

APPENDIX M

HAZARD QUOTIENT CALCULATIONS

UPPER COLUMBIA RIVER

FINAL **Aquatic Baseline Ecological Risk Assessment** **Appendix M** **Hazard Quotient Calculations**

Prepared for

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July 2026

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ACRONYMS AND ABBREVIATIONS

0 DL	nondetected values treated as zero
1/2 DL	nondetected values treated as half of the detection limit
95 UCL	95th percentile upper confidence limit of the mean
ADA	aerial deposition area
AVGZ	aquatic vegetation growth zone
AWQC	ambient water quality criteria
BERA	baseline ecological risk assessment
BTV	background threshold value
BW	body weight
CaCl ₂	calcium chloride
CB	China Bend
CBN	Columbia Beach North
CBS	Columbia Beach South
COPC	chemical of potential concern
C _{orgsed}	OC-normalized concentration in sediment
CS50	medium, coarse, and very coarse sand > 50 percent of substrate
C _{sed}	concentration in sediment
CSM	conceptual site model
C _{soil}	concentration in soil
DDE	dichlorodiphenyldichloroethylene
DDx	sum of 2,4'-DDD, 4,4'-DDD, 2,4'-DDE, 4,4'-DDE, 2,4'-DDT, and 4,4'-DDT
DL	detection limit
DME	Deadman's Eddy
DOC	dissolved organic carbon
EC20	concentration that causes a 20 percent effect relative to the control
eCEC	effective cation exchange capacity
Eco-SSL	ecological soil screening level
ECx	concentration that causes an x percent effect relative to the control

ED20	effective dose with a 20 percent reduction in the response relative to the control
ED50	effective dose with a 50 percent reduction in the response relative to the control
EDx	effective dose with an x percent reduction in the response relative to the control
ELS	early life stage
EPA	U.S. Environmental Protection Agency
EPC	exposure point concentration
FI	flying insect
FIR	food ingestion rate
H ₂ O	water
HQ	hazard quotient
IR	ingestion rate
LL	Lower Lacustrine CSM Unit
LOAEL	lowest-observed-adverse-effect level
LOE	line of evidence
LOEL	lowest-observed-effect level
MDL	method detection limit
MFE	Marcus Flats East
ML	Middle Lacustrine CSM Unit
MRL	method reporting limit
NA	not applicable
NDB	no data or benchmark
NDT	no data or TRV
nm	not measured
NOEC	no-observed-effect concentration
NP	Northport
OC	organic carbon
OU	operable unit

OU1N	OU 1 North
OU1S	OU 1 South
PAF	potentially affected fraction
PCB	polychlorinated biphenyl
PEC	probable effects concentration
PNEC	predicted no-effect concentration
RBA	relative bioavailability (or relative bioavailability adjustment)
REF	Reference
RFA	Relict Floodplain A
RFB	Relict Floodplain B
RFC	Relict Floodplain C
RFD	Relict Floodplain D
RFDA	relict floodplain deposition area
RI	remedial investigation
RM	river mile
SEM	simultaneously extracted metals
SIR	soil or sediment ingestion rate
SSD	species sensitivity distribution
SSL	soil screening level
T	Transitional CSM Unit
TA	terrestrial arthropod
TEQ	toxic equivalency
TM	terrestrial mammal
TOC	total organic carbon
TPA	terrestrial plant above ground
TPB	terrestrial plant below ground
TRV	toxicity reference value
TW	terrestrial worm
UCR	Upper Columbia River

UL	Upper Lacustrine CSM Unit
USGS	U.S. Geological Survey
WSDA	windblown sediment deposition area
XRF	x-ray fluorescence

UNITS OF MEASURE

bw	body weight
cmol/kg	centimole(s) per kilogram of dry soil
°C	degree(s) Celsius
in.	inch(es)
kg dw/day	kilogram(s) (dry weight) per day
µg/L	microgram(s) per liter
µmol/g	micromole(s) per gram
µmol/gOC	micromole(s) per gram organic carbon
mg/kg	milligram(s) per kilogram
mg/kg bw/day	milligram(s) per kilogram of body weight per day
mg/kg-dw	milligram(s) per kilogram-dry weight
mg/kg _{diet} dw	milligram(s) per kilogram diet dry weight
mg/kgOC	milligram(s) per kilogram organic carbon
mg/L	milligram(s) per liter
mm	millimeter(s)
M	molarity

1 INTRODUCTION TO HQ CALCULATION TABLES

Hazard quotient (HQ) calculations are presented as Tables M-1 through M-12 in Appendix M. Tables are organized by media type and receptor group, and include rows for both location-specific HQ calculations and areawide HQ calculations, where appropriate. Calculations for all of the HQs presented in the line of evidence (LOE) estimation sections of Volumes 2, 3, and 4 of the Aquatic Baseline Ecological Risk Assessment (BERA) are presented within the Appendix M tables. There are additional rows beyond those presented in the LOE estimation sections, for HQs calculated for replicate samples,¹ the background threshold value (BTV) HQ calculation,² and selected uncertainty evaluations that feed into the most relevant and reliable scenarios identified for birds (lead and mercury alternative reproduction toxicity reference values [TRVs]).³

¹ For some sample locations, multiple replicate samples were collected at the same location (see discussion in Volume 1 Section 3.3.1 and specific chemistry data for each replicate in Appendix B). In these cases, HQs were calculated for each replicate sample, and the replicate that produced the highest HQ was the replicate included in the LOE estimation. Which replicate produces the highest HQ varies by COPC and by the replicate's bioavailability conditions. Thus, Appendix M includes HQ calculations for each replicate. The Chosen Replicate column indicates on a per-row basis which of the replicates produced the highest HQ: "NA" means that location does not have replicates; "no" means that location did have replicates but this specific replicate did not have the highest HQ for that COPC, receptor, and benchmark; and "yes" means that the location did have replicates and this specific replicate did have the highest HQ for that COPC, receptor, and benchmark.

² Rows for BTVs are included to show the calculation of the BTV HQ; these rows are identified as "BTV" in the OU, Location ID, Sample ID, and/or Sample Location ID columns, depending on the table. The BTV HQ is also included as a column ("BTV HQ") to compare the sample HQ against the BTV HQ.

³ The HQs calculated using the alternative lead and mercury reproduction TRVs for birds are presented in separate tables (Tables M-6 and M-11) from those that went into the LOE estimation results.

2 FILTERING HQ CALCULATION TABLES TO MATCH THE LOE ESTIMATION

The following sections describe how each table should be filtered to attain the same results as are presented in the LOE estimations of Volumes 2, 3, and 4 of the Aquatic BERA.

2.1 TABLE M-1. SAMPLE-SPECIFIC HQS FOR AMPHIBIANS, AQUATIC PLANTS, BENTHIC INVERTEBRATES, AND ZOOPLANKTON IN SURFACE WATER

Table M-1 presents the HQs calculated to evaluate direct contact exposure of receptors to surface water. The following filters should be applied to match rows to the LOE estimation:

- “CSM Unit”—select the desired conceptual site model (CSM) unit.
- “Sample Type”—select all rows for aquatic plants, zooplankton, early life stage (ELS) amphibians, and ELS fish; for benthic invertebrates, do not include near-surface rows.
- “COPC”—select the desired chemical of potential concern (COPC).

2.2 TABLE M-2. SAMPLE-SPECIFIC POREWATER HQS FOR AQUATIC PLANTS, BENTHIC INVERTEBRATES, ELS FISH, AND ELS WHITE STURGEON

Table M-2 presents the HQs calculated to evaluate direct contact exposure of receptors to porewater. The following filters should be applied to match rows to the LOE estimation:

- “CSM Unit”—select the desired CSM unit or reference area.
- “Receptor”—select the desired receptor group. When selecting “ELS fish” as the receptor group, also choose the desired option in the Feeding Guild column:
 - “all ELS fish” for reference areas and the COPCs that have the same benchmarks between ELS white sturgeon and other ELS fish
 - “all ELS fish except white sturgeon” for the shallow porewater zone in Operable Unit (OU) 1 and OU 2 for all porewater COPCs; and for reference areas and COPCs that have different benchmarks between ELS white sturgeon and other ELS fish and the other ELS fish results that are desired
 - “ELS white sturgeon” for the shallow and deep porewater zone in OU 1 and OU 2 for all porewater COPCs; and for reference areas and COPCs that have different

benchmarks between ELS white sturgeon and other ELS fish, and the ELS white sturgeon results that are desired.

- “Study ID” —select all studies (except remove “2013 Phase 2 Sediment Study” for OU 1 evaluations only).
- “Chosen Replicate” —select “yes” and “NA.”
- “COPC” —select the desired COPC.
- “Benchmark Type” —select the desired benchmark type (either aquatic life or taxa-specific).

2.3 TABLE M-3. SAMPLE-SPECIFIC HQS FOR BENTHIC INVERTEBRATES IN SEDIMENT

Table M-3 presents the HQs calculated to evaluate direct contact exposure of receptors to sediment. The following filters should be applied to match rows to the LOE estimation:

- “OU” —select the desired OU. Deselect “BTV” to view Site HQs (or alternatively, deselect “BTV” from the Location ID column).
- “CSM Unit” —select the desired CSM unit.
- “Chosen Replicate” —select “yes” and “NA.”
- “COPC” —select the desired COPC.

2.4 TABLE M-4. DIETARY HQ CALCULATIONS FOR FISH

Table M-4 presents the HQs calculated to evaluate dietary exposure of fish receptors to COPCs in food and sediment. The following filters should be applied to match rows to the LOE estimation:

- “OU” —select the desired OU. Deselect “BTV” to view Site HQs (or alternatively, deselect “BTV” from the Location ID column).
- “CSM Unit” —select the desired CSM unit.
- “Receptor” —select the desired receptor.
- “Chosen Replicate” —select “yes” and “NA.”
- “COPC” —select the desired COPC.

2.5 TABLE M-5. DIETARY HQ CALCULATIONS FOR AQUATIC-ASSOCIATED BIRDS

Table M-5 presents the HQs calculated to evaluate dietary exposure of aquatic-associated bird receptors to COPCs in food and sediment. The following filters should be applied to match rows to the LOE estimation:

- “OU” —select the desired OU. Deselect “BTV” to view Site HQs (or alternatively, deselect “BTV” from the Location ID column).
- “CSM Unit” —select the desired CSM unit.
- “Receptor” —select the desired receptor.
- “Chosen Replicate” —select “yes” and “NA.”
- “COPC” —select the desired COPC.
- “Endpoint” —select the desired endpoint (growth, reproduction, or survival).

2.6 TABLE M-6. ALTERNATIVE LEAD AND MERCURY DIETARY HQ CALCULATIONS FOR AQUATIC-ASSOCIATED BIRDS

Table M-6 presents the alternative HQs calculated to evaluate dietary exposure of bird receptors to COPCs in food and sediment for lead and mercury reproduction. In the specific case of lead and mercury reproduction, alternative TRVs were identified and used to calculate HQs as part of an uncertainty analysis in Appendix O. The following filters should be applied to match rows to the discussion in Appendix O:

- “OU” —select the desired OU. Deselect “BTV” to view Site HQs (or alternatively, deselect “BTV” from the Location ID column).
- “CSM Unit” —select the desired CSM unit.
- “Receptor” —select the desired receptor.
- “Chosen Replicate” —select “yes” and “NA.”
- “COPC” —select the desired COPC (either lead or mercury).

2.7 TABLE M-7. DIETARY HQ CALCULATIONS FOR AQUATIC-ASSOCIATED MAMMALS

Table M-7 presents the HQs calculated to evaluate dietary exposure of mammal receptors to COPCs in food and sediment. The same filters as discussed above for Table M-5 (aquatic-associated birds) should be applied to match rows to the LOE estimation.

2.8 TABLE M-8. SAMPLE-SPECIFIC HQS FOR TERRESTRIAL PLANTS

Table M-8 presents the HQs calculated to evaluate direct contact exposure of terrestrial plants to COPCs in soil. The following filters should be applied to match rows to the LOE estimation:

- “Location Group” —select the desired location group (relict floodplain deposition areas [RFDAs] or windblown sediment deposition areas [WSDAs]).
- “Location ID” —deselect BTV.
- “Chosen Replicate” —select “yes” and “NA.”
- “COPC” —select the desired COPC.

Note that there are multiple “Location Groups” and “Location Subgroups” for the BTV rows. For benchmarks that are not bioavailability adjusted, a single BTV HQ was calculated for all areas within the RFDAs and WSDAs. For the bioavailability-adjusted benchmarks, area-specific bioavailability parameters were used to calculate area-specific BTV HQs; these rows list the specific applicable “Location Group” and “Location Subgroup.”

2.9 TABLE M-9. SAMPLE-SPECIFIC HQS FOR TERRESTRIAL INVERTEBRATES

Table M-9 presents the HQs calculated to evaluate direct contact exposure of soil invertebrates to COPCs in soil. The same filters as discussed above for Table M-8 for terrestrial plants should be applied for soil invertebrates in Table M-9 to match rows to the LOE estimation.

2.10 TABLE M-10. SAMPLE-SPECIFIC DIETARY HQ CALCULATIONS FOR TERRESTRIAL BIRDS

Table M-10 presents the HQs calculated to evaluate dietary exposure of bird receptors to COPCs in food and soil. The following filters should be applied to match rows to the LOE estimation:

- “Location Group” —deselect “BTV” to view Site HQs (or alternatively, deselect “BTV” from the Sample Location ID column).
- “Receptor” —select the desired receptor.
- “Chosen Replicate” —select “yes” and “NA.”
- “COPC” —select the desired COPC.
- “Endpoint” —select the desired endpoint (growth, reproduction, or survival).

2.11 TABLE M-11. ALTERNATIVE LEAD AND MERCURY DIETARY HQ CALCULATIONS FOR TERRESTRIAL BIRDS

Table M-11 presents the alternative HQs calculated to evaluate dietary exposure of bird receptors to COPCs in food and soil for lead and mercury reproduction. In this specific case of lead and mercury reproduction TRVs, alternative TRVs were identified and used to calculate HQs as part of an uncertainty analysis in Appendix O. The following filters should be applied to match rows to the discussion in Appendix O:

- “Location Group” —deselect “BTV” to view Site HQs (or alternatively, deselect “BTV” from the Sample Location ID column).
- “Receptor” —select the desired receptor.
- “Chosen Replicate” —select “yes” and “NA.”
- “COPC” —select the desired COPC (either lead or mercury).

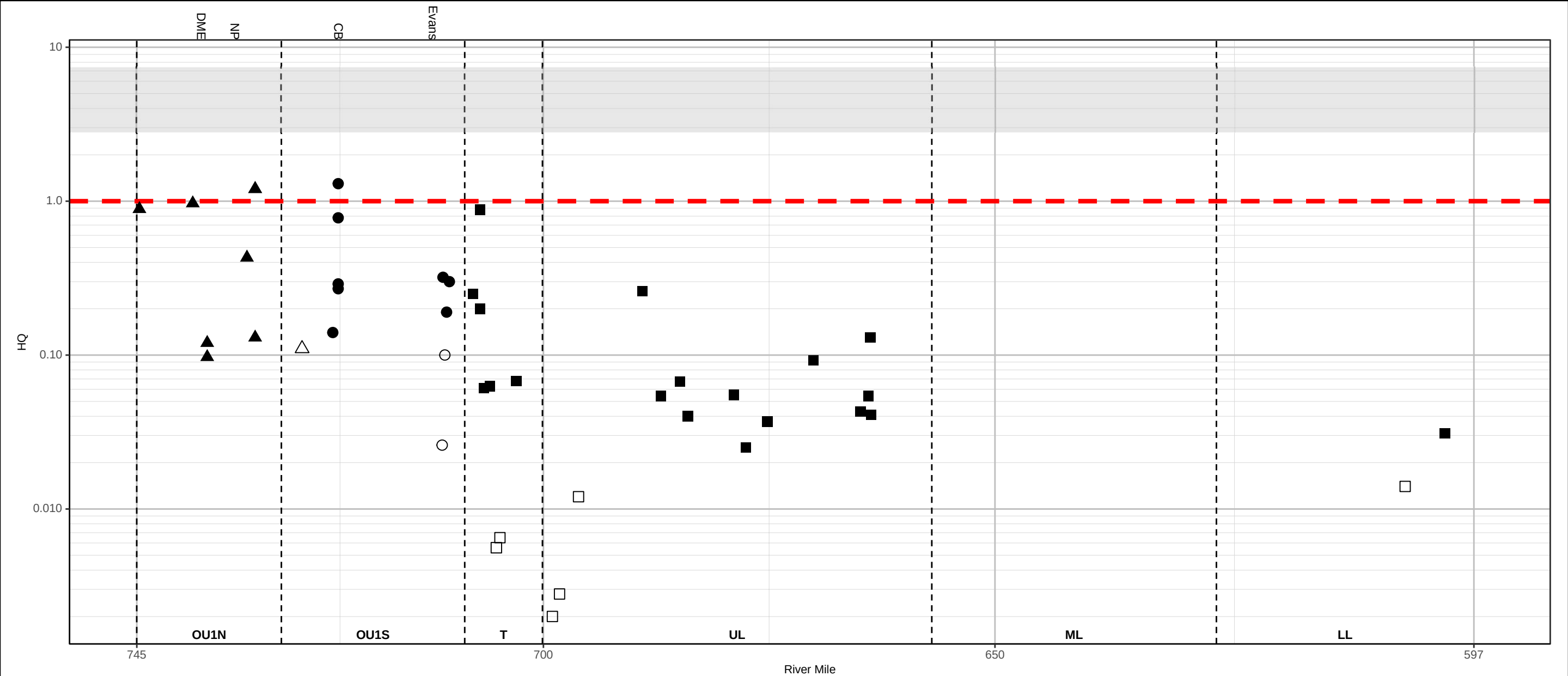
2.12 TABLE M-12. SAMPLE-SPECIFIC DIETARY HQ CALCULATIONS FOR TERRESTRIAL MAMMALS

Table M-12 presents the HQs calculated to evaluate dietary exposure of mammalian receptors to COPCs in food and soil. The same filters as discussed above for Table M-10 (terrestrial birds) should be applied to match rows to the LOE estimation.

3 REFERENCES

- Burgess, N.M., and M.W. Meyer. 2008. Methylmercury exposure associated with reduced productivity in common loons. *Ecotoxicology* 17(2):83–91. <https://doi.org/10.1007/s10646-007-0167-8>.
- Sample, B.E., W.N. Beyer, and R. Wentsel. 2019. Revisiting the Avian Eco-SSL for Lead: Recommendations for Revision. *Integr. Environ. Assess. Manag.* 15(5):739–749. <https://doi.org/10.1002/ieam.4157>.

FIGURES



Notes:
 HQs shown are based on the taxa-specific benchmark, if available, and if not, the aquatic life benchmark. See Table 4-9 in Volume 1.
 Nondetected results include detected values flagged as "U*" by the data validator due to contamination in the relevant blank.
 OU1N - OU 1 North
 OU1S - OU 1 South
 T - Transitional CSM Unit
 UL - Upper Lacustrine CSM Unit
 ML - Middle Lacustrine CSM Unit
 LL - Lower Lacustrine CSM Unit
 DME - Deadman's Eddy
 NP - Northport
 CB - China Bend

- Detected Value, 2013 Phase 2 Sediment Study
- ▲ Detected Value, 2015 USGS Porewater Study
- Detected Value, 2019 Phase 3 Sediment Study
- Nondetected Value, 2013 Phase 2 Sediment Study
- △ Nondetected Value, 2015 USGS Porewater Study
- Nondetected Value, 2019 Phase 3 Sediment Study
- HQ = 1
- - - CSM Unit Boundary
- BTV HQ Range: 2.80—7.40

Figure M-1a. Aquatic Plant HQs by River Mile for Copper in Porewater
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

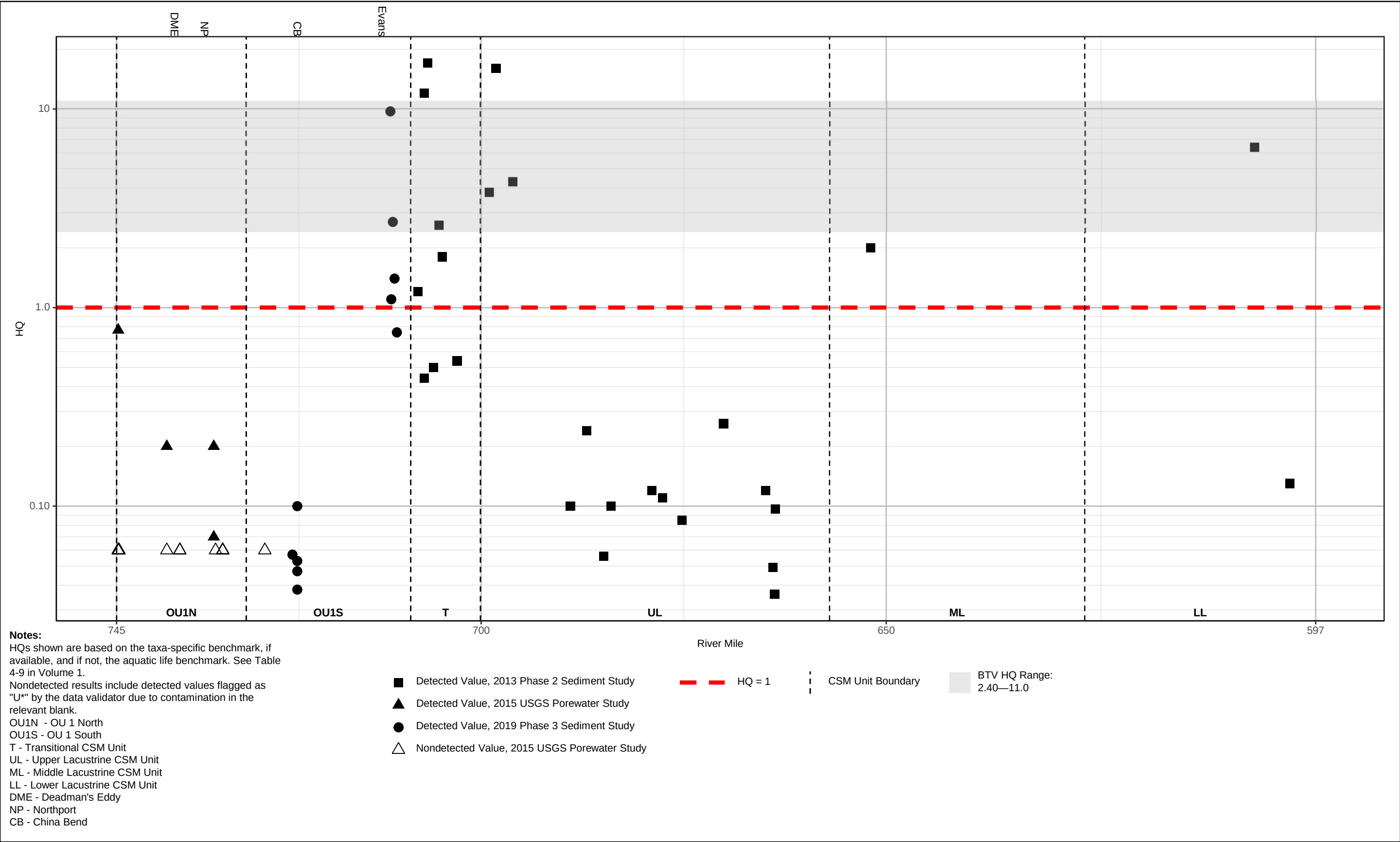


Figure M-1b. Aquatic Plant HQs by River Mile for Iron in Porewater
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

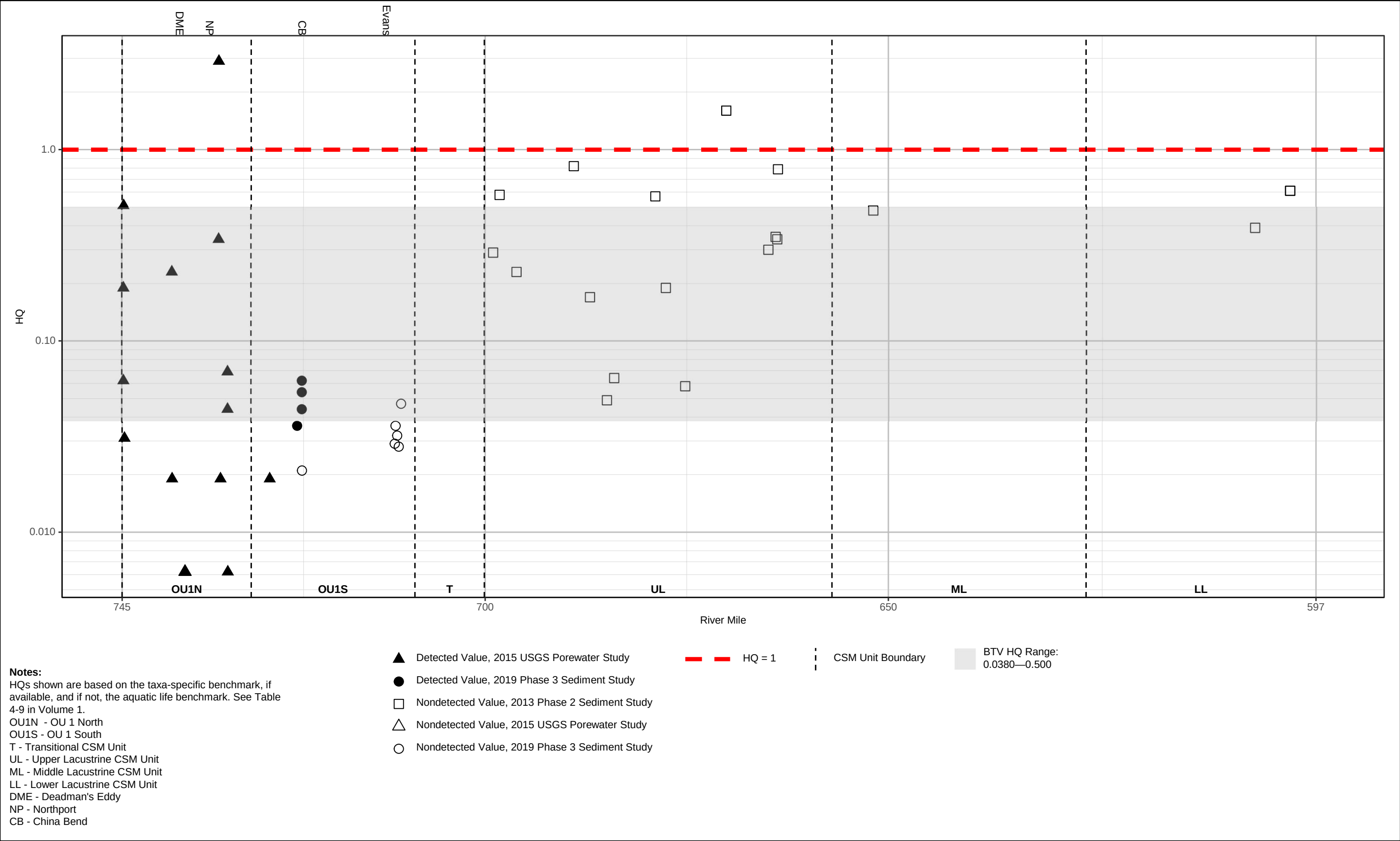


Figure M-1d. Aquatic Plant HQs by River Mile for Zinc in Porewater
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

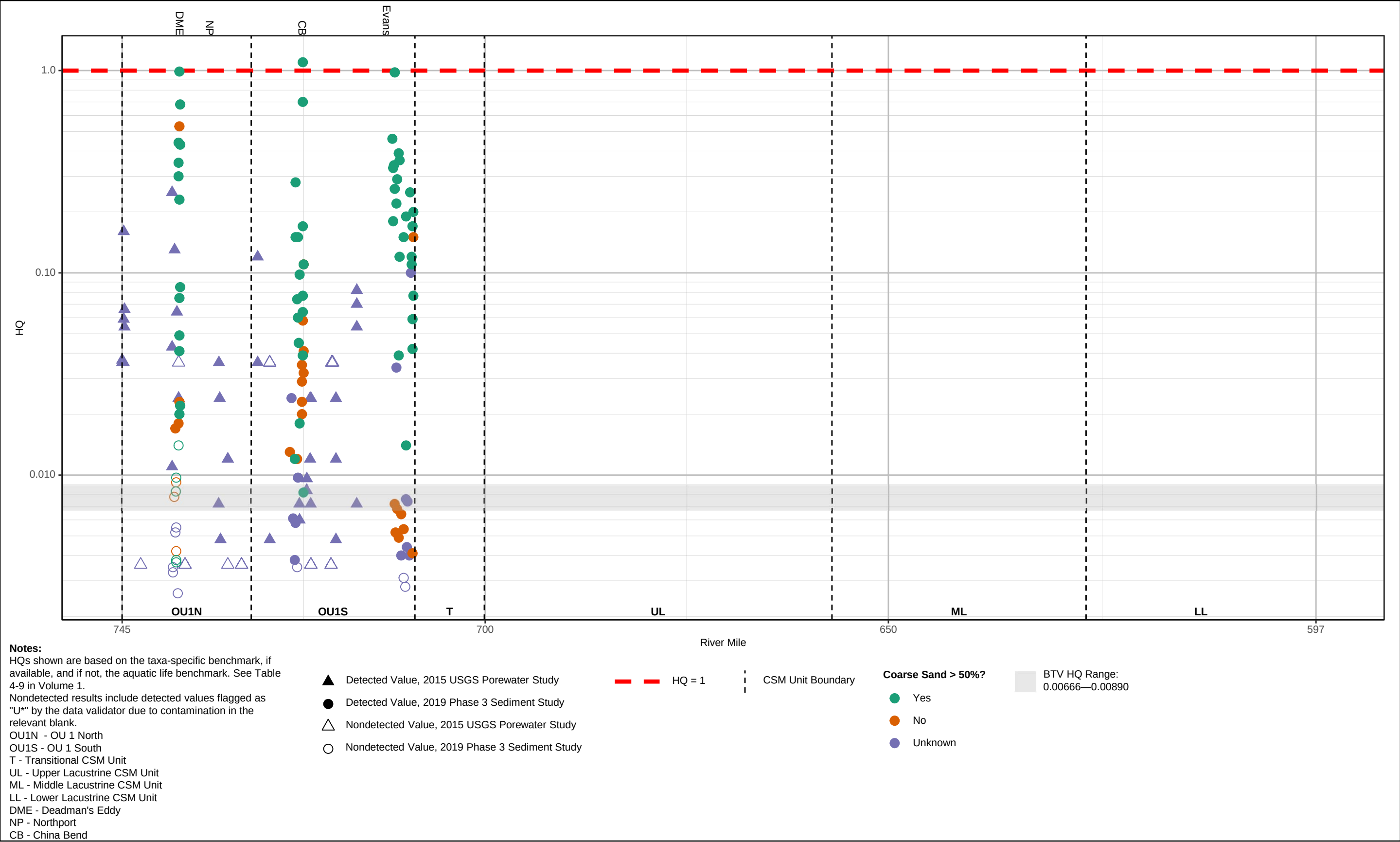
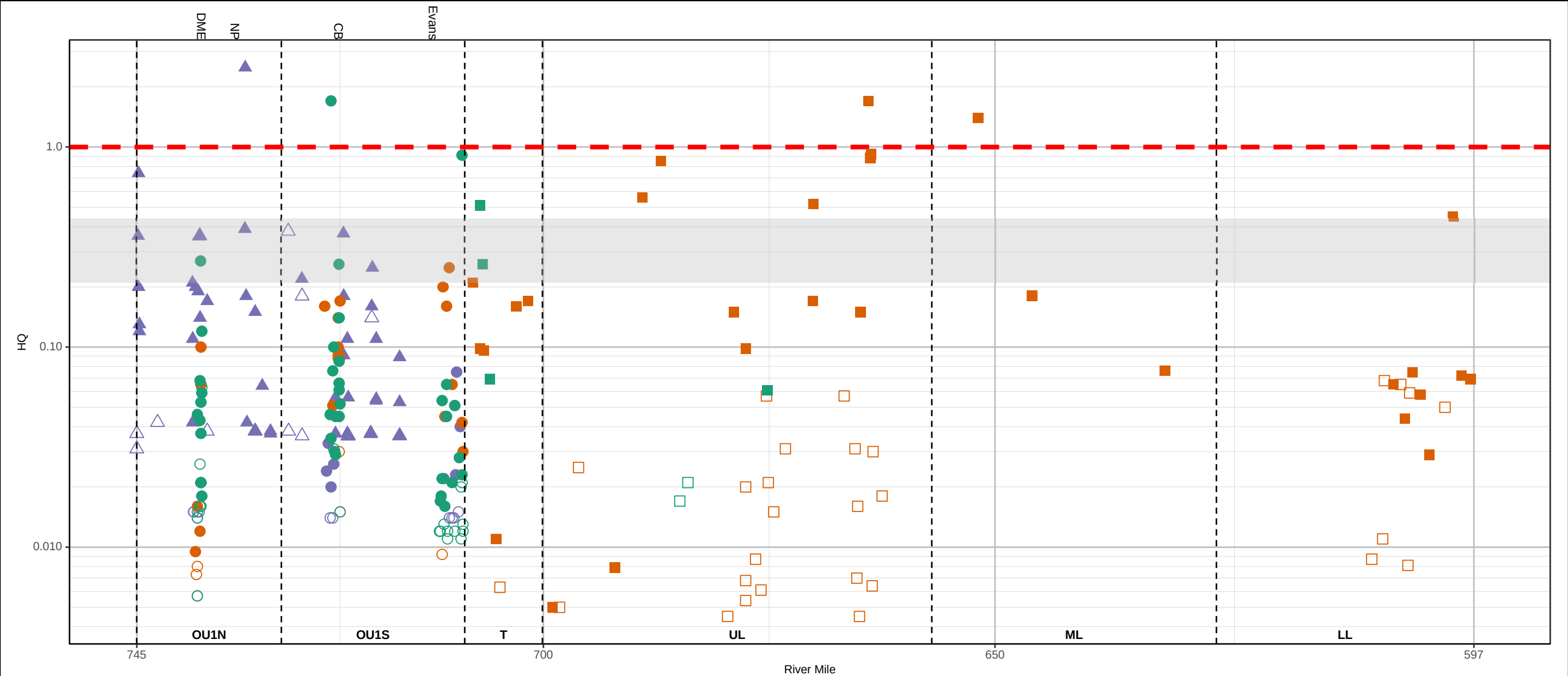


Figure M-2a. Benthic Invertebrate HQs by River Mile for Antimony in Porewater
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington



Notes:
HQs shown are based on the taxa-specific benchmark, if available, and if not, the aquatic life benchmark. See Table 4-9 in Volume 1.
Samples with similar HQs and RMs may be plotted directly on top of each other.
Nondetected results include detected values flagged as "U*" by the data validator due to contamination in the relevant blank.
OU1N - OU 1 North
OU1S - OU 1 South
T - Transitional CSM Unit
UL - Upper Lacustrine CSM Unit
ML - Middle Lacustrine CSM Unit
LL - Lower Lacustrine CSM Unit
DME - Deadman's Eddy
NP - Northport
CB - China Bend

- Detected Value, 2013 Phase 2 Sediment Study
- ▲ Detected Value, 2015 USGS Porewater Study
- Detected Value, 2019 Phase 3 Sediment Study
- Nondetected Value, 2013 Phase 2 Sediment Study
- △ Nondetected Value, 2015 USGS Porewater Study
- Nondetected Value, 2019 Phase 3 Sediment Study

— HQ = 1

- - - CSM Unit Boundary

Coarse Sand > 50%?

- Yes
- No
- Unknown

■ BTV HQ Range:
0.210—0.440

Figure M-2b. Benthic Invertebrate HQs by River Mile for Cadmium in Porewater
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

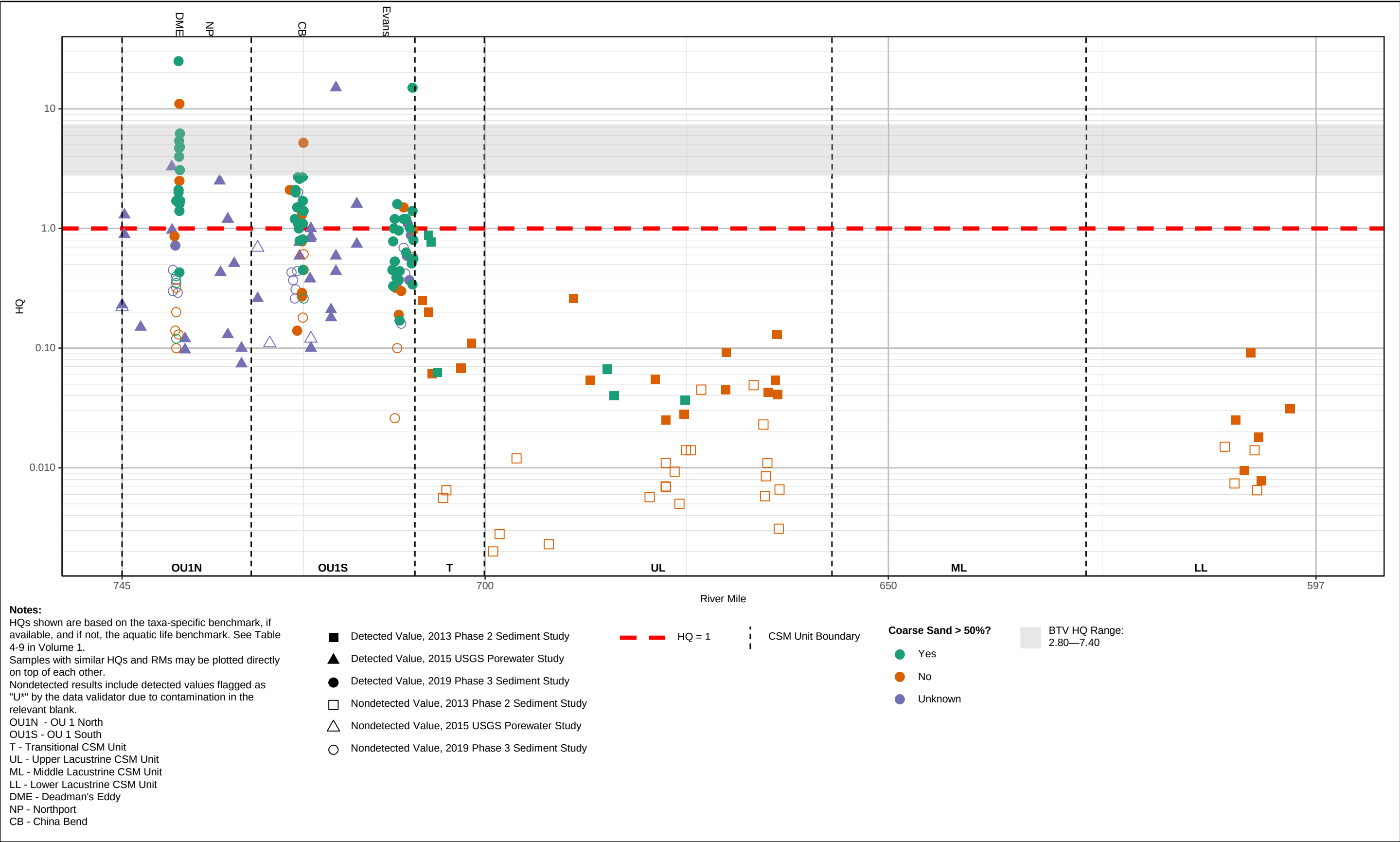


Figure M-2c. Benthic Invertebrate HQs by River Mile for Copper in Porewater
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

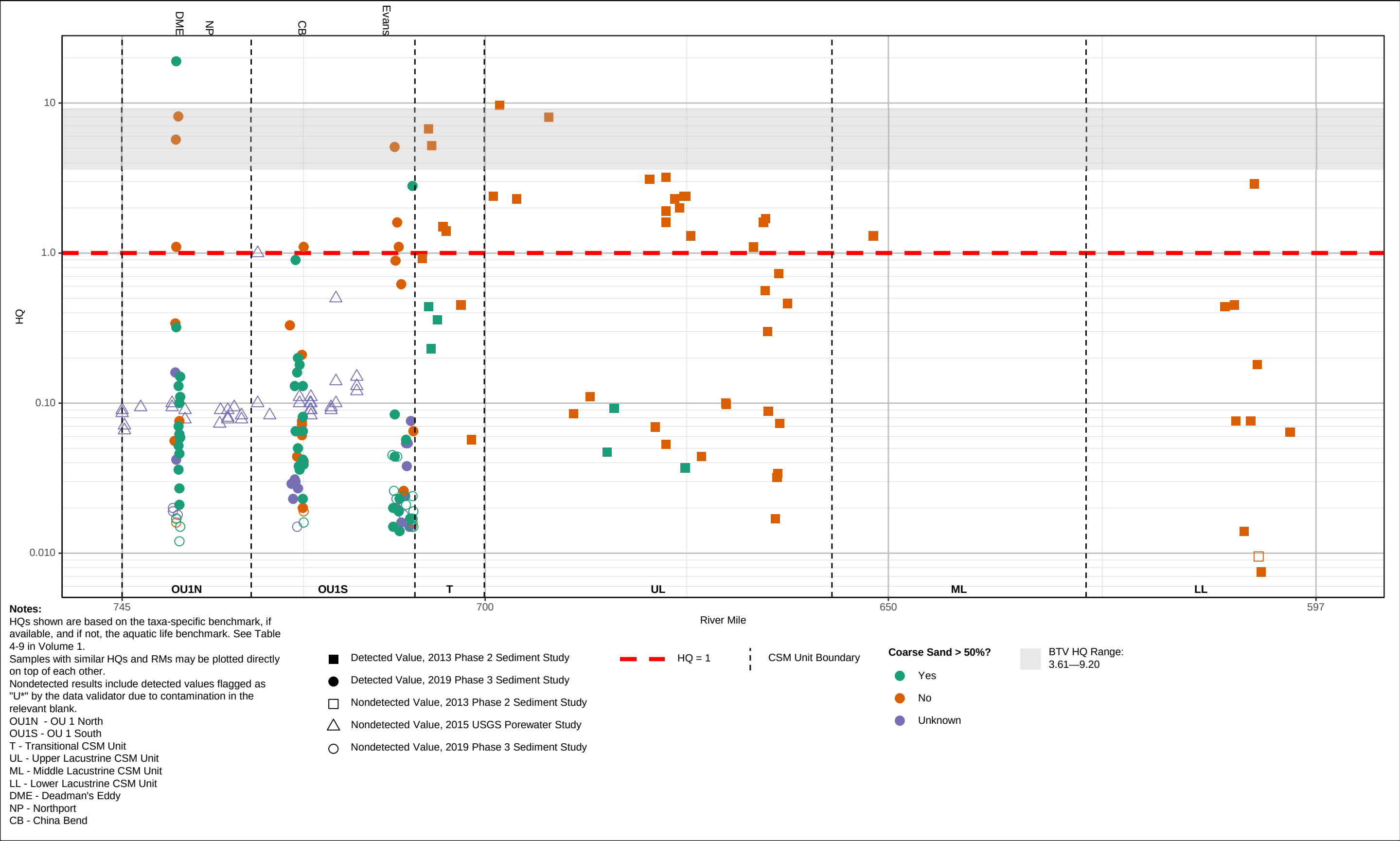


Figure M-2d. Benthic Invertebrate HQs by River Mile for Iron in Porewater
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

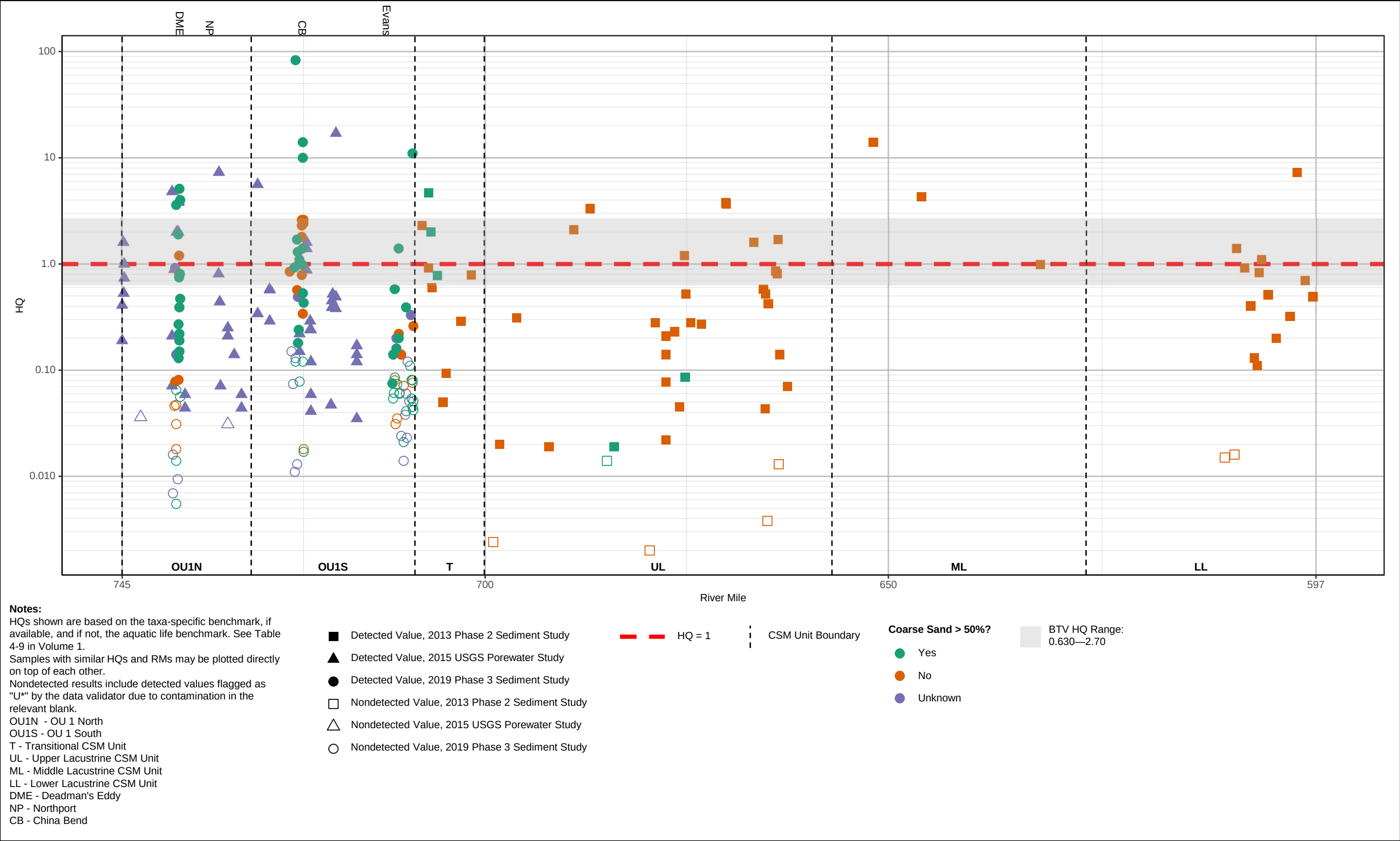


Figure M-2e. Benthic Invertebrate HQs by River Mile for Lead in Porewater
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

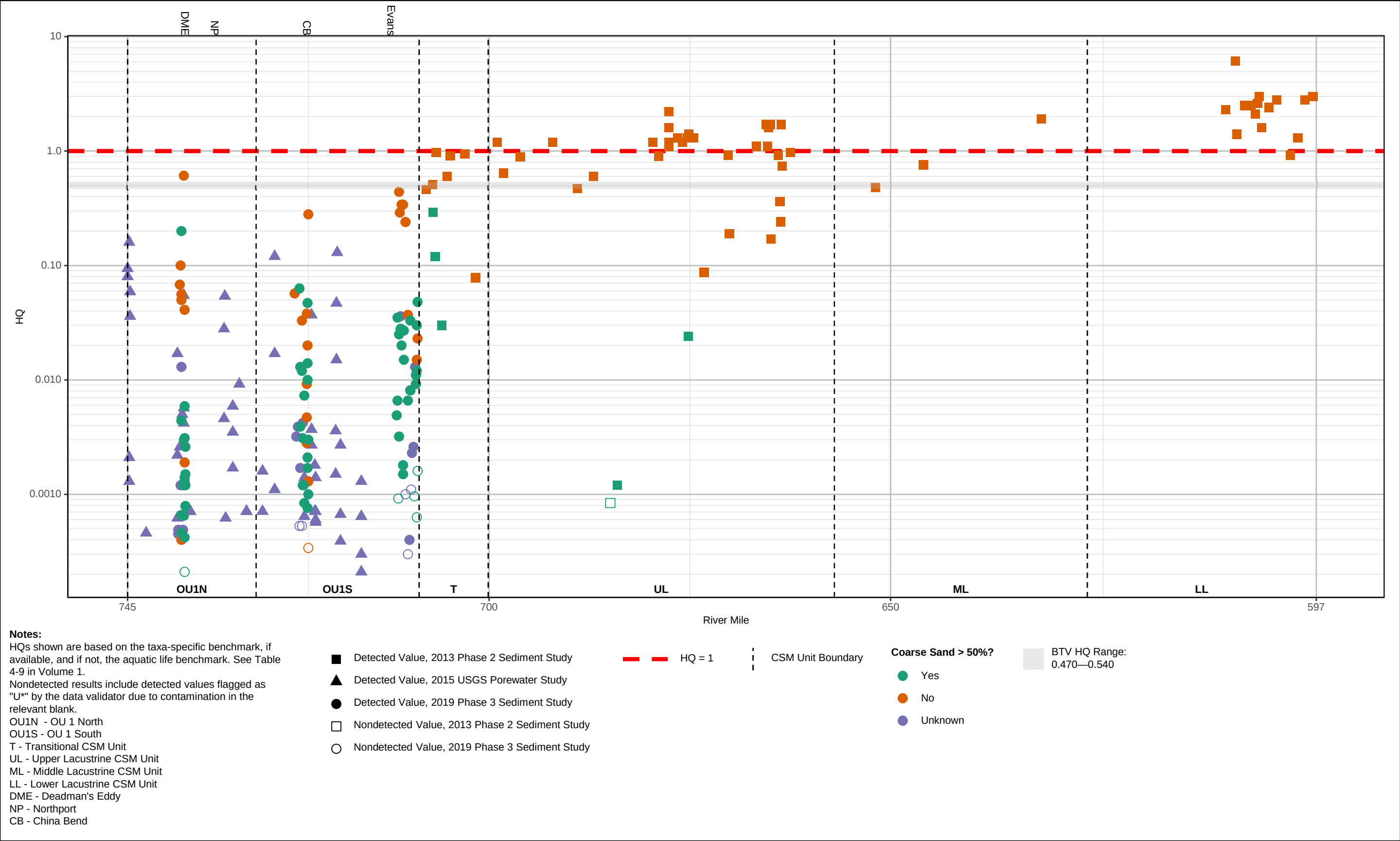


Figure M-2f. Benthic Invertebrate HQs by River Mile for Manganese in Porewater
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

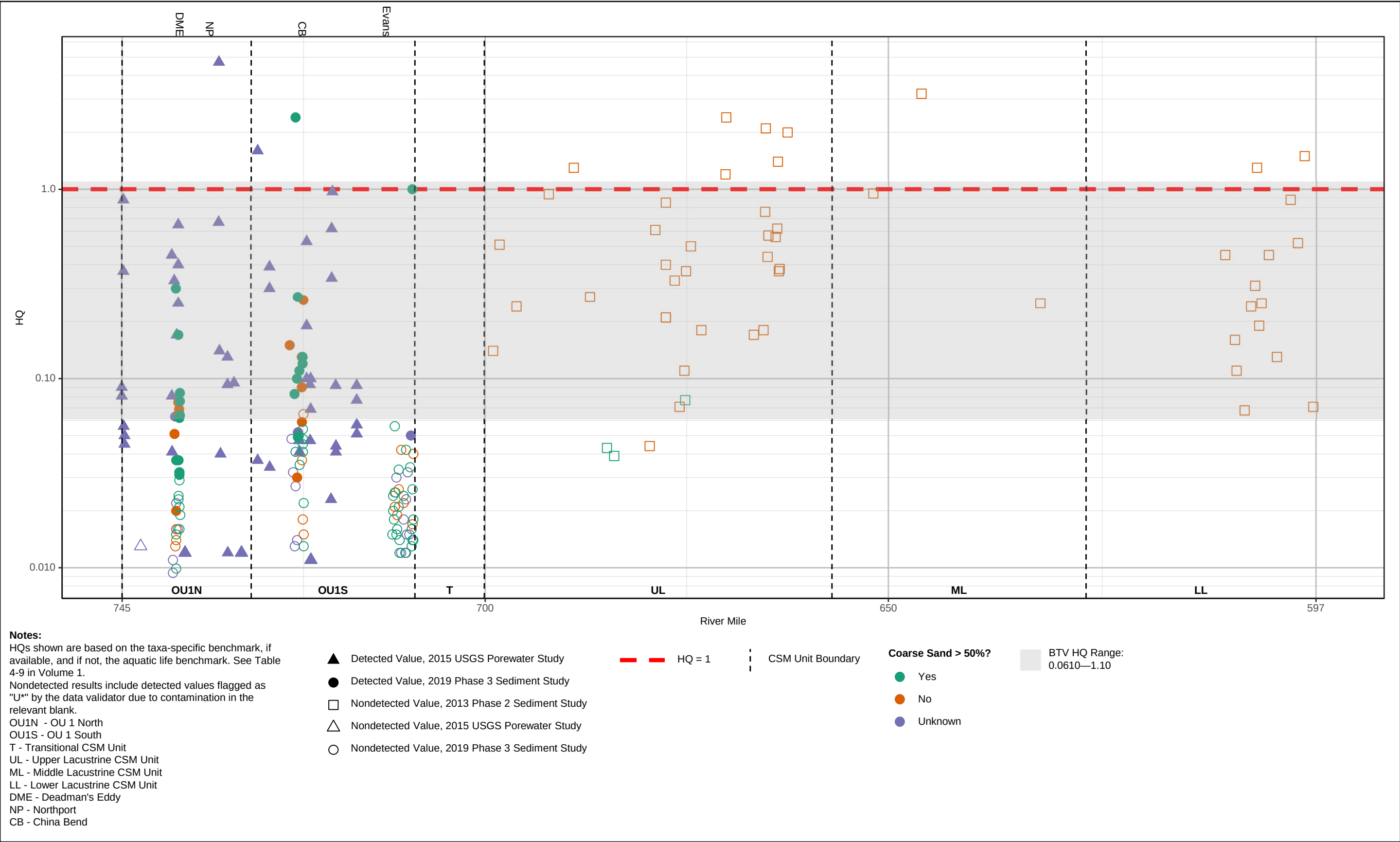


Figure M-2g. Benthic Invertebrate HQs by River Mile for Zinc in Porewater
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

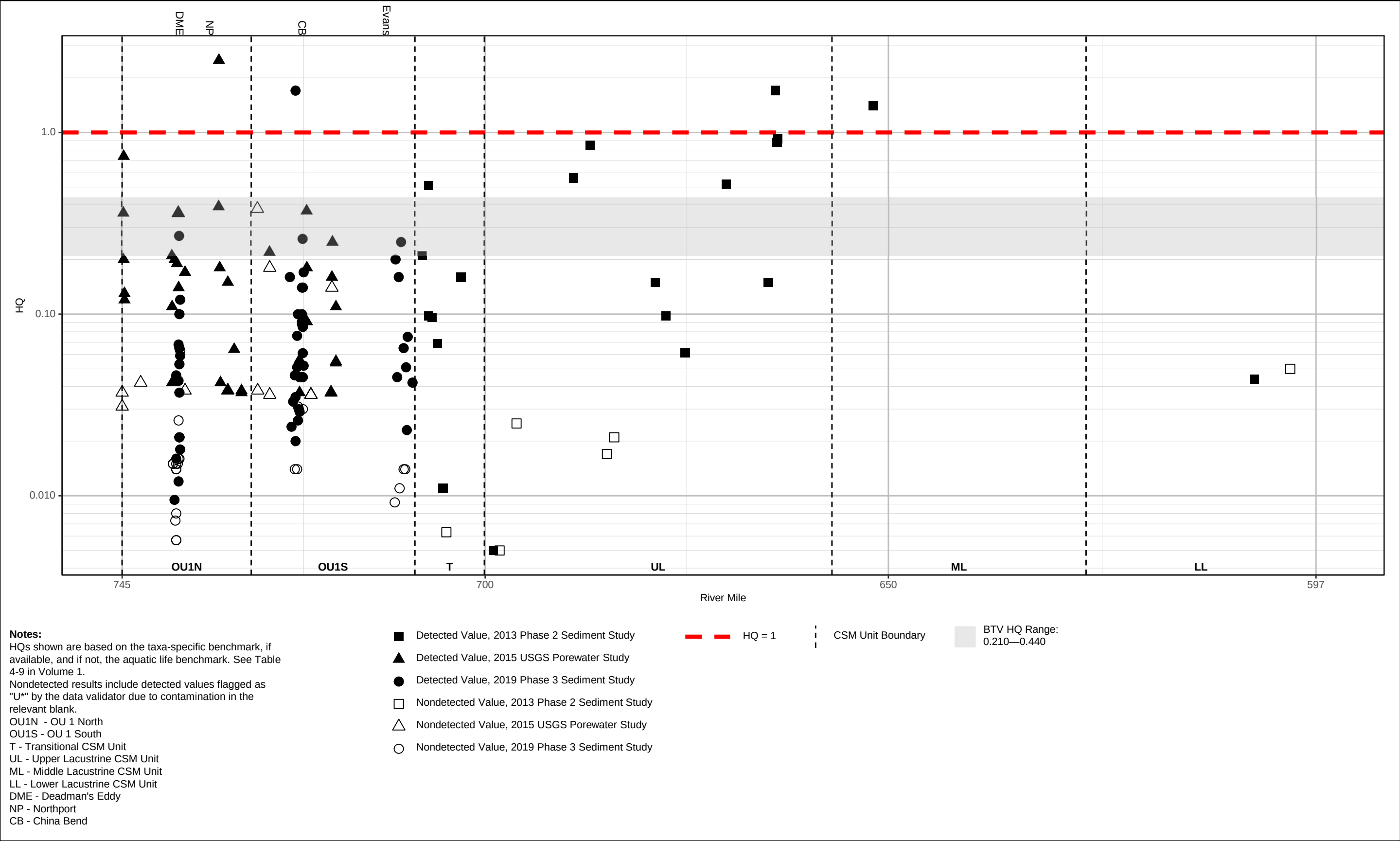
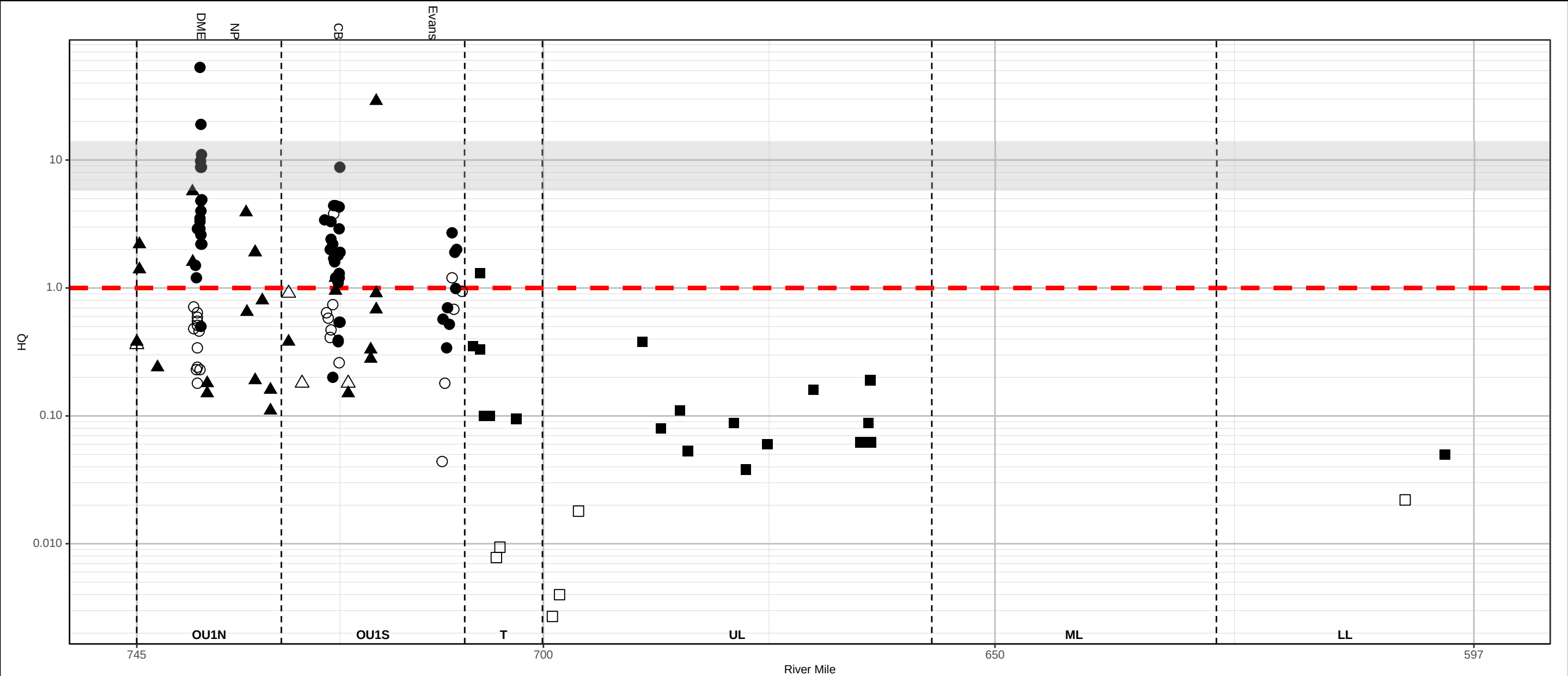


Figure M-3a. ELS Fish HQs by River Mile for Cadmium in Porewater
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington



Notes:
 HQs shown are based on the taxa-specific benchmark, if available, and if not, the aquatic life benchmark. See Table 4-9 in Volume 1.
 Nondetected results include detected values flagged as "U*" by the data validator due to contamination in the relevant blank.
 OU1N - OU 1 North
 OU1S - OU 1 South
 T - Transitional CSM Unit
 UL - Upper Lacustrine CSM Unit
 ML - Middle Lacustrine CSM Unit
 LL - Lower Lacustrine CSM Unit
 DME - Deadman's Eddy
 NP - Northport
 CB - China Bend

- Detected Value, 2013 Phase 2 Sediment Study
- ▲ Detected Value, 2015 USGS Porewater Study
- Detected Value, 2019 Phase 3 Sediment Study
- Nondetected Value, 2013 Phase 2 Sediment Study
- △ Nondetected Value, 2015 USGS Porewater Study
- Nondetected Value, 2019 Phase 3 Sediment Study
- HQ = 1
- - - CSM Unit Boundary
- BTV HQ Range: 5.80—14.0

Figure M-3b. ELS Fish HQs by River Mile for Copper in Porewater
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

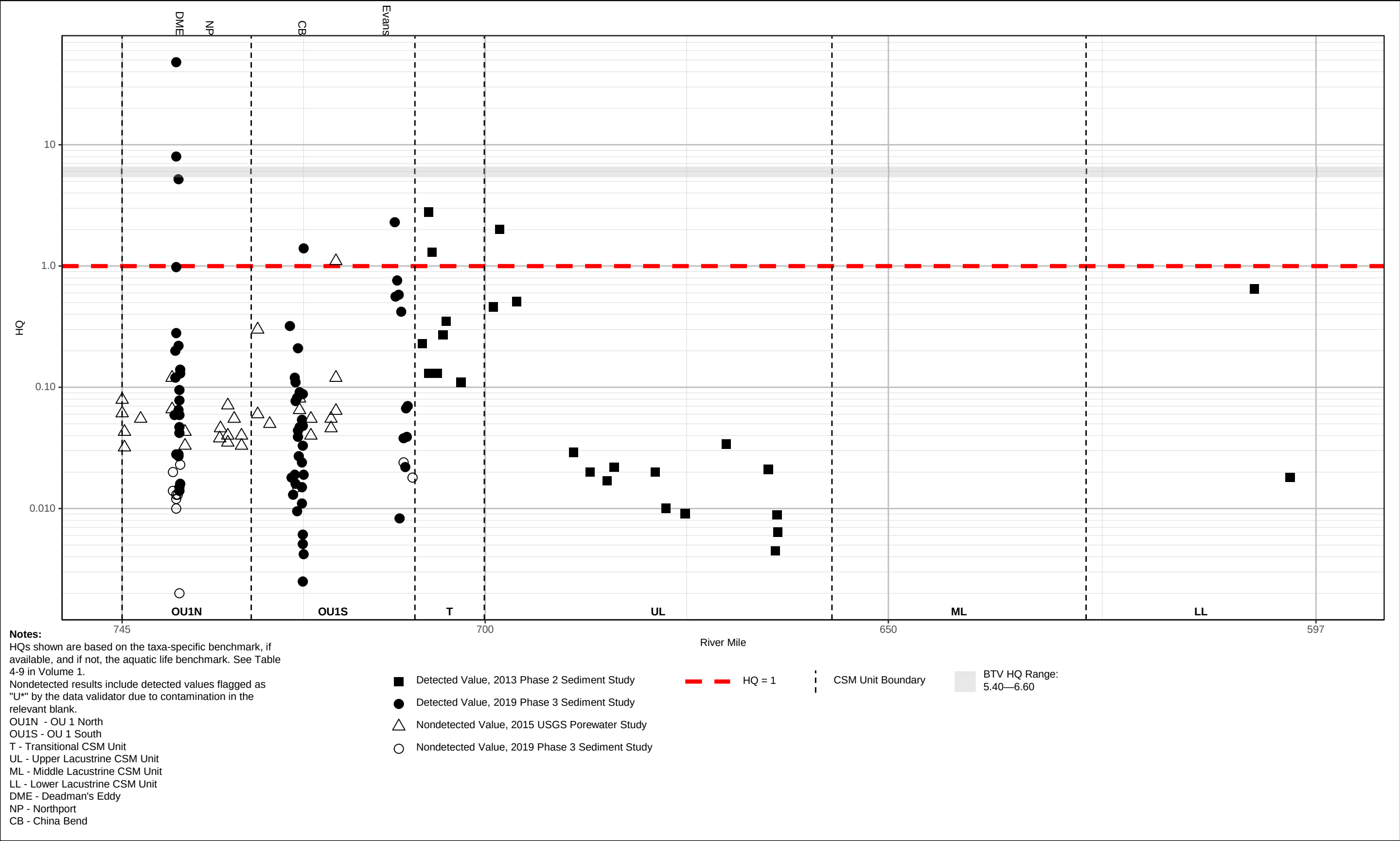
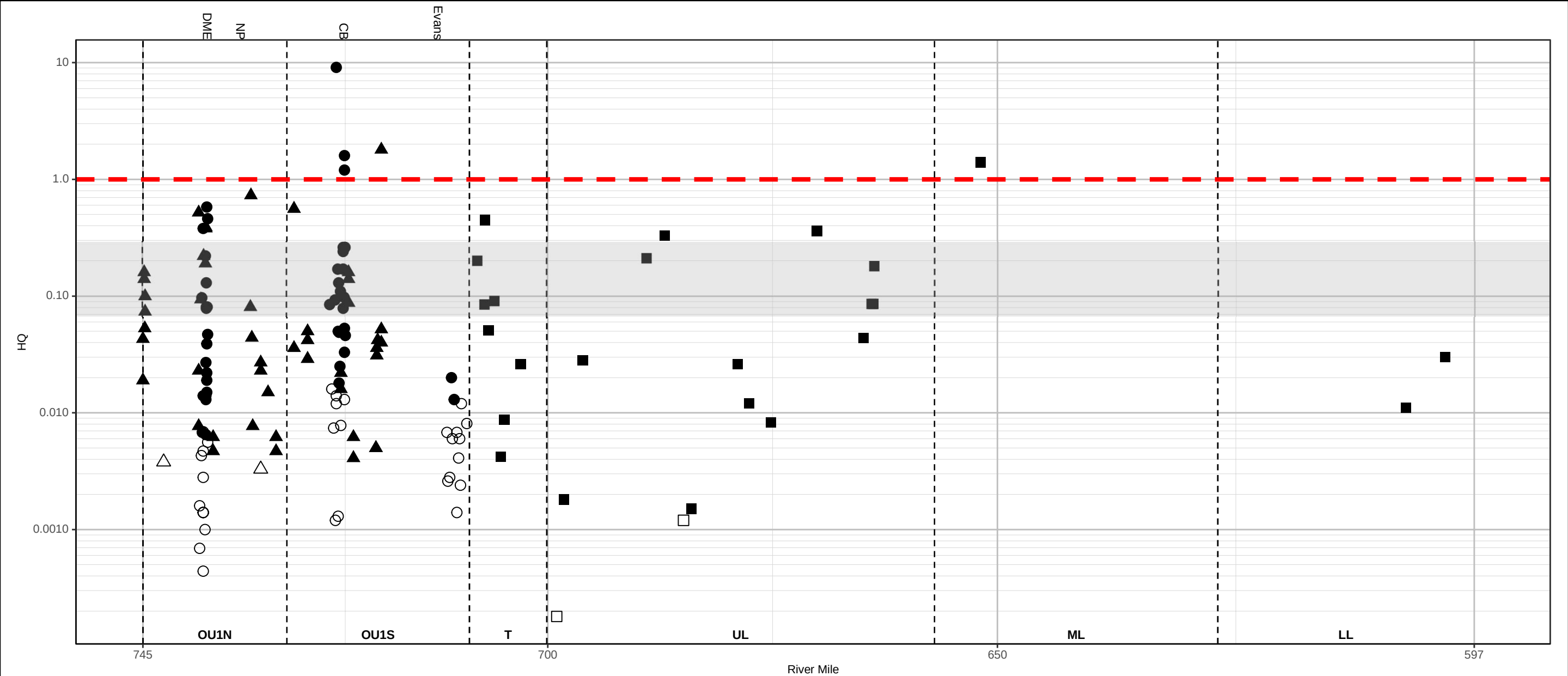


Figure M-3c. ELS Fish HQs by River Mile for Iron in Porewater
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington



Notes:
 HQs shown are based on the taxa-specific benchmark, if available, and if not, the aquatic life benchmark. See Table 4-9 in Volume 1.
 Nondetected results include detected values flagged as "U*" by the data validator due to contamination in the relevant blank.
 OU1N - OU 1 North
 OU1S - OU 1 South
 T - Transitional CSM Unit
 UL - Upper Lacustrine CSM Unit
 ML - Middle Lacustrine CSM Unit
 LL - Lower Lacustrine CSM Unit
 DME - Deadman's Eddy
 NP - Northport
 CB - China Bend

- Detected Value, 2013 Phase 2 Sediment Study
- ▲ Detected Value, 2015 USGS Porewater Study
- Detected Value, 2019 Phase 3 Sediment Study
- Nondetected Value, 2013 Phase 2 Sediment Study
- △ Nondetected Value, 2015 USGS Porewater Study
- Nondetected Value, 2019 Phase 3 Sediment Study
- HQ = 1
- - - CSM Unit Boundary
- BTV HQ Range: 0.0670—0.290

Figure M-3d. ELS Fish HQs by River Mile for Lead in Porewater
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

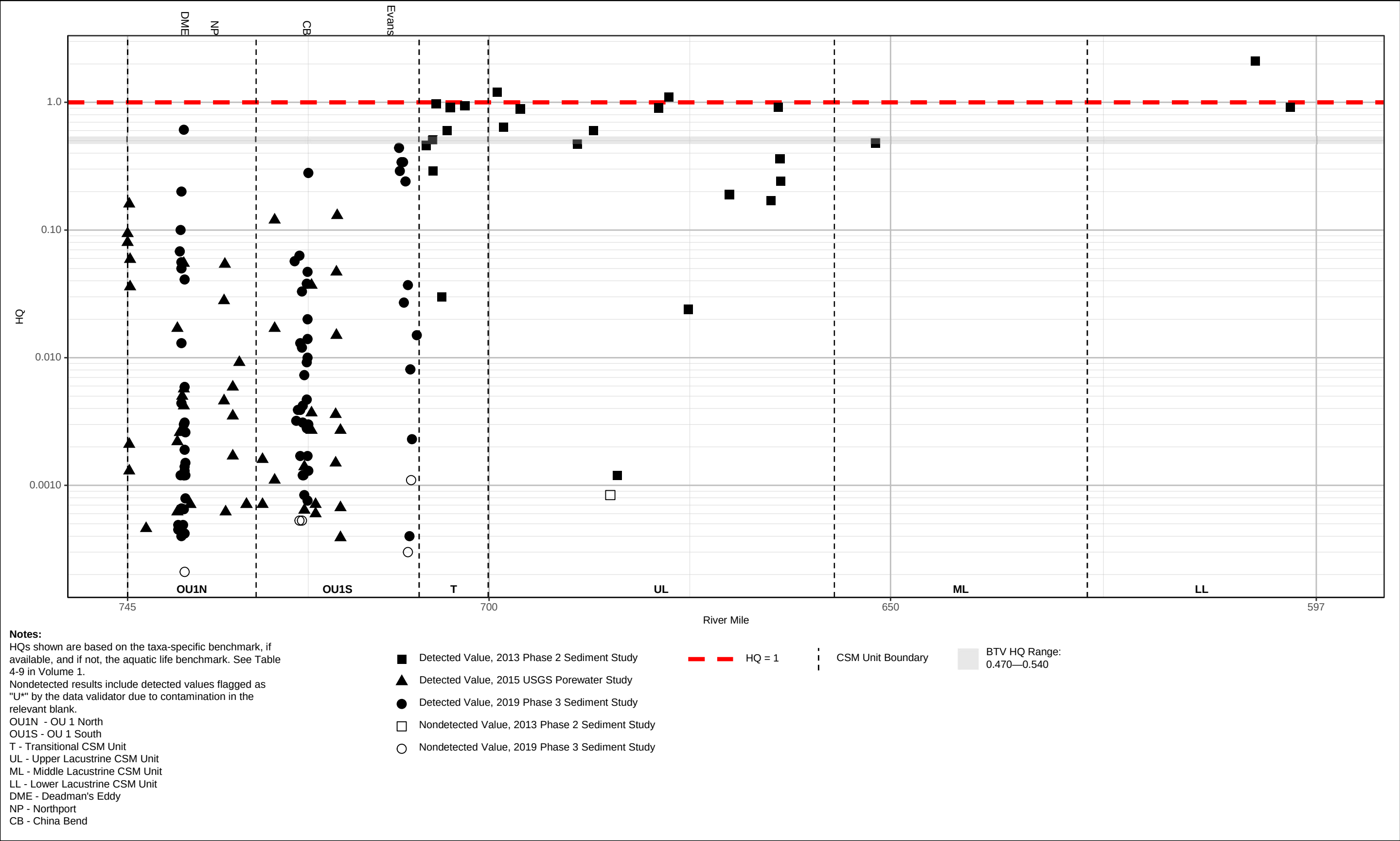


Figure M-3e. ELS Fish HQs by River Mile for Mangnese in Porewater
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

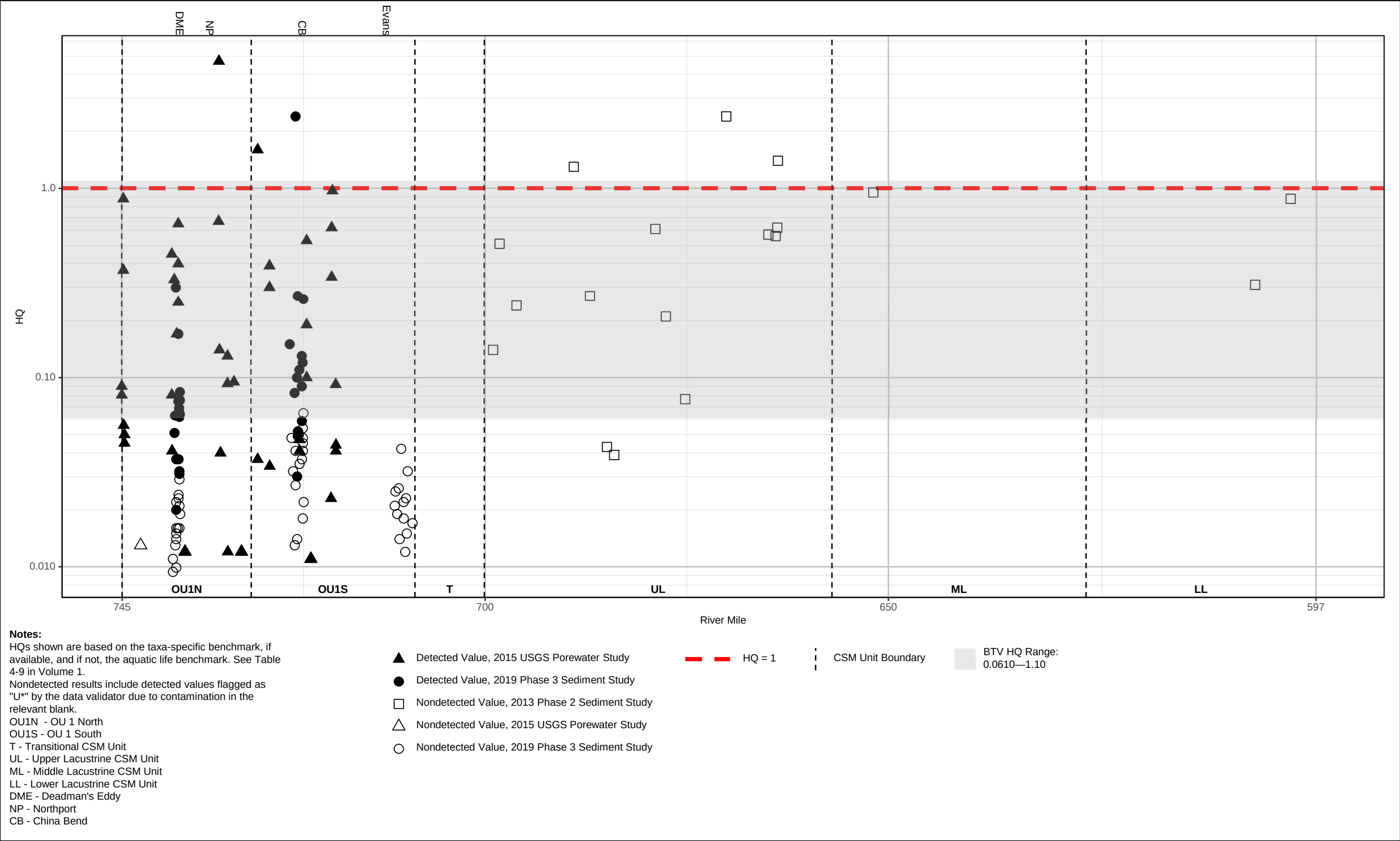


Figure M-3f. ELS Fish HQs by River Mile for Zinc in Porewater
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

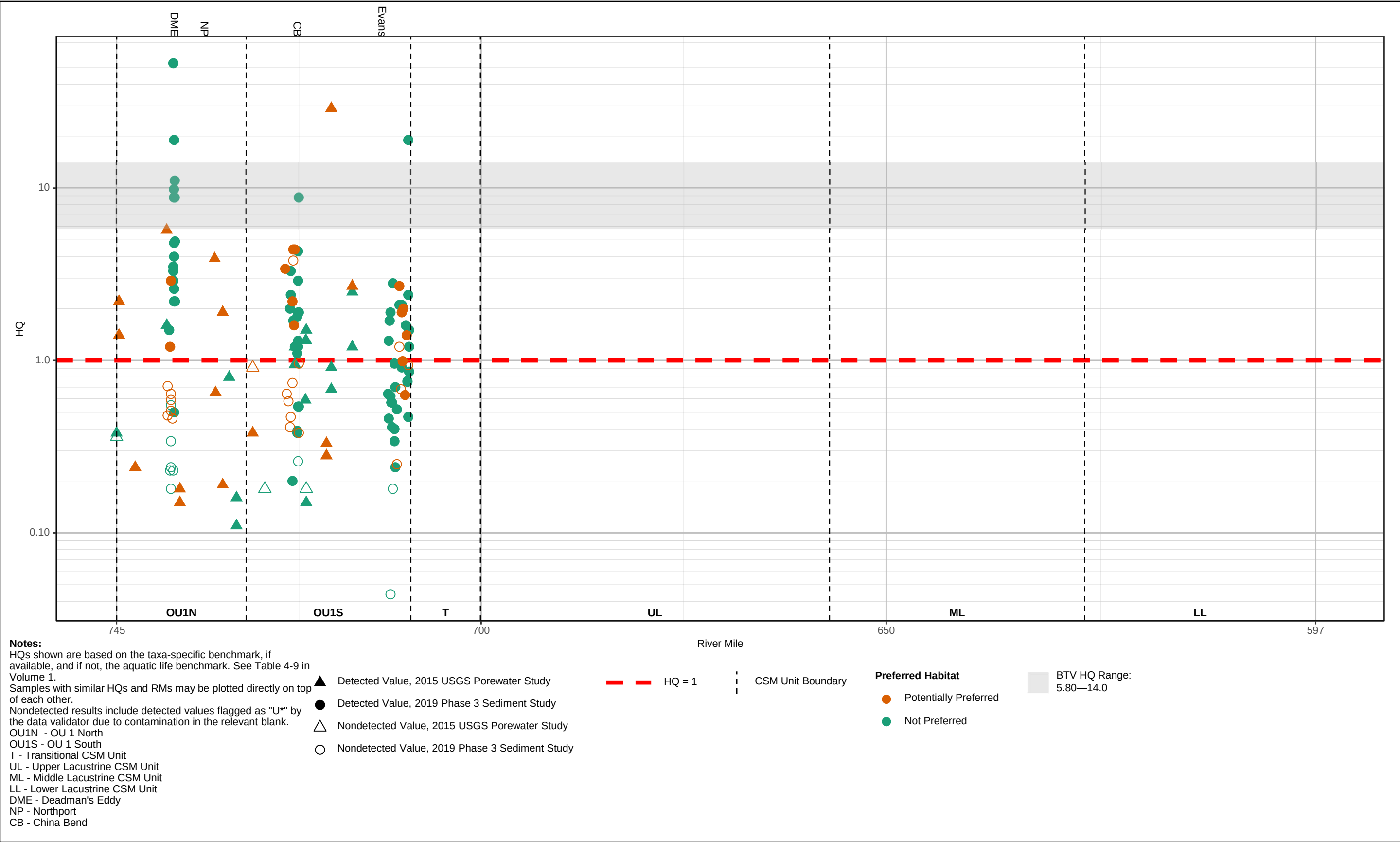


Figure M-4a. ELS White Sturgeon HQs by River Mile for Copper in Porewater
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

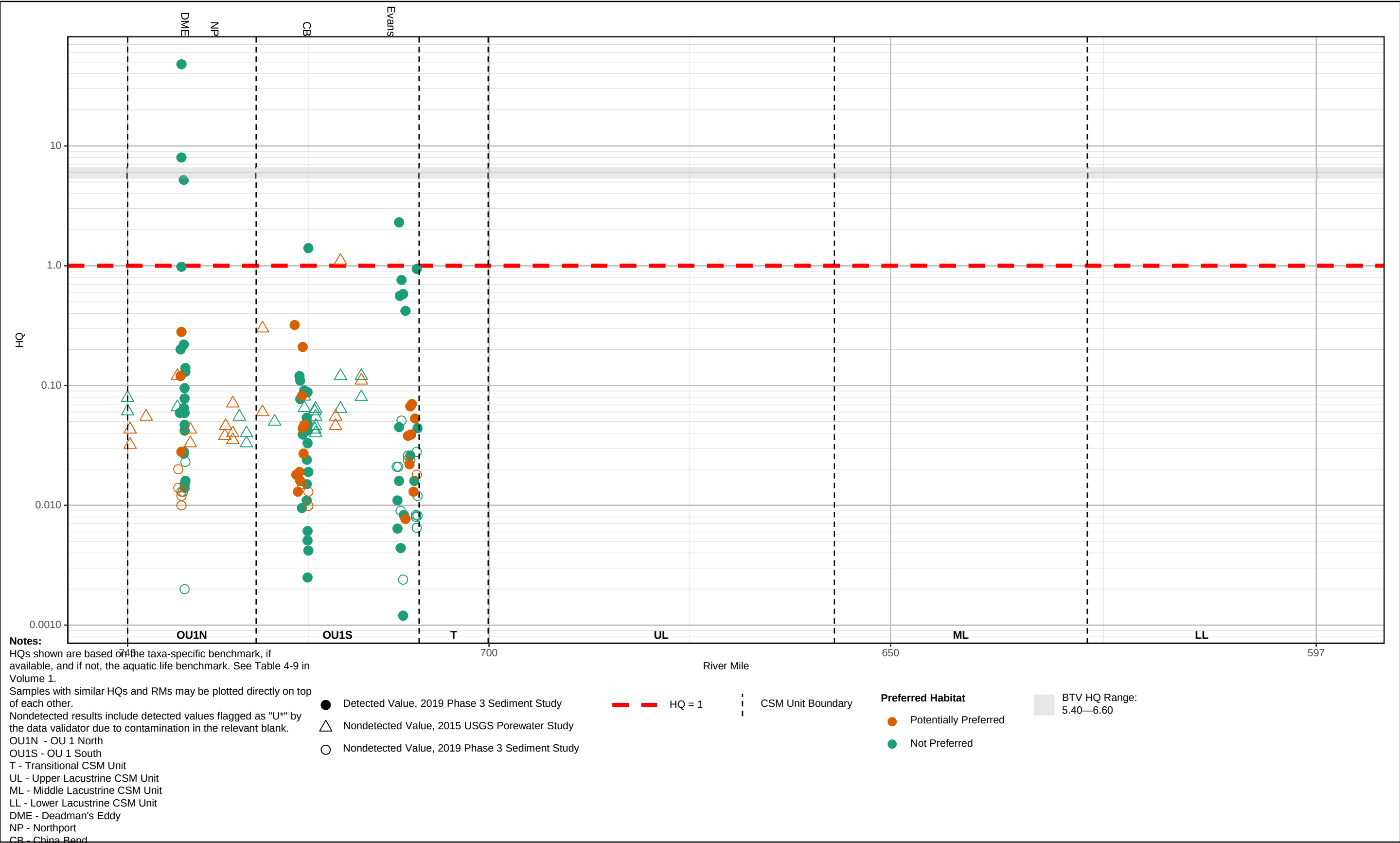


Figure M-4b. ELS White Sturgeon HQs by River Mile for Iron in Porewater
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

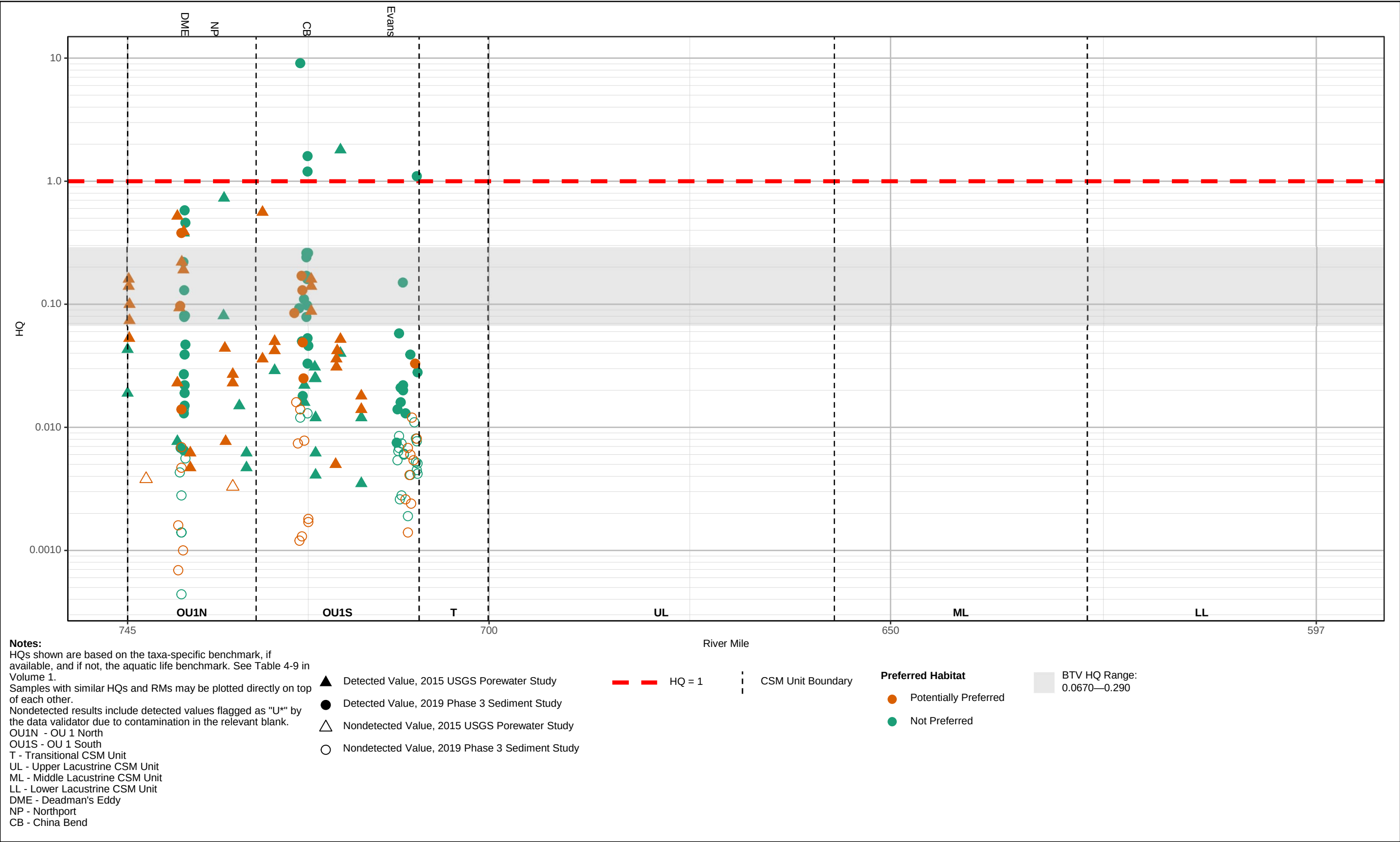
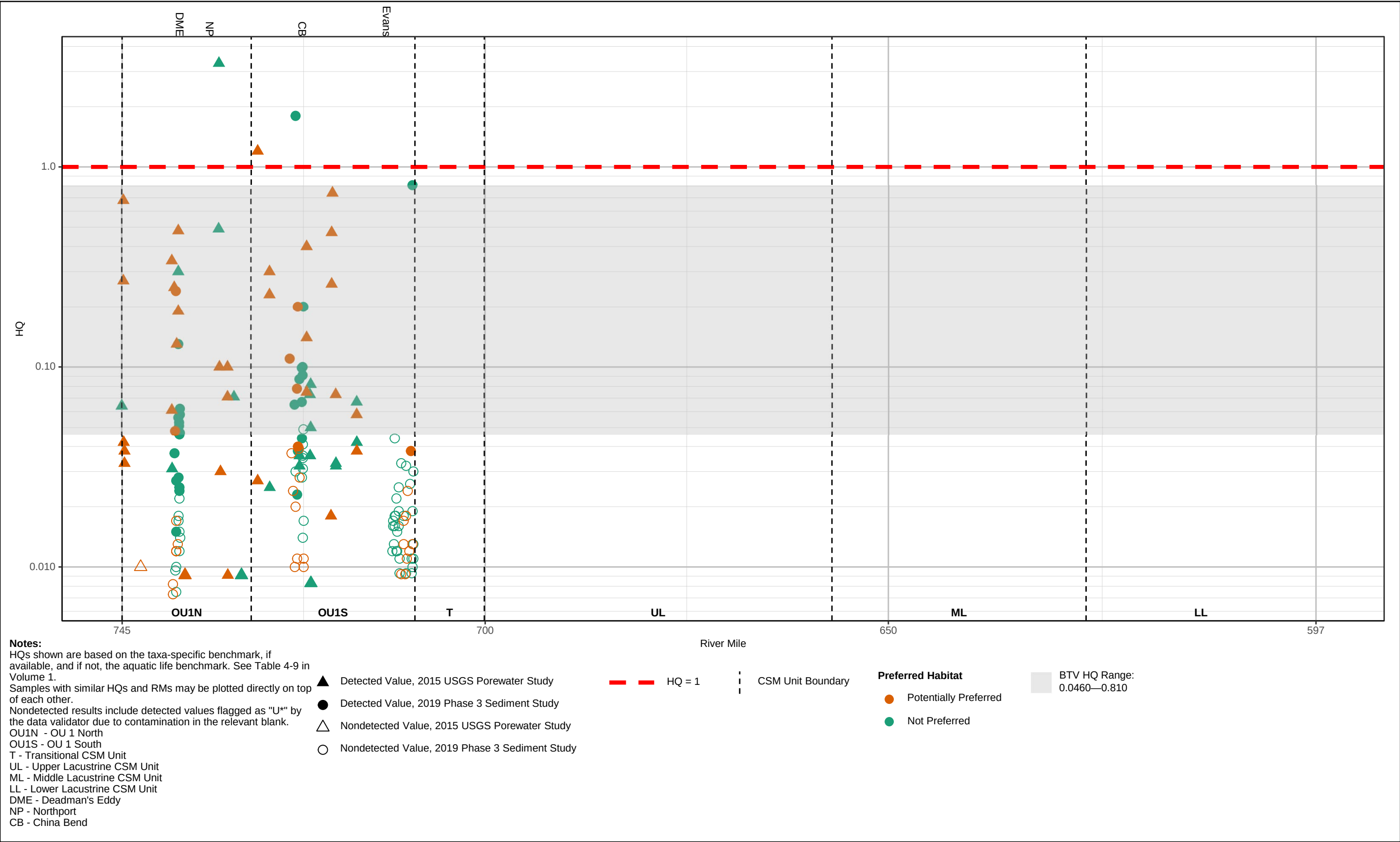


Figure M-4c. ELS White Sturgeon HQs by River Mile for Lead in Porewater
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington



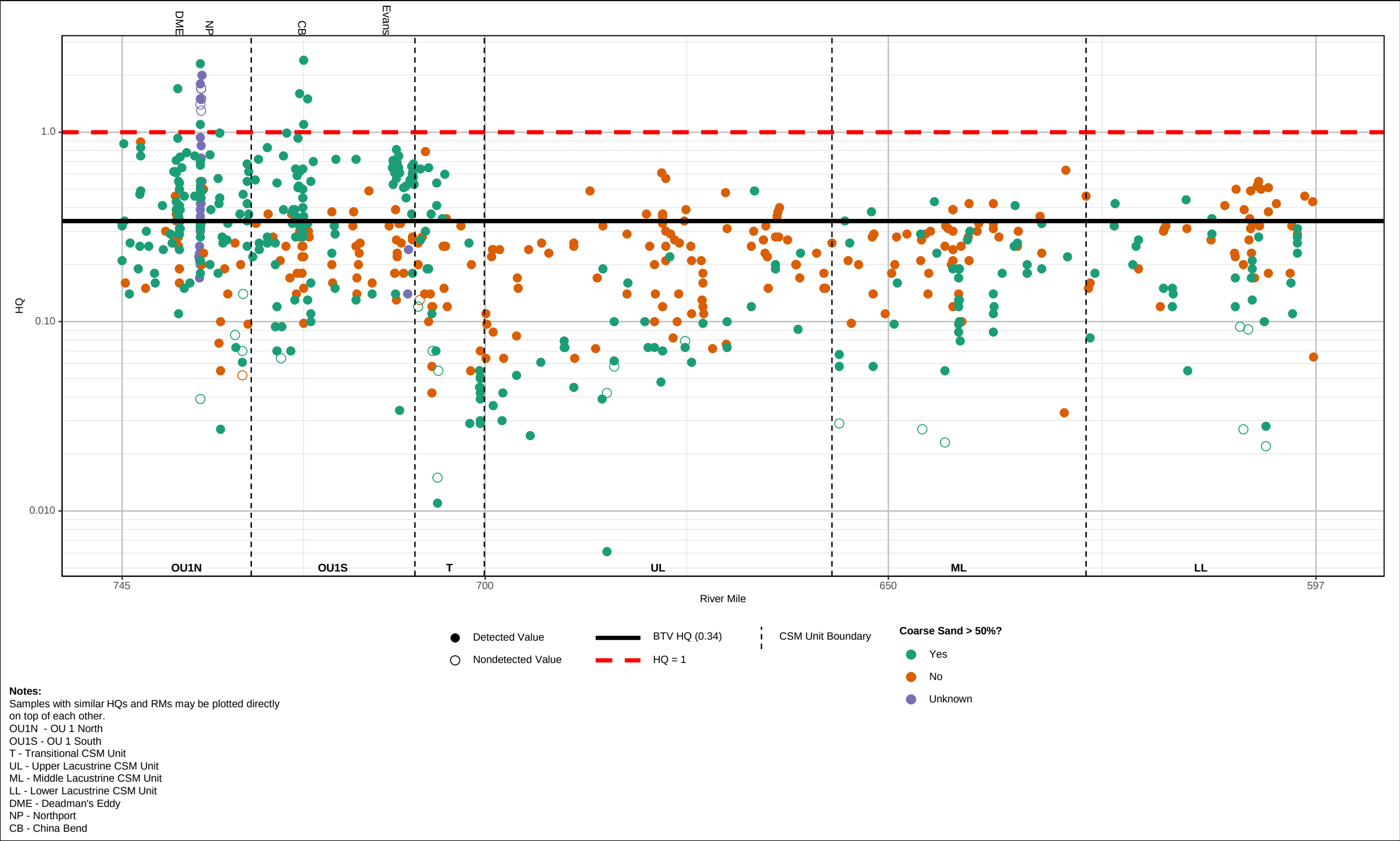


Figure M-5a. Benthic Invertebrate HQs by River Mile for Arsenic in Sediment
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

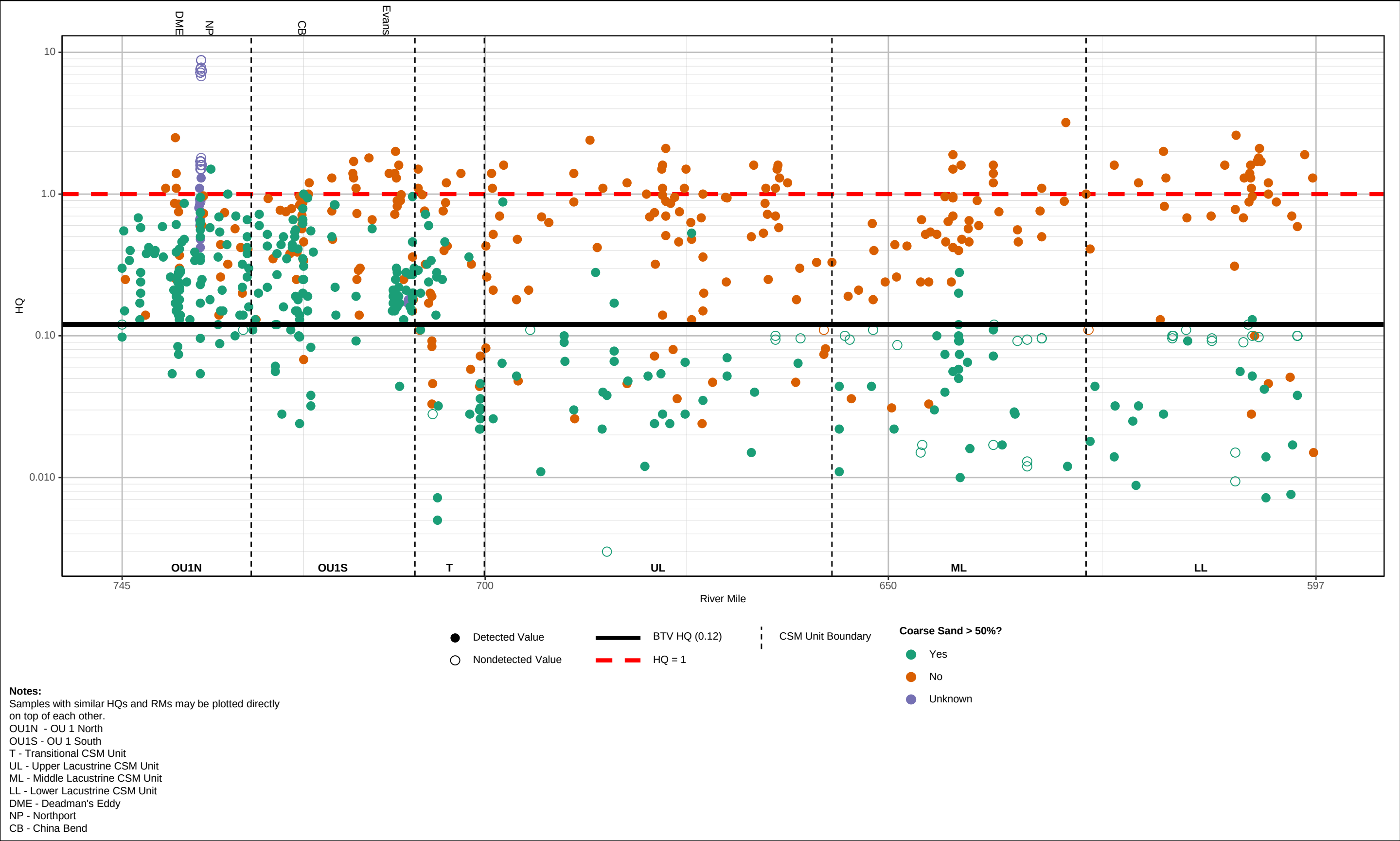


Figure M-5b. Benthic Invertebrate HQs by River Mile for Cadmium in Sediment
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

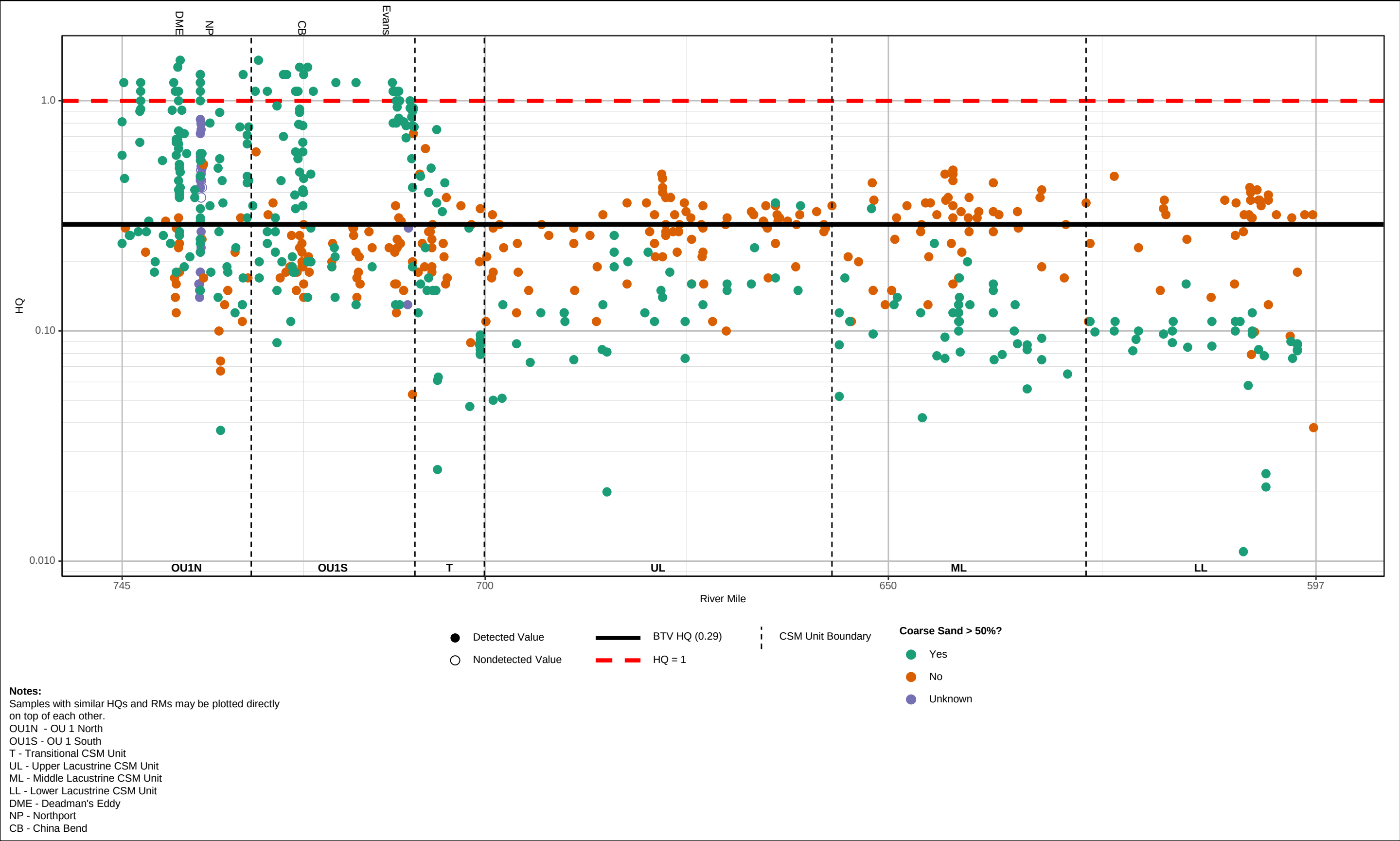


Figure M-5c. Benthic Invertebrate HQs by River Mile for Chromium in Sediment
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

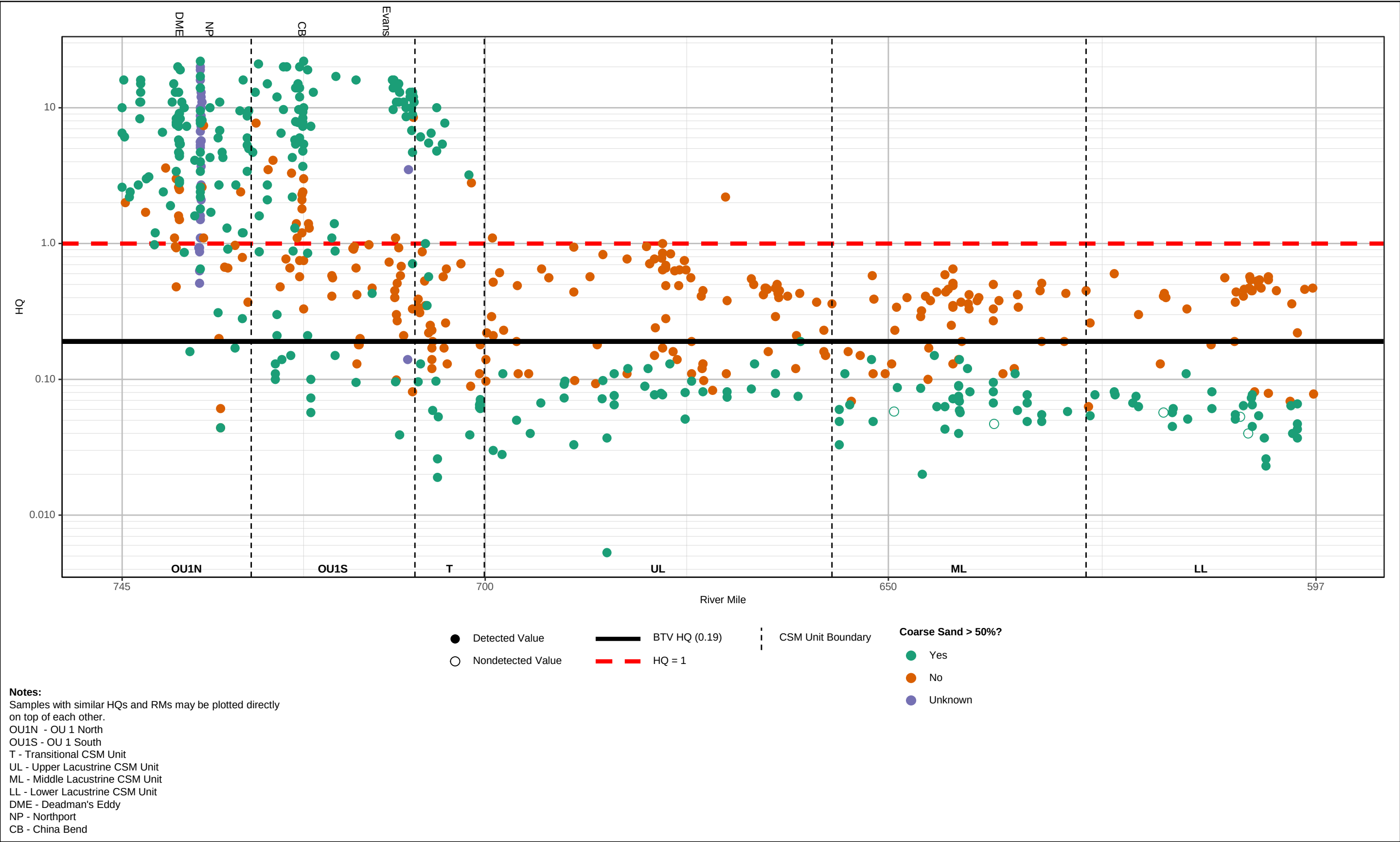


Figure M-5d. Benthic Invertebrate HQs by River Mile for Copper in Sediment
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

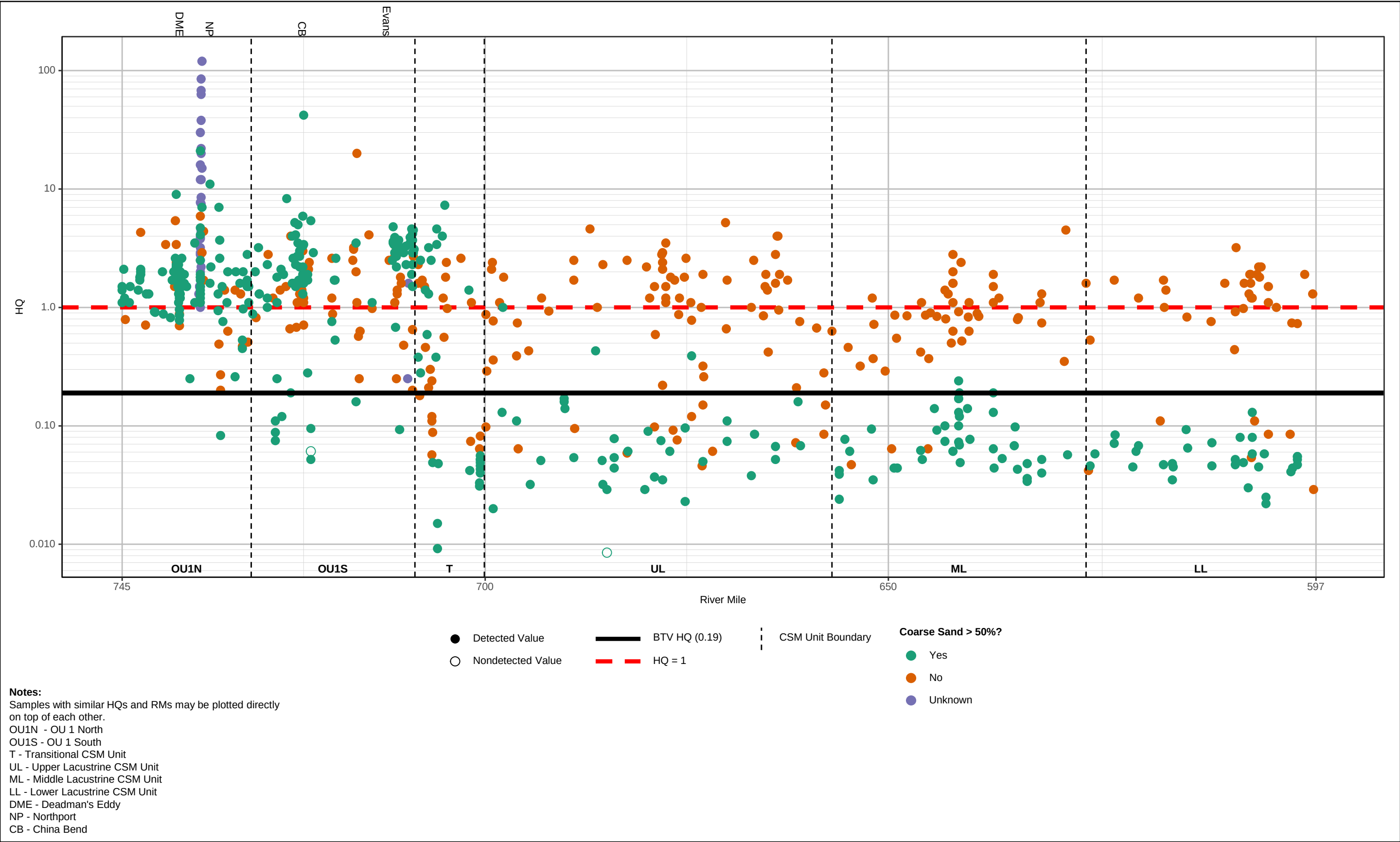


Figure M-5e. Benthic Invertebrate HQs by River Mile for Lead in Sediment
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

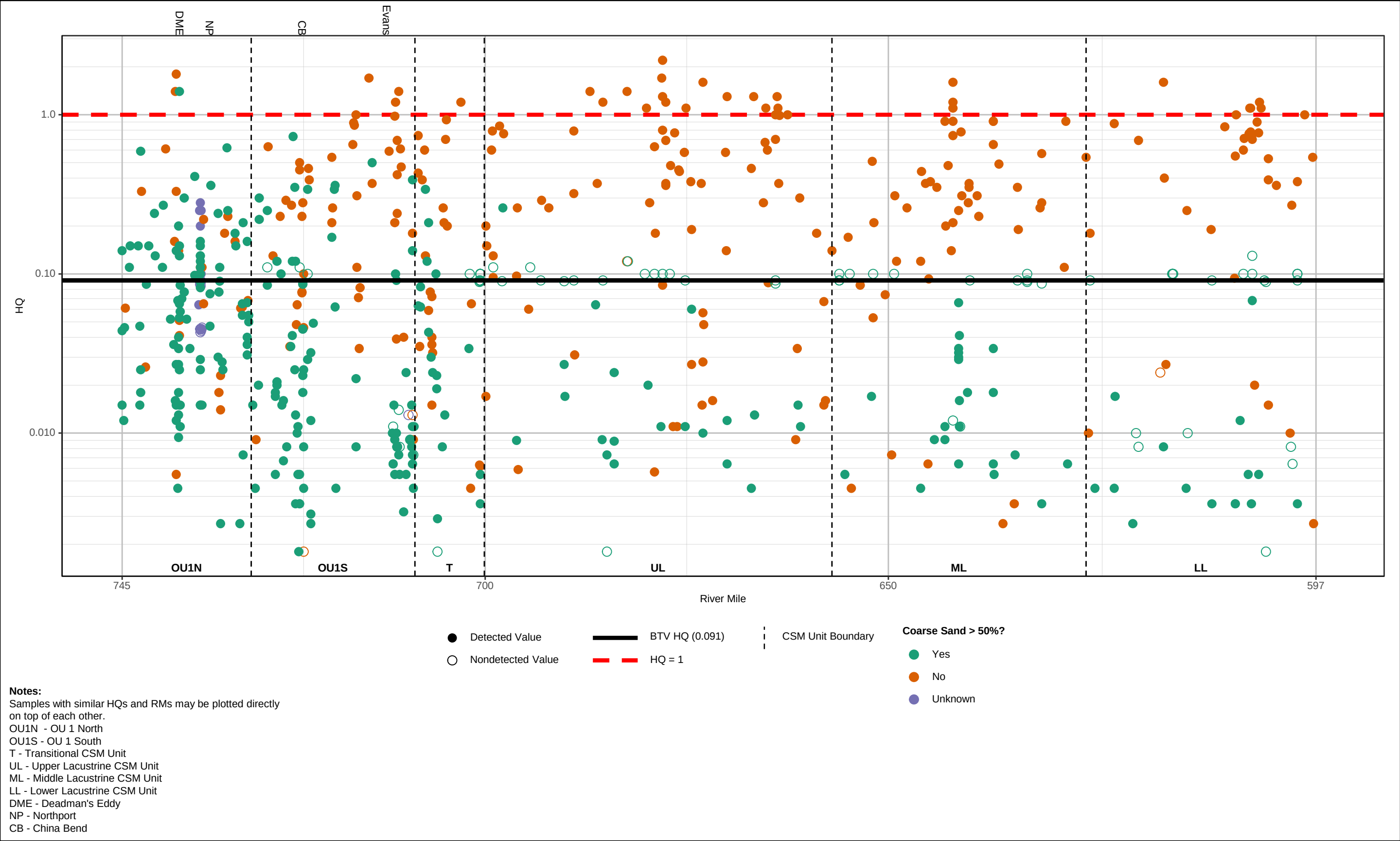


Figure M-5f. Benthic Invertebrate HQs by River Mile for Mercury in Sediment
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

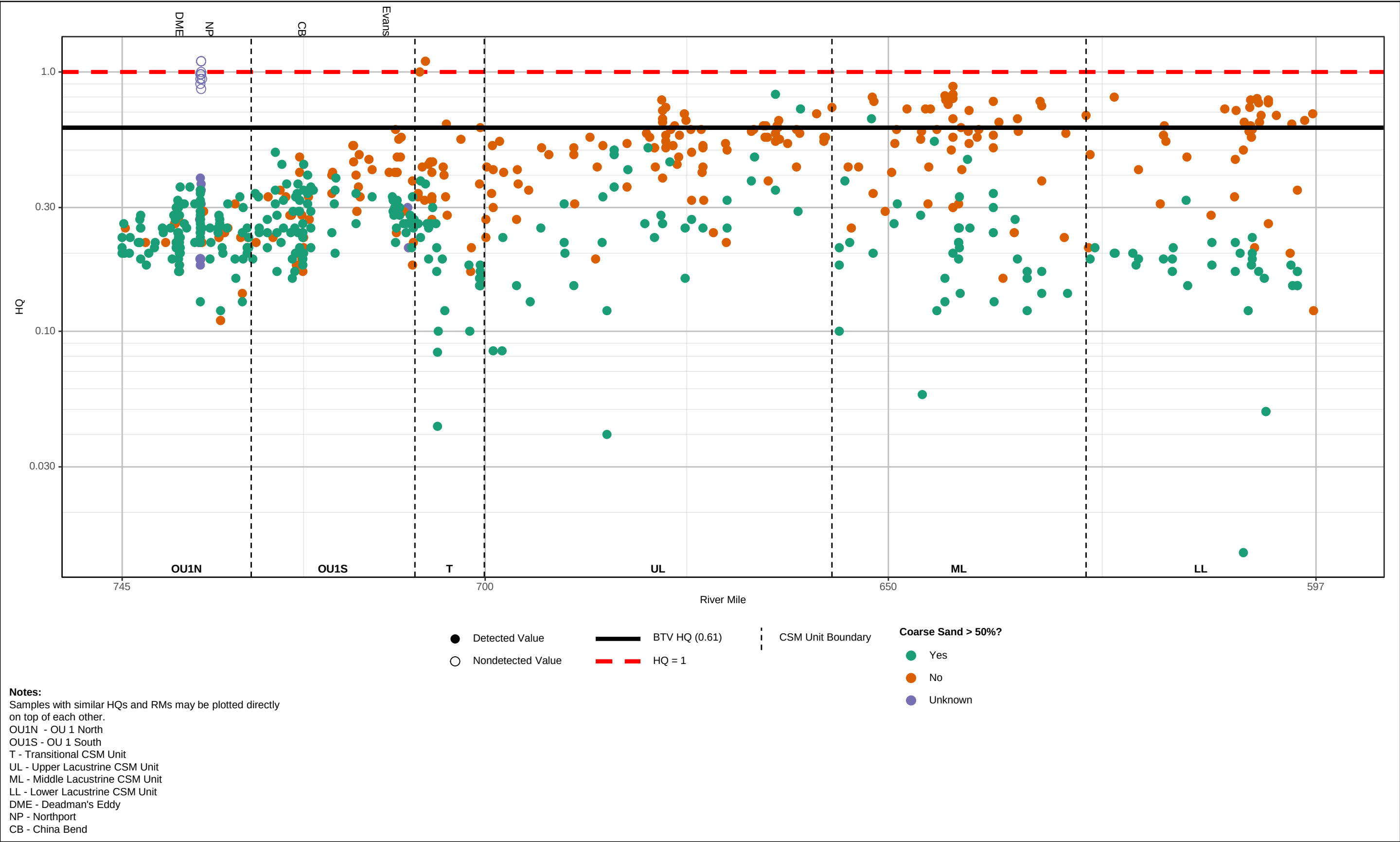


Figure M-5g. Benthic Invertebrate HQs by River Mile for Nickel in Sediment
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

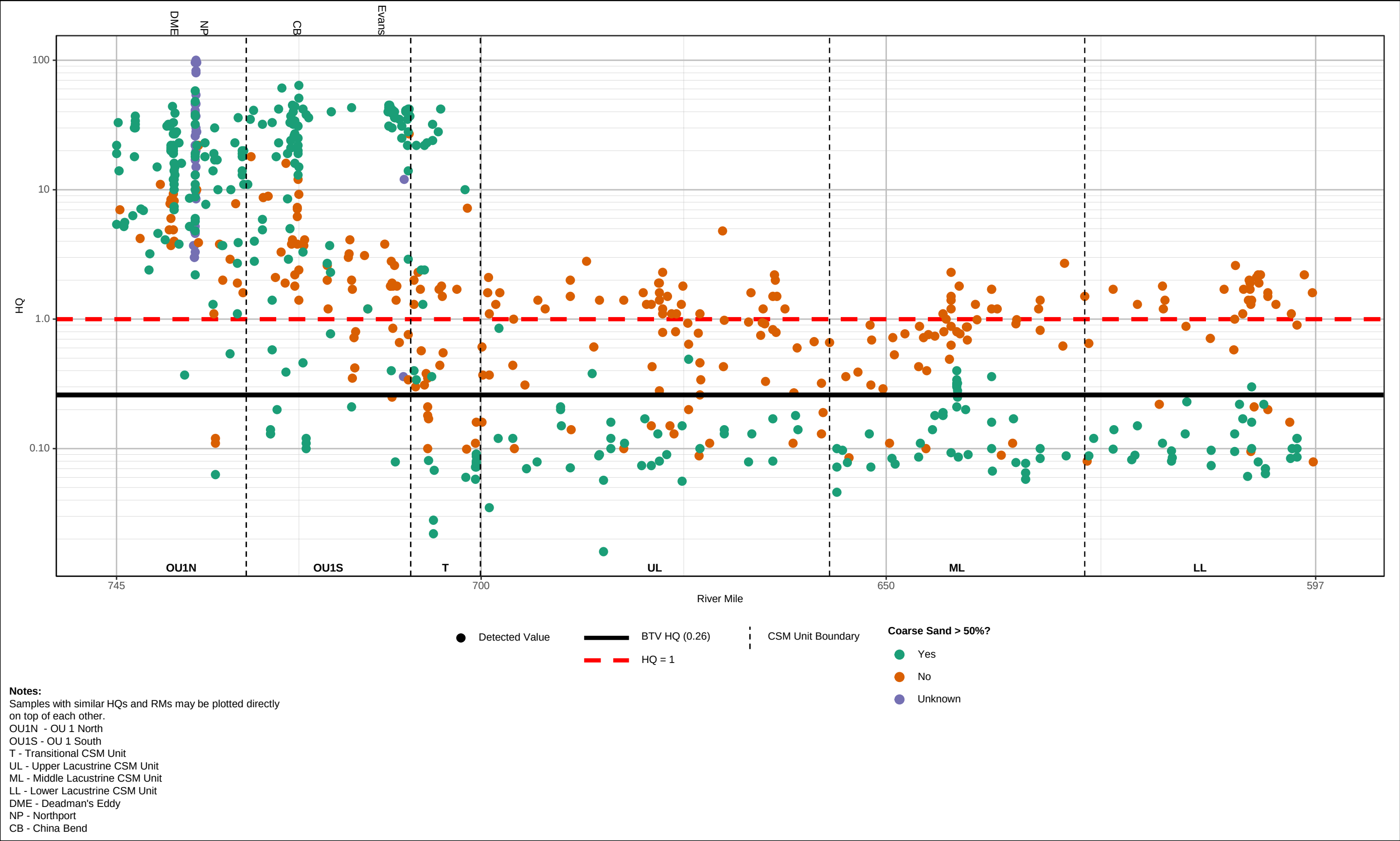


Figure M-5h. Benthic Invertebrate HQs by River Mile for Zinc in Sediment
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

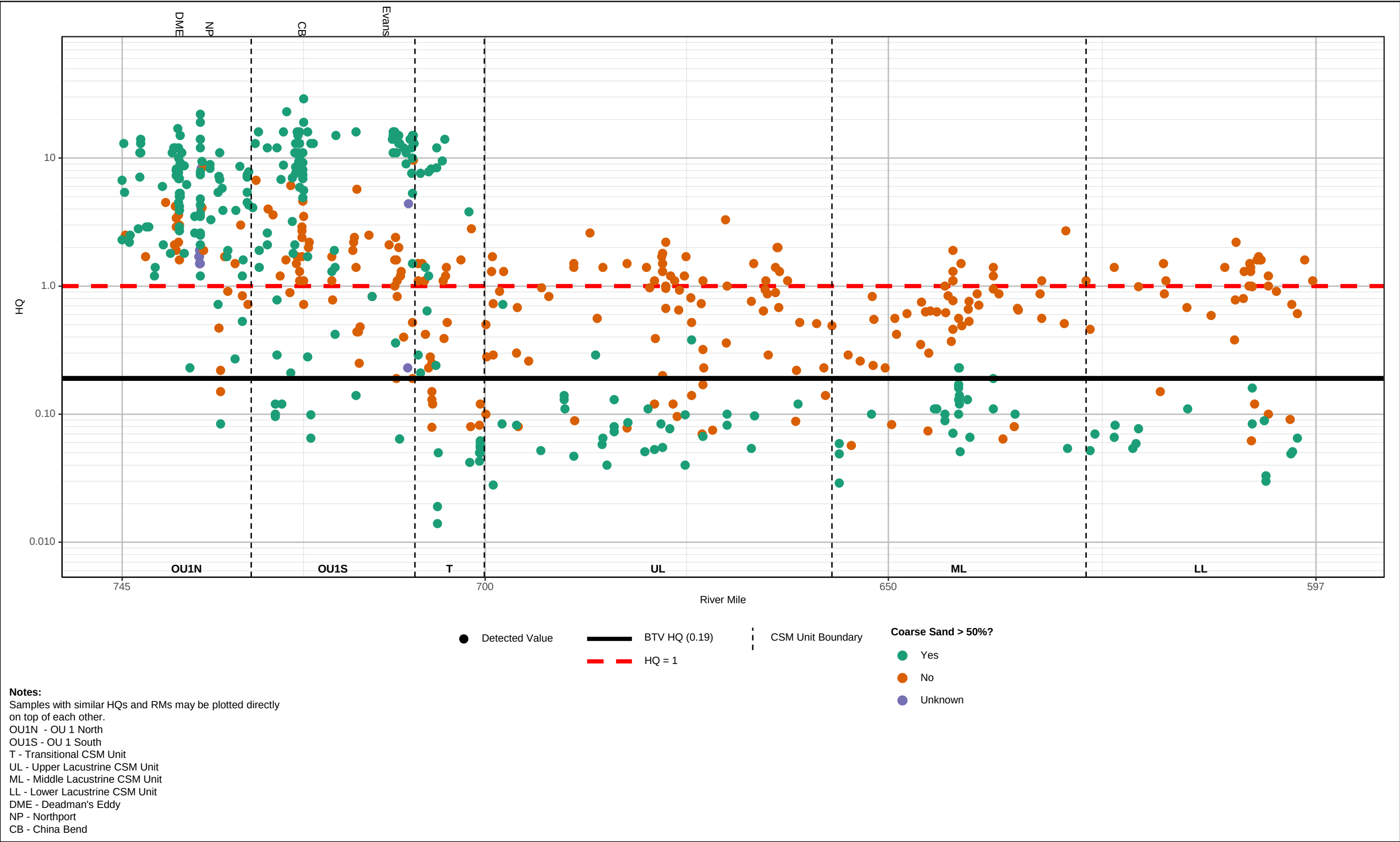


Figure M-5i. Benthic Invertebrate HQs by River Mile for Mean PEC Quotient (Cadmium, Copper, Lead, Zinc) in Sediment
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

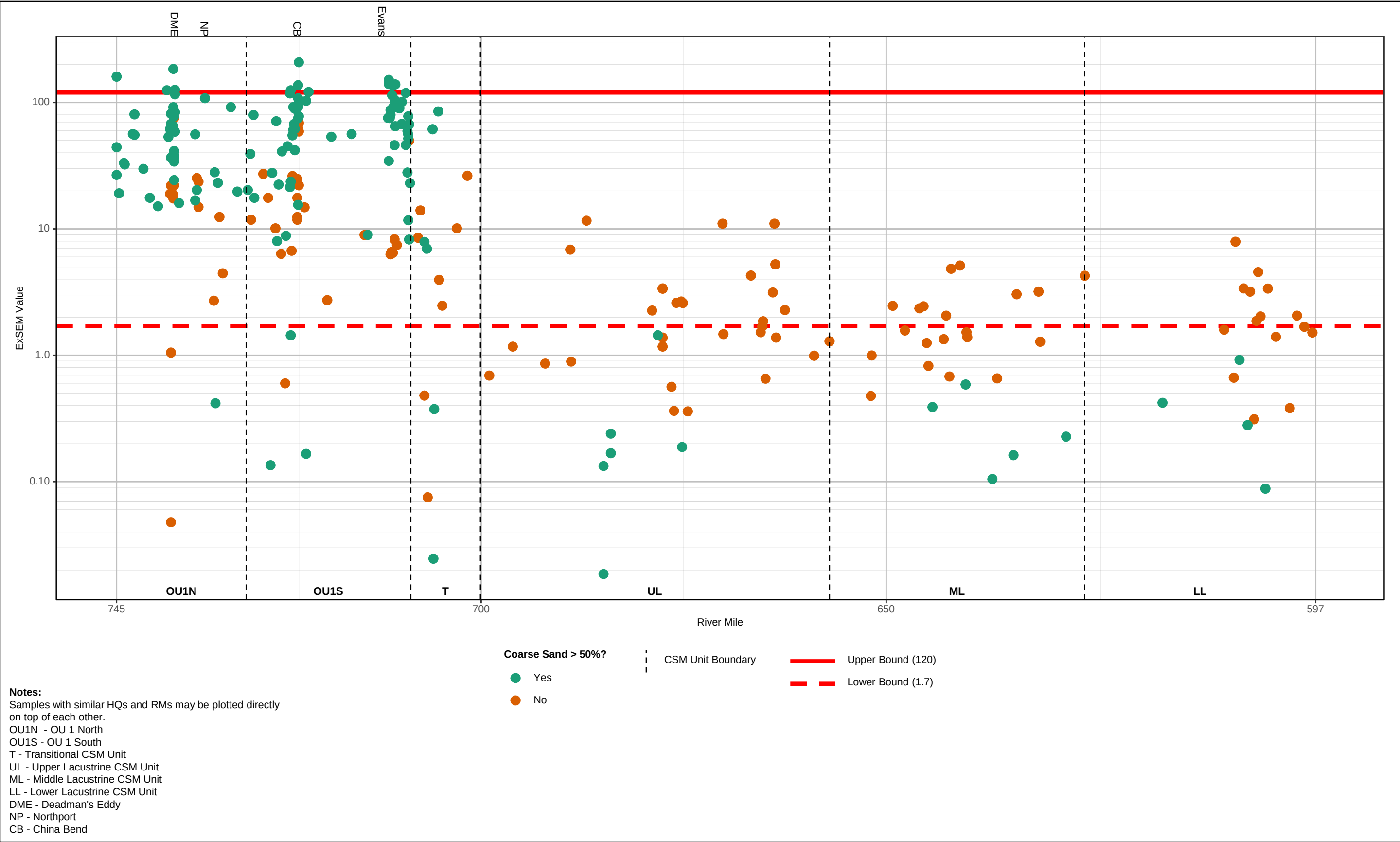


Figure M-5j. Benthic Invertebrate HQs by River Mile for Excess SEM (Cadmium, Copper, Lead, Nickel, Zinc) in Sediment
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

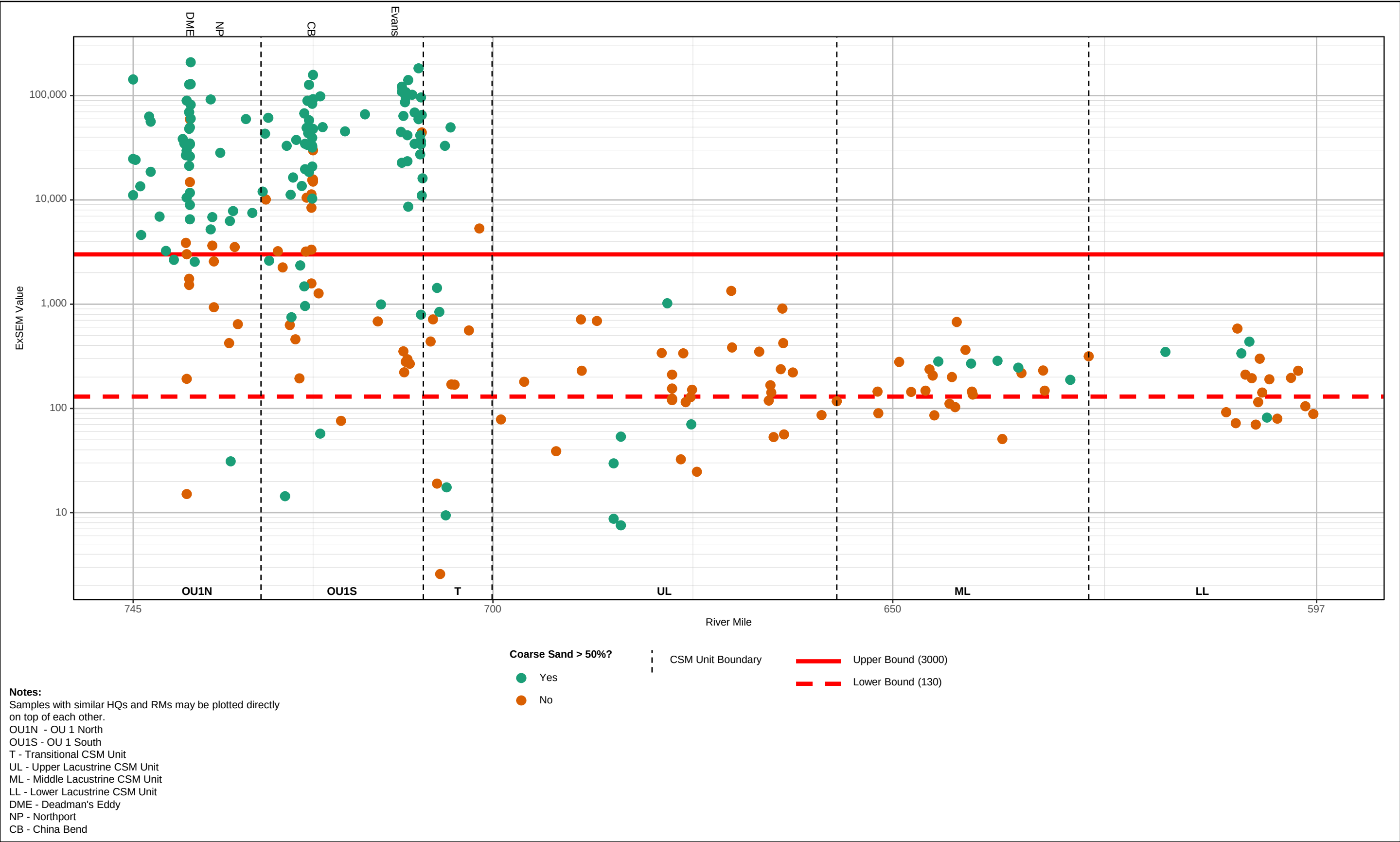


Figure M-5k. Benthic Invertebrate HQs by River Mile for OC-Normalized Excess SEM (Cadmium, Copper, Lead, Nickel, Zinc) in Sediment
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

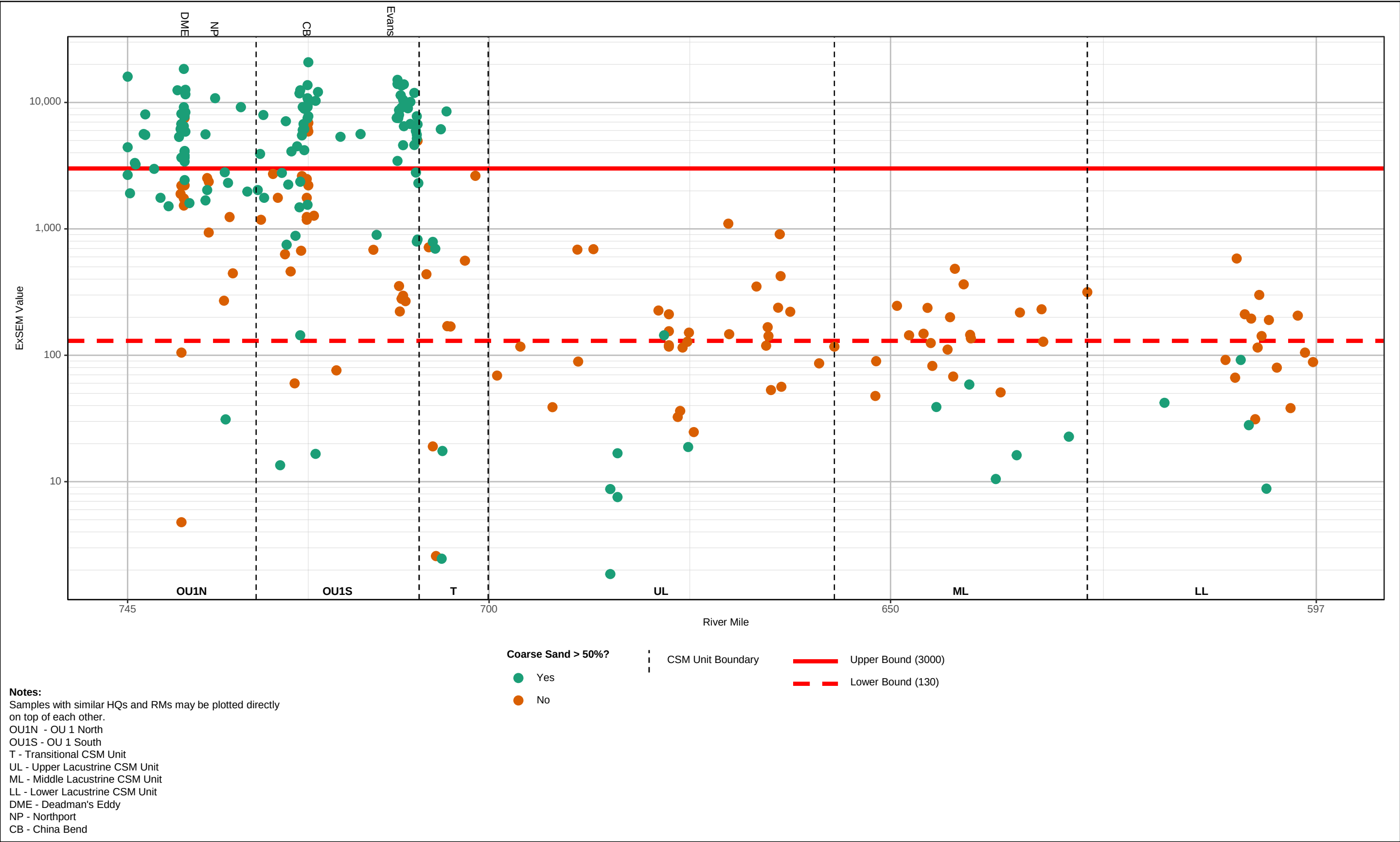


Figure M-5I. Benthic Invertebrate HQs by River Mile for OC-Normalized Excess SEM with 1% OC Floor (Cadmium, Copper, Lead, Nickel, Zinc) in Sediment
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

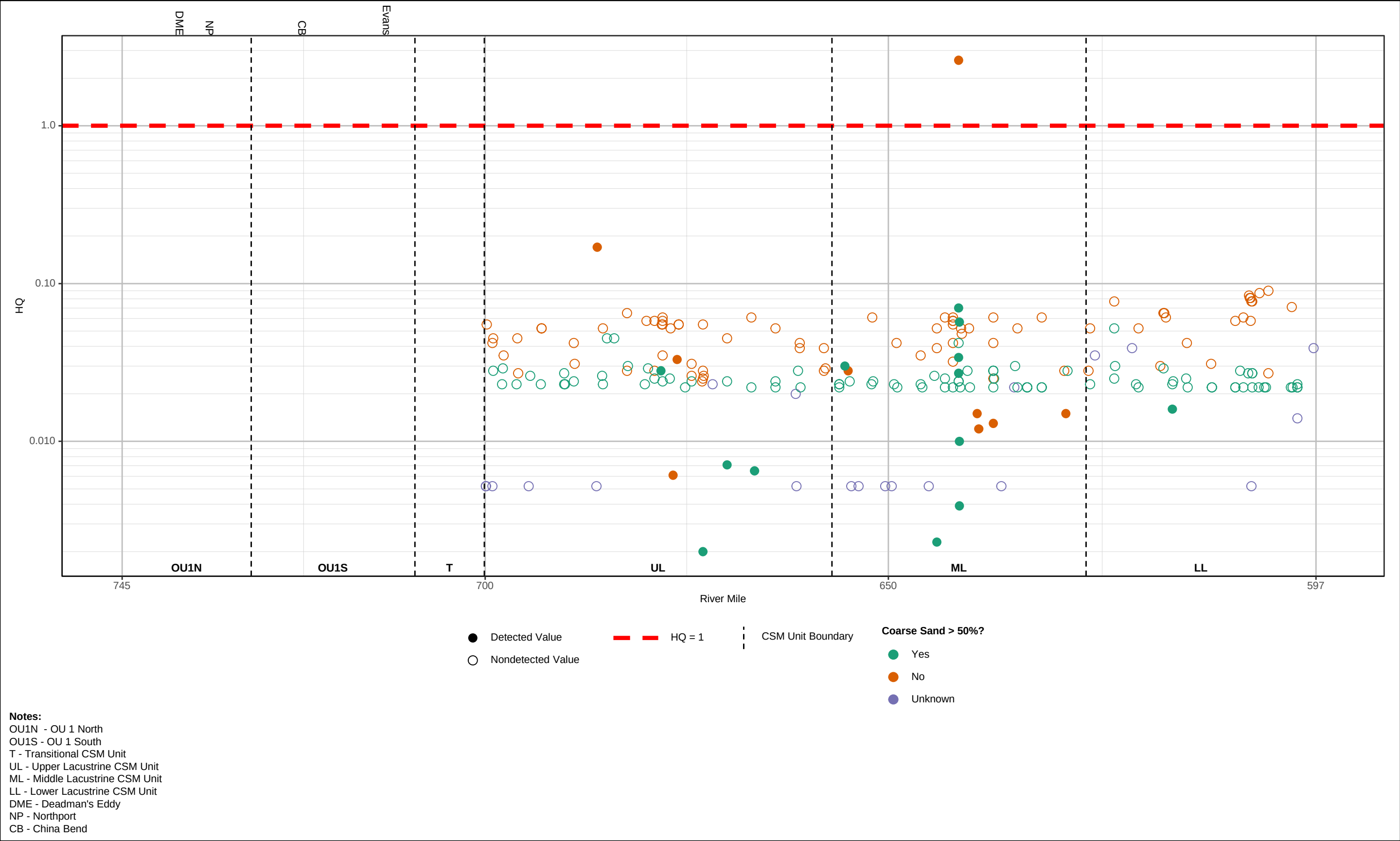


Figure M-5m. Benthic Invertebrate HQs by River Mile for Total DDE (0 DL) in Sediment
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

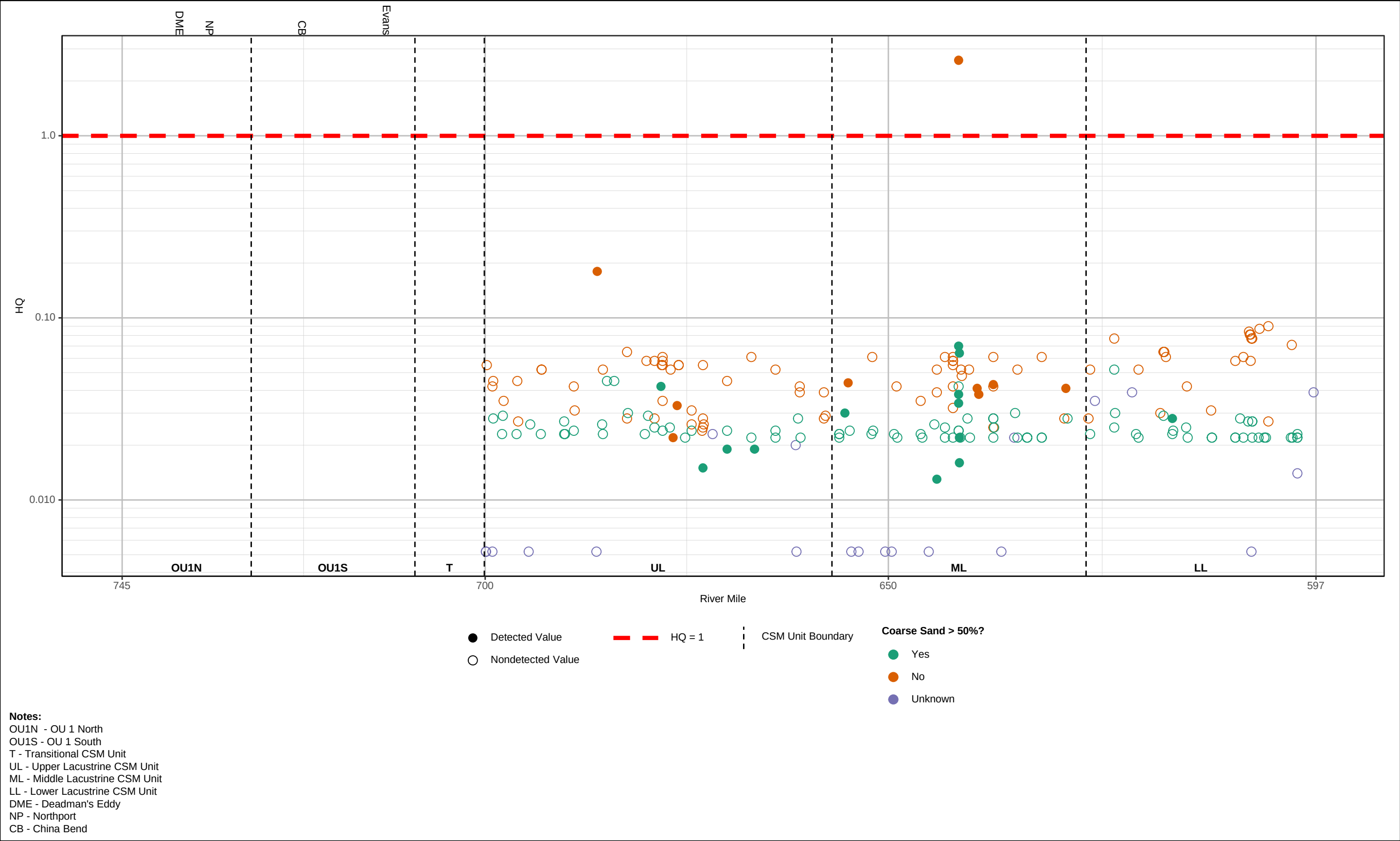


Figure M-5n. Benthic Invertebrate HQs by River Mile for Total DDE (1/2 DL) in Sediment
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

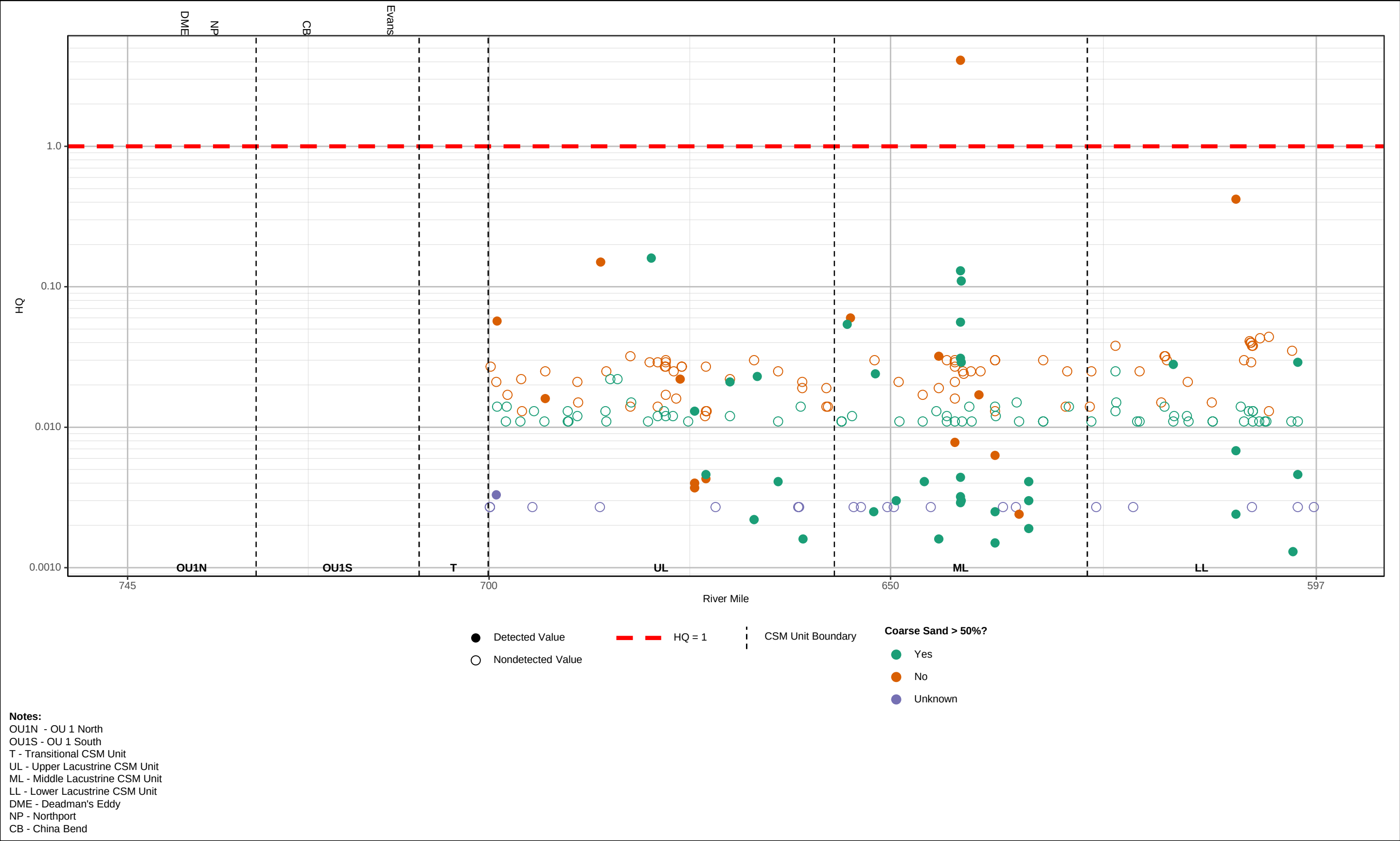


Figure M-5o. Benthic Invertebrate HQs by River Mile for Total DDT (0 DL) in Sediment
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

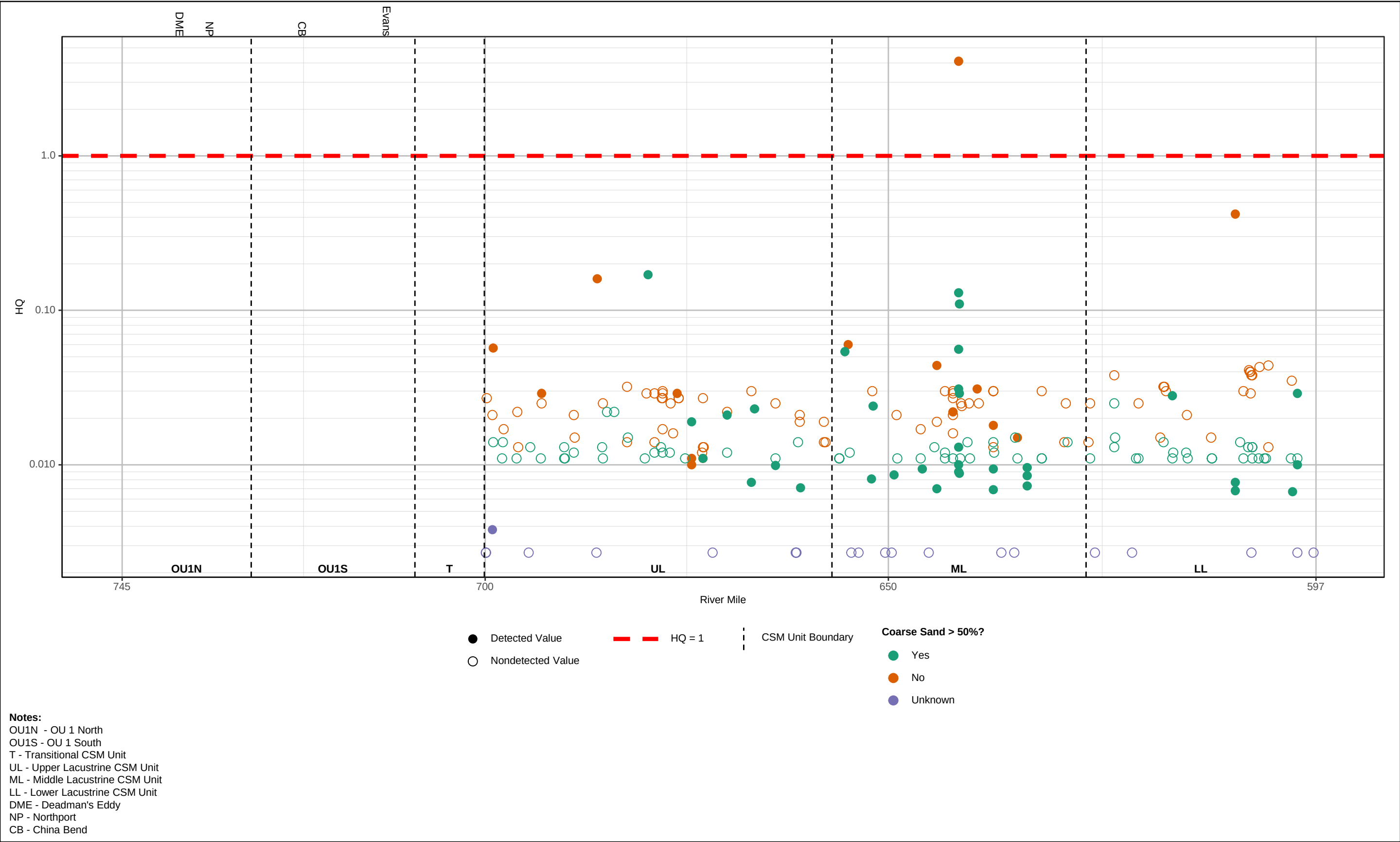


Figure M-5p. Benthic Invertebrate HQs by River Mile for Total DDT (1/2 DL) in Sediment
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

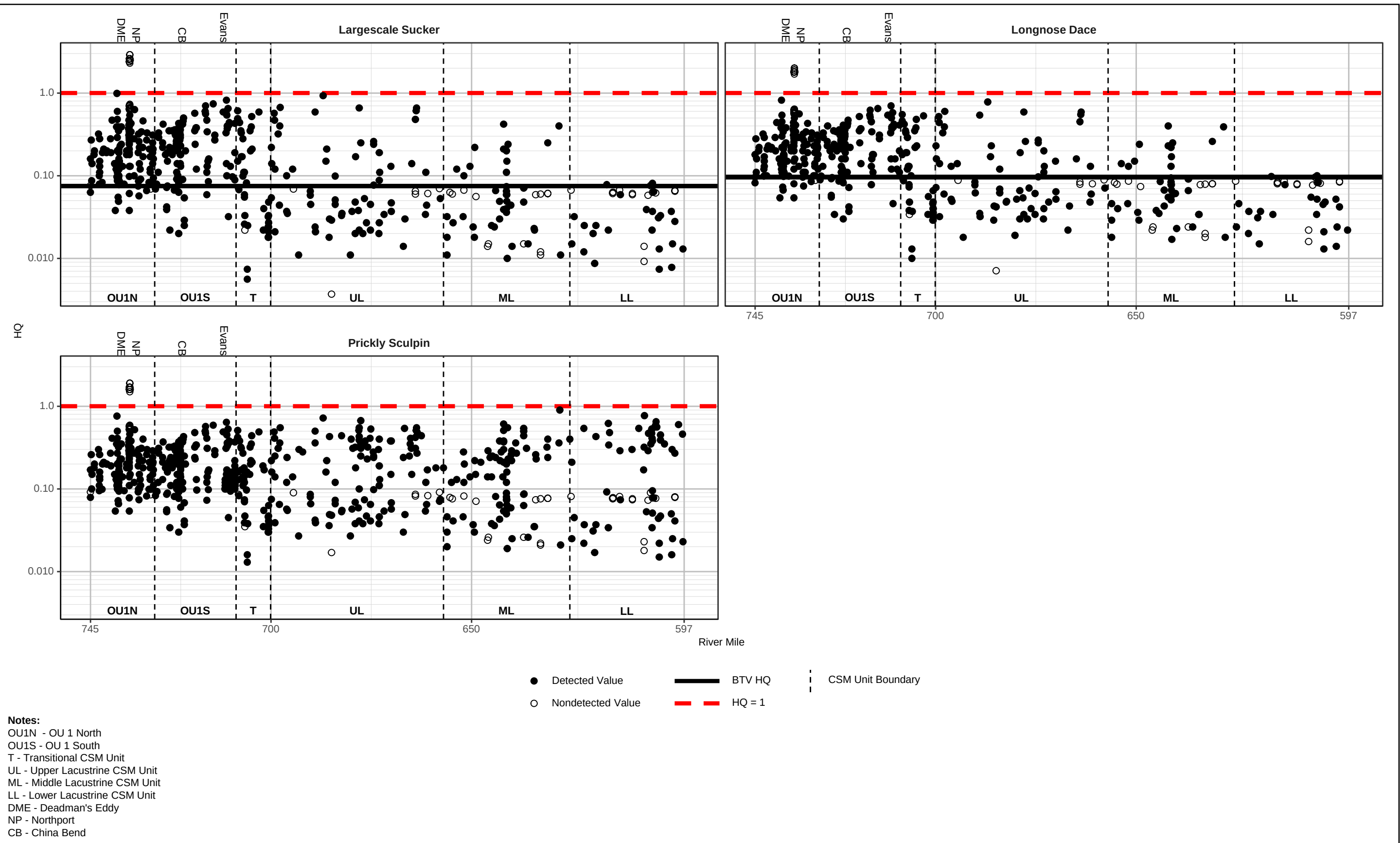
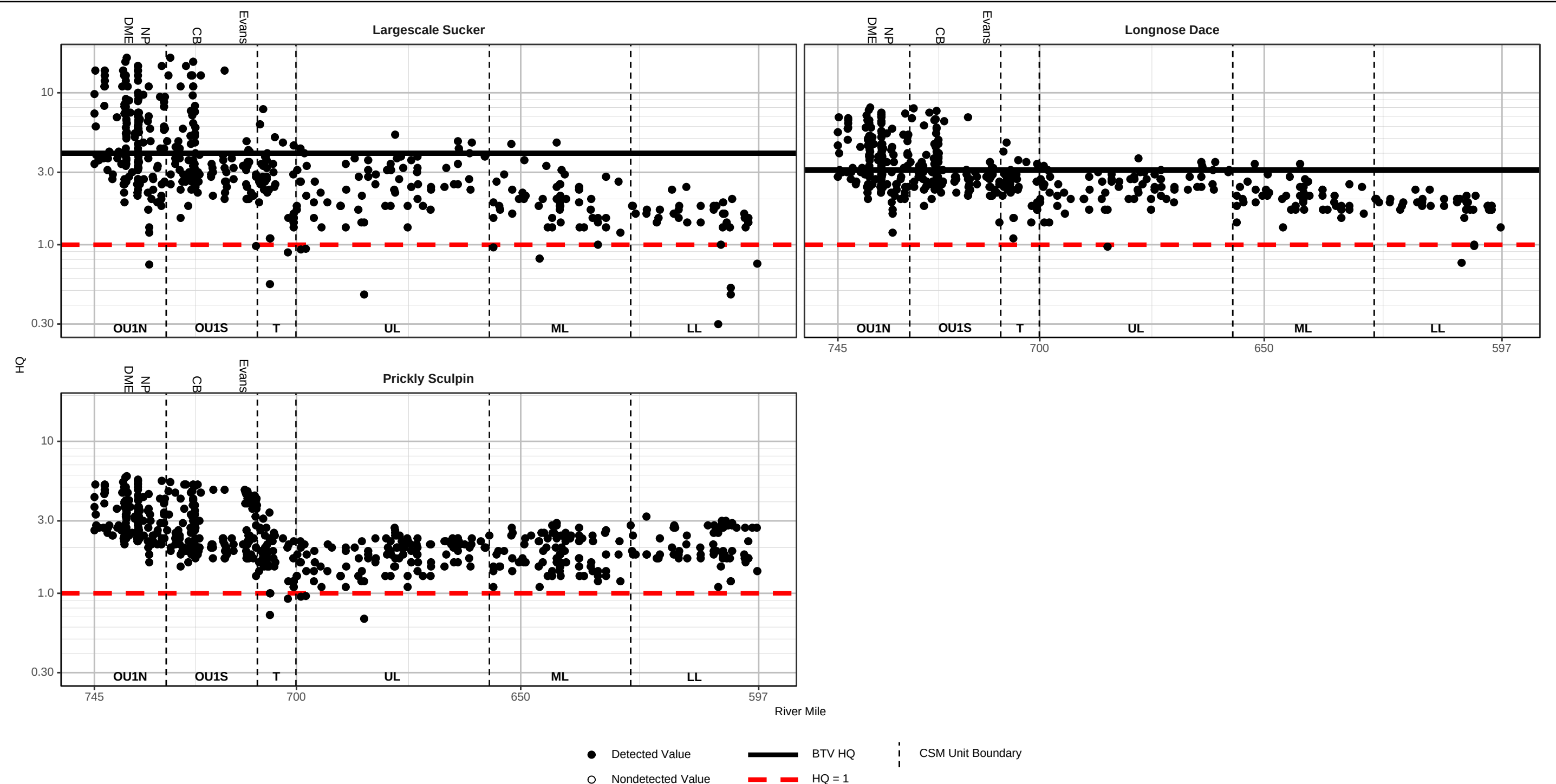


Figure M-6a. Point-by-Point Dietary Fish HQs by River Mile for Cadmium
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington



Notes:
 OU1N - OU 1 North
 OU1S - OU 1 South
 T - Transitional CSM Unit
 UL - Upper Lacustrine CSM Unit
 ML - Middle Lacustrine CSM Unit
 LL - Lower Lacustrine CSM Unit
 DME - Deadman's Eddy
 NP - Northport
 CB - China Bend

Figure M-6b. Point-by-Point Dietary Fish HQs by River Mile for Chromium
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

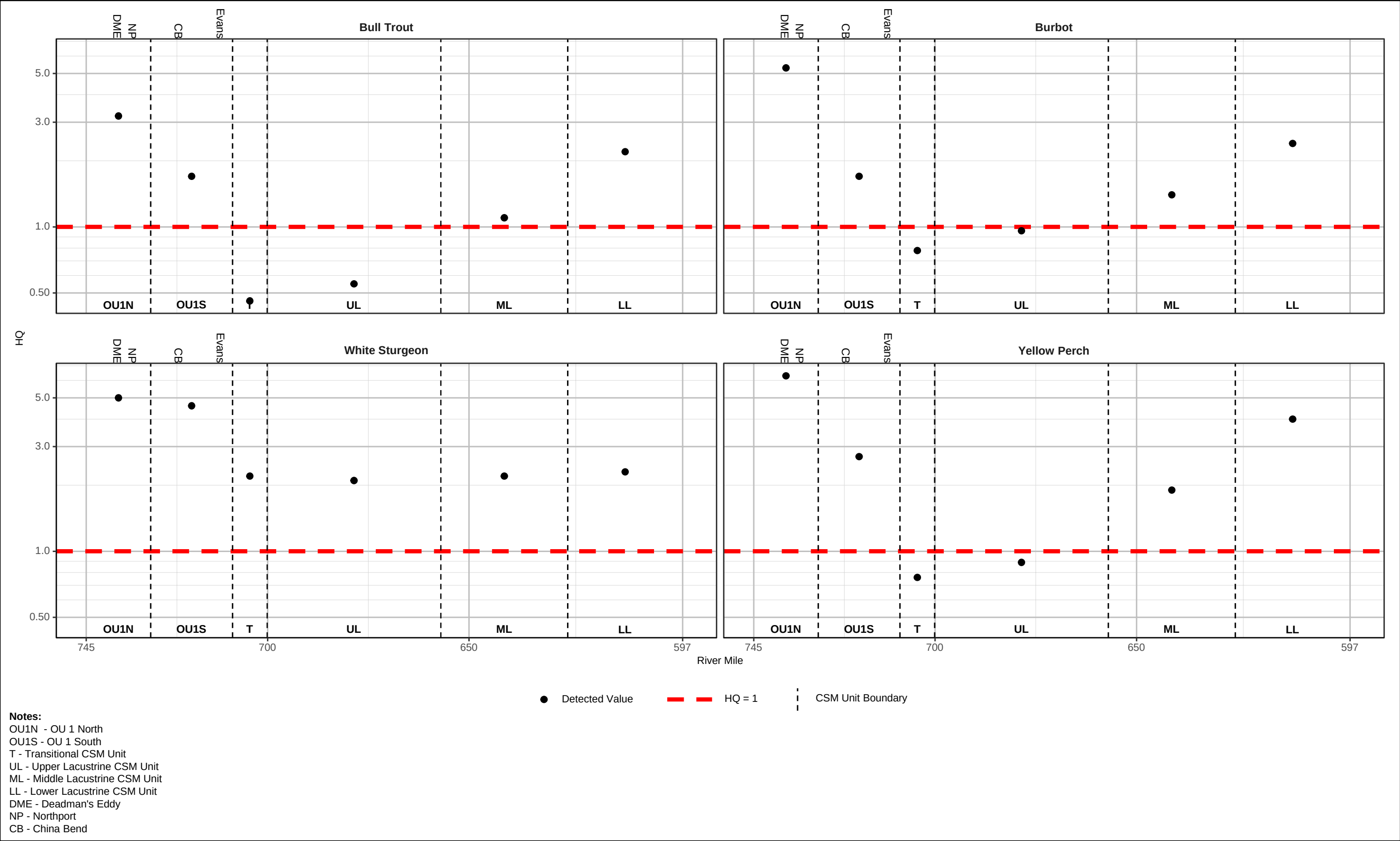


Figure M-6c. Areawide Dietary Fish HQs by River Mile for Chromium
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

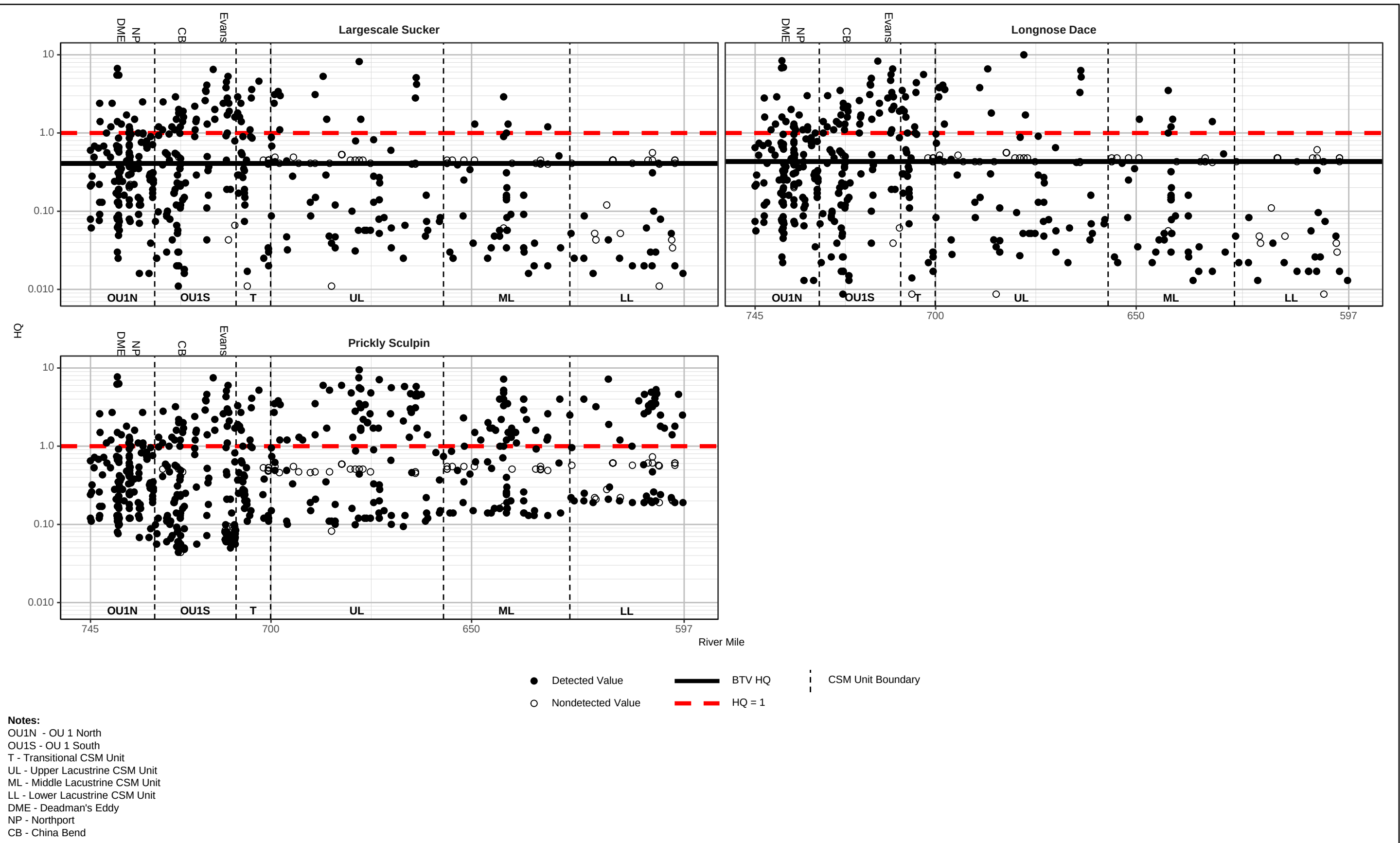


Figure M-6d. Point-by-Point Dietary Fish HQs by River Mile for Mercury
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

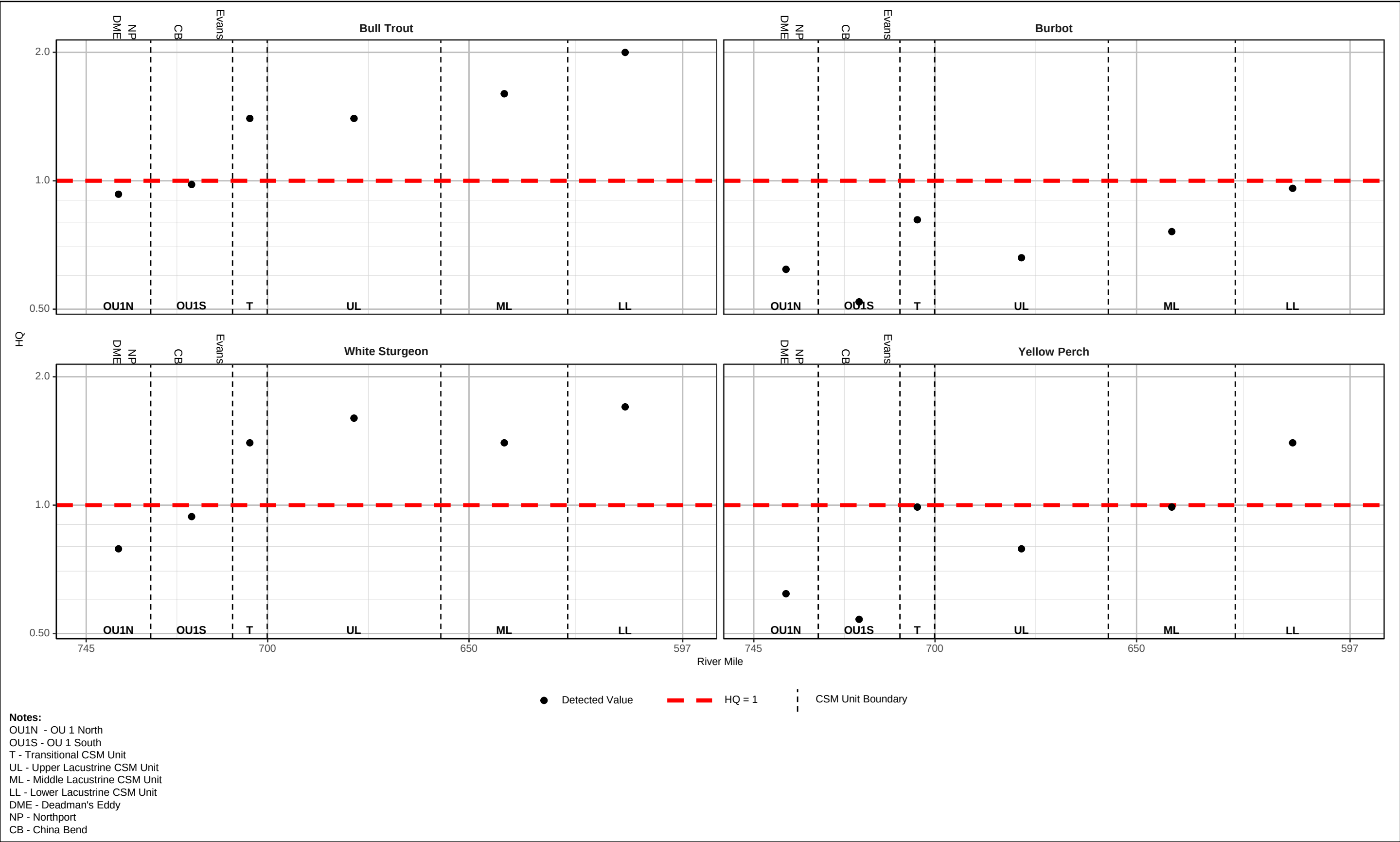


Figure M-6e. Areawide Dietary Fish HQs by River Mile for Mercury
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

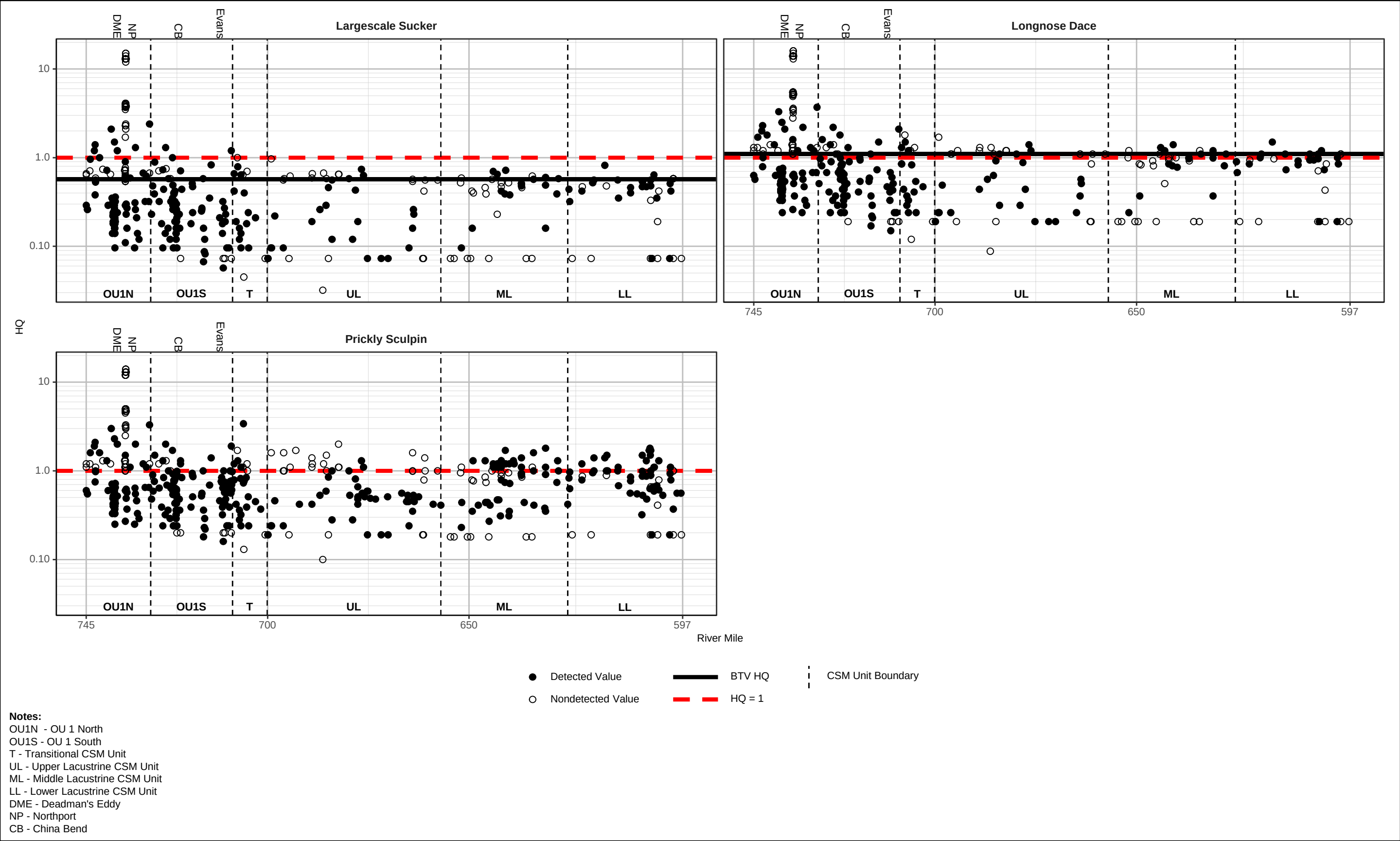


Figure M-6f. Point-by-Point Dietary Fish HQs by River Mile for Selenium
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

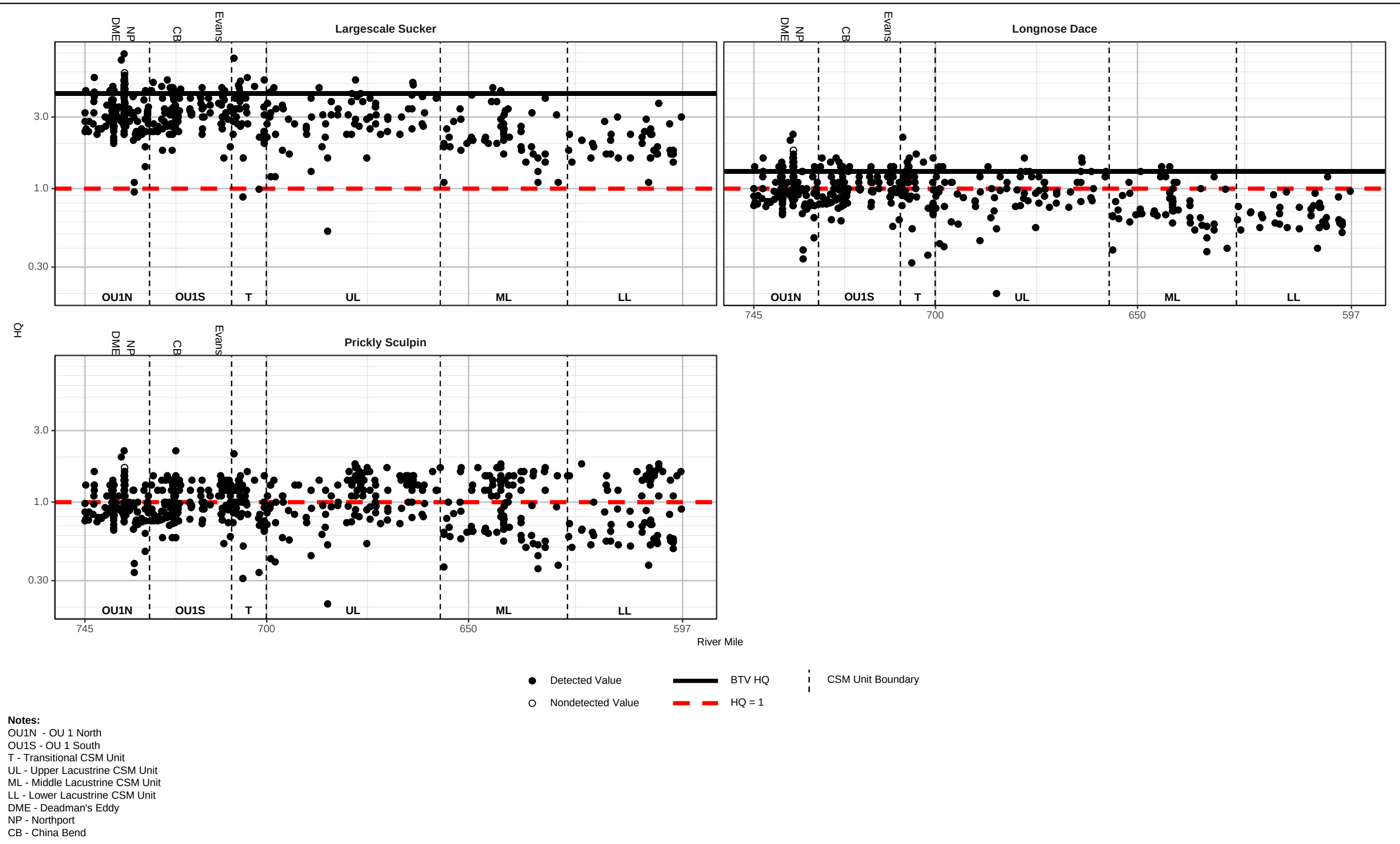


Figure M-6g. Point-by-Point Dietary Fish HQs by River Mile for Vanadium
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

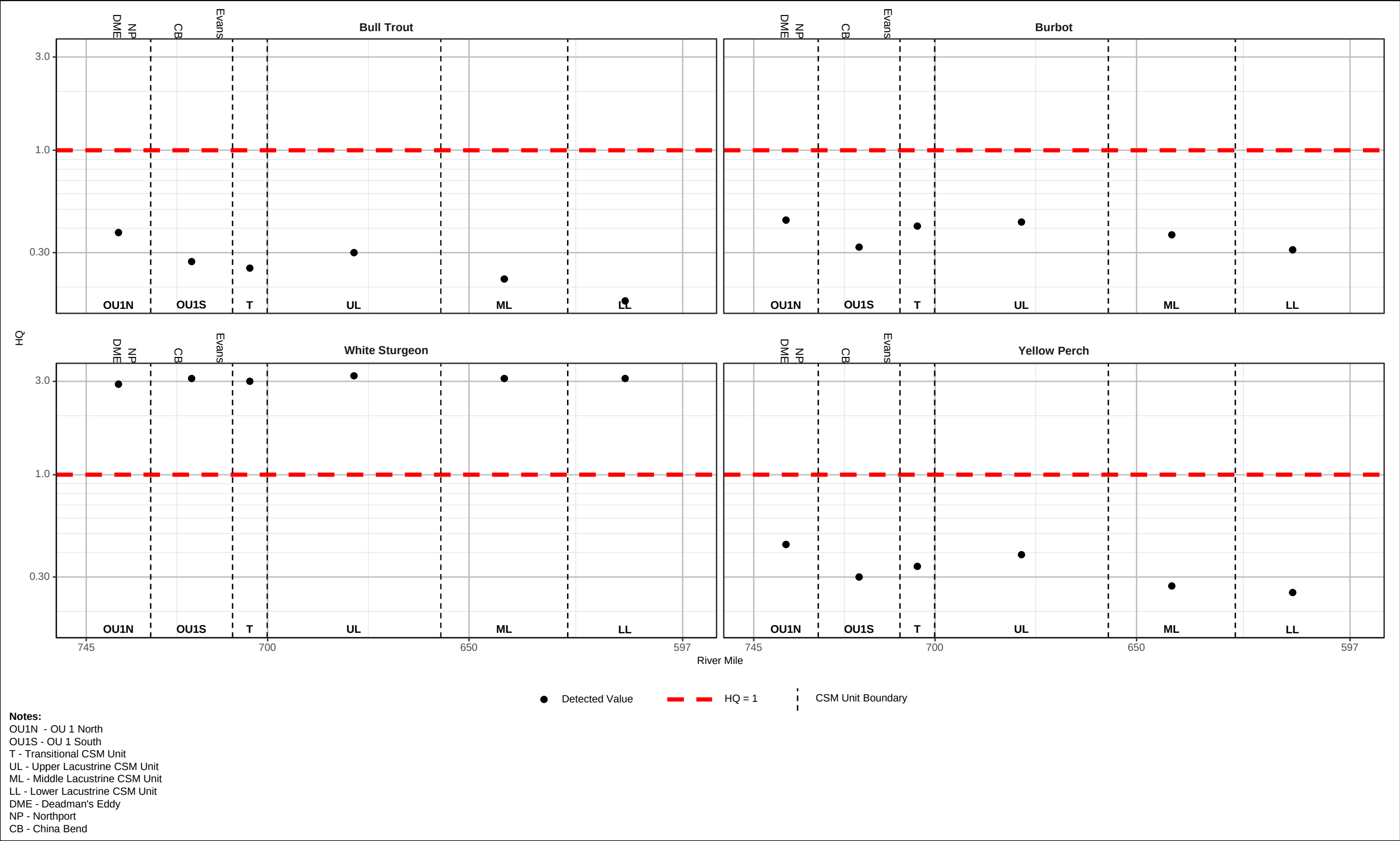


Figure M-6h. Areawide Dietary Fish HQs by River Mile for Vanadium
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

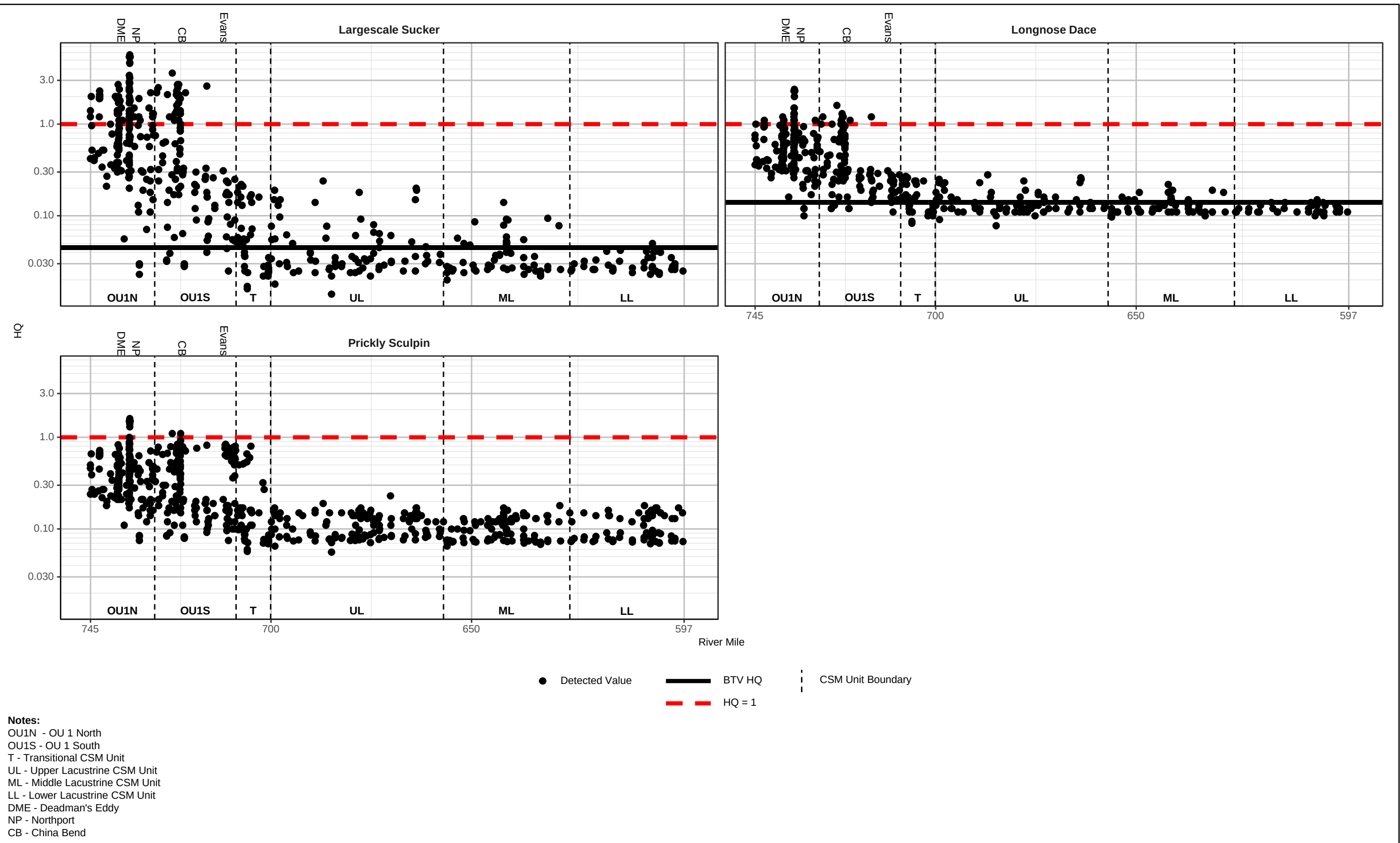


Figure M-6i. Point-by-Point Dietary Fish HQs by River Mile for Zinc
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

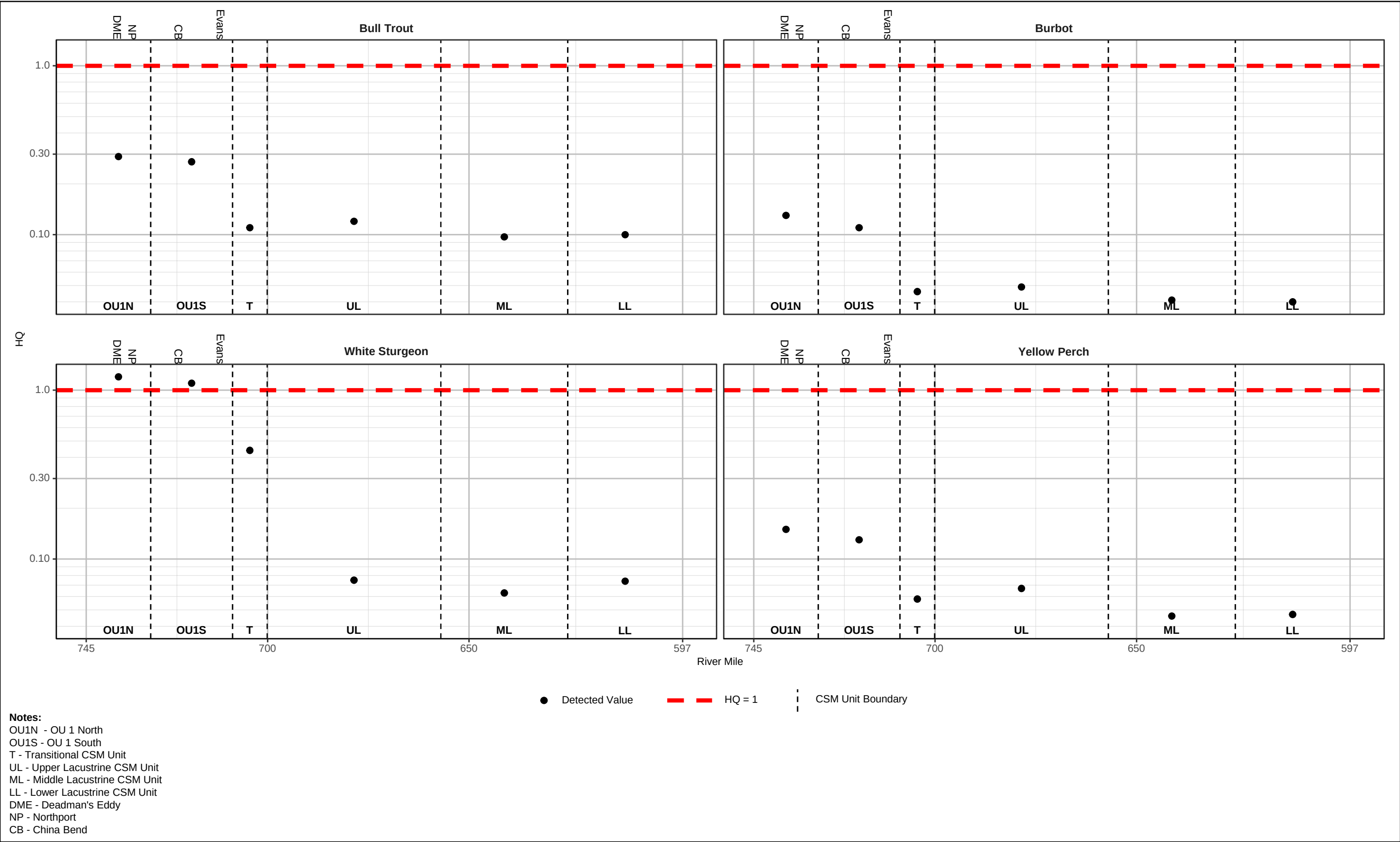


Figure M-6j. Areawide Dietary Fish HQs by River Mile for Zinc
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

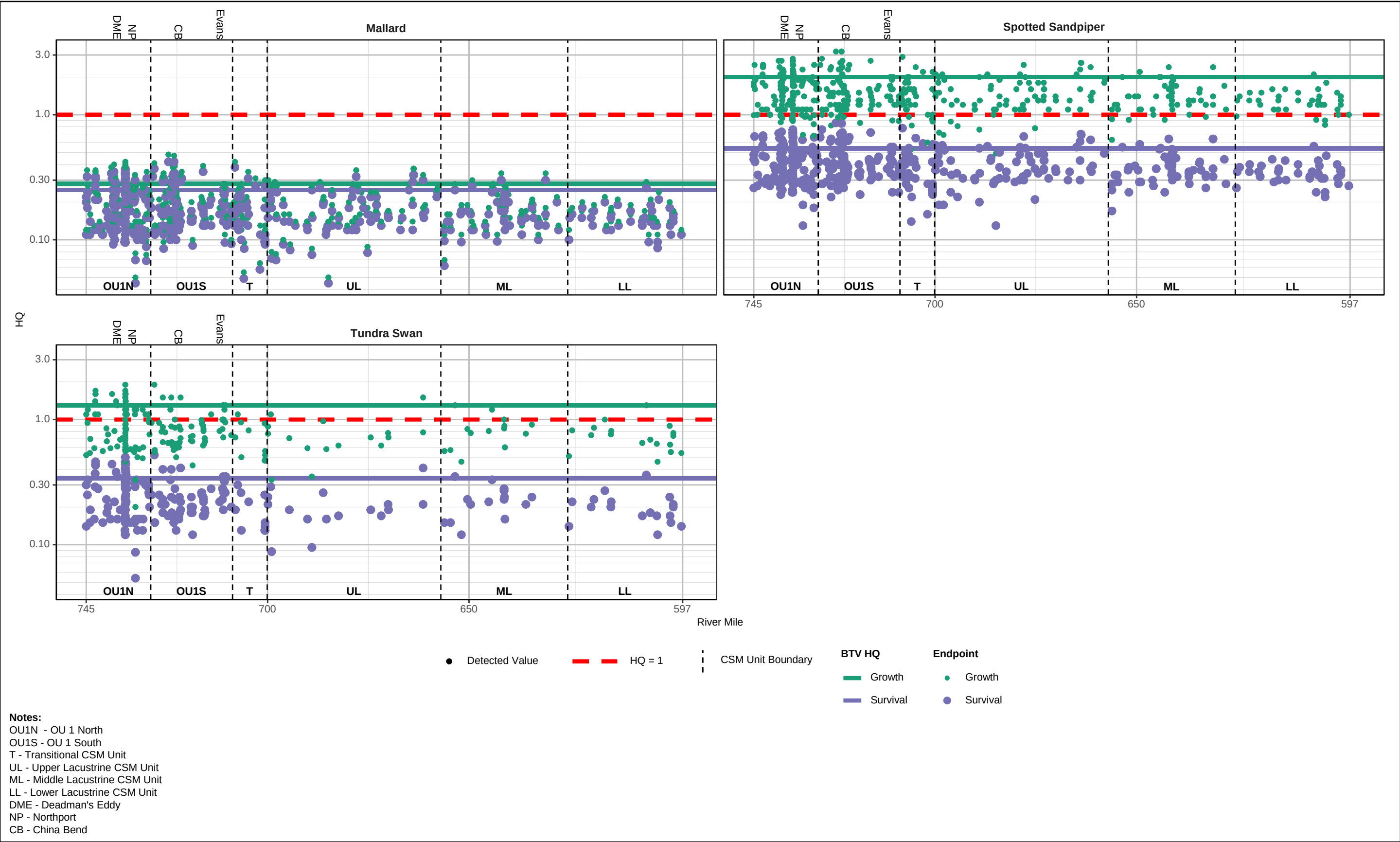


Figure M-7a. Point-by-Point Bird HQs by River Mile for Aluminum
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

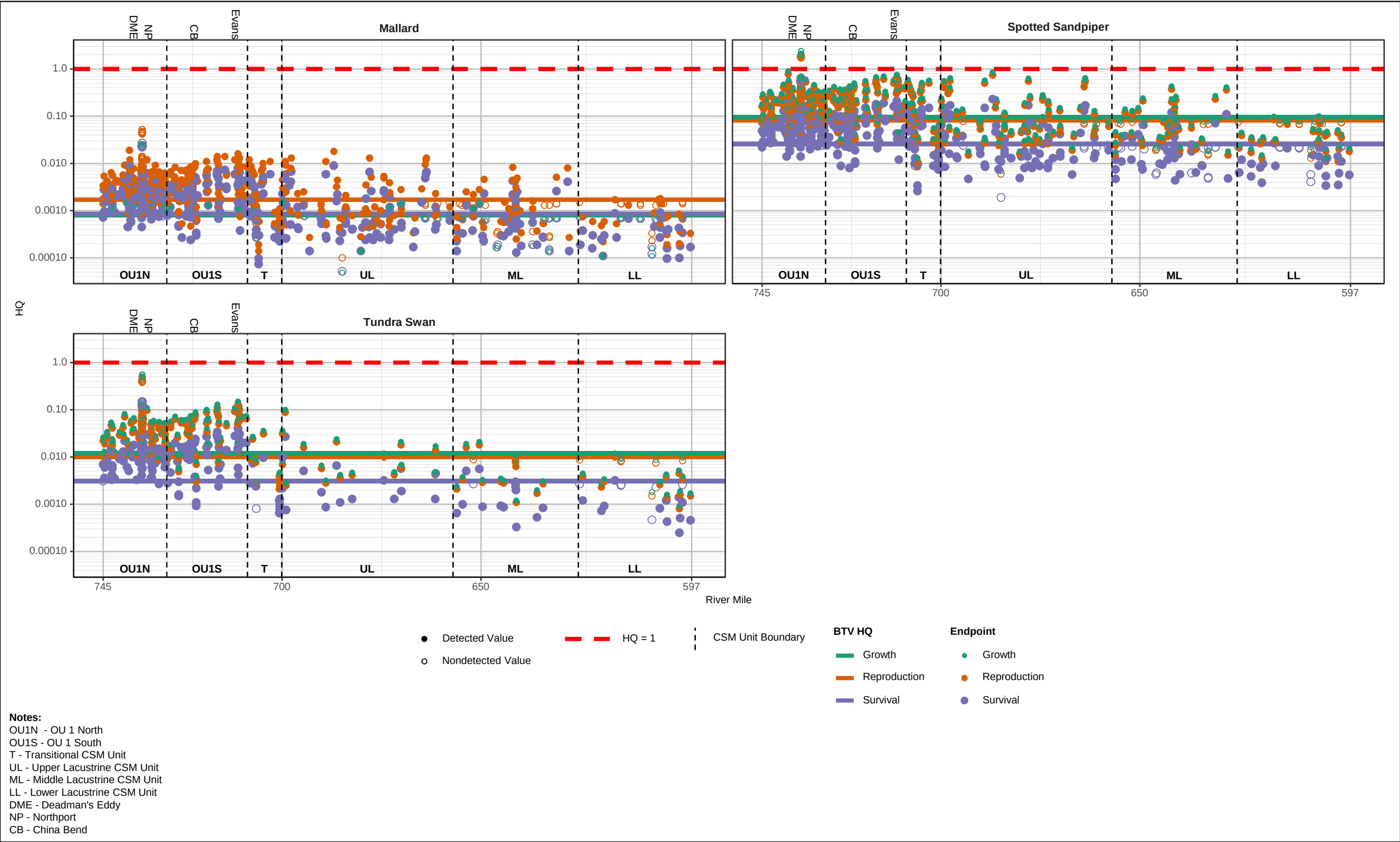


Figure M-7b. Point-by-Point Bird HQs by River Mile for Cadmium
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

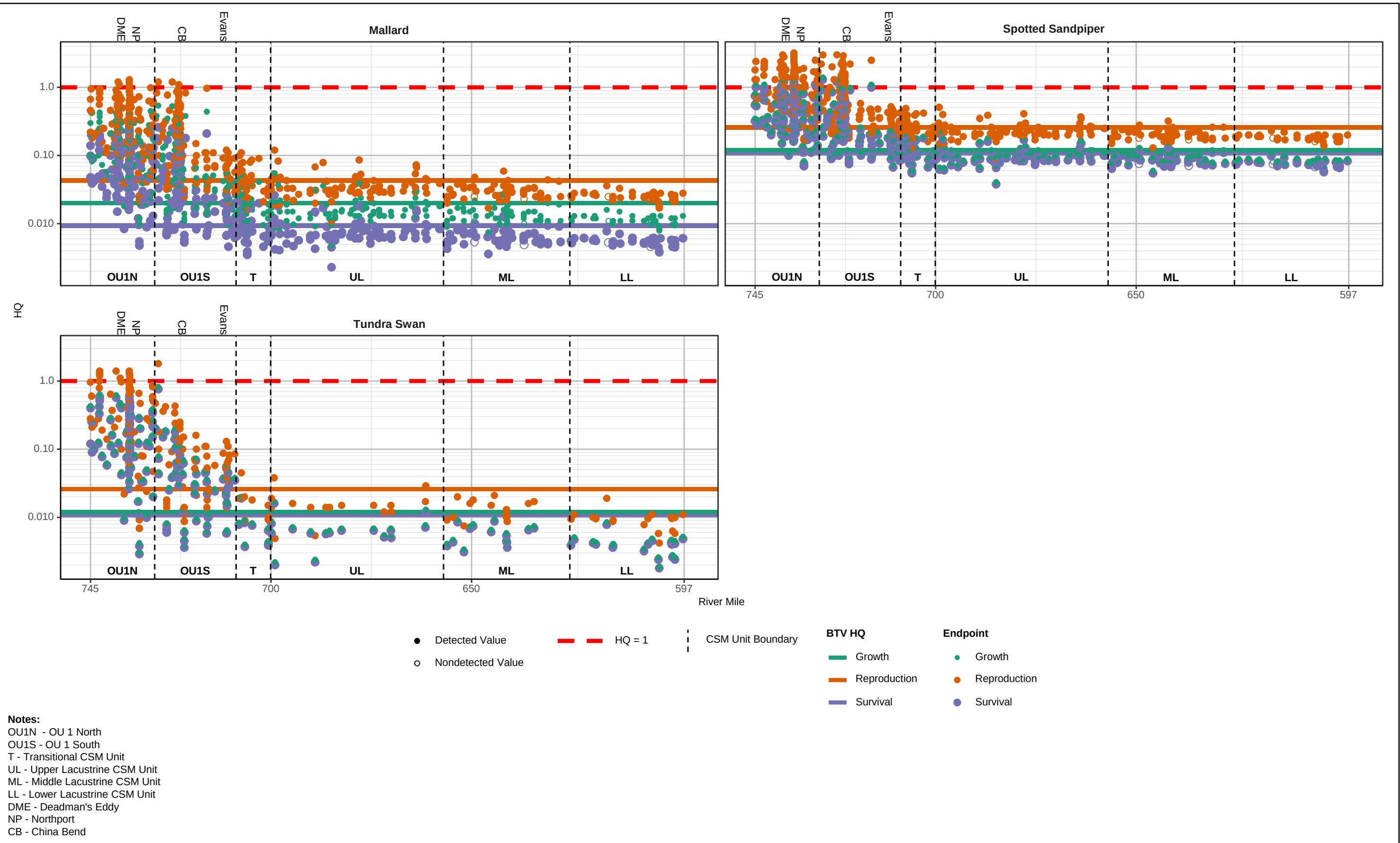


Figure M-7c. Point-by-Point Bird HQs by River Mile for Copper
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

