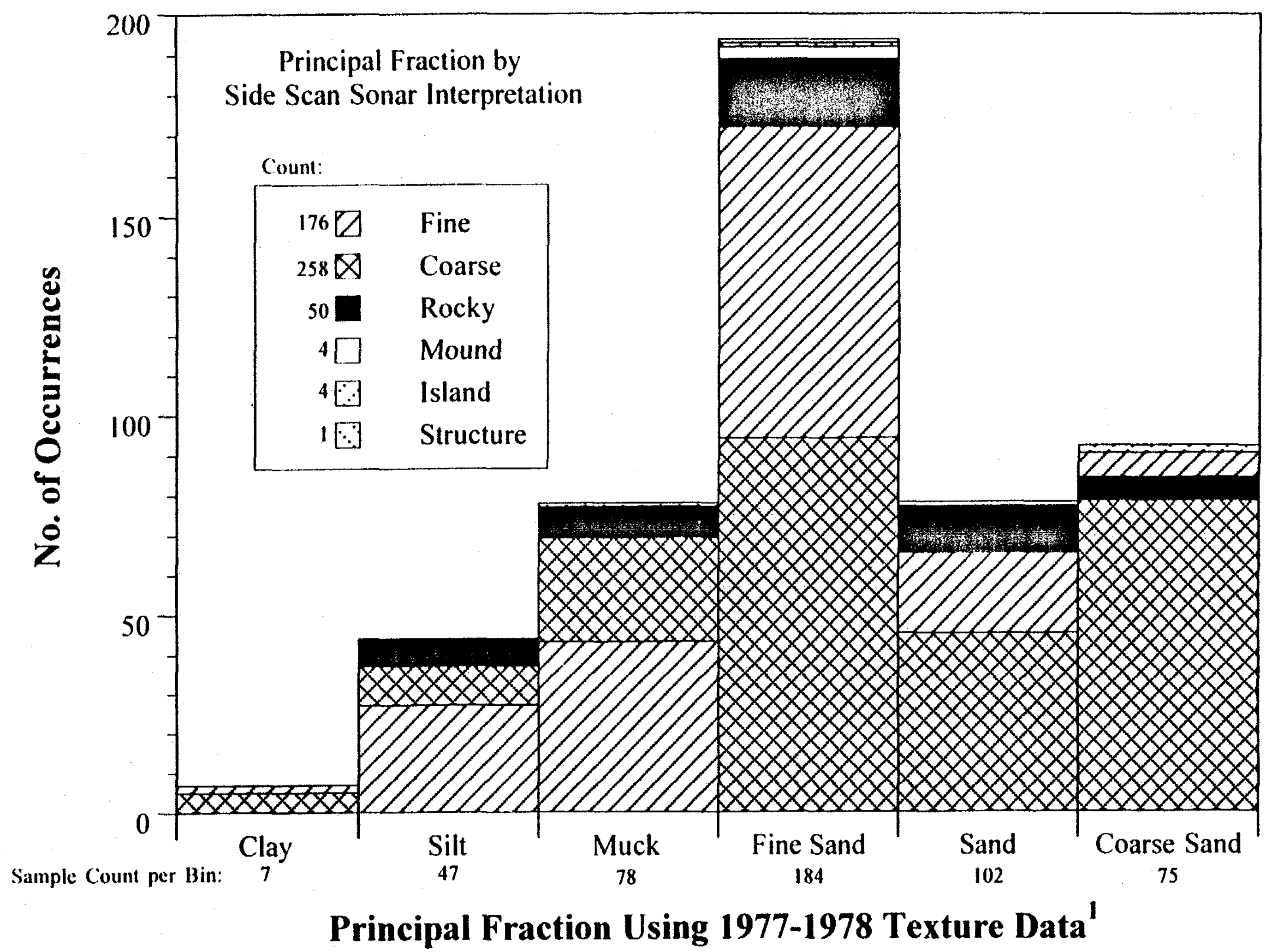
$$\Delta_i = \frac{\text{1994 Inventory - 1976-78 Inventory}}{\text{1976-78 Inventory}}$$

TAMS

10.9983


Thompson Island Dam
N
4-21
4-22
4-23
4-24
4-28
4-27
4-27
4-25
Legend:
1994 Sample Locations
NYSDEC Hotspot Locations
4-26
5000 0 5000 10000 Feet
Note:
Plate locations are approximate.
Lock 1 Dam (RM 159.4)
4-28

10.9984



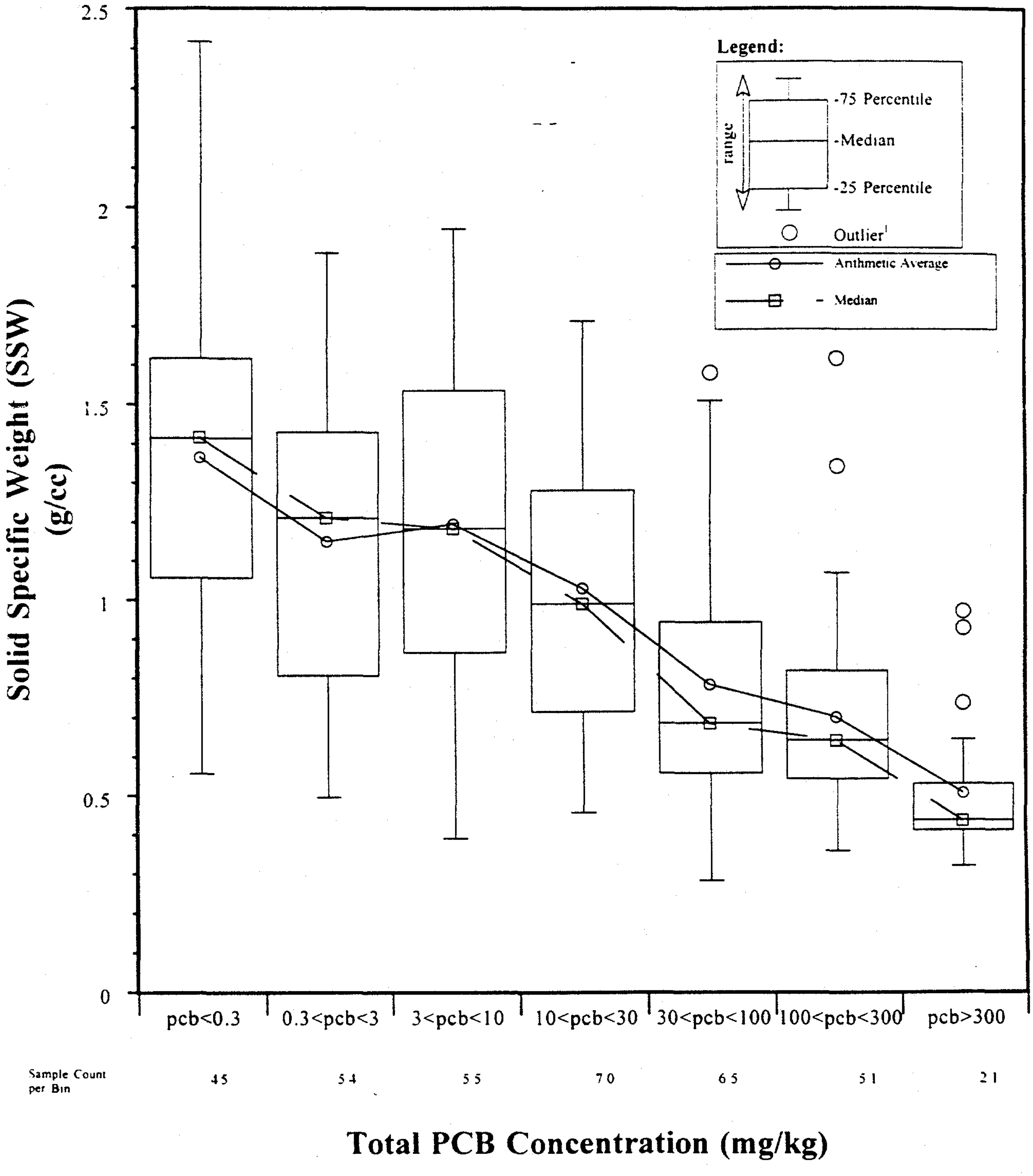
Notes: 1) 1977-1978 data represents all NYSDEC sampling points between the TI Dam and Lock 5. Sediment texture data were obtained from NYSDEC (NYSDEC, 1990) and Normandeau (1977).

Source: TAMS/Gradient Database, Release 3.5

TAMS

Figure 4-18
Comparison of 1977-1978 Sediment Classifications and Interpretation of the Side-Scan Sonar Images

10.9985

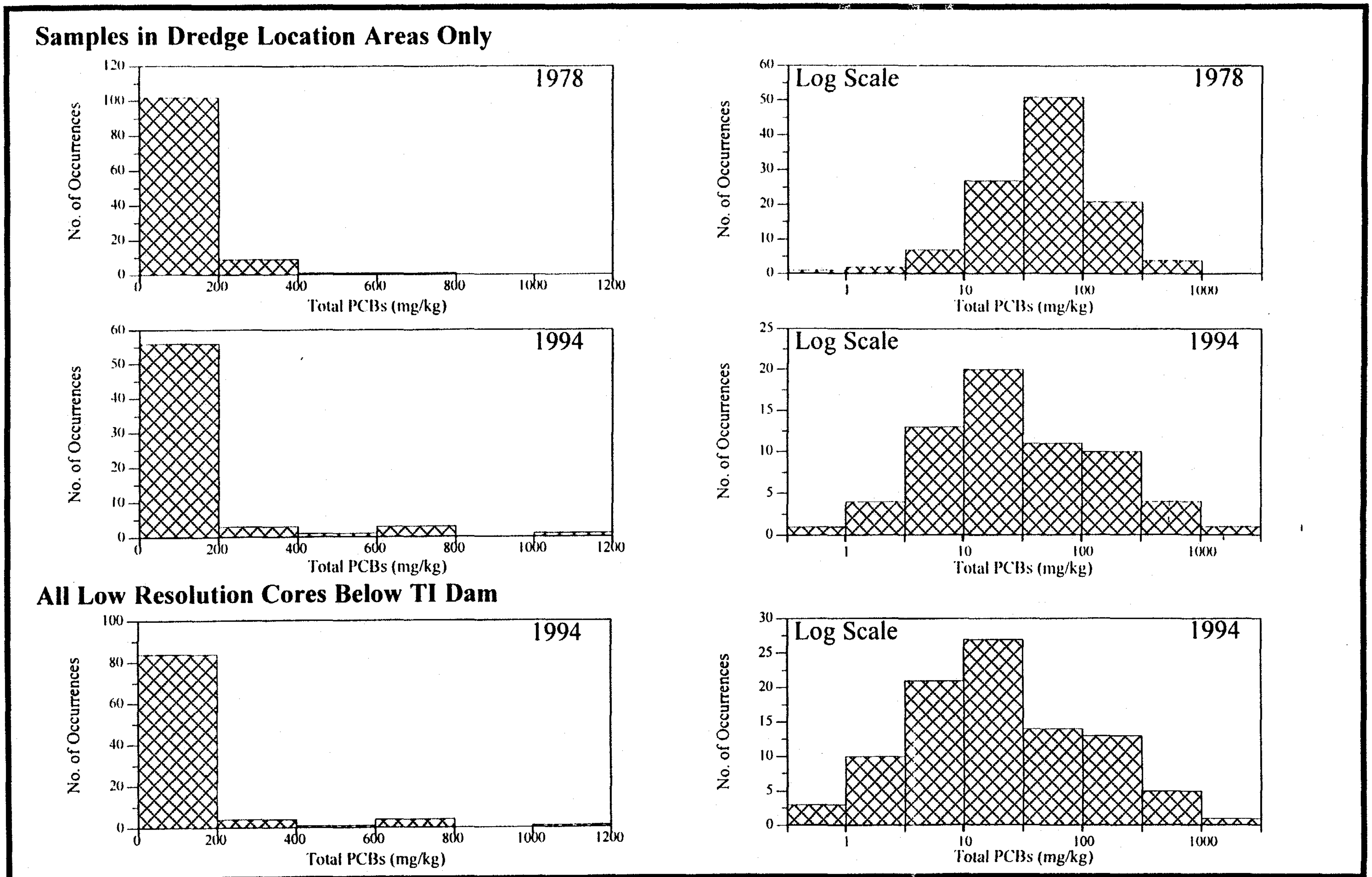


Note 1) See text for discussion

Source: TAMS/Gradient Database, Release 3.5

TAMS

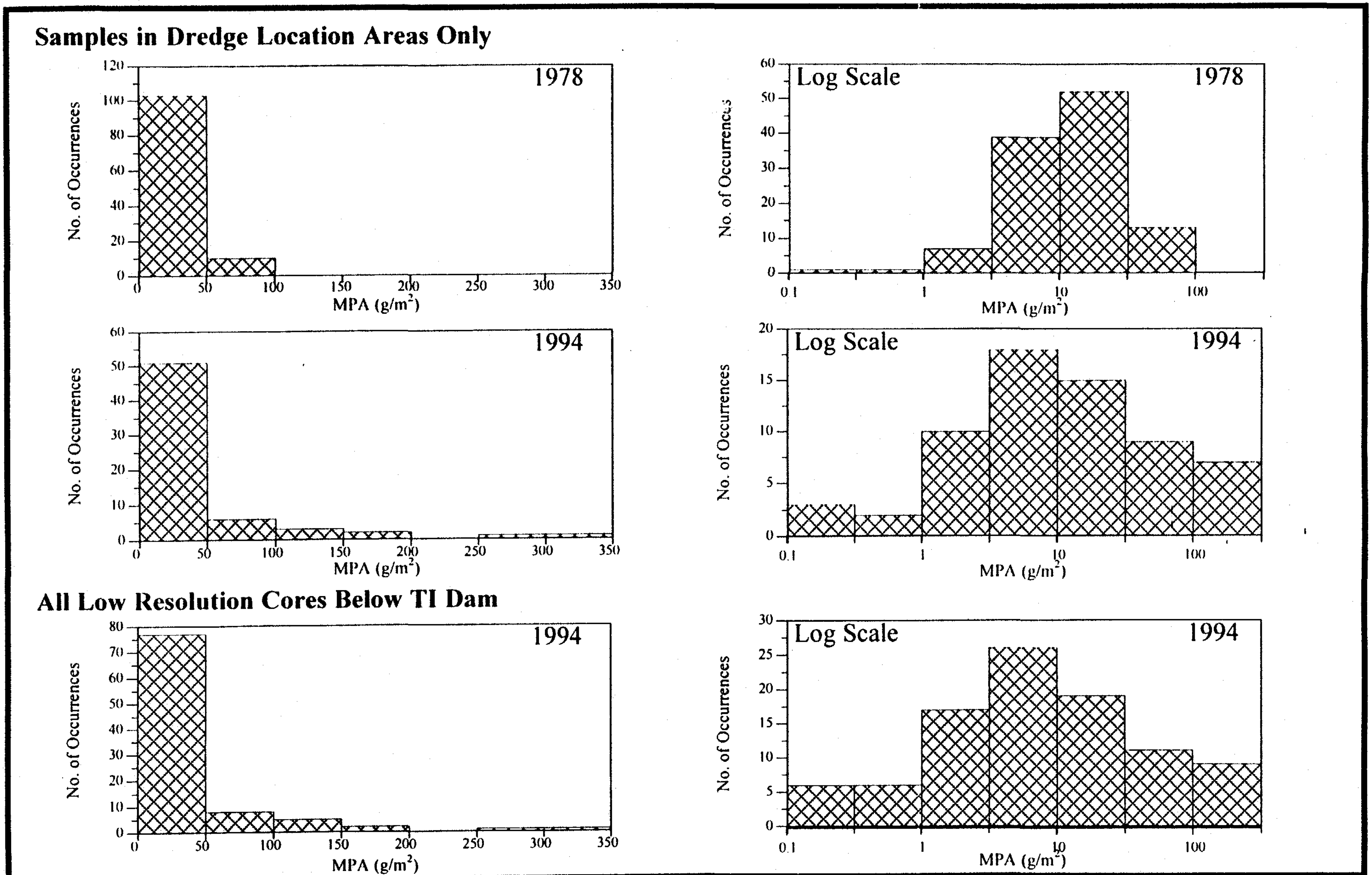
Figure 4-17
Relationship Between Total PCB Concentration and Solid Specific Weight for Low Resolution Core Samples



