List of Appendices

Appendix A (DIGITAL ONLY). All biota found in 1997-1999 Puget Sound sampling, listing abundance data from all sites.


Appendix C (DIGITAL ONLY). Results of all t-tests comparing abundances of taxa in 1998 vs. 1999 samples (summarized in Appendix B).

Appendix D (DIGITAL ONLY). Results of spatial autocorrelation tests for each taxon sampled (summarized in Appendix E).

Appendix E (PAPER: attached). GIS maps of results of spatial autocorrelation tests for key taxa.

Appendix F (DIGITAL ONLY). Results of nested ANOVA tests for all taxa (summarized in Table 2).

Appendix G (PAPER: attached). Listing of all non-rare taxa found in Puget sound surveys, and comparison with historical samples (summarized in Tables 4 and 5).
Appendix B2. Spatial distribution of Allorchestes angusta
Puget Sound 1999 vs 1998: South Basin
Low Zone Pebble Beach Taxa Distributions

Upper Case

Carr

Budd

T-TEST: AME-SA-C
All an. with Year = 1, and y: All an. with Year = 2
t = -2.9845, df = 178, p-value = 0.0032
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
-0.6091086 -0.1242247

Indicator values are based on 10 samples from
a 50 m horizontal transect at MLLW
98 Allorchestes angusta:
0 0 0
99 Allorchestes angusta:
73 37 0
Appendix B1. Spatial distribution of Alia gausapata
Puget Sound 1999 vs 1998: South Basin
Low Zone Pebble Beach Taxa Distributions

T-TEST: ALL GA Q
Alia gq with Year = 1, and y: Alia gq with Year = 2
\( t = -0.2522, df = 178, p\text{-value} = 0.8012 \)
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
\(-3.235732 \text{ to } 2.682398\)

Indicator values are based on 10 samples
from a 50 m horizontal transect at MLLW
98 Alia gausapata:
\[ \begin{array}{ccc}
11 & 6 & 0 \\
\end{array} \]
99 Alia gausapata:
\[ \begin{array}{ccc}
18 & 9 & 0 \\
\end{array} \]
Appendix B3. Spatial distribution of Armandia brevis
Puget Sound 1999 vs 1998: South Basin
Low Zone Pebble Beach Taxa Distributions

T-TEST: ARM.BR.C
Arm.br.C with Year = 1, and y: Arm.br.C with Year = 2
t = 3.2406, df = 178, p-value = 0.0014
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
0.1086214 0.4459342

Indicator values are based on 10 samples from a 50 m horizontal transect at MLLW
98 Armandia brevis:

| 27 | 14 | 0 |

99 Armandia brevis:

| 0 | 0 | 0 |

T-TEST: ARM BR C
Axilru.C with Year = 1, and y: Axilru.C with Year = 2
\[ t = -1.7518, \text{ df} = 176, \text{ p-value} = 0.0815 \]
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
-0.070881926 0.004215259

Indicator values are based on 10 samples from a 50 m horizontal transect at MLLW

98 Axiothella rubrocincta:
0 0 0

99 Axiothella rubrocincta:
3 2 0
Appendix B5. Spatial distribution of Balanus glandula
Puget Sound 1999 vs 1998: South Basin
Low Zone Pebble Beach Taxa Distributions

T-TEST: BAL GL Q
Bal gl Q with Year = 1, and y: Bal gl Q with Year = 2
t = -1.6584, df = 178, p-value = 0.099
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
-10.8035841  0.9369174

Indicator values are based on 10 samples from
a 50 m horizontal transect at MLLW
98 Balanus glandula:

8 5 2
99 Balanus glandula:

13 7 1
Appendix B6. Spatial distribution of Crepidula dorsata 
Puget Sound 1999 vs 1998: South Basin
Low Zone Pebble Beach Taxa Distributions

Upper Case

Carr

Budd

T-TEST: CRE.DO.Q
Cre.do.Q with Year = 1 and y. Cre.do.Q with Year = 2
\[ t = 2.91, df = 178, p-value = 0.0041 \]
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
0.2861096 1.4916681