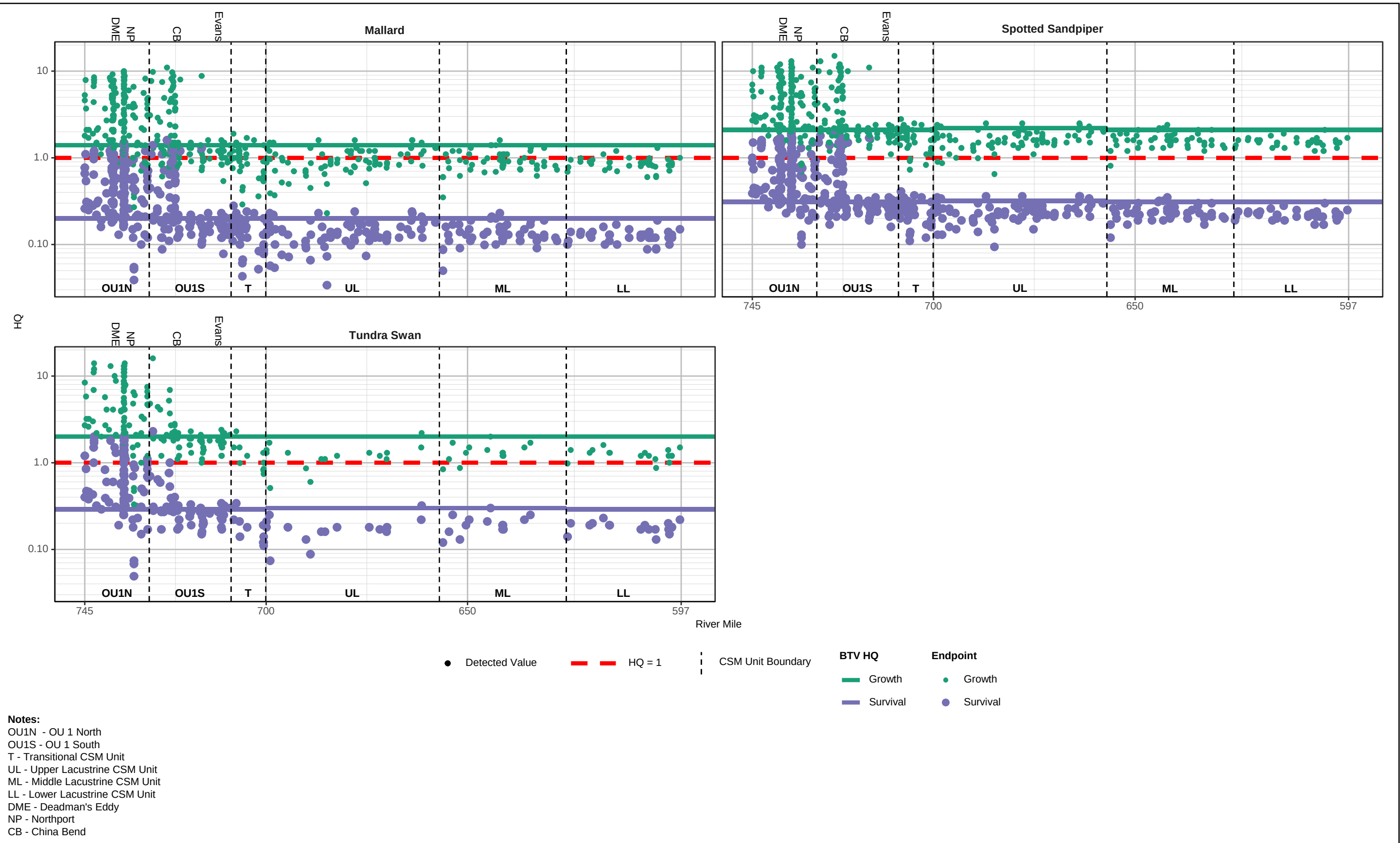


Figure M-7d. Point-by-Point Bird HQs by River Mile for Iron
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

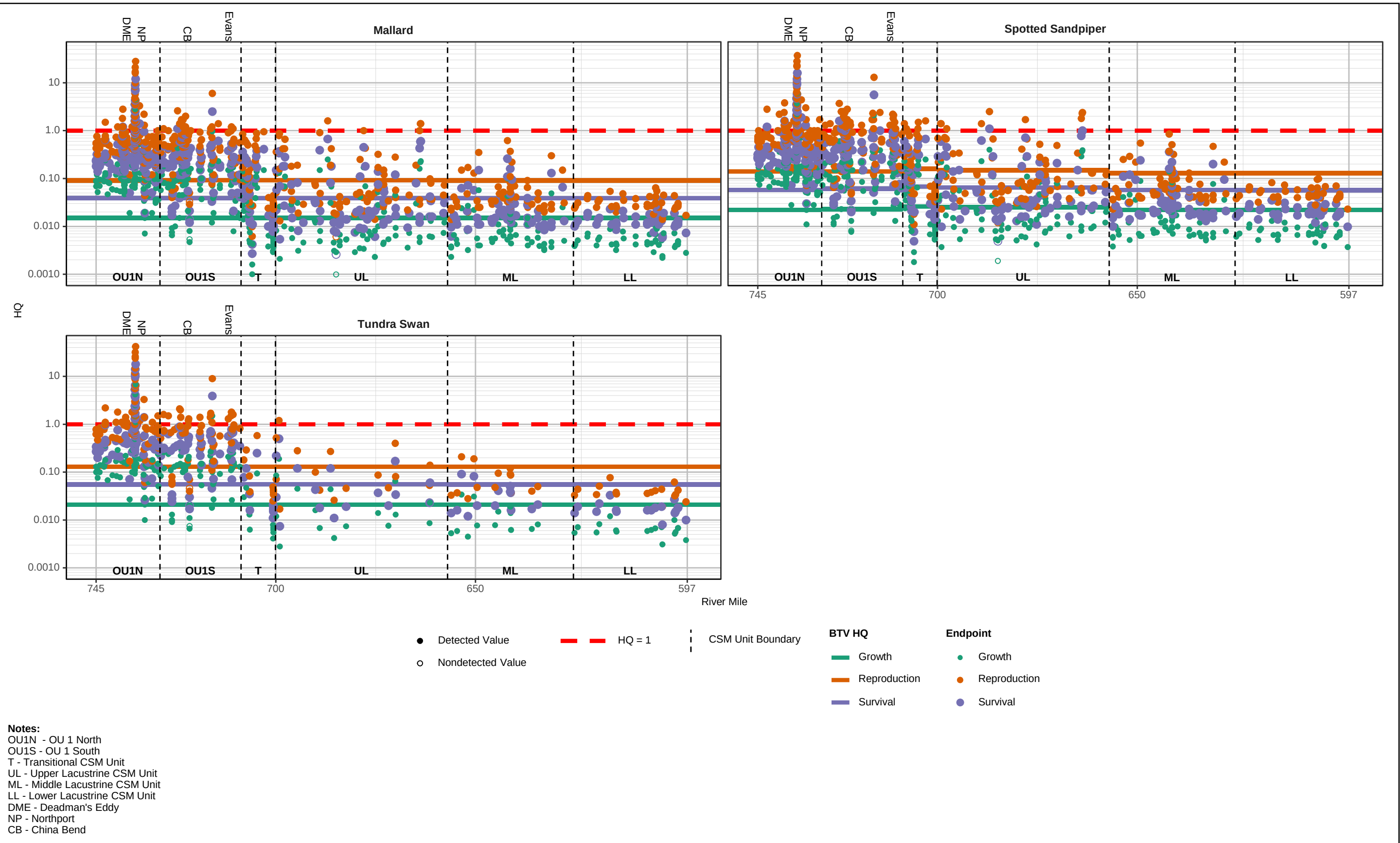


Figure M-7e. Point-by-Point Bird HQs by River Mile for Lead
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

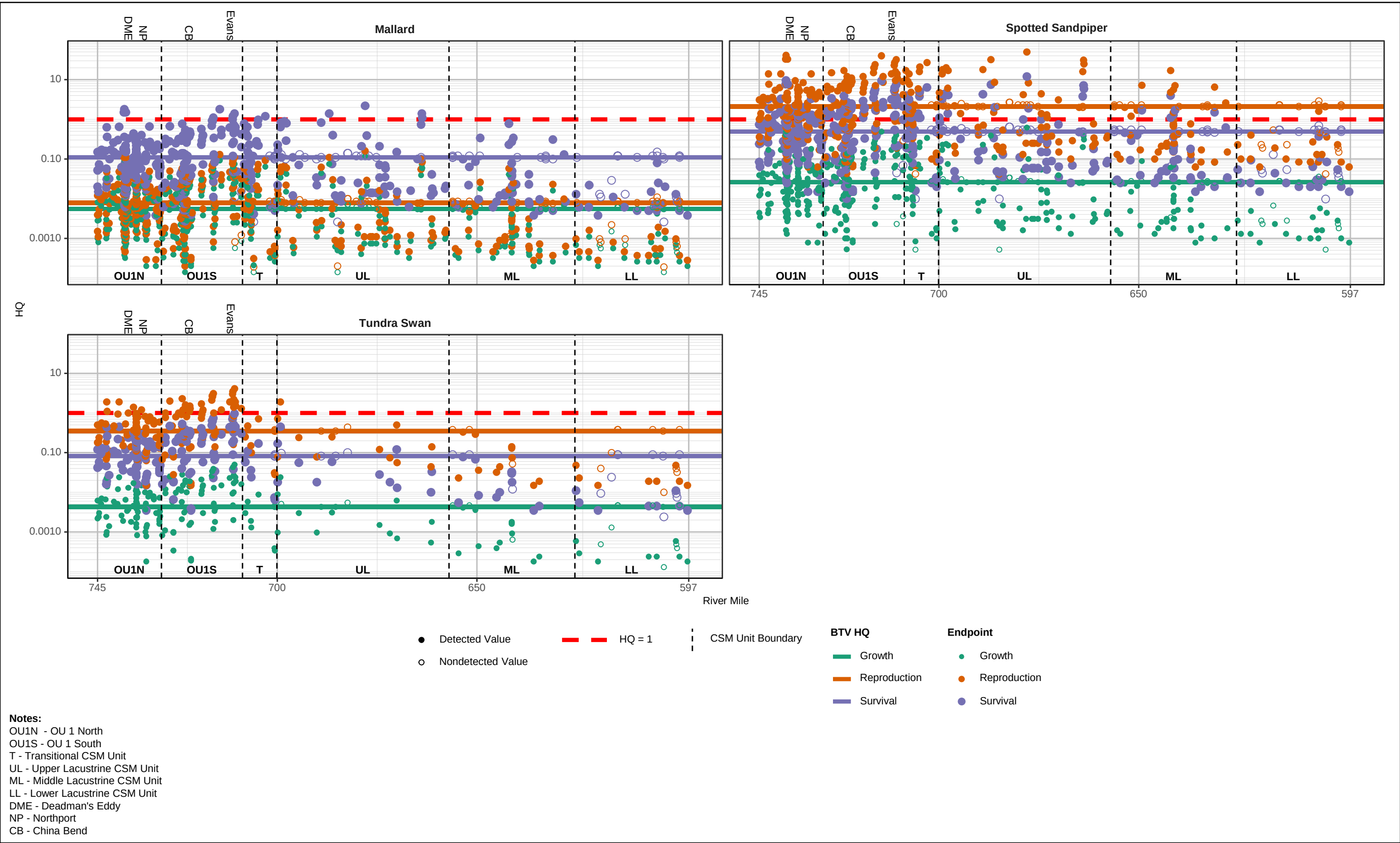


Figure M-7f. Point-by-Point Bird HQs by River Mile for Mercury
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

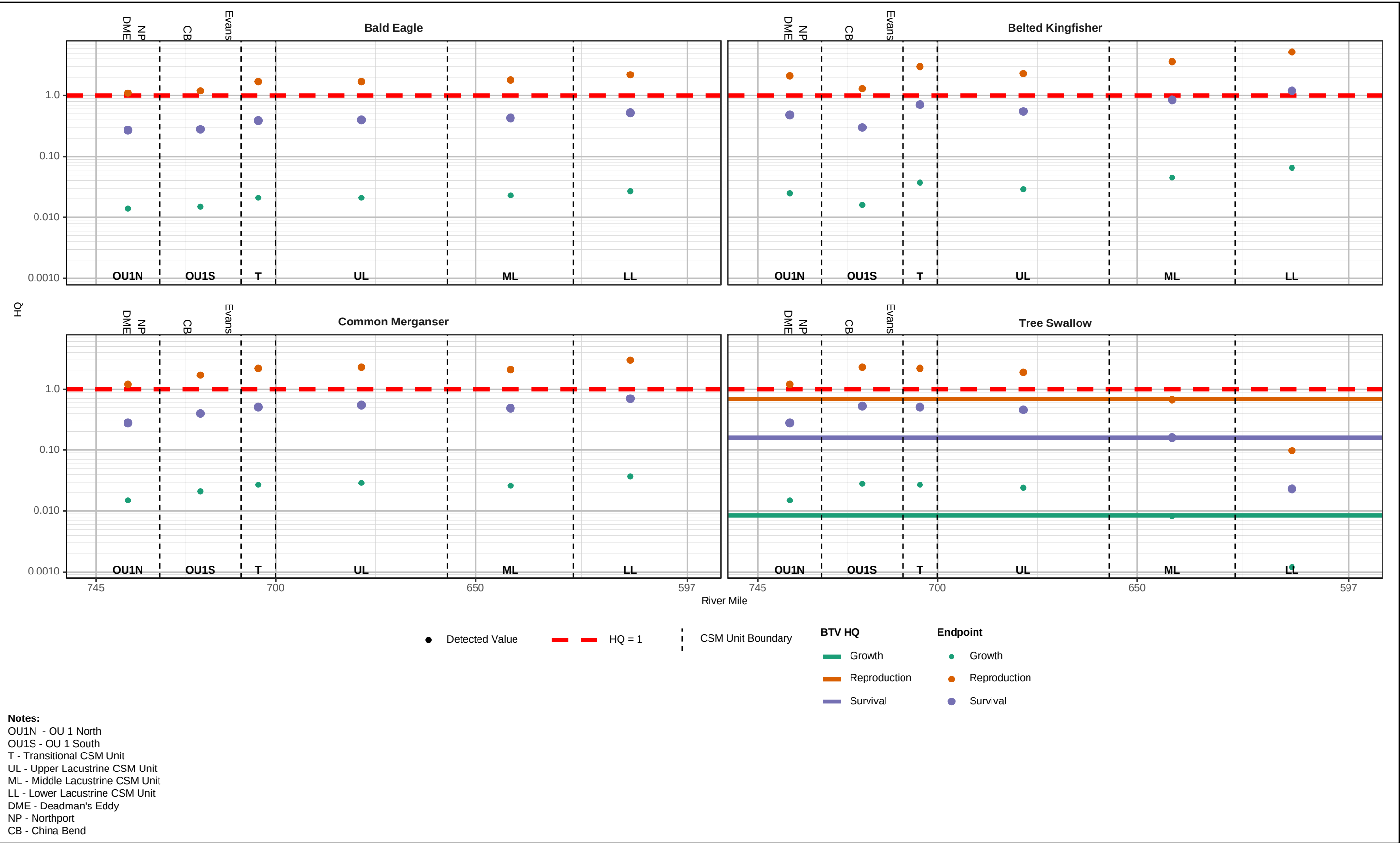


Figure M-7g. Areawide Bird HQs by River Mile for Mercury
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

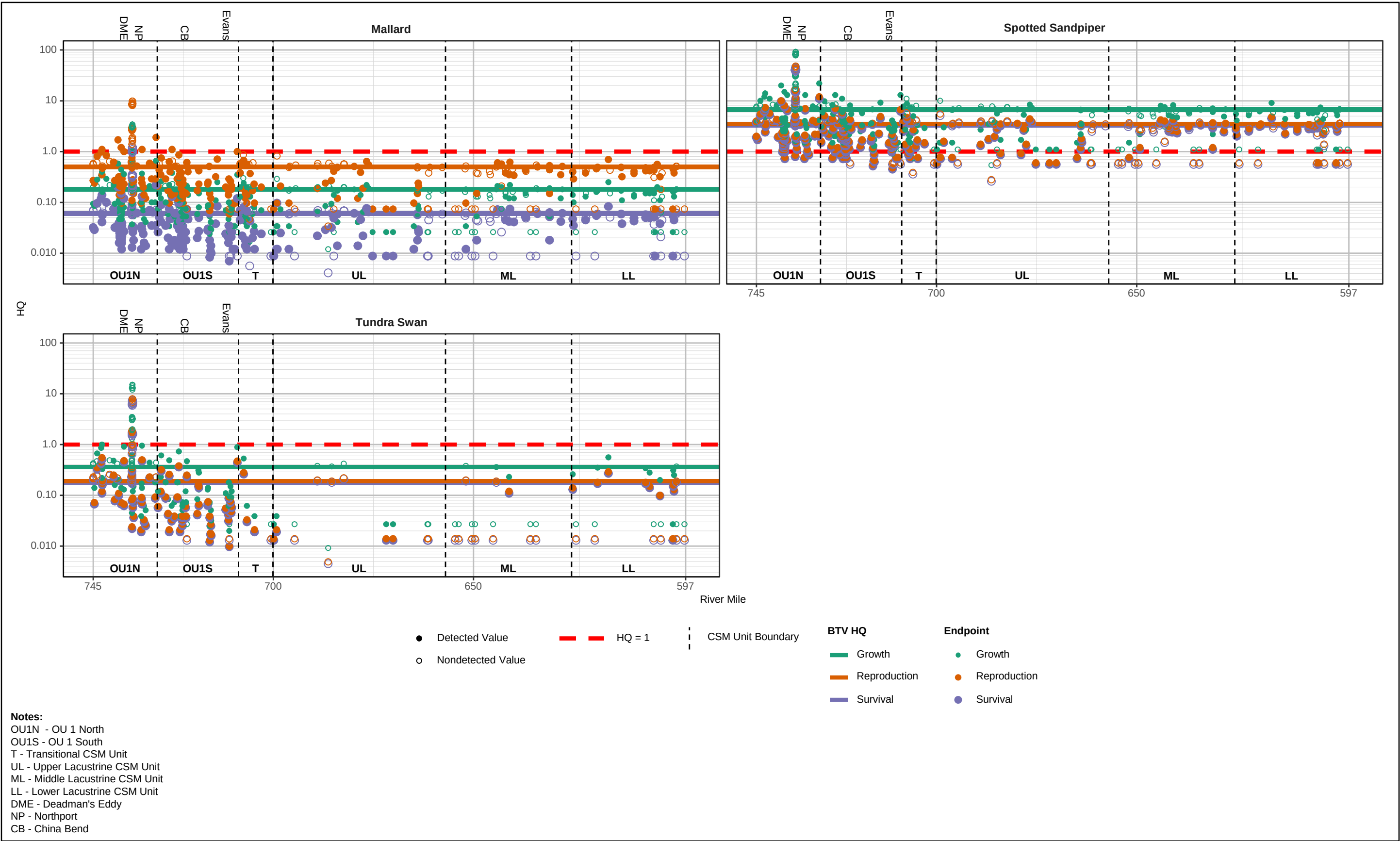


Figure M-7h. Point-by-Point Bird HQs by River Mile for Selenium
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

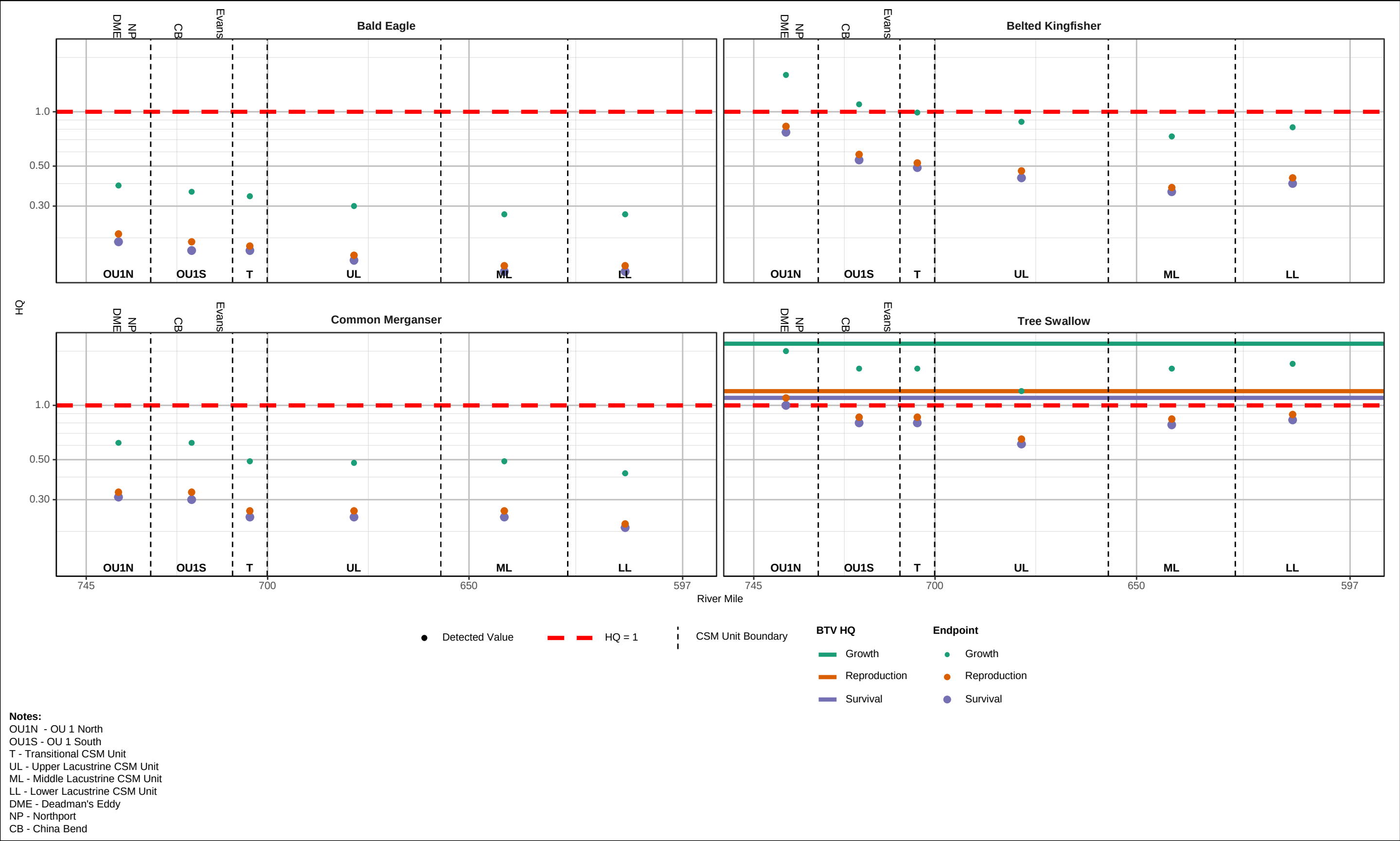


Figure M-7i. Areawide Bird HQs by River Mile for Selenium
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

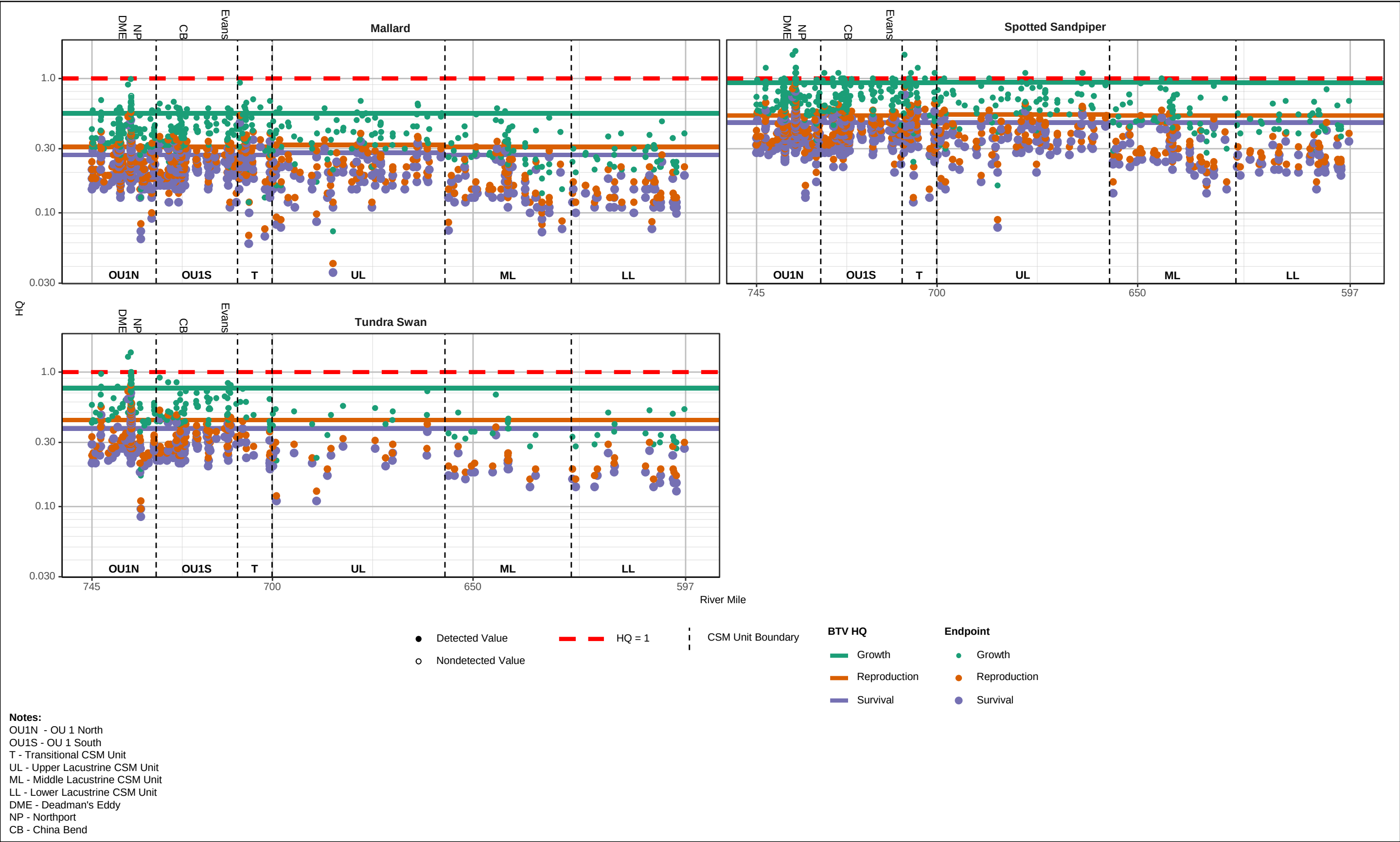


Figure M-7j. Point-by-Point Bird HQs by River Mile for Vanadium
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

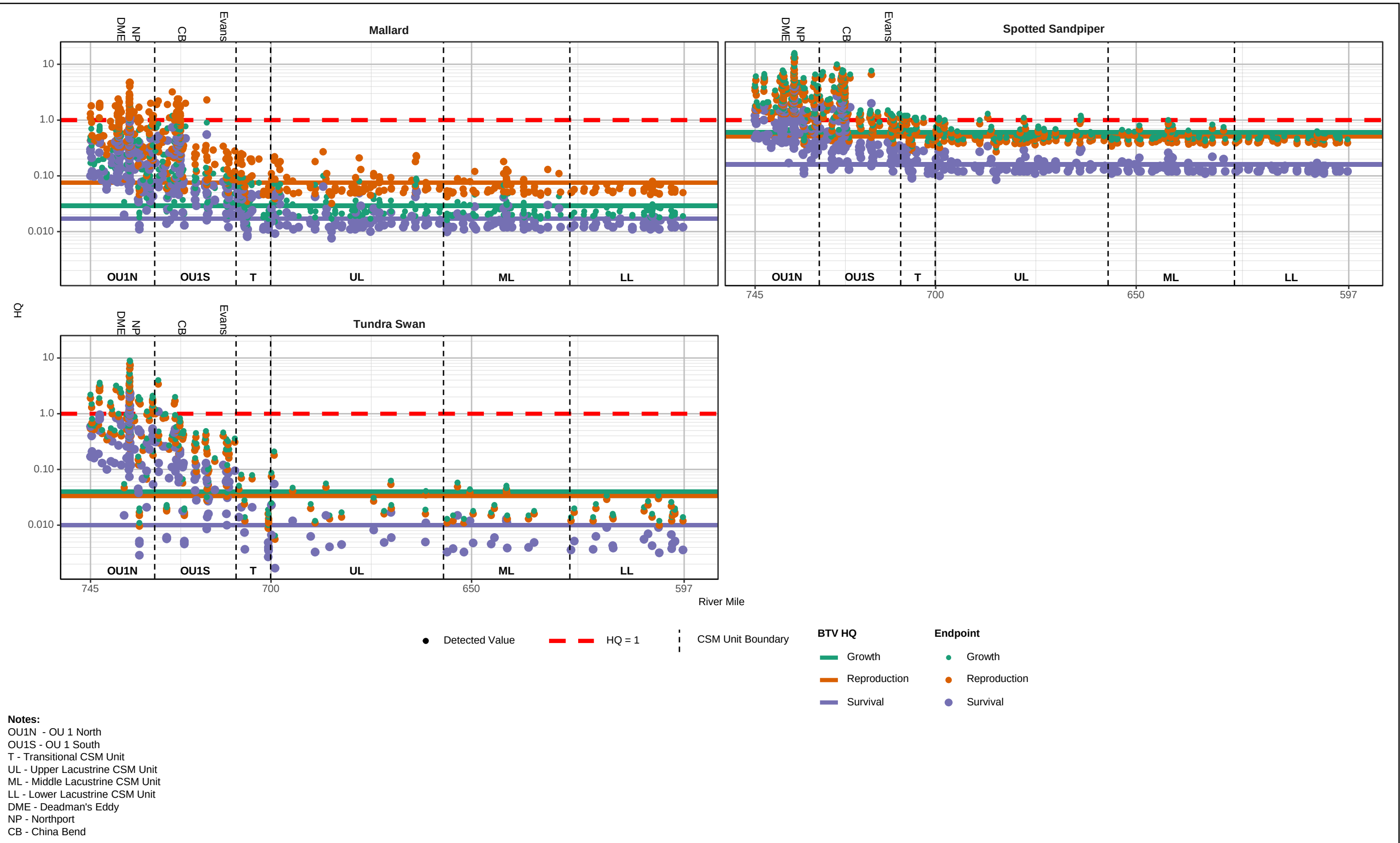


Figure M-7k. Point-by-Point Bird HQs by River Mile for Zinc
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

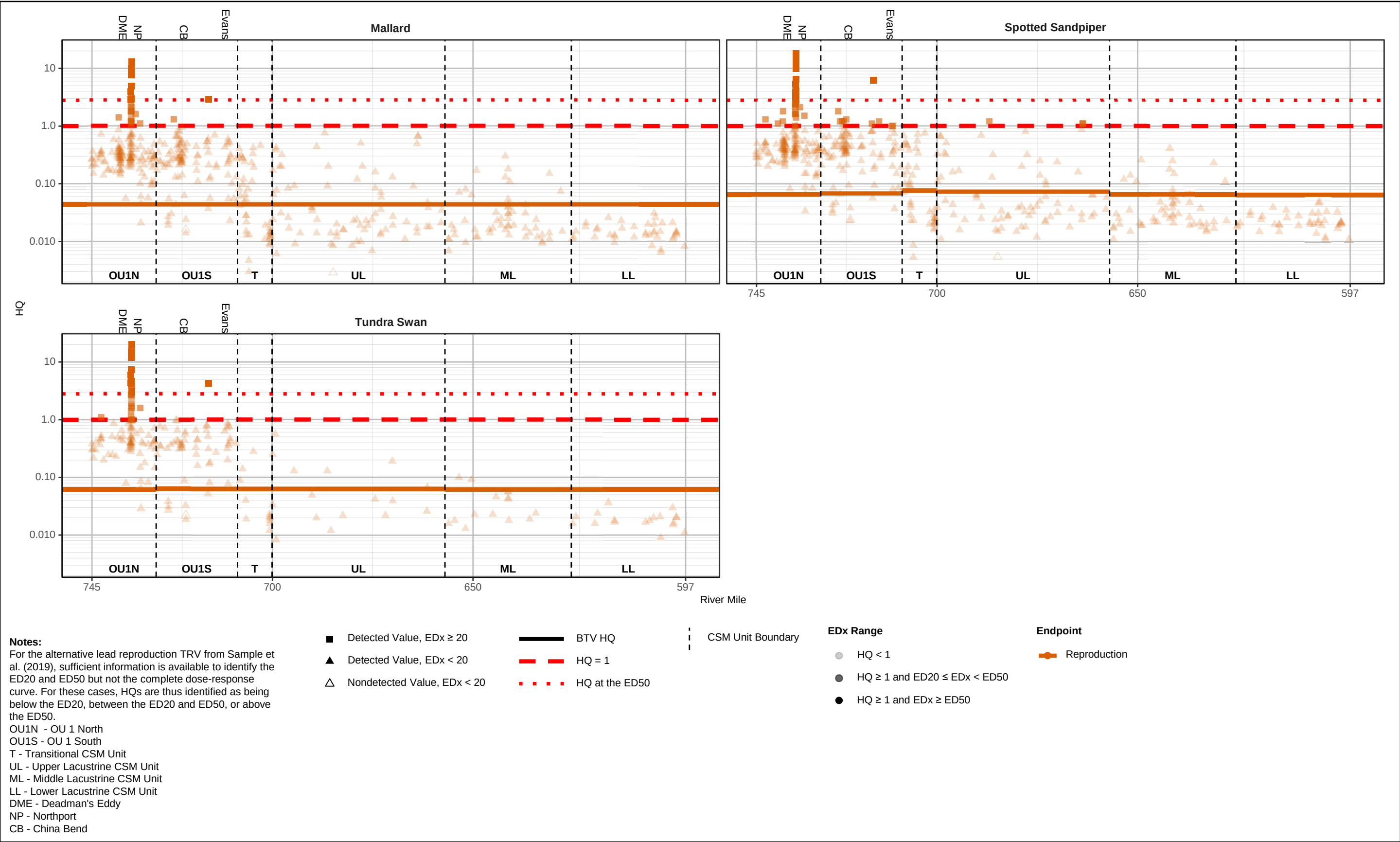


Figure M-7I. Point-by-Point Bird HQs by River Mile for Lead, Using the Alternative Reproduction TRV
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

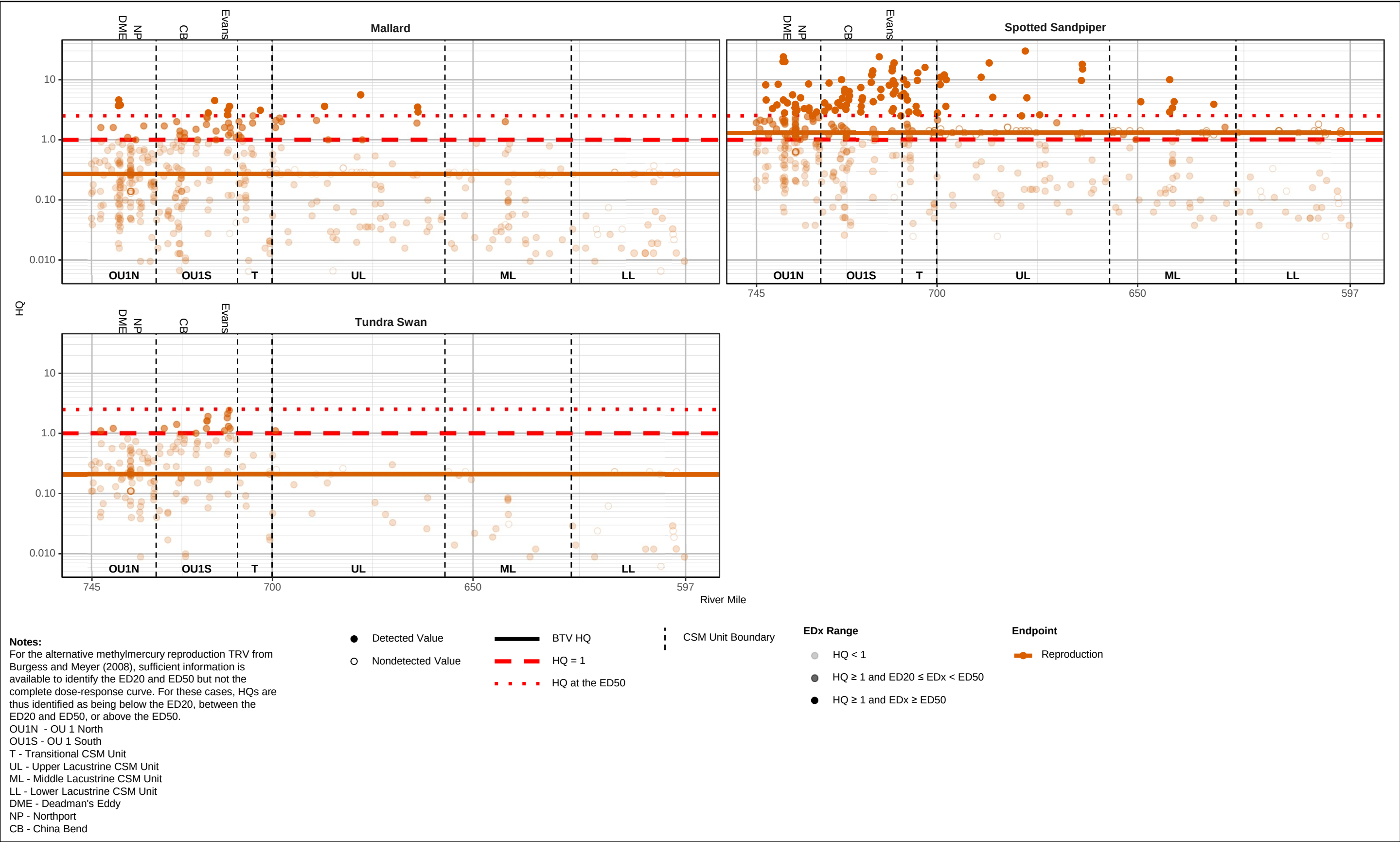


Figure M-7m. Point-by-Point Bird HQs by River Mile for Mercury, Using the Alternative Reproduction TRV
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

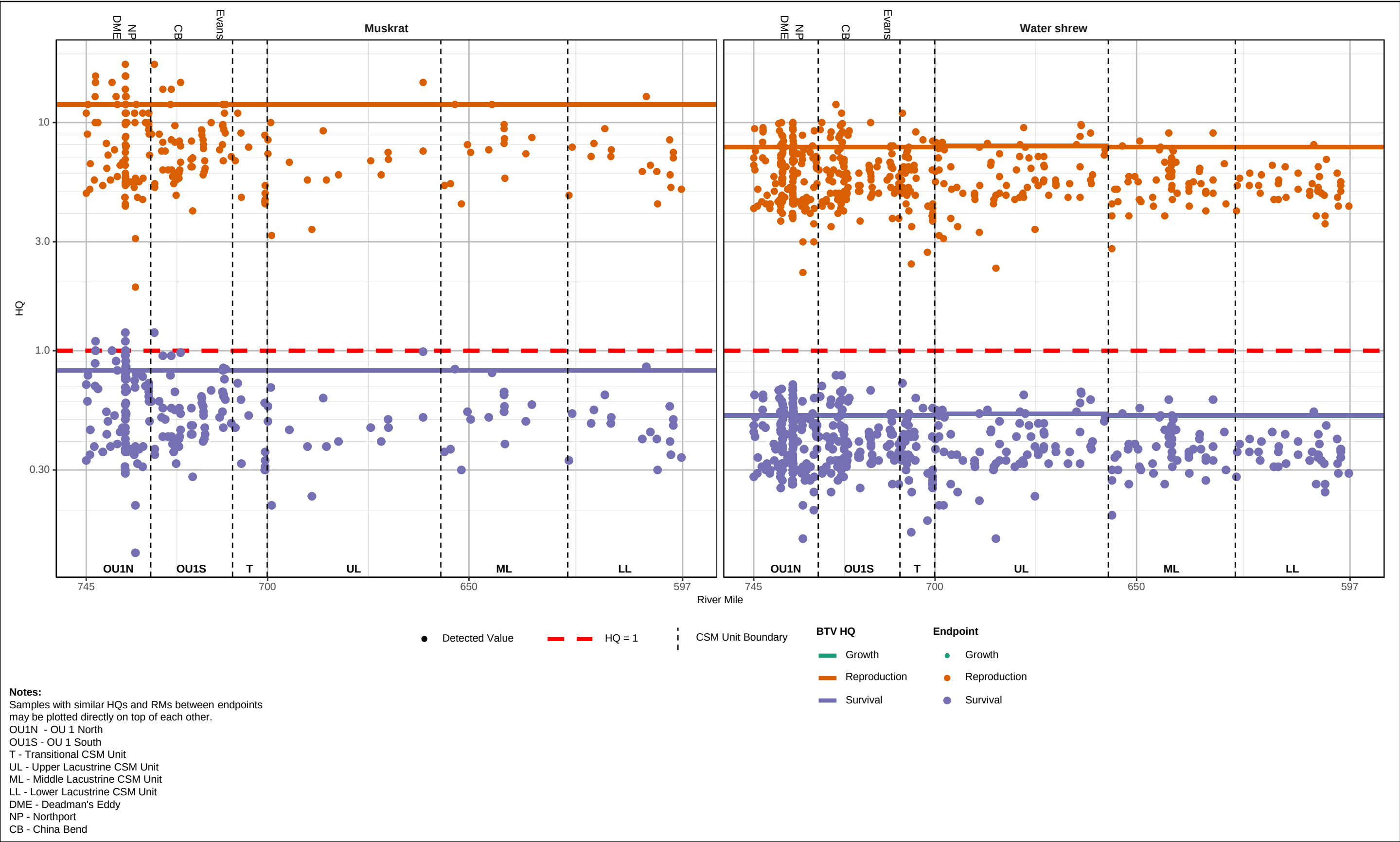


Figure M-8a. Point-by-Point Dietary Mammal HQs by River Mile for Aluminum
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

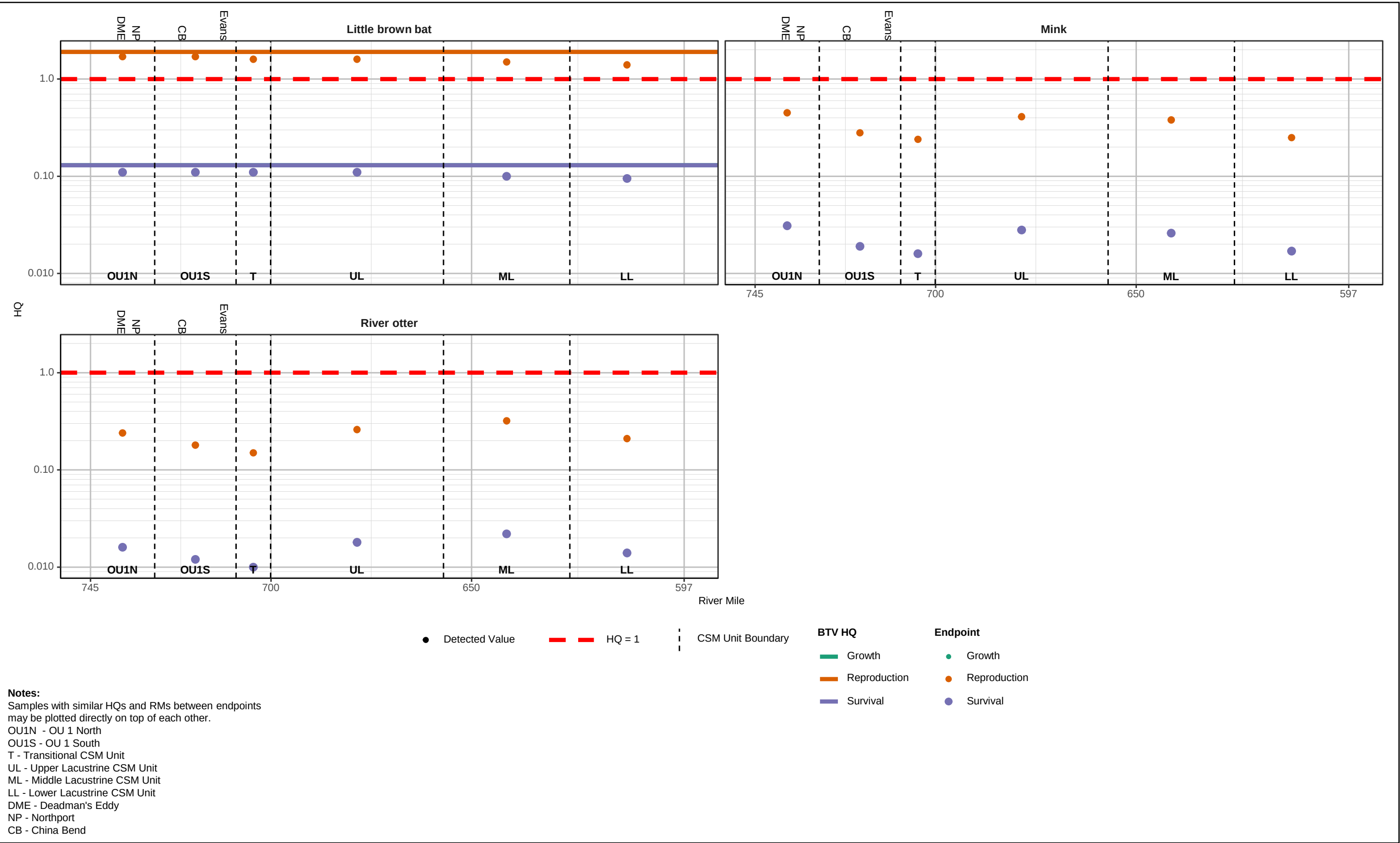


Figure M-8b. Areawide Dietary Mammal HQs by River Mile for Aluminum
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

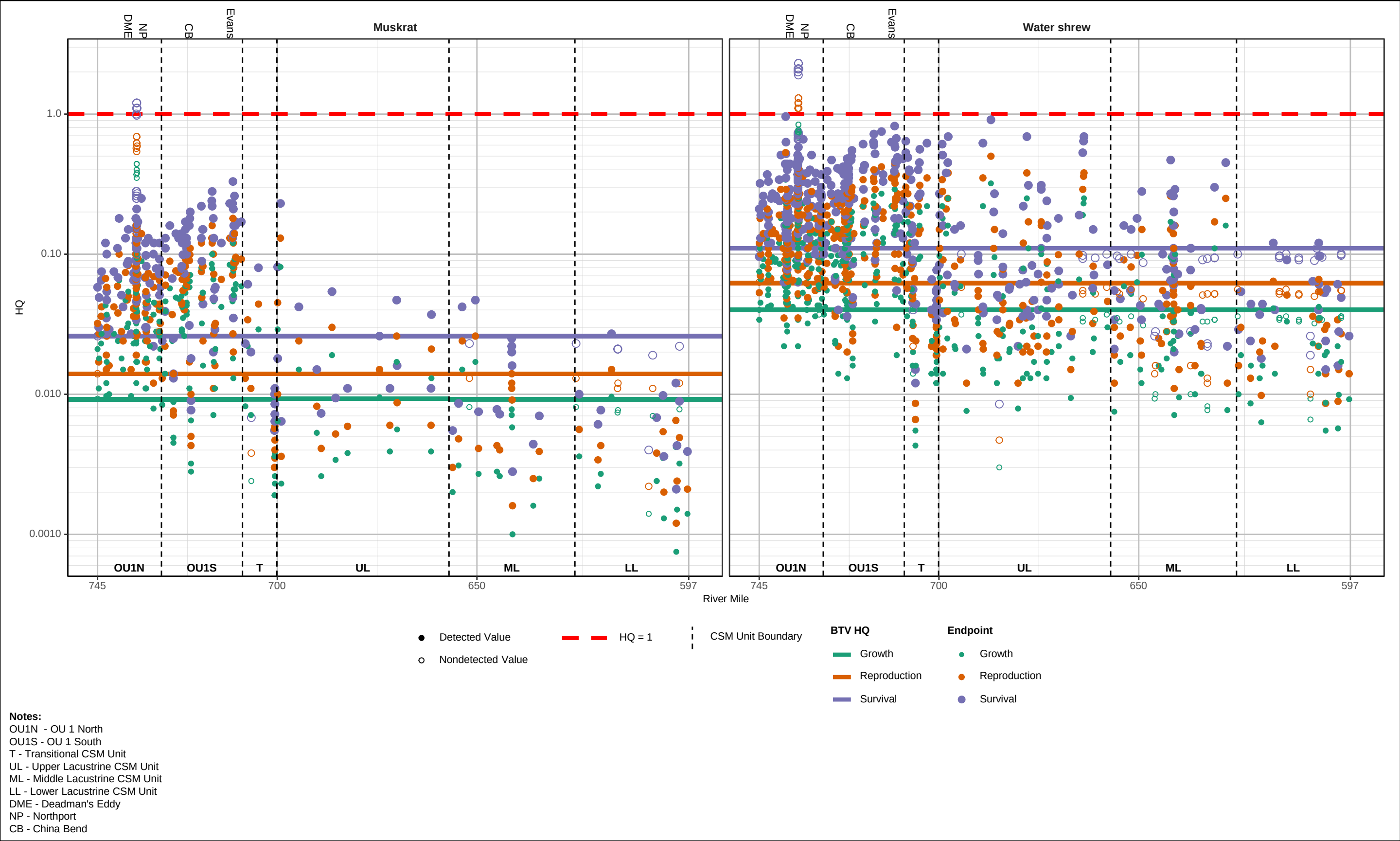


Figure M-8c. Point-by-Point Dietary Mammal HQs by River Mile for Cadmium
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

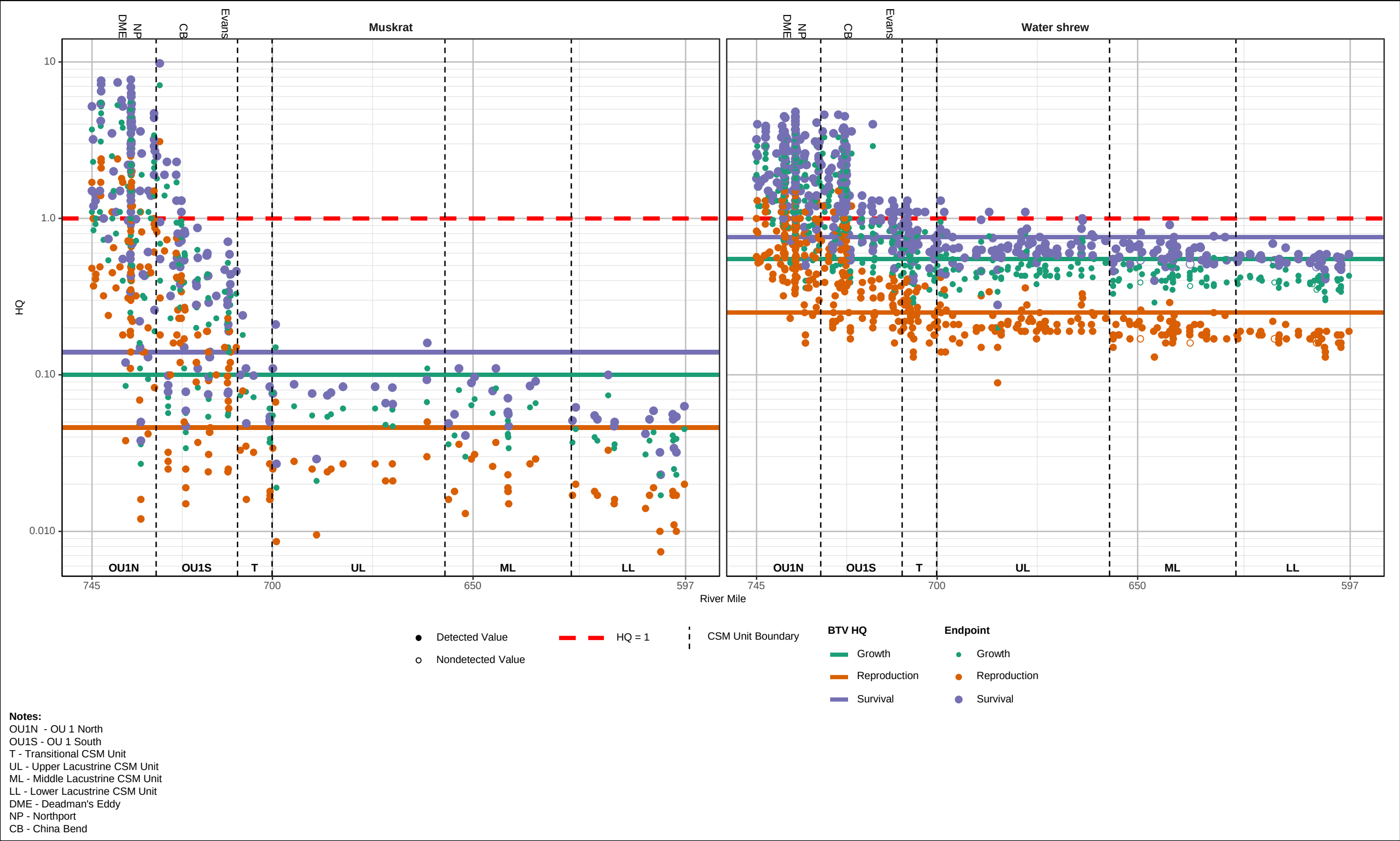


Figure M-8d. Point-by-Point Dietary Mammal HQs by River Mile for Copper
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

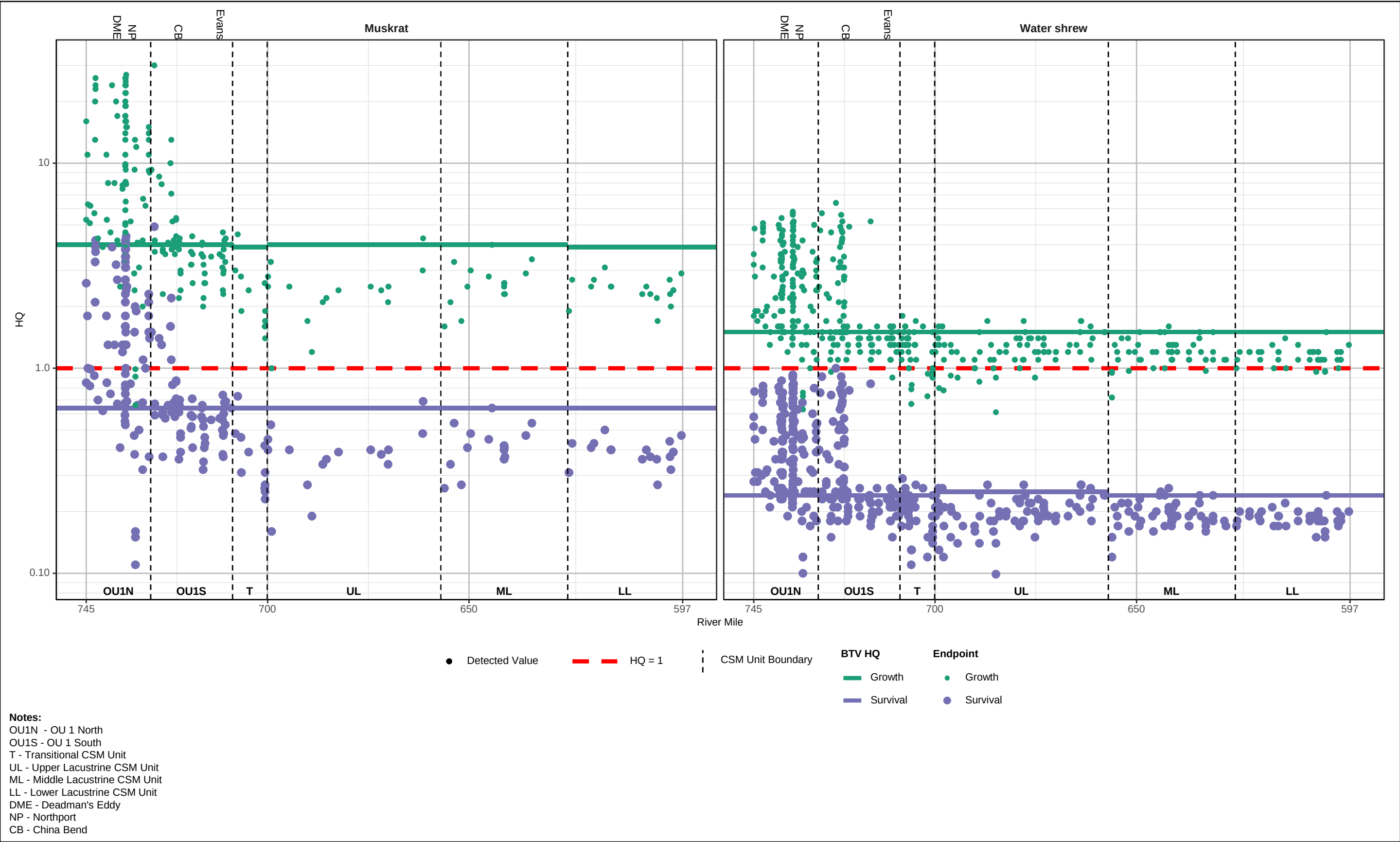


Figure M-8e. Point-by-Point Dietary Mammal HQs by River Mile for Iron
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

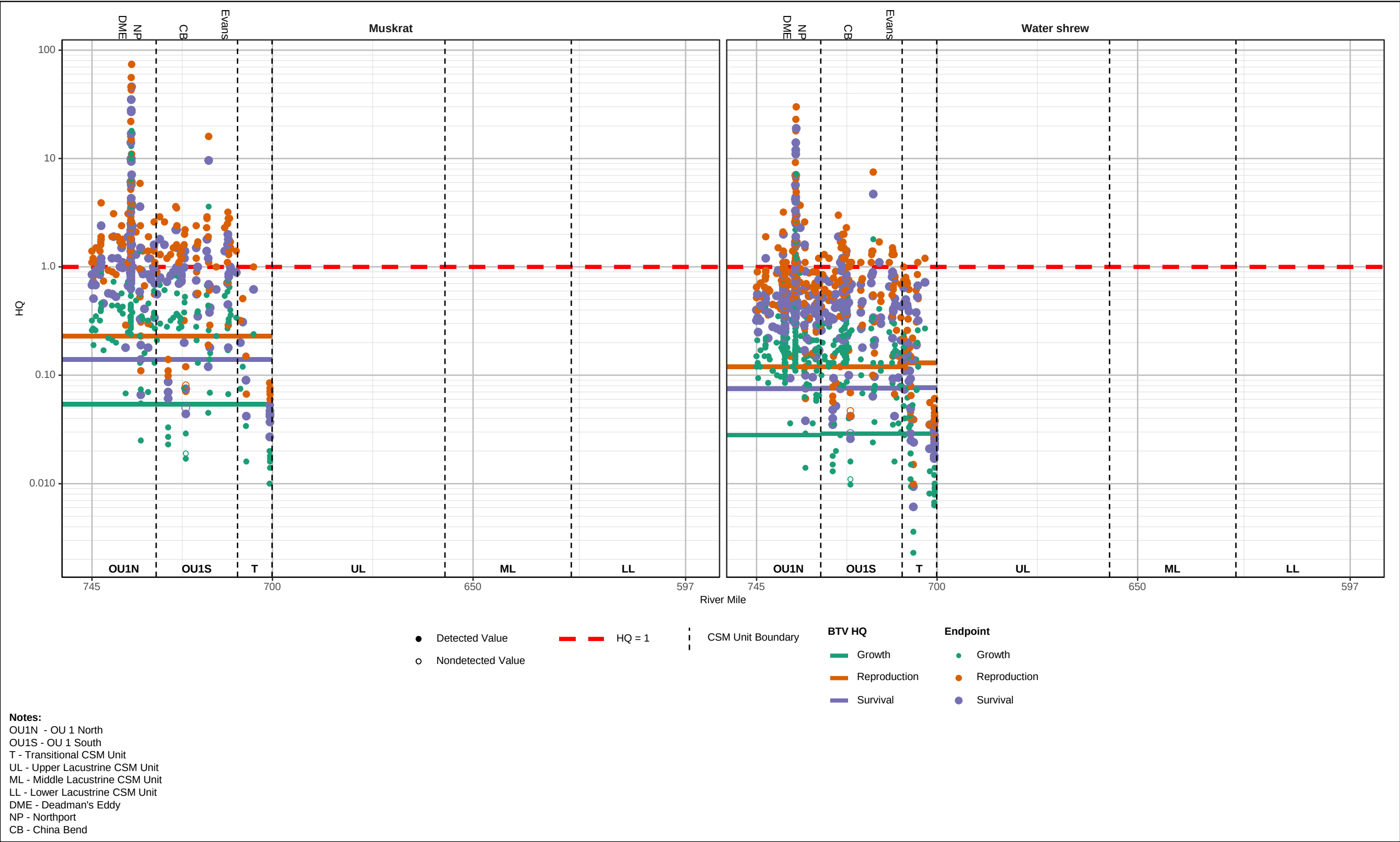


Figure M-8f. Point-by-Point Dietary Mammal HQs by River Mile for Lead
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

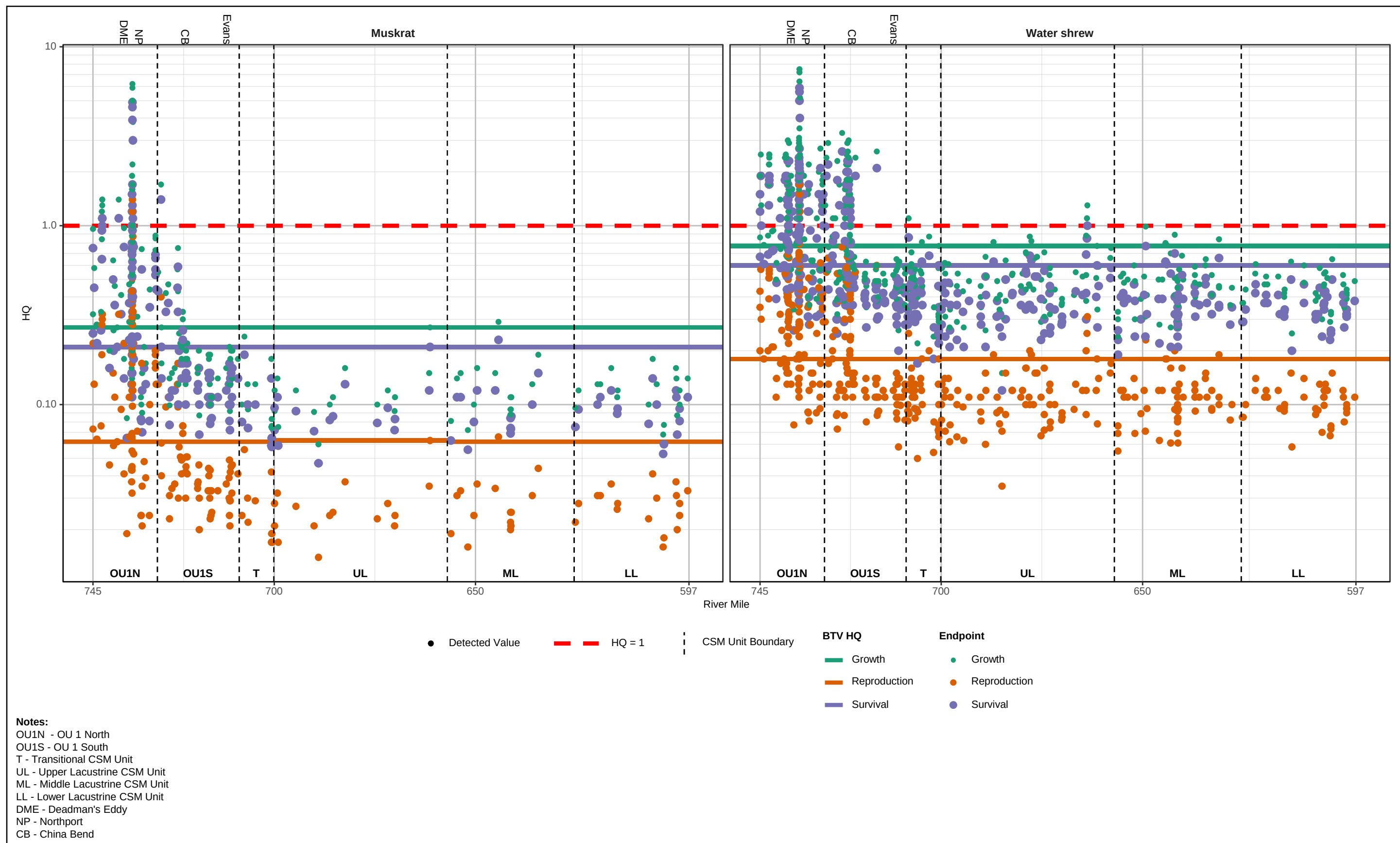


Figure M-8g. Point-by-Point Dietary Mammal HQs by River Mile for Manganese
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

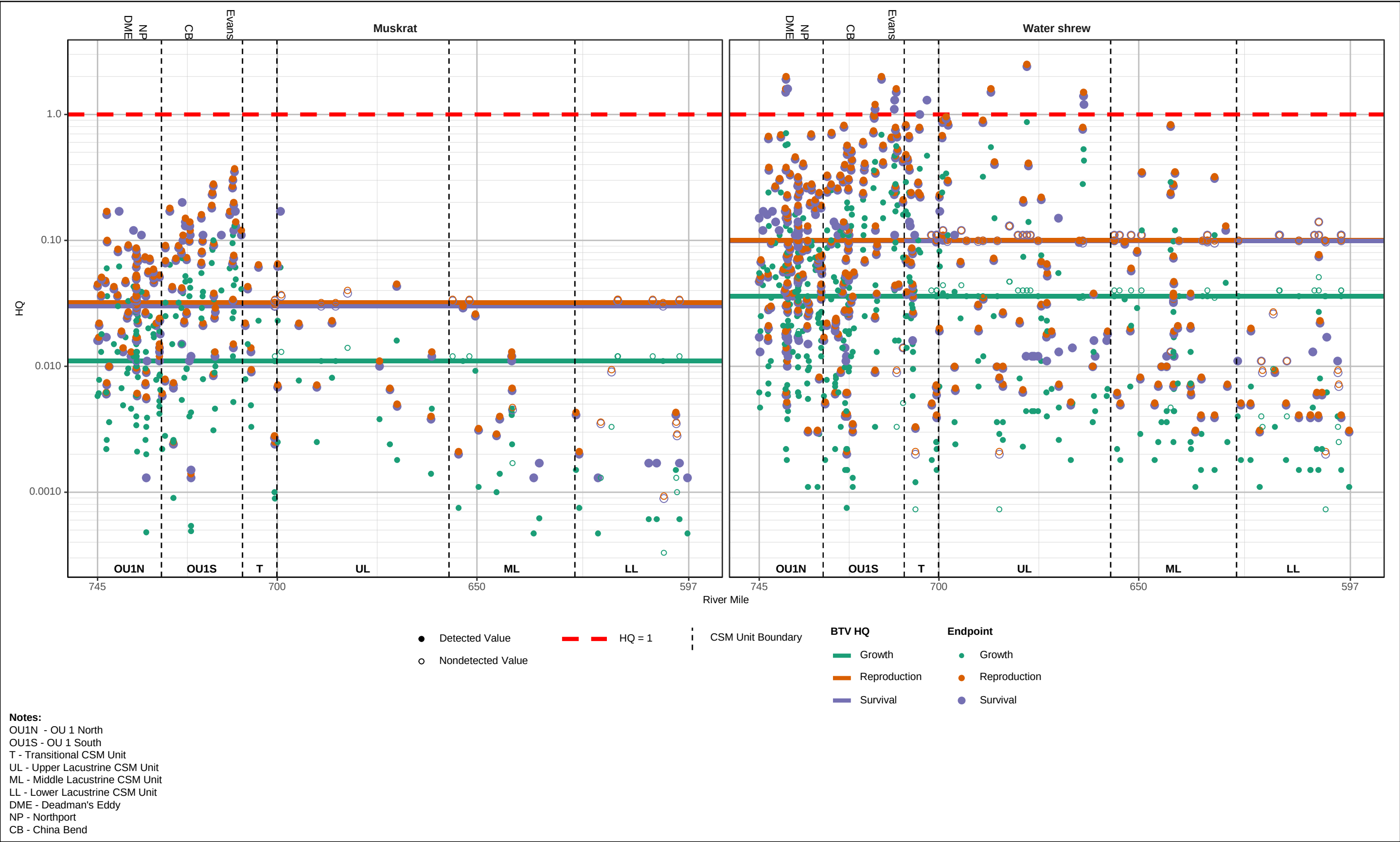


Figure M-8h. Point-by-Point Dietary Mammal HQs by River Mile for Mercury
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

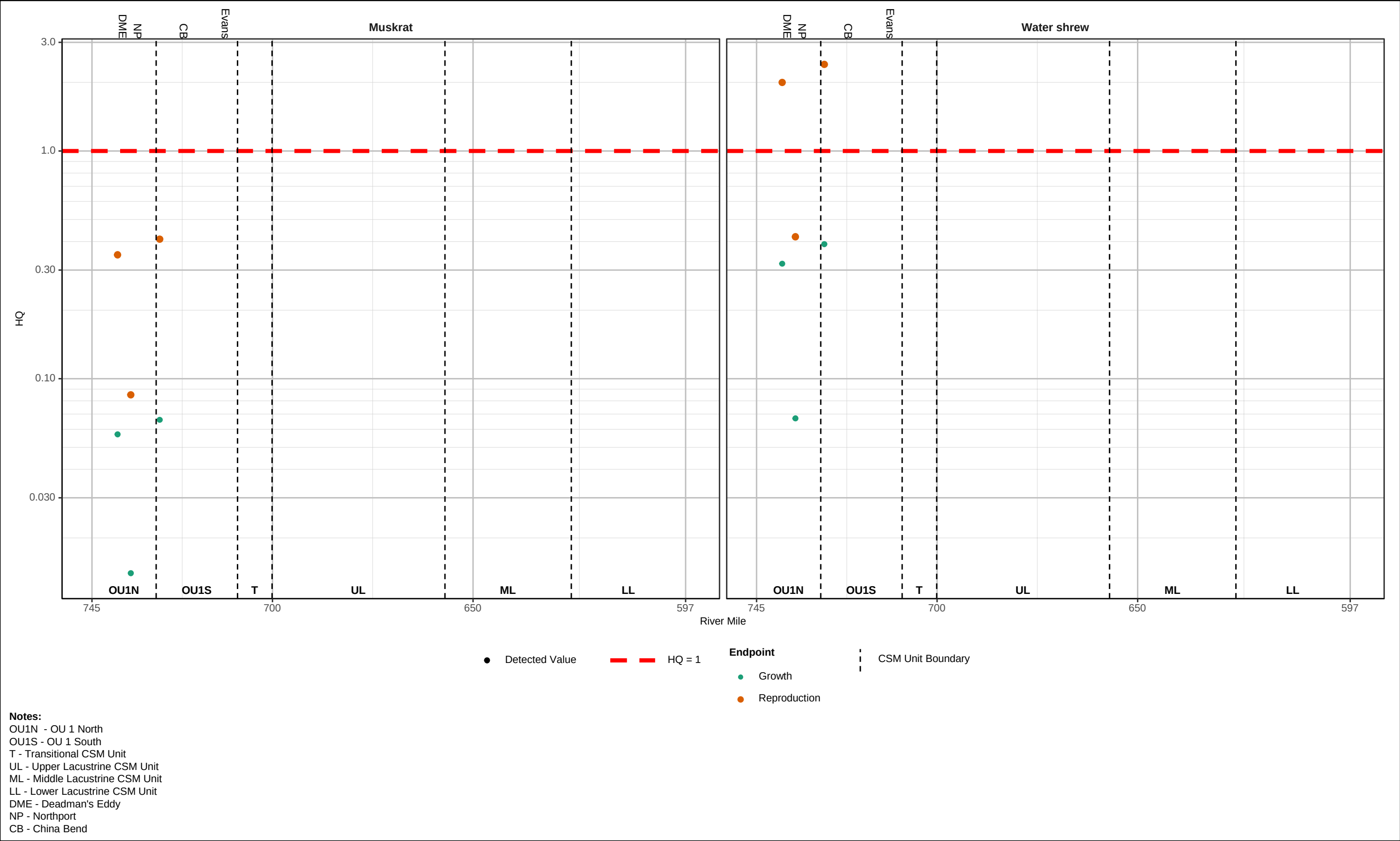


Figure M-8i. Point-by-Point Dietary Mammal HQs by River Mile for Molybdenum
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

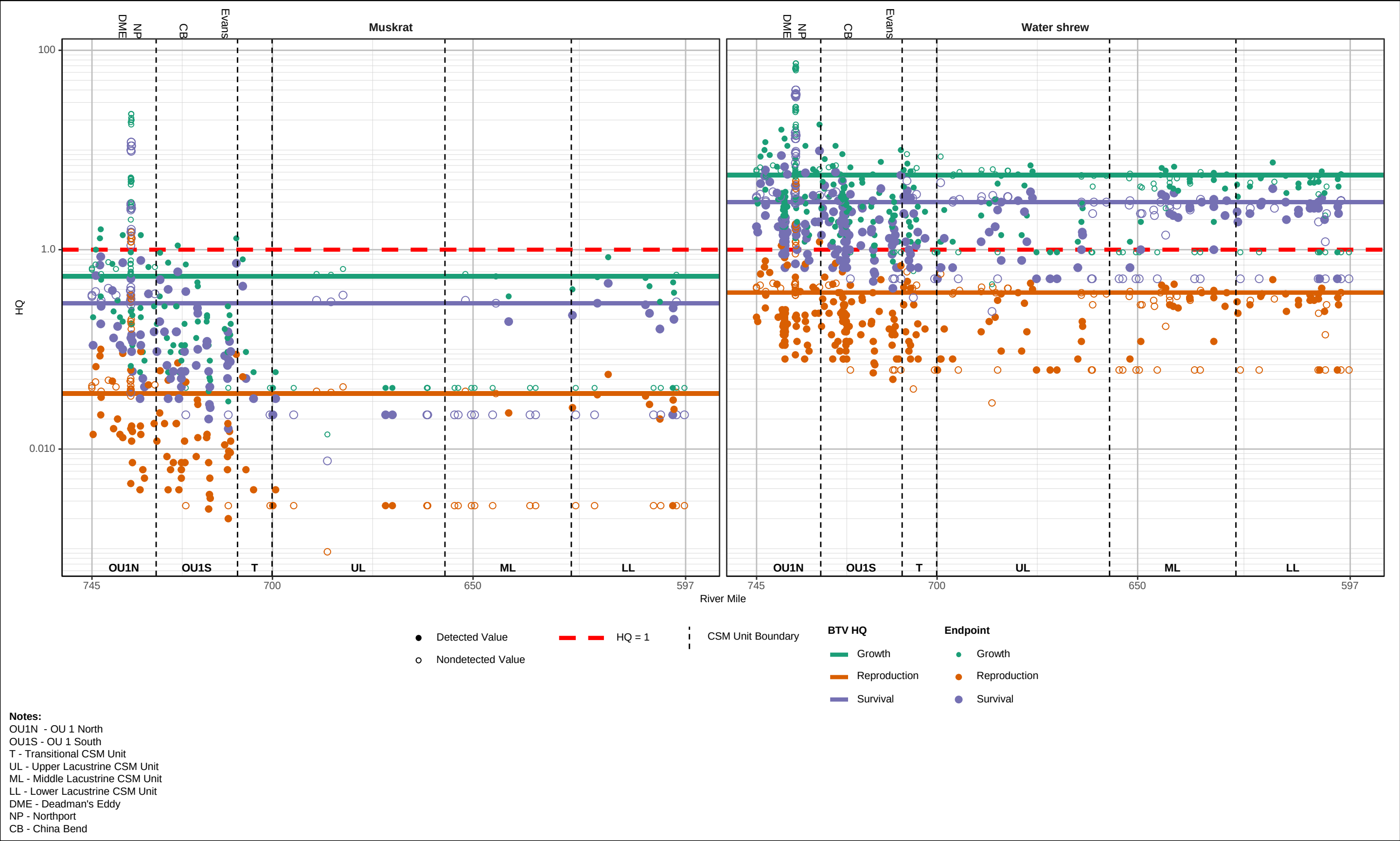


Figure M-8j. Point-by-Point Dietary Mammal HQs by River Mile for Selenium
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

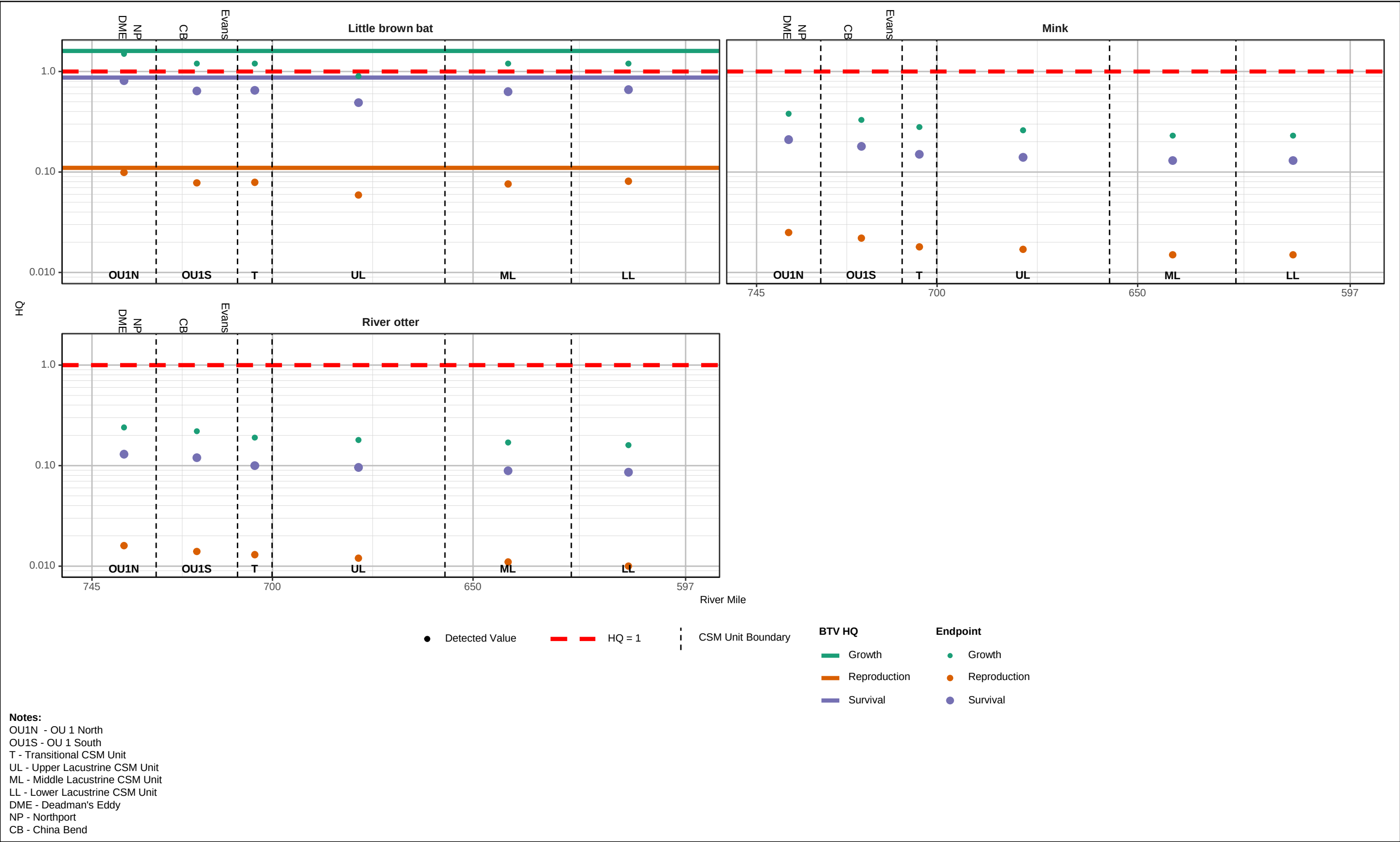


Figure M-8k. Areawide Dietary Mammal HQs by River Mile for Selenium
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

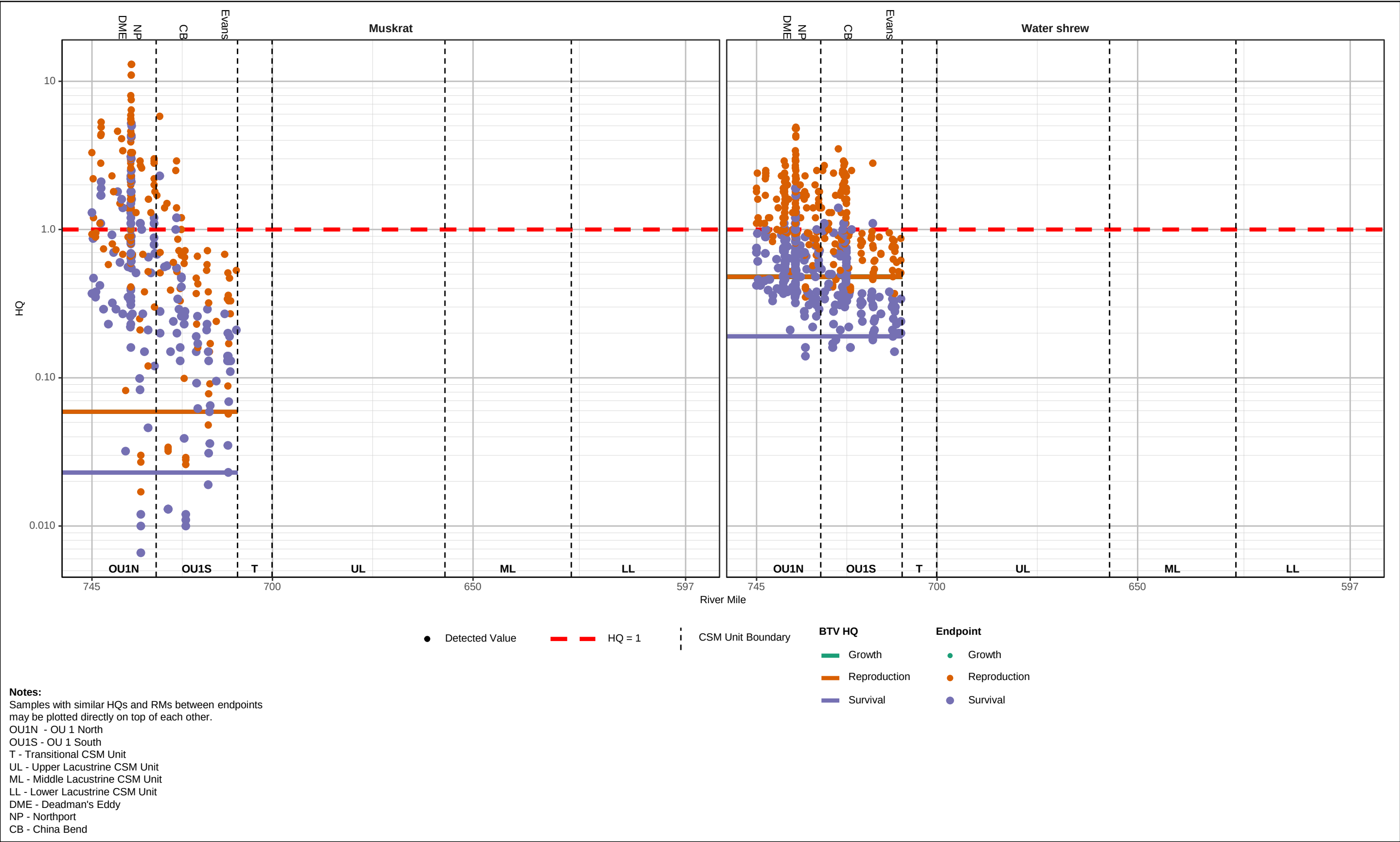


Figure M-8I. Point-by-Point Dietary Mammal HQs by River Mile for Zinc
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

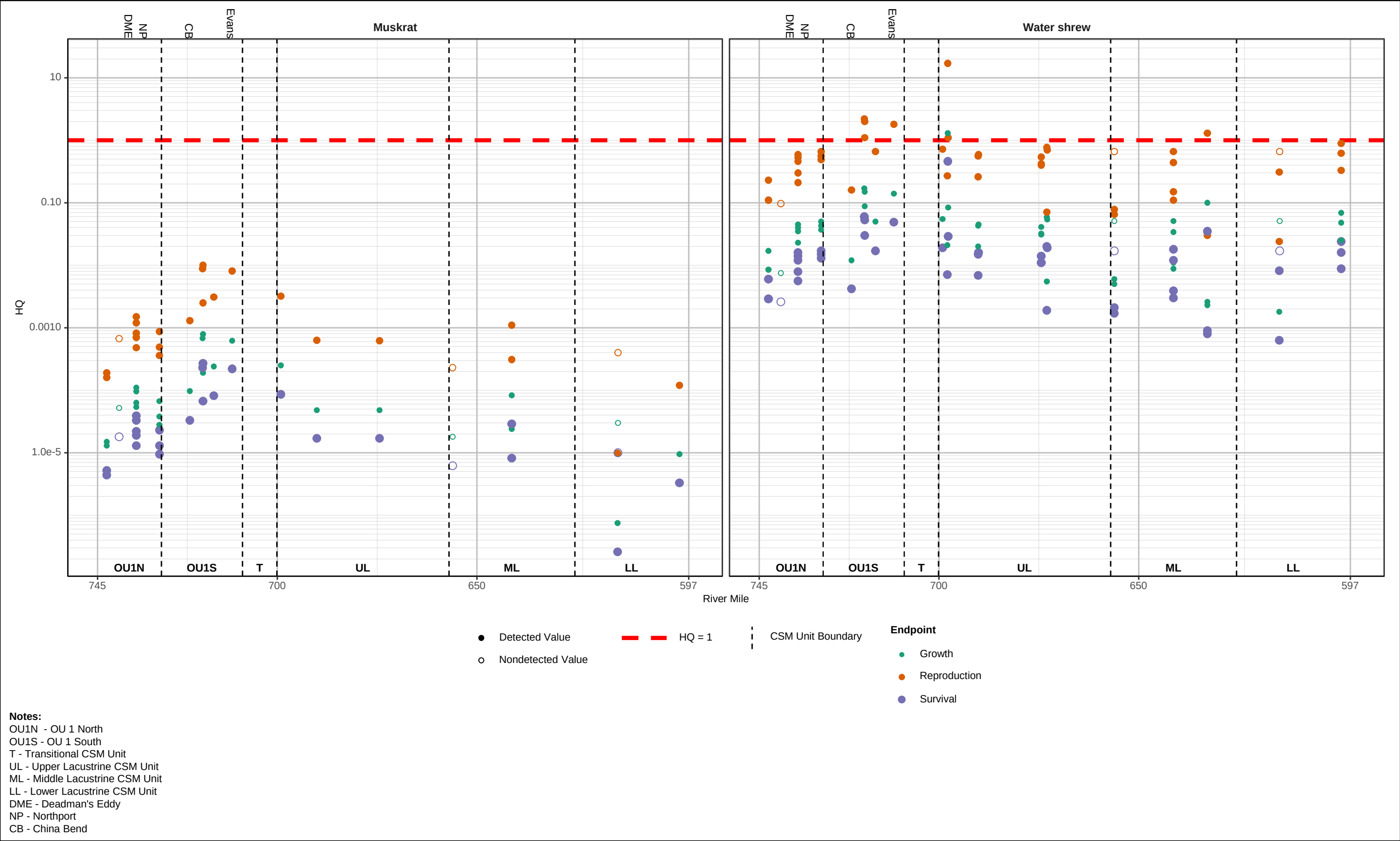


Figure M-8m. Point-by-Point Dietary Mammal HQs by River Mile for Dioxin/Furan Mammal TEQ, 0 DL
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

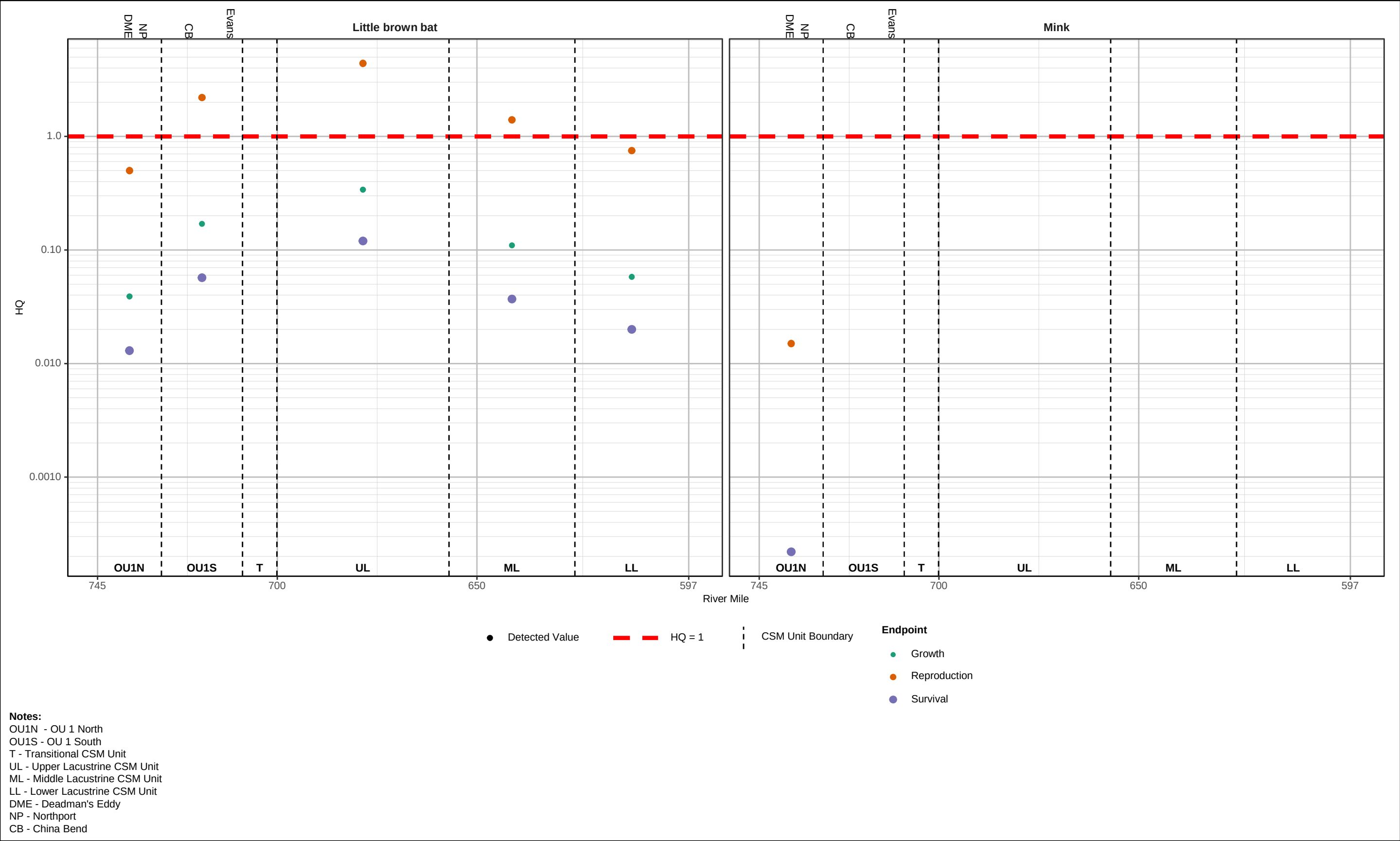


Figure M-8n. Areawide Dietary Mammal HQs by River Mile for Dioxin/Furan Mammal TEQ, 0 DL
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

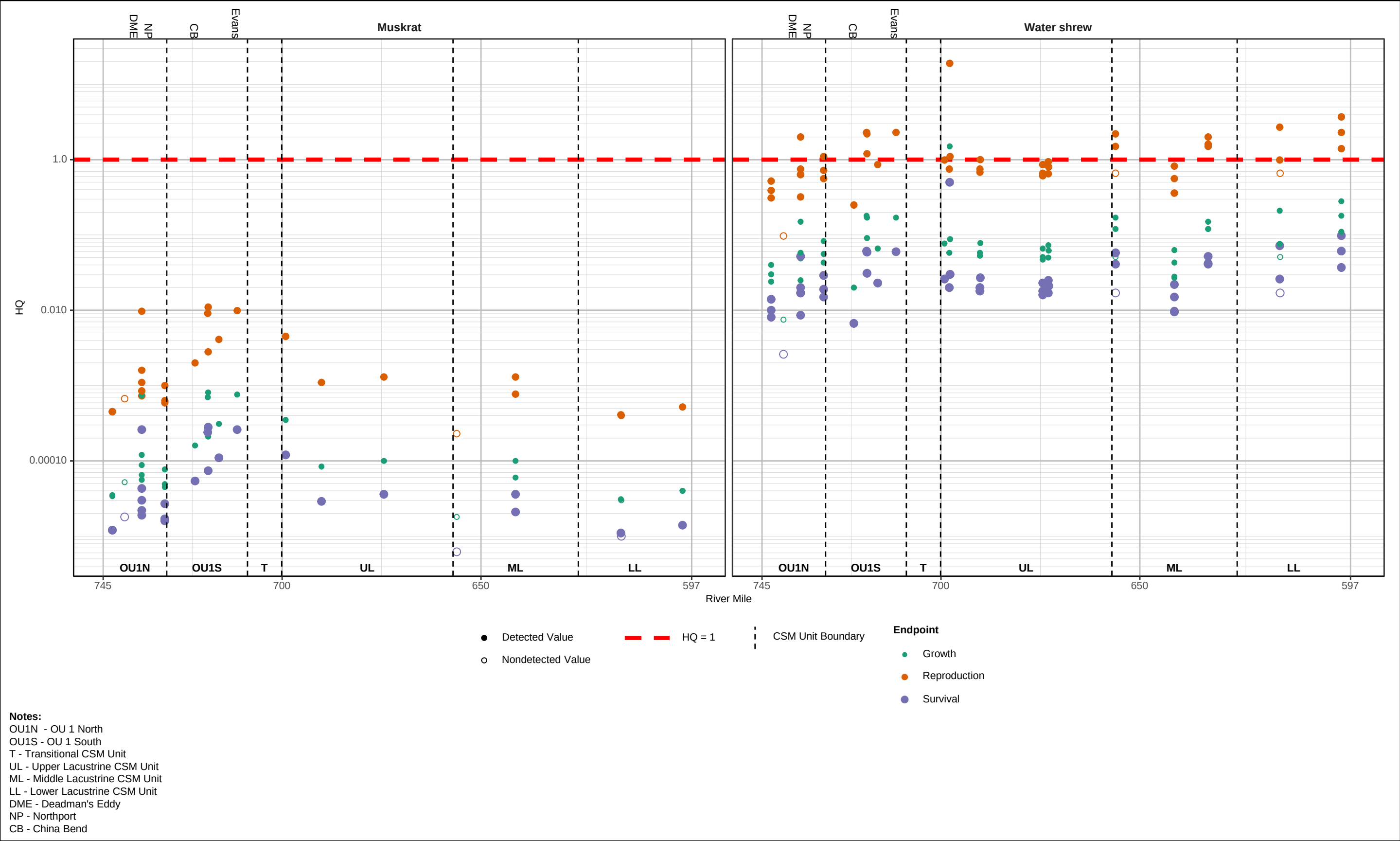


Figure M-8o. Point-by-Point Dietary Mammal HQs by River Mile for Dioxin/Furan Mammal TEQ, 1/2 DL
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

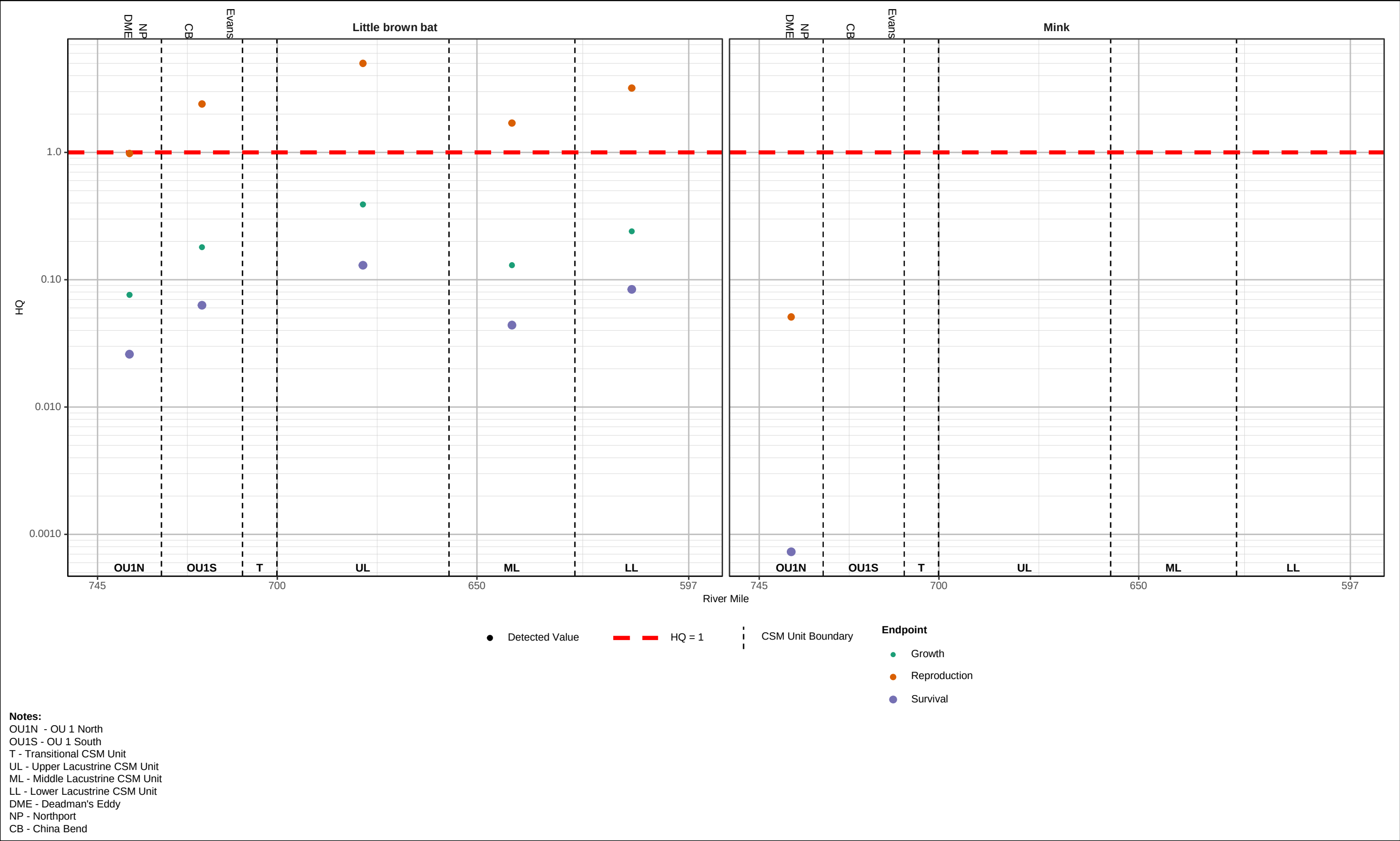


Figure M-8p. Areawide Dietary Mammal HQs by River Mile for Dioxin/Furan Mammal TEQ, 1/2 DL
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

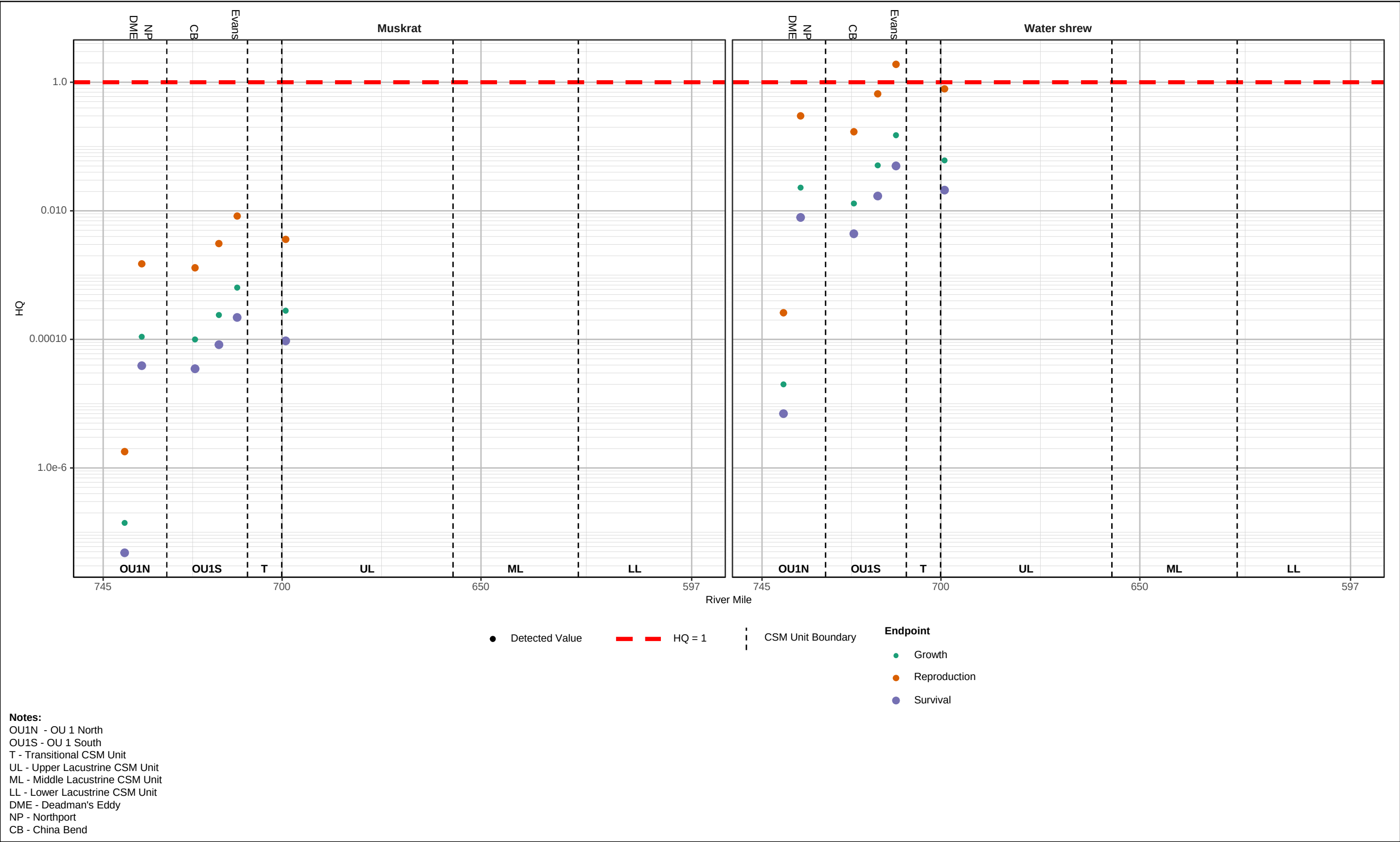


Figure M-8q. Point-by-Point Dietary Mammal HQs by River Mile for Total Mammal TEQ, 0 DL
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

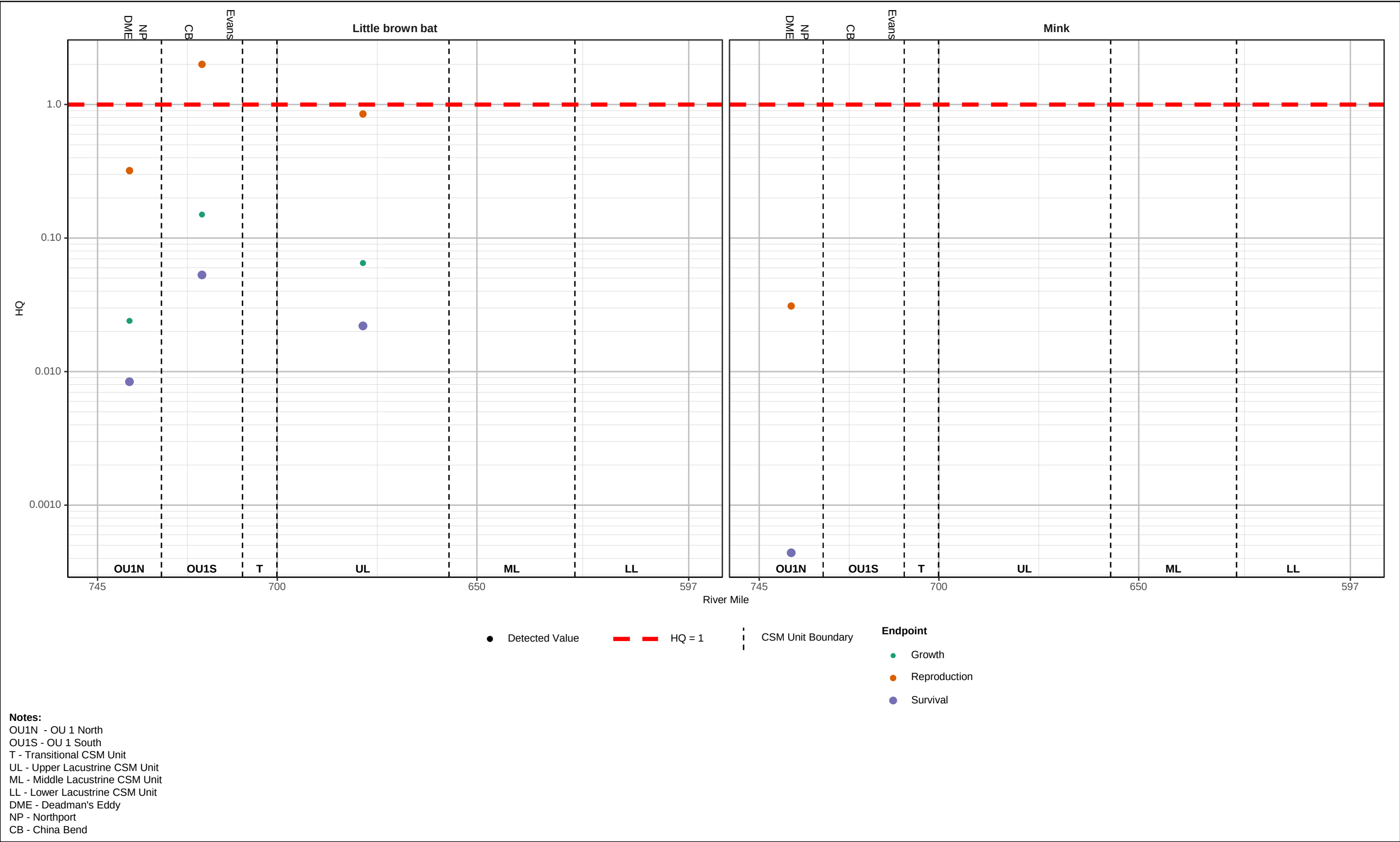


Figure M-8r. Areawide Dietary Mammal HQs by River Mile for Total Mammal TEQ, 0 DL
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

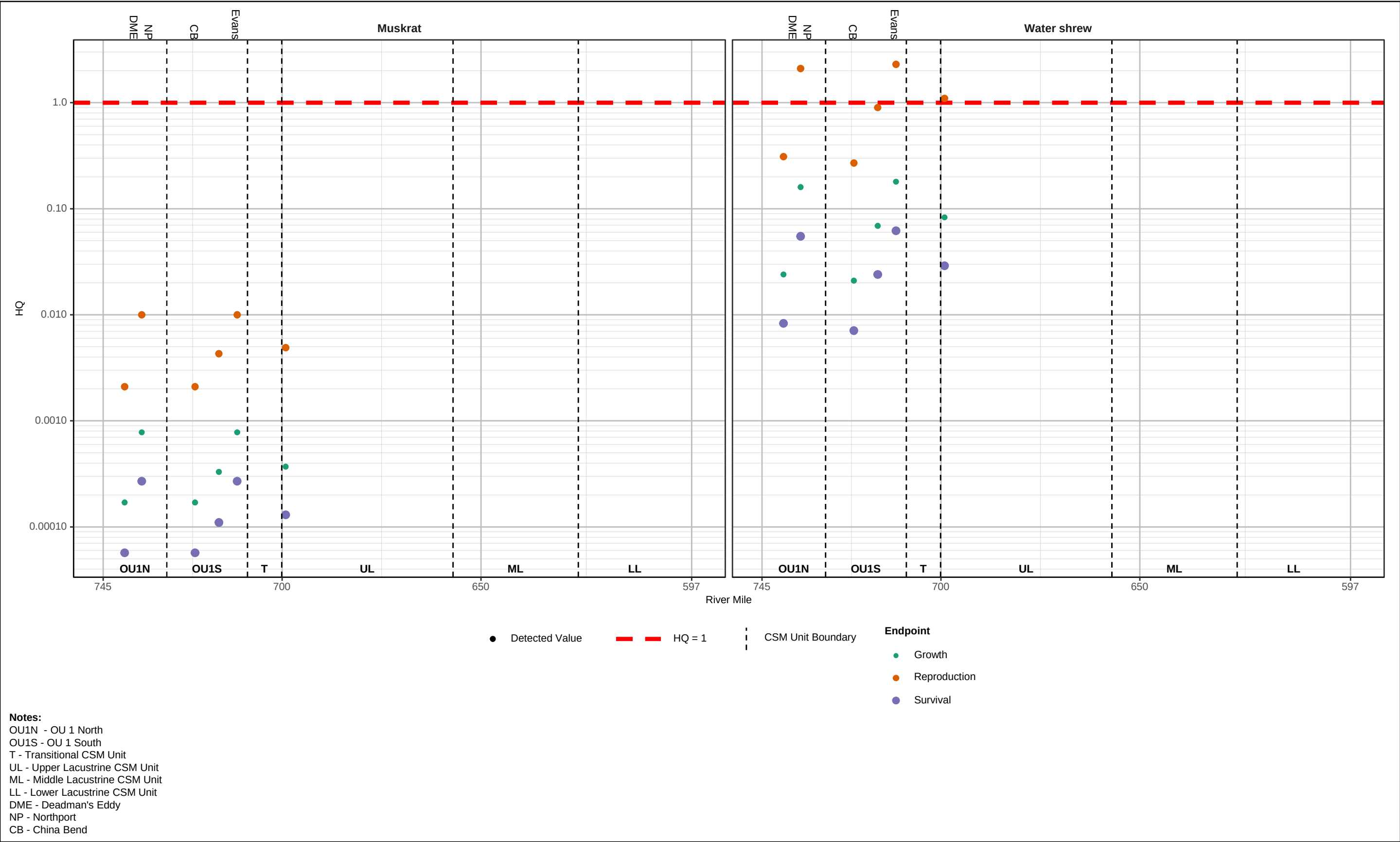


Figure M-8s. Point-by-Point Dietary Mammal HQs by River Mile for Total Mammal TEQ, 1/2
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

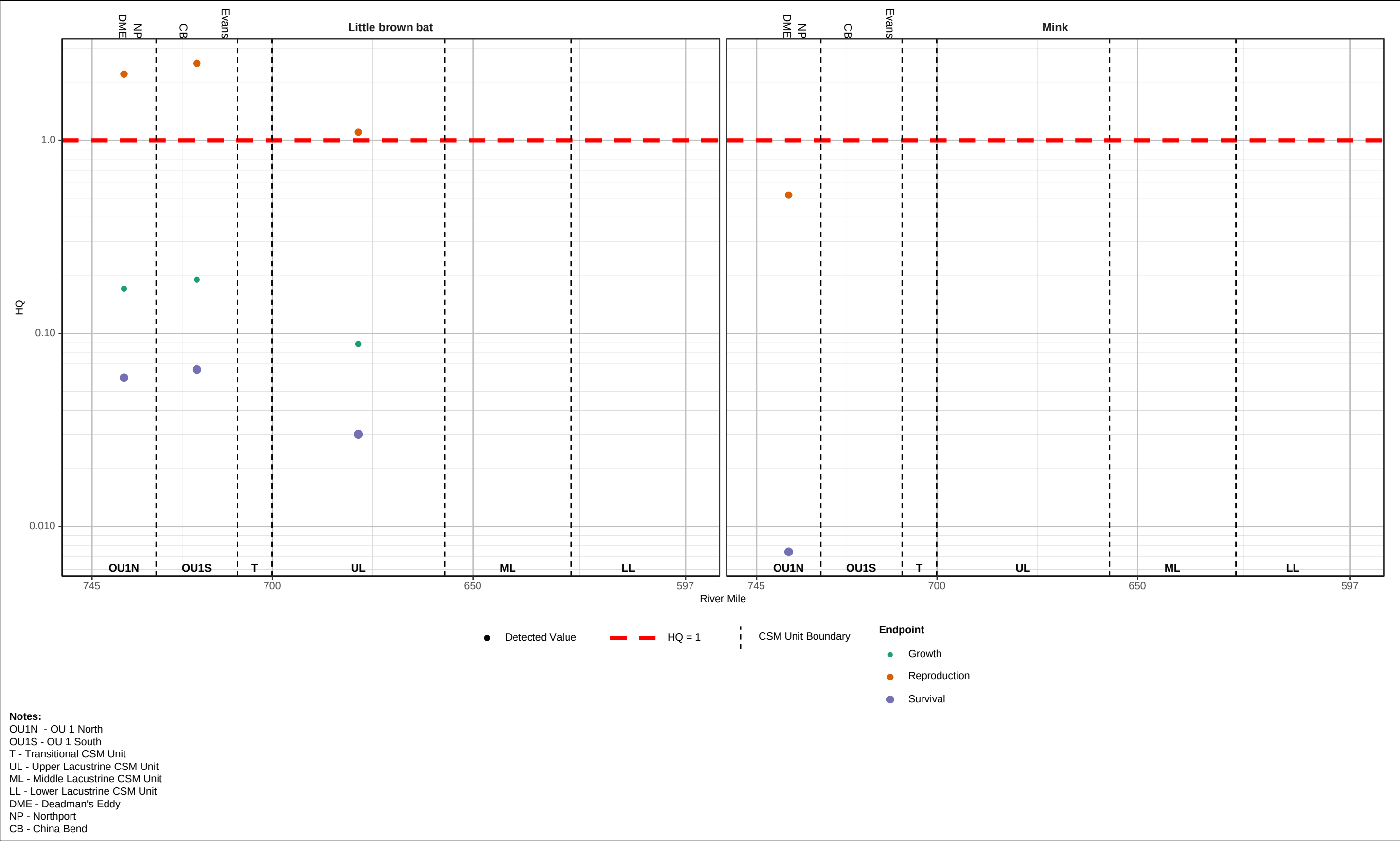


Figure M-8t. Areawide Dietary Mammal HQs by River Mile for Total Mammal TEQ, 1/2
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

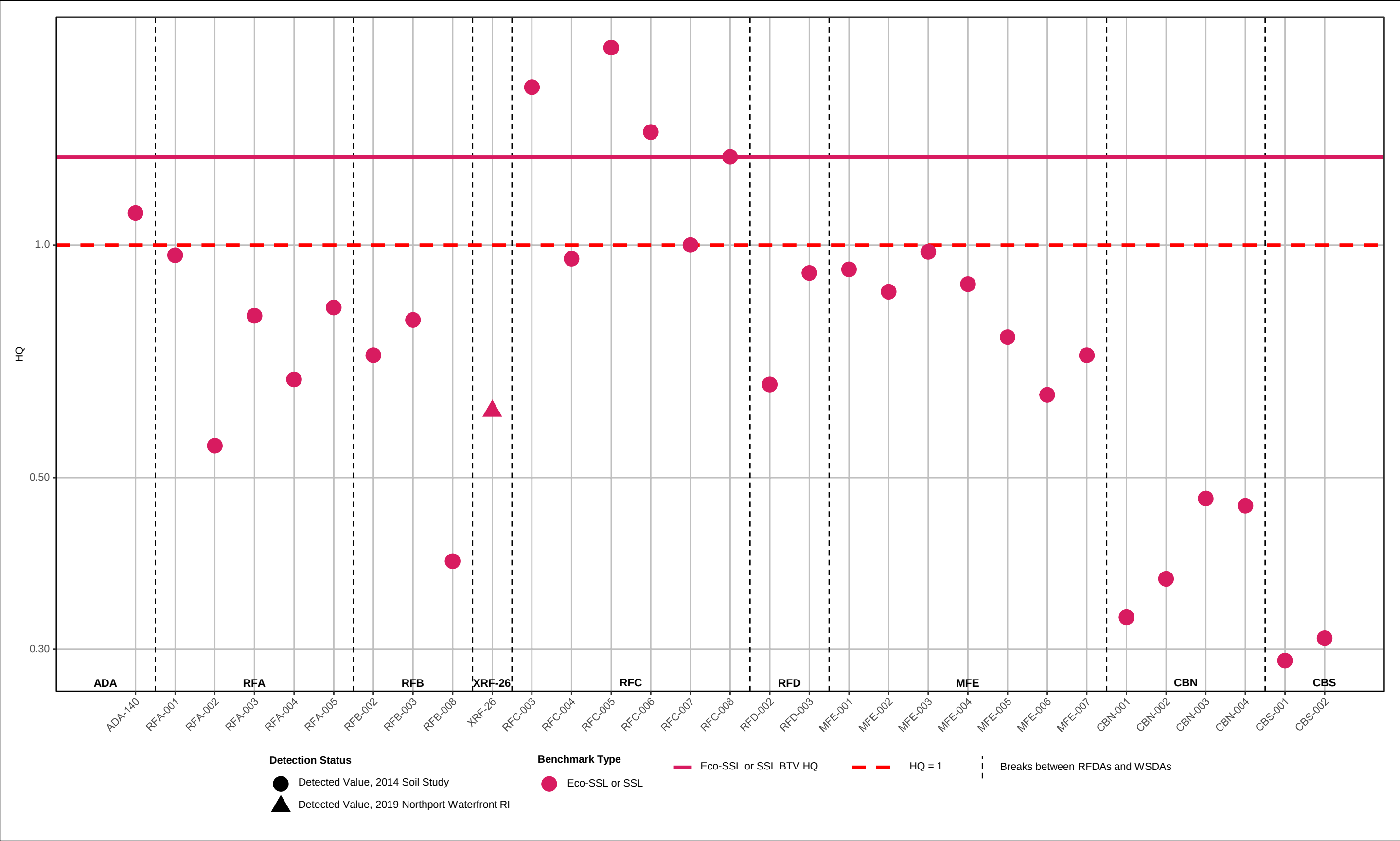


Figure M-9a. Terrestrial Plant HQs by Location for Arsenic
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

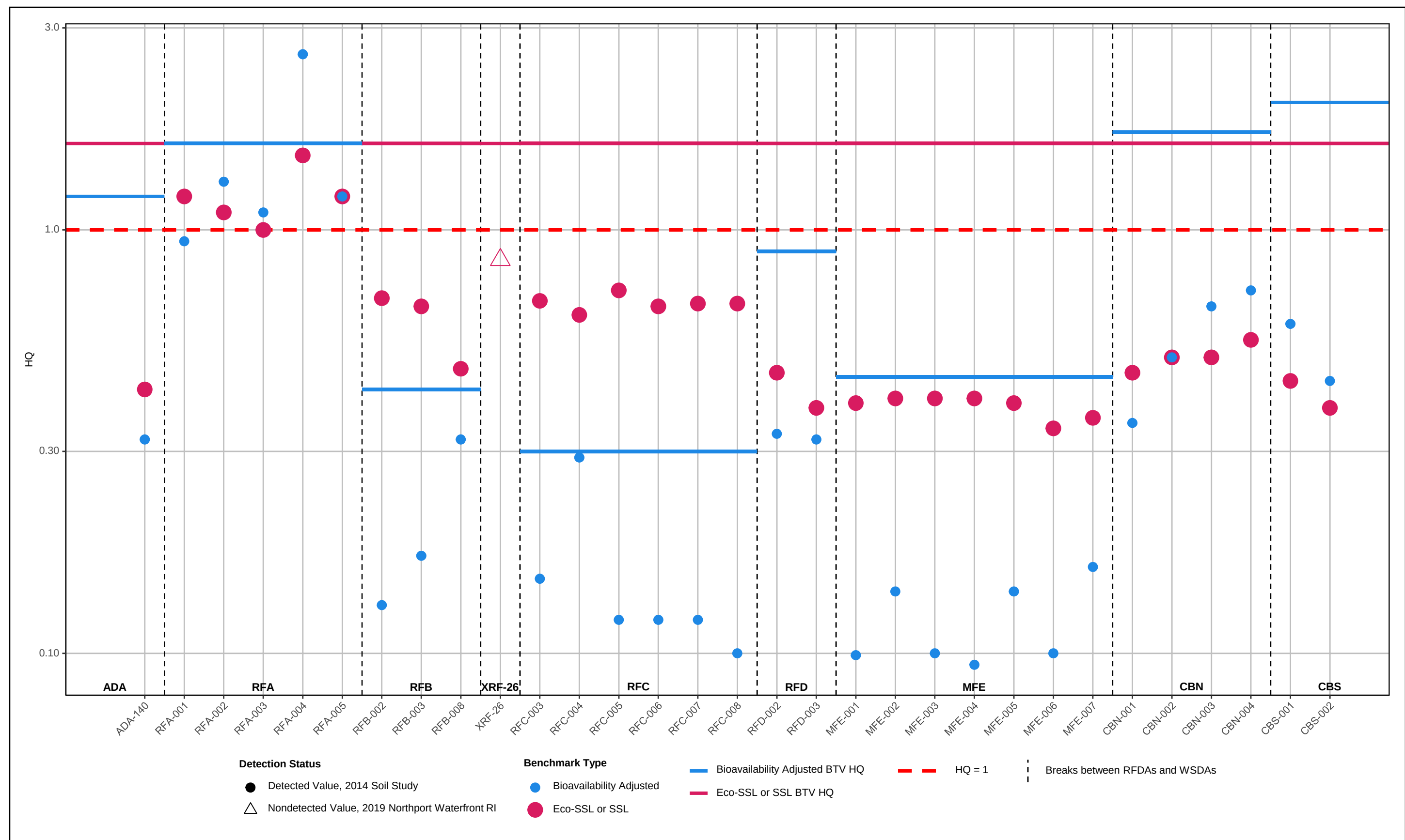


Figure M-9b. Terrestrial Plant HQs by Location for Cobalt
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

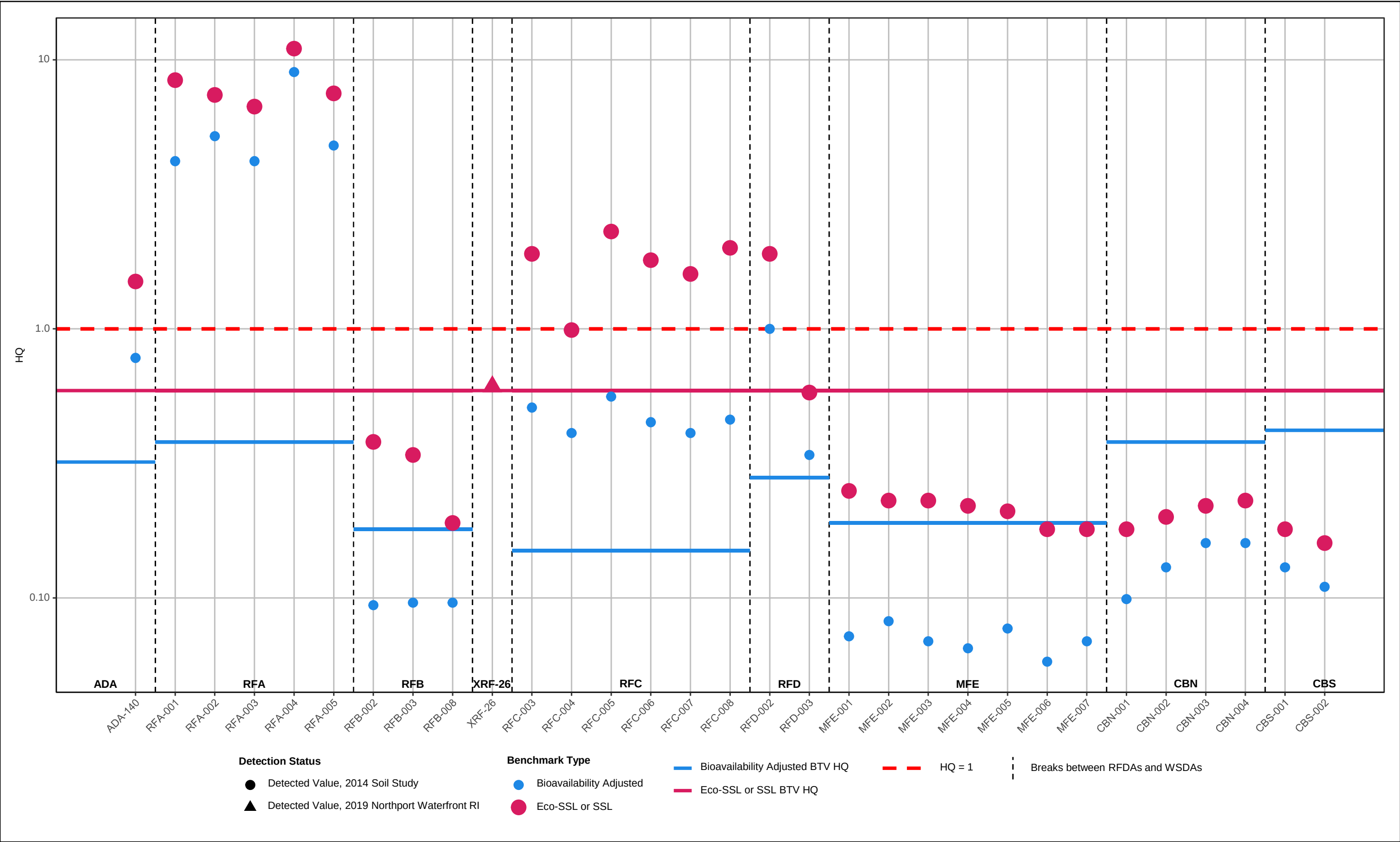


Figure M-9c. Terrestrial Plant HQs by Location for Copper
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

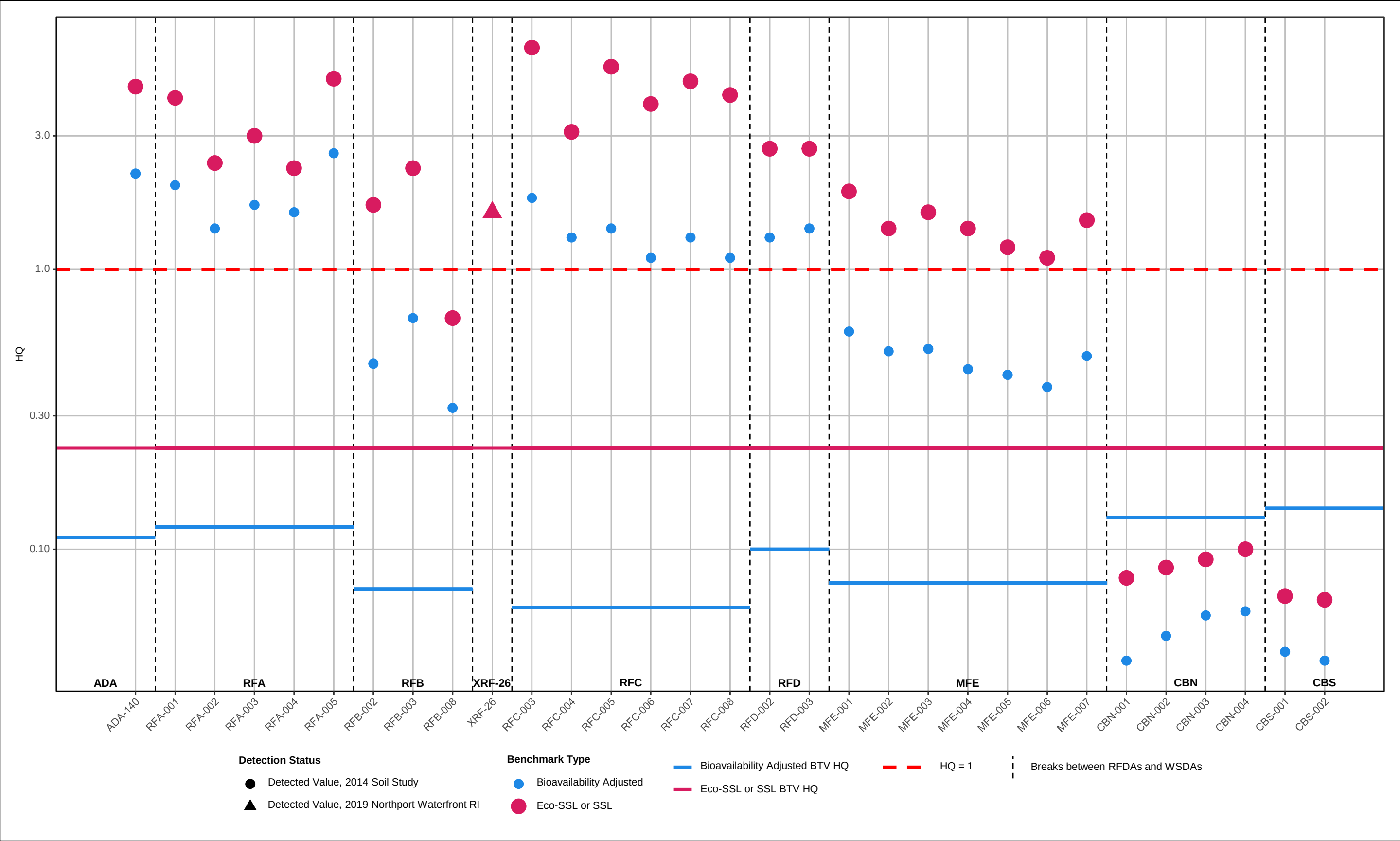


Figure M-9d. Terrestrial Plant HQs by Location for Lead
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

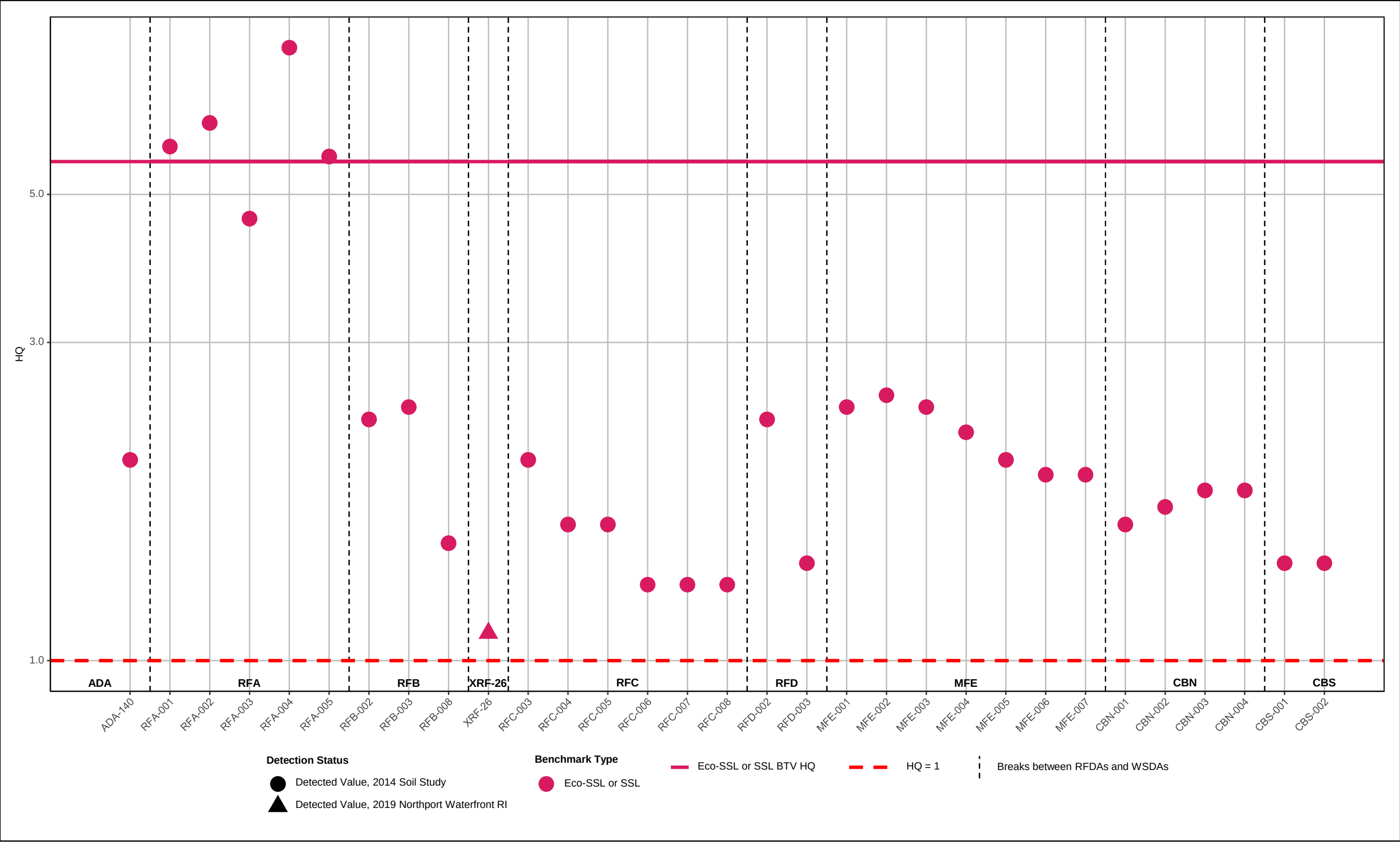


Figure M-9e. Terrestrial Plant HQs by Location for Manganese
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

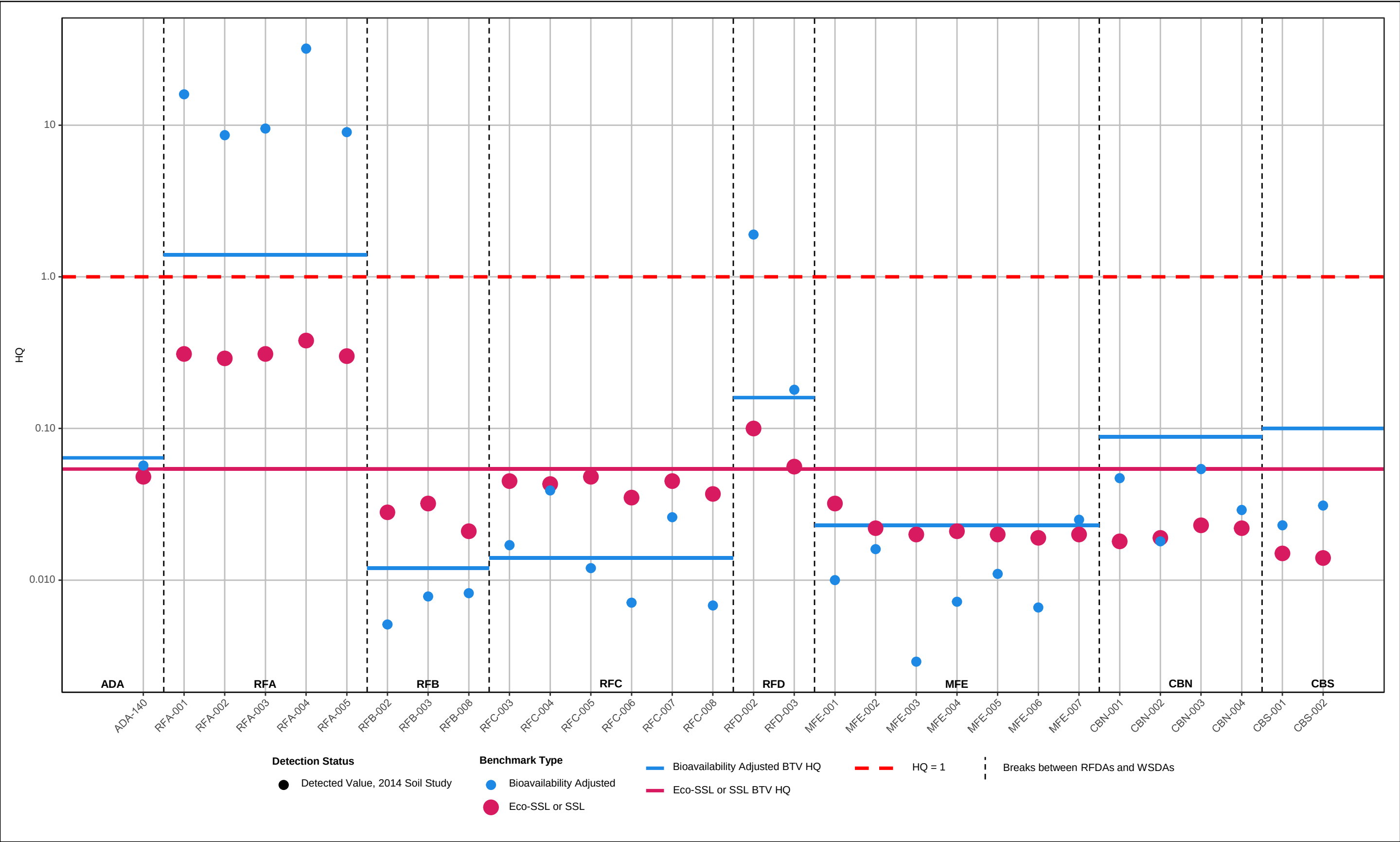


Figure M-9f. Terrestrial Plant HQs by Location for Molybdenum
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

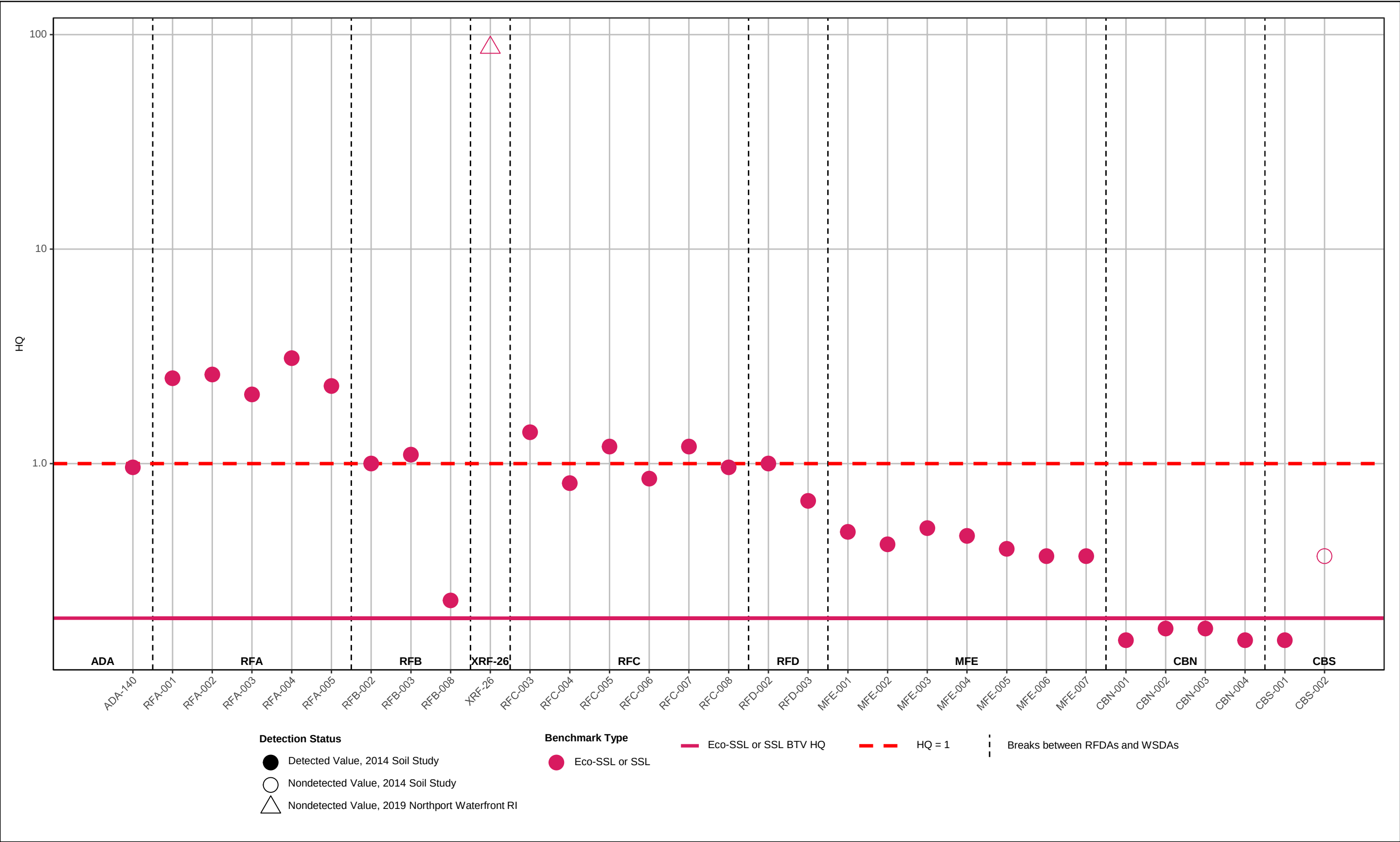


Figure M-9g. Terrestrial Plant HQs by Location for Selenium
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

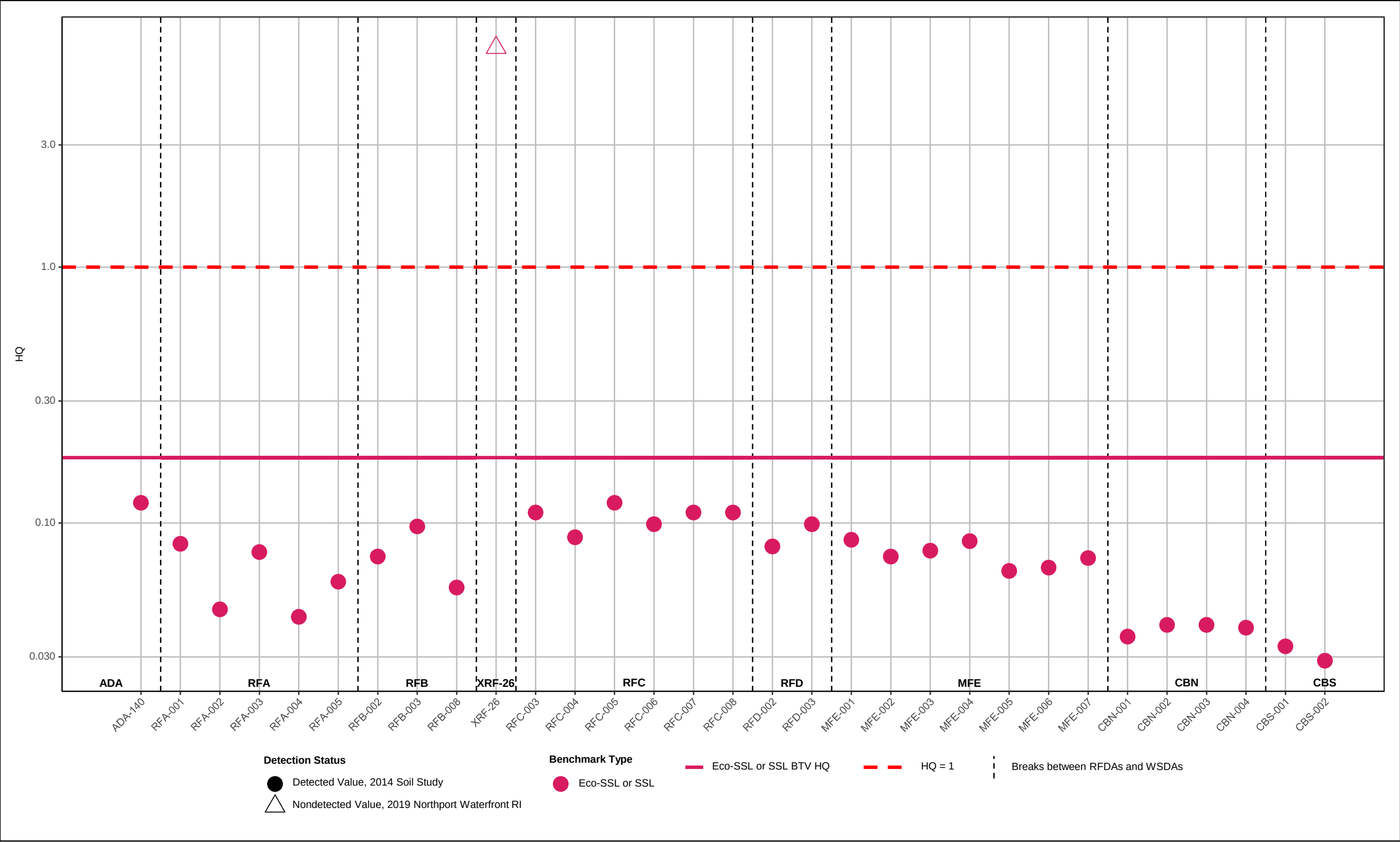


Figure M-9h. Terrestrial Plant HQs by Location for Thallium
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

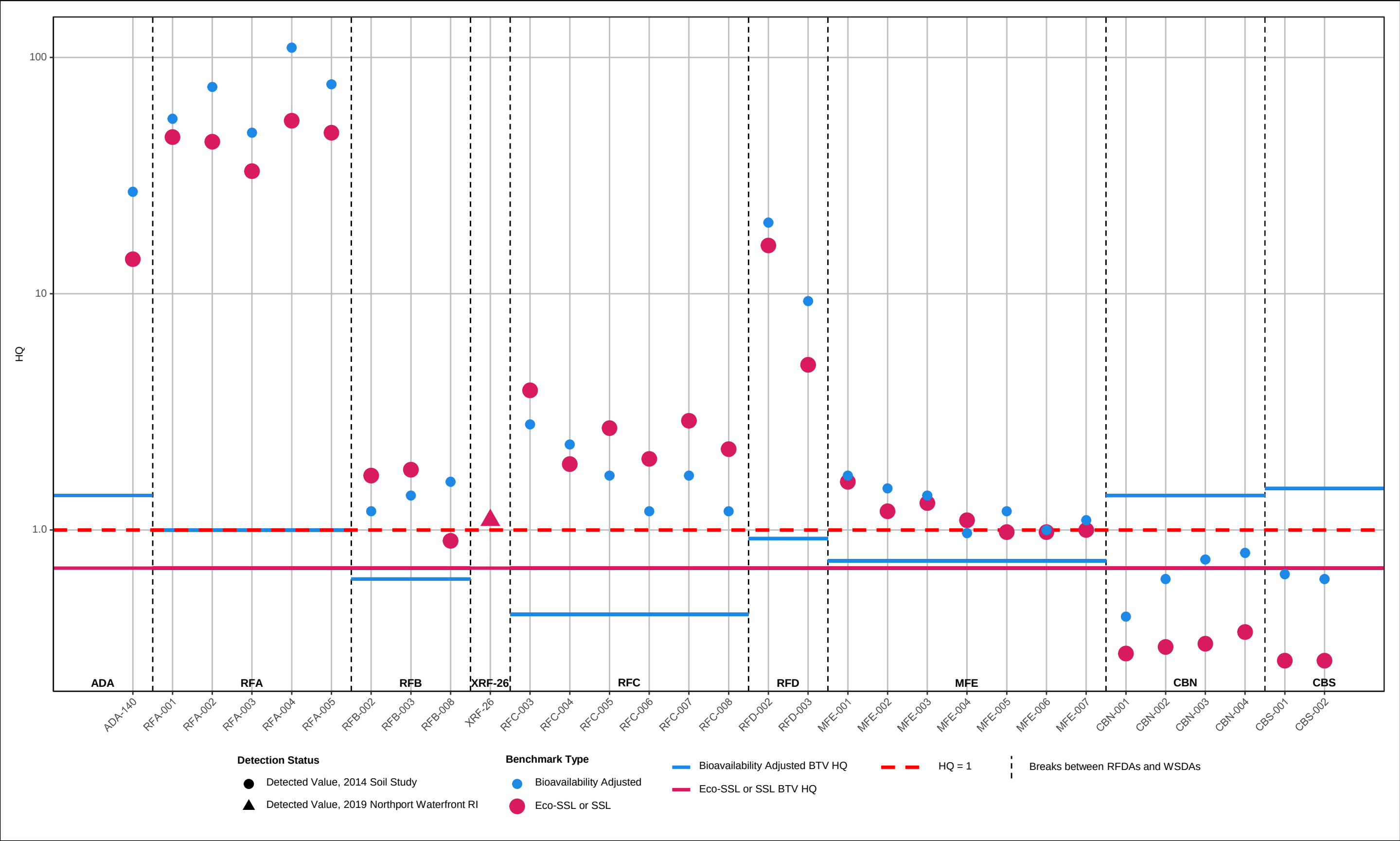


Figure M-9i. Terrestrial Plant HQs by Location for Zinc
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

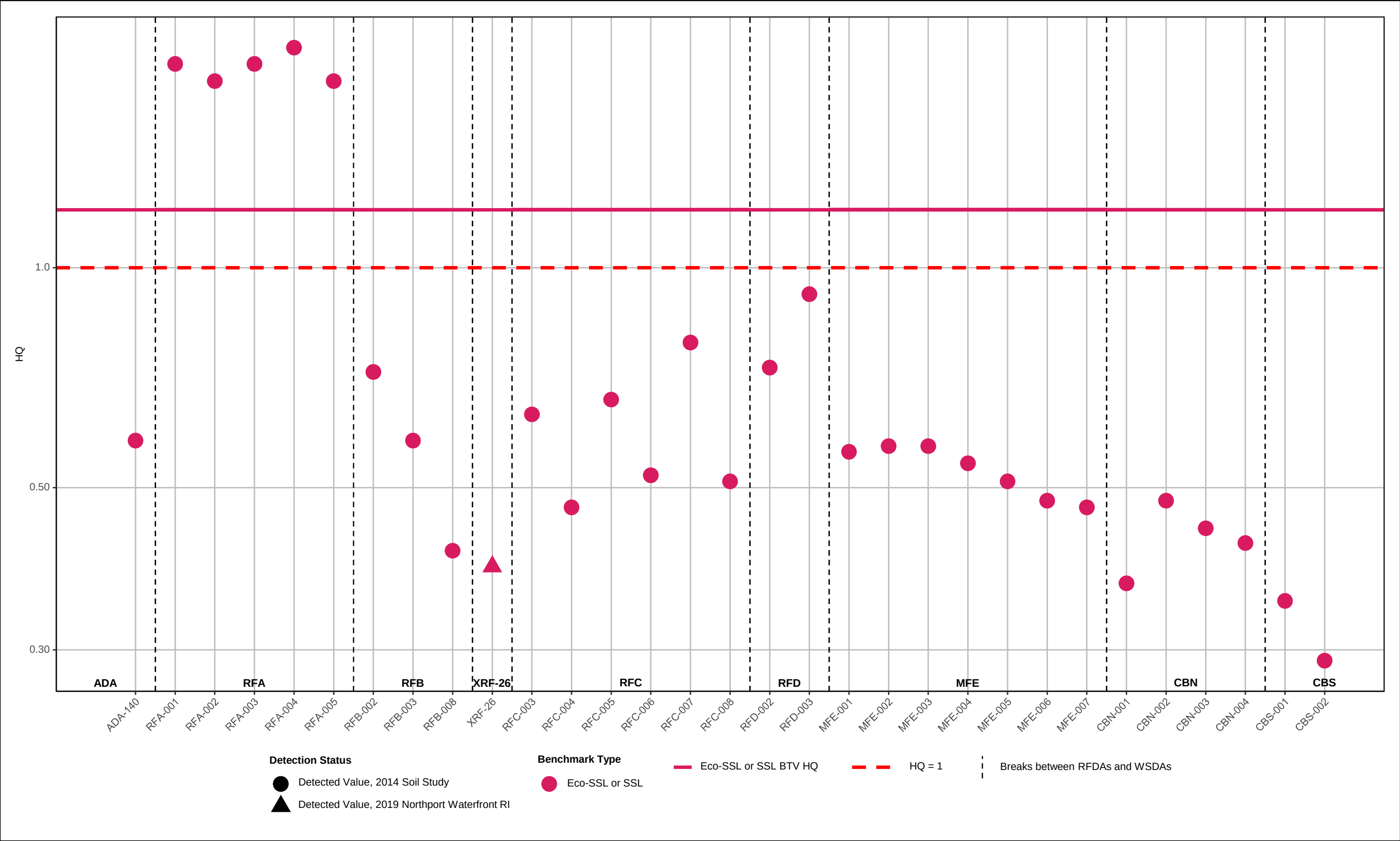


Figure M-10a. Soil Invertebrate HQs by Location for Barium
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

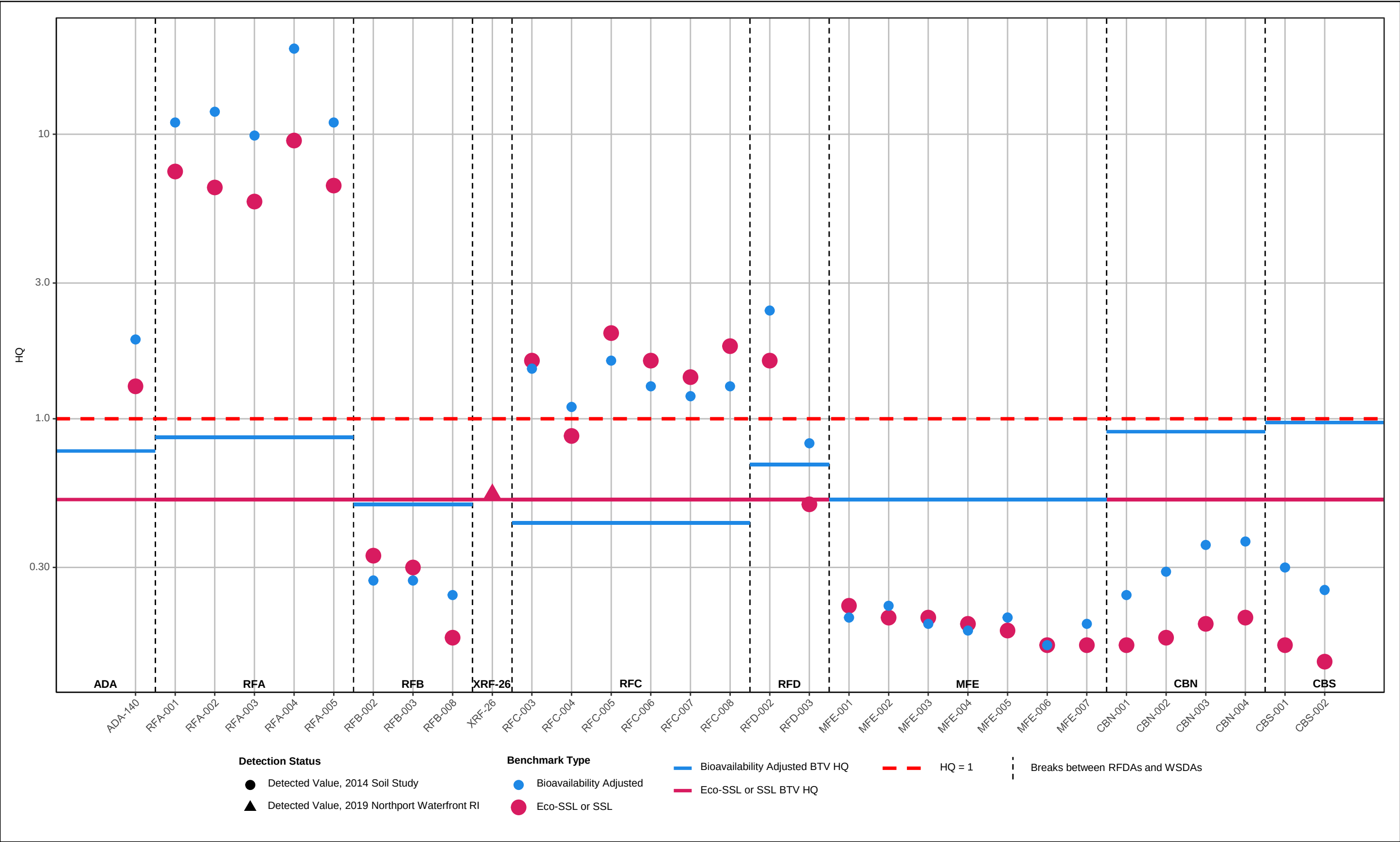


Figure M-10b. Soil Invertebrate HQs by Location for Copper
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

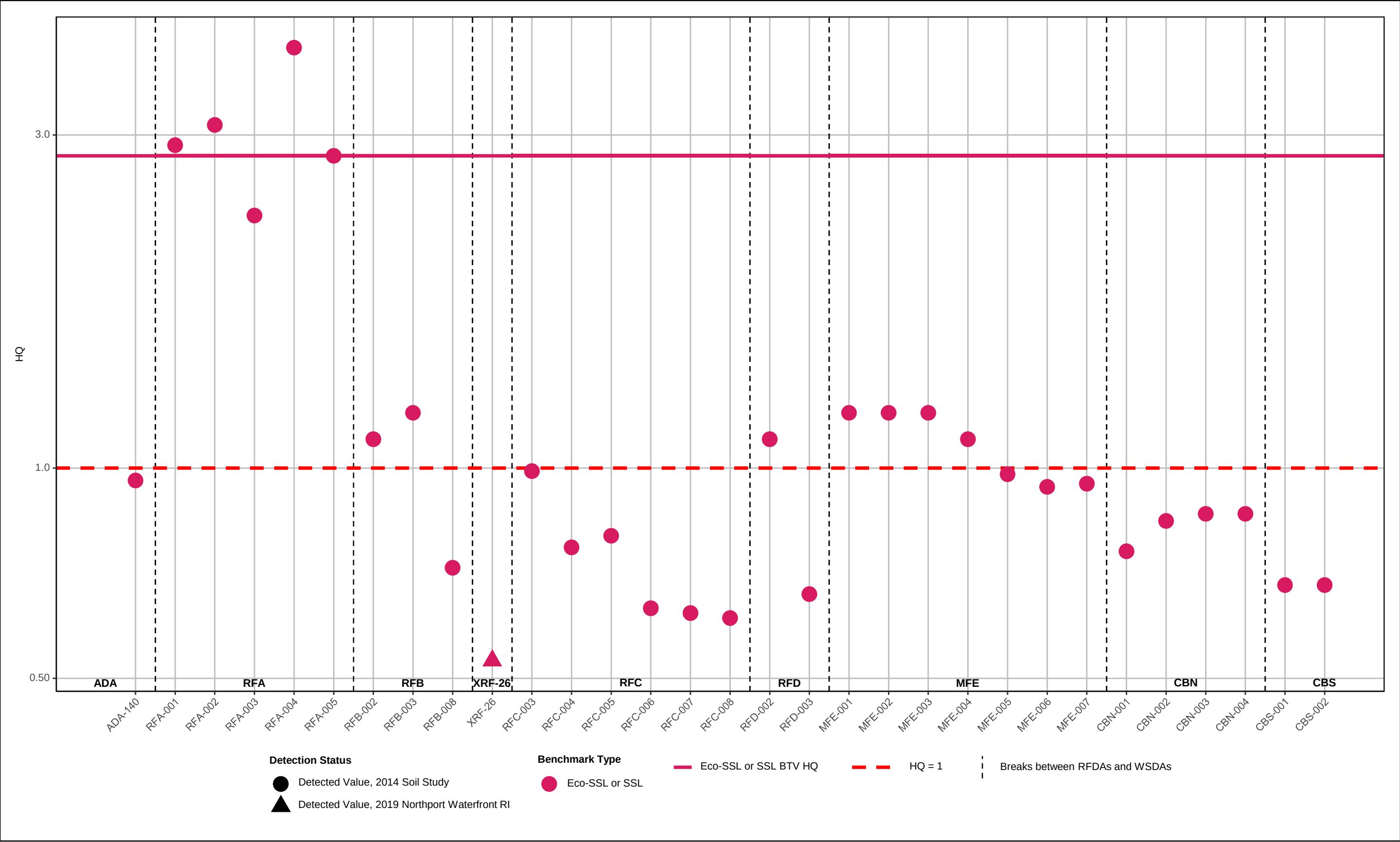


Figure M-10c. Soil Invertebrate HQs by Location for Manganese
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

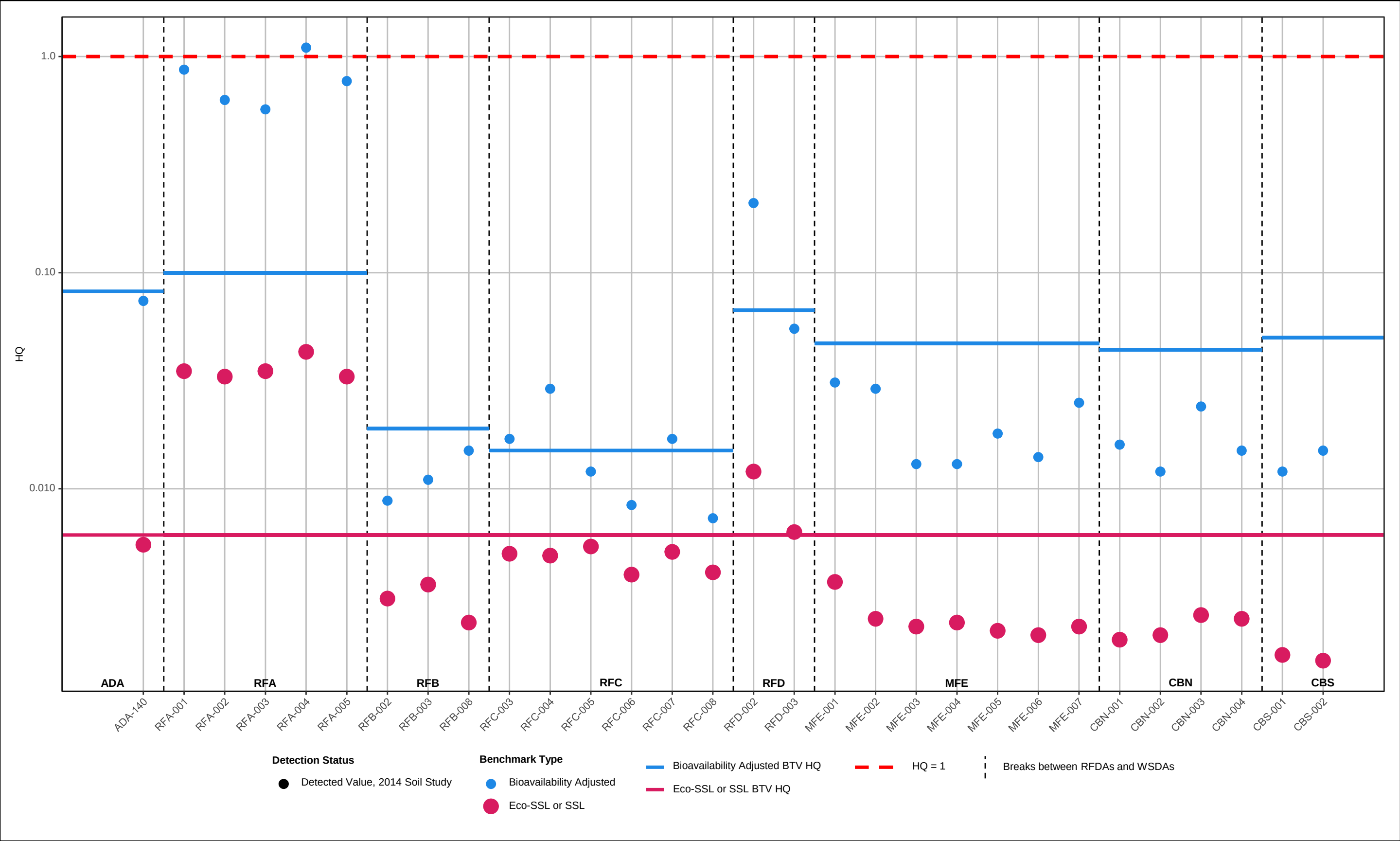


Figure M-10d. Soil Invertebrate HQs by Location for Molybdenum
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

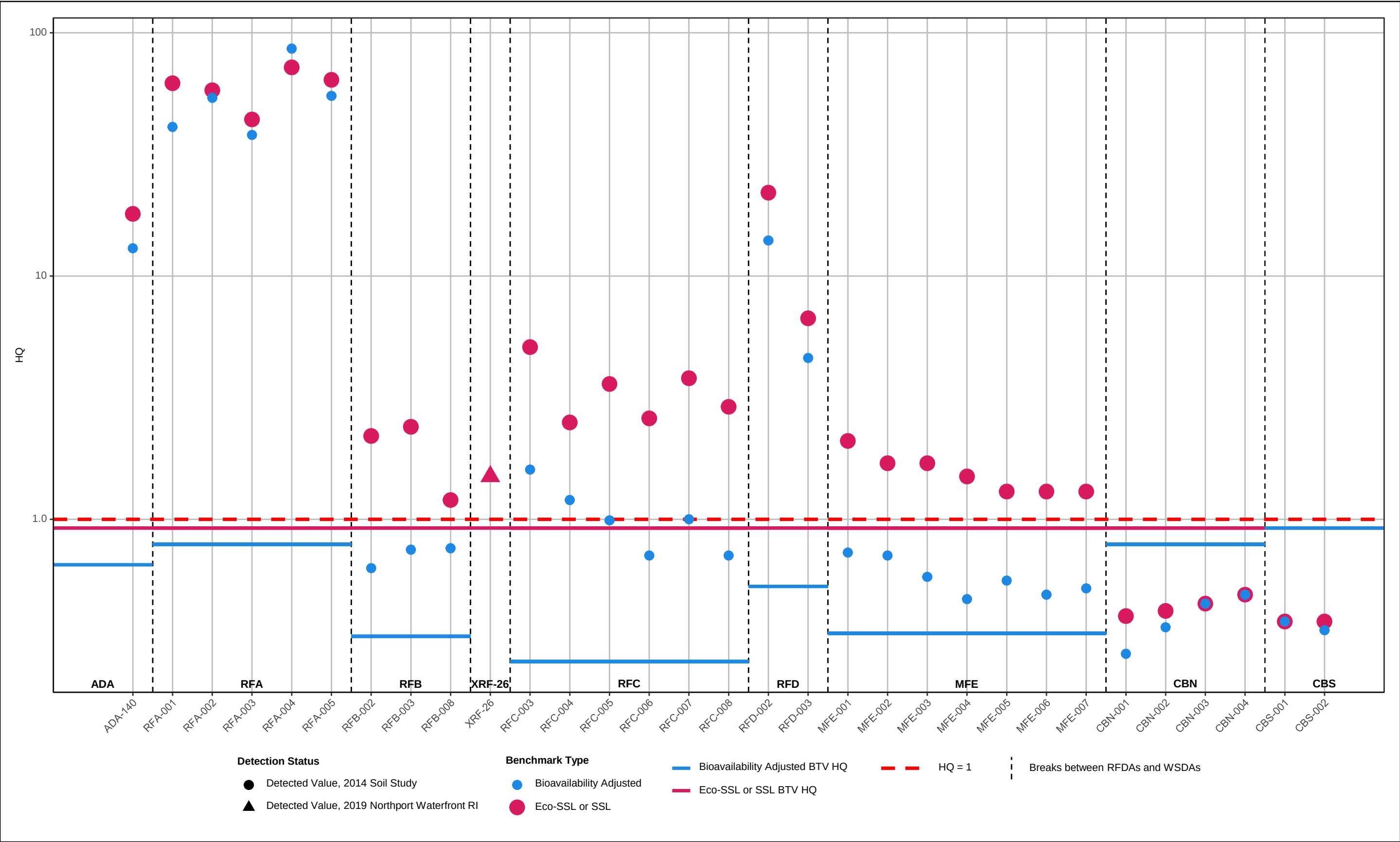


Figure M-10e. Soil Invertebrate HQs by Location for Zinc
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

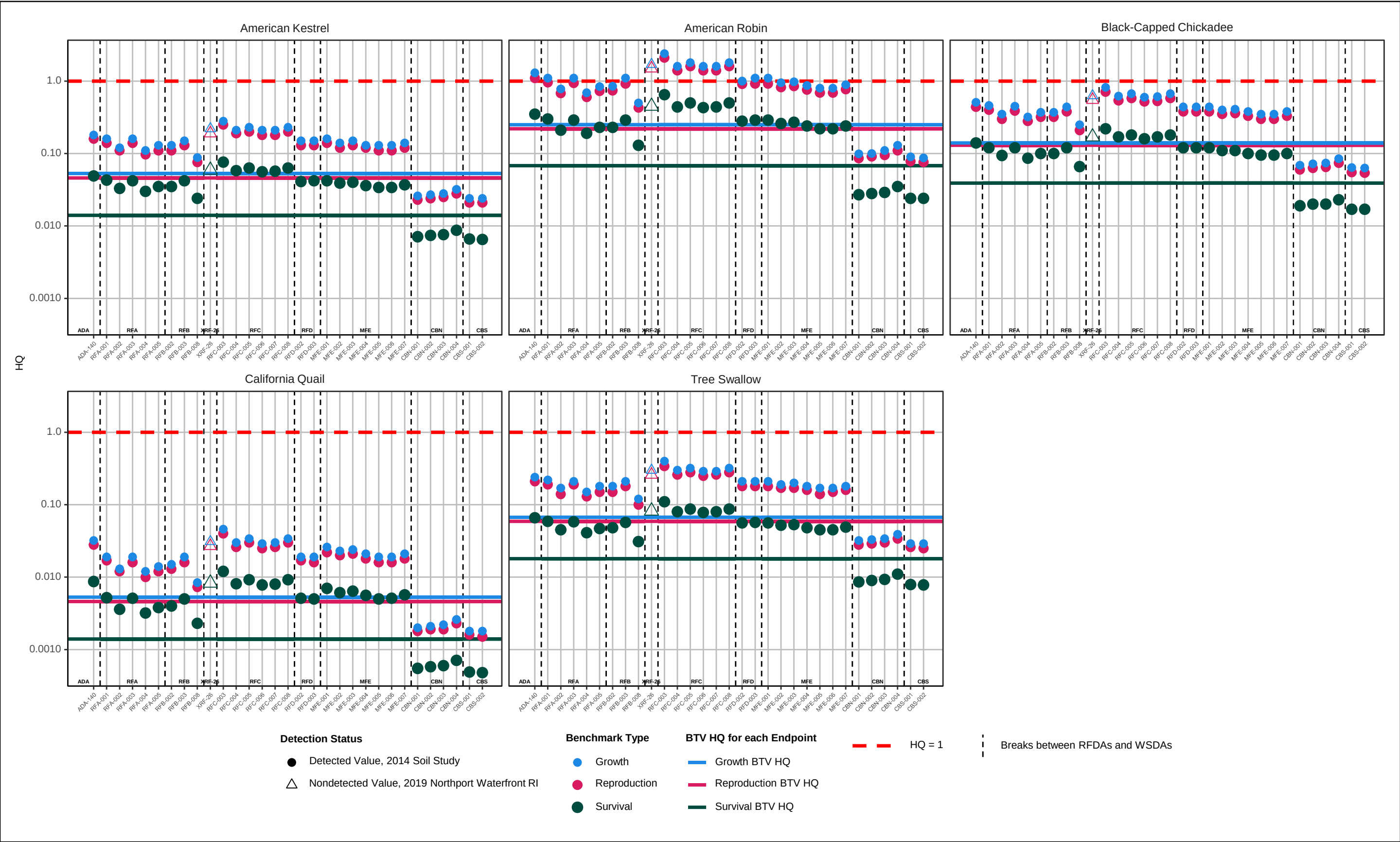


Figure M-11a. Terrestrial Bird HQs by Location for Cadmium
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

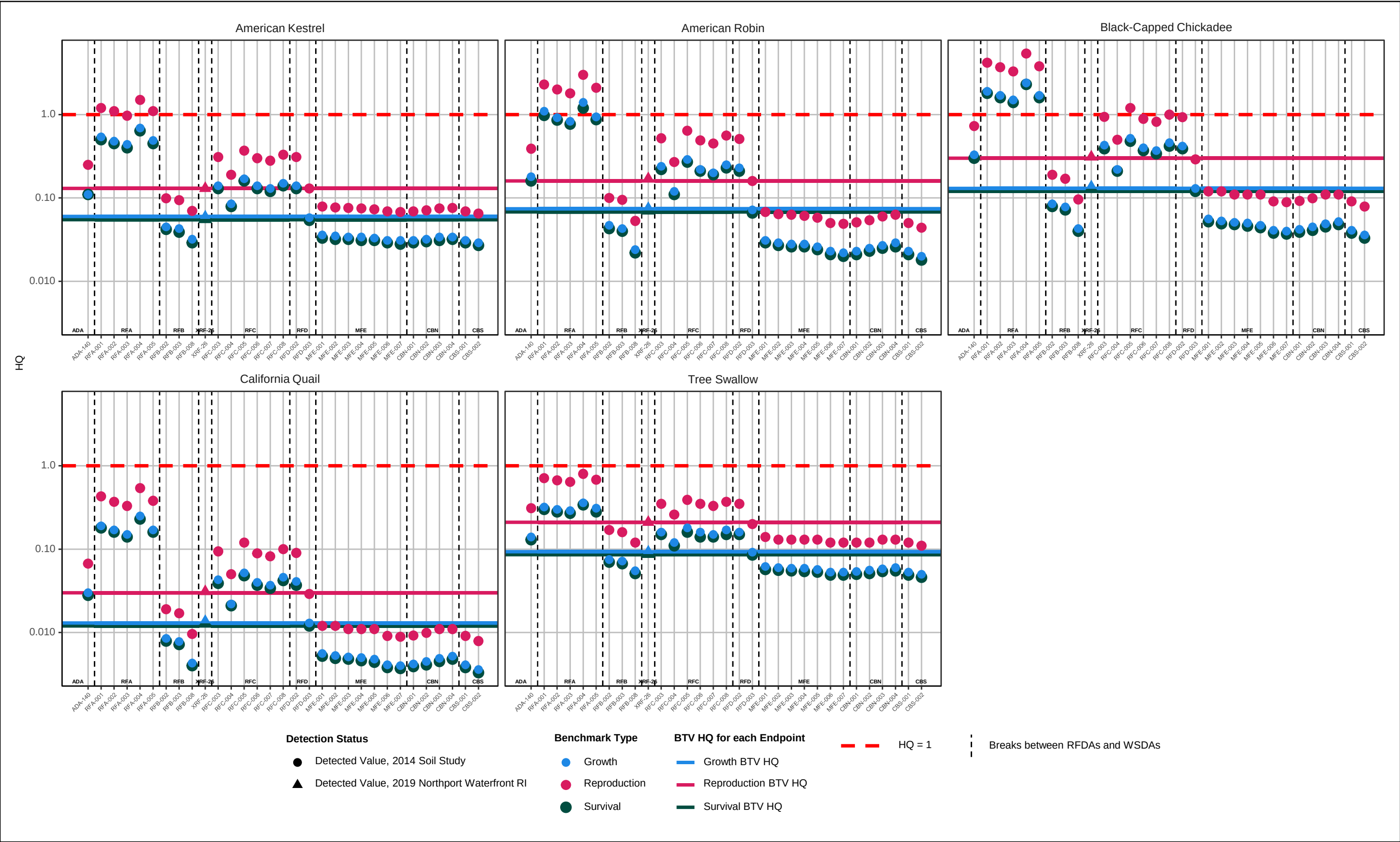


Figure M-11b. Terrestrial Bird HQs by Location for Copper
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

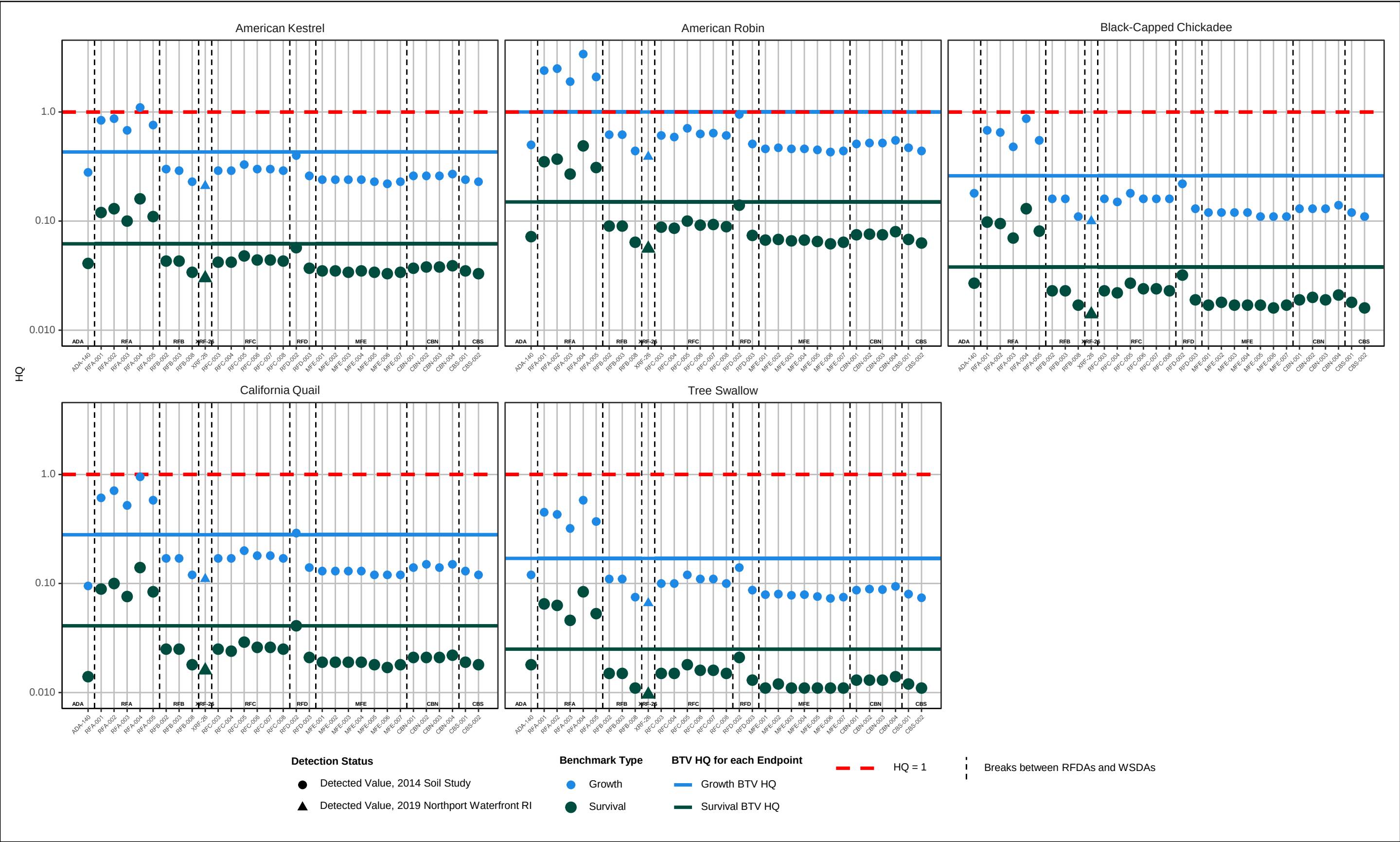


Figure M-11c. Terrestrial Bird HQs by Location for Iron
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

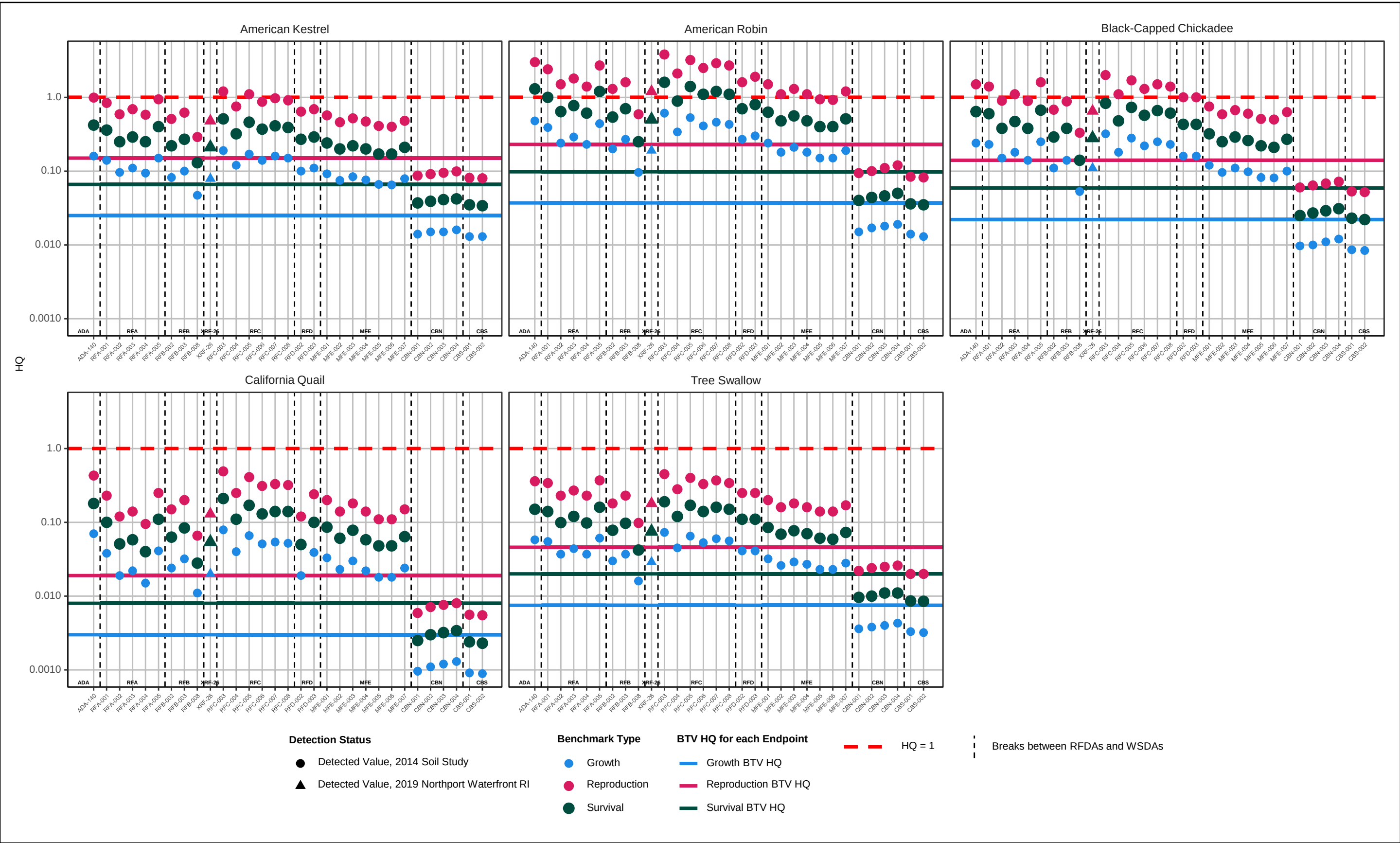


Figure M-11d. Terrestrial Bird HQs by Location for Lead
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

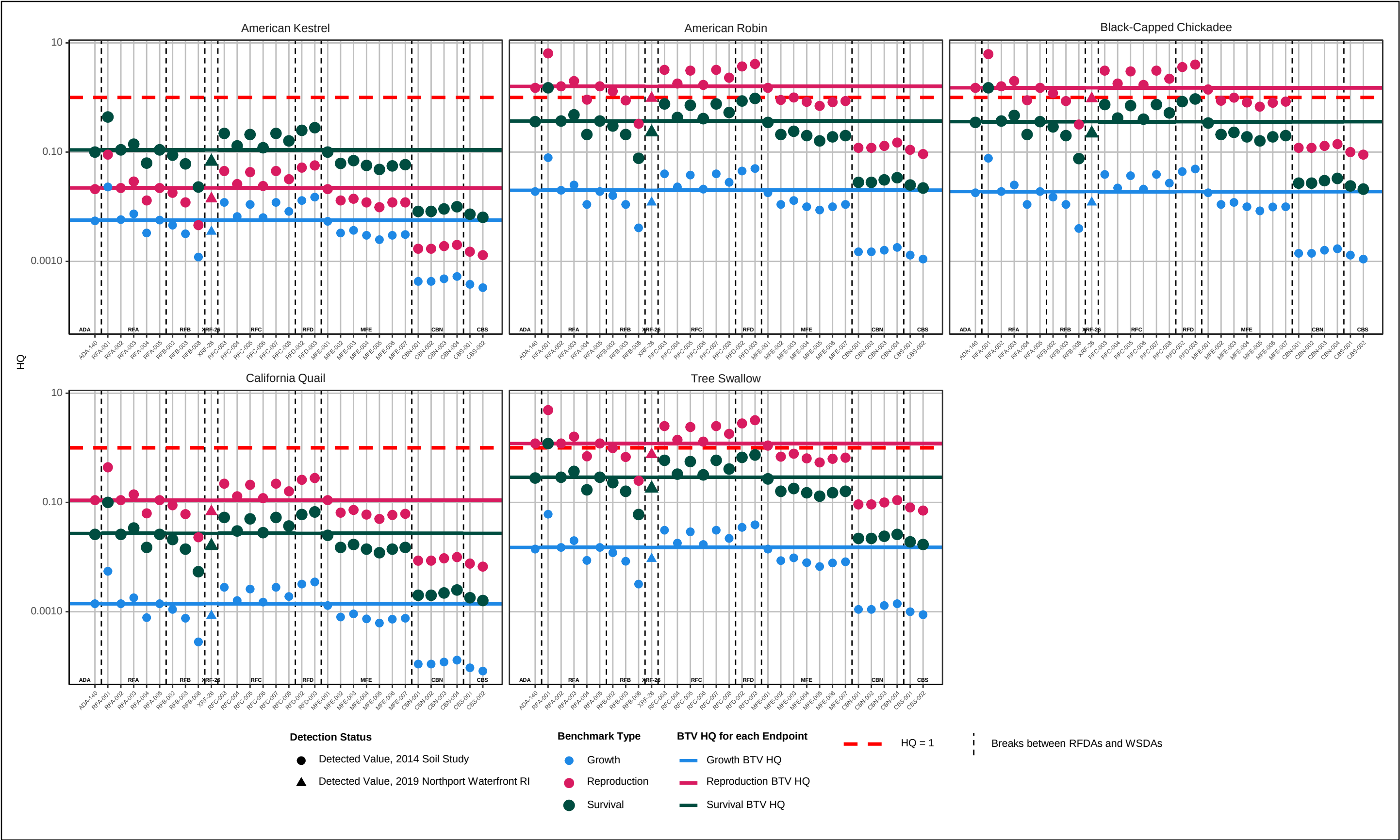


Figure M-11e. Terrestrial Bird HQs by Location for Mercury
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

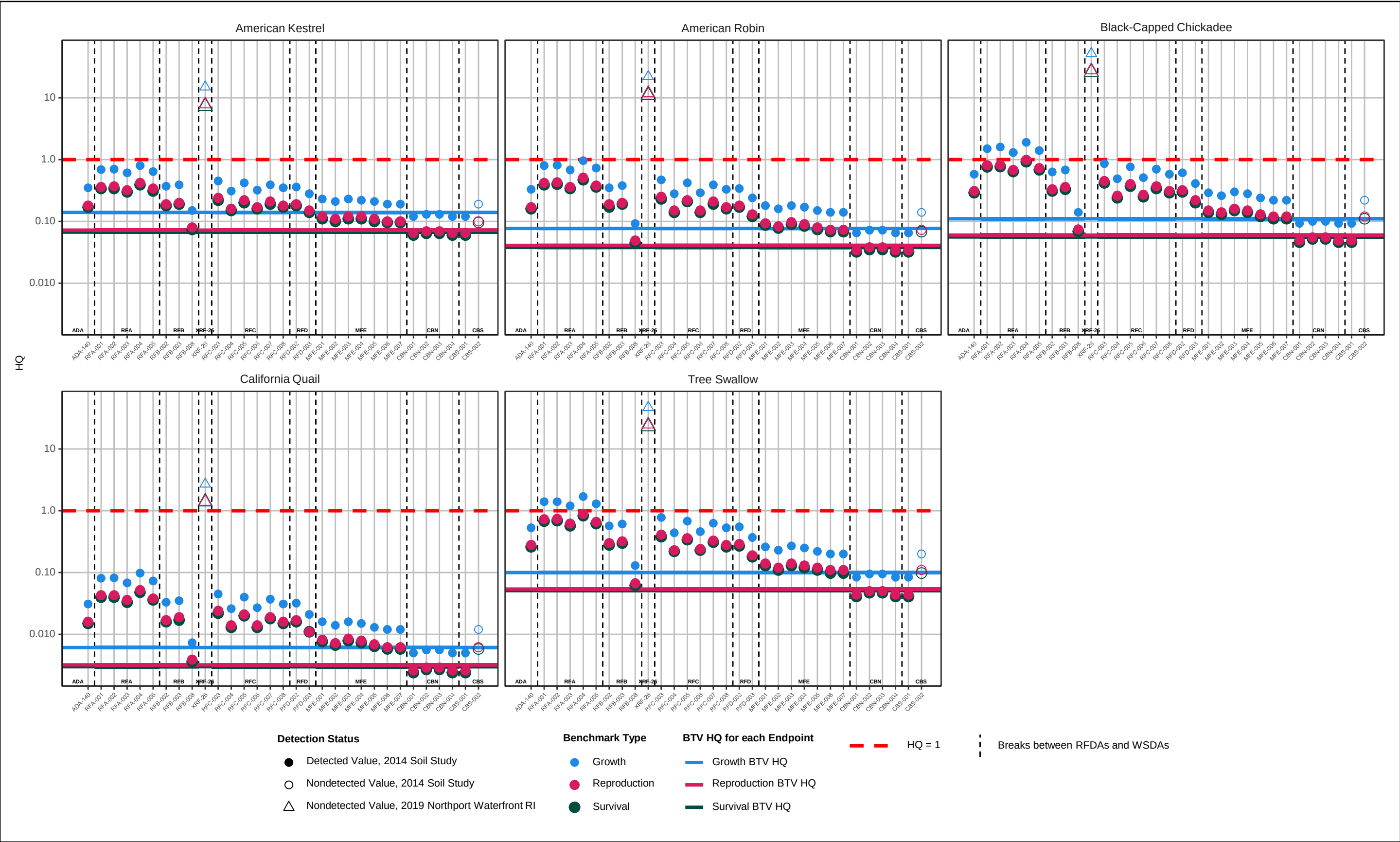


Figure M-11f. Terrestrial Bird HQs by Location for Selenium
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

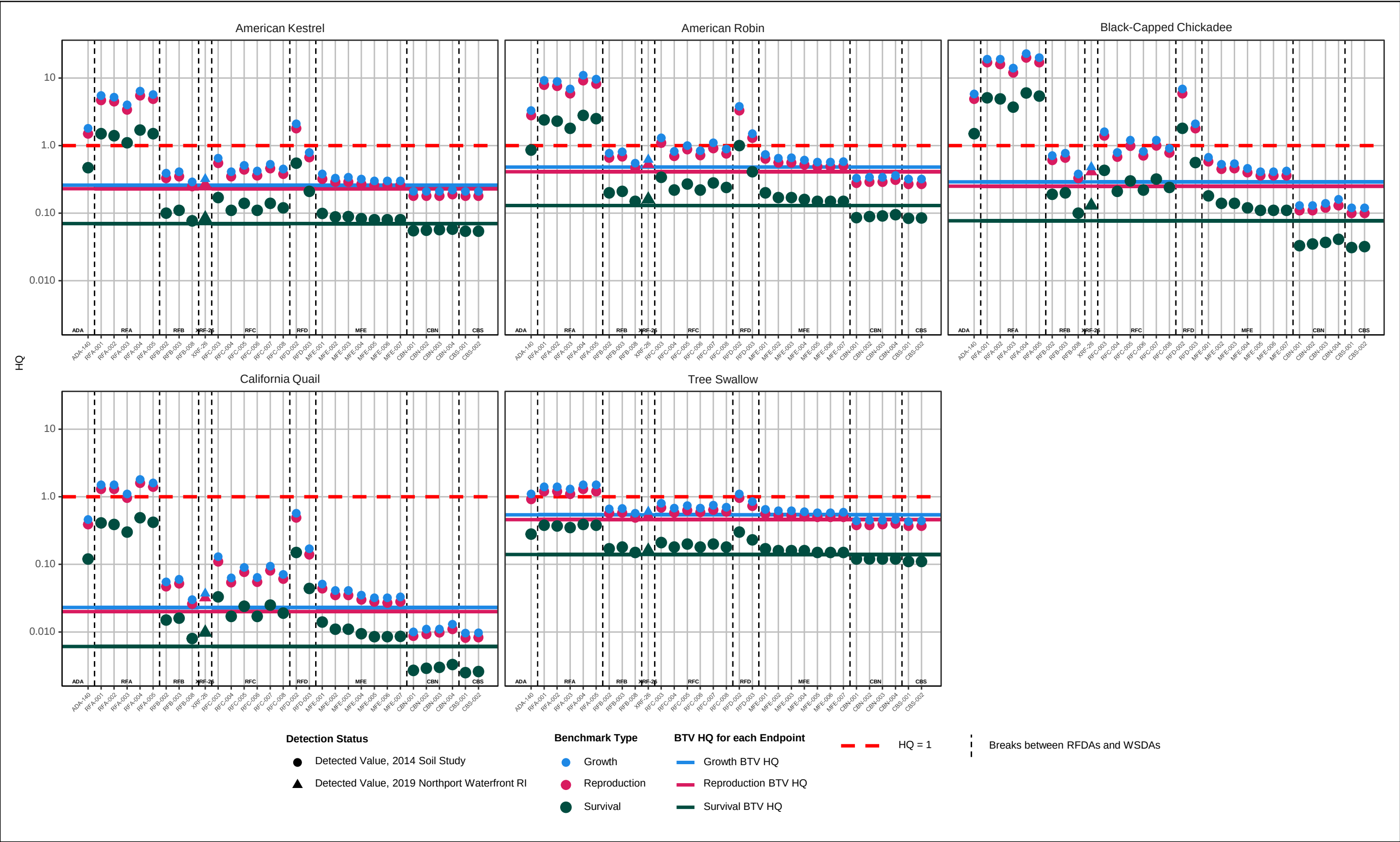


Figure M-11g. Terrestrial Bird HQs by Location for Zinc
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

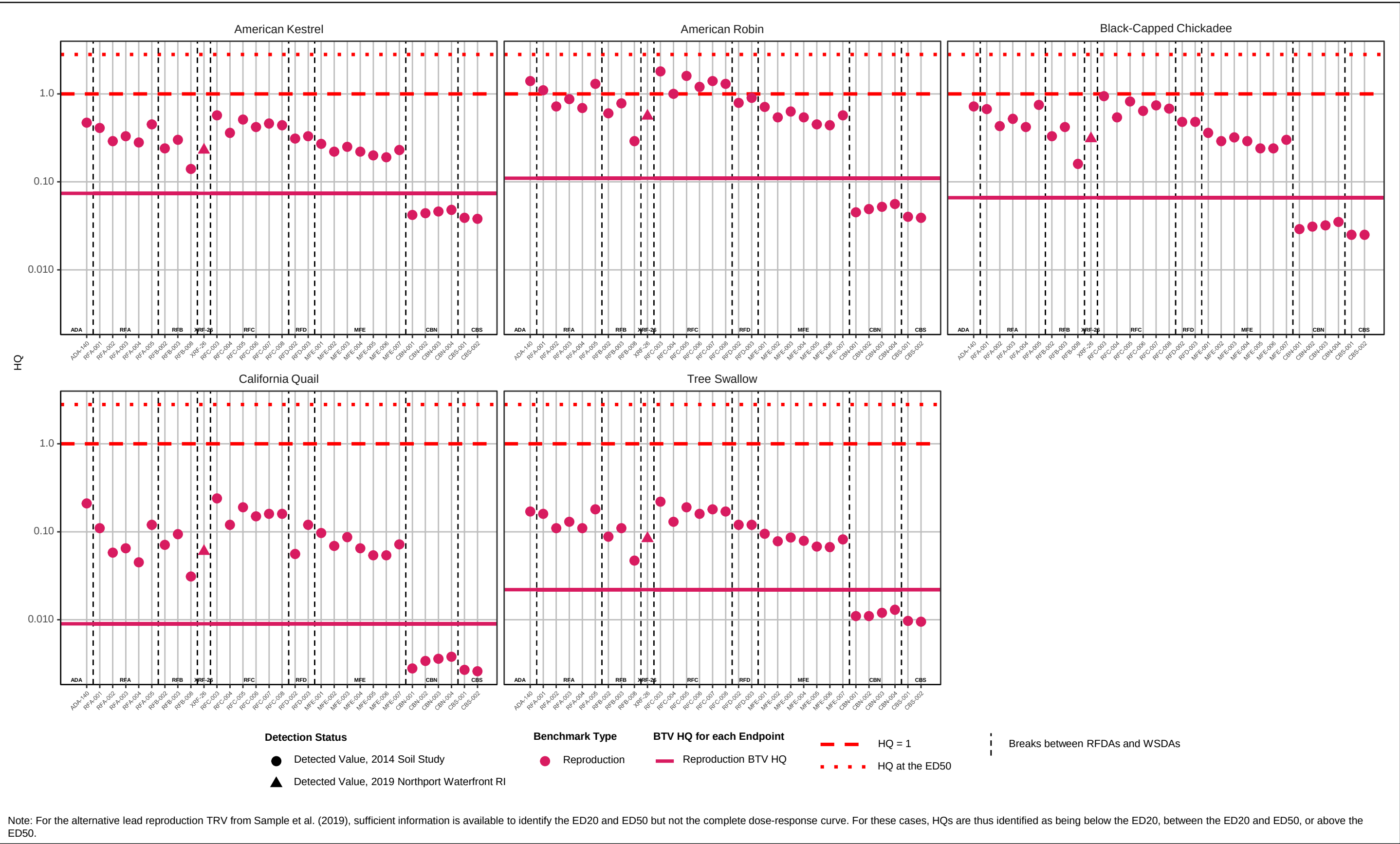


Figure M-11h. Terrestrial Bird HQs by Location for Lead, Using the Alternative Reproduction TRV
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

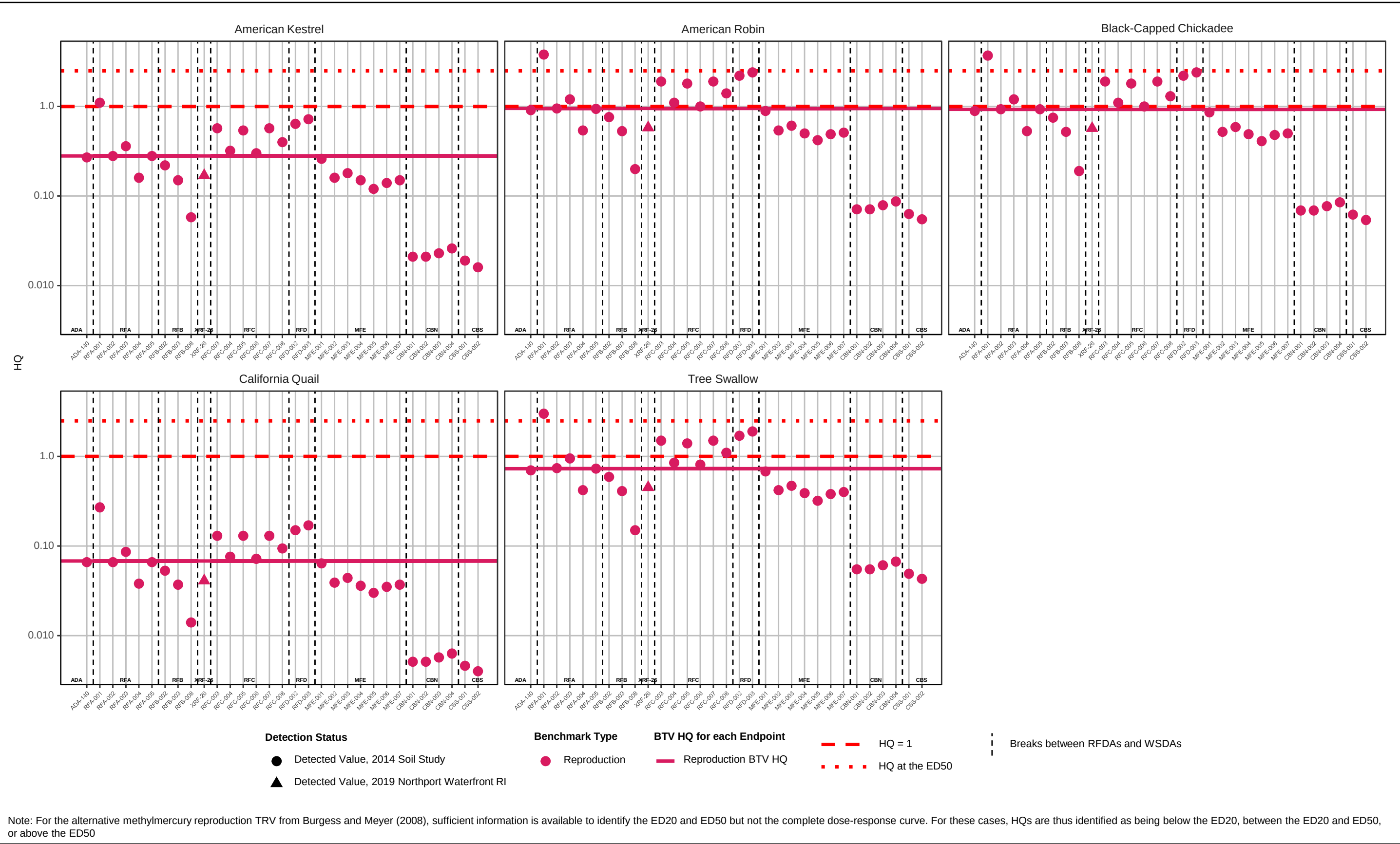


Figure M-11i. Terrestrial Bird HQs by Location for Mercury, Using the Alternative Reproduction TRV
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

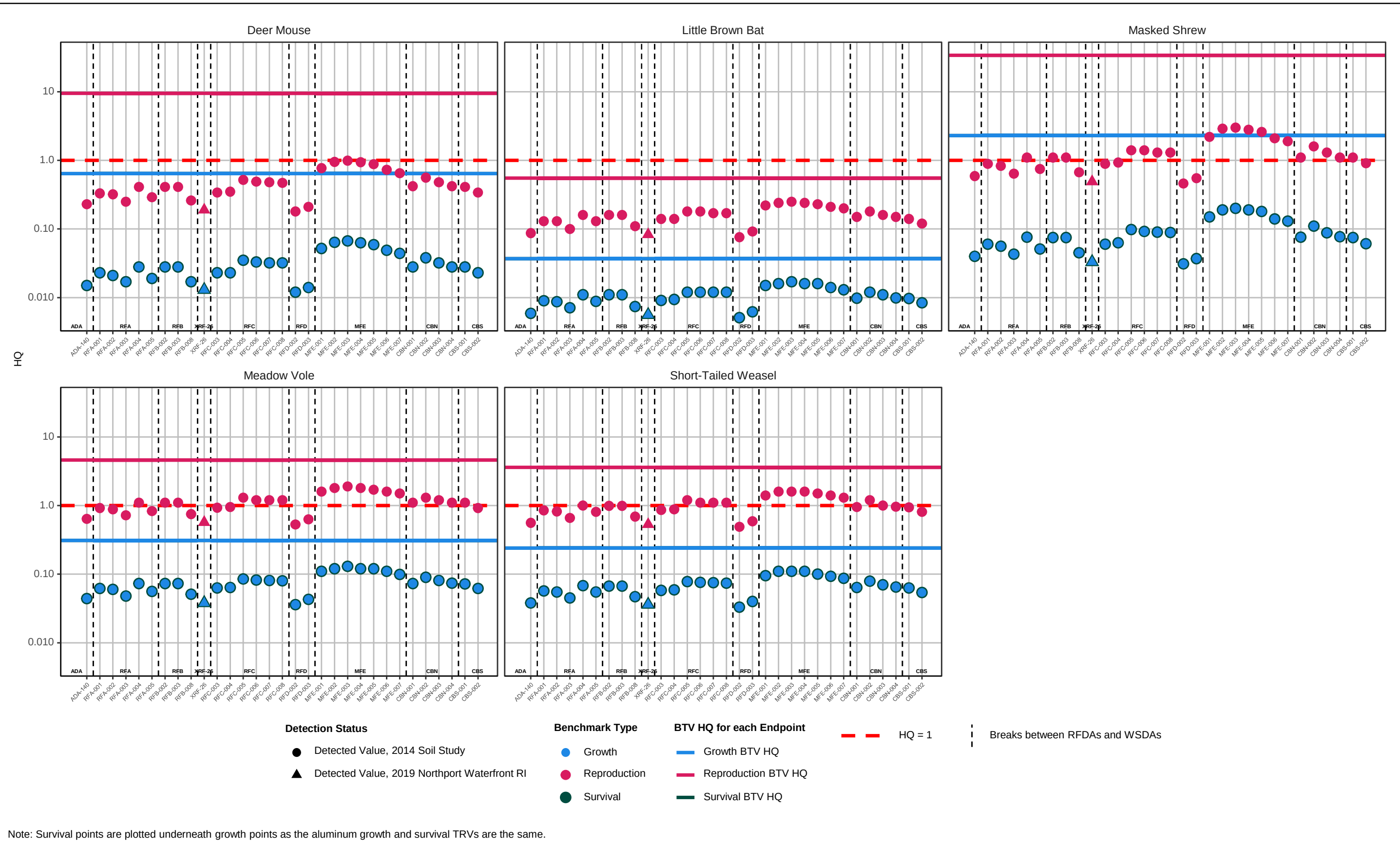


Figure M-12a. Terrestrial Mammal HQs by Location for Aluminum
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

