RETURN TO 1998 ROD AR INDEX

FINAL REPORT

Site: New Bedford
Break: 4.6
Other: 48871

SDMS DocID 48871

for

MODELING OF THE TRANSPORT, DISTRIBUTION, AND FATE OF PCBS AND HEAVY METALS IN THE ACUSHNET RIVER/ NEW BEDFORD HARBOR/BUZZARDS BAY SYSTEM

APPENDIX VOLUME 3
Appendices G - M

Under Contract No. 4236-MOD-0019

to

EBASCO SERVICES, INC.
211 Congress Street
Boston, MA 02110

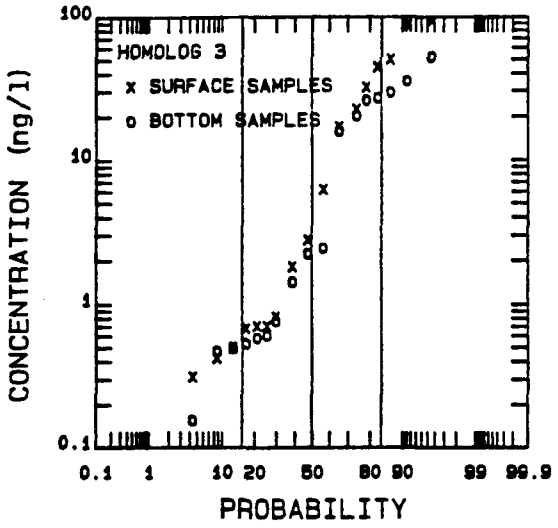
September 21, 1990

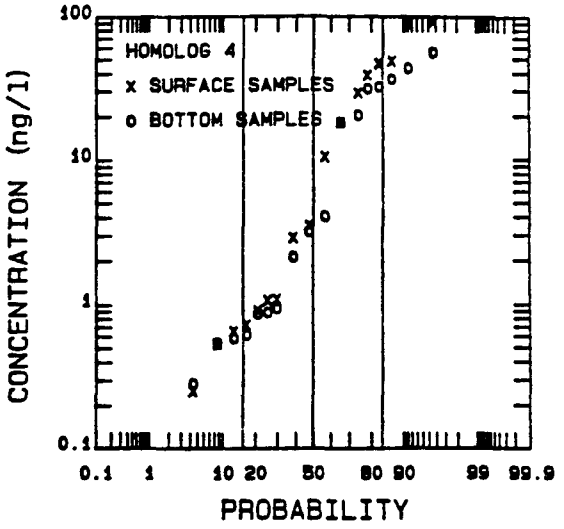
from

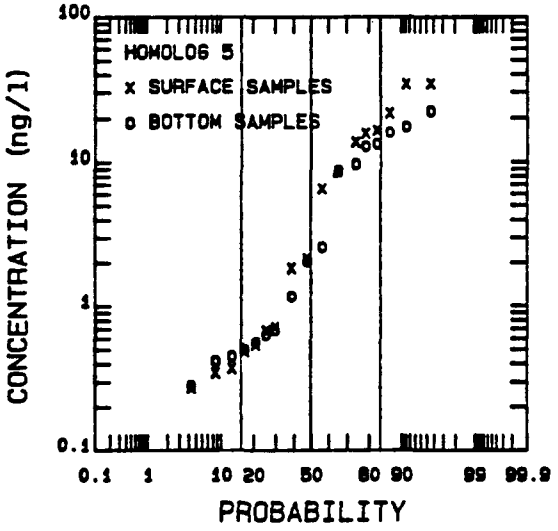
BATTELLE MEMORIAL INSTITUTE
Duxbury Operations
397 Washington Street
Duxbury, MA 02332

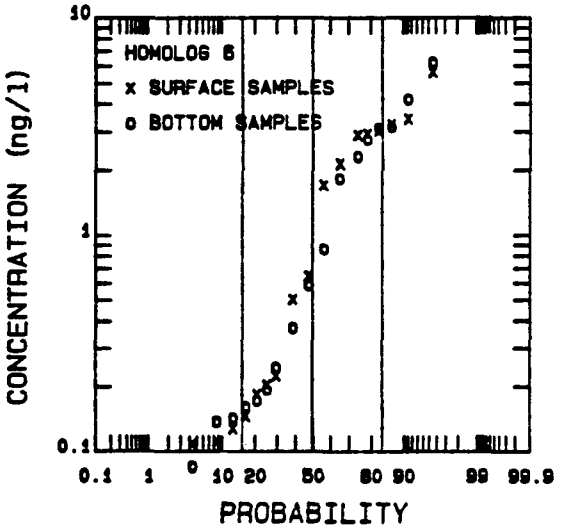
APPENDIX G

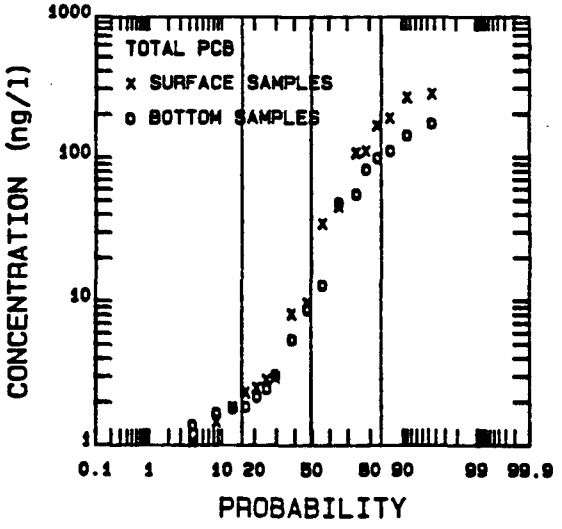
COMPARISON OF SURFACE AND BOTTOM SAMPLES

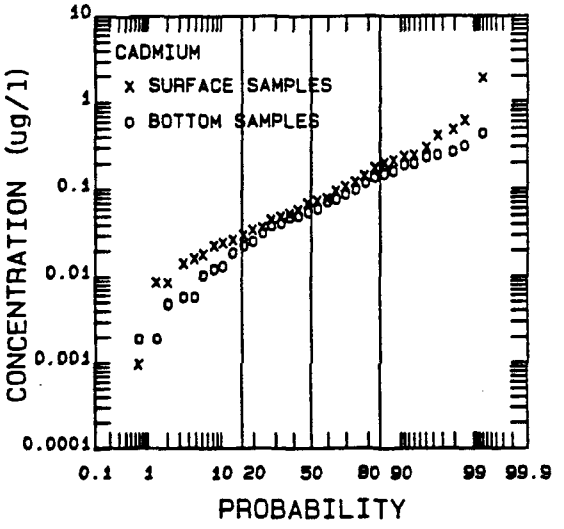

HOMOLOG 3
x SURFACE SAMPLES
o BOTTOM SAMPLES
CONCENTRATION (ng/l)
PROBABILITY

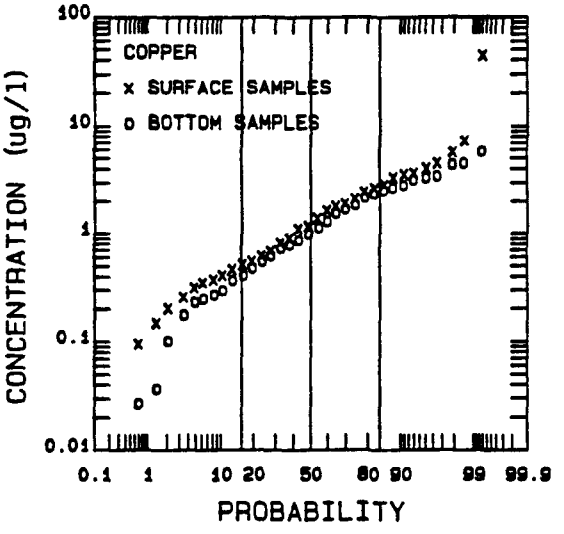

HOMOLOG 4
x SURFACE SAMPLES
o BOTTOM SAMPLES
CONCENTRATION (ng/l)
PROBABILITY

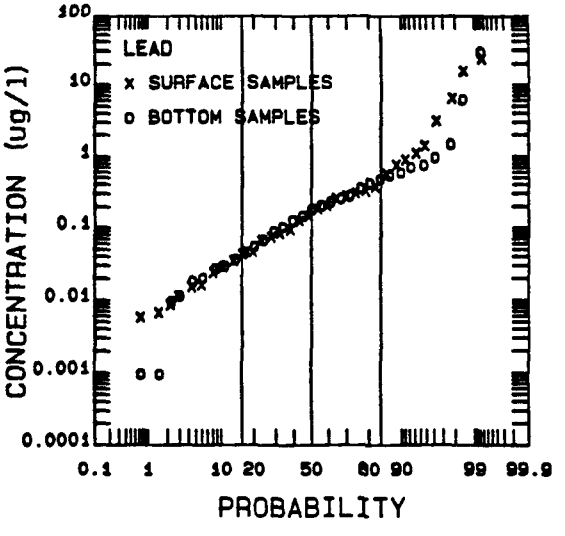

HOMOLOG 5
x SURFACE SAMPLES
o BOTTOM SAMPLES
CONCENTRATION (ng/l)
PROBABILITY


HOMOLOG 6
x SURFACE SAMPLES
o BOTTOM SAMPLES
CONCENTRATION (ng/l)
PROBABILITY


TOTAL PCB
x SURFACE SAMPLES
o BOTTOM SAMPLES
CONCENTRATION (ng/l)
PROBABILITY


CADMIUM
x SURFACE SAMPLES
o BOTTOM SAMPLES
CONCENTRATION (ug/l)
10
1
0.1
0.01
0.001
0.0001
0.1 1 10 20 50 80 90 99 99.9
PROBABILITY


COPPER
x SURFACE SAMPLES
o BOTTOM SAMPLES
CONCENTRATION (ug/l)
100
10
1
0.1
0.01
0.1 1 10 20 50 80 90 99 99.9
PROBABILITY

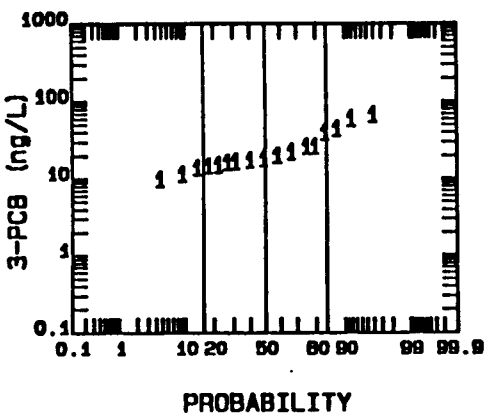

LEAD
x SURFACE SAMPLES
o BOTTOM SAMPLES
CONCENTRATION (ug/l)
100
10
1
0.1
0.01
0.001
0.0001
0.1 1 10 20 50 80 90 99 99.9
PROBABILITY

