

Assignment of Feeding Guild Classifications and Functional Roles to Puget Sound Benthic Macroinvertebrates

C. Herrmann^{1,2}, M. Dutch¹, S. Weakland¹, V. Partridge¹, K. Welch¹
 WA State Department of Ecology¹
 Washington Conservation Corps/AmeriCorps²



PUGET SOUND ECOSYSTEM MONITORING PROGRAM

I. Introduction

Project

- Functional feeding guilds have been used to elucidate benthic food web dynamics in the Strait of Georgia and other estuaries worldwide. Sediment-dwelling macroinvertebrates (benthos) from Puget Sound have not been examined in this way.
- This study applies feeding guild information to Puget Sound benthos to better understand functional changes in benthos assemblages, carbon cycling in the sediments, and potential relationships between the benthic and pelagic food webs.

Program

- The WA Department of Ecology's Marine Sediment Monitoring Team (MSMT) collected benthos throughout Puget Sound as part of the annual sediment quality monitoring work conducted for the Puget Sound Ecosystem Monitoring Program (PSEMP).
- The PSEMP sediment monitoring study design, sampling and analytical methods, and list of parameters are described in Dutch et al. (2009).

Sample Design

- Species-level identification and enumeration of benthos was conducted for two rounds of Puget Sound sediment surveys:
 - Baseline** - 1997 through 2003 (n=300 samples)
 - Resample** - 2004 – Present (Regions n=40/yr, Bays n=30/yr)
- Each region is sampled every ~10 years, each bay every 6 years.

II. Study Questions

- How are the Puget Sound benthos distributed among feeding guilds developed by Macdonald et al. (2012) for the Strait of Georgia?
- Can we find spatial or temporal shifts in feeding guild distribution for the Puget Sound benthos, and if so, what are potential drivers for these shifts?

III. Methods

- The feeding guild classification system developed by Macdonald et al. (2012) has been adopted and applied to 1,324 benthic taxa collected by the MSMT.
- Feeding guild categories incorporated a suite of feeding and functional characteristics, including (1) feeding mode, (2) food type and source, (3) motility, and (4) life habit.
- Nine feeding guilds categories were used:**

Surface Detritivore (SRD)	Collects and ingests sediment and surface particles
Subsurface Detritivore (SSD)	Ingests particles from below sediment surface
Facultative Detritivore (FD)	Feeds using combination of SU, SRD, and SSD
Facultative Carnivore (FC)	Predator or scavenger on meio/macrofauna; also deposit feeds
Benthic Carnivore (BC)	Feeds exclusively on meio/macrofauna
Herbivore (HE)	Feeds exclusively on meio/macroalgae
Macro-Omnivore (OM)	Feeds on large particulate matter; not known to consume detritus
Planktivorous Carnivore (PC)	Feeds on zooplankton
Suspensivore (SU)	Feeds exclusively from water column

IV. Results

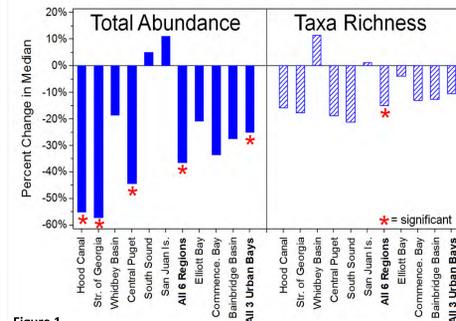


Figure 1. Percent change in median for 6 Regions and 3 Urban Bays between sample periods. Note overall negative trend. (Kruskal-Wallis $\alpha = .05$)

- The first five feeding guilds listed represent 75% of taxa classified and 93% of individual samples. The remaining guilds were therefore combined into an "Other" category. (Table 1)

Feeding Guild	No. of Taxa	Total No. Individuals	Examples of Dominant Taxa
SRD	210	7692	Cirratulidae, Pinnotheridae, Leuconidae
SSD	85	5121	Oligochaeta, Capitellidae, Cossuridae
FD	265	13517	Oweniidae, Leptocheliidae, Lasaeidae
FC	206	7828	Syllidae, Lumbrineridae, Nephtyidae
BC	227	6449	Pholoidae, Edwardsiidae, Lysianassidae
Other:	331	3121	
HE	33	226	Littorinidae, Limapontiidae, Haminoeidae
OM	43	454	Ischnochitonidae, Onuphidae, Paramunnidae
PC	82	515	Pontoporeiidae, Pontogeneiidae, Virgulariidae
SU	173	1926	Serpulidae, Mytilidae, Balanidae
Total:	1324	43728	

Table 1. Trophic functional classification of macrobenthic taxa in Puget Sound, with examples of most abundant families within each guild.

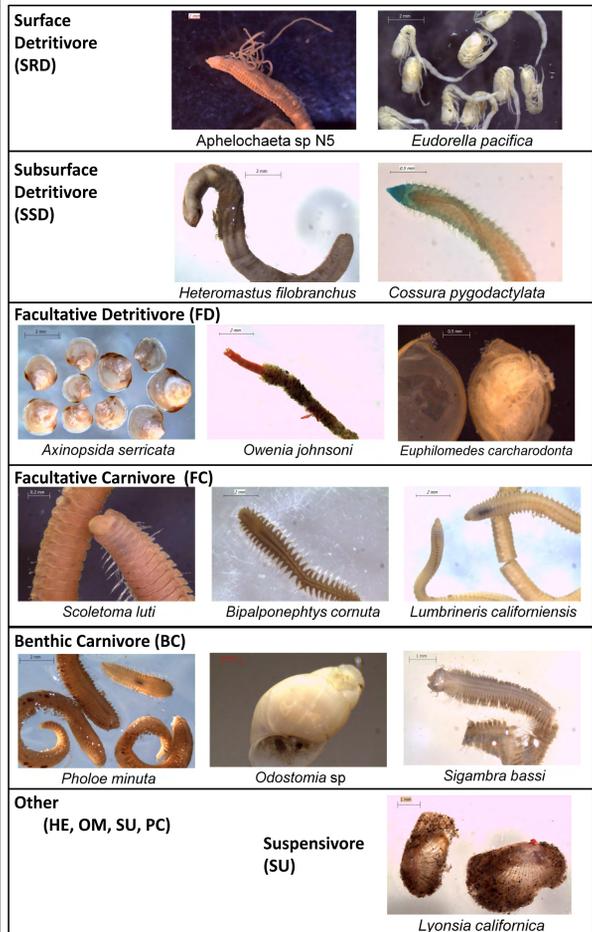


Figure 3. Examples of most commonly occurring species by guild.



Figure 4. MSMT regions and Bays.

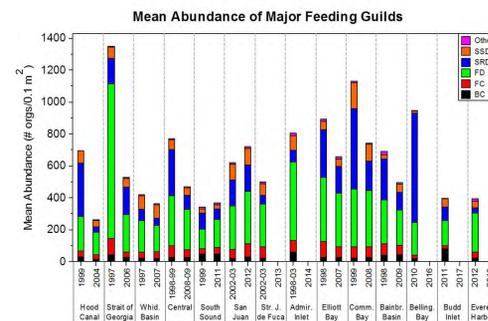


Figure 2. Summed mean abundance, by guild, for regions/bays across sample dates. Missing bars indicate data not yet analyzed or study areas not yet sampled.