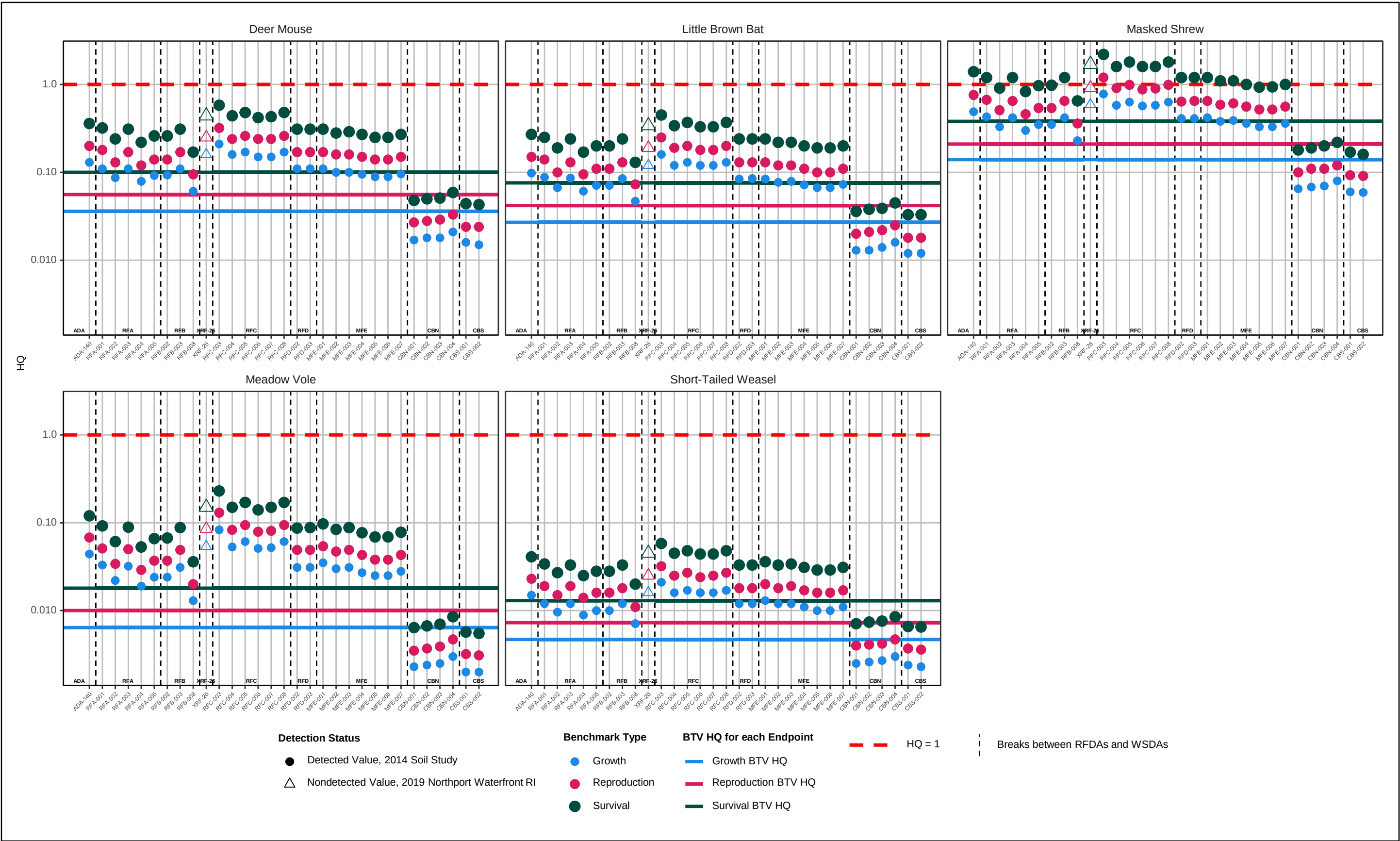


Figure M-12b. Terrestrial Mammal HQs by Location for Cadmium
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

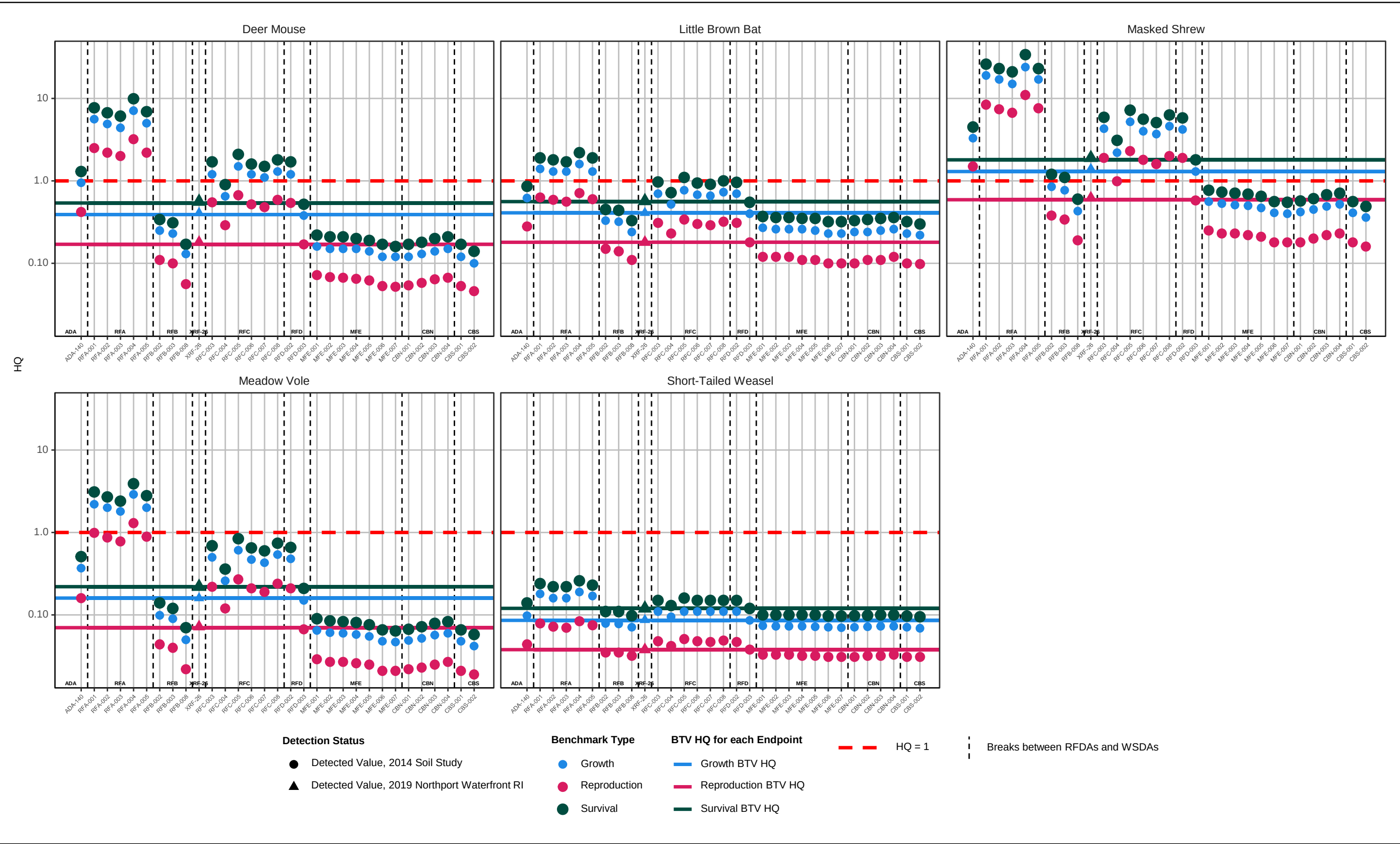


Figure M-12c. Terrestrial Mammal HQs by Location for Copper
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

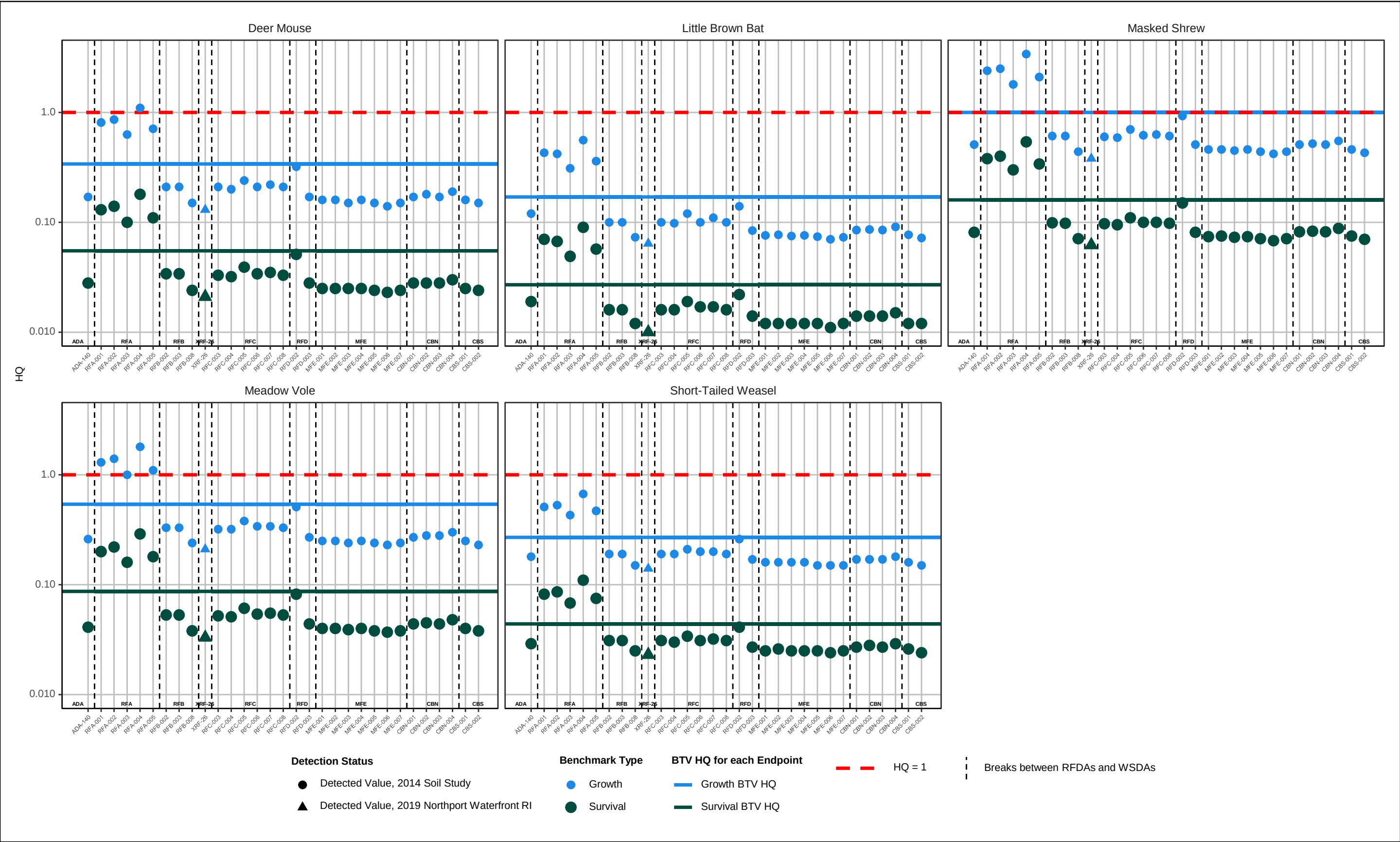


Figure M-12d. Terrestrial Mammal HQs by Location for Iron
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

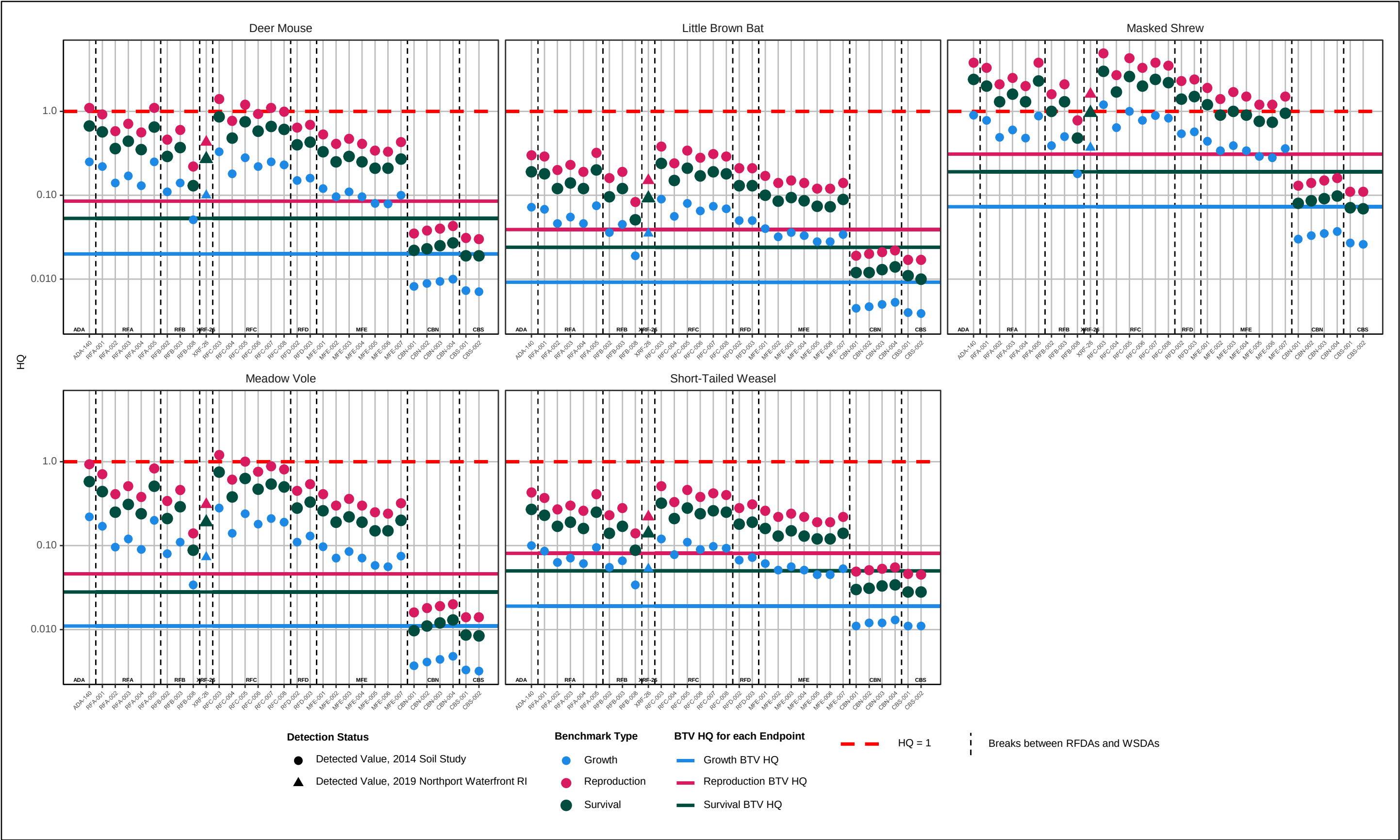


Figure M-12e. Terrestrial Mammal HQs by Location for Lead
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

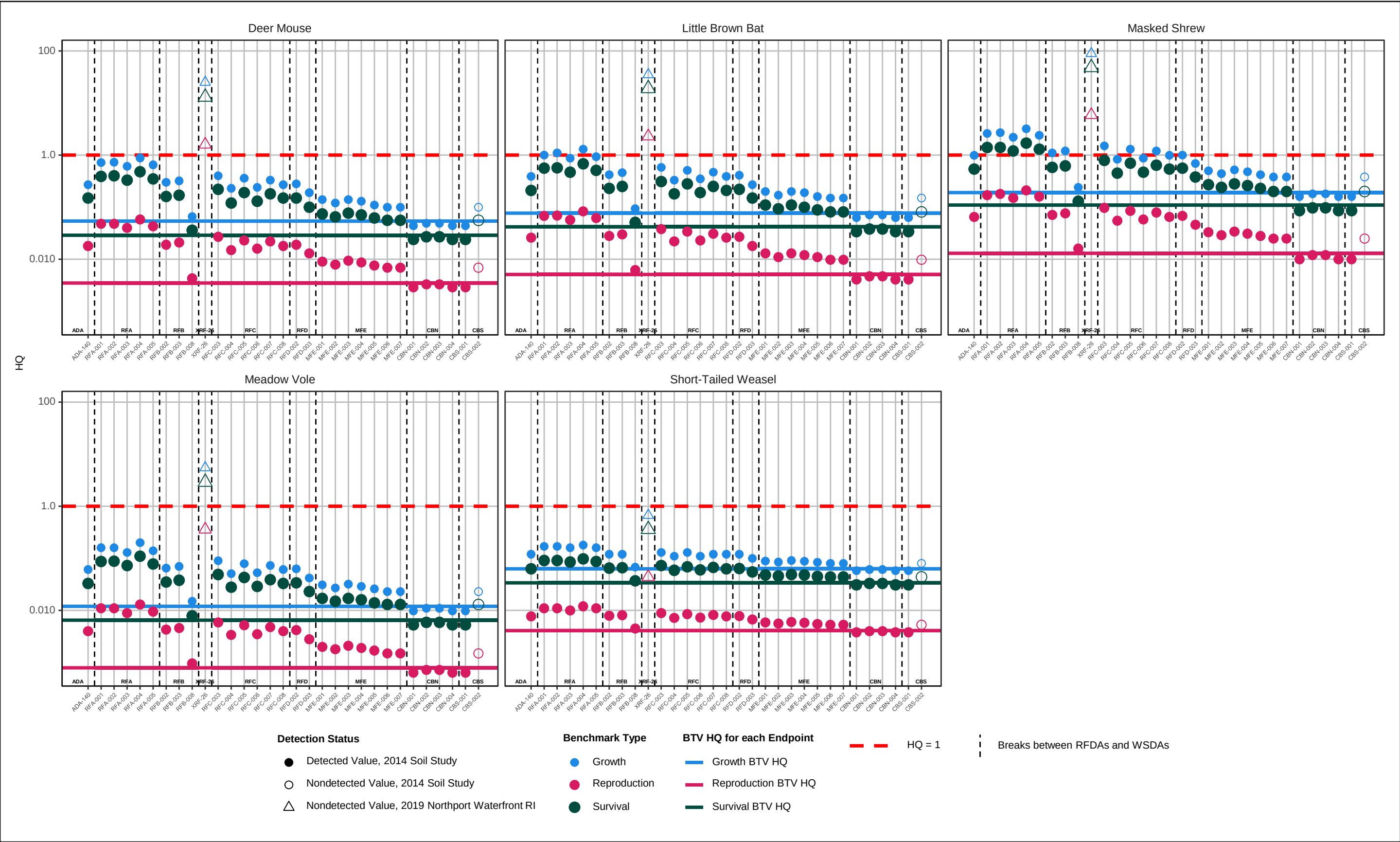


Figure M-12f. Terrestrial Mammal HQs by Location for Selenium
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

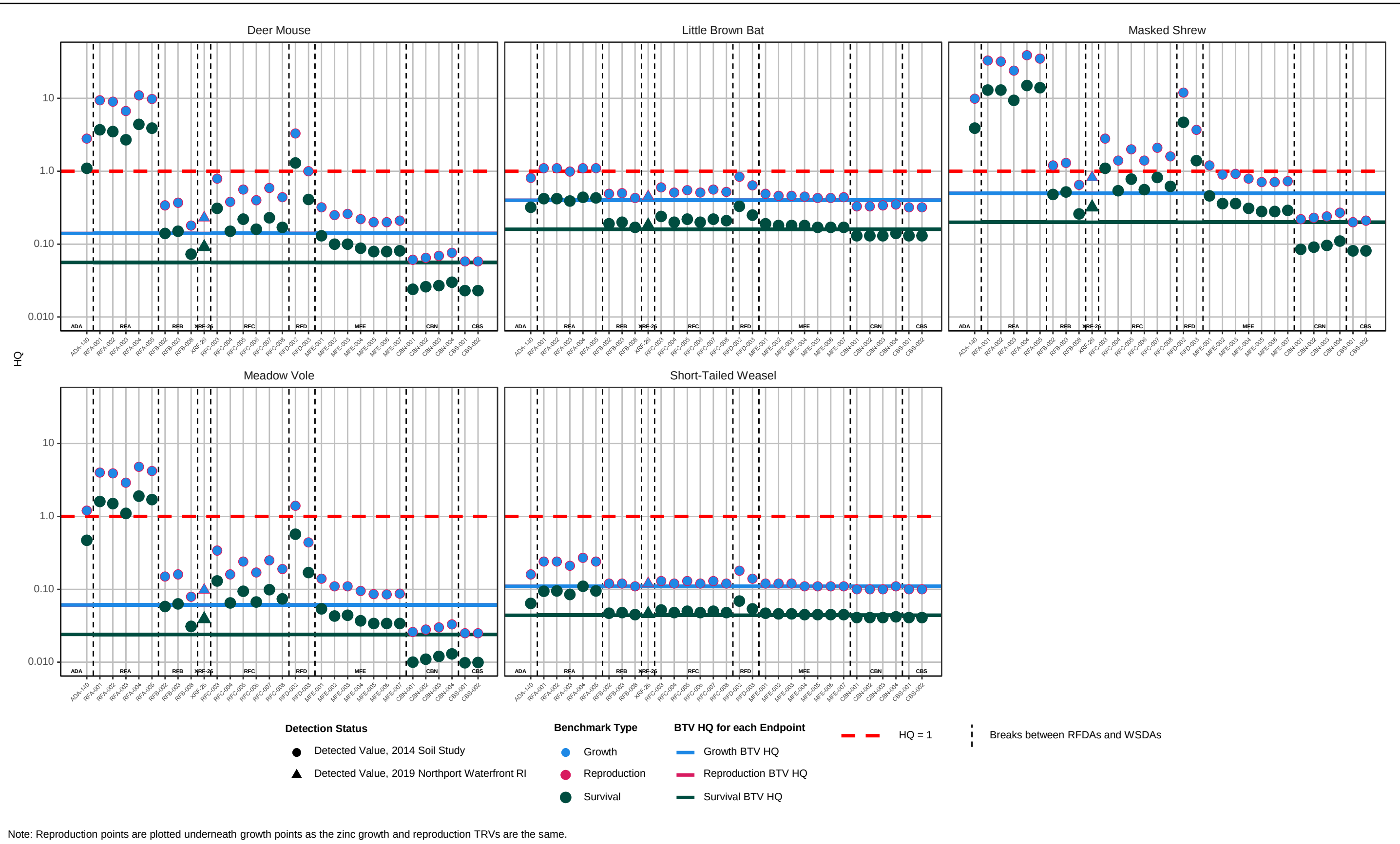


Figure M-12g. Terrestrial Mammal HQs by Location for Zinc
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

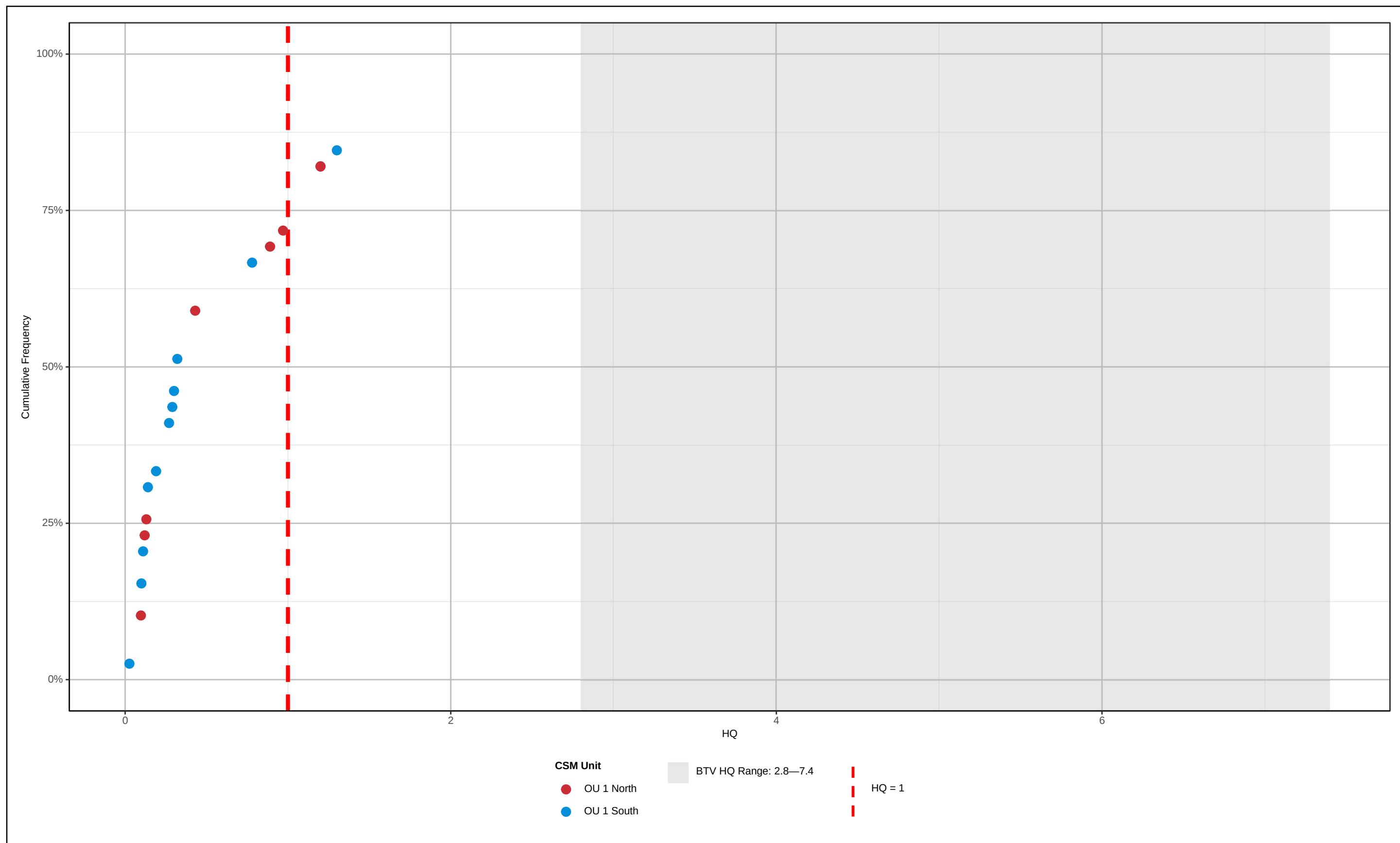


Figure M-13a. Cumulative Frequency of Copper HQs for Aquatic Plants in Porewater in OU 1
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

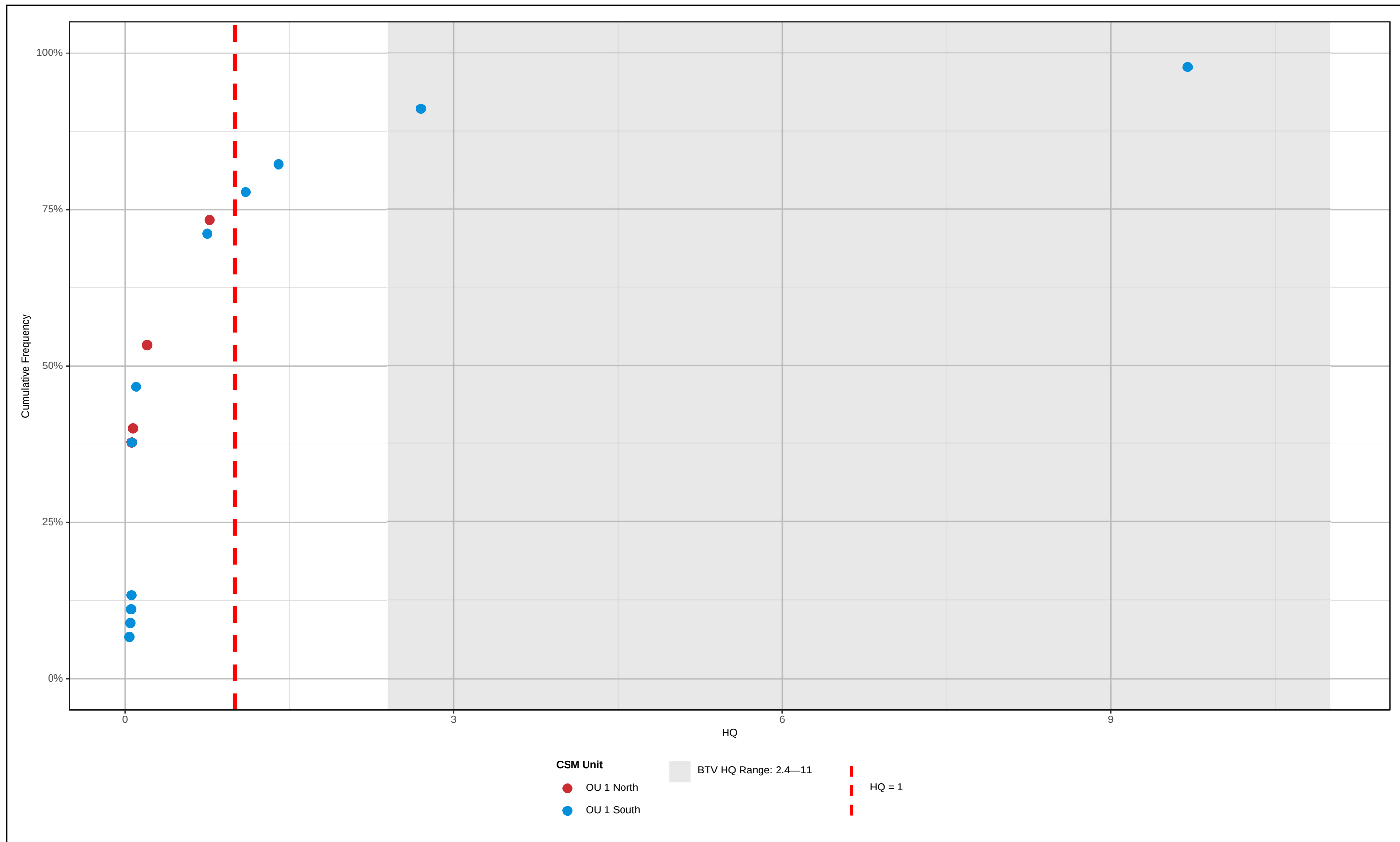


Figure M-13b. Cumulative Frequency of Iron HQs for Aquatic Plants in Porewater in OU 1
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

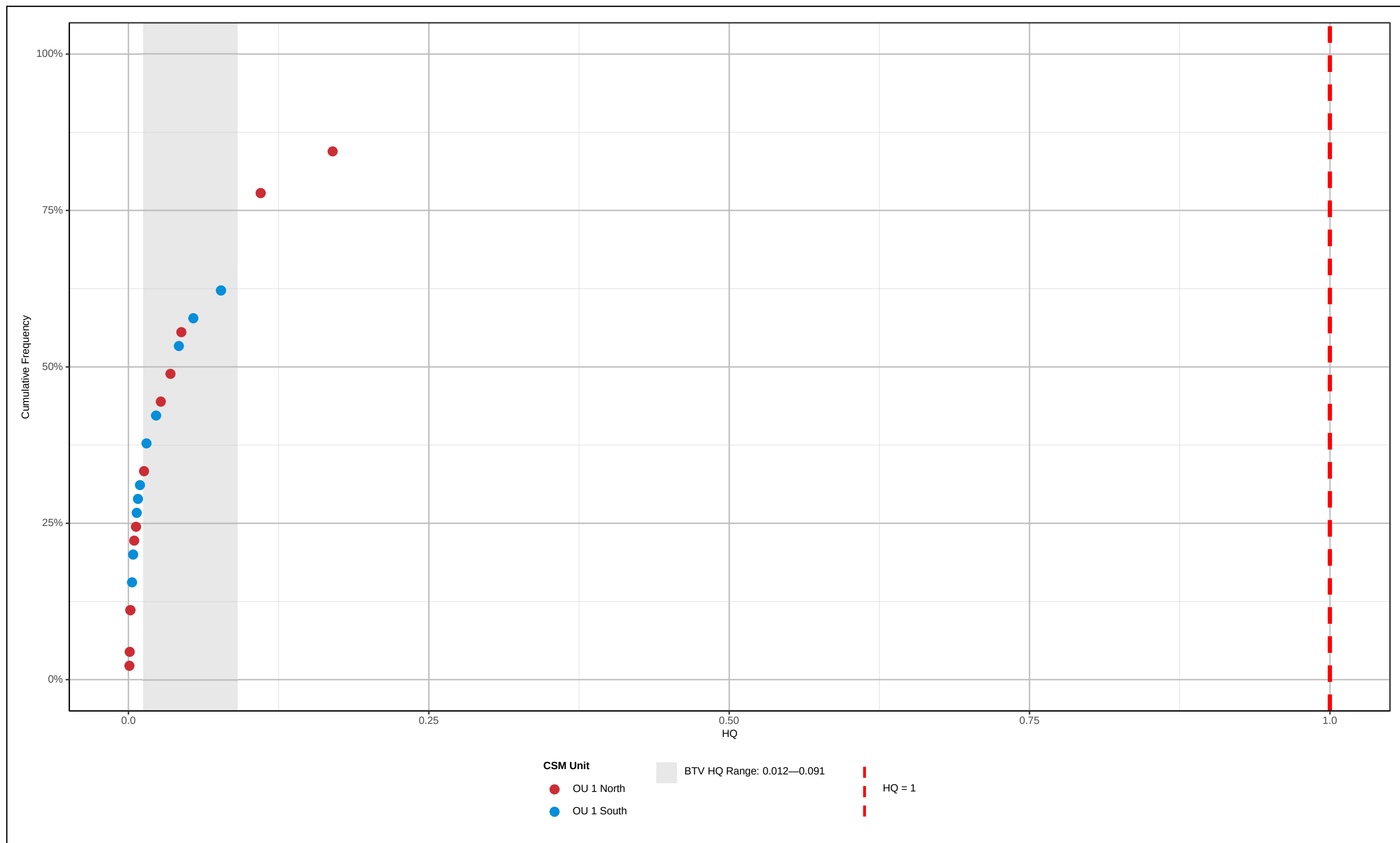


Figure M-13c. Cumulative Frequency of Lead HQs for Aquatic Plants in Porewater in OU 1
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

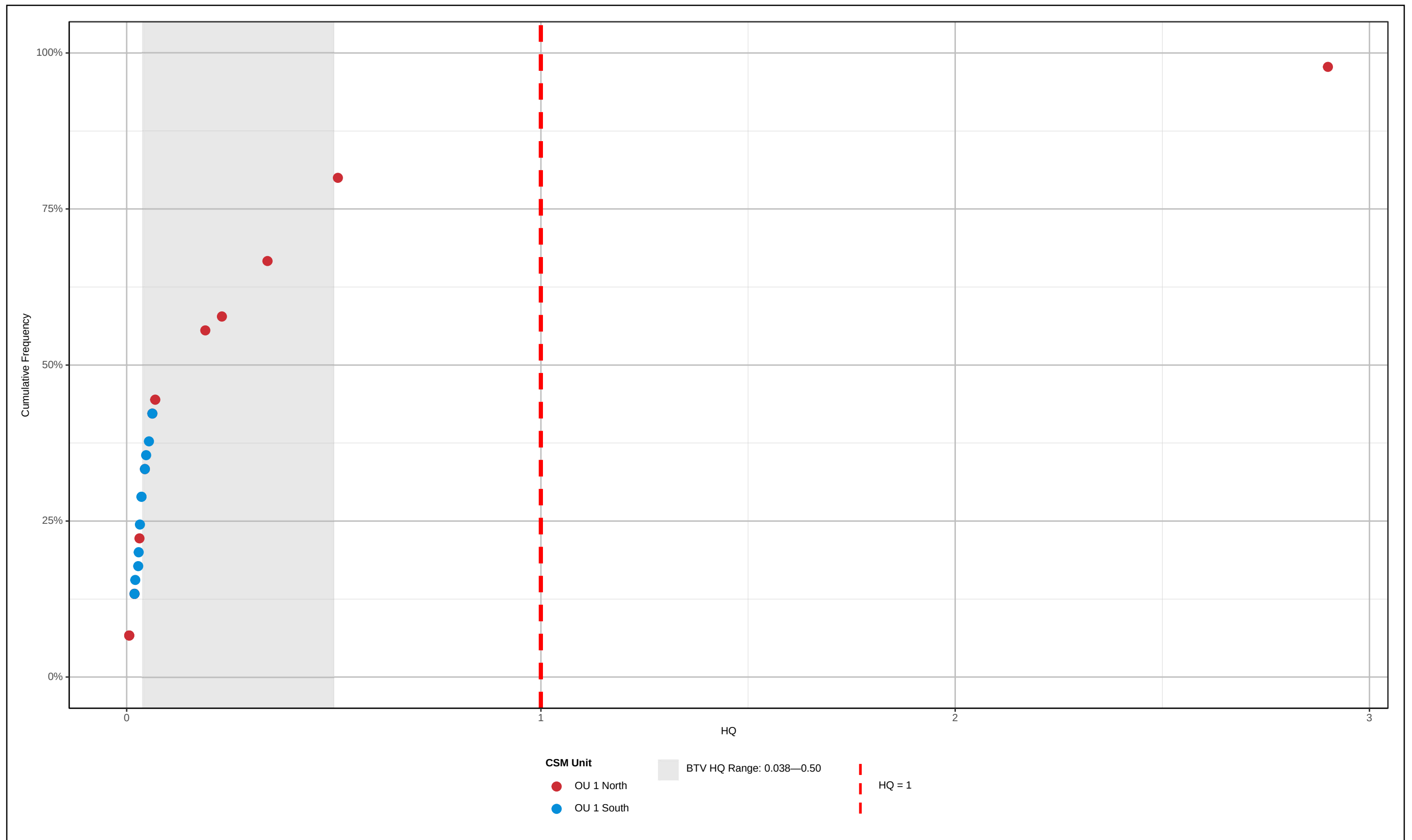


Figure M-13d. Cumulative Frequency of Zinc HQs for Aquatic Plants in Porewater in OU 1
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

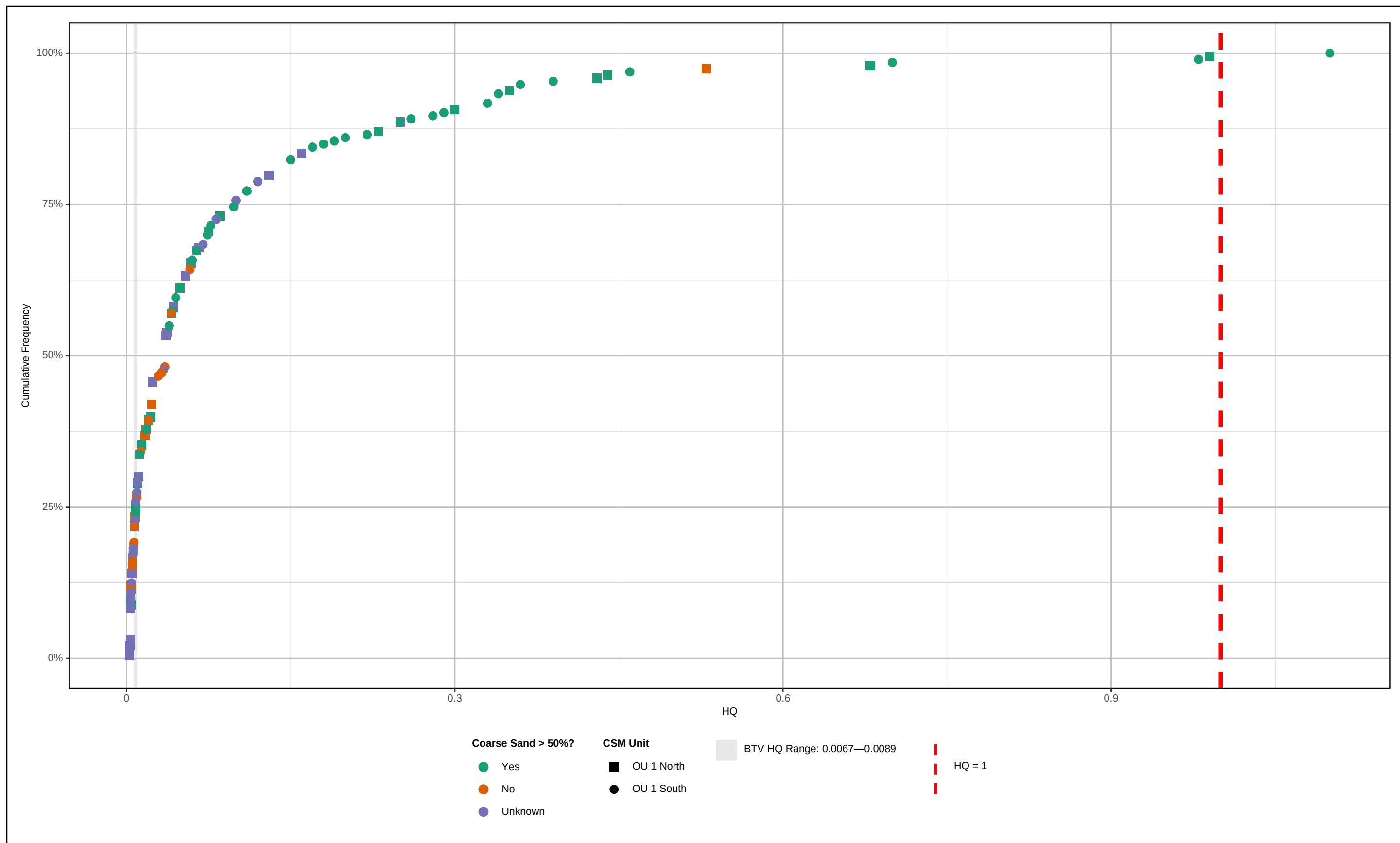


Figure M-14a. Cumulative Frequency of Antimony HQs for Benthic Invertebrates in Porewater in OU 1
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

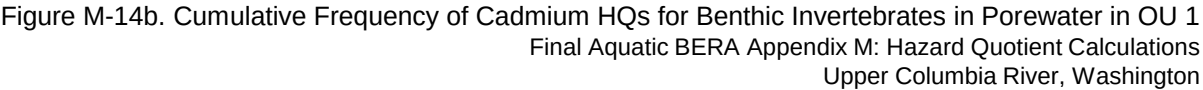
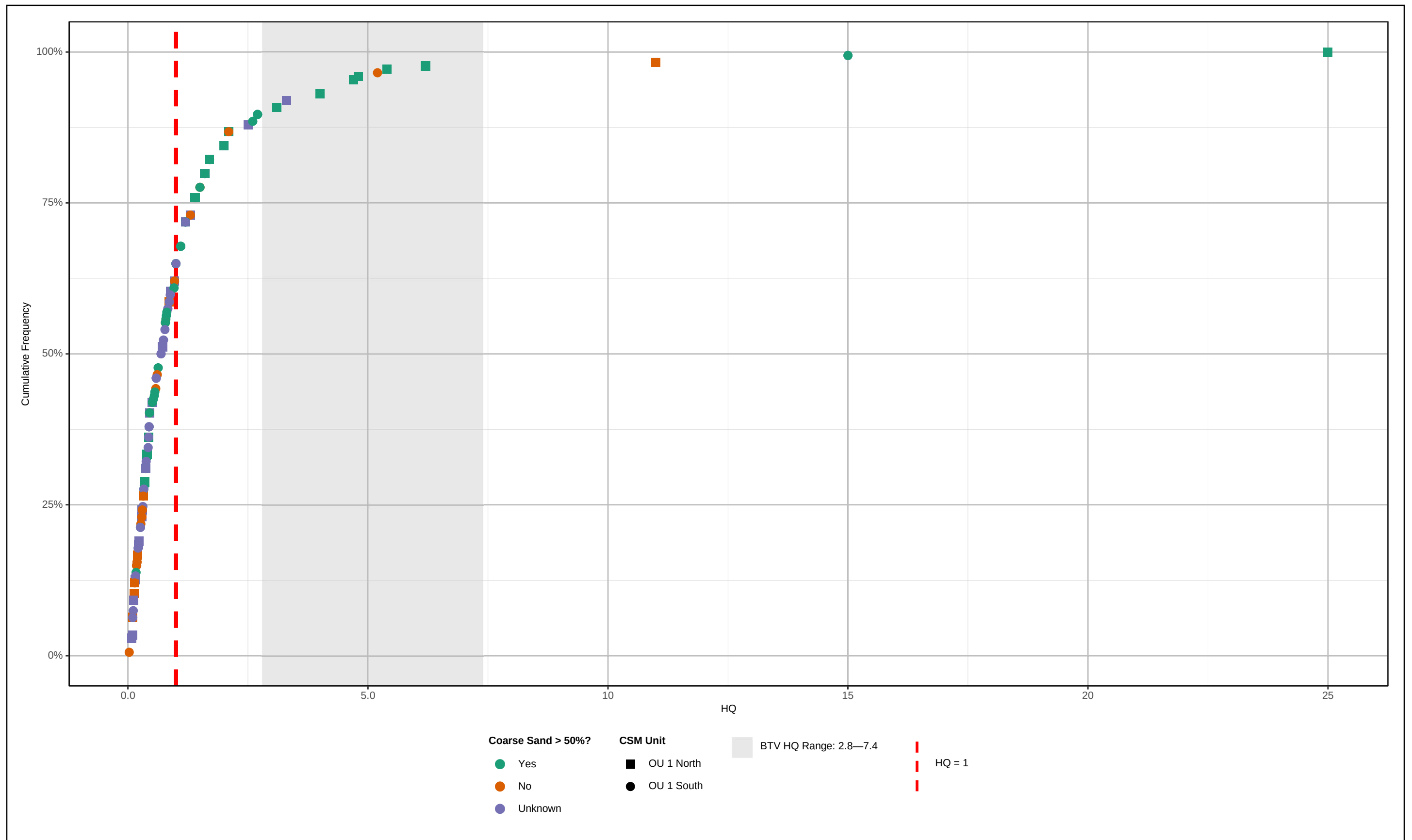


Figure M-14b. Cumulative Frequency of Cadmium HQs for Benthic Invertebrates in Porewater in OU 1



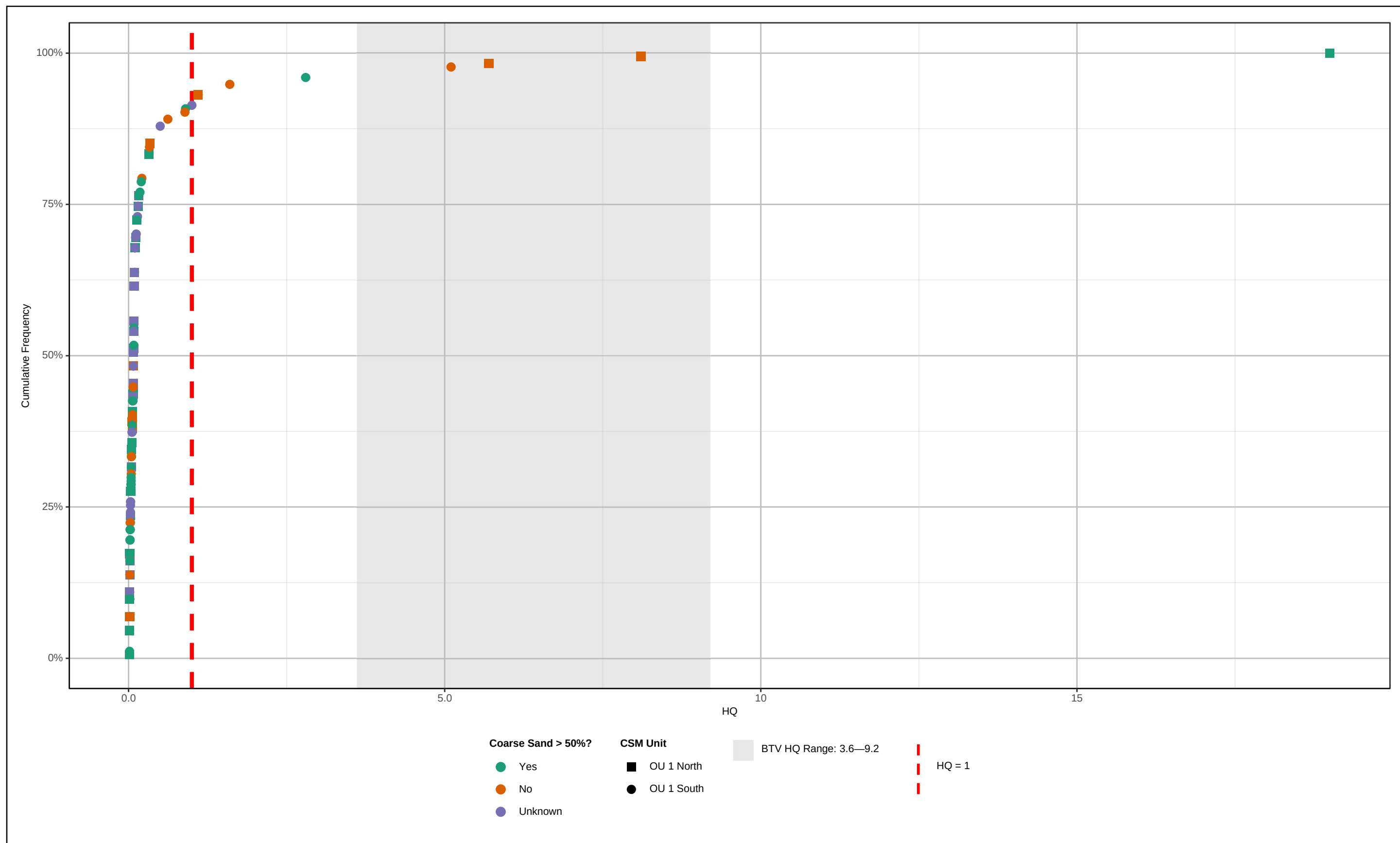


Figure M-14d. Cumulative Frequency of Iron HQs for Benthic Invertebrates in Porewater in OU 1
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

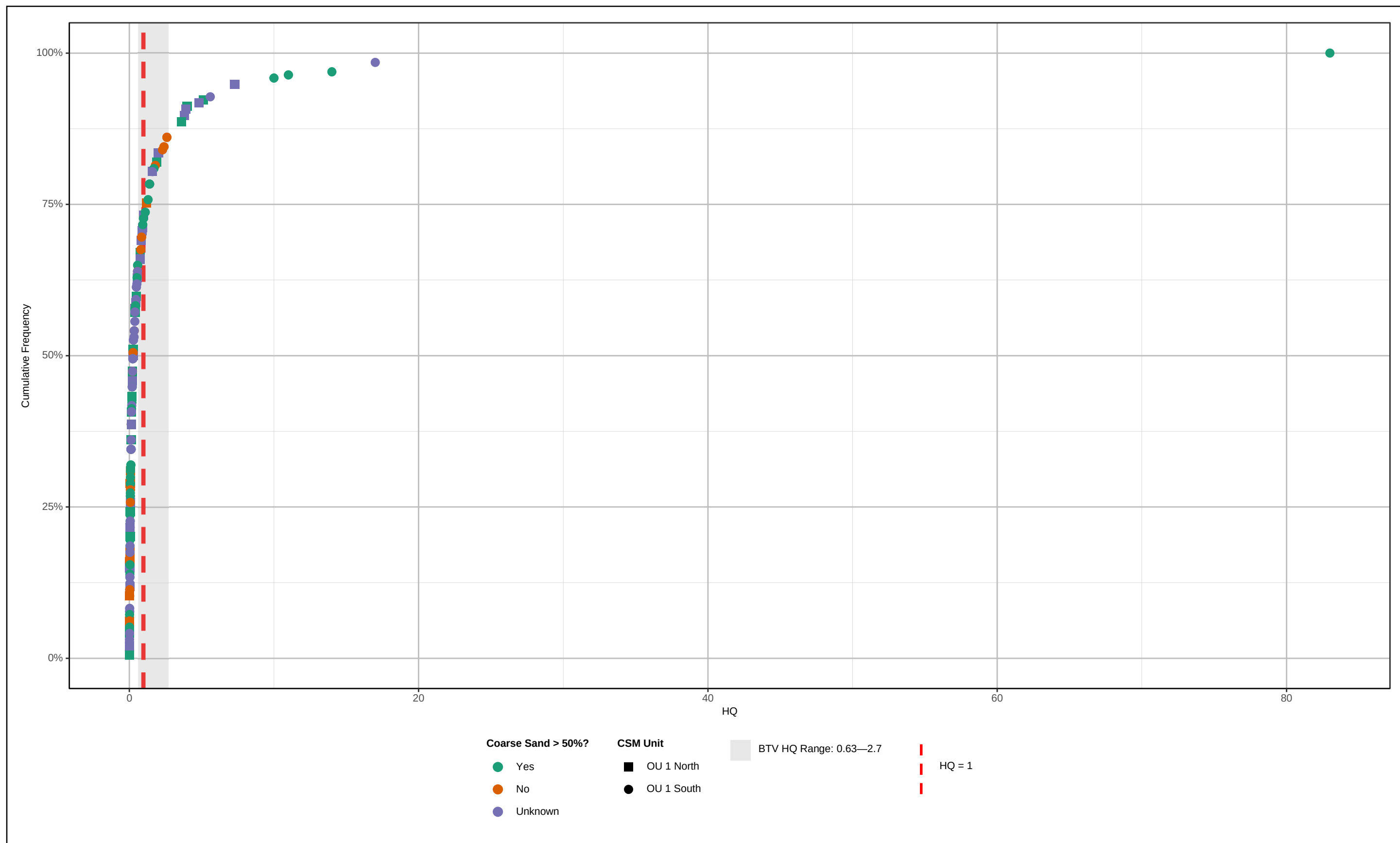


Figure M-14e. Cumulative Frequency of Lead HQs for Benthic Invertebrates in Porewater in OU 1
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

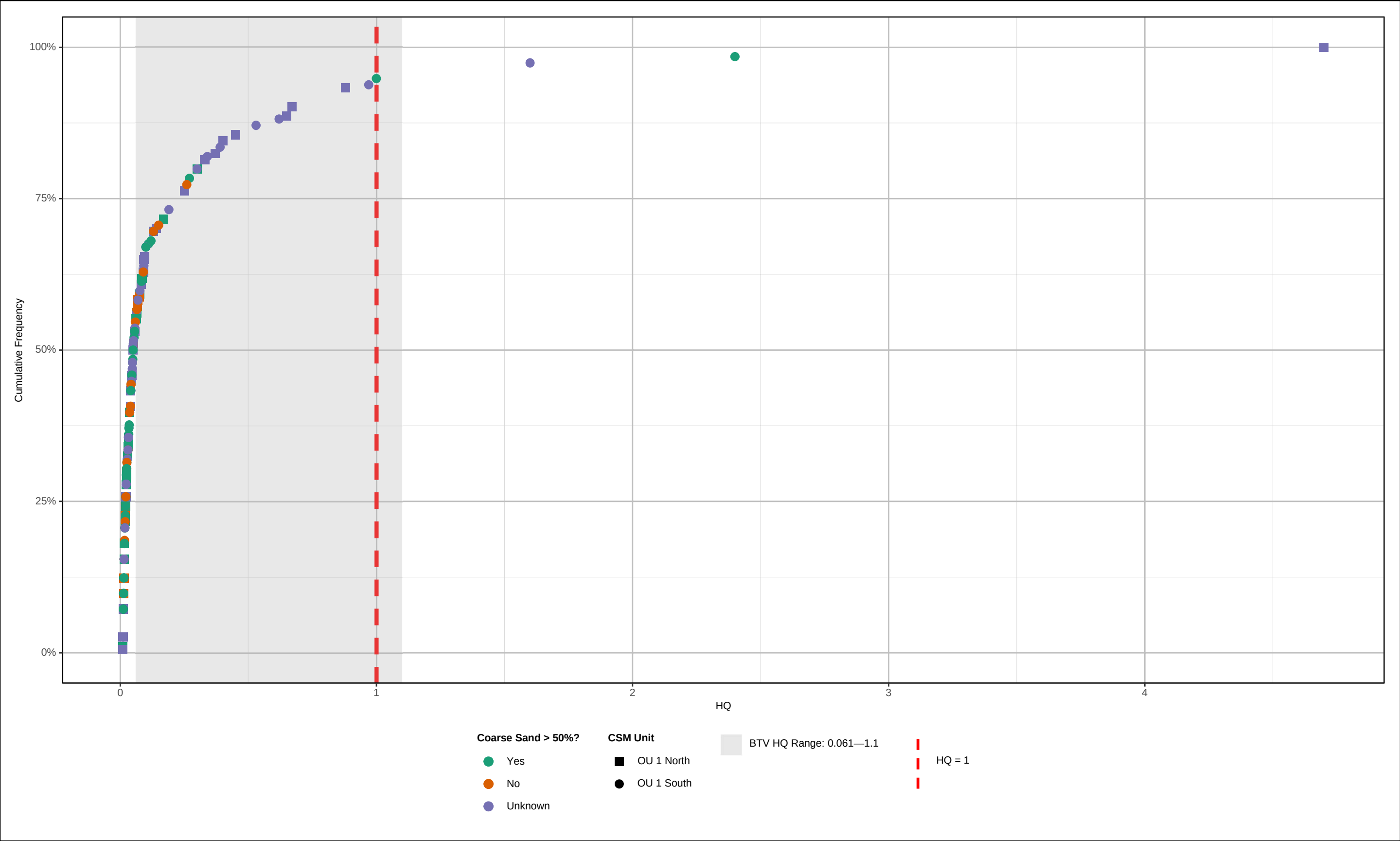


Figure M-14f. Cumulative Frequency of Zinc HQs for Benthic Invertebrates in Porewater in OU 1
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

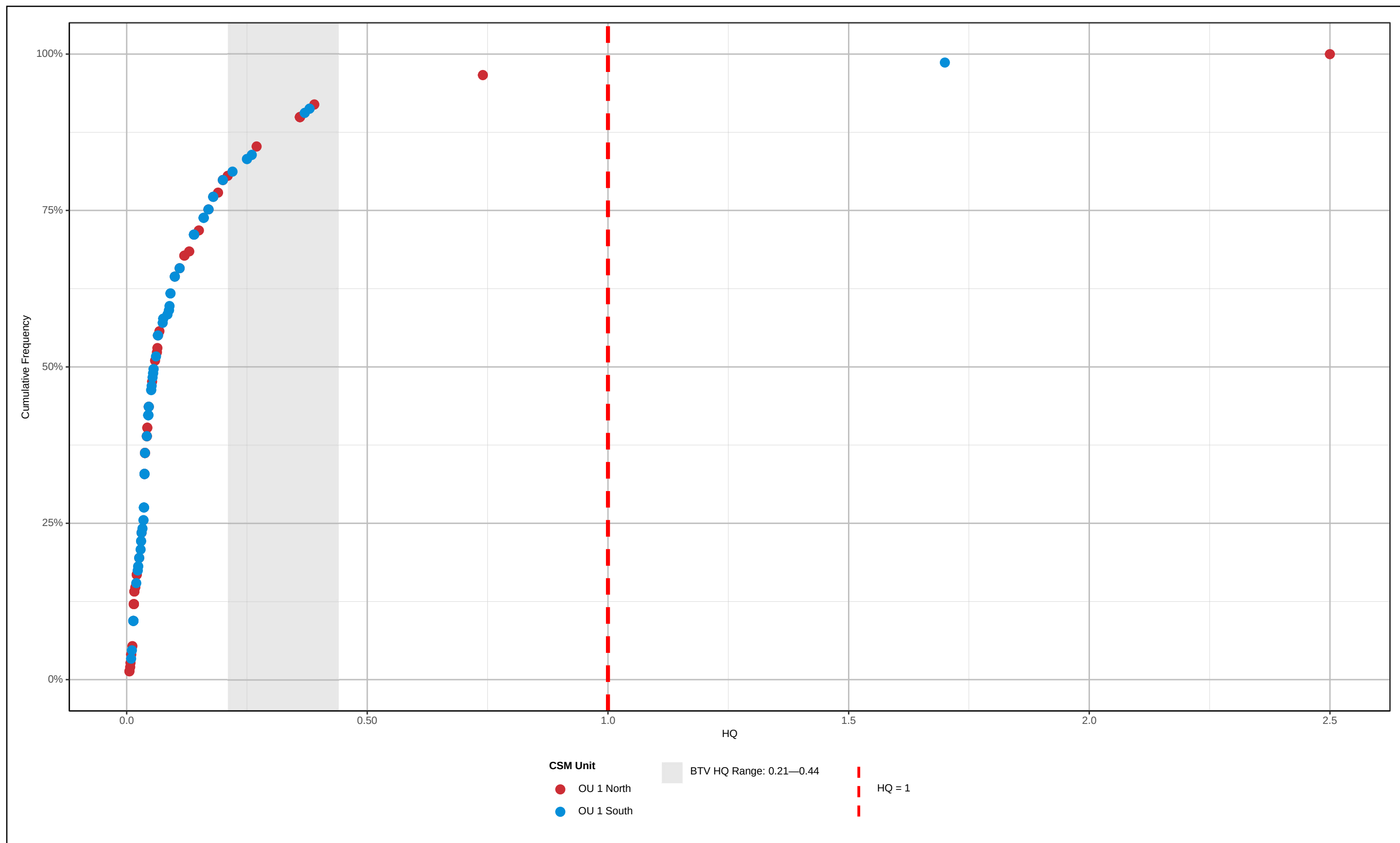


Figure M-15a. Cumulative Frequency of Cadmium HQs for ELS Fish in Porewater in OU 1
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

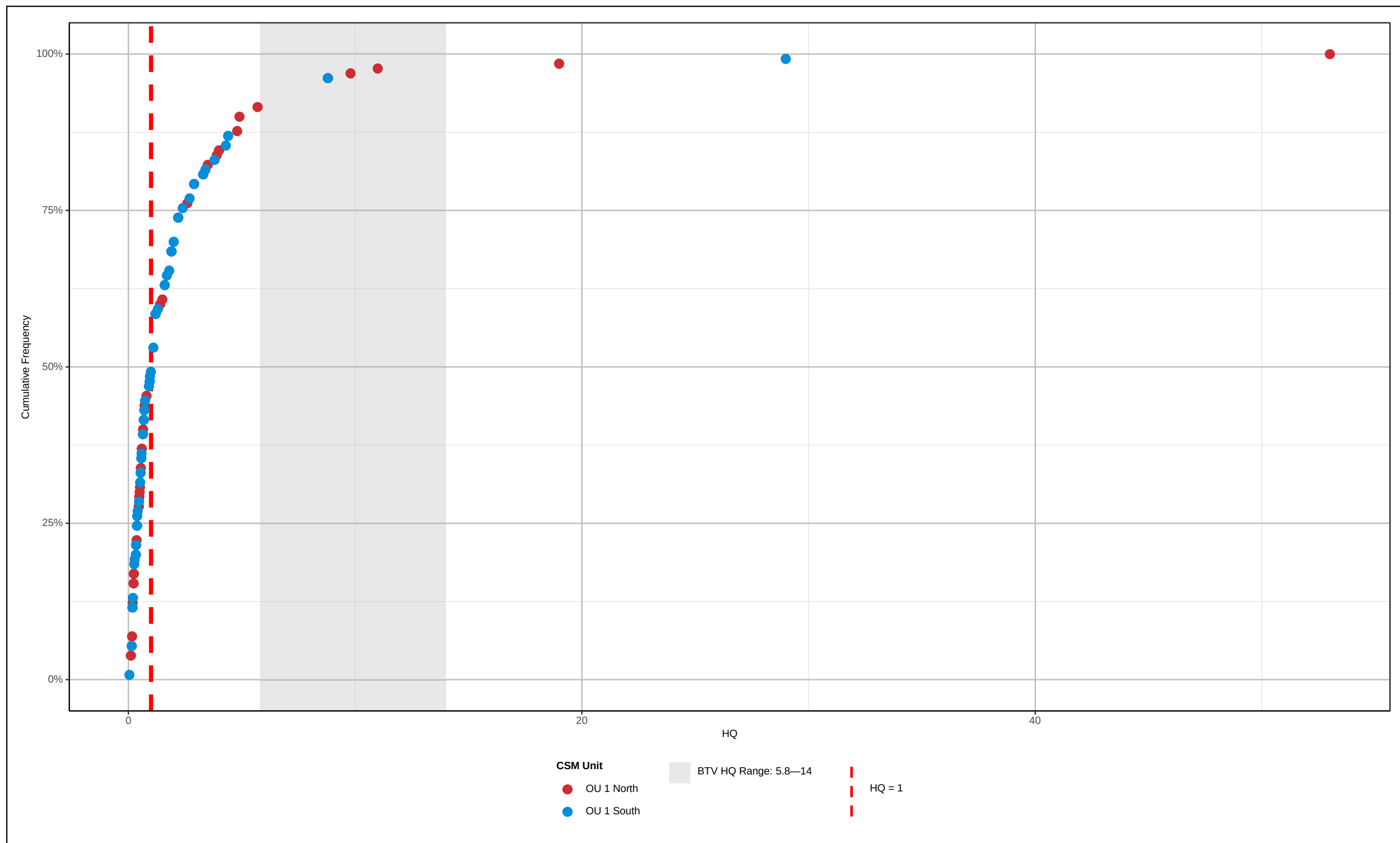


Figure M-15b. Cumulative Frequency of Copper HQs for ELS Fish in Porewater in OU 1
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

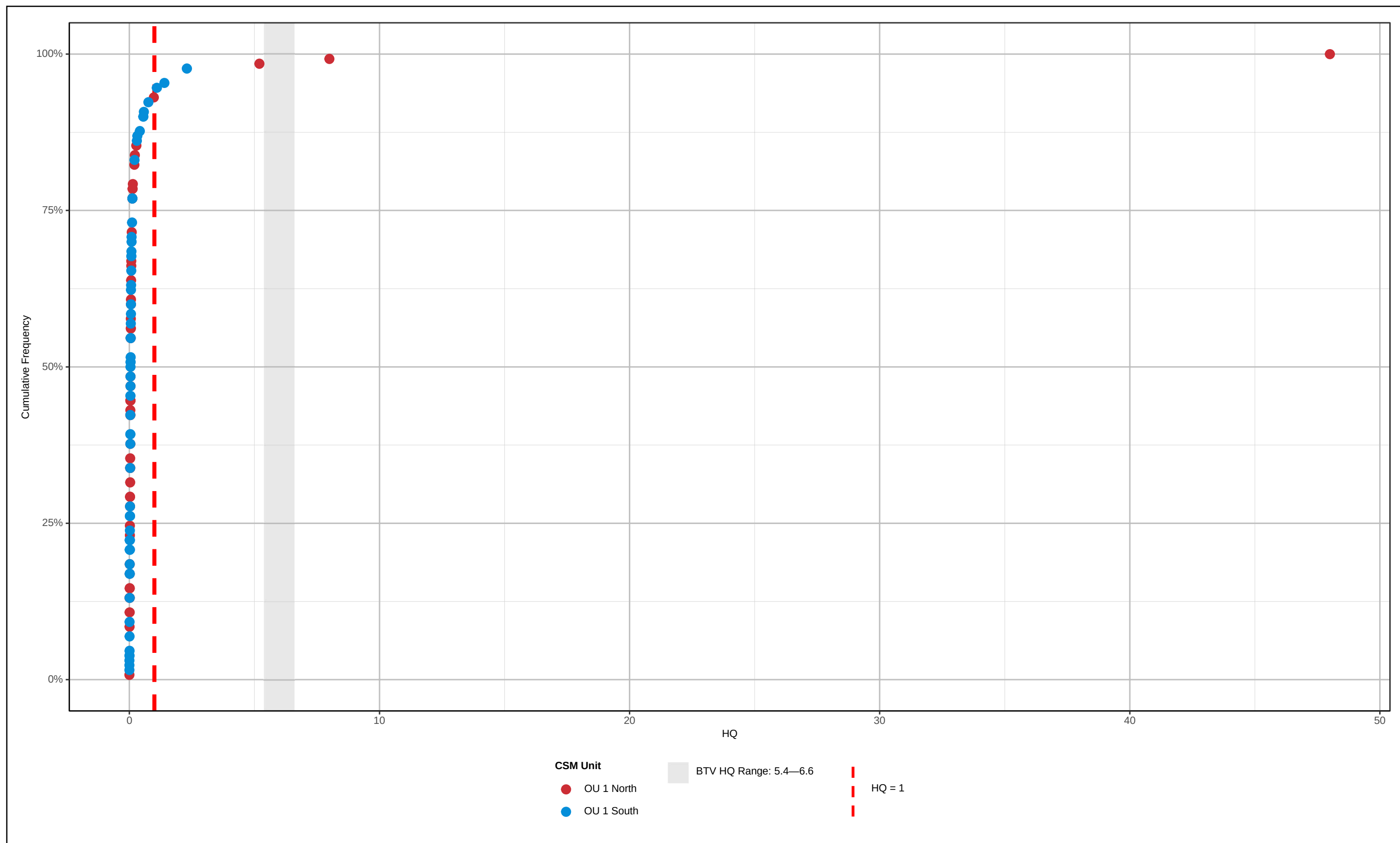


Figure M-15c. Cumulative Frequency of Iron HQs for ELS Fish in Porewater in OU 1
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

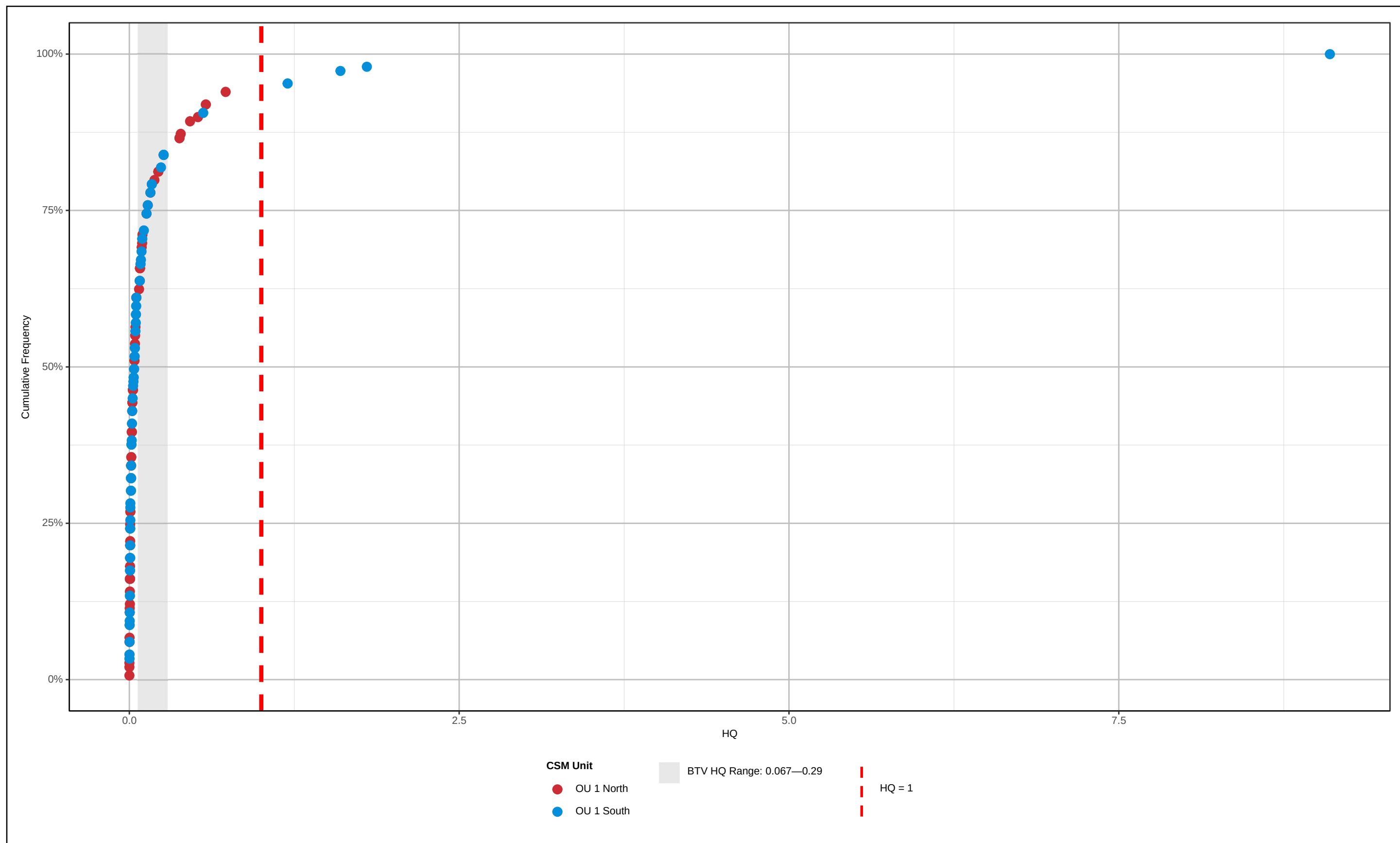


Figure M-15d. Cumulative Frequency of Lead HQs for ELS Fish in Porewater in OU 1
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

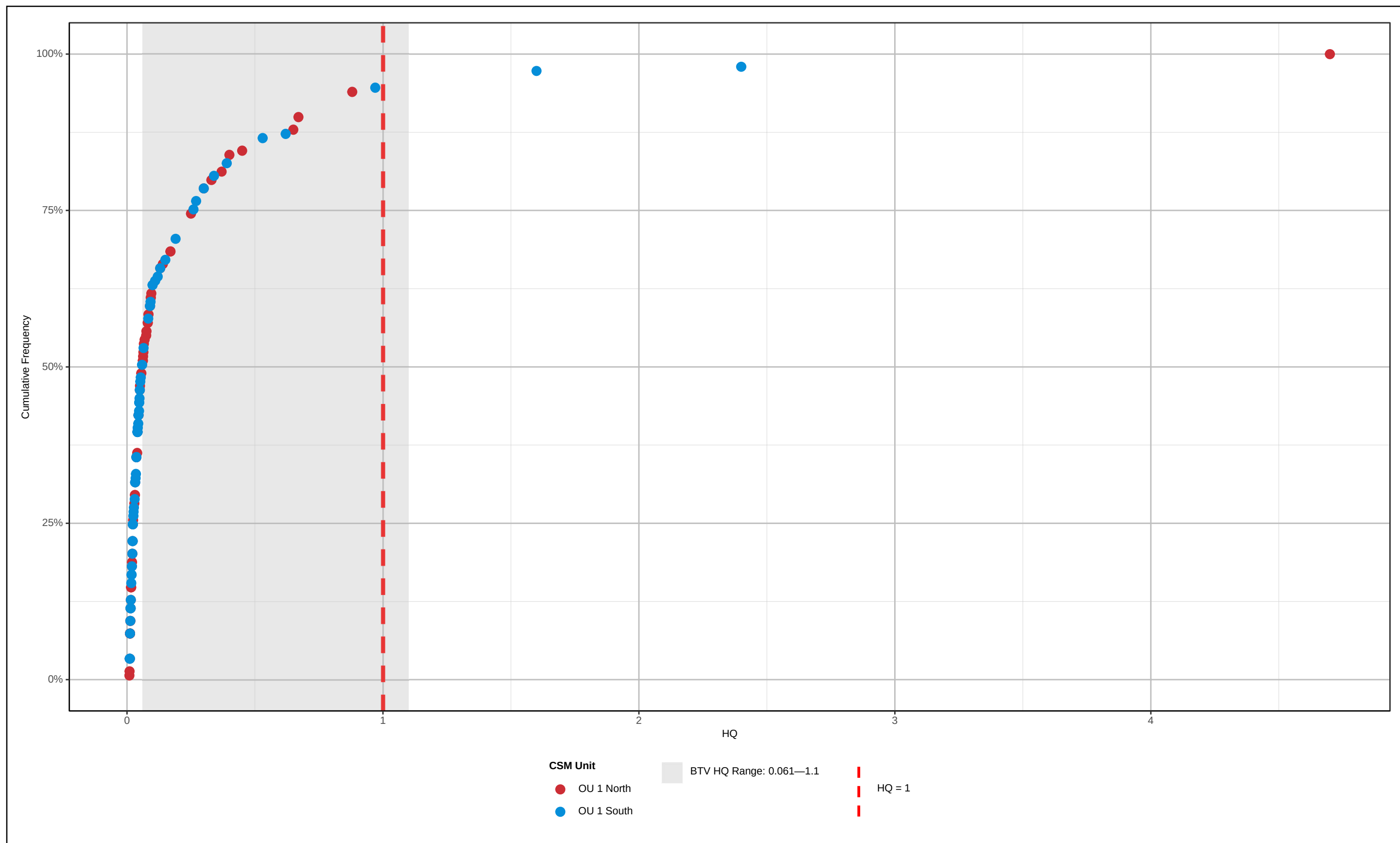


Figure M-15e. Cumulative Frequency of Zinc HQs for ELS Fish in Porewater in OU 1
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

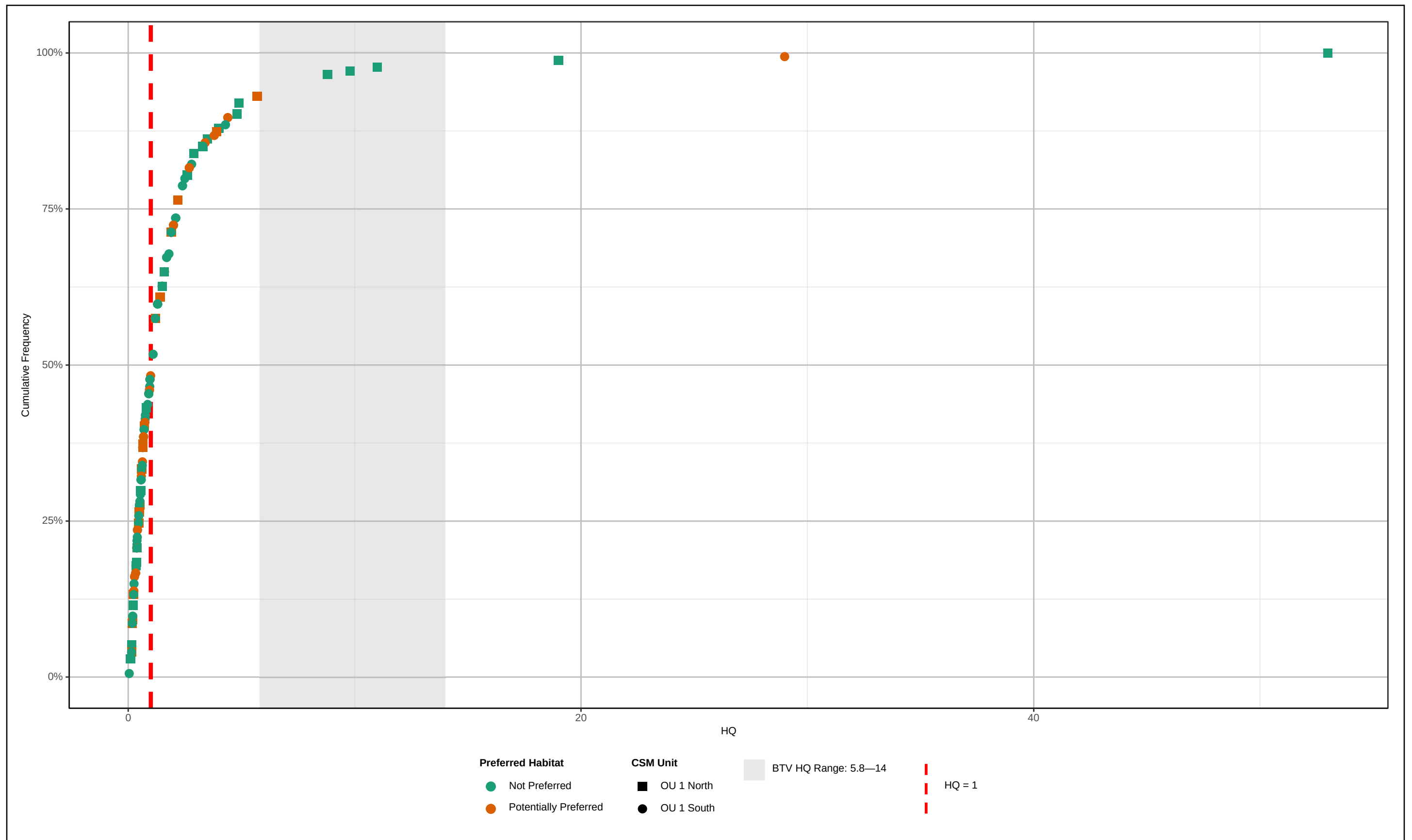


Figure M-16a. Cumulative Frequency of Copper HQs for ELS White Sturgeon in Porewater in OU 1
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

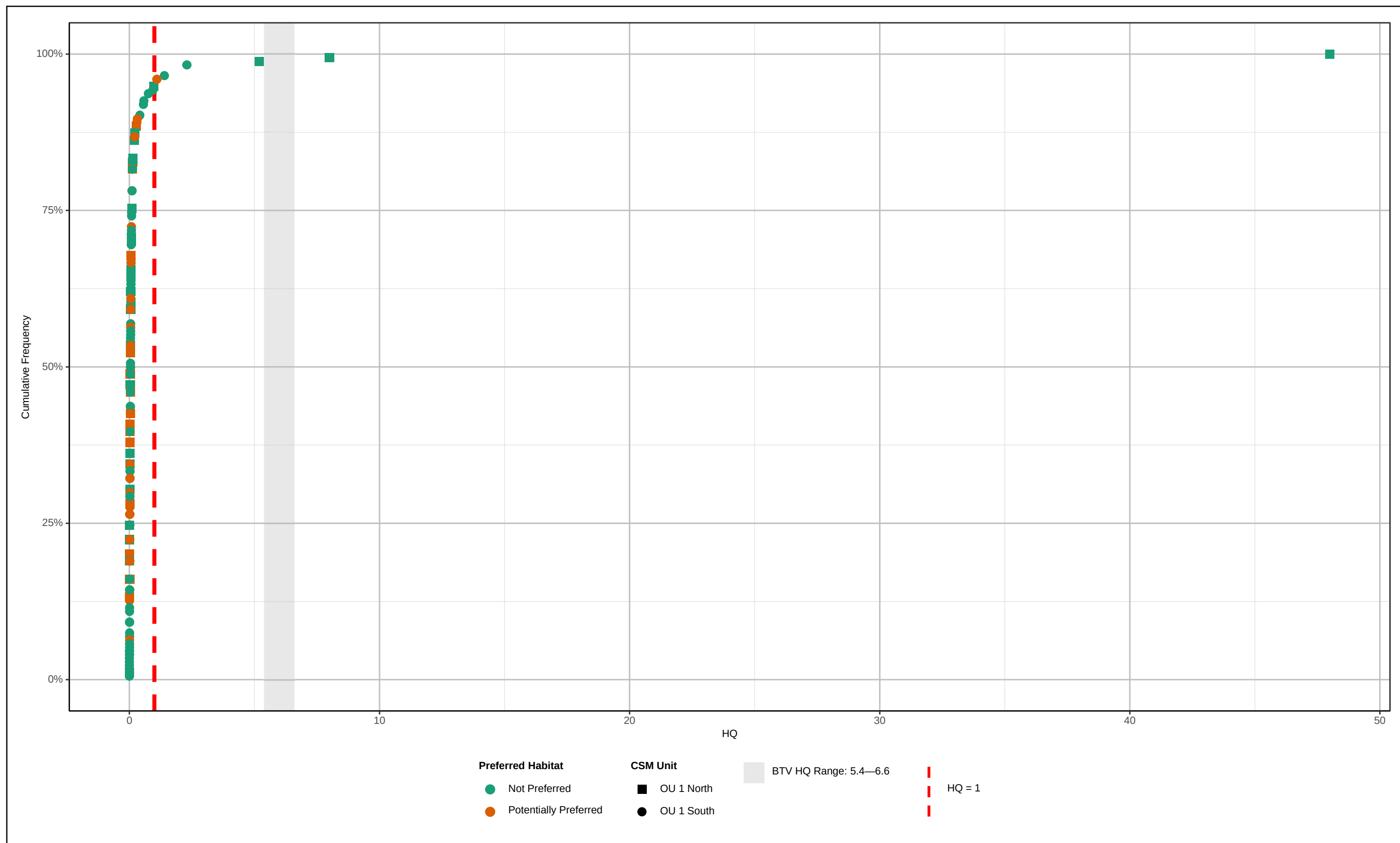


Figure M-16b. Cumulative Frequency of Iron HQs for ELS White Sturgeon in Porewater in OU 1
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

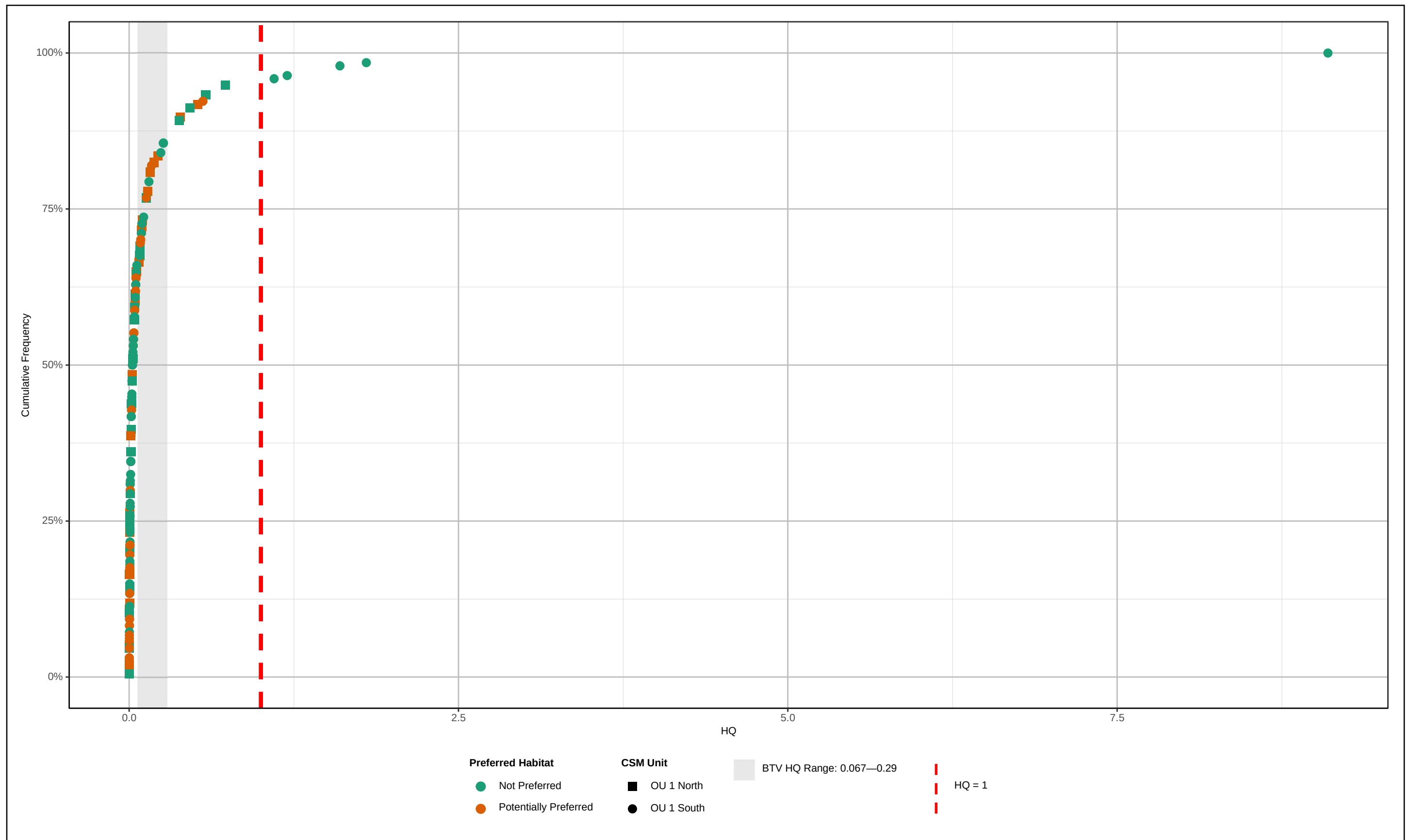


Figure M-16c. Cumulative Frequency of Lead HQs for ELS White Sturgeon in Porewater in OU 1
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

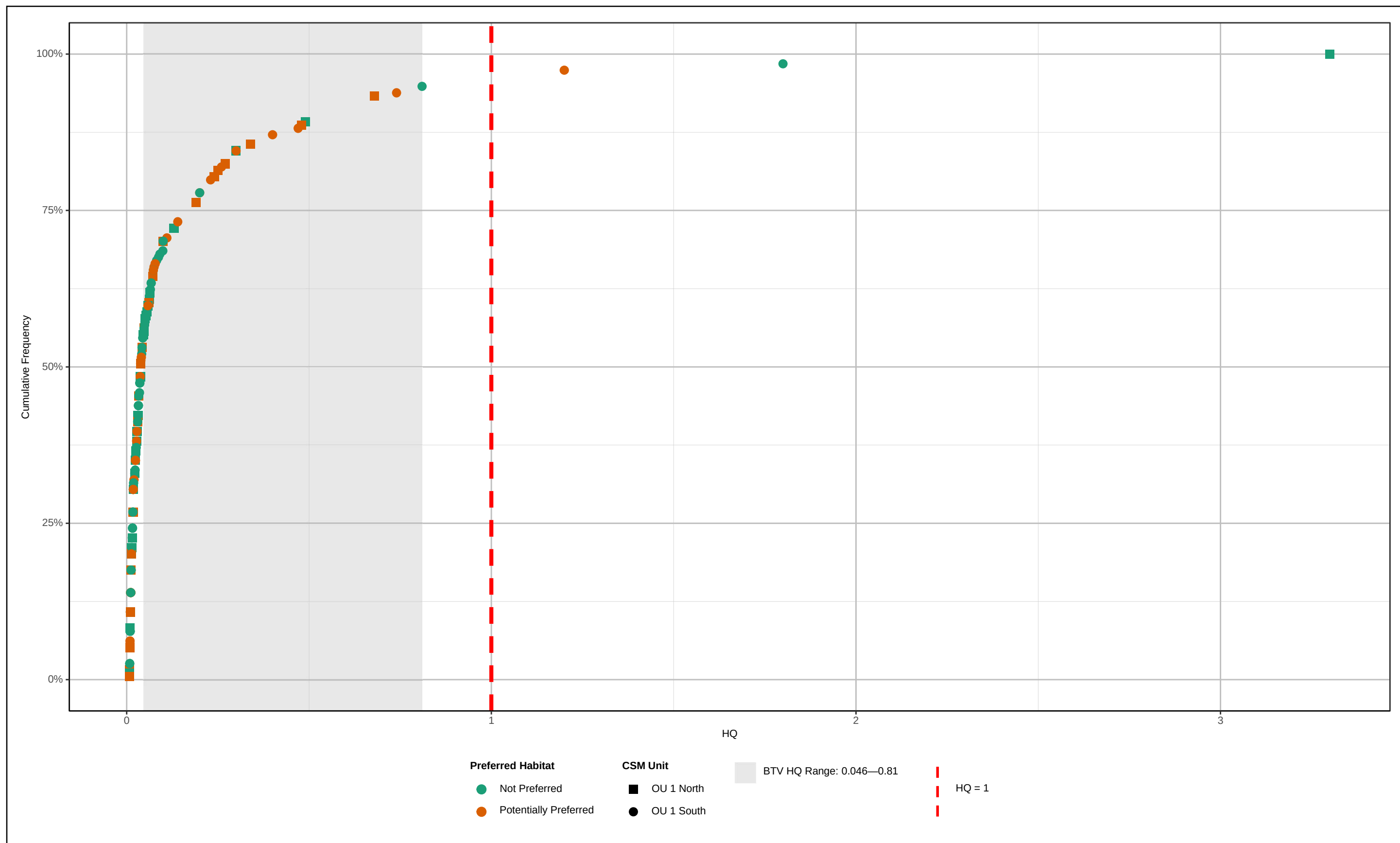


Figure M-16d. Cumulative Frequency of Zinc HQs for ELS White Sturgeon in Porewater in OU 1
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

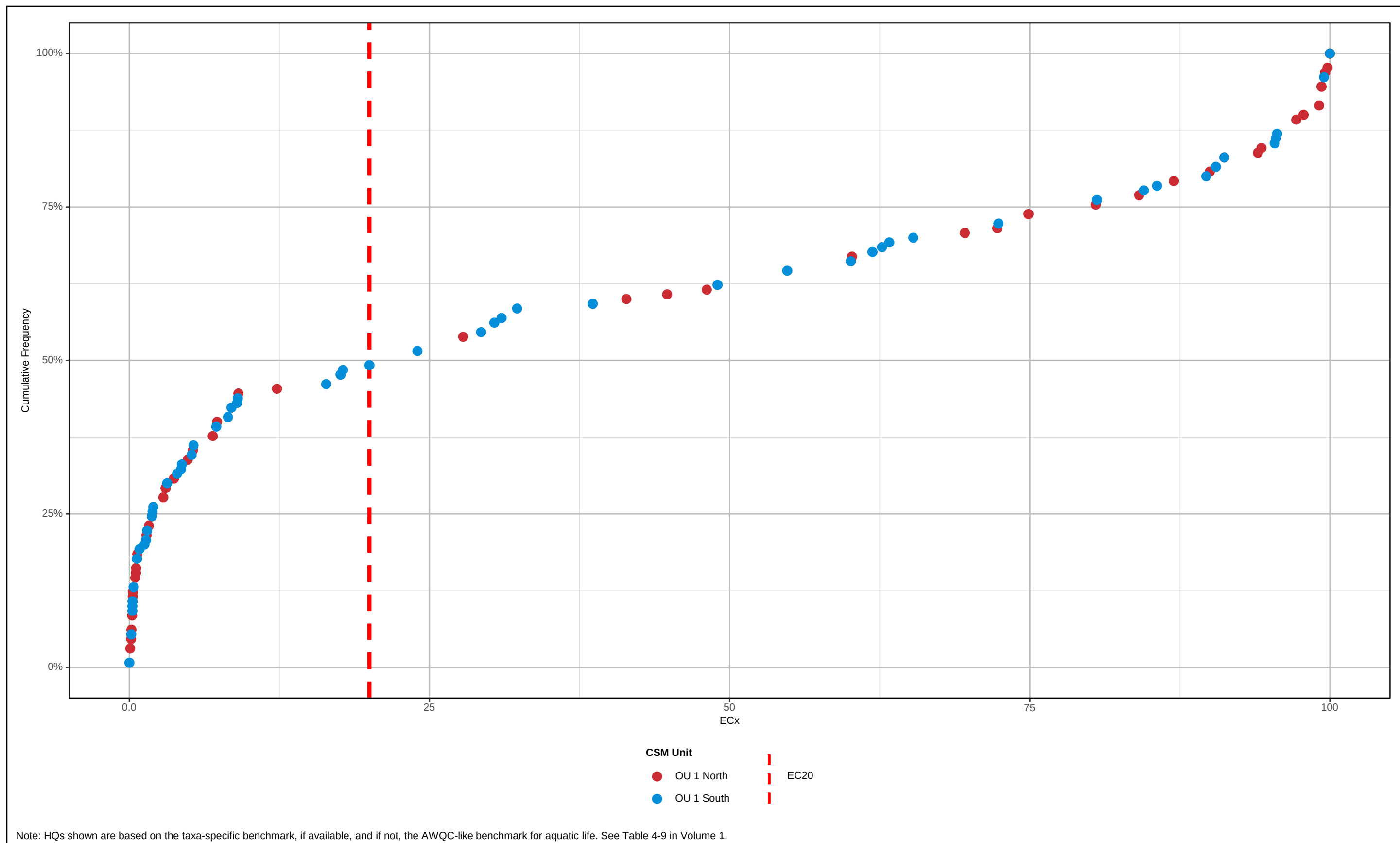


Figure M-17a. Cumulative Frequency of Copper ECx Values for ELS Fish in Porewater in OU 1
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

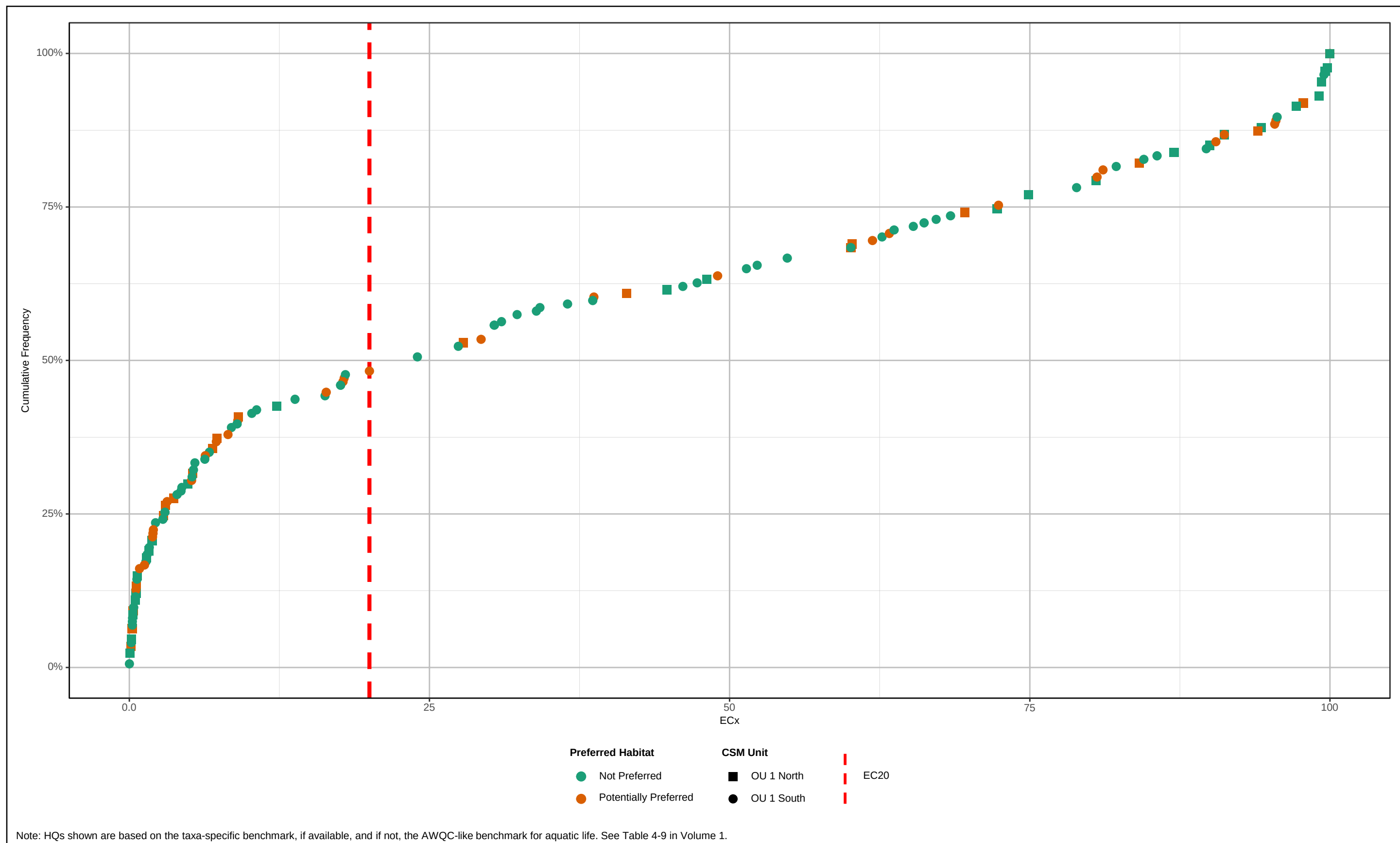


Figure M-17b. Cumulative Frequency of Copper ECx Values for ELS White Sturgeon in Porewater in OU 1
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

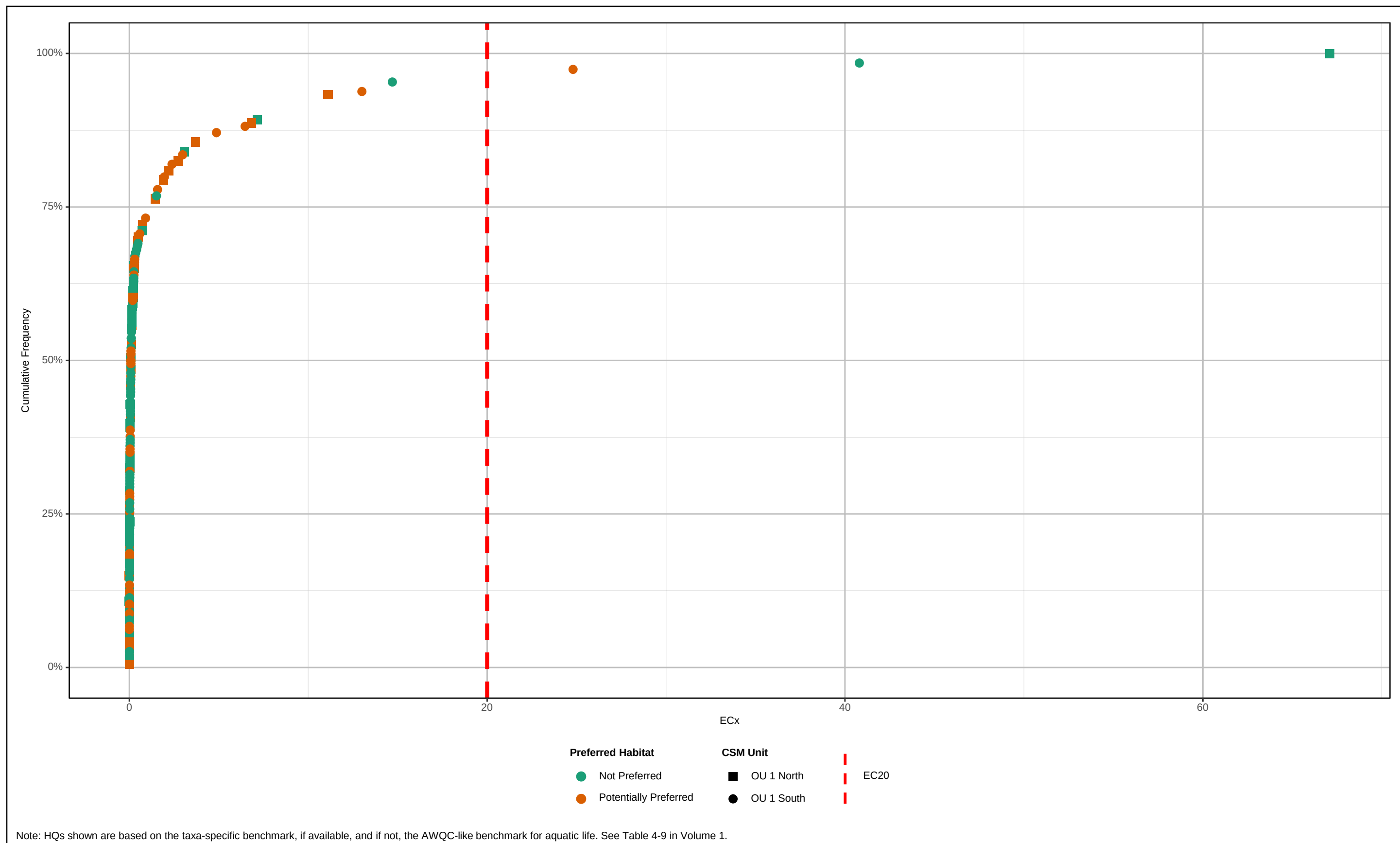


Figure M-17c. Cumulative Frequency of Zinc ECx Values for ELS White Sturgeon in Porewater in OU 1
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

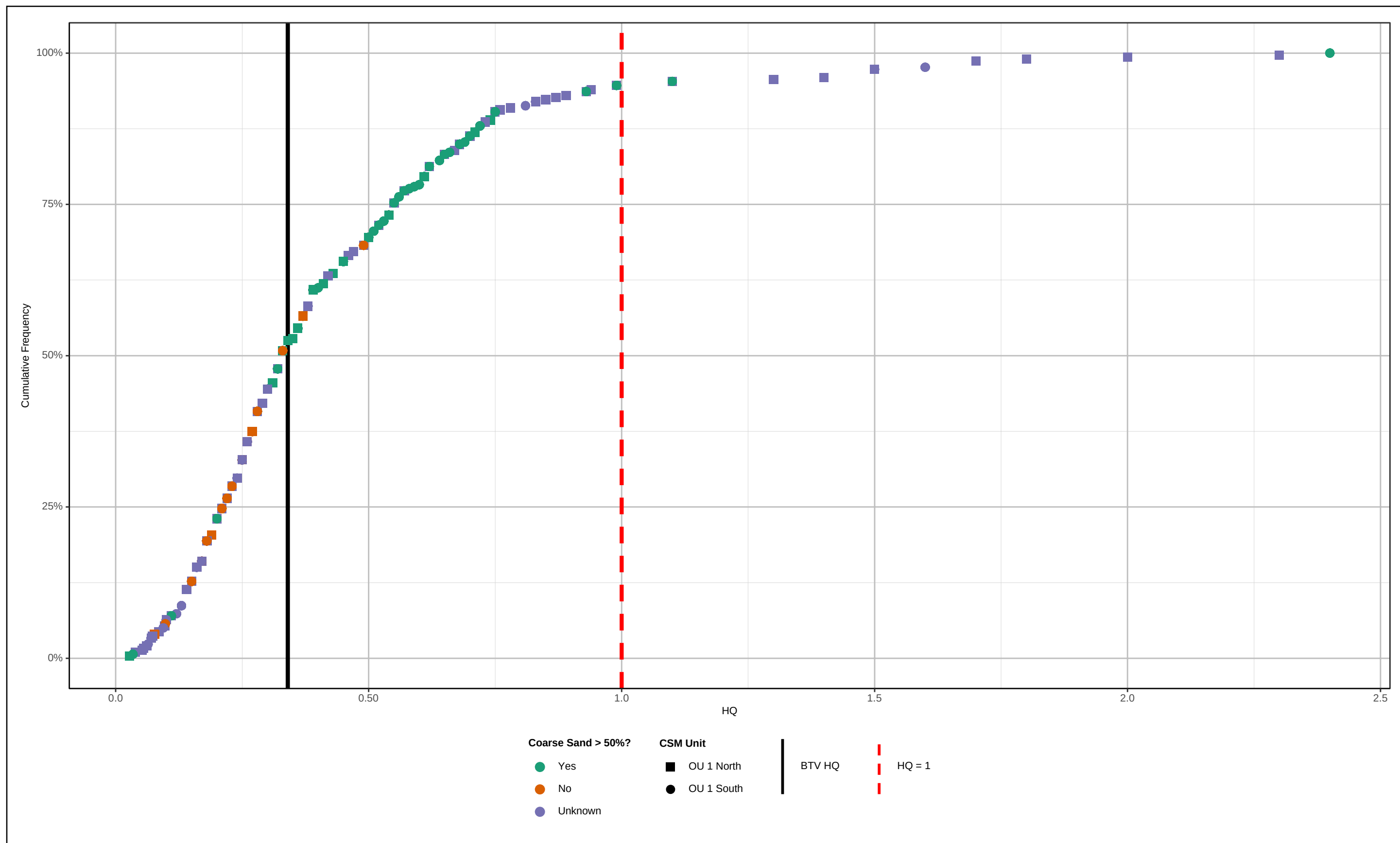


Figure M-18a. Cumulative Frequency of Arsenic HQs for Benthic Invertebrates in Sediment in OU 1
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

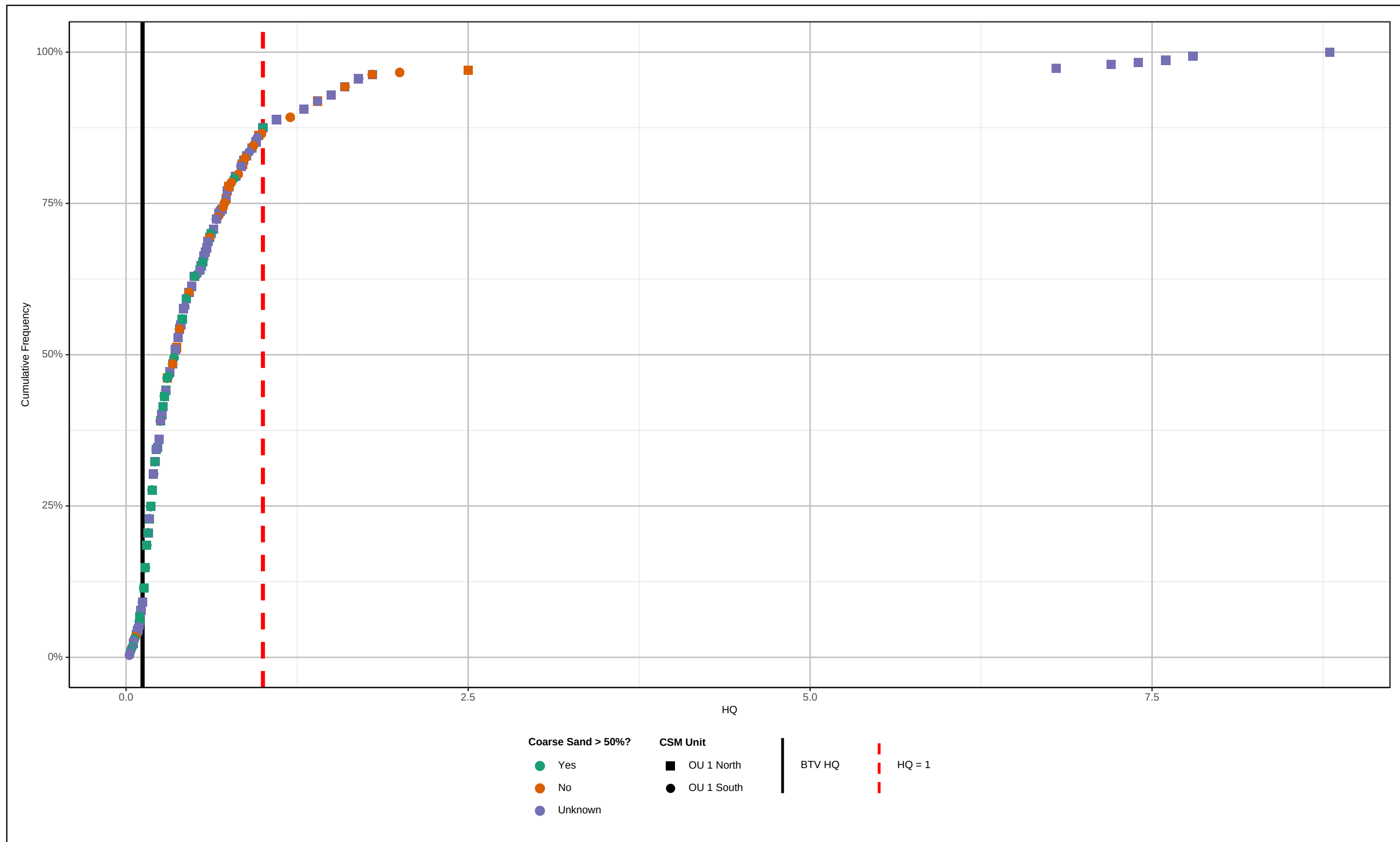


Figure M-18b. Cumulative Frequency of Cadmium HQs for Benthic Invertebrates in Sediment in OU 1
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

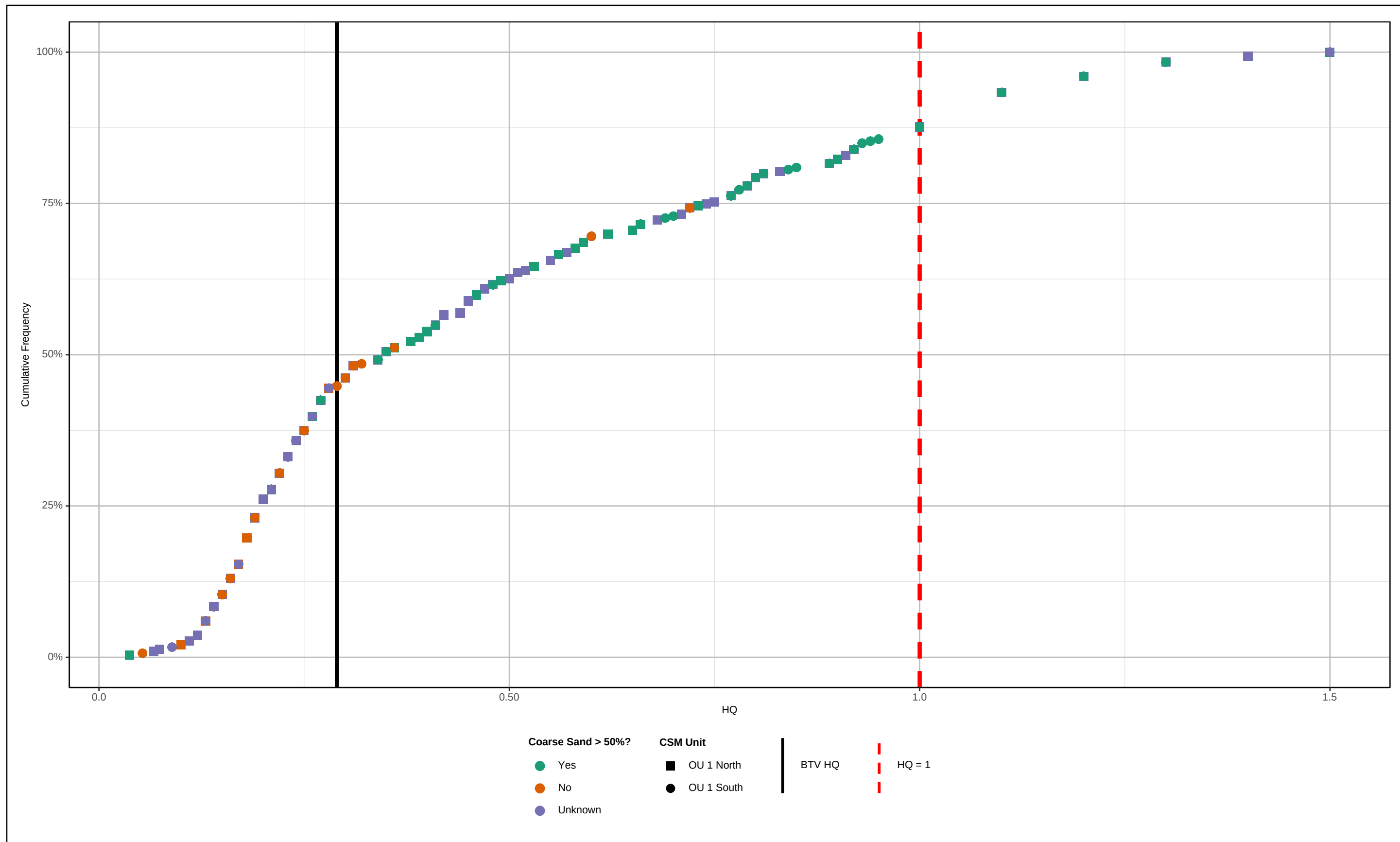


Figure M-18c. Cumulative Frequency of Chromium HQs for Benthic Invertebrates in Sediment in OU 1
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

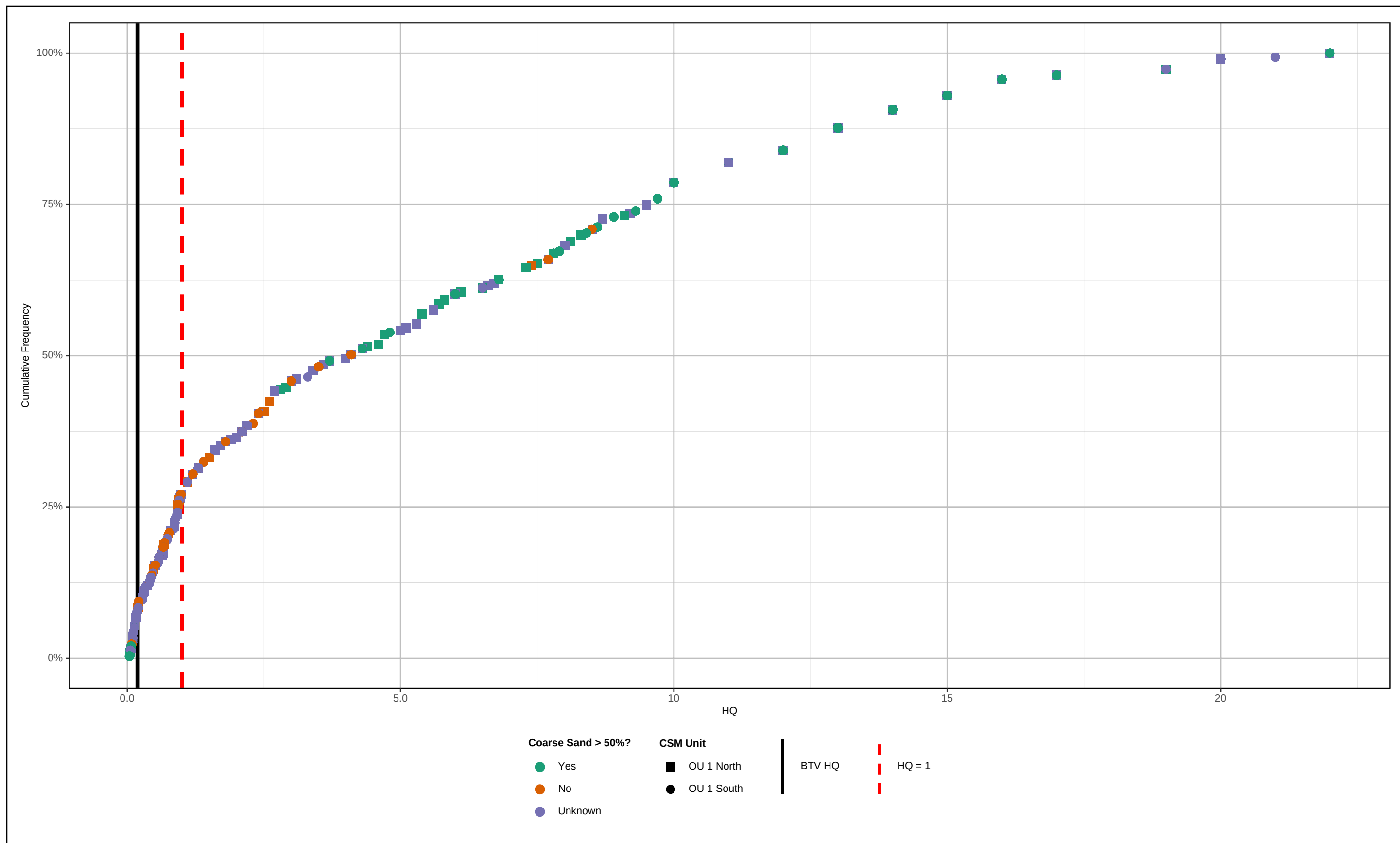


Figure M-18d. Cumulative Frequency of Copper HQs for Benthic Invertebrates in Sediment in OU 1
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

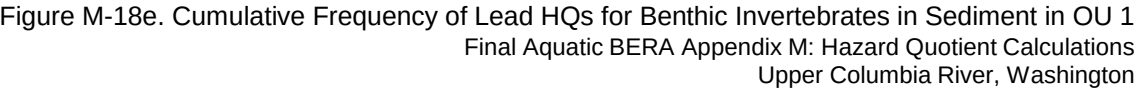


Figure M-18e. Cumulative Frequency of Lead HQs for Benthic Invertebrates in Sediment in OU 1

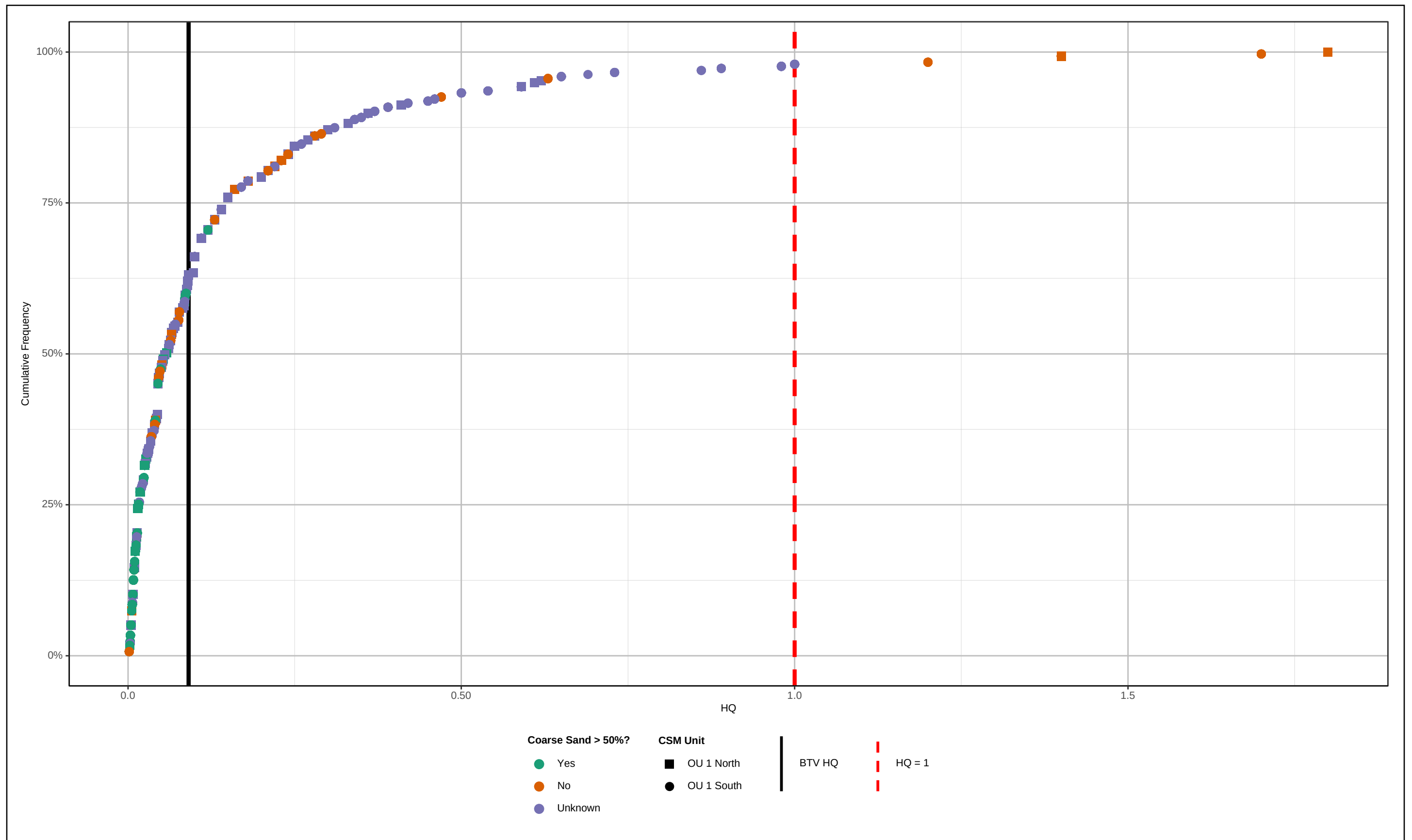


Figure M-18f. Cumulative Frequency of Mercury HQs for Benthic Invertebrates in Sediment in OU 1
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

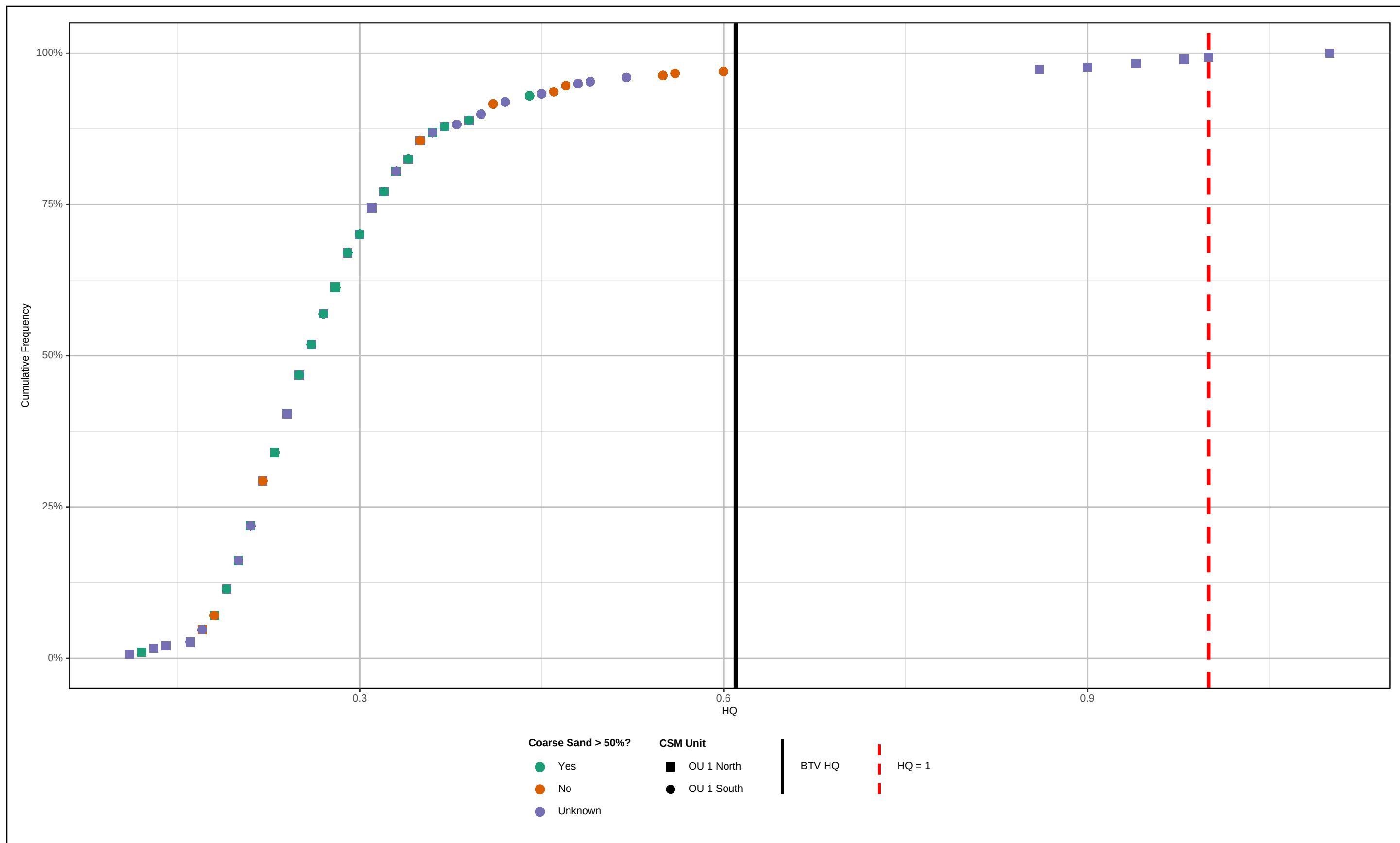


Figure M-18g. Cumulative Frequency of Nickel HQs for Benthic Invertebrates in Sediment in OU 1
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 Upper Columbia River, Washington

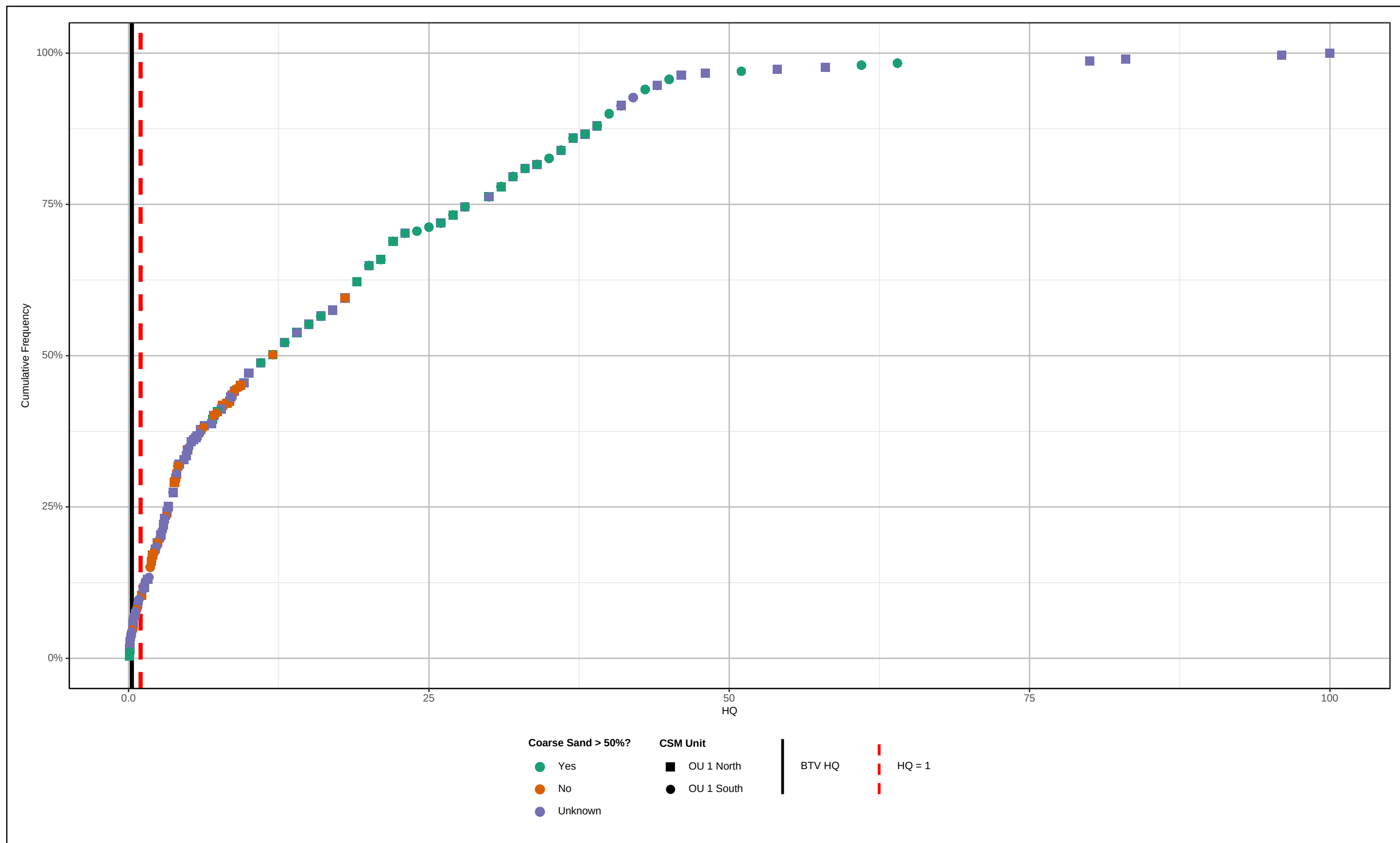


Figure M-18h. Cumulative Frequency of Zinc HQs for Benthic Invertebrates in Sediment in OU 1
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

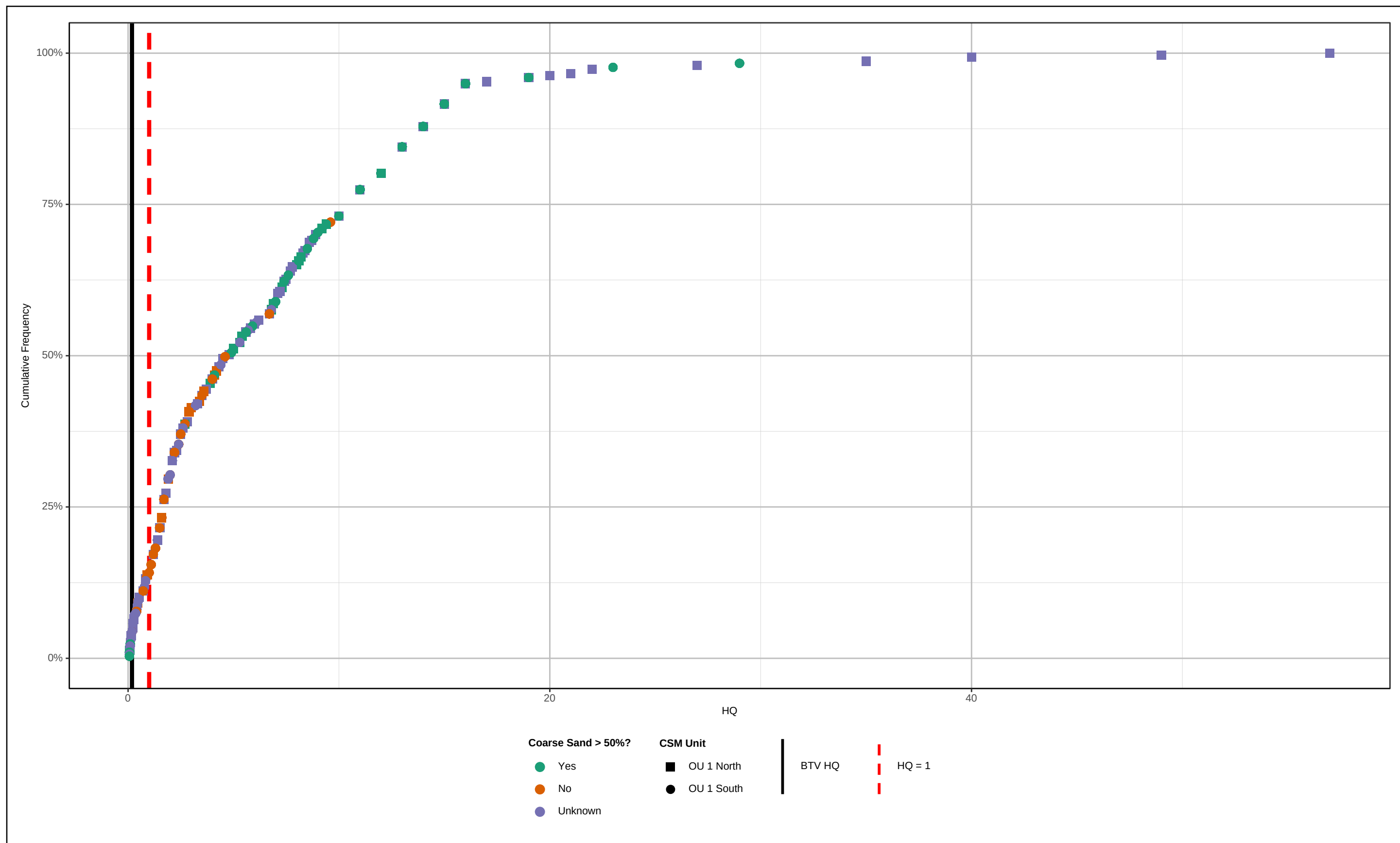


Figure M-18i. Cumulative Frequency of Mean PEC Quotient (Cadmium, Copper, Lead, Zinc) HQs for Benthic Invertebrates in Sediment in OU 1
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

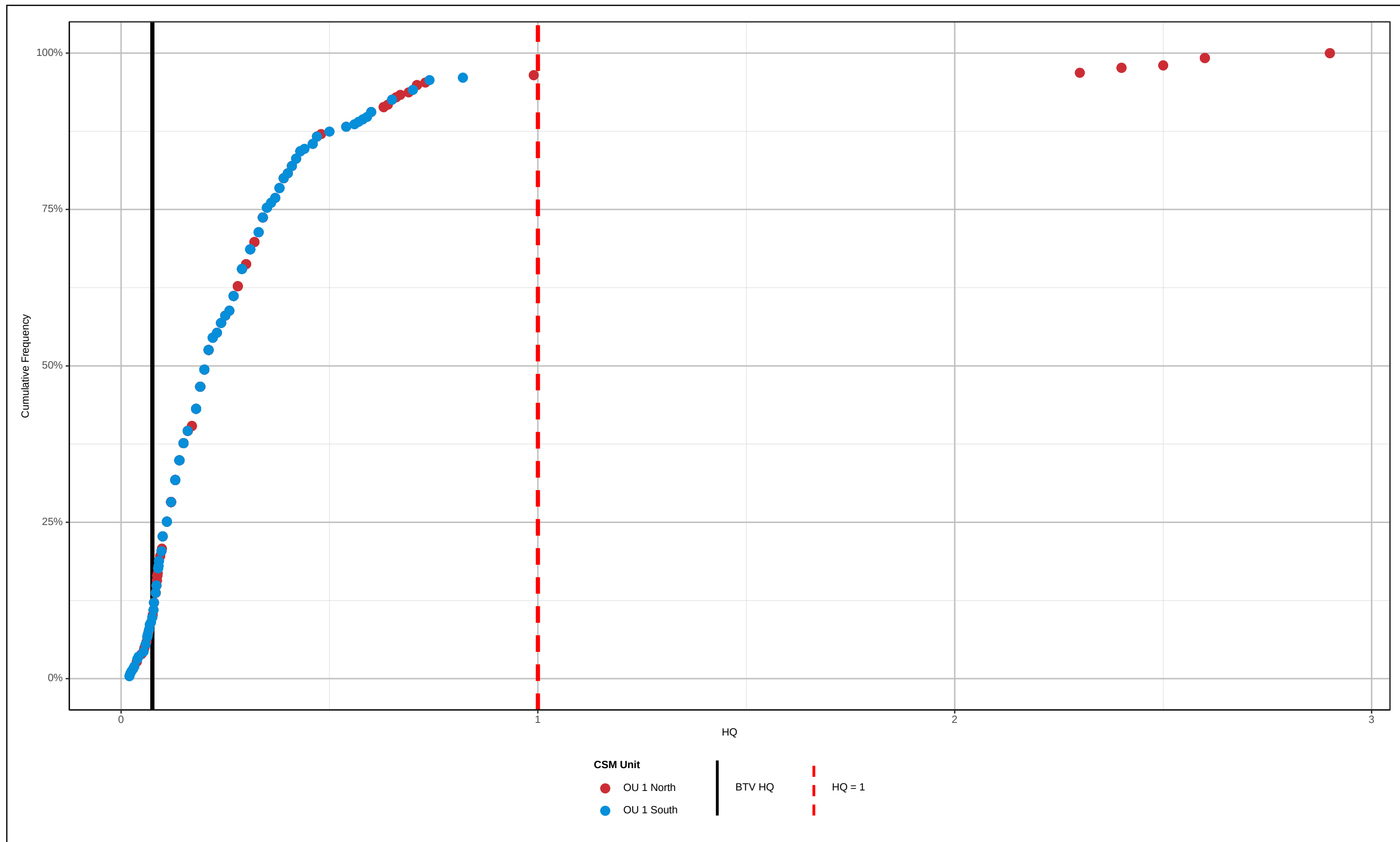


Figure M-19a. Cumulative Frequency of Cadmium Dietary HQs for Largescale Sucker in OU 1
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

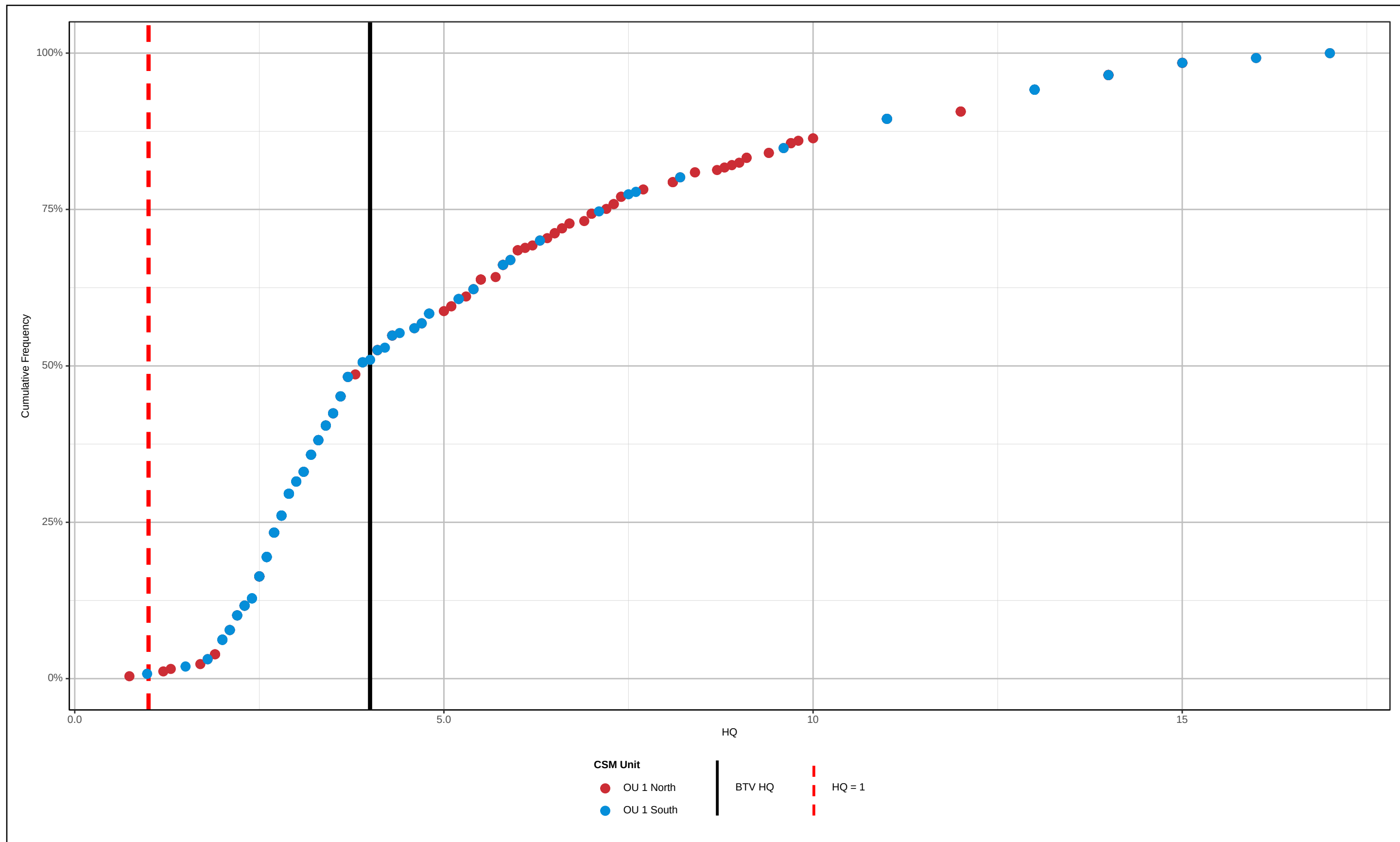


Figure M-19b. Cumulative Frequency of Chromium Dietary HQs for Largescale Sucker in OU 1
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

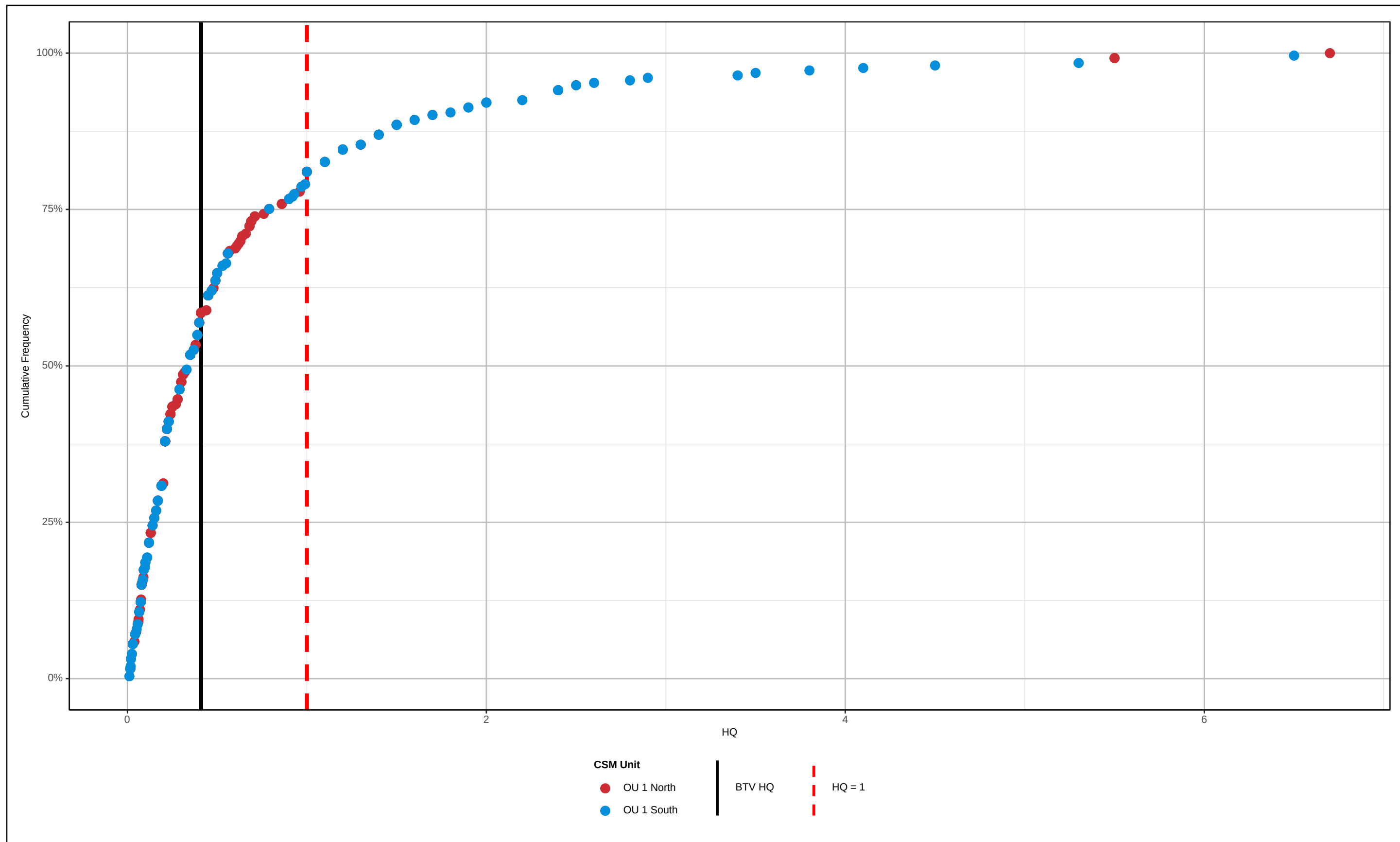


Figure M-19c. Cumulative Frequency of Mercury Dietary HQs for Largescale Sucker in OU 1
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

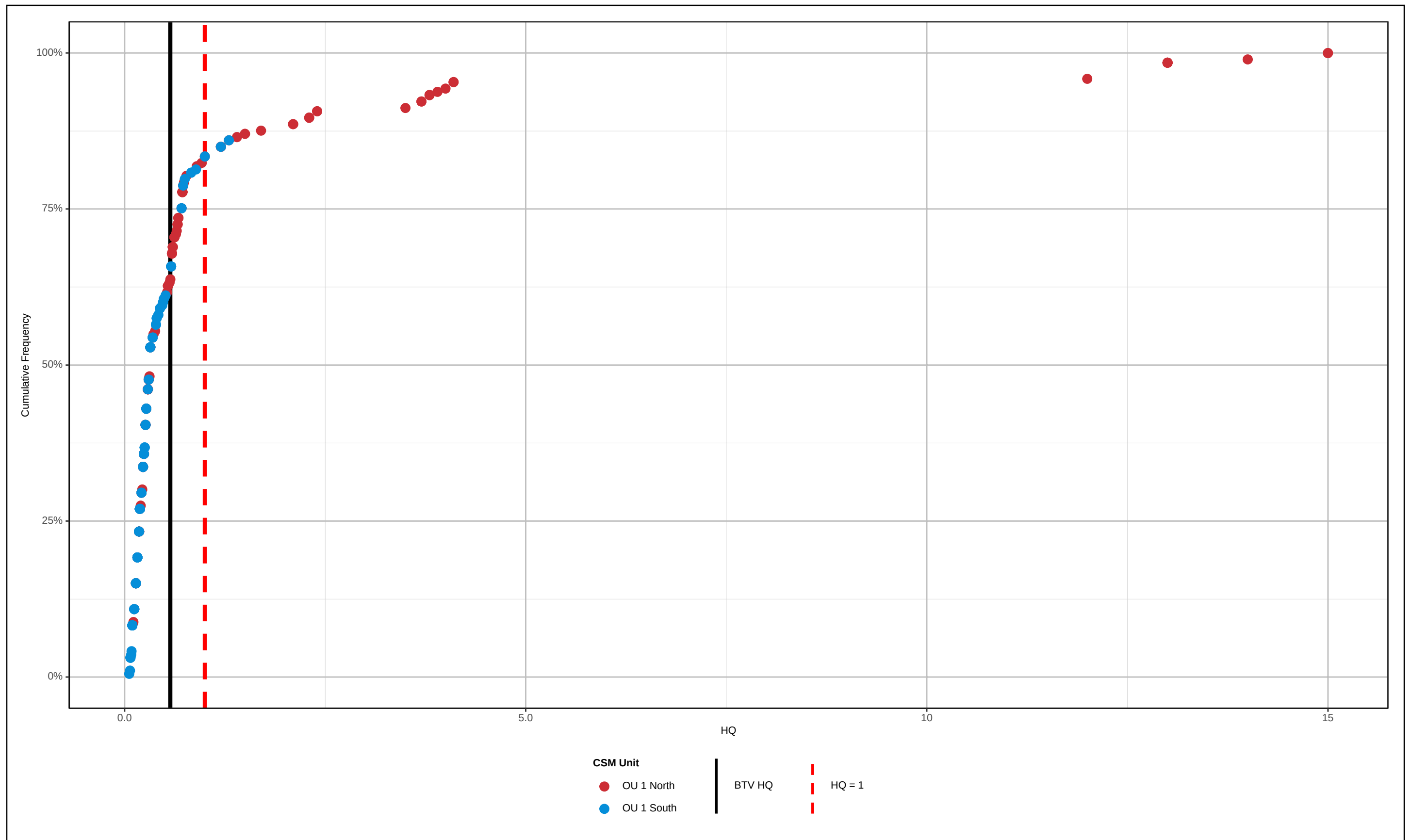


Figure M-19d. Cumulative Frequency of Selenium Dietary HQs for Largescale Sucker in OU 1
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

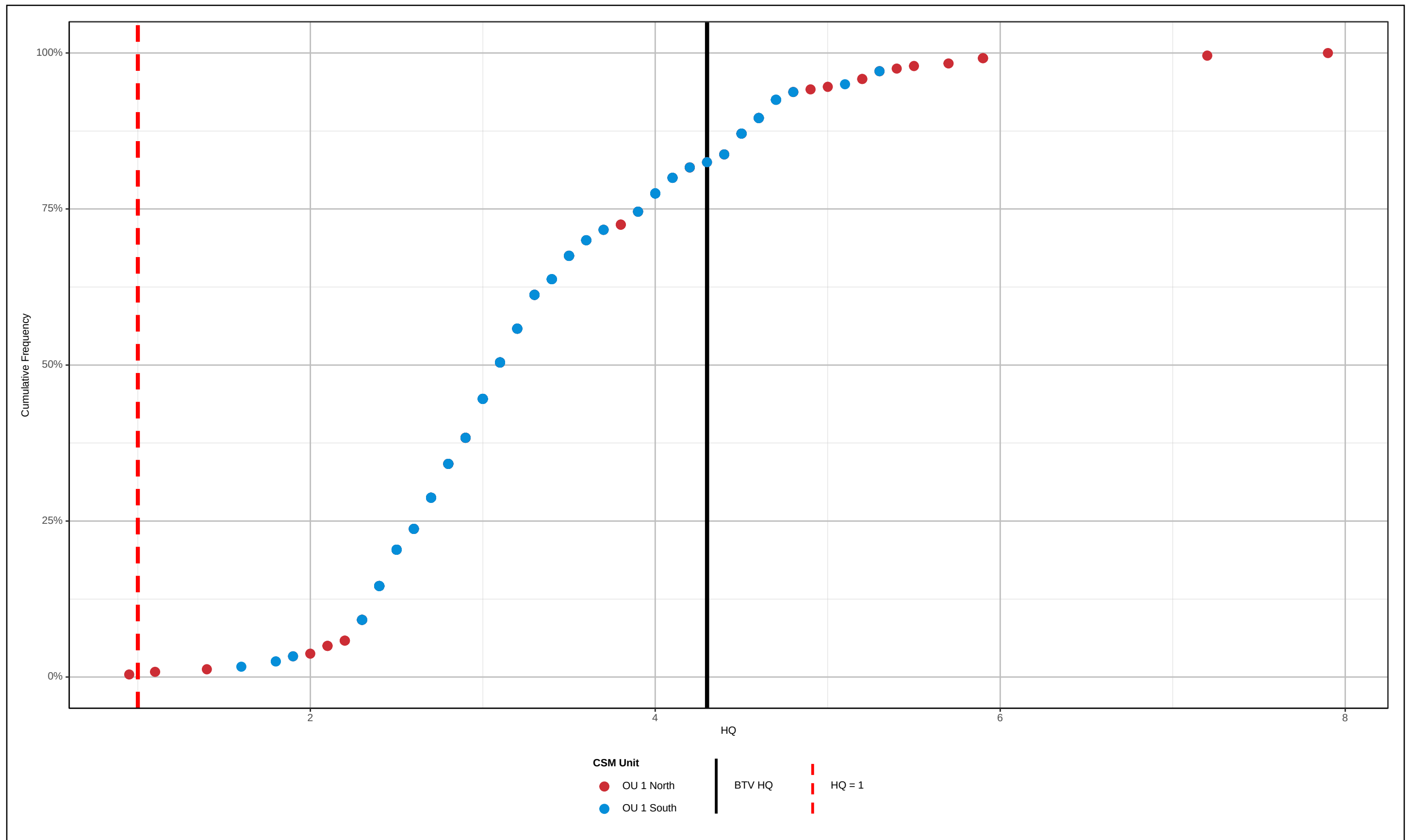


Figure M-19e. Cumulative Frequency of Vanadium Dietary HQs for Largescale Sucker in OU 1
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

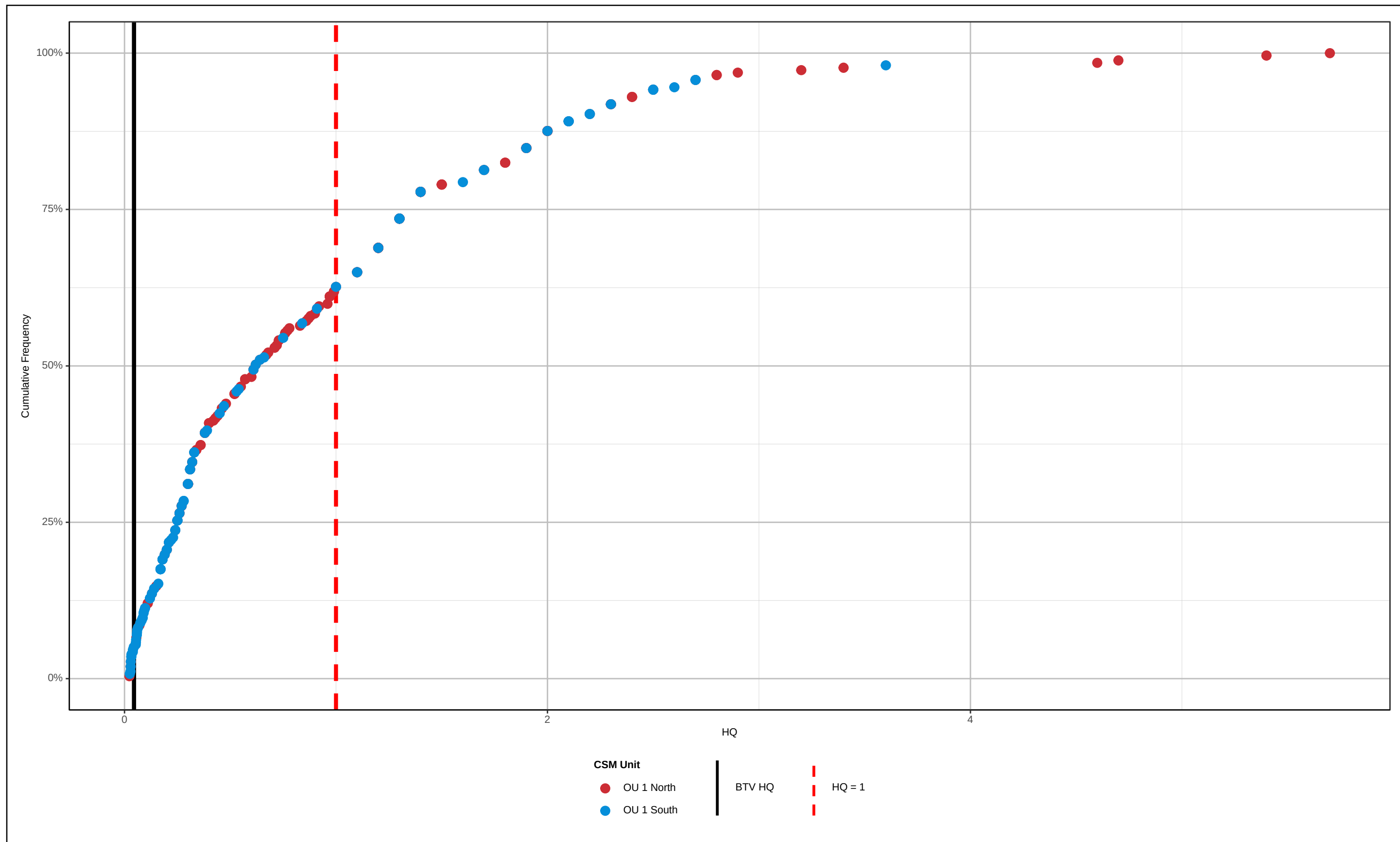


Figure M-19f. Cumulative Frequency of Zinc Dietary HQs for Largescale Sucker in OU 1
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

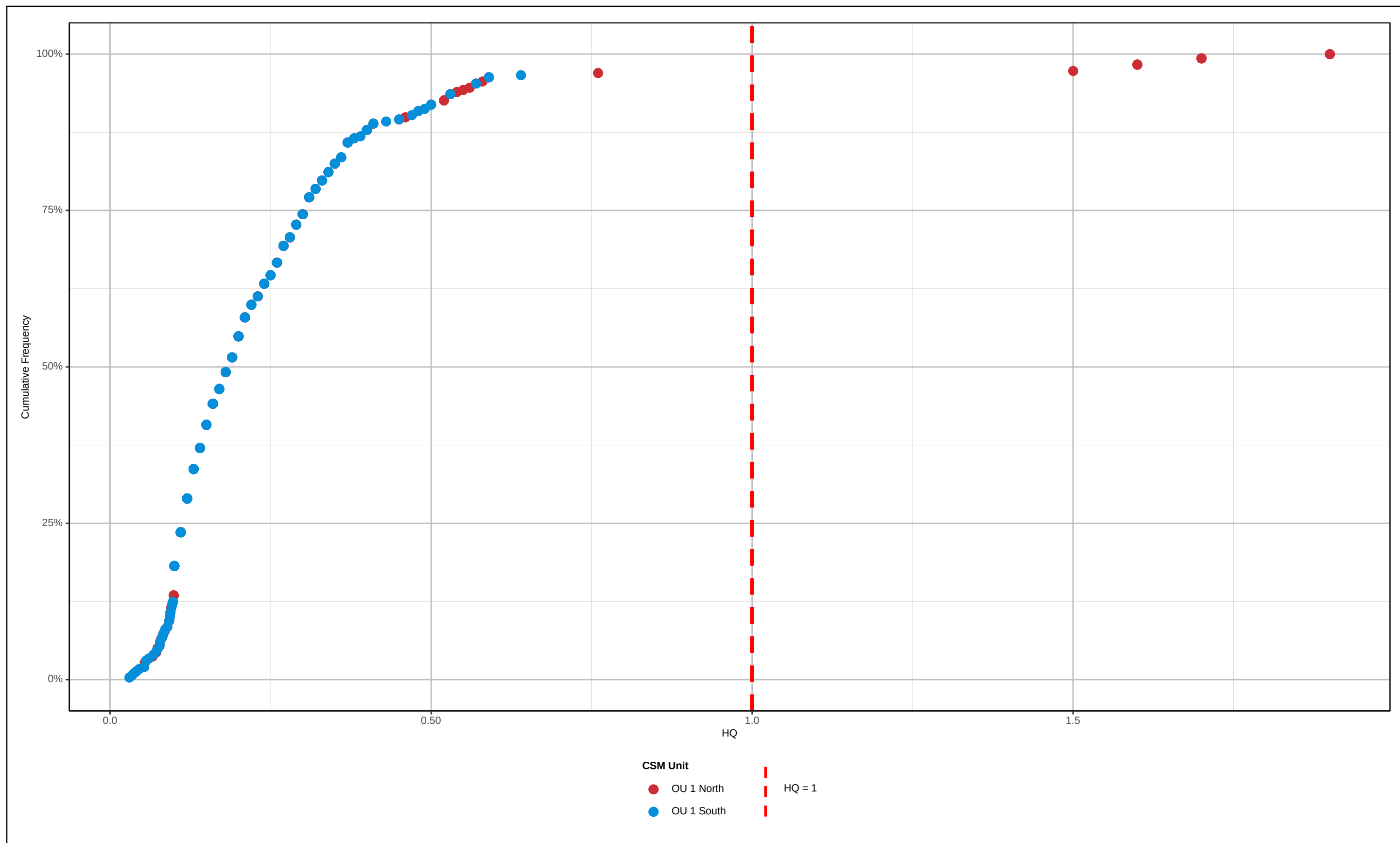


Figure M-19g. Cumulative Frequency of Cadmium Dietary HQs for Prickly Sculpin in OU 1
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

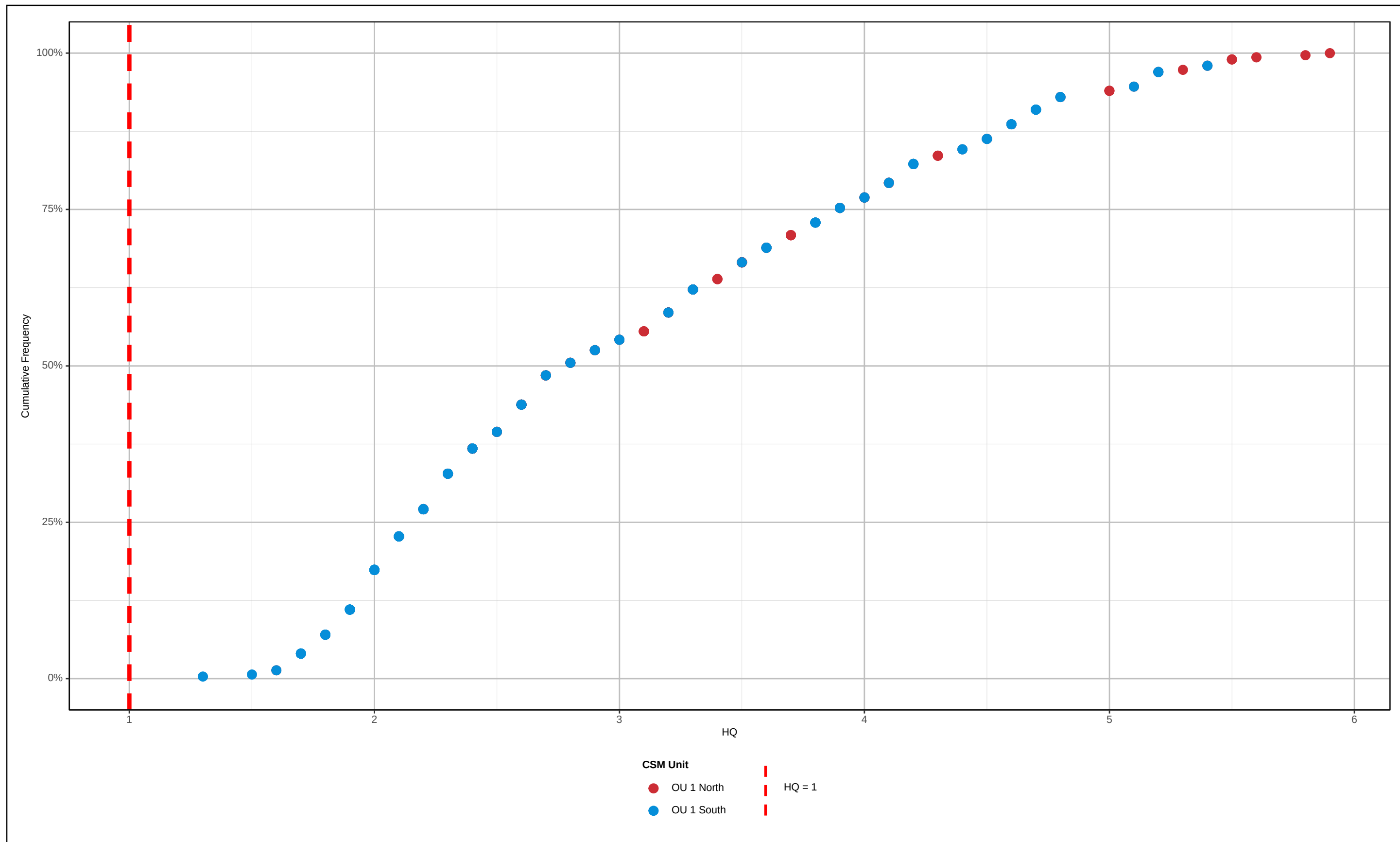


Figure M-19h. Cumulative Frequency of Chromium Dietary HQs for Prickly Sculpin in OU 1
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

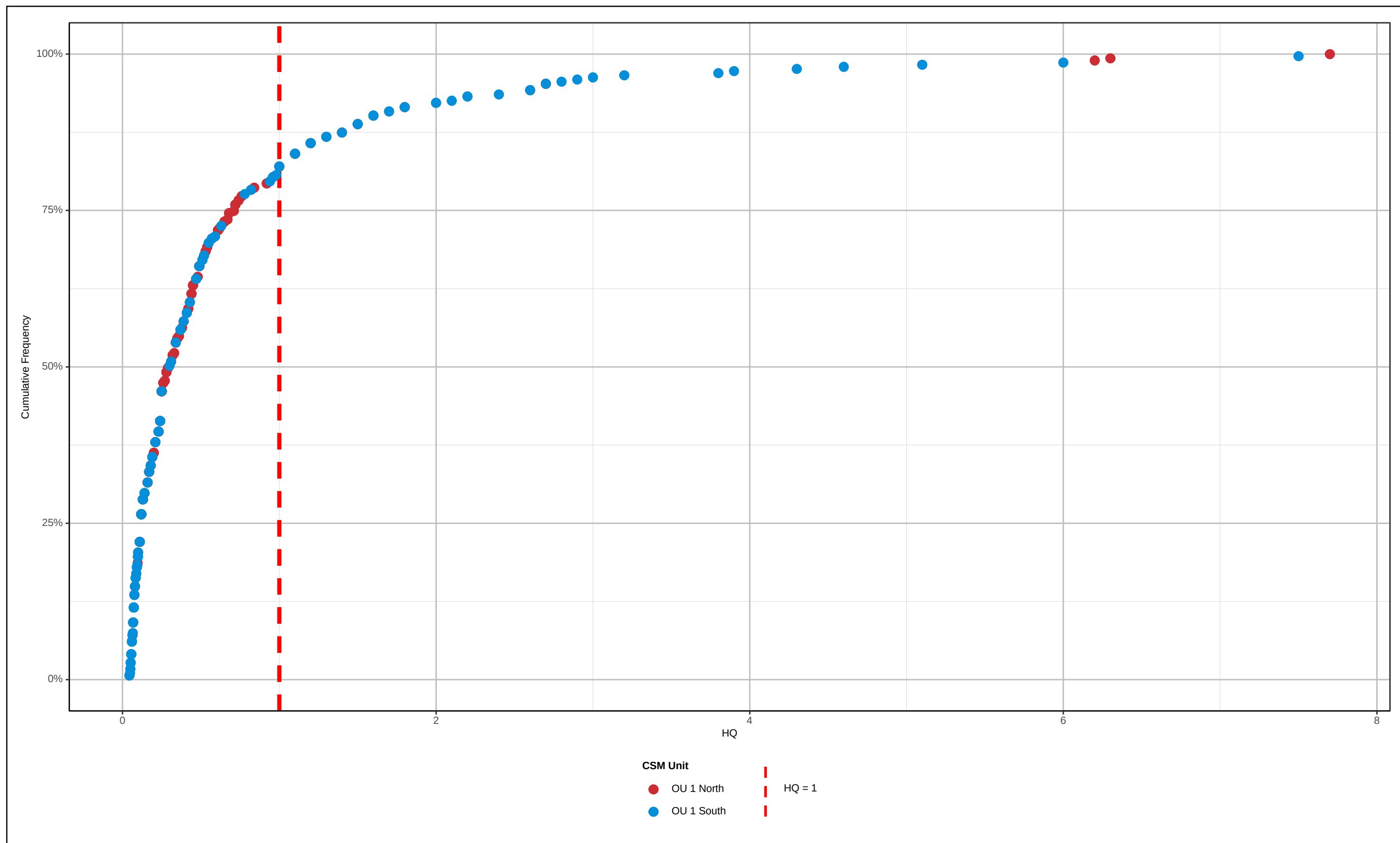


Figure M-19i. Cumulative Frequency of Mercury Dietary HQs for Prickly Sculpin in OU 1
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

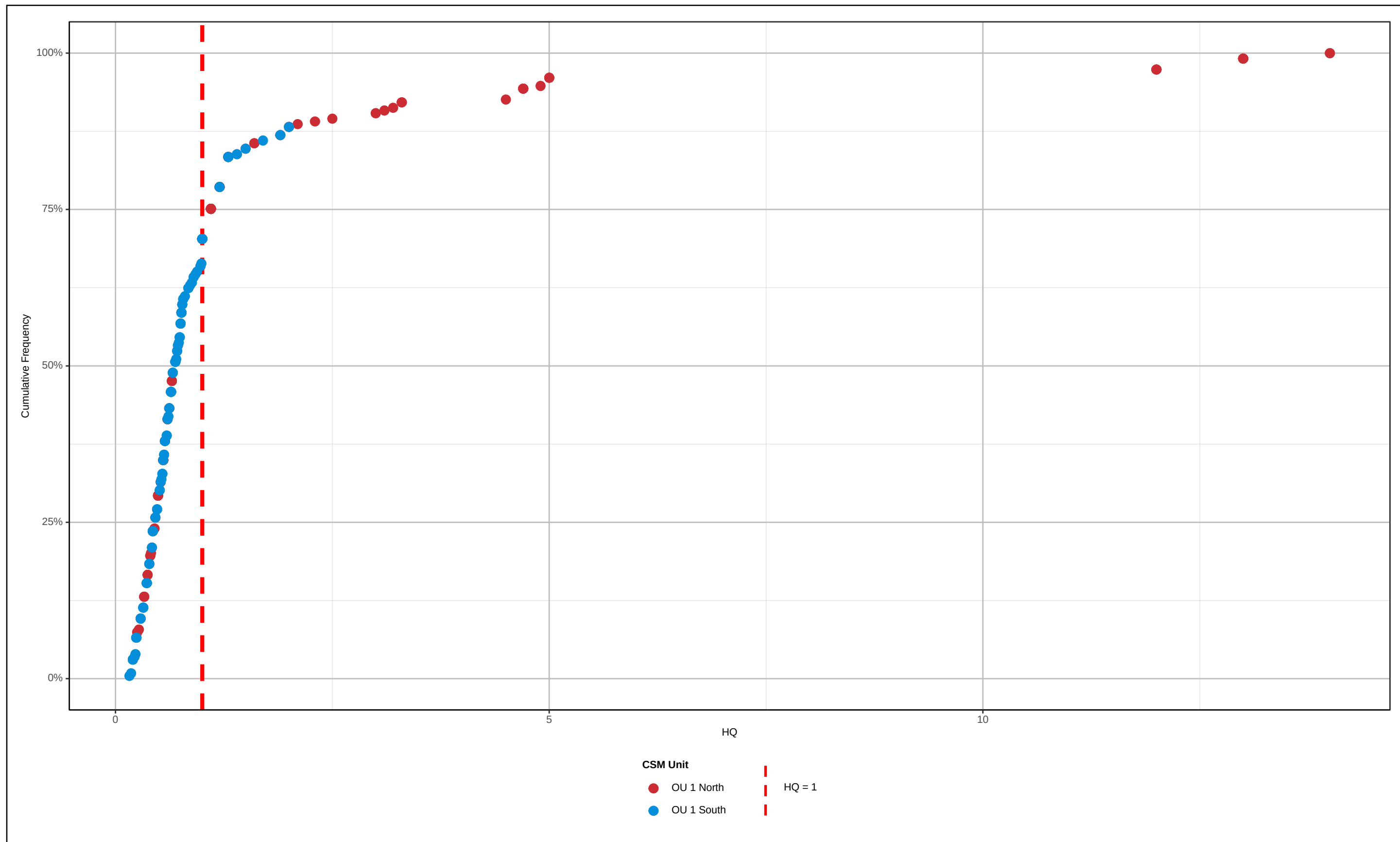


Figure M-19j. Cumulative Frequency of Selenium Dietary HQs for Prickly Sculpin in OU 1
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

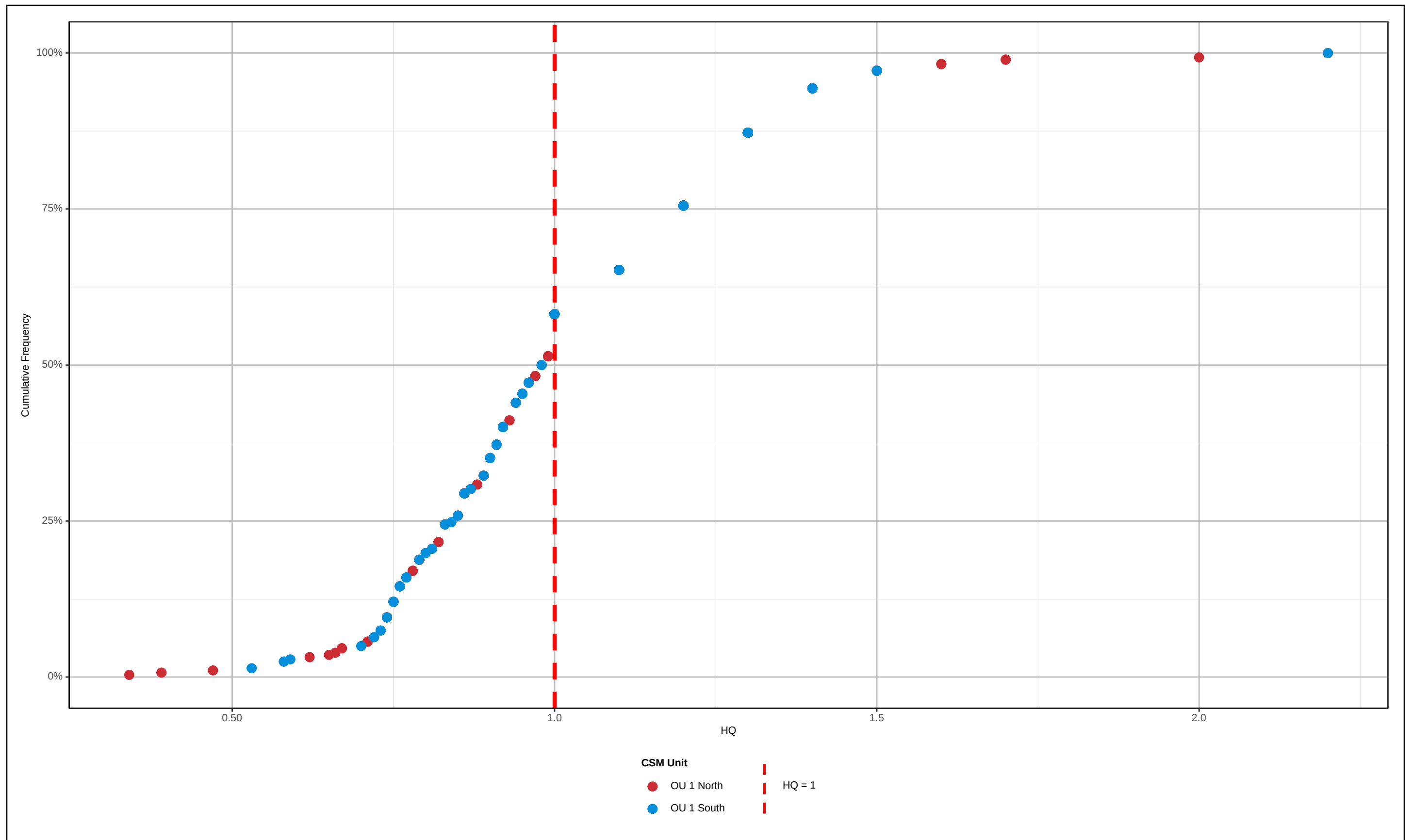


Figure M-19k. Cumulative Frequency of Vanadium Dietary HQs for Prickly Sculpin in OU 1
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

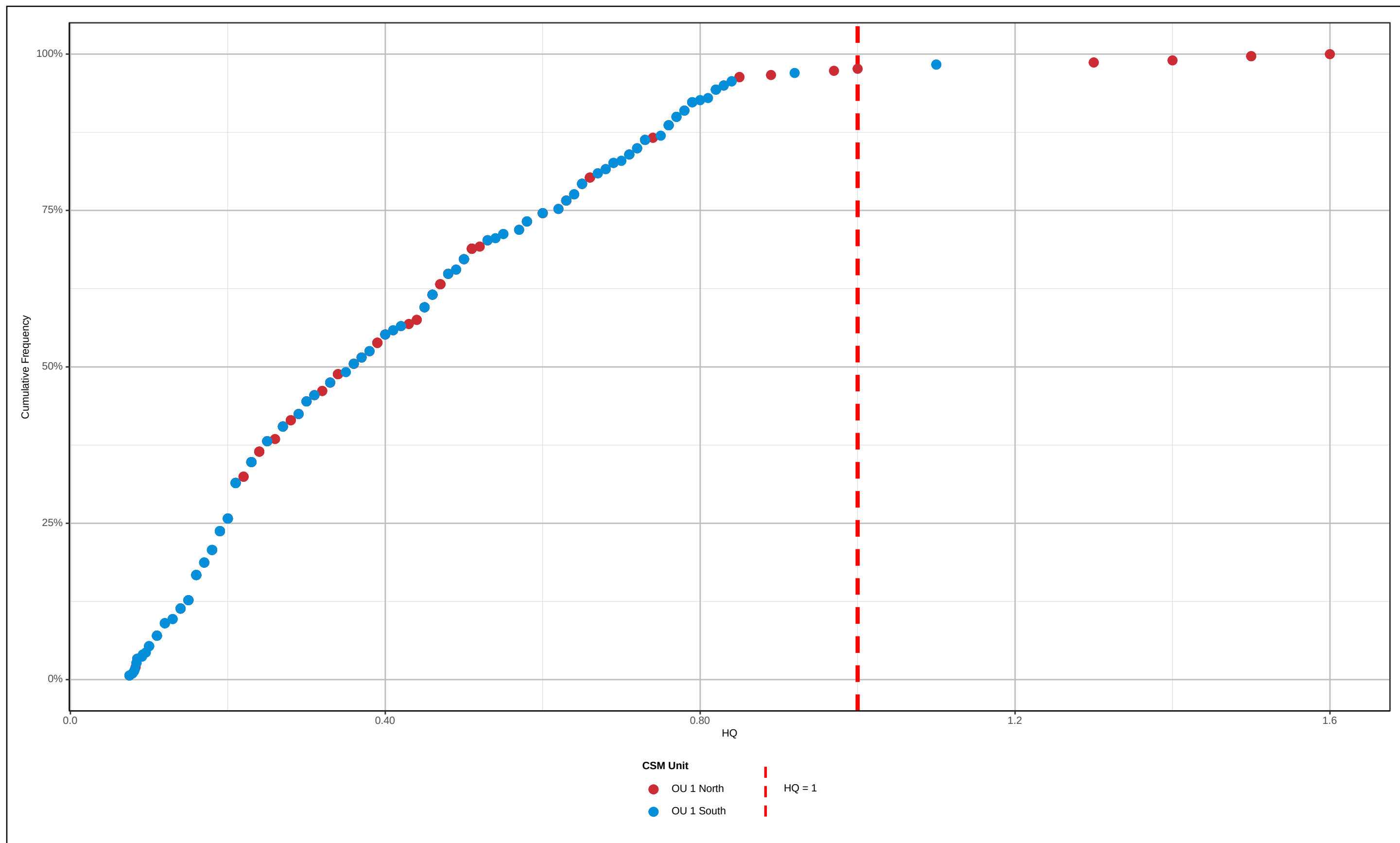


Figure M-19I. Cumulative Frequency of Zinc Dietary HQs for Prickly Sculpin in OU 1
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

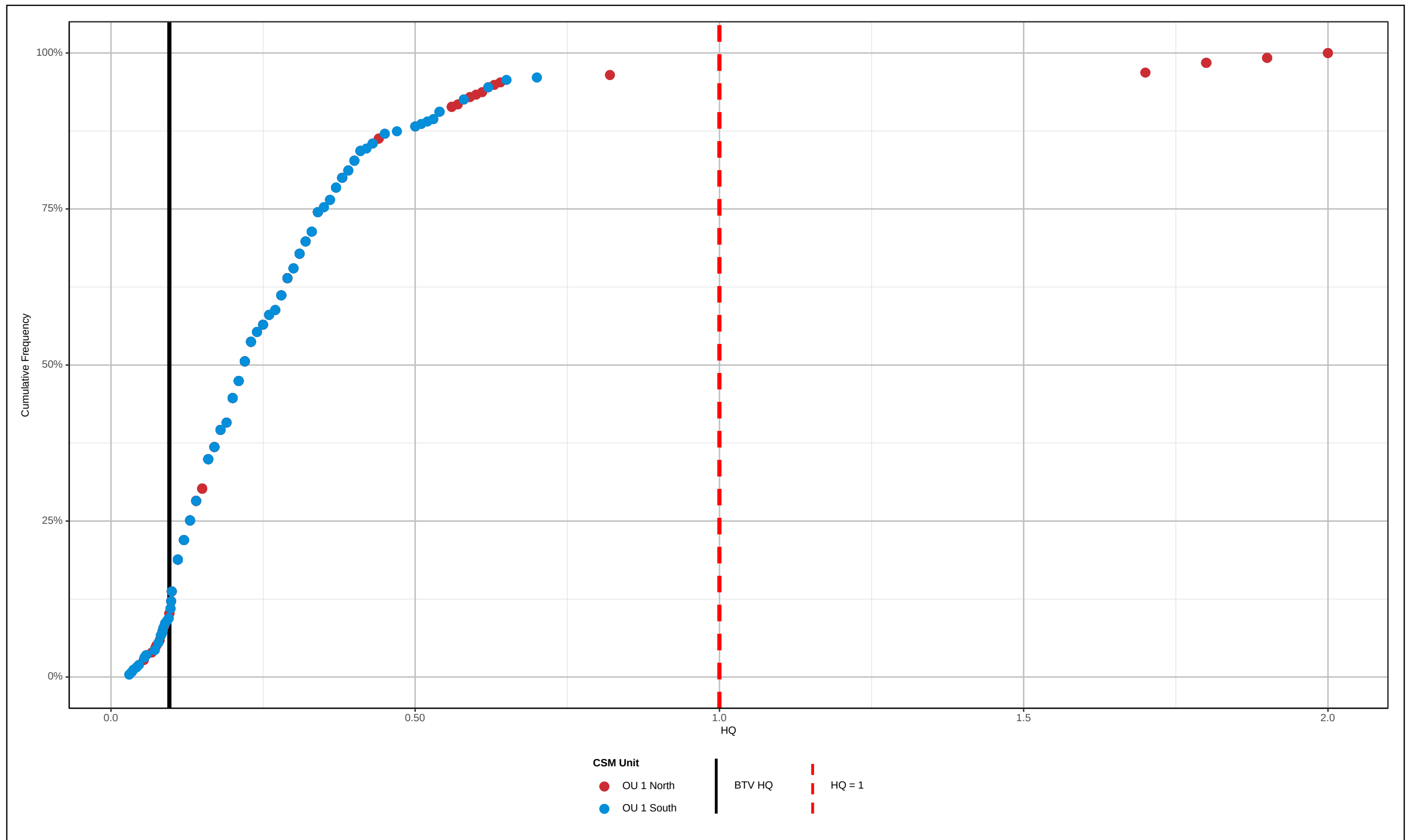


Figure M-19m. Cumulative Frequency of Cadmium Dietary HQs for Longnose Dace in OU 1
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

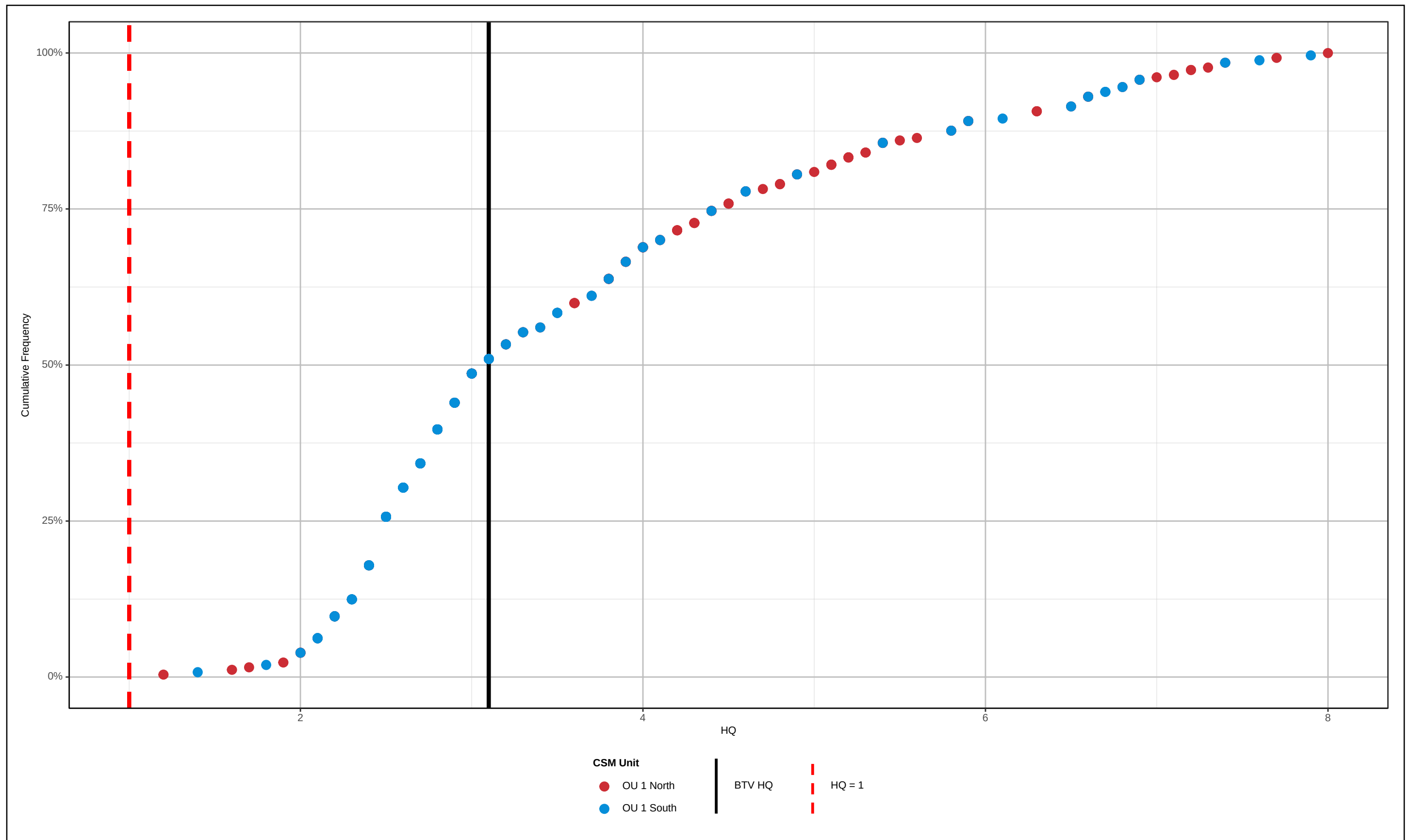


Figure M-19n. Cumulative Frequency of Chromium Dietary HQs for Longnose Dace in OU 1
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

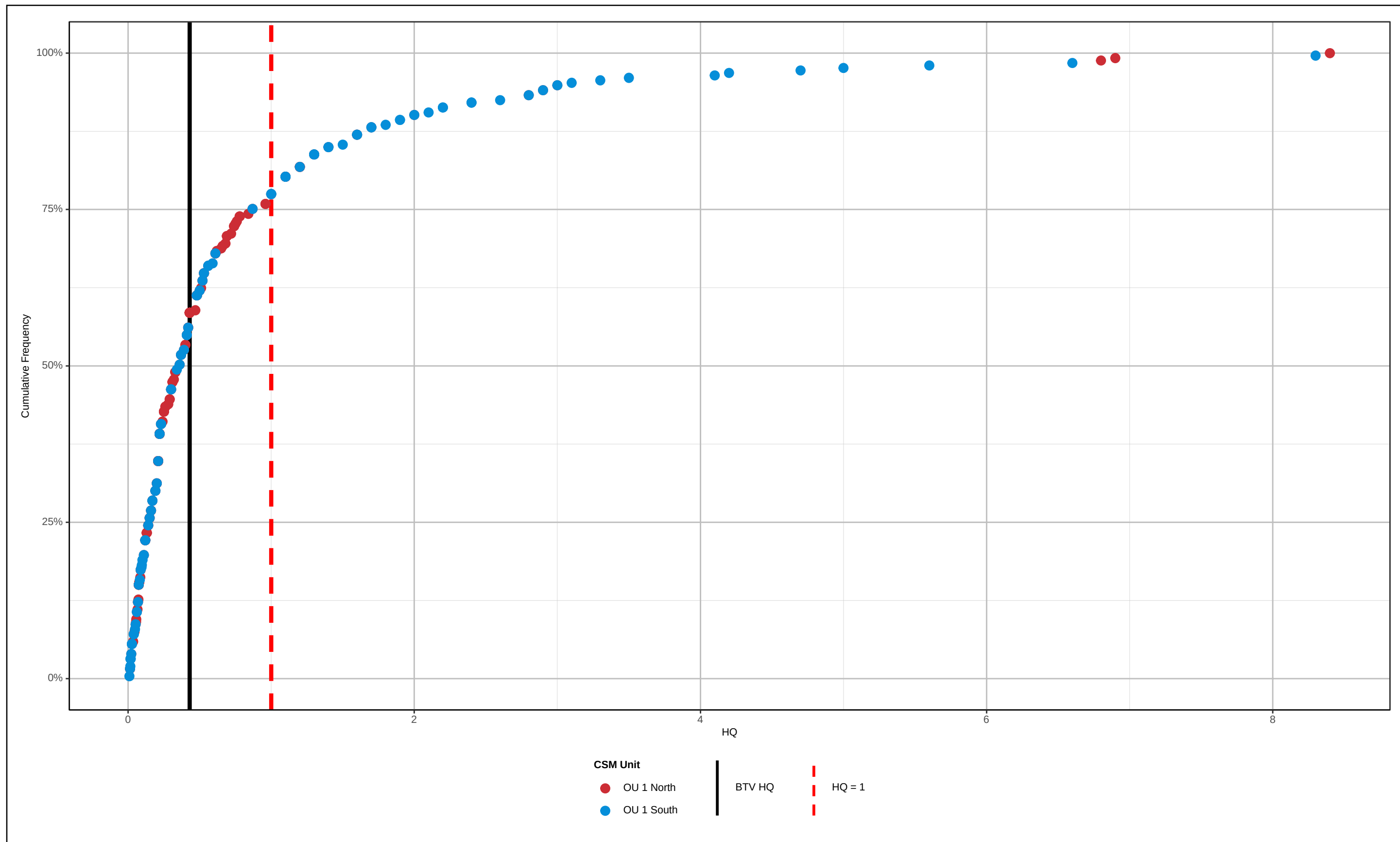


Figure M-19o. Cumulative Frequency of Mercury Dietary HQs for Longnose Dace in OU 1
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

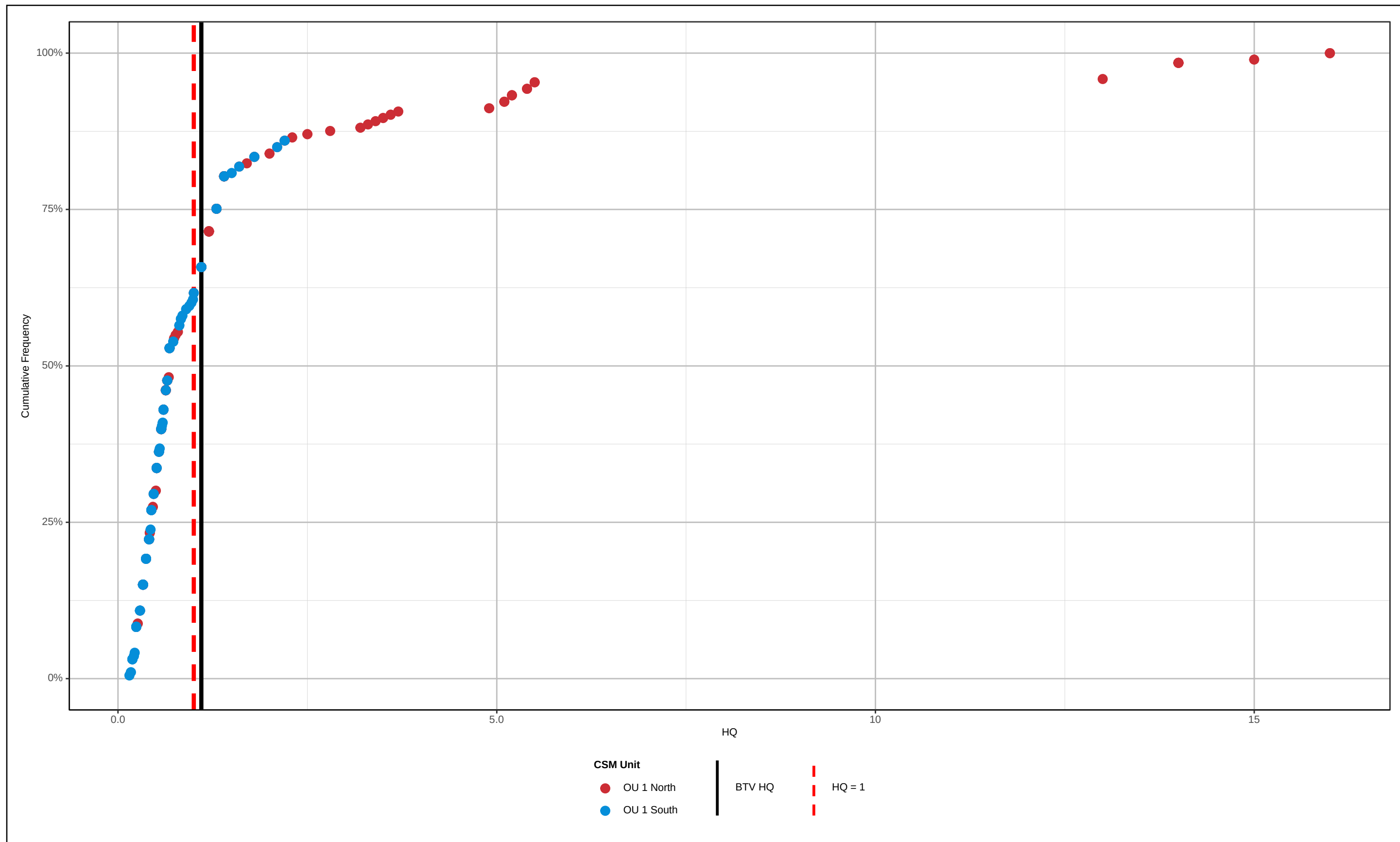


Figure M-19p. Cumulative Frequency of Selenium Dietary HQs for Longnose Dace in OU 1
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

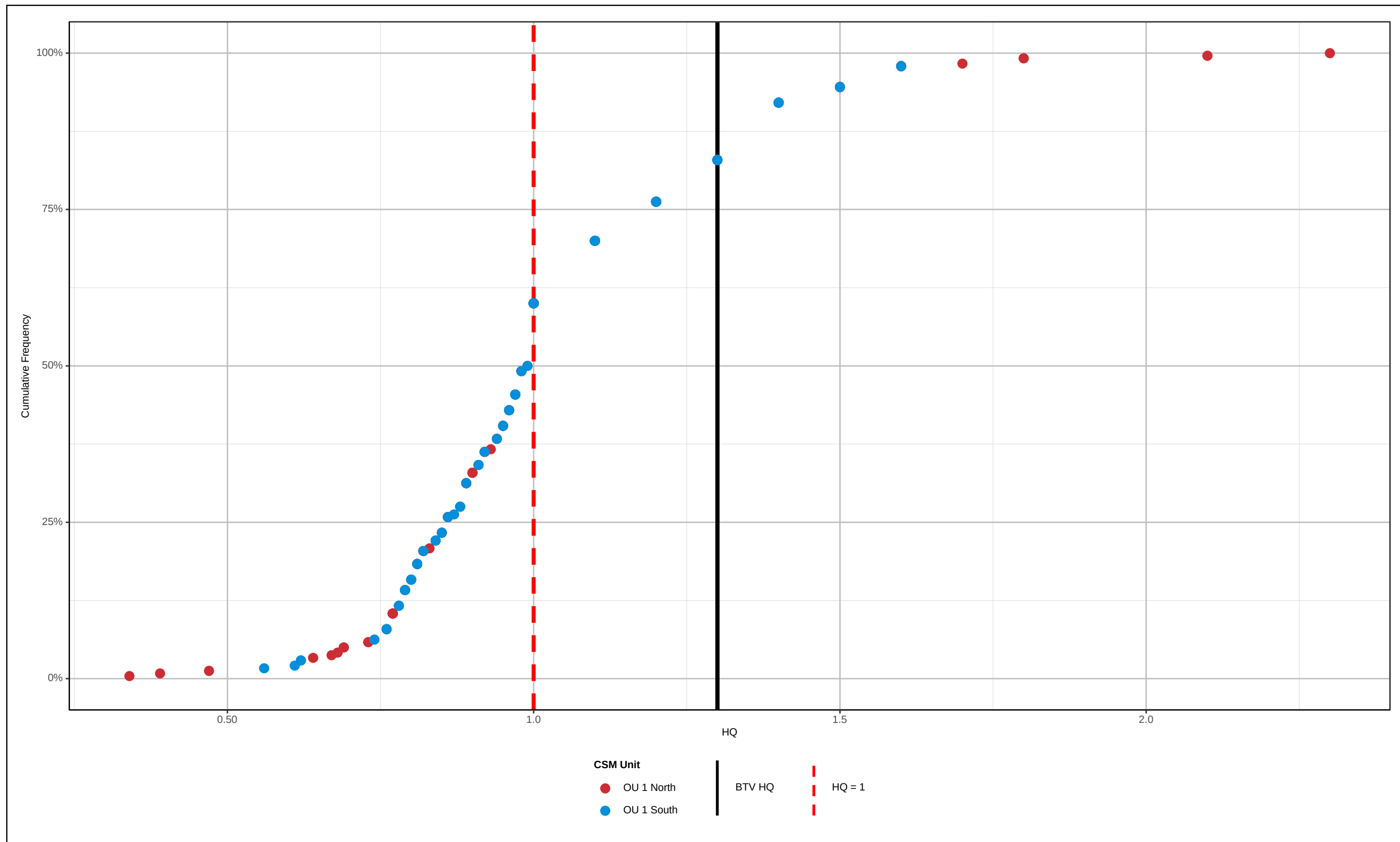


Figure M-19q. Cumulative Frequency of Vanadium Dietary HQs for Longnose Dace in OU 1
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

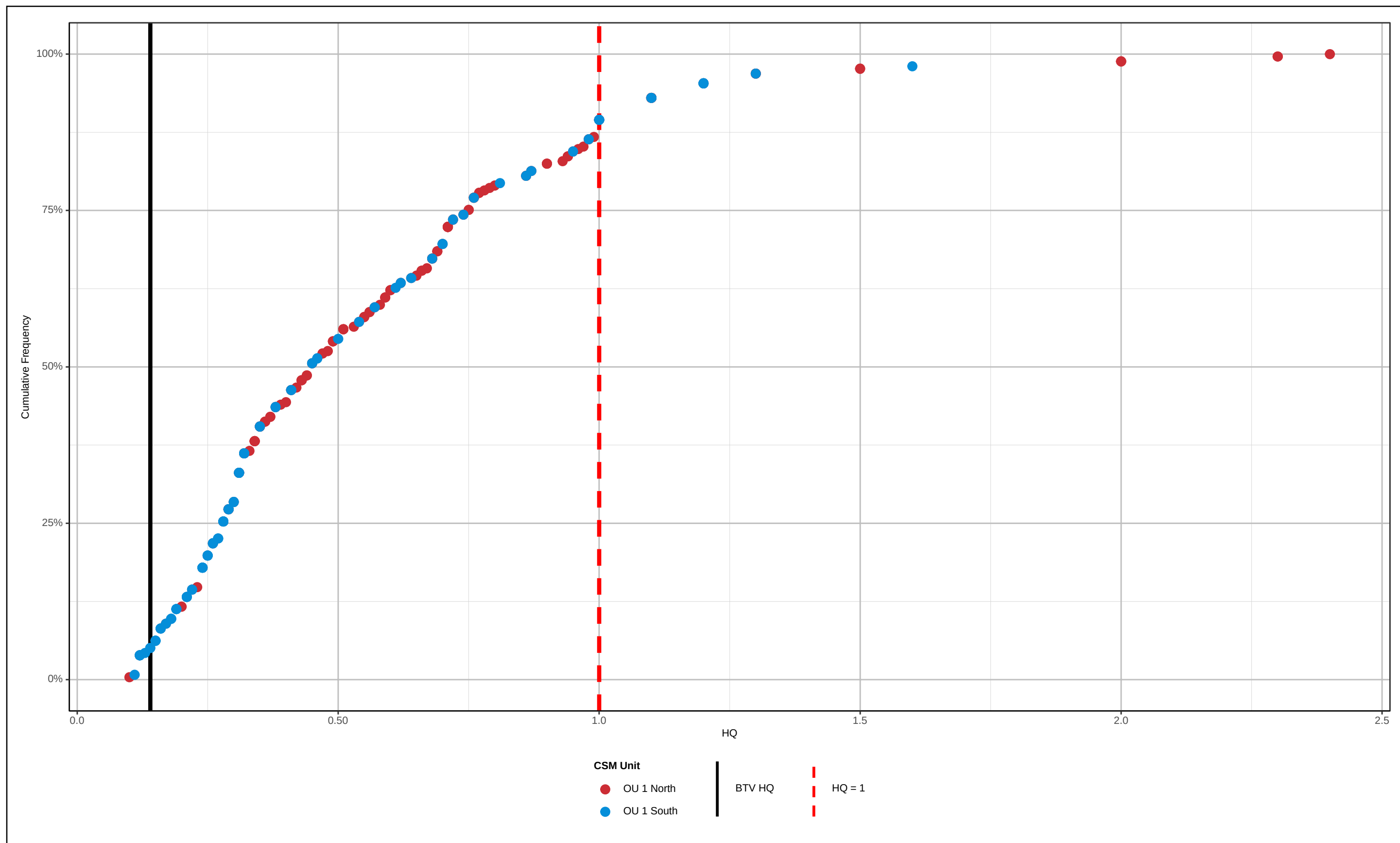


Figure M-19r. Cumulative Frequency of Zinc Dietary HQs for Longnose Dace in OU 1
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