Source: TAMS/Gradient Database, Release 3.5

TAMS

Figure 4-19
Distribution of Length-Weighted Core Averages in 1976-1978 NYSDEC Survey and Low Resolution Sediment Core Samples

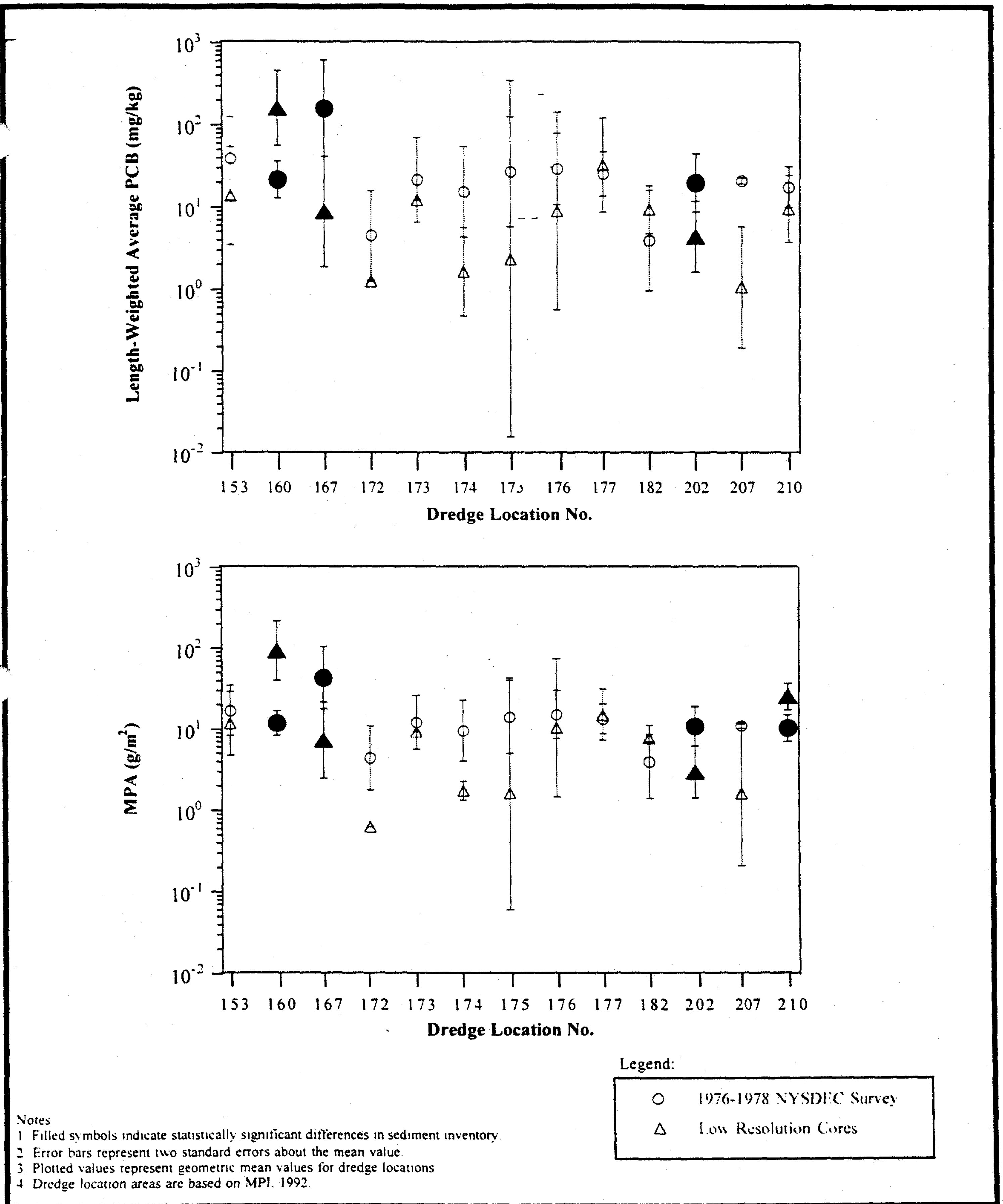


Source: TAMS/Gradient Database, Release 3.5

TAMS

Figure 4-20
Distribution of MPA in 1976-1978 NYSDEC Survey and Low Resolution Sediment Core Samples

10.9988

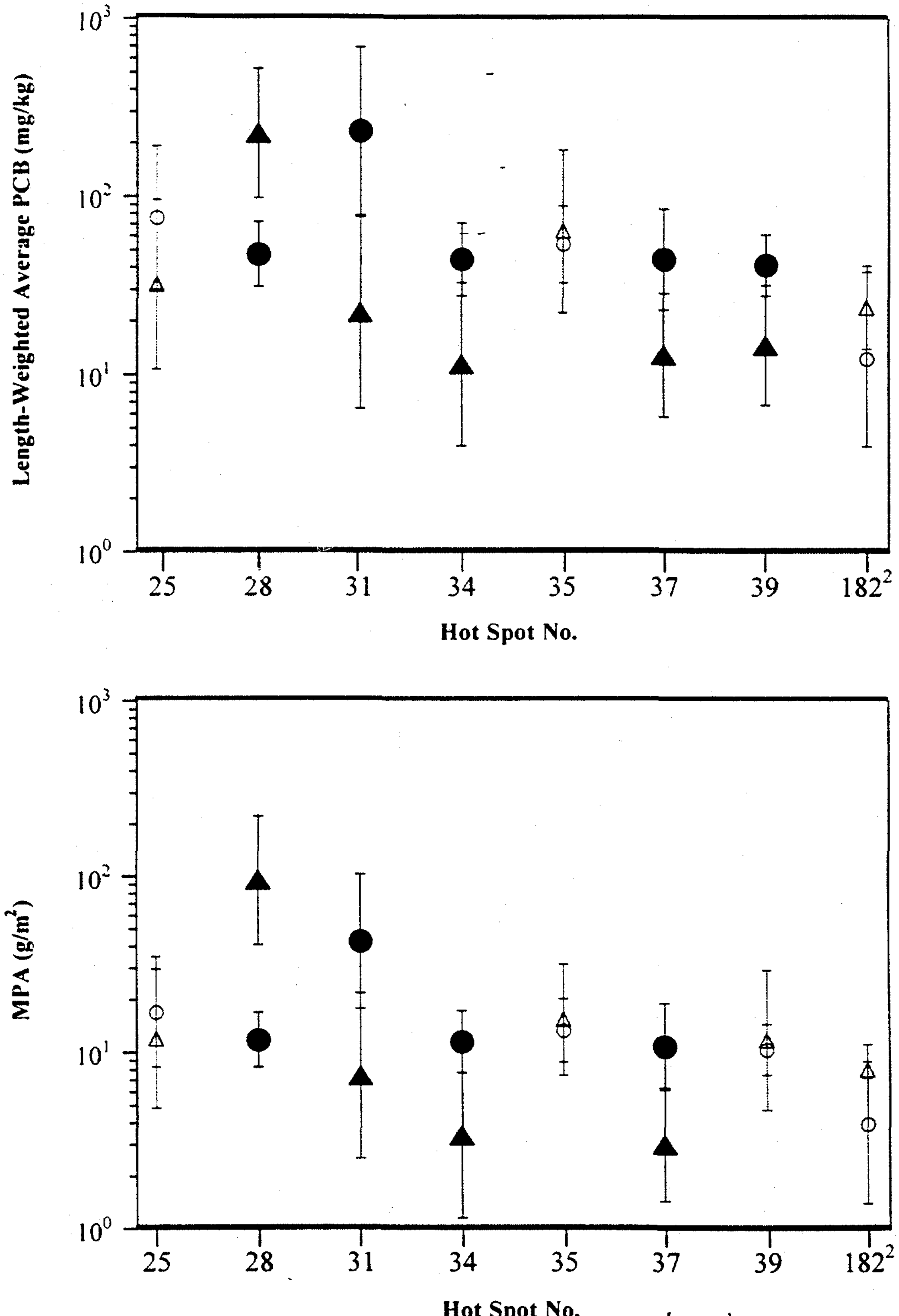


Source: TAMS/Gradient Database, Release 3.5

TAMS

Figure 4-21
Comparison of Geometric Mean PCB MPA and Length-Weighted Core Averages from the 1976-1978 NYSDEC and Low Resolution Core Surveys in Dredge Locations

10.9989



Notes:

1. Filled symbols indicate statistically significant differences in sediment inventory.
2. No hot spot number was designated for this area. The number given is the dredge location number designated by. MPI. 1992
3. Error bars represent two standard errors about the mean value.
4. Plotted values represent geometric mean mass per unit area for hot spots.
5. Hot spot areas are based on MPI. 1992

Legend:

○ 1976-1978 NYSDEC Survey

Δ Low Resolution Cores

Source: TAMS/Gradient Database. Release 3.5

TAMS

Figure 4-22

Comparison of Geometric Mean PCB MPA and Length-Weighted Core Averages from the 1976-1978 NYSDEC and Low Resolution Core Surveys in Hot Spots

Summary

- Low resolution core results confirmed findings of DEIR, based on a spatially more extensive data set.

- Dechlorination levels were found to be consistent with high resolution core results although the degree of dechlorination was higher per unit of total PCB concentration

- Side-scan sonar image results correlated with 1994 sediment PCB levels, supporting to the 1984 correlation

- Ancillary sediment characteristics also correlated with total PCBs but no strong, predictive relationships were evident.

Summary (cont'd)

- TI Pool *hot spot* inventories of PCBs have declined, with areas > 10 g/m^2 exhibiting an average loss of 39% (with 28% attributed to re-release, 11% dechlorination based on molar balance).

- Inventories below TI Dam show both loss and gain, with loss of 50 to 80% of original *hot spot* inventory in three areas.

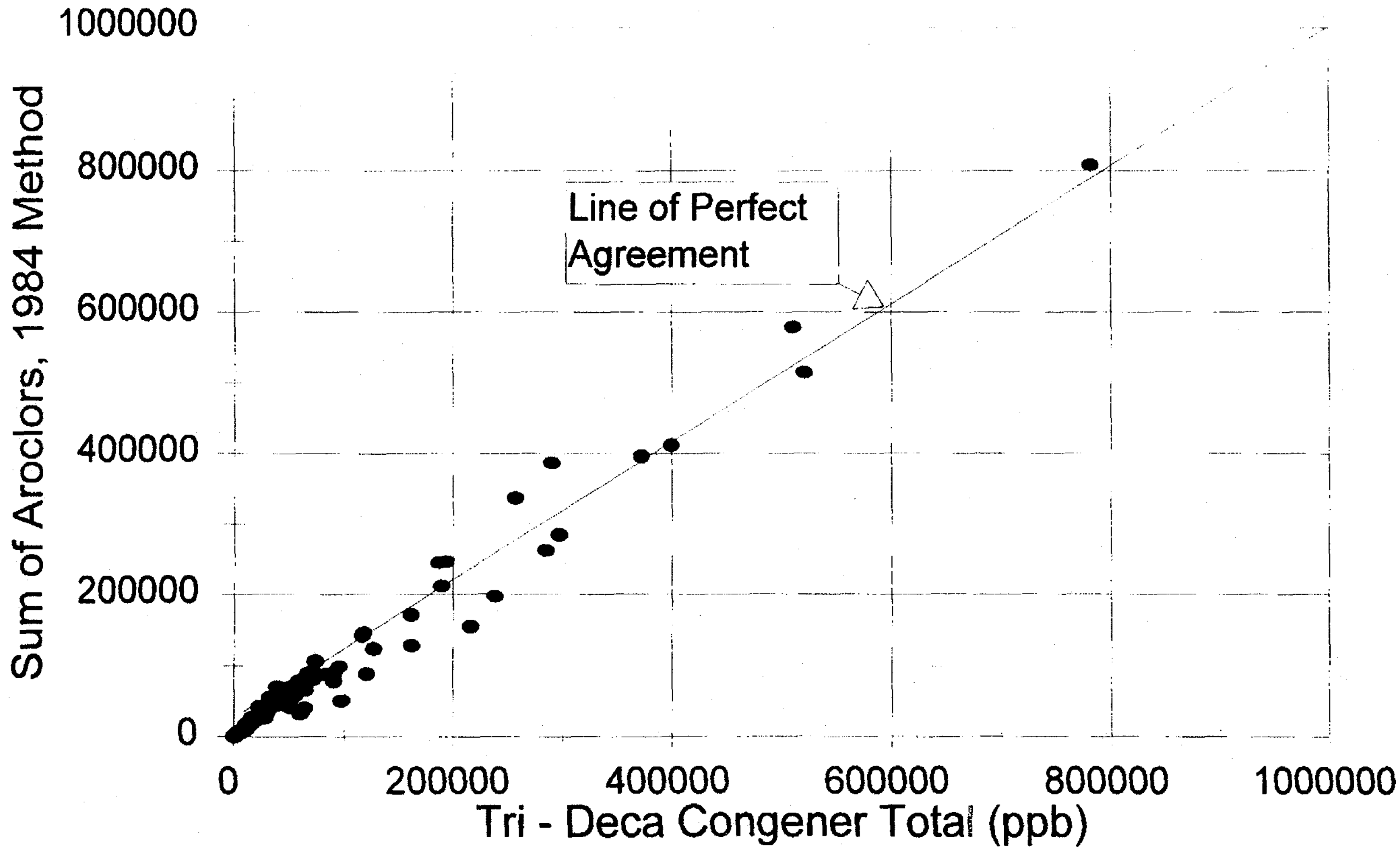
- Inventory gains are attributed to poor 1976-1978 survey results which underestimated hot spots 28 & 39. The current inventories for these *hot spots* combined is 24 metric tons.