- Stacked bars elucidate within-region anomalies. Note the decrease of Facultative Detritivores in the Strait of Georgia region from 1997 to 2006.
- Commencement Bay experienced a loss of Surface Detritivores from 1999 to 2008, while abundance of other guilds remained relatively unchanged. (Figure 2)

IV. Results (continued)

- Examples of changes in Feeding Guilds between Baseline and Resample periods can be seen in Figures 4-10. For instance:
 - Surface Detritivores and Facultative Detritivores** - Abundances declined in the Central and Strait of Georgia Regions, but...
 - Surface Detritivores also increased locally** - Abundances of *Aphelocheata* spp., a stress-tolerant cirratulid polychaete, increased in northern Bellingham Bay.

V. Summary/Conclusions

- Examination of benthos based on feeding guilds elucidates functional shifts in assemblages over time, locally and regionally.
- These shifts vary throughout Puget Sound, and are likely associated with changes in other environmental parameters at varying geographic scales.
- Corroboration with Canadian colleagues regarding findings in the Strait of Georgia, and with oceanographers studying changes in water column parameters, will provide further insight.

Literature Cited:
 Dutch M., Partridge V., Weakland S., Welch K., Long E. 2009. WA Dept. of Ecol. Pub No. 09-03-121.
 Macdonald T.A., Burd B.J., Macdonald V.I., van Roodelaar A. 2010. Can. Tech. Rep. Fish. Aquat. Sci. 2874: iv + 63.
 Macdonald T.A., Burd B.J., van Roodelaar A. 2012. Mar. Ecol. Prog. Ser. 445: 129-140
Acknowledgements:
 • Biological Environmental Services developed the classification framework and provided additional advice in support of this project.
 • Funding for this project was provided in part through an AmeriCorps State grant awarded to Washington Conservation Corps.



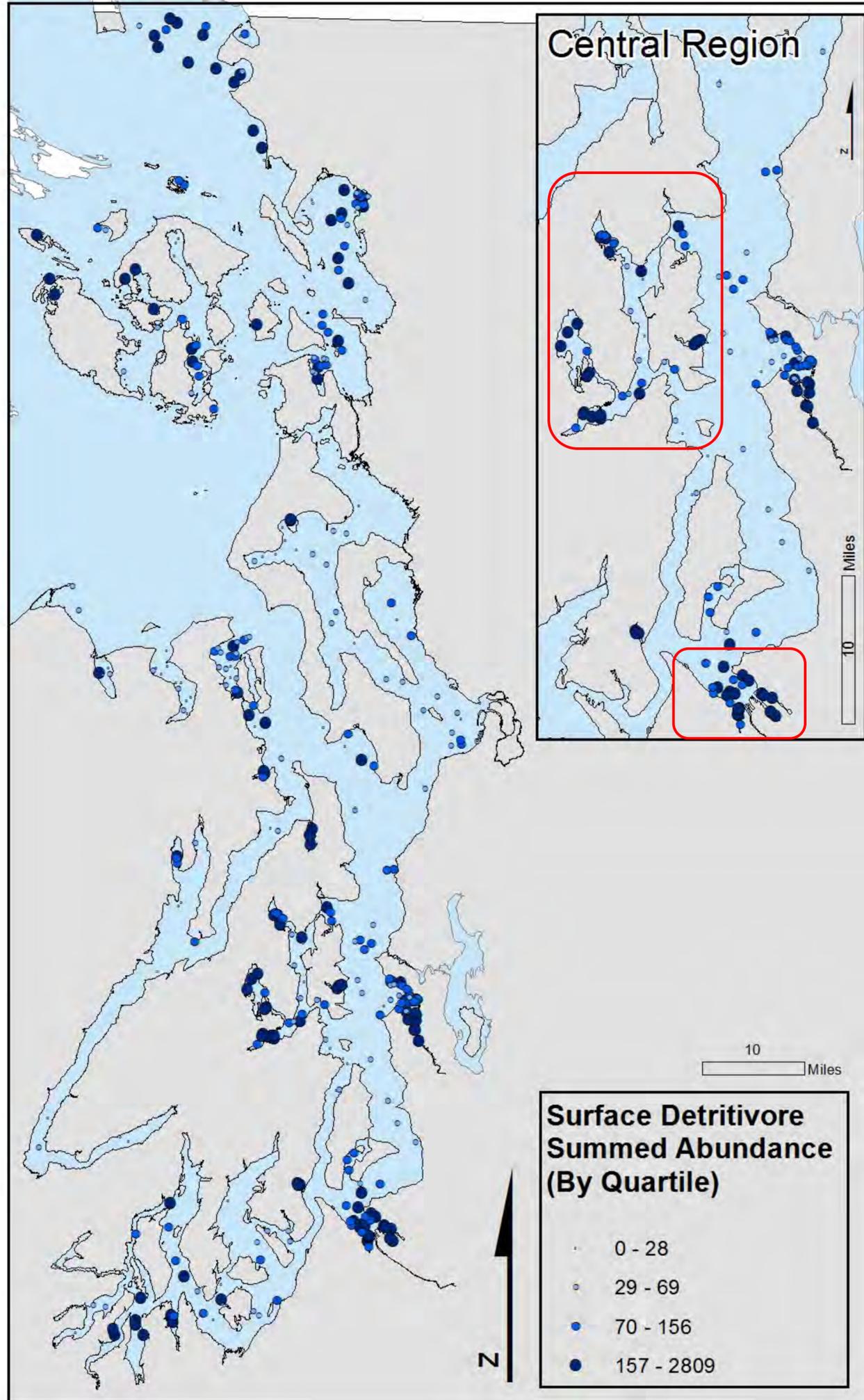
General information and all data generated during these surveys can be accessed from Ecology's Marine Sediment Monitoring website: www.ecy.wa.gov/programs/eap/psamp/index.htm. The poster was prepared for the 2014 Salish Sea Ecosystem Conference, April 30 – May 2, 2014, in Seattle, WA. This poster is Washington State Department of Ecology Publication No. 14-03-027.