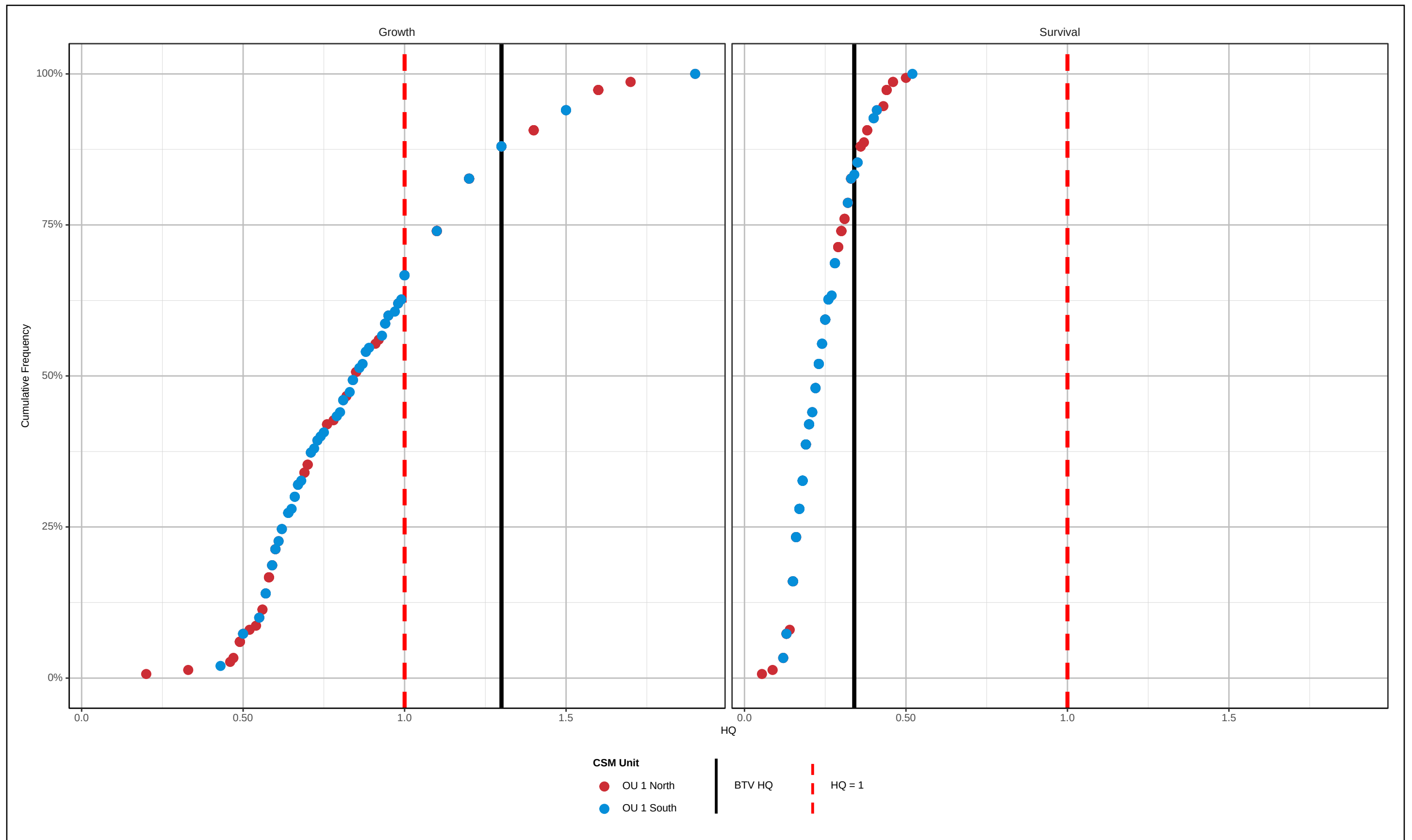


Figure M-20a. Cumulative Frequency of Aluminum Dietary HQs for Tundra Swan in OU 1
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

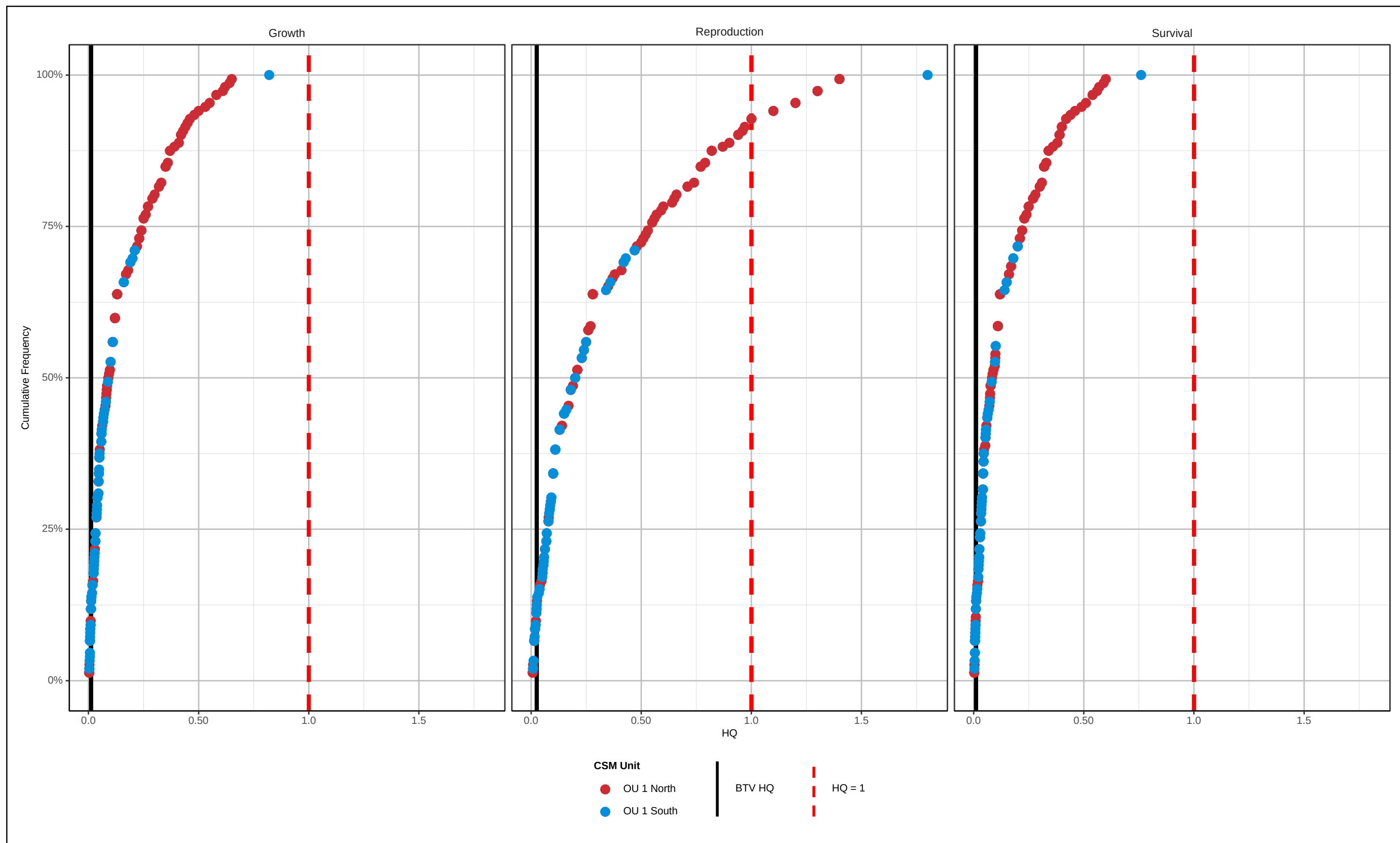
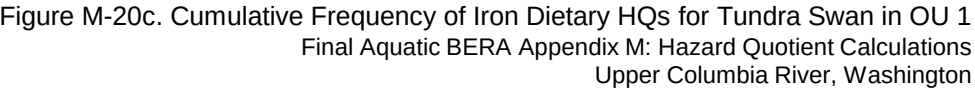


Figure M-20b. Cumulative Frequency of Copper Dietary HQs for Tundra Swan in OU 1
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington



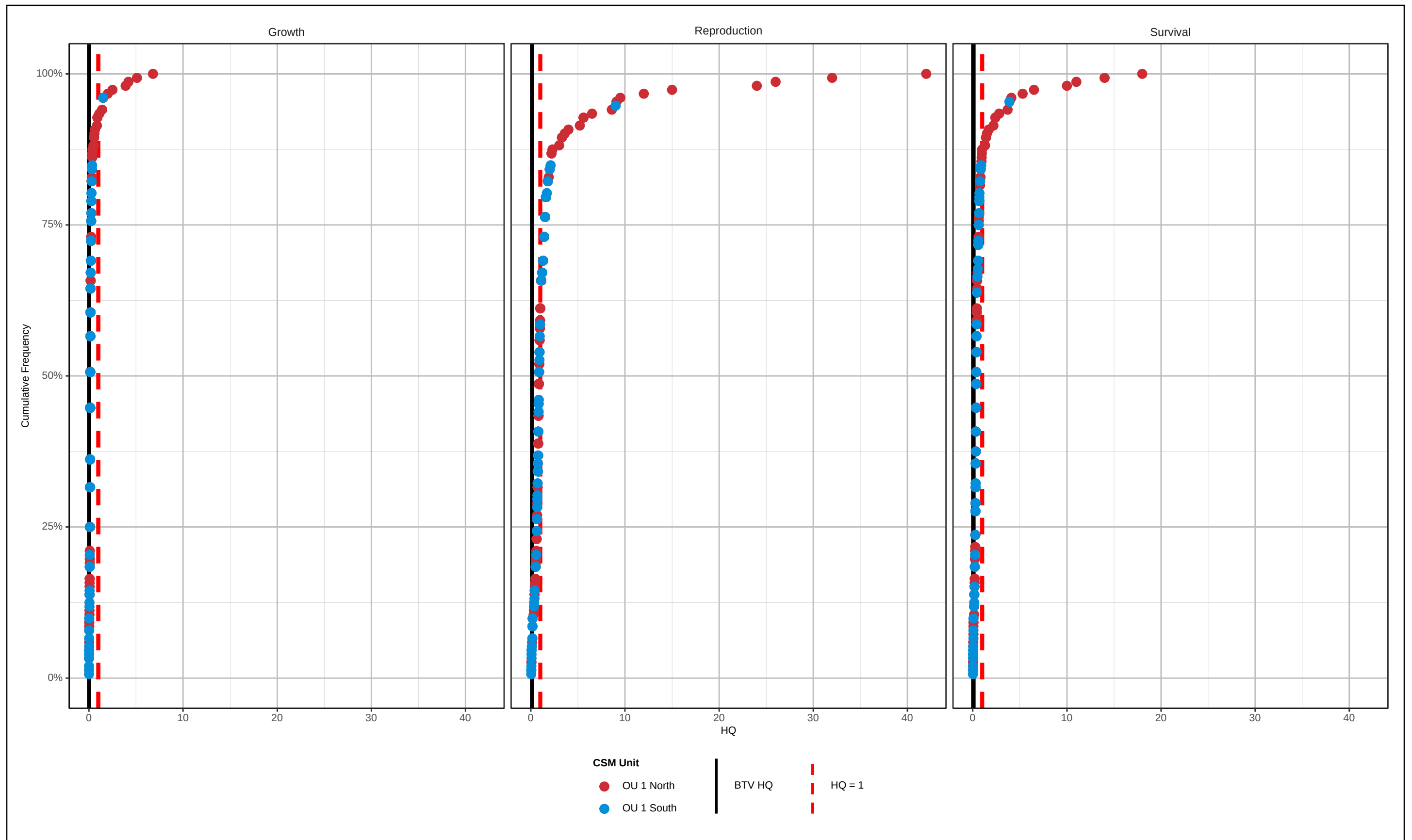


Figure M-20d. Cumulative Frequency of Lead Dietary HQs for Tundra Swan in OU 1
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

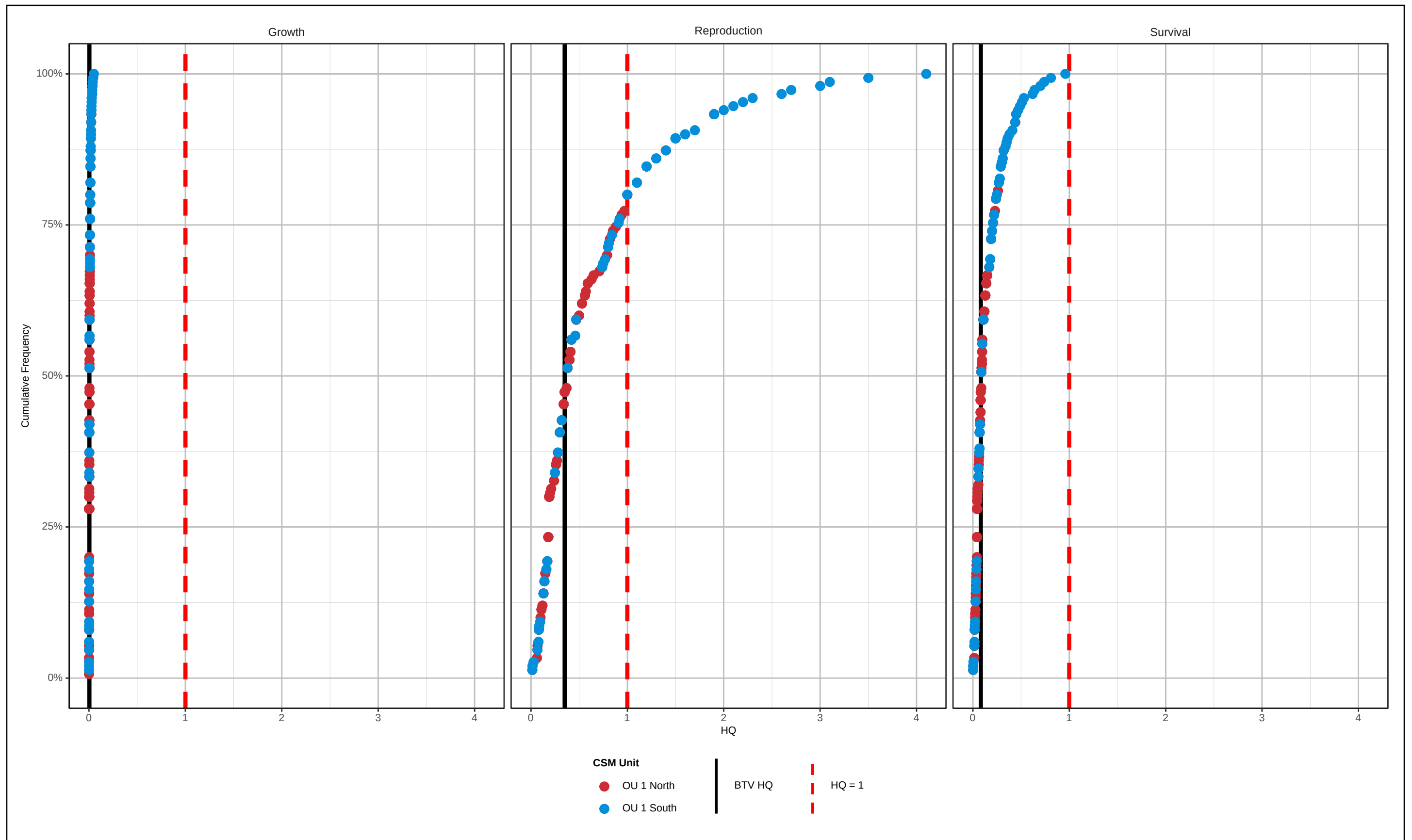


Figure M-20e. Cumulative Frequency of Mercury Dietary HQs for Tundra Swan in OU 1
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

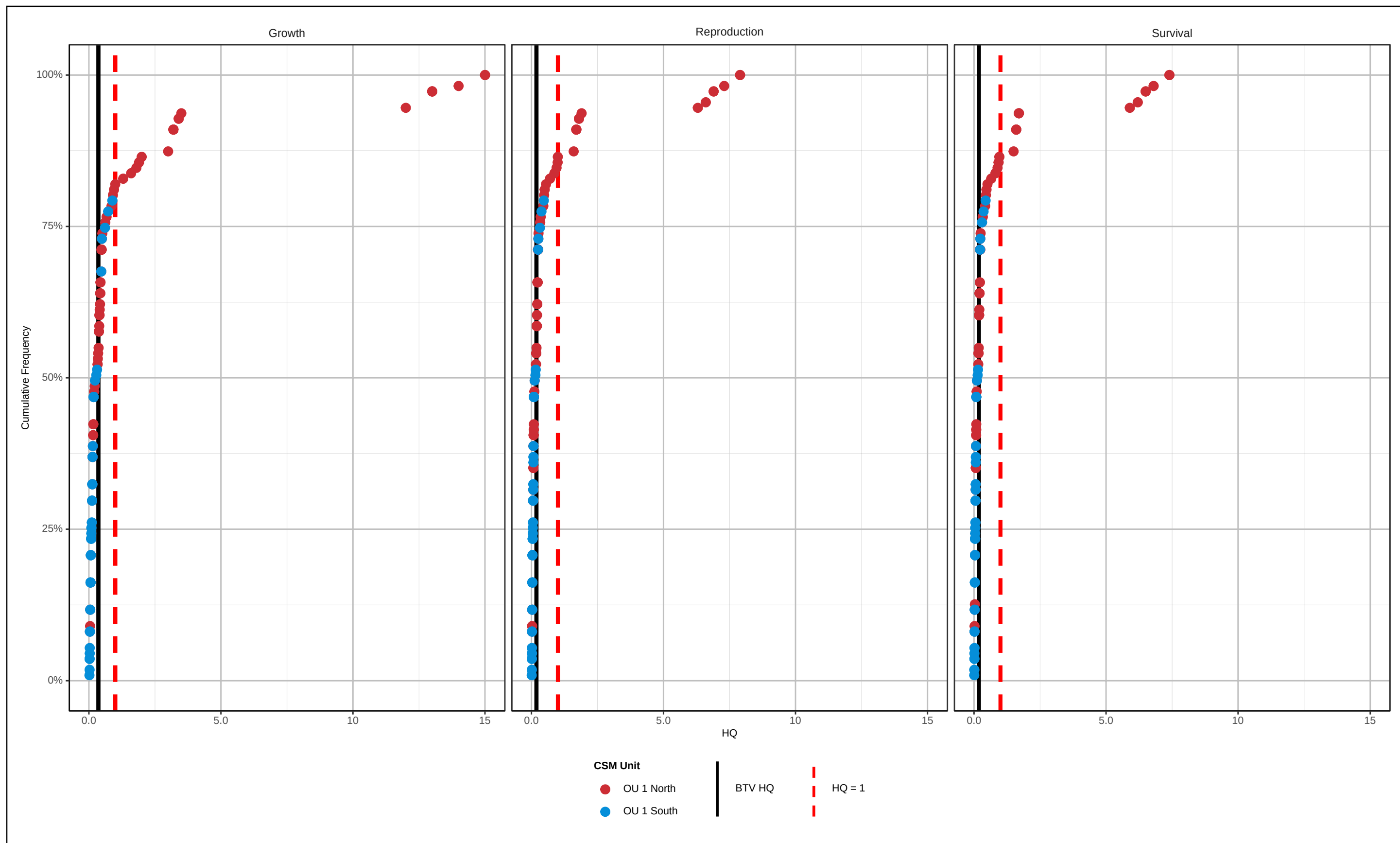


Figure M-20f. Cumulative Frequency of Selenium Dietary HQs for Tundra Swan in OU 1
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

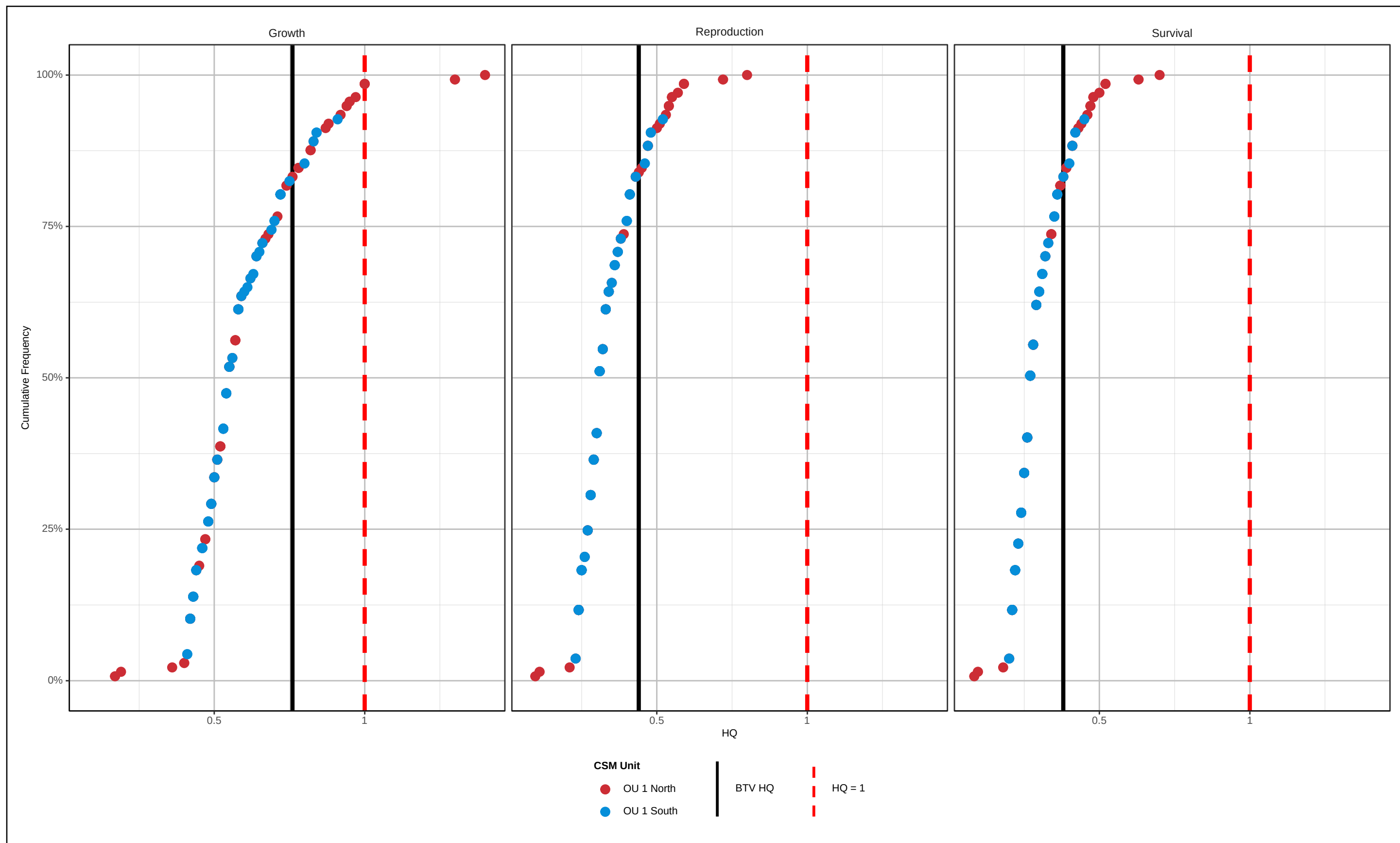


Figure M-20g. Cumulative Frequency of Vanadium Dietary HQs for Tundra Swan in OU 1
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

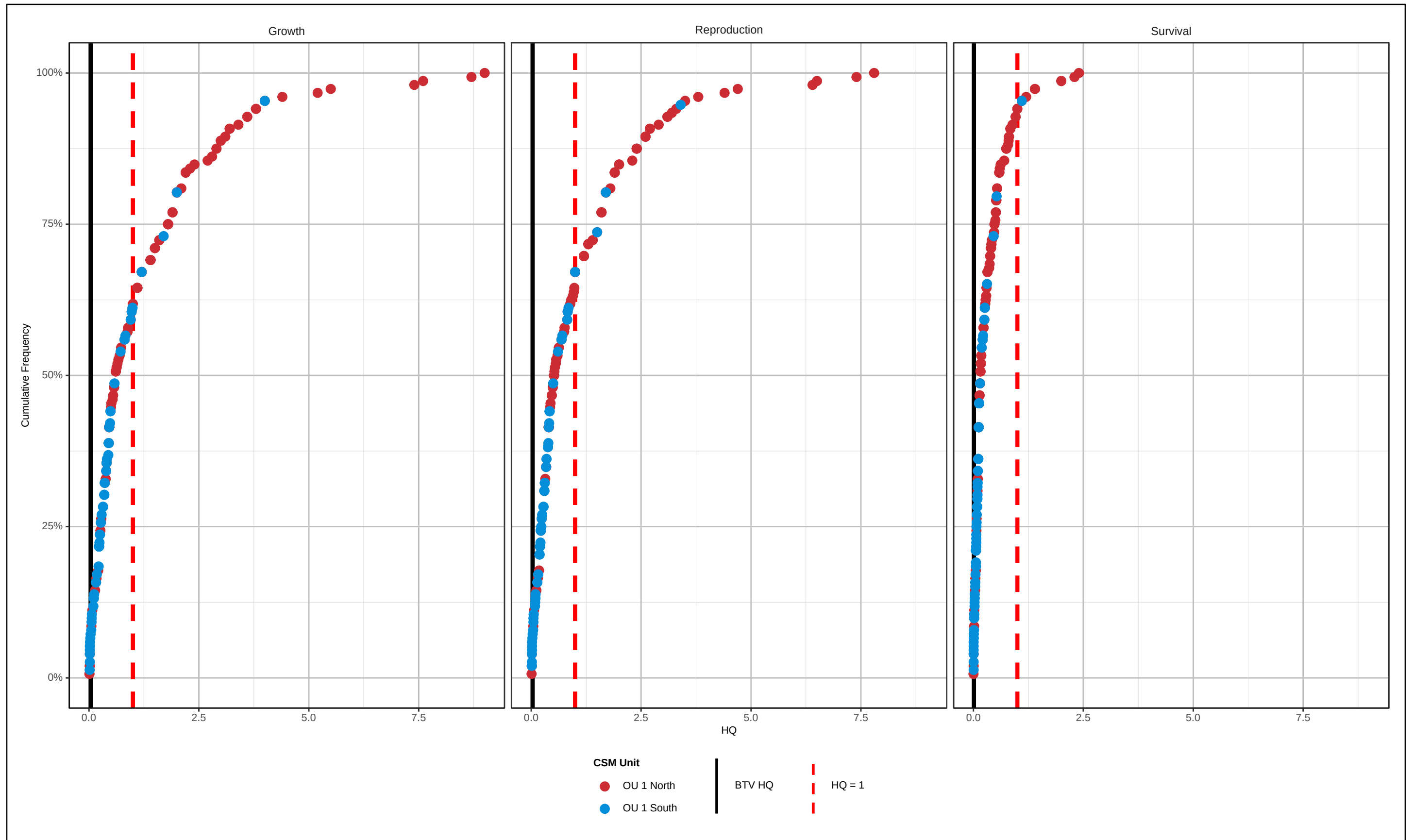


Figure M-20h. Cumulative Frequency of Zinc Dietary HQs for Tundra Swan in OU 1
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

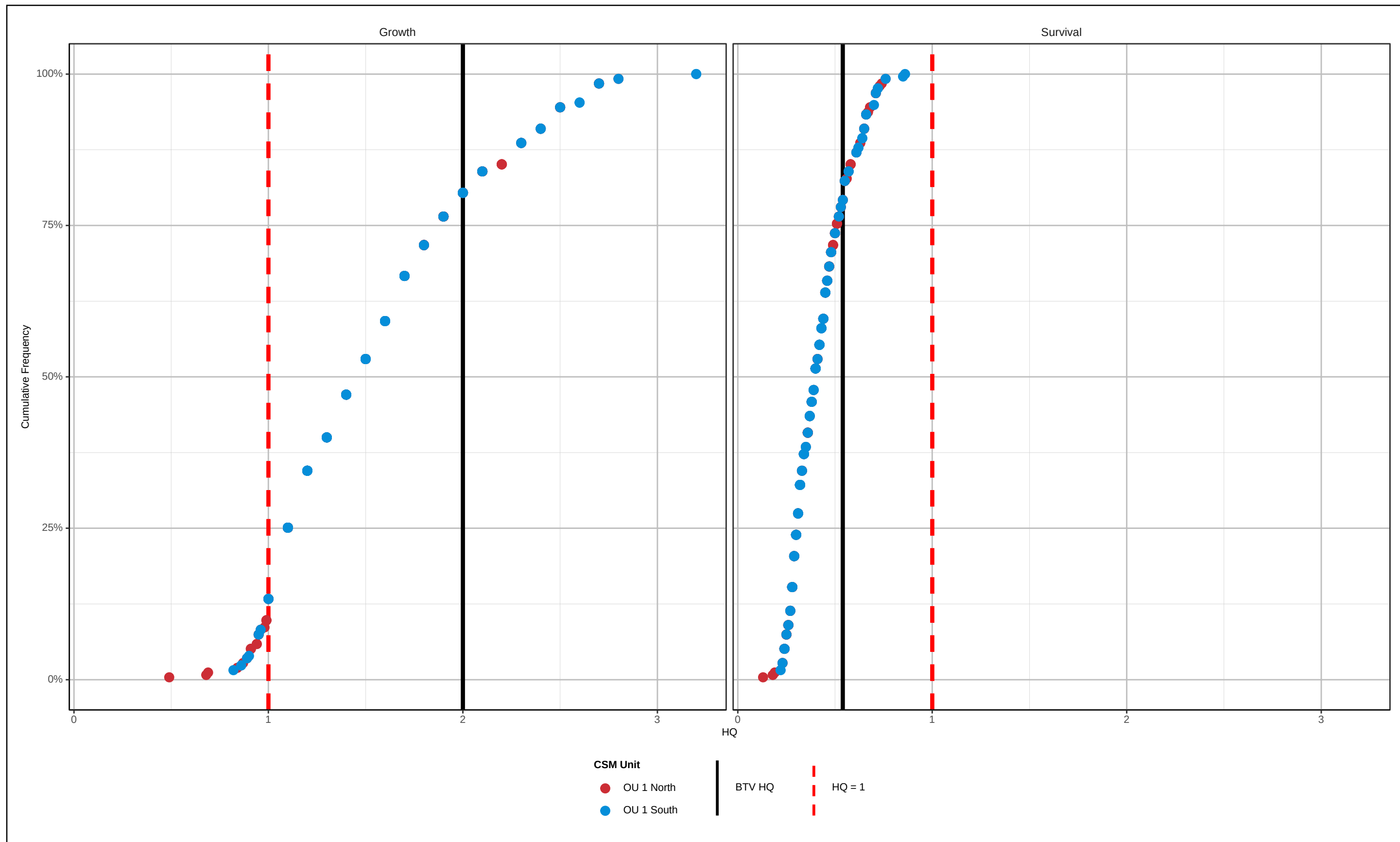


Figure M-20i. Cumulative Frequency of Aluminum Dietary HQs for Spotted Sandpiper in OU 1
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

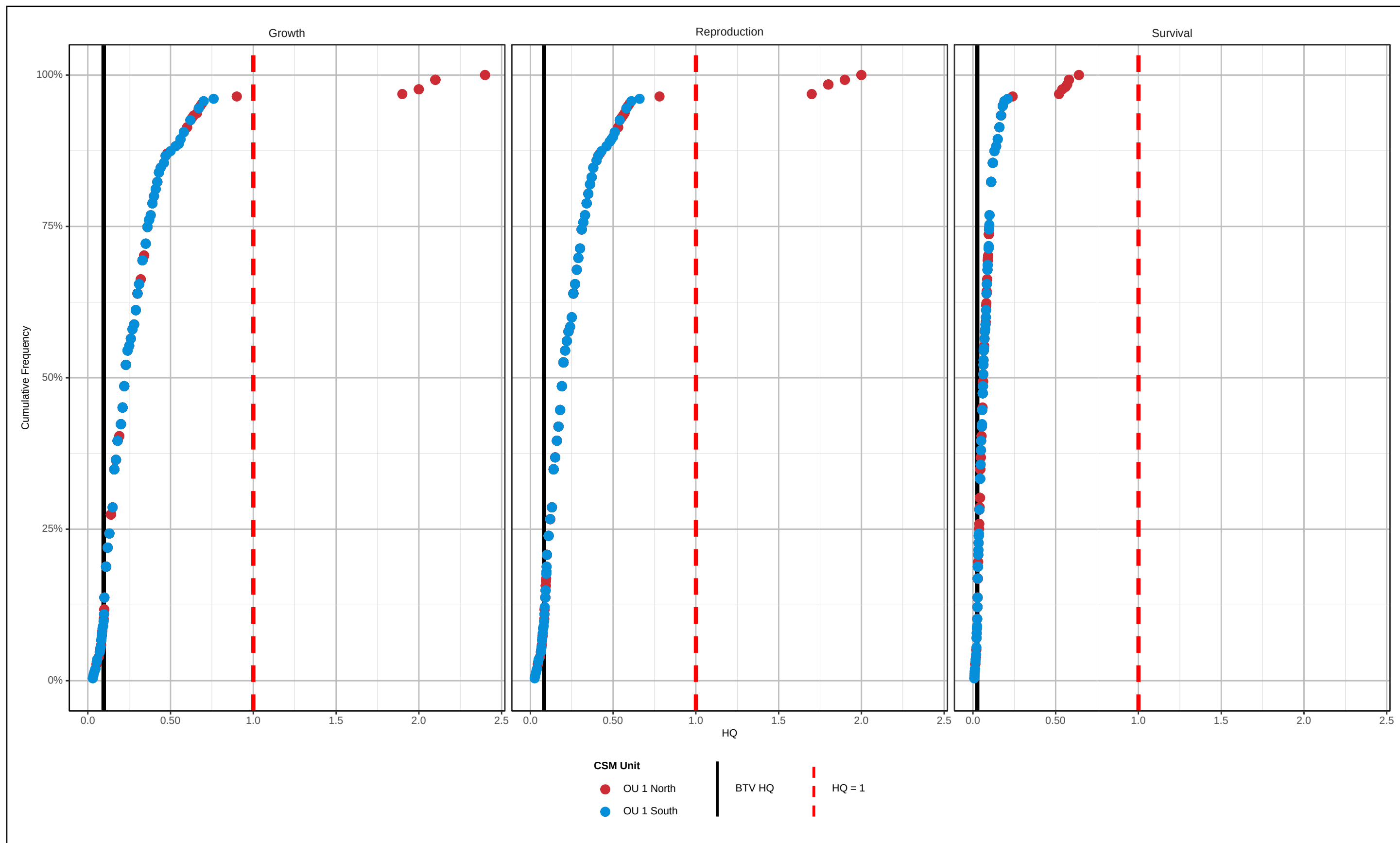


Figure M-20j. Cumulative Frequency of Cadmium Dietary HQs for Spotted Sandpiper in OU 1
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

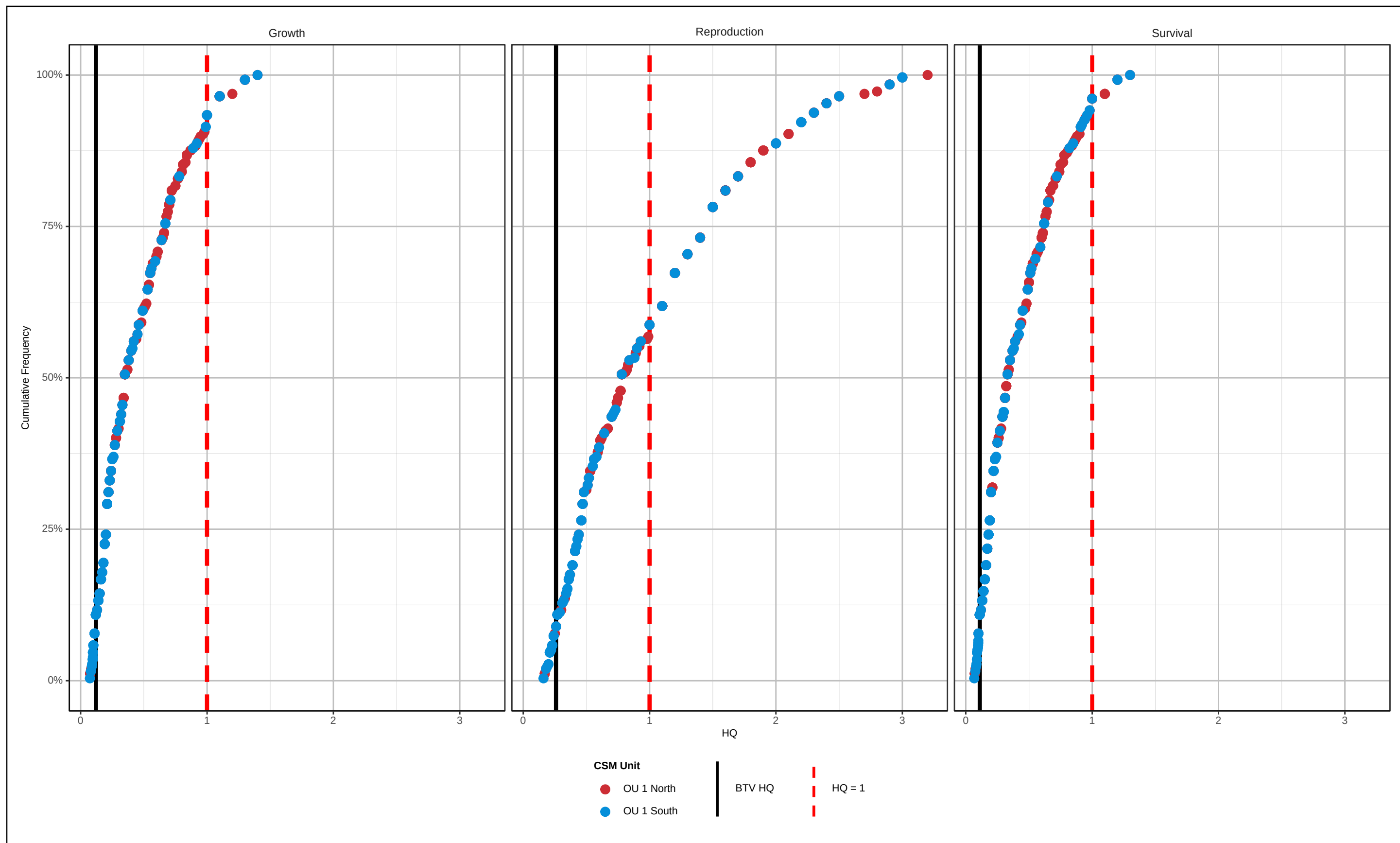


Figure M-20k. Cumulative Frequency of Copper Dietary HQs for Spotted Sandpiper in OU 1
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

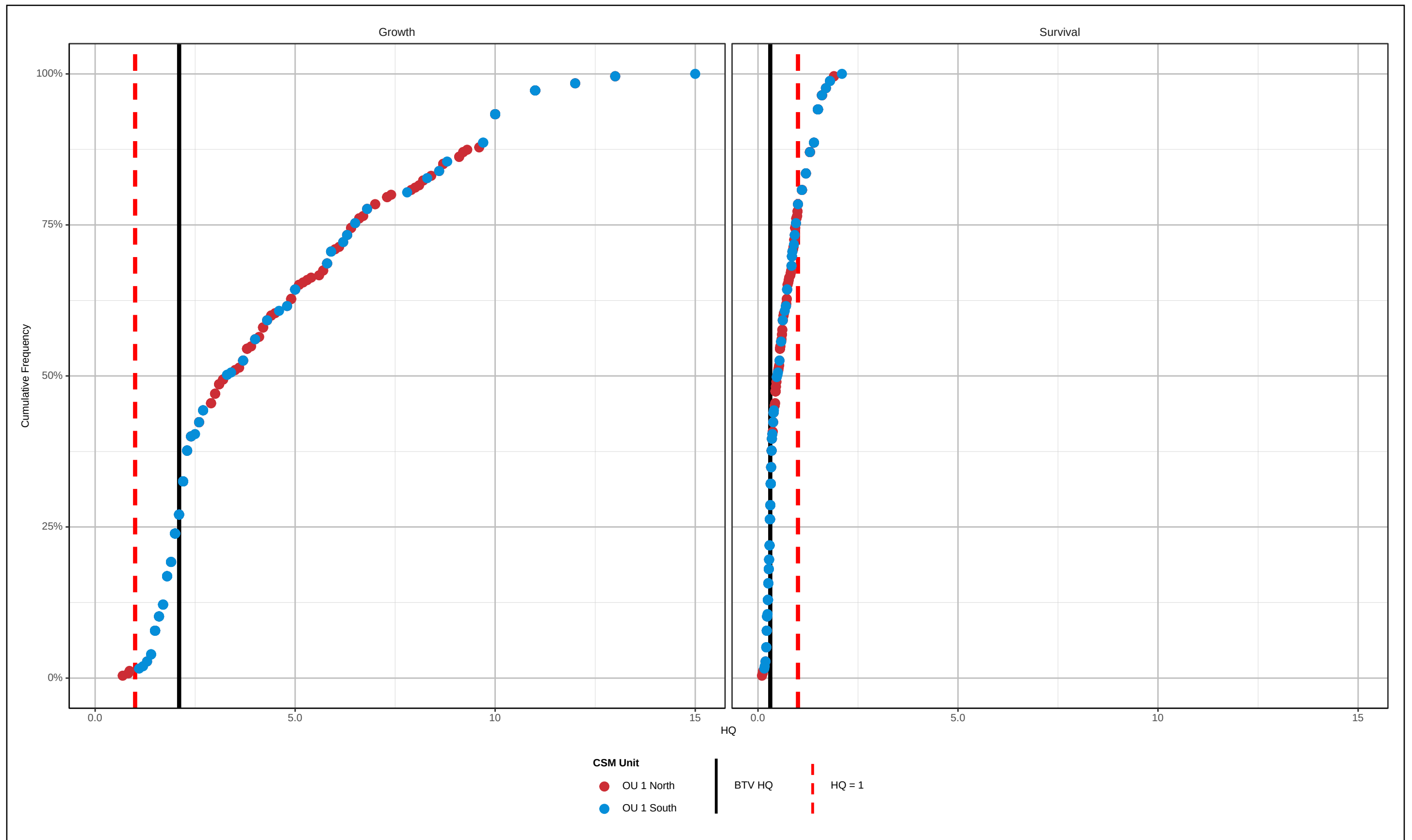


Figure M-20I. Cumulative Frequency of Iron Dietary HQs for Spotted Sandpiper in OU 1
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

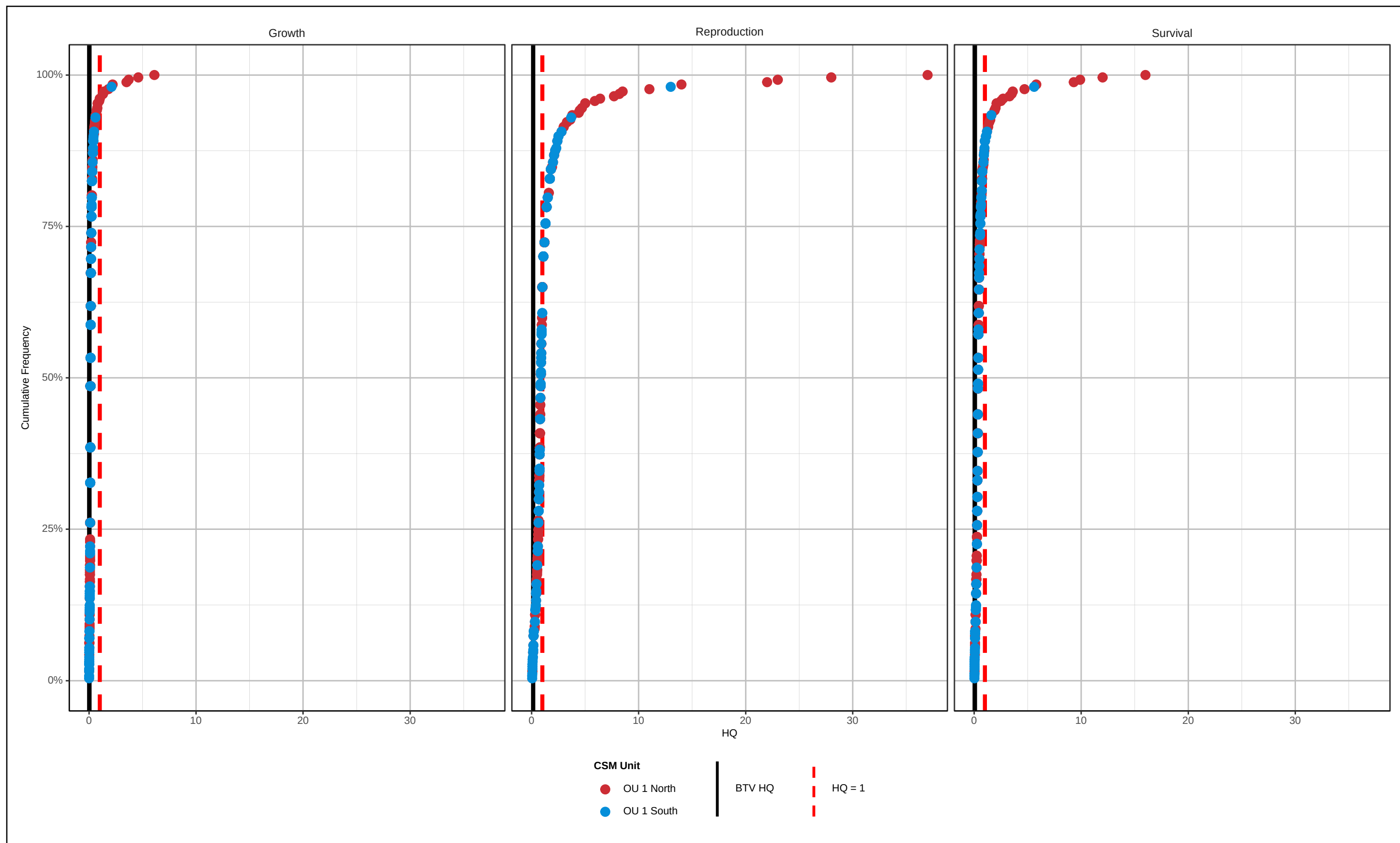


Figure M-20m. Cumulative Frequency of Lead Dietary HQs for Spotted Sandpiper in OU 1
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

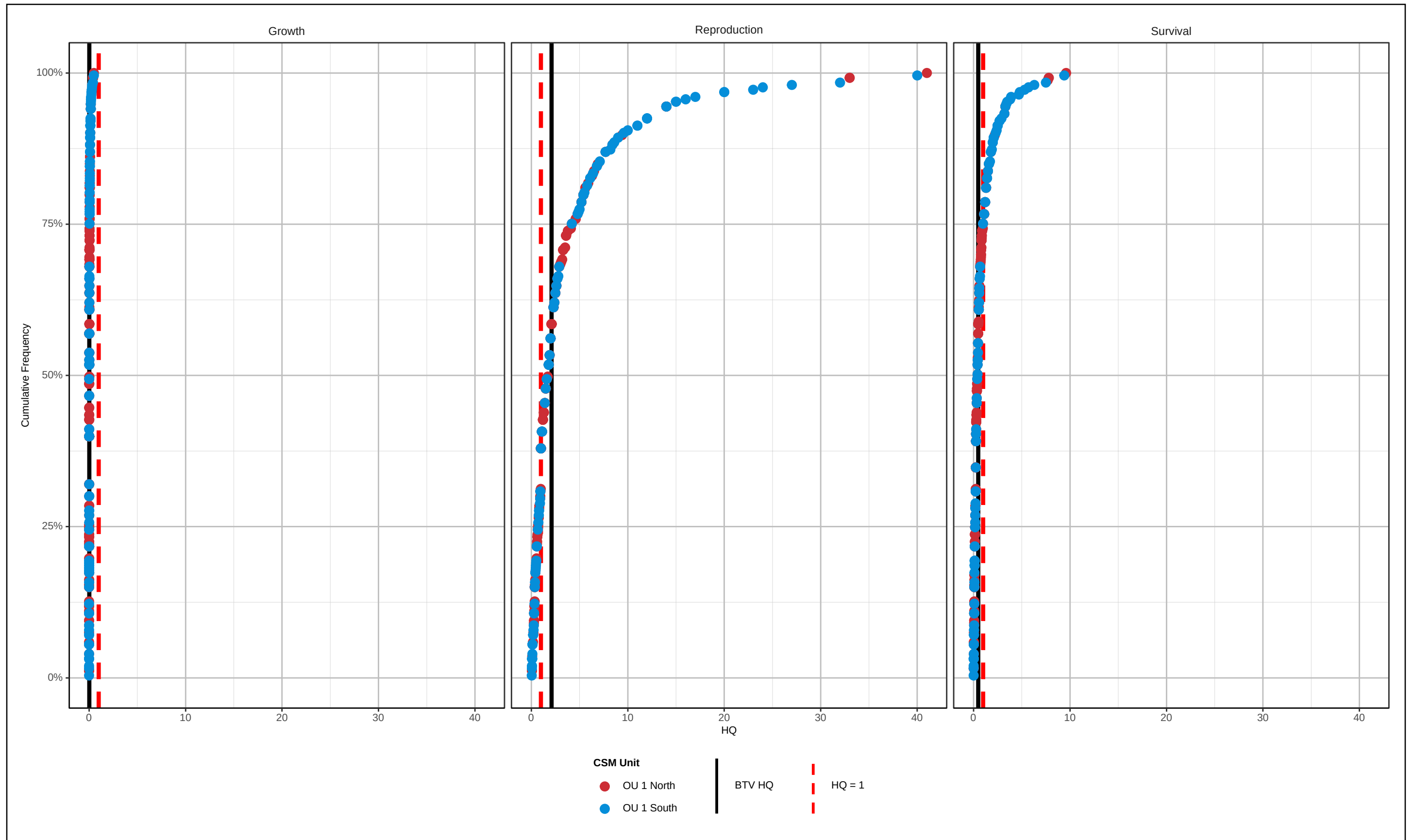


Figure M-20n. Cumulative Frequency of Mercury Dietary HQs for Spotted Sandpiper in OU 1
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

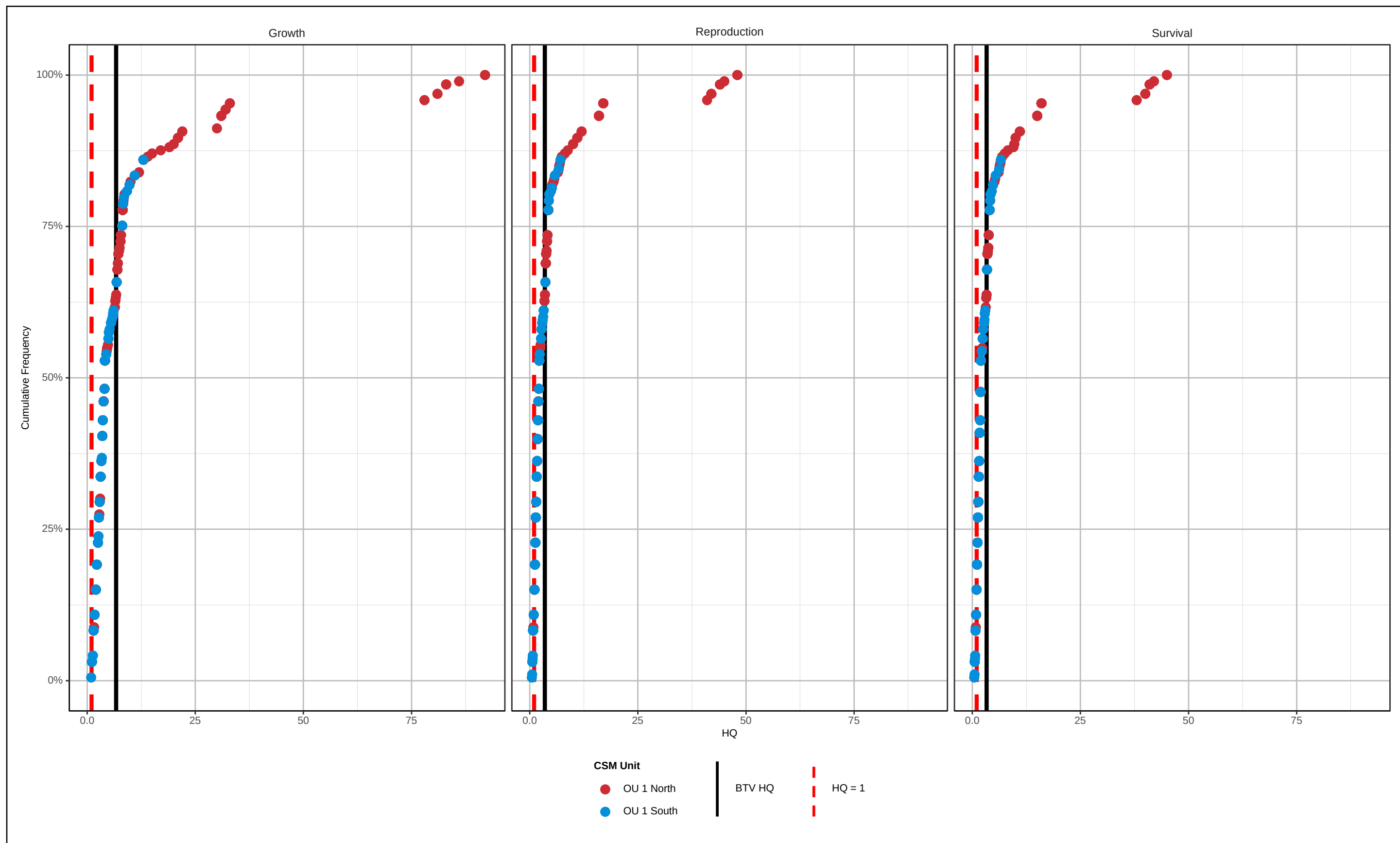


Figure M-20o. Cumulative Frequency of Selenium Dietary HQs for Spotted Sandpiper in OU 1
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

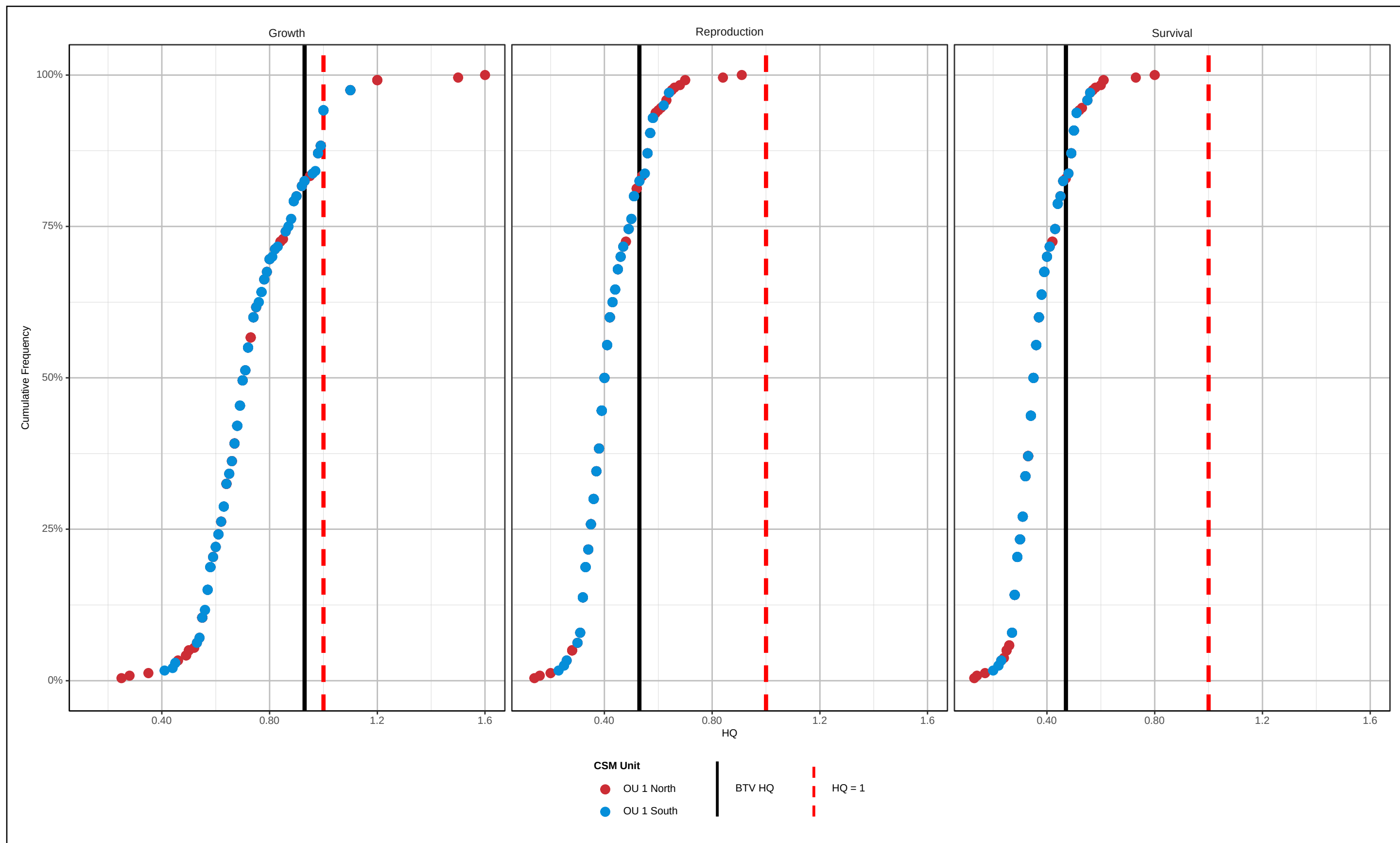


Figure M-20p. Cumulative Frequency of Vanadium Dietary HQs for Spotted Sandpiper in OU 1
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 Upper Columbia River, Washington

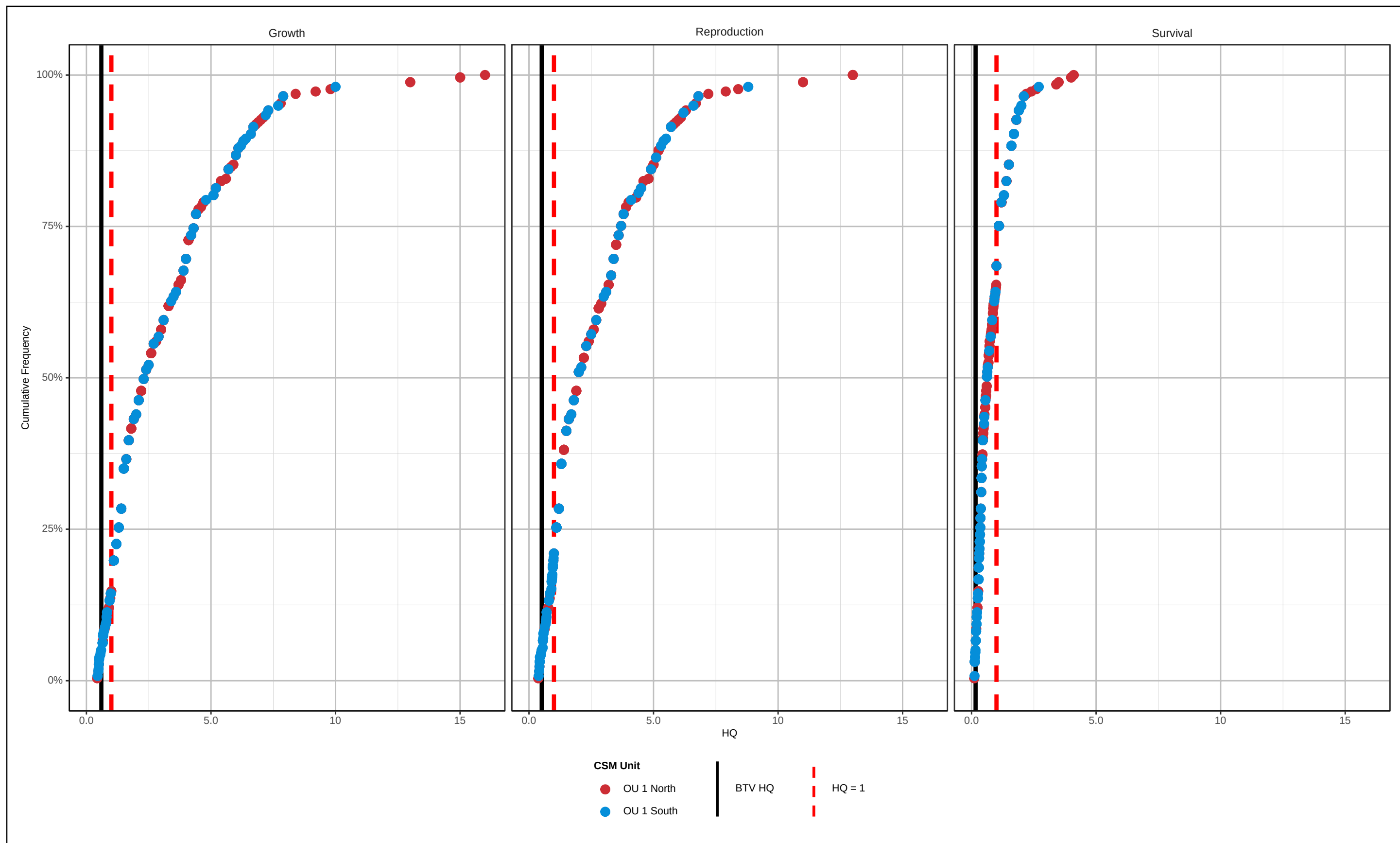


Figure M-20q. Cumulative Frequency of Zinc Dietary HQs for Spotted Sandpiper in OU 1
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

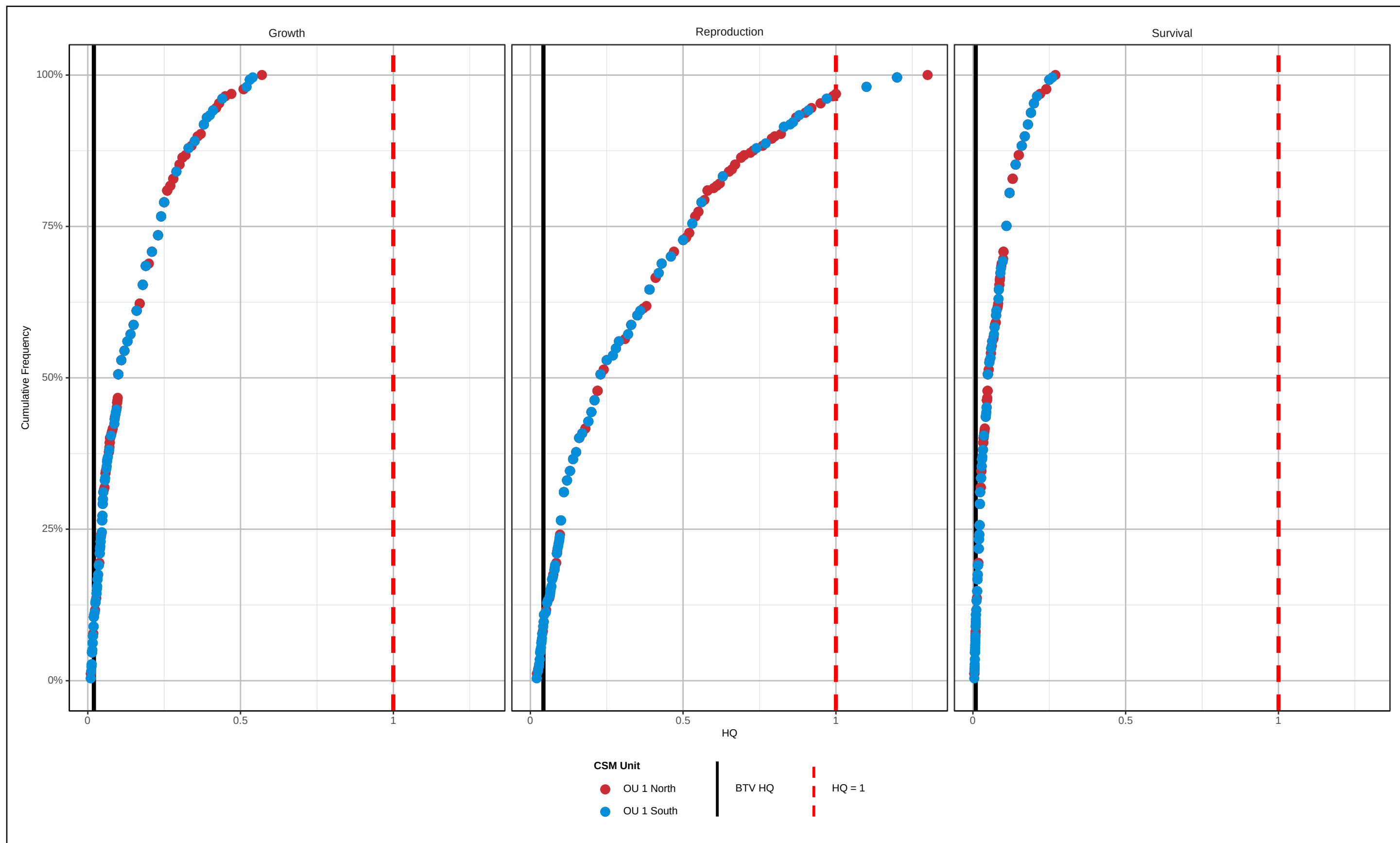


Figure M-20r. Cumulative Frequency of Copper Dietary HQs for Mallard in OU 1
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

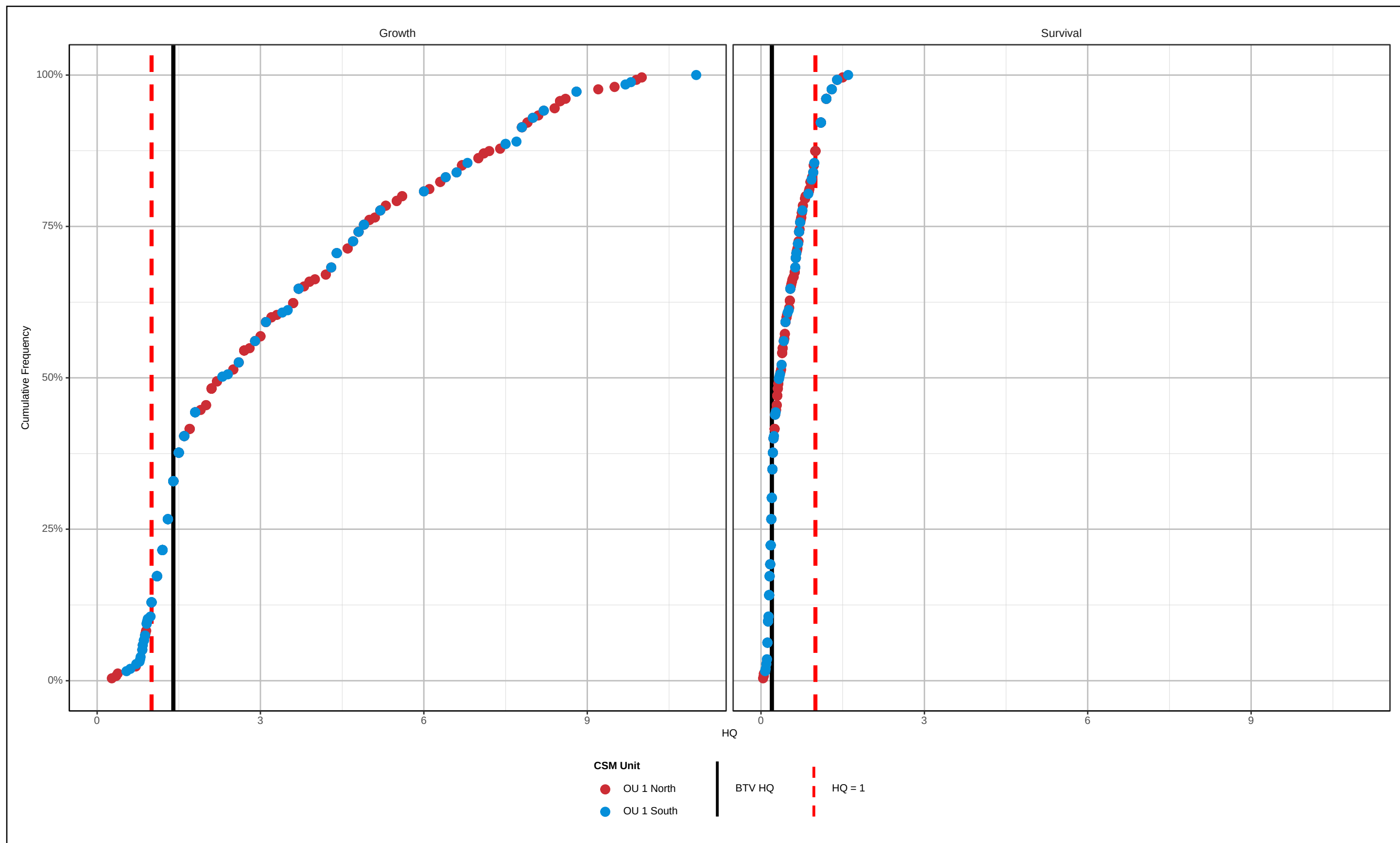


Figure M-20s. Cumulative Frequency of Iron Dietary HQs for Mallard in OU 1
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

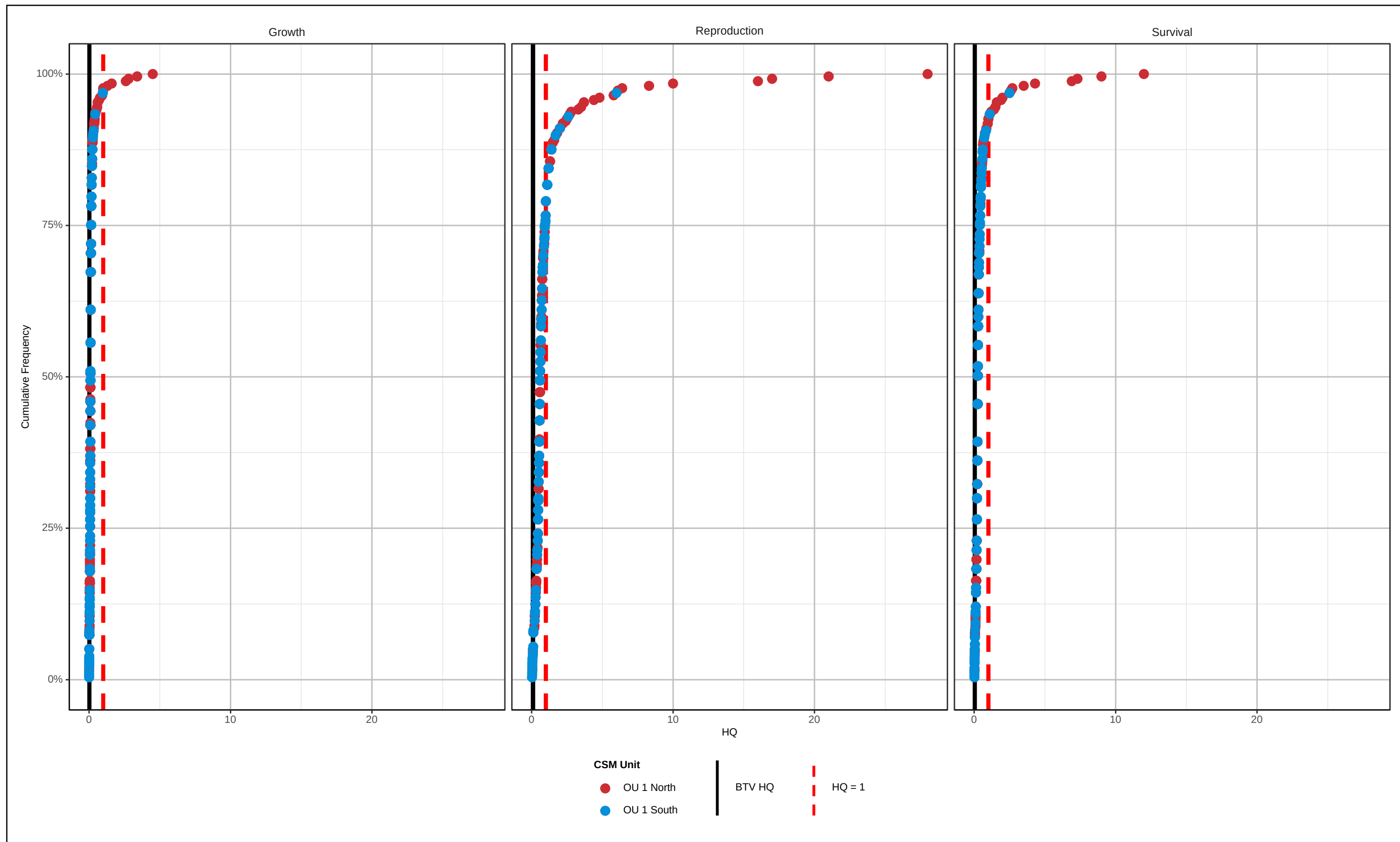


Figure M-20t. Cumulative Frequency of Lead Dietary HQs for Mallard in OU 1
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

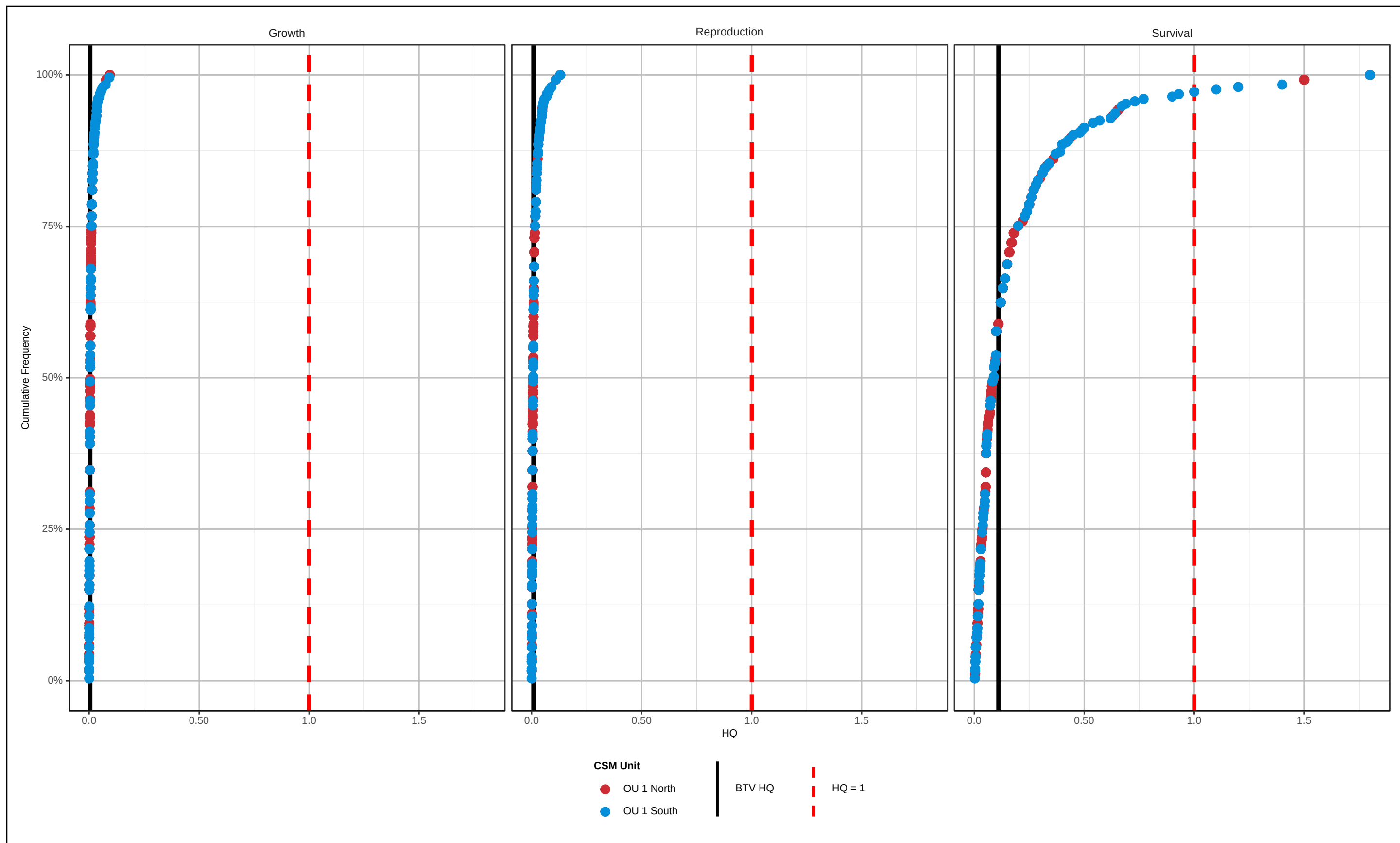


Figure M-20u. Cumulative Frequency of Mercury Dietary HQs for Mallard in OU 1
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

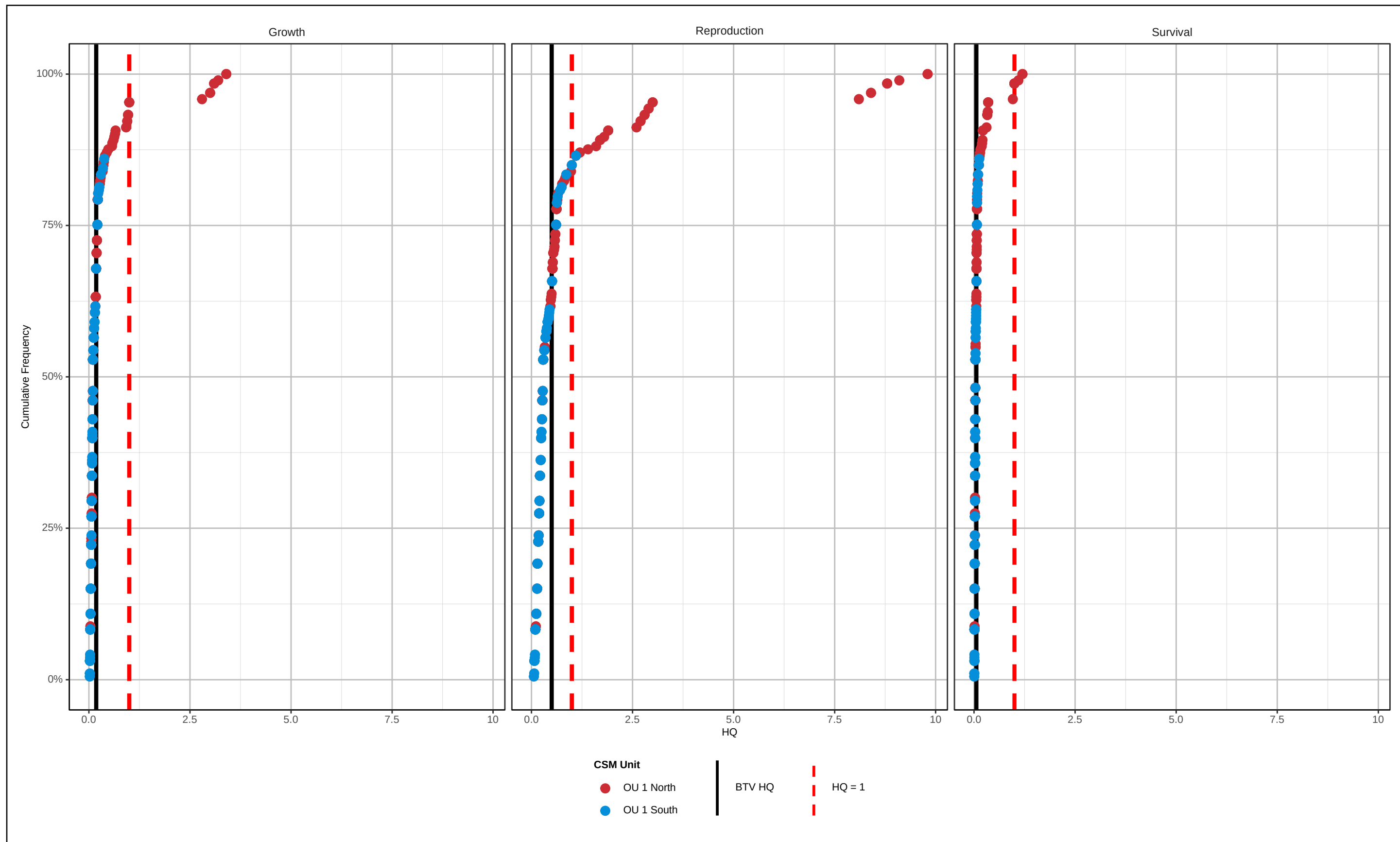


Figure M-20v. Cumulative Frequency of Selenium Dietary HQs for Mallard in OU 1
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 Upper Columbia River, Washington

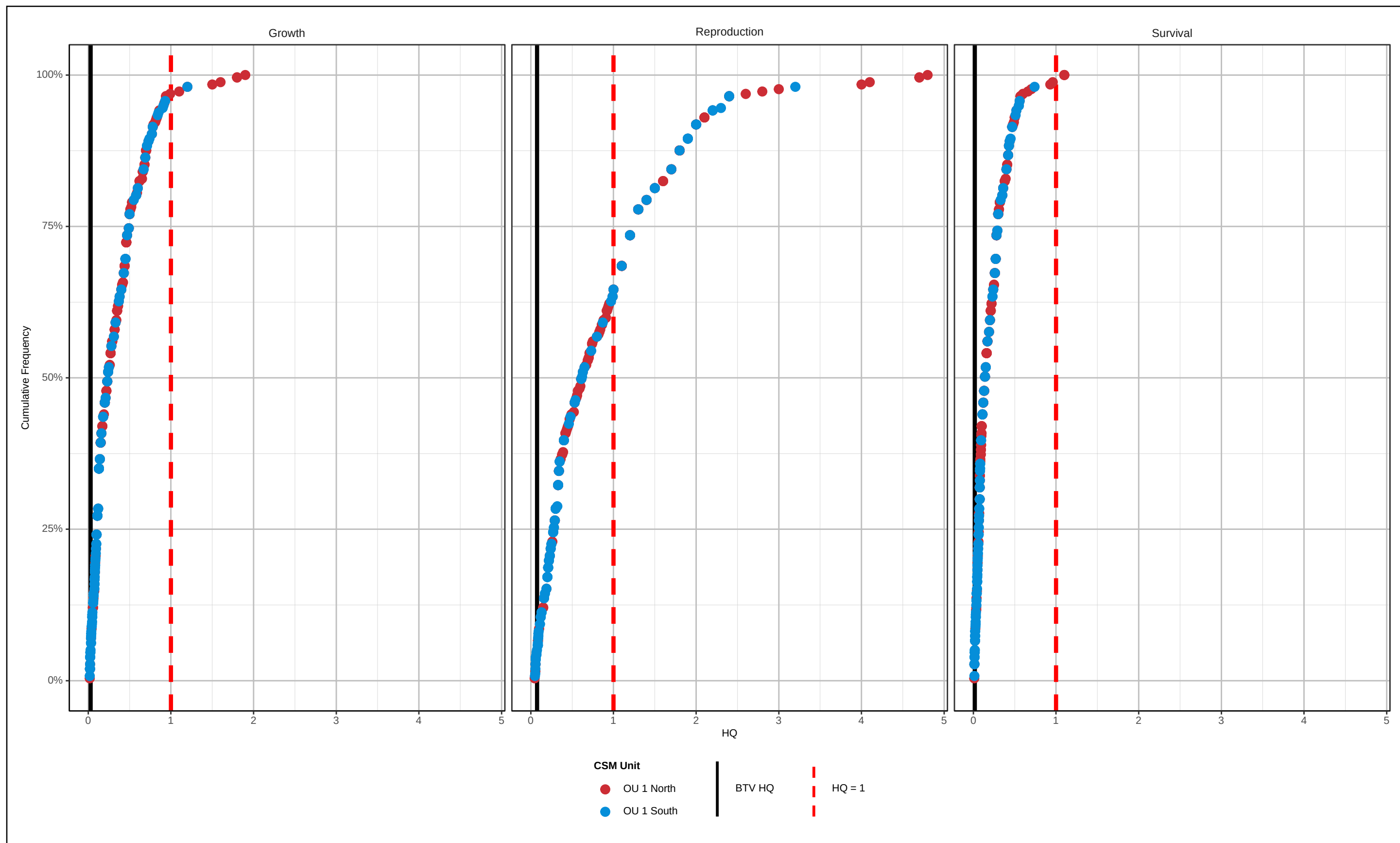


Figure M-20w. Cumulative Frequency of Zinc Dietary HQs for Mallard in OU 1
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

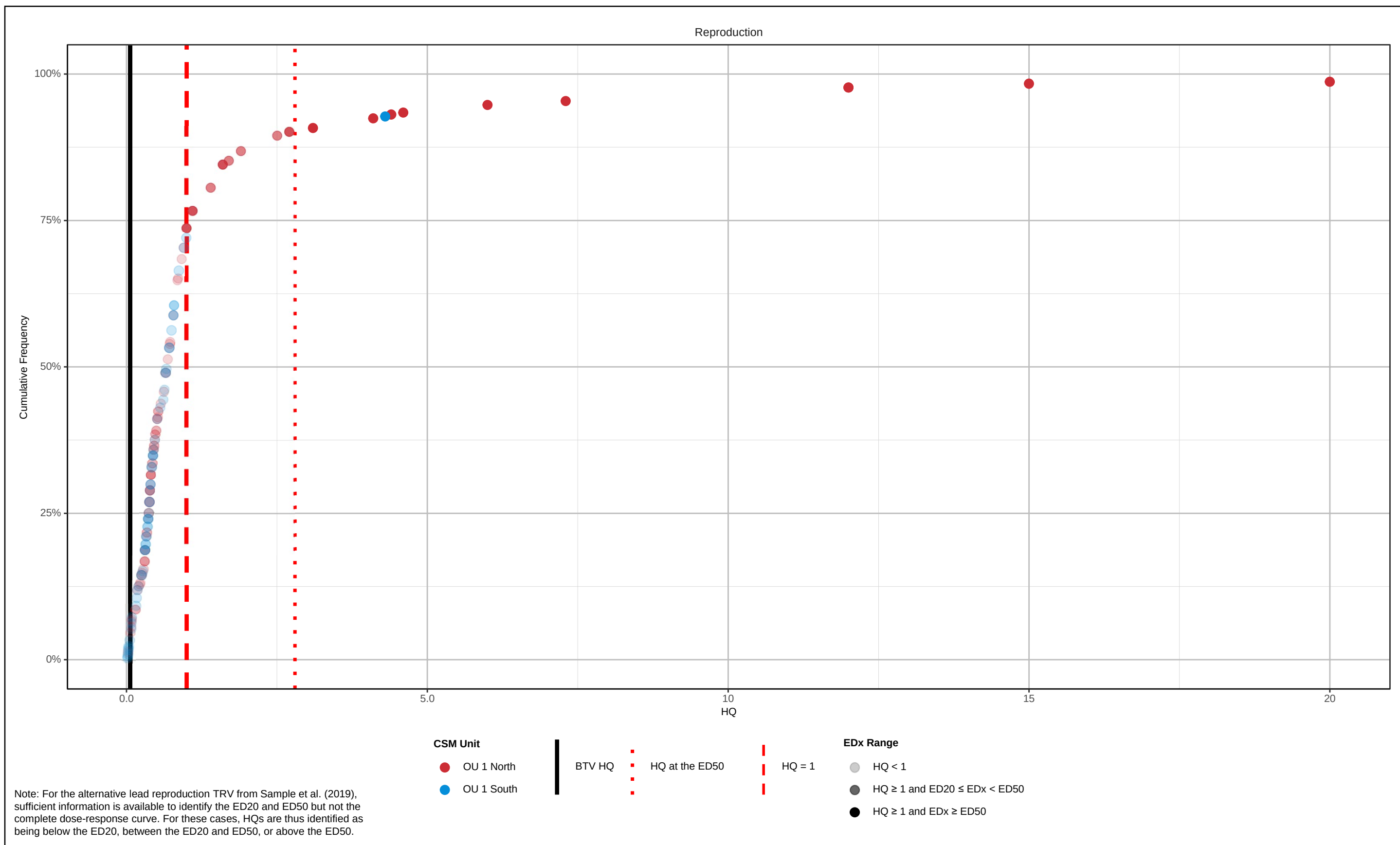


Figure M-20x. Cumulative Frequency of Alternative Lead Reproduction Dietary HQs for Tundra Swan in OU 1
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

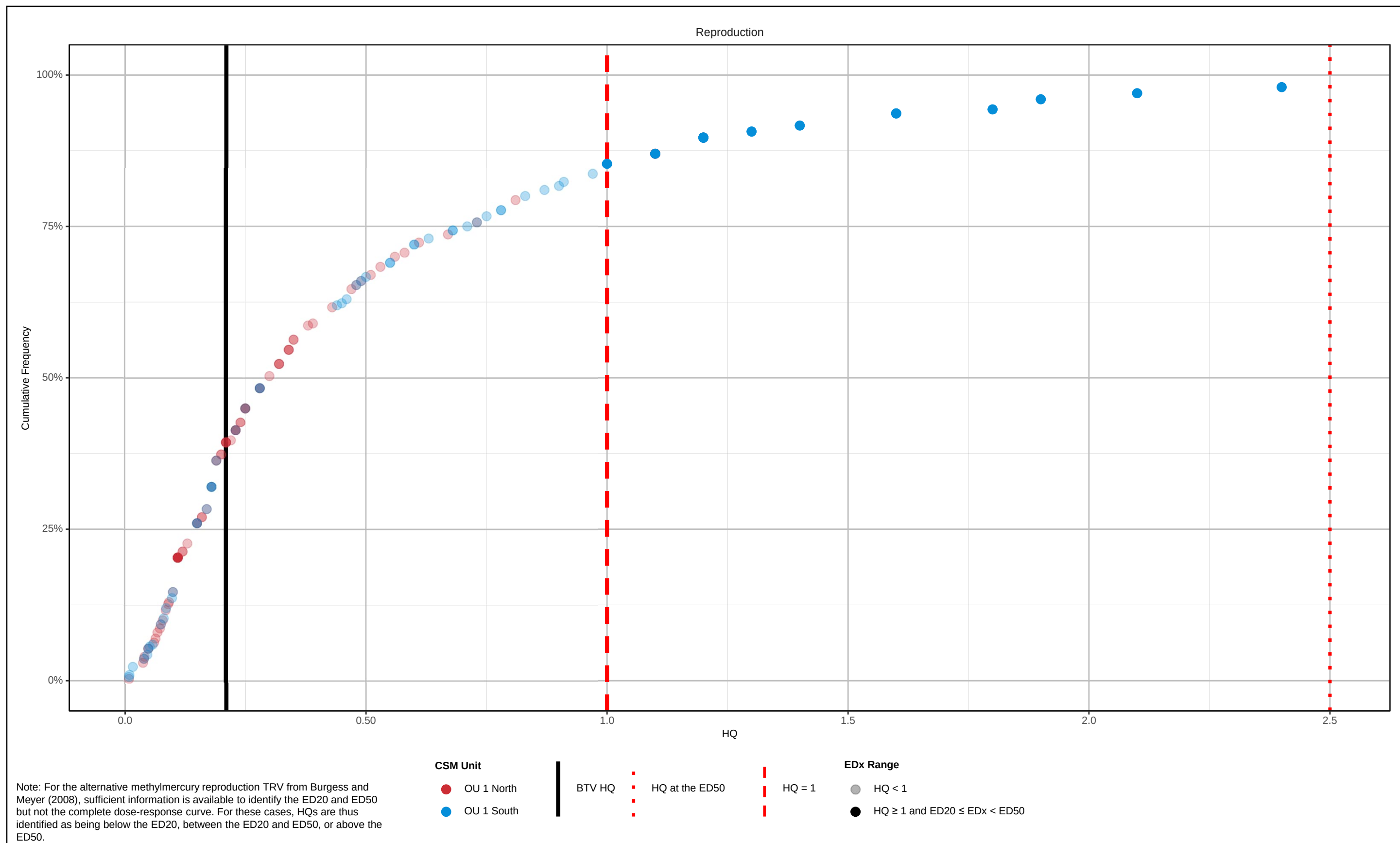


Figure M-20y. Cumulative Frequency of Alternative Mercury Reproduction Dietary HQs for Tundra Swan in OU 1
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

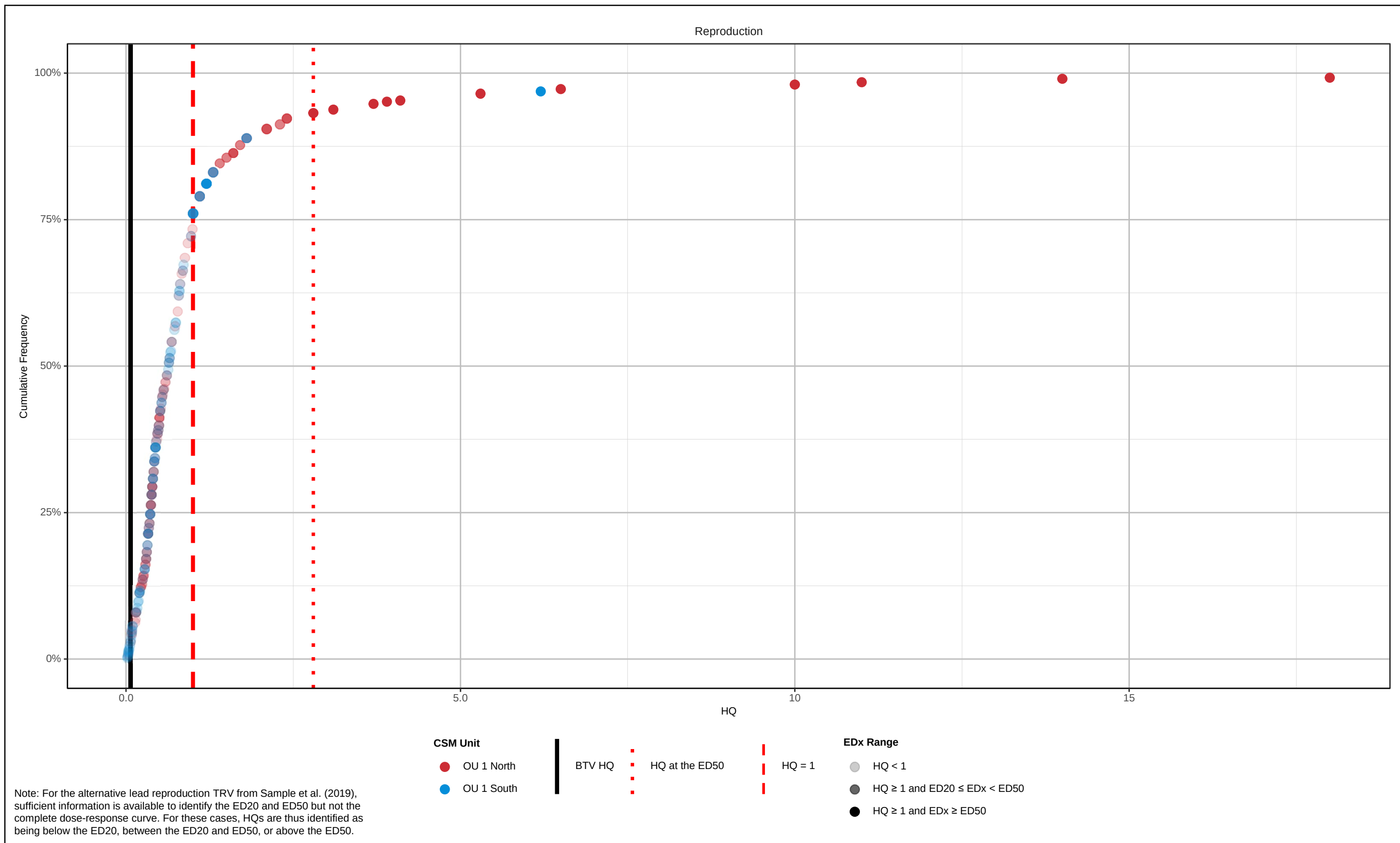


Figure M-20z. Cumulative Frequency of Alternative Lead Reproduction Dietary HQs for Spotted Sandpiper in OU 1
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

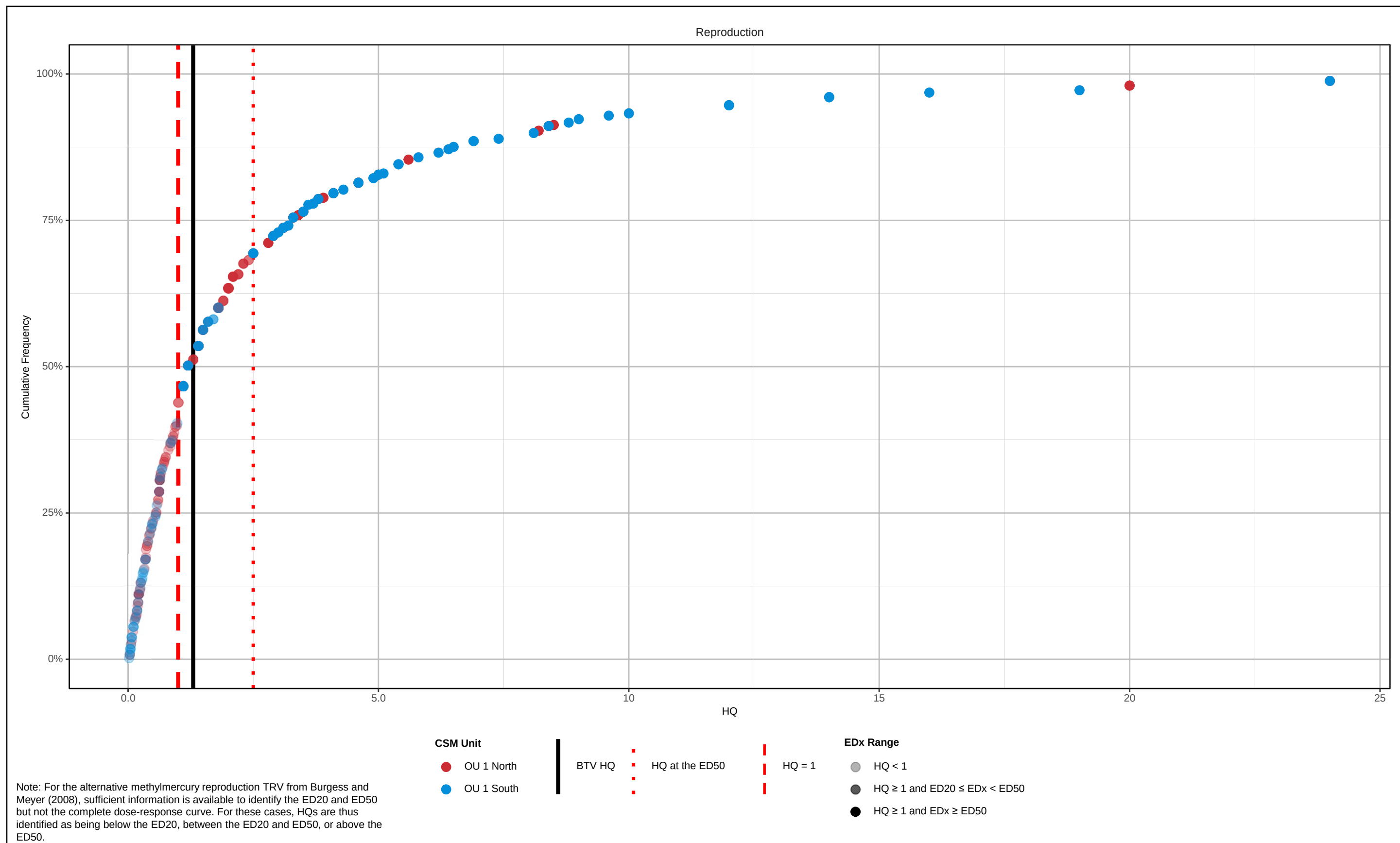


Figure M-20aa. Cumulative Frequency of Alternative Mercury Reproduction Dietary HQs for Spotted Sandpiper in OU 1
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

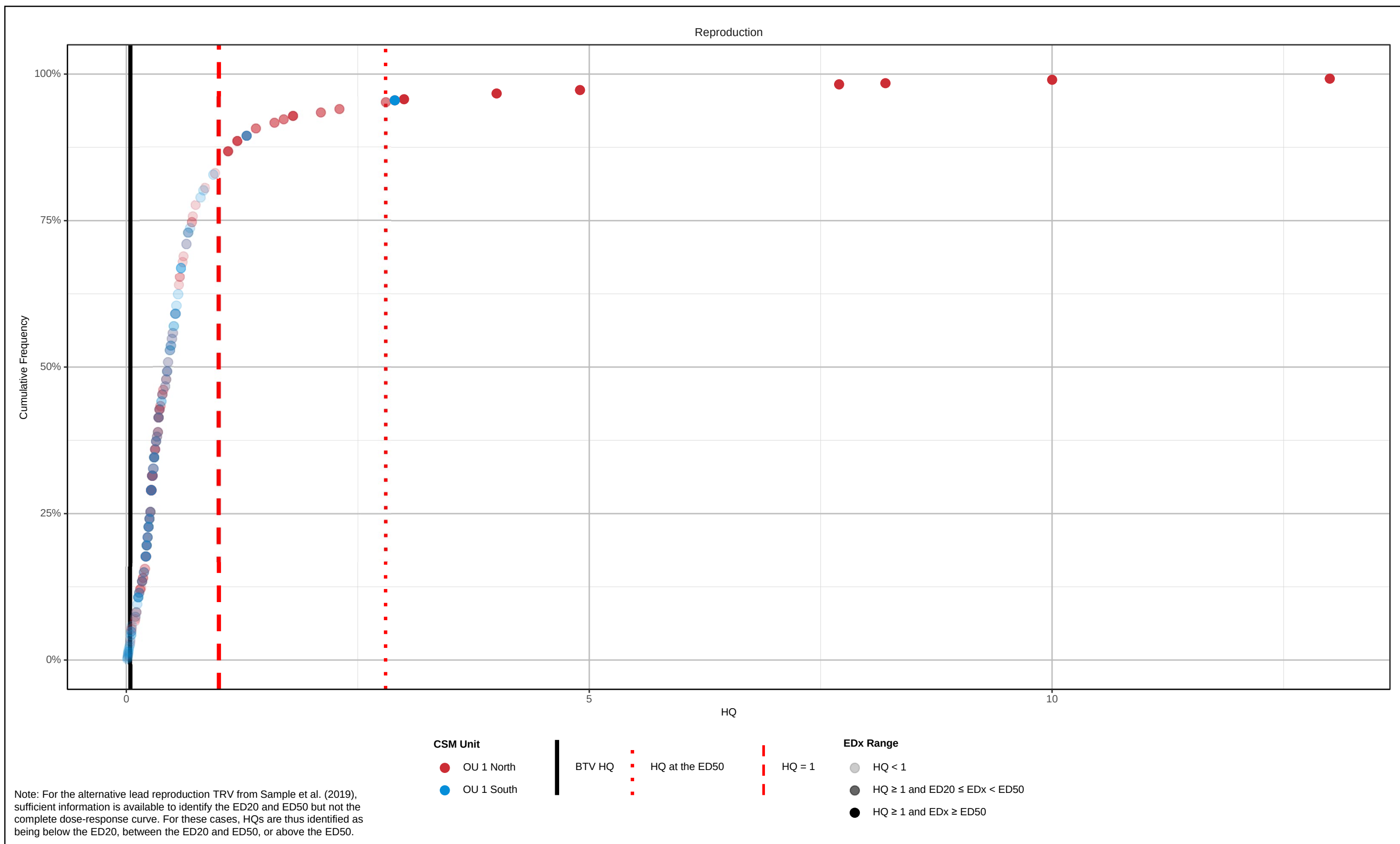


Figure M-20ab. Cumulative Frequency of Alternative Lead Reproduction Dietary HQs for Mallard in OU 1
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

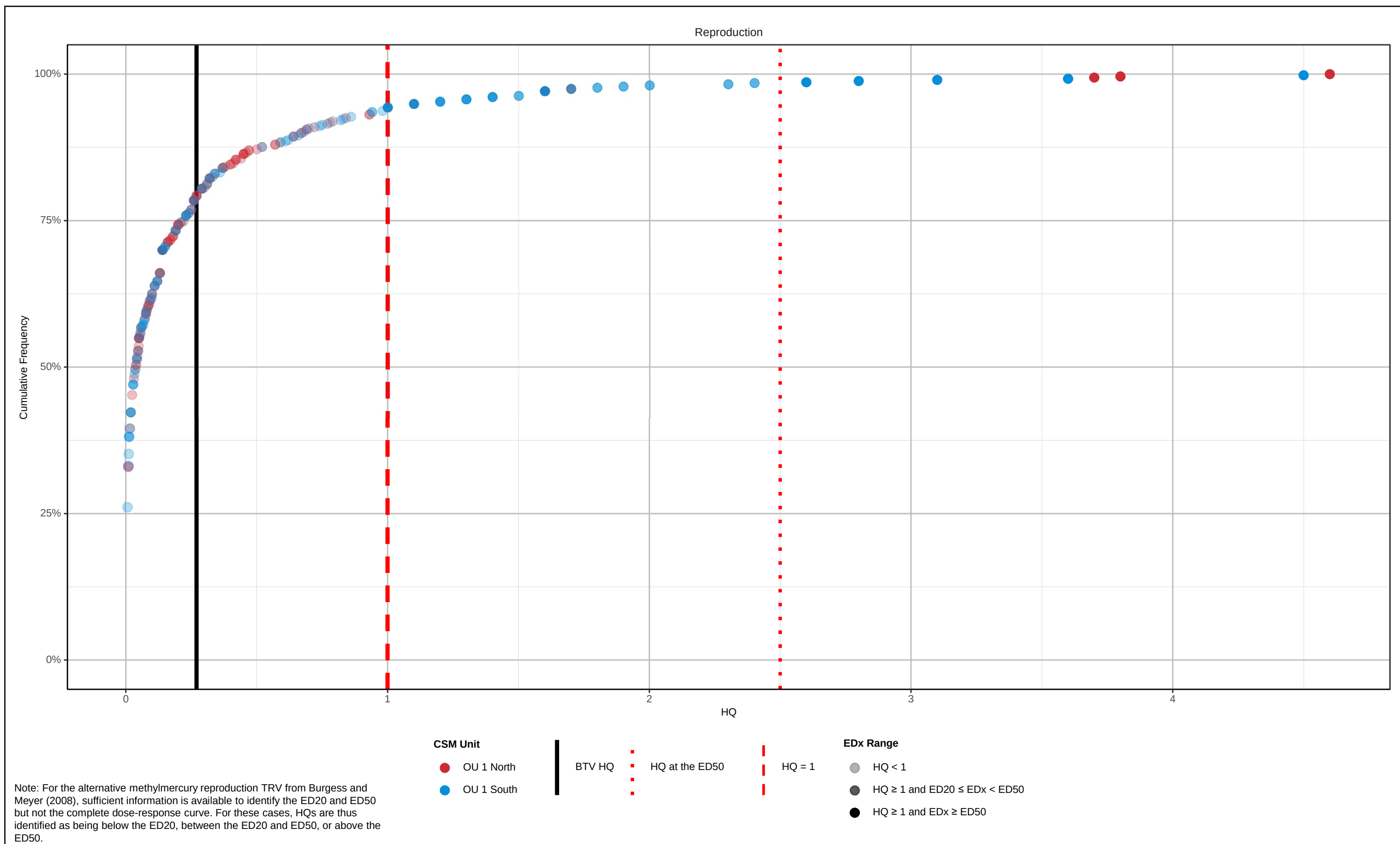


Figure M-20ac. Cumulative Frequency of Alternative Mercury Reproduction Dietary HQs for Mallard in OU 1
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

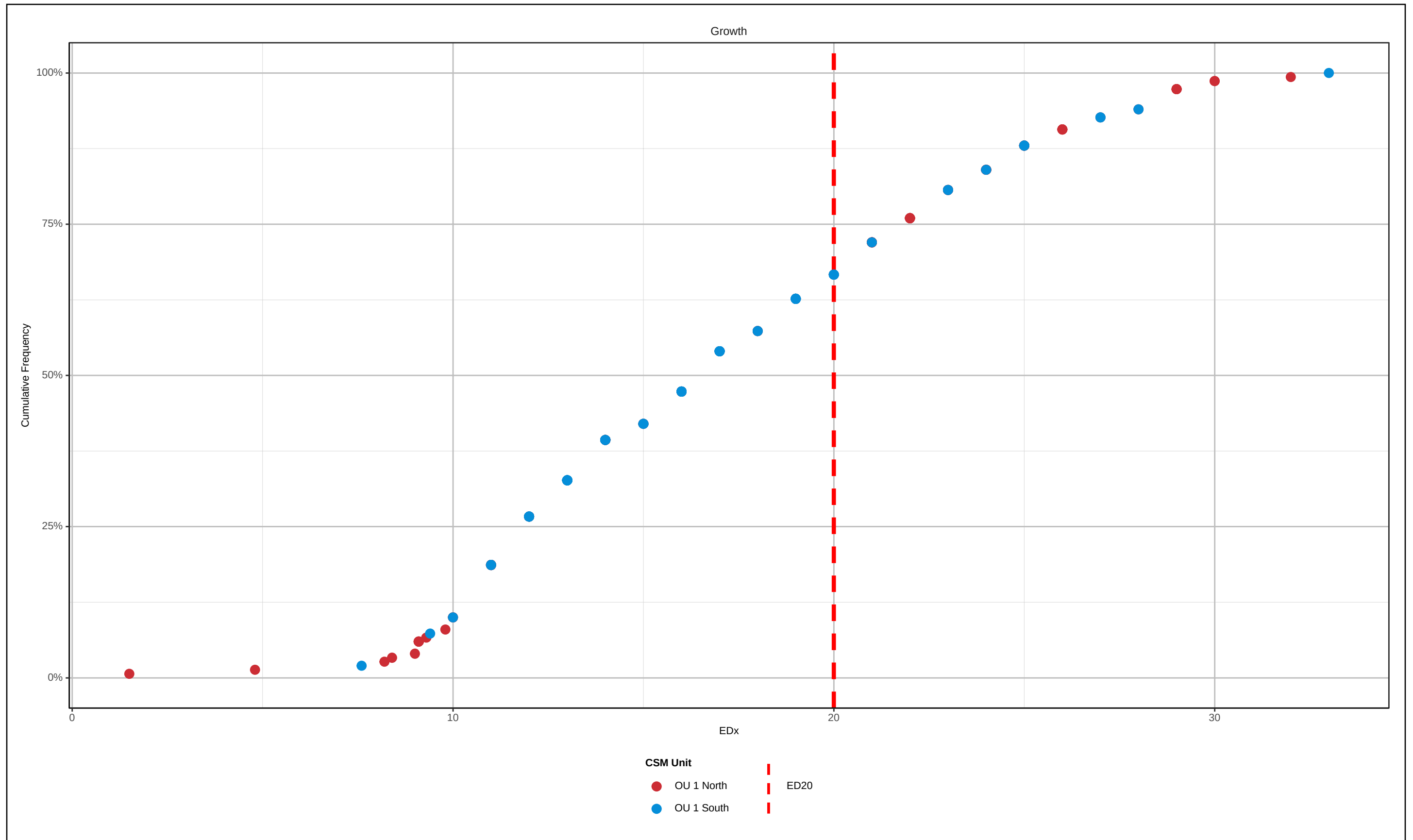


Figure M-21a. Cumulative Frequency of Aluminum EDx Values for Tundra Swan in OU 1
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

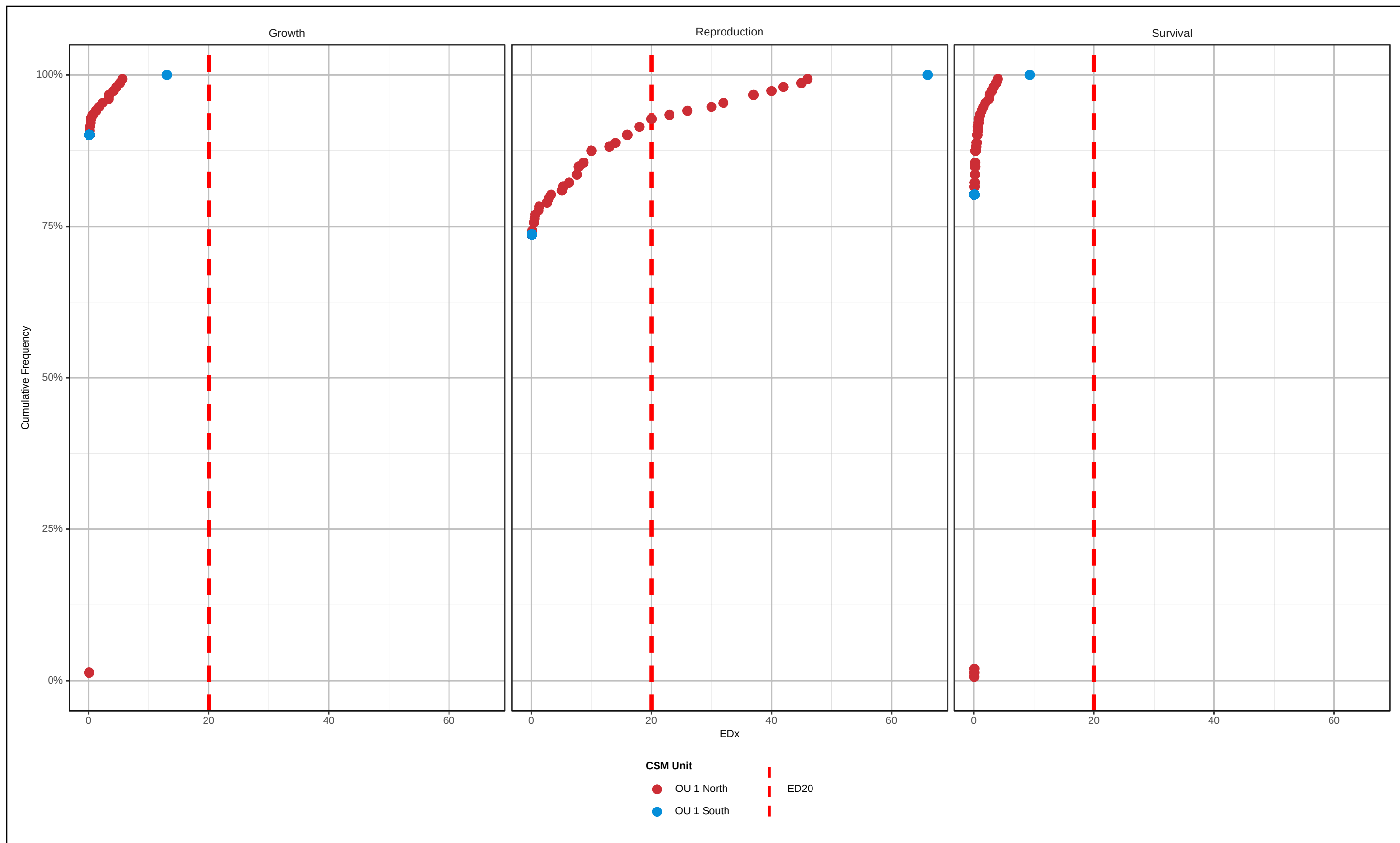


Figure M-21b. Cumulative Frequency of Copper EDx Values for Tundra Swan in OU 1
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

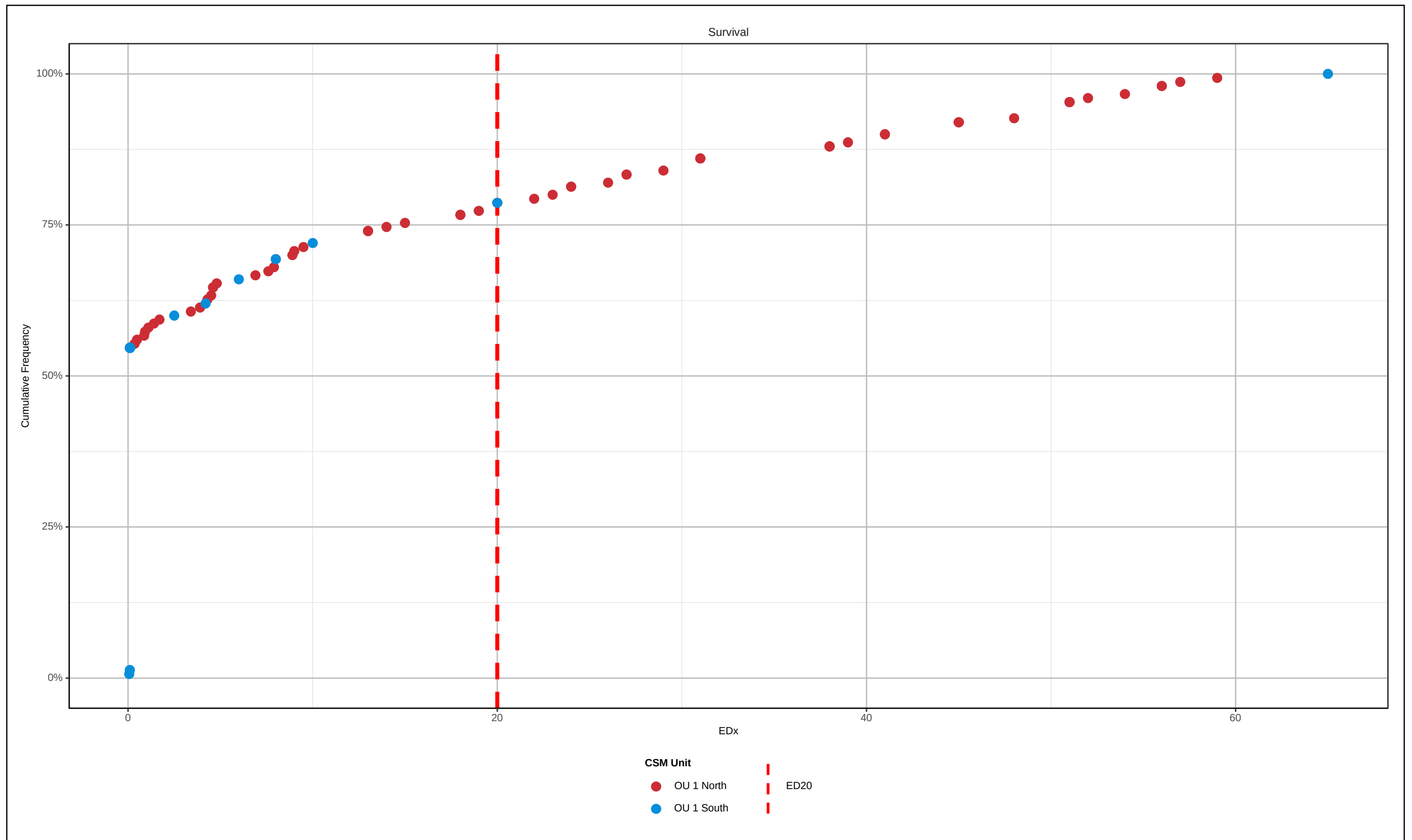


Figure M-21c. Cumulative Frequency of Iron EDx Values for Tundra Swan in OU 1
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

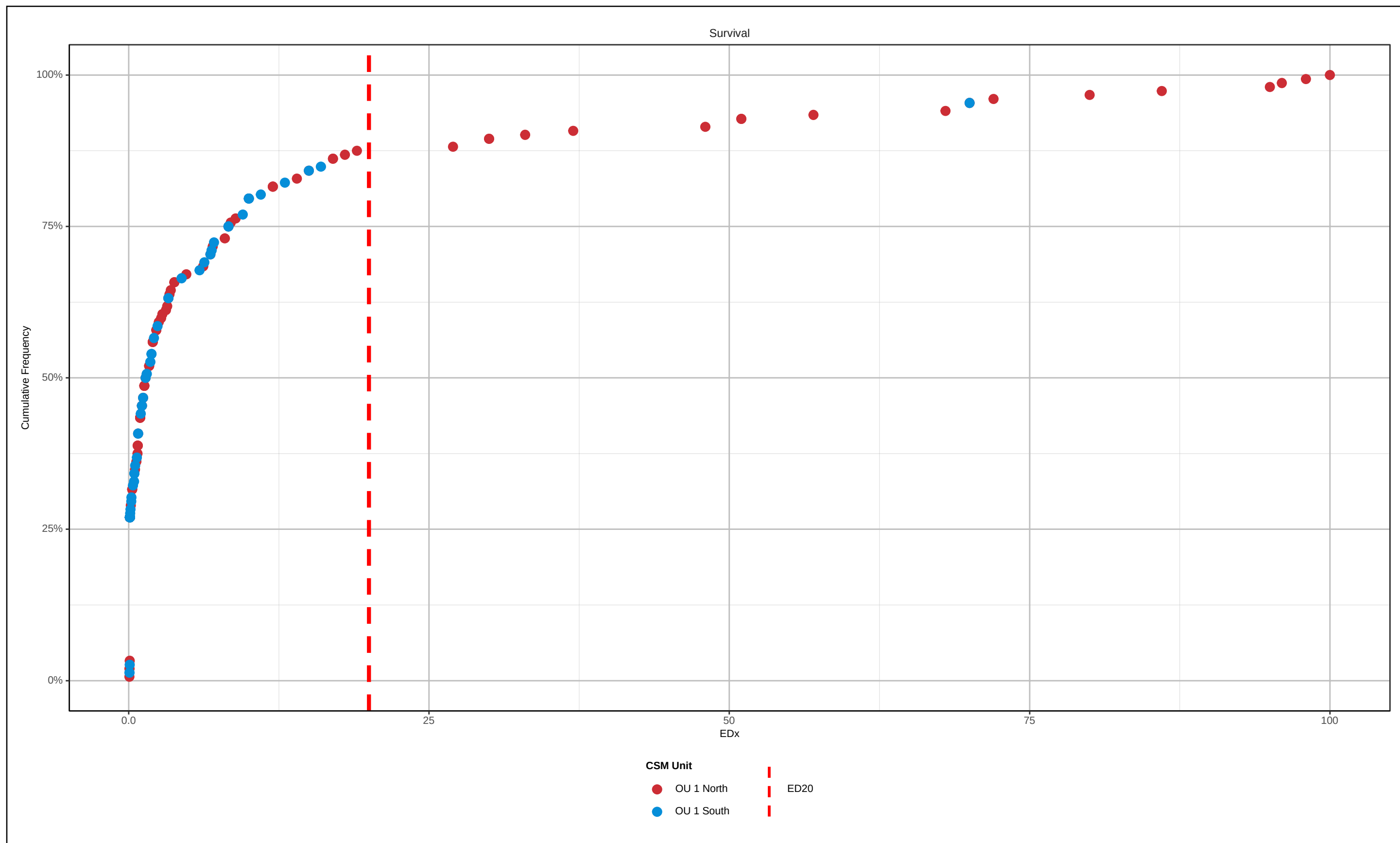


Figure M-21d. Cumulative Frequency of Lead EDx Values for Tundra Swan in OU 1
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

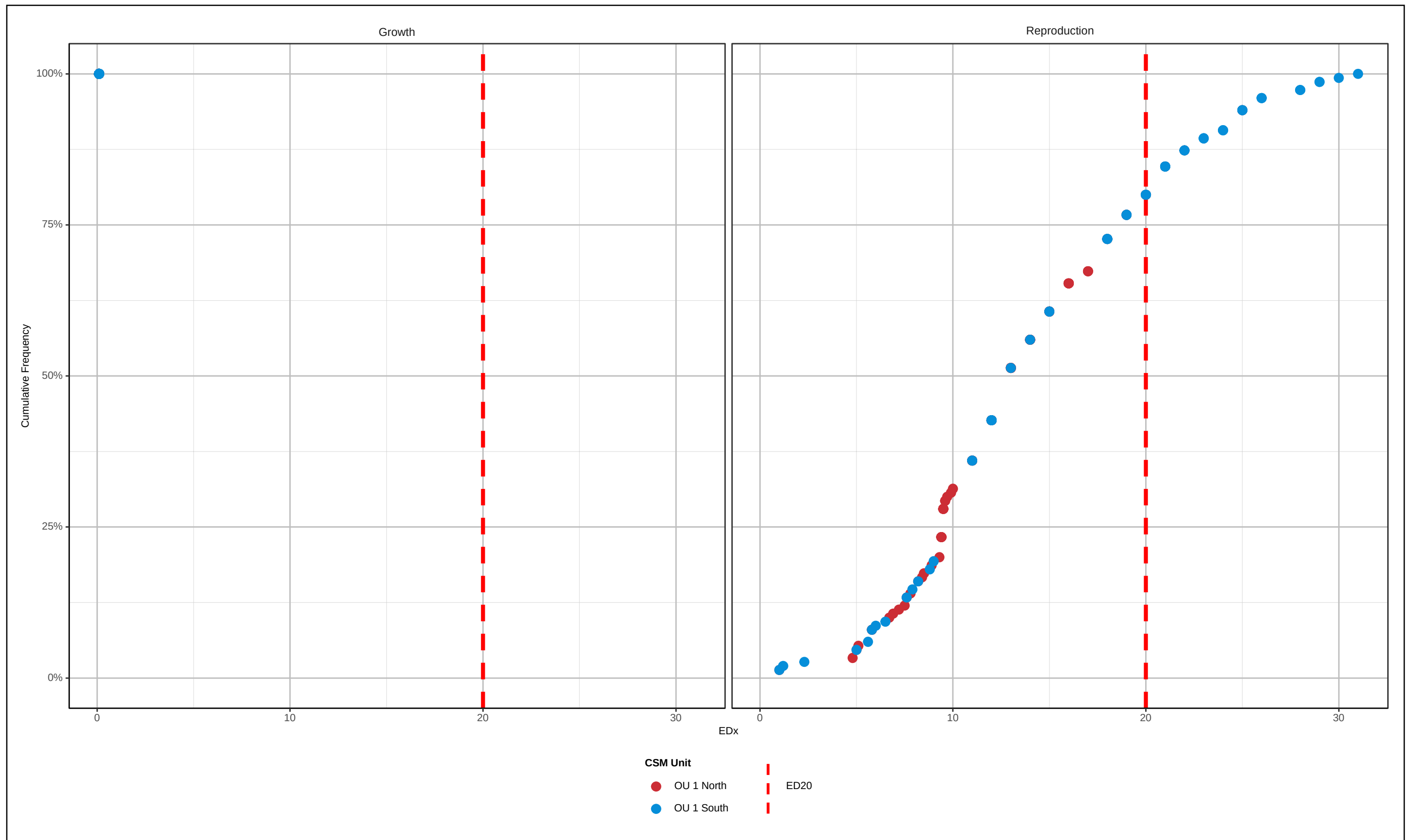


Figure M-21e. Cumulative Frequency of Mercury EDx Values for Tundra Swan in OU 1
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

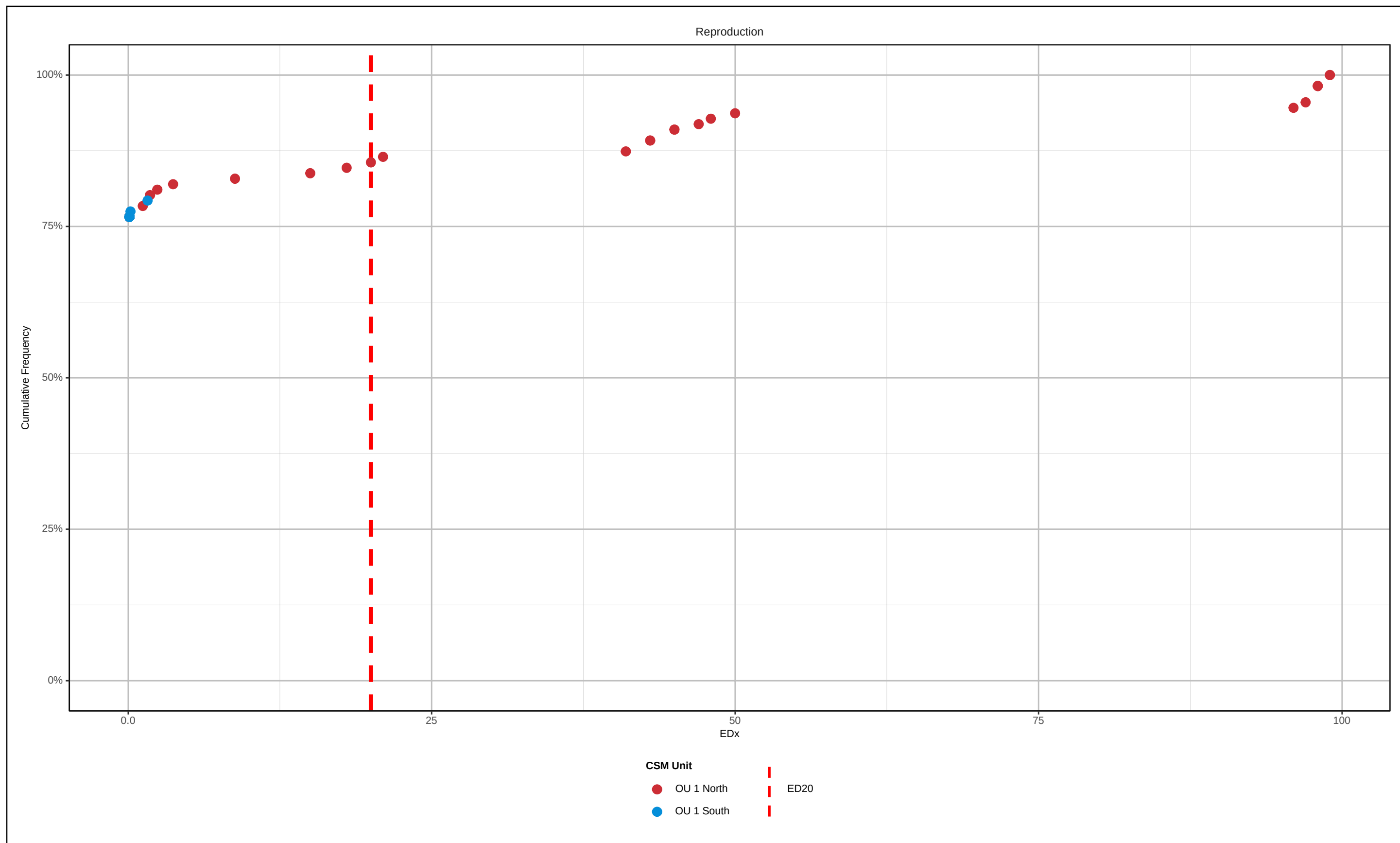


Figure M-21f. Cumulative Frequency of Selenium EDx Values for Tundra Swan in OU 1
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

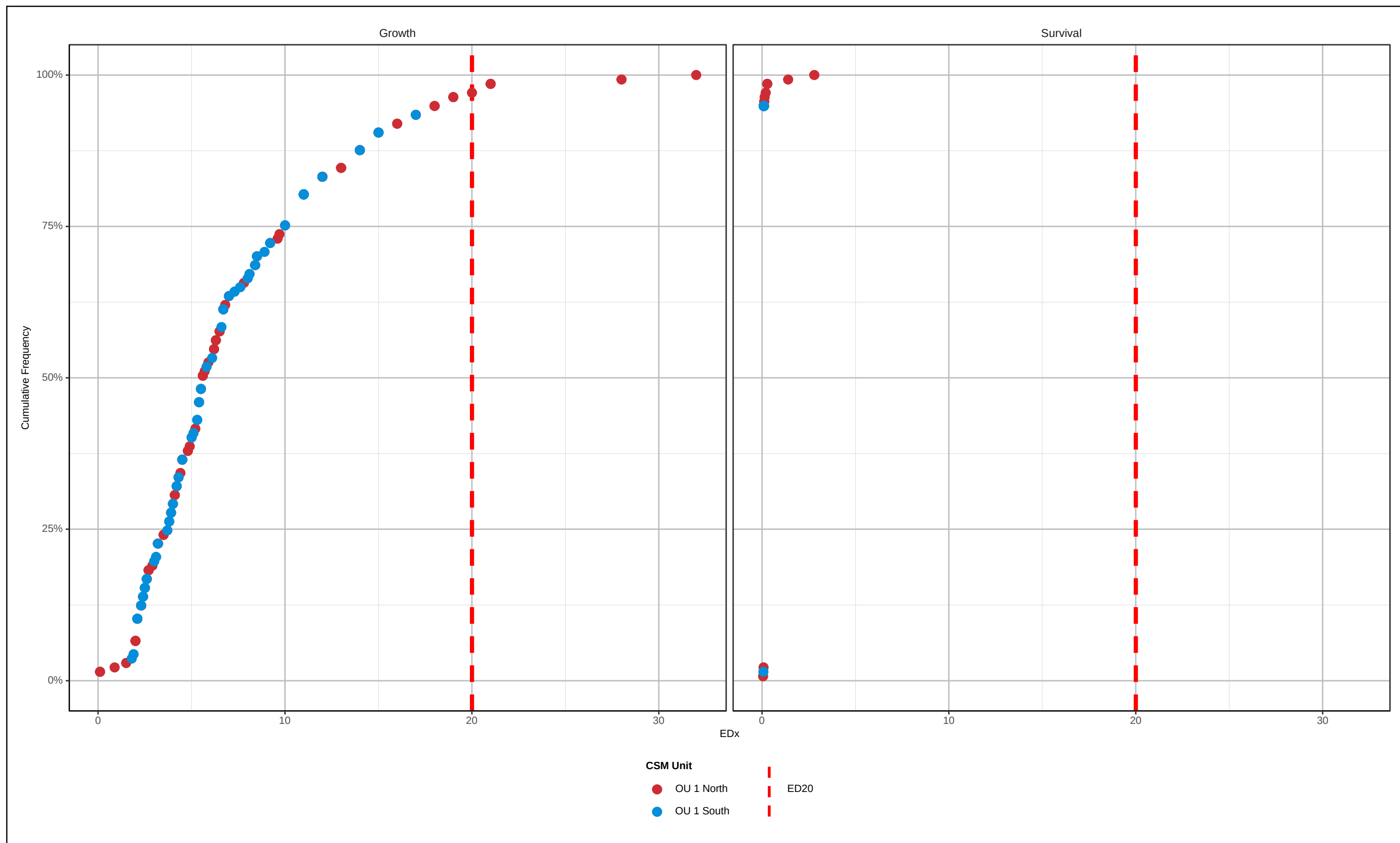


Figure M-21g. Cumulative Frequency of Vanadium EDx Values for Tundra Swan in OU 1
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

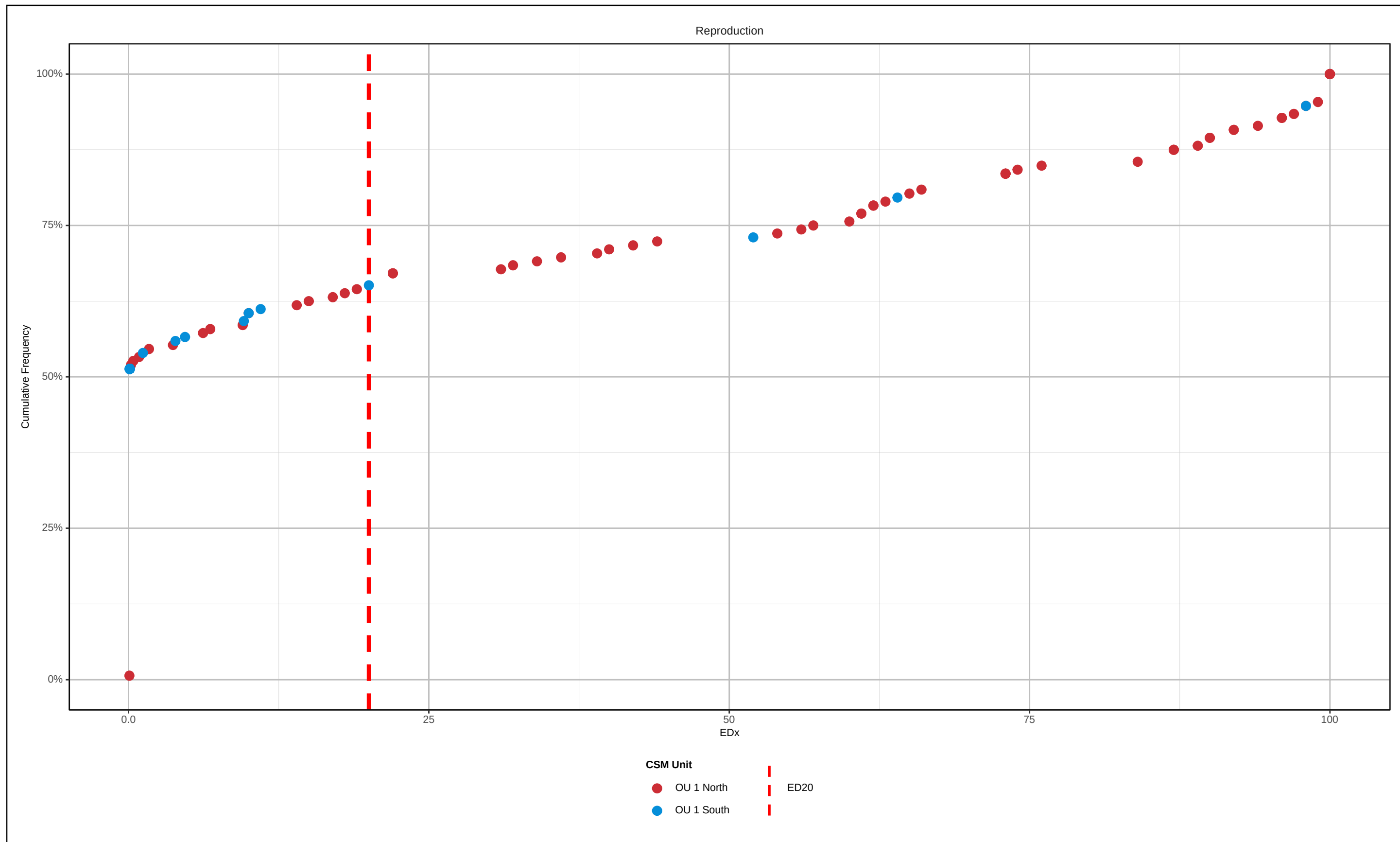


Figure M-21h. Cumulative Frequency of Zinc EDx Values for Tundra Swan in OU 1
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

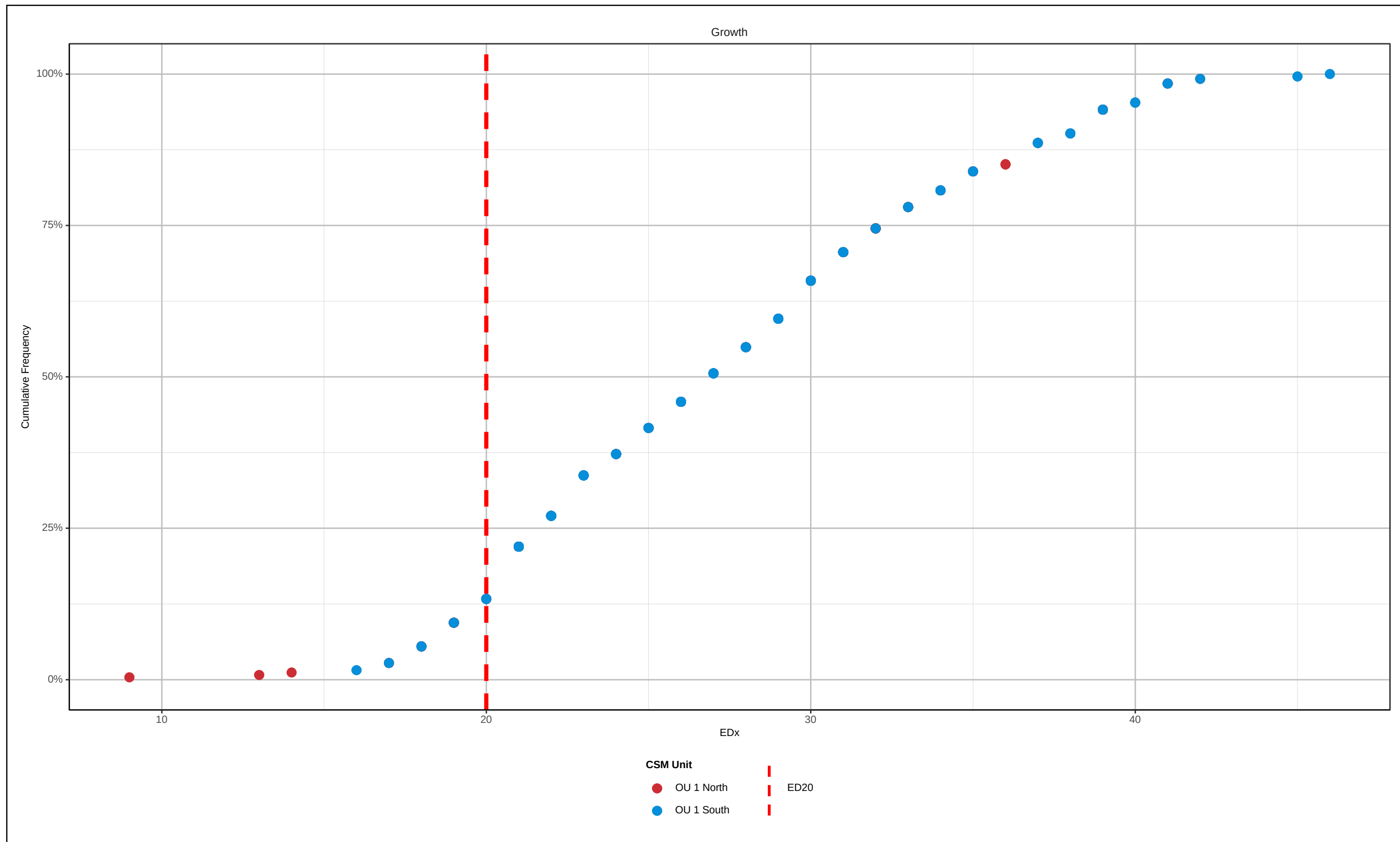


Figure M-21i. Cumulative Frequency of Aluminum EDx Values for Spotted Sandpiper in OU 1
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

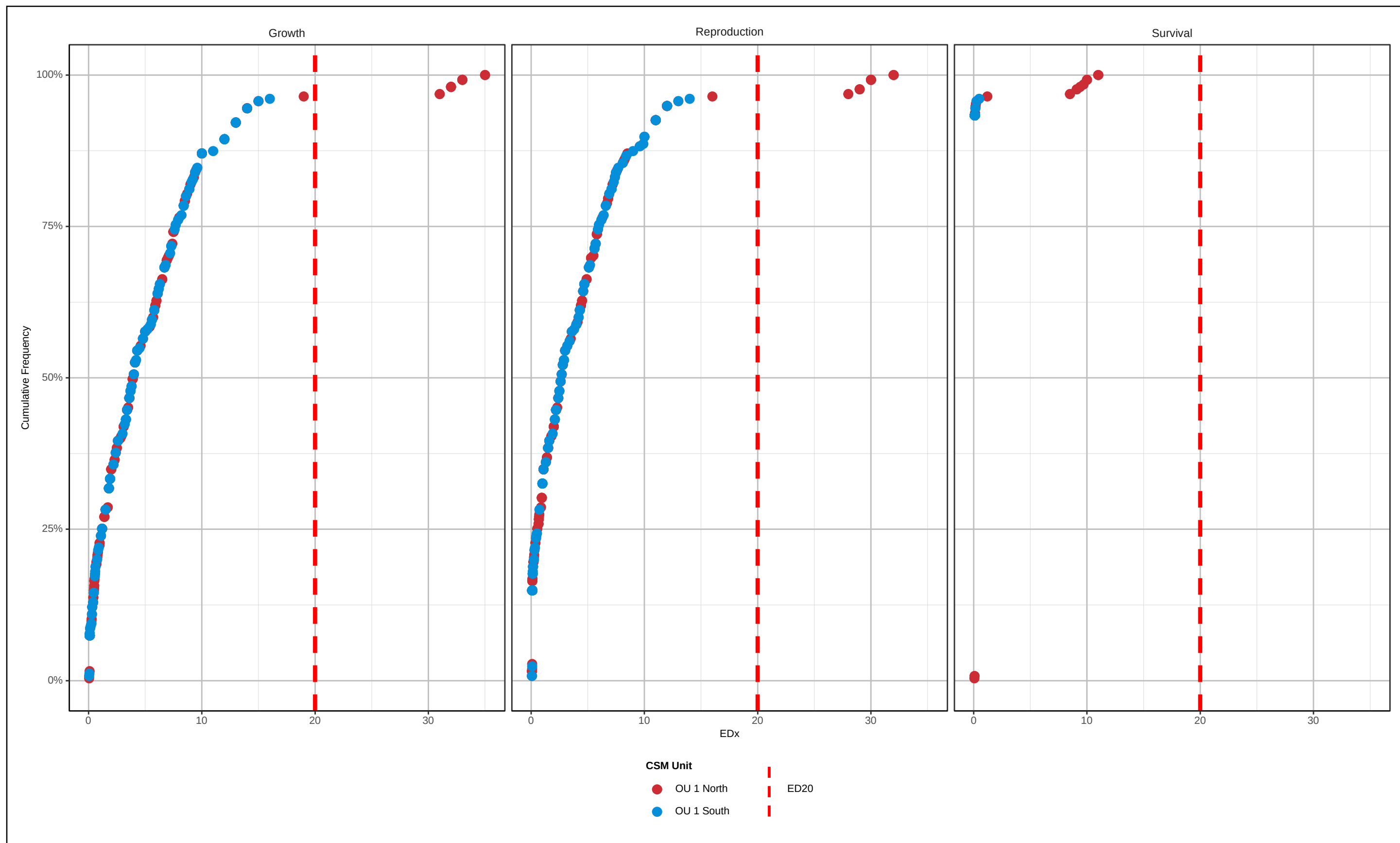


Figure M-21j. Cumulative Frequency of Cadmium EDx Values for Spotted Sandpiper in OU 1
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

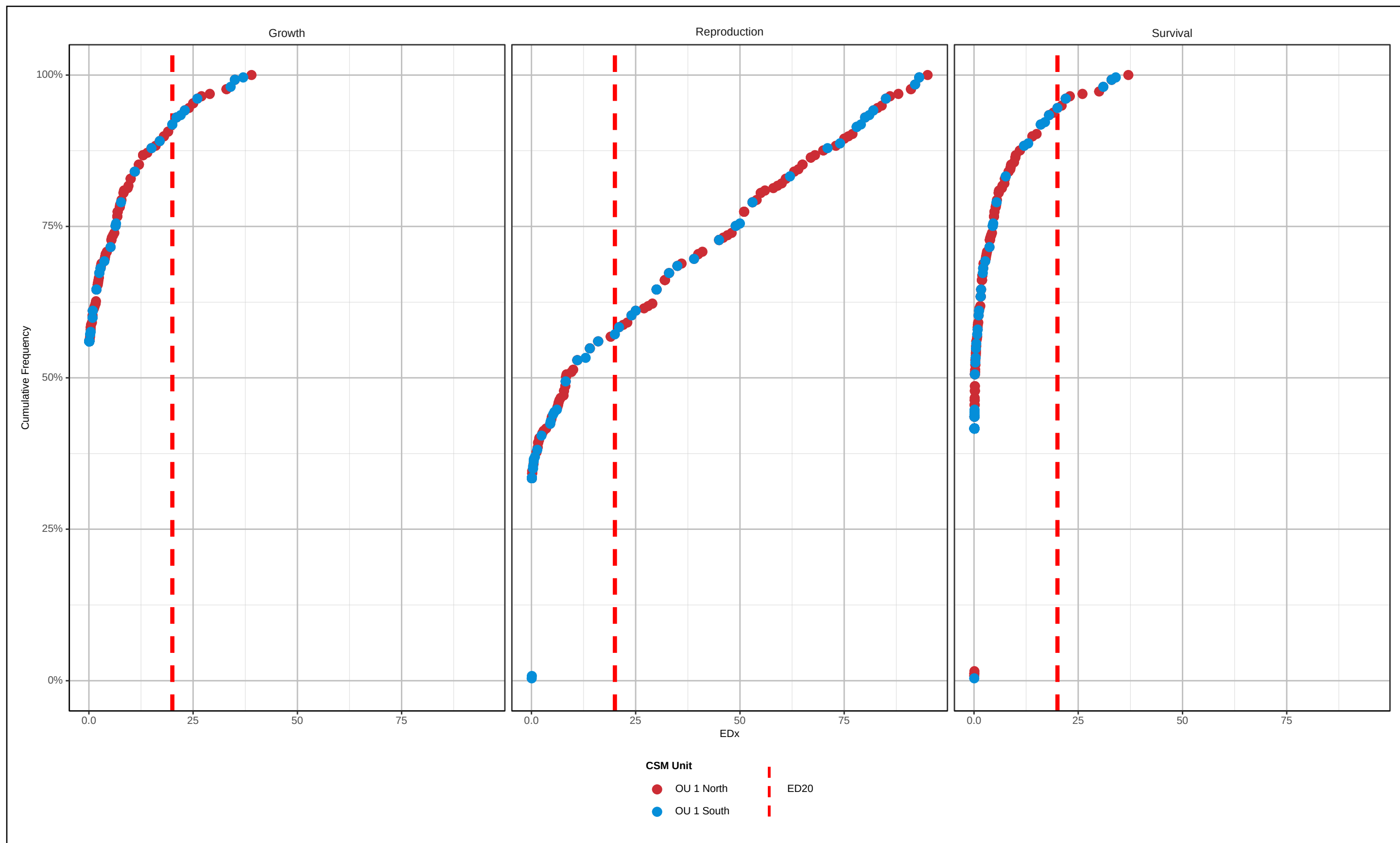


Figure M-21k. Cumulative Frequency of Copper EDx Values for Spotted Sandpiper in OU 1
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

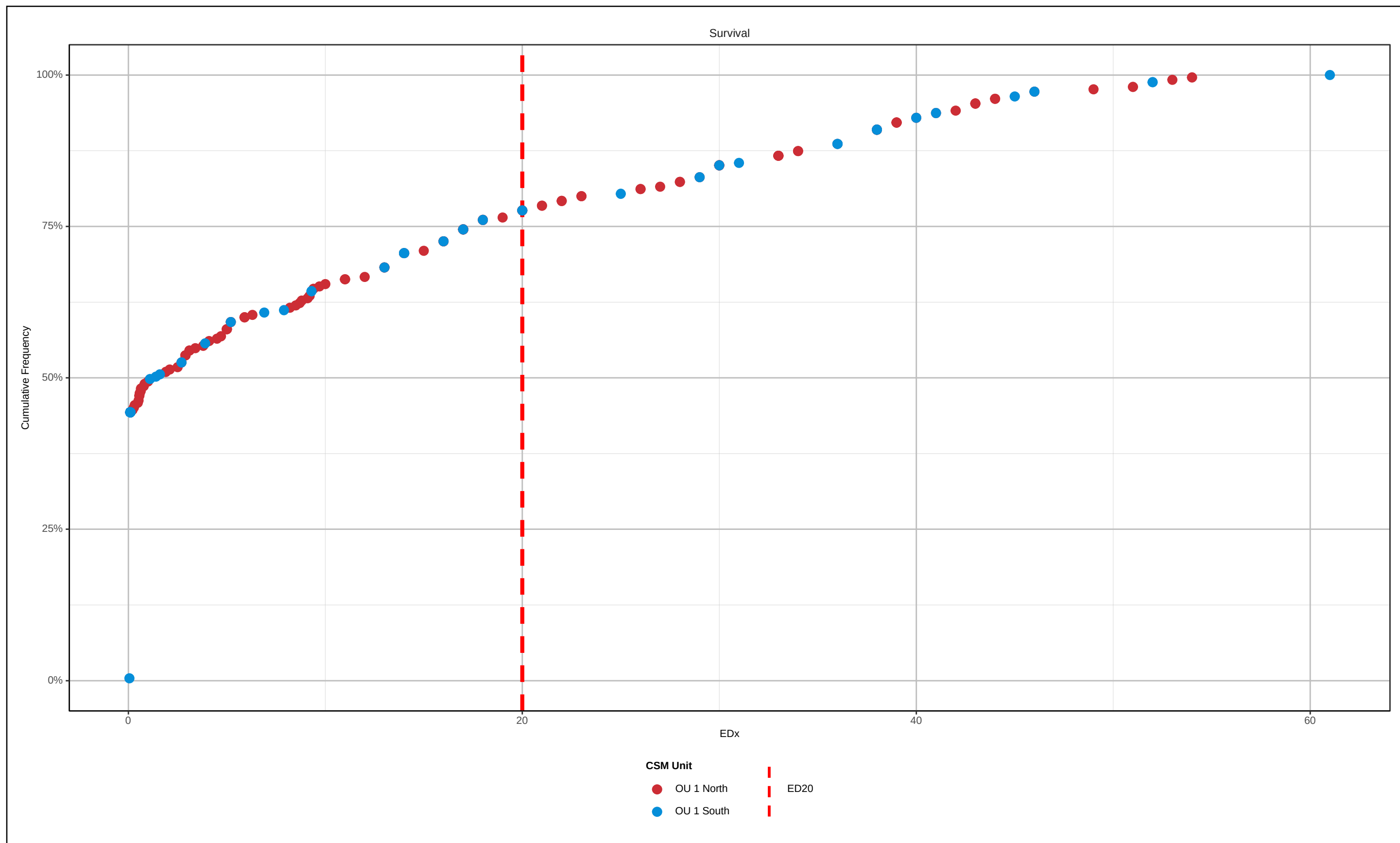


Figure M-21I. Cumulative Frequency of Iron EDx Values for Spotted Sandpiper in OU 1
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

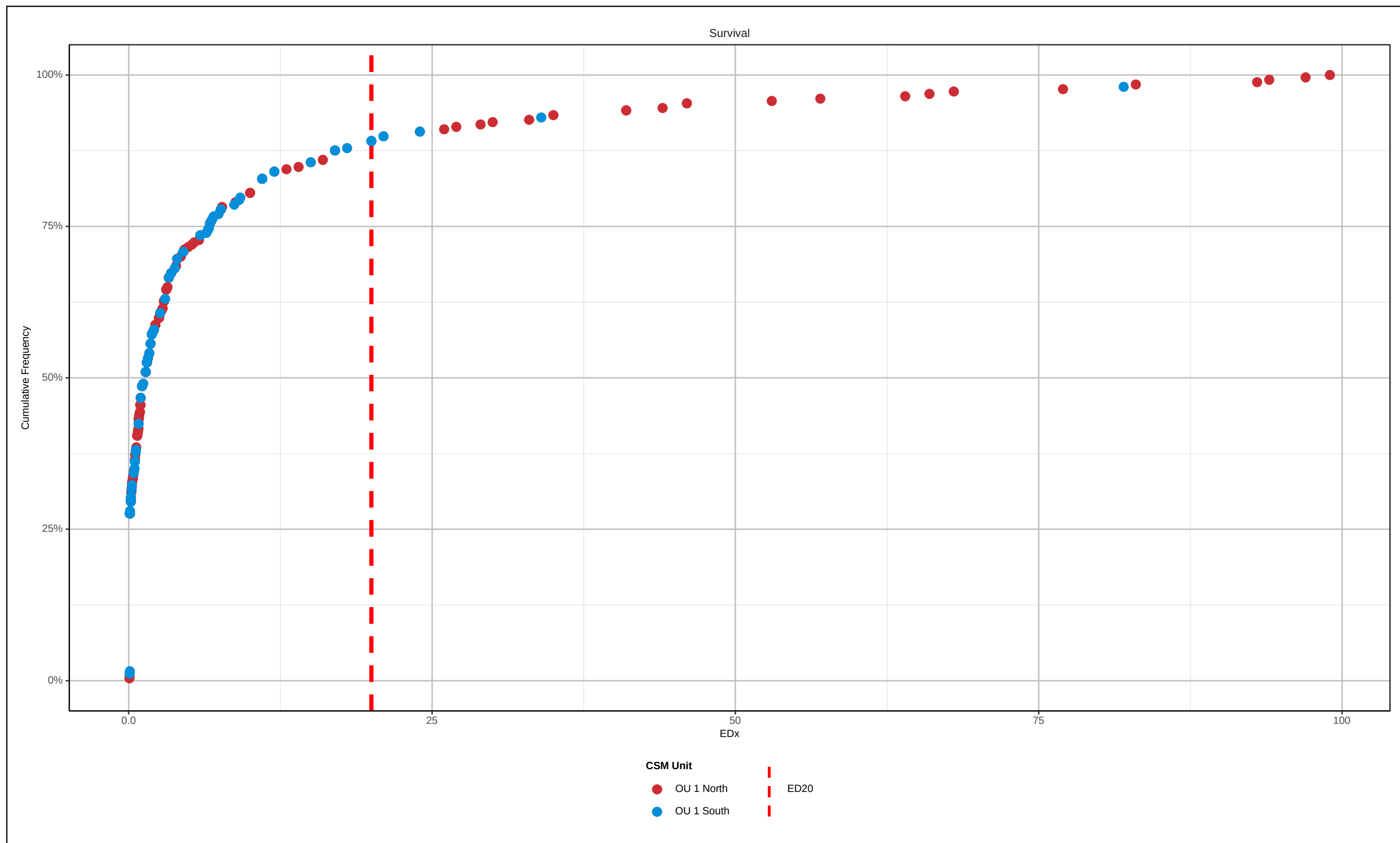


Figure M-21m. Cumulative Frequency of Lead EDx Values for Spotted Sandpiper in OU 1
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

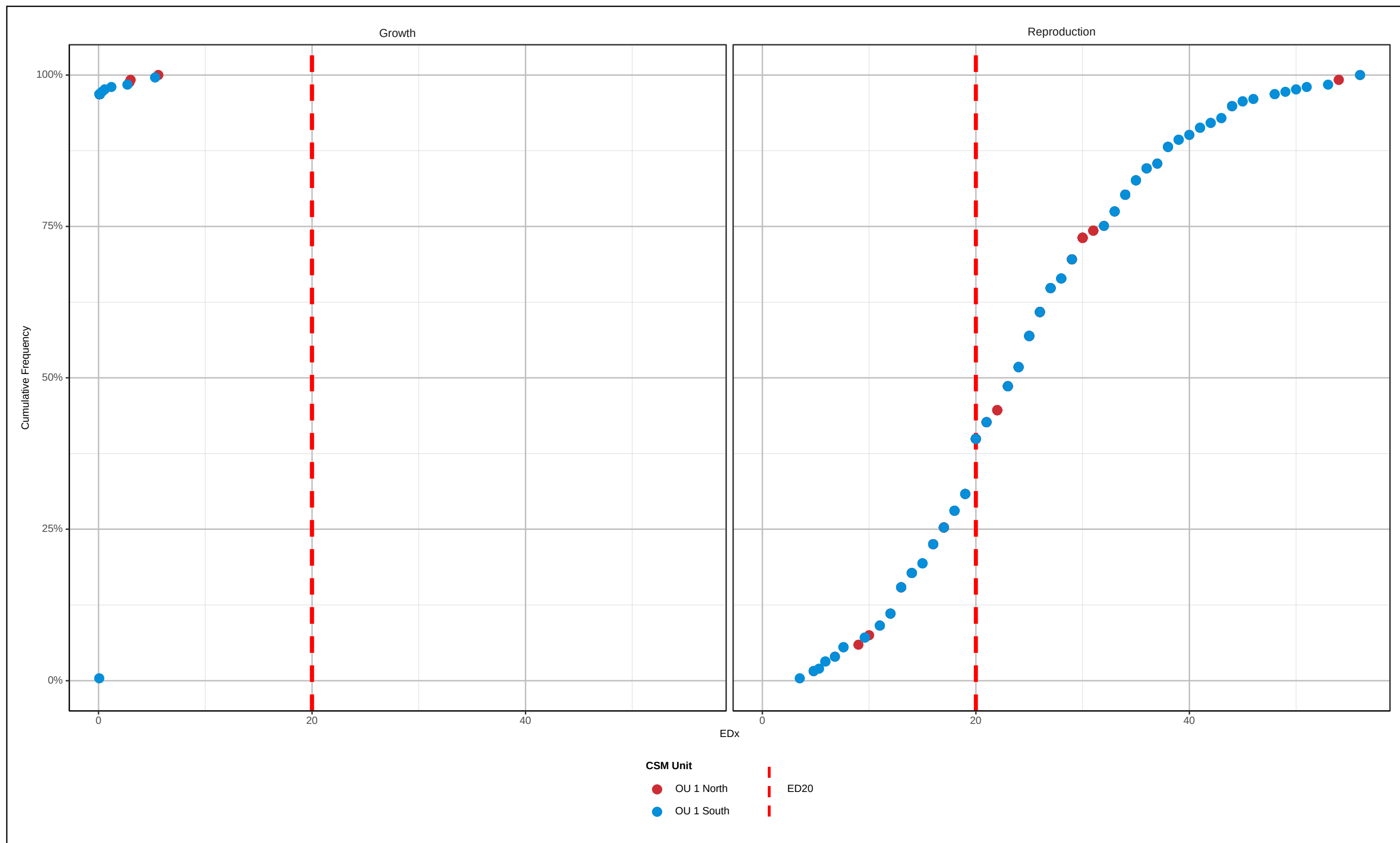


Figure M-21n. Cumulative Frequency of Mercury EDx Values for Spotted Sandpiper in OU 1
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

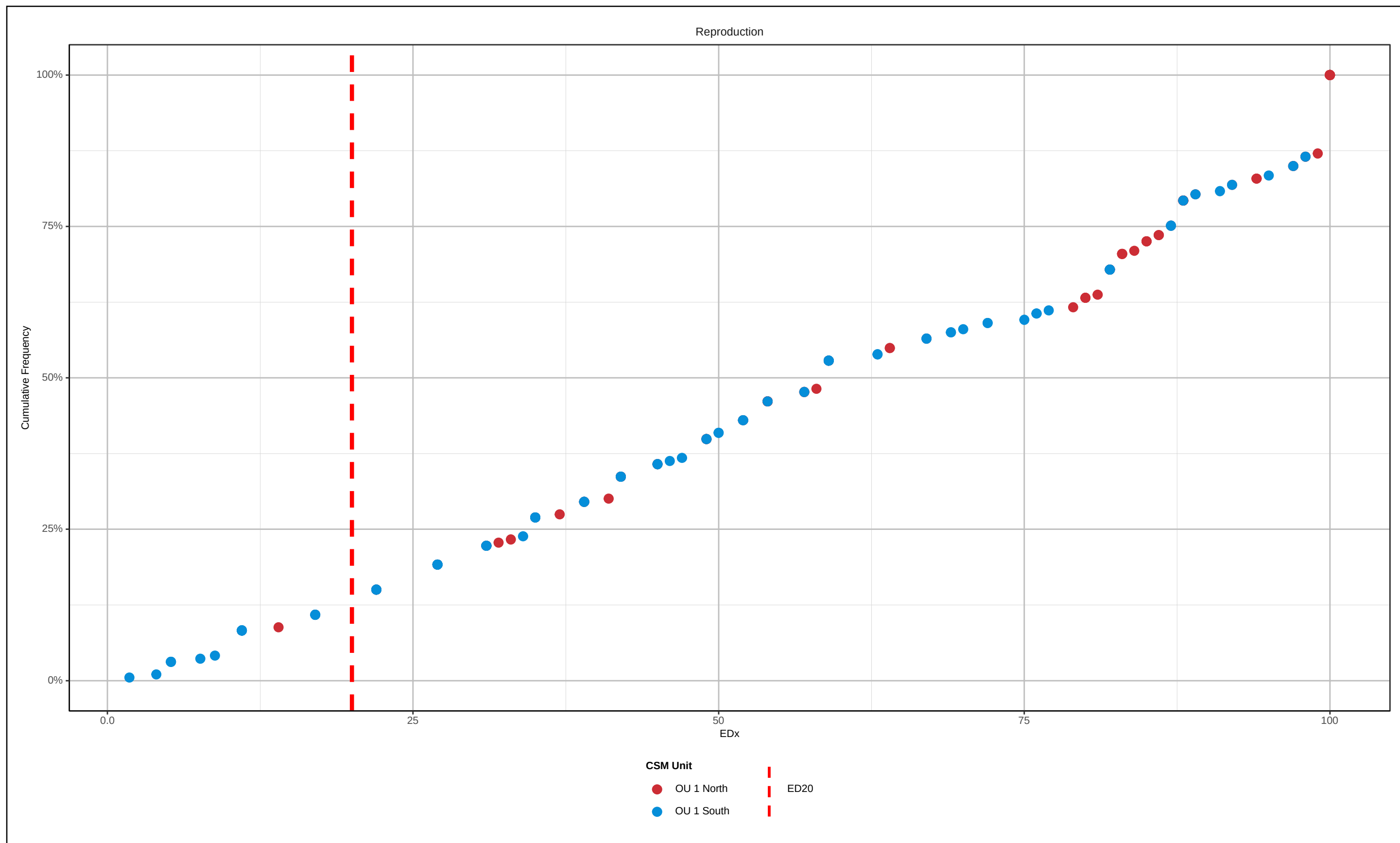


Figure M-210. Cumulative Frequency of Selenium EDx Values for Spotted Sandpiper in OU 1
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

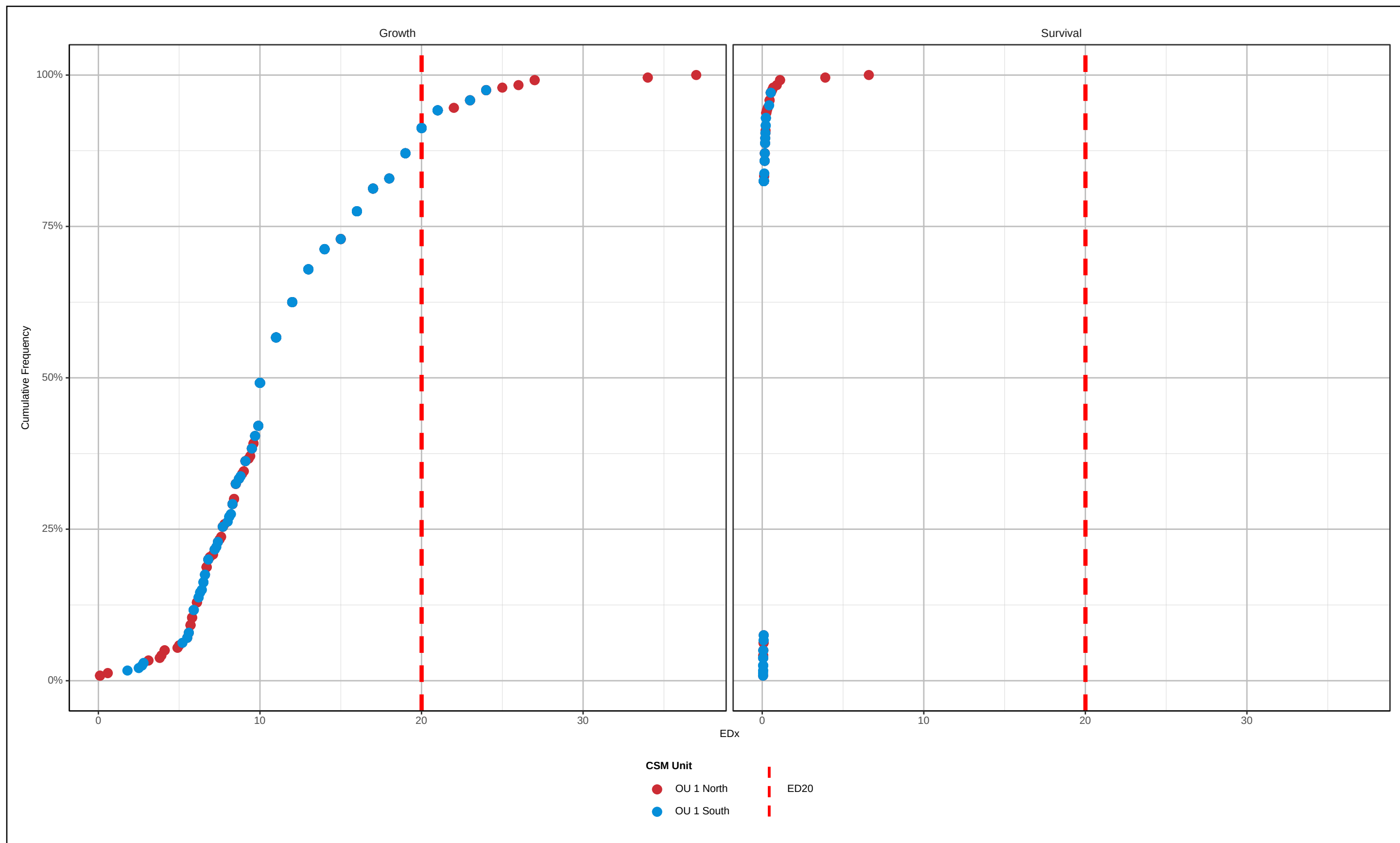


Figure M-21p. Cumulative Frequency of Vanadium EDx Values for Spotted Sandpiper in OU 1
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

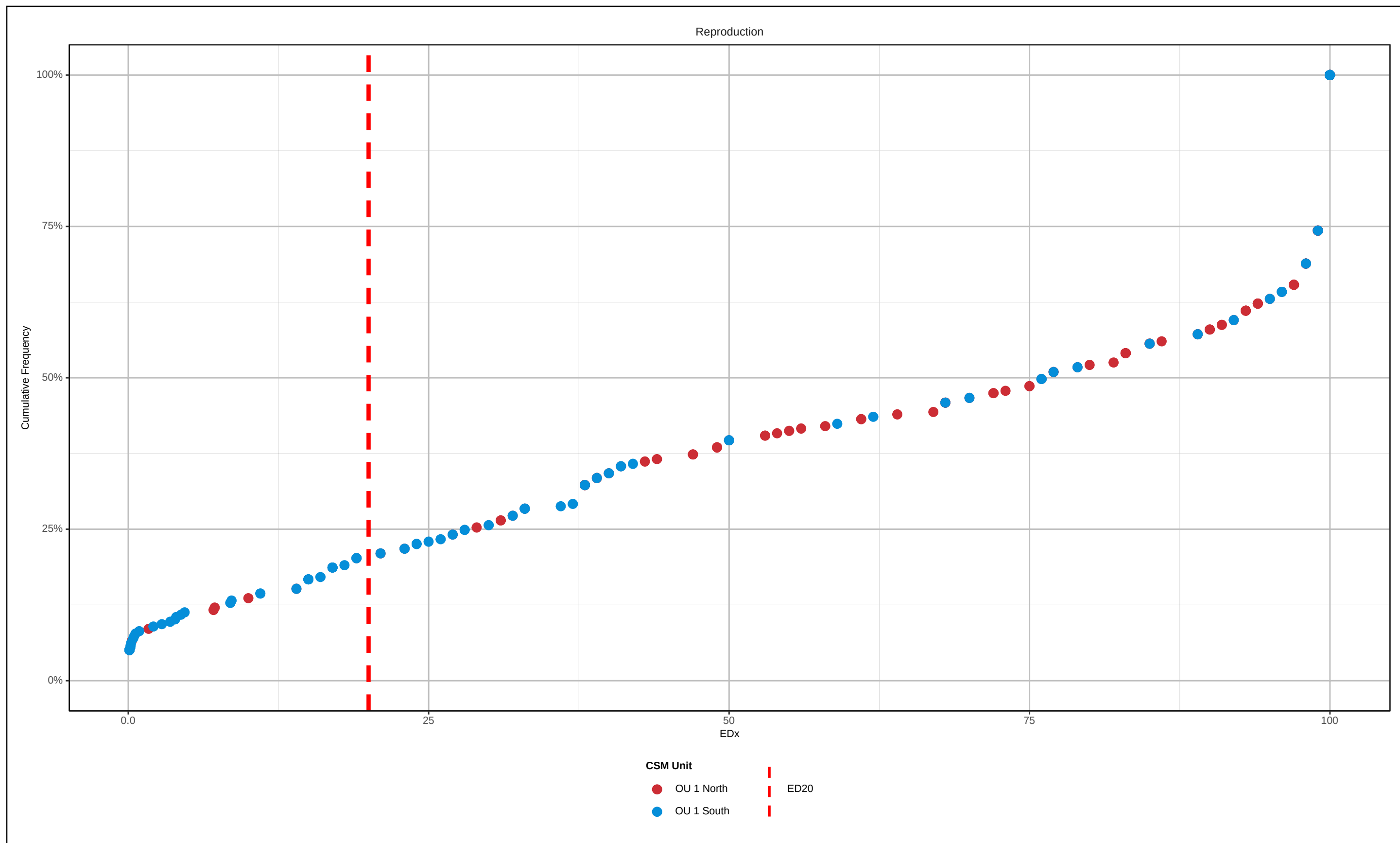


Figure M-21q. Cumulative Frequency of Zinc EDx Values for Spotted Sandpiper in OU 1
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

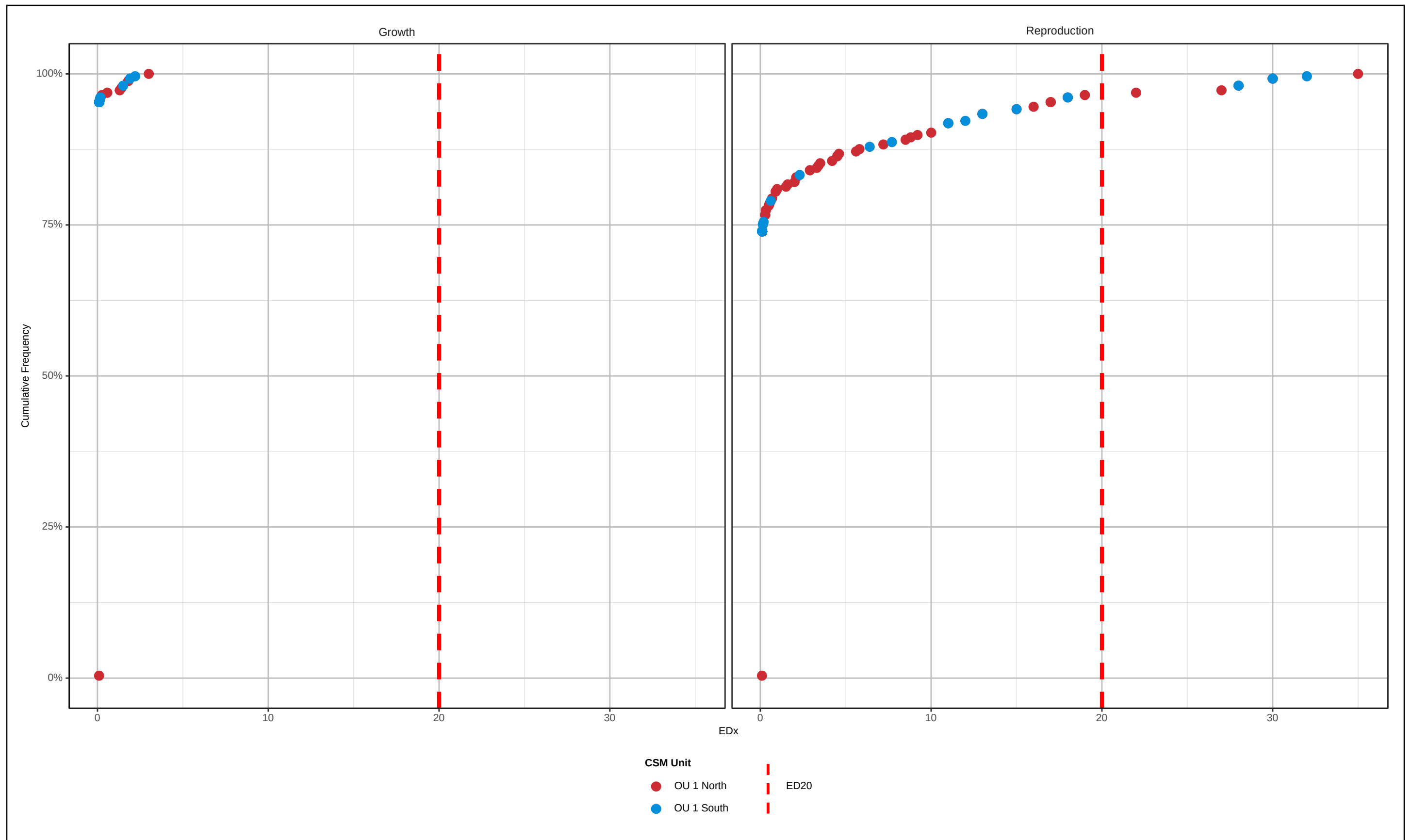


Figure M-21r. Cumulative Frequency of Copper EDx Values for Mallard in OU 1
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

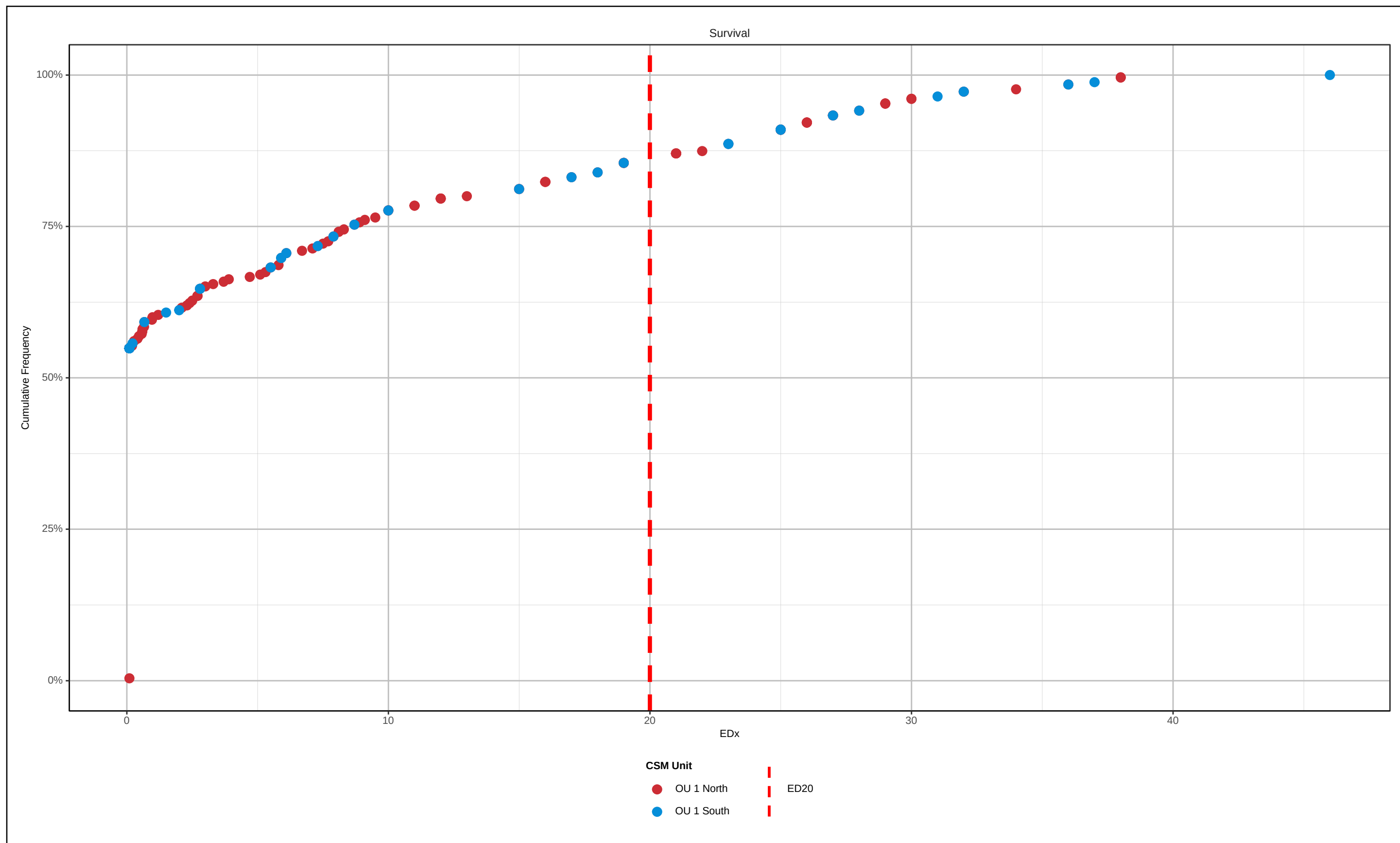


Figure M-21s. Cumulative Frequency of Iron EDx Values for Mallard in OU 1
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

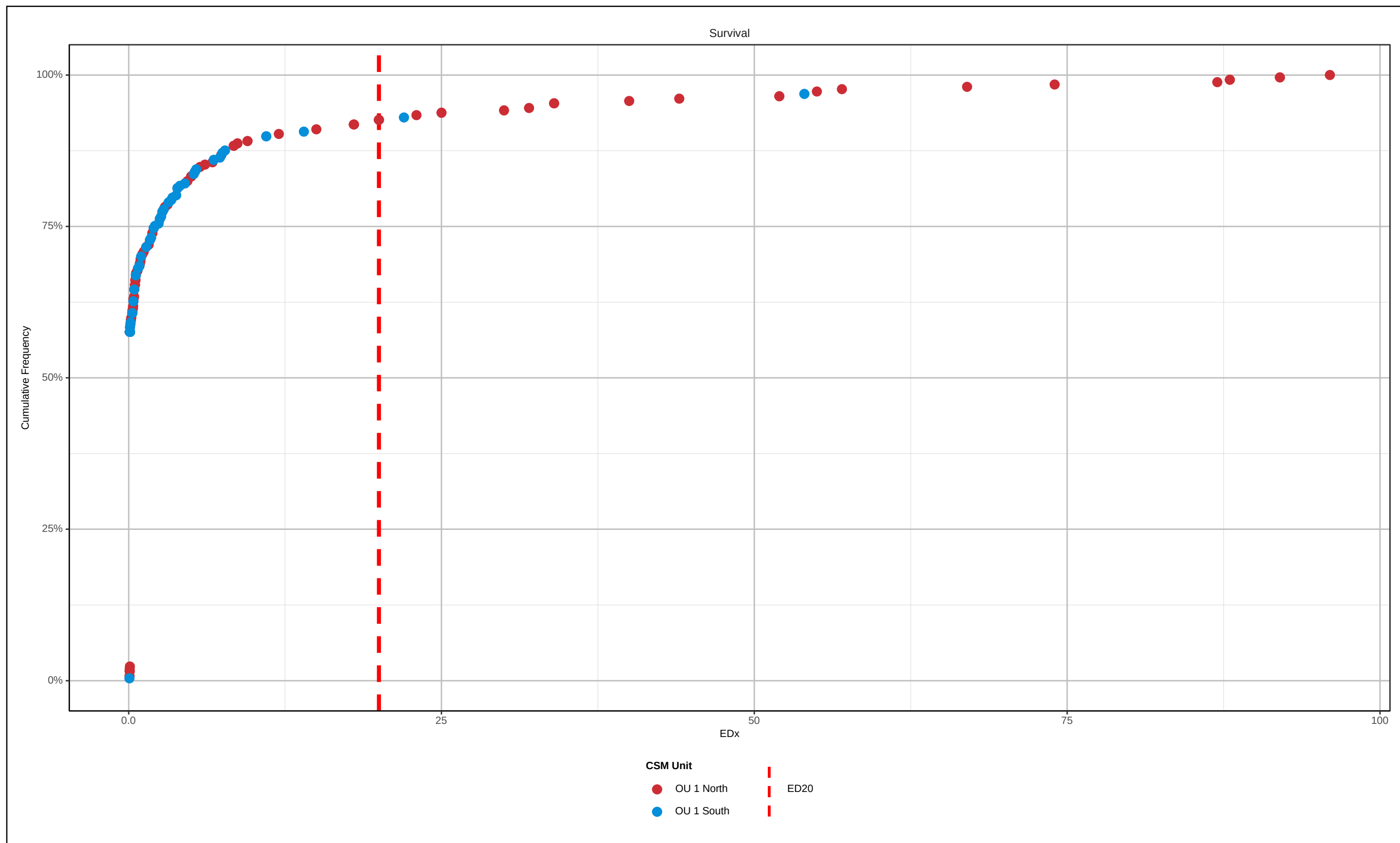


Figure M-21t. Cumulative Frequency of Lead EDx Values for Mallard in OU 1
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

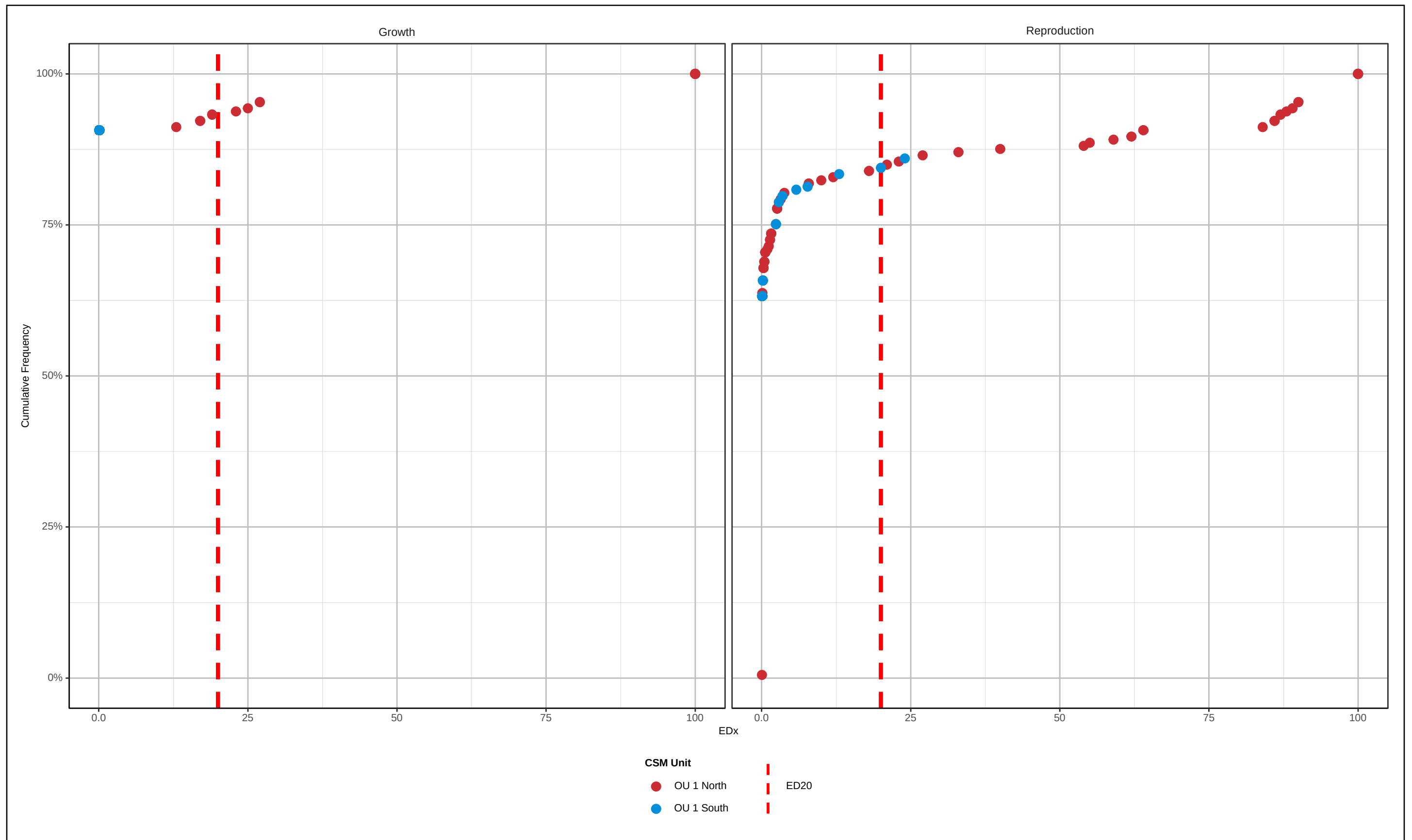


Figure M-21u. Cumulative Frequency of Selenium EDx Values for Mallard in OU 1
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

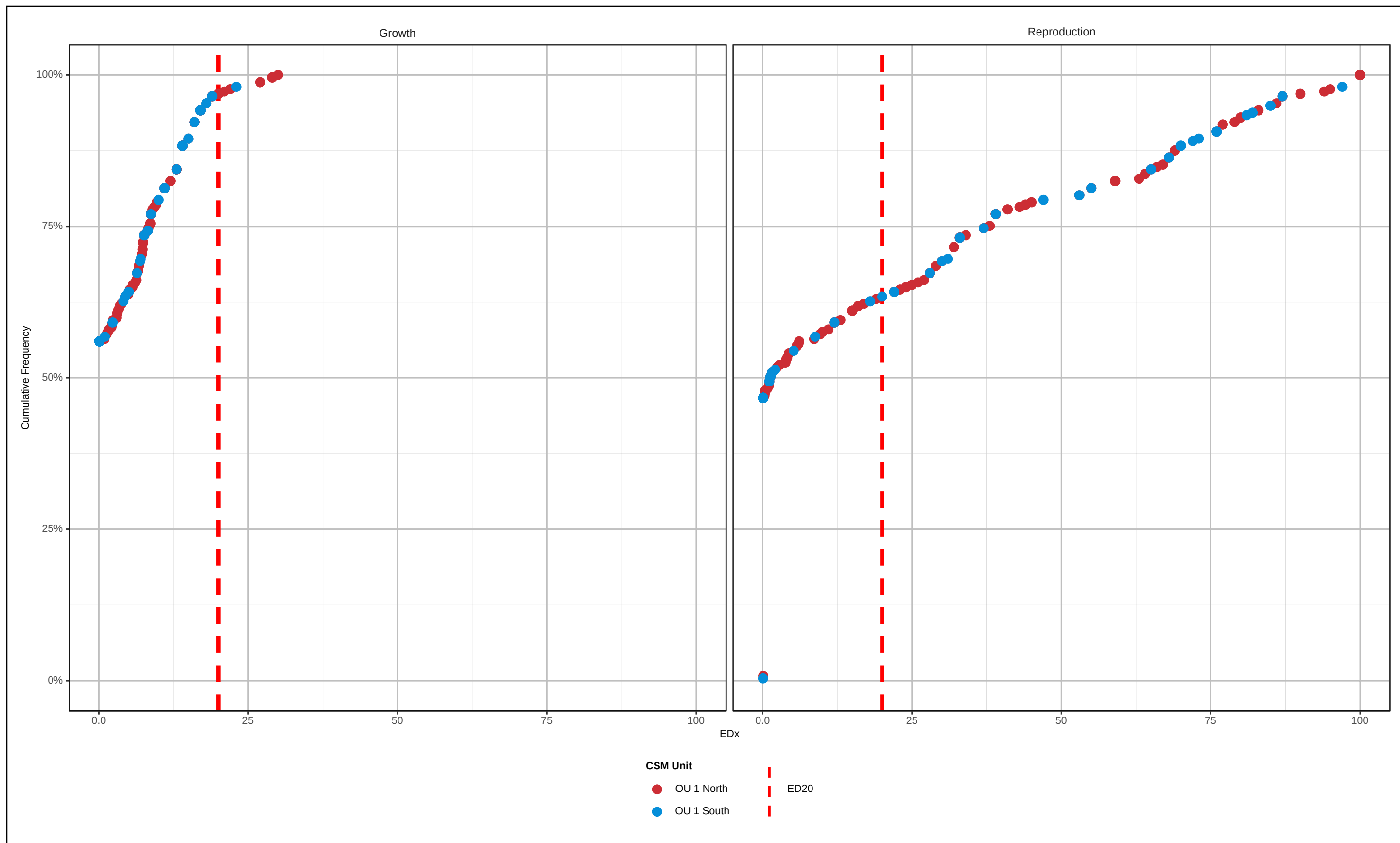


Figure M-21v. Cumulative Frequency of Zinc EDx Values for Mallard in OU 1
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

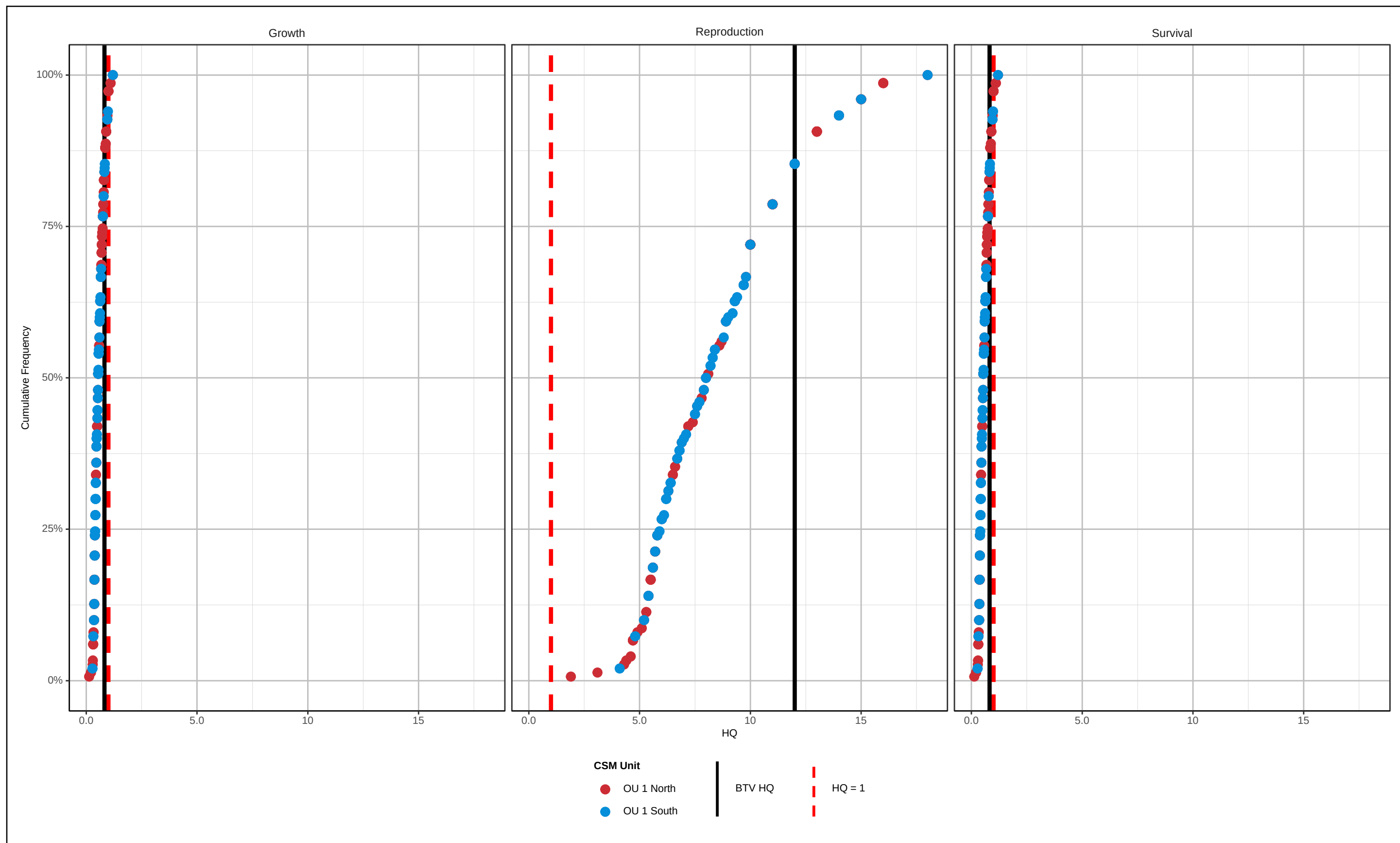


Figure M-22a. Cumulative Frequency of Aluminum Dietary HQs for Muskrat in OU 1
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

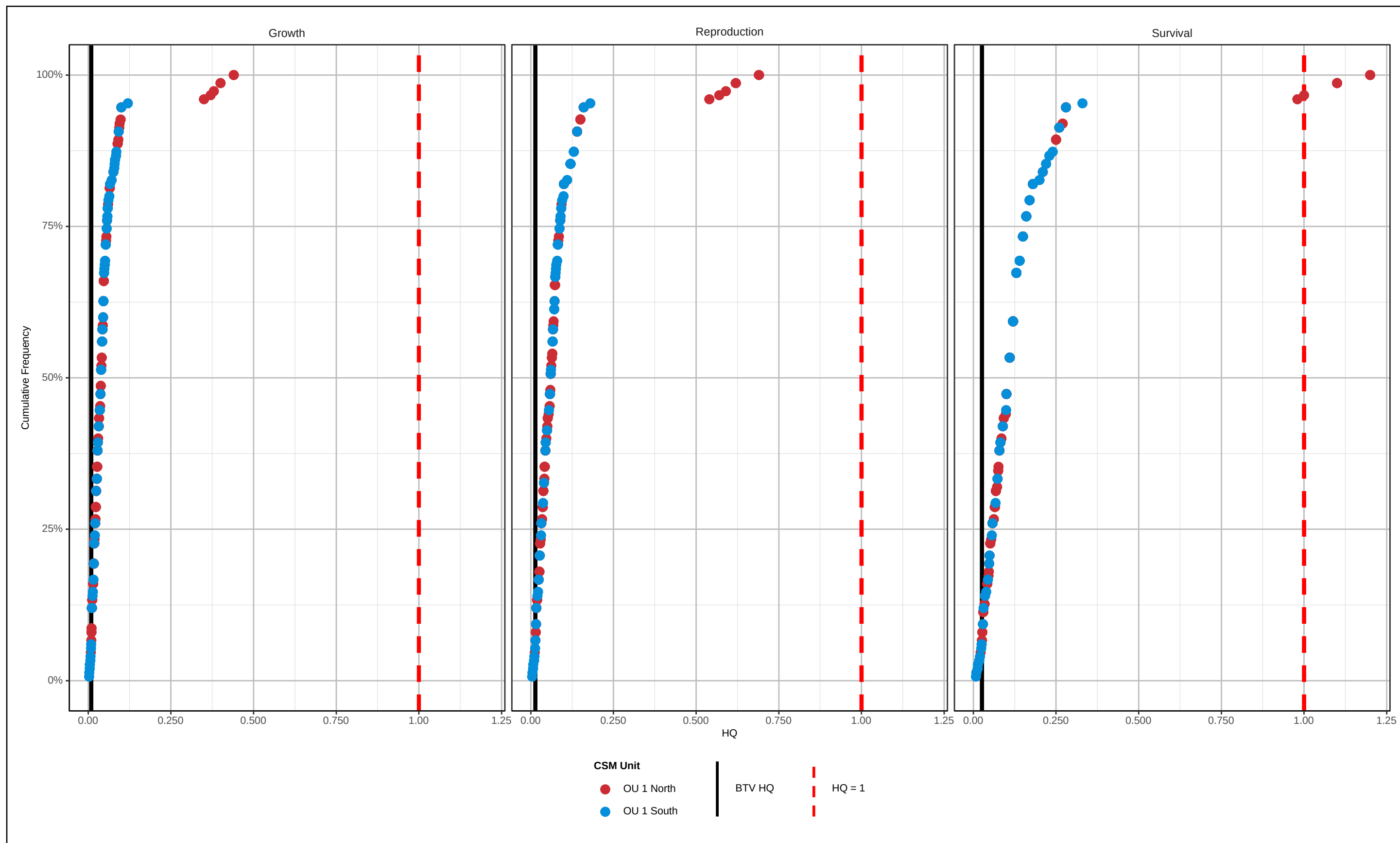


Figure M-22b. Cumulative Frequency of Cadmium Dietary HQs for Muskrat in OU 1
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

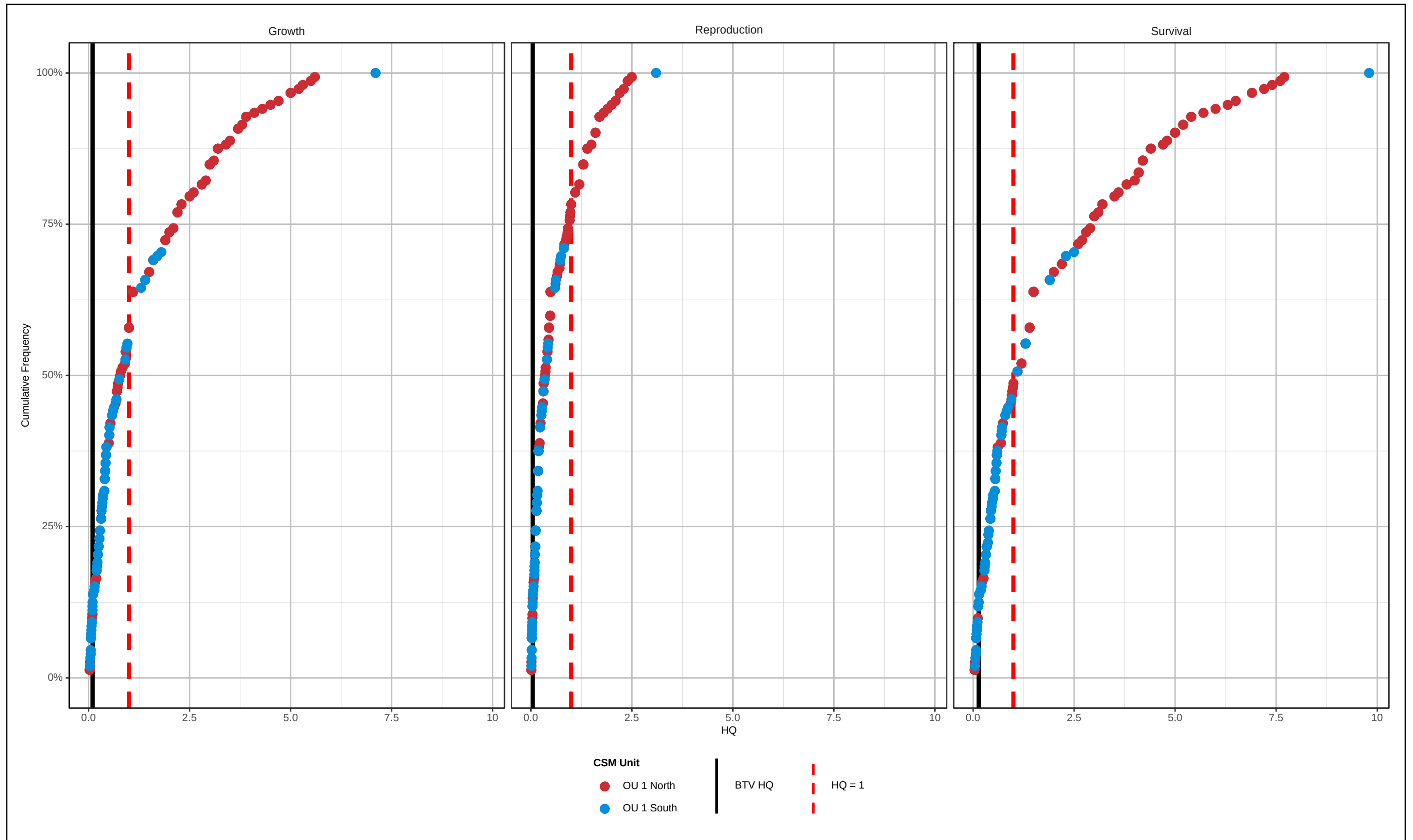


Figure M-22c. Cumulative Frequency of Copper Dietary HQs for Muskrat in OU 1
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

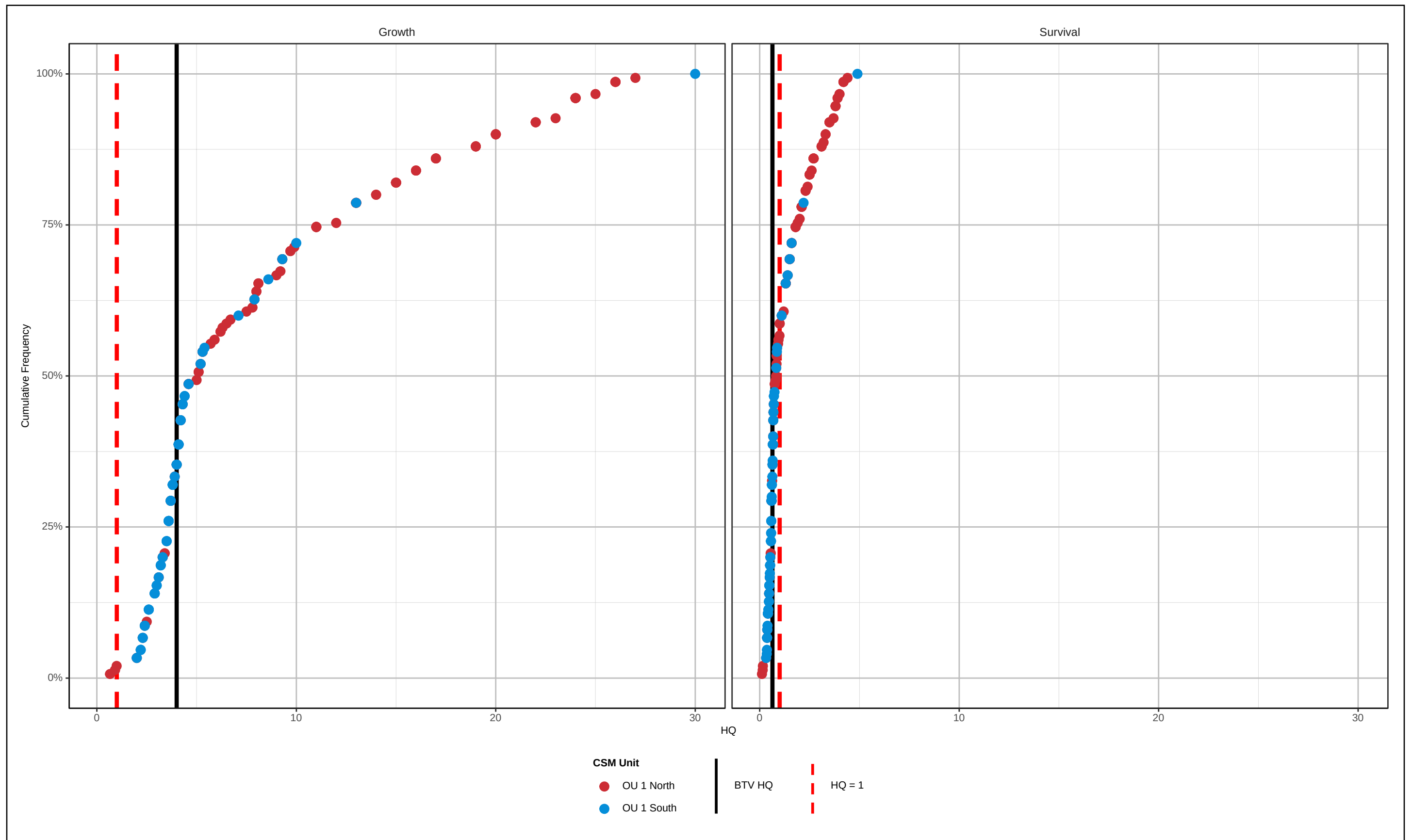


Figure M-22d. Cumulative Frequency of Iron Dietary HQs for Muskrat in OU 1
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