- Evidence for burial of contaminated sediment was not apparent in all but one *hot spot.*

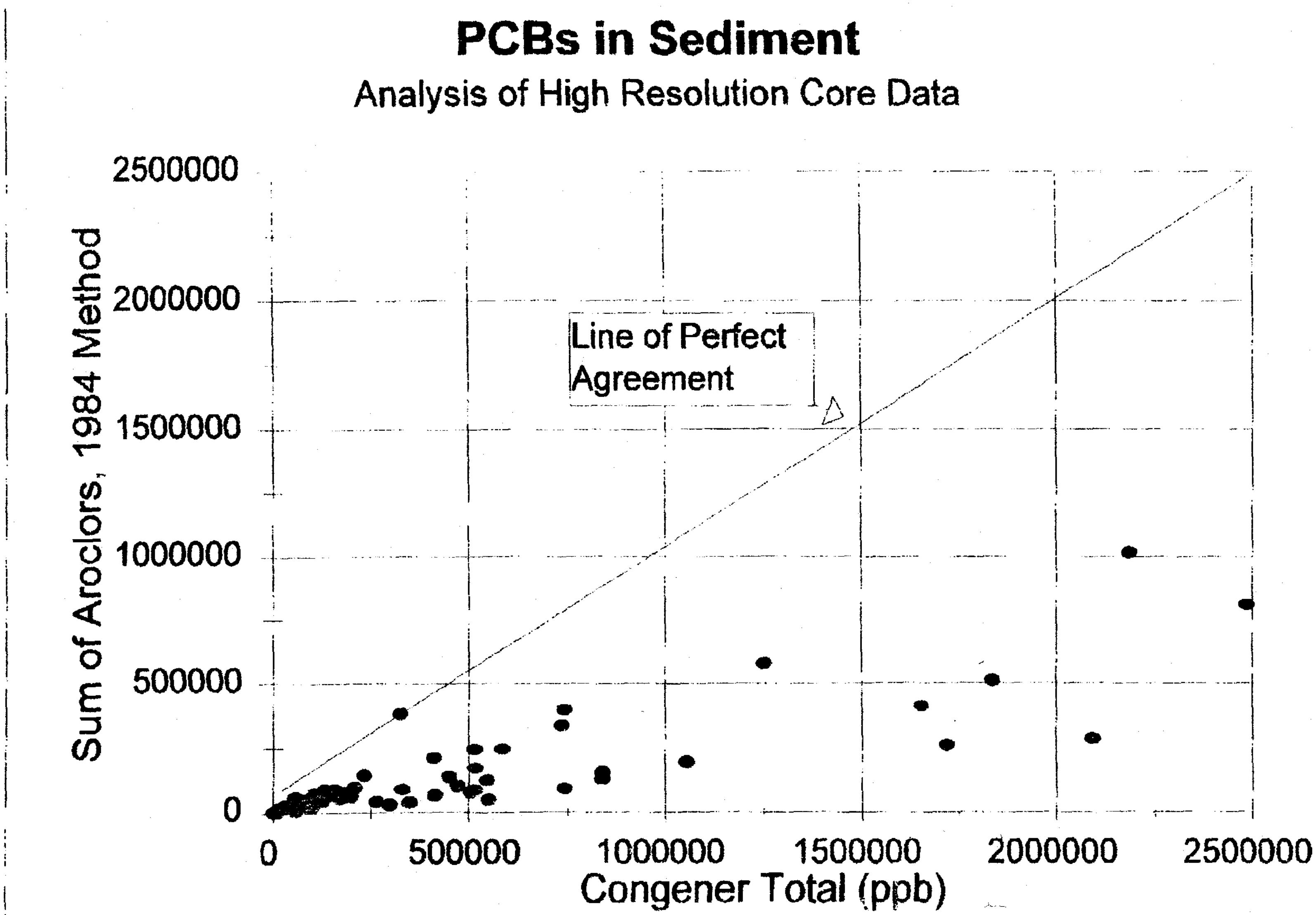
TAMS

PCBs in Sediment

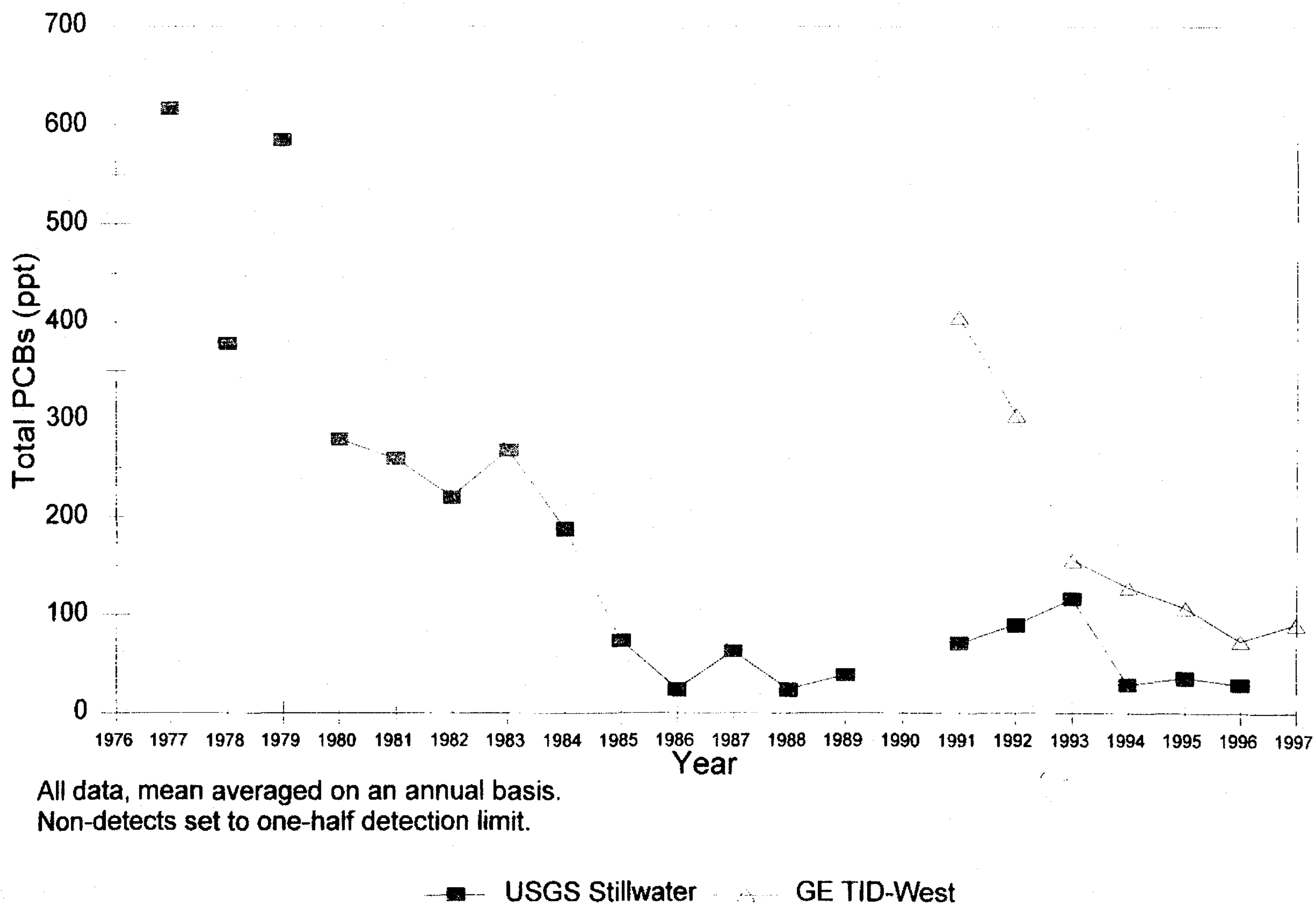
Analysis of High Resolution Core Data



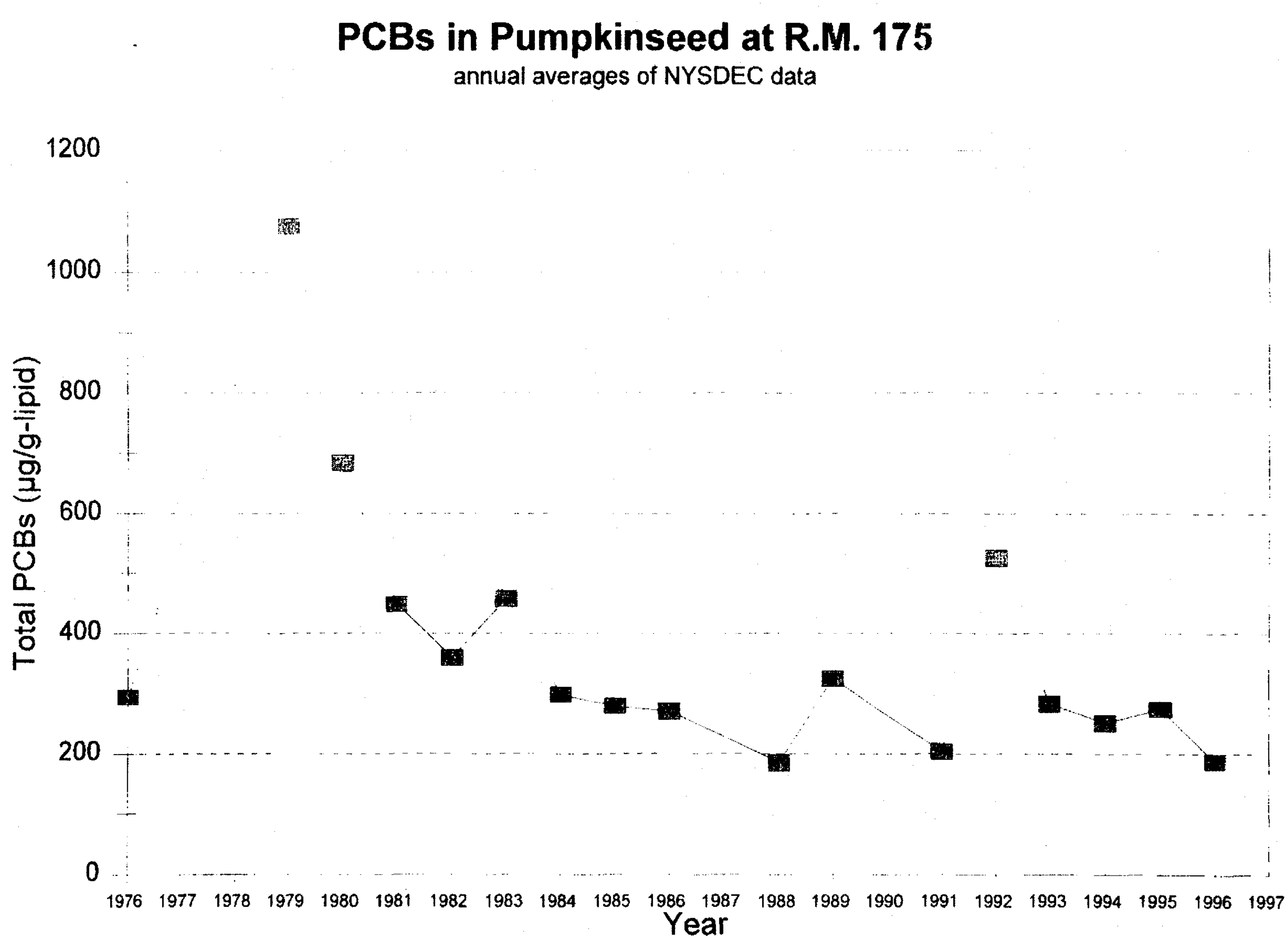
10.9993


PCBs in Sediment
Analysis of High Resolution Core Data
Sum of Aroclors, 1984 Method
Congener Total (ppb)
Line of Perfect Agreement
0
500000
1000000
1500000
2000000
2500000

Trends in PCB Concentration



All data, mean averaged on an annual basis.
Non-detects set to one-half detection limit.

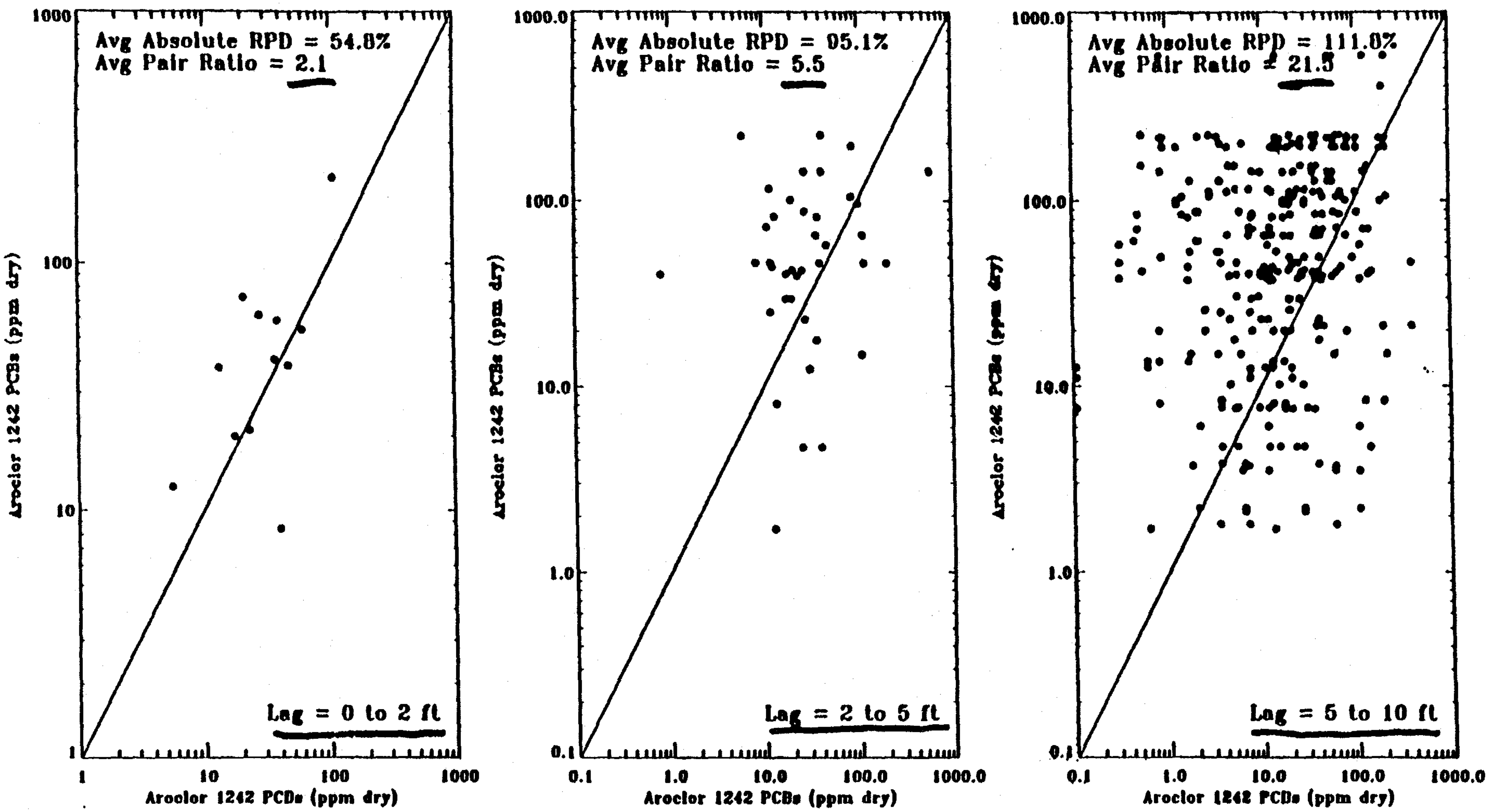

PCBs in Pumpkinseed at R.M. 175
annual averages of NYSDEC data
Total PCBs (µg/g-lipid)
1200
1000
800
600
400
200
0
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
Year