Figures 5-10 (Following pages). Total abundance by feeding guild between two sampling periods (abundance data summarized by quartile). Notable shifts circled in red. The Central Puget Sound region (inset) is highlighted due to its likelihood for response to anthropogenic pressures. F5: SRD, F6: SSD, F7: FD, F8: FC, F9: BC, F10: Other

Baseline

1997-2003



Resample

2004 - Present

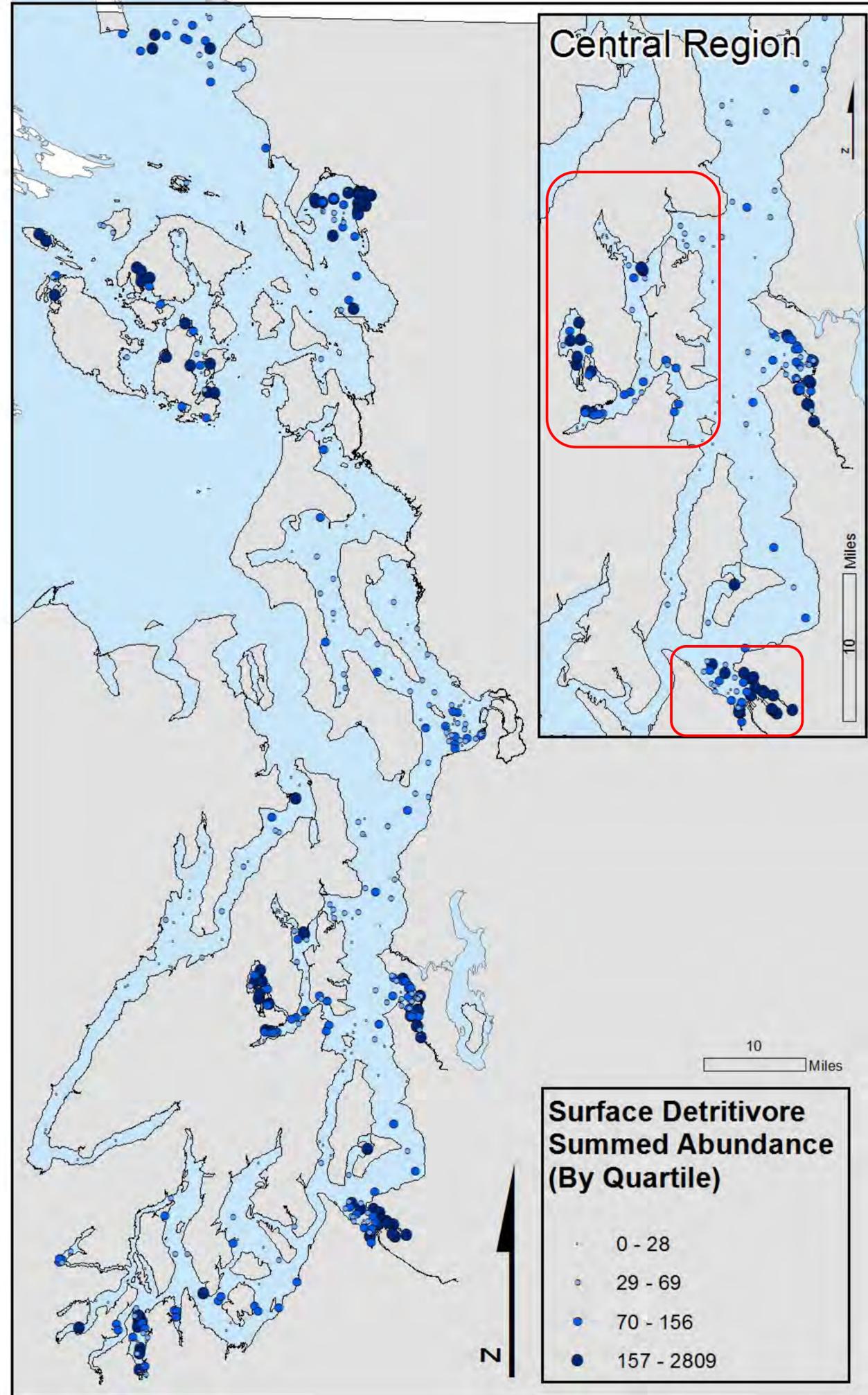
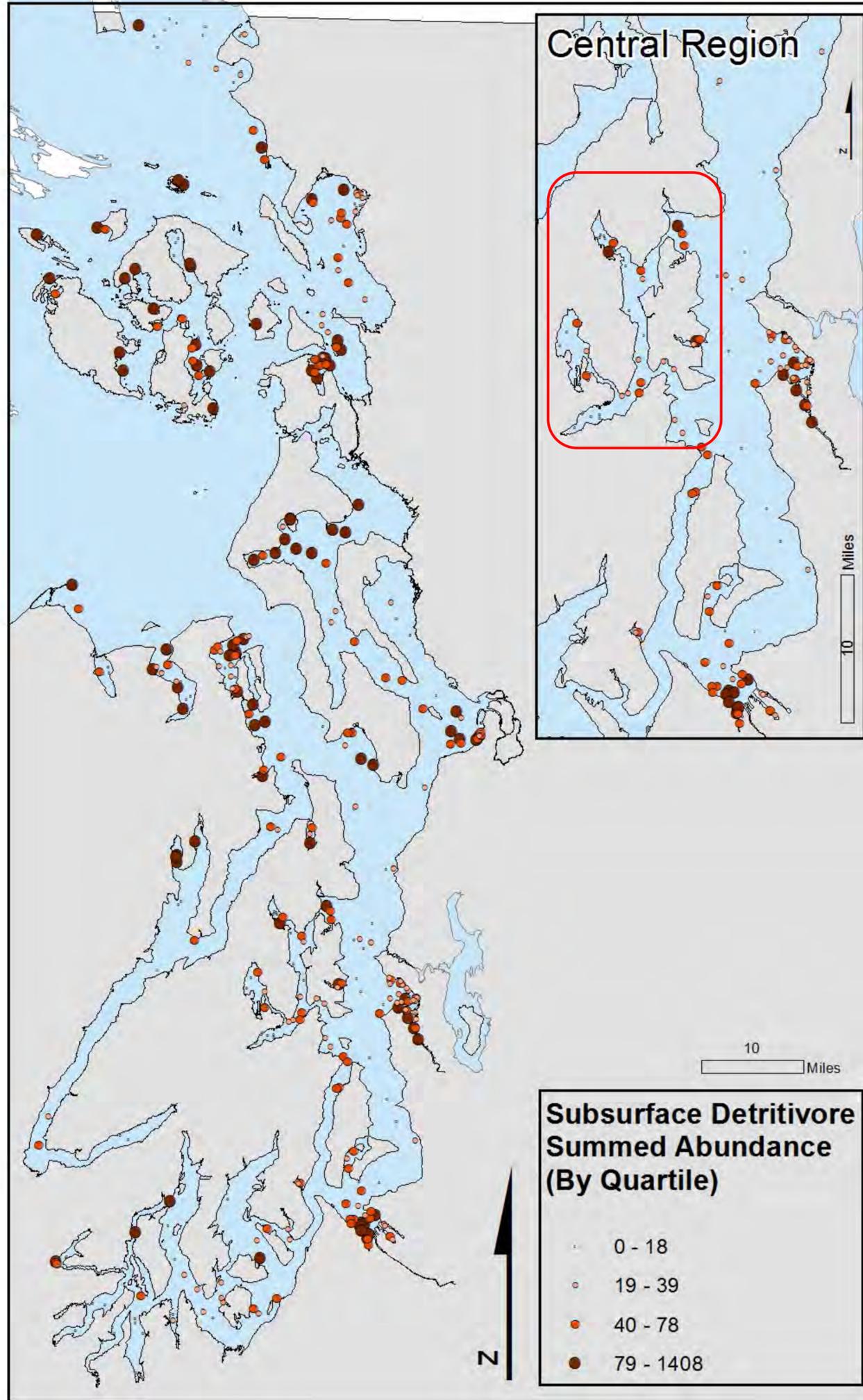


Figure 5.

