

FRASER RIVER ACTION PLAN



REVIEW OF
INFORMATION ON
THE OCCURRENCE
OF CHEMICAL
CONTAMINANTS
IN THE AQUATIC
ENVIRONMENT OF
THE FRASER
RIVER BASIN

Maps of Individual
Parameters

DOE FRAP 95-25



Environment
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Pêches
et Océans

REVIEW OF INFORMATION ON THE
ENVIRONMENTAL OCCURRENCE OF
CHEMICAL CONTAMINANTS AND
CONDITIONS OF ENVIRONMENTAL
DEGRADATION IN THE AQUATIC ENVIRONMENT
OF THE FRASER RIVER BASIN.

MAPS OF INDIVIDUAL PARAMETERS

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Pacific and Yukon Region
North Vancouver, British Columbia

and

Department of Fisheries and Oceans
Pacific Region
Vancouver, British Columbia
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Abstract

This document is a collection of maps which form the background information summarized in the accompanying report, DOE FRAP 95-24. Data on environmental contaminants from aquatic media (water, sediment, fish tissues) in the Fraser River Basin were assembled from government environmental databases, relevant unpublished environmental studies and other sources into a GIS-compatible form suitable for display and summary in ArcInfo.

Figures in this document show sampling locations and contaminant levels relative to environmental guidelines, where such guidelines exist. For contaminants not having such guideline levels, data are compared to levels based on the data distribution, typically the 80th percentile. Data presented in the figures are from the period 1980 to 1994 for most measurements, and for the period 1986 to 1994 for dissolved nutrients in water.

The database from which these figures are produced is available in Dbase V format (12 Mb) suitable for display in ArcView II is available by special arrangement from Environment Canada, Vancouver.

Résumé

Cet ouvrage est une collection de cartes à l'appui de l'information résumée dans le rapport d'accompagnement, DOE FRAP 95-24. Les données sur les contaminants trouvés dans des éléments du milieu aquatique (eau, sédiments, tissus de poisson) du bassin du Fraser ont été colligées à partir de bases de données environnementales de source gouvernementale, d'études inédites sur l'environnement et d'autres sources, sous une forme compatible avec les SIG. Ces données peuvent être affichées et résumées dans le cadre du système ARC/INFO.

Ce document montre les lieux d'échantillonnage et compare les niveaux de contaminants à ceux que prescrivent les lignes directrices environnementales, là où il en existe. En l'absence de telles lignes directrices, les valeurs sont comparées à des niveaux basés sur la distribution des données, typiquement le 80^e percentile. Les données présentées dans les graphiques portent de 1980 à 1984 pour la plupart des mesures et portent de 1986 à 1994 pour les éléments nutritifs dissous dans l'eau.

La base de données qui sert à produire cette information est disponible en format Dbase V (12 Mo) et les données peuvent être affichées dans le cadre d'ArcView II, qui peut s'obtenir auprès du bureau d'Environnement Canada à Vancouver.

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NOTES REGARDING MAPS

Water* - Observations during the period of freshet (April to July) are not shown.

Fish** - Information is not available regarding specific tissues analyzed. These may include observations on specific tissues (liver and/or muscle) and whole body analyses. Species, age, sex and other sample-related details are also not available.

NY*, BCMELP* and H&WC* - Guidelines for fish body burdens expressed on a dry weight basis were converted to weight wet basis and from wet weight basis to dry weight basis using an average moisture content of 77.35% (based on 169 observations).

Methodology

The 80th percentile is calculated for all parameters using all available data including the period of freshet. Data reported as less than detection where the detection limit is not specified are excluded for calculations and maps. Data reported as less than detection where the detection limit is higher than the regulatory guideline are excluded from calculations and maps. Data reported as less than detection were excluded from computation of the 80th percentile if the detection limit was higher than the best method detection limit recorded in the database. Nonetheless, these data are included on maps if the detection limit is less than the value of the 80th percentile. Maps are not presented where there are less than 10 observations above detection limits in the database.

Abbreviations Used in Maps

- T4CP - Tetrachlorophenol
- T4CDD - Tetrachlorodibenzodioxin
- T4CDF - Tetrachlorodibenzofuran
- P5CDD - Pentachlorodibenzodioxin
- P5CDF - Pentachlorodibenzofuran
- H6CDD - Hexachlorodibenzodioxin
- H7CDF - Heptachlorodibenzofuran
- O8CDD - Octachlorodibenzodioxin
- Cl₂-dehydroabietic Acid - Dichlorodehydroabietic Acid
- S.A.D. - Strong Acid Digestible
- W.A.D. - Weak Acid Digestible
- NO₂/NO₃ - Nitrite and Nitrate
- WW - wet weight basis

**APPENDIX 1. DISTRIBUTION OF OBSERVATIONS FOR PARAMETERS
WITH REGULATORY GUIDELINES**

1.1 Biota, Fish

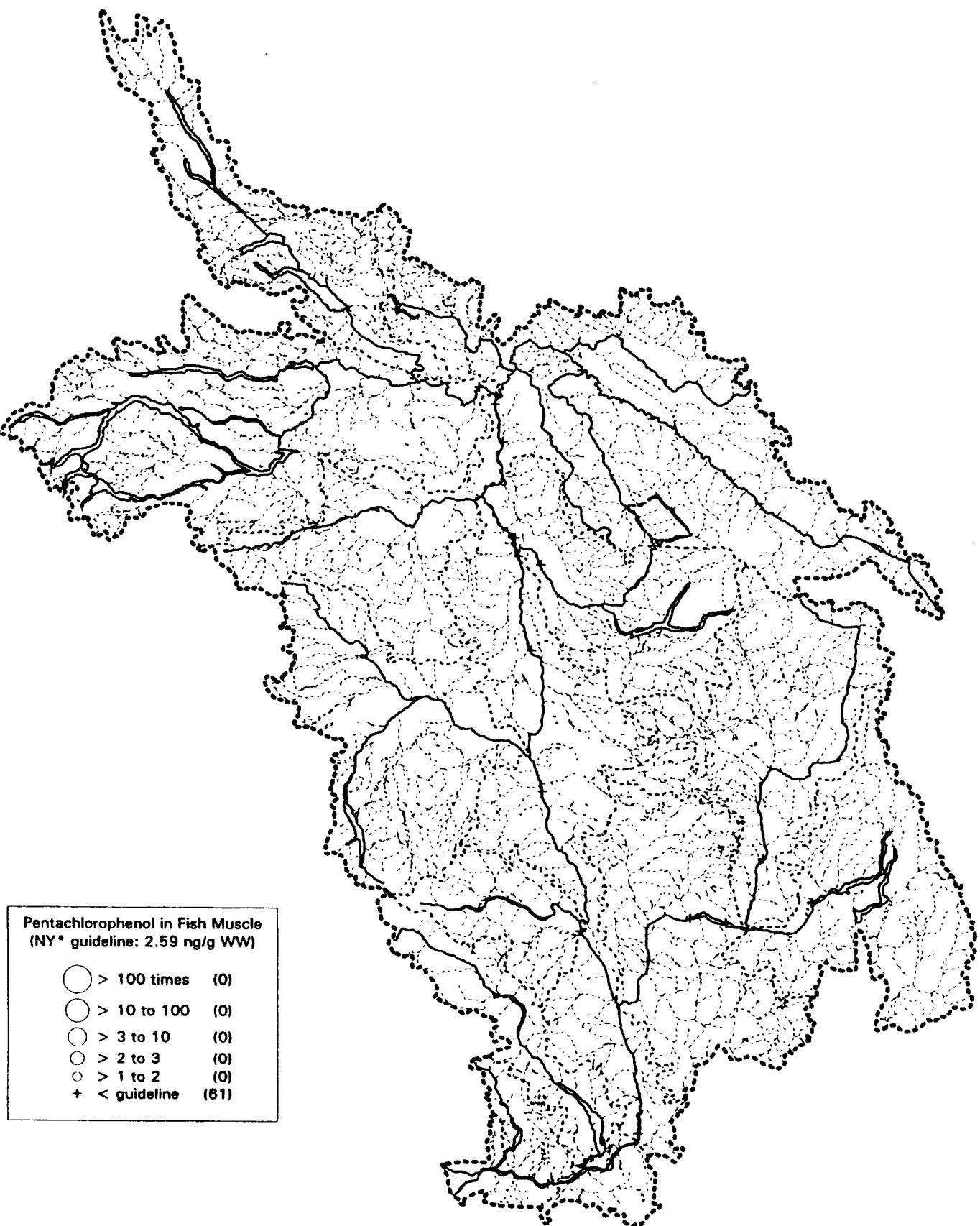
1.1.1 Chlorophenols in fish

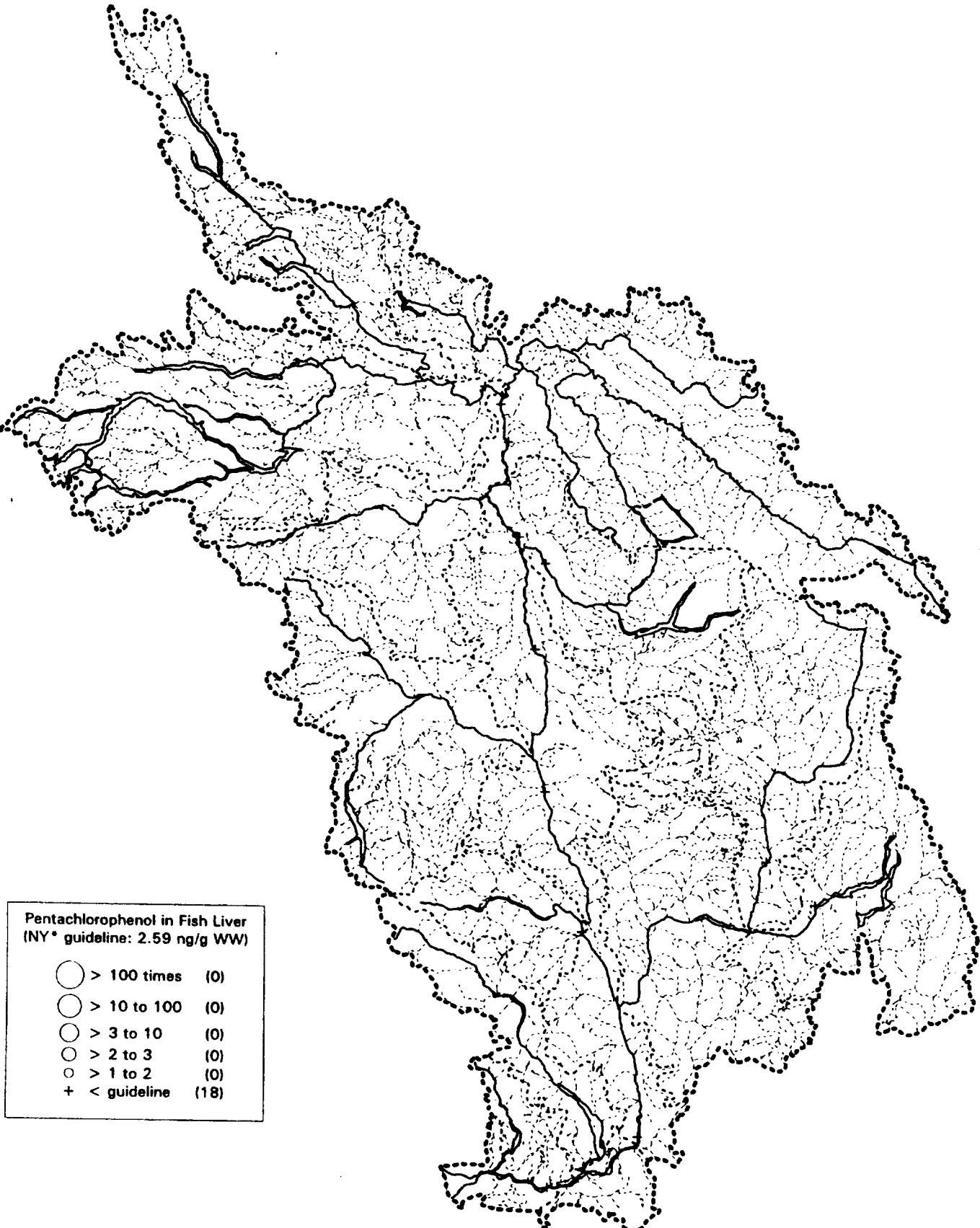
Pentachlorophenol in Fish Muscle

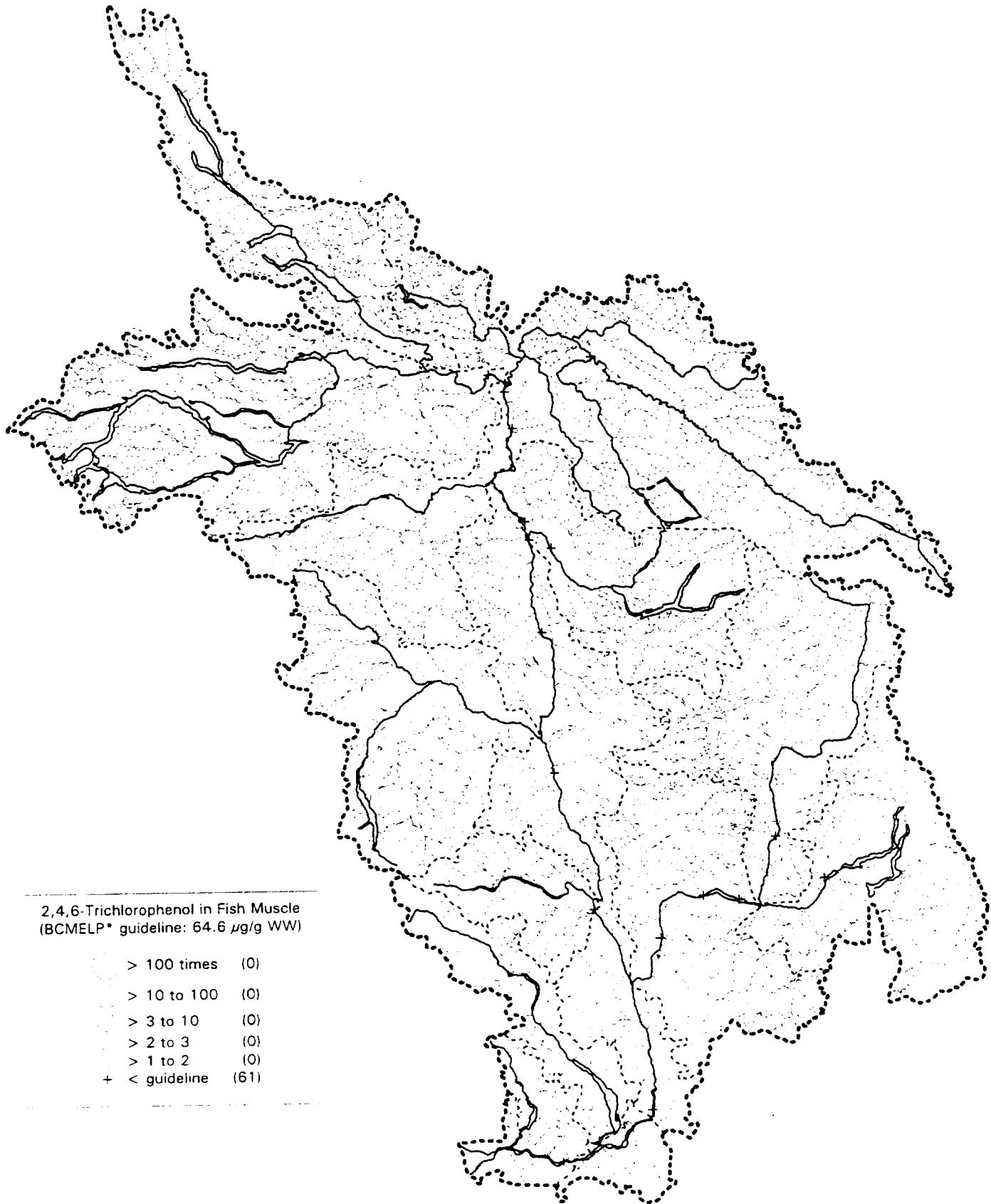
Pentachlorophenol in Fish Liver

2,4,6-Trichlorophenol in Fish Muscle

2,4,6-Trichlorophenol in Fish Liver

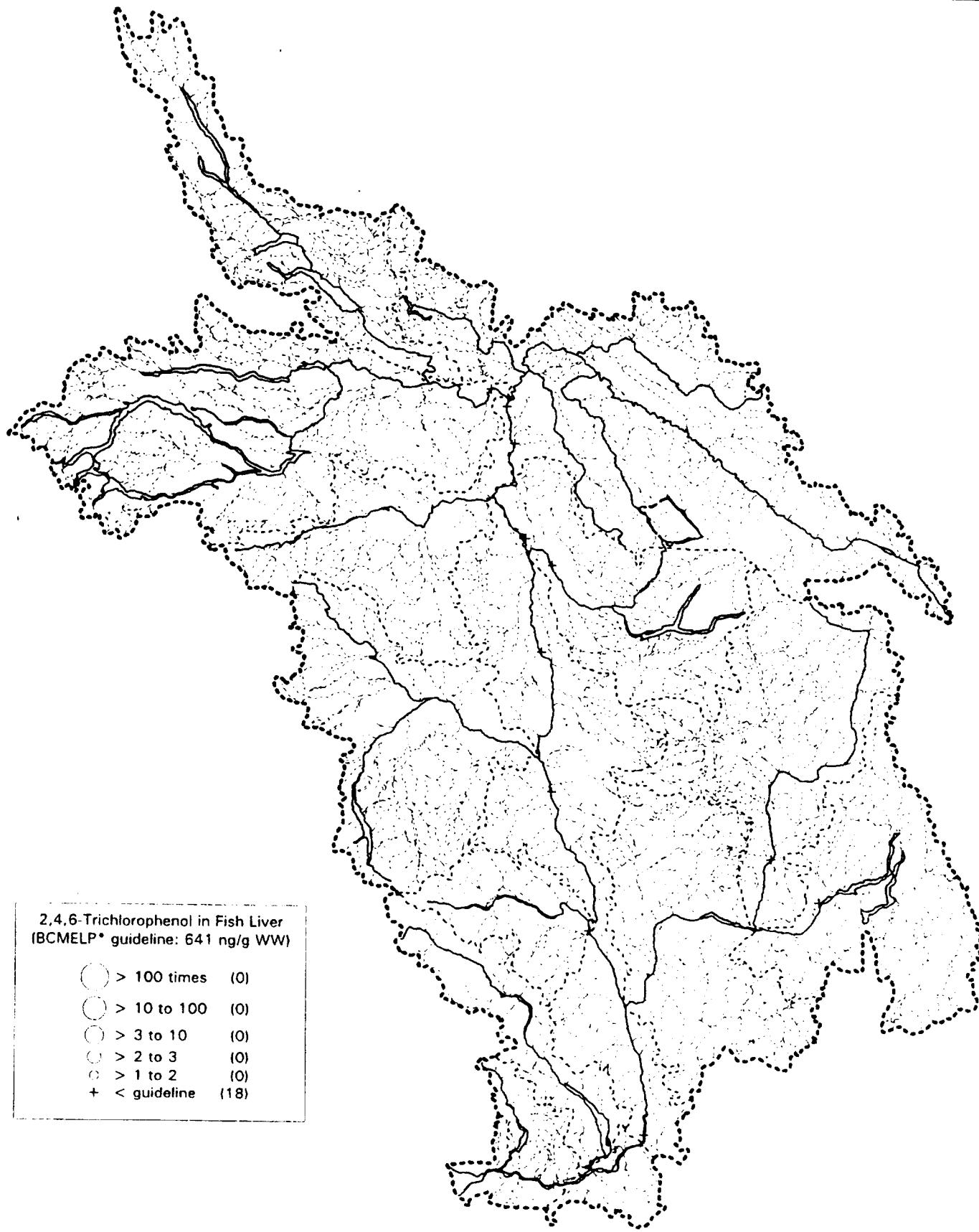






2,4,6-Trichlorophenol in Fish Liver
(BCMELP* guideline: 641 ng/g WW)

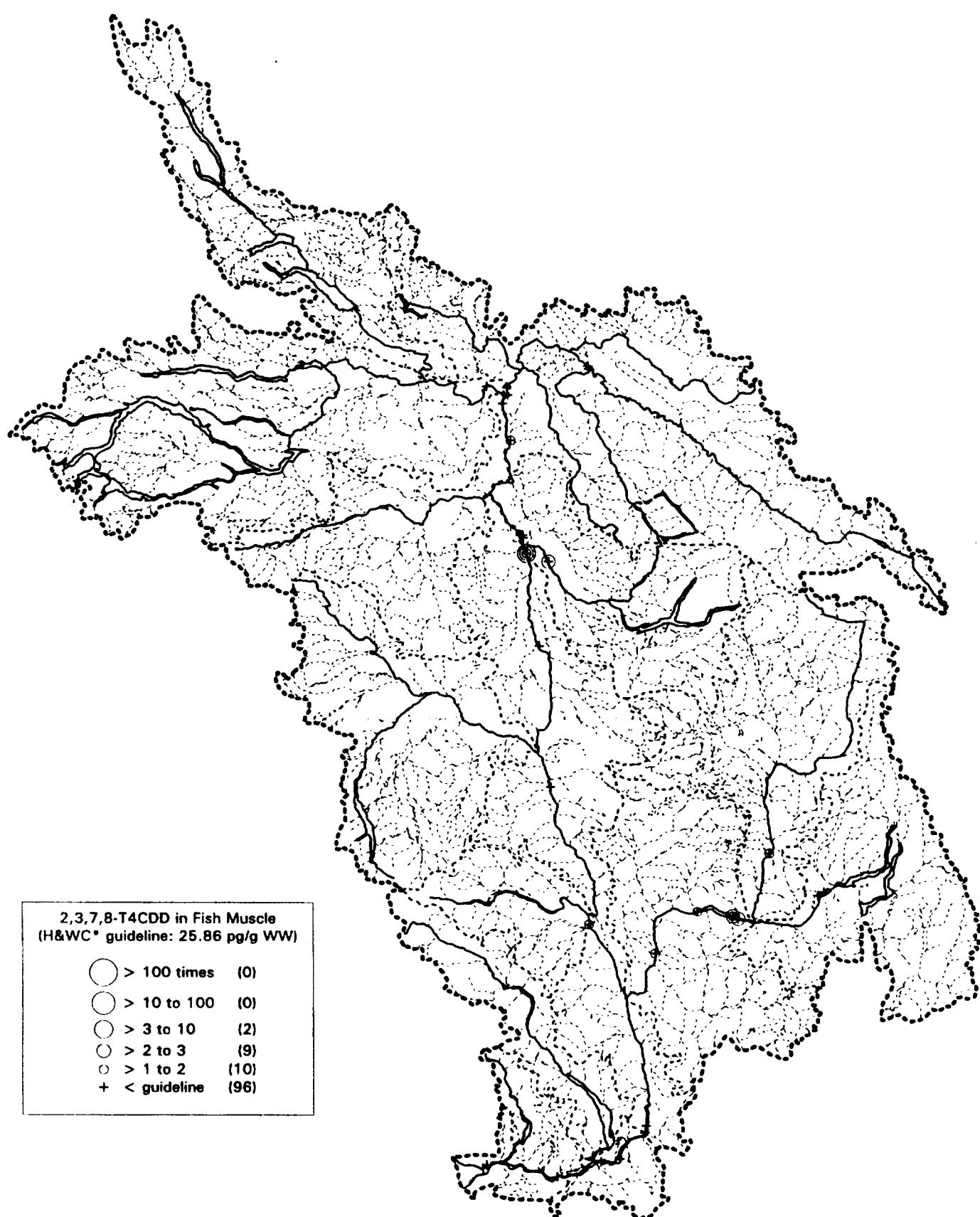
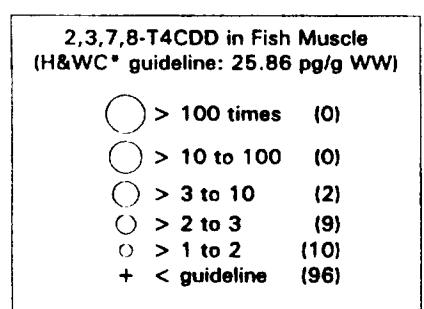
- (○) > 100 times (0)
- (○) > 10 to 100 (0)
- (○) > 3 to 10 (0)
- (○) > 2 to 3 (0)
- (○) > 1 to 2 (0)
- (+) < guideline (18)

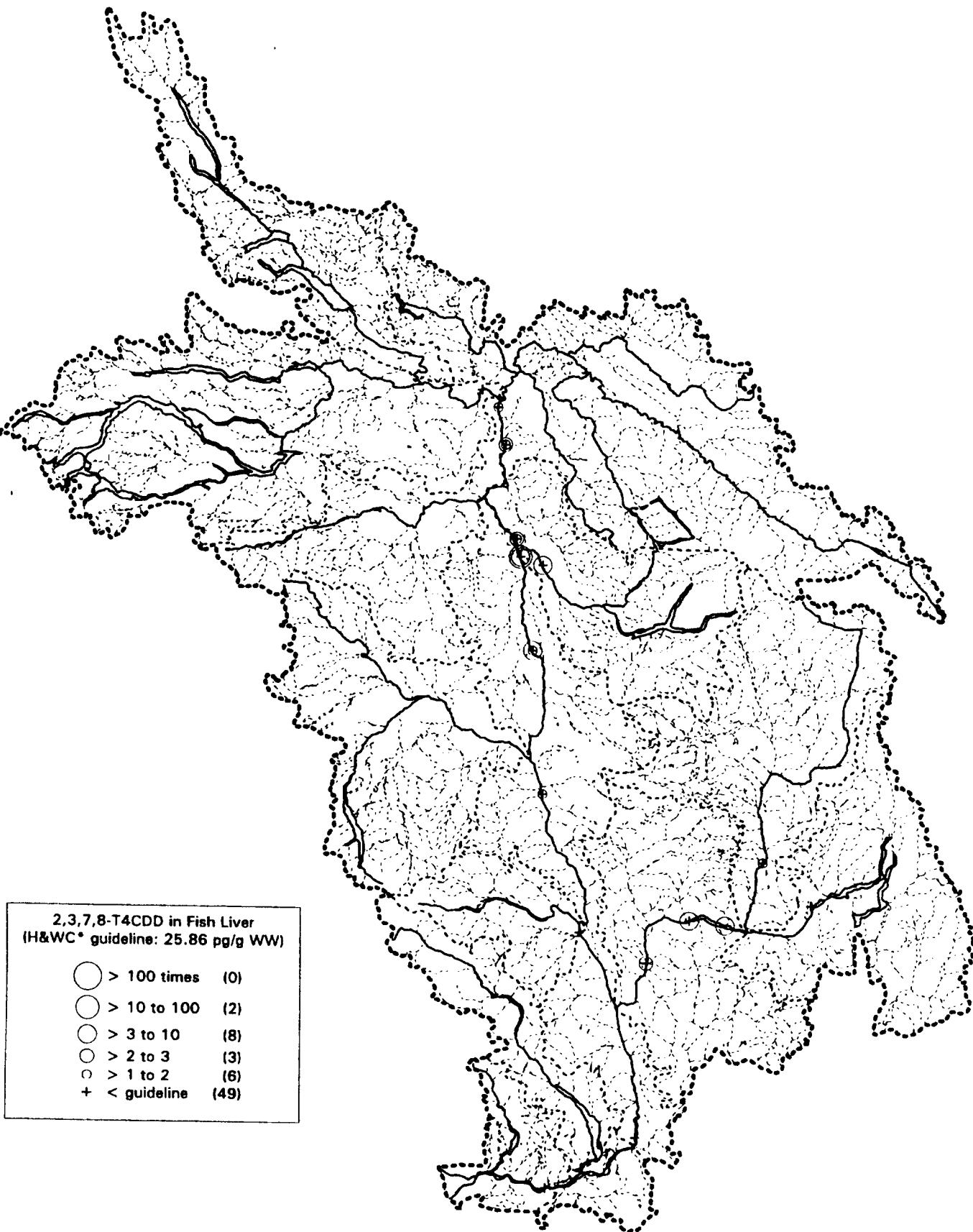


1.1.2 Dioxins and furans in fish

2,3,7,8-T4CDD in Fish Muscle

2,3,7,8-T4CDD in Fish Liver





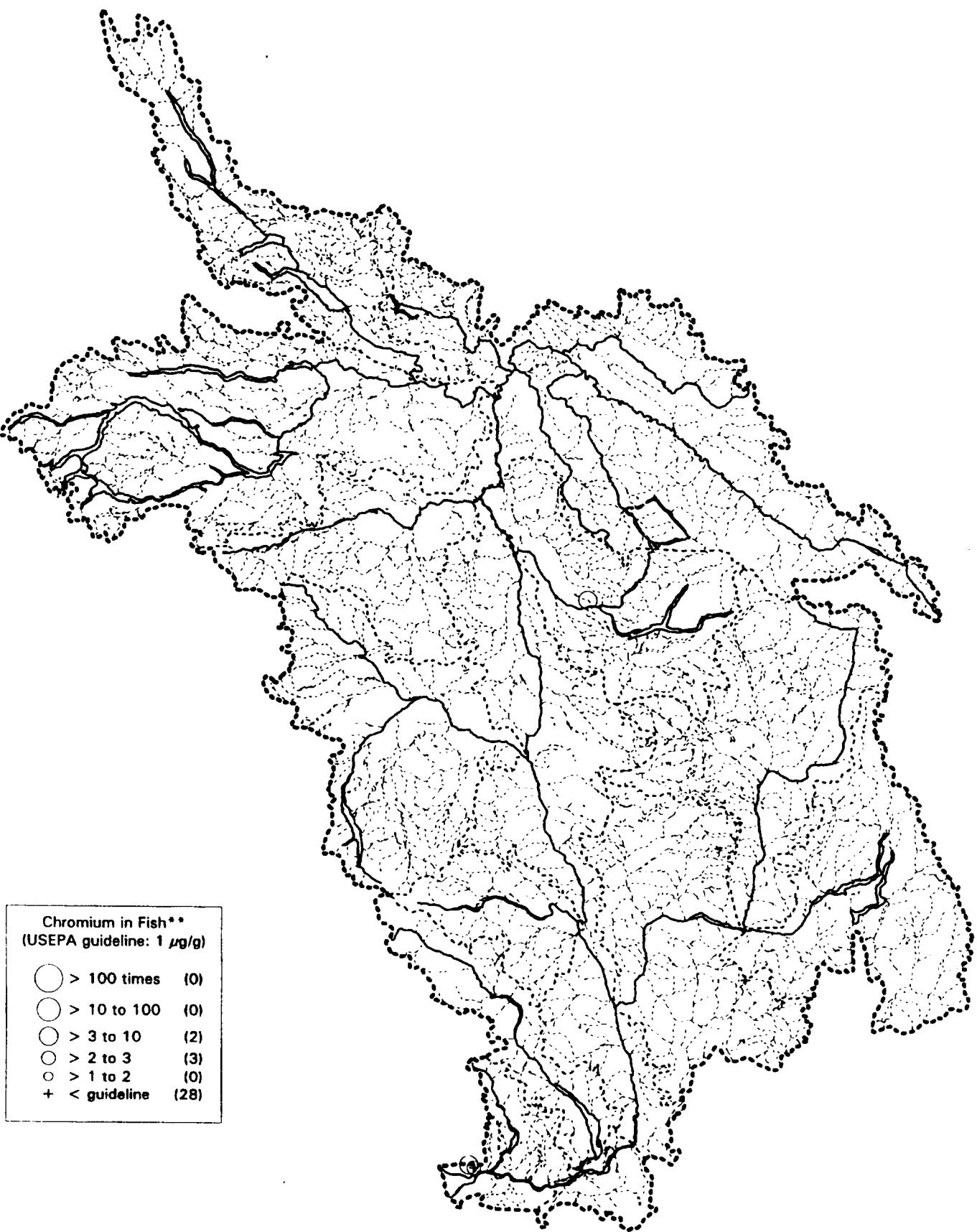
1.1.3 Metals in fish

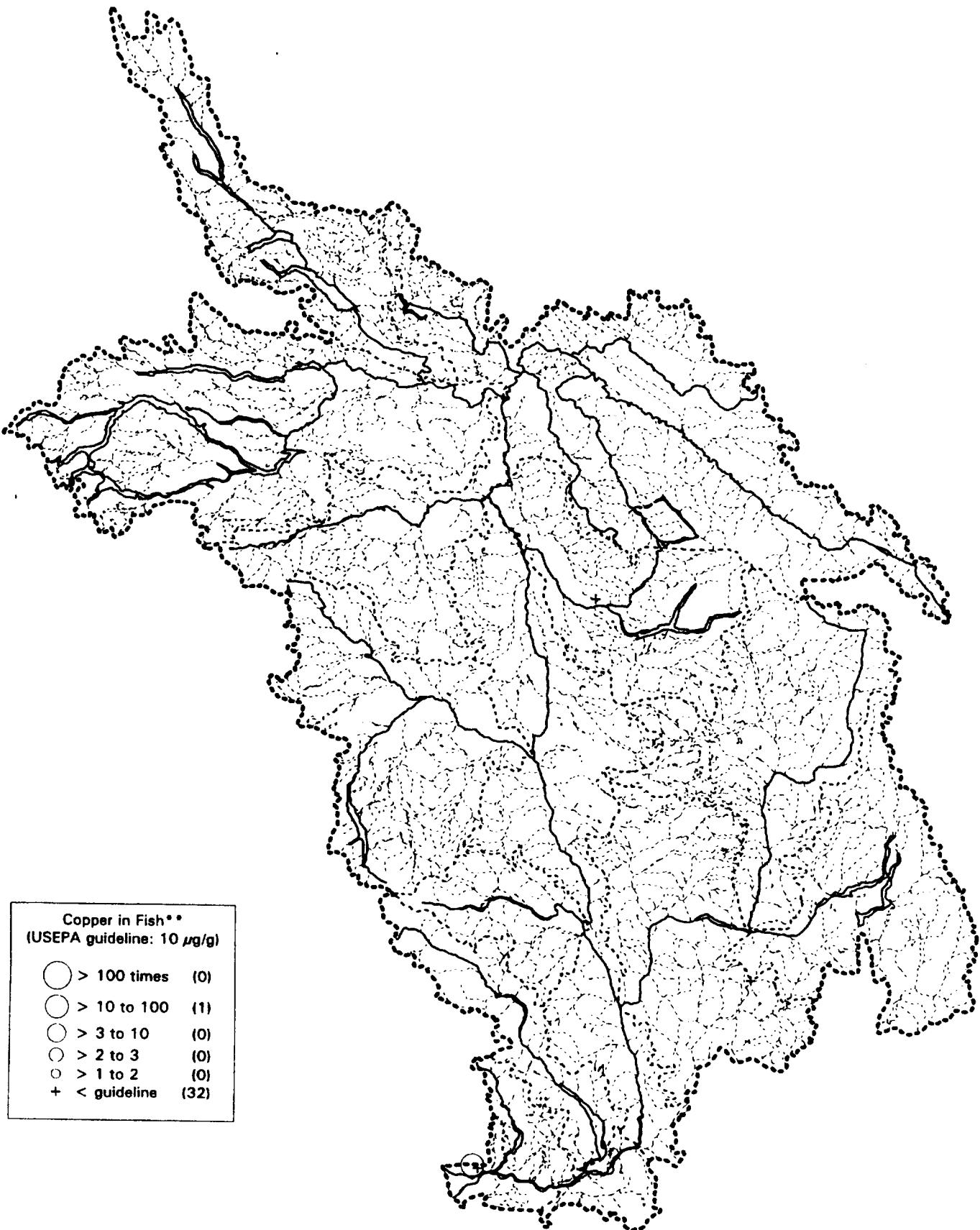
Chromium

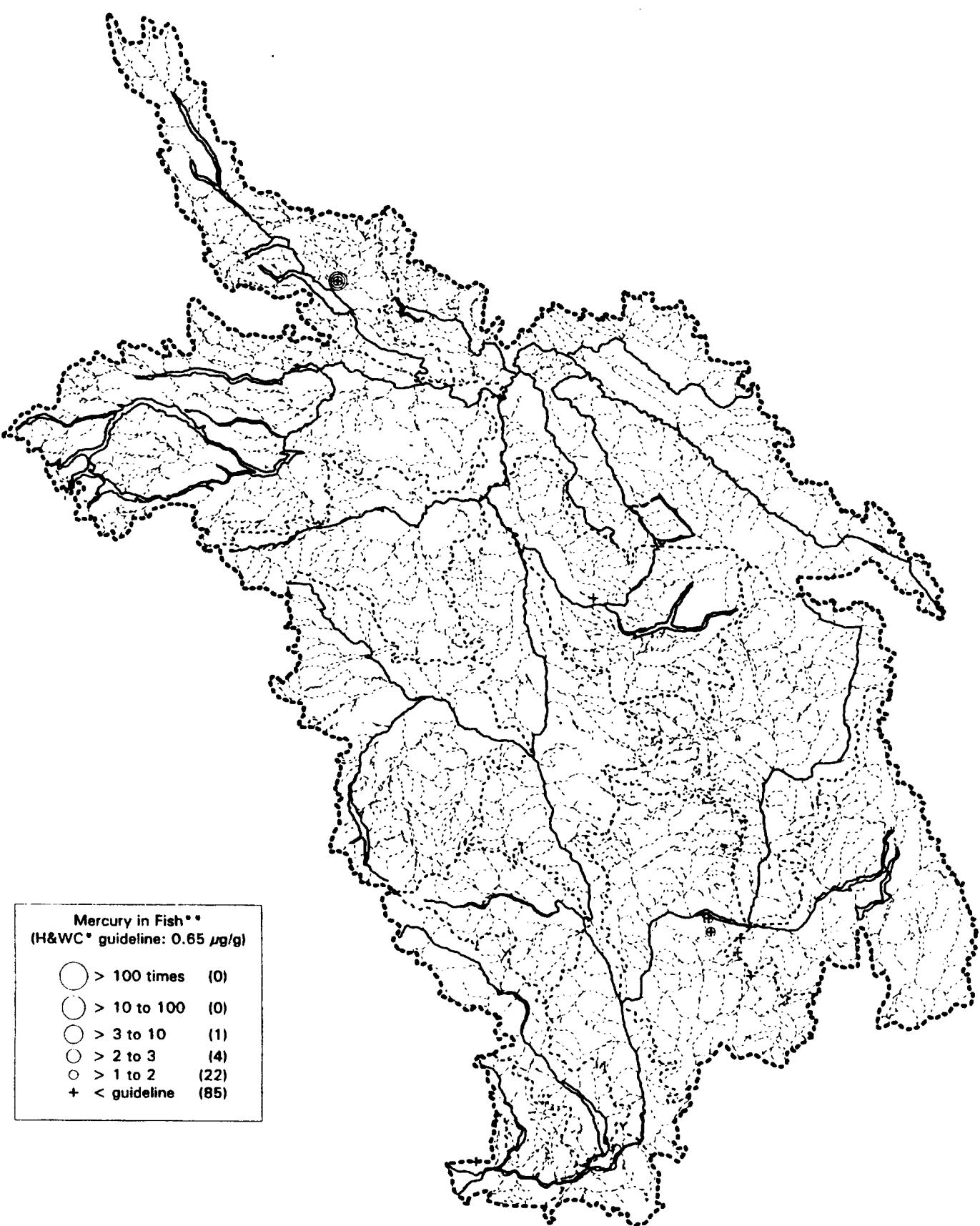
Copper

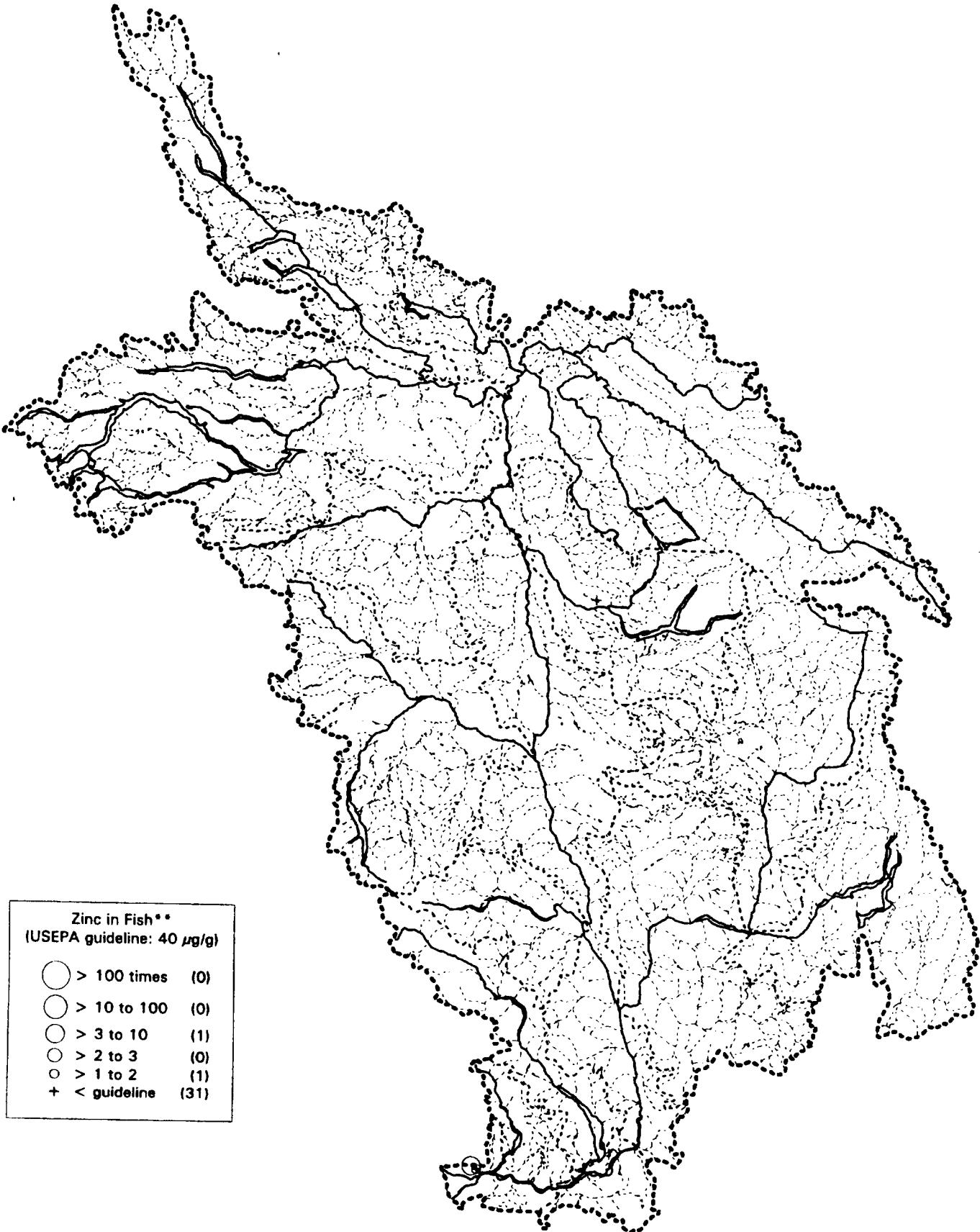
Mercury

Zinc





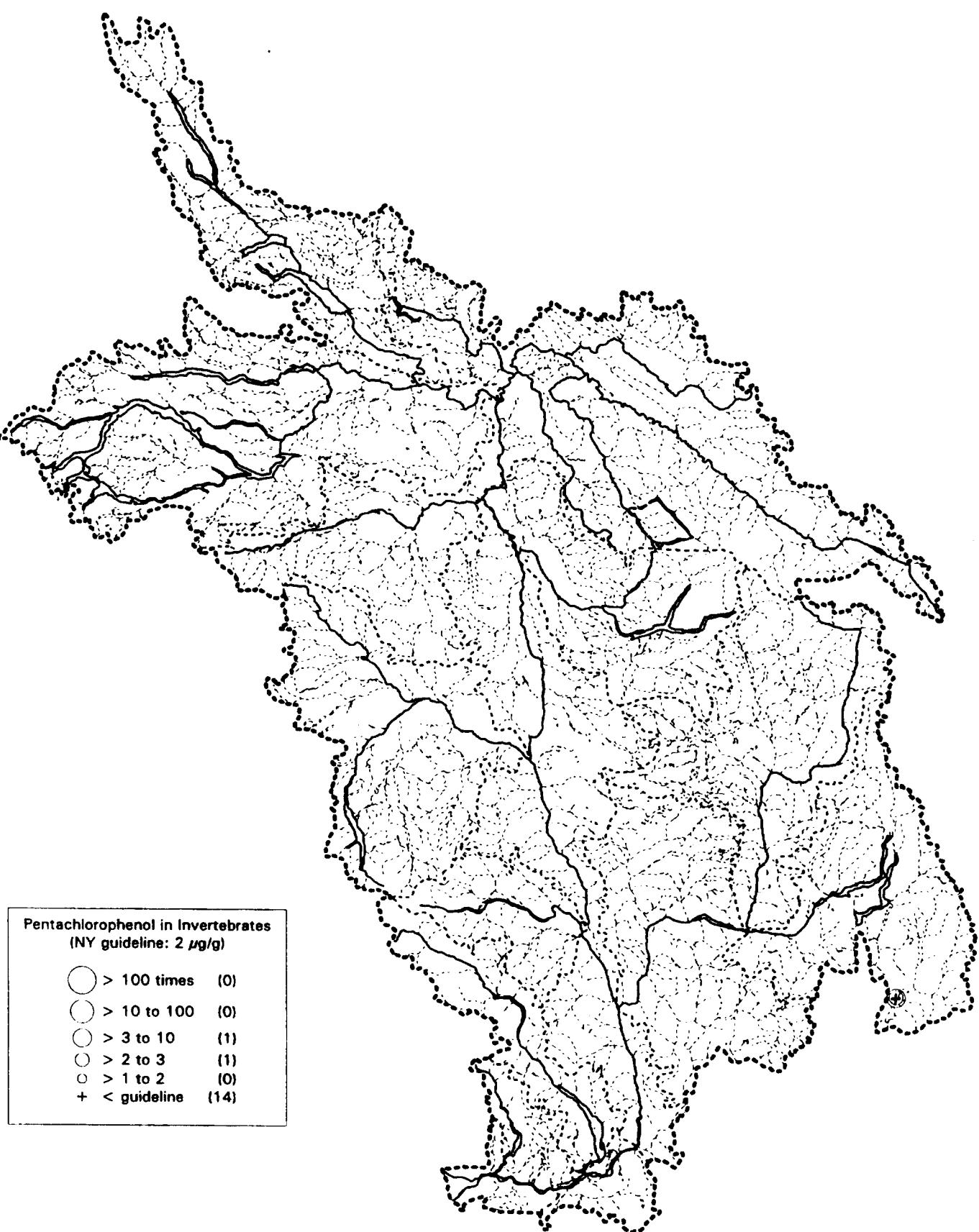




1.2 BIOTA, Aquatic Invertebrates

1.2.1 Chlorophenols in aquatic invertebrates

Pentachlorophenol



1.3 Sediment

1.3.1 Metals in sediment

Arsenic

Barium

Cadmium

Cobalt

Chromium

Copper

Iron

Lead

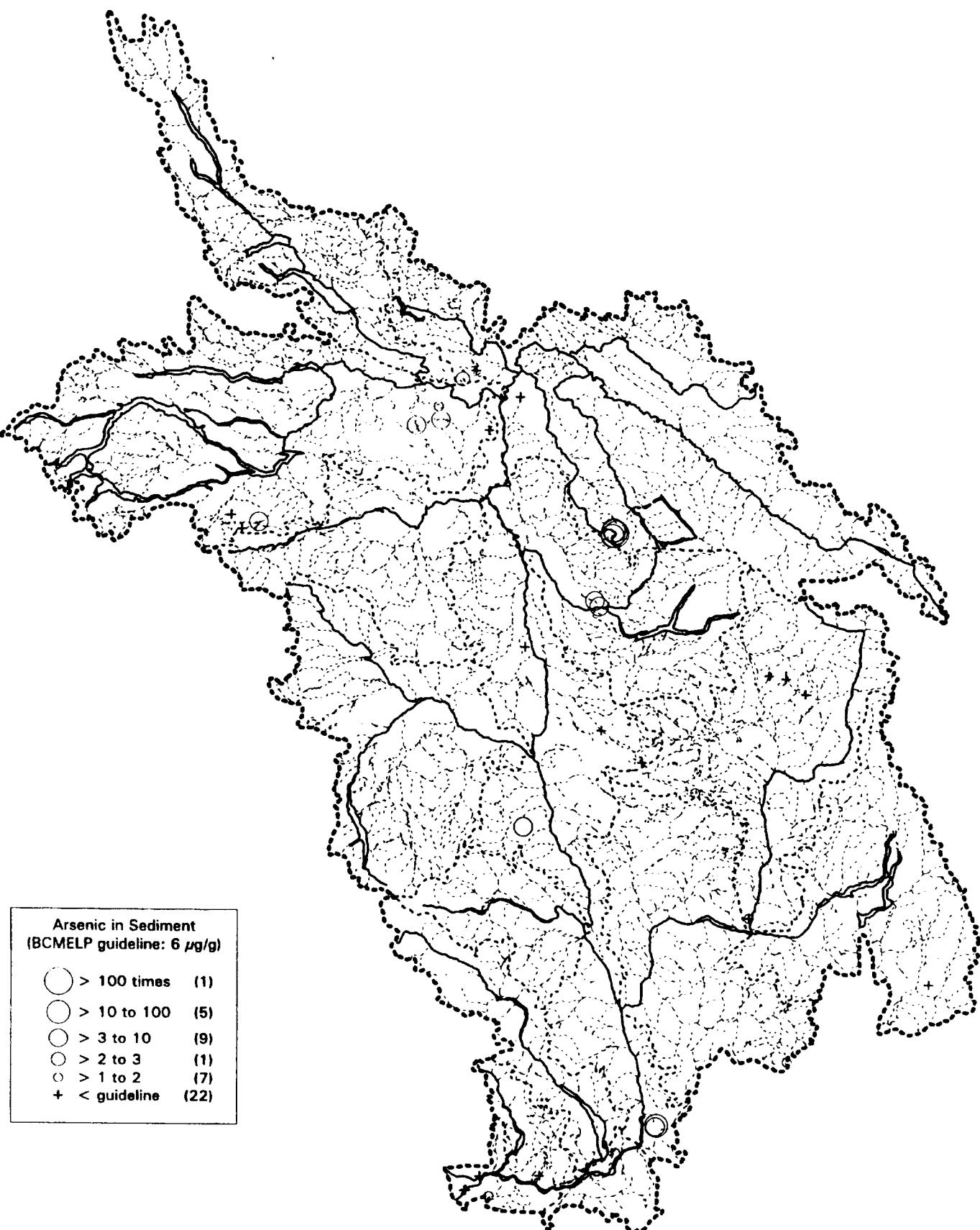
Manganese

Mercury

Nickel

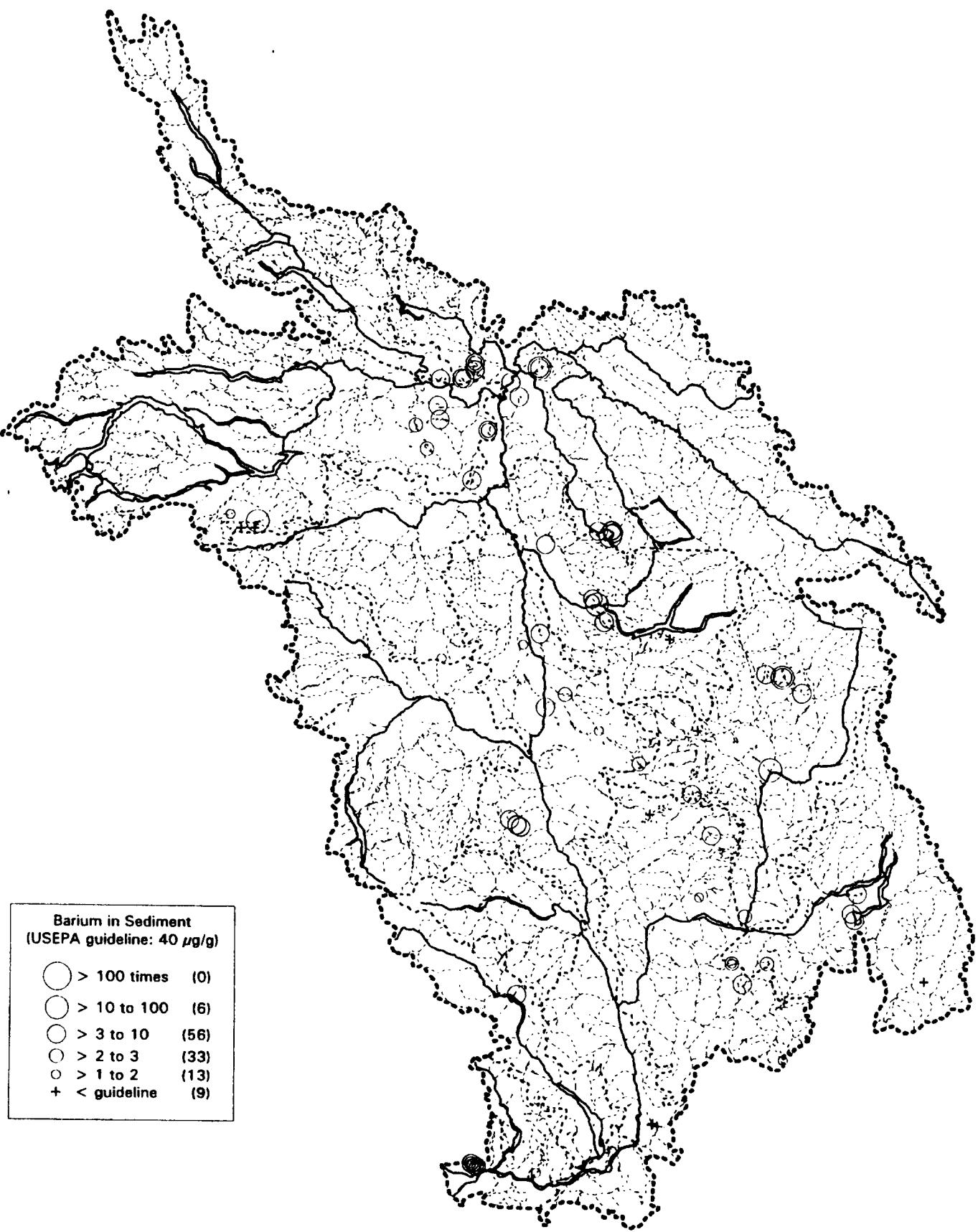
Selenium

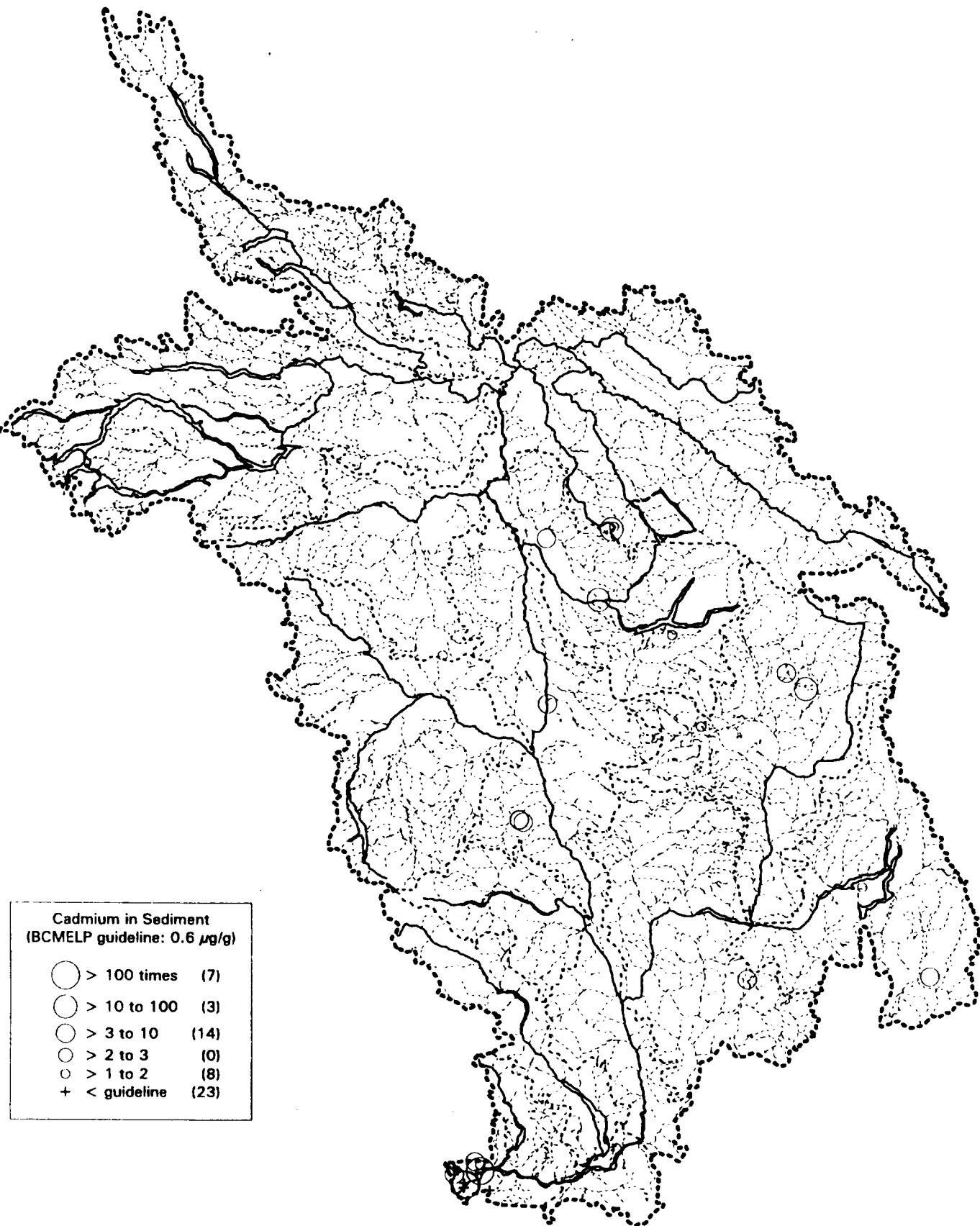
Zinc

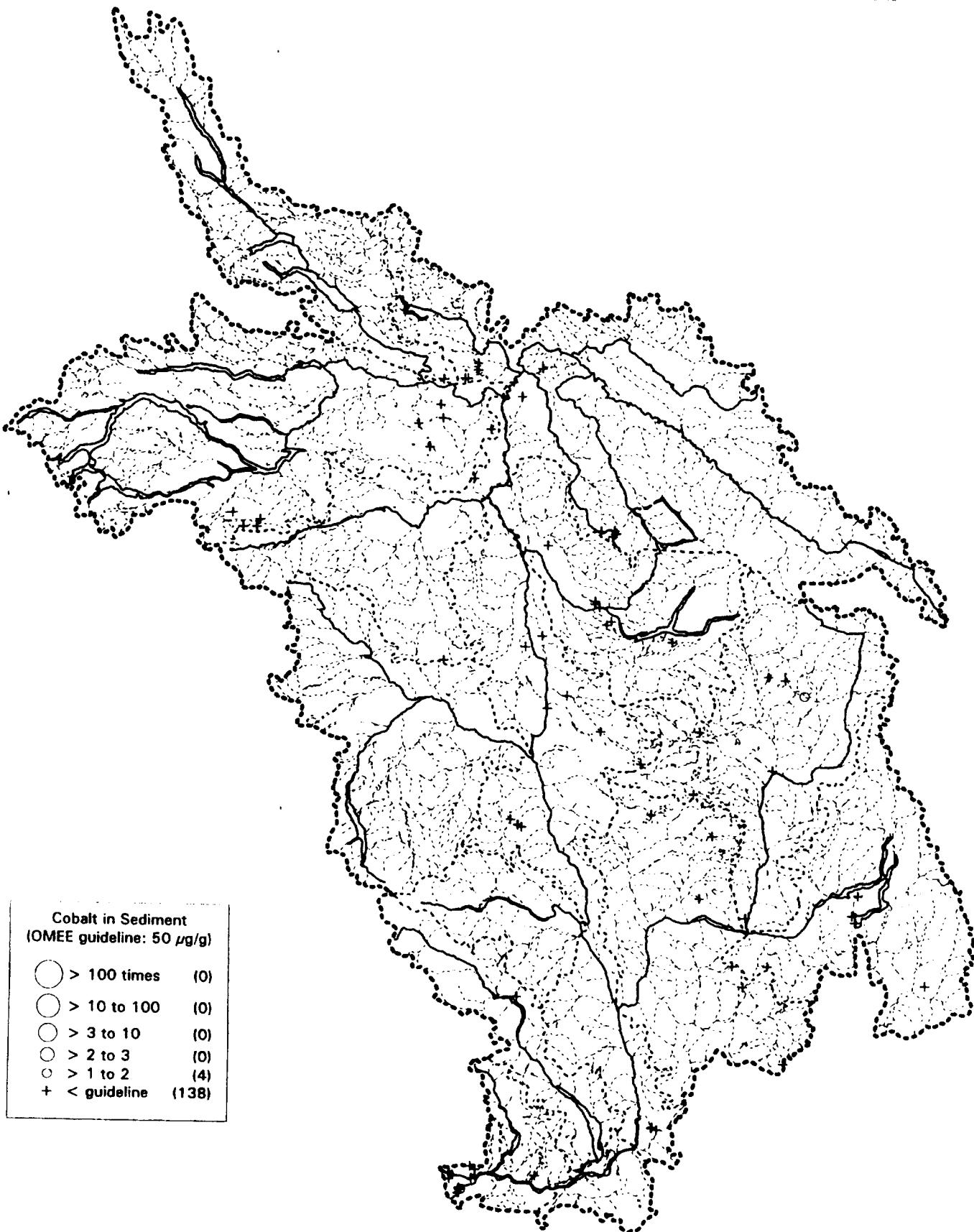


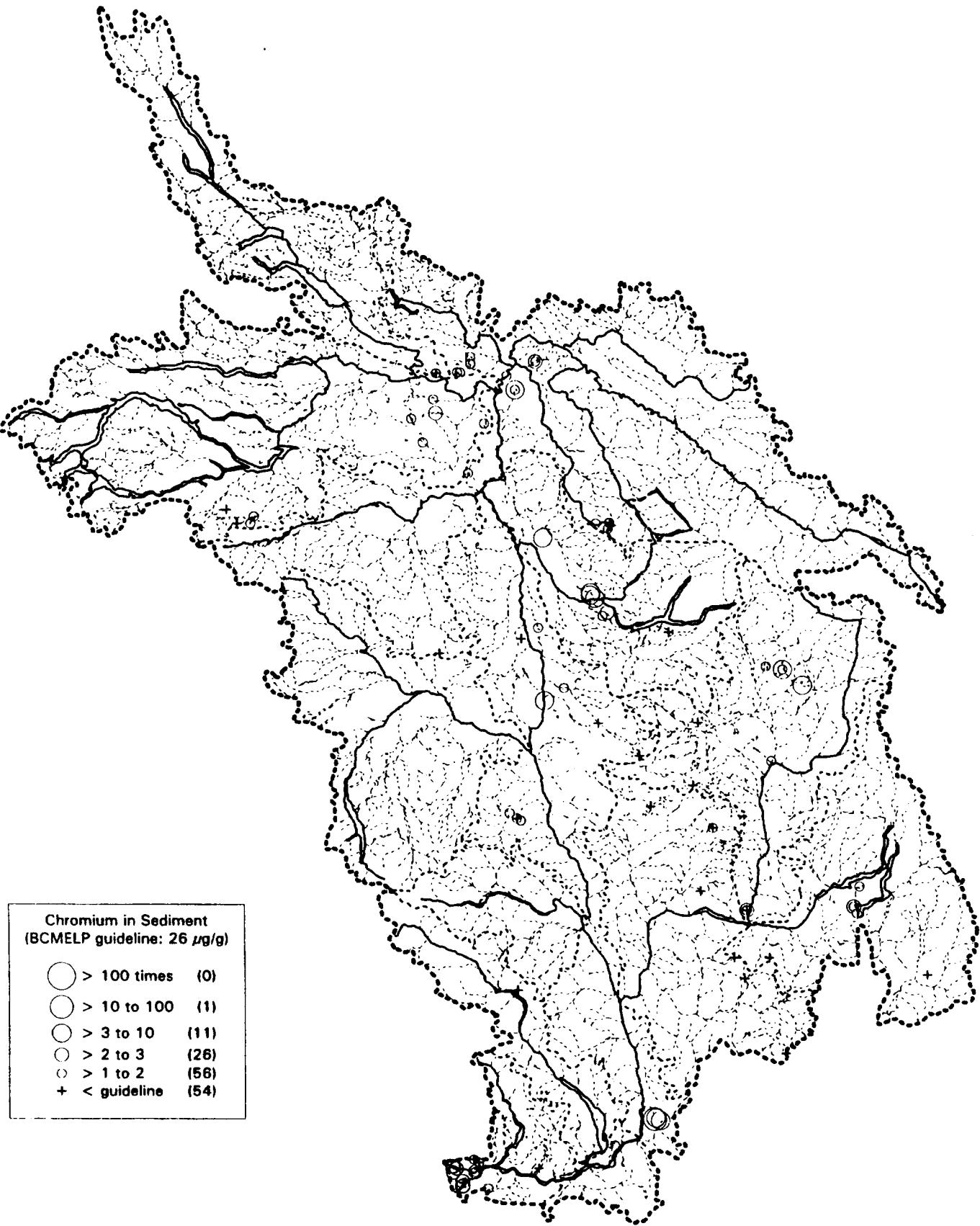
Arsenic in Sediment
(BCMELP guideline: 6 µg/g)

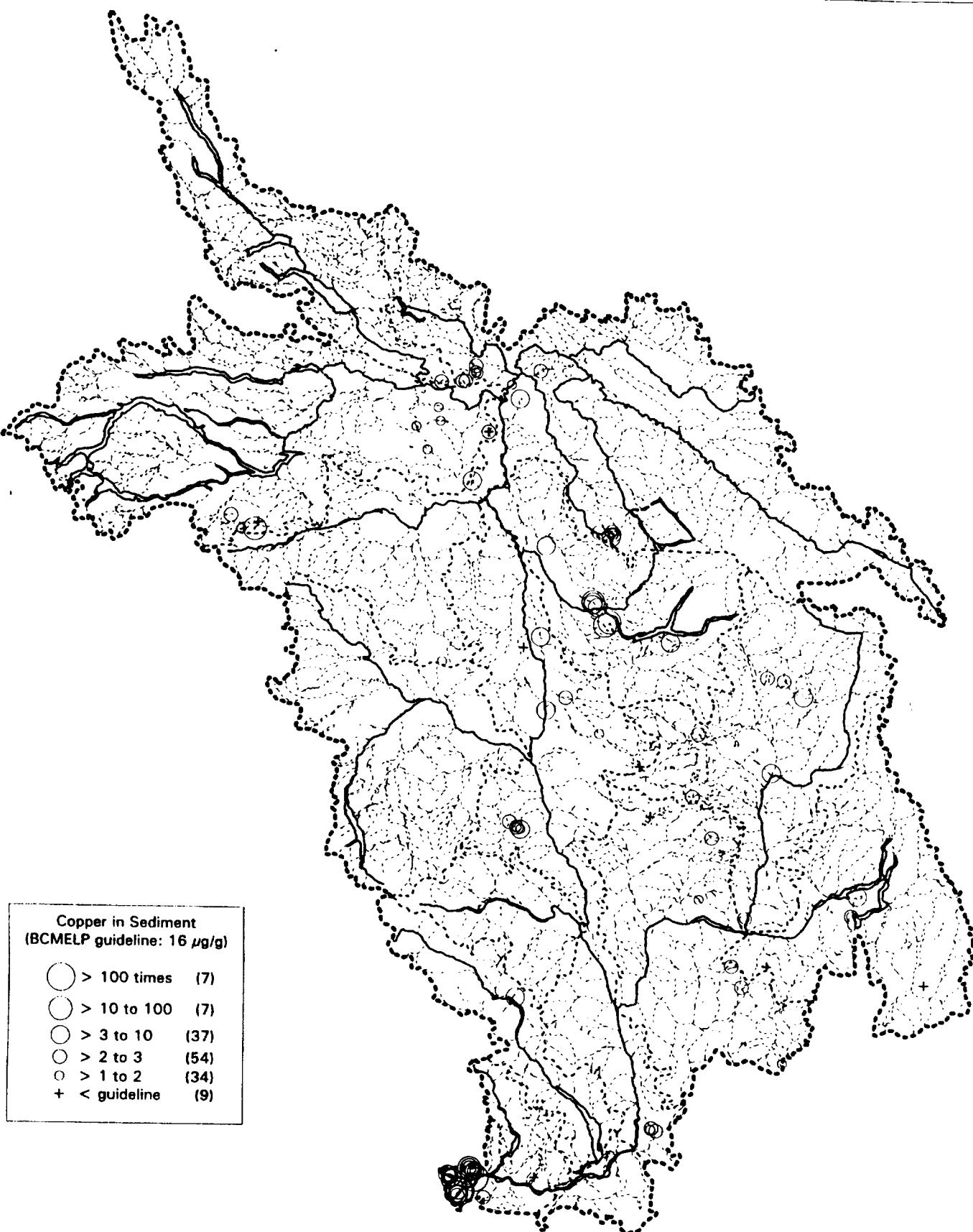
- (1) Circle: > 100 times guideline
- (5) Circle: > 10 to 100
- (9) Circle: > 3 to 10
- (1) Circle: > 2 to 3
- (7) Circle: > 1 to 2
- (22) Plus sign: < guideline

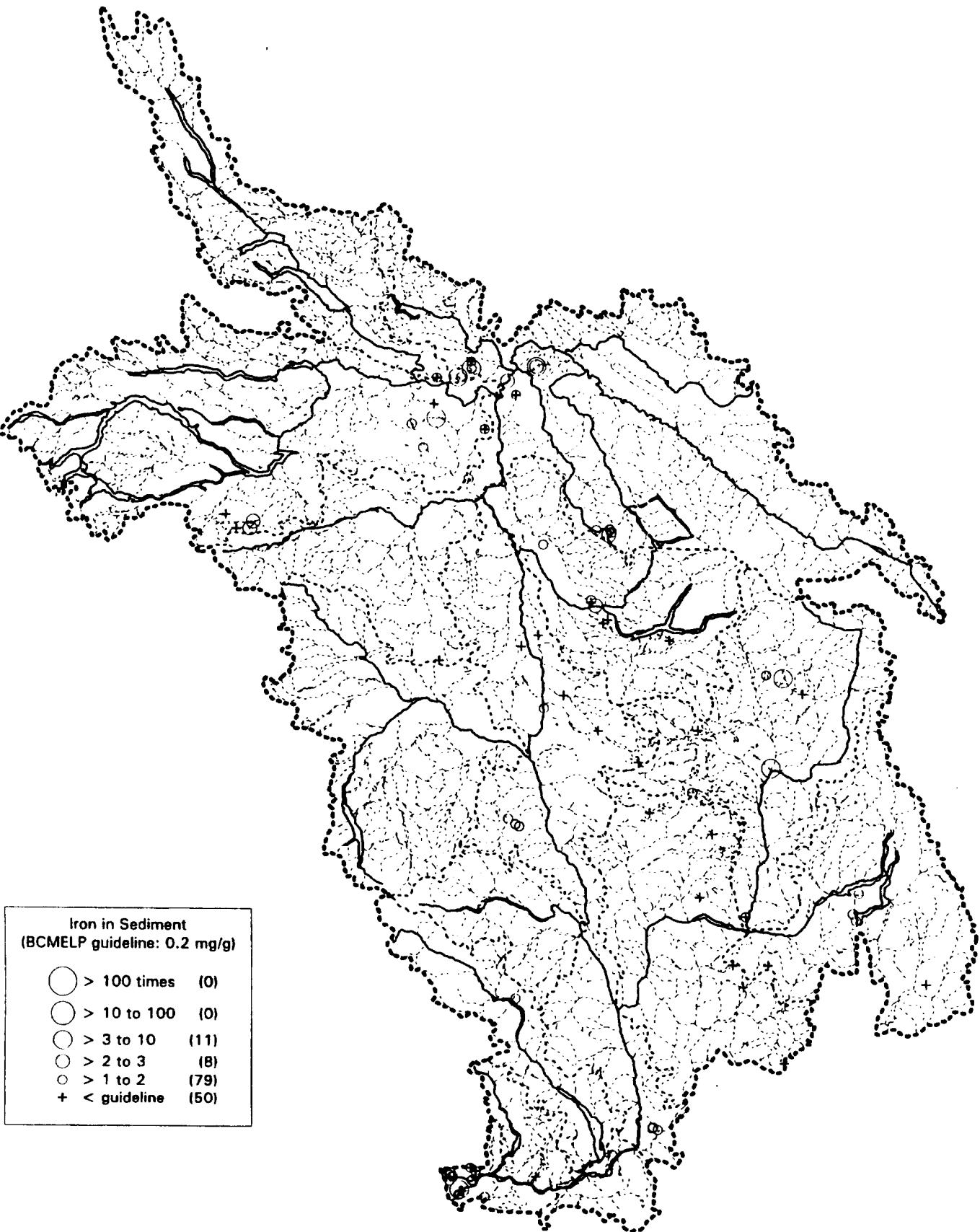


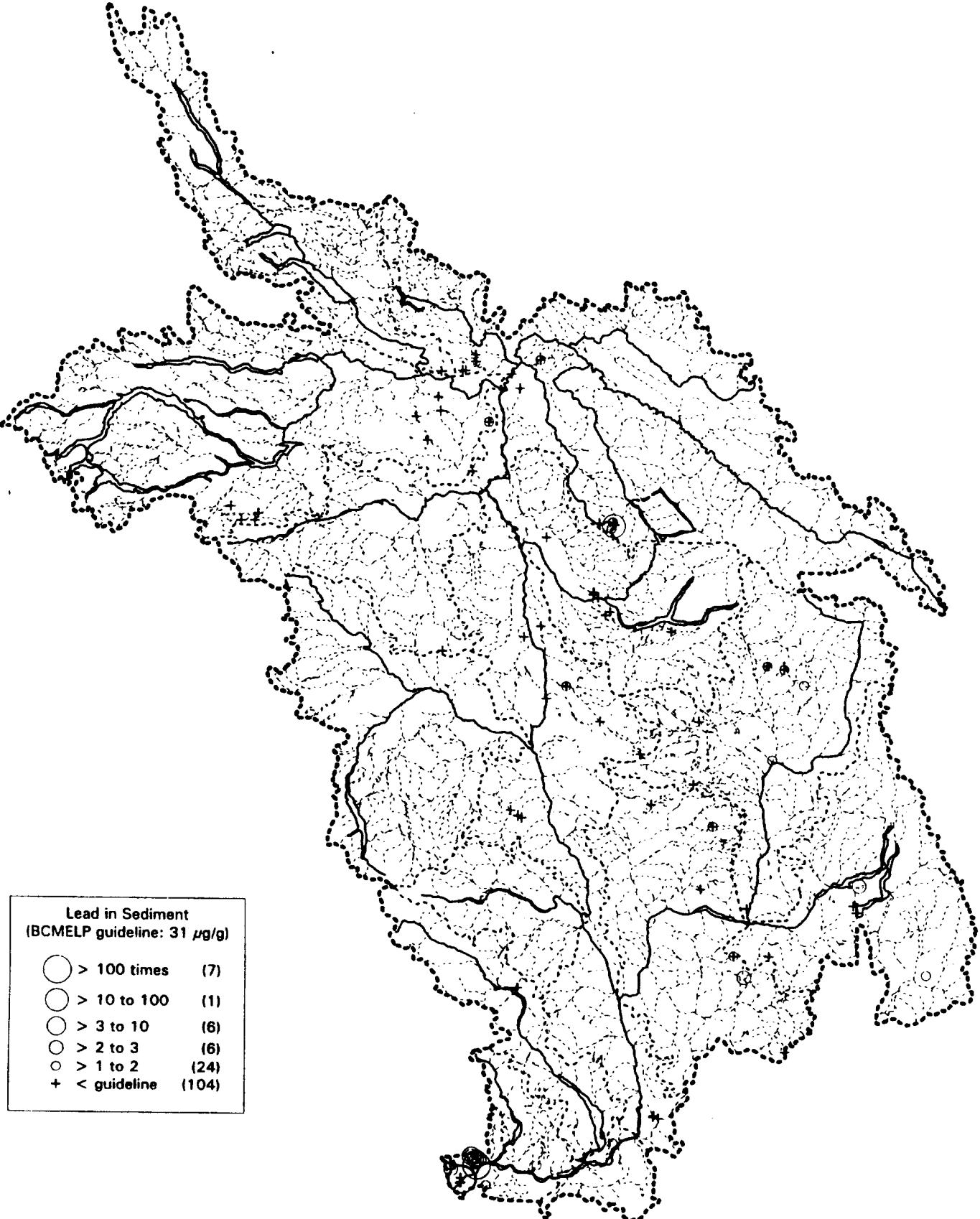


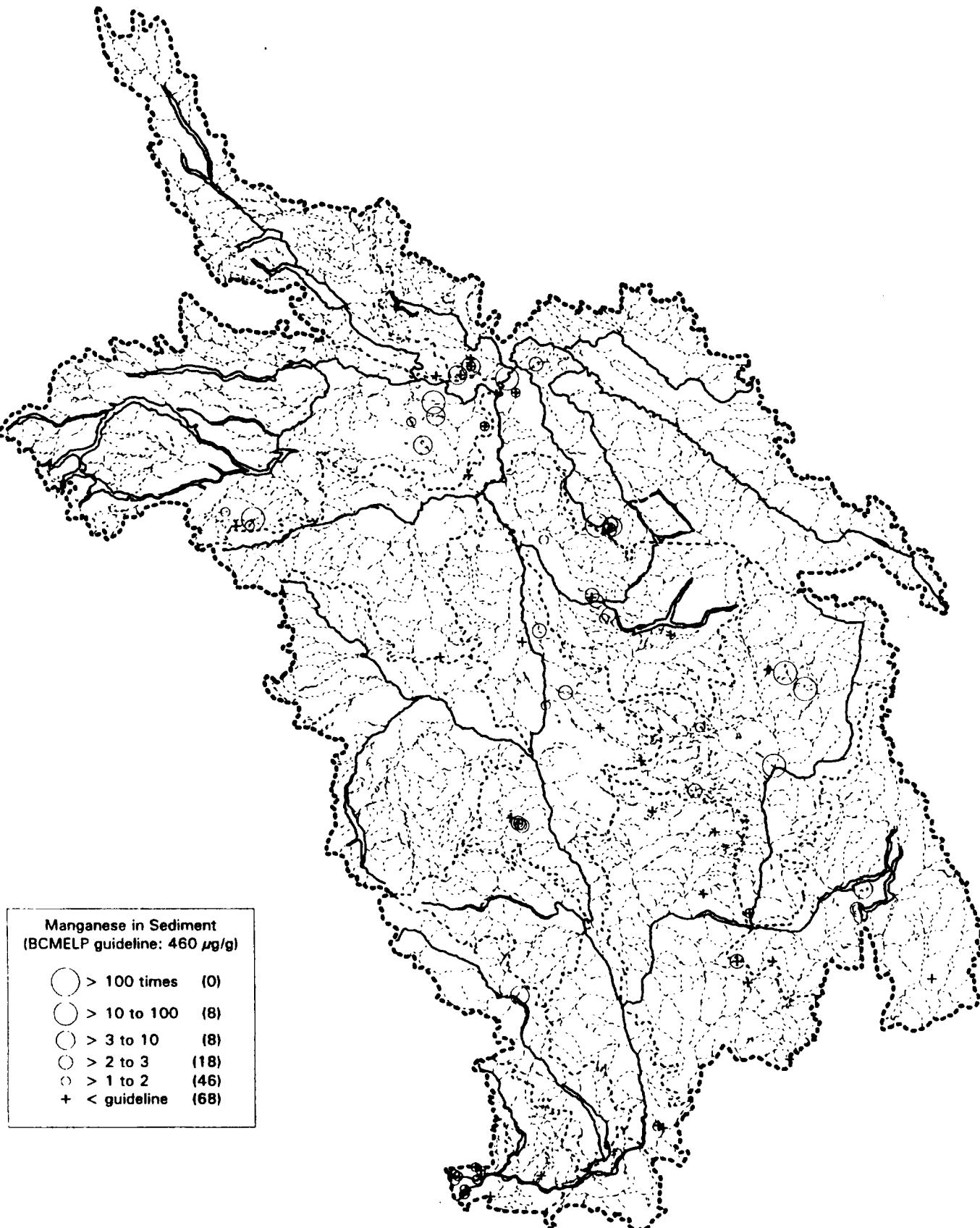


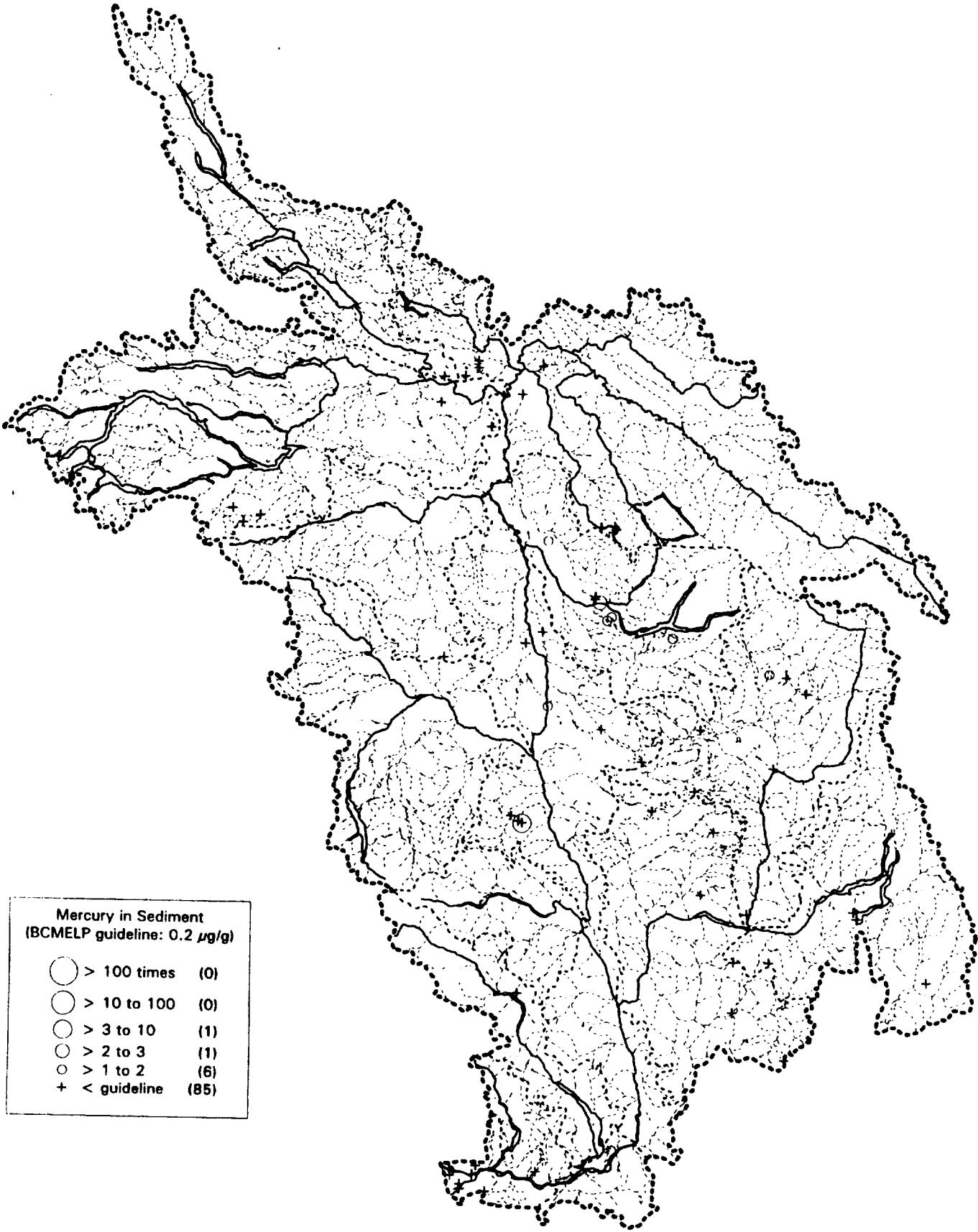


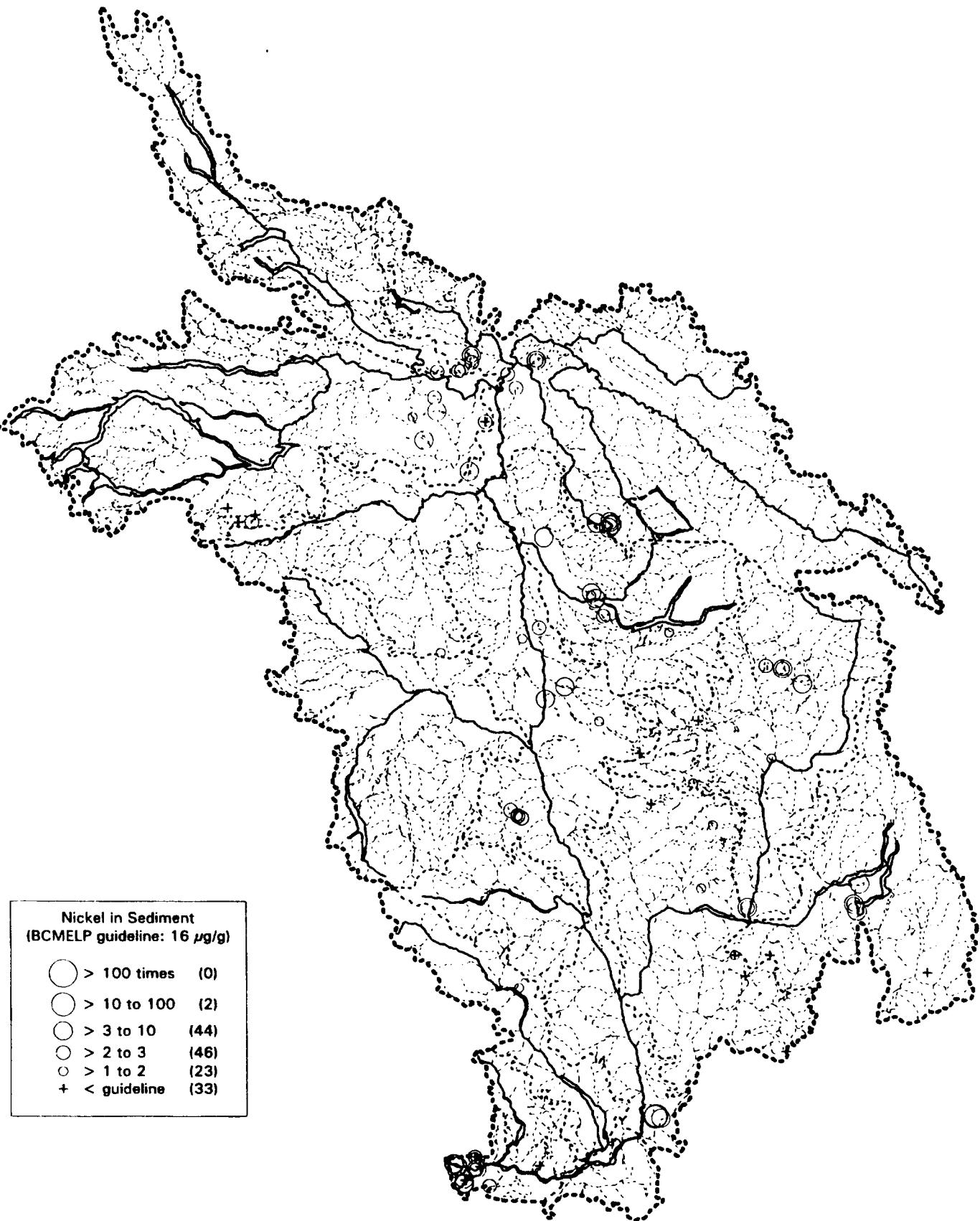


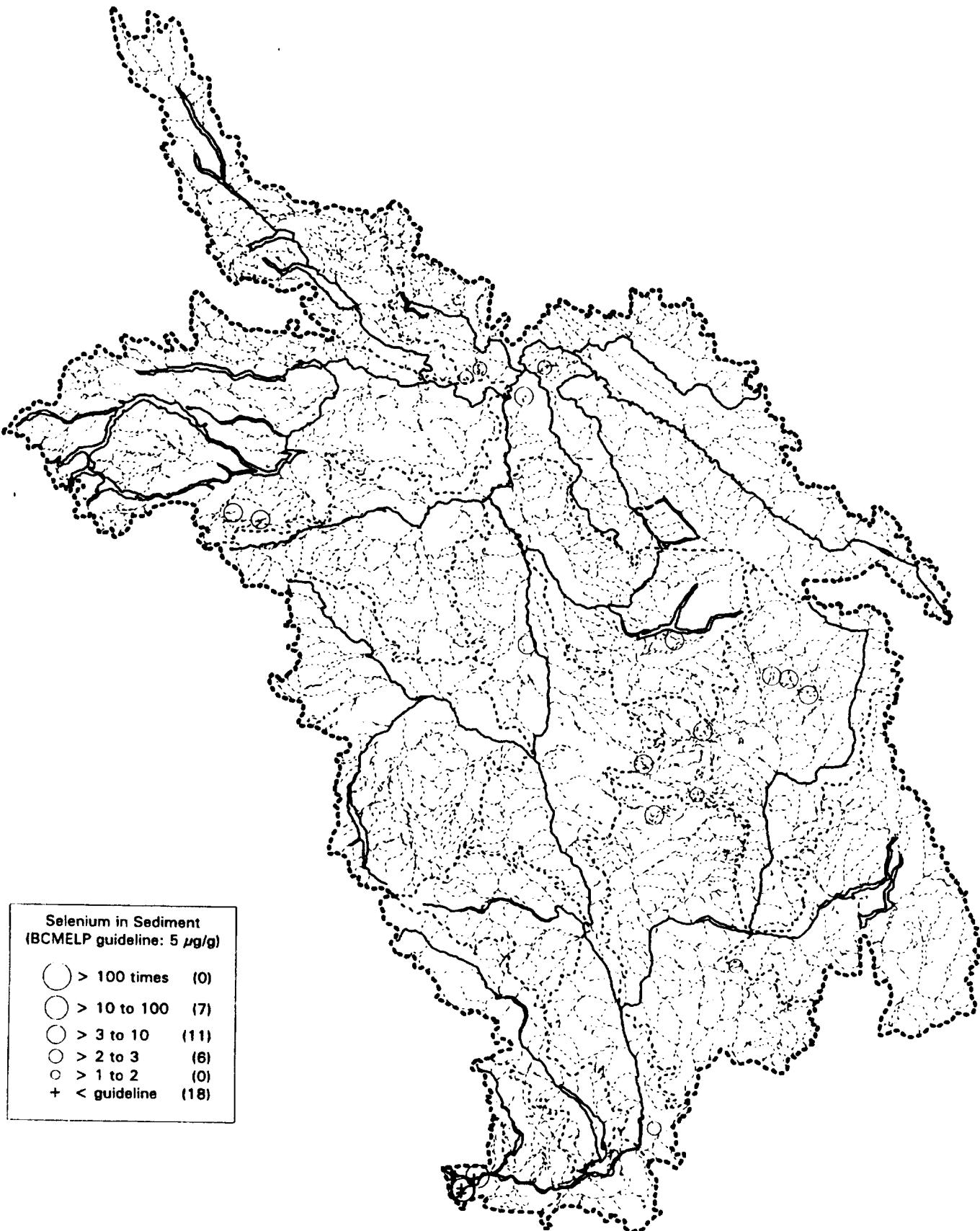


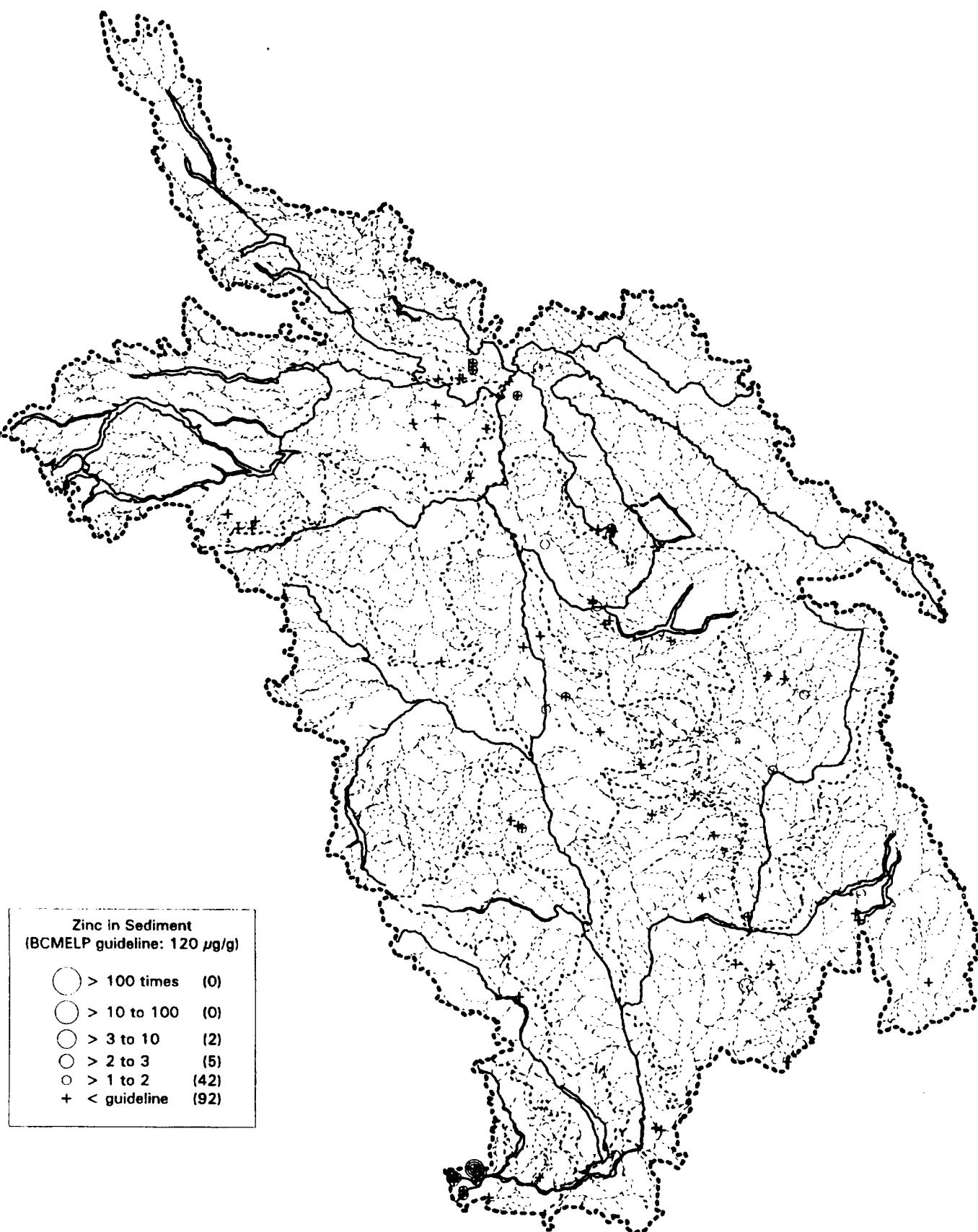












1.3.2 Polycyclic aromatic hydrocarbons (PAHs) in sediment

Acenaphthene

Acenaphthylene

Anthracene

Benzo(a)anthracene

Benzo(a)pyrene

Benzo(ghi)perylene

Benzo(k)fluoranthene

Crysene

Fluoranthene

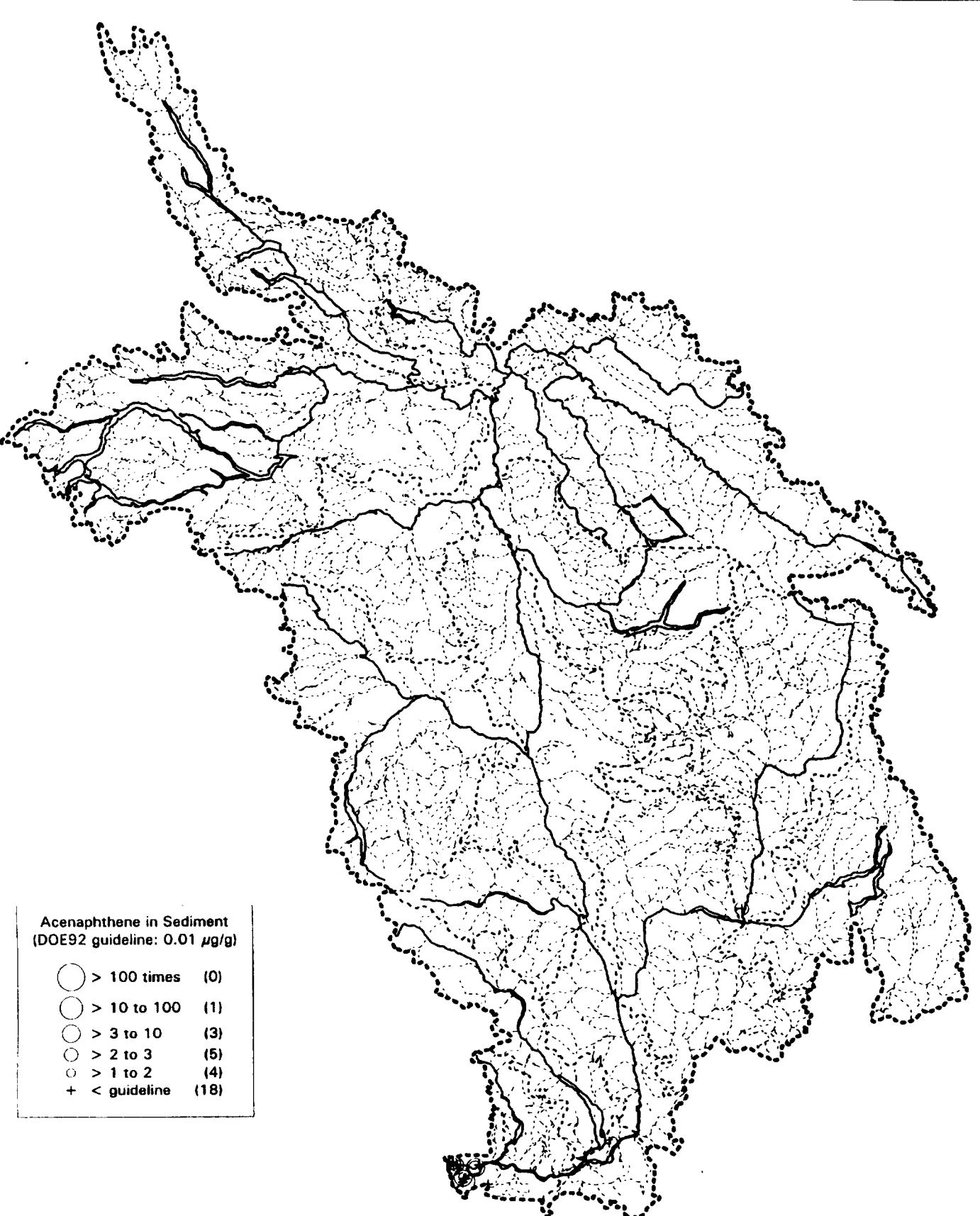
Fluorene

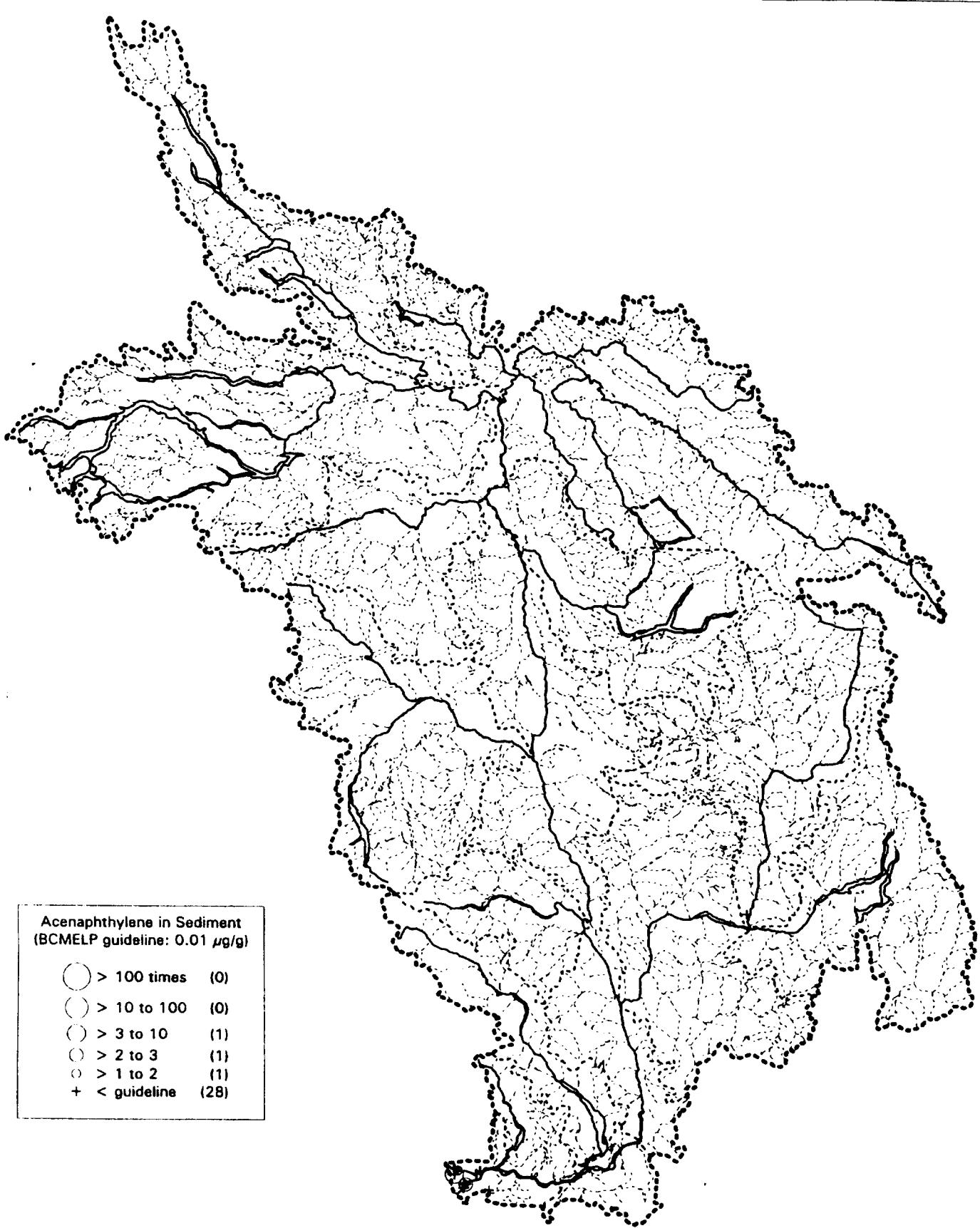
Indeno(1,2,3-cd)pyrene

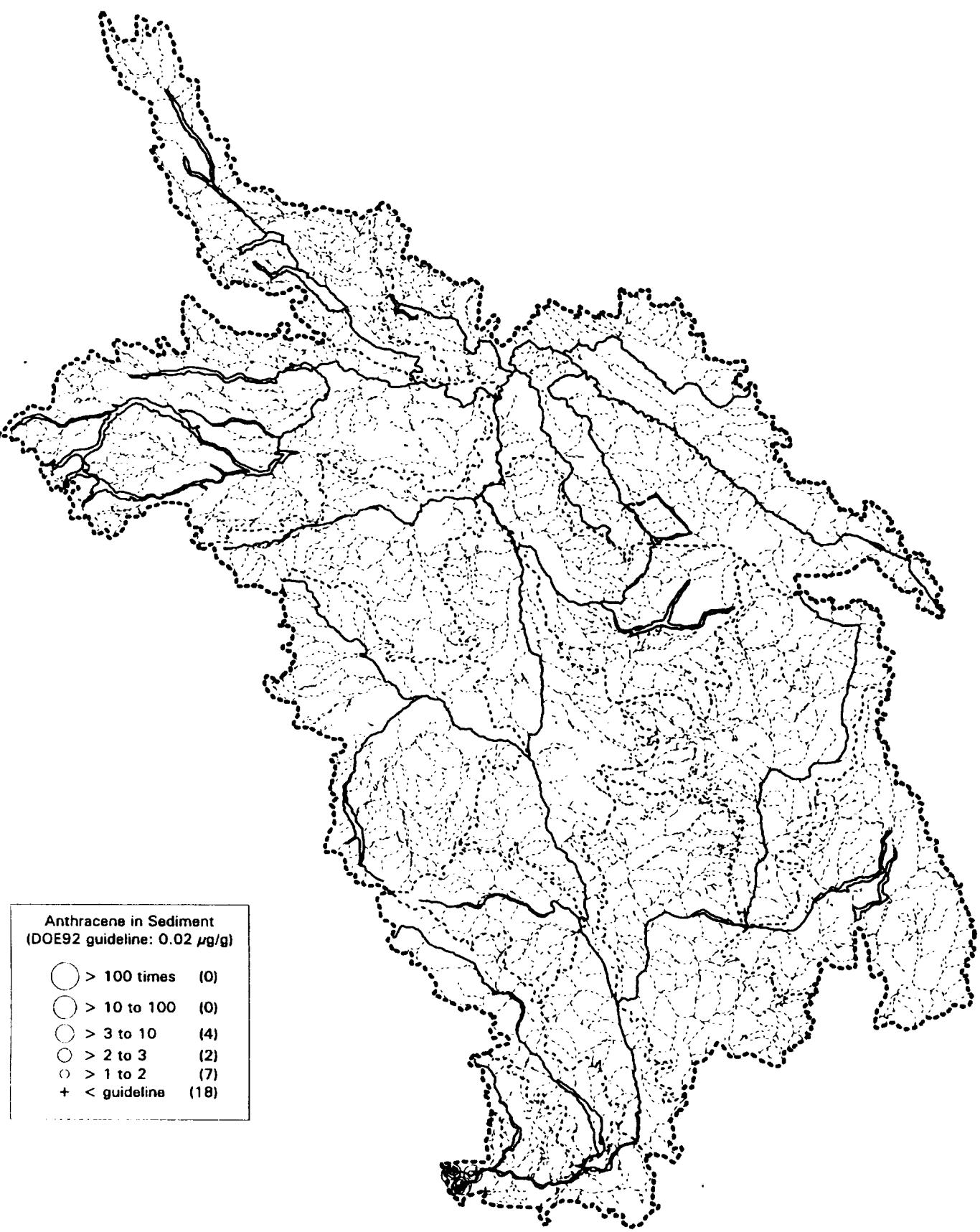
Naphthalene

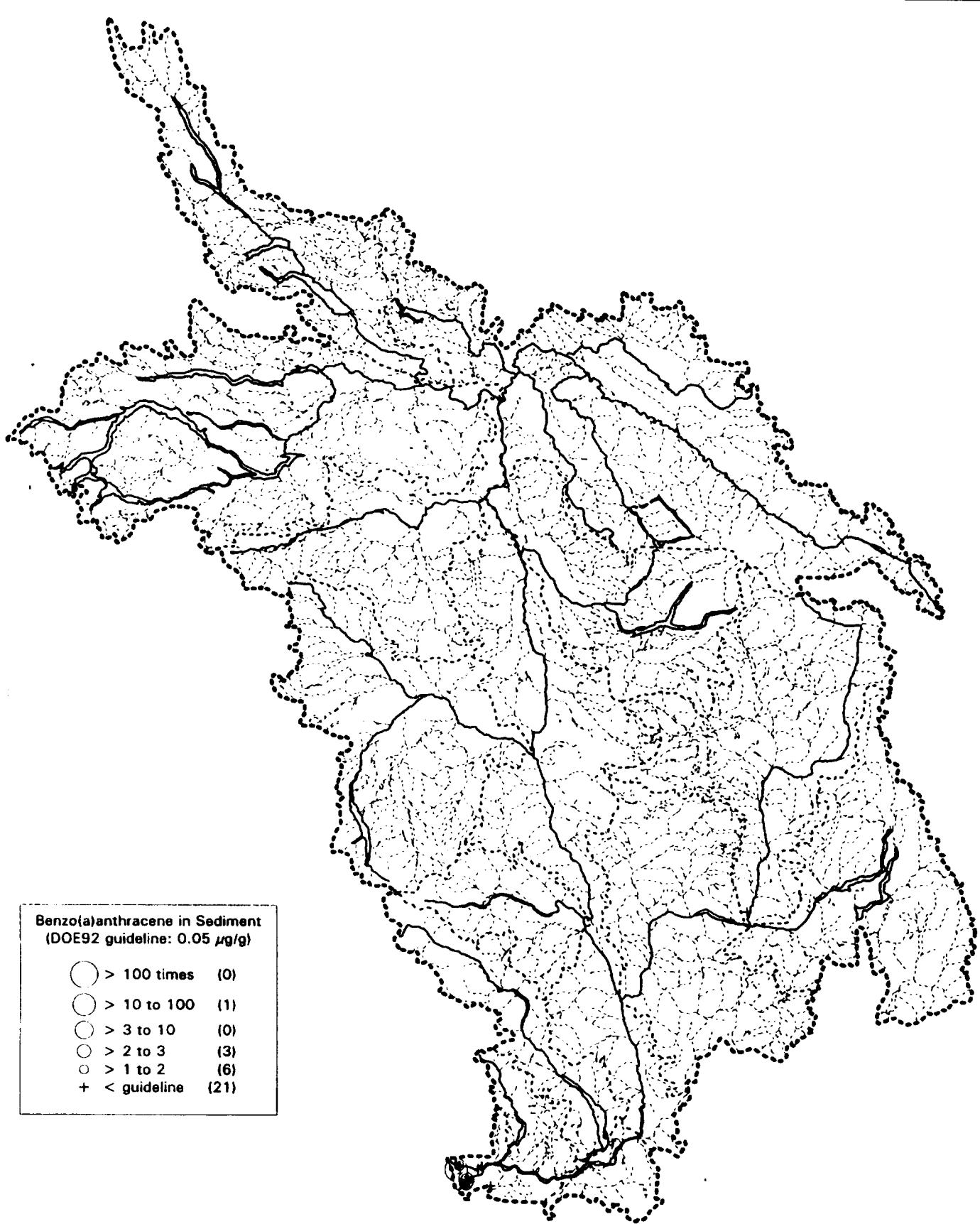
Phenanthrene

Pyrene



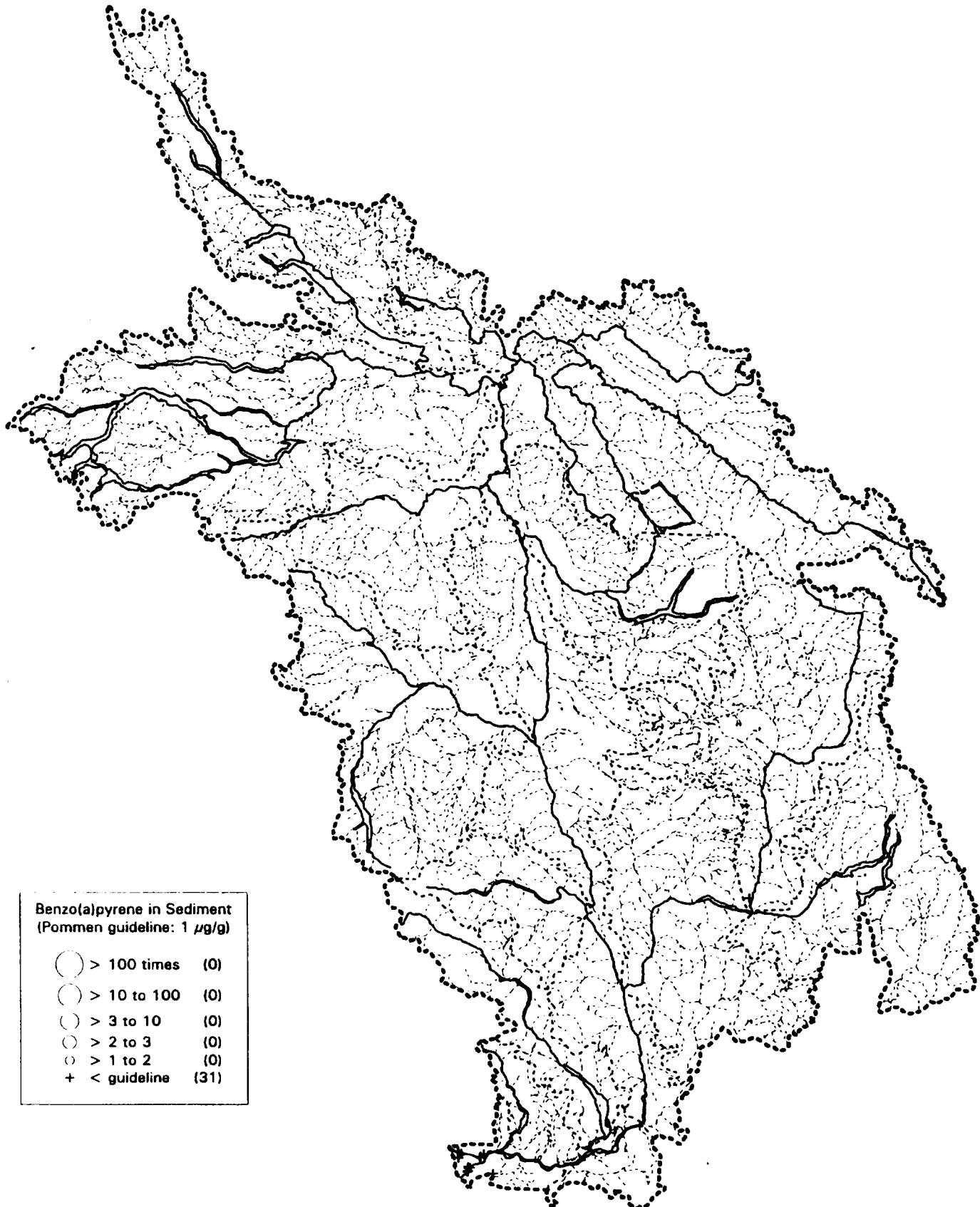


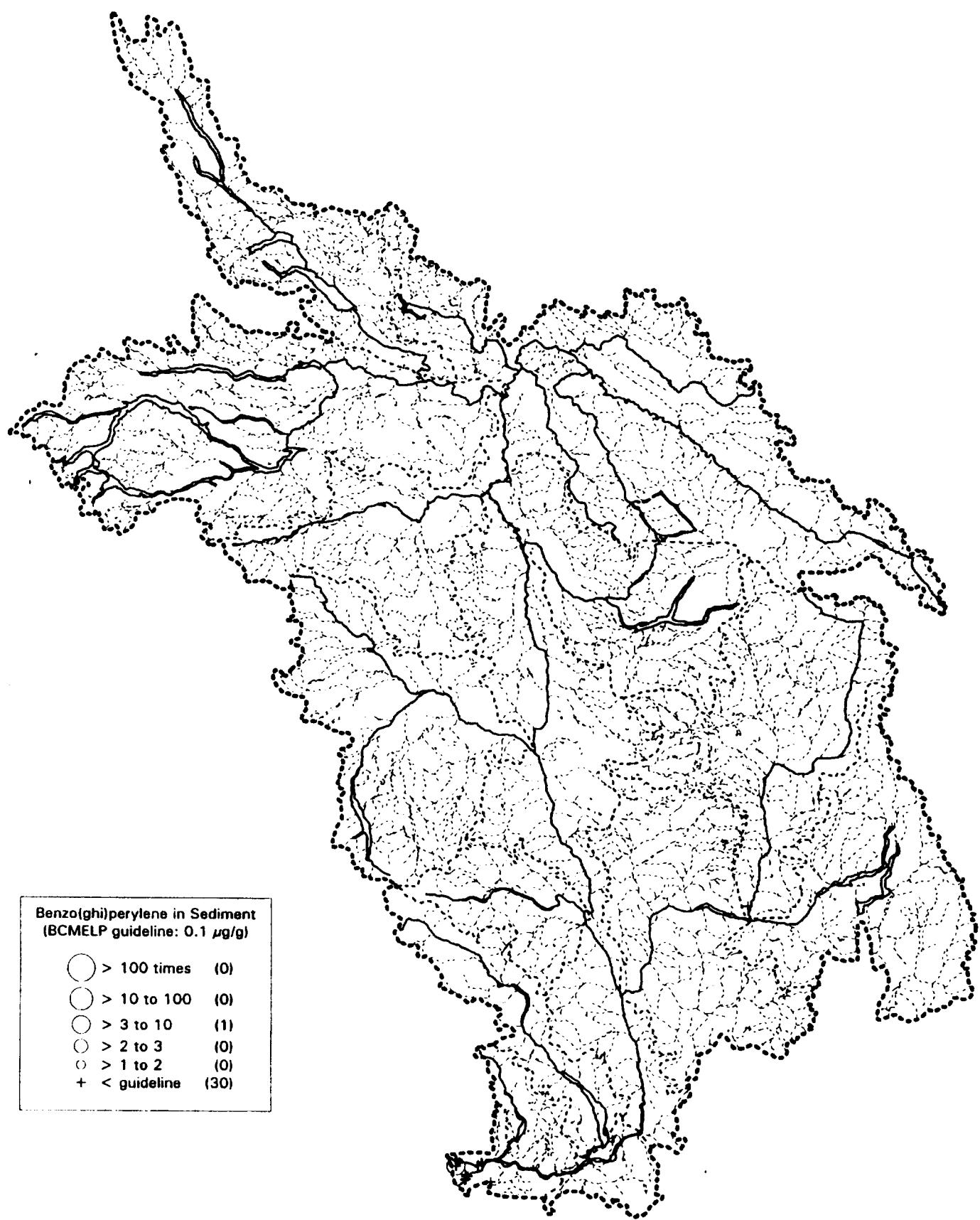


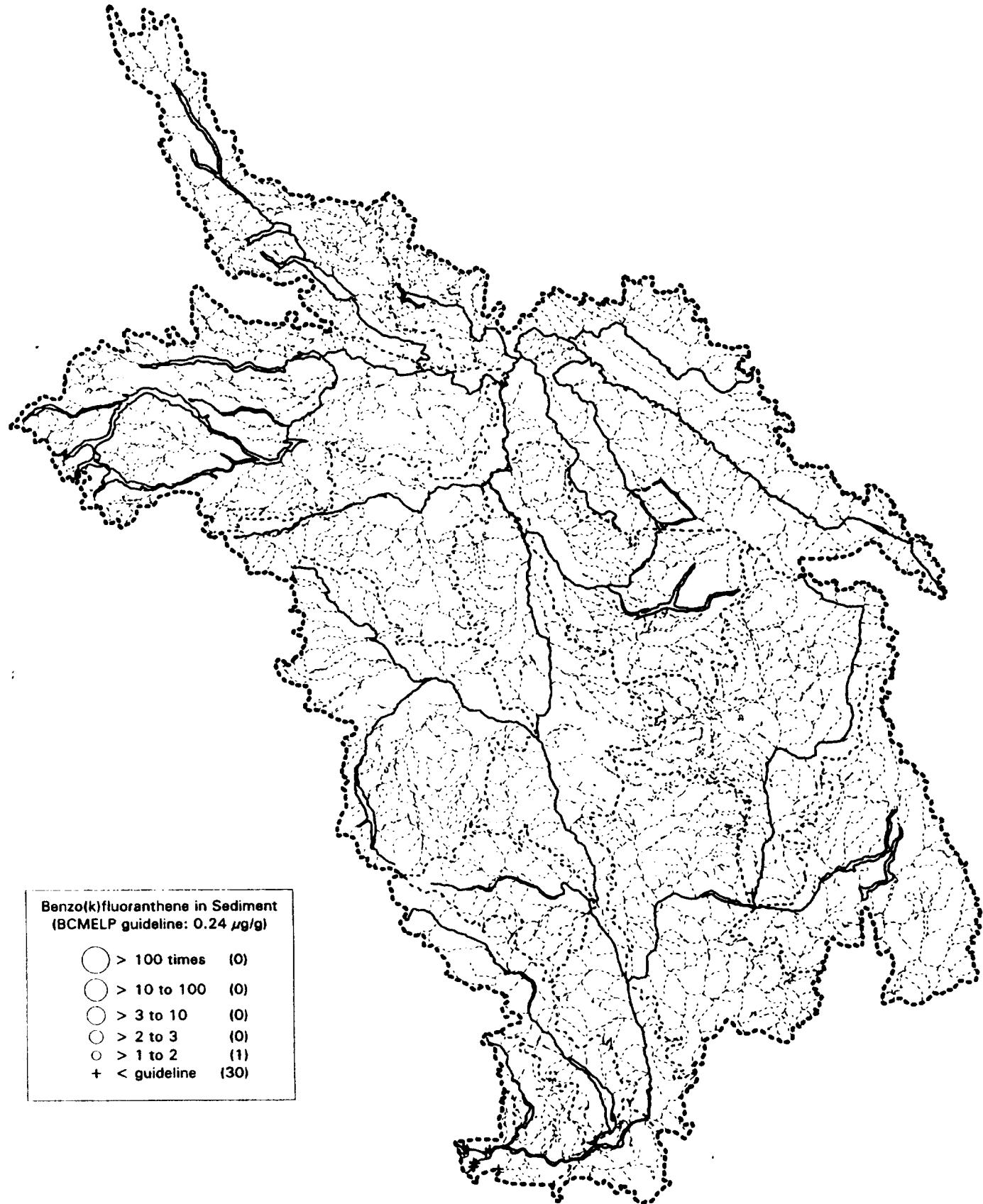
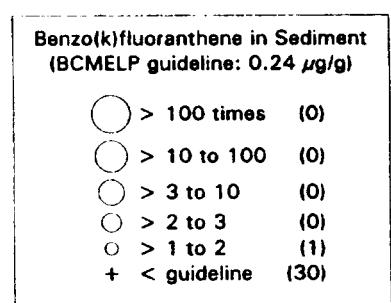


