**Sex Determination in Pacific Golden-Plover (Pluvialis fulva) Using Skeletal Wing Measurements.**

Bri Hogan
Brigham Young University- Hawaii  Laie, HI

---

**Abstract**

The purpose of this study was to investigate sexual dimorphism in Pacific Golden-plovers (Pluvialis fulva). Five linear skeletal measurements (humerus length, ulna length, radius length, carpometacarpus length, and deltoid crest to bicipital crest) were recorded in a total of 48 specimens. The sex of the specimens was determined by gonadal inspection prior to dis-articulation. Data were analyzed by two-way ANOVA and no statistical difference between males and females was found.

**Introduction**

Many bird species are sexually dimorphic, a fact that can be useful when attempting to determine gender from skeletal remains. Sexual dimorphism in Black-headed Gulls (Larus ridibundus) is observed with females being larger (Palomares et al. 1997). Males of the Jack Snipe (Lymnocryptes minimus) as well as Shorebirds, gulls, and alcids, Yellow Legged Gulls (Larus chachinnans), and Blue-fronted Amazon (Amazona aestiva) were all sexually dimorphic with males being larger (Bosch 1996, Szekely et al. 2000, Sikora and Dubiec 2007, Berkunsky et al. 2009). However, it has been found that a few birds such as the Greater Golden-plover (Pluvialis apricaria) are not sexually dimorphic (Jukema and Piersma 1992). Also, 21 species of Trans-Saharan migratory birds were found to not be sexually dimorphic (Rubolini et al. 2004). The Pacific Golden-Plover (P. fulva) were found to be sexually dimorphic using skeletal measurements of the femur, tibiotarsus, tarsus metatarsus, craniol width, craniol length, interorhital constrictation, and sternum. Craniol width, tarsusmetatarsus length, and tibiotarsus length were the most significant (Herrera 2011). Skeletal measurements of the wing have not been used as an indicator of gender. The purpose of this study was to take measurements of the humerus, ulna, radius, carpometacarpus, and deltoid crest to bicipital crest to determine if these data could be used in determining the sex in skeletal specimens of the Pacific Golden