Legacy and emerging Persistent Organic Pollutants in Antarctic benthic invertebrates near Rothera Point, Western Antarctic Peninsula.

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Appendix 3. Statistics.

Appendix 3A. Explanation of Bonferonni Correction

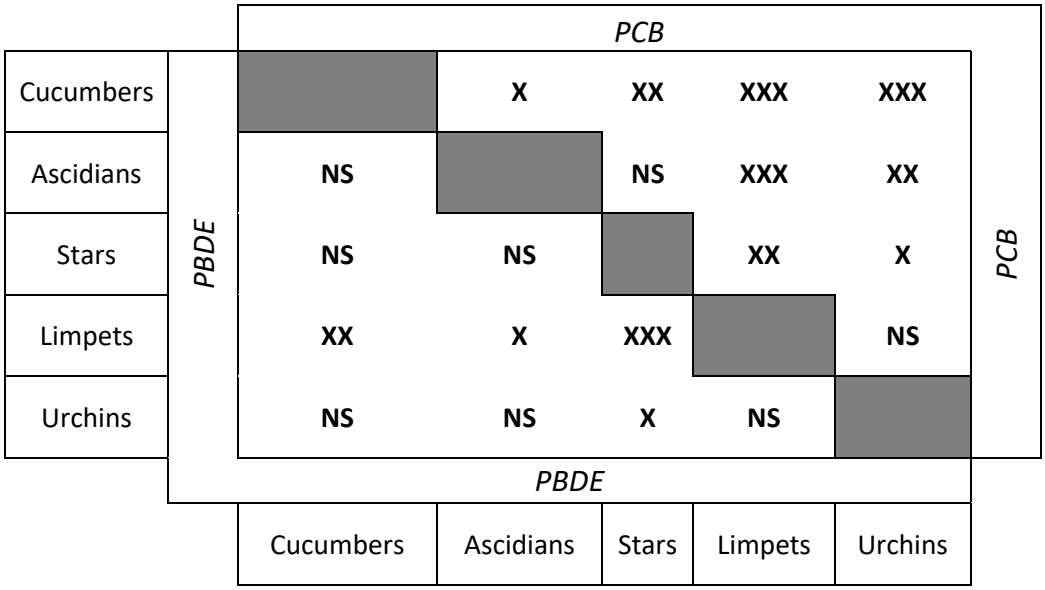
Bonferonni correction is a method for accounting for statistical inferences in dependent variables[1]. The question whether to employ a Bonferonni correction is not trivial and must be case-specific[2,3]. Recent research has formulated 3 major rationales for its usage[4], 2 of which are clearly not applicable to the current study. First, here it is not imperative to avoid the type I error (as it may have been in medical research) and, second, we have a distinctly defined null-hypothesis. However, the choice of rejecting or accepting the last rationale – presence of an *universal* null hypothesis is less straightforward.

The research question "Are there differences in concentrations of POPs between different sampling locations?" presents a broad nature and a high level of aggregation of data, which may be also intercorrelated. Therefore, a Bonferonni correction is required here to avoid analytical overexploitation on the dependent variable. On the other hand, the question "Are there differences in concentration of PCBs, PBDEs or OCPs" has a much lower level of generalization: the relative concentrations of PCBs are almost exactly the same across the species; the PBDEs are mainly represented by one congener (BDE-209); and the differences in OCPs were calculated on the basis of an individual compounds. As such, the choice was not to use Bonferonni (or other) correction for the latter research question, but instead to consider the statistical significance on 3 different levels, according to the actual p-value.

1. Dunn, O. J. Multiple Comparisons among Means. *J. Am. Stat. Assoc.* **56,** 52–64 (1961).
2. Streiner, D. L. & Norman, G. R. Correction for Multiple Testing: Is There a Resolution? *Chest* **140,** 16–18 (2011).
3. Cabin, R. J. & Mitchell, R. J. To Bonferroni or Not to Bonferroni: When and How Are the Questions. *Bulletin of the Ecological Society of America* **81,** 246–248
4. Armstrong, R. A. When to use the Bonferroni correction. *Ophthalmic Physiol. Opt.* **34,** 502–

508 (2014).

Appendix 3B. Significance of differences of interspecies concentrations of PCBs and PBDEs sums.



X	p-value between	0.01	0.05
XX	p-value between	0.005	0.01
XXX	p-value below		0.005
NS	Not Significant		

Appendix 3C. Significance of differences of interspecies concentrations of (individual) OCPs.