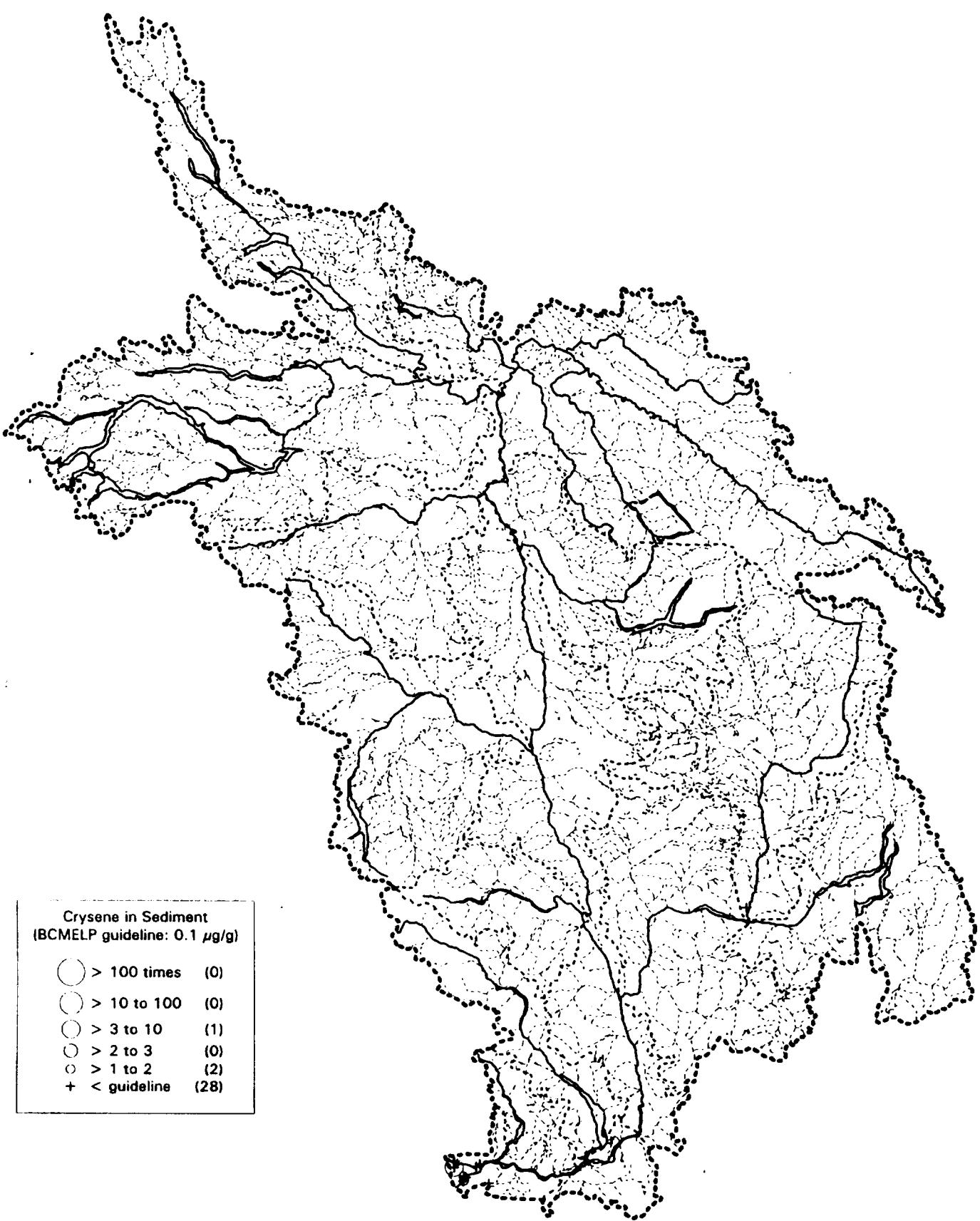
Benzo(a)pyrene in Sediment
(Pommen guideline: 1 µg/g)

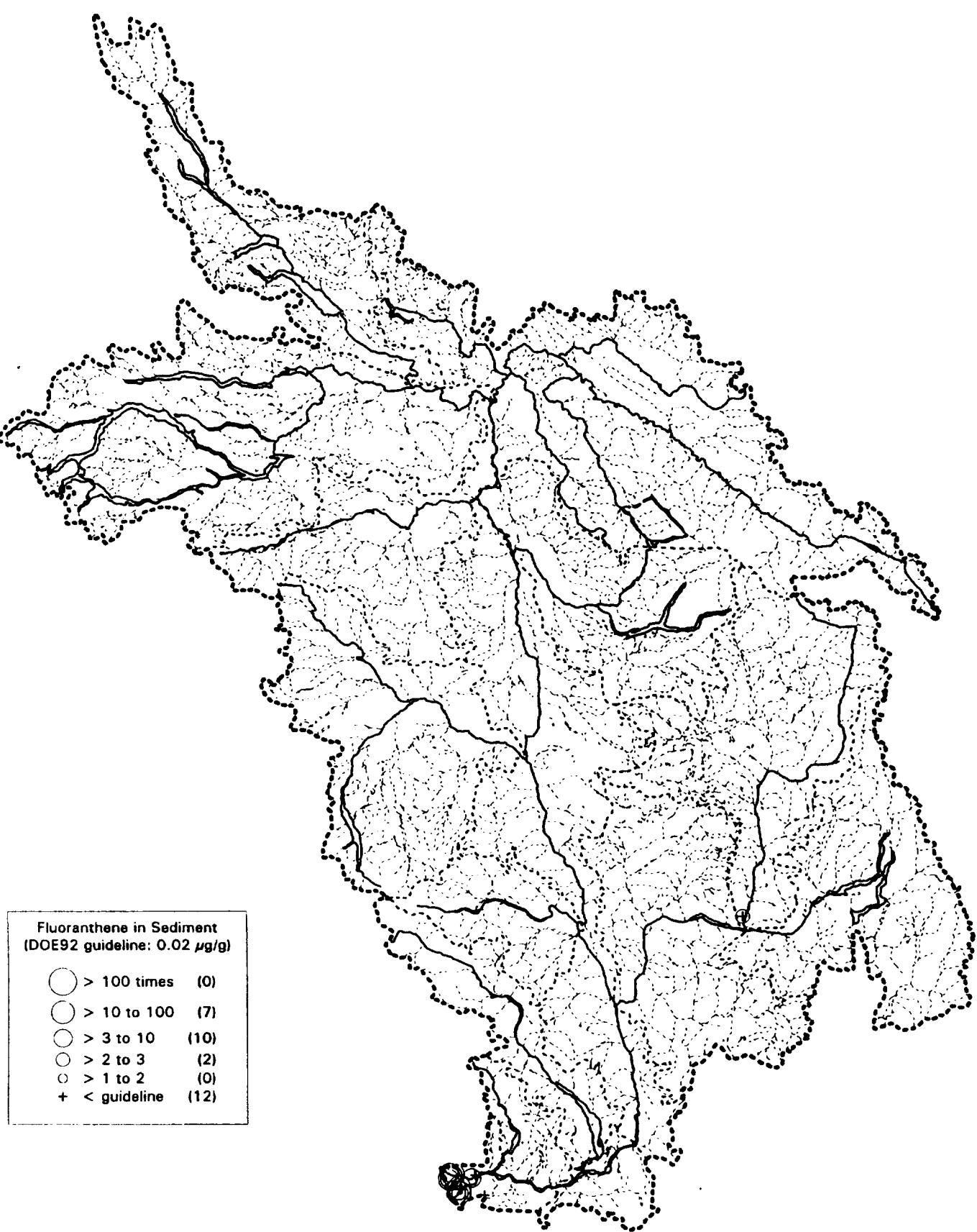
- (○) > 100 times (0)
- (○) > 10 to 100 (0)
- (○) > 3 to 10 (0)
- (○) > 2 to 3 (0)
- (○) > 1 to 2 (0)
- + < guideline (31)

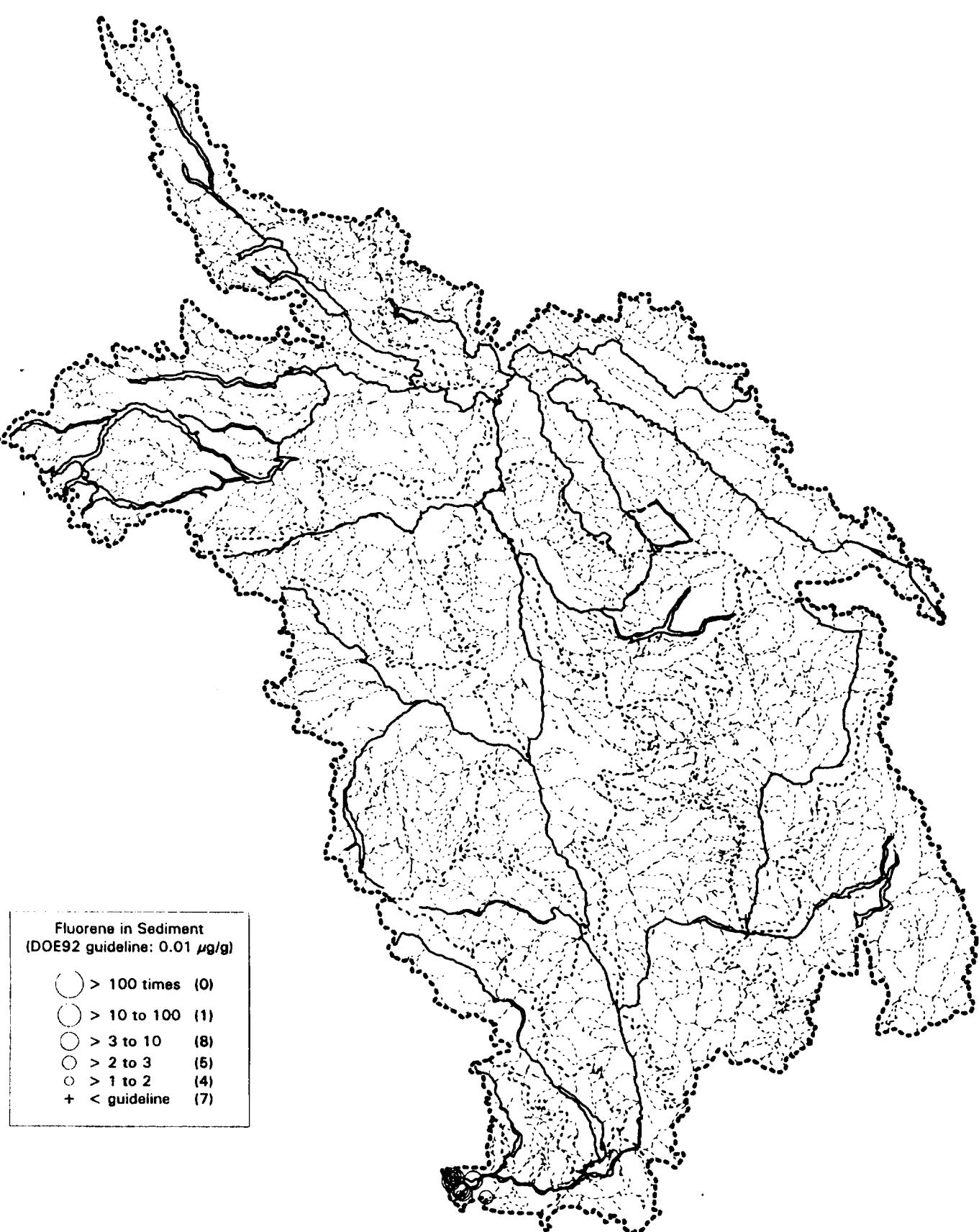


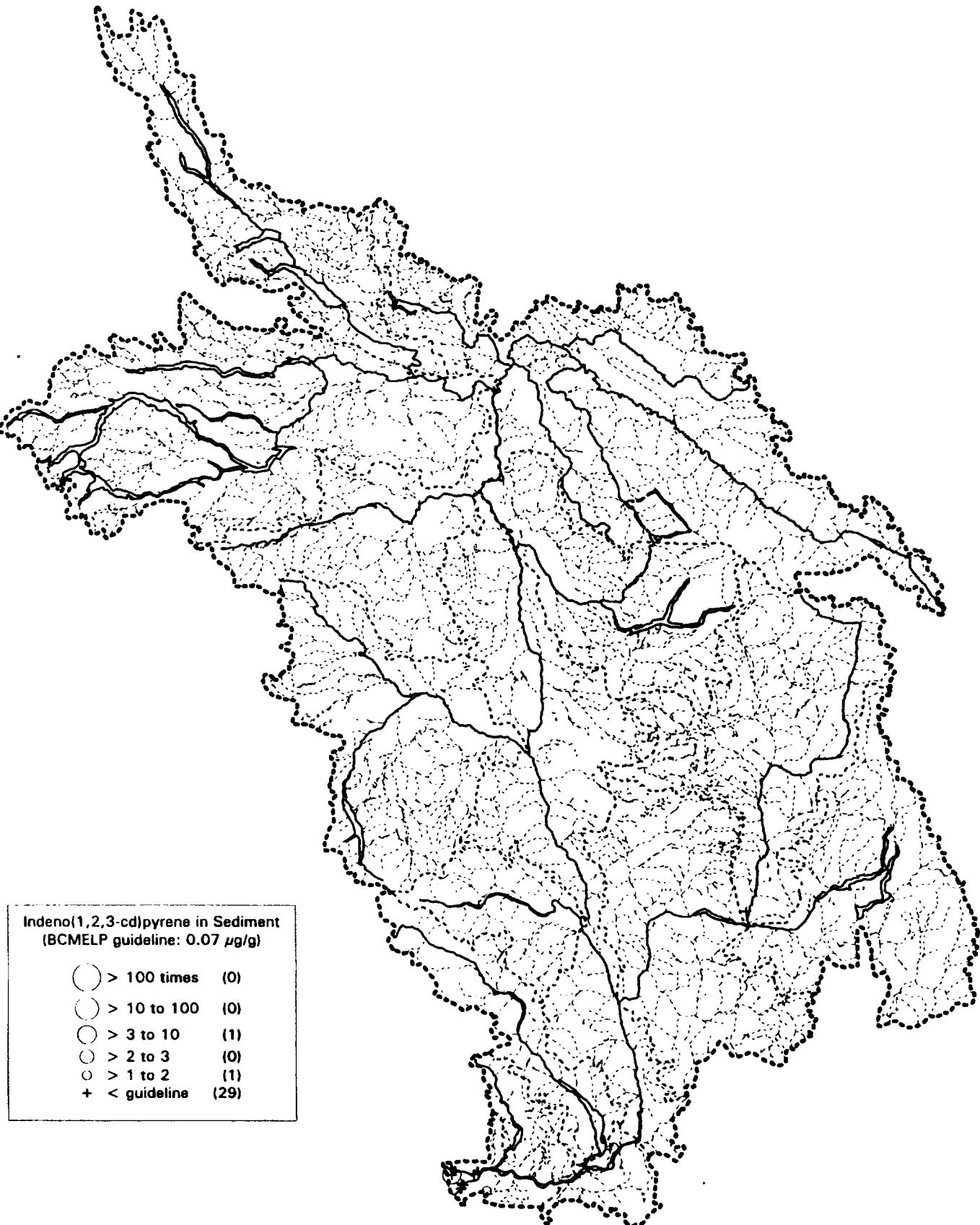


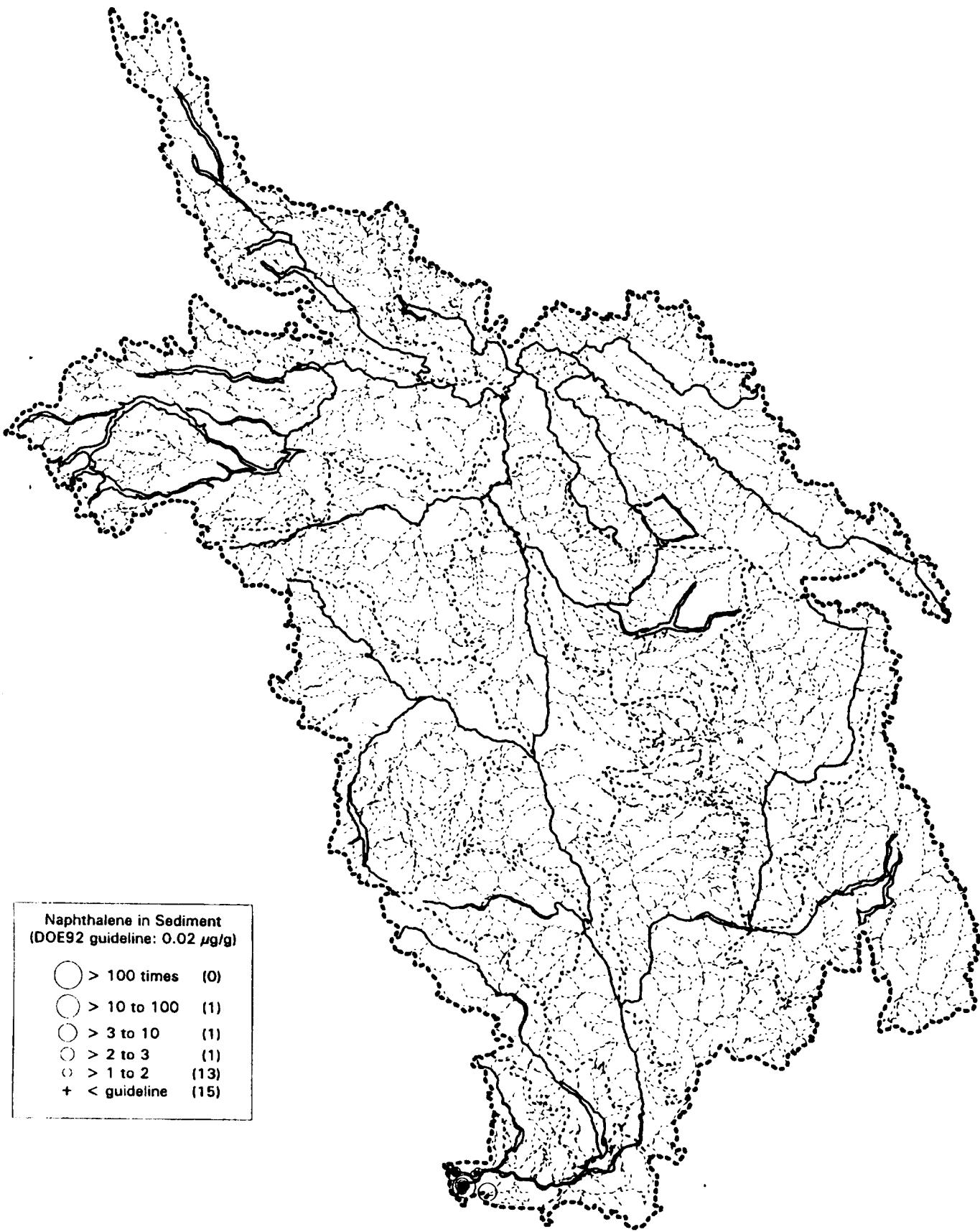






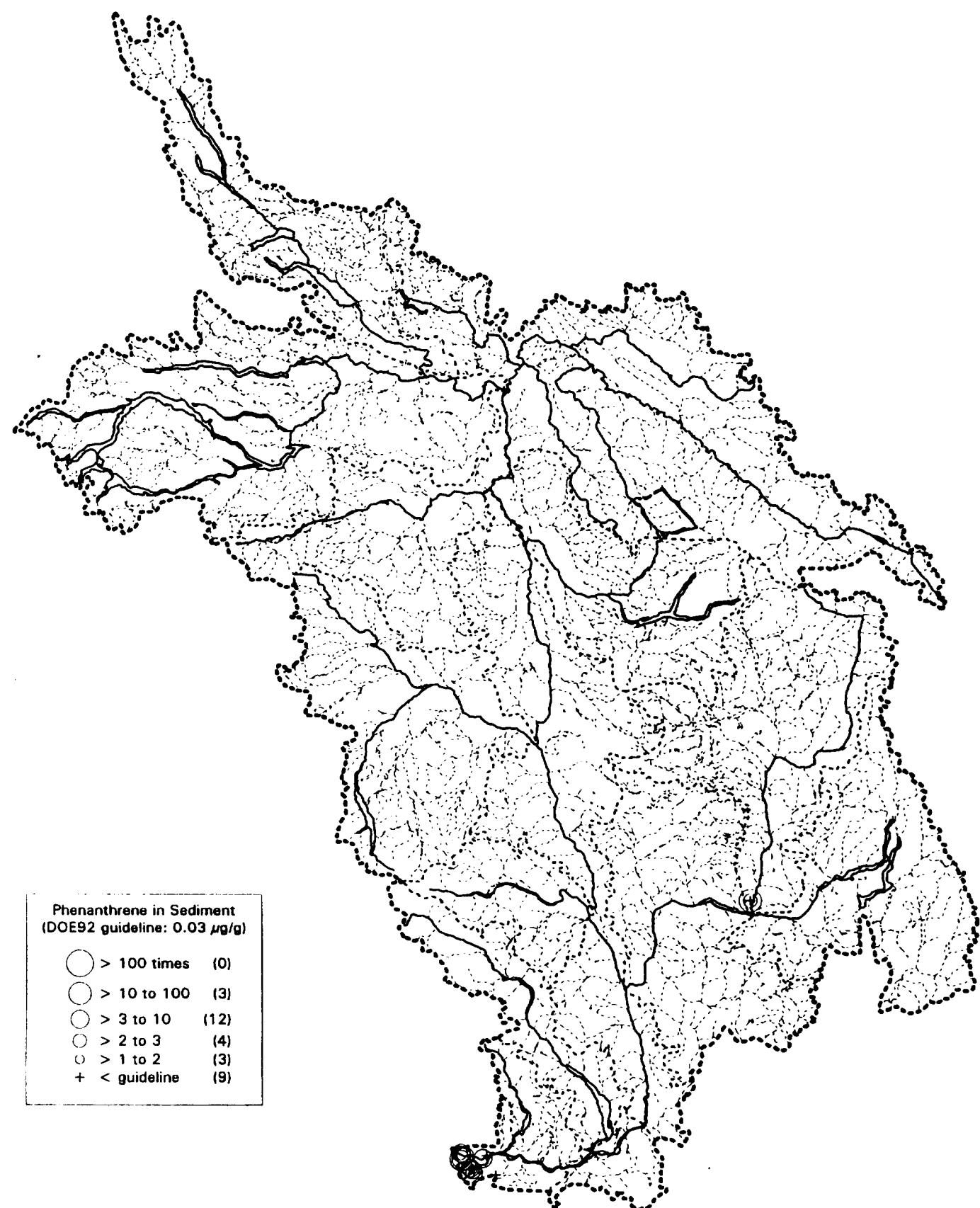


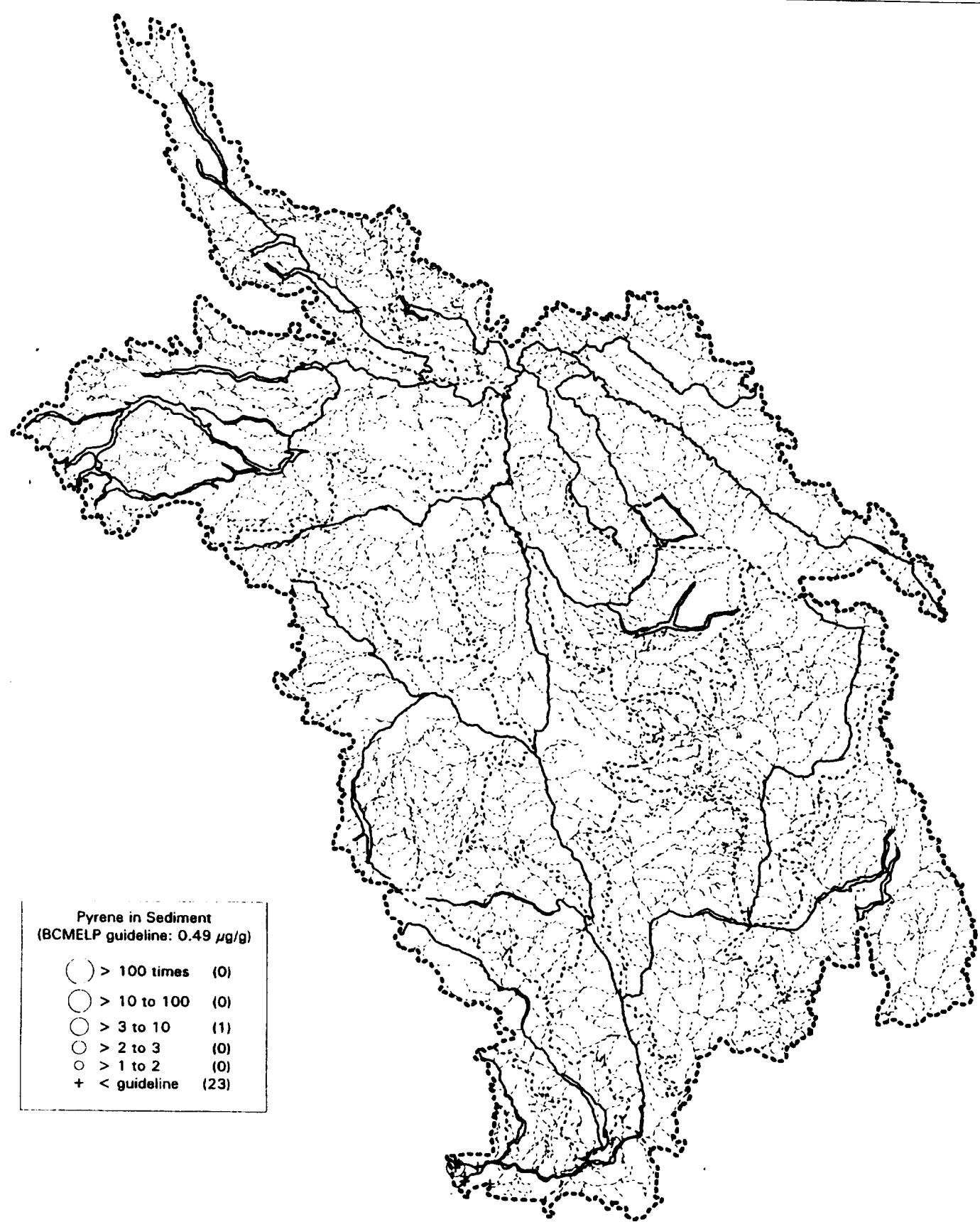
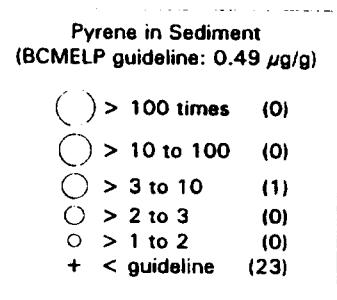




Phenanthrene in Sediment
(DOE92 guideline: 0.03 µg/g)

- > 100 times (0)
- > 10 to 100 (3)
- > 3 to 10 (12)
- > 2 to 3 (4)
- > 1 to 2 (3)
- + < guideline (9)

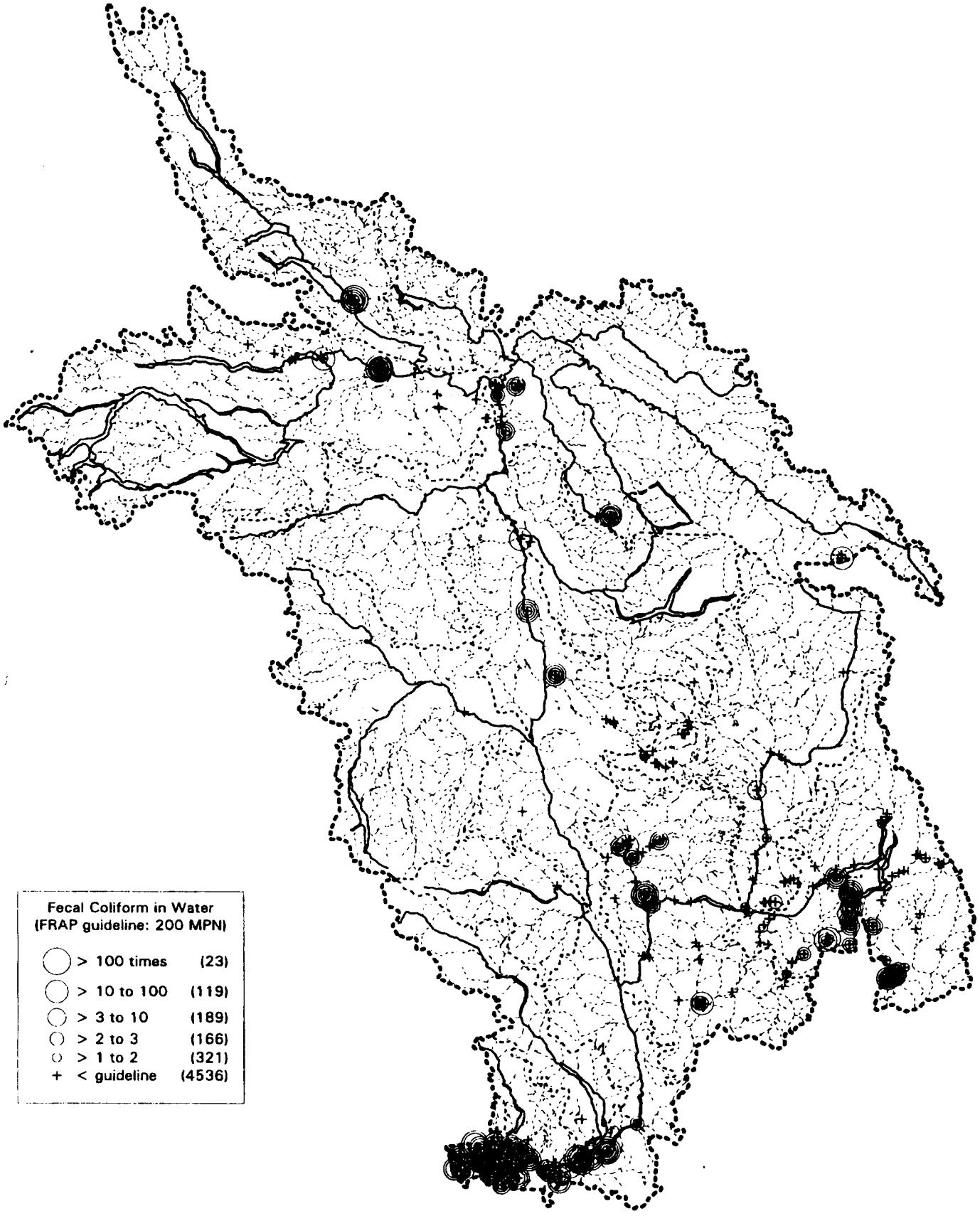




1.4 Water

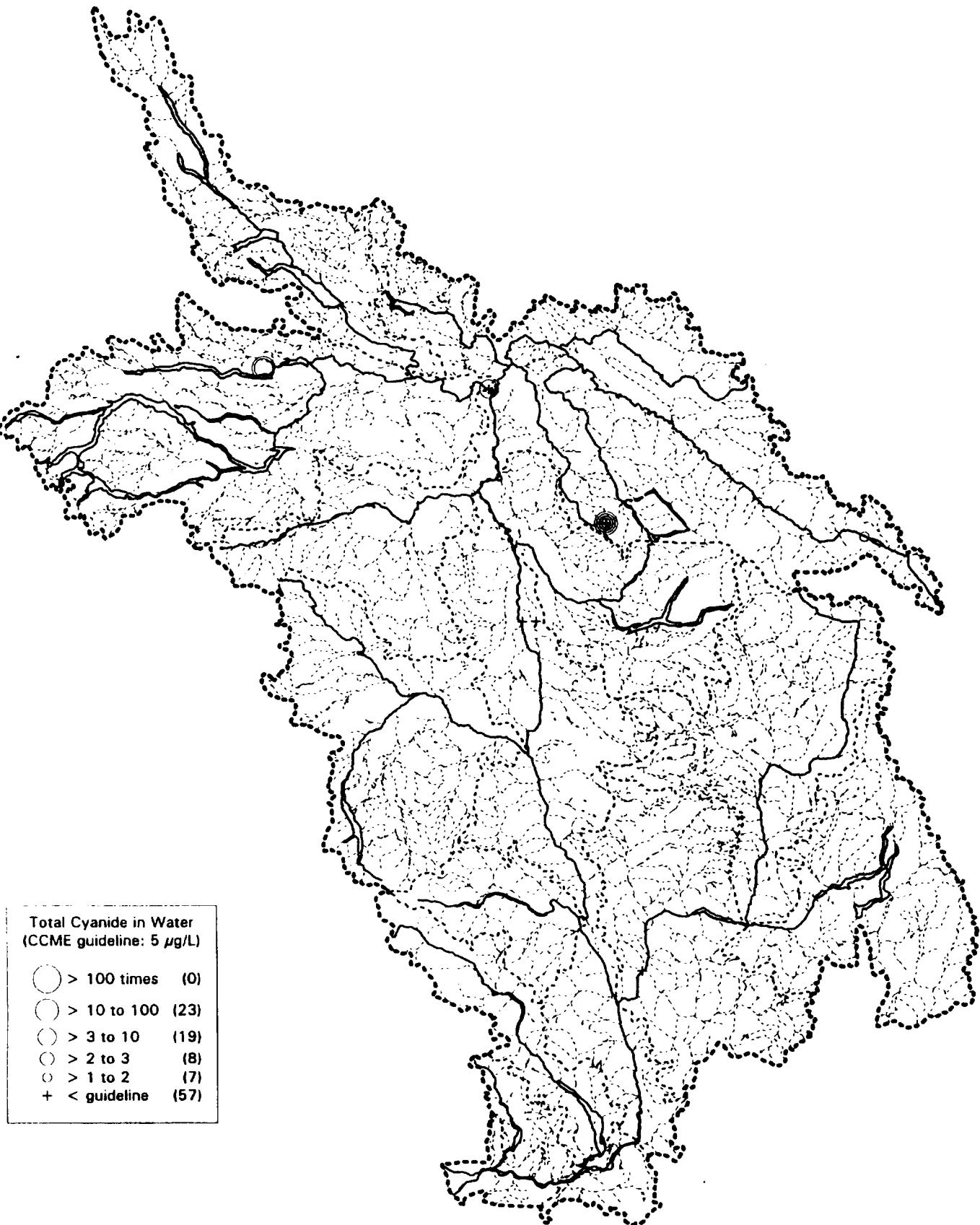
1.4.1 Human pathogens in water

Fecal Coliform



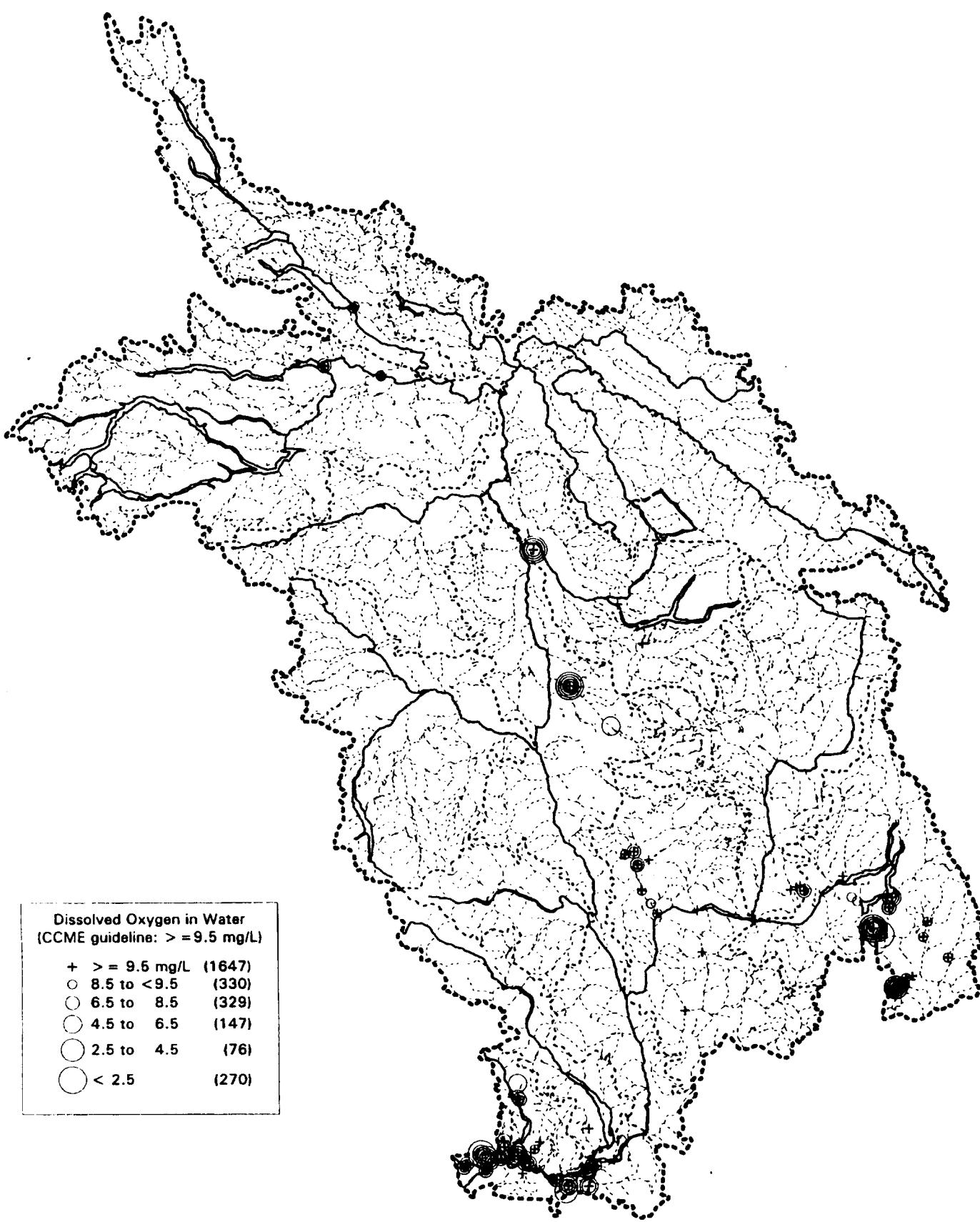
1.4.2 Cyanides in water

Total Cyanide



1.4.3 Dissolved oxygen in water

Dissolved Oxygen



1.4.4 Metals in water

Dissolved Aluminum

Aluminum

Arsenic

Barium

Beryllium

Cadmium

Cobalt

Chromium

Copper

Iron

Lead

Manganese

Mercury

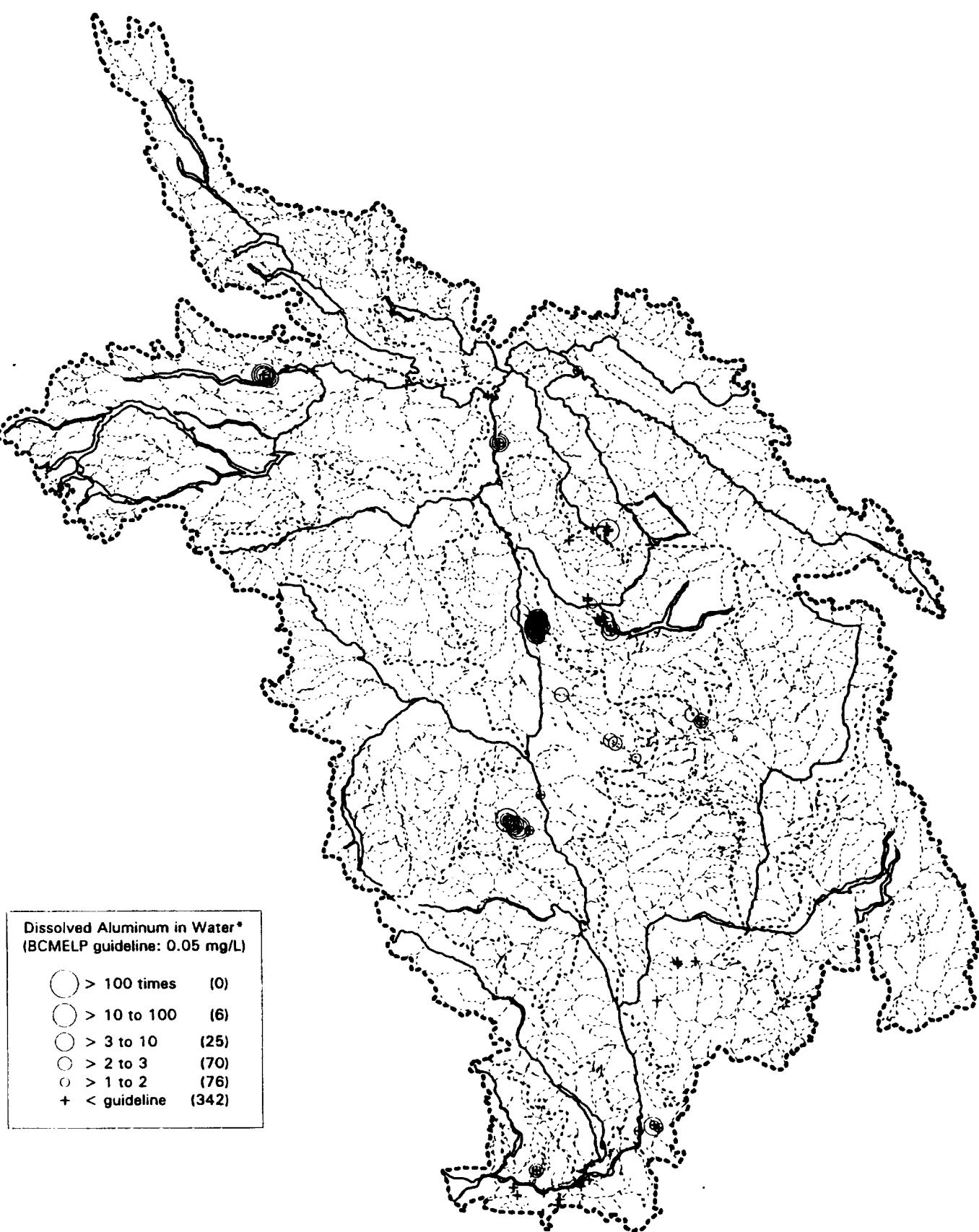
Molybdenum

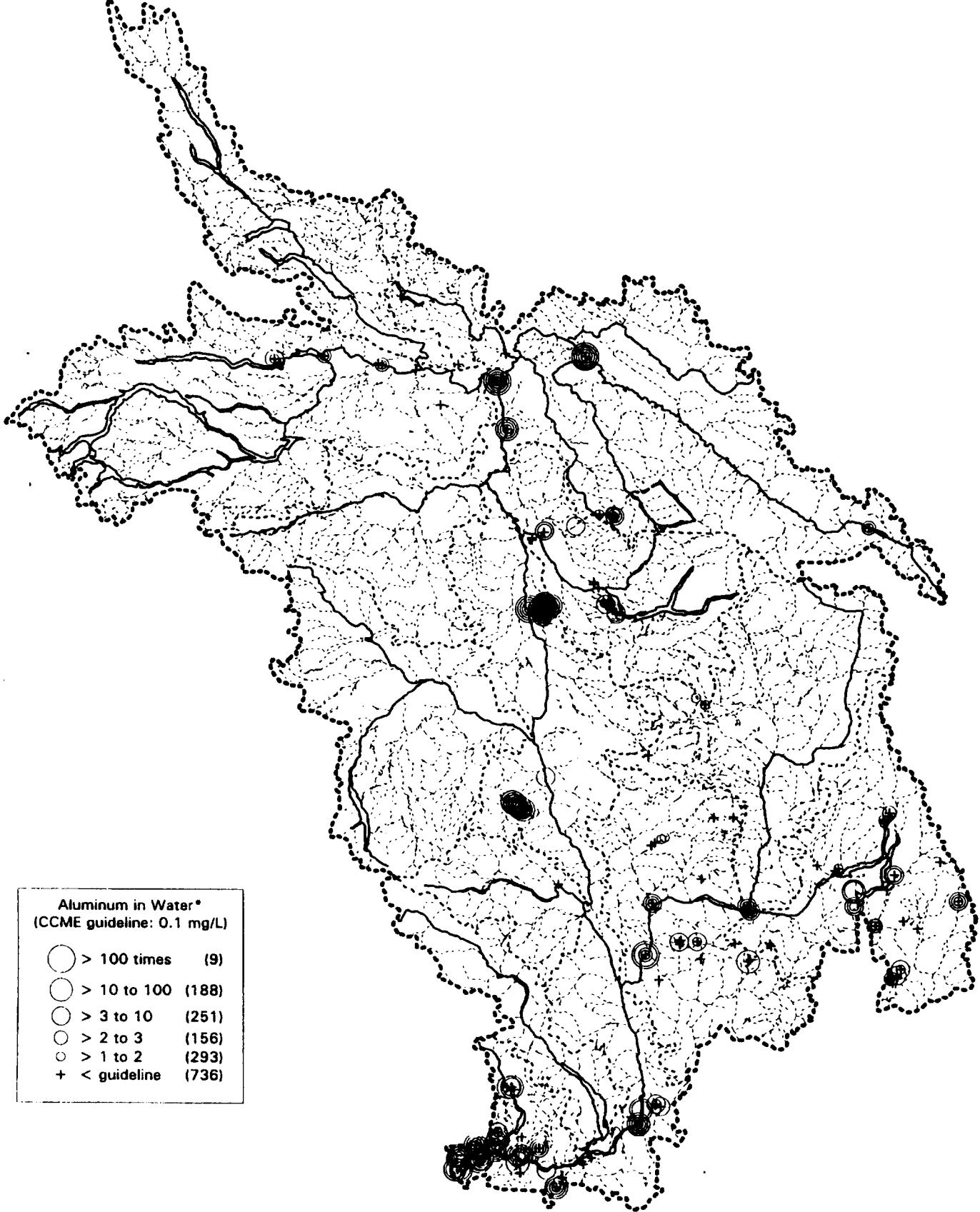
Nickel

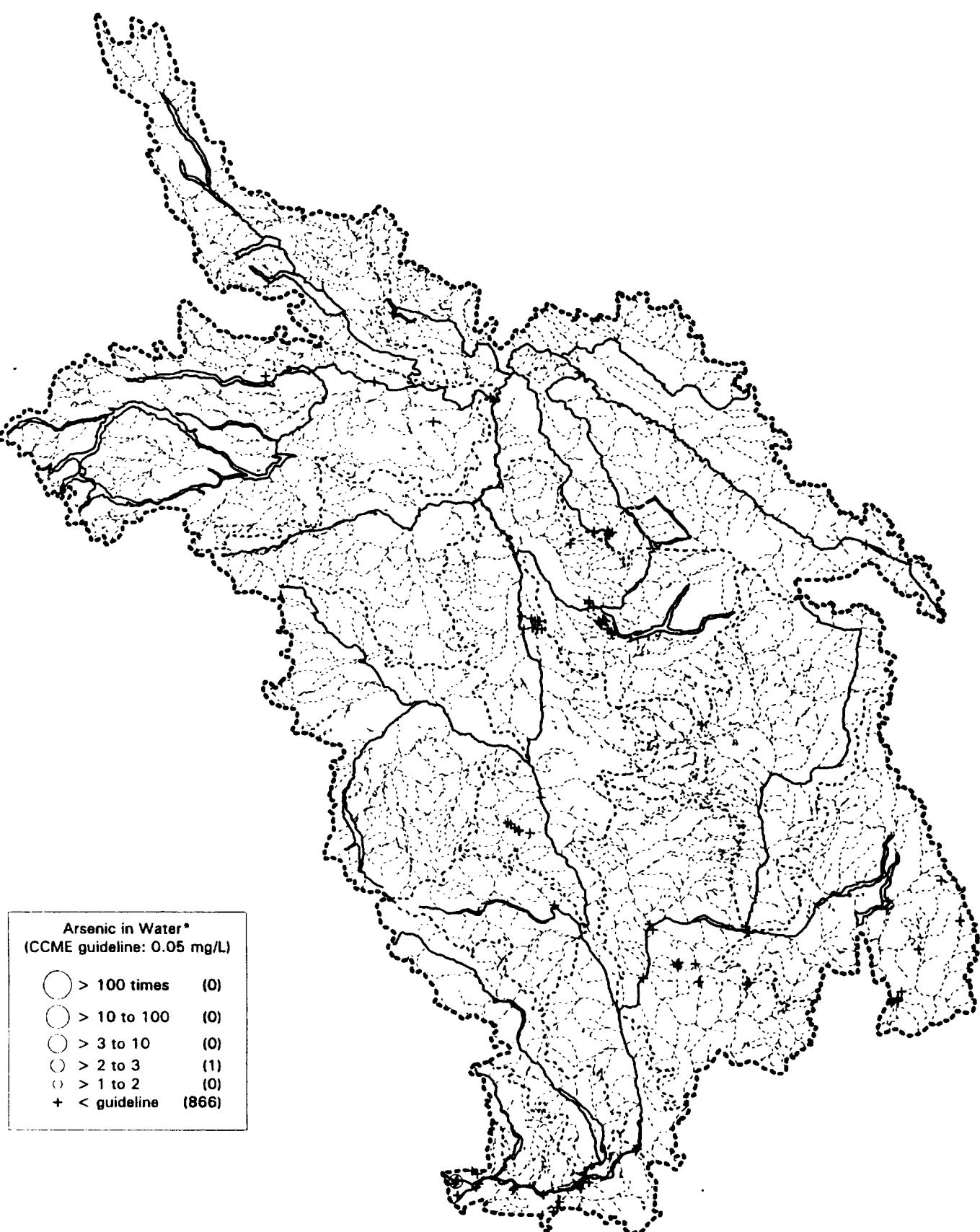
Selenium

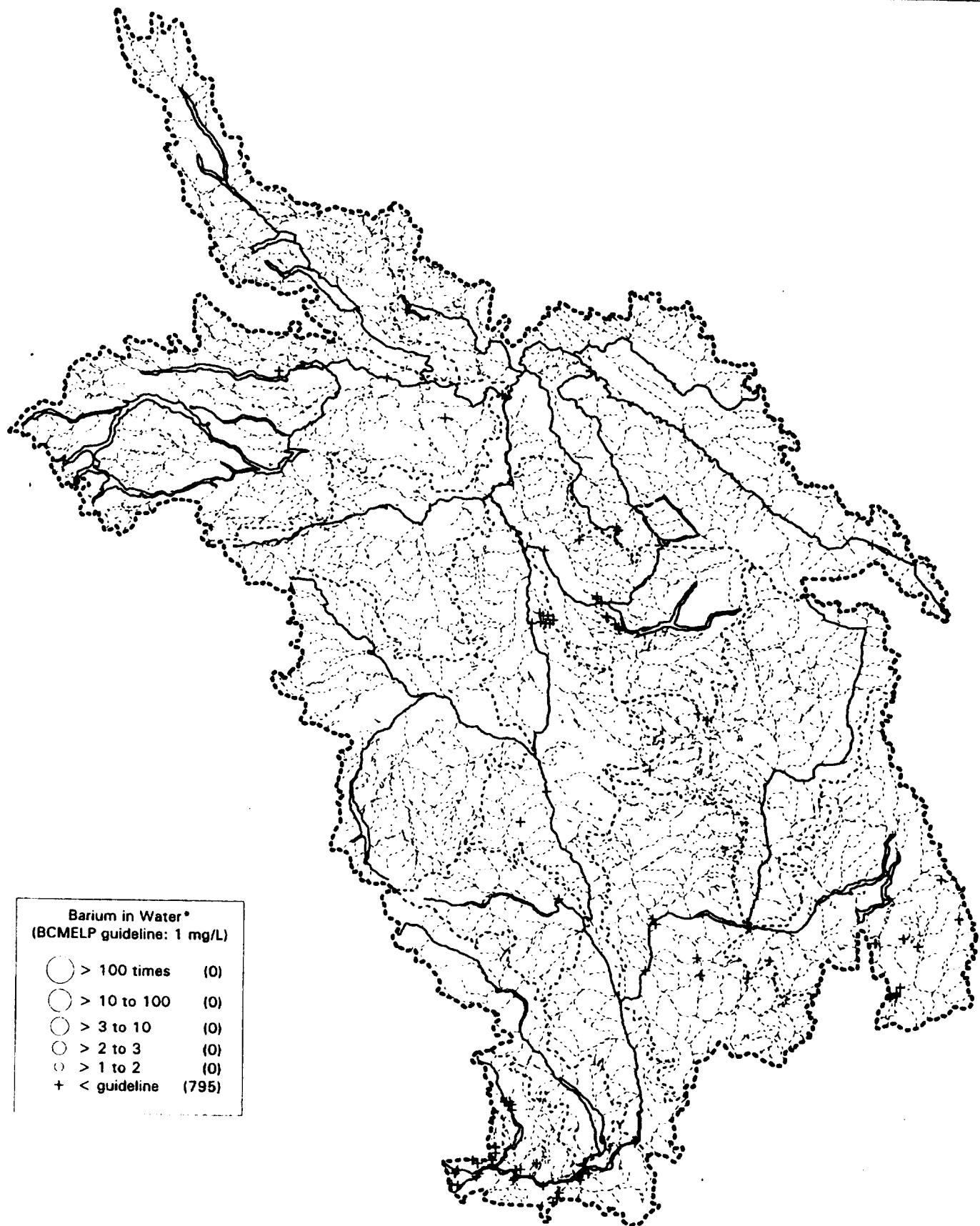
Titanium

Zinc



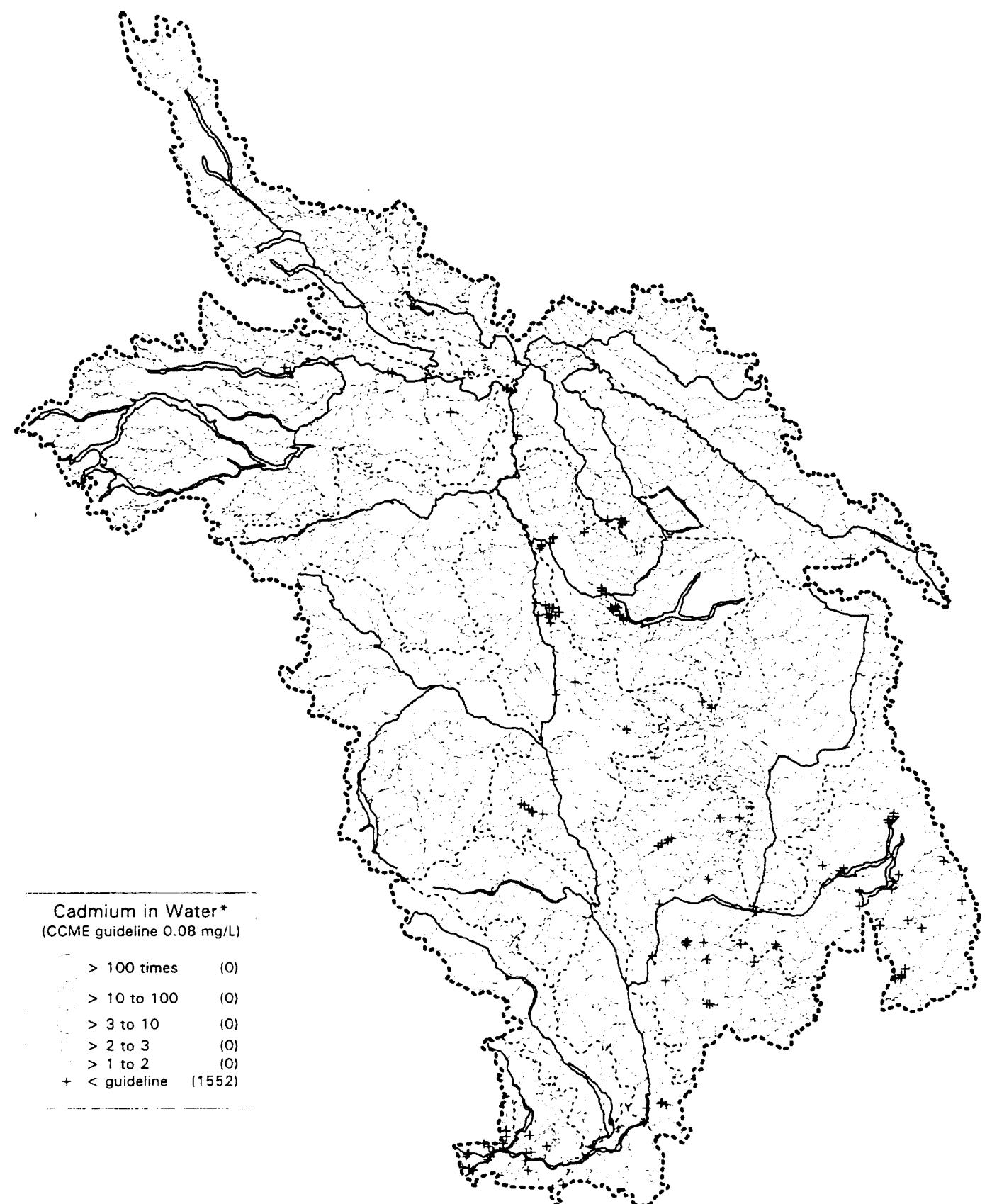


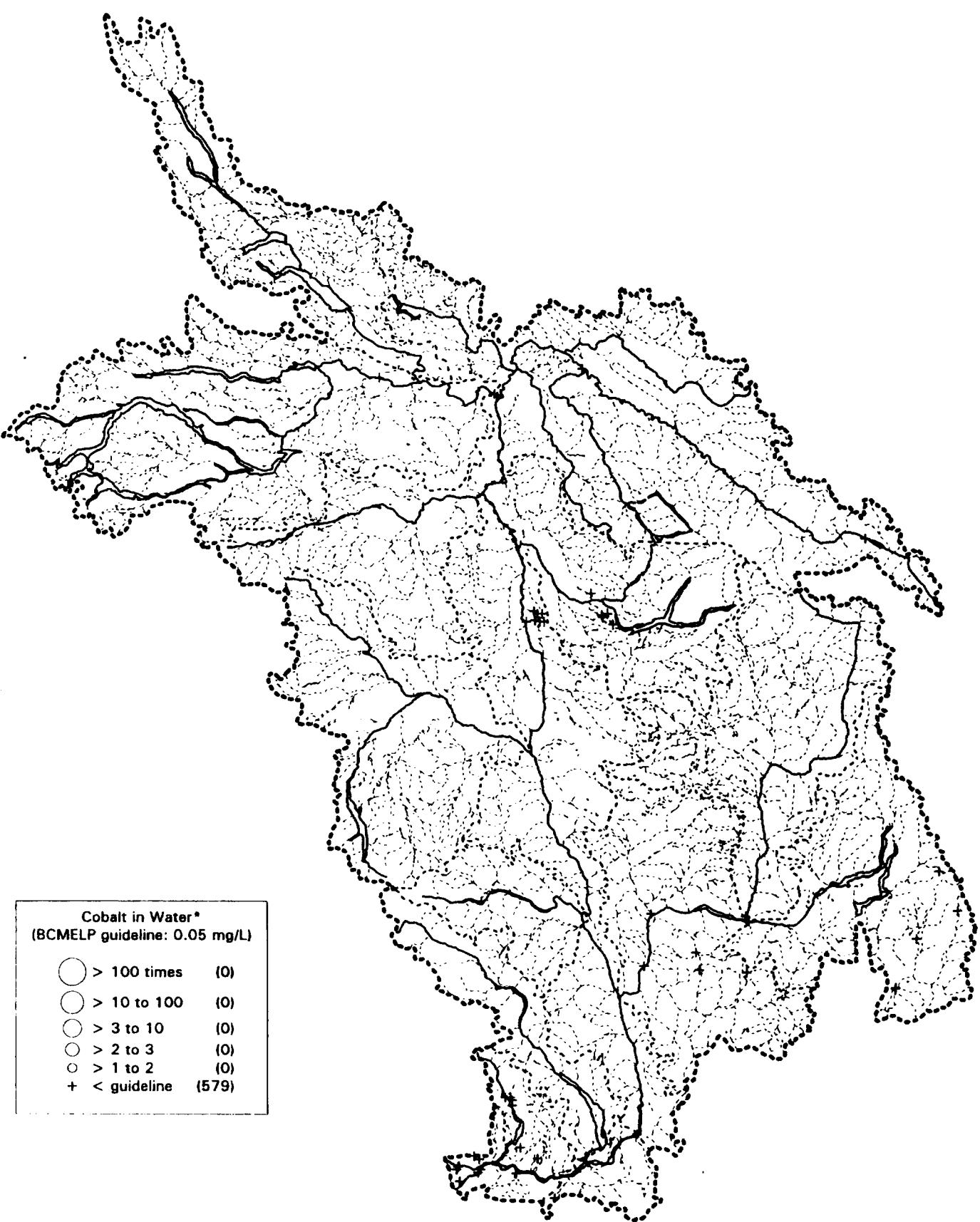


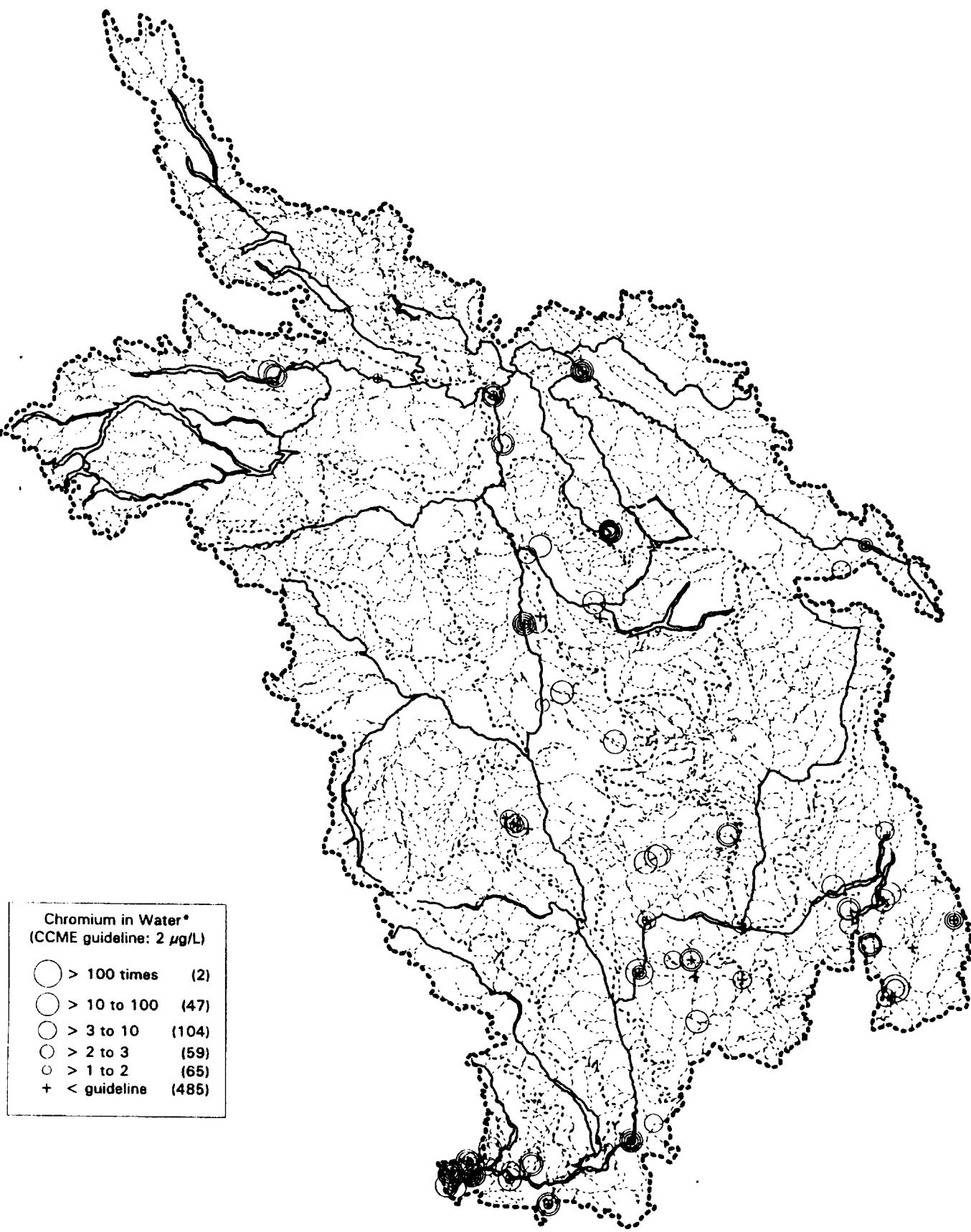


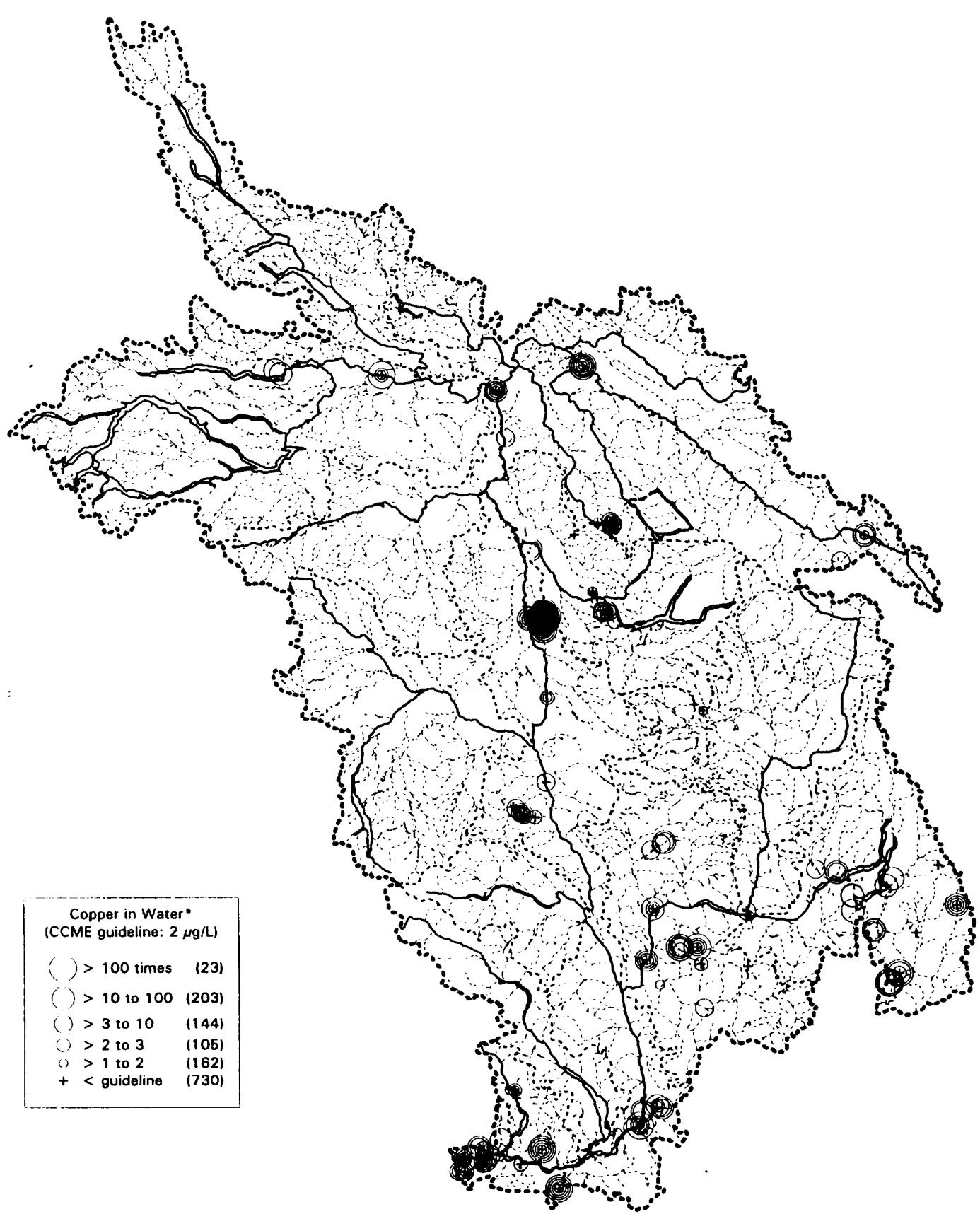
Beryllium in Water*
(BCMEPL guideline: 5.3 µg/L)

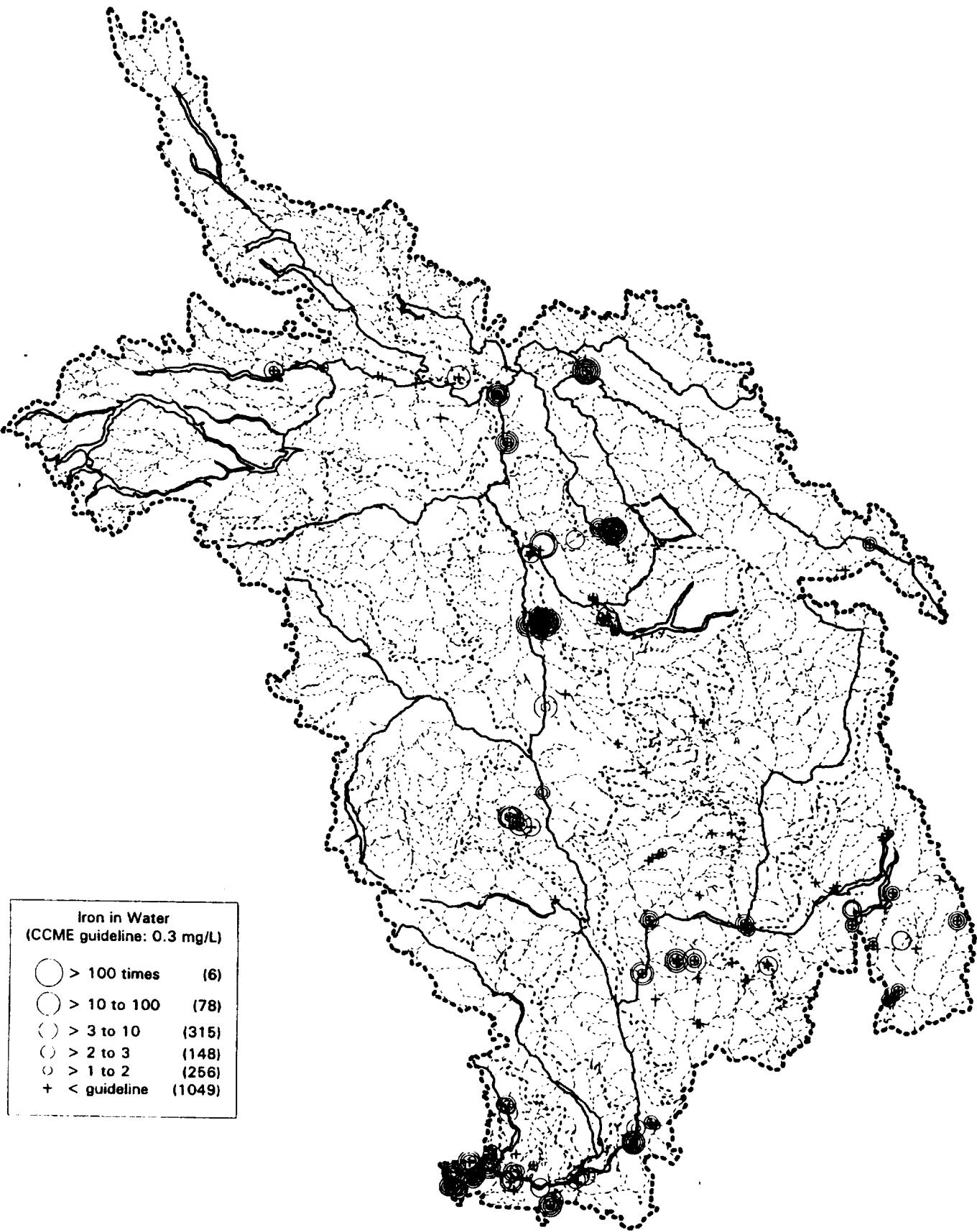
- > 100 times (0)
- > 10 to 100 (0)
- > 3 to 10 (0)
- > 2 to 3 (0)
- > 1 to 2 (0)
- + < guideline (45)

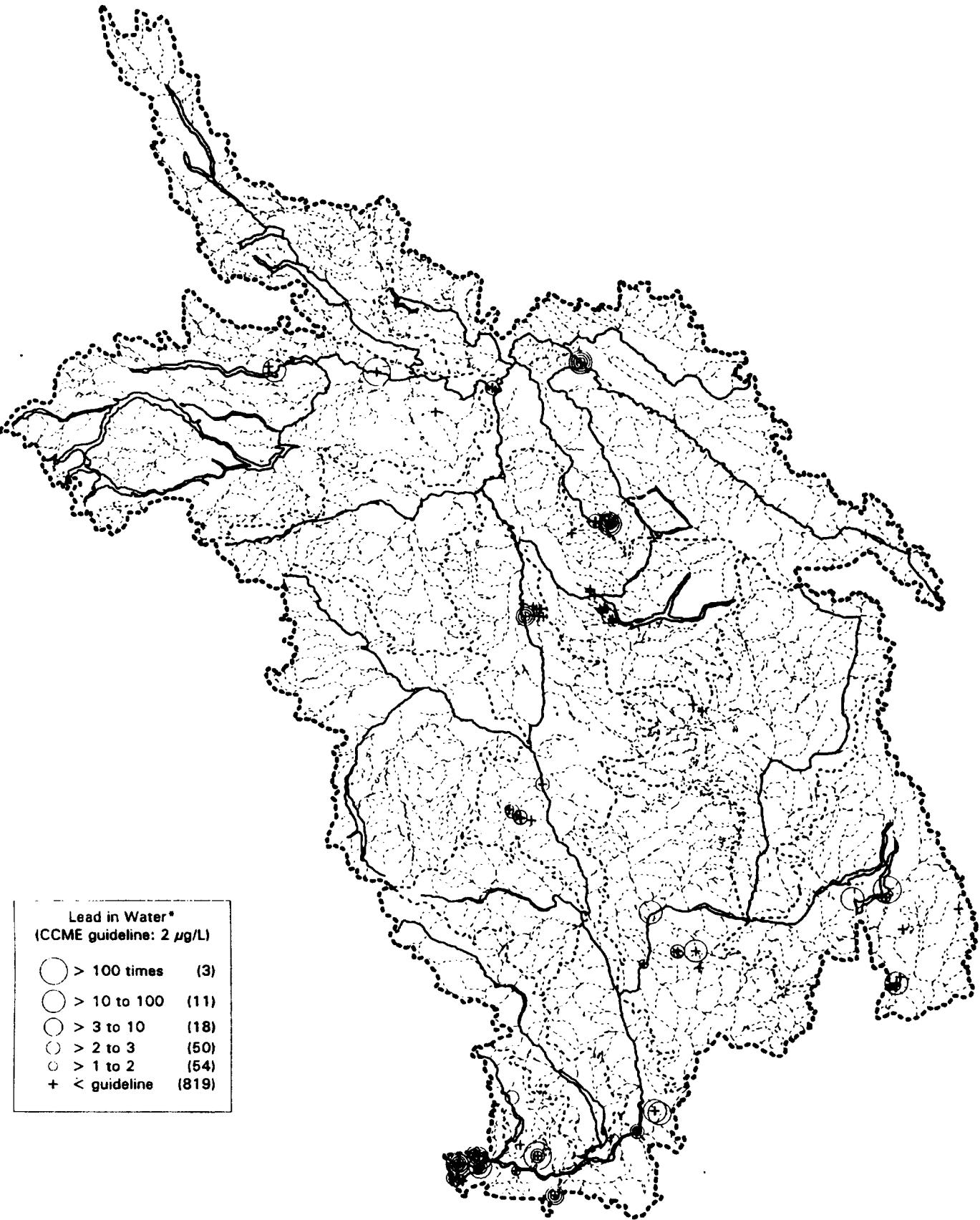


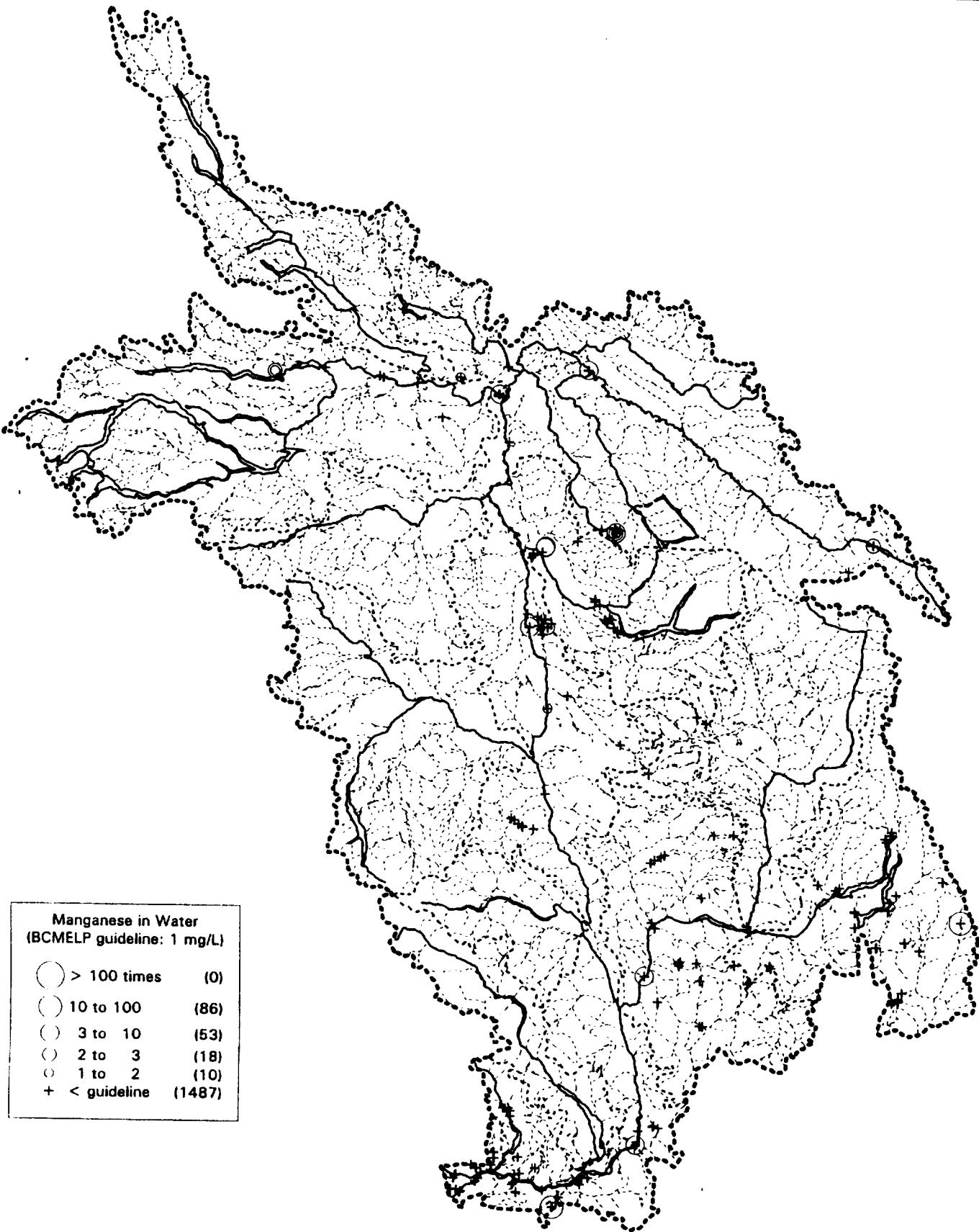


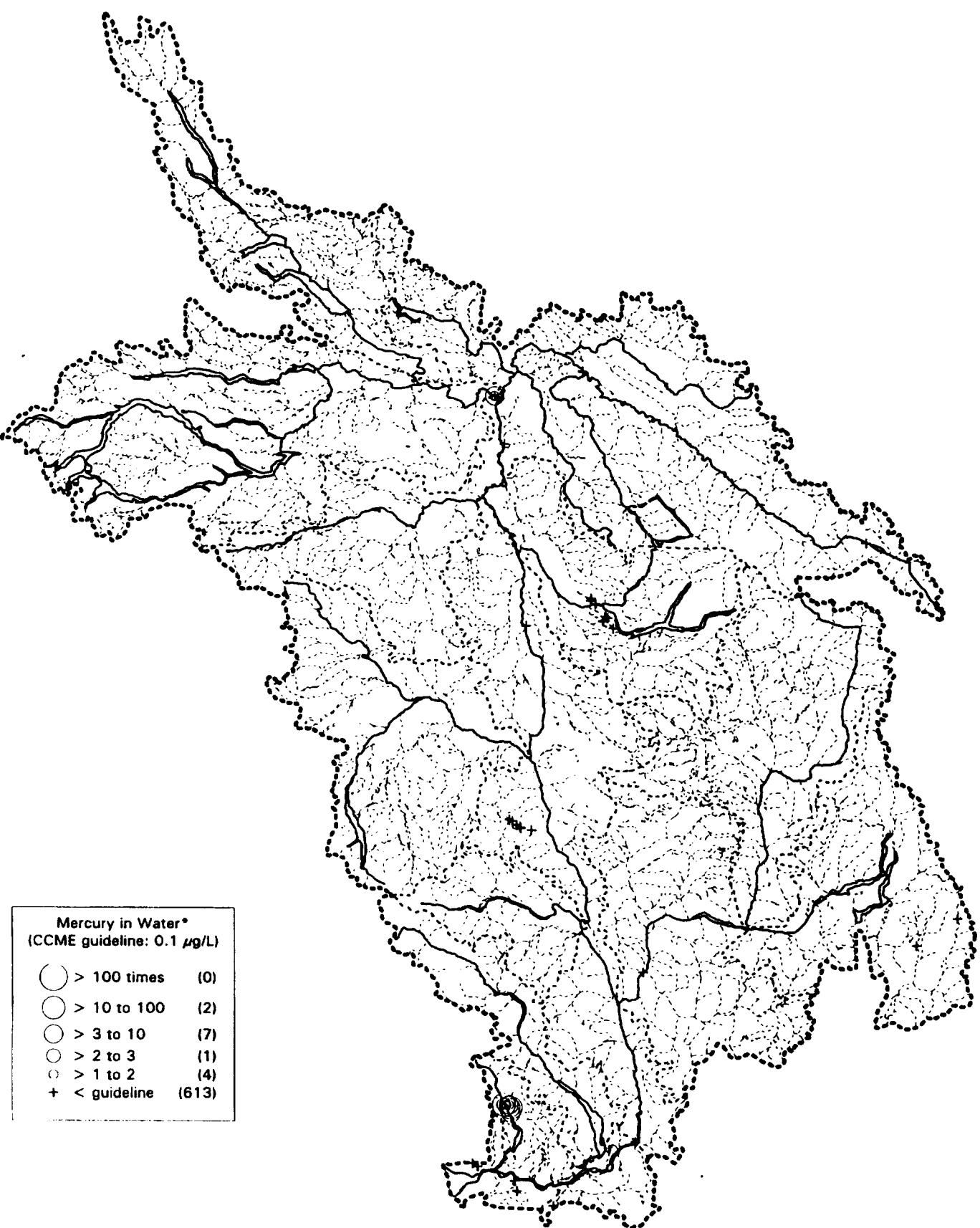


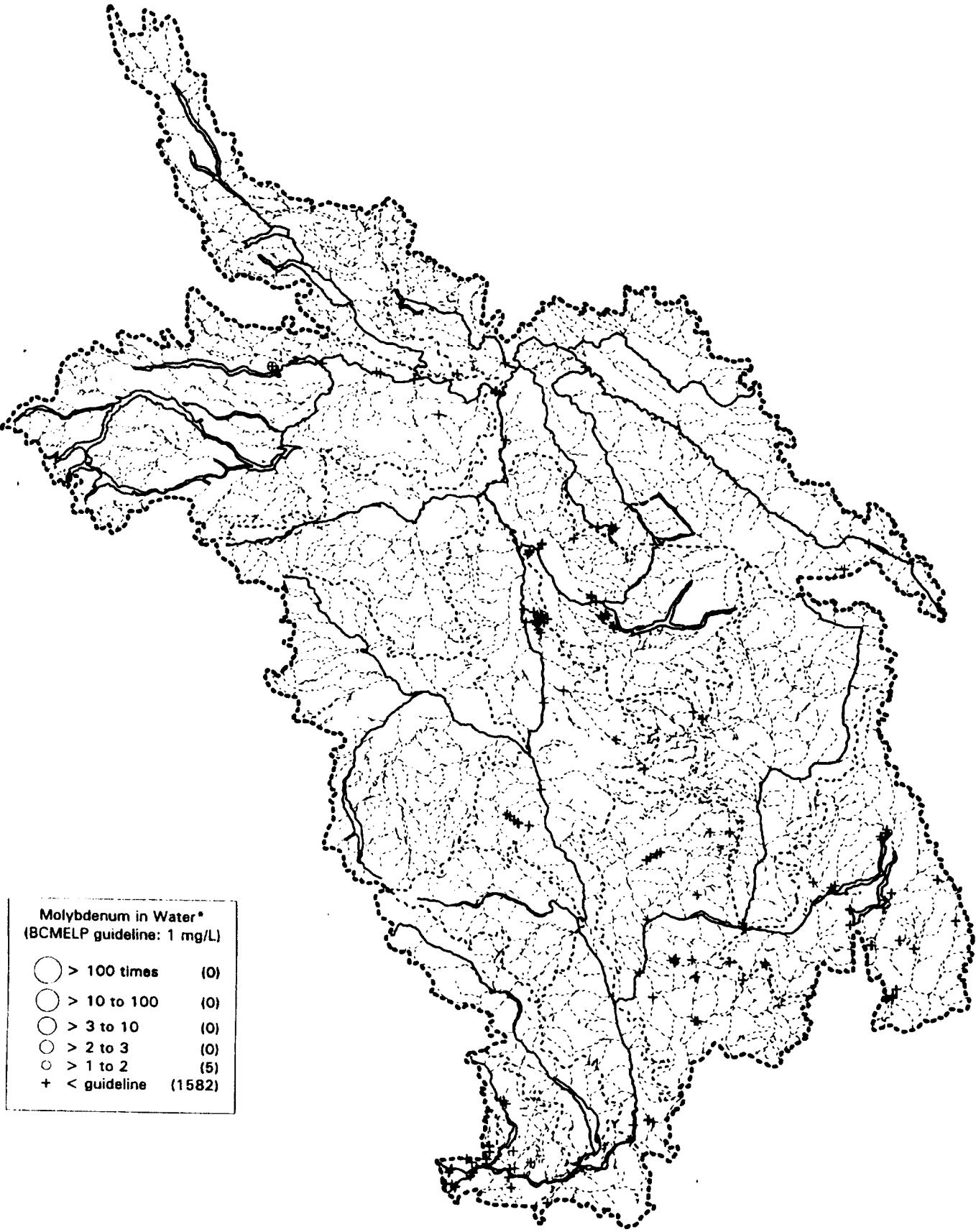


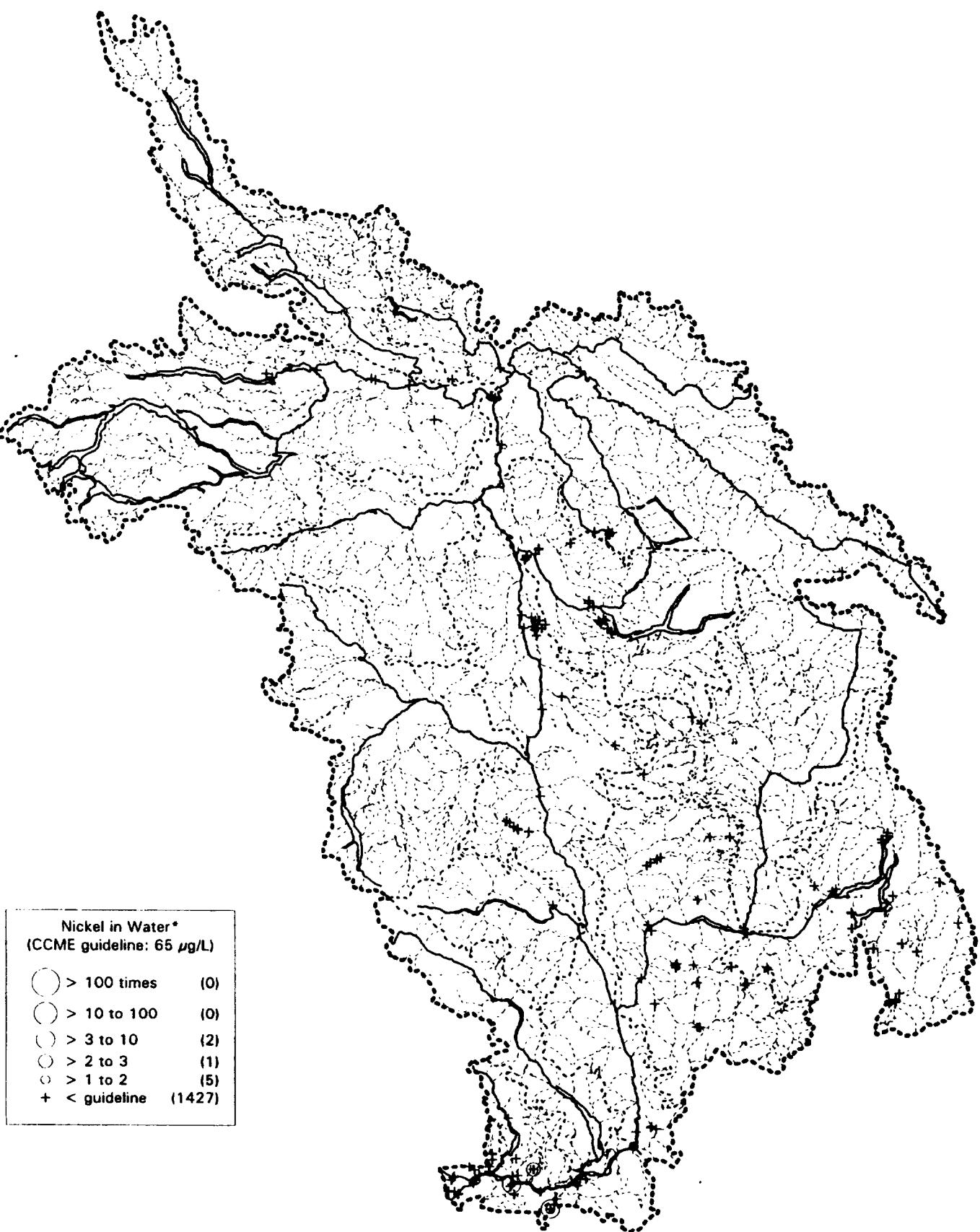


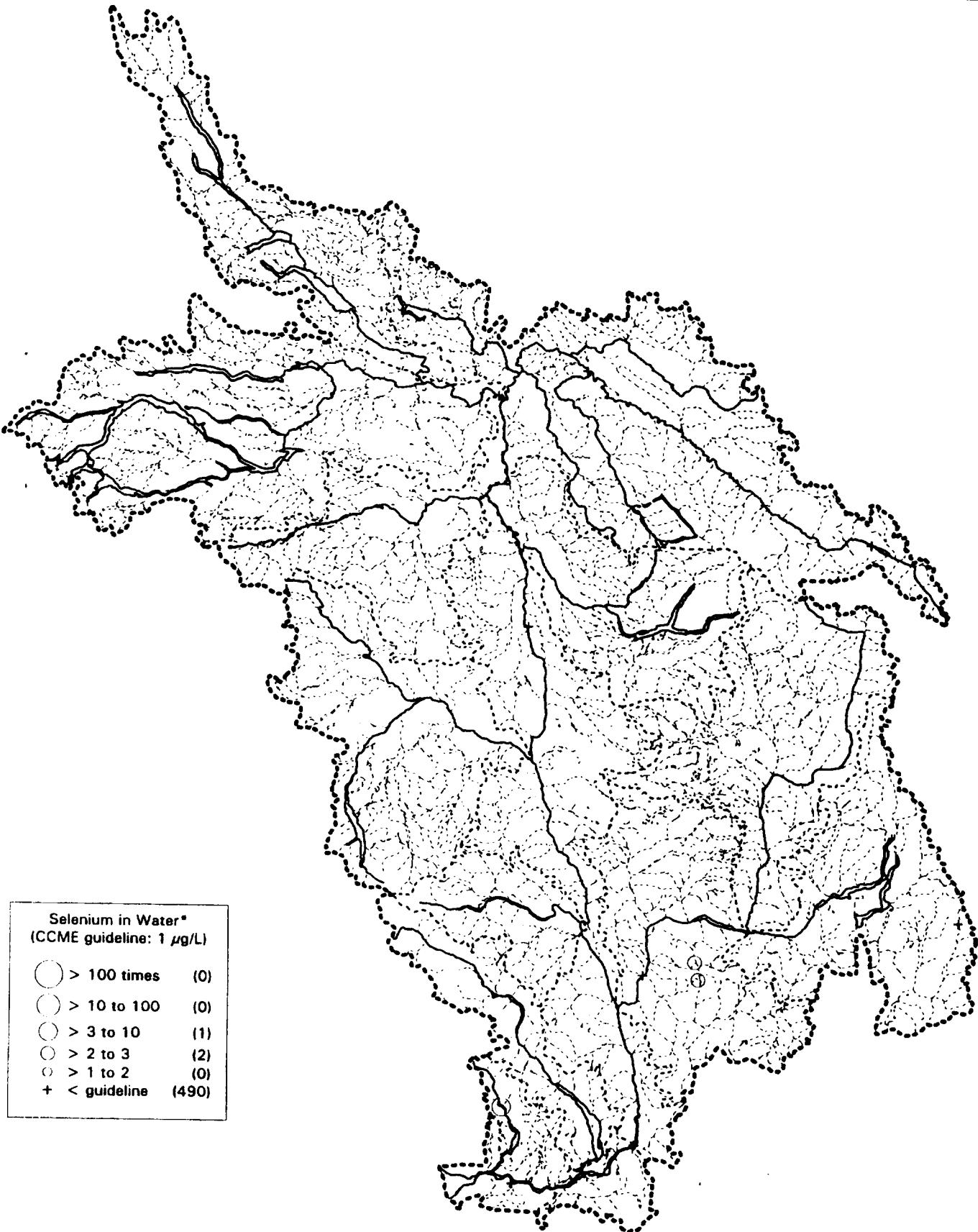


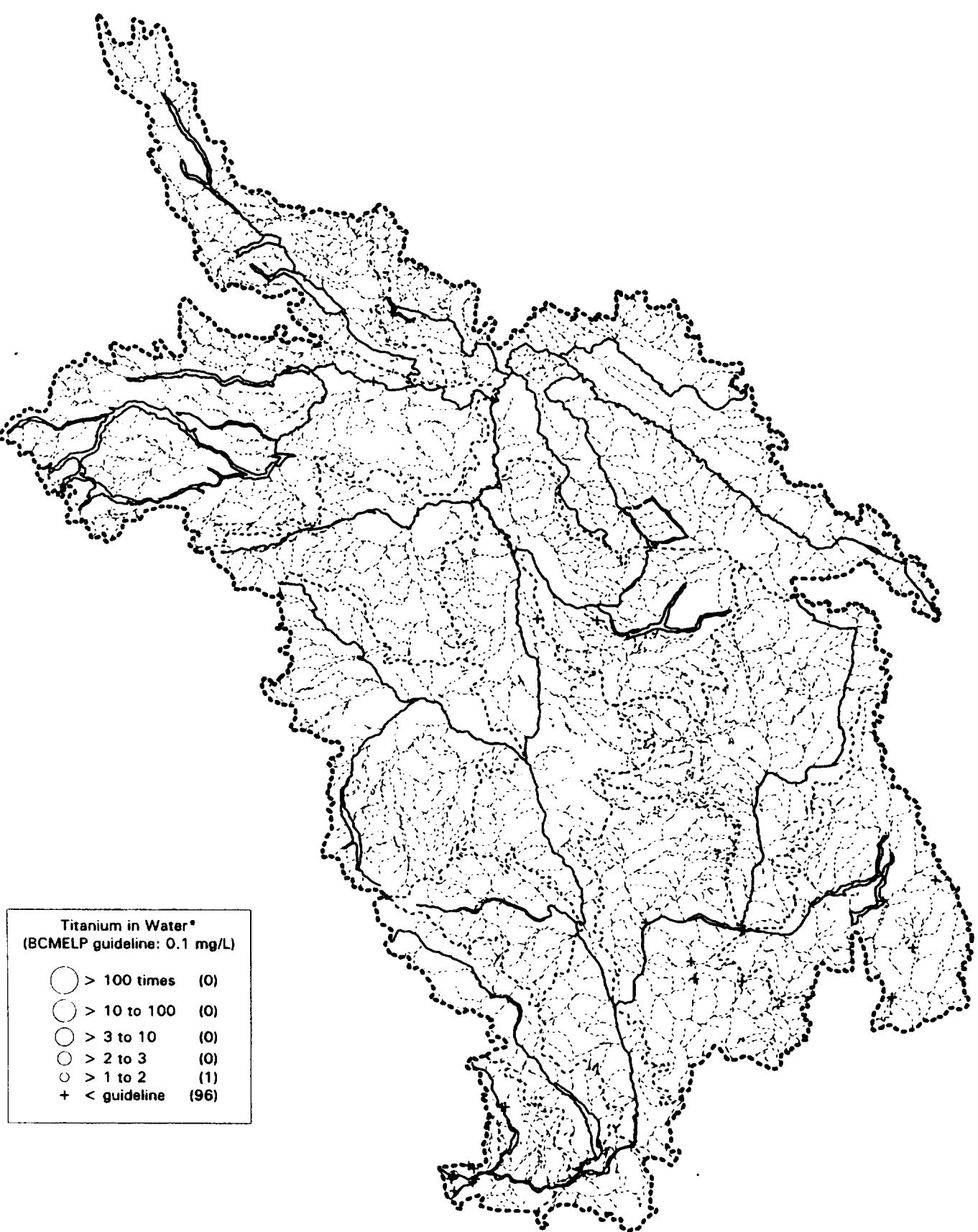


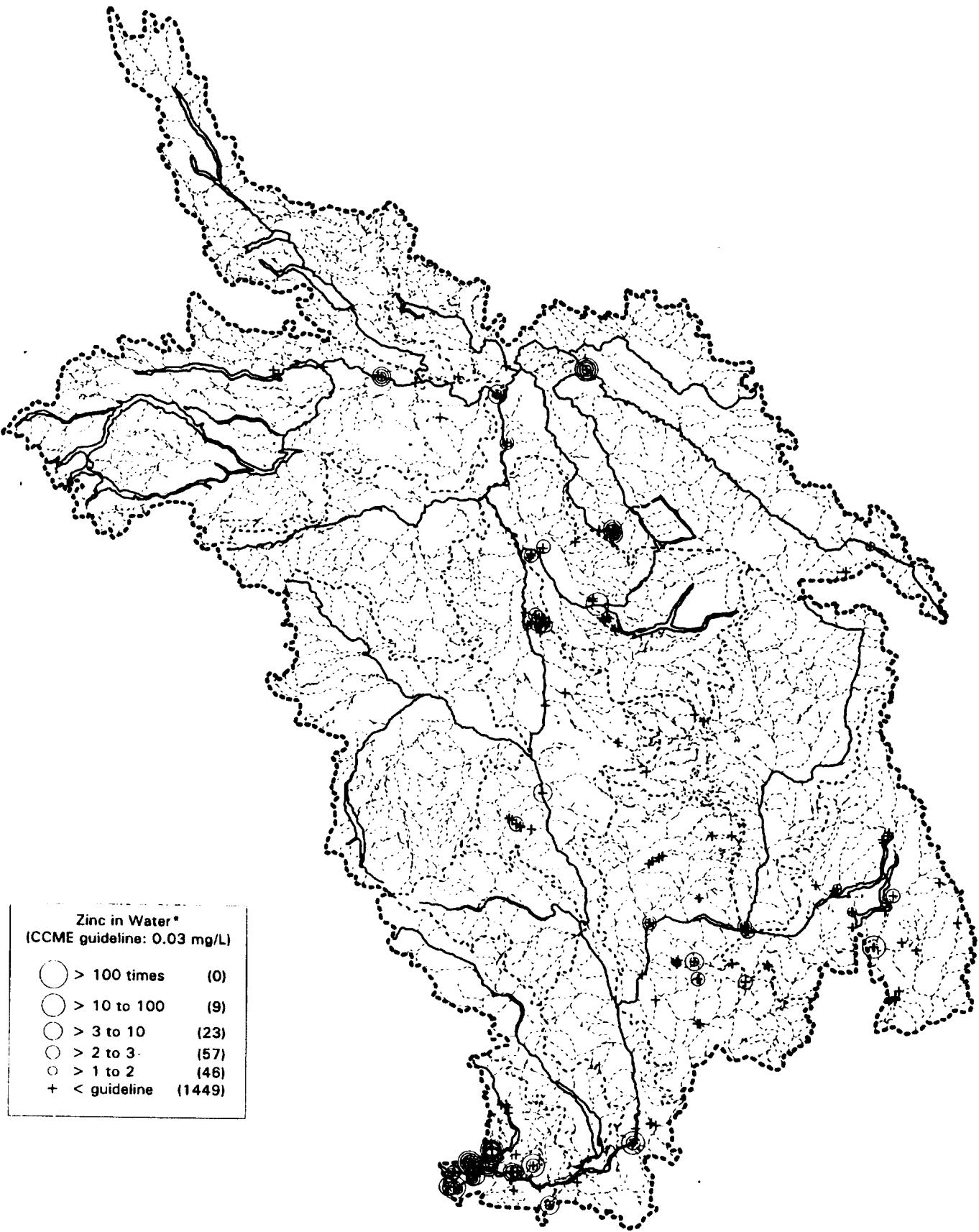












1.4.5 Nutrients in water

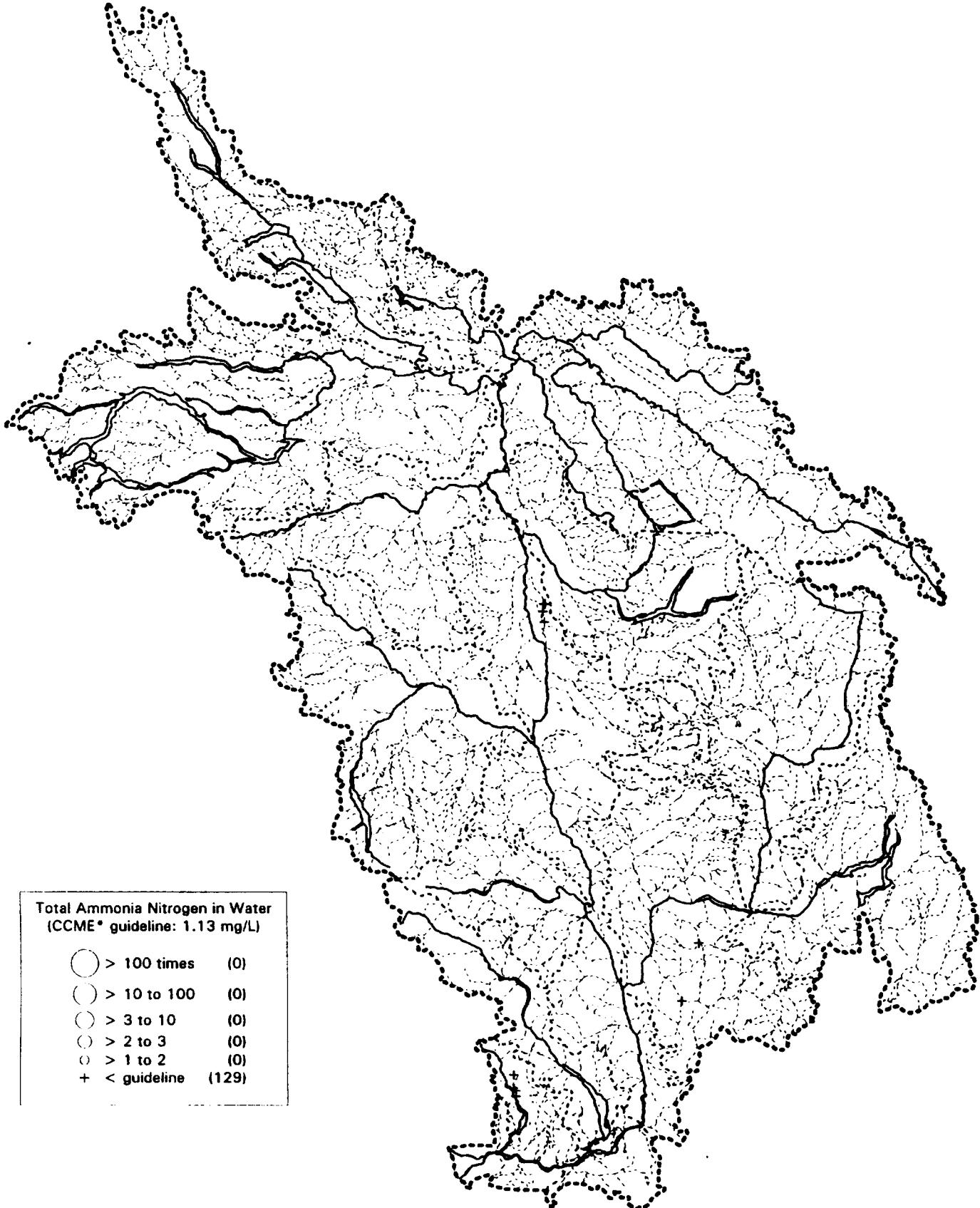
Total Ammonia Nitrogen

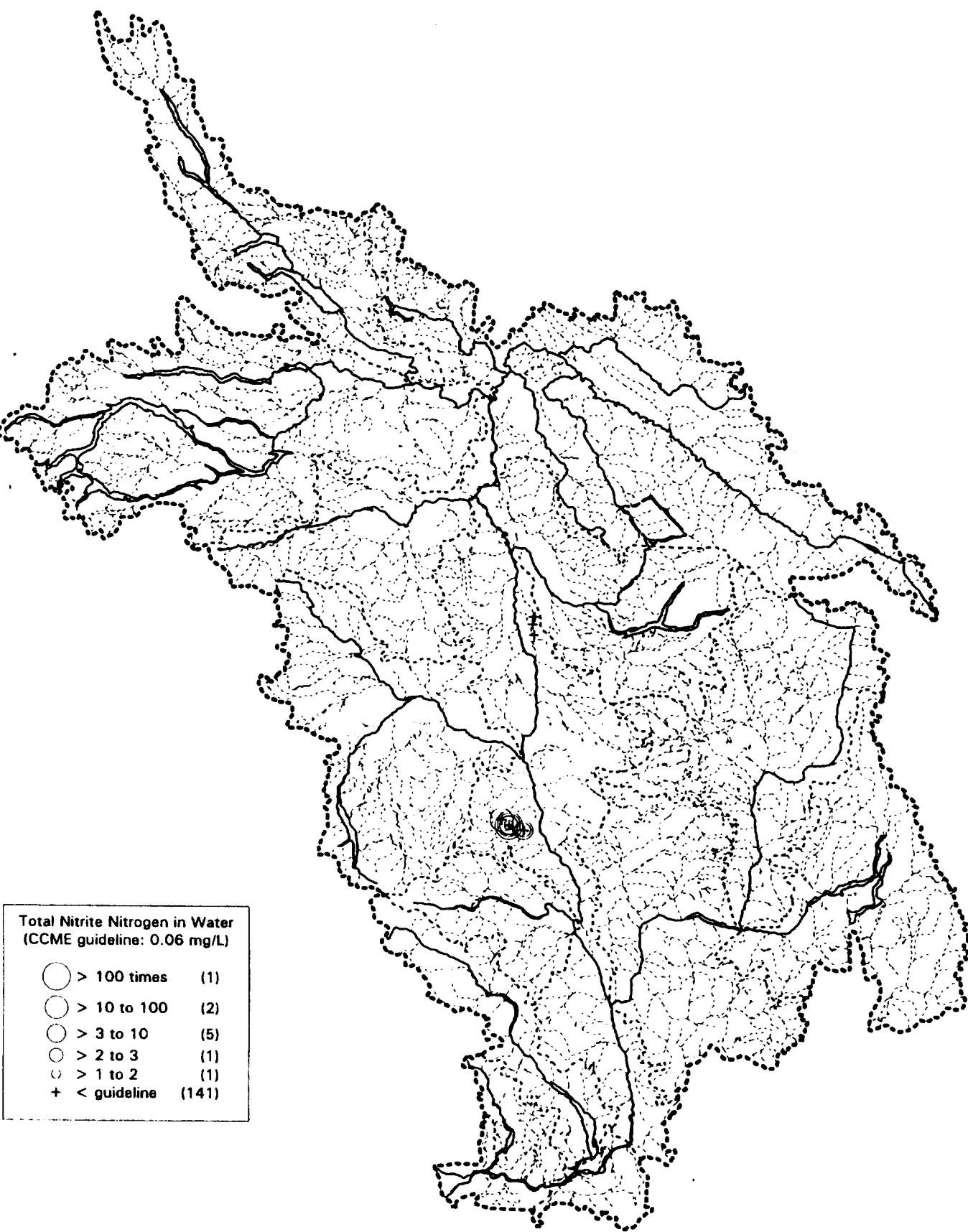
Total Nitrite Nitrogen

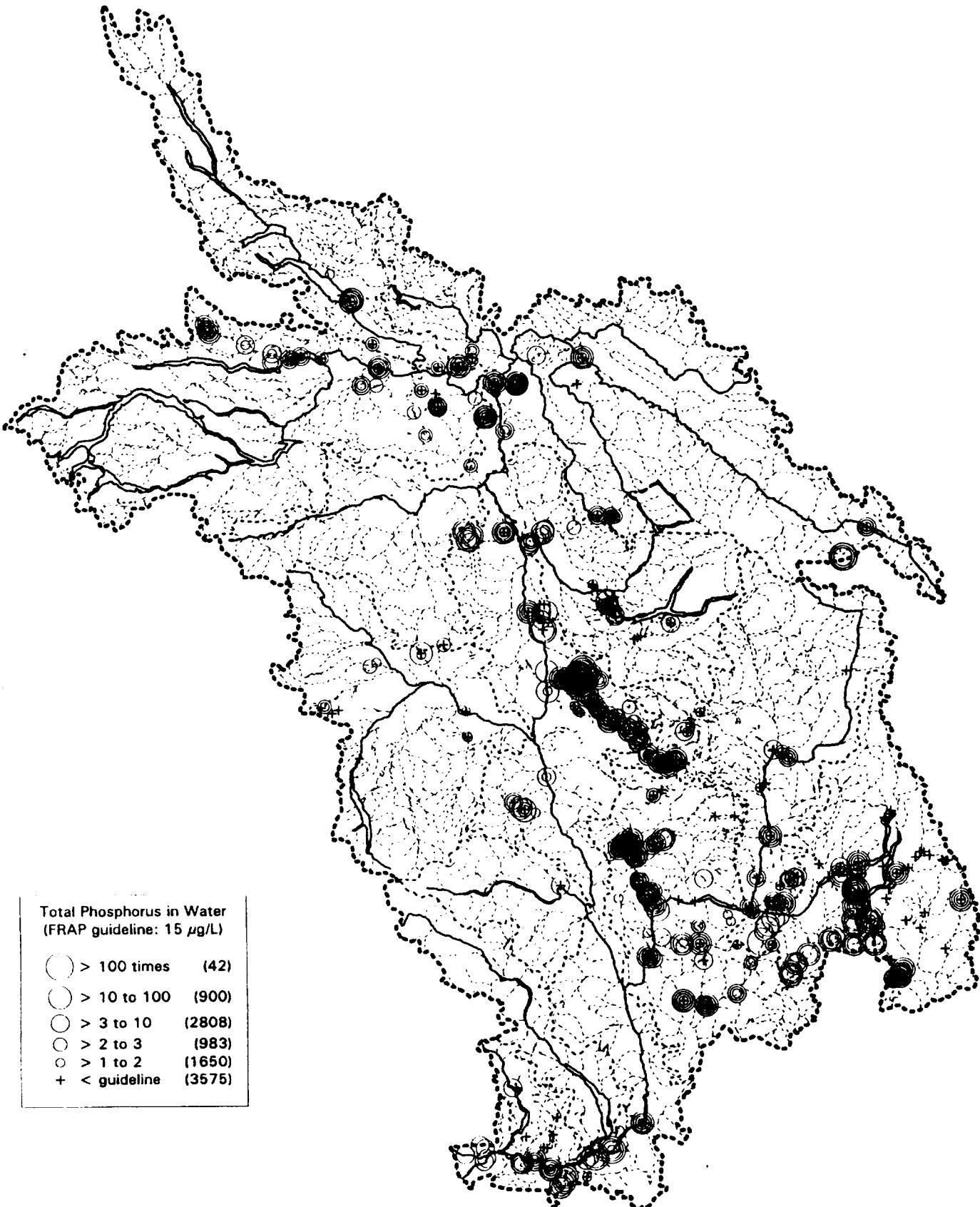
Total Phosphorus

Total Ammonia Nitrogen in Water
(CCME* guideline: 1.13 mg/L)

- (○) > 100 times (0)
- (○) > 10 to 100 (0)
- (○) > 3 to 10 (0)
- (○) > 2 to 3 (0)
- (○) > 1 to 2 (0)
- (+) < guideline (129)