Indicator values are based on 10 samples from
a 50 m horizontal transect at MLLW

98 Crepidula dorsata:

9 5 0

99 Crepidula dorsata:

10 5 0
Appendix B7. Spatial distribution of Diopatra ornata
Puget Sound 1999 vs 1998: South Basin
Low Zone Pebble Beach Taxa Distributions

Upper Case

Carr

Budd

T-TEST: Dio.or.C
Dio.or.C with Year = 1, and y: Dio.or.C with Year = 2
$ t = 1$, df = 178, p-value $= 0.3187$
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
-0.01081534 0.03303757

Indicator values are based on 10 samples from
a 50 m horizontal transect at MLLW

98 Diopatra ornata:

10 5 0

99 Diopatra ornata:

0 0 0

T-TEST: EDWARDSIA A.
Edw.A.C with Year = 1 , and y: Edw.A.C with Year = 2
t = 3.2945, df = 178, p-value = 0.0012
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
0.06683425 0.26649908

Indicator values are based on 10 samples from a 50 m horizontal transect at MLLW

98 Edwardsia sp:

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99 Edwardsia sp:

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Appendix B9. Spatial distribution of Edwardsia sipunculoide
Puget Sound 1999 vs 1998: South Basin
Low Zone Pebble Beach Taxa Distributions

Upper Case

Carr

Budd

T-TEST: EDW.SI.C
Edw.si.C with Year = 1, and y: Edw.si.C with Year = 2
t = -1.288, df = 176, p-value = 0.1993
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
-0.16377285 0.03543952

Indicator values are based on 10 samples from
a 50 m horizontal transect at MLLW
98 Edwardsia sipunculoide:
1 1 0
99 Edwardsia sipunculoide:
13 7 0
Appendix B10. Spatial distribution of Eogammarus oclairi
Puget Sound 1999 vs 1998: South Basin
Low Zone Pebble Beach Taxa Distributions

Upper Case

Carr

Budd

T-TEST: EOG.OC
Eog.oc. with Year = 1, and y: Eog.oc. with Year = 2
t = -2.6998, df = 178, p-value = 0.0076
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
-0.51927686 -0.08072314

Indicator values are based on 10 samples from
a 50 m horizontal transect at MLW

98 Eogammarus oclairi:
0 0 0

99 Eogammarus oclairi:
80 40 0
Appendix B11. Spatial distribution of Harmothoe imbricata
Puget Sound 1999 vs 1998: South Basin
Low Zone Pebble Beach Taxa Distributions

T-TEST: HARM.IM.C
HAR.IM.C with Year = 1, and y: HAR.IM.C with Year = 2
t = -1.6485, df = 178, p-value = 0.101
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
-0.097647803 0.008758914

Indicator values are based on 10 samples from
a 50 m horizontal transect at MLLW

98 Harmothoe imbricata:

0 0 0

99 Harmothoe imbricata:

15 8 0

Upper Case

Carr

Budd

T-TEST: HEM OR.Q
Hem.or.Q with Year = 1, and y: Hem.or.Q with Year = 2
t = 4.6907, df = 178, p-value = 0
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
2.639031 6.472080

Indicator values are based on 10 samples from a 50 m horizontal transect at MLLW
98 Hemigrapsus oregonensis:

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99 Hemigrapsus oregonensis:

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Appendix B13. Spatial distribution of Hermissenda crassicornis
Puget Sound 1999 vs 1998: South Basin
Low Zone Pebble Beach Taxa Distributions

T-TEST: HER.CR.Q
Her.cr.Q with Year = 1, and y: Her.cr.Q with Year = 2
\[ t = -1.7518, \text{df} = 178, p\text{-value} = 0.0815 \]
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
\(-0.070881926, 0.004215259\)

Indicator values are based on 10 samples from a 50 m horizontal transect at MLLW

68 Hermissenda crassicornis:
1 0 0

99 Hermissenda crassicornis:
3 2 0
Appendix B14. Spatial distribution of clam siphon holes
Puget Sound 1999 vs 1998: South Basin
Low Zone Pebble Beach Taxa Distributions