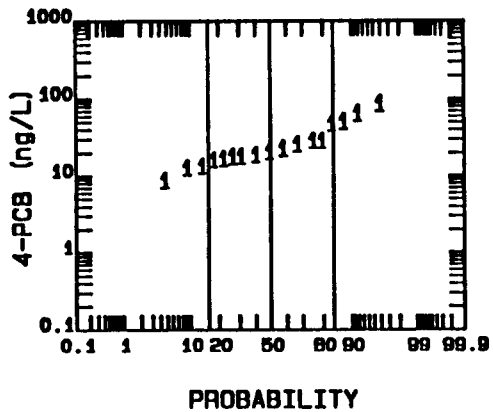
APPENDIX H

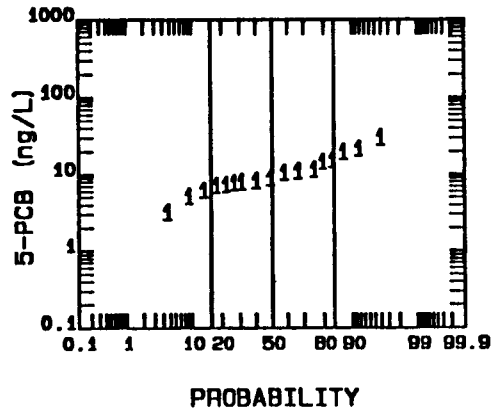
PROBABILITY PLOTS OF WATER COLUMN CONCENTRATIONS

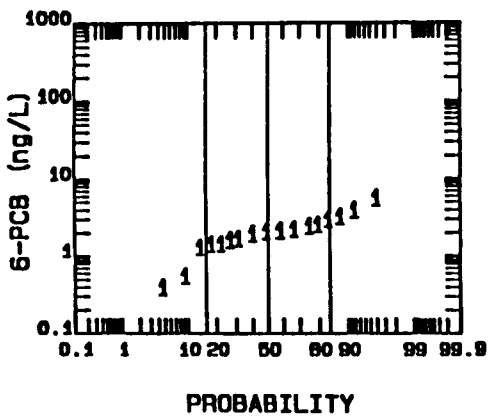
AREA 1 WATER COLUMN DISSOLVED PCB

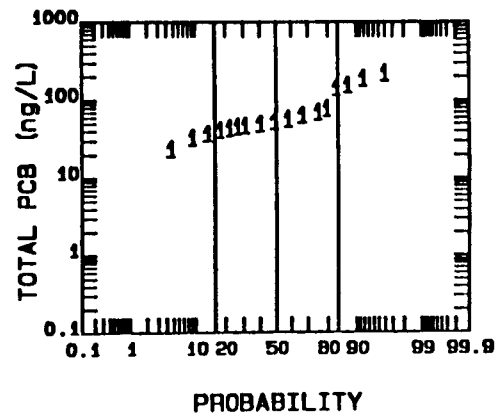
CRUISE 1





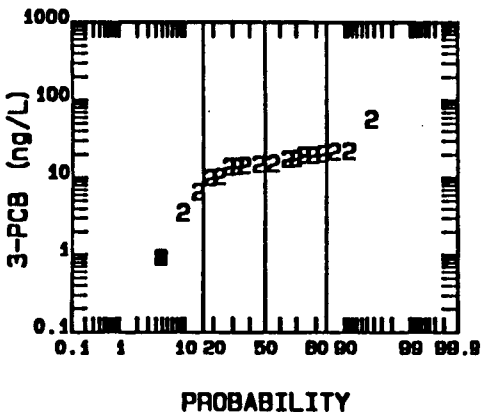


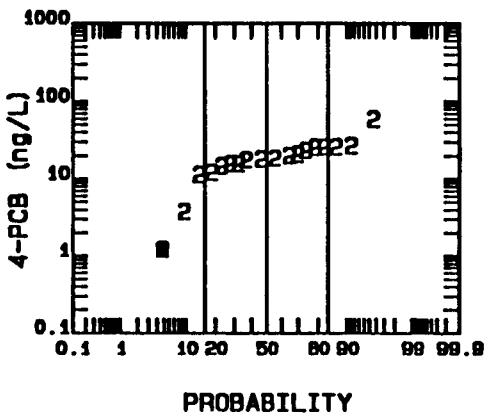


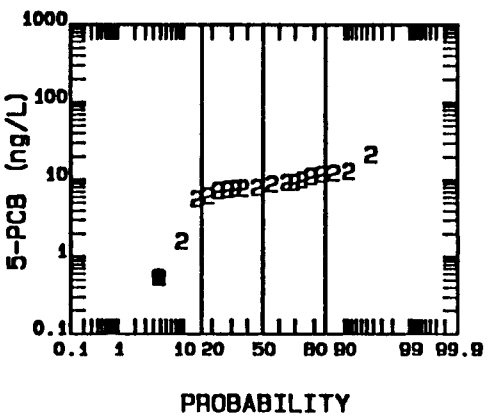


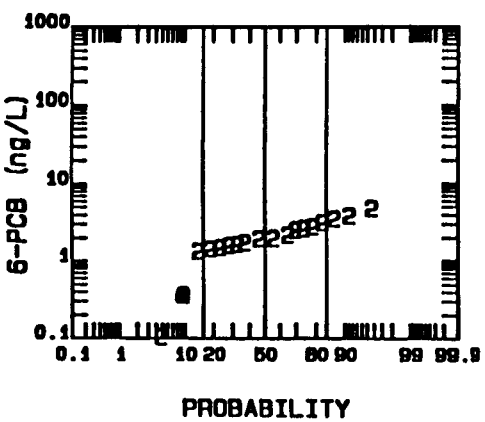
AREA 1 WATER COLUMN DISSOLVED PCB

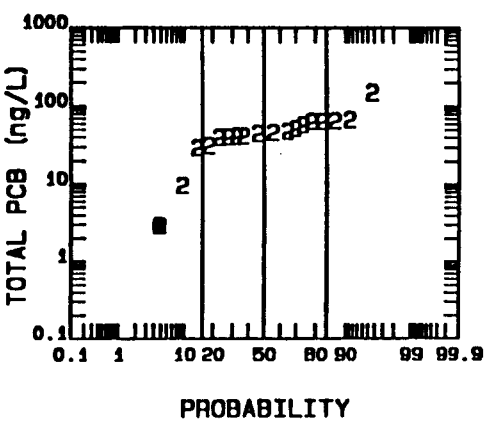
CRUISE 2





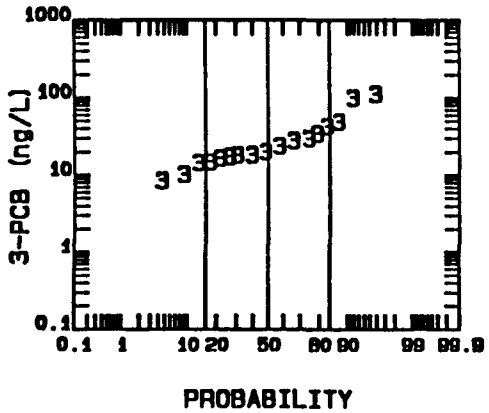


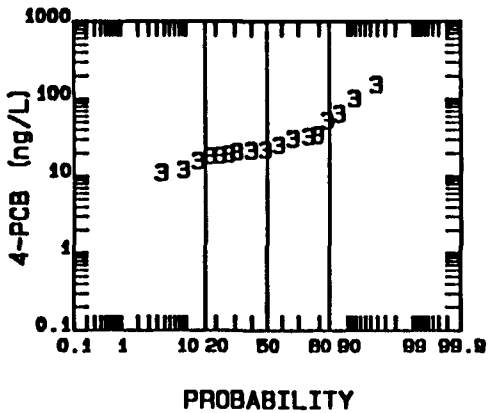


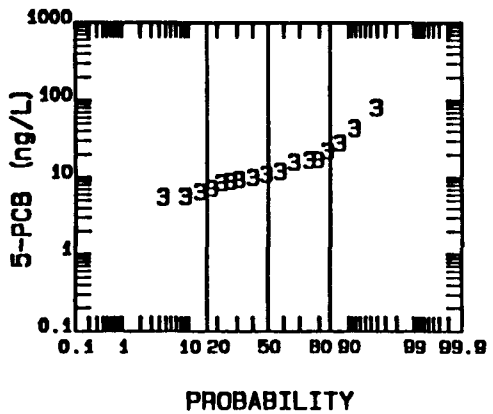


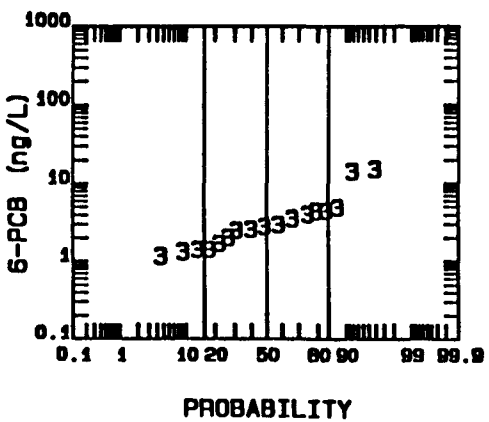
AREA 1 WATER COLUMN DISSOLVED PCB

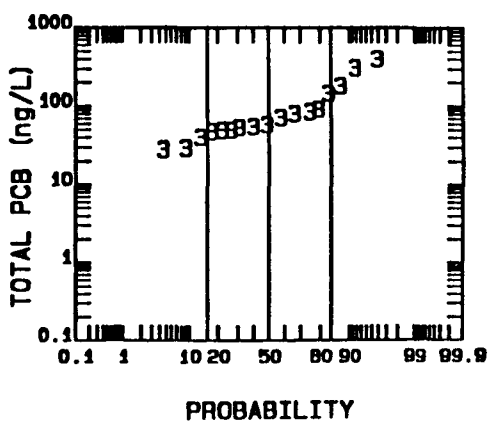
CRUISE 3





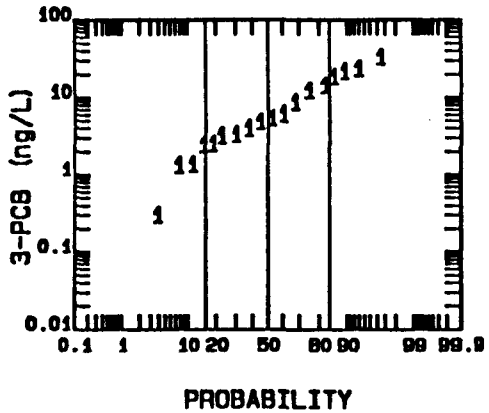


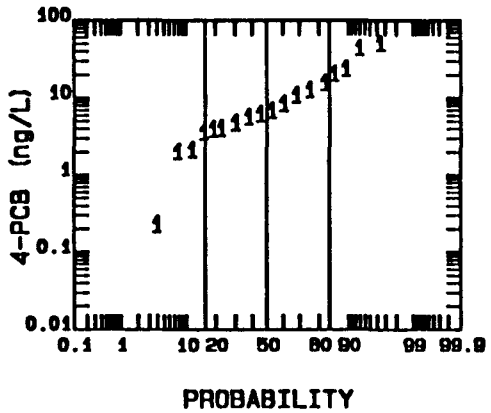


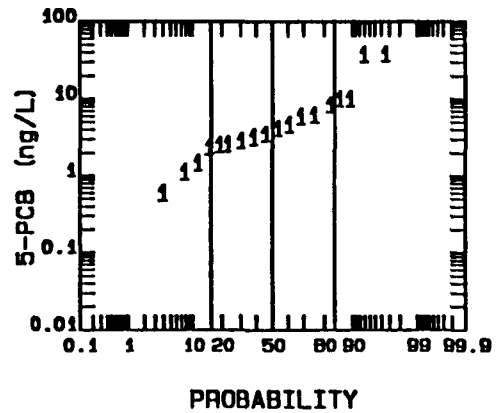


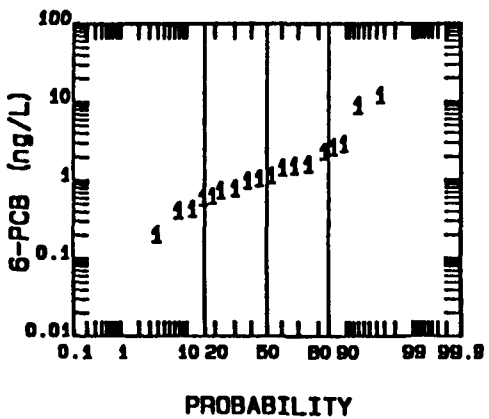
AREA 2 WATER COLUMN DISSOLVED PCB

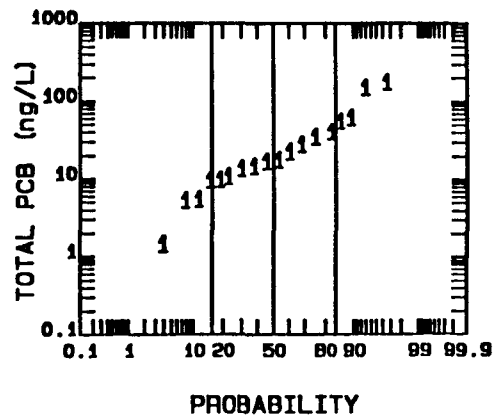
CRUISE 1





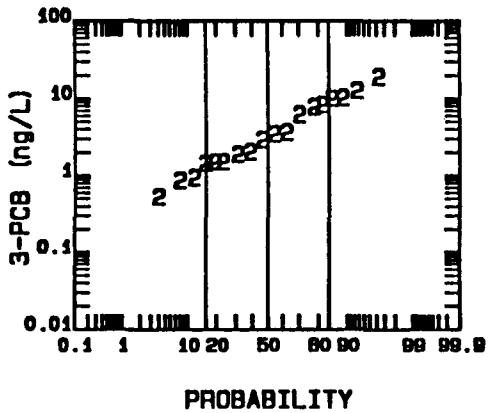


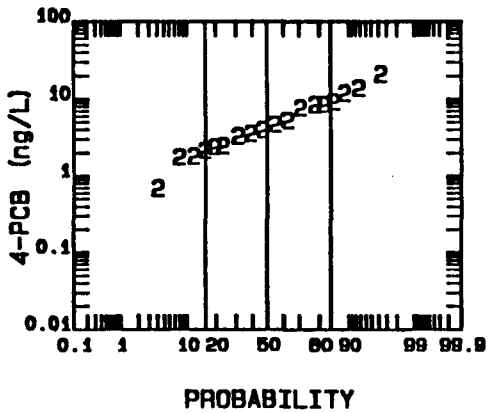


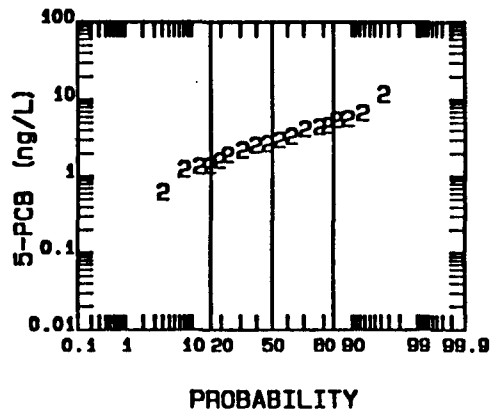


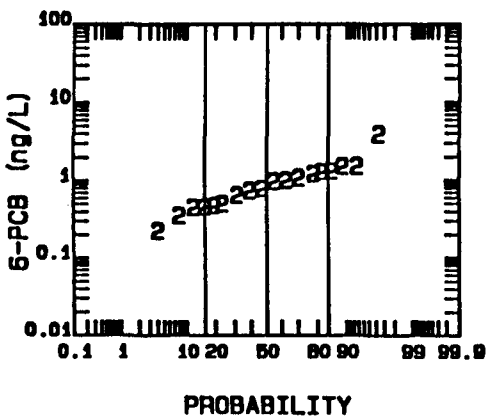
AREA 2 WATER COLUMN DISSOLVED PCB

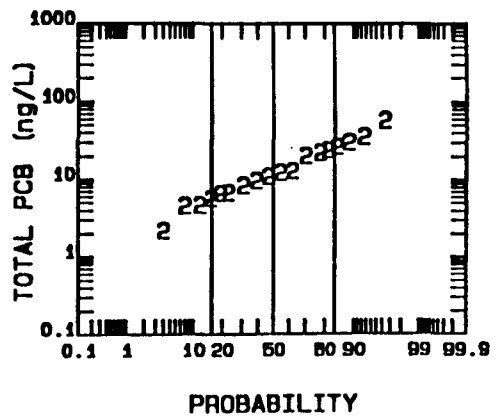
CRUISE 2





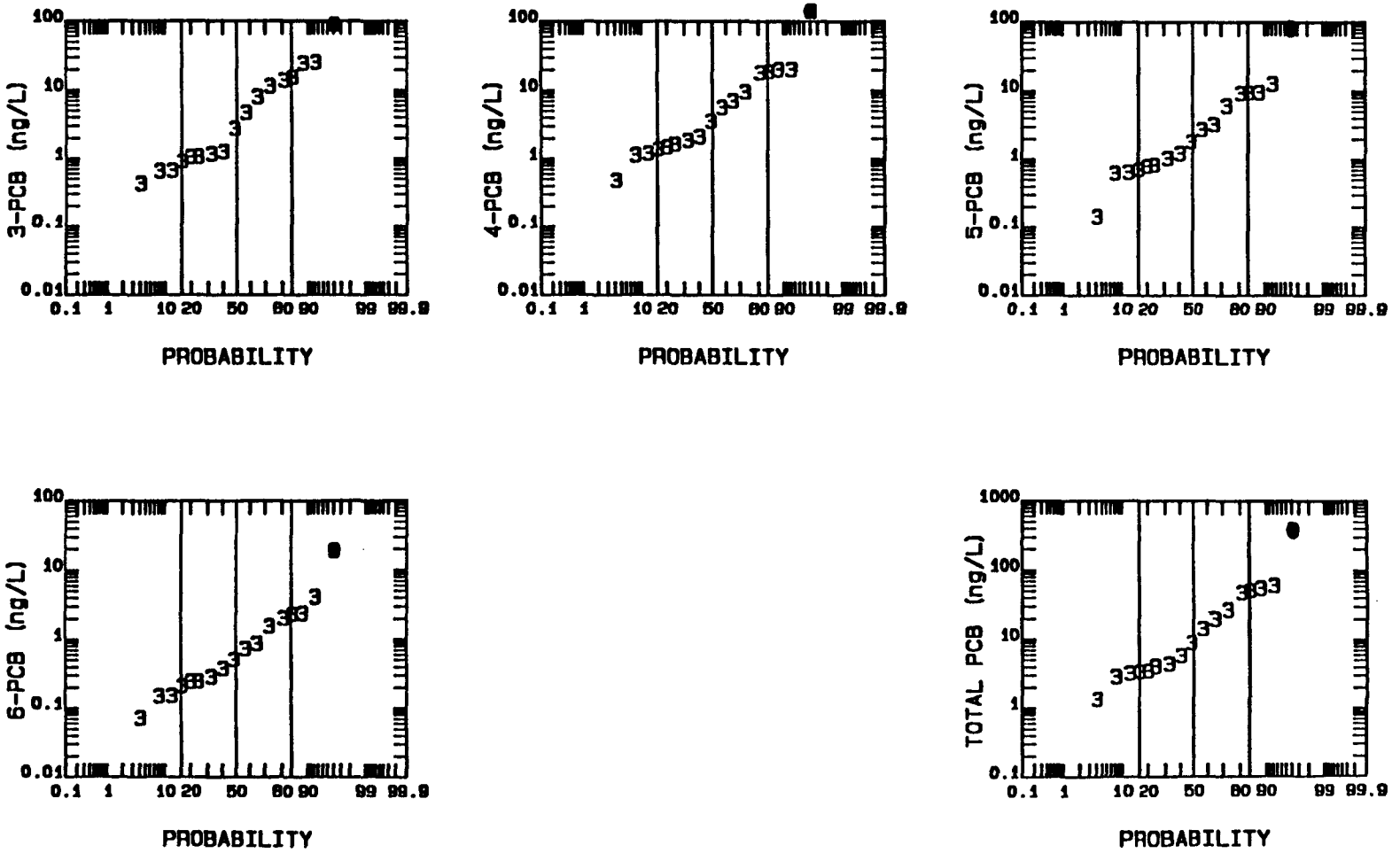






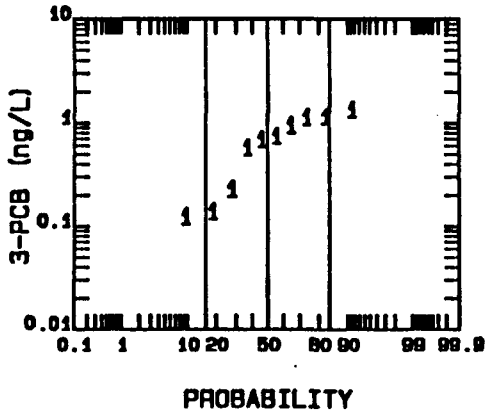
AREA 2 WATER COLUMN DISSOLVED PCB

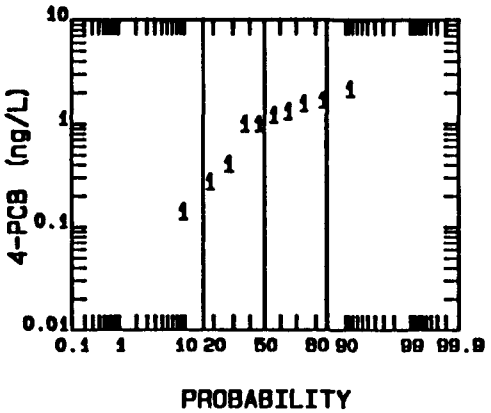
CRUISE 3

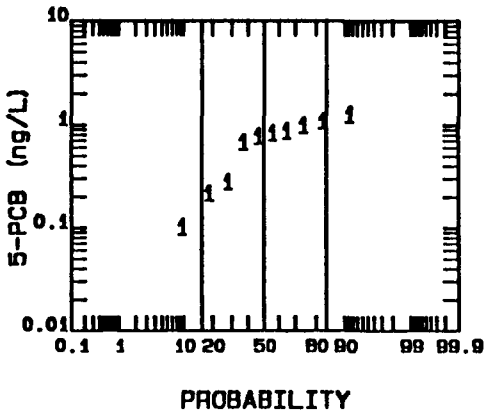


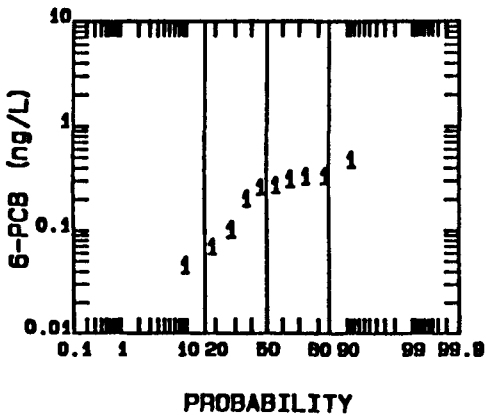
AREA 3 WATER COLUMN DISSOLVED PCB

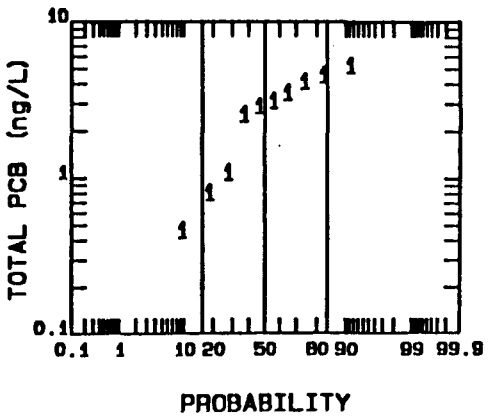
CRUISE 1





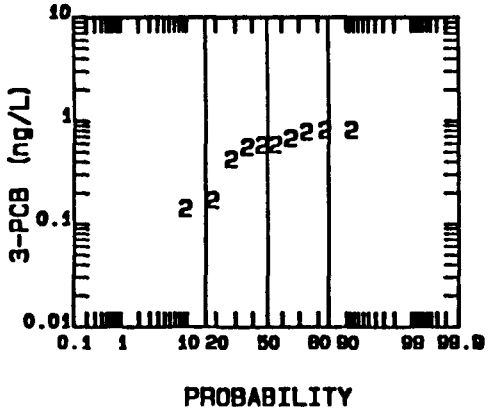


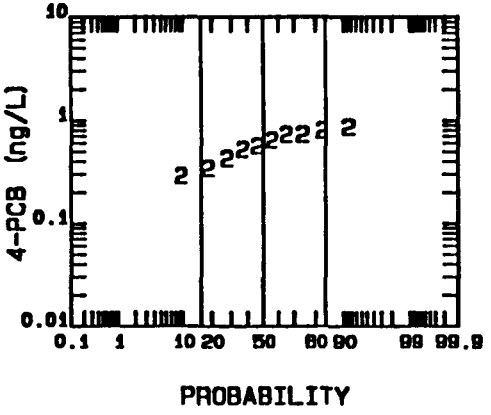


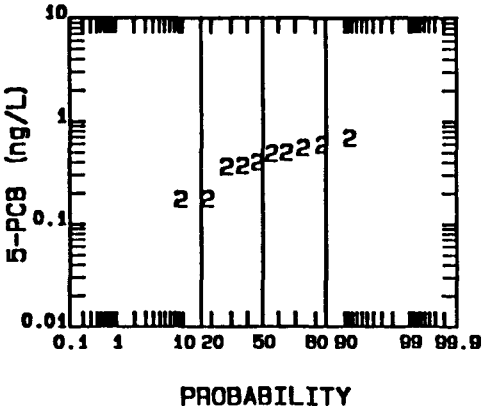


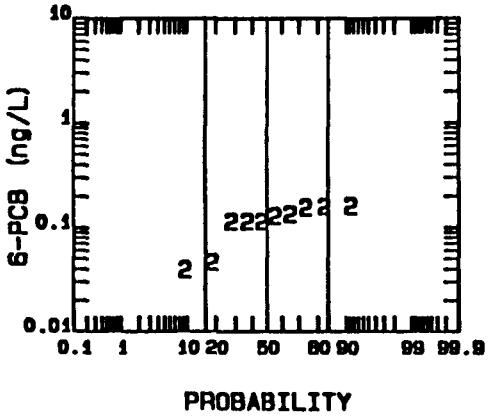
AREA 3 WATER COLUMN DISSOLVED PCB

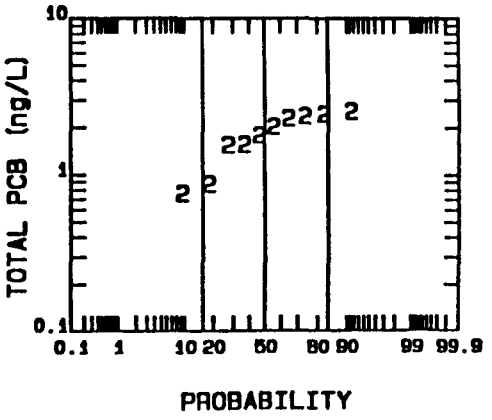
CRUISE 2





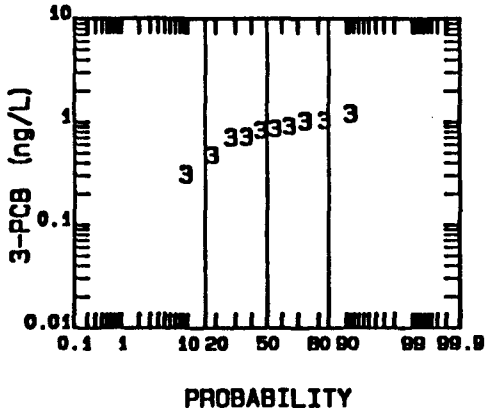


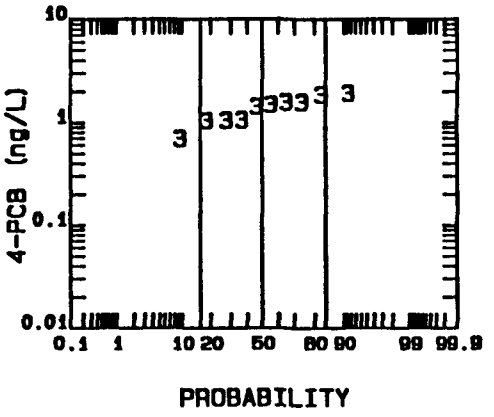


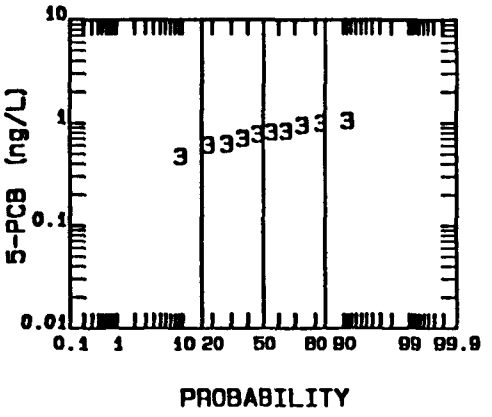


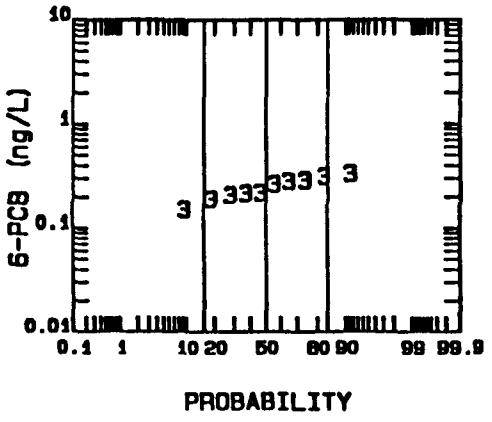
AREA 3 WATER COLUMN DISSOLVED PCB

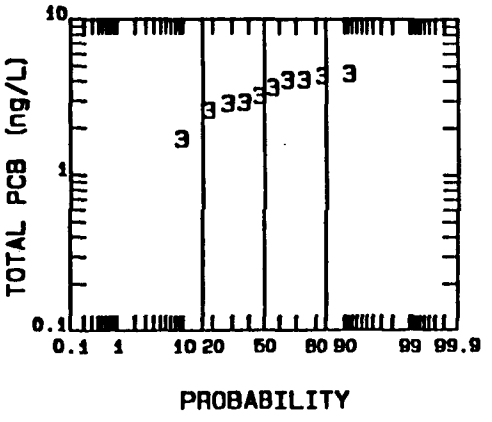
CRUISE 3





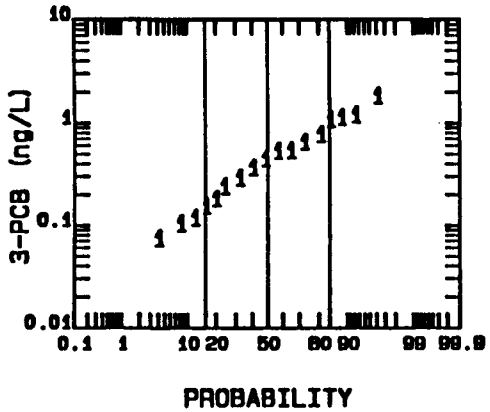


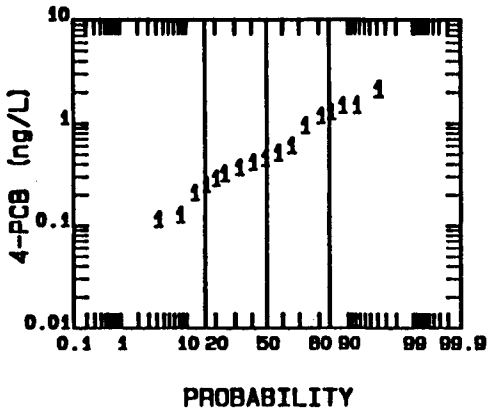


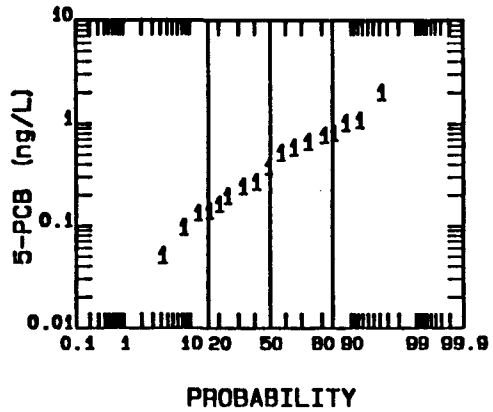


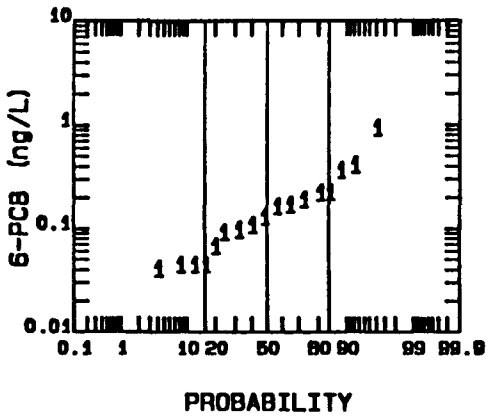
AREA 4 WATER COLUMN DISSOLVED PCB

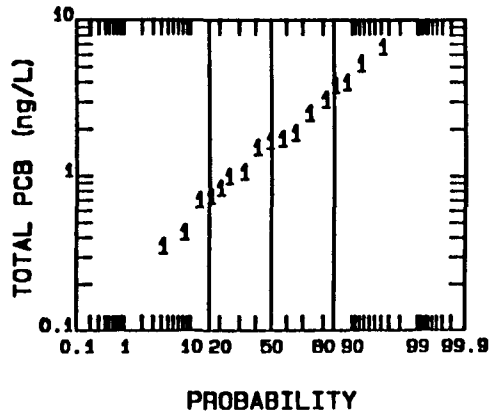
CRUISE 1





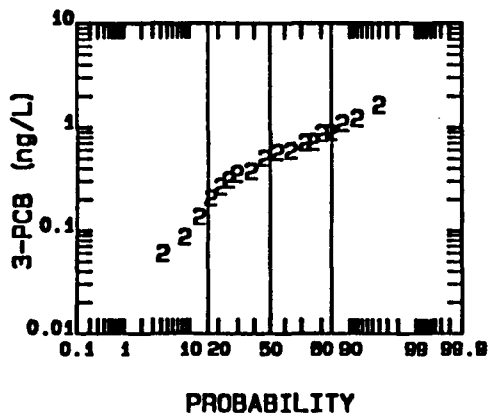


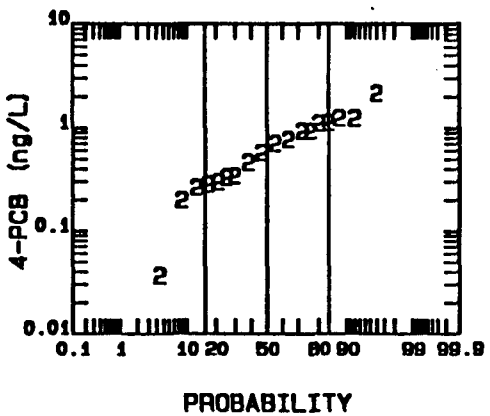


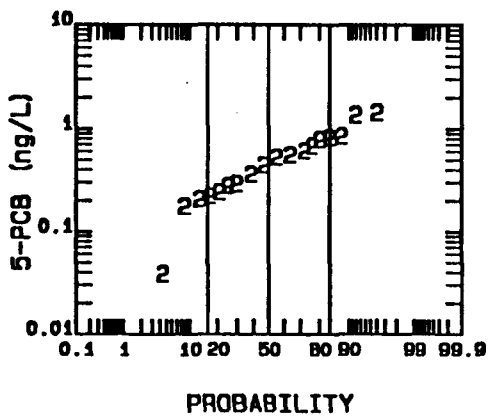


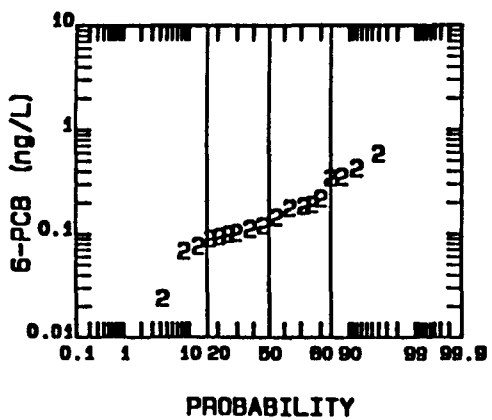
AREA 4 WATER COLUMN DISSOLVED PCB

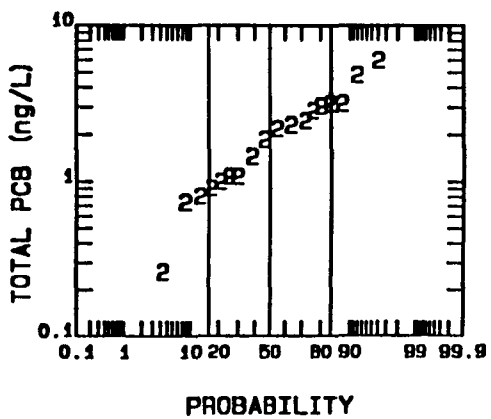
CRUISE 2





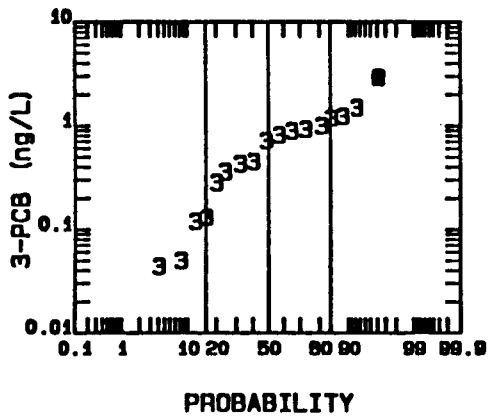


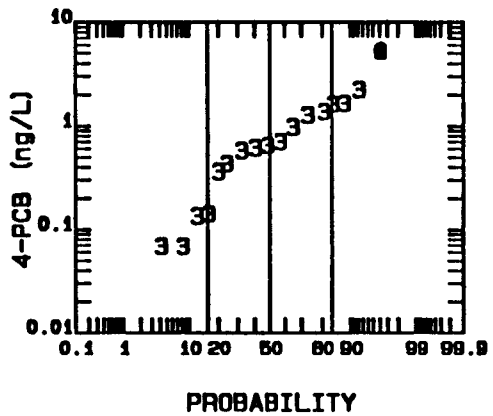


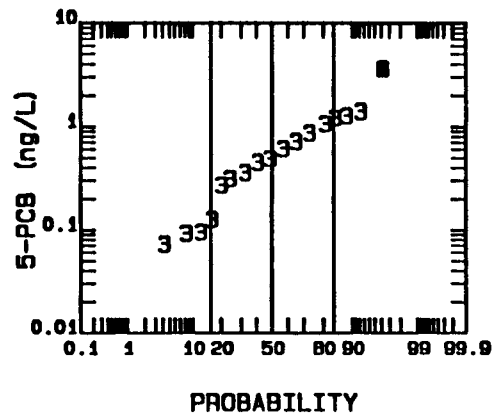


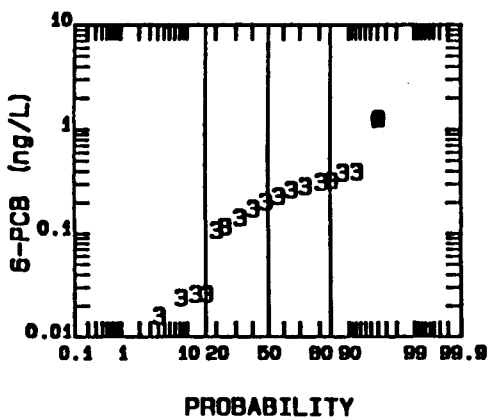
AREA 4 WATER COLUMN DISSOLVED PCB

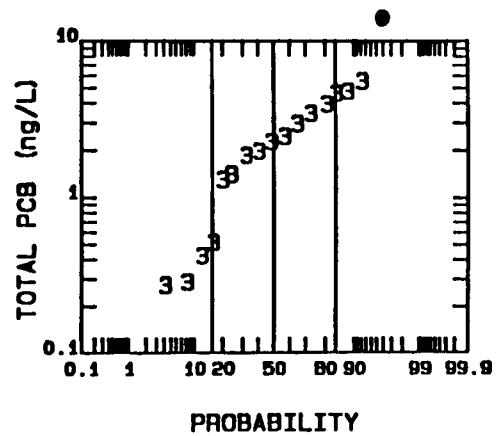
CRUISE 3



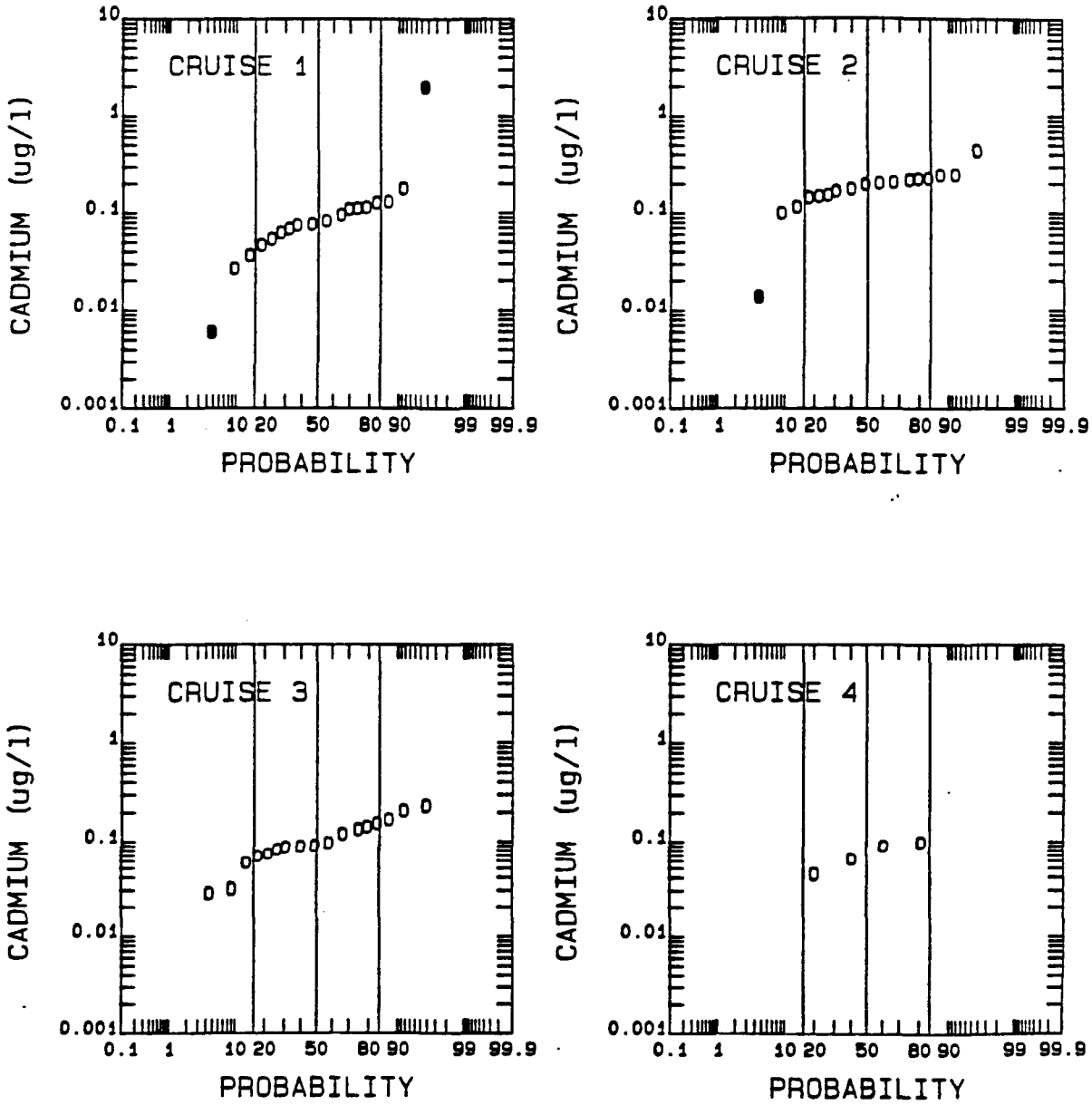




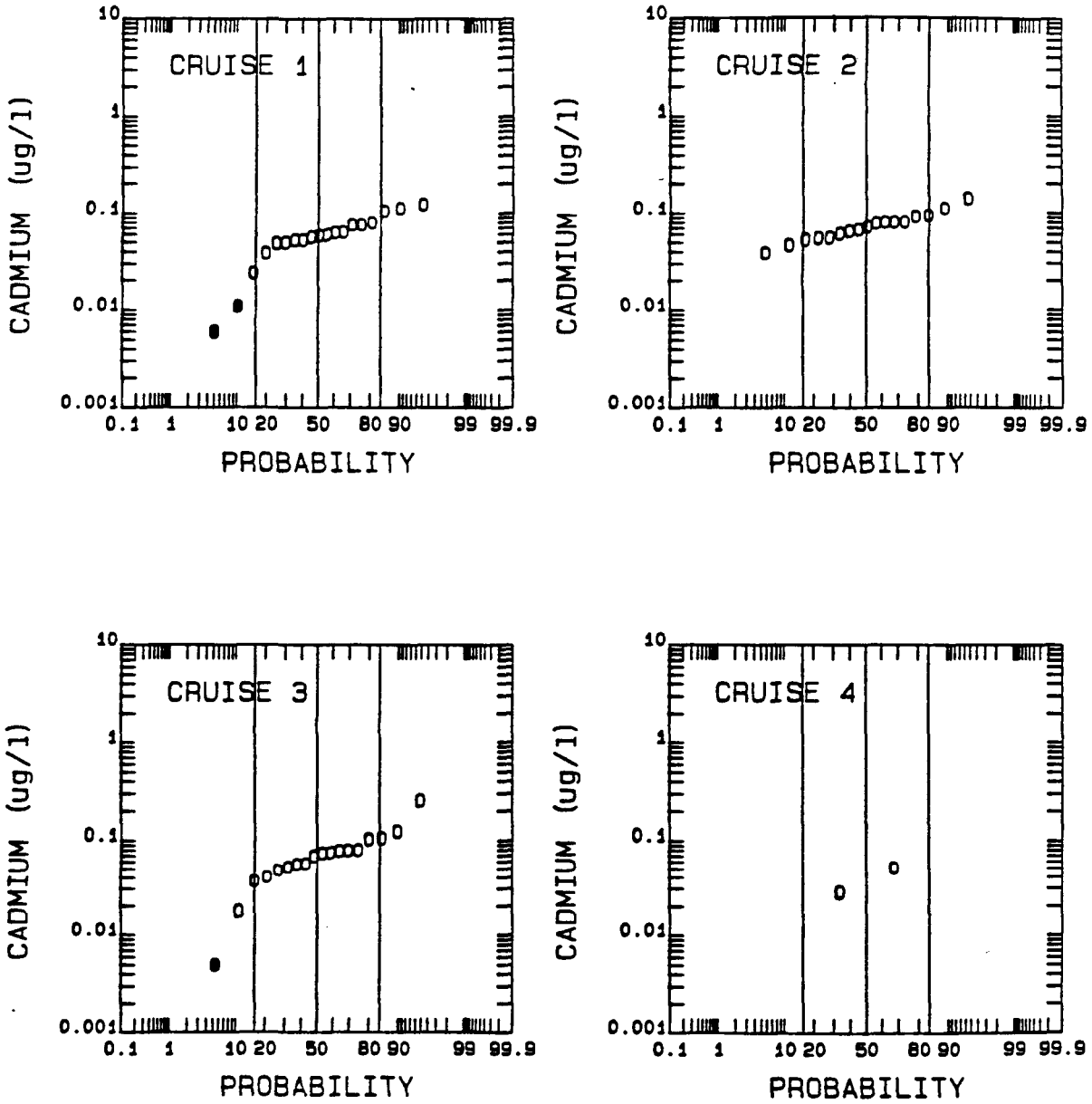




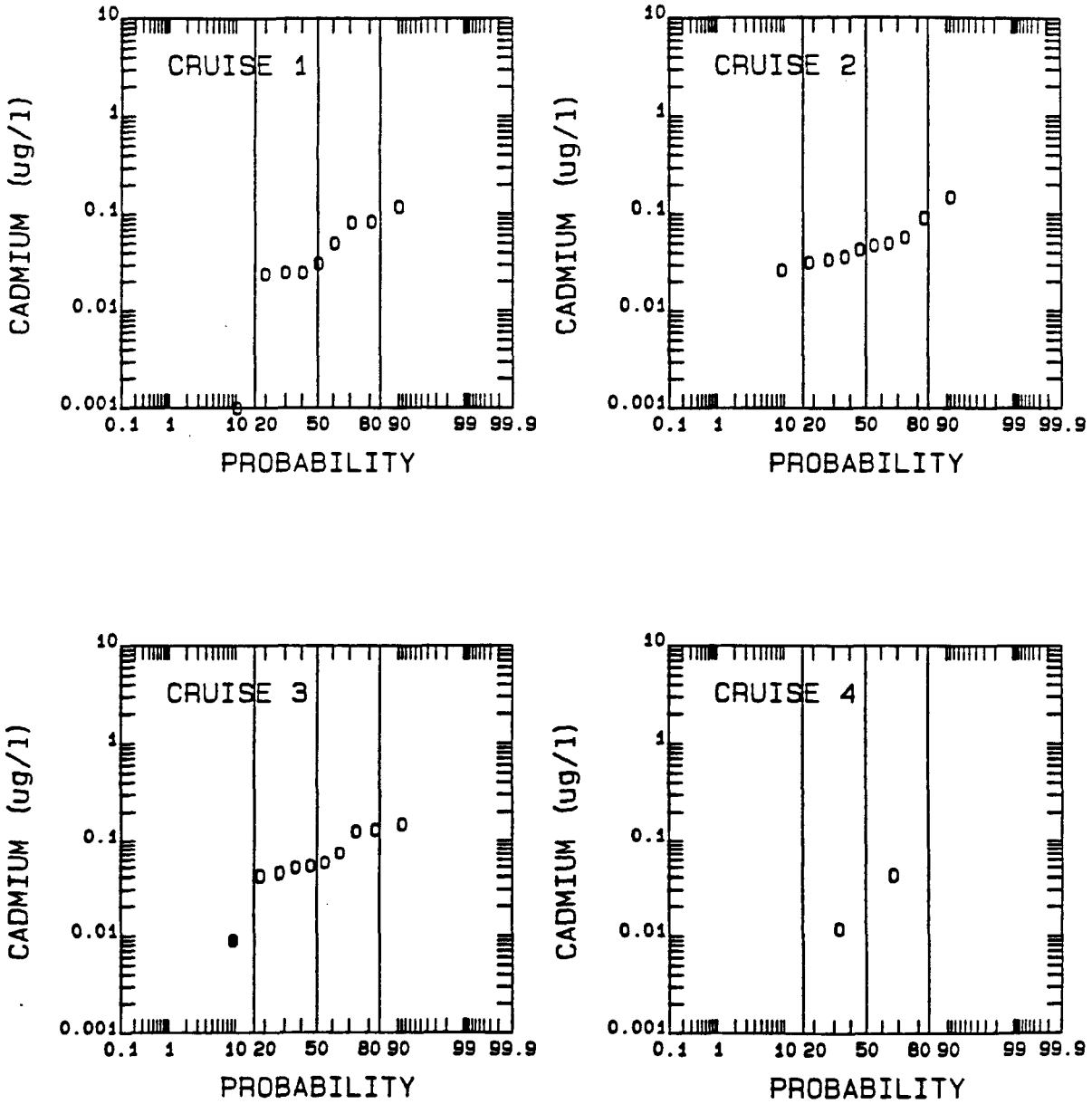
DISSOLVED CADMIUM CONC. - AREA 1



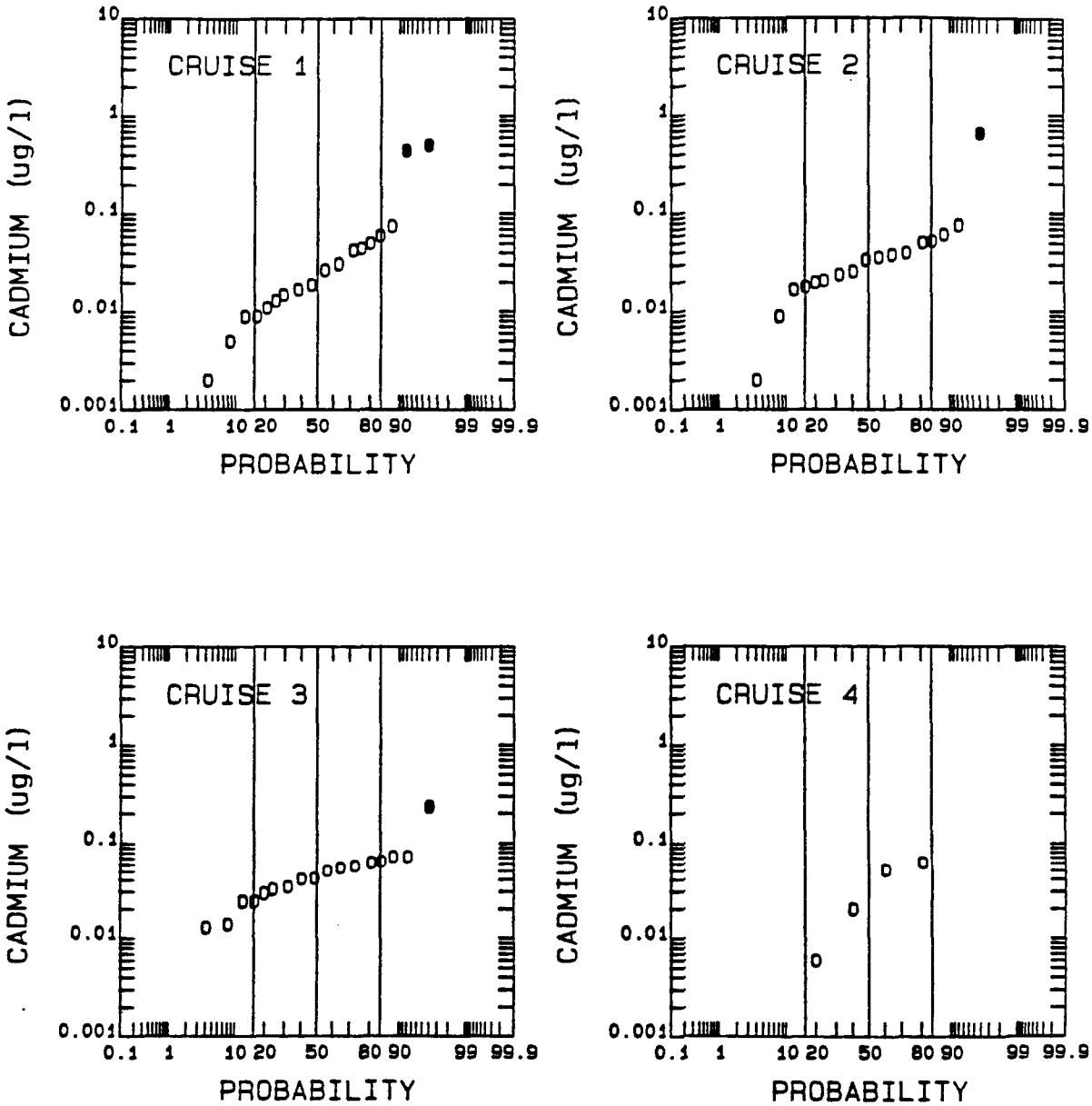
DISSOLVED CADMIUM CONC. - AREA 2



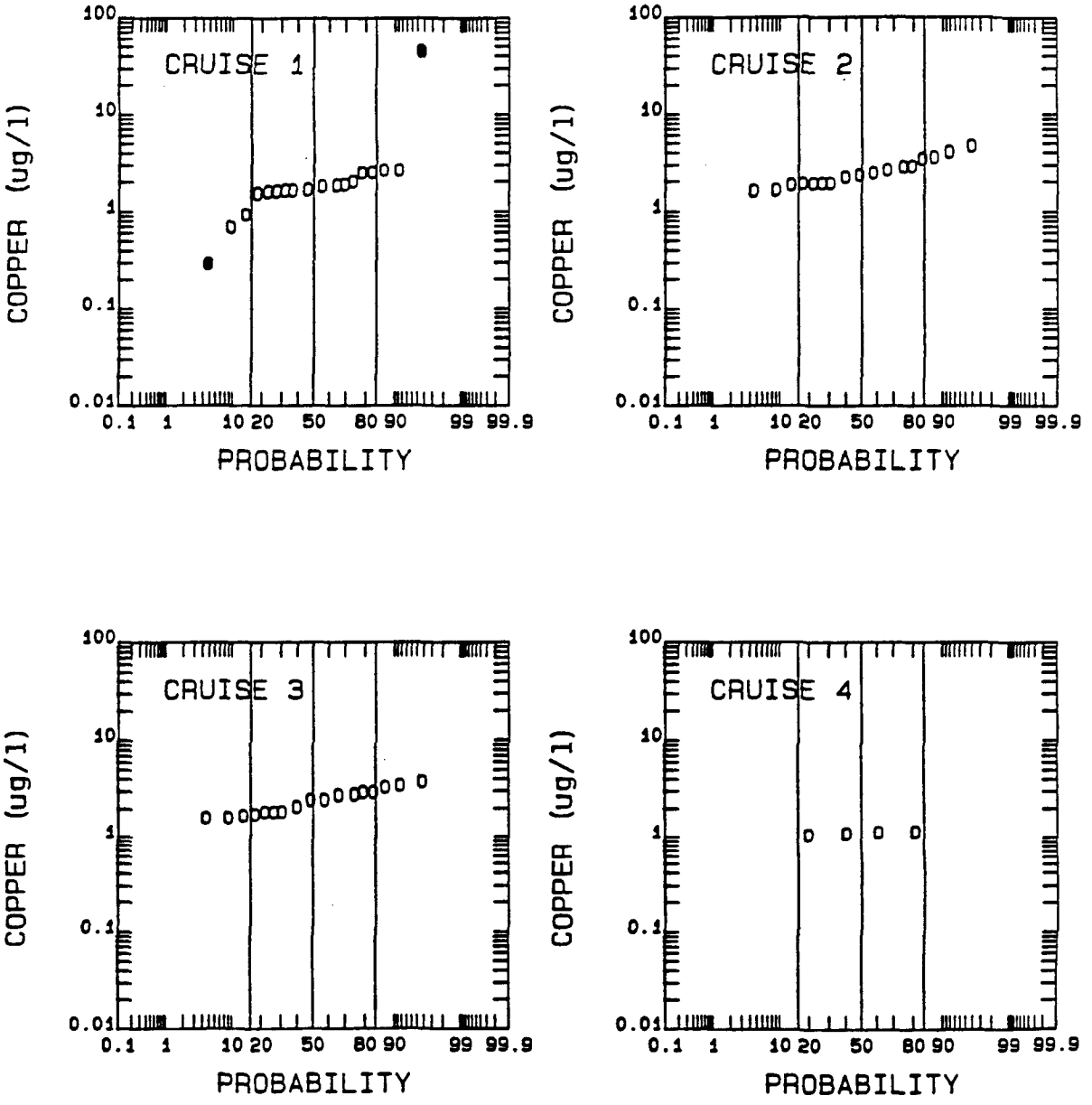
DISSOLVED CADMIUM CONC. - AREA 3



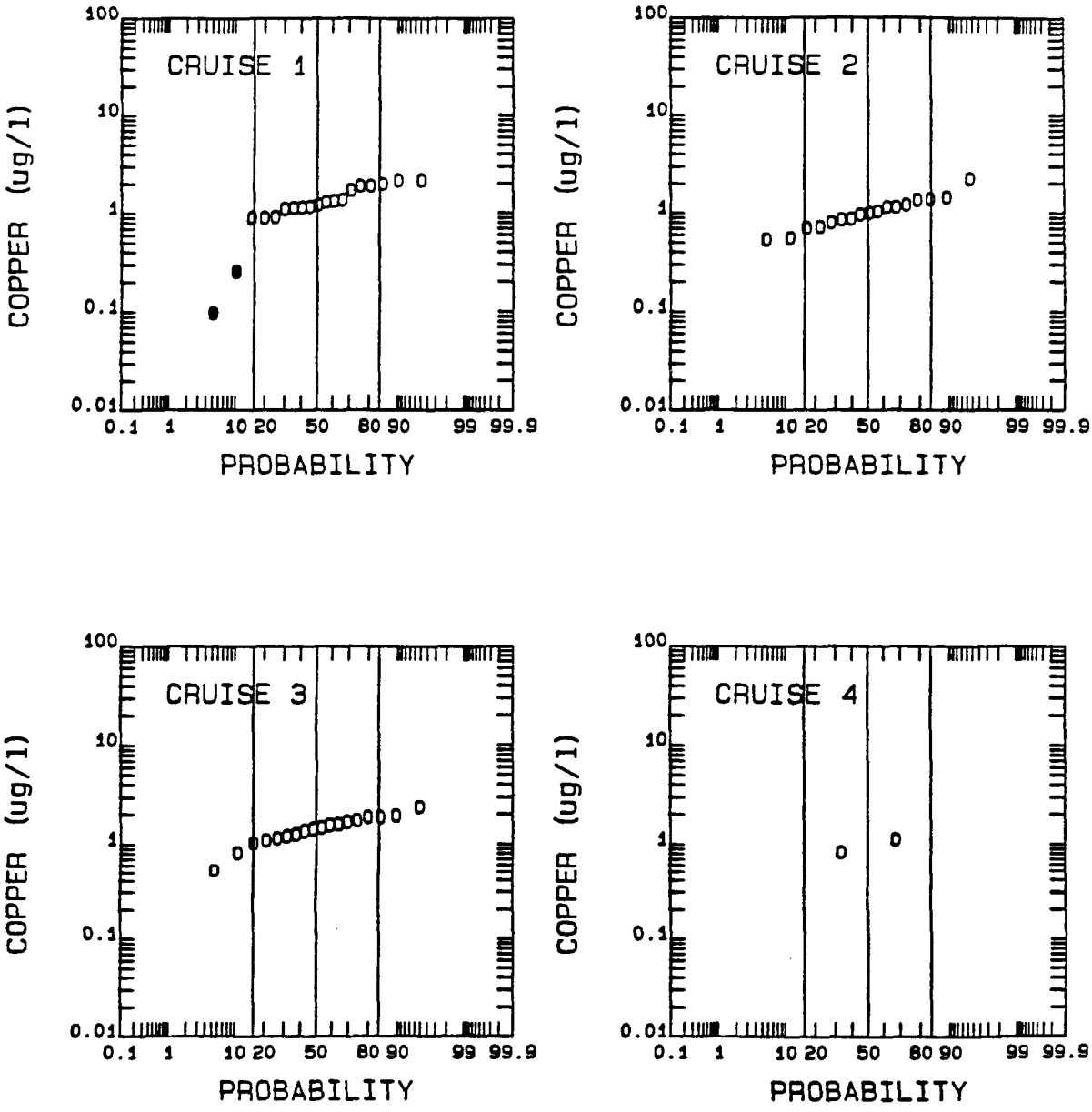
DISSOLVED CADMIUM CONC. - AREA 4



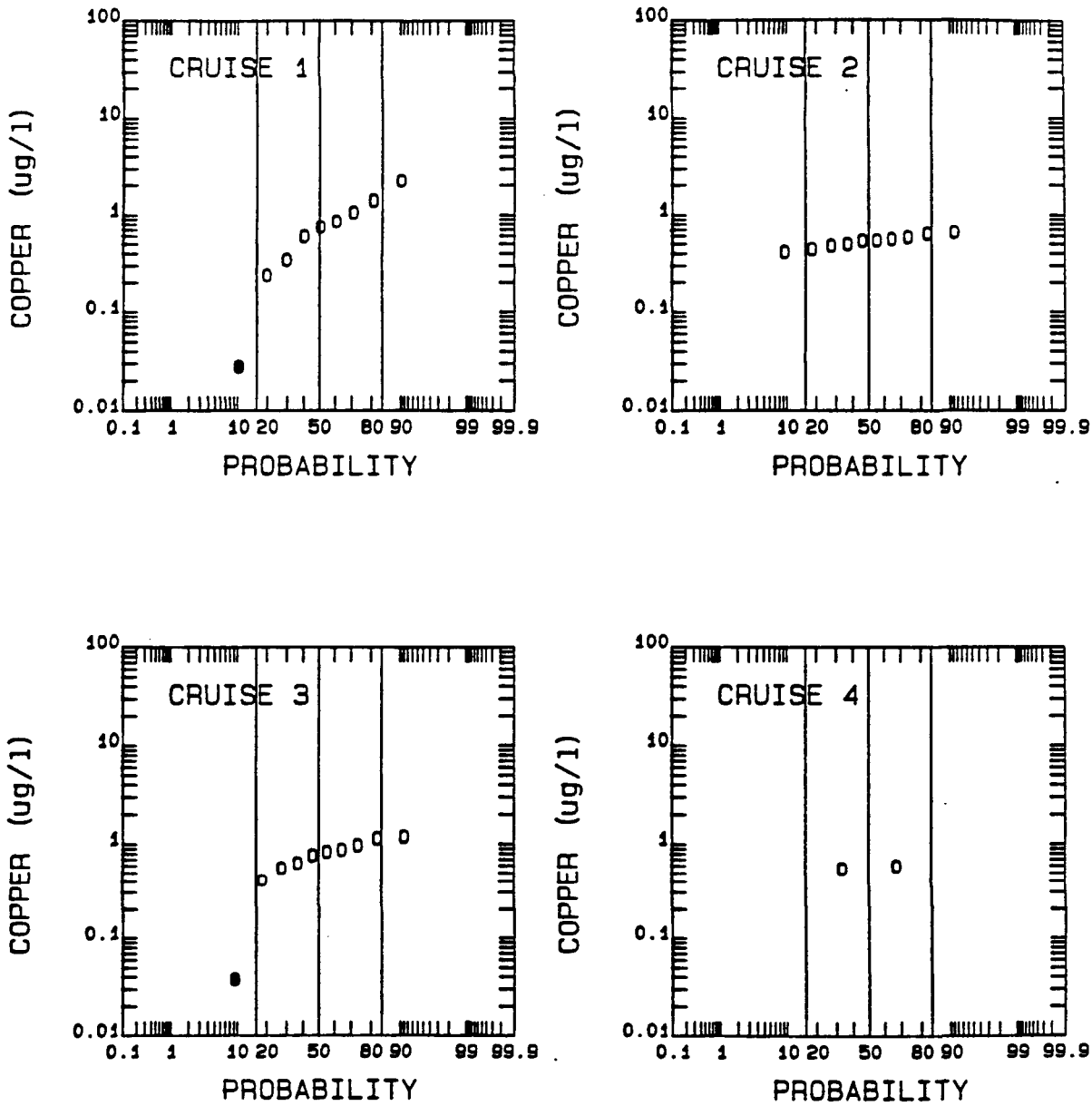
DISSOLVED COPPER CONC. - AREA 1



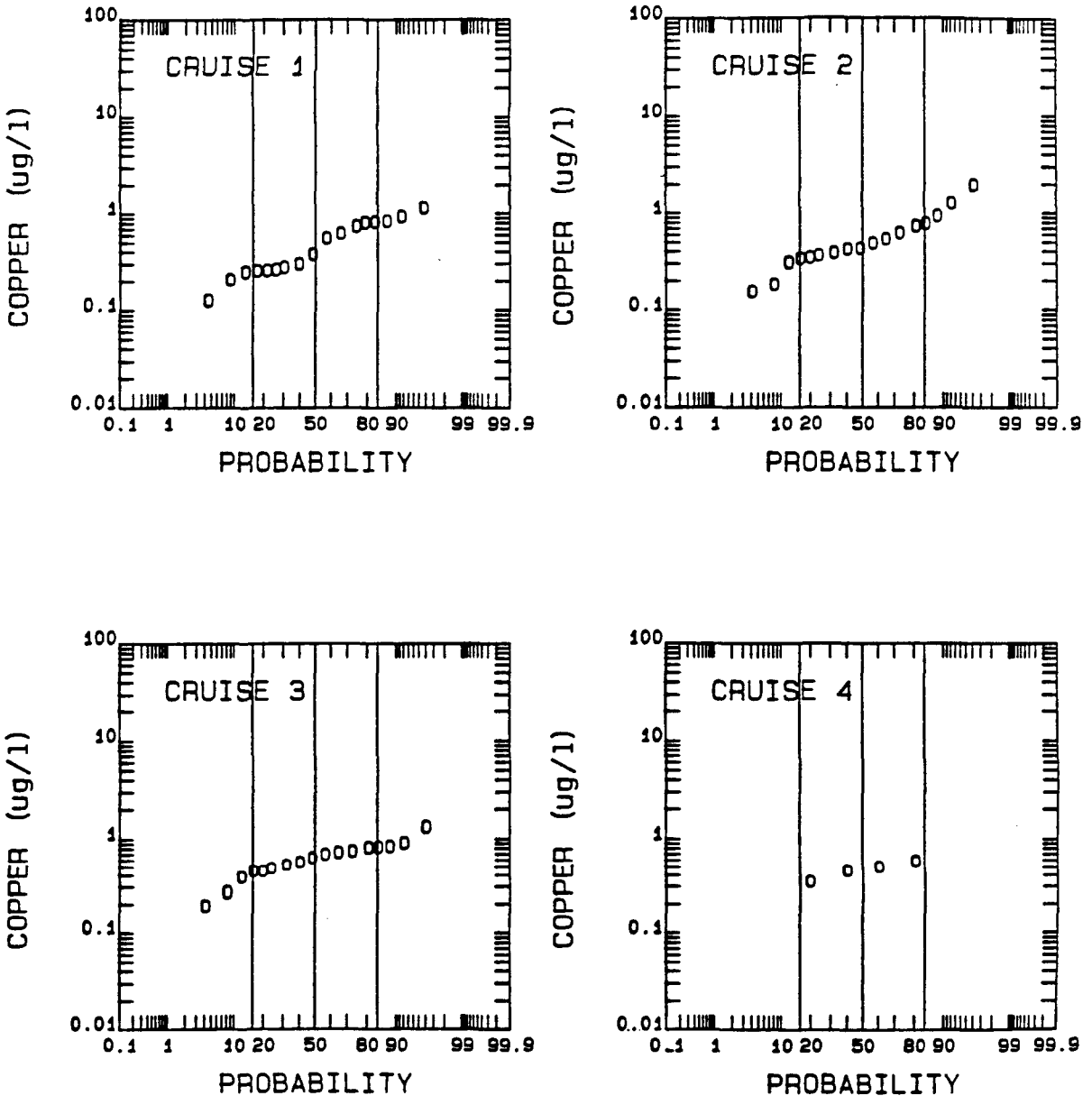
DISSOLVED COPPER CONC. - AREA 2



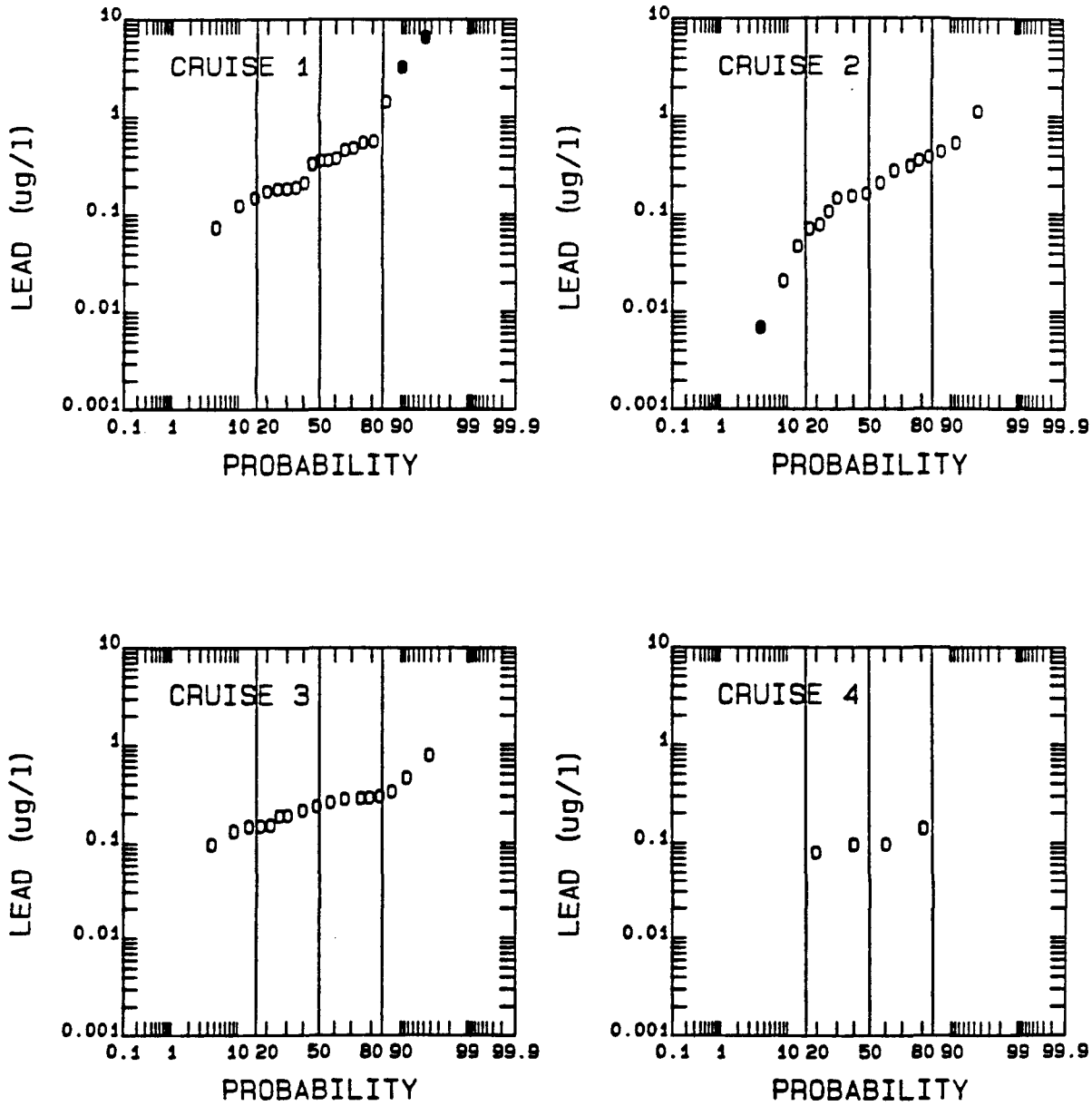
DISSOLVED COPPER CONC. - AREA 3



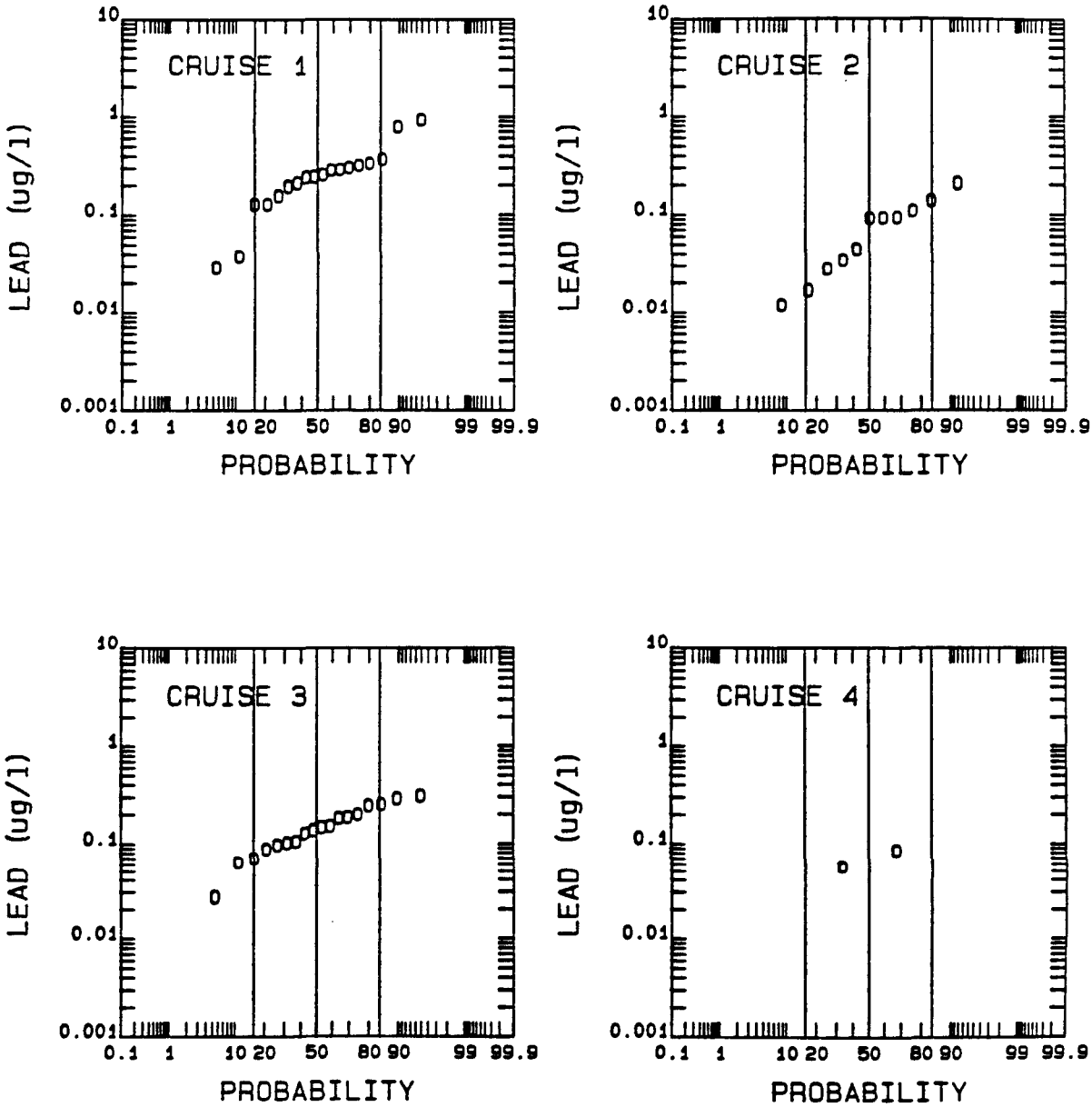
DISSOLVED COPPER CONC. - AREA 4



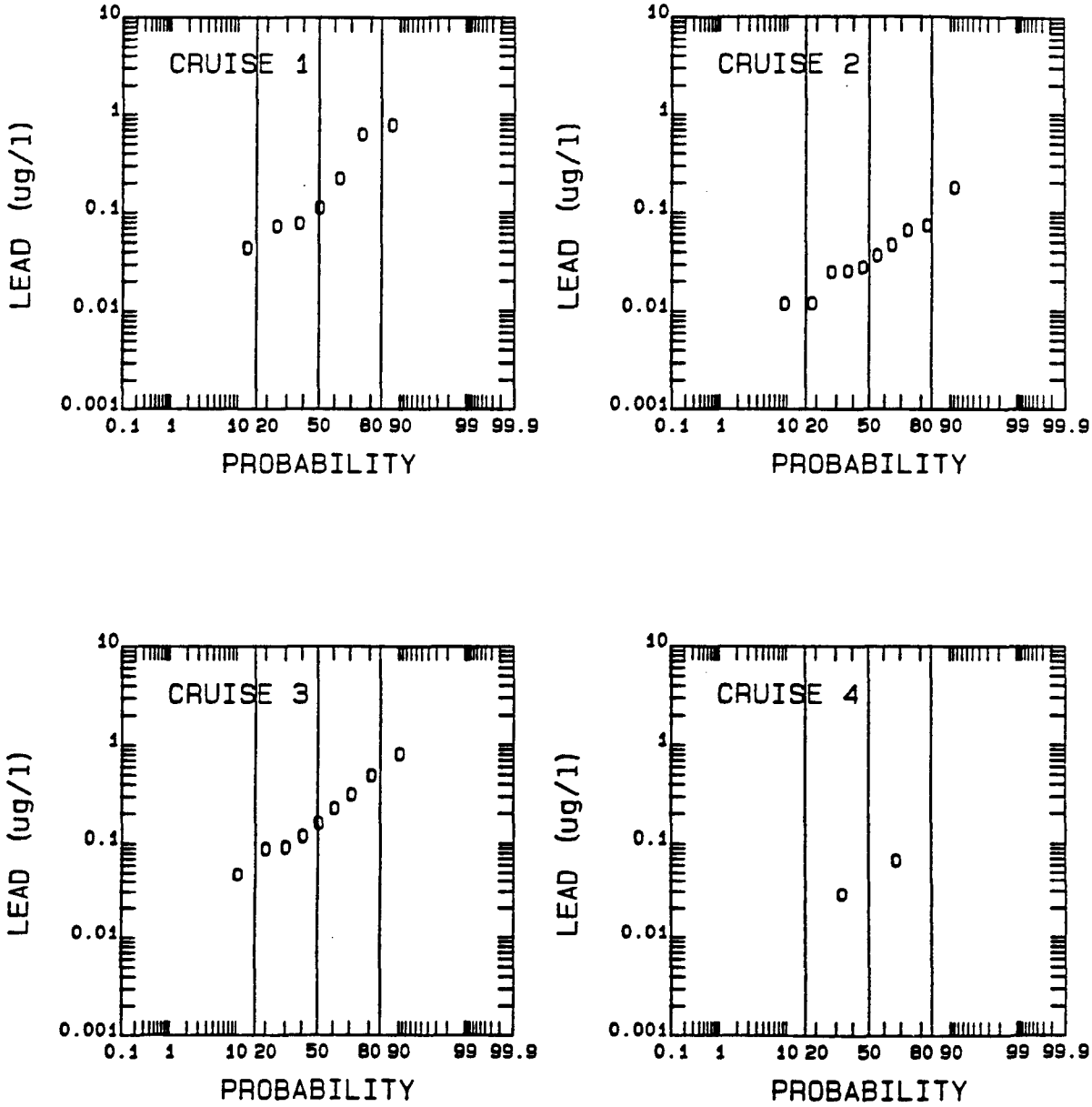
DISSOLVED LEAD CONC. - AREA 1



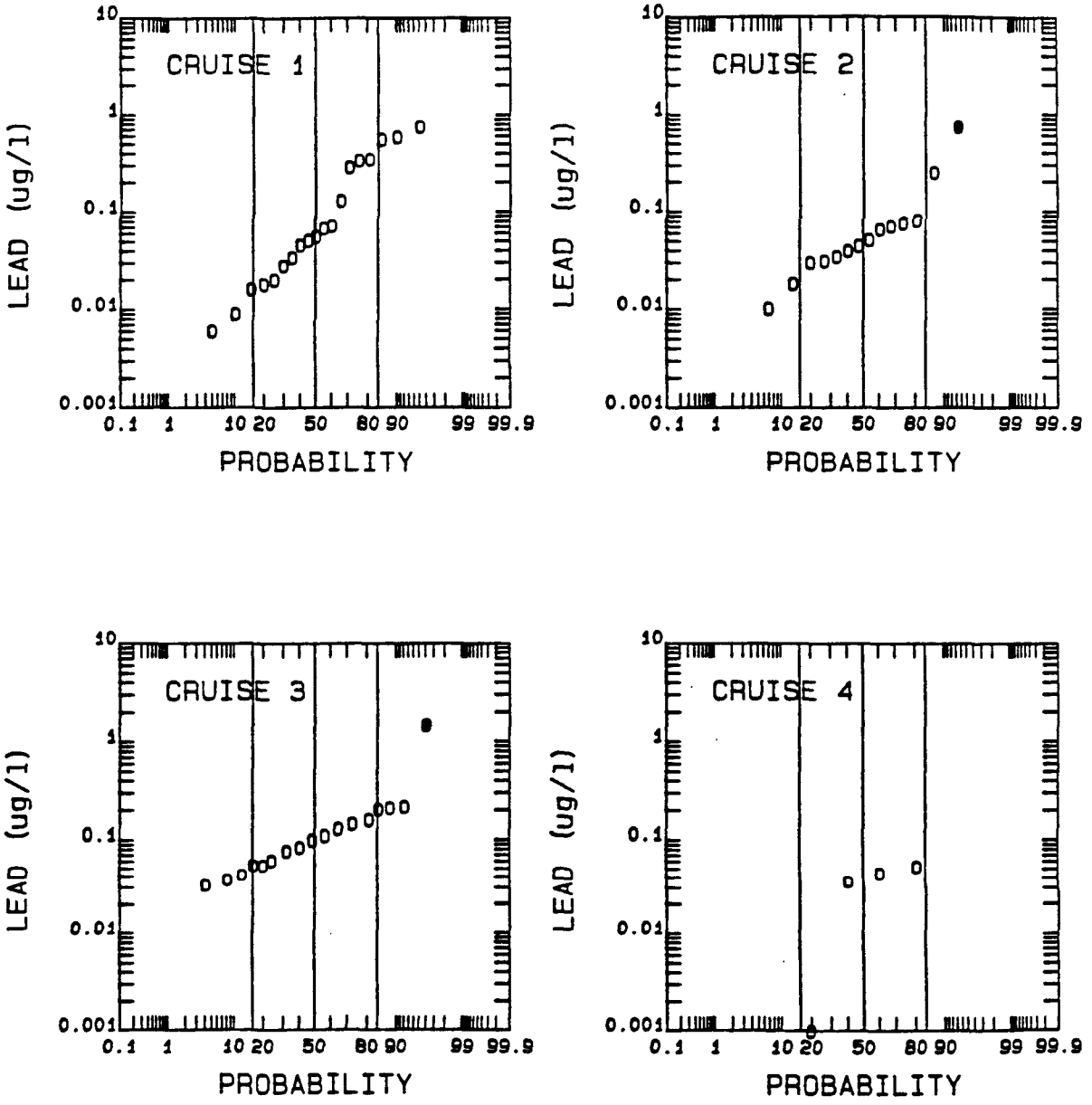
DISSOLVED LEAD CONC. - AREA 2



DISSOLVED LEAD CONC. - AREA 3



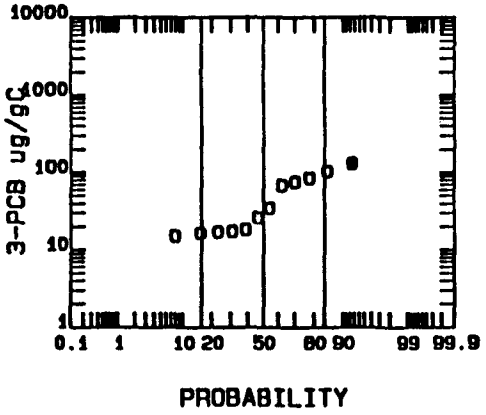
DISSOLVED LEAD CONC. - AREA 4

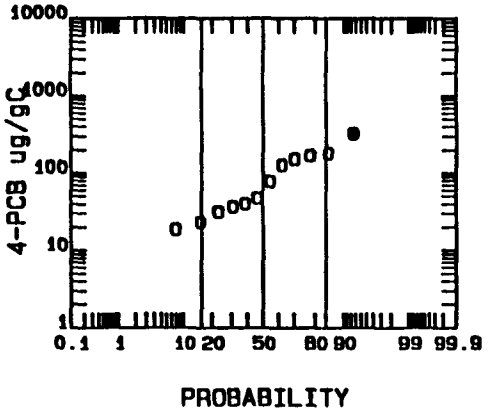


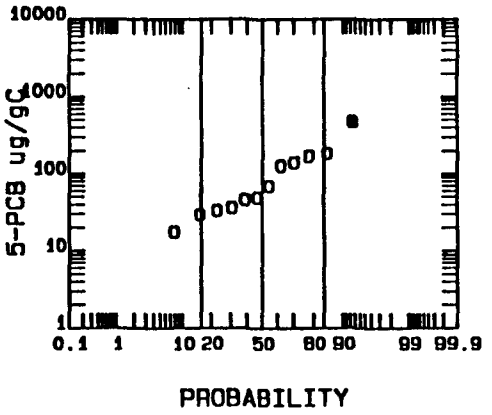
APPENDIX I

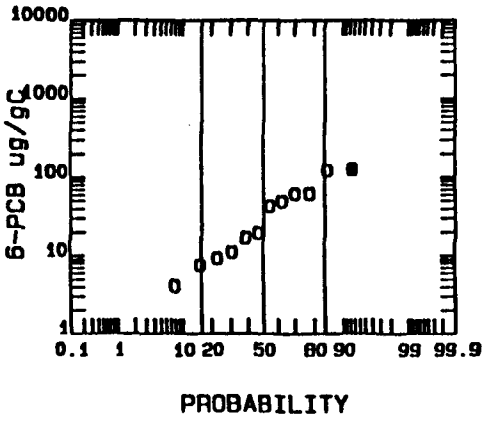
PROBABILITY PLOTS OF BULK SEDIMENT CONCENTRATIONS

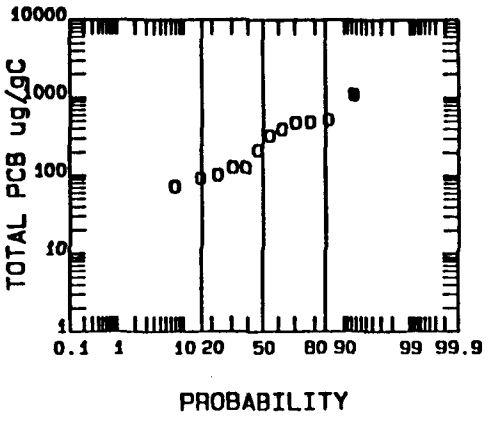
AREA 1 CARBON NORMALIZED SEDIMENT BULK PCB



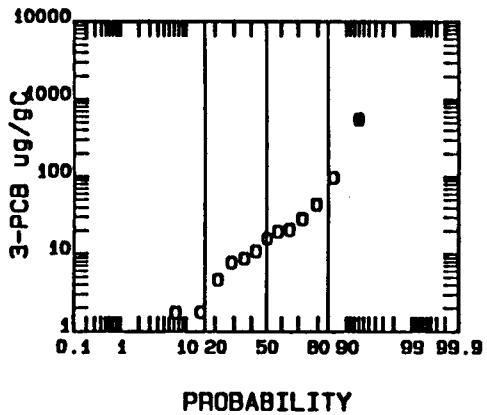


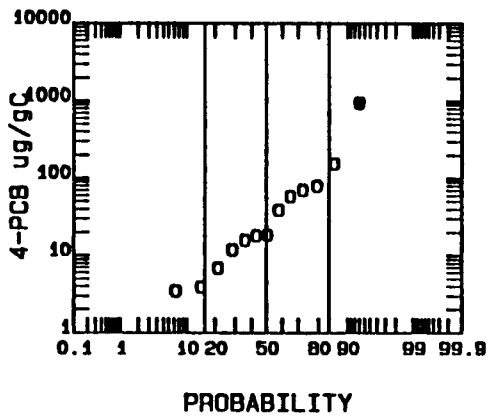


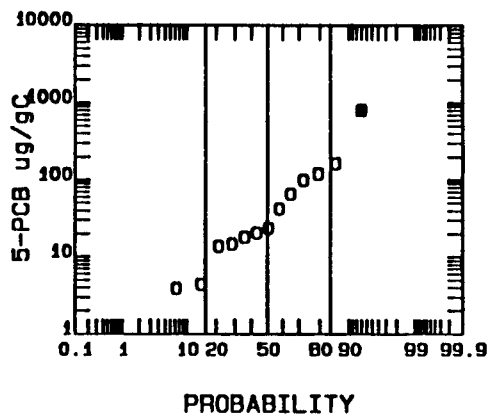


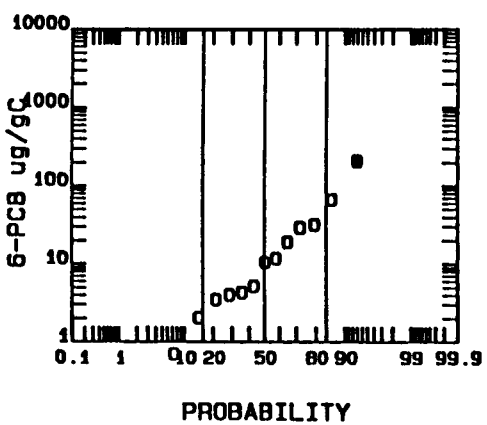


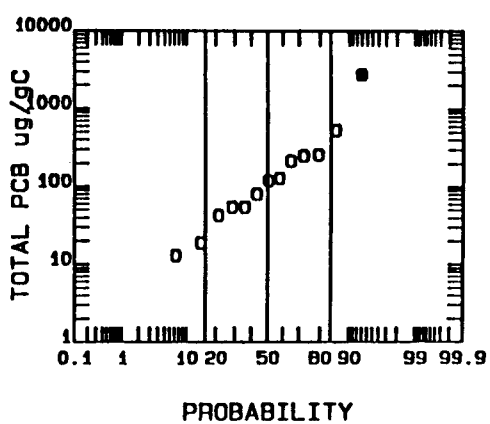
AREA 2 CARBON NORMALIZED SEDIMENT BULK PCB



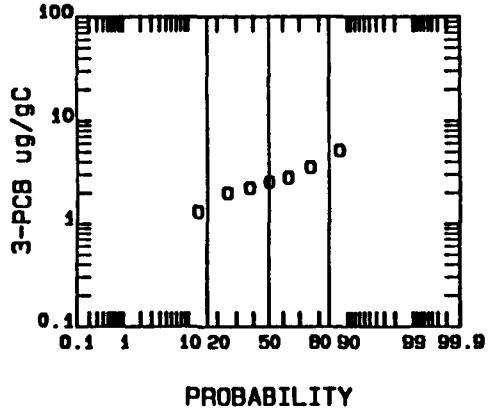


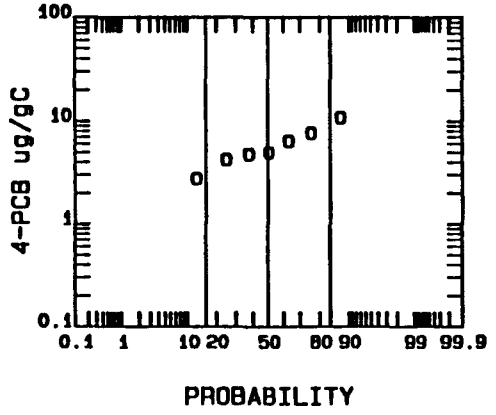


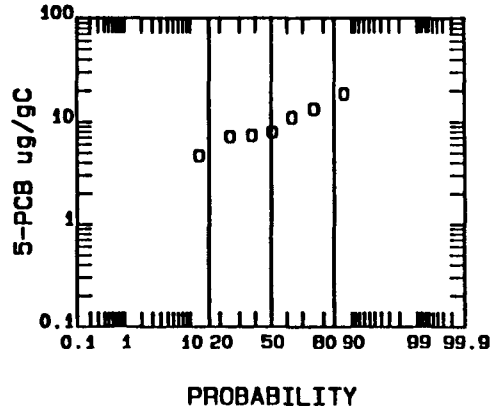


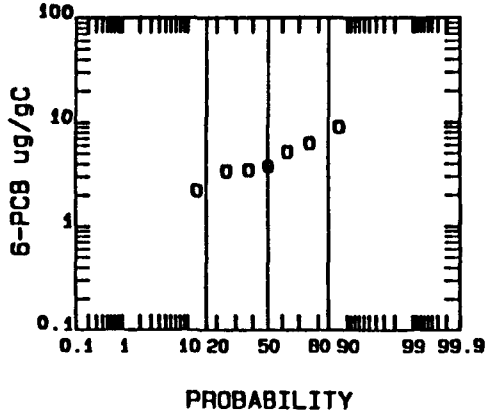


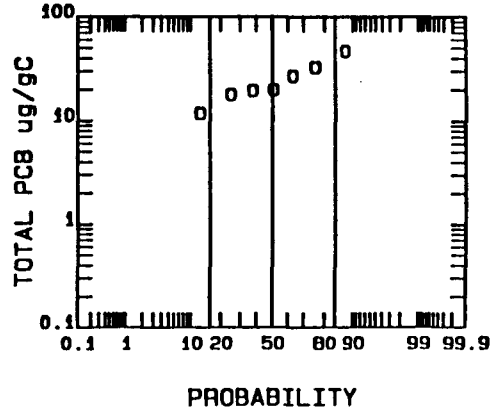
AREA 3 CARBON NORMALIZED SEDIMENT BULK PCB



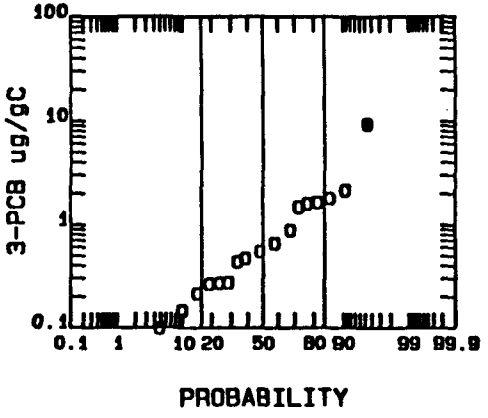


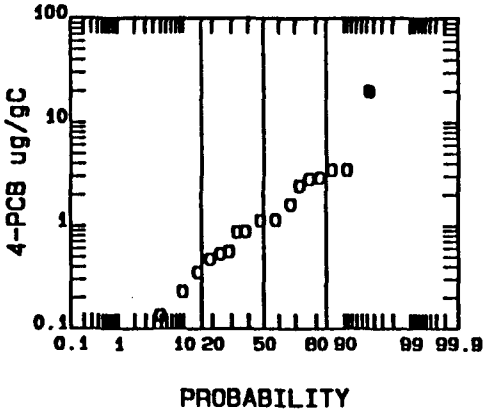


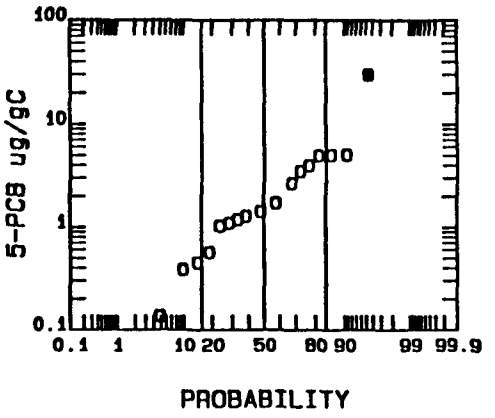


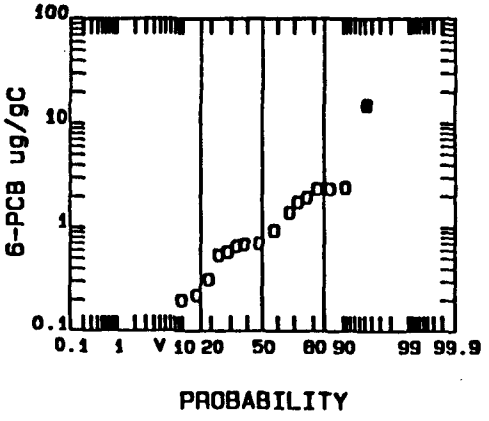


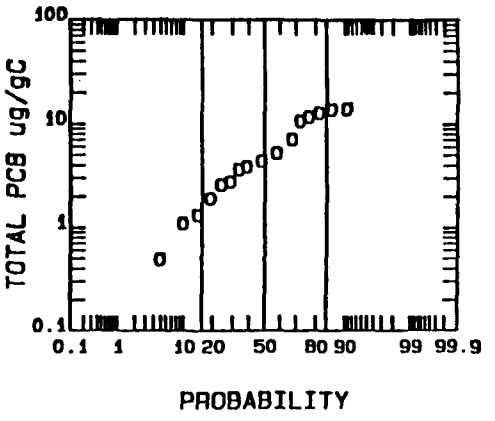
AREA 4 CARBON NORMALIZED SEDIMENT BULK PCB



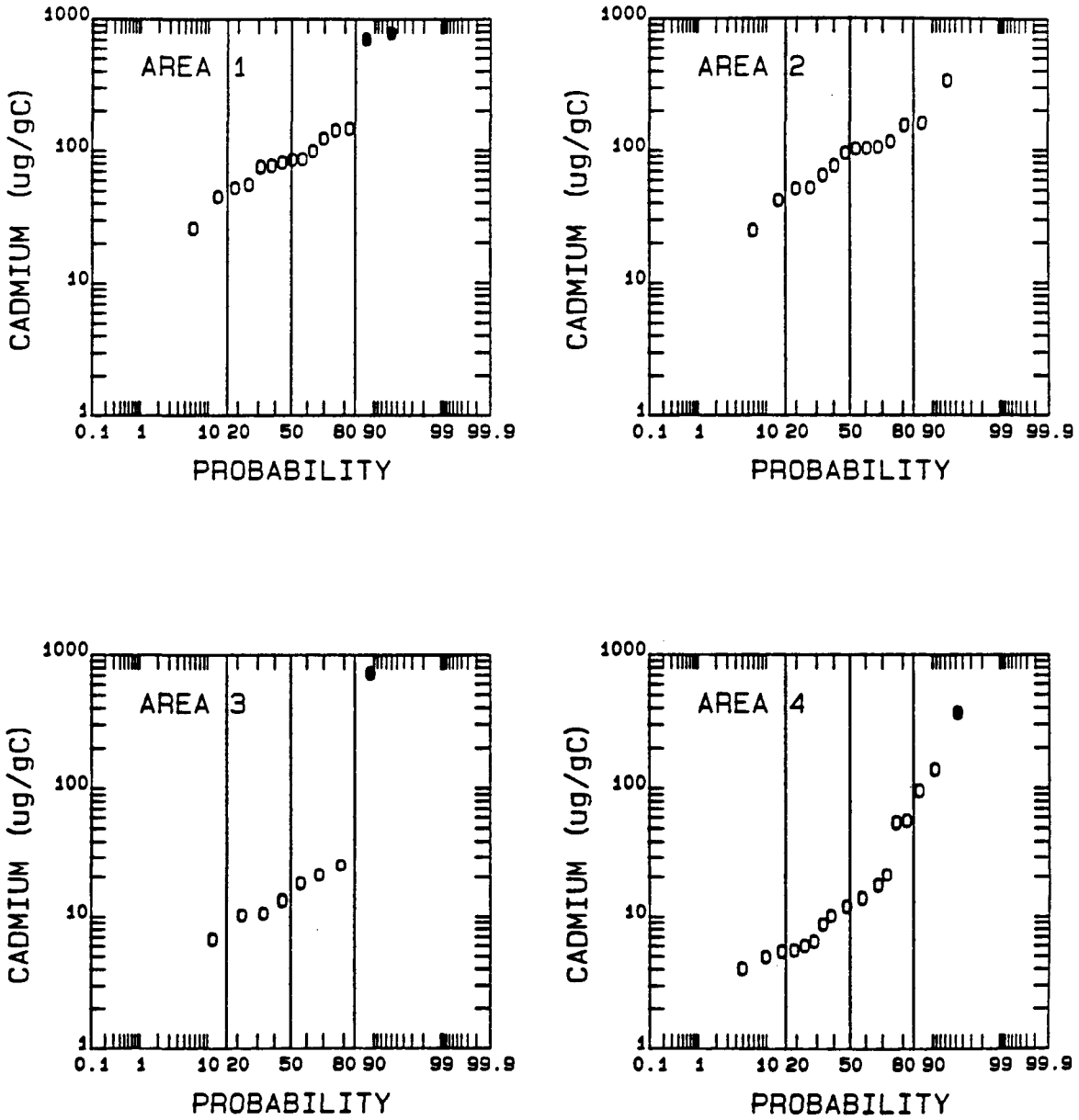




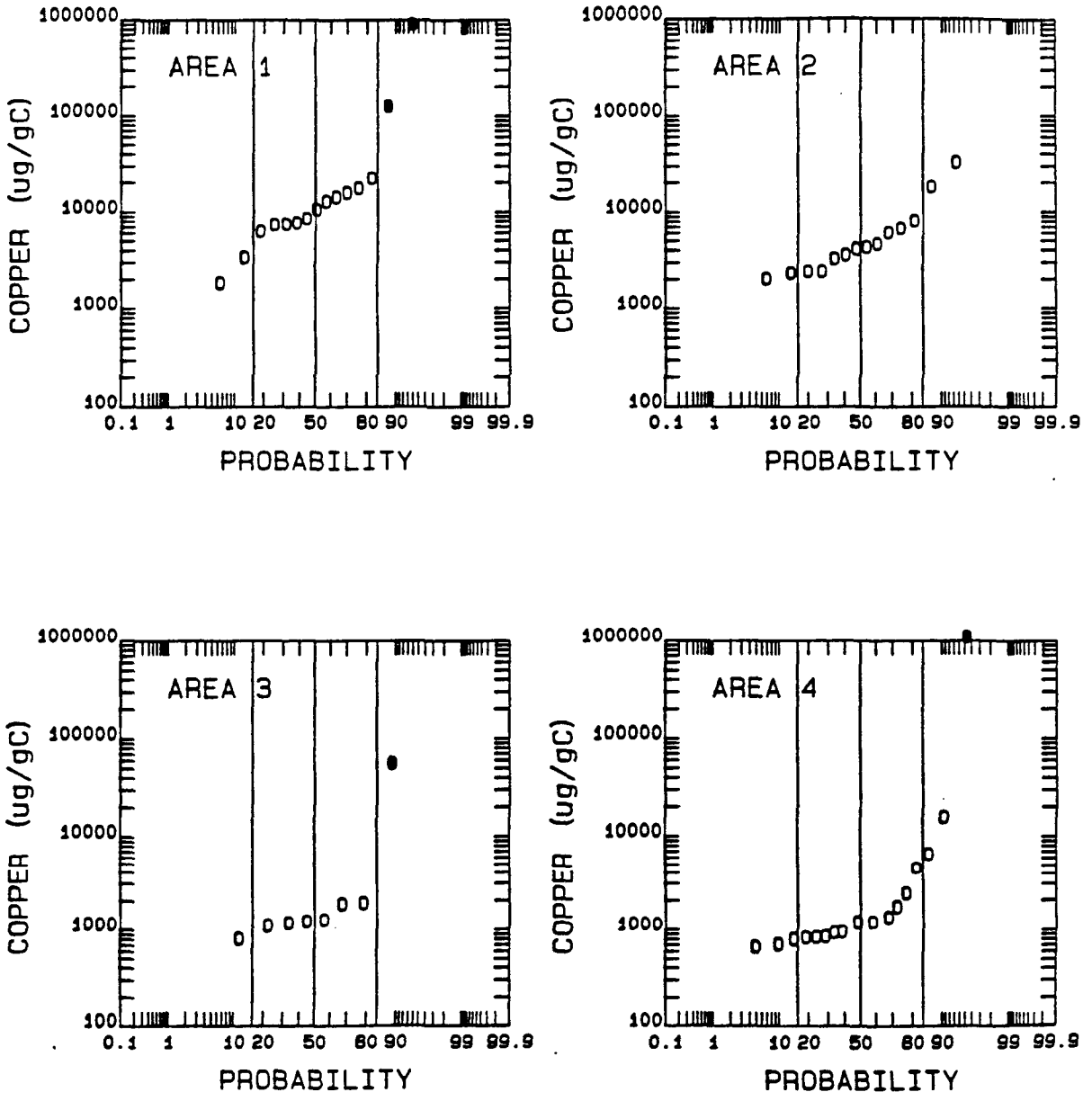




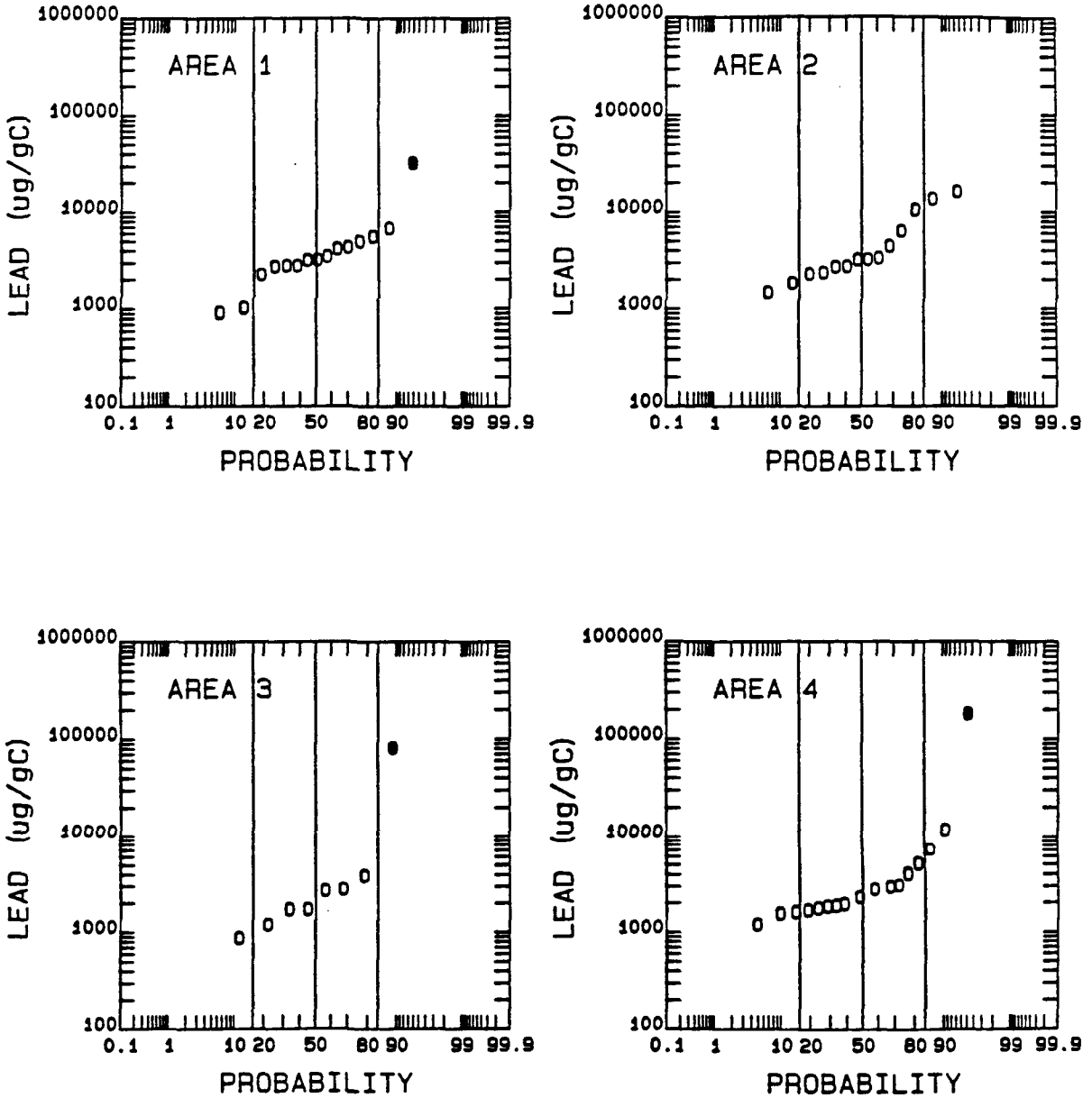
CARBON NORMALIZED BULK SEDIMENT - CADMIUM



CARBON NORMALIZED BULK SEDIMENT - COPPER

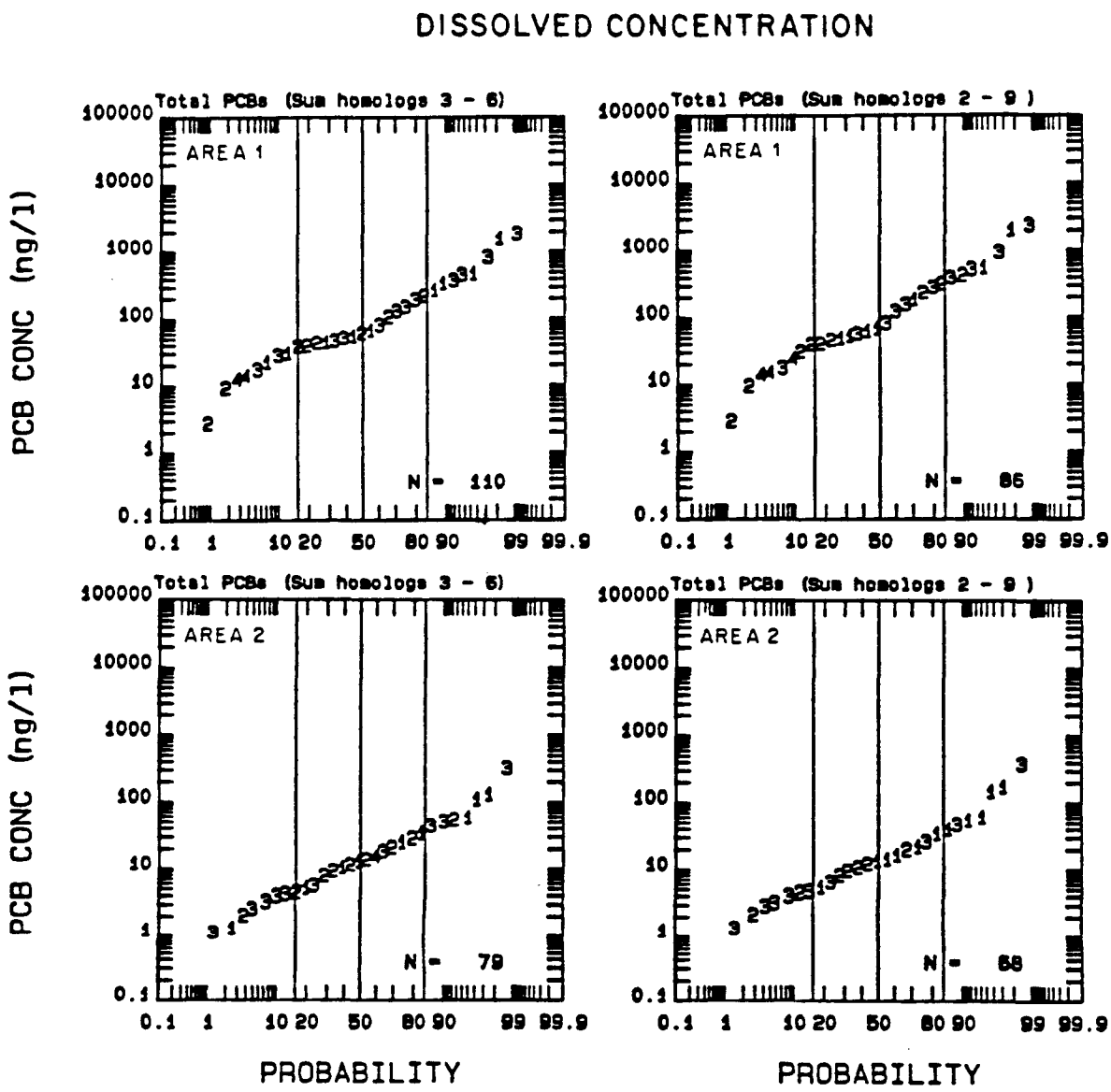


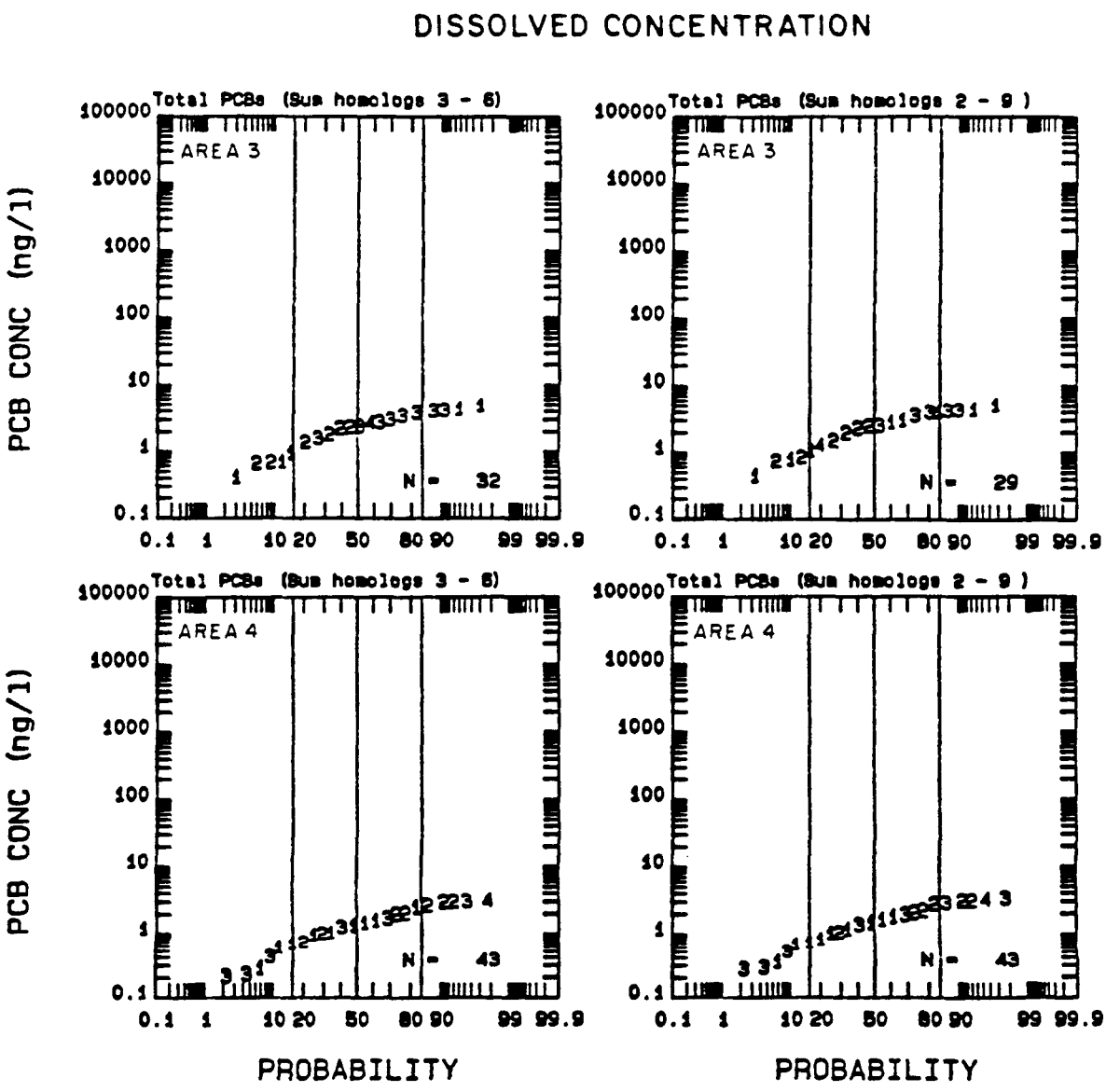
CARBON NORMALIZED BULK SEDIMENT - LEAD



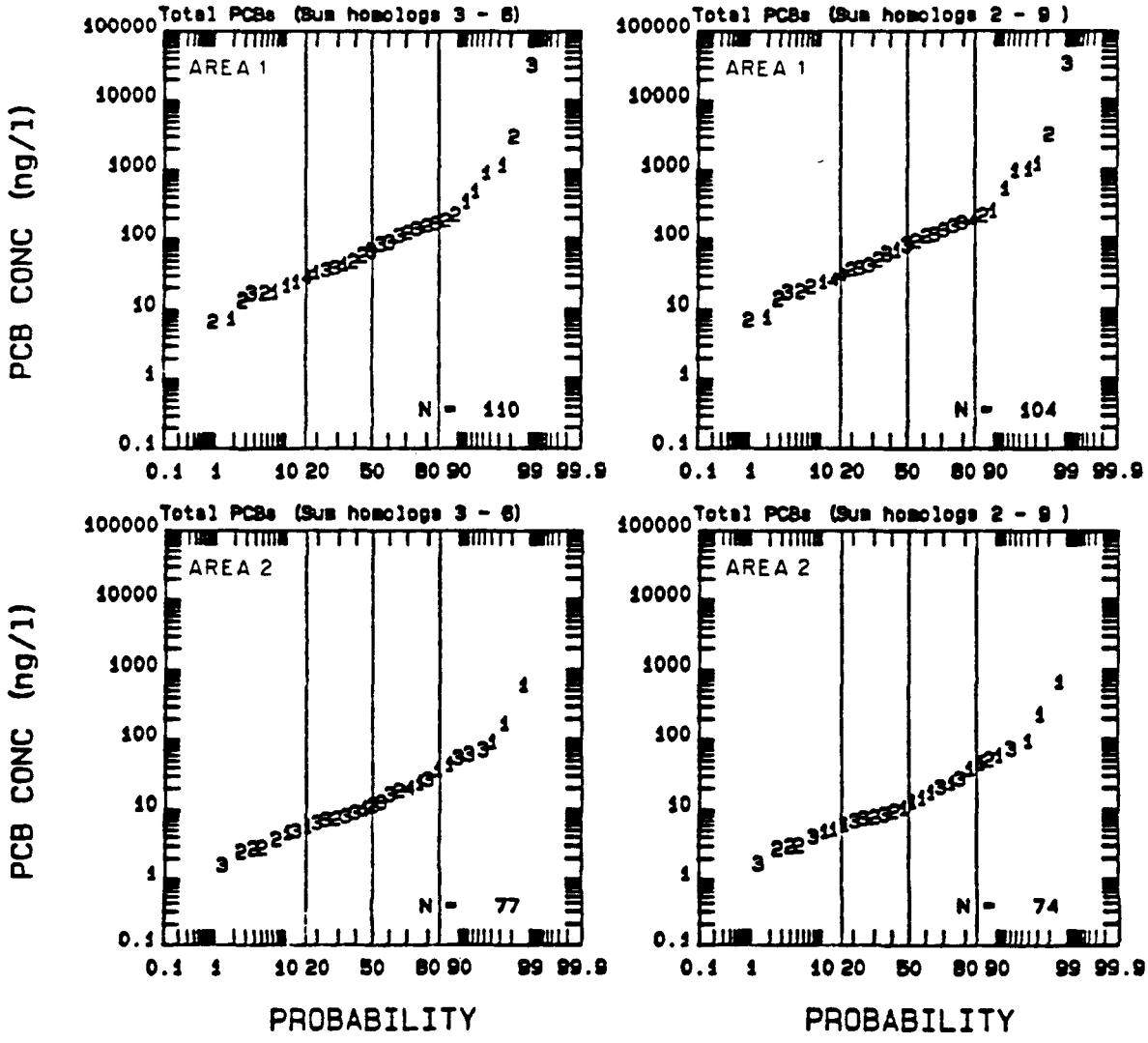
APPENDIX J

DISSOLVED AND PARTICULATE WATER COLUMN DATA AND SEDIMENT DATA

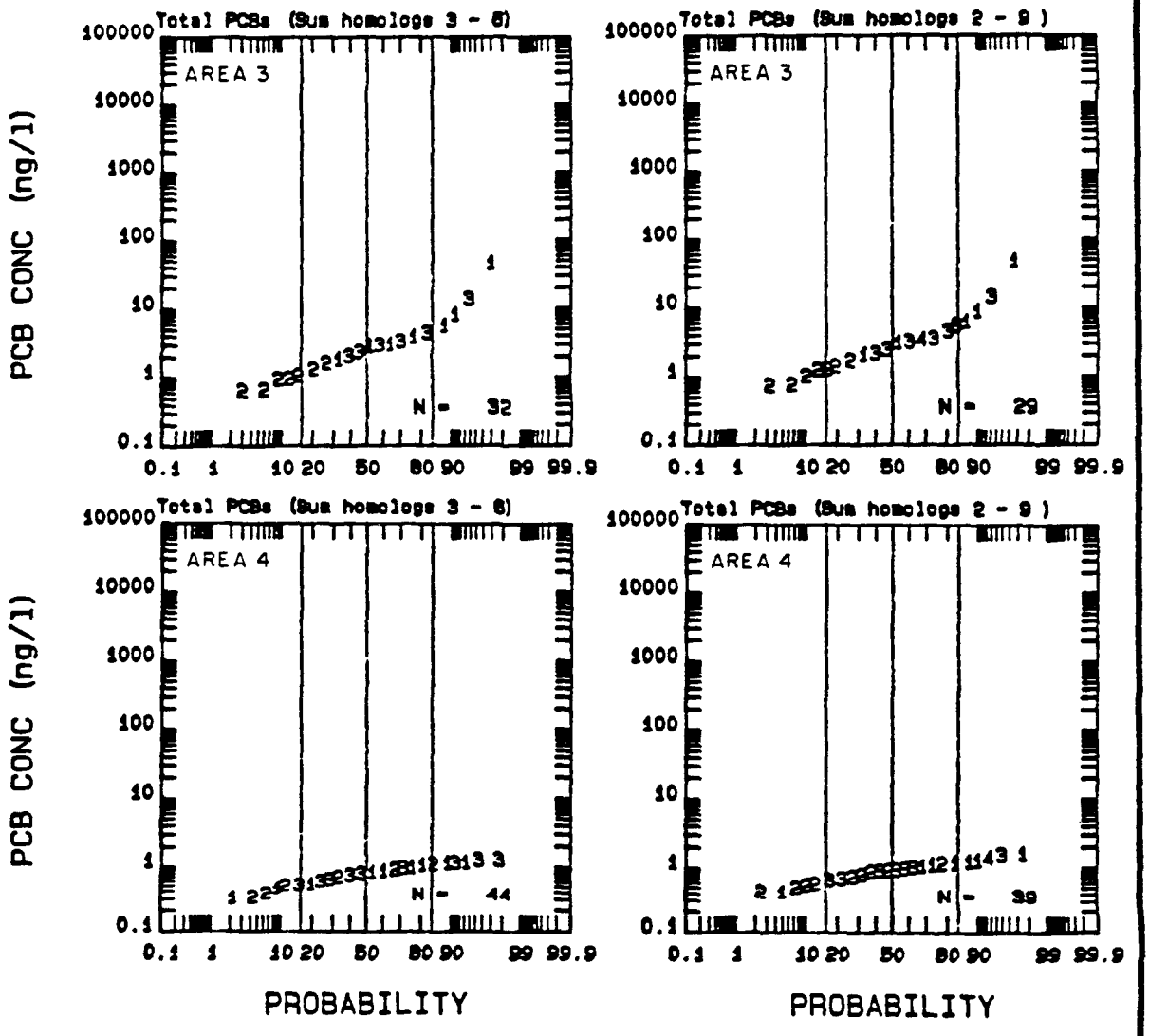

DISSOLVED CONCENTRATION
Total PCBs (Sum homologs 3 - 6)
AREA 1
N = 110
Total PCBs (Sum homologs 2 - 9)
AREA 1
N = 86
Total PCBs (Sum homologs 3 - 6)
AREA 2
N = 79
Total PCBs (Sum homologs 2 - 9)
AREA 2
N = 68
PCB CONC (ng/l)
PCB CONC (ng/l)
PROBABILITY
PROBABILITY
100000
10000
1000
100
10
1
0.1
0.1 1 10 20 50 80 90 99 99.9


DISSOLVED CONCENTRATION
Total PCBs (Sum homologs 3 - 6)
AREA 3
N = 32
Total PCBs (Sum homologs 2 - 9)
AREA 3
N = 29
Total PCBs (Sum homologs 3 - 6)
AREA 4
N = 43
Total PCBs (Sum homologs 2 - 9)
AREA 4
N = 43
PCB CONC (ng/l)
PCB CONC (ng/l)
100000
10000
1000
100
10
1
0.1
0.1 1 10 20 50 80 90 99 99.9
PROBABILITY
PROBABILITY

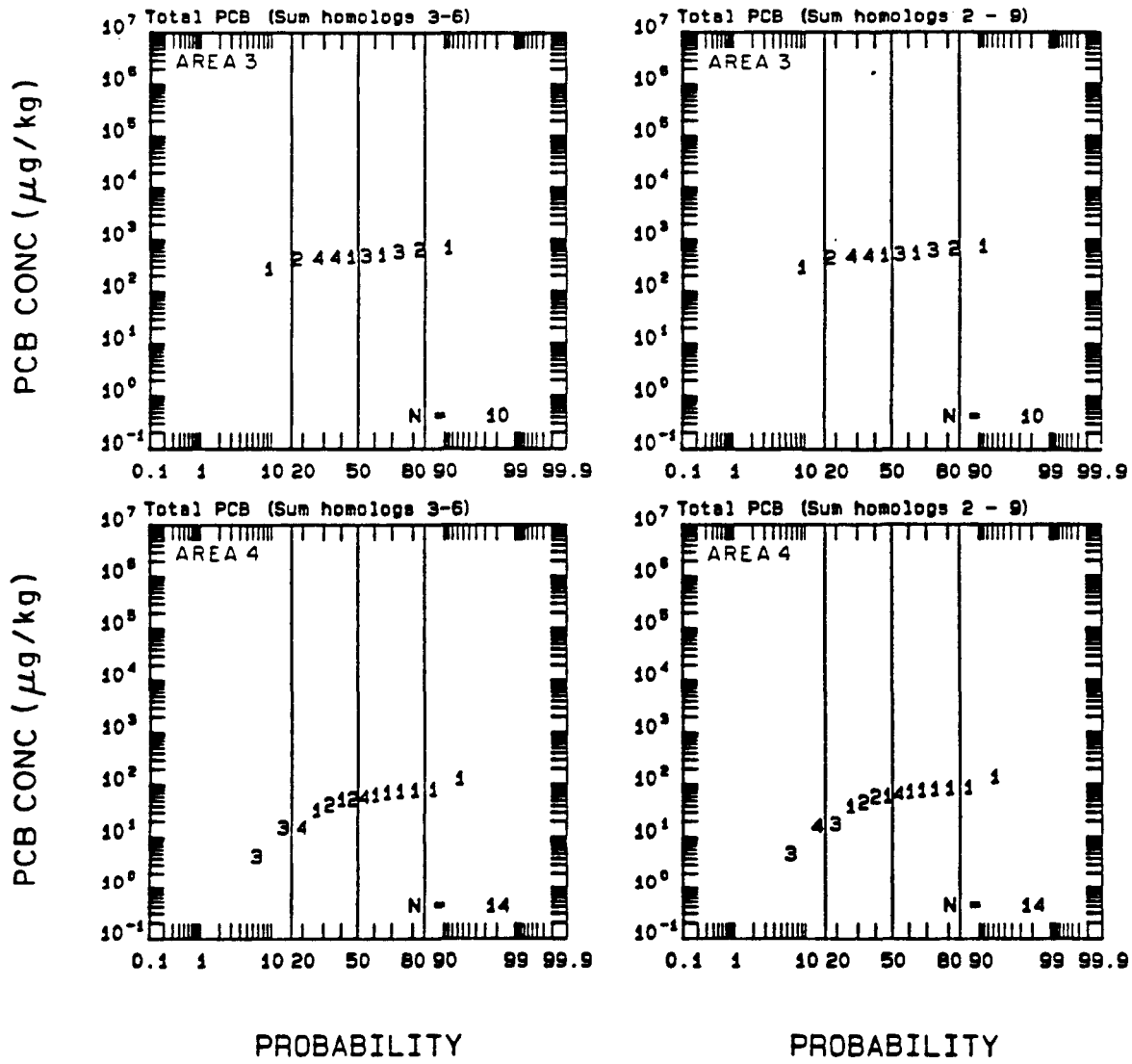
PARTICULATE CONCENTRATION



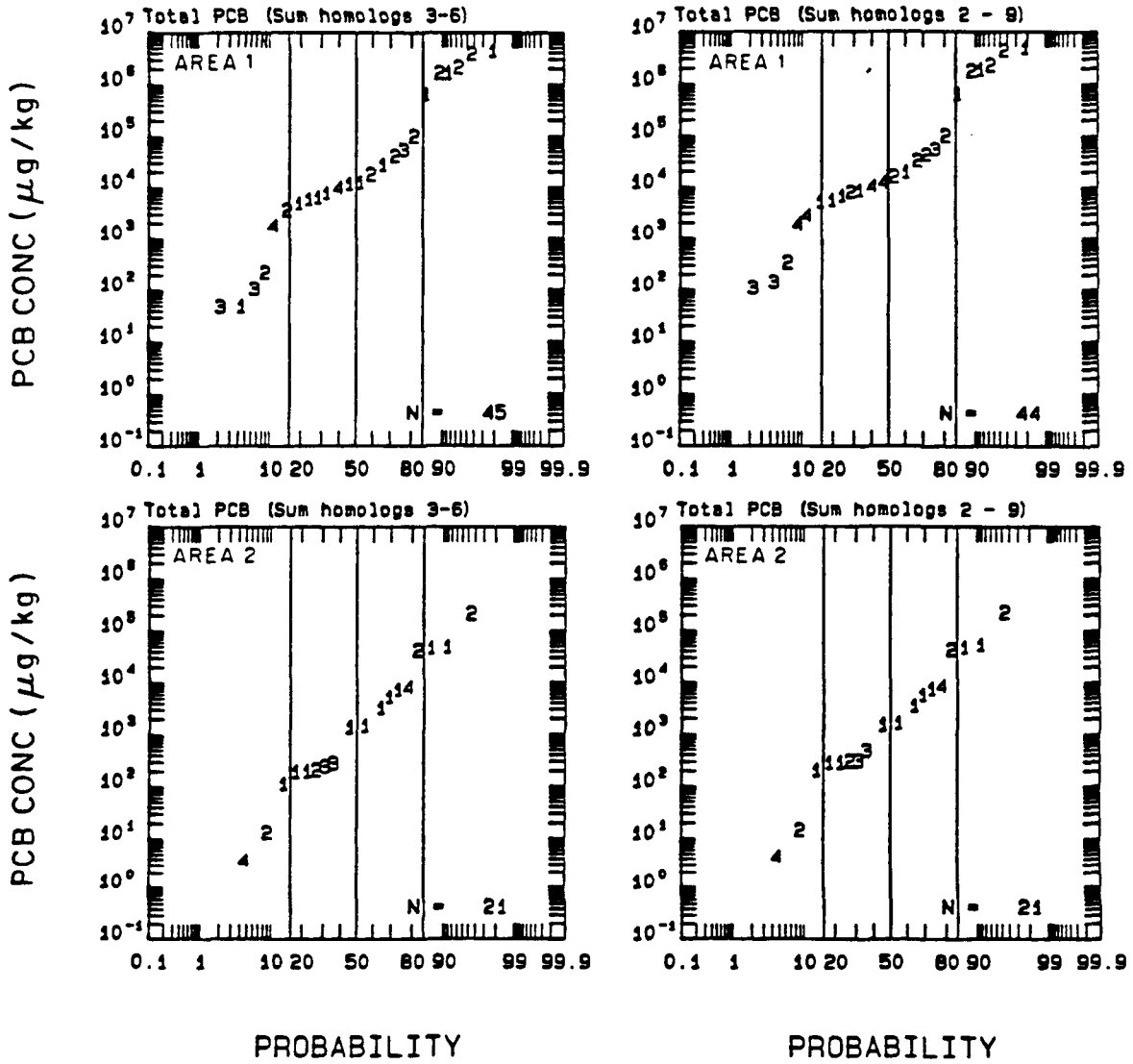
PARTICULATE CONCENTRATION



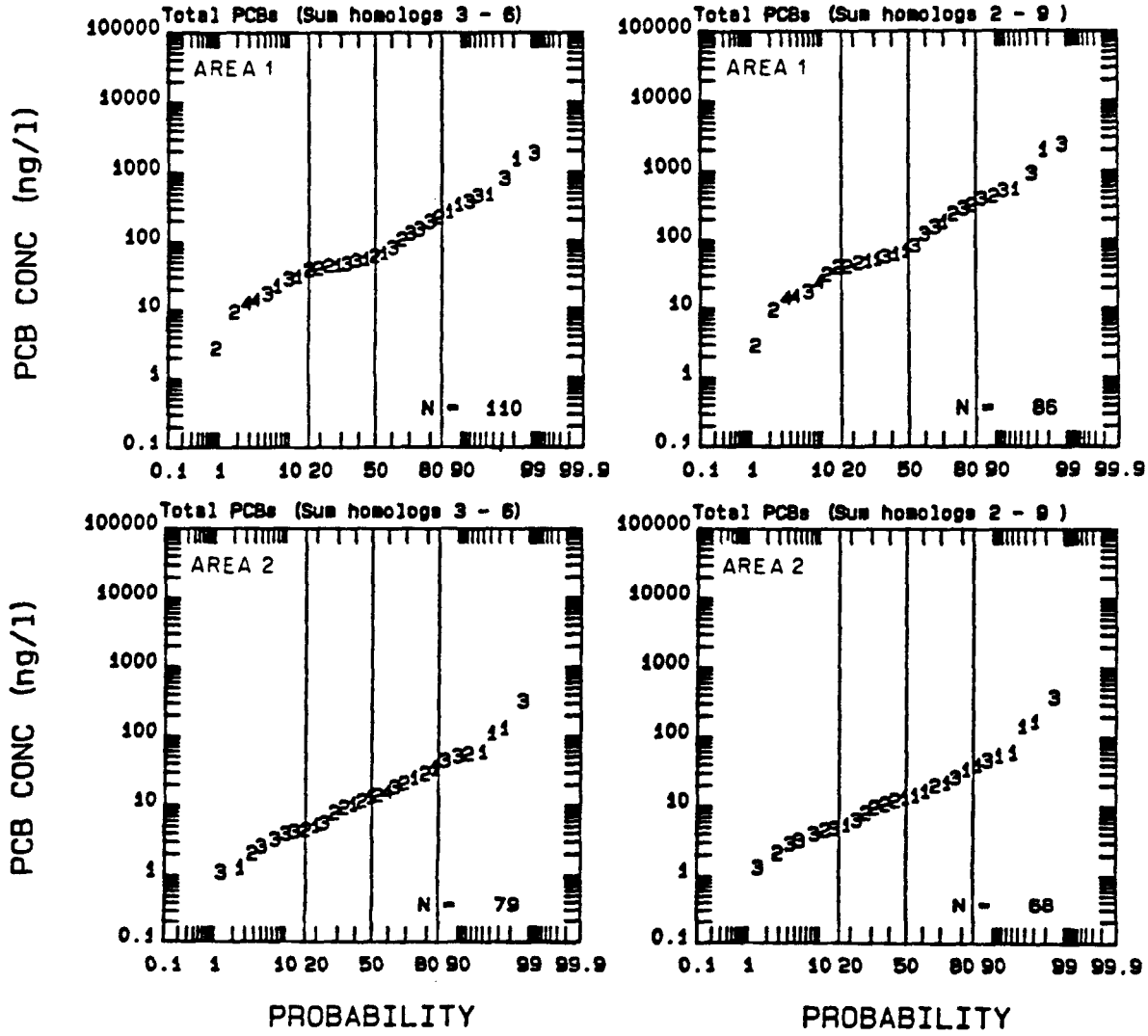
BULK SEDIMENT

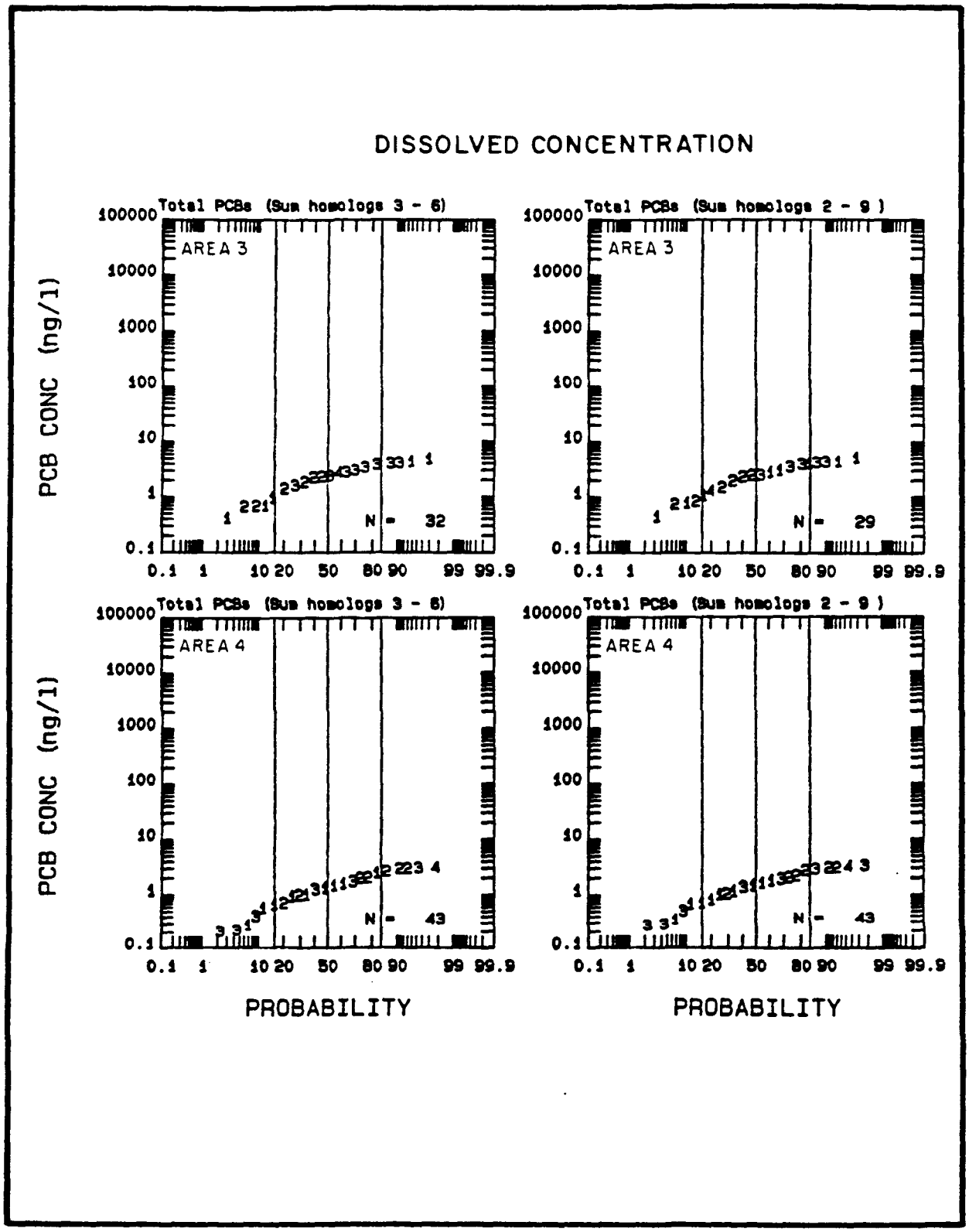


BULK SEDIMENT

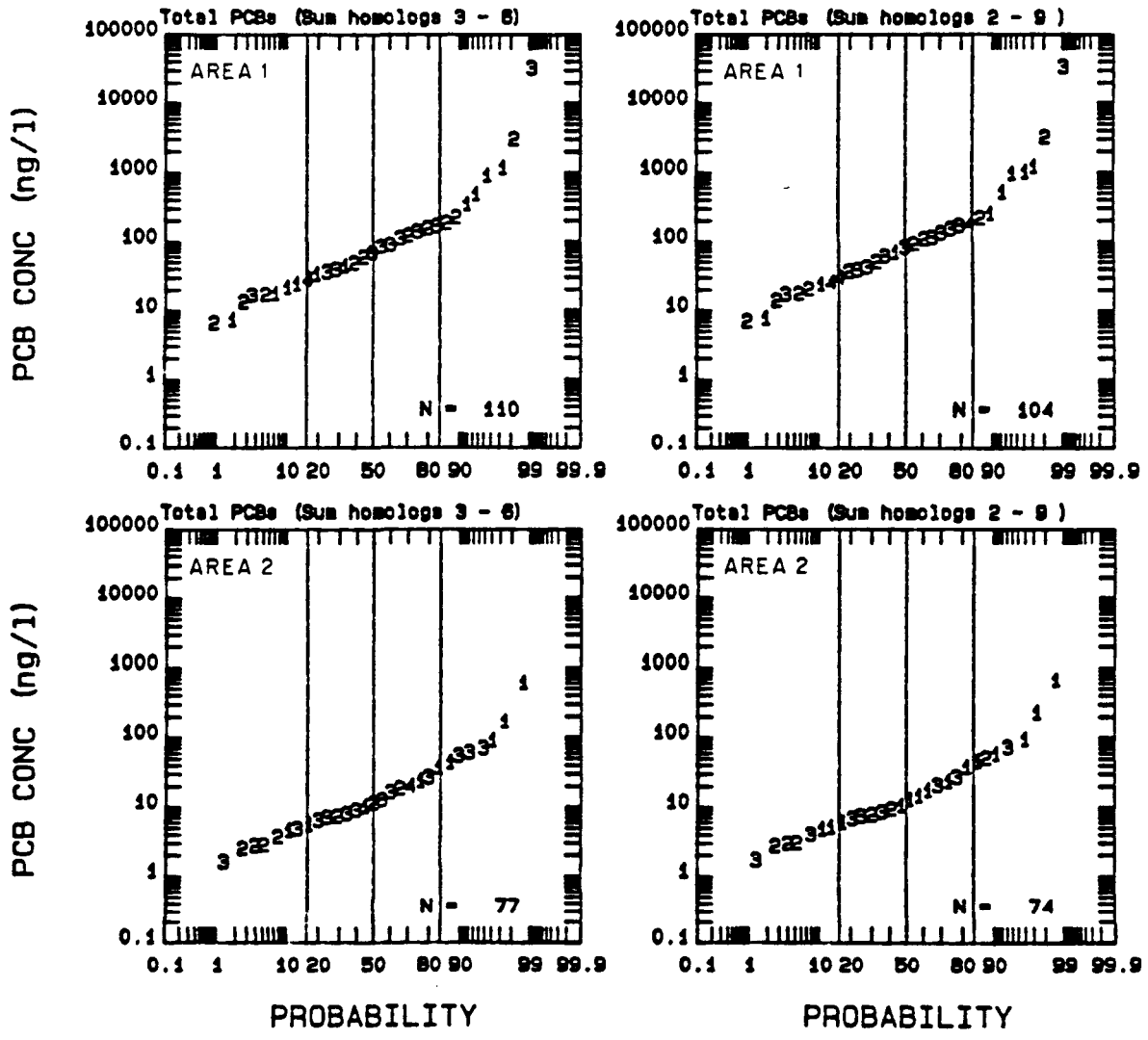


DISSOLVED CONCENTRATION

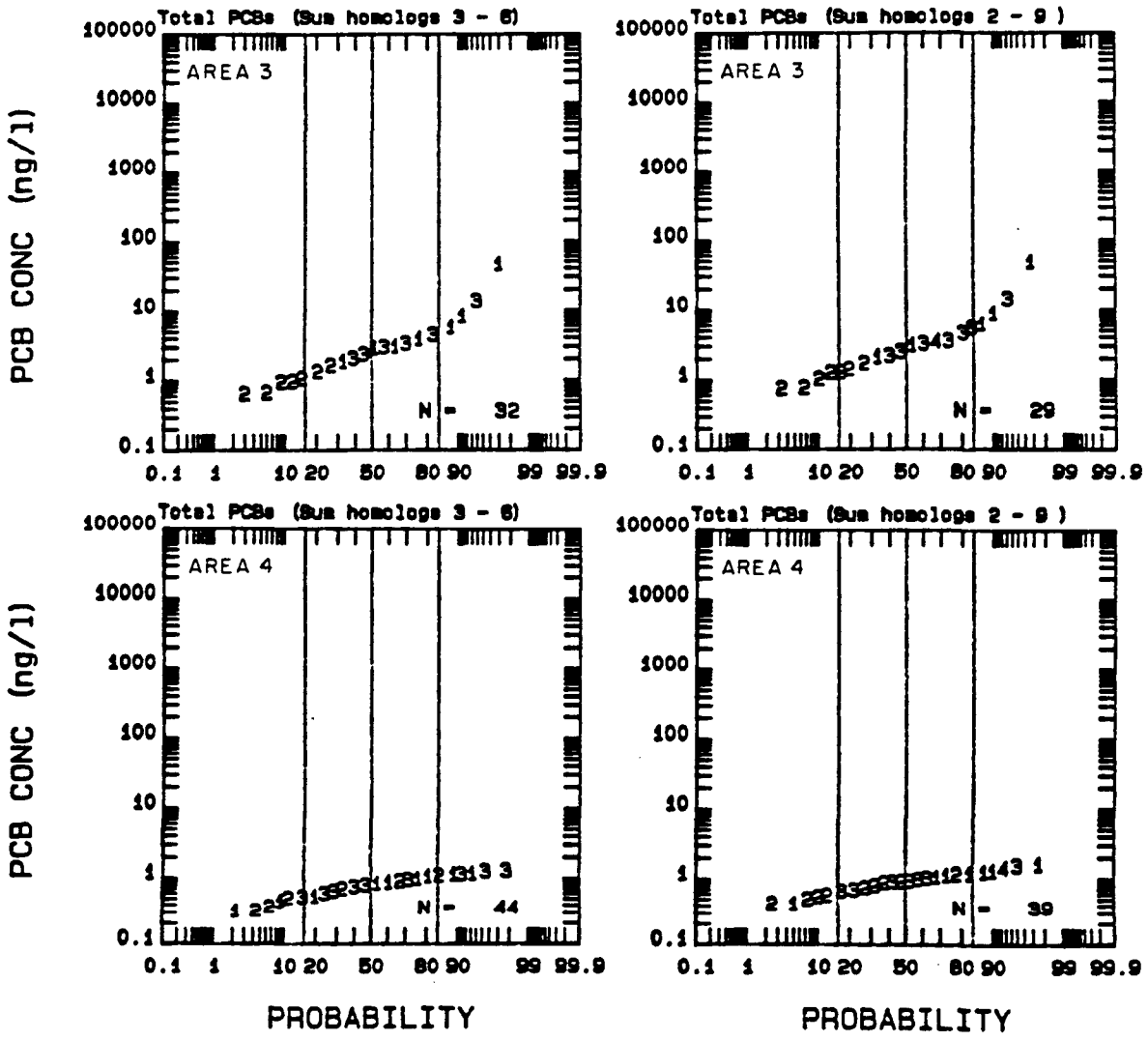


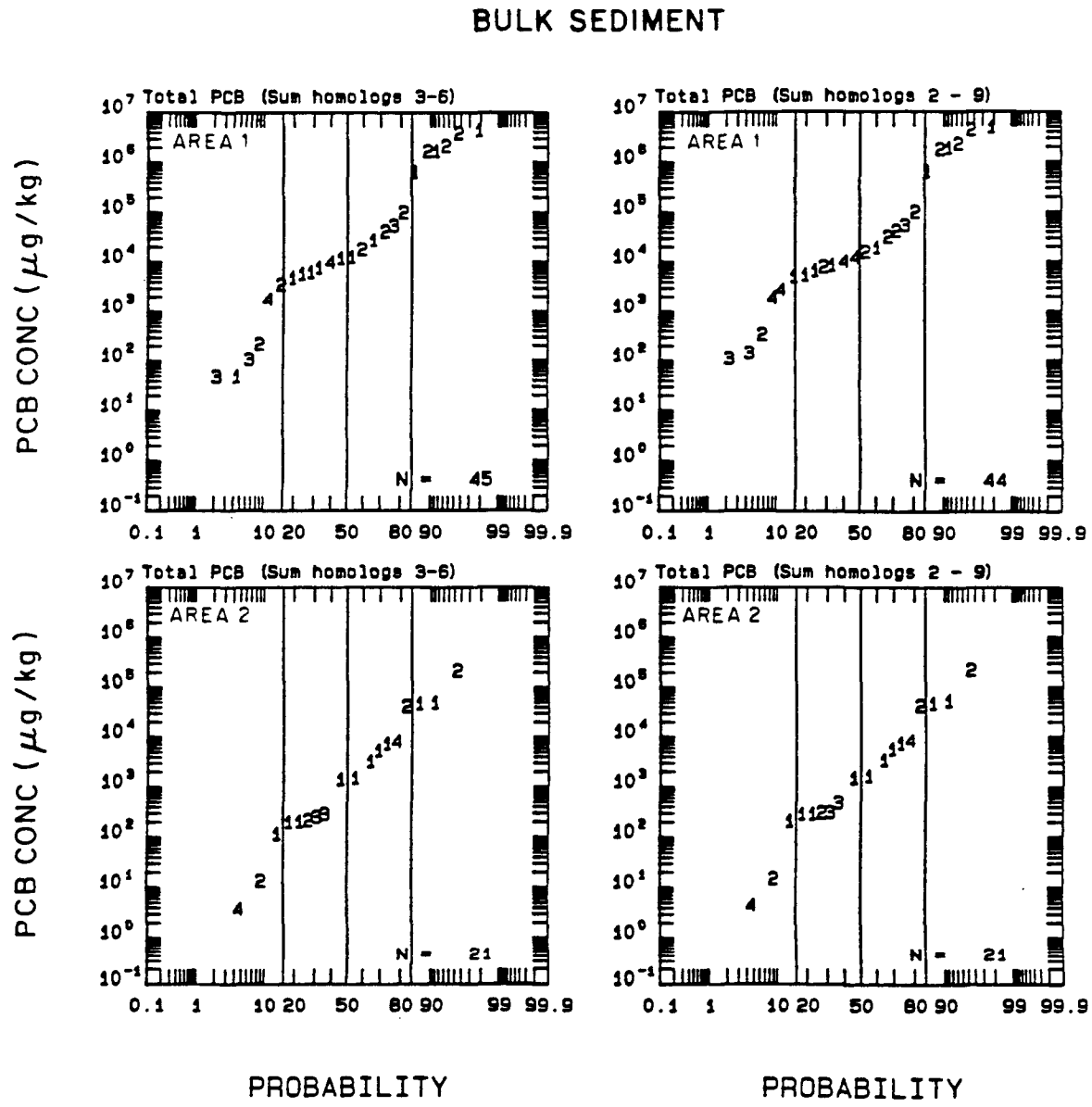

DISSOLVED CONCENTRATION
Total PCBs (Sum homologs 3 - 6)
AREA 3
N = 32
Total PCBs (Sum homologs 2 - 9)
AREA 3
N = 29
Total PCBs (Sum homologs 3 - 6)
AREA 4
N = 43
Total PCBs (Sum homologs 2 - 9)
AREA 4
N = 43
PCB CONC (ng/l)
PCB CONC (ng/l)
100000
10000
1000
100
10
1
0.1
0.1 1 10 20 50 80 90 99 99.9
PROBABILITY
PROBABILITY

