Comparing Age Assignments

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Preliminaries

```
> library(FSA)                          # for ageBias(), agePrecision()
```

Loading Data

```
> SB <- read.csv("StripedBass4.csv")    # appropriately set the working directory before this
> str(SB)
'data.frame':   1202 obs. of  2 variables:
 $ reader1: int  2 2 2 2 2 2 2 2 2 2 ...
 $ reader2: int  2 2 2 2 2 2 2 2 2 2 ...
```

Examine Age Bias

```
> ab <- ageBias(reader2~reader1,data=SB)
```

```
> summary(ab,what="table",flip.table=TRUE)
```

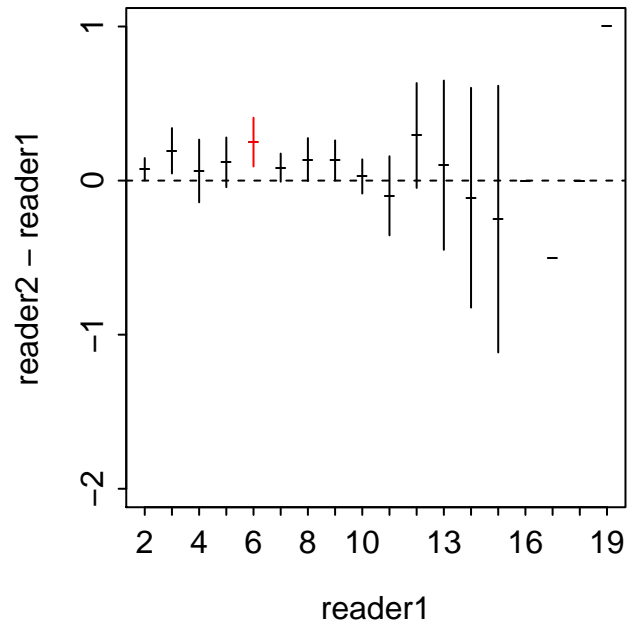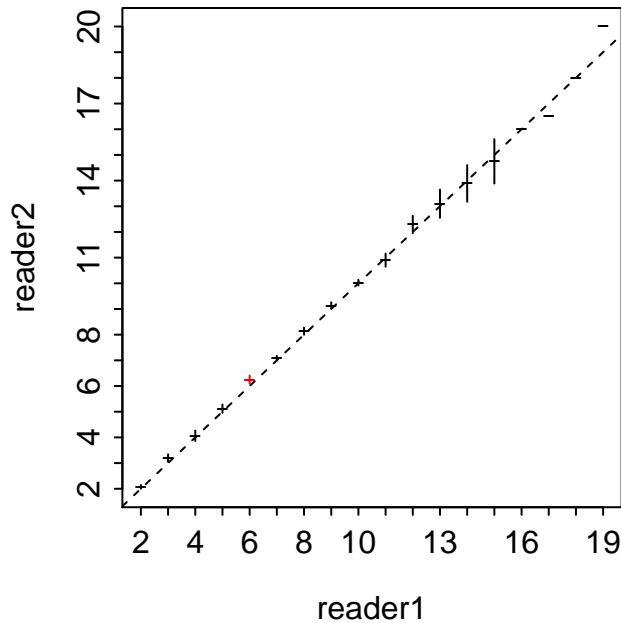|						reader1													
reader2	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-
19	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
18	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	1	-	-
17	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1	-	-	-
16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	1	-	-	-
15	-	-	-	-	-	-	-	-	-	-	1	2	2	3	-	-	-	-	-
14	-	-	-	-	-	-	-	-	-	2	6	8	5	4	-	-	-	-	-
13	-	-	-	-	-	-	1	-	-	3	5	8	1	-	-	-	-	-	-
12	-	-	-	-	-	-	-	1	17	13	23	9	1	-	-	-	-	-	-
11	-	-	-	-	-	1	1	4	22	25	4	1	-	-	-	-	-	-	-
10	-	-	-	-	-	2	15	51	144	24	2	1	-	-	-	-	-	-	-