Baseline

1997-2003



Resample

2004 - Present

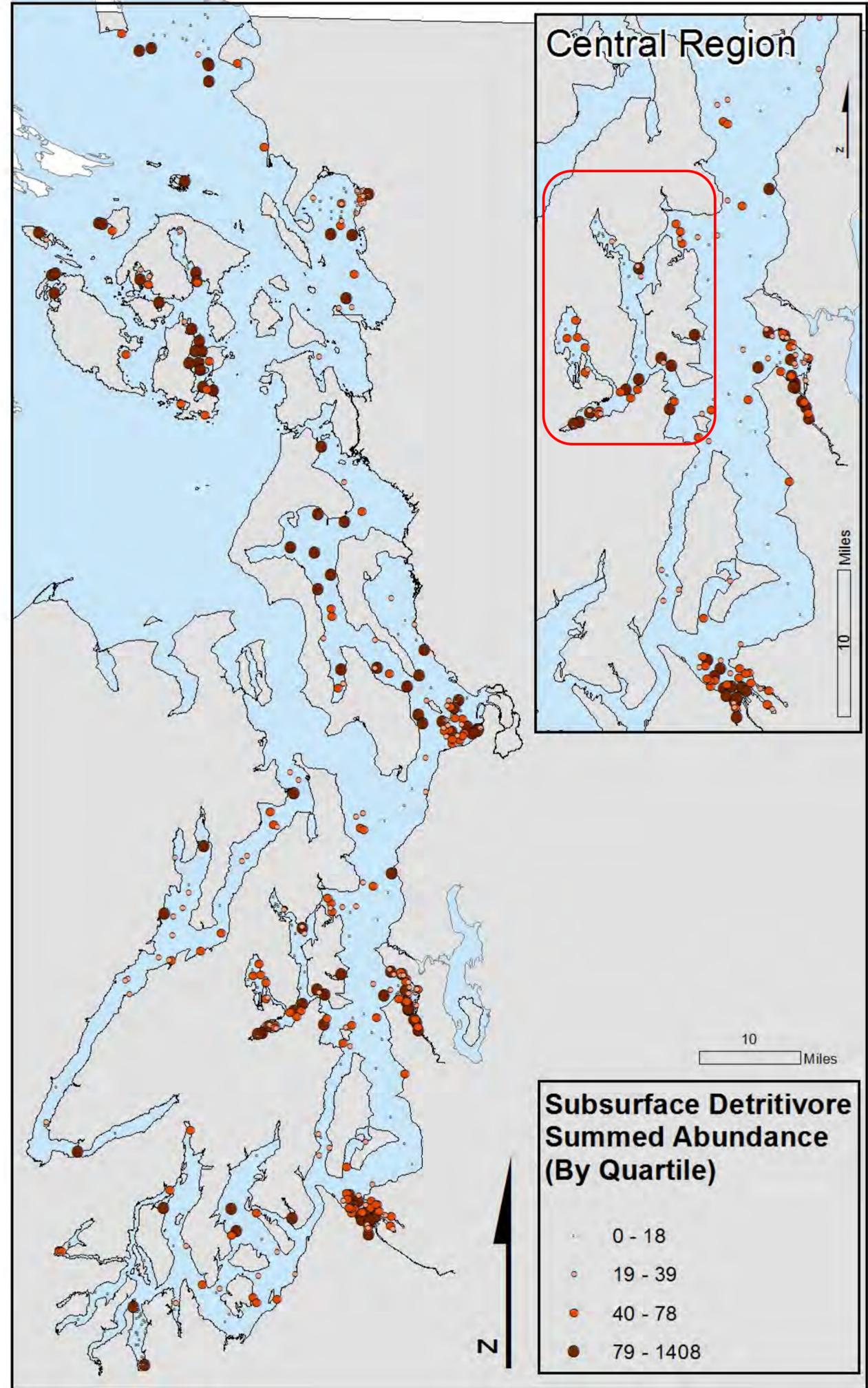
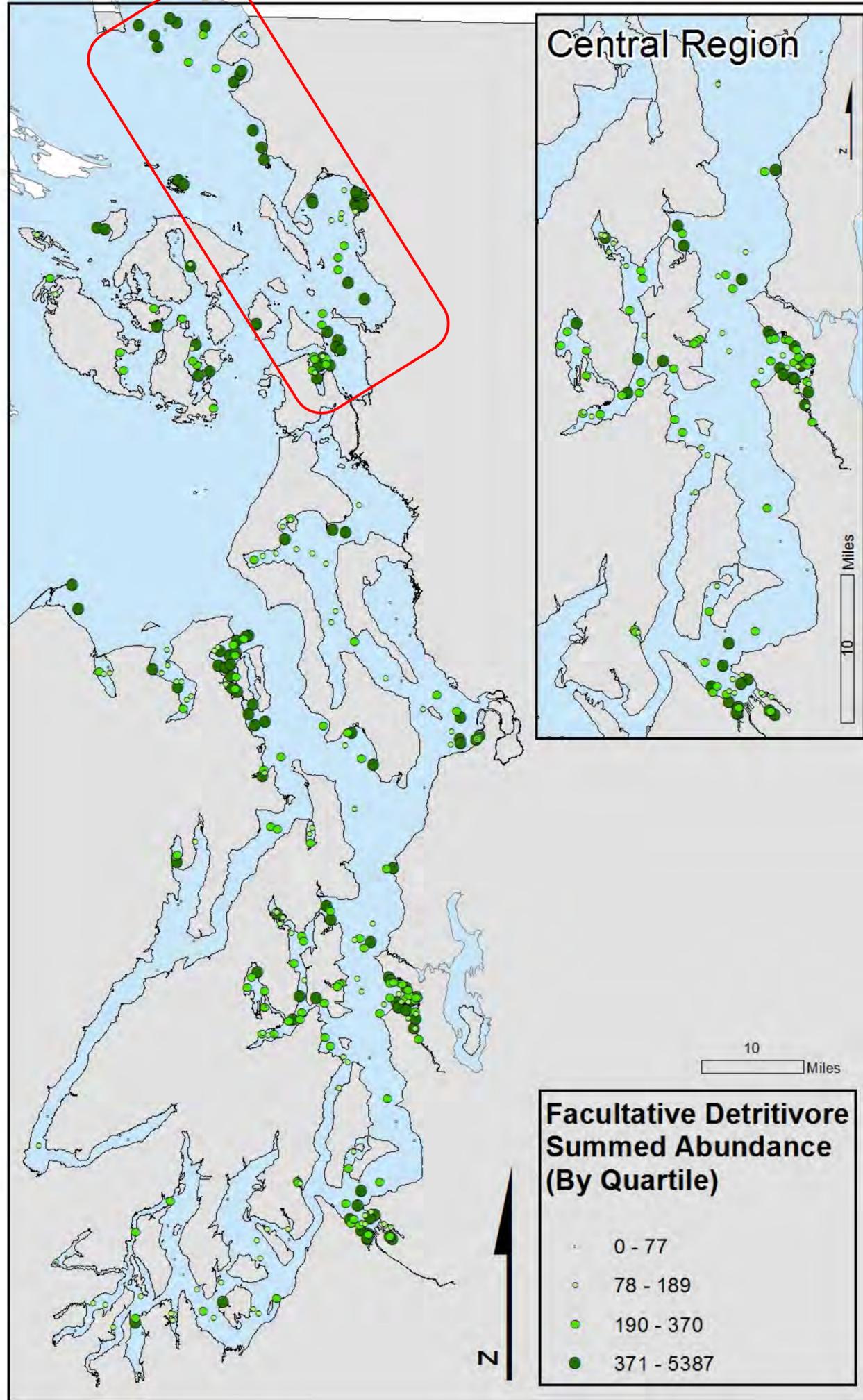


Figure 6.