SCF = Sea cucumber
A = Ascidian
SST = Sea star
SU = Sea urchin
SL = limpet

Statistics values = The Mann-Whitney U statistic, equal to min(U for x, U for y) if alternative is equal to None (deprecated; exists for backward compatibility), and U for y otherwise

```
SCF A

HCB no difference found
HCH alpha-
 statistics  148.0 p-value  5.5810663821847943e-05
HCH beta- no difference found
HCH gamma-
 statistics  207.0 p-value  0.0020490070085374974
HCH delta-
 statistics  254.0 p-value  0.018798077703420662
HCH epsilon-
 statistics  214.0 p-value  0.002955611333006968
Heptachlor
 statistics  67.0 p-value  8.589039170678466e-08
Oxychlordan
 statistics  183.0 p-value  0.0005290999203994083
Hept. ep. (B)
 statistics  271.0 p-value  0.03648480179427856
DDE o,p'-
 statistics  243.0 p-value  0.011773985067118608
Ch. trans (g) no difference found
Ch. cis- (a) no difference found
DDE p,p'-
 statistics  226.0 p-value  0.005376340858529473
End. alpha-
 statistics  190.0 p-value  0.0007977540471249249
Mirex no difference found


 SCF SST

HCB no difference found
HCH alpha- no difference found
HCH beta- no difference found
HCH gamma-
 statistics  53.0 p-value  0.006491206628688183
HCH delta-
 statistics  72.0 p-value  0.03671712578800128
HCH epsilon- no difference found
Heptachlor
 statistics  75.0 p-value  0.04642780339796862
```

```
Oxychlordan
 statistics  37.0 p-value  0.0010746700946077331
Hept. ep. (B) no difference found
DDE o,p'- no difference found
Ch. trans (g) no difference found
Ch. cis- (a) no difference found
DDE p,p'-
 statistics  46.0 p-value  0.0030721169771417084
End. alpha- no difference found
Mirex no difference found


 SCF SL

HCB no difference found
HCH alpha- no difference found
HCH beta-
 statistics  53.0 p-value  0.0403826648016666
HCH gamma-
 statistics  45.0 p-value  0.01844421285352491
HCH delta- no difference found
HCH epsilon- no difference found
Heptachlor no difference found
Oxychlordan no difference found
Hept. ep. (B) no difference found
DDE o,p'-
 statistics  52.0 p-value  0.03681913506015133
Ch. trans (g) no difference found
Ch. cis- (a) no difference found
DDE p,p'-
 statistics  23.0 p-value  0.001247217297723964
End. alpha- no difference found
Mirex
 statistics  24.0 p-value  0.0014345563960383074


 SCF SU

HCB
 statistics  28.0 p-value  0.0214800730142125
HCH alpha- no difference found
HCH beta- no difference found
HCH gamma-
 statistics  32.0 p-value  0.034647042755779005
HCH delta- no difference found
HCH epsilon- no difference found
Heptachlor no difference found
Oxychlordan
 statistics  14.0 p-value  0.0029734377243145716
Hept. ep. (B) no difference found
DDE o,p'-
 statistics  10.0 p-value  0.0015467246613805905
Ch. trans (g) no difference found
Ch. cis- (a)
 statistics  35.0 p-value  0.04837703685437085
DDE p,p'-
 statistics  23.0 p-value  0.011197615987668465
End. alpha- no difference found
Mirex
 statistics  27.0 p-value  0.018947105700081363
```

A SST

HCB no difference found
HCH alpha-
 statistics 43.0 p-value 0.001747528523787258
HCH beta- no difference found
HCH gamma-
 statistics 55.0 p-value 0.006285922691210745
HCH delta-
 statistics 66.0 p-value 0.017590141696240954
HCH epsilon- no difference found
Heptachlor
 statistics 49.0 p-value 0.003383780759939502
Oxychlordan
 statistics 75.0 p-value 0.03691377495557096
Hept. ep. (B)
 statistics 21.0 p-value 0.00010811454406201593
DDE o,p'- no difference found
Ch. trans (g)
 statistics 65.0 p-value 0.016109750067359065
Ch. cis- (a) no difference found
DDE p,p'- no difference found
End. alpha- no difference found
Mirex no difference found

A SL

HCB no difference found
HCH alpha- no difference found
HCH beta- no difference found
HCH gamma-
 statistics 51.0 p-value 0.027579118888853754
HCH delta- no difference found
HCH epsilon- no difference found
Heptachlor no difference found
Oxychlordan no difference found
Hept. ep. (B) no difference found
DDE o,p'- no difference found
Ch. trans (g) no difference found
Ch. cis- (a) no difference found
DDE p,p'- no difference found
End. alpha- no difference found
Mirex
 statistics 33.0 p-value 0.003907784690770291