9	-	-	-	-	1	1	29	89	32	4	-	-	-	-	-	-	-	-	-
8	-	-	-	-	3	21	97	25	9	-	-	-	-	-	-	-	-	-	-
7	-	-	-	3	23	149	38	5	-	-	-	-	-	-	-	-	-	-	-
6	-	-	-	6	51	15	2	-	-	-	-	-	-	-	-	-	-	-	-
5	-	-	5	45	10	1	-	1	-	-	-	-	-	-	-	-	-	-	-
4	-	6	25	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	4	25	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	50	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

```
> summary(ab,what="symmetry")
      symTest df    chi.sq               p
1    McNemars  1  9.204793 0.0024138229
2 EvansHoenig  5 19.824421 0.0013481675
3     Bowkers 37 72.685469 0.0004126986
```

```
> summary(ab,what="bias")
 reader1    n min max   mean     SE      t adj.p    sig    LCI    UCI
      2   54    2   3   2.07 0.0360  2.059 0.5329  FALSE   2.00   2.15
      3   31    3   4   3.19 0.0721  2.683 0.1527  FALSE   3.05   3.34
      4   32    2   5   4.06 0.0998  0.626 1.0000  FALSE   3.86   4.27
      5   59    4   7   5.12 0.0805  1.474 1.0000  FALSE   4.96   5.28
      6   88    5   9   6.25 0.0796  3.141 0.0322   TRUE   6.09   6.41
      7  190    5  11   7.08 0.0462  1.823 0.6294  FALSE   6.99   7.18
      8  183    6  13   8.14 0.0705  1.937 0.5423  FALSE   8.00   8.28