ATTACHMENT D

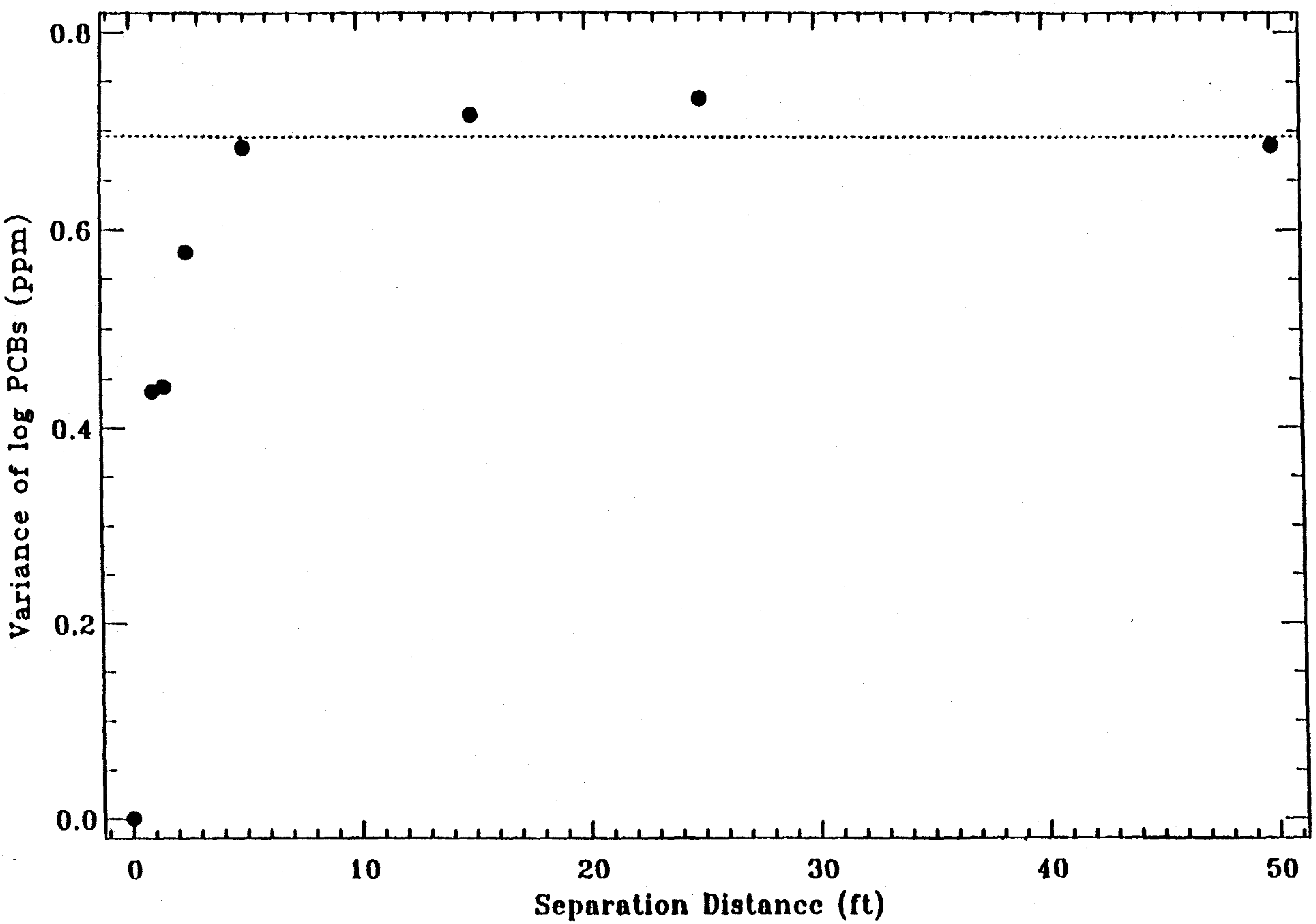
Spatial Heterogeneity of Surface Sediment PCBs

- **Detailed Analysis of H7 Area**
  - High density of samples (Harza, 1990 and OBG, 1991)
  - Compare Aroclor 1242 data for 0-8" average
  - Log PCBs correlated only within 5 ft in H7 area

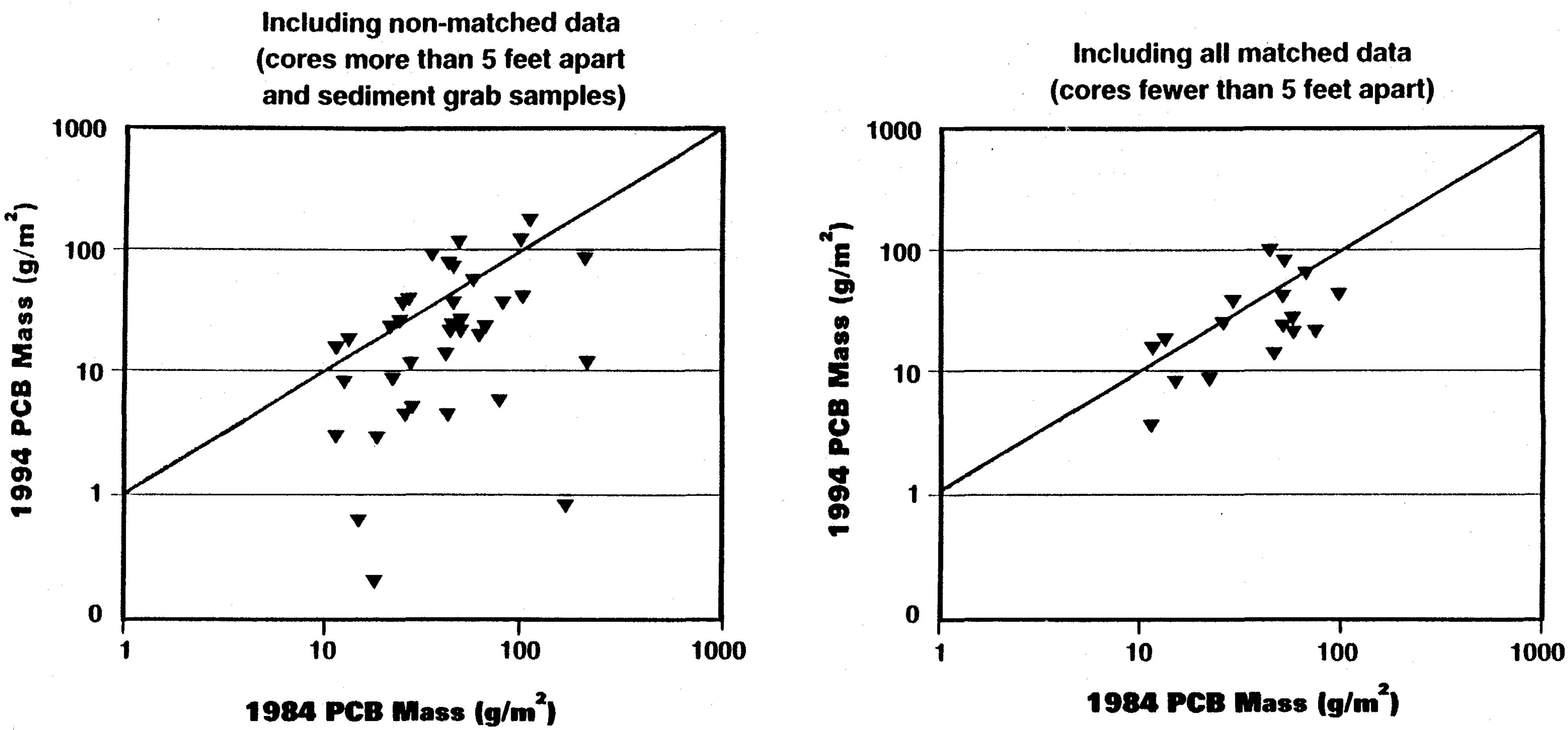
Upper 6-8 inches



10.9999


0.8
0.6
0.4
0.2
0.0
Variance of log PCBs (ppm)
0
10
20
30
40
50
Separation Distance (ft)

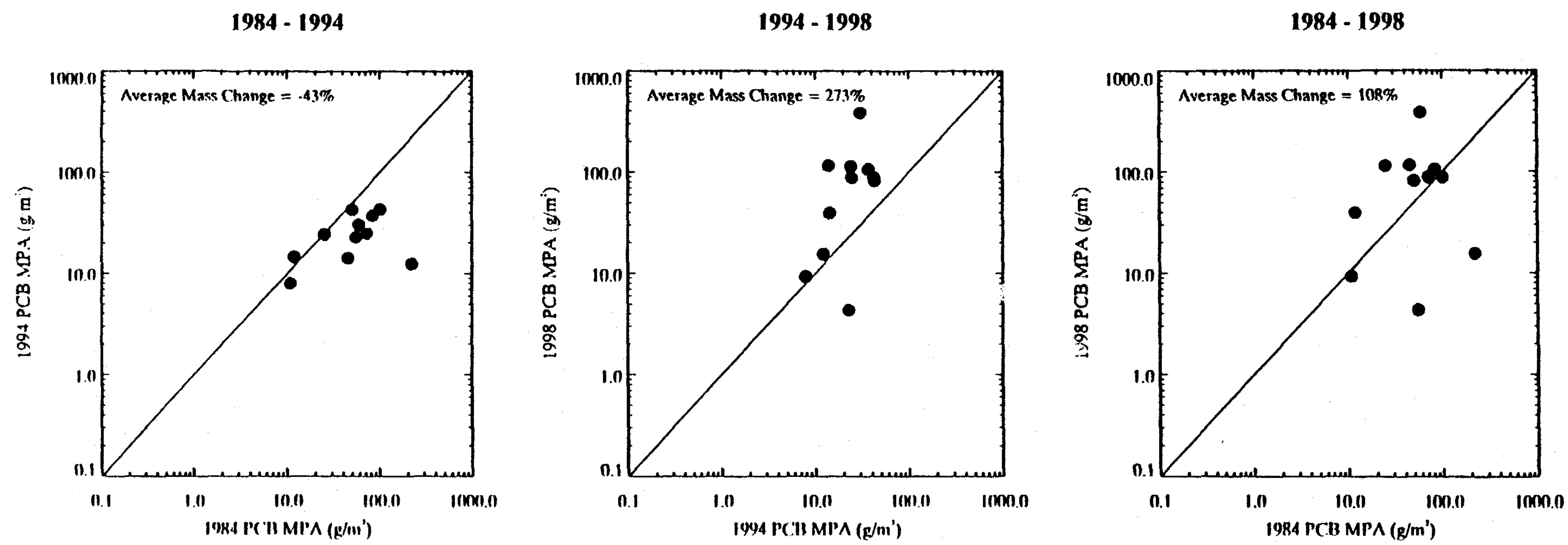
EFFECT OF INCLUDING NON-MATCHED DATA ON 1984-1994 PCB MASS COMPARISONS



10.10001

Collection of 1998 Sediment Cores

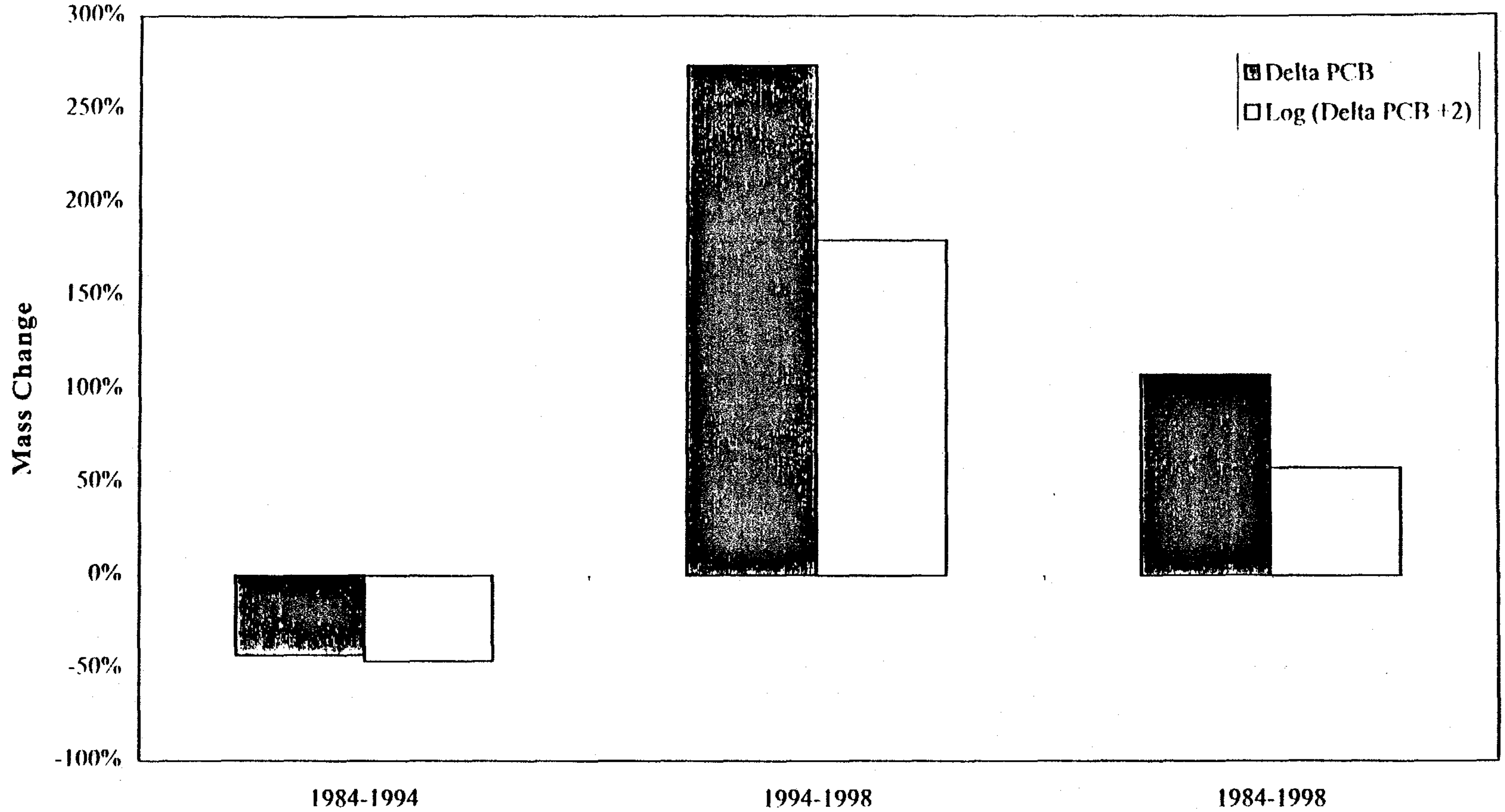
- **Objective**
  - Provide information to assess changes in core profiles observed between 1984 and 1994 using sampling and analytical methods comparable to 1994
- **Coring Locations**
  - "Hot Spot" 8, 9, 14, 16 within TIP
  - 16 coring locations sampled in both 1984 and 1994 (12 complete)
  - vibra-coring methodology
- **Segmentation**
  - 1 cm segments within 0-5 cm of core
  - 5 - 23 cm to correspond to EPA's 0-9 inch segment
  - Every 23 cm the full length of core
- **Core Segment Analysis**
  - Capillary column PCBs
  - Bulk density, moisture content, TOC
  - ^{137}Cs and ^{7}Be within surficial 1 cm segments



General Electric Company - Hudson River Project

Calculated PCB Mass Per Unit Area for Colocated 1984, 1994, and 1998 Sediment Cores in Thompson Island Pool

Note: Data Represent Cores With Separation Distances Less Than 5 ft



GENERAL ELECTRIC COMPANY - Hudson River Project

Changes in TIP Sediment Mass Estimated from Differences in Calculated MPA for Colocated Sediment Cores Collected in 1984, 1994, and 1998