Baseline

1997-2003



Resample

2004 - Present

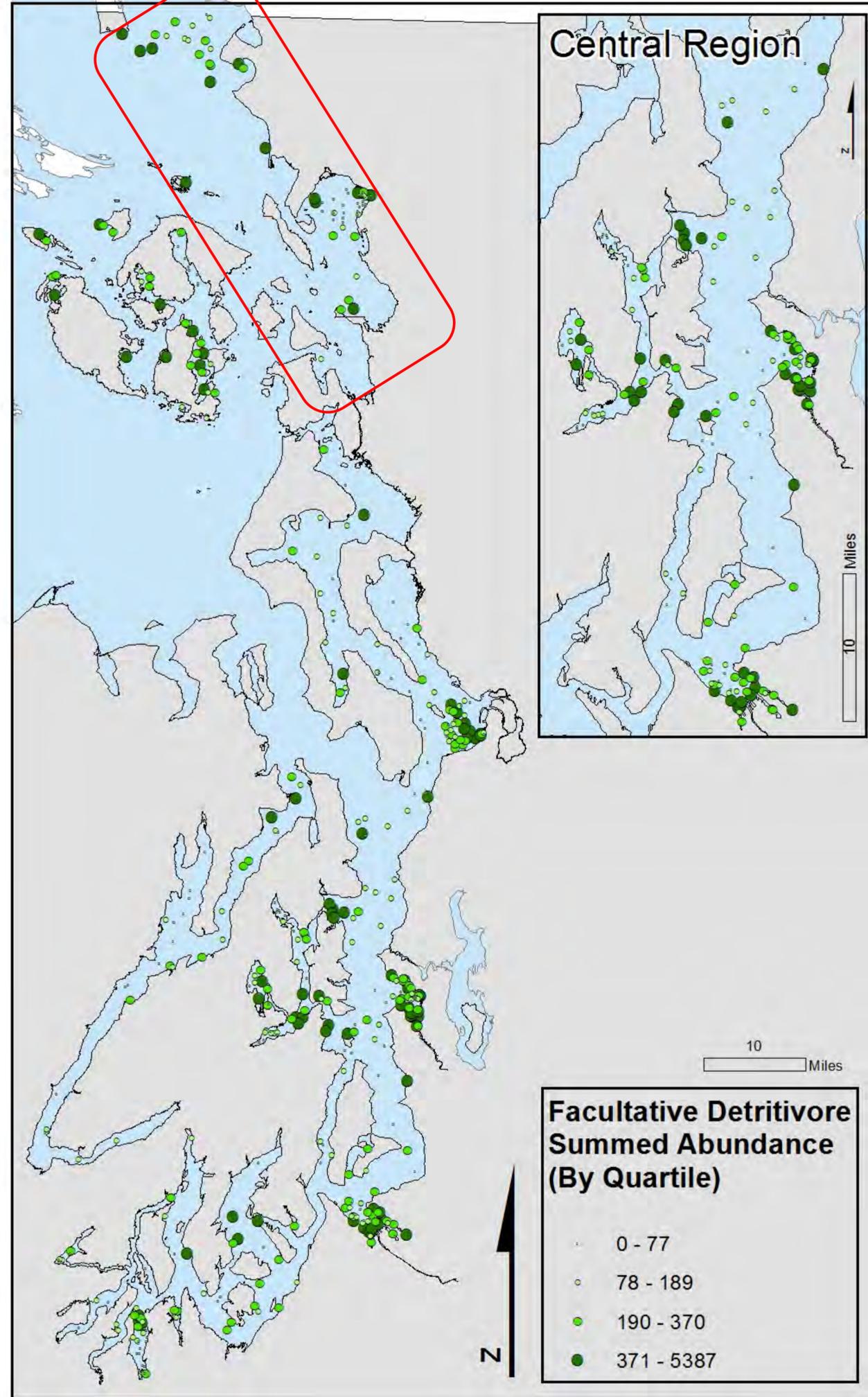
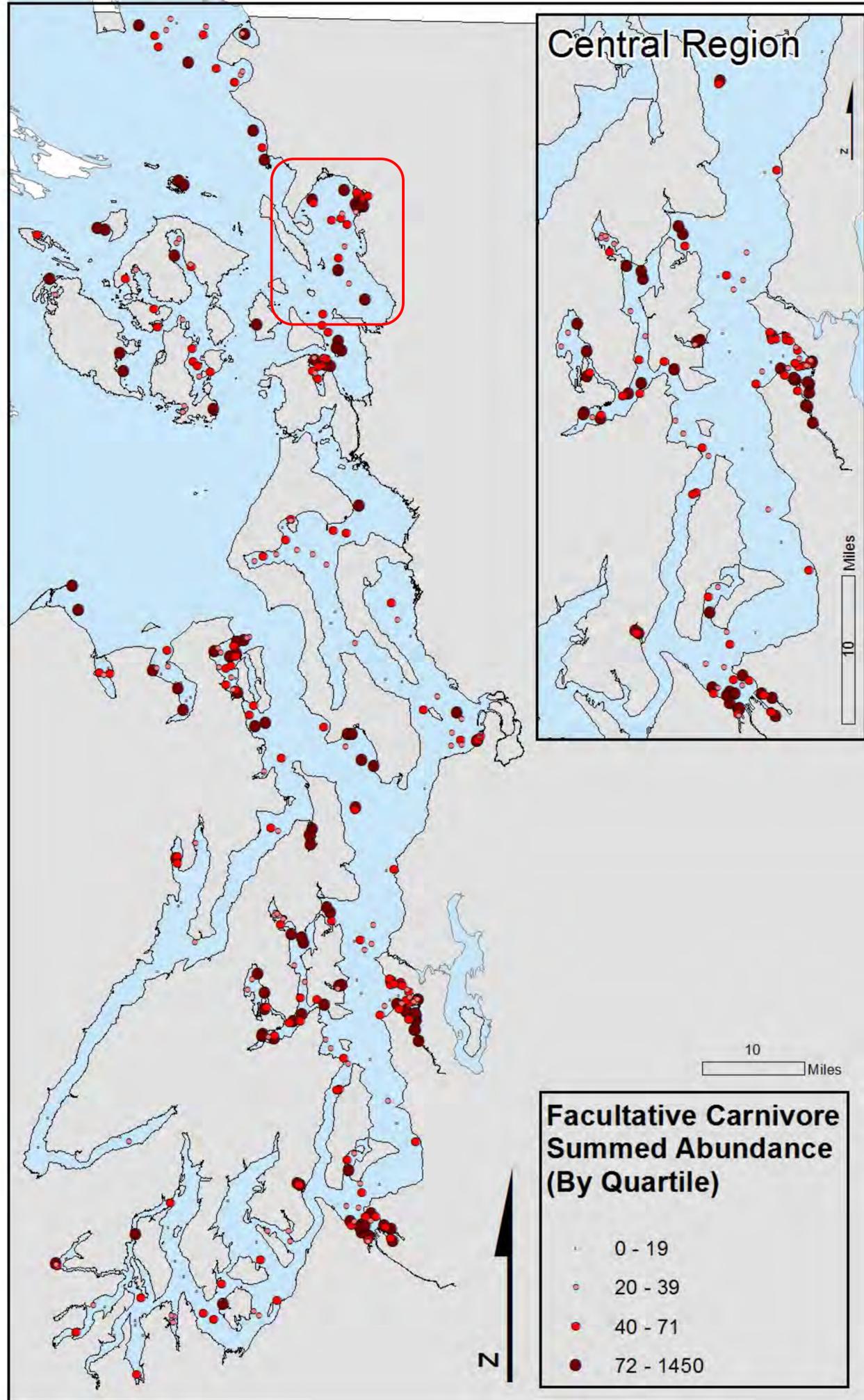