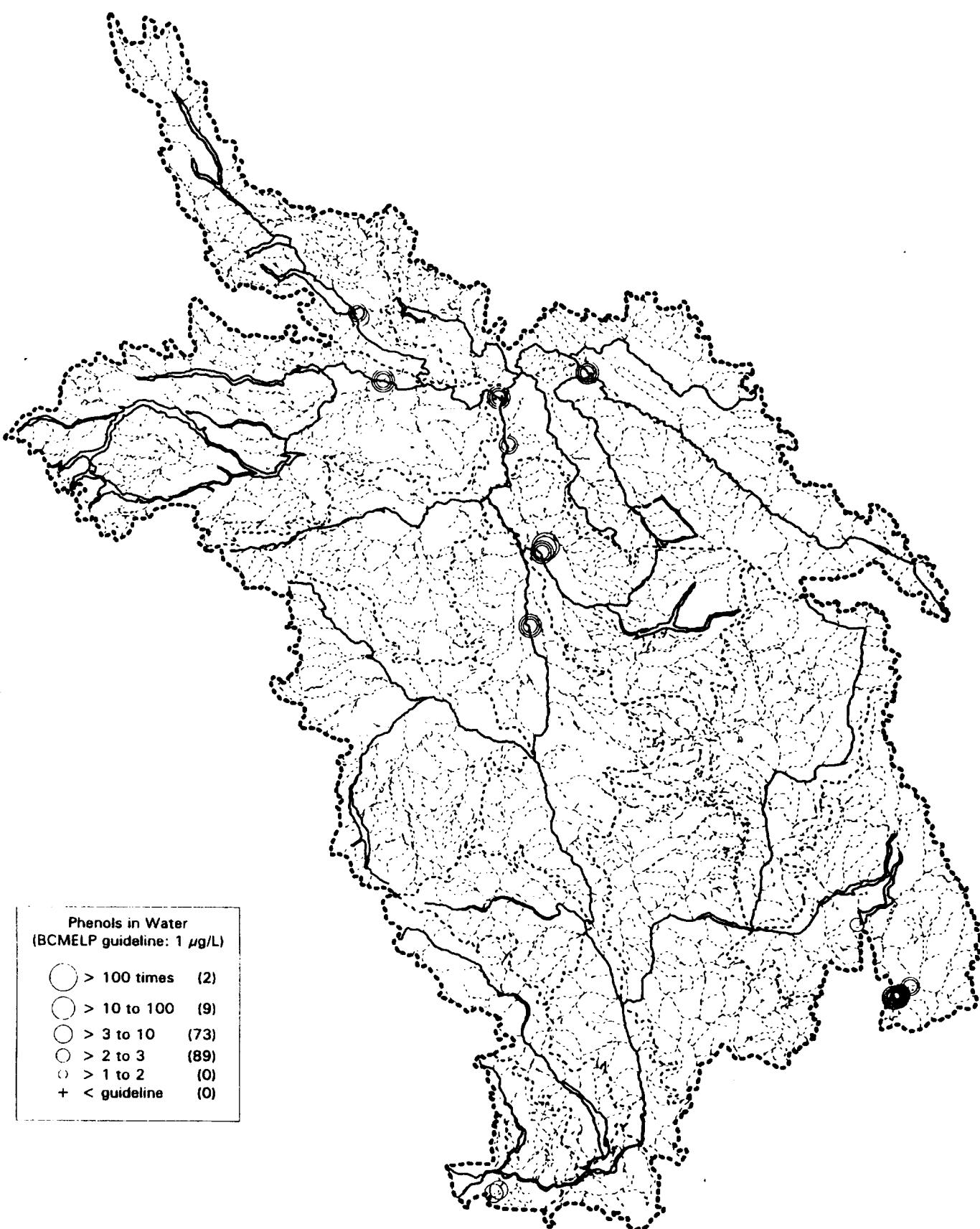






1.4.6 Organics, miscellaneous in water

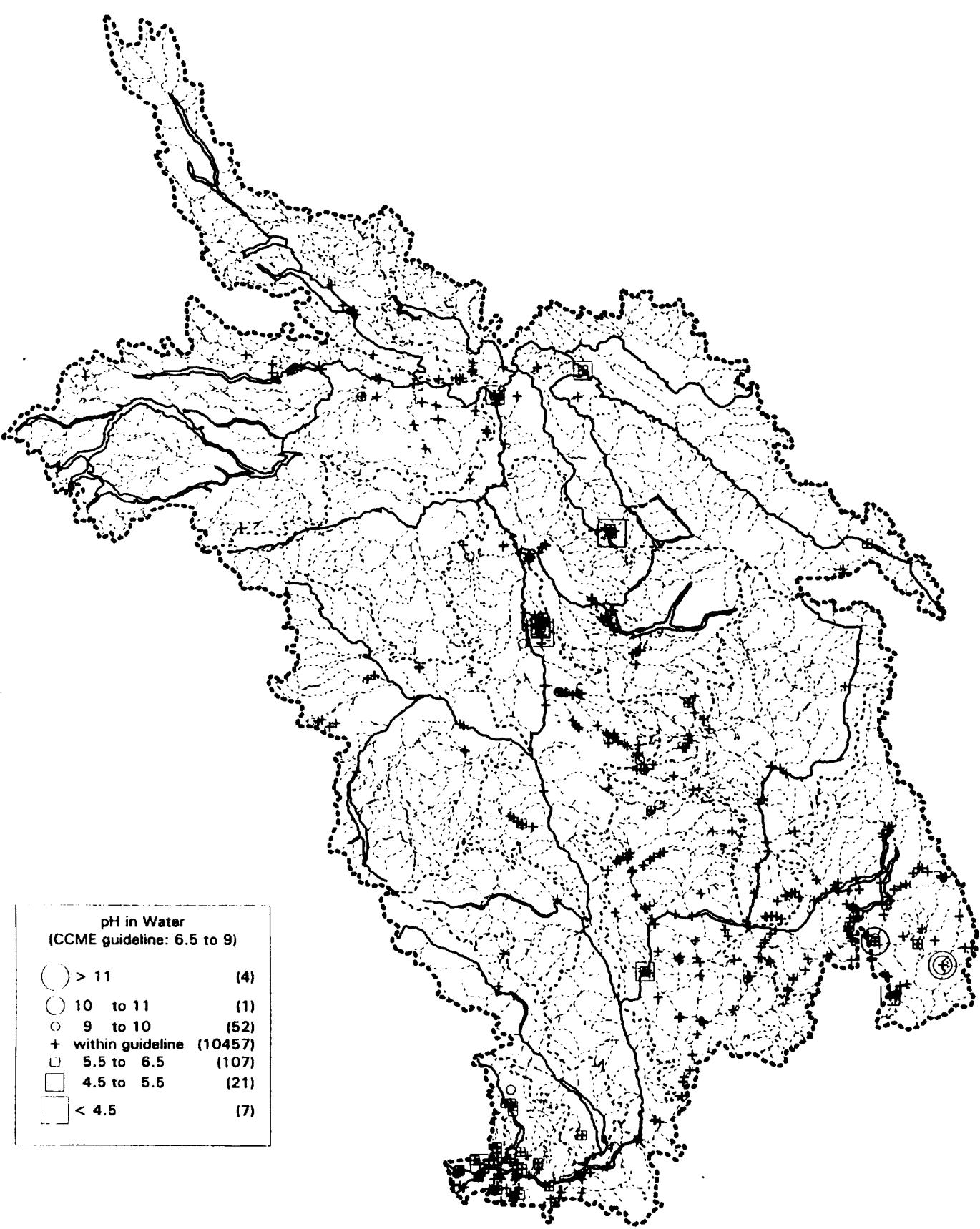
Phenols

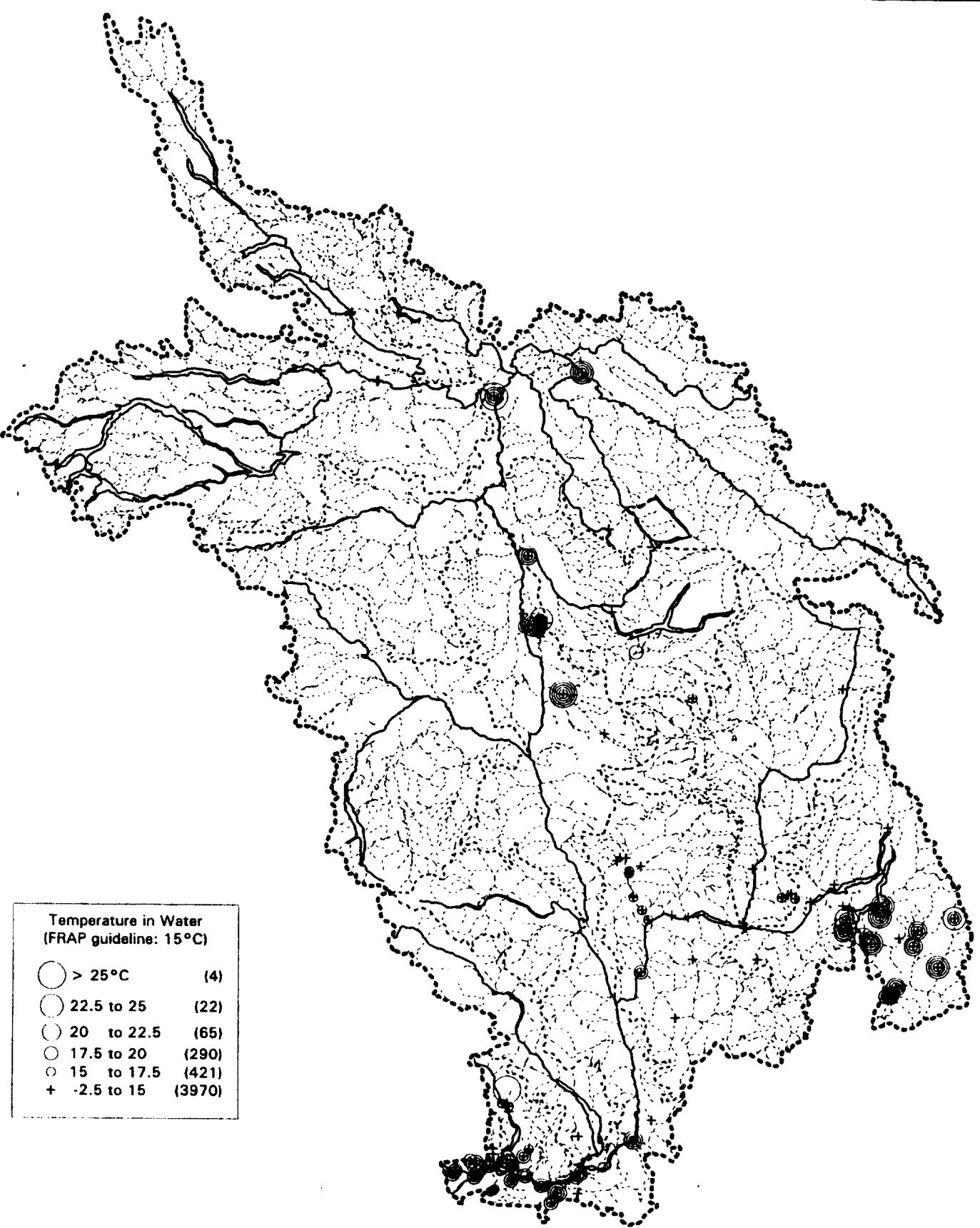


1.4.7 Physical parameters in water

pH

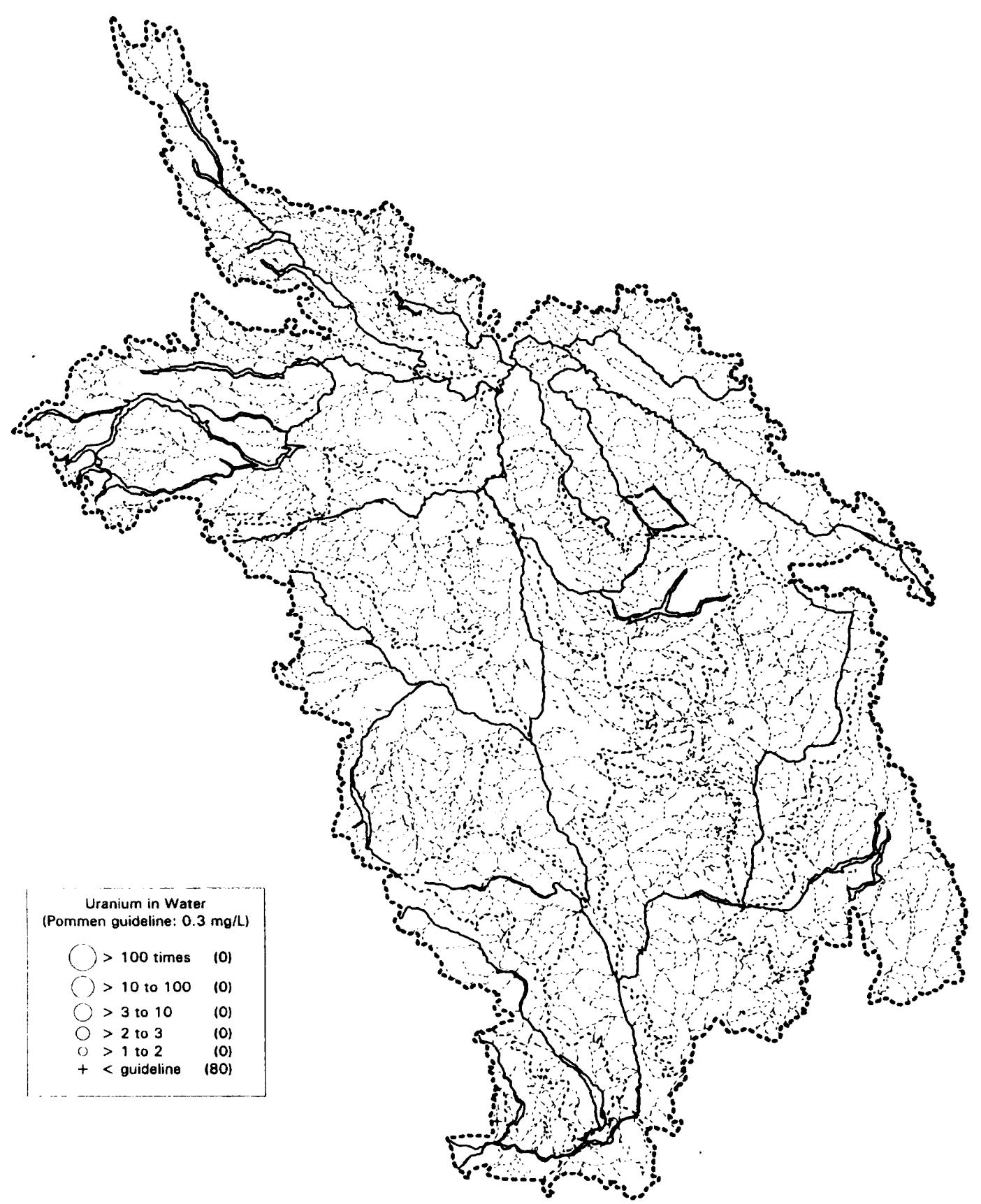
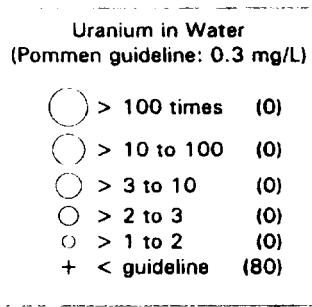
Temperature





1.4.8 Radioactives in water

Uranium



APPENDIX 2. DISTRIBUTION OF OBSERVATIONS FOR PARAMETERS WITHOUT REGULATORY GUIDELINES

2.1 Biota, Fish

2.1.1 Chlorophenols in fish

Tetrachloroguaiacols in Fish Muscle

Tetrachloroguaiacols in Fish Liver

Tetrachlorocatechols in Fish Muscle

Tetrachlorocatechols in Fish Liver

2,3,4,6-T4CP in Fish Muscle

2,3,4,6-T4CP in Fish Liver

3,4,5-Trichloroguaiacol in Fish Muscle

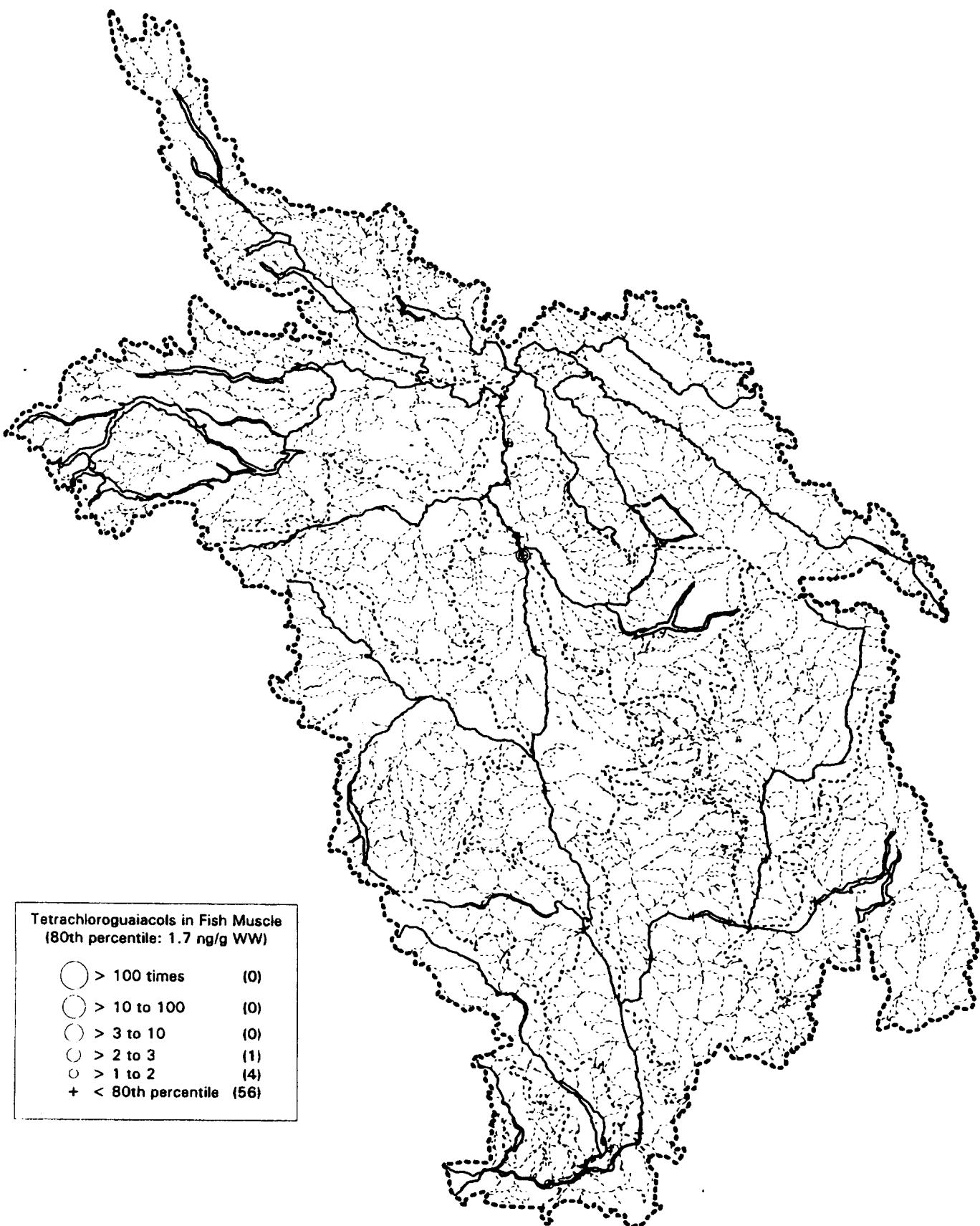
3,4,5-Trichloroguaiacol in Fish Liver

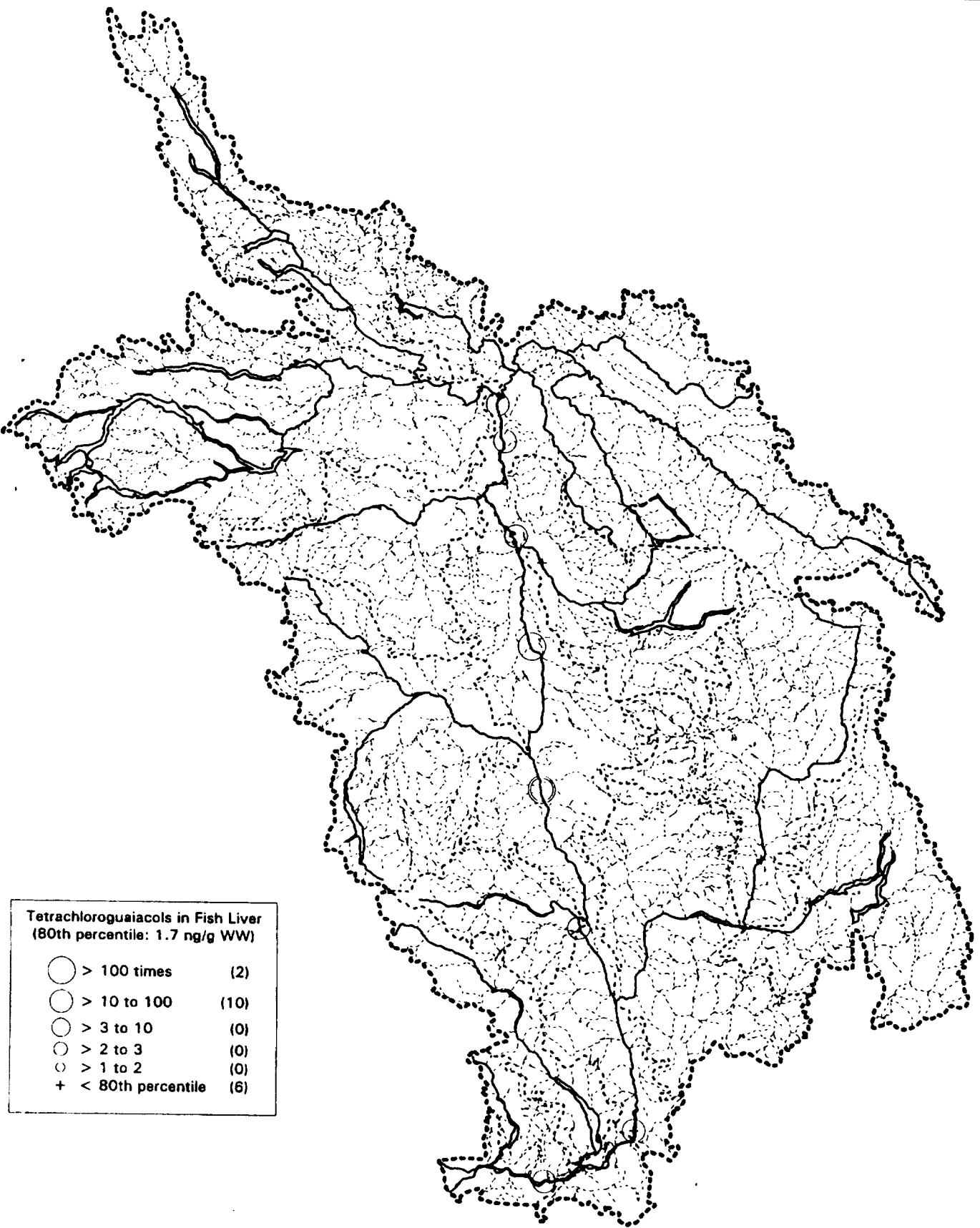
3,4,5-Trichlorocatechol in Fish Muscle

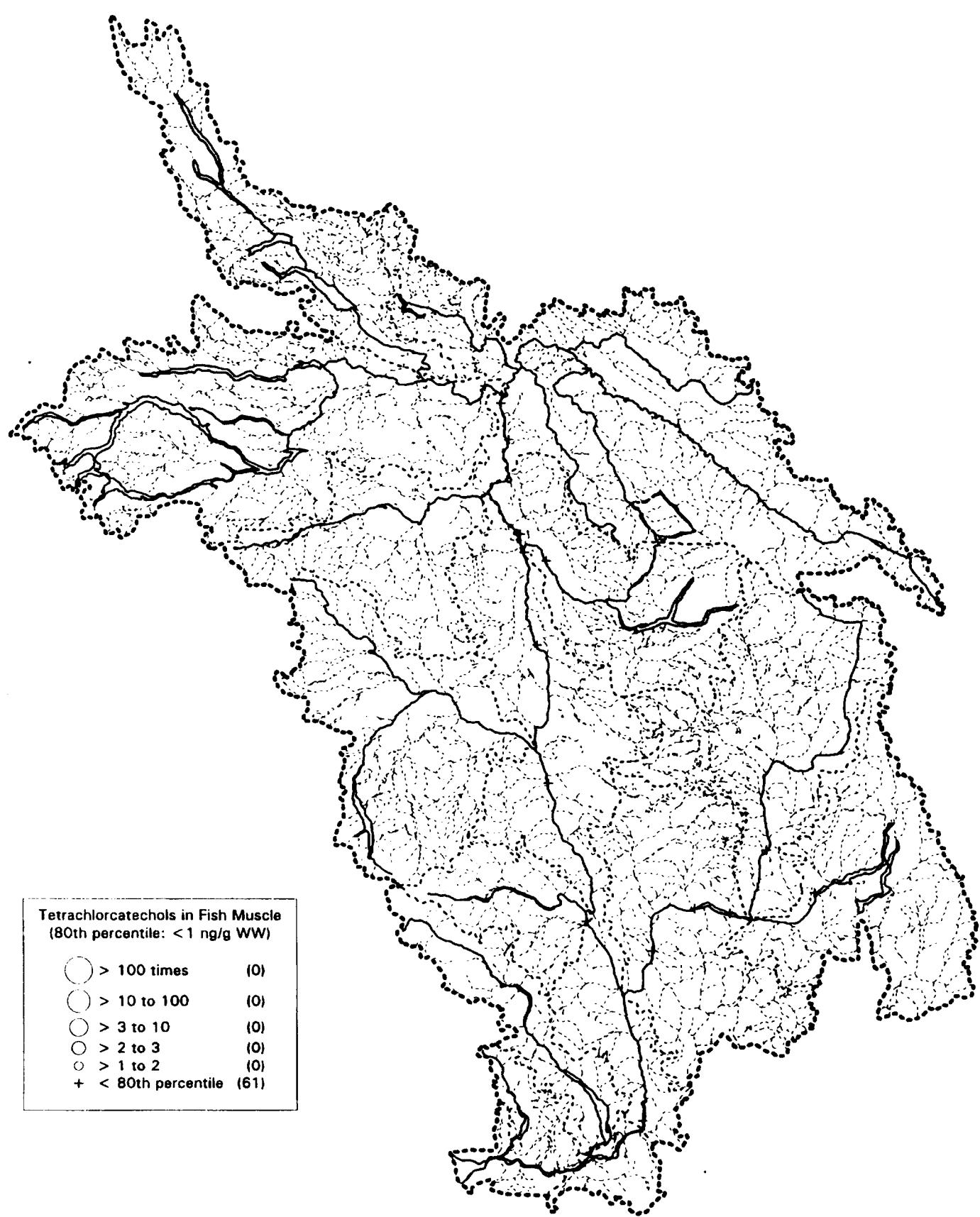
3,4,5-Trichlorocatechol in Fish Liver

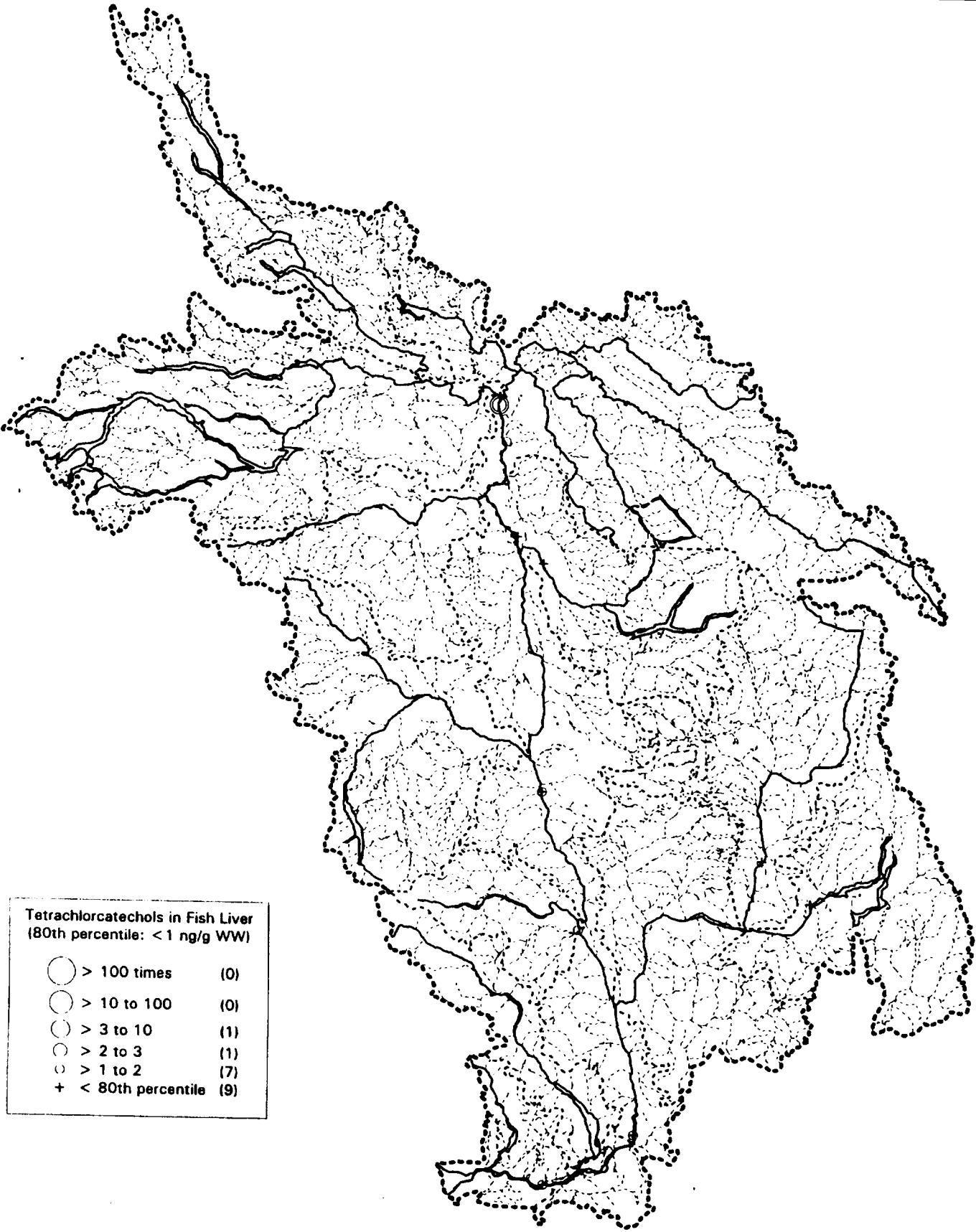
Tetrachloroguaiacols in Fish Muscle
(80th percentile: 1.7 ng/g WW)

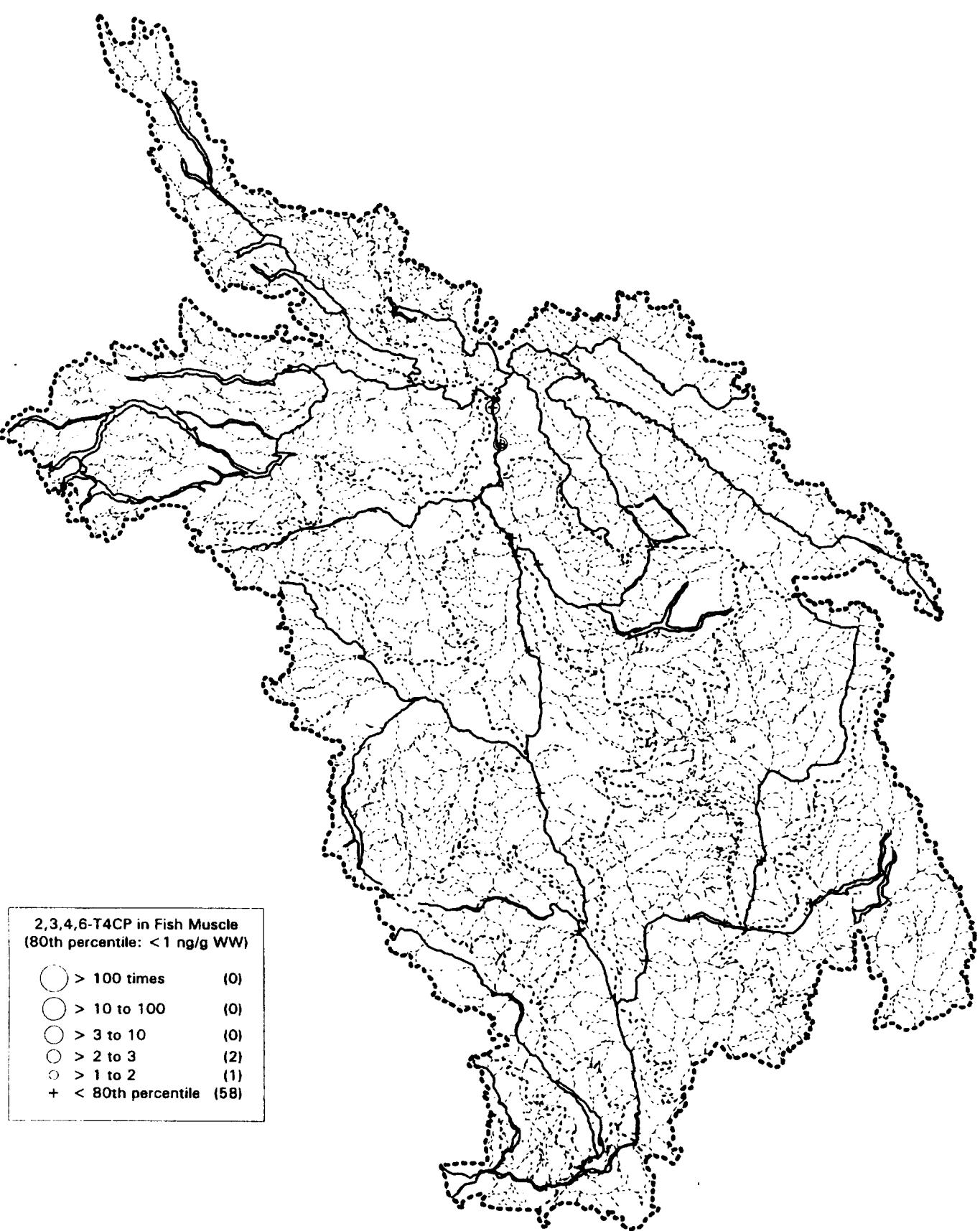
- | | |
|---------------------|------|
| ○ > 100 times | (0) |
| ○ > 10 to 100 | (0) |
| ○ > 3 to 10 | (0) |
| ○ > 2 to 3 | (1) |
| ○ > 1 to 2 | (4) |
| + < 80th percentile | (56) |

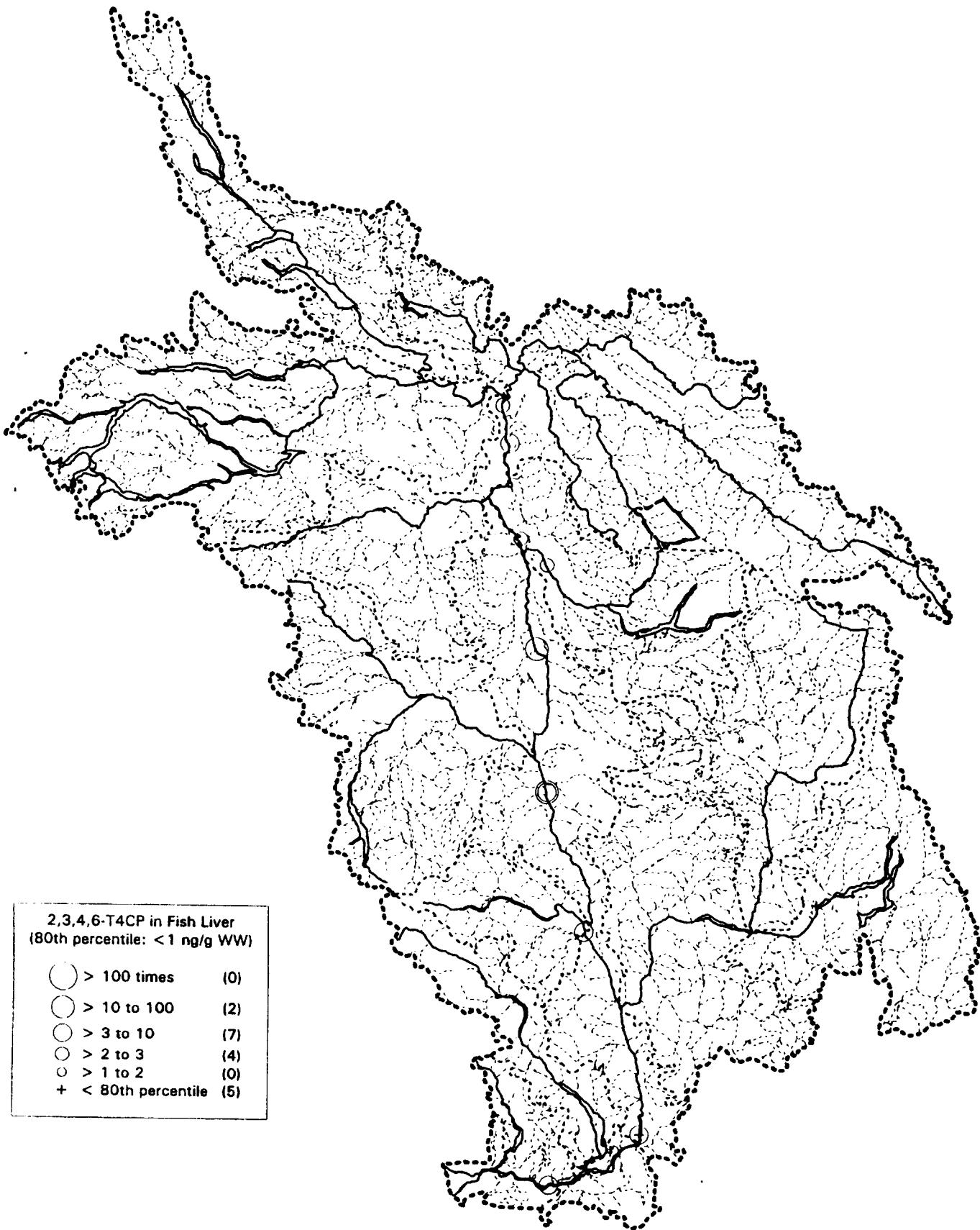


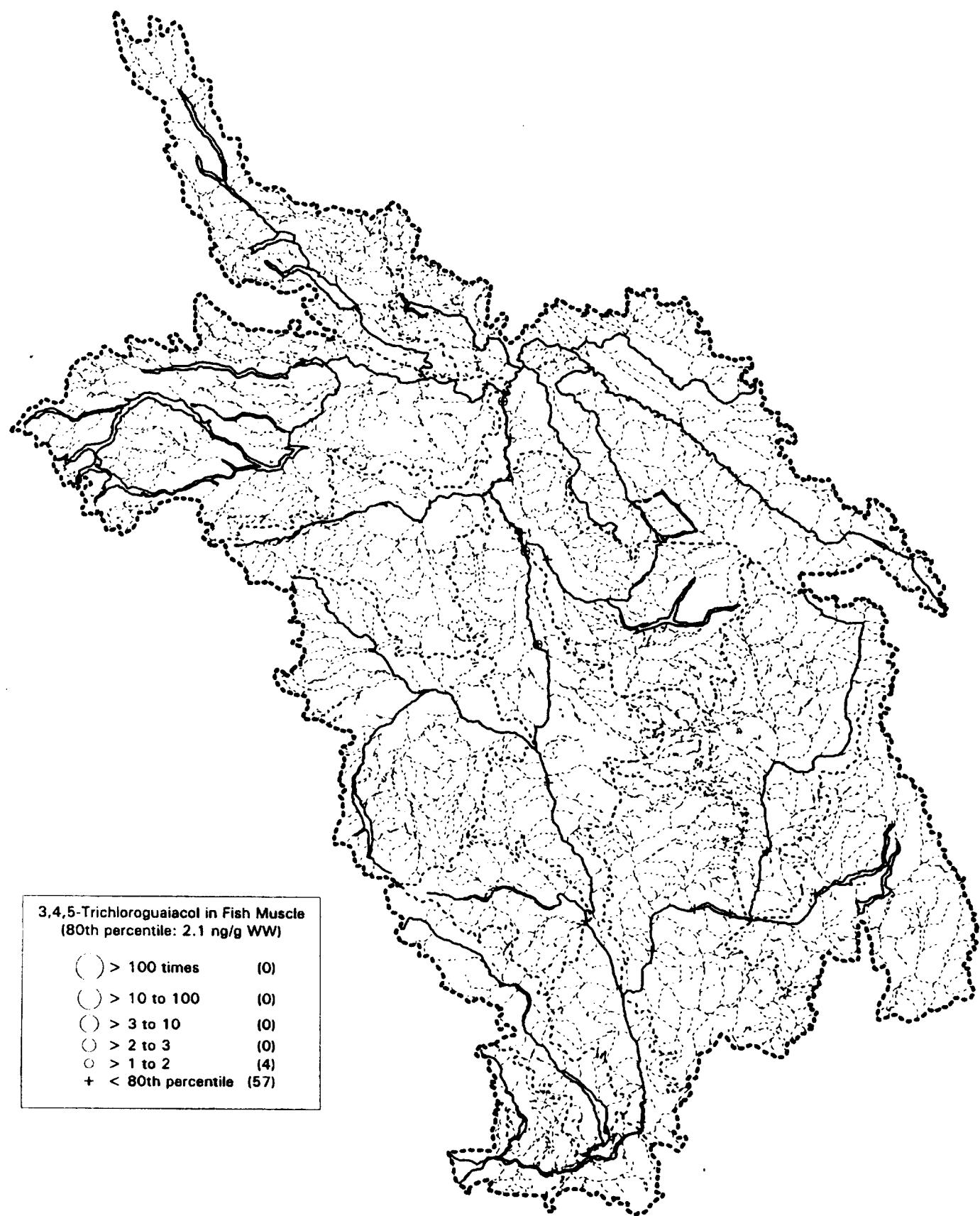


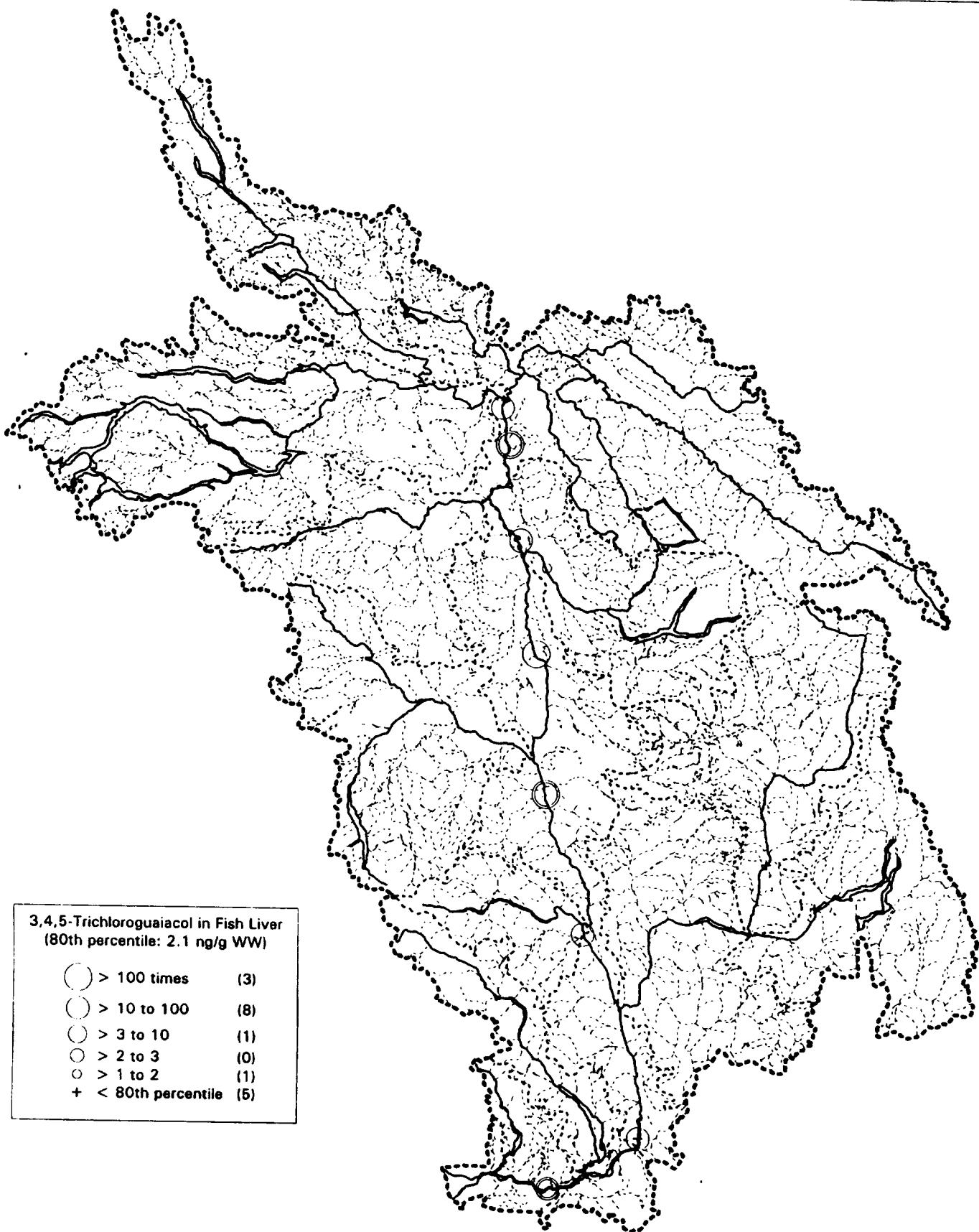






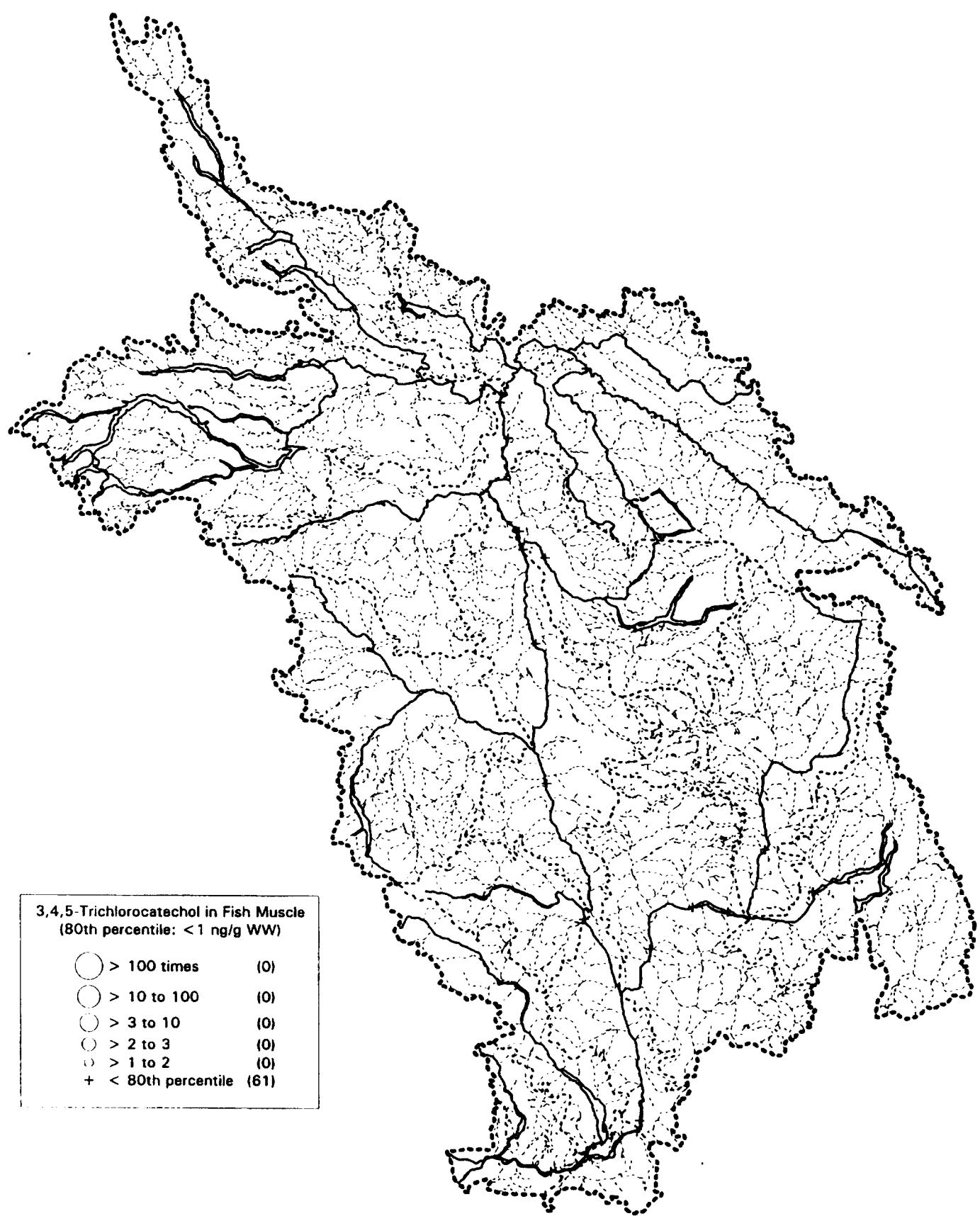






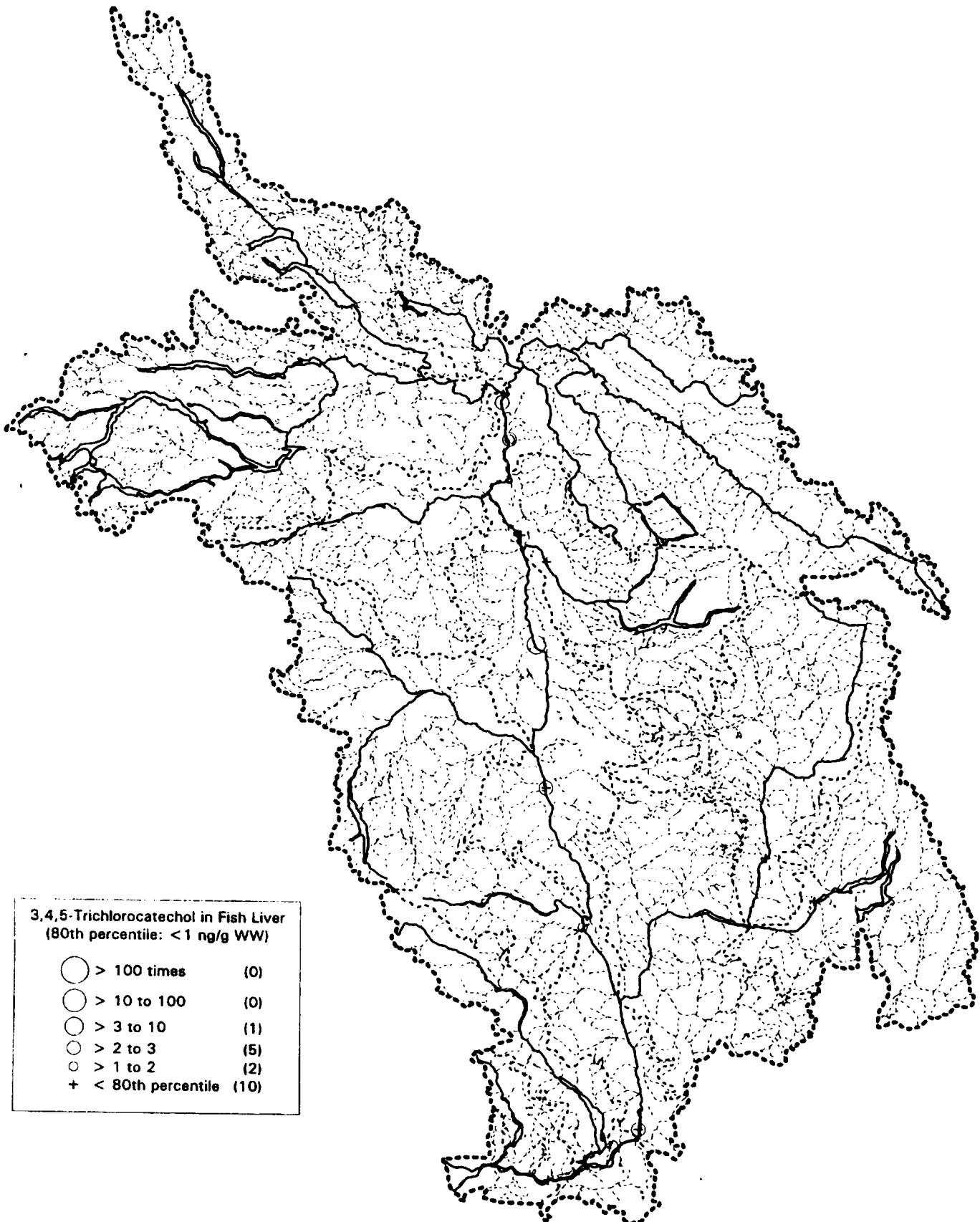
3,4,5-Trichloroguaiacol in Fish Liver
(80th percentile: 2.1 ng/g WW)

- () > 100 times (3)
- () > 10 to 100 (8)
- () > 3 to 10 (1)
- () > 2 to 3 (0)
- () > 1 to 2 (1)
- + < 80th percentile (5)



**3,4,5-Trichlorocatechol in Fish Liver
(80th percentile: <1 ng/g WW)**

- | | | |
|---|-------------------|------|
| ○ | > 100 times | (0) |
| ○ | > 10 to 100 | (0) |
| ○ | > 3 to 10 | (1) |
| ○ | > 2 to 3 | (5) |
| ○ | > 1 to 2 | (2) |
| + | < 80th percentile | (10) |



2.1.2 Dioxins and furans in fish

T4CDD in Fish Muscle

T4CDD in Fish Liver

T4CDF in Fish Muscle

T4CDF in Fish Liver

2,3,7,8-T4CDF in Fish Muscle

2,3,7,8-T4CDF in Fish Liver

P5CDD in Fish Muscle

P5CDD in Fish Liver

1,2,3,7,8-P5CDD in Fish Muscle

1,2,3,7,8-P5CDD in Fish Liver

P5CDF in Fish Muscle

P5CDF in Fish Liver

2,3,4,7,8-P5CDF in Fish Muscle

2,3,4,7,8-P5CDF in Fish Liver

H6CDD in Fish Muscle

H6CDD in Fish Liver

1,2,3,6,7,8-H6CDD in Fish Muscle

1,2,3,6,7,8-H6CDD in Fish Liver

1,2,3,7,8,9-H6CDD in Fish Muscle

1,2,3,7,8,9-H6CDD in Fish Liver

H7CDD in Fish Muscle

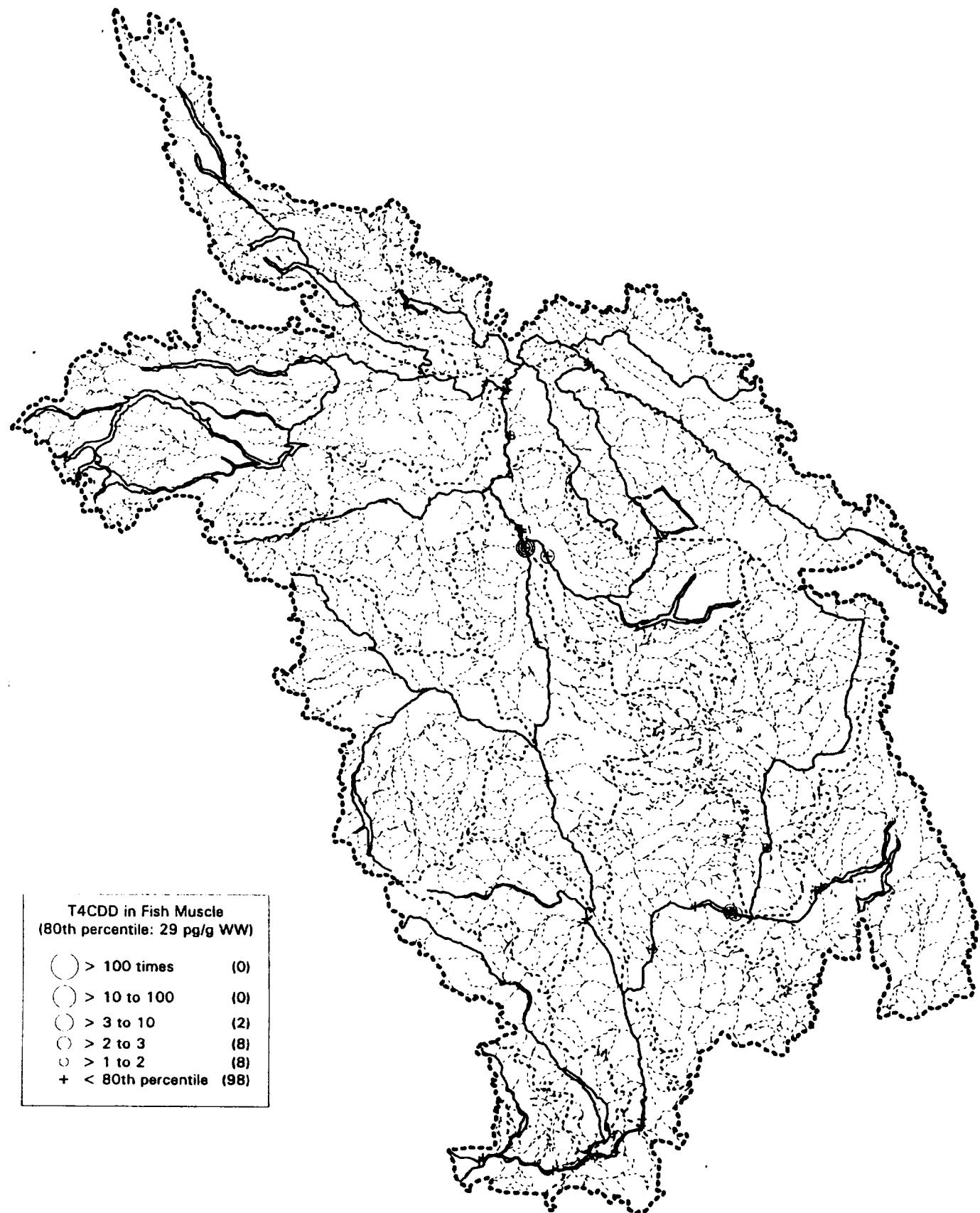
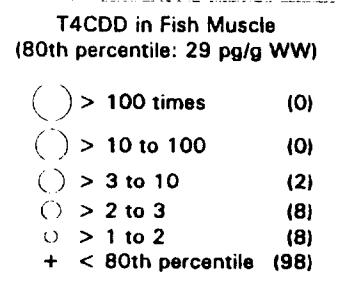
H7CDD in Fish Liver

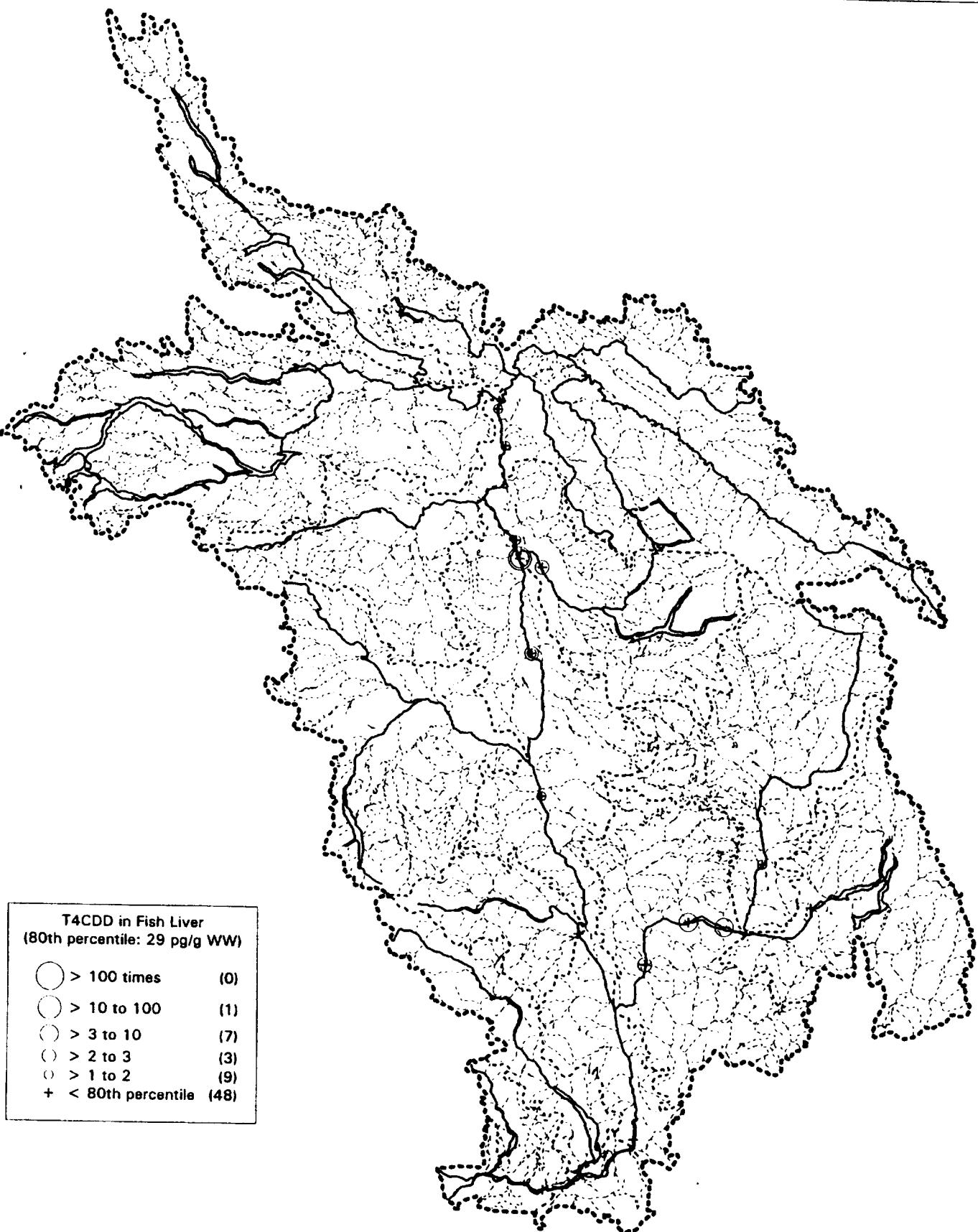
1,2,3,4,6,7,8-H7CDD in Fish Muscle

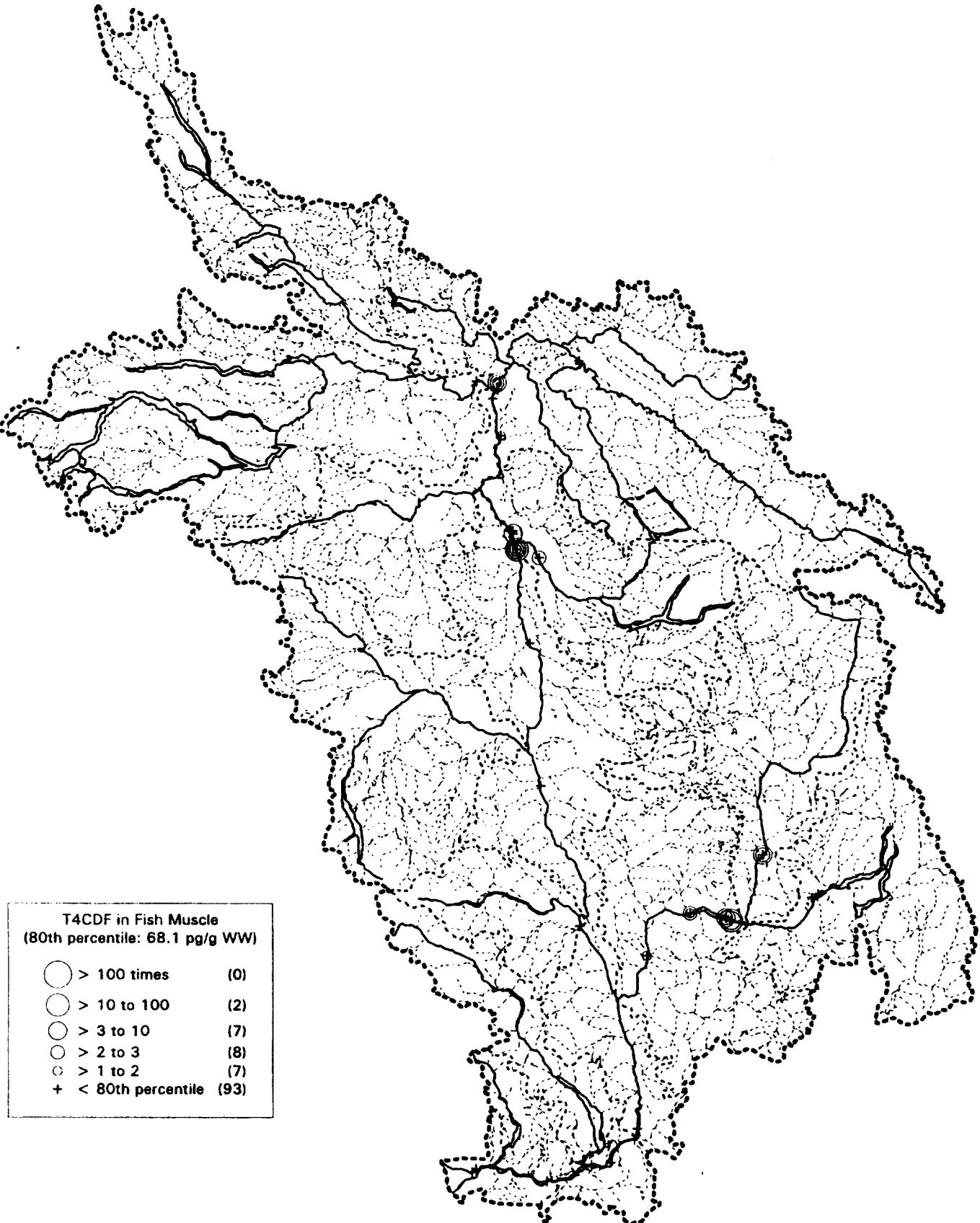
1,2,3,4,6,7,8-H7CDD in Fish Liver

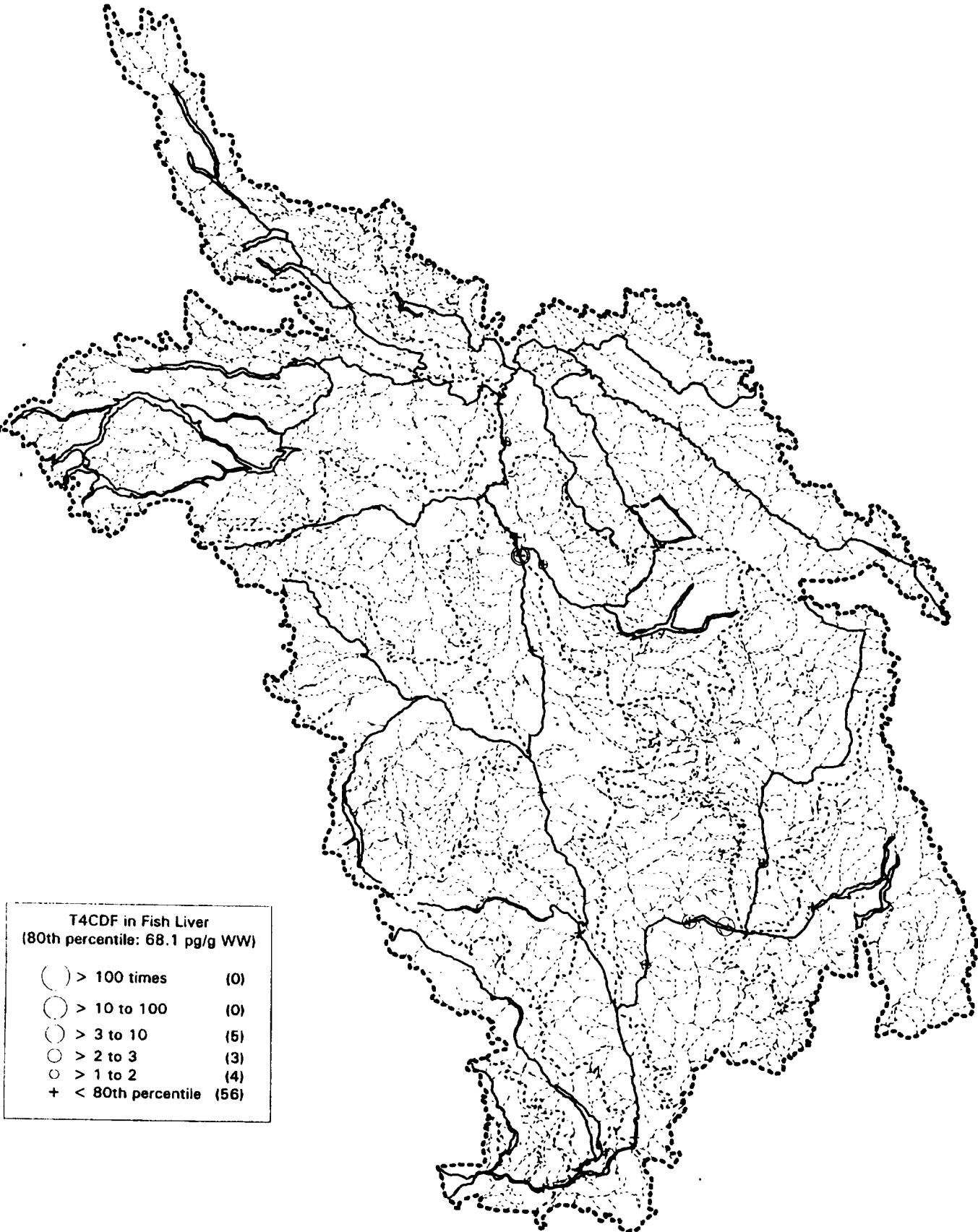
O8CDD in Fish Muscle

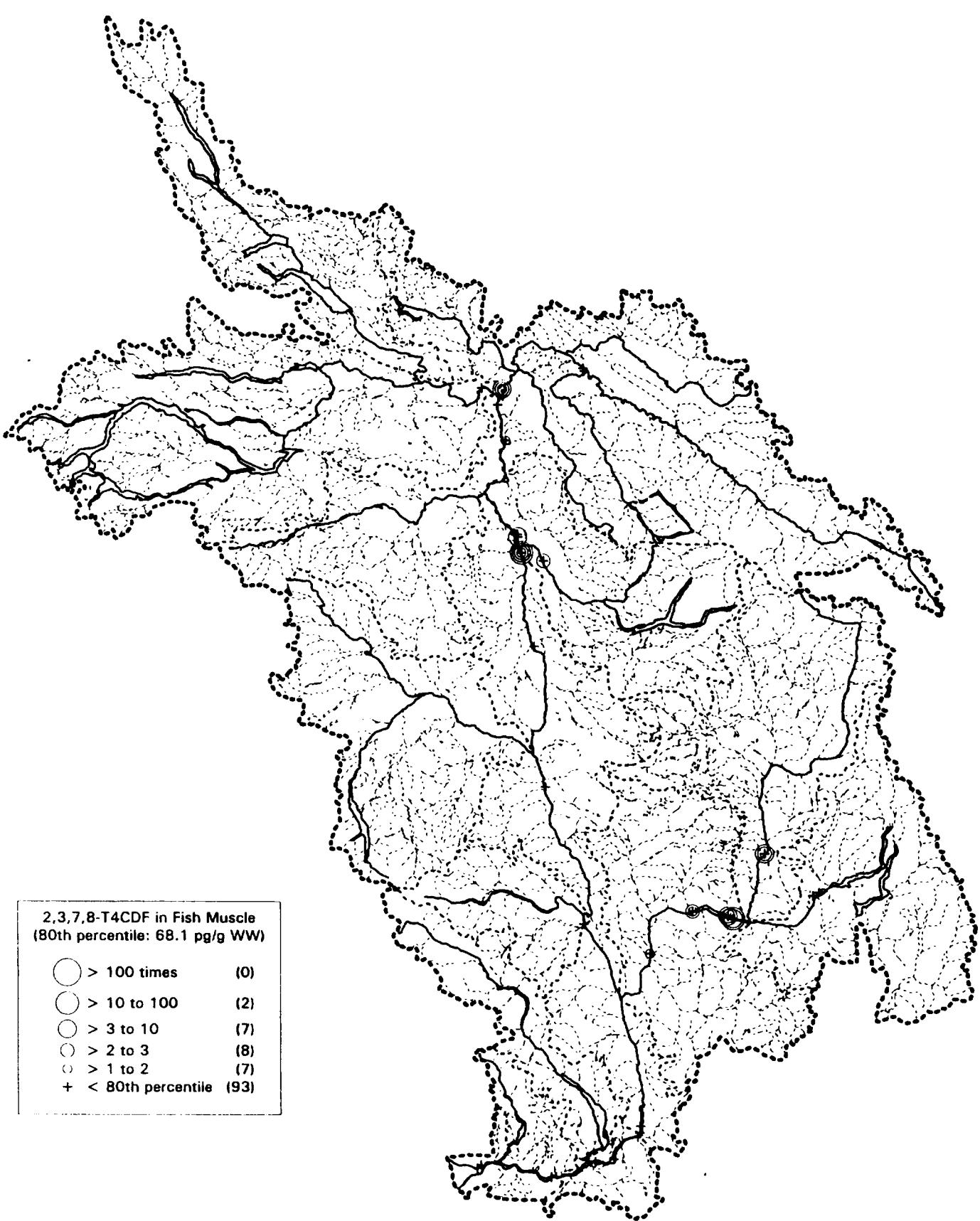
O8CDD in Fish Liver

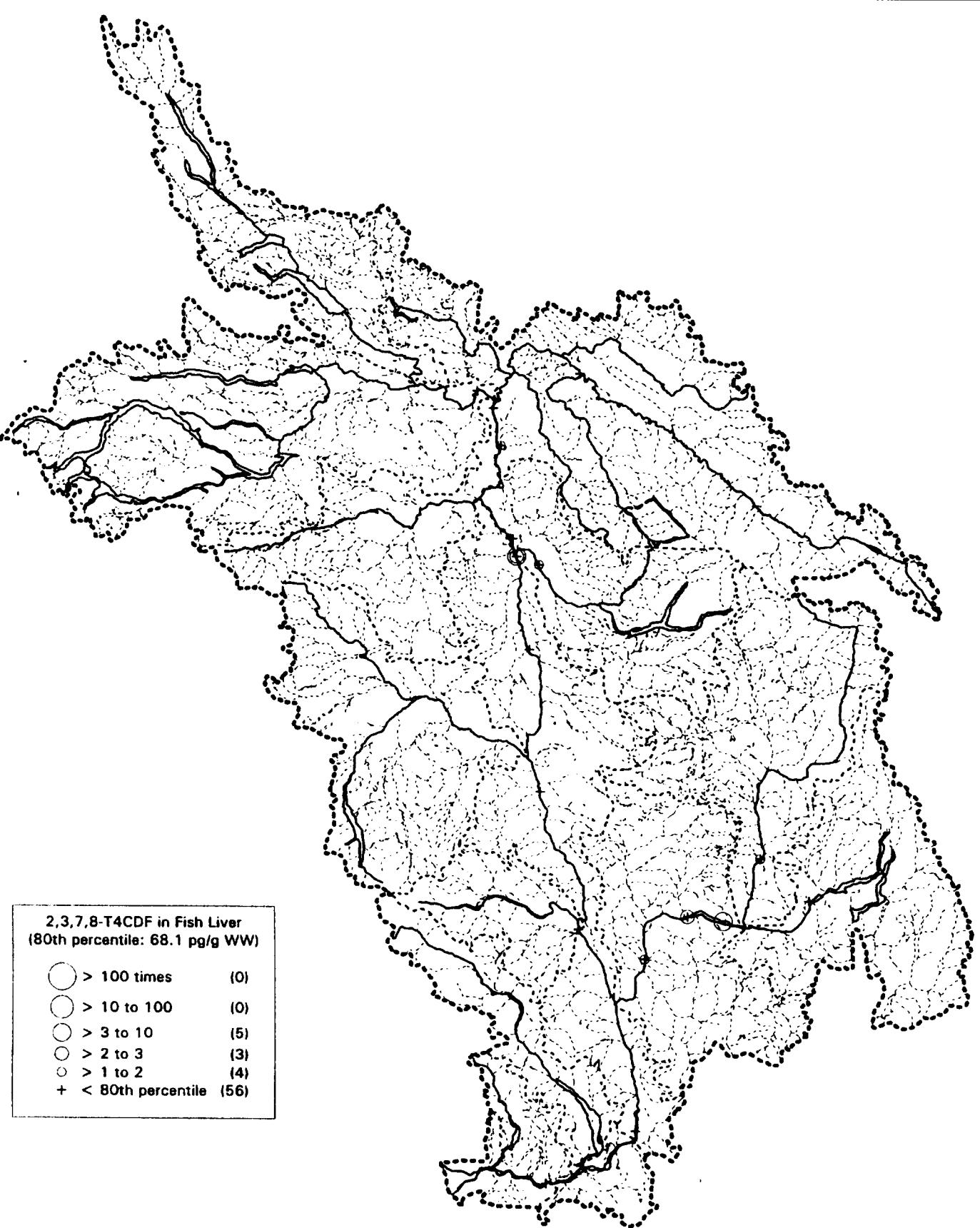


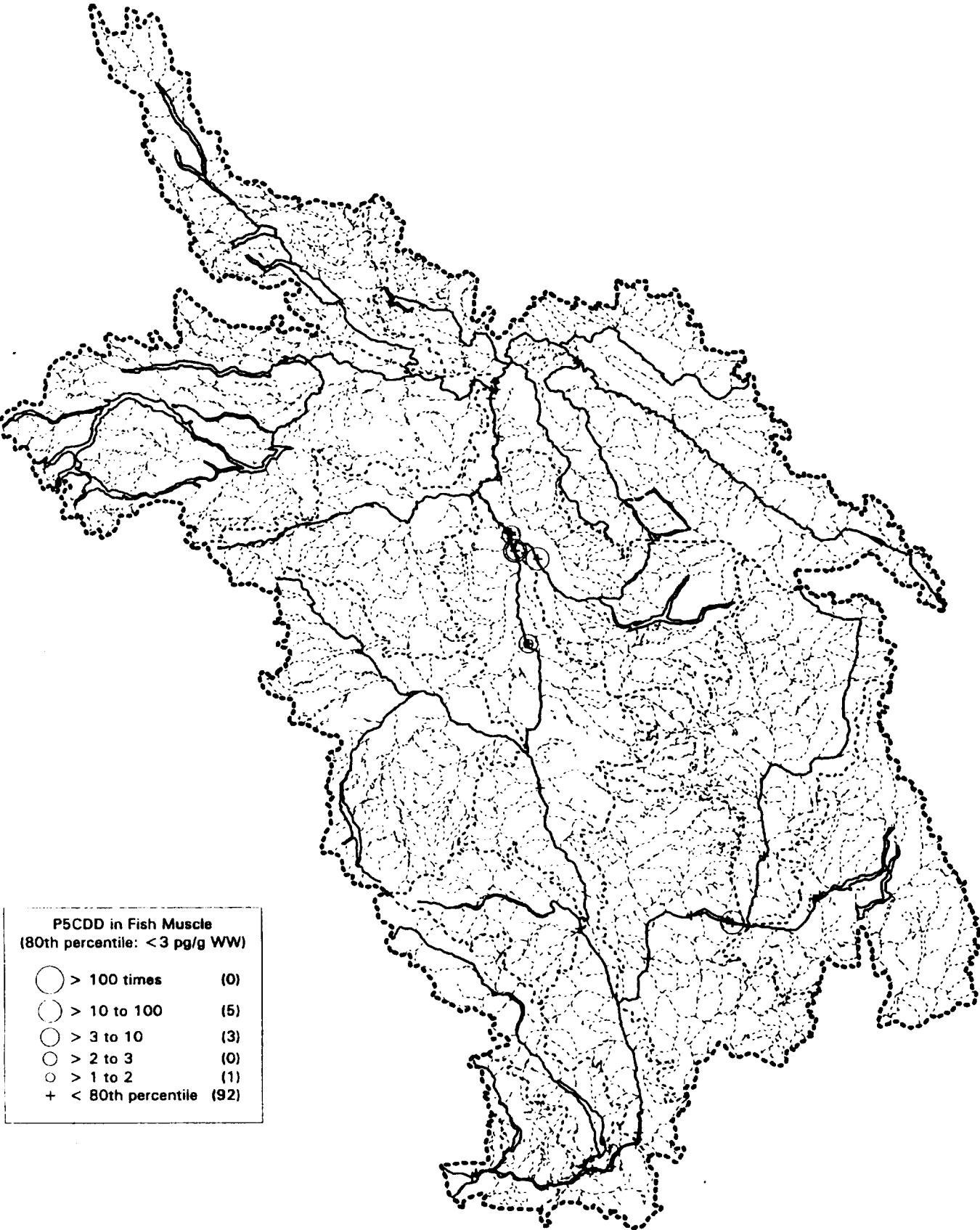


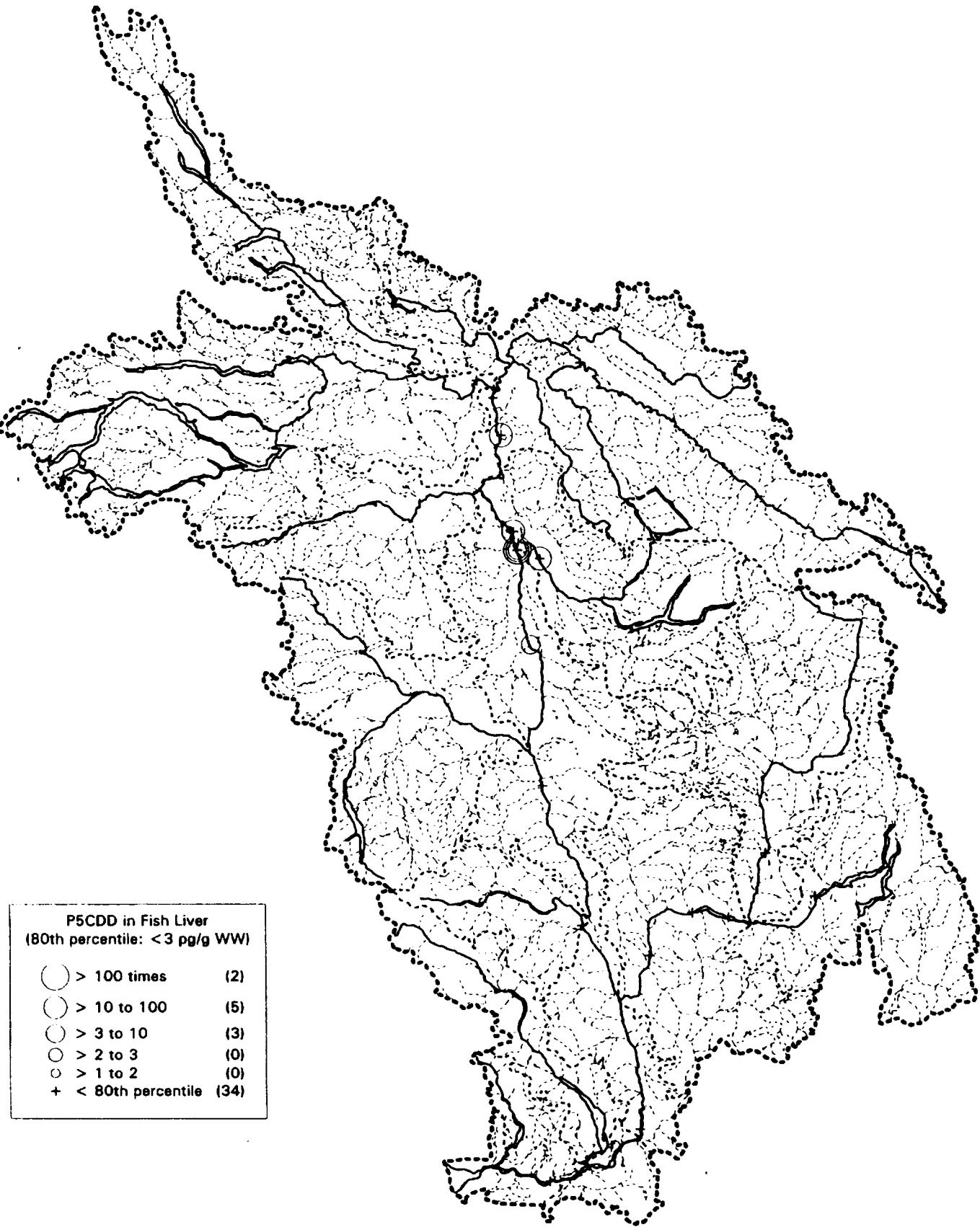


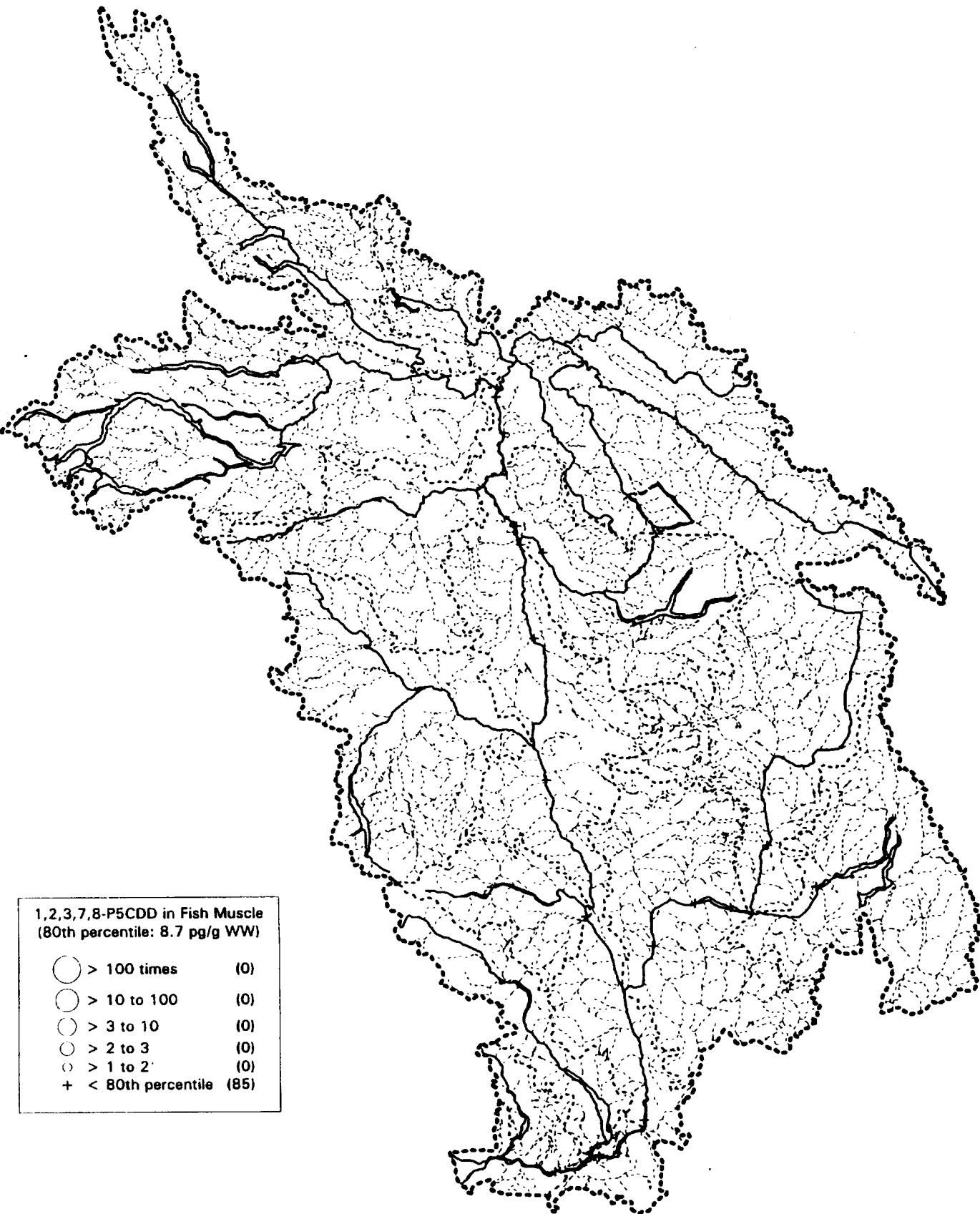


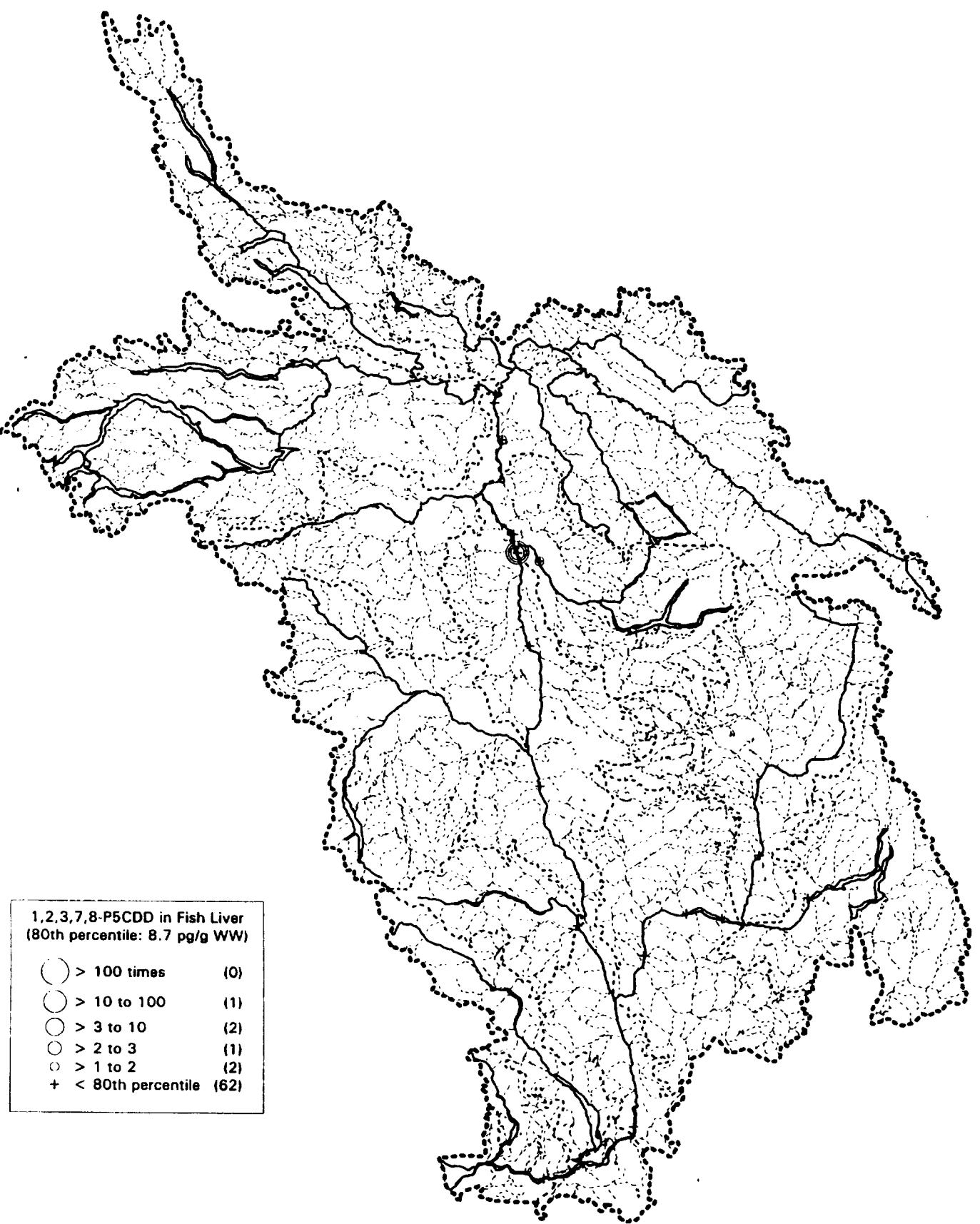


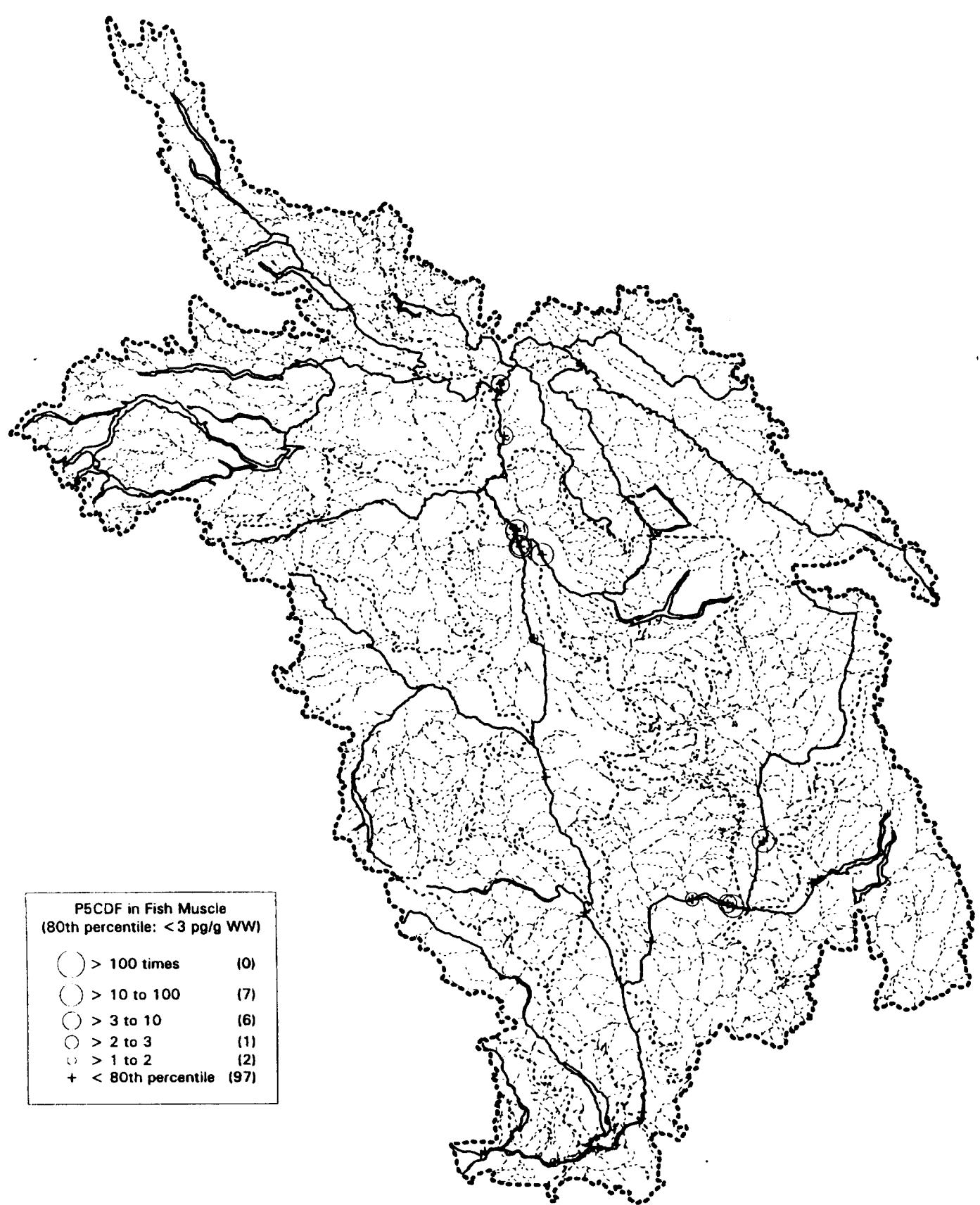


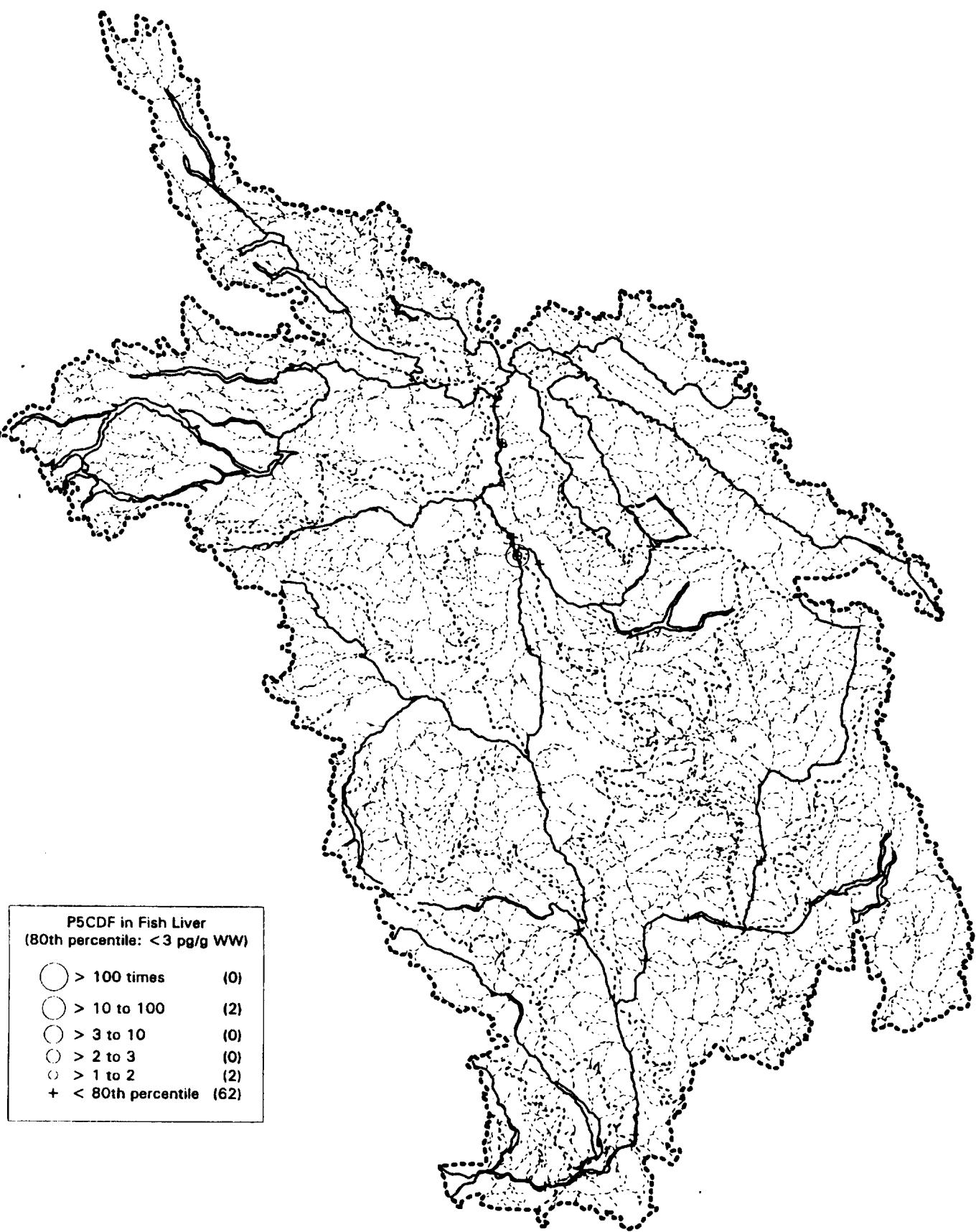


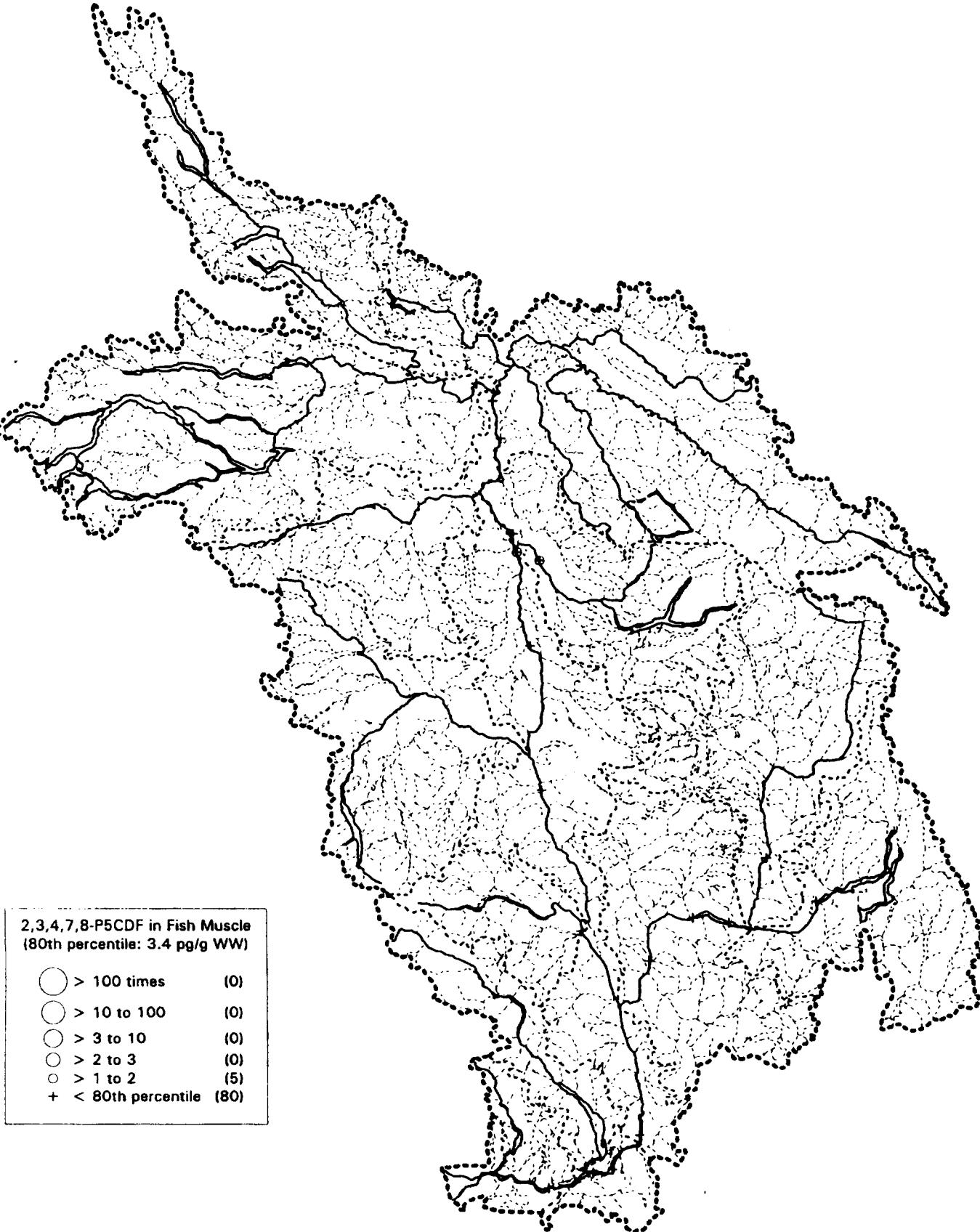


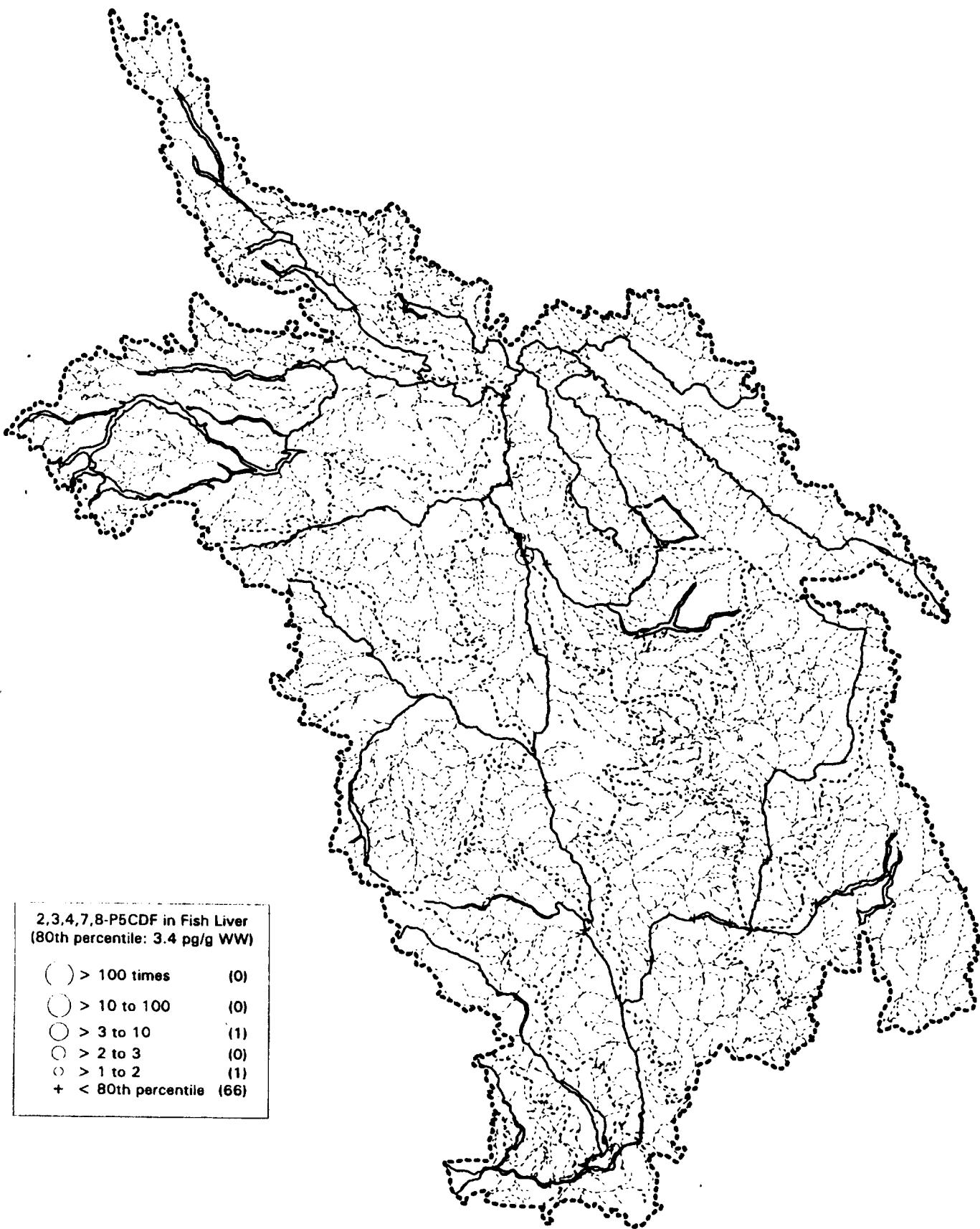
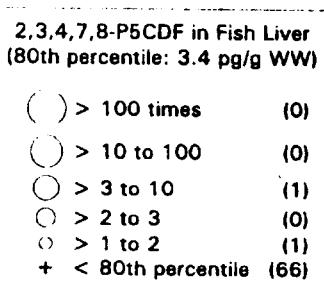


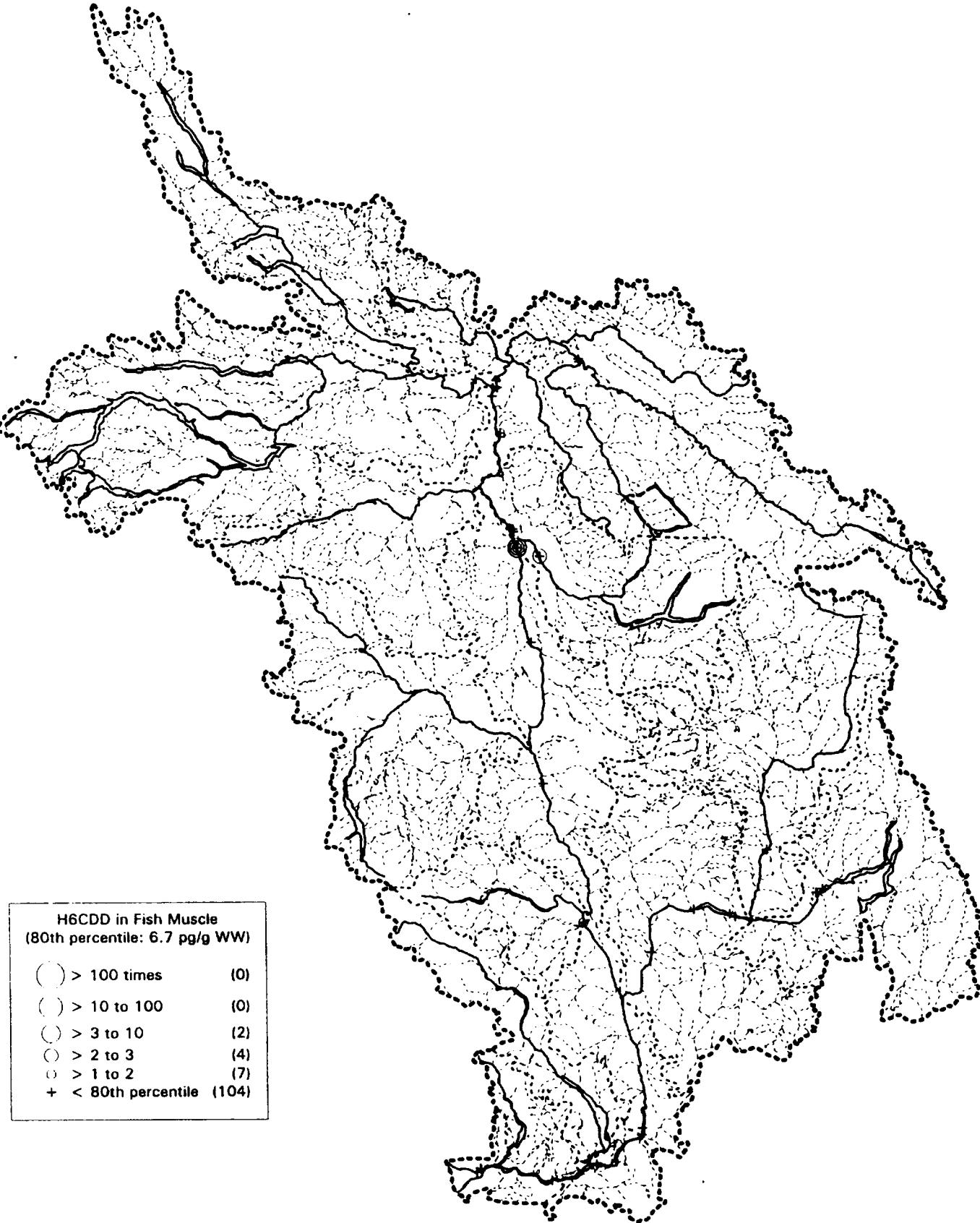


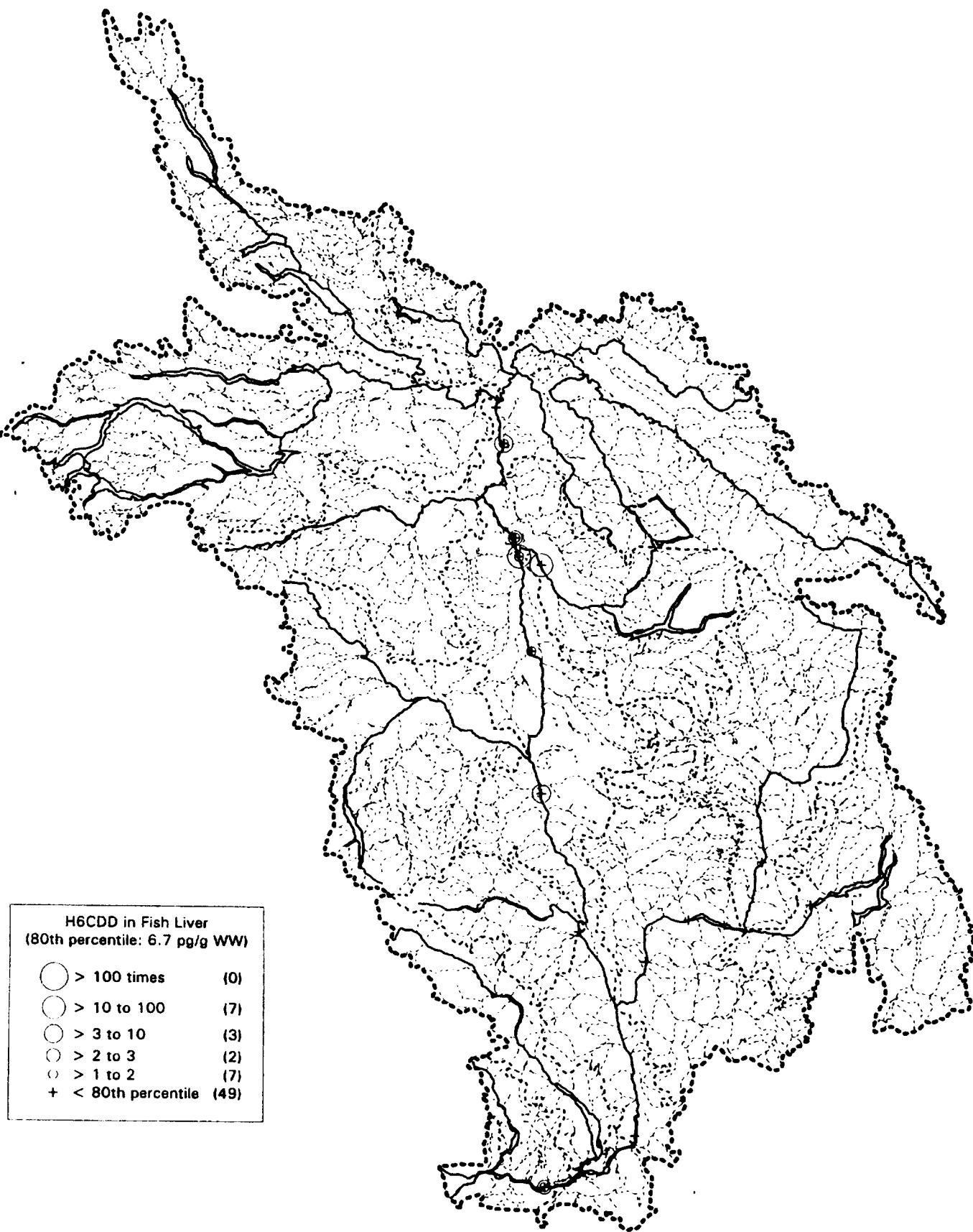






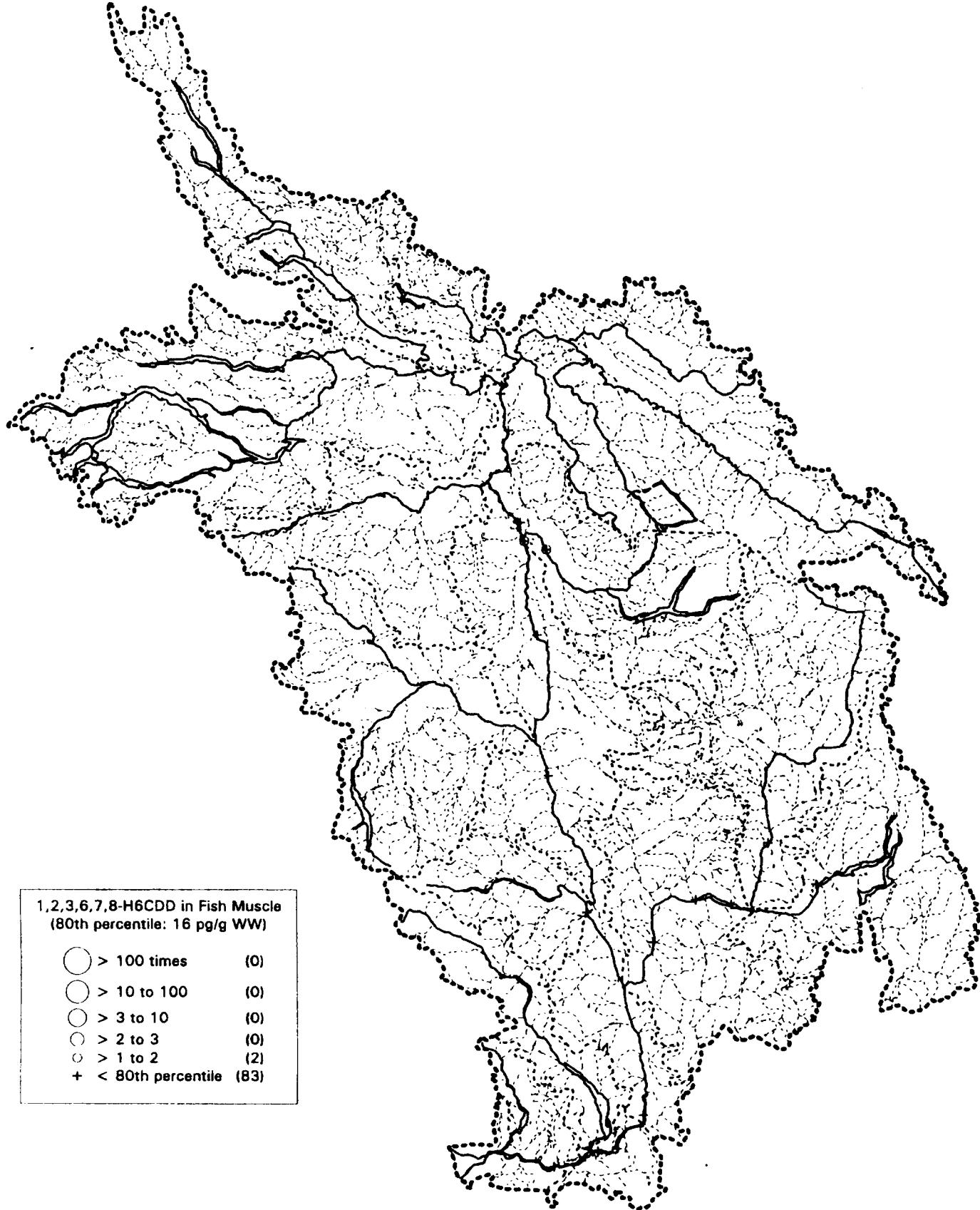


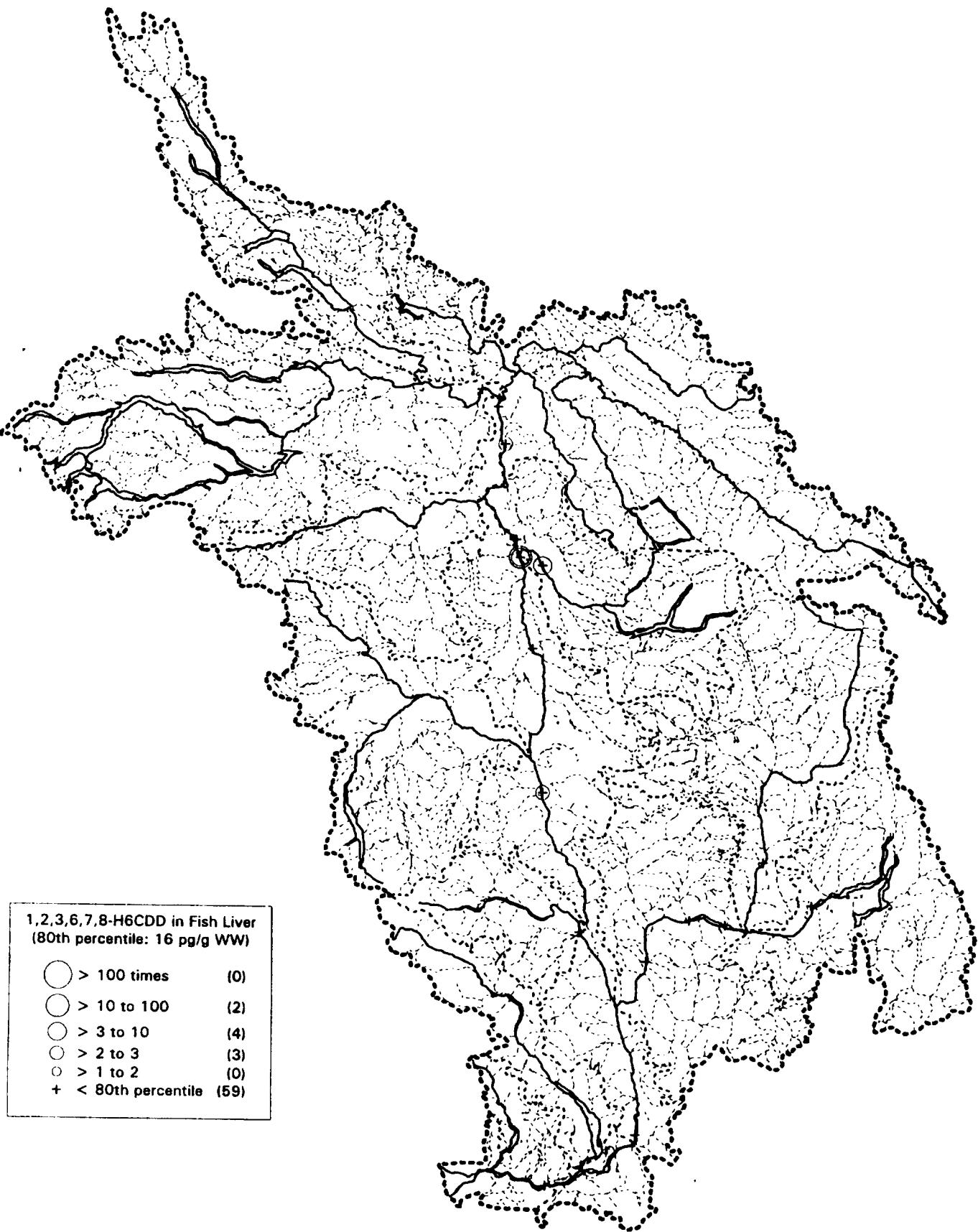


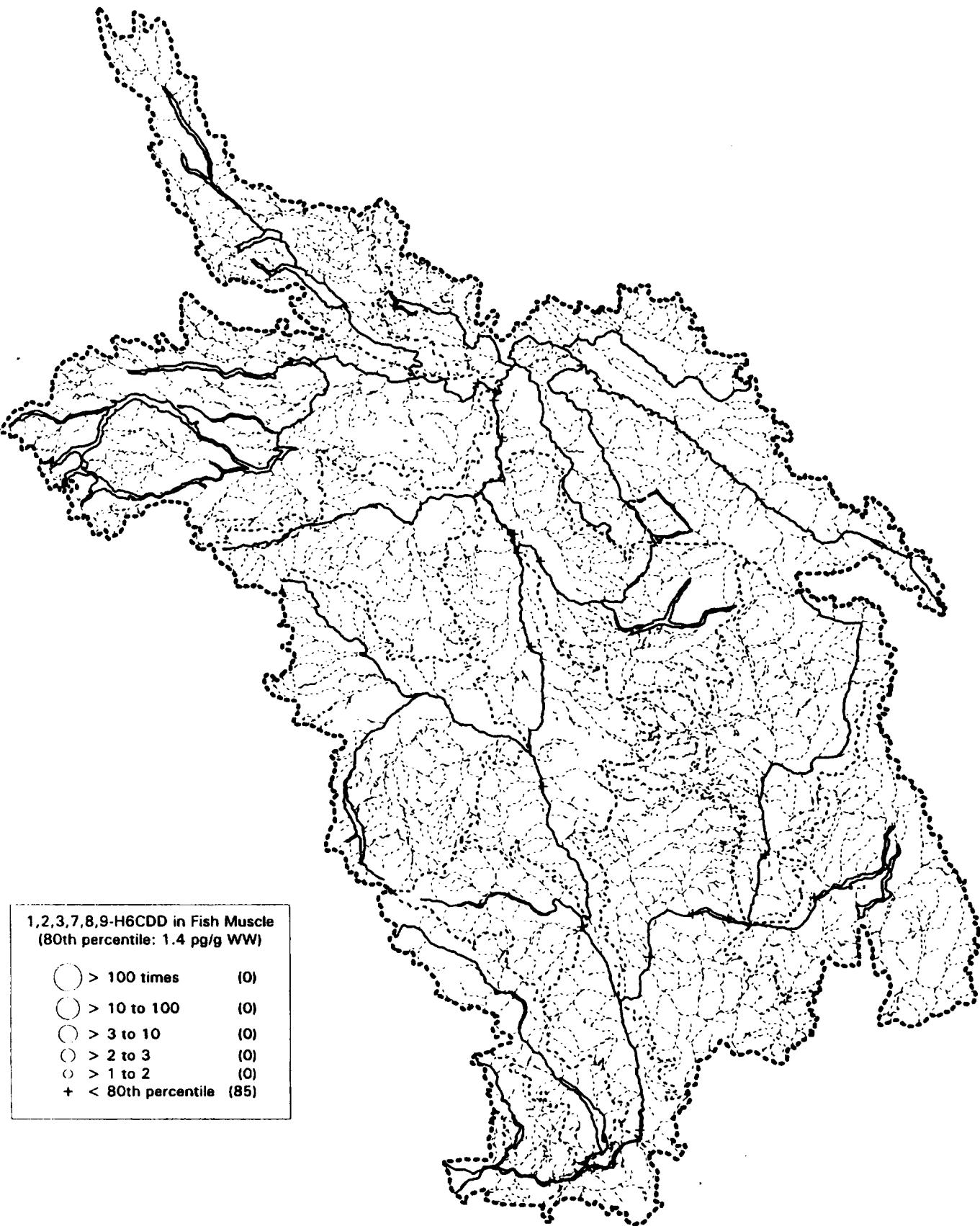


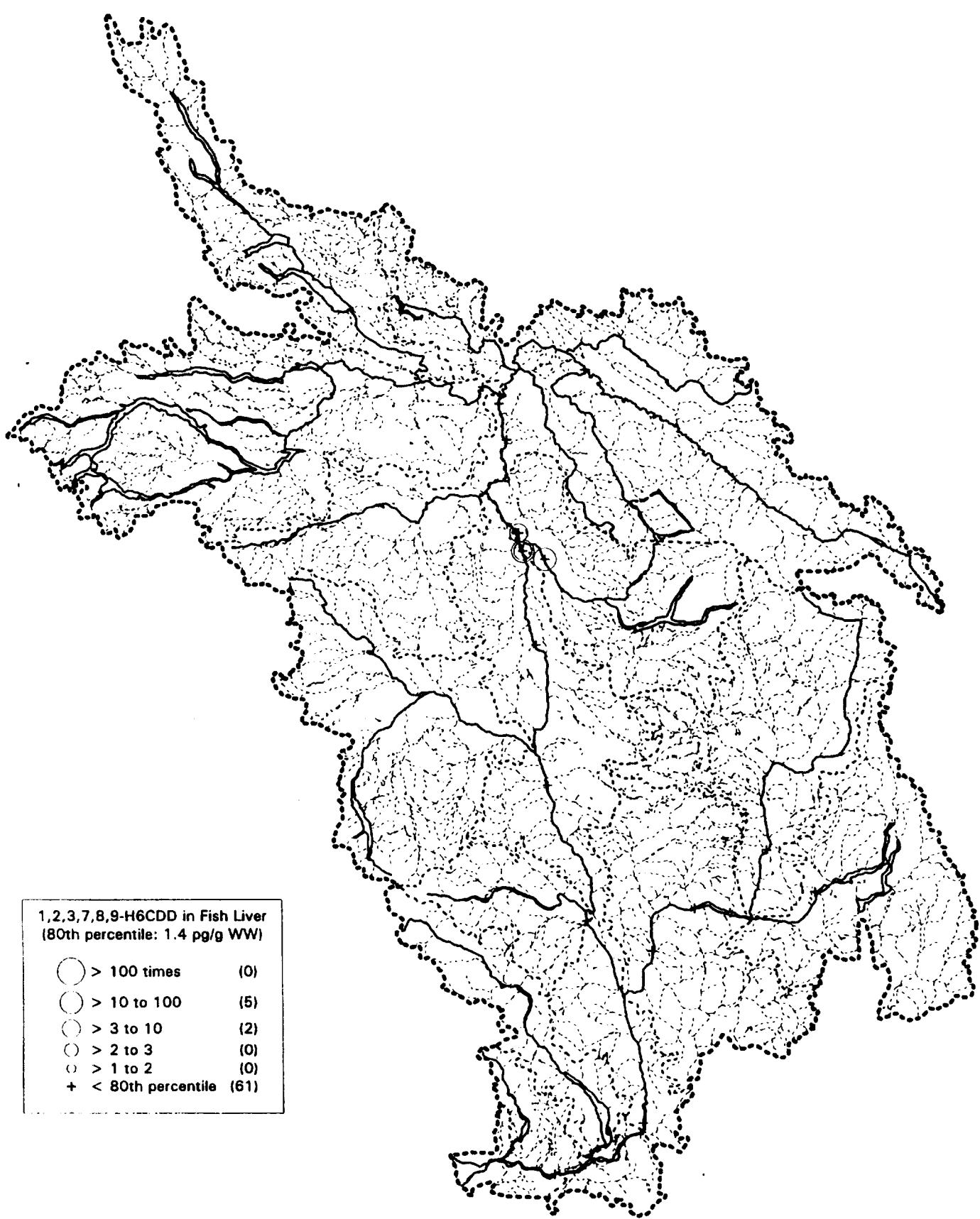
1,2,3,6,7,8-HxCDD in Fish Muscle
(80th percentile: 16 pg/g WW)