PARTICULATE CONCENTRATION

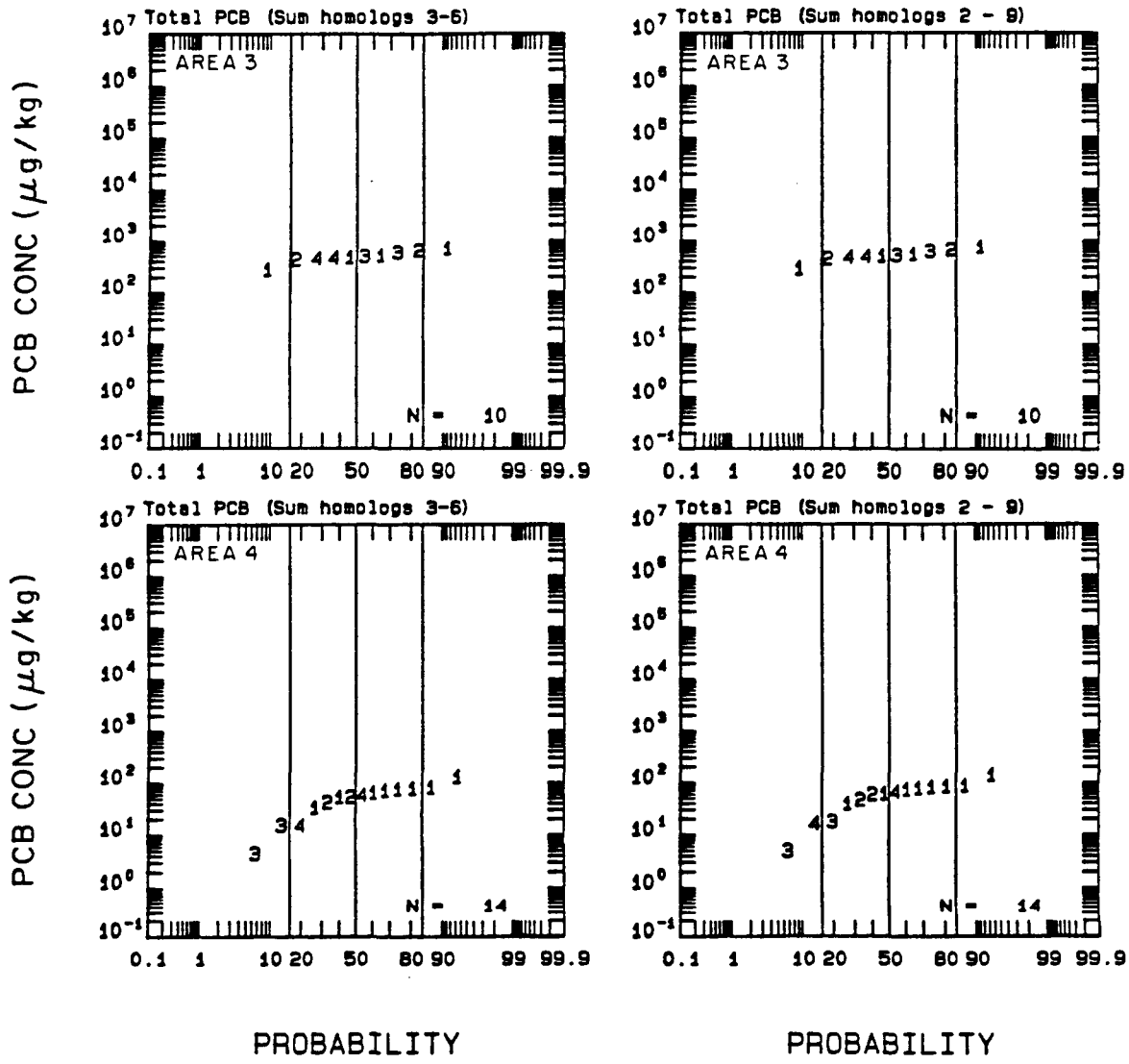


PARTICULATE CONCENTRATION




BULK SEDIMENT
Total PCB (Sum homologs 3-6)
AREA 1
N = 45
Total PCB (Sum homologs 2 - 9)
AREA 1
N = 44
Total PCB (Sum homologs 3-6)
AREA 2
N = 21
Total PCB (Sum homologs 2 - 9)
AREA 2
N = 21
PCB CONC (µg/kg)
PCB CONC (µg/kg)
PROBABILITY
PROBABILITY

BULK SEDIMENT



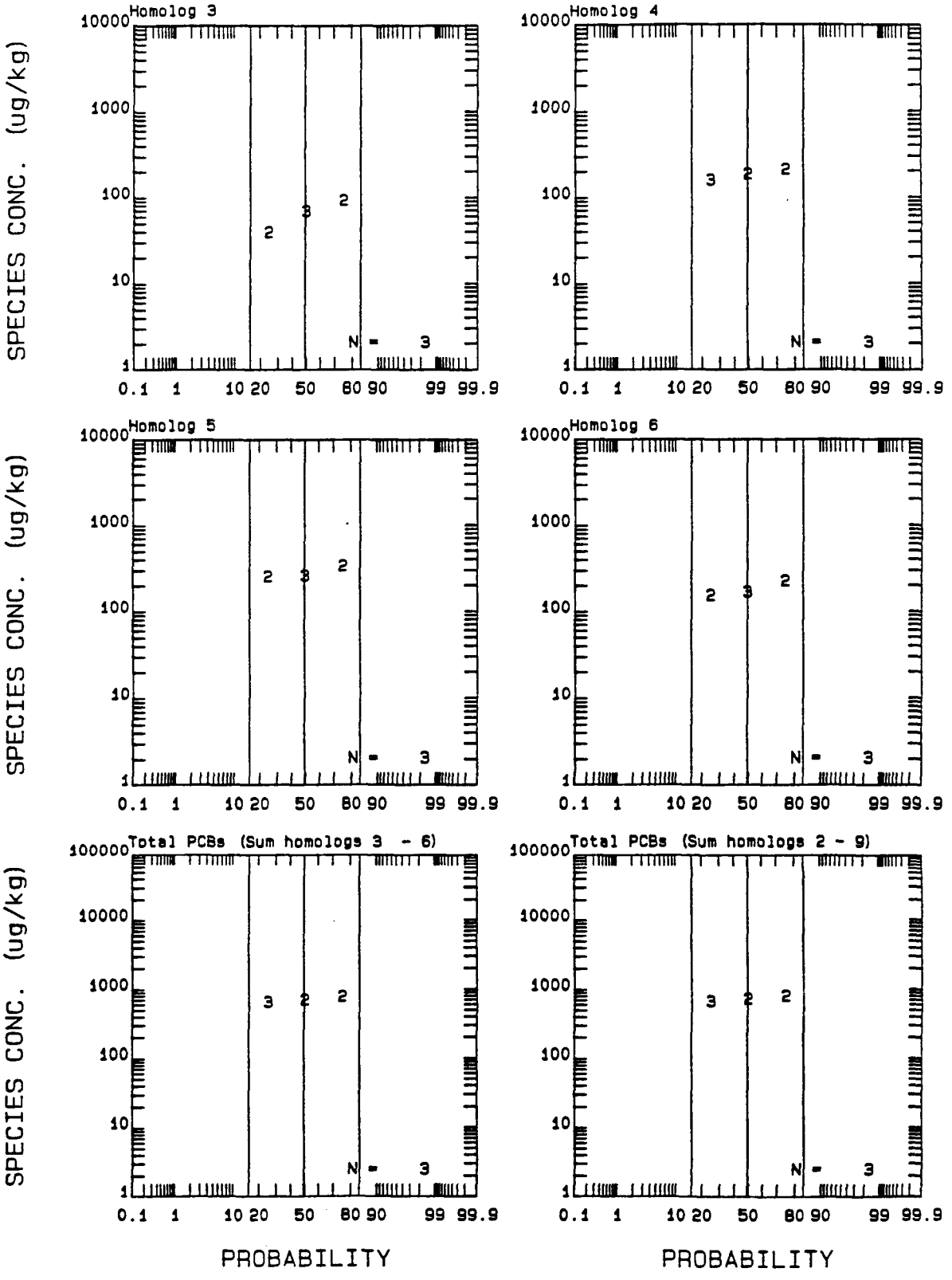
APPENDIX K

BIOTA PROBABILITY DISTRIBUTIONS

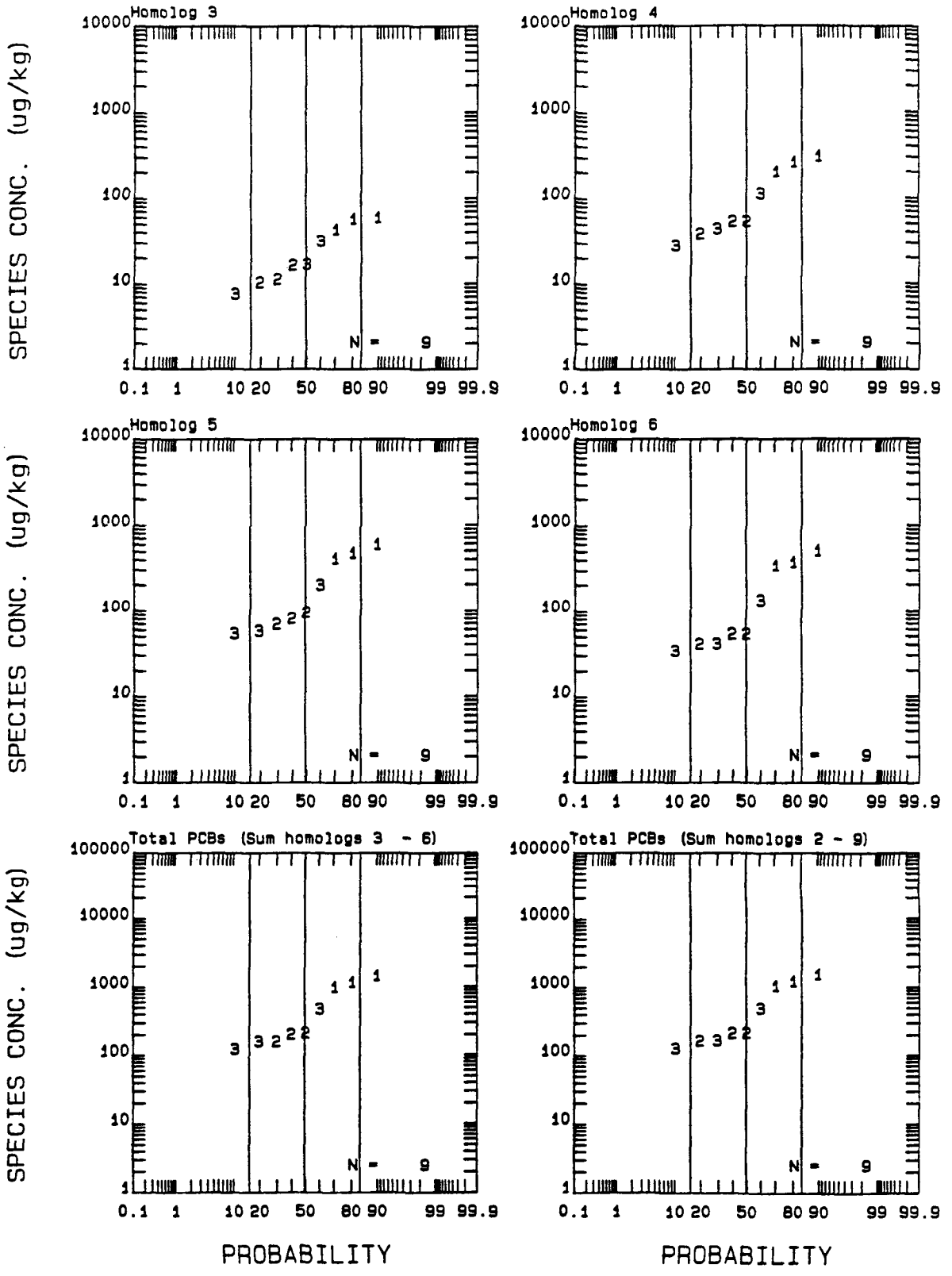
This appendix presents the probability distributions for each species by size (where applicable) and area. Plots are presented for homologs 3, 4, 5, 6, total PCB (the sum of homologs 2 through 9 and 3 through 6), cadmium, copper and lead concentrations in lobster, flounder, mussel, clam, green crab, spider crab and polychaetes. The data from all three cruises are plotted together with the plotting symbol being the cruise number. If no plot is presented for a species in an area, no data were reported for that area.