Upper Case
Carr
Budd

T-TEST: HOLES. Q
Holes.Q with Year = 1. and y: Holes.Q with Year = 2
\[ t = -6.2828, \text{ df} = 178, \text{ p-value} = 0 \]
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
\(-1.6645191 - 0.8688142\)

Indicator values are based on 10 samples from
a 50 m horizontal transect at MLLW

98 holes in sediment (unident.):

\[
\begin{array}{ccc}
\text{Holes} & \text{Year 1} & \text{Year 2} \\
\text{Number} & \text{Number} & \text{Number} \\
1 & 4 & 2 \\
2 & 23 & 12 \\
3 & & 0 \\
4 & & \\
5 & & \\
6 & & \\
\end{array}
\]

99 holes in sediment (unident.):
Appendix B15. Spatial distribution of Leptosynapta clarki
Puget Sound 1999 vs 1998: South Basin
Low Zone Pebble Beach Taxa Distributions

Upper Case

Carr

Budd

T-TEST: LEP.CLA.
Lep.cla. with Year = 1, and y: Lep.cla. with Year = 2
t = 3.3799, df = 178, p-value = 0.0009
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
0.4392569 1.6718542

Indicator values are based on 10 samples from a 50 m horizontal transect at MLLW

98 Leptosynapta clarki:

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99 Leptosynapta clarki:

|   | 8  | 4  | 0  |
Appendix B16. Spatial distribution of Littorina scutulata
Puget Sound 1999 vs 1998: South Basin
Low Zone Pebble Beach Taxa Distributions

Upper Case

Carr

Budd

T-TEST: LIT.SC.Q
Lit.sc.Q with Year = 1, and y: Lit.sc.Q with Year = 2
\( t = -5.4474, \, df = 178, \, p-value = 0 \)
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
-83.91528 -39.28472

Indicator values are based on 10 samples from a 50 m horizontal transect at MLLW
98 Littorina scutulata:
- 1 0

99 Littorina scutulata:
51 26 0
Appendix B17. Spatial distribution of Lophopanopeus bellus Puget Sound 1999 vs 1998: South Basin Low Zone Pebble Beach Taxa Distributions

T-TEST: LOP.BE.Q
Lop.be.Q with Year = 1, and y: Lop.be.Q with Year = 2
\( t = 3.107, df = 178, p-value = 0.0022 \)
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
\( 0.1094582 \) 0.4905418

Indicator values are based on 10 samples from a 50 m horizontal transect at MLLW

98 Lophopanopeus bellus bellus:

99 Lophopanopeus bellus bellus:

T-TEST: MACOM.C
Macom.C with Year = 1, and y: Macom.C with Year = 2
\[ t = 4.2242, df = 178, p-value = 0 \]
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
0.319705 0.893995

Indicator values are based on 10 samples from a 50 m horizontal transect at MLLW
96 Macoma nasuta: 
0 0 0
99 Macoma nasuta: 

10 5 0
Appendix B19. Spatial distribution of Macoma secta (juv)
Puget Sound 1999 vs 1998: South Basin
Low Zone Pebble Beach Taxa Distributions

Upper Case

Carr

Budd

T-TEST: MAC.SE.C
Mac.se.C with Year = 1, and y: Mac.se.C with Year = 2
t = -1, df = 178, p-value = 0.3187
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
-0.03503757 0.01881534

Indicator values are based on 10 samples from a 50 m horizontal transect at MLLW

1998 Macoma secta:
0 0 0

1999 Macoma secta:

10 5 0
Appendix B20. Spatial distribution of Macoma inquinata (juv)
Puget Sound 1999 vs 1998: South Basin
Low Zone Pebble Beach Taxa Distributions

T-TEST: M.I.JU.C
M.I.JU.C with Year = 1, and y: M.I.JU.C with Year = 2
$t = -1.6485$, df = 178, p-value = 0.101
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
-0.097847803 0.00879914