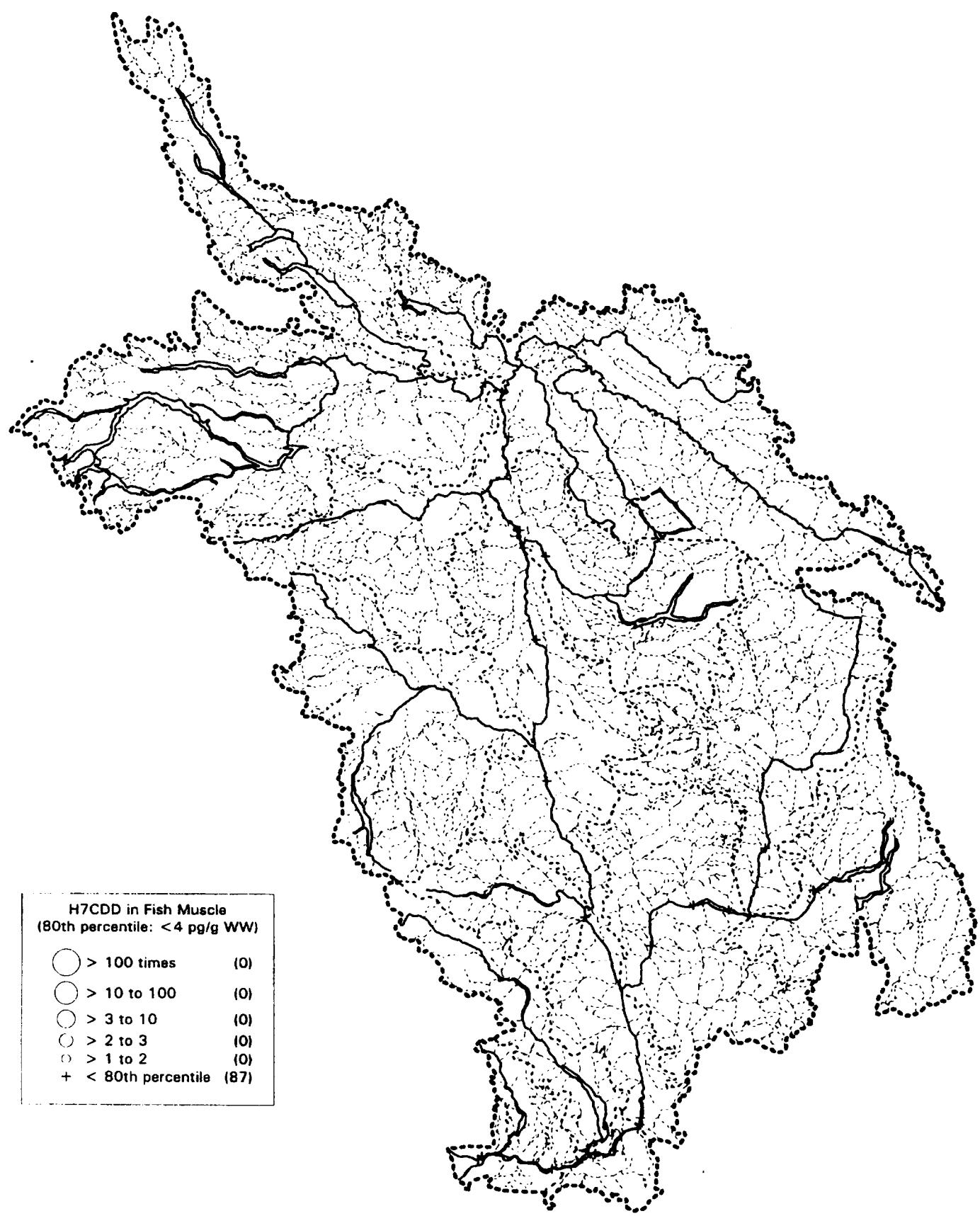
- | | |
|---------------------|------|
| ○ > 100 times | (0) |
| ○ > 10 to 100 | (0) |
| ○ > 3 to 10 | (0) |
| ○ > 2 to 3 | (0) |
| ○ > 1 to 2 | (2) |
| + < 80th percentile | (83) |

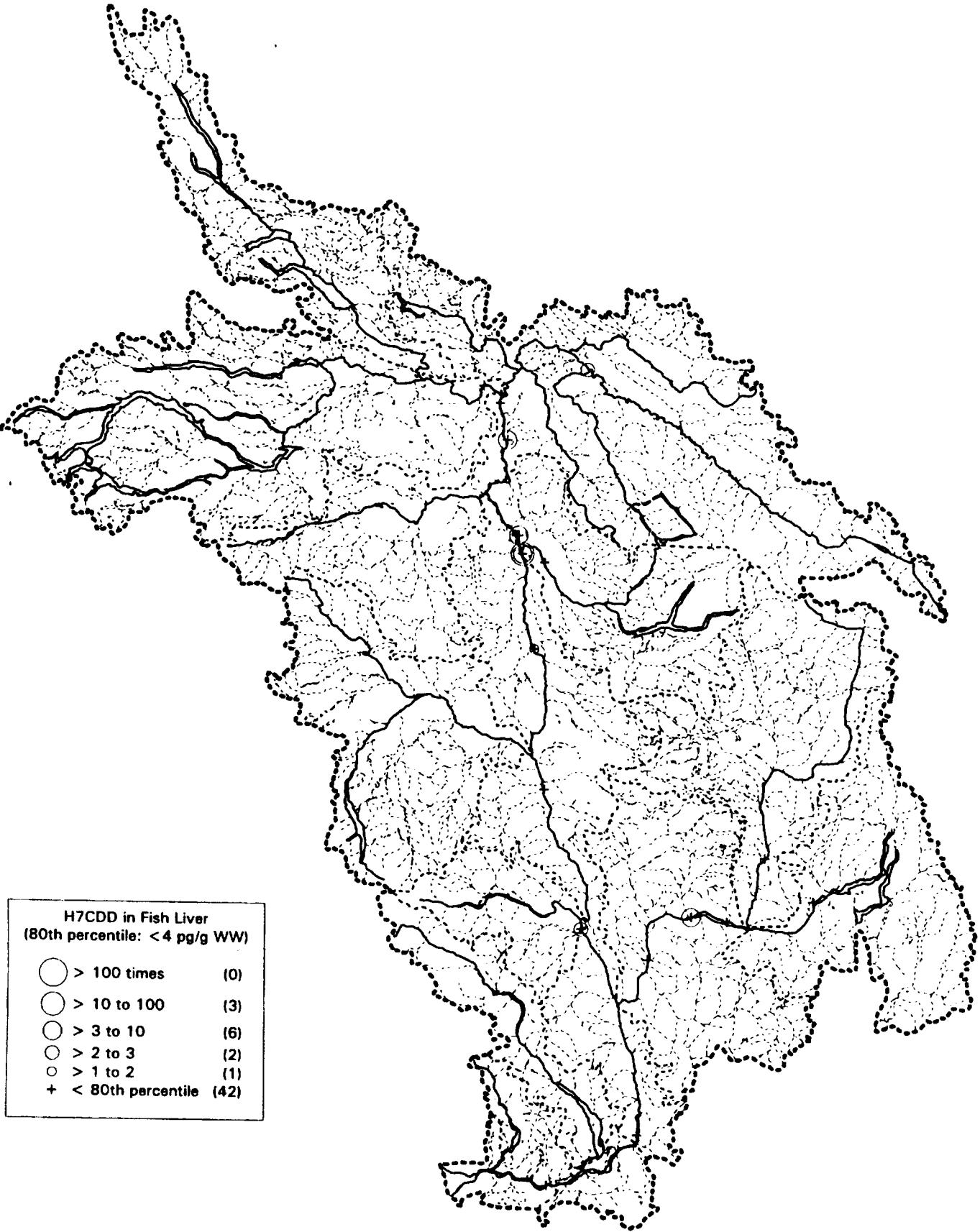


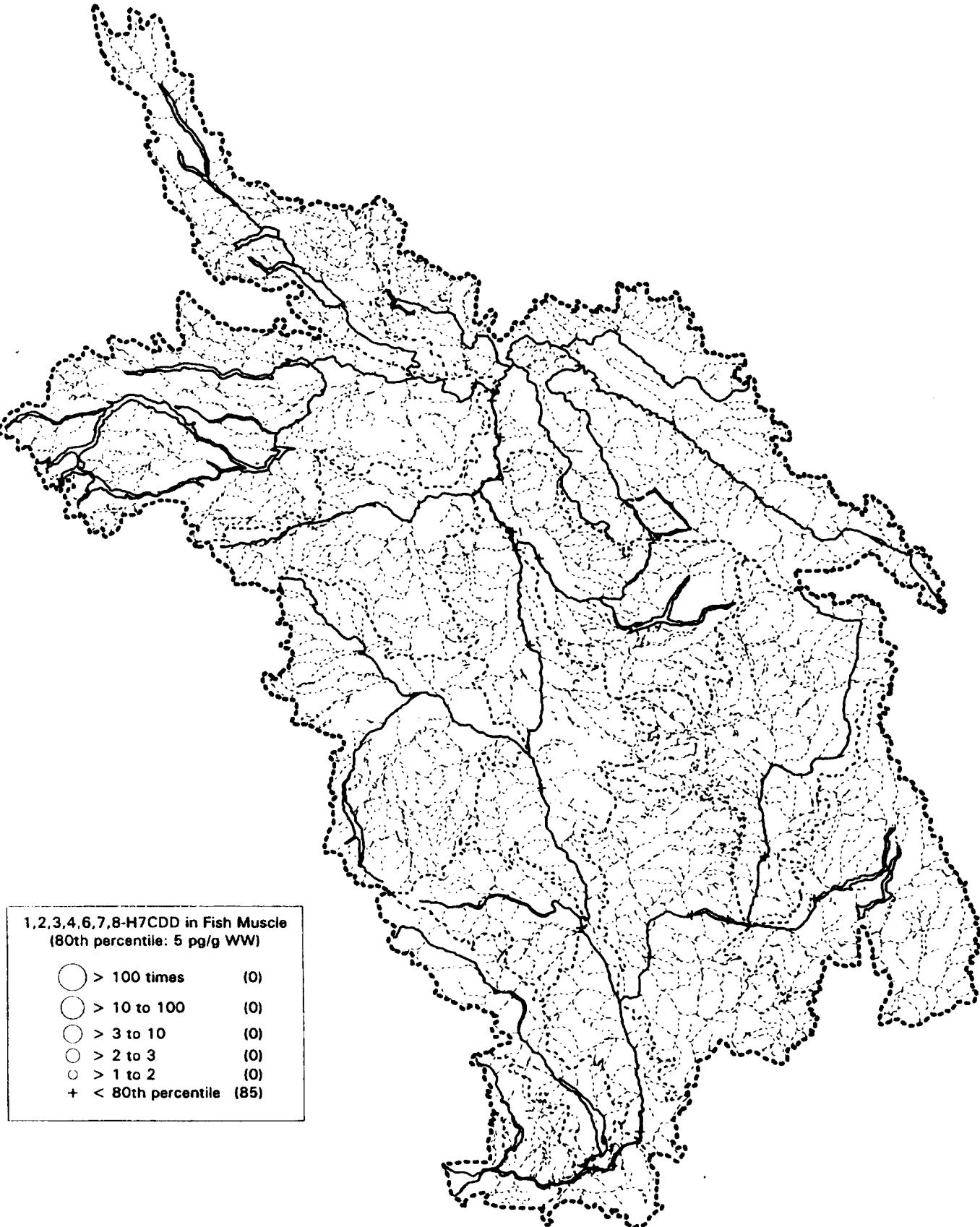






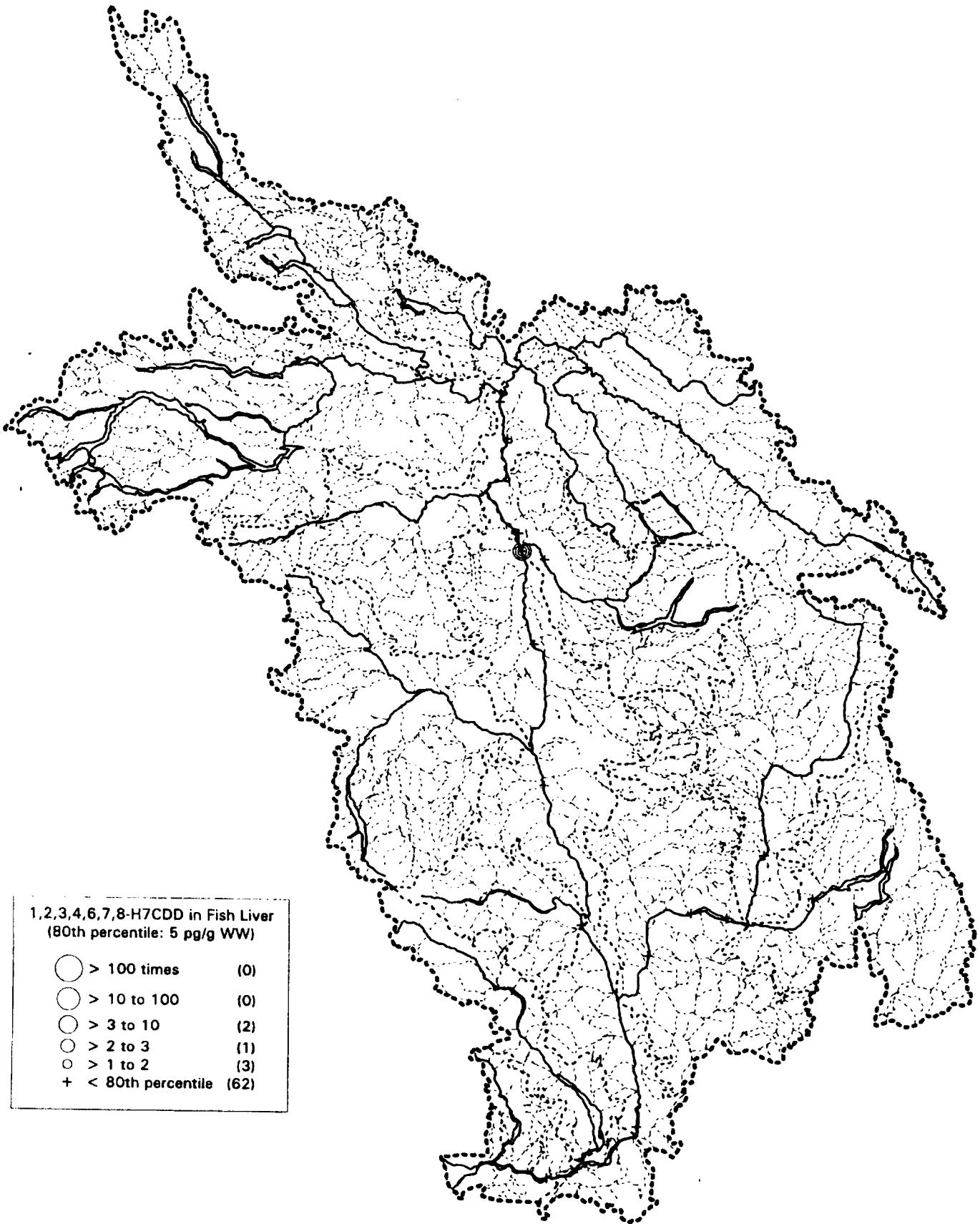


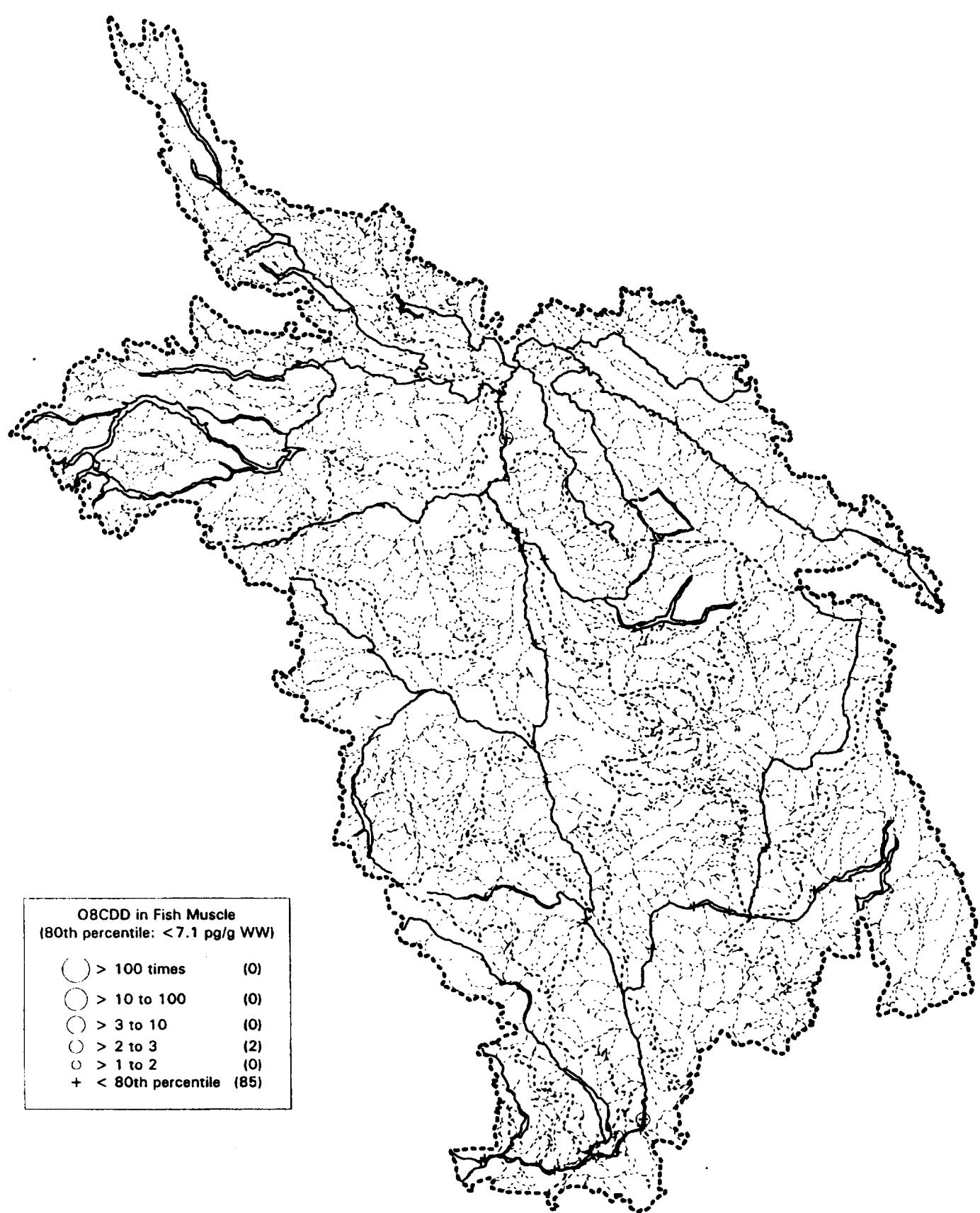


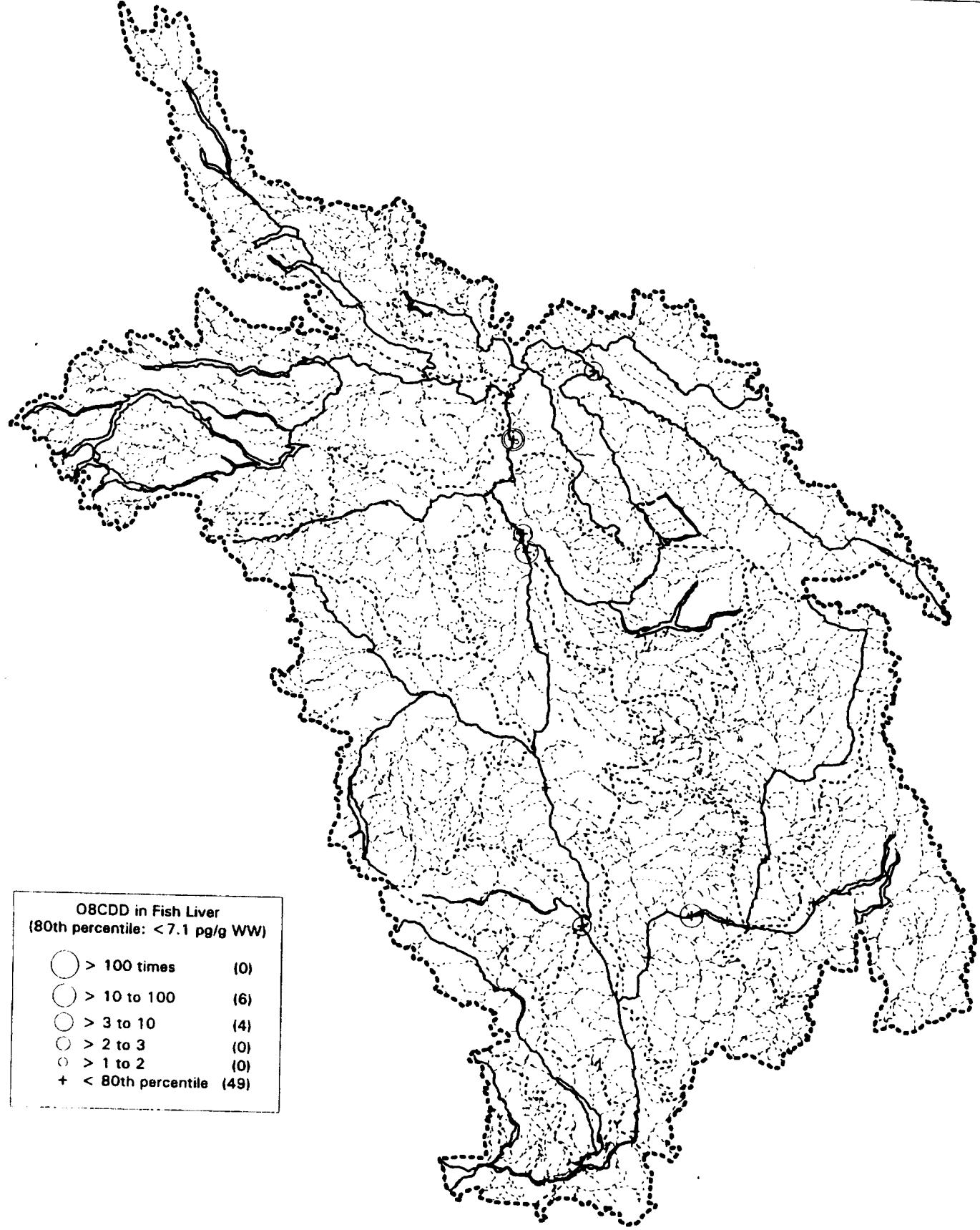


1,2,3,4,6,7,8-HxCDD in Fish Liver
(80th percentile: 5 pg/g WW)

- | | |
|---------------------|------|
| ○ > 100 times | (0) |
| ○ > 10 to 100 | (0) |
| ○ > 3 to 10 | (2) |
| ○ > 2 to 3 | (1) |
| ○ > 1 to 2 | (3) |
| + < 80th percentile | (62) |



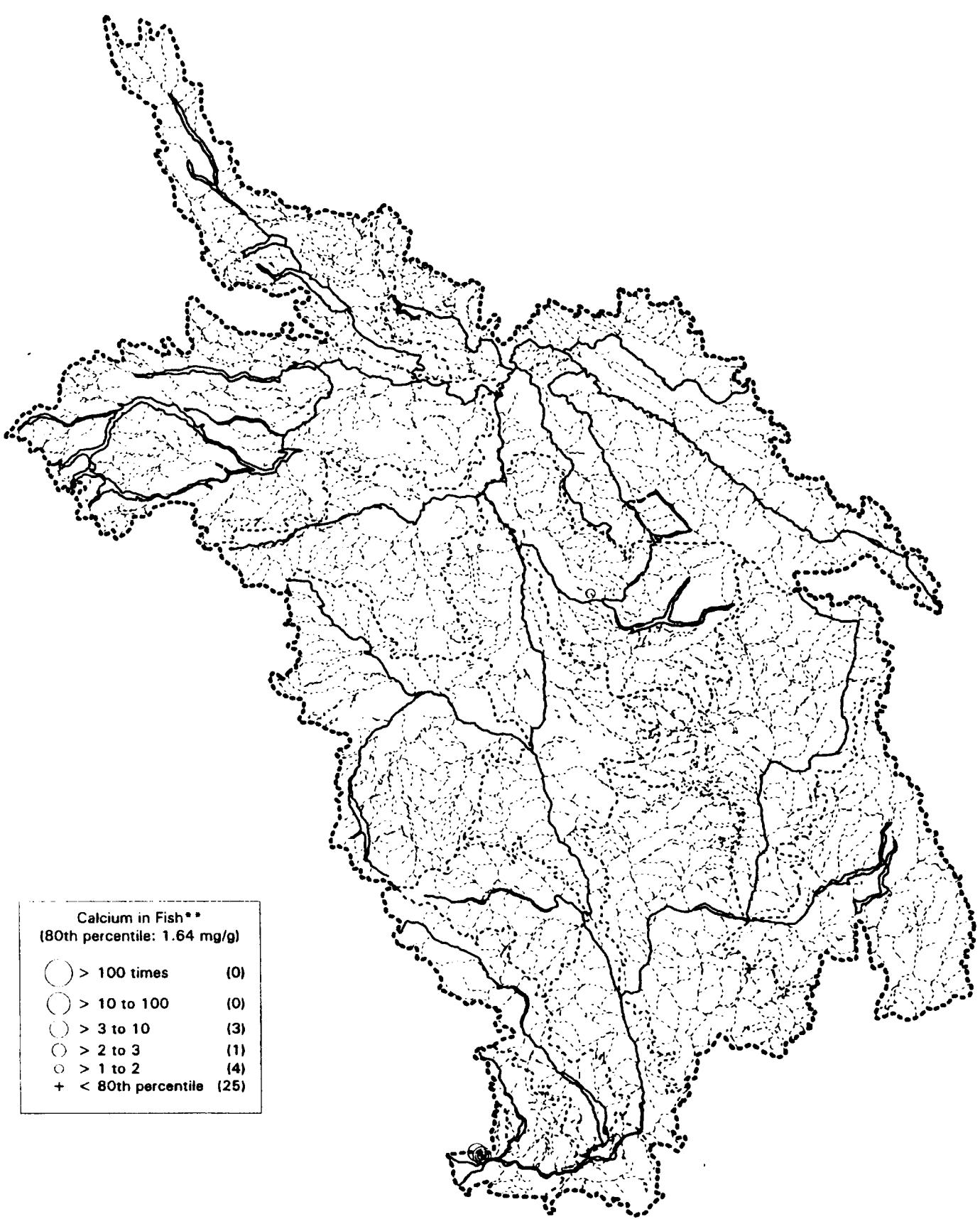


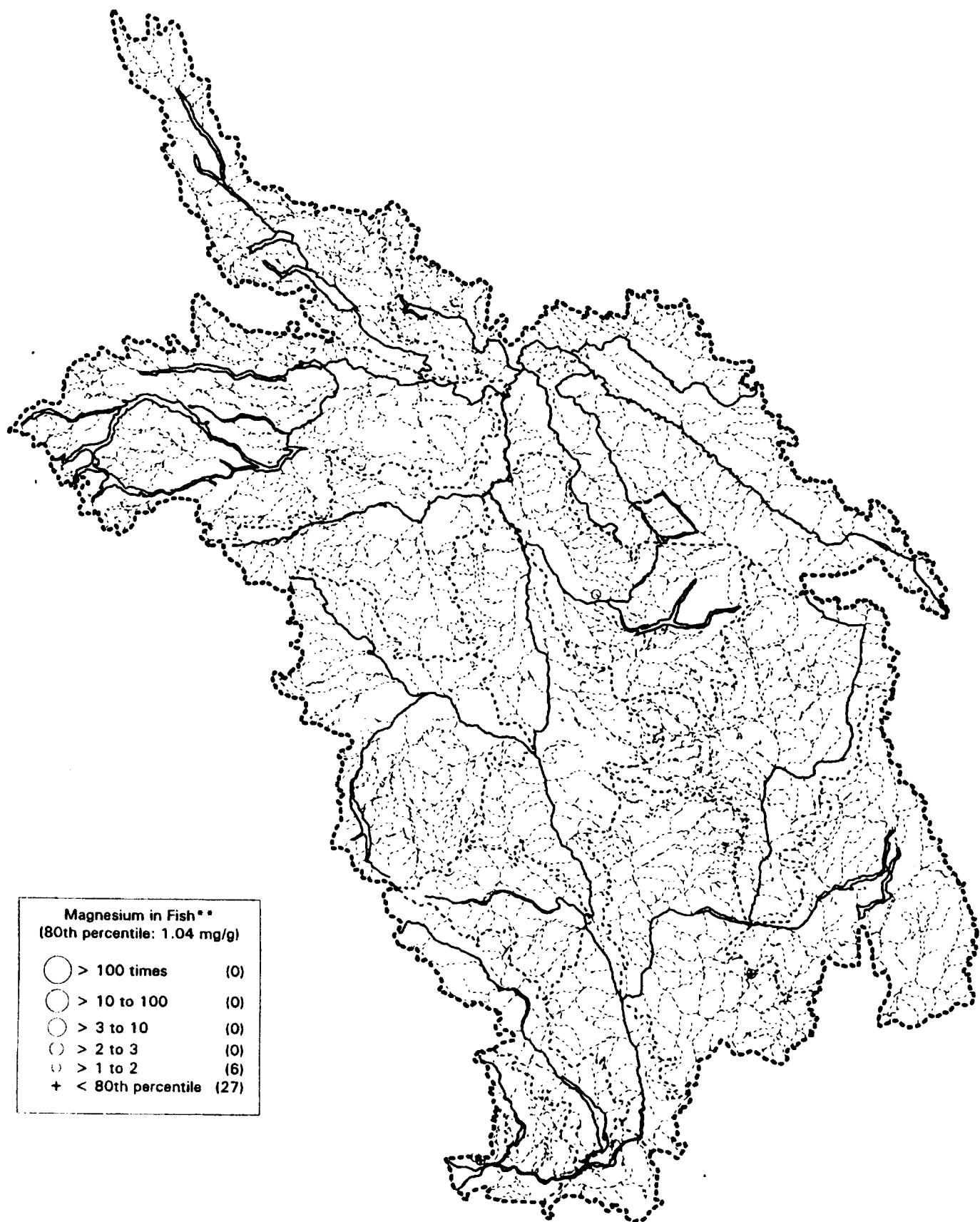


2.1.3 Inorganic parameters in fish

Calcium

Magnesium



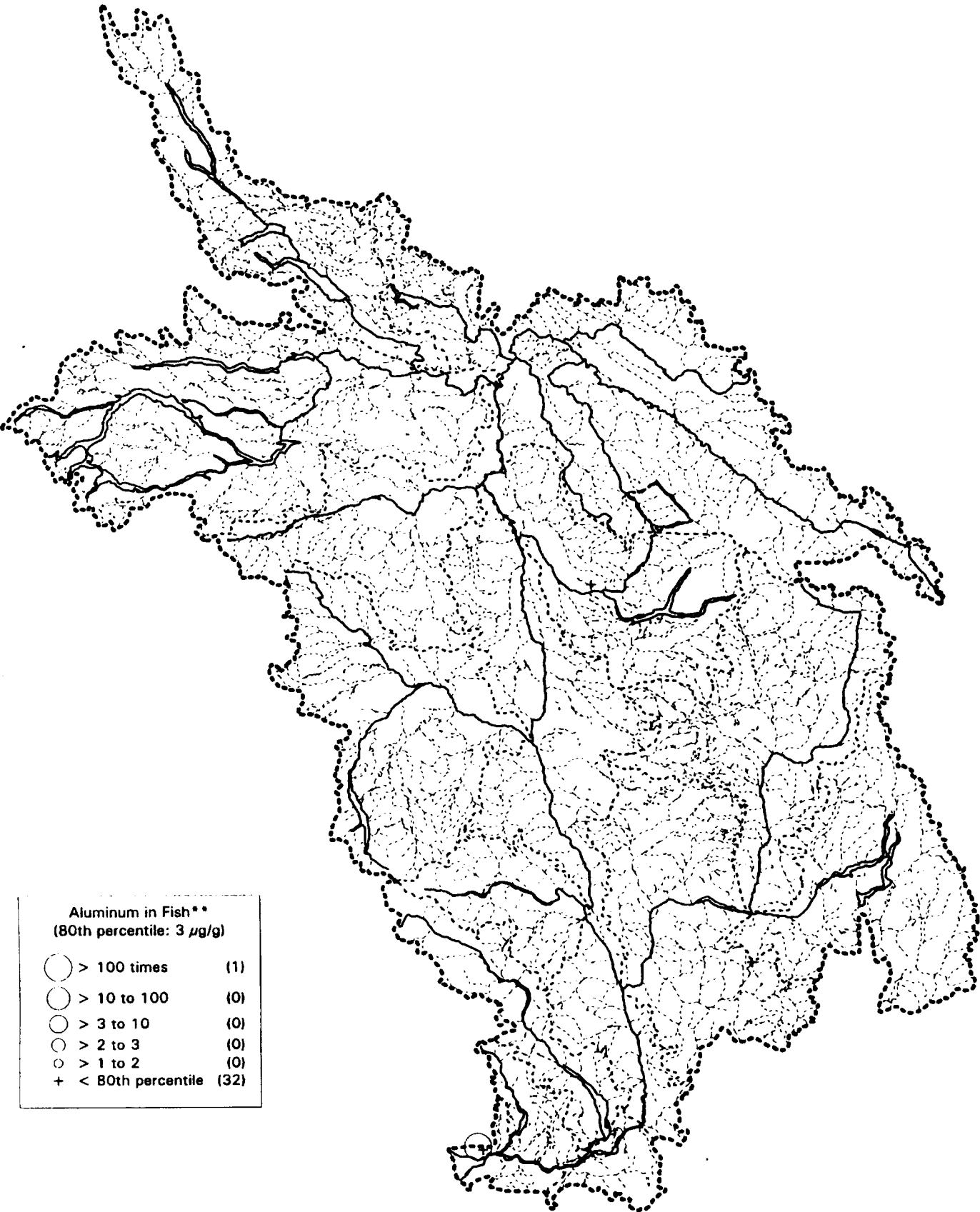


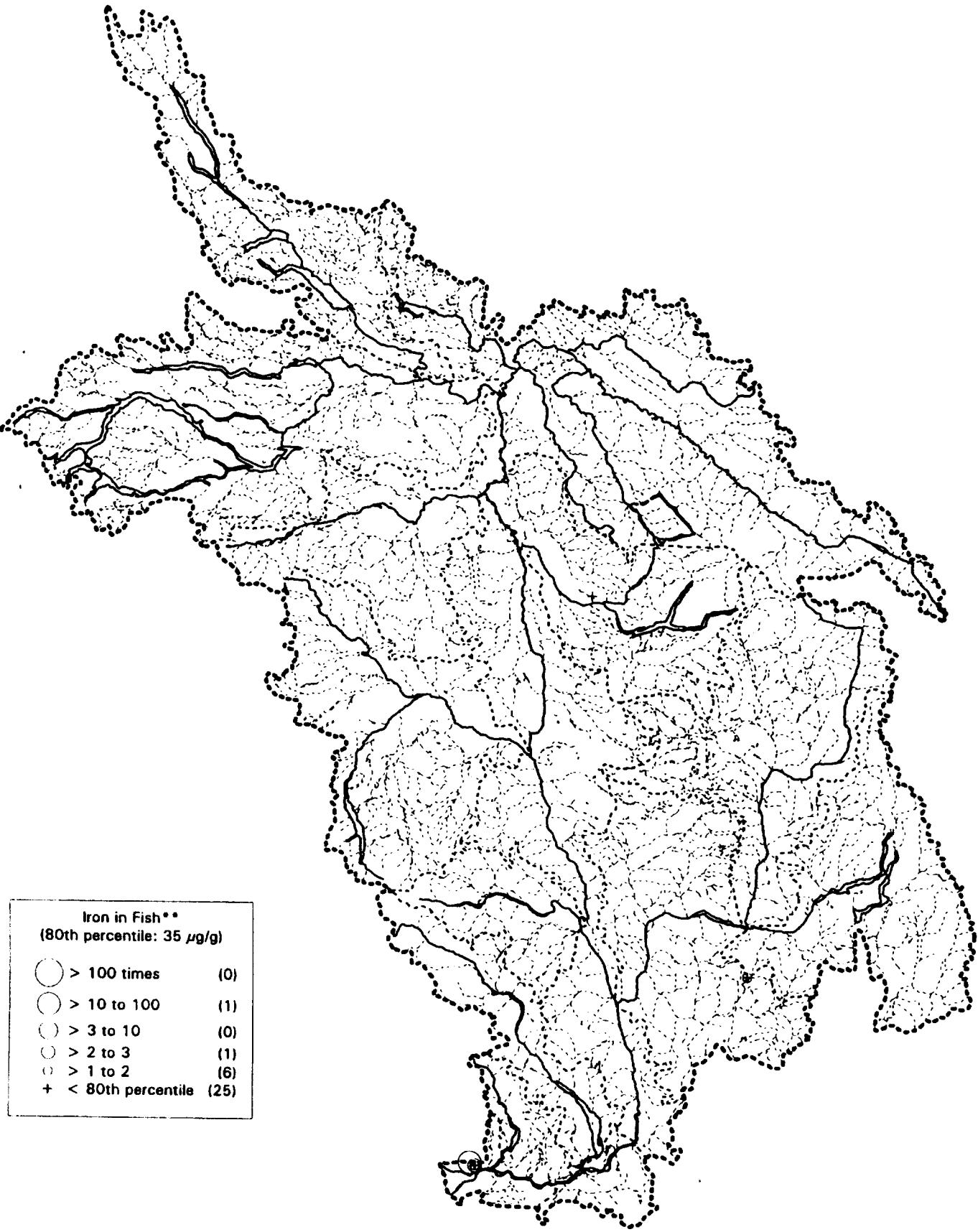
2.1.4 **Metals in fish**

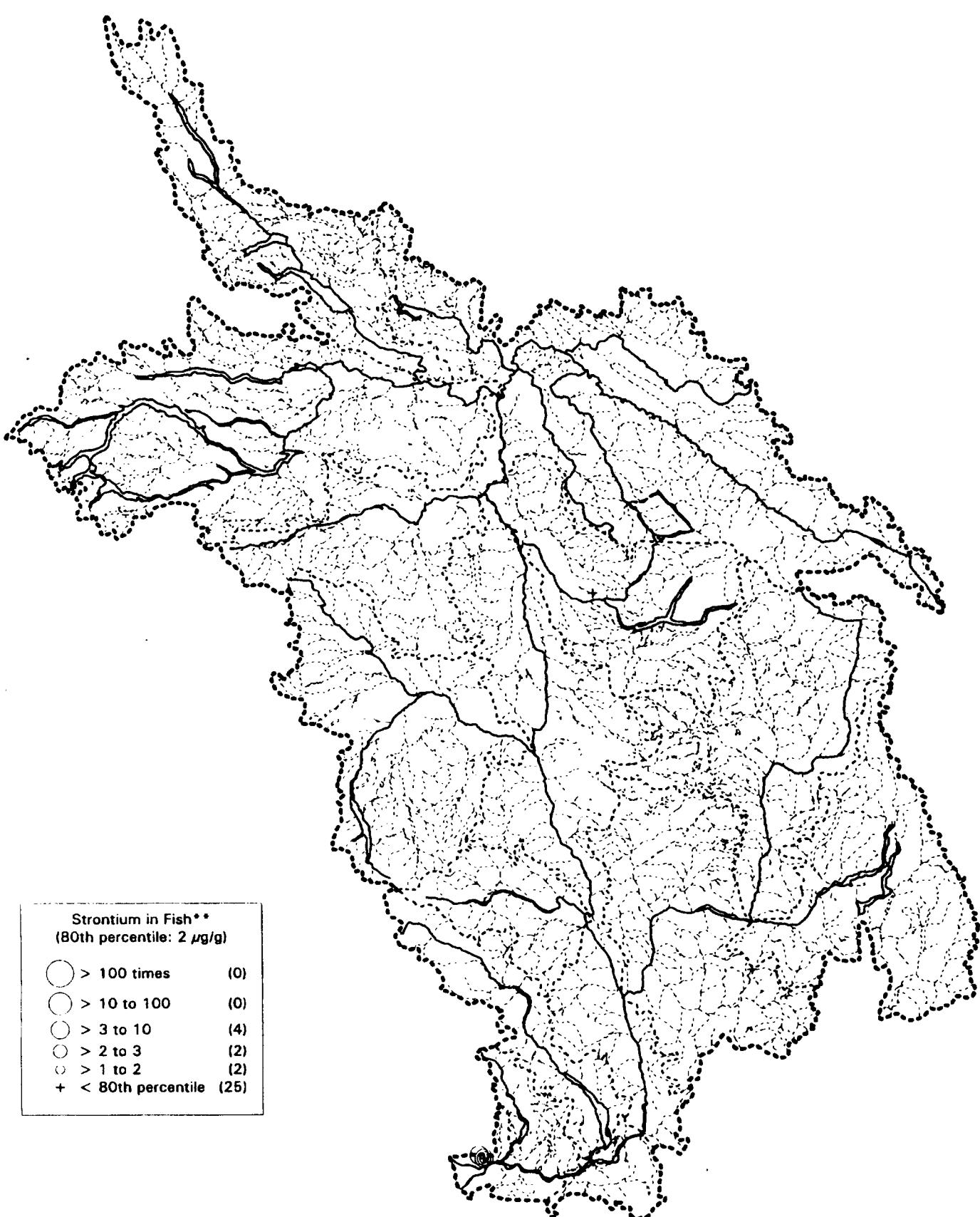
Aluminum

Iron

Strontium

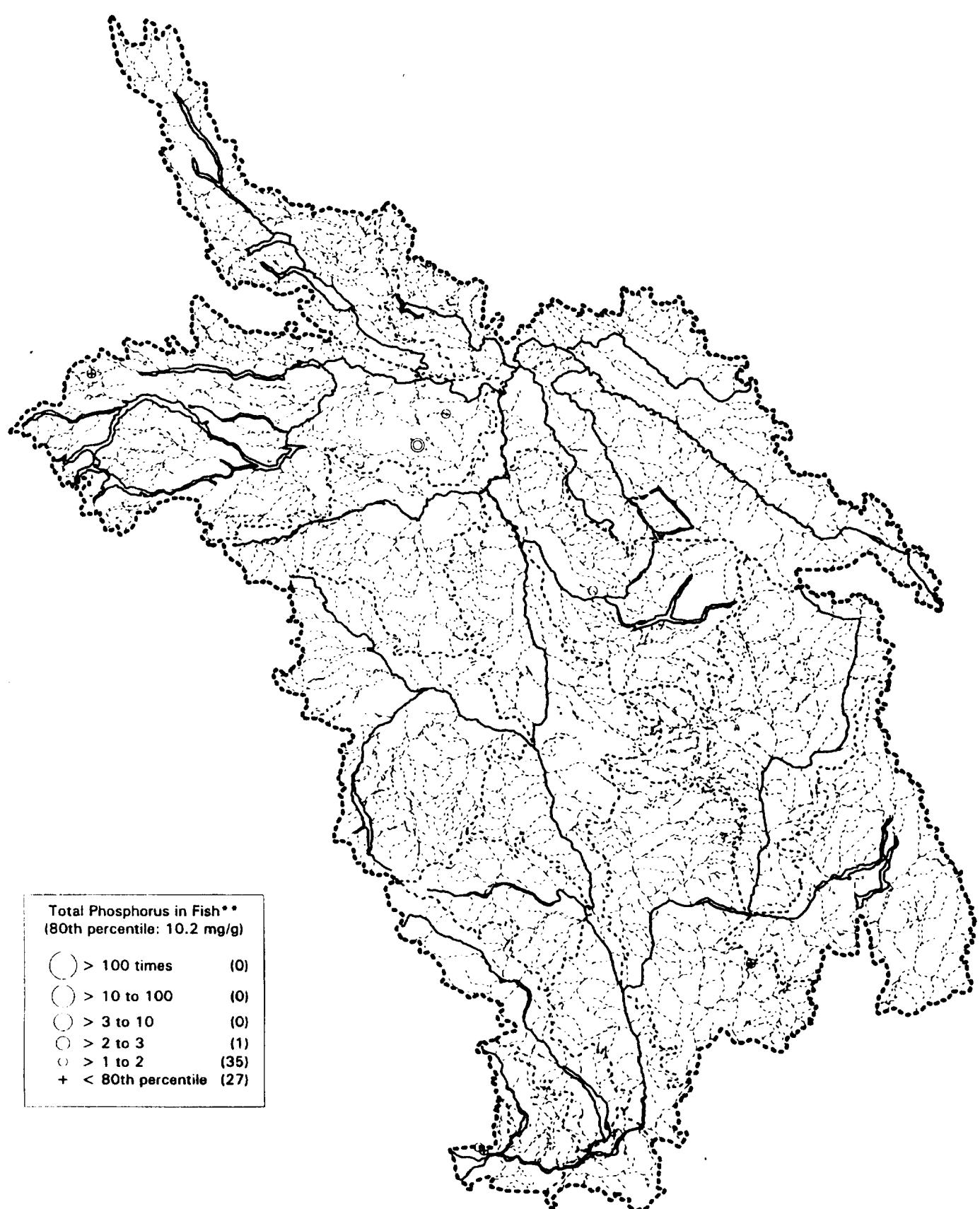






2.1.5 Nutrients in fish

Total Phosphorus



2.2 Sediment

2.2.1 Chlorophenols in sediment

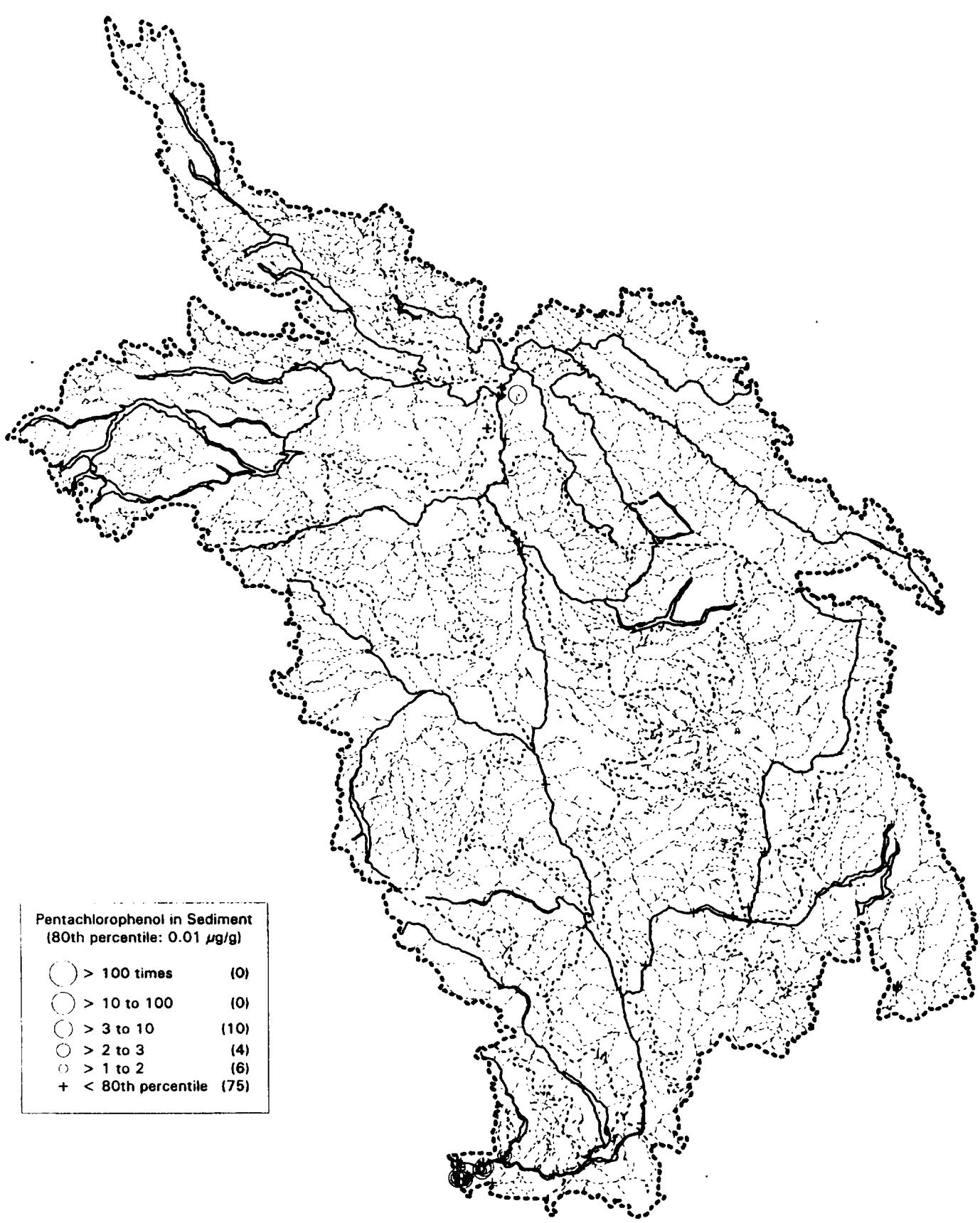
Pentachlorophenol

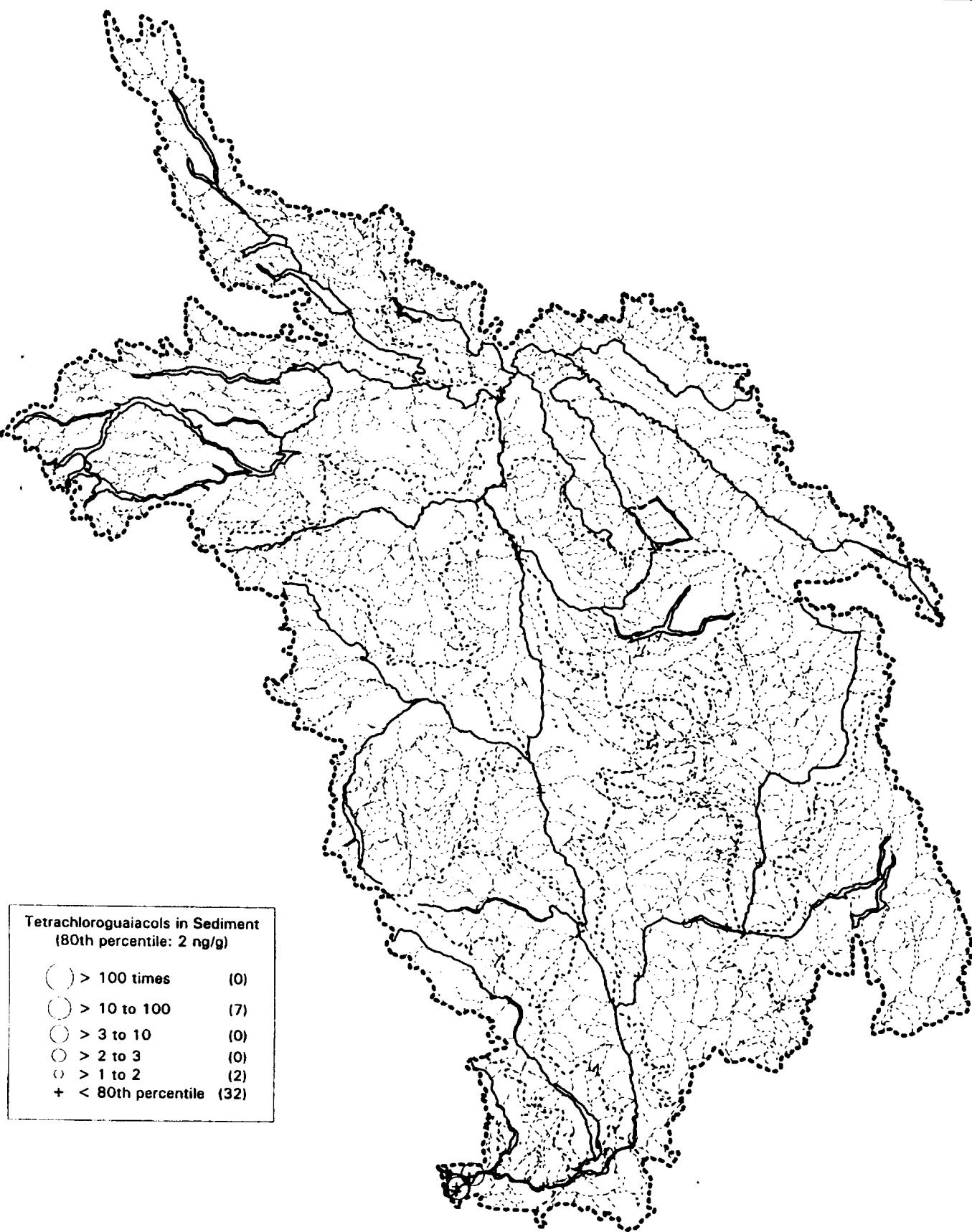
Tetrachloroguaiacols

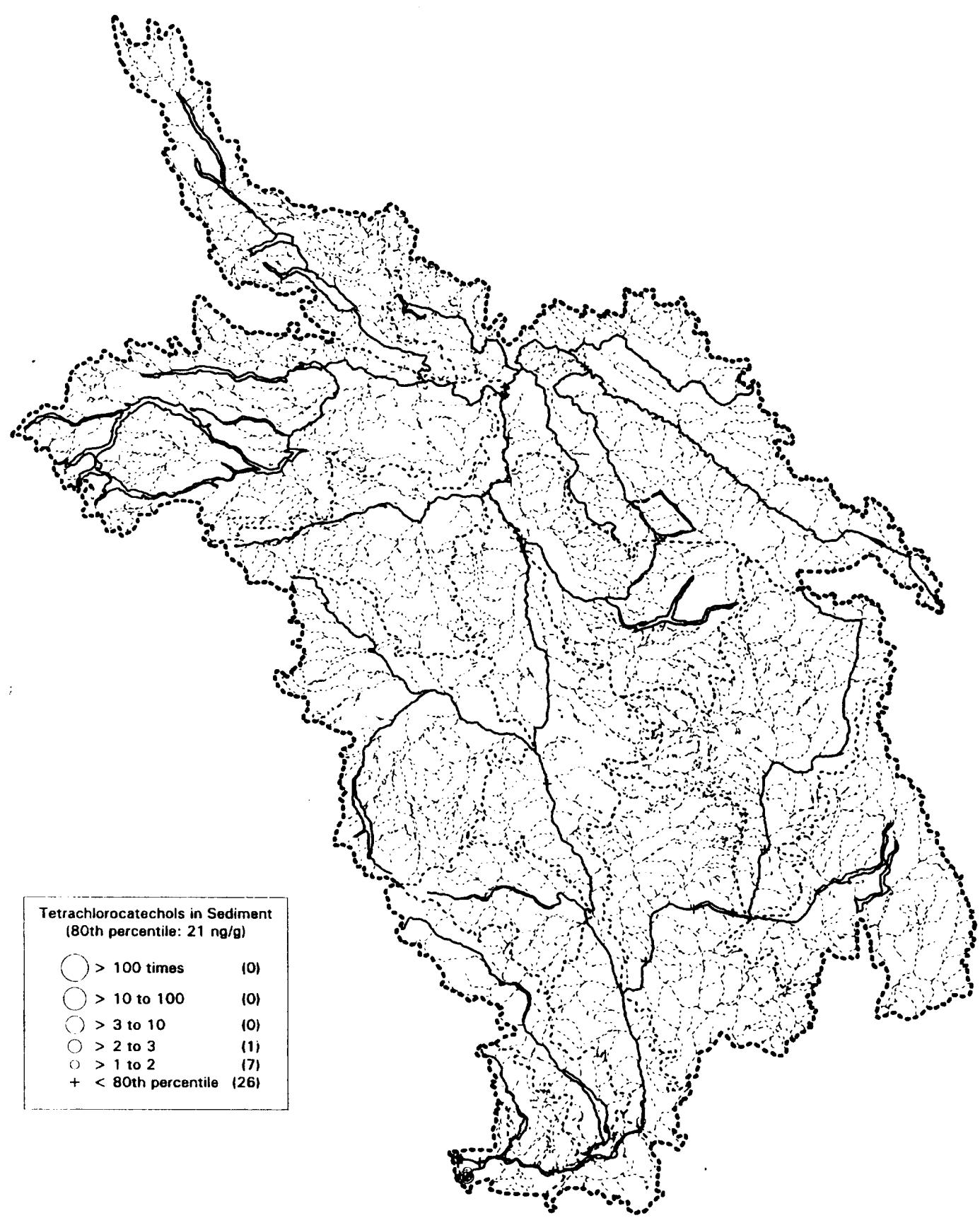
Tetrachlorocatechols

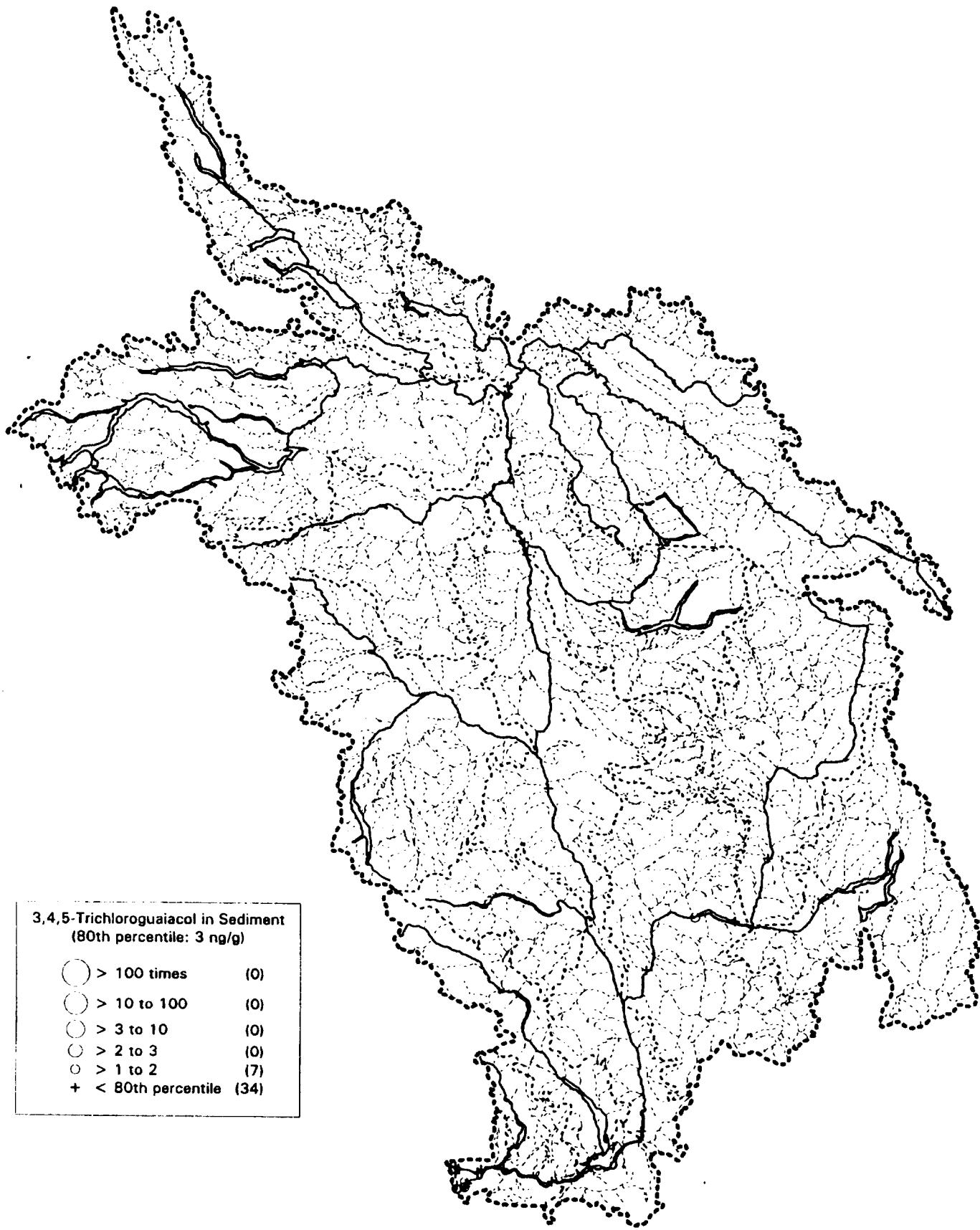
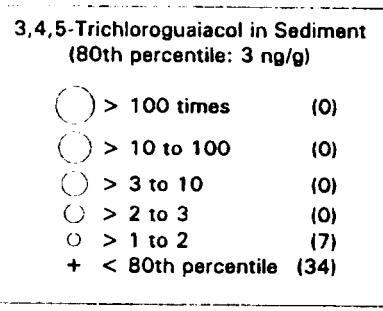
3,4,5-Trichloroguaiacol

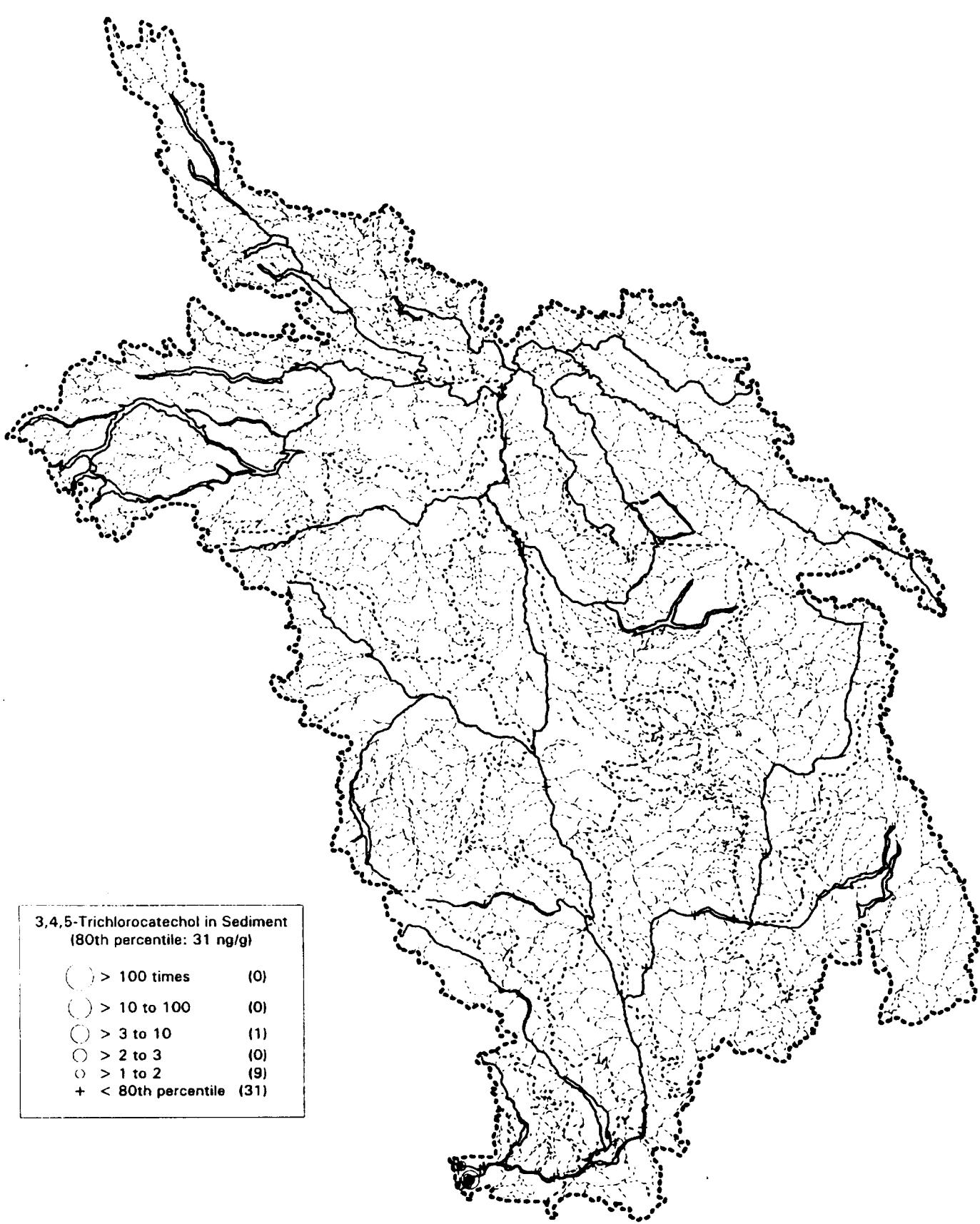
3,4,5-Trichlorocatechol





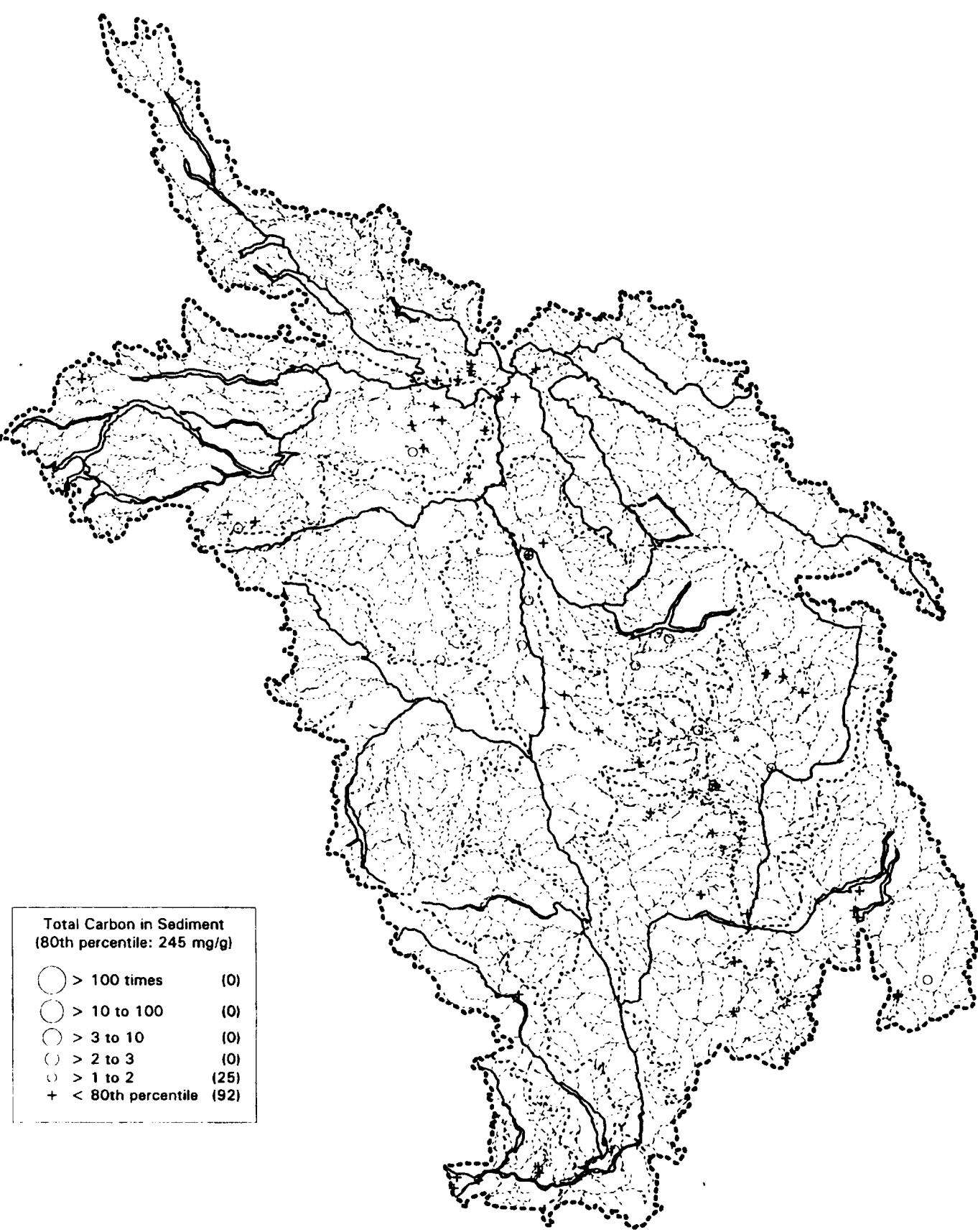






2.2.2 Descriptive parameters in sediment

Total Carbon

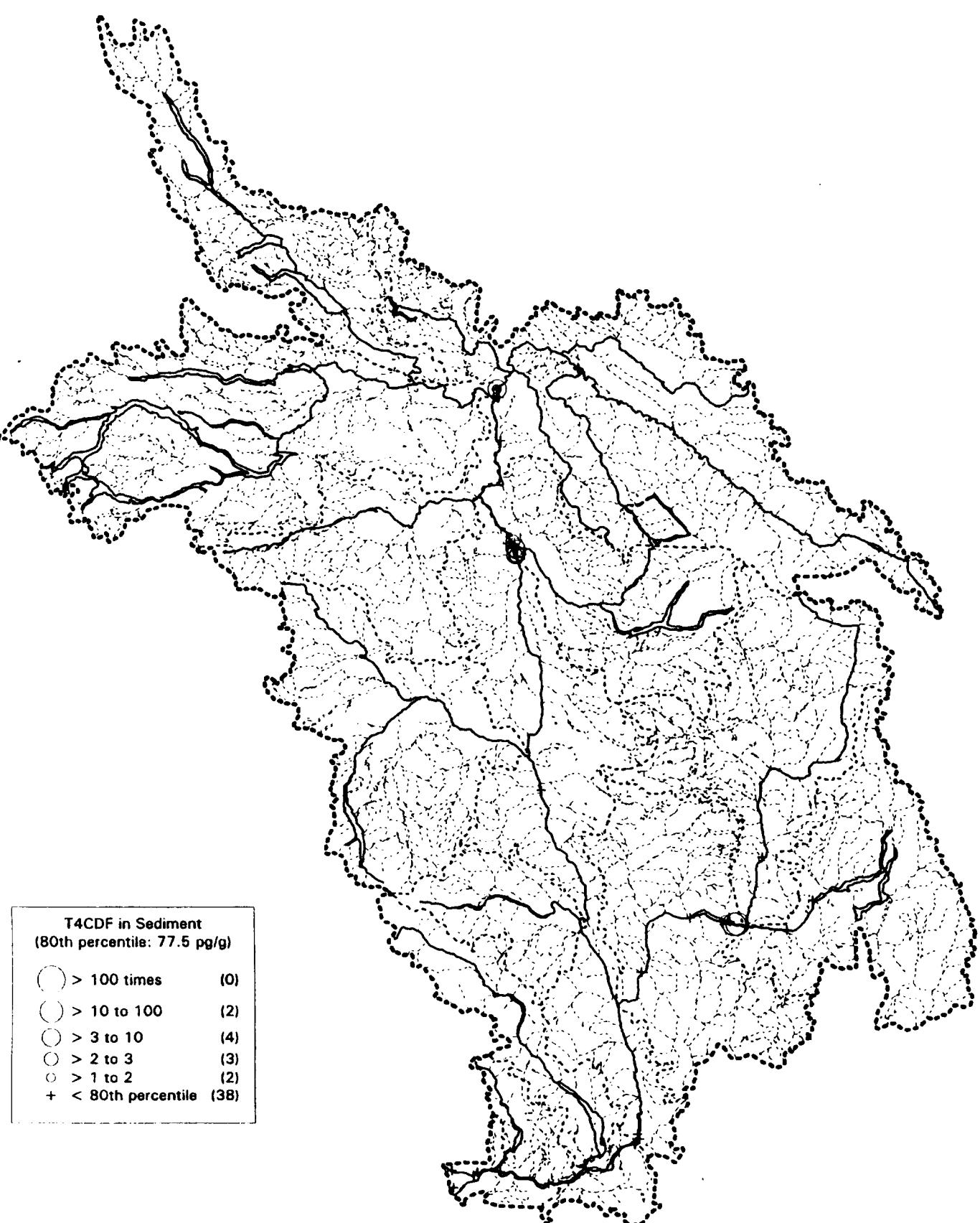


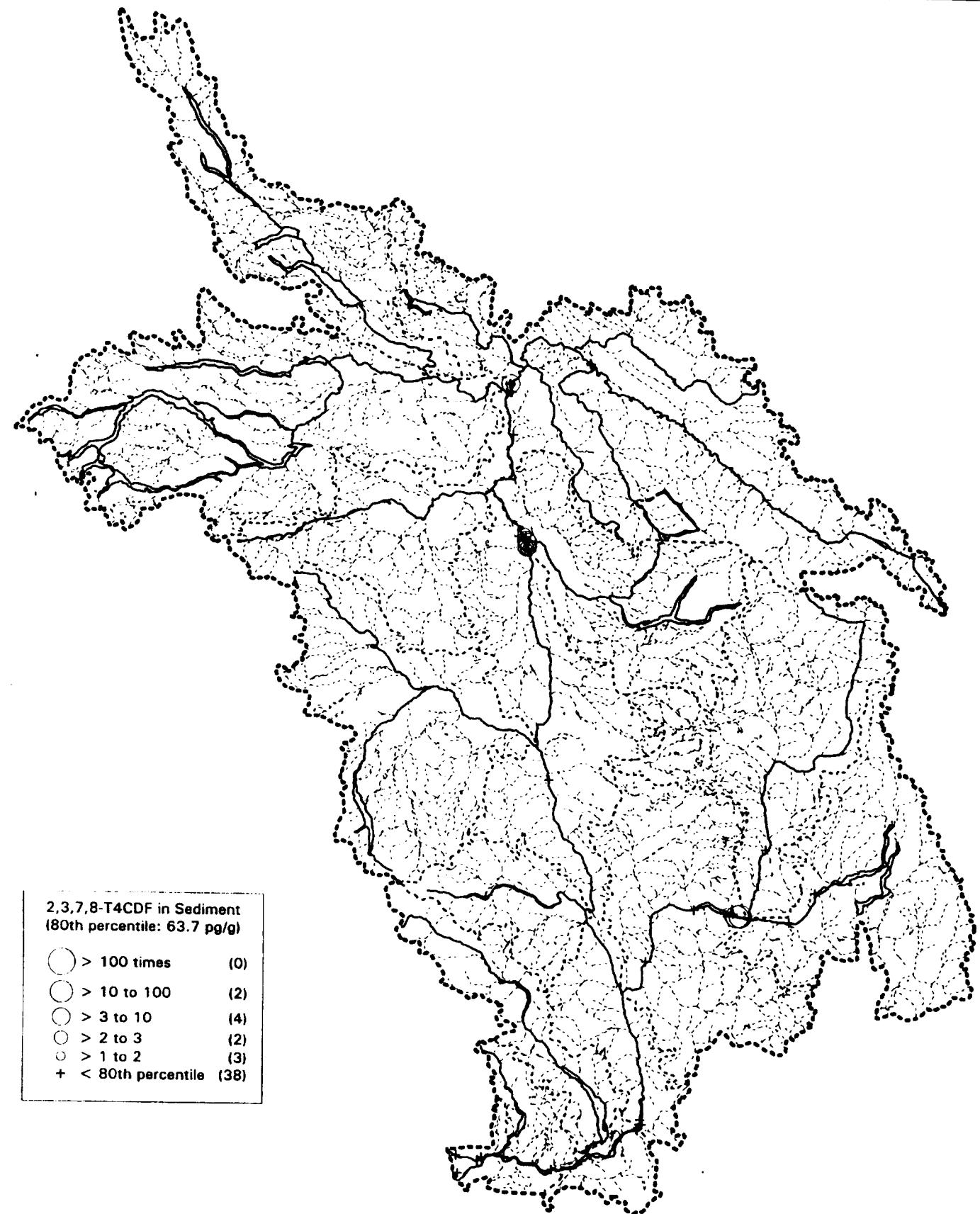
2.2.3 Dioxins and furans in sediment

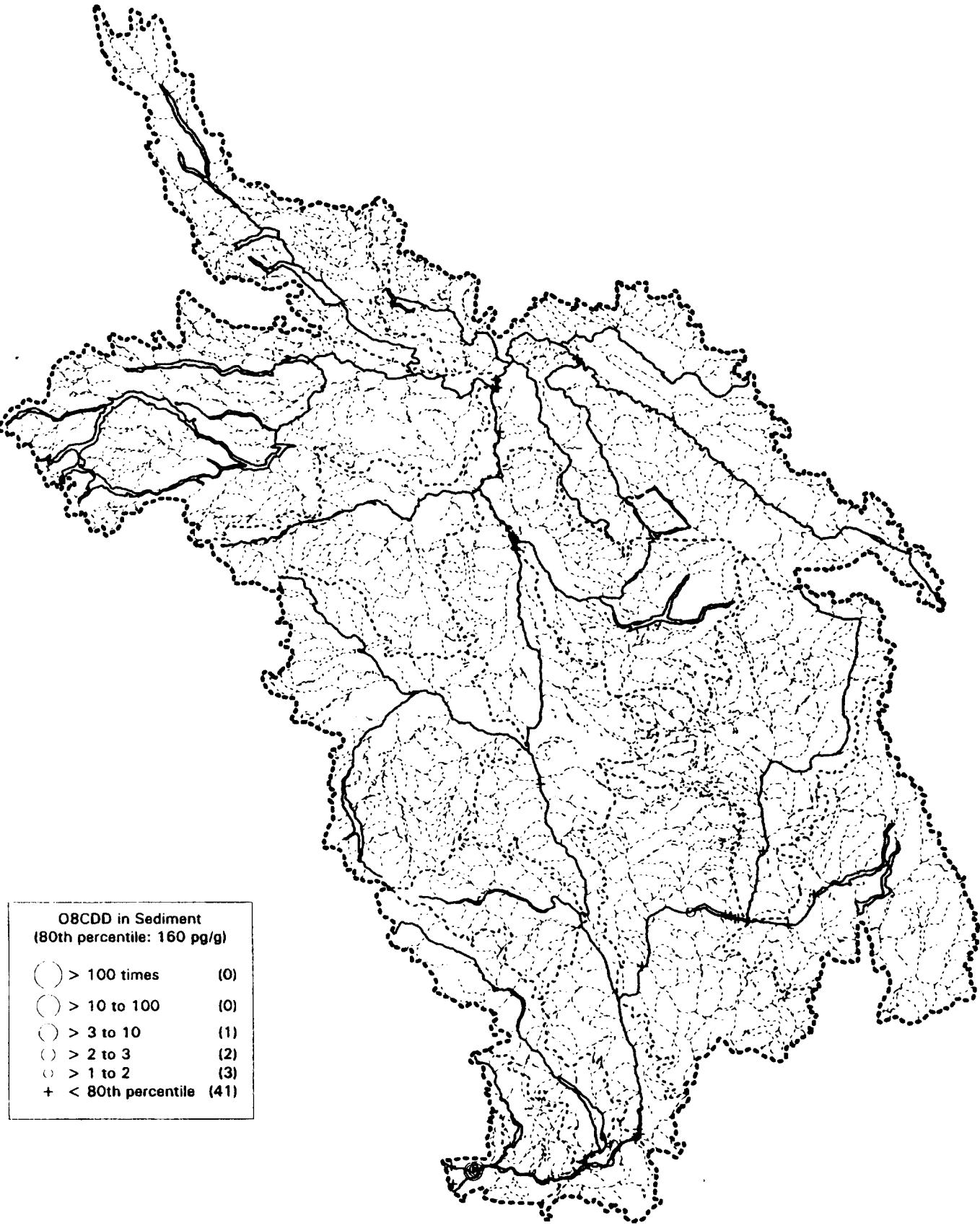
T4CDF

2,3,7,8-T4CDF

O8CDD







2.2.4 Inorganic parameters in sediment

Acid Volatile Sulphide

Calcium

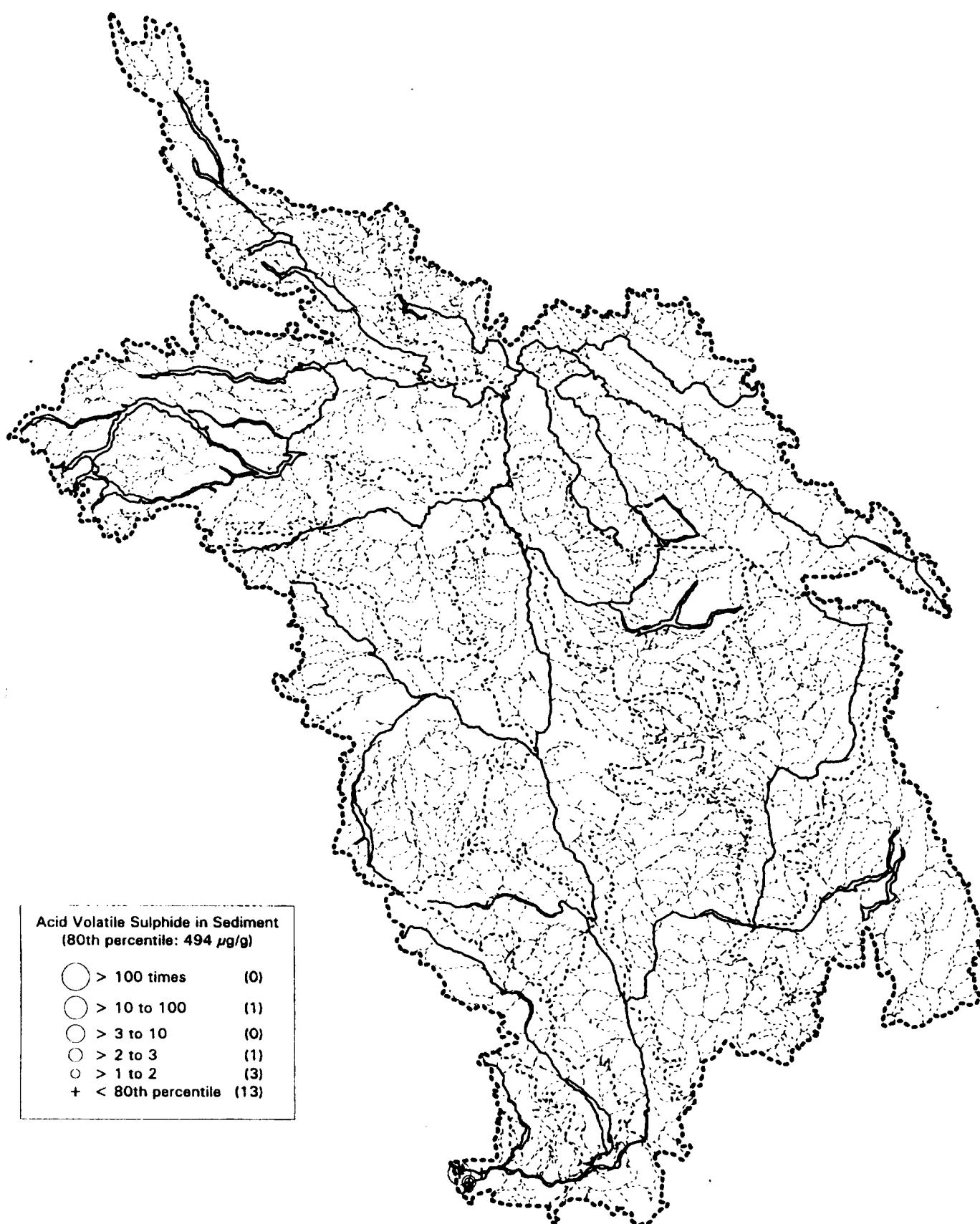
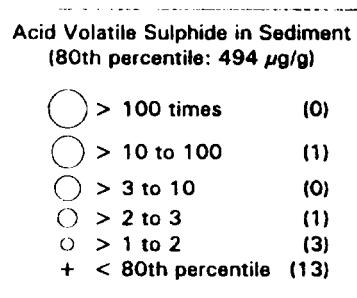
Extractable Calcium

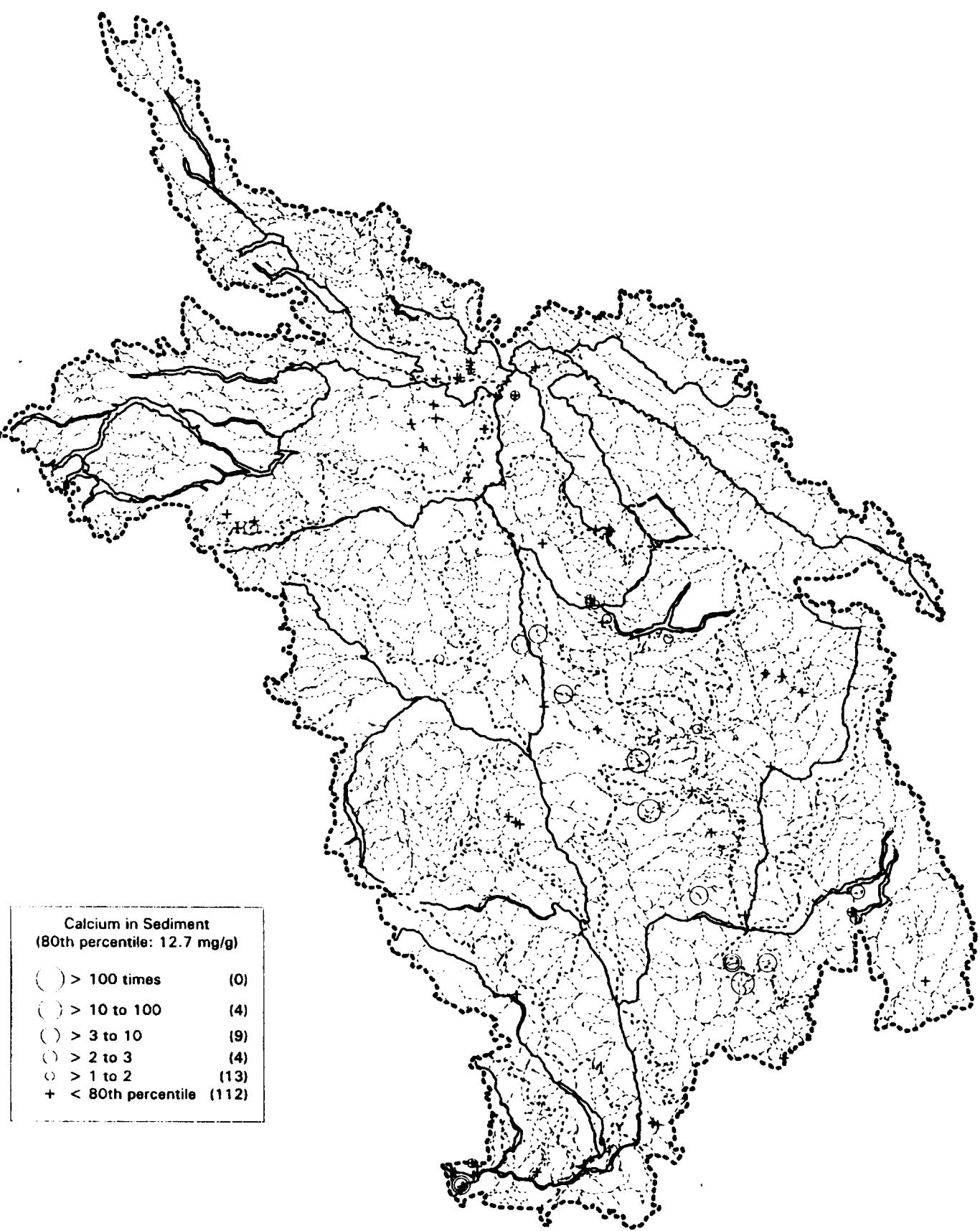
Magnesium

Extractable Magnesium

Total Inorganic Carbon

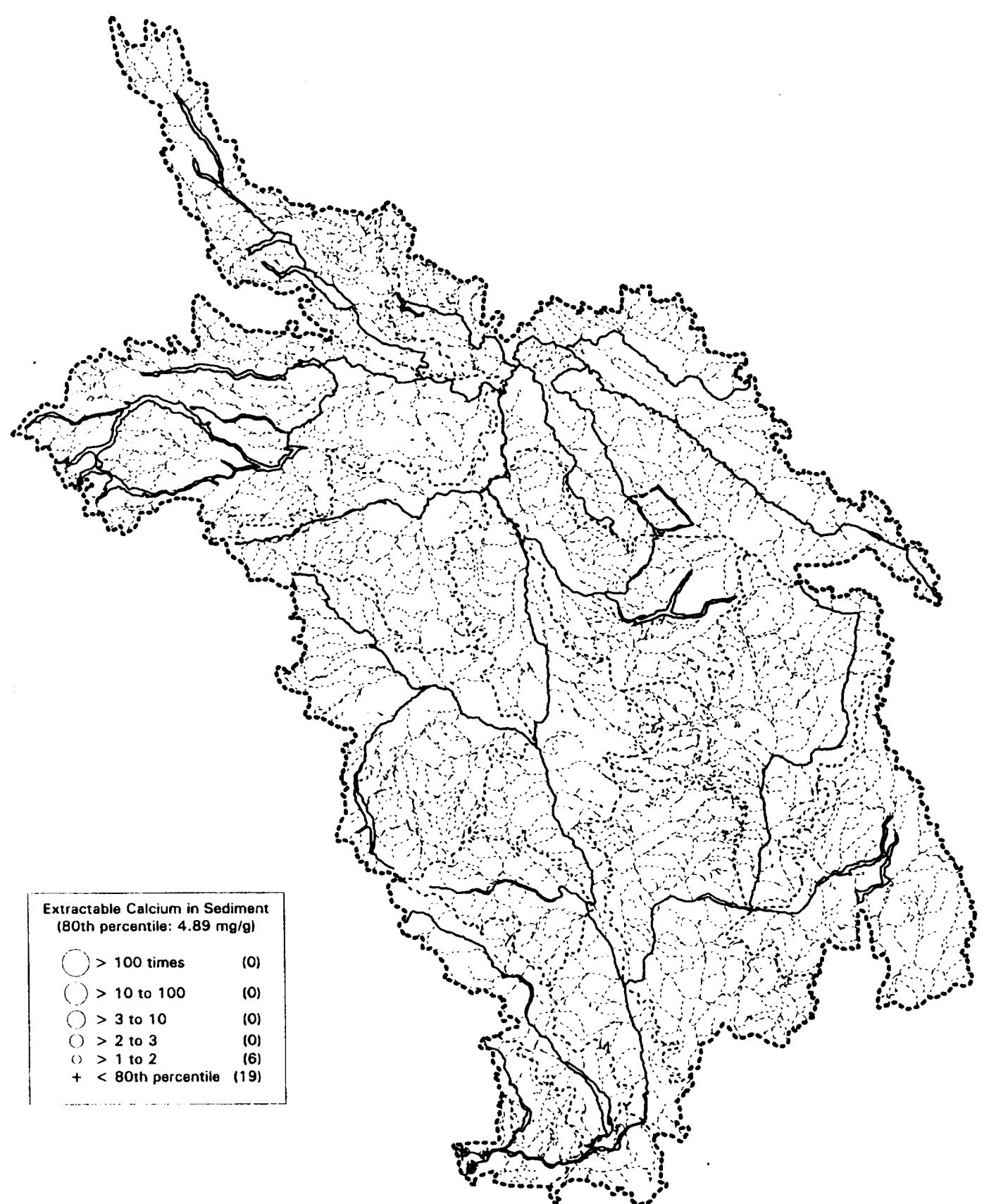
Total Sulfur

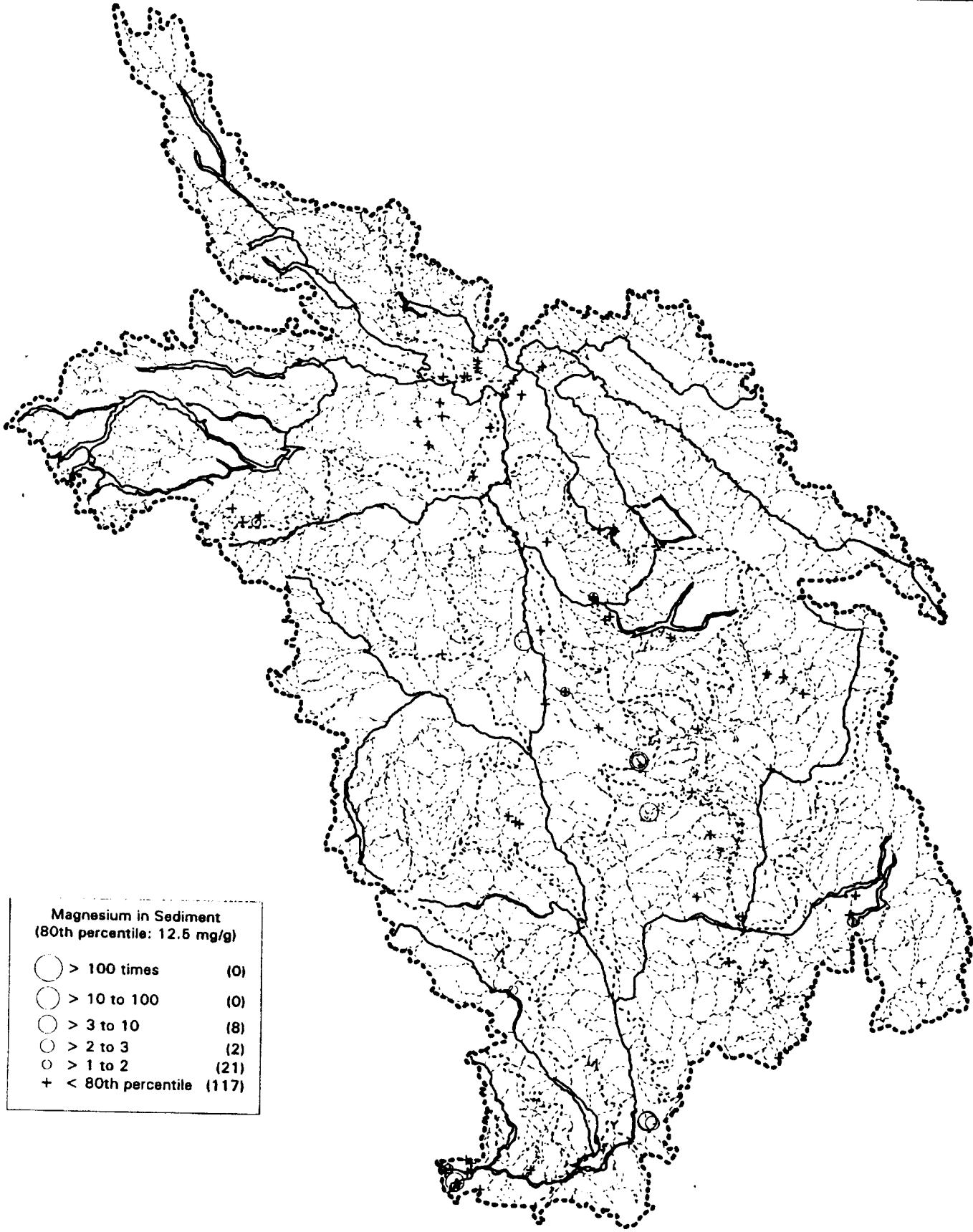


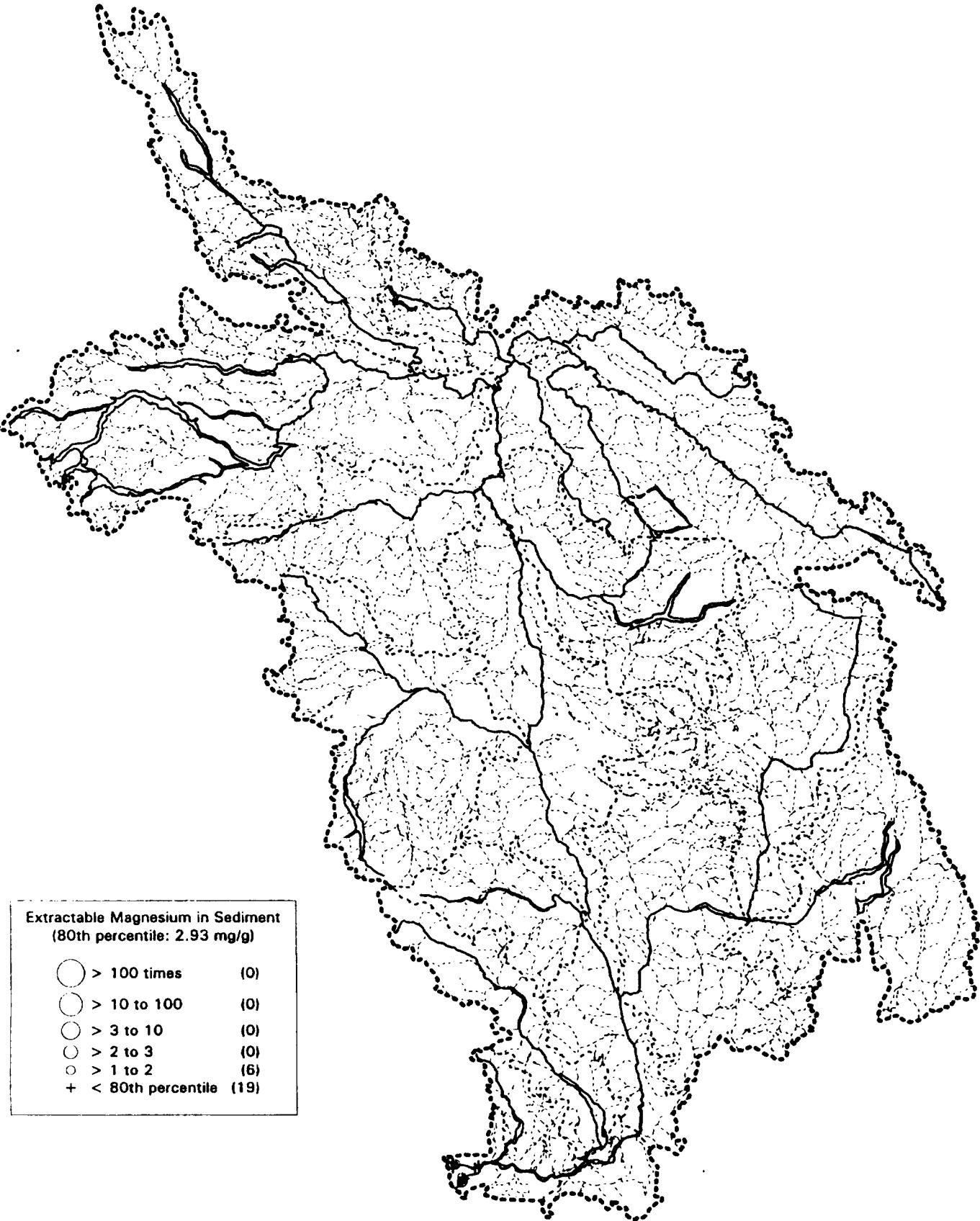


Extractable Calcium in Sediment
(80th percentile: 4.89 mg/g)

(○) > 100 times	(0)
(○) > 10 to 100	(0)
(○) > 3 to 10	(0)
(○) > 2 to 3	(0)
(○) > 1 to 2	(6)
+ < 80th percentile	(19)

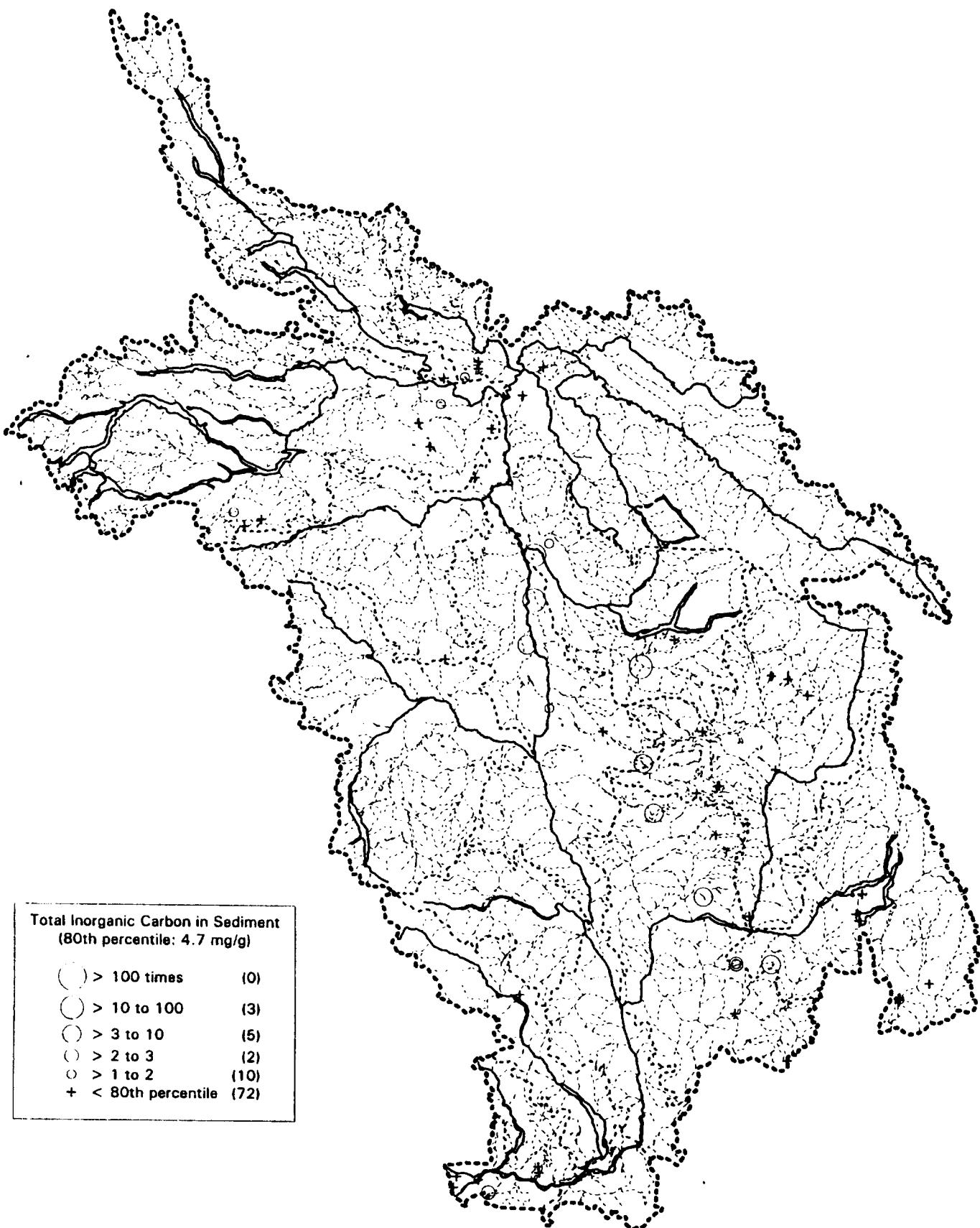


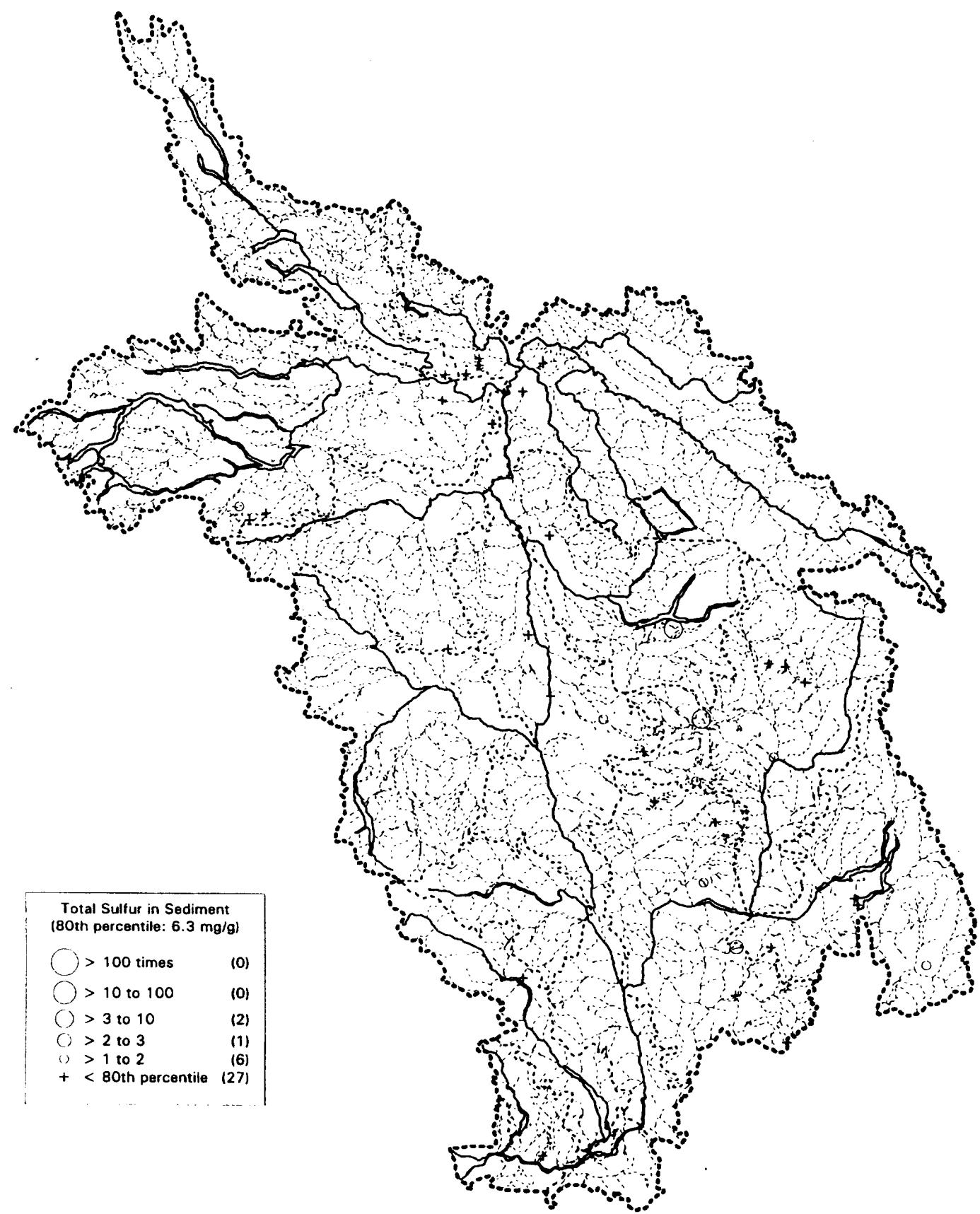




Total Inorganic Carbon in Sediment
(80th percentile: 4.7 mg/g)

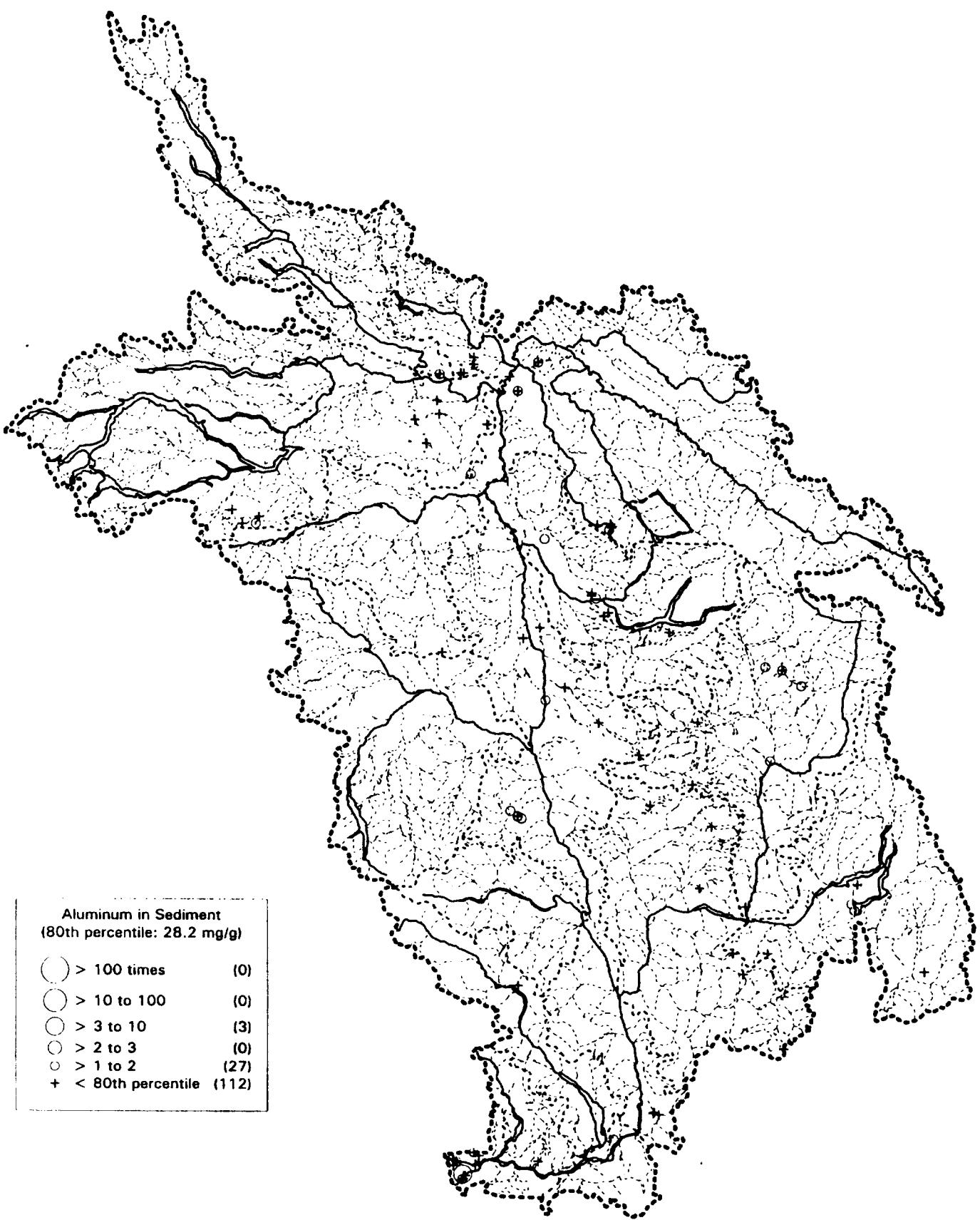
- | | |
|---------------------|------|
| () > 100 times | (0) |
| () > 10 to 100 | (3) |
| () > 3 to 10 | (5) |
| () > 2 to 3 | (2) |
| () > 1 to 2 | (10) |
| + < 80th percentile | (72) |