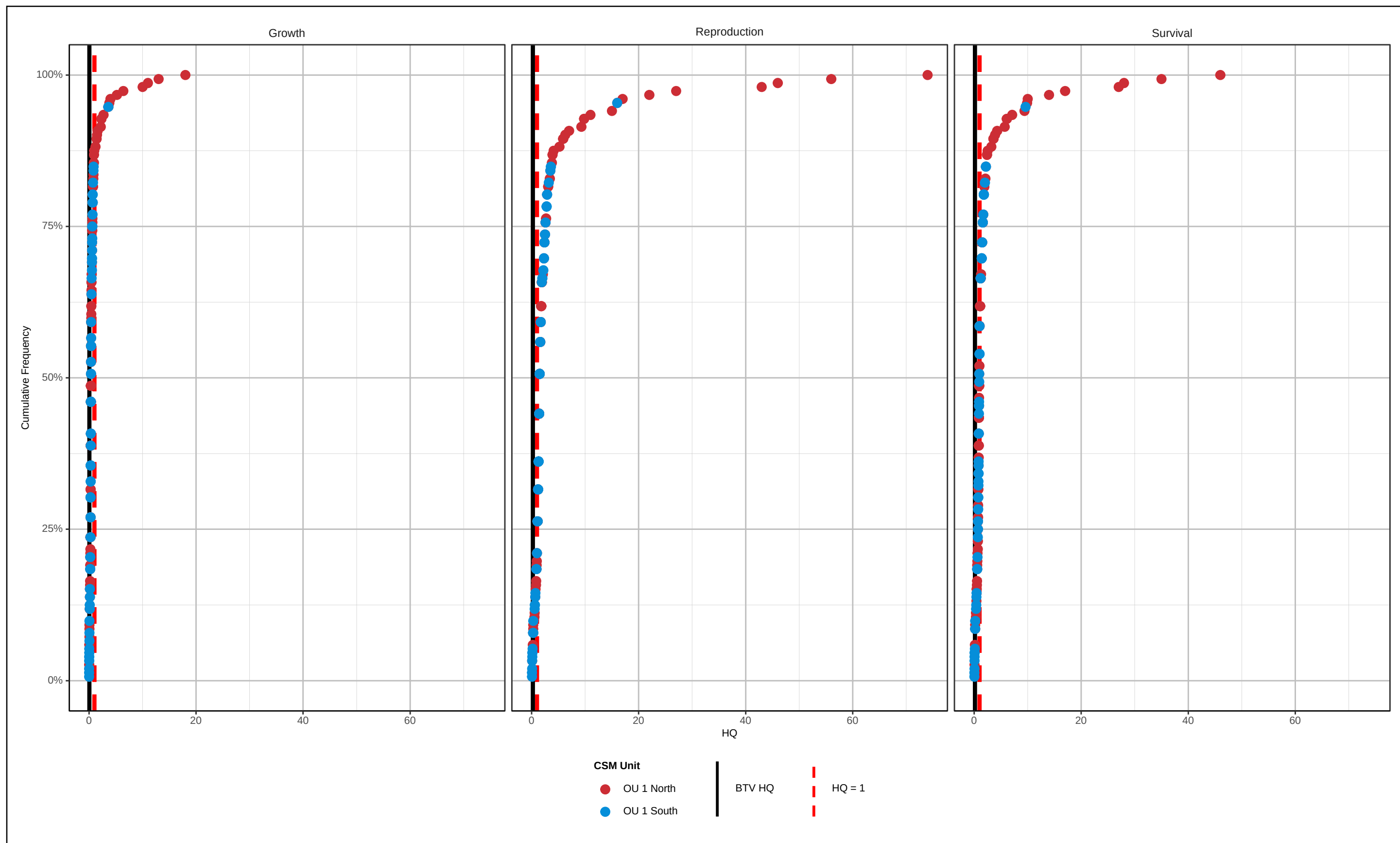


Figure M-22e. Cumulative Frequency of Lead Dietary HQs for Muskrat in OU 1
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

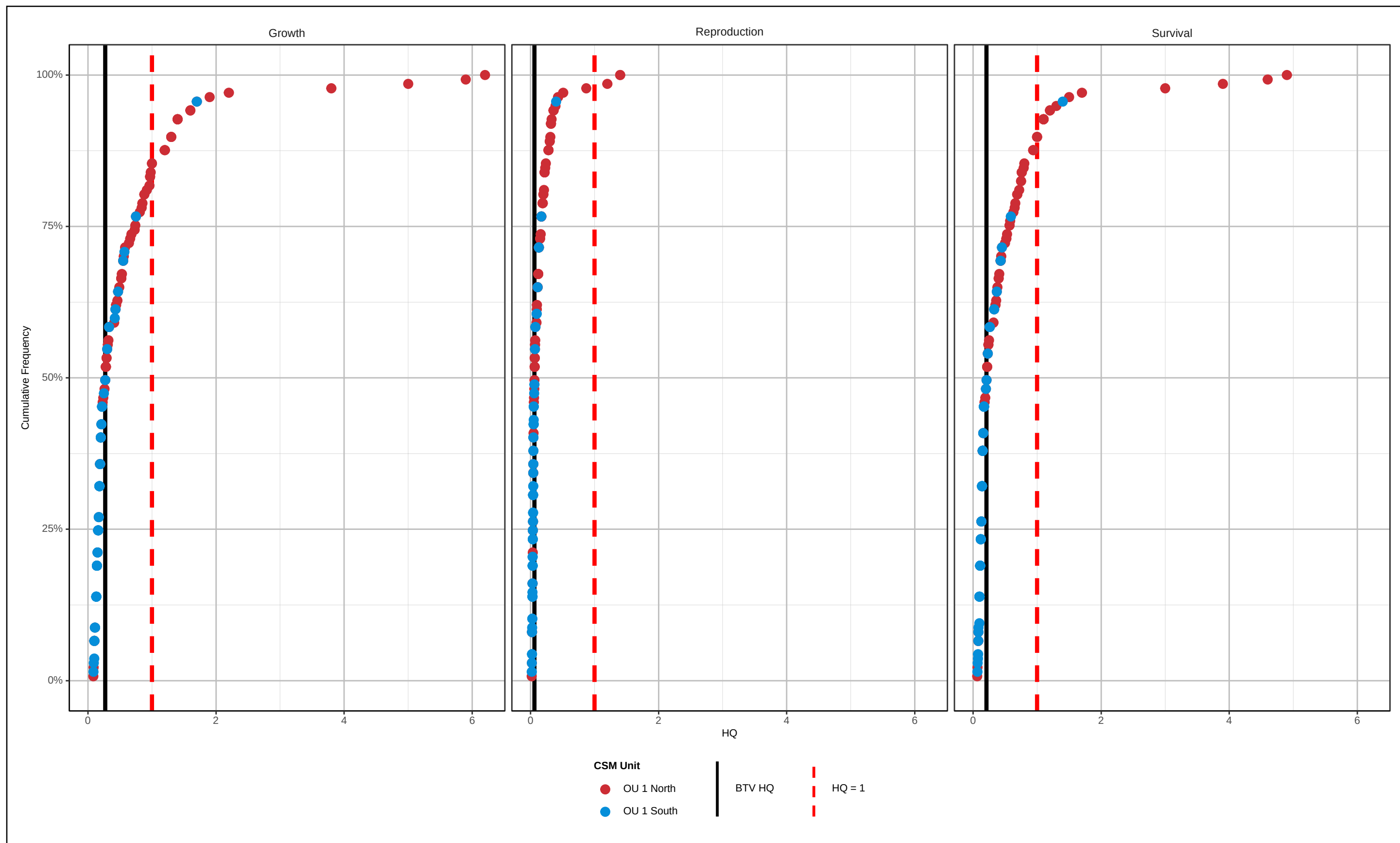


Figure M-22f. Cumulative Frequency of Manganese Dietary HQs for Muskrat in OU 1
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

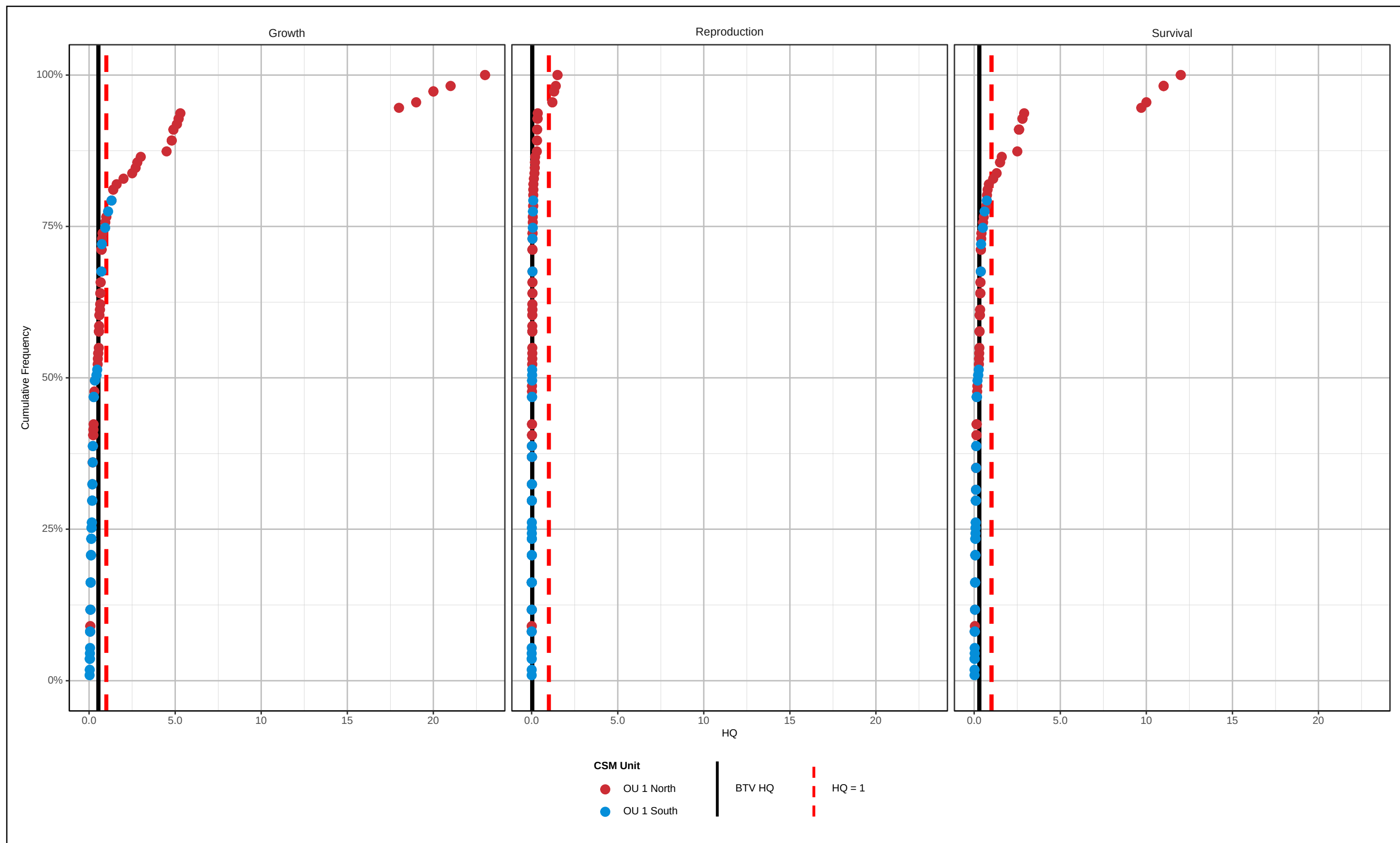


Figure M-22g. Cumulative Frequency of Selenium Dietary HQs for Muskrat in OU 1
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

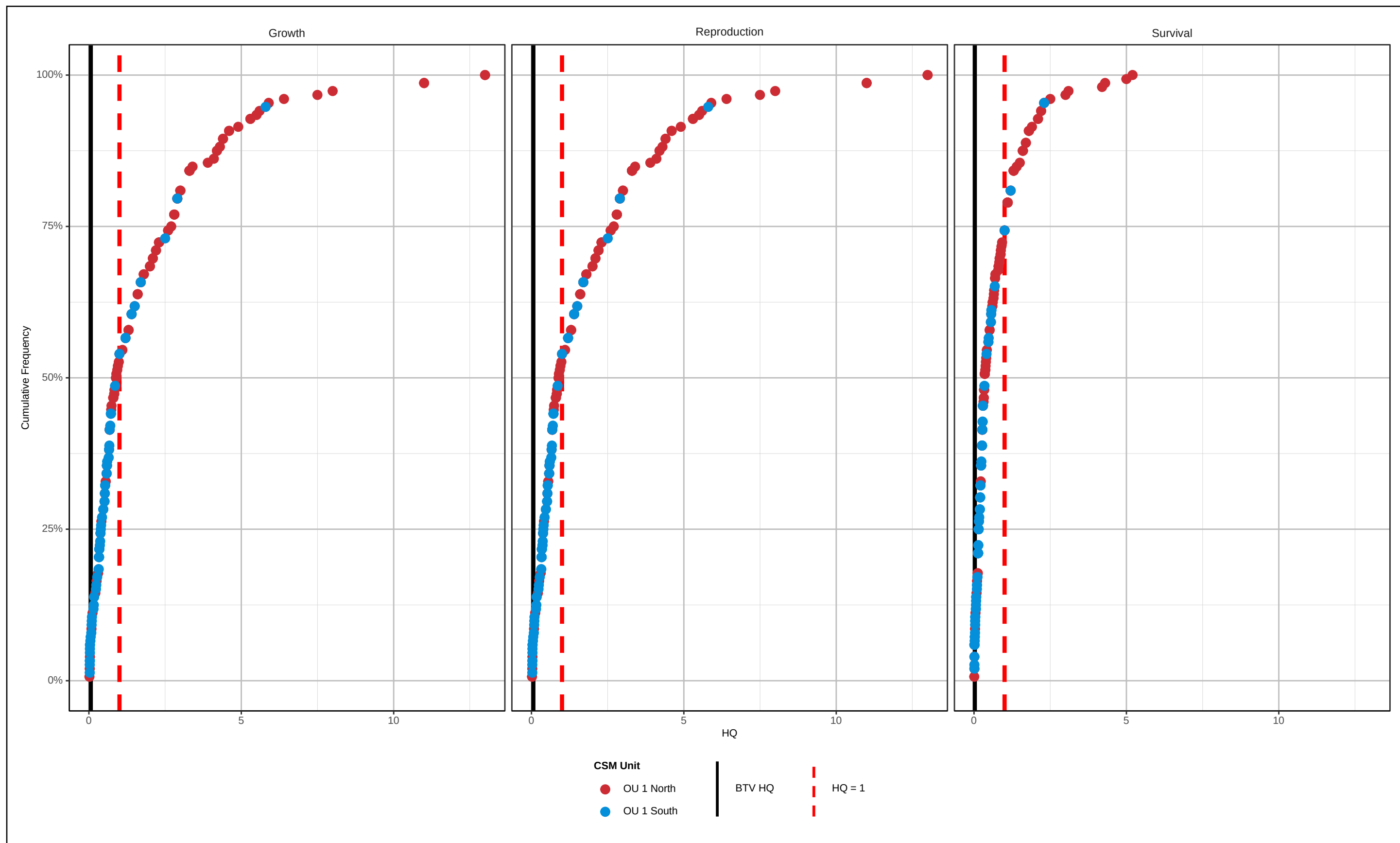


Figure M-22h. Cumulative Frequency of Zinc Dietary HQs for Muskrat in OU 1
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

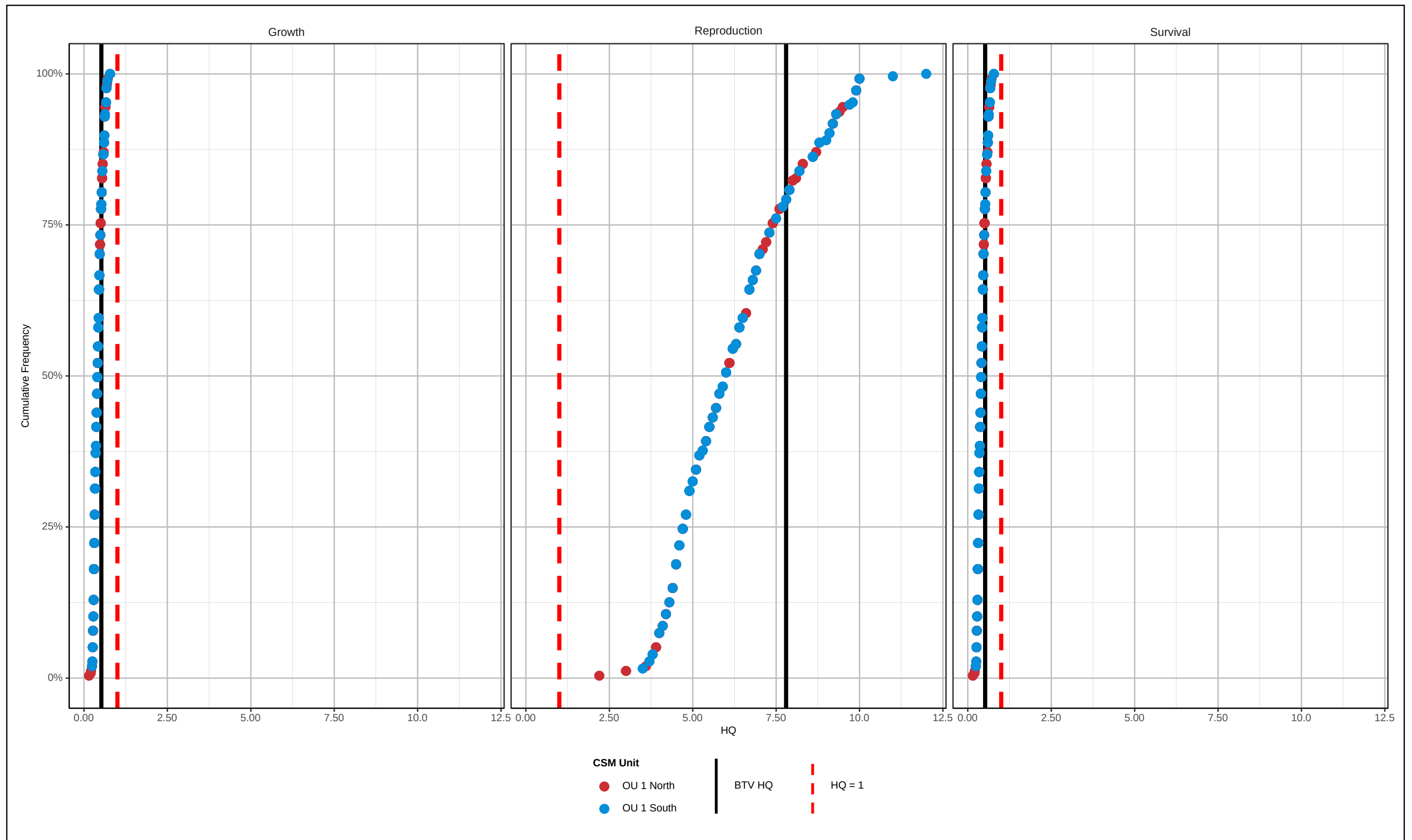


Figure M-22i. Cumulative Frequency of Aluminum Dietary HQs for Water Shrew in OU 1
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

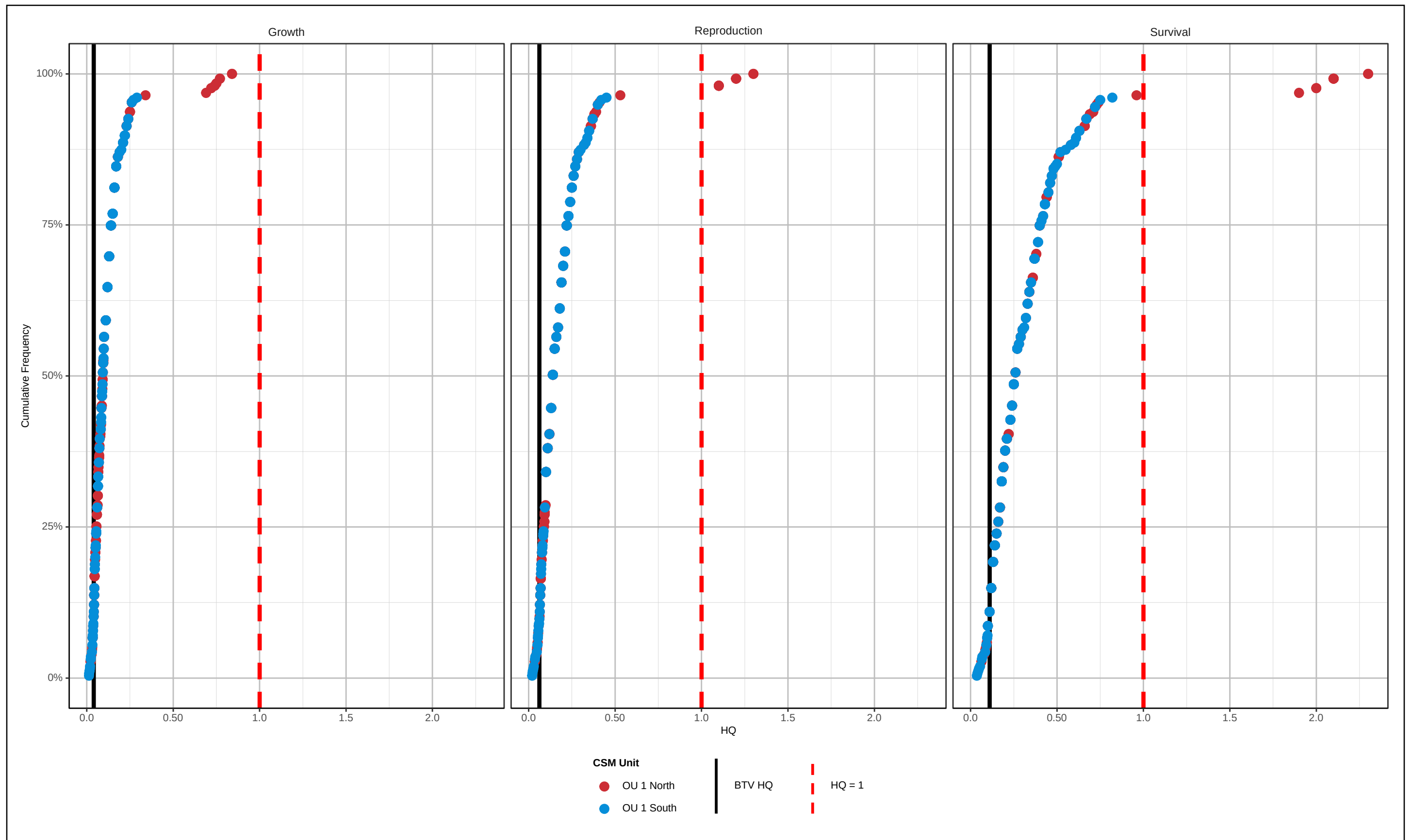


Figure M-22j. Cumulative Frequency of Cadmium Dietary HQs for Water Shrew in OU 1
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

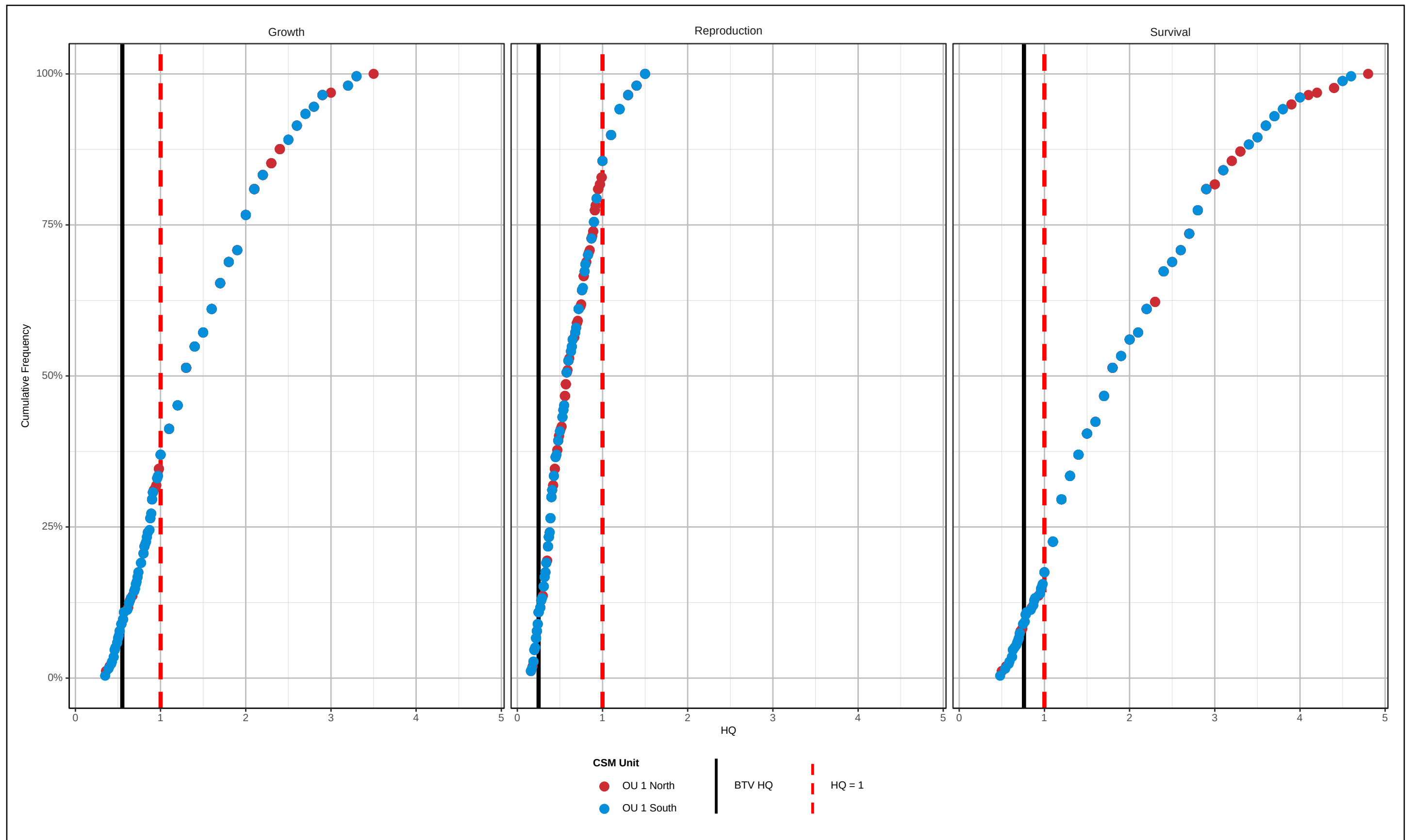


Figure M-22k. Cumulative Frequency of Copper Dietary HQs for Water Shrew in OU 1
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

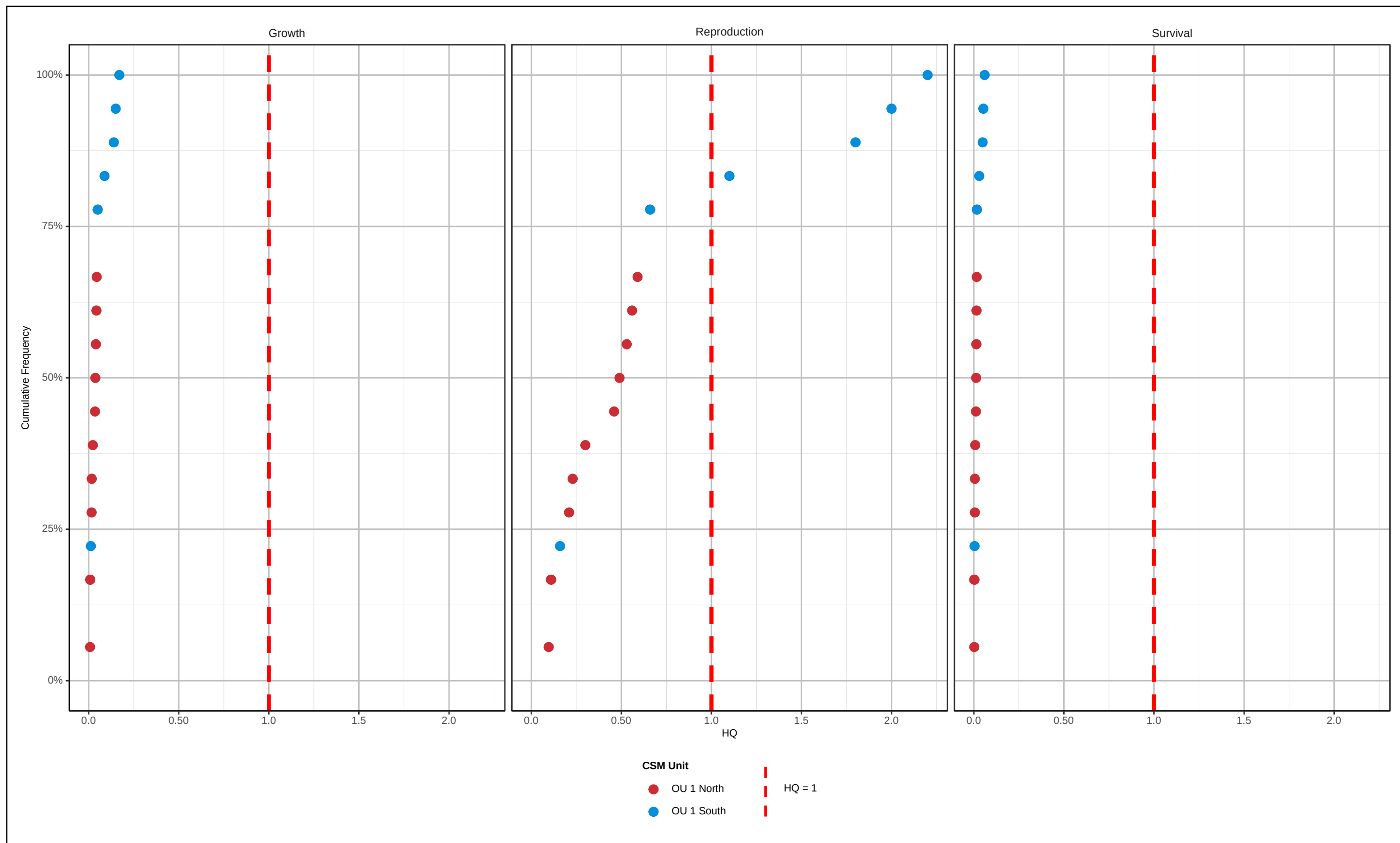


Figure M-22I. Cumulative Frequency of Dioxin/Furan Mammal TEQ, 0 DL Dietary HQs for Water Shrew in OU 1
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

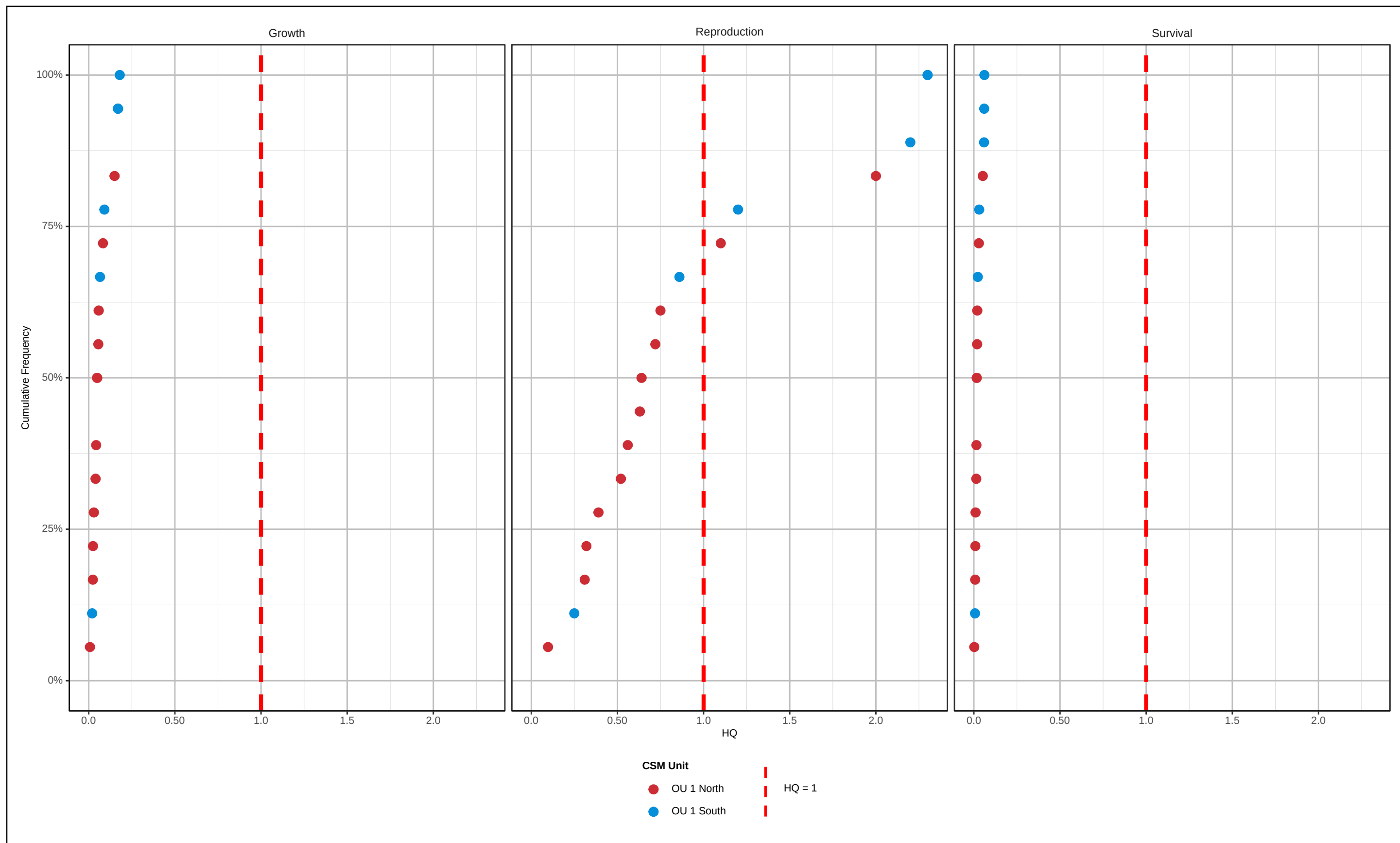


Figure M-22m. Cumulative Frequency of Dioxin/Furan Mammal TEQ, 1/2 DL Dietary HQs for Water Shrew in OU 1
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

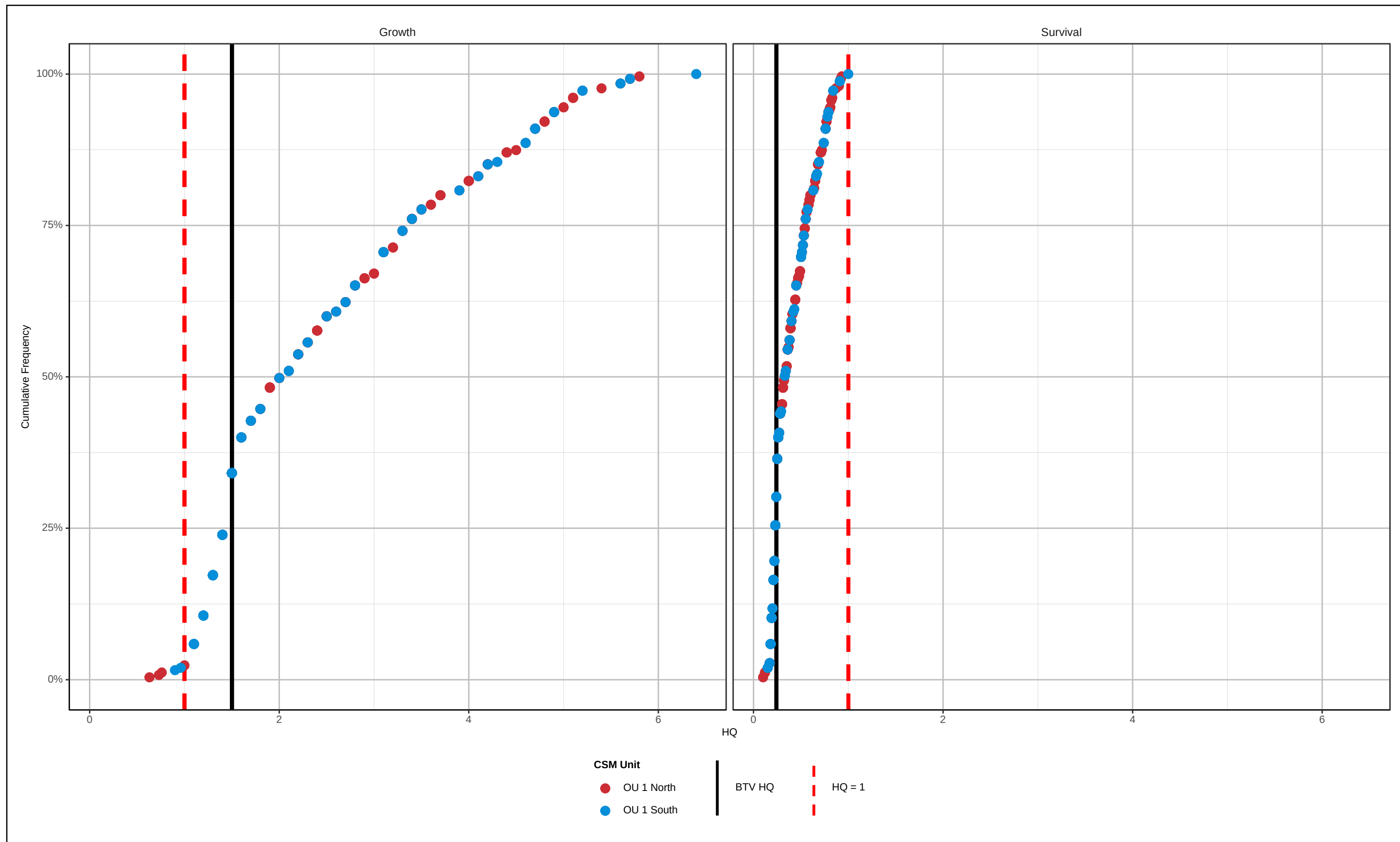


Figure M-22n. Cumulative Frequency of Iron Dietary HQs for Water Shrew in OU 1
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

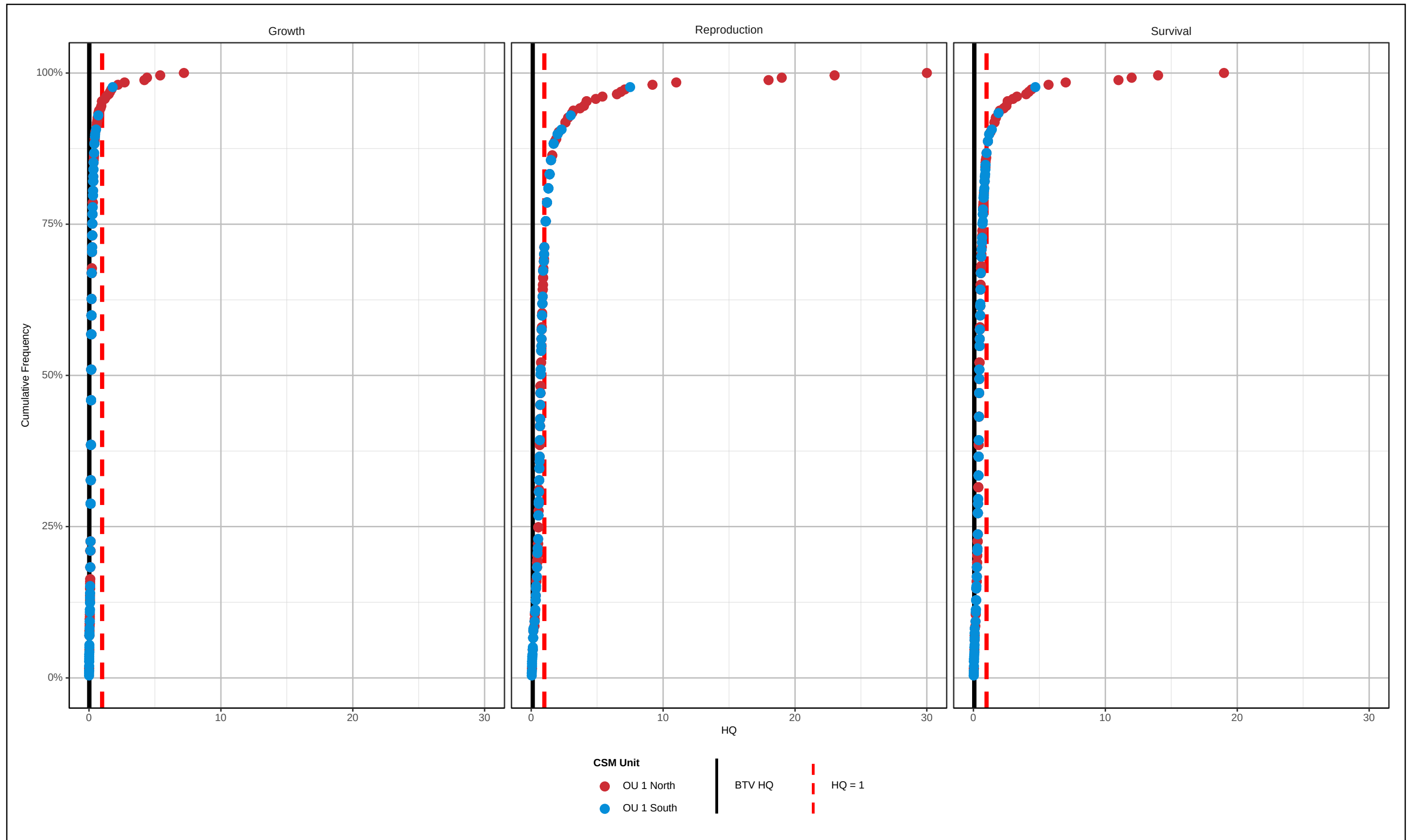


Figure M-22o. Cumulative Frequency of Lead Dietary HQs for Water Shrew in OU 1
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

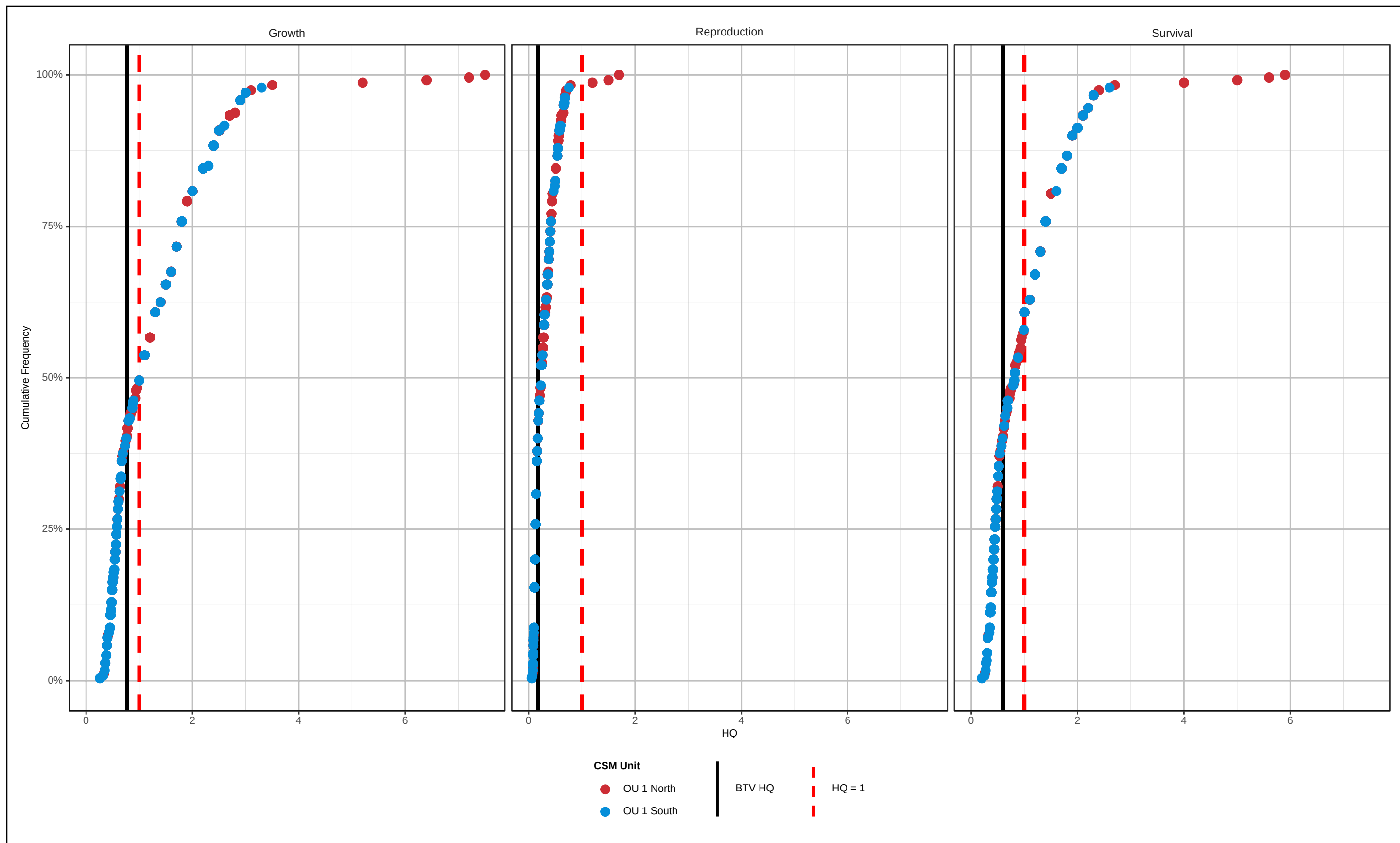


Figure M-22p. Cumulative Frequency of Manganese Dietary HQs for Water Shrew in OU 1
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

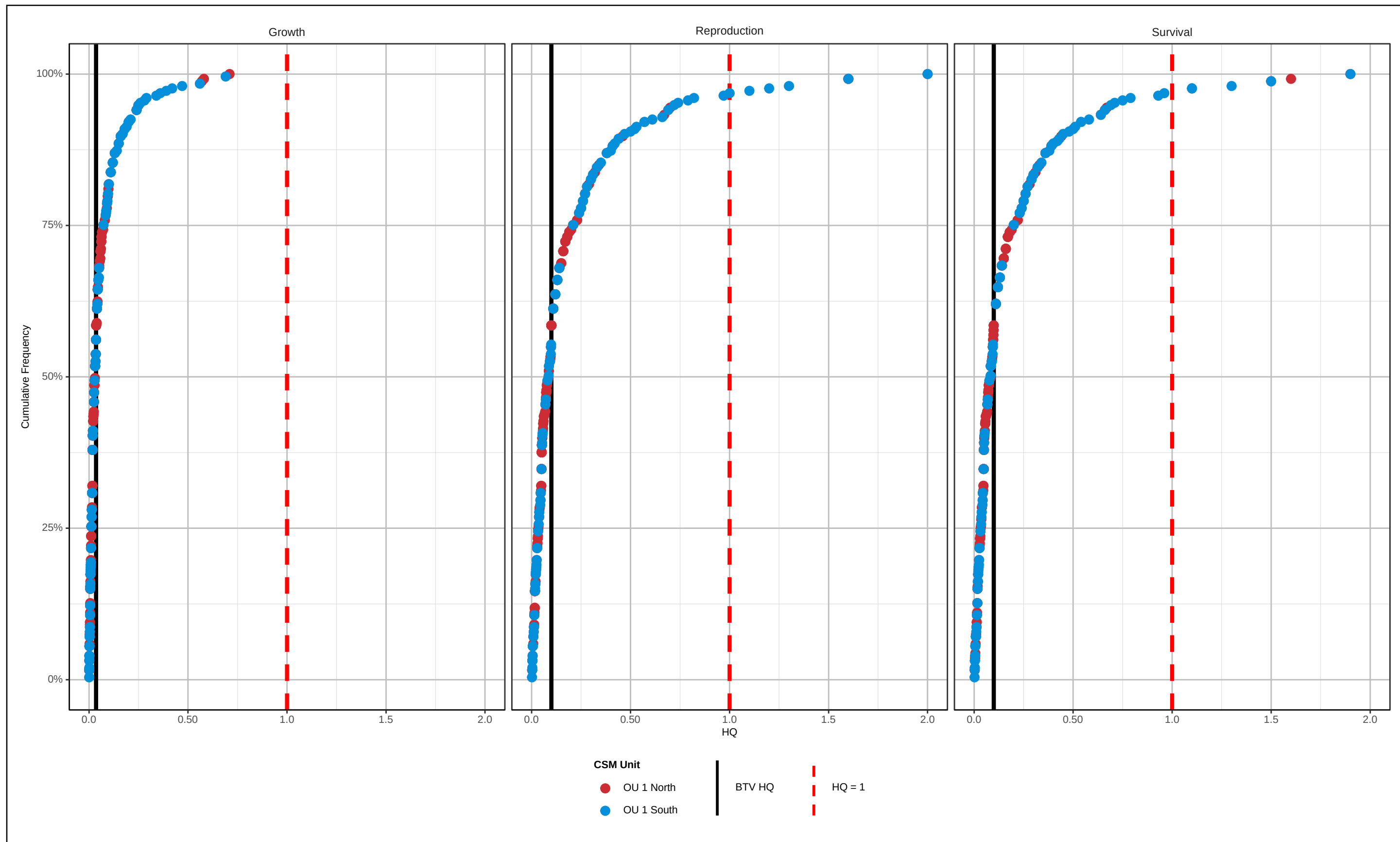


Figure M-22q. Cumulative Frequency of Mercury Dietary HQs for Water Shrew in OU 1
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

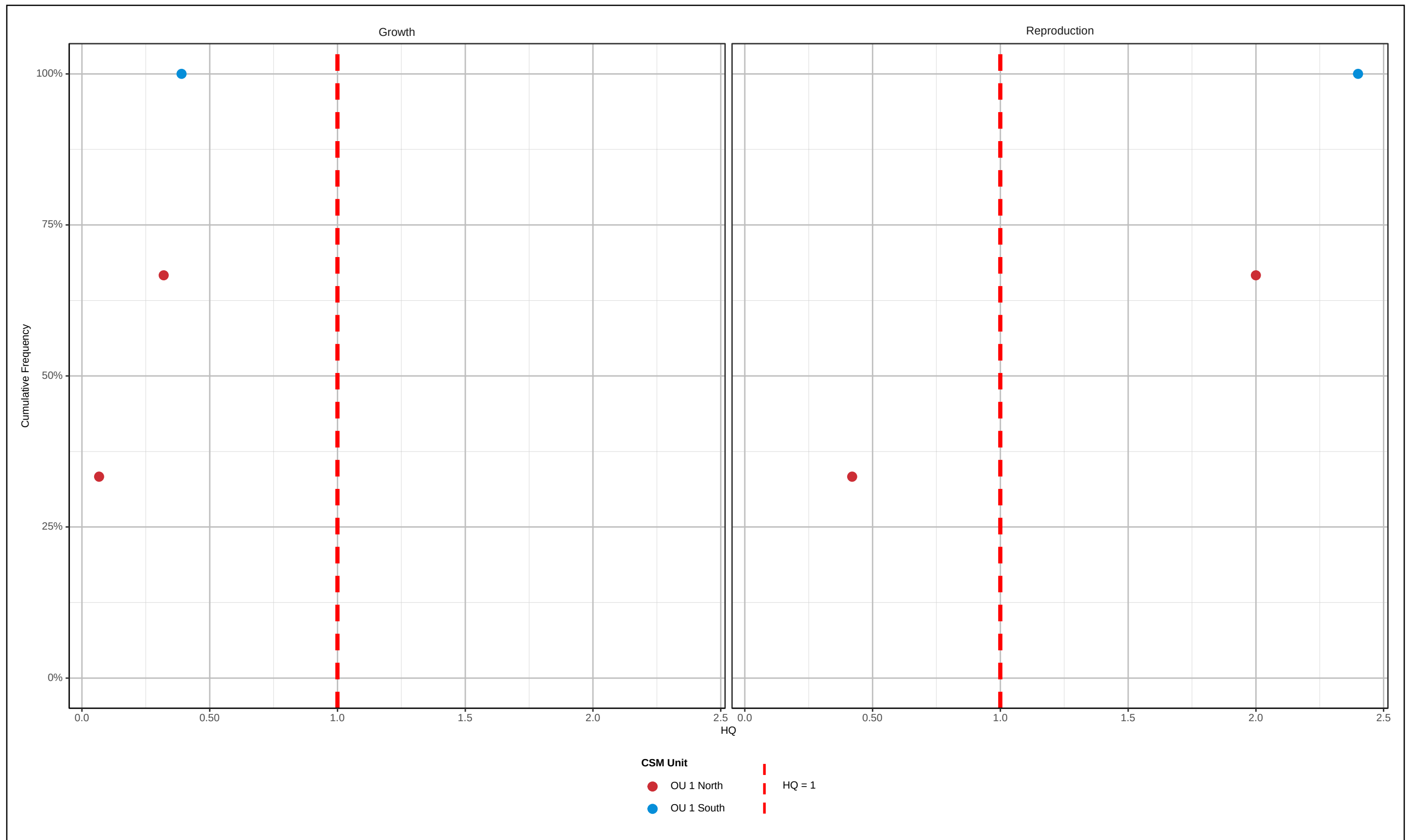


Figure M-22r. Cumulative Frequency of Molybdenum Dietary HQs for Water Shrew in OU 1
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

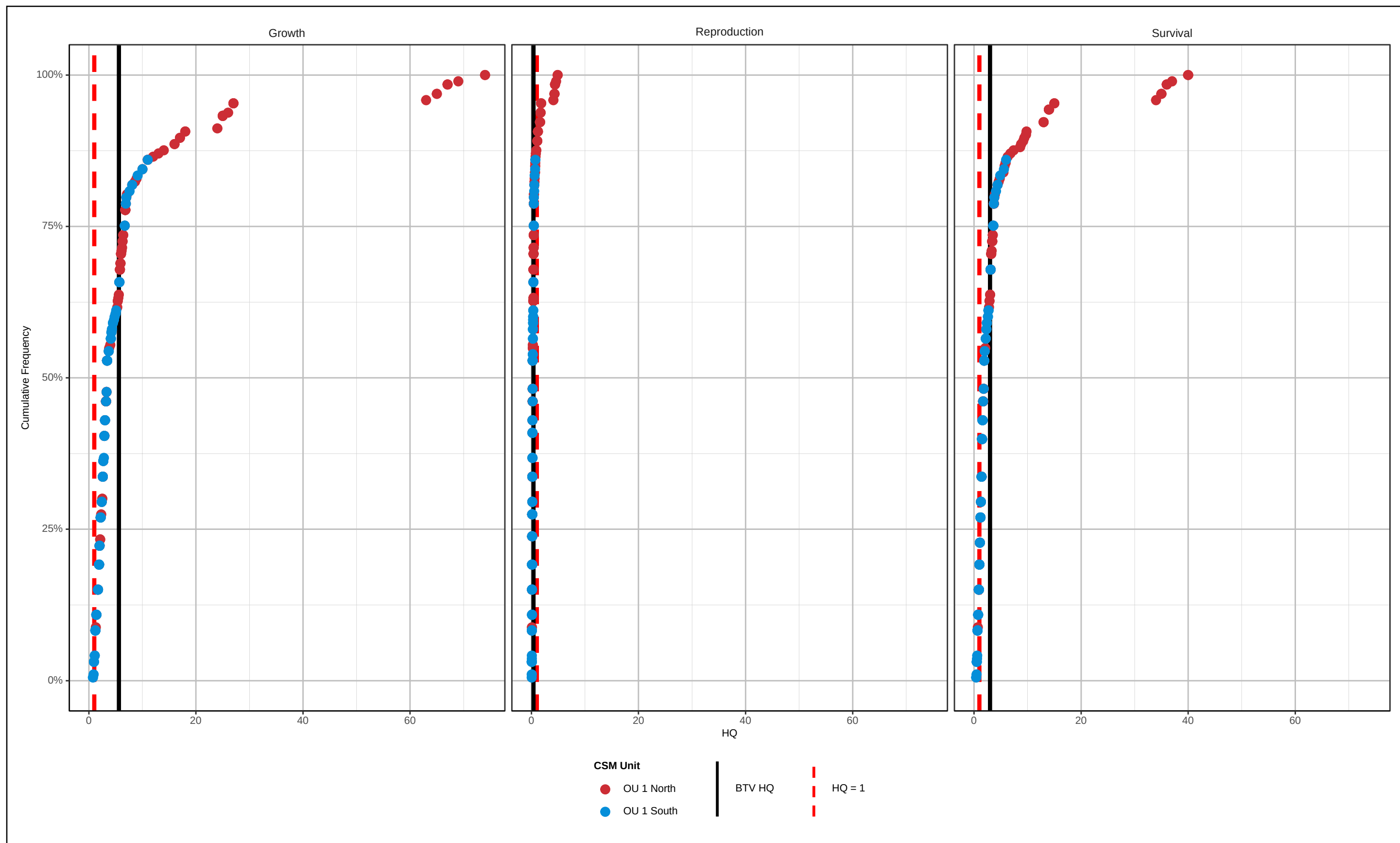


Figure M-22s. Cumulative Frequency of Selenium Dietary HQs for Water Shrew in OU 1
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

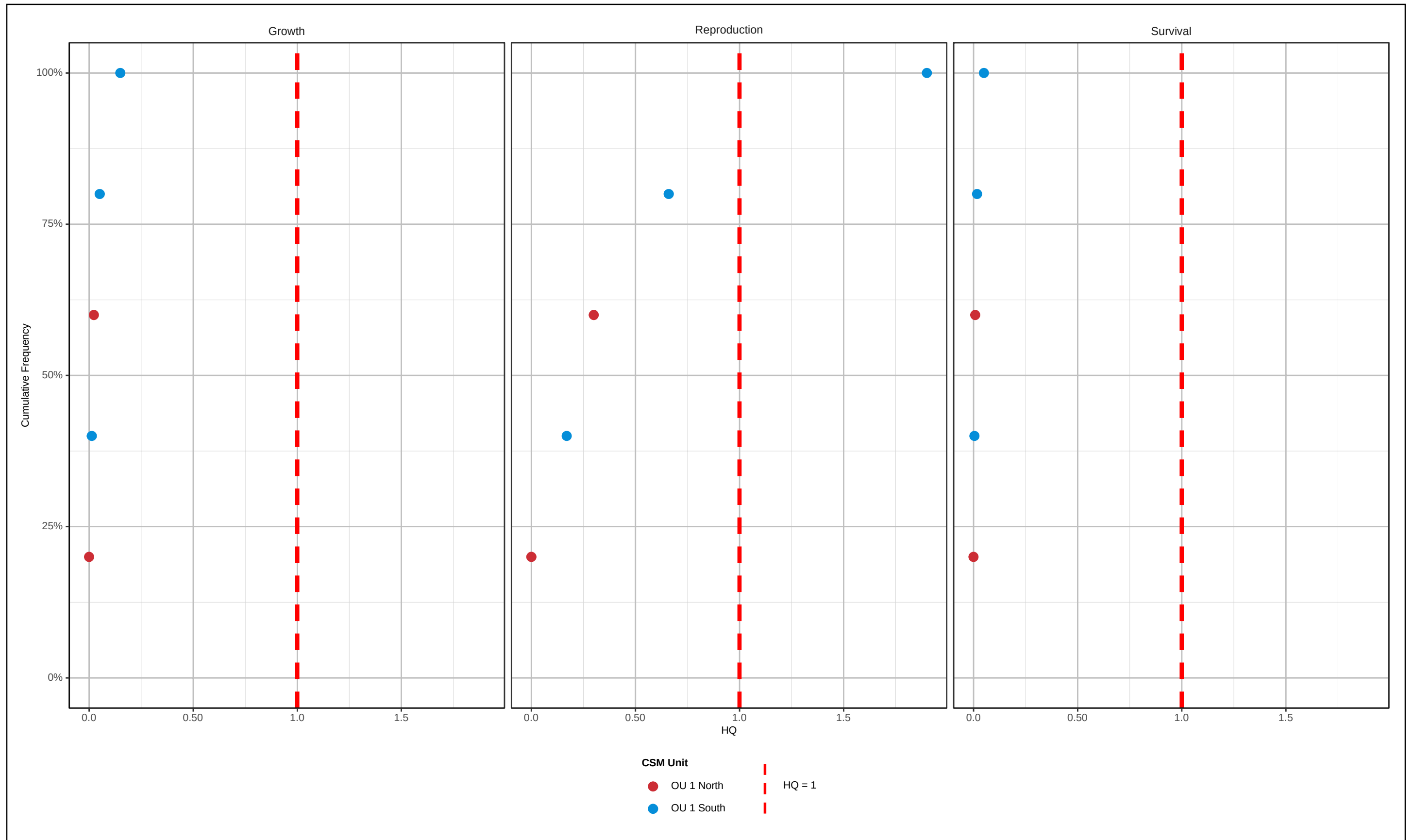


Figure M-22t. Cumulative Frequency of Total Mammal TEQ, 0 DL Dietary HQs for Water Shrew in OU 1

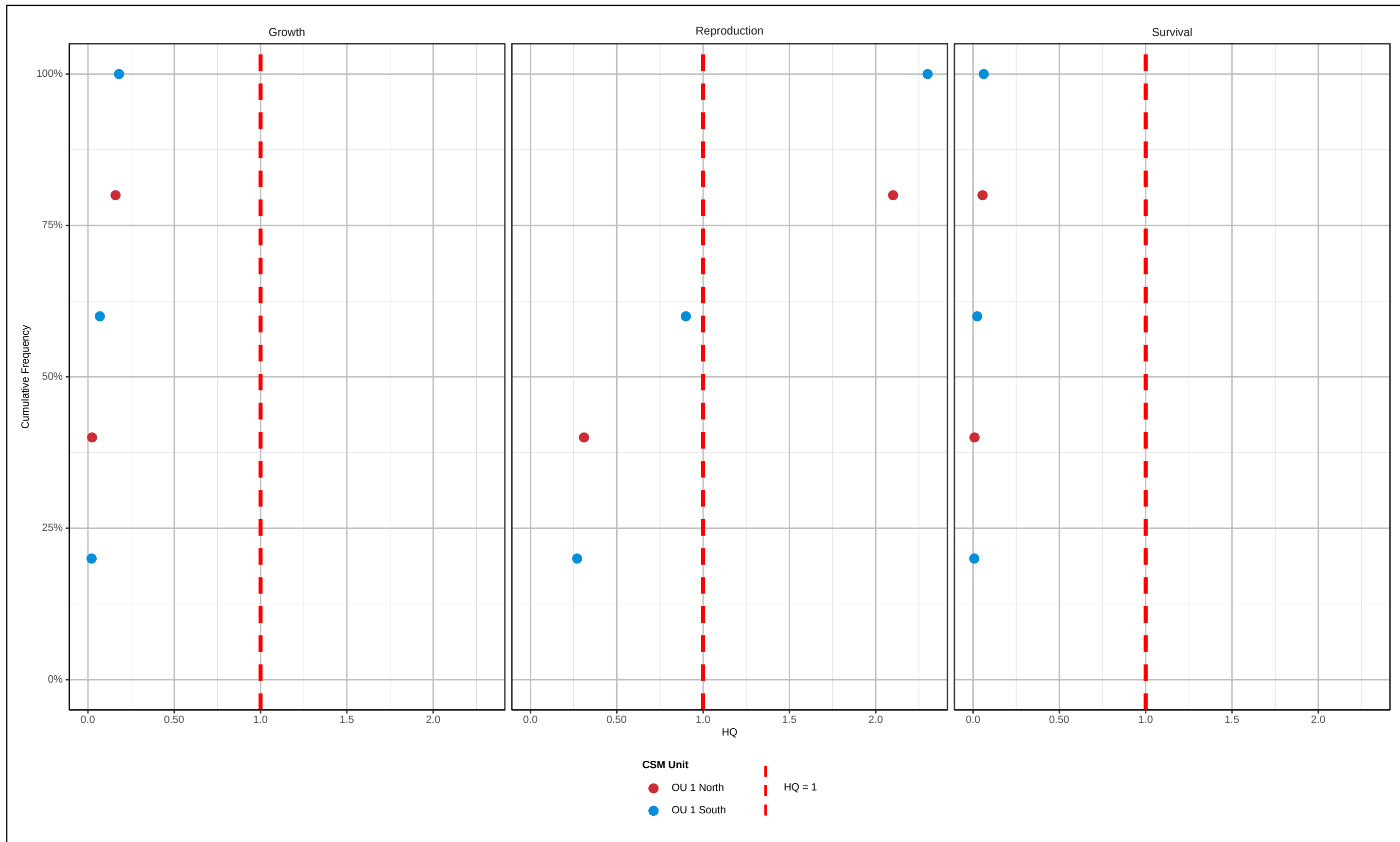


Figure M-22u. Cumulative Frequency of Total Mammal TEQ, 1/2 DL Dietary HQs for Water Shrew in OU 1
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

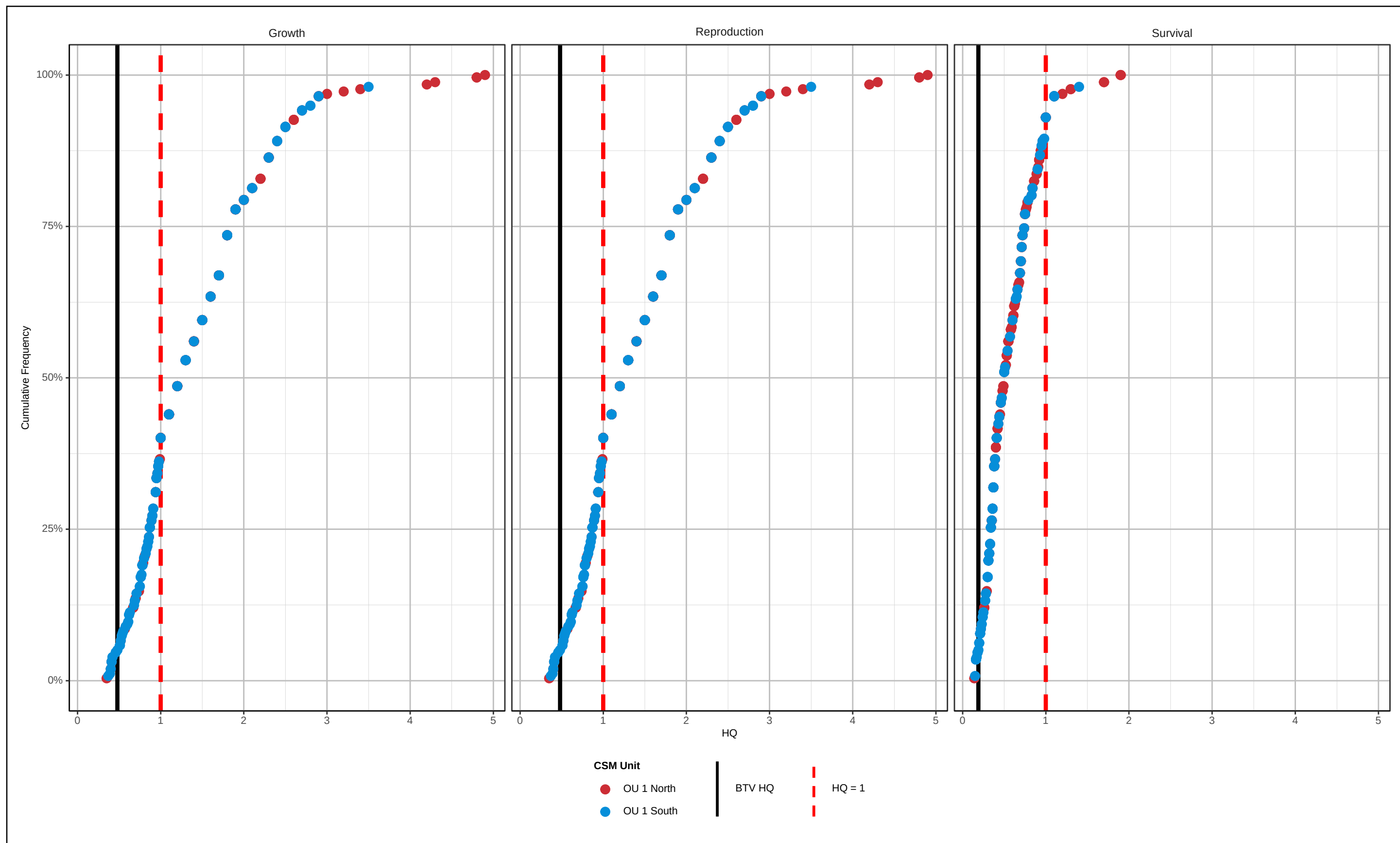


Figure M-22v. Cumulative Frequency of Zinc Dietary HQs for Water Shrew in OU 1
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

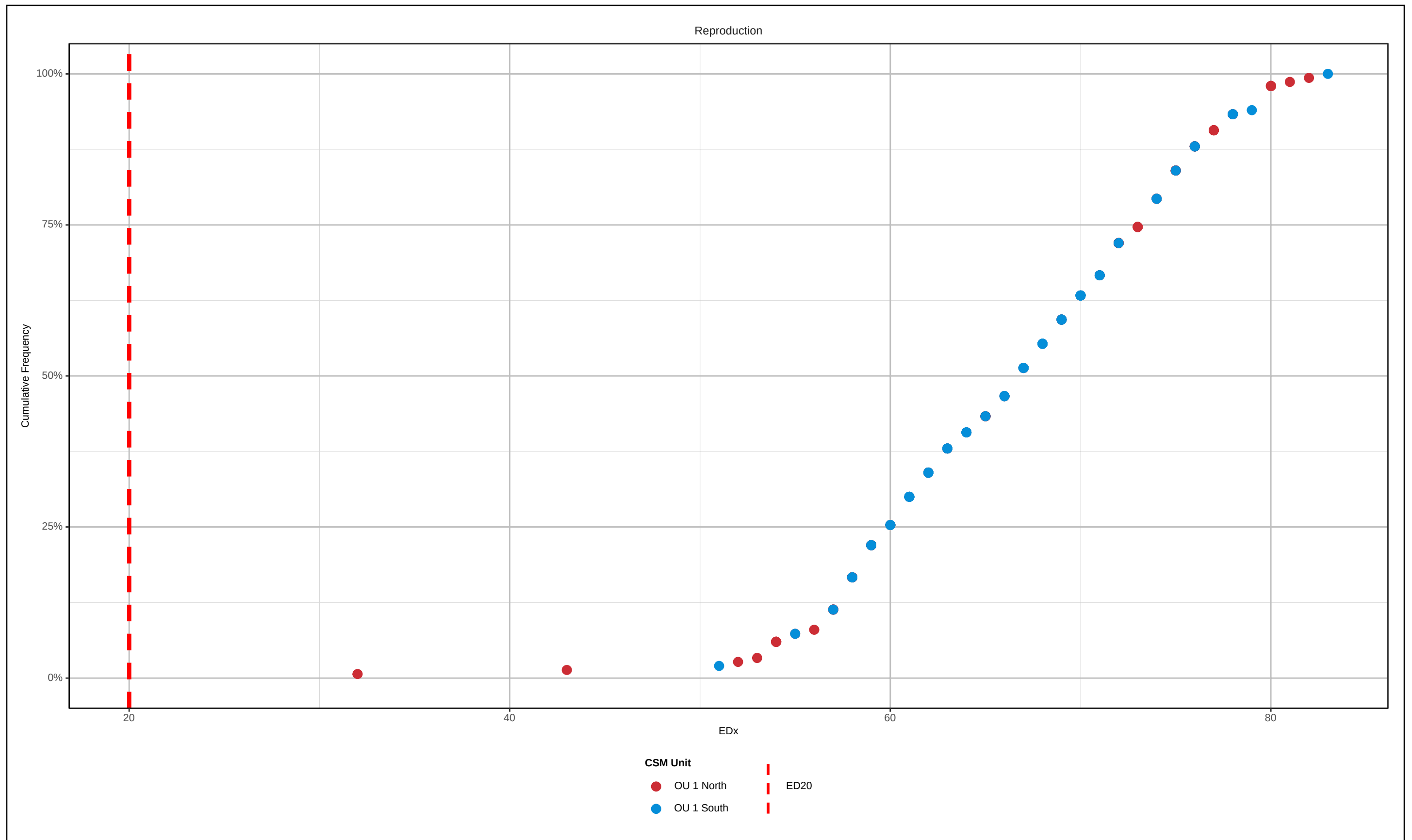


Figure M-23a. Cumulative Frequency of Aluminum EDx Values for Muskrat in OU 1
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

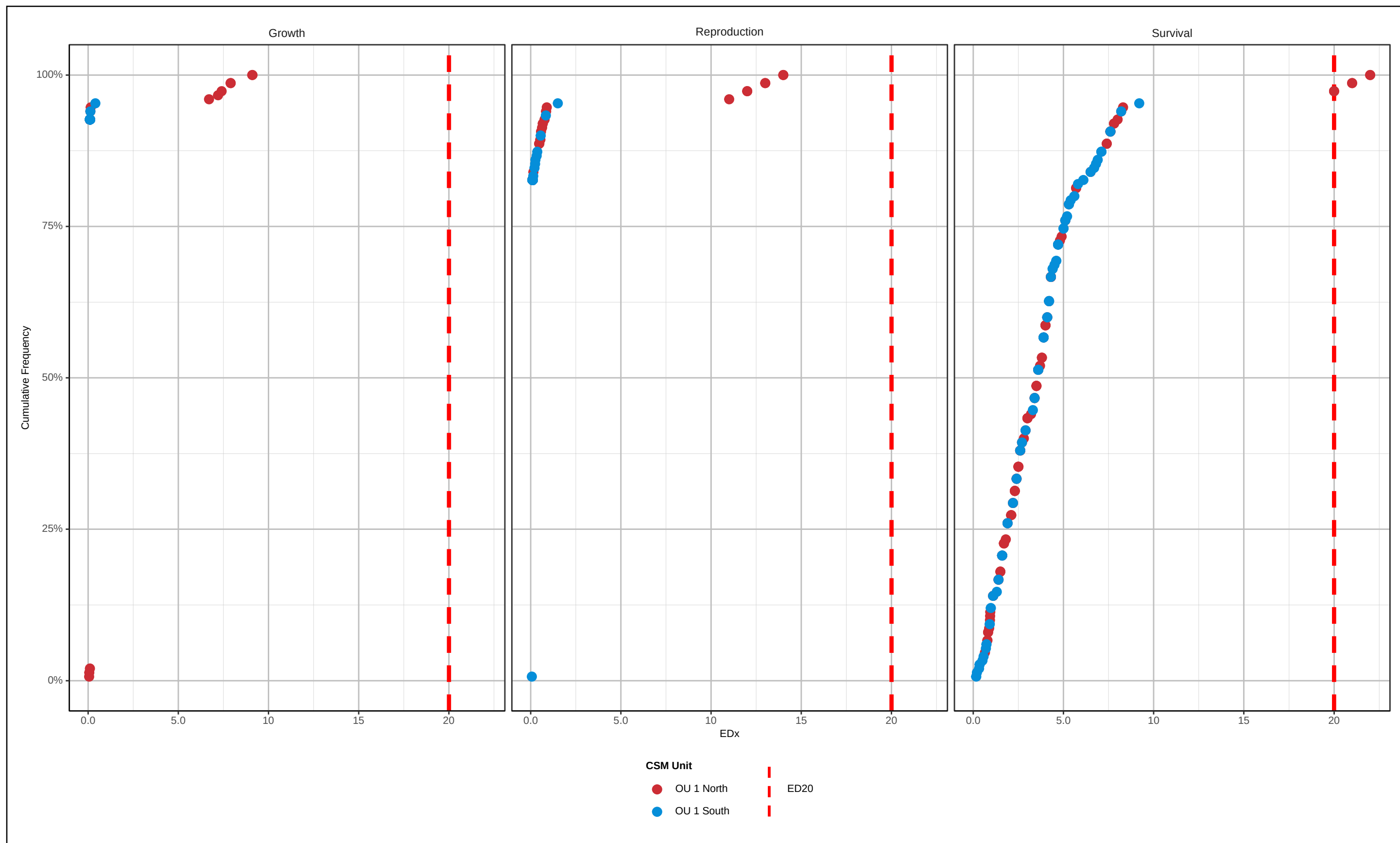


Figure M-23b. Cumulative Frequency of Cadmium EDx Values for Muskrat in OU 1
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

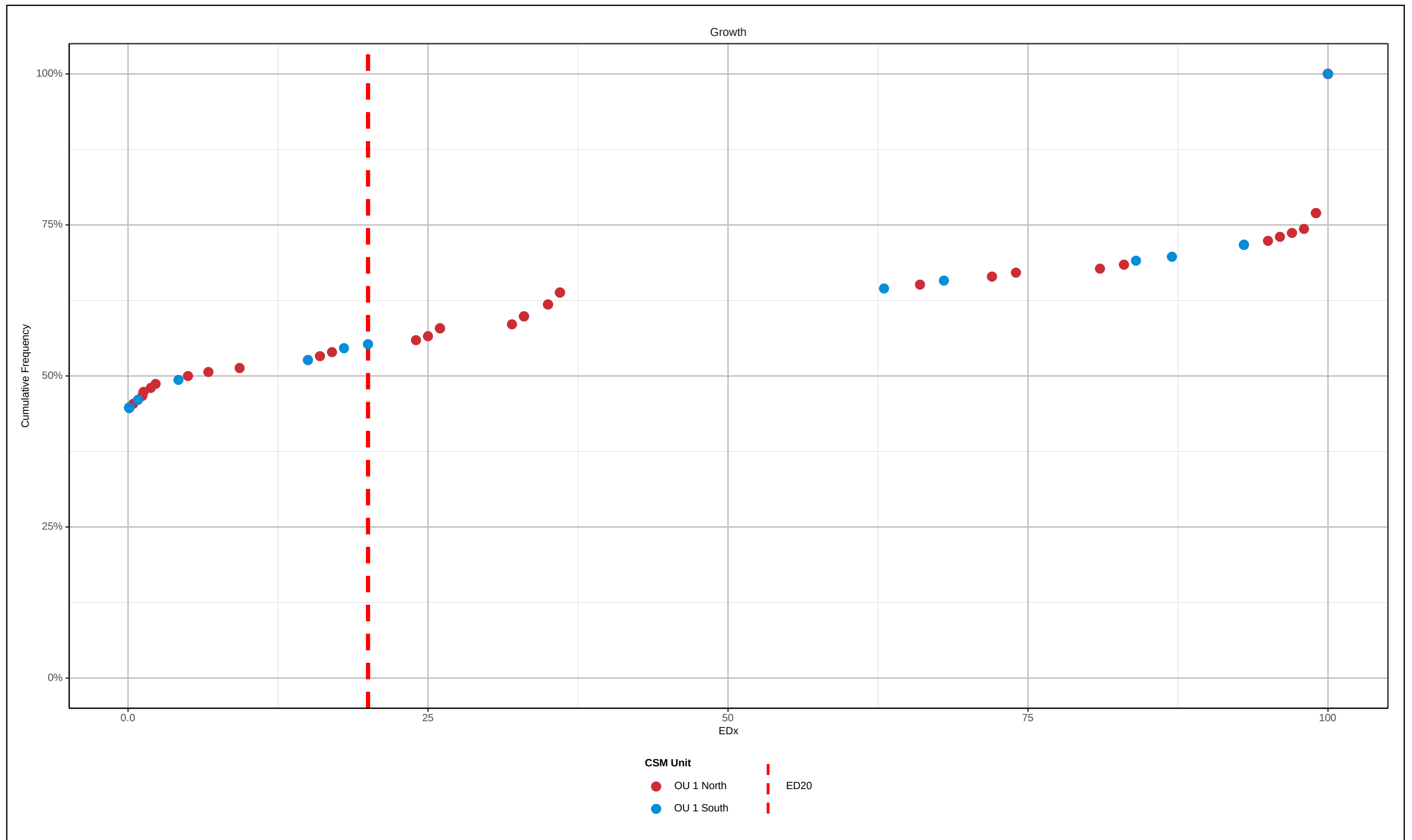


Figure M-23c. Cumulative Frequency of Copper EDx Values for Muskrat in OU 1
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

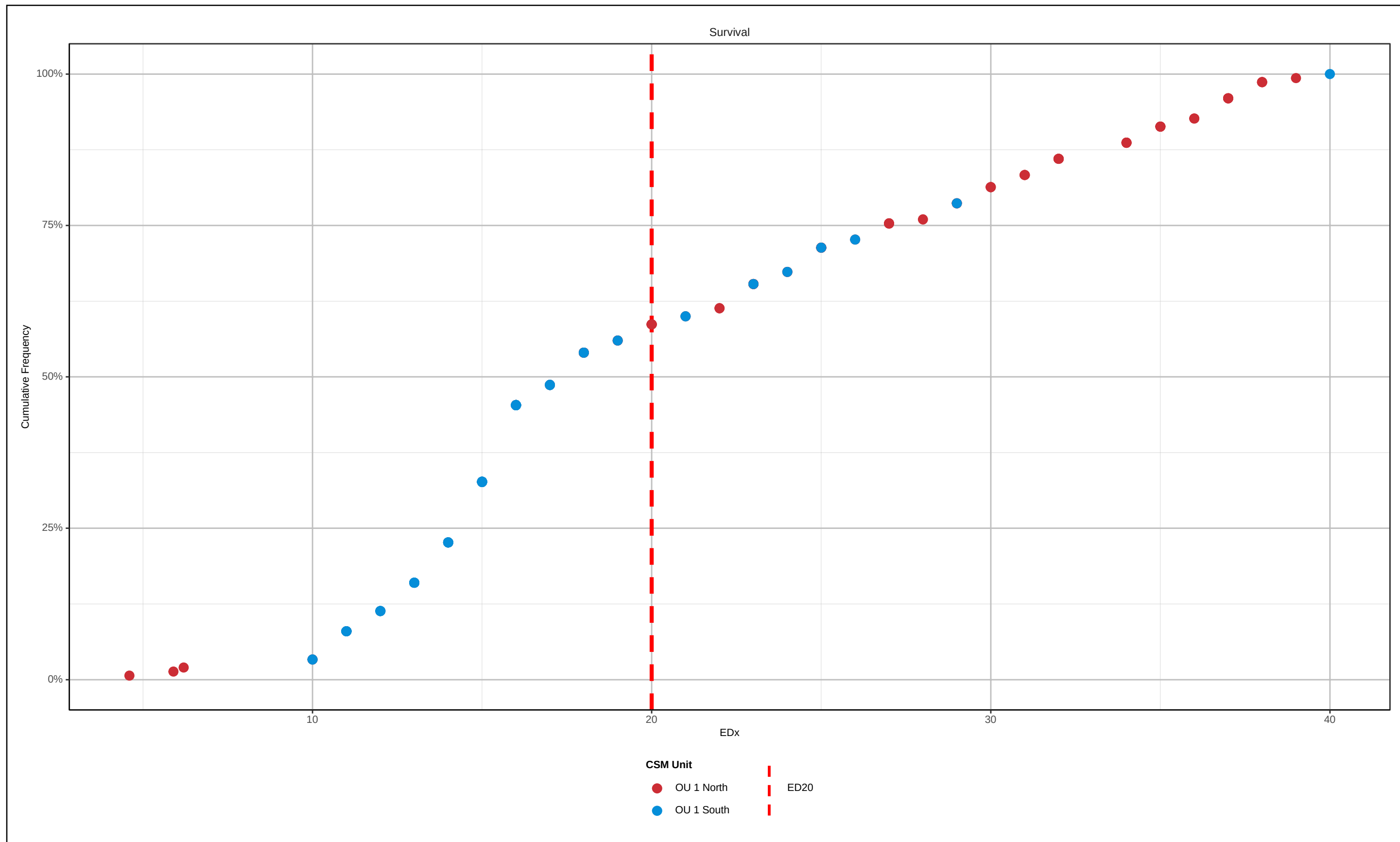


Figure M-23d. Cumulative Frequency of Iron EDx Values for Muskrat in OU 1
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

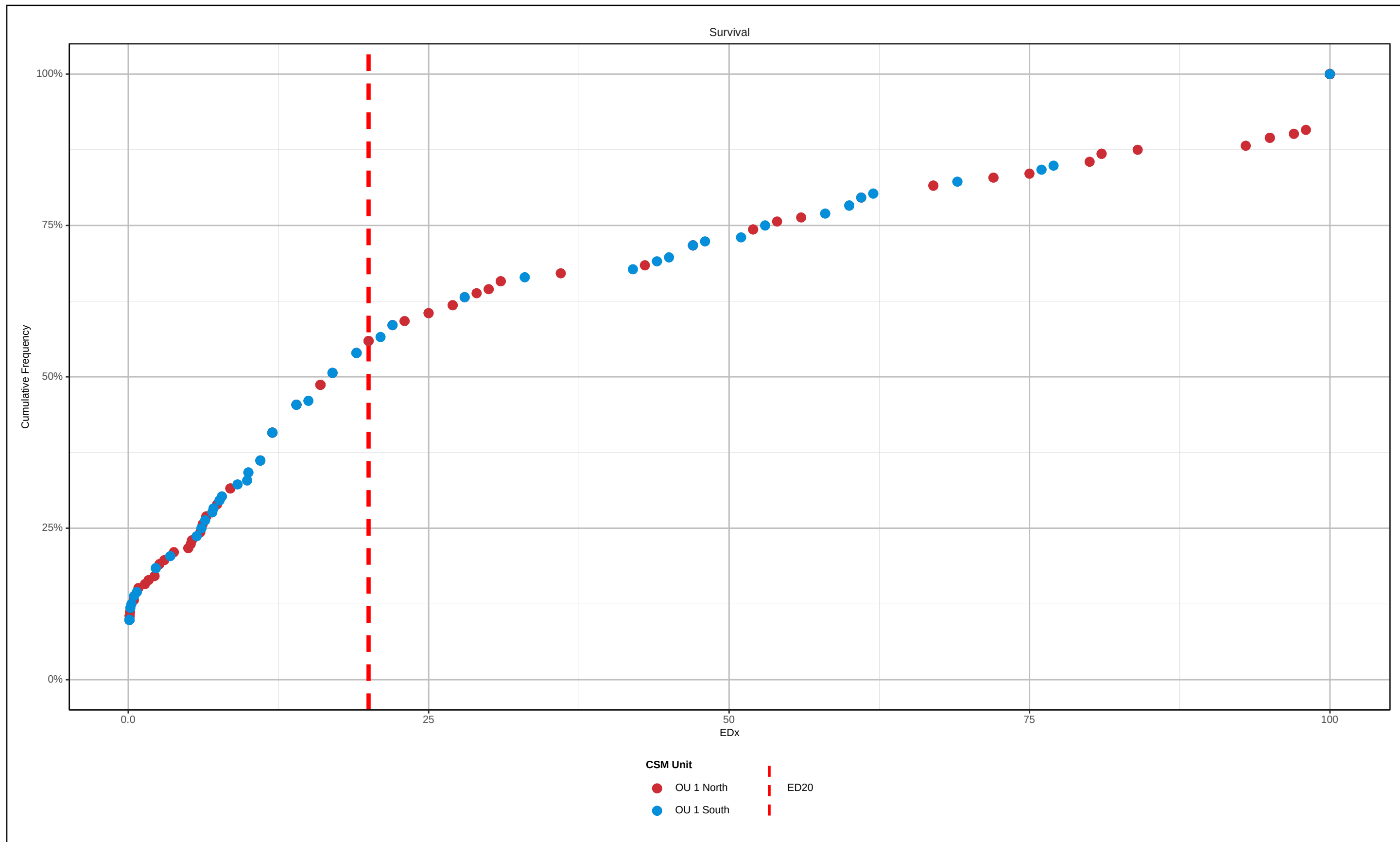


Figure M-23e. Cumulative Frequency of Lead EDx Values for Muskrat in OU 1
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

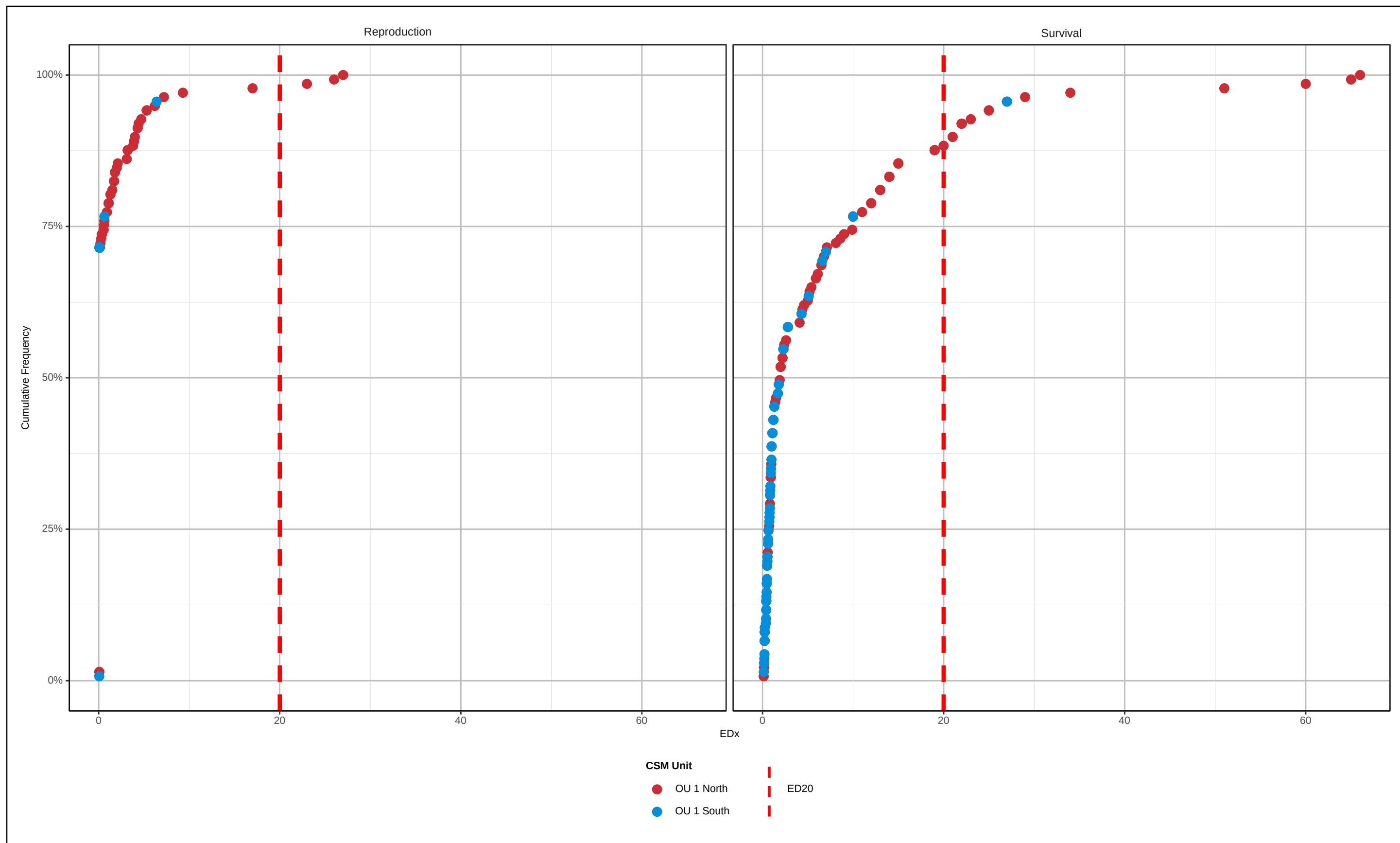


Figure M-23f. Cumulative Frequency of Manganese EDx Values for Muskrat in OU 1
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

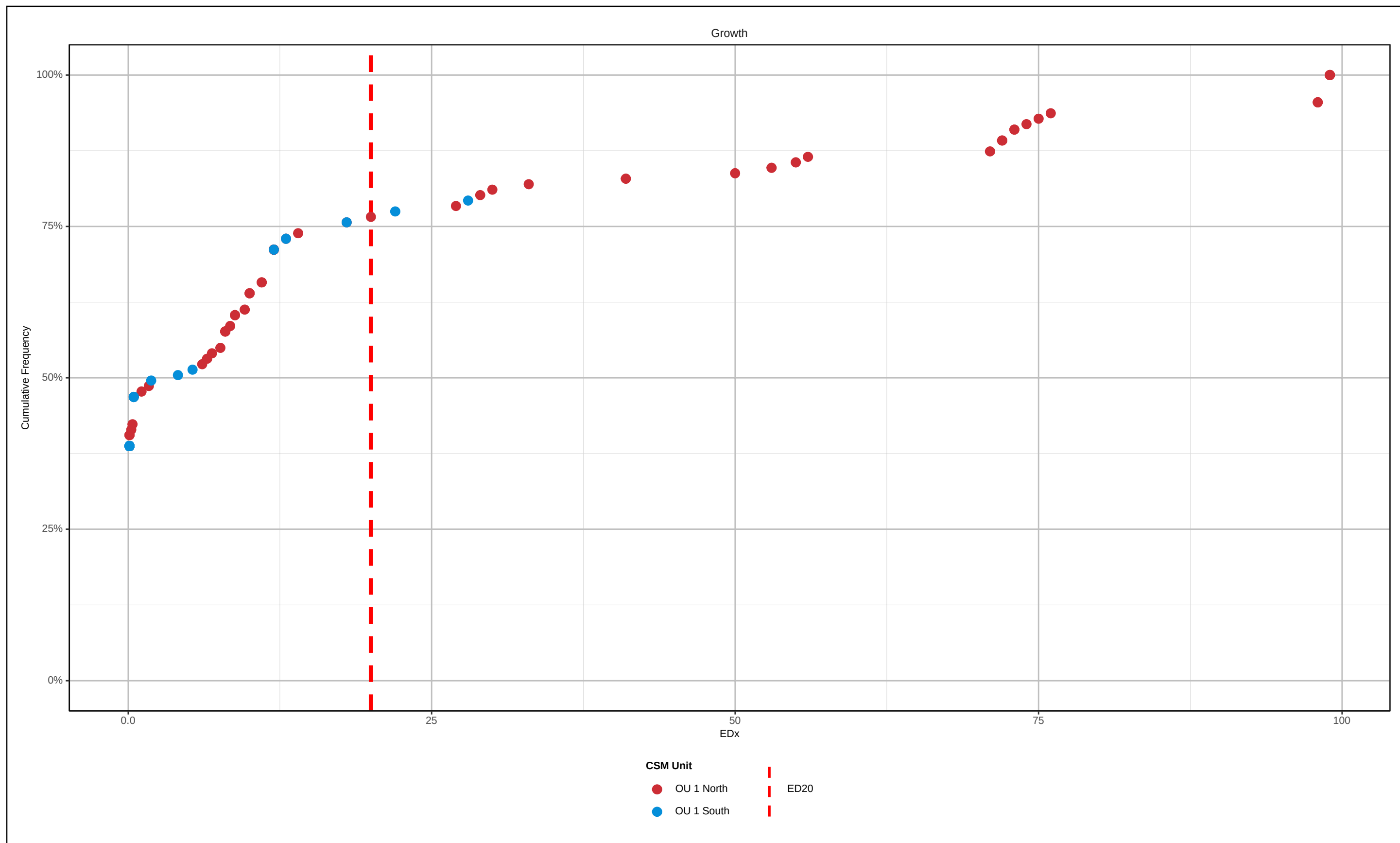


Figure M-23g. Cumulative Frequency of Selenium EDx Values for Muskrat in OU 1
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

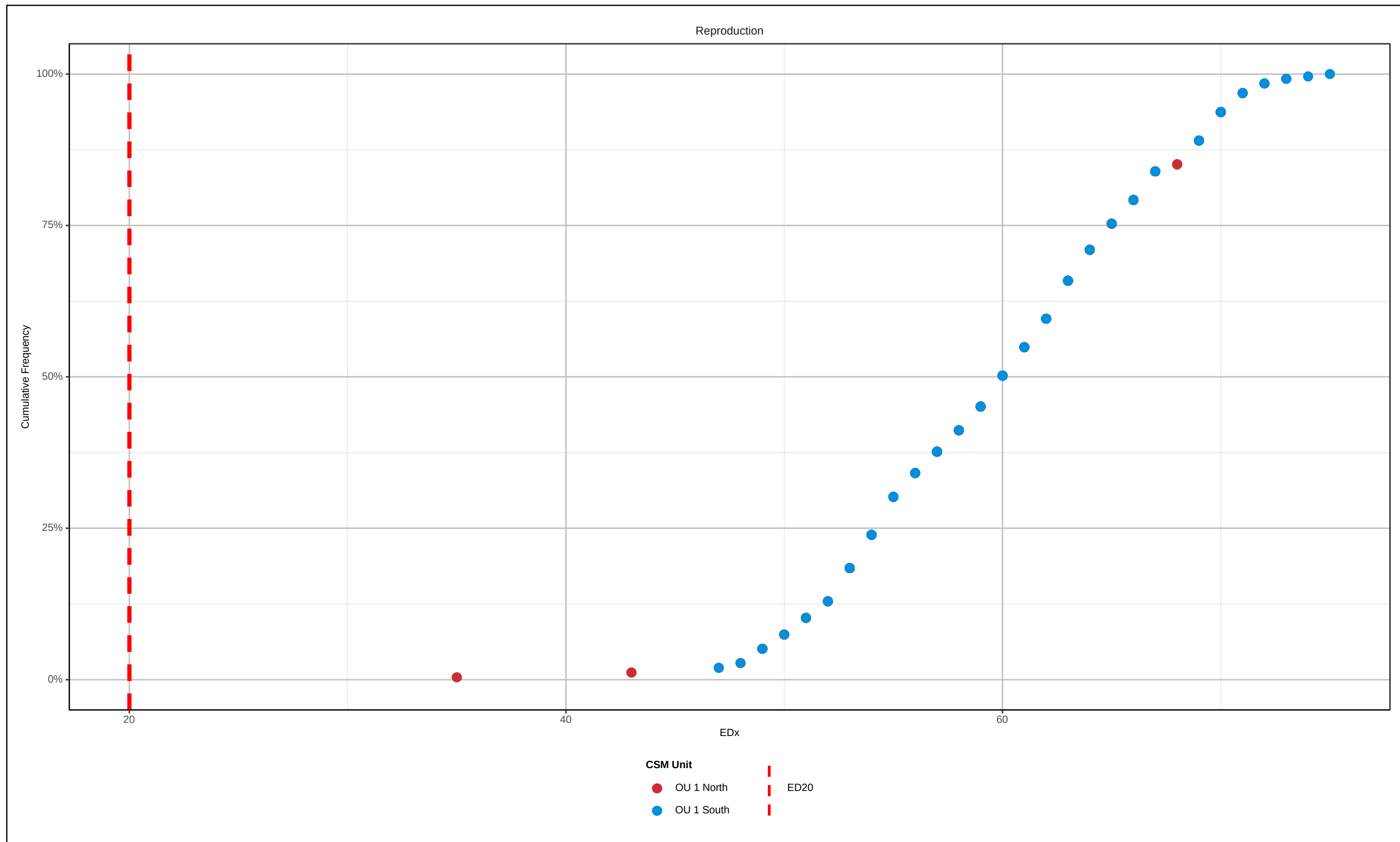


Figure M-23h. Cumulative Frequency of Aluminum EDx Values for Water Shrew in OU 1
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

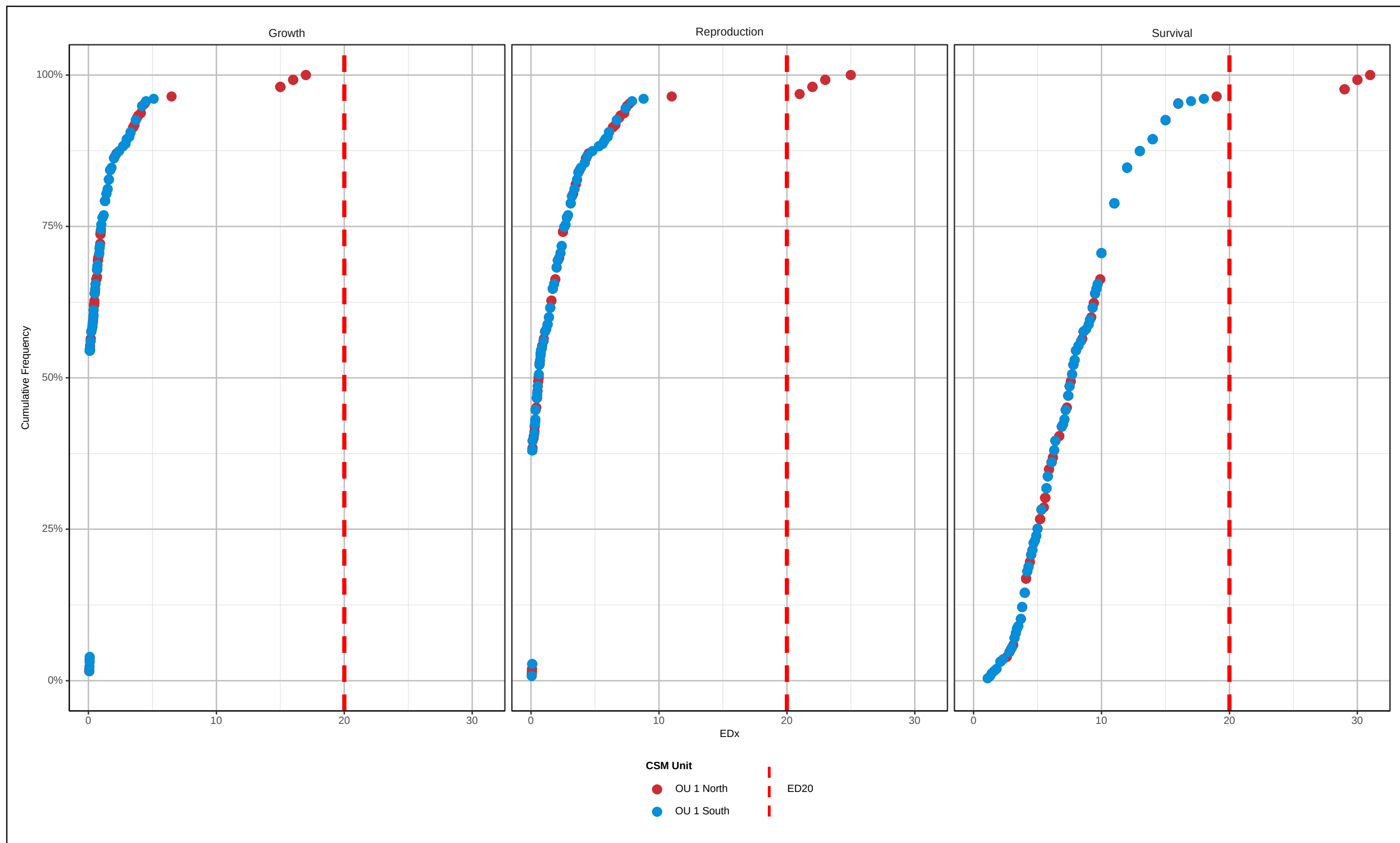


Figure M-23i. Cumulative Frequency of Cadmium EDx Values for Water Shrew in OU 1
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

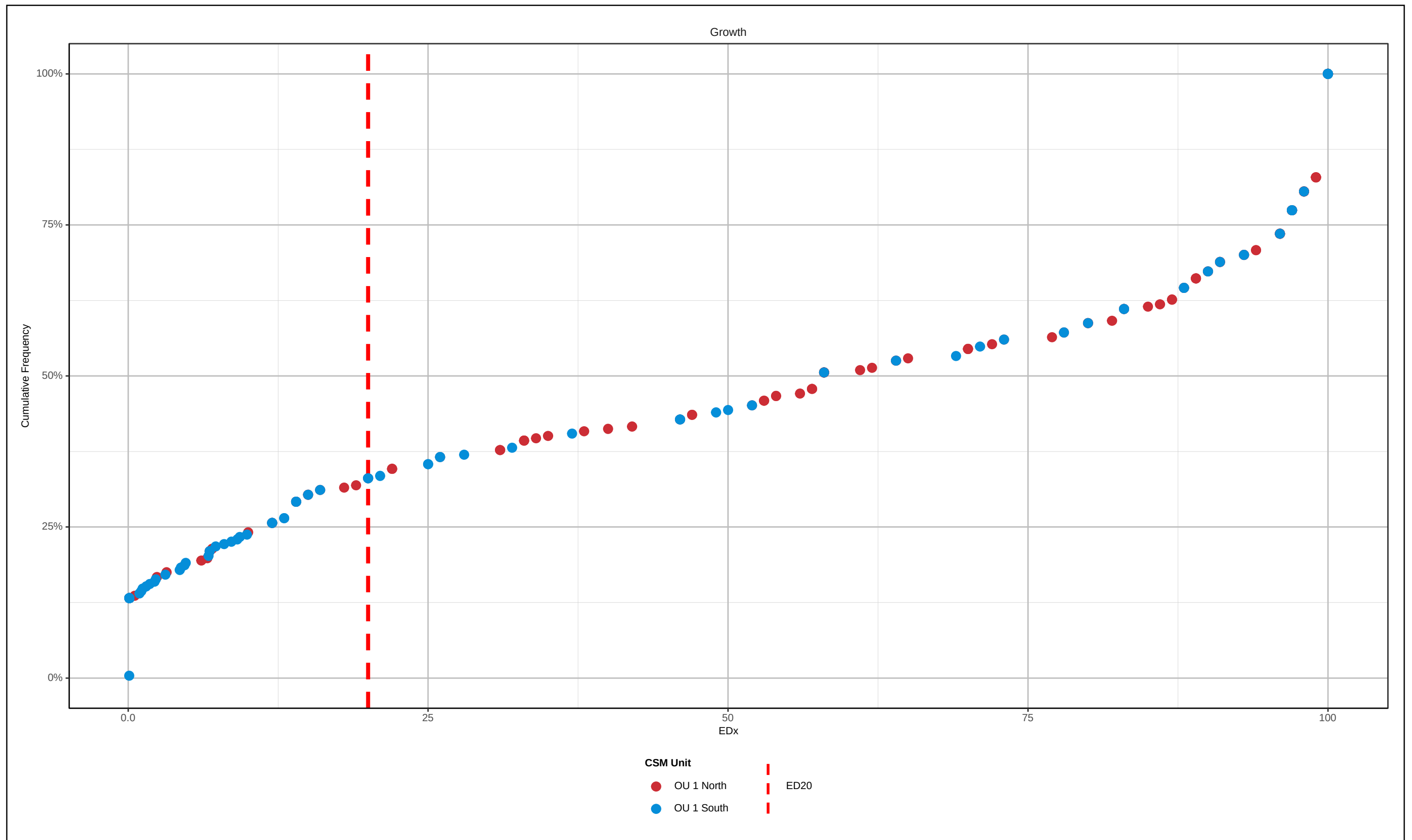


Figure M-23j. Cumulative Frequency of Copper EDx Values for Water Shrew in OU 1
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

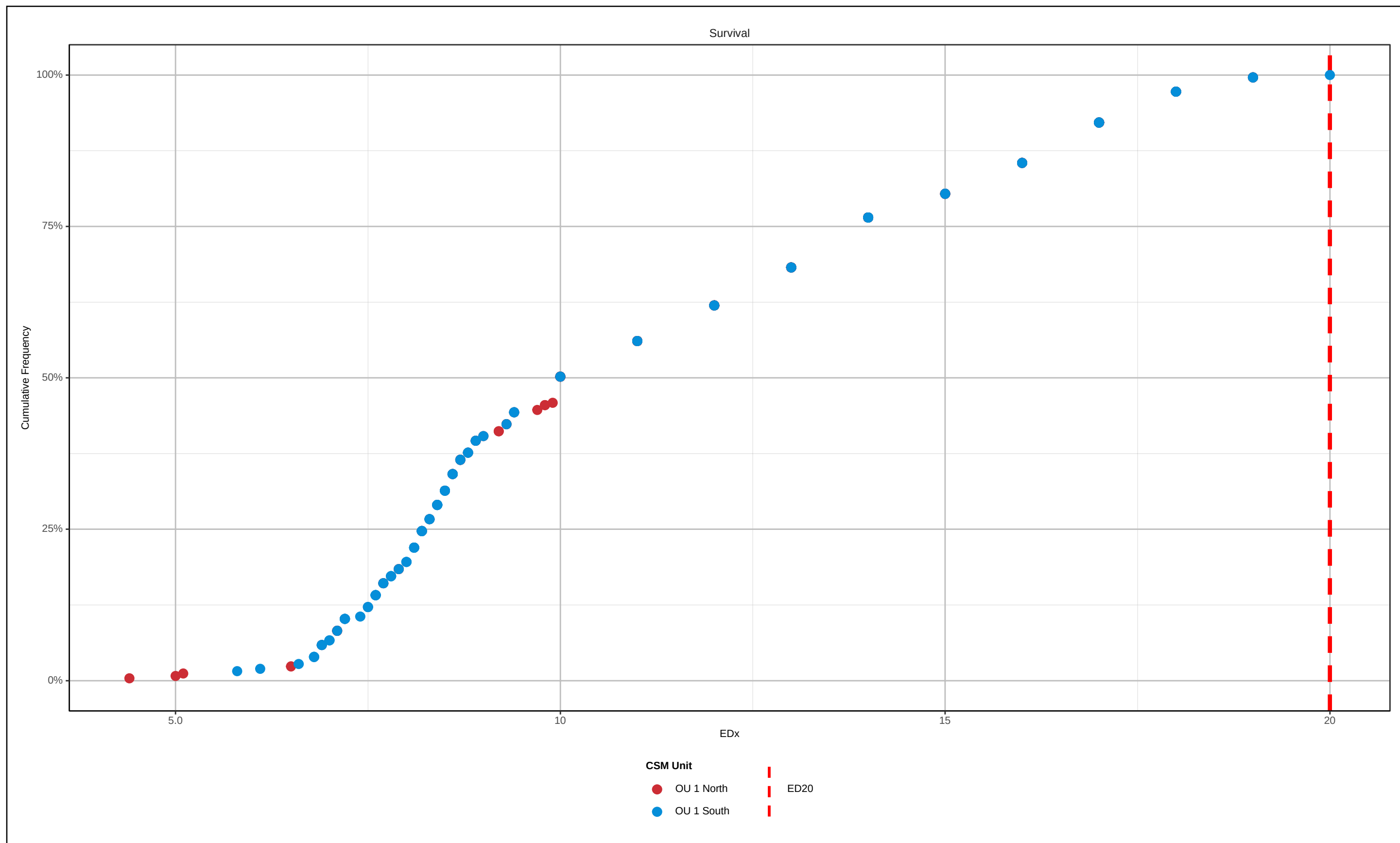


Figure M-23k. Cumulative Frequency of Iron EDx Values for Water Shrew in OU 1
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

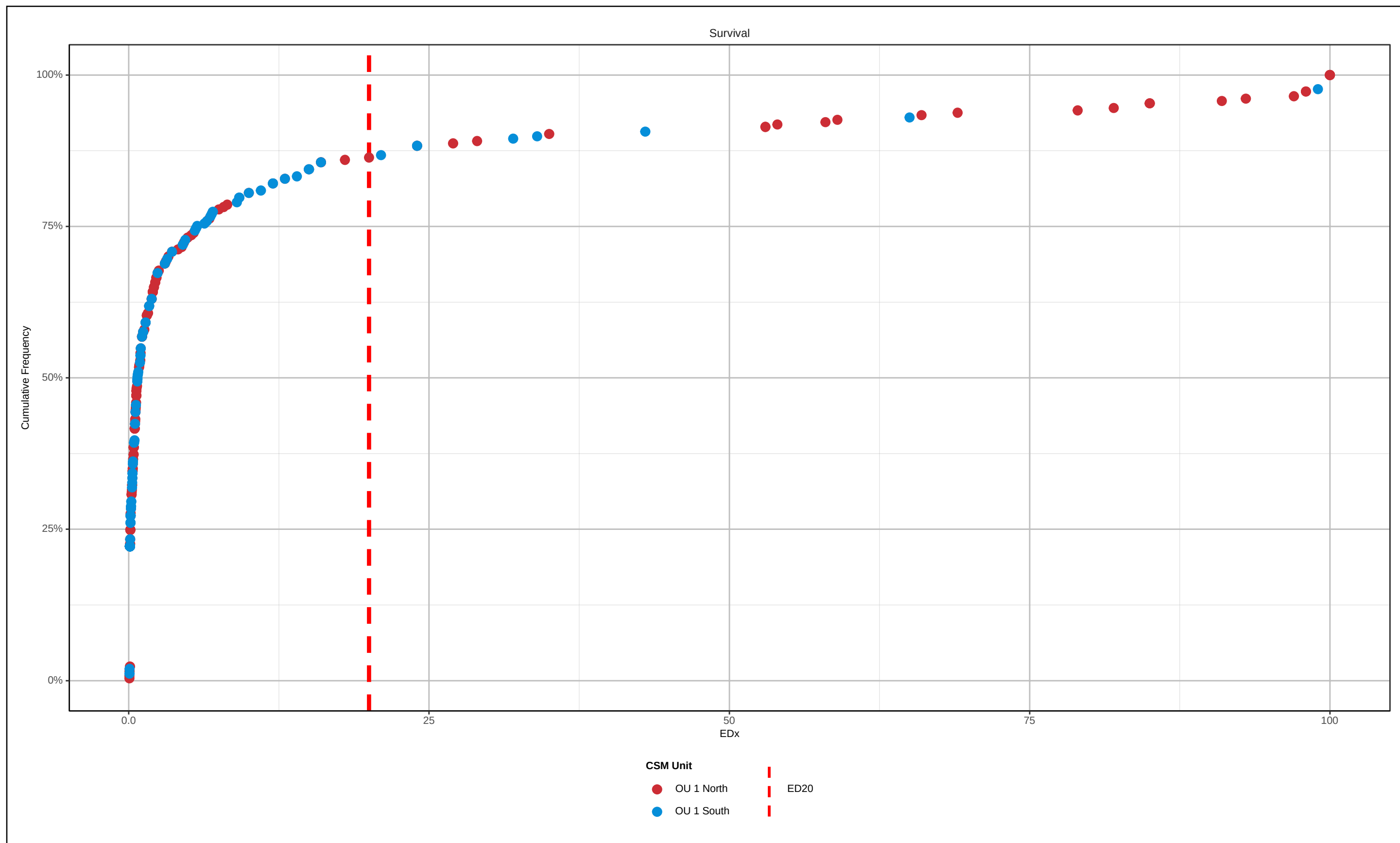


Figure M-23I. Cumulative Frequency of Lead EDx Values for Water Shrew in OU 1
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

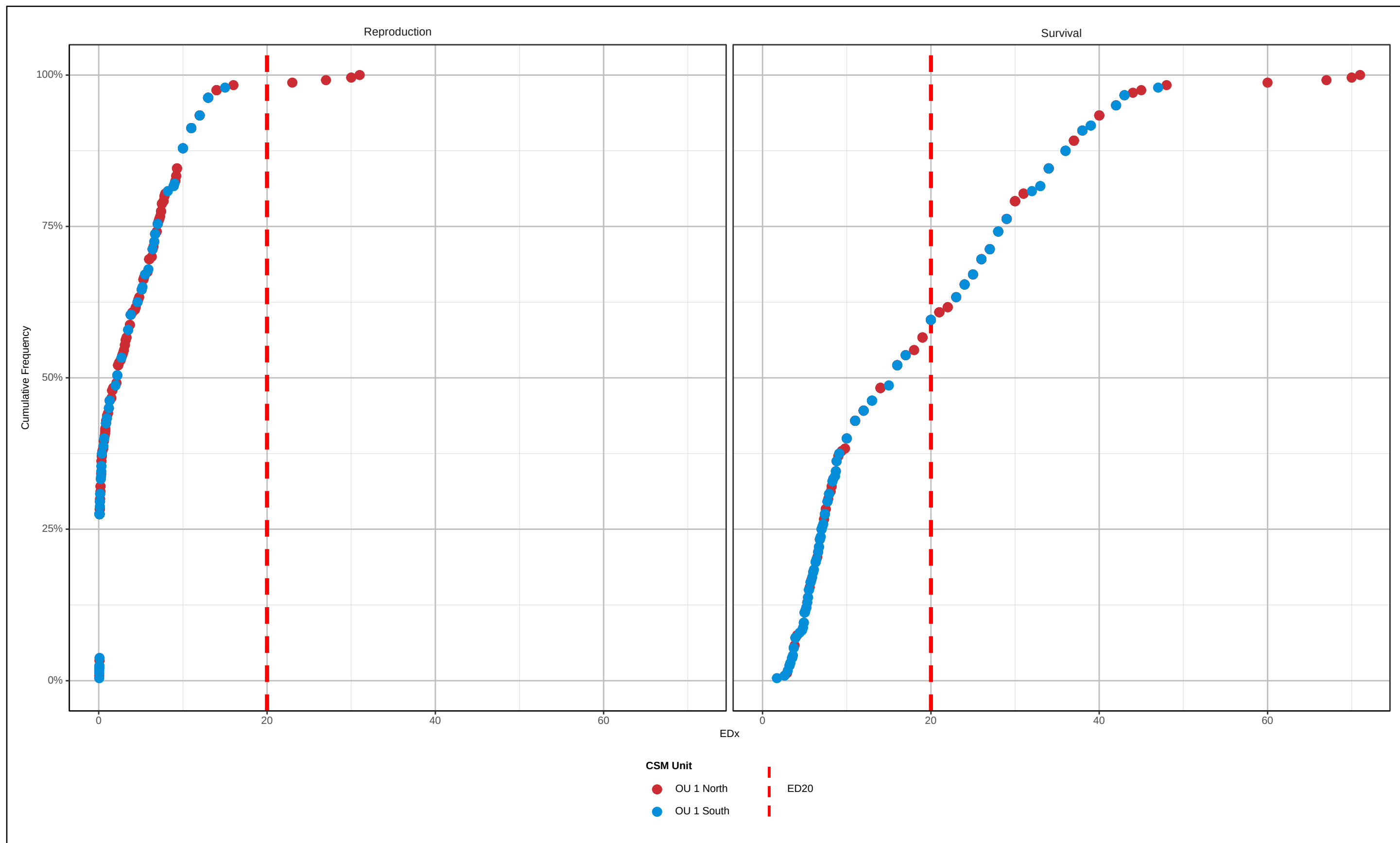


Figure M-23m. Cumulative Frequency of Manganese EDx Values for Water Shrew in OU 1
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

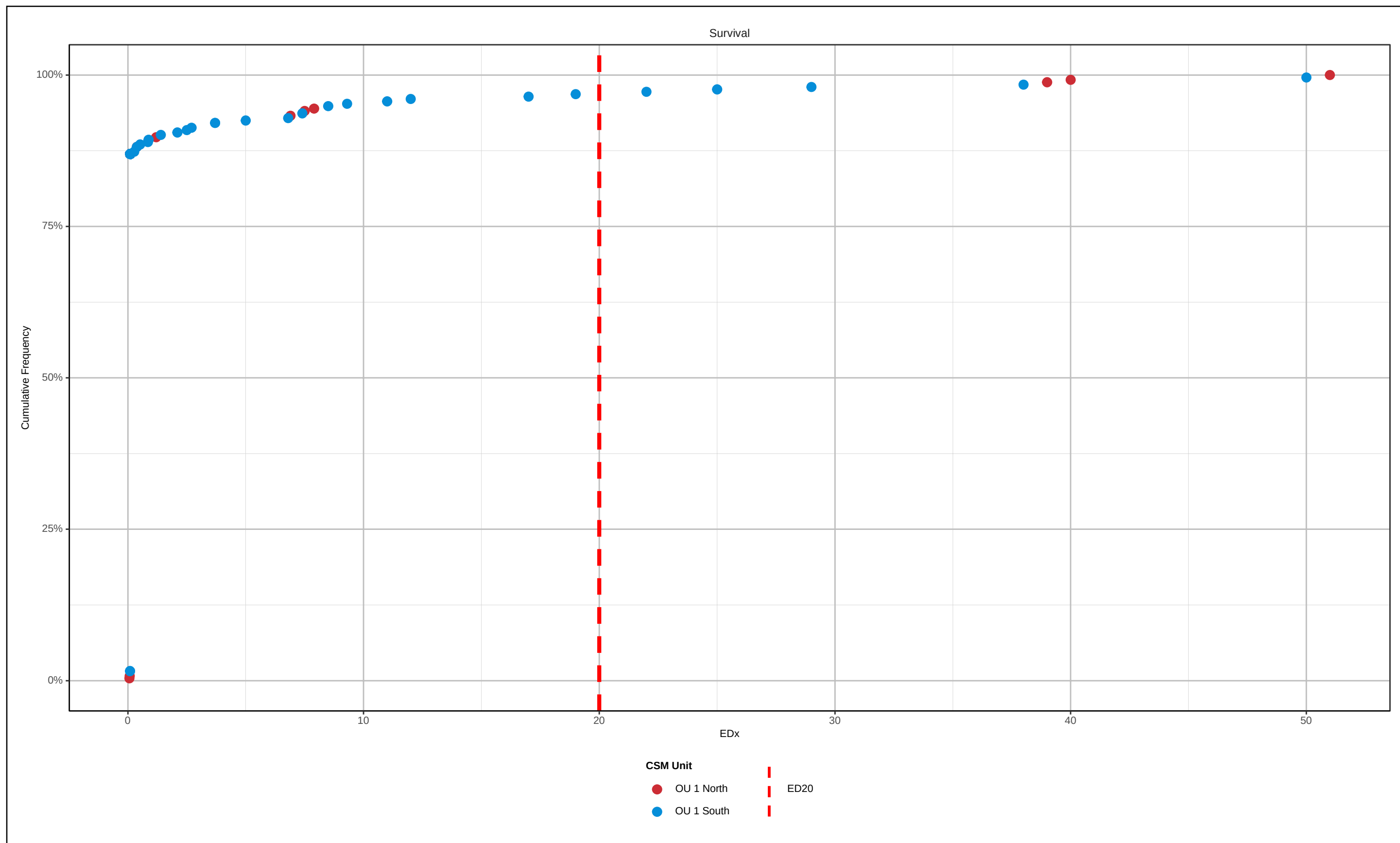


Figure M-23n. Cumulative Frequency of Mercury EDx Values for Water Shrew in OU 1
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

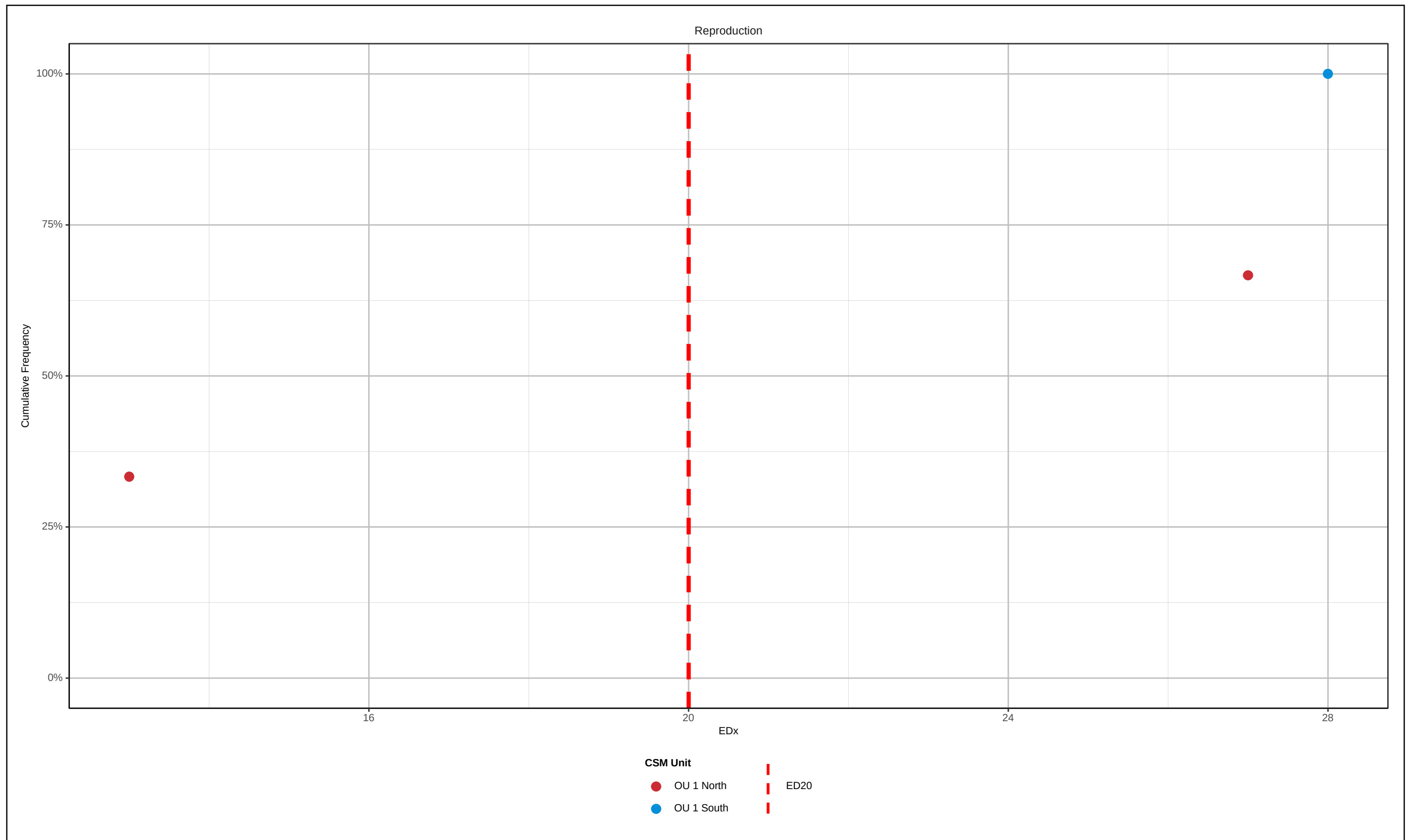


Figure M-23o. Cumulative Frequency of Molybdenum EDx Values for Water Shrew in OU 1
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

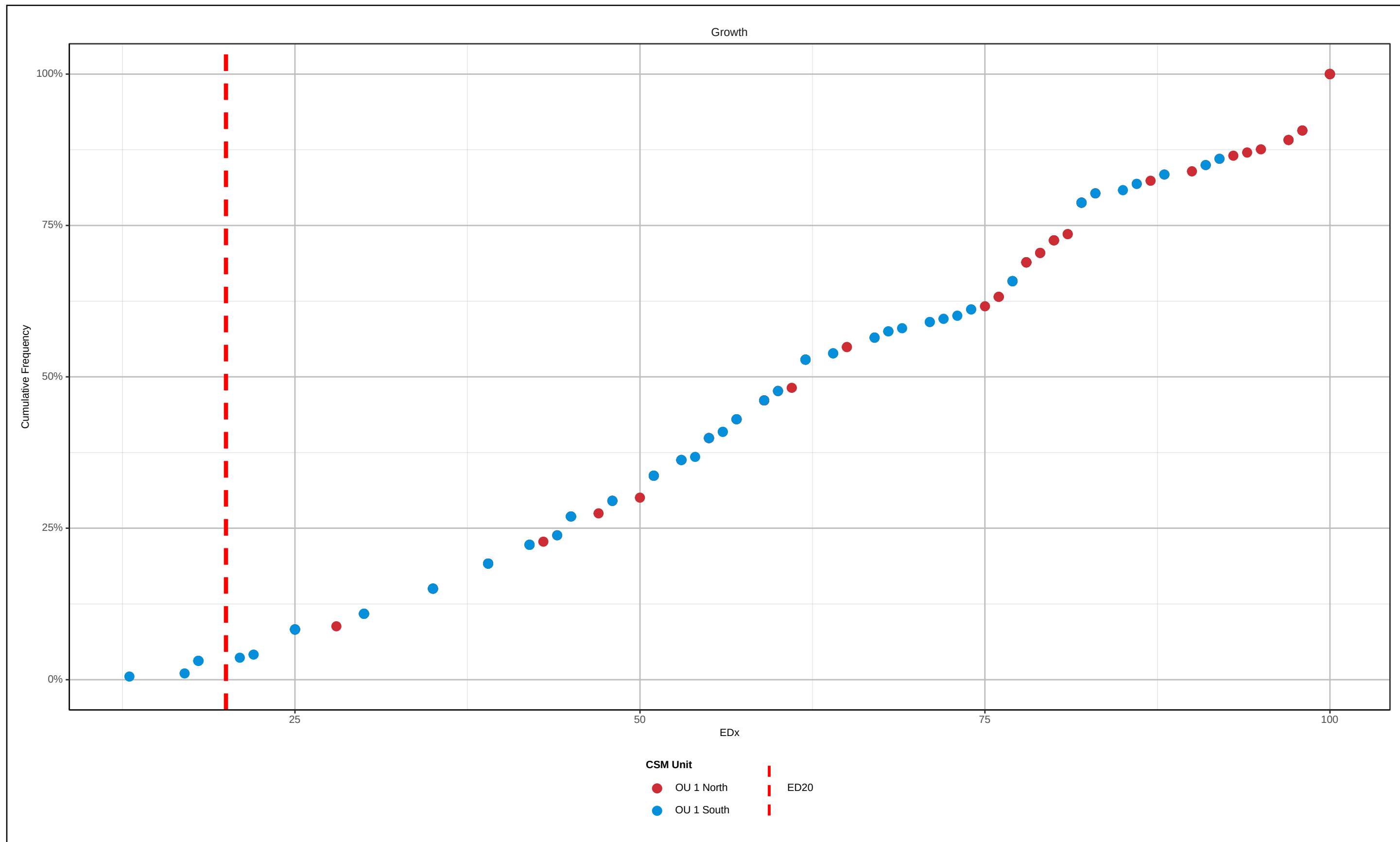


Figure M-23p. Cumulative Frequency of Selenium Dietary EDx Values for Water Shrew in OU 1
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

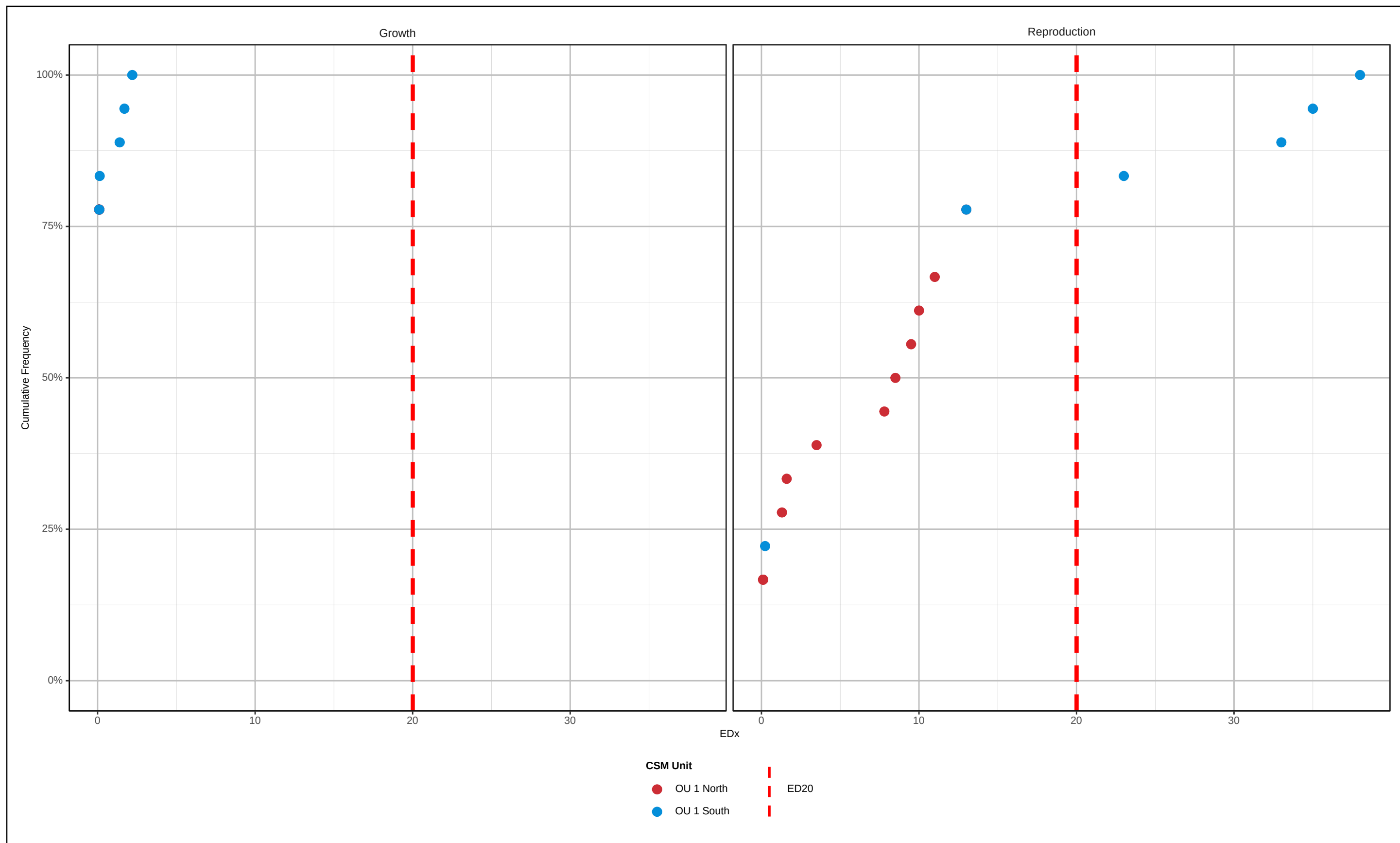


Figure M-23q. Cumulative Frequency of Dioxin/Furan Mammal TEQ, 0 DL EDx Values for Water Shrew in OU 1
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

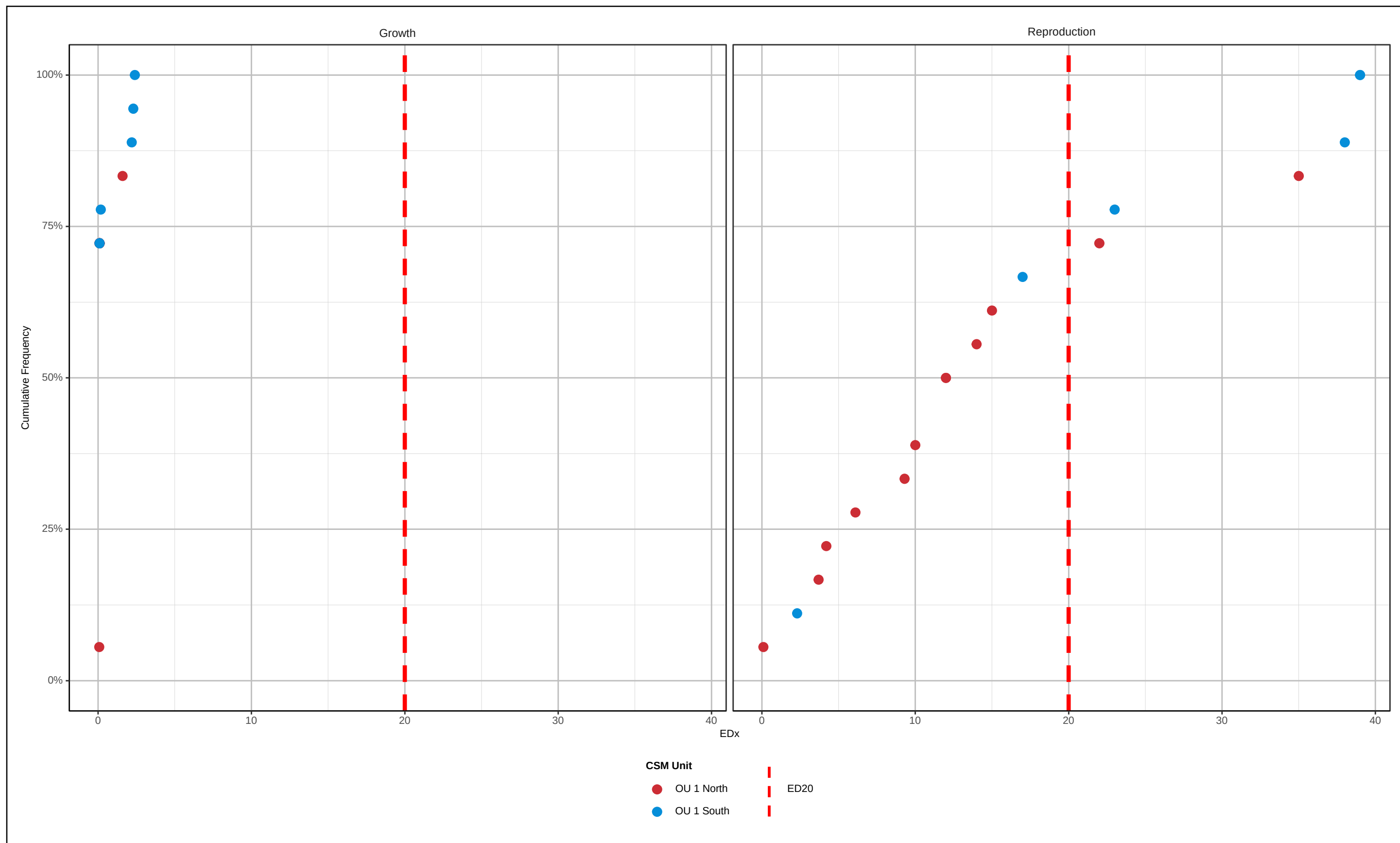


Figure M-23r. Cumulative Frequency of Dioxin/Furan Mammal TEQ, 1/2 DL EDx Values for Water Shrew in OU 1
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

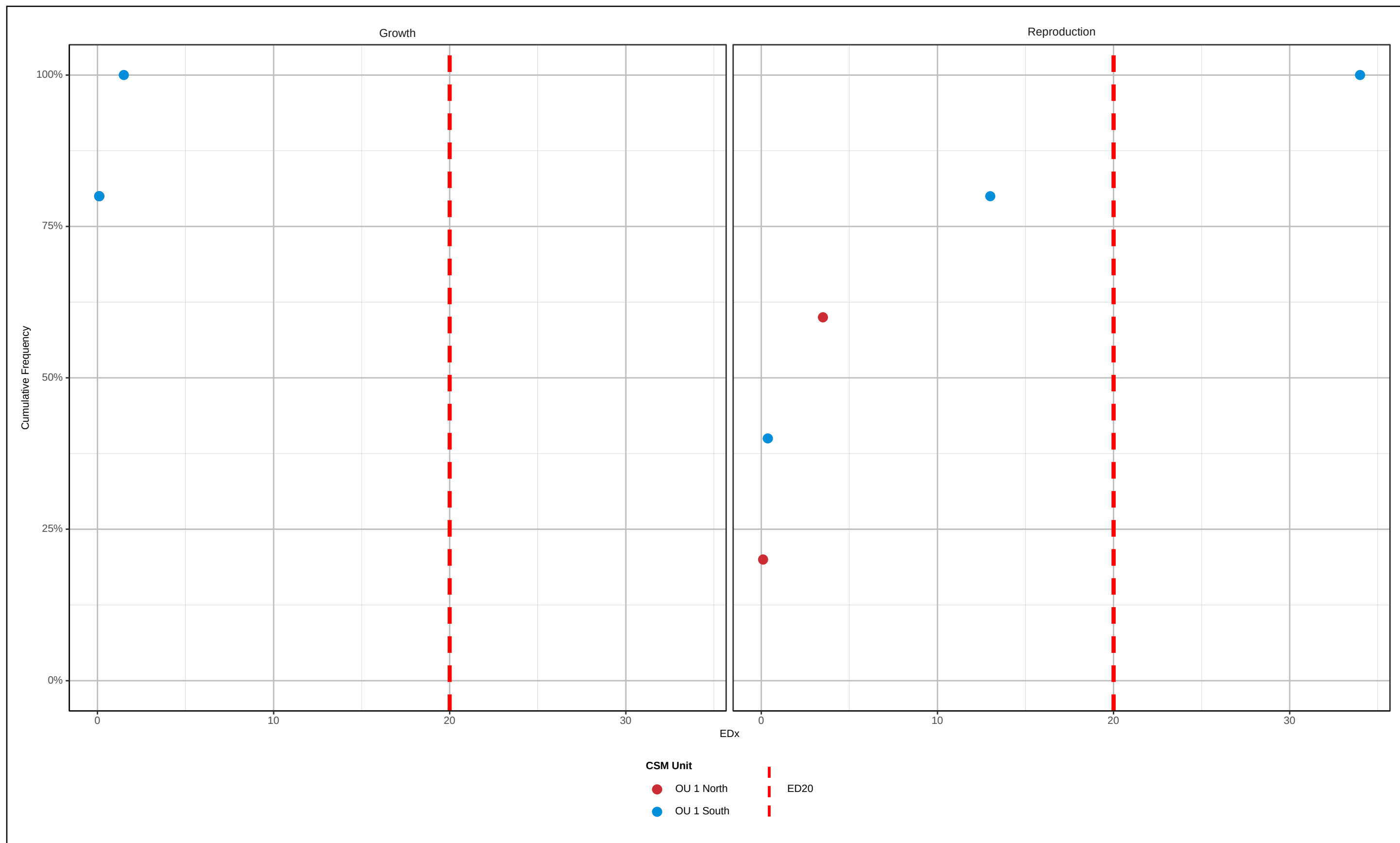


Figure M-23s. Cumulative Frequency of Total Mammal TEQ, 0 DL EDx Values for Water Shrew in OU 1
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

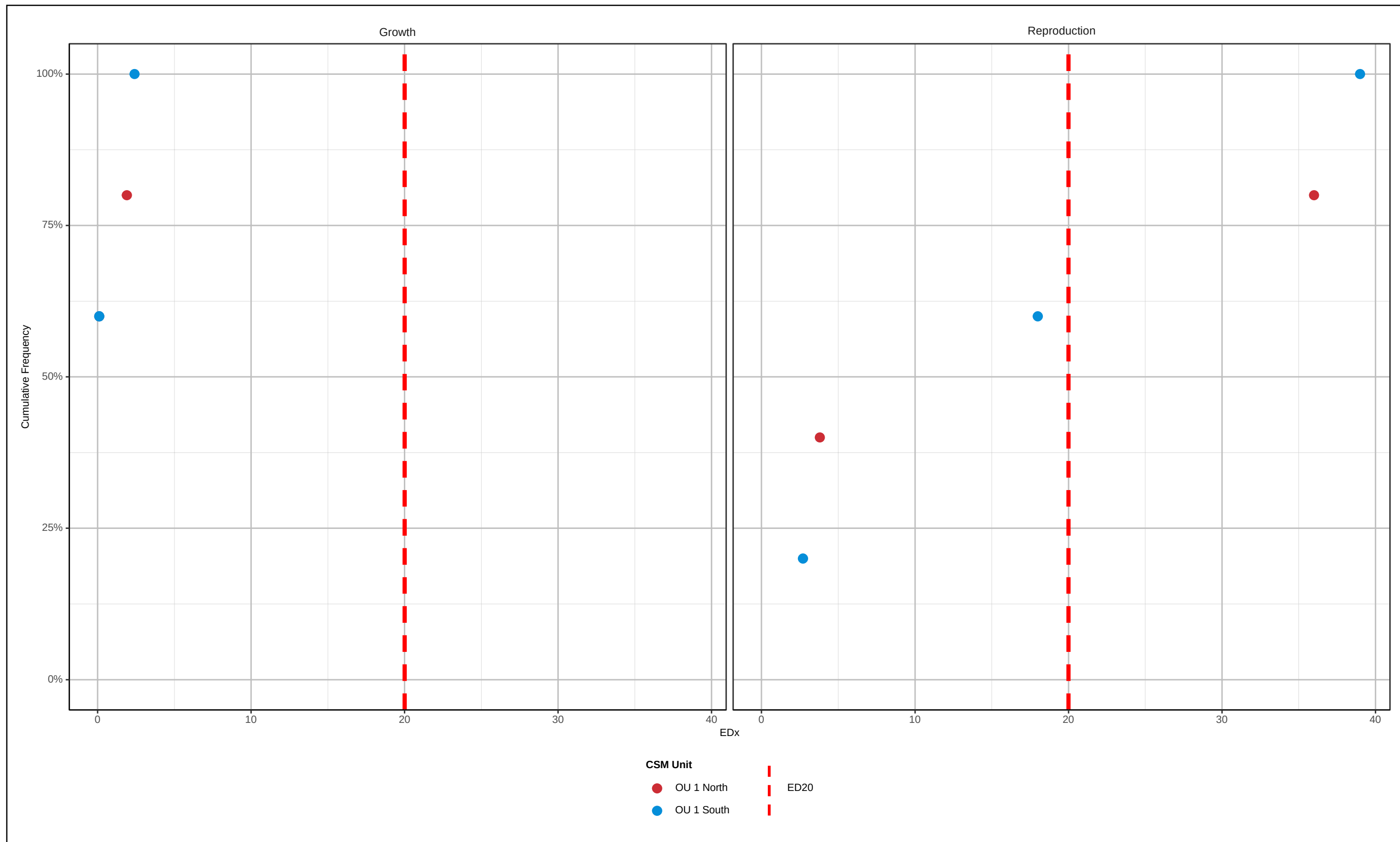


Figure M-23t. Cumulative Frequency of Total Mammal TEQ, 1/2 DL EDx Values for Water Shrew in OU 1
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

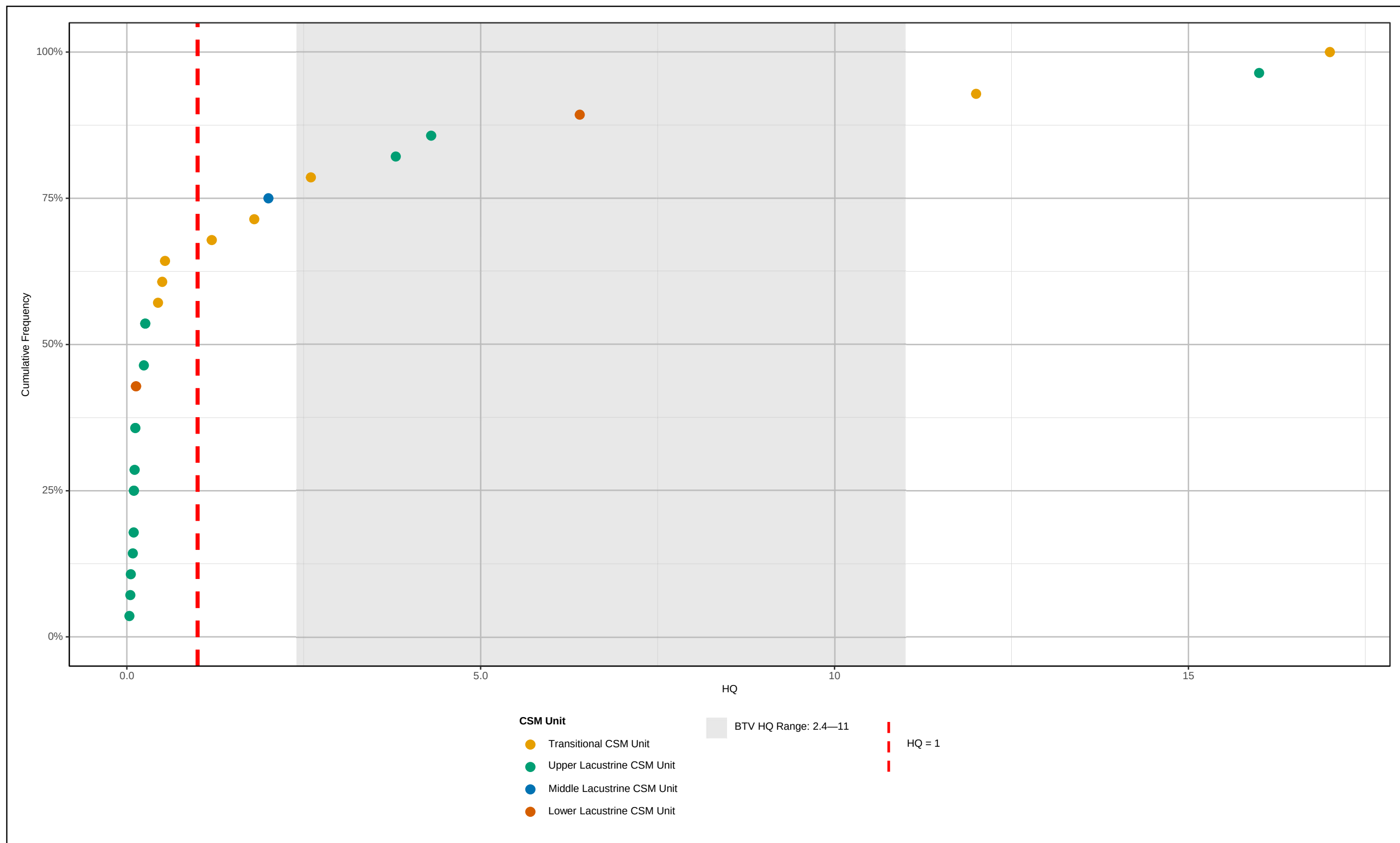


Figure M-24a. Cumulative Frequency of Iron HQs for Aquatic Plants in Porewater in OU 2
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

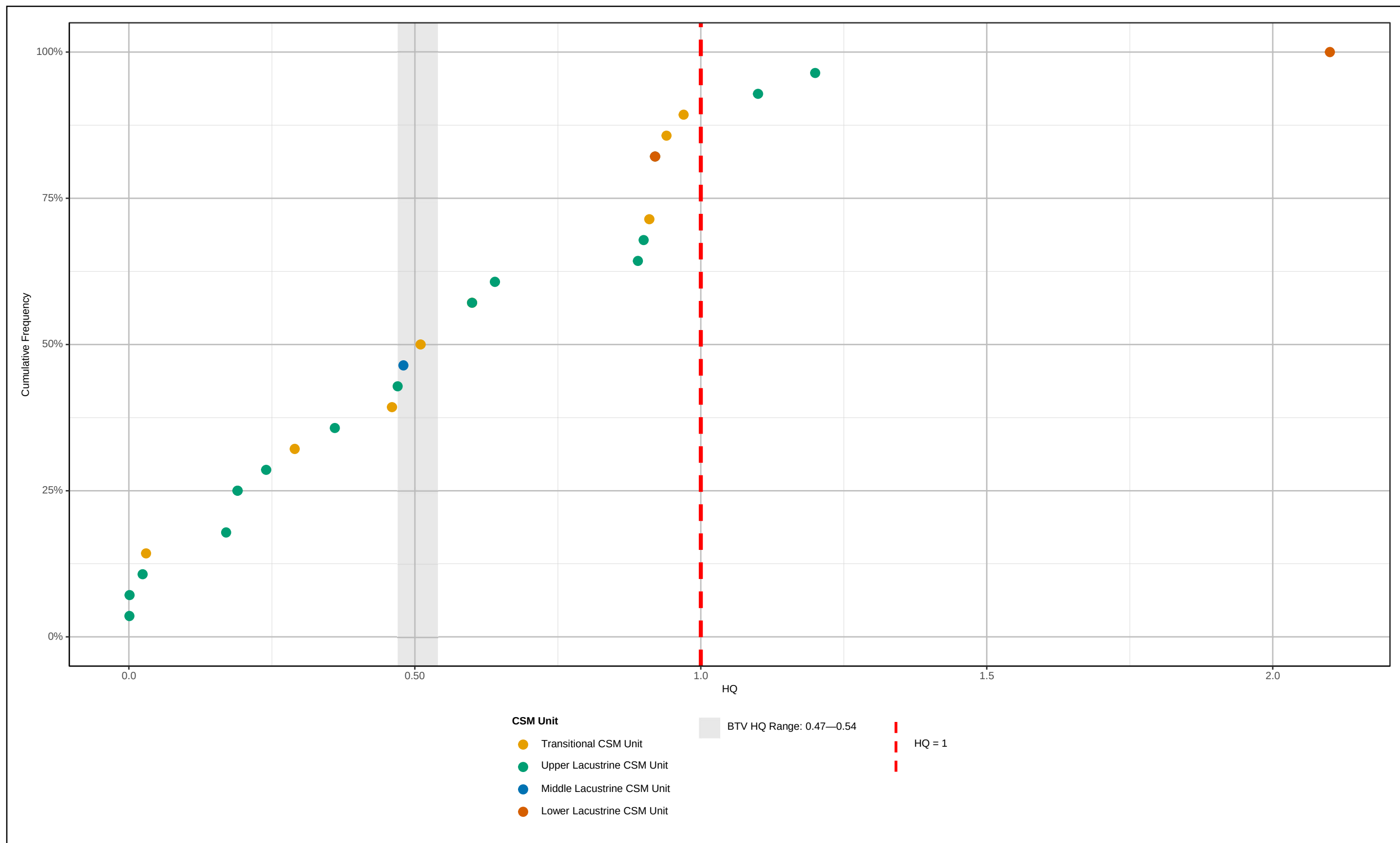


Figure M-24b. Cumulative Frequency of Manganese HQs for Aquatic Plants in Porewater in OU 2
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

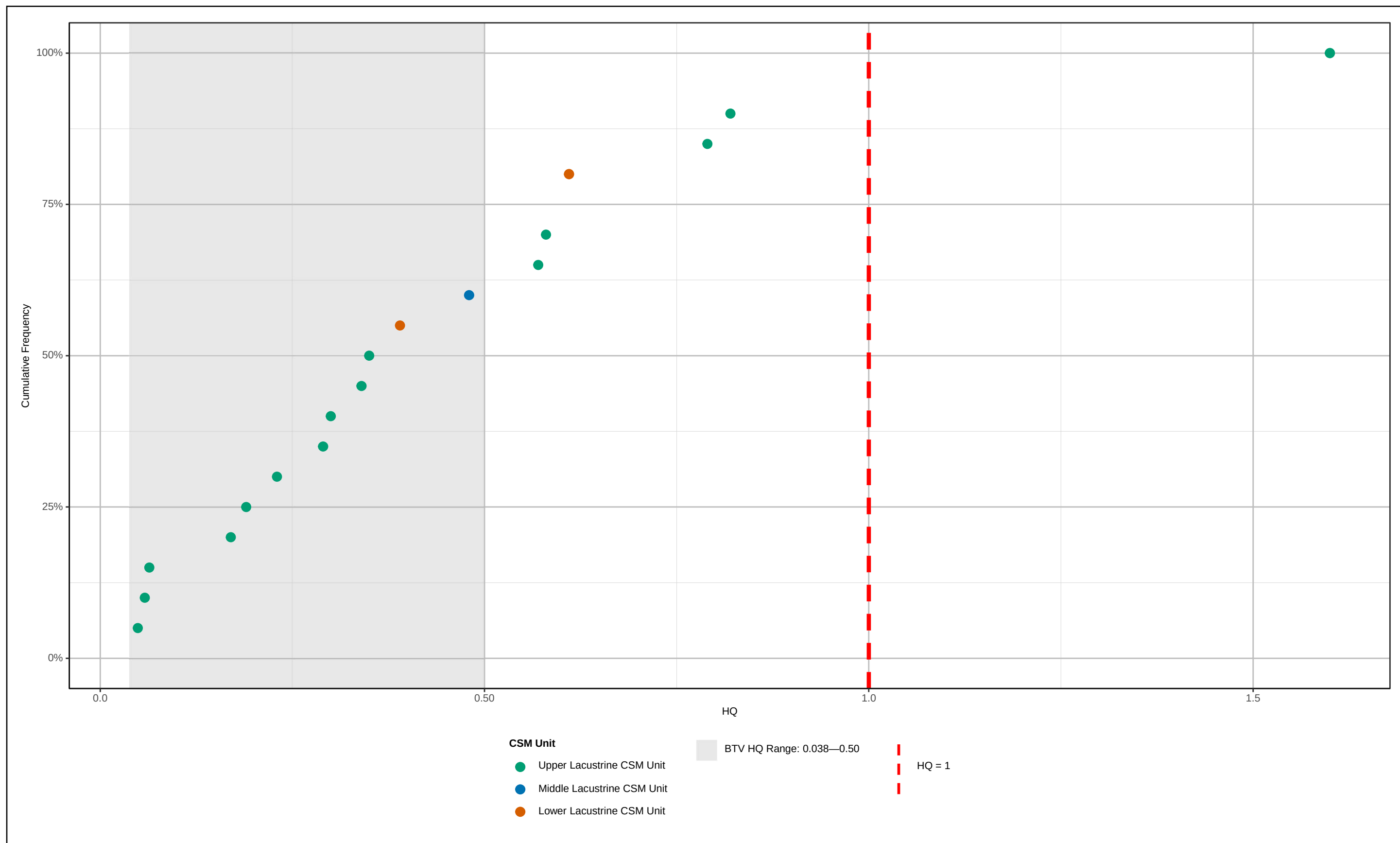


Figure M-24c. Cumulative Frequency of Zinc HQs for Aquatic Plants in Porewater in OU 2
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

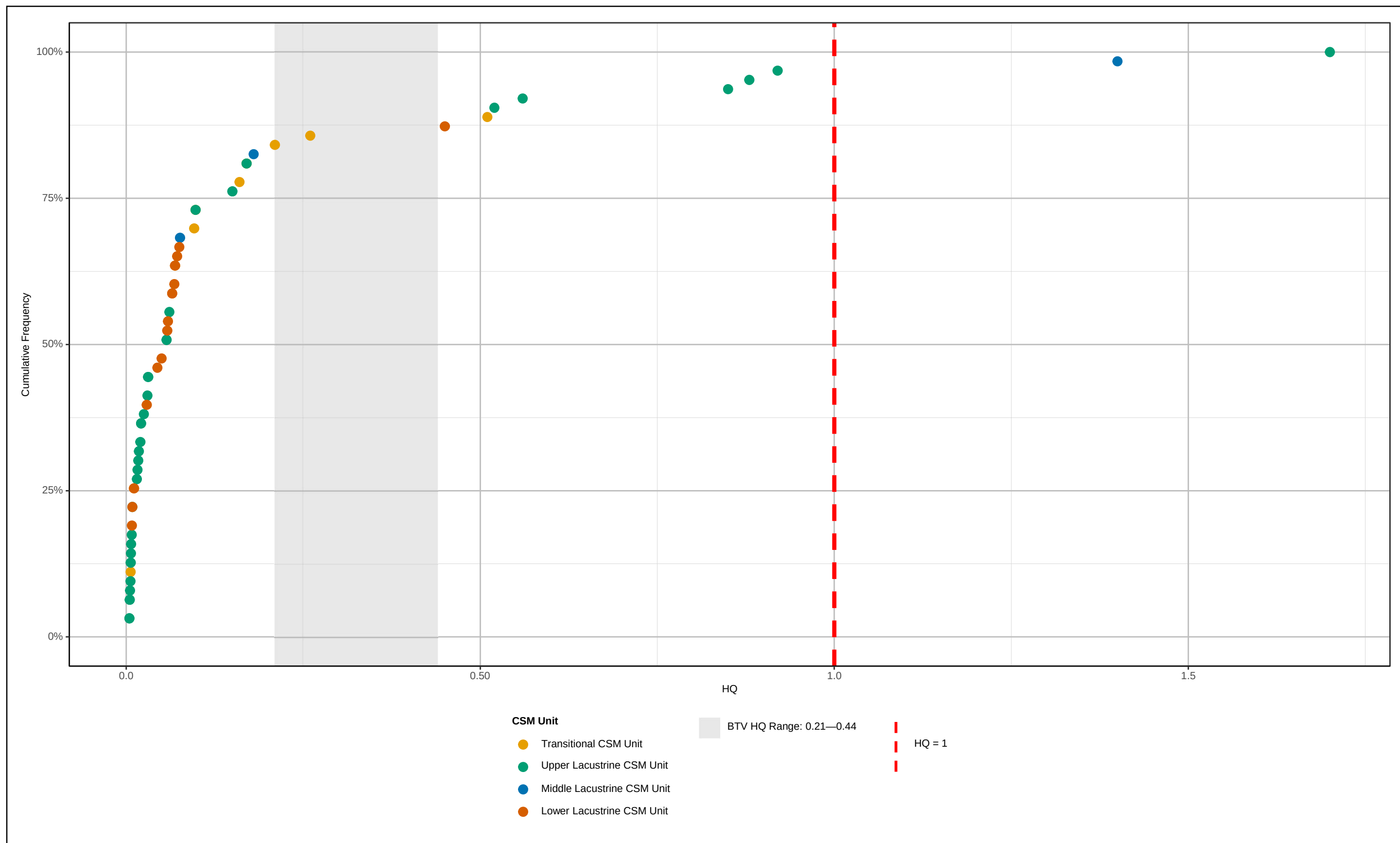


Figure M-25a. Cumulative Frequency of Cadmium HQs for Benthic Invertebrates in Porewater in OU 2
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

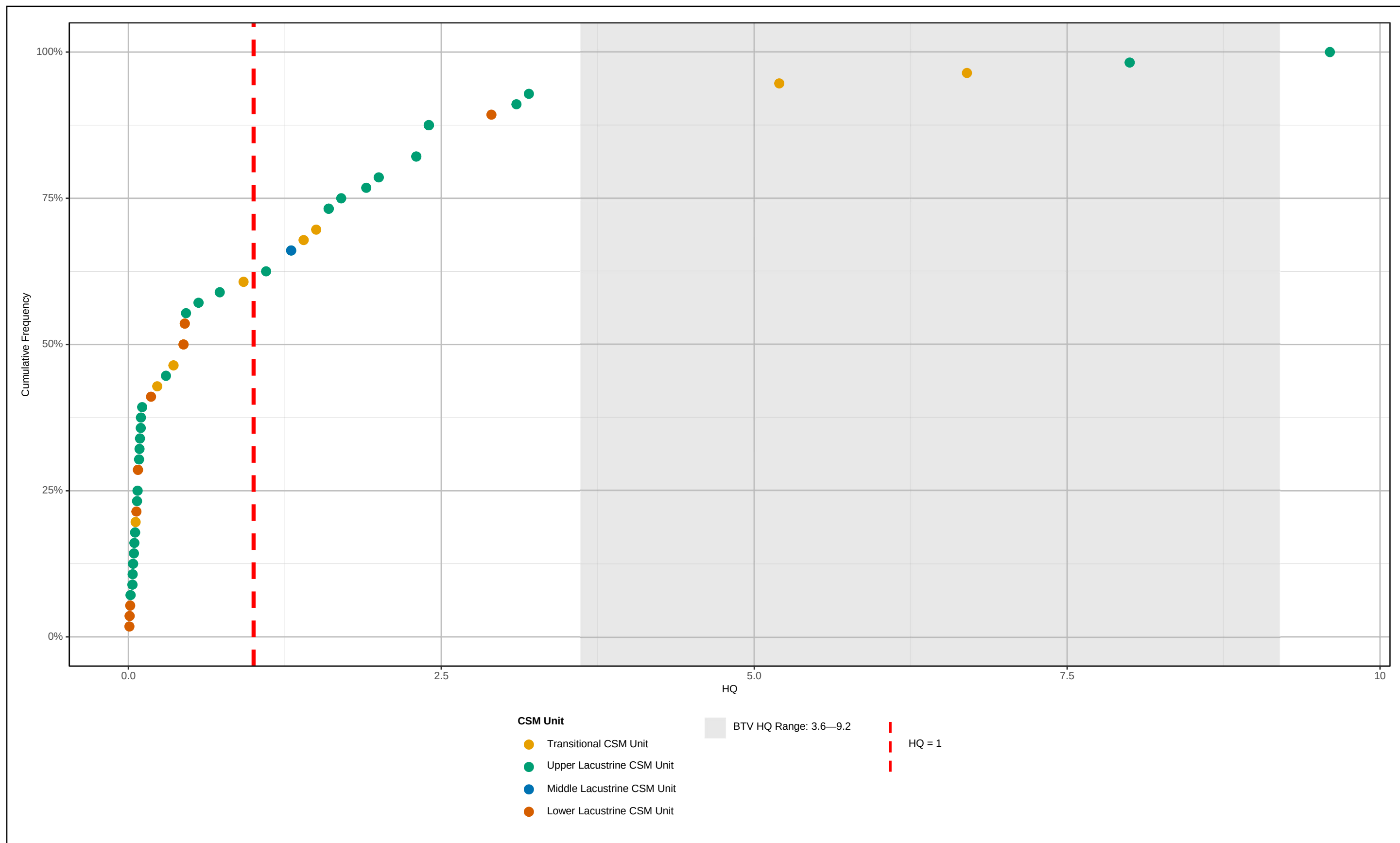
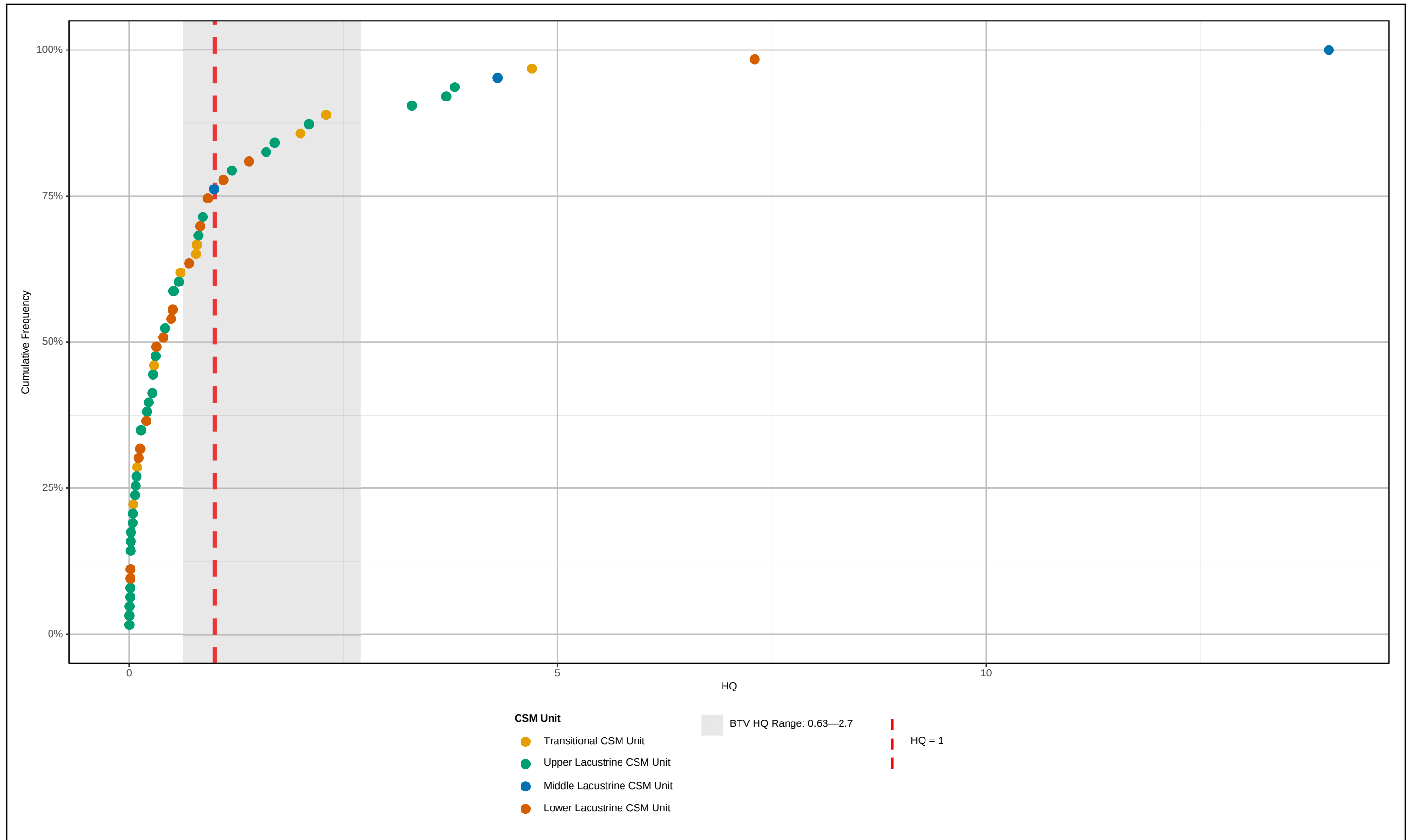


Figure M-25b. Cumulative Frequency of Iron HQs for Benthic Invertebrates in Porewater in OU 2
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington



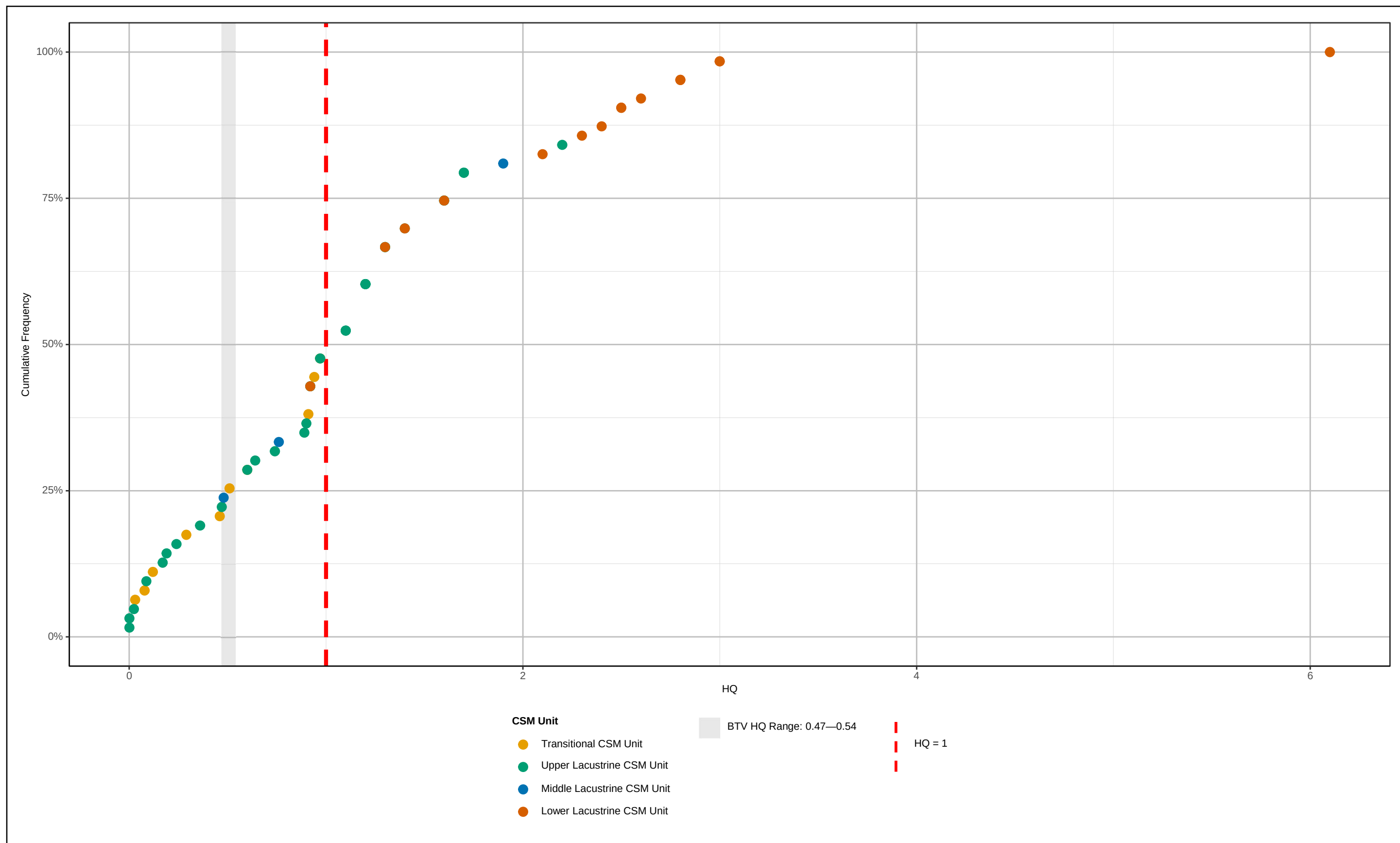


Figure M-25d. Cumulative Frequency of Manganese HQs for Benthic Invertebrates in Porewater in OU 2
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

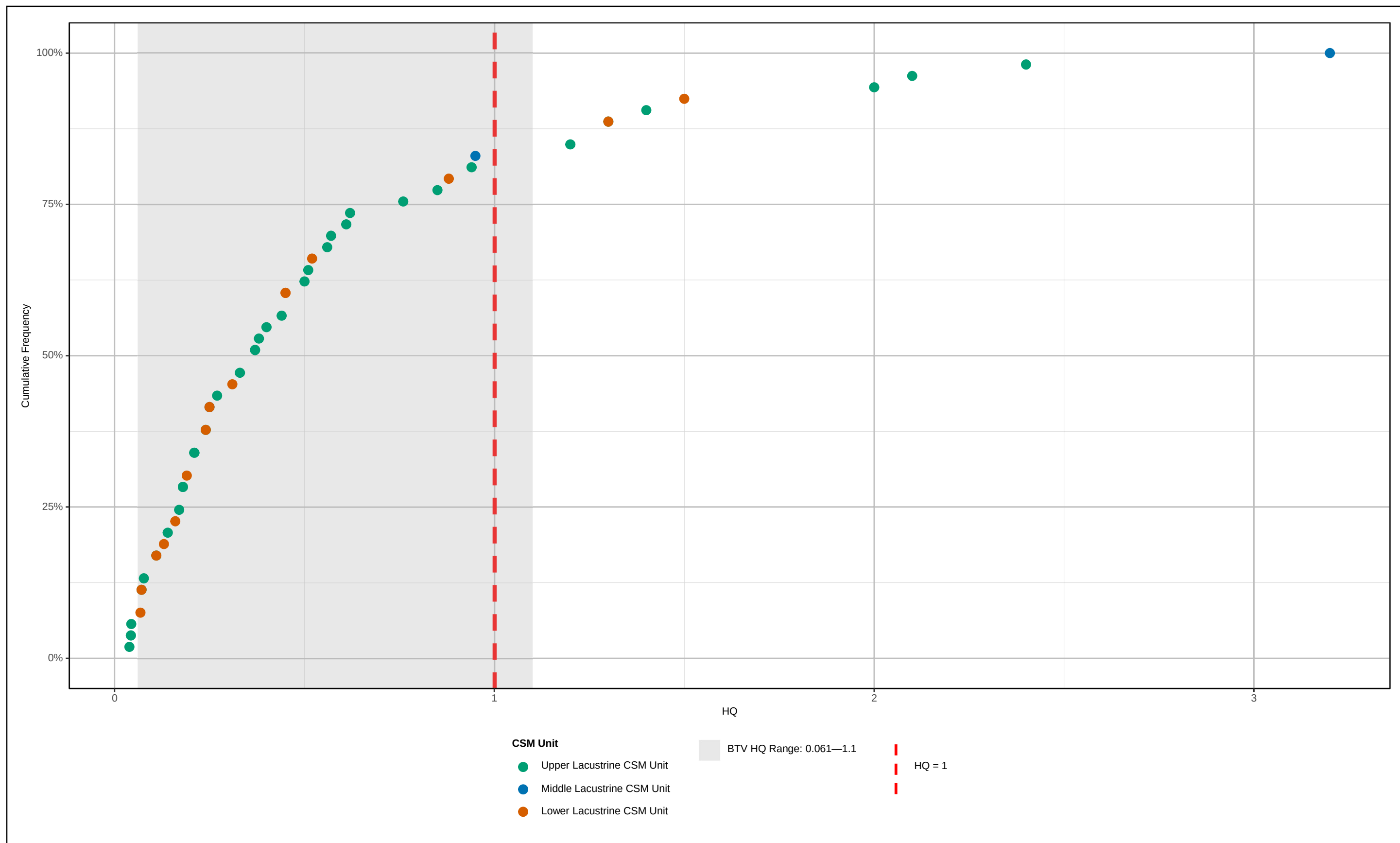


Figure M-25e. Cumulative Frequency of Zinc HQs for Benthic Invertebrates in Porewater in OU 2
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

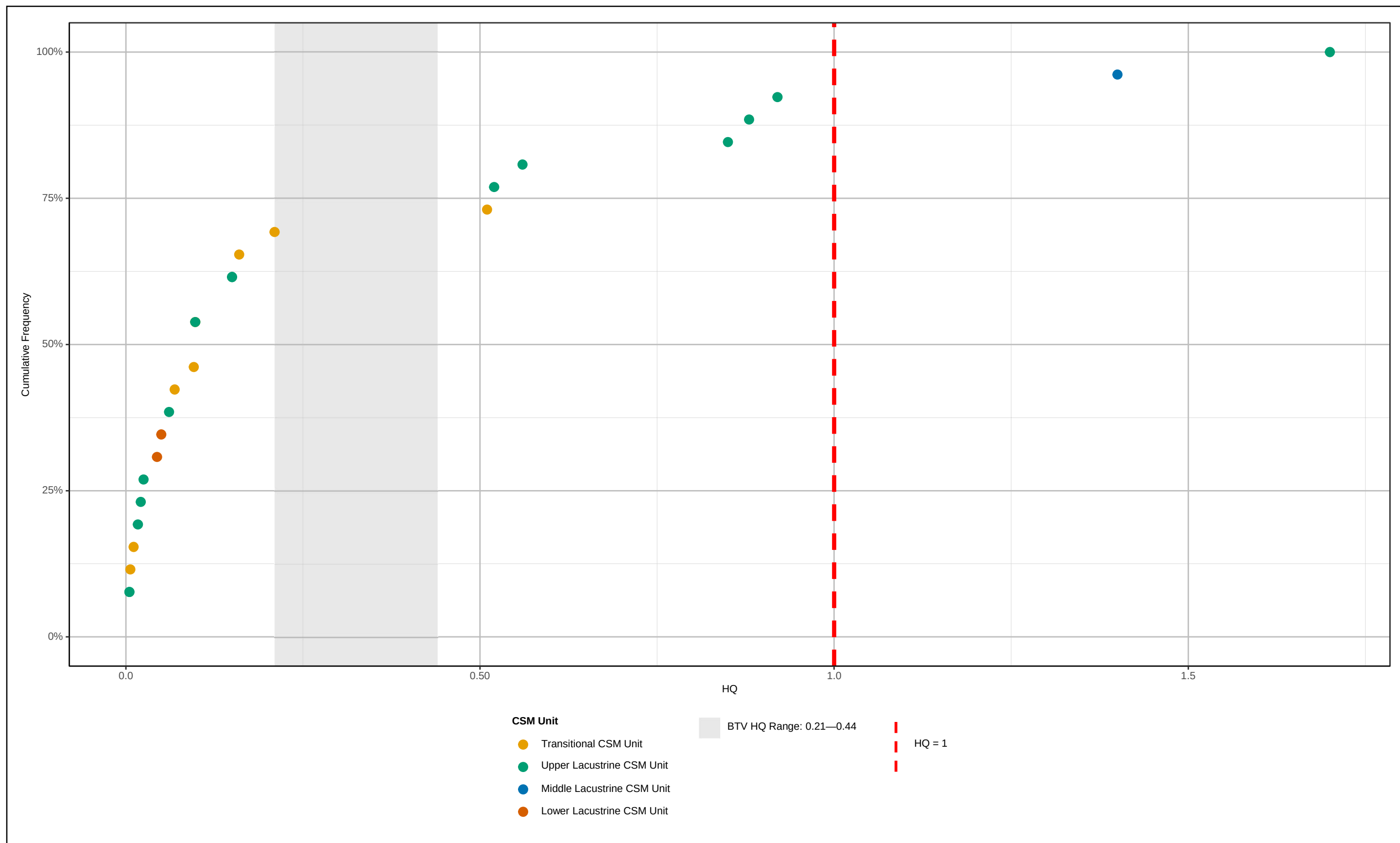


Figure M-26a. Cumulative Frequency of Cadmium HQs for ELS Fish in Porewater in OU 2
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

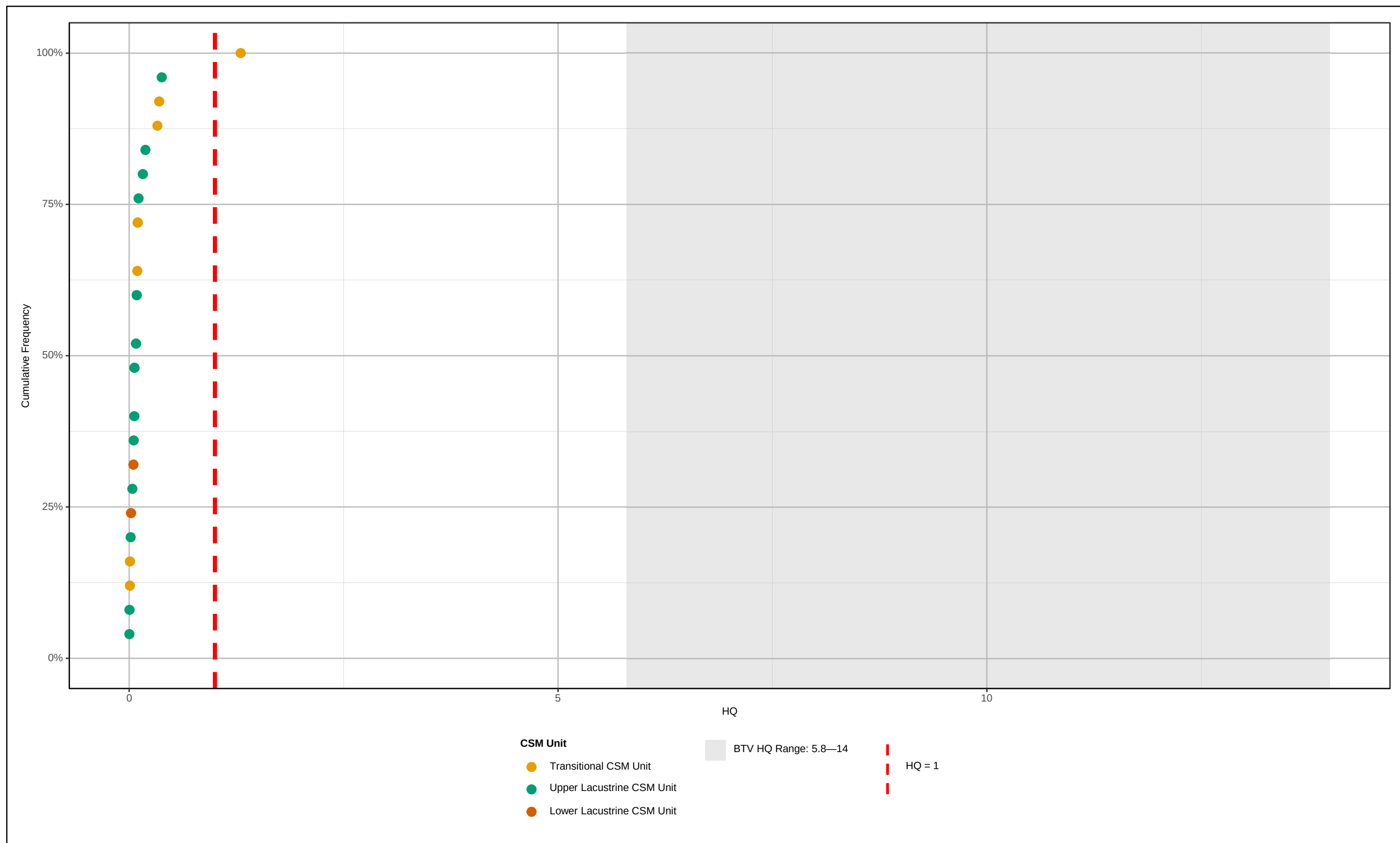


Figure M-26b. Cumulative Frequency of Copper HQs for ELS Fish in Porewater in OU 2
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

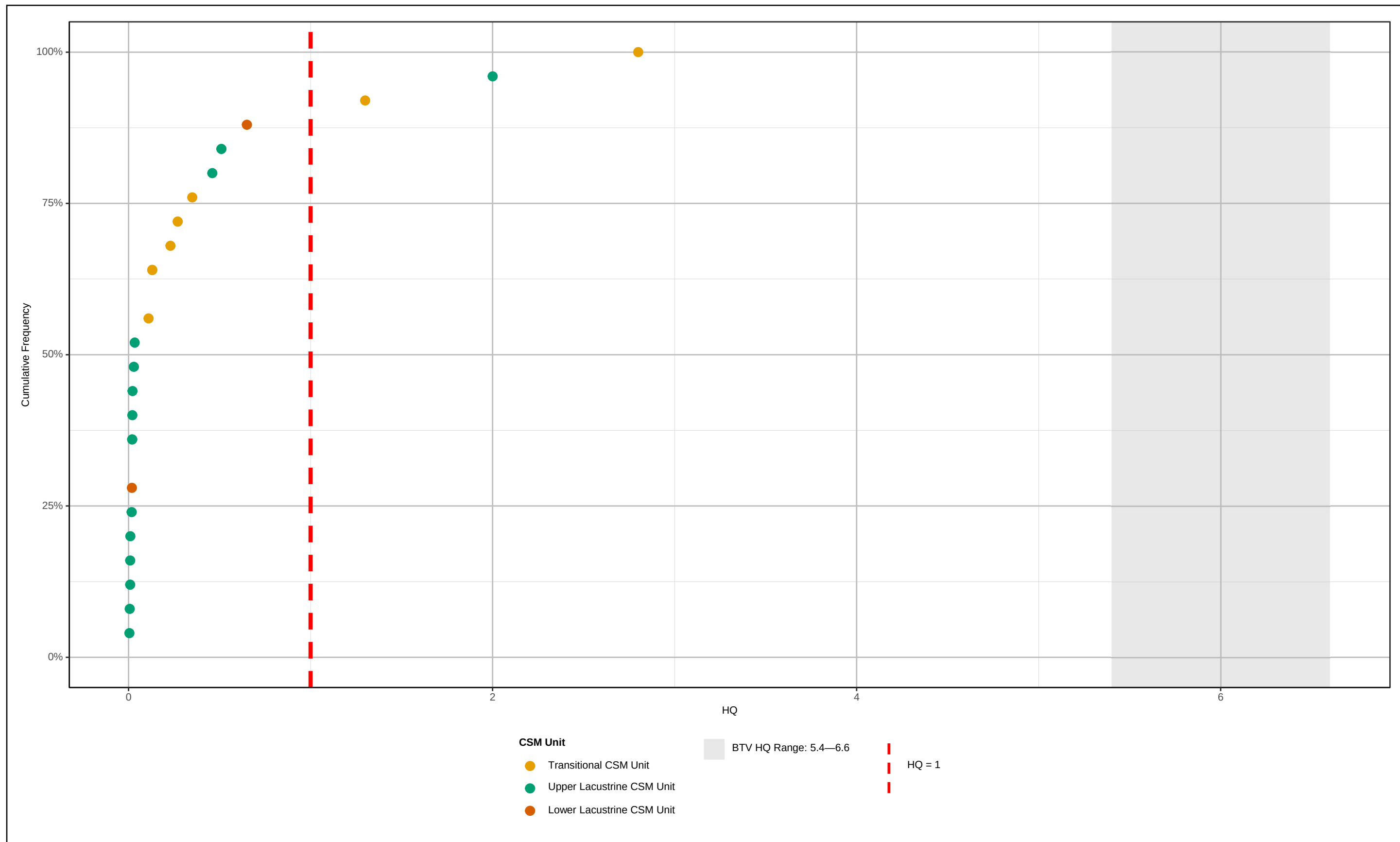


Figure M-26c. Cumulative Frequency of Iron HQs for ELS Fish in Porewater in OU 2
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

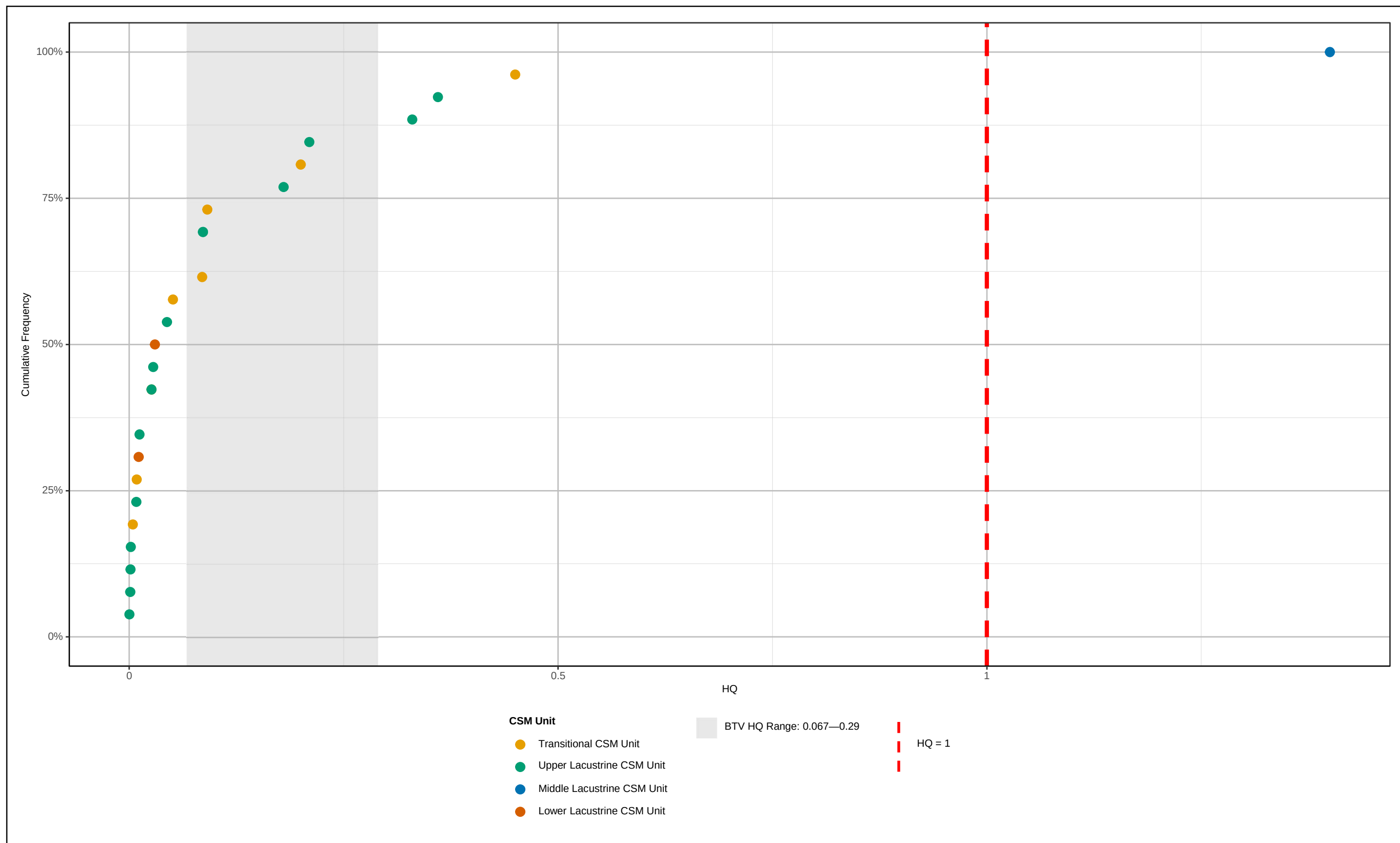


Figure M-26d. Cumulative Frequency of Lead HQs for ELS Fish in Porewater in OU 2
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

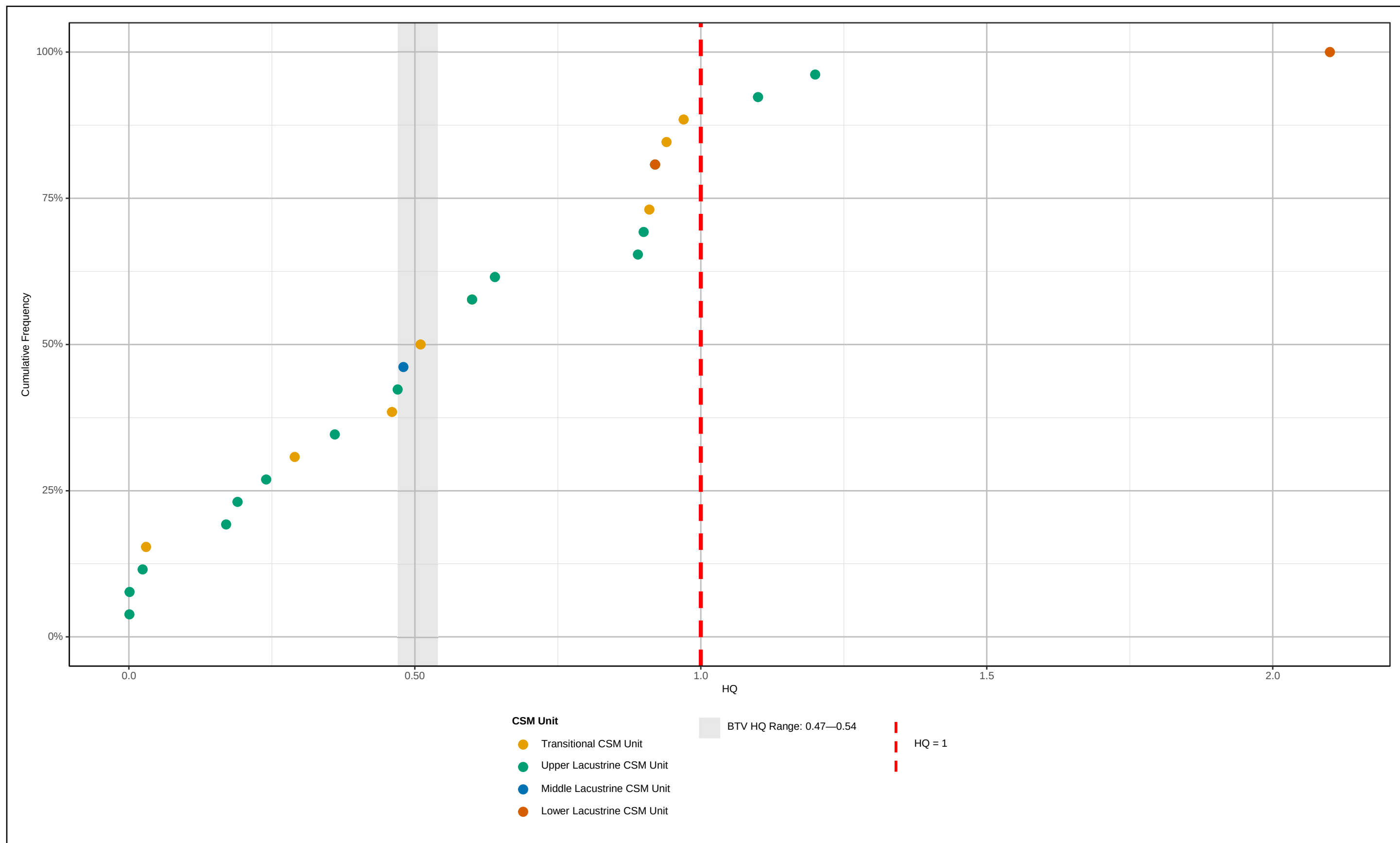


Figure M-26e. Cumulative Frequency of Manganese HQs for ELS Fish in Porewater in OU 2
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

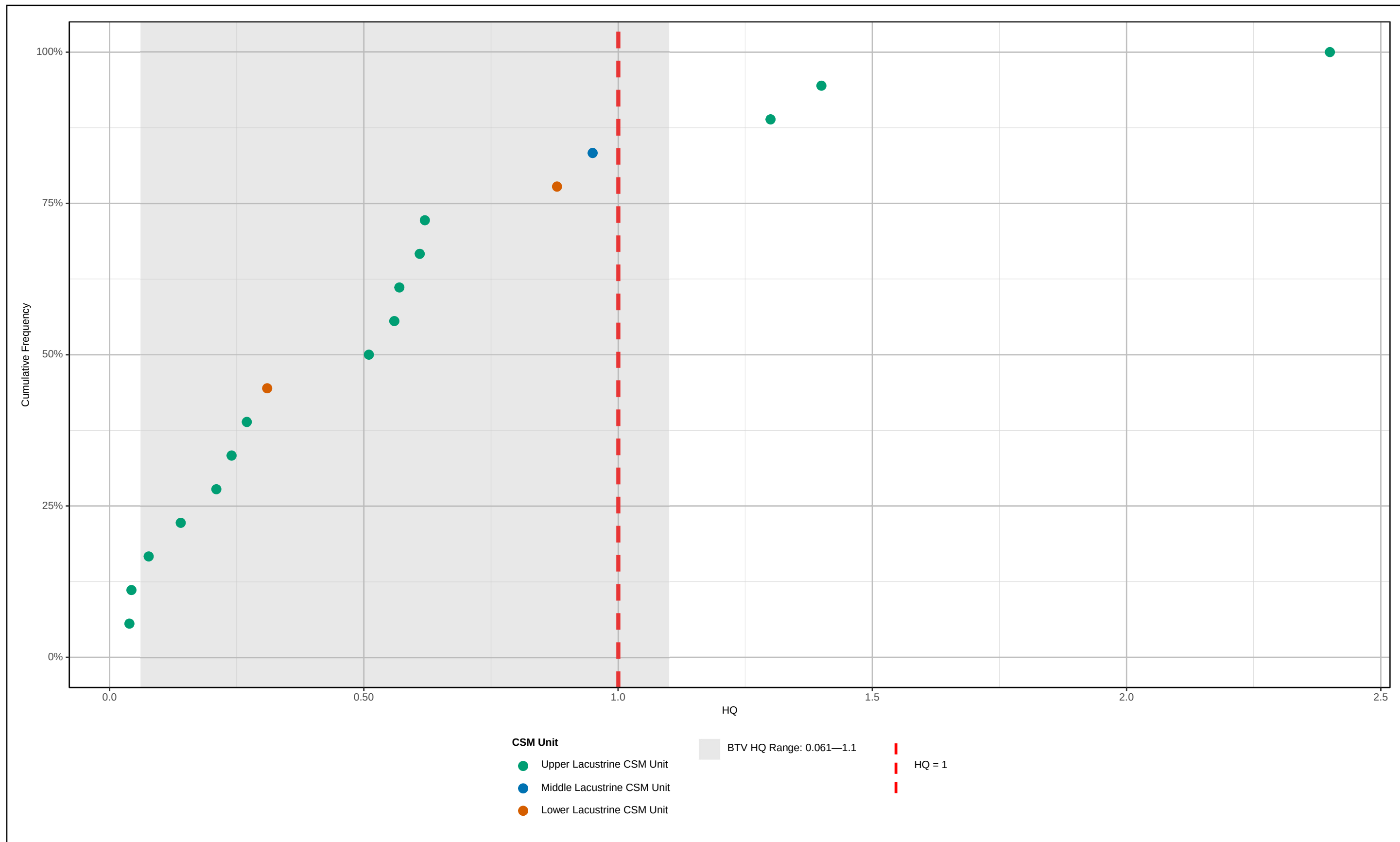


Figure M-26f. Cumulative Frequency of Zinc HQs for ELS Fish in Porewater in OU 2
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

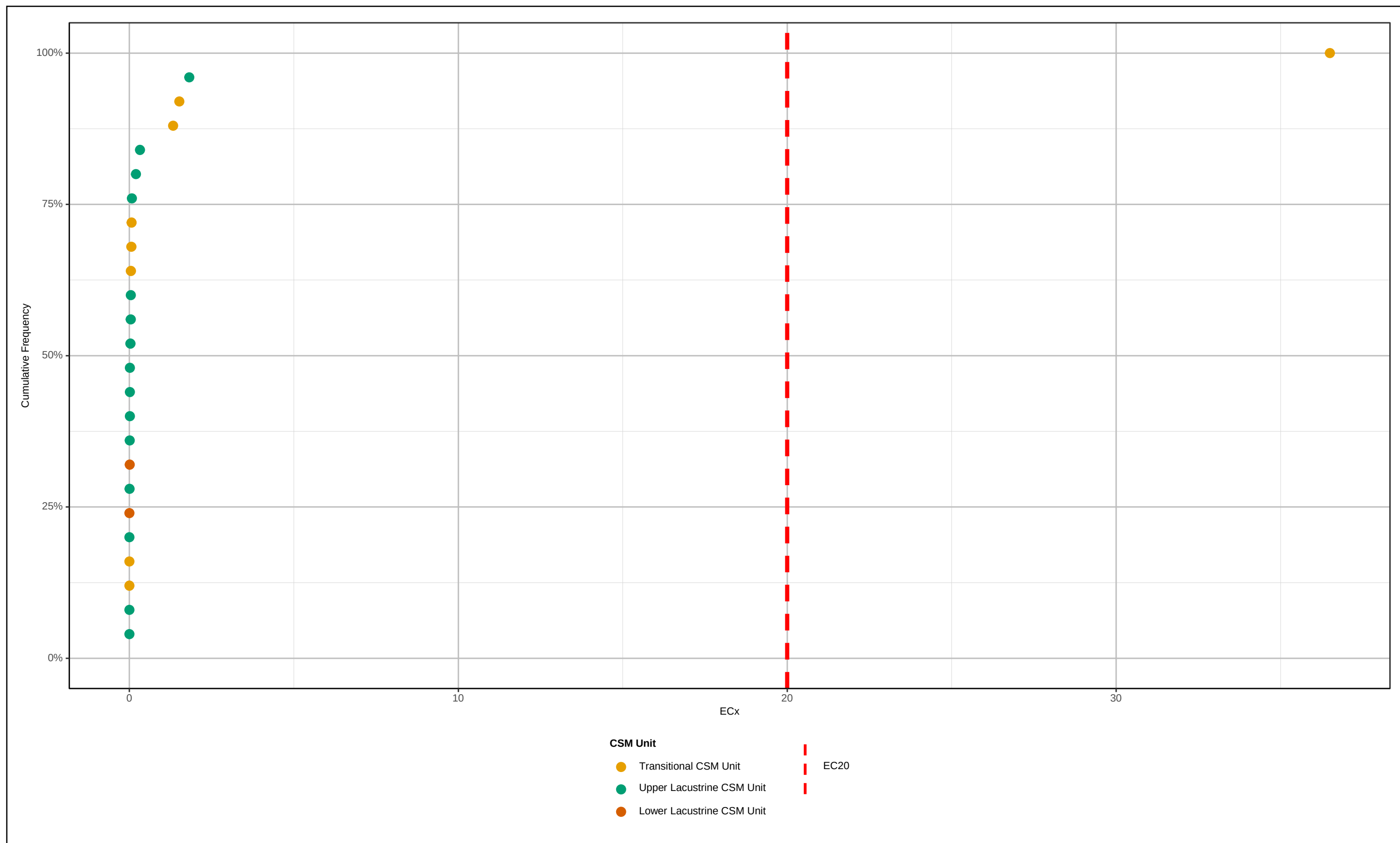


Figure M-27. Cumulative Frequency of Copper ECx Values for ELS Fish in Porewater in OU 2
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

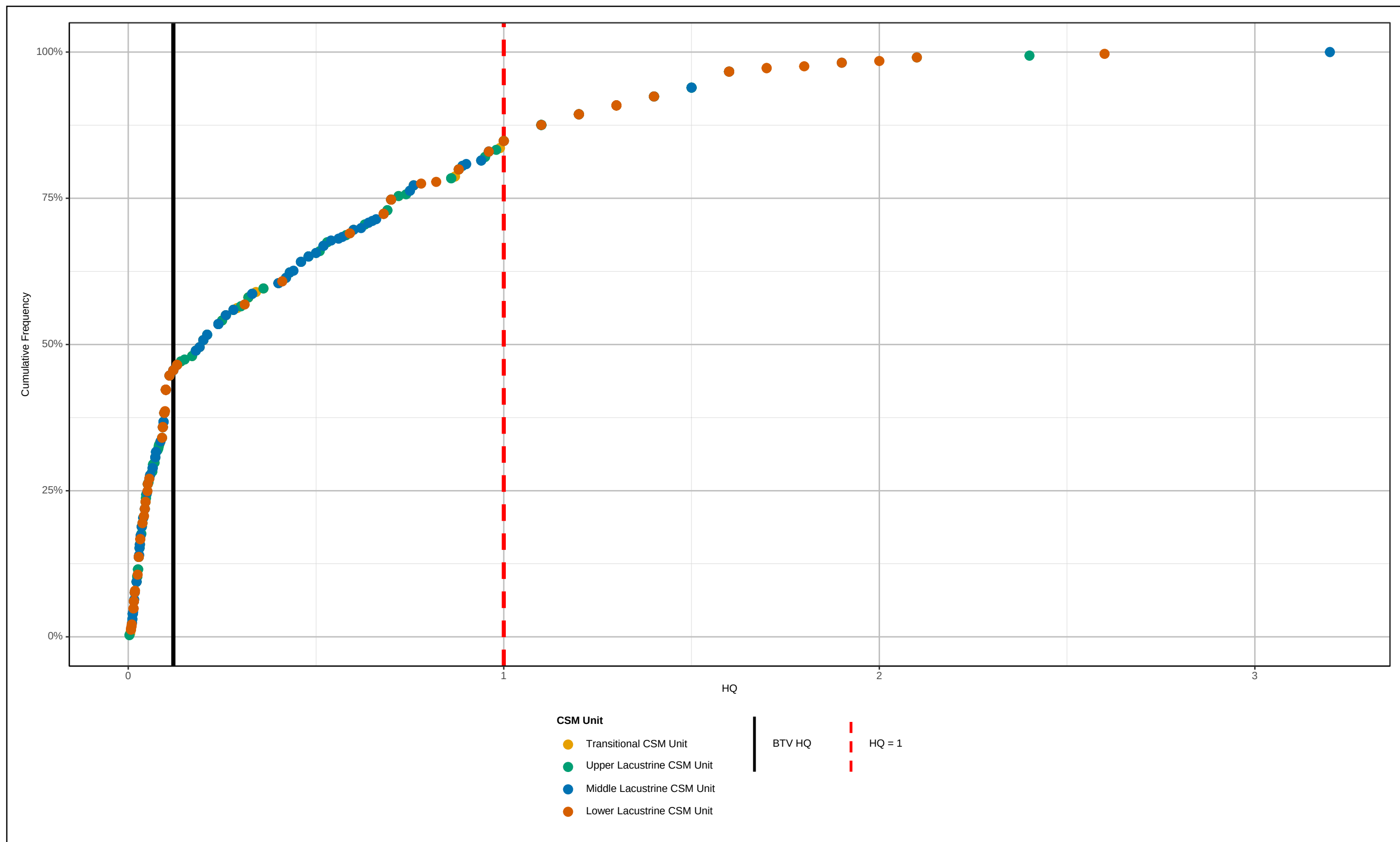


Figure M-28a. Cumulative Frequency of Cadmium HQs for Benthic Invertebrates in Sediment in OU 2
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