BIOTA PCB PROBABILITY DISTRIBUTIONS

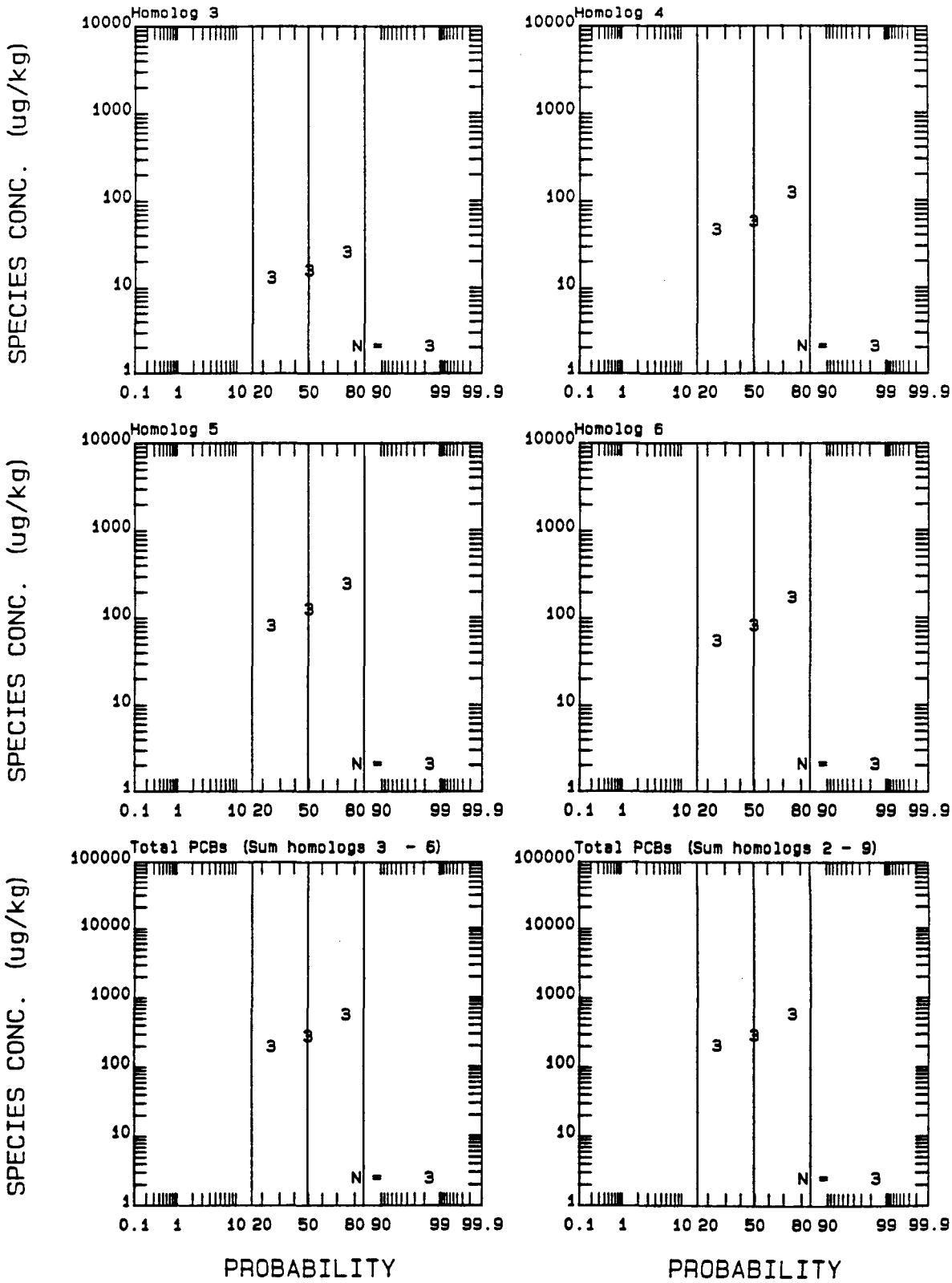
AREA 2, LOBSTER, SMALL



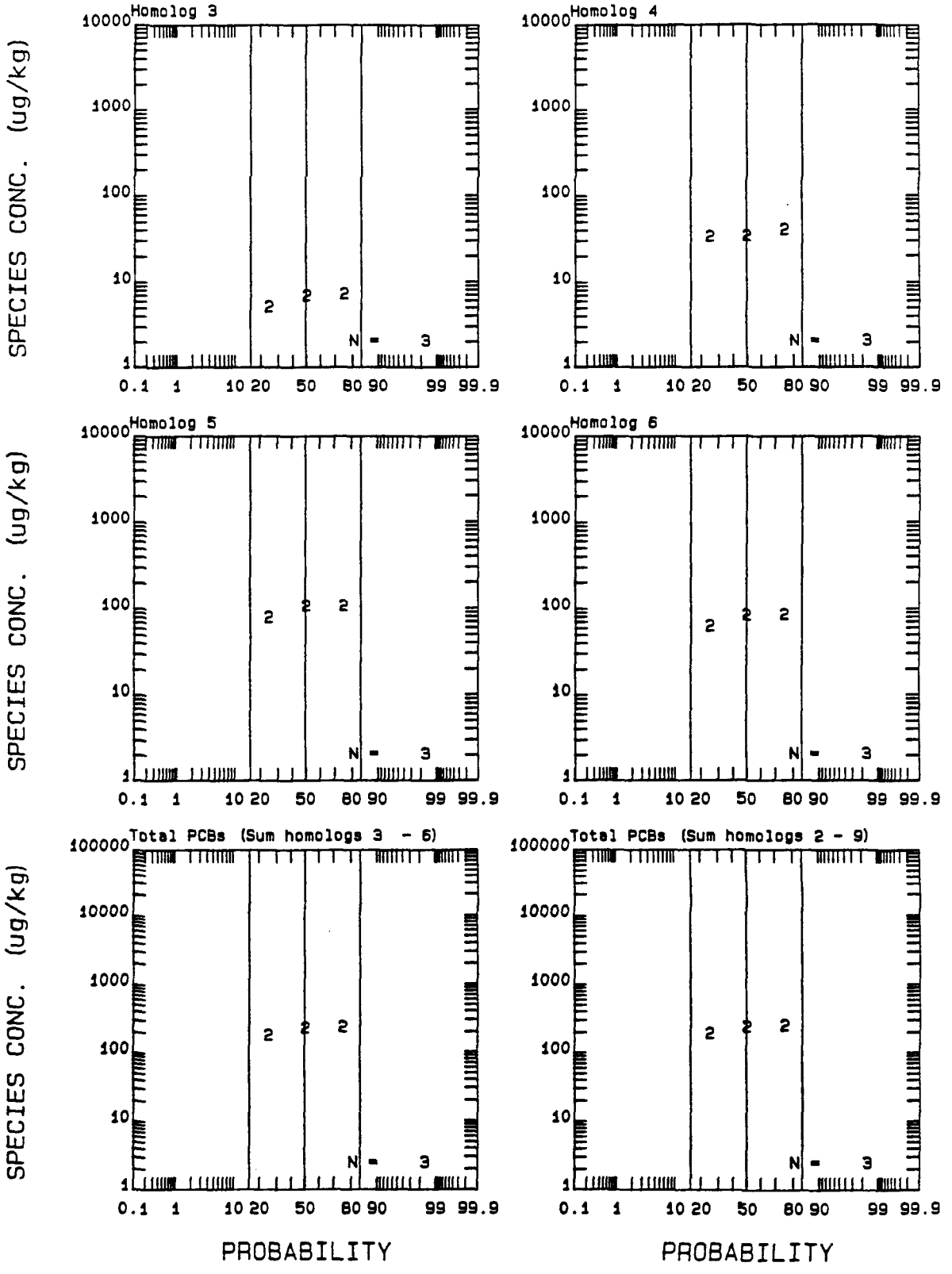
AREA 2, LOBSTER, MEDIUM



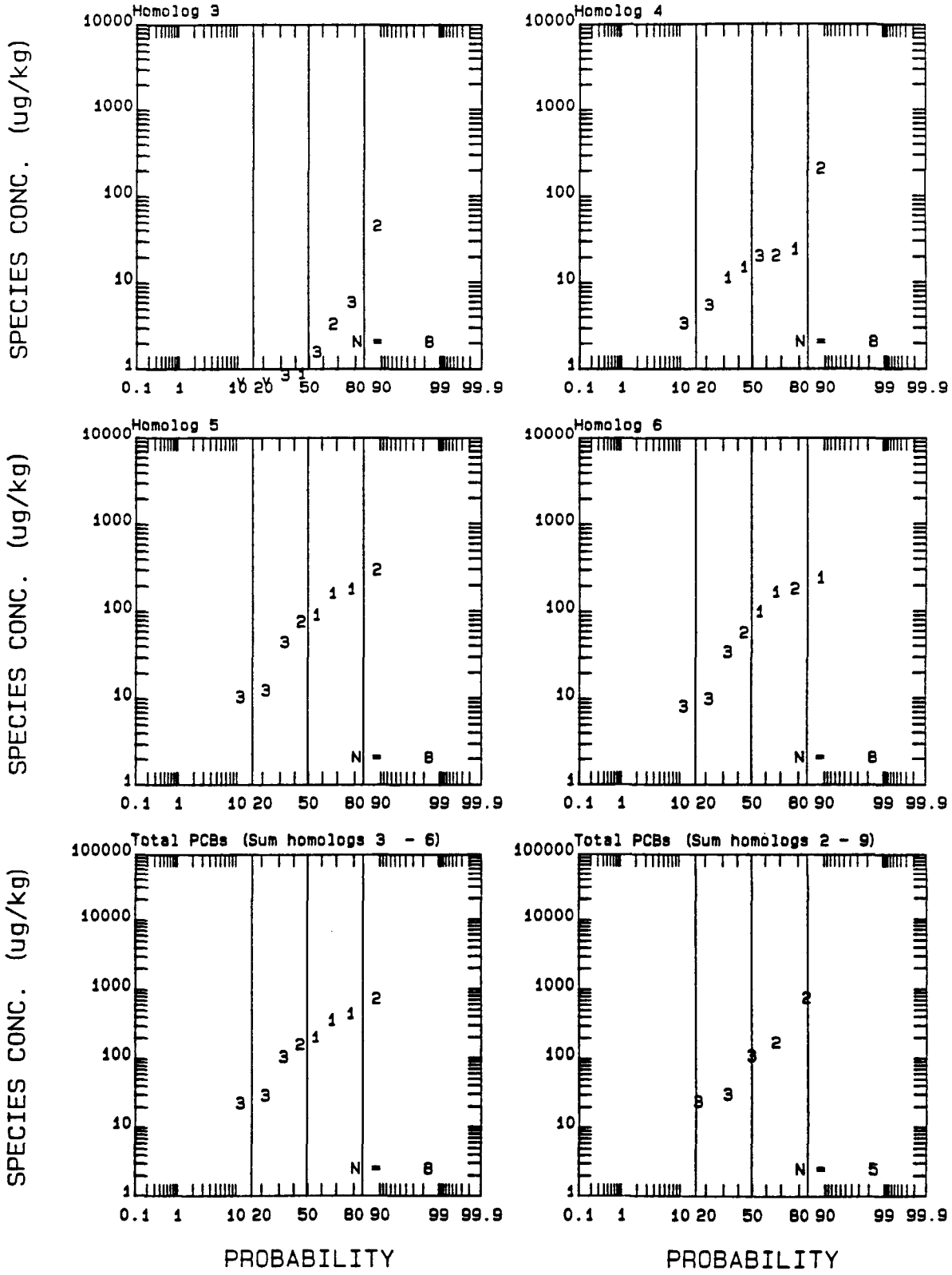
AREA 2, LOBSTER, LARGE



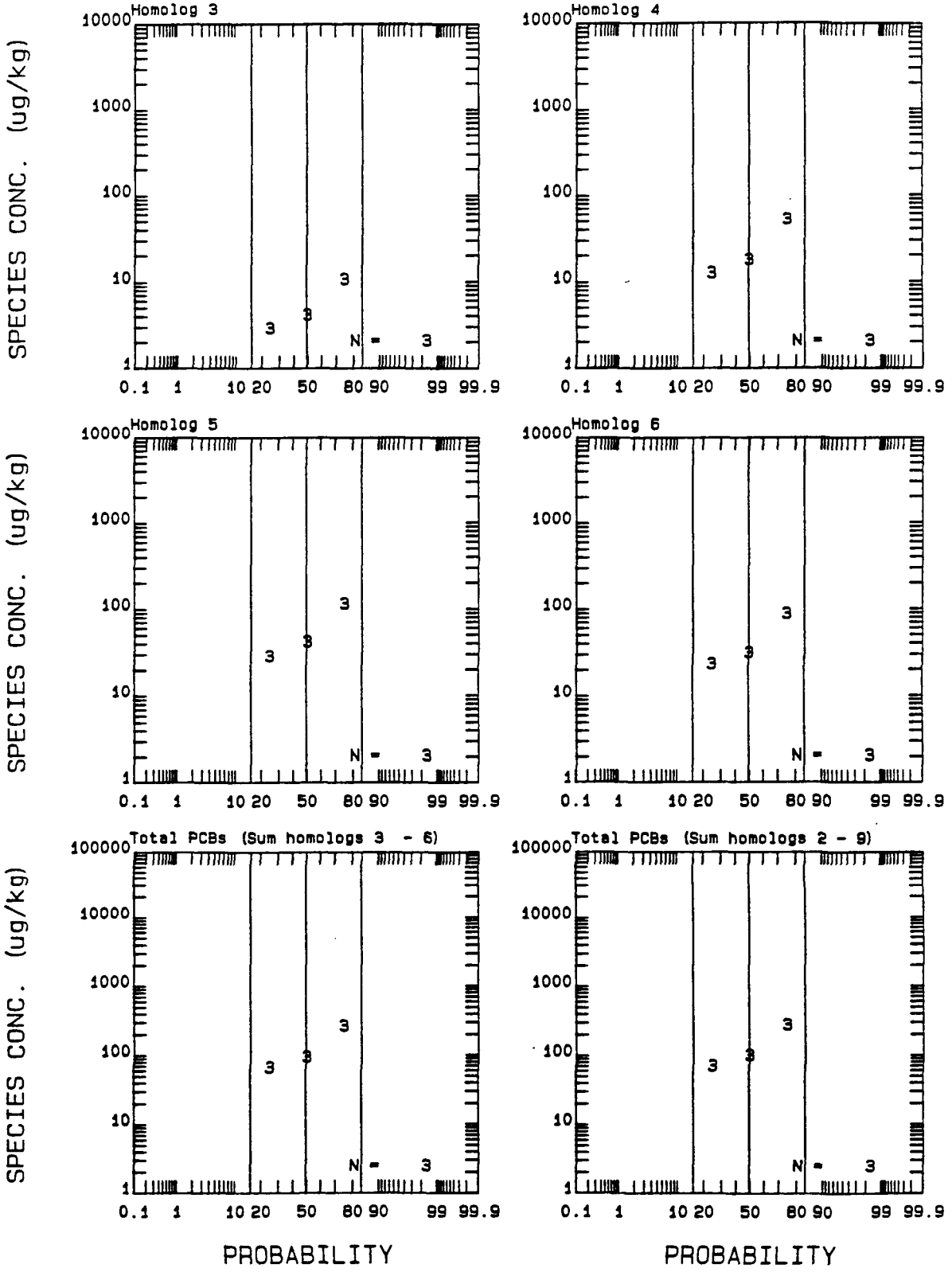
AREA 3, LOBSTER, SMALL



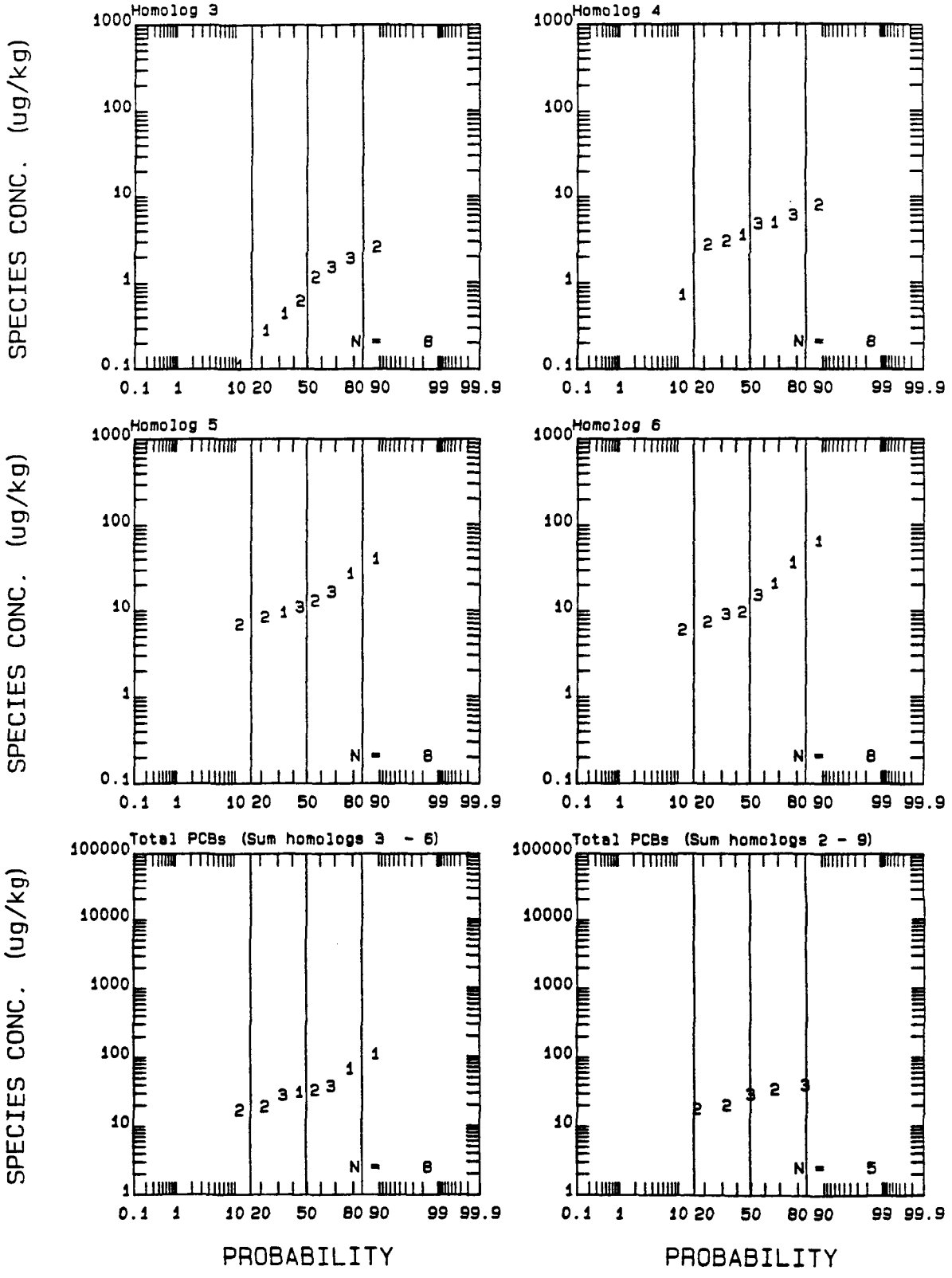
AREA 3, LOBSTER, MEDIUM



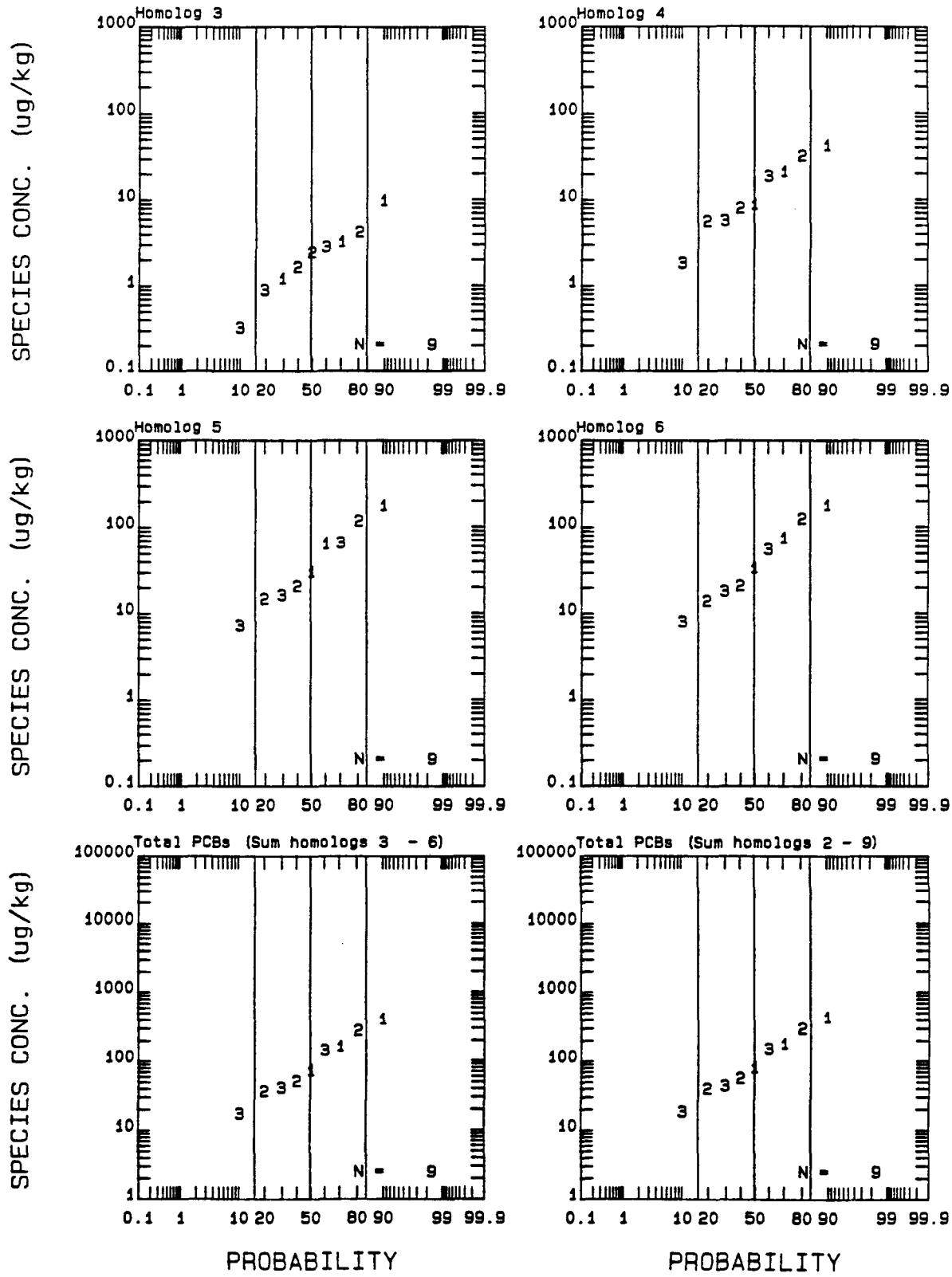
AREA 3, LOBSTER, LARGE



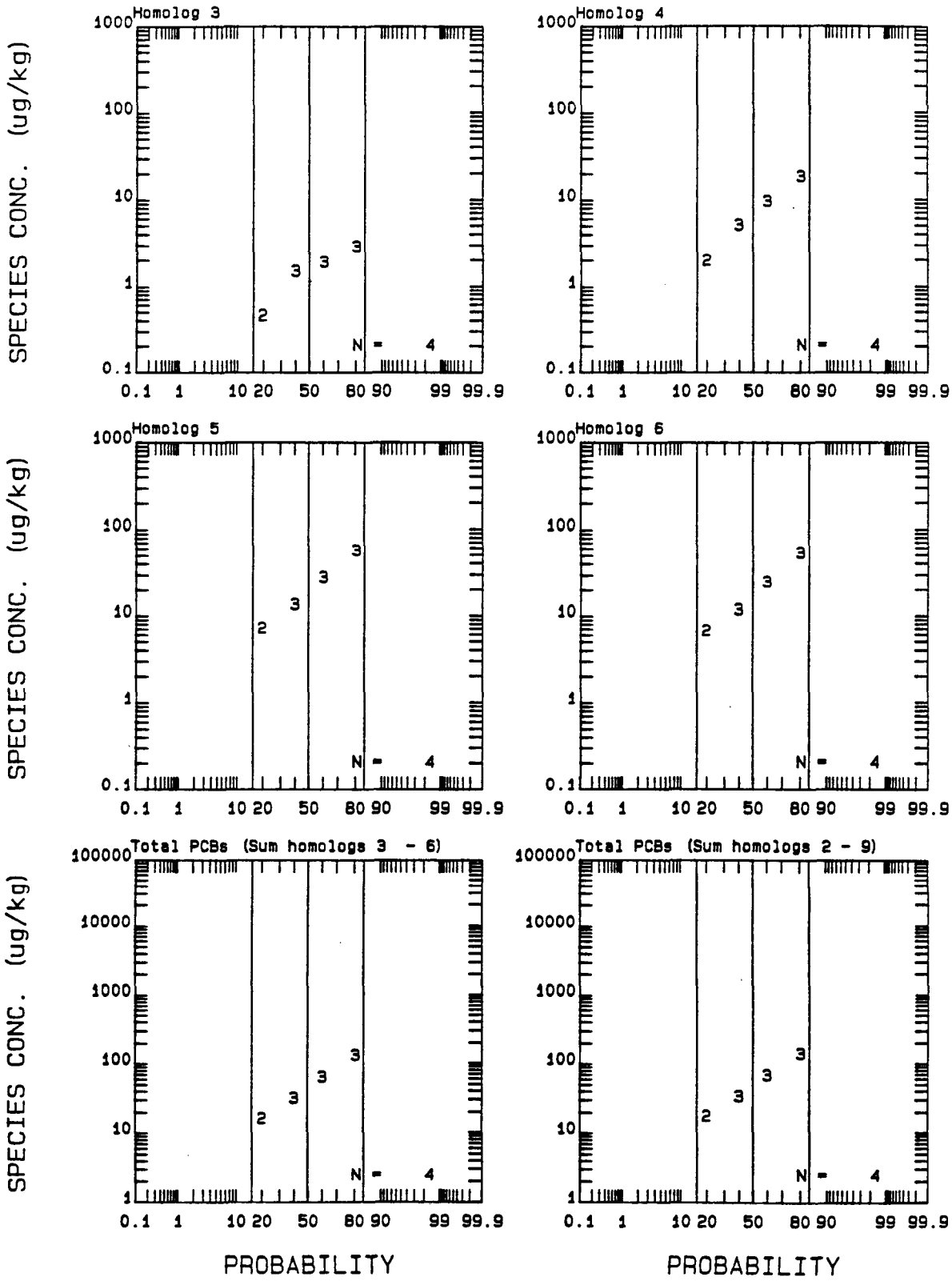
AREA 4, LOBSTER, SMALL



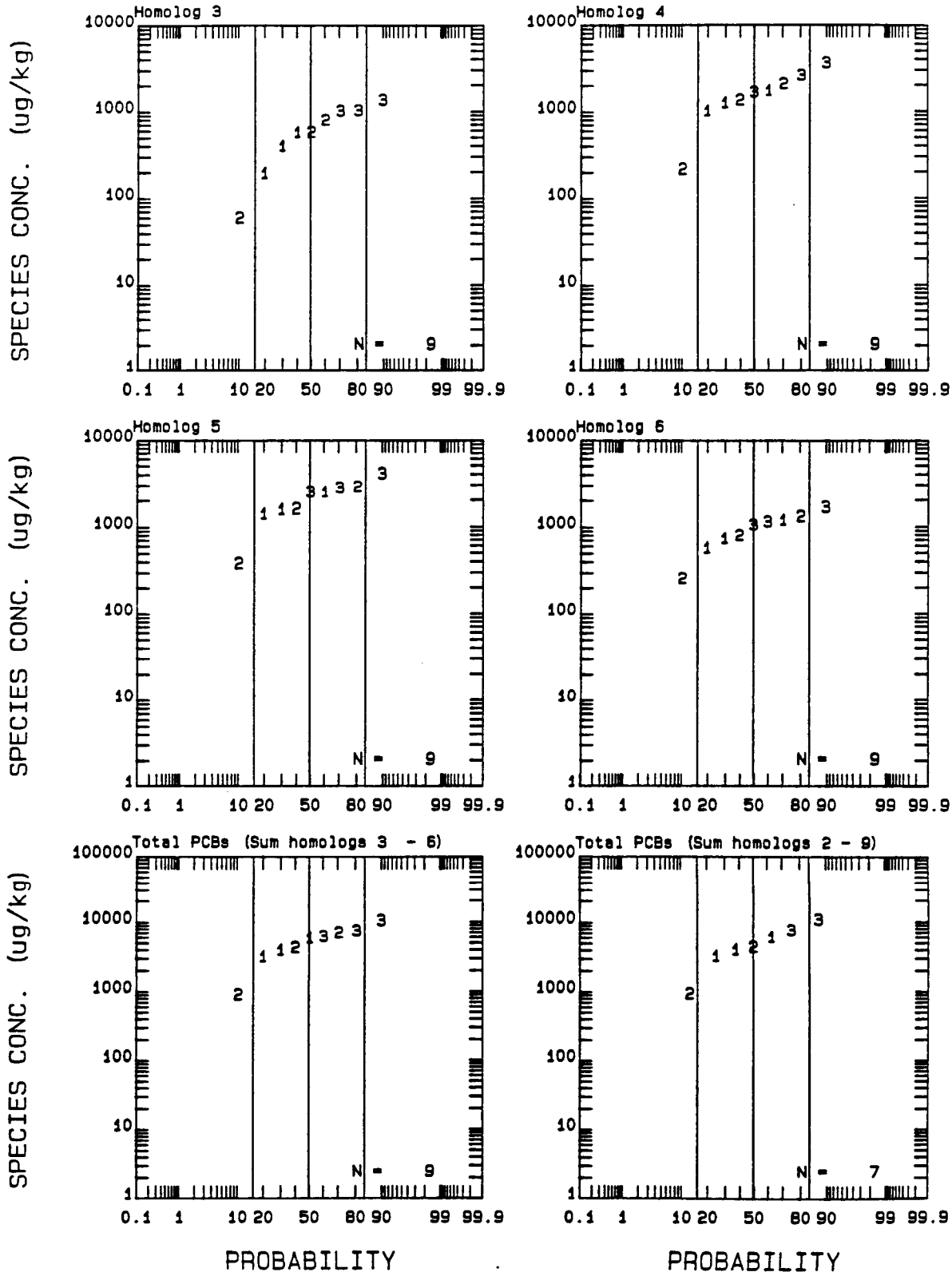
AREA 4, LOBSTER, MEDIUM



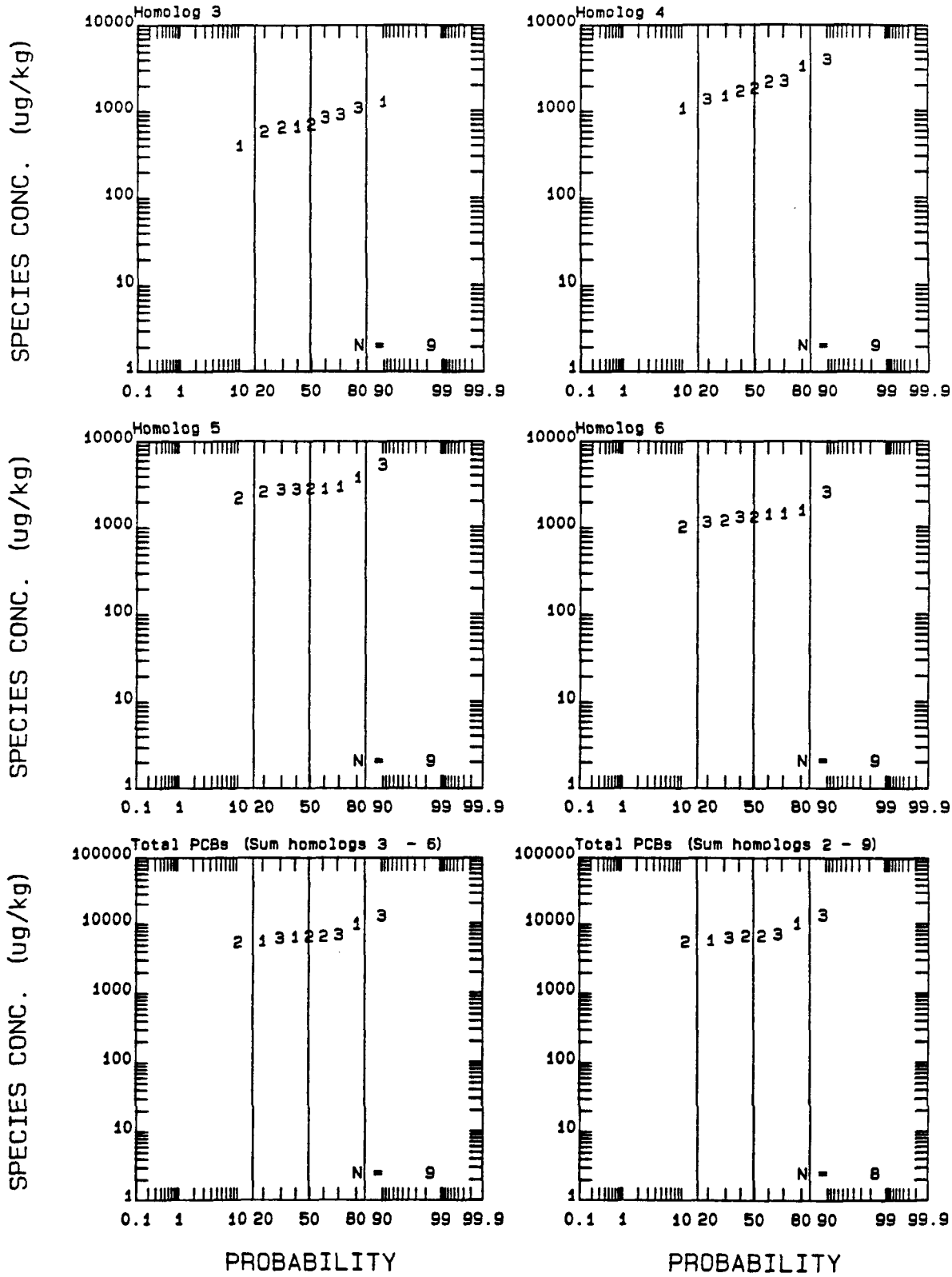
AREA 4, LOBSTER, LARGE



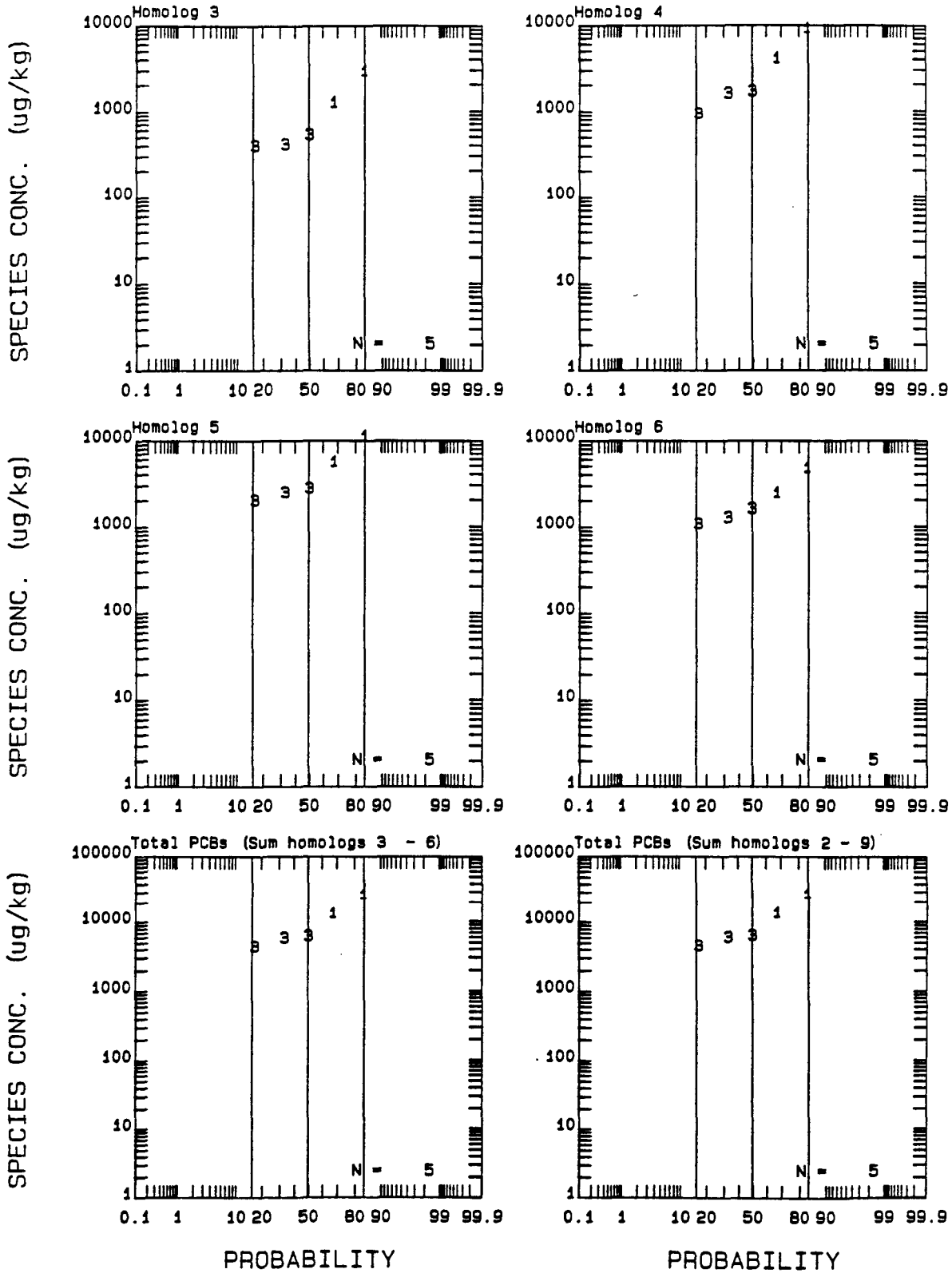
AREA 1, FLOUNDER, SMALL



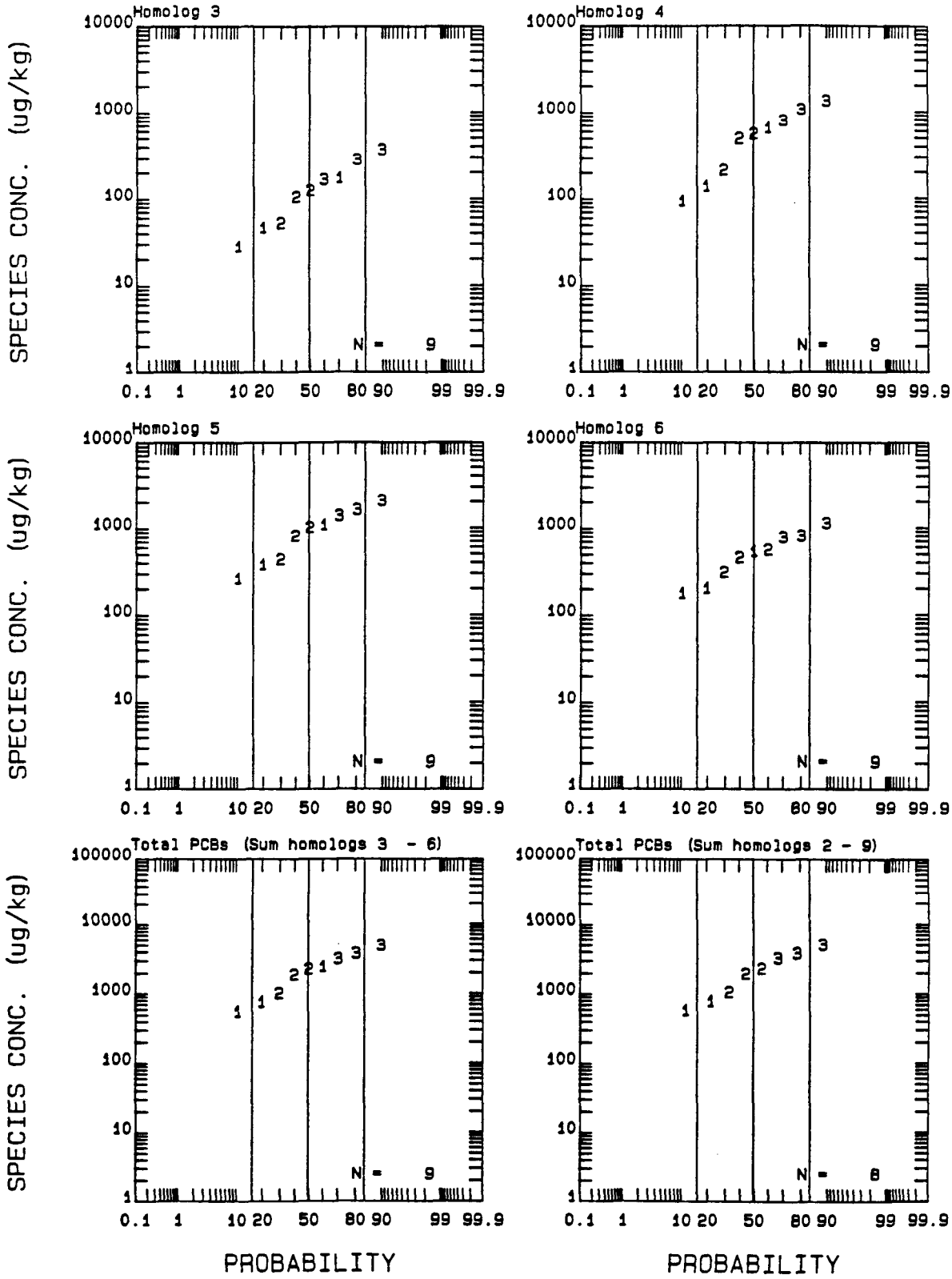
AREA 1, FLOUNDER, MEDIUM



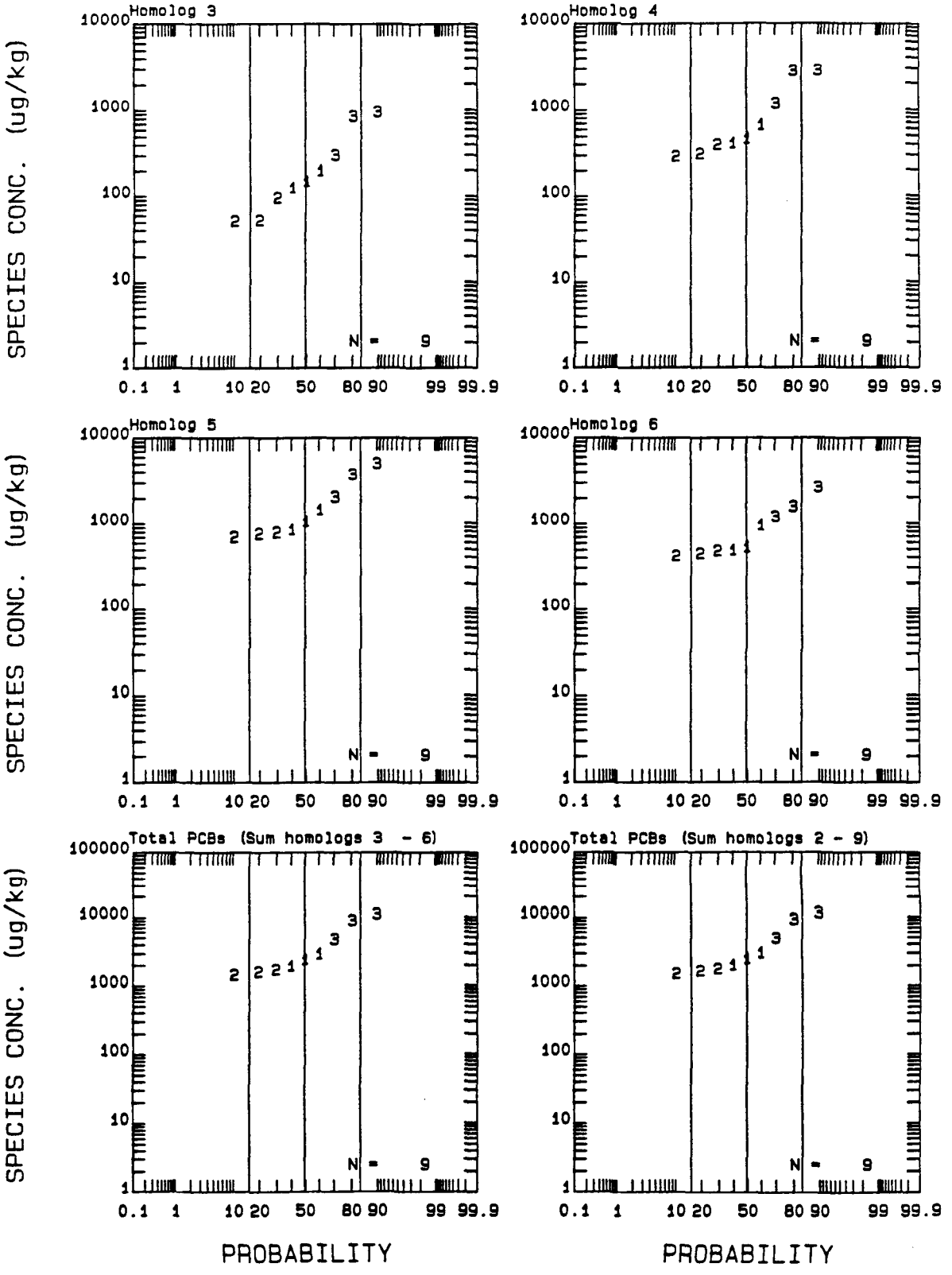
AREA 1, FLOUNDER, LARGE



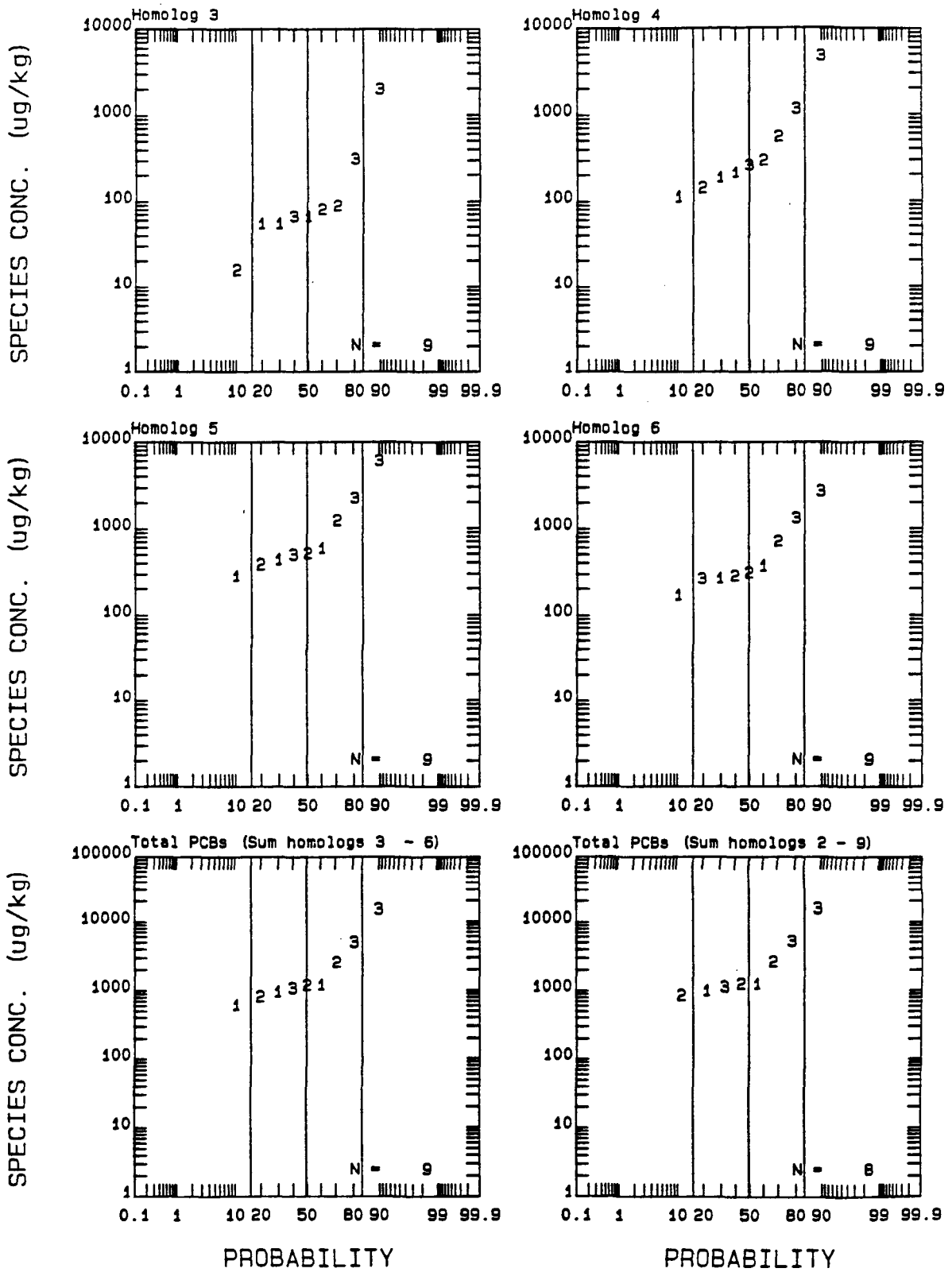
AREA 2, FLOUNDER, SMALL



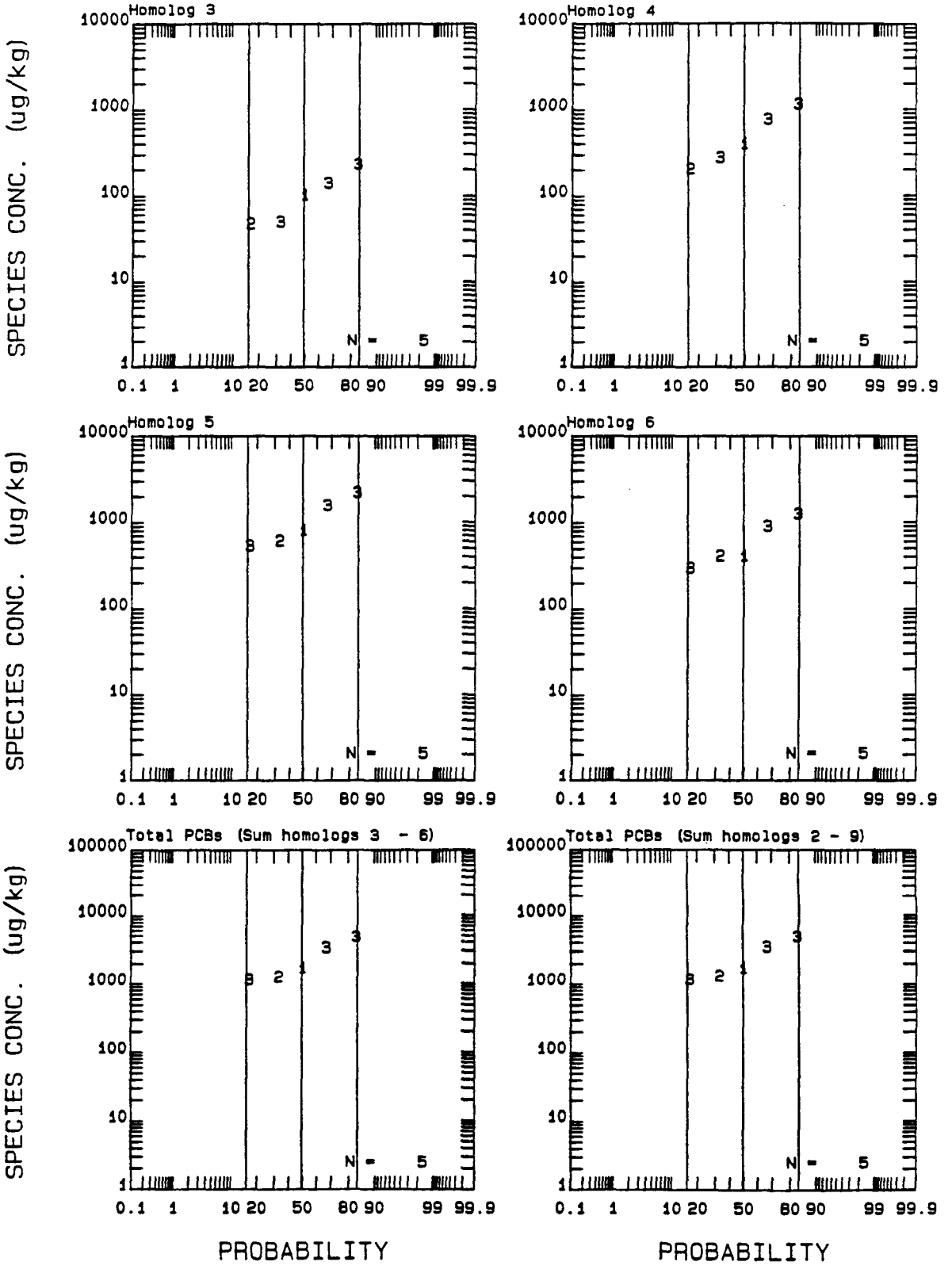
AREA 2, FLOUNDER, MEDIUM



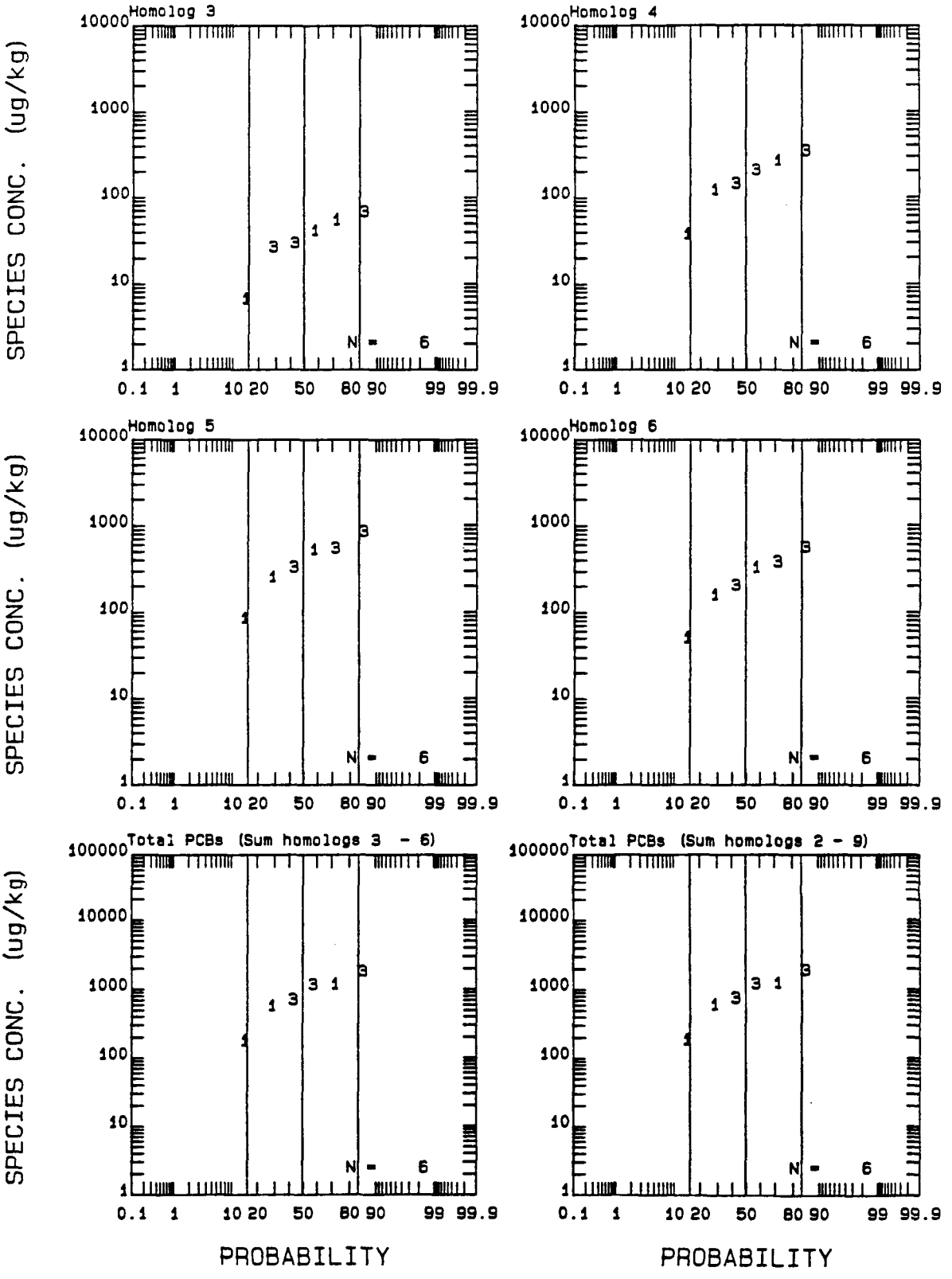
AREA 2, FLOUNDER, LARGE



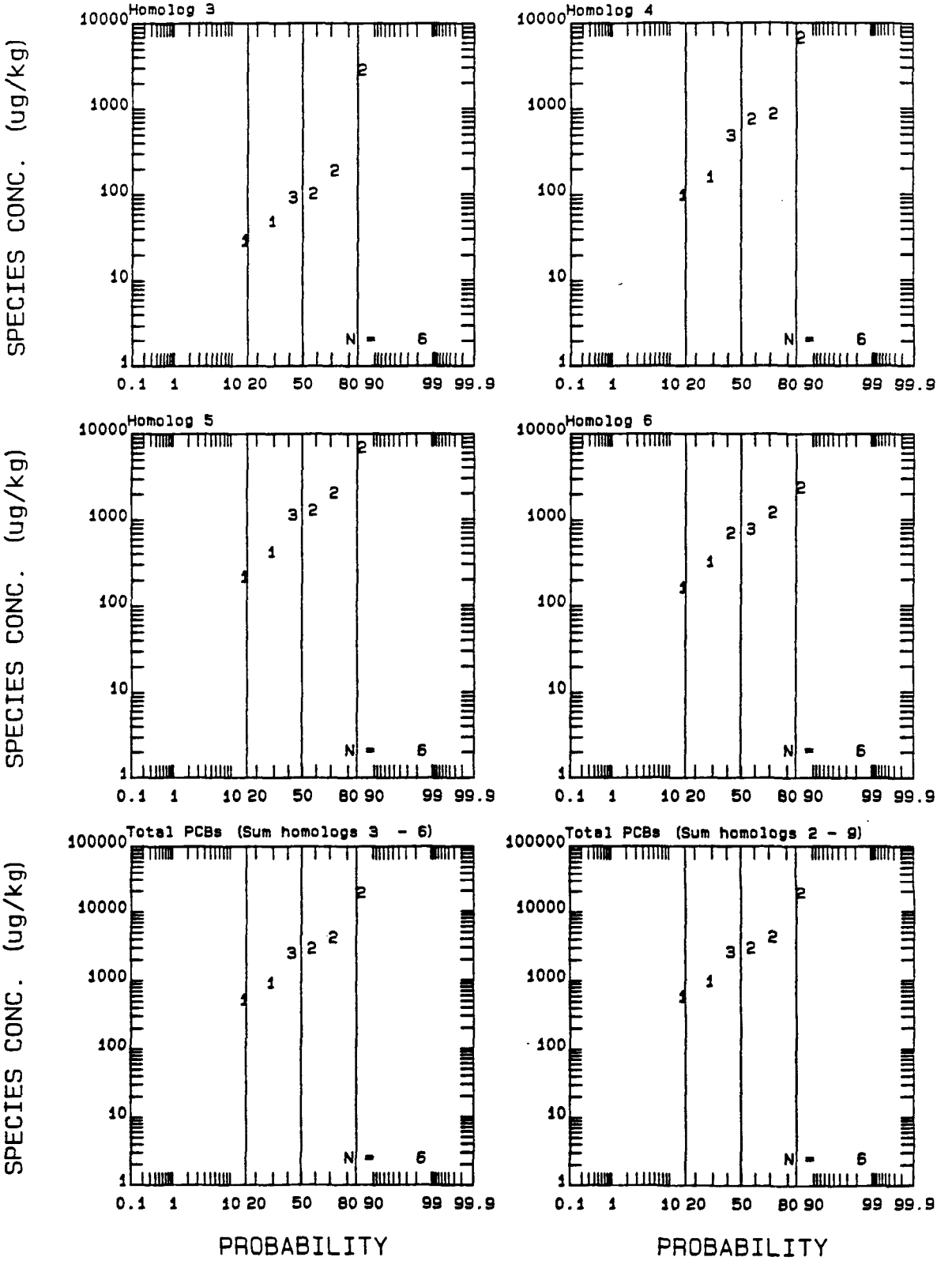
AREA 3, FLOUNDER, SMALL



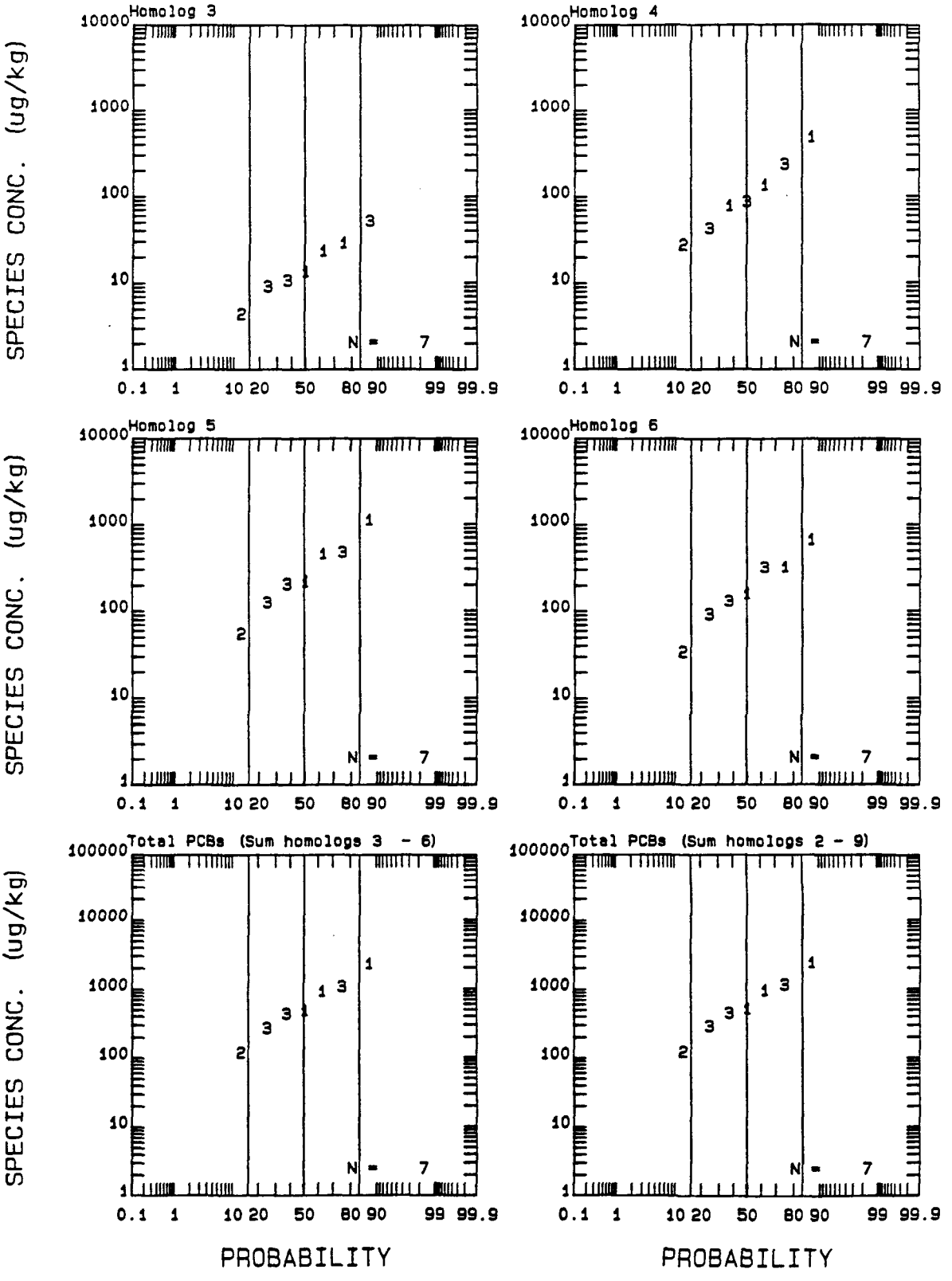
AREA 3, FLOUNDER, MEDIUM



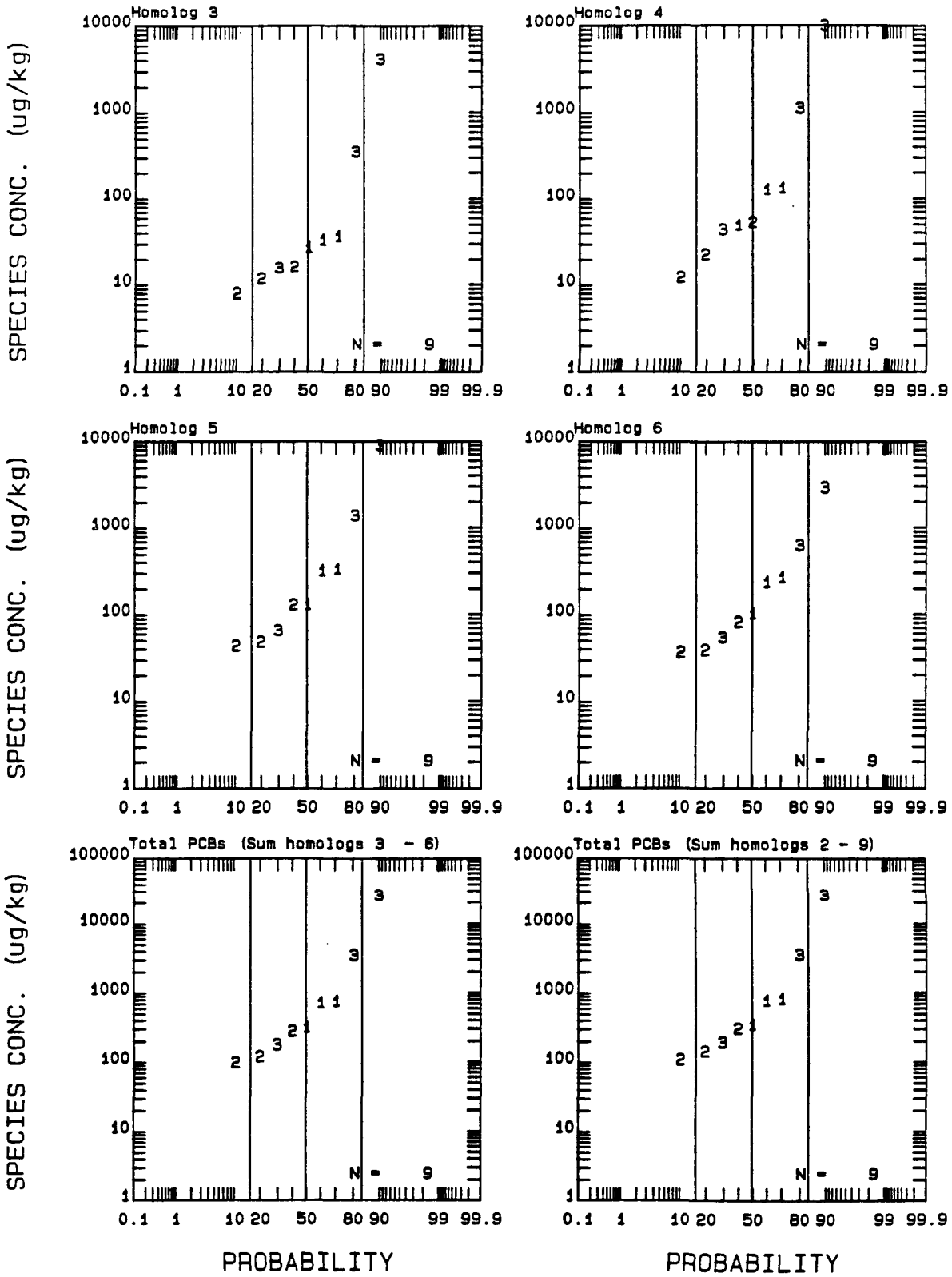
AREA 3, FLOUNDER, LARGE



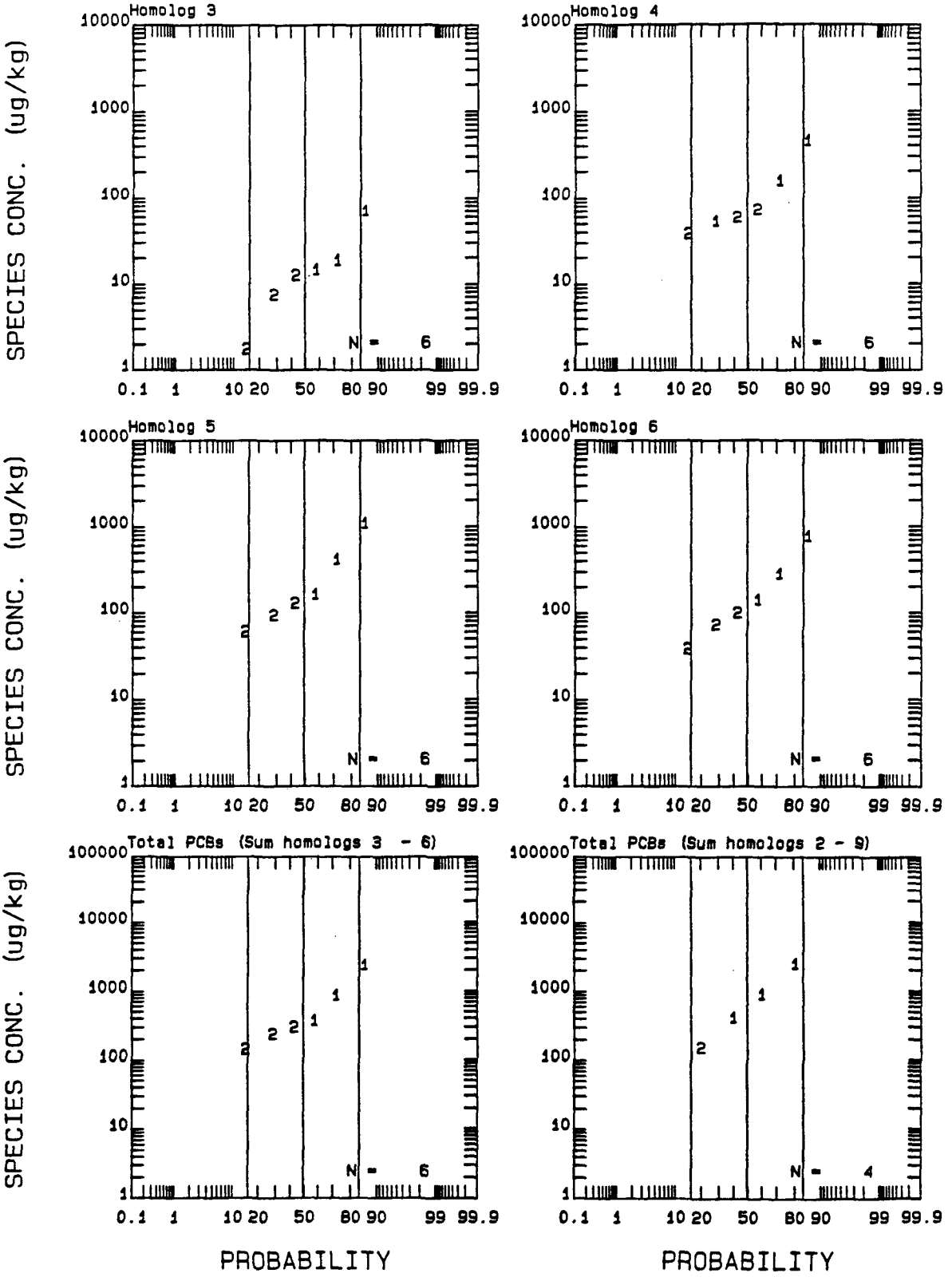
AREA 4, FLOUNDER, SMALL



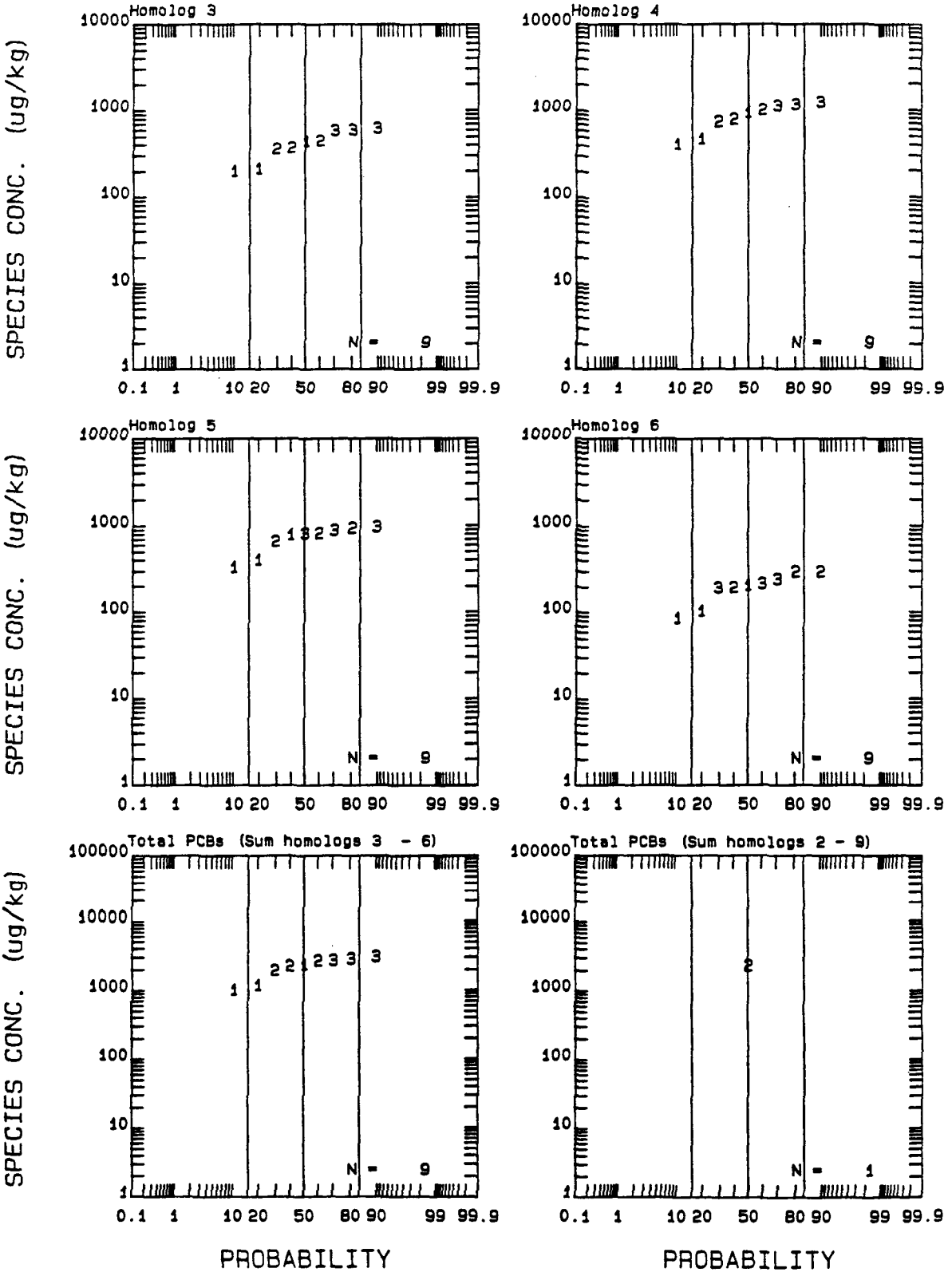
AREA 4, FLOUNDER, MEDIUM



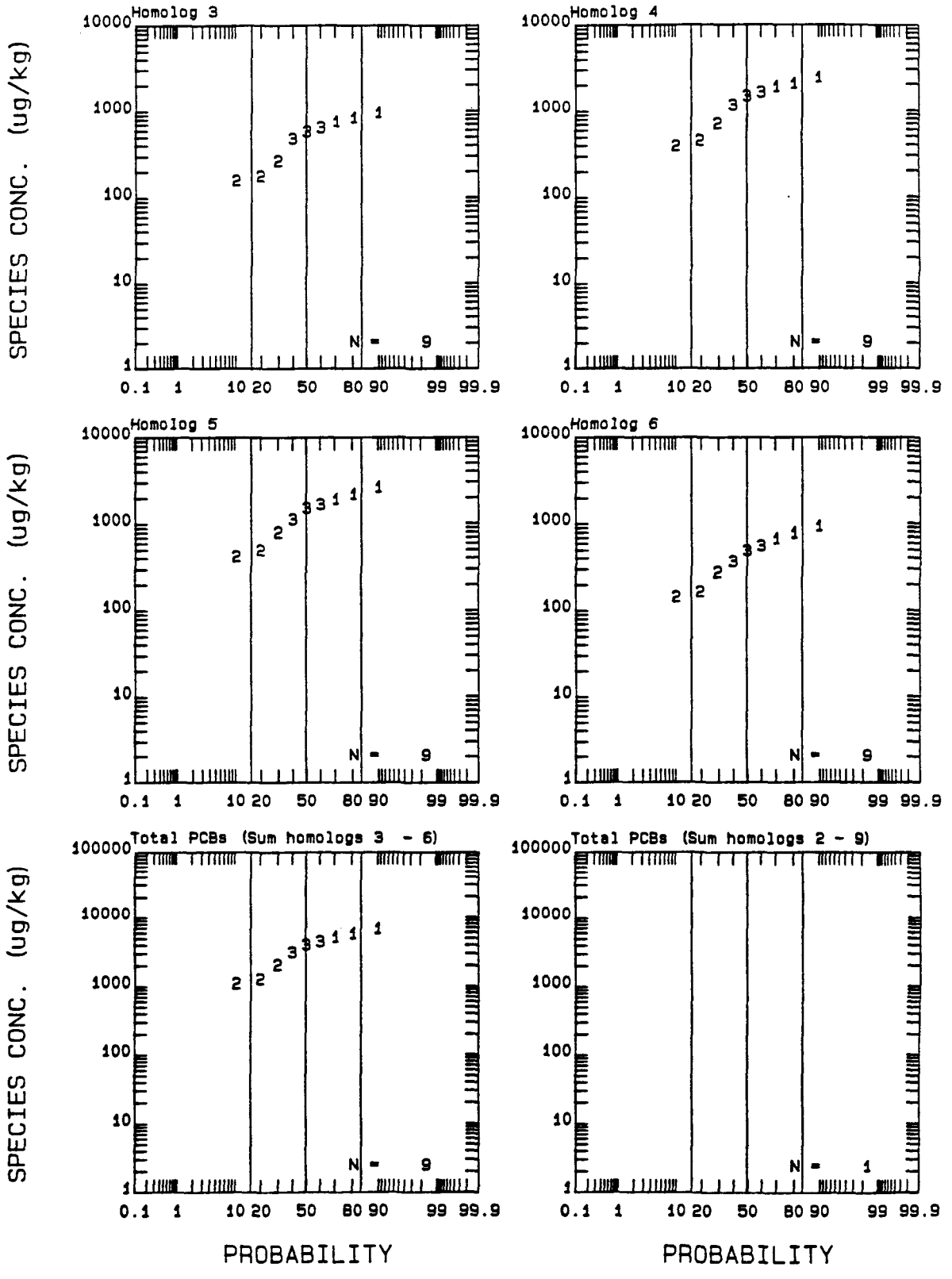
AREA 4, FLOUNDER, LARGE



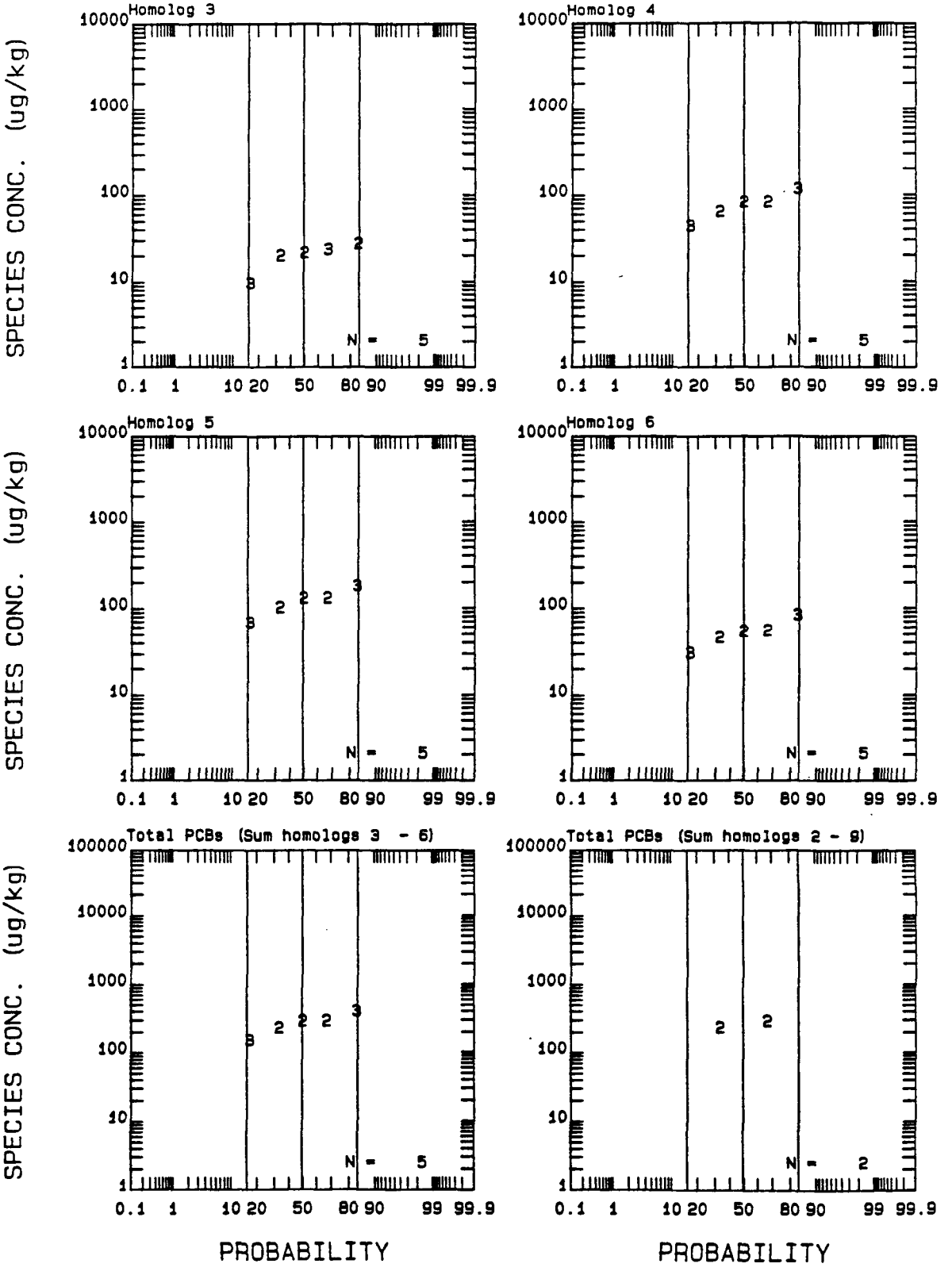
AREA 1, MUSSEL



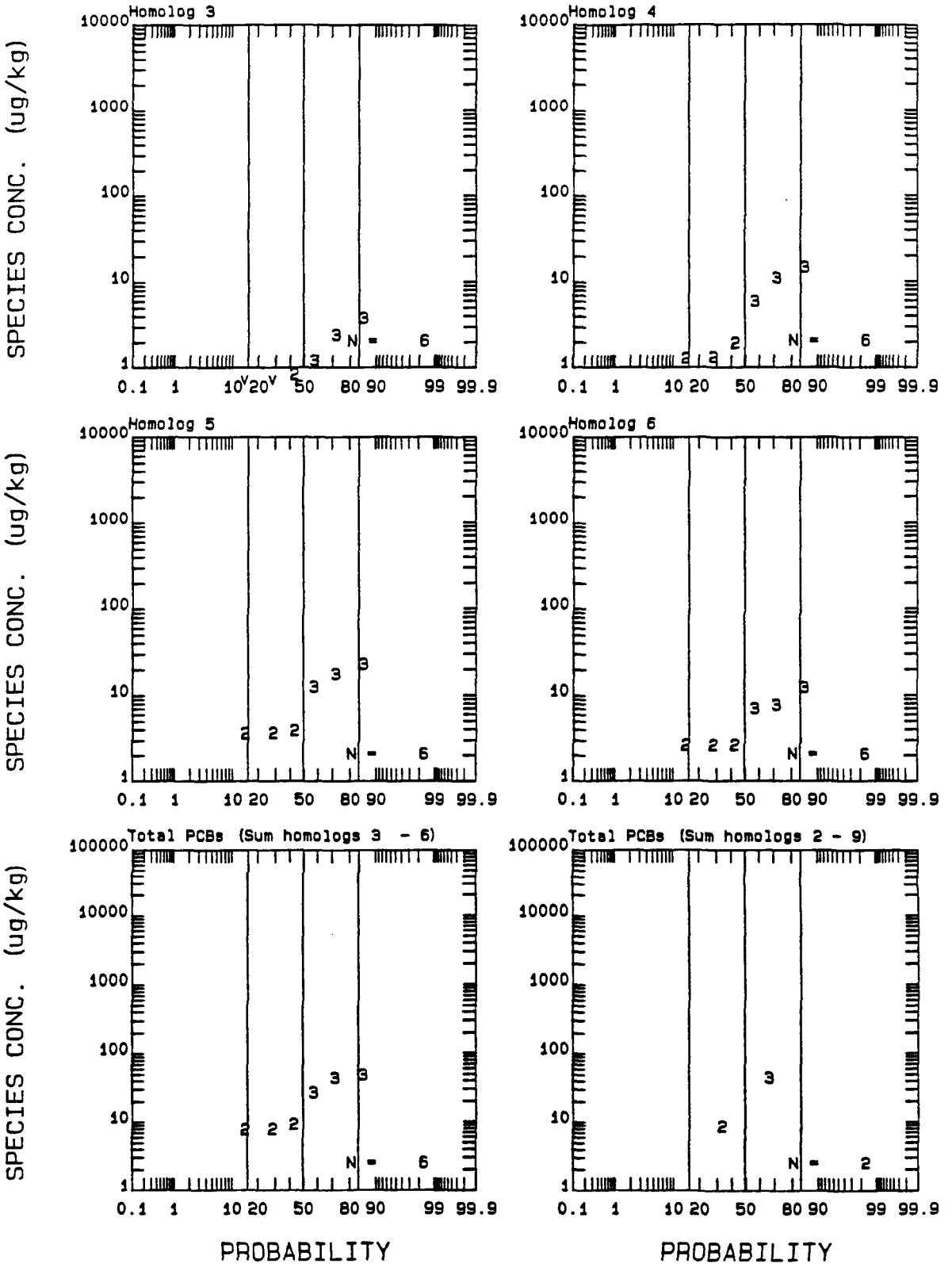
AREA 2, MUSSEL



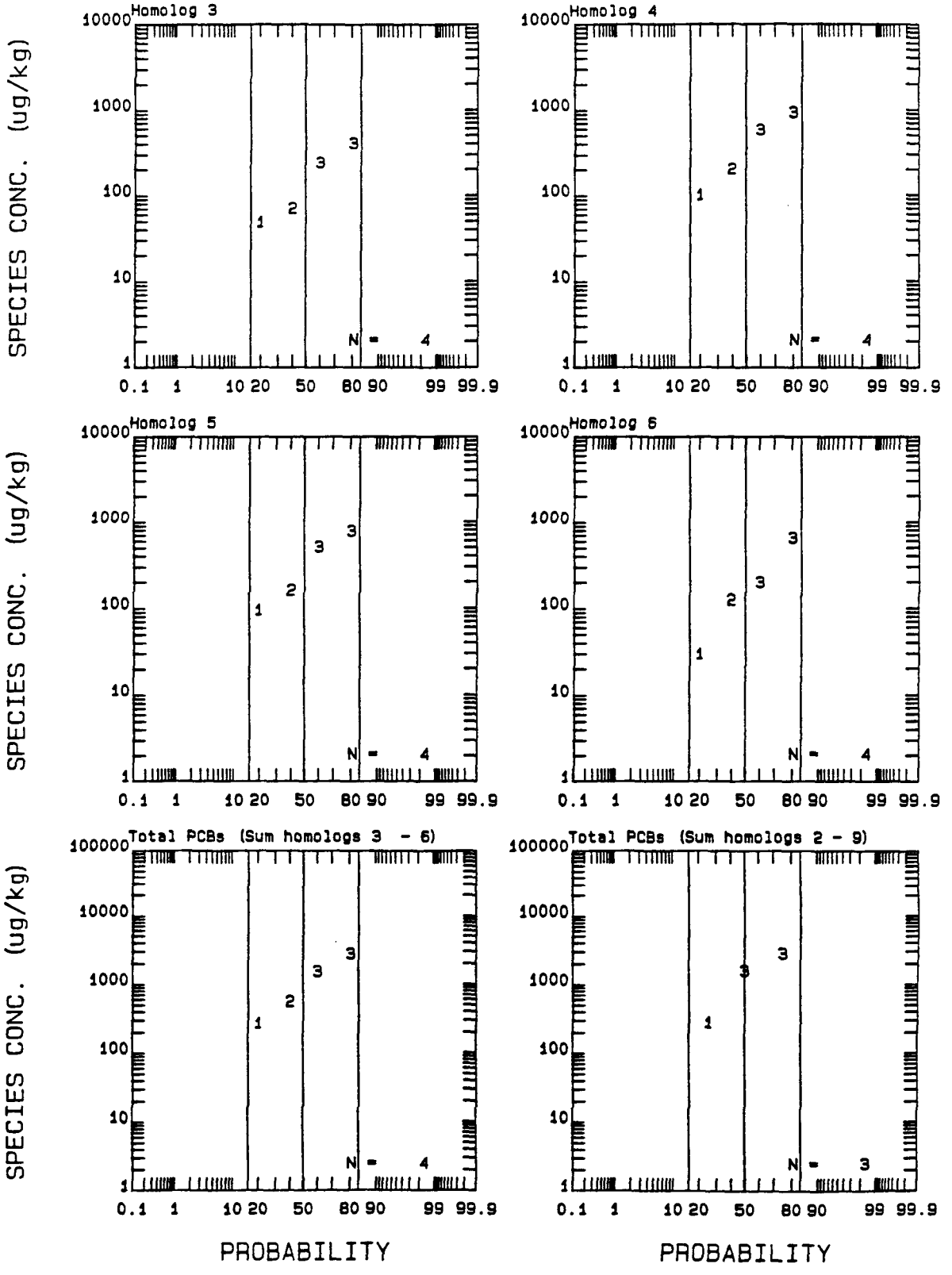
AREA 3, MUSSEL



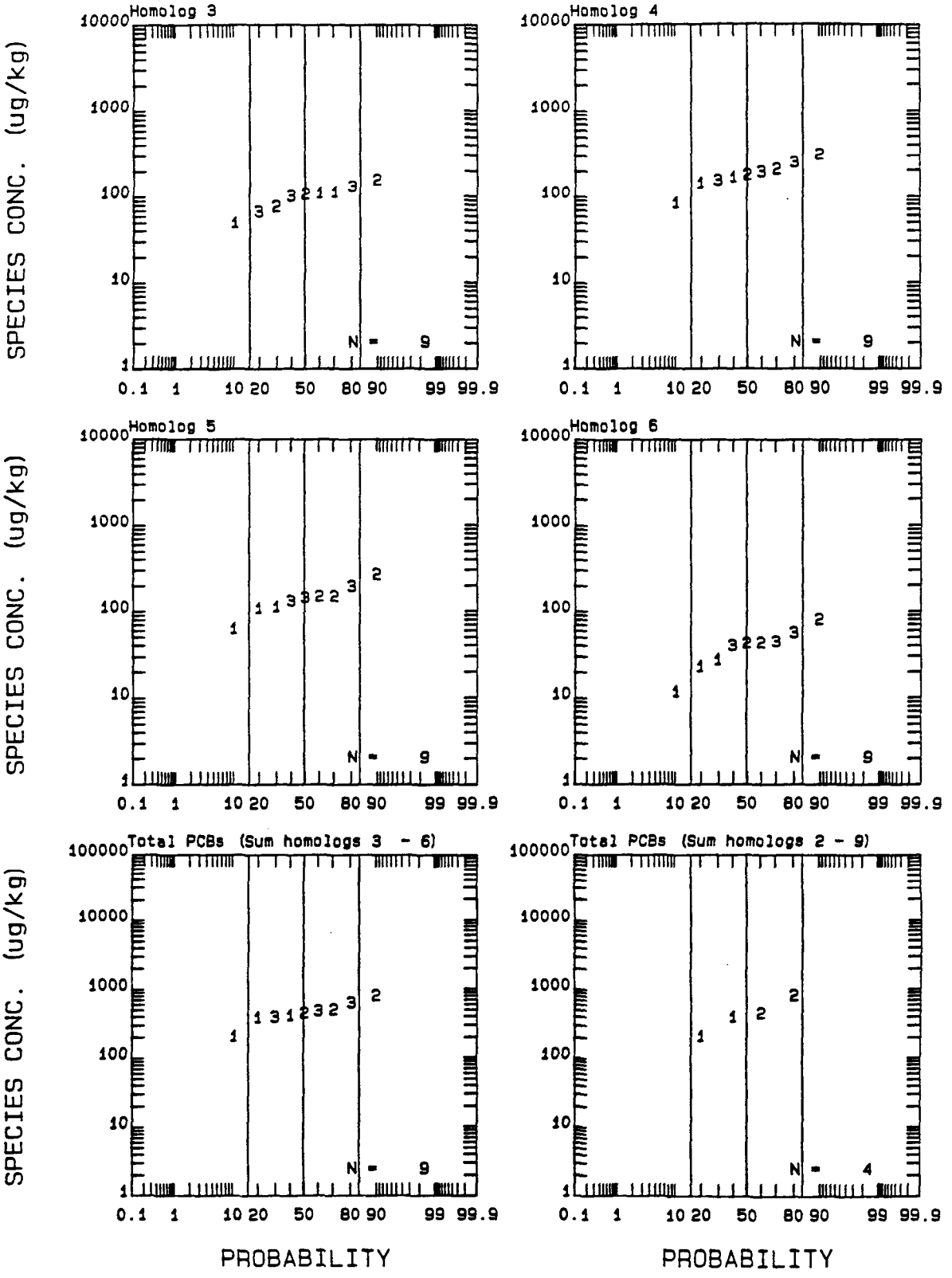
AREA 4, MUSSEL



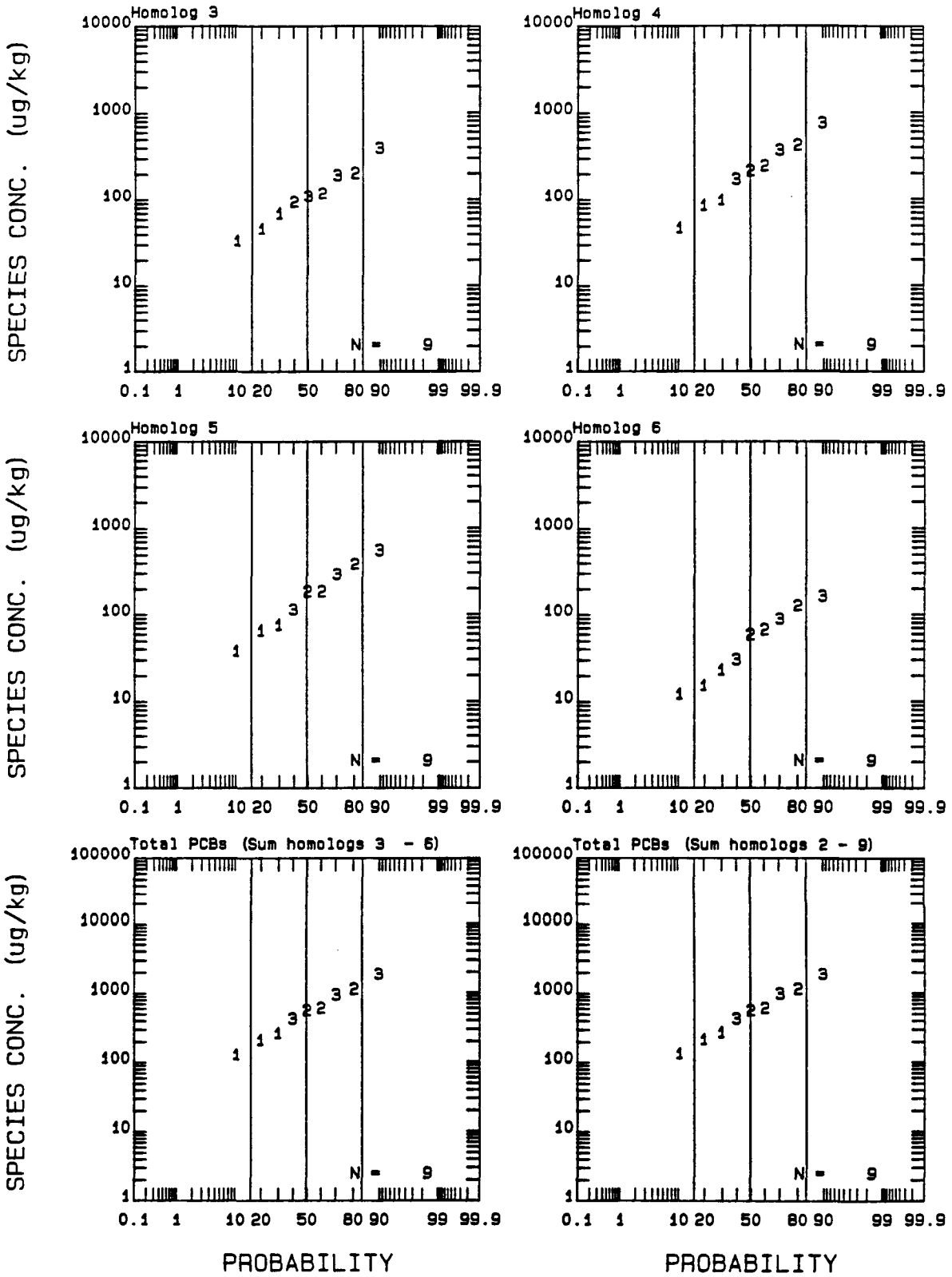
AREA 1, CLAM, SMALL



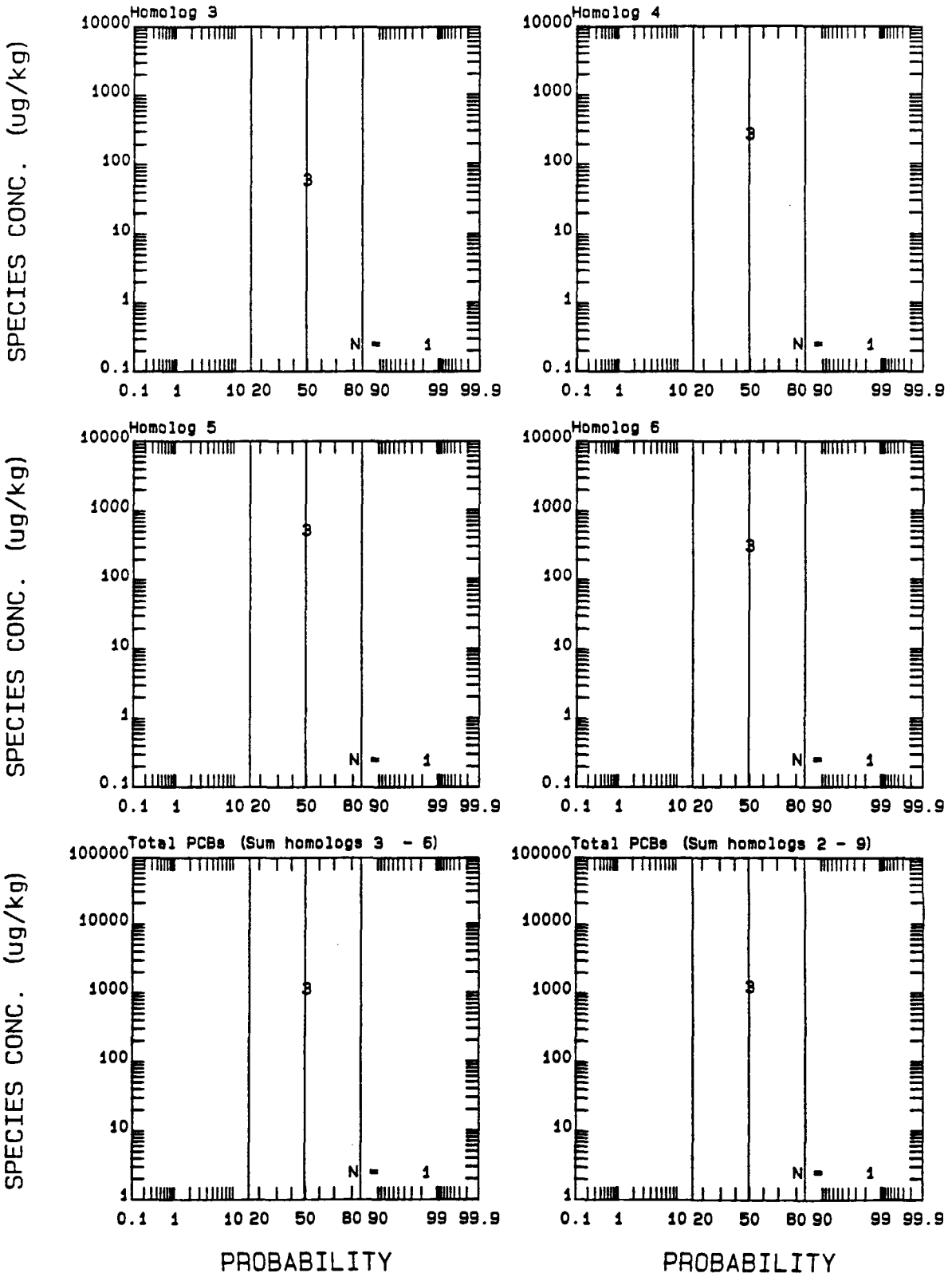
AREA 1, CLAM, MEDIUM



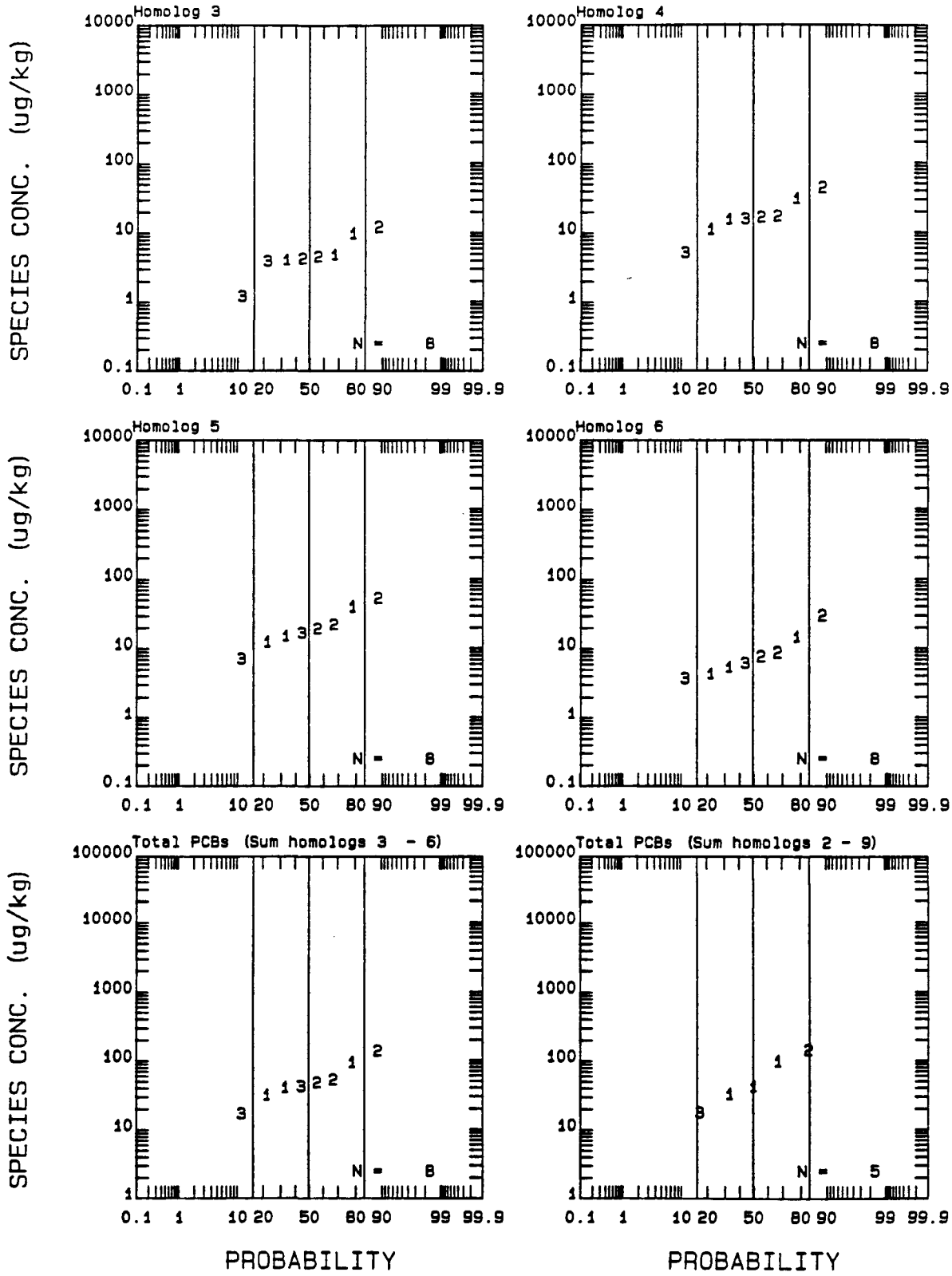
AREA 1, CLAM, LARGE



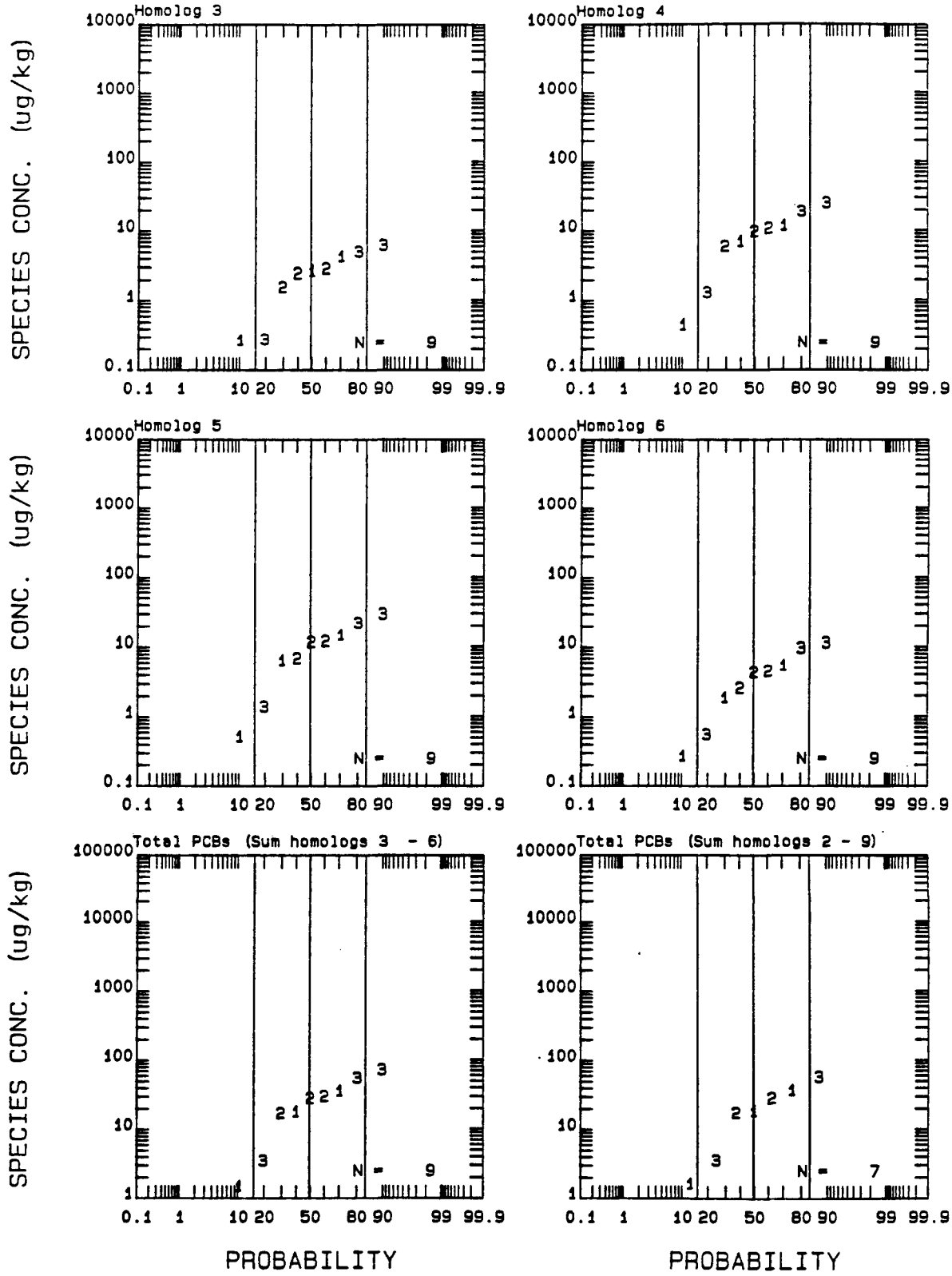
AREA 2, CLAM, SMALL



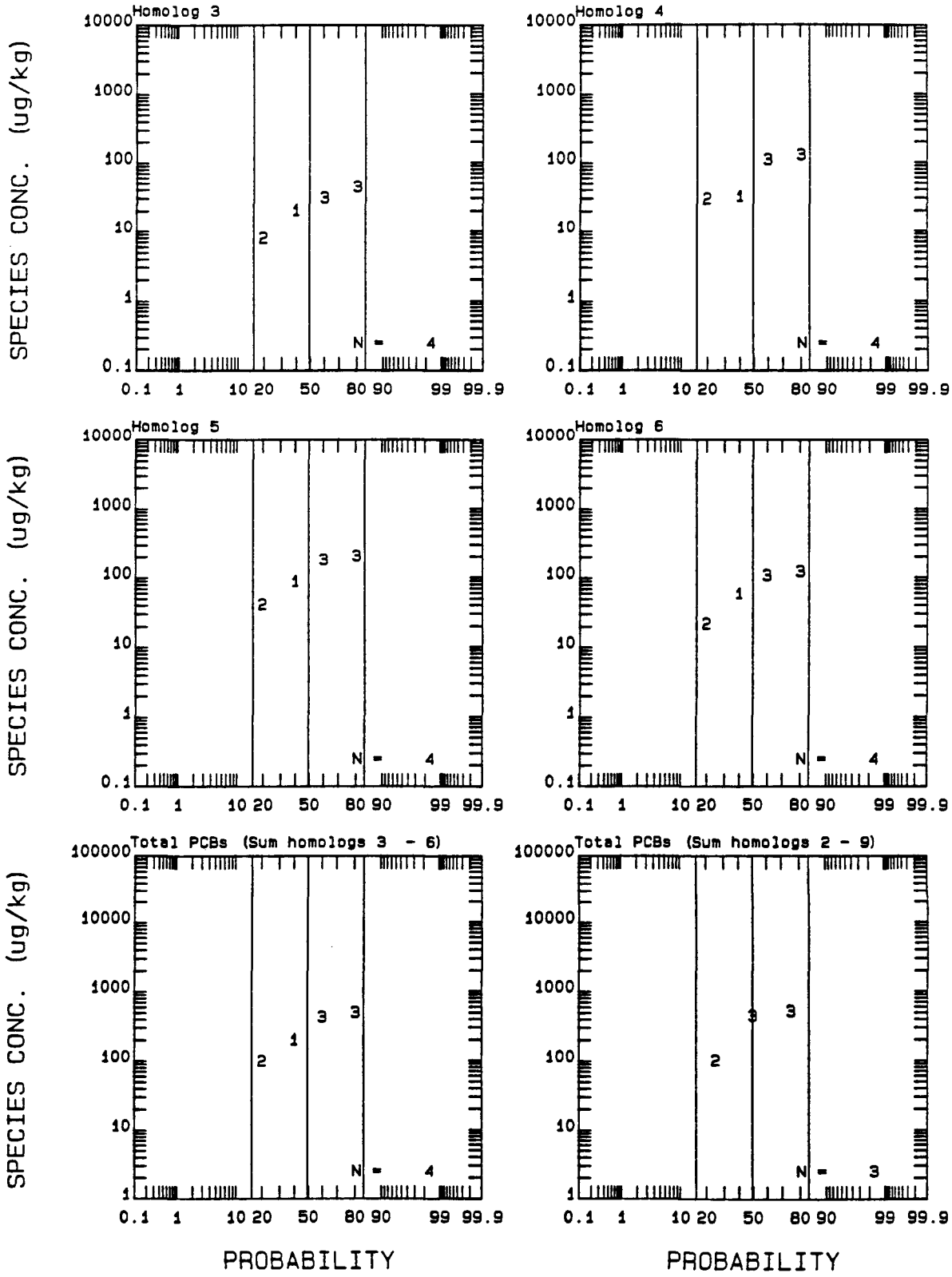
AREA 2, CLAM, MEDIUM



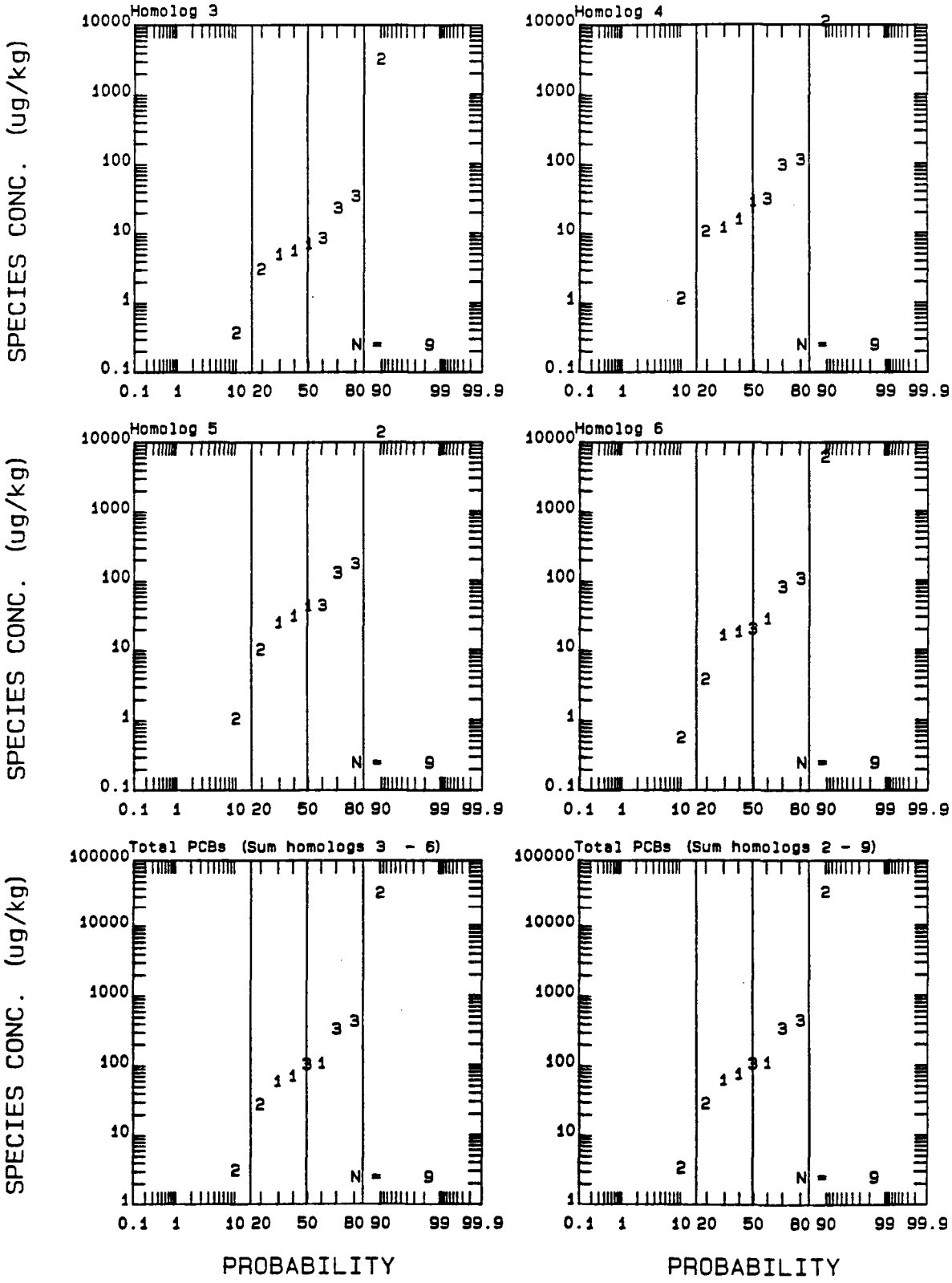
AREA 2, CLAM, LARGE



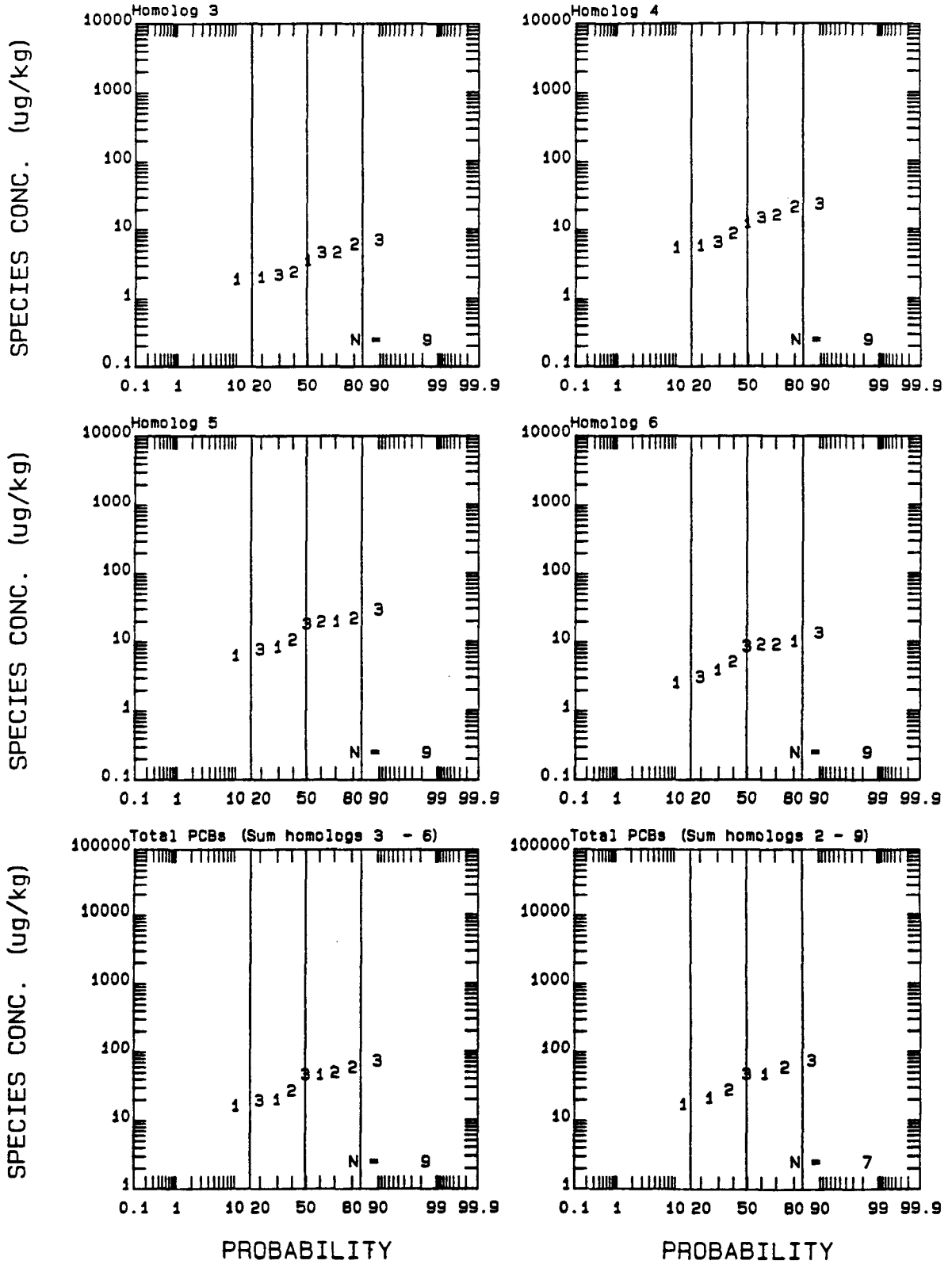
AREA 3, CLAM, SMALL



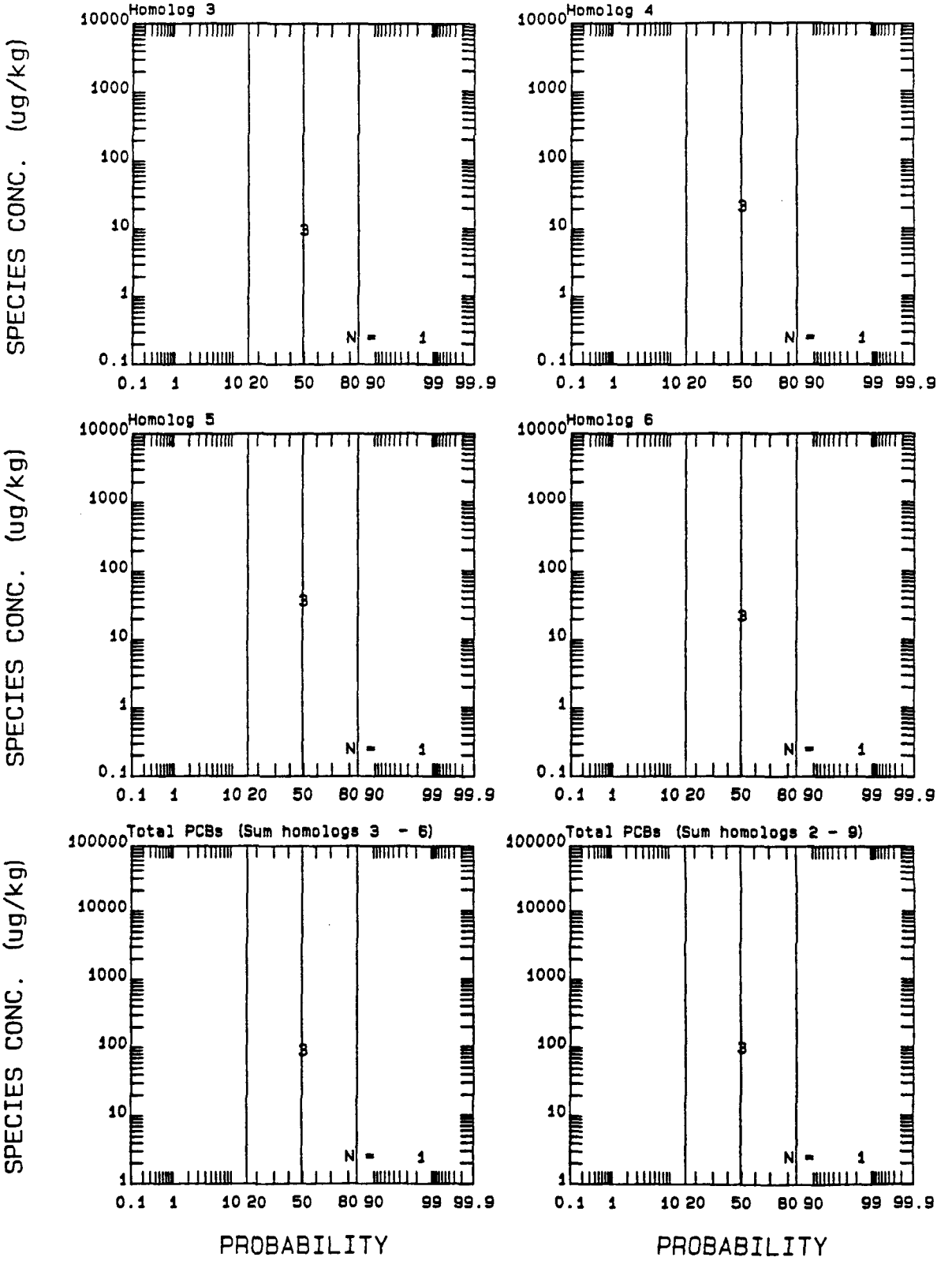
AREA 3, CLAM, MEDIUM



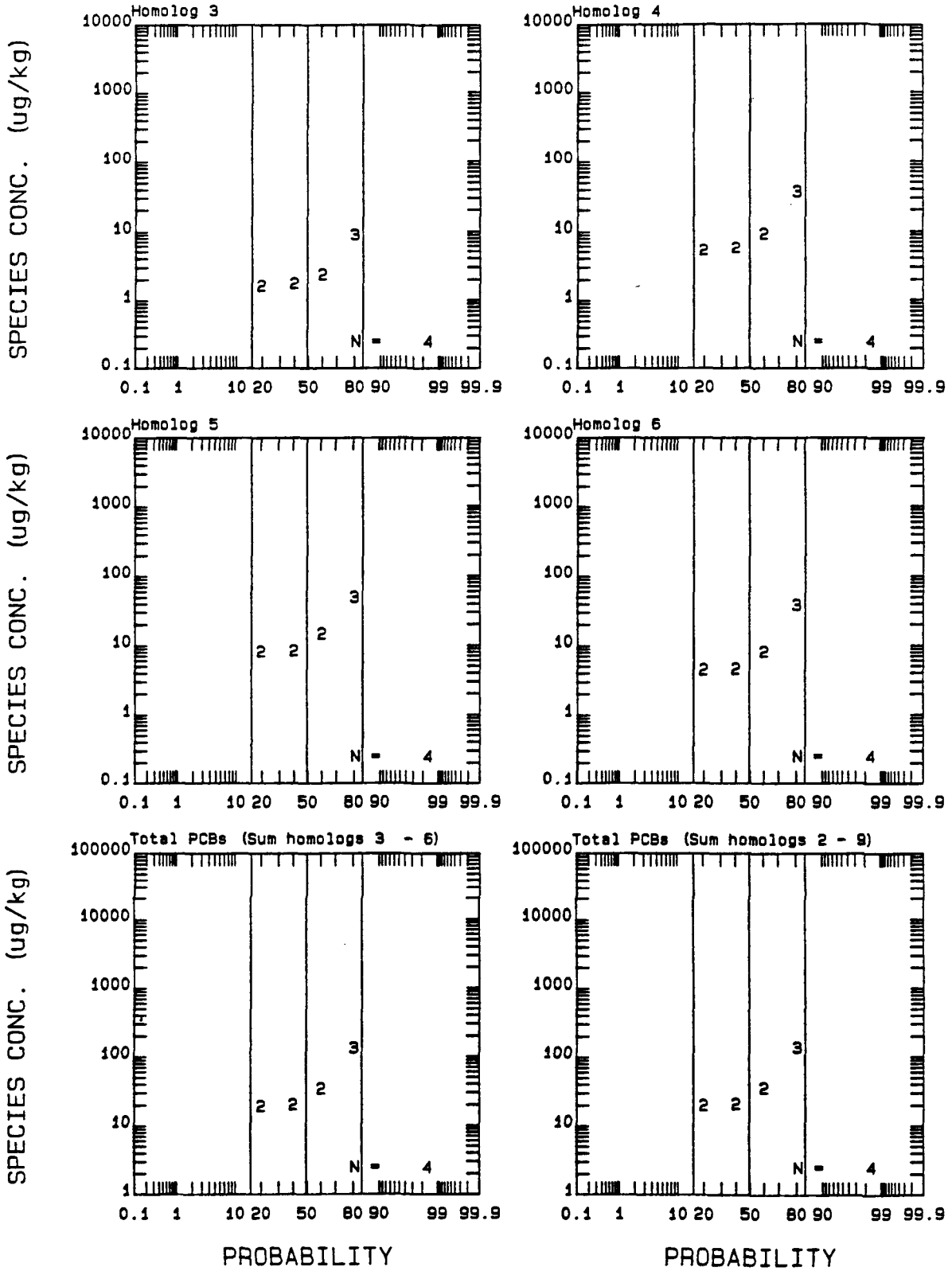
AREA 3, CLAM, LARGE



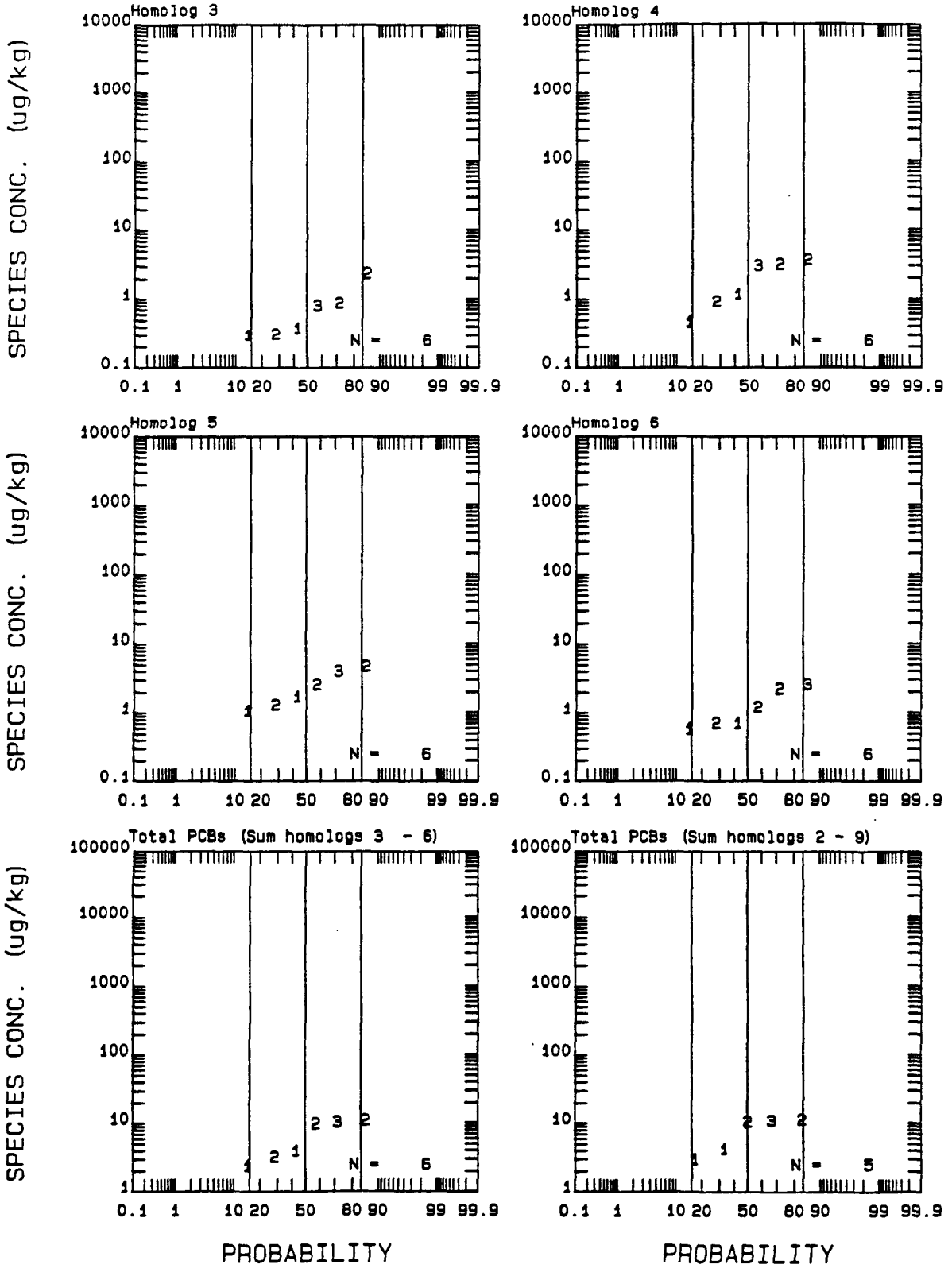
AREA 4, CLAM, SMALL



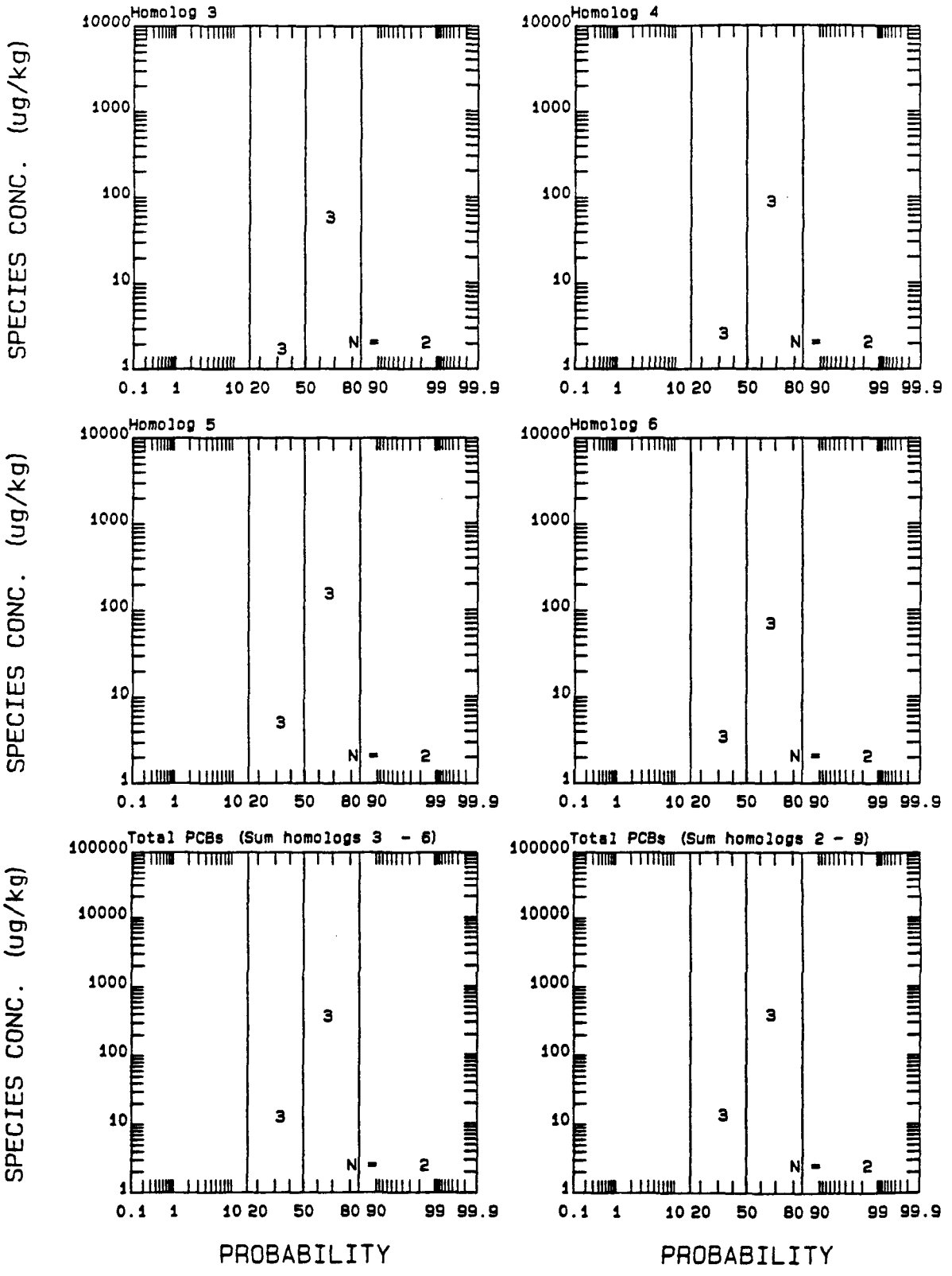