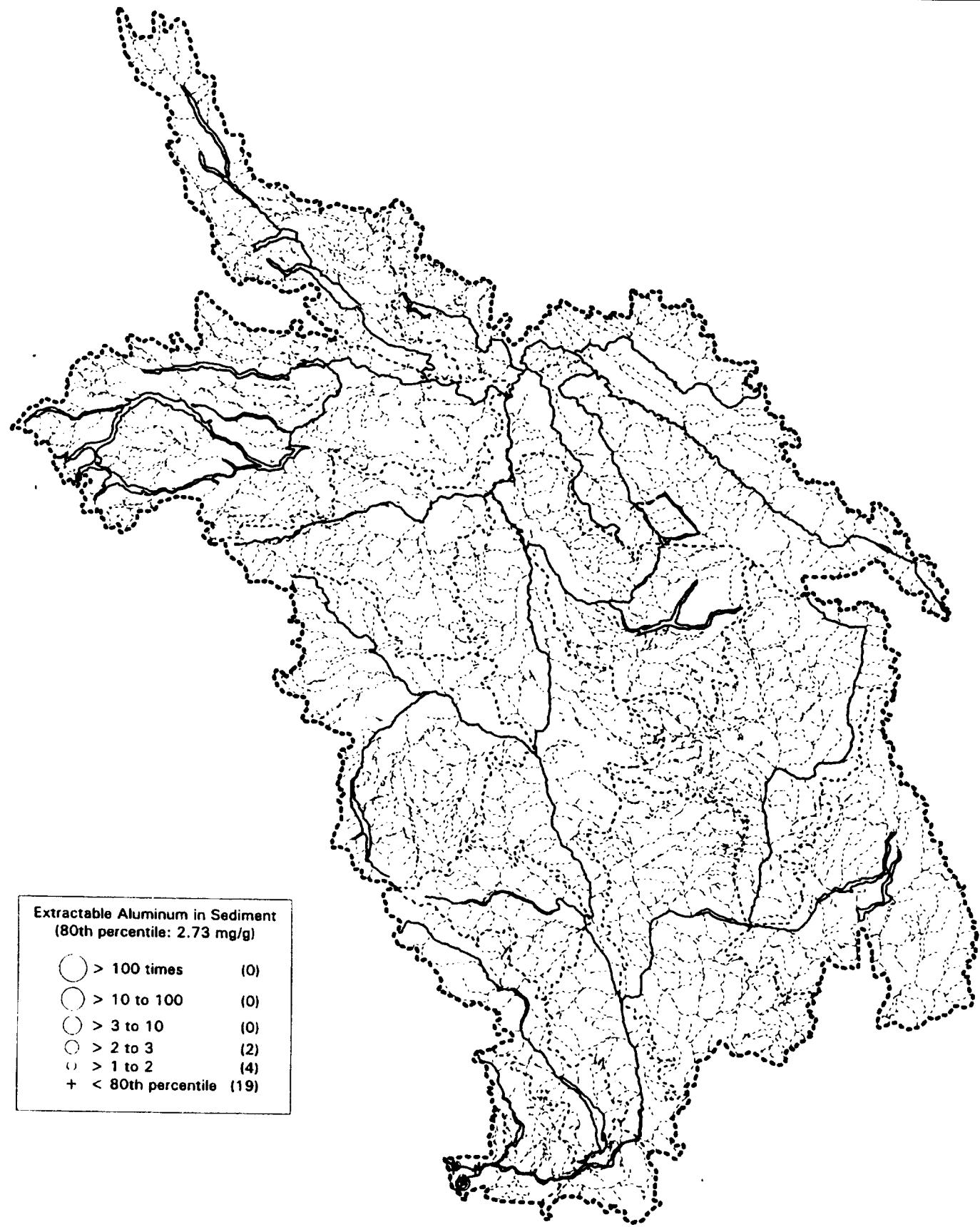


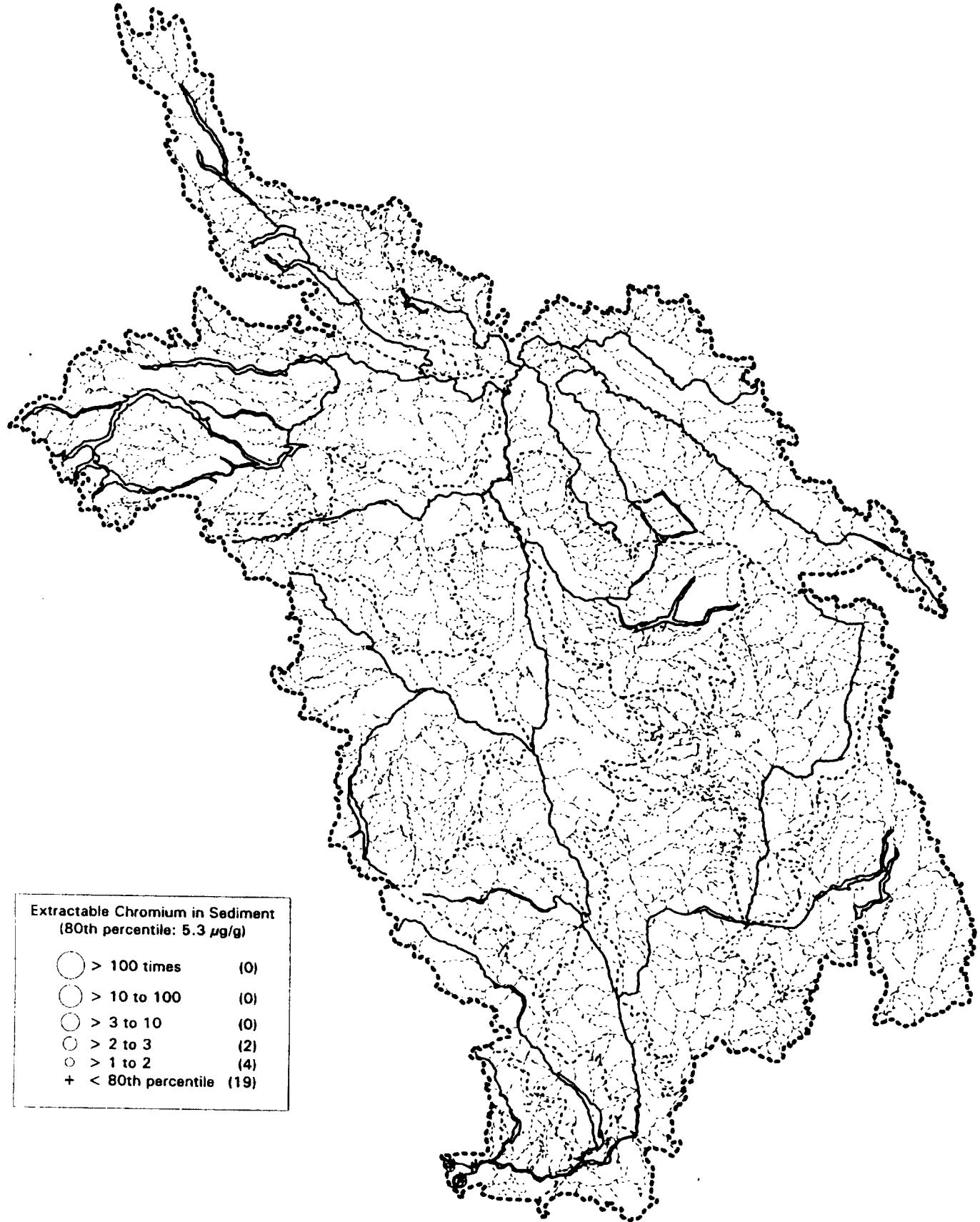


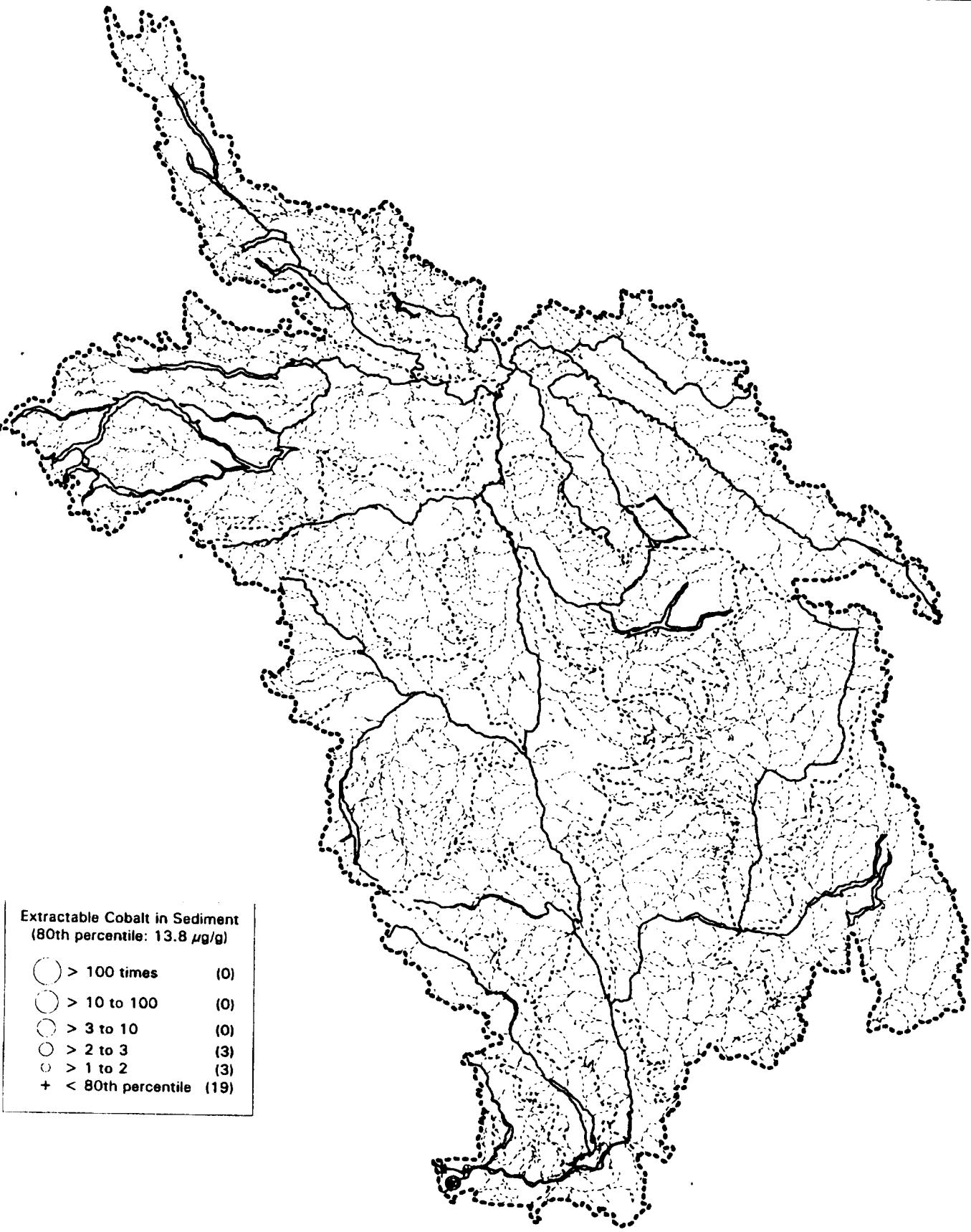
2.2.5 Metals in sediment

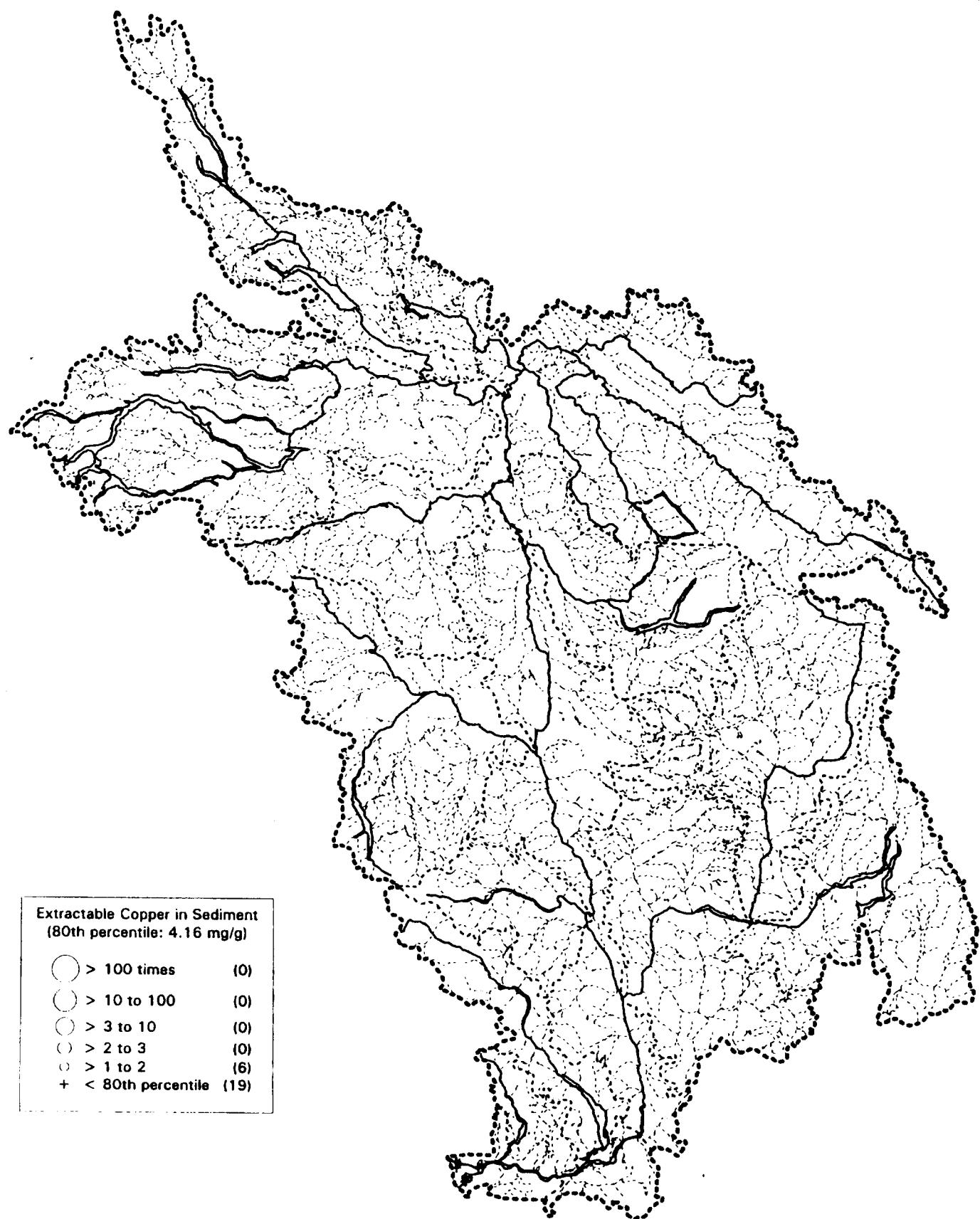
Aluminum
Extractable Aluminum
Extractable Chromium
Extractable Cobalt
Extractable Copper
Extractable Iron
Extractable Lead
Extractable Manganese
Molybdenum
Extractable Nickel
Strontium
Tin
Vanadium
Extractable Zinc

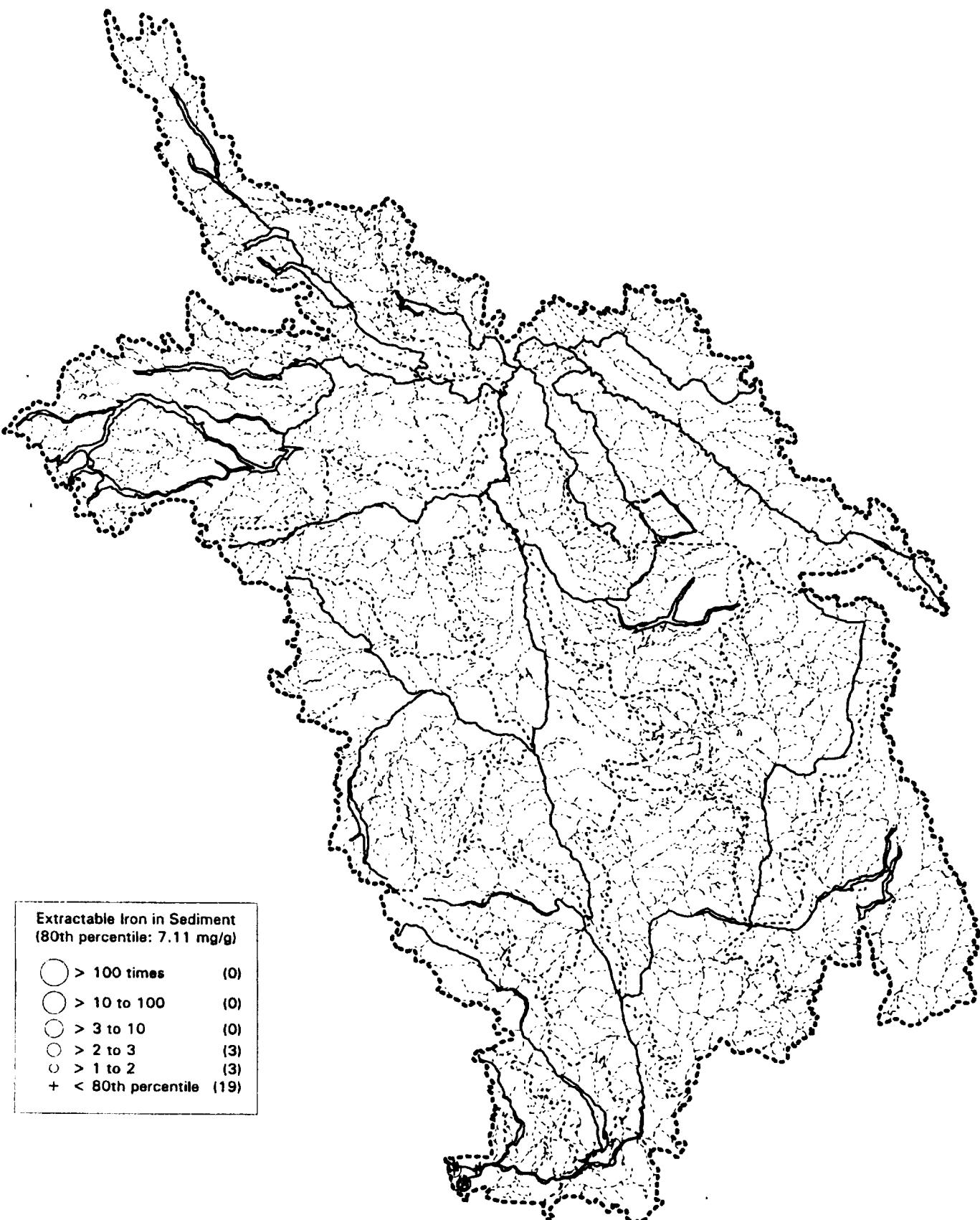


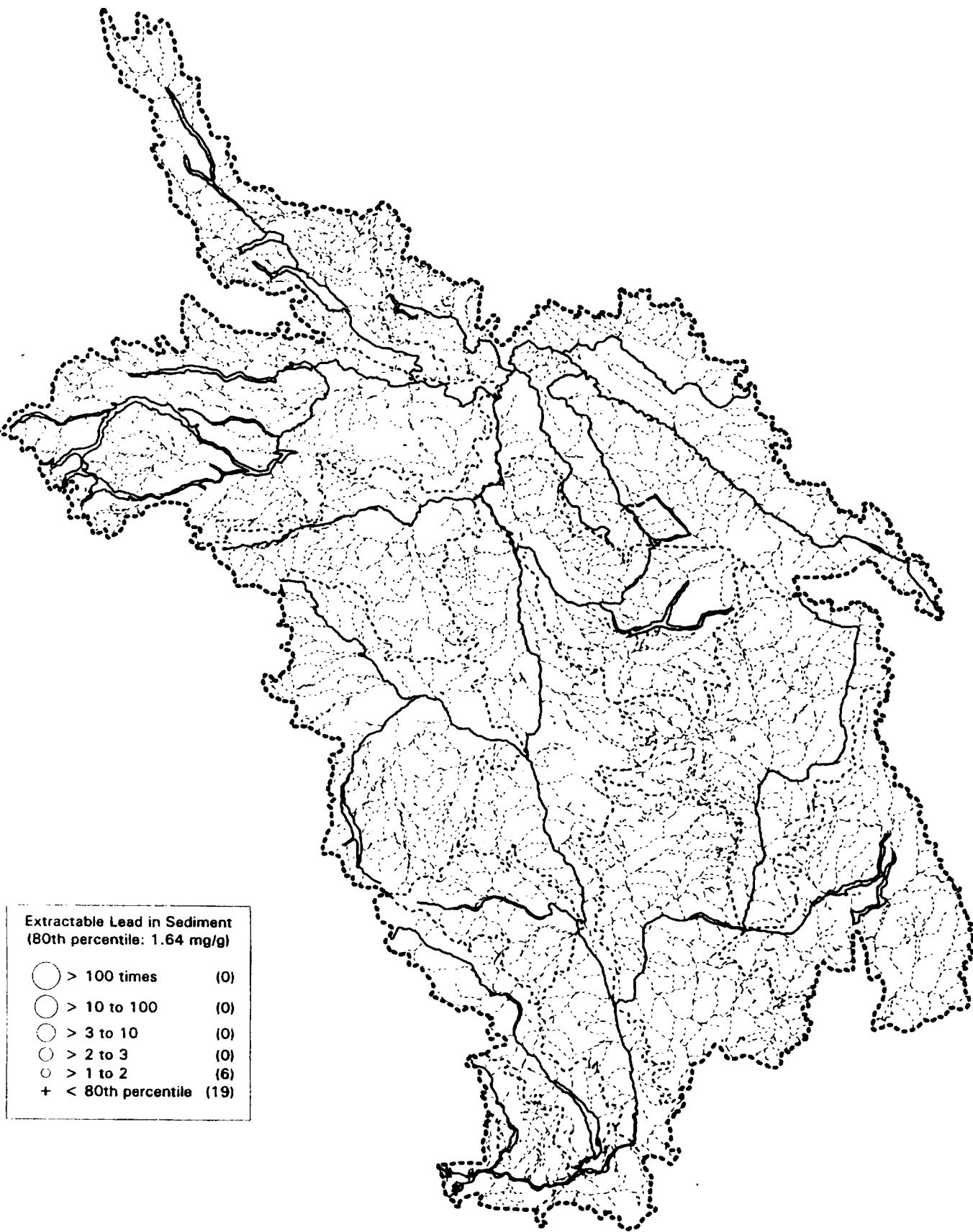


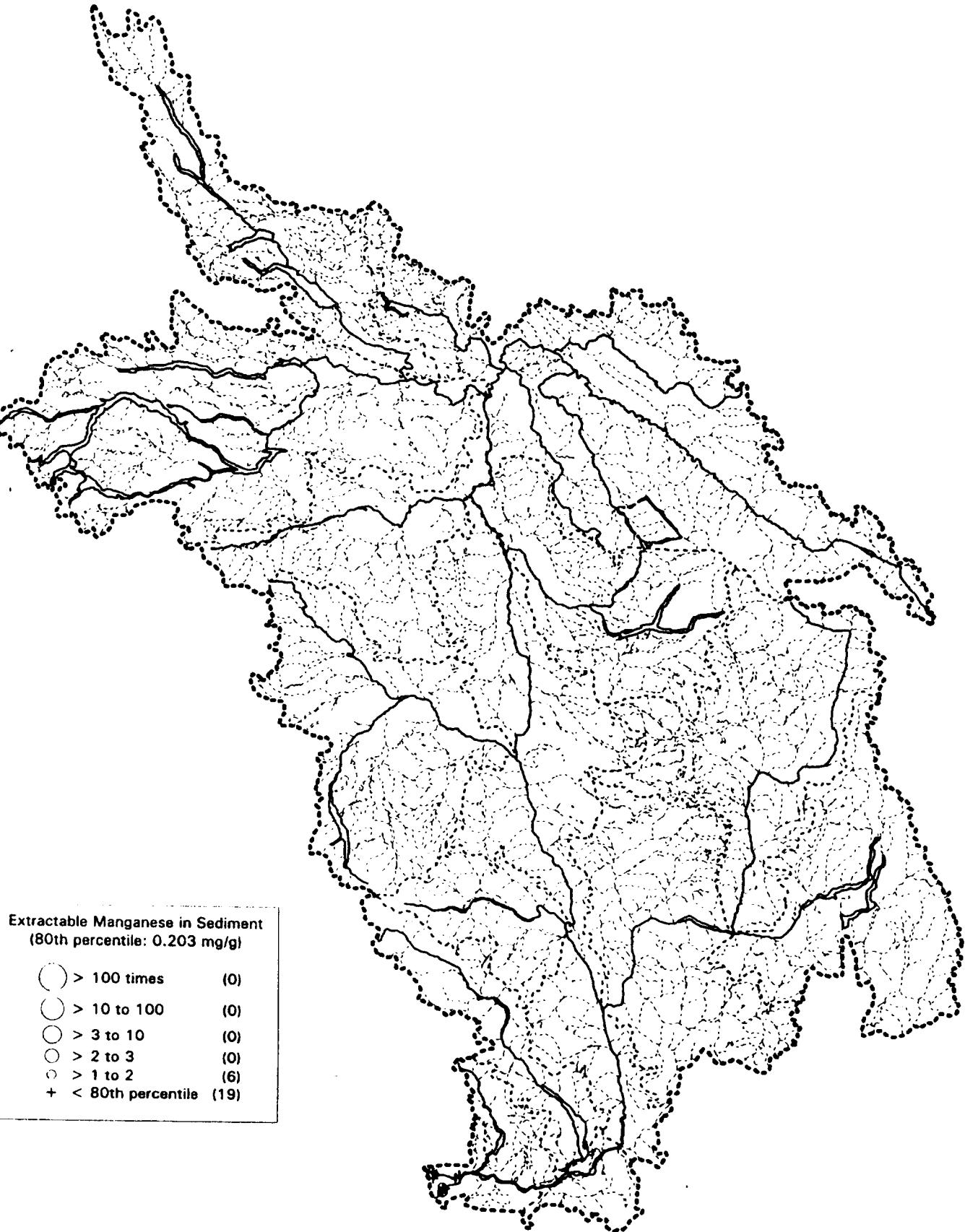


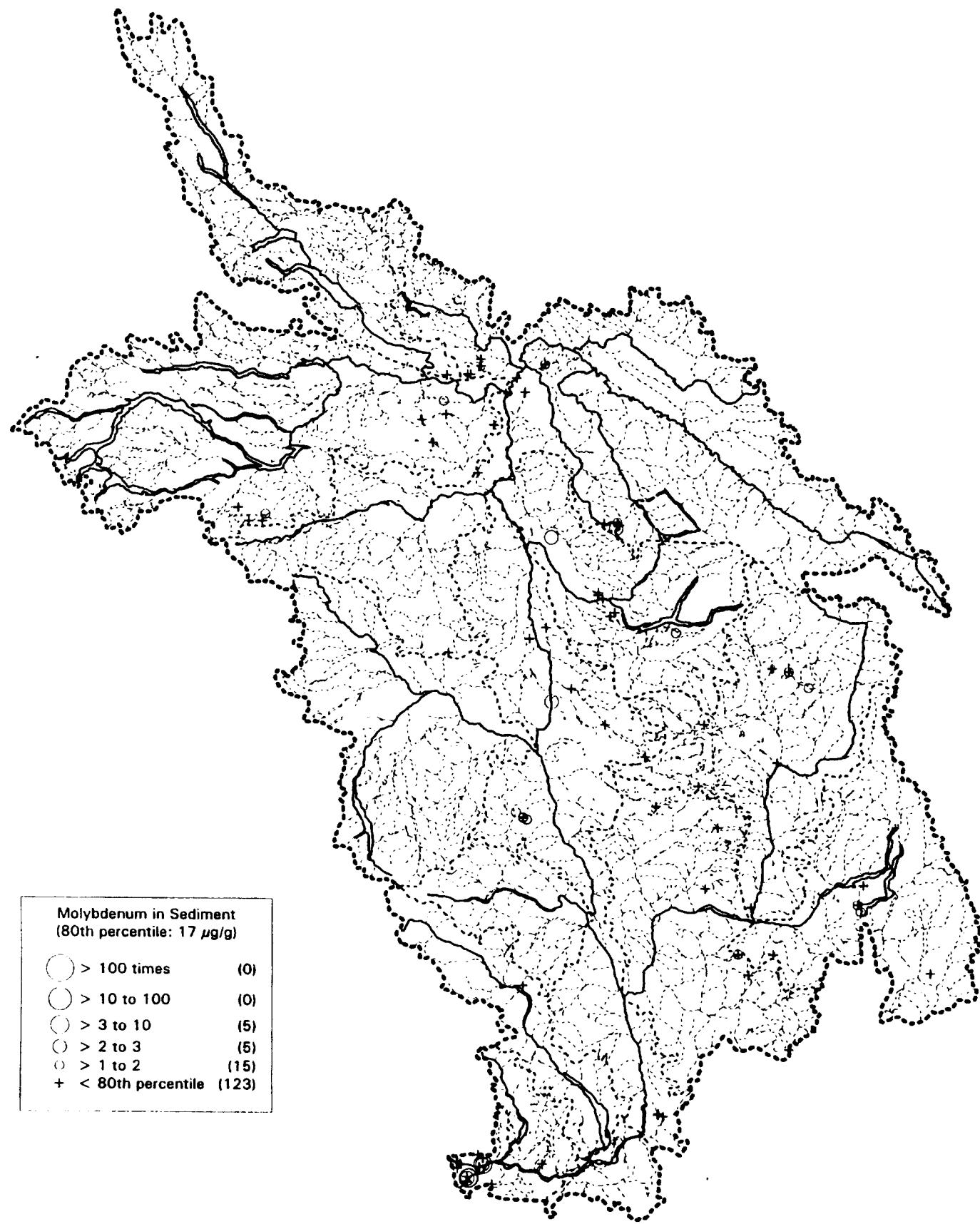






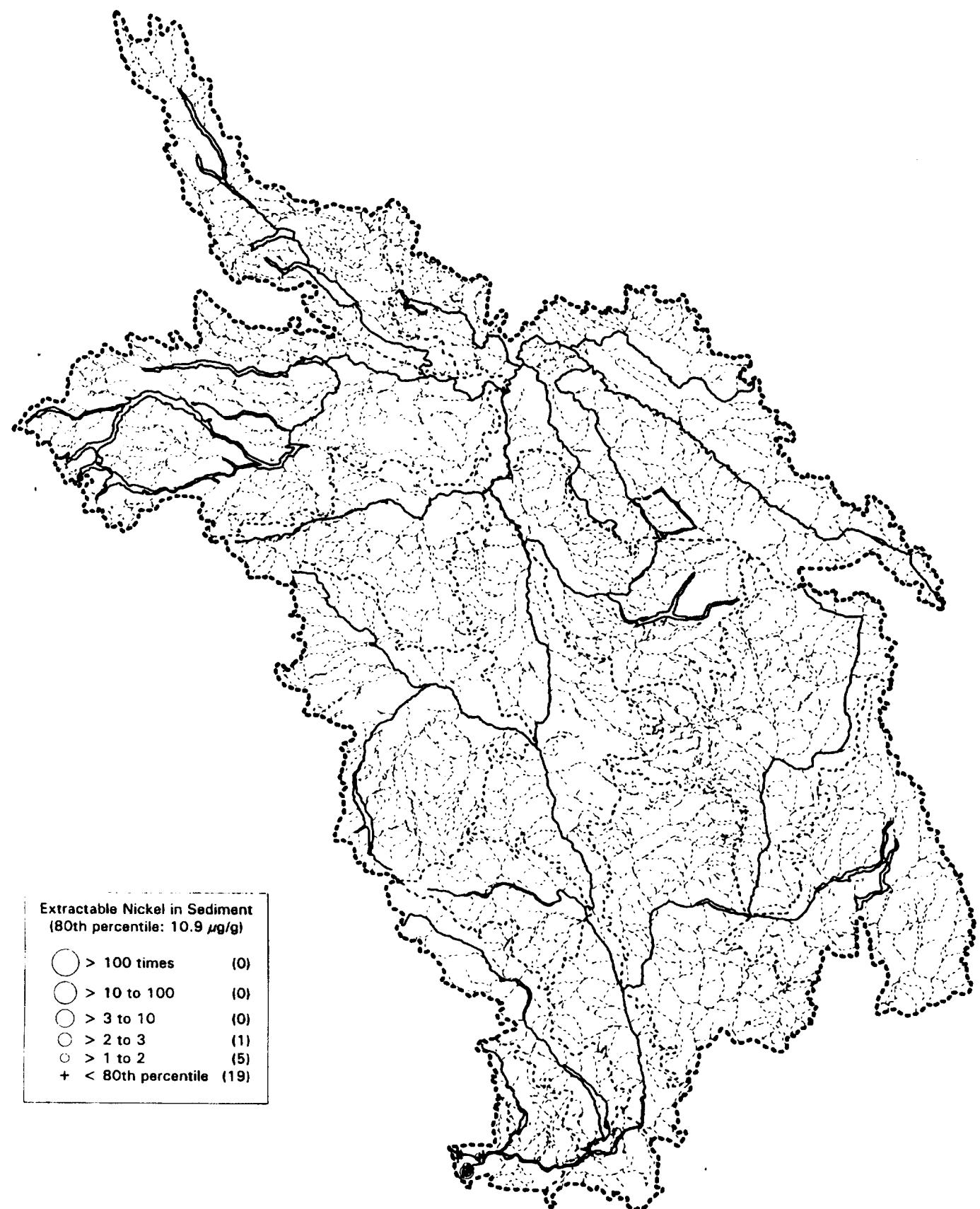
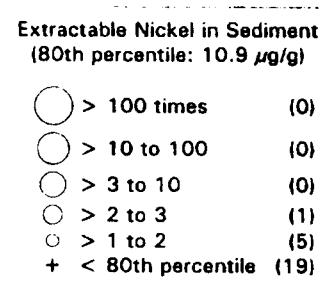


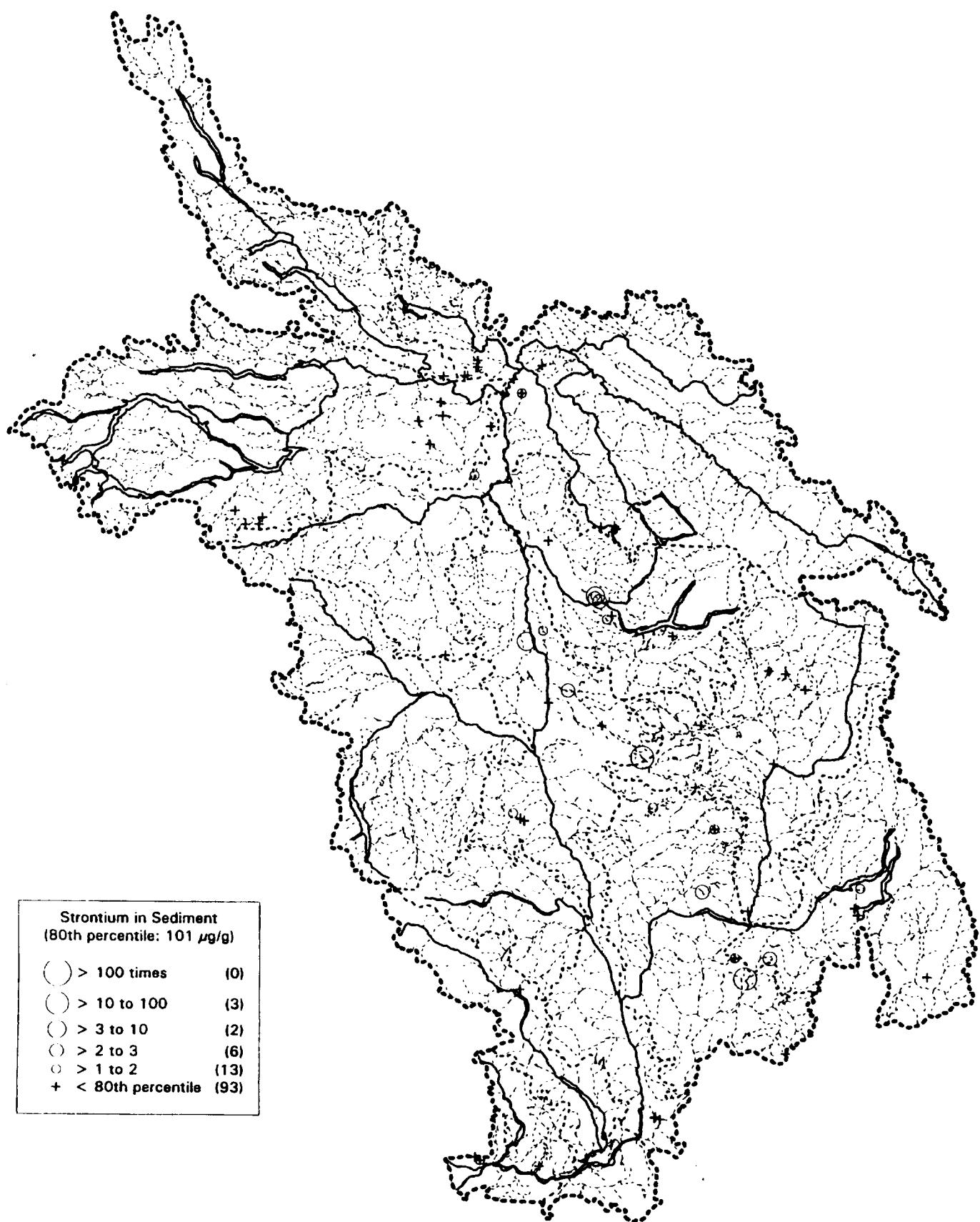


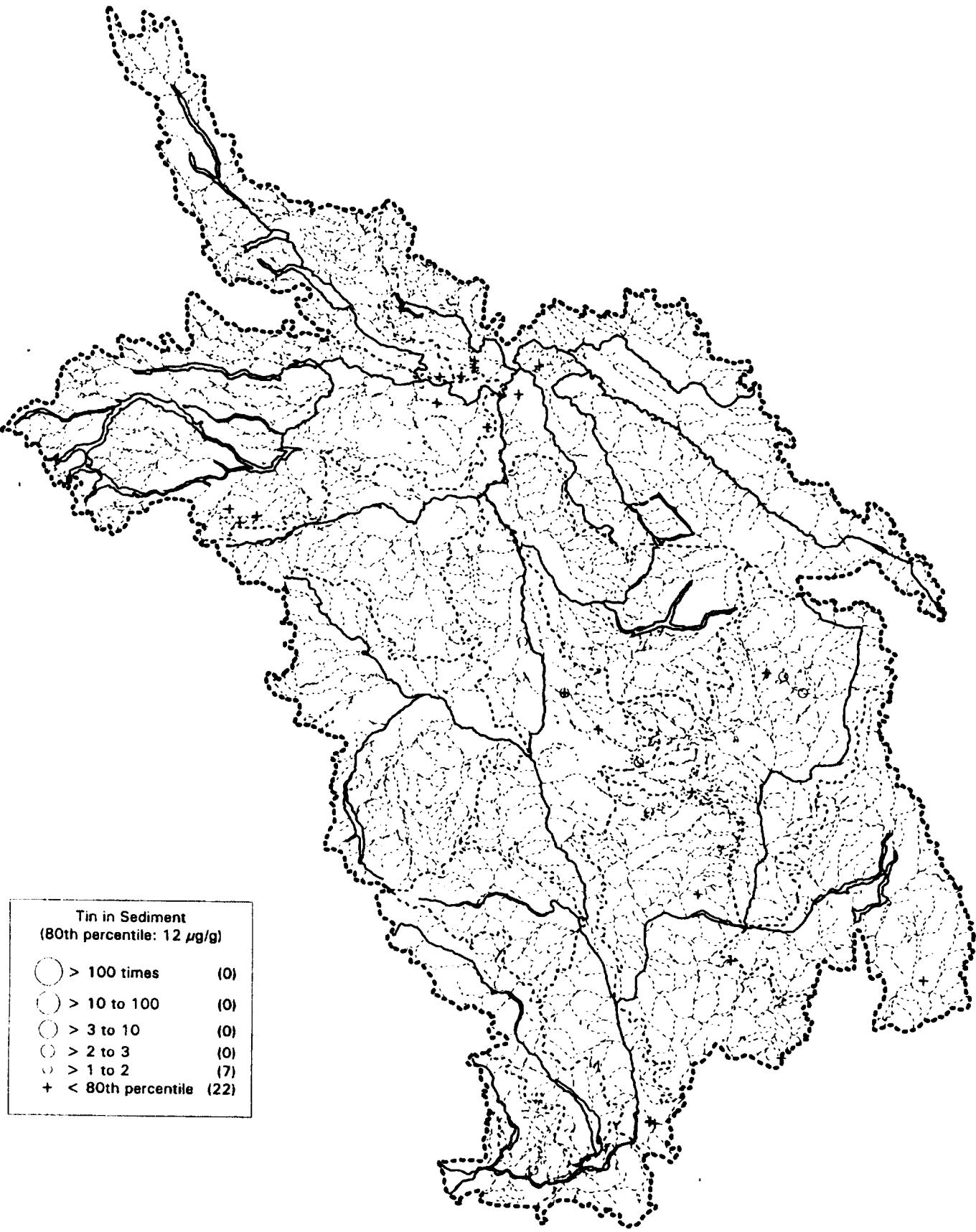


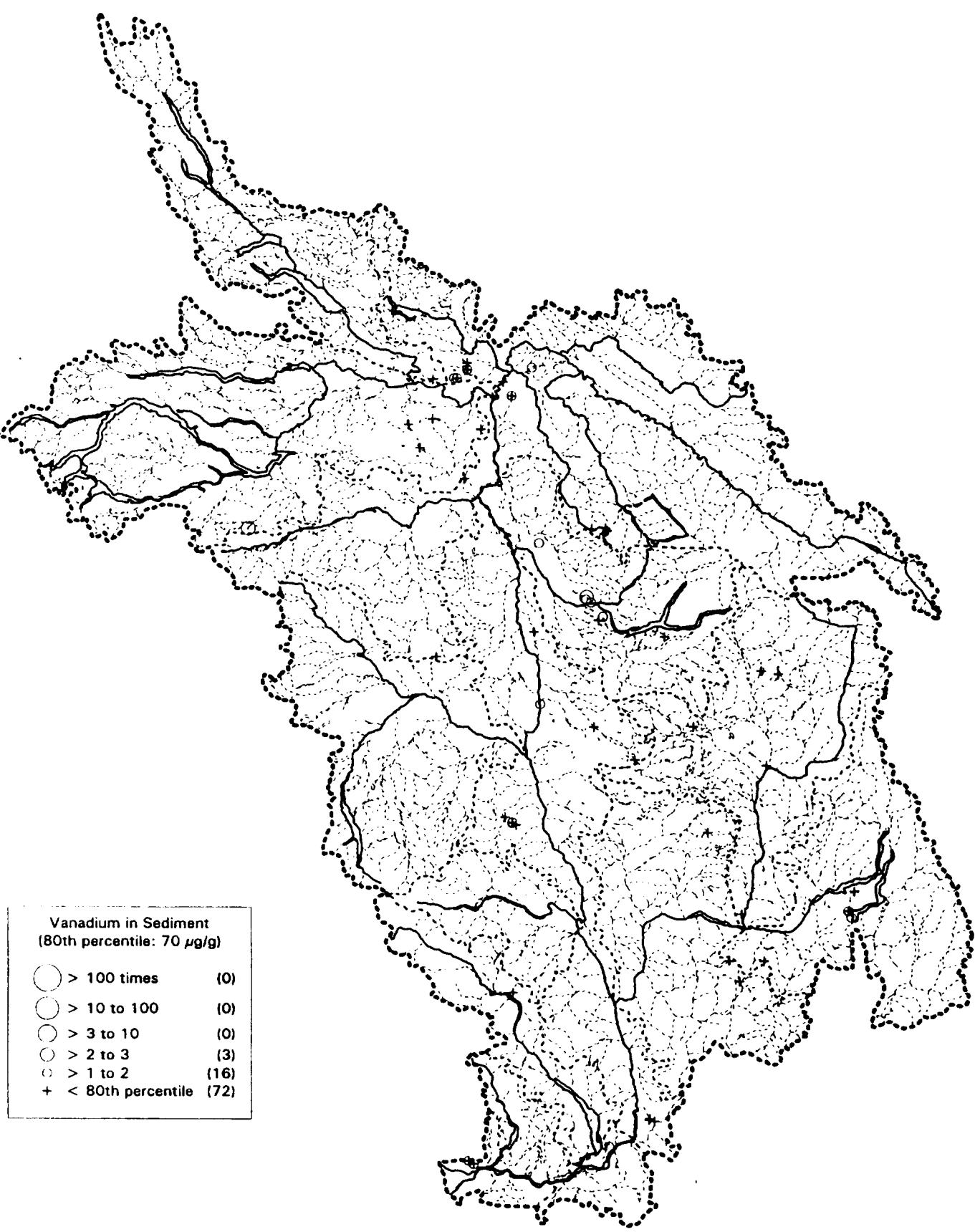
Molybdenum in Sediment
(80th percentile: 17 µg/g)

○	> 100 times	(0)
○	> 10 to 100	(0)
○	> 3 to 10	(5)
○	> 2 to 3	(5)
○	> 1 to 2	(15)
+	< 80th percentile	(123)



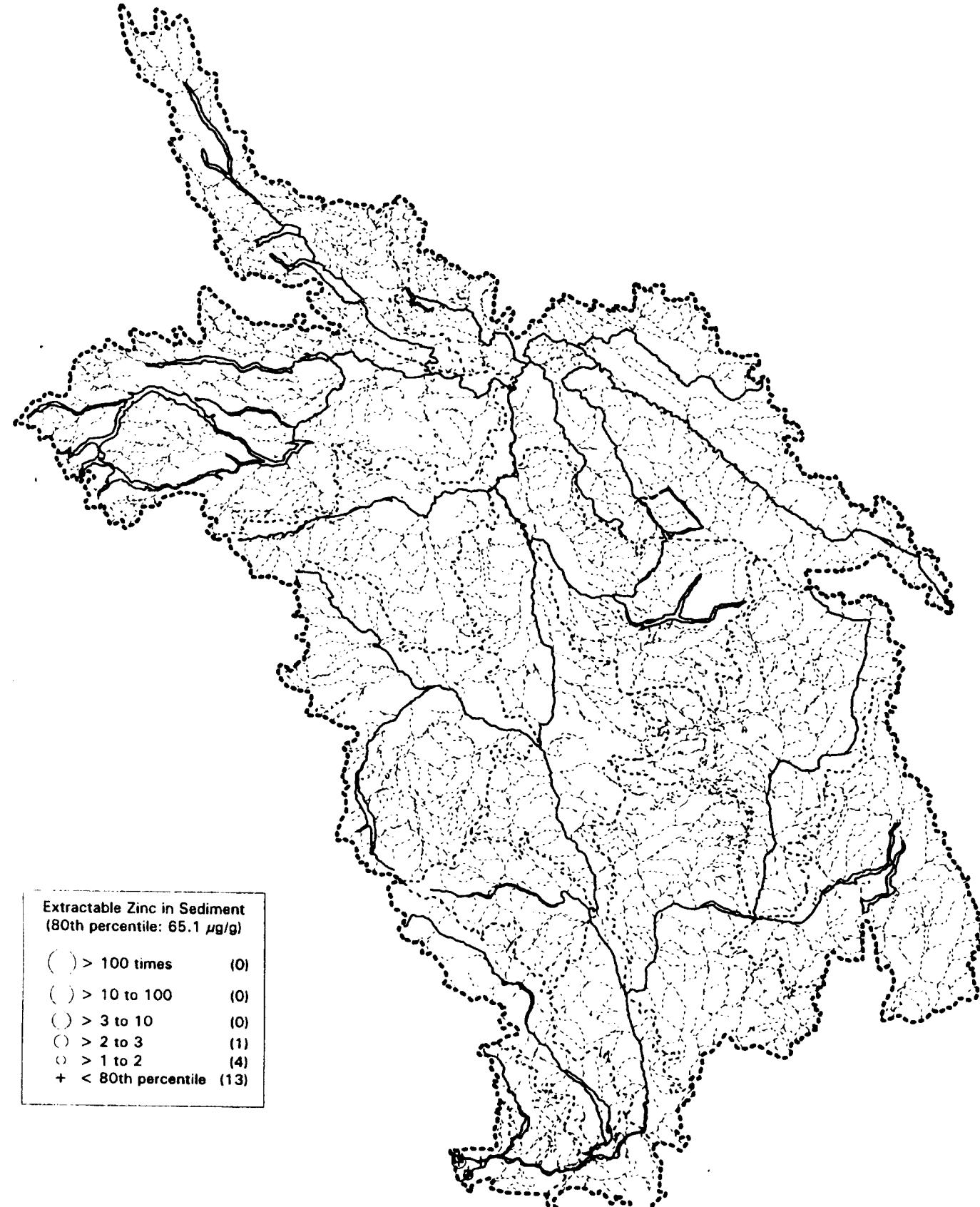






Extractable Zinc in Sediment
(80th percentile: 65.1 $\mu\text{g/g}$)

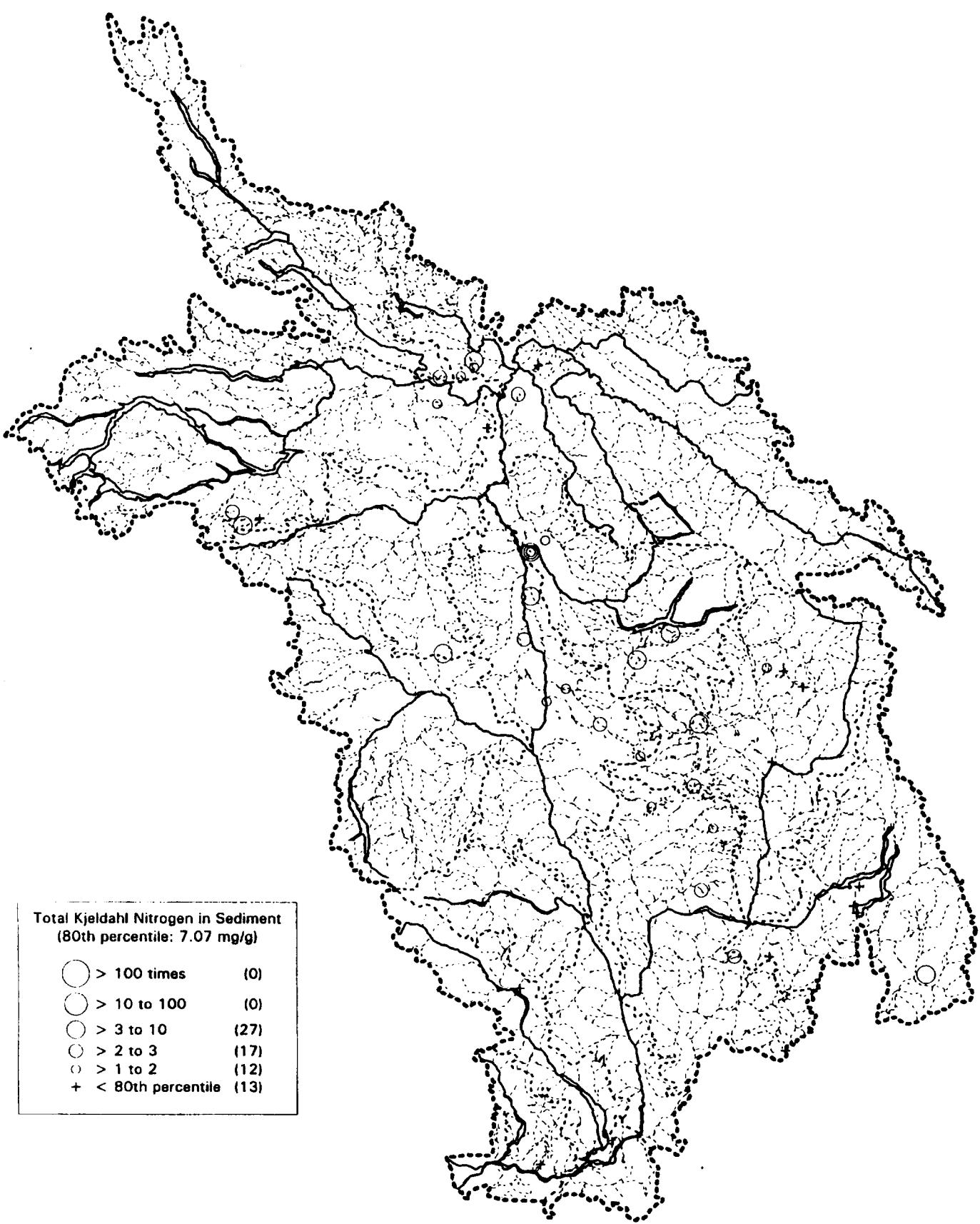
- | | |
|---------------------|------|
| () > 100 times | (0) |
| () > 10 to 100 | (0) |
| () > 3 to 10 | (0) |
| () > 2 to 3 | (1) |
| () > 1 to 2 | (4) |
| + < 80th percentile | (13) |

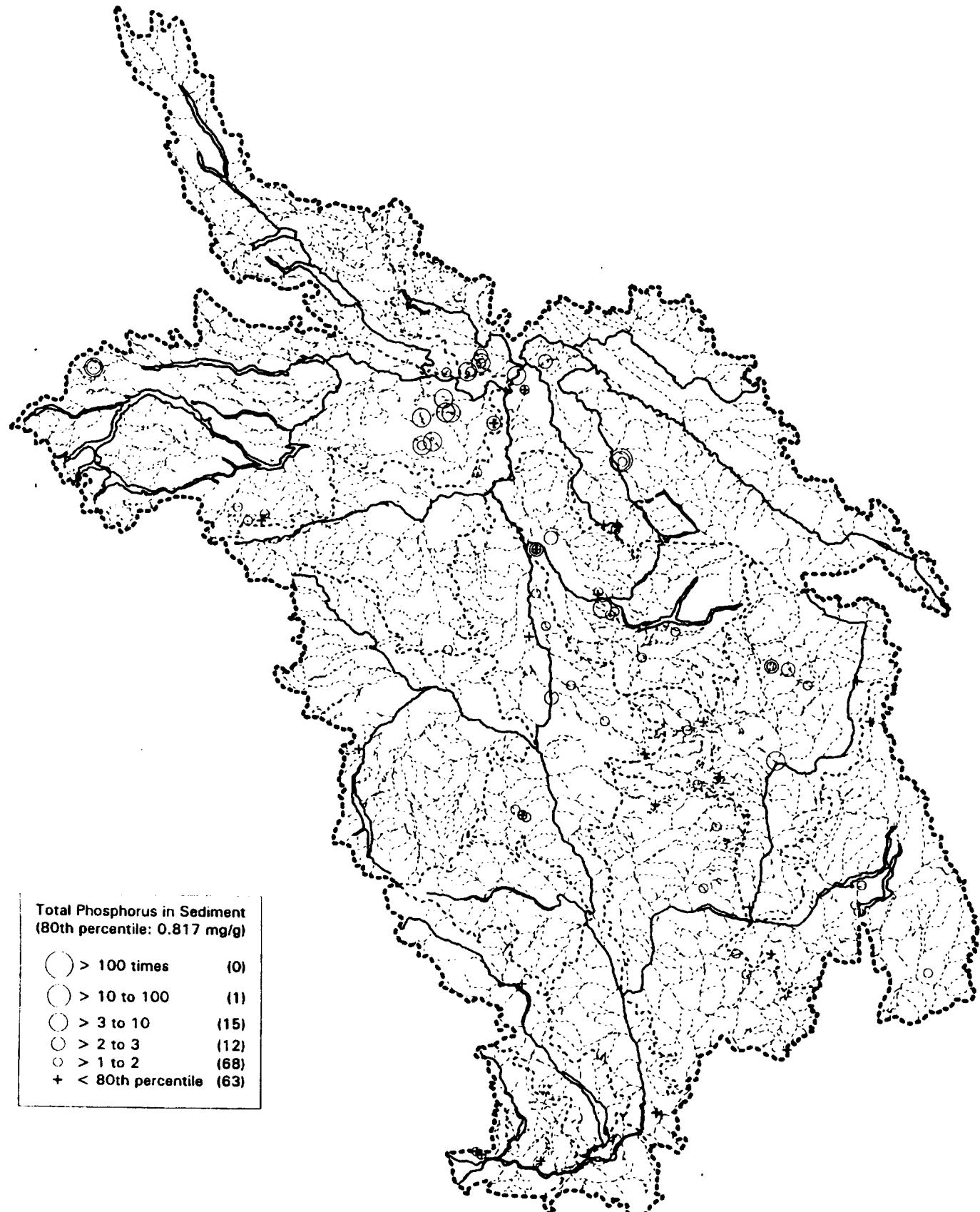


2.2.6 Nutrients in sediment

Total Kjeldahl Nitrogen

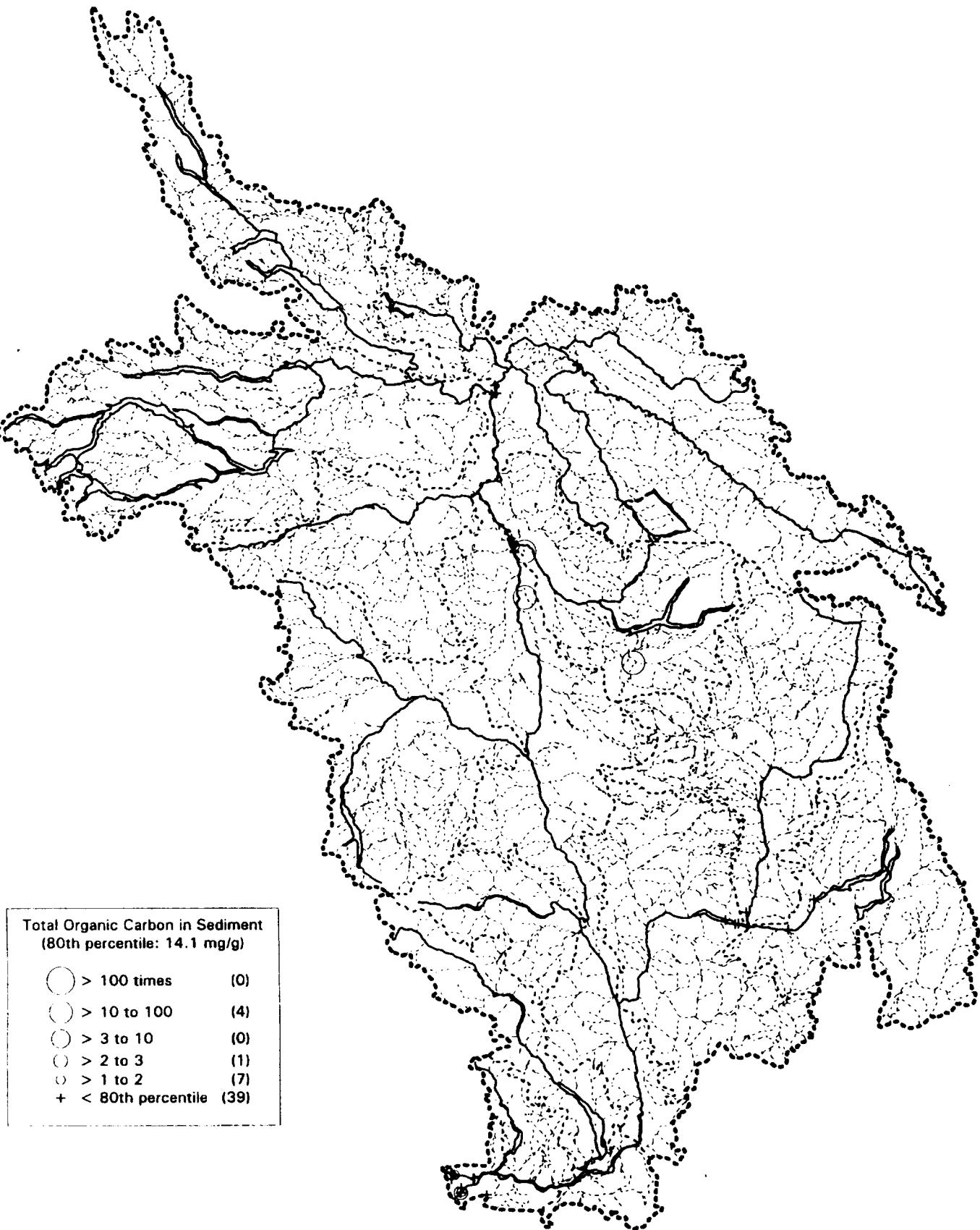
Total Phosphorus





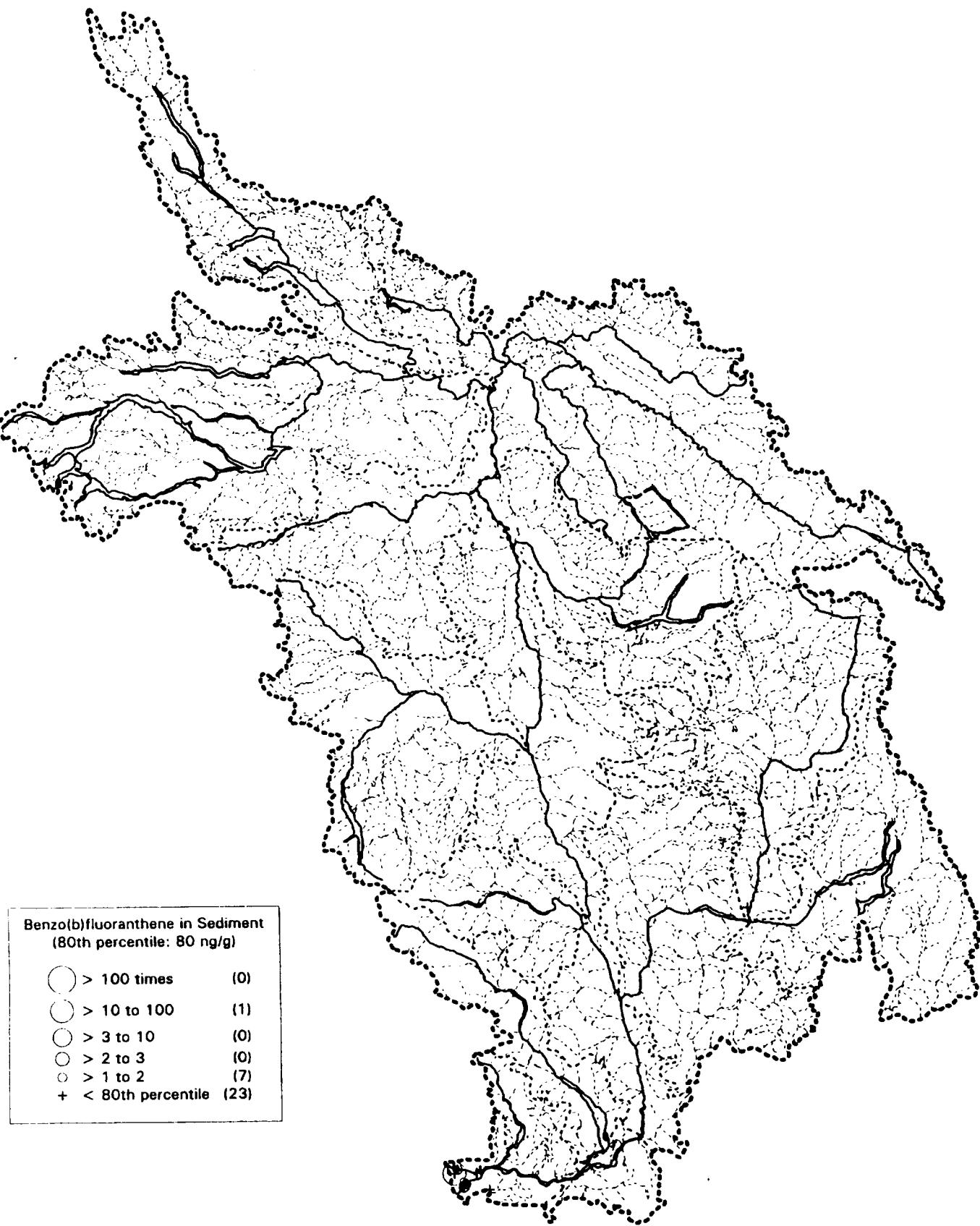
2.2.7 Organics, miscellaneous in sediment

Total Organic Carbon



2.2.8 Polycyclic aromatic hydrocarbons (PAHs) in sediment

Benzo(b)fluoranthene



2.2.9 Resin acids and fatty acids in sediment

Abietic Acid

Chlorodehydroabietic Acid

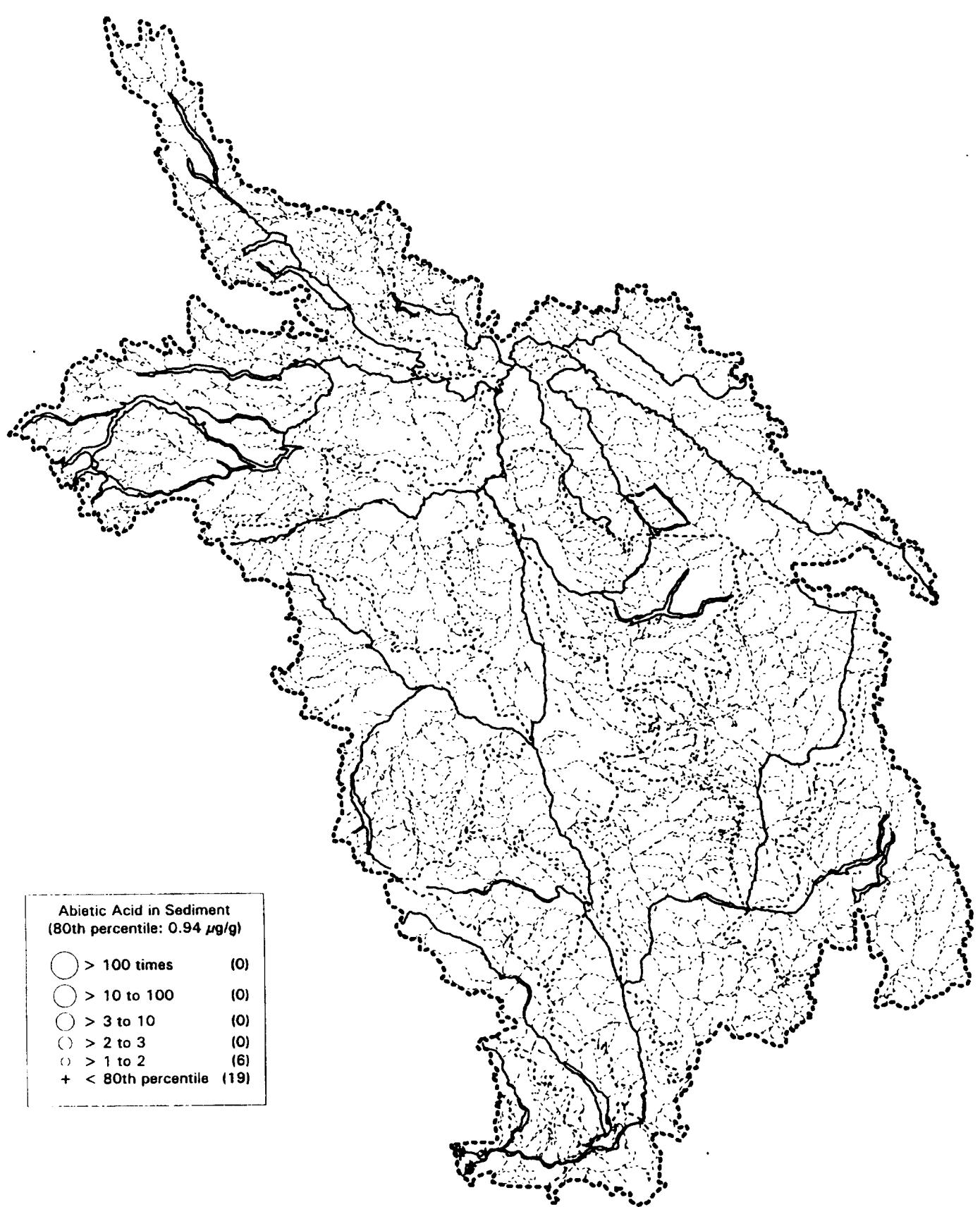
Dehydroabietic Acid

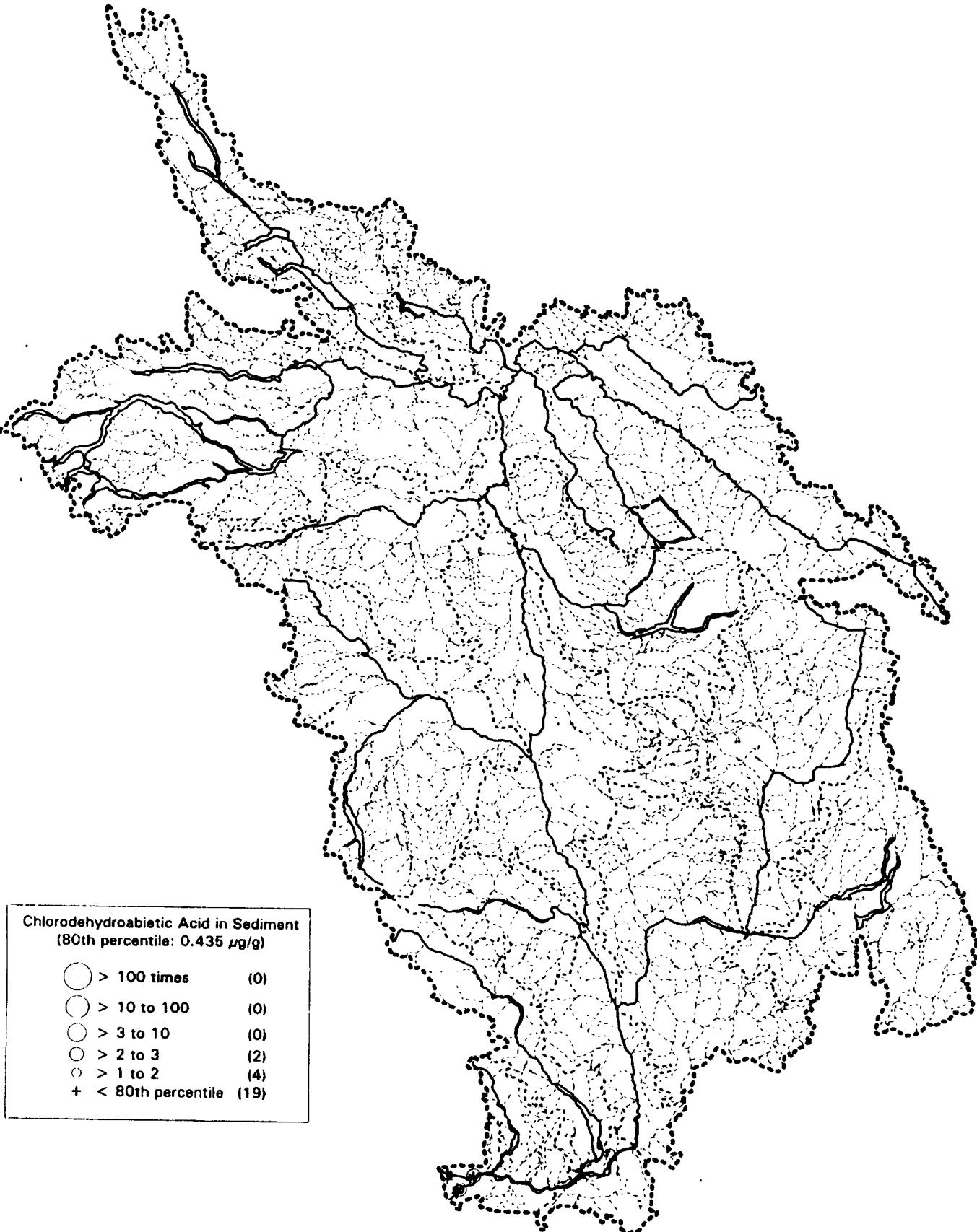
Cl₂-dehydroabietic Acid

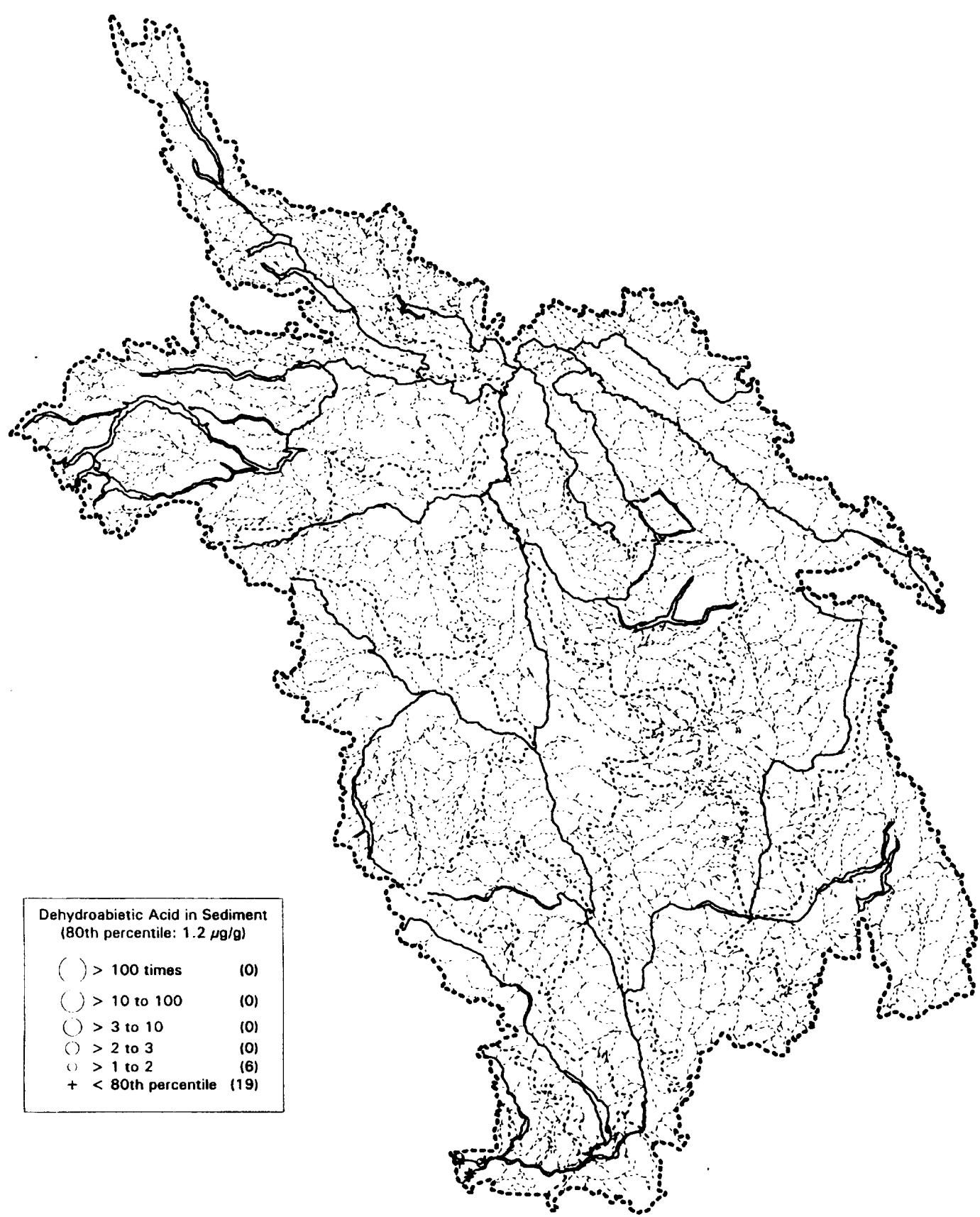
Isopimaric Acid

Pimaric Acid

Sandaraco Pimaric Acid

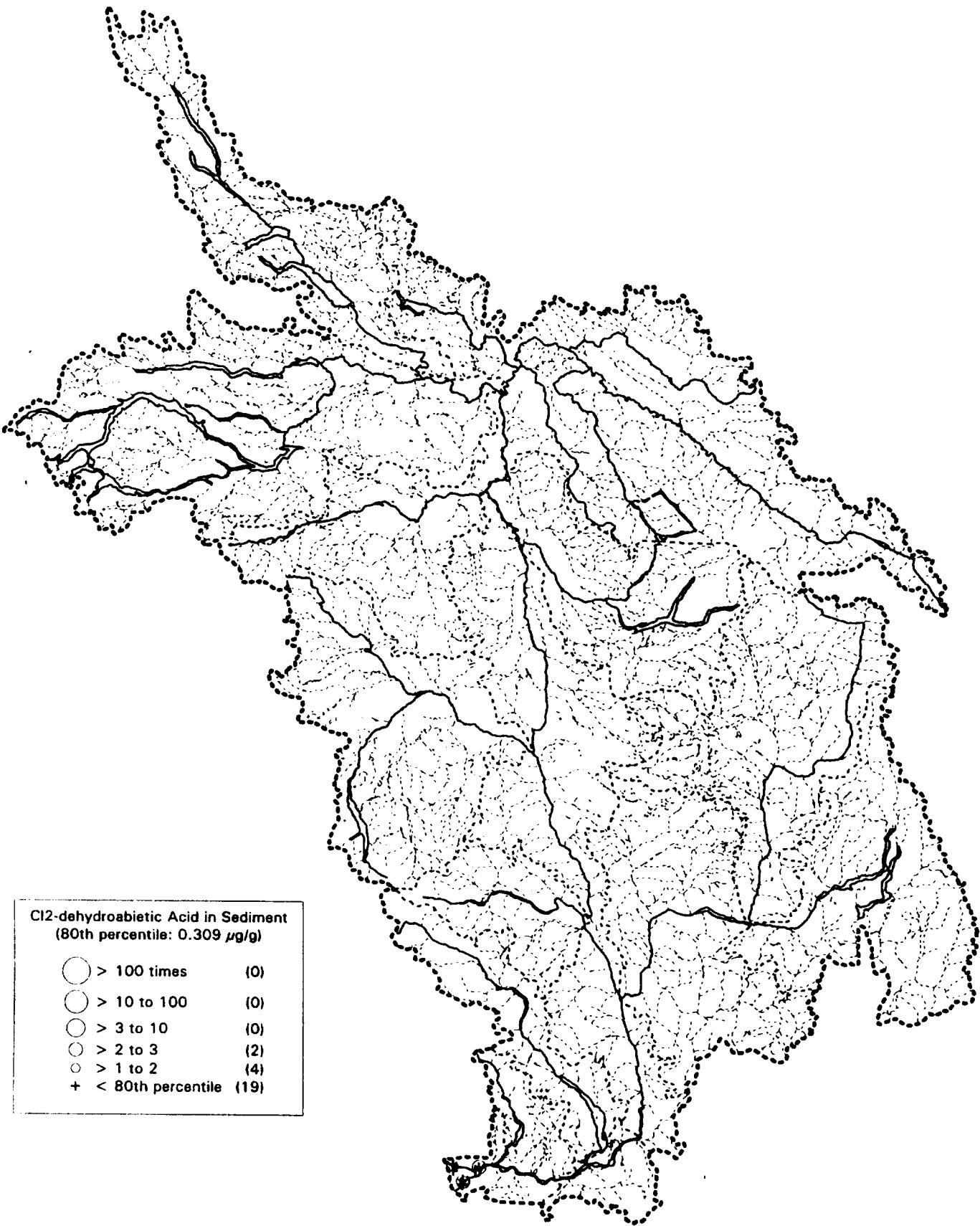
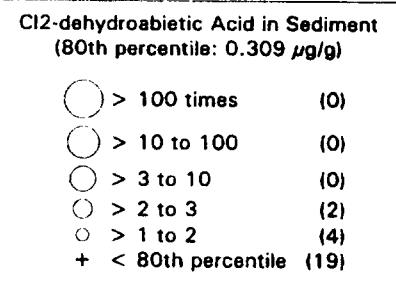


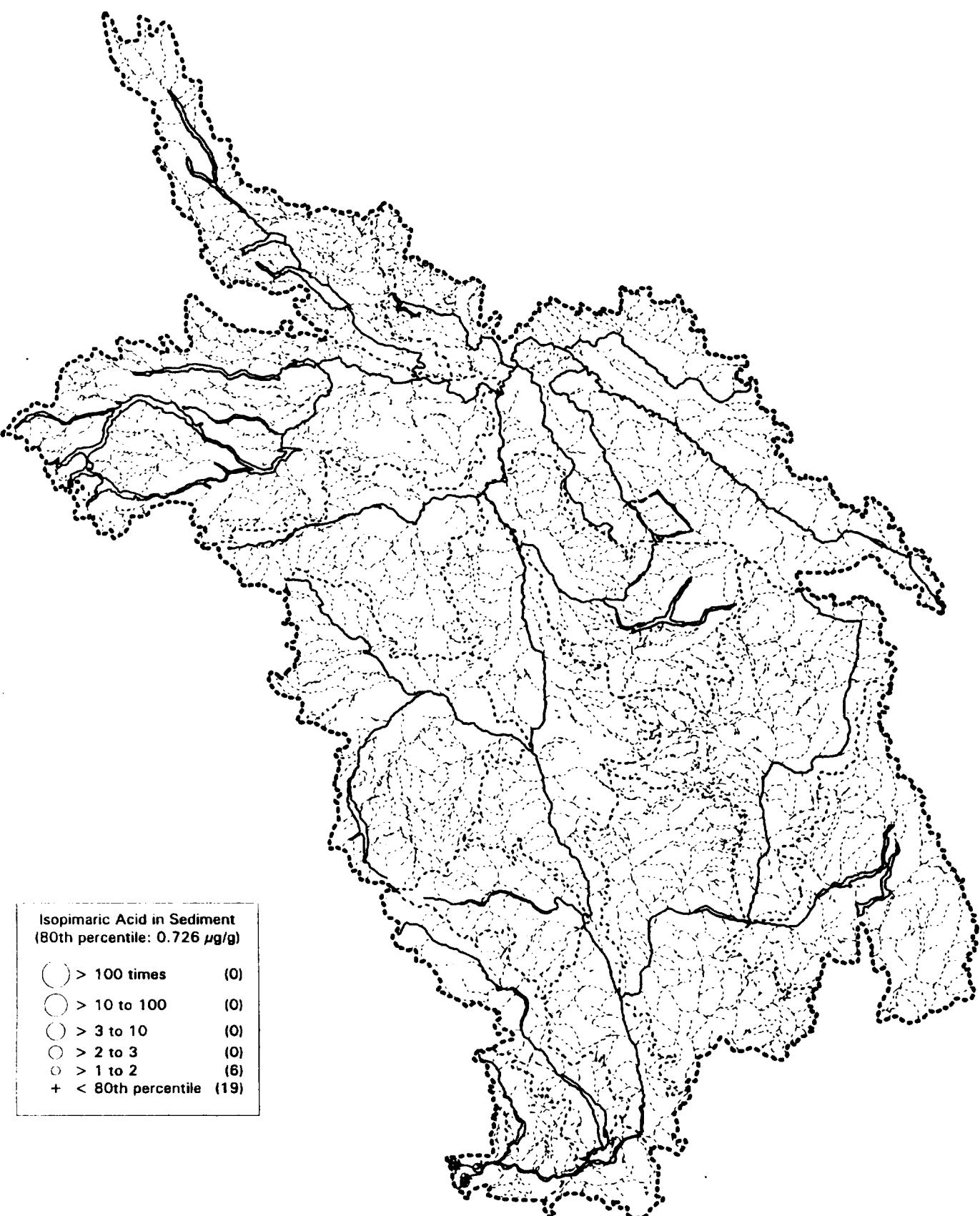




Dehydroabietic Acid in Sediment
(80th percentile: 1.2 µg/g)

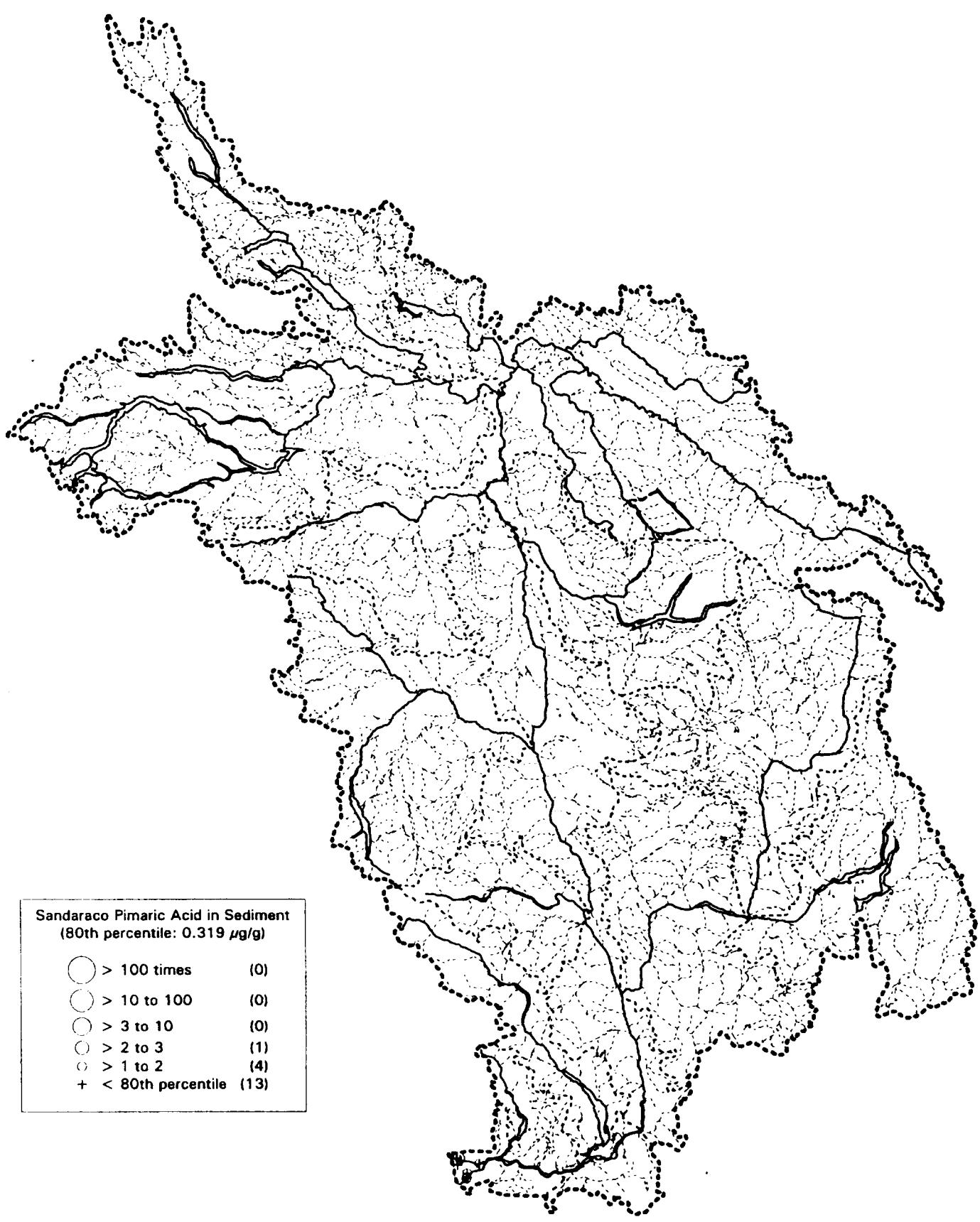
()	> 100 times	(0)
()	> 10 to 100	(0)
()	> 3 to 10	(0)
()	> 2 to 3	(0)
()	> 1 to 2	(6)
+	< 80th percentile	(19)





Pimarc Acid in Sediment
(80th percentile: 0.424 $\mu\text{g/g}$)

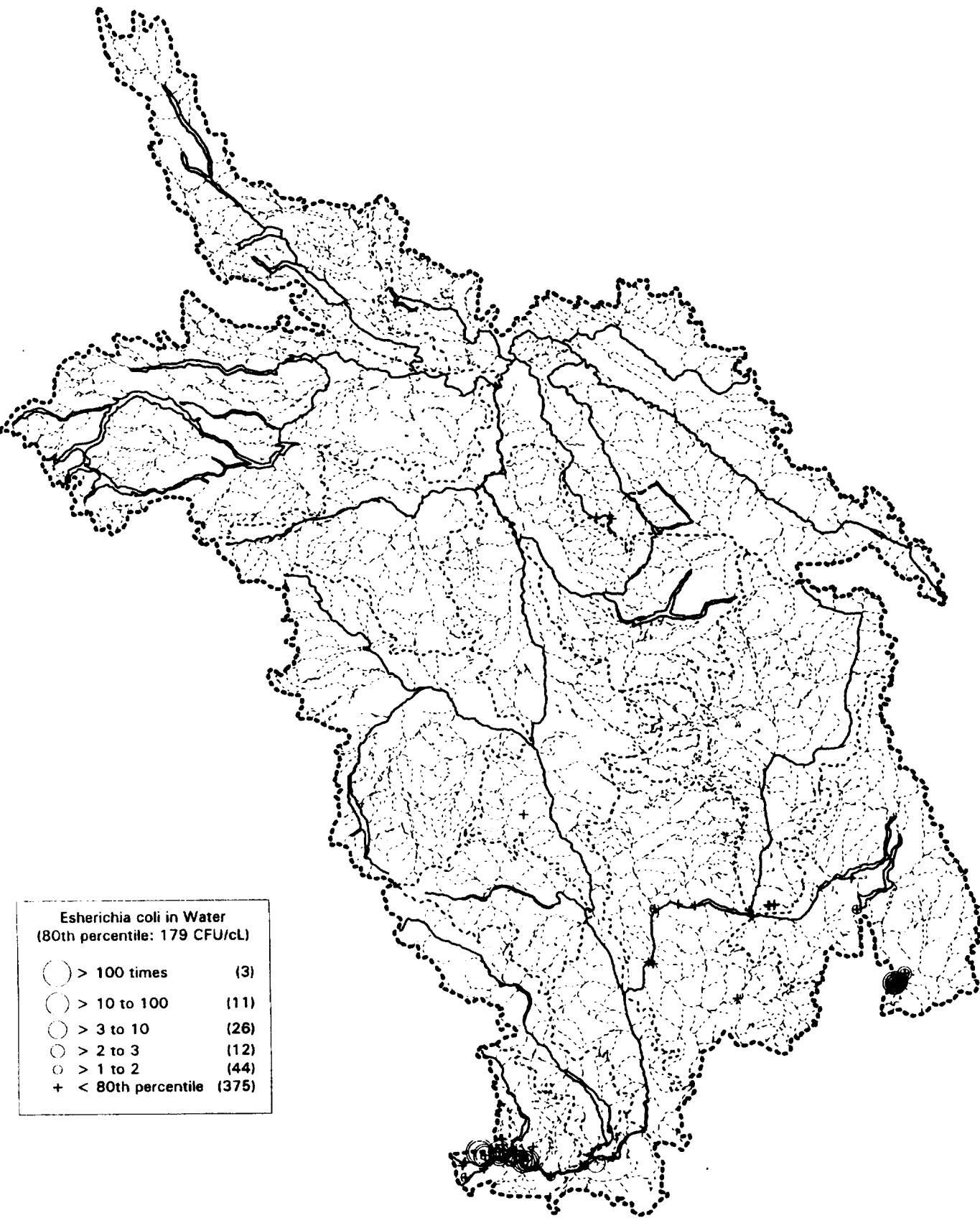
○ > 100 times	(0)
○ > 10 to 100	(0)
○ > 3 to 10	(0)
○ > 2 to 3	(0)
○ > 1 to 2	(6)
+ < 80th percentile	(19)

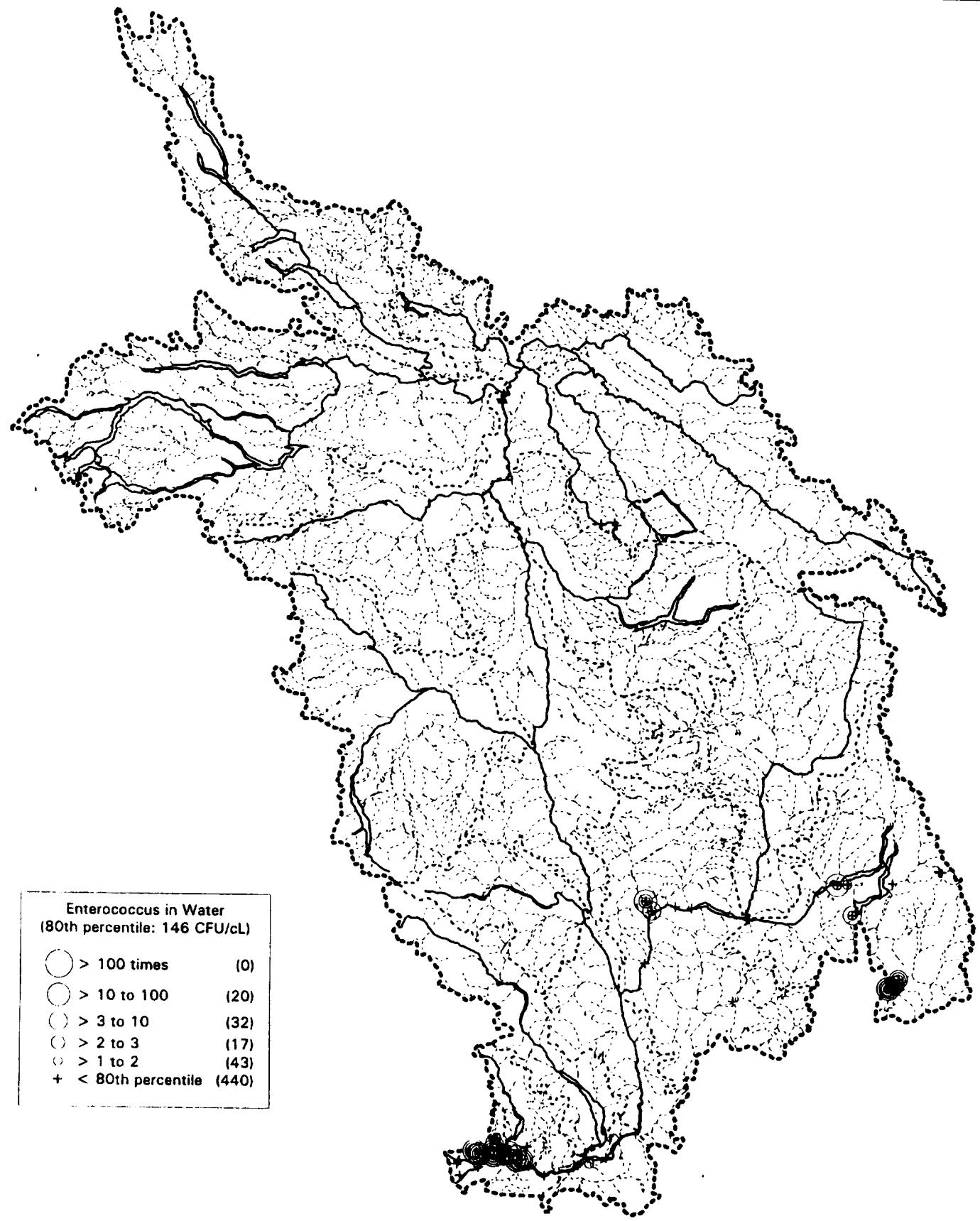


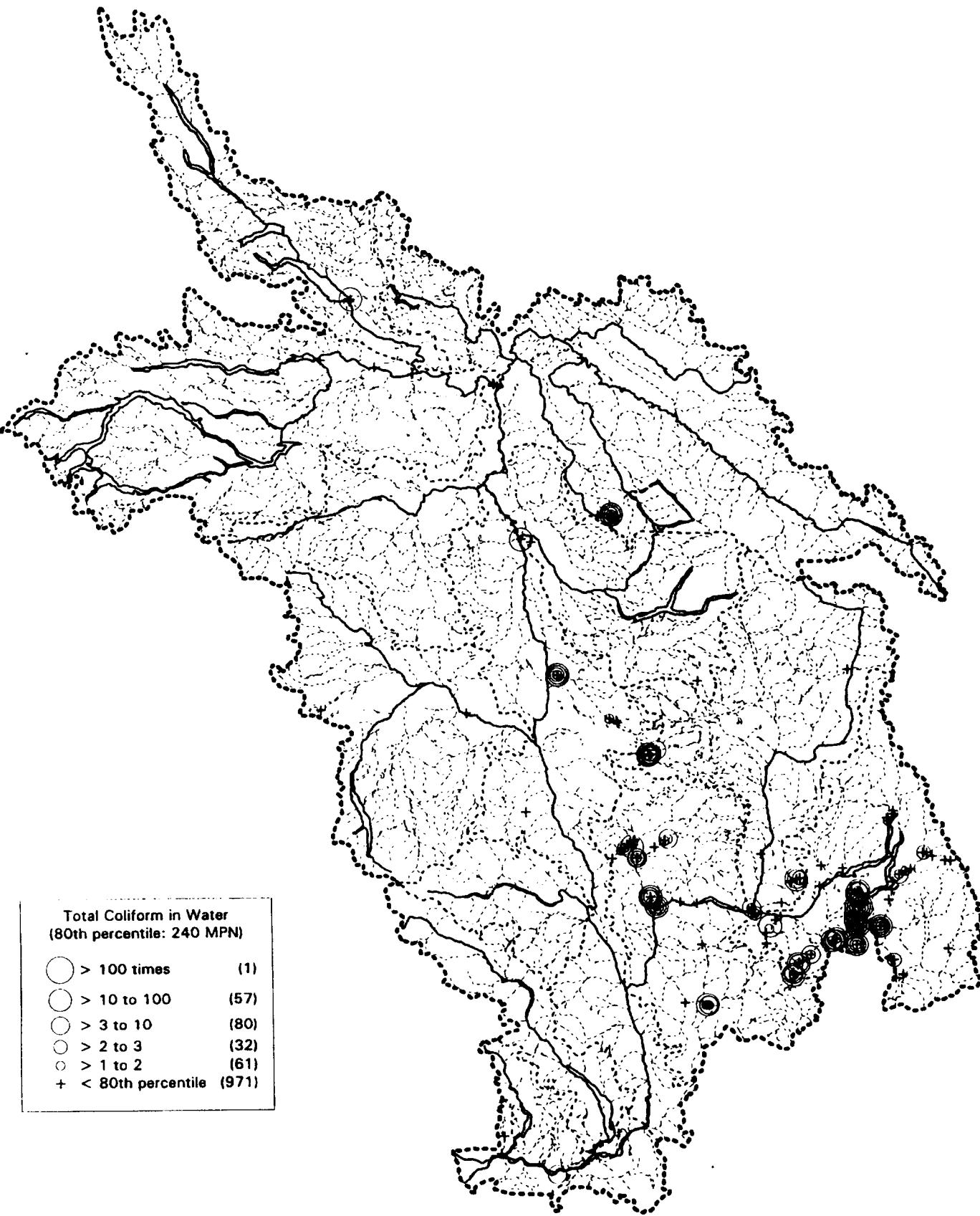
2.3 Water

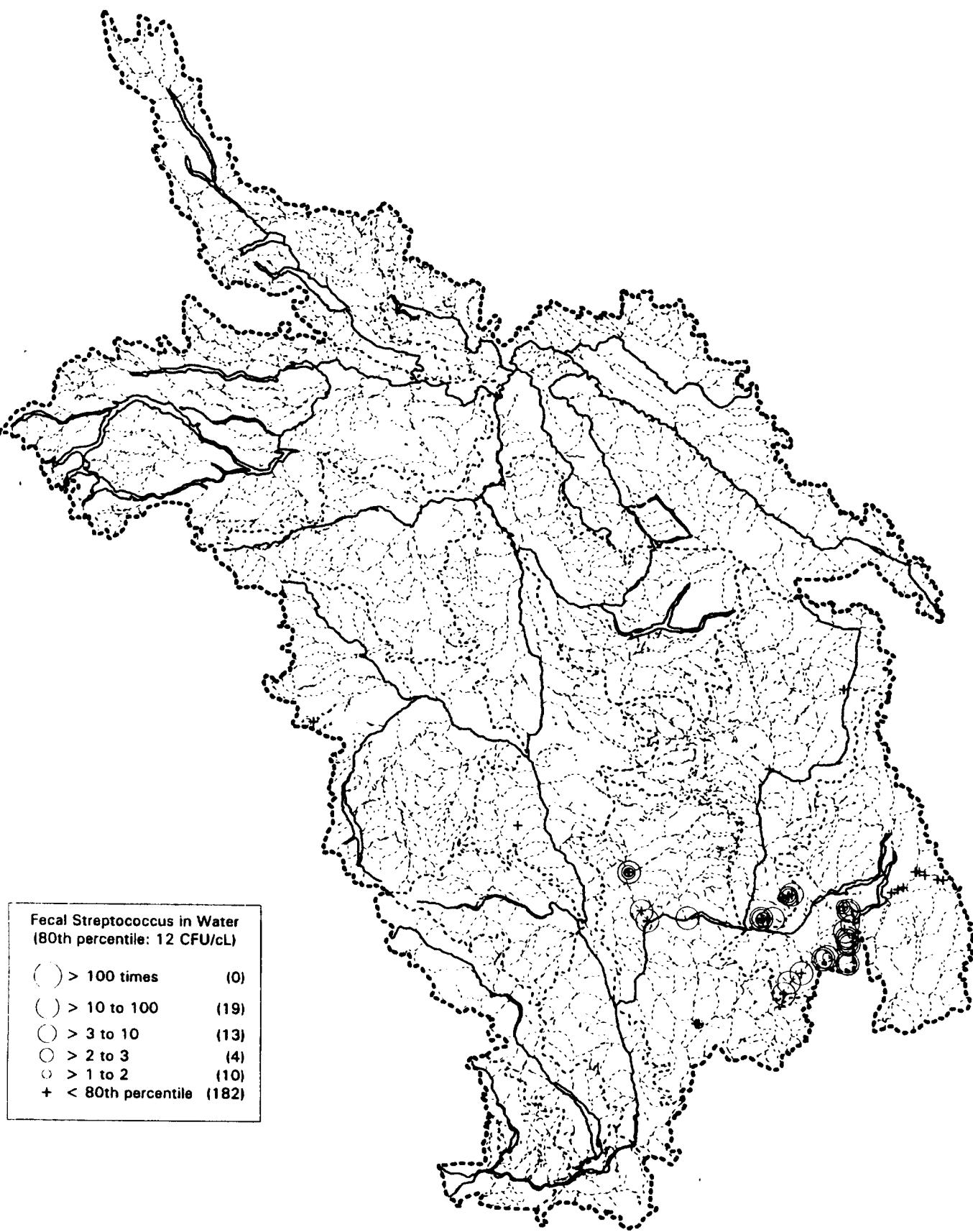
2.3.1 Human pathogens in water

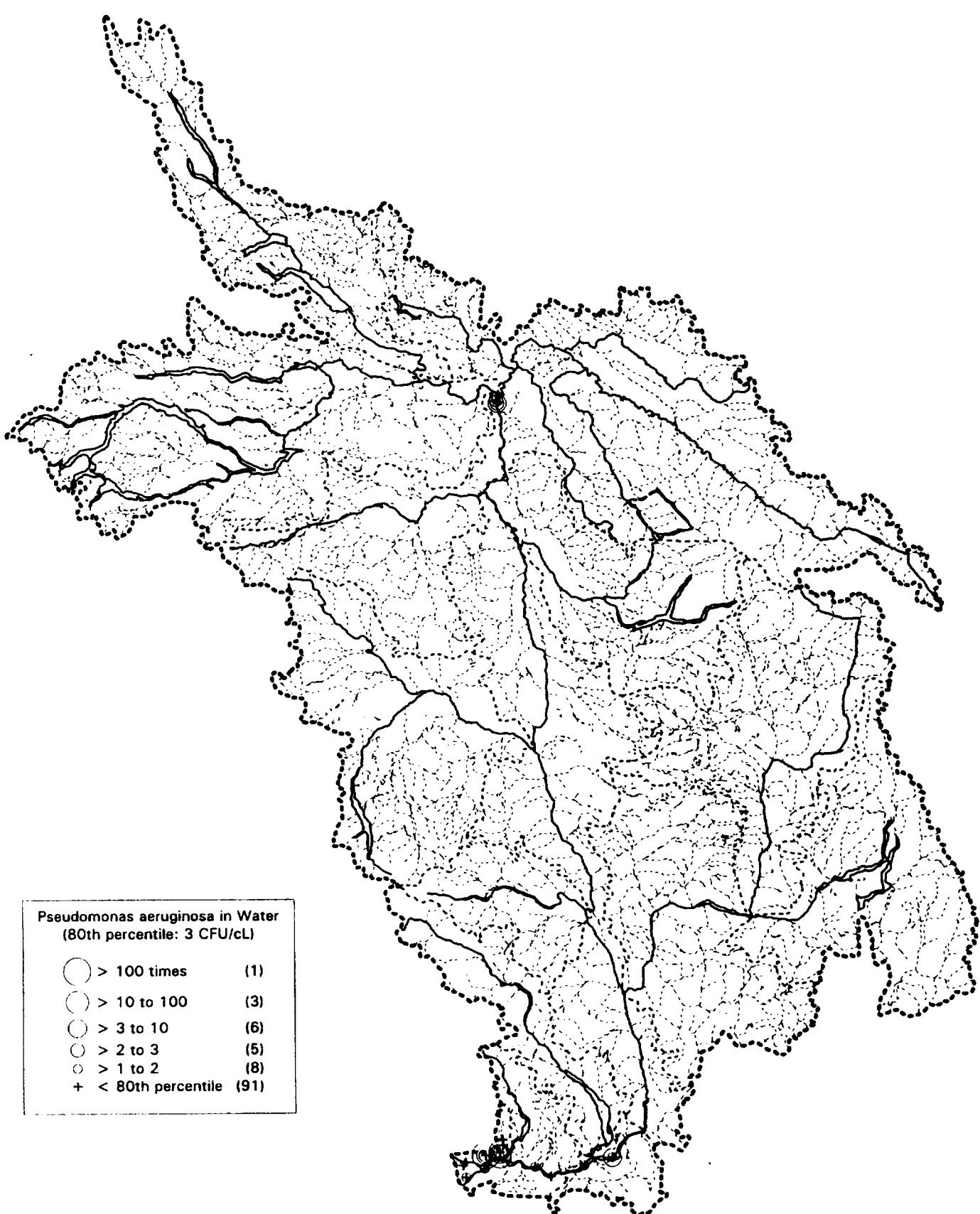
Esherichia coli
Enterococcus
Total Coliform
Fecal Streptococcus
Pseudomonas aeruginosa







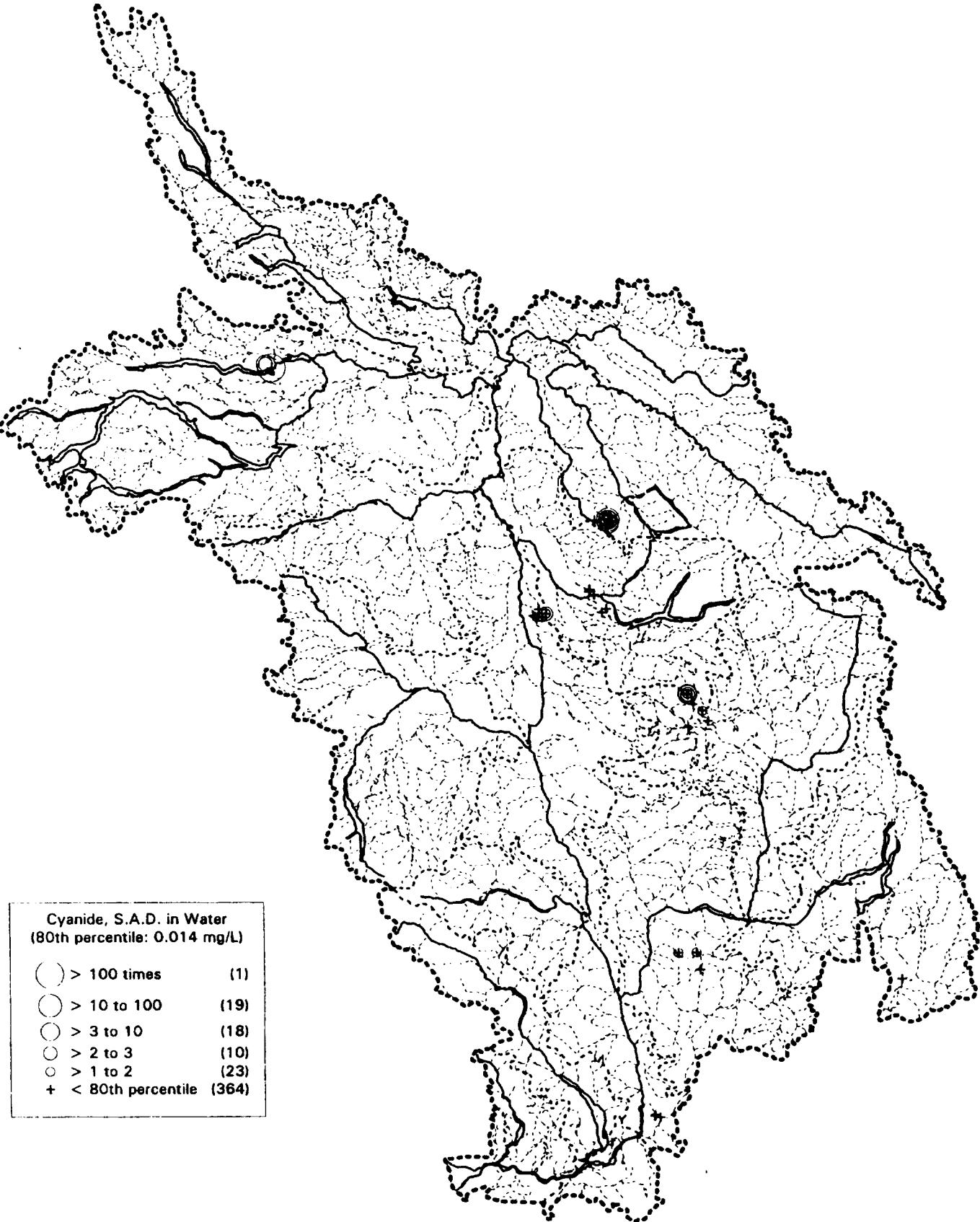


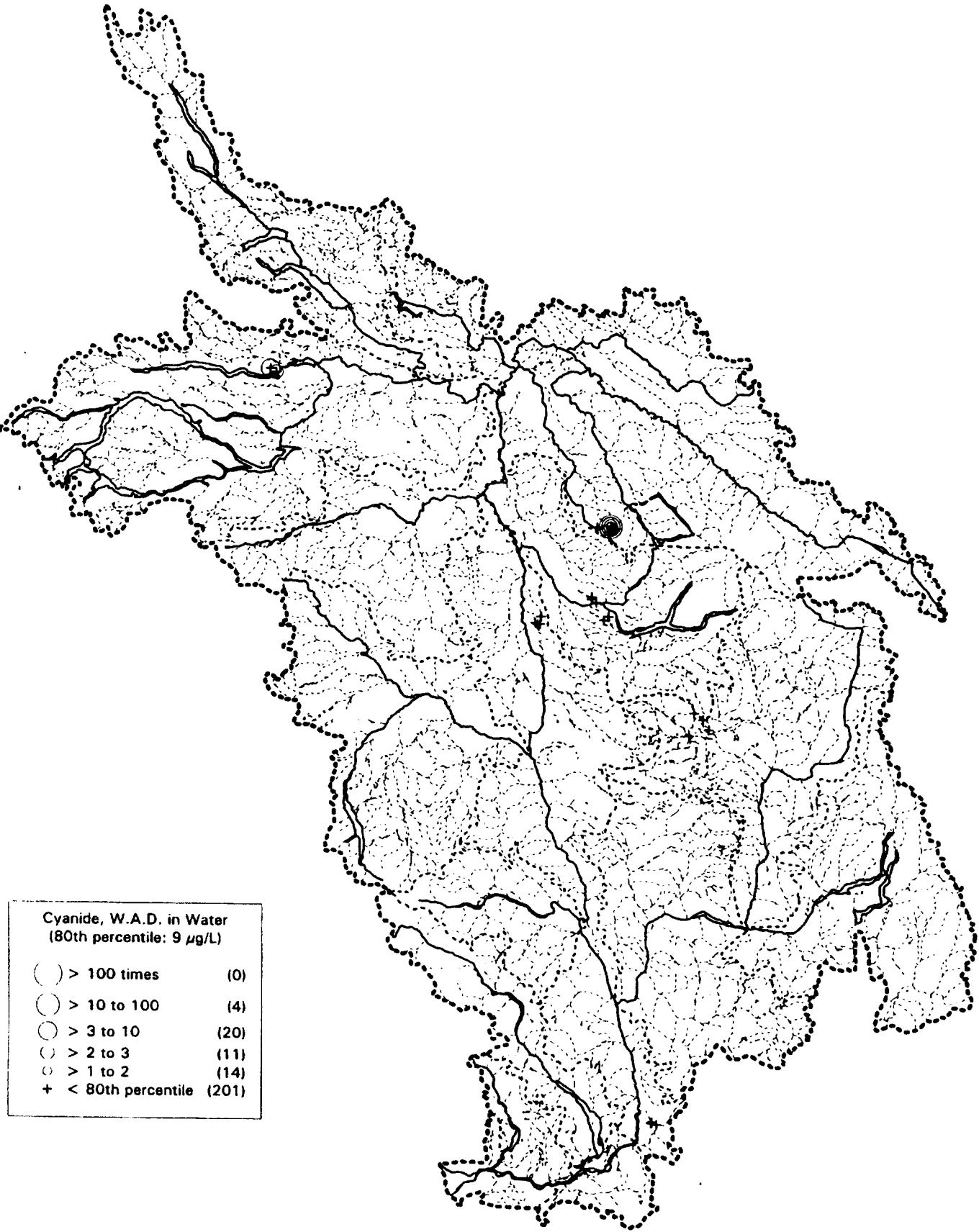


2.3.2 Cyanides in water

Cyanide, S.A.D.

Cyanide, W.A.D.