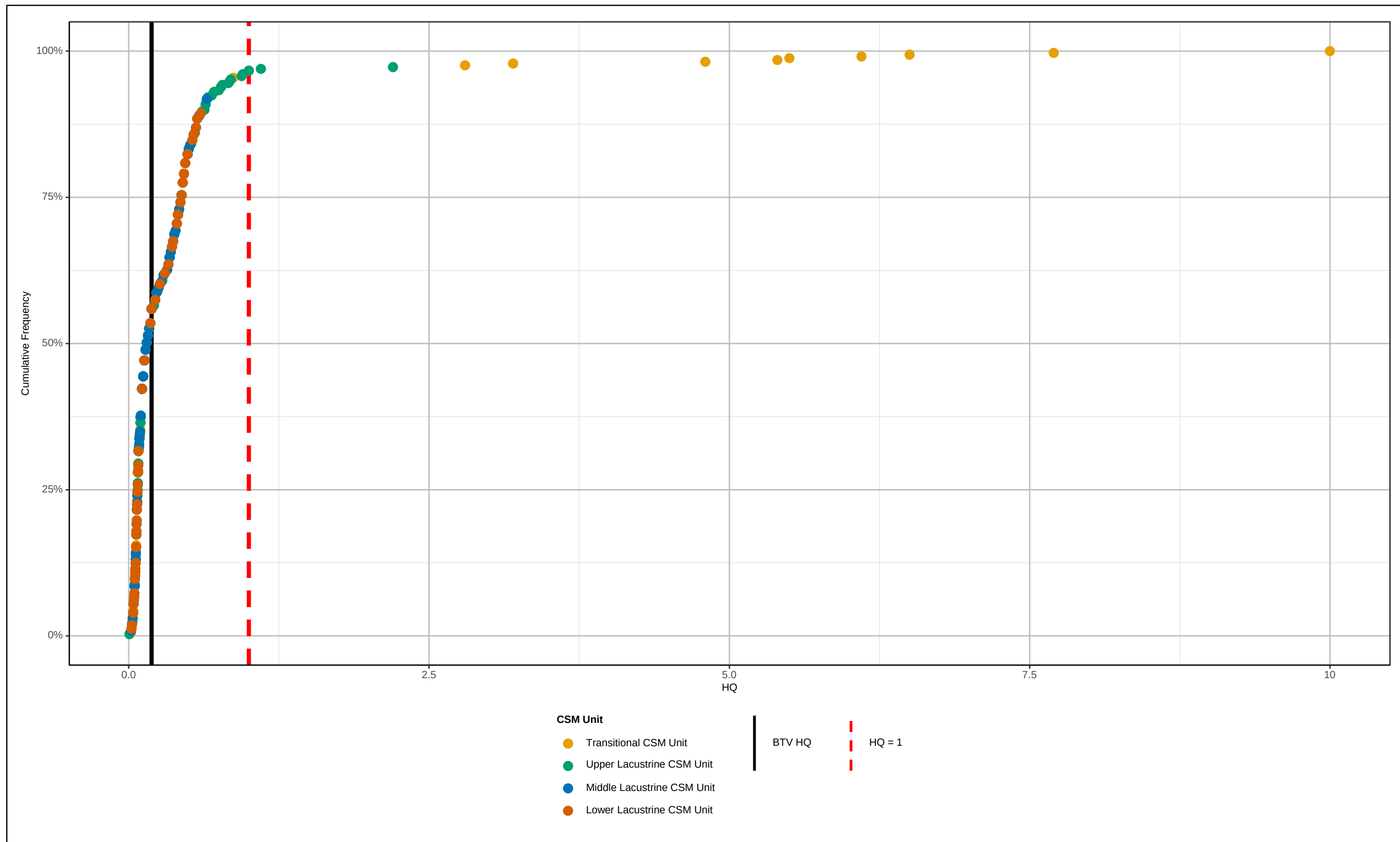


Figure M-28b. Cumulative Frequency of Copper HQs for Benthic Invertebrates in Sediment in OU 2
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

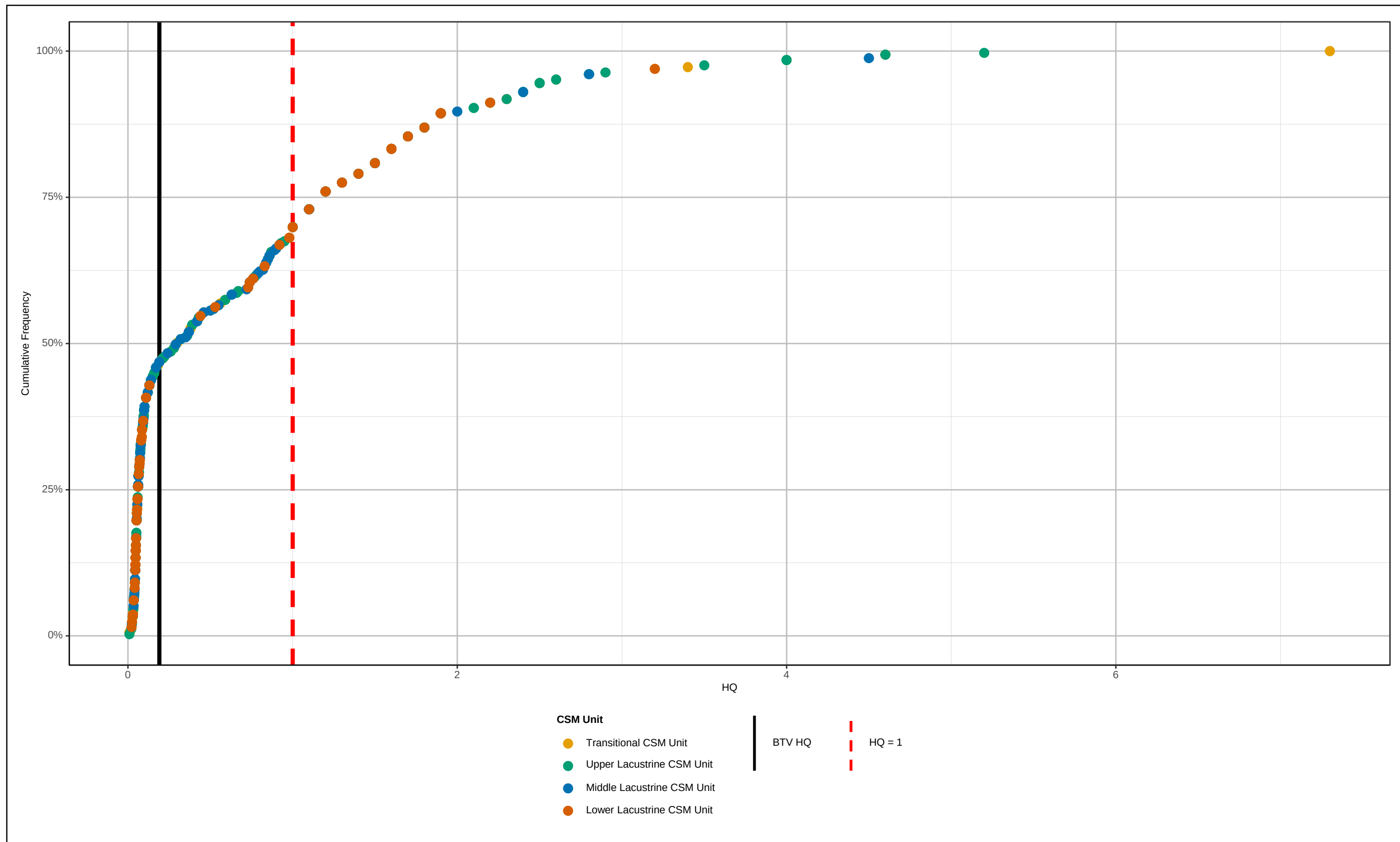


Figure M-28c. Cumulative Frequency of Lead HQs for Benthic Invertebrates in Sediment in OU 2
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

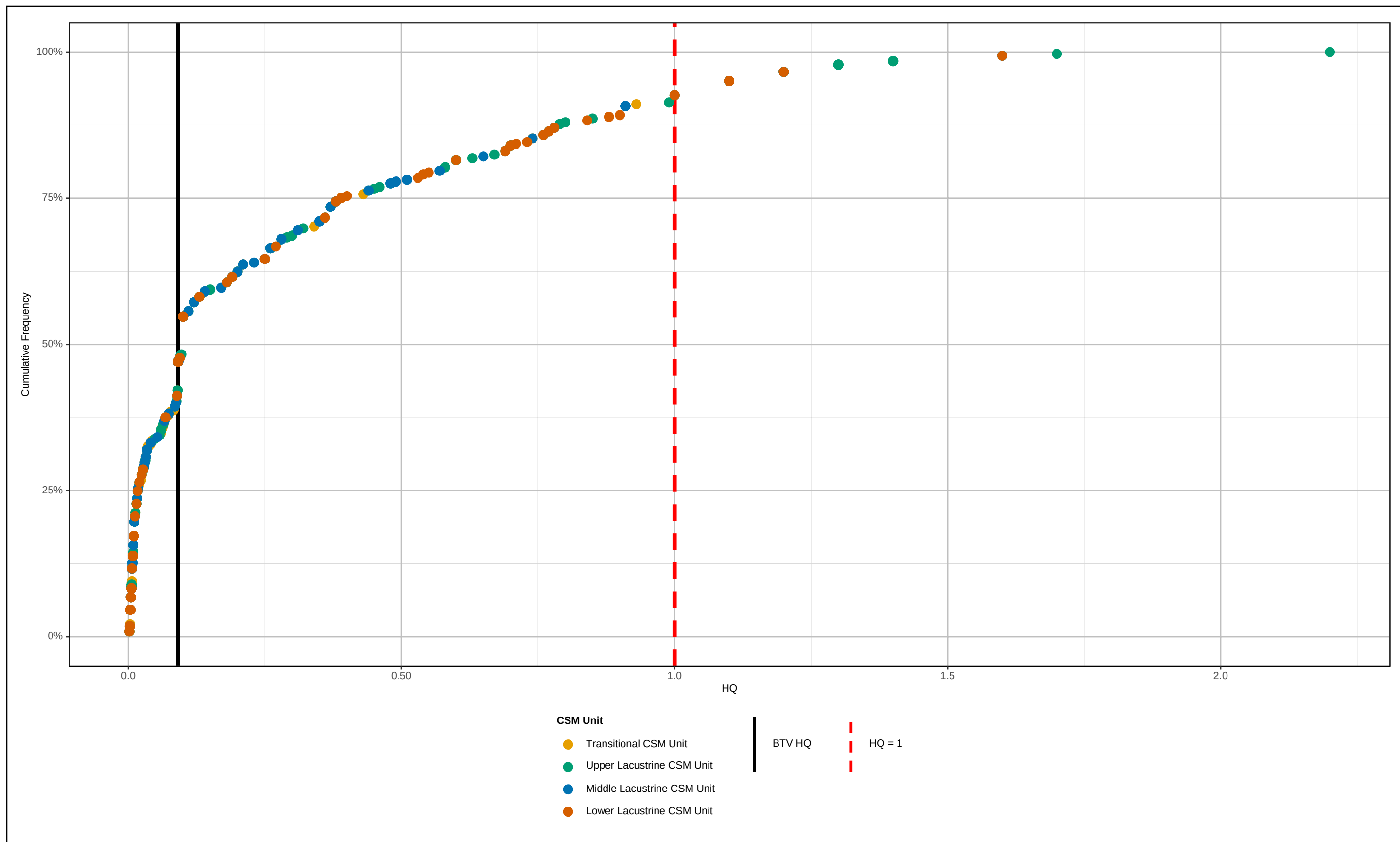


Figure M-28d. Cumulative Frequency of Mercury HQs for Benthic Invertebrates in Sediment in OU 2
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

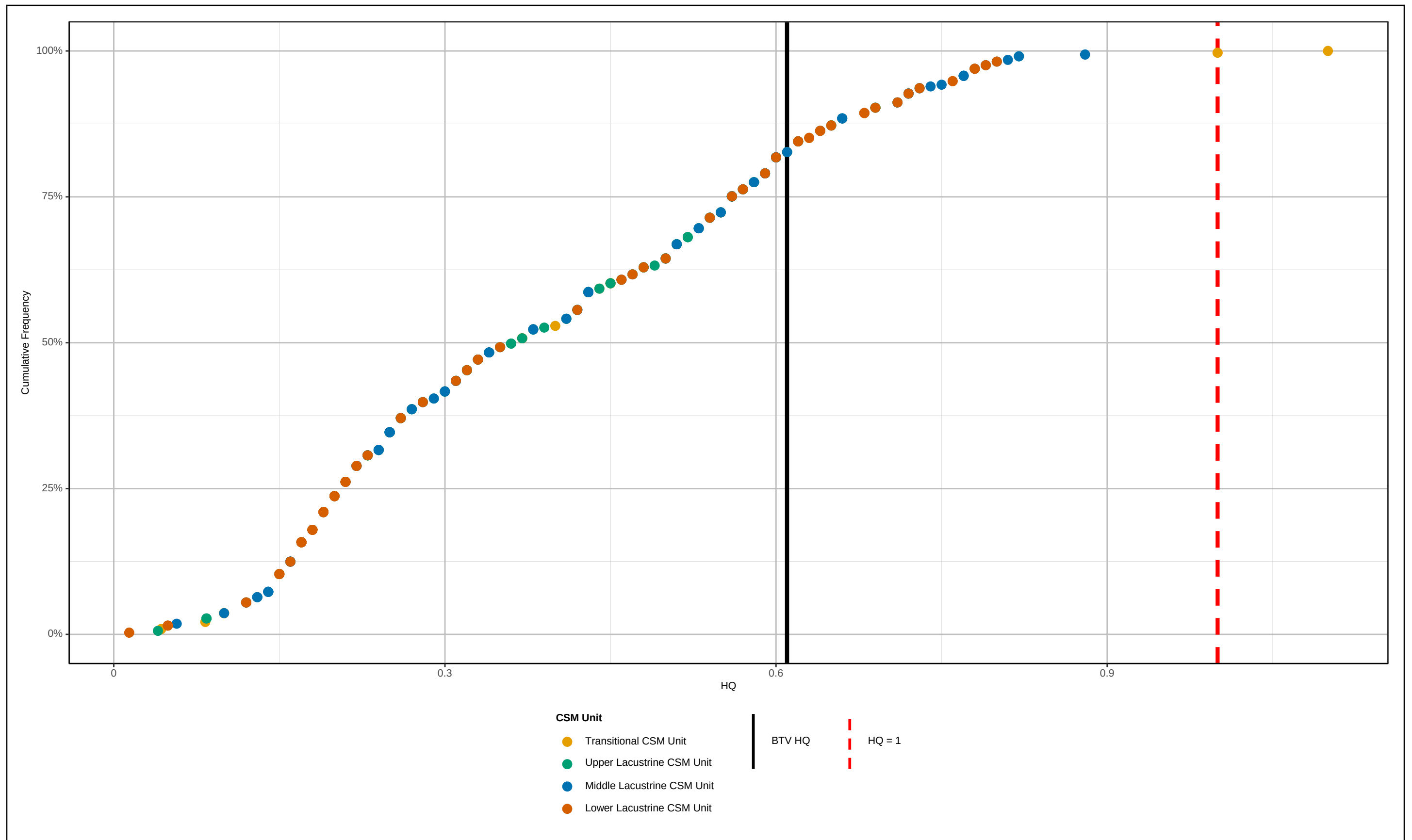


Figure M-28e. Cumulative Frequency of Nickel HQs for Benthic Invertebrates in Sediment in OU 2
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

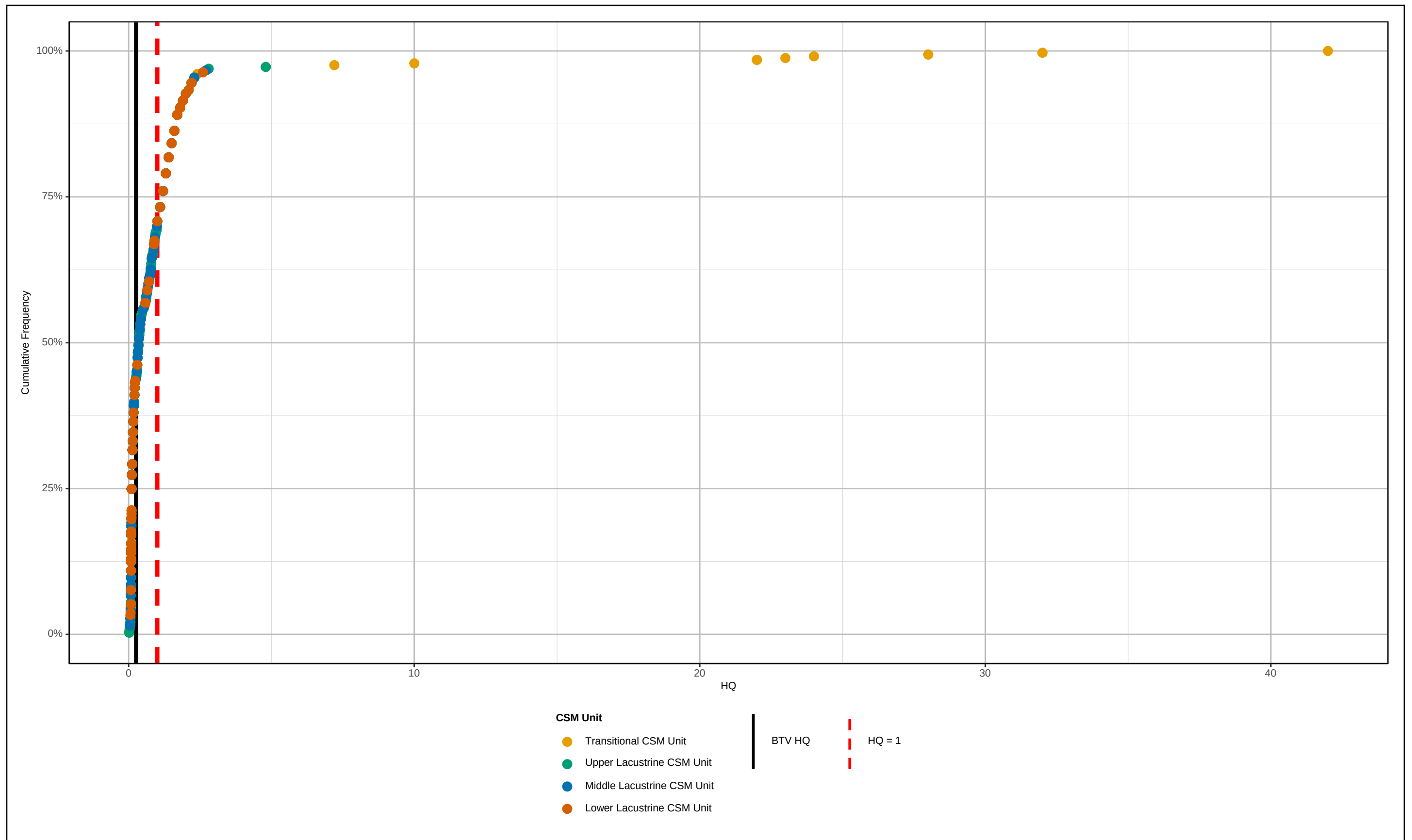


Figure M-28f. Cumulative Frequency of Zinc HQs for Benthic Invertebrates in Sediment in OU 2
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

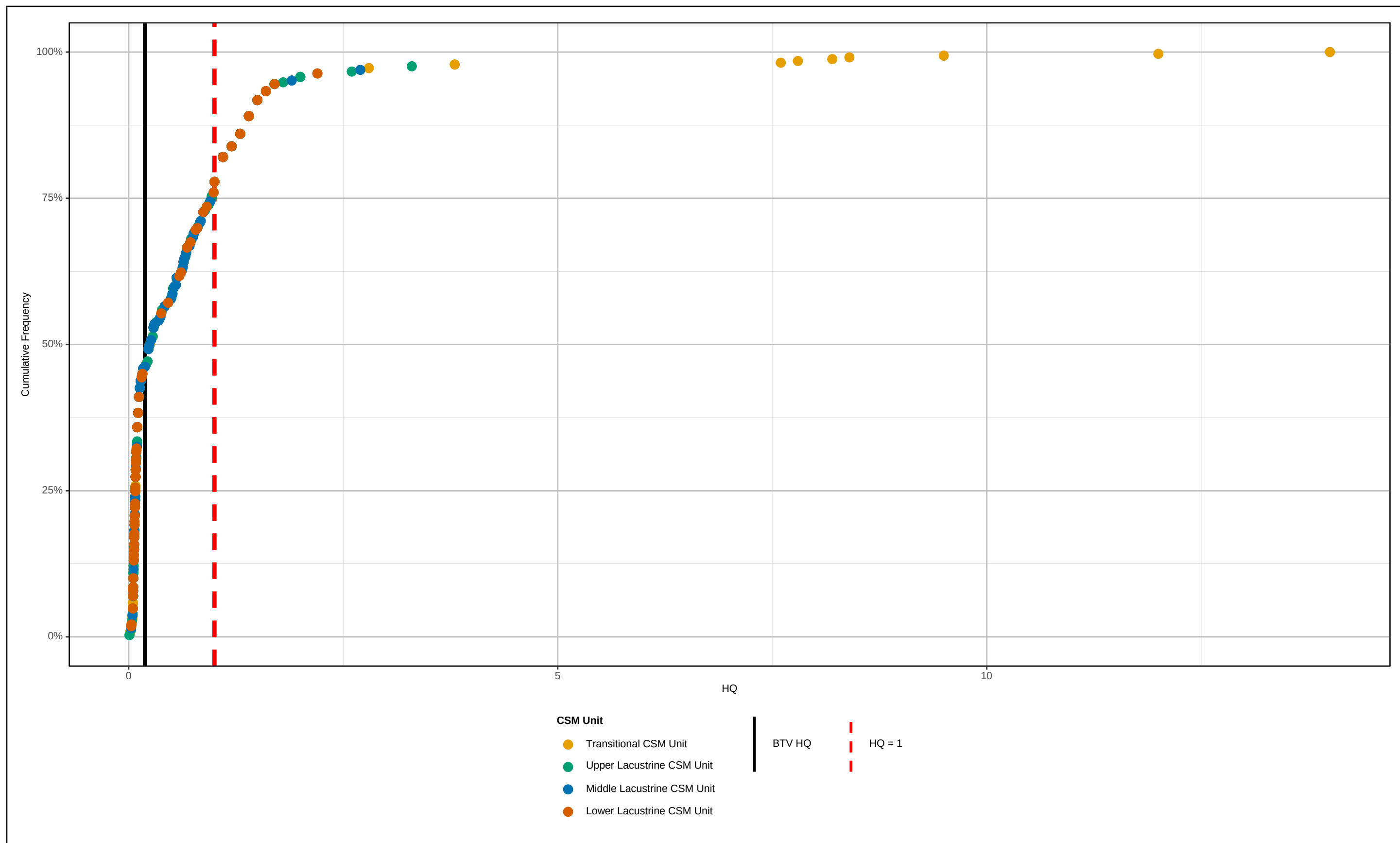


Figure M-28g. Cumulative Frequency of Mean PEC Quotient (Cadmium, Copper, Lead, Zinc) HQs for Benthic Invertebrates in Sediment in OU 2
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

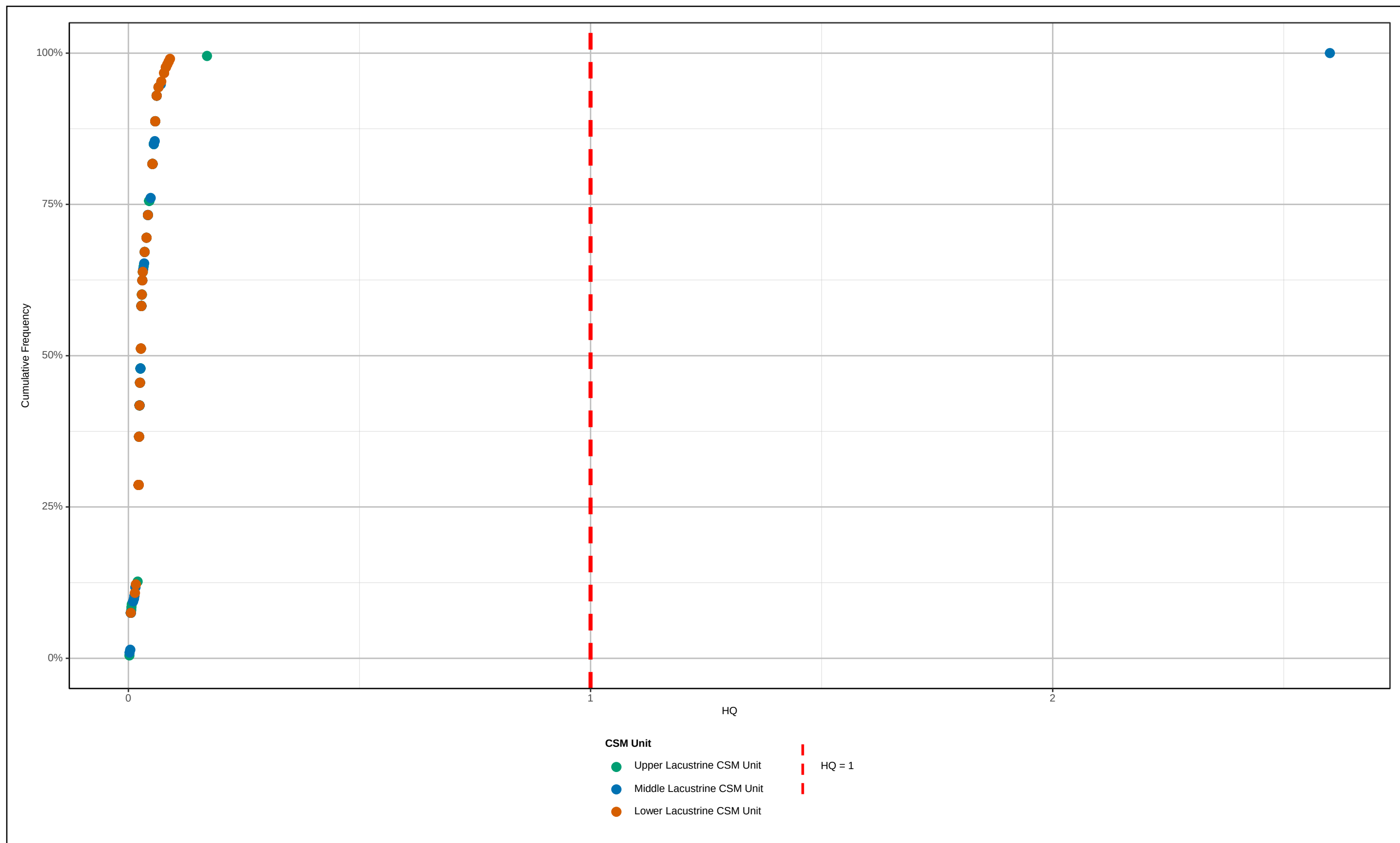


Figure M-28h. Cumulative Frequency of Total DDE, 0 DL HQs for Benthic Invertebrates in Sediment in OU 2
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

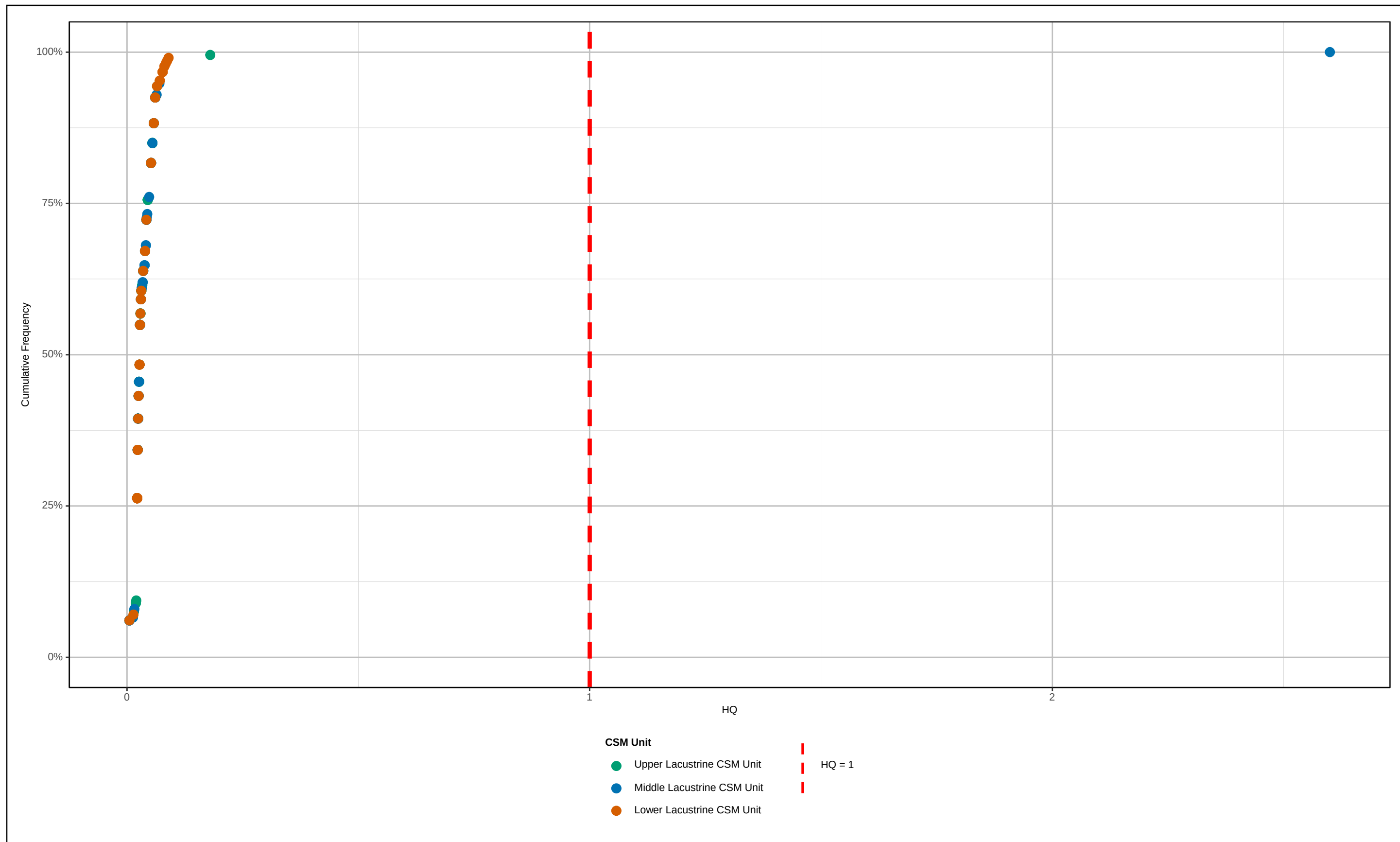


Figure M-28i. Cumulative Frequency of Total DDE, 1/2 DL HQs for Benthic Invertebrates in Sediment in OU 2
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

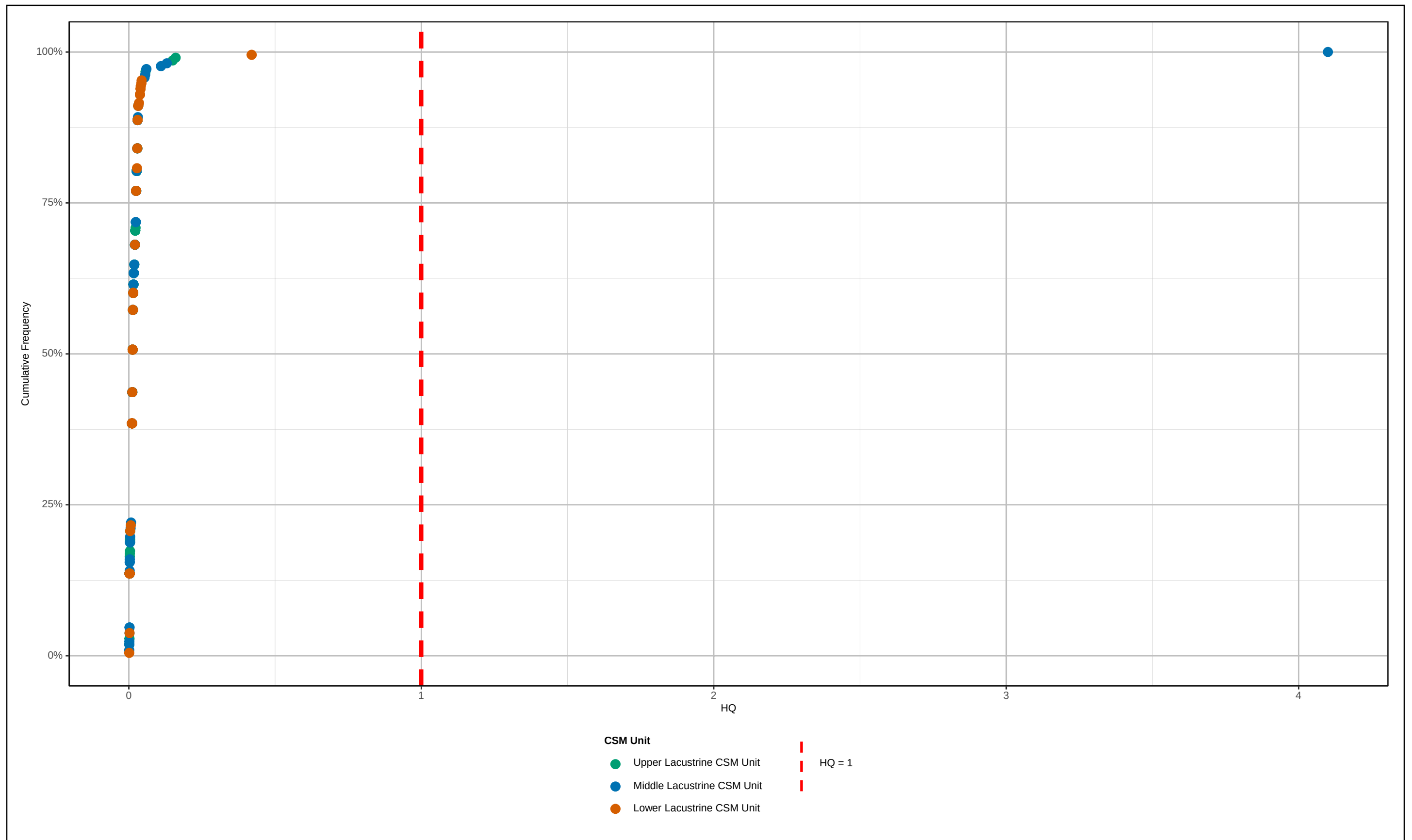


Figure M-28j. Cumulative Frequency of Total DDT, 0 DL HQs for Benthic Invertebrates in Sediment in OU 2

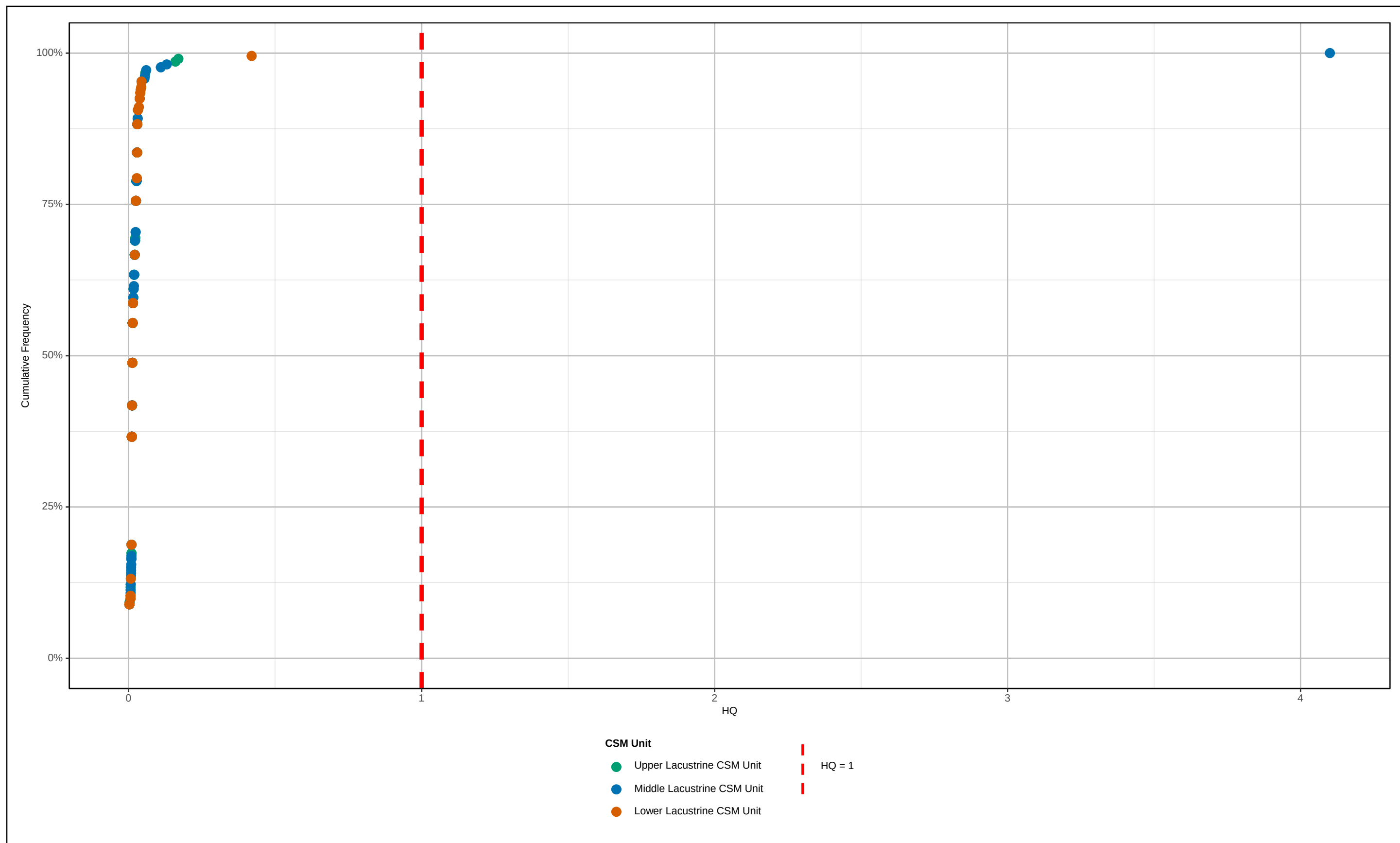


Figure M-28k. Cumulative Frequency of Total DDT, 1/2 DL HQs for Benthic Invertebrates in Sediment in OU 2
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

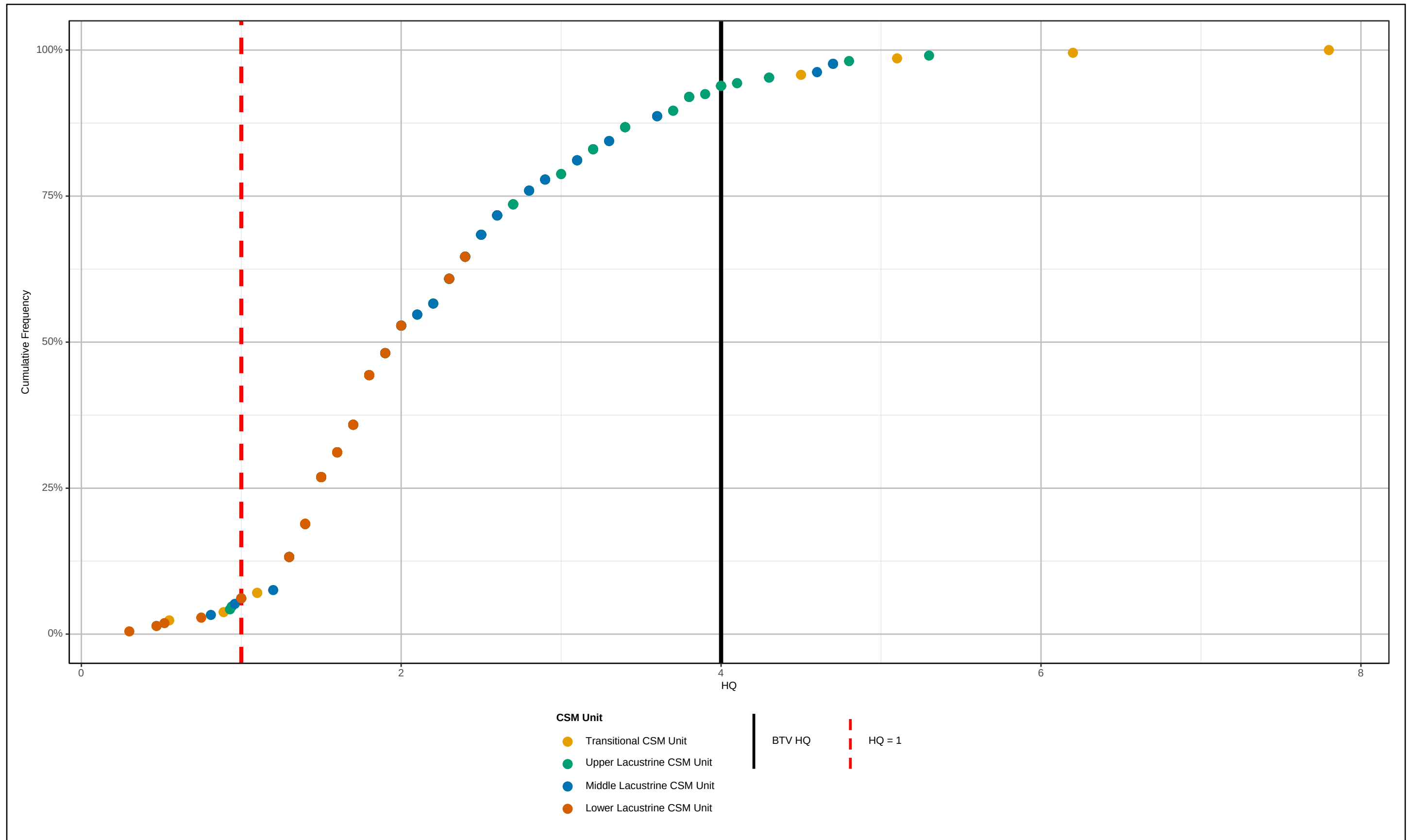


Figure M-29a. Cumulative Frequency of Chromium Dietary HQs for Largescale Sucker in OU 2
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

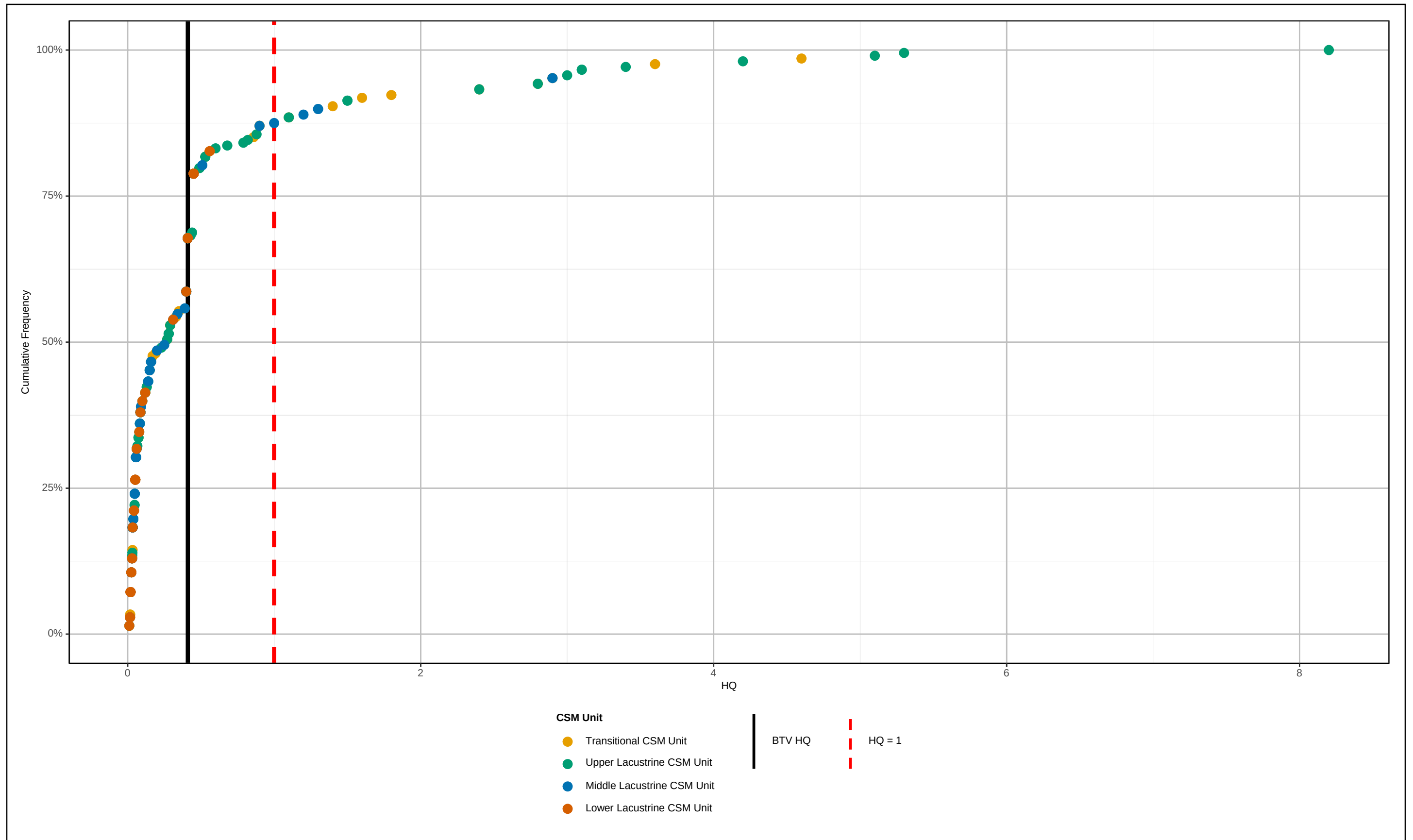


Figure M-29b. Cumulative Frequency of Mercury Dietary HQs for Largescale Sucker in OU 2
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

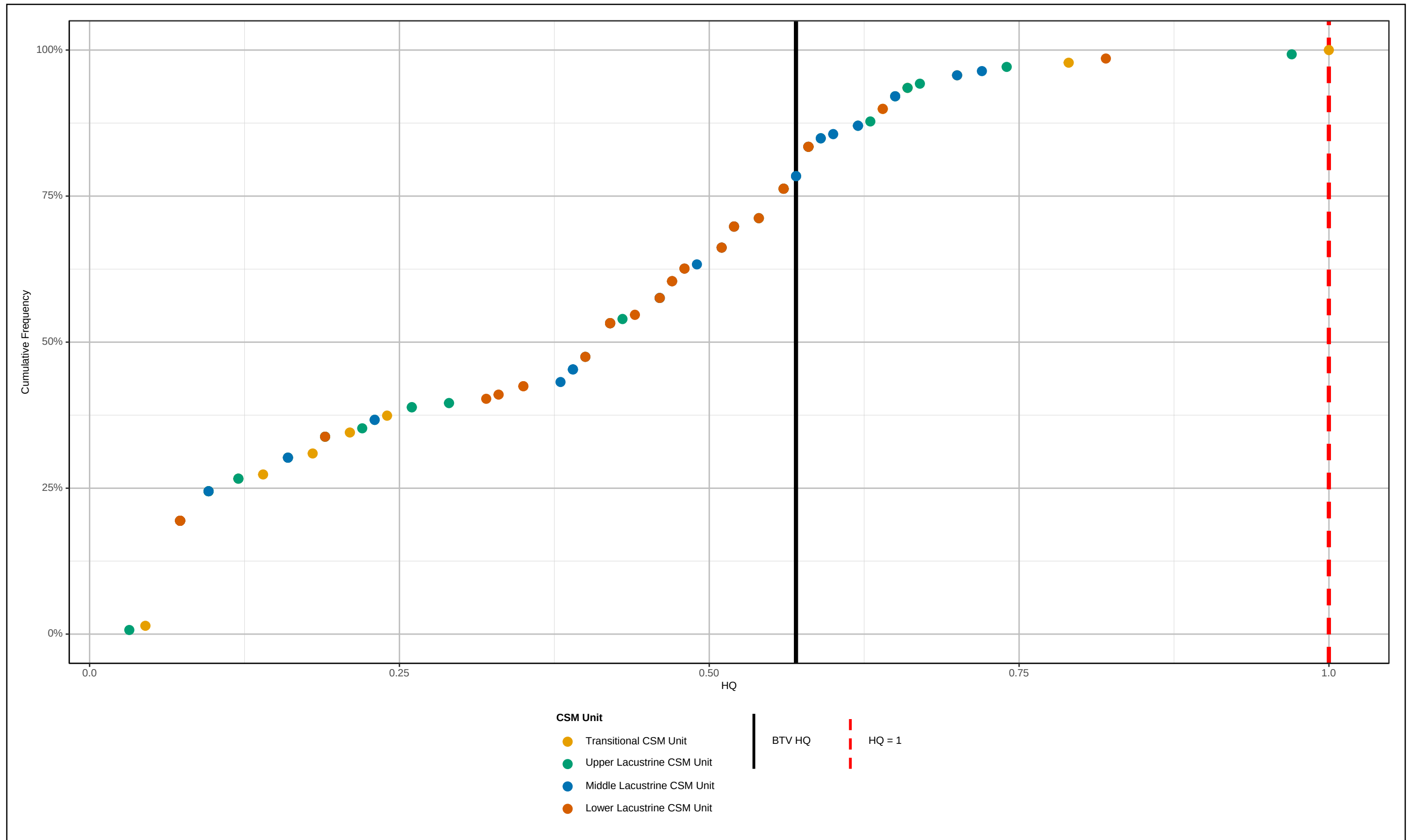


Figure M-29c. Cumulative Frequency of Selenium Dietary HQs for Largescale Sucker in OU 2
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

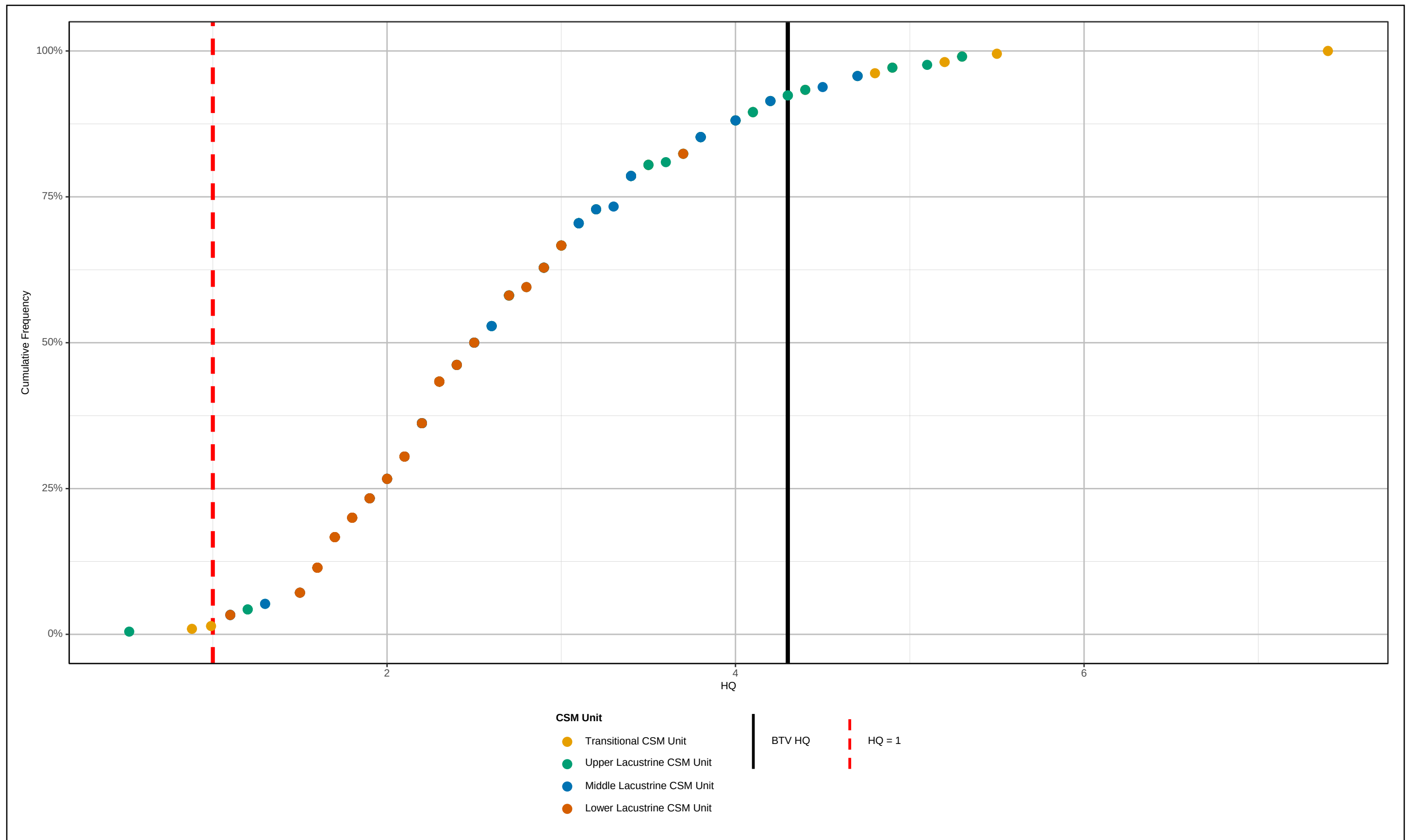


Figure M-29d. Cumulative Frequency of Vanadium Dietary HQs for Largescale Sucker in OU 2
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

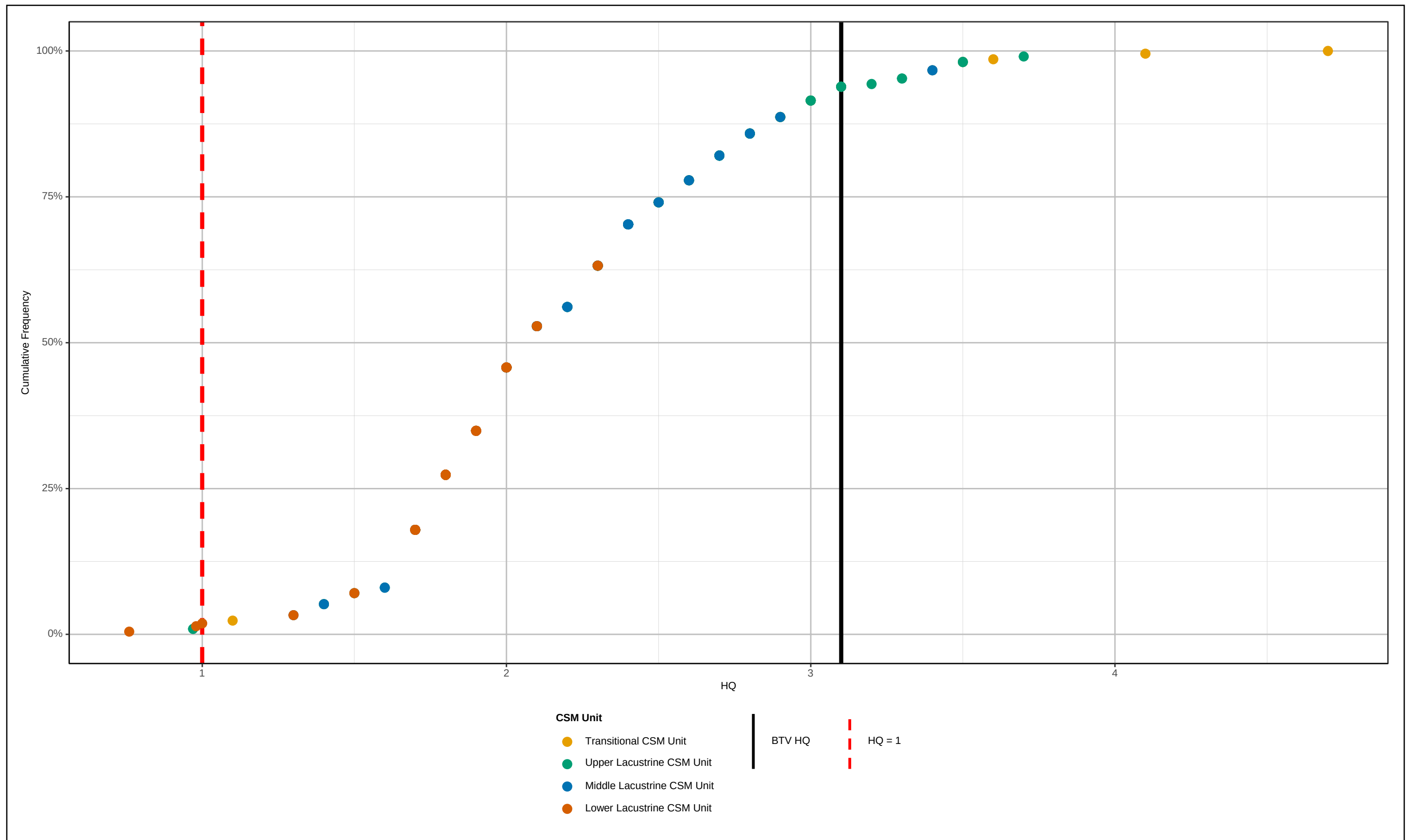


Figure M-29e. Cumulative Frequency of Chromium Dietary HQs for Longnose Dace in OU 2
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

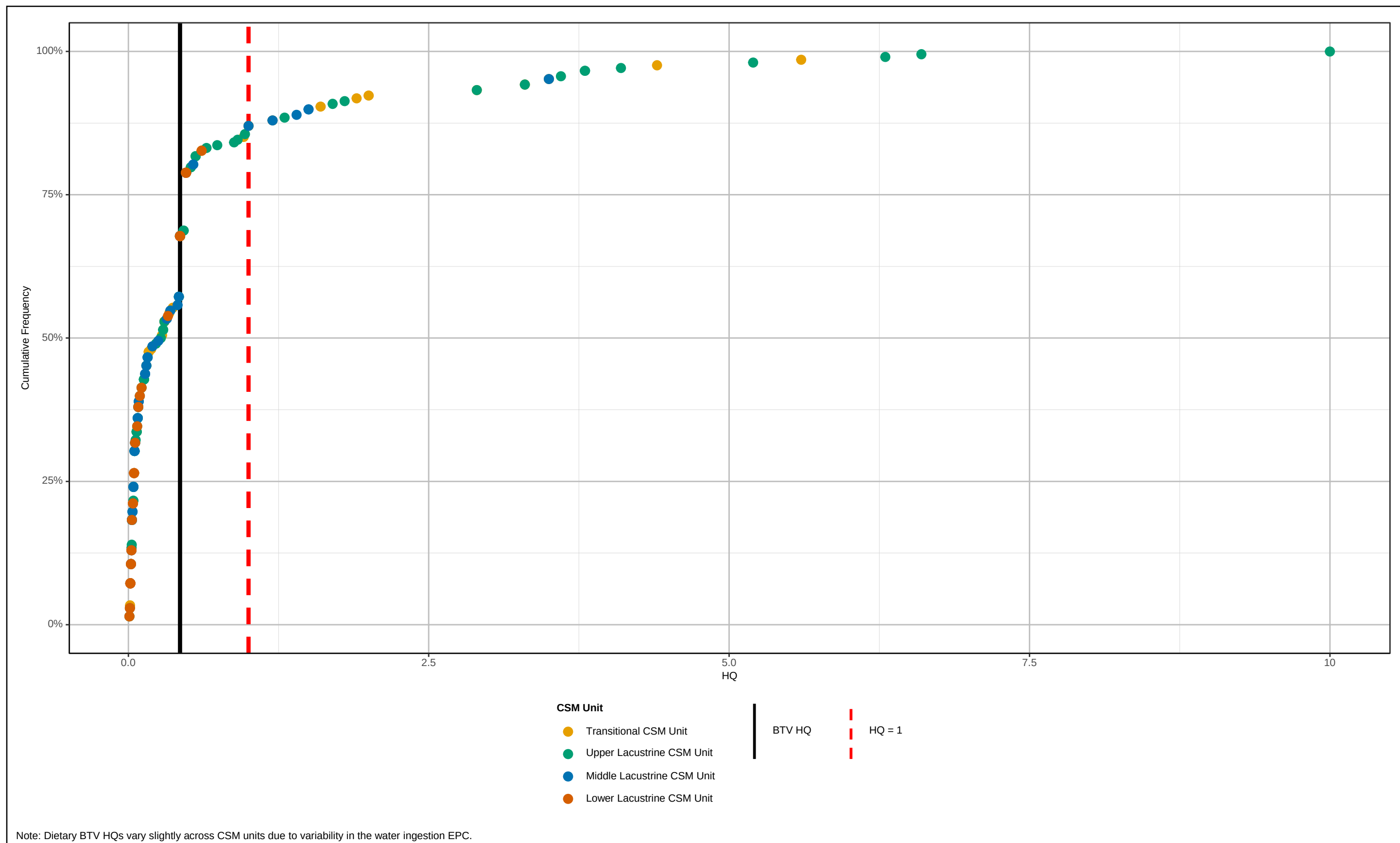


Figure M-29f. Cumulative Frequency of Mercury Dietary HQs for Longnose Dace in OU 2
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

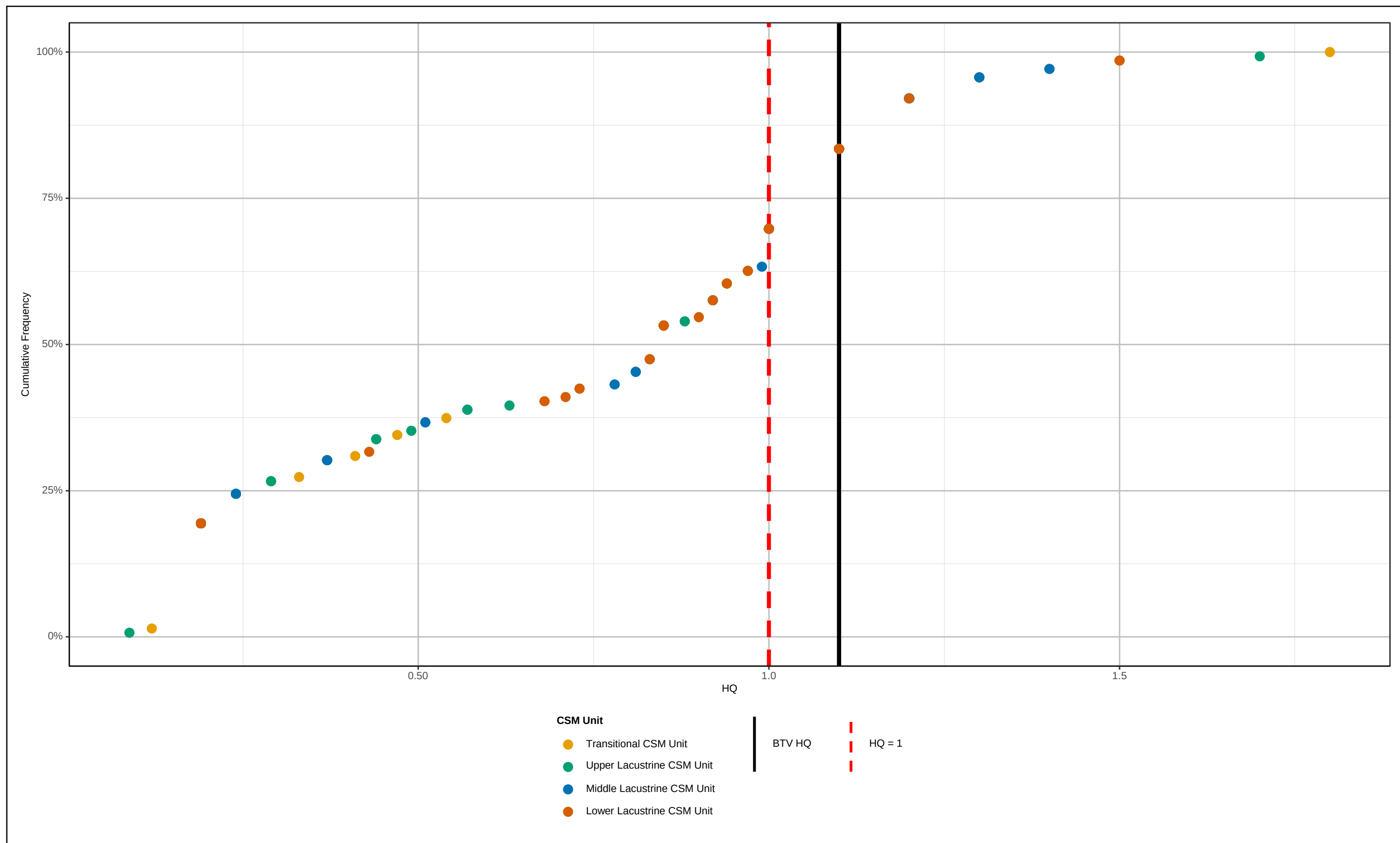


Figure M-29g. Cumulative Frequency of Selenium Dietary HQs for Longnose Dace in OU 2
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

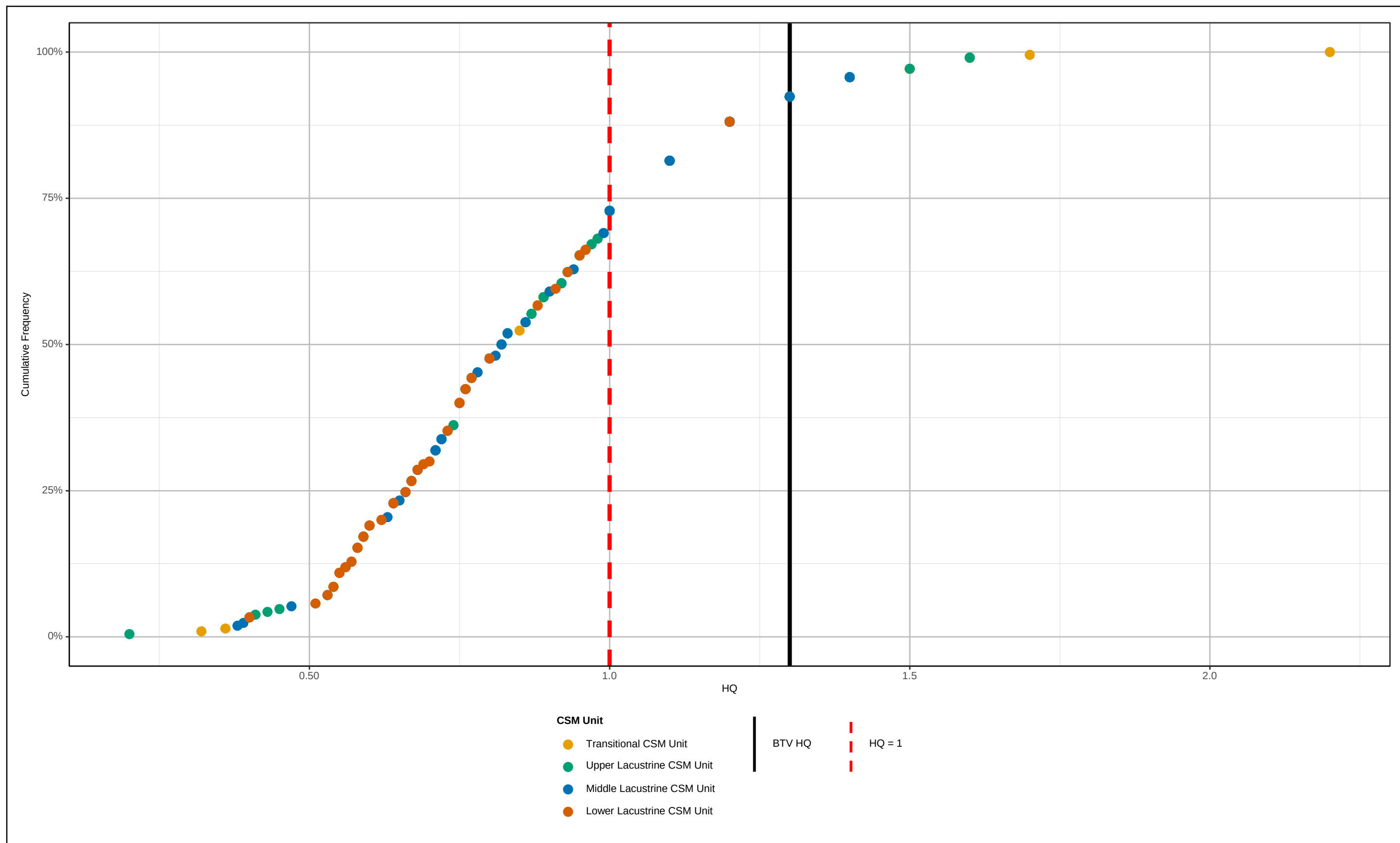


Figure M-29h. Cumulative Frequency of Vanadium Dietary HQs for Longnose Dace in OU 2
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

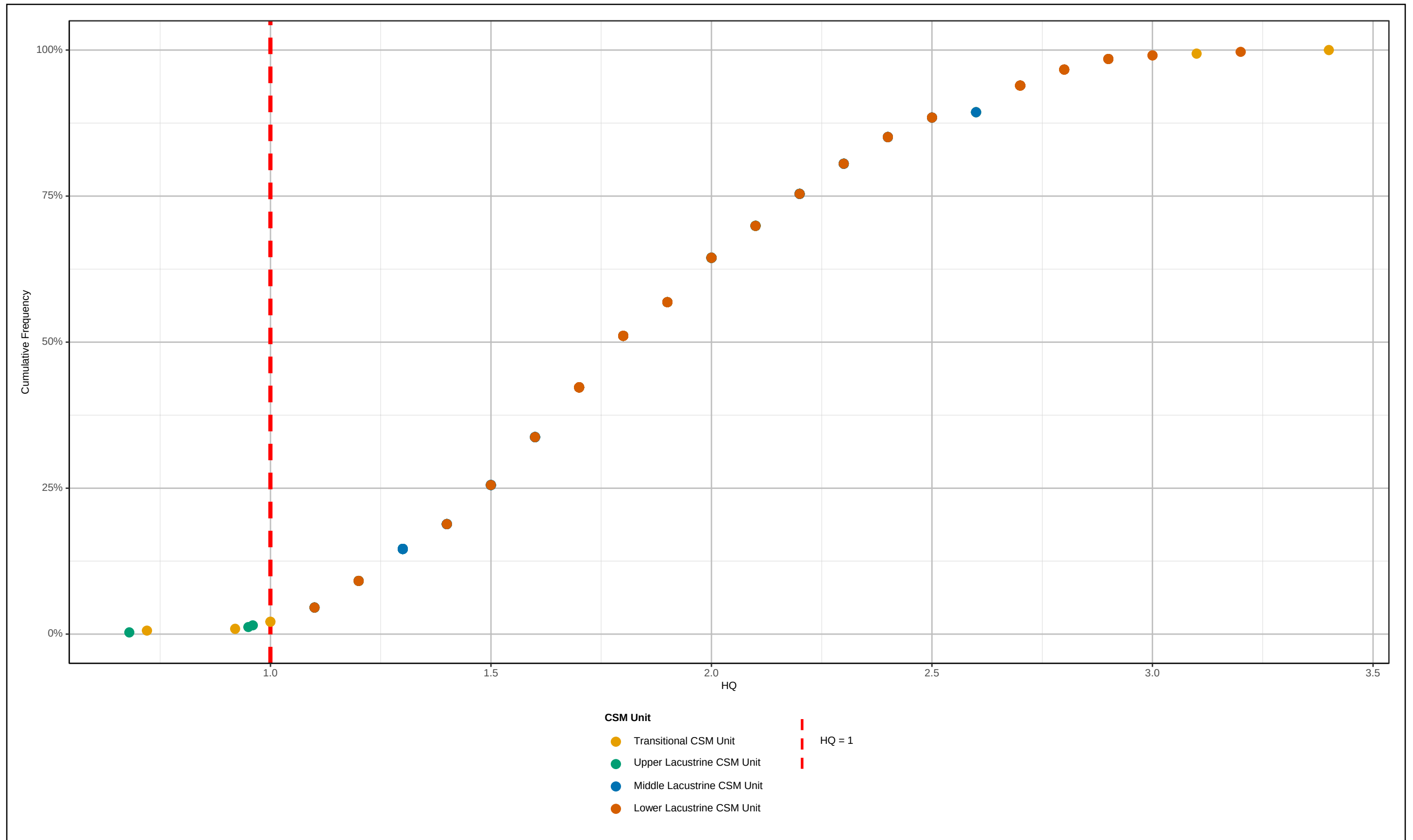


Figure M-29i. Cumulative Frequency of Chromium Dietary HQs for Prickly Sculpin in OU 2
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

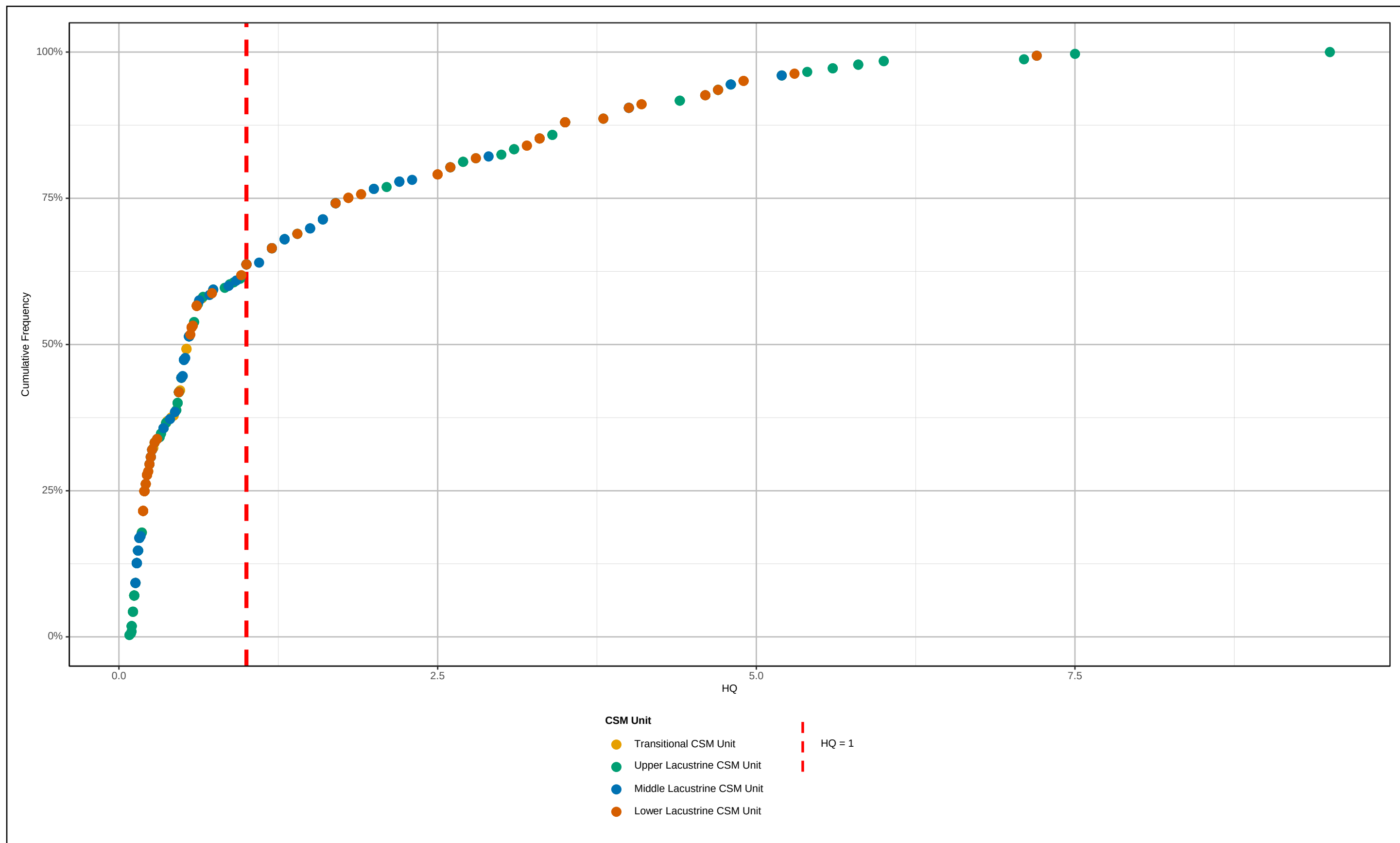


Figure M-29j. Cumulative Frequency of Mercury Dietary HQs for Prickly Sculpin in OU 2
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

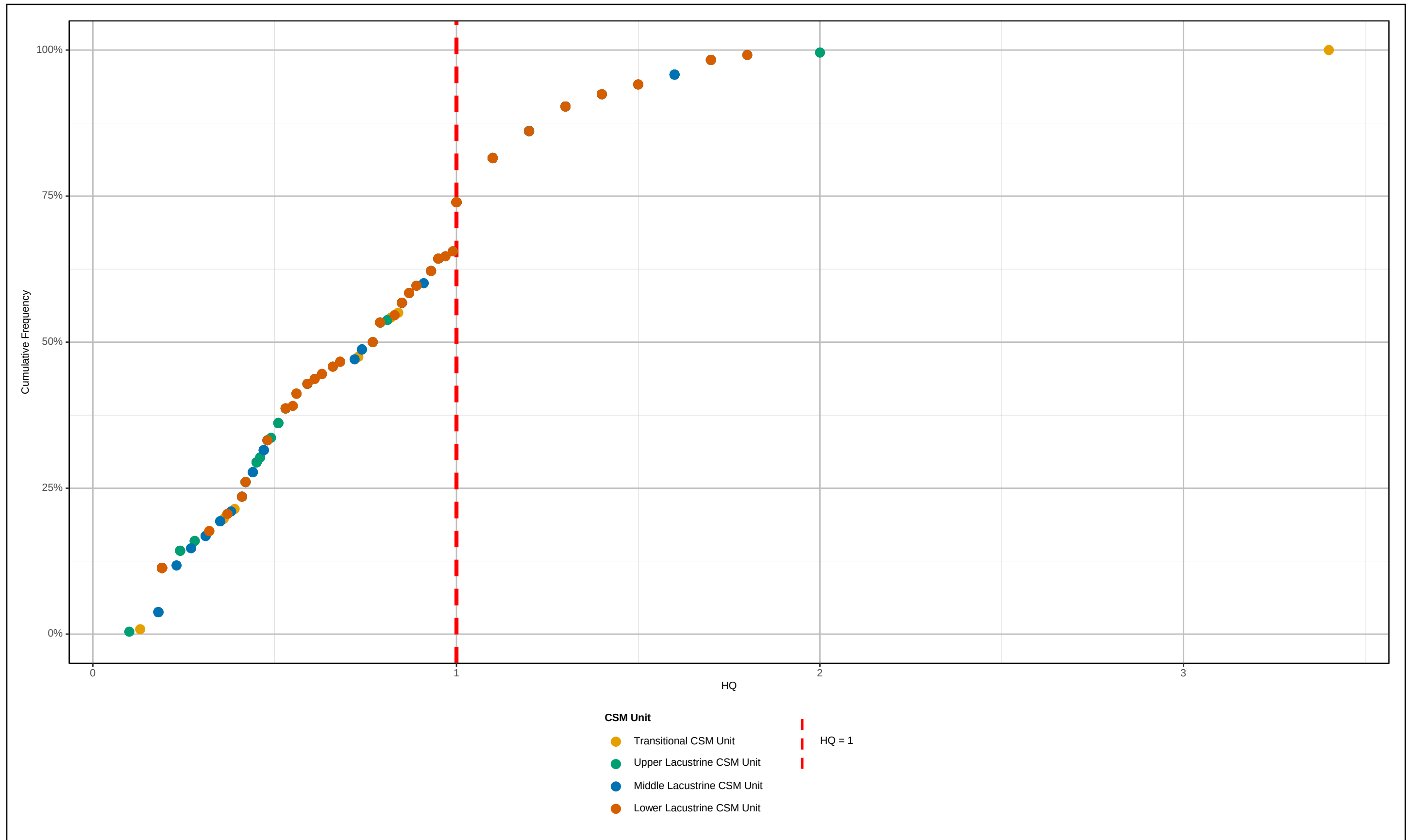


Figure M-29k. Cumulative Frequency of Selenium Dietary HQs for Prickly Sculpin in OU 2
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

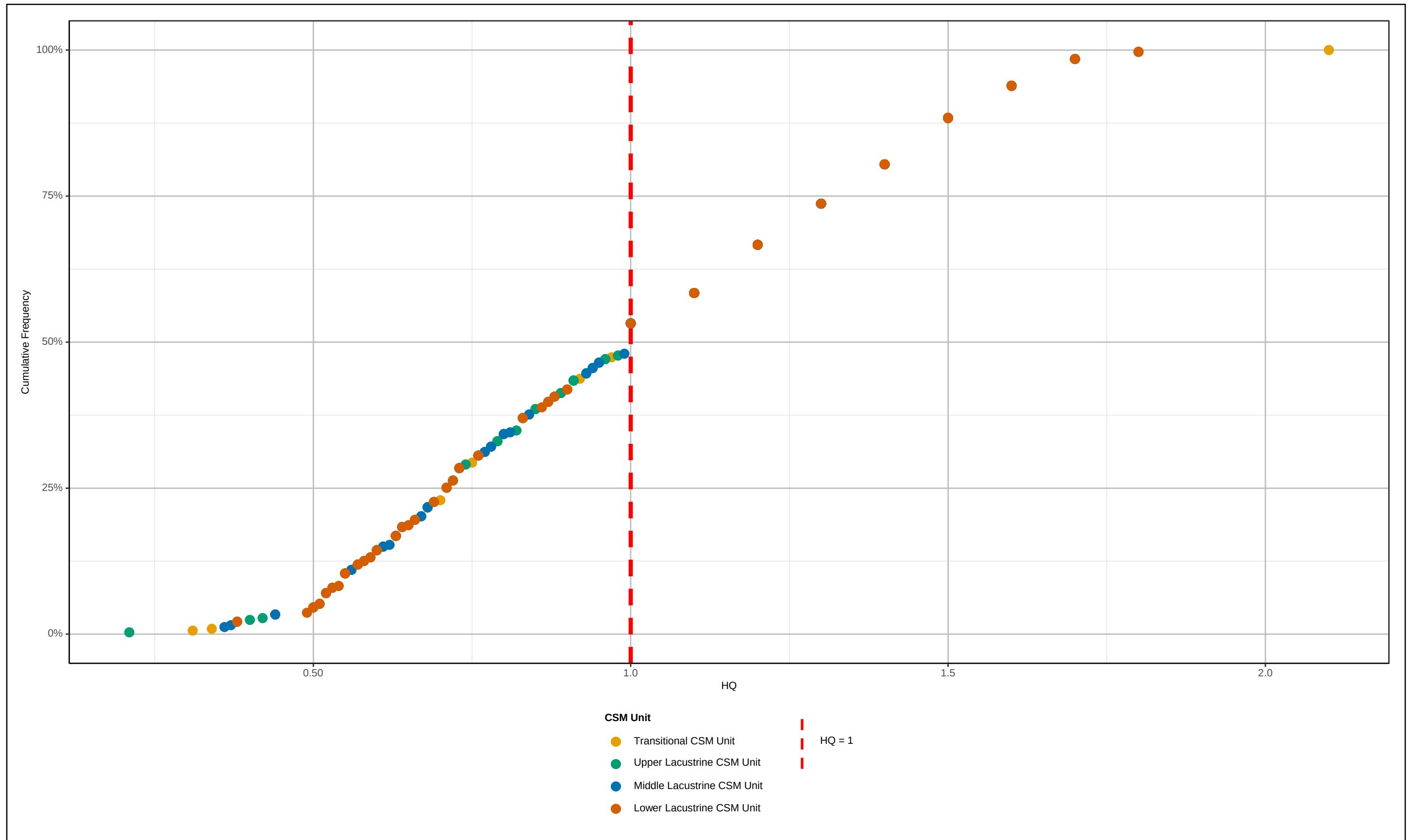


Figure M-29I. Cumulative Frequency of Vanadium Dietary HQs for Prickly Sculpin in OU 2
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

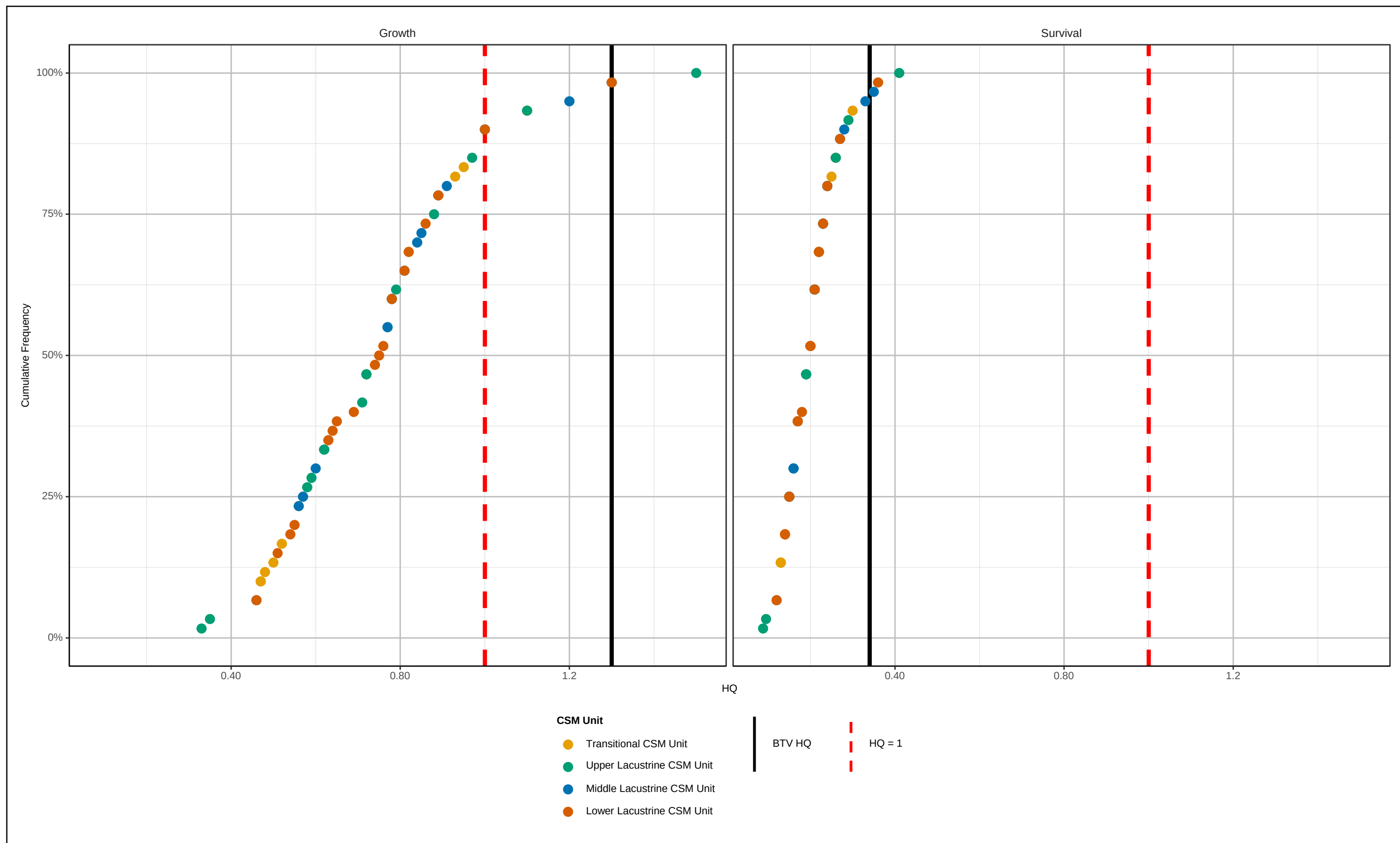
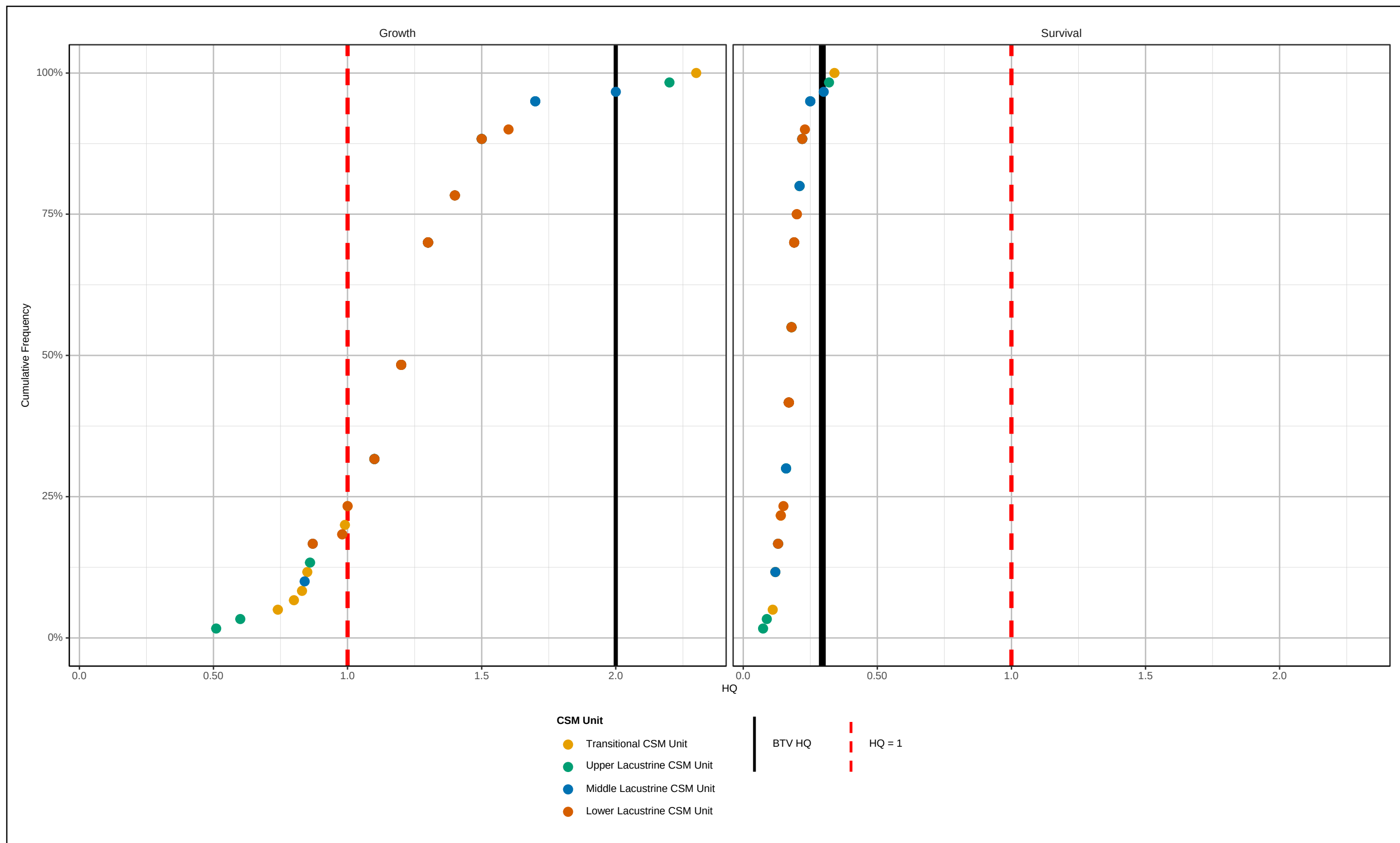


Figure M-30a. Cumulative Frequency of Aluminum Dietary HQs for Tundra Swan in OU 2
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington



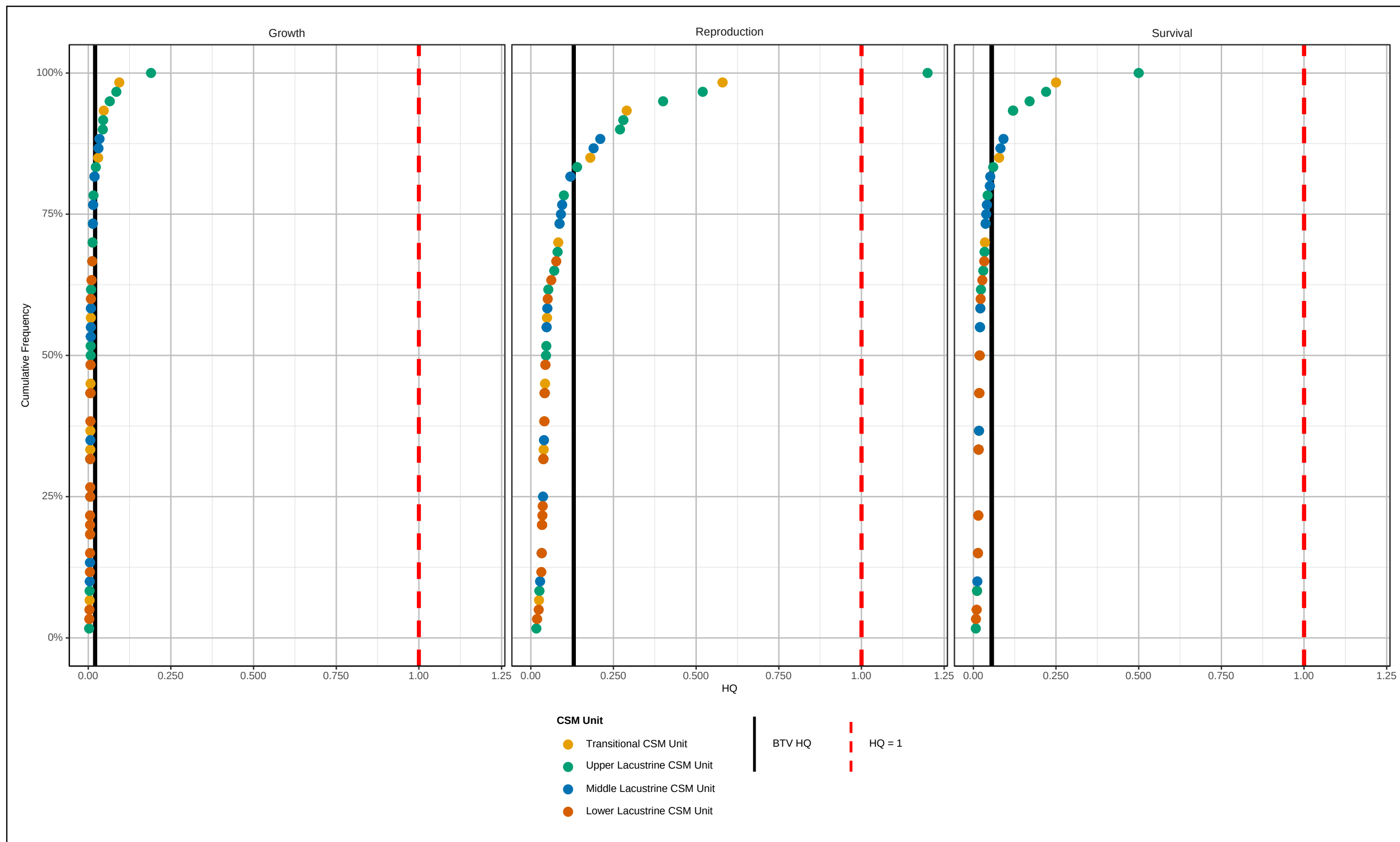


Figure M-30c. Cumulative Frequency of Lead Dietary HQs for Tundra Swan in OU 2
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

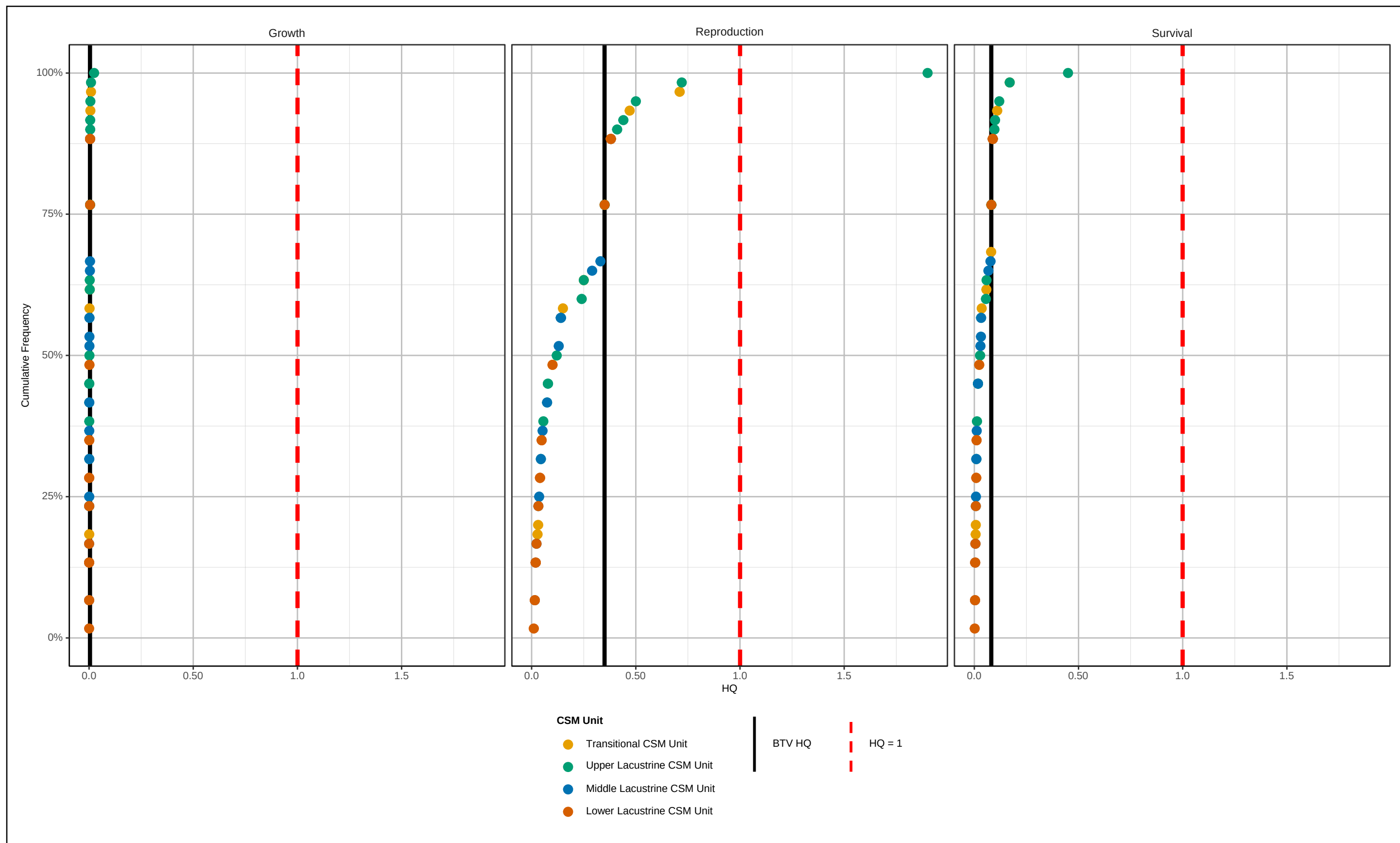


Figure M-30d. Cumulative Frequency of Mercury Dietary HQs for Tundra Swan in OU 2
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

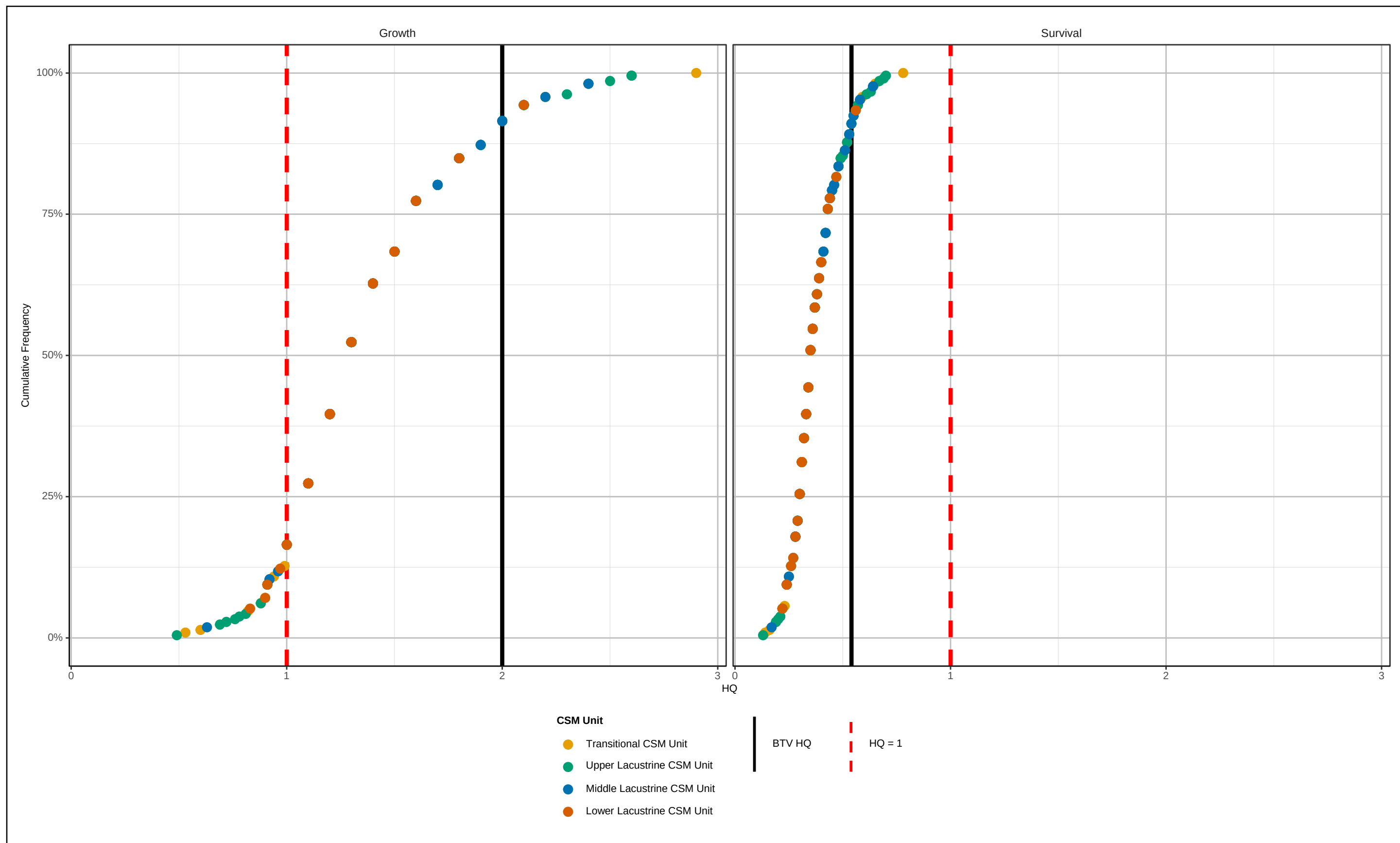


Figure M-30e. Cumulative Frequency of Aluminum Dietary HQs for Spotted Sandpiper in OU 2
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

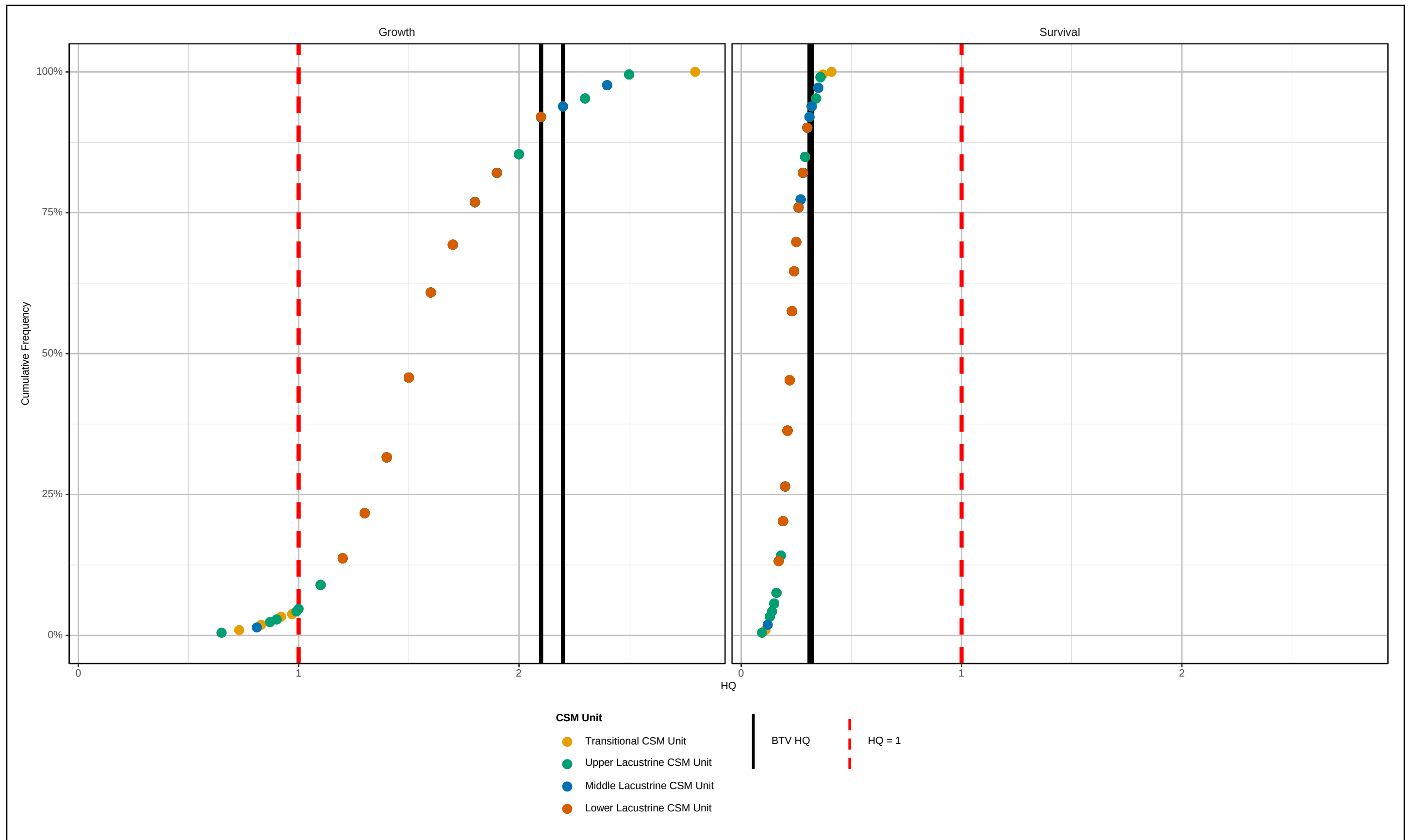


Figure M-30f. Cumulative Frequency of Iron Dietary HQs for Spotted Sandpiper in OU 2
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

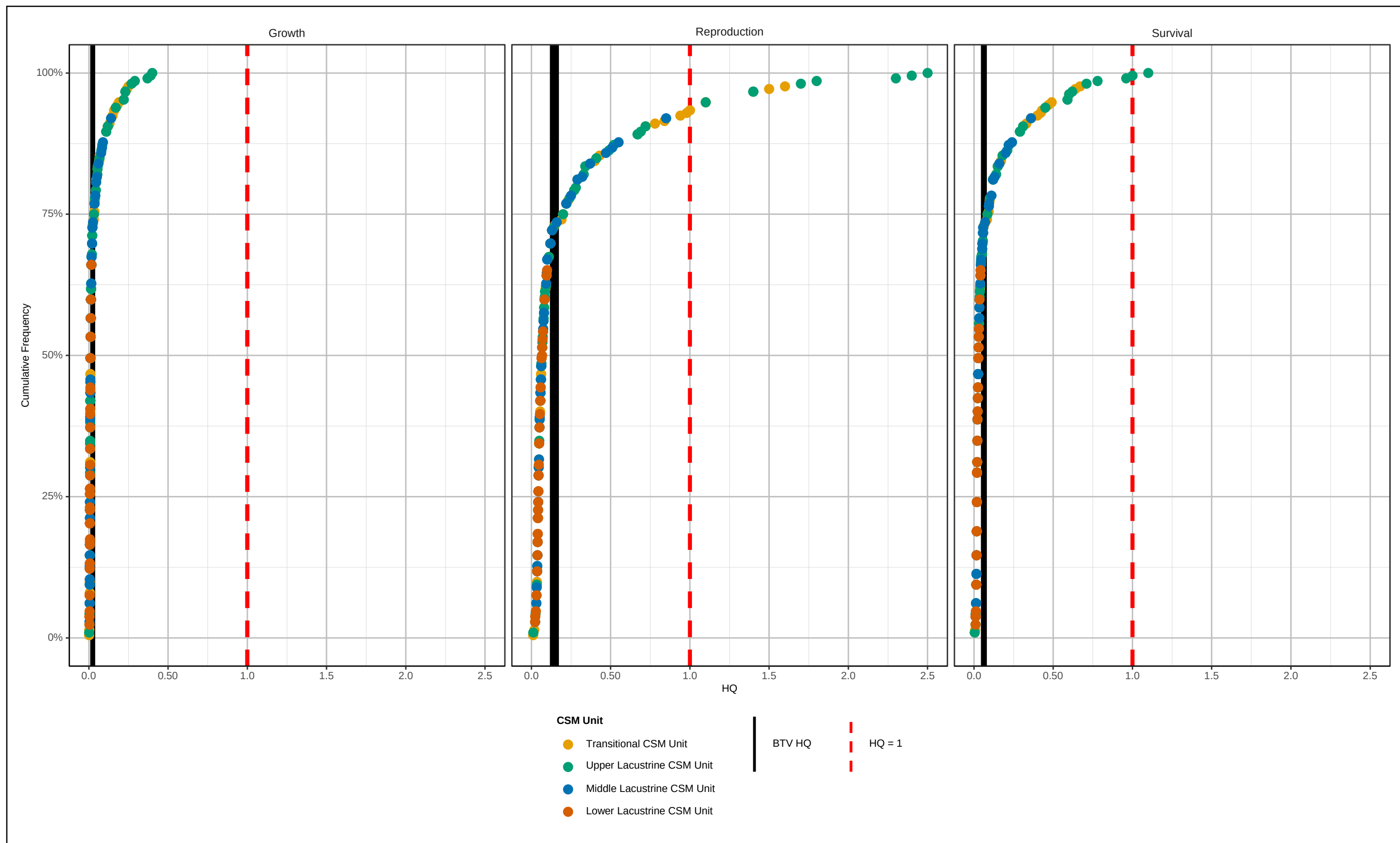


Figure M-30g. Cumulative Frequency of Lead Dietary HQs for Spotted Sandpiper in OU 2
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

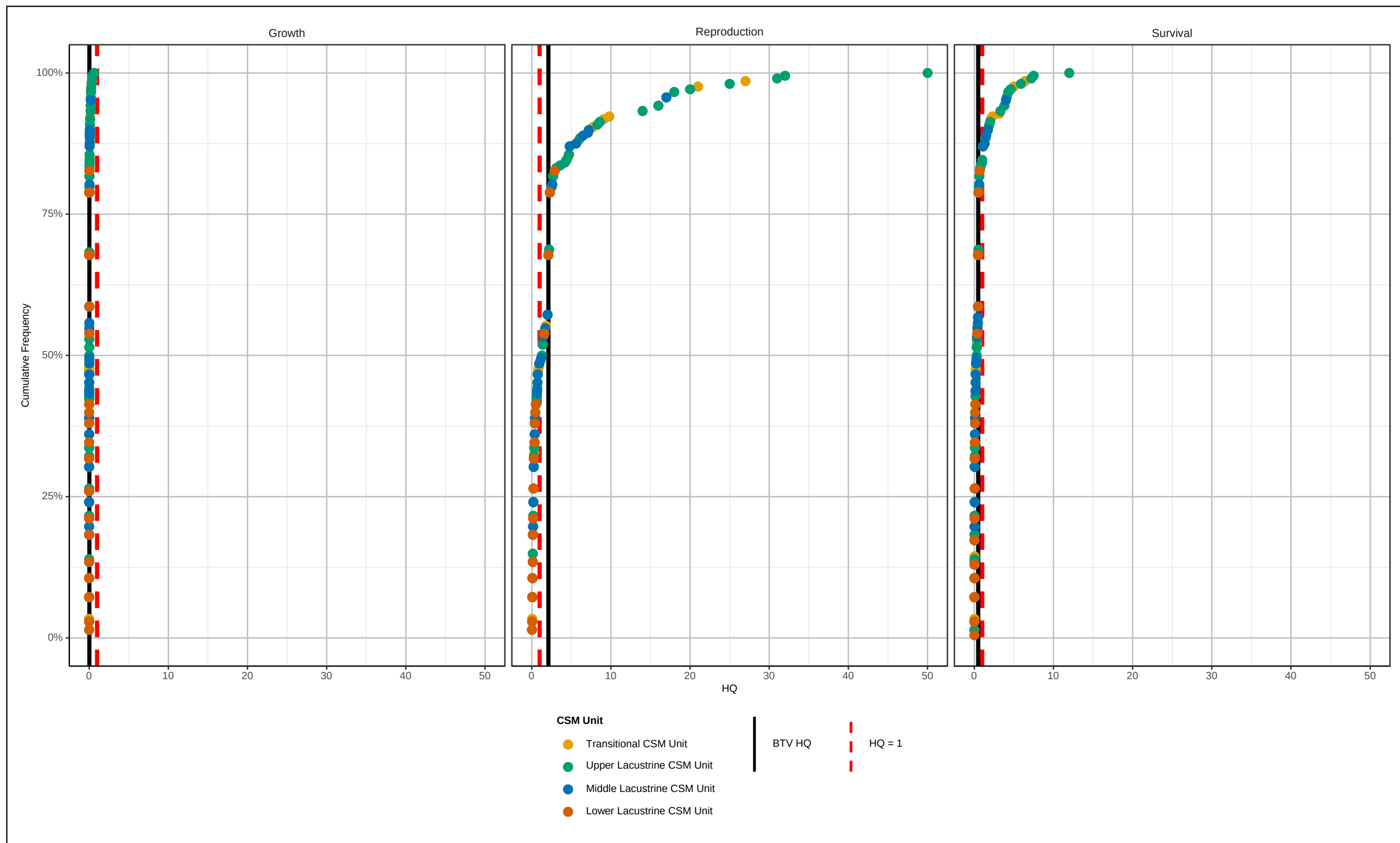


Figure M-30h. Cumulative Frequency of Mercury Dietary HQs for Spotted Sandpiper in OU 2
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

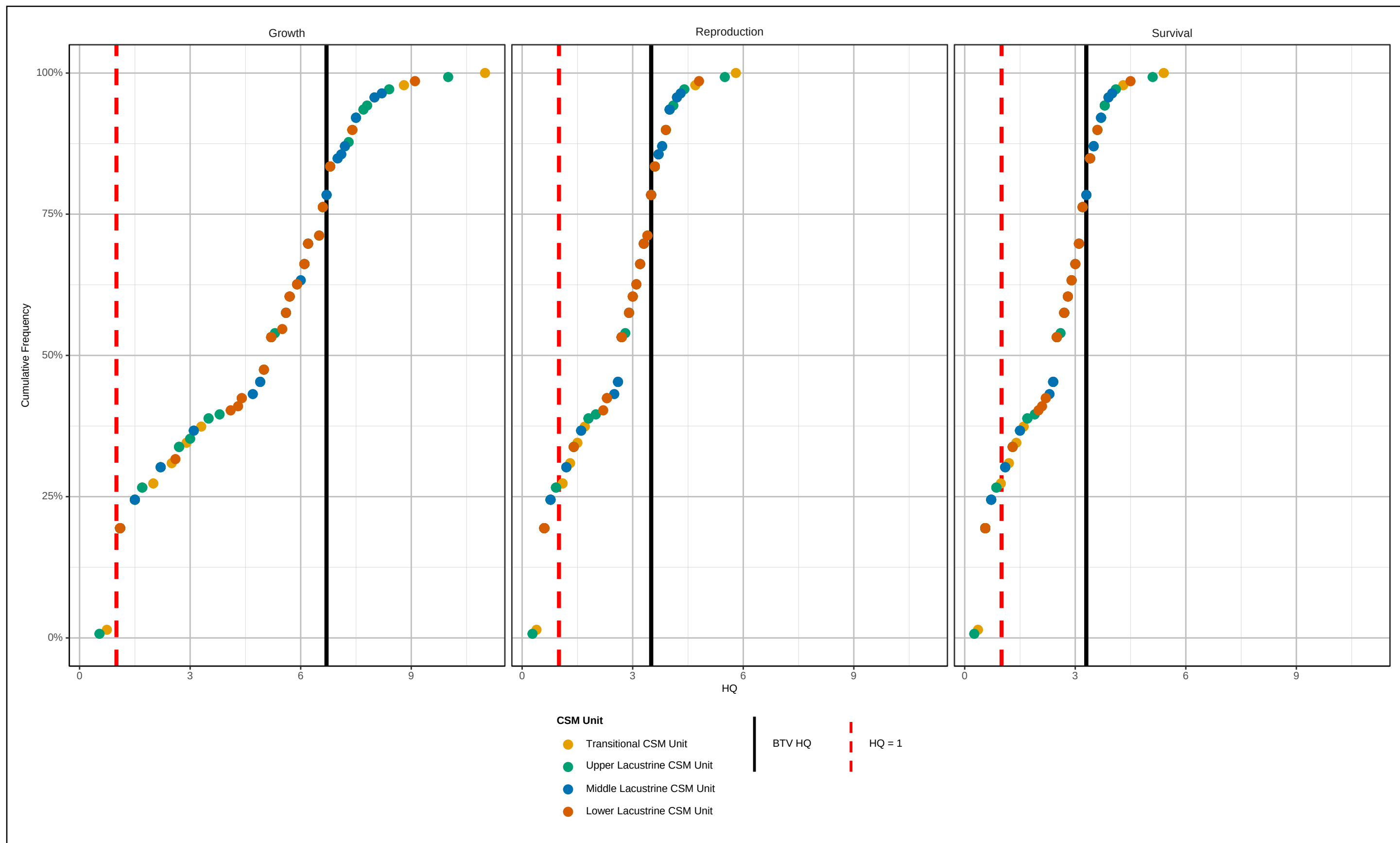


Figure M-30i. Cumulative Frequency of Selenium Dietary HQs for Spotted Sandpiper in OU 2
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

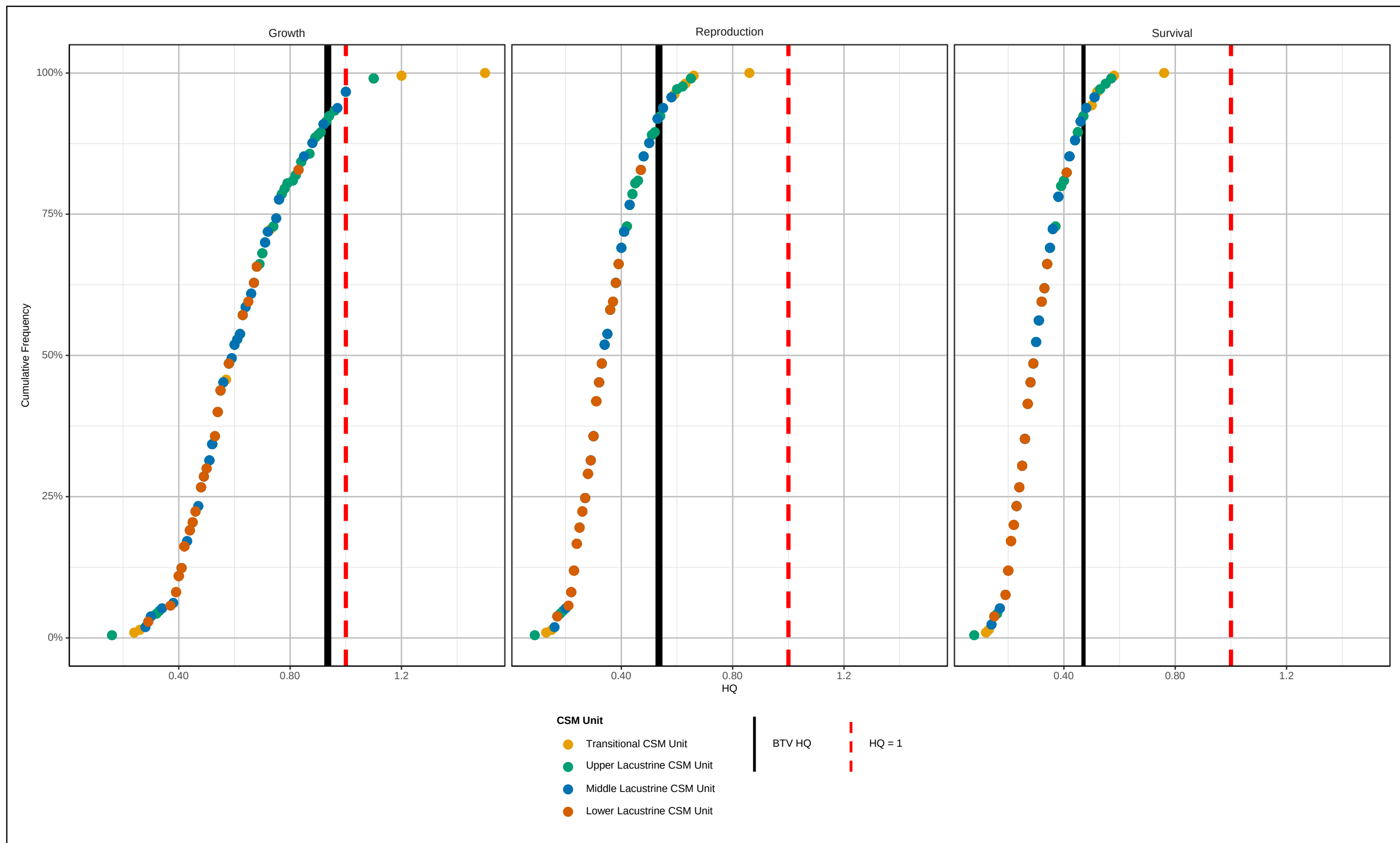


Figure M-30j. Cumulative Frequency of Vanadium Dietary HQs for Spotted Sandpiper in OU 2
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

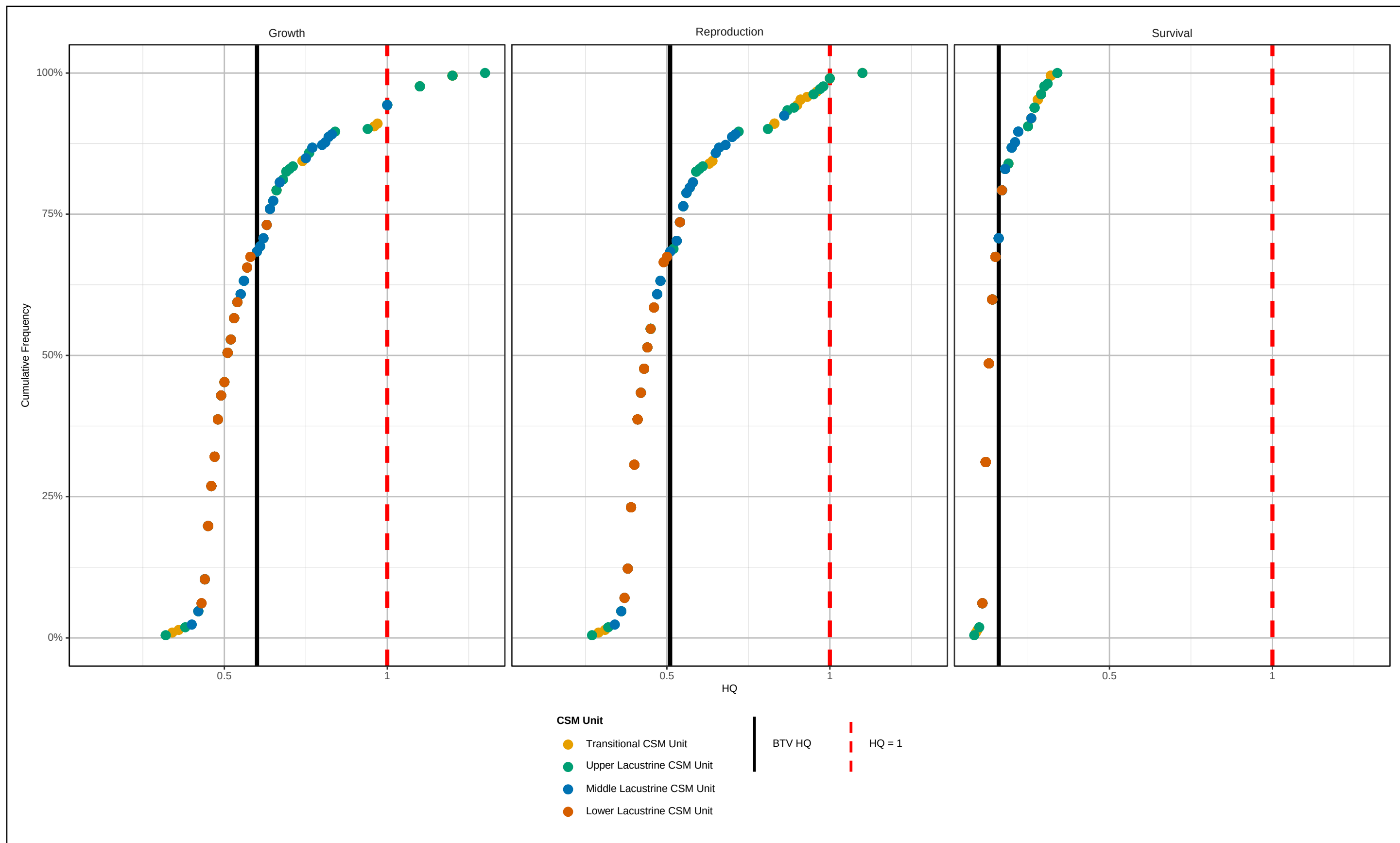


Figure M-30k. Cumulative Frequency of Zinc Dietary HQs for Spotted Sandpiper in OU 2
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

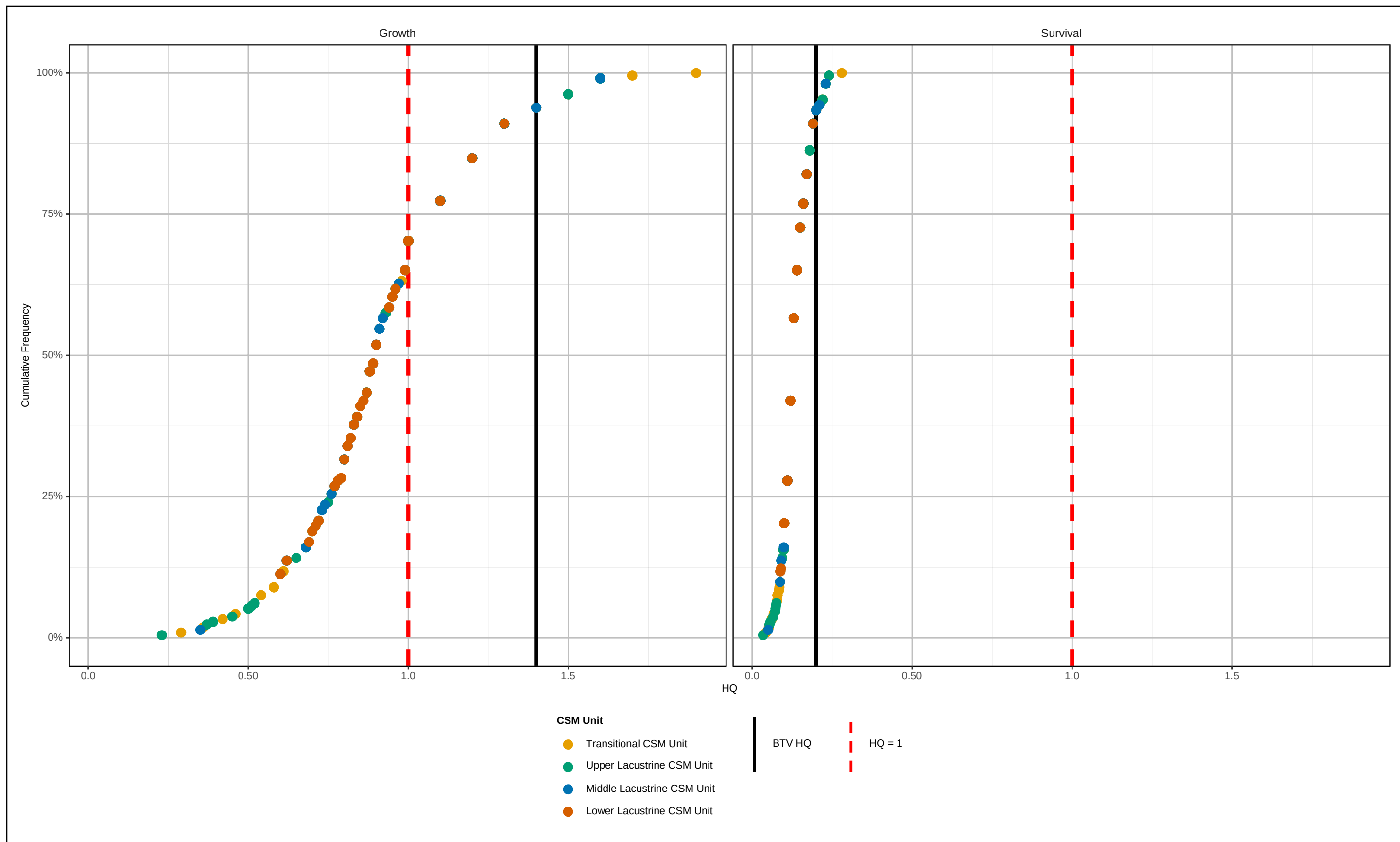


Figure M-30I. Cumulative Frequency of Iron Dietary HQs for Mallard in OU 2
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

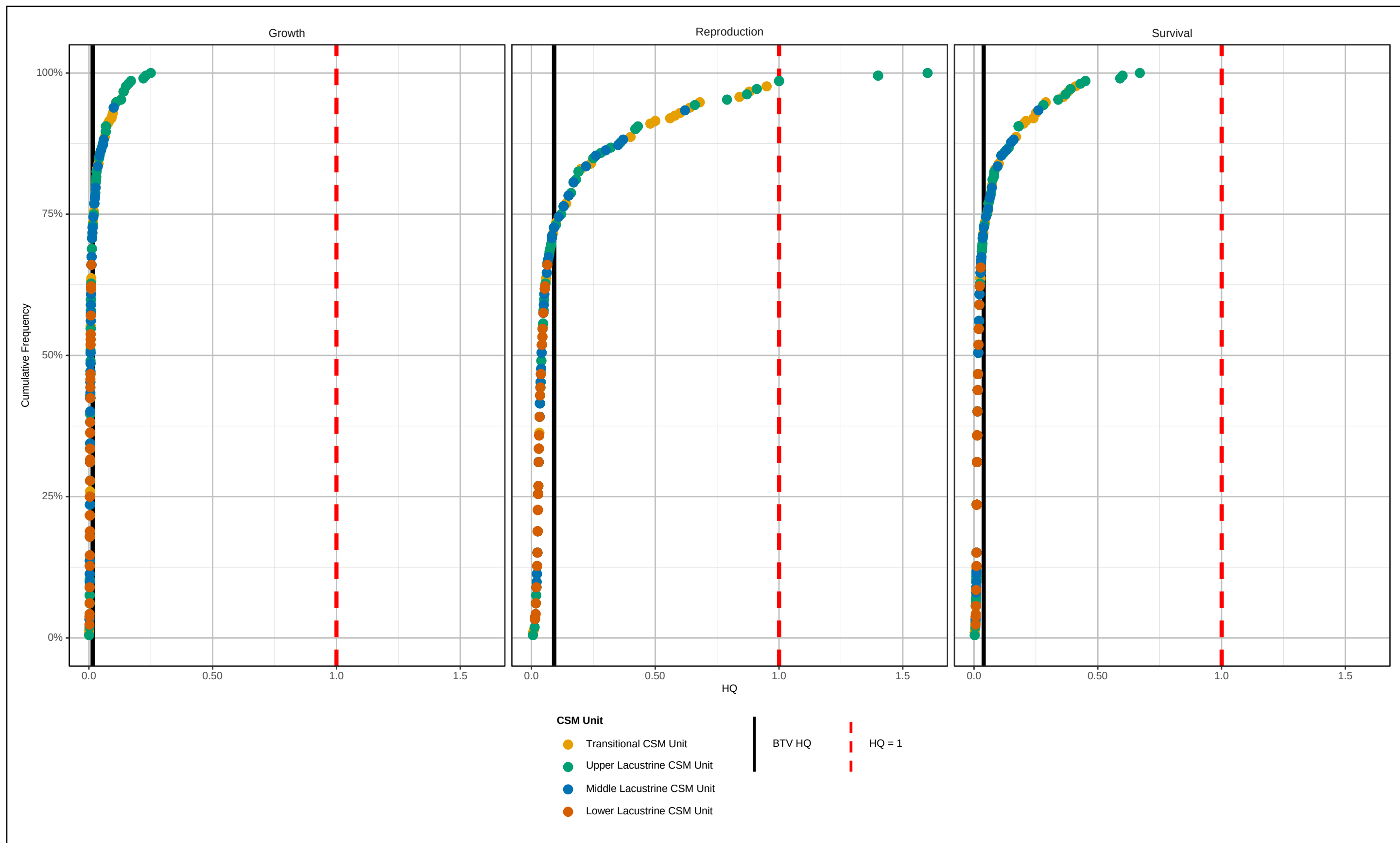


Figure M-30m. Cumulative Frequency of Lead Dietary HQs for Mallard in OU 2
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

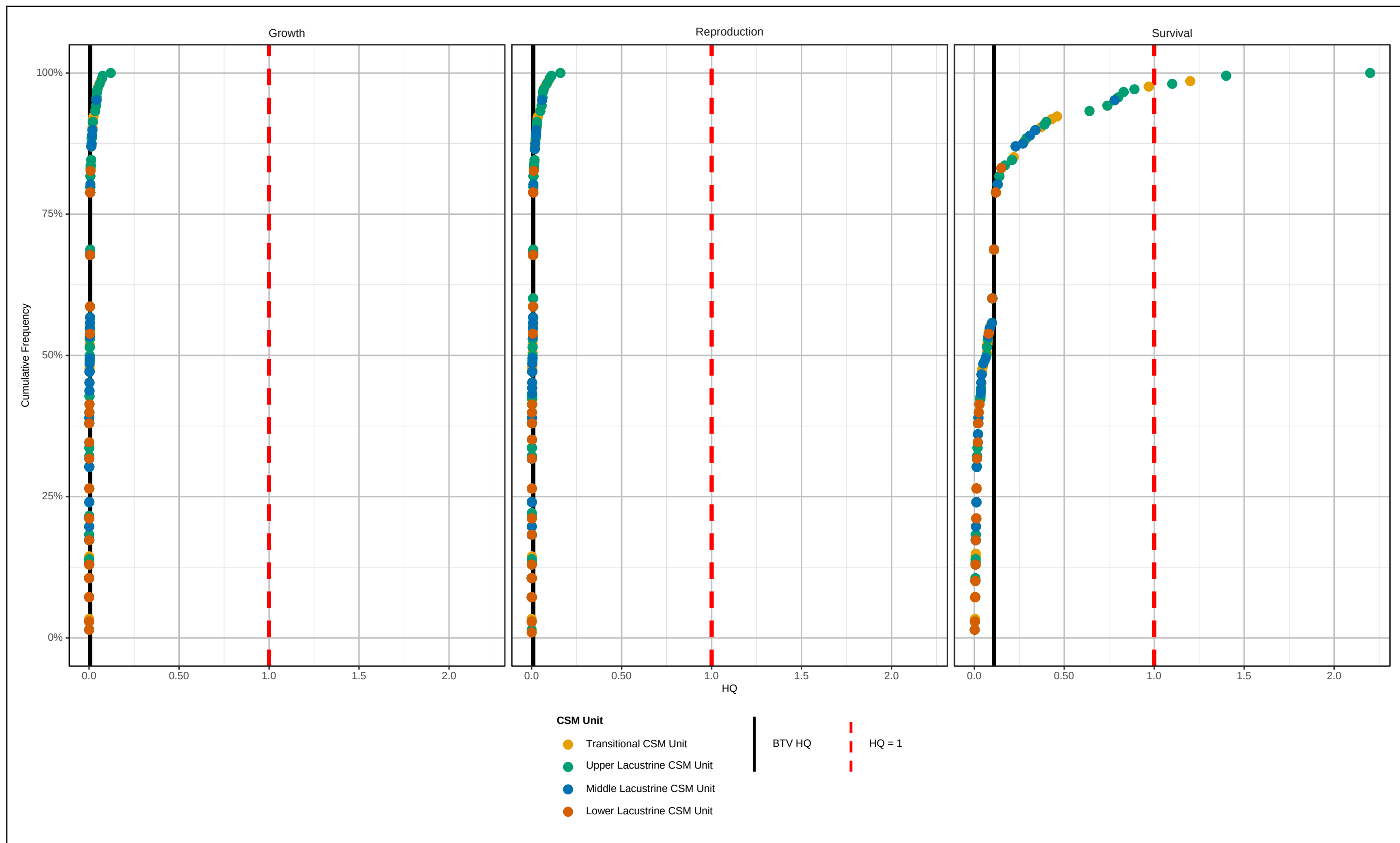


Figure M-30n. Cumulative Frequency of Mercury Dietary HQs for Mallard in OU 2
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

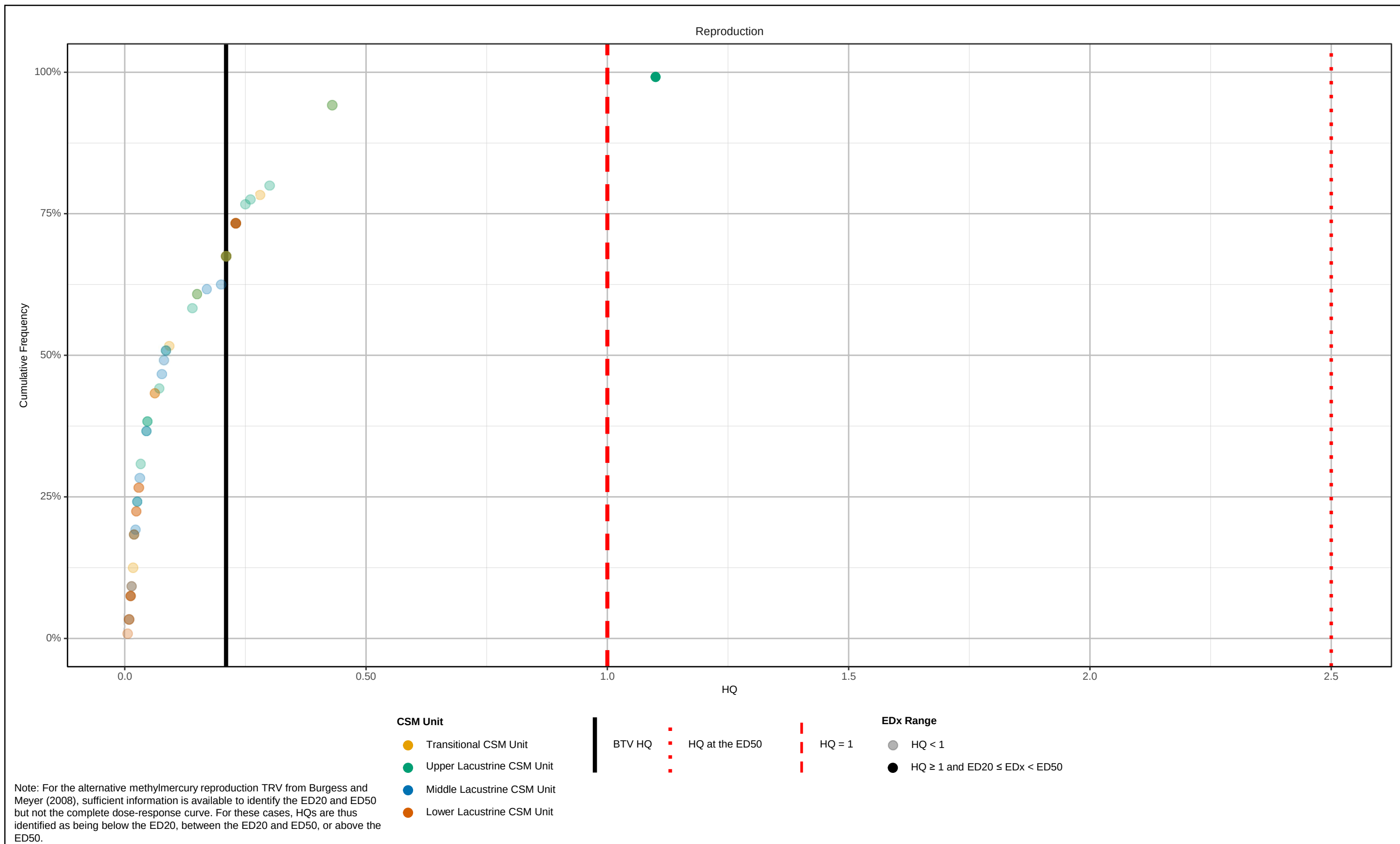


Figure M-30o. Cumulative Frequency of Alternative Mercury Reproduction Dietary HQs for Tundra Swan in OU 2
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

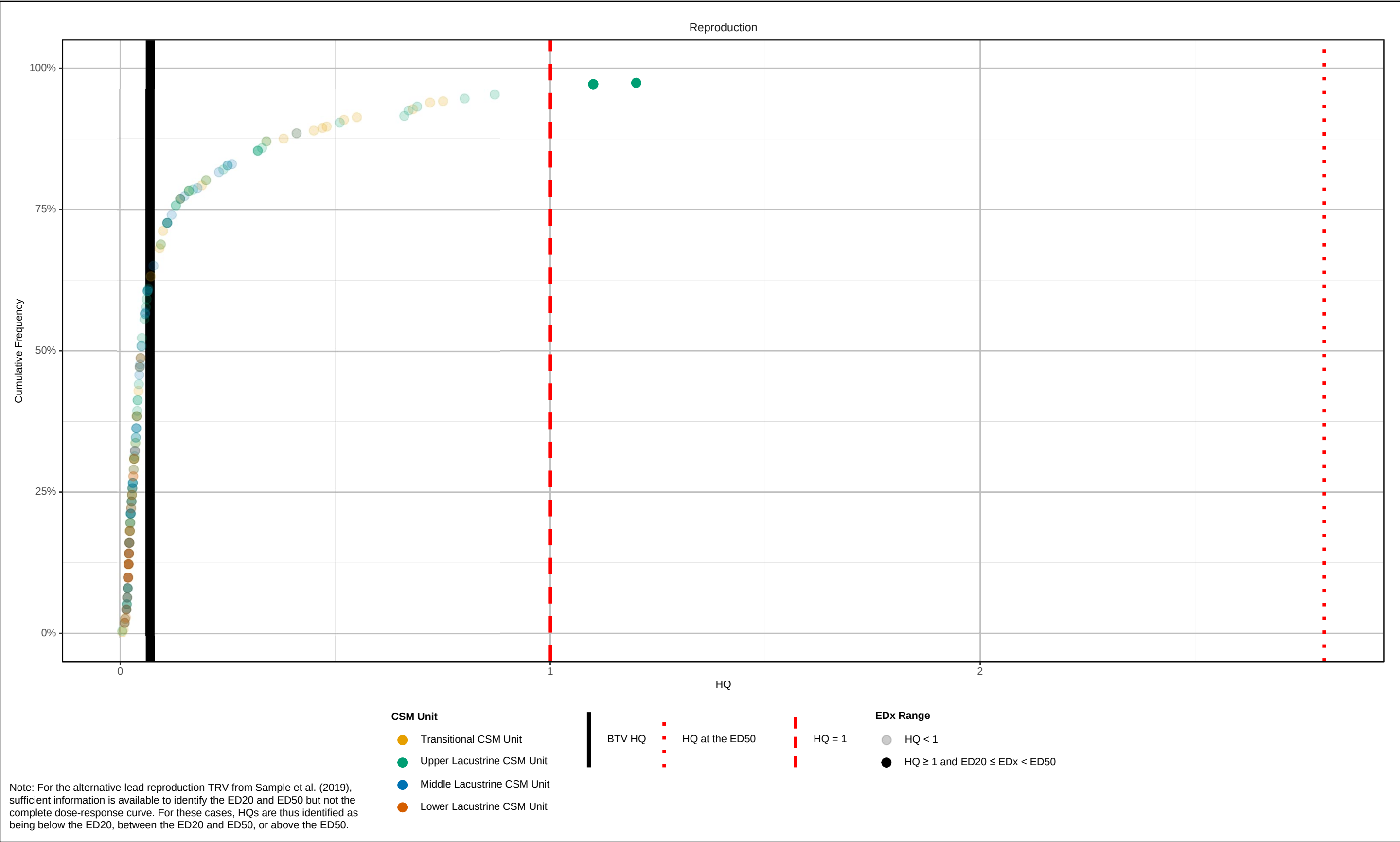


Figure M-30p. Cumulative Frequency of Alternative Lead Reproduction Dietary HQs for Spotted Sandpiper in OU 2
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

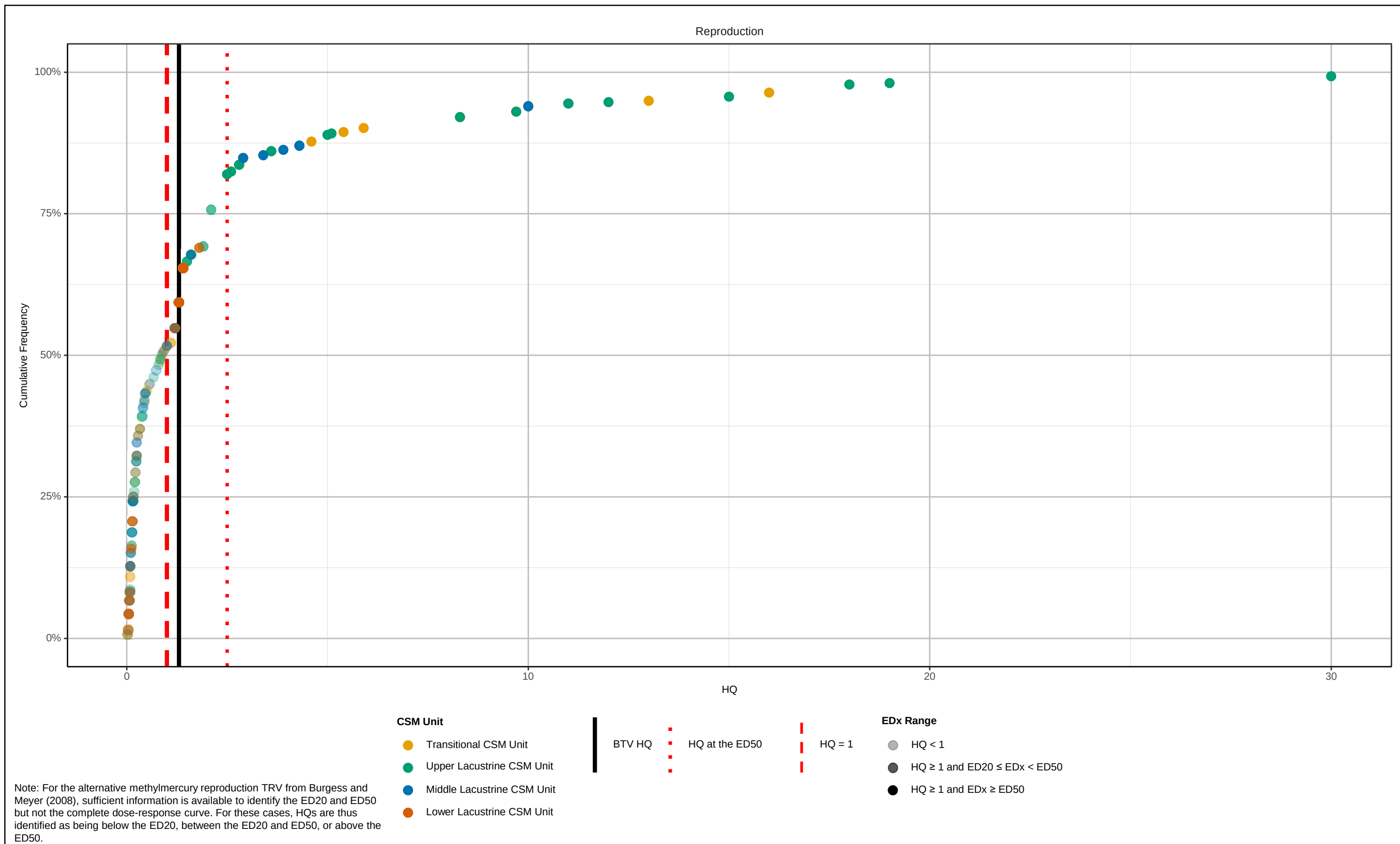


Figure M-30q. Cumulative Frequency of Alternative Mercury Reproduction Dietary HQs for Spotted Sandpiper in OU 2
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

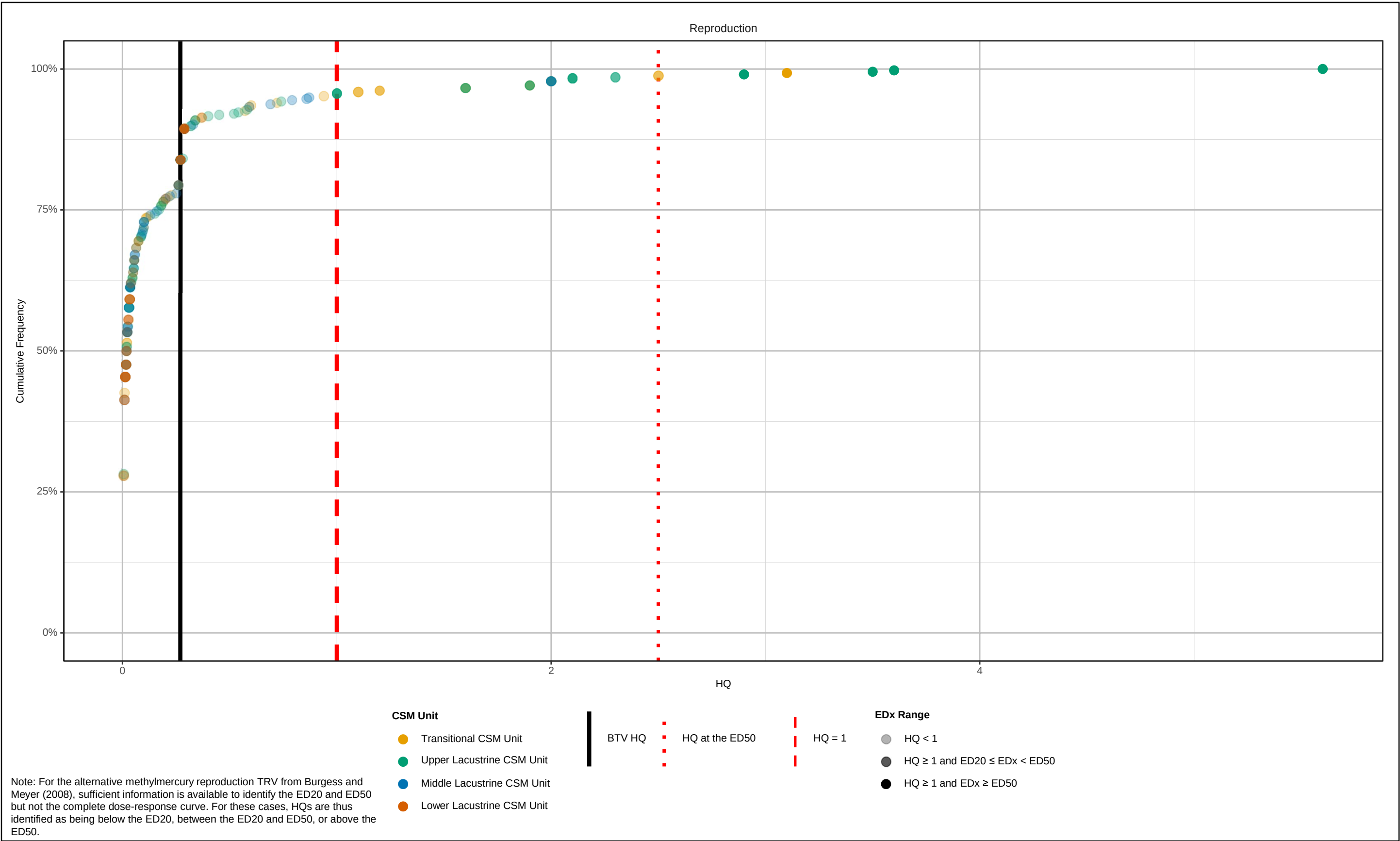


Figure M-30r. Cumulative Frequency of Alternative Mercury Reproduction Dietary HQs for Mallard in OU 2
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

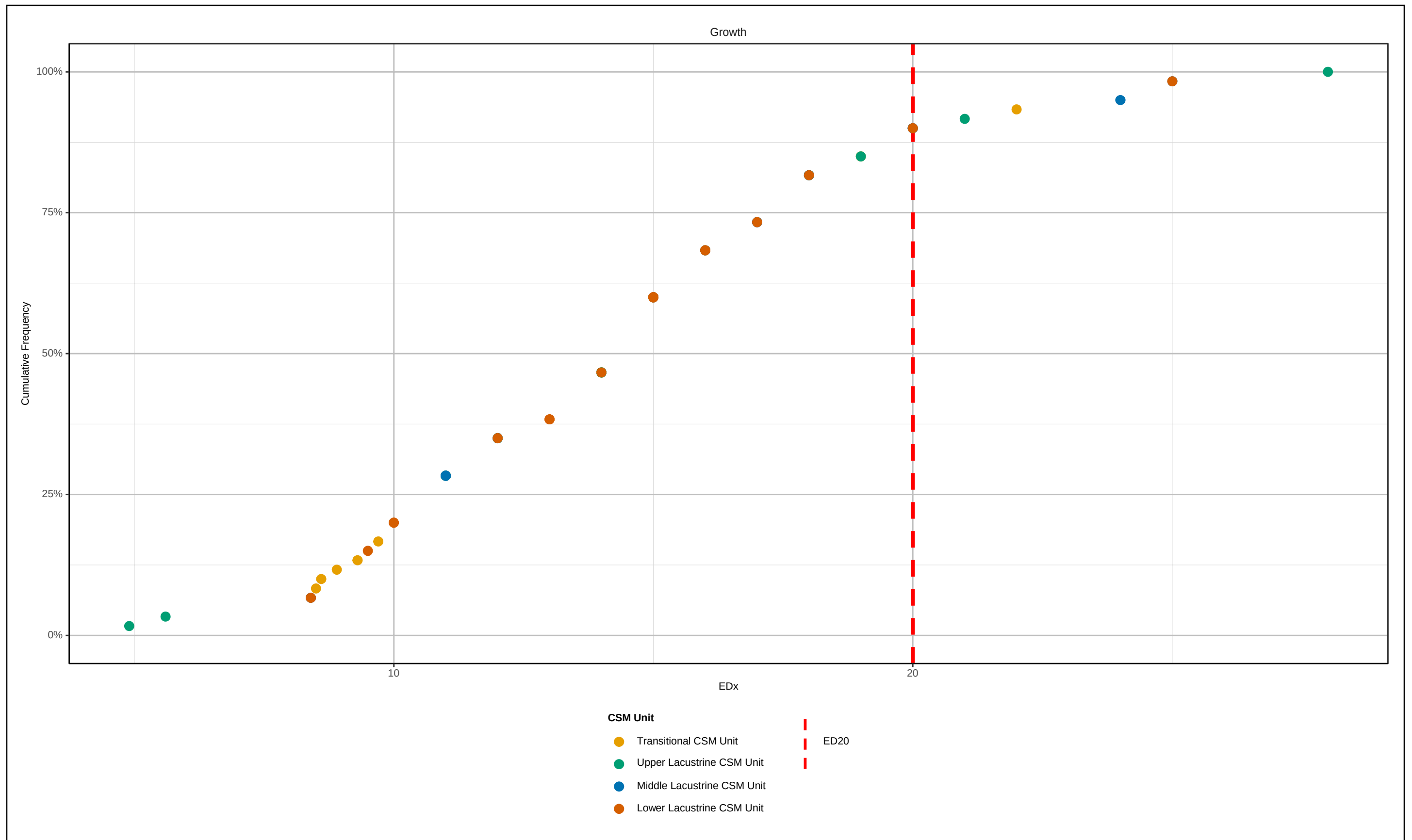


Figure M-31a. Cumulative Frequency of Aluminum EDx Values for Tundra Swan in OU 2
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

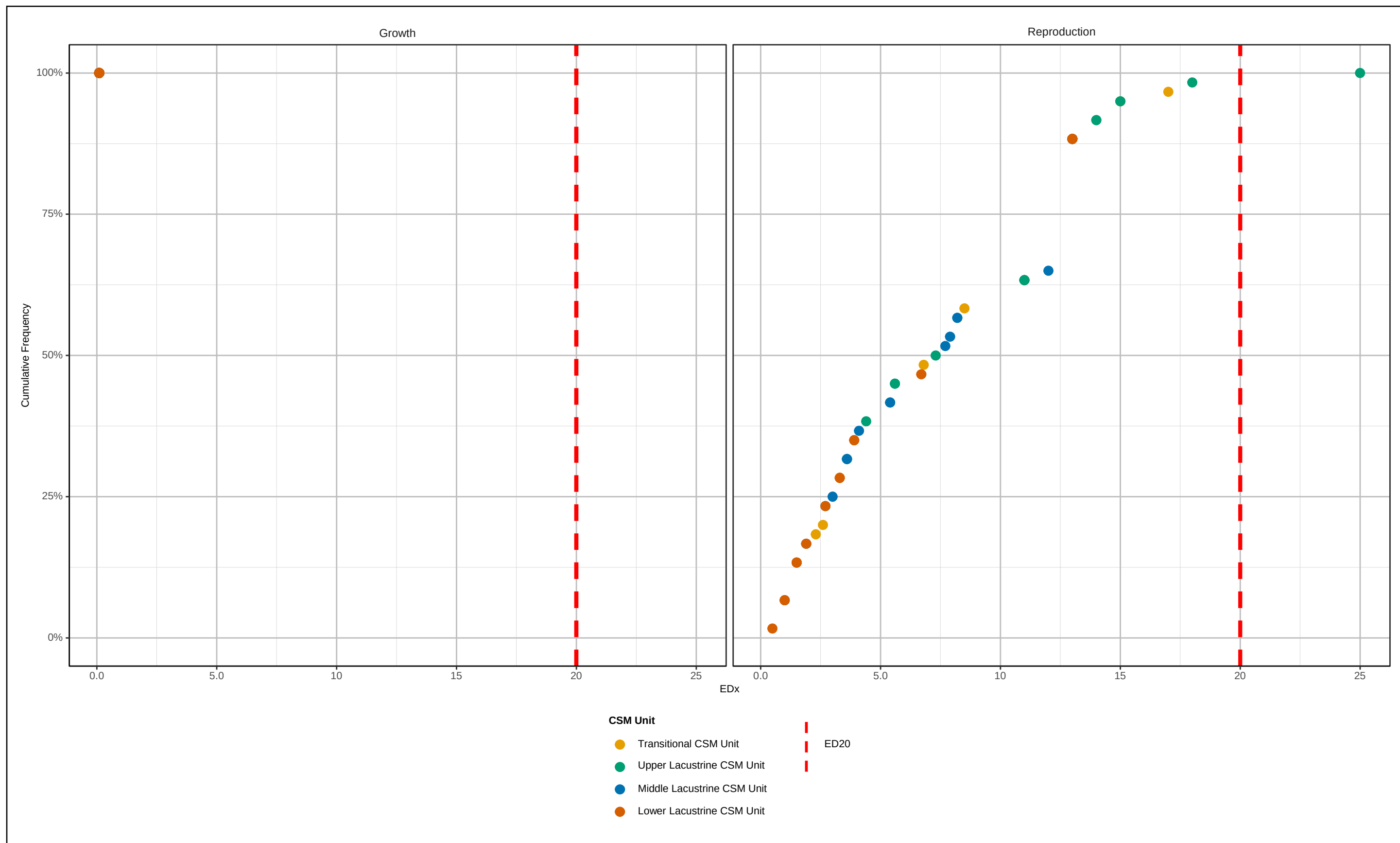


Figure M-31b. Cumulative Frequency of Mercury EDx Values for Tundra Swan in OU 2
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

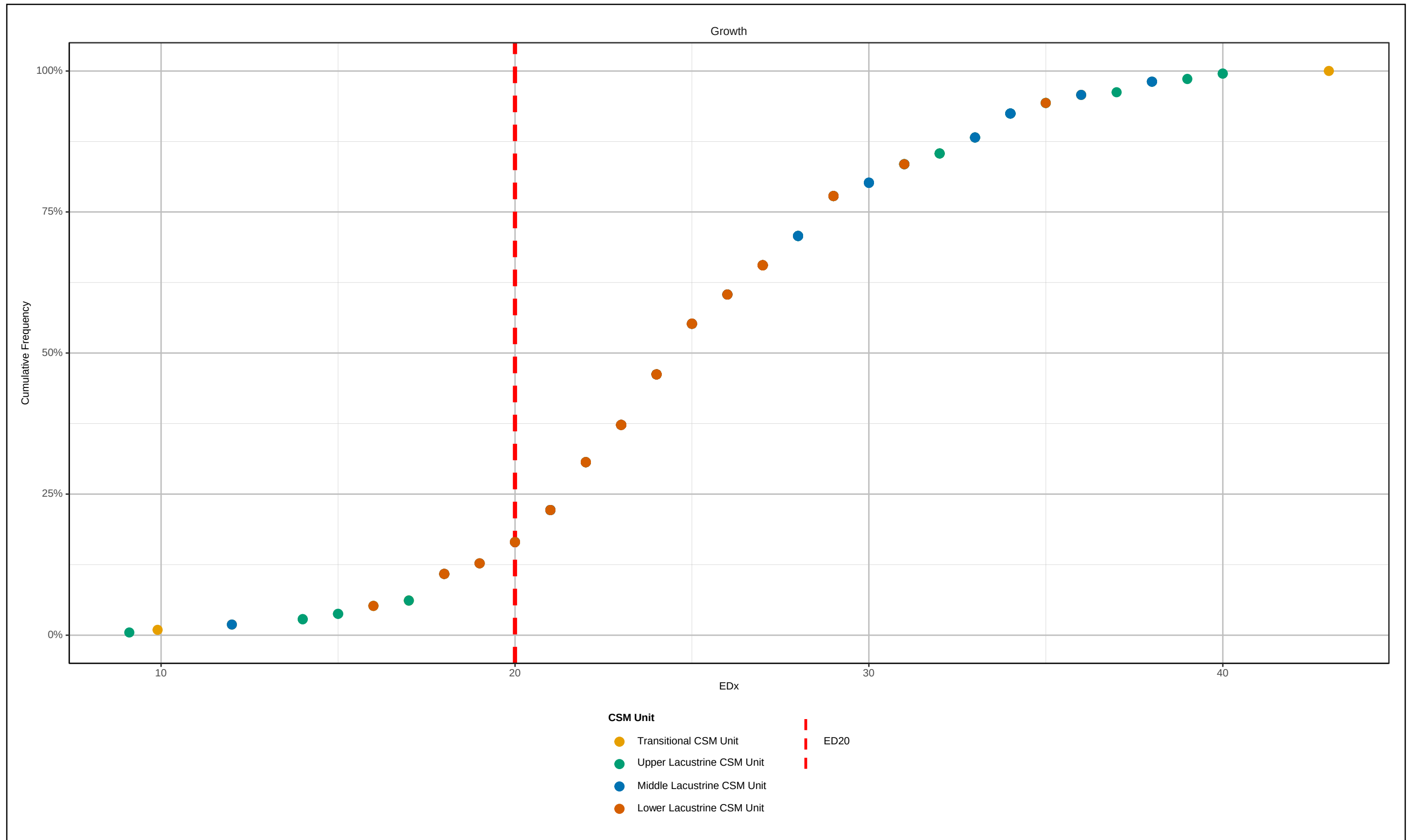


Figure M-31c. Cumulative Frequency of Aluminum EDx Values for Spotted Sandpiper in OU 2
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 Upper Columbia River, Washington

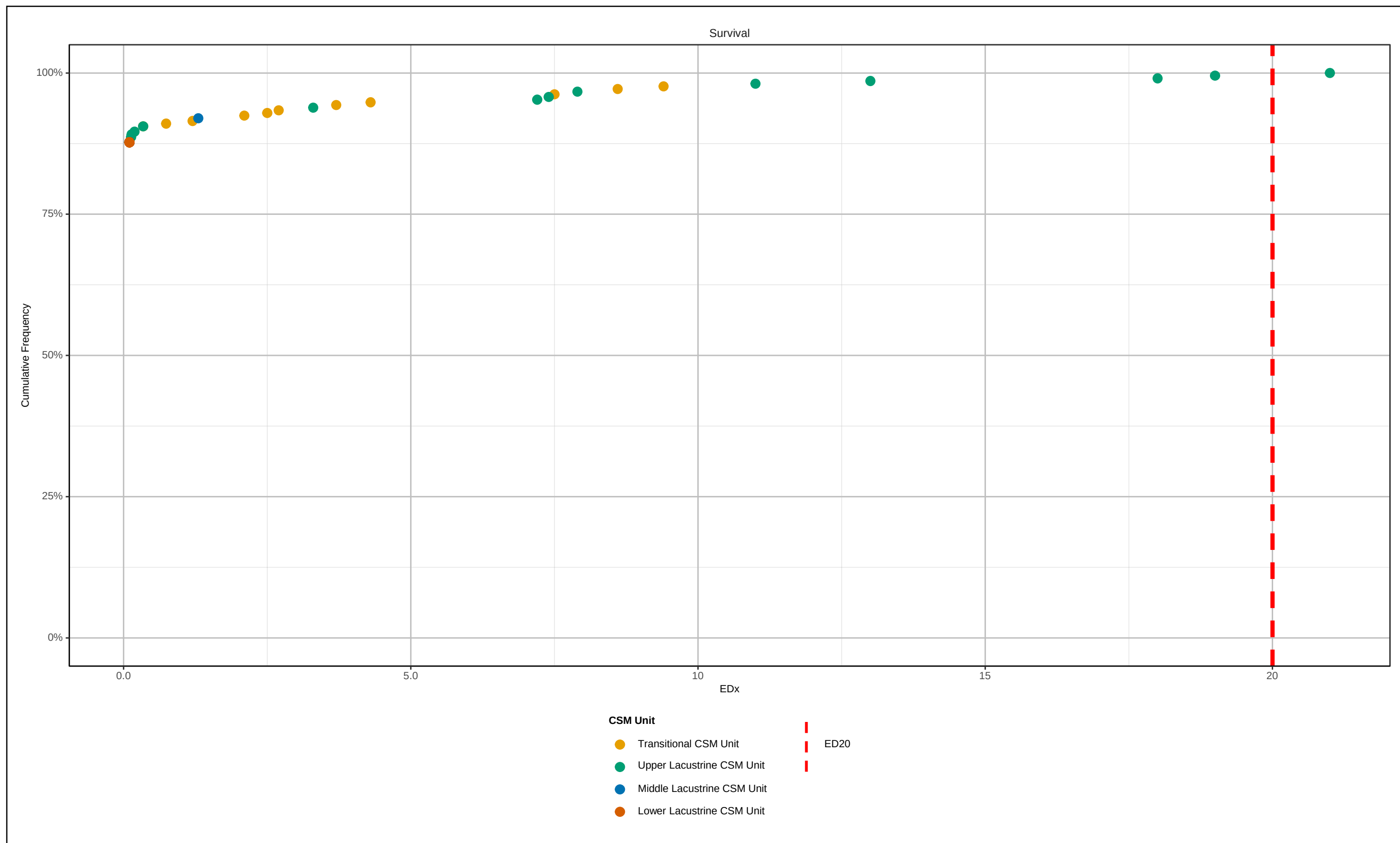


Figure M-31d. Cumulative Frequency of Lead EDx Values for Spotted Sandpiper in OU 2
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

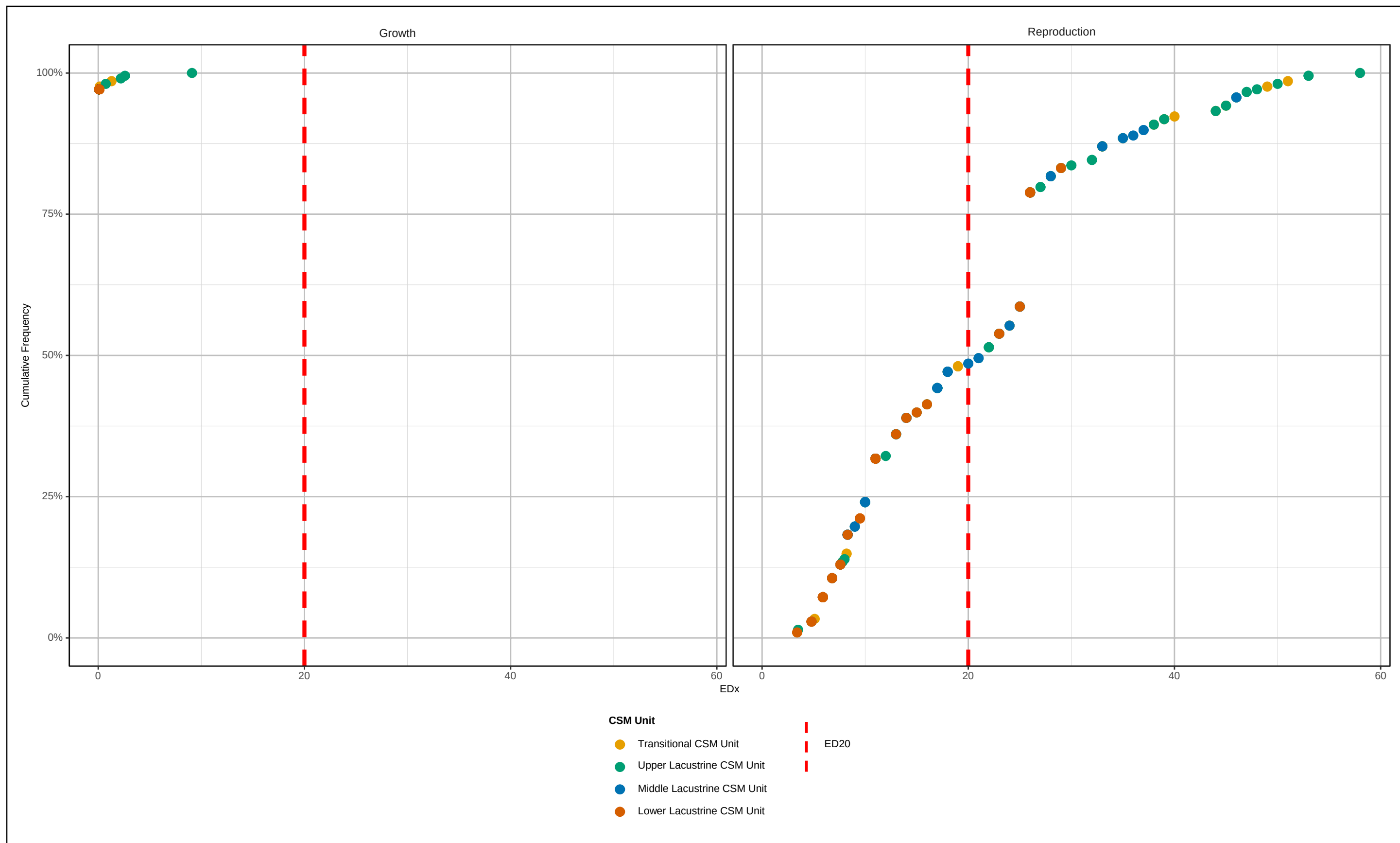


Figure M-31e. Cumulative Frequency of Mercury EDx Values for Spotted Sandpiper in OU 2
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

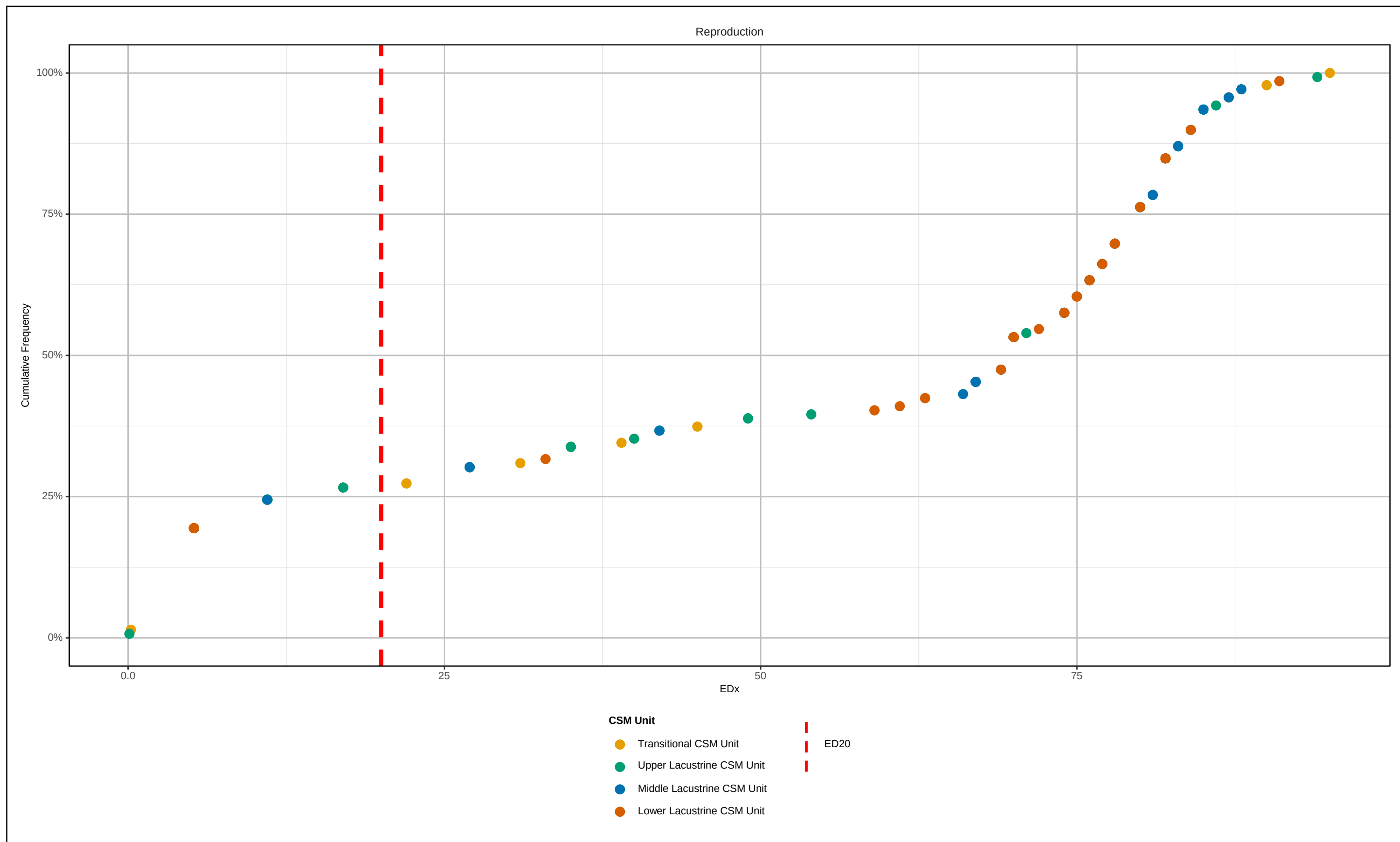


Figure M-31f. Cumulative Frequency of Selenium EDx Values for Spotted Sandpiper in OU 2
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

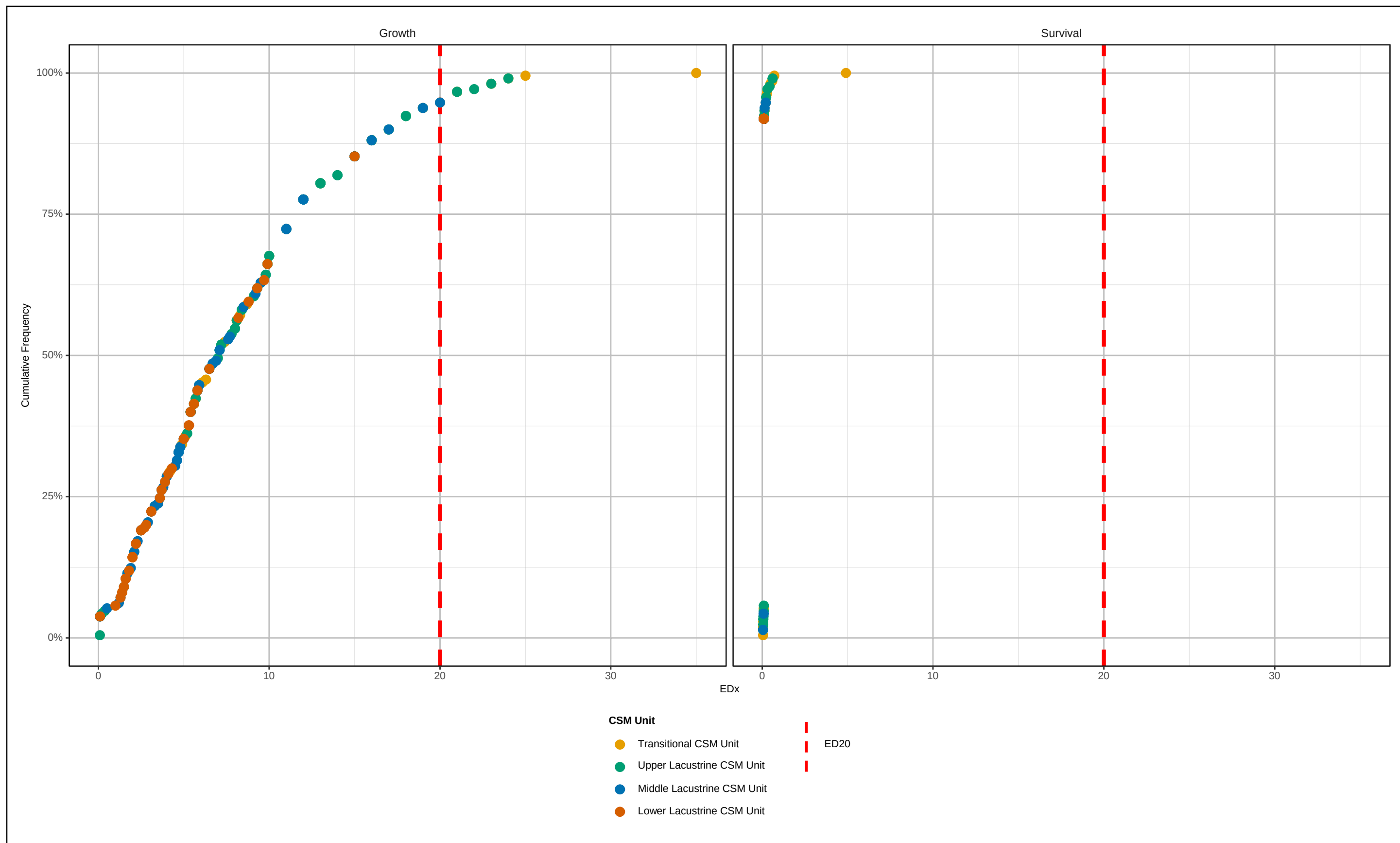


Figure M-31g. Cumulative Frequency of Vanadium EDx Values for Spotted Sandpiper in OU 2
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

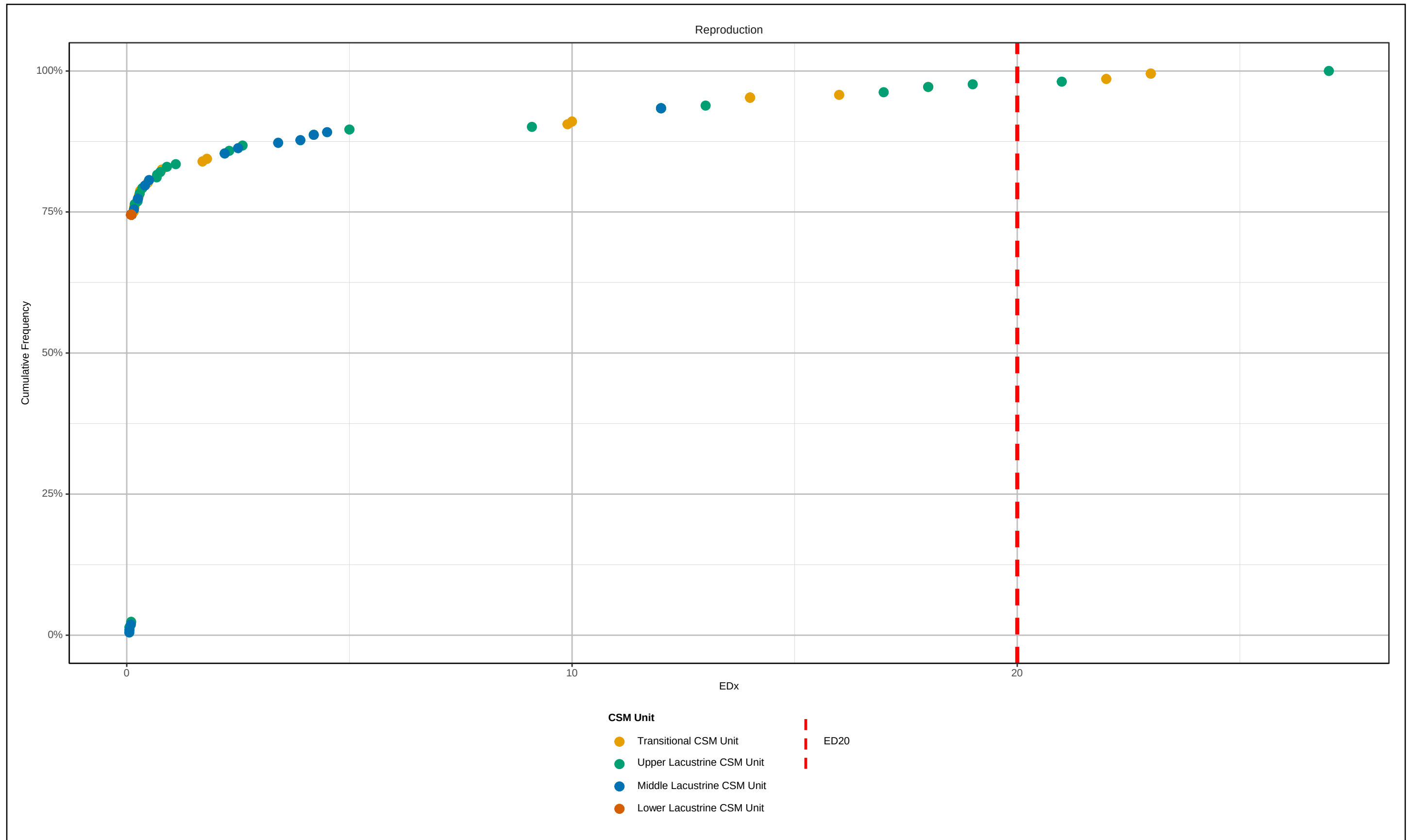


Figure M-31h. Cumulative Frequency of Zinc EDx Values for Spotted Sandpiper in OU 2
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

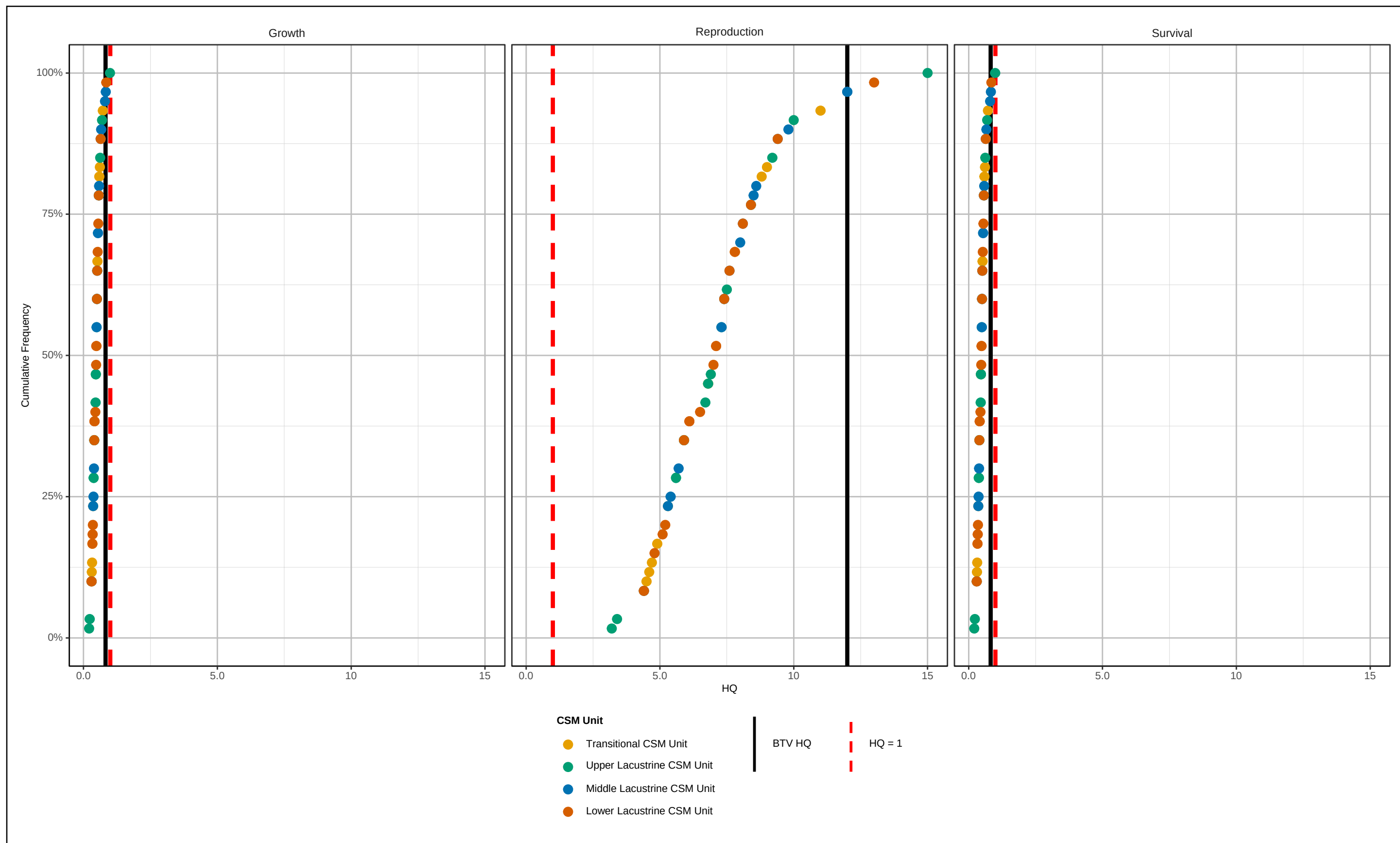


Figure M-32a. Cumulative Frequency of Aluminum Dietary HQs for Muskrat in OU 2
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

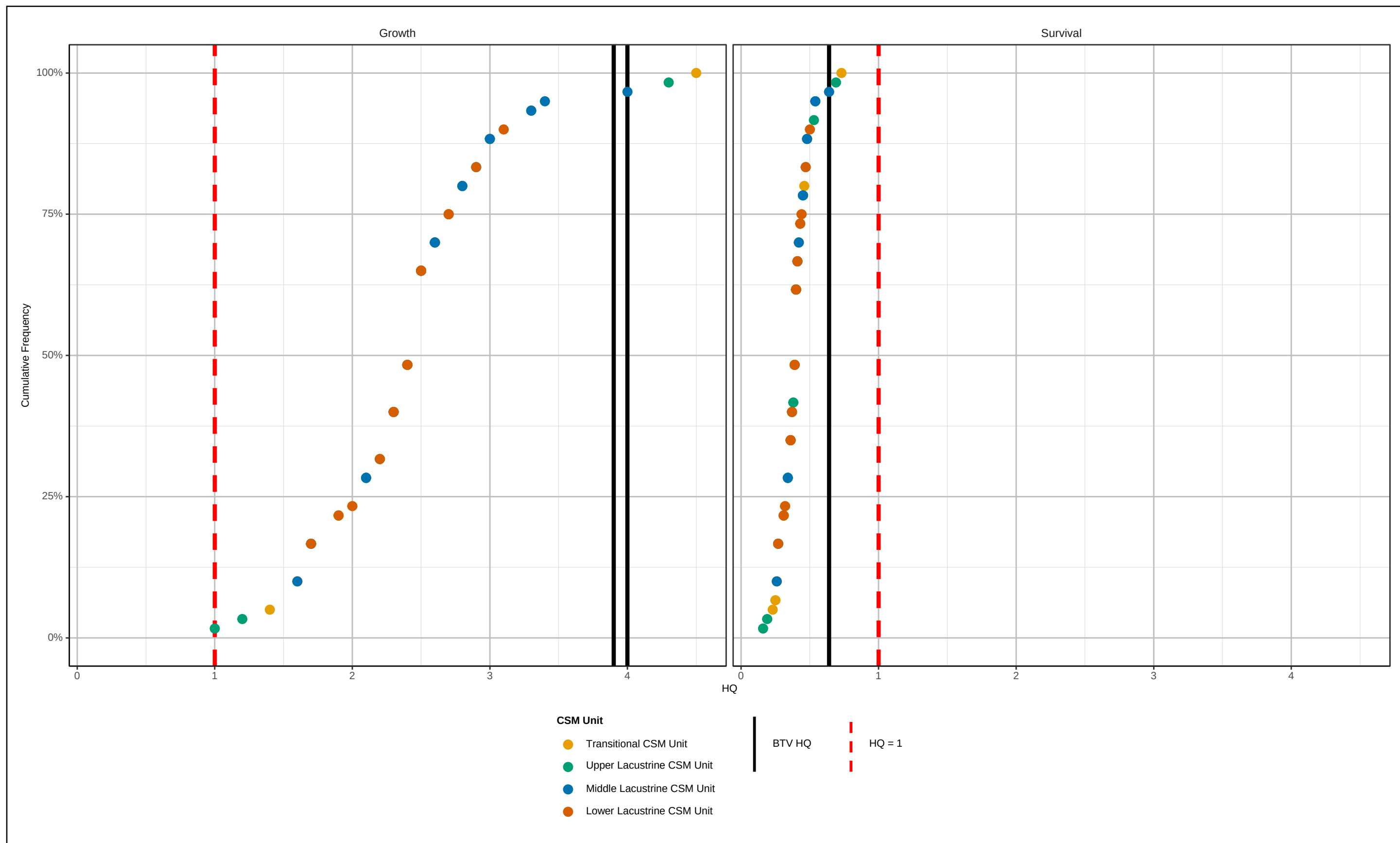


Figure M-32b. Cumulative Frequency of Iron Dietary HQs for Muskrat in OU 2
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

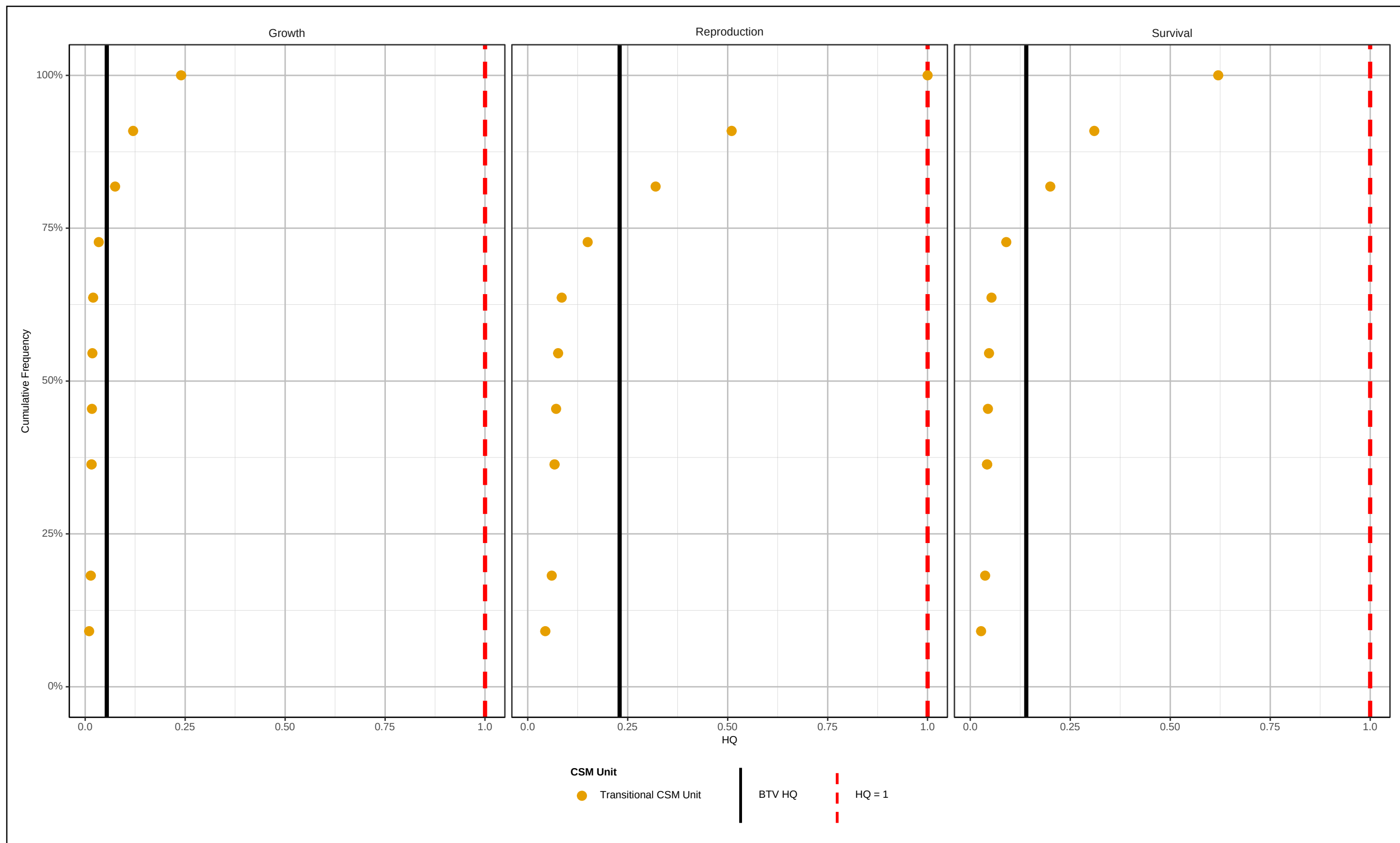


Figure M-32c. Cumulative Frequency of Lead Dietary HQs for Muskrat in OU 2
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

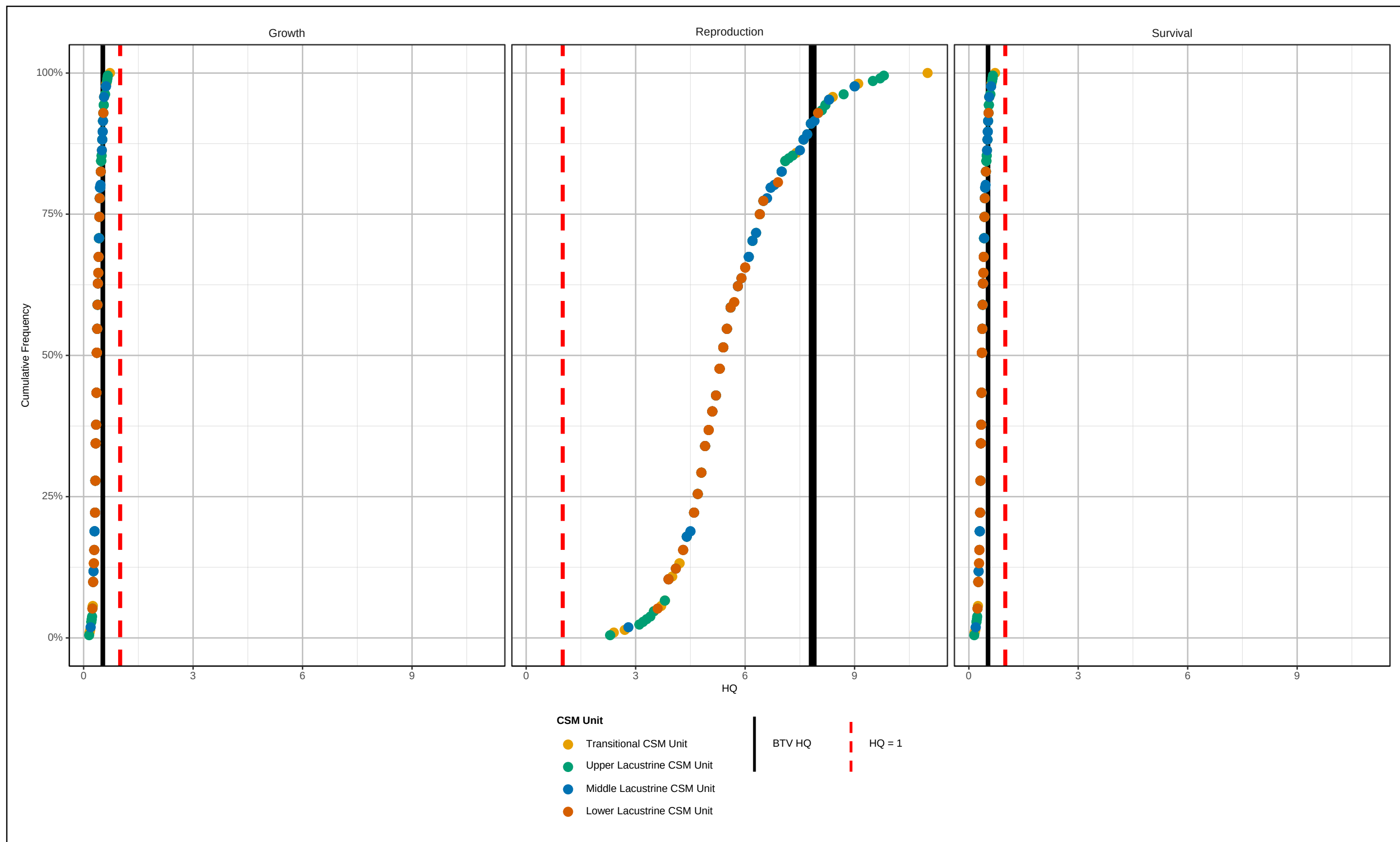


Figure M-32d. Cumulative Frequency of Aluminum Dietary HQs for Water Shrew in OU 2
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

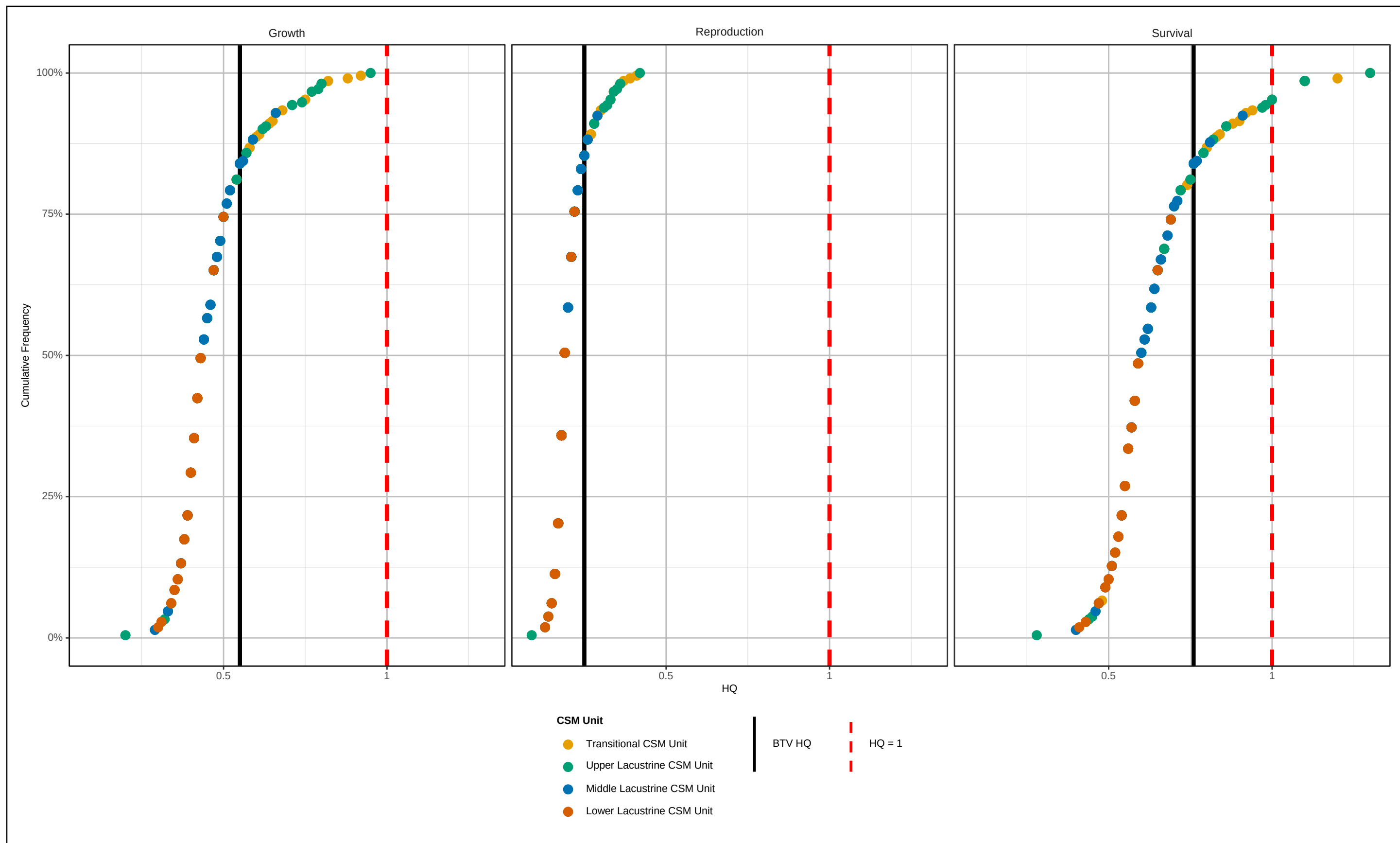


Figure M-32e. Cumulative Frequency of Copper Dietary HQs for Water Shrew in OU 2
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