AREA 4, CLAM, MEDIUM



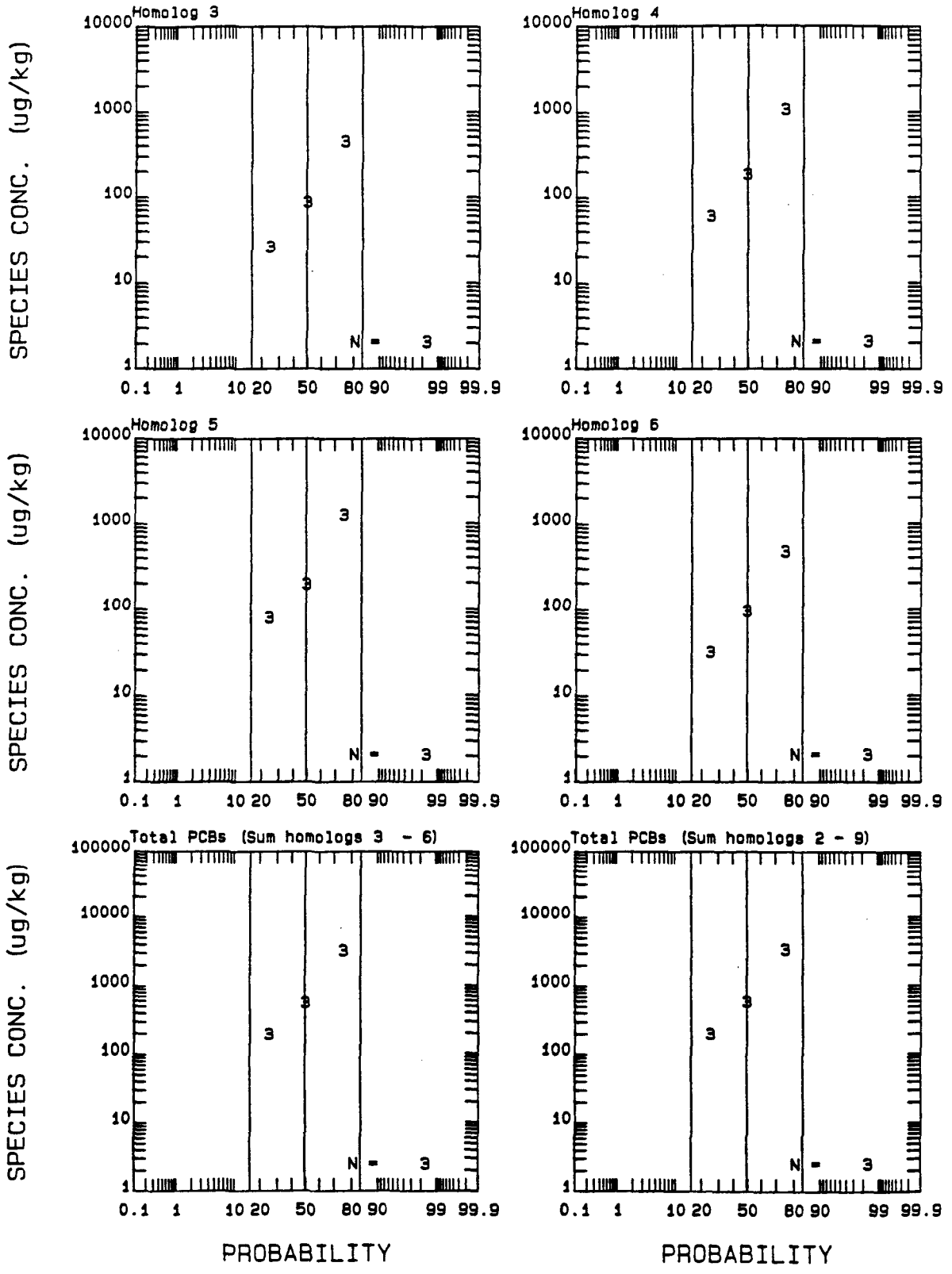
AREA 4, CLAM, LARGE



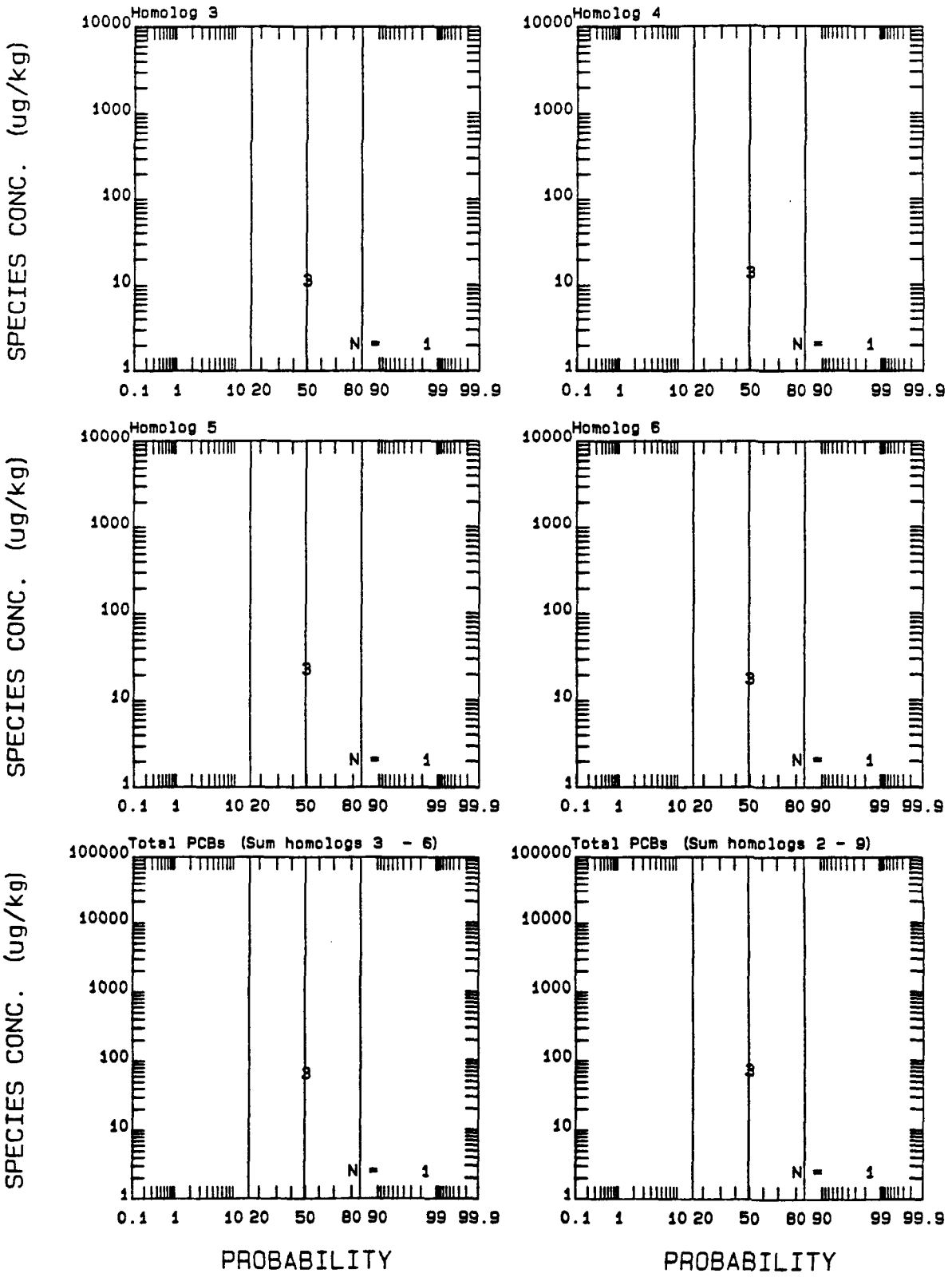
AREA 1, GREEN CRAB, SMALL



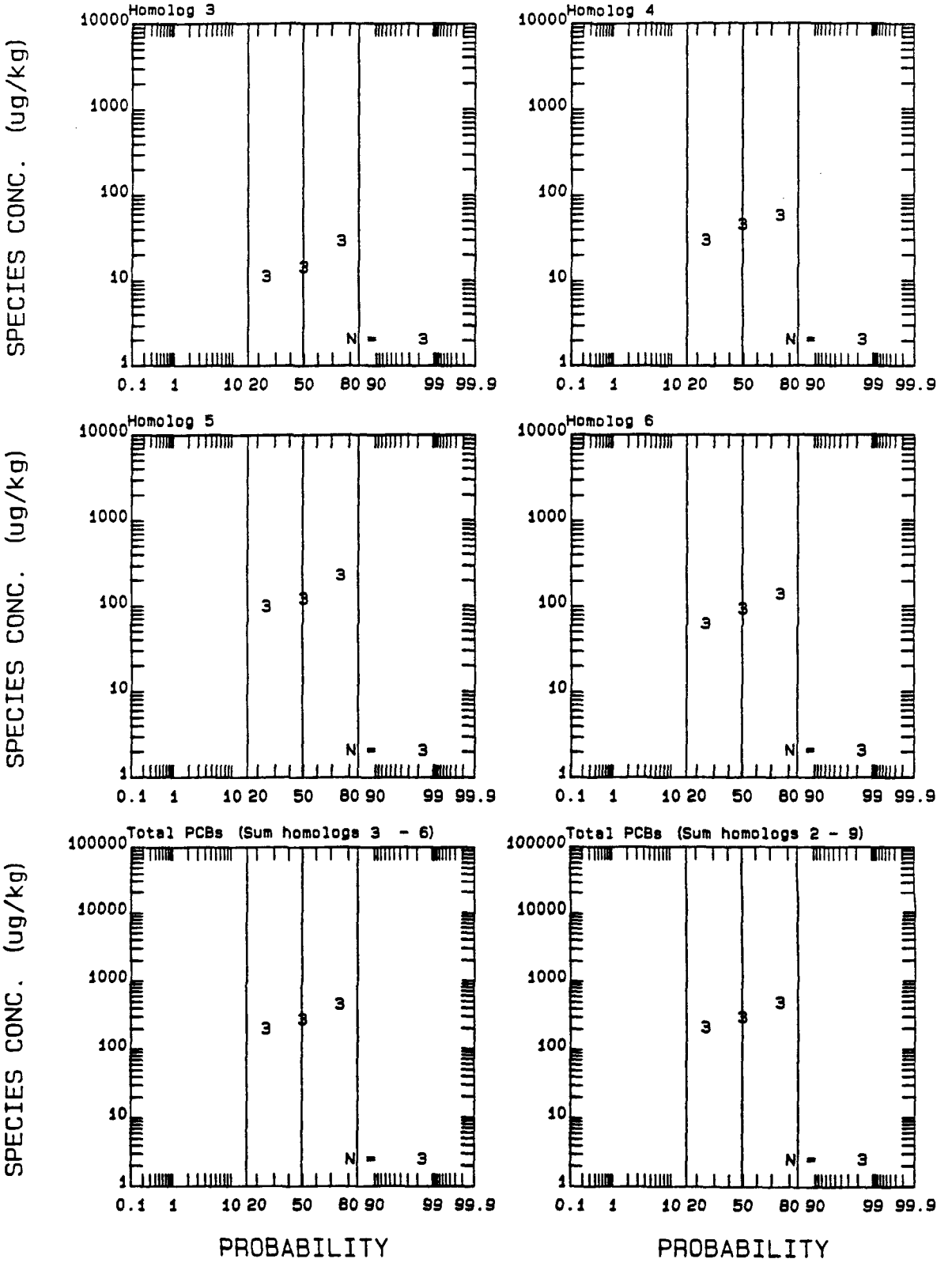
AREA 1, GREEN CRAB, LARGE



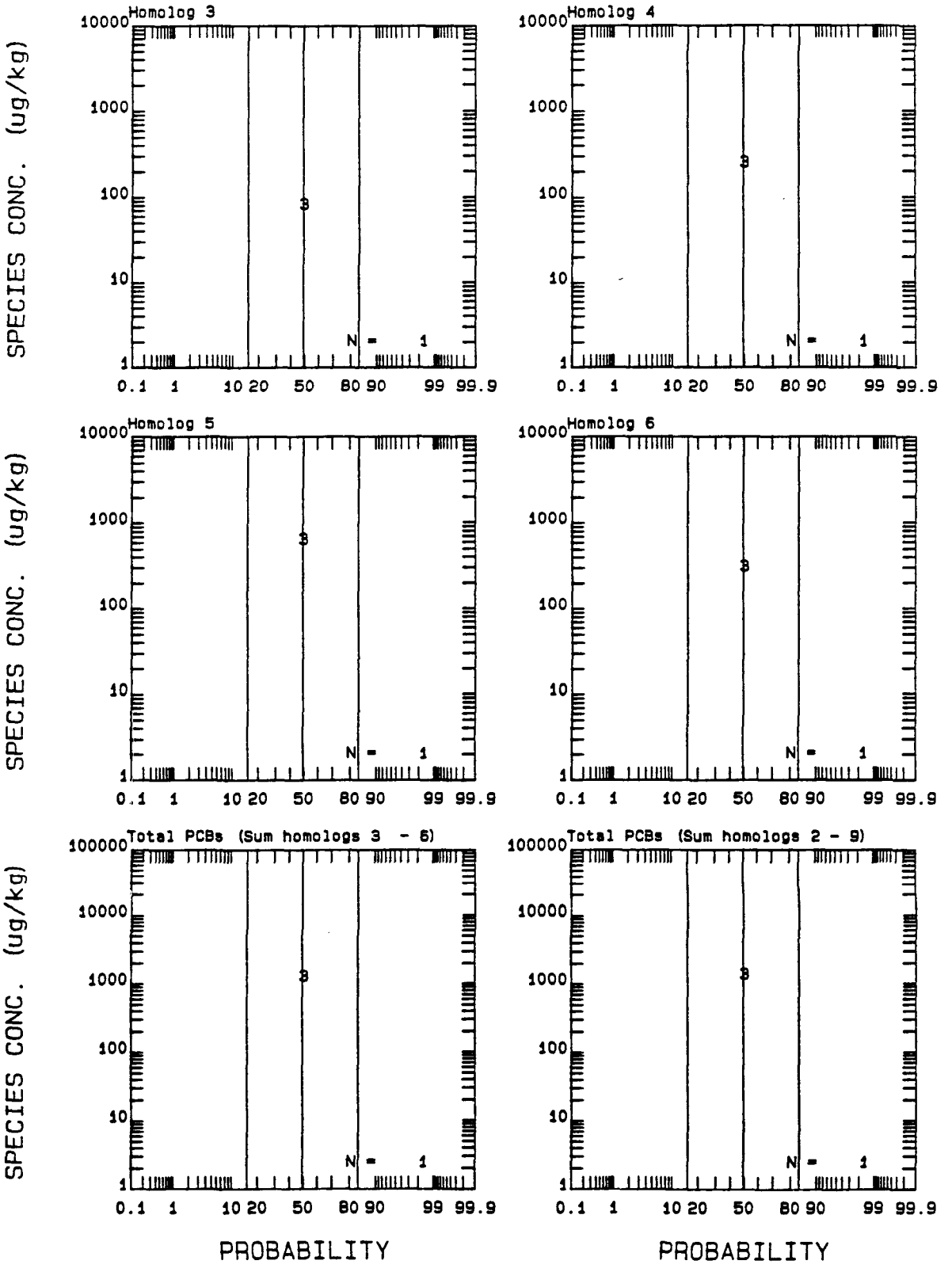
AREA 2, GREEN CRAB, SMALL



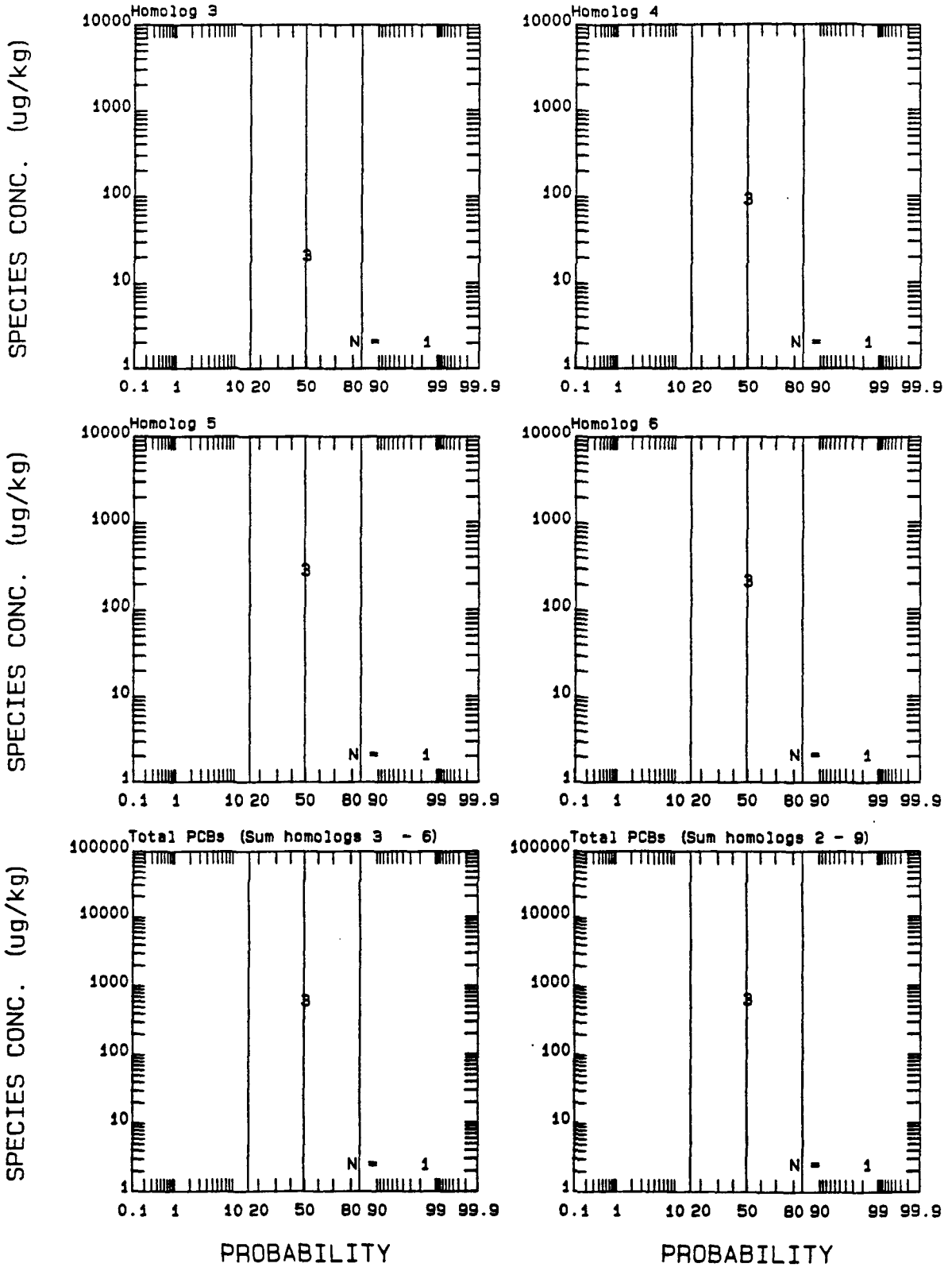
AREA 2, GREEN CRAB, LARGE



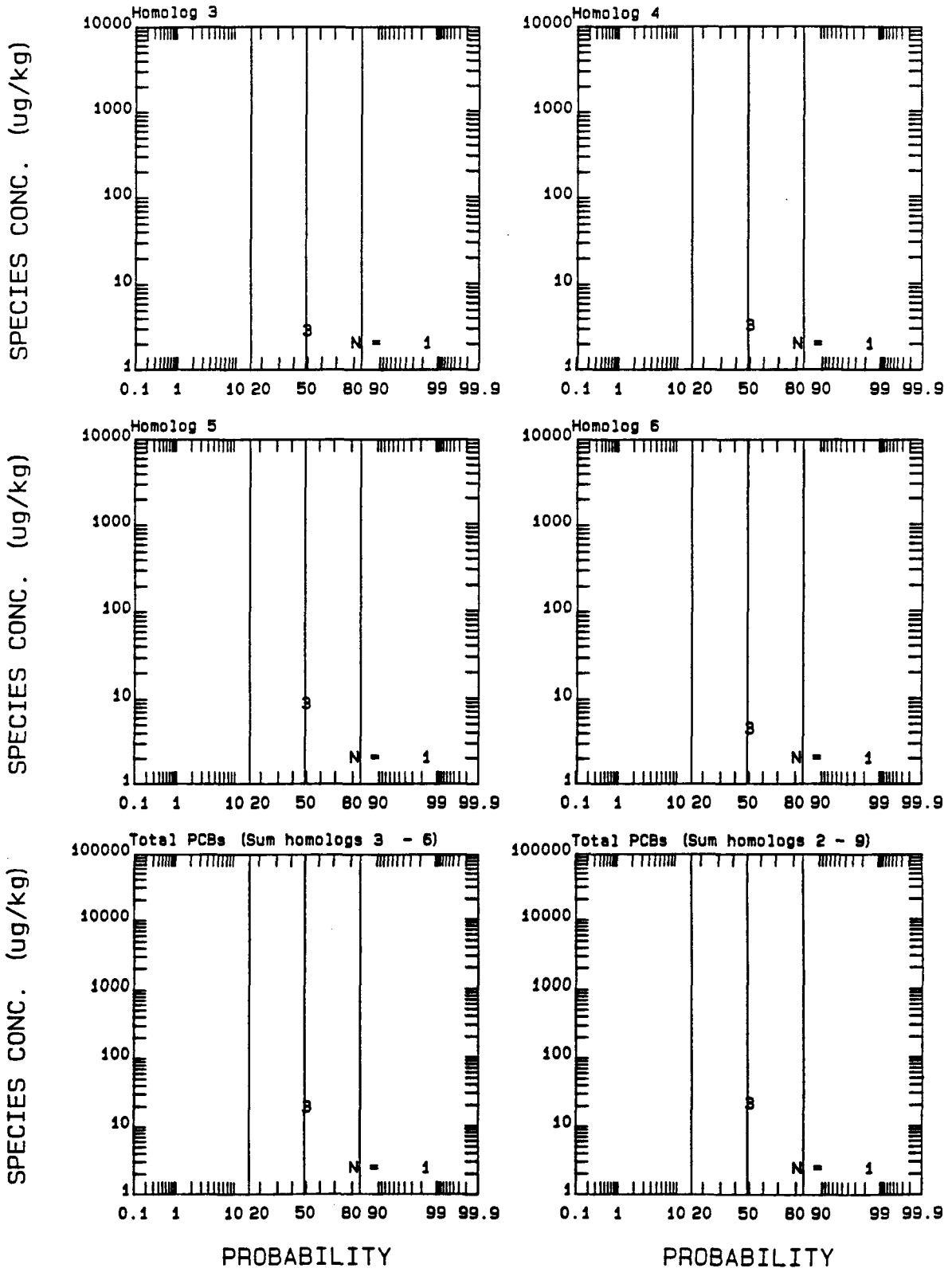
AREA 3, GREEN CRAB, SMALL



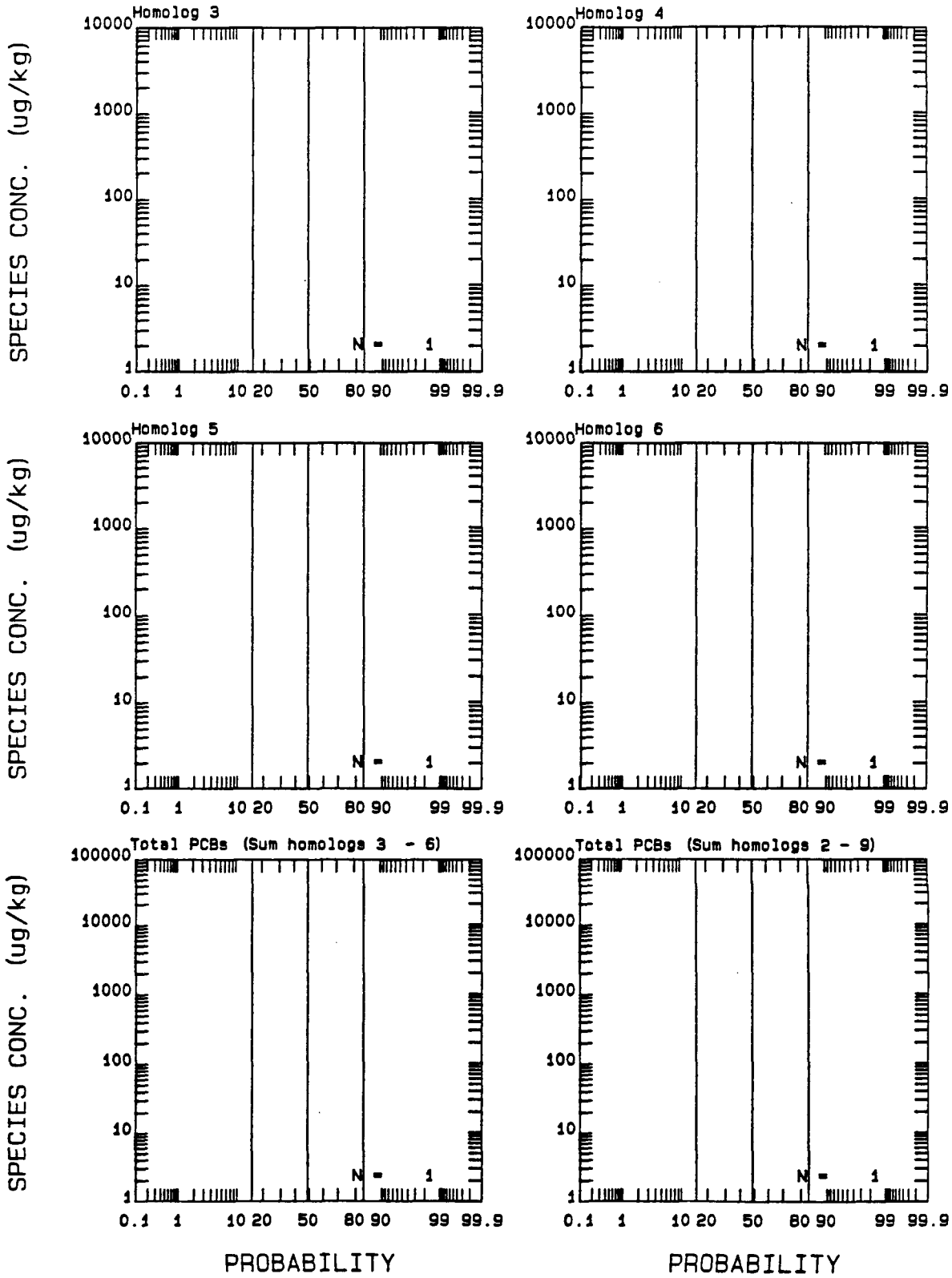
AREA 3, GREEN CRAB, LARGE



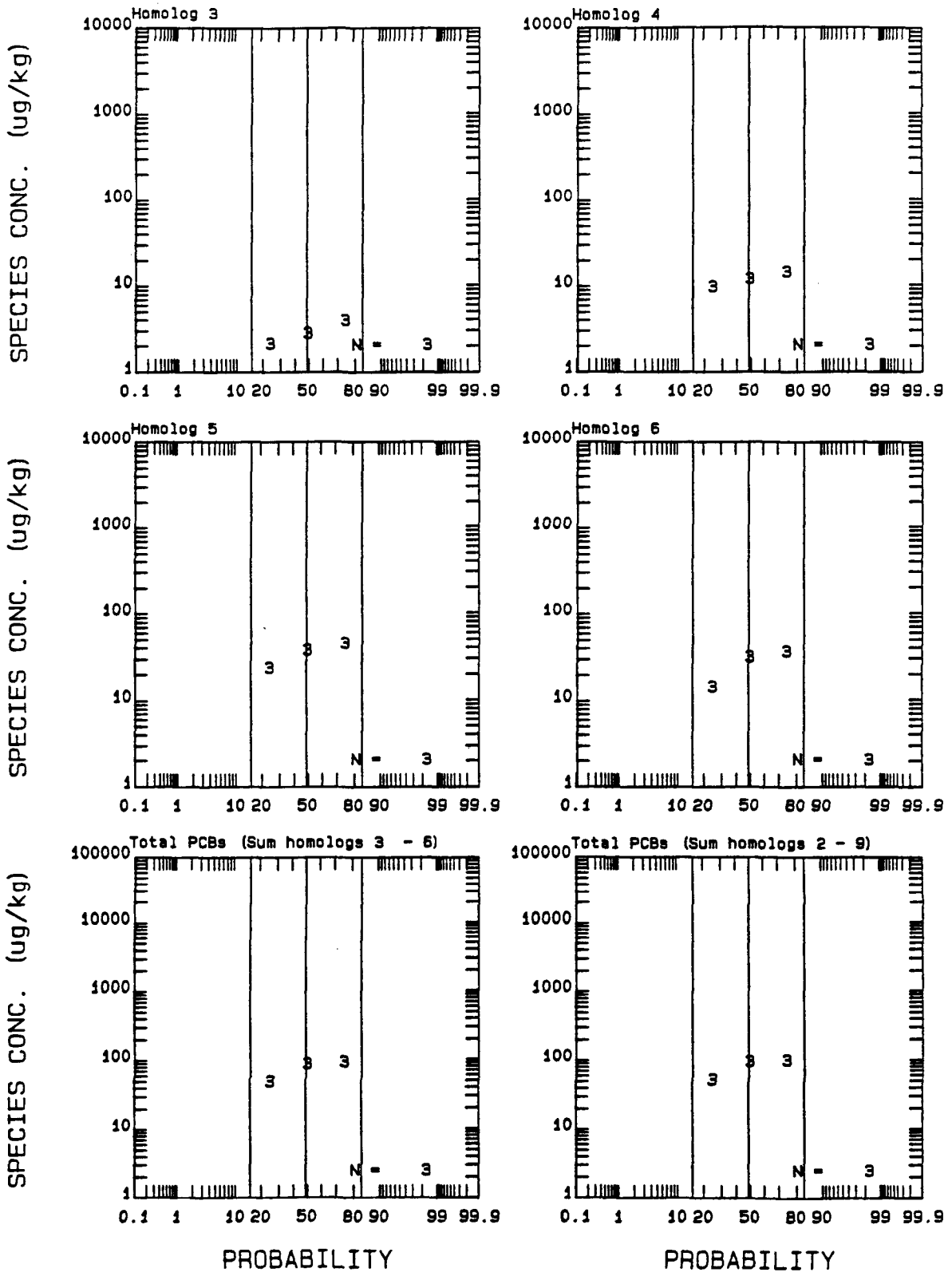
AREA 4, GREEN CRAB, SMALL



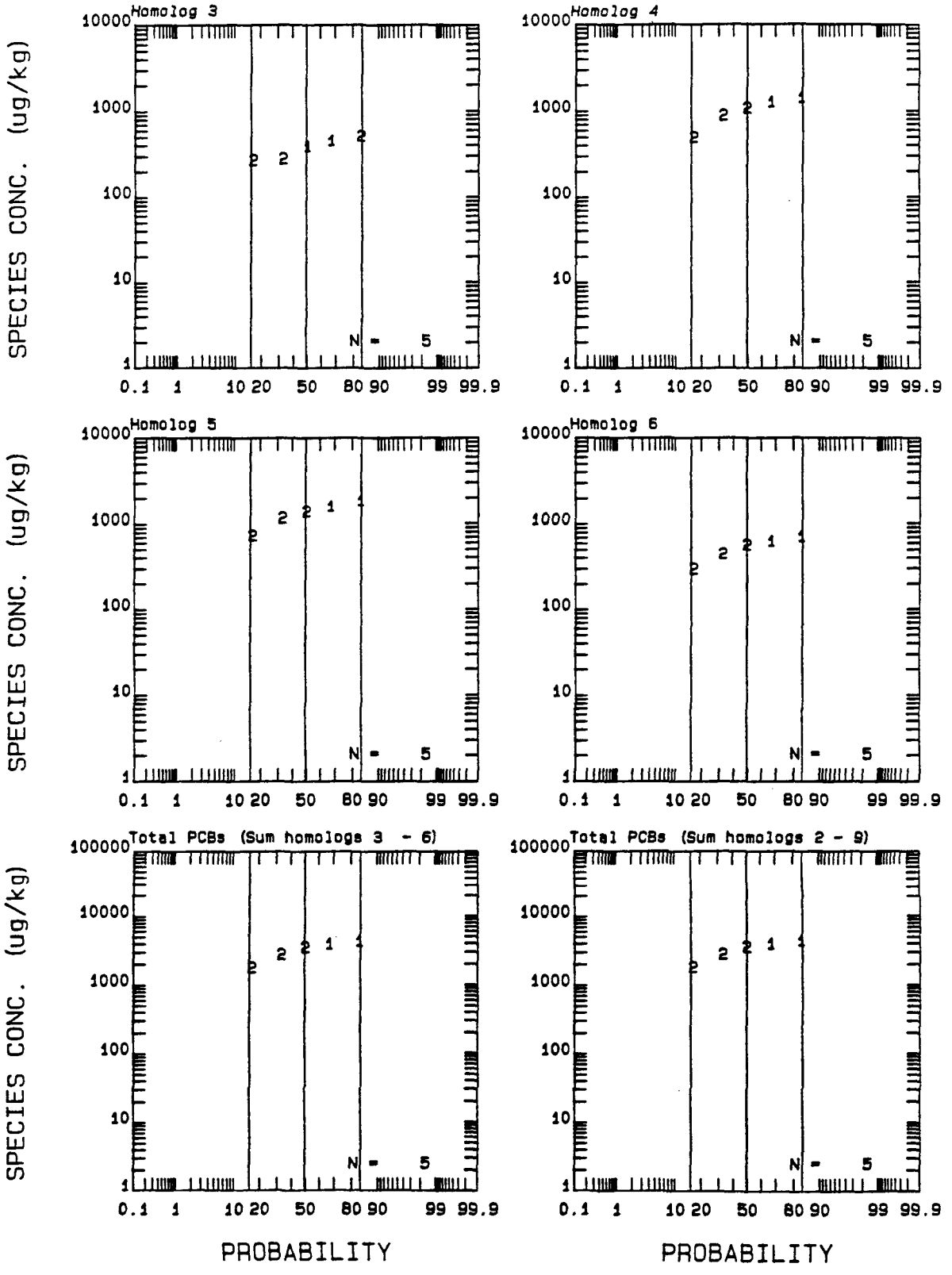
AREA 4, GREEN CRAB, MEDIUM



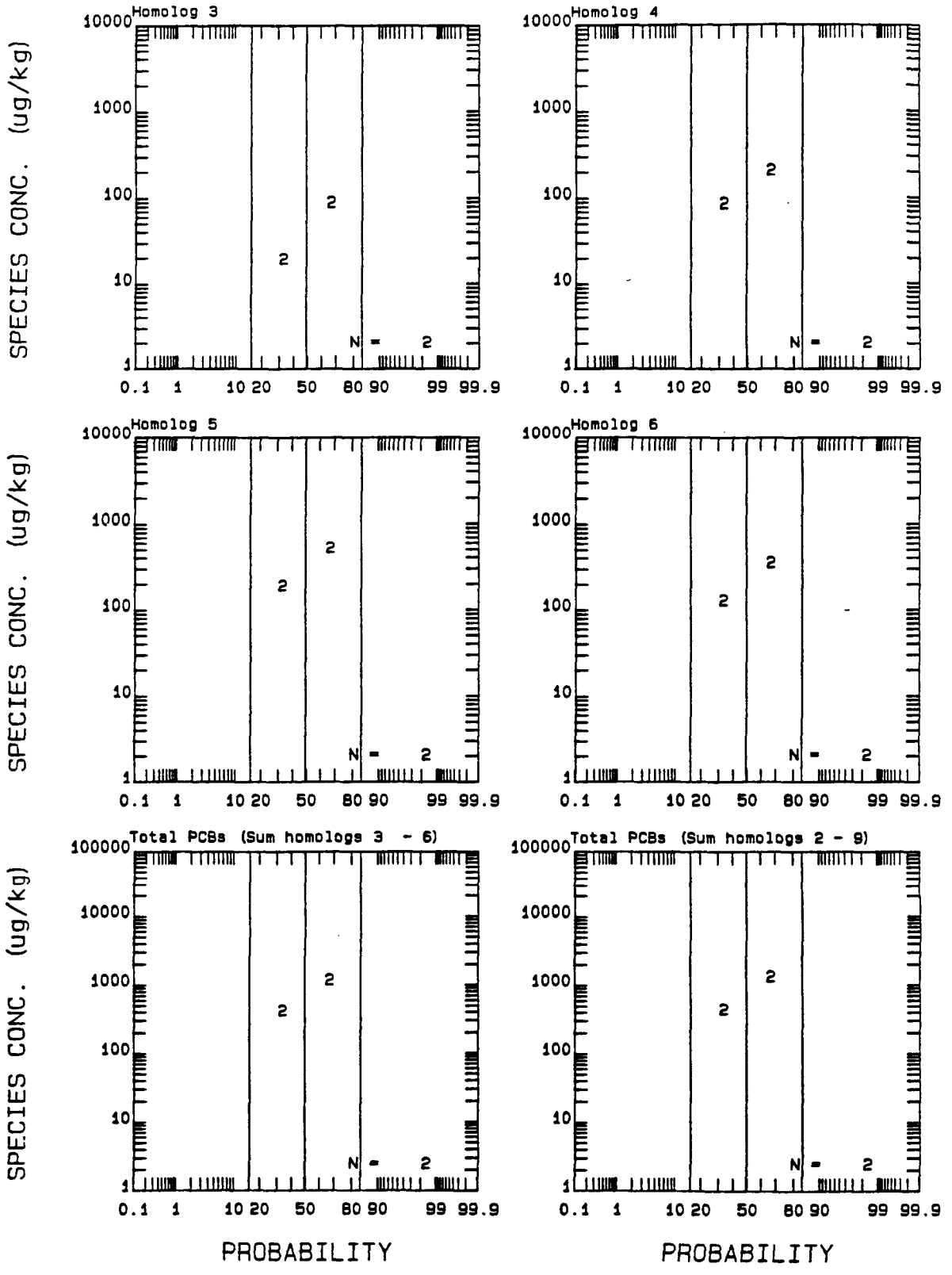
AREA 4, GREEN CRAB, LARGE



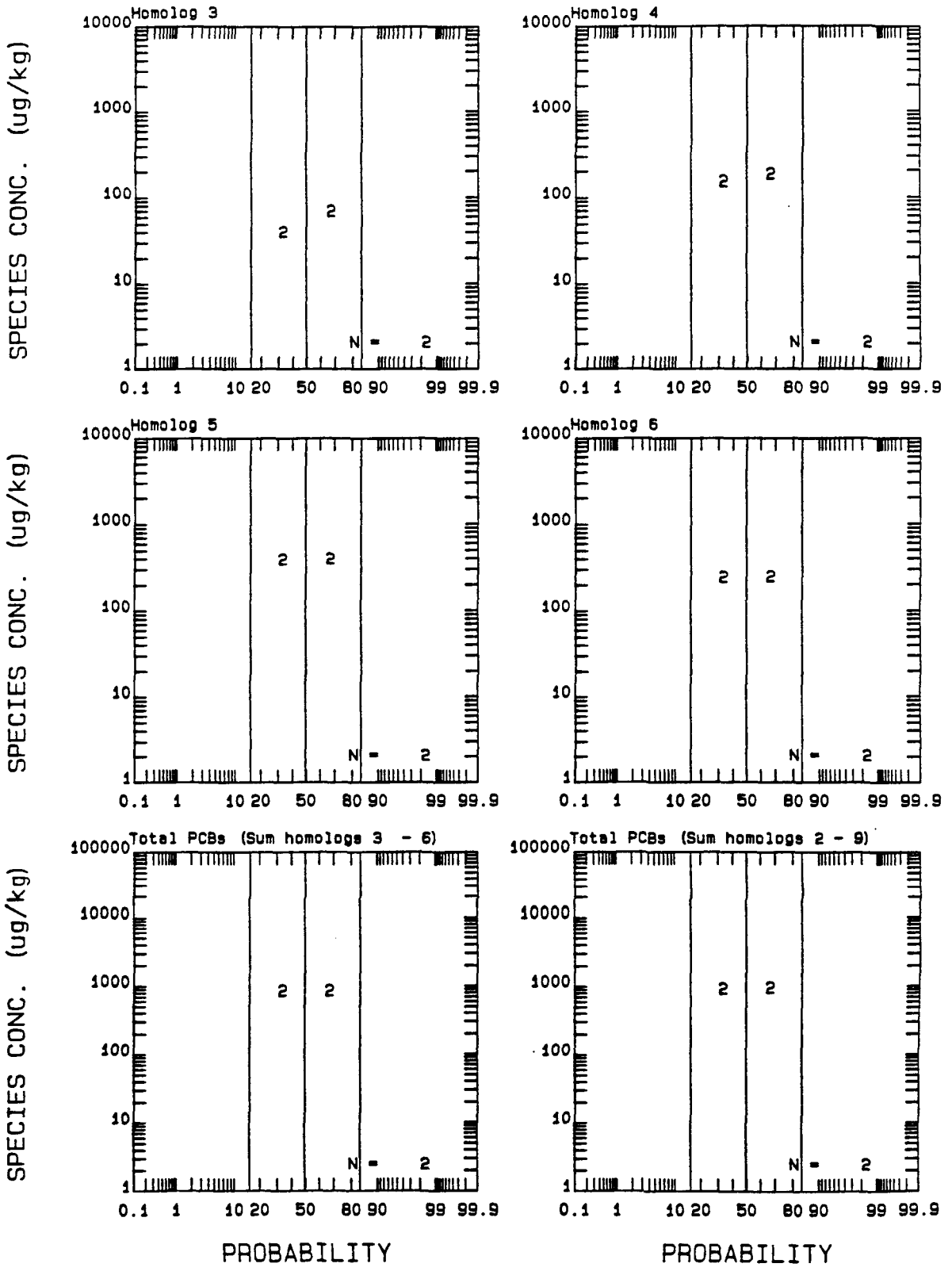
AREA 1, SPIDER CRAB, LARGE



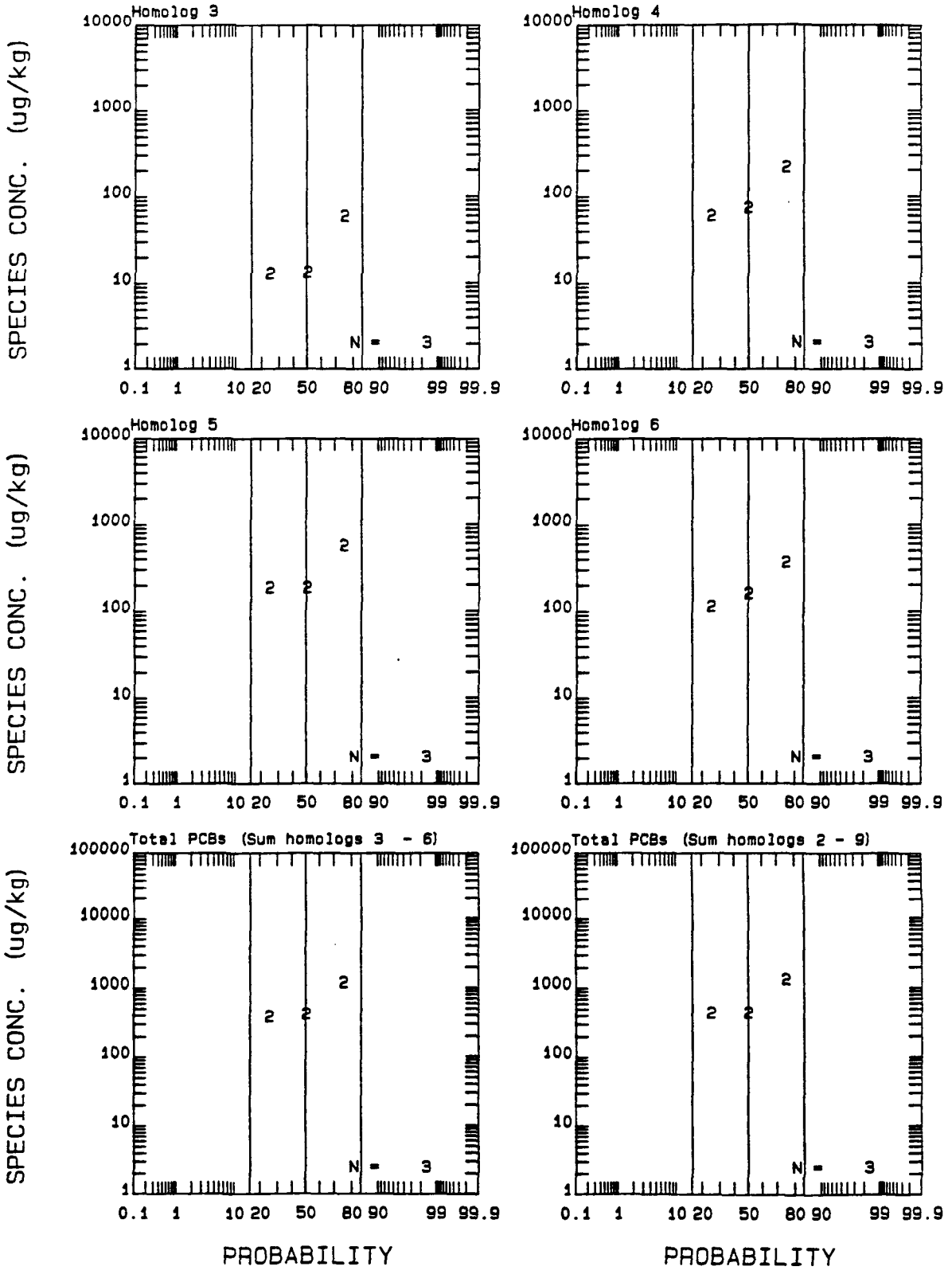
AREA 2, SPIDER CRAB, SMALL



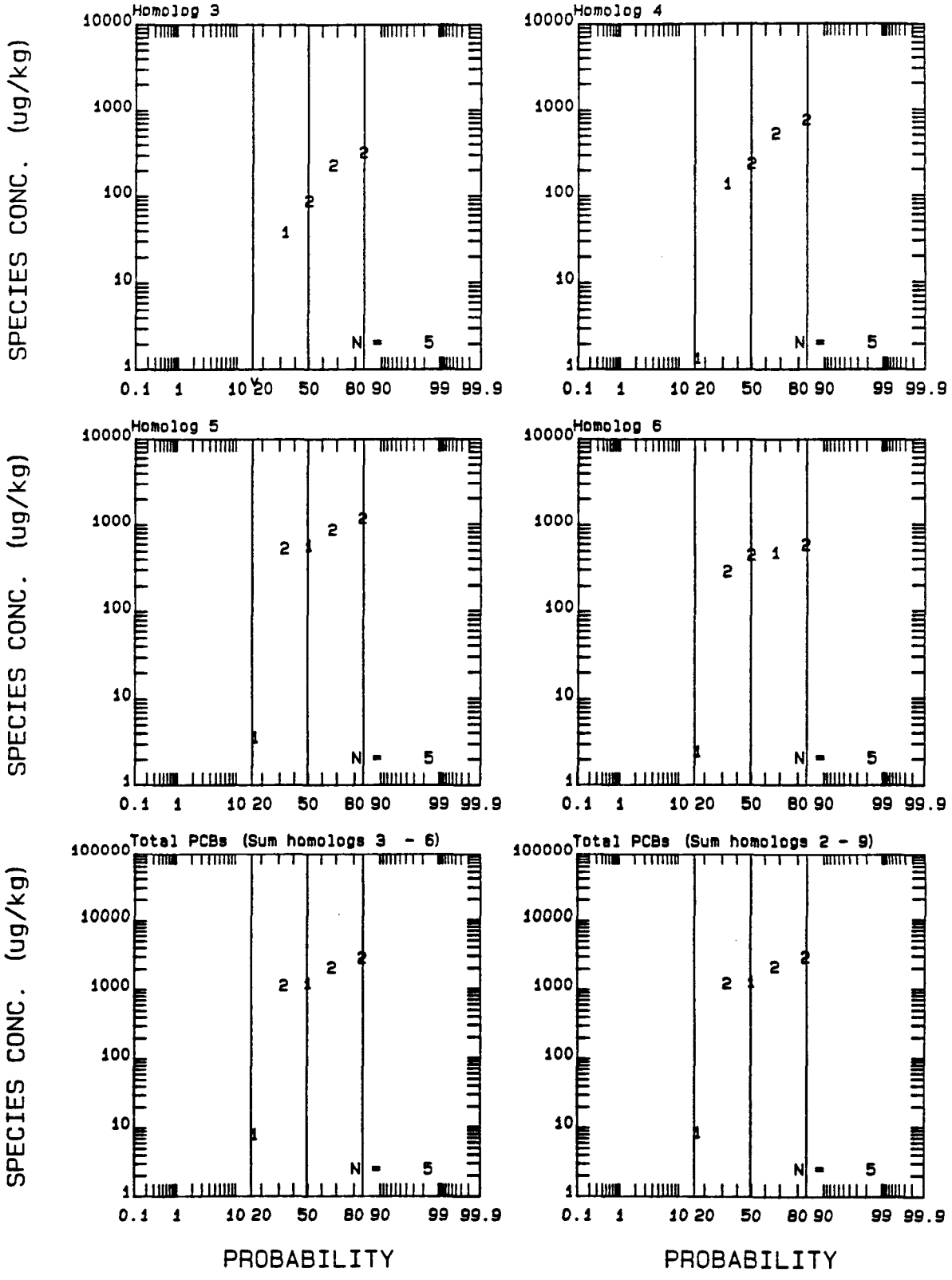
AREA 2, SPIDER CRAB, LARGE



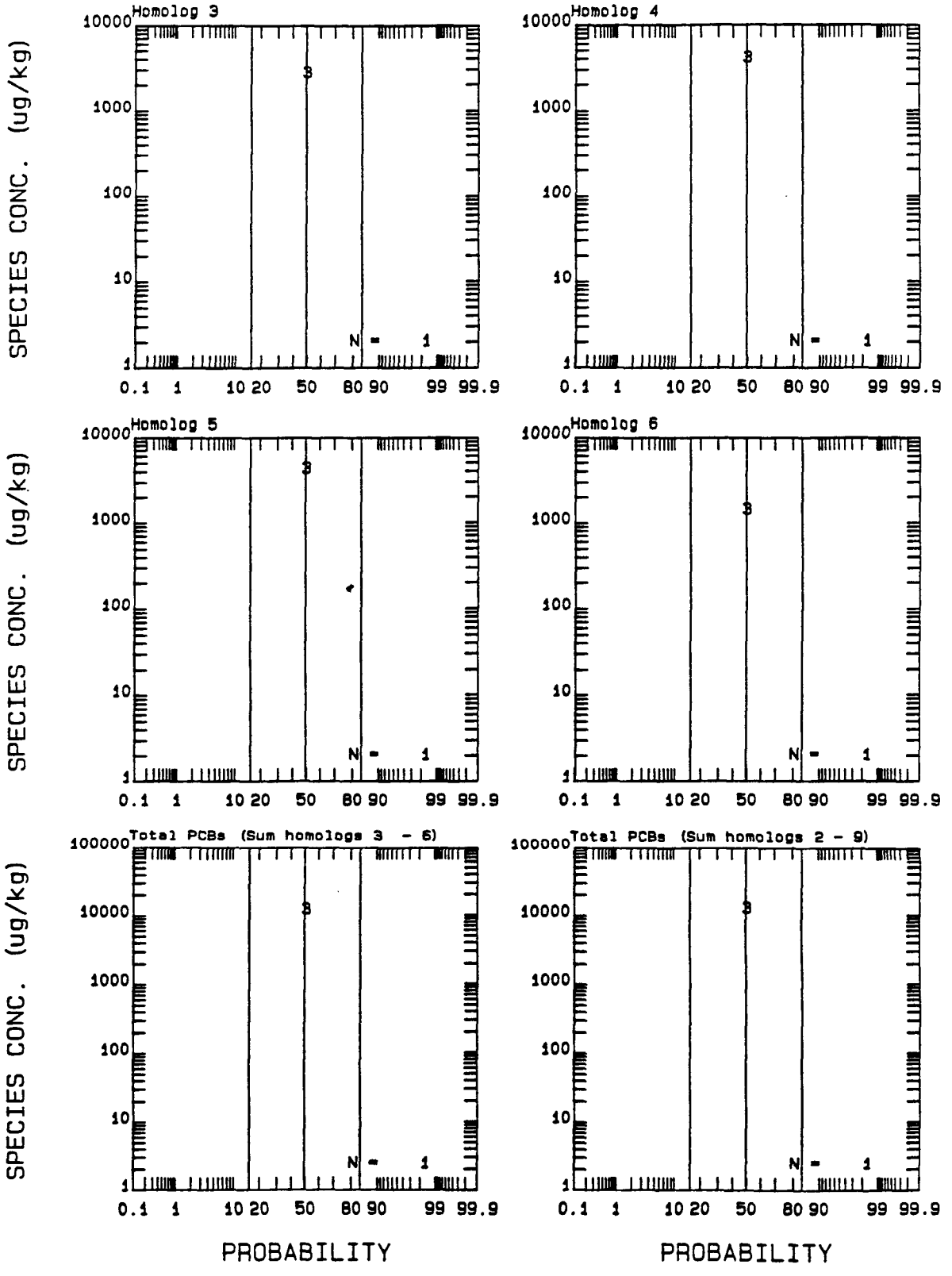
AREA 3, SPIDER CRAB, SMALL



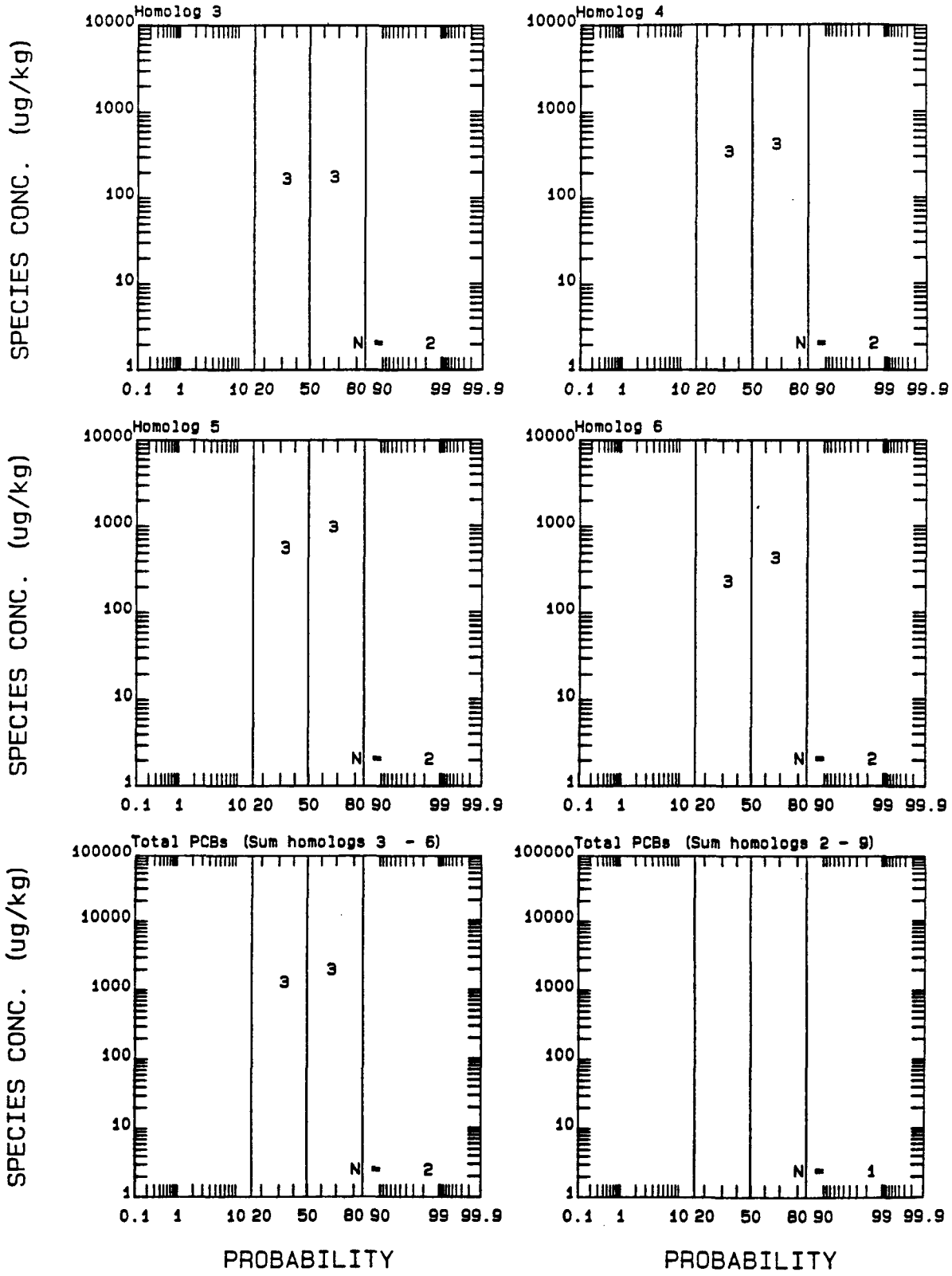
AREA 3, SPIDER CRAB, LARGE



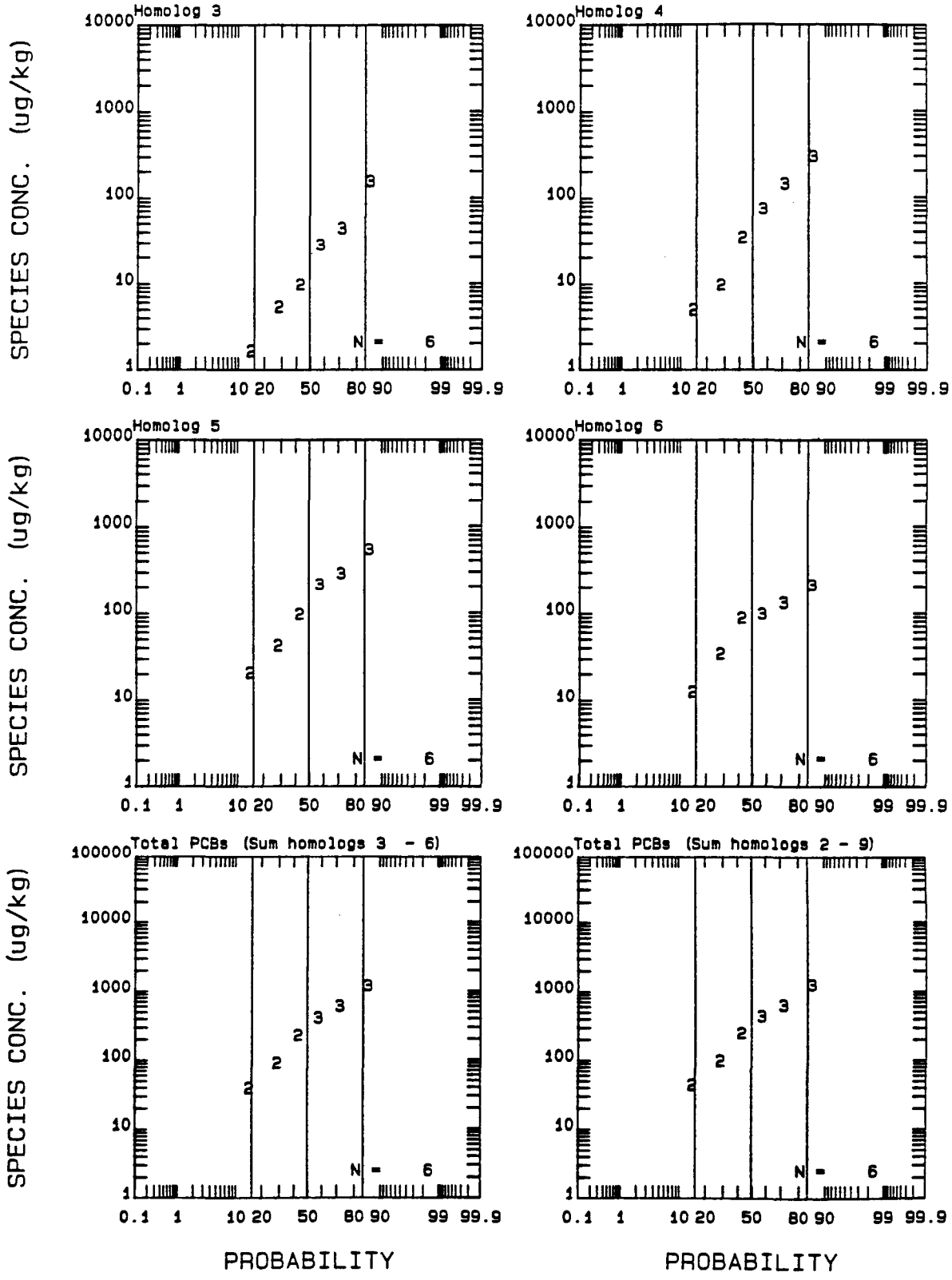
AREA 1, POLYCHAETE



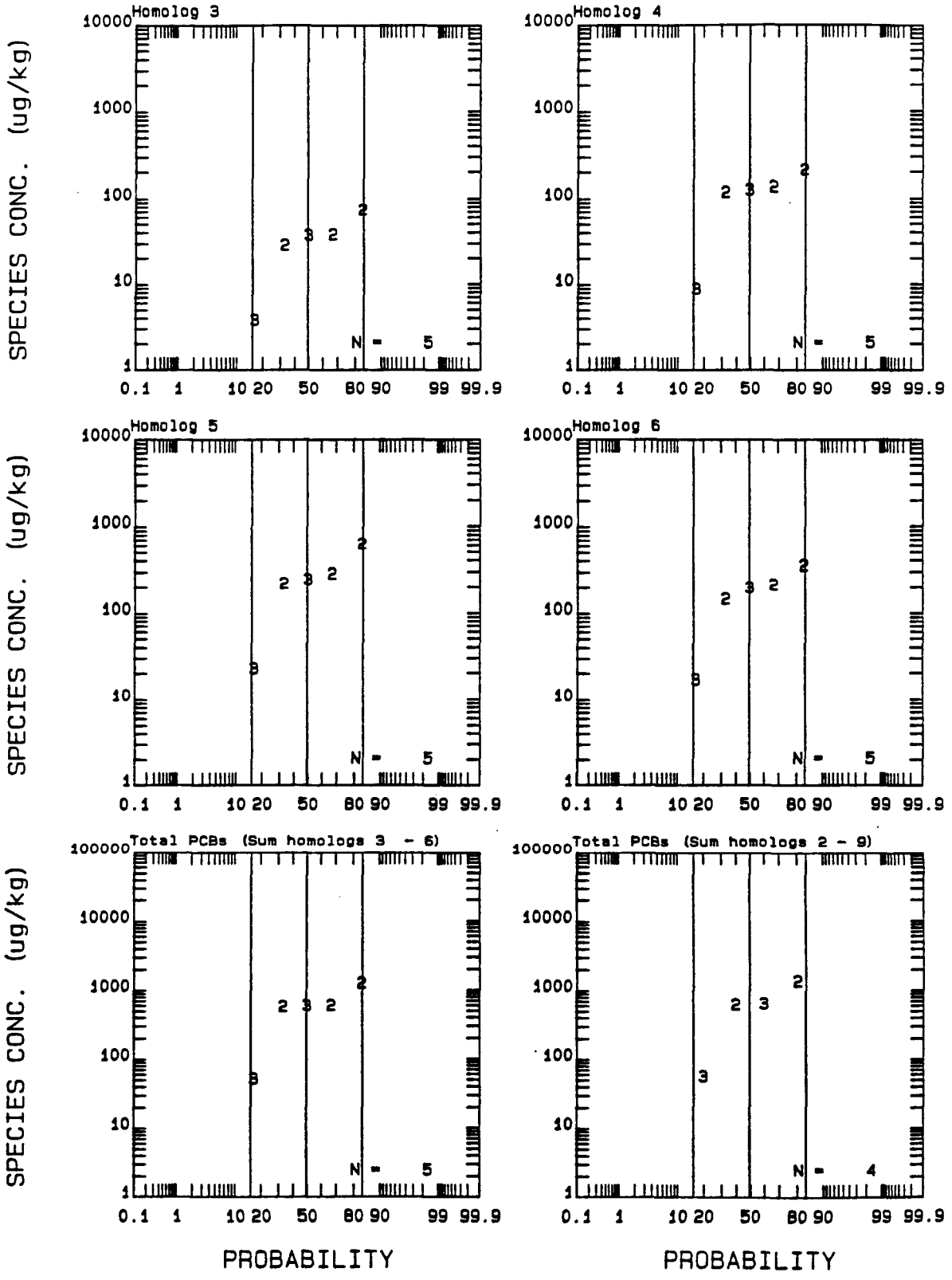
AREA 2, POLYCHAETE



AREA 3, POLYCHAETE

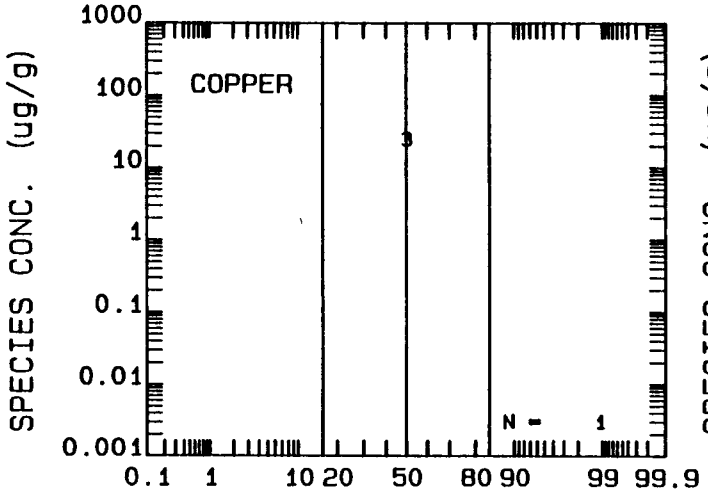


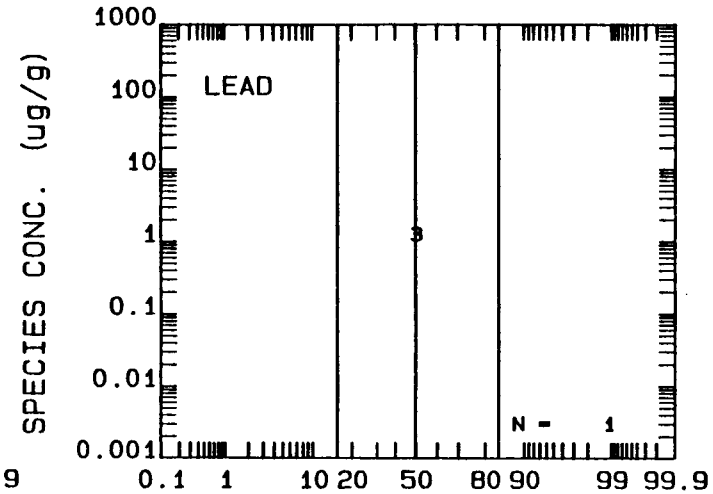
AREA 4, POLYCHAETE

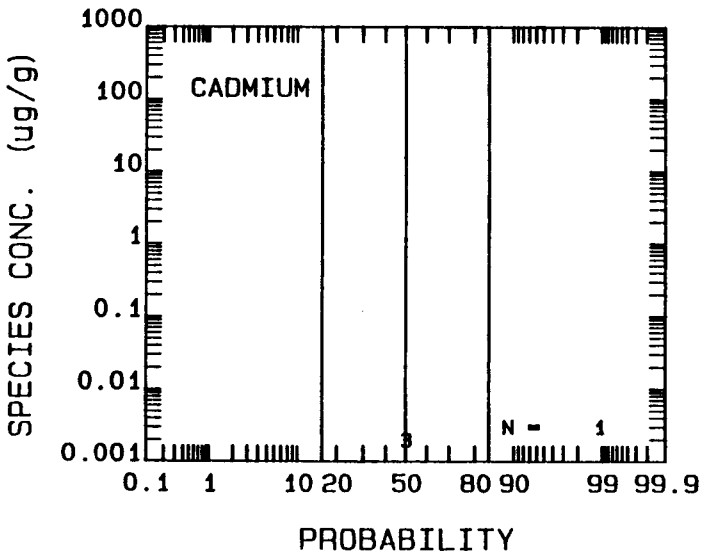


BIOTA METALS PROBABILITY DISTRIBUTIONS

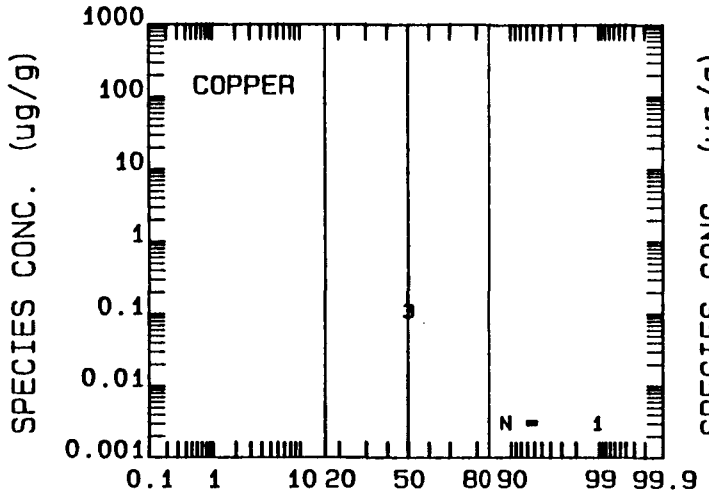
AREA 1, LOBSTER, MEDIUM

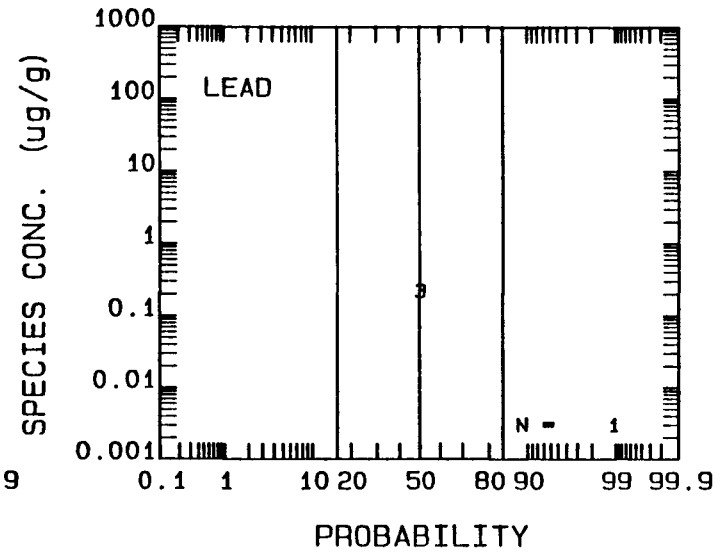


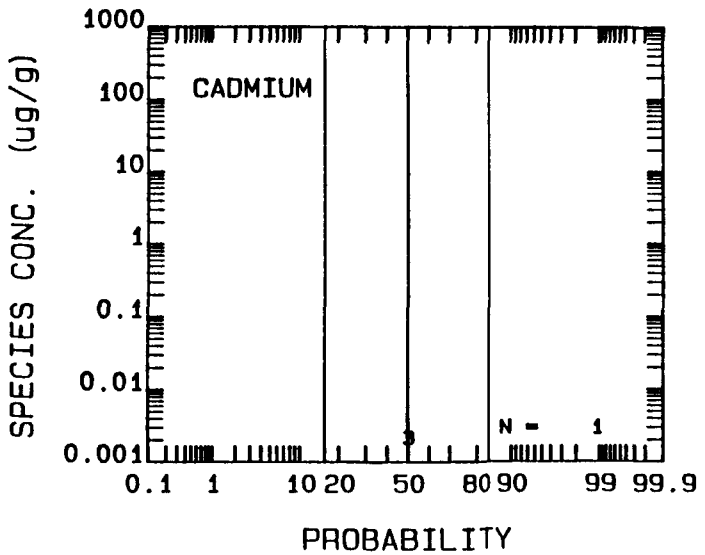




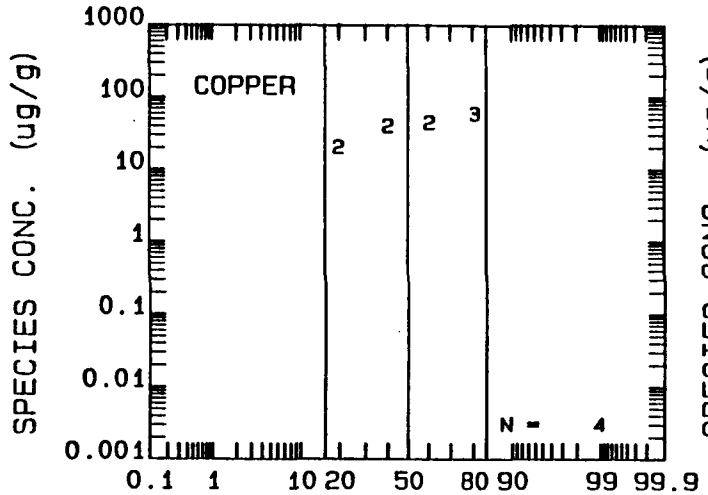
AREA 1, LOBSTER, LARGE

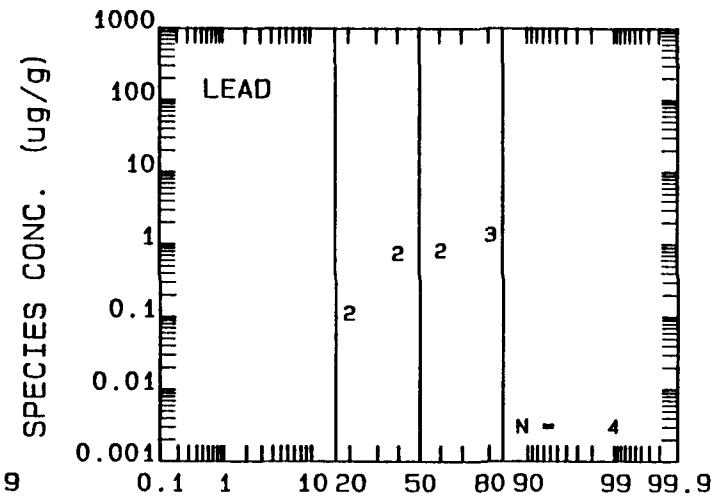


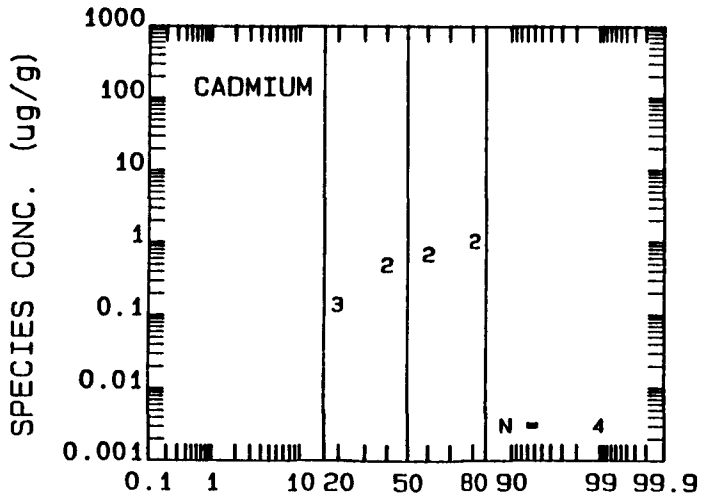




AREA 2, LOBSTER, SMALL

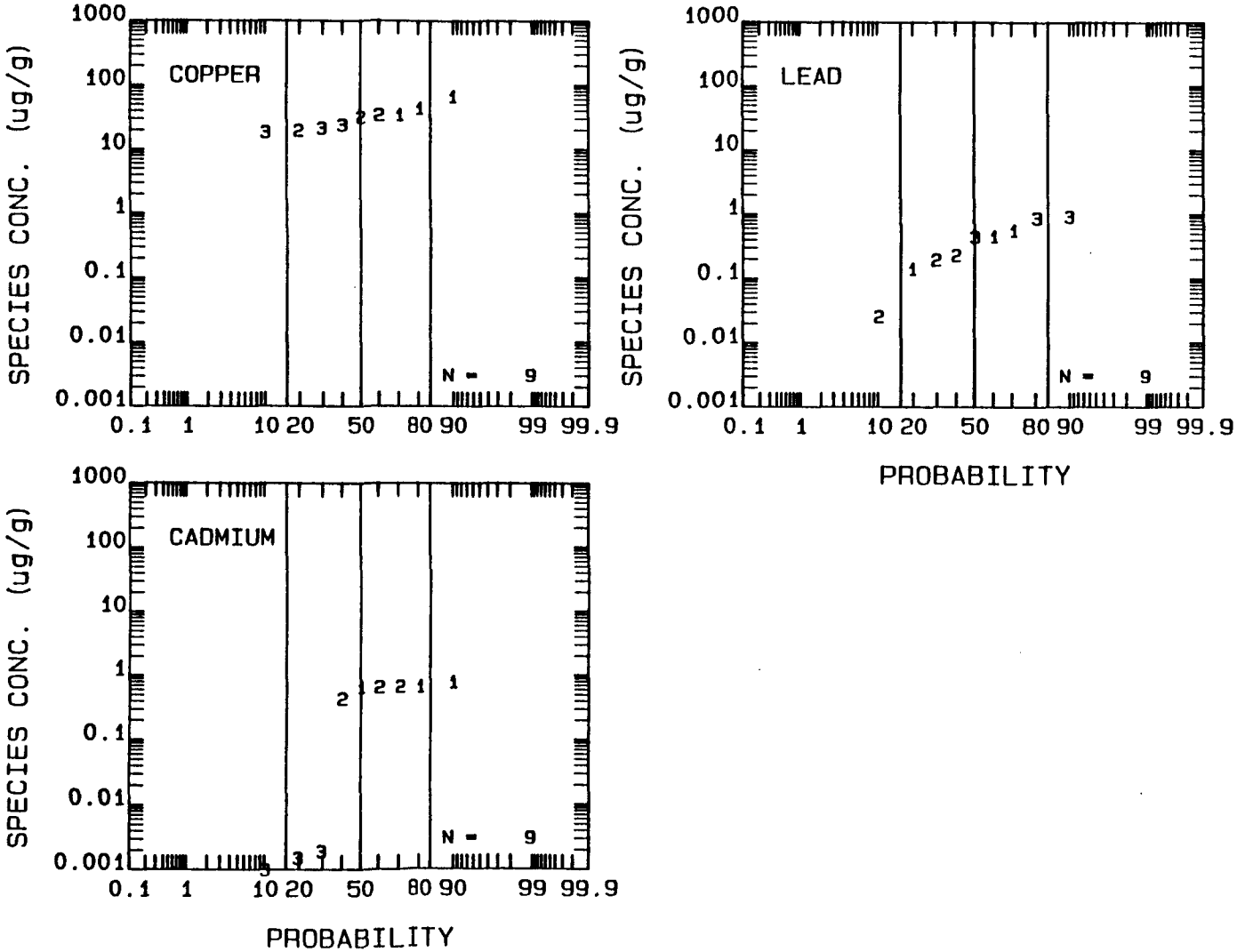




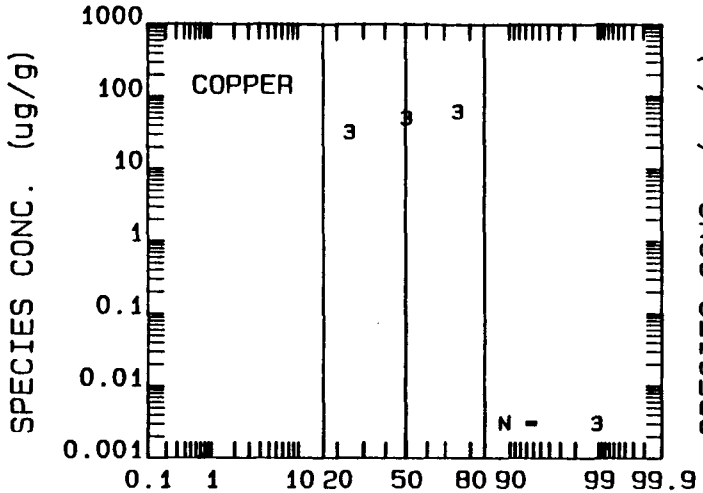


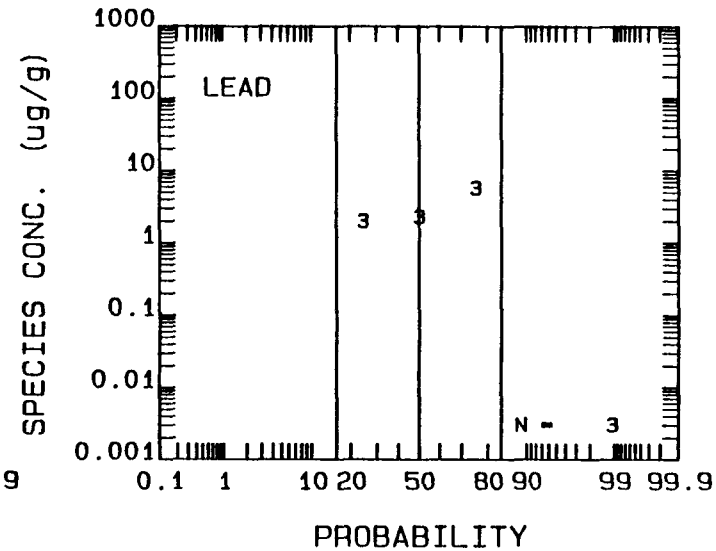
PROBABILITY

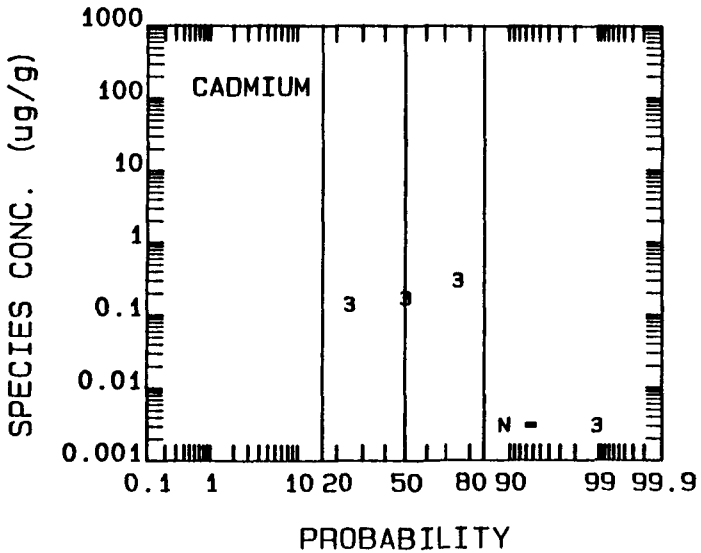
AREA 2, LOBSTER, MEDIUM



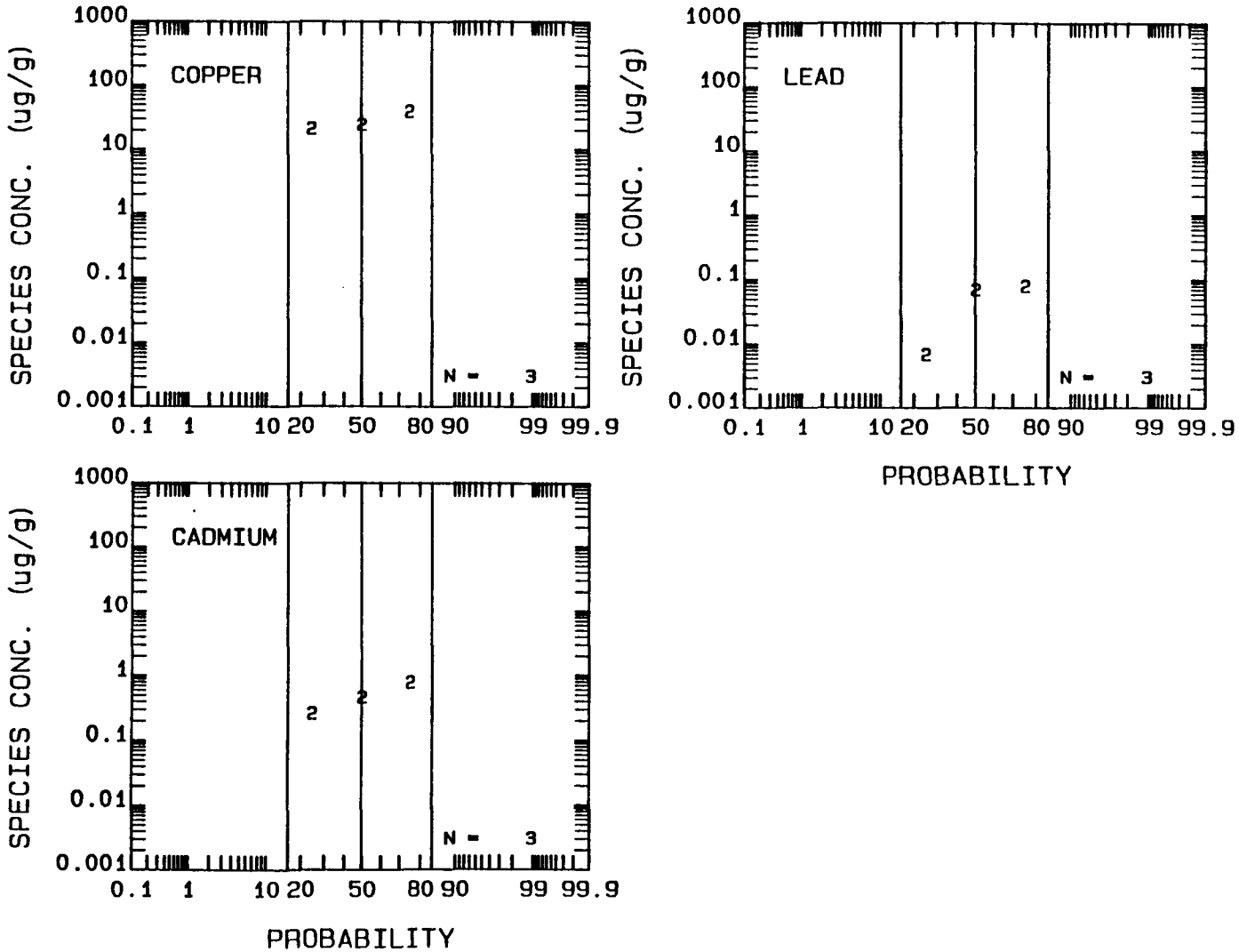
AREA 2, LOBSTER, LARGE



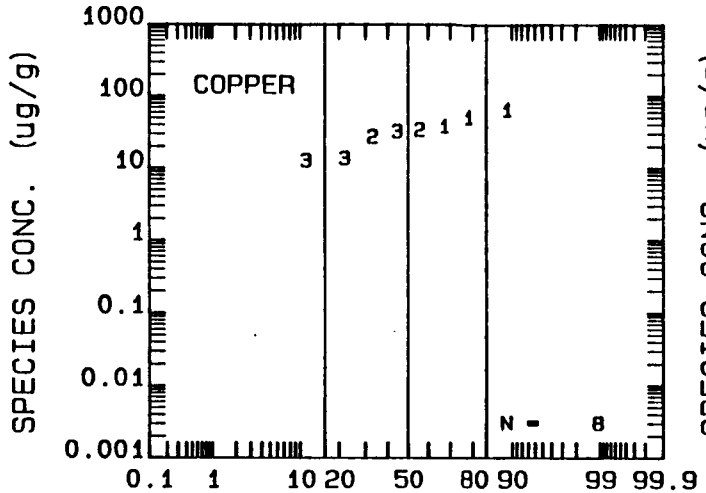


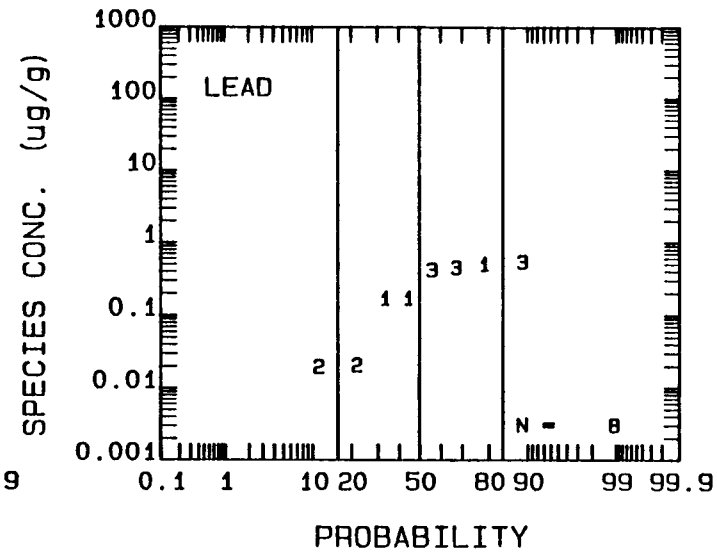


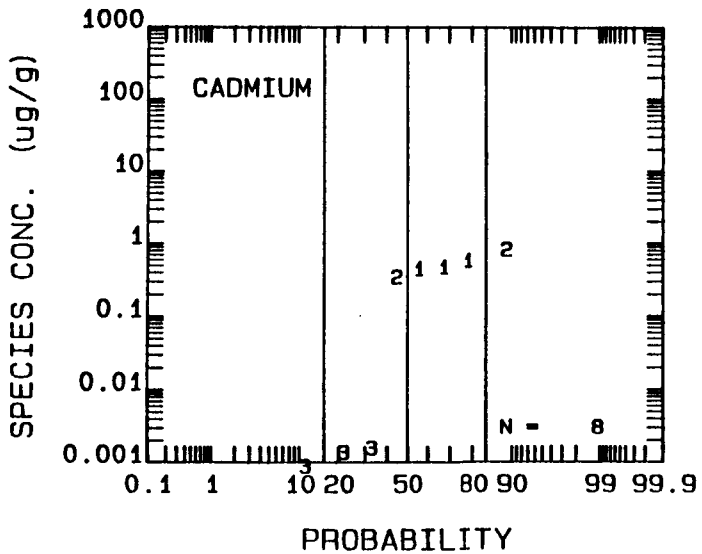
AREA 3, LOBSTER, SMALL



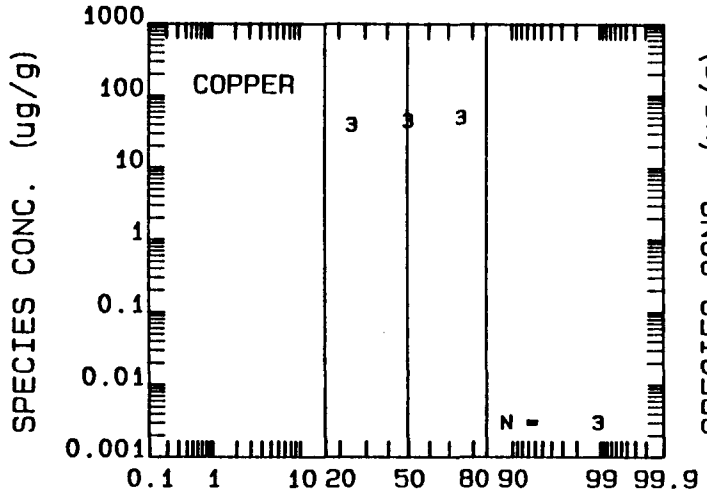
AREA 3, LOBSTER, MEDIUM

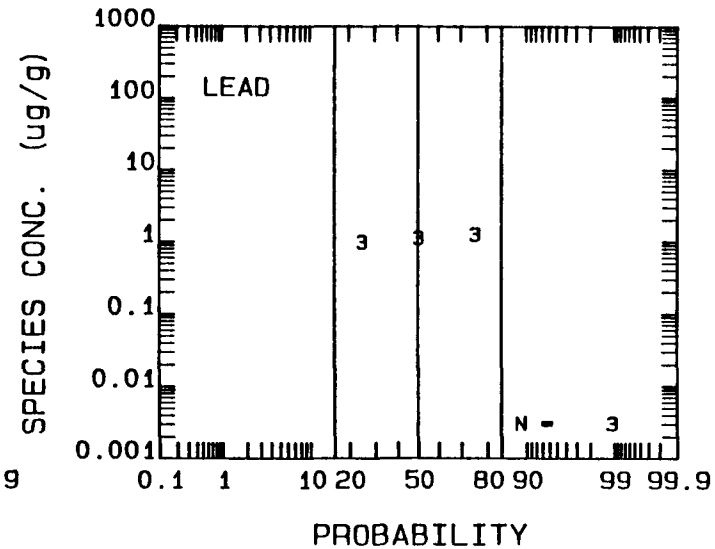


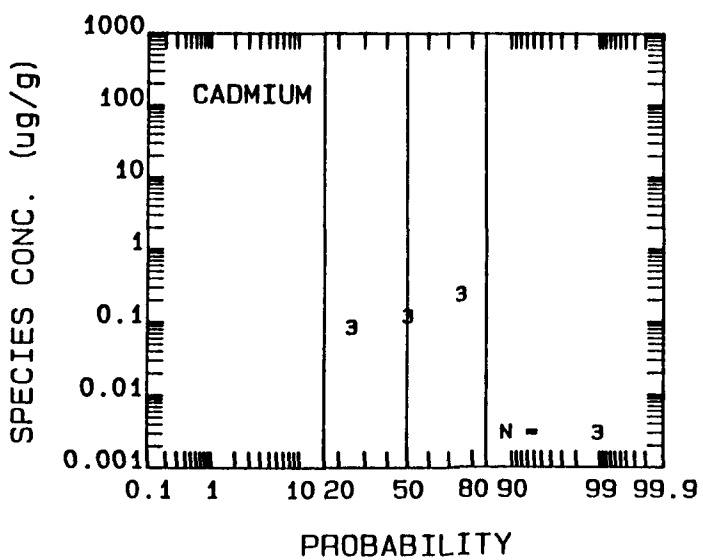




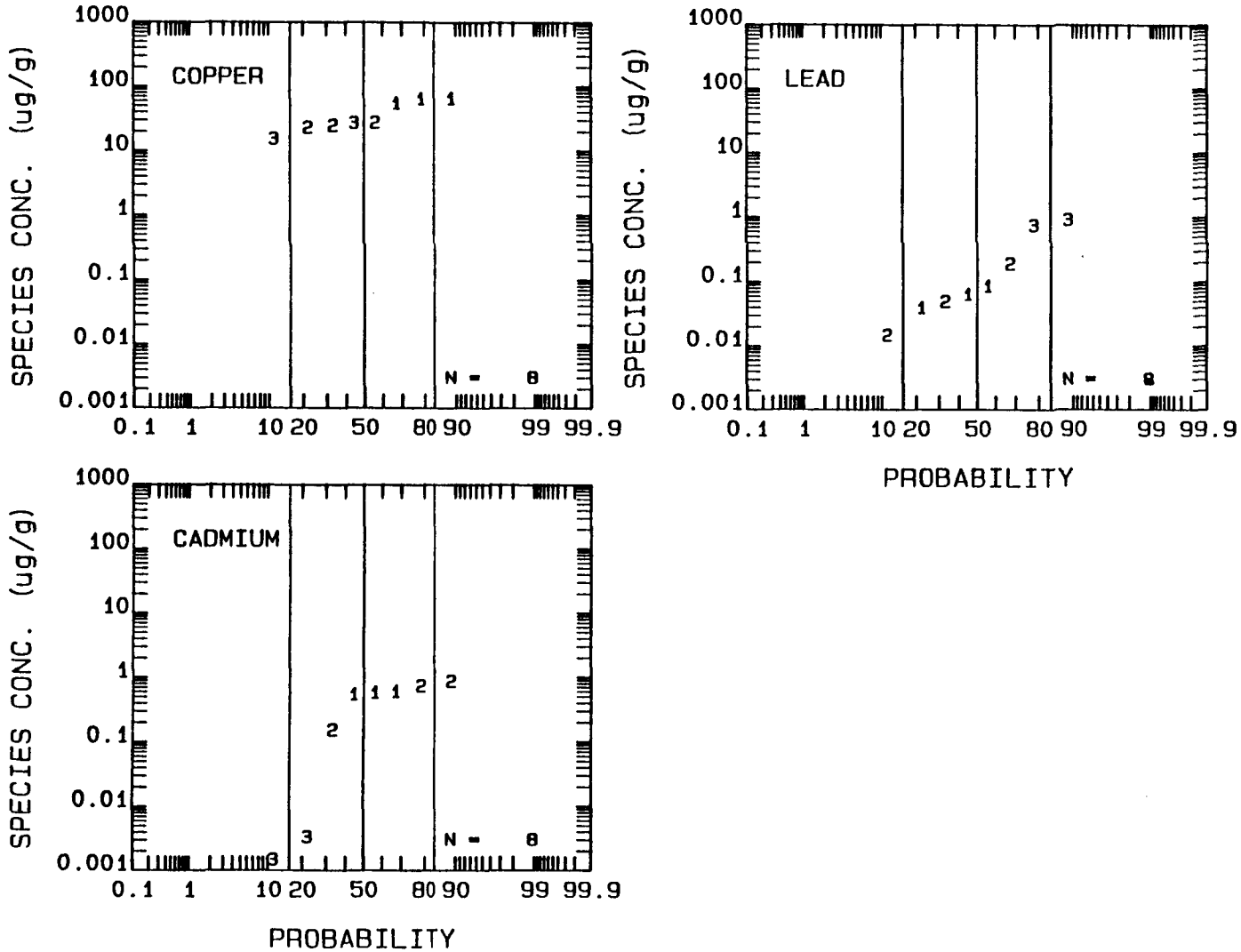