KTR - coremass.xls - Total MPA PLOT
8/17/98 - 9:52 AM

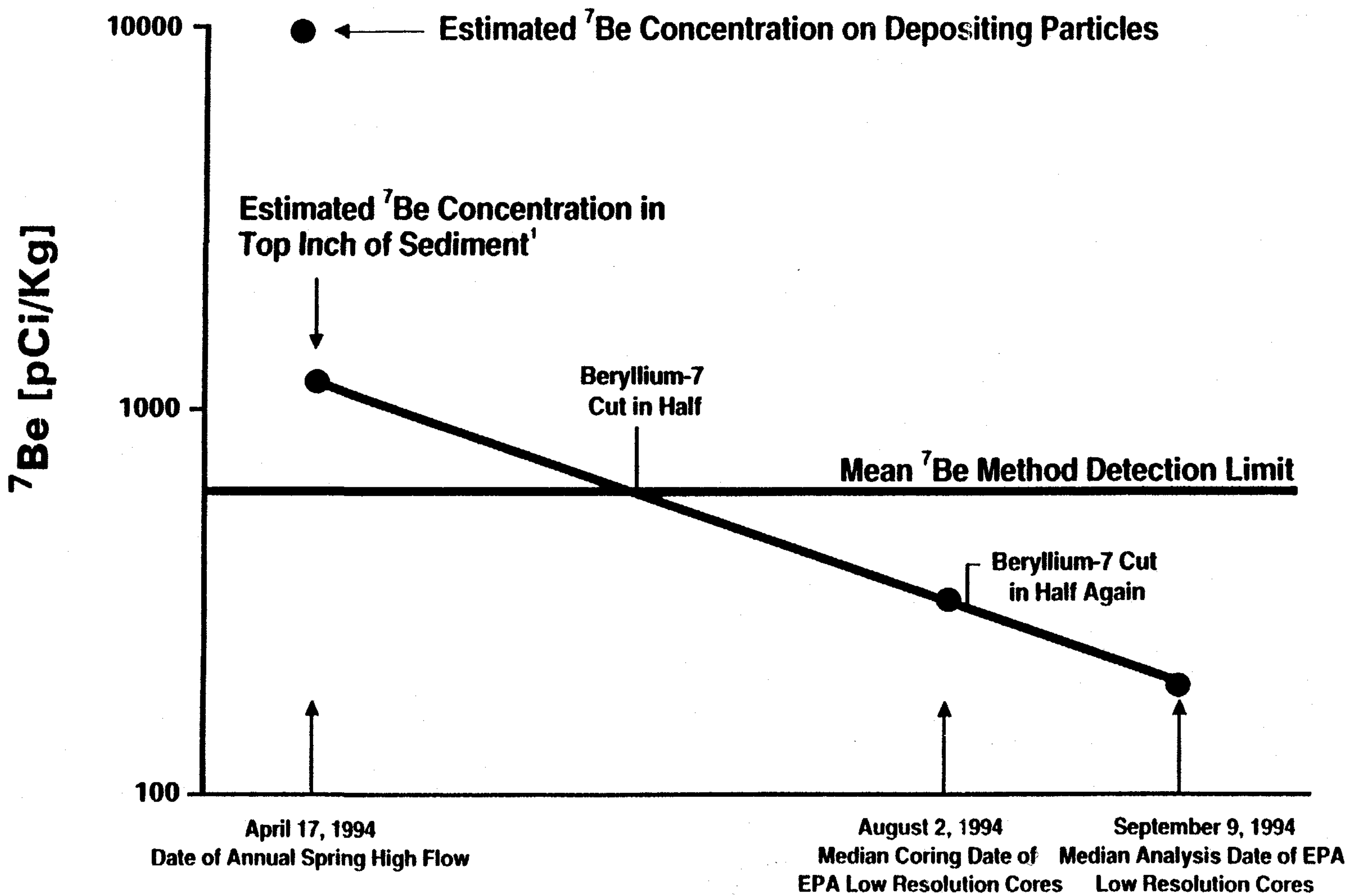
10.10004

EPA Performed an Inappropriate Statistical Analysis of the Data

- **Below TIP EPA correctly applied the arithmetic mean to assess mass changes**
  - "the arithmetic mean [of the sediment inventory] must be used if the degree of change is needed" (p 4-28)

- **Within the TIP the EPA incorrectly applied the geometric mean of the "Delta PCB +2" function**
  - Delta PCB is calculated from the proportional change in mass from 1984 to 1994
  - For the purpose of assessing PCB mass changes the arithmetic mean is the correct statistic