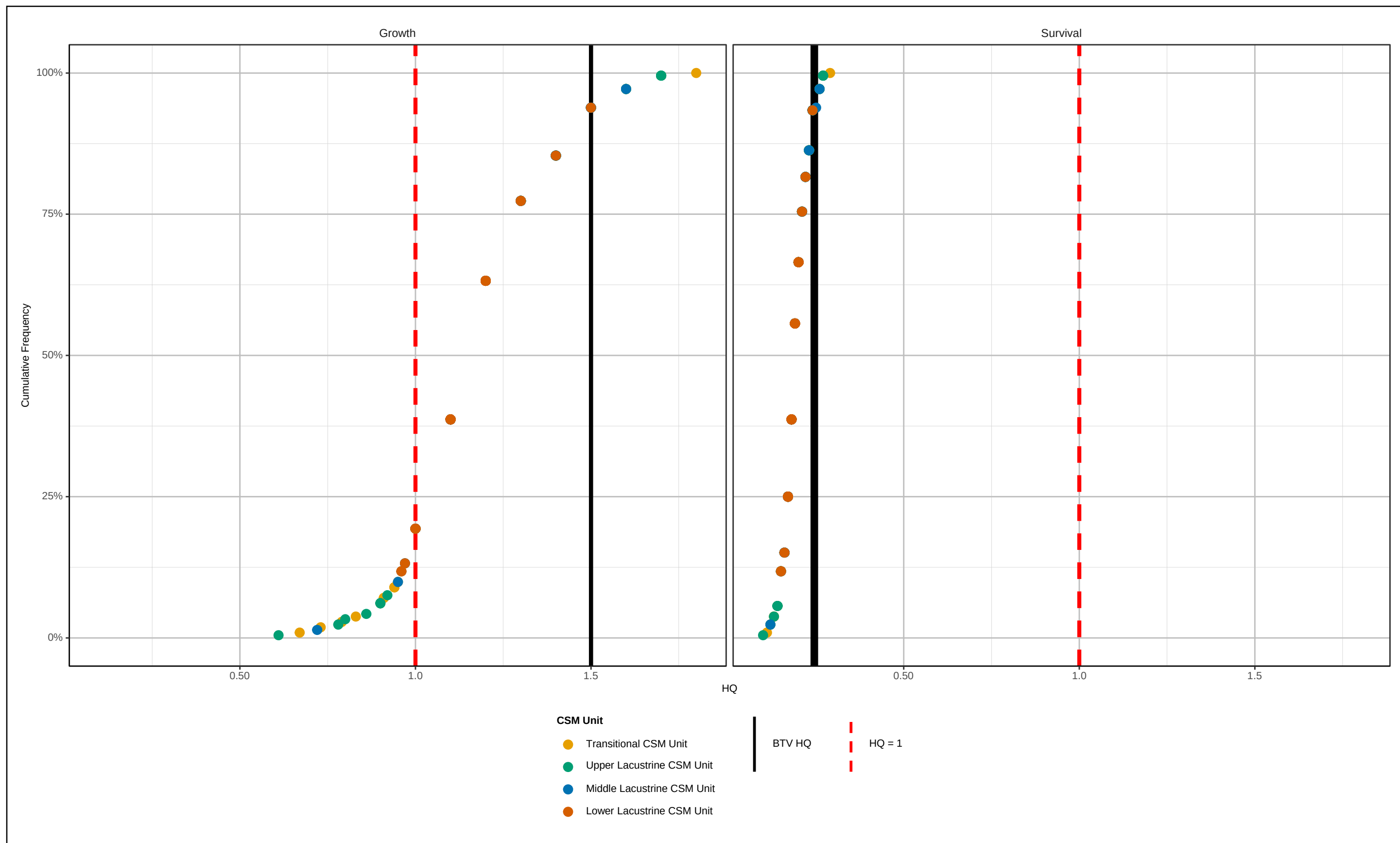


Figure M-32f. Cumulative Frequency of Iron Dietary HQs for Water Shrew in OU 2
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

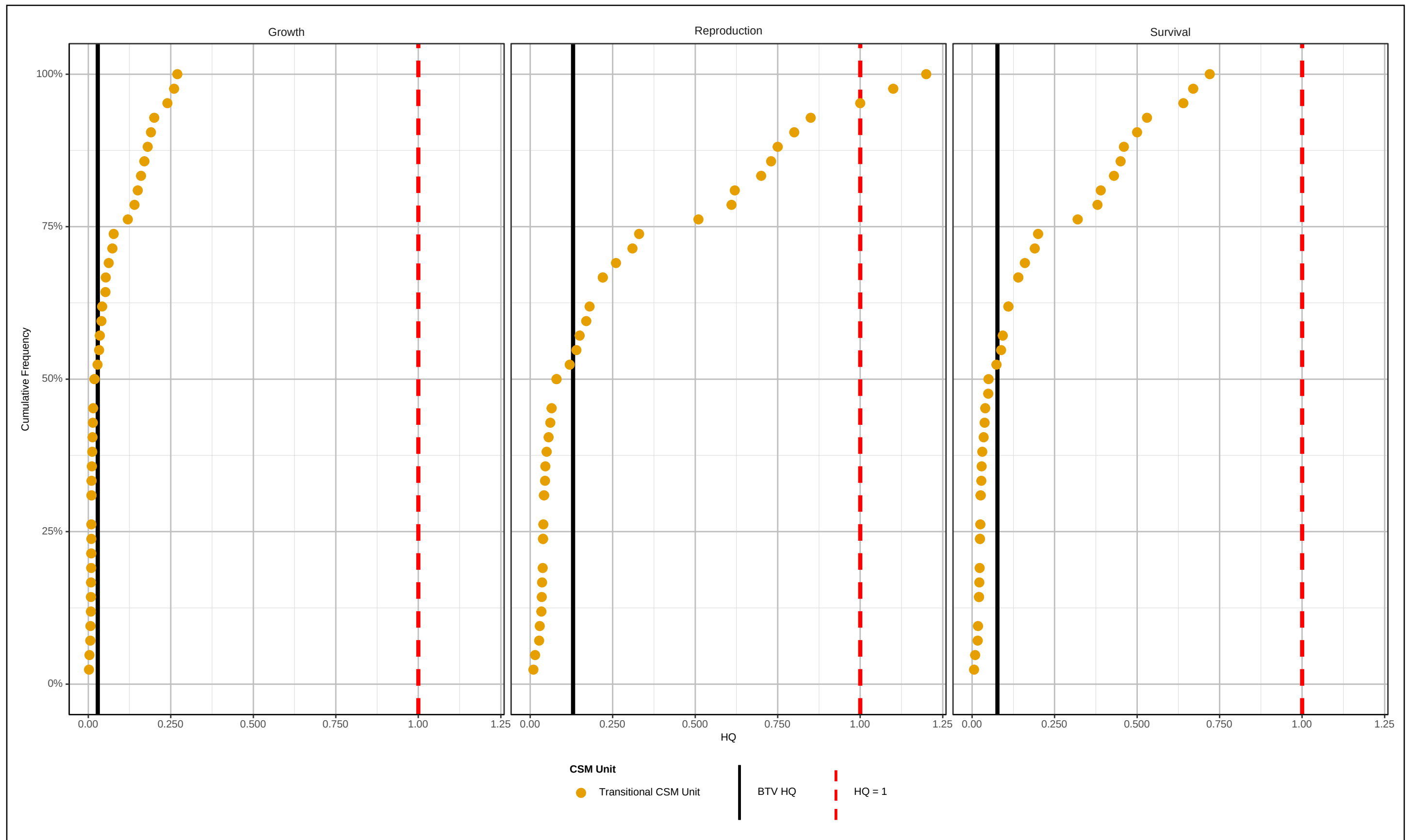


Figure M-32g. Cumulative Frequency of Lead Dietary HQs for Water Shrew in OU 2
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

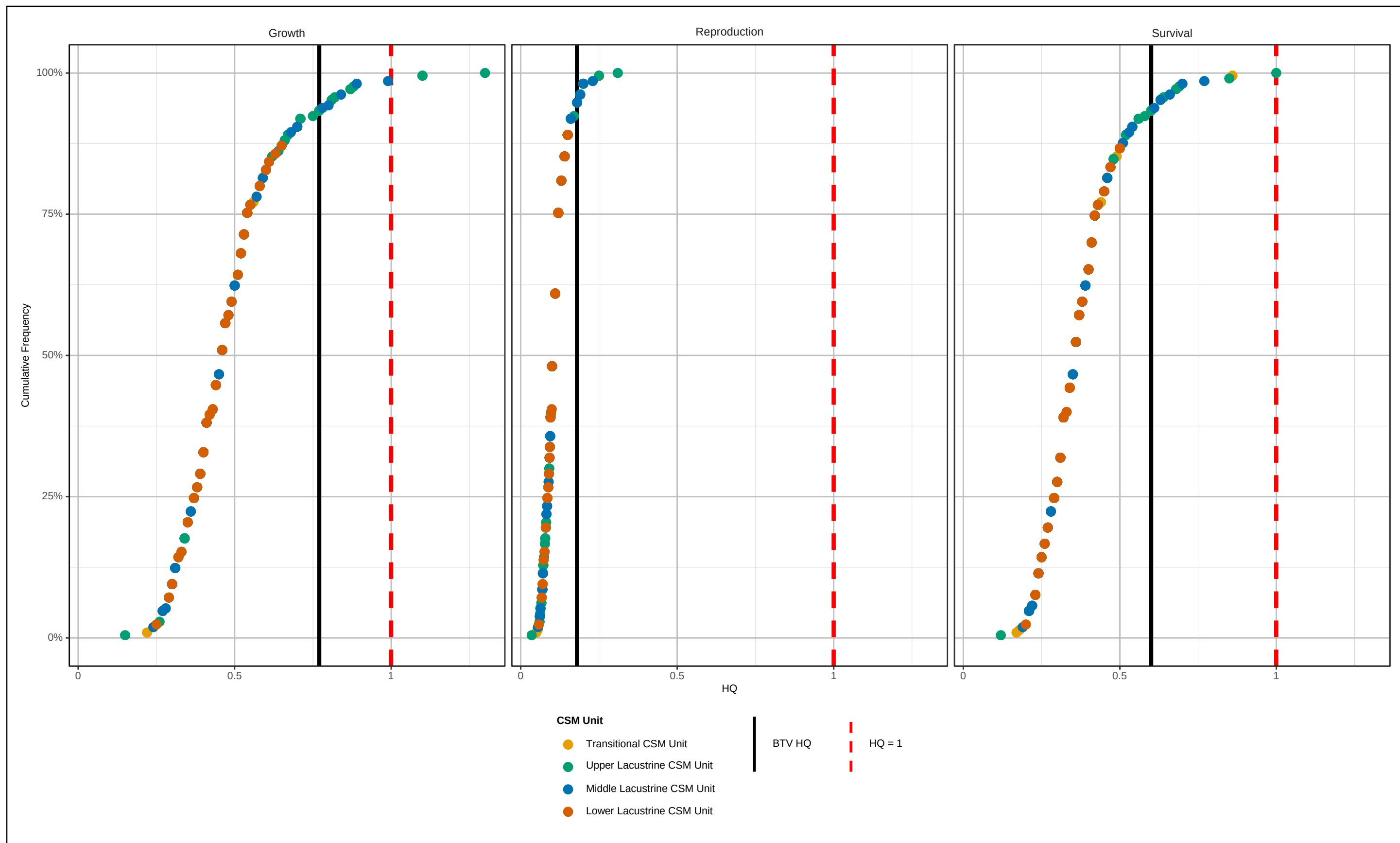


Figure M-32h. Cumulative Frequency of Manganese Dietary HQs for Water Shrew in OU 2
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

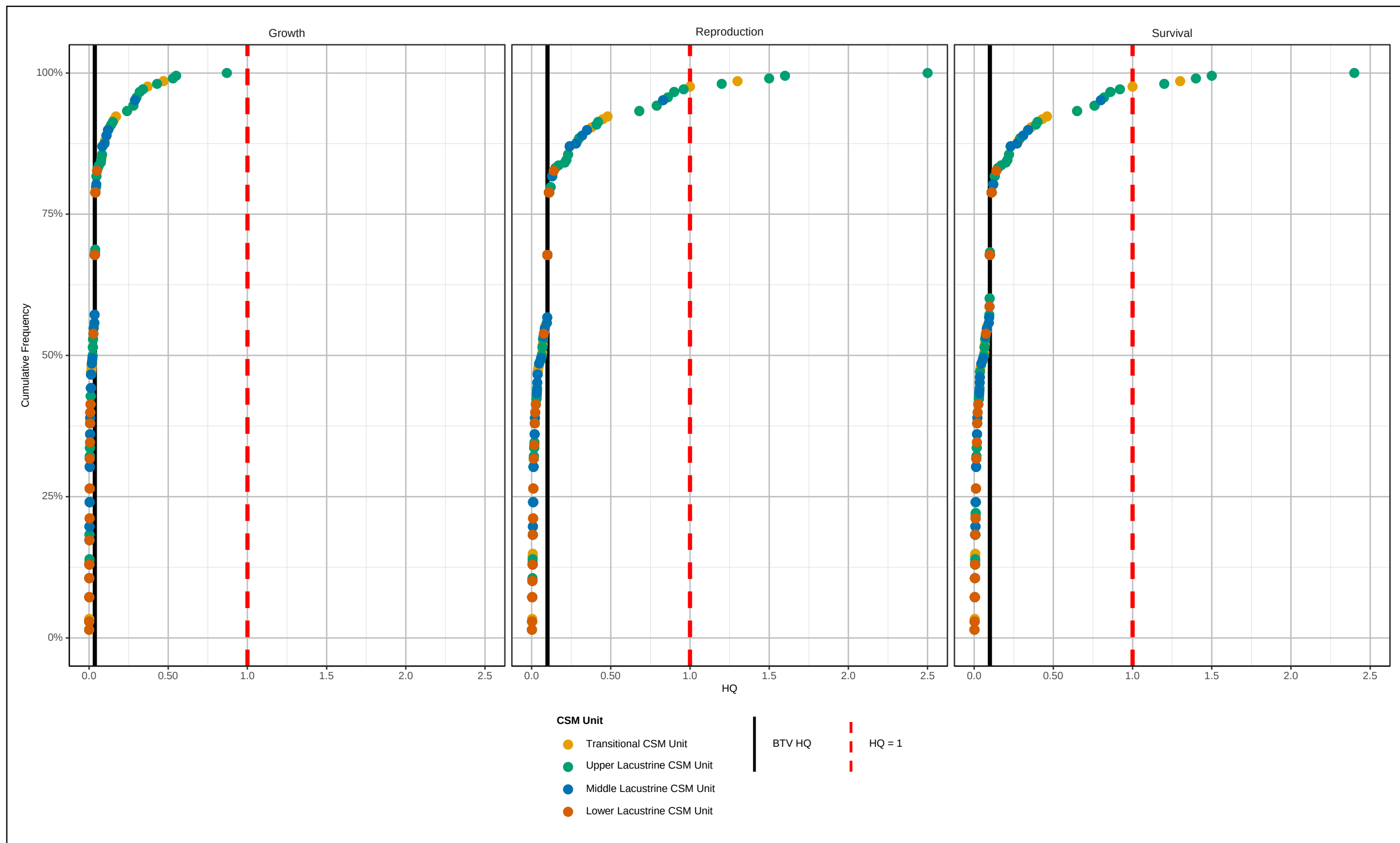


Figure M-32i. Cumulative Frequency of Mercury Dietary HQs for Water Shrew in OU 2
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

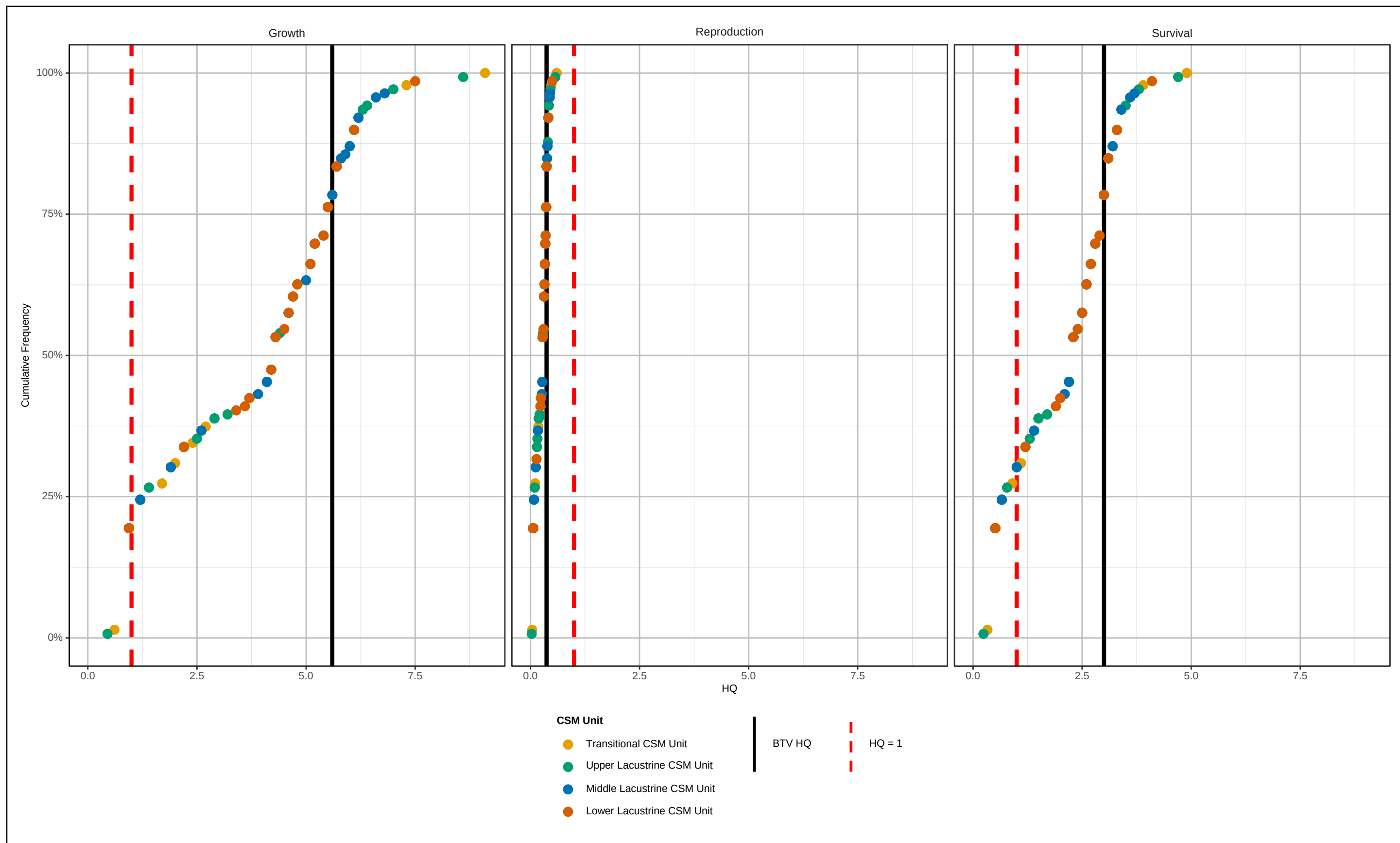


Figure M-32j. Cumulative Frequency of Selenium Dietary HQs for Water Shrew in OU 2
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

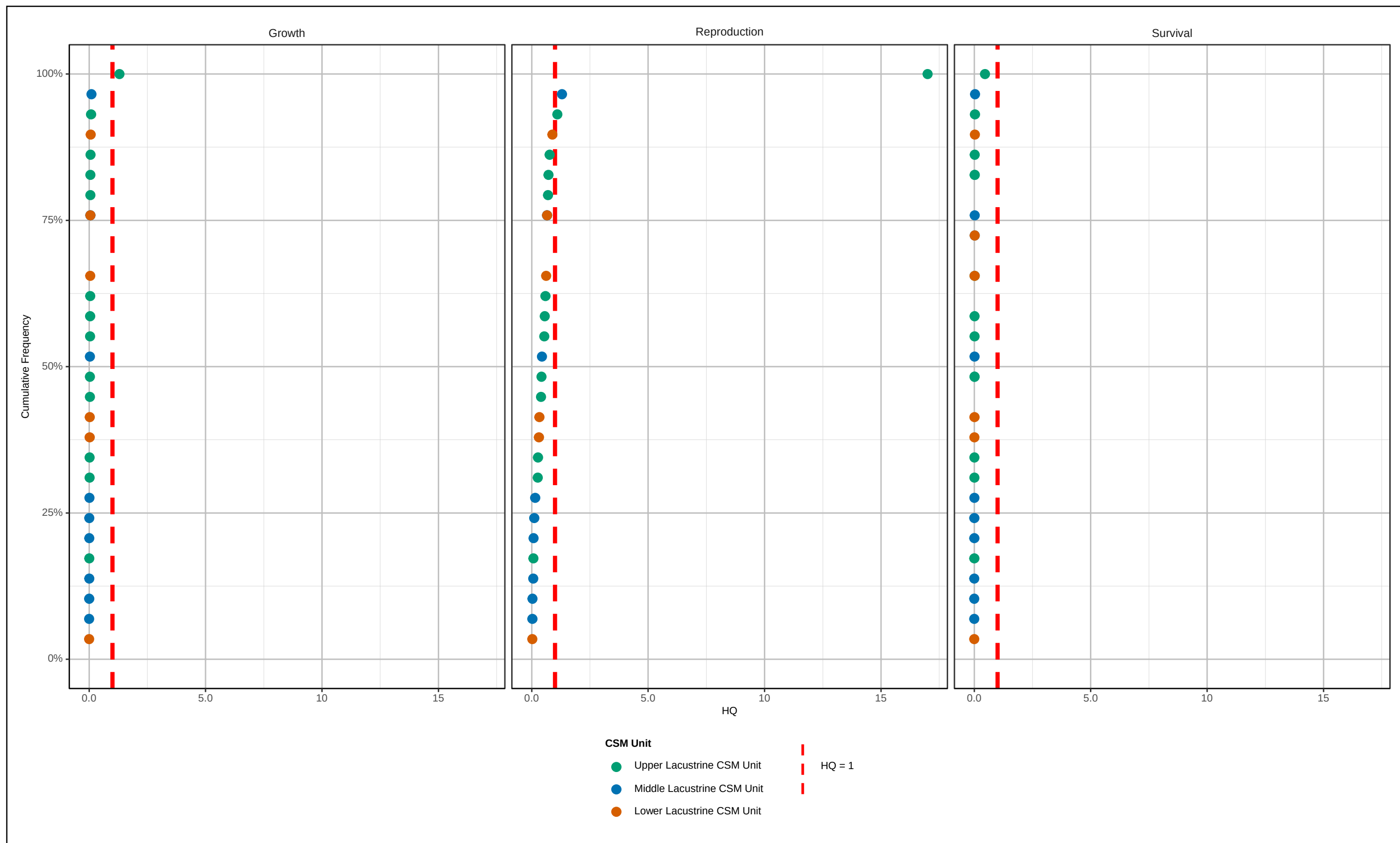


Figure M-32k. Cumulative Frequency of Dioxin/Furan Mammal TEQ, 0 DL Dietary HQs for Water Shrew in OU 2
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

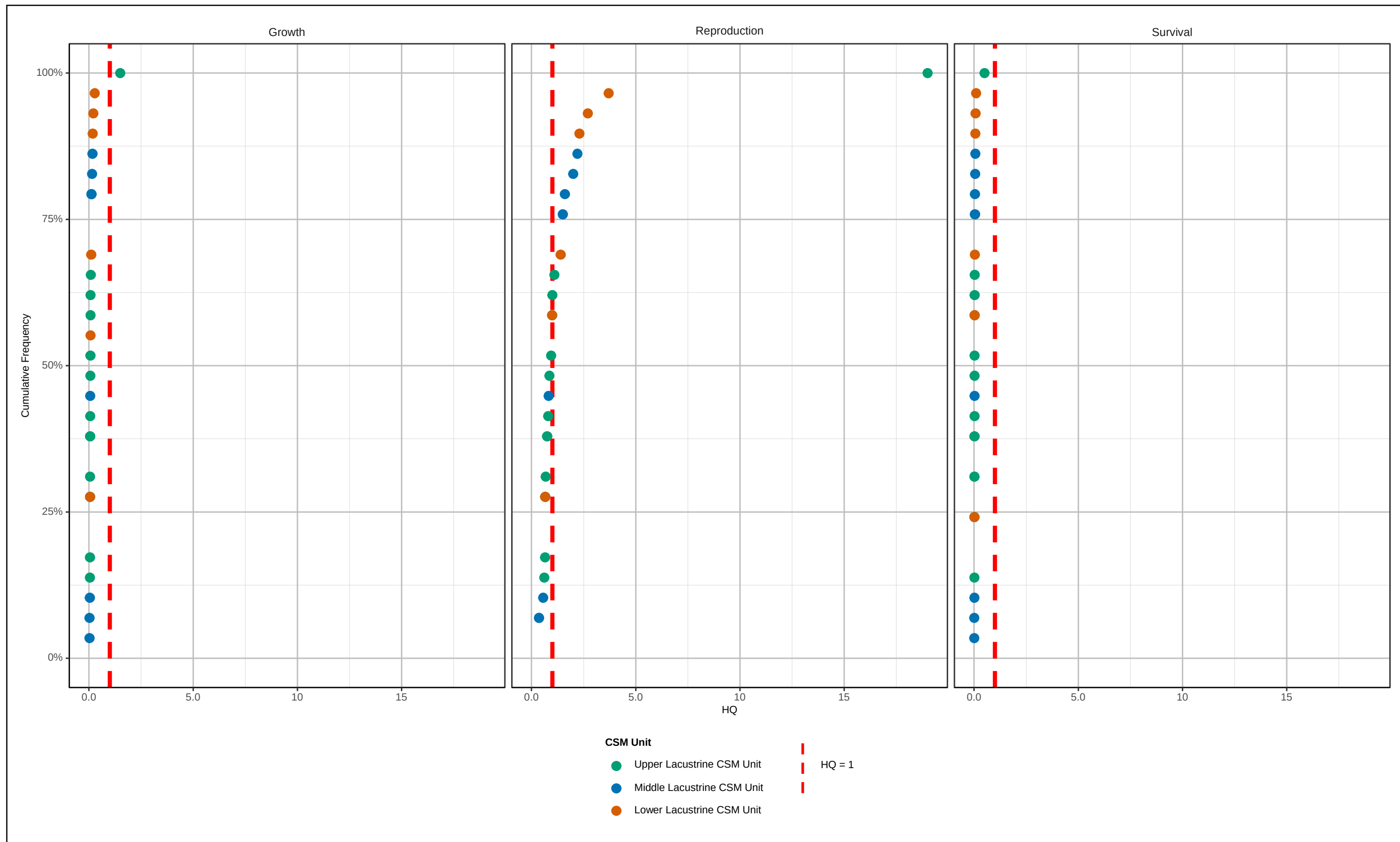


Figure M-32I. Cumulative Frequency of Dioxin/Furan Mammal TEQ, 1/2 DL Dietary HQs for Water Shrew in OU 2
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

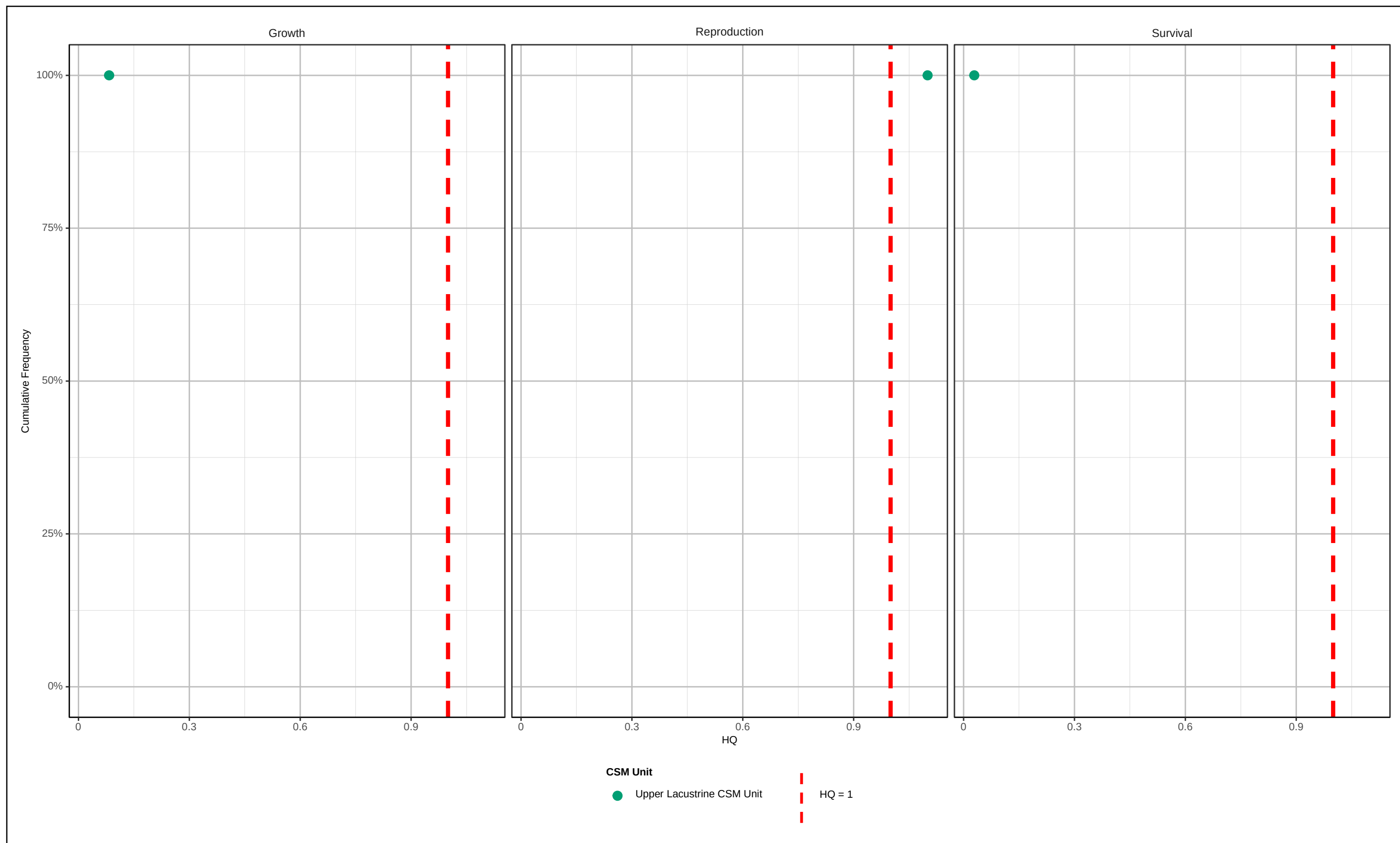


Figure M-32m. Cumulative Frequency of Total Mammal TEQ, 1/2 DL Dietary HQs for Water Shrew in OU 2
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

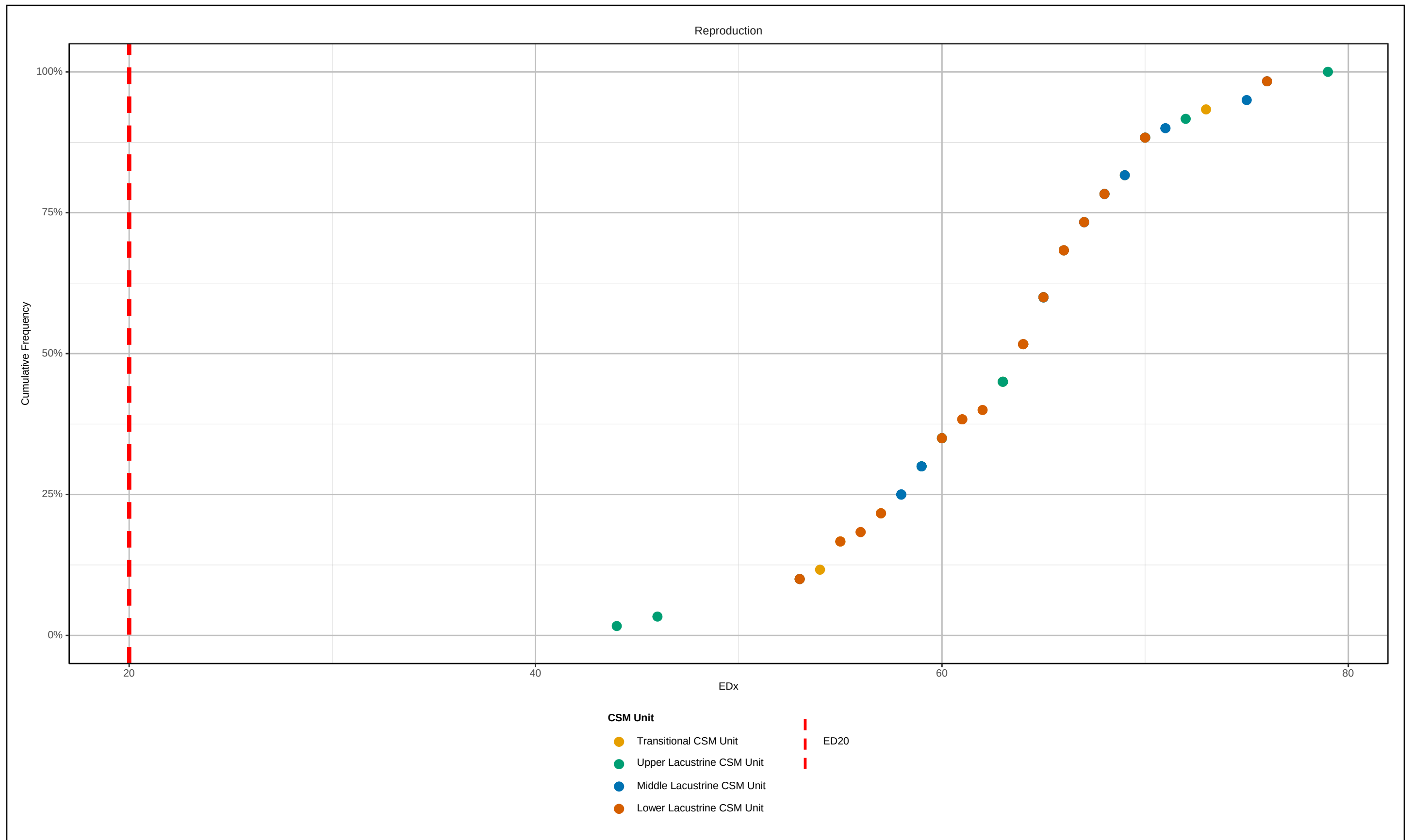


Figure M-33a. Cumulative Frequency of Aluminum EDx Values for Muskrat in OU 2
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

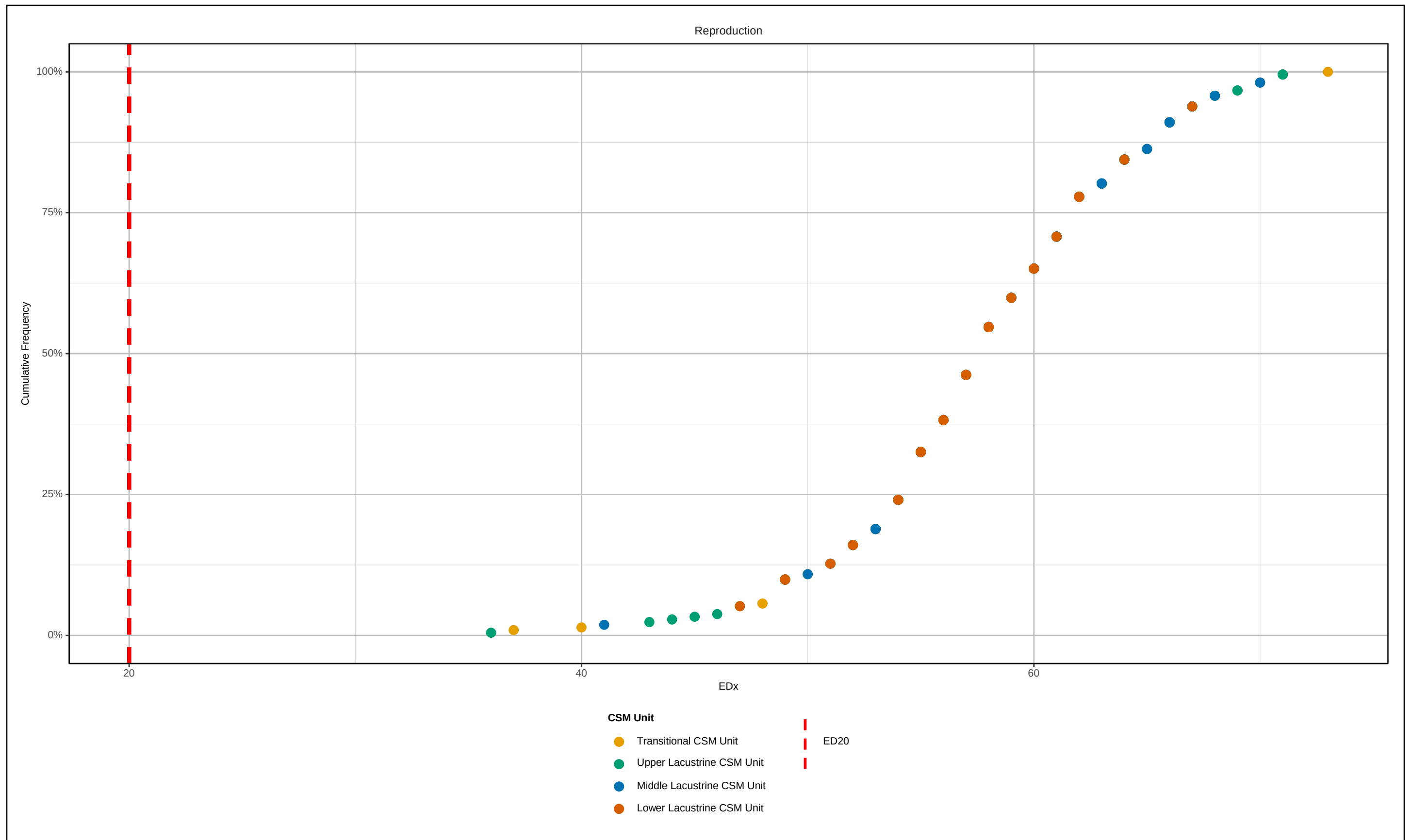


Figure M-33b. Cumulative Frequency of Aluminum EDx Values for Water Shrew in OU 2
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

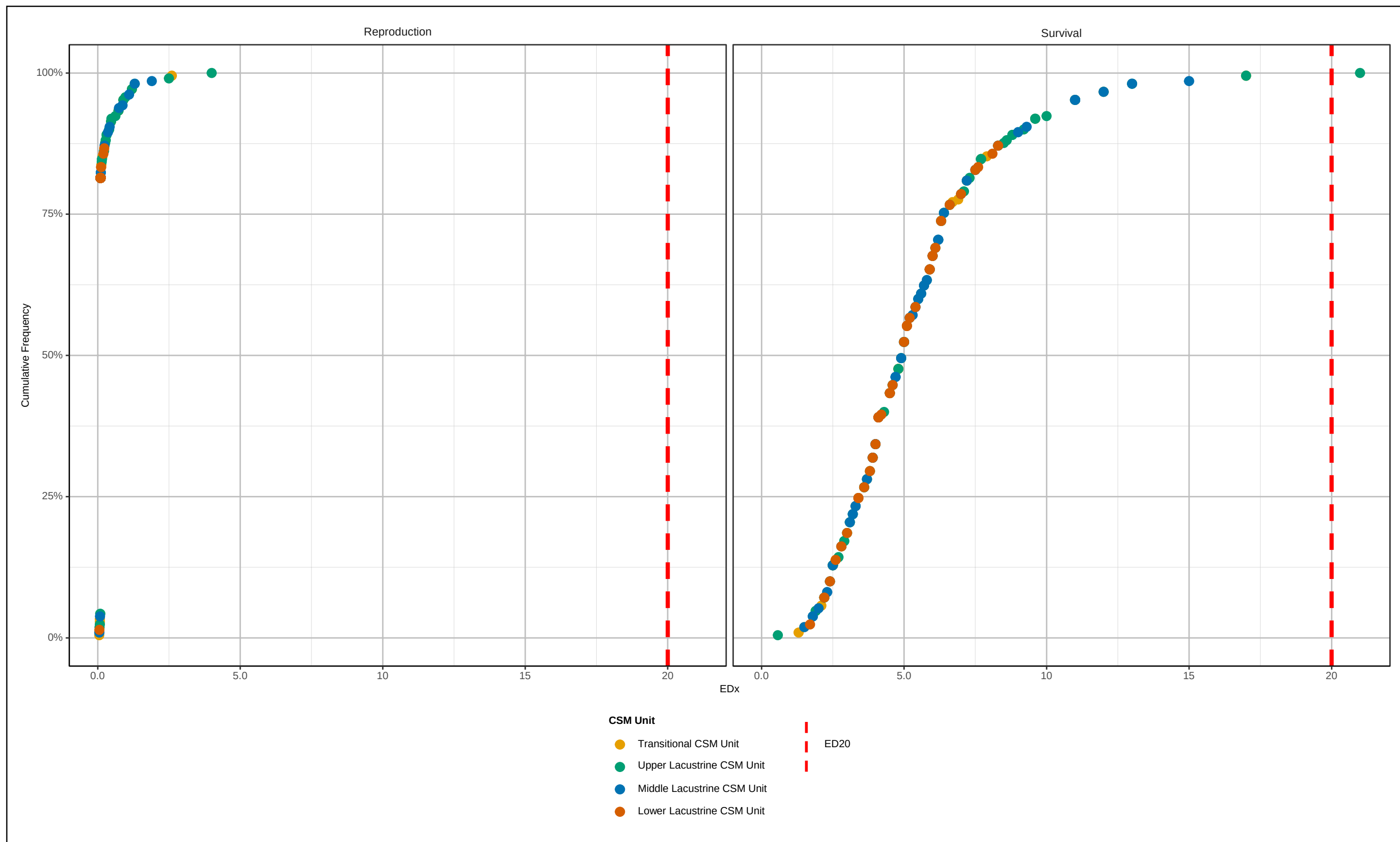


Figure M-33c. Cumulative Frequency of Manganese EDx Values for Water Shrew in OU 2
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

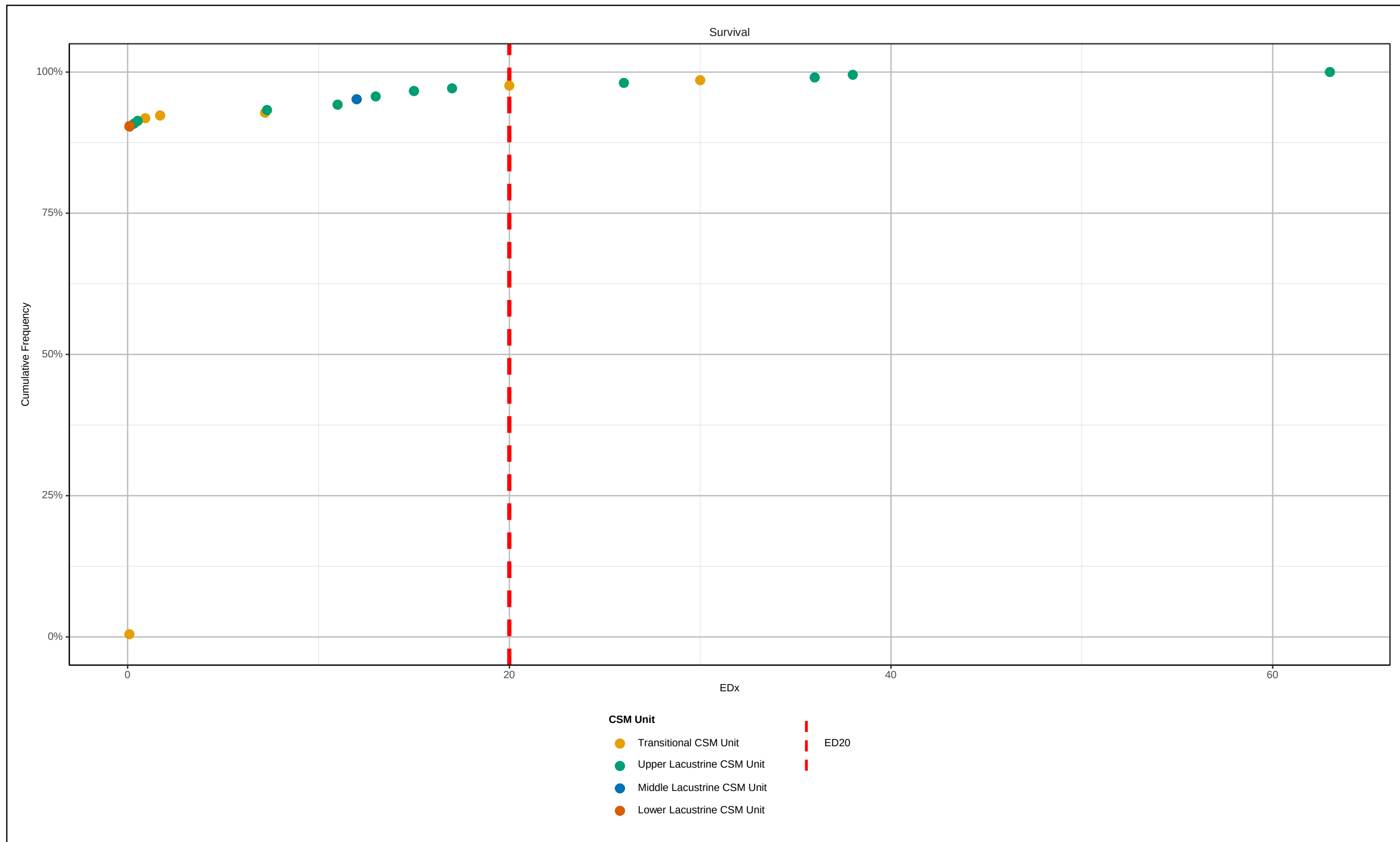


Figure M-33d. Cumulative Frequency of Mercury EDx Values for Water Shrew in OU 2
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

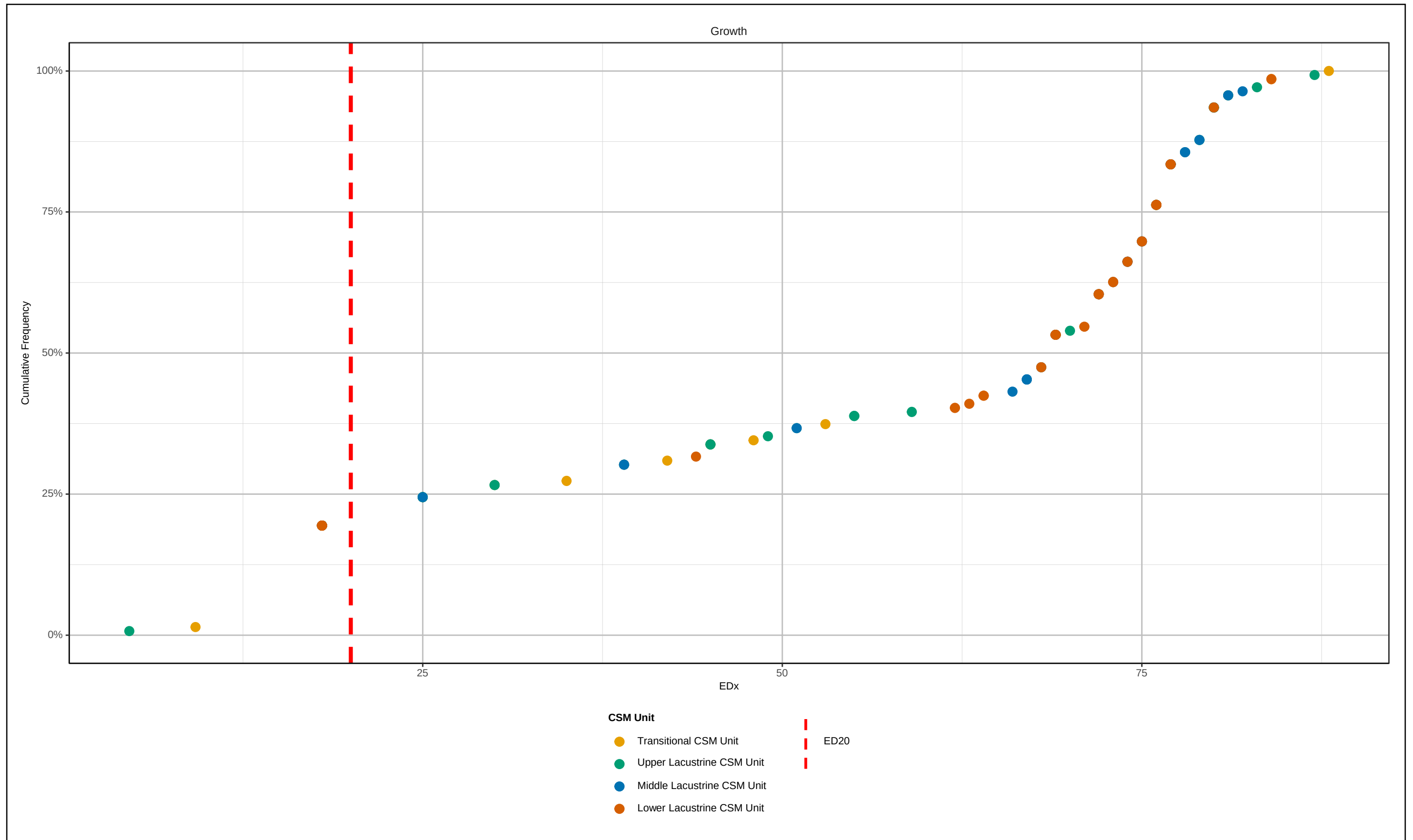


Figure M-33e. Cumulative Frequency of Selenium EDx Values for Water Shrew in OU 2
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

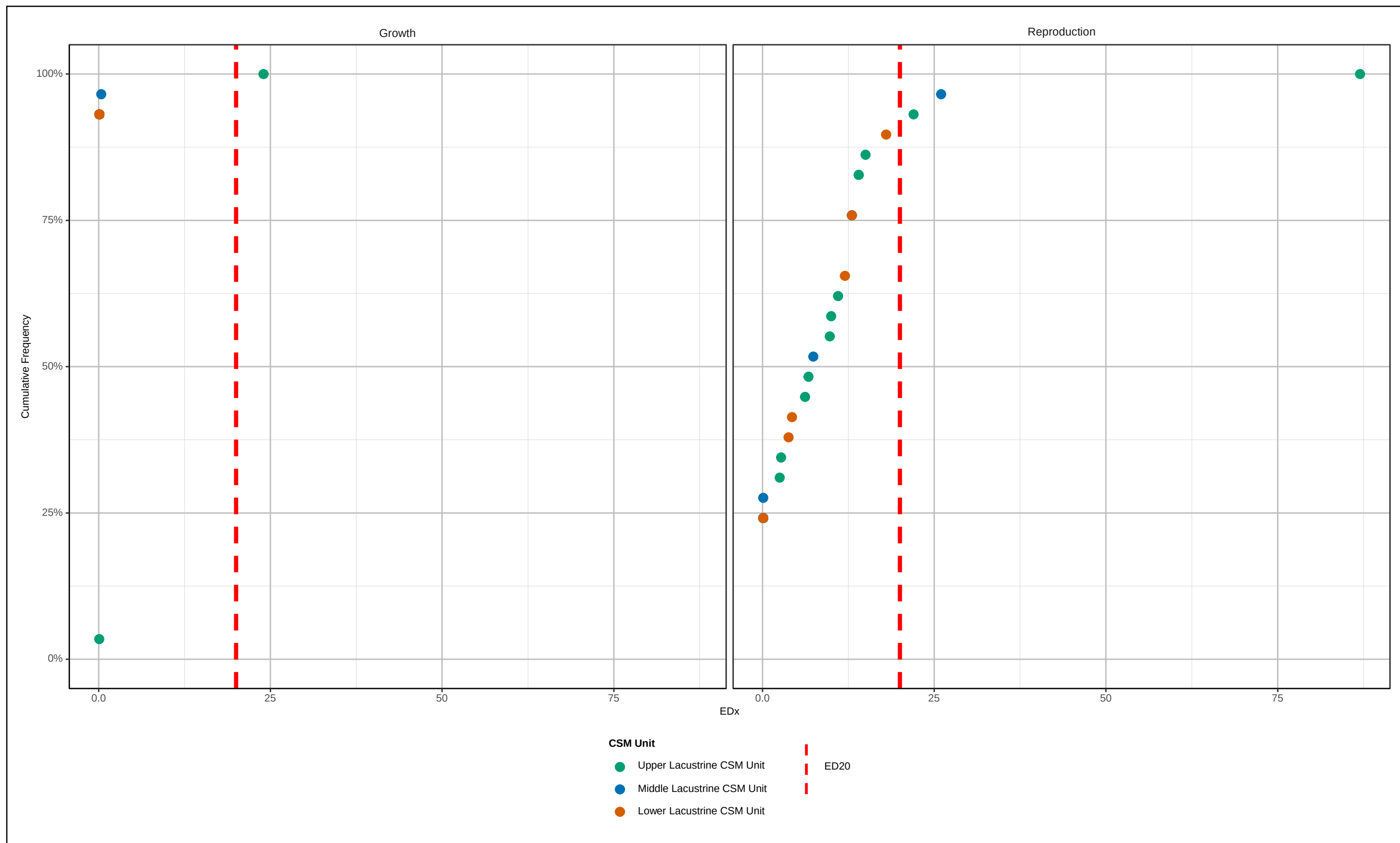


Figure M-33f. Cumulative Frequency of Dioxin/Furan Mammal TEQ, 0 DL EDx Values for Water Shrew in OU 2
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

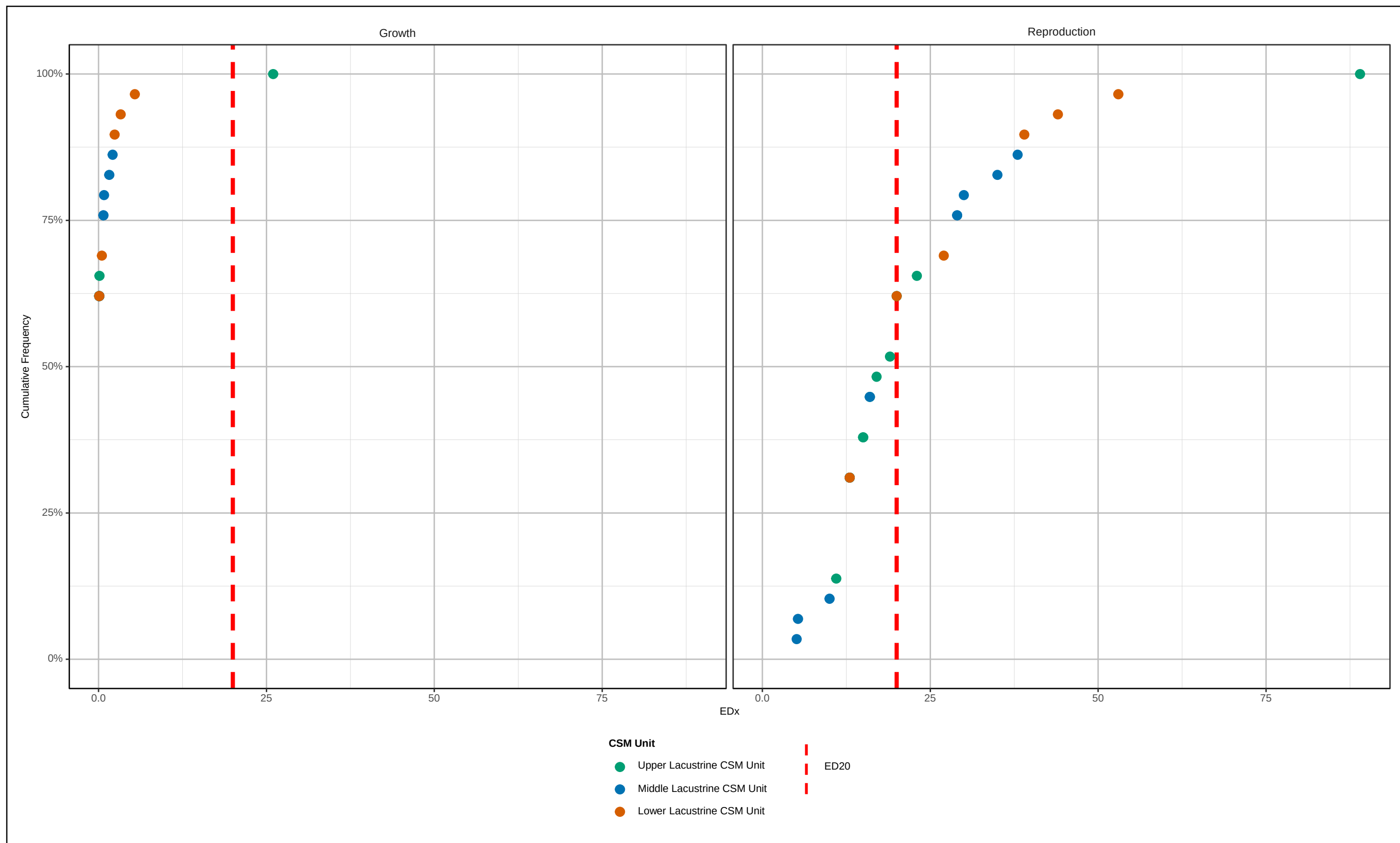


Figure M-33g. Cumulative Frequency of Dioxin/Furan Mammal TEQ, 1/2 DL EDx Values for Water Shrew in OU 2
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

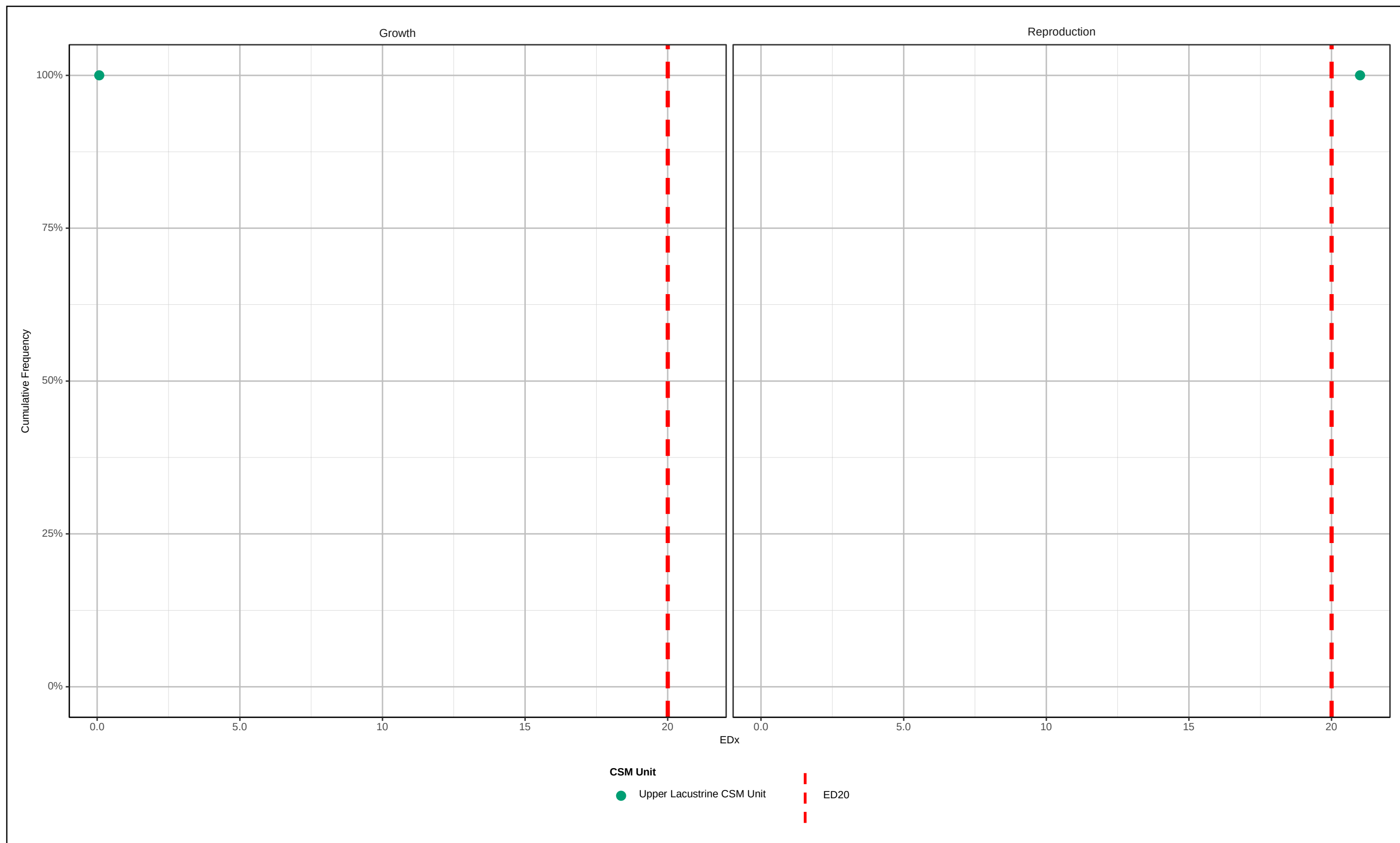


Figure M-33h. Cumulative Frequency of Total Mammal TEQ, 1/2 DL EDx Values for Water Shrew in OU 2
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

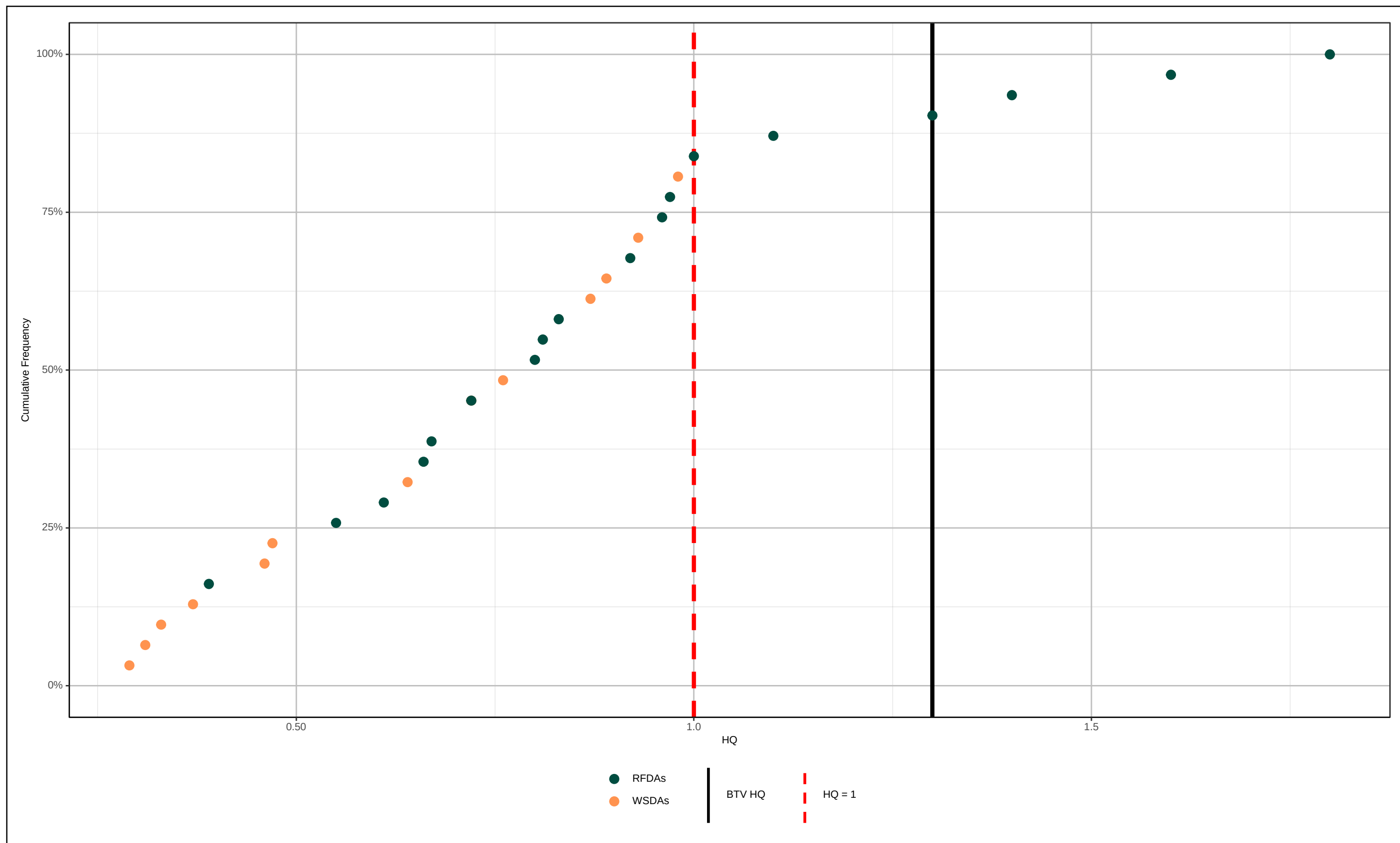


Figure M-34a. Cumulative Frequency of Arsenic HQs for Terrestrial Plants in the RFDAs and WSDAs
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

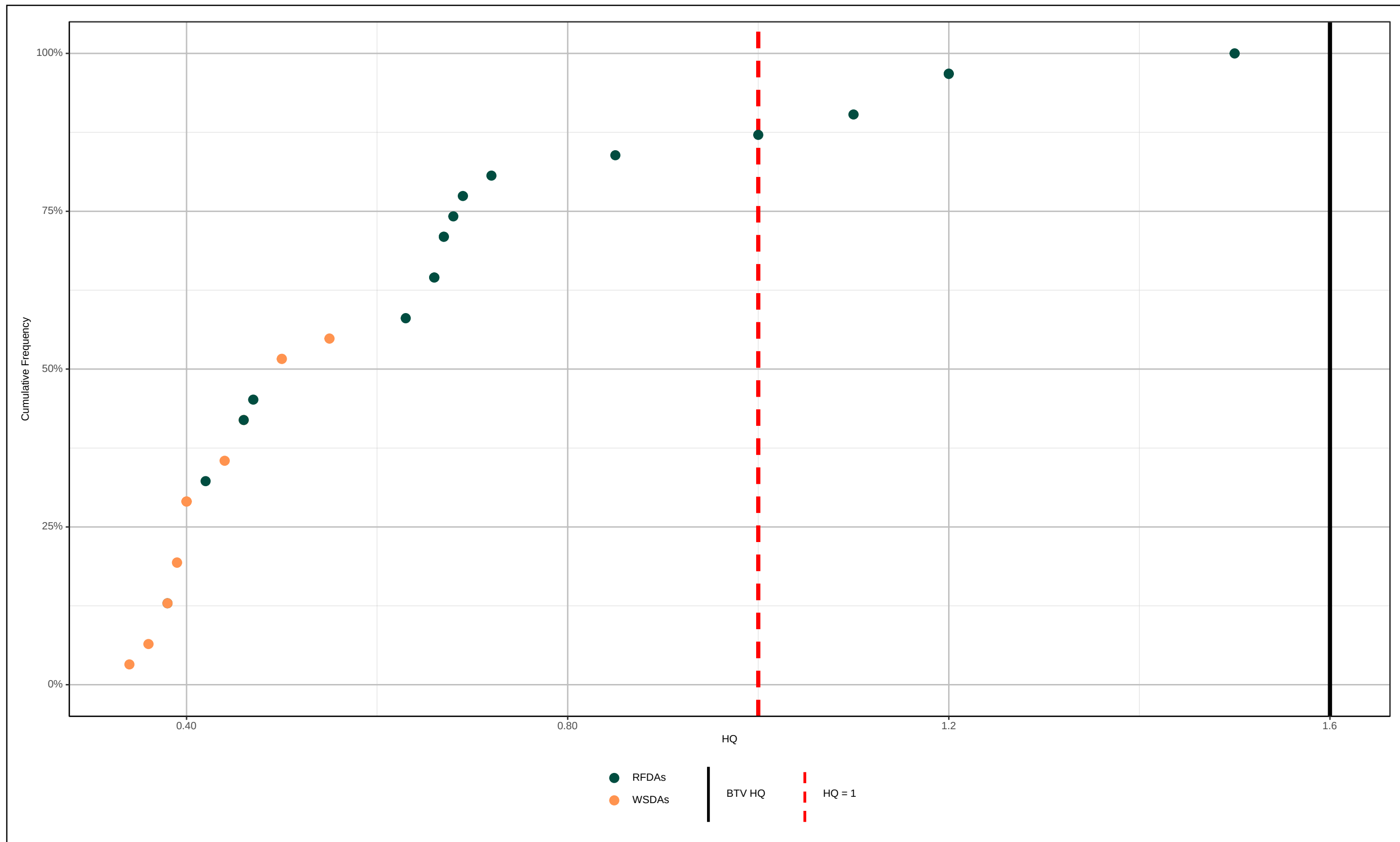


Figure M-34b. Cumulative Frequency of Cobalt HQs for Terrestrial Plants in the RFDAs and WSDAs
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

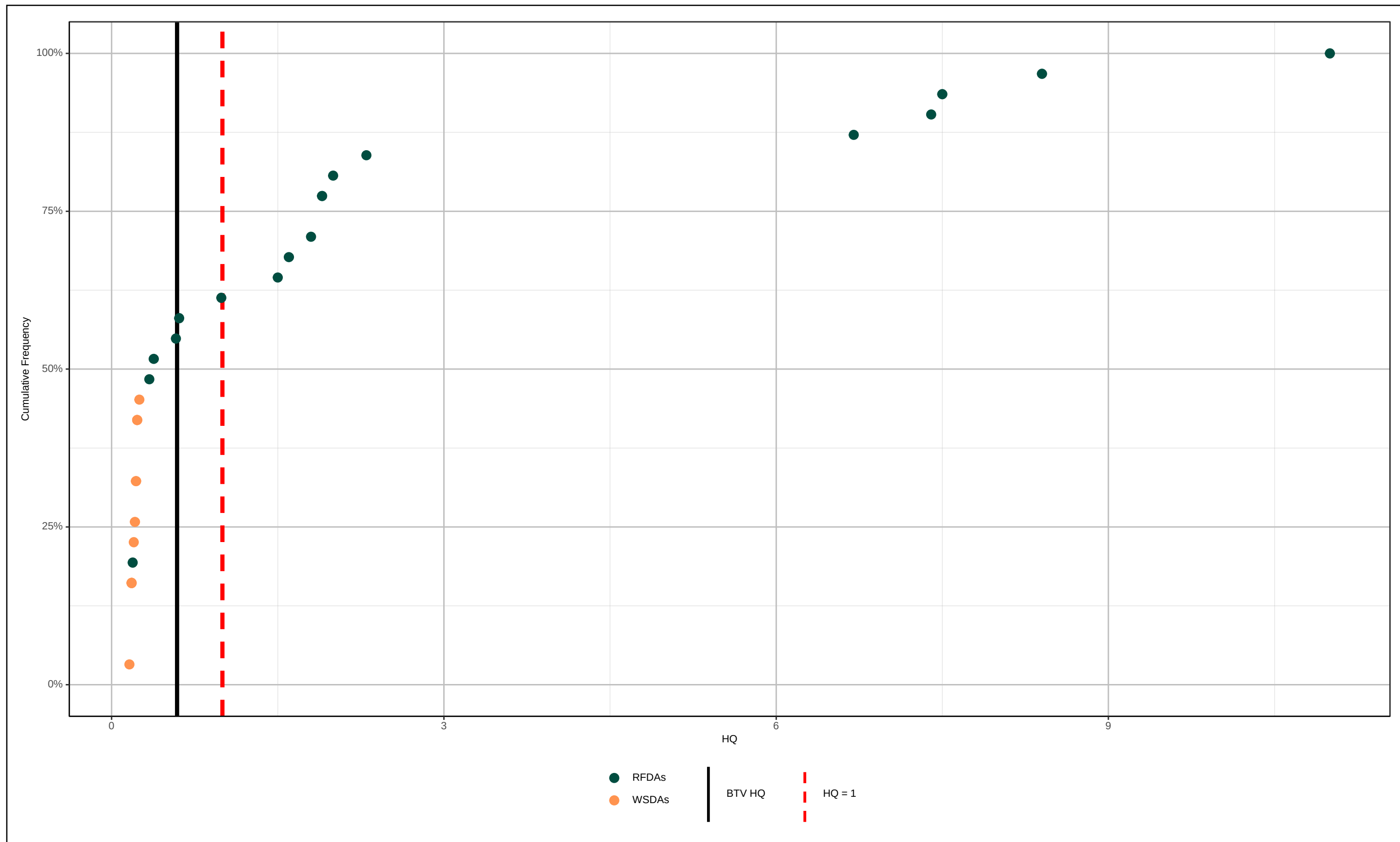


Figure M-34c. Cumulative Frequency of Copper HQs for Terrestrial Plants in the RFDAs and WSDAs
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

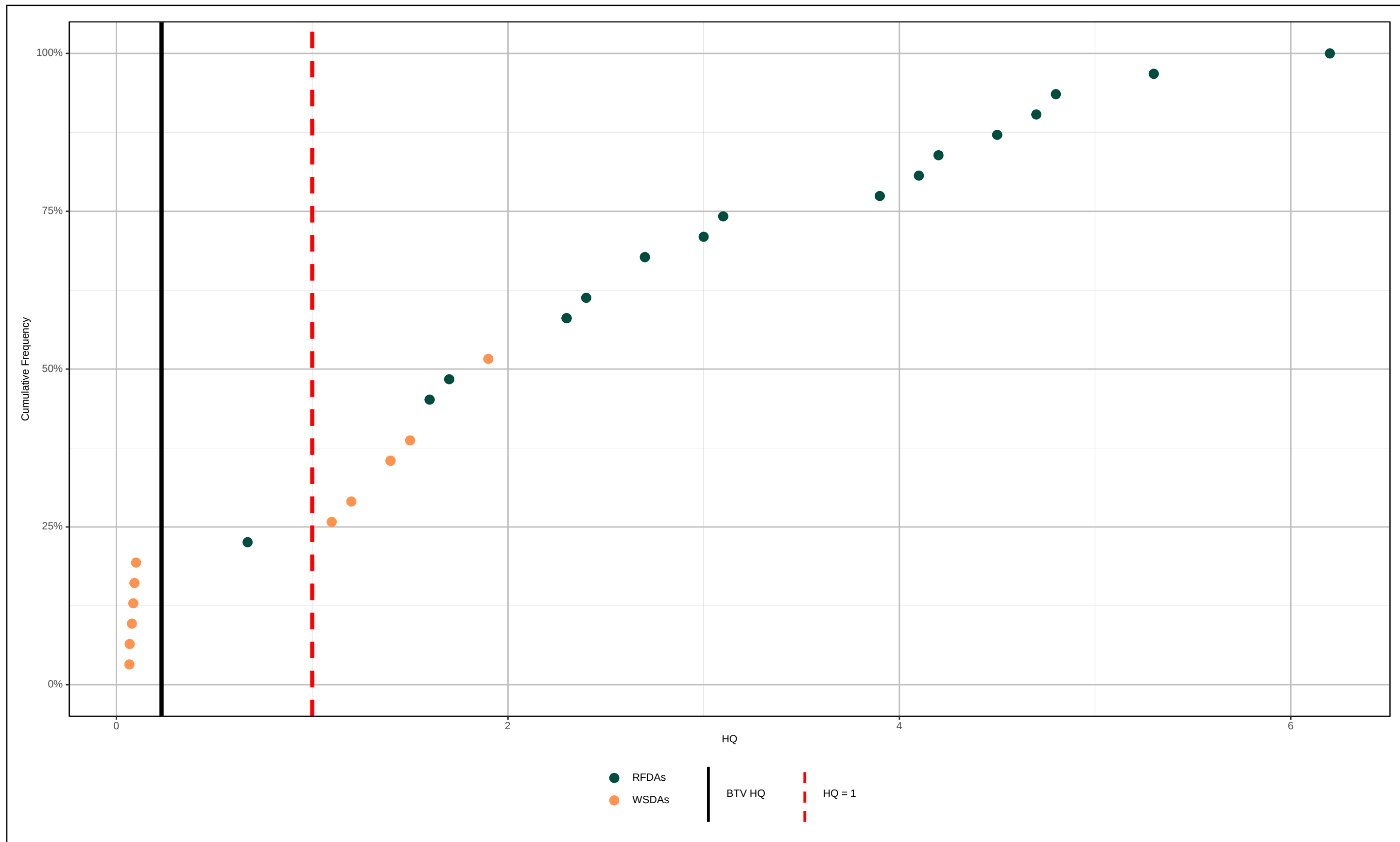


Figure M-34d. Cumulative Frequency of Lead HQs for Terrestrial Plants in the RFDAs and WSDAs
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

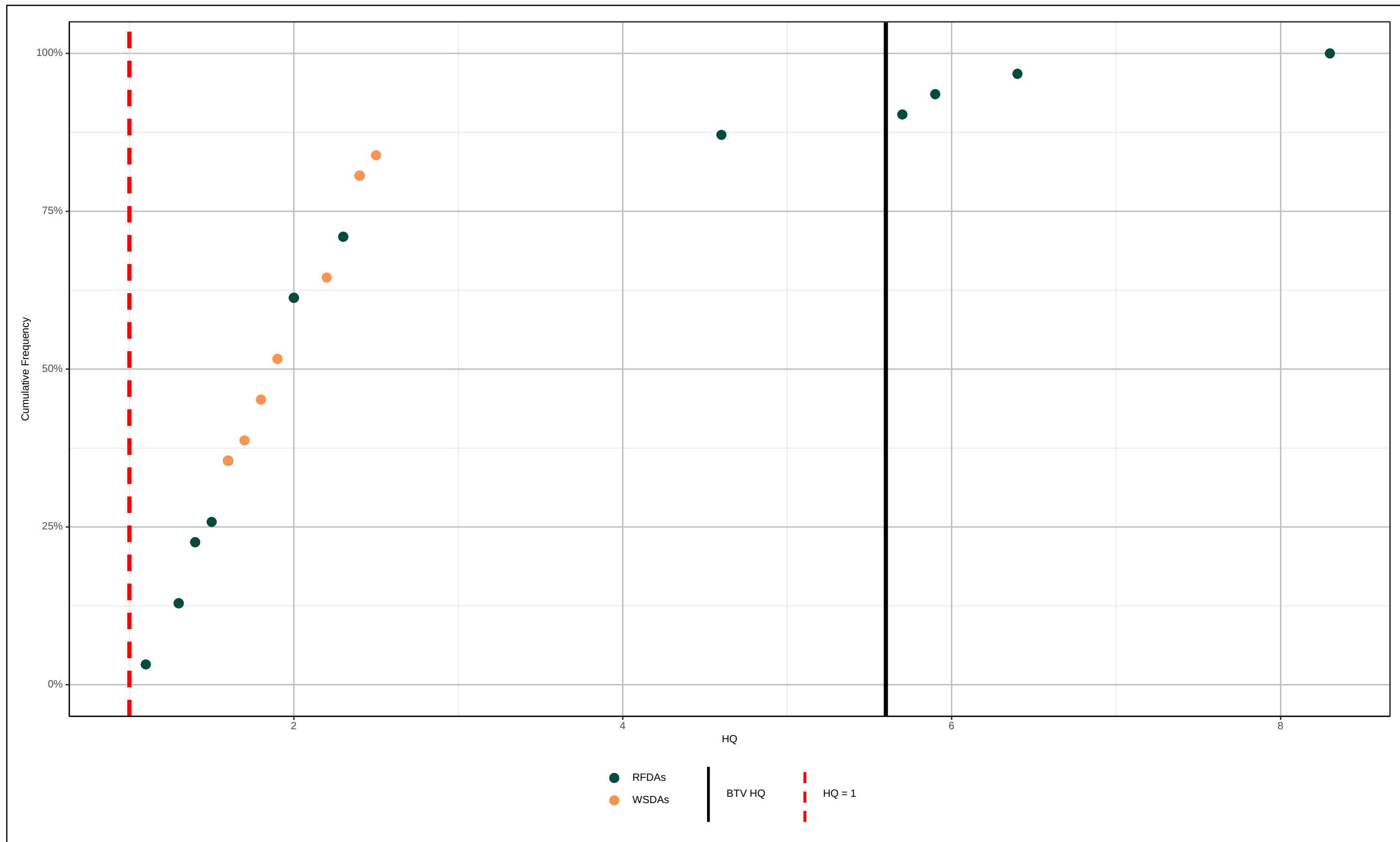


Figure M-34e. Cumulative Frequency of Manganese HQs for Terrestrial Plants in the RFDAs and WSDAs
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

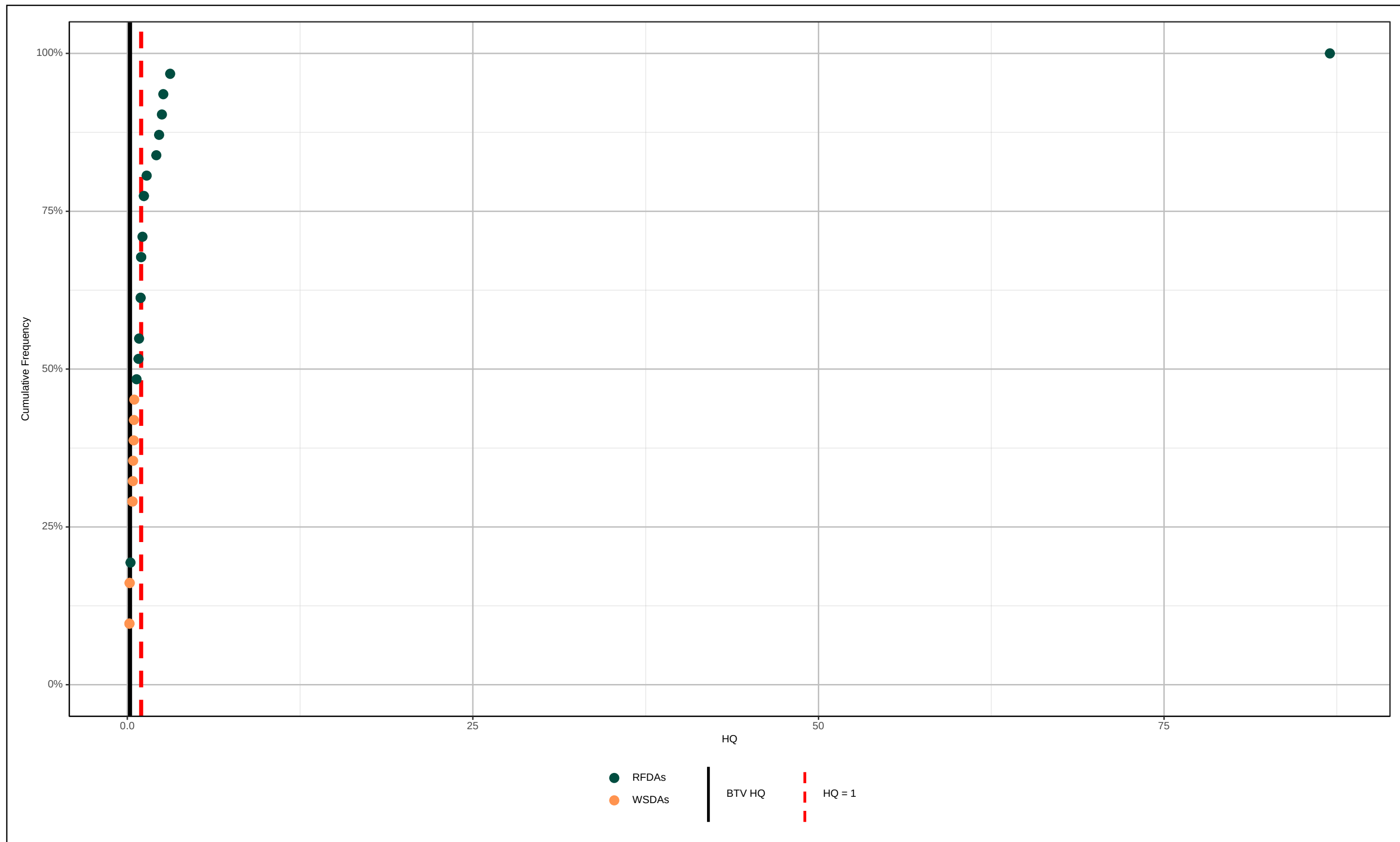


Figure M-34f. Cumulative Frequency of Selenium HQs for Terrestrial Plants in the RFDAs and WSDAs
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

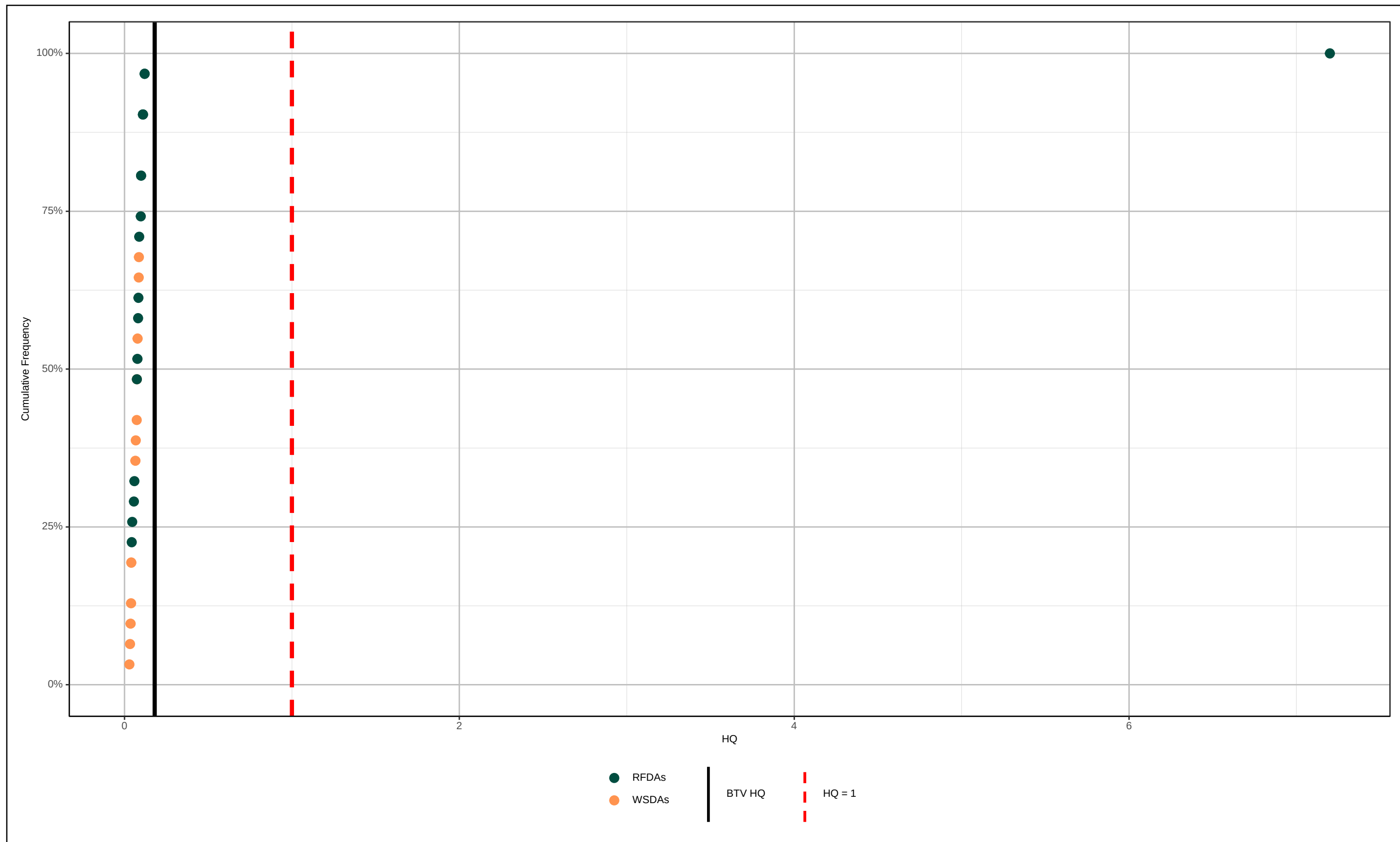


Figure M-34g. Cumulative Frequency of Thallium HQs for Terrestrial Plants in the RFDAs and WSDAs
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

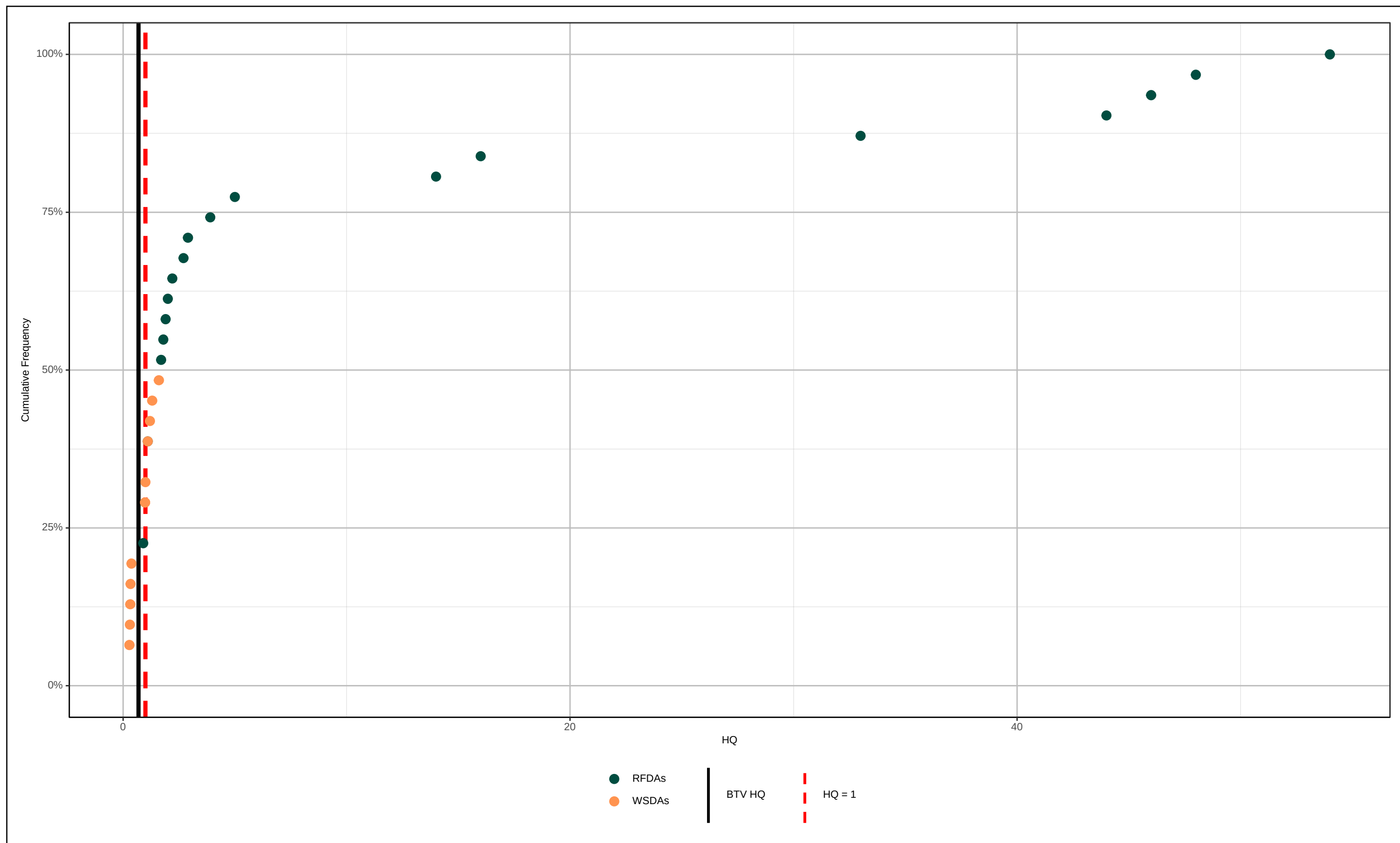


Figure M-34h. Cumulative Frequency of Zinc HQs for Terrestrial Plants in the RFDAs and WSDAs
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

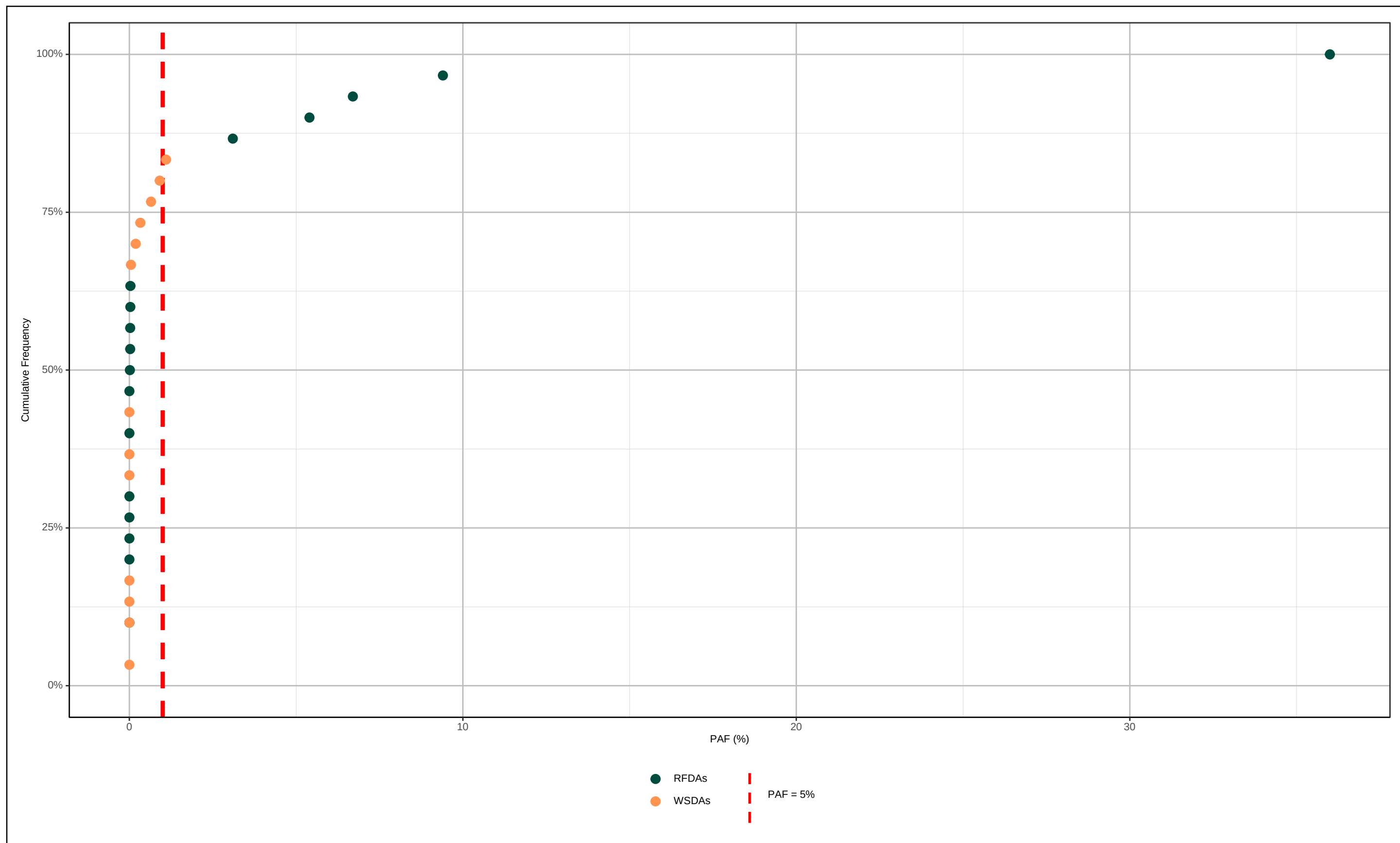


Figure M-35a. Cumulative Frequency of Cobalt PAFs for Terrestrial Plants in the RFDAs and WSDAs
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

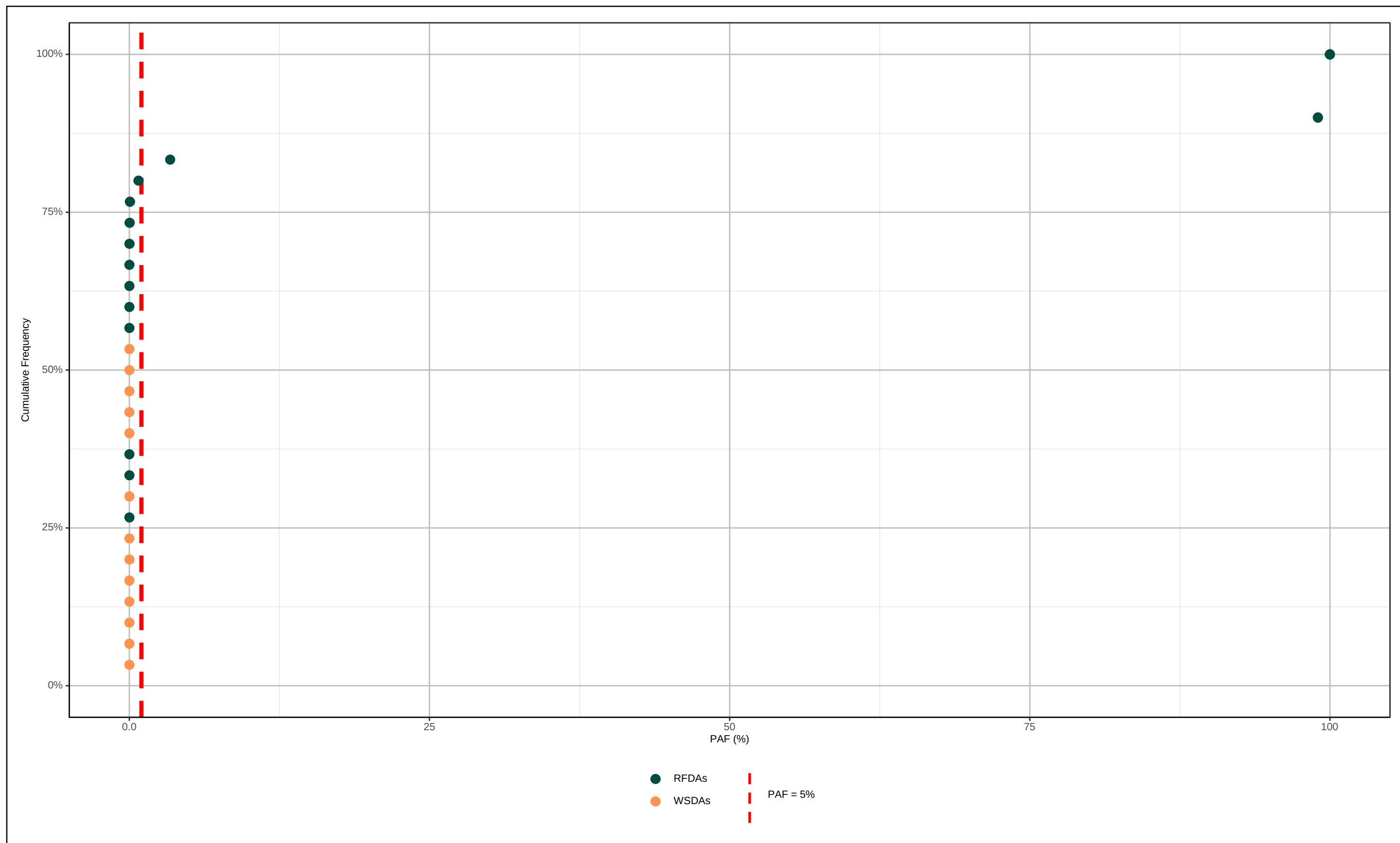


Figure M-35b. Cumulative Frequency of Copper PAFs for Terrestrial Plants in the RFDAs and WSDAs
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

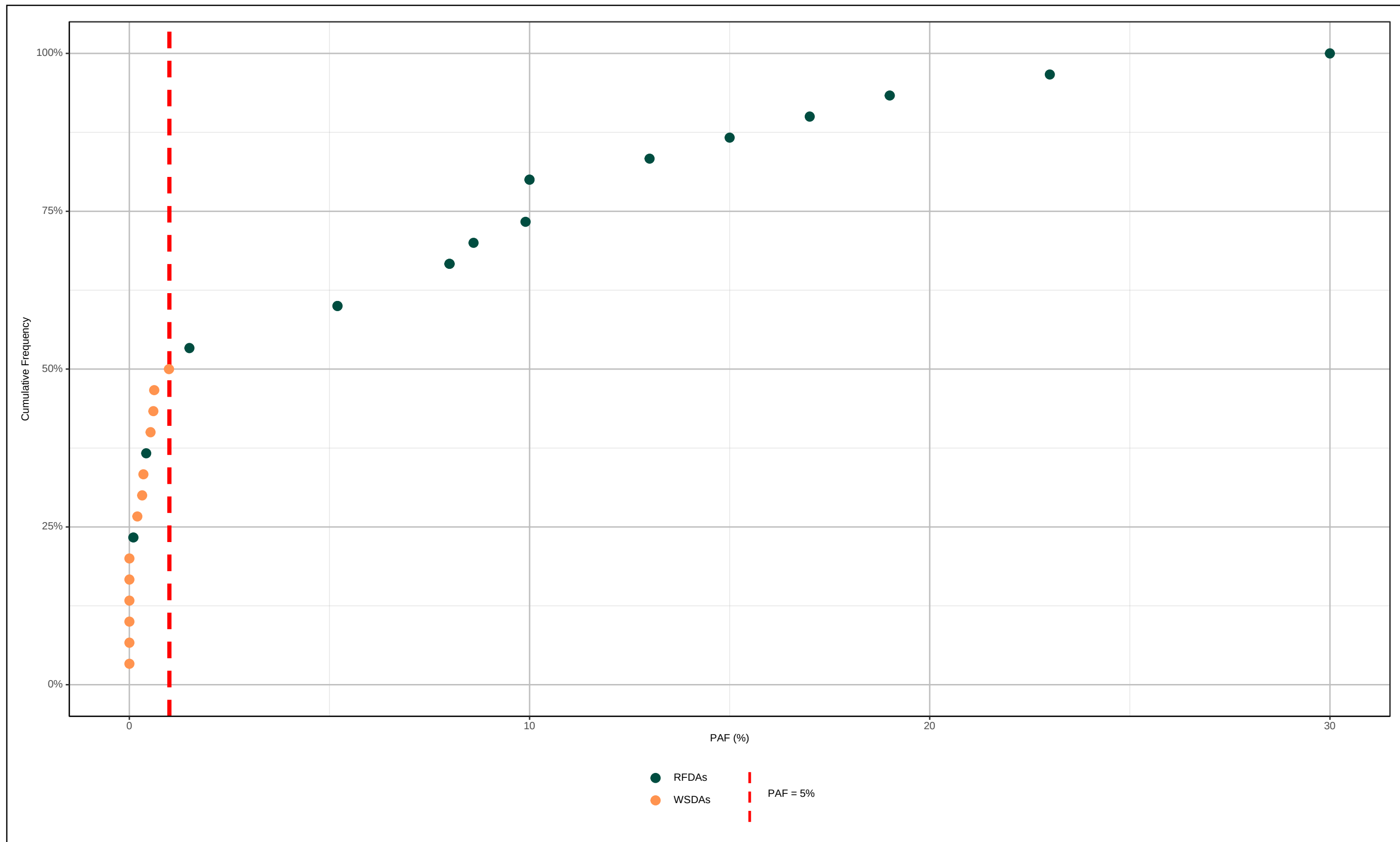


Figure M-35c. Cumulative Frequency of Lead PAFs for Terrestrial Plants in the RFDAs and WSDAs
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

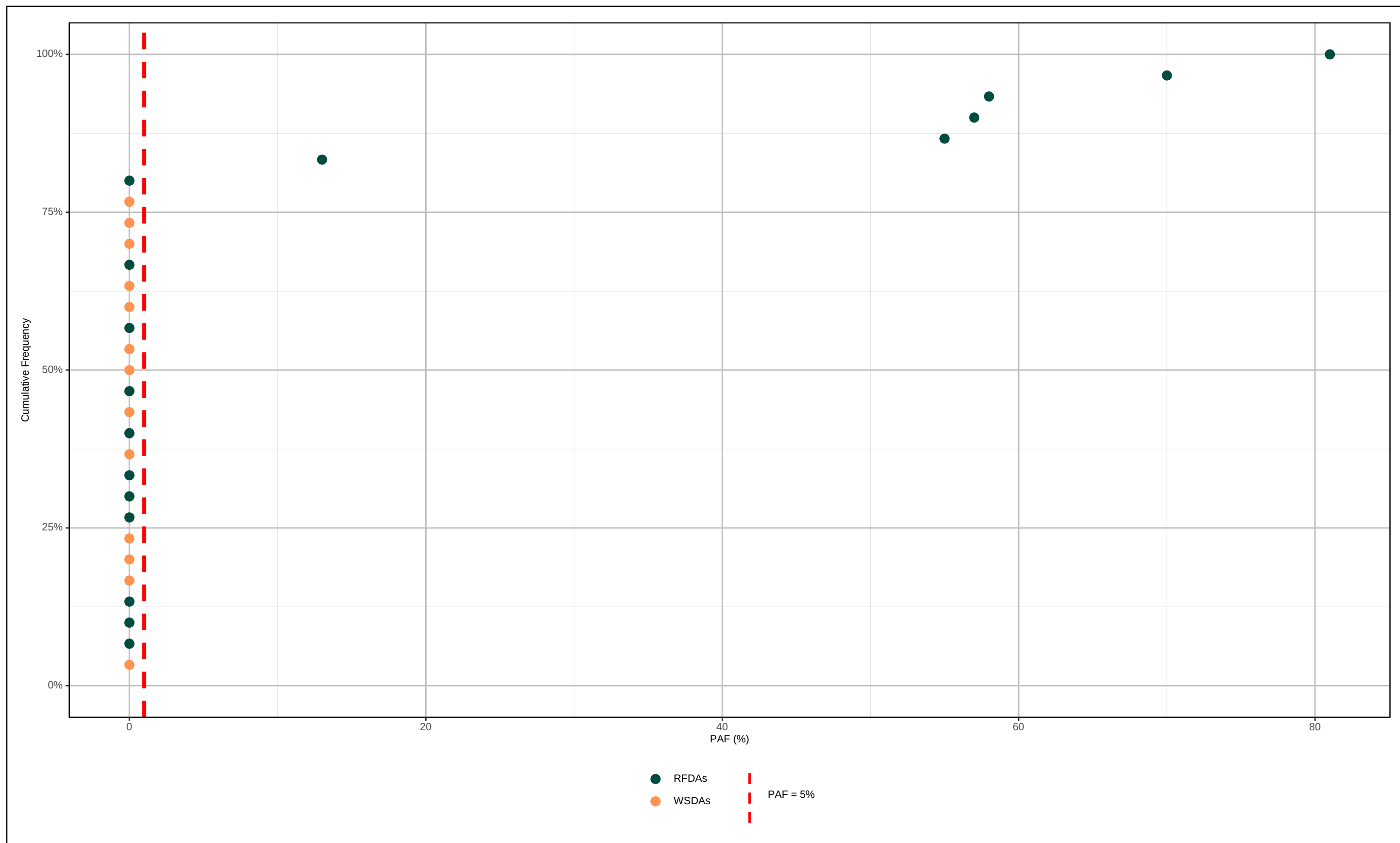


Figure M-35d. Cumulative Frequency of Molybdenum PAFs for Terrestrial Plants in the RFDAs and WSDAs
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

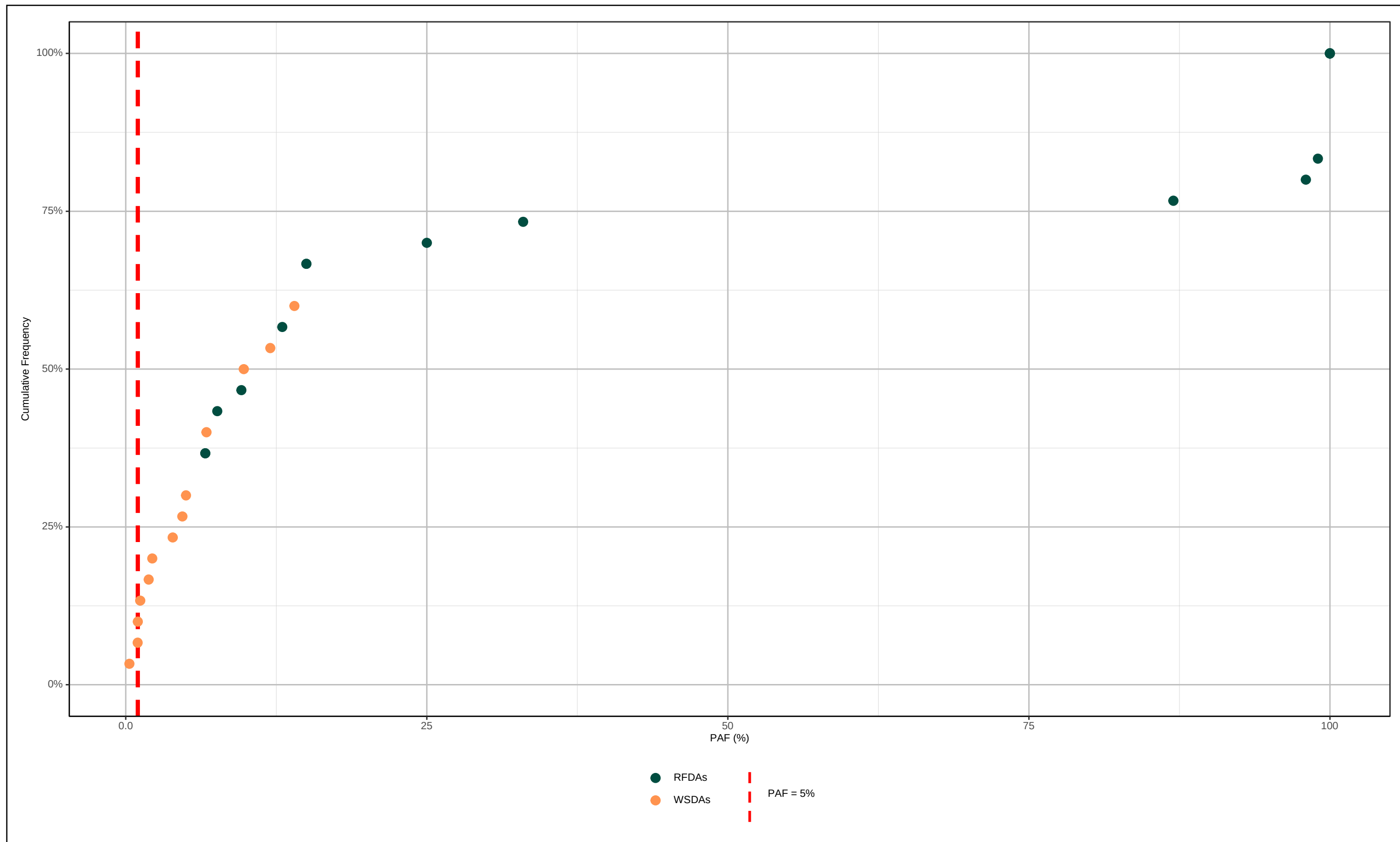


Figure M-35e. Cumulative Frequency of Zinc PAFs for Terrestrial Plants in the RFDAs and WSDAs
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

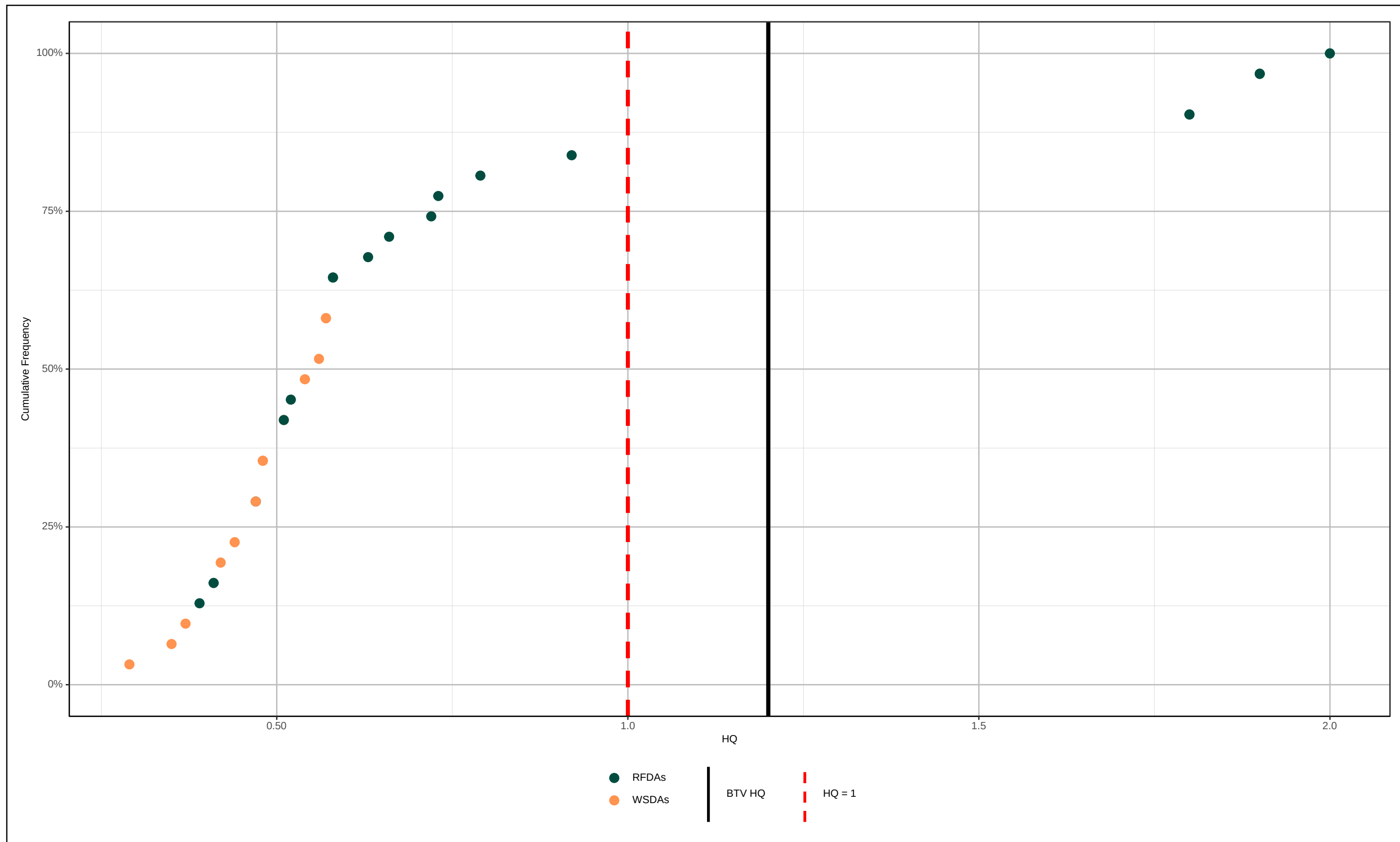


Figure M-36a. Cumulative Frequency of Barium HQs for Soil Invertebrates in the RFDAs and WSDAs
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

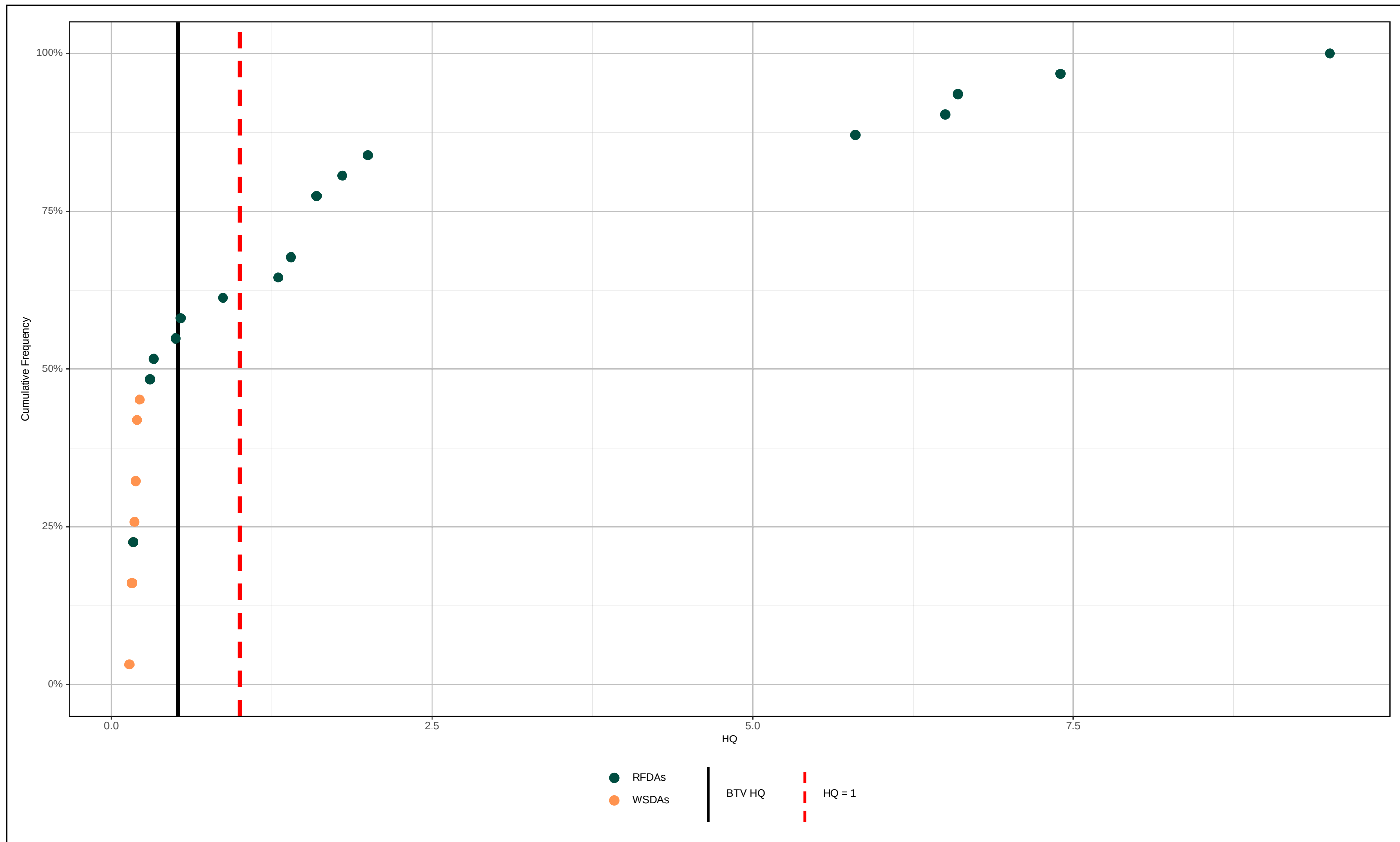


Figure M-36b. Cumulative Frequency of Cobalt HQs for Soil Invertebrates in the RFDAs and WSDAs
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

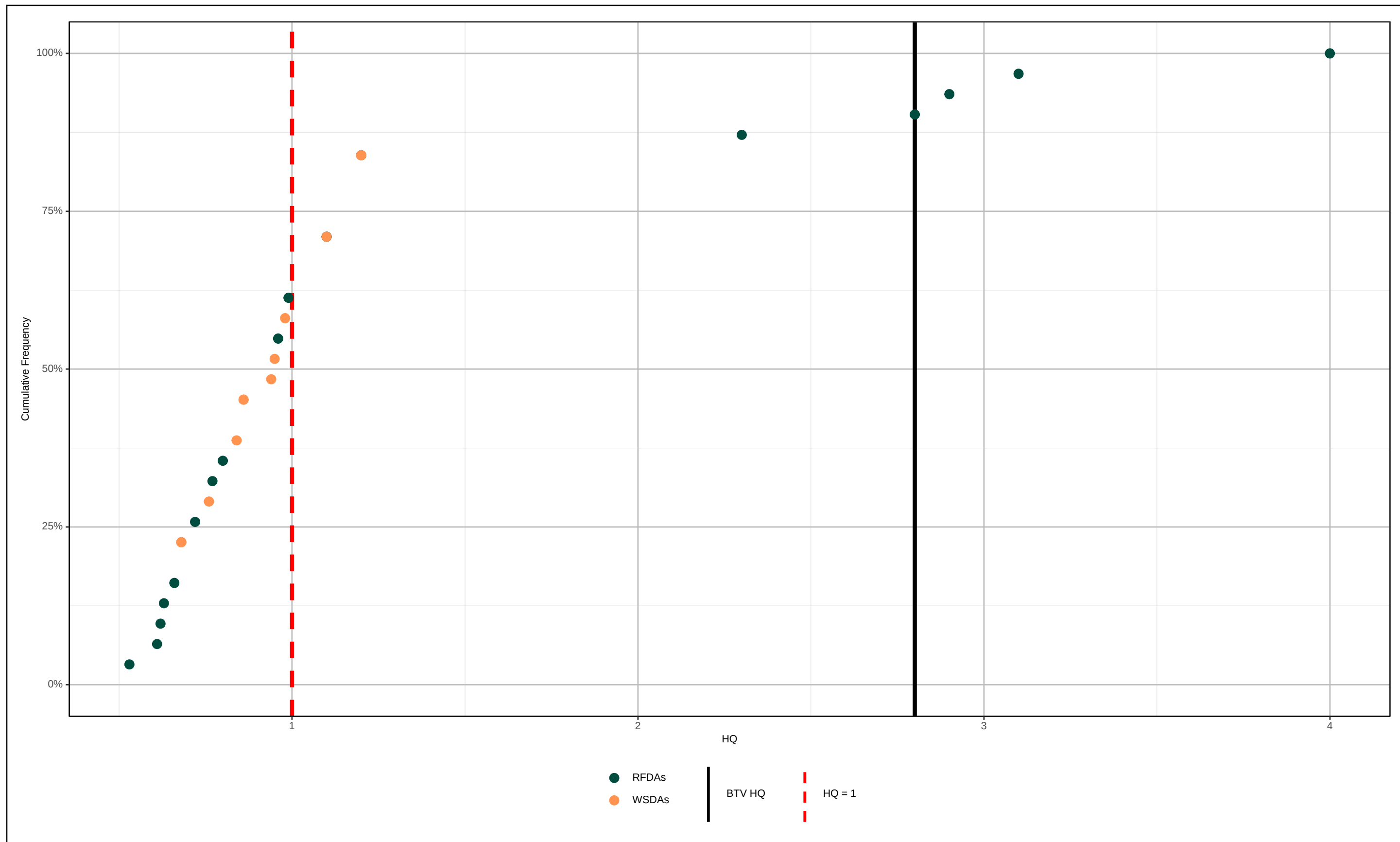


Figure M-36c. Cumulative Frequency of Manganese HQs for Soil Invertebrates in the RFDAs and WSDAs
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

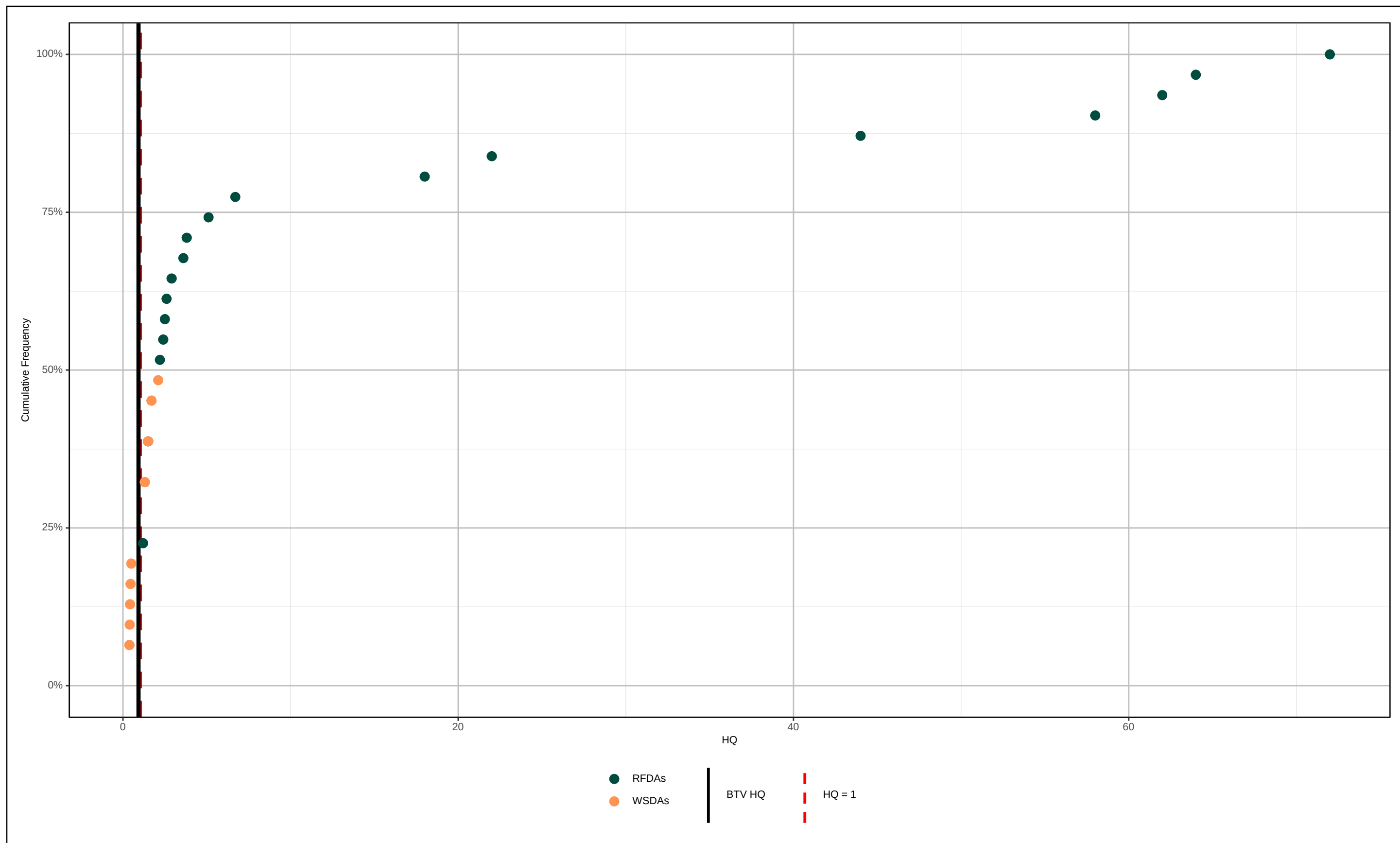


Figure M-36d. Cumulative Frequency of Zinc HQs for Soil Invertebrates in the RFDAs and WSDAs
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

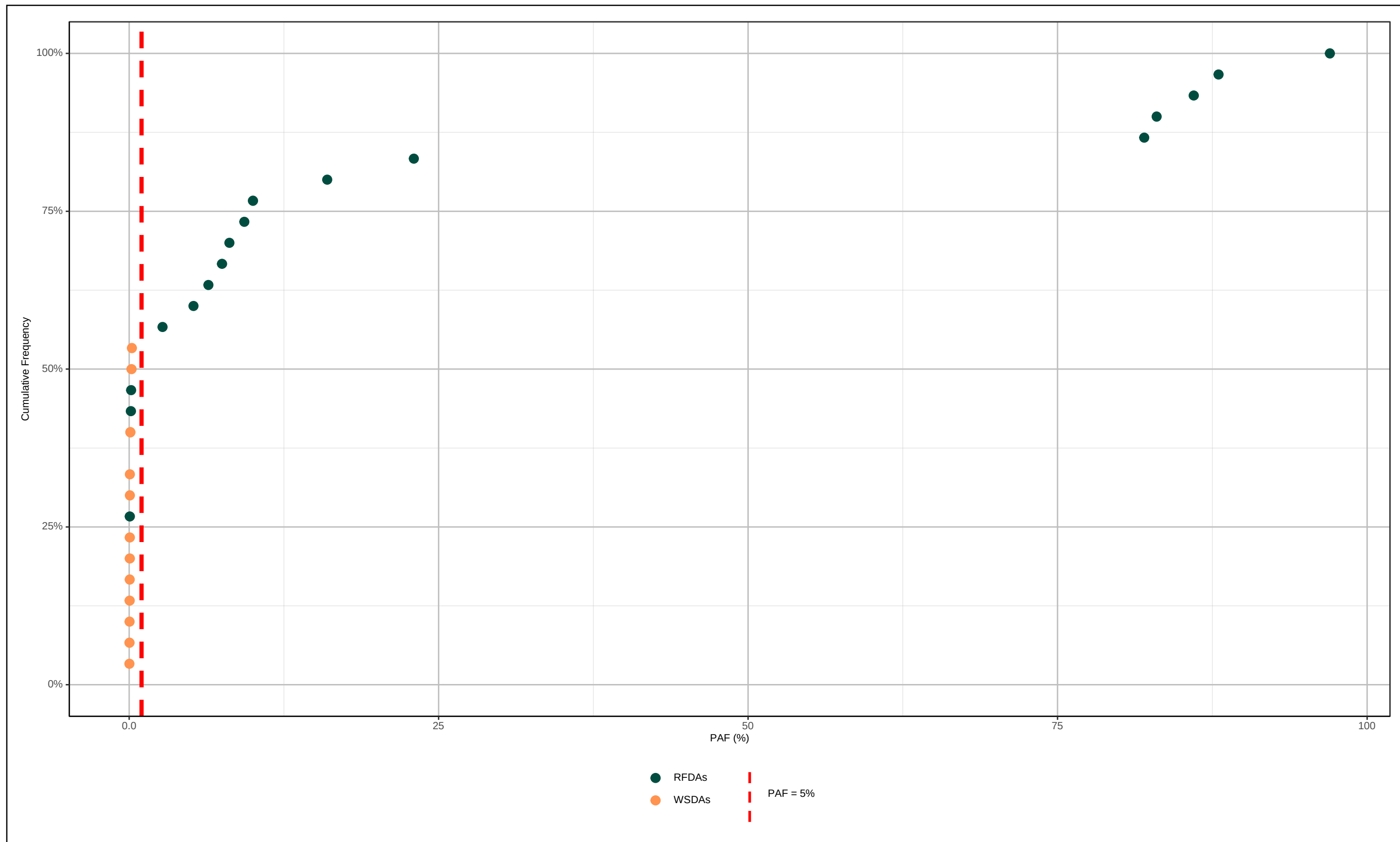


Figure M-37a. Cumulative Frequency of Copper PAFs for Soil Invertebrates in the RFDAs and WSDAs
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

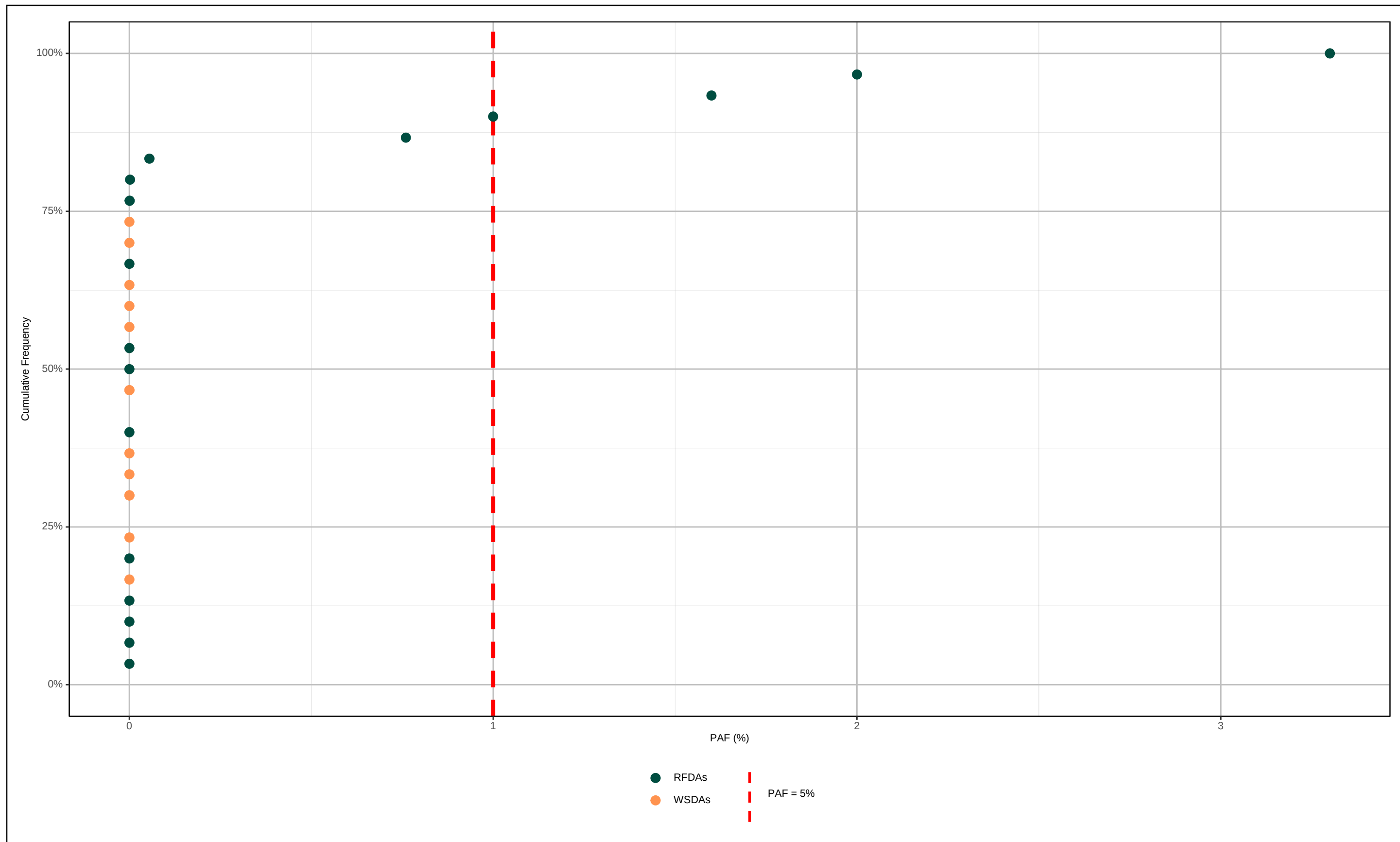


Figure M-37b. Cumulative Frequency of Molybdenum PAFs for Soil Invertebrates in the RFDAs and WSDAs
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

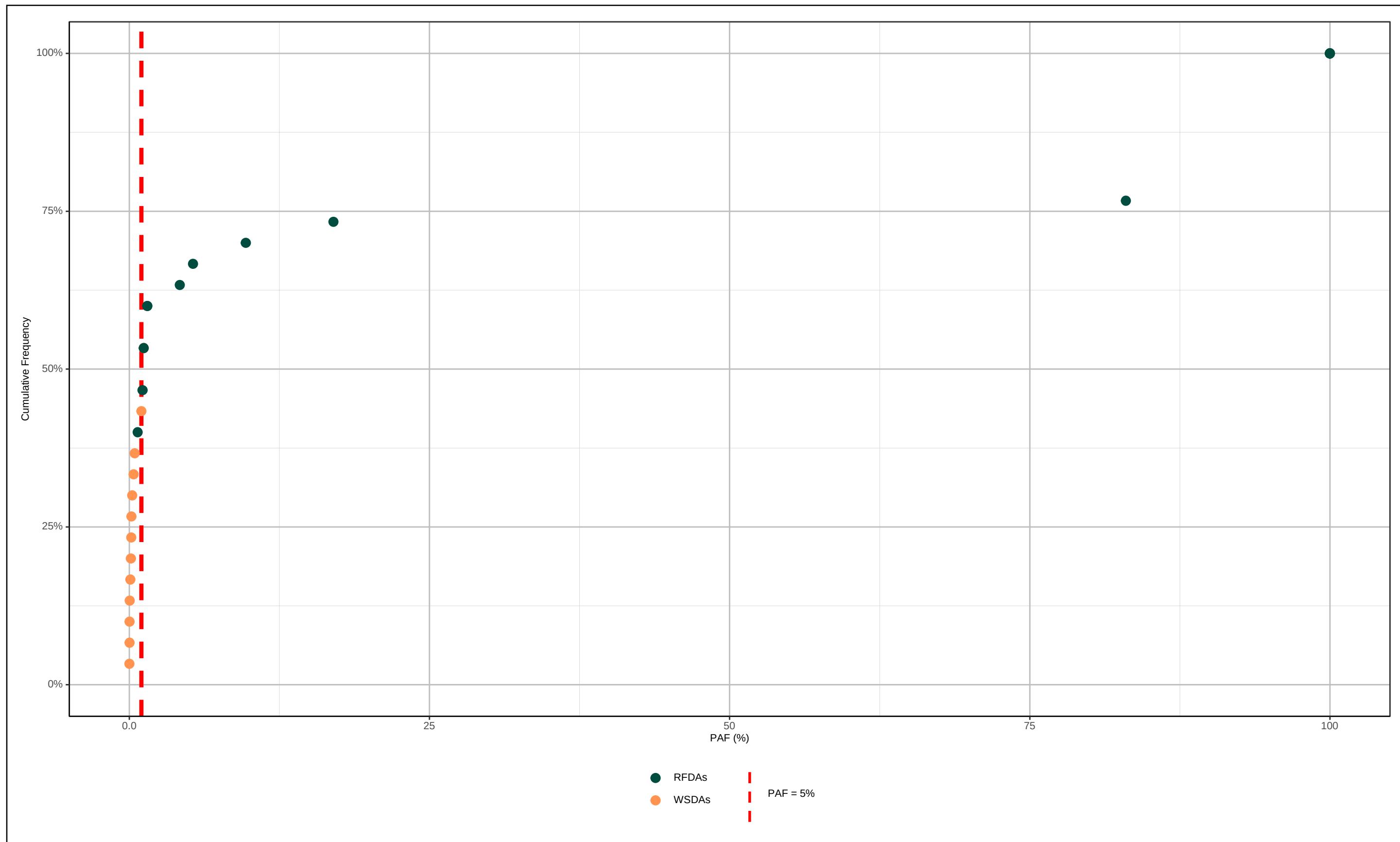


Figure M-37c. Cumulative Frequency of Zinc PAFs for Soil Invertebrates in the RFDAs and WSDAs
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

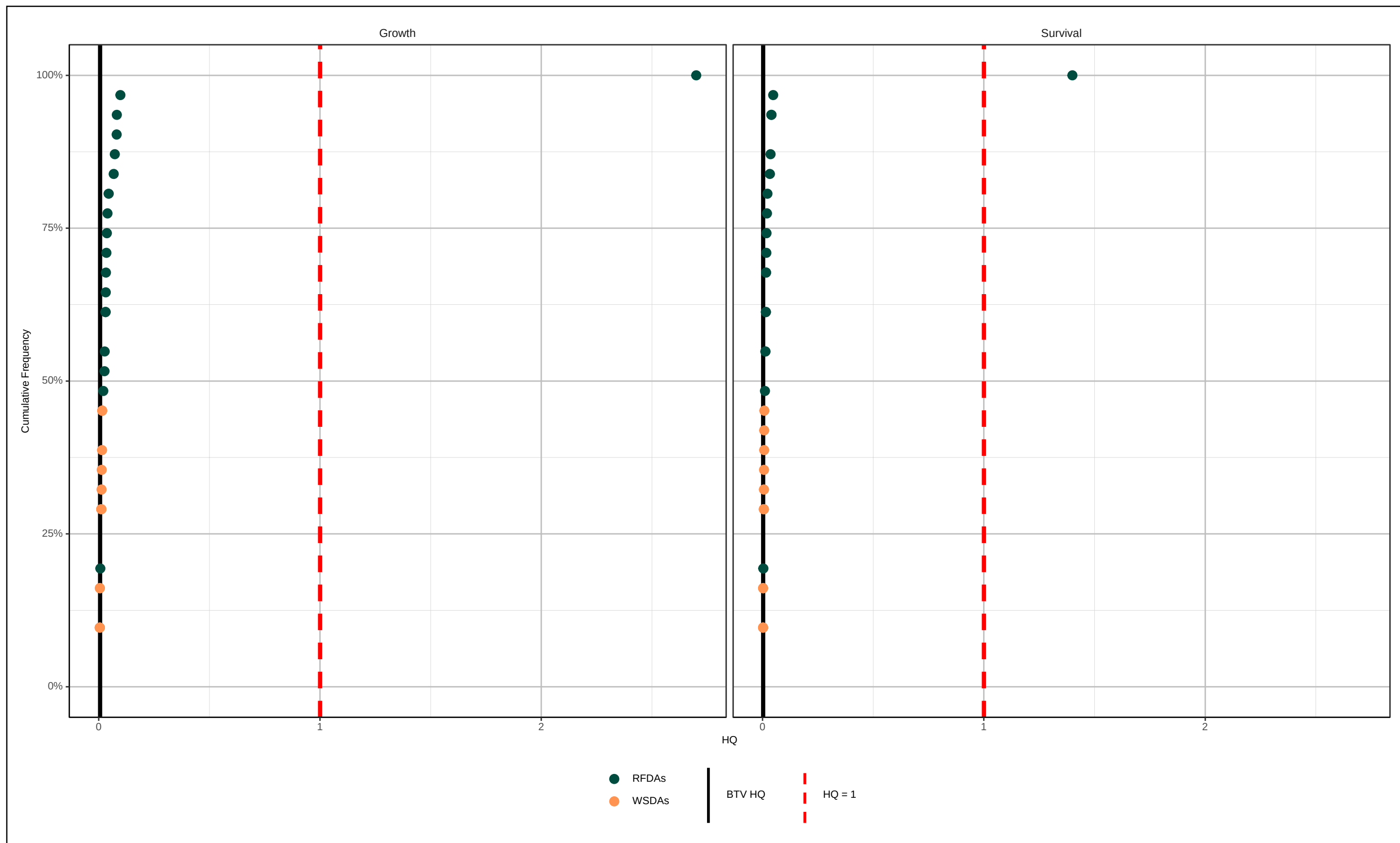


Figure M-38a. Cumulative Frequency of Selenium Dietary HQs for California Quail in the RFDAs and WSDAs
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

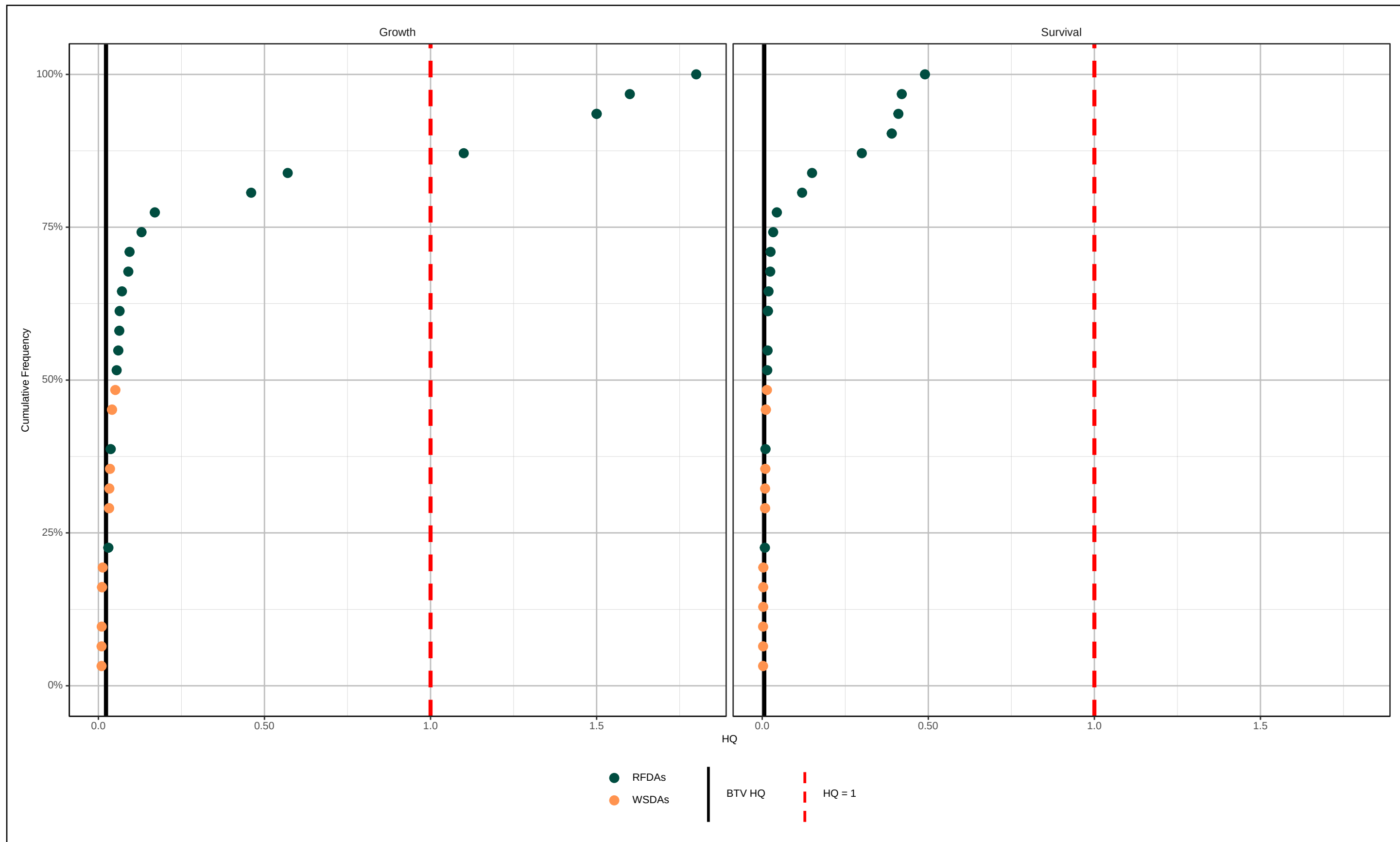


Figure M-38b. Cumulative Frequency of Zinc Dietary HQs for California Quail in the RFDAs and WSDAs
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

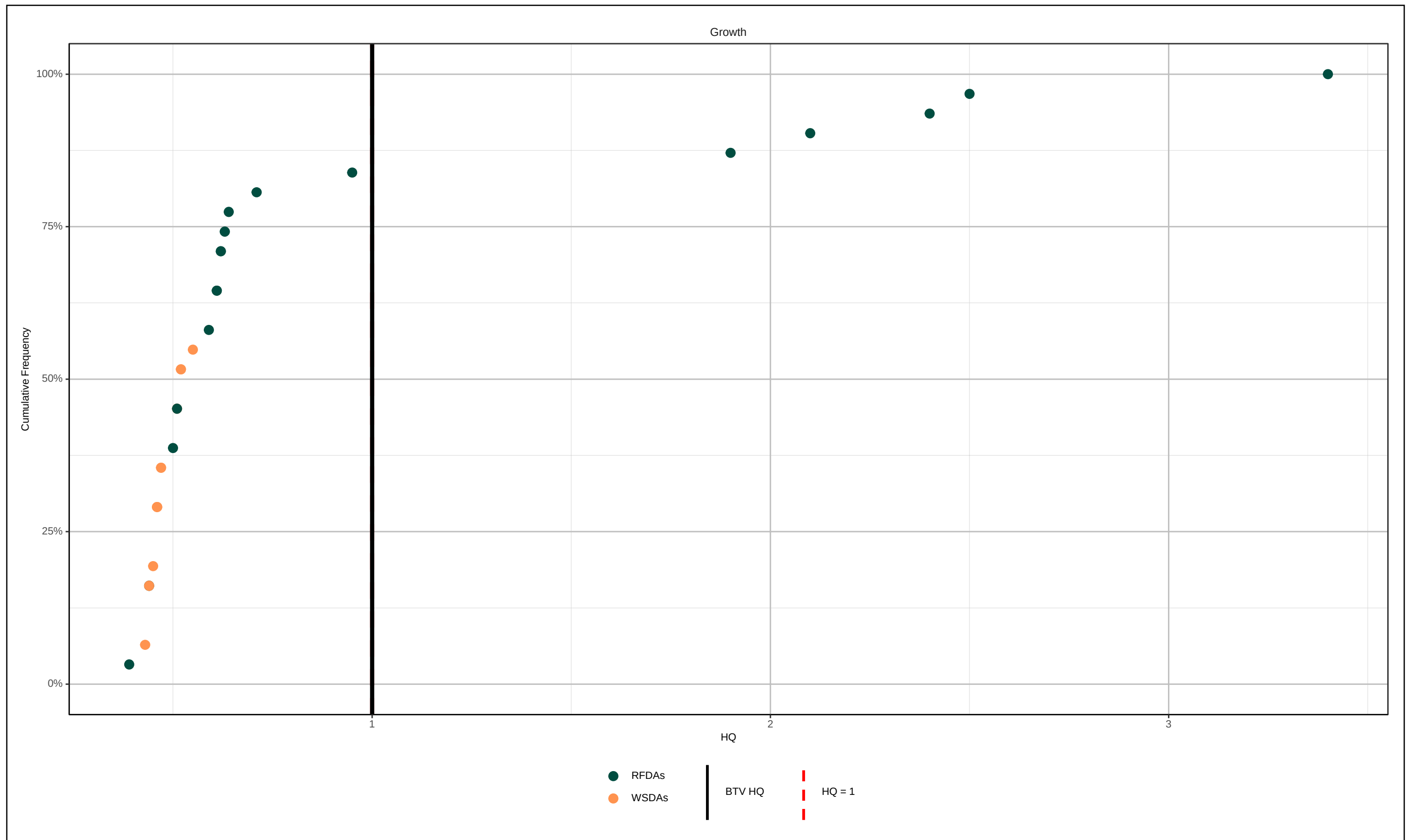


Figure M-38c. Cumulative Frequency of Iron Dietary HQs for American Robin in the RFDAs and WSDAs
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

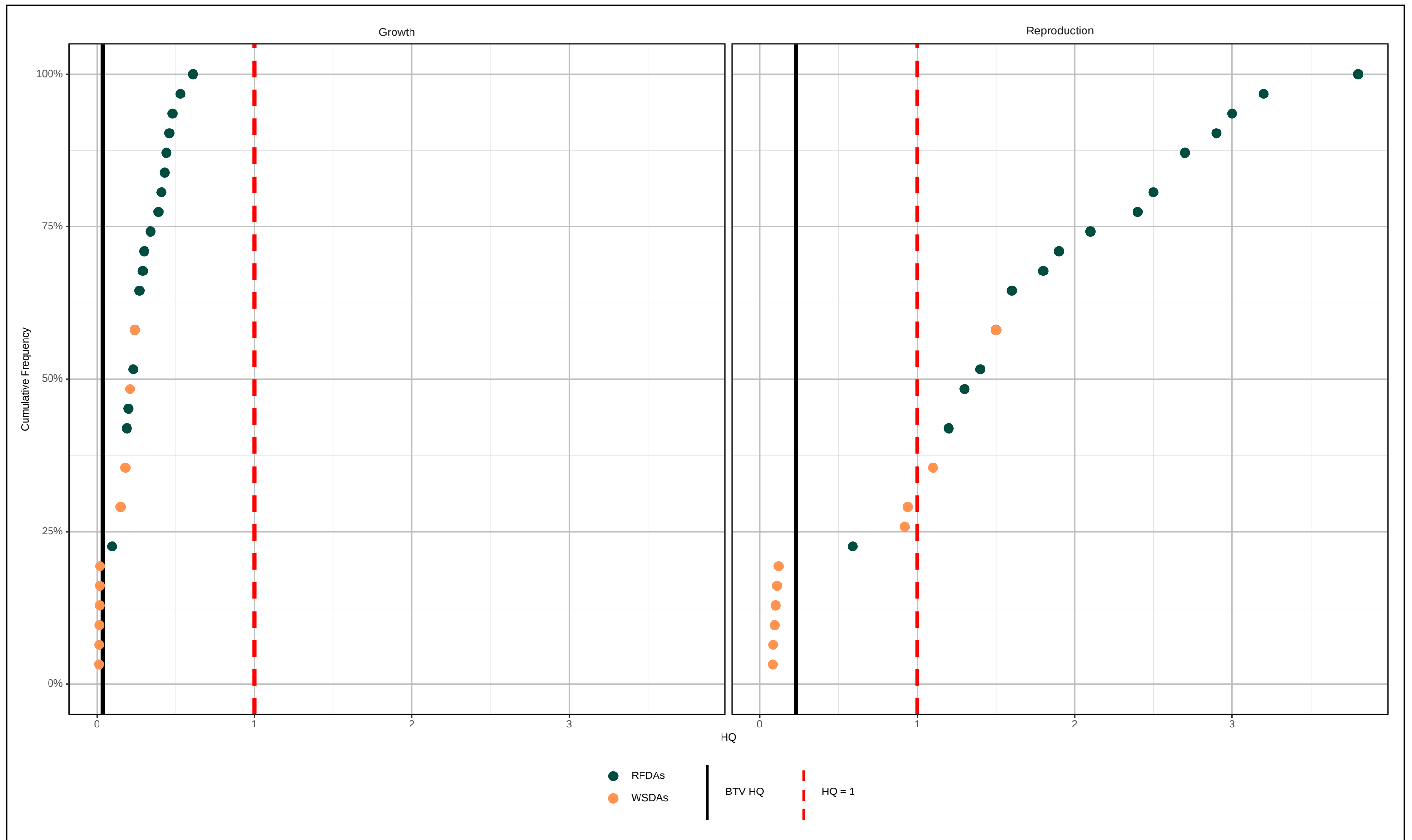


Figure M-38d. Cumulative Frequency of Lead Dietary HQs for American Robin in the RFDAs and WSDAs
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

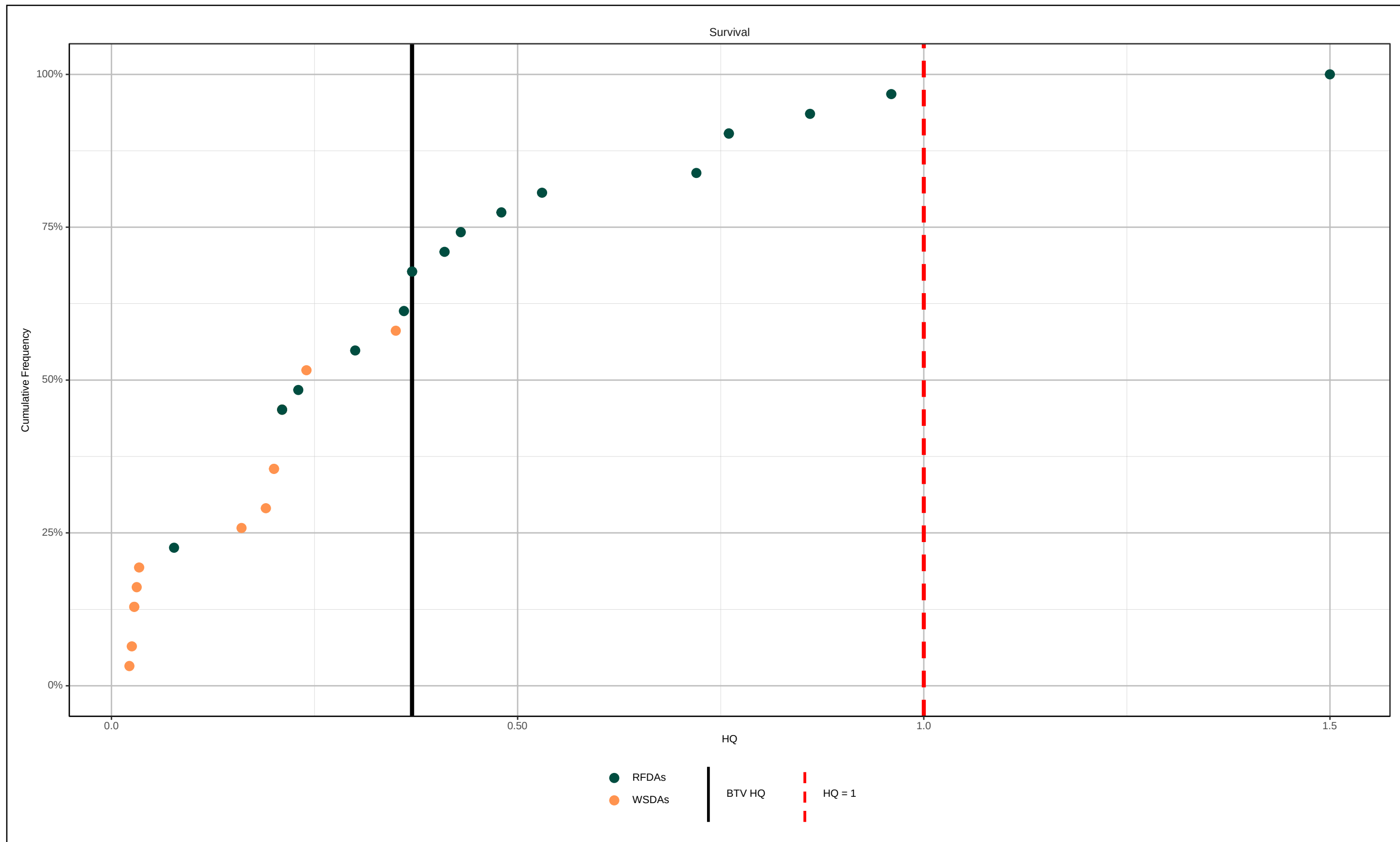


Figure M-38e. Cumulative Frequency of Mercury Dietary HQs for American Robin in the RFDAs and WSDAs
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

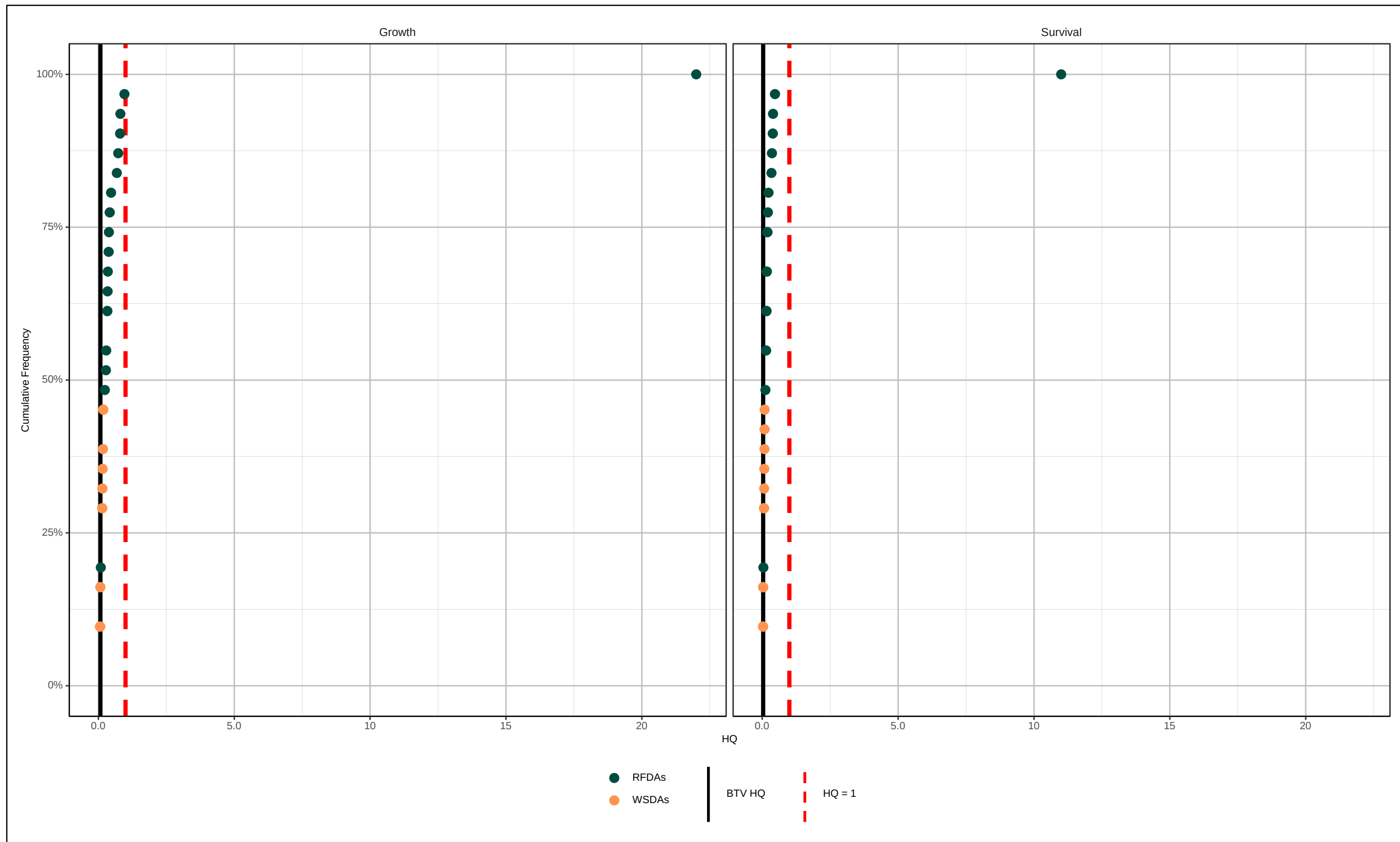


Figure M-38f. Cumulative Frequency of Selenium Dietary HQs for American Robin in the RFDAs and WSDAs
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

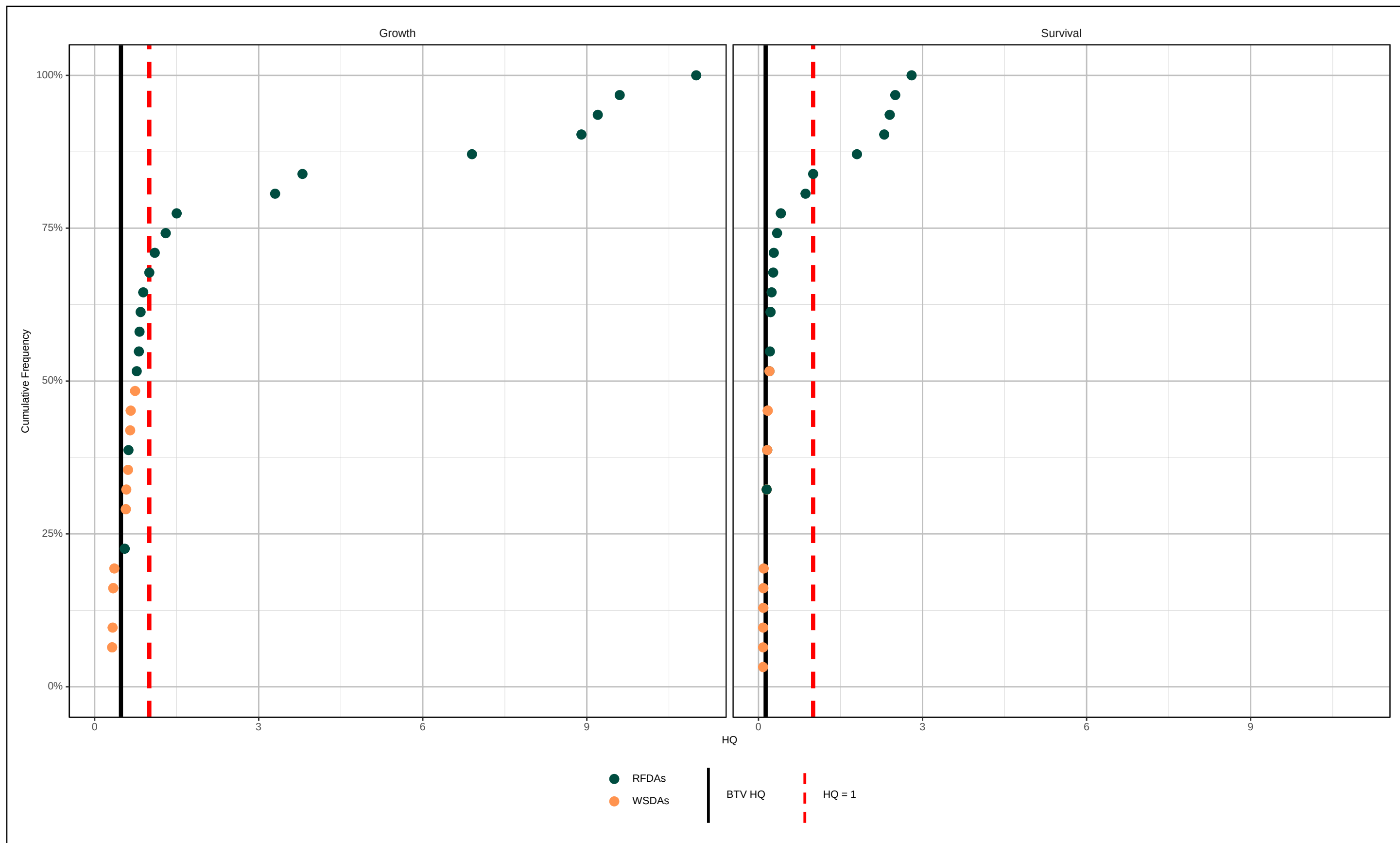


Figure M-38g. Cumulative Frequency of Zinc Dietary HQs for American Robin in the RFDAs and WSDAs
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

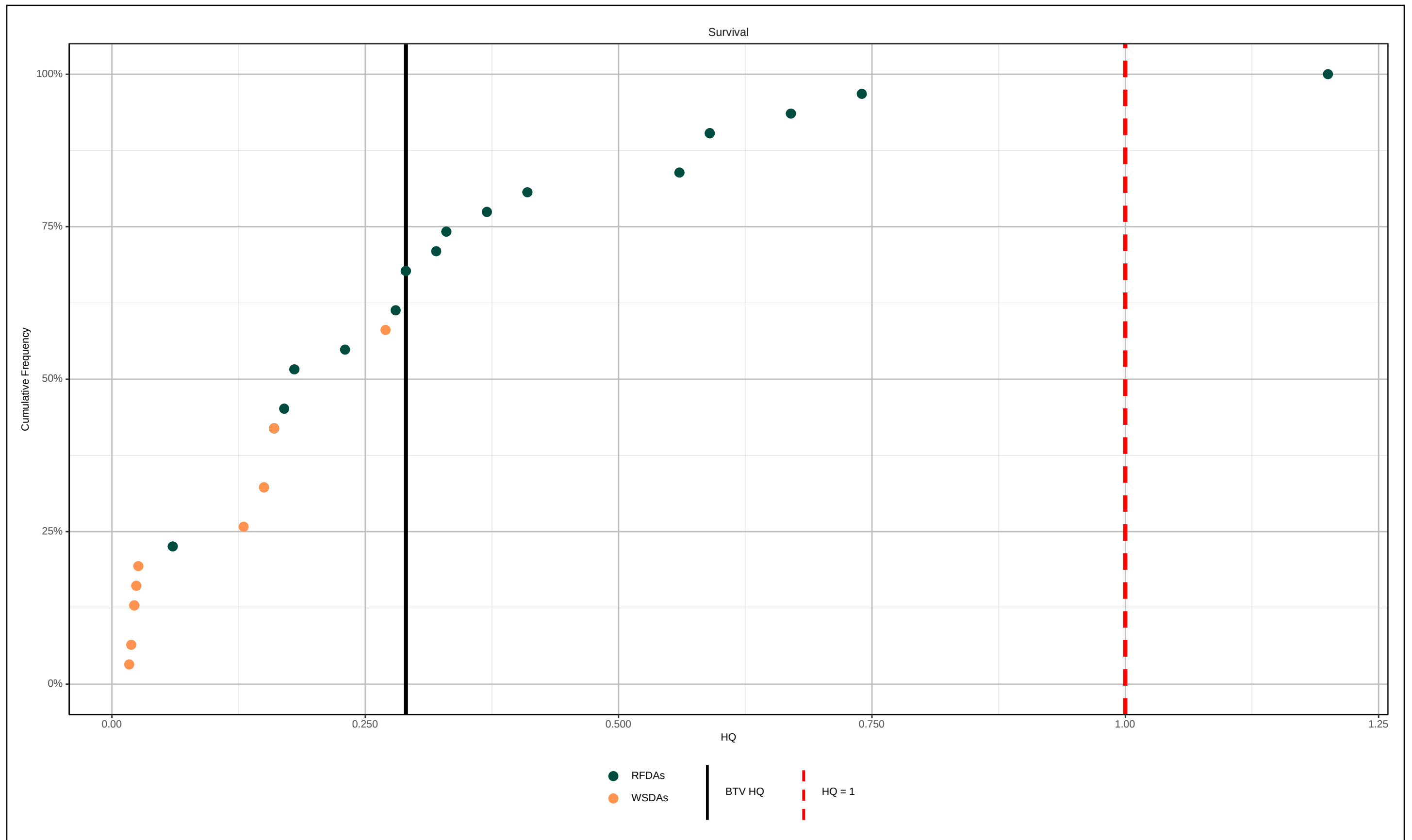


Figure M-38h. Cumulative Frequency of Mercury Dietary HQs for Tree Swallow in the RFDAs and WSDAs
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

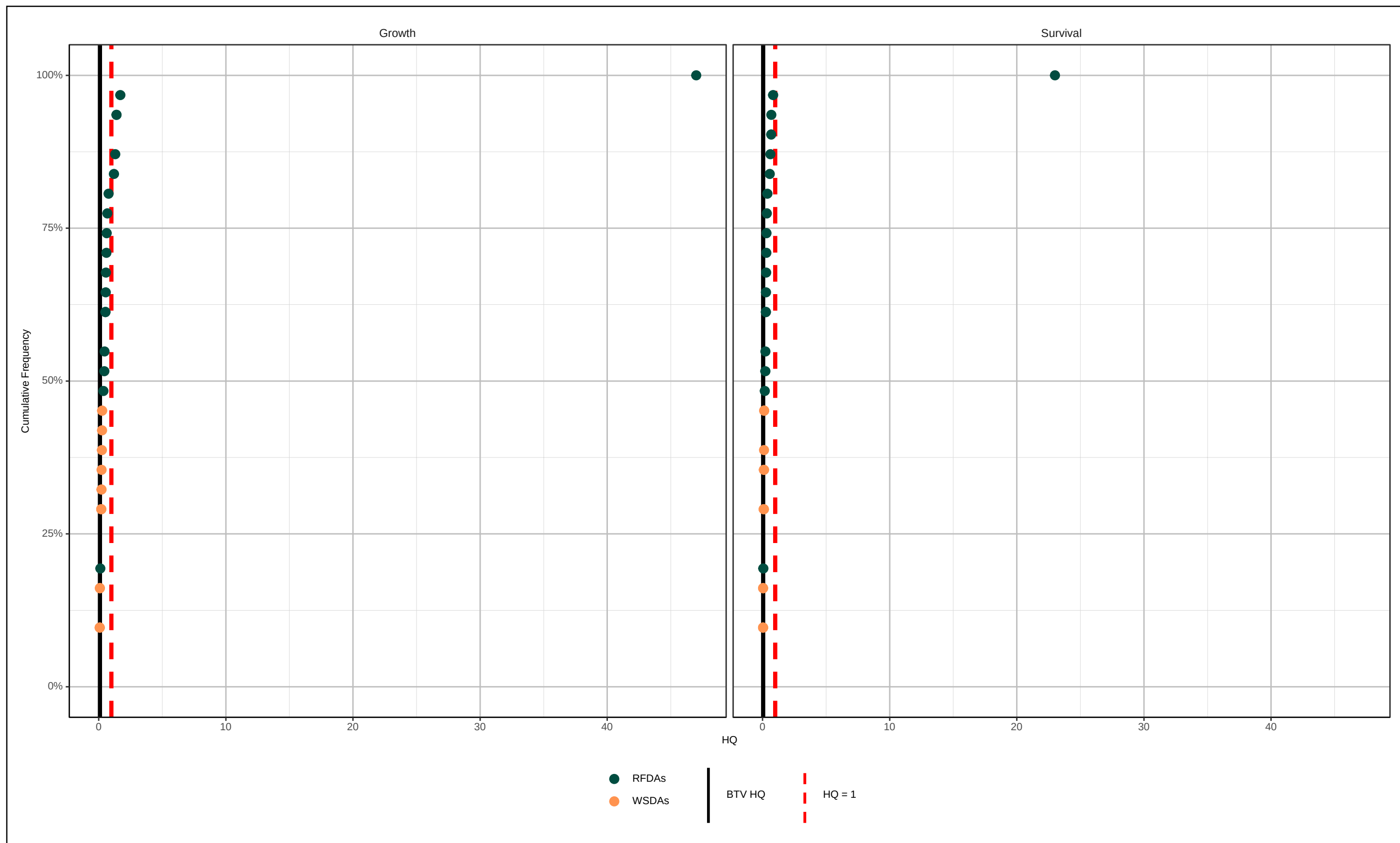


Figure M-38i. Cumulative Frequency of Selenium Dietary HQs for Tree Swallow in the RFDAs and WSDAs
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

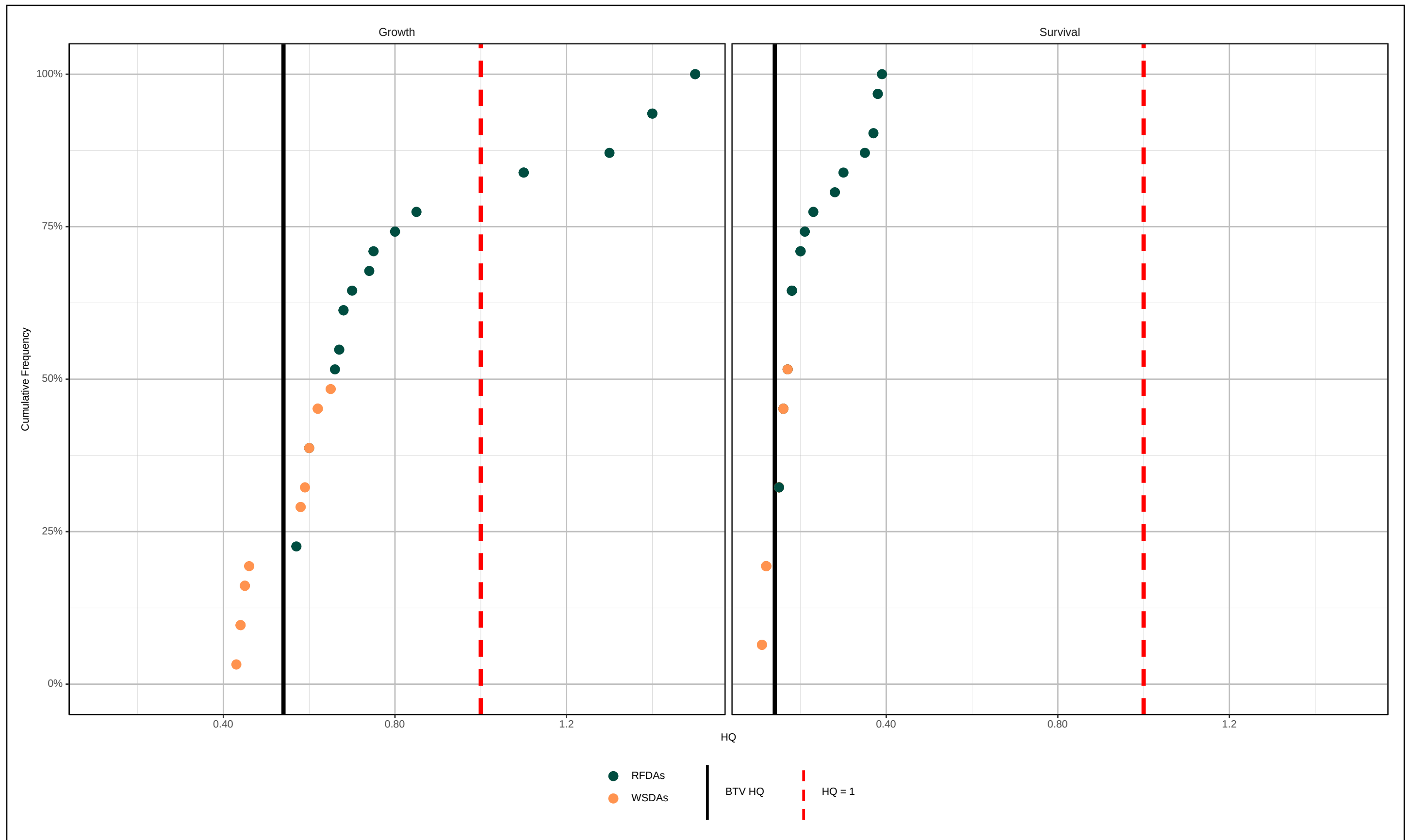


Figure M-38j. Cumulative Frequency of Zinc Dietary HQs for Tree Swallow in the RFDAs and WSDAs
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

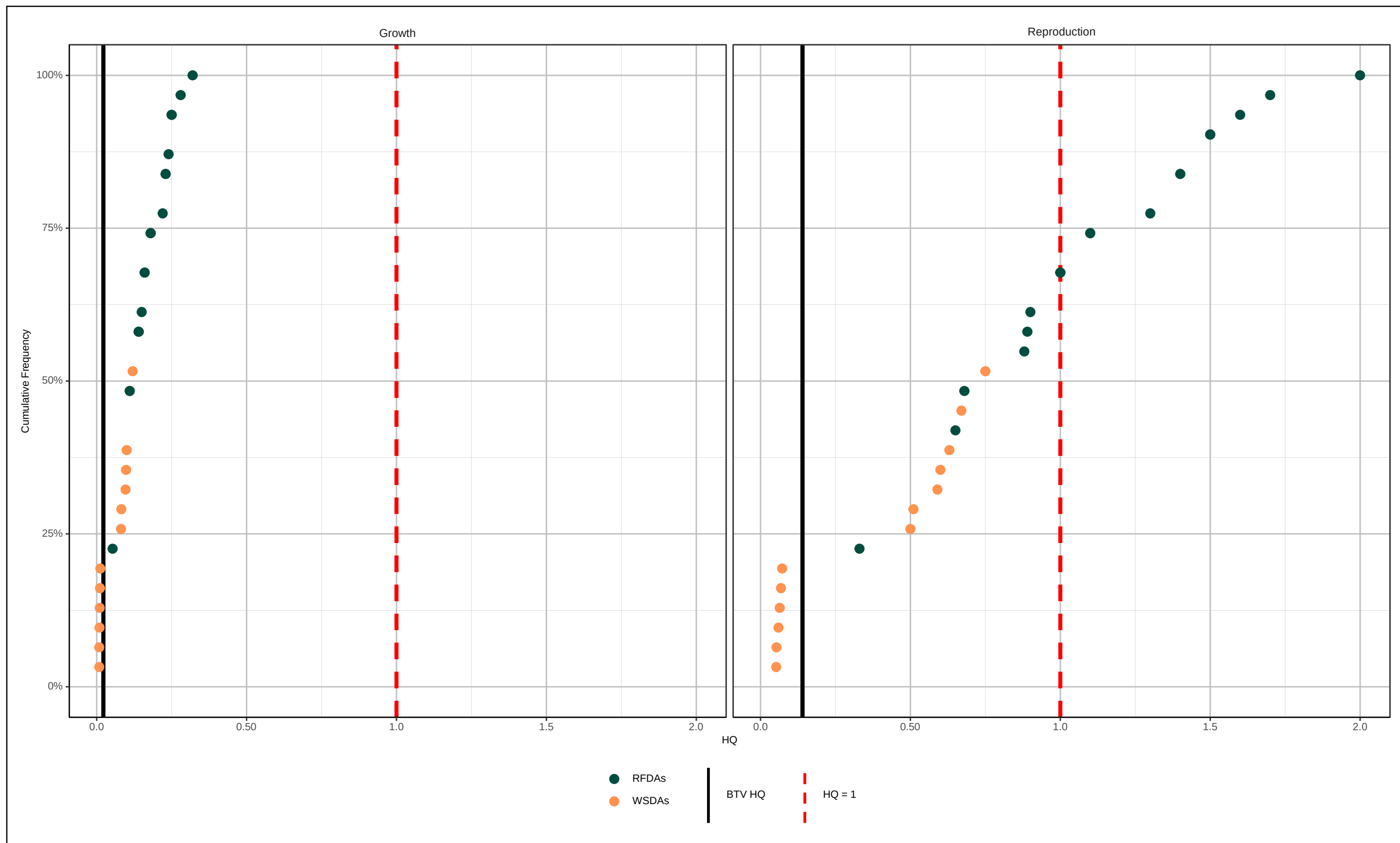


Figure M-38k. Cumulative Frequency of Lead Dietary HQs for Black-Capped Chickadee in the RFDA and WSDA
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

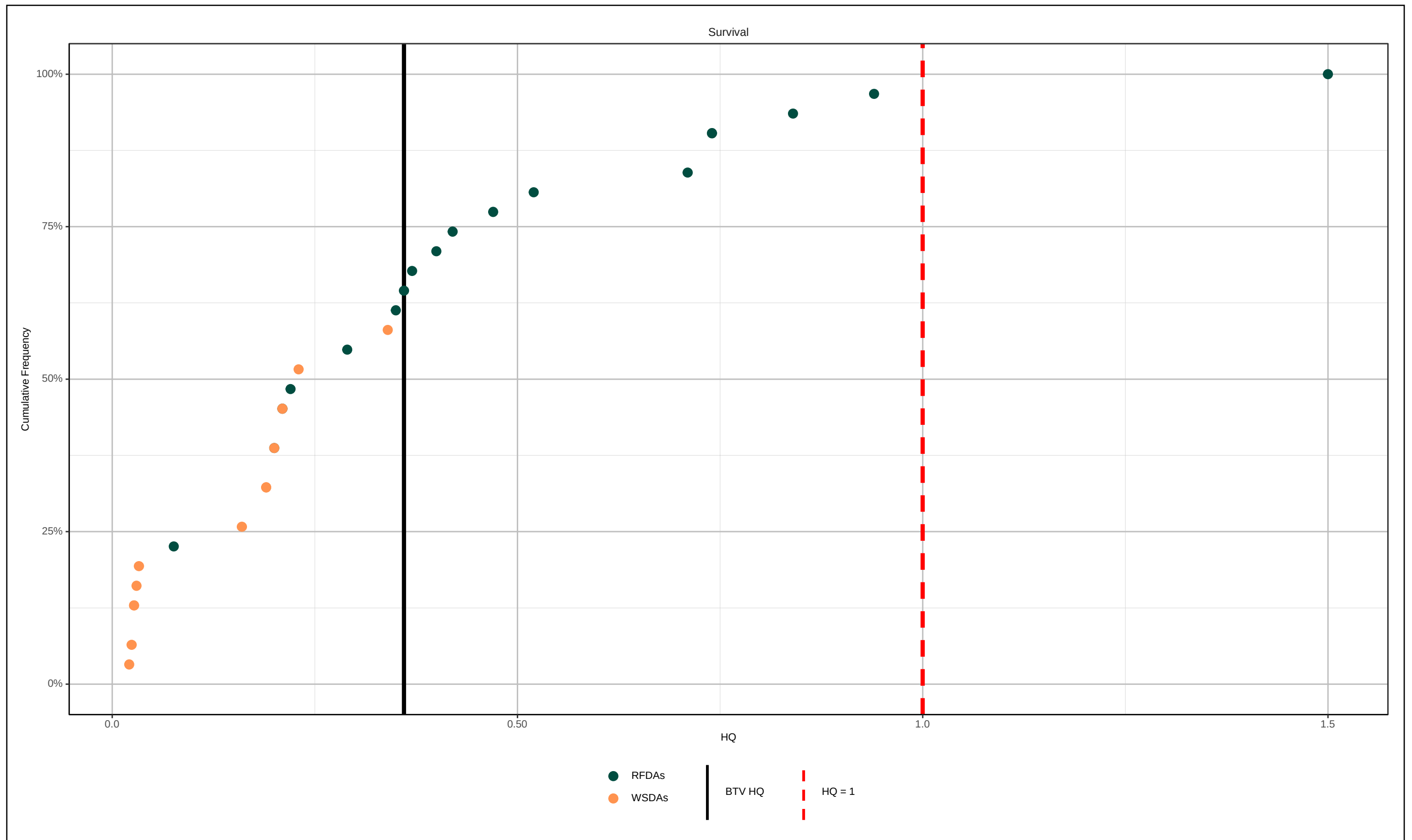


Figure M-38I. Cumulative Frequency of Mercury Dietary HQs for Black-Capped Chickadee in the RFDAs and WSDAs
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

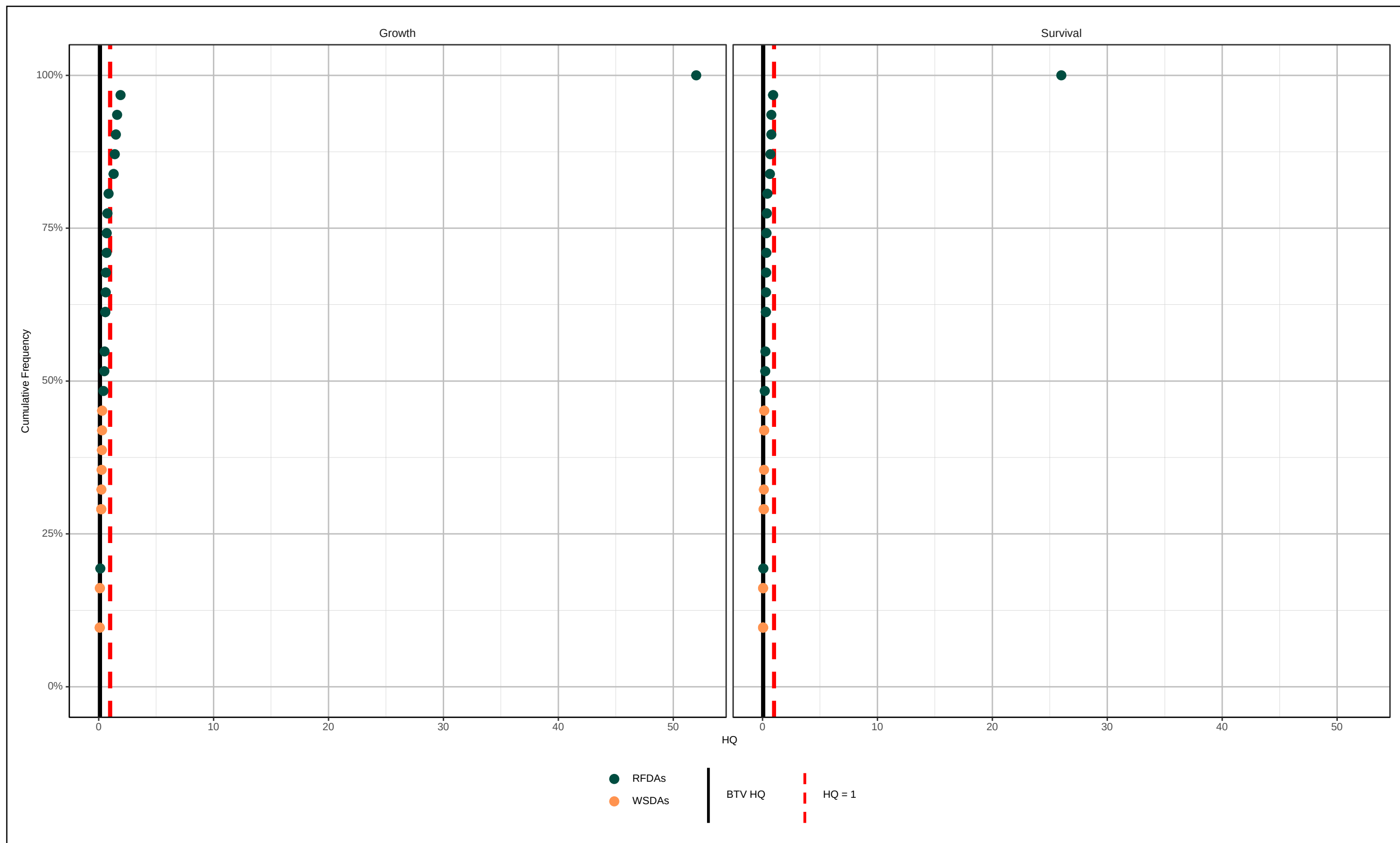


Figure M-38m. Cumulative Frequency of Selenium Dietary HQs for Black-Capped Chickadee in the RFDAs and WSDAs
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

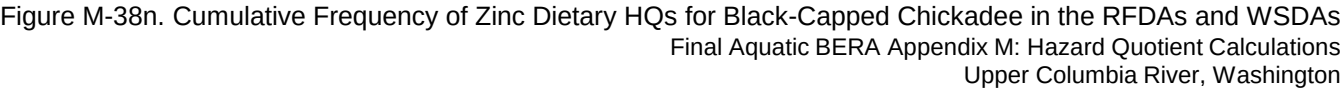


Figure M-38n. Cumulative Frequency of Zinc Dietary HQs for Black-Capped Chickadee in the RFDAs and WSDAs
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

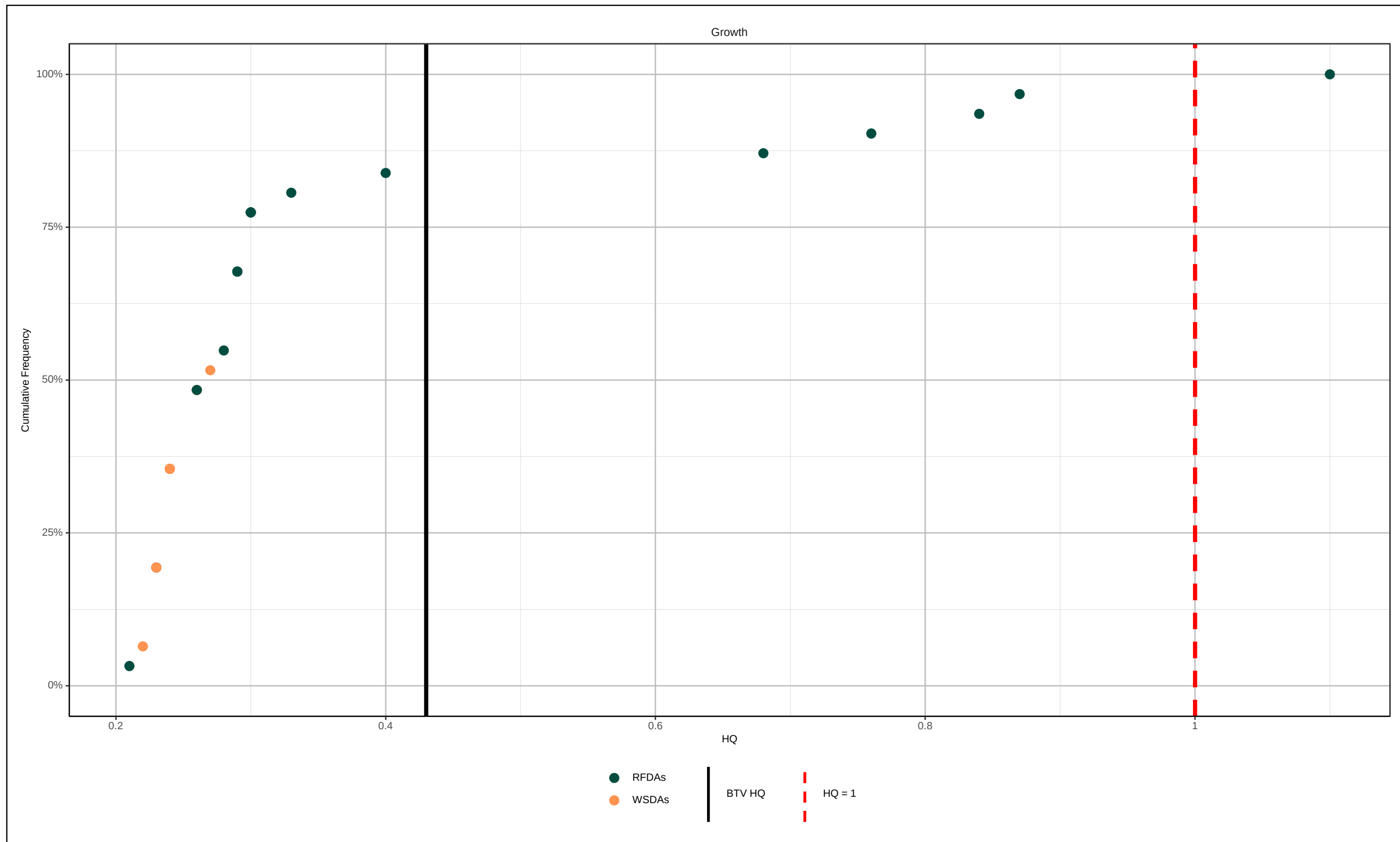


Figure M-380. Cumulative Frequency of Iron Dietary HQs for American Kestrel in the RFDAs and WSDAs
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

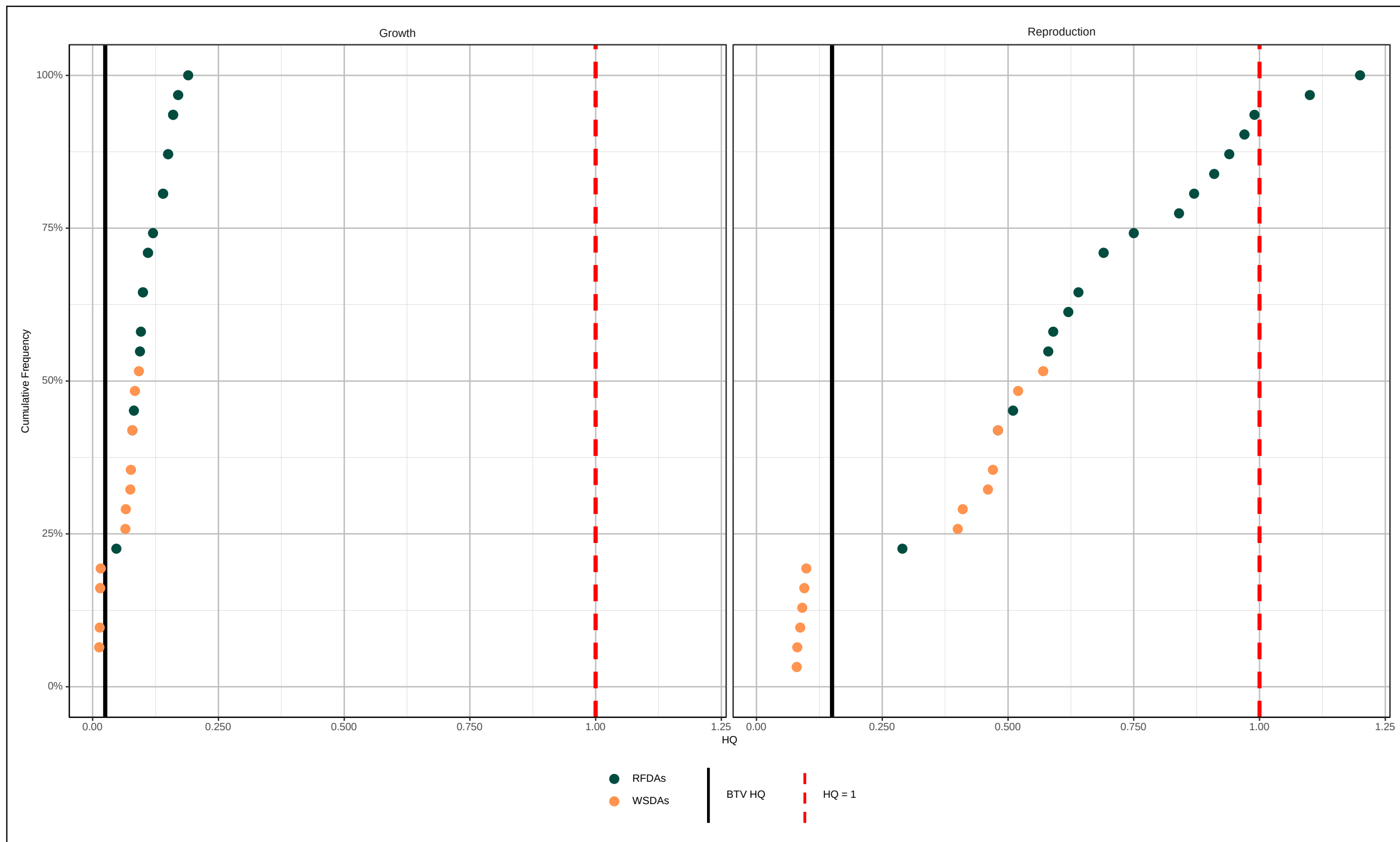


Figure M-38p. Cumulative Frequency of Lead Dietary HQs for American Kestrel in the RFDAs and WSDAs
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

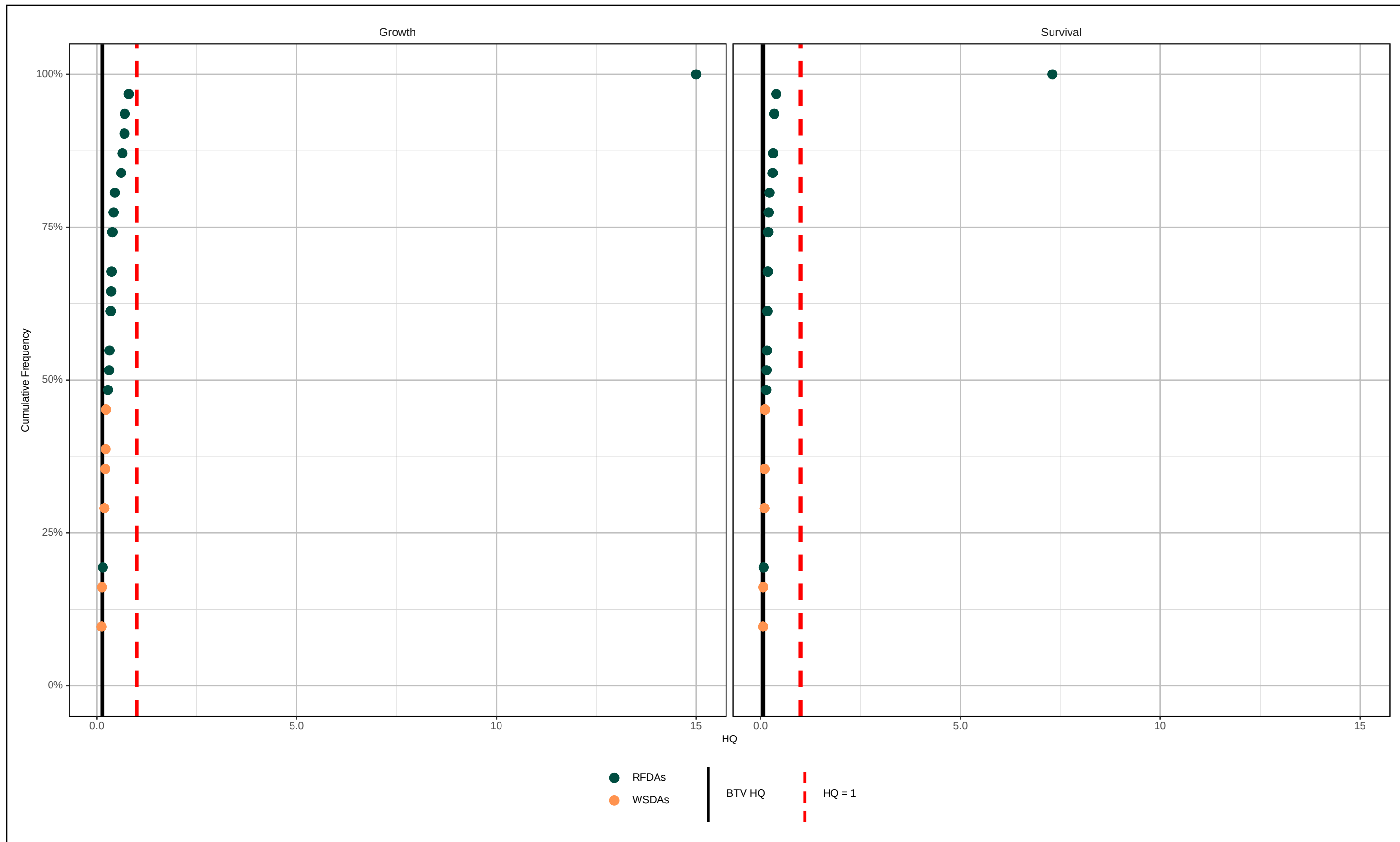


Figure M-38q. Cumulative Frequency of Selenium Dietary HQs for American Kestrel in the RFDAs and WSDAs
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

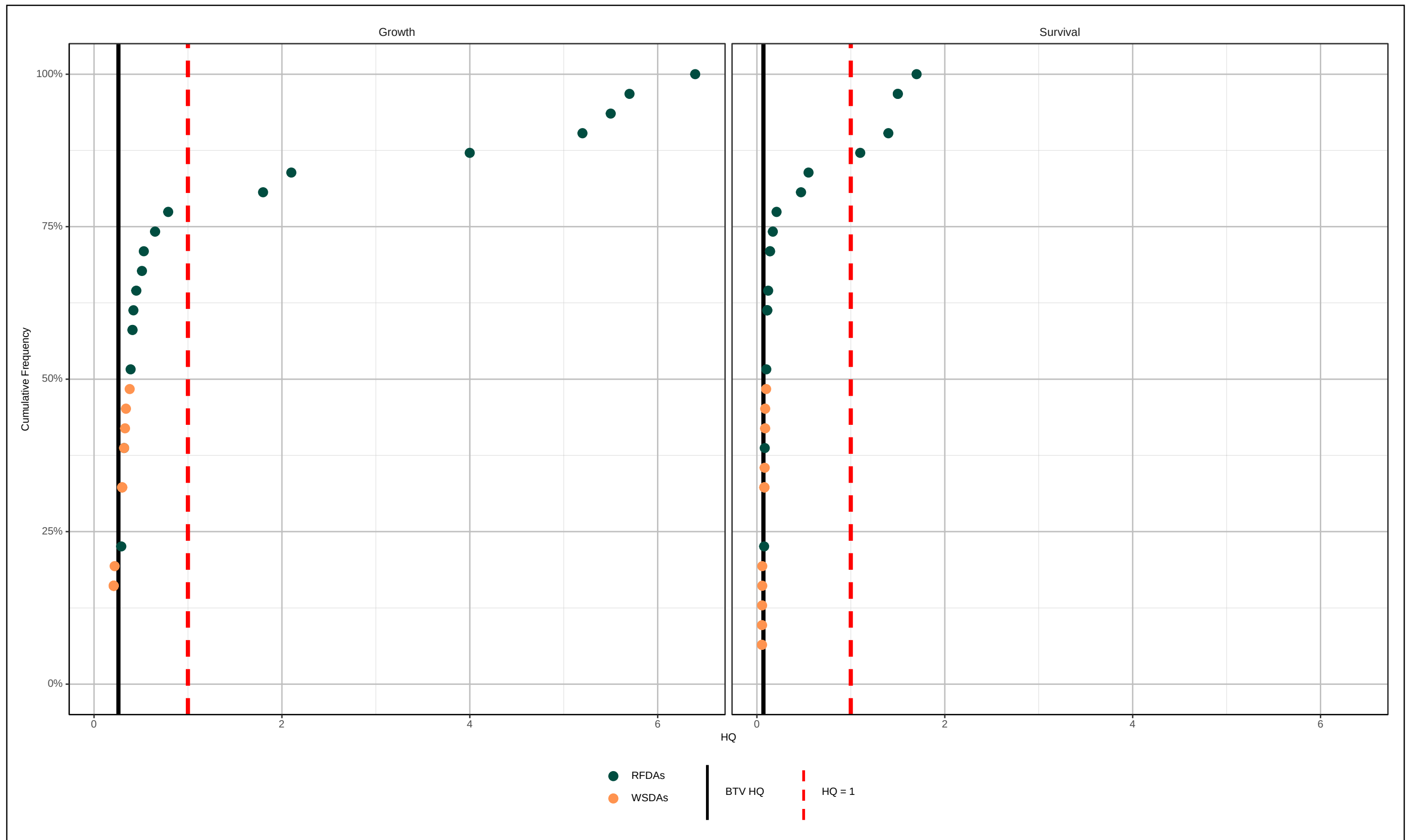
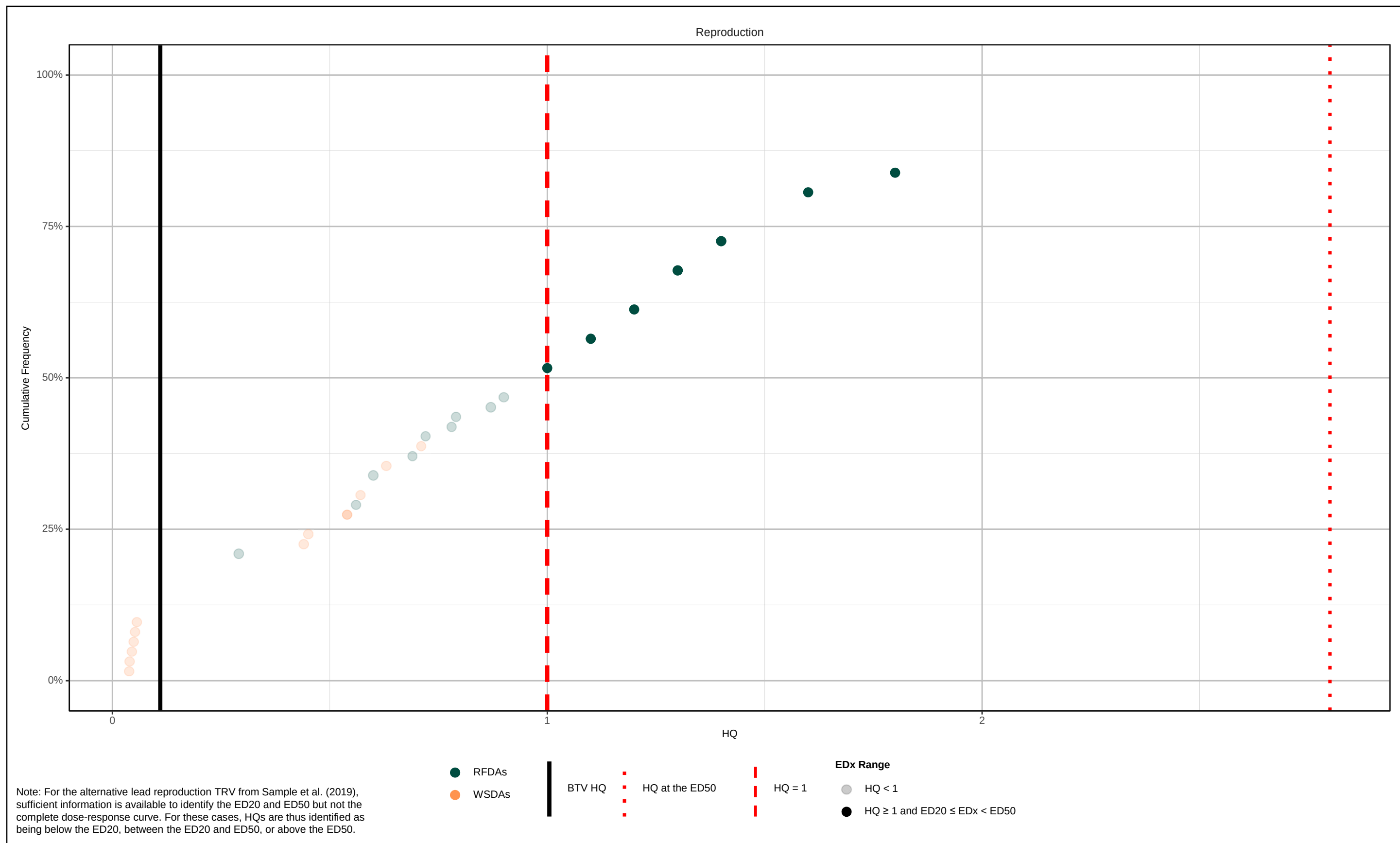