      9  176    5  12   9.13 0.0660  1.981 0.5404  FALSE   9.00   9.26
     10  224    8  12  10.03 0.0562  0.477 1.0000  FALSE   9.92  10.14
     11   71    9  14  10.90 0.1287 -0.766 1.0000  FALSE  10.64  11.16
     12   41   10  15  12.29 0.1684  1.738 0.7187  FALSE  11.95  12.63
     13   30   10  18  13.10 0.2685  0.372 1.0000  FALSE  12.55  13.65
     14    9   12  15  13.89 0.3093 -0.359 1.0000  FALSE  13.18  14.60
     15    8   14  17  14.75 0.3660 -0.683 1.0000  FALSE  13.88  15.62
     16    2   16  16  16.00     NA     NA     NA  FALSE     NA     NA
     17    2   16  17  16.50     NA     NA     NA  FALSE     NA     NA
     18    1   18  18  18.00     NA     NA     NA  FALSE     NA     NA
     19    1   20  20  20.00     NA     NA     NA  FALSE     NA     NA

> plot(ab)                                        # Left
> plot(ab,diff=TRUE)                              # Right
```
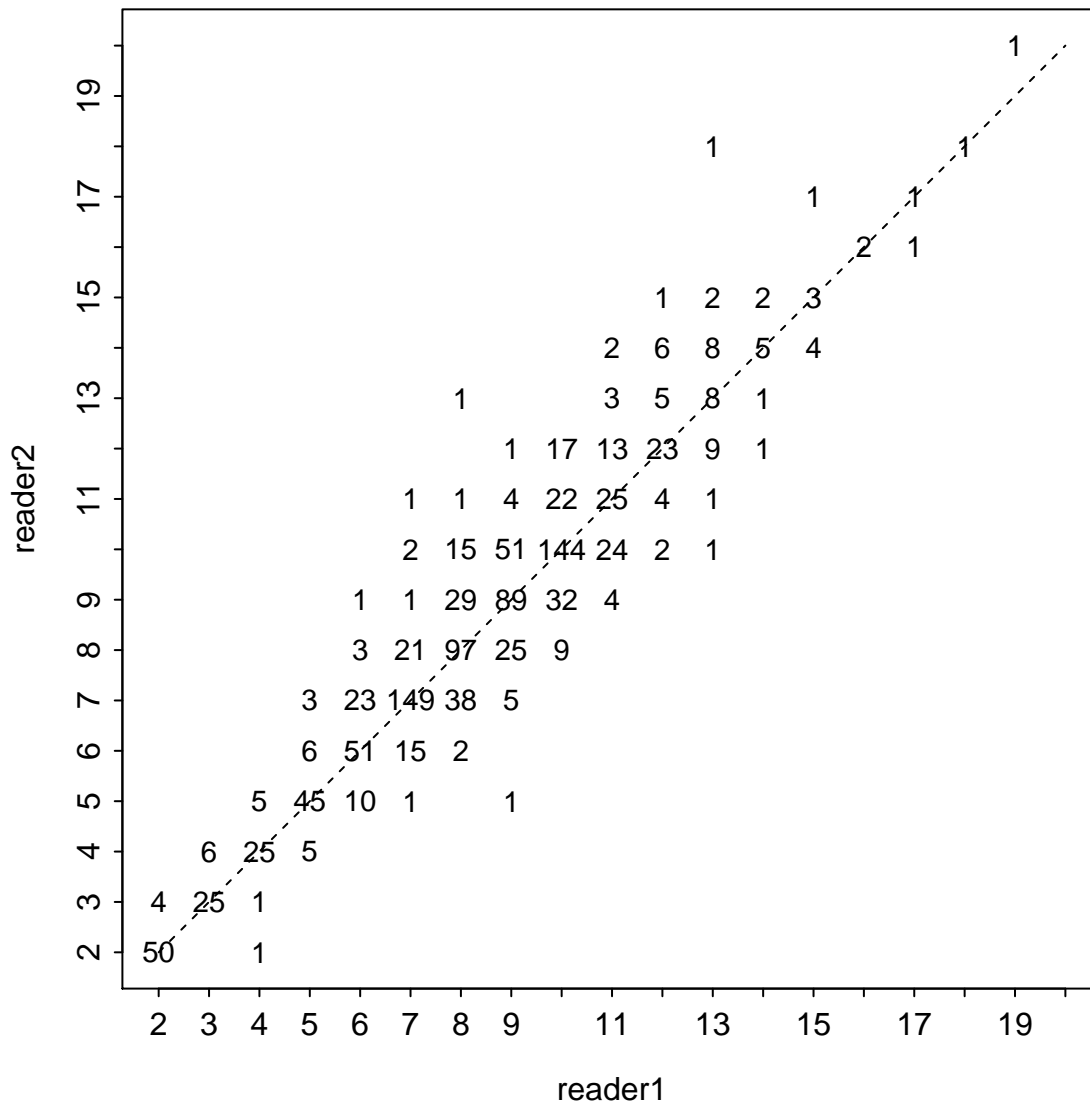


```
> plot(ab,diff=TRUE,show.range=TRUE)              # Left
> plot(ab,diff=TRUE,show.pts=TRUE,transparency=1/25)   # Right
```
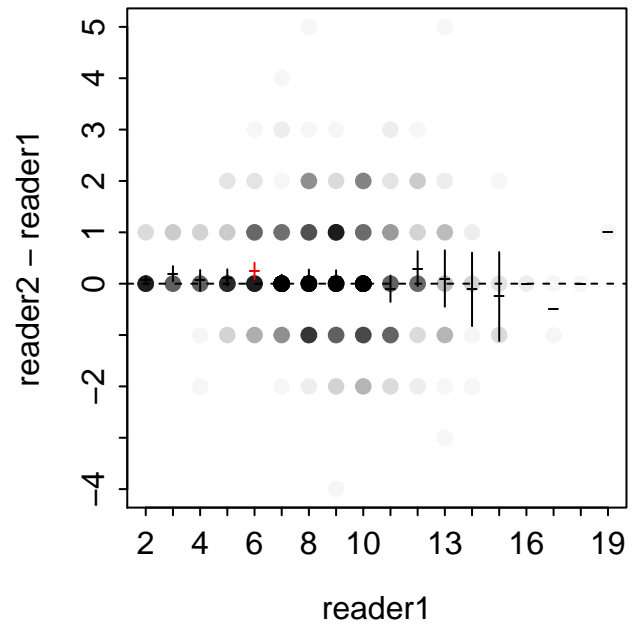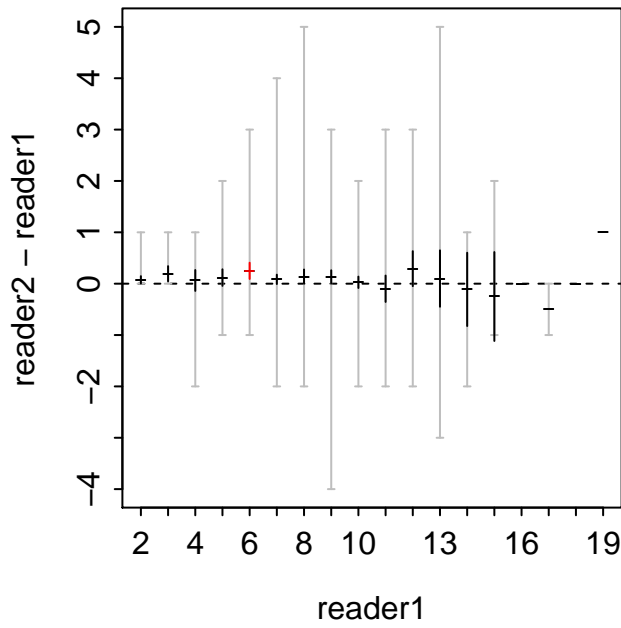
```
> plot(ab,what="numbers",xlim=c(2,20),ylim=c(2,20))
```