A SU

HCB
 statistics 32.0 p-value 0.029859558464299187
HCH alpha- no difference found
HCH beta- no difference found
HCH gamma- no difference found
HCH delta- no difference found
HCH epsilon- no difference found
Heptachlor no difference found
Oxychlordan no difference found
Hept. ep. (B)

```
 statistics  23.0 p-value  0.009778282270008598
DDE o,p'- no difference found
Ch. trans (g) no difference found
Ch. cis- (a) no difference found
DDE p,p'- no difference found
End. alpha-
 statistics  24.0 p-value  0.01116994174316034
Mirex
 statistics  35.0 p-value  0.04161606632084231


 SST SL

HCB no difference found
HCH alpha- no difference found
HCH beta-
 statistics  11.0 p-value  0.01712888443293505
HCH gamma- no difference found
HCH delta- no difference found
HCH epsilon- no difference found
Heptachlor no difference found
Oxychlordan no difference found
Hept. ep. (B) no difference found
DDE o,p'-
 statistics  15.0 p-value  0.045168795869826826
Ch. trans (g) no difference found
Ch. cis- (a) no difference found
DDE p,p'-
 statistics  9.0 p-value  0.009936767845410874
End. alpha- no difference found
Mirex
 statistics  4.0 p-value  0.0021317156915536613


 SST SU

HCB
 statistics  7.0 p-value  0.022750131948179195
HCH alpha- no difference found
HCH beta-
 statistics  9.0 p-value  0.041518219688779105
HCH gamma- no difference found
HCH delta-
 statistics  8.0 p-value  0.030974075706740573
HCH epsilon- no difference found
Heptachlor
 statistics  9.0 p-value  0.041518219688779105
Oxychlordan
 statistics  7.0 p-value  0.022750131948179195
Hept. ep. (B)
 statistics  7.0 p-value  0.022750131948179195
DDE o,p'-
 statistics  5.0 p-value  0.011705298080558346
Ch. trans (g)
 statistics  8.0 p-value  0.030974075706740573
Ch. cis- (a)
 statistics  5.0 p-value  0.011705298080558346
DDE p,p'-
 statistics  7.0 p-value  0.022750131948179195
End. alpha- no difference found
Mirex no difference found
```

```
 SL  SU

HCB no difference found
HCH alpha- no difference found
HCH beta- no difference found
HCH gamma- no difference found
HCH delta- no difference found
HCH epsilon- no difference found
Heptachlor no difference found
Oxychlordan no difference found
Hept. ep. (B) no difference found
DDE o,p'-
 statistics  5.0 p-value  0.02565995179403558
Ch. trans (g) no difference found
Ch. cis- (a) no difference found
DDE p,p'-
 statistics  6.0 p-value  0.03701762392744832
End. alpha- no difference found
Mirex no difference found
```

Appendix 3D. Significance of differences of location concentrations of (individual) OCPs.

Note: For PCBs and PBDEs no differences were found at all.

Cucumbers

```
HCB no difference found
HCH alpha- no difference found
HCH beta- no difference found
HCH gamma-
 statistics  30.0 p-value  0.0018462476541649497
HCH delta- no difference found
HCH epsilon- no difference found
Heptachlor no difference found
Aldrin no difference found
Isodrin no difference found
Oxychlordan no difference found
Heptachlor epoxide (iso B)
 statistics  48.0 p-value  0.02143405940857073
DDE o,p'- no difference found
Chlordane trans- (gamma) no difference found
Chlordane cis- (alpha) no difference found
DDE p,p'- no difference found
Endosulfan alpha-
 statistics  54.0 p-value  0.04161696569853907
DDD o,p'- (TDE) no difference found
Dieldrin no difference found
Endrin no difference found
DDD p,p'- (TDE) no difference found
Endosulfan beta- no difference found
heptachlor endo epoxide (iso A) no difference found
Methoxychlor no difference found
Mirex no difference found
```

Stars

```
HCB
 statistics  4.0 p-value  0.03630046972497867
HCH alpha- no difference found
HCH beta- no difference found
HCH gamma- no difference found
HCH delta- no difference found
HCH epsilon- no difference found
Heptachlor no difference found
Aldrin no difference found
Isodrin no difference found
Oxychlordan no difference found
Heptachlor epoxide (iso B) no difference found
DDE o,p'- no difference found
Chlordane trans- (gamma) no difference found
Chlordane cis- (alpha) no difference found
DDE p,p'- no difference found
Endosulfan alpha- no difference found
```

DDD o,p'- (TDE) no difference found
Dieldrin no difference found
Endrin no difference found
DDD p,p'- (TDE) no difference found
Endosulfan beta- no difference found
heptachlor endo epoxide (iso A) no difference found
Methoxychlor no difference found
Mirex no difference found