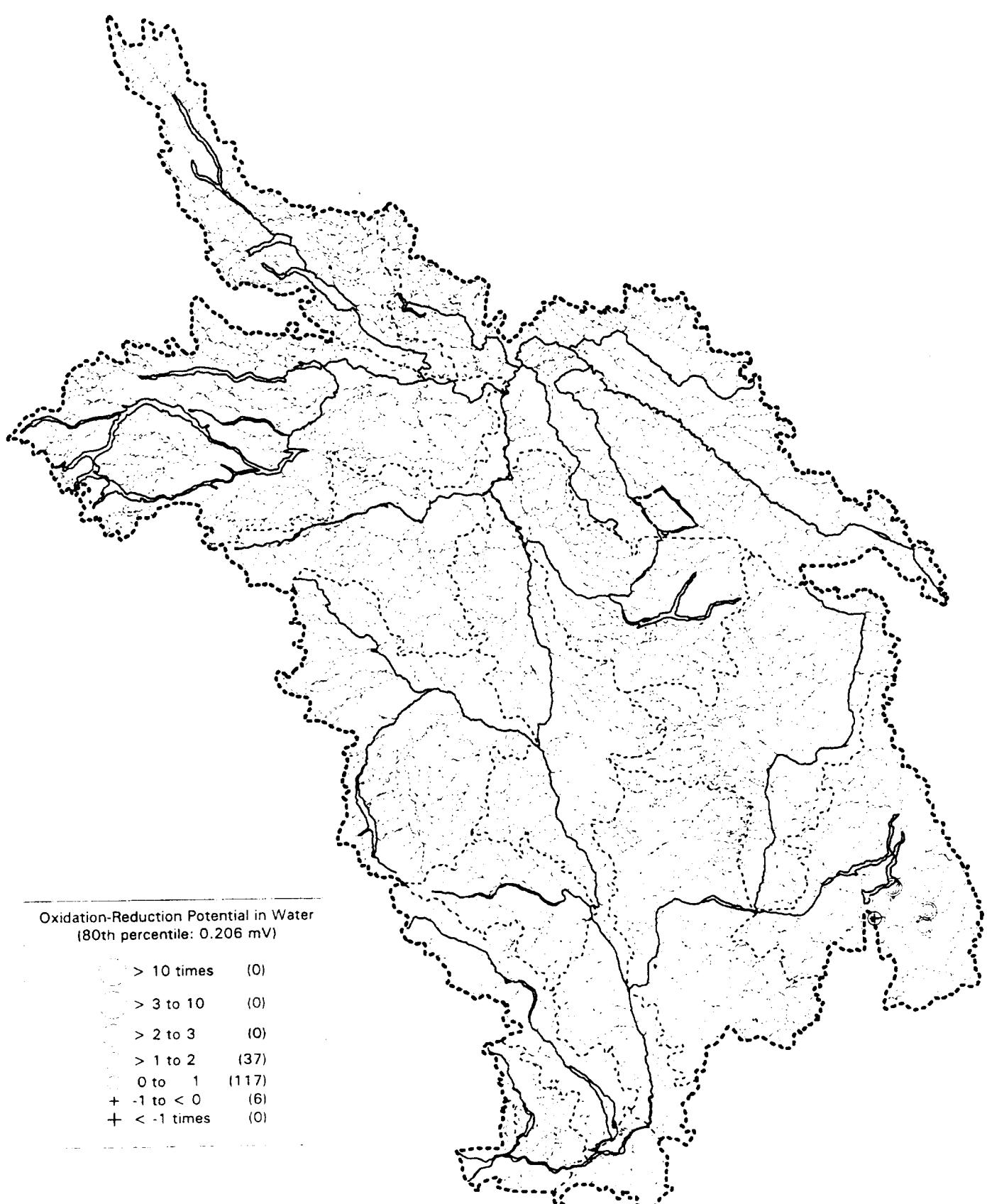
2.3.3 Descriptive parameters in water

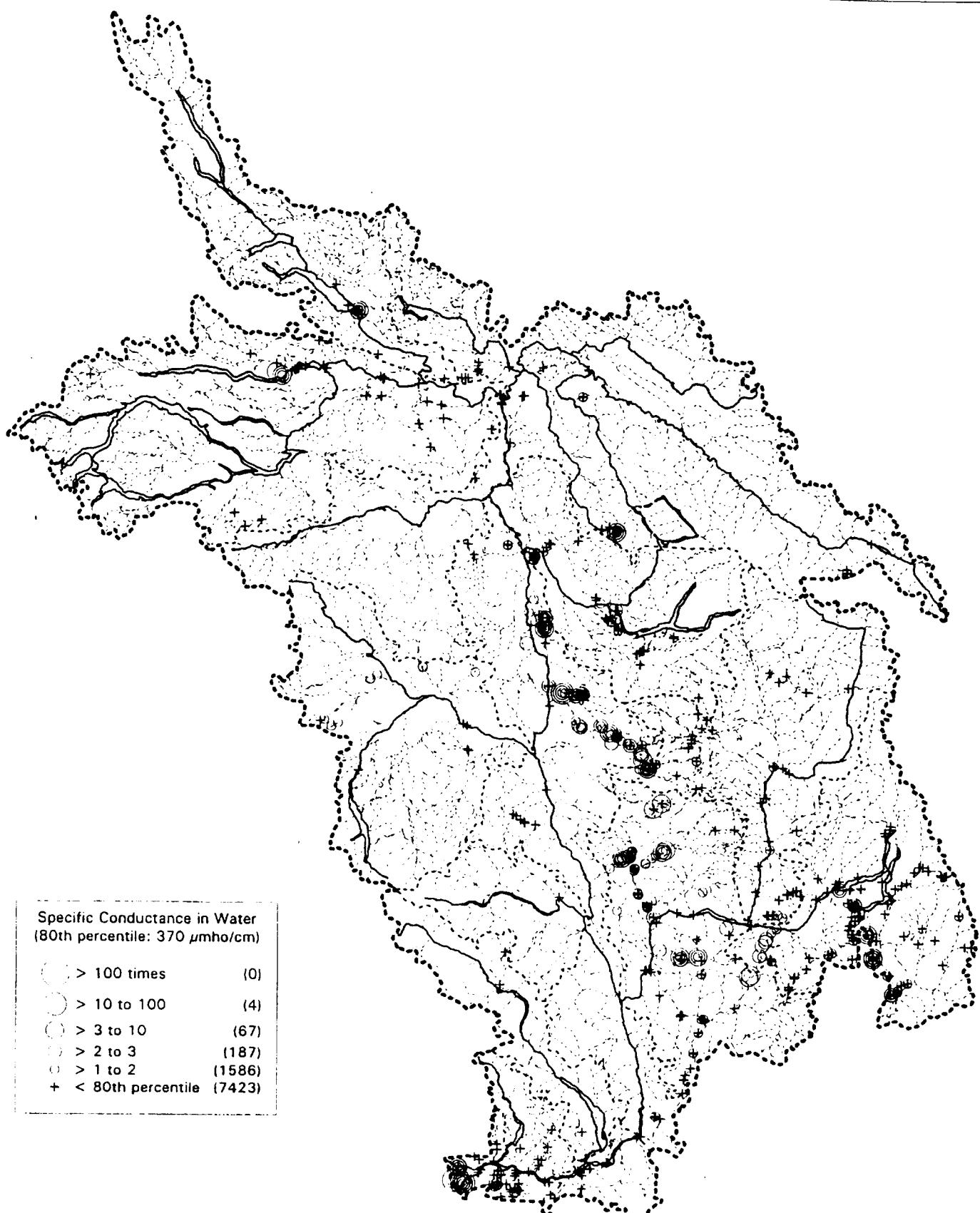
Oxidation-Reduction Potential

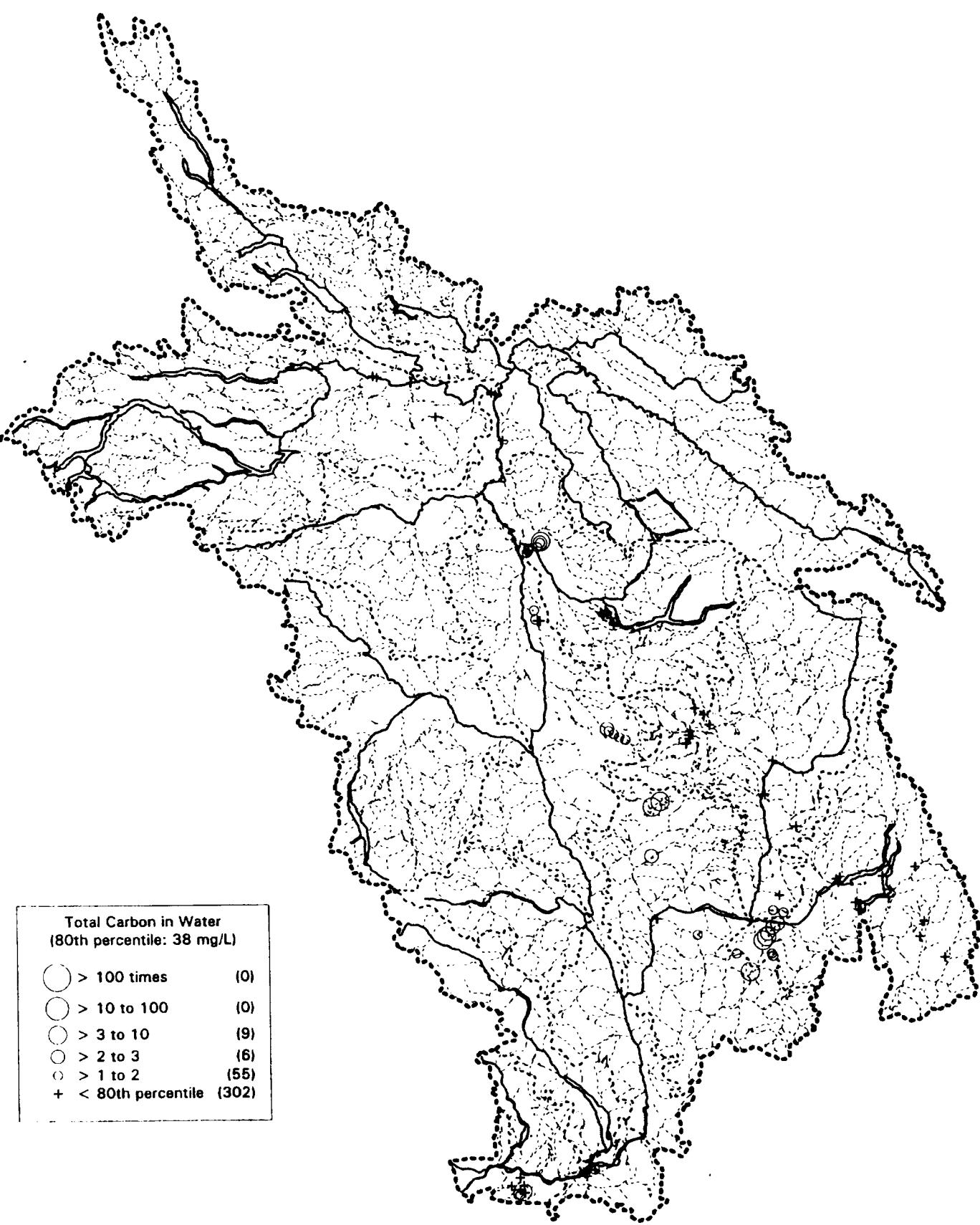
Specific Conductance

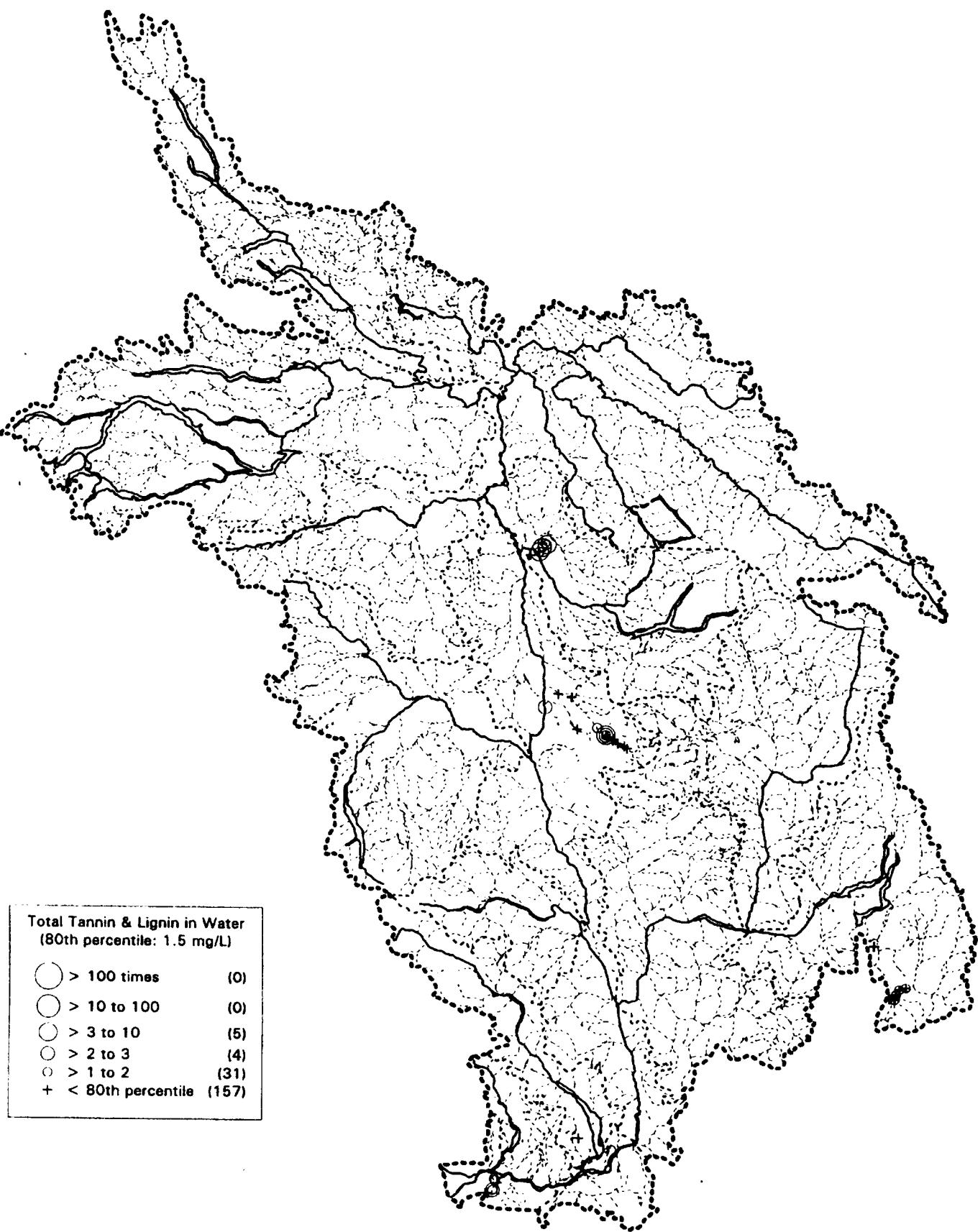
Total Carbon

Total Tannin & Lignin



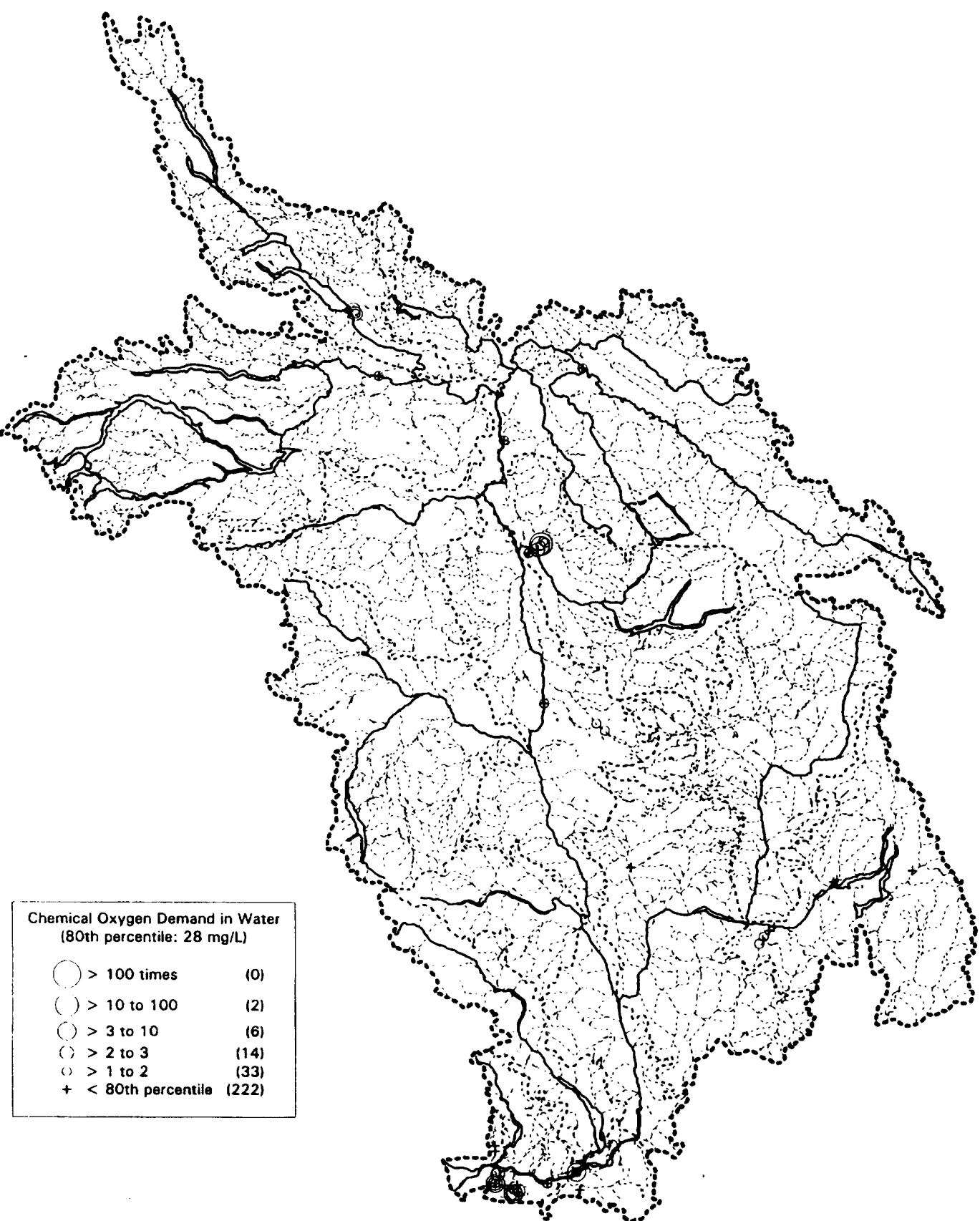






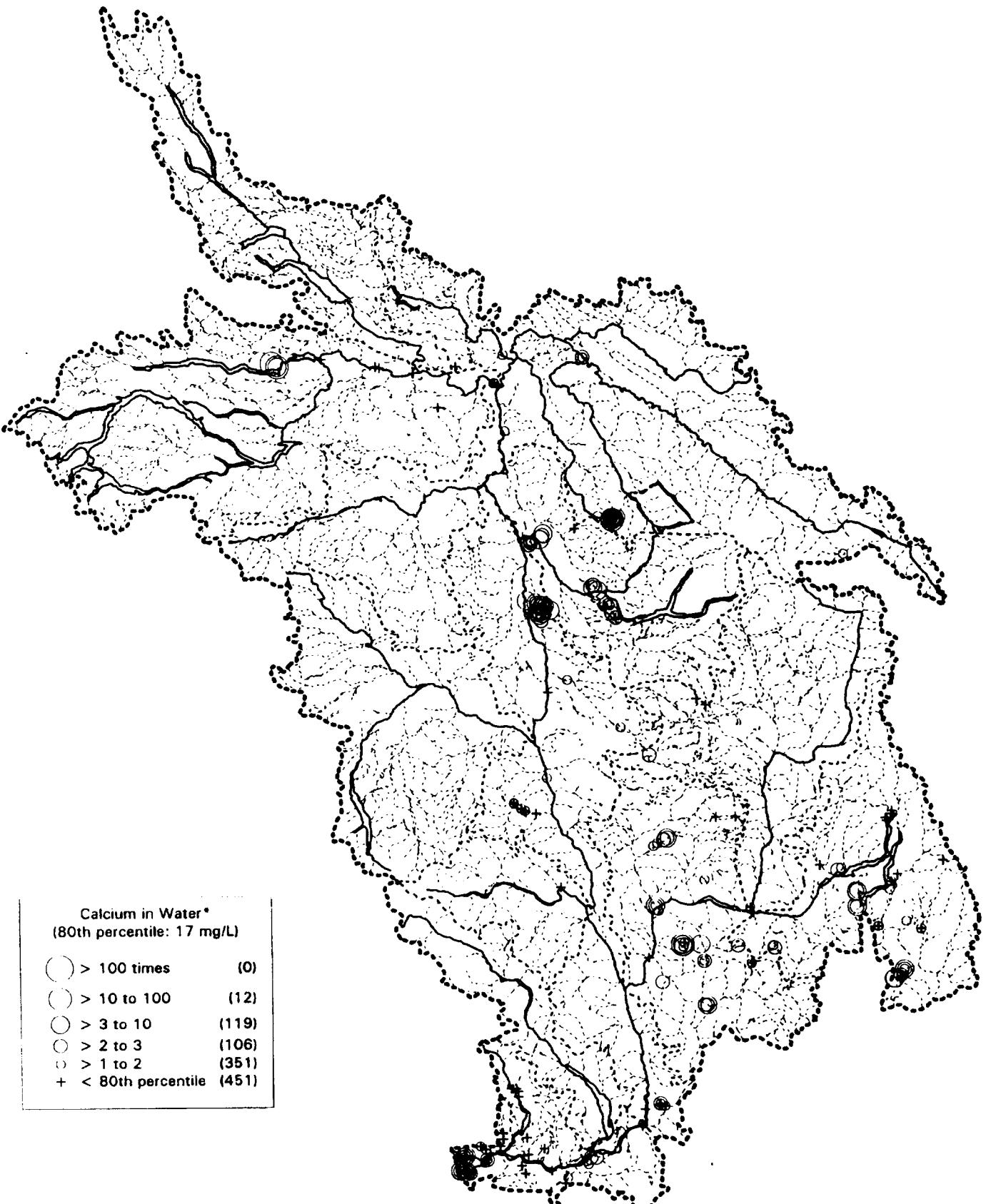
2.3.4 Dissolved oxygen in water

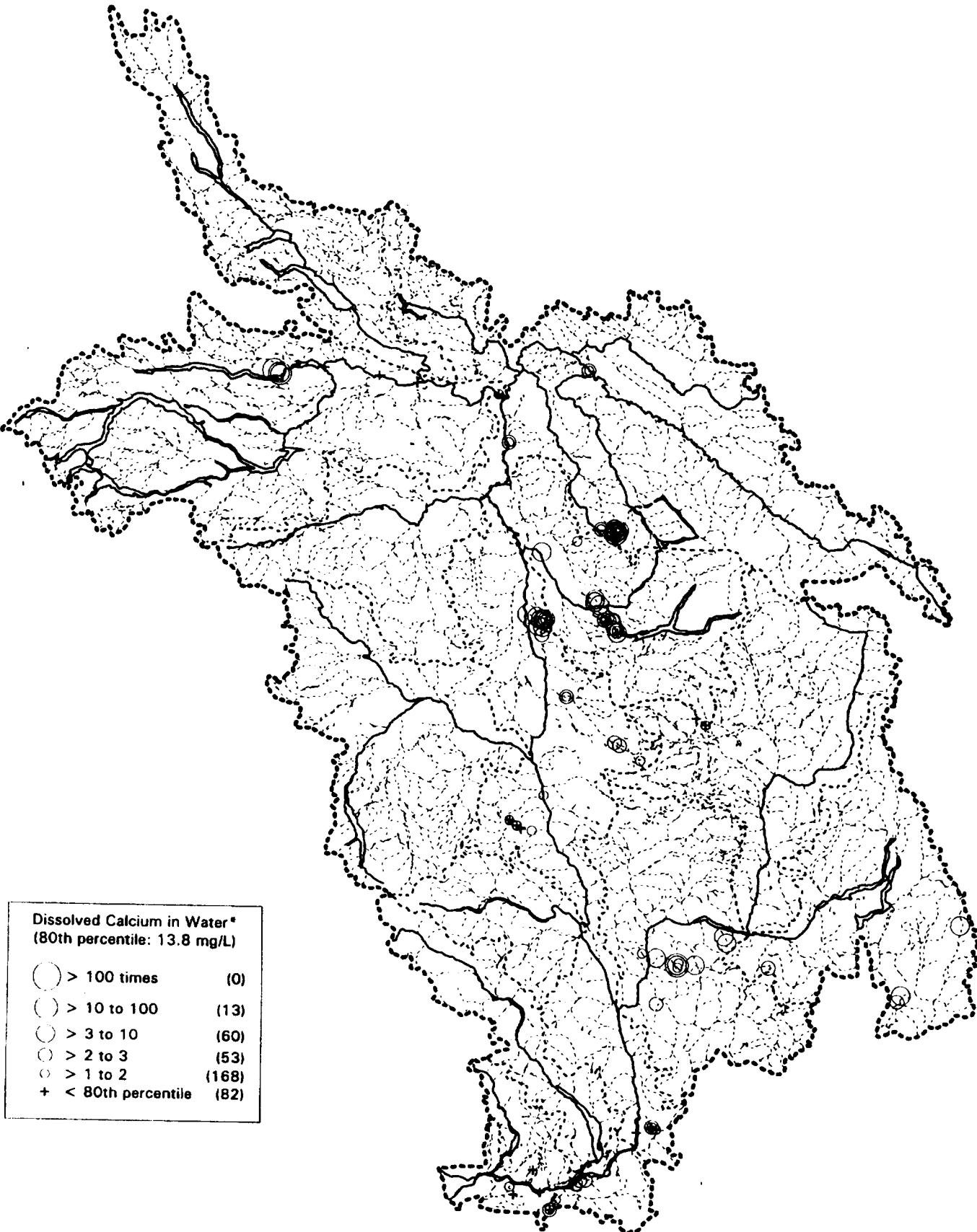
Chemical Oxygen Demand

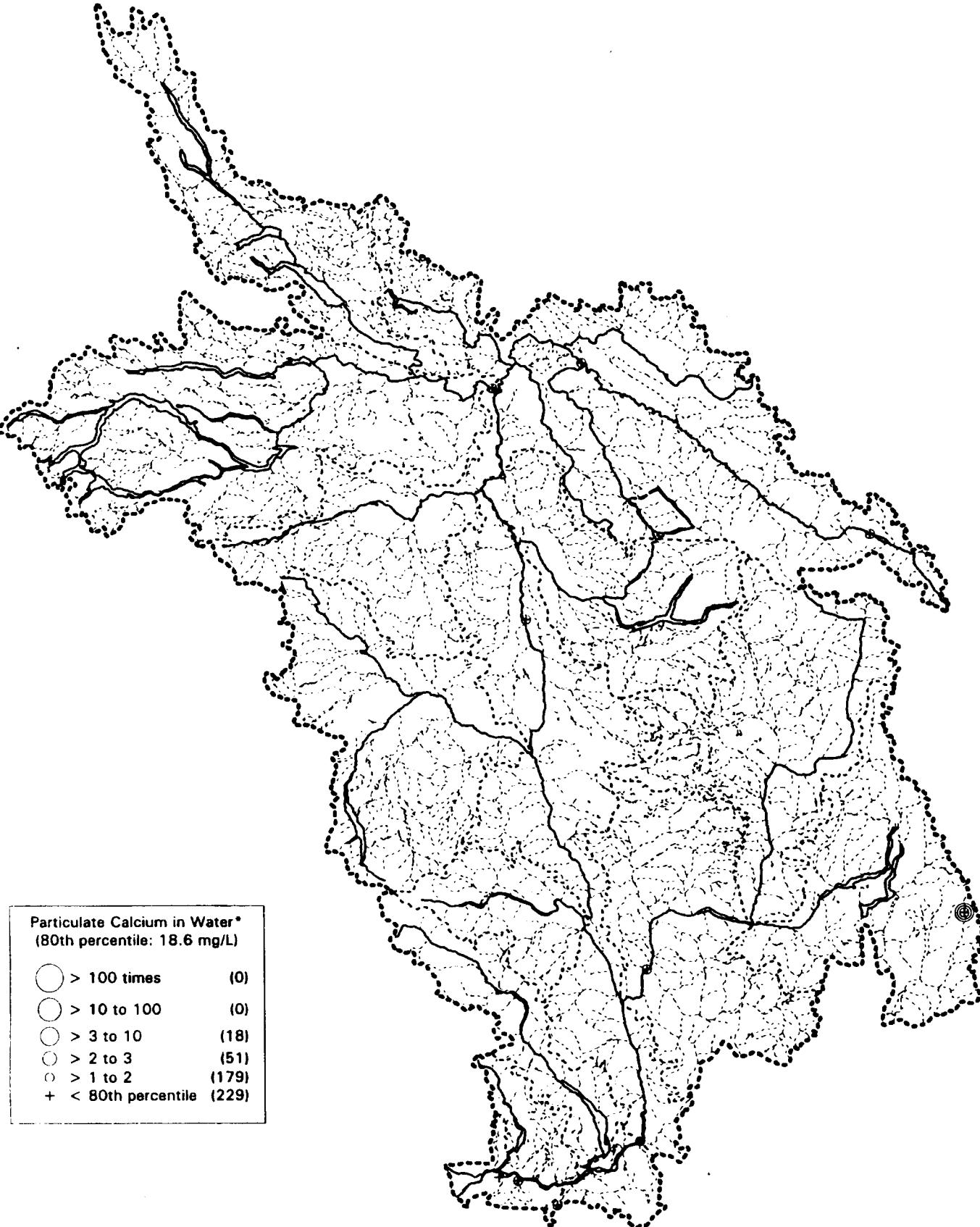


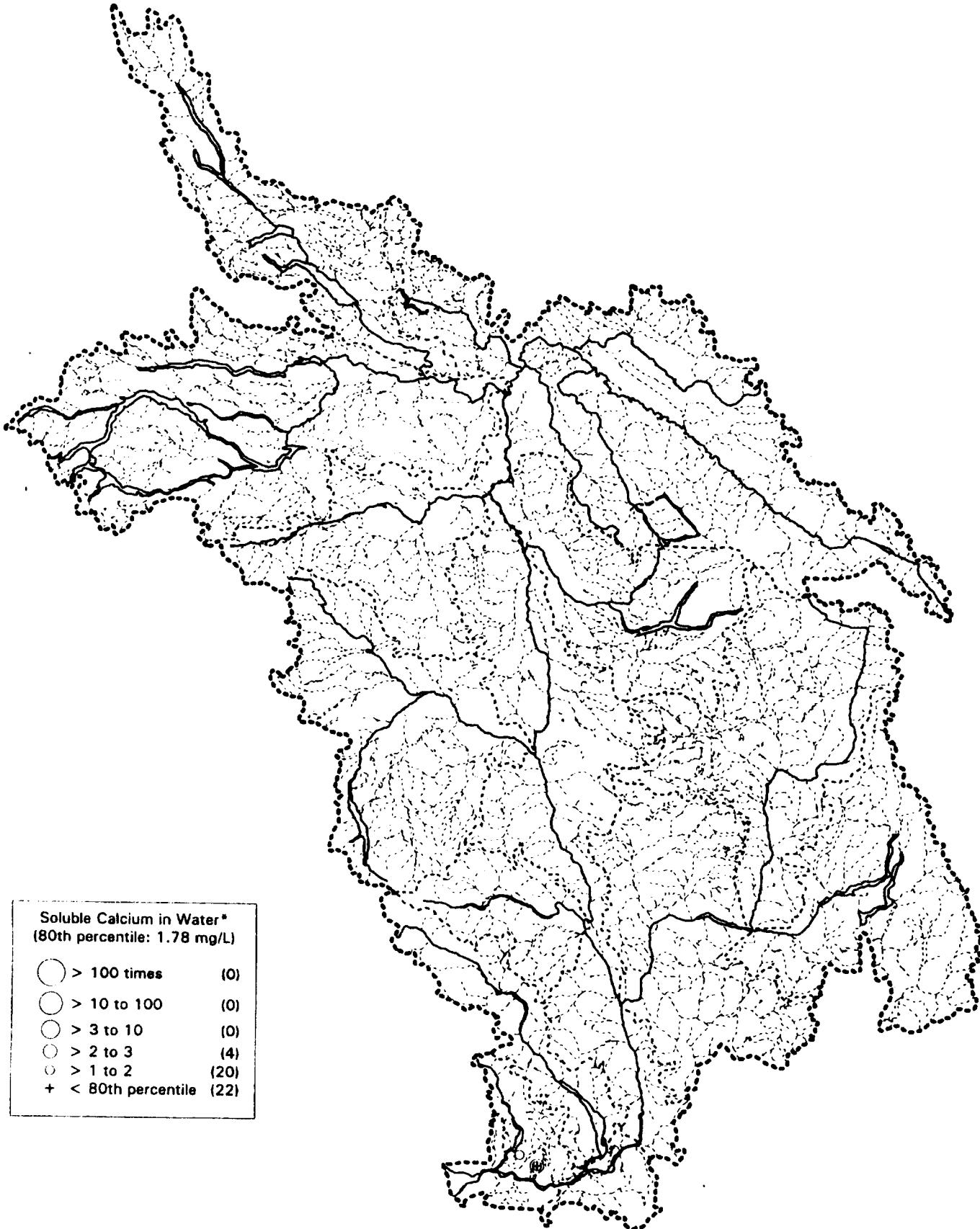
2.3.5 Inorganic parameters in water

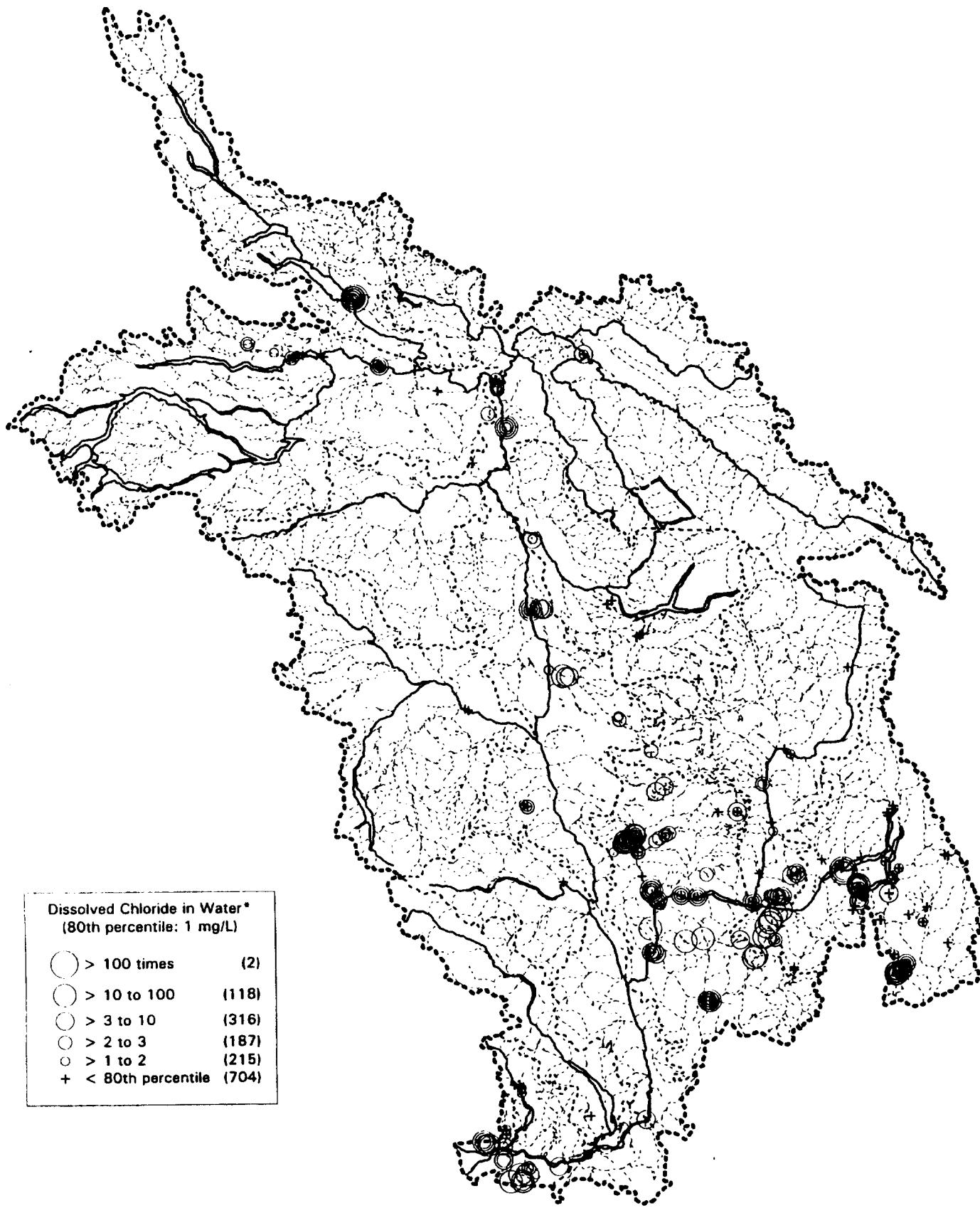
Calcium
Dissolved Calcium
Particulate Calcium
Soluble Calcium
Dissolved Chloride
Soluble Chloride
Total Chloride
Dissolved Fluoride
Magnesium
Dissolved Magnesium
Particulate Magnesium
Soluble Magnesium
Potassium
Dissolved Potassium
Particulate Potassium
Soluble Potassium
Dissolved Reactive Silica
Silicon
Dissolved Silicon
Sodium
Dissolved Sodium
Particulate Sodium
Soluble Sodium
Sulfate
Dissolved Sulfate
Soluble Sulfate
Dissolved Sulfur
Total Sulfur
Total Inorganic Carbon

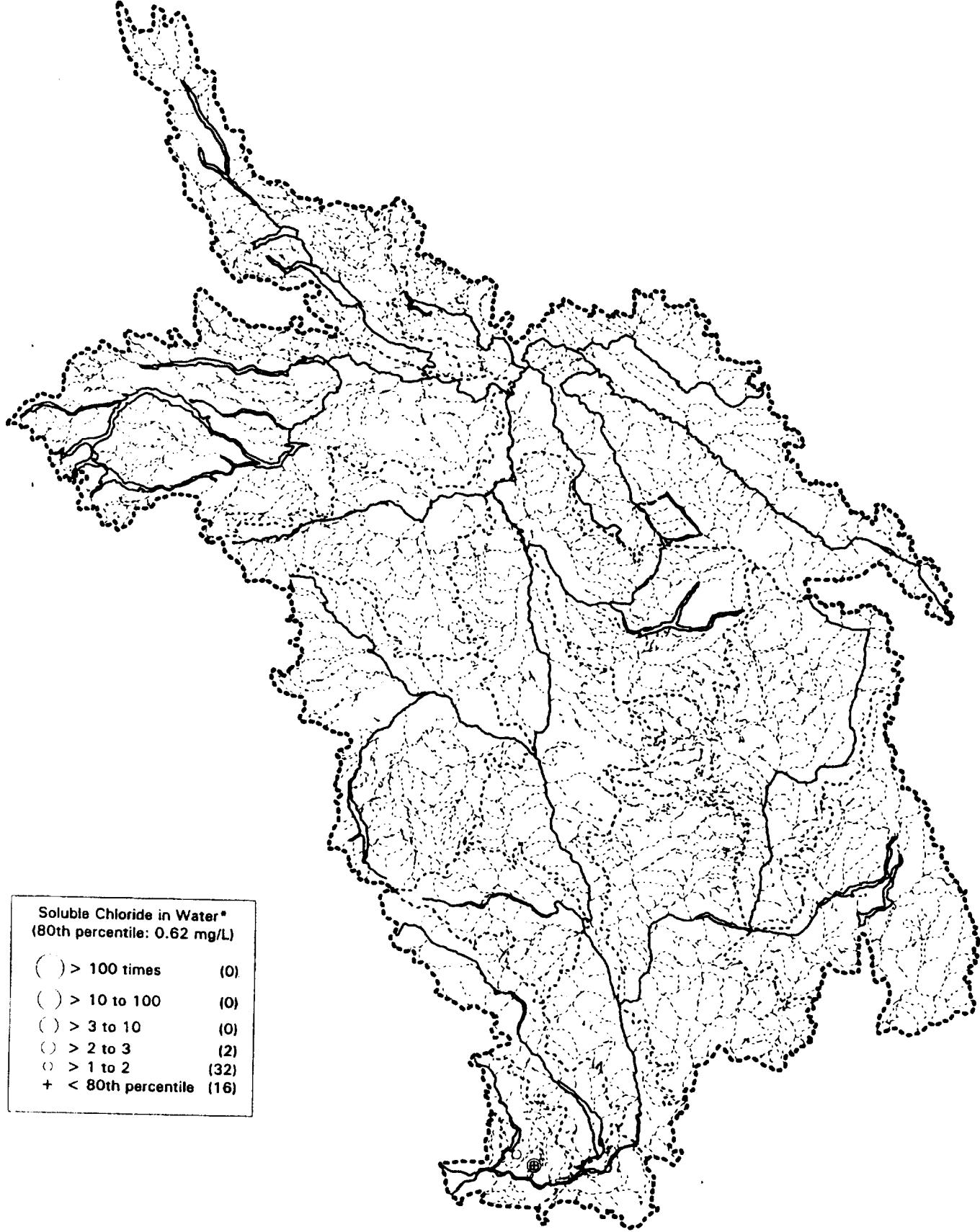


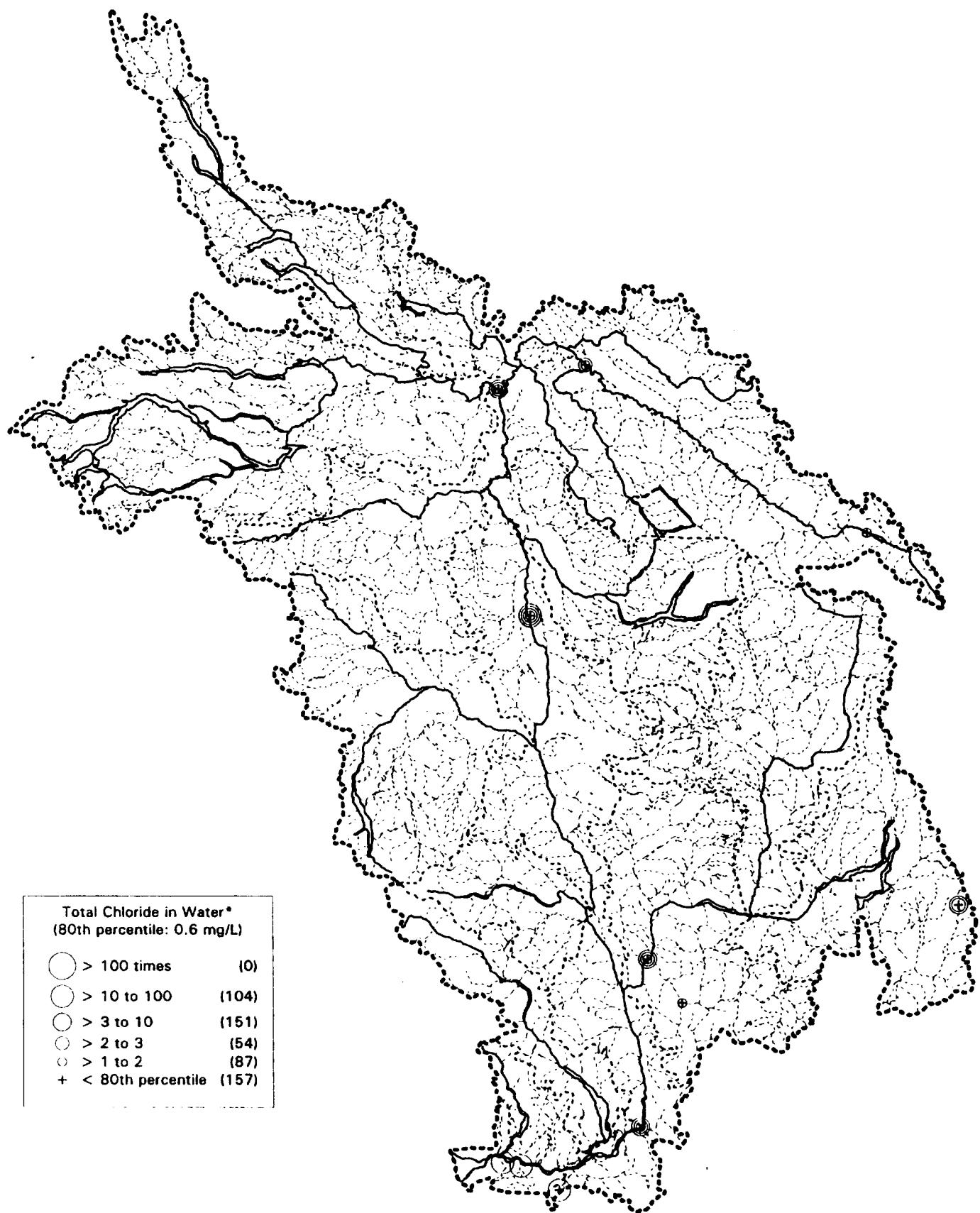


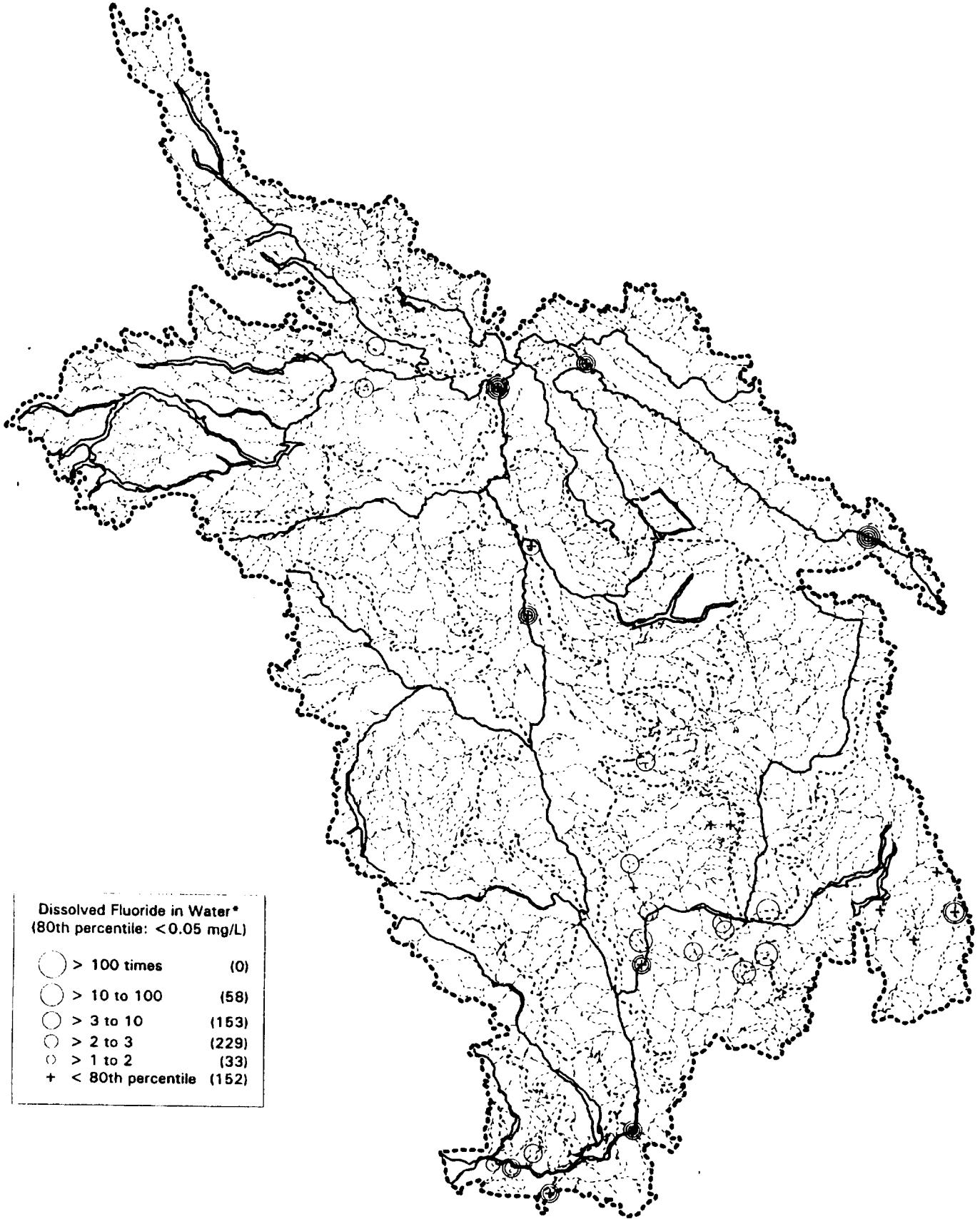


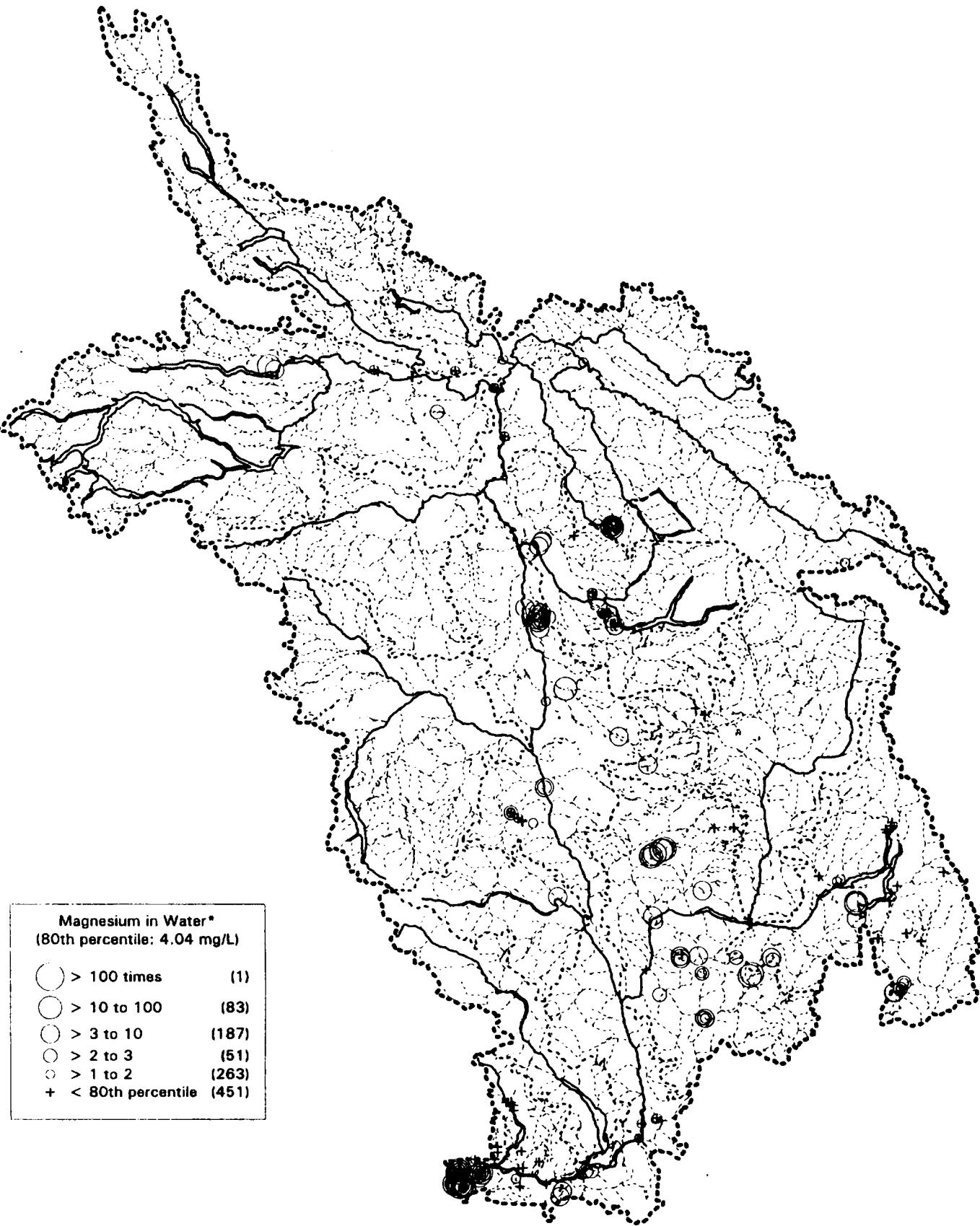


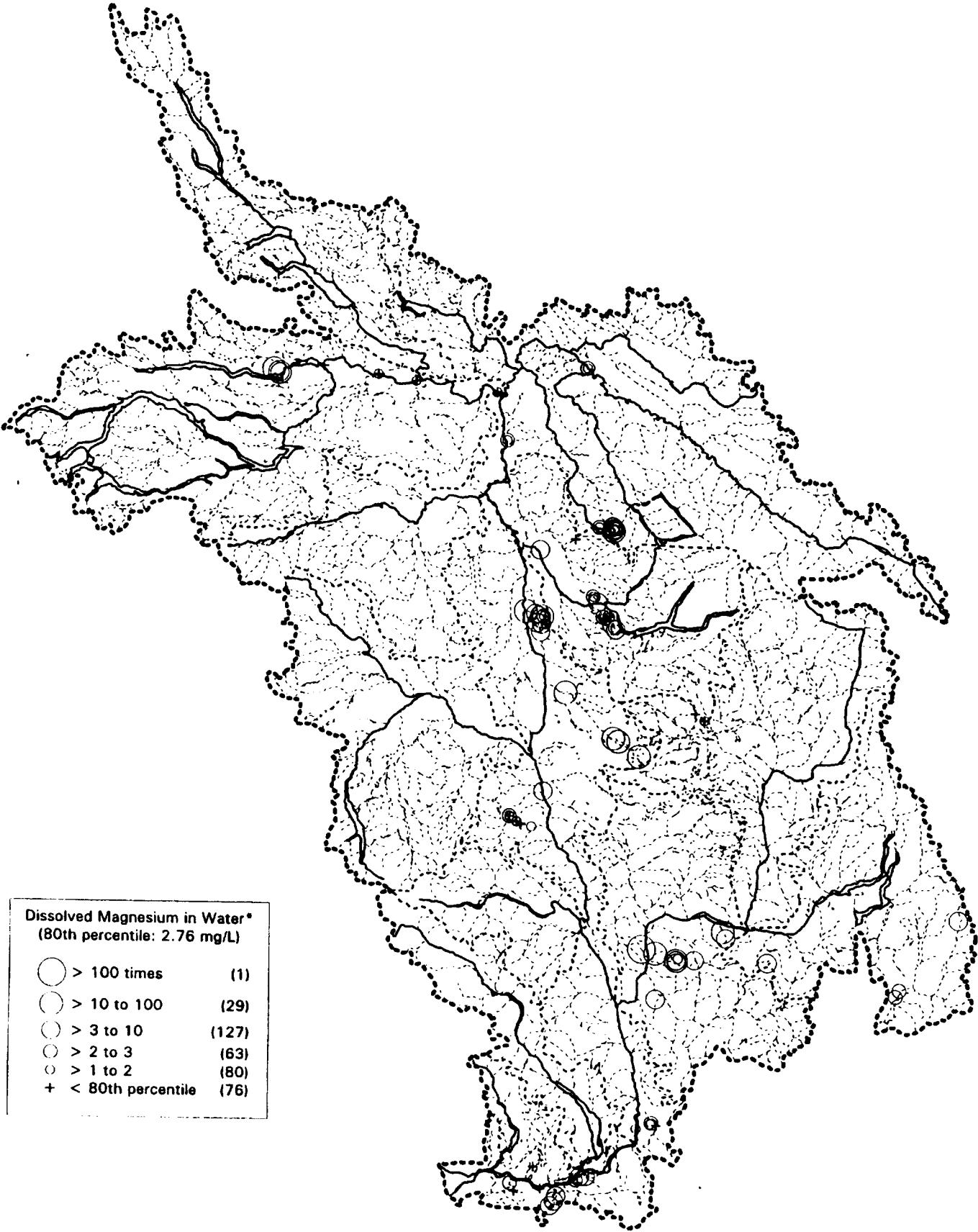


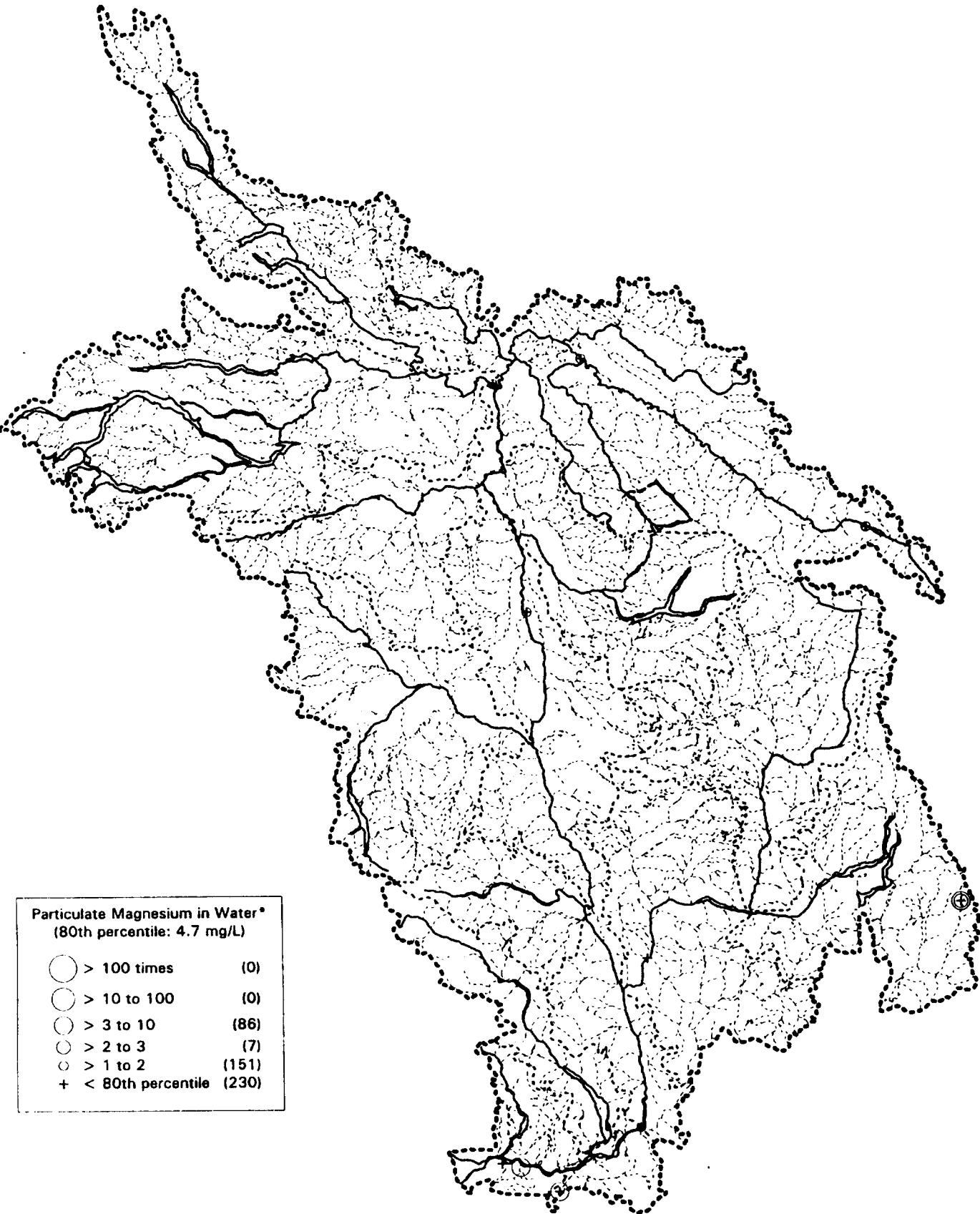


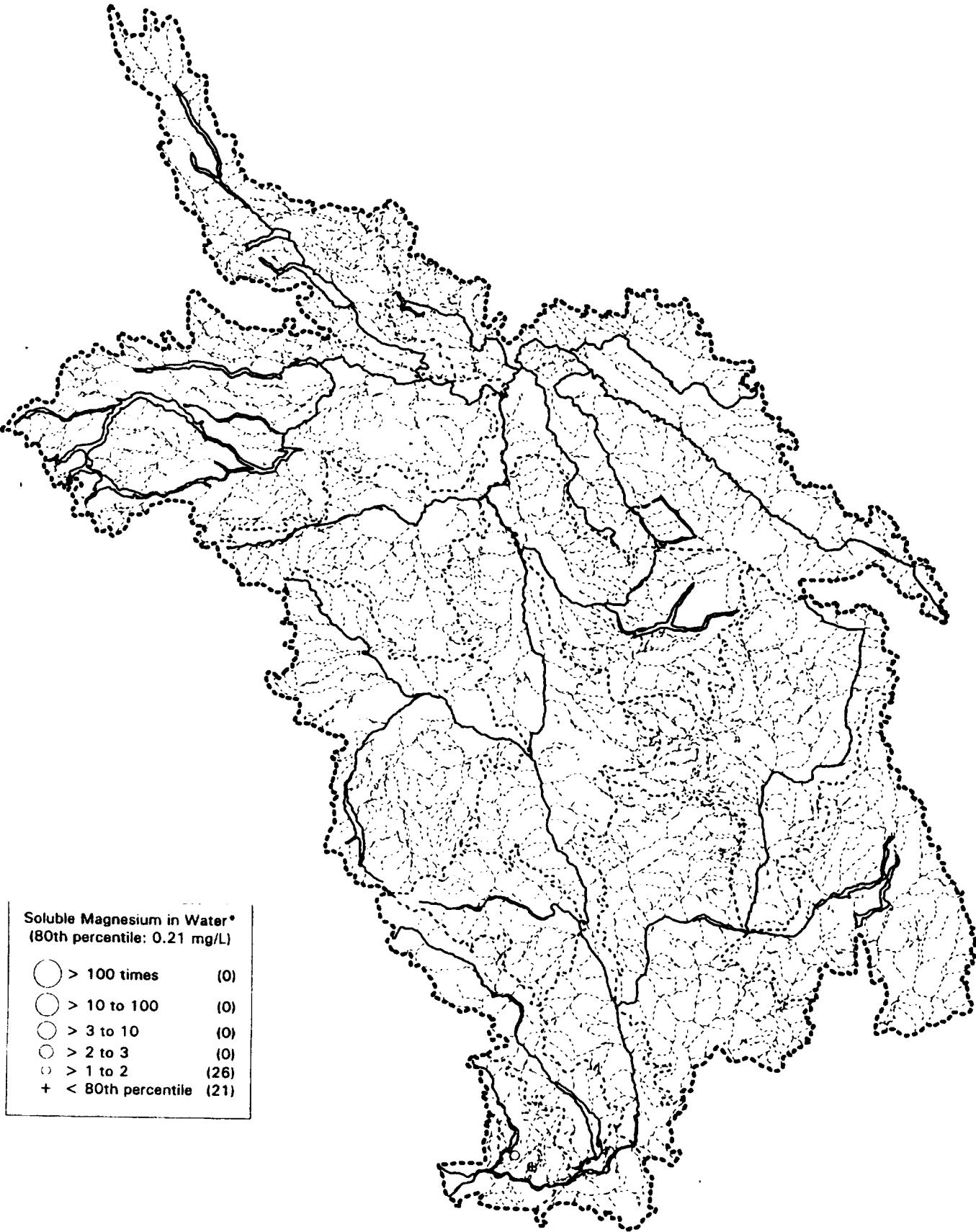


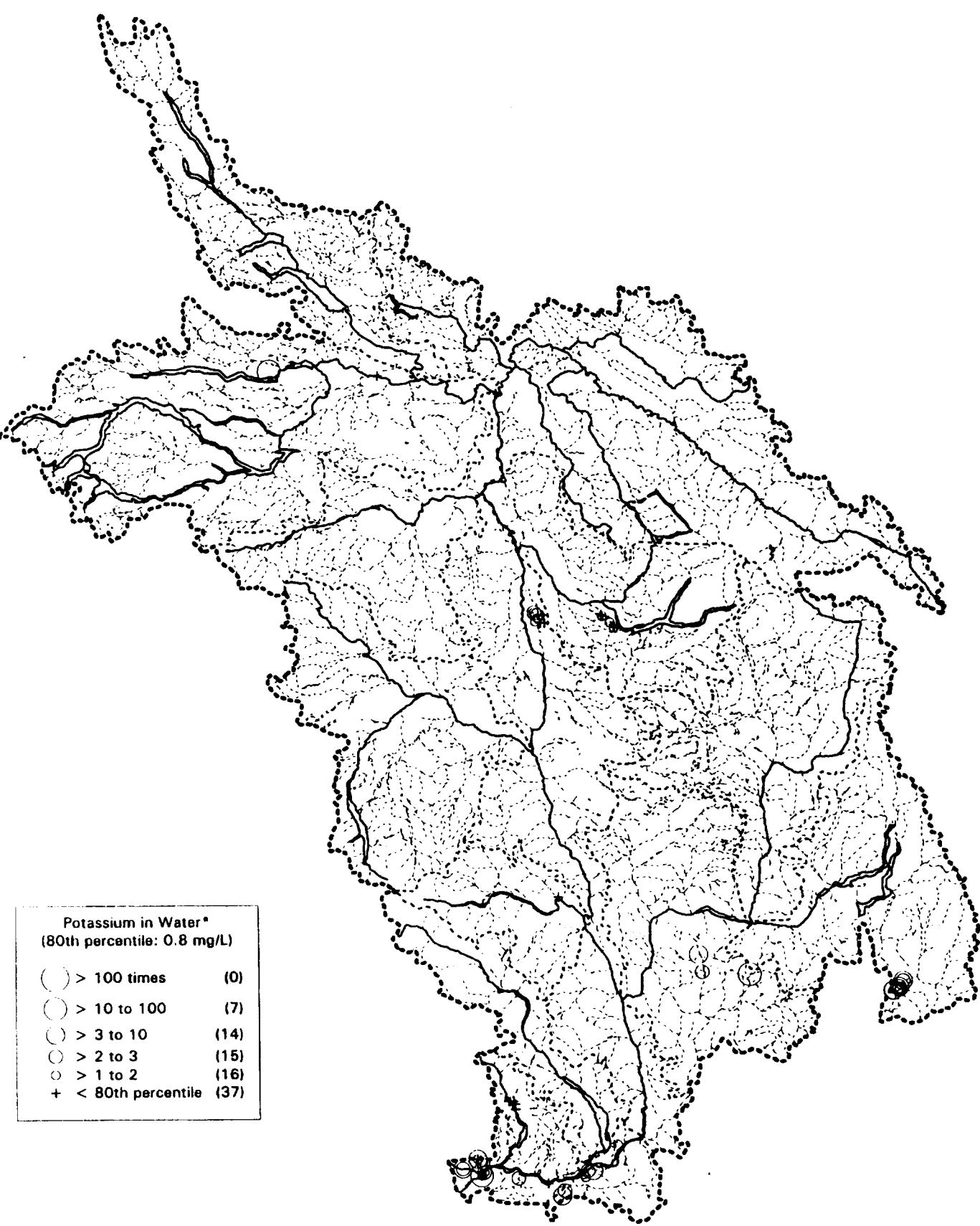


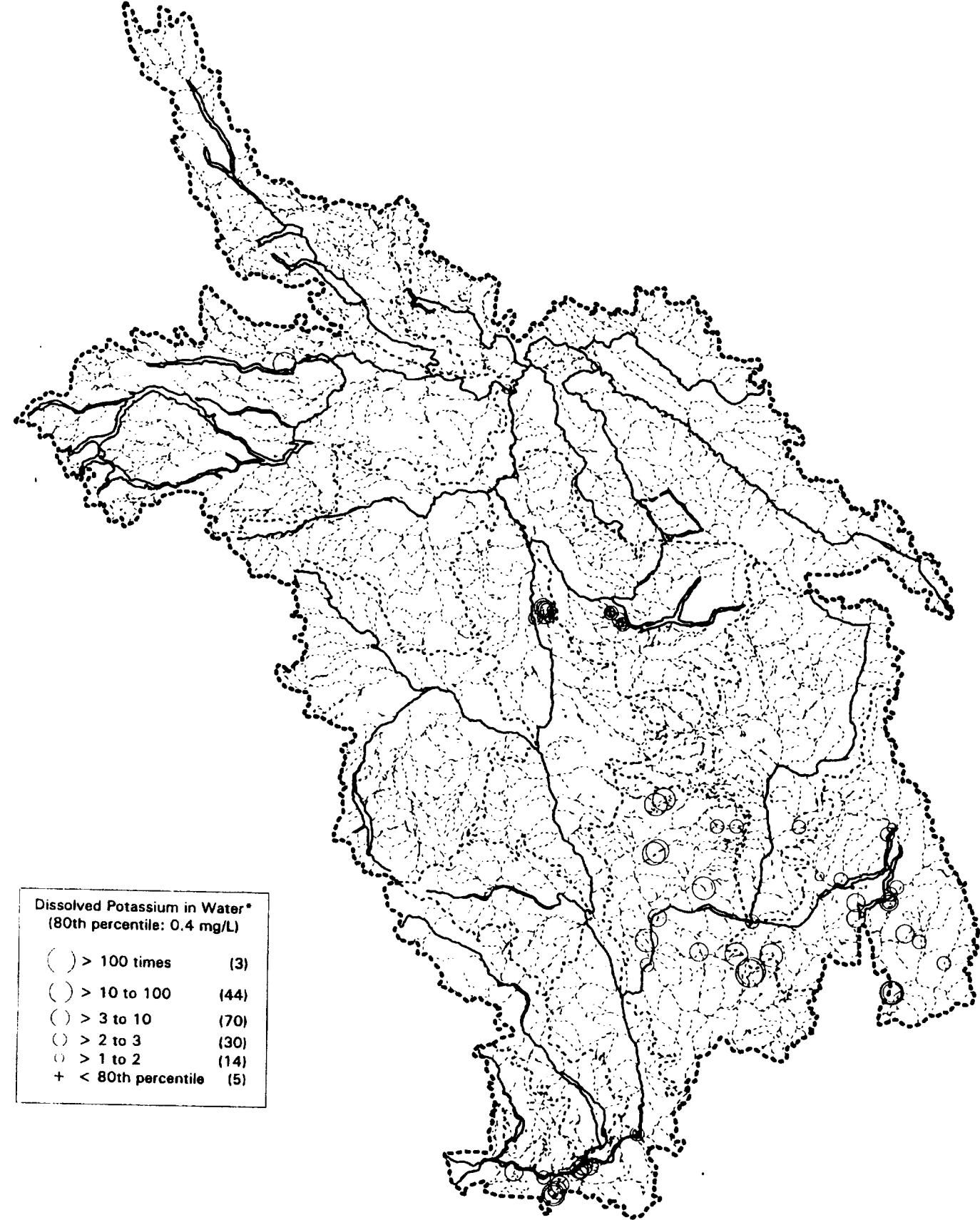


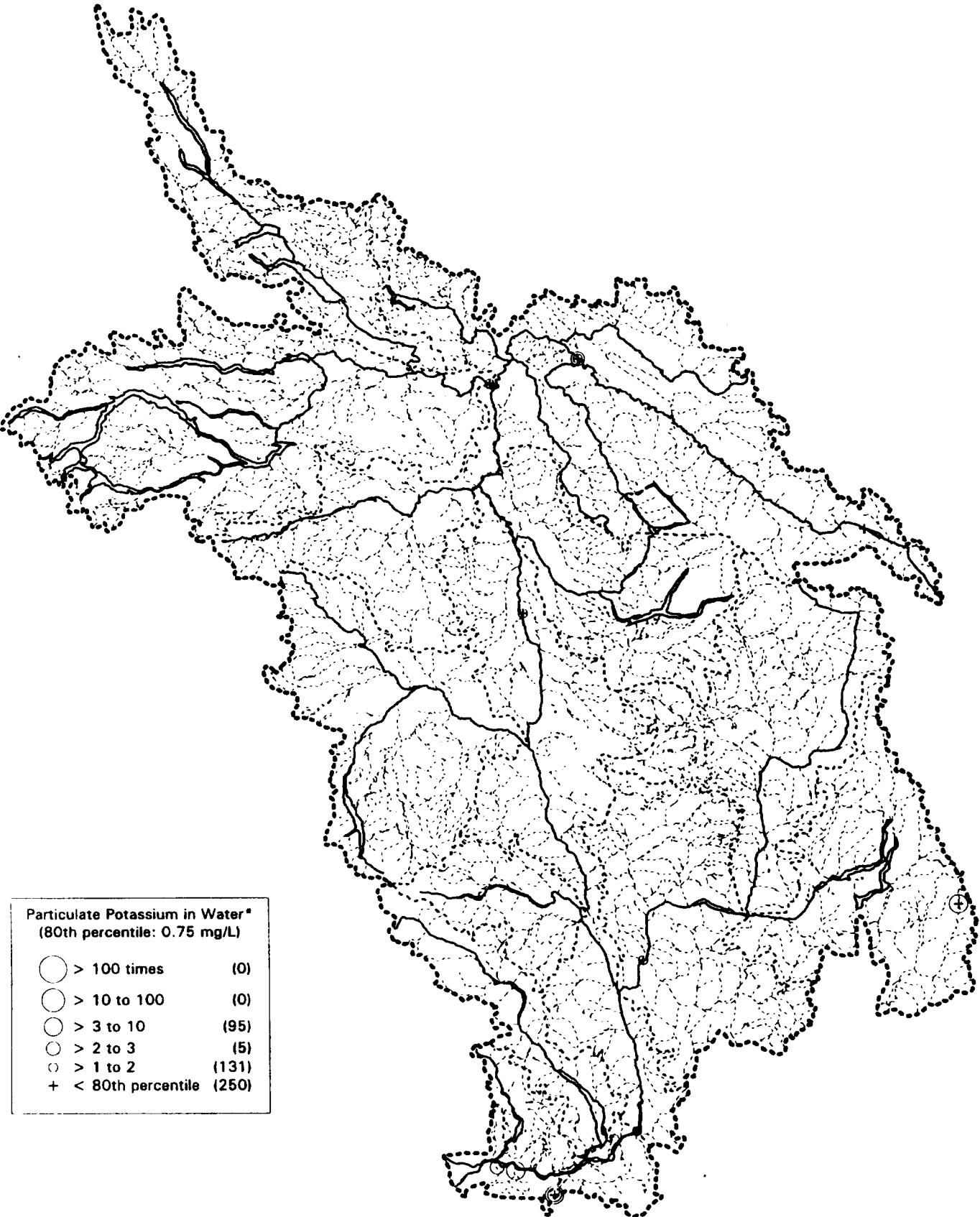


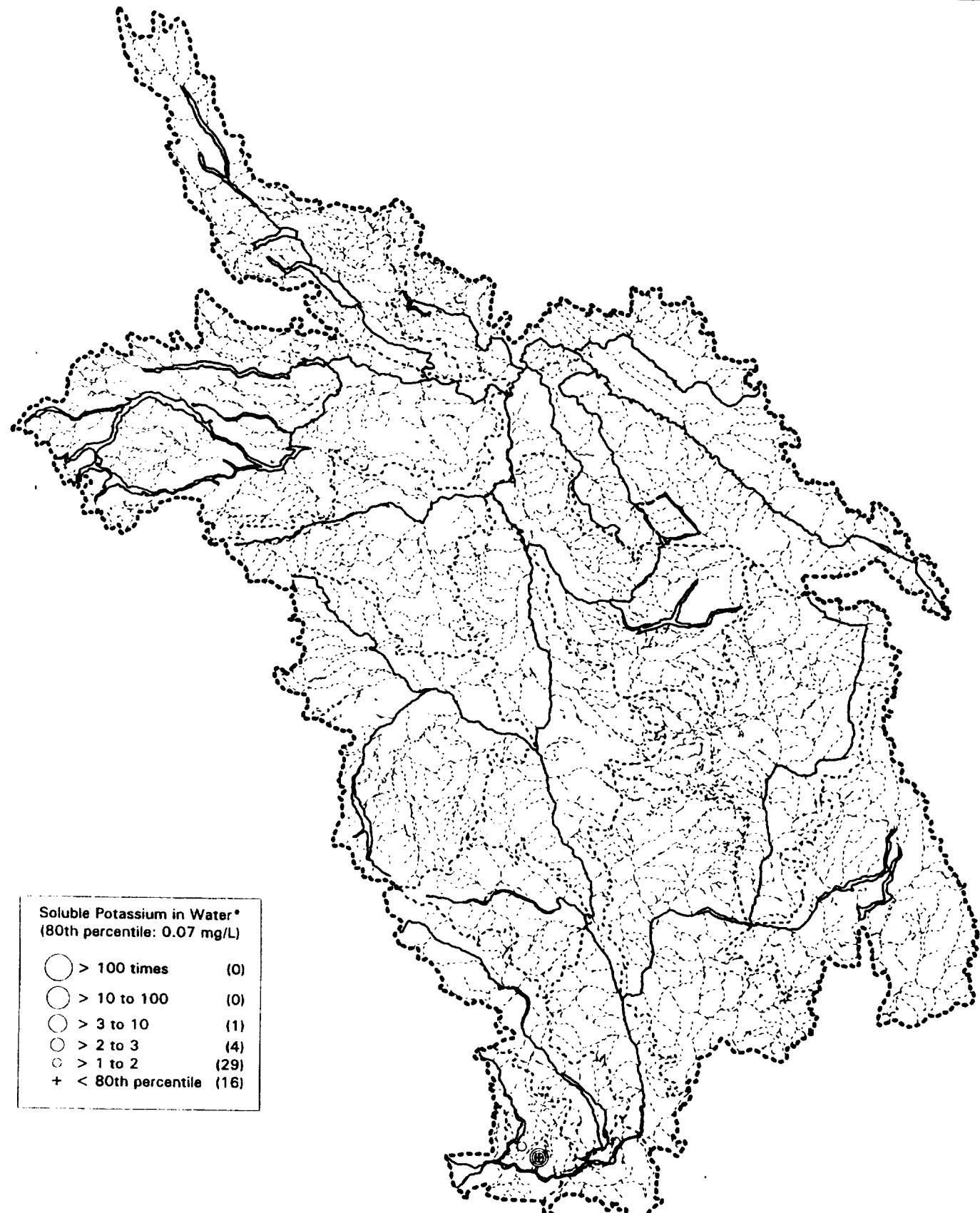


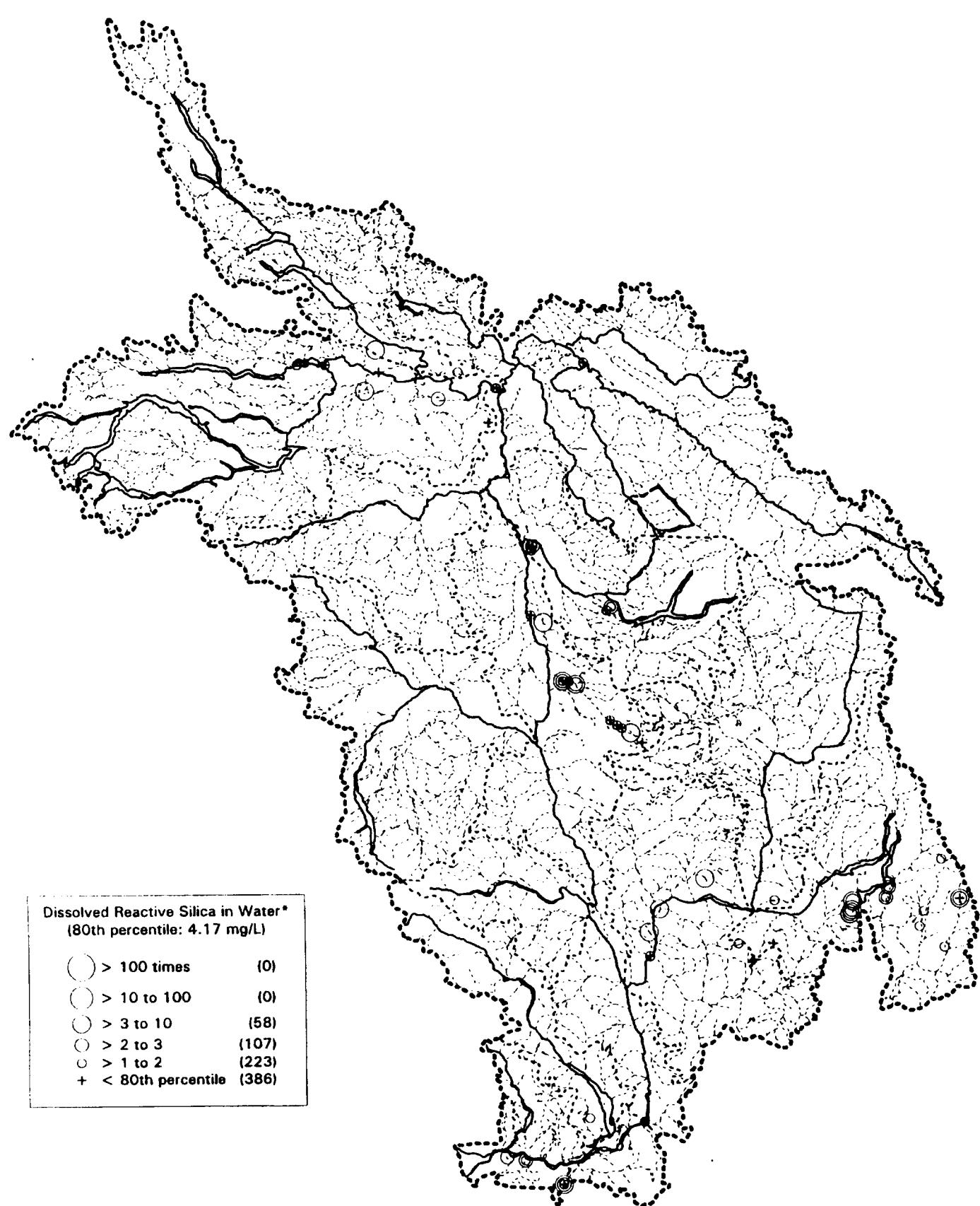


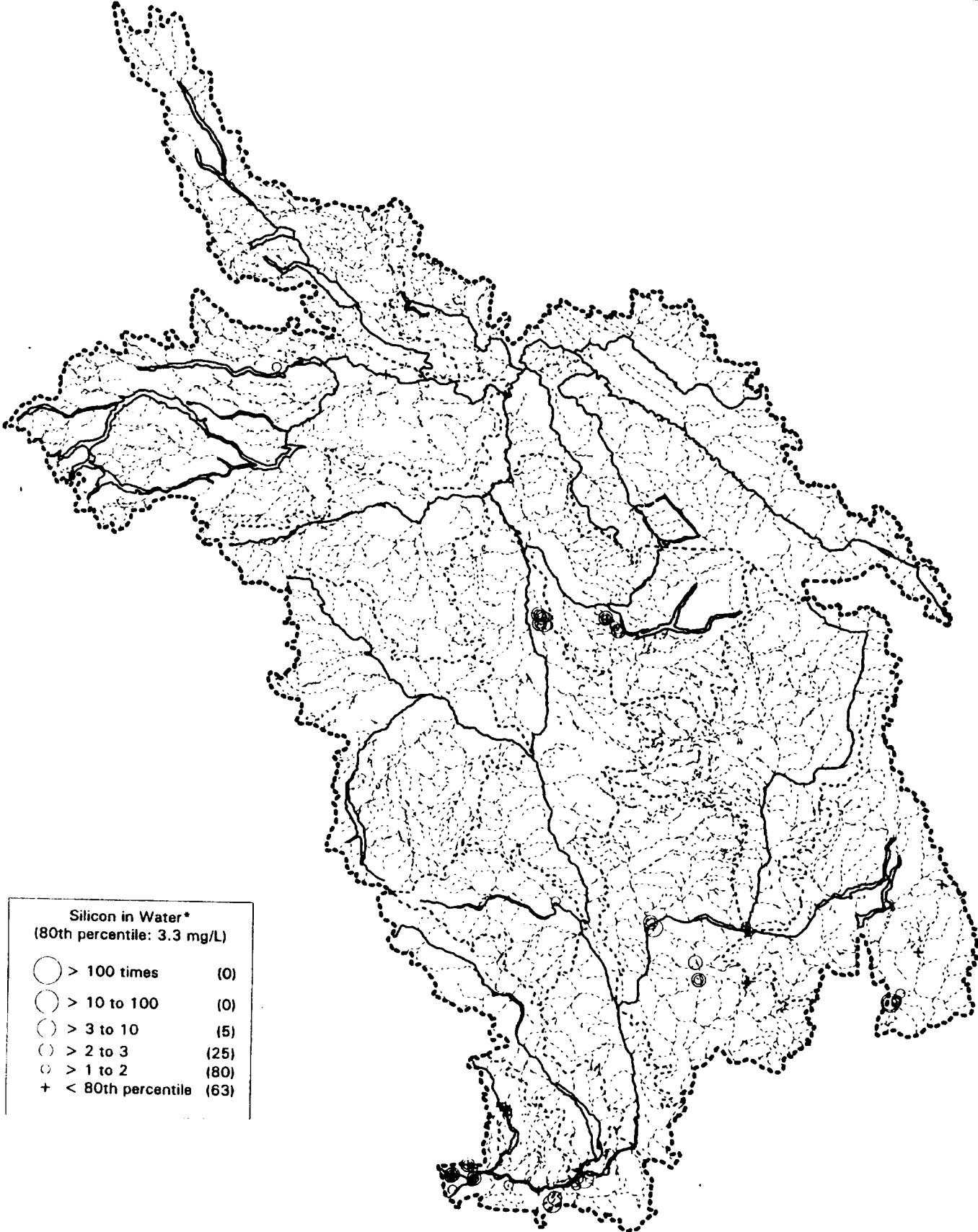


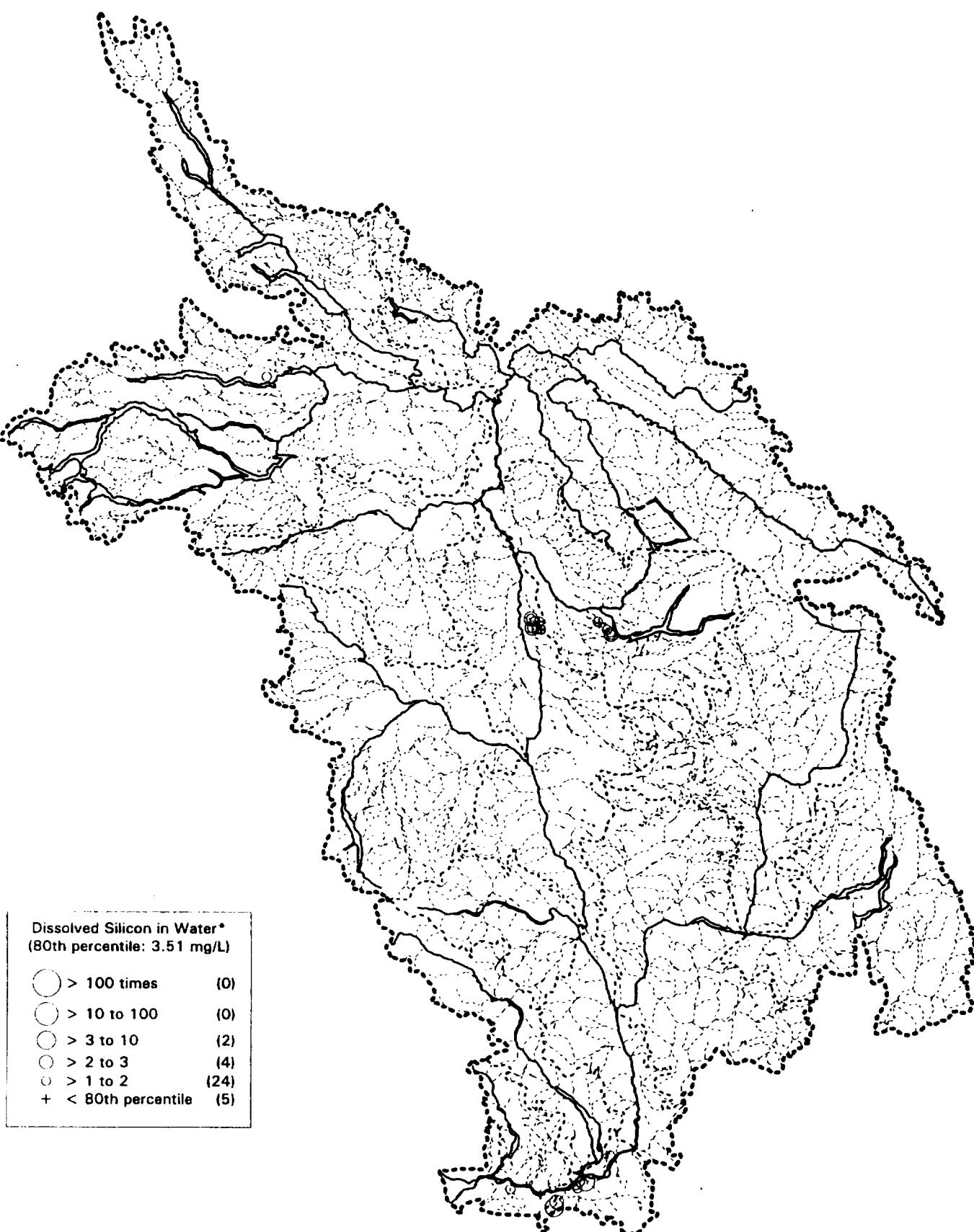


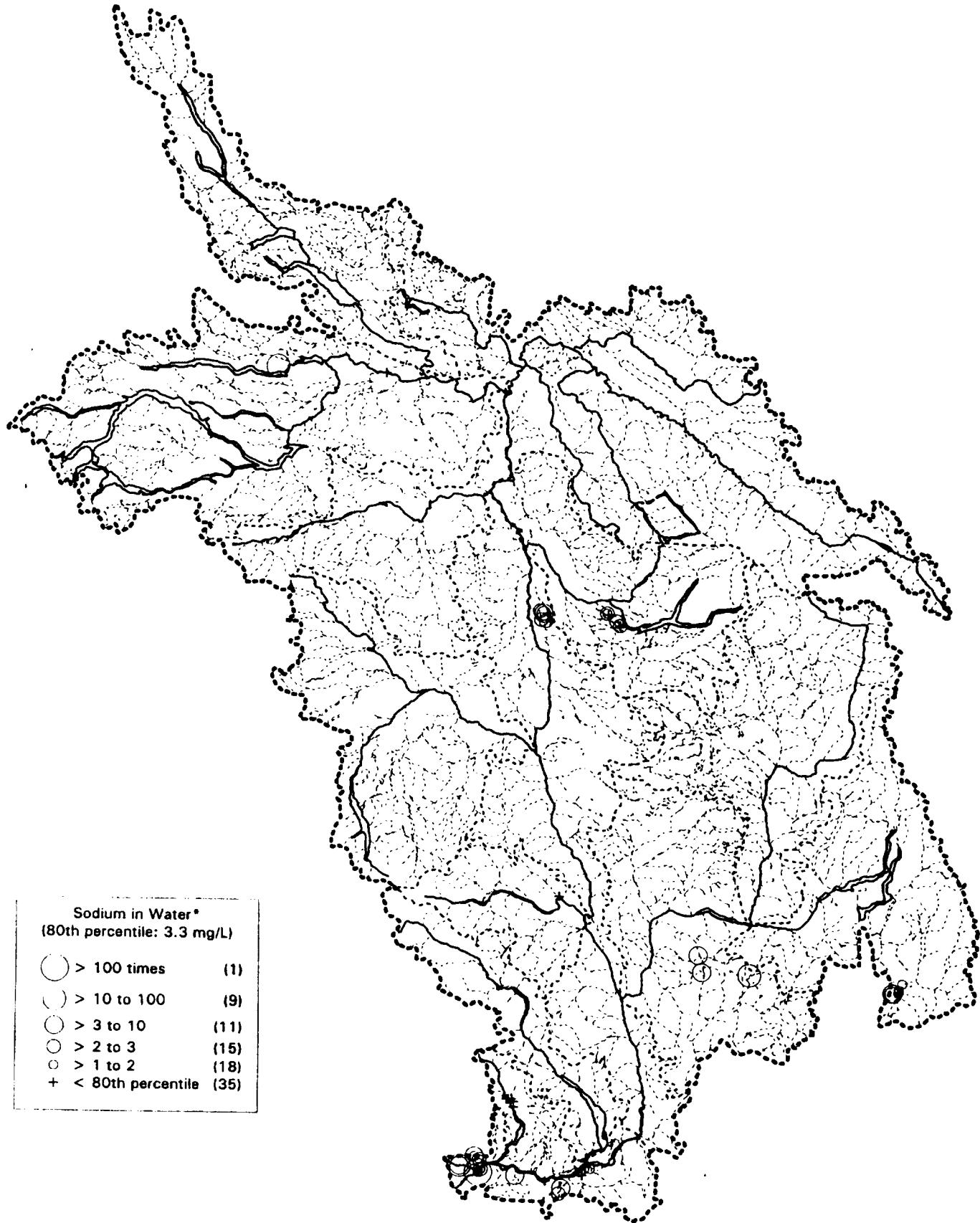
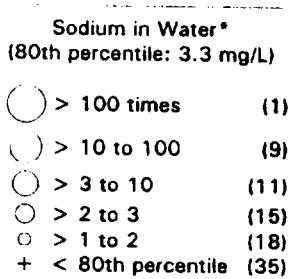