AREA 3, LOBSTER, LARGE



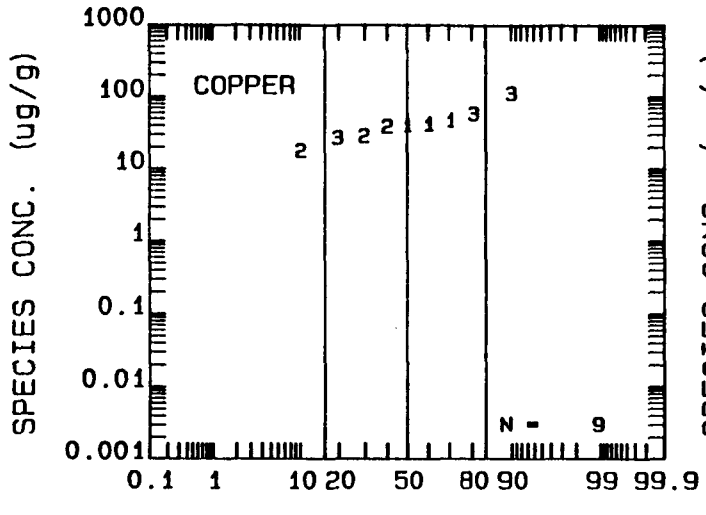


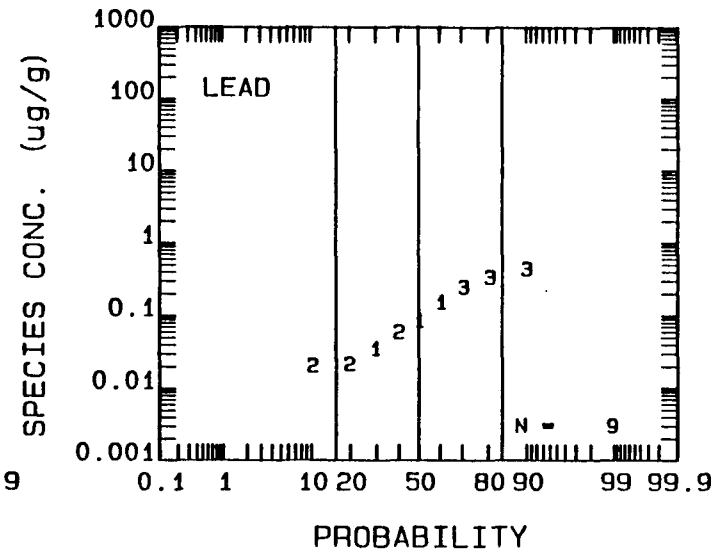


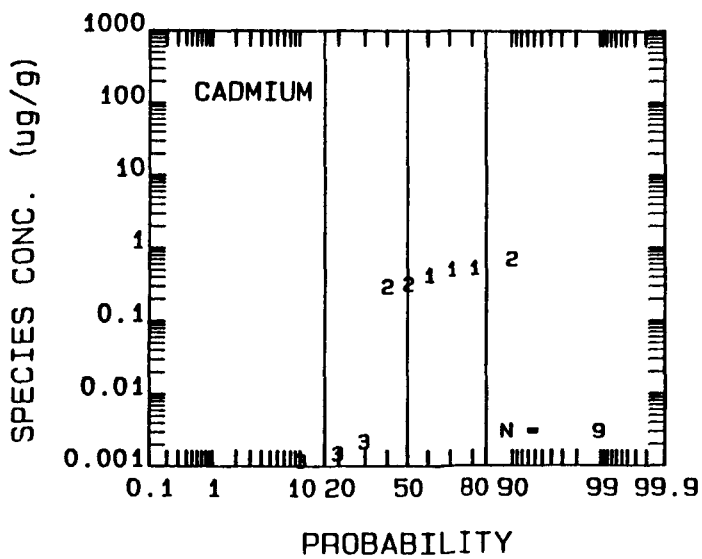
AREA 4, LOBSTER, SMALL



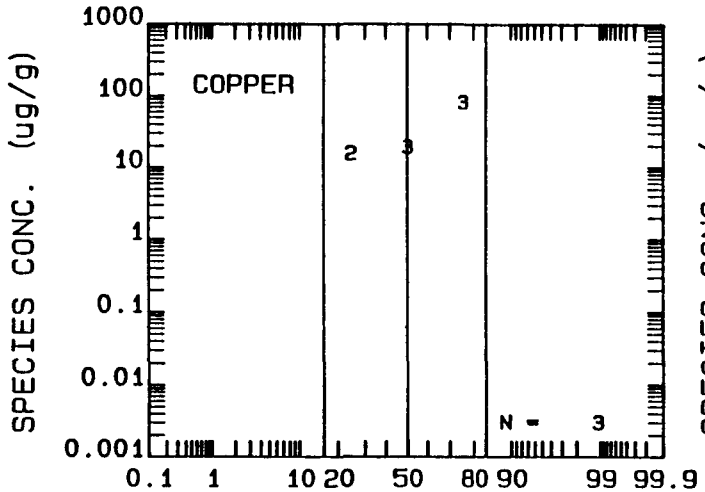
AREA 4, LOBSTER, MEDIUM

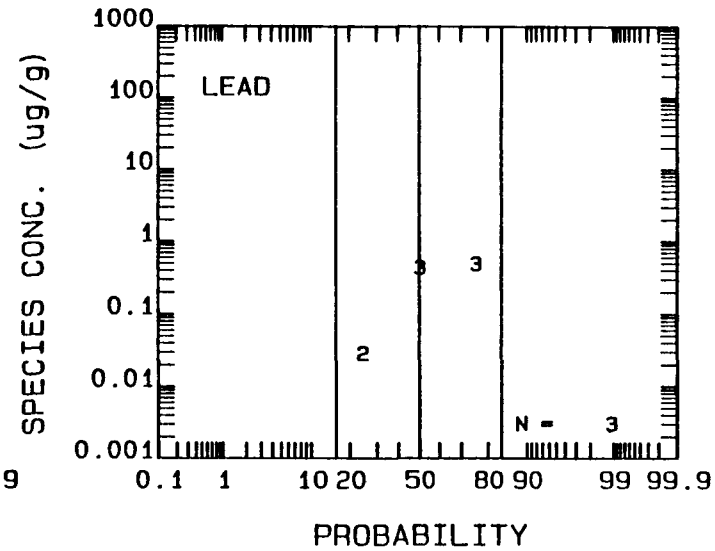


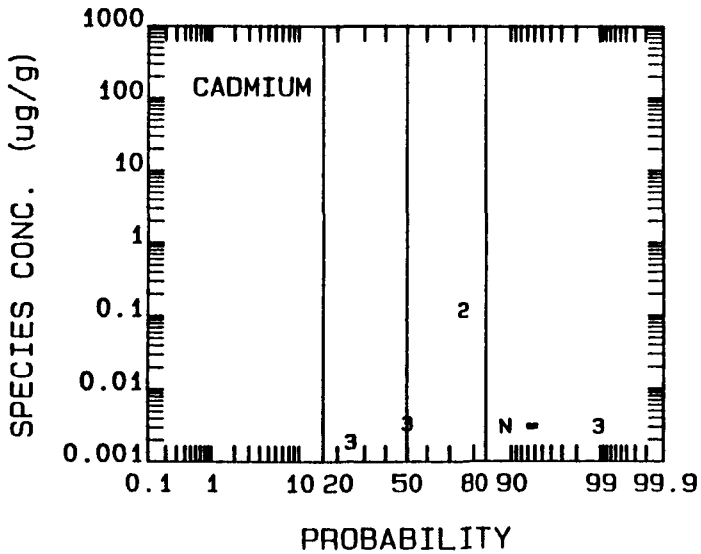




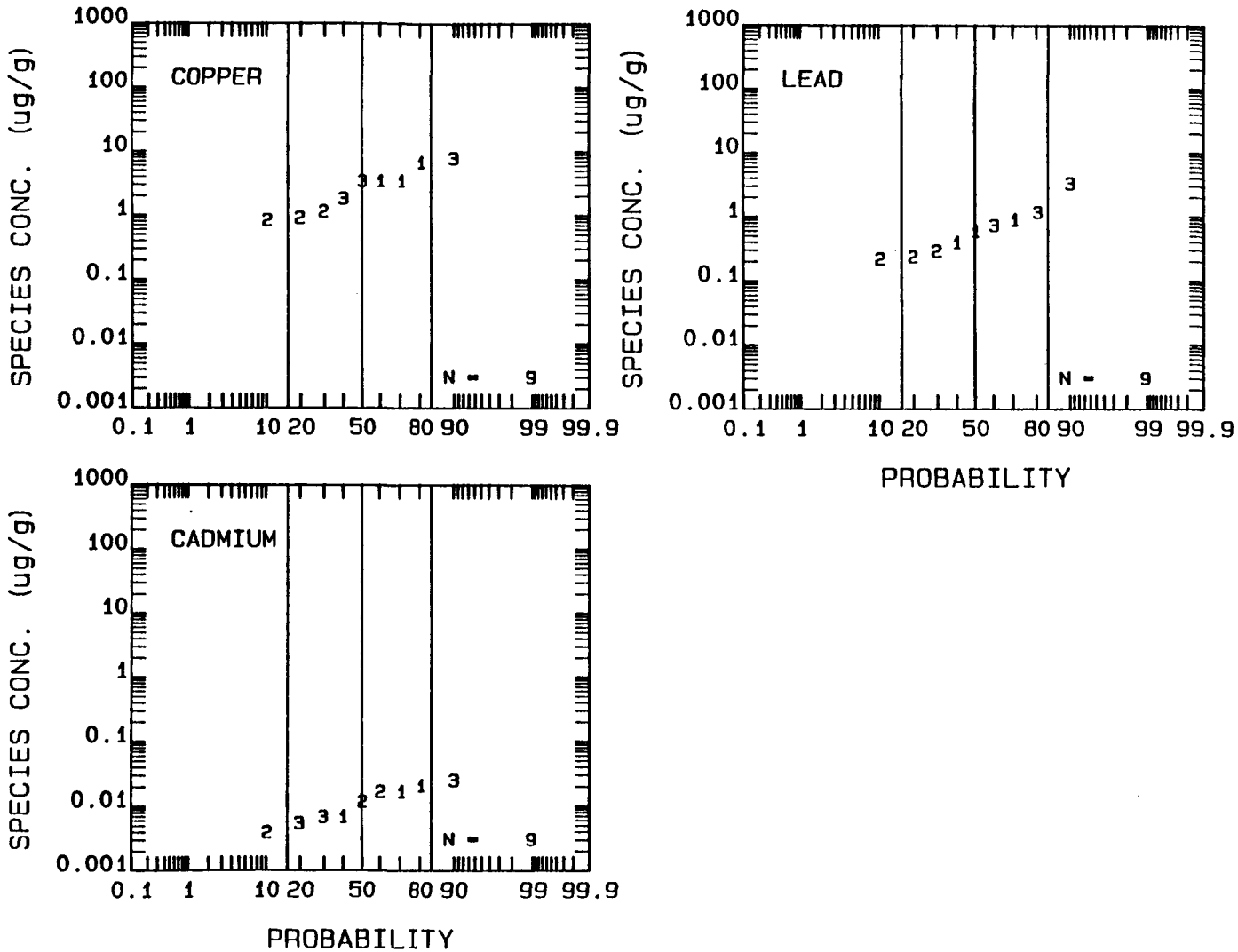
AREA 4, LOBSTER, LARGE



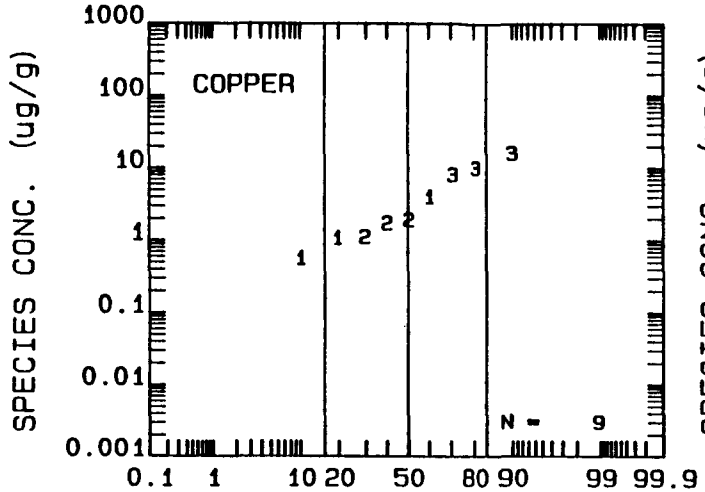


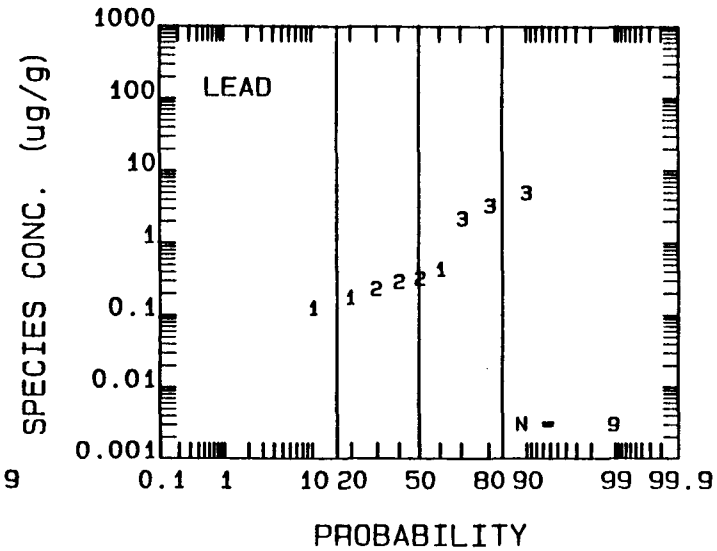


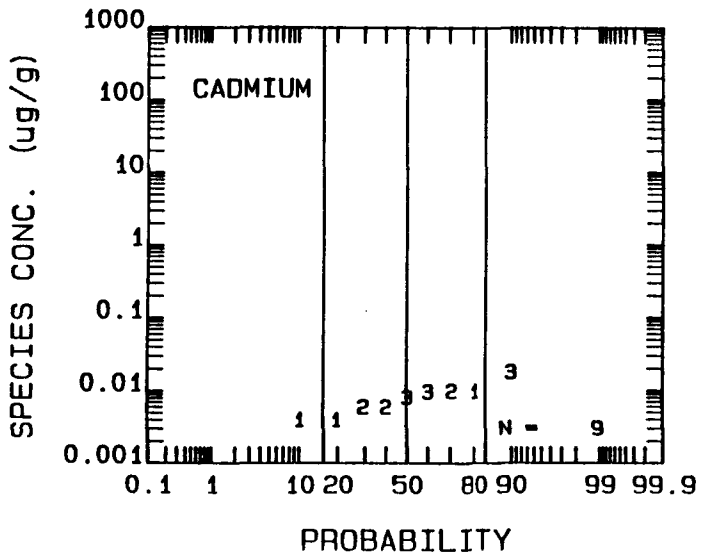
AREA 1, FLOUNDER, SMALL



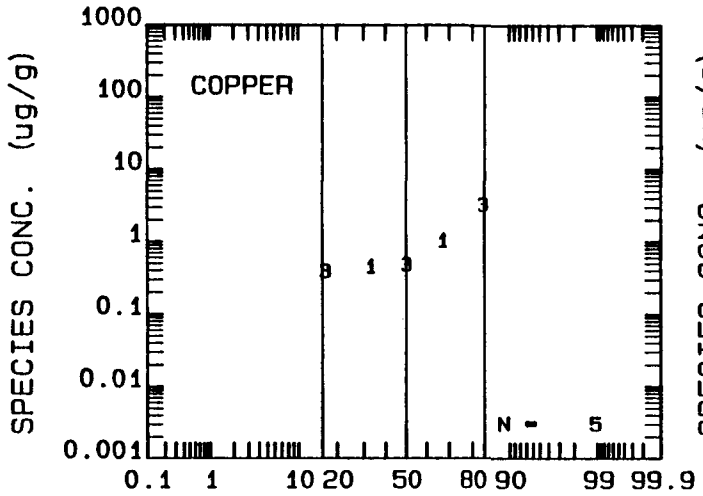
AREA 1, FLOUNDER, MEDIUM

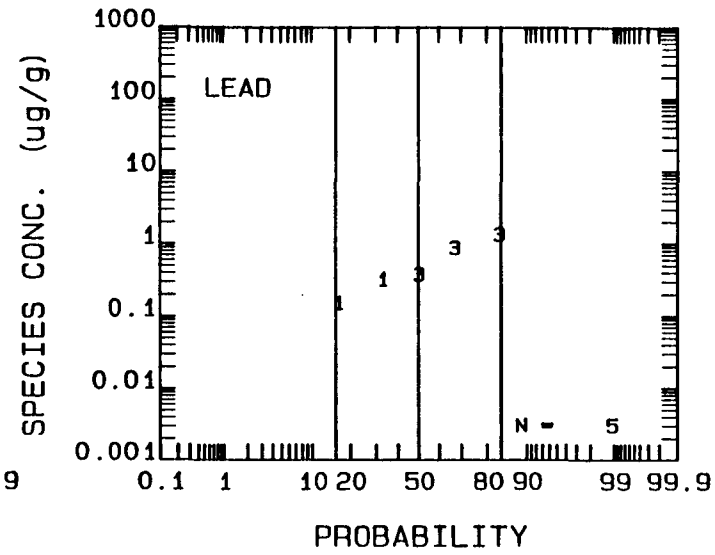


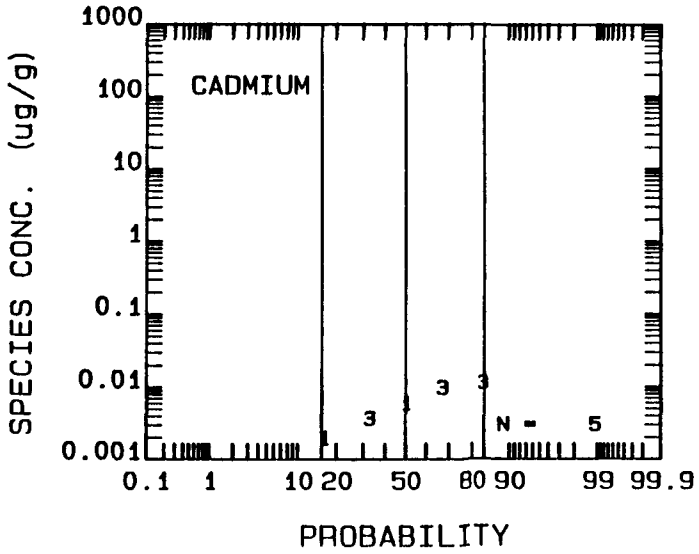




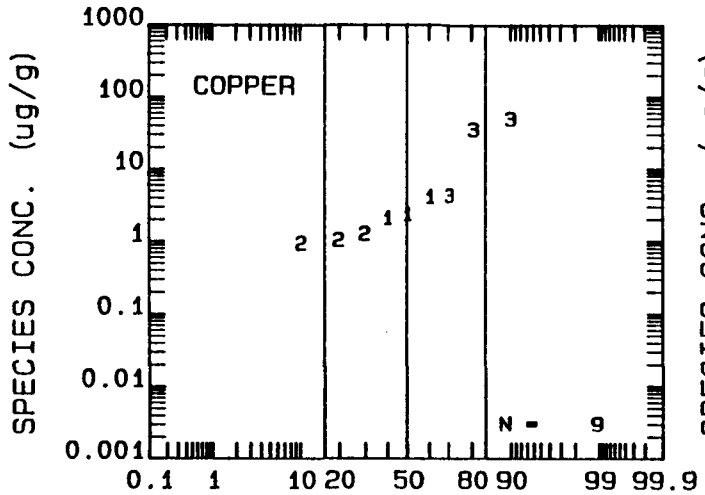
AREA 1, FLOUNDER, LARGE

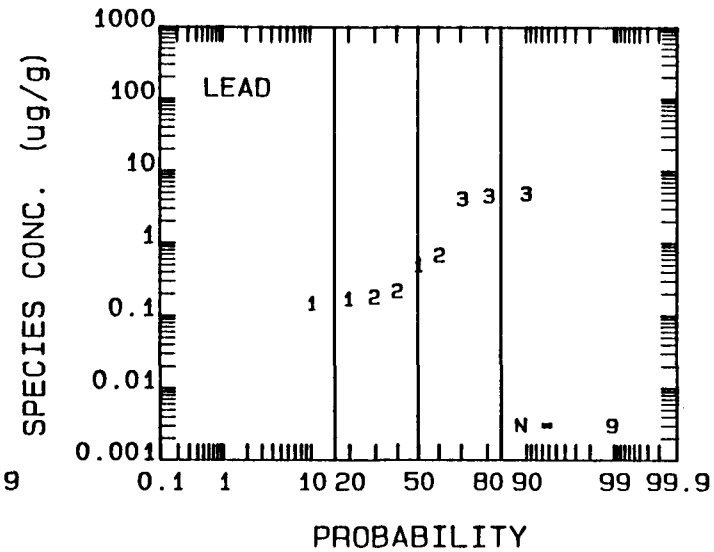


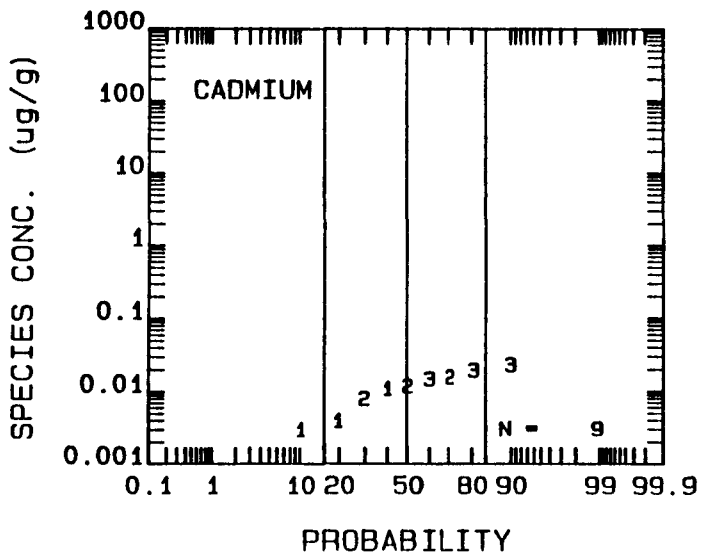




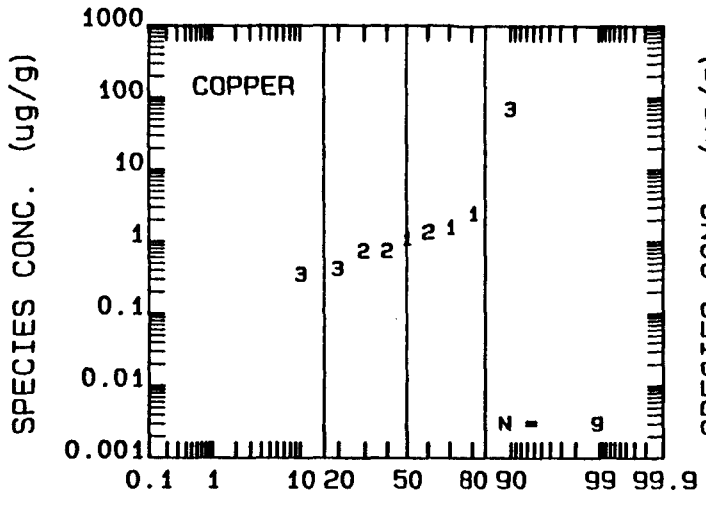
AREA 2, FLOUNDER, SMALL

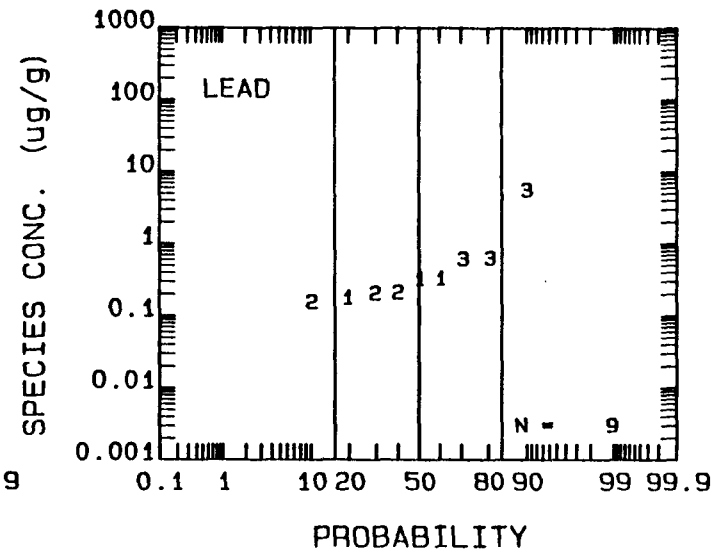


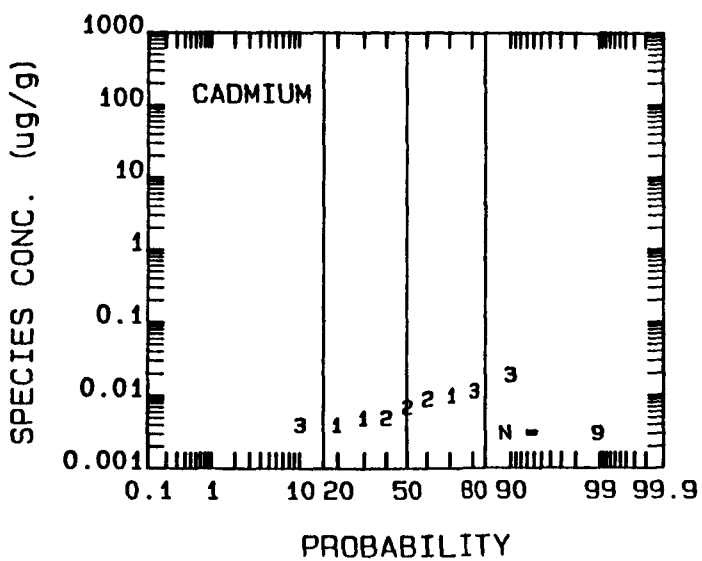




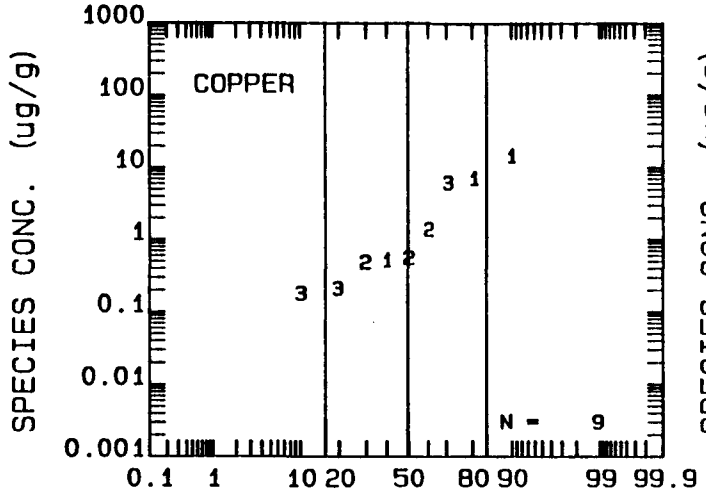
AREA 2, FLOUNDER, MEDIUM

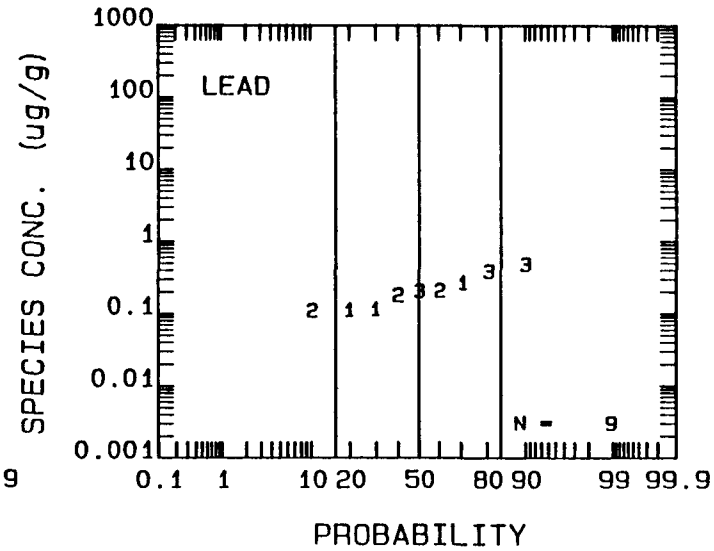


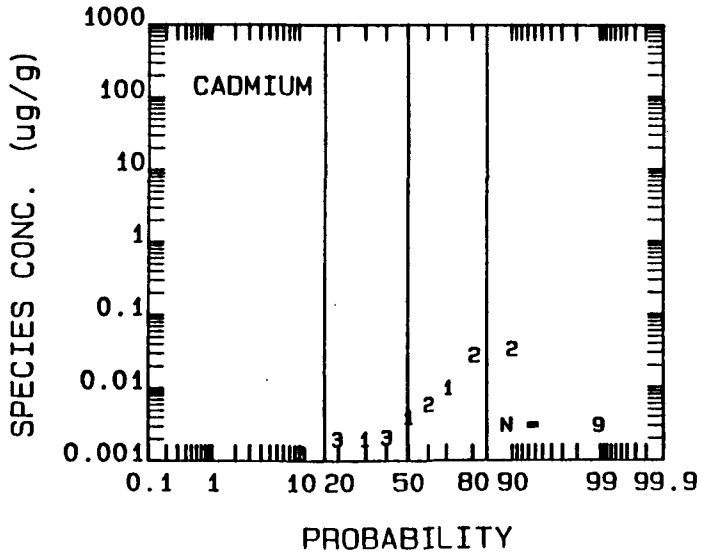




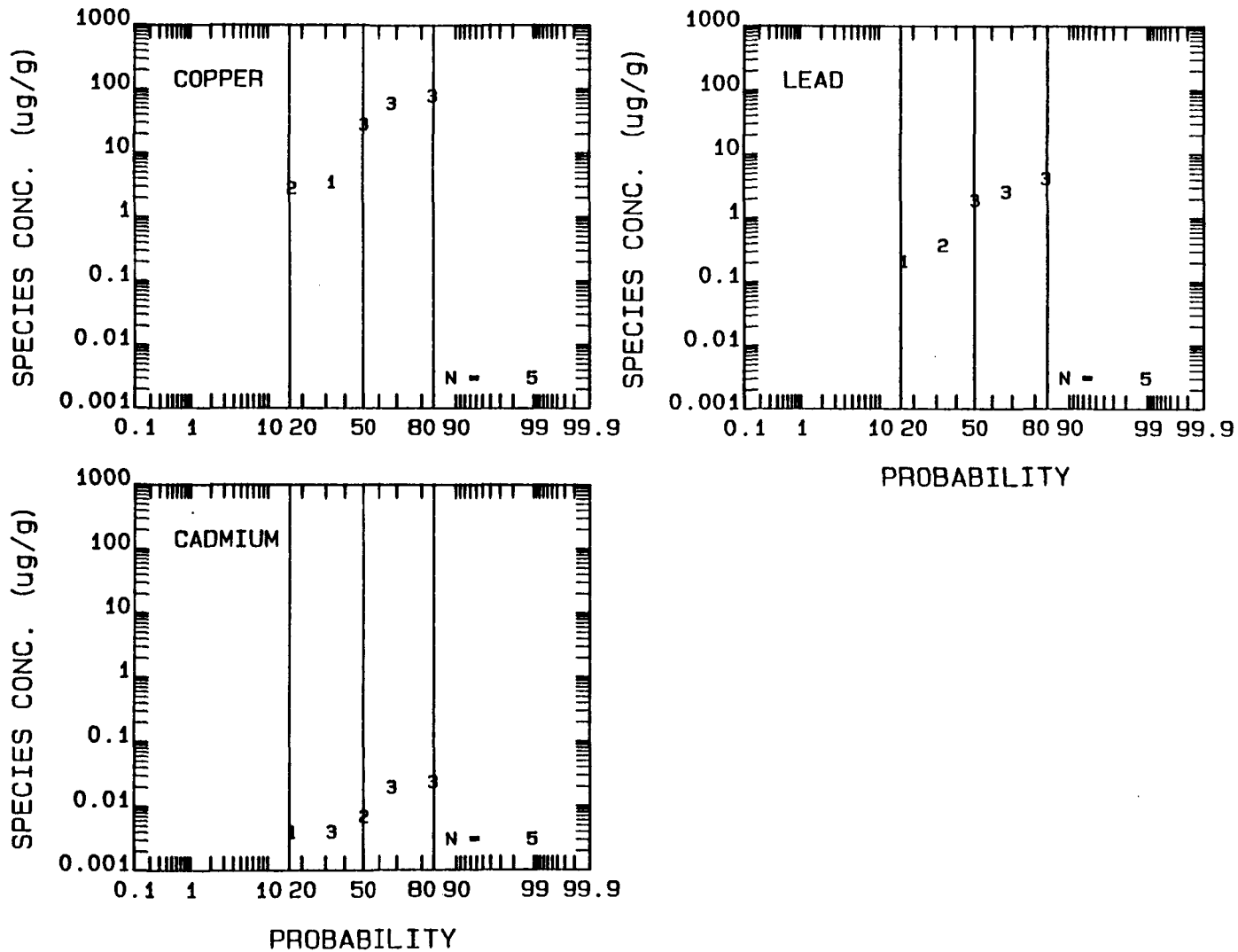
AREA 2, FLOUNDER, LARGE



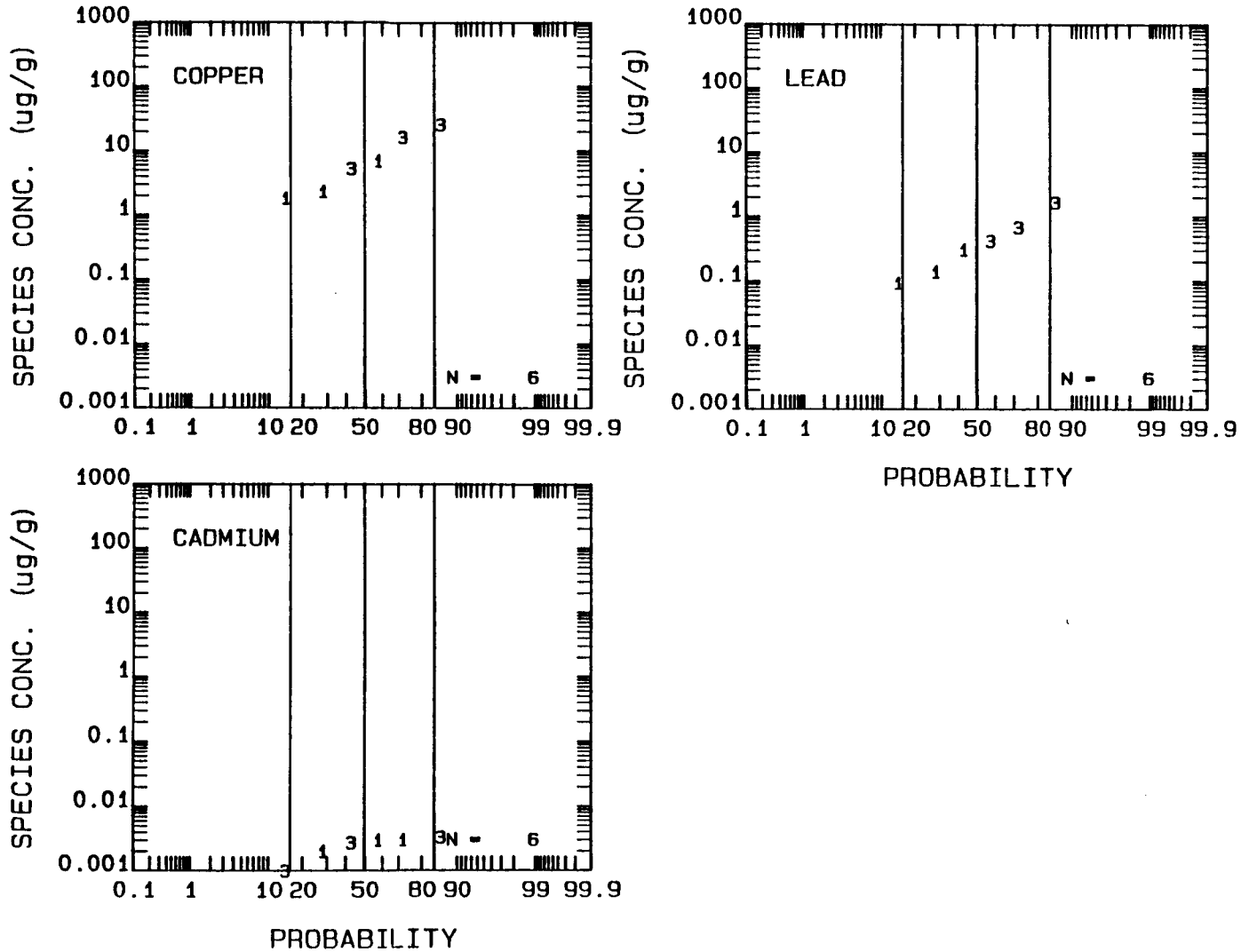




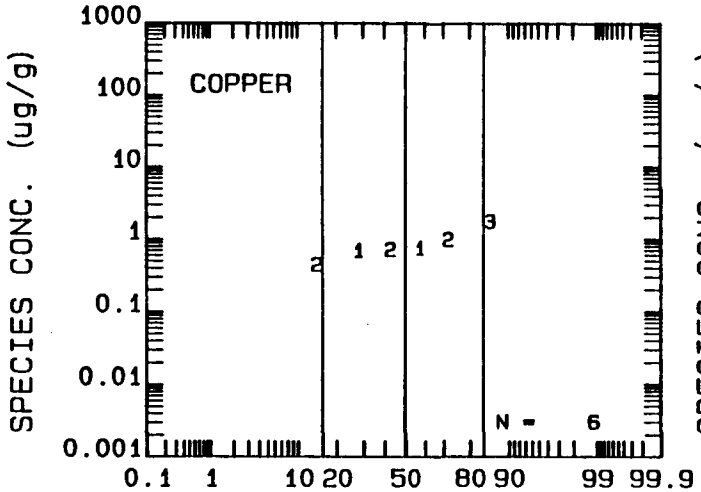
AREA 3, FLOUNDER, SMALL

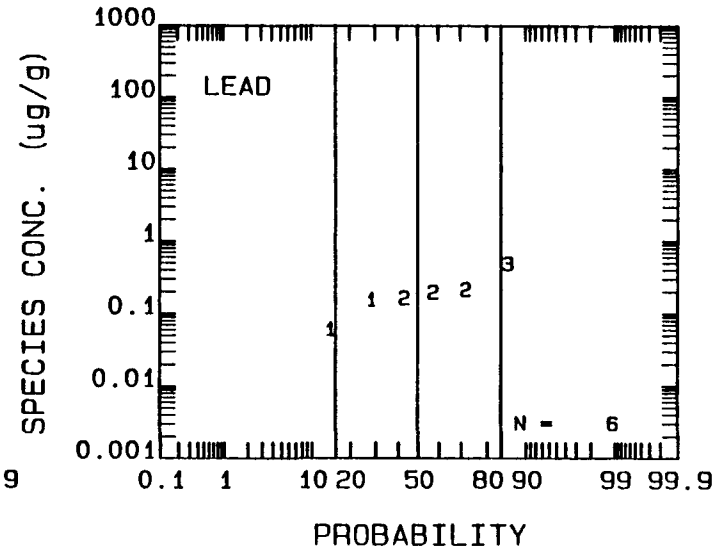


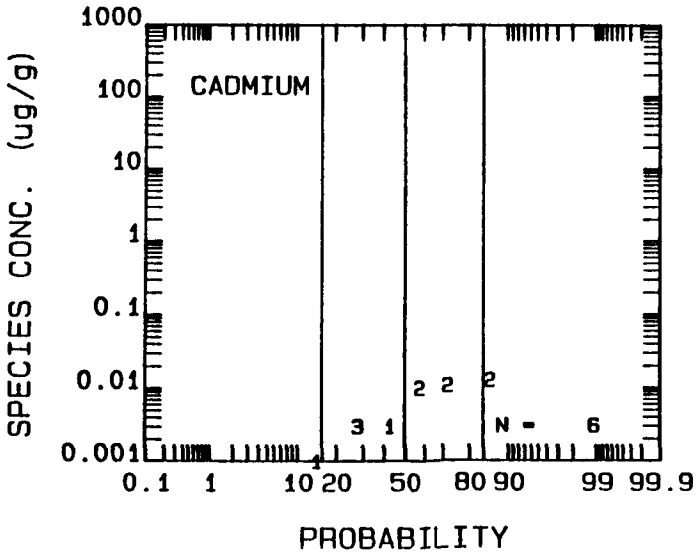
AREA 3, FLOUNDER, MEDIUM



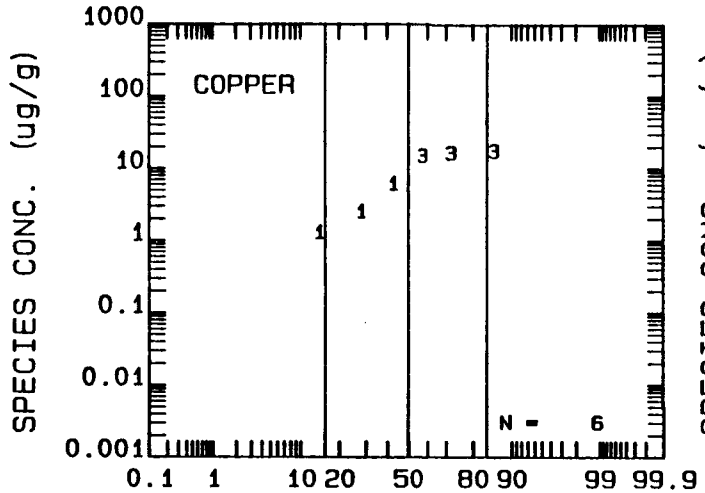
AREA 3, FLOUNDER, LARGE

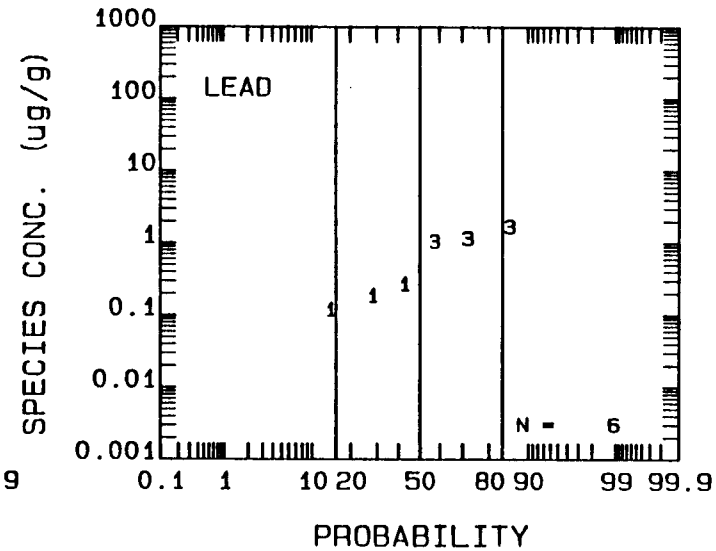


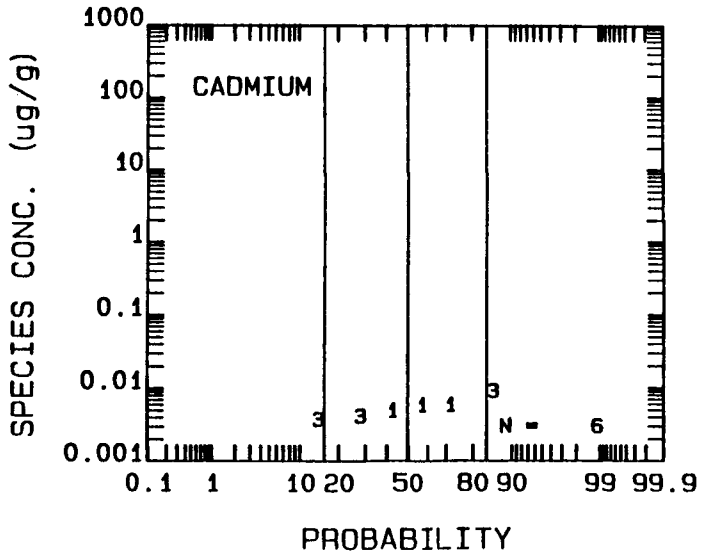




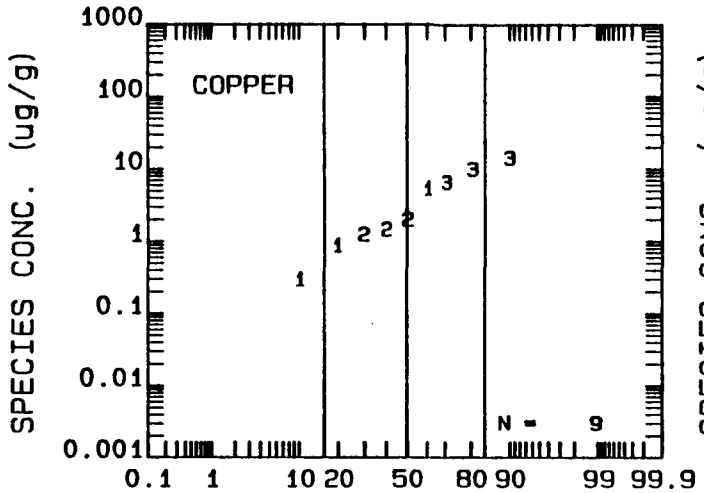
AREA 4, FLOUNDER, SMALL

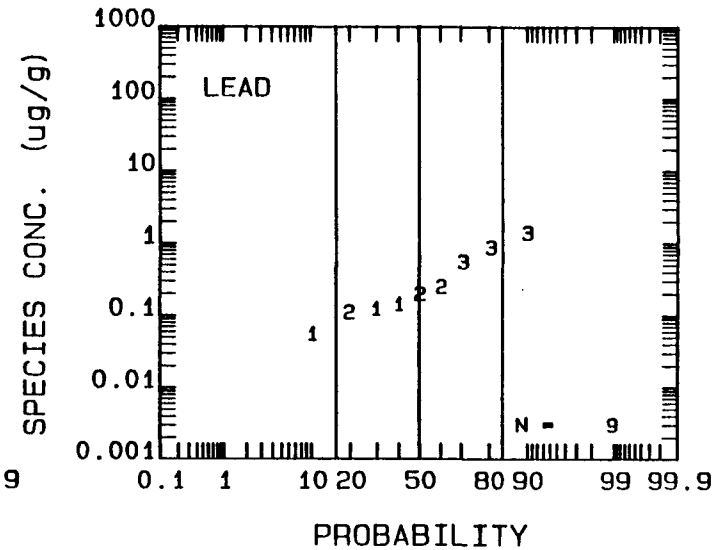


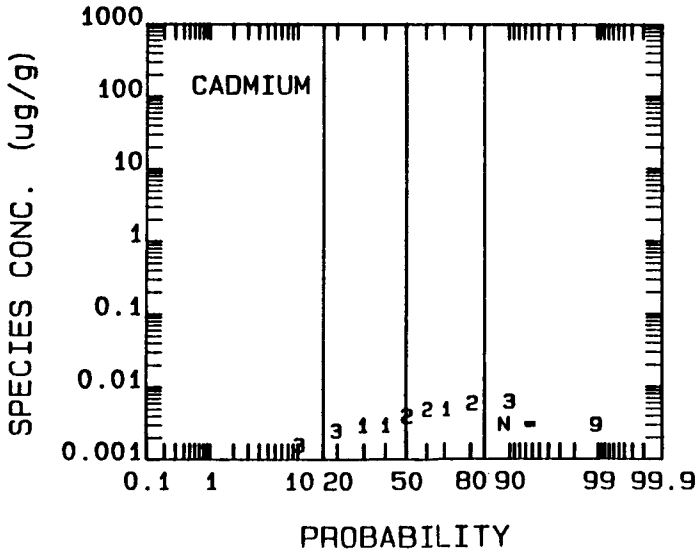




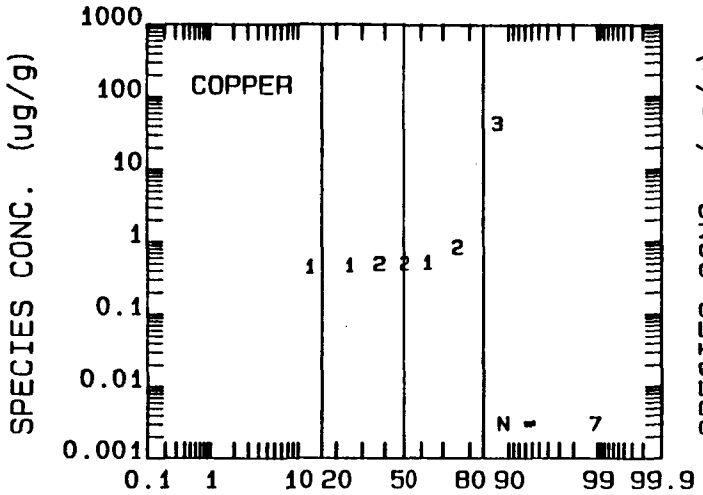
AREA 4, FLOUNDER, MEDIUM

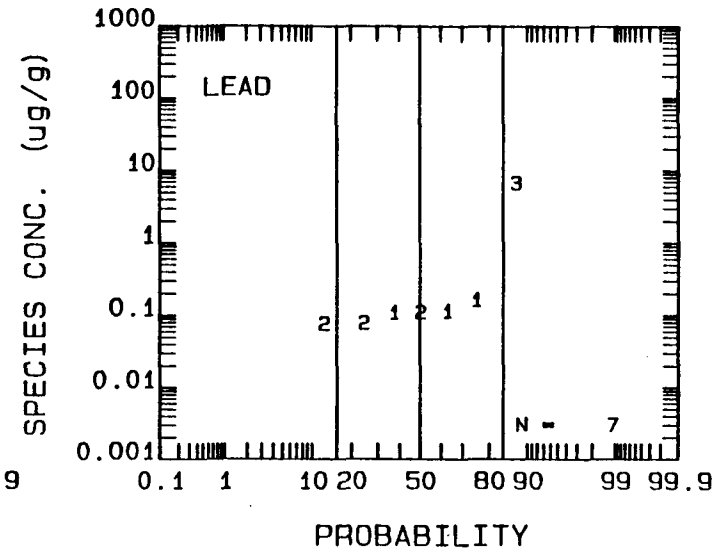


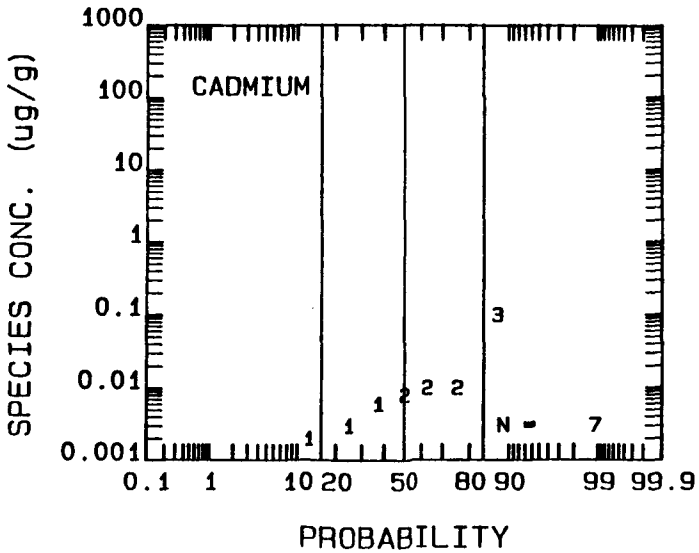




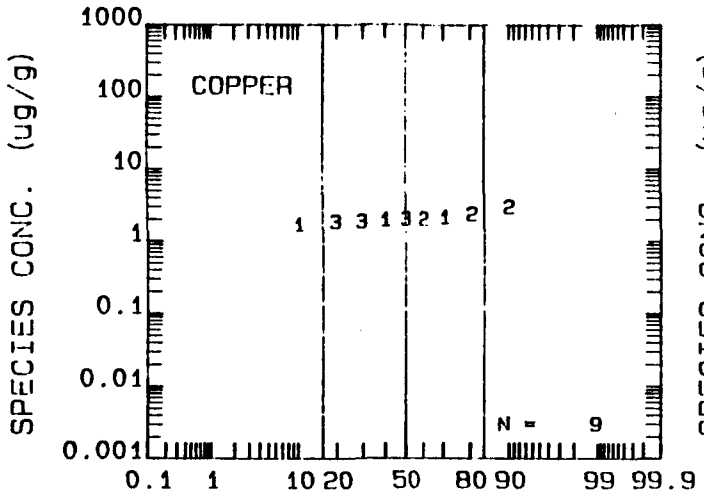
AREA 4, FLOUNDER, LARGE

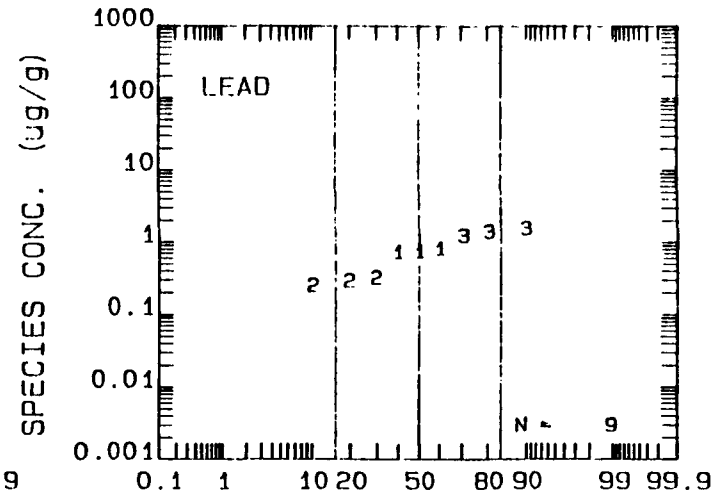


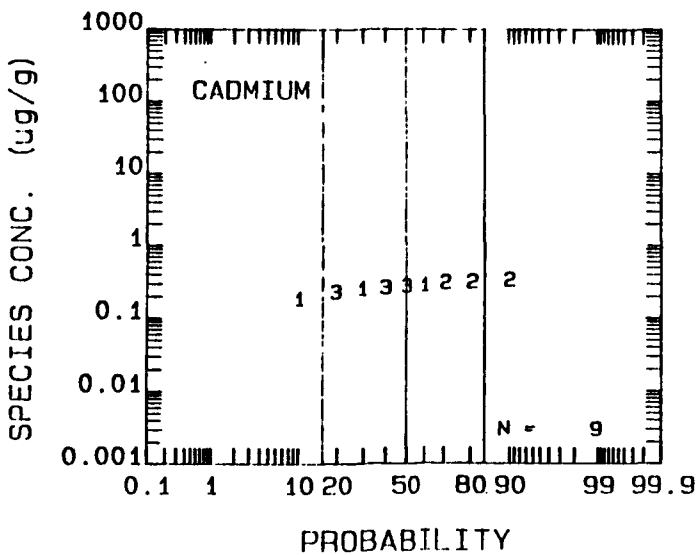




AREA 1, MUSSEL,







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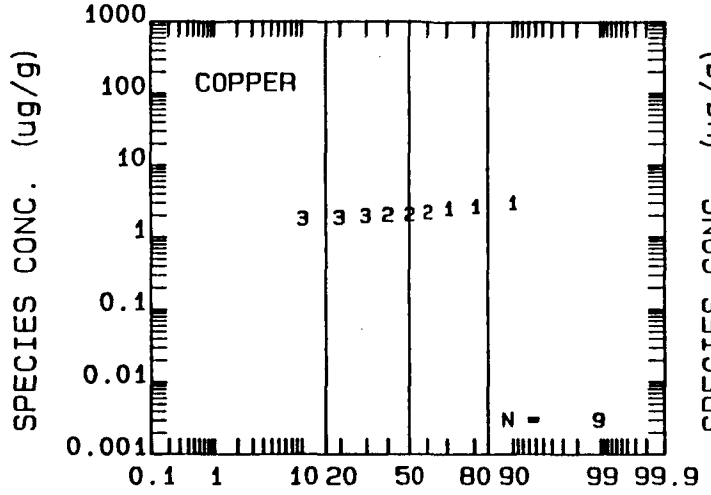
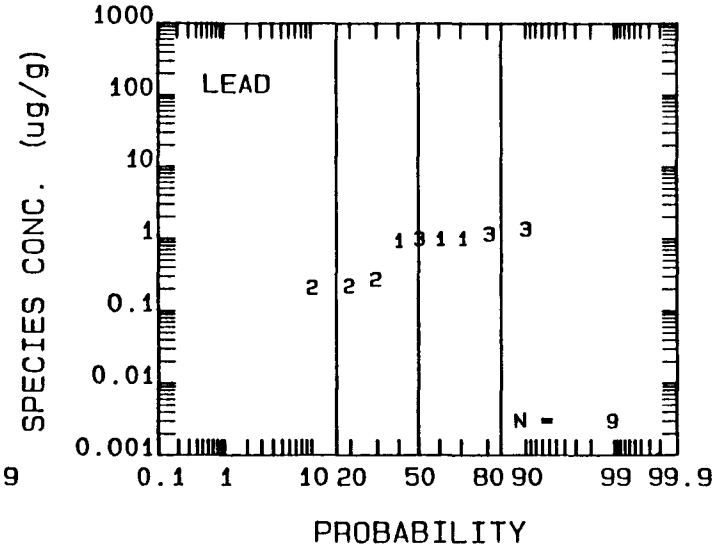
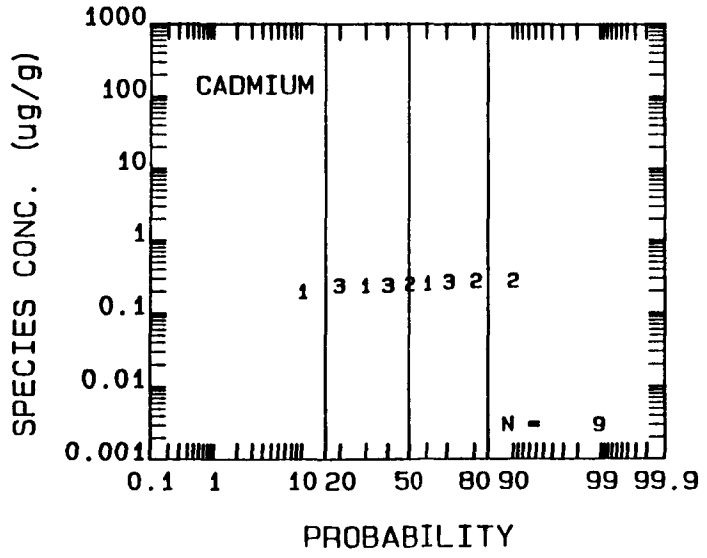
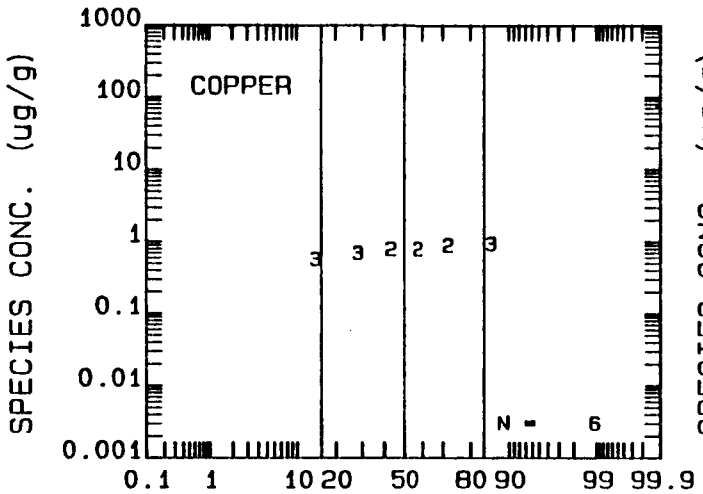
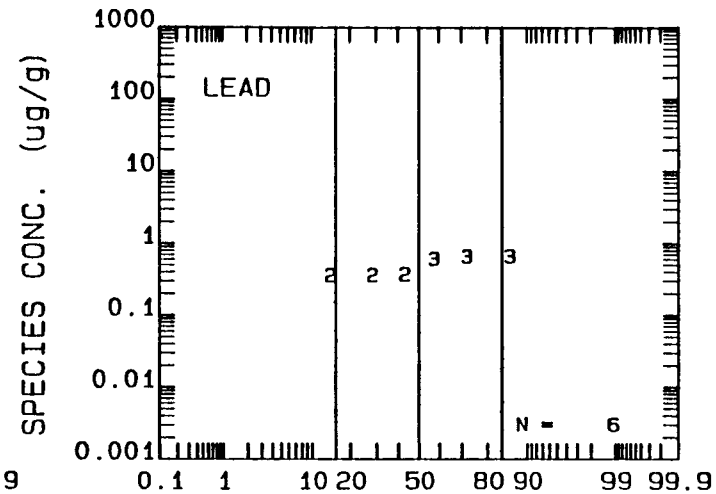