SENSITIVITY OF BERYLLIUM-7 DETECTION TO DECAY RATE AND ANALYSIS DATE

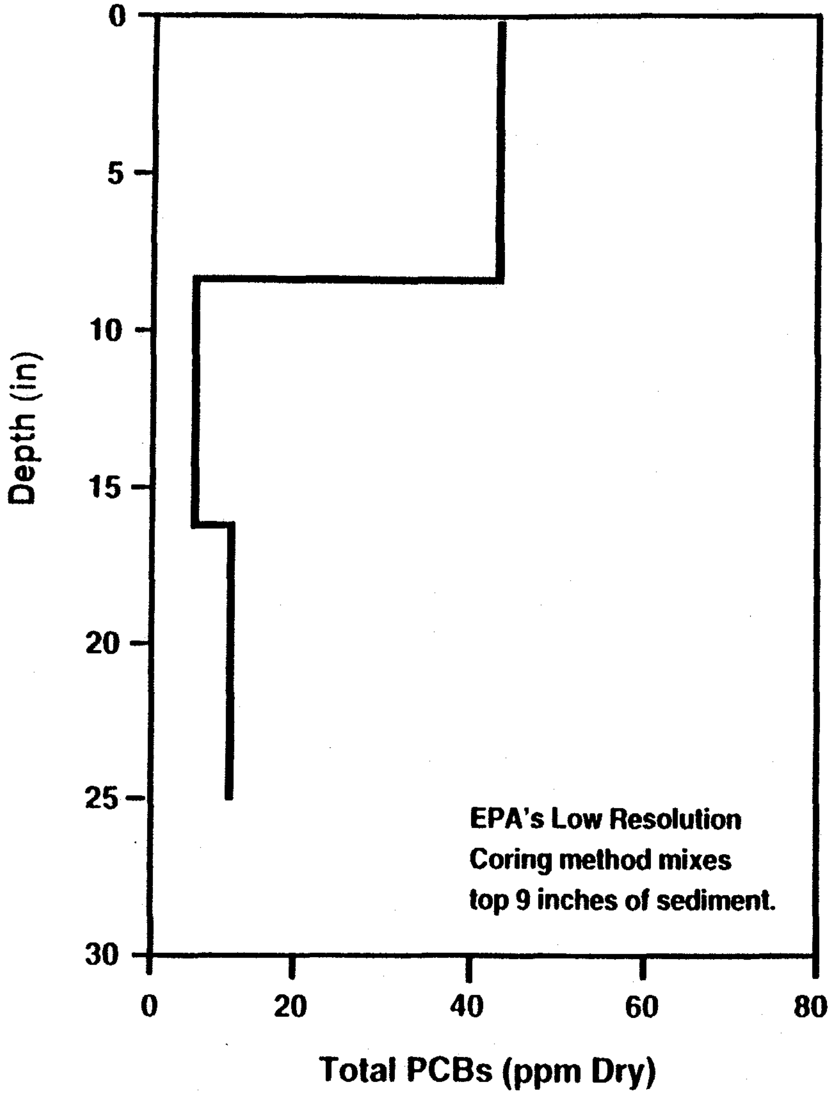


[1]Assuming 0.3 cm of deposition

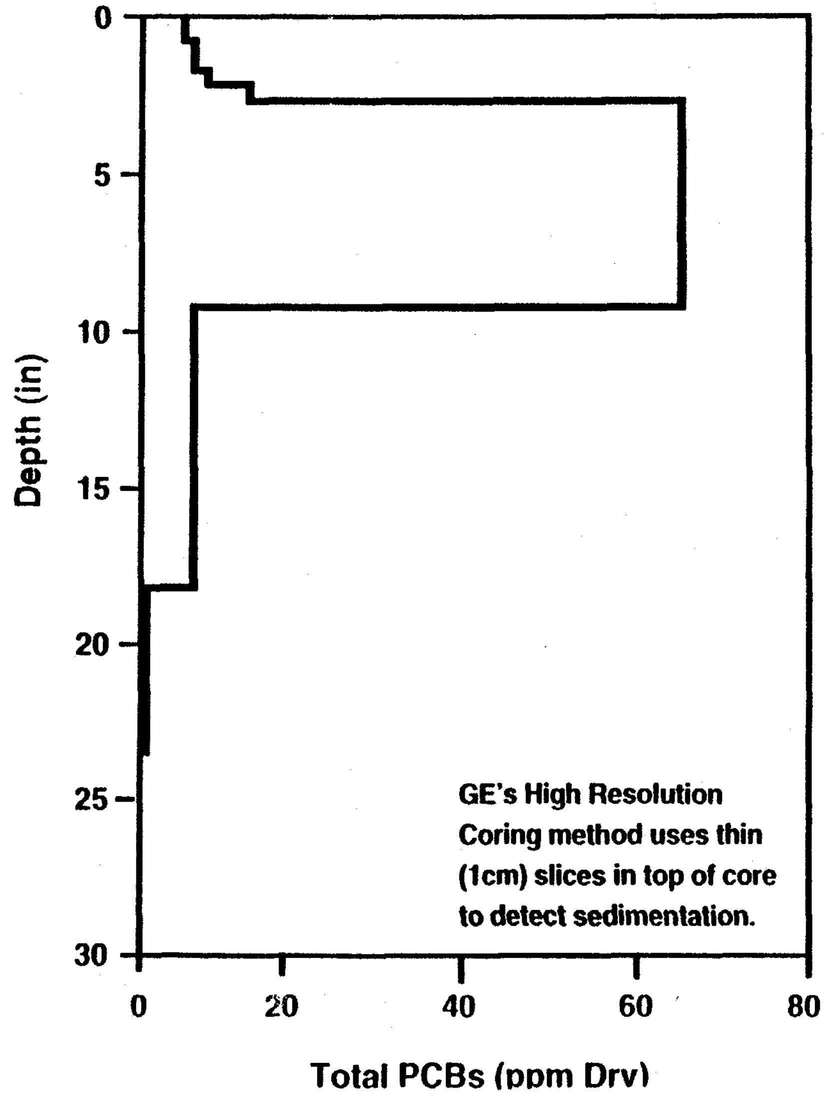
CONCENTRATION OF PCBs AT VARIOUS SEDIMENT DEPTHS

1994 Sediment Cores vs. 1998 Sediment Cores at Same Locations

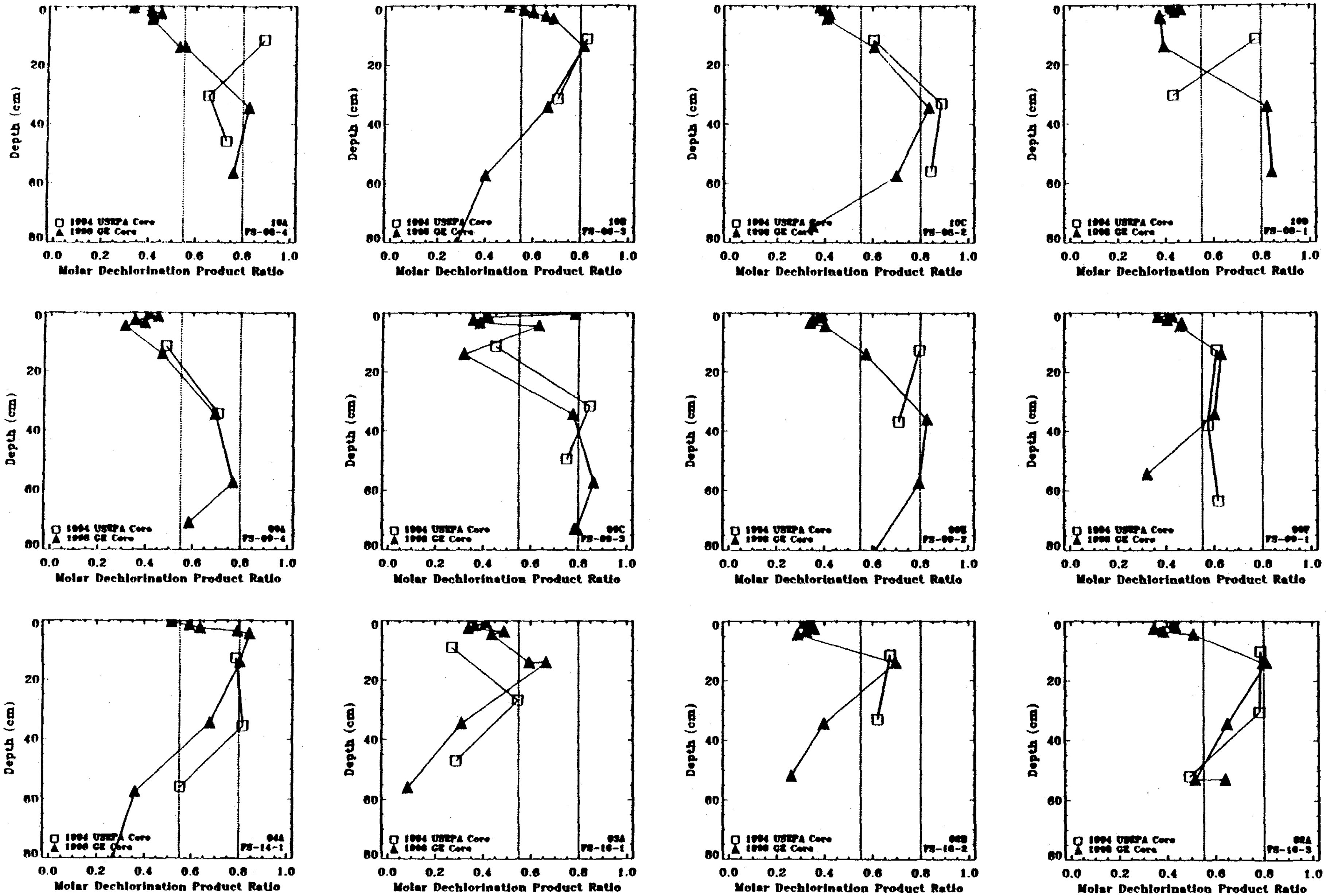
1994 USEPA Core LR-02A



1998 GE Co-Located Core FS-16-3

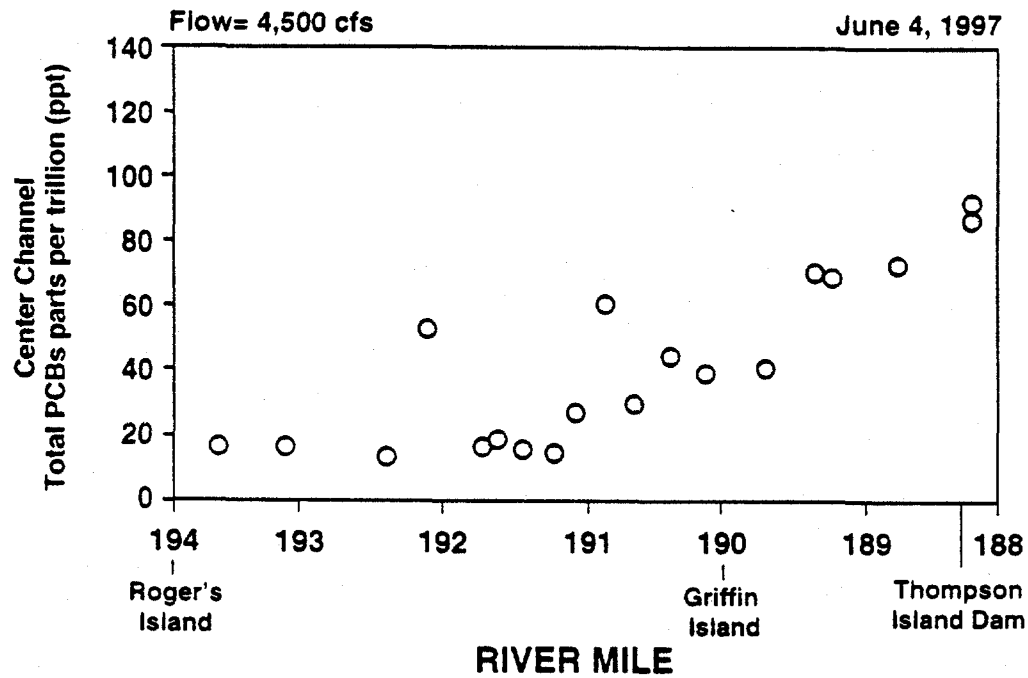


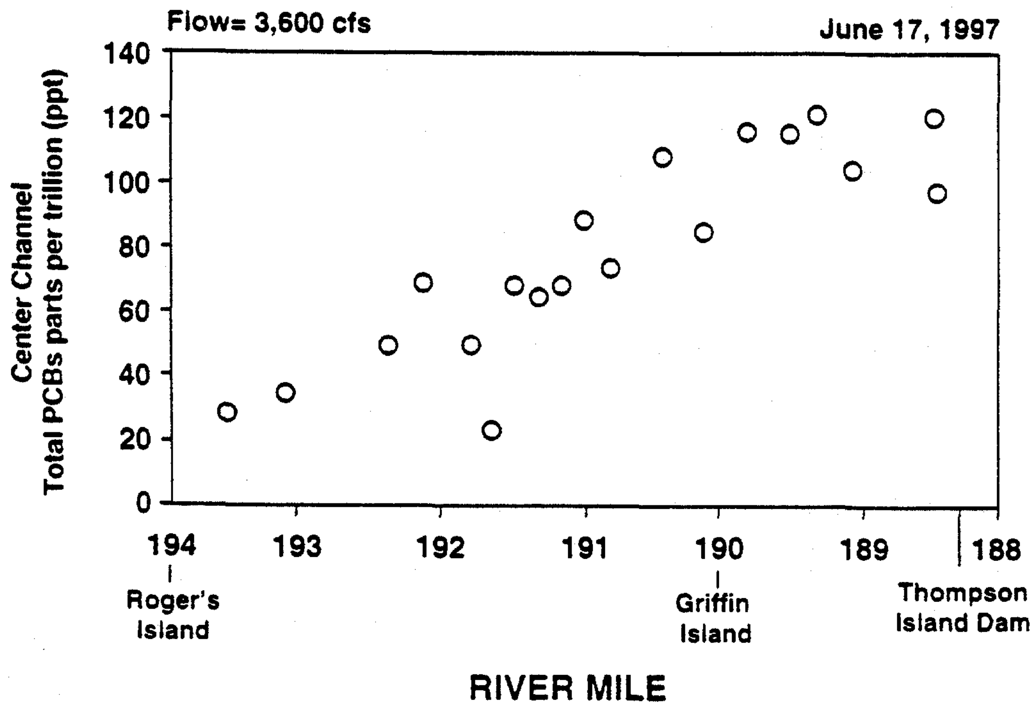
10.10007



Sediment Core Molar Dechlorination Product Ratio Depth Profiles for Colocated 1994 USEPA Low Resolution and 1998 GE Focused Sediment Data Located within Thompson Island Pool

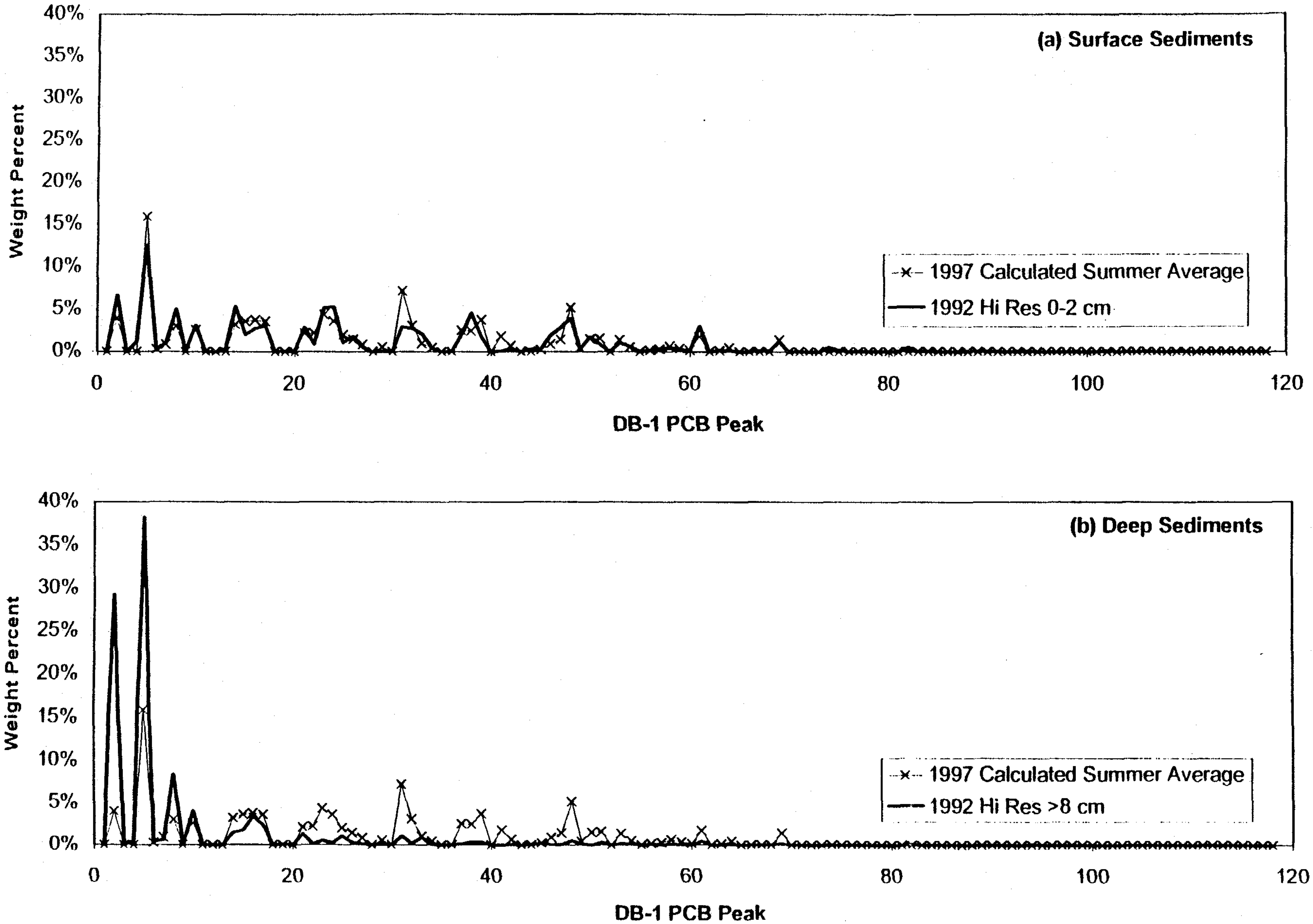
INCREASE OF PCBs ACROSS THOMPSON ISLAND POOL





10.10009

Comparison of PCB Peak Compositions for Calculated Diffusional Sediment Source (1997 Summer Average) with (a) Surface and (b) Deep Sediments from 1992 EPA High Resolution Cores Collected from TIP



10.10010

Conclusions

- Absence of detectable ^{7}Be does not indicate that burial is not occurring - only that less burial has occurred than at locations with detectable ^{7}Be
- The higher resolution 1998 cores exhibit a concentration and composition profile consistent with burial
- Removing inappropriately compared samples, the EPA methodology produces a mass loss of 17% rather than 40%
- The inconsistency in inventory changes between 84, 94, and 98 and the inconceivable mass loss on a tri and higher basis between 84 and 94 demonstrates the inaccuracy and imprecision of EPA's methodology
- PCB loading and compositional patterns within the TIP indicate that the PCB source is diffuse (not isolated to hot spots) and consistent with surface sediment PCB composition

Conclusions

- **Fate, transport, and bioaccumulation modeling is the appropriate means of assessing the importance of sediment changes over time**
  - integrates 20 years of water column, sediment, and biota data
  - provides a quantitative and mechanistic evaluation of the entire data set
  - constrained by the principals of mass balance

10.10013

GE's Preliminary Review of EPA's July 1998 Low-Resolution Coring Report

August 1998

GE Corporate Environmental Programs

Introduction

EPA's Low-Resolution Sediment Coring Report on the Hudson River contains serious flaws that invalidate the report's four conclusions, as described in further detail on Pages 3-5. Also, data collected and analyzed this summer by GE show that, contrary to EPA's public statements, old PCB deposits in the Upper Hudson River continue to be buried by fresh sediment flowing into the river.

GE has completed a preliminary assessment of EPA's report and a preliminary analysis of its own 1998 sediment sampling and determined that:

- The report selectively excluded data, misused a key statistic, extrapolated from a limited number of samples to a large area of the upper river despite enormous variability, made invalid assumptions for which there is no scientific support, and improperly treated dissimilar data as comparable. EPA's methodology and therefore the conclusions in its report are so fundamentally flawed they cannot be used to support a scientifically defensible Hudson River remedial decision.

- The report's conclusion that large quantities of PCBs are washing out of old, buried deposits in the Upper Hudson River is not accurate and, therefore, its implication that there may be an environmental "emergency" is unfounded.

- Despite EPA officials' statements to the contrary, the report — based on data EPA collected four years ago — contains no "startling" information about the Hudson River. River conditions continue to improve. PCB levels in fish in the Upper Hudson (based on the three species sampled) declined 50 percent between 1994 and 1997. Old PCB deposits in the Upper Hudson remain in the same well-documented locations where they have been for 25 years, and fresh sediment washing into the river every day continues to bury them and make them inaccessible to fish and the rest of the food web.

- GE and EPA agree that there is less PCB in the Upper Hudson River today than there was in 1984, the base year EPA used for comparison. GE's 1998 sampling of sediments confirms this. But GE's analysis also shows that EPA's estimate of the loss between 1984 and 1994 is wrong, as is its claim that PCBs disappeared from buried deposits.

In light of the serious problems discovered in the report thus far, GE is calling on EPA to begin an expedited review of the report by independent experts outside the Agency and is urging EPA not to act on the conclusions until this review is completed and made public. EPA has said it would not conduct peer review of this report until August 1999 even though it said it may make an "emergency" decision based on this report as early as this fall. It is only logical to have independent experts review the report before action is taken, and GE believes the independent review should be started without delay. We hope today's meeting of EPA's Science and Technical Committee will initiate this process.

GE will present its full scientific review of the report in formal comments due to EPA by Aug. 31. Among other recommendations, GE will urge the Agency to subject the conclusions in this report to rigorous testing in its computer model that is being developed to predict future conditions in the Hudson. GE believes that when the modeling is conducted, the fallacy of the conclusions issued in July will be readily apparent.

GE scientists and consultants continue to review all of the data on the Hudson, and the picture that emerges is quite clear: More fresh sediment enters the Upper Hudson River than leaves it. This "net gain" in fresh sediment covers the river bottom and, along with GE's major clean-up program at the Hudson Falls plant site, is a significant contributor to the river's robust natural recovery, especially the sharp decline in PCB levels in fish.

Some PCBs disappear from the upper river each year through natural processes like erosion. These processes appear largely to affect those PCBs found on the surface sediments, not in the old, buried deposits. Based on GE's analysis of water, sediment and fish data, the old, buried deposits are not a significant source of PCBs to the river system. Little loss of PCBs from these areas would be expected because these deposits are located in depositional areas (along shorelines and in quiescent backwaters where sediment builds up), not in the main channel of the river. EPA's theory, based on indirect measurements and flawed statistical analysis, is that, for some unknown reason, in these areas, which for decades have been known to be depositional, erosion began to occur between the 1980s and 1990s — a notion that is implausible on its face and is contradicted by all of the available data on the river.

Unless corrected, the serious flaws in this report should be a matter of substantial public concern because they may lead the Agency to conclude incorrectly that the old, buried deposits are the main source of PCBs to the water and fish of the Upper Hudson, when, in fact, PCBs on the surface of the river bottom are the primary source.

This, in turn, is likely to lead the Agency to adopt an ineffective, damaging and counterproductive remedy: dredging. Based on all the data available, it is clear that dredging the old, buried deposits of PCBs would not reduce PCB levels in fish because the fish do not derive most of their PCBs from those deposits.

Based on huge volumes of field data and scientific analyses conducted over the past six years, GE believes a far more effective strategy is cutting off on-shore sources of PCBs. GE has pursued this strategy in its cleanup of the Hudson Falls plant site, with excellent results for the river. This approach has reduced PCB influx to the river and contributed to an average 50 percent reduction in PCB levels in fish in the Upper Hudson (based on the three species sampled) — without the risk, damage or disruption of dredging.

To date, GE has invested $150 million in the clean-up program and associated research. The company is committed to completing the job.

Summary of EPA Conclusions and GE Analysis

• **EPA Conclusion #1** said that "there was little evidence found of widespread burial of PCB-contaminated sediment by clean sediment in the Thompson Island Pool" (EPA, Volume 2CA Low-Resolution Sediment Coring Report, Page ES-3).

EPA's Conclusion #1 is based on a flawed analysis of the 1994 data that produces an incorrect conclusion. It is also contradicted by 1998 data collected by GE at 12 locations that EPA sampled in 1994. GE subjected this data to a more precise analysis. The more recent data show clear evidence of burial of old PCB deposits with layers of fresh sediment in locations that EPA said were subject to erosion.

EPA may have reached its incorrect conclusion for the following reasons:

• EPA analyzed its cores in nine-inch slices, which caused them to miss evidence of burial. GE segmented the top of its cores in slices of four-tenths of an inch; therefore, the resolution in the GE analysis was 22 times better and allowed distinct layers of sediment to be distinguished and analyzed in a more precise way. Through this analysis, GE determined that PCB levels in the top layers of sediment were declining as they were buried by fresh sediment.

• To reach its conclusion that burial was not occurring, EPA looked for the presence or absence of Beryllium-7, a naturally occurring isotope found in river sediment. In surface sediments where Beryllium-7 was not detected, EPA concluded burial was not occurring (EPA Report, Page ES-3). But Beryllium-7 has a half life of 53 days (meaning its concentration is cut in half every 53 days). EPA did its analysis an average of 145 days after the Spring 1994 high flow that would have resulted in most of that year's burial. Given the low initial concentration of Beryllium-7 in the sediment sample, by the time EPA analyzed the cores, most of the Beryllium-7 would have naturally disintegrated and what remained would have been below detection capability. Thus, while Beryllium-7 may be a good indicator of the presence of recently deposited sediments, its absence cannot be used to conclude, as the report did, that burial has not occurred.

• **EPA Conclusion #2** said that "from 1984 to 1994, there has been a net loss of approximately 40 percent of the PCB inventory from highly contaminated sediments in the Thompson Island Pool" (EPA Report, ES-4).

EPA's Conclusion #2 is based on so little data and so flawed a methodology that it is not possible to make a reliable estimate.

• EPA sought to determine the mass of PCBs present in old, buried deposits in the Thompson Island Pool. New York State did the same work in 1984, collecting 409 core samples.

EPA chose to collect only 60, sampling fewer than one-third of the buried PCB deposits in the Thompson Island Pool. EPA then extrapolated the results to all of the buried deposits in the entire Thompson Island Pool (a six-mile stretch of river) despite a sampling density the equivalent of one sample every three acres. EPA's approach was based on an incorrect assumption that conditions in one area of the Thompson Island Pool are similar to other areas when voluminous data collected by EPA, New York State and GE over the years show that sediment deposition and PCB distribution in the Thompson Island Pool are highly variable.

• There is a fundamental flaw in EPA's methodology. EPA states in its report (EPA Report, Appendix E) that it is necessary to correct sediment data to account for differences in analytical techniques. However, EPA inexplicably failed to make that correction in its analysis. Had the Agency corrected the data as it proposed to do, EPA would have arrived at the conclusion that most of the PCBs in the Thompson Island Pool had disappeared between 1984 and 1994. This implausible answer should have led EPA to recognize that its methodology was incapable of accurately assessing PCB mass. As it is, EPA did not discover the fundamental flaw.