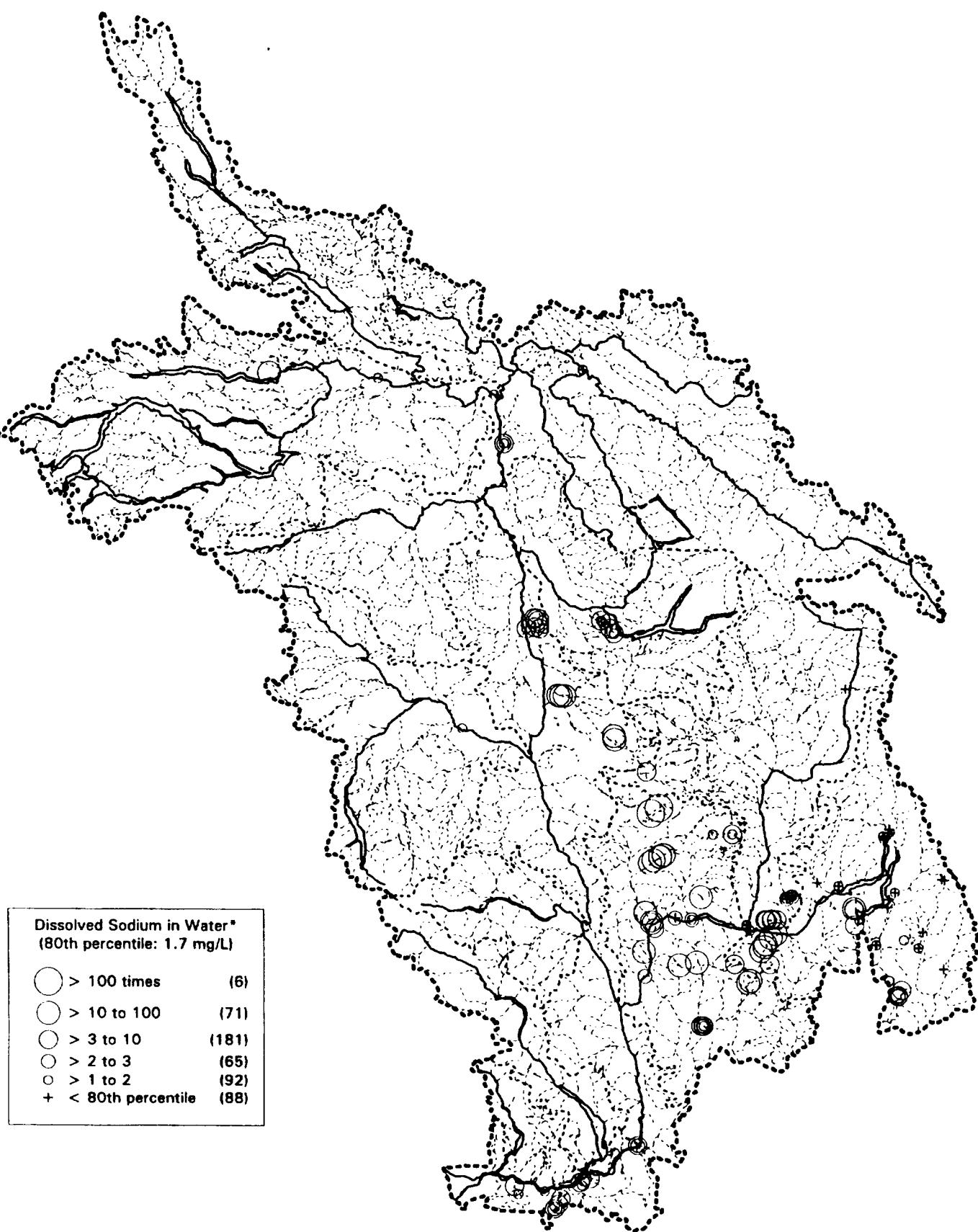


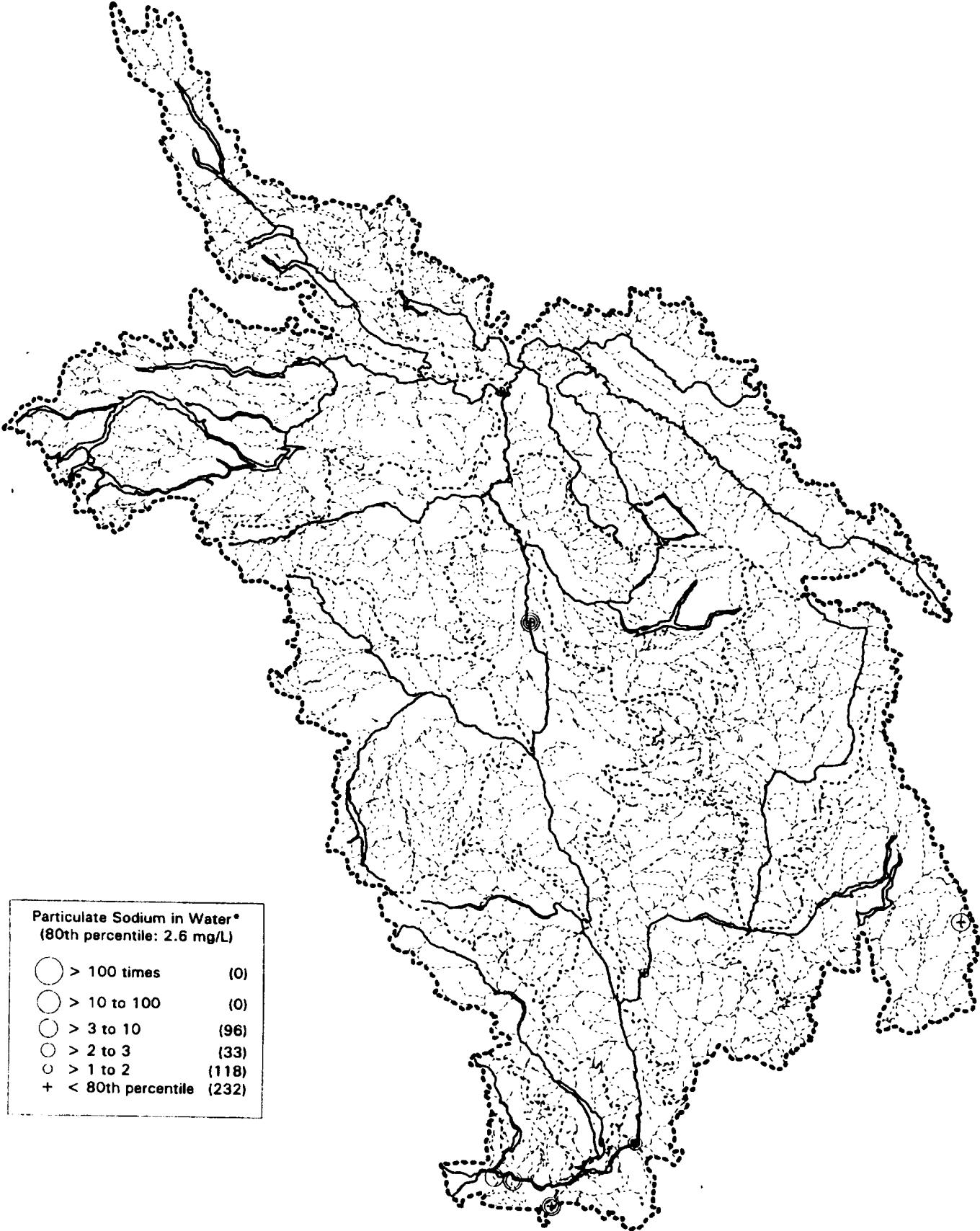


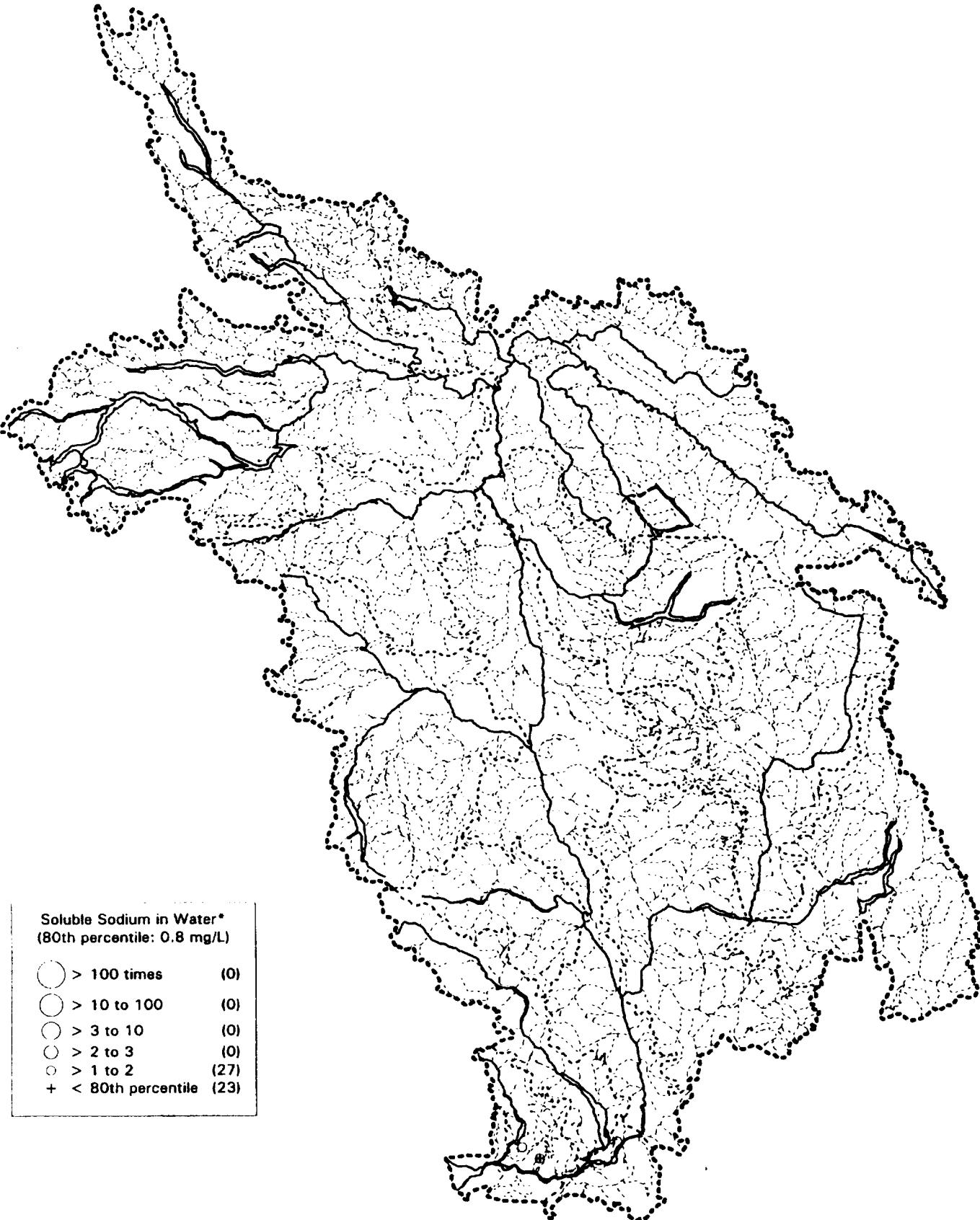


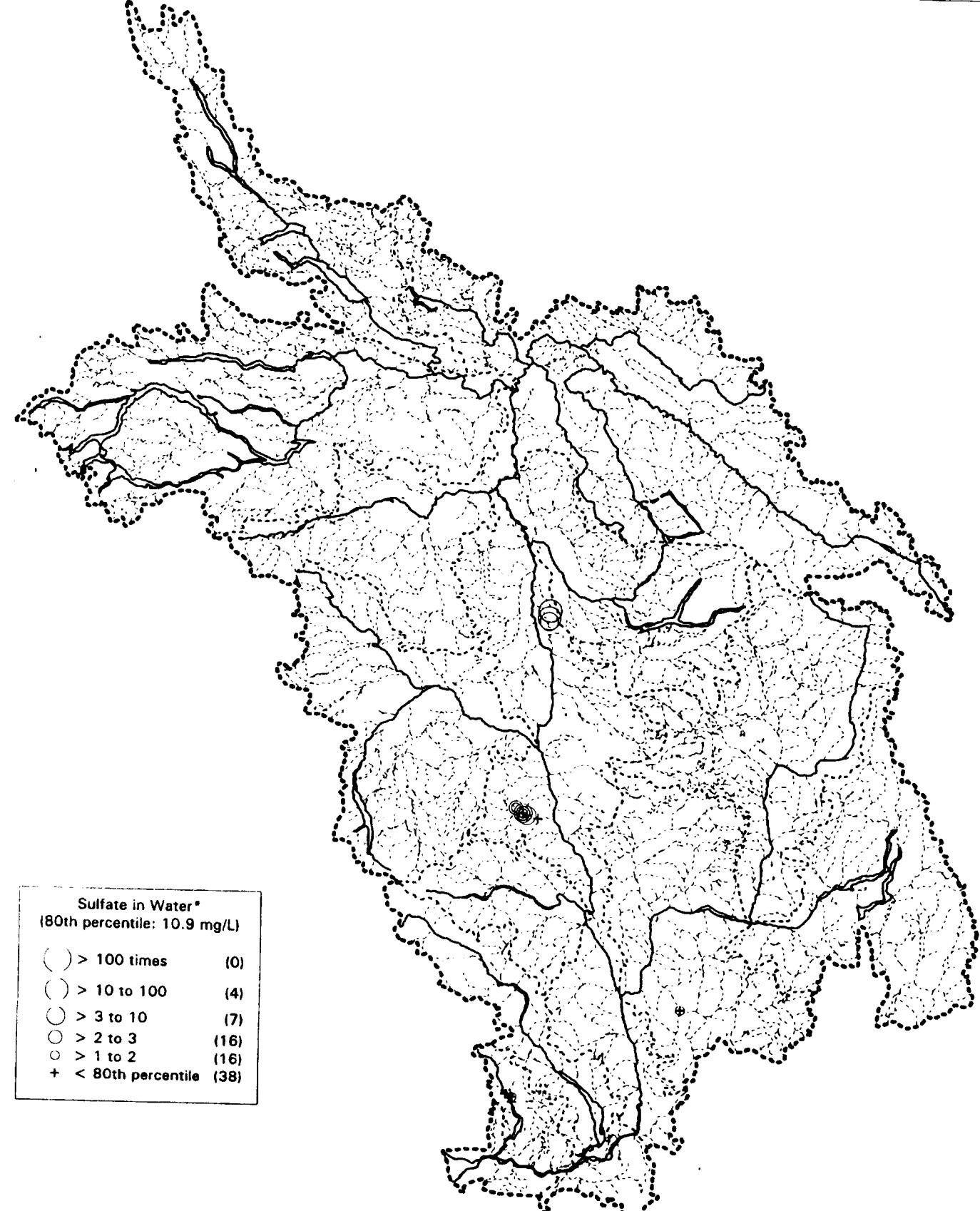


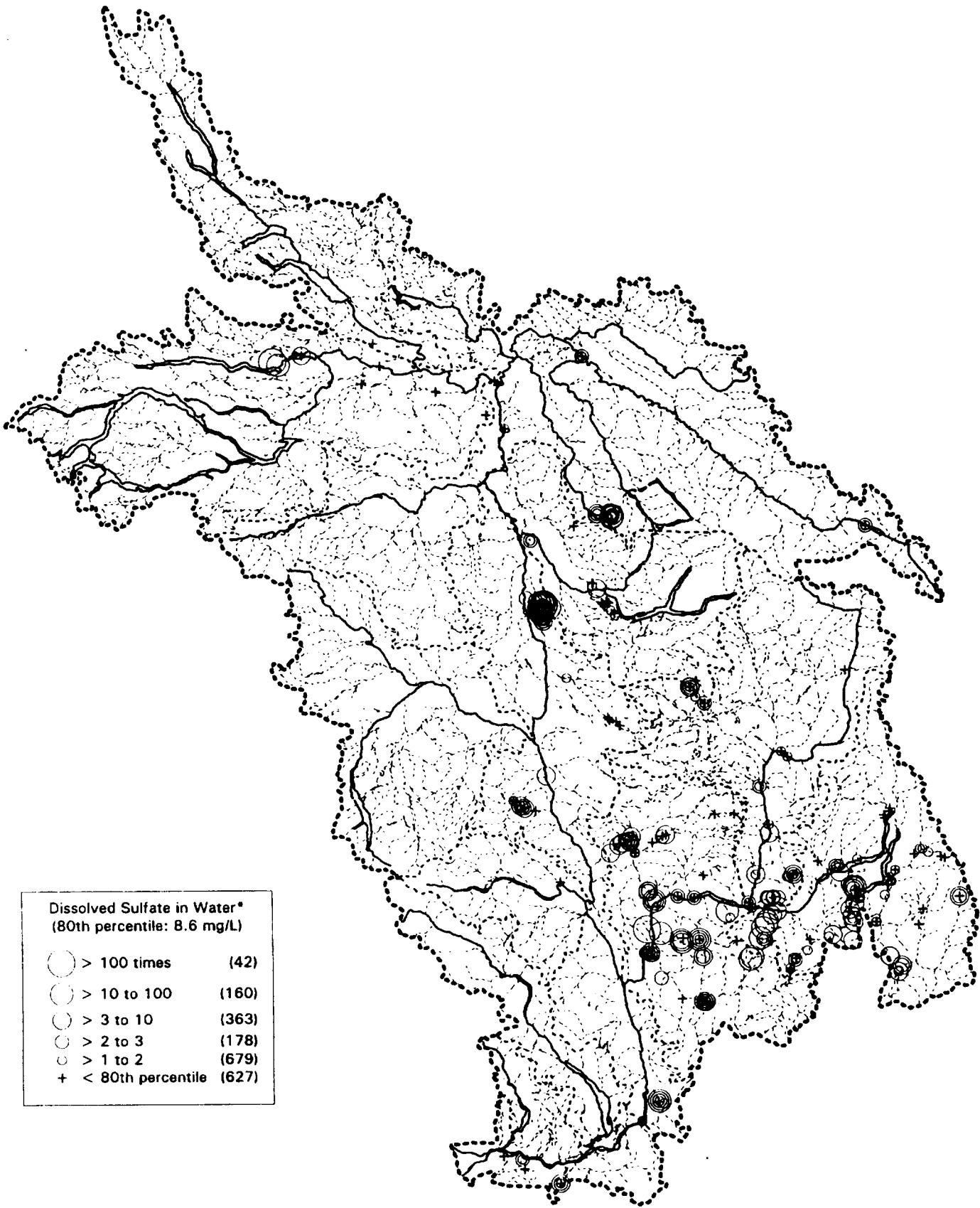


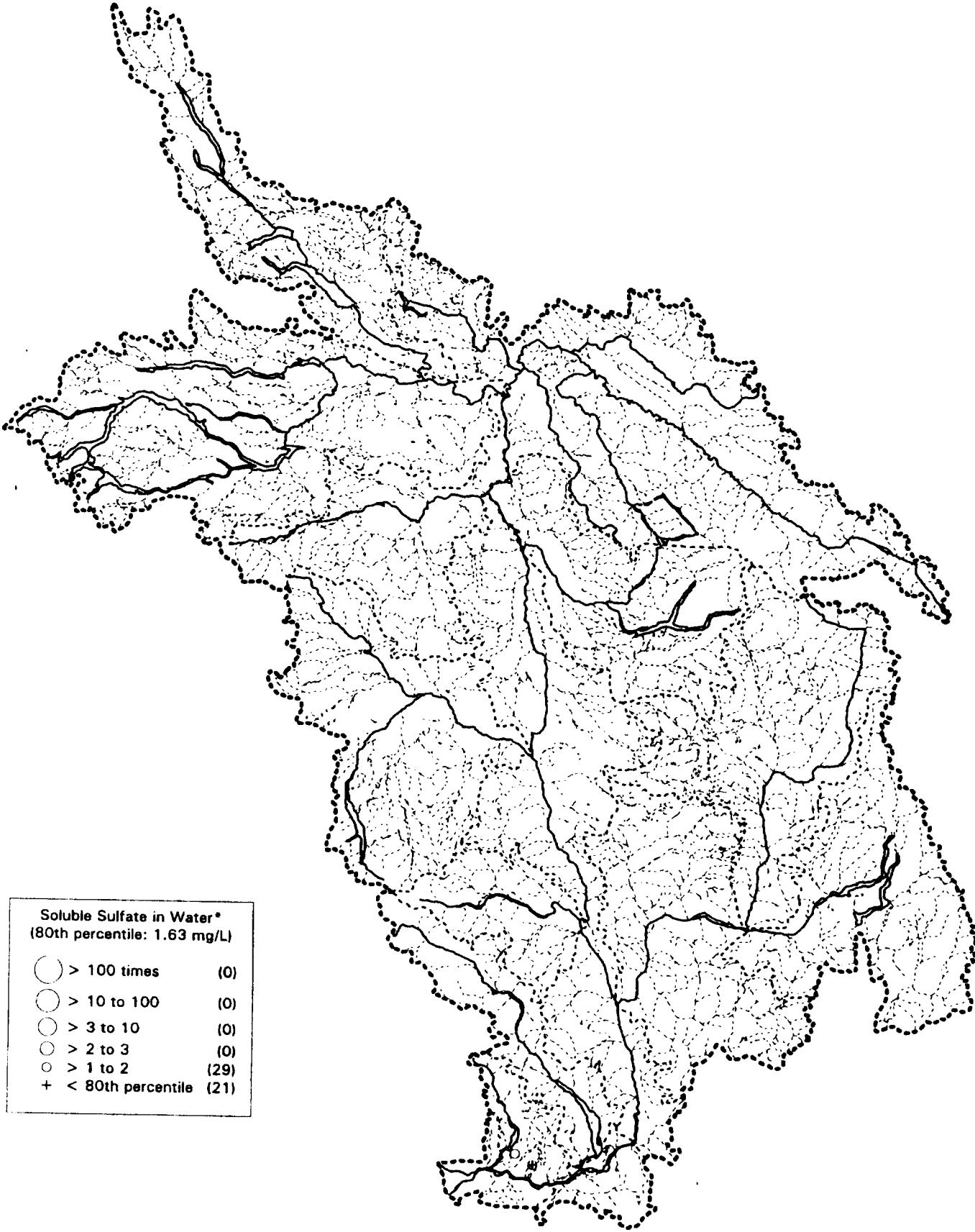


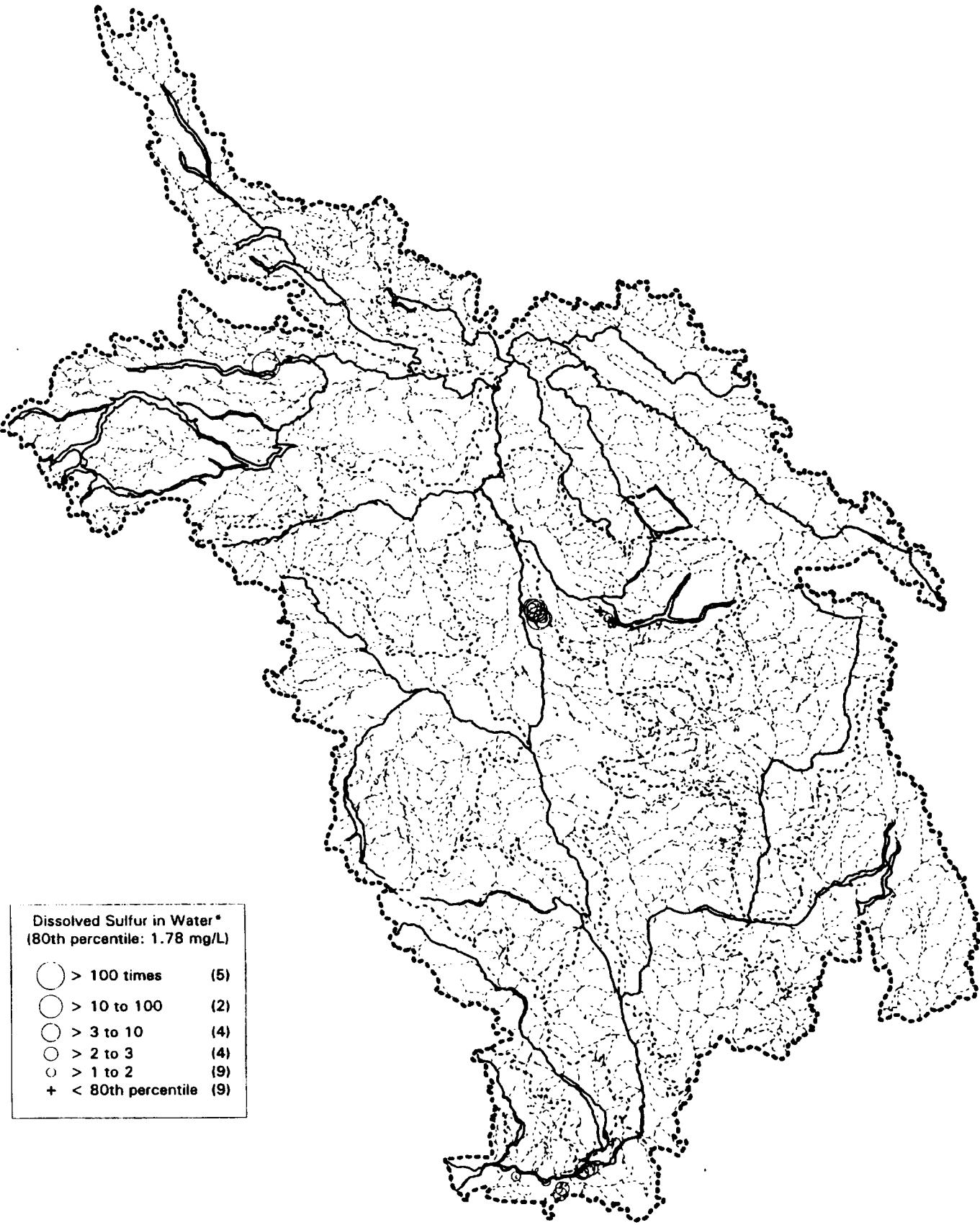


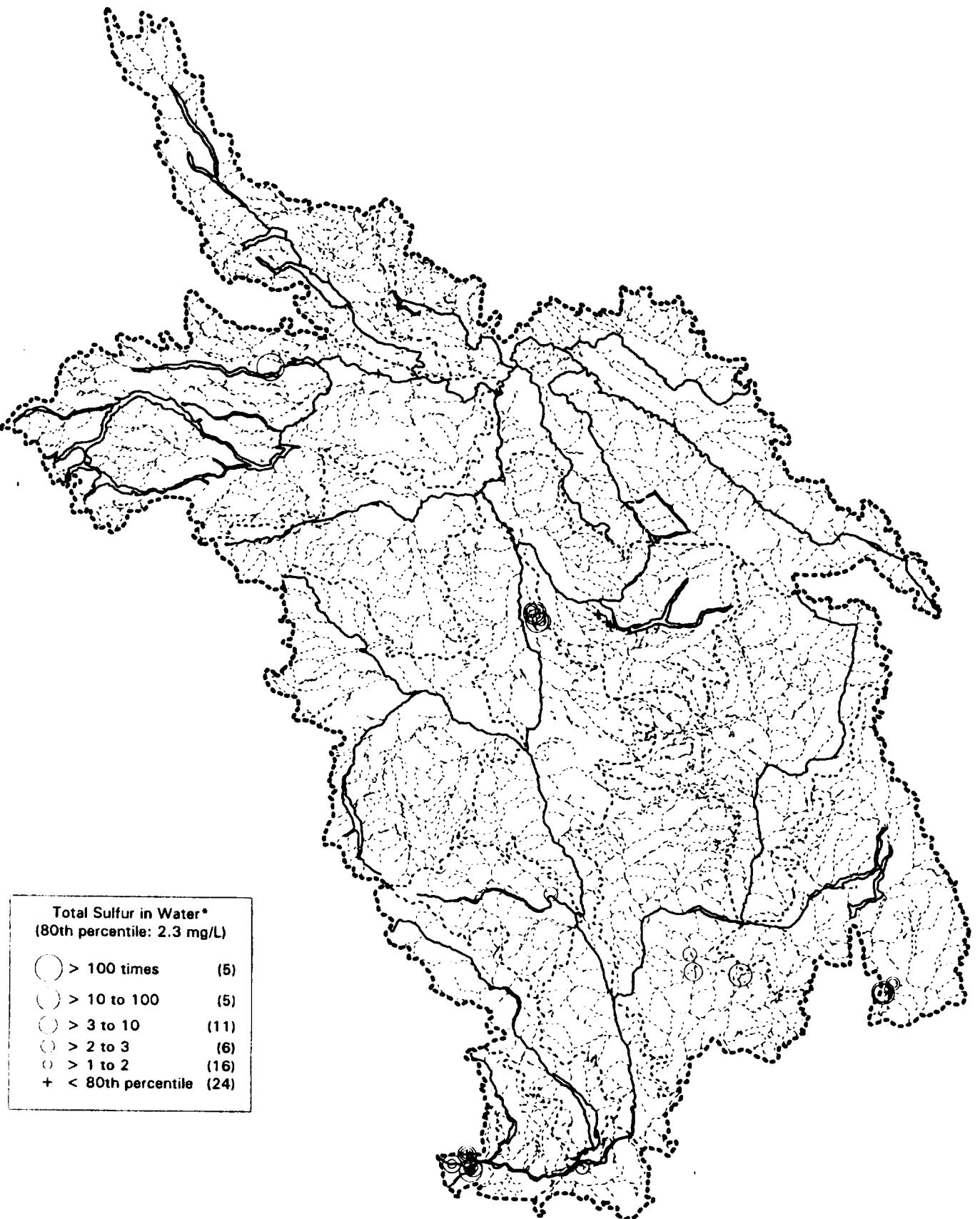


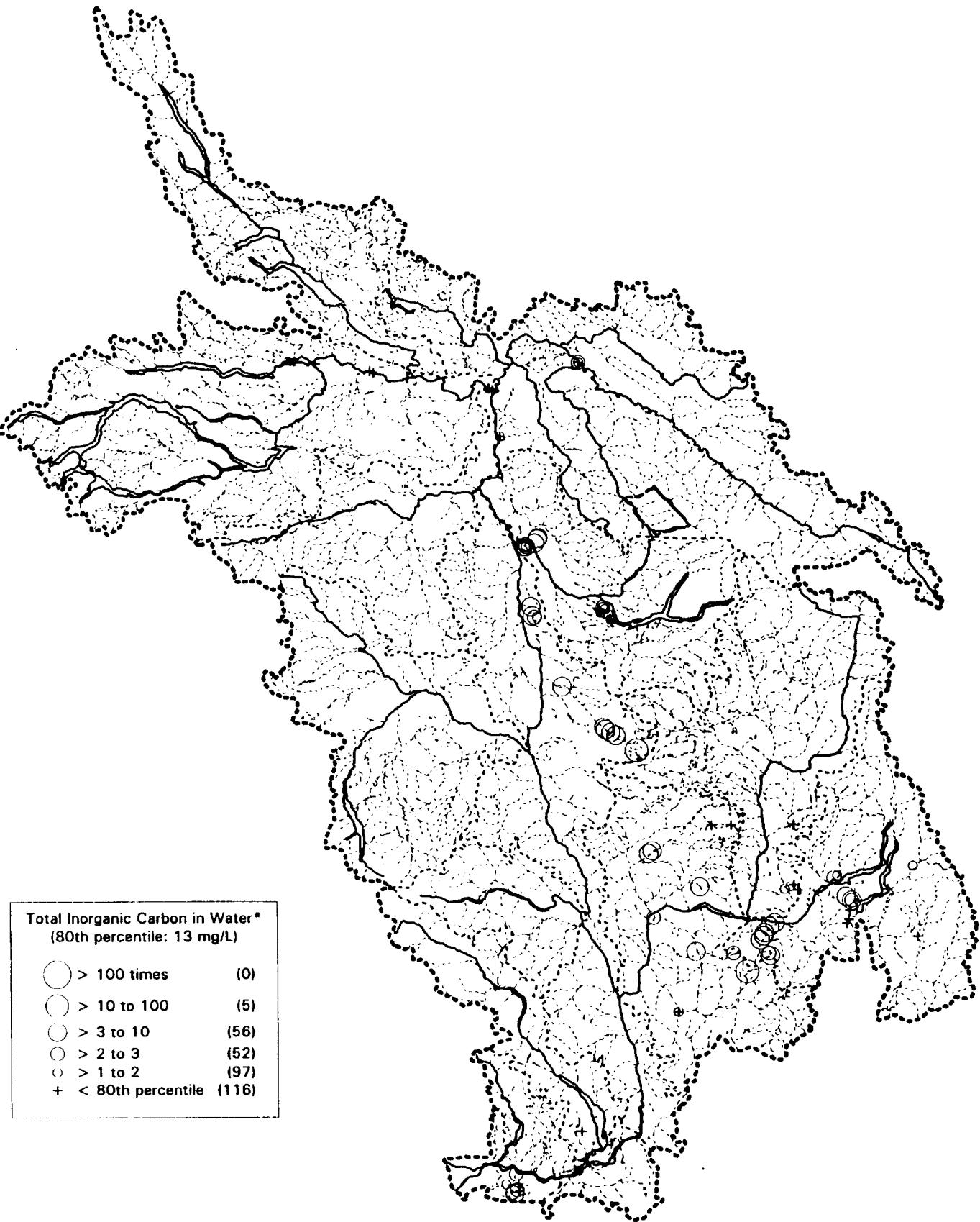






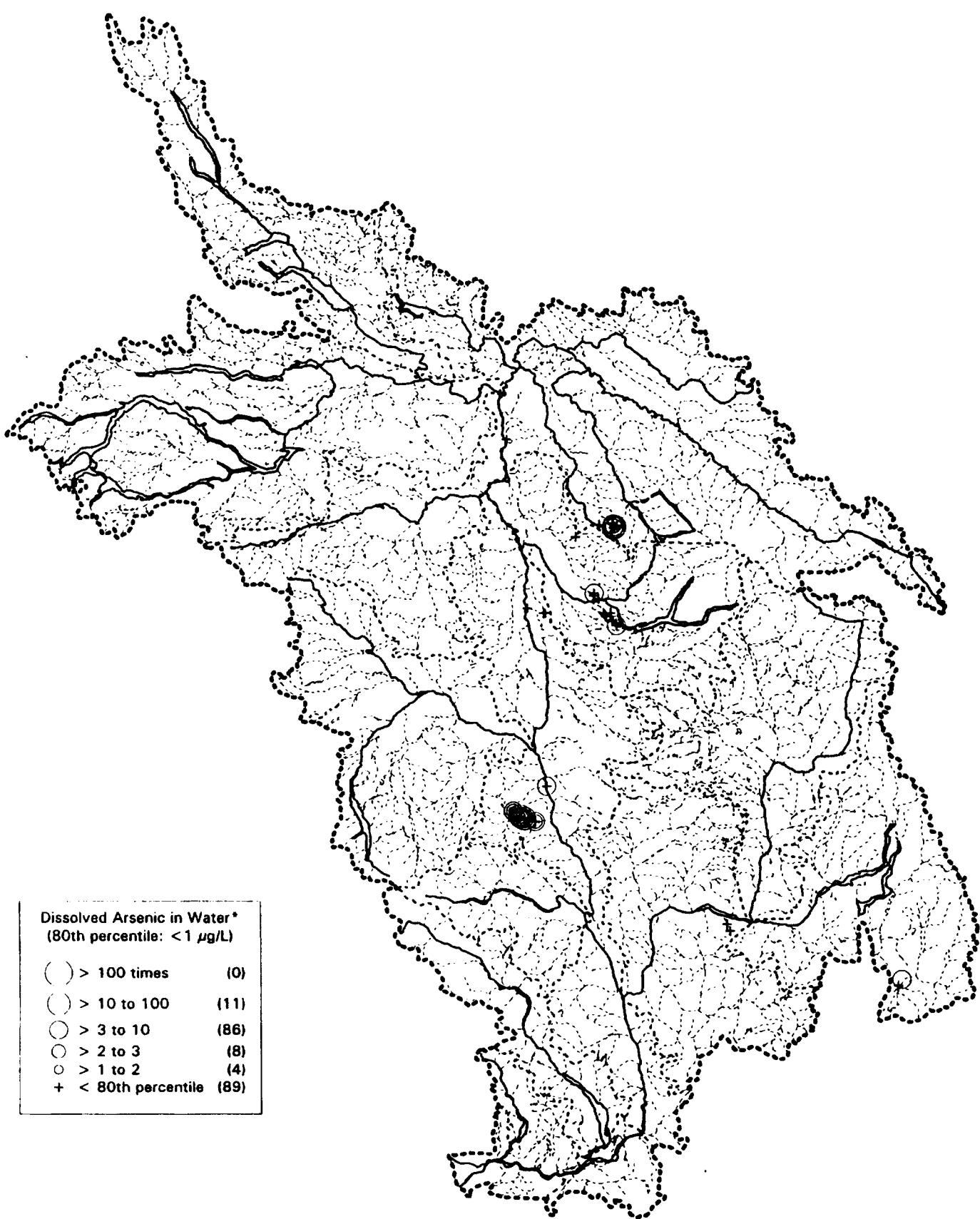


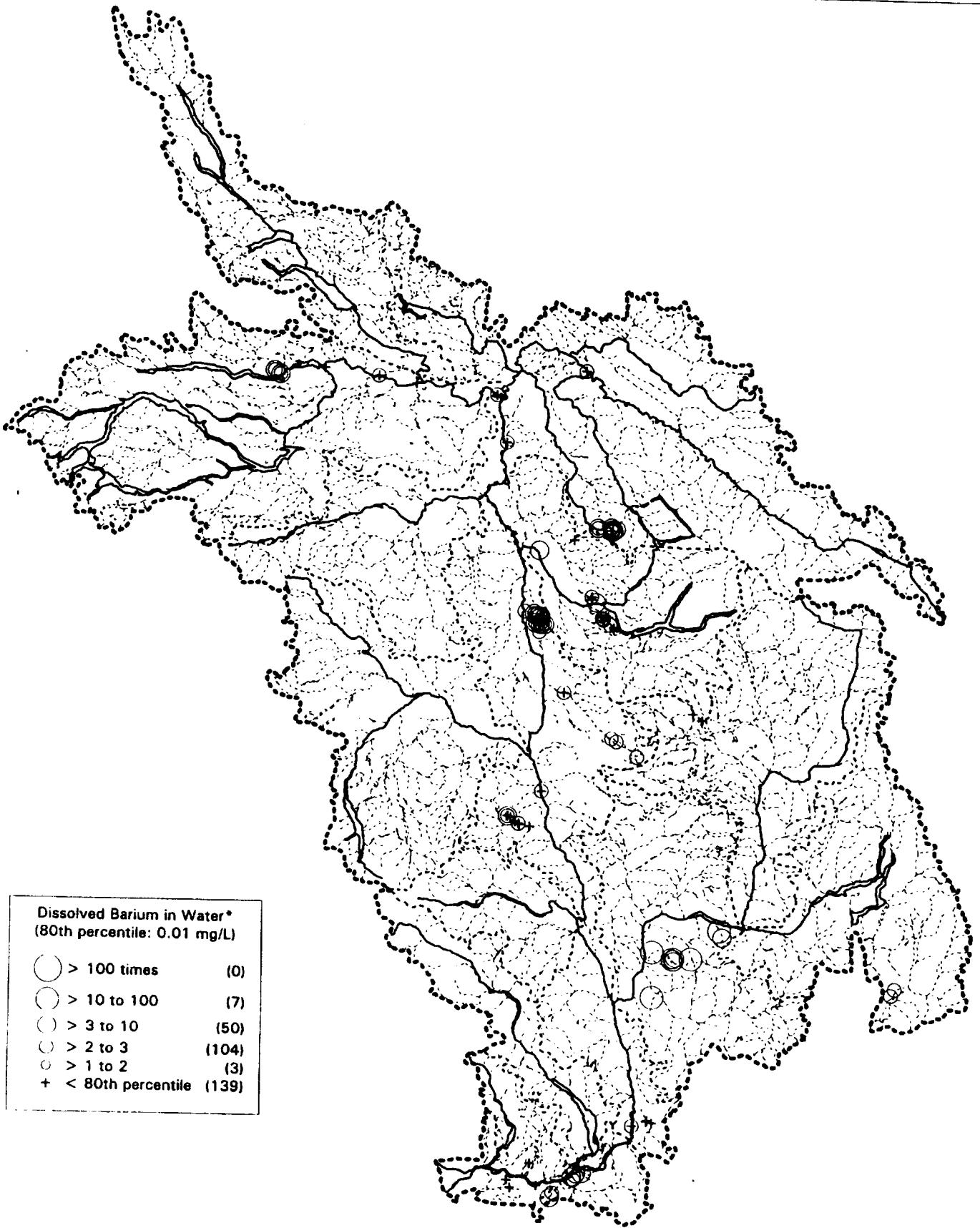


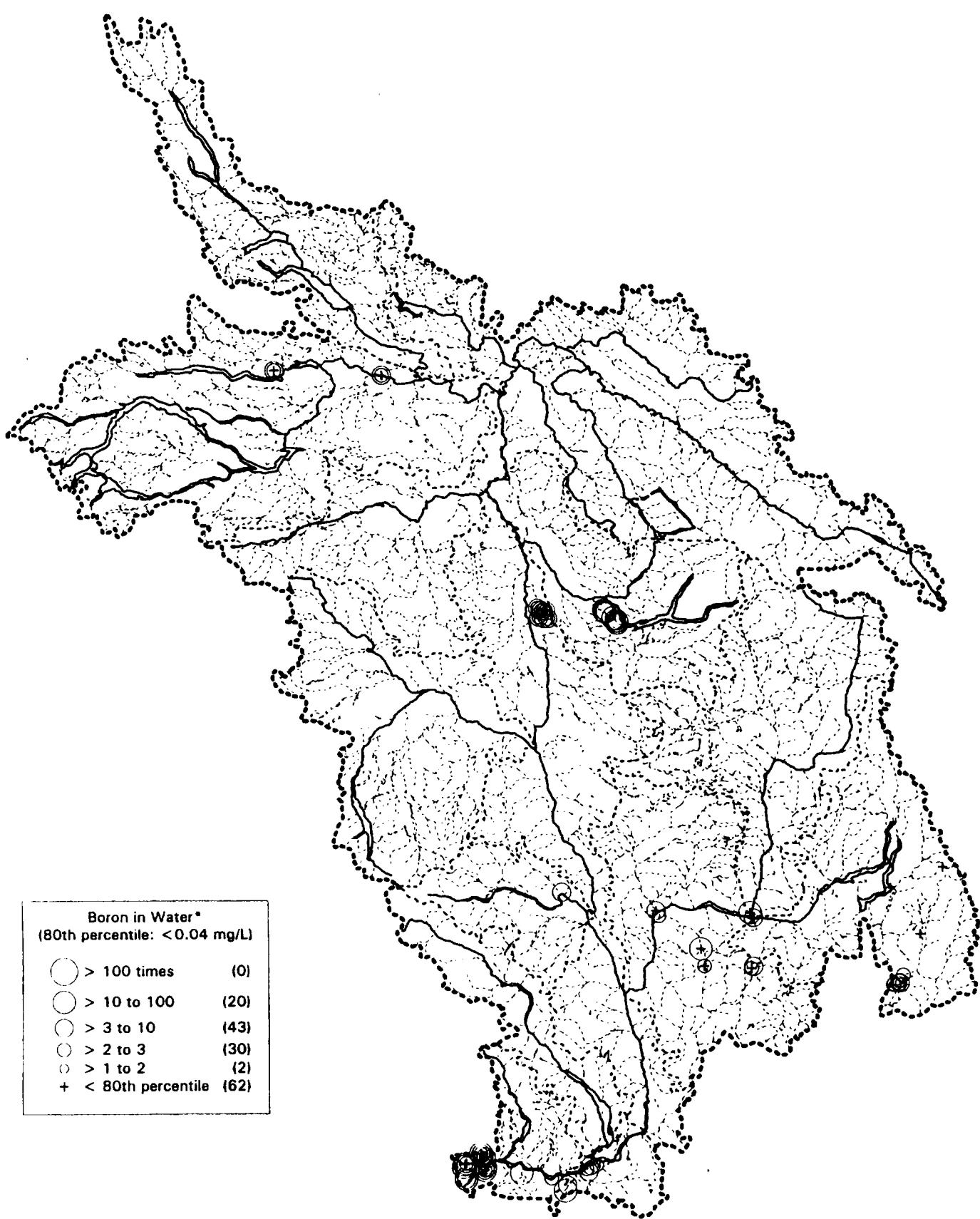


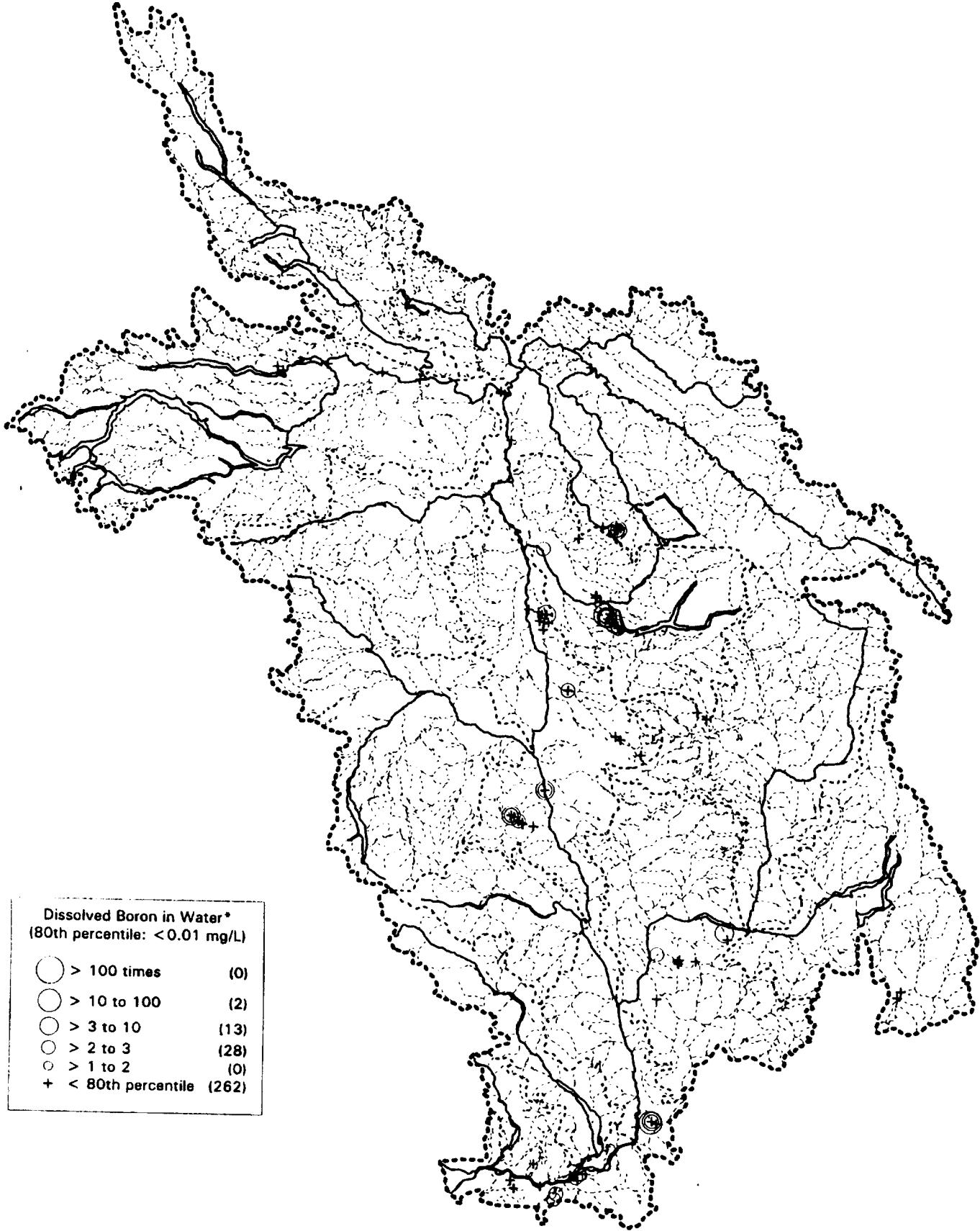
2.3.6 Metals in water

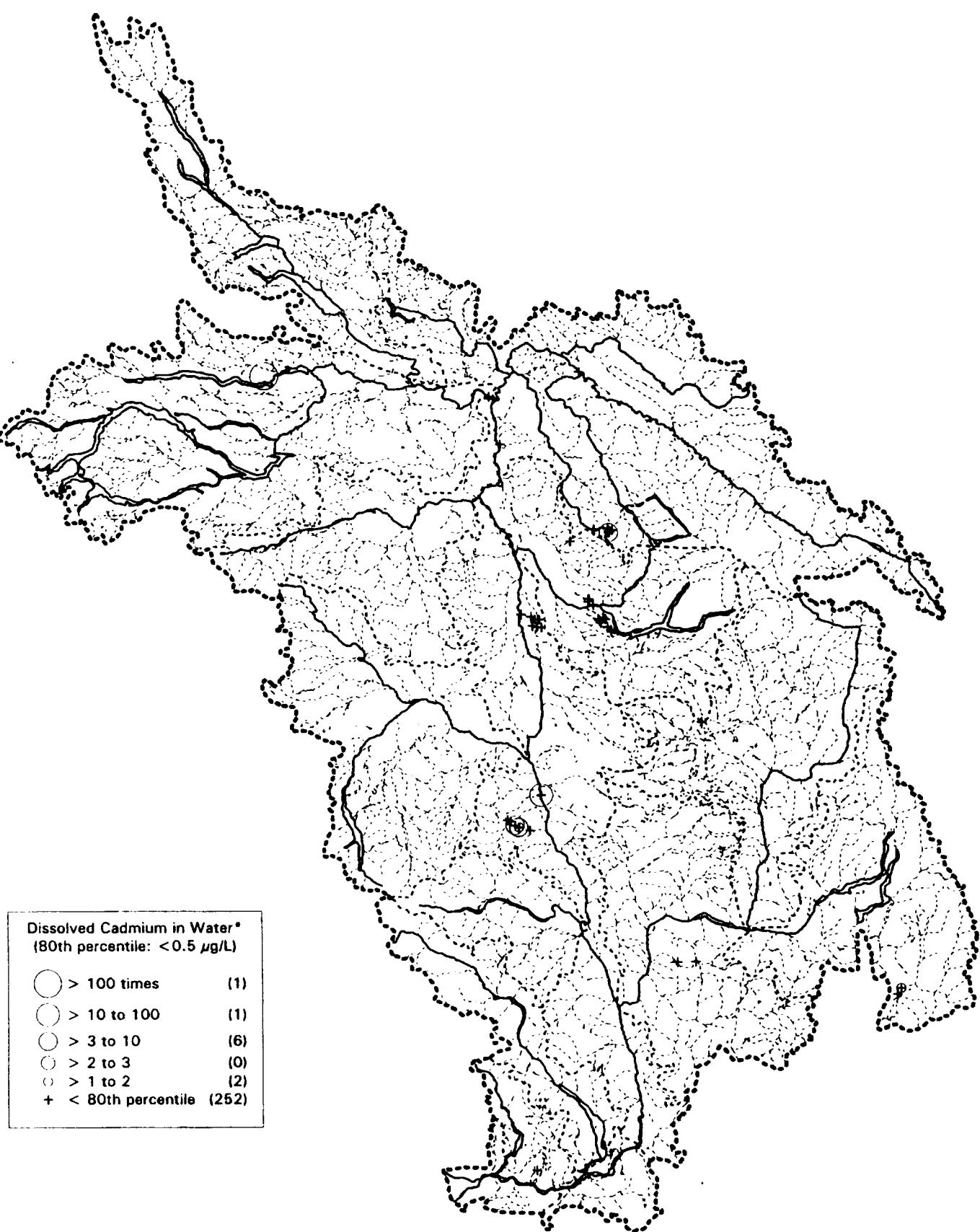
Dissolved Arsenic
Dissolved Barium
Boron
Dissolved Boron
Dissolved Cadmium
Dissolved Copper
Dissolved Iron
Dissolved Lead
Lithium
Dissolved Manganese
Dissolved Molybdenum
Dissolved Nickel
Strontium
Dissolved Strontium
Vanadium
Dissolved Vanadium
Dissolved Zinc

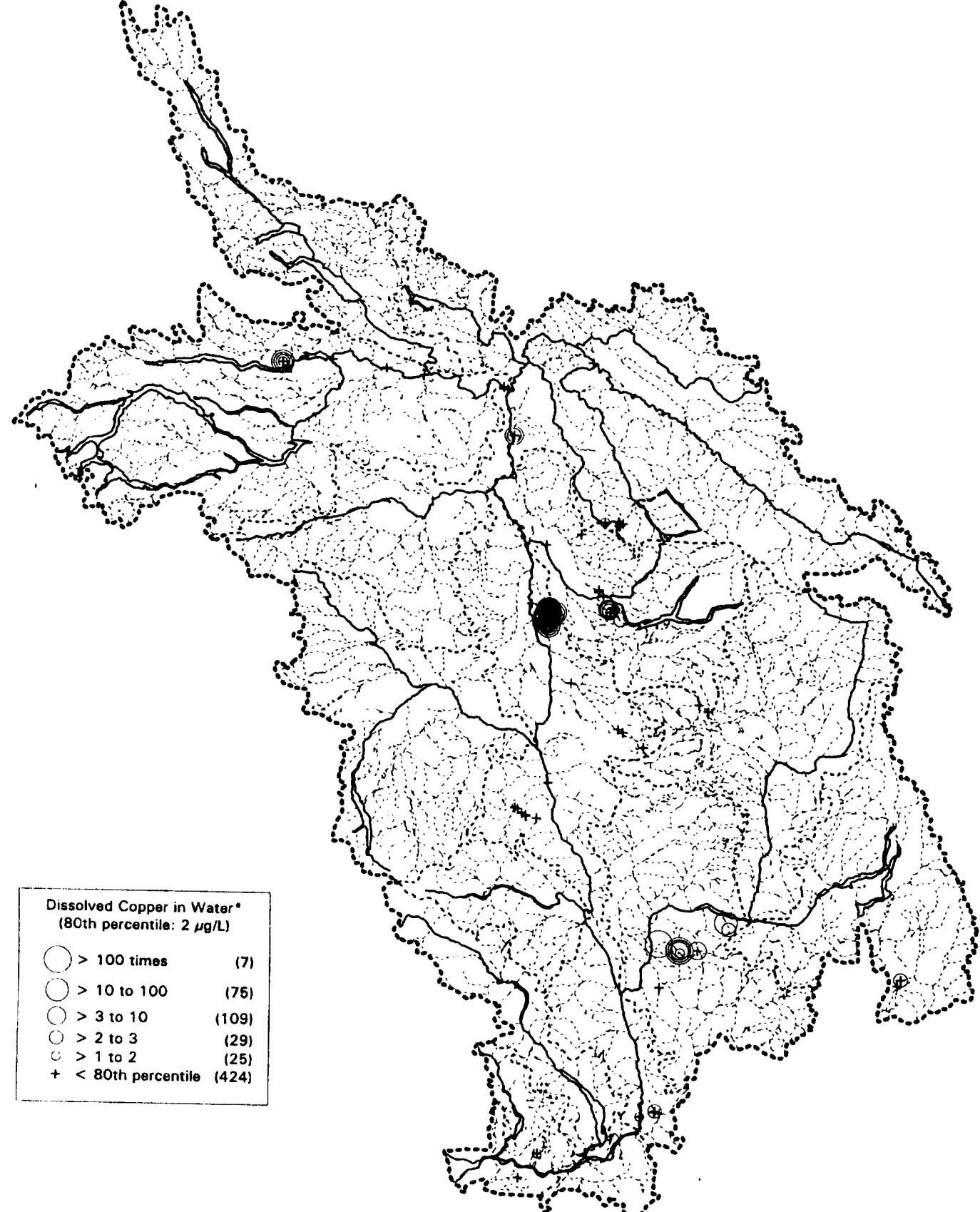


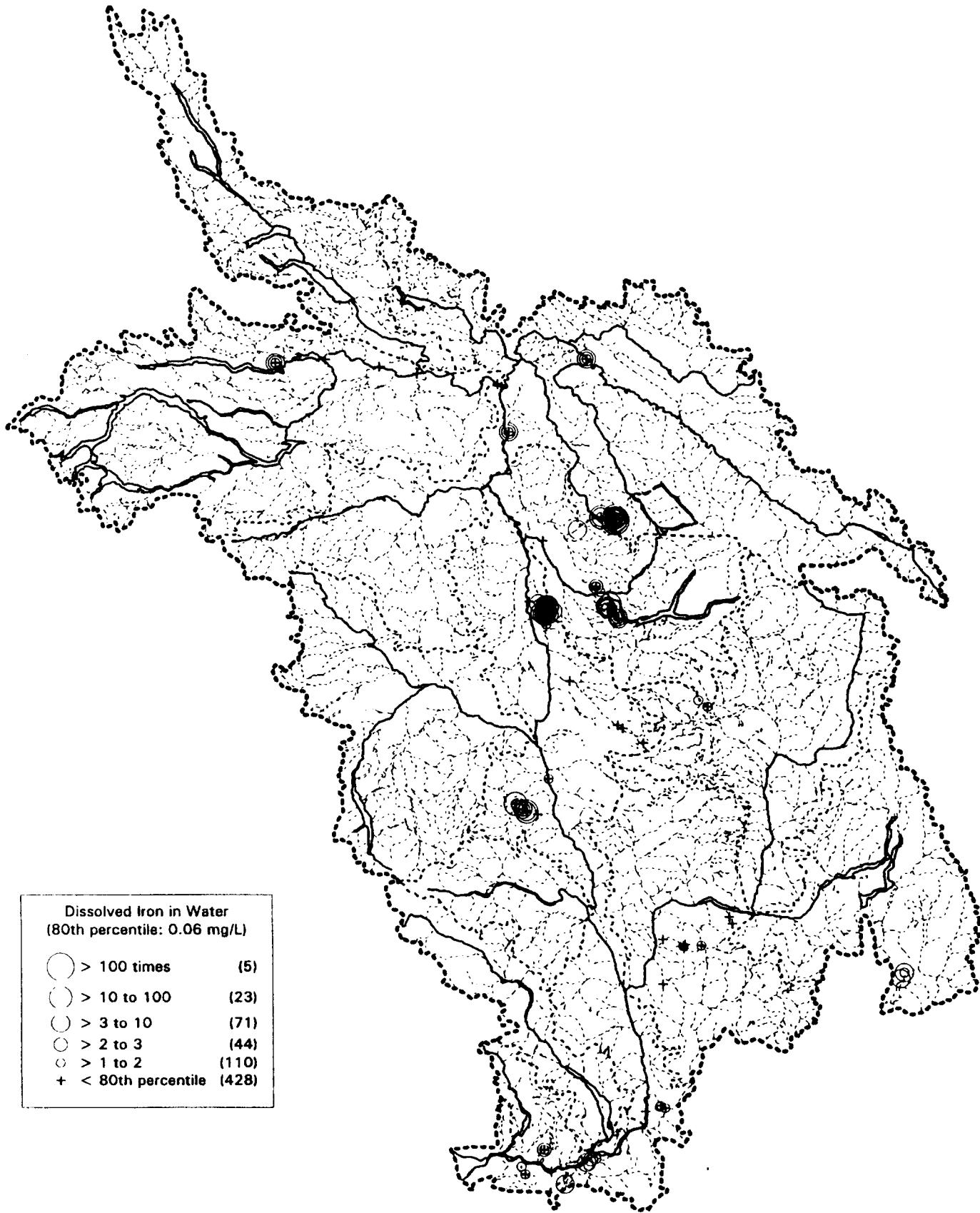


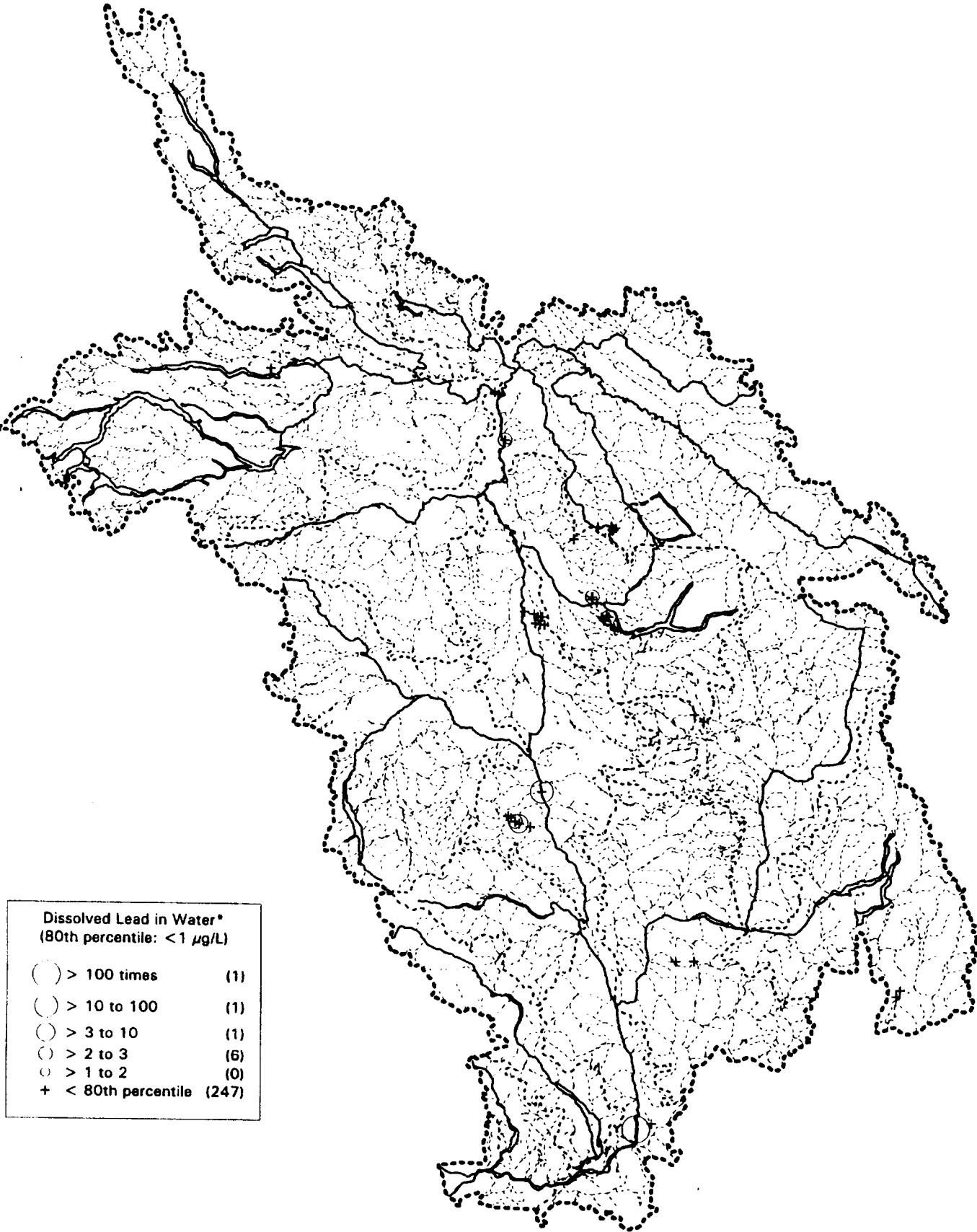


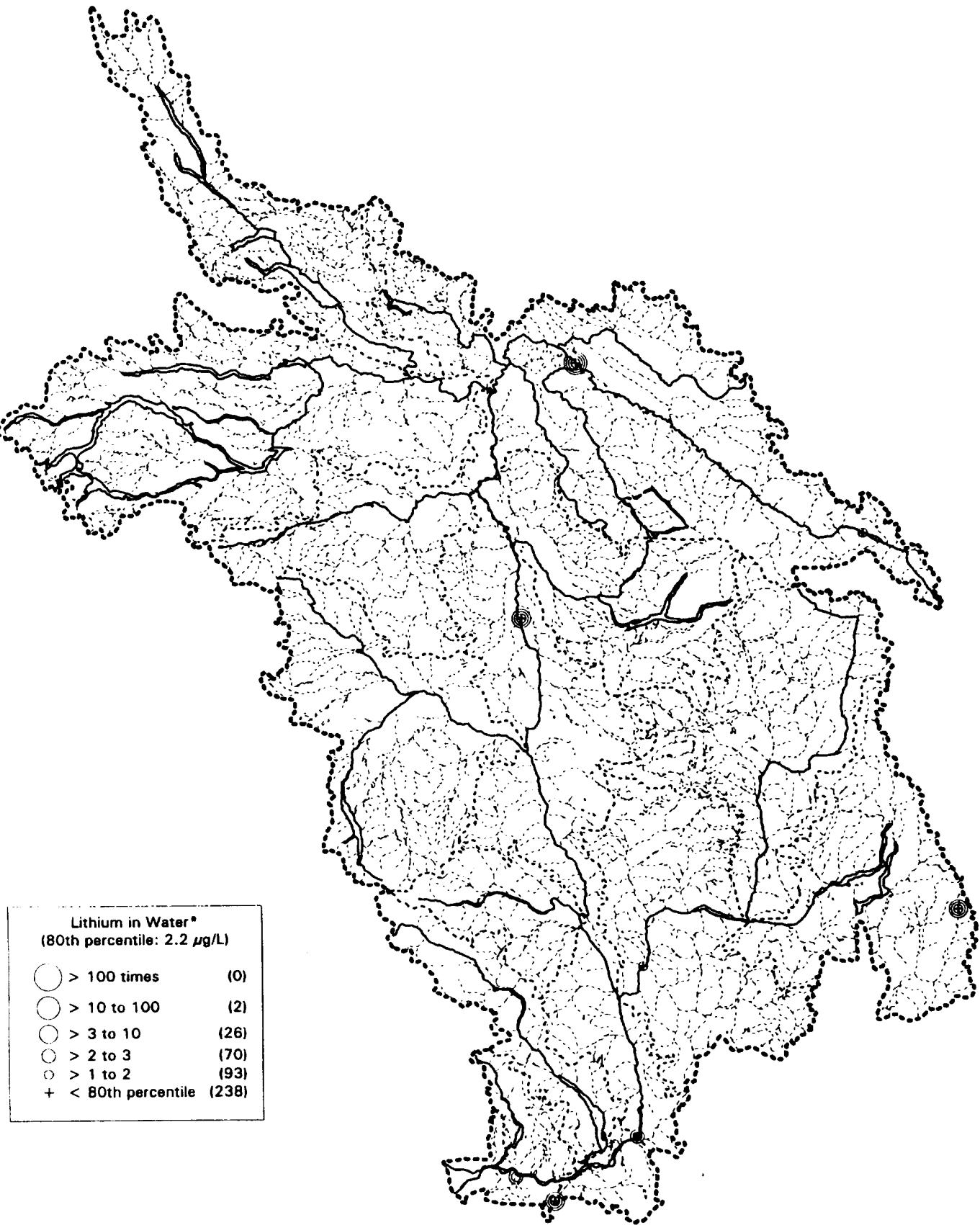


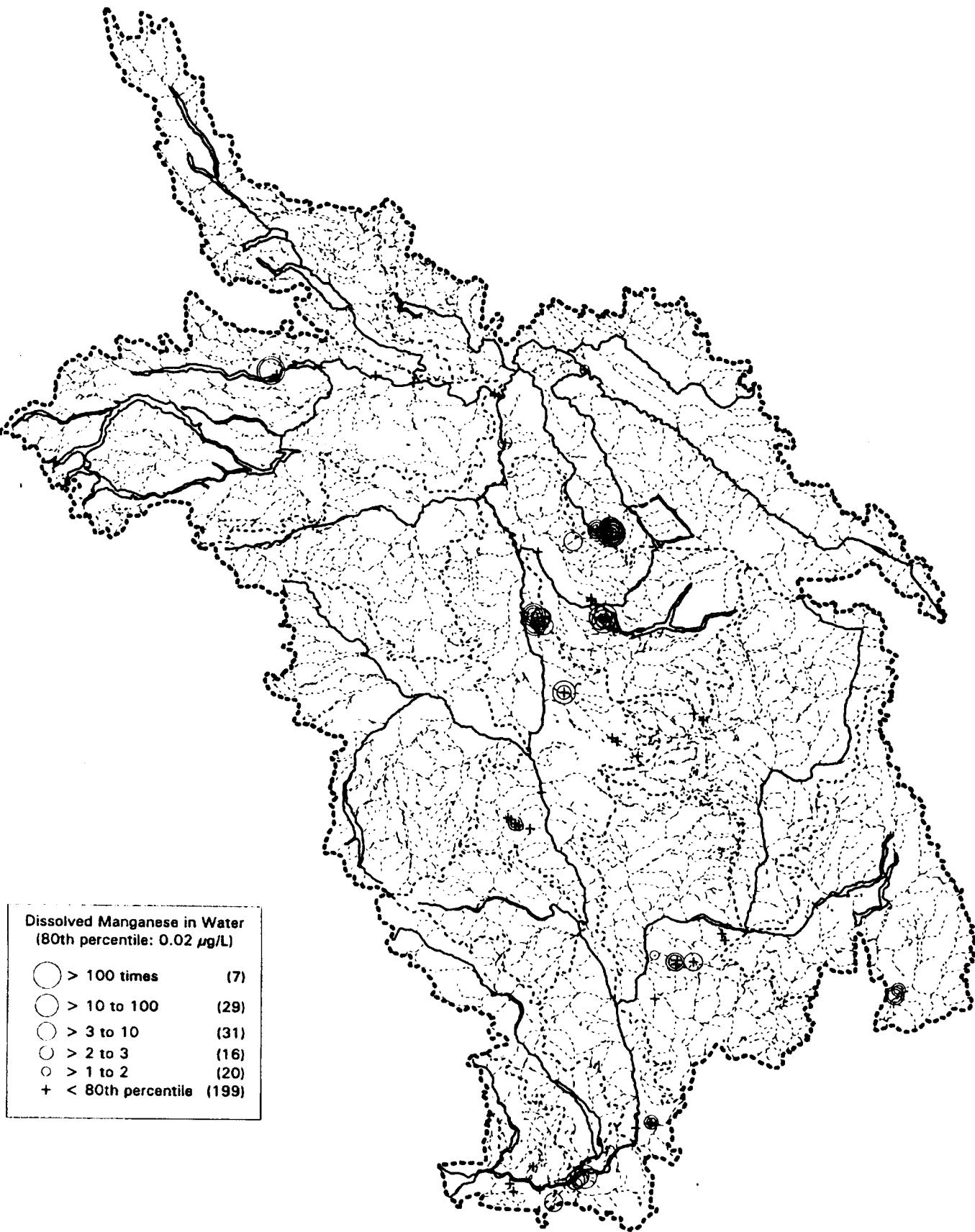


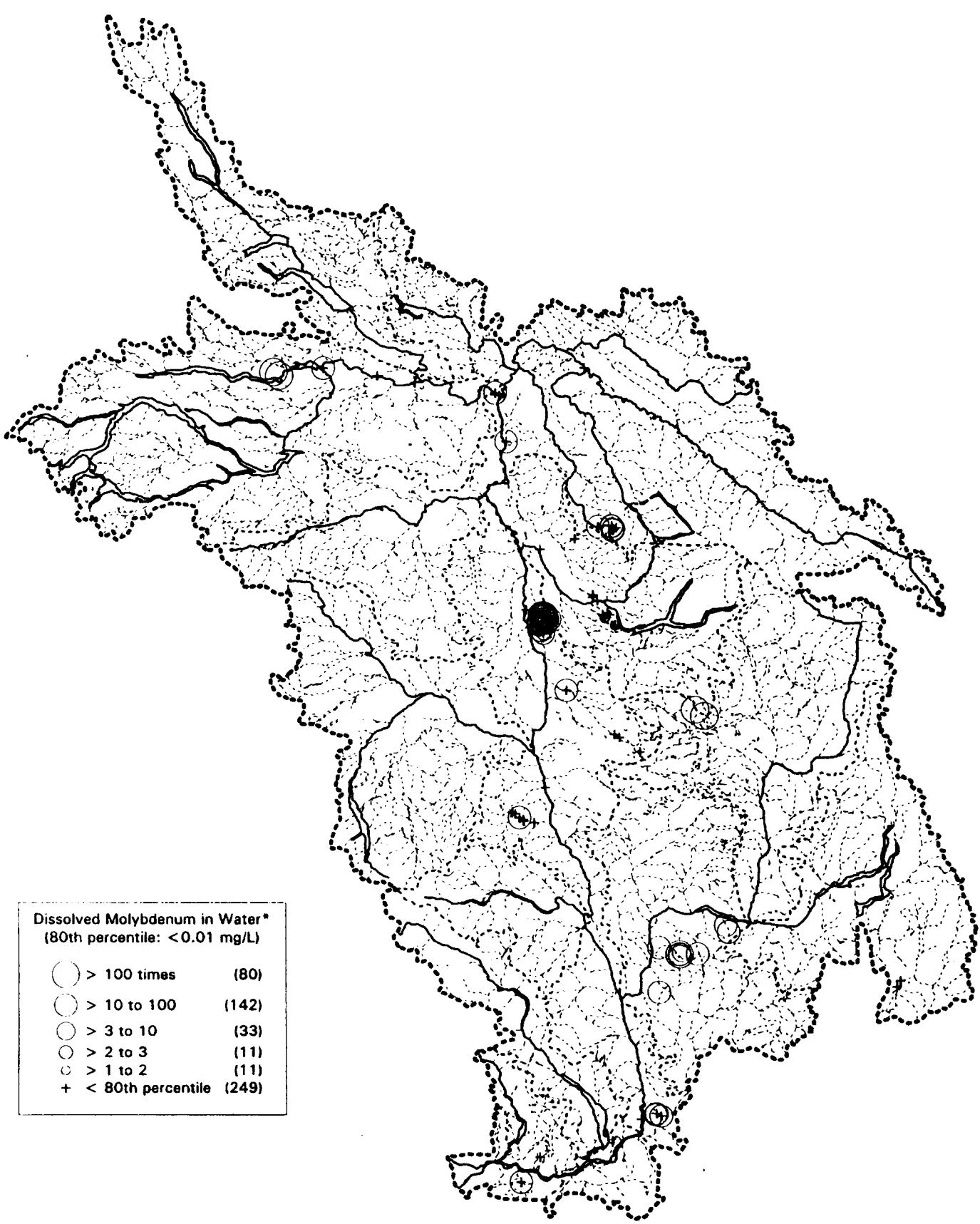


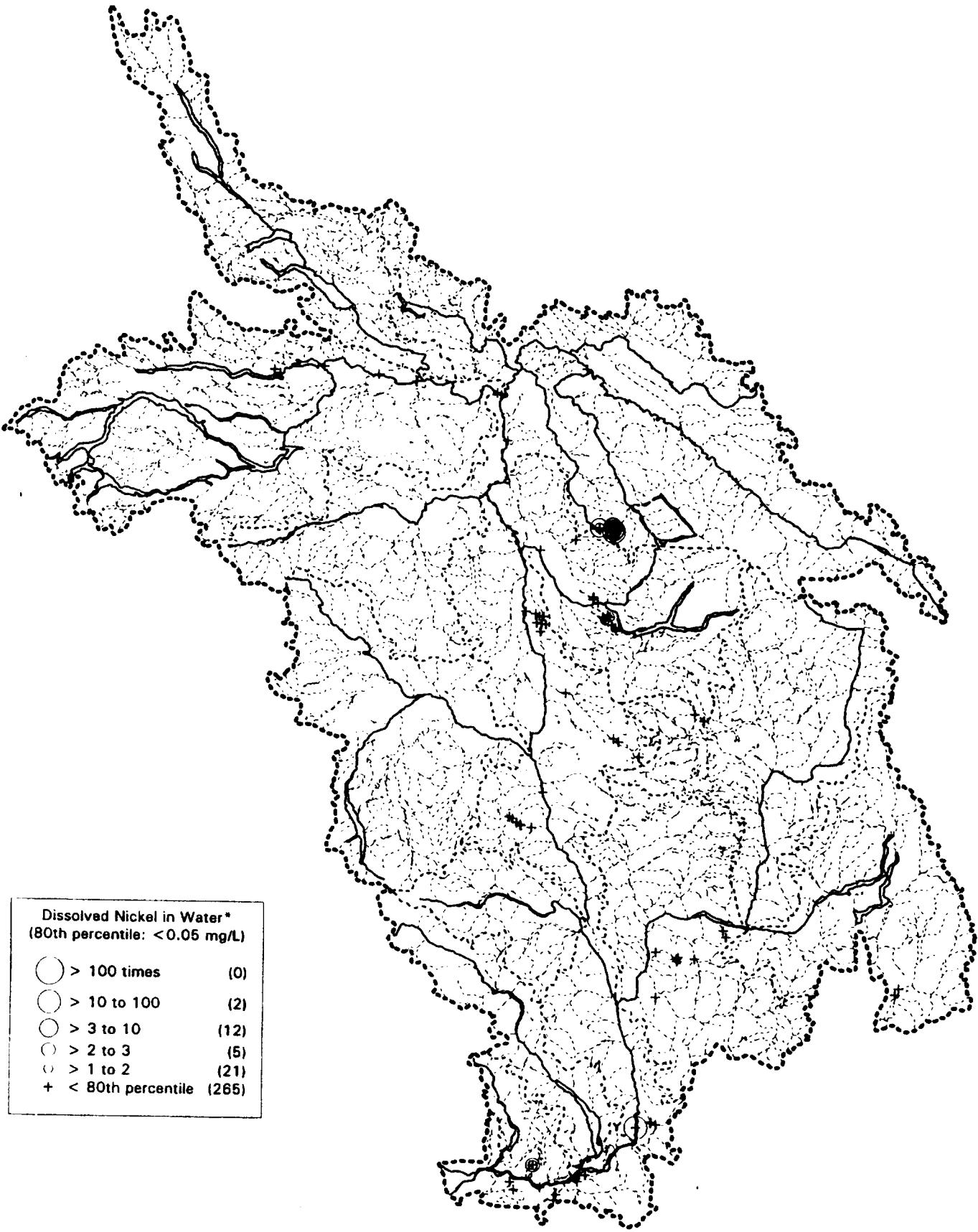


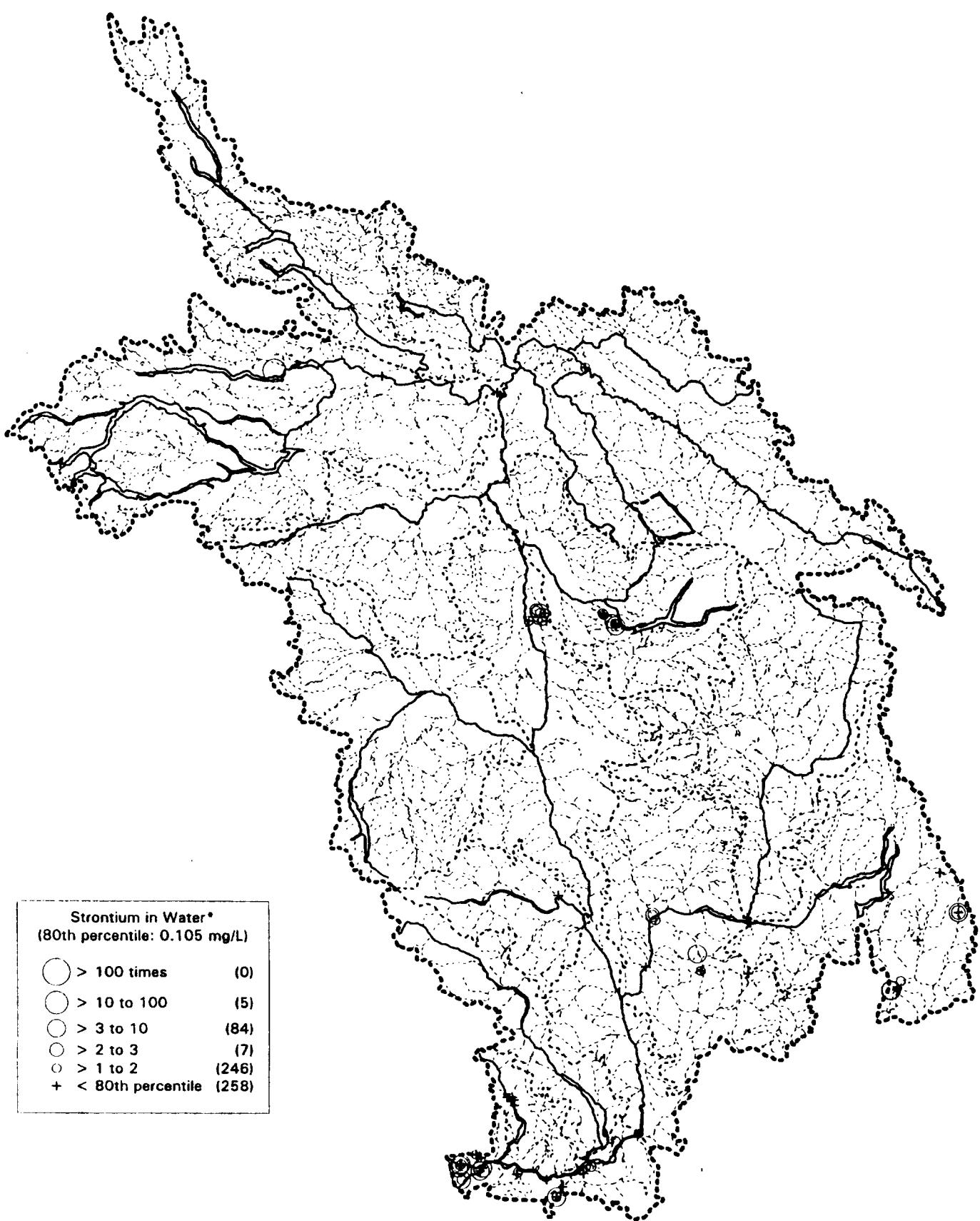


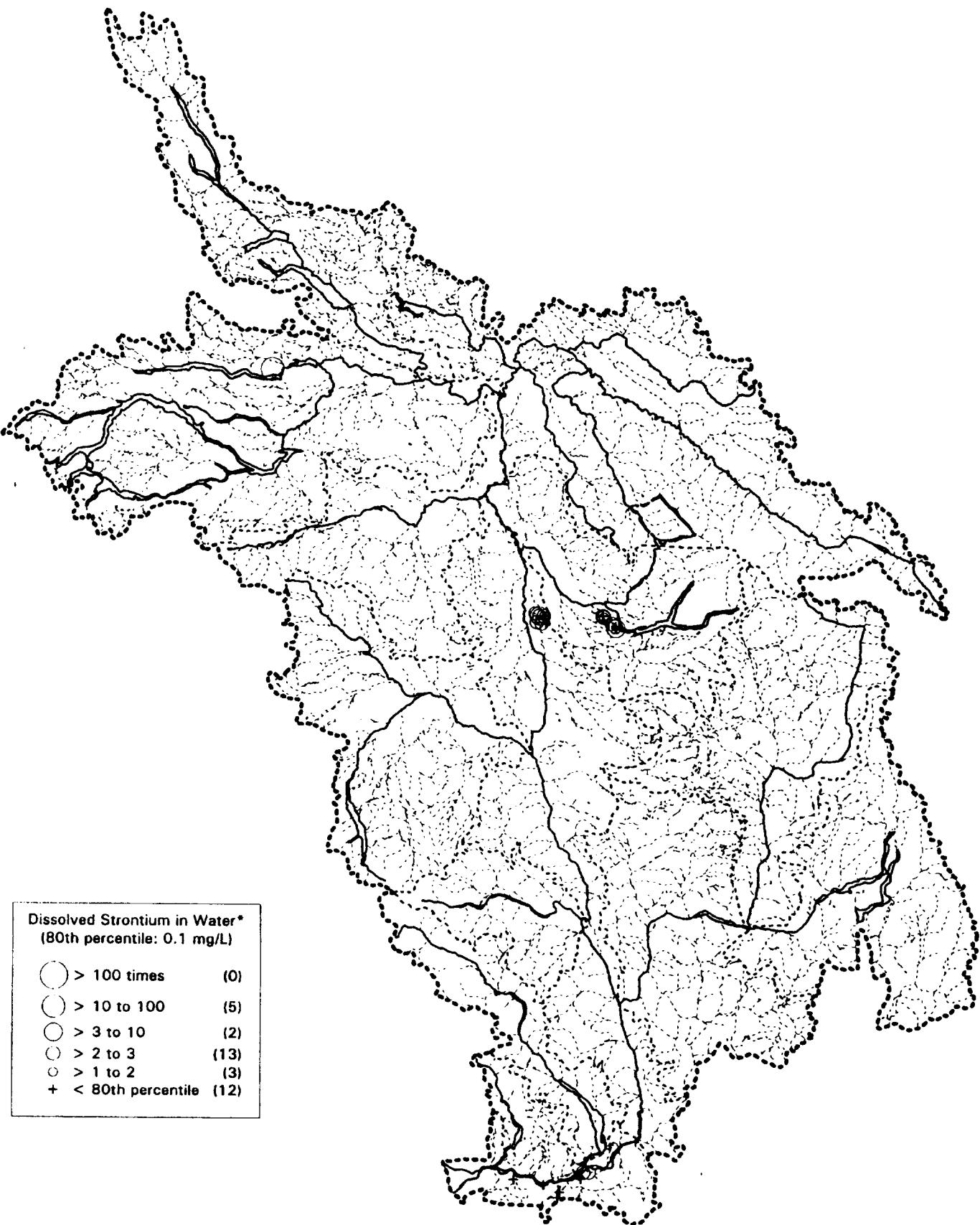


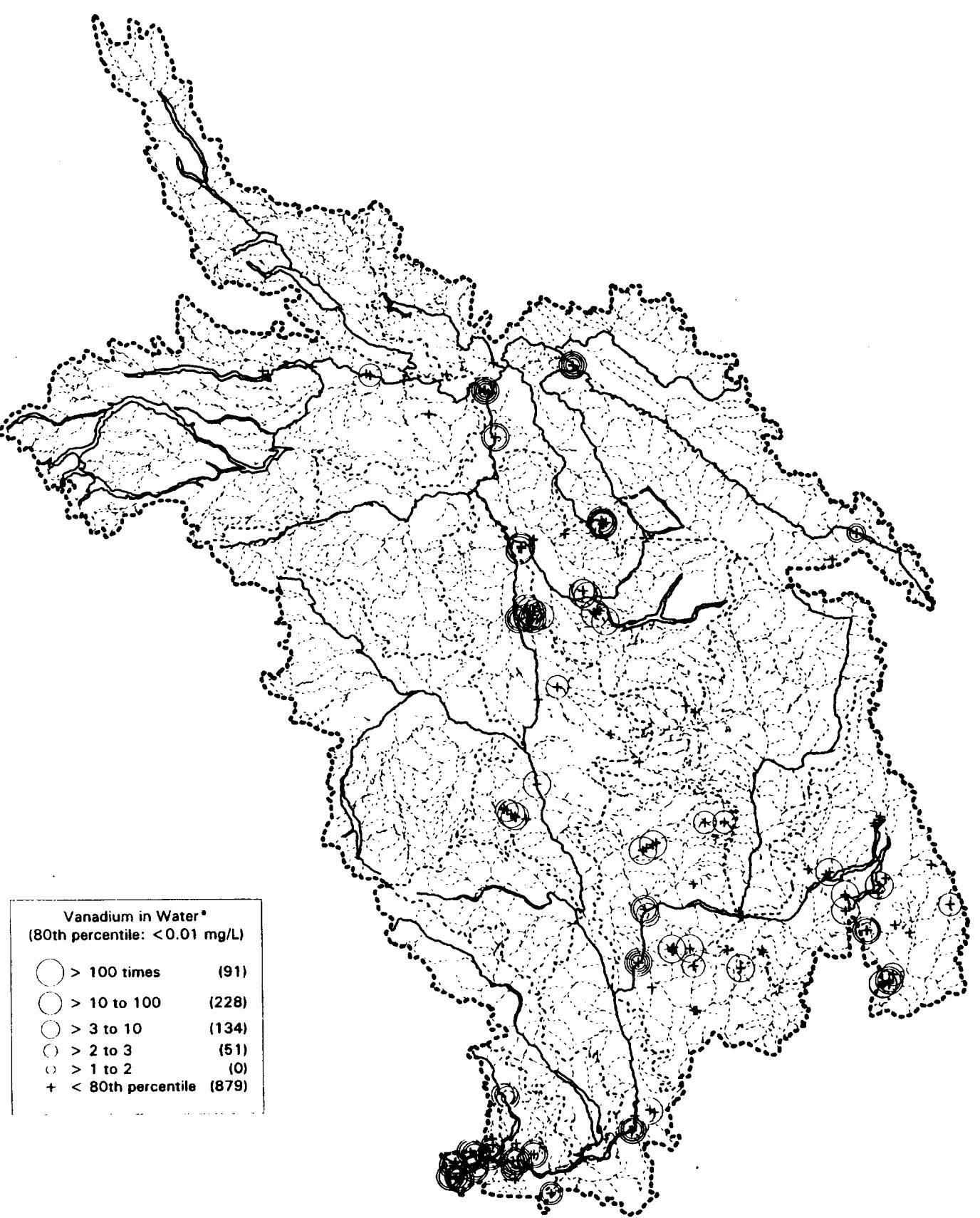


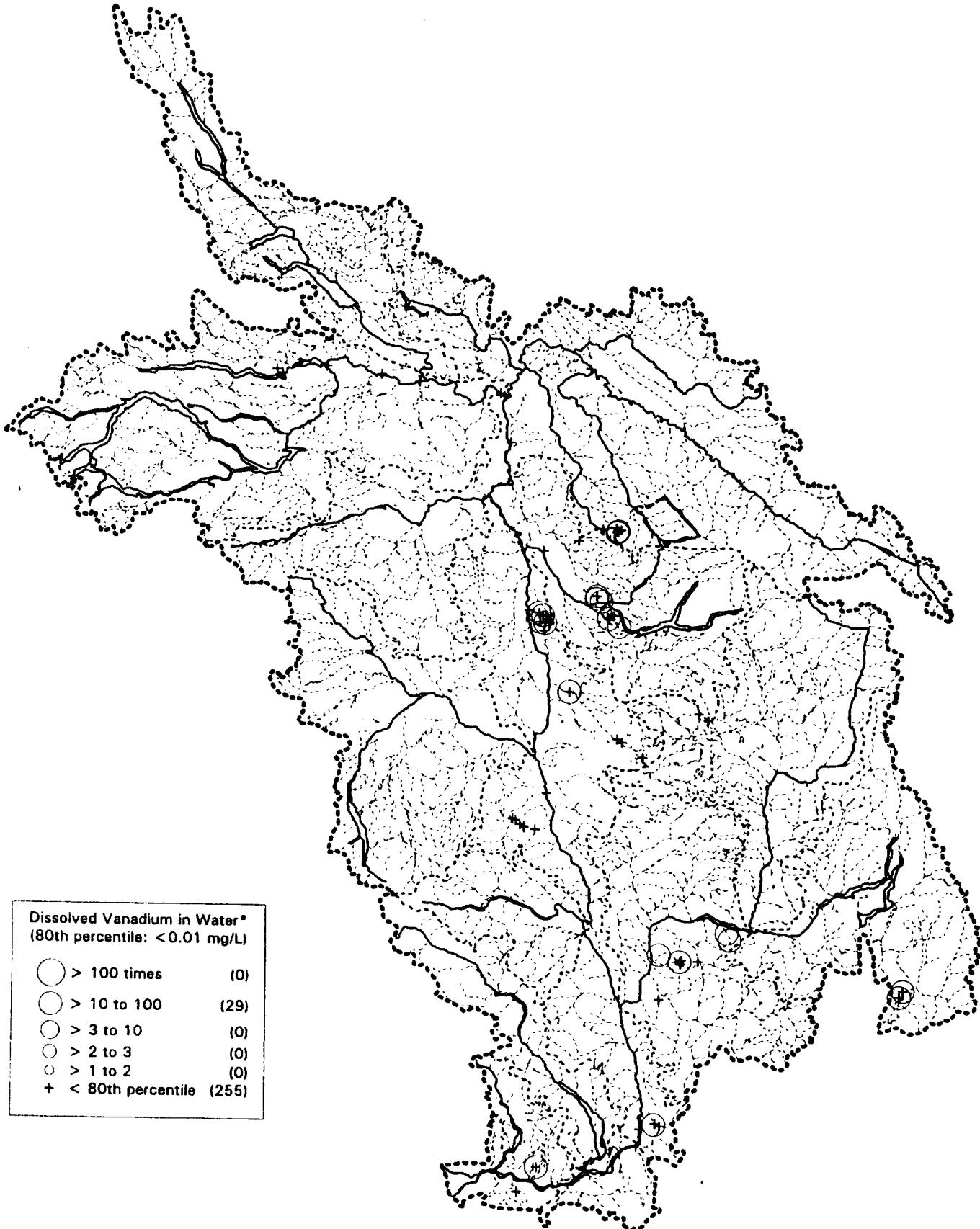


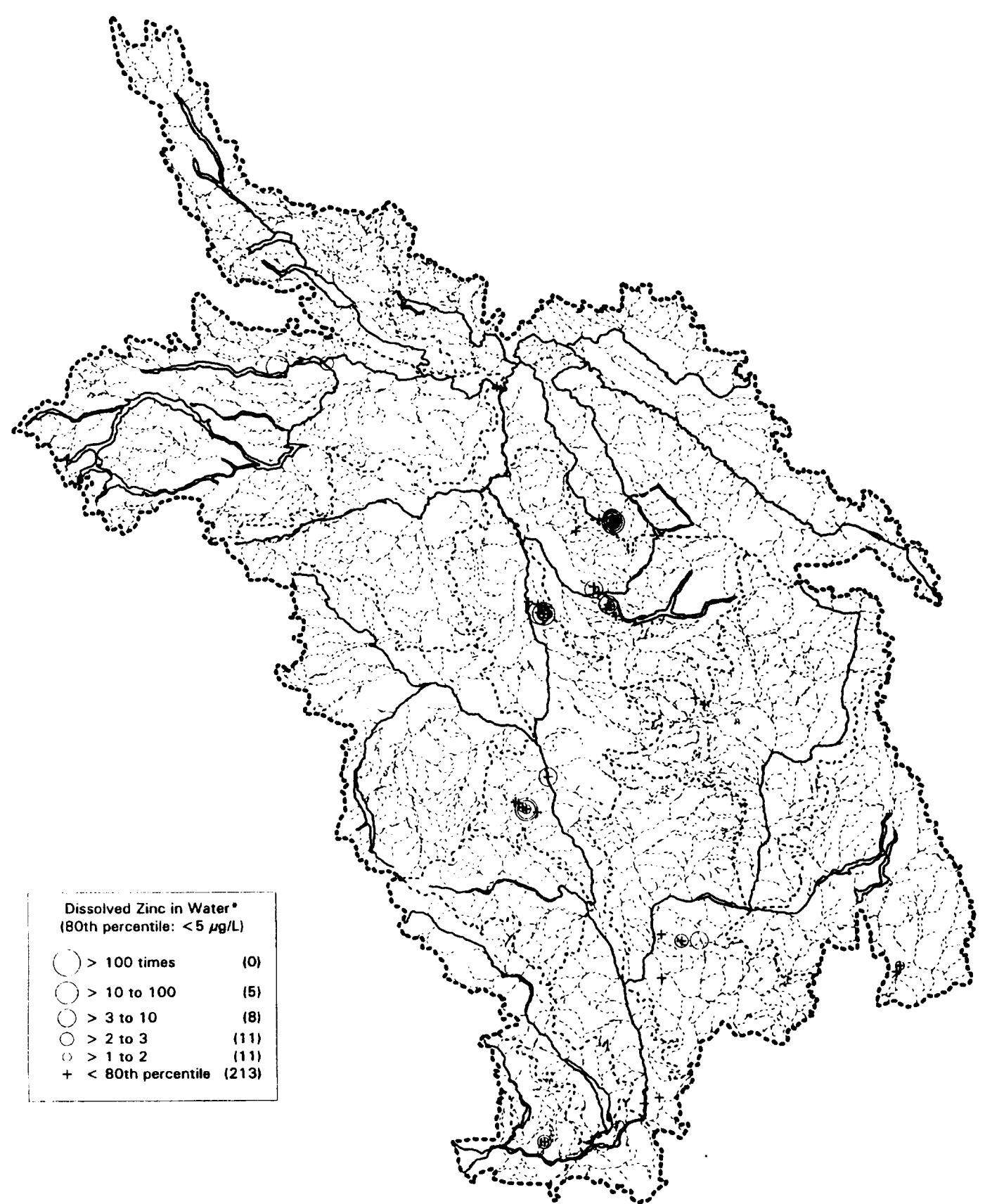












2.3.7 Nutrients in water

Ammonium

Dissolved Ammonia Nitrogen

Total Kjeldahl Nitrogen

Dissolved Kjeldahl Nitrogen

Total Nitrate Nitrogen

Dissolved Nitrate Nitrogen

Soluble Nitrate

Dissolved Nitrite Nitrogen

Total NO₂/NO₃ Nitrogen

Dissolved NO₂/NO₃ Nitrogen

Total Nitrogen

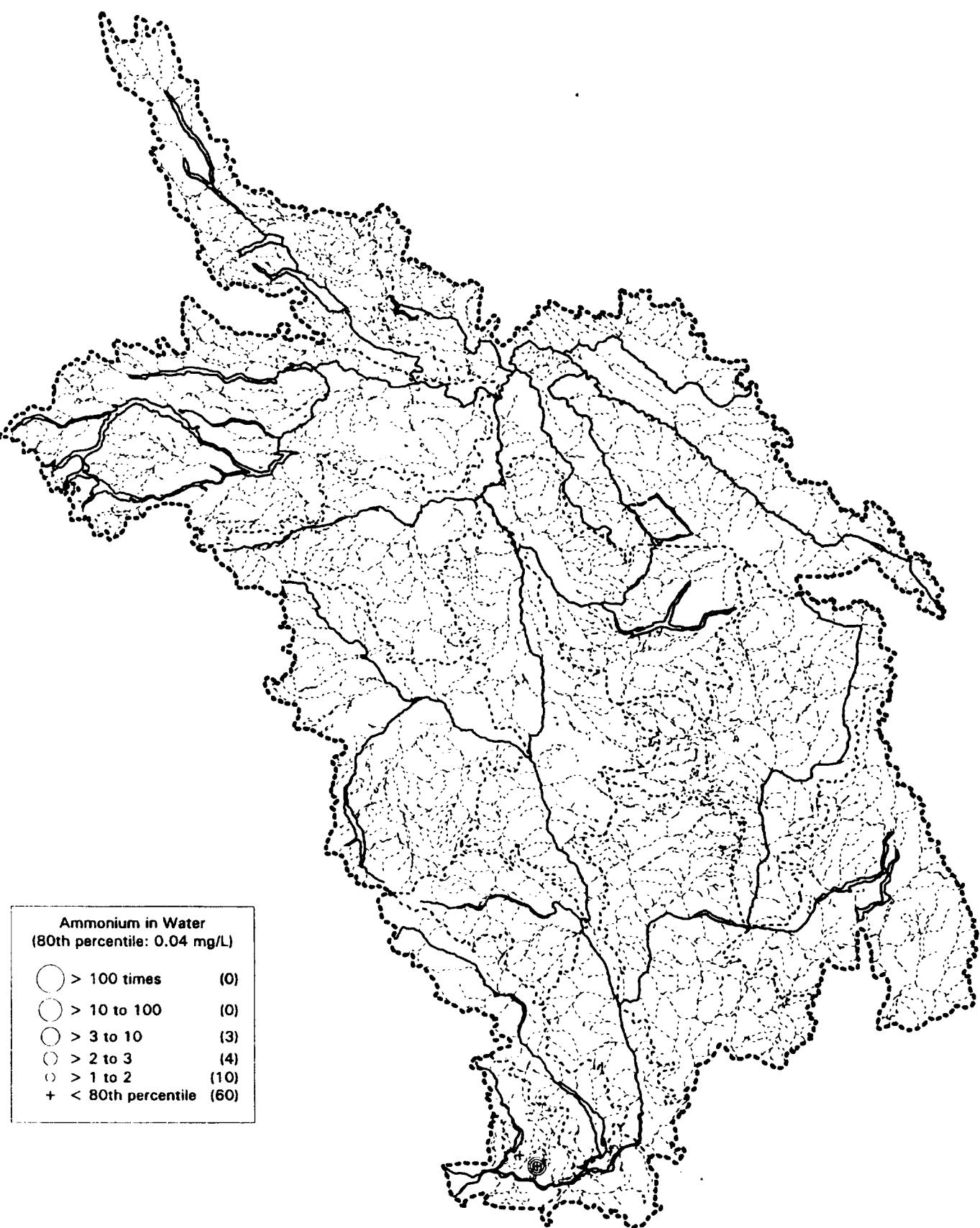
Total Dissolved Nitrogen

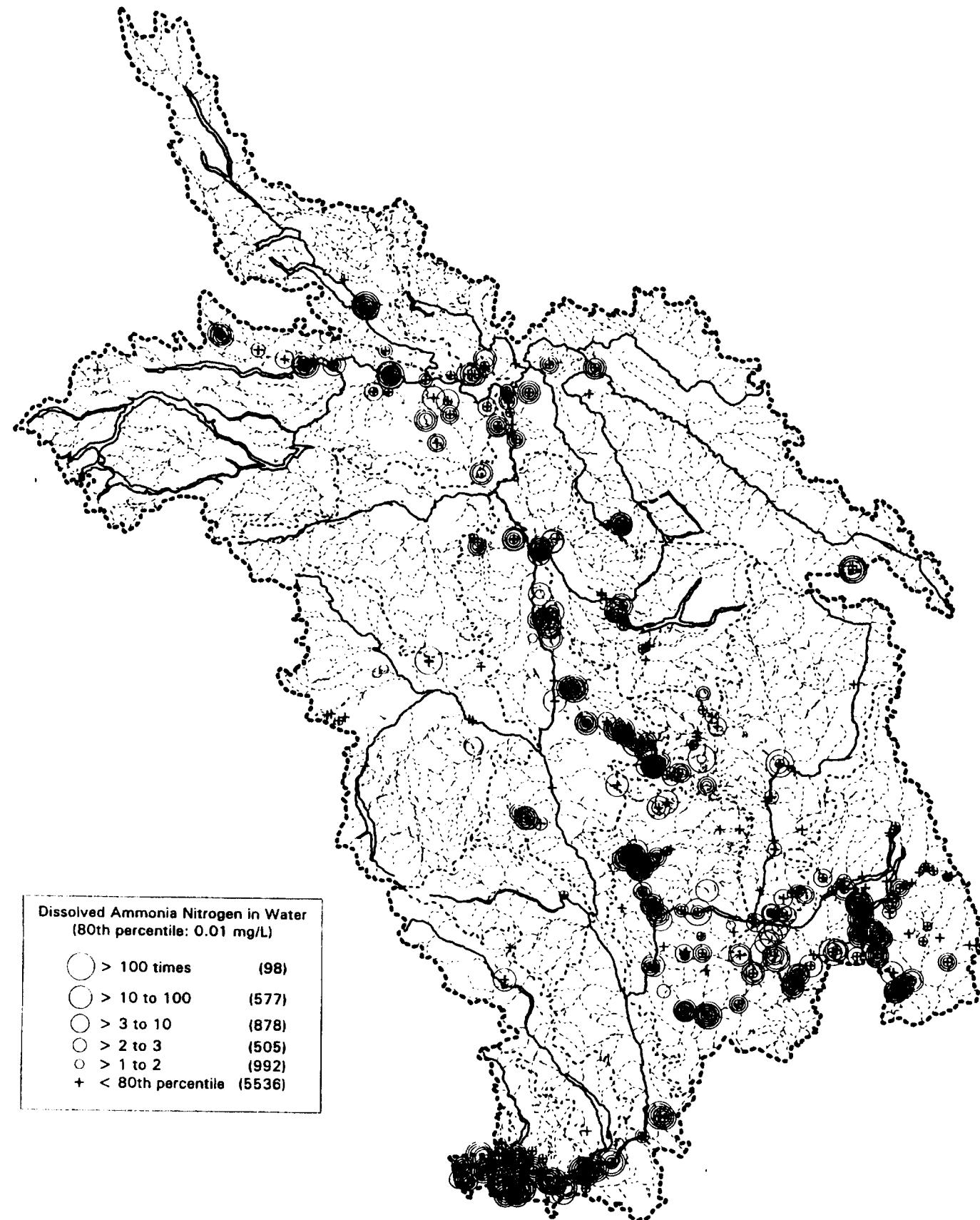
Total Organic Nitrogen

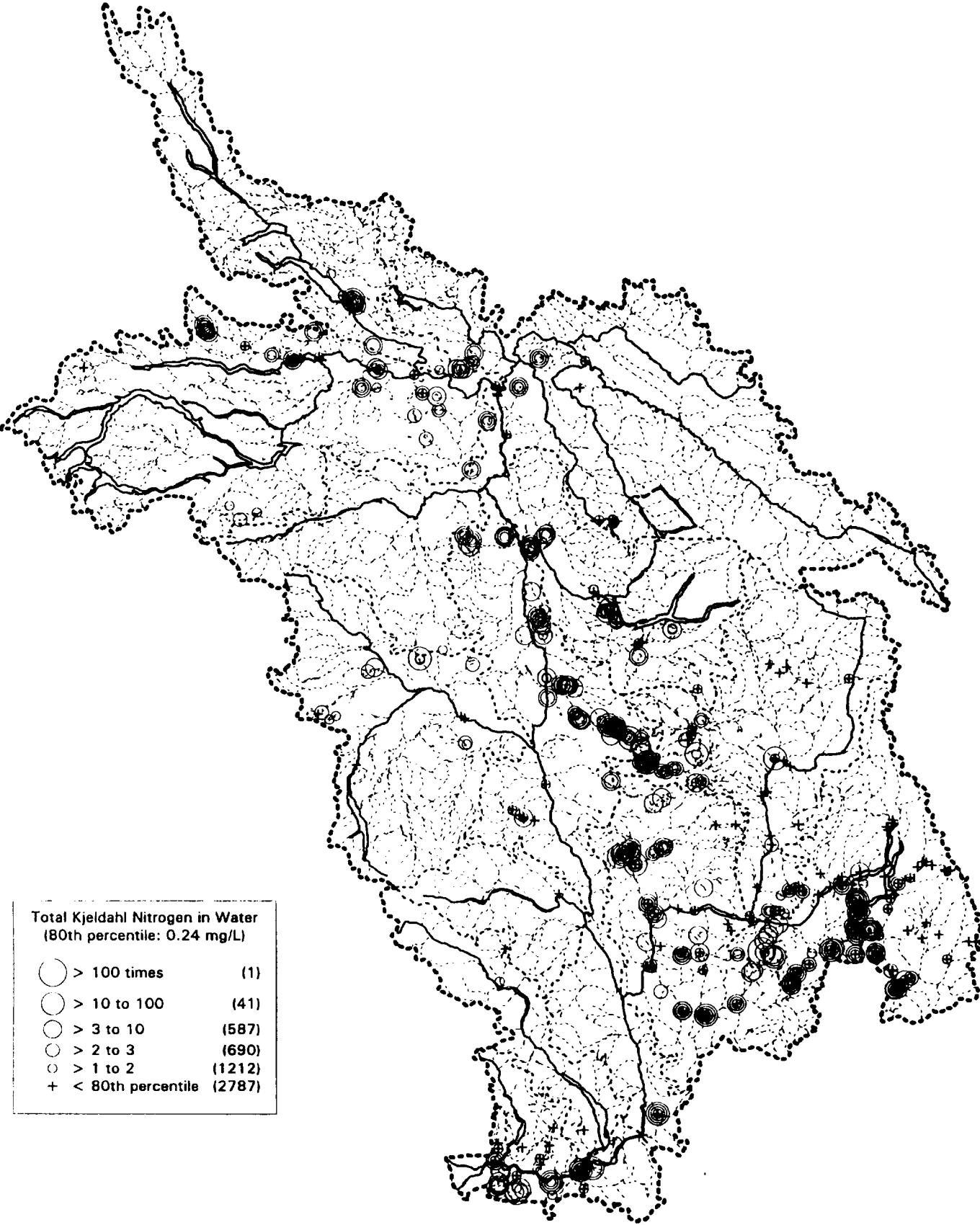
Ortho Phosphorus

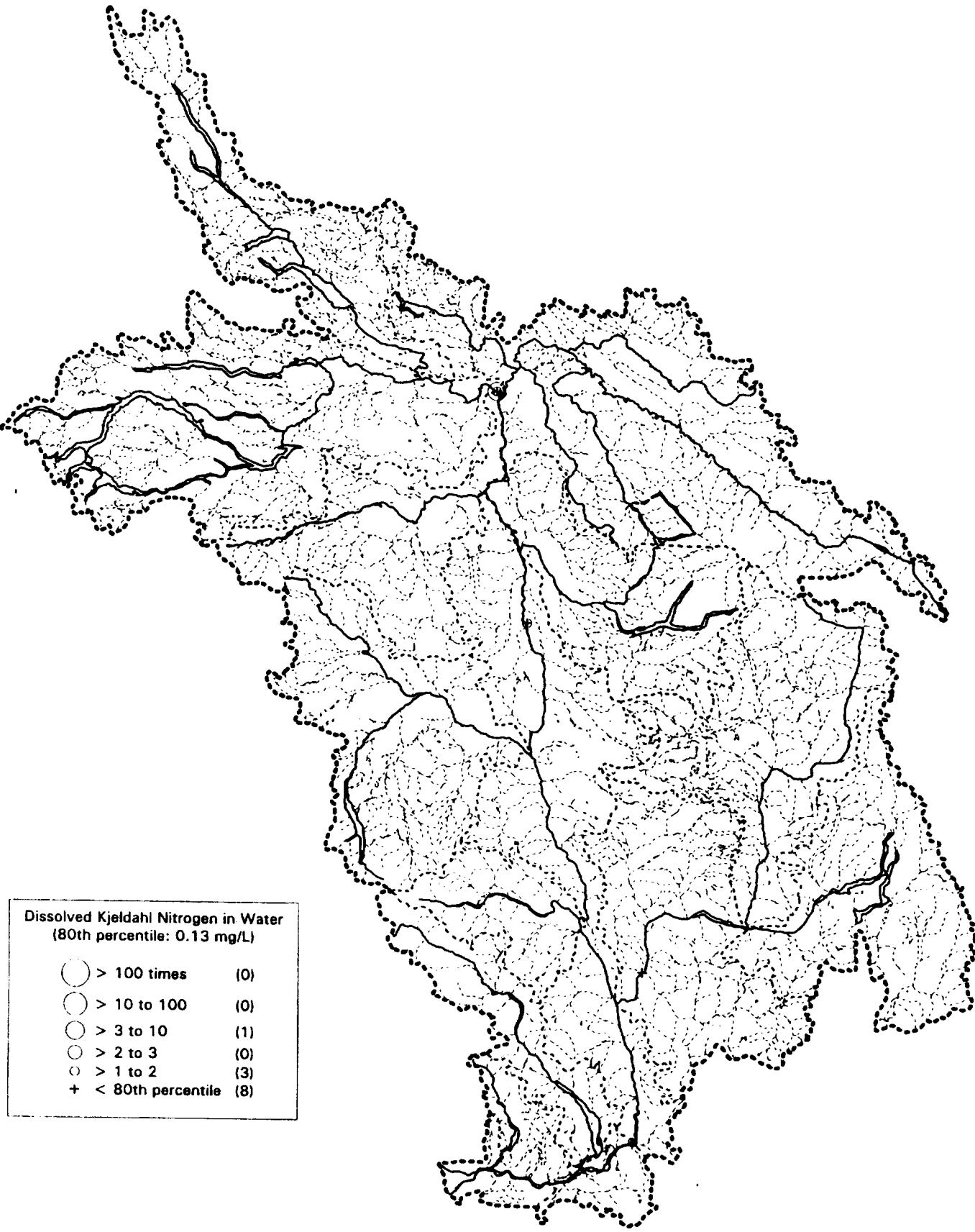
Dissolved Ortho Phosphorus

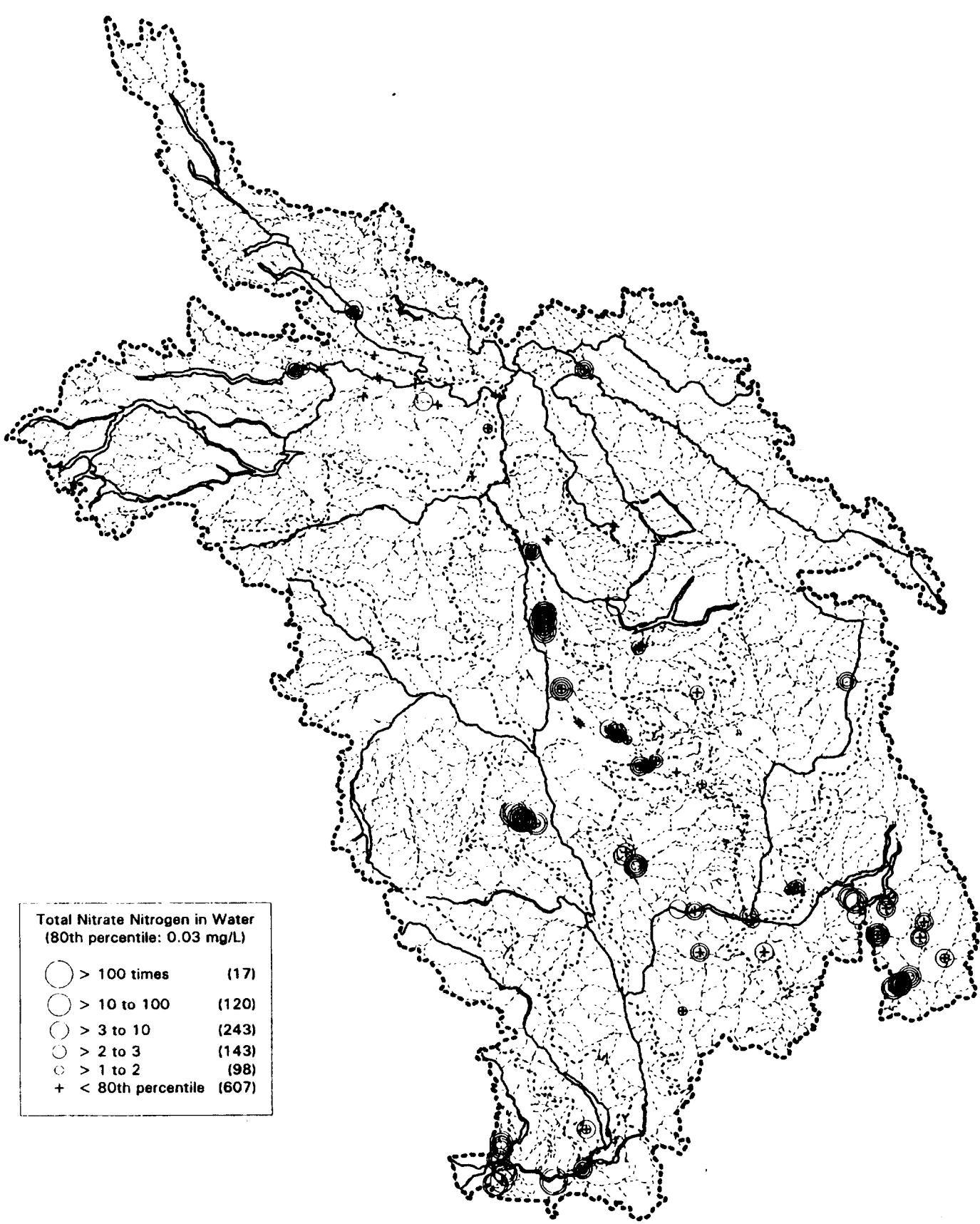
Total Dissolved Phosphorus

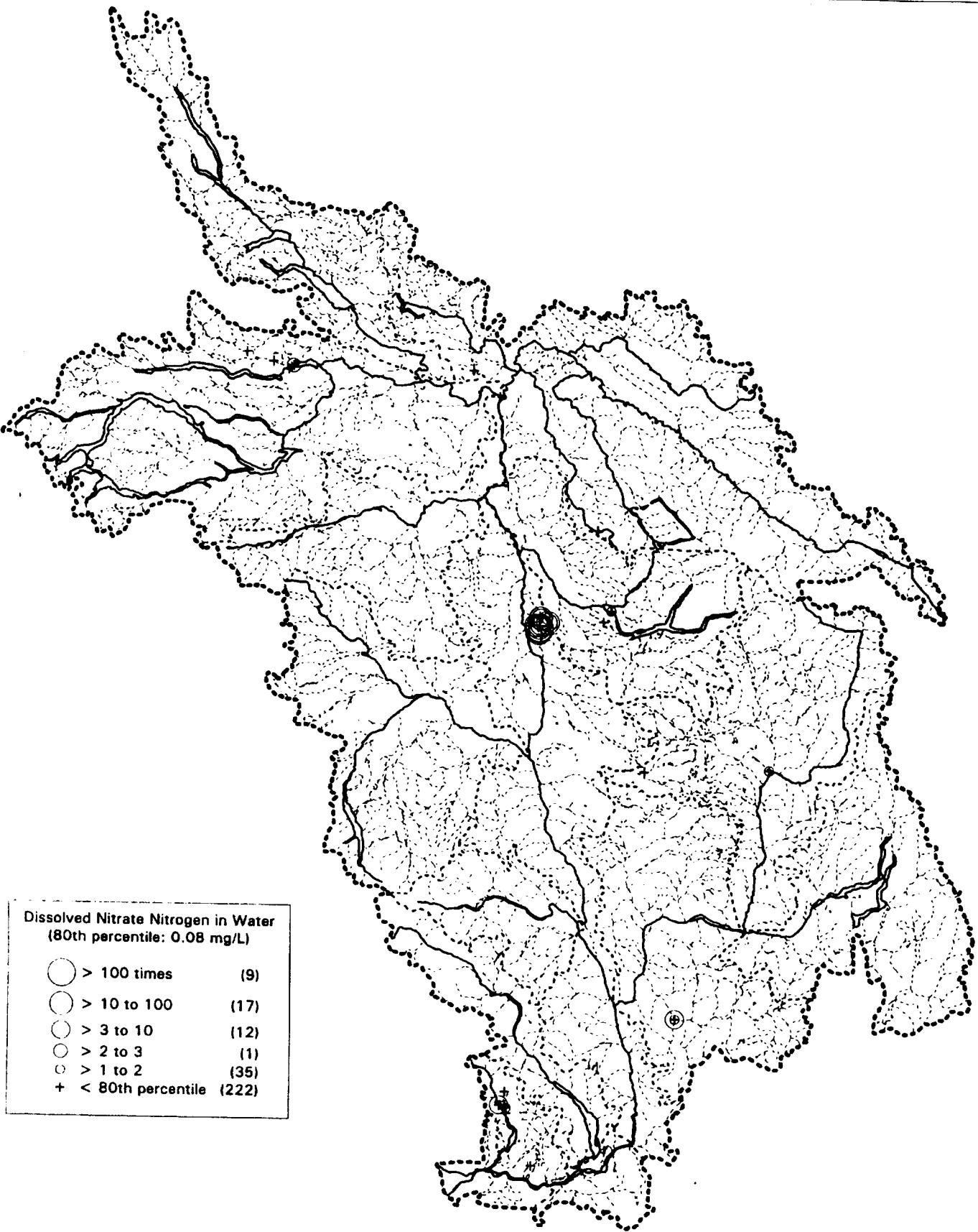


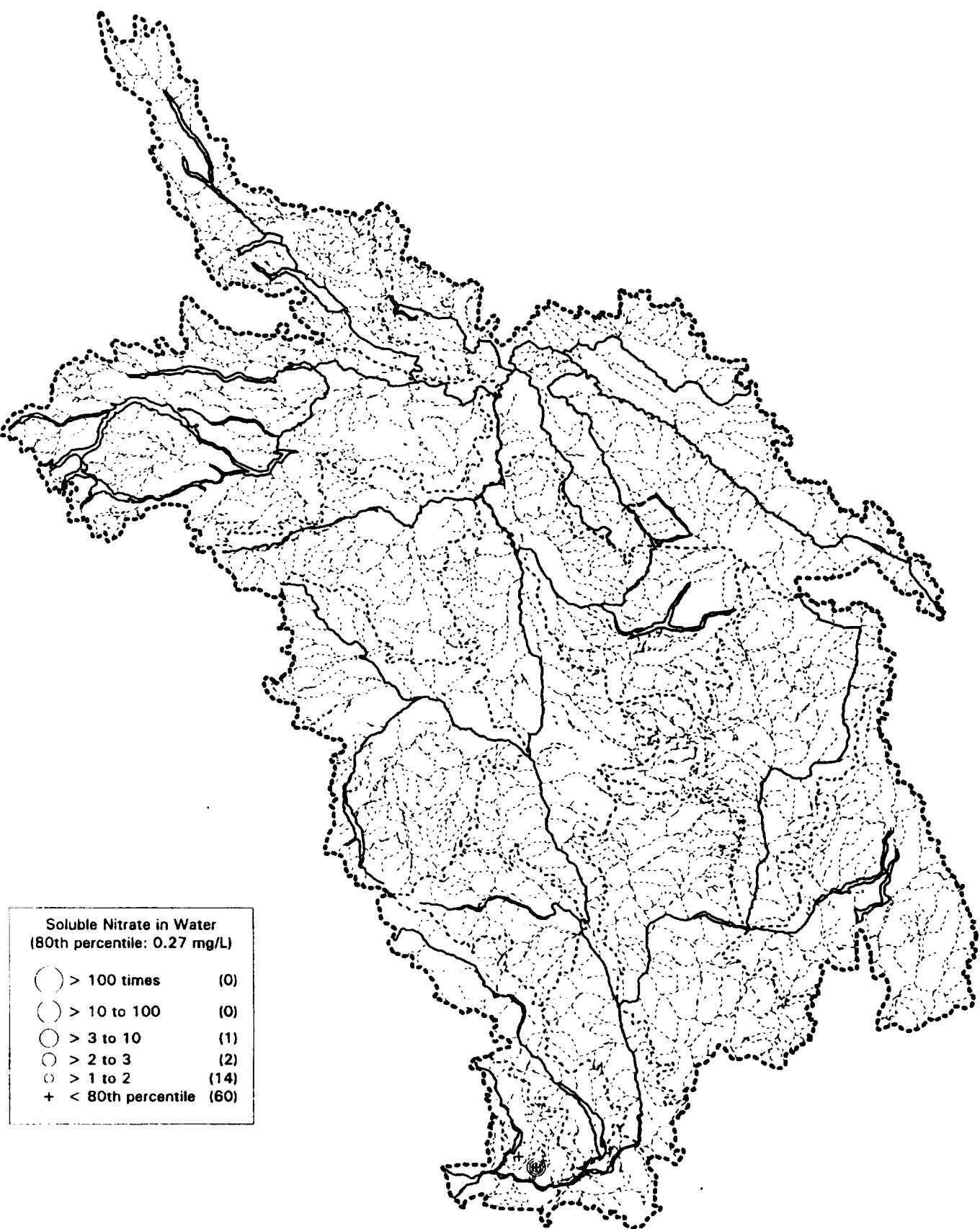


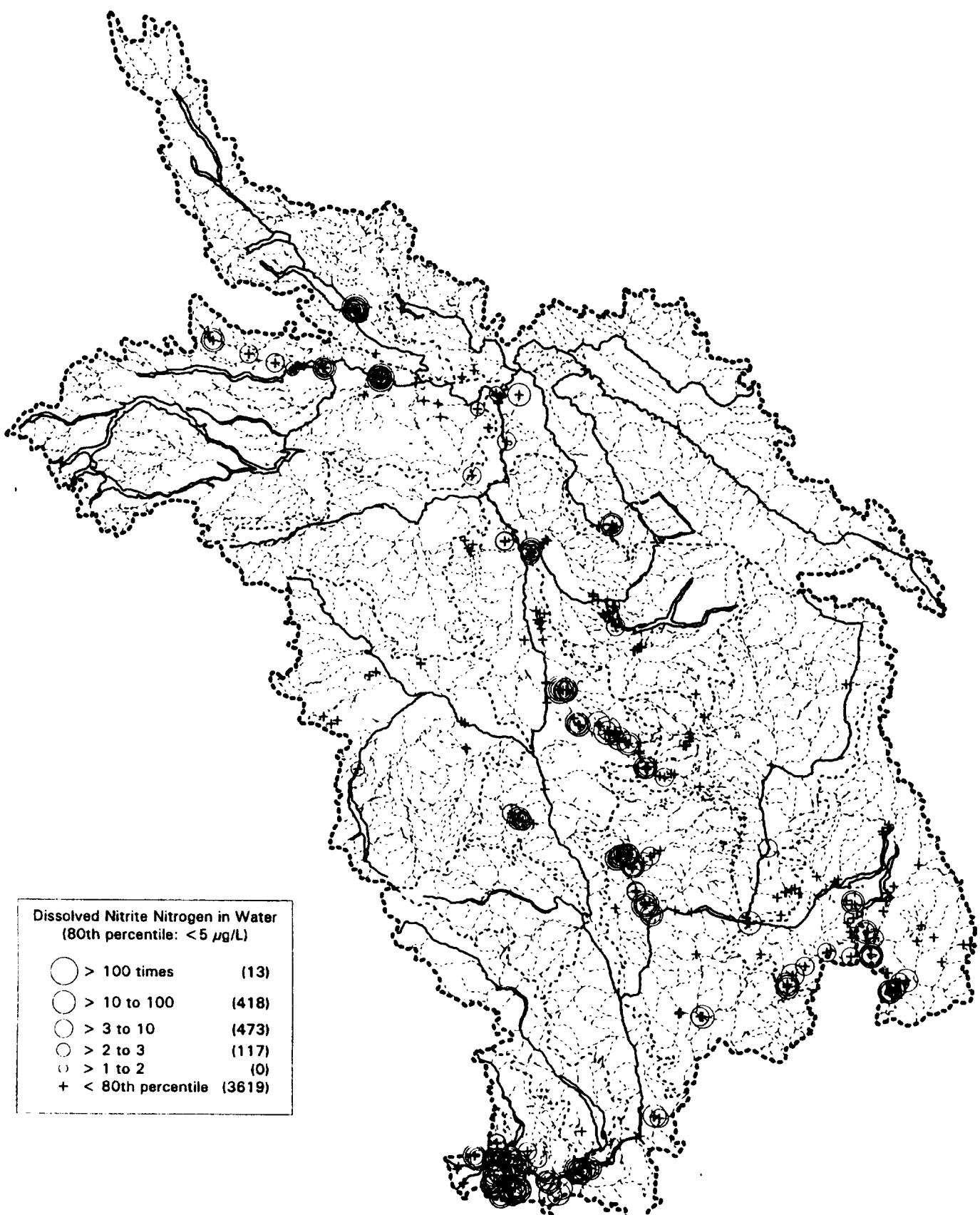


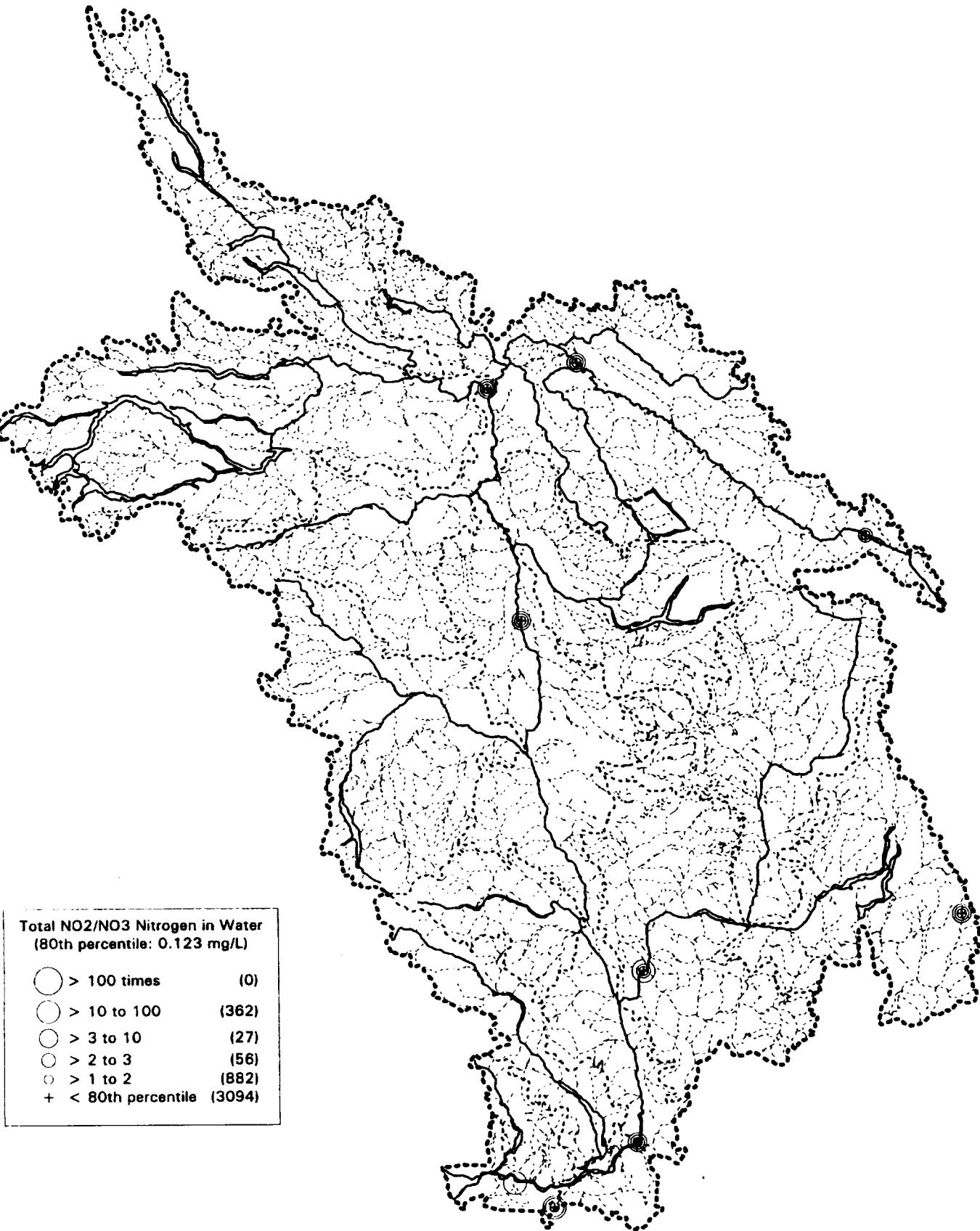


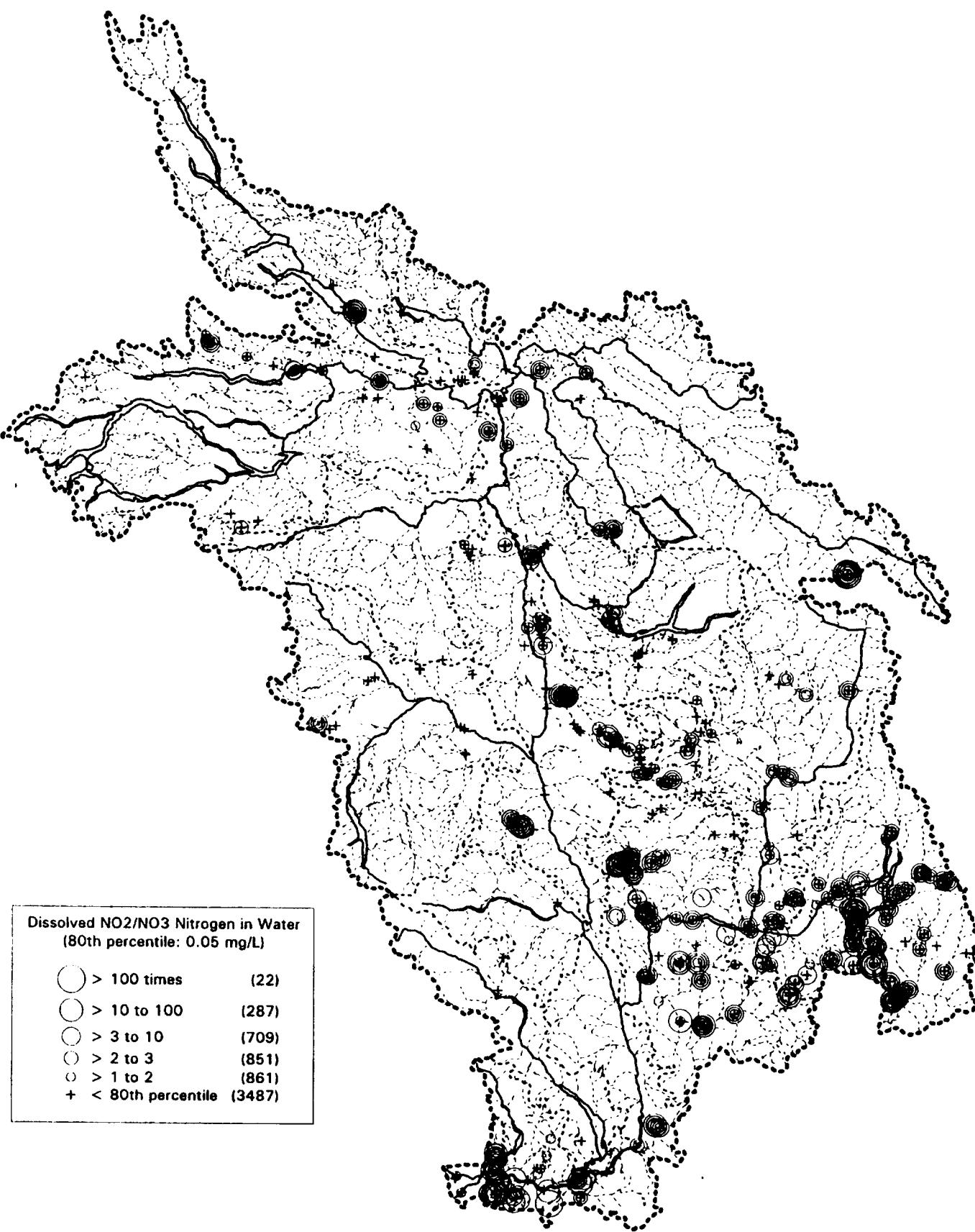


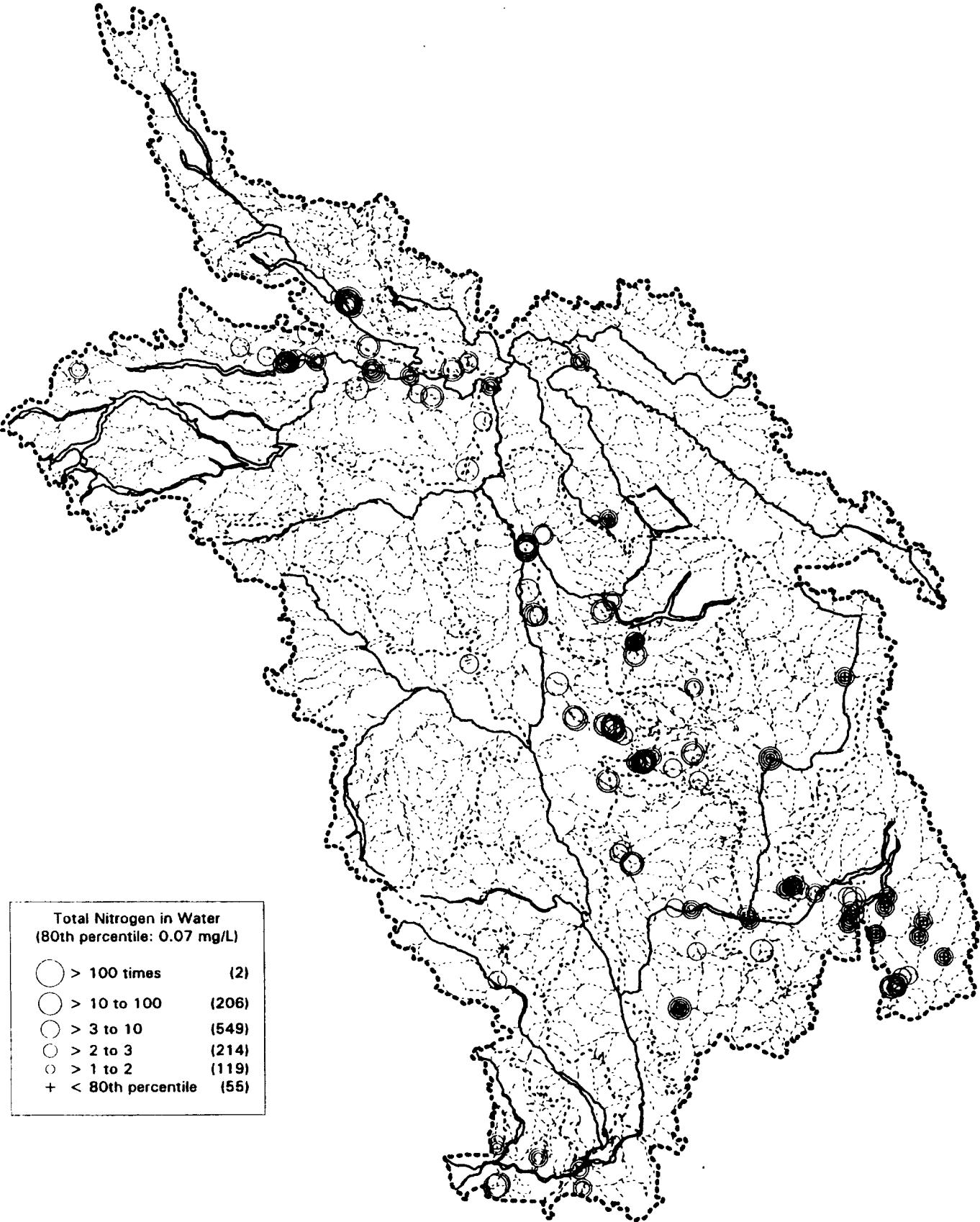


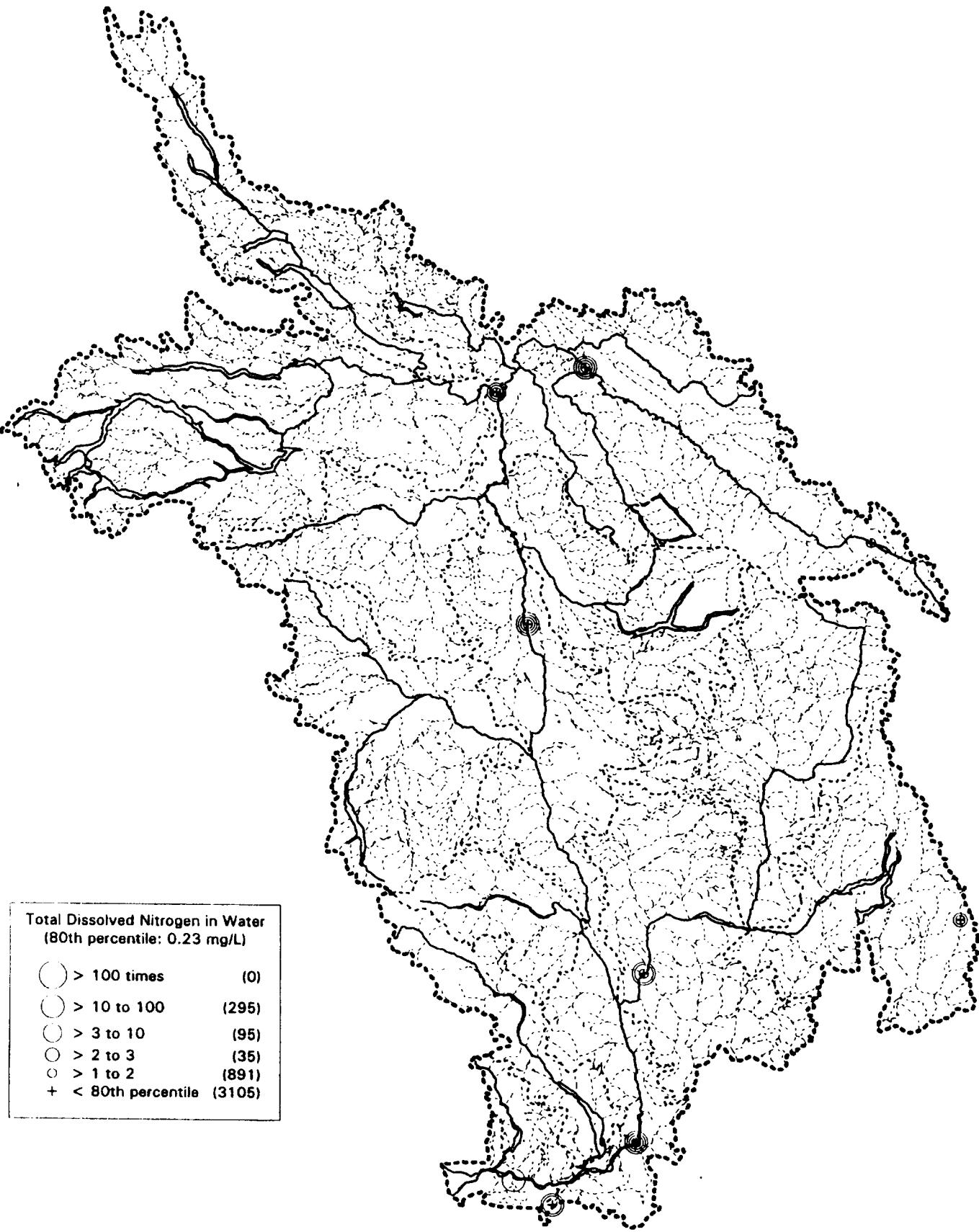


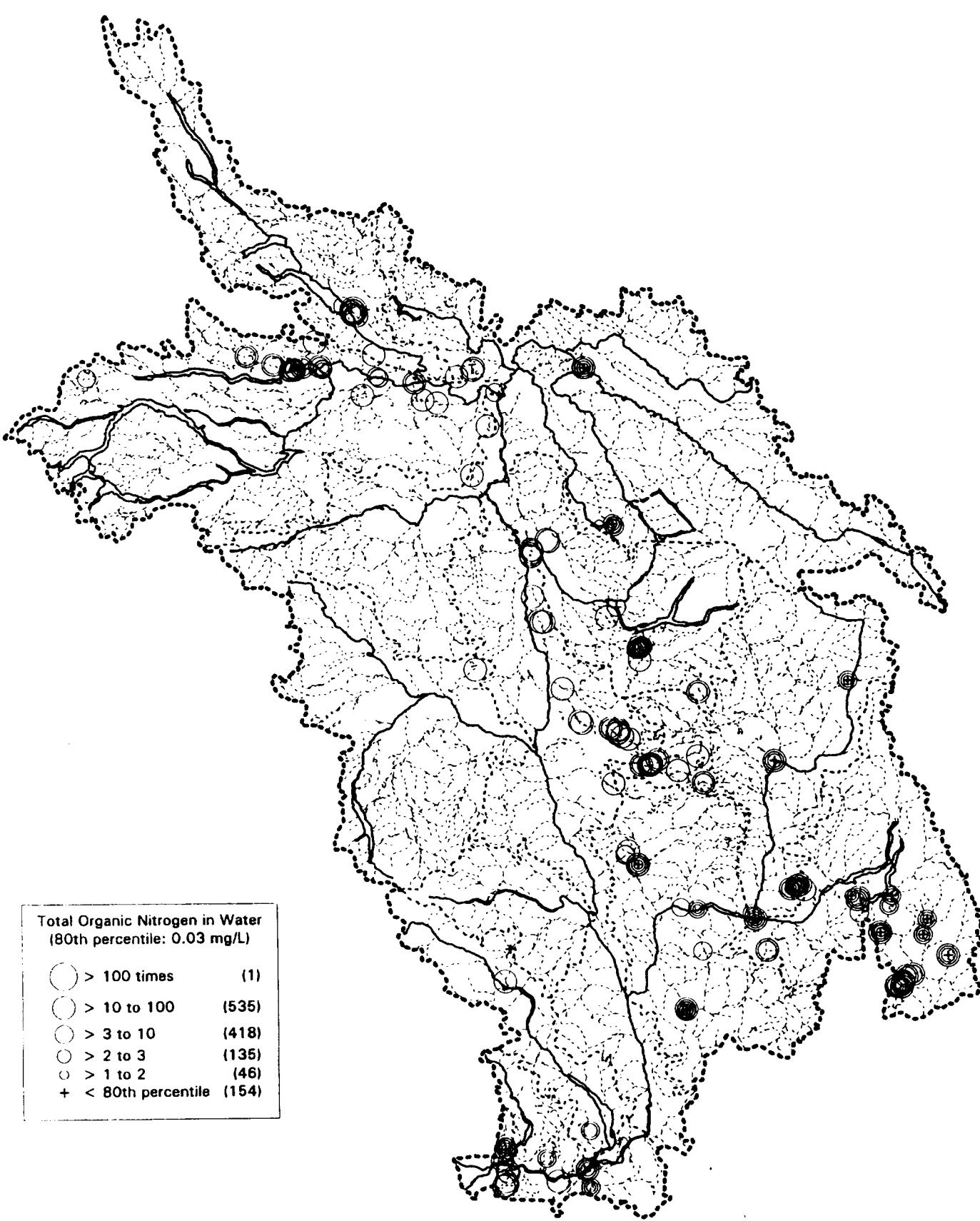






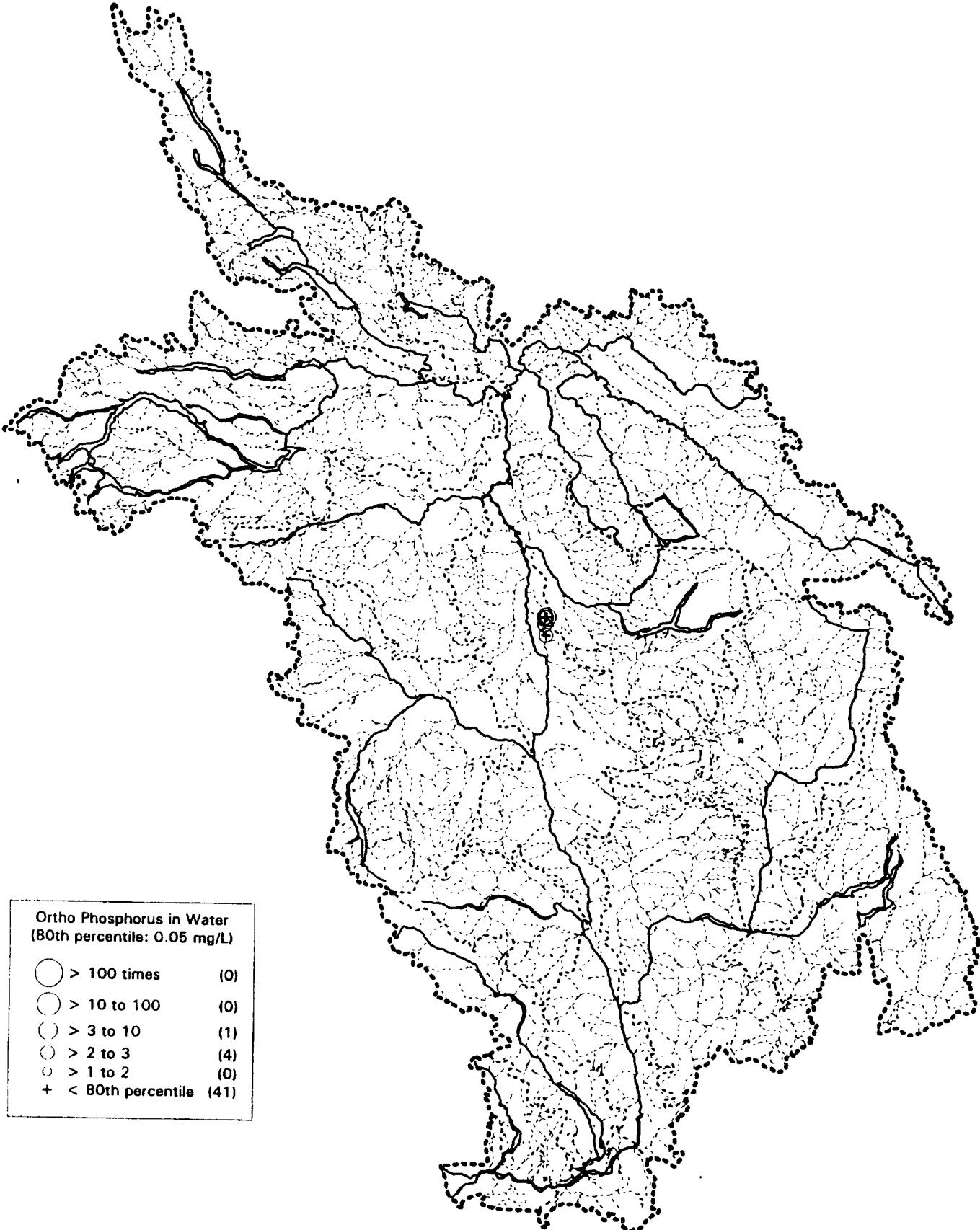






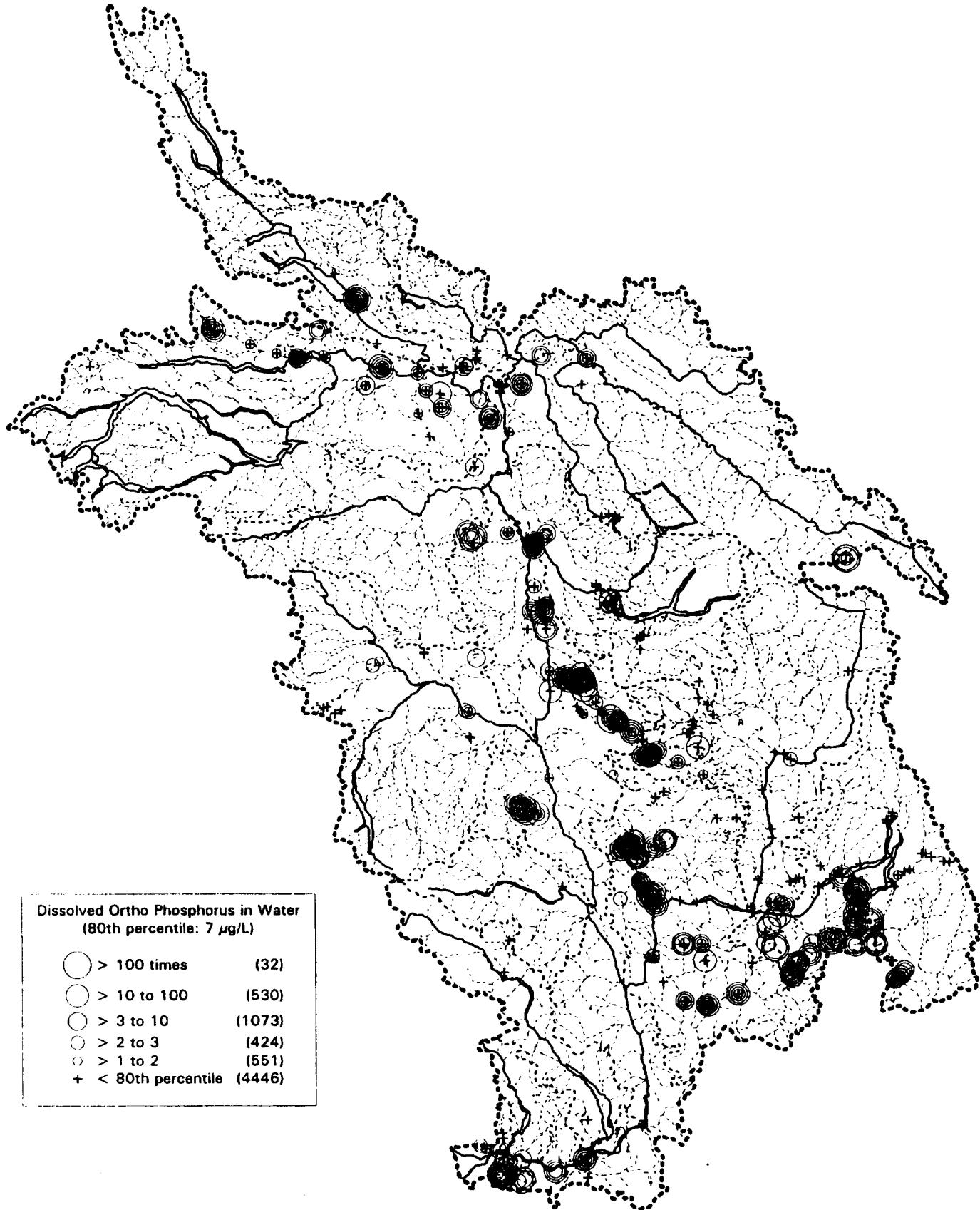
Total Organic Nitrogen in Water
(80th percentile: 0.03 mg/L)