Indicator values are based on 10 samples from
a 50 m horizontal transect at MLLW
98 Macoma inquinata:

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99 Macoma inquinata:

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Appendix B21. Spatial distribution of Mytilus trossulus
Puget Sound 1999 vs 1998: South Basin
Low Zone Pebble Beach Taxa Distributions

Upper Case

Carr

Budd

T-TEST: MYT.TR.Q
Myt.tr.Q with Year = 1, and v: Myt.tr.Q with Year = 2
t = -0.7895, df = 178, p-value = 0.4362
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
-0.2352312 0.1018979

Indicator values are based on 10 samples from
a 50 m horizontal transect at MLLW
98 Mytilus trossulus:
10 5 0
99 Mytilus trossulus:
10 5 0
Appendix B22. Spatial distribution of Neotrypaea californiensis
Puget Sound 1999 vs 1998: South Basin
Low Zone Pebble Beach Taxa Distributions

T-TEST: NEO.CA.C
Neo.ca.C with Year = 1, and y: Neo.ca.C with Year = 2
t = -2.0289, df = 178, p-value = 0.044
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
-0.219180140 -0.003042082

Indicator values are based on 10 samples from a 50 m horizontal transect at MLLW

99 Neotrypaea californiensis:

|    | 1 | 1 | 8 |

99 Neotrypaea californiensis:

|    | 25 | 13 | 0 |
Appendix B23. Spatial distribution of Onuphis 'holobranchiata'
Puget Sound 1999 vs 1998: South Basin
Low Zone Pebble Beach Taxa Distributions

Upper Case

Carr

Budd

T-TEST: MYT.TR.Q
Onu ho.C with Year = 1, and y: Onu ho.C with Year = 2
\( t = 1.4222, df = 178, p-value = 0.1567 \)
Alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
\(-0.008611769 \quad 0.053056213 \)

Indicator values are based on 10 samples from
a 50 m horizontal transect at MLLW

98 Onuphis 'holobranchiata':

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99 Onuphis 'holobranchiata':

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Appendix B24. Spatial distribution of Pagurus (all) Puget Sound 1999 vs 1998: South Basin Low Zone Pebble Beach Taxa Distributions

T-TEST: PAGUR Q
Pagur. Q with Year = 1, and y: Pagur. Q with Year = 2
\( t = 1.5921, df = 178, p\text{-value} = 0.1131 \)
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
-0.2794207 2.6127540

Indicator values are based on 10 samples from a 50 m horizontal transect at MLLW

98 Pagurus spp. (beriganus and others):

|   | 12 | 6 | 0 |

99 Pagurus spp. (beriganus and others):

|   |   | 7 | 4 | 0 |

T-TEST: PAGUR.Q
Polyno C with Year = 1, and y: Polyno C with Year = 2
$ t = 1.4222, df = 178, p-value = 0.1567$
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
-0.0038111769  0.053096213

Indicator values are based on 10 samples from a 50 m horizontal transect at MLLW
98 Polynoid (unident., in core):
5 3 0
99 Polynoid (unident., in core):
0 0 0
Appendix B27. Spatial distribution of Spiochaetopterus costarum Puget Sound 1999 vs 1998: South Basin Low Zone Pebble Beach Taxa Distributions

T-TEST: TUBE Q
Spi.co.C with Year = 1, and y: Spi.co.C with Year = 2
t = 1.7518, df = 178, p-value = 0.0815
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
-0.004215259 0.070881926

Indicator values are based on 10 samples from a 50 m horizontal transect at MLLW
98 Spiro tubes:

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99 Spiro tubes:

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Appendix B28. Spatial distribution of ulvoids (all) Puget Sound 1999 vs 1998: South Basin Low Zone Pebble Beach Taxa Distributions

T-TEST: ULVOID O
Ulvoid O with Year = 1 , and y: Ulvoid O with Year = 2
t = 3.3396, df = 178, p-value = 0.001
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
7.204703 28.017519

Indicator values are based on 10 samples from
a 50 m horizontal transect at MLLW
99 Ulvoids (unident.):
9 5 0
10 5 0