• EPA's analysis also suffered because it compared results from two different and incompatible sampling techniques — the equivalent of comparing apples to oranges. Approximately half of EPA's 1994 core samples were collected five feet or farther away from the original sample location — too far for a valid comparison in an area where conditions change dramatically over very short distances — or drawn from "grab samples" (scoops of mud) rather than the 1984 "core samples" (long tubes of mud). Had EPA compared apples to apples, the results would show that EPA's claim of a 40 percent loss of PCB inventory was highly exaggerated.

• In 15 of the 76 cores it collected in 1994, EPA acknowledged (EPA Report, Page 2-20) that the full amount of PCBs present at the sampling location was not captured. As a result, EPA's analysis missed deposits of PCBs located at greater sediment depth and, therefore, under-estimated the total PCBs that are present in the buried deposits. This contributed to its incorrect conclusion that there was a 40 percent loss of PCBs between 1984 and 1994.

• In its calculation of PCB mass change in the Thompson Island Pool, EPA used the geometric mean rather than the arithmetic mean to calculate the average mass, which EPA acknowledged in Section 4 of its report is not appropriate to calculate the mass average. Had EPA correctly calculated the average, the results would have showed that EPA's claim of a 40 percent loss was wrong.

• **EPA's Conclusion #3 and #4** said the following:

— "From 1976-1978 to 1994, between the Thompson Island Dam and the Federal Dam at Troy, there has been a <u>net loss</u> of PCB inventory in *hot spot* sediments sampled in the low resolution coring program" [EPA's italics, GE's underscoring] (EPA Report, Page ES-4).

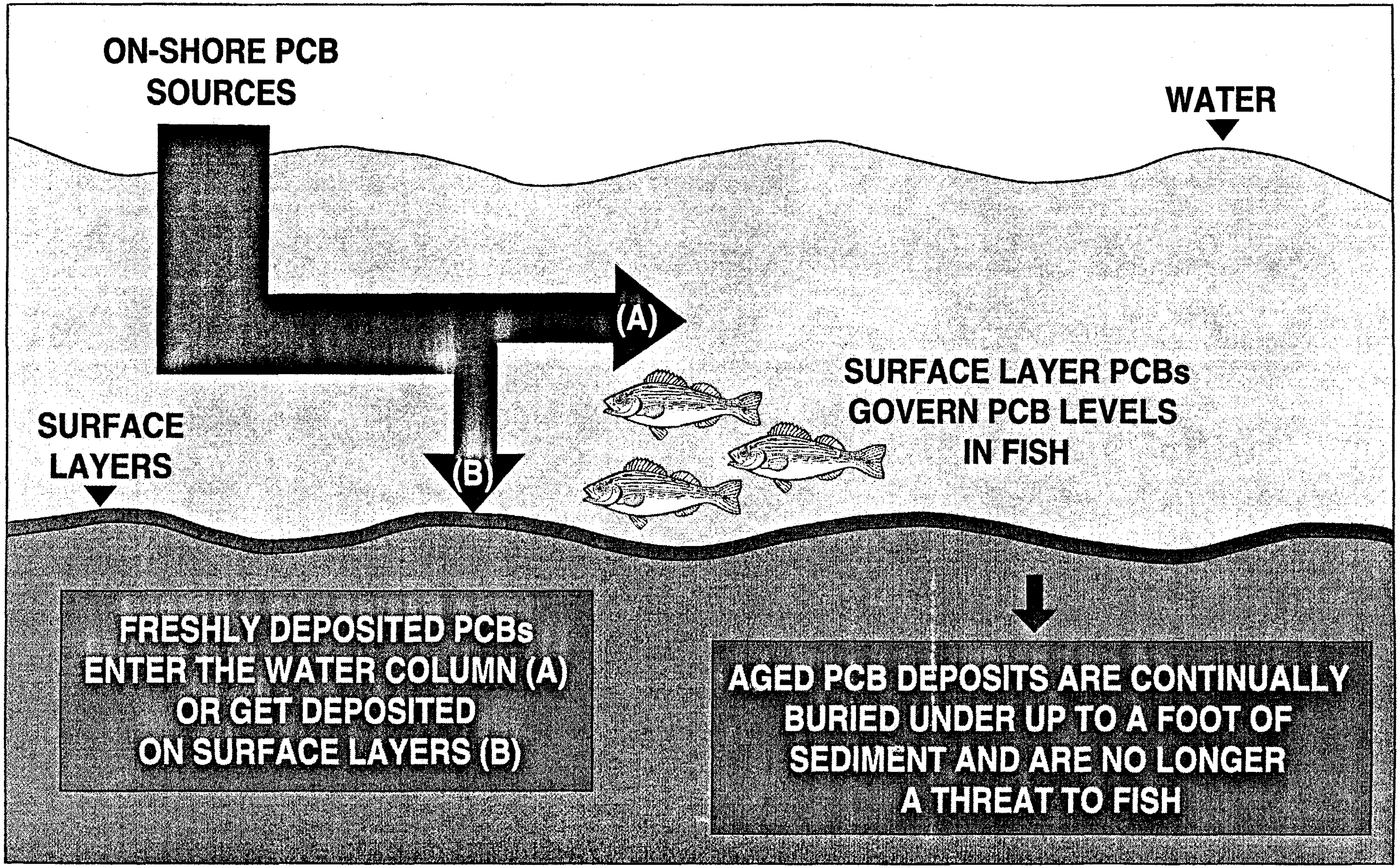
— "The PCB inventory for *Hot Spot* 28 calculated from the low resolution coring data is considerably greater than previous estimates. This apparent 'gain' in inventory is attributed to significant underestimates in previous studies rather than actual deposition of PCBs in *Hot Spot* 28" [EPA's italics, GE's underscoring] (EPA Report, Page ES-4).

These two conclusions, which deal with the area south of the Thompson Island Pool, contradict each other because the data EPA relies on as reliable in one conclusion is dismissed as unreliable in the next.

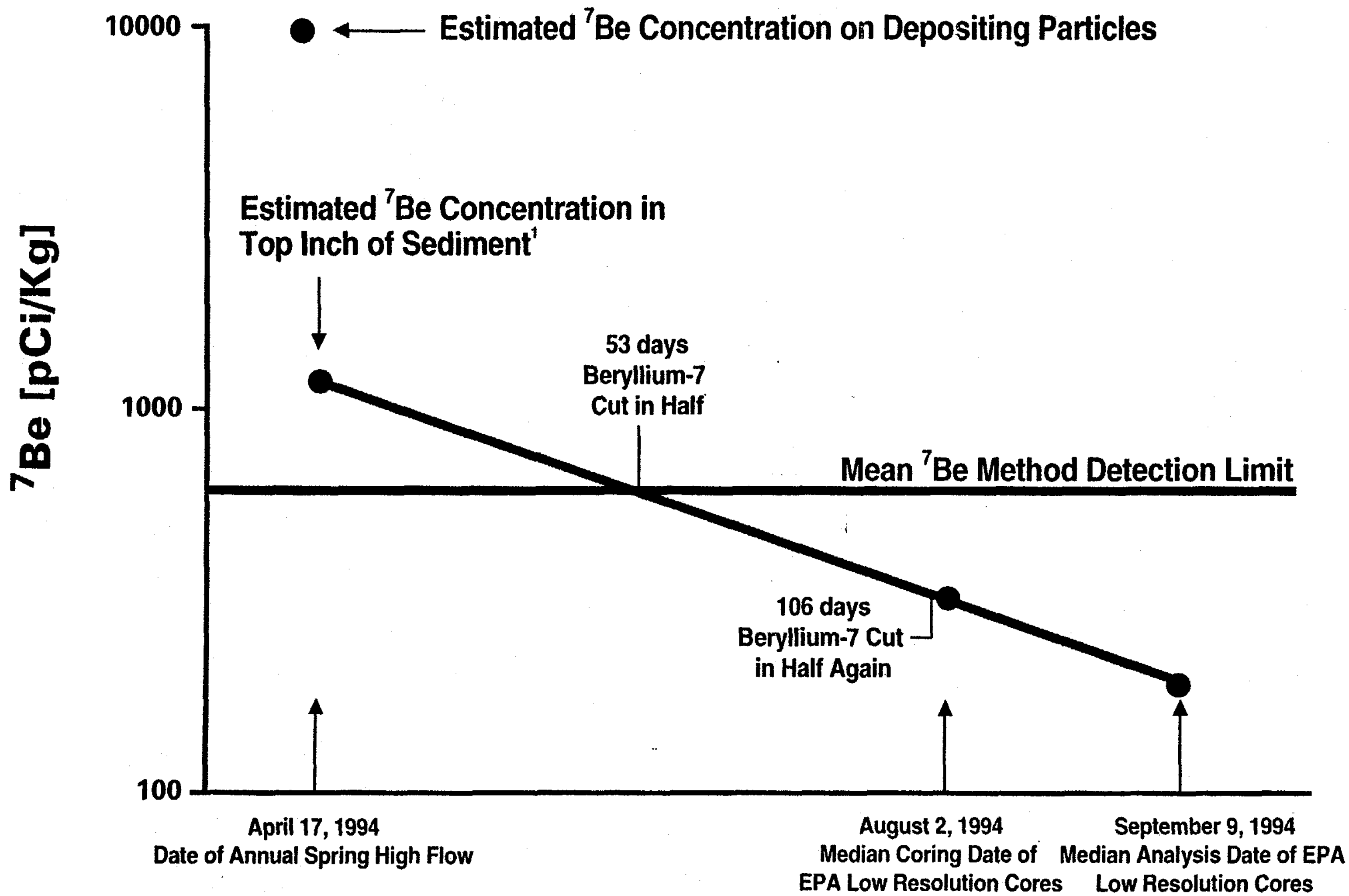
The validity of EPA's approach is seriously compromised when it says the very same data that provided reliable support for Conclusion #3 is too unreliable to support Conclusion #4. In Conclusion #3, EPA says there was a net loss of PCBs in deposits south of the pool, based on a comparison of 1994 data with that collected in 1976/78 by New York State. Then, in Conclusion #4, EPA says that at the largest deposit south of the pool there was a big gain. To try to reconcile this apparent contradiction, EPA arbitrarily dismisses that big gain, saying the 1976/78 New York State data may be incorrectly low, and assuming, without any justification, that its own 1994 data are right.

There is no basis for EPA's assumption that the 1994 data for "hot spot" 28 are more reliable, especially when the '76-'78 data included about three times as many samples (27 were collected by the state in '76-'78 vs. 10 collected by EPA in 1994).

IDENTIFYING THE PCB SOURCE THAT AFFECTS FISH



SENSITIVITY OF BERYLLIUM-7 DETECTION TO DECAY RATE AND ANALYSIS DATE



[1]Assuming 0.3 cm of deposition

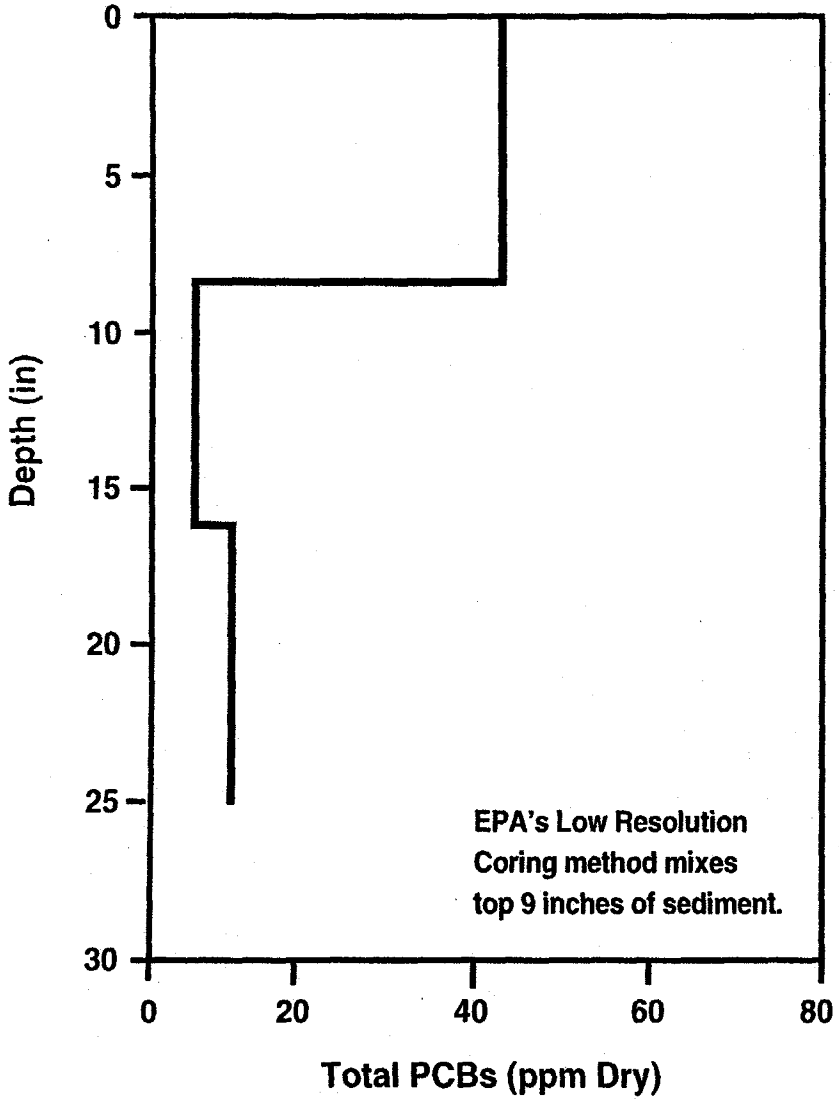
CONCLUSION: The absence of Beryllium-7 does not mean an absence of burial.