Figure 7.

Baseline

1997-2003



Resample

2004 - Present

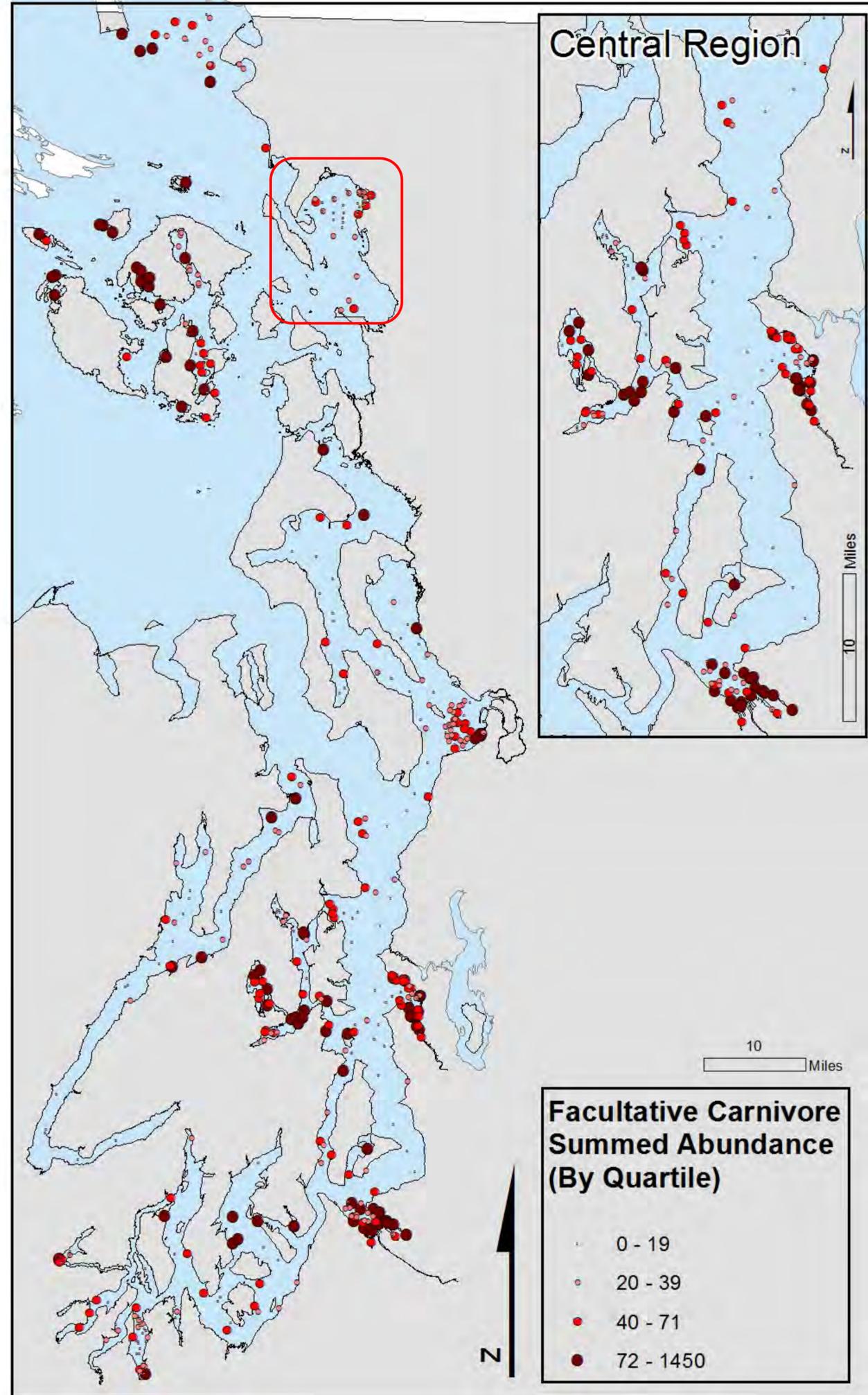
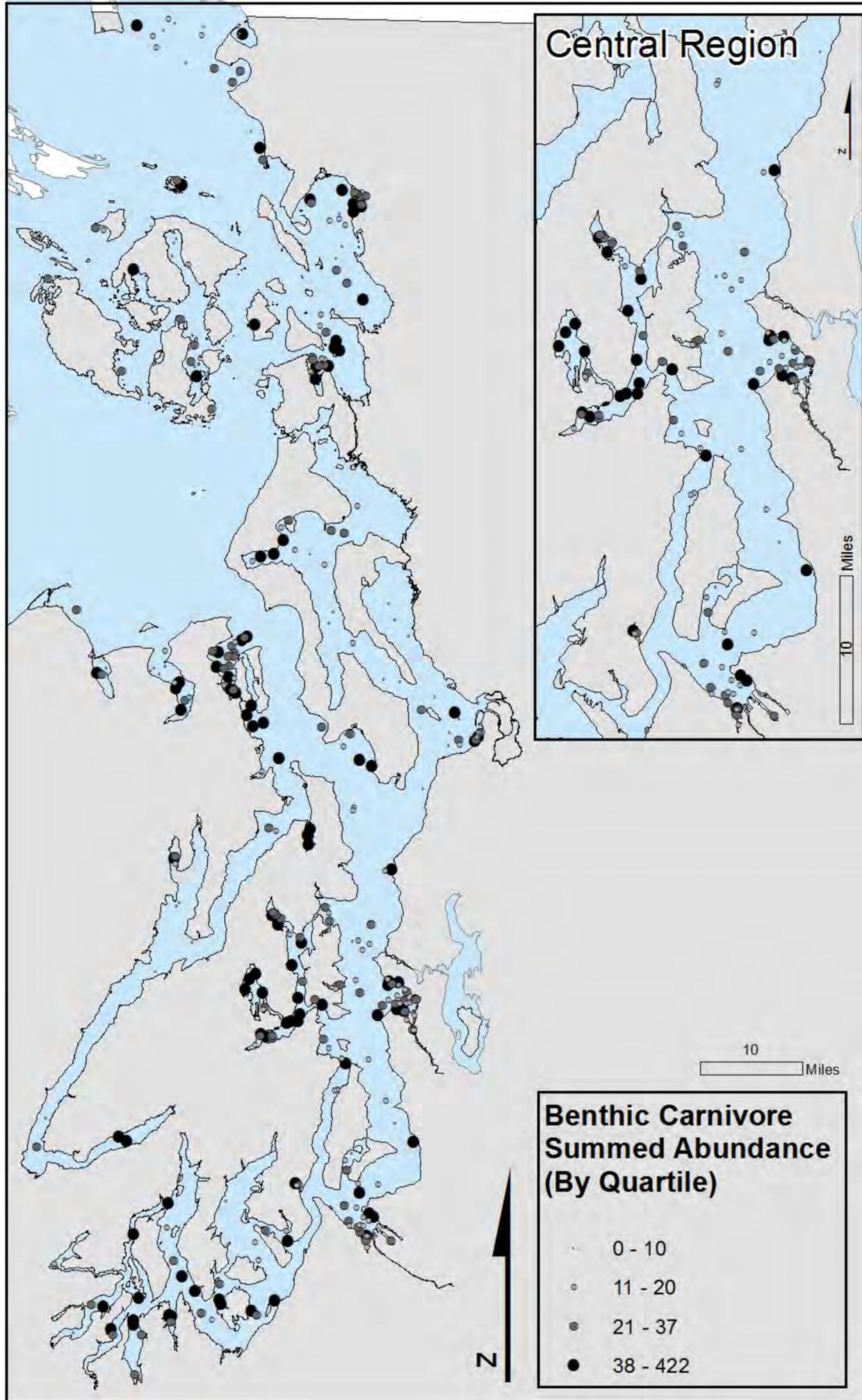