Figure M-38r. Cumulative Frequency of Zinc Dietary HQs for American Kestrel in the RFDAs and WSDAs
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington



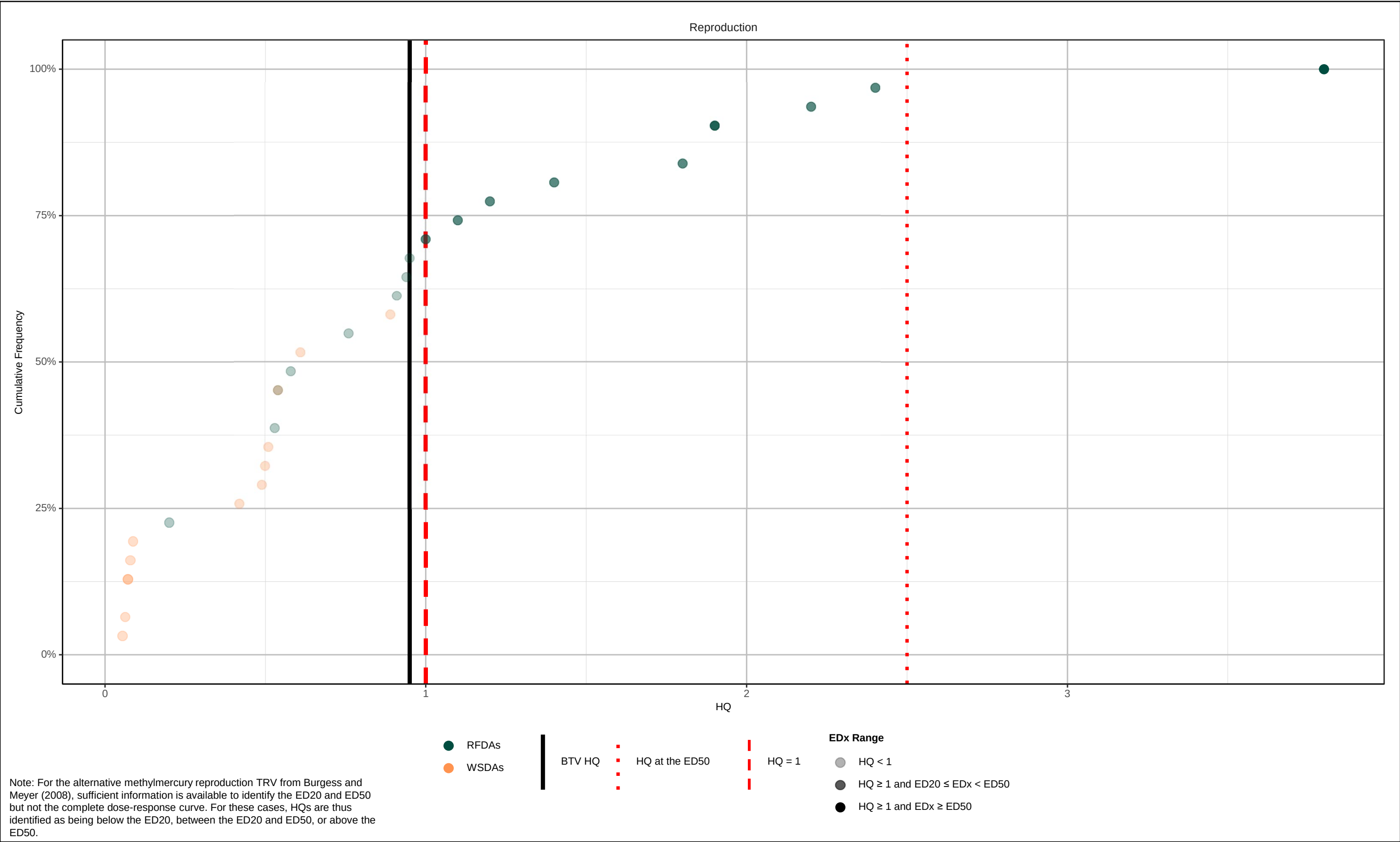


Figure M-38t. Cumulative Frequency of Alternative Mercury Reproduction Dietary HQs for American Robin in the RFDAs and WSDAs
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

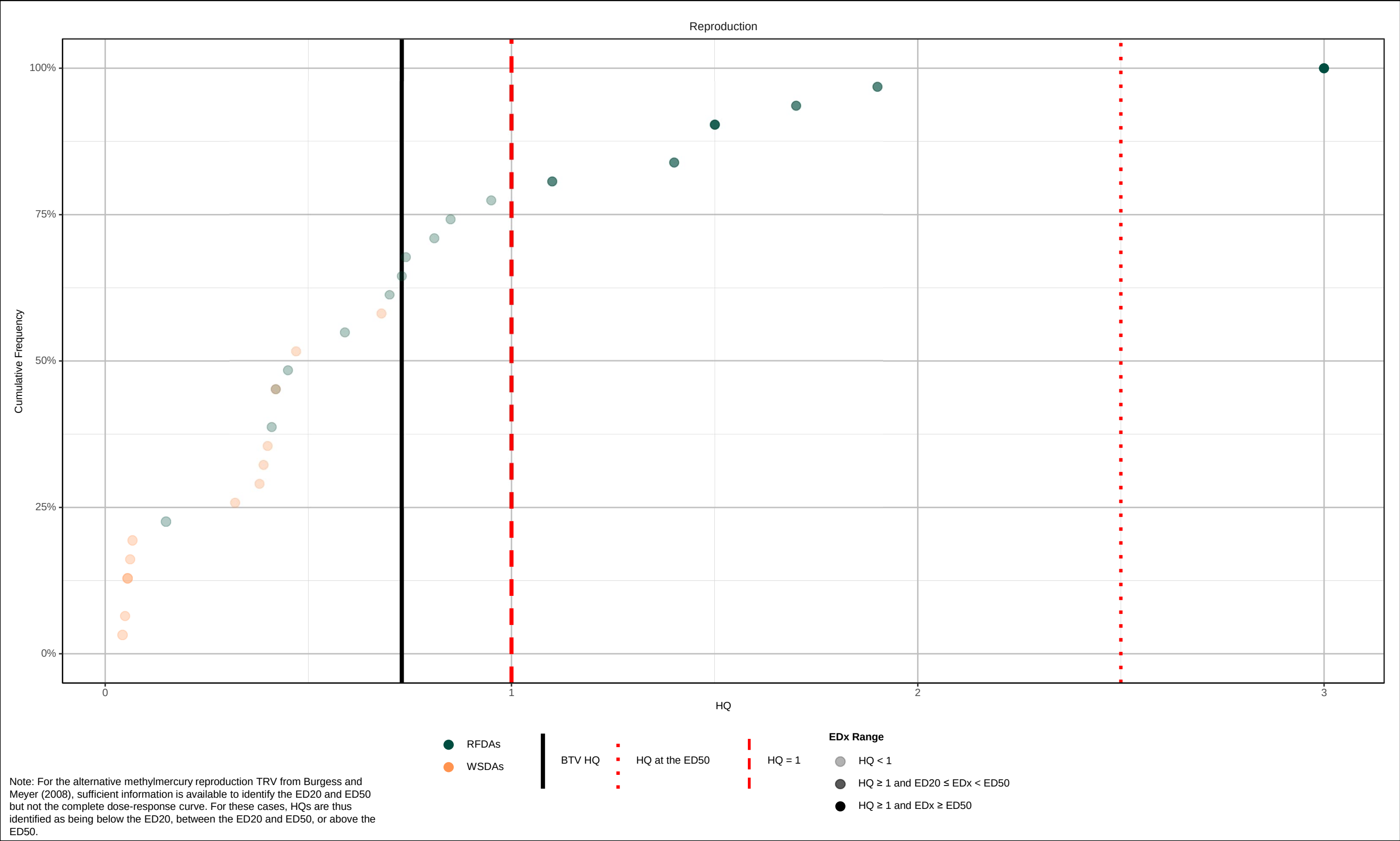


Figure M-38u. Cumulative Frequency of Alternative Mercury Reproduction Dietary HQs for Tree Swallow in the RFDAs and WSDAs
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

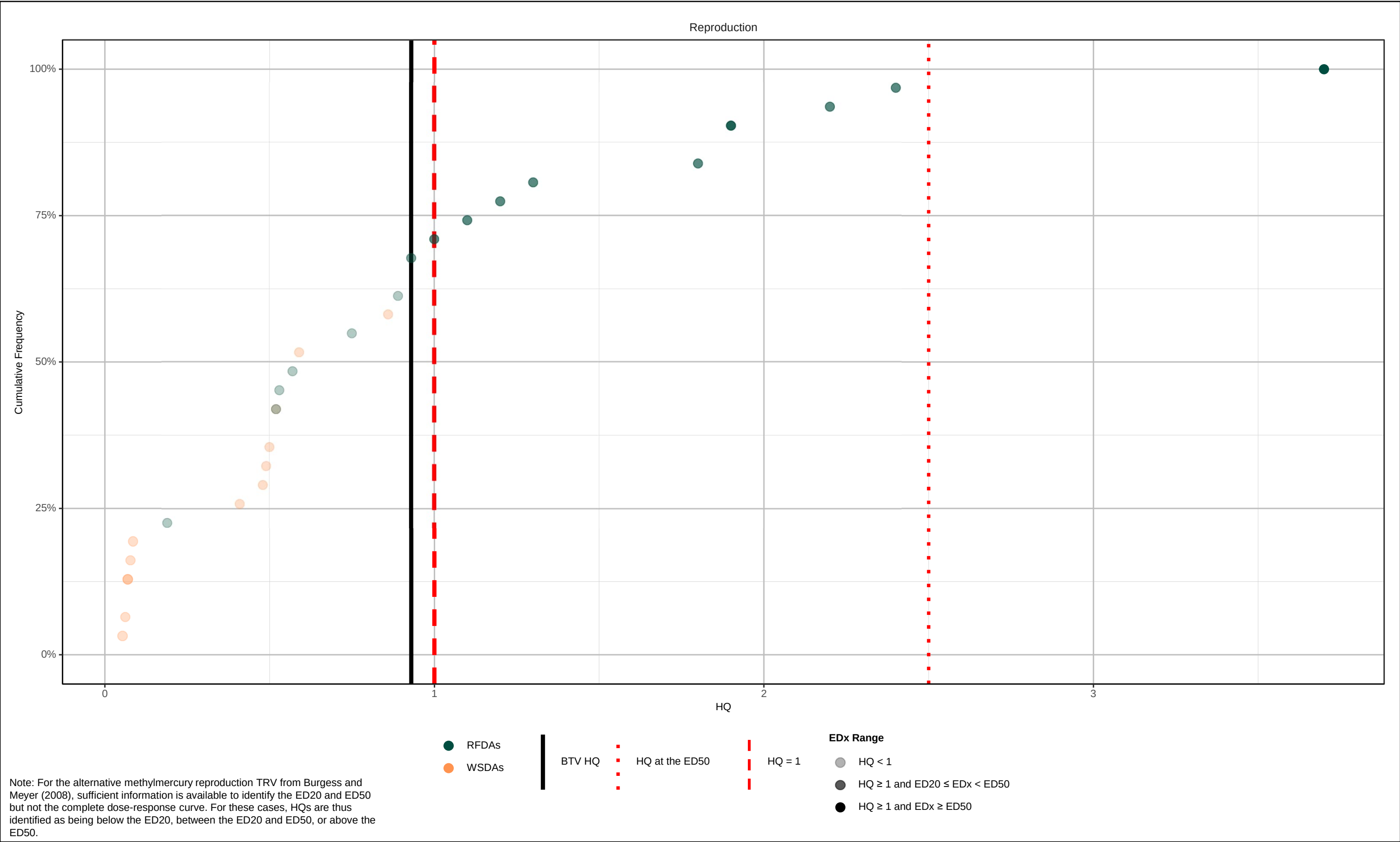


Figure M-38v. Cumulative Frequency of Alternative Mercury Reproduction Dietary HQs for Black-Capped Chickadee in the RFDAs and WSDAs
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

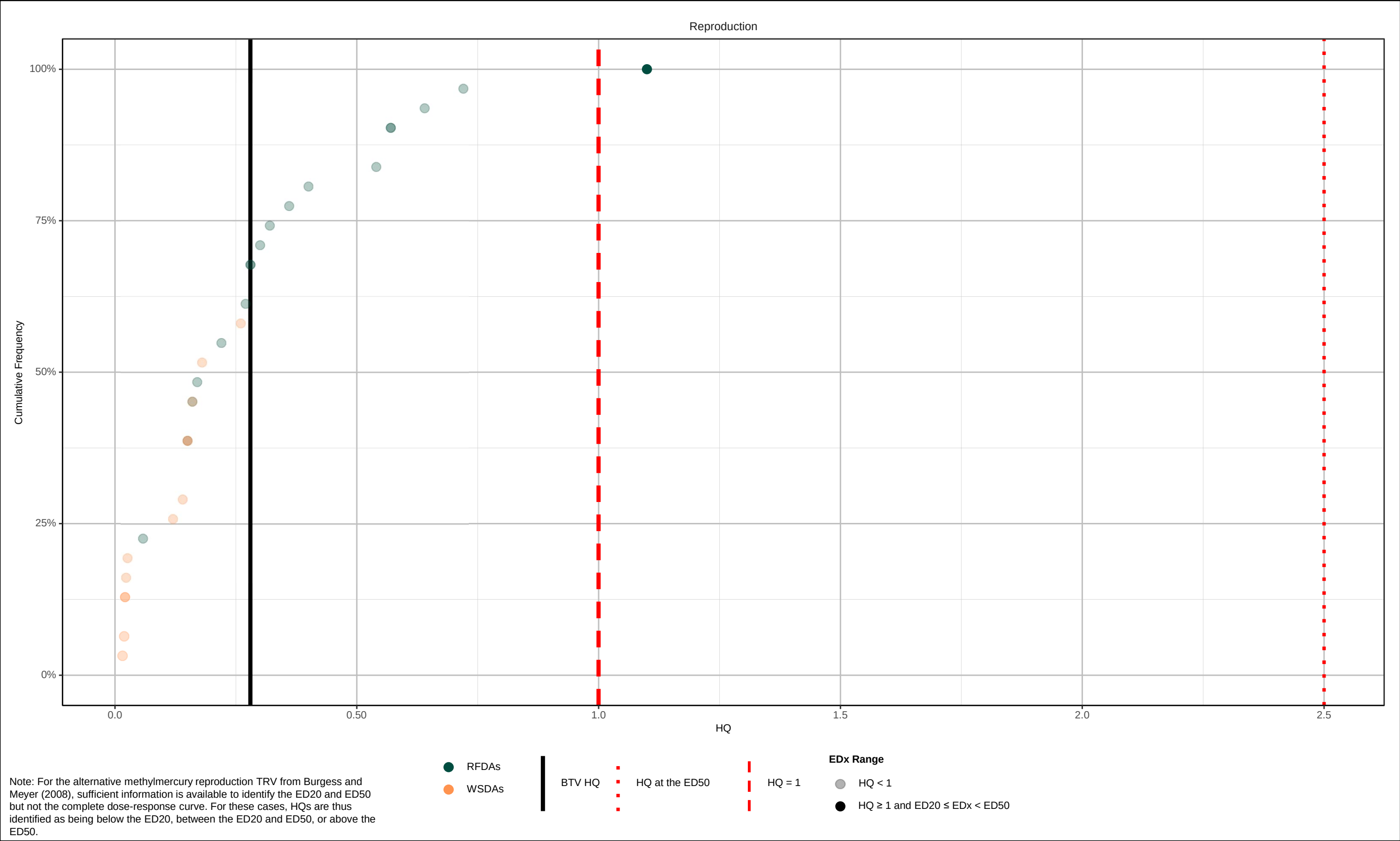


Figure M-38w. Cumulative Frequency of Alternative Mercury Reproduction Dietary HQs for American Kestrel in the RFDAs and WSDAs
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

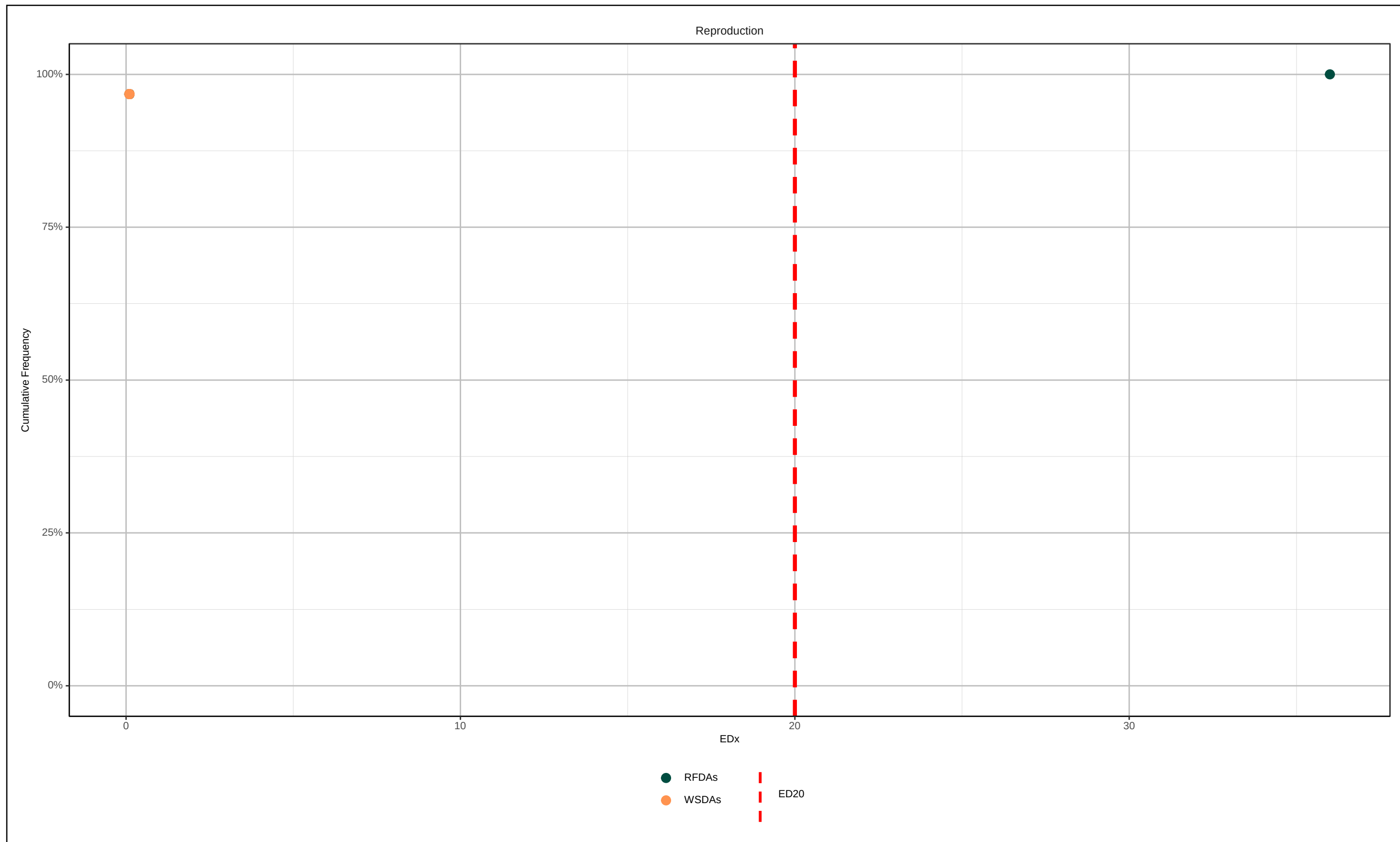


Figure M-39a. Cumulative Frequency of Selenium EDx Values for California Quail in the RFDAs and WSDAs
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

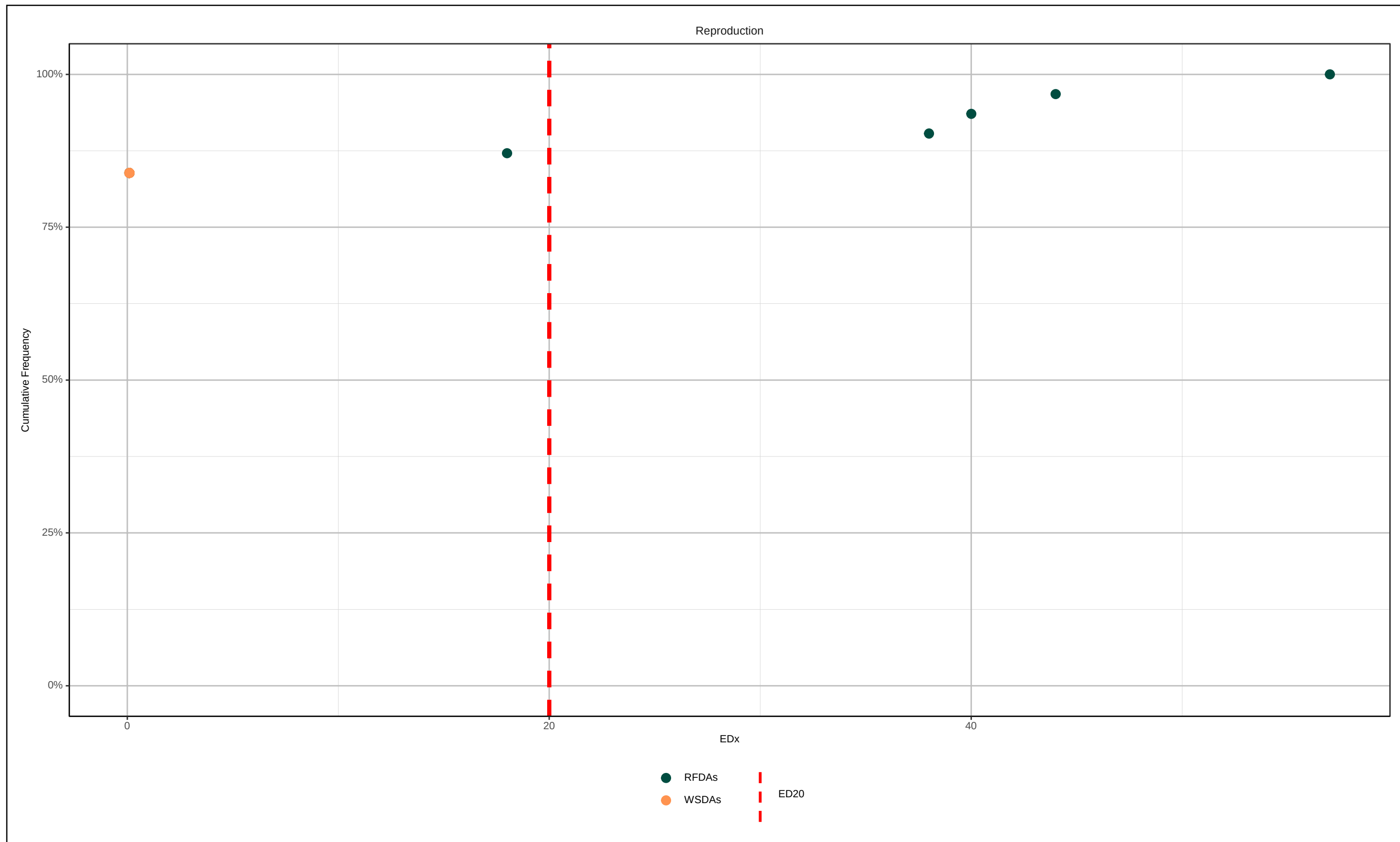


Figure M-39b. Cumulative Frequency of Zinc EDx Values for California Quail in the RFDAs and WSDAs
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

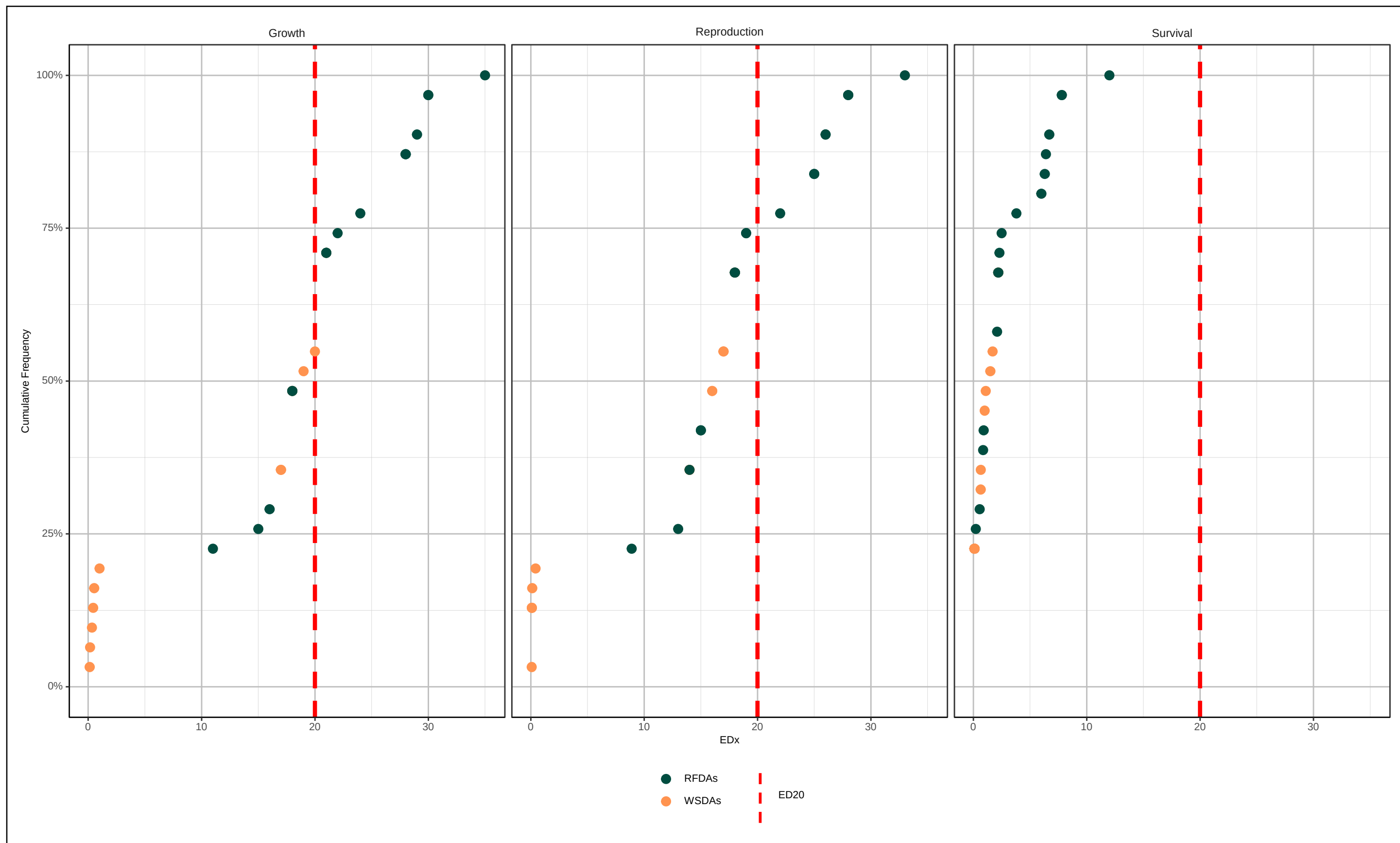


Figure M-39c. Cumulative Frequency of Cadmium EDx Values for American Robin in the RFDA and WSDA
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

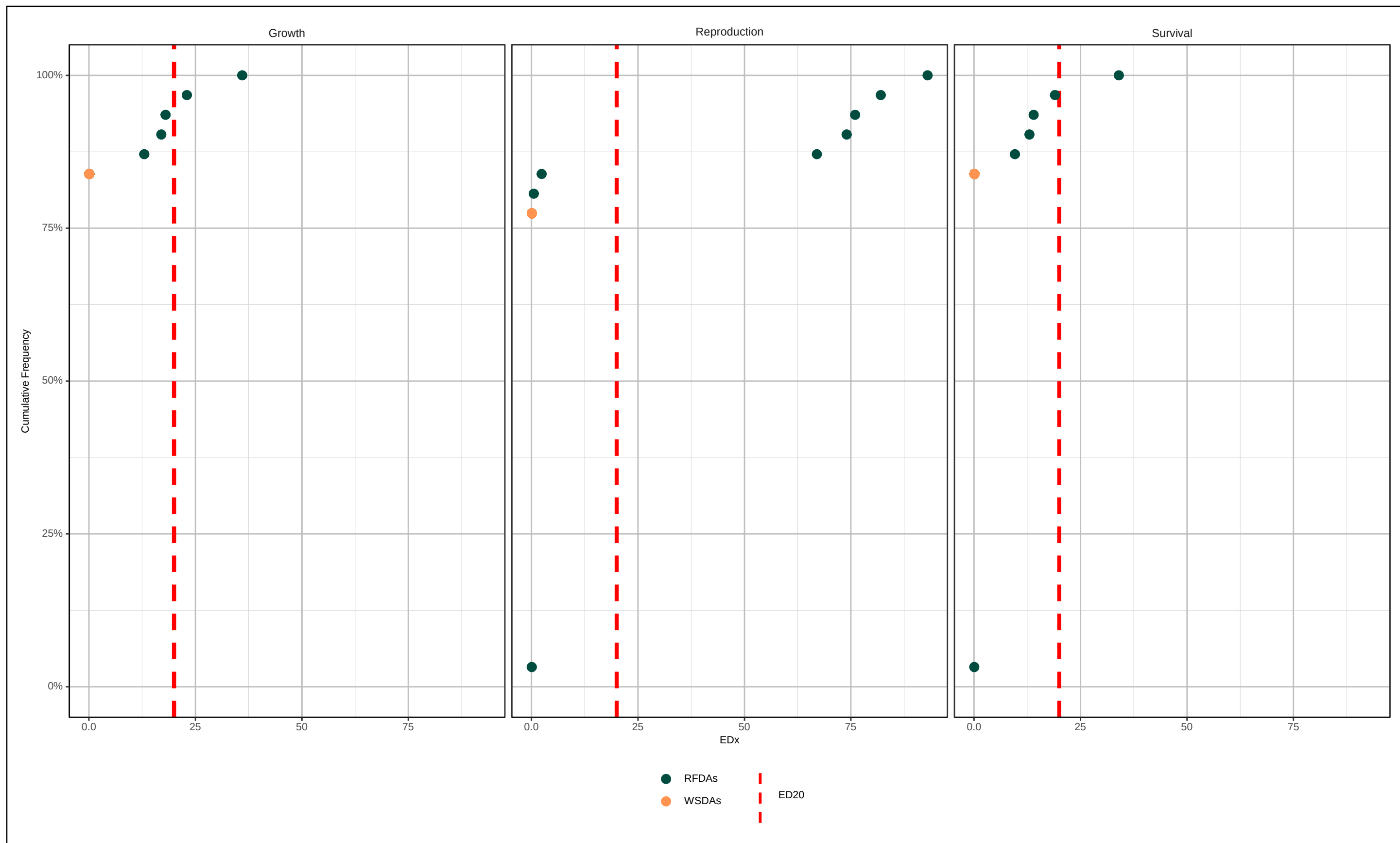


Figure M-39d. Cumulative Frequency of Copper EDx Values for American Robin in the RFDA and WSDA
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

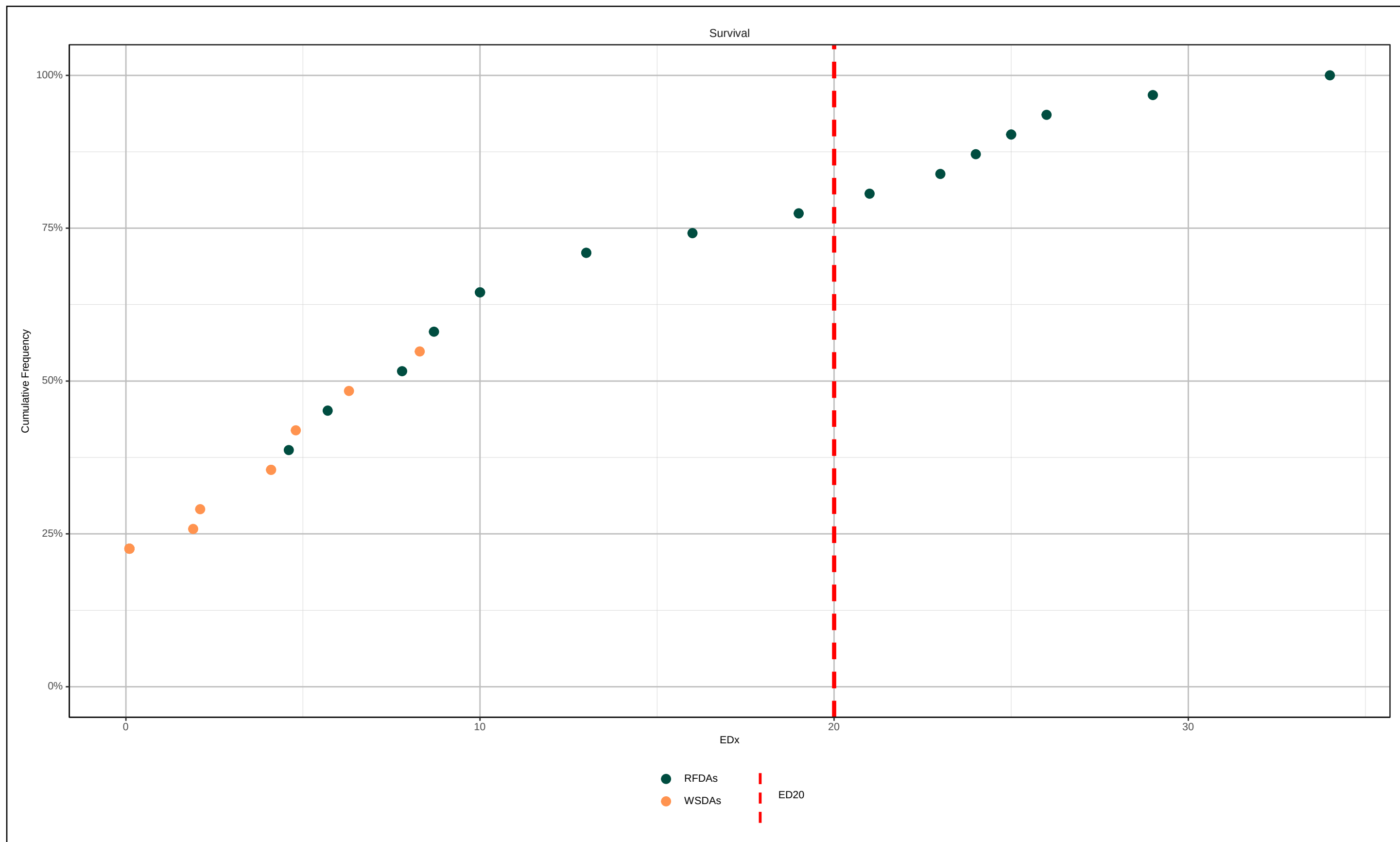


Figure M-39e. Cumulative Frequency of Lead EDx Values for American Robin in the RFDAs and WSDAs
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

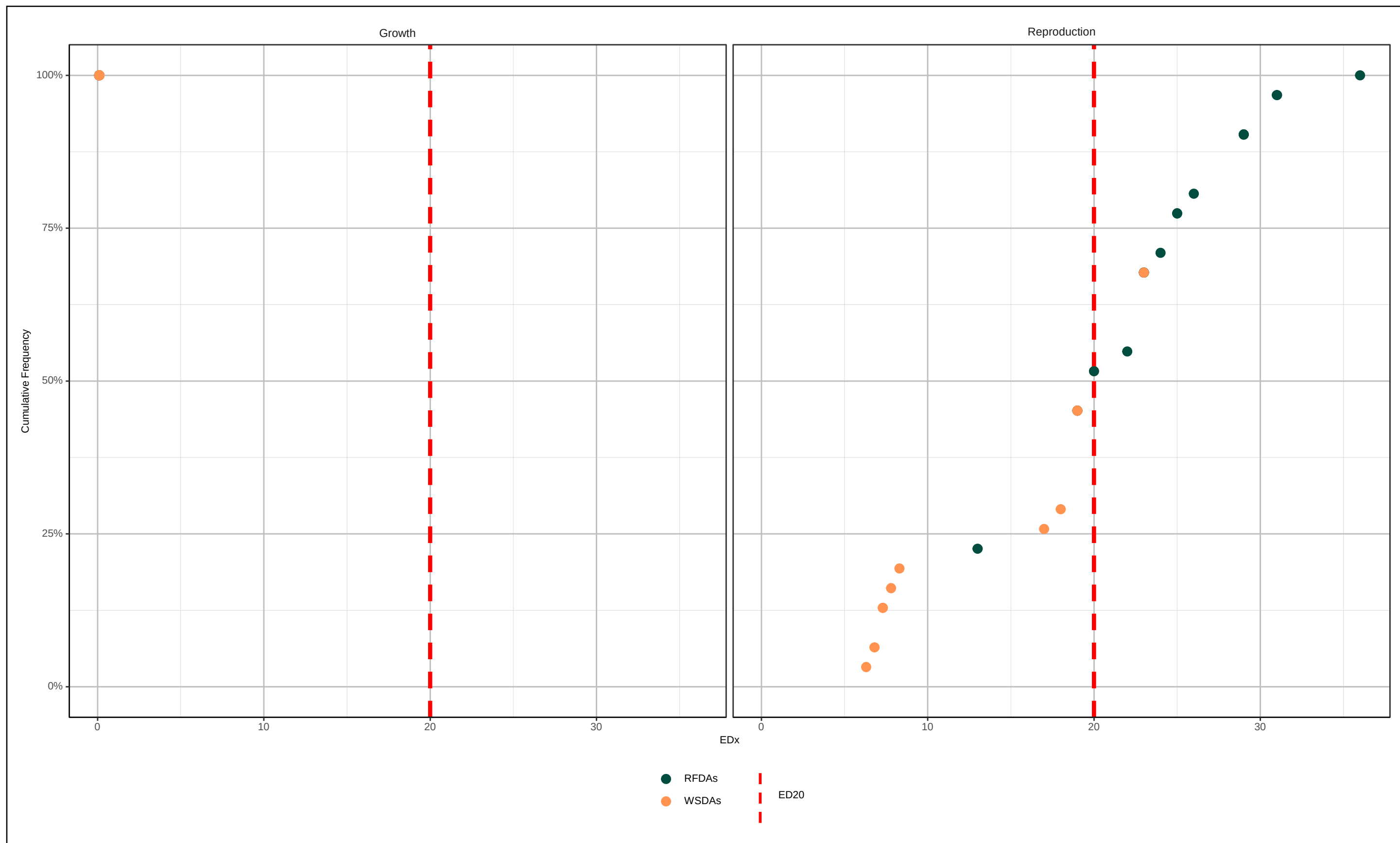


Figure M-39f. Cumulative Frequency of Mercury EDx Values for American Robin in the RFDA and WSDA
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

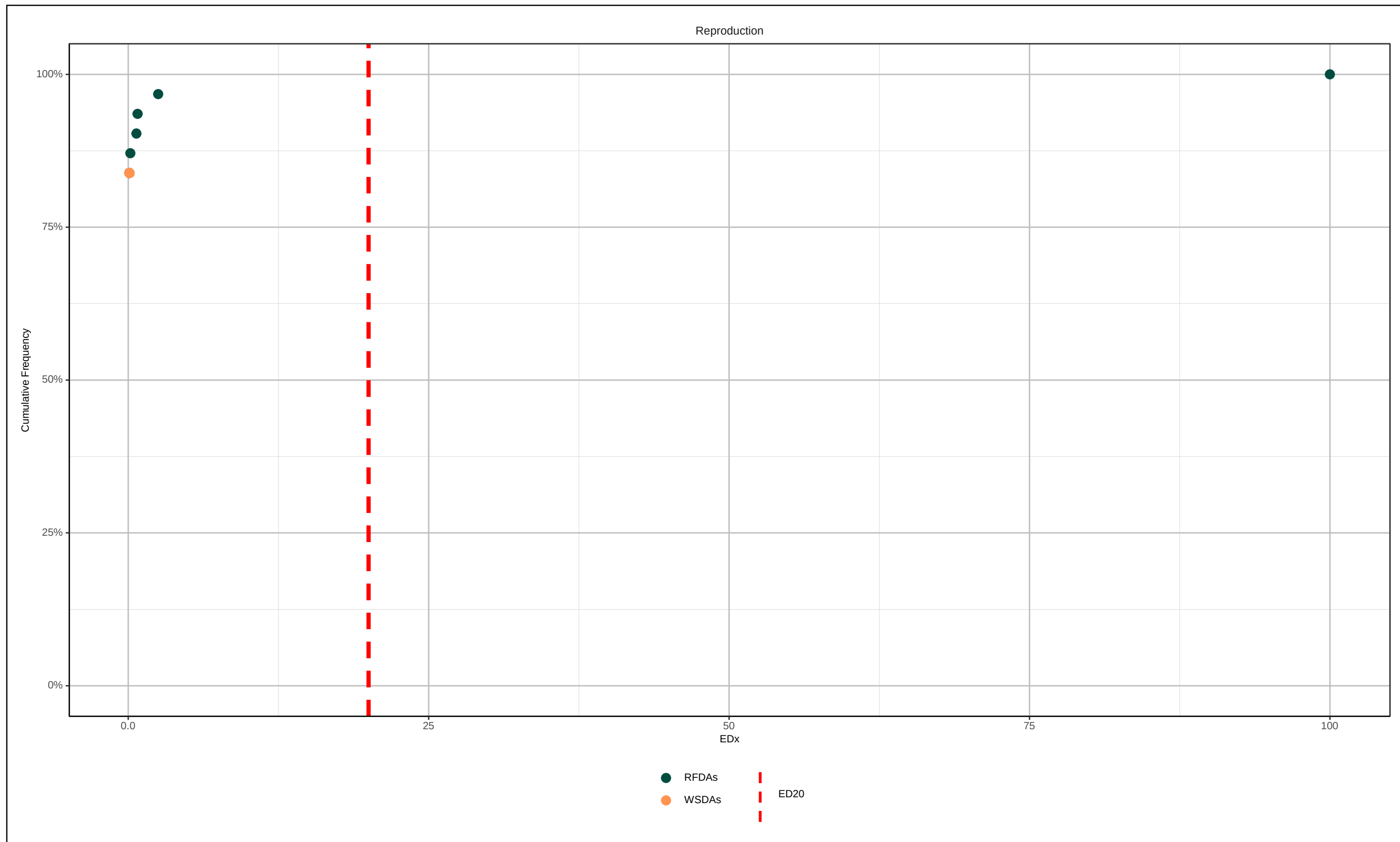


Figure M-39g. Cumulative Frequency of Selenium EDx Values for American Robin in the RFDAs and WSDAs
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

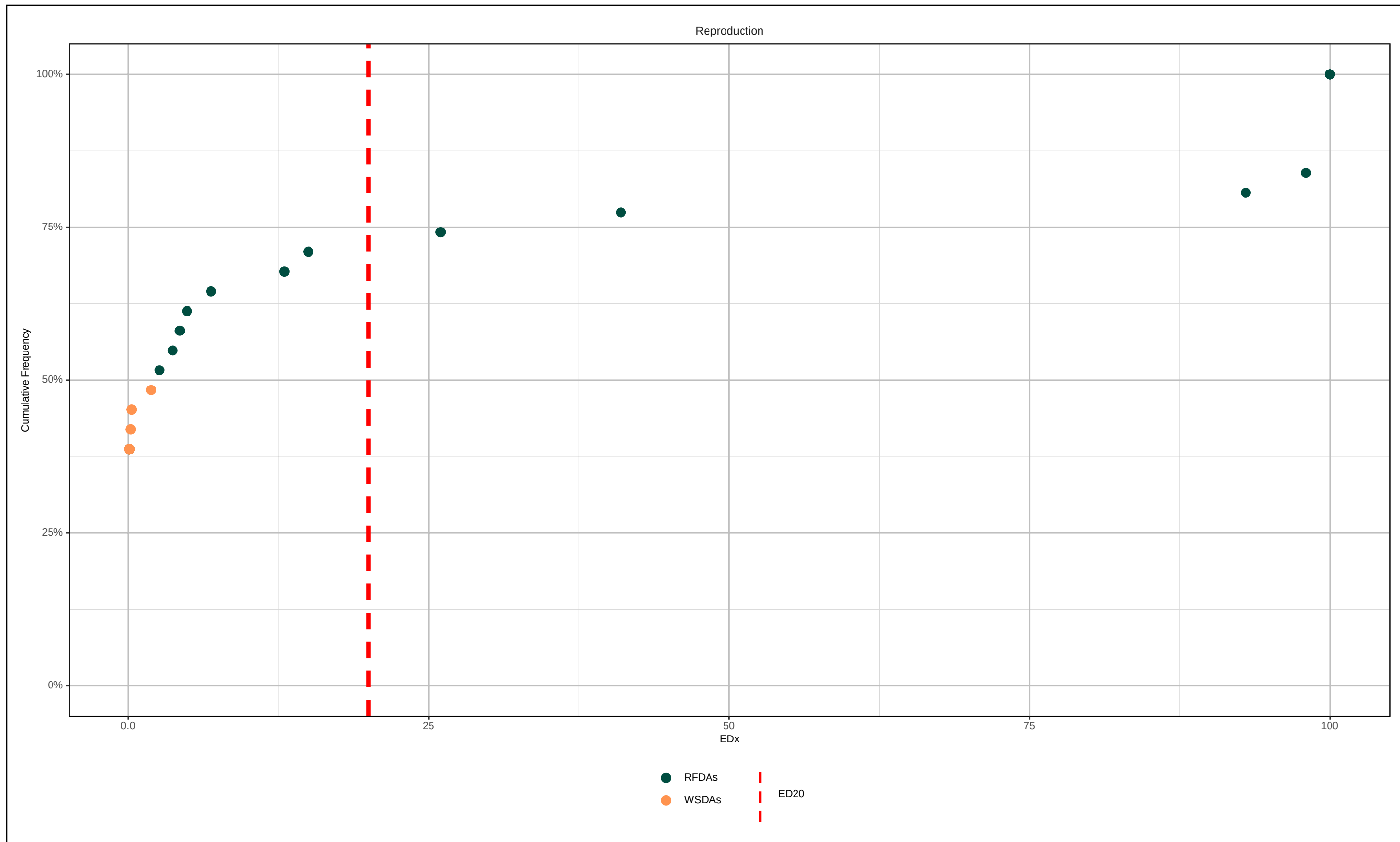


Figure M-39h. Cumulative Frequency of Zinc EDx Values for American Robin in the RFDA and WSD Areas
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

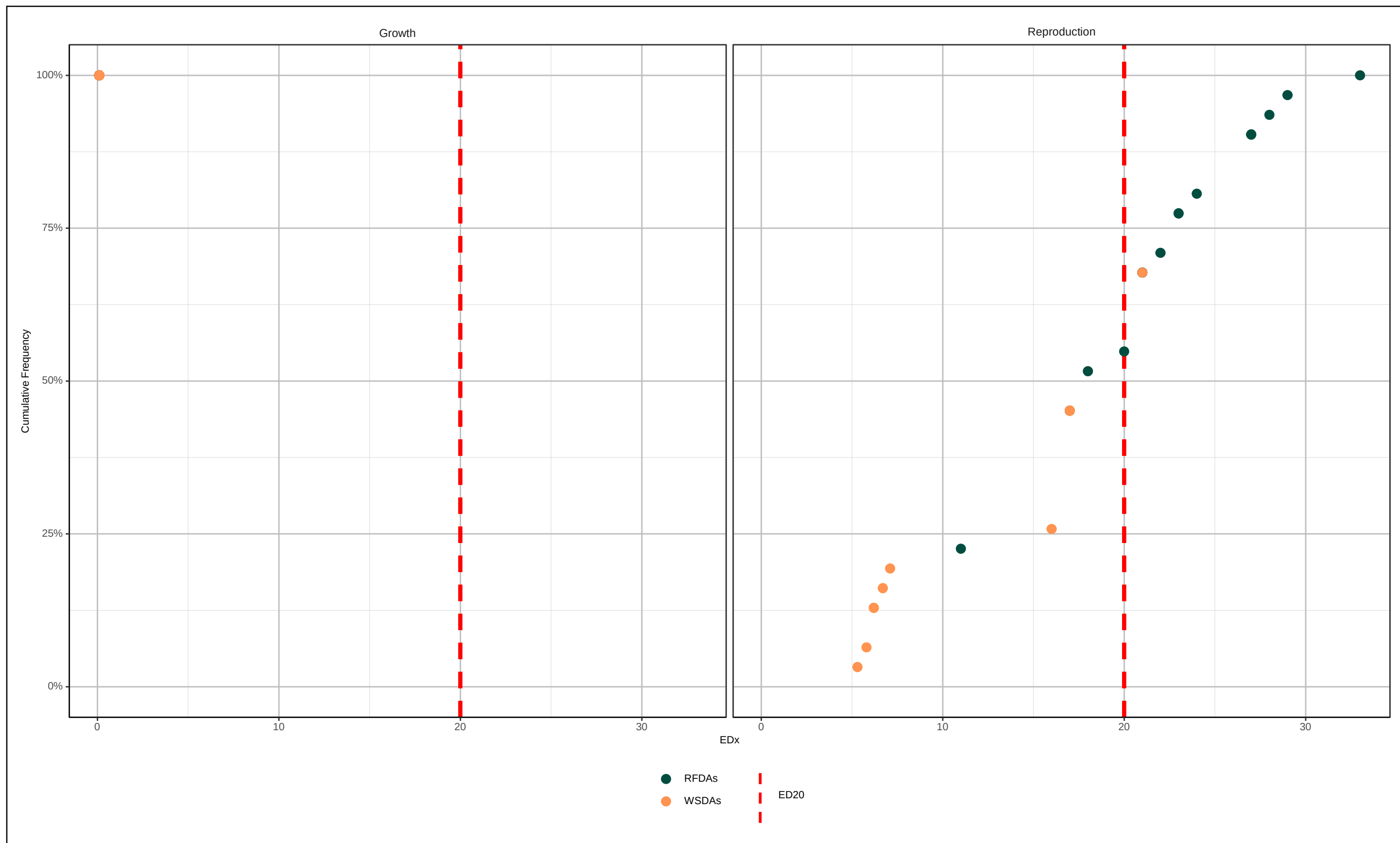


Figure M-39i. Cumulative Frequency of Mercury EDx Values for Tree Swallow in the RFDAs and WSDAs
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

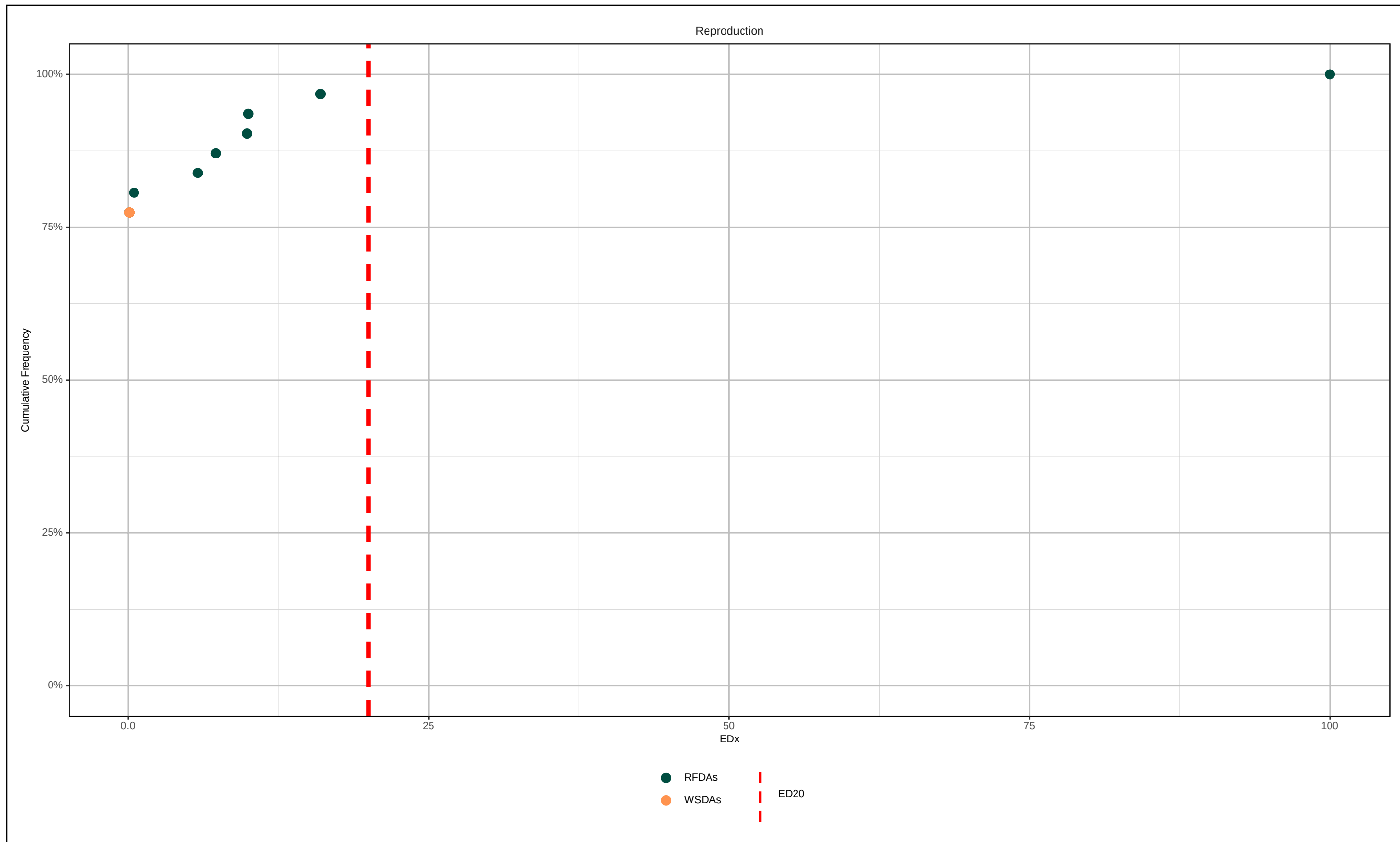


Figure M-39j. Cumulative Frequency of Selenium EDx Values for Tree Swallow in the RFDA and WSDAs
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

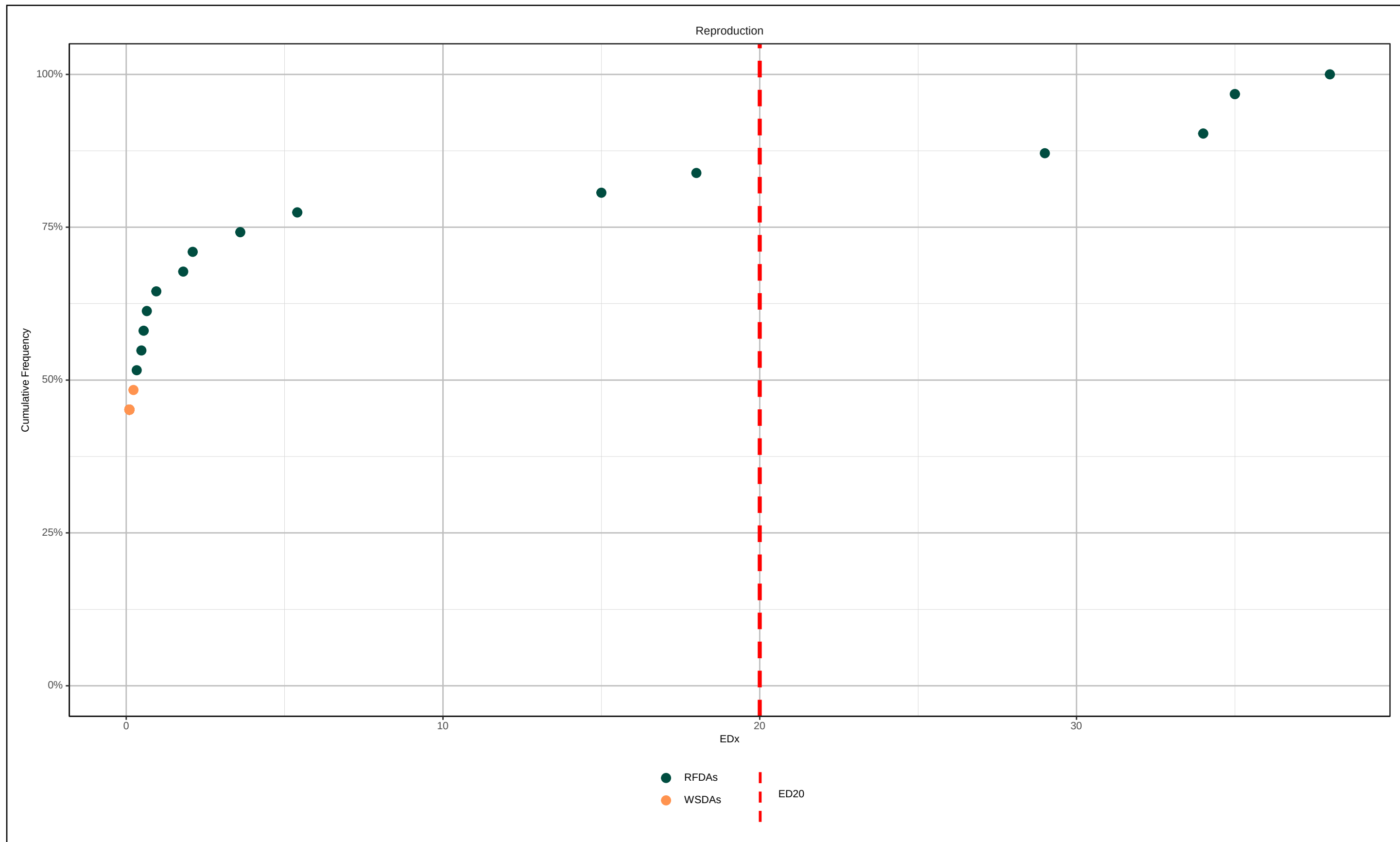


Figure M-39k. Cumulative Frequency of Zinc EDx Values for Tree Swallow in the RFDAs and WSDAs
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

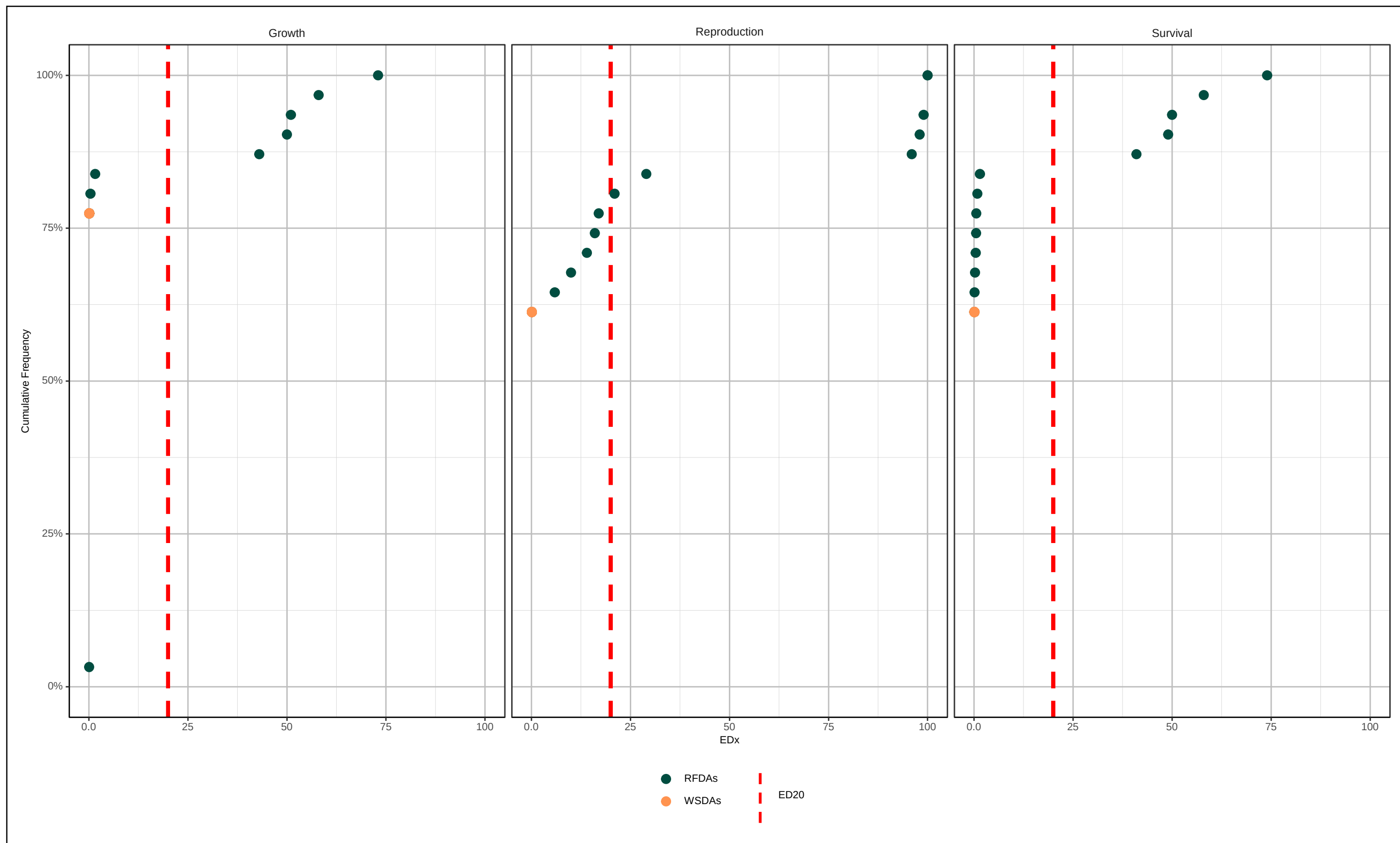


Figure M-39I. Cumulative Frequency of Copper EDx Values for Black-Capped Chickadee in the RFDAs and WSDAs
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

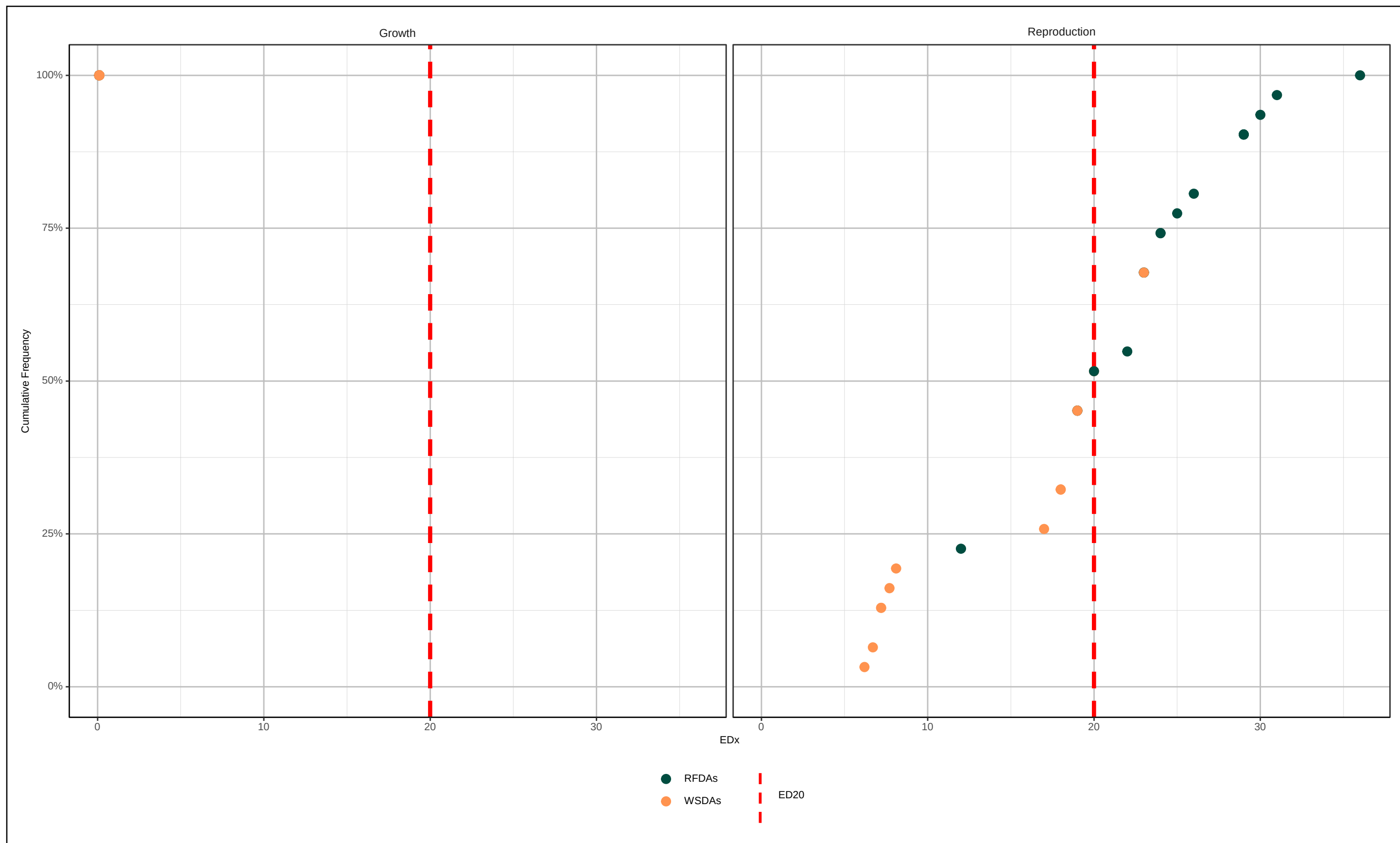


Figure M-39m. Cumulative Frequency of Mercury EDx Values for Black-Capped Chickadee in the RFDAs and WSDAs
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

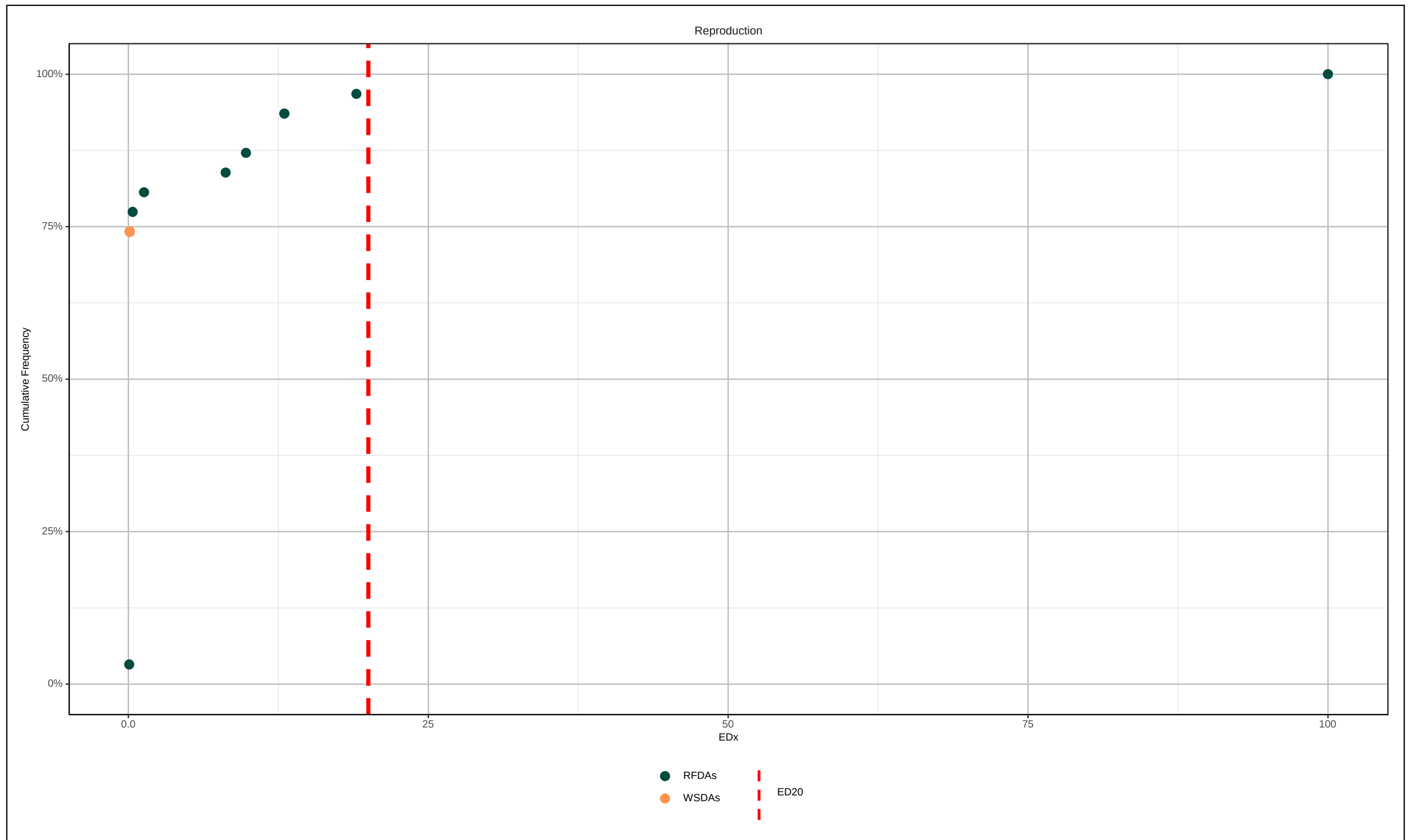


Figure M-39n. Cumulative Frequency of Selenium EDx Values for Black-Capped Chickadee in the RFDAs and WSDAs
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

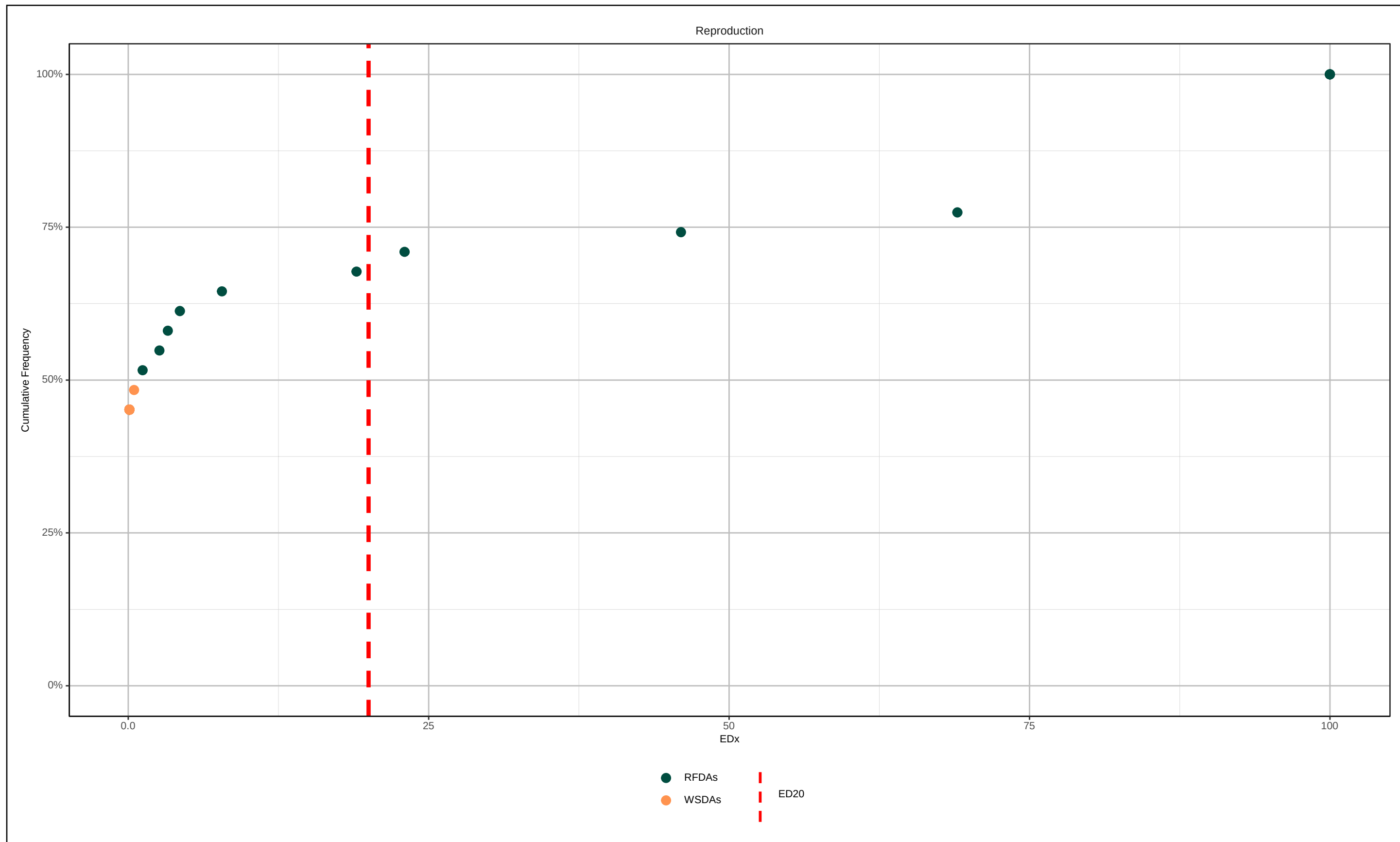


Figure M-39o. Cumulative Frequency of Zinc EDx Values for Black-Capped Chickadee in the RFDAs and WSDAs
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

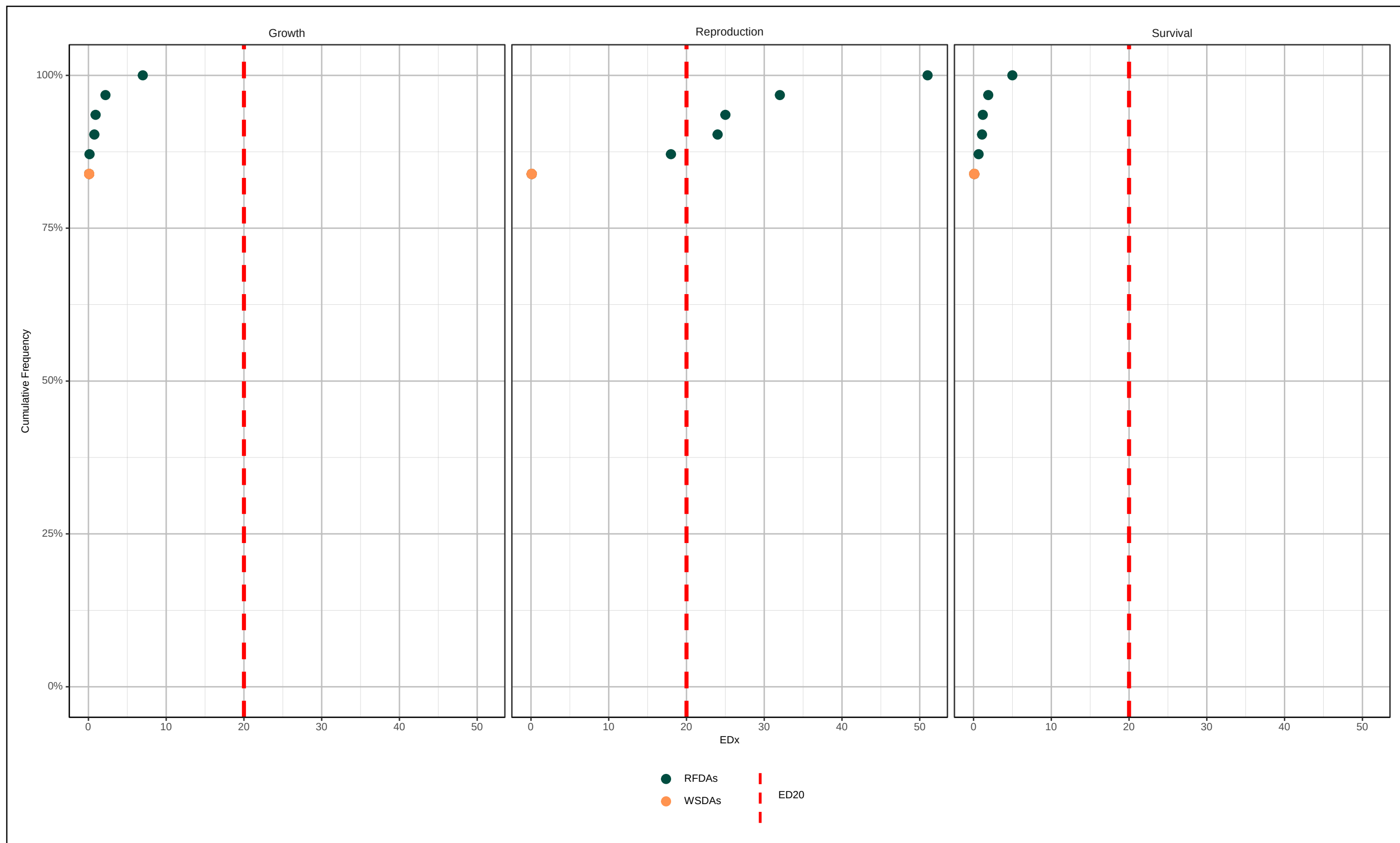


Figure M-39p. Cumulative Frequency of Copper EDx Values for American Kestrel in the RFDAs and WSDAs
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

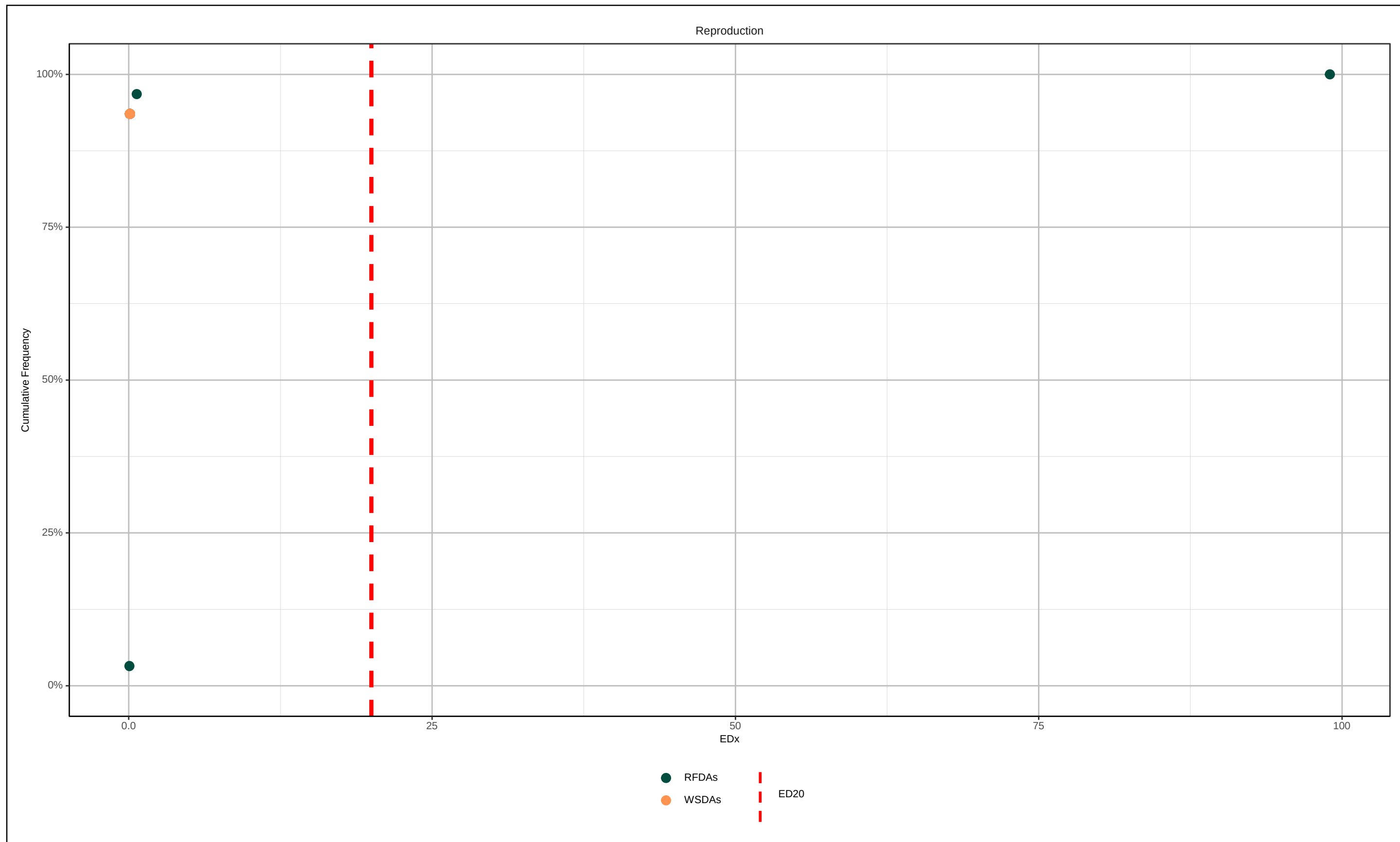


Figure M-39q. Cumulative Frequency of Selenium EDx Values for American Kestrel in the RFDA and WSDA
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

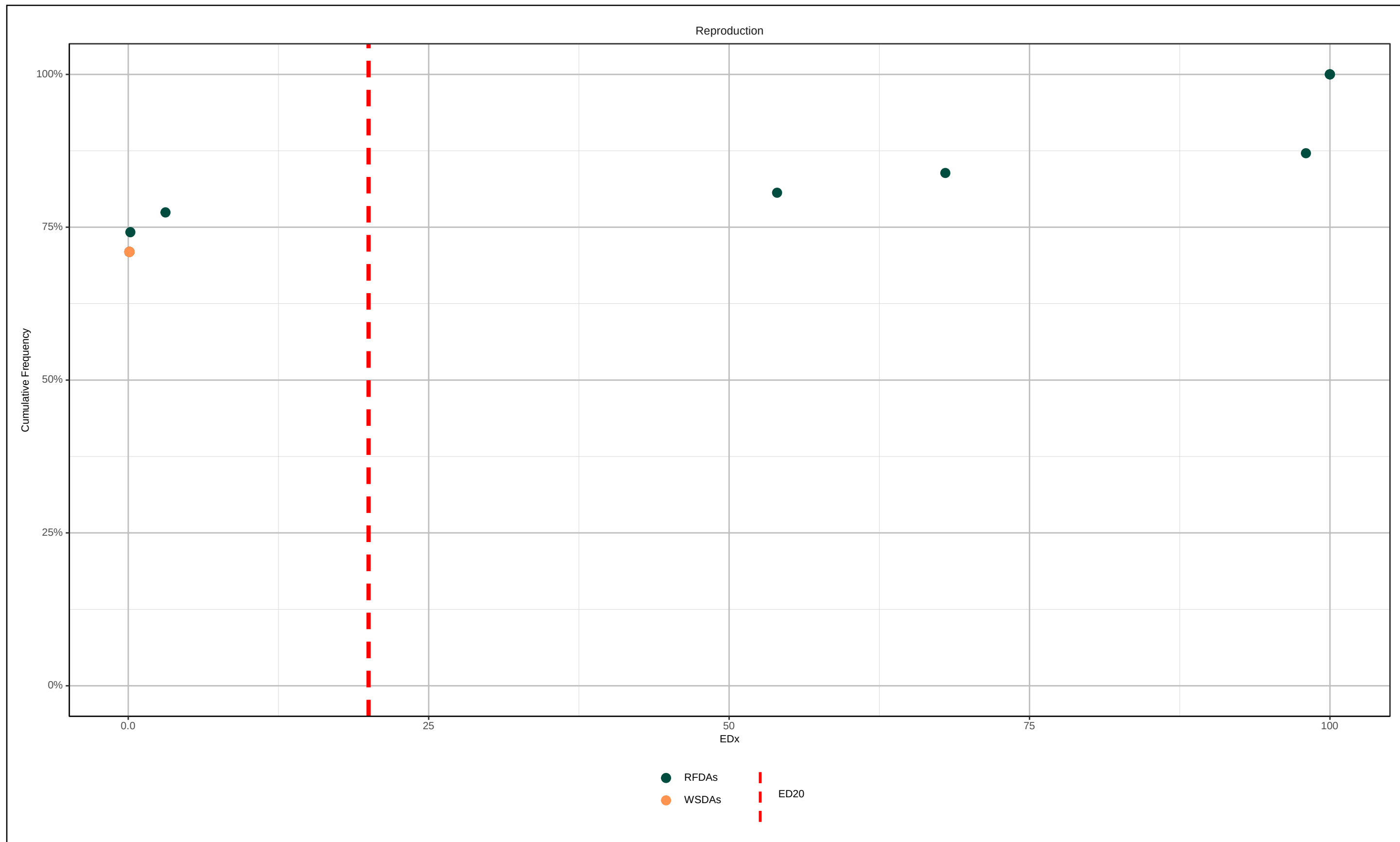


Figure M-39r. Cumulative Frequency of Zinc EDx Values for American Kestrel in the RFDA and WSDA
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

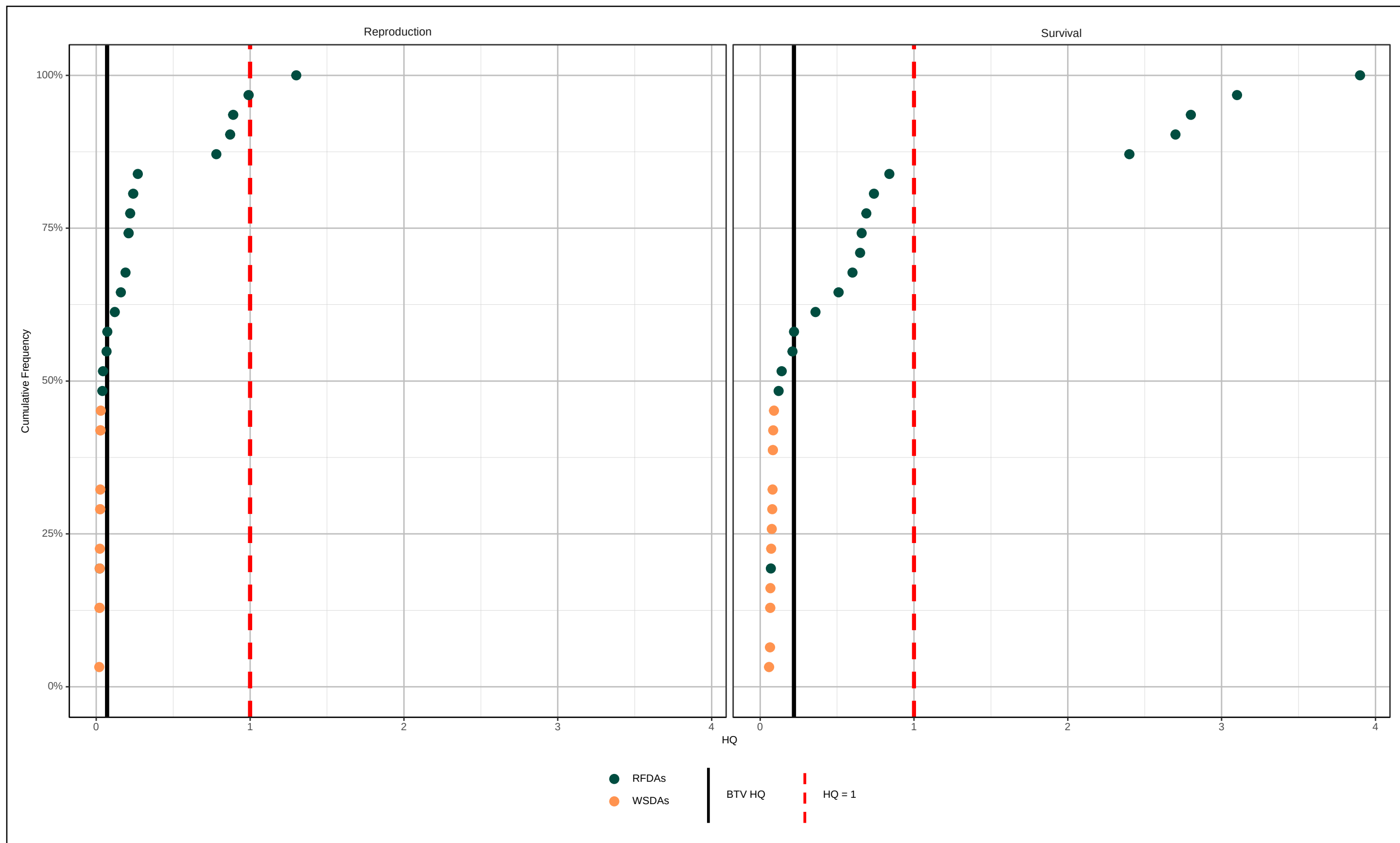


Figure M-40a. Cumulative Frequency of Copper Dietary HQs for Meadow Vole in the RFDAs and WSDAs
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

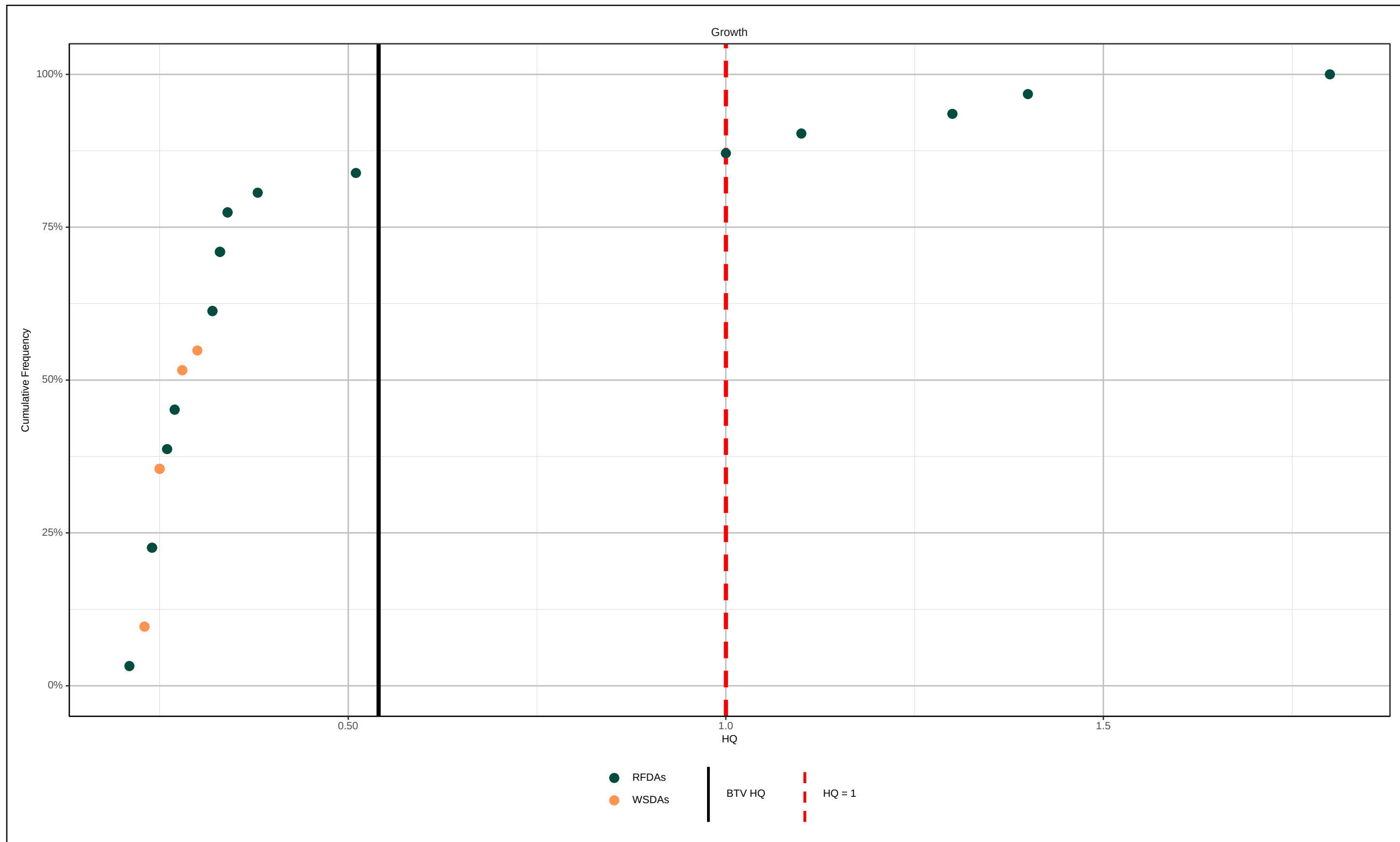


Figure M-40b. Cumulative Frequency of Iron Dietary HQs for Meadow Vole in the RFDAs and WSDAs
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

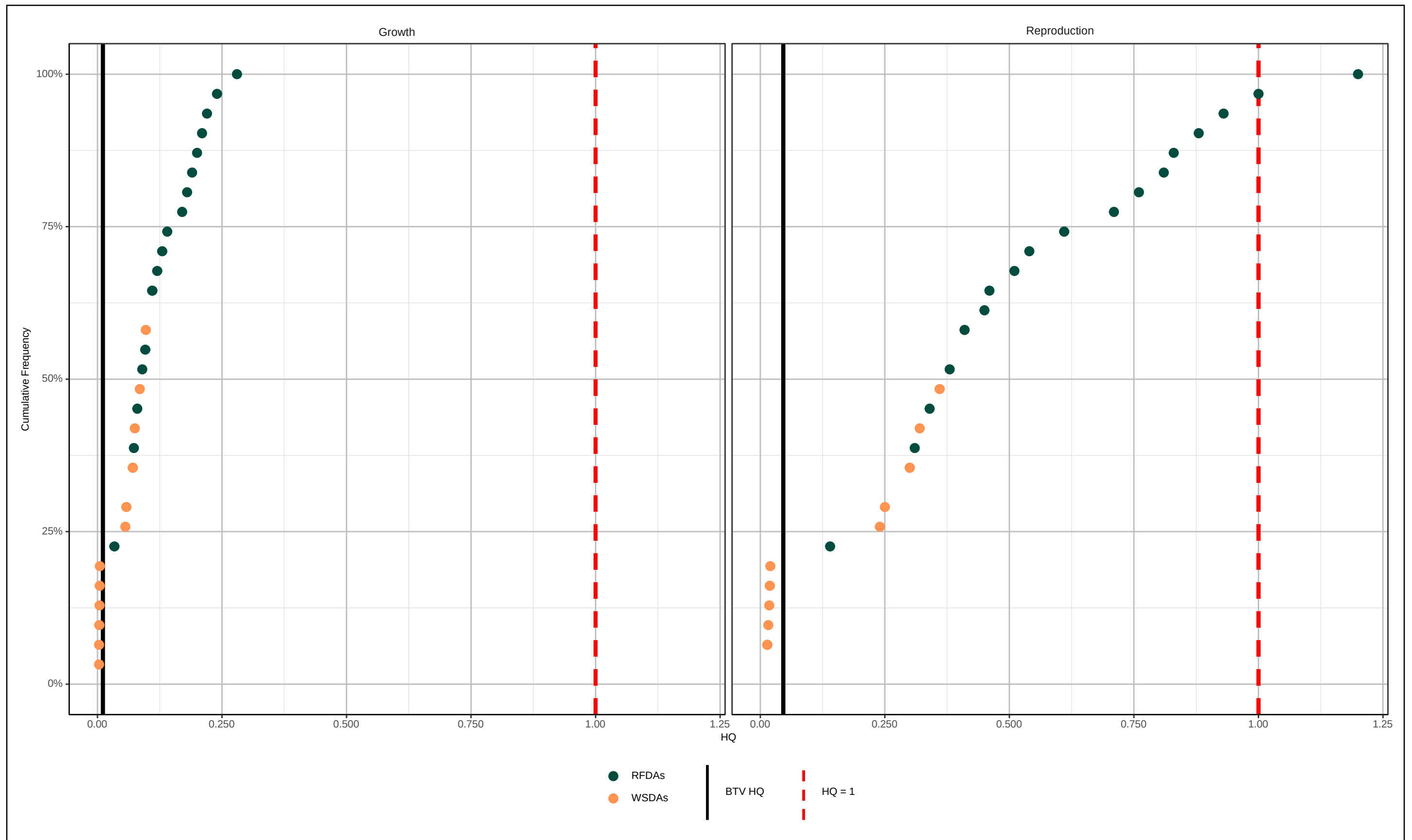


Figure M-40c. Cumulative Frequency of Lead Dietary HQs for Meadow Vole in the RFDAs and WSDAs
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

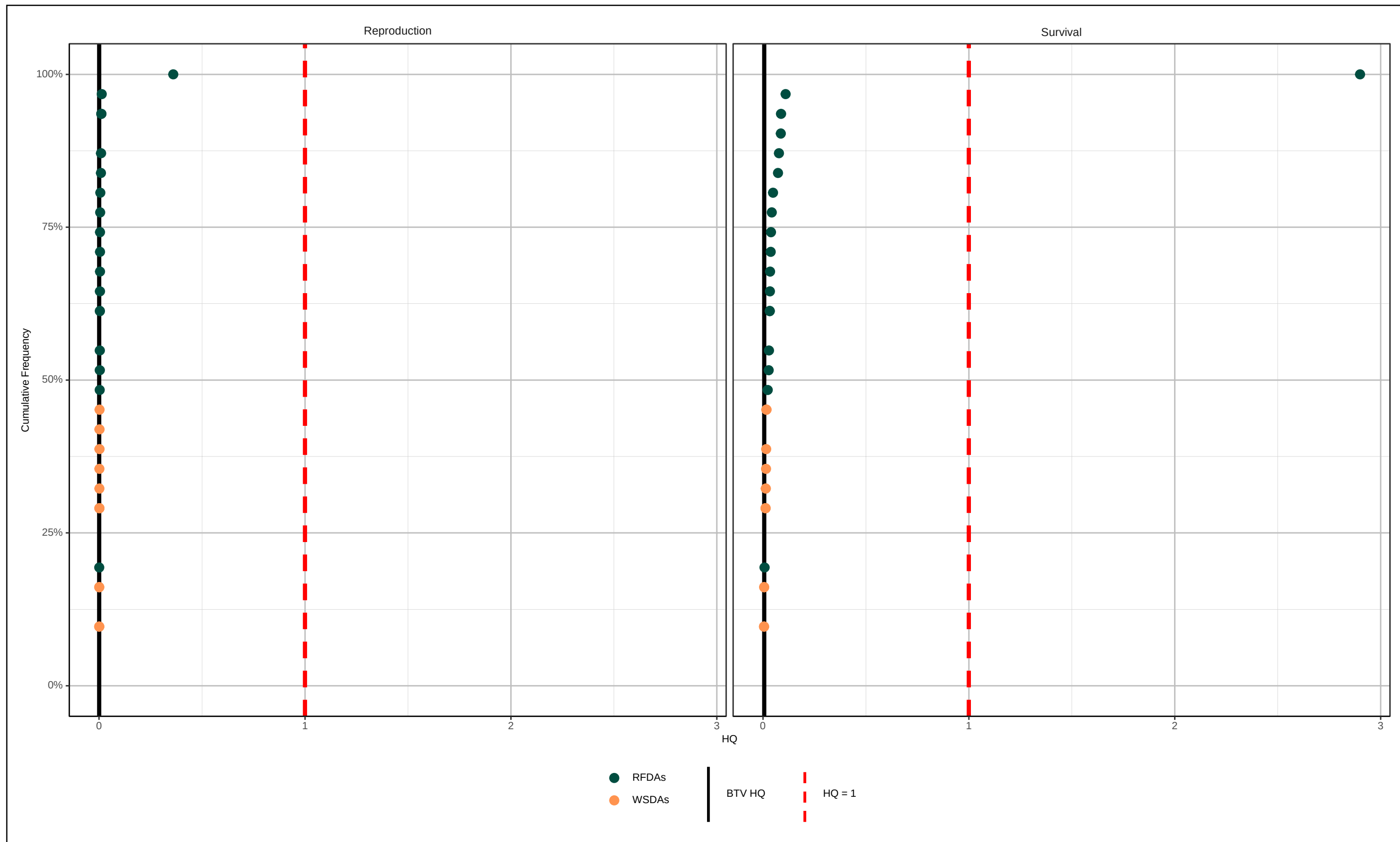


Figure M-40d. Cumulative Frequency of Selenium Dietary HQs for Meadow Vole in the RFDAs and WSDAs
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

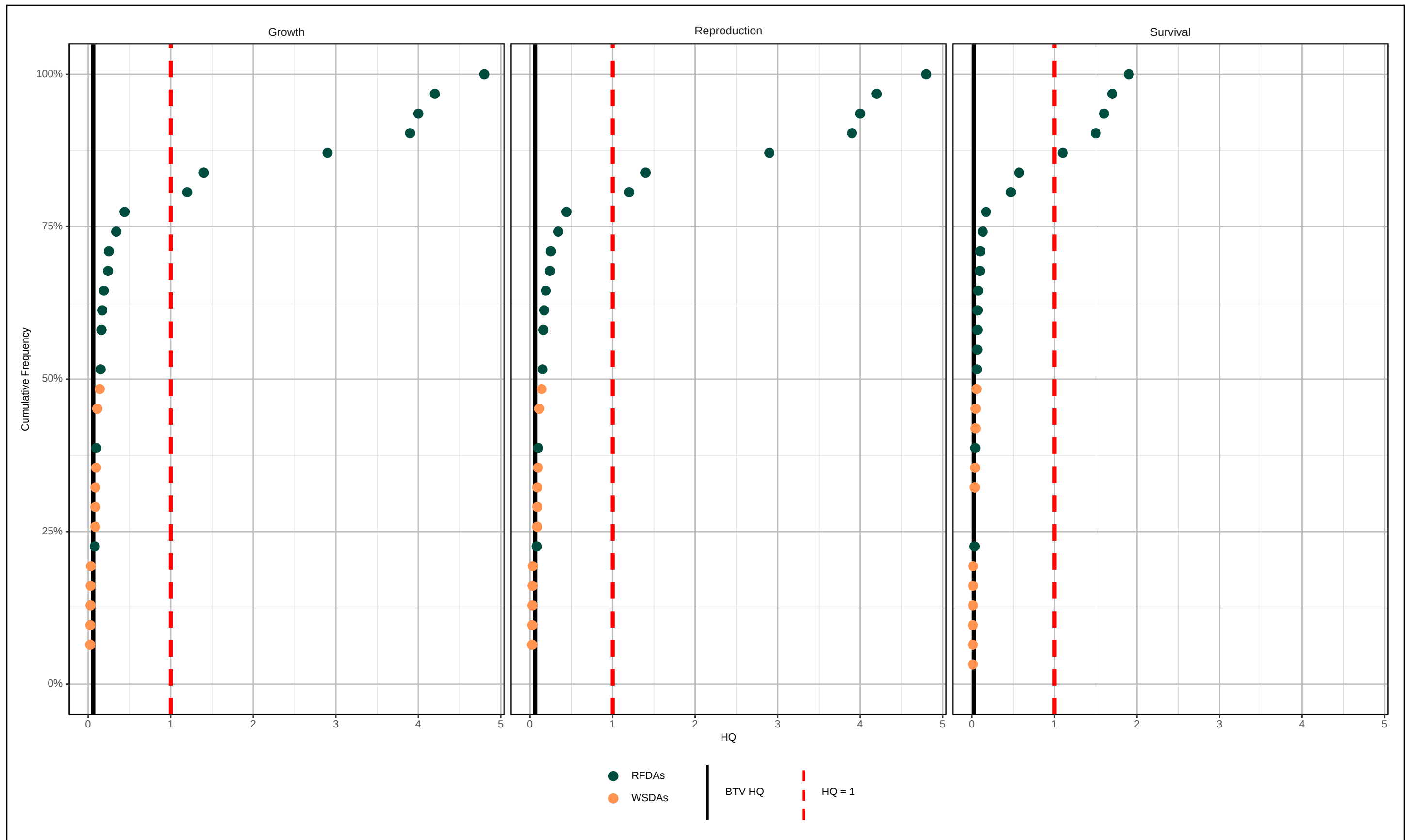


Figure M-40e. Cumulative Frequency of Zinc Dietary HQs for Meadow Vole in the RFDAs and WSDAs
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

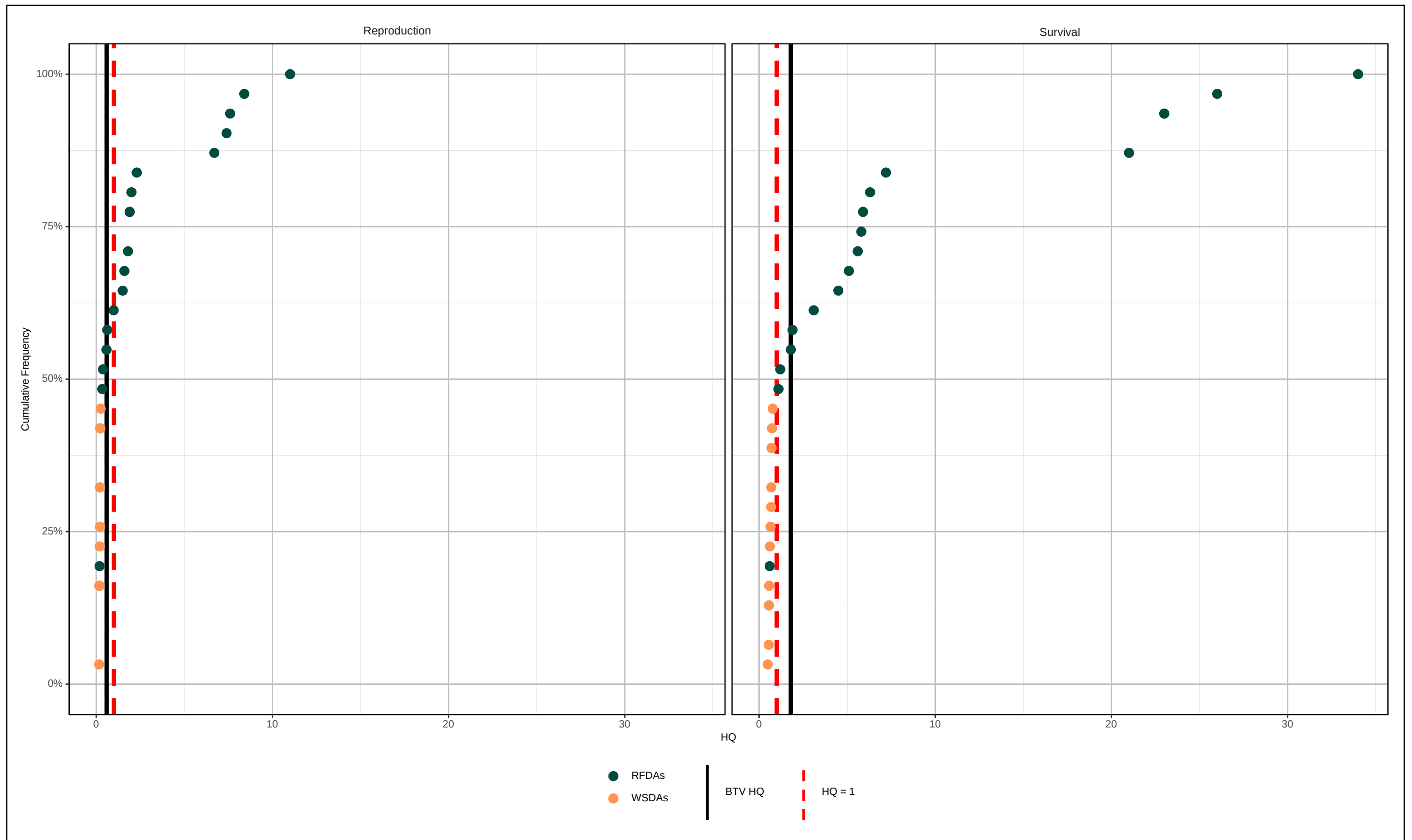


Figure M-40f. Cumulative Frequency of Copper Dietary HQs for Masked Shrew in the RFDAs and WSDAs
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

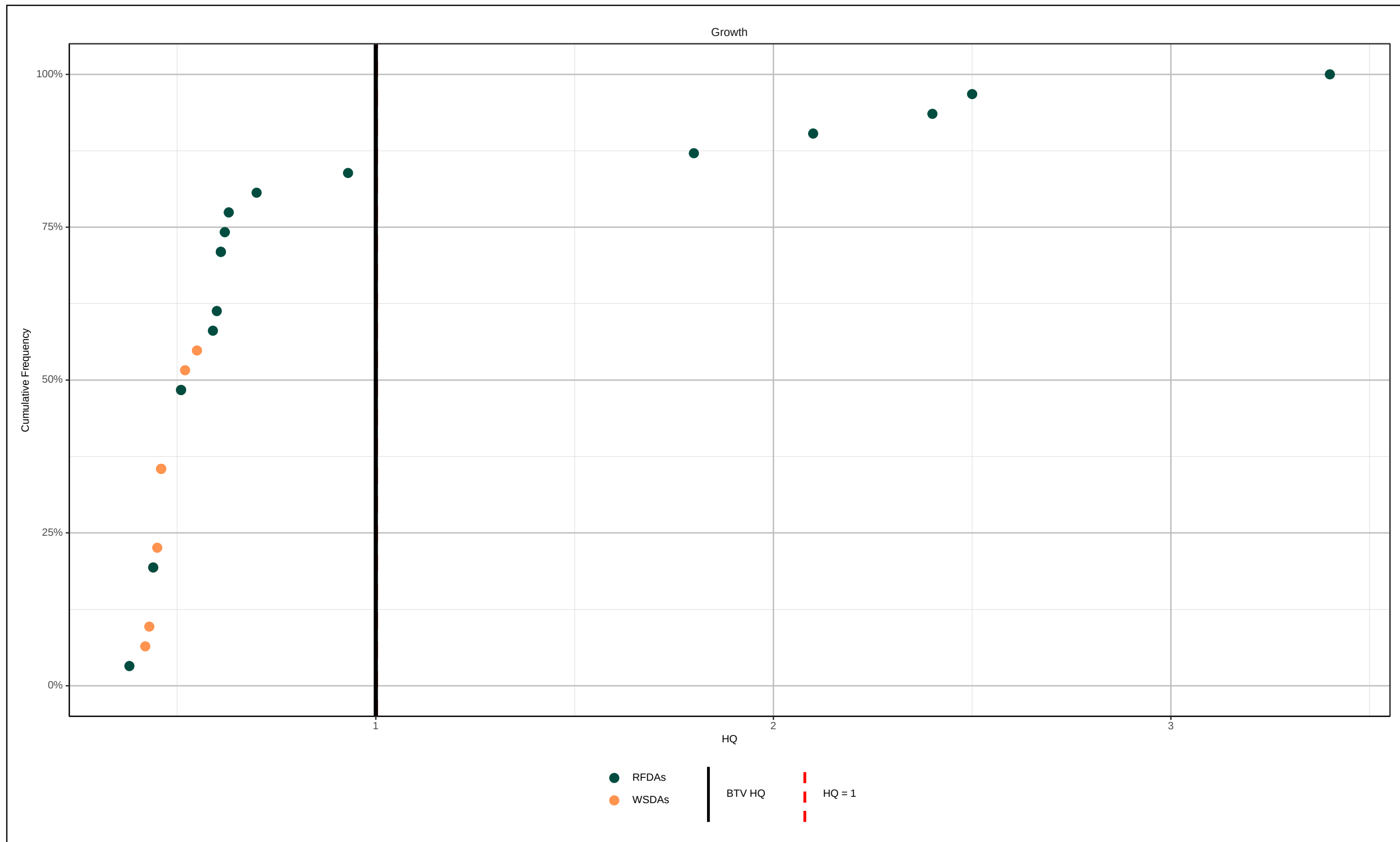


Figure M-40g. Cumulative Frequency of Iron Dietary HQs for Masked Shrew in the RFDAs and WSDAs
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

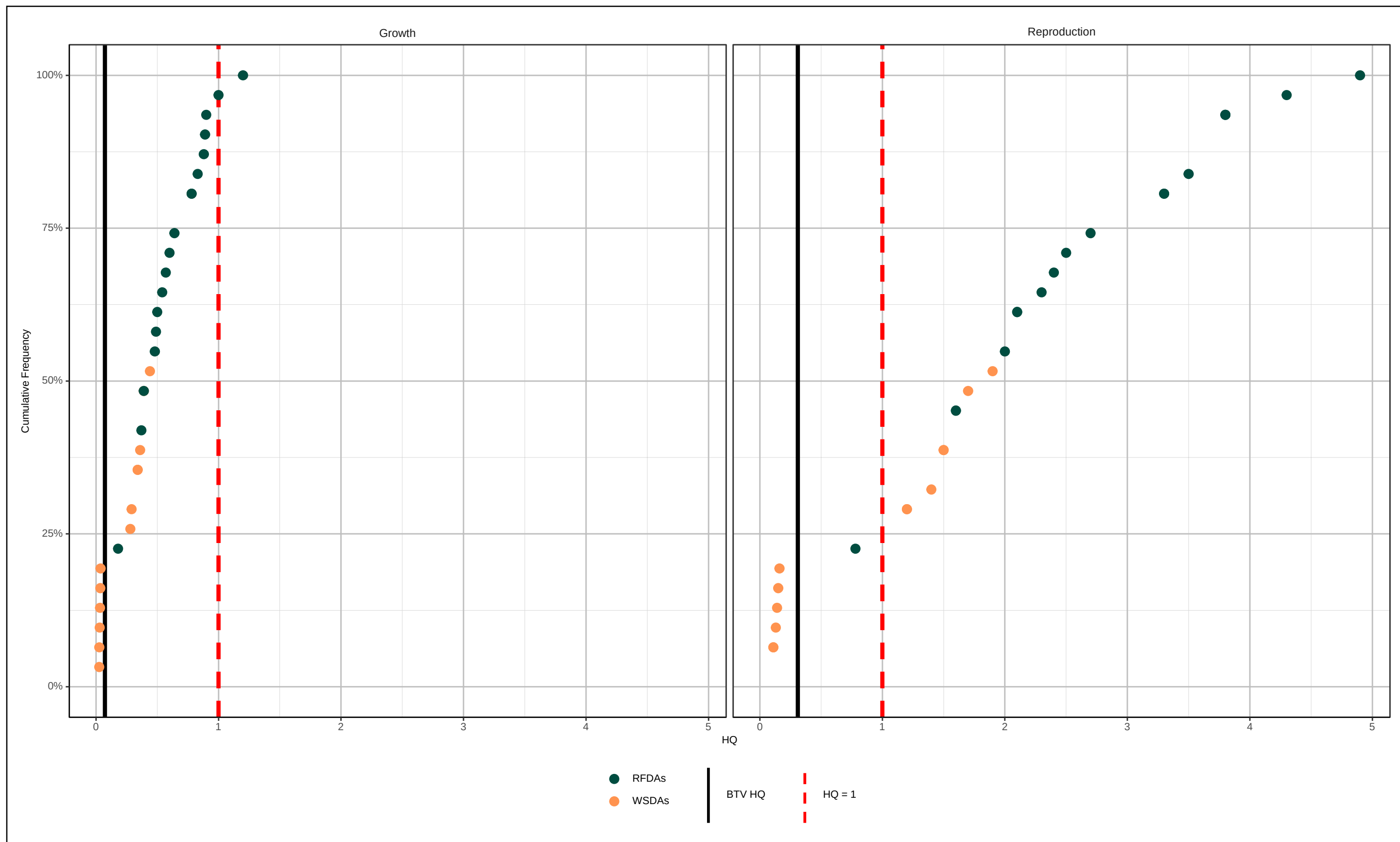


Figure M-40h. Cumulative Frequency of Lead Dietary HQs for Masked Shrew in the RFDAs and WSDAs
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

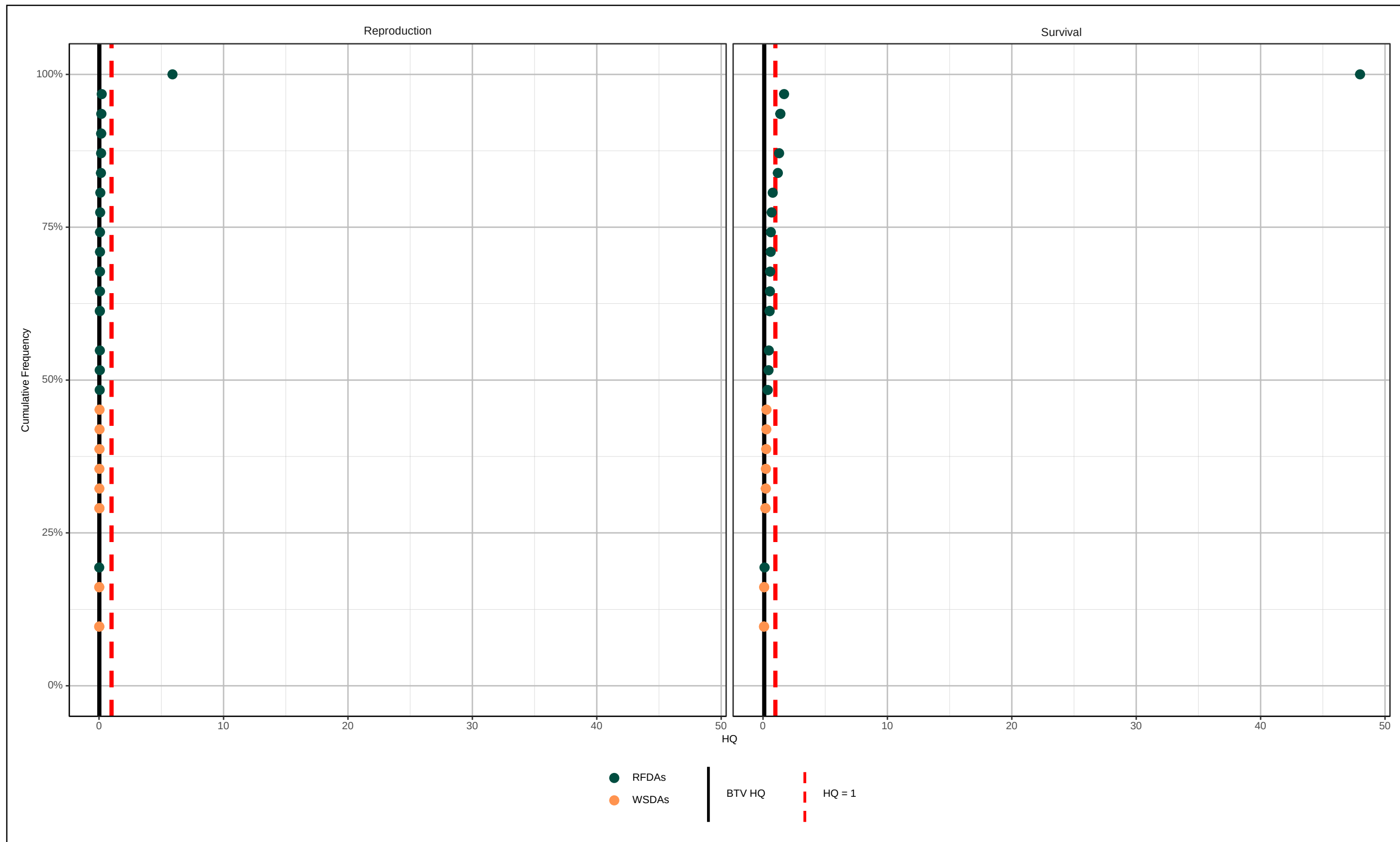


Figure M-40i. Cumulative Frequency of Selenium Dietary HQs for Masked Shrew in the RFDAs and WSDAs
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

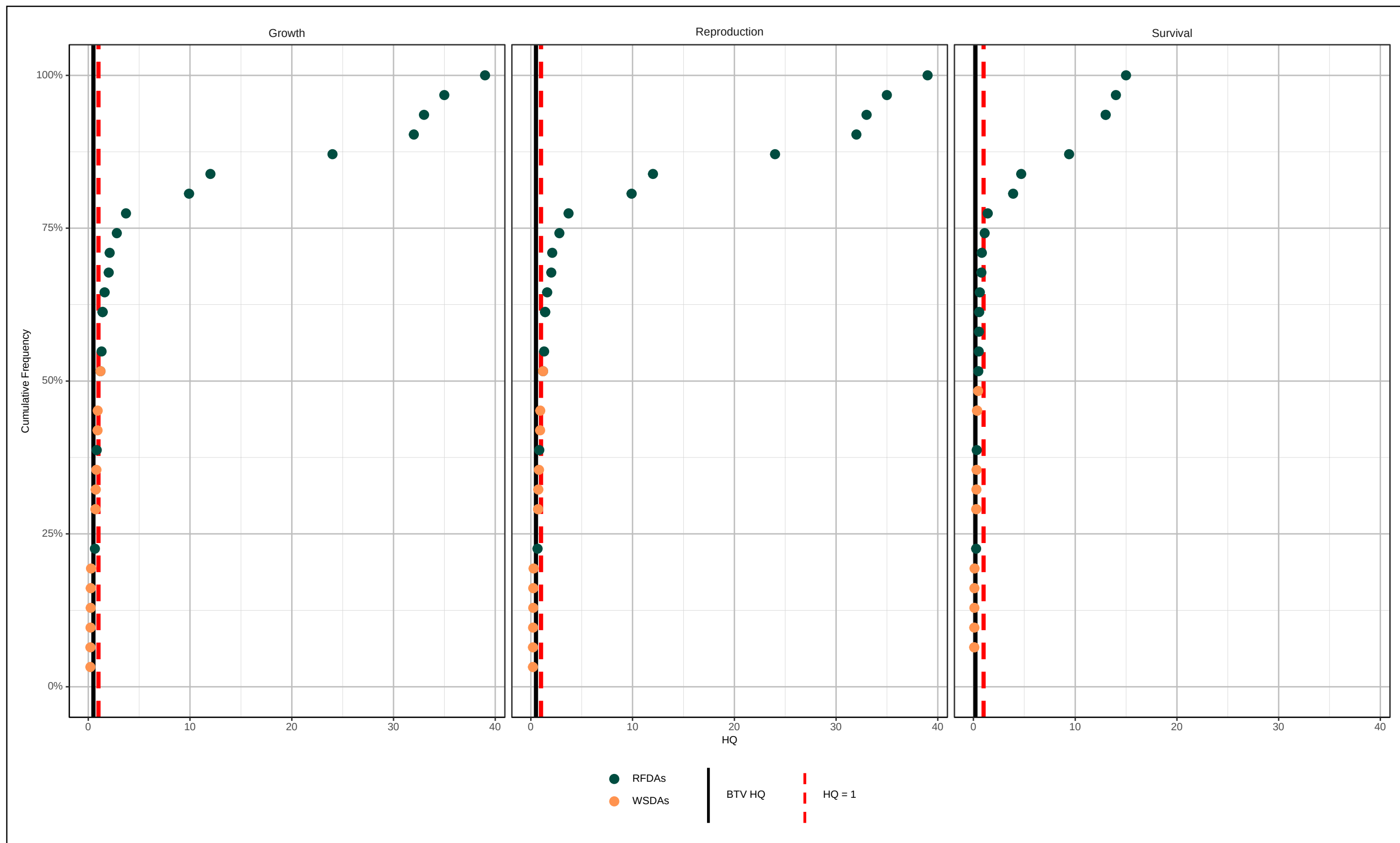


Figure M-40j. Cumulative Frequency of Zinc Dietary HQs for Masked Shrew in the RFDAs and WSDAs
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

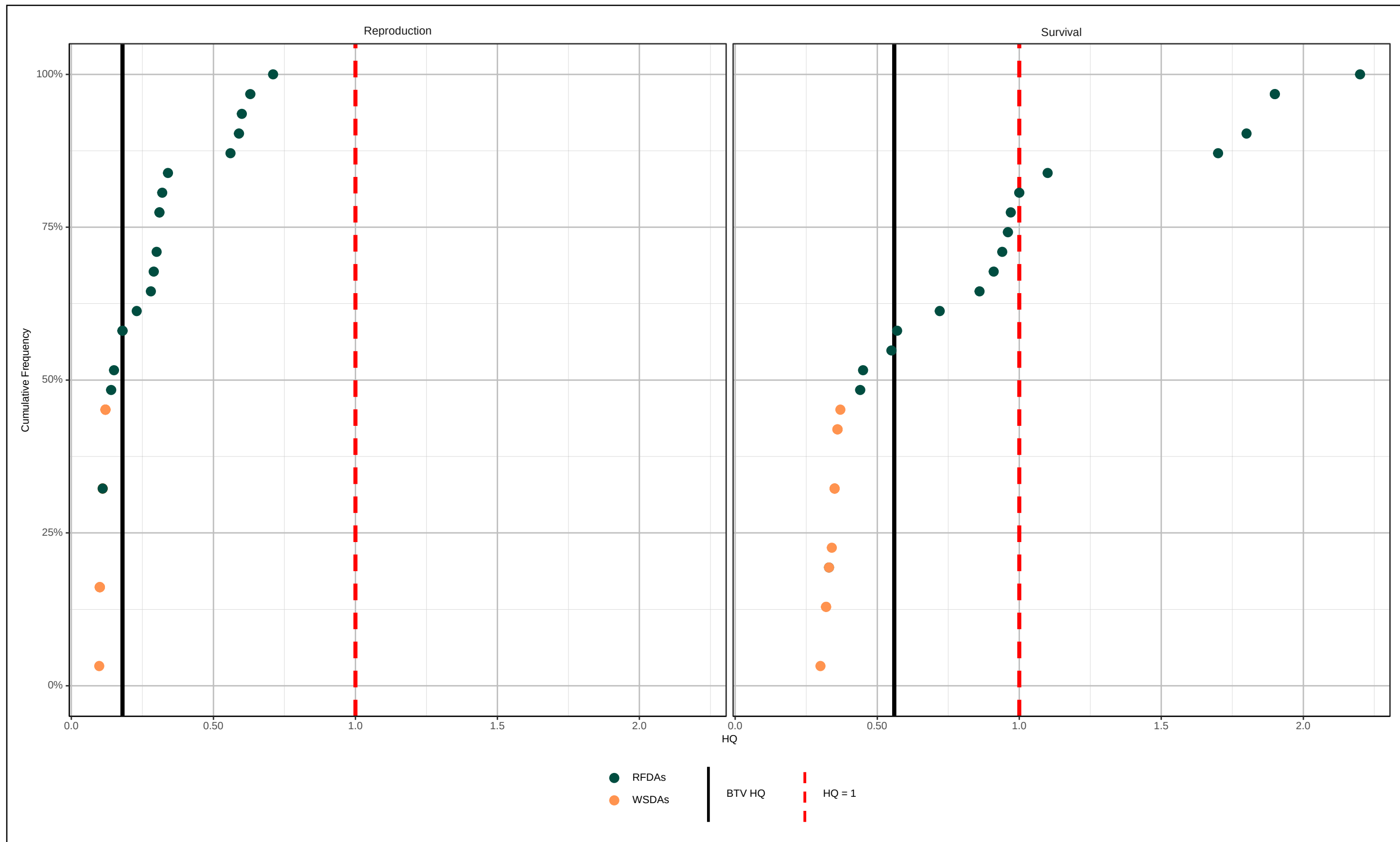


Figure M-40k. Cumulative Frequency of Copper Dietary HQs for Little Brown Bat in the RFDAs and WSDAs
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

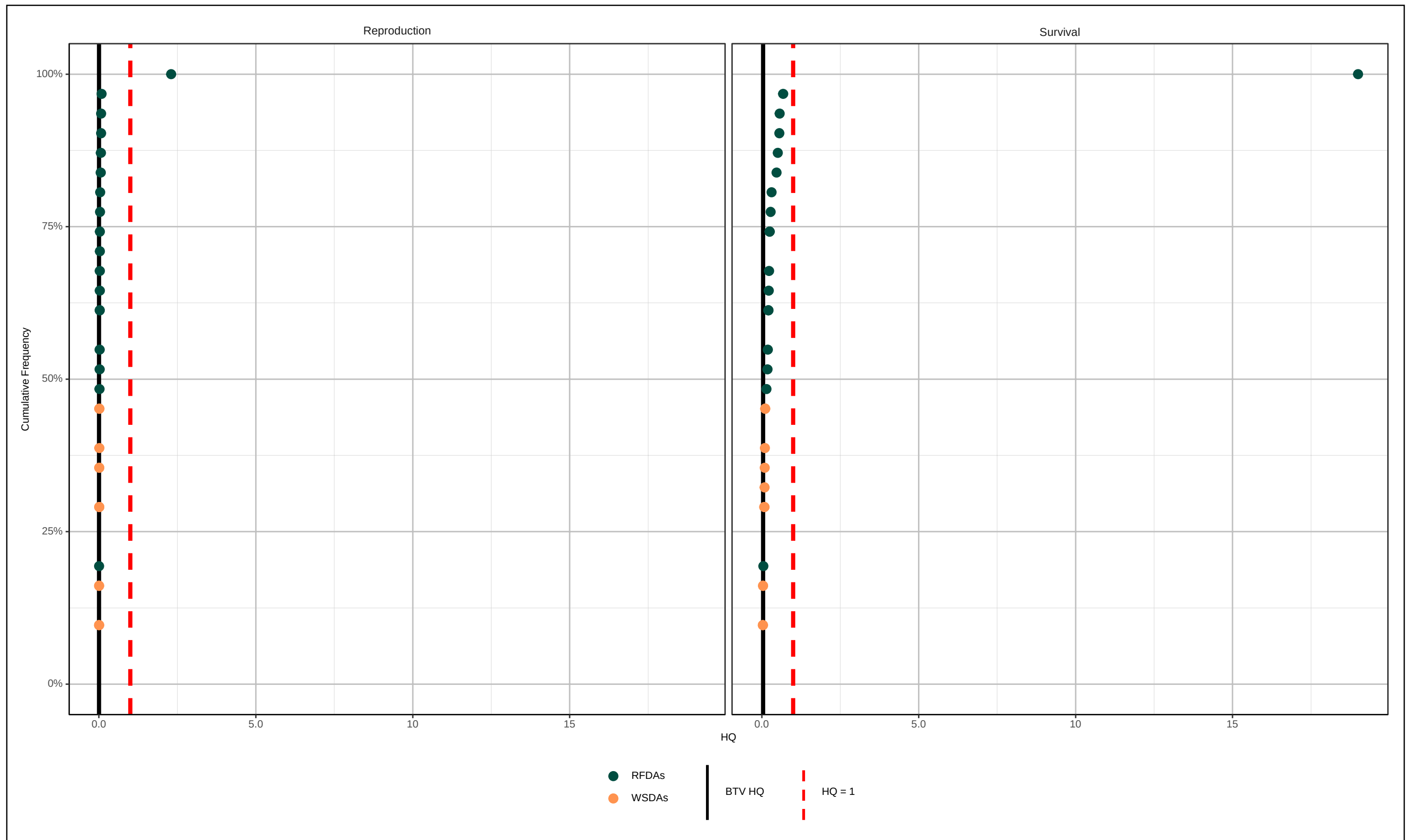


Figure M-40I. Cumulative Frequency of Selenium Dietary HQs for Little Brown Bat in the RFDAs and WSDAs
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

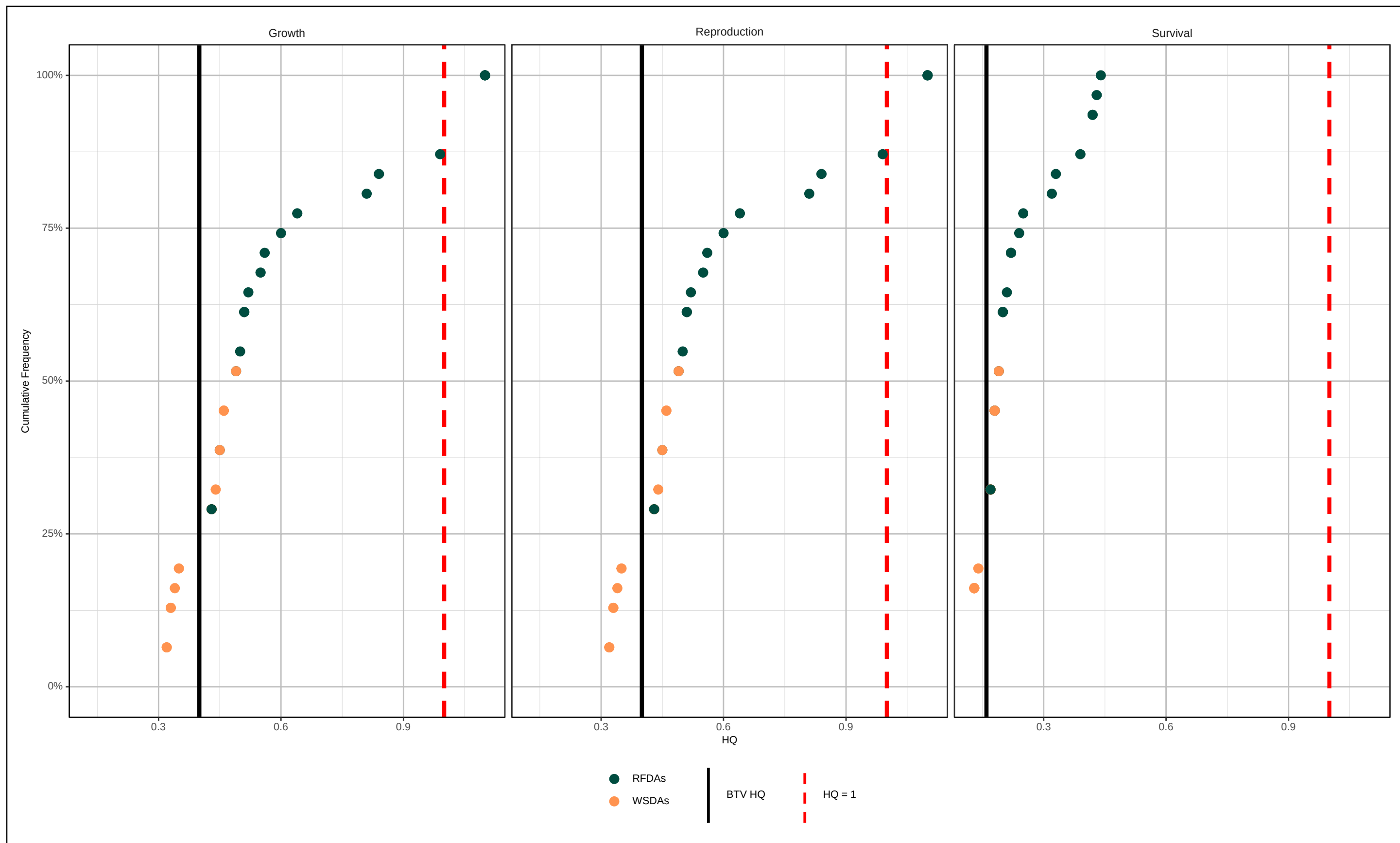


Figure M-40m. Cumulative Frequency of Zinc Dietary HQs for Little Brown Bat in the RFDAs and WSDAs
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

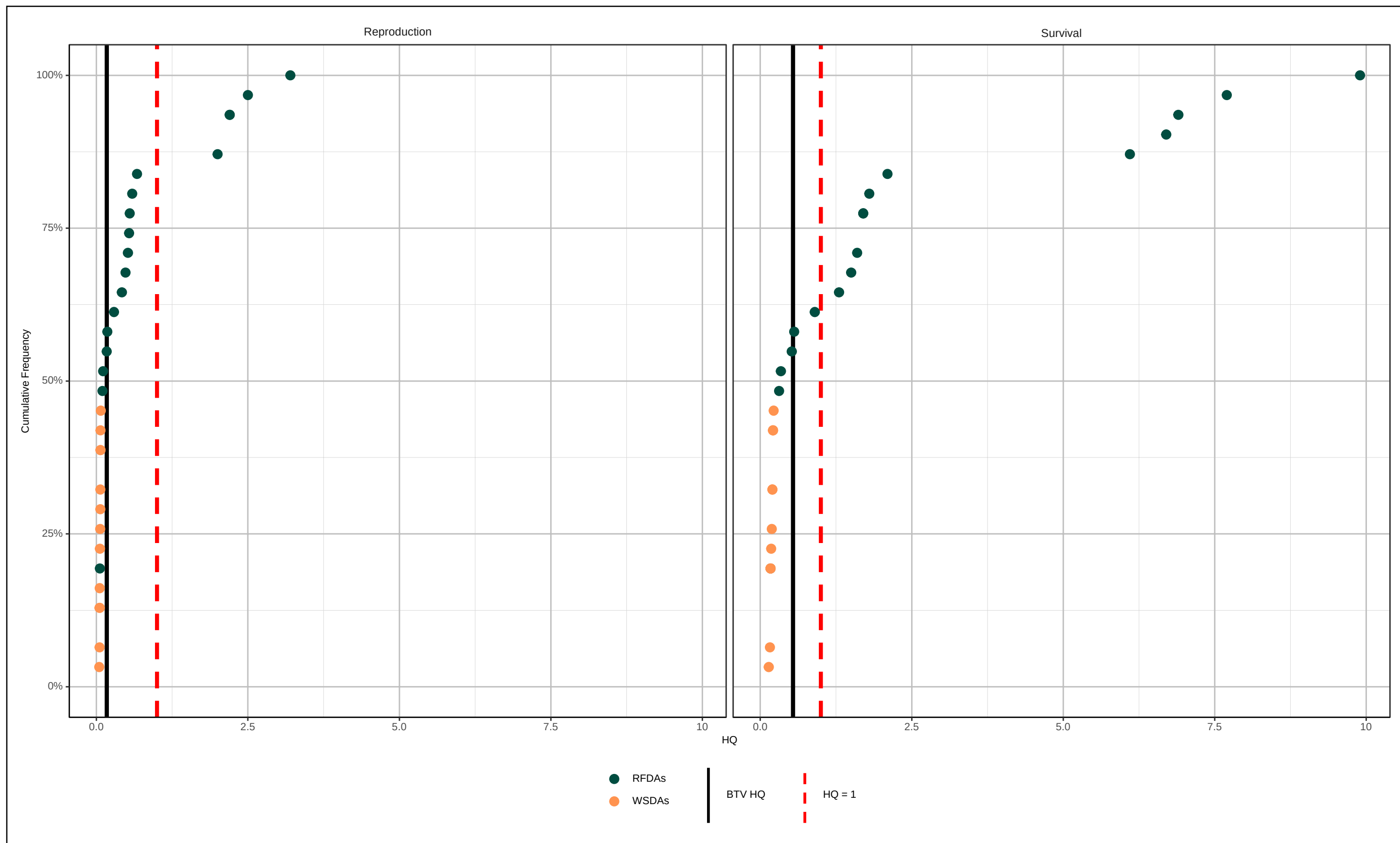


Figure M-40n. Cumulative Frequency of Copper Dietary HQs for Deer Mouse in the RFDAs and WSDAs
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

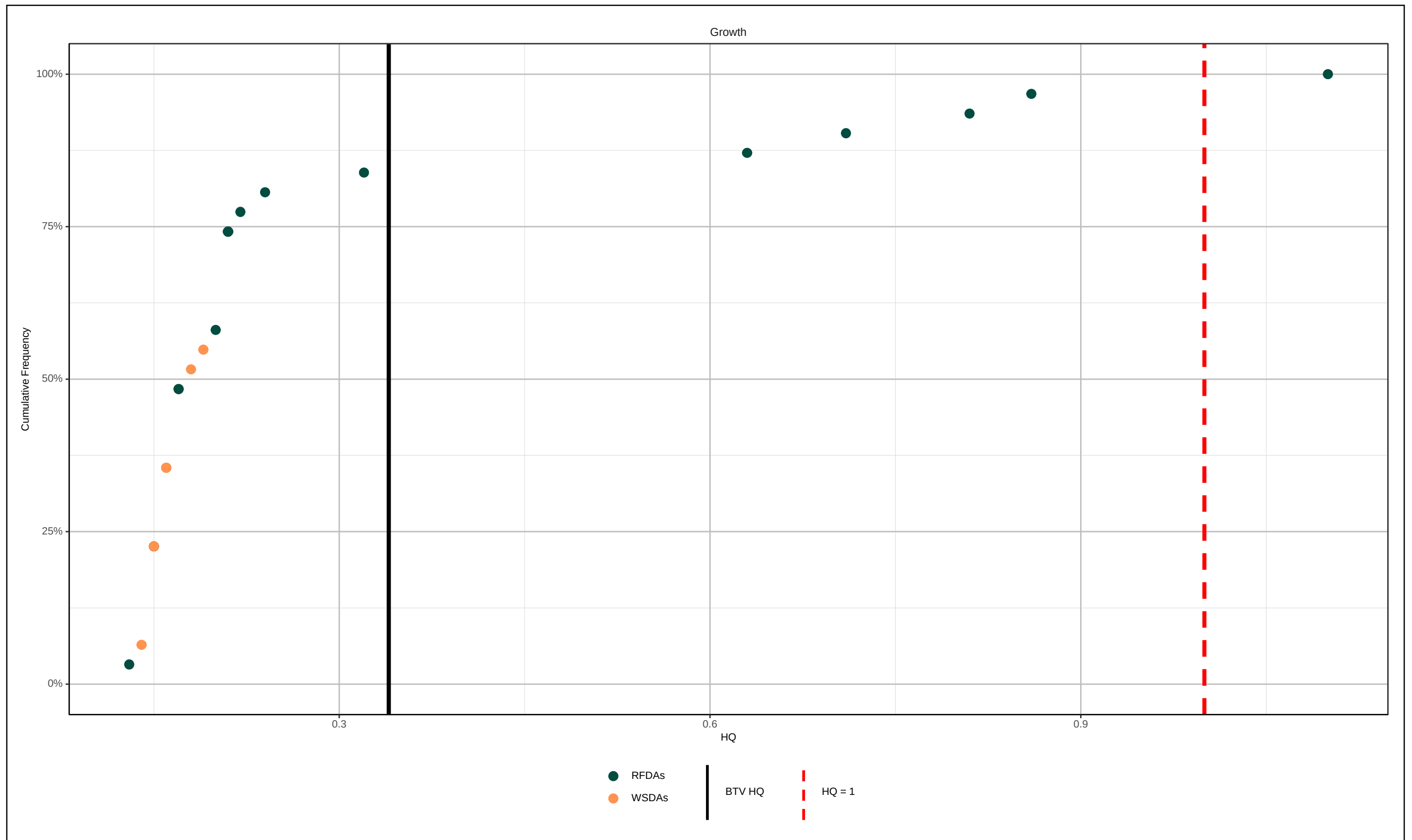


Figure M-40o. Cumulative Frequency of Iron Dietary HQs for Deer Mouse in the RFDAs and WSDAs
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

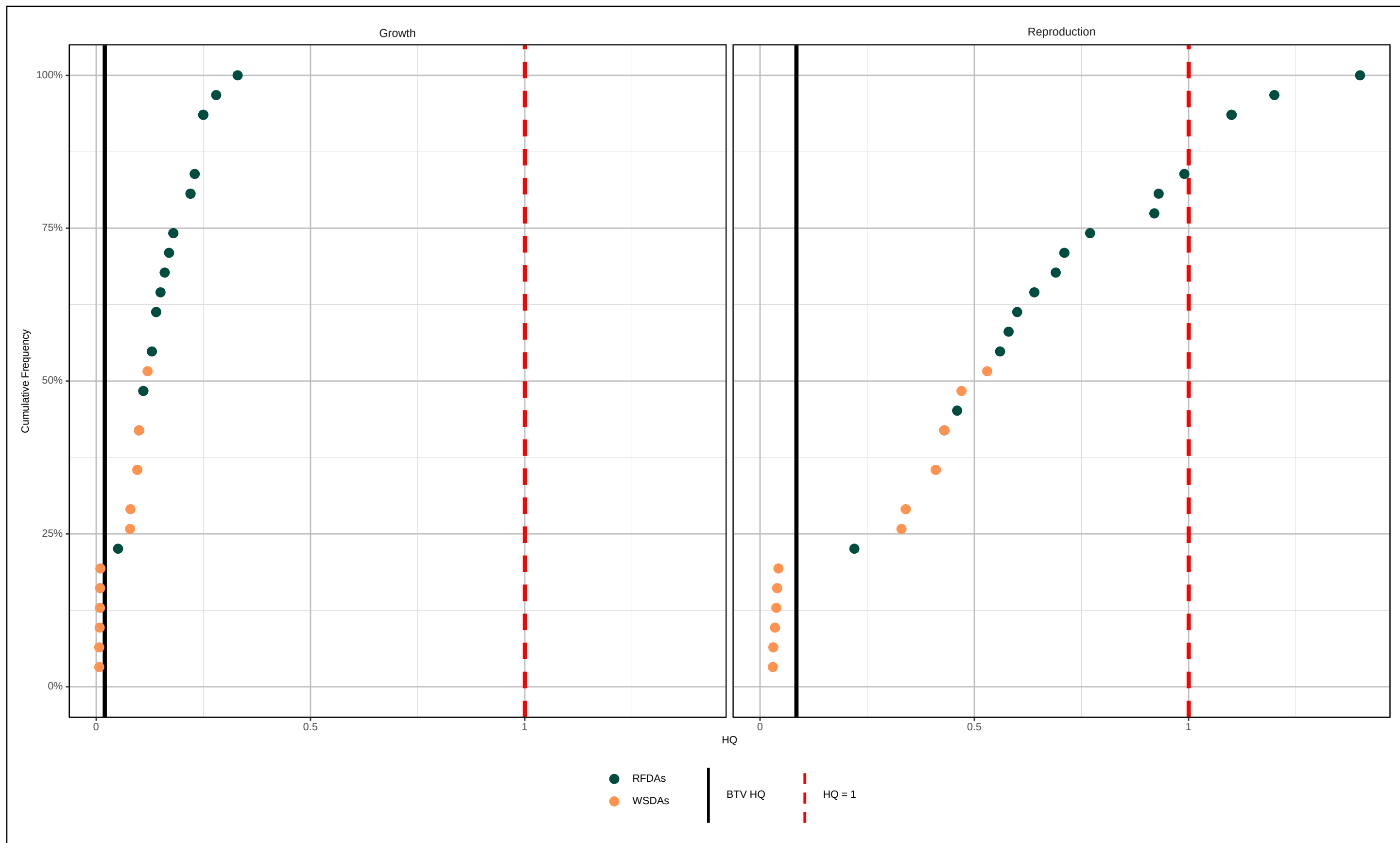


Figure M-40p. Cumulative Frequency of Lead Dietary HQs for Deer Mouse in the RFDAs and WSDAs
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

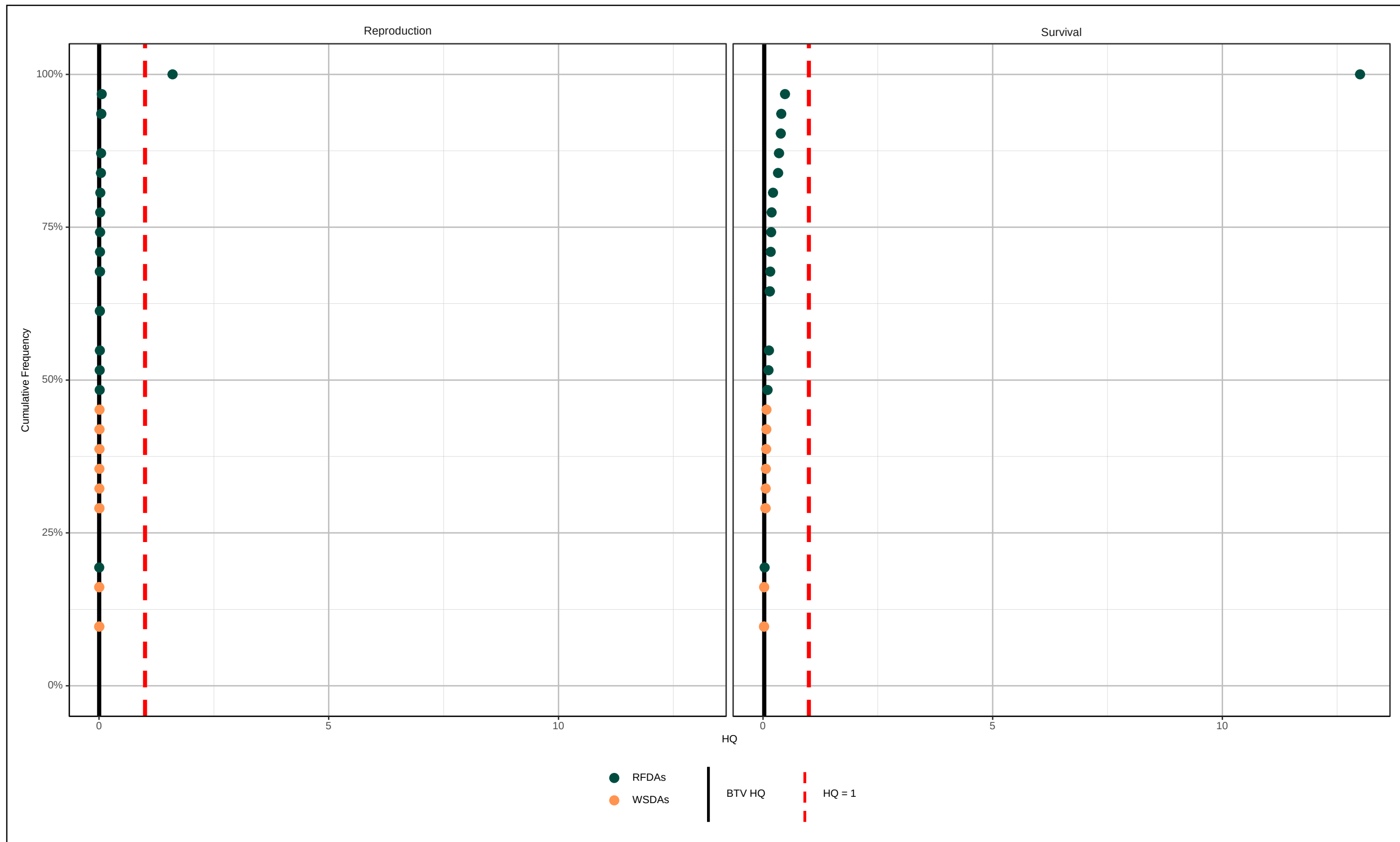


Figure M-40q. Cumulative Frequency of Selenium Dietary HQs for Deer Mouse in the RFDAs and WSDAs
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

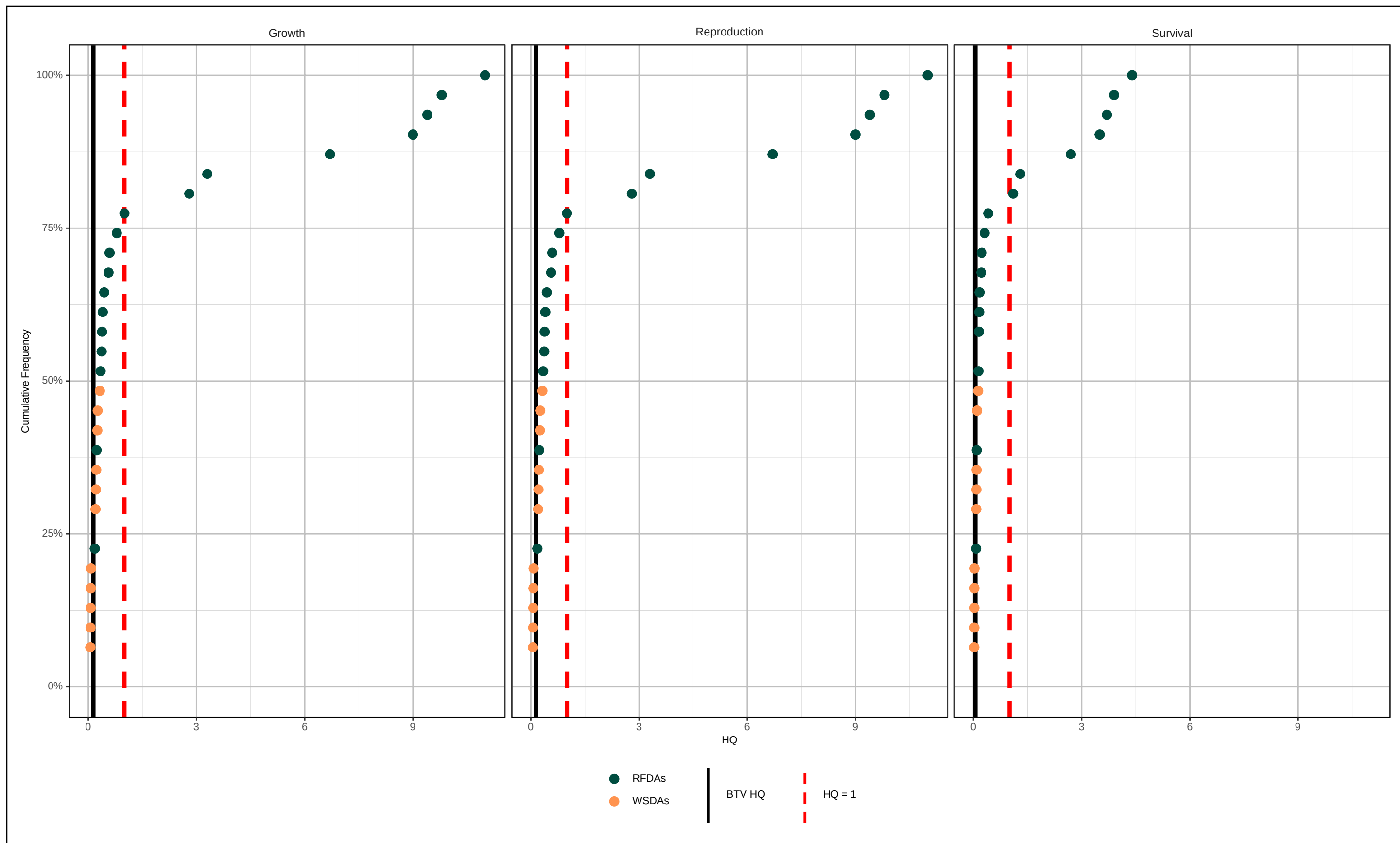


Figure M-40r. Cumulative Frequency of Zinc Dietary HQs for Deer Mouse in the RFDAs and WSDAs
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

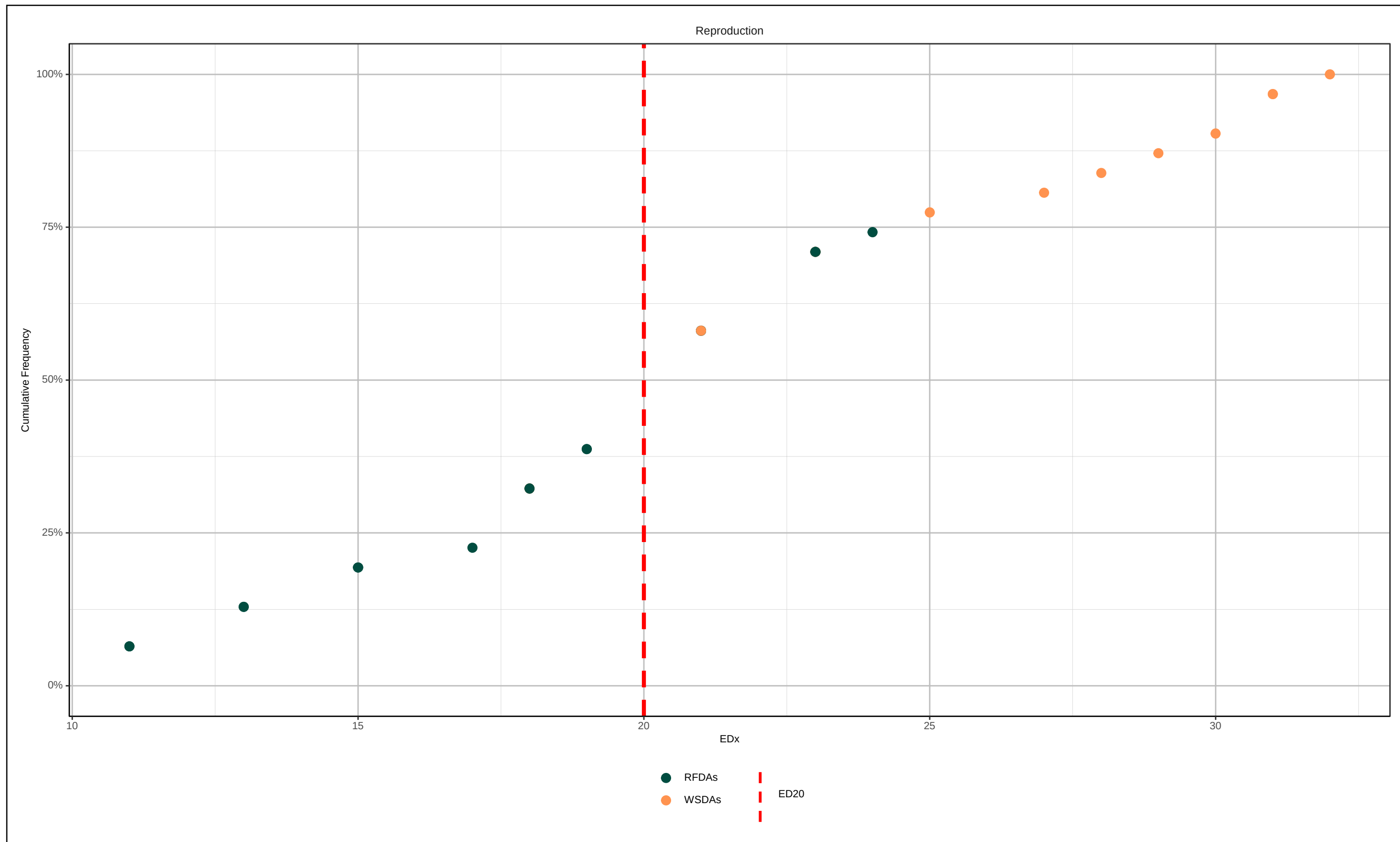


Figure M-41a. Cumulative Frequency of Aluminum EDx Values for Meadow Vole in the RFDAs and WSDAs
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

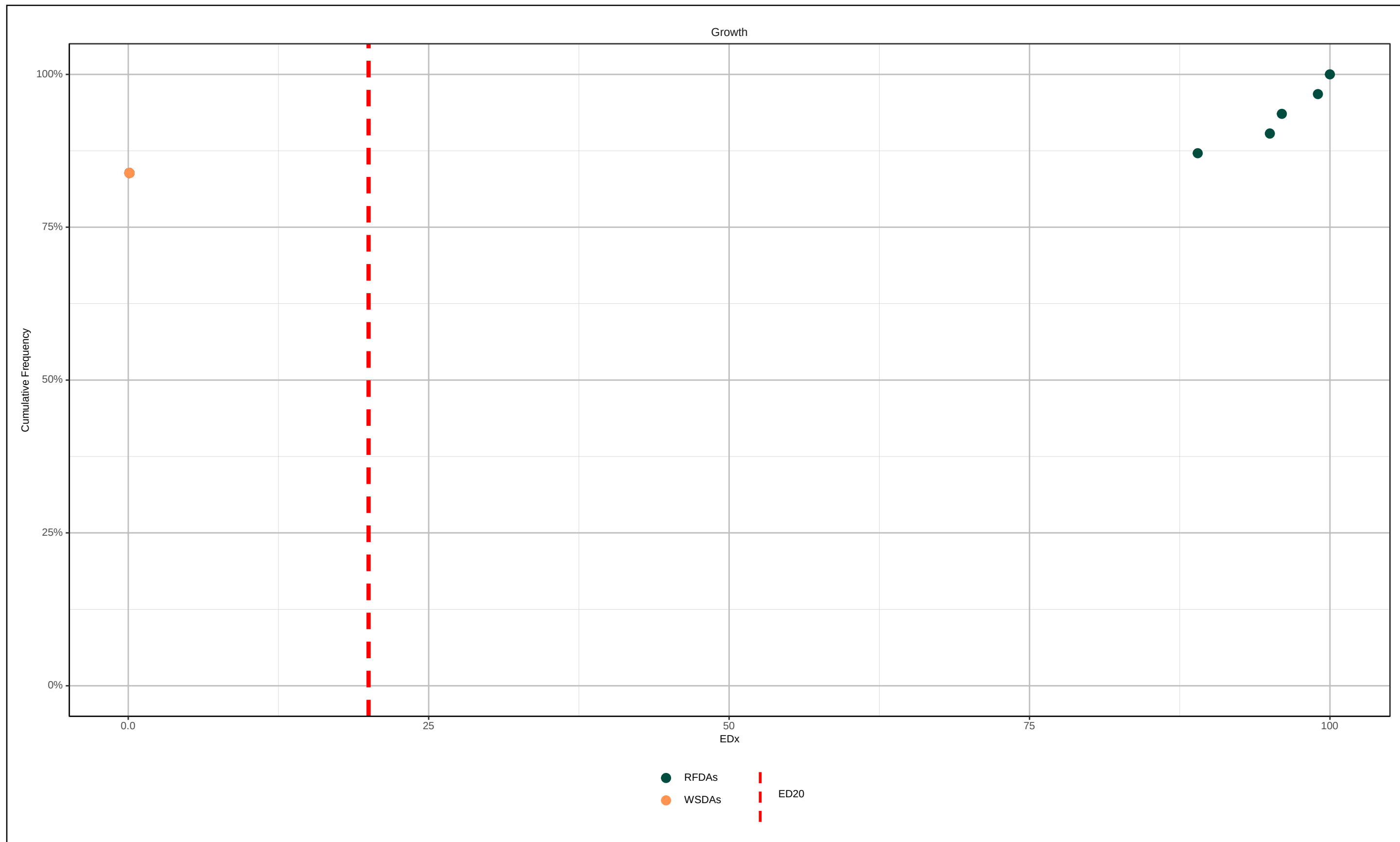


Figure M-41b. Cumulative Frequency of Copper EDx Values for Meadow Vole in the RFDAs and WSDAs
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

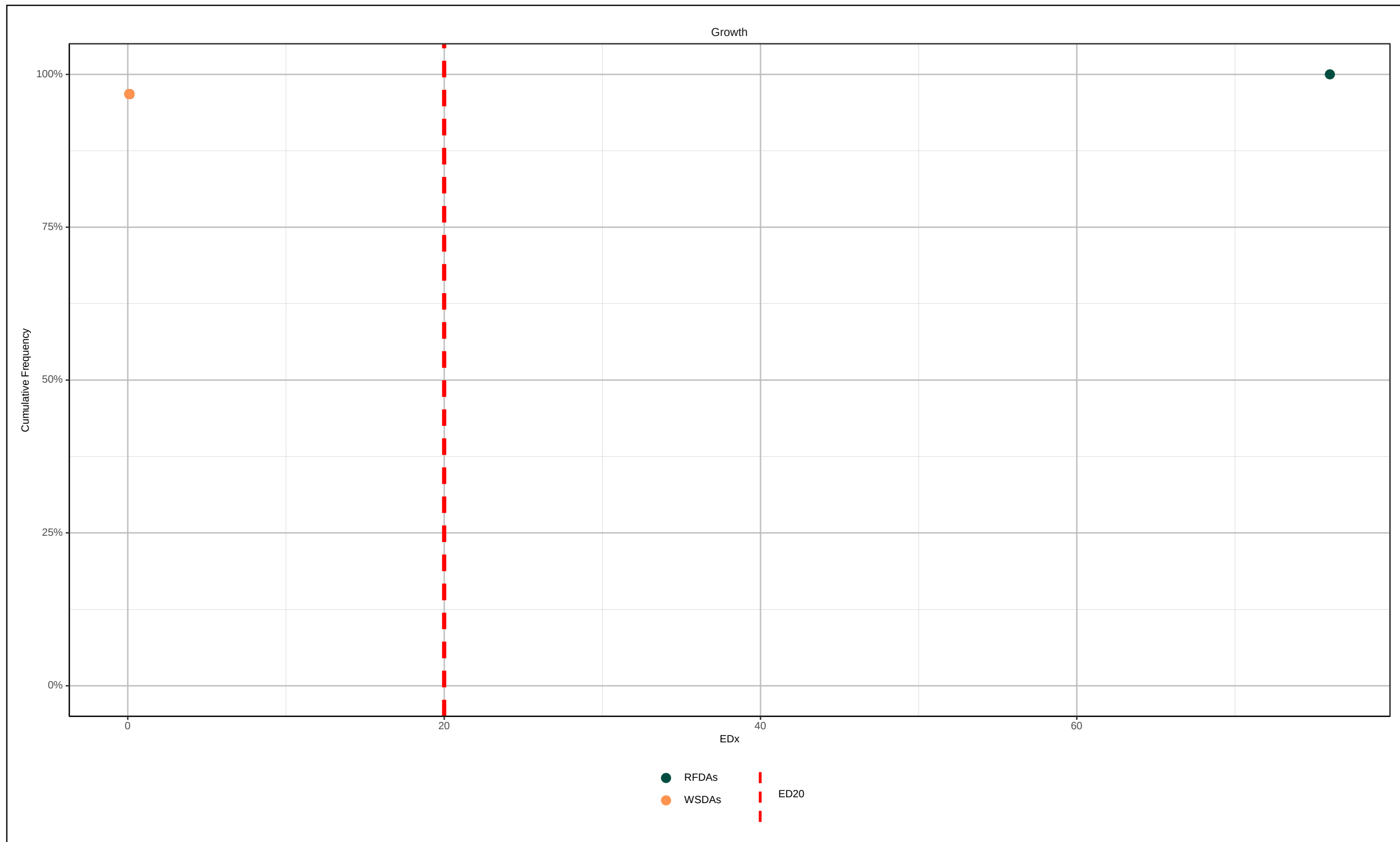


Figure M-41c. Cumulative Frequency of Selenium EDx Values for Meadow Vole in the RFDAs and WSDAs
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

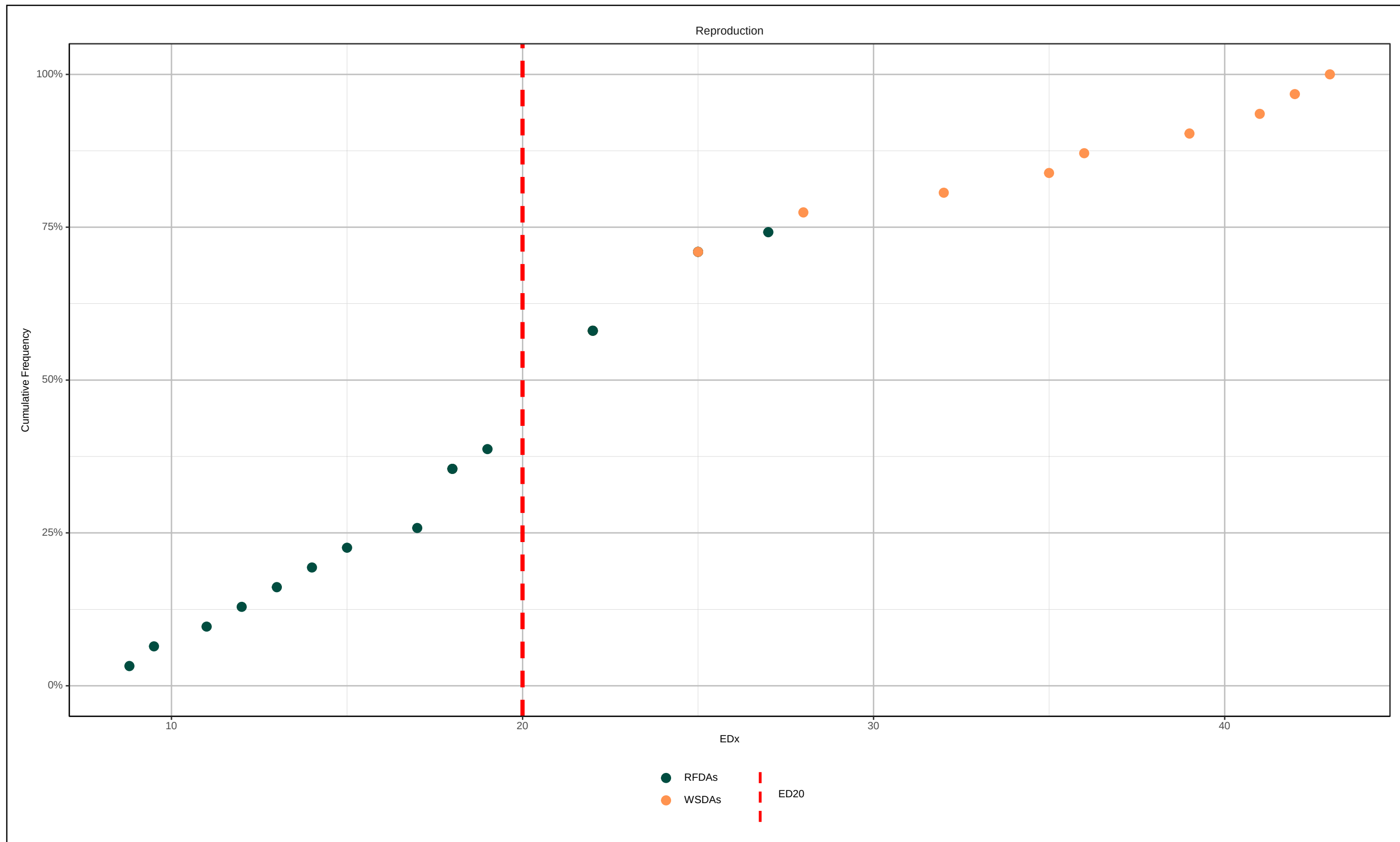


Figure M-41d. Cumulative Frequency of Aluminum EDx Values for Masked Shrew in the RFDA and WSDA
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

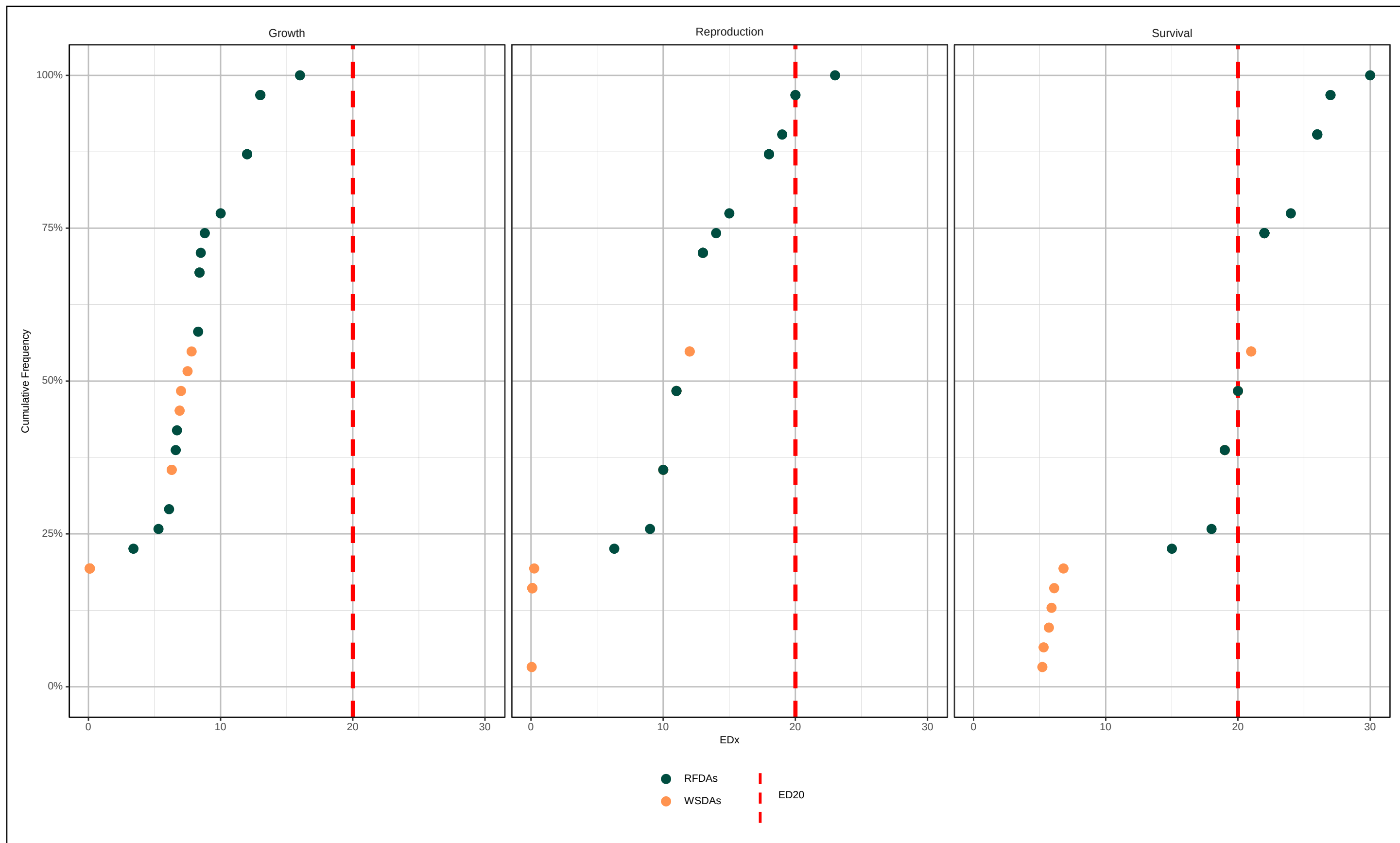


Figure M-41e. Cumulative Frequency of Cadmium EDx Values for Masked Shrew in the RFDAs and WSDAs
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington

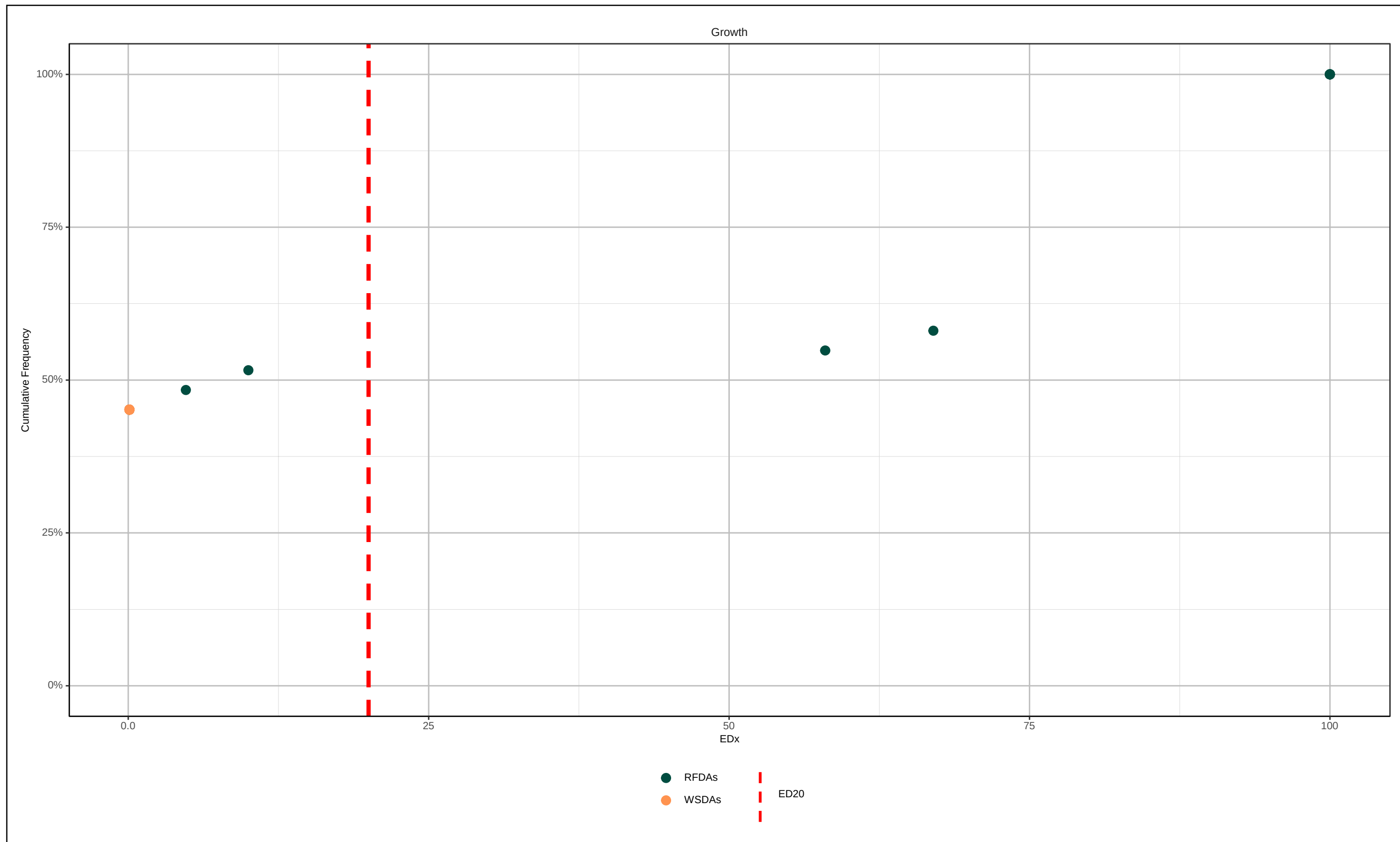


Figure M-41f. Cumulative Frequency of Copper EDx Values for Masked Shrew in the RFDA and WSDAs
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

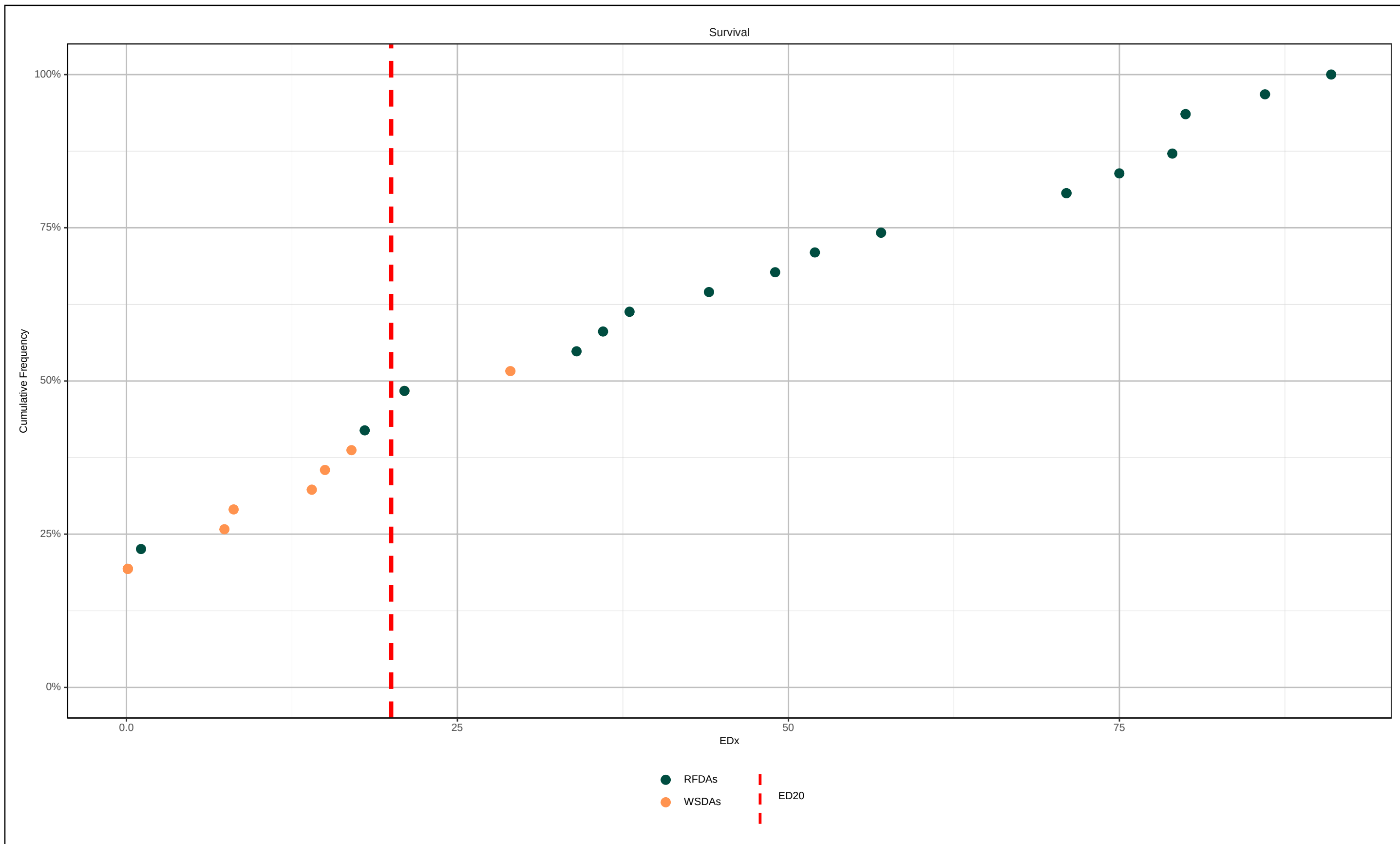


Figure M-41g. Cumulative Frequency of Lead EDx Values for Masked Shrew in the RFDAs and WSDAs
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

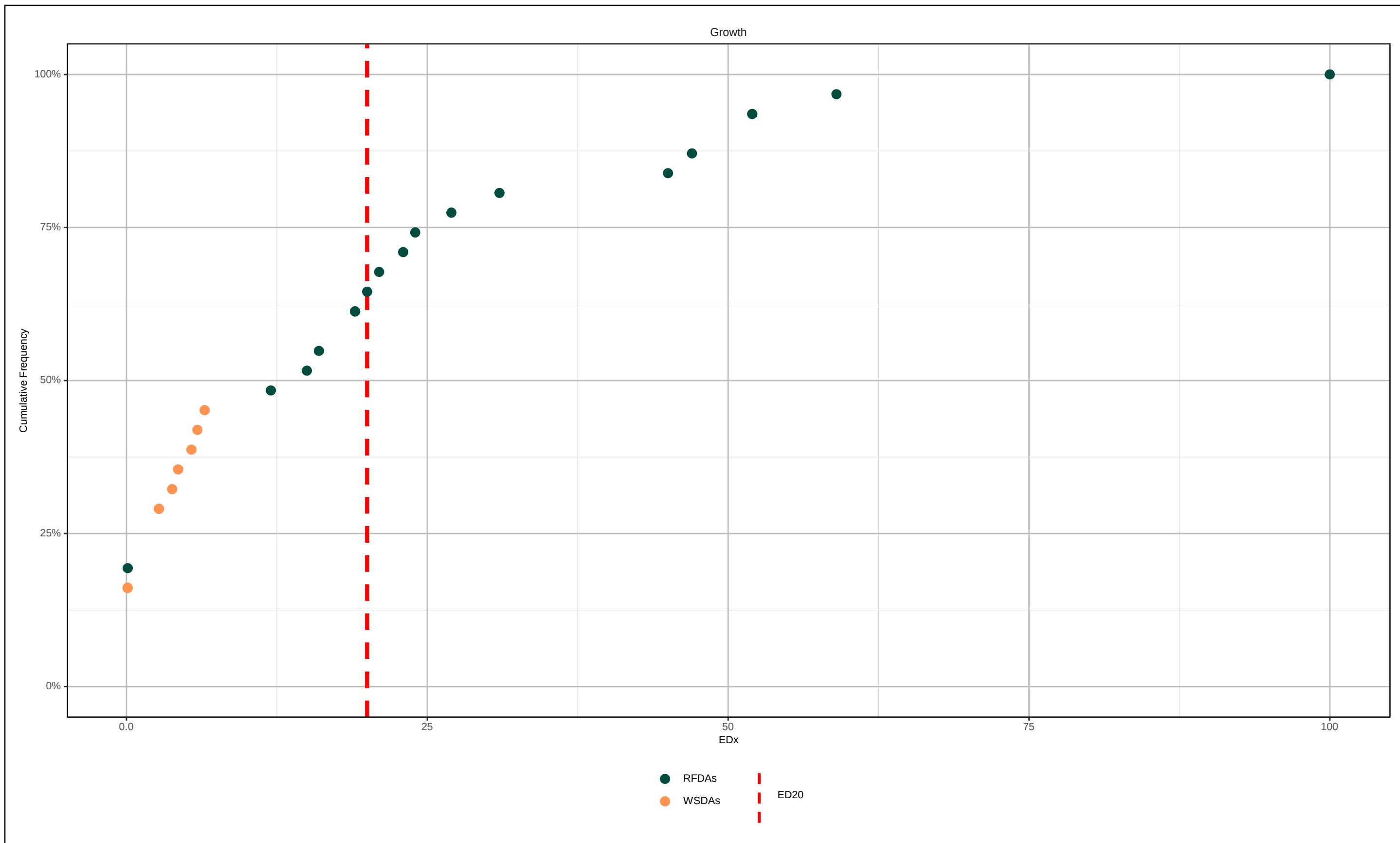


Figure M-41h. Cumulative Frequency of Selenium EDx Values for Masked Shrew in the RFDAs and WSDAs
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

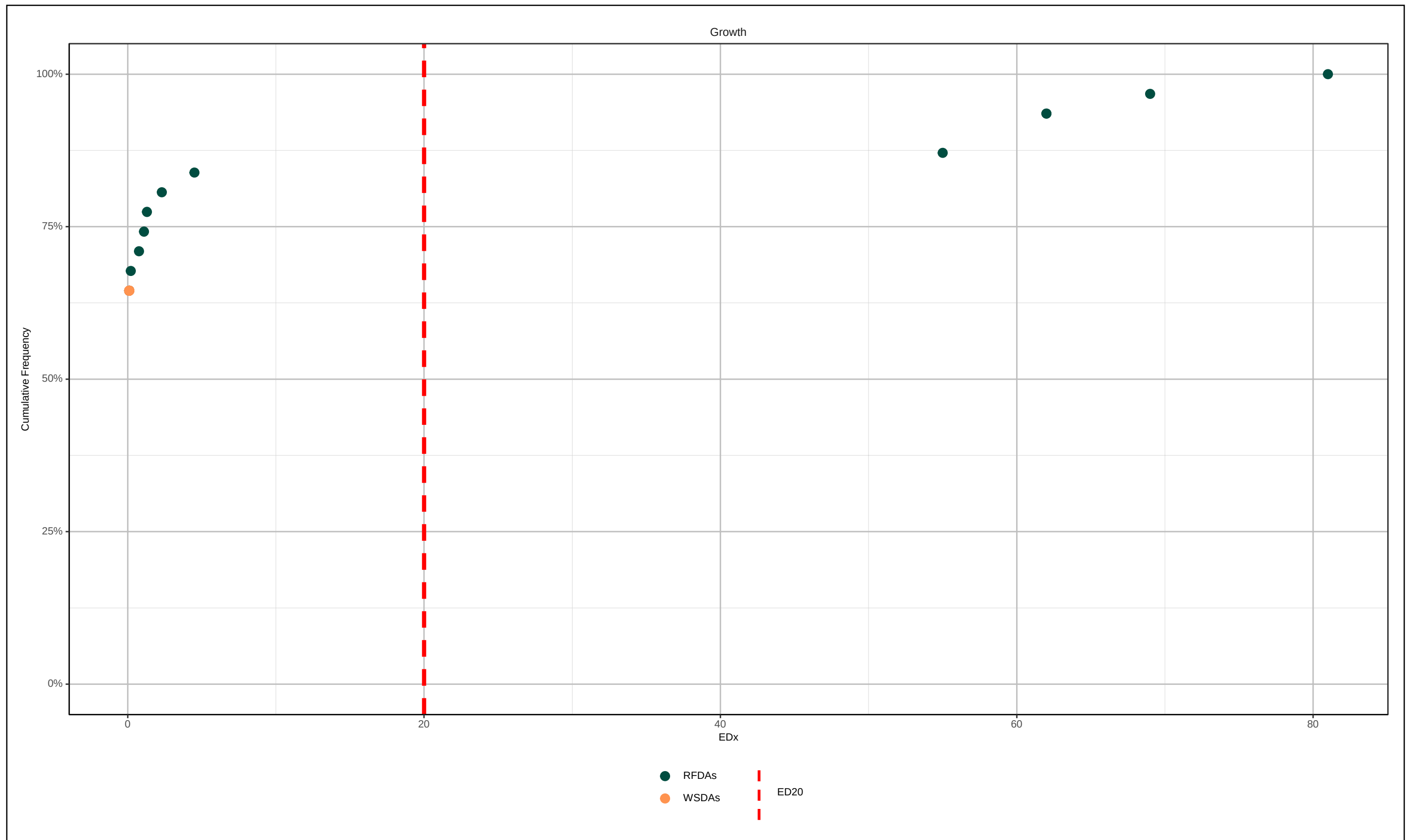


Figure M-41i. Cumulative Frequency of Copper EDx Values for Little Brown Bat in the RFDAs and WSDAs
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

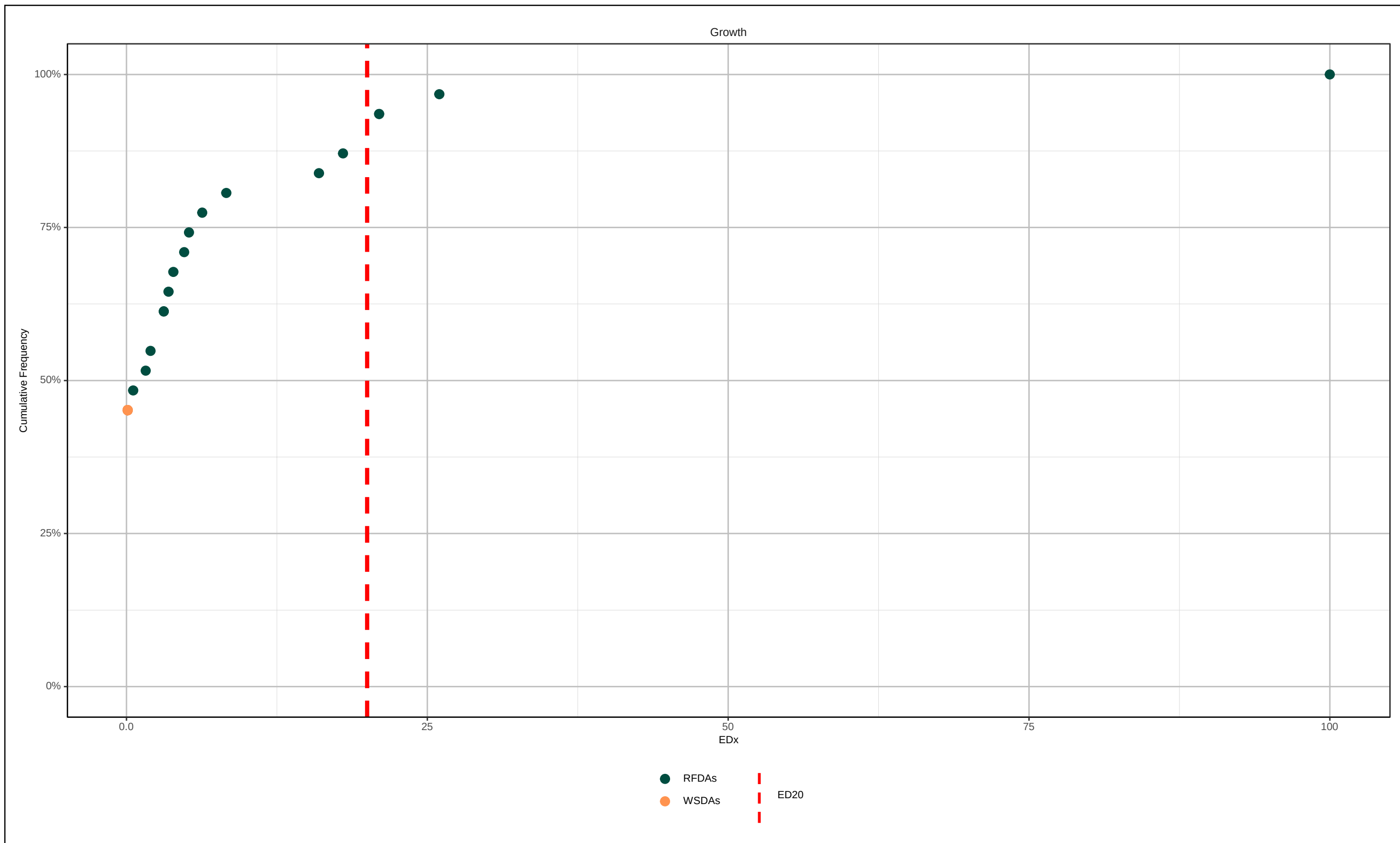


Figure M-41j. Cumulative Frequency of Selenium EDx Values for Little Brown Bat in the RFDAs and WSDAs
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

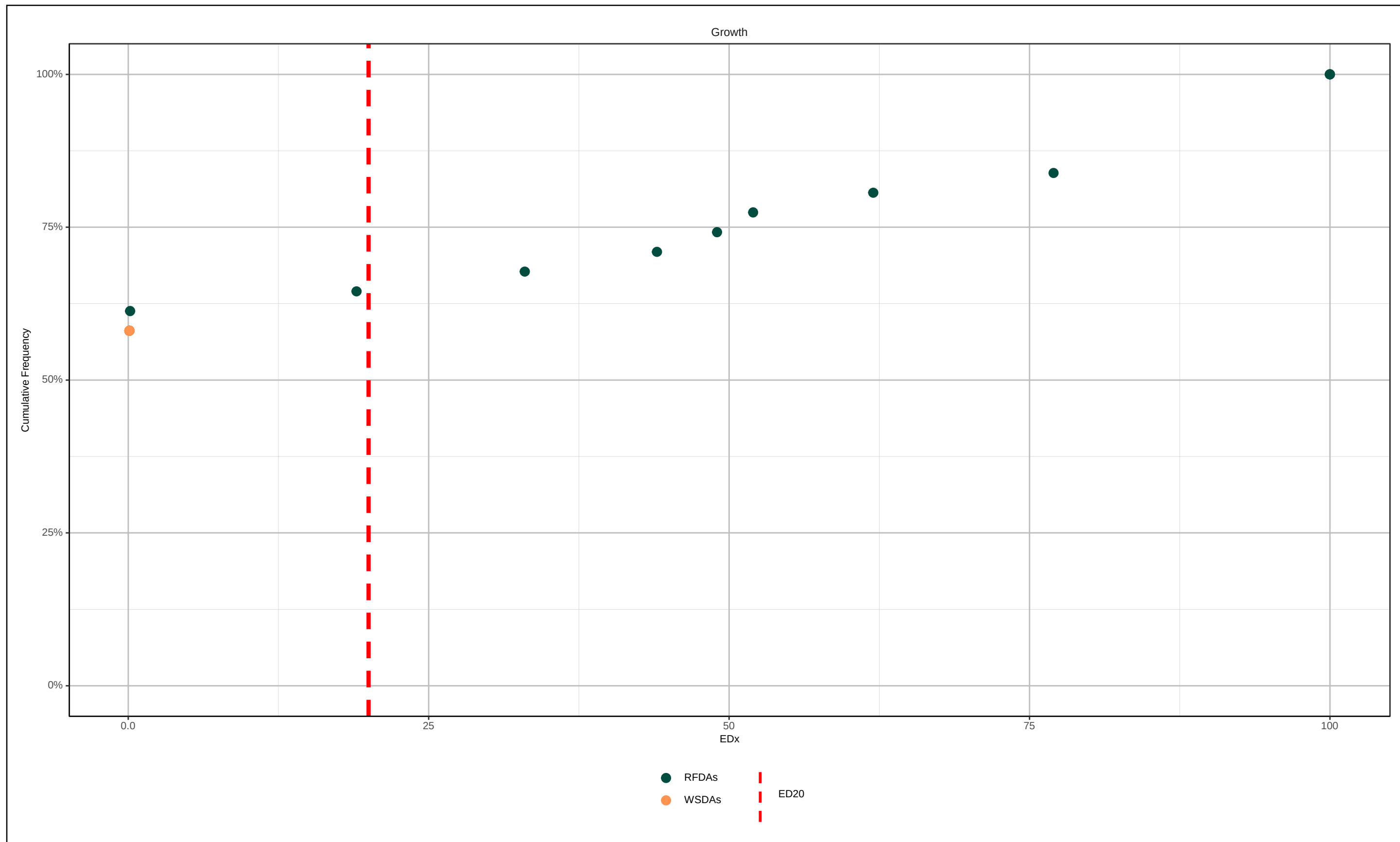


Figure M-41k. Cumulative Frequency of Copper EDx Values for Deer Mouse in the RFDAs and WSDAs
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

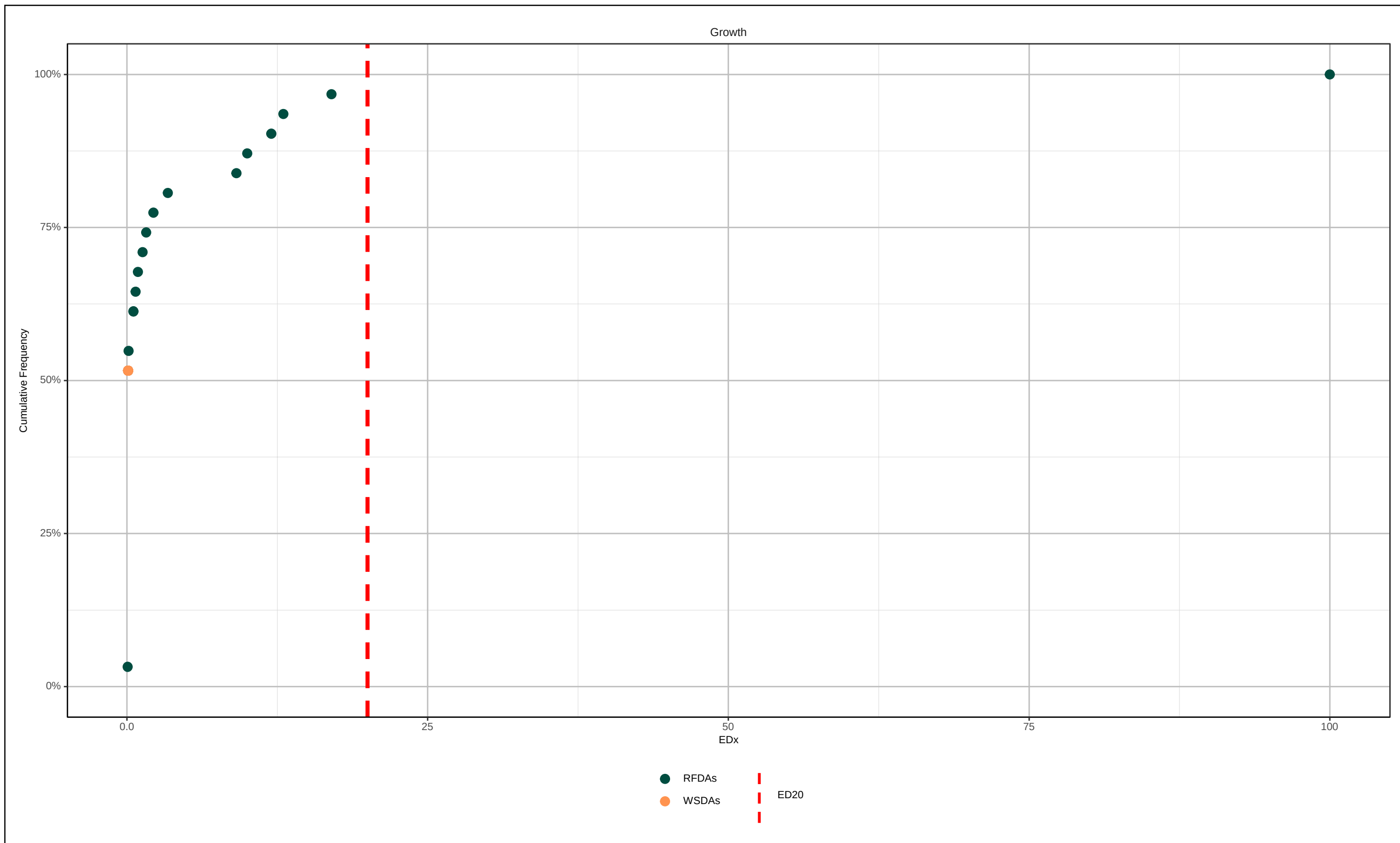


Figure M-411. Cumulative Frequency of Selenium EDx Values for Deer Mouse in the RFDA and WSDAs
Final Aquatic BERA Appendix M: Hazard Quotient Calculations
Upper Columbia River, Washington

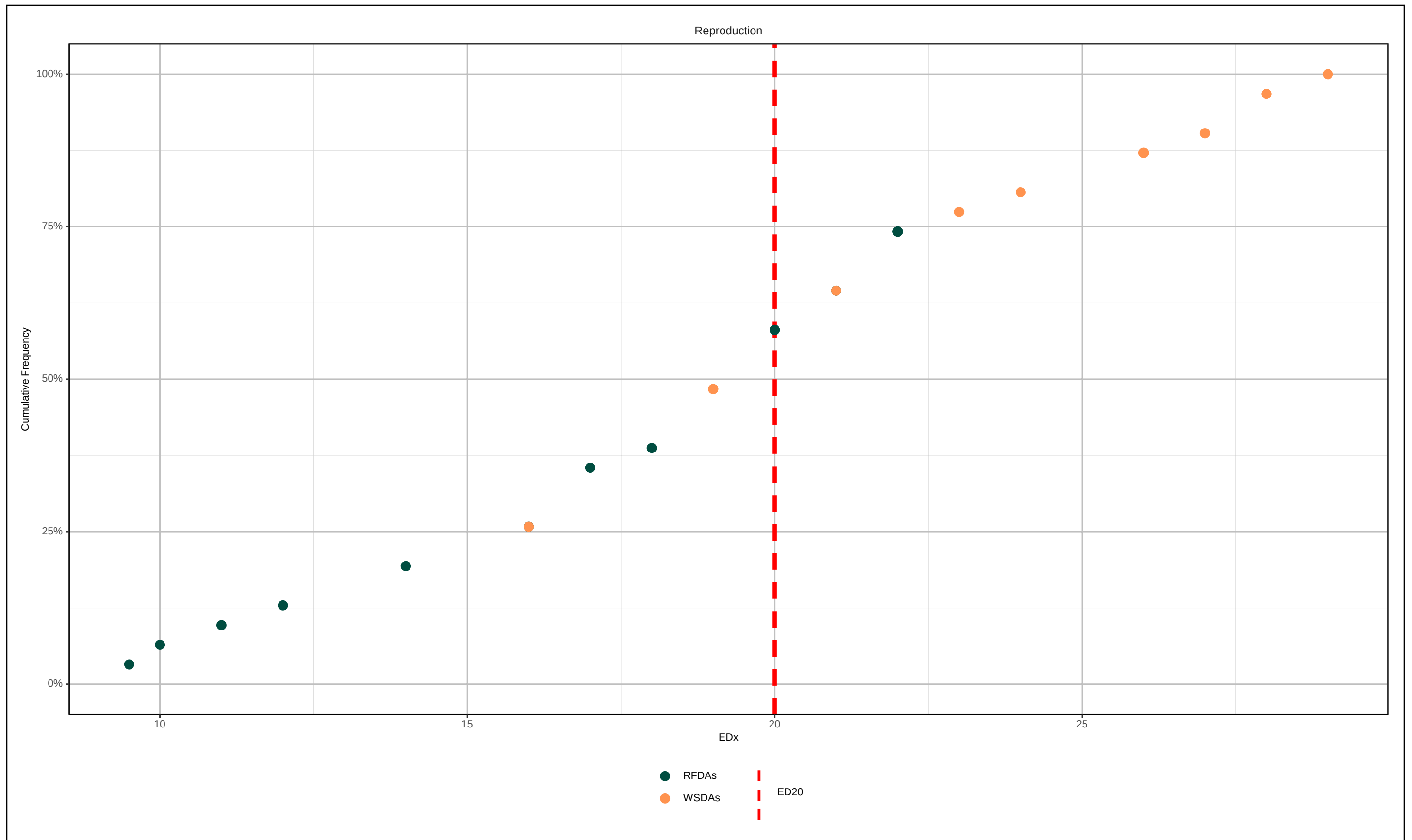


Figure M-41m. Cumulative Frequency of Aluminum EDx Values for Short-Tailed Weasel in the RFDAs and WSDAs
 Final Aquatic BERA Appendix M: Hazard Quotient Calculations
 Upper Columbia River, Washington