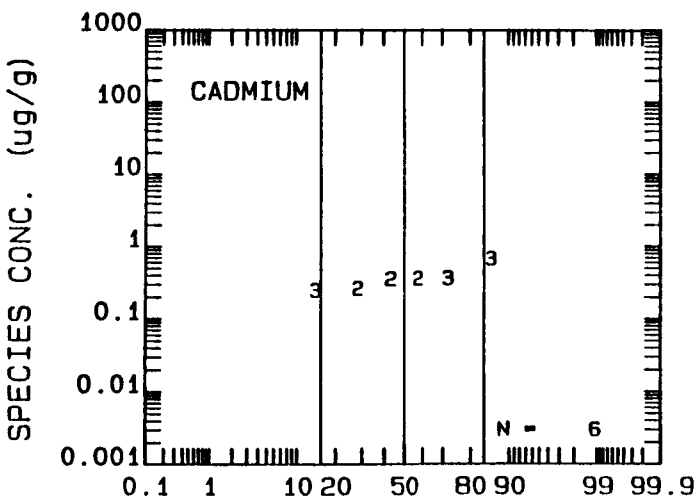




AREA 3, MUSSEL,

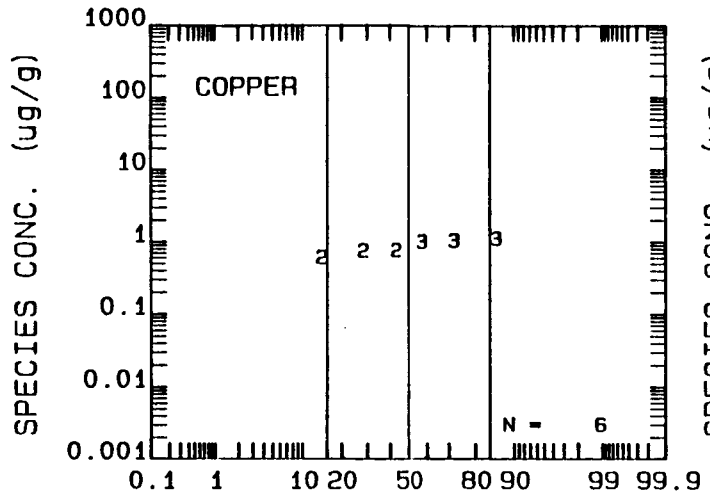


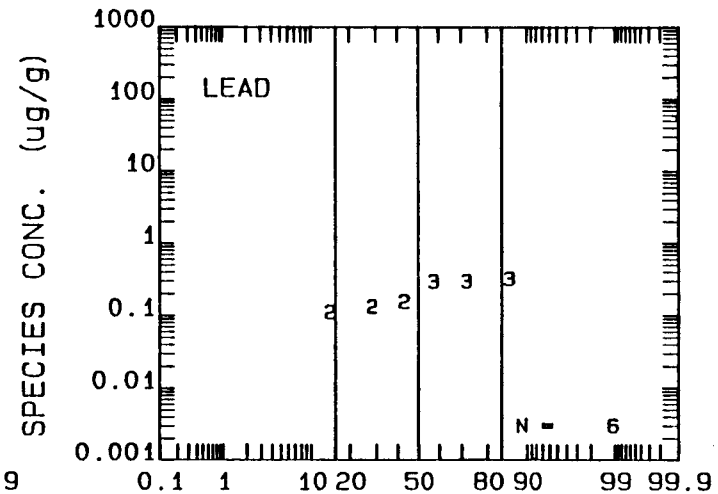


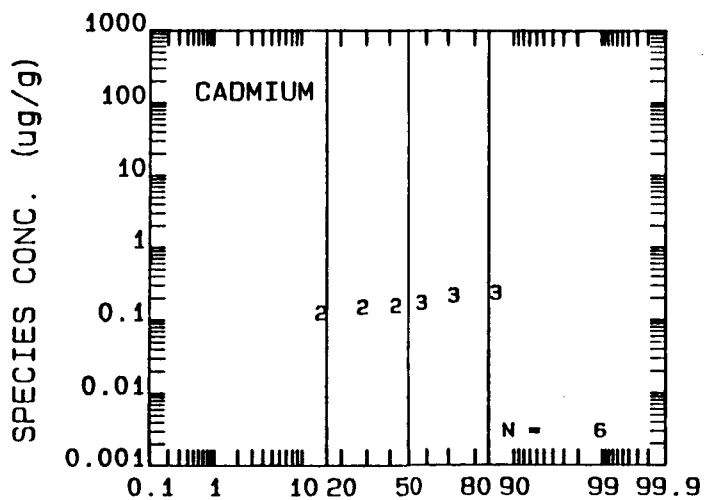


PROBABILITY

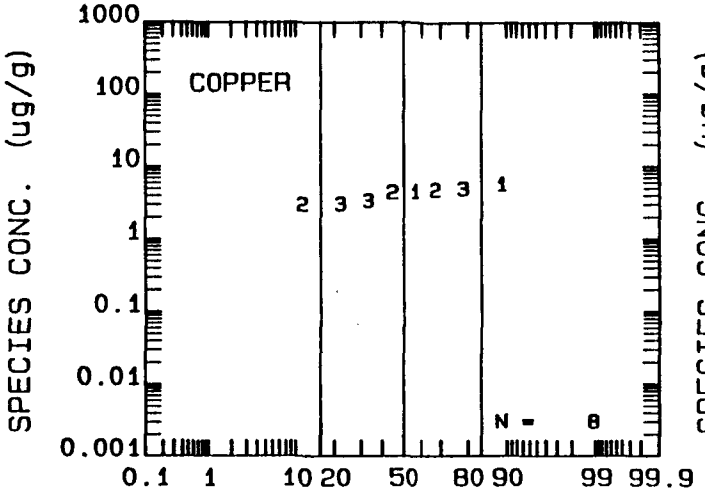
AREA 4, MUSSEL,

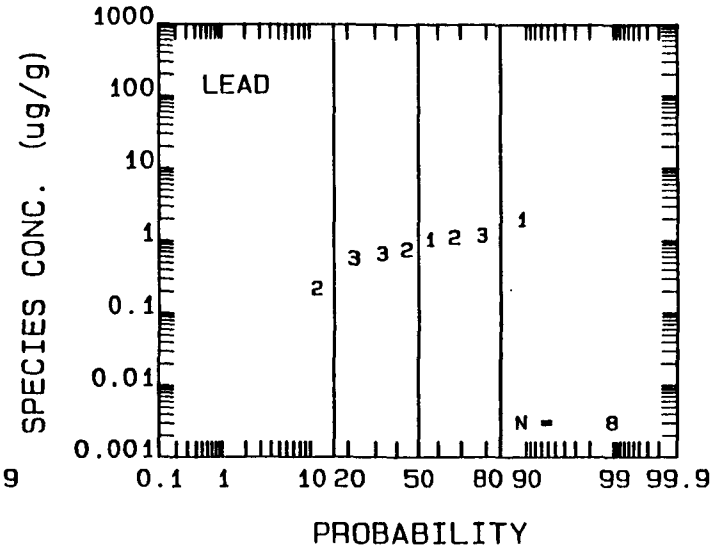


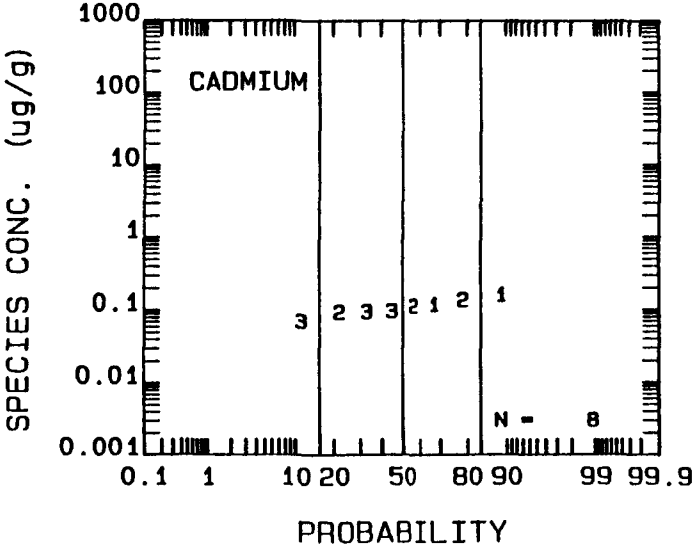




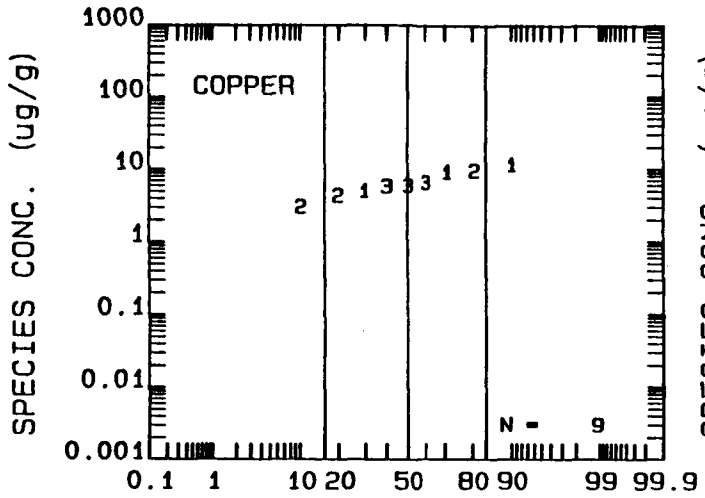
AREA 1, CLAM, MEDIUM

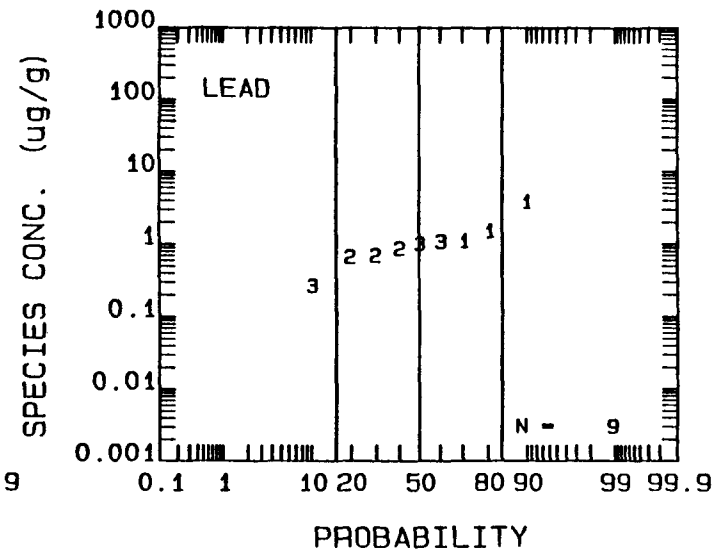


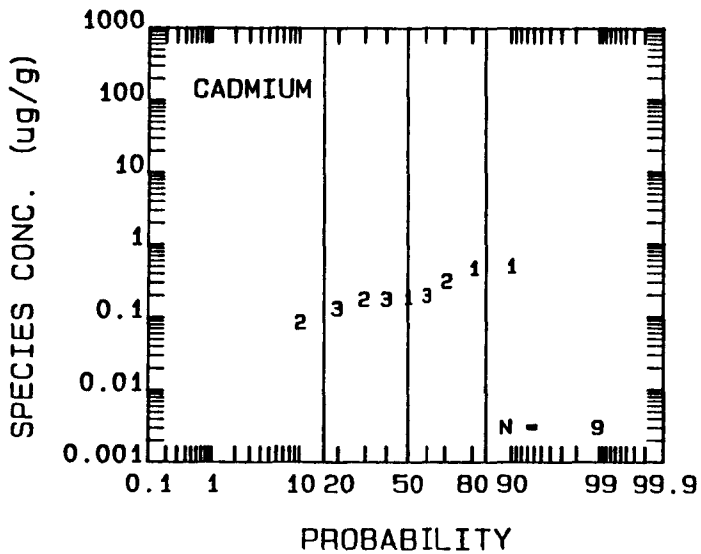




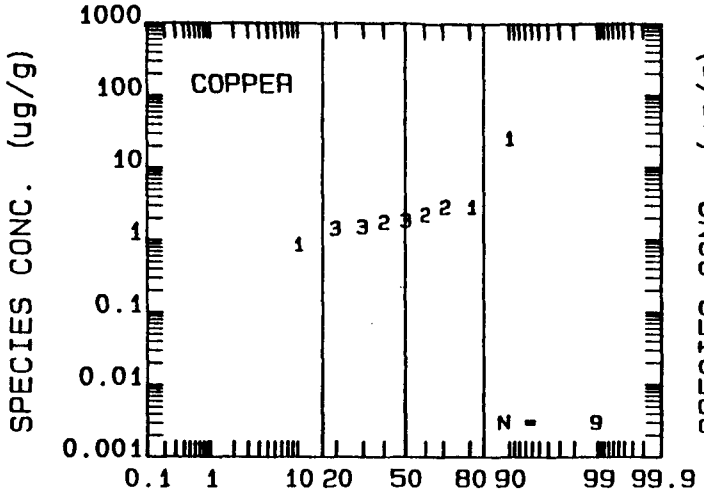
AREA 1, CLAM, LARGE

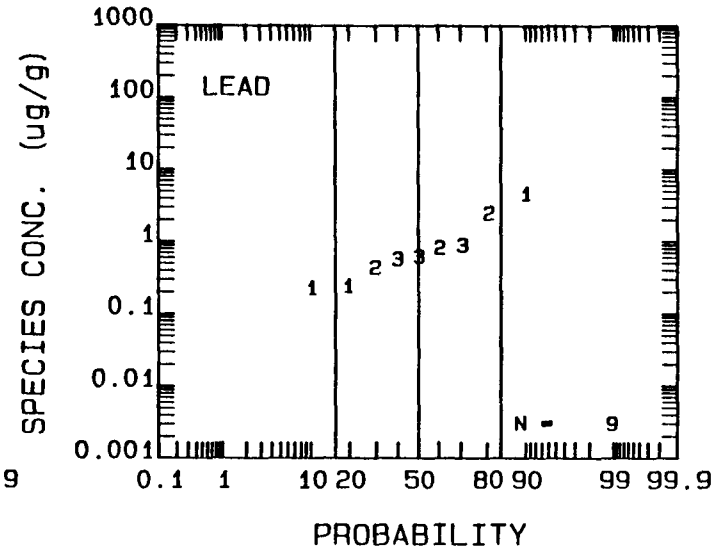


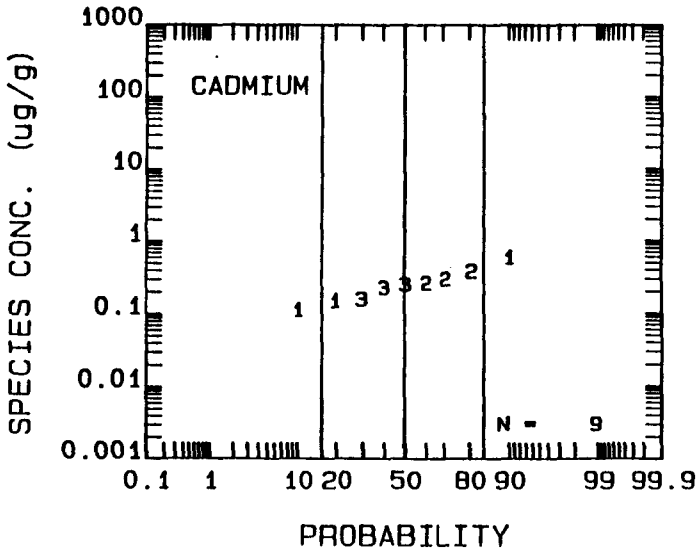




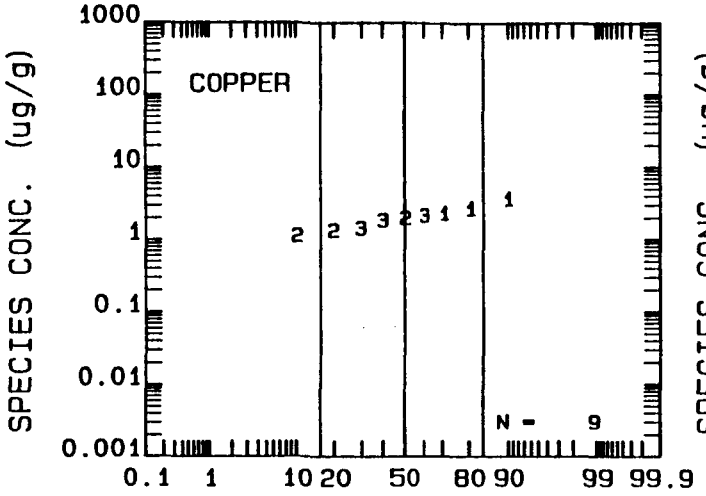
AREA 2, CLAM, MEDIUM

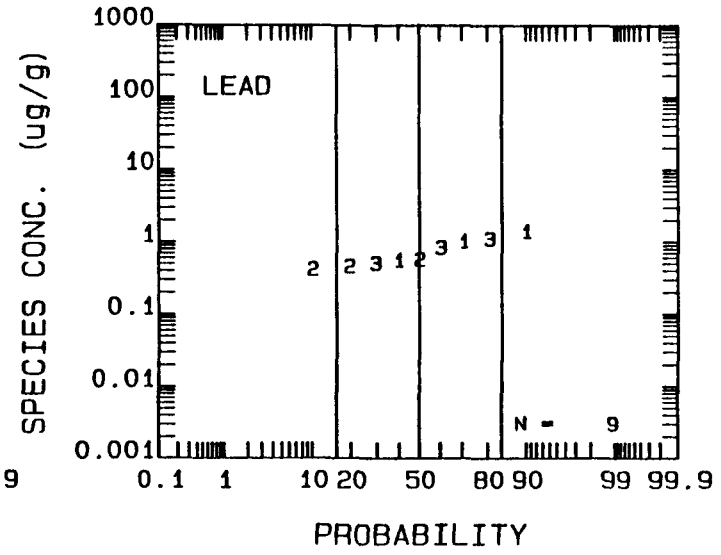


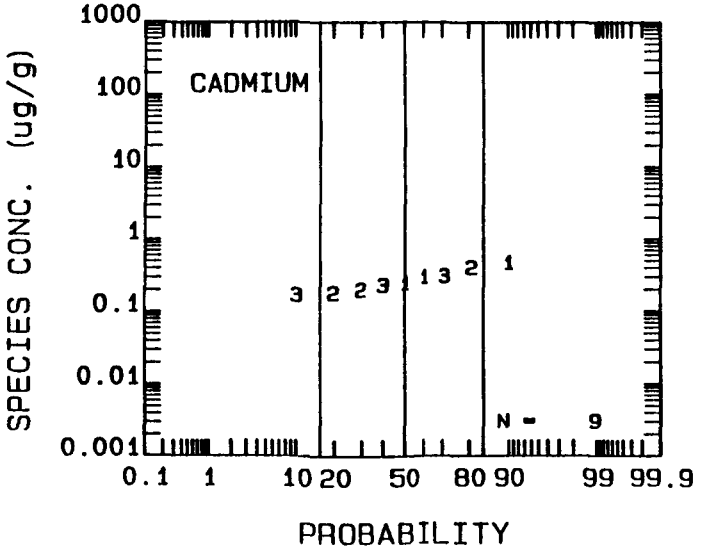




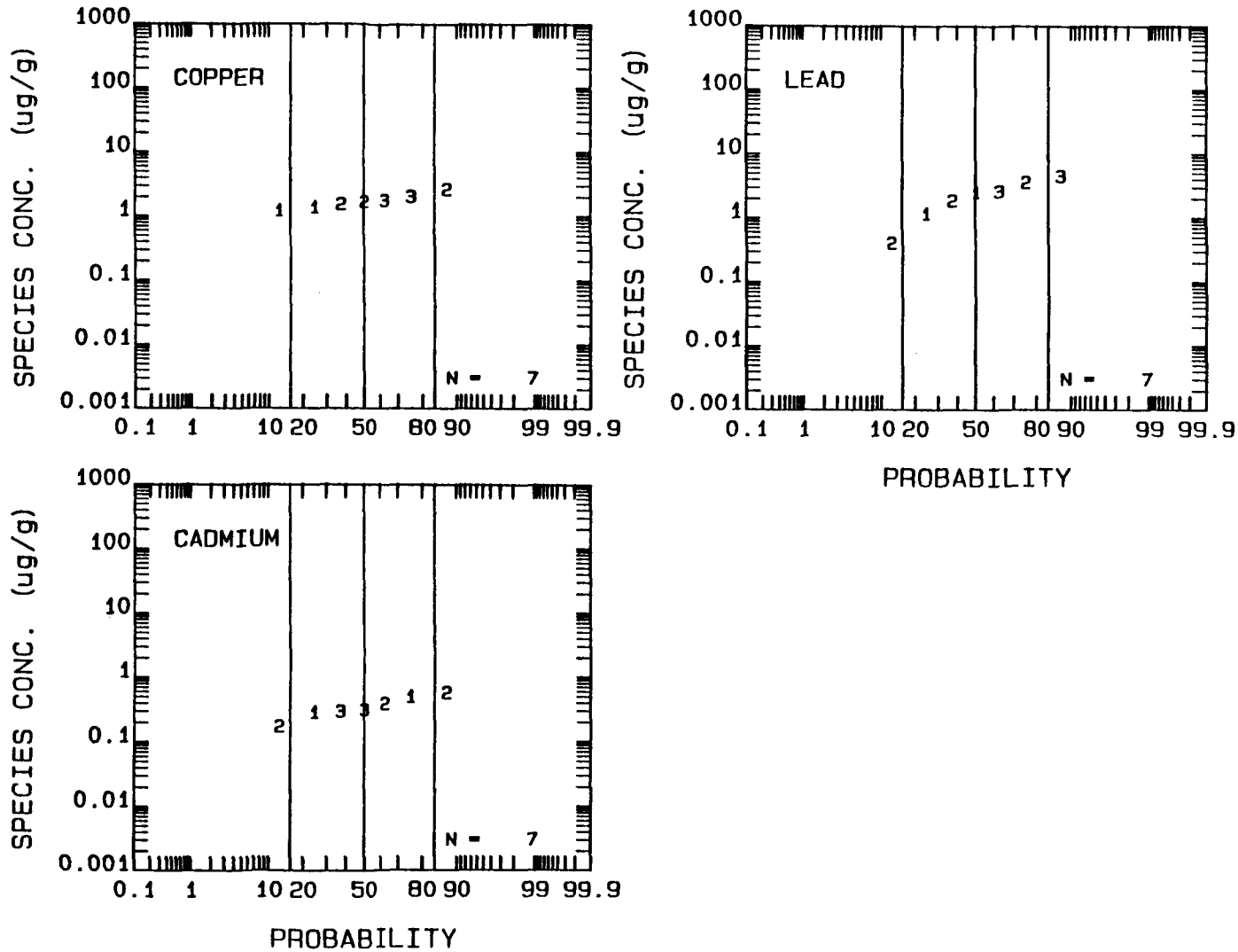
AREA 2, CLAM, LARGE



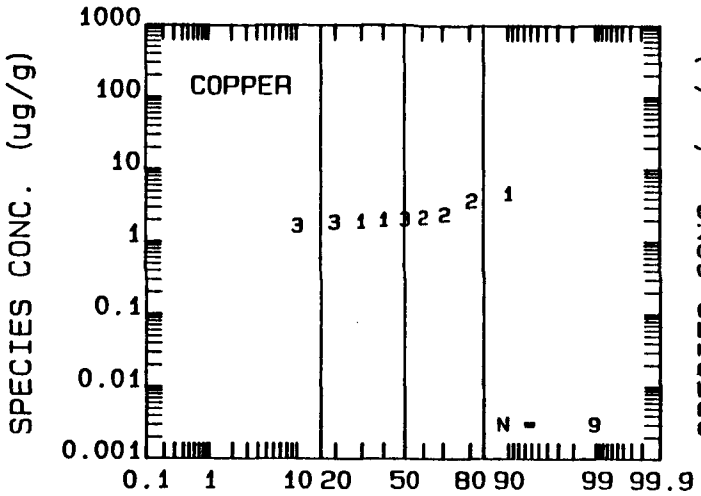


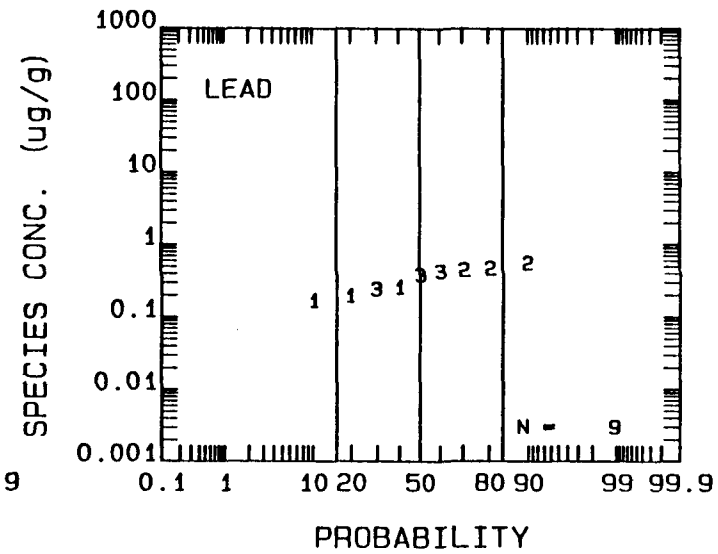


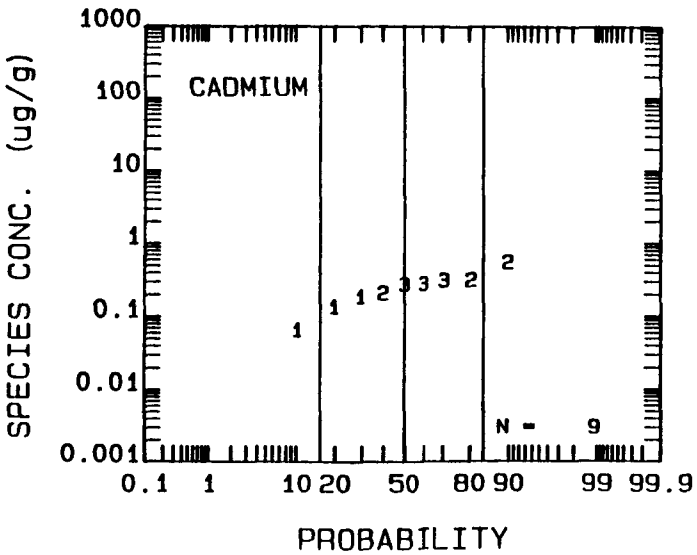
AREA 3, CLAM, MEDIUM



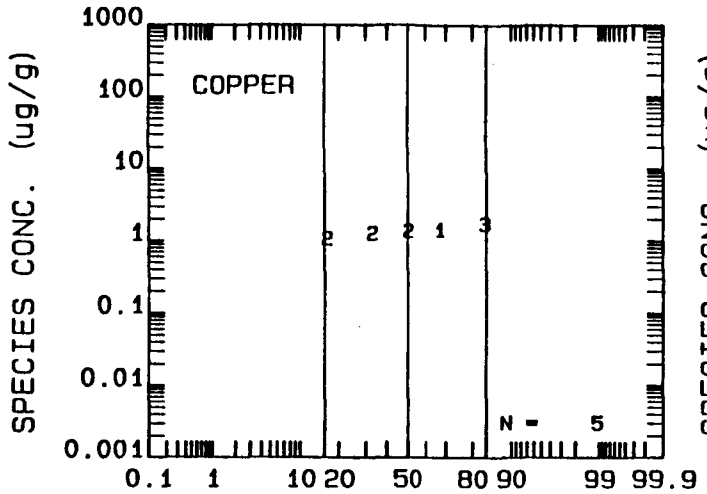
AREA 3, CLAM, LARGE

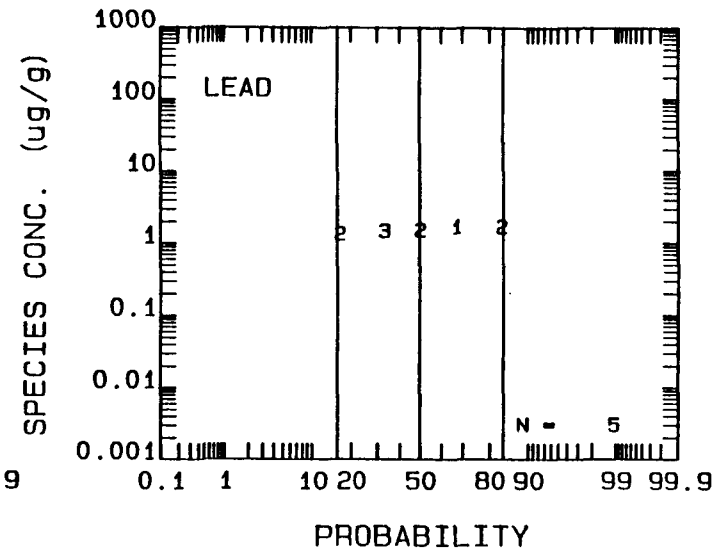


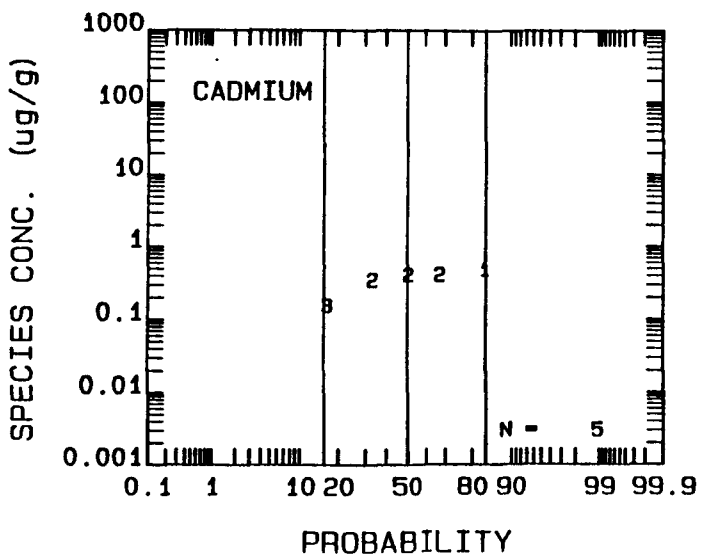




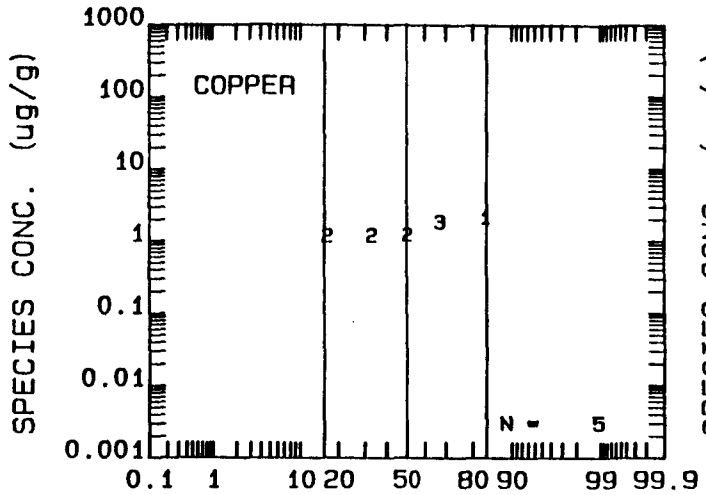
AREA 4, CLAM, MEDIUM

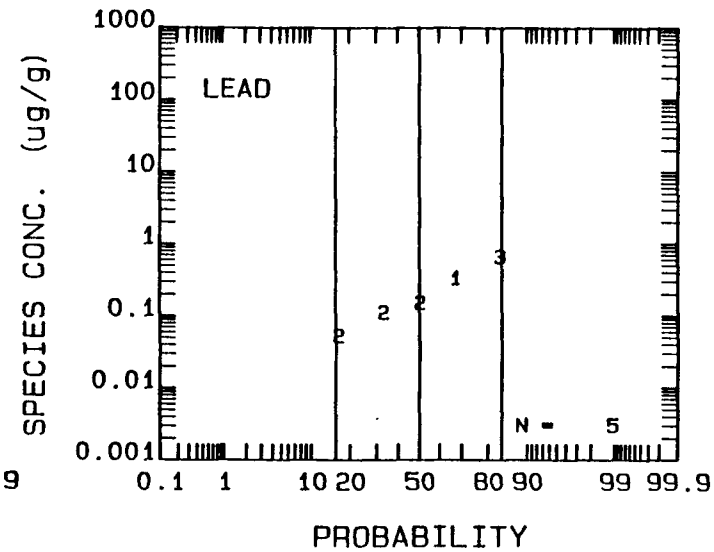


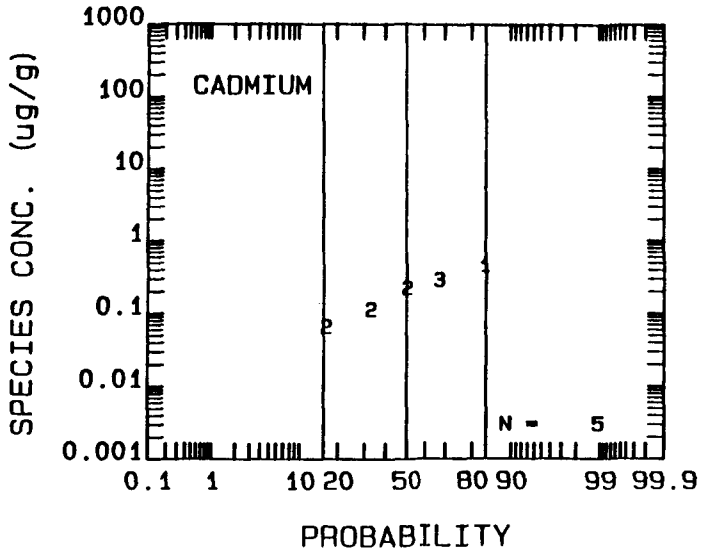




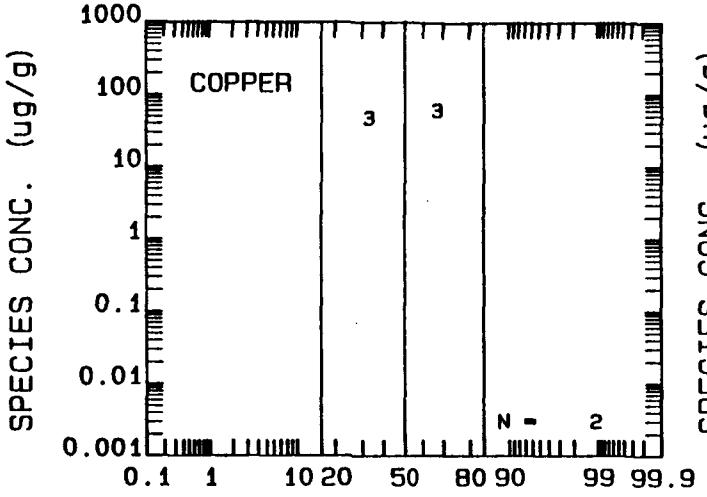
AREA 4, CLAM, LARGE

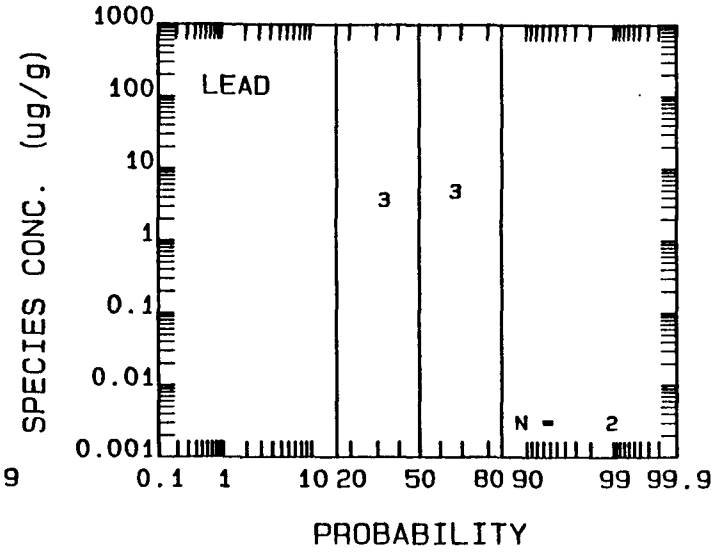


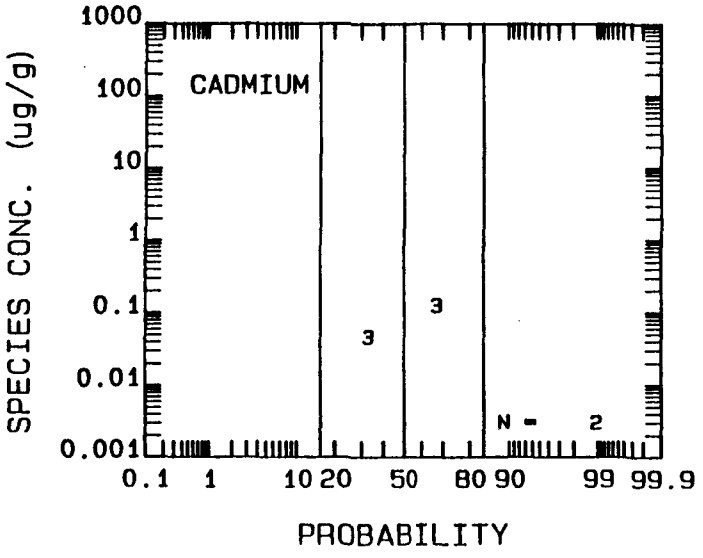




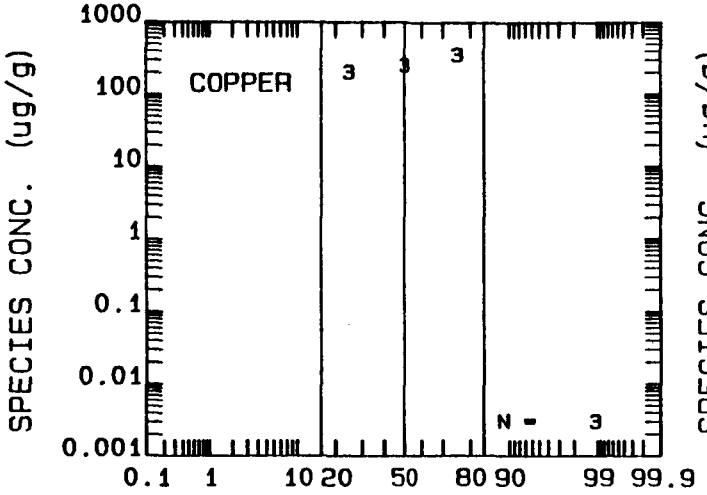
AREA 1, GREEN CRAB, SMALL

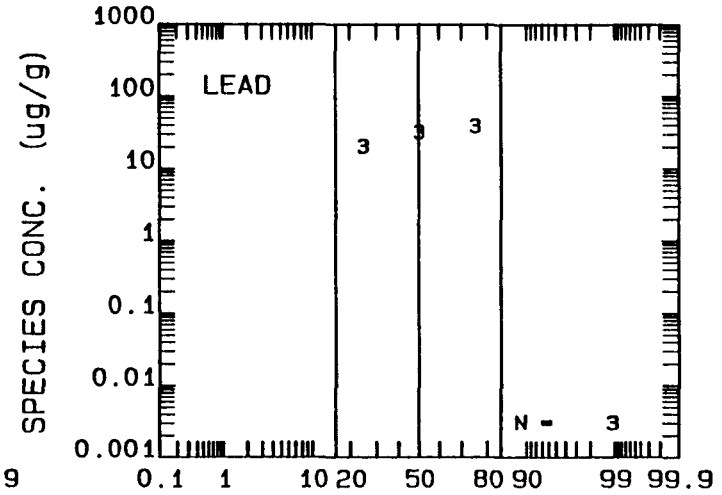


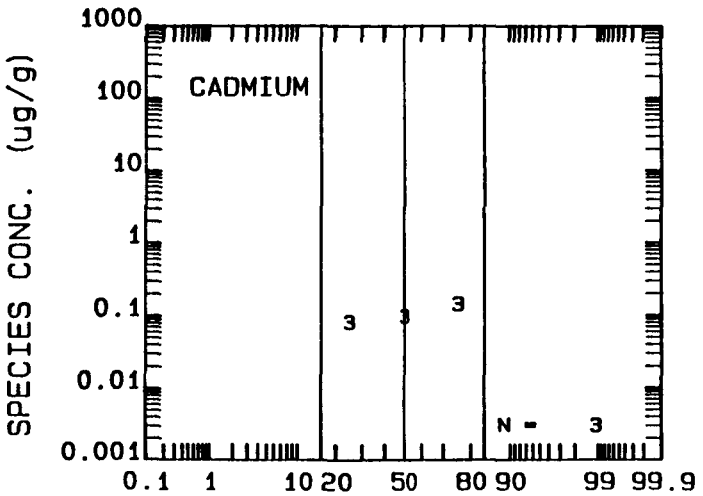




AREA 1, GREEN CRAB, LARGE

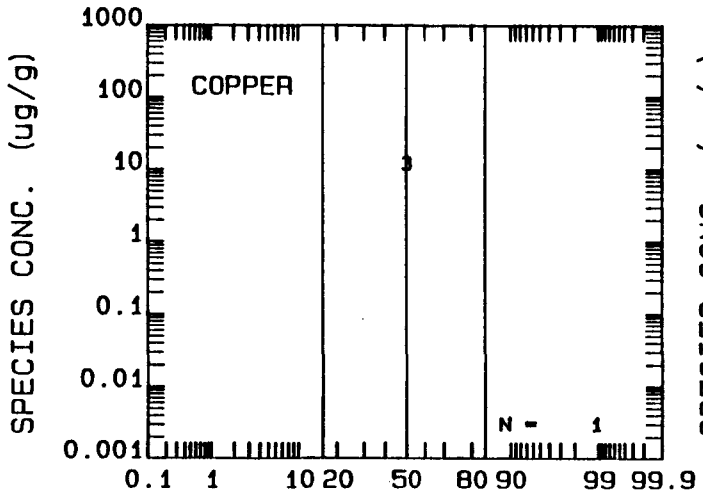


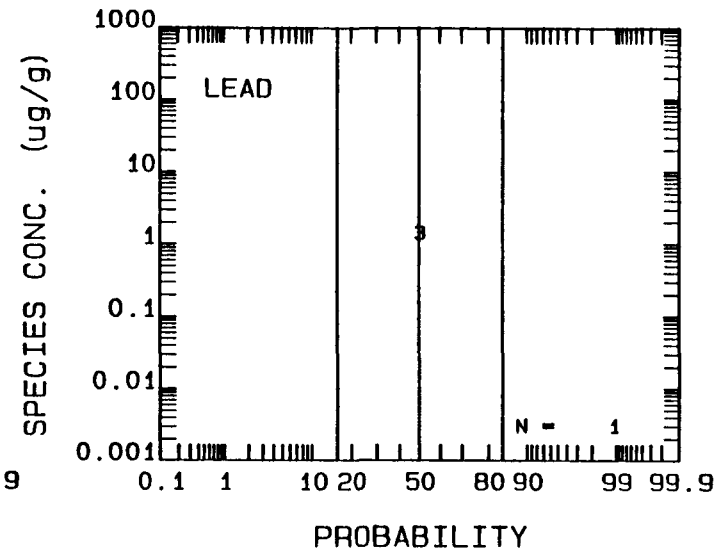


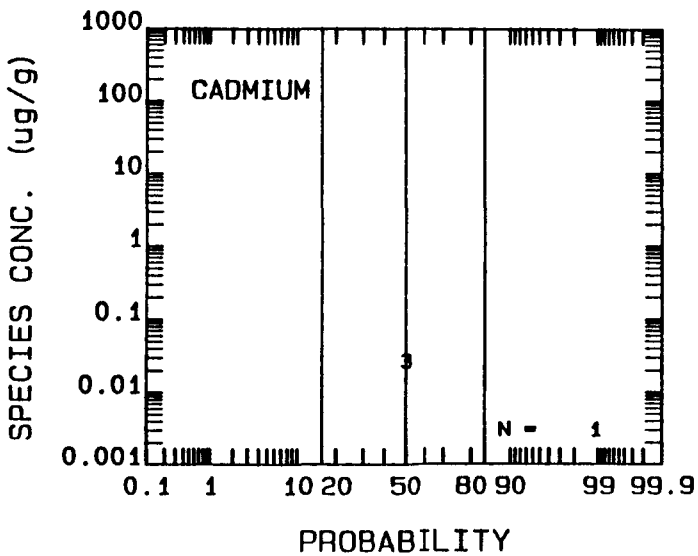


PROBABILITY

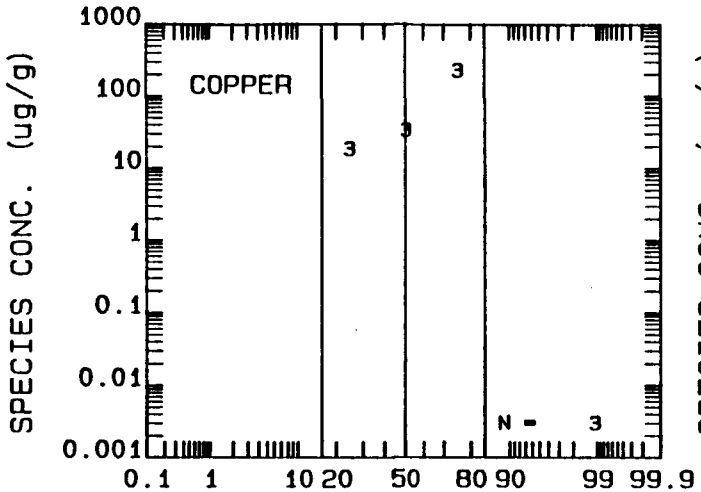
AREA 2, GREEN CRAB, SMALL

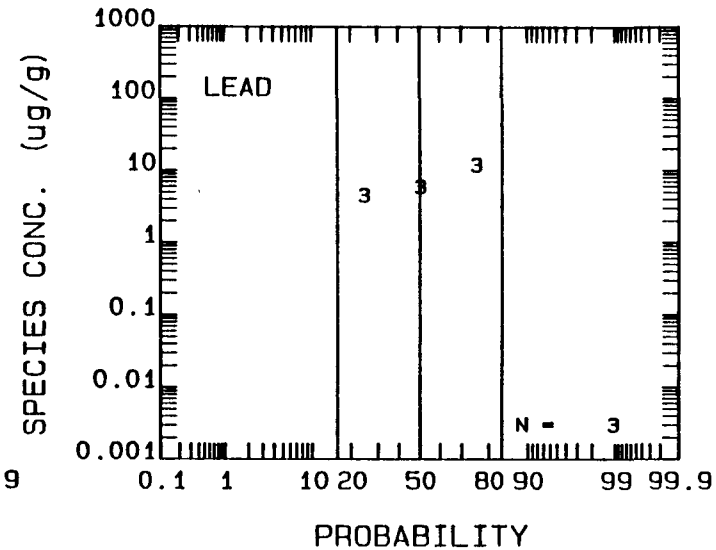


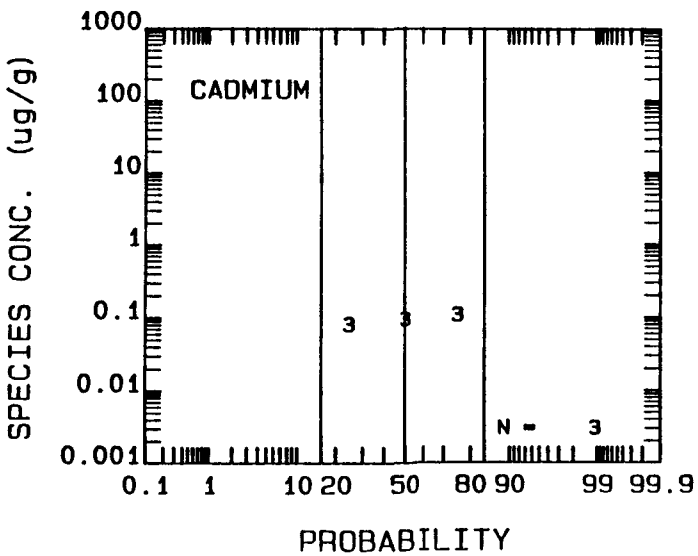




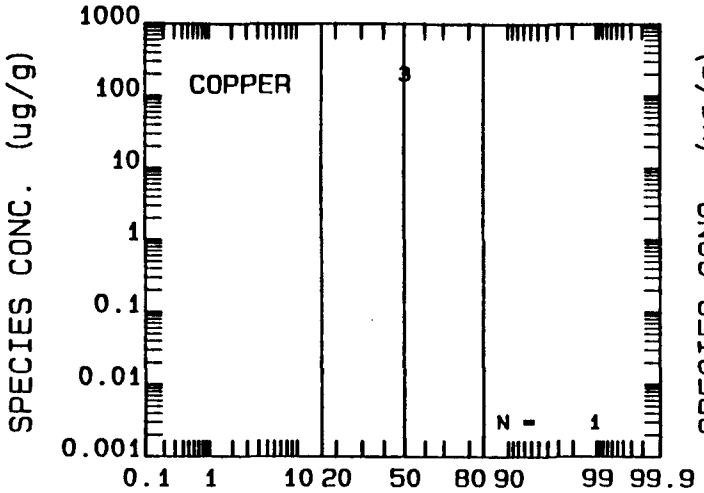
AREA 2, GREEN CRAB, LARGE

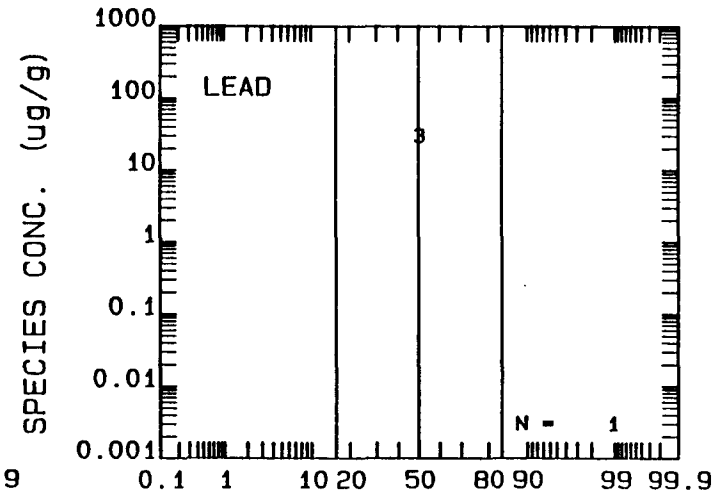


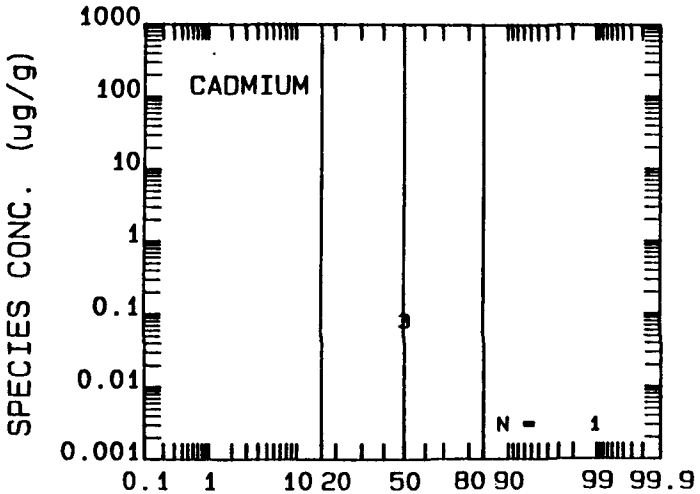




AREA 3, GREEN CRAB, LARGE

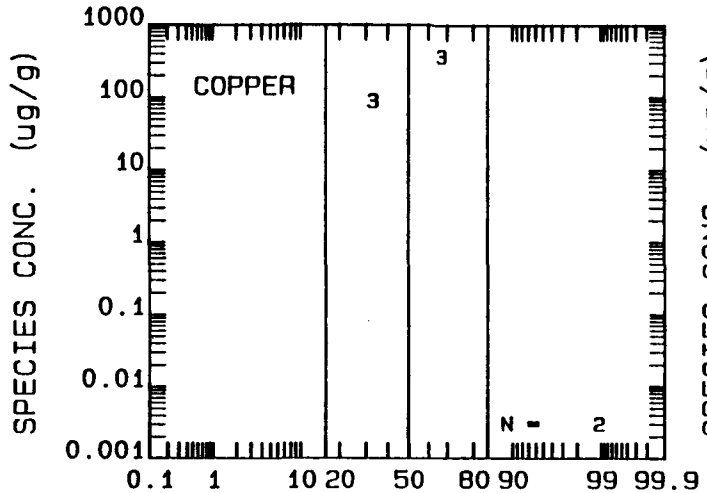


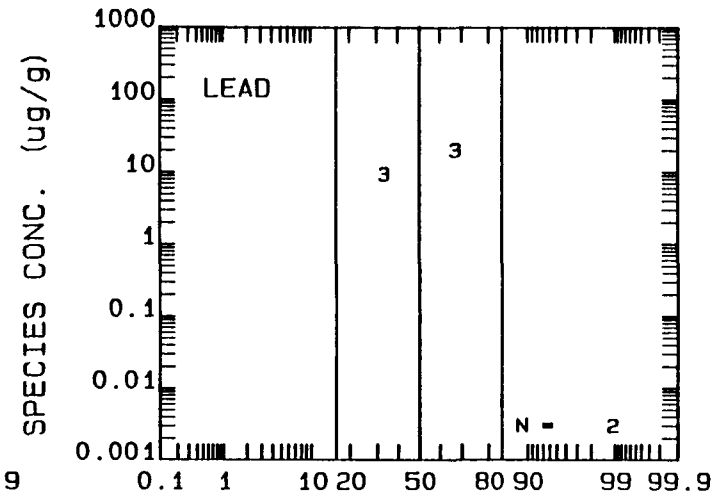


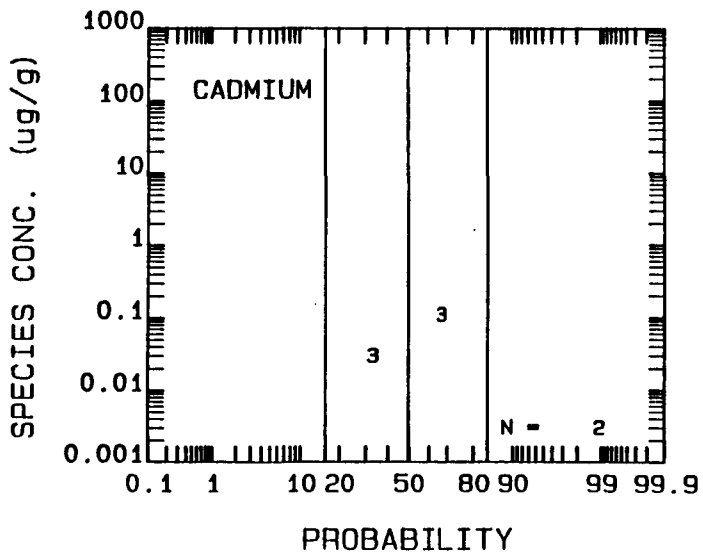


PROBABILITY

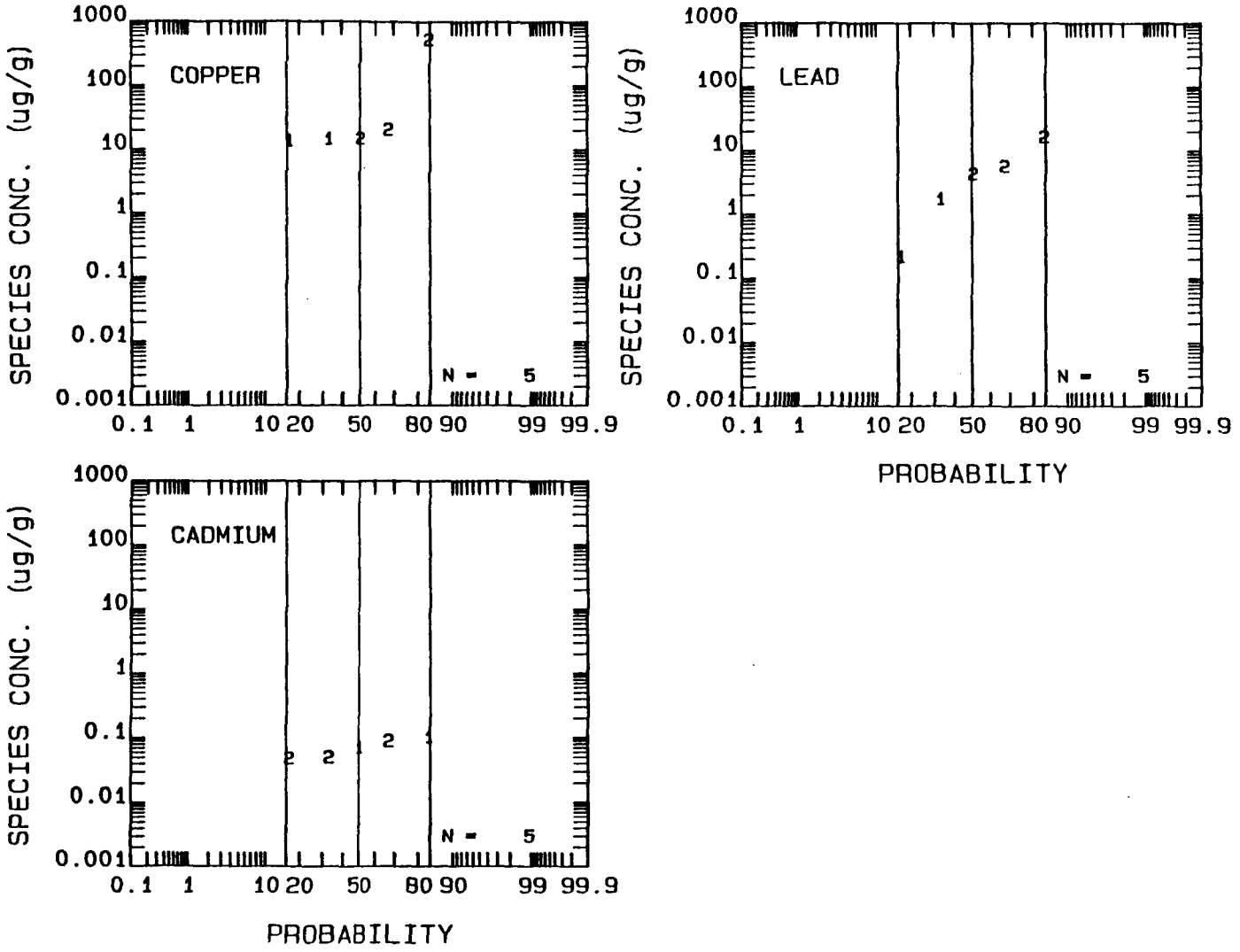
AREA 4, GREEN CRAB, LARGE



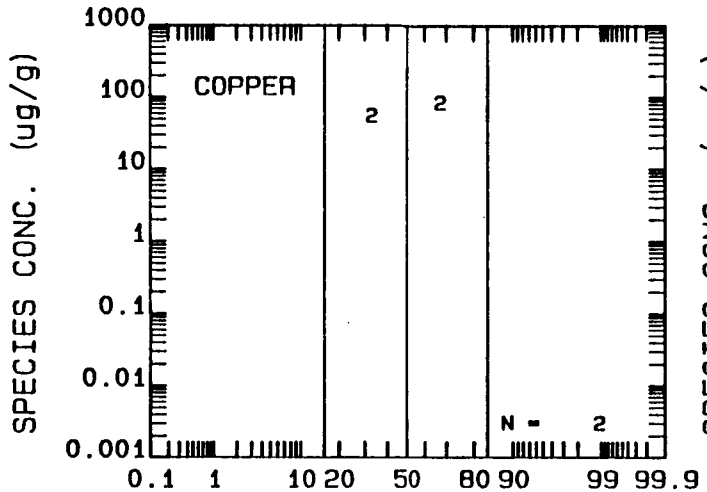


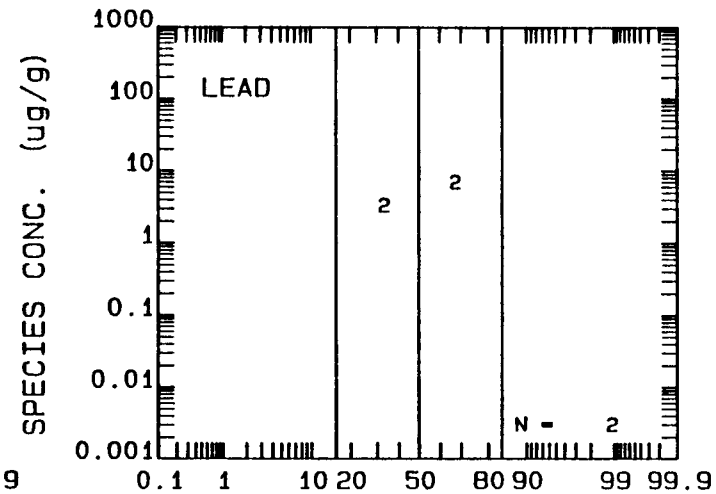


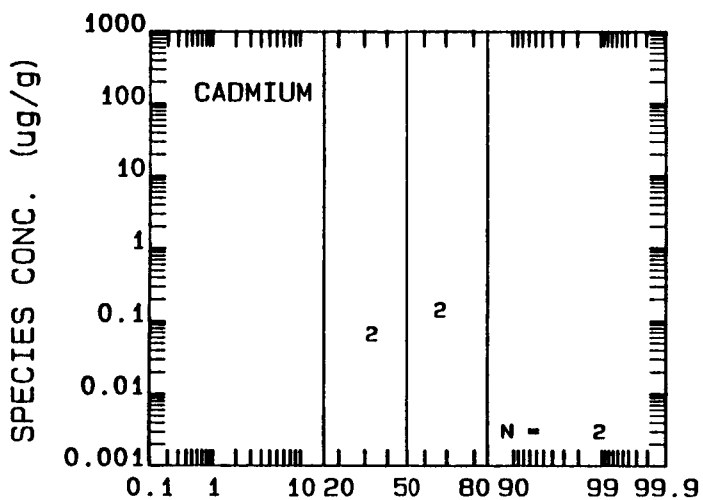
AREA 1, SPIDER CRAB, LARGE



AREA 2, SPIDER CRAB, SMALL

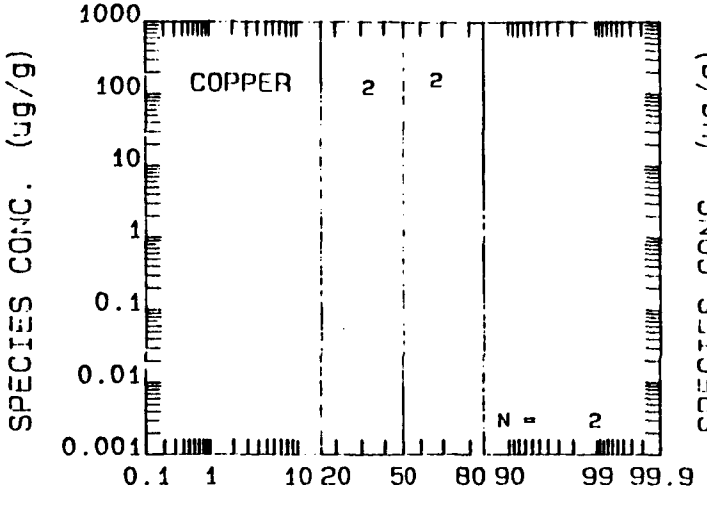


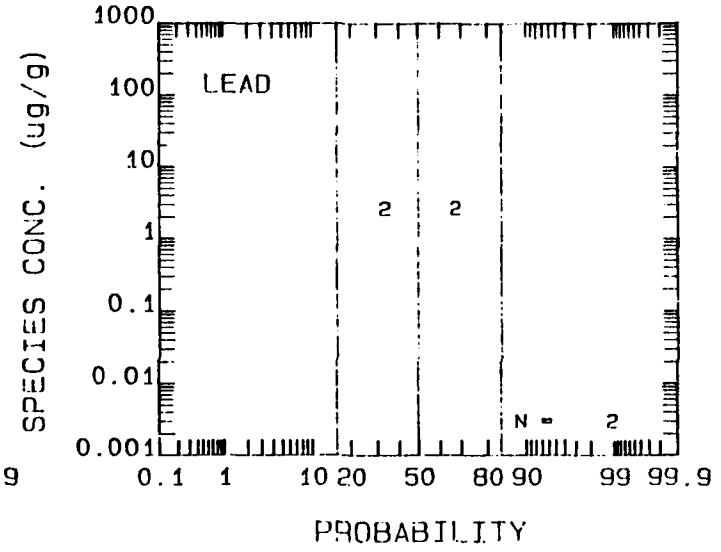


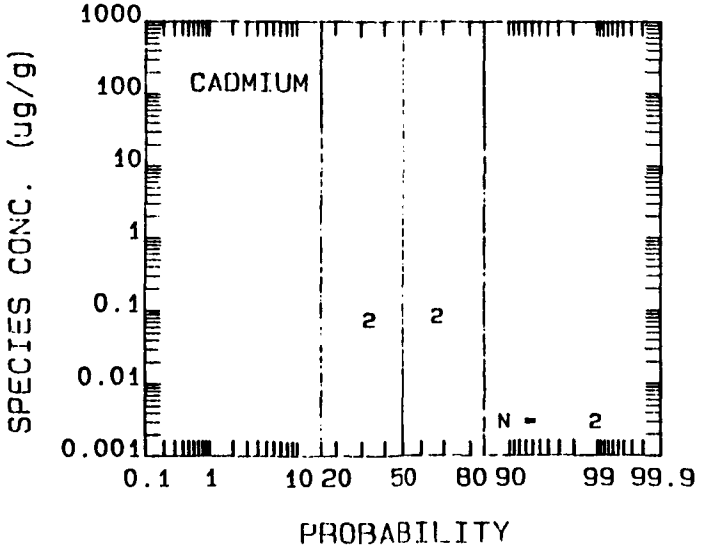


PROBABILITY

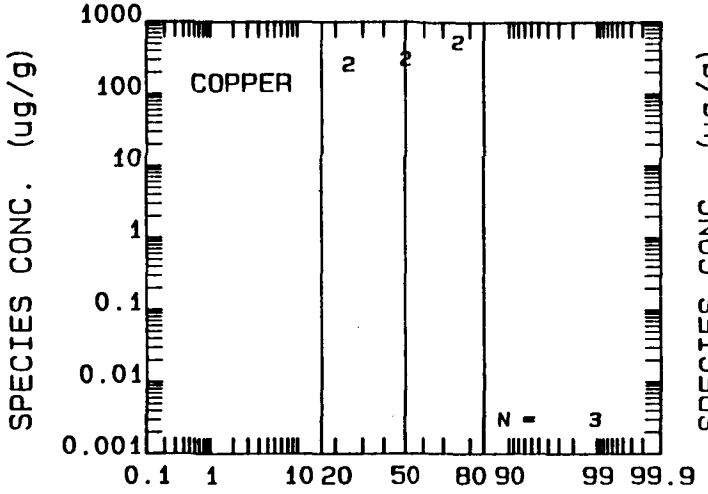
AREA 2, SPIDER CRAB, LARGE

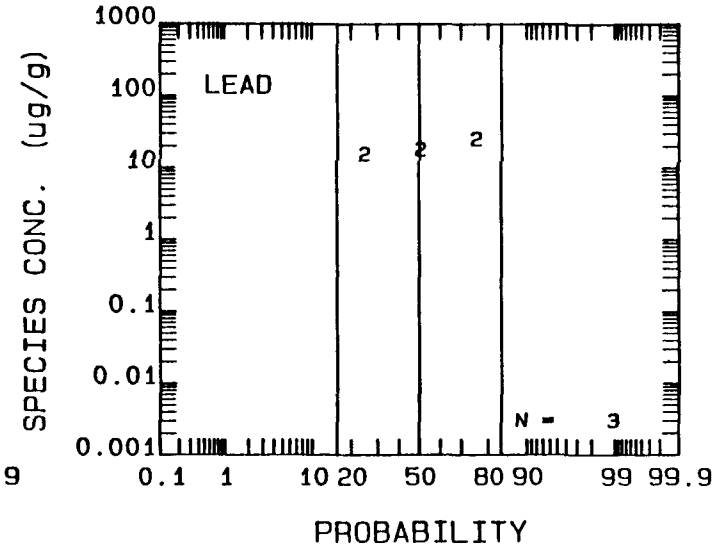


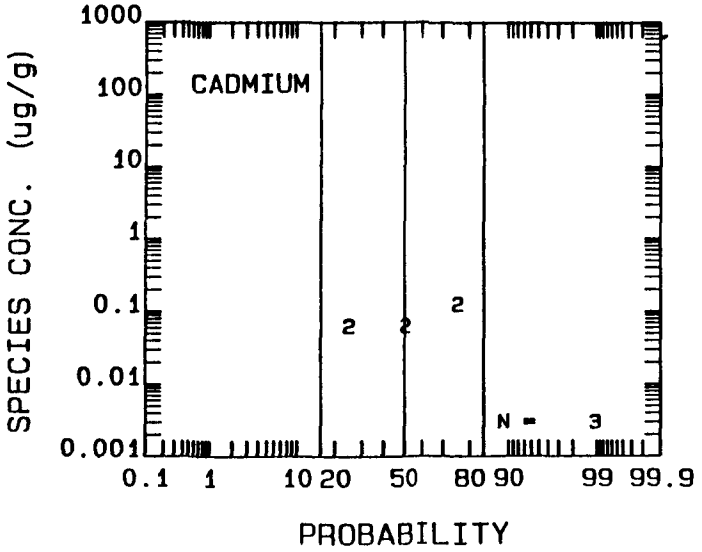




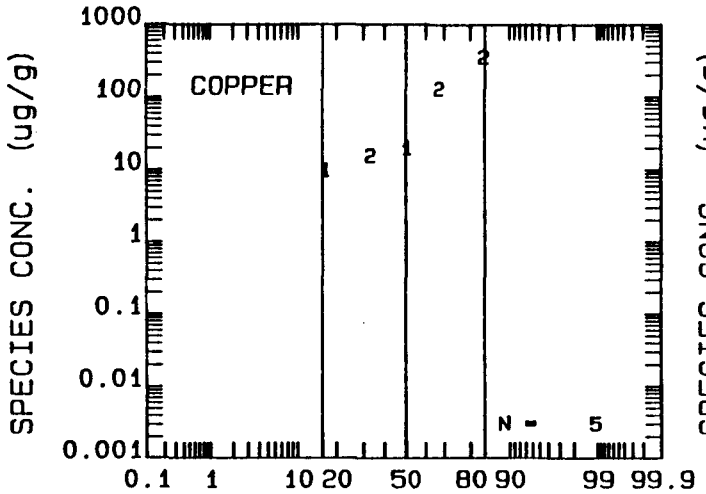
AREA 3, SPIDER CRAB, SMALL

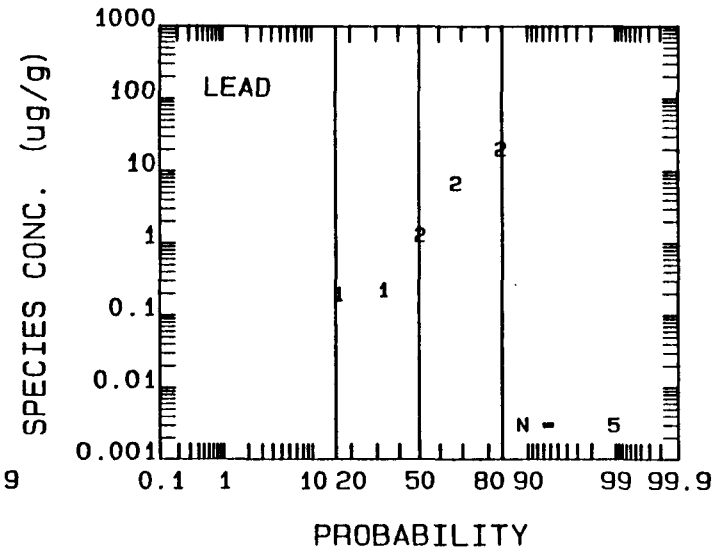


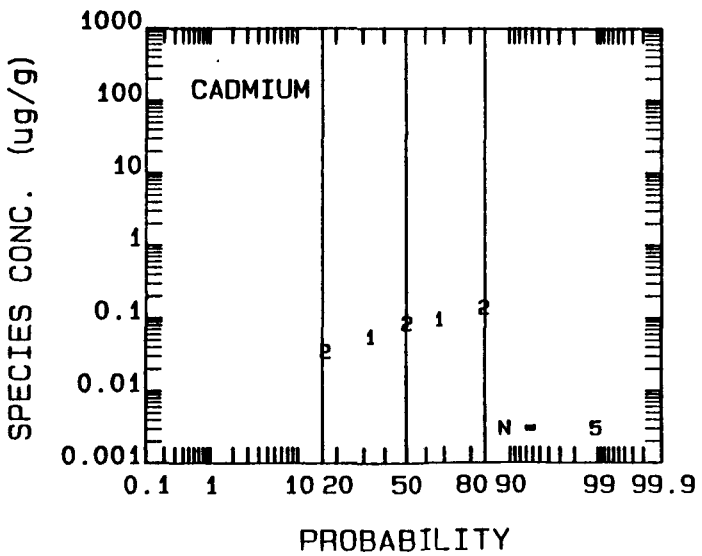




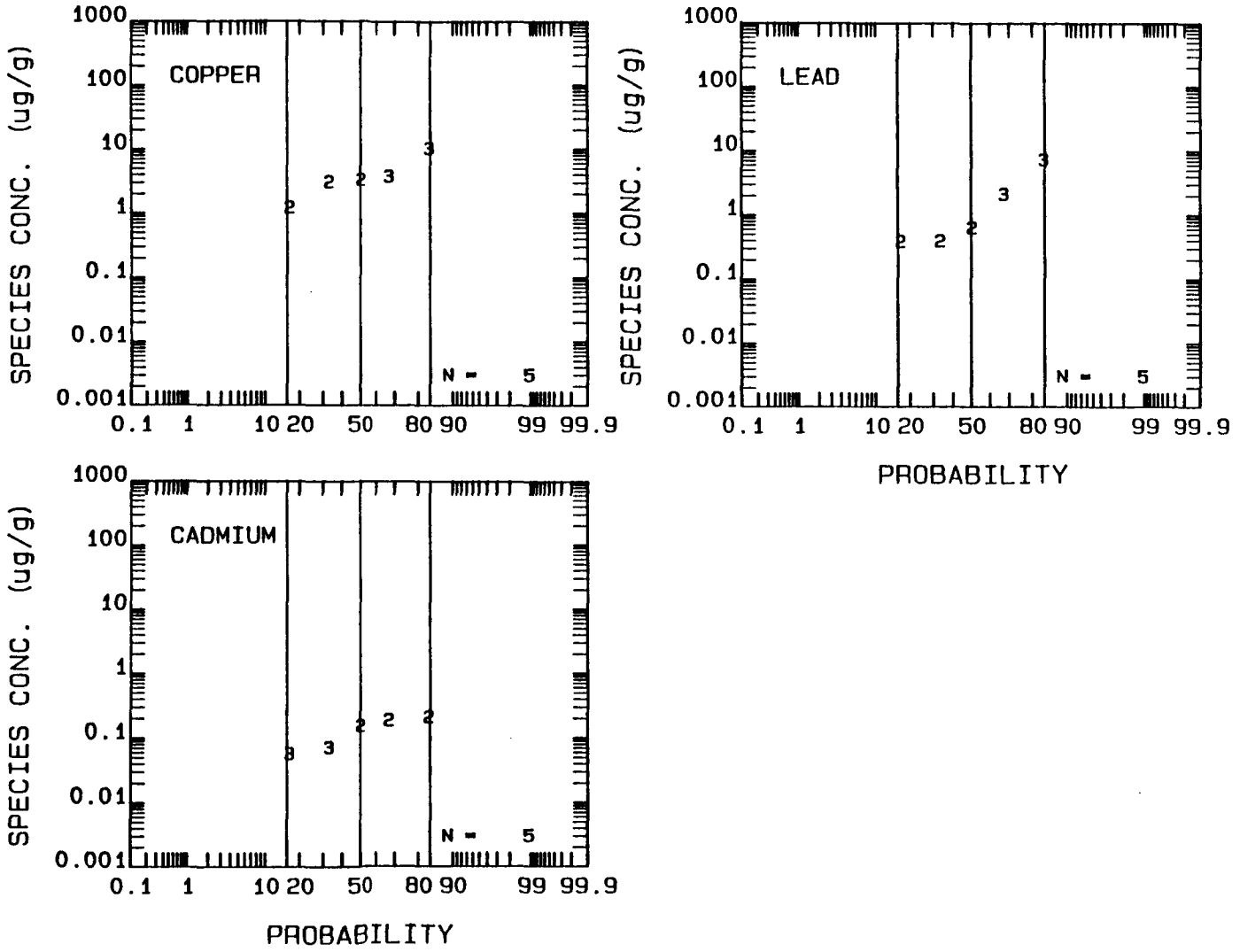
AREA 3, SPIDER CRAB, LARGE



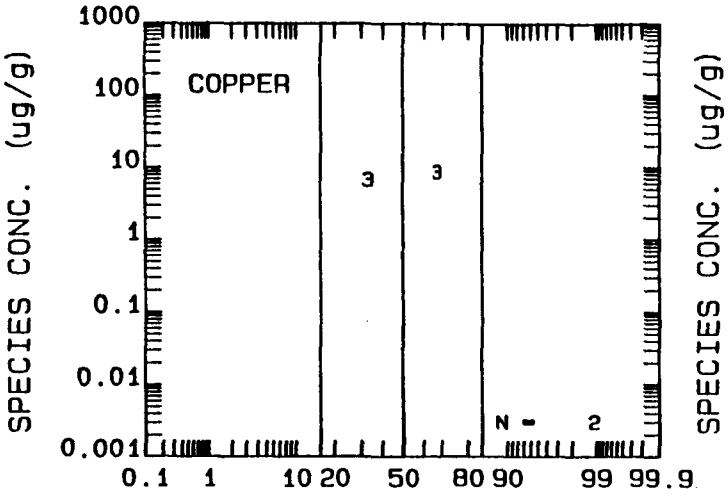


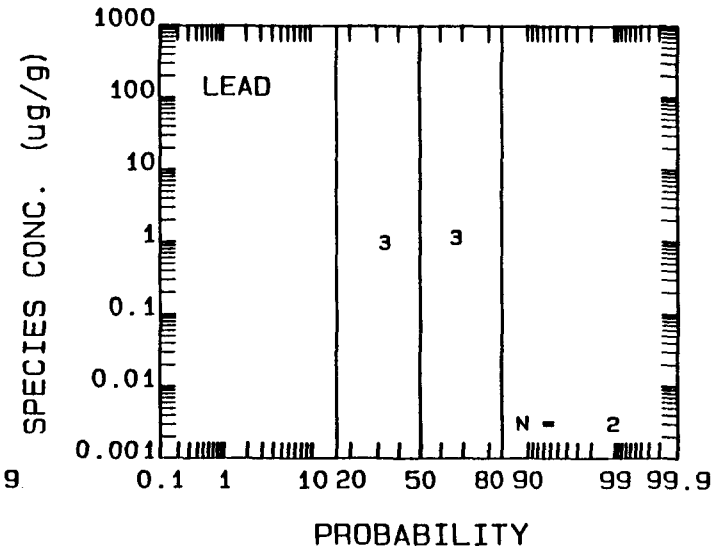


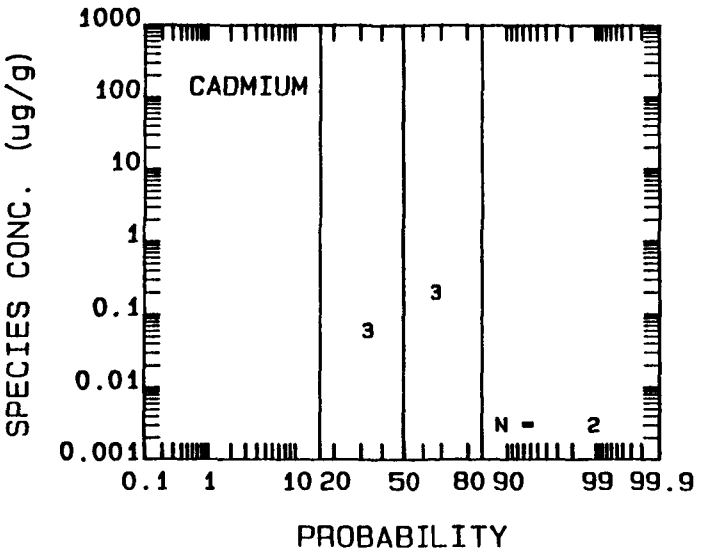
AREA 3, POLYCHAETE,



AREA 4, POLYCHAETE,







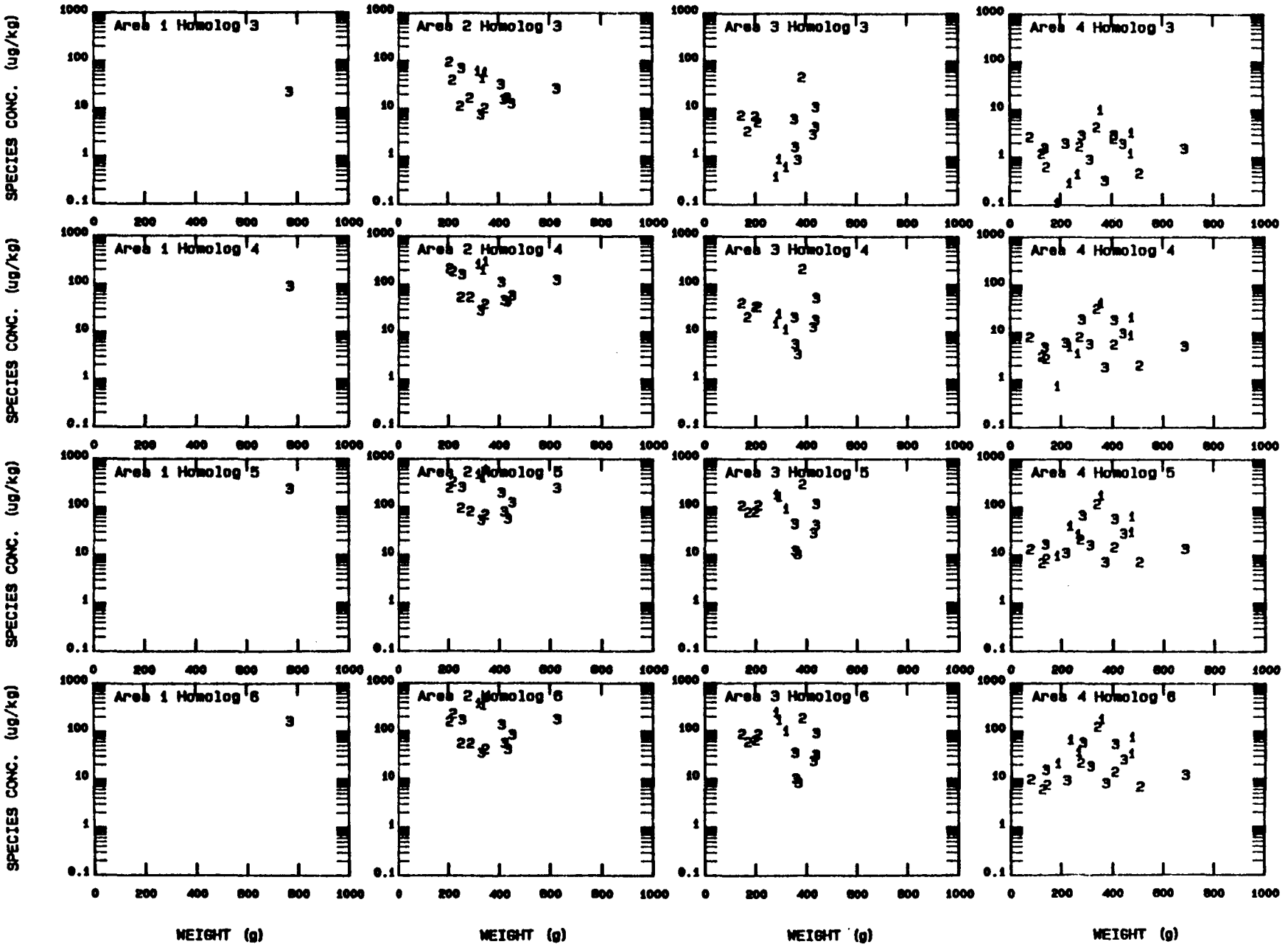
APPENDIX L

CONCENTRATION VERSUS ORGANISM WEIGHT PLOTS

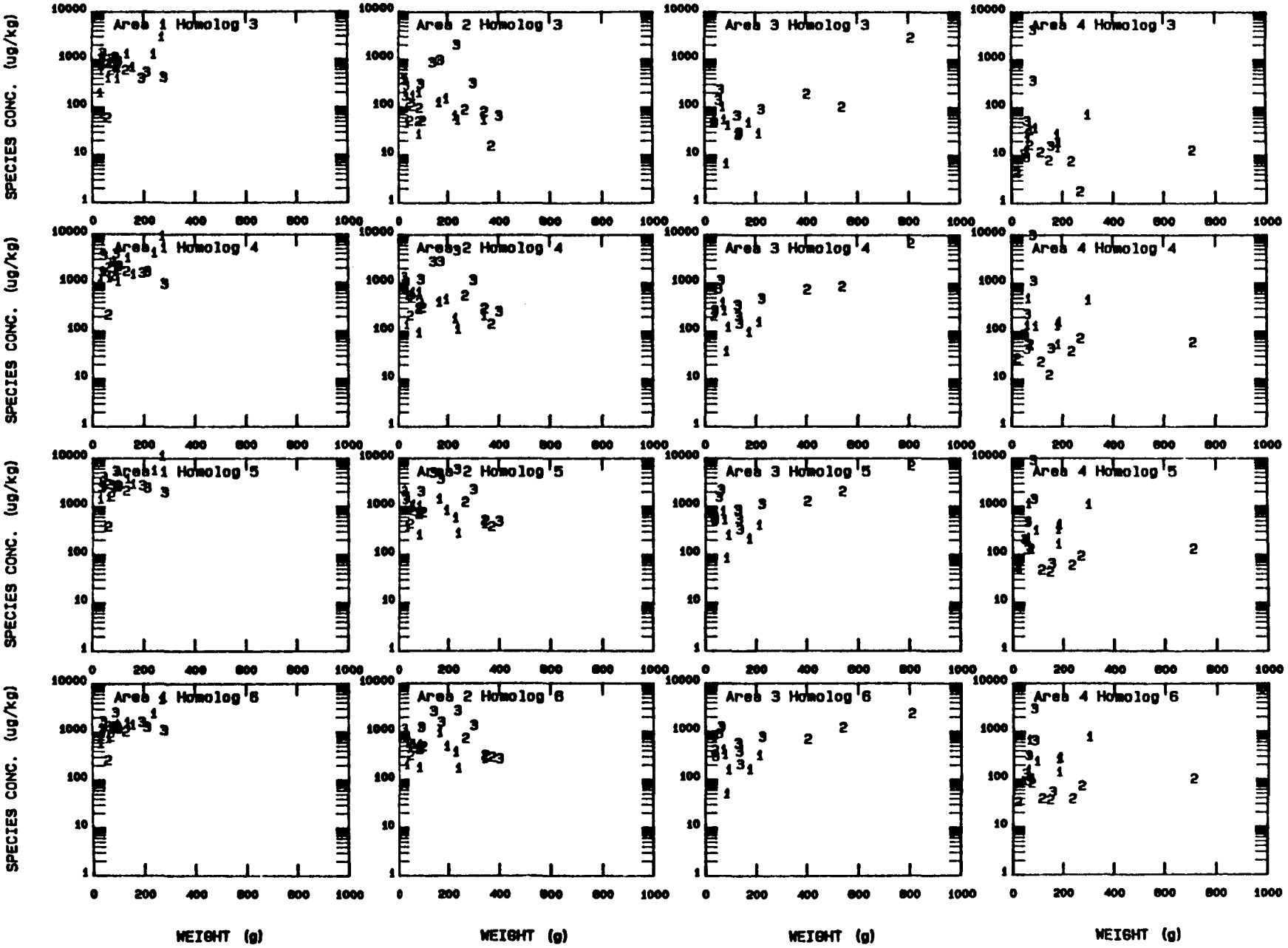
This appendix presents plots of PCB and metals concentration versus organism weight. For each species a plot is presented showing the relationship between homologs 3, 4, 5, 6, cadmium, copper and lead and organism weight. The data from the three cruises are presented on each plot with the plotting symbol being the cruise number.