Figure 8.

Baseline

1997-2003



Resample

2004 - Present

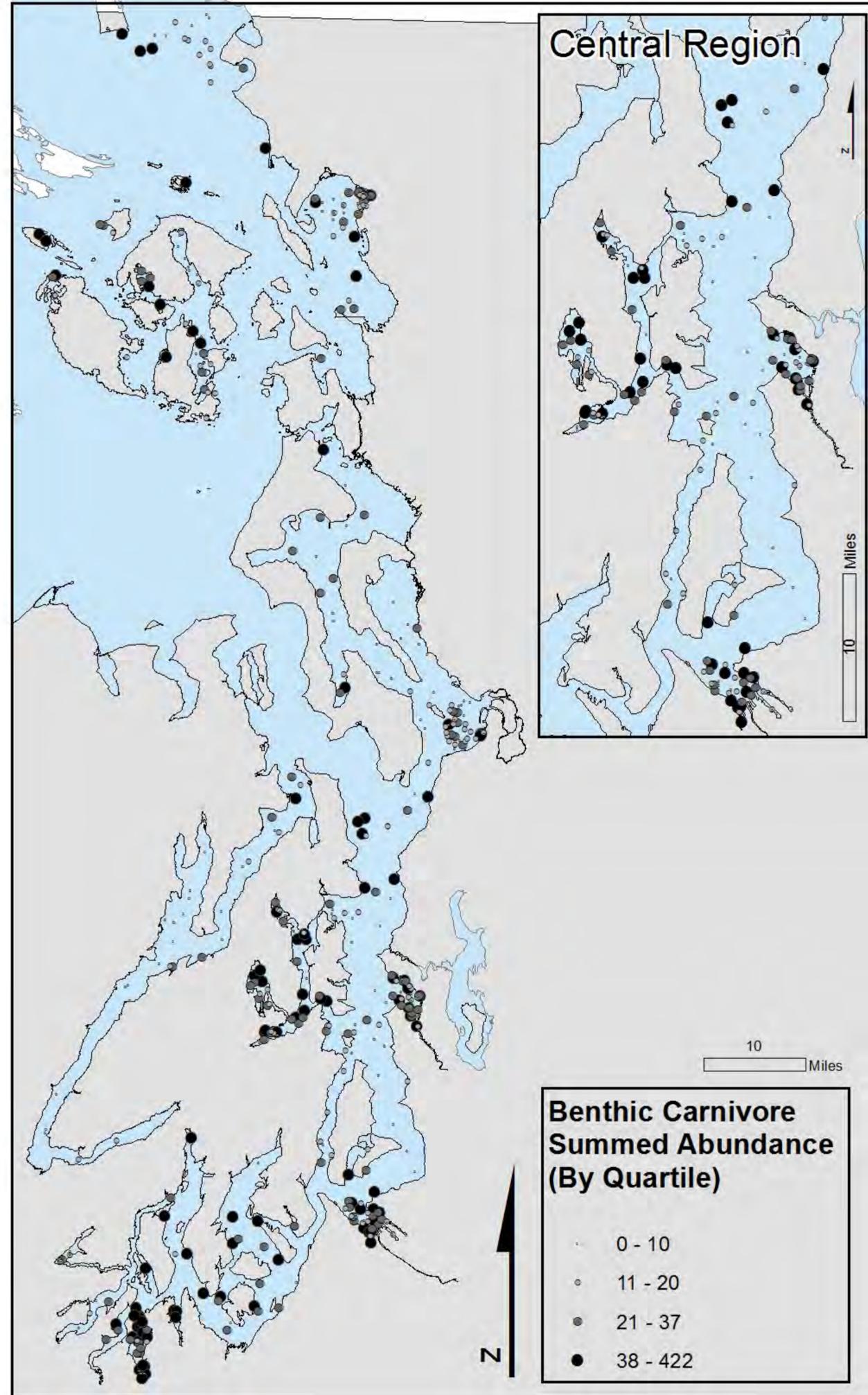
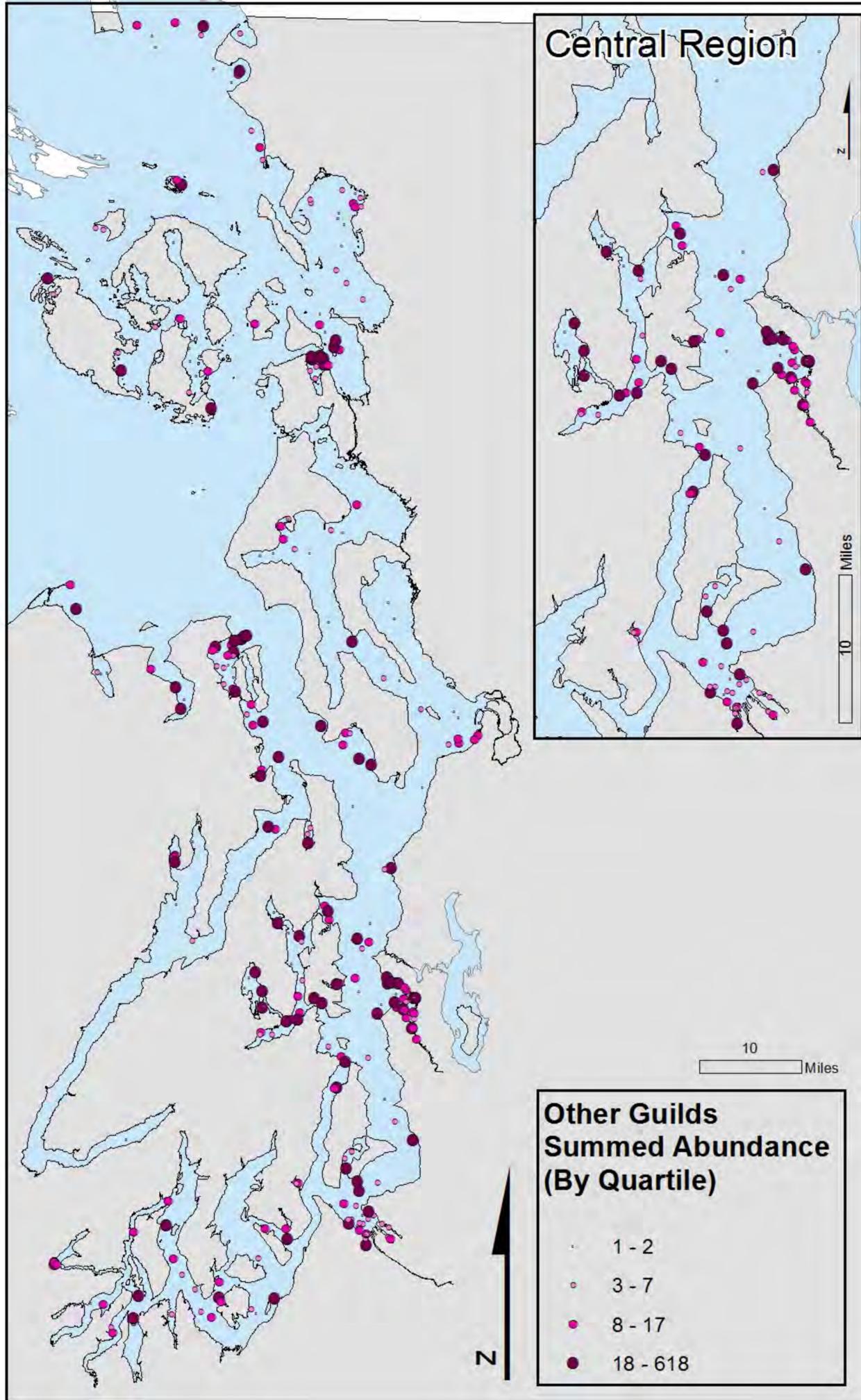