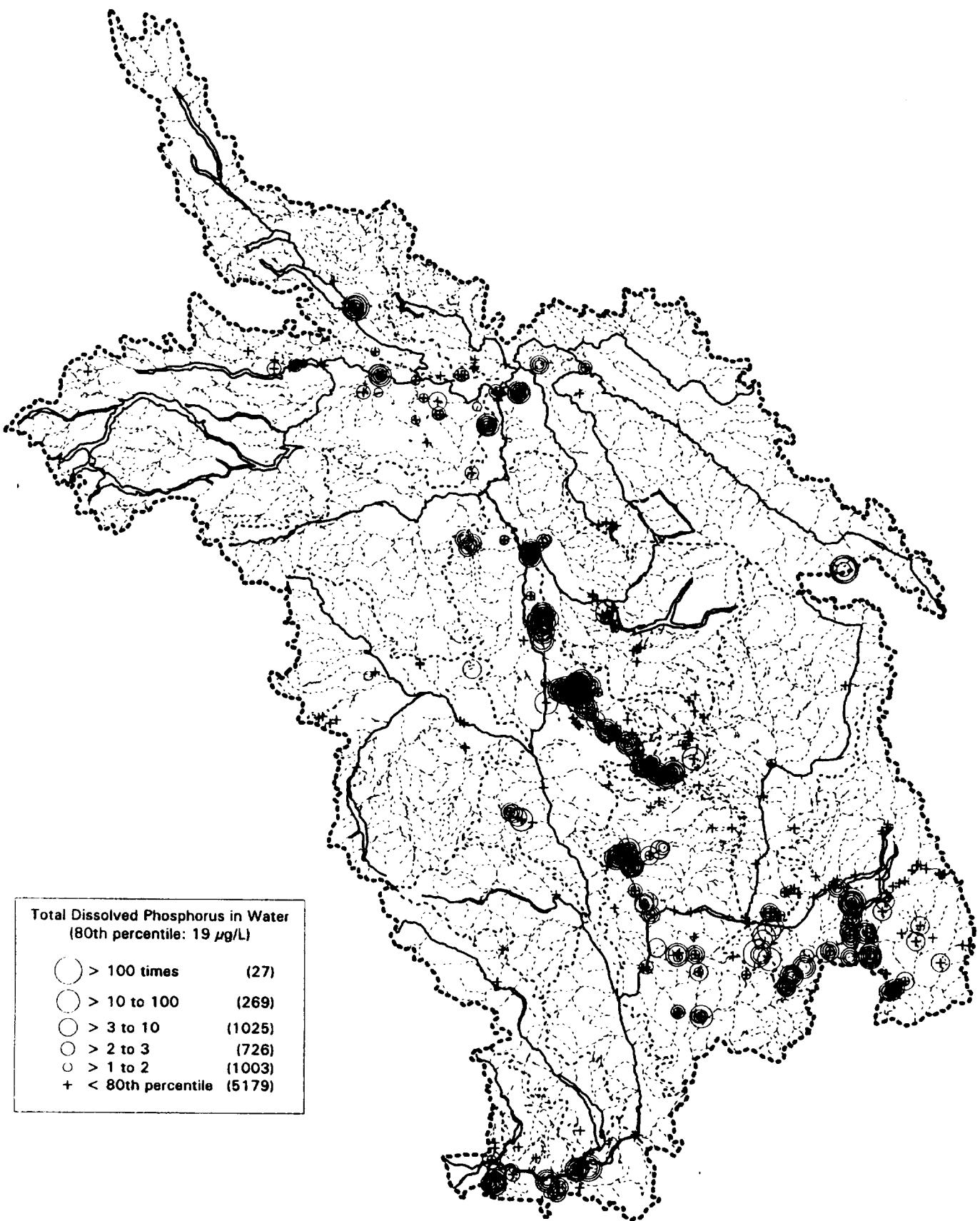
(○) > 100 times	(1)
(○) > 10 to 100	(535)
(○) > 3 to 10	(418)
(○) > 2 to 3	(135)
(○) > 1 to 2	(46)
(+ < 80th percentile	(154)



Dissolved Ortho Phosphorus in Water
(80th percentile: 7 µg/L)

○ > 100 times	(32)
○ > 10 to 100	(530)
○ > 3 to 10	(1073)
○ > 2 to 3	(424)
○ > 1 to 2	(551)
+ < 80th percentile	(4446)

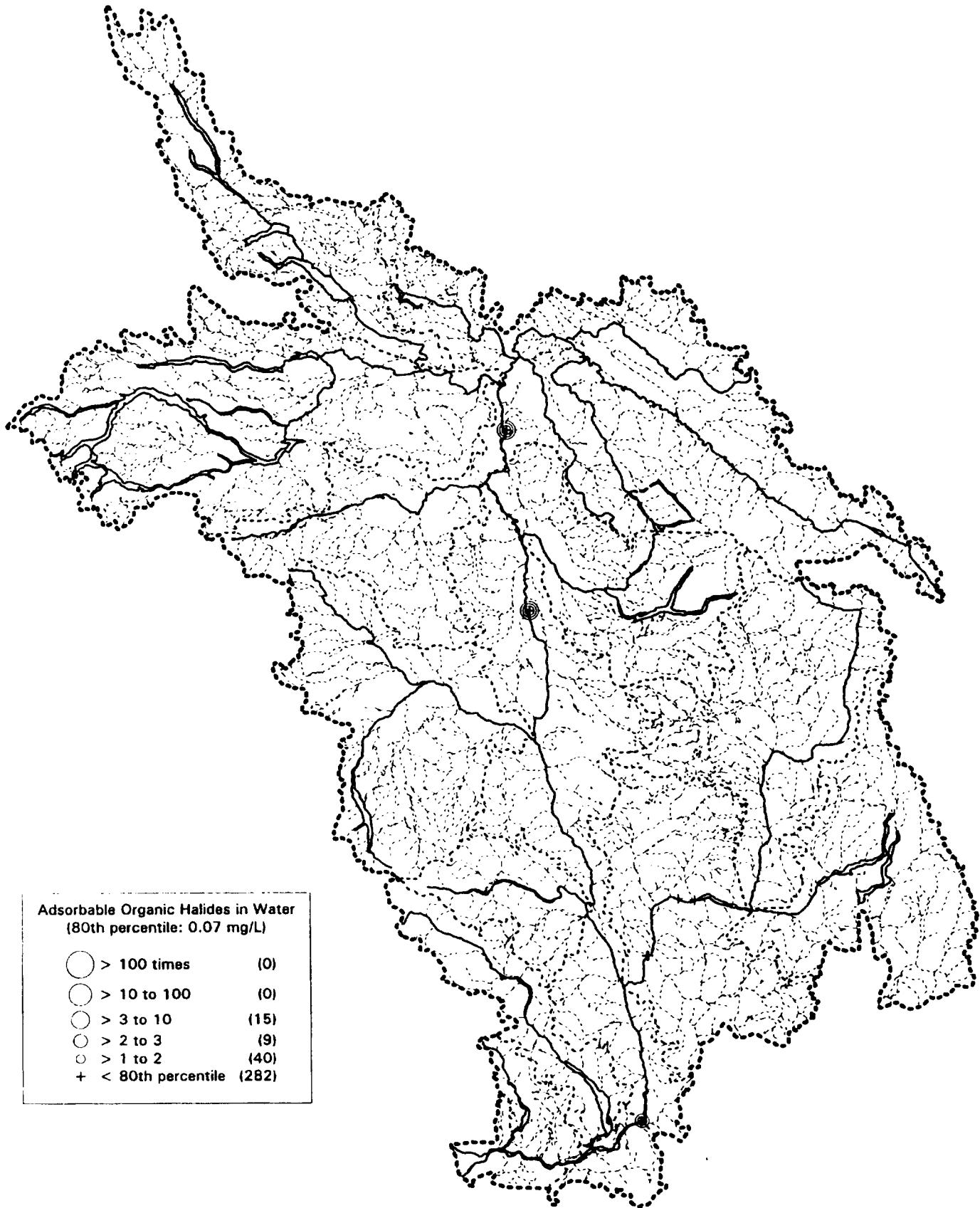
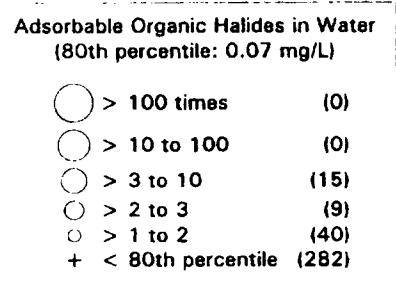


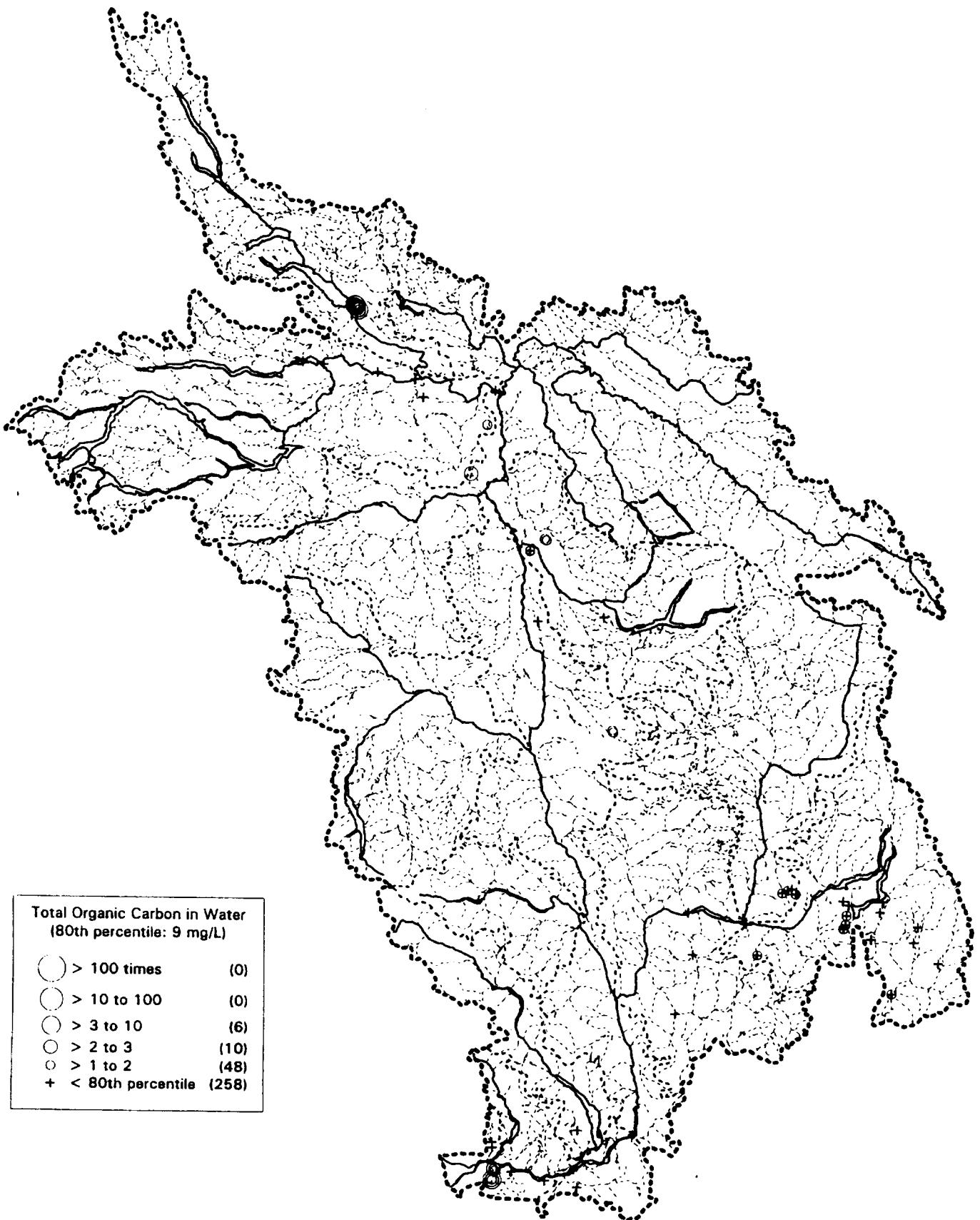


2.3.8 Organics, miscellaneous in water

Adsorbable Organic Halides

Total Organic Carbon





2.3.9 Physical parameters in water

Acidity pH 8.3

Acidity pH 8.3

Free Acidity

Alkalinity 4.5/4.2

Phenolphthalein 8.3 Alkalinity

Total 4.5 Alkalinity

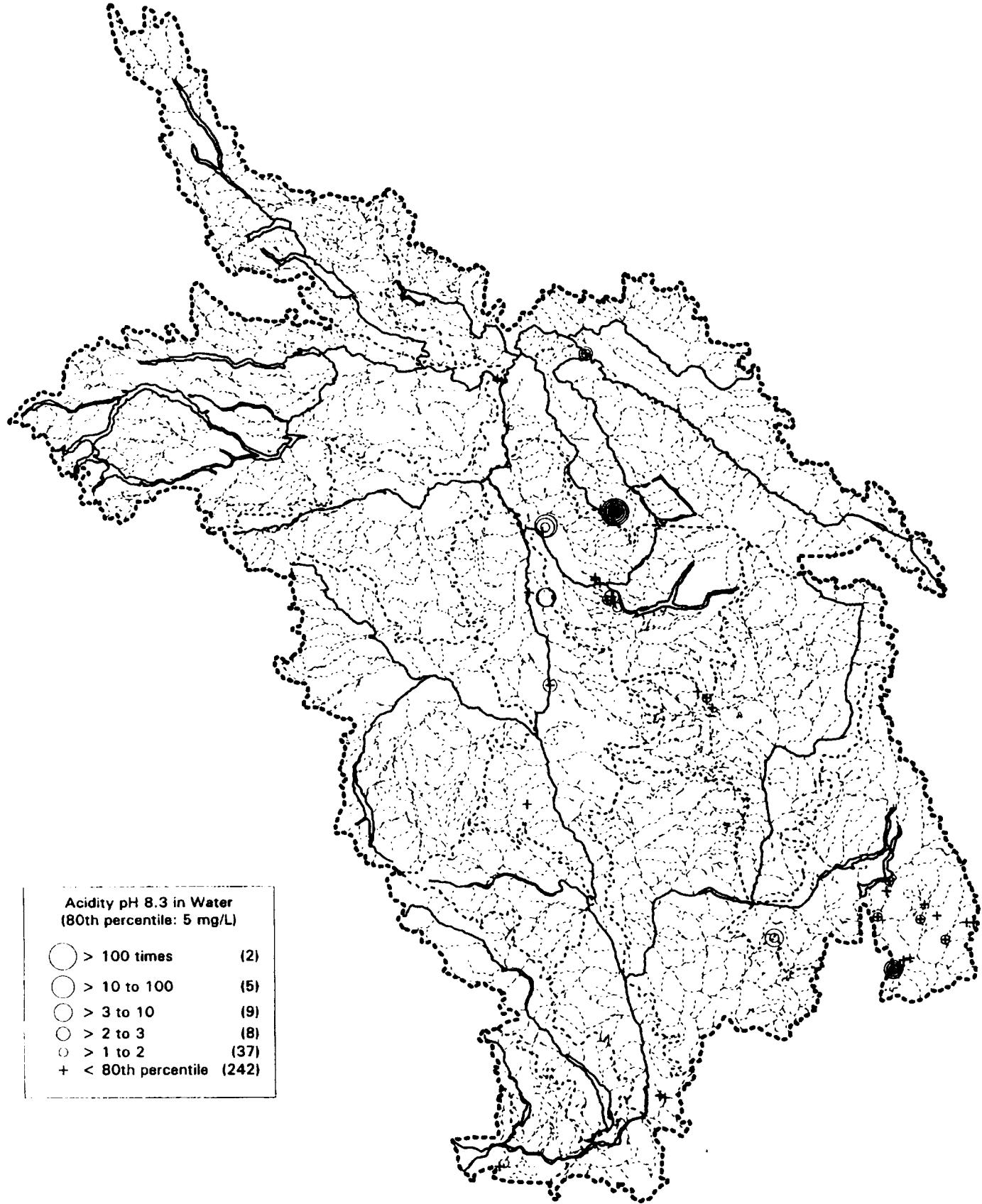
Total Alkalinity

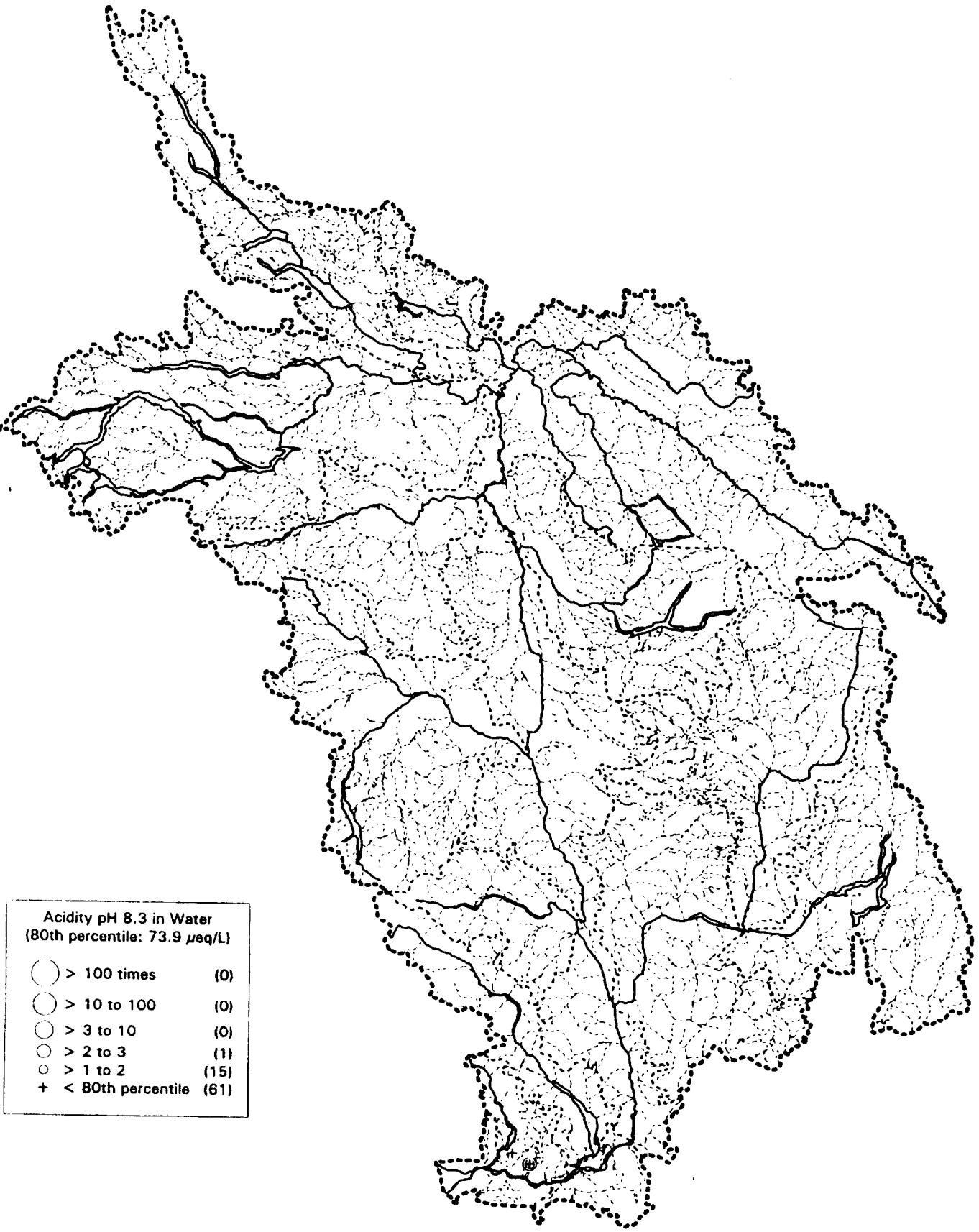
Total Hardness

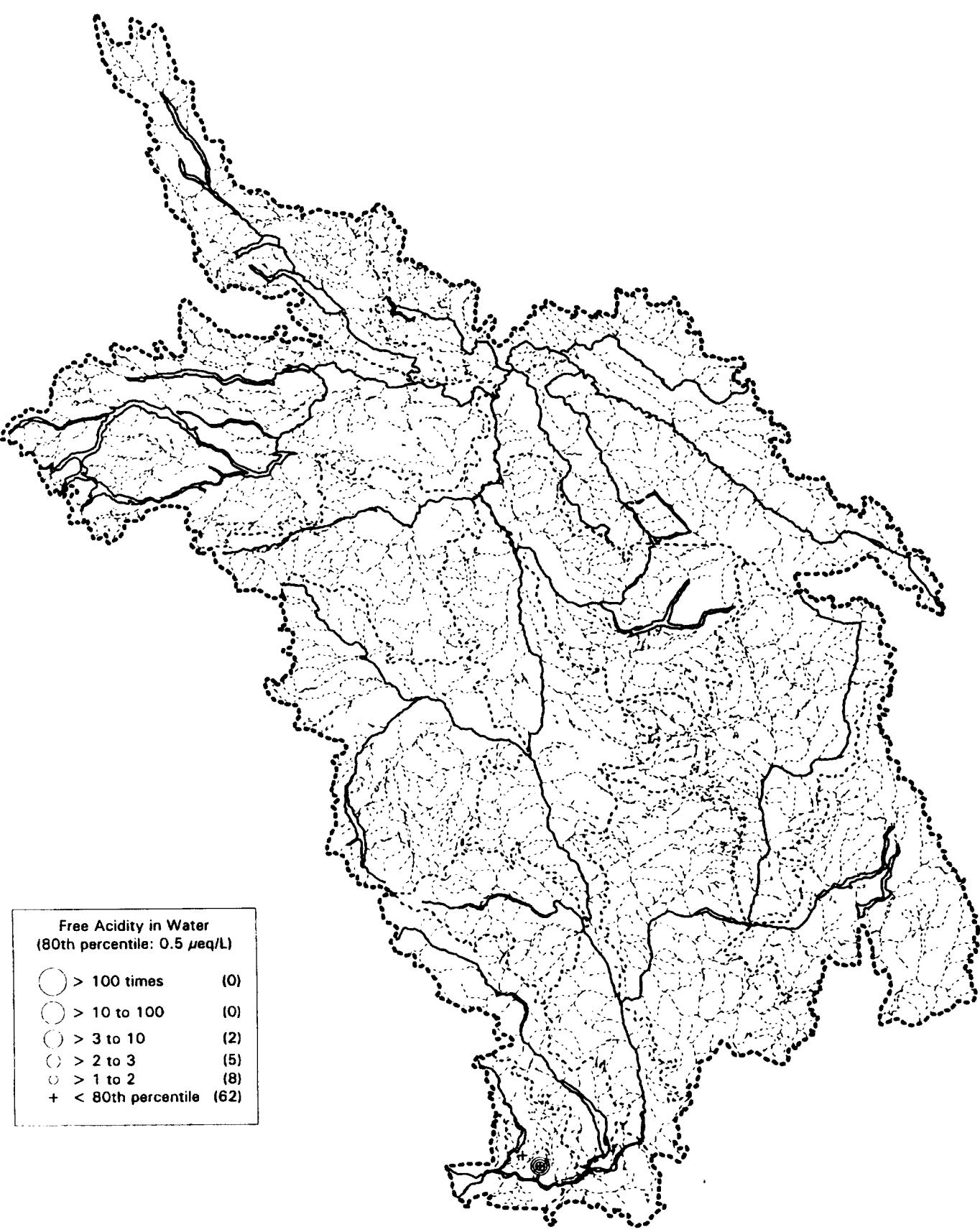
Dissolved Hardness

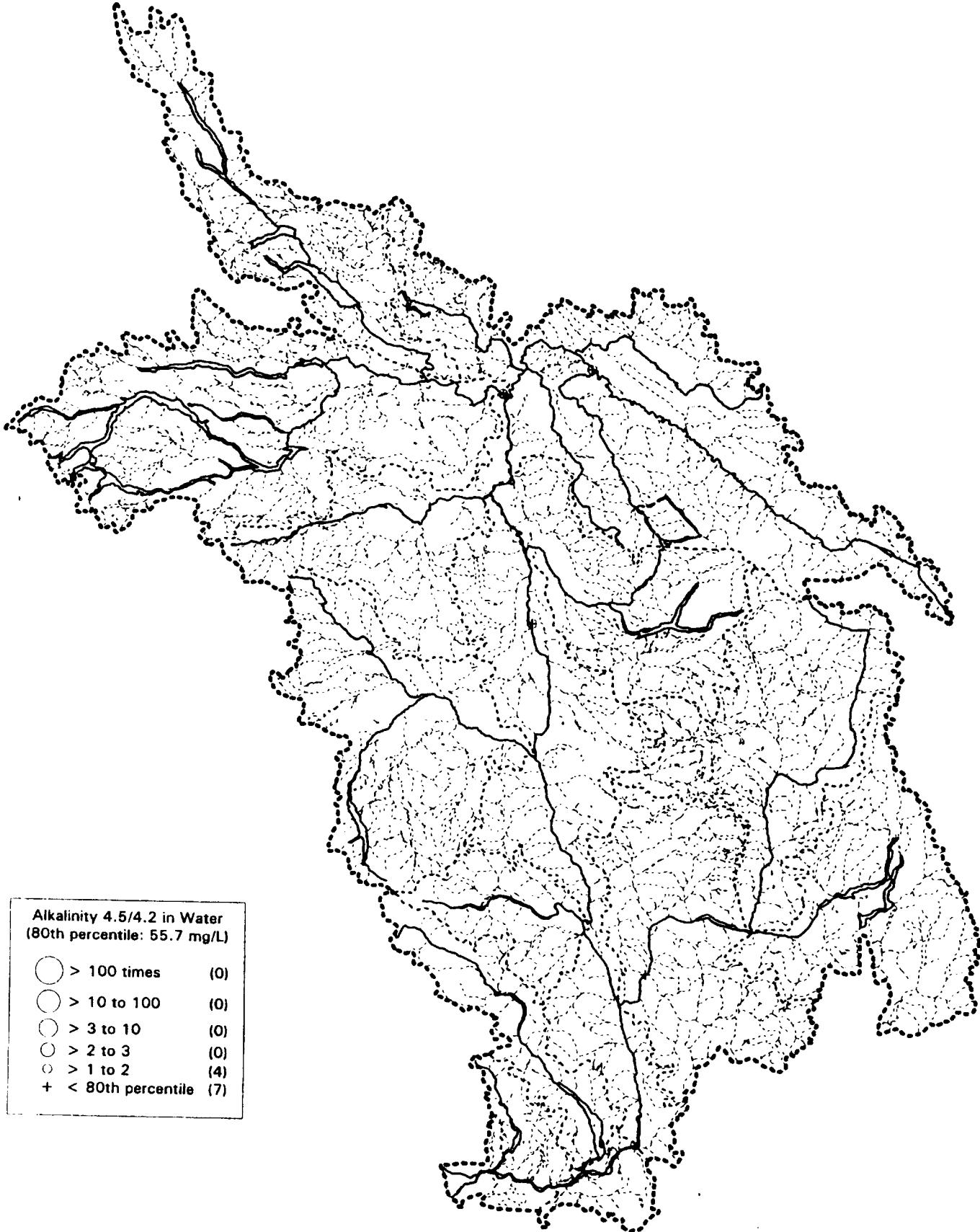
Acidity pH 8.3 in Water
(80th percentile: 5 mg/L)

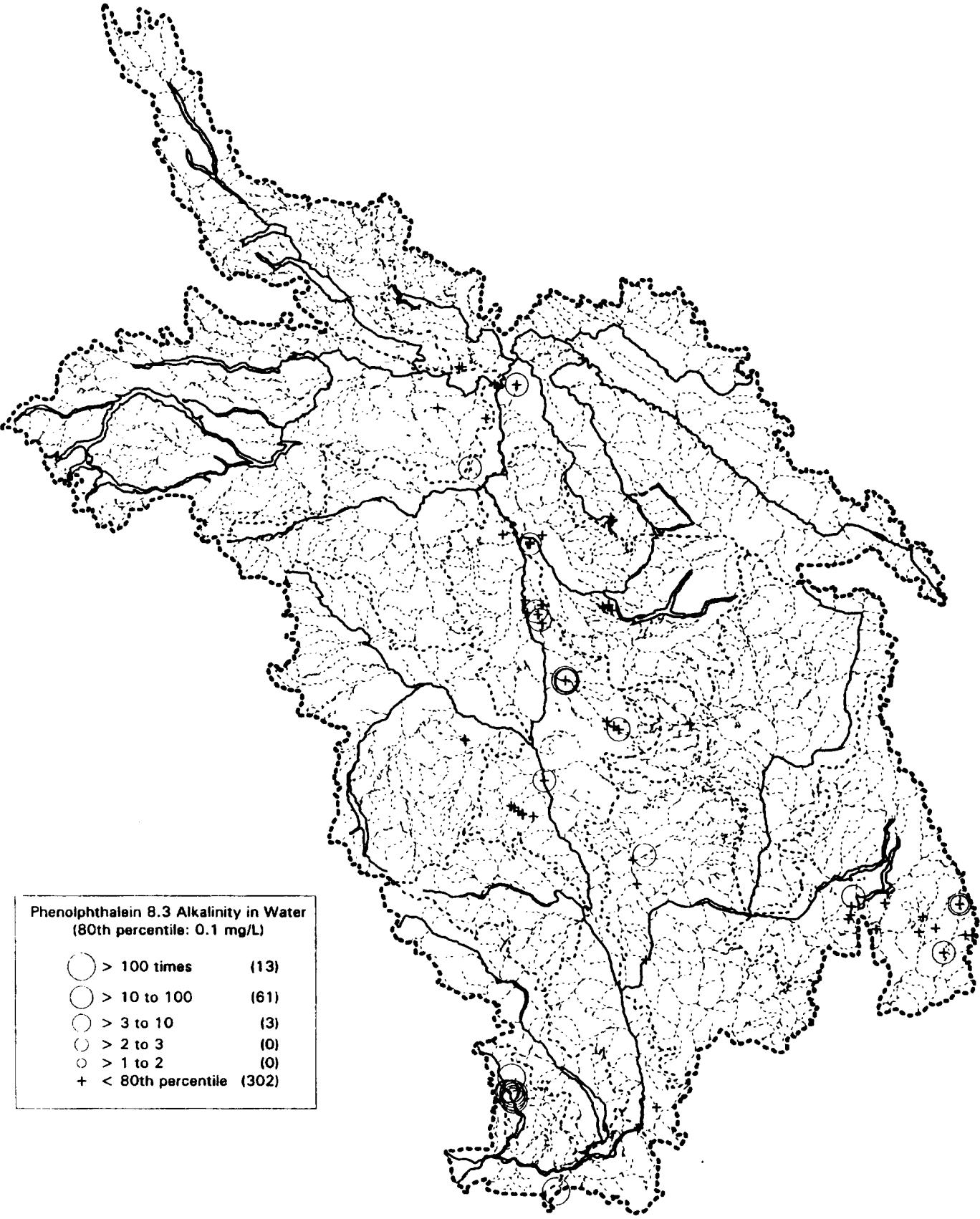
- | | |
|---------------------|-------|
| ○ > 100 times | (2) |
| ○ > 10 to 100 | (5) |
| ○ > 3 to 10 | (9) |
| ○ > 2 to 3 | (8) |
| ○ > 1 to 2 | (37) |
| + < 80th percentile | (242) |





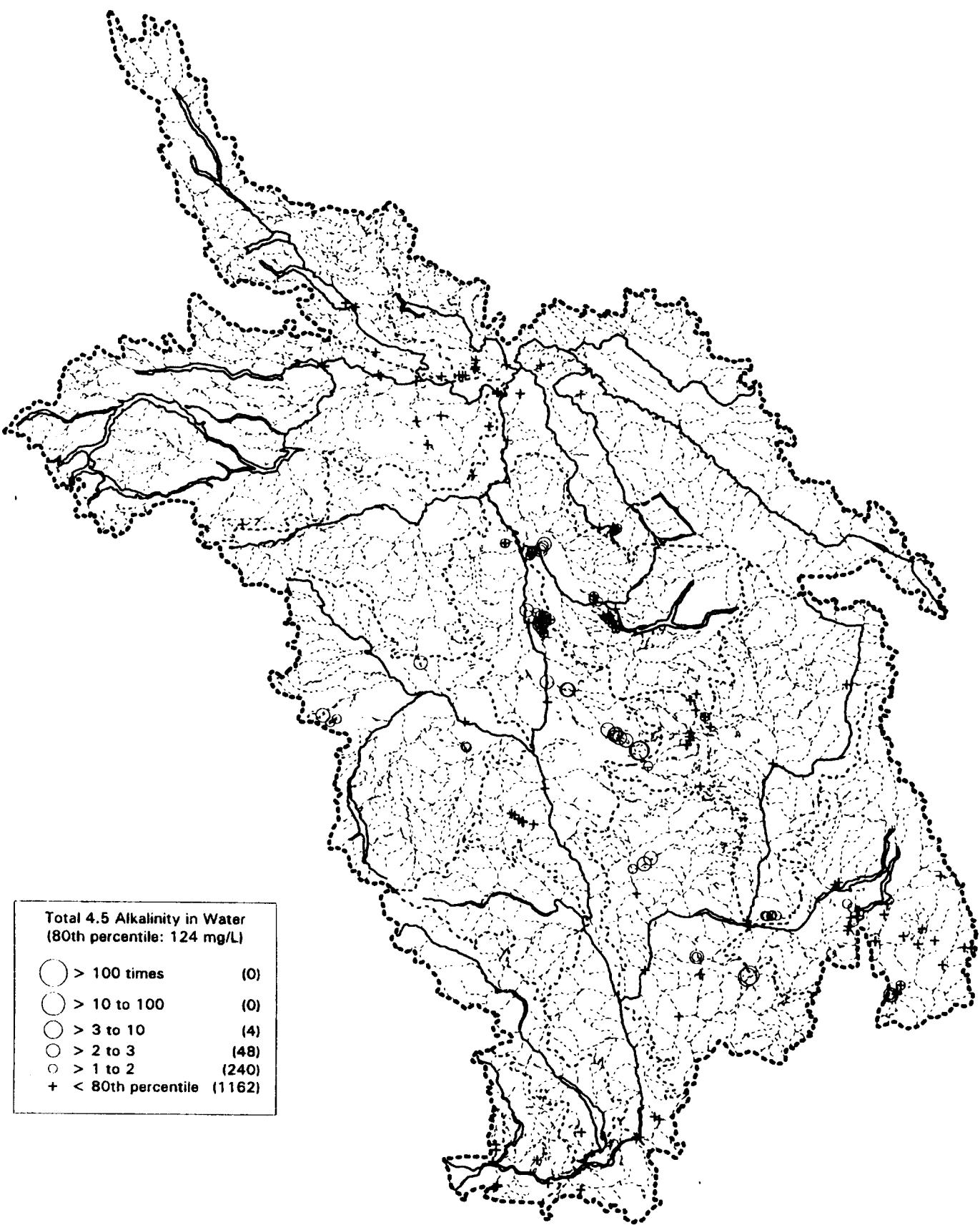


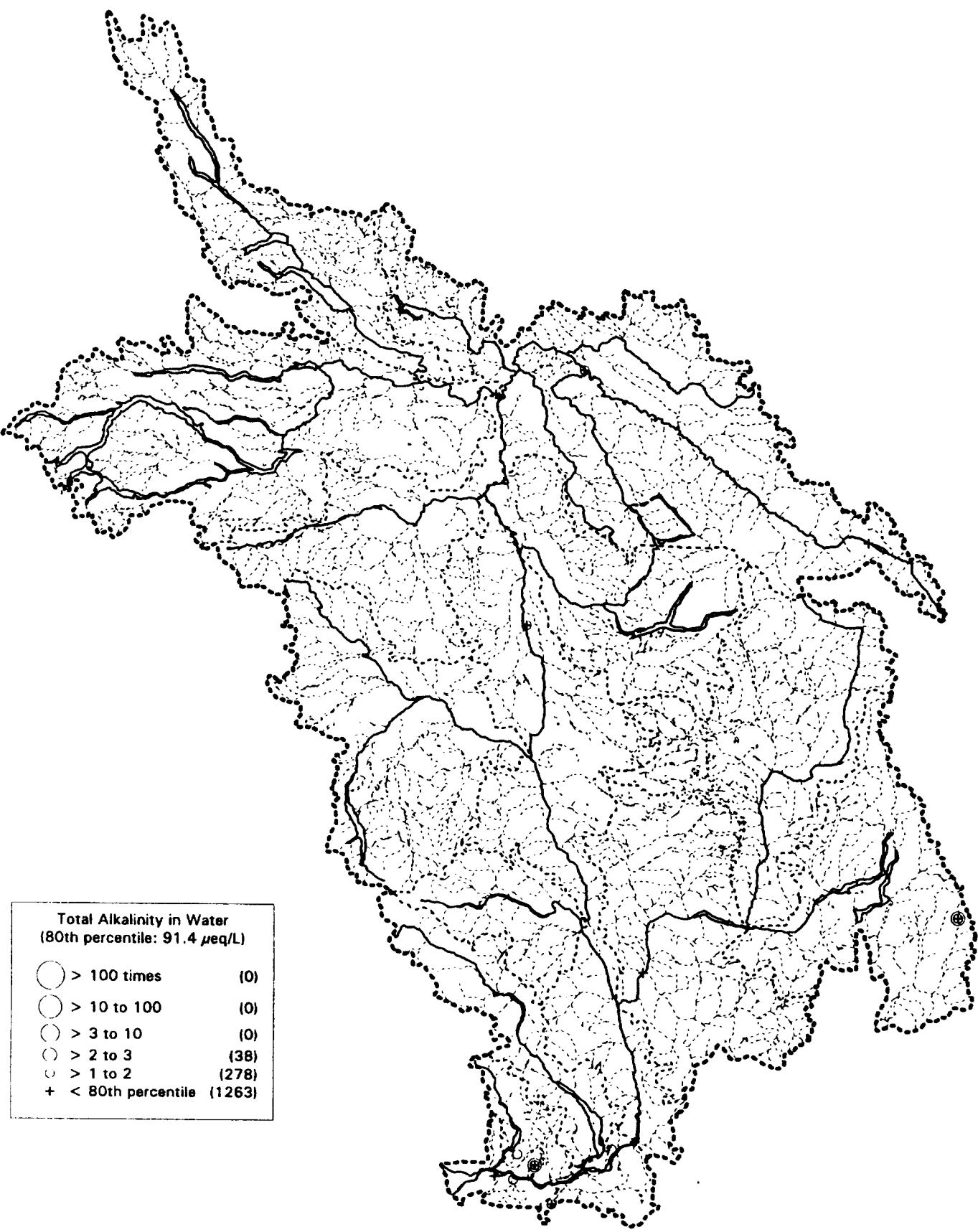


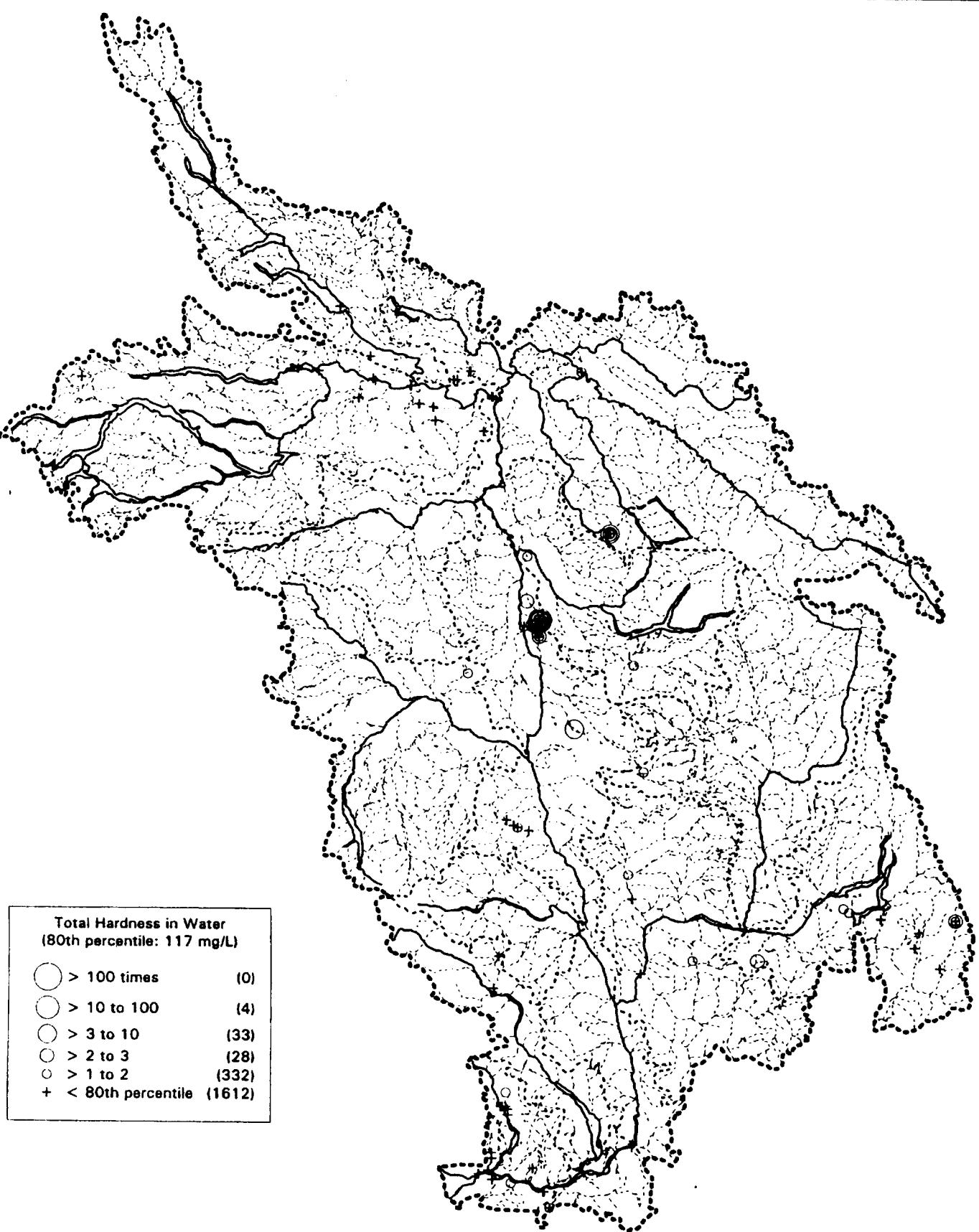


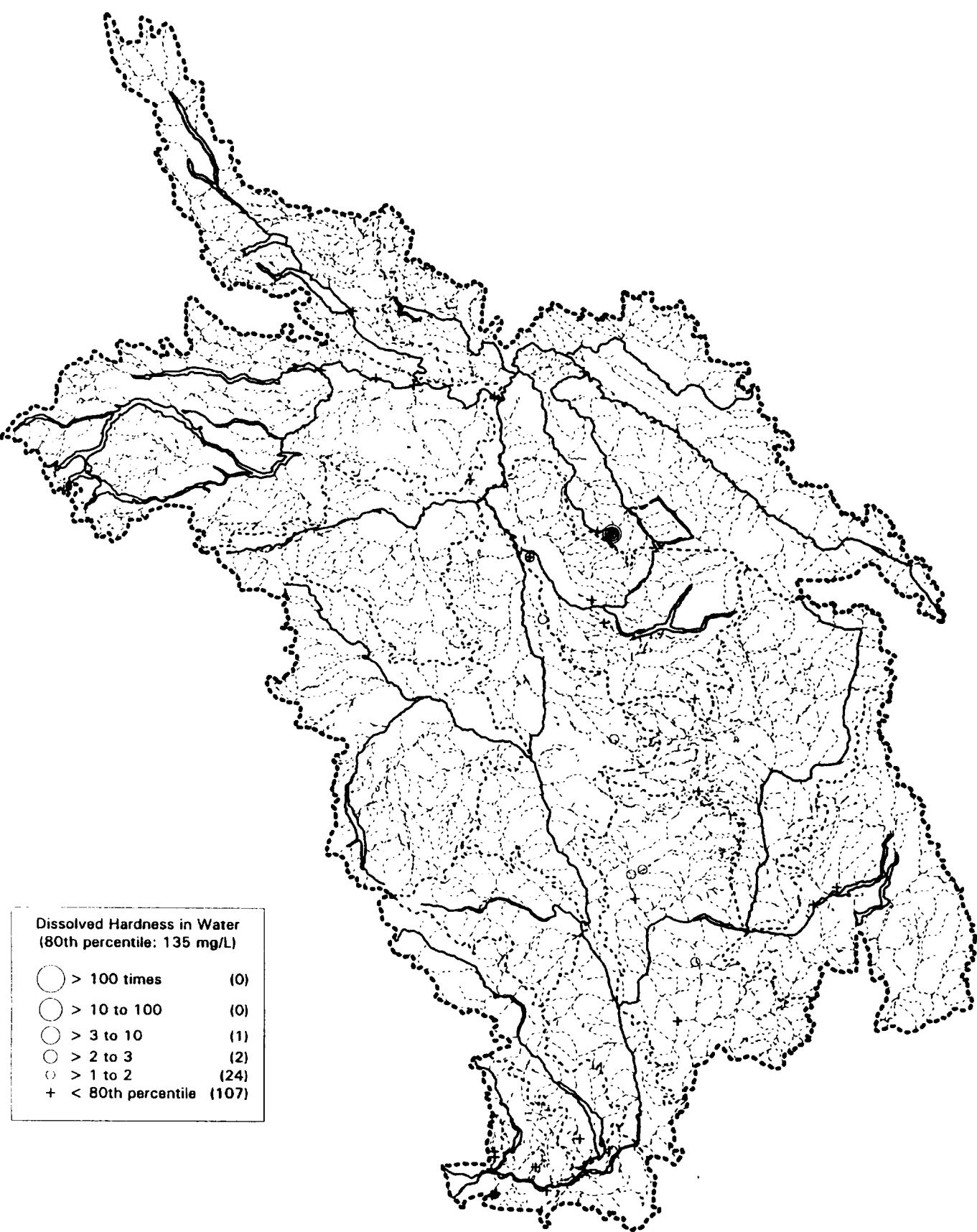
Phenolphthalein 8.3 Alkalinity in Water
(80th percentile: 0.1 mg/L)

- | | |
|---------------|-------------------------|
| ○ > 100 times | (13) |
| ○ > 10 to 100 | (61) |
| ○ > 3 to 10 | (3) |
| ○ > 2 to 3 | (0) |
| ○ > 1 to 2 | (0) |
| + | < 80th percentile (302) |



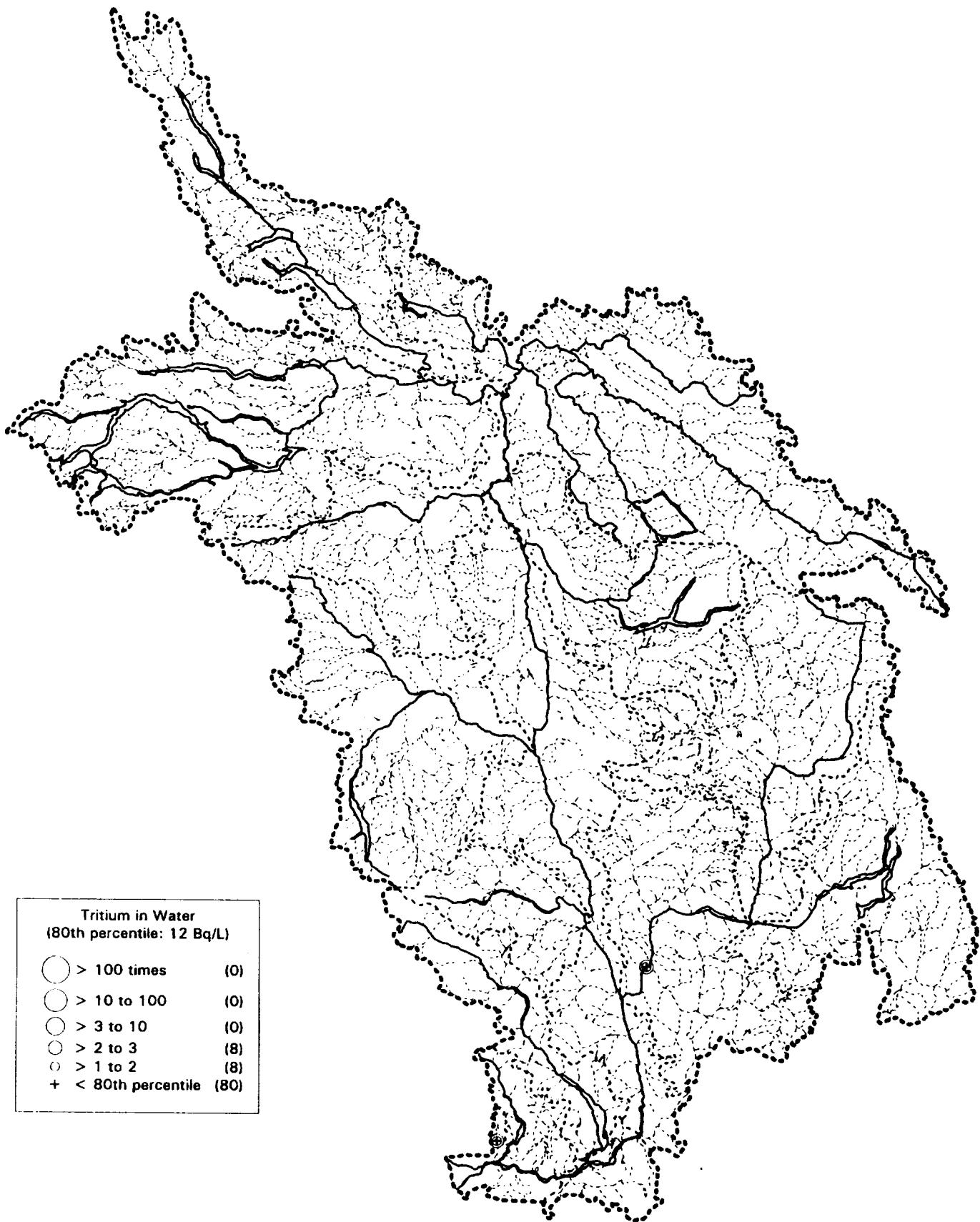






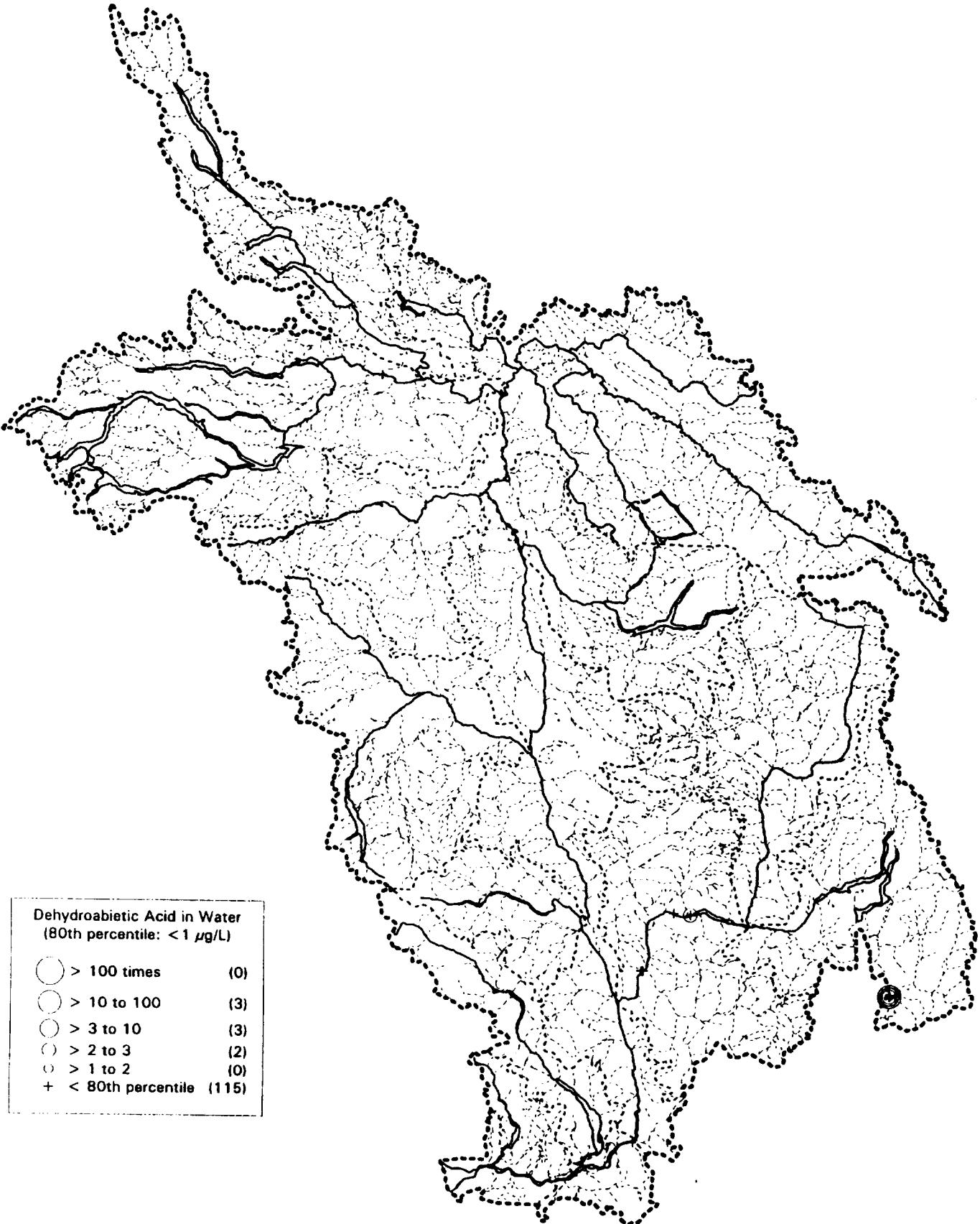
2.3.10 Radioactives in water

Tritium



2.3.11 Resin acids and fatty acids in water

Dehydroabietic Acid



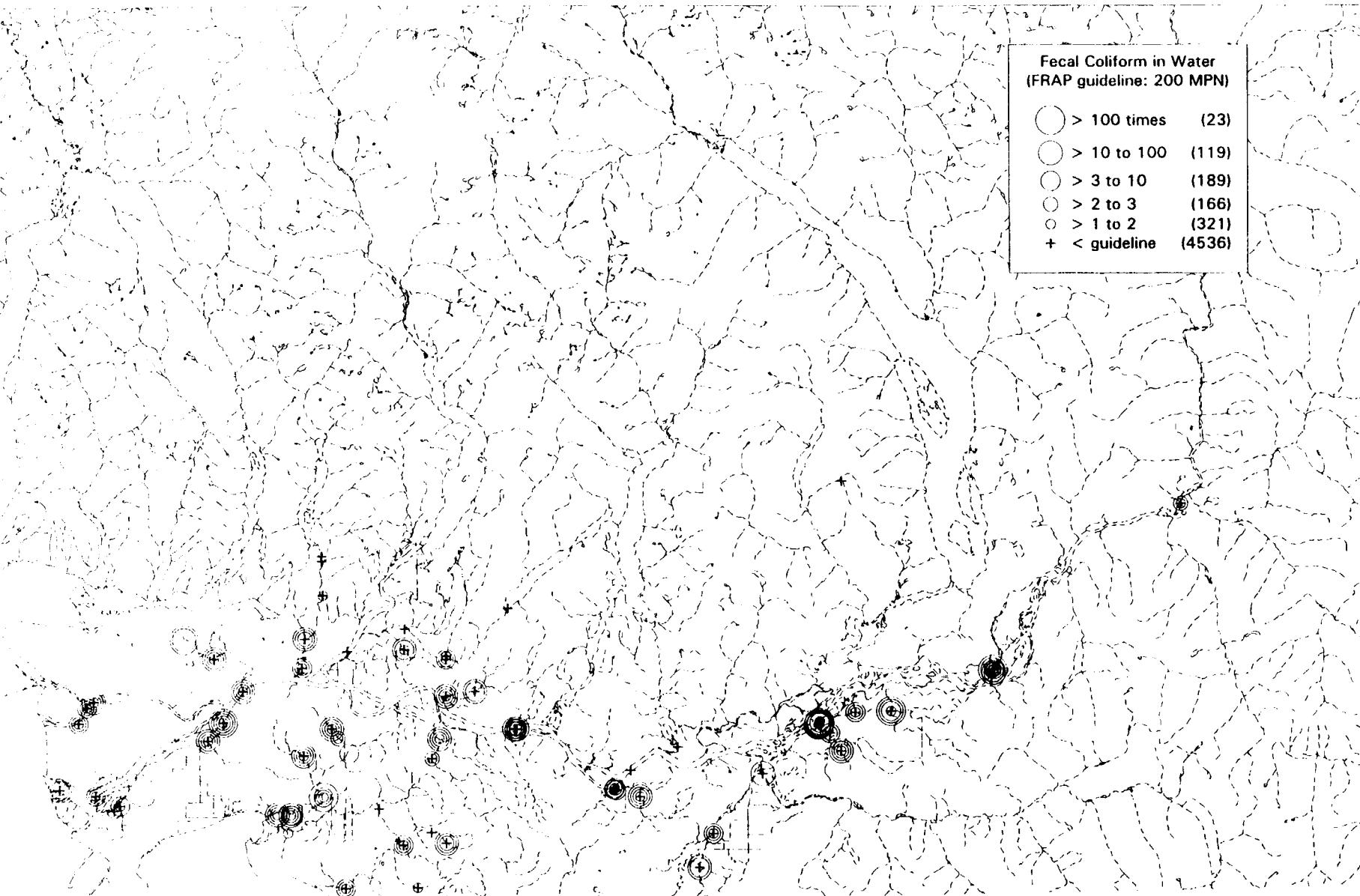
APPENDIX 3. ENLARGEMENTS OF THE LOWER FRASER FOR SELECTED PARAMETERS

This section presents enlargements of the lower Fraser for selected parameters. Note that the numbers of stations (in parentheses) in the map legends refer to the number of stations within the entire Fraser Basin and not to the area of the lower Fraser shown in the map.

Fecal Coliform in Water
Dissolved Oxygen in Water
Aluminum in Water
Chromium in Water
Copper in Water
Iron in Water
Lead in Water
Zinc in Water
pH in Water
Temperature in Water
Pentachlorophenol in Sediment
Esherichia coli in Water
Enterococcus in Water
Specific Conductance in Water
Calcium in Water
Magnesium in Water
Dissolved Ammonia Nitrogen in Water
Dissolved Nitrite Nitrogen in Water
Dissolved NO₂/NO₃ Nitrogen in Water
Dissolved Ortho Phosphorus in Water
Total Dissolved Phosphorus in Water

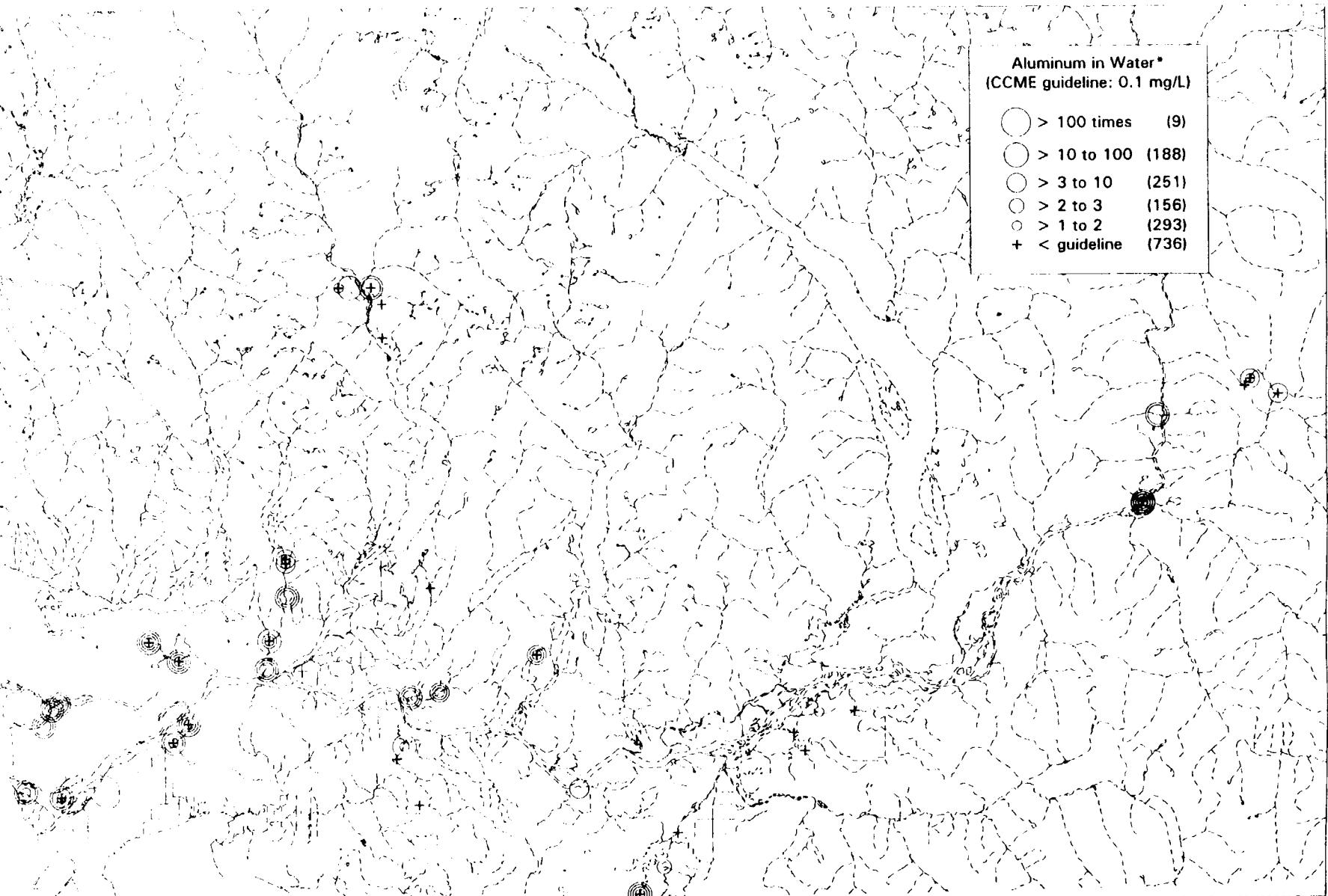
Fecal Coliform in Water
(FRAP guideline: 200 MPN)

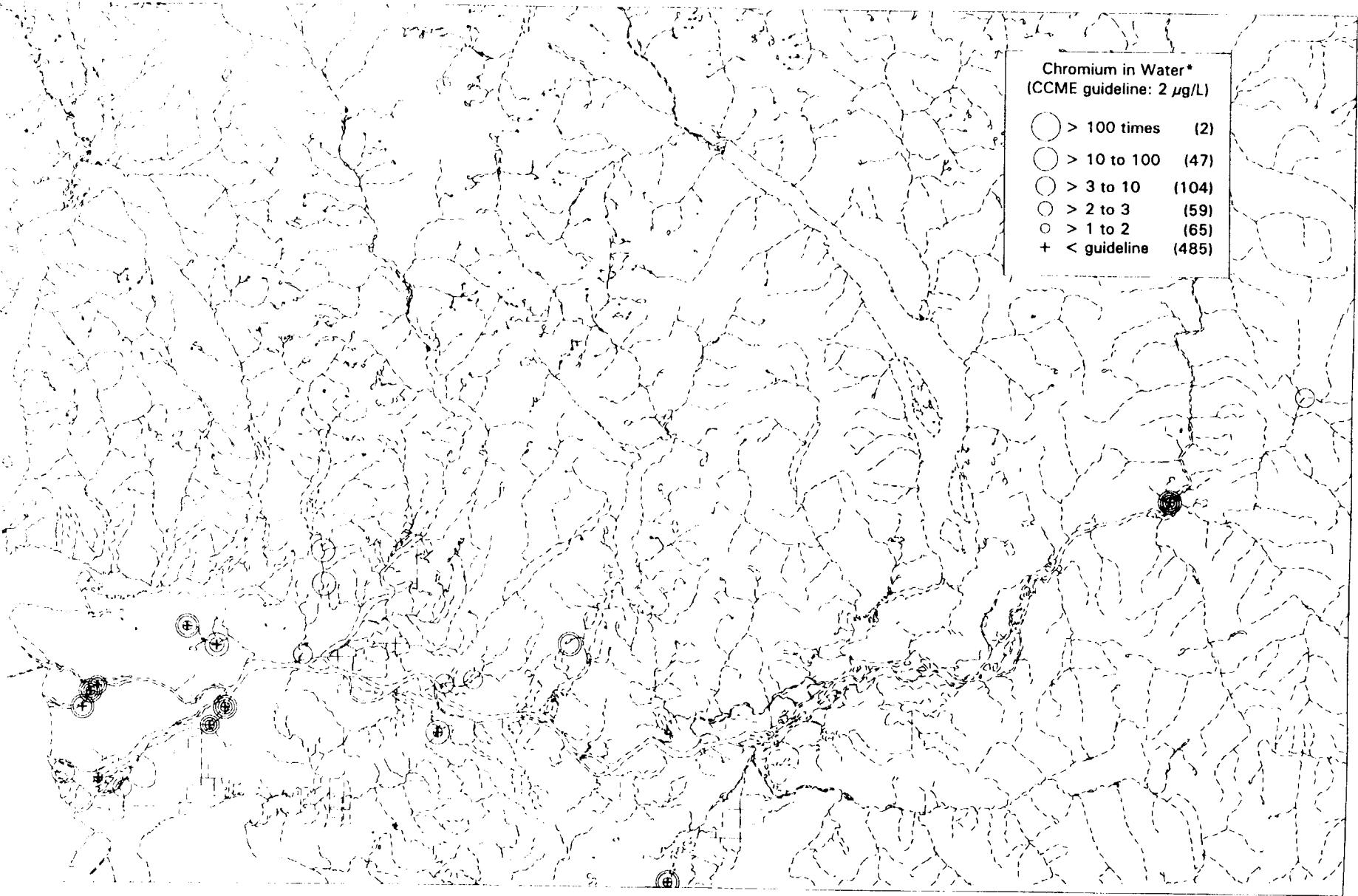
- (○) > 100 times (23)
- (○) > 10 to 100 (119)
- (○) > 3 to 10 (189)
- (○) > 2 to 3 (166)
- (○) > 1 to 2 (321)
- (+) < guideline (4536)



Dissolved Oxygen in Water
(CCME guideline: $\geq 9.5 \text{ mg/L}$)

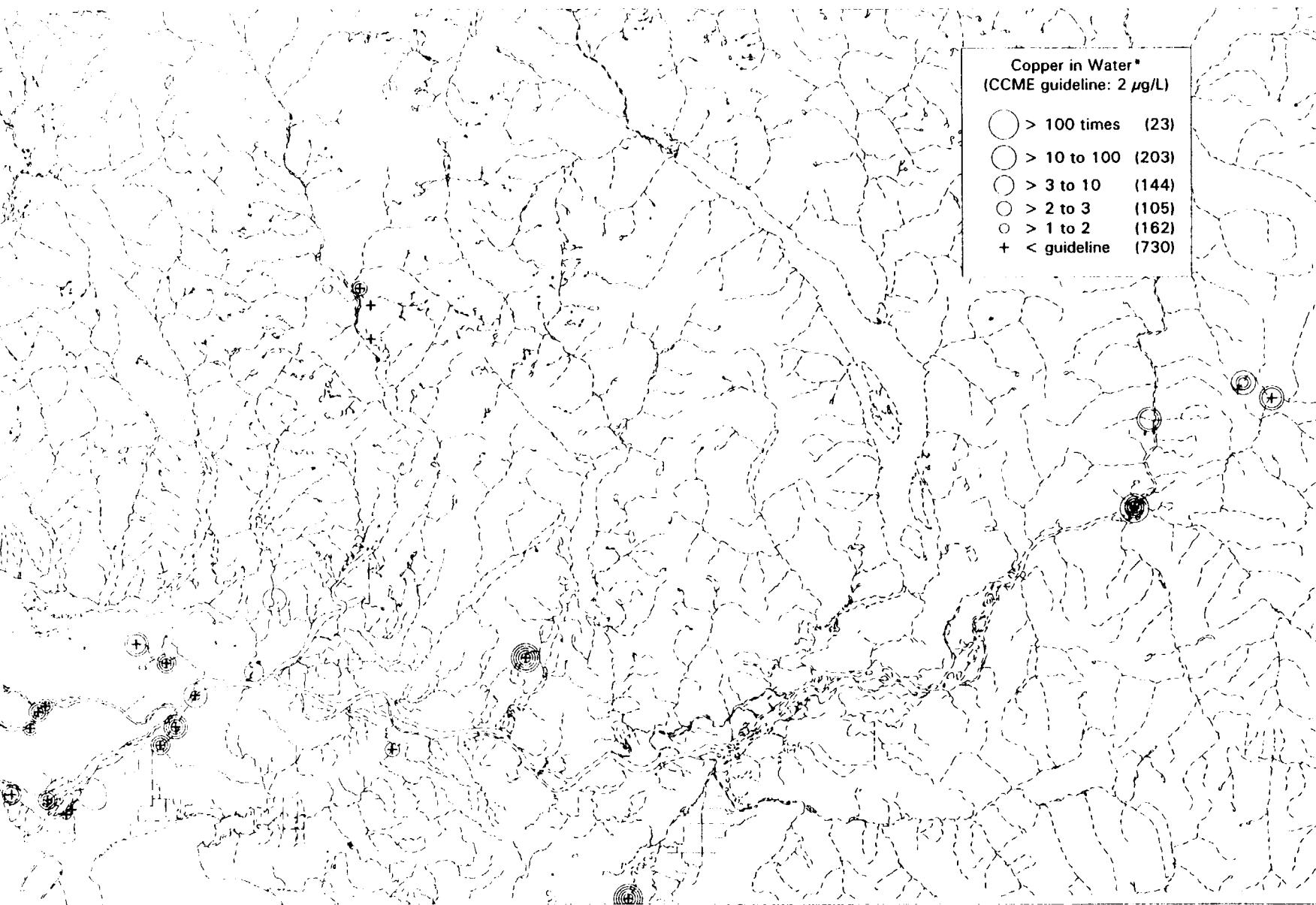
+	$\geq 9.5 \text{ mg/L}$	(1647)
○	$8.5 \text{ to } < 9.5$	(330)
○	$6.5 \text{ to } 8.5$	(329)
○	$4.5 \text{ to } 6.5$	(147)
○	$2.5 \text{ to } 4.5$	(76)
○	< 2.5	(270)





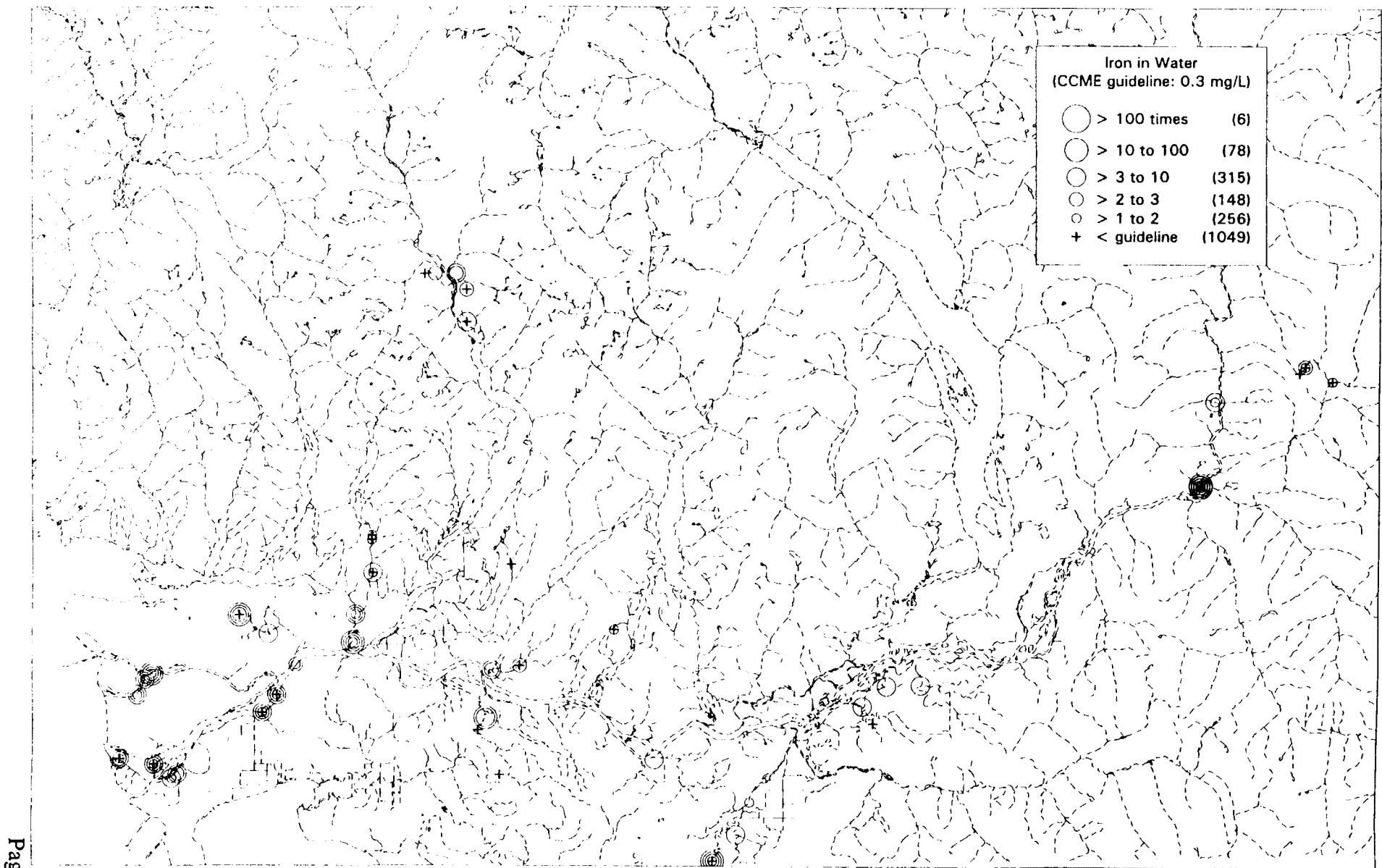
Copper in Water*
(CCME guideline: 2 µg/L)

- > 100 times (23)
- > 10 to 100 (203)
- > 3 to 10 (144)
- > 2 to 3 (105)
- > 1 to 2 (162)
- + < guideline (730)



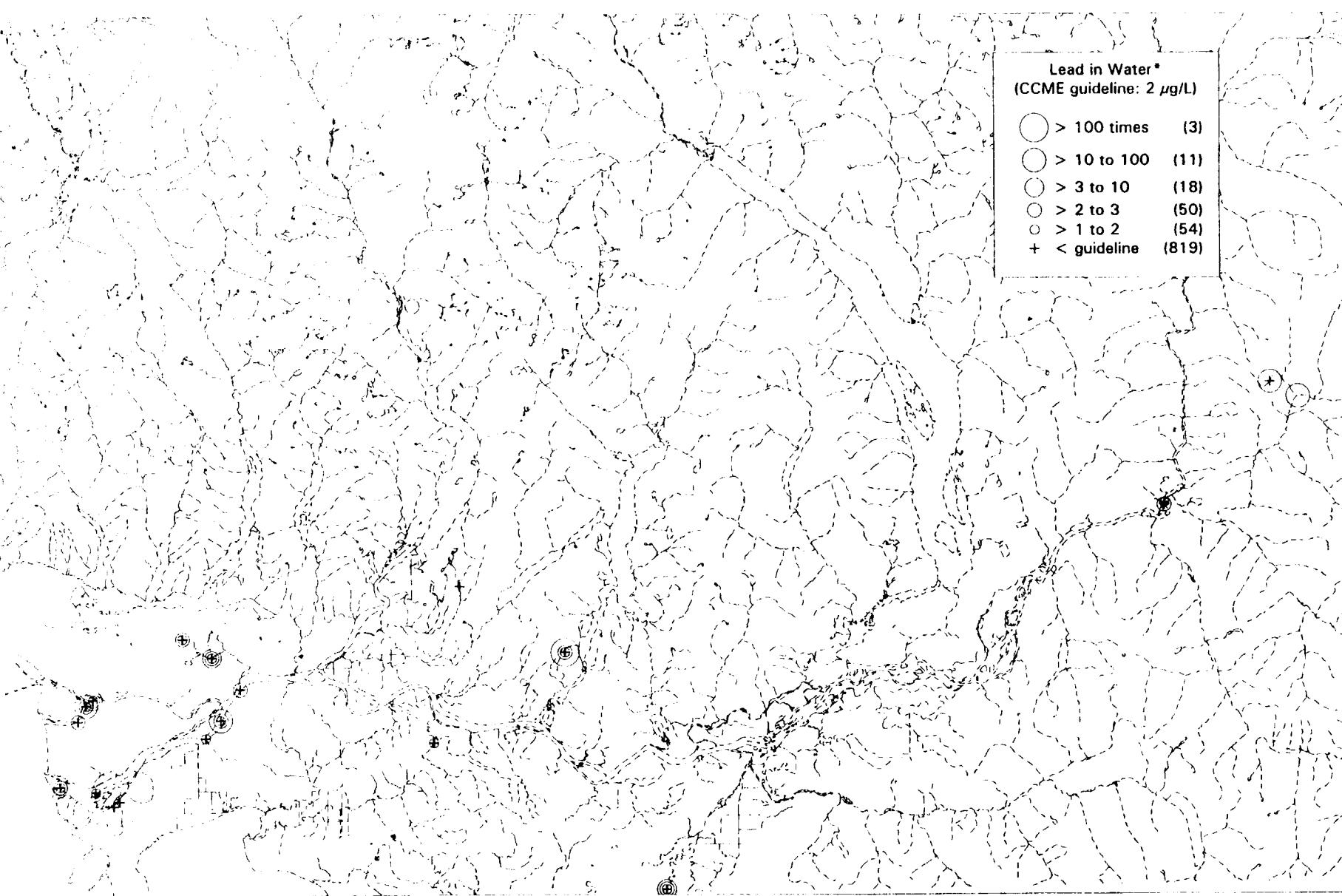
Iron in Water
(CCME guideline: 0.3 mg/L)

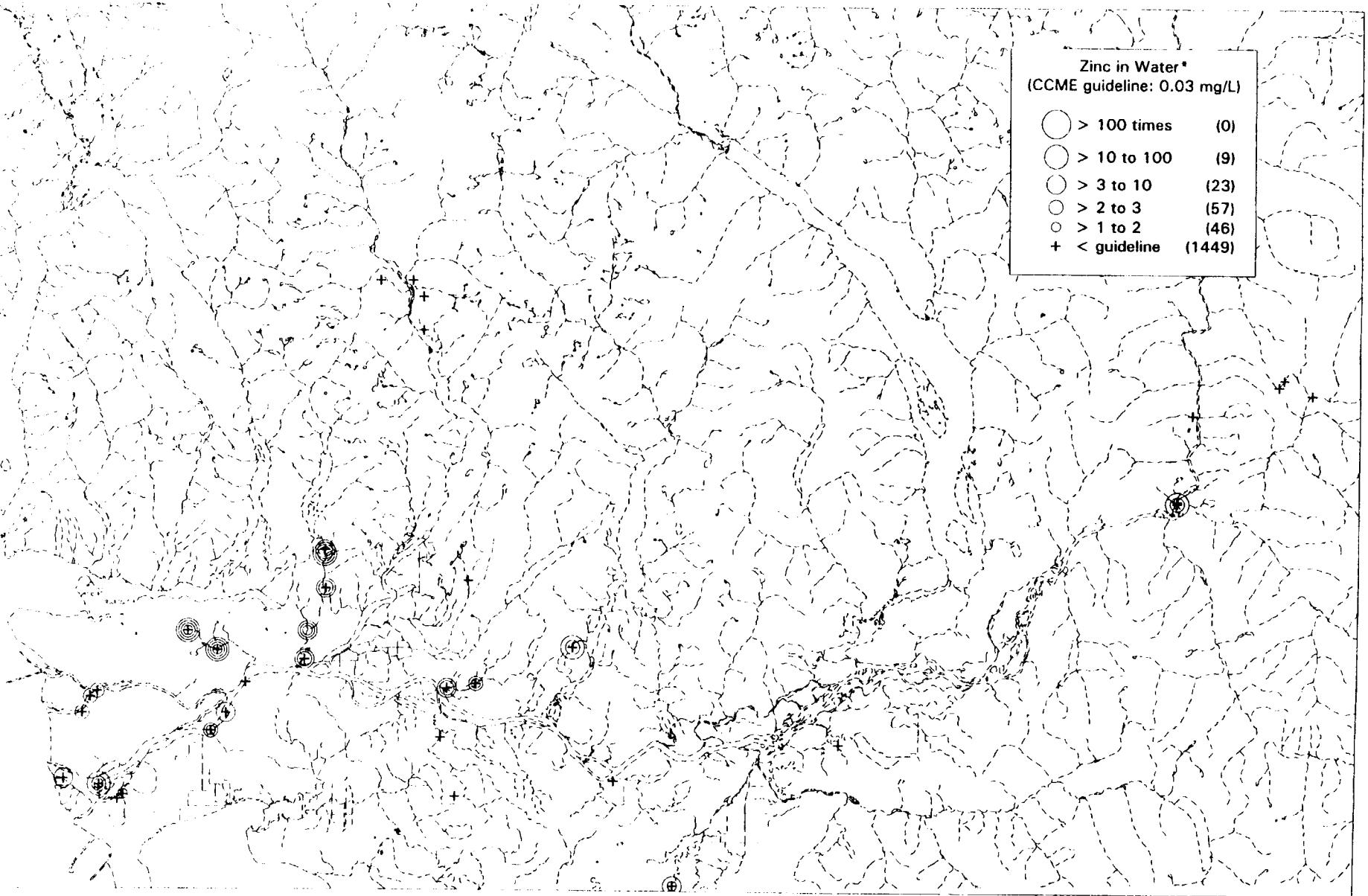
> 100 times	(6)
> 10 to 100	(78)
> 3 to 10	(315)
> 2 to 3	(148)
> 1 to 2	(256)
+ < guideline	(1049)

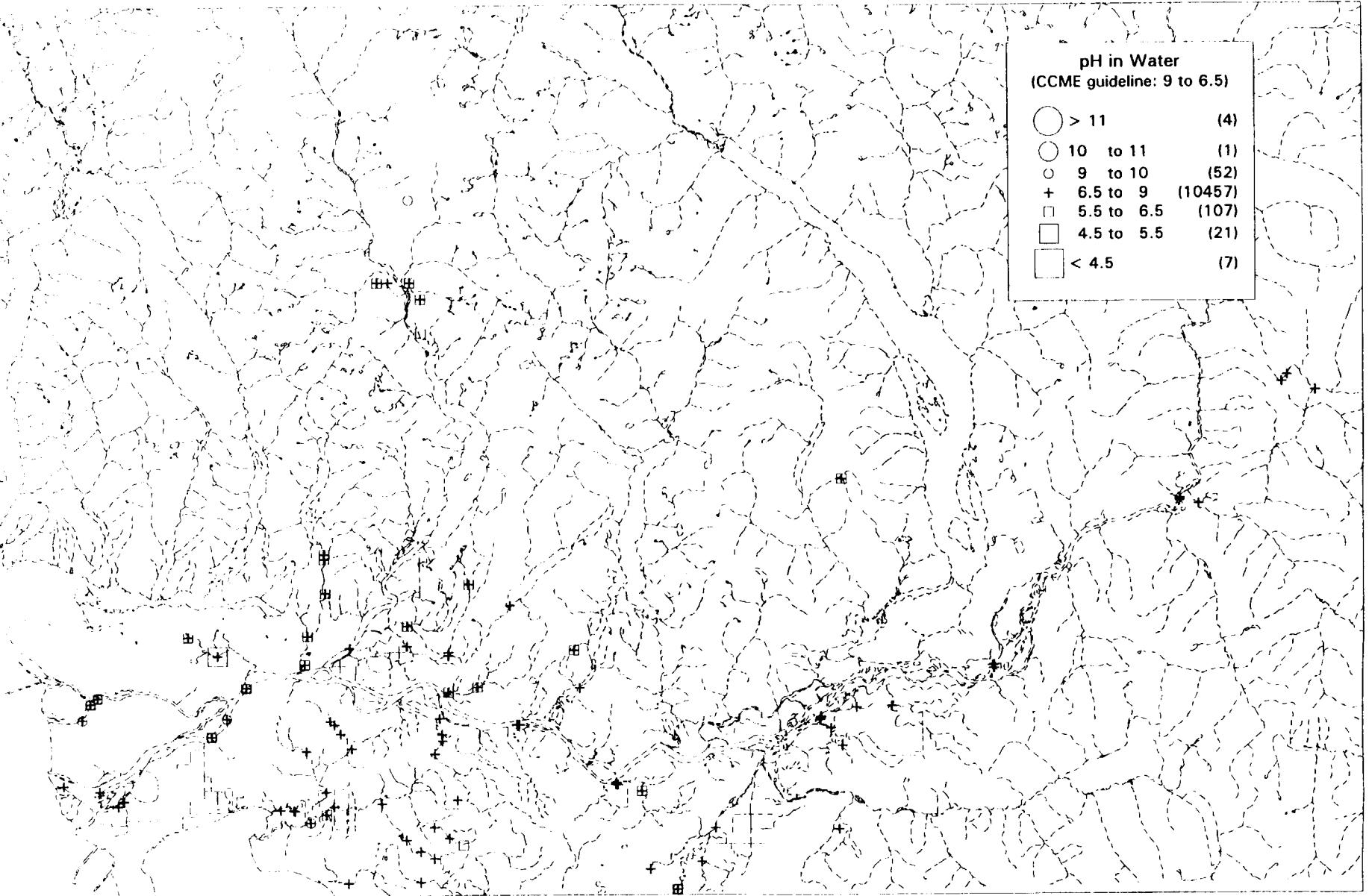


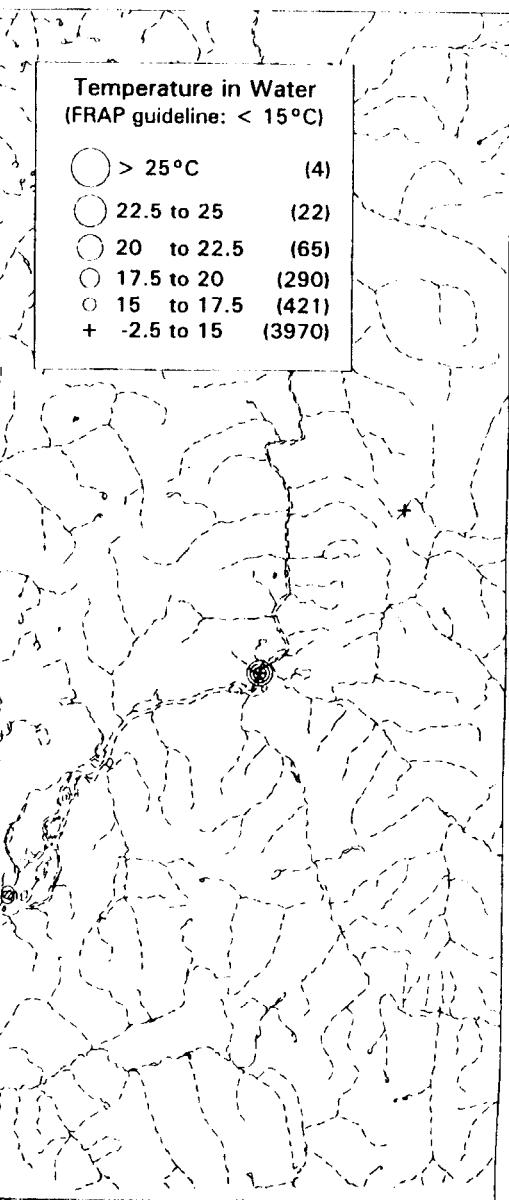
Lead in Water*
(CCME guideline: 2 µg/L)

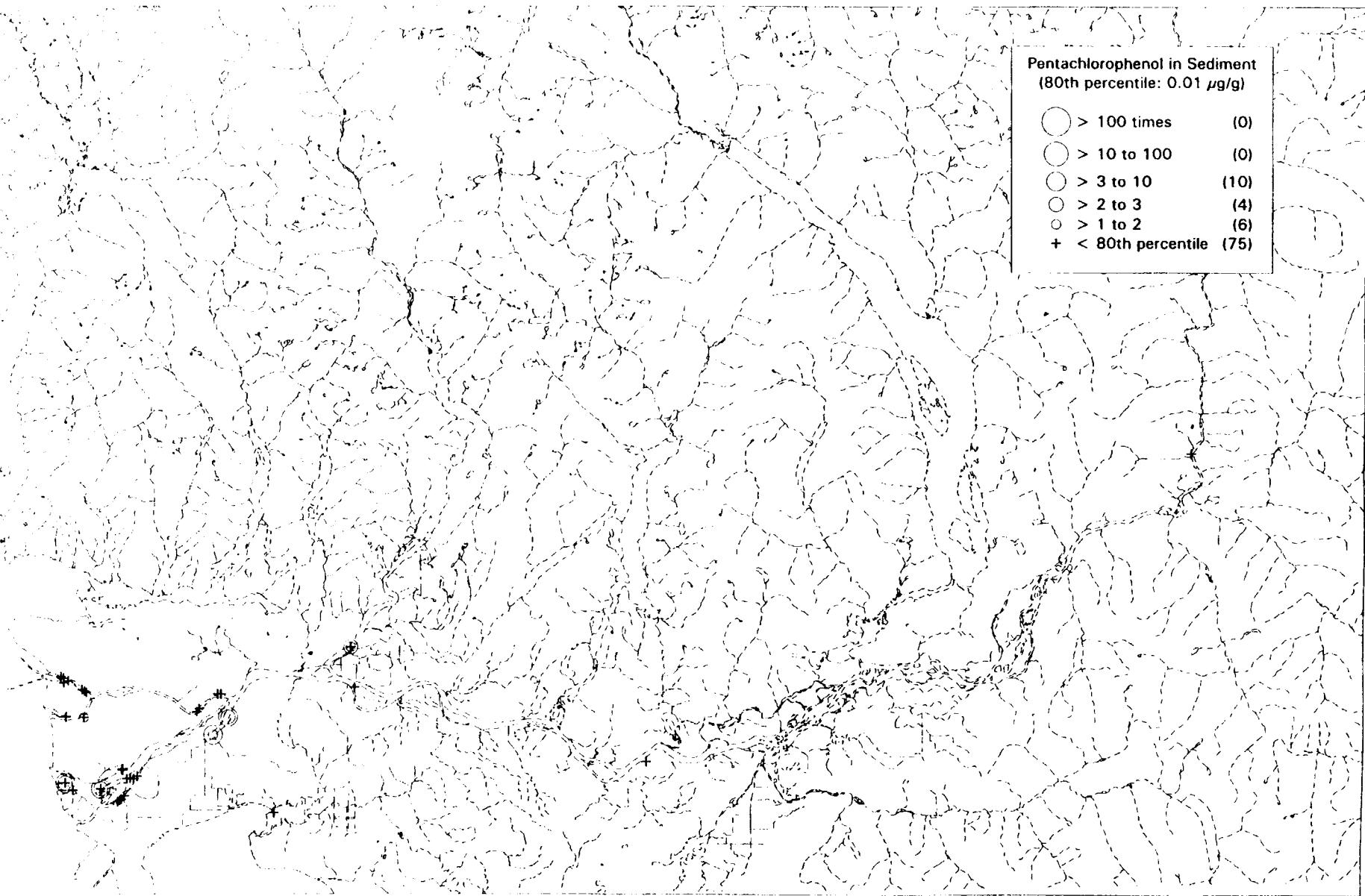
- > 100 times (3)
- > 10 to 100 (11)
- > 3 to 10 (18)
- > 2 to 3 (50)
- > 1 to 2 (54)
- + < guideline (819)

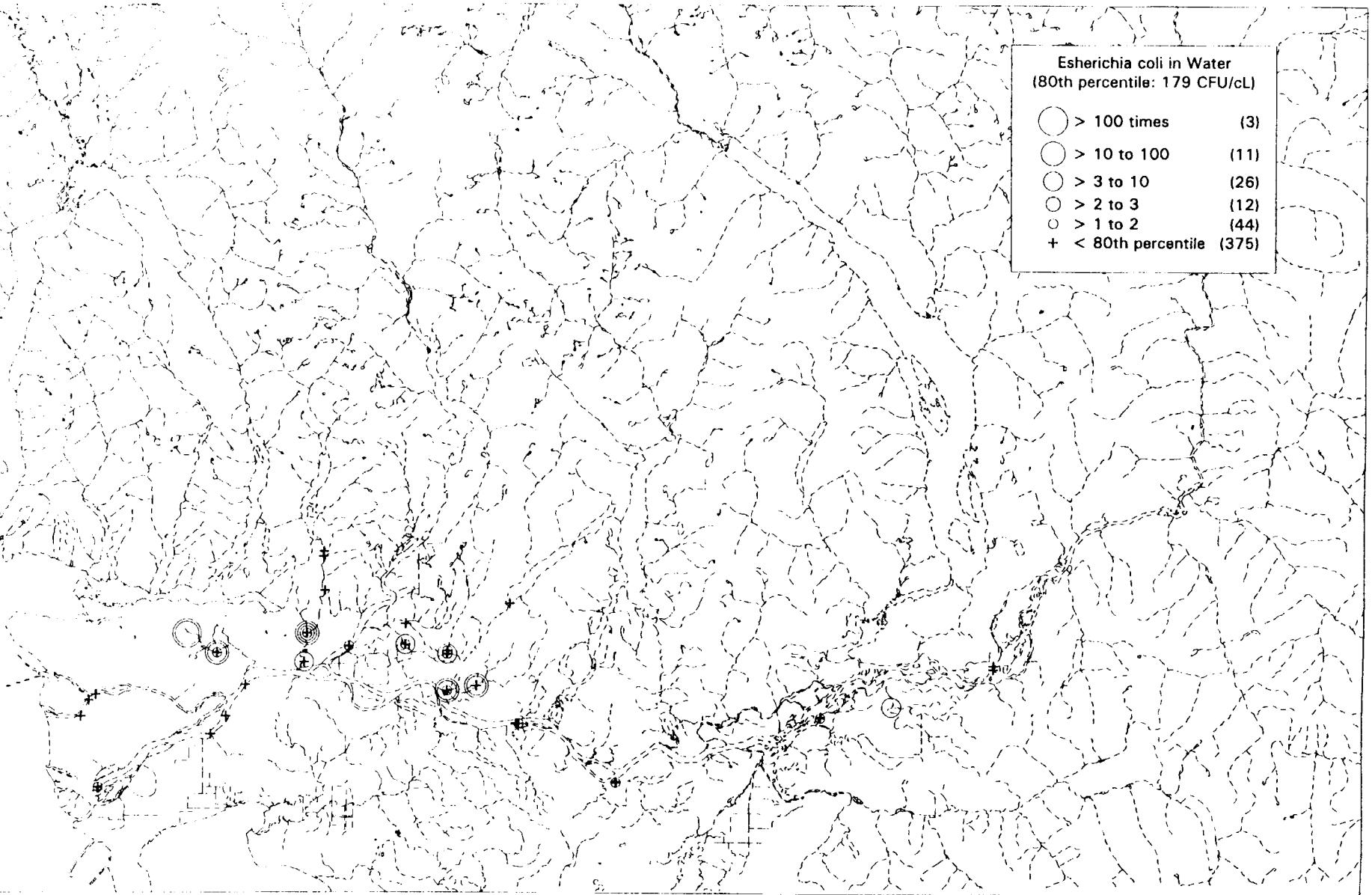


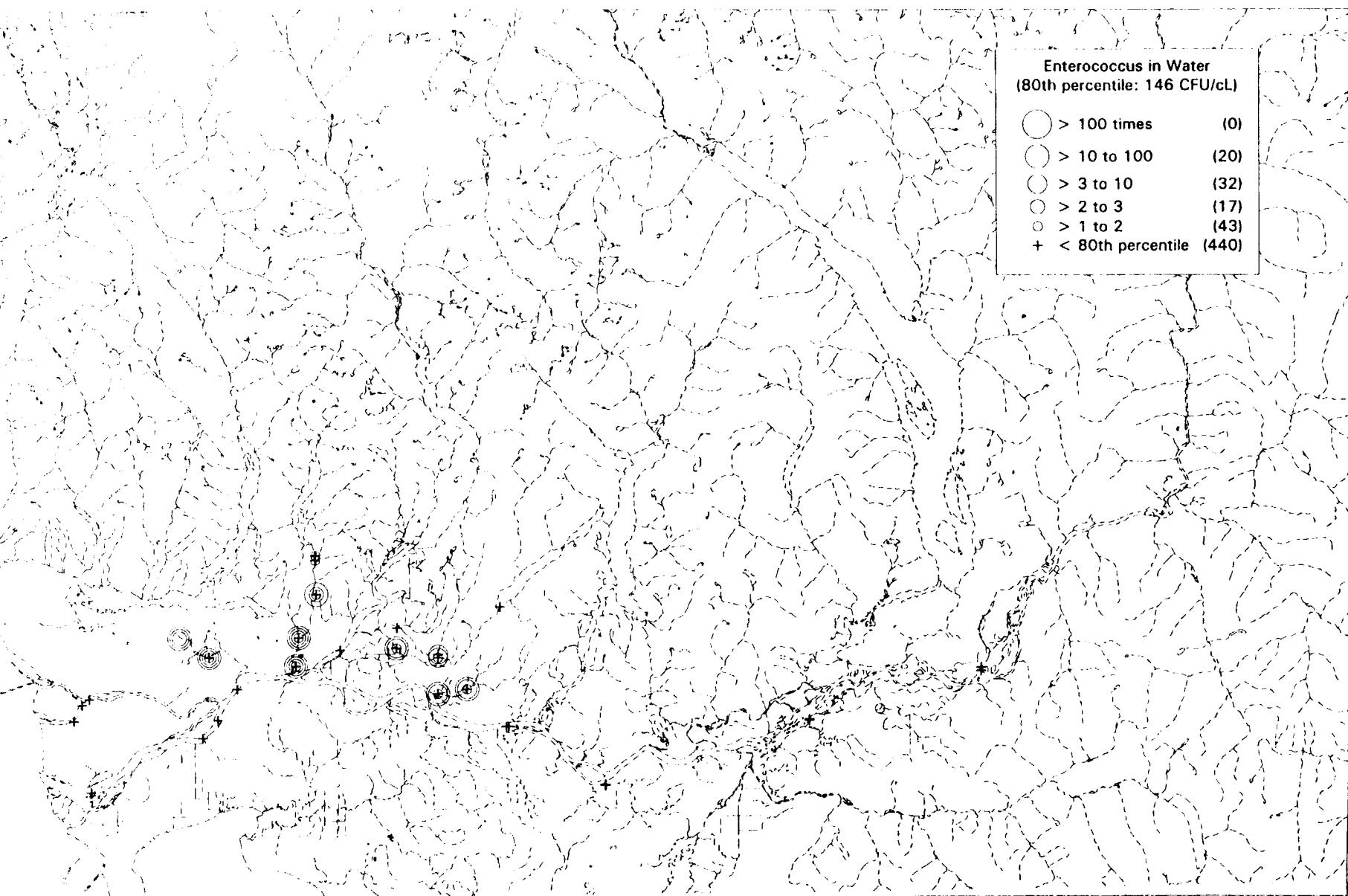


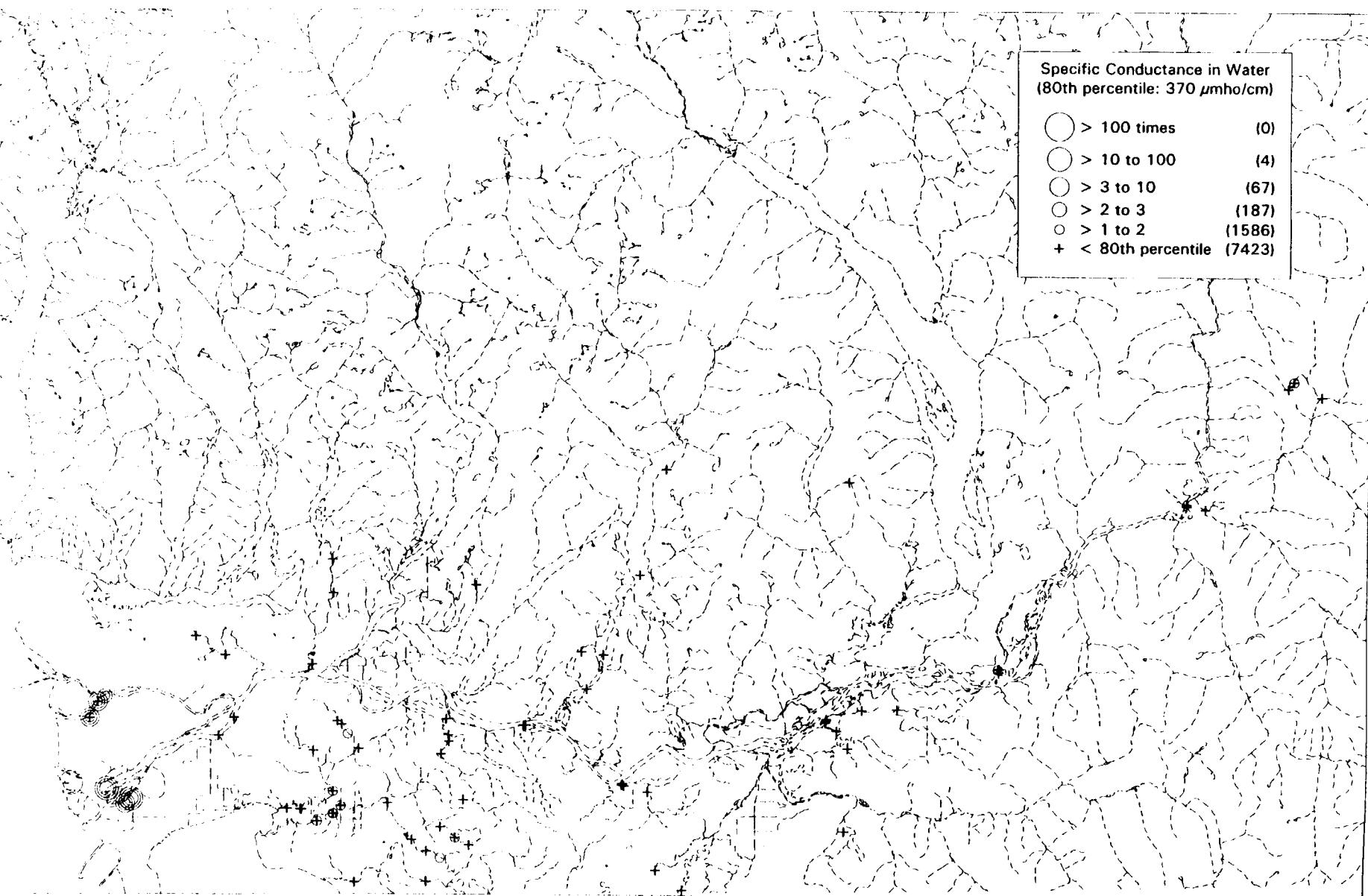


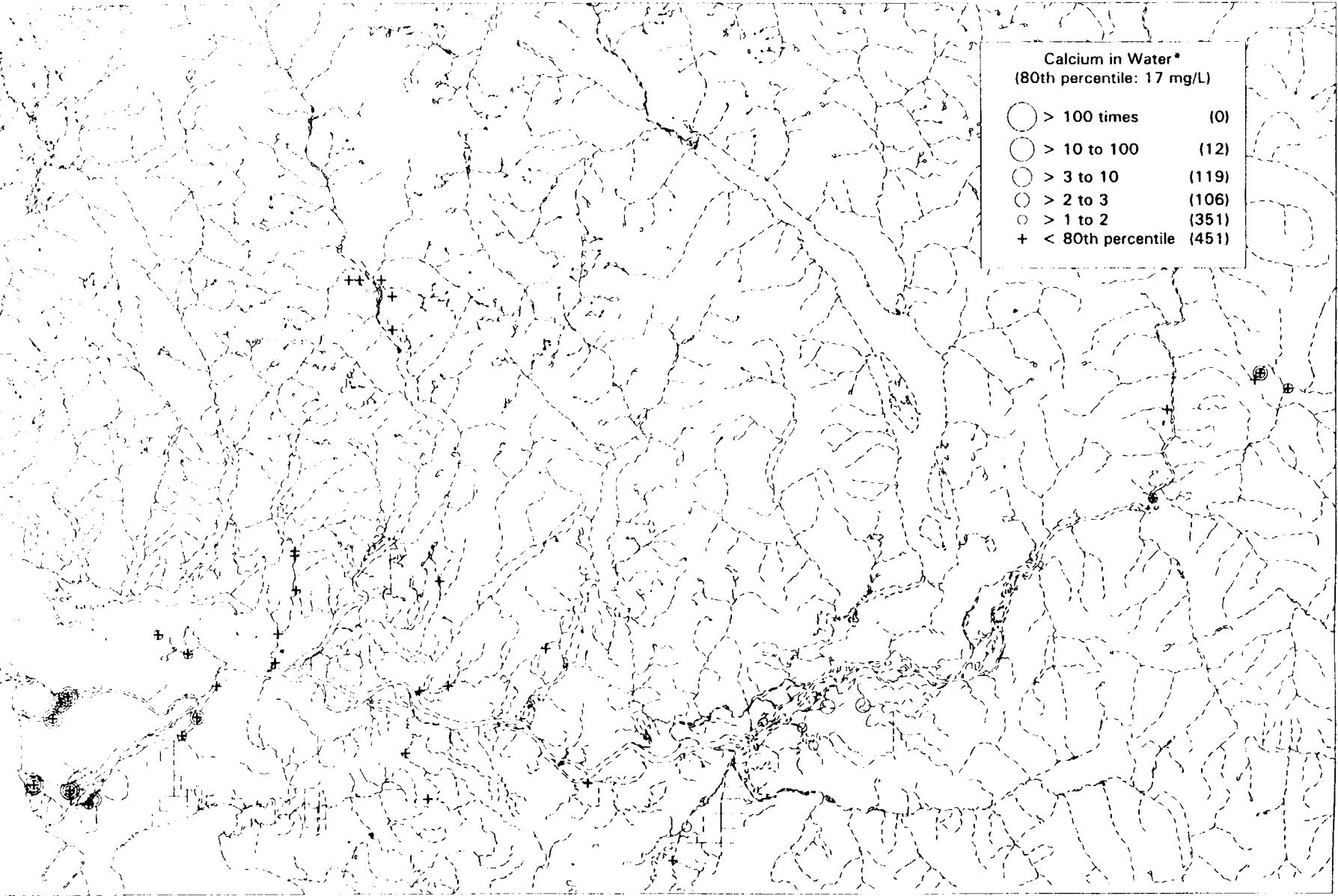


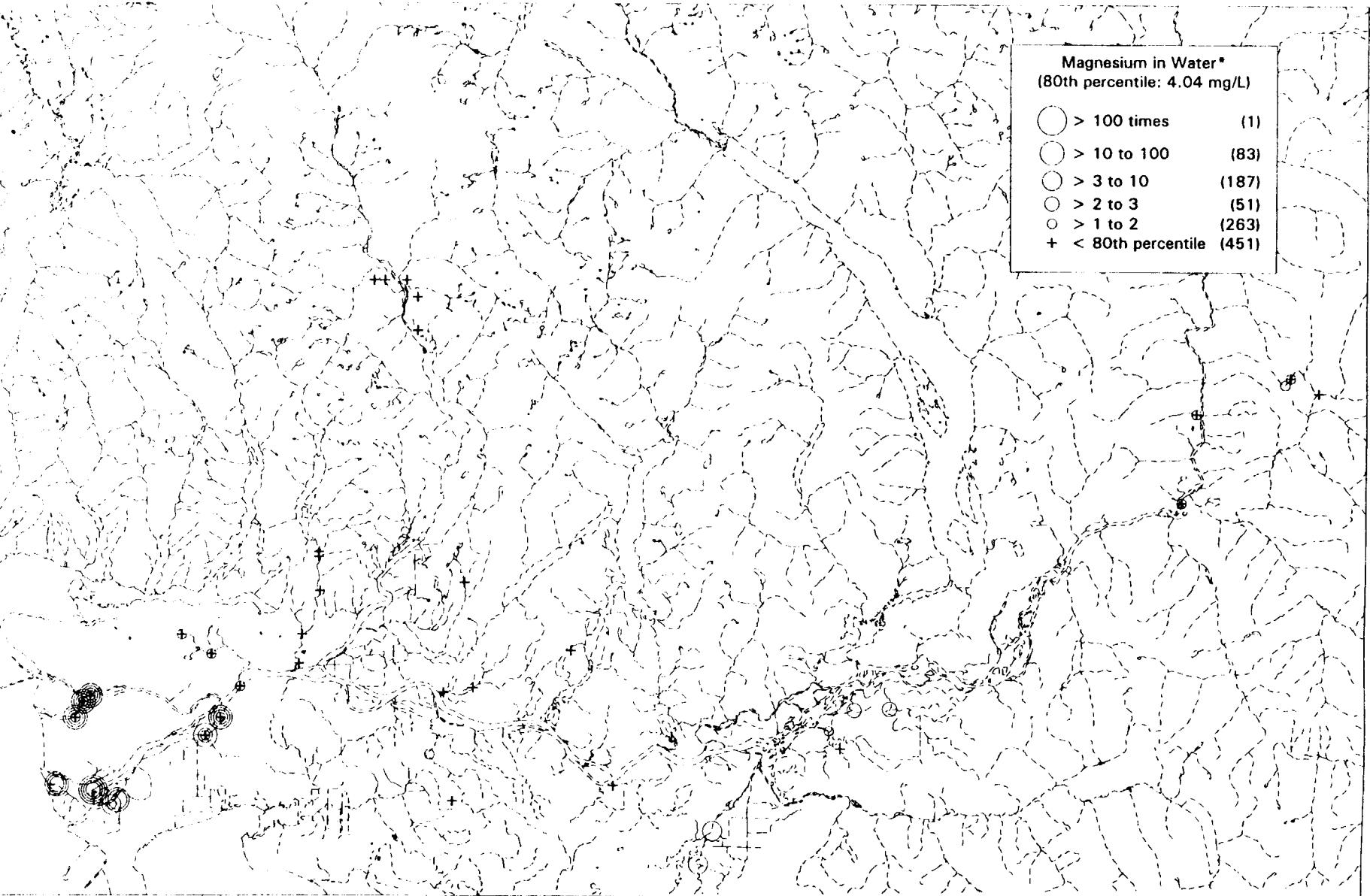


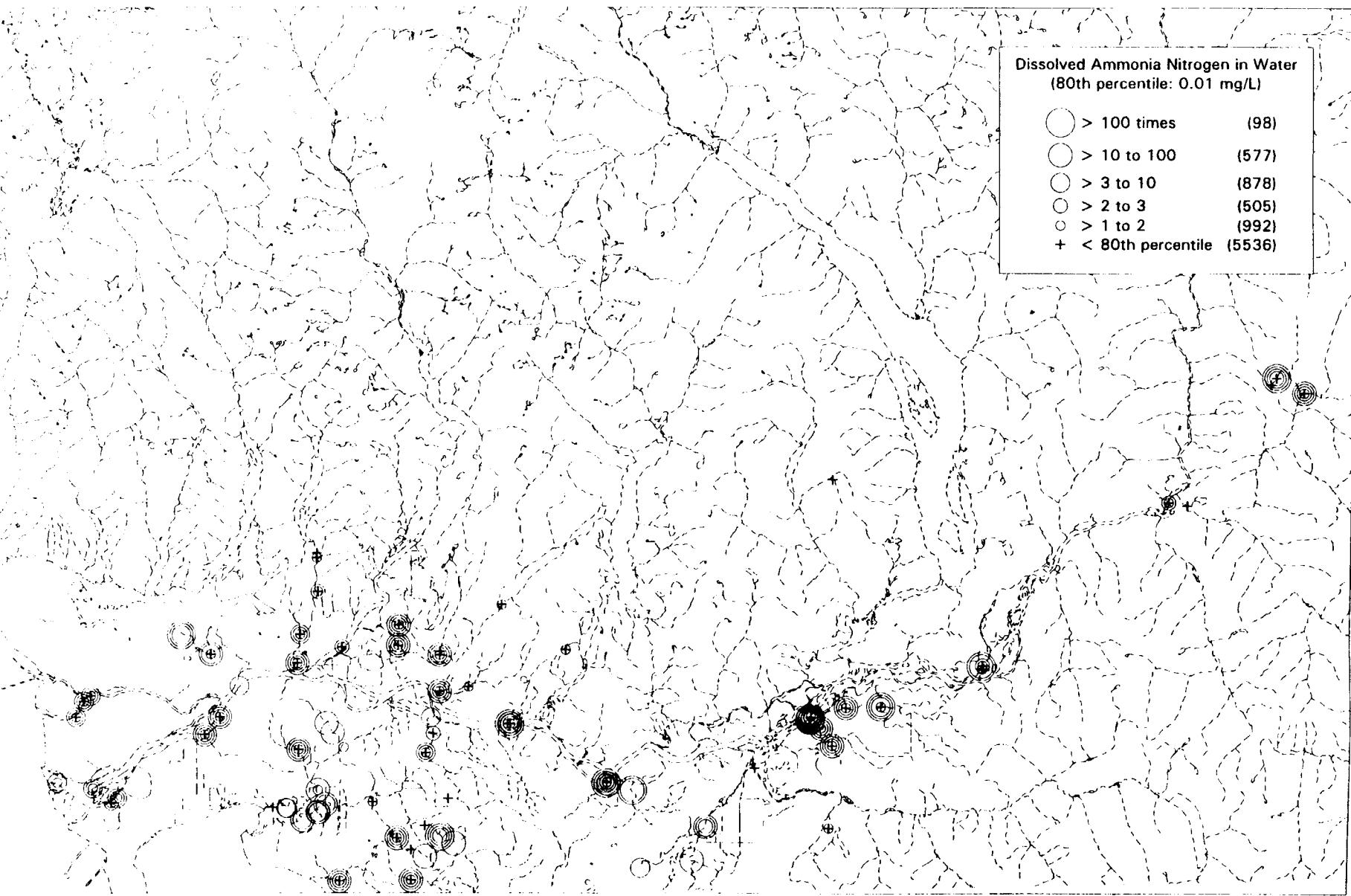


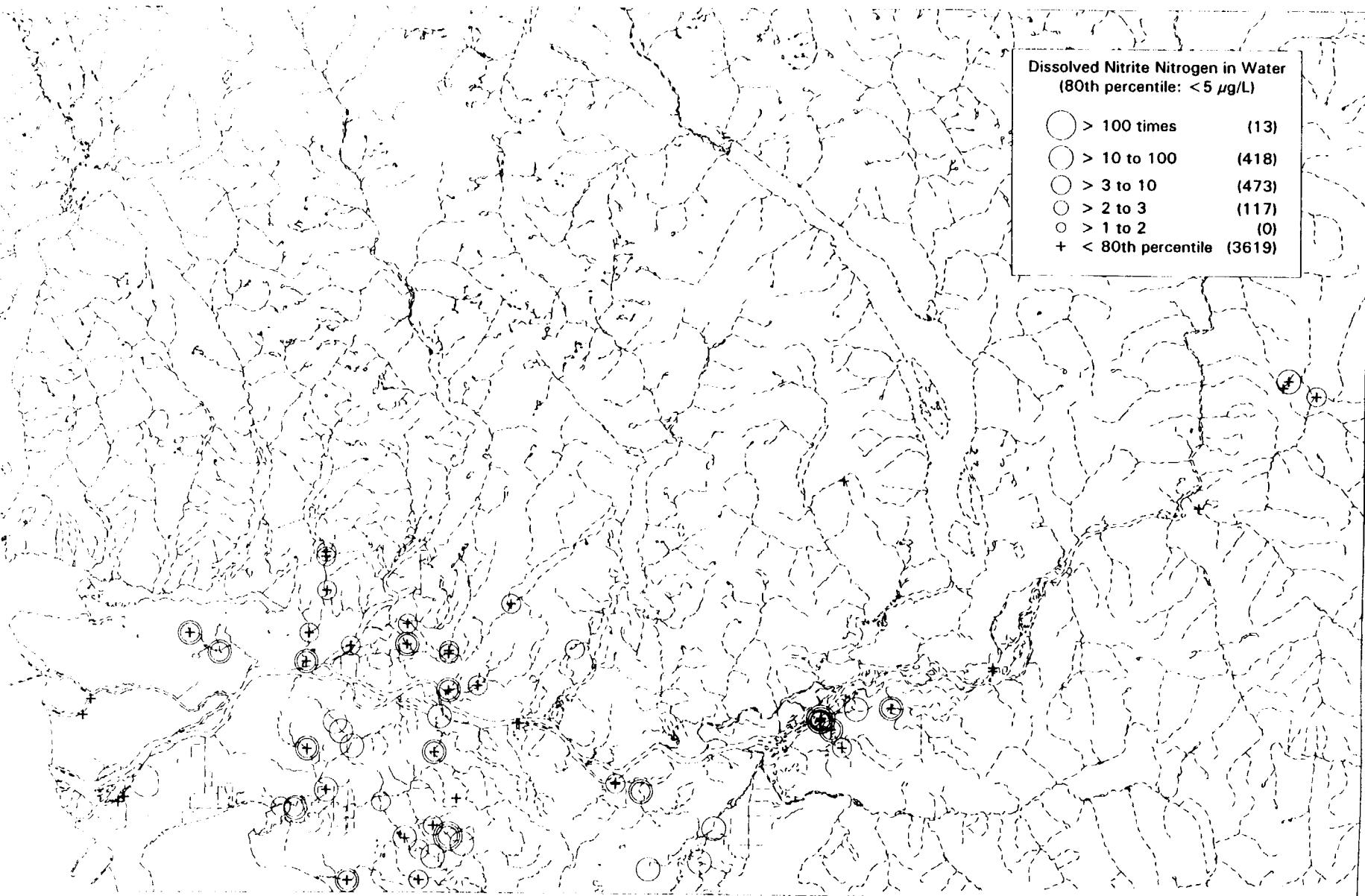












Dissolved NO₂/NO₃ Nitrogen in Water
(80th percentile: 0.05 mg/L)

○	> 100 times	(22)
○	> 10 to 100	(287)
○	> 3 to 10	(709)
○	> 2 to 3	(851)
○	> 1 to 2	(861)
+	< 80th percentile	(3487)