PCB CONCENTRATION VERSUS WEIGHT PLOTS

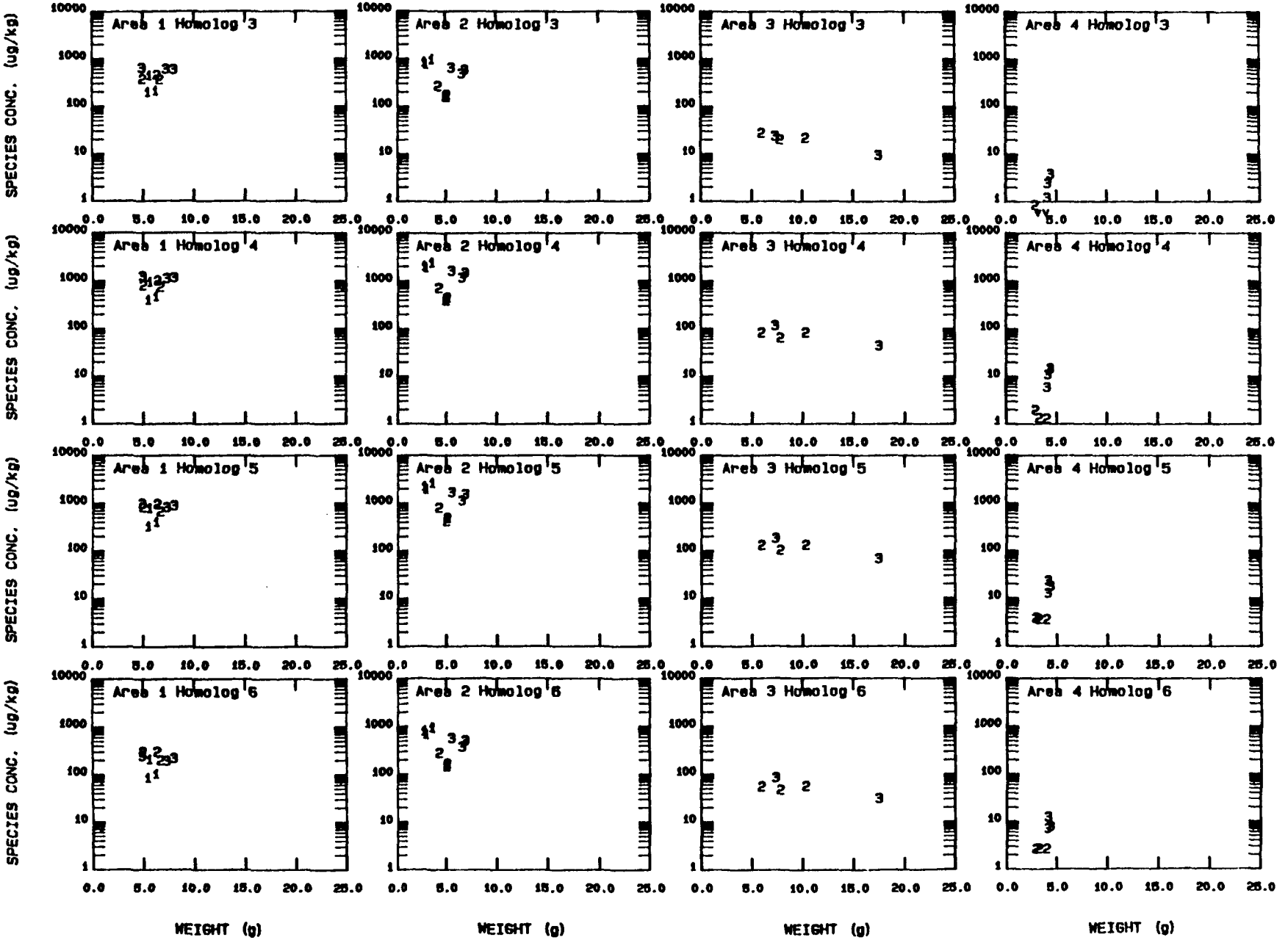
LOBSTER


Area 1 Homolog 3
Area 2 Homolog 3
Area 3 Homolog 3
Area 4 Homolog 3
Area 1 Homolog 4
Area 2 Homolog 4
Area 3 Homolog 4
Area 4 Homolog 4
Area 1 Homolog 5
Area 2 Homolog 5
Area 3 Homolog 5
Area 4 Homolog 5
Area 1 Homolog 6
Area 2 Homolog 6
Area 3 Homolog 6
Area 4 Homolog 6
SPECIES CONC. (ug/kg)
WEIGHT (g)

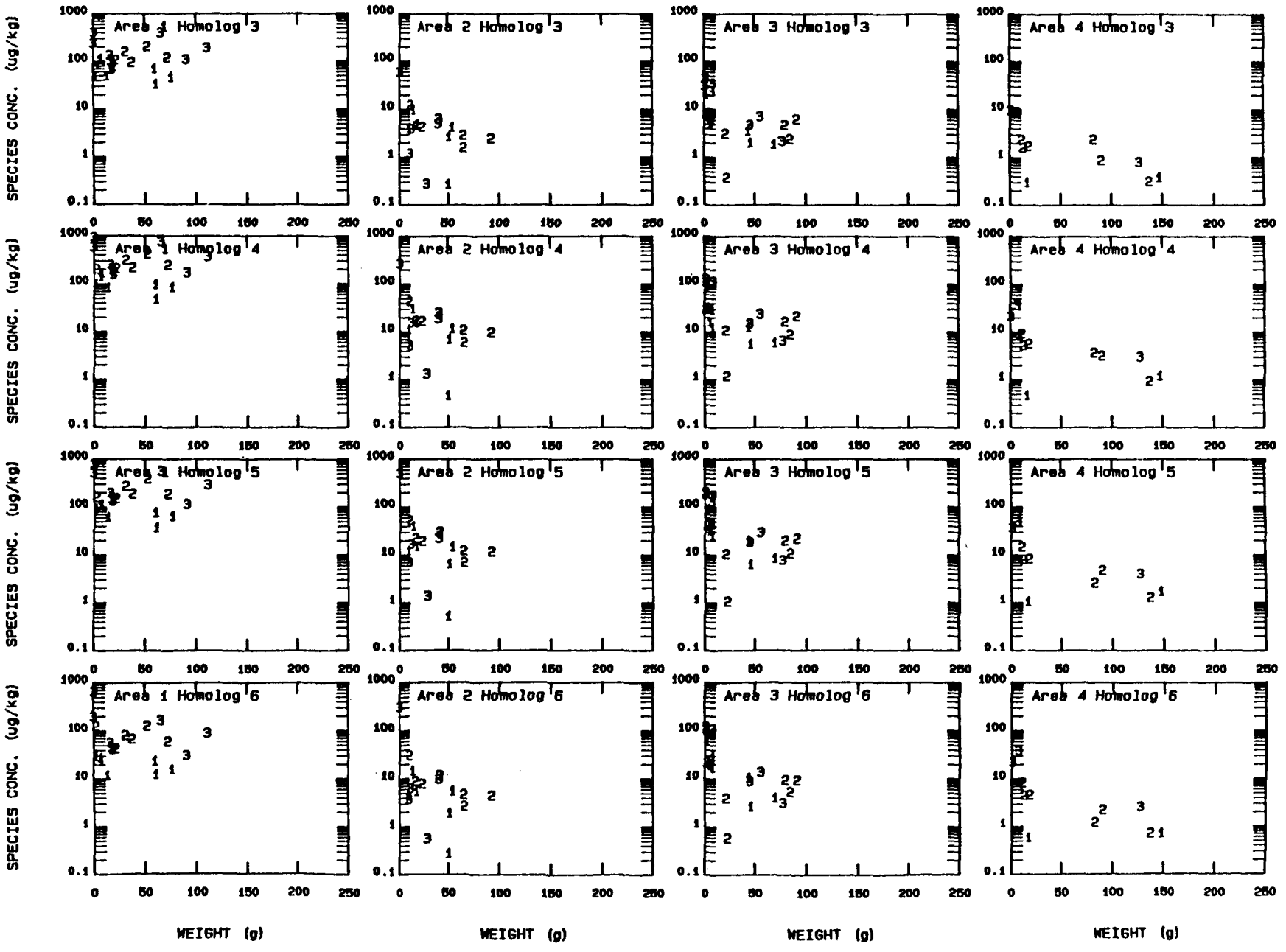
FLOUNDER


Area 1 Homolog 3
Area 2 Homolog 3
Area 3 Homolog 3
Area 4 Homolog 3
Area 1 Homolog 4
Area 2 Homolog 4
Area 3 Homolog 4
Area 4 Homolog 4
Area 1 Homolog 5
Area 2 Homolog 5
Area 3 Homolog 5
Area 4 Homolog 5
Area 1 Homolog 6
Area 2 Homolog 6
Area 3 Homolog 6
Area 4 Homolog 6
SPECIES CONC. (ug/kg)
WEIGHT (g)

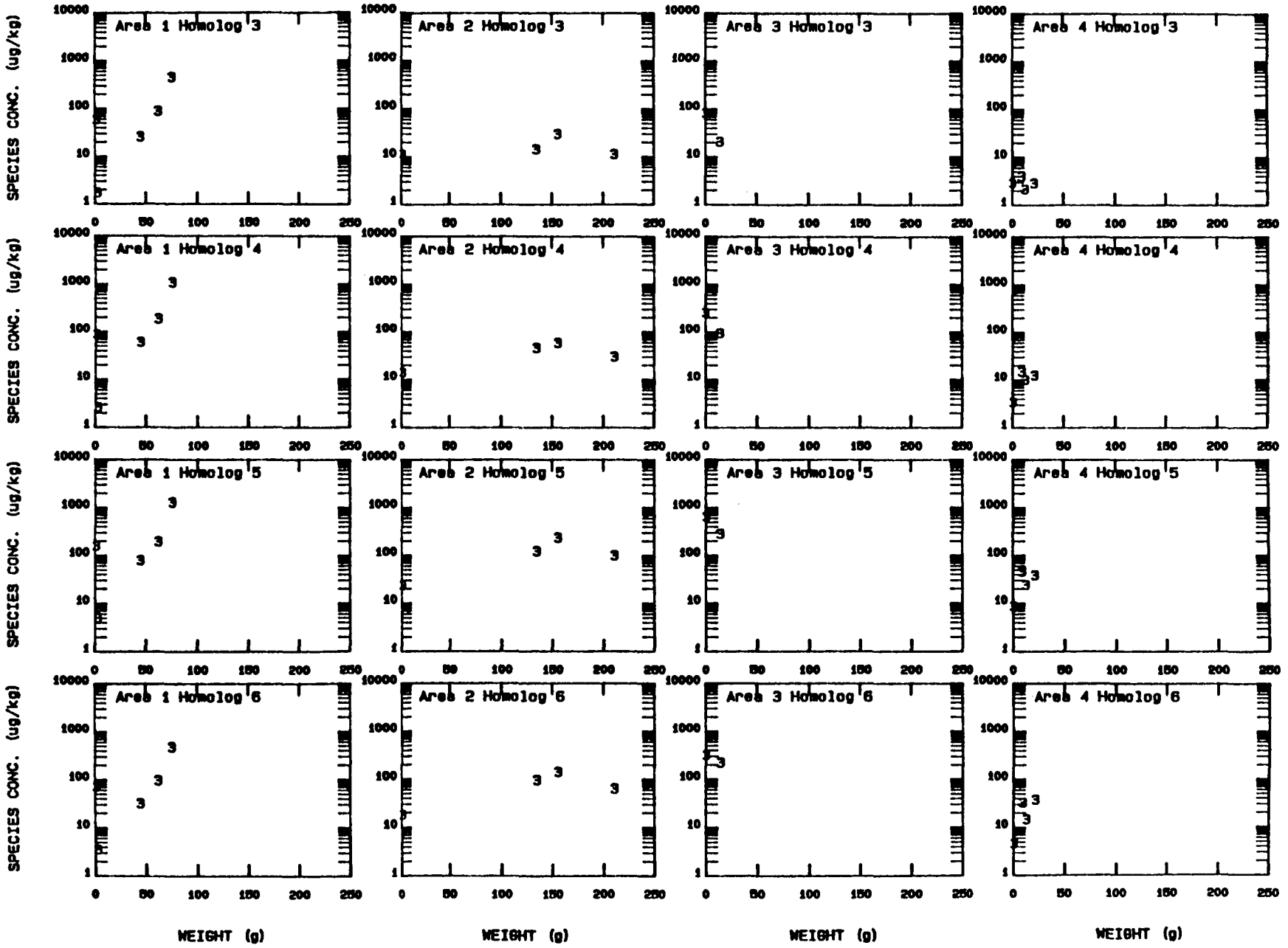
MUSSEL


Area 1 Homolog 3
Area 2 Homolog 3
Area 3 Homolog 3
Area 4 Homolog 3
Area 1 Homolog 4
Area 2 Homolog 4
Area 3 Homolog 4
Area 4 Homolog 4
Area 1 Homolog 5
Area 2 Homolog 5
Area 3 Homolog 5
Area 4 Homolog 5
Area 1 Homolog 6
Area 2 Homolog 6
Area 3 Homolog 6
Area 4 Homolog 6
SPECIES CONC. (ug/kg)
WEIGHT (g)

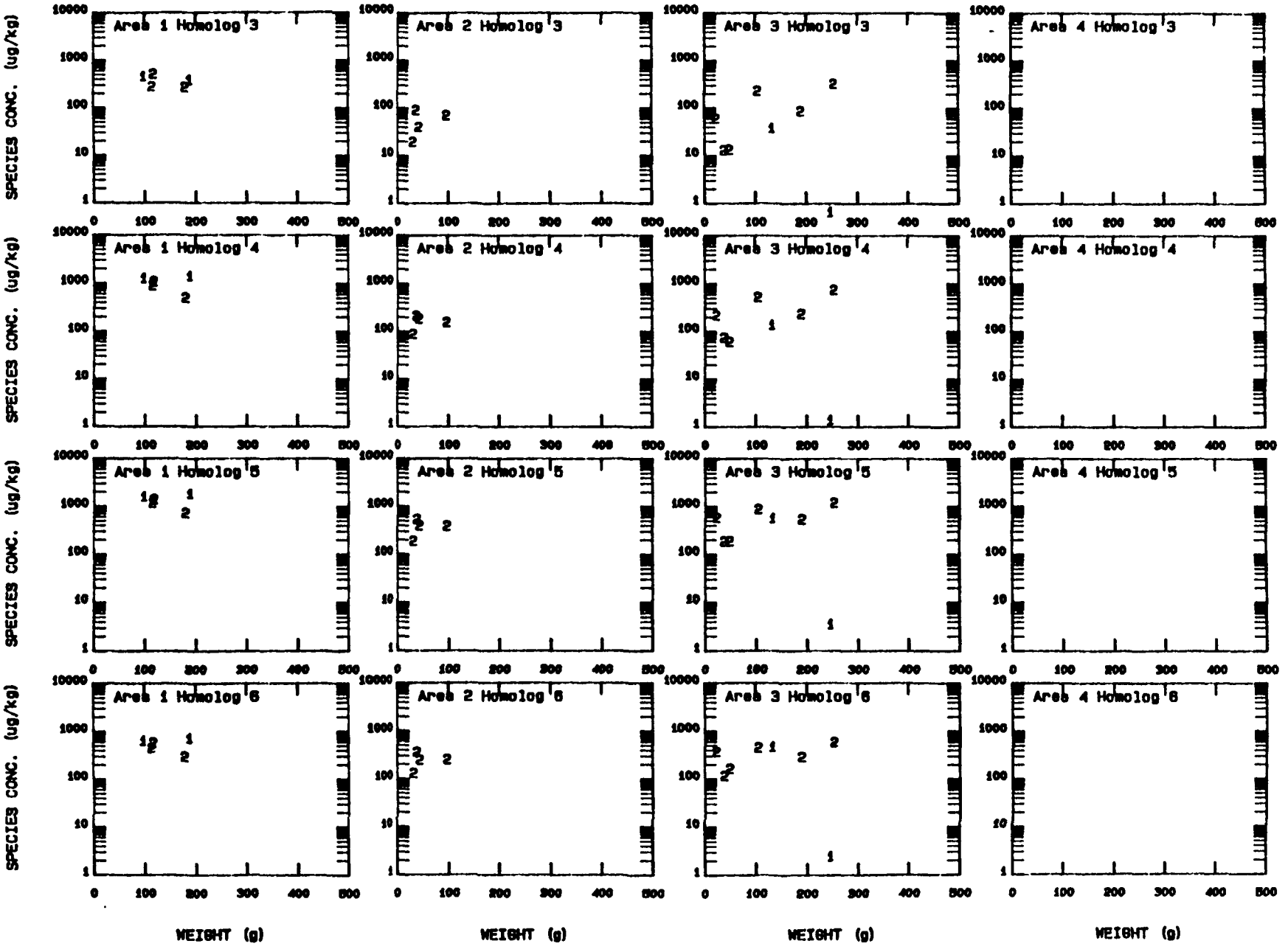
CLAM


Area 1 Homolog 3
Area 2 Homolog 3
Area 3 Homolog 3
Area 4 Homolog 3
Area 1 Homolog 4
Area 2 Homolog 4
Area 3 Homolog 4
Area 4 Homolog 4
Area 1 Homolog 5
Area 2 Homolog 5
Area 3 Homolog 5
Area 4 Homolog 5
Area 1 Homolog 6
Area 2 Homolog 6
Area 3 Homolog 6
Area 4 Homolog 6
SPECIES CONC. (ug/kg)
WEIGHT (g)

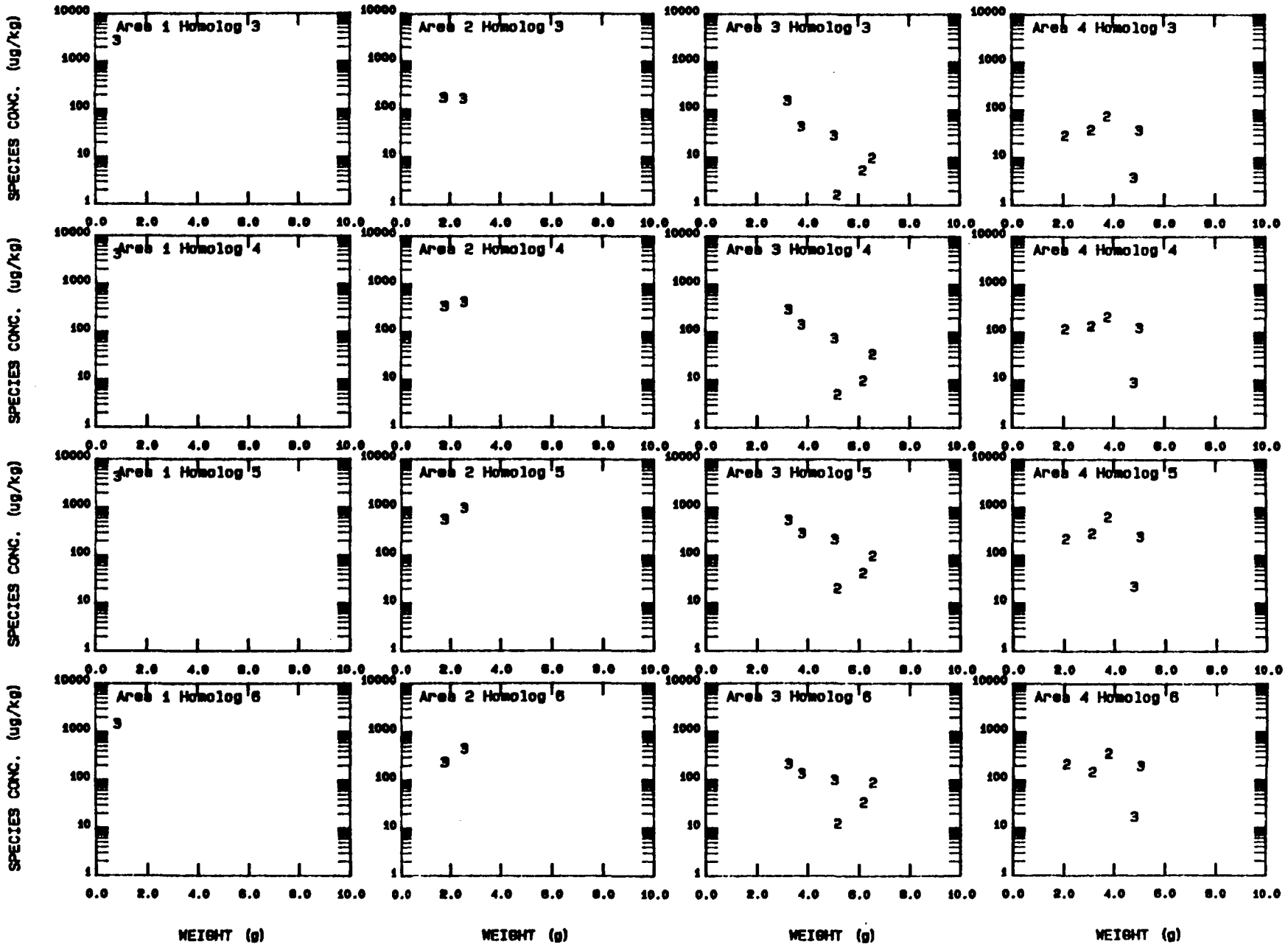
GREEN CRAB


Area 1 Homolog 3
Area 2 Homolog 3
Area 3 Homolog 3
Area 4 Homolog 3
Area 1 Homolog 4
Area 2 Homolog 4
Area 3 Homolog 4
Area 4 Homolog 4
Area 1 Homolog 5
Area 2 Homolog 5
Area 3 Homolog 5
Area 4 Homolog 5
Area 1 Homolog 6
Area 2 Homolog 6
Area 3 Homolog 6
Area 4 Homolog 6
SPECIES CONC. (ug/kg)
WEIGHT (g)

SPIDER CRAB

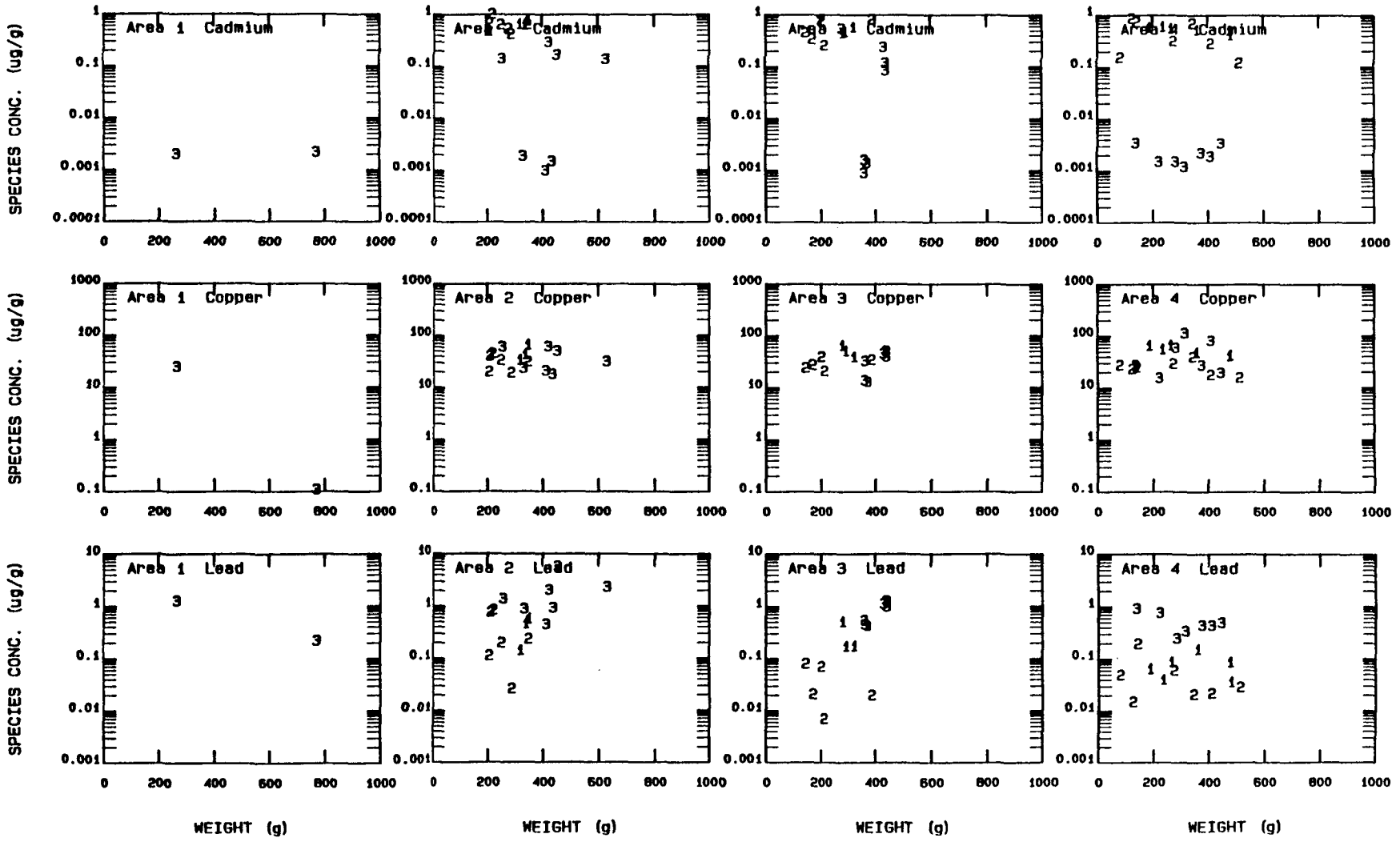

Area 1 Homolog 3
Area 2 Homolog 3
Area 3 Homolog 3
Area 4 Homolog 3
Area 1 Homolog 4
Area 2 Homolog 4
Area 3 Homolog 4
Area 4 Homolog 4
Area 1 Homolog 5
Area 2 Homolog 5
Area 3 Homolog 5
Area 4 Homolog 5
Area 1 Homolog 6
Area 2 Homolog 6
Area 3 Homolog 6
Area 4 Homolog 6
SPECIES CONC. (ug/kg)
WEIGHT (g)

POLYCHAETES

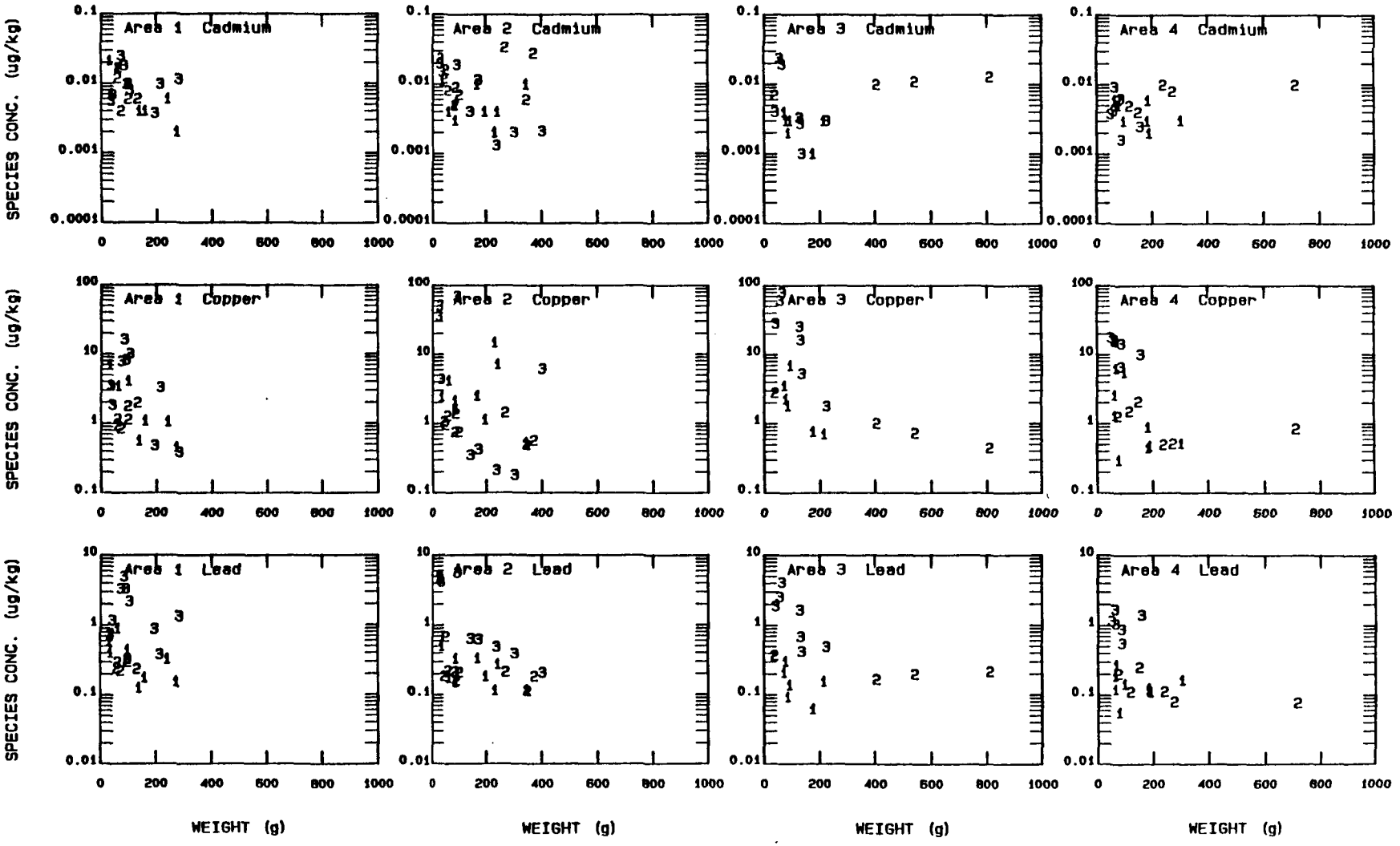


METALS CONCENTRATION VERSUS WEIGHT PLOTS

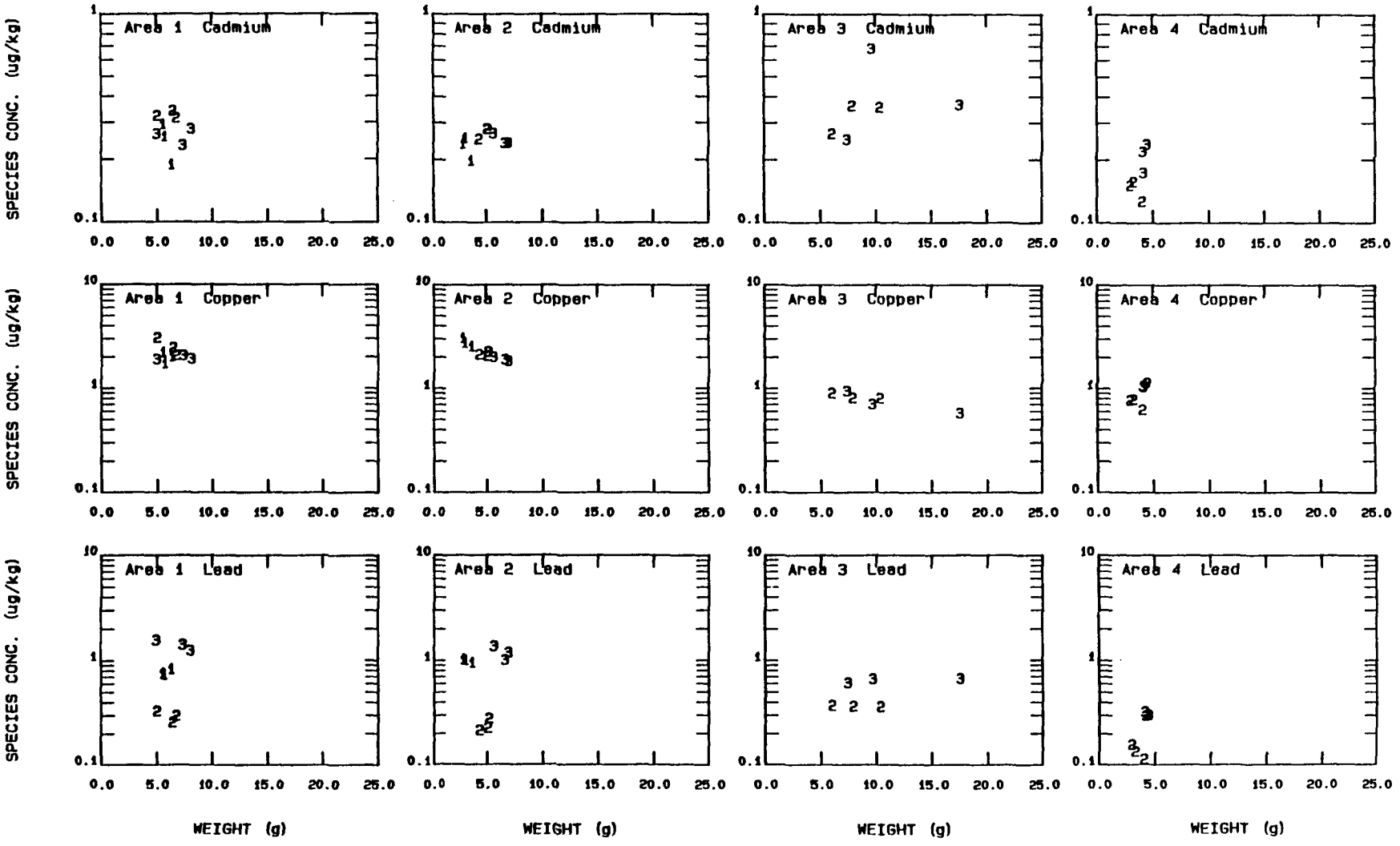
LOBSTER


Area 1 Cadmium
Area 2 Cadmium
Area 3 Cadmium
Area 4 Cadmium
Area 1 Copper
Area 2 Copper
Area 3 Copper
Area 4 Copper
Area 1 Lead
Area 2 Lead
Area 3 Lead
Area 4 Lead
SPECIES CONC. (ug/g)
WEIGHT (g)

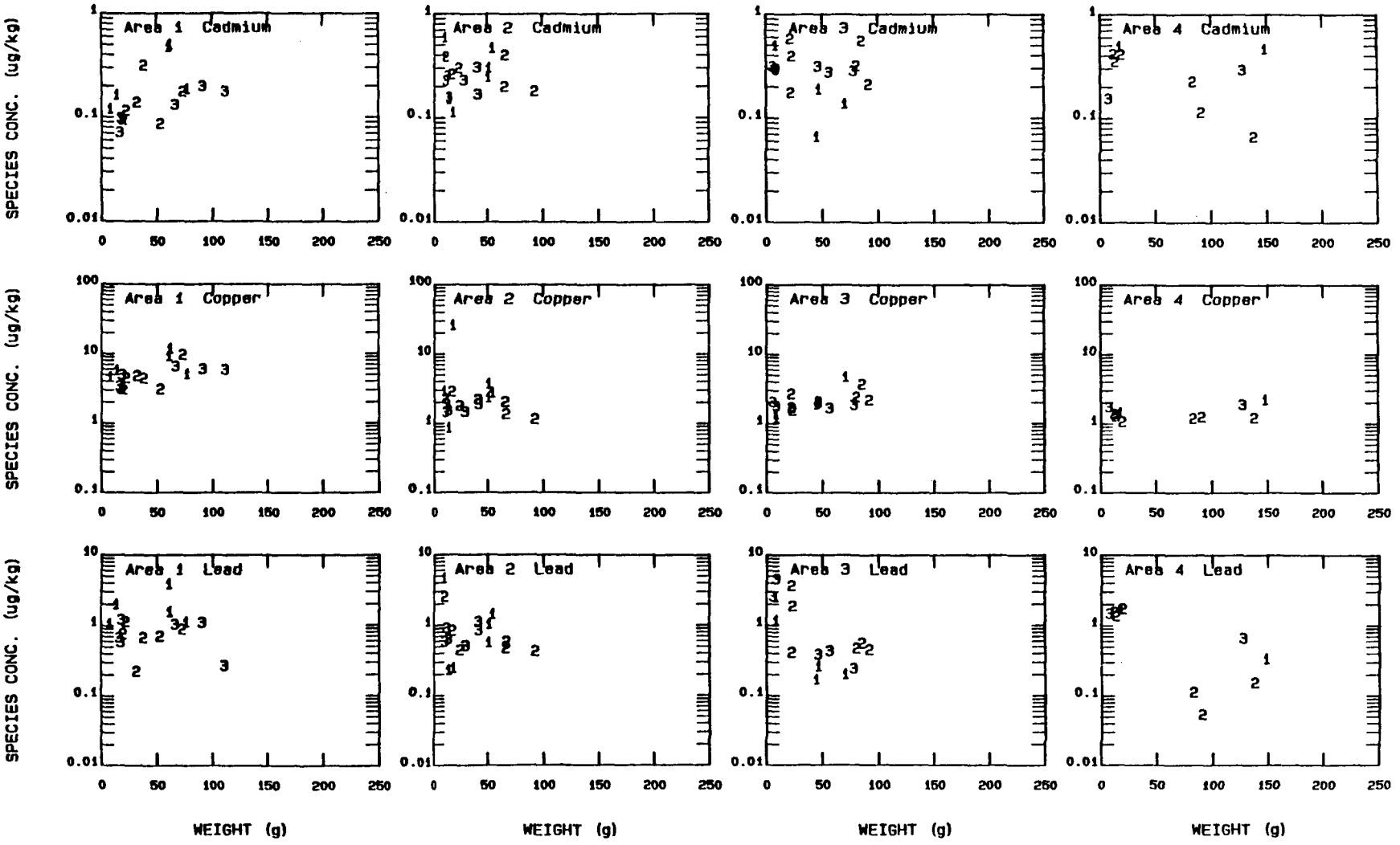
FLOUNDER


Area 1 Cadmium
Area 2 Cadmium
Area 3 Cadmium
Area 4 Cadmium
Area 1 Copper
Area 2 Copper
Area 3 Copper
Area 4 Copper
Area 1 Lead
Area 2 Lead
Area 3 Lead
Area 4 Lead
SPECIES CONC. (ug/kg)
WEIGHT (g)

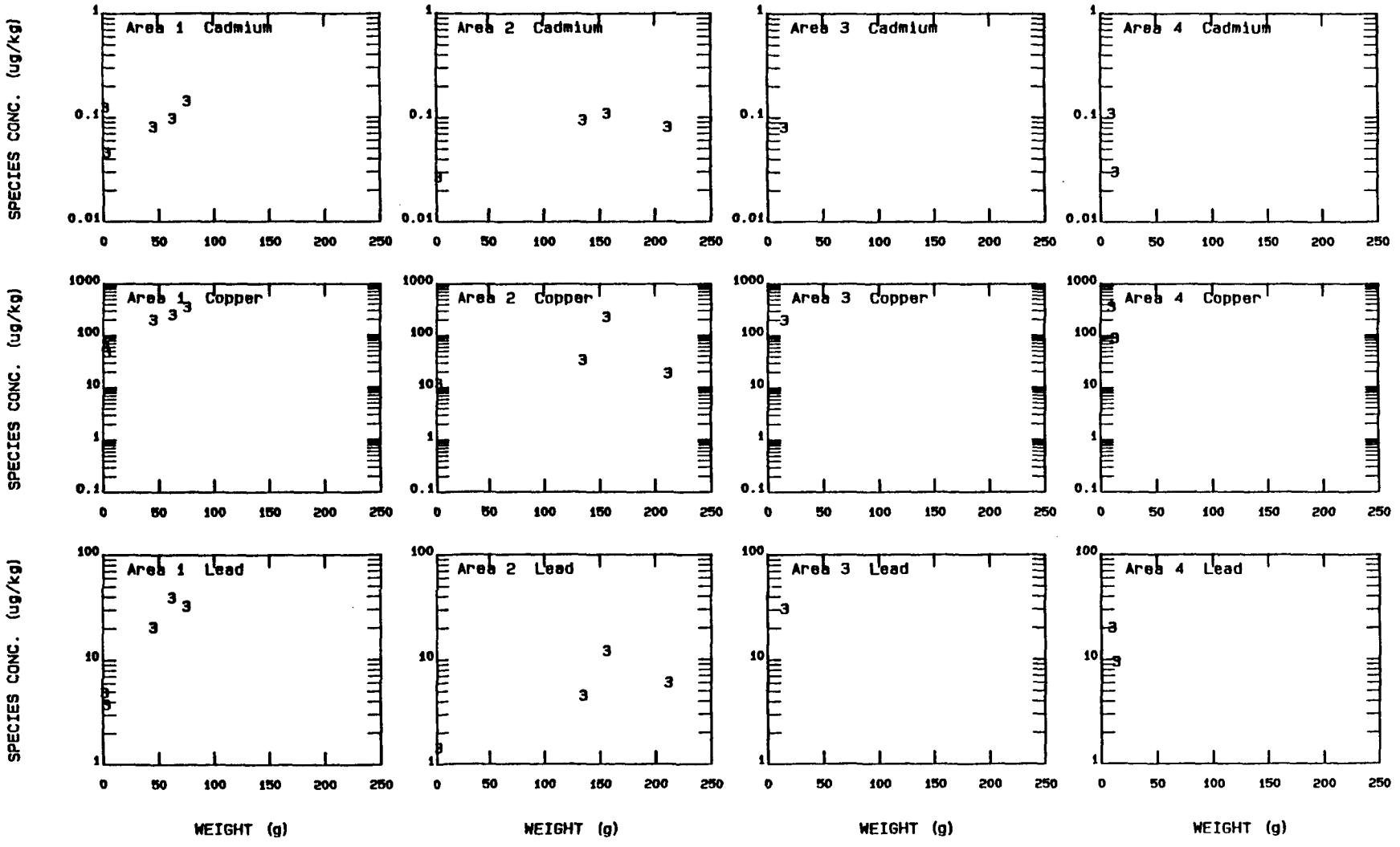
MUSSEL


Area 1 Cadmium
Area 2 Cadmium
Area 3 Cadmium
Area 4 Cadmium
Area 1 Copper
Area 2 Copper
Area 3 Copper
Area 4 Copper
Area 1 Lead
Area 2 Lead
Area 3 Lead
Area 4 Lead
SPECIES CONC. (ug/kg)
WEIGHT (g)
0.1
1
10
0.0
5.0
10.0
15.0
20.0
25.0

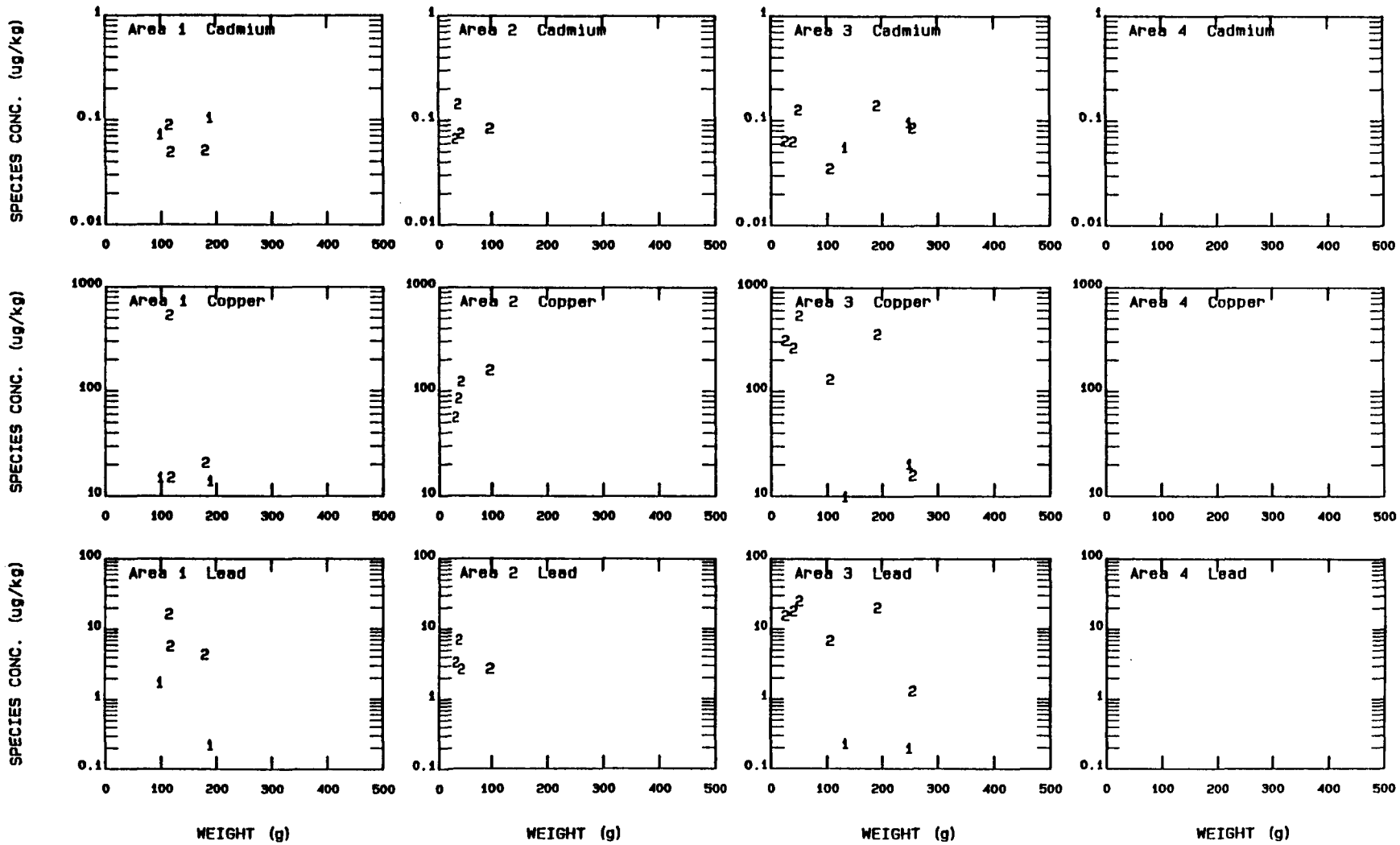
CLAM


Area 1 Cadmium
Area 2 Cadmium
Area 3 Cadmium
Area 4 Cadmium
Area 1 Copper
Area 2 Copper
Area 3 Copper
Area 4 Copper
Area 1 Lead
Area 2 Lead
Area 3 Lead
Area 4 Lead
SPECIES CONC. (ug/kg)
WEIGHT (g)

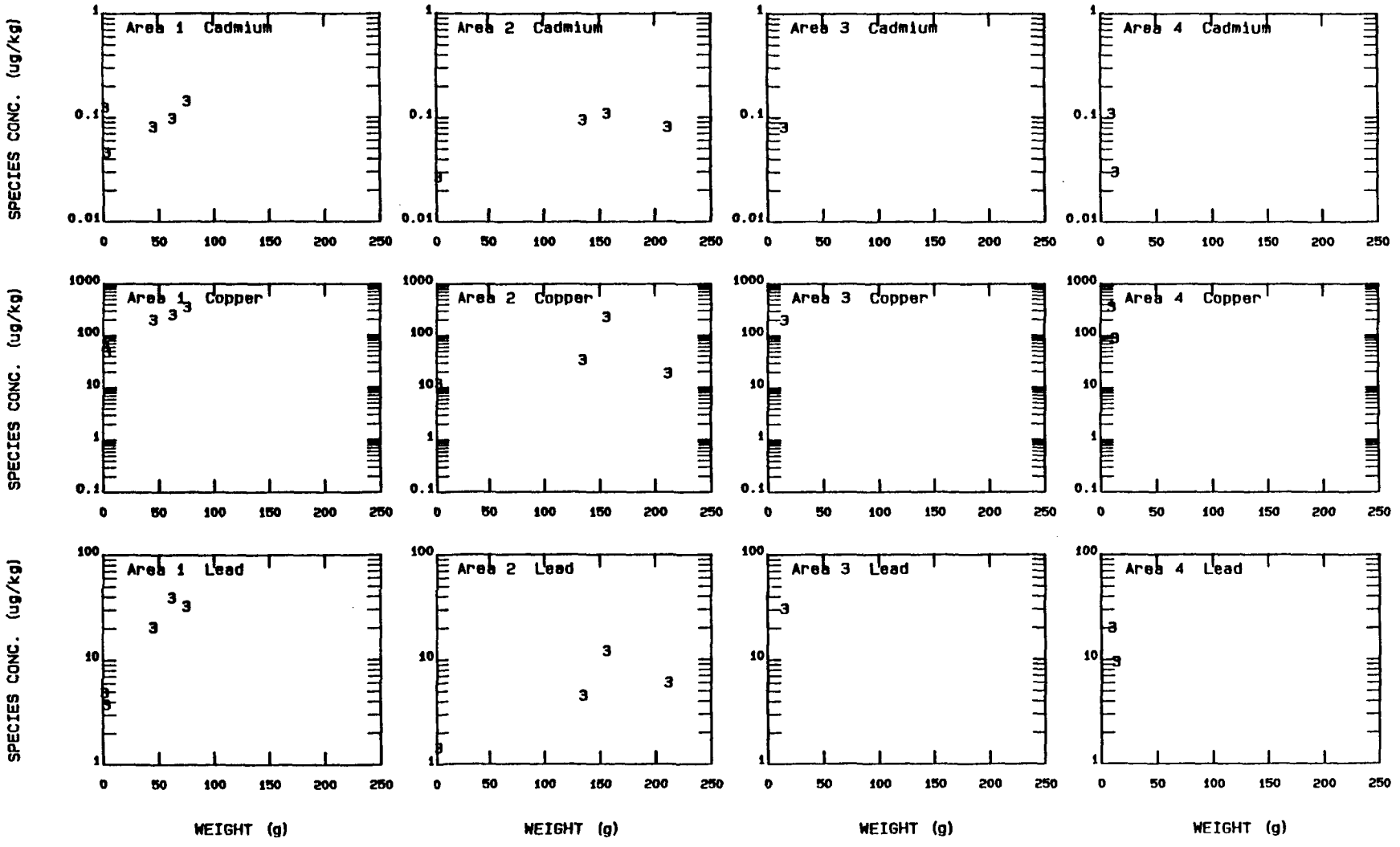
GREEN CRAB


Area 1 Cadmium
Area 2 Cadmium
Area 3 Cadmium
Area 4 Cadmium
Area 1 Copper
Area 2 Copper
Area 3 Copper
Area 4 Copper
Area 1 Lead
Area 2 Lead
Area 3 Lead
Area 4 Lead
SPECIES CONC. (ug/kg)
WEIGHT (g)

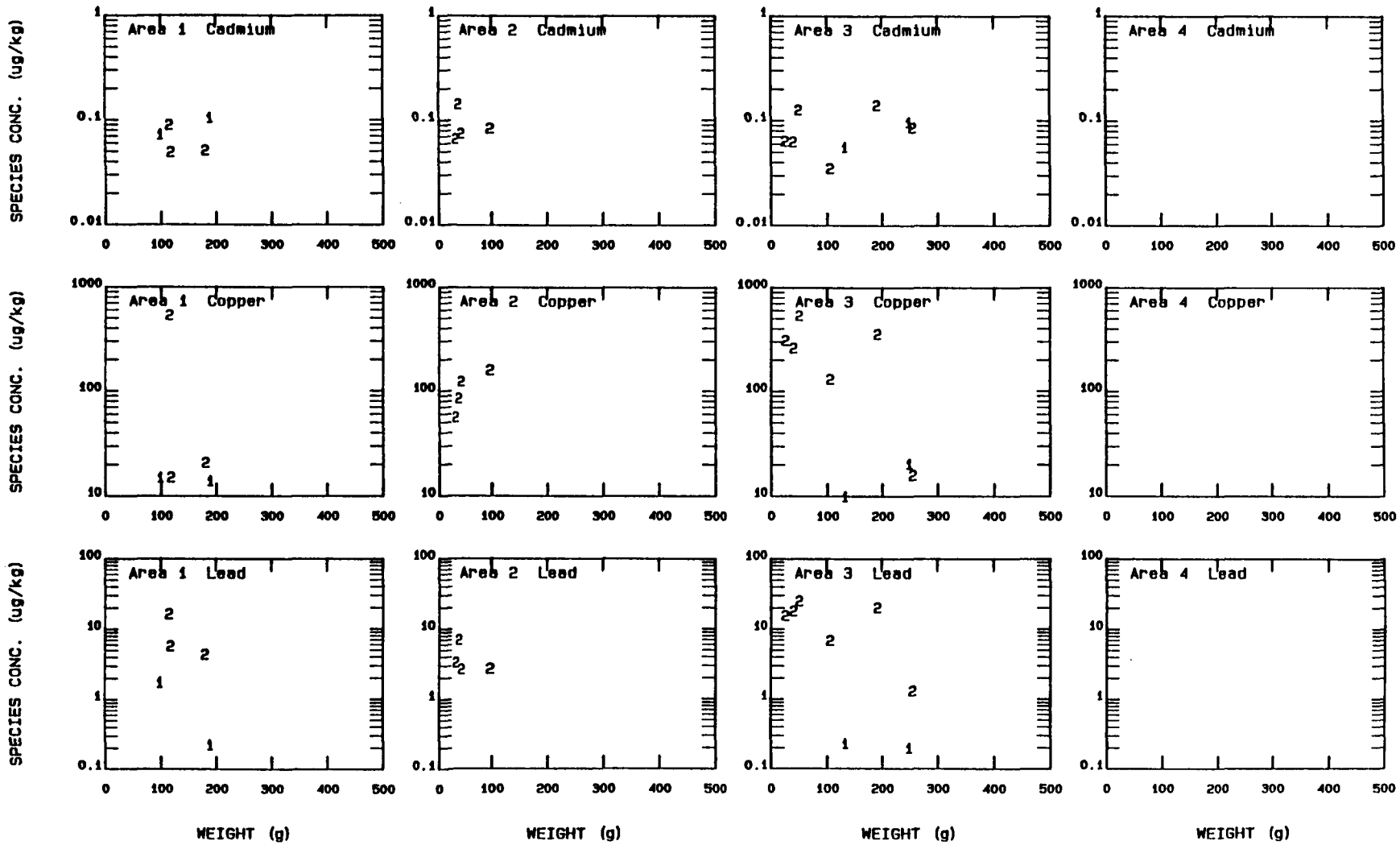
SPIDER CRAB


Area 1 Cadmium
Area 2 Cadmium
Area 3 Cadmium
Area 4 Cadmium
Area 1 Copper
Area 2 Copper
Area 3 Copper
Area 4 Copper
Area 1 Lead
Area 2 Lead
Area 3 Lead
Area 4 Lead
SPECIES CONC. (ug/kg)
WEIGHT (g)

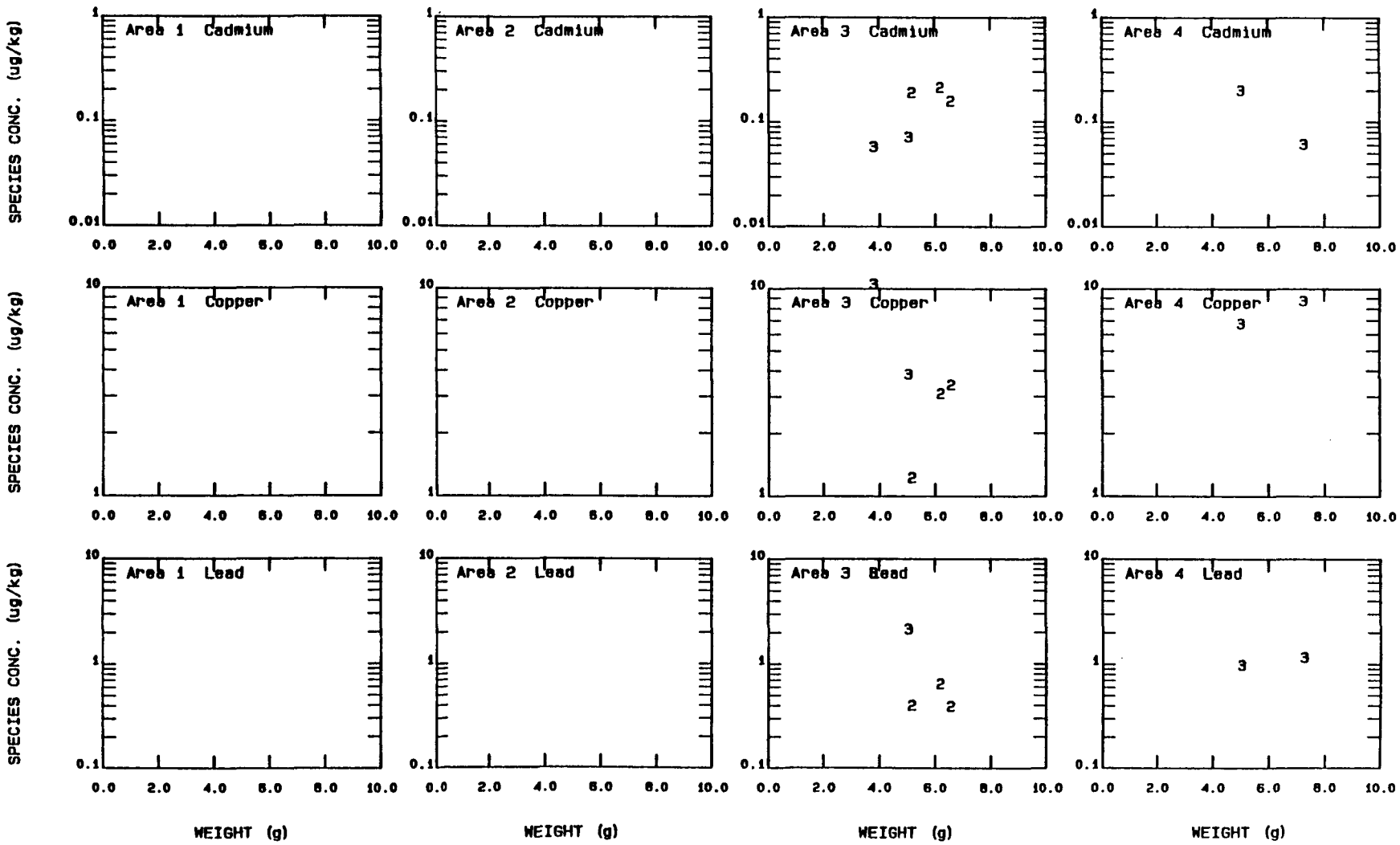
GREEN CRAB


Area 1 Cadmium
Area 2 Cadmium
Area 3 Cadmium
Area 4 Cadmium
Area 1 Copper
Area 2 Copper
Area 3 Copper
Area 4 Copper
Area 1 Lead
Area 2 Lead
Area 3 Lead
Area 4 Lead
SPECIES CONC. (ug/kg)
WEIGHT (g)

SPIDER CRAB


Area 1 Cadmium
Area 2 Cadmium
Area 3 Cadmium
Area 4 Cadmium
Area 1 Copper
Area 2 Copper
Area 3 Copper
Area 4 Copper
Area 1 Lead
Area 2 Lead
Area 3 Lead
Area 4 Lead
SPECIES CONC. (ug/kg)
WEIGHT (g)

POLYCHAETES



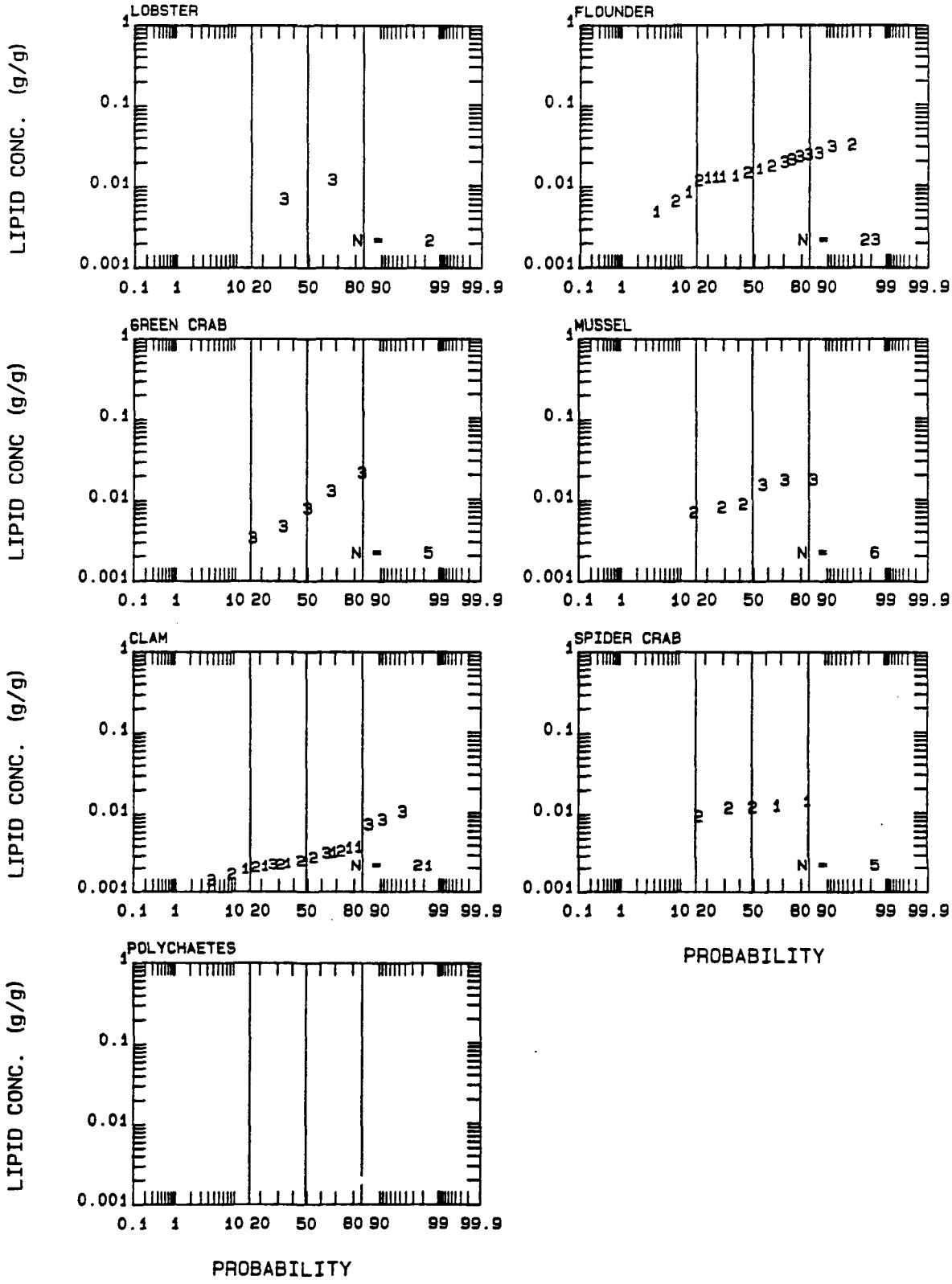
APPENDIX M

LIPID DATA

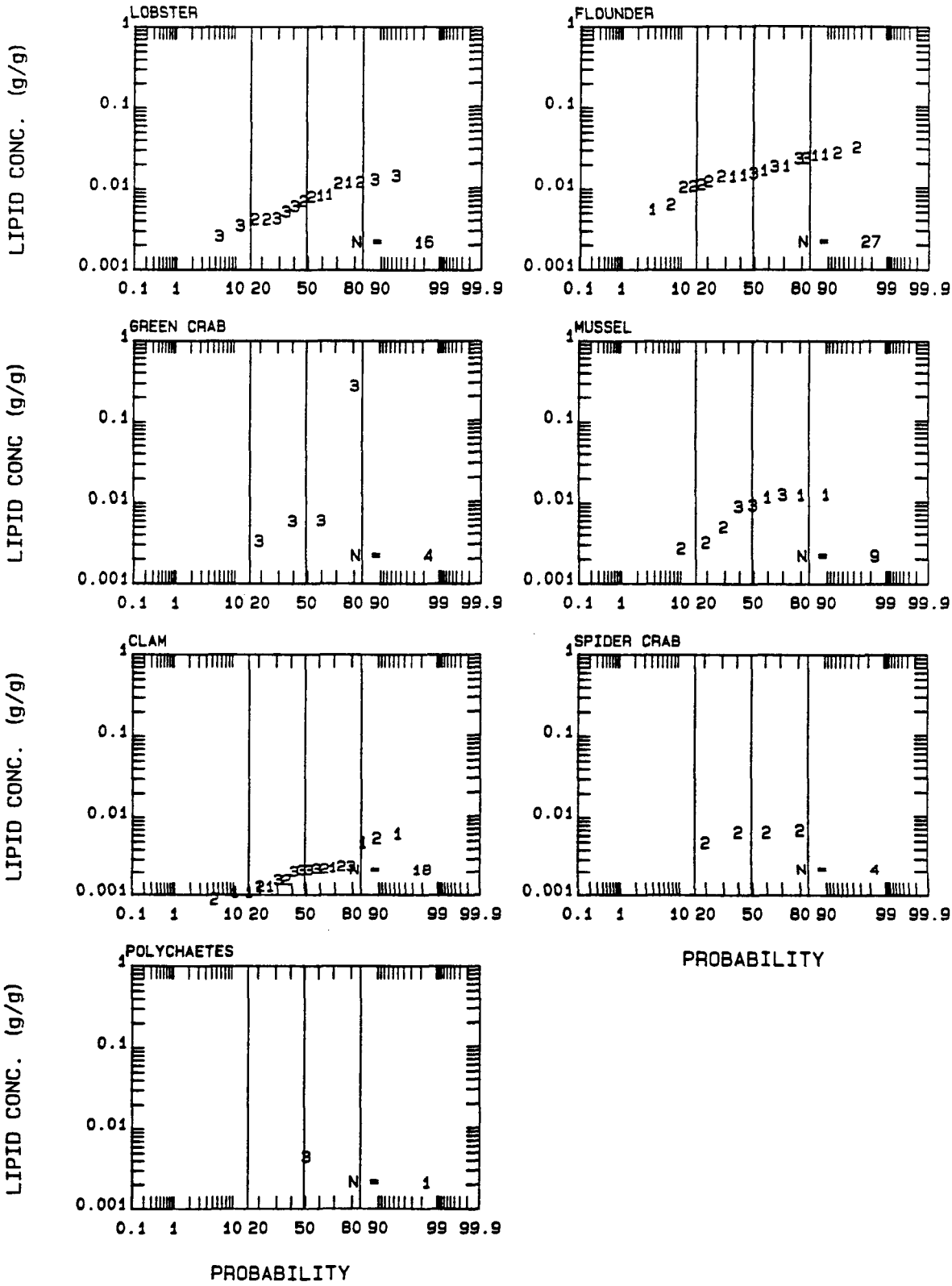
This appendix includes the probability distributions of lipids in each species by area. Also included are plots for each area of the lipid concentration versus organism weight. The data from the three cruises are plotted with the plotting symbol being the cruise number.

LIPID PROBABILITY DISTRIBUTIONS

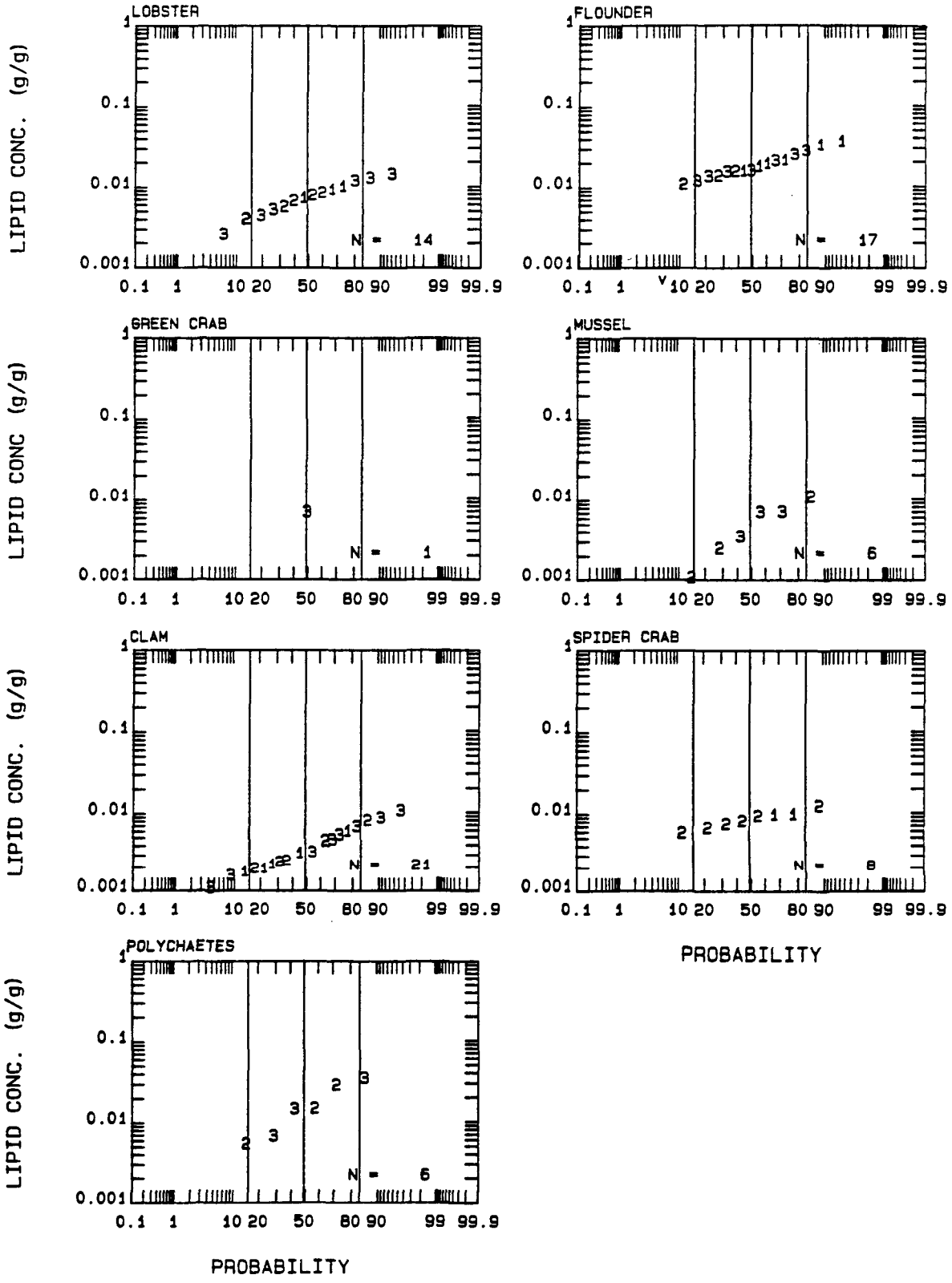
AREA 1


LOBSTER
N = 2
FLOUNDER
N = 23
GREEN CRAB
N = 5
MUSSEL
N = 6
CLAM
N = 21
SPIDER CRAB
N = 5
POLYCHAETES
LIPID CONC. (g/g)
LIPID CONC (g/g)
1
0.1
0.01
0.001
0.1 1 10 20 50 80 90 99 99.9
PROBABILITY

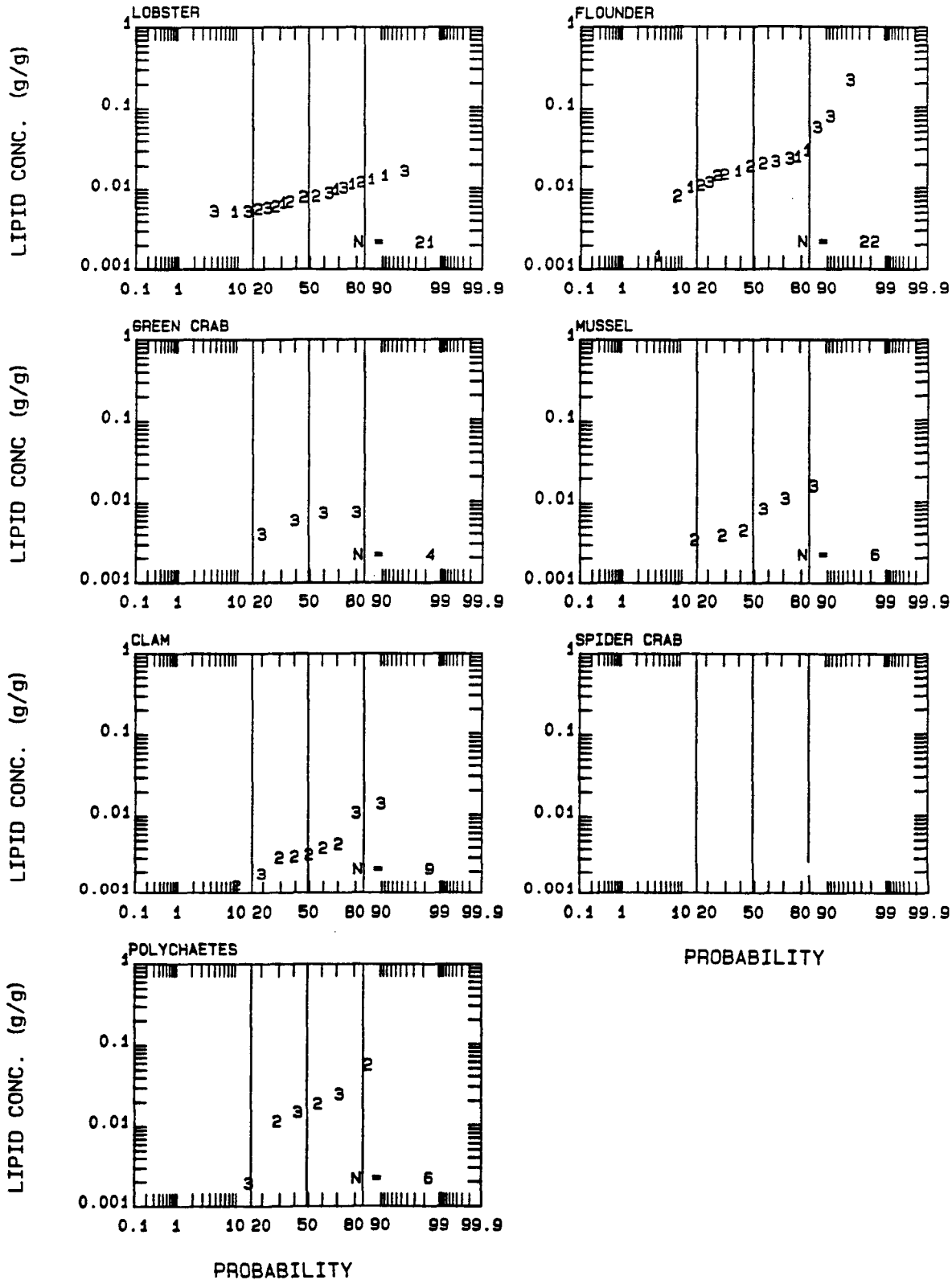
AREA 2


LOBSTER
N = 16
FLOUNDER
N = 27
GREEN CRAB
N = 4
MUSSEL
N = 9
CLAM
N = 18
SPIDER CRAB
N = 4
POLYCHAETES
N = 1
LIPID CONC. (g/g)
LIPID CONC (g/g)
1
0.1
0.01
0.001
0.1 1 10 20 50 80 90 99 99.9
PROBABILITY

AREA 3

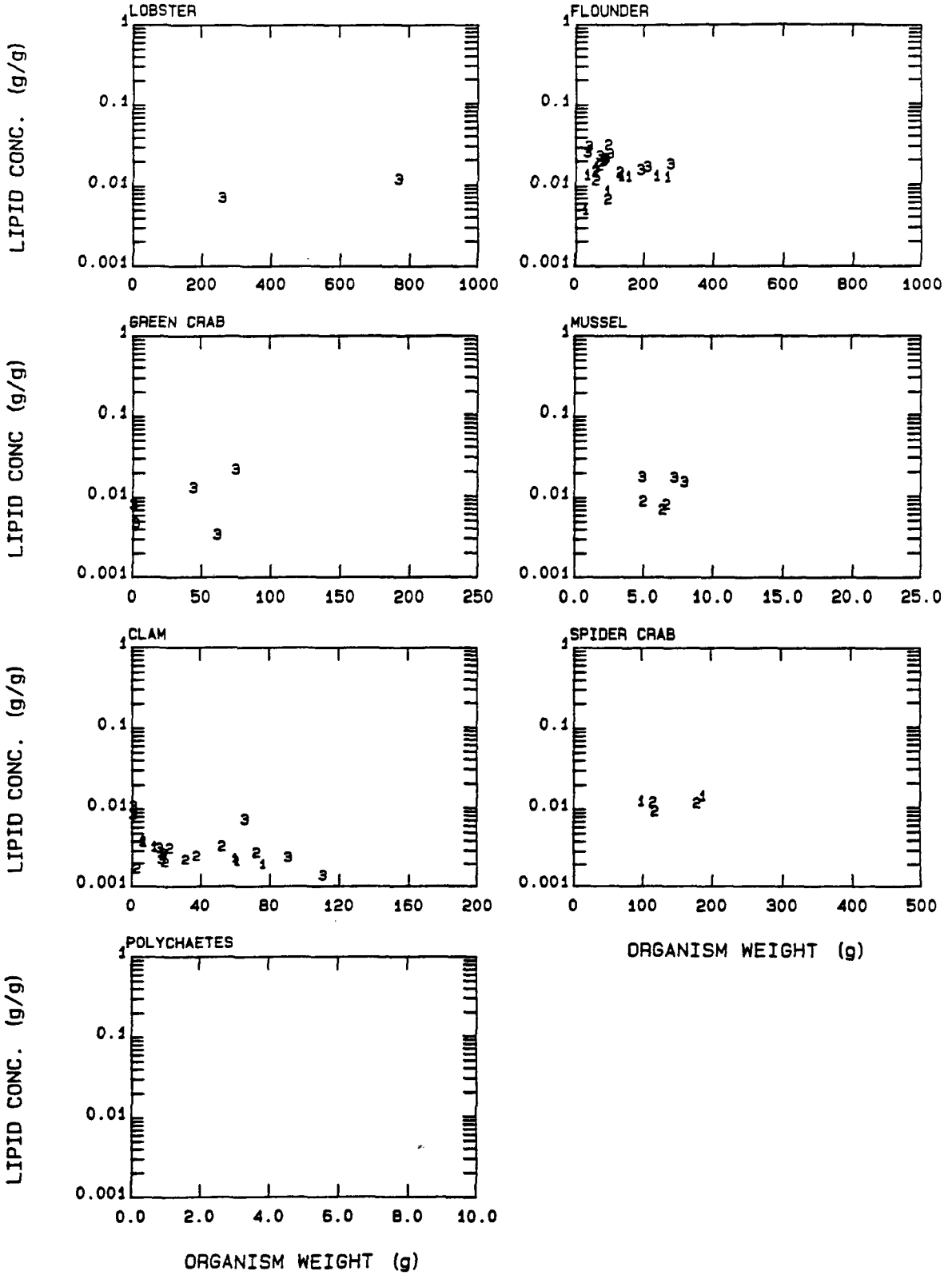

LOBSTER
N = 14
FLOUNDER
N = 17
GREEN CRAB
N = 1
MUSSEL
N = 6
CLAM
N = 21
SPIDER CRAB
N = 8
POLYCHAETES
N = 6
LIPID CONC. (g/g)
LIPID CONC (g/g)
1
0.1
0.01
0.001
0.1 1 10 20 50 80 90 99 99.9
PROBABILITY

AREA 4

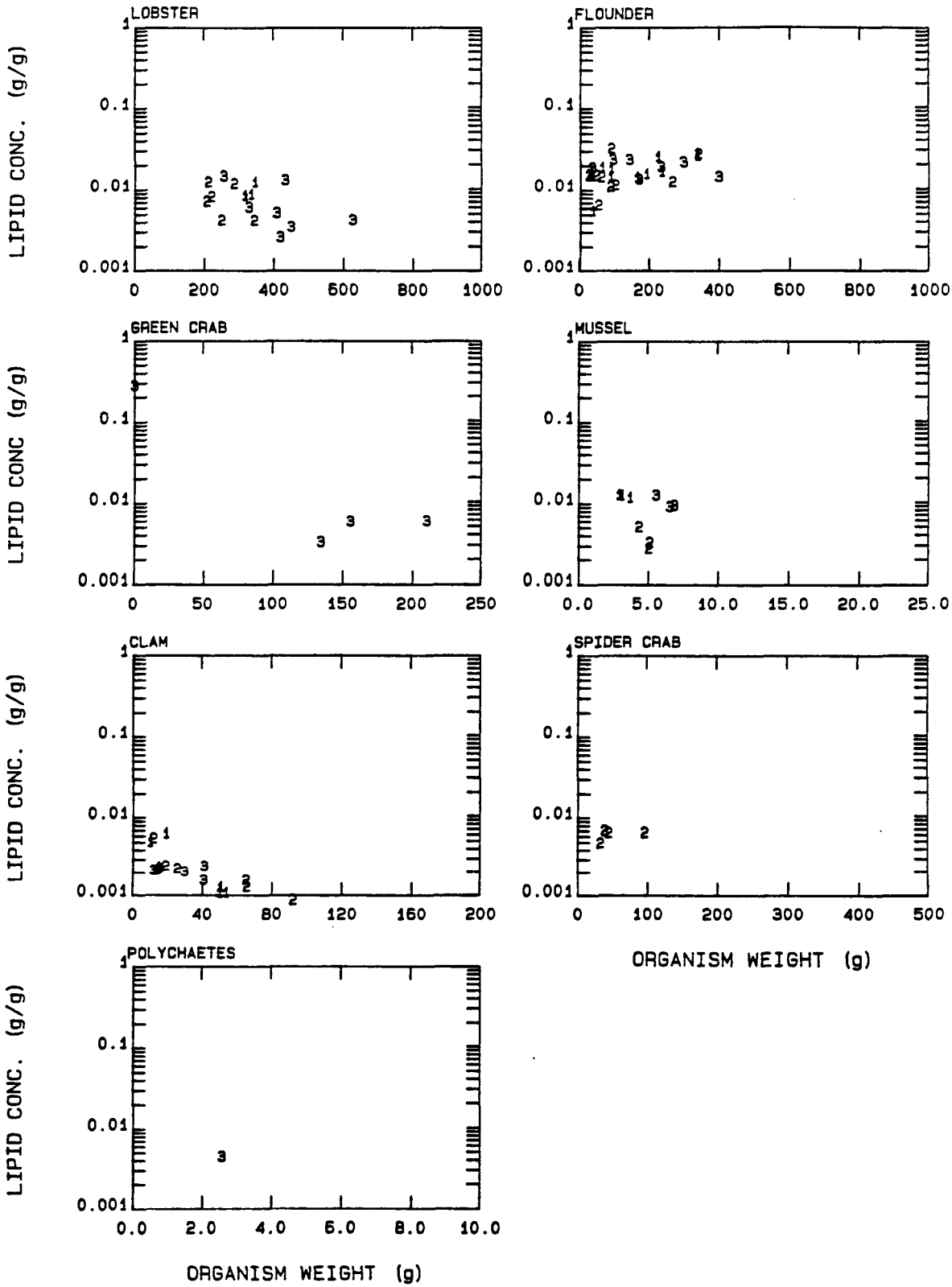

LOBSTER
FLOUNDER
GREEN CRAB
MUSSEL
CLAM
SPIDER CRAB
POLYCHAETES
LIPID CONC. (g/g)
LIPID CONC (g/g)
N = 21
N = 22
N = 4
N = 6
N = 9
N = 6
0.001
0.01
0.1
1
0.1 1 10 20 50 80 90 99 99.9
PROBABILITY

LIPID VERSUS WEIGHT PLOTS

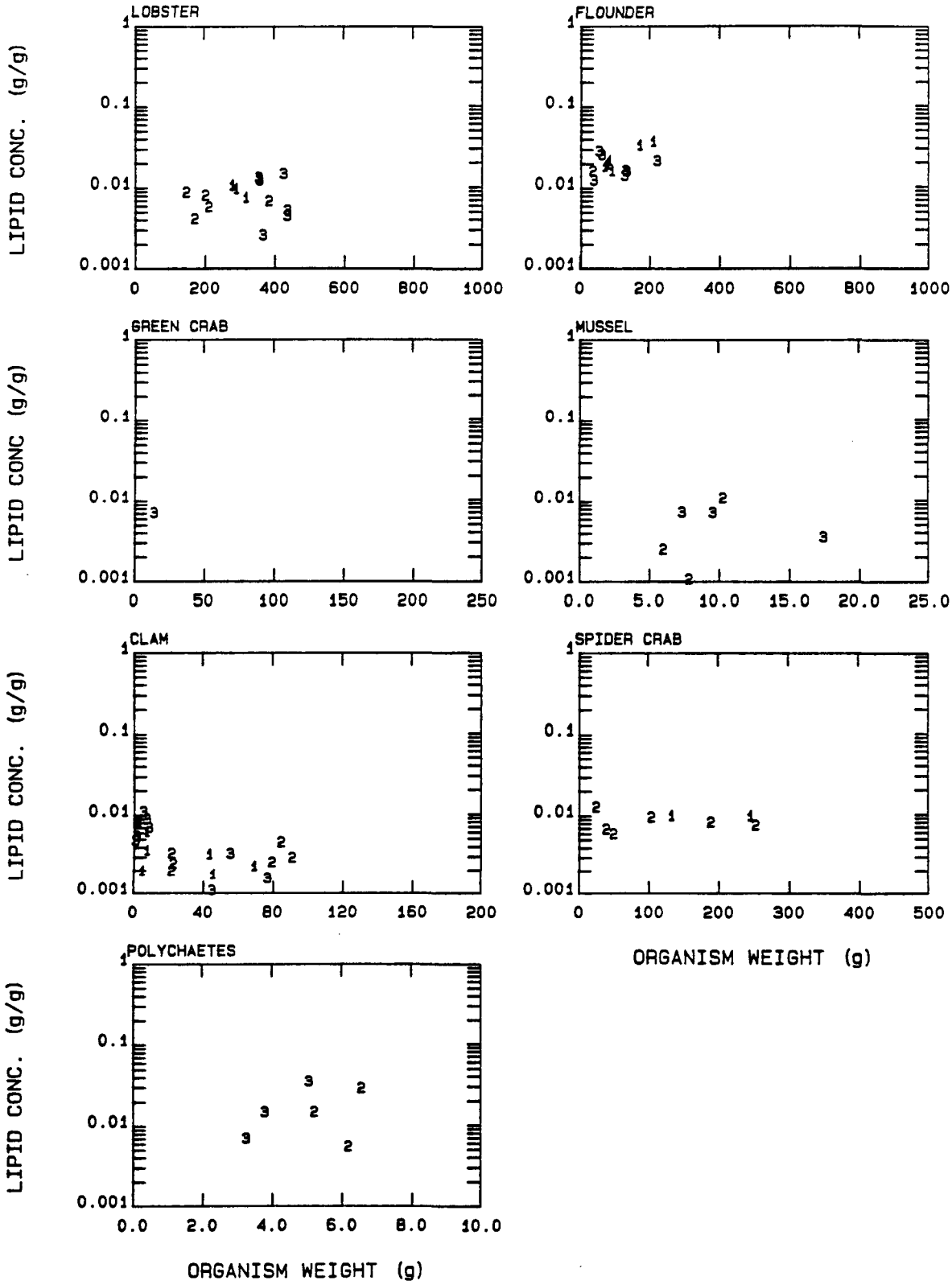
AREA 1


LOBSTER
FLOUNDER
GREEN CRAB
MUSSEL
CLAM
SPIDER CRAB
POLYCHAETES
LIPID CONC. (g/g)
LIPID CONC (g/g)
ORGANISM WEIGHT (g)

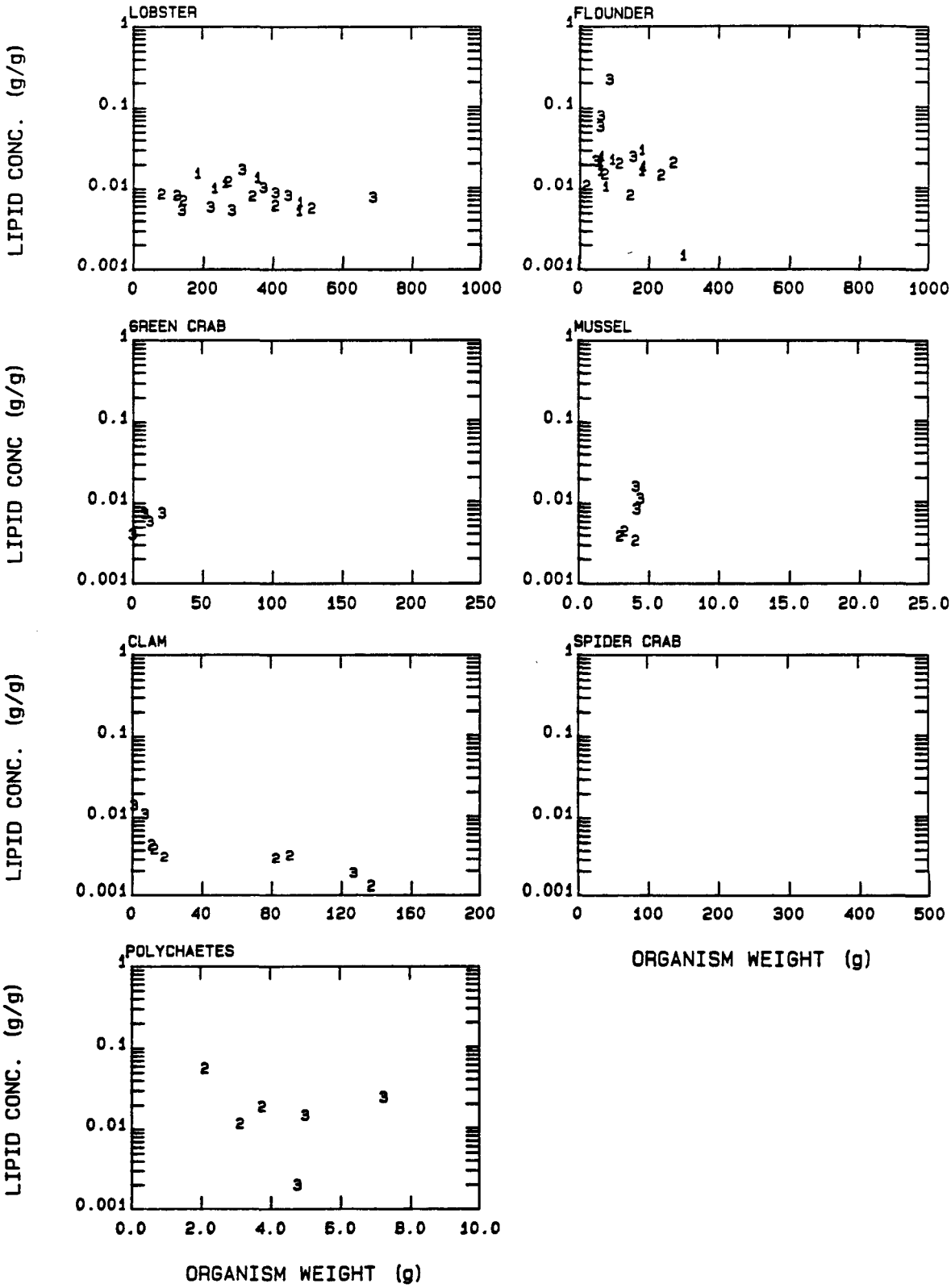
AREA 2


LOBSTER
FLOUNDER
GREEN CRAB
MUSSEL
CLAM
SPIDER CRAB
POLYCHAETES
LIPID CONC. (g/g)
LIPID CONC (g/g)
ORGANISM WEIGHT (g)

AREA 3


LOBSTER
FLOUNDER
GREEN CRAB
MUSSEL
CLAM
SPIDER CRAB
POLYCHAETES
LIPID CONC. (g/g)
LIPID CONC (g/g)
ORGANISM WEIGHT (g)

AREA 4


LOBSTER
FLOUNDER
GREEN CRAB
MUSSEL
CLAM
SPIDER CRAB
POLYCHAETES
LIPID CONC. (g/g)
LIPID CONC (g/g)
ORGANISM WEIGHT (g)