10.10020

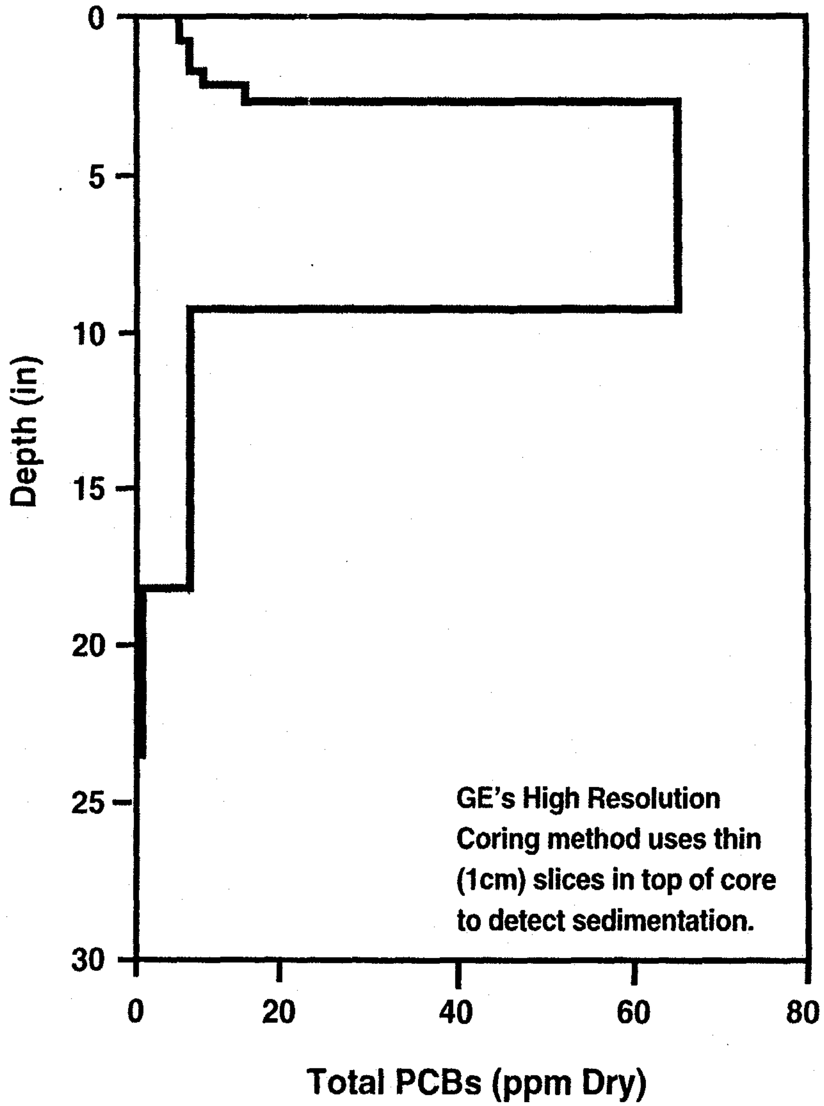
CONCENTRATION OF PCBs AT VARIOUS SEDIMENT DEPTHS

1994 Sediment Cores vs. 1998 Sediment Cores at Same Locations

1994 USEPA Core LR-02A

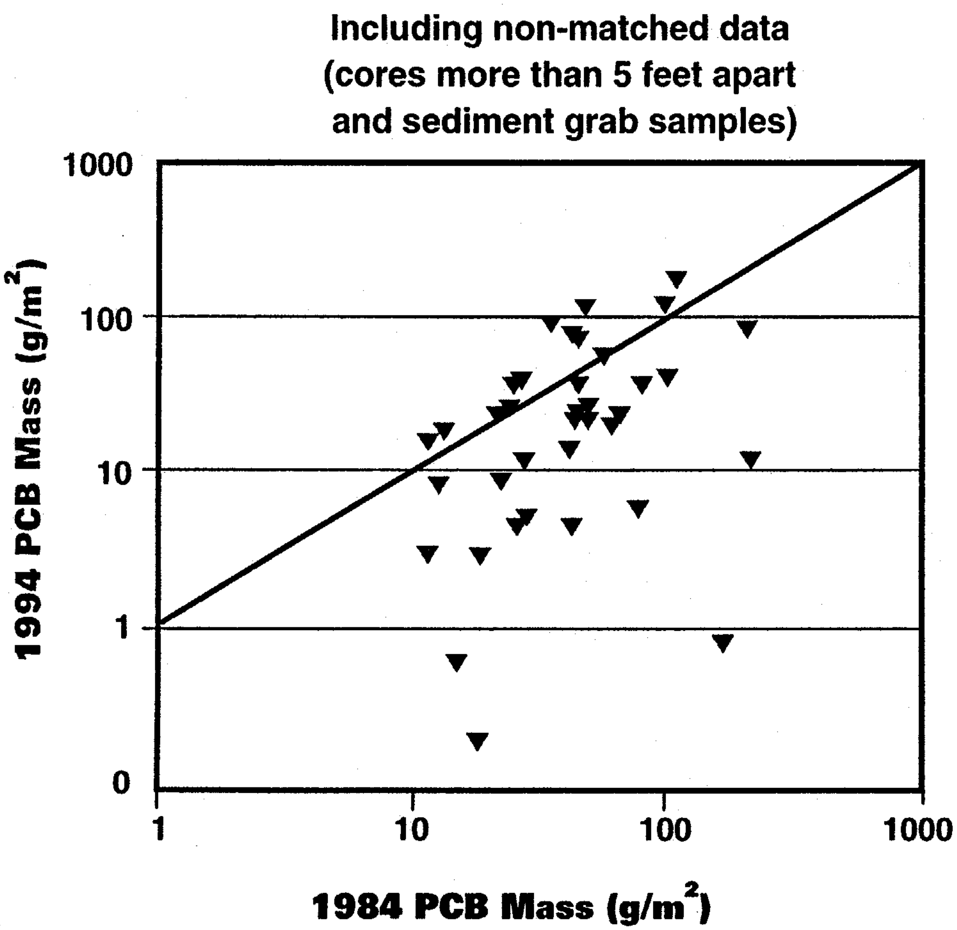


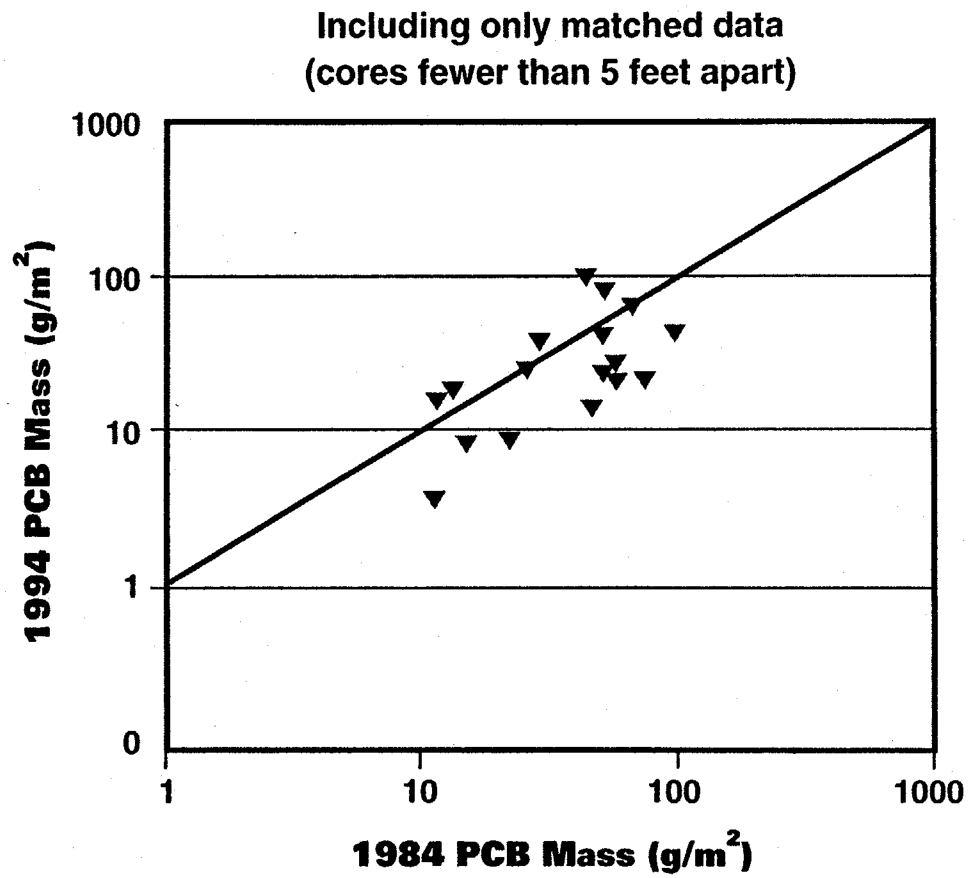
1998 GE Co-Located Core FS-16-3



CONCLUSION: EPA's less precise sampling technique fails to detect lower PCB levels at surface — the key indication of burial.

EFFECT OF INCLUDING NON-MATCHED DATA ON 1984-1994 PCB MASS COMPARISONS

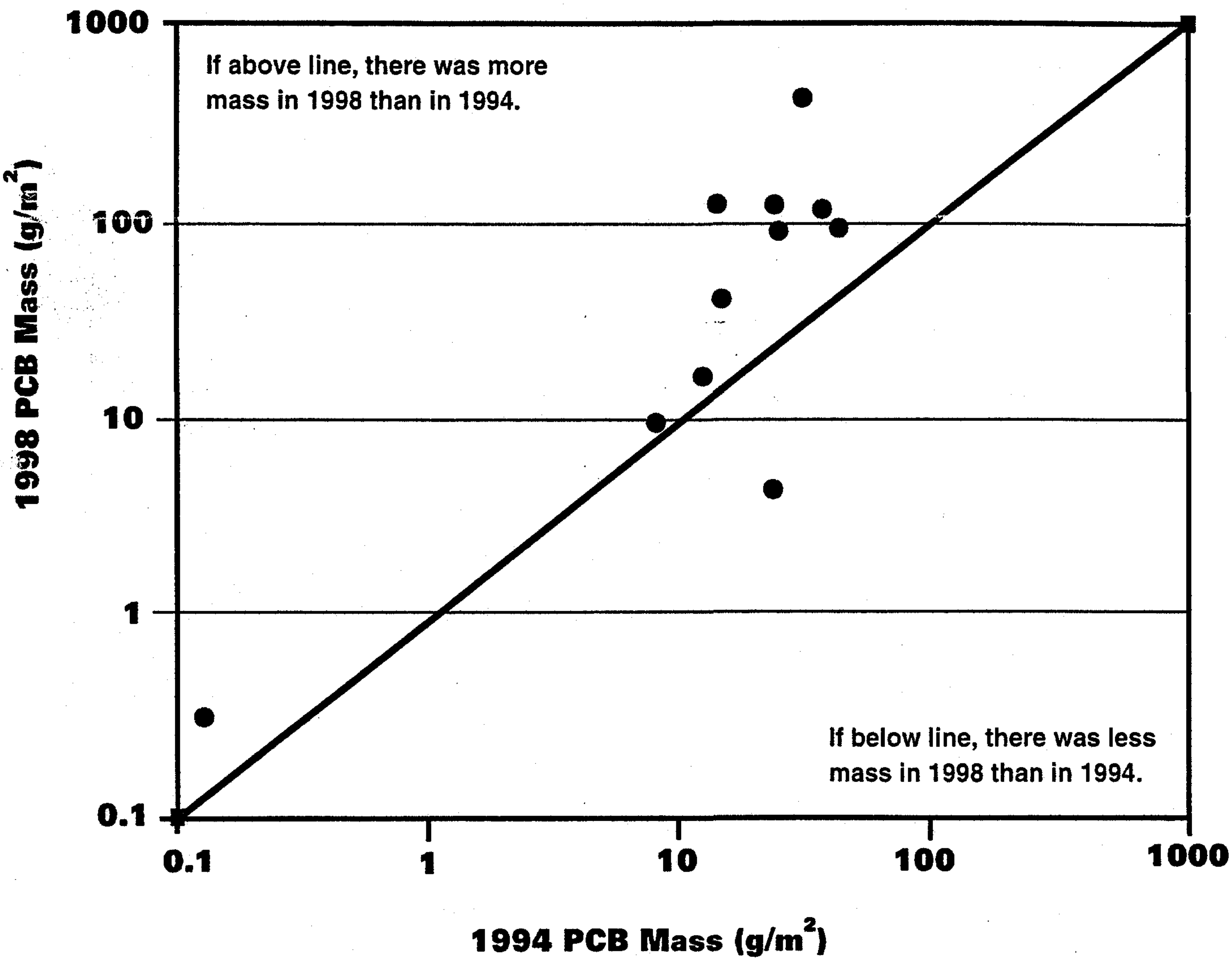




CONCLUSION: EPA's use of non-matched data in almost half the sample locations led to an over-estimated loss of PCBs from Thompson Island Pool sediments.

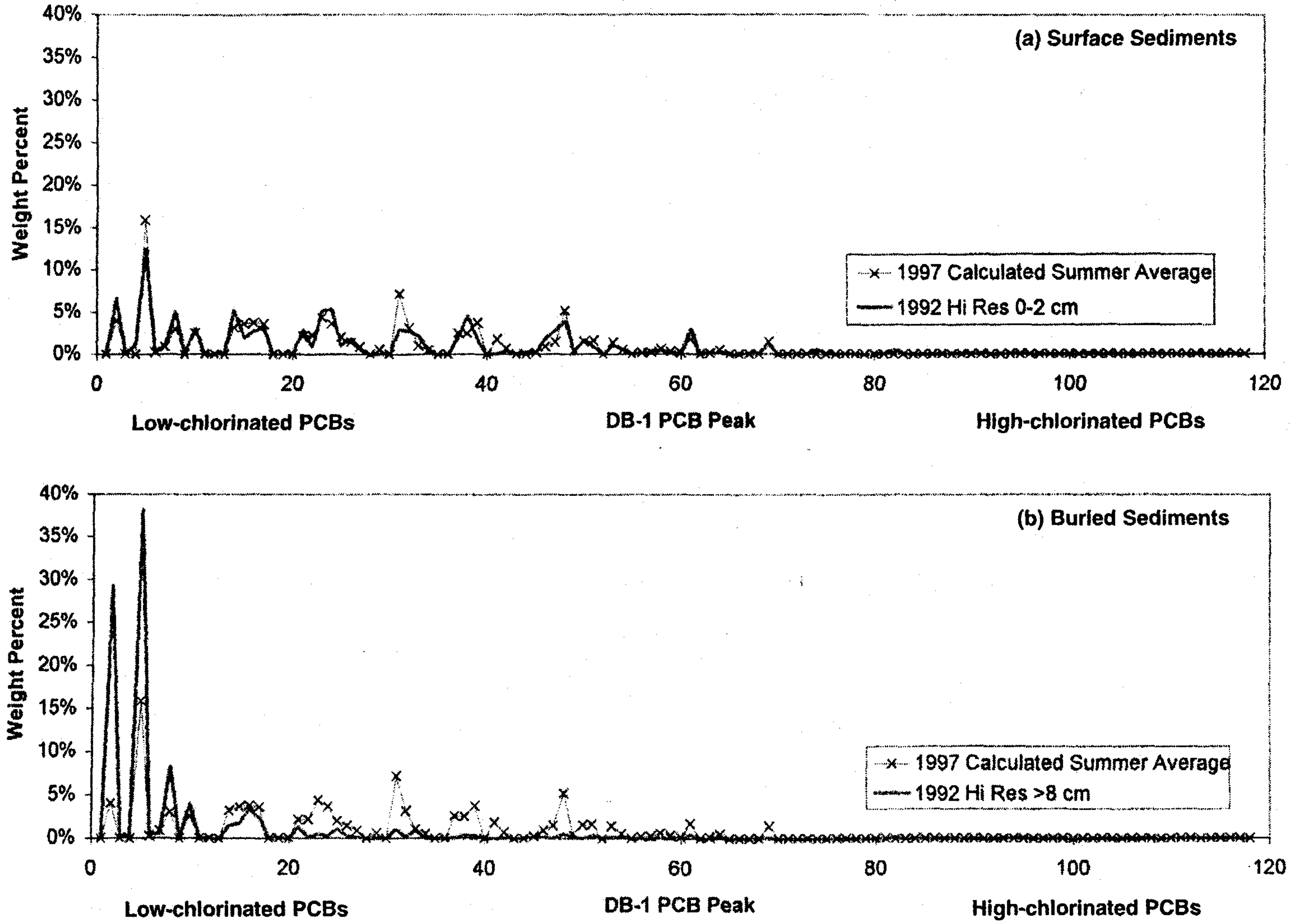
10.10022

PCBs IN SEDIMENT CORES COLLECTED AT SAME LOCATIONS IN 1998 AND 1994



CONCLUSION: EPA's 1994 mass estimates are biased low and overestimate the mass loss between 1984 and 1994.

COMPARING THE CHEMICAL SIGNATURE OF THE SEDIMENT PCB SOURCE WITH THAT OF PCBs IN SURFACE AND BURIED SEDIMENTS



CONCLUSION: The chemical composition of the PCBs in the water is consistent with the surface sediment PCB composition and not with the composition of old, buried sediments.

10.10024