Figure 9.

Baseline

1997-2003



Resample

2004 - Present

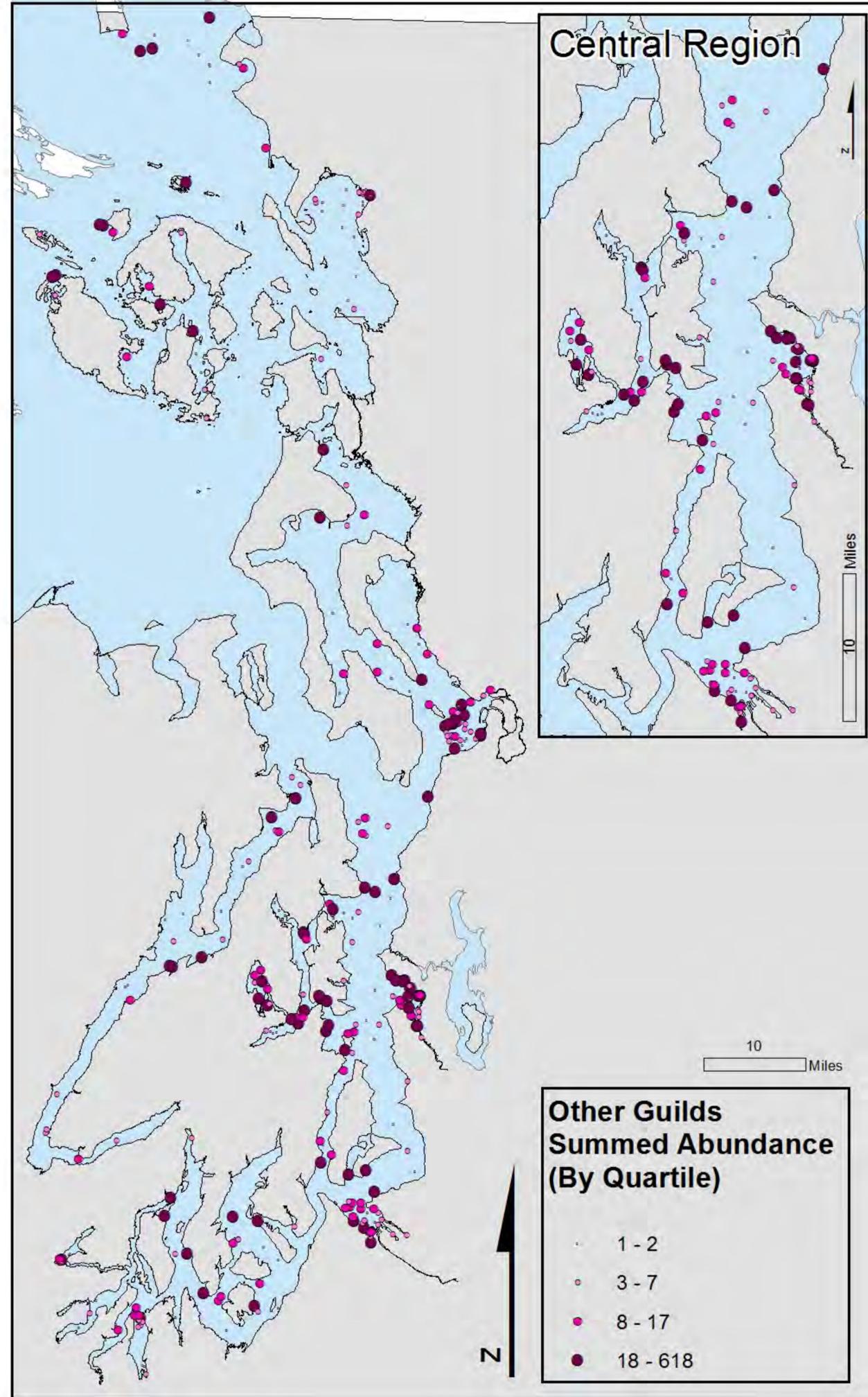


Figure 10.