Examine Age Precision

```
> ap <- agePrecision(reader2~reader1,data=SB)
> summary(ap,what="difference",digits=1)
   -4    -3    -2    -1     0     1     2     3     4     5
 0.08  0.08  2.16 14.06 61.81 16.31  4.58  0.67  0.08  0.17


> summary(ap,what="absolute difference",digits=2)
    0     1     2     3     4     5
61.81 30.37  6.74  0.75  0.17  0.17


> summary(ap,what="precision")
    n R  ACV   APE PercAgree
 1202 2 3.98 2.815     61.81


> summary(ap,what="detail")  # only some rows shown

     reader2 reader1  avg        sd       APE       ACV
1          2       2  2.0 0.0000000  0.000000  0.000000
2          2       2  2.0 0.0000000  0.000000  0.000000
3          2       2  2.0 0.0000000  0.000000  0.000000
1200      18      13 15.5 3.5355339 16.129032 22.809896
1201      18      18 18.0 0.0000000  0.000000  0.000000
1202      20      19 19.5 0.7071068  2.564103  3.626189
```

Application Assignment

Herbst and Marsden (2012) reprint is here compared the precision, bias, and reader uncertainty of scales, dorsal fin rays, and otolith age estimates from 151 lake whitefish (*Coregonus clupeaformis*) from Lake Champlain in 2009. The data for their comparisons were recorded in `WhitefishLC.csv`. This file contains inital age assessments for two readers on three structures (variable names are the structure name with a "1"" or "2"" appended to denote the reader). In addition, the two readers developed a consensus age (variable name is the structure name with a "C"" appended).

Create a script that performs the following tasks:

1. Use a variety of methods (tabular, graphical, and statistical) to describe any apparent bias in **consensus** ages between scales and otoliths.

2. Describe any apparent bias in age assessment for otoliths between the two readers.

3. Describe precision of age assessment for otoliths between the two readers.

4. (*Time Permitting*) Describe any apparent bias in age assessment for scales between the two readers.

5. (*Time Permitting*) Describe precision of age assessment for scales between the two readers.

6. (*Time Permitting*) Use a variety of methods (tabular, graphical, and statistical) to describe any apparent bias in **consensus** ages between fin rays and otoliths.

7. (*Time Permitting*) Describe any apparent bias in age assessment for fin rays between the two readers.

8. (*Time Permitting*) Describe precision of age assessment for fin rays between the two readers.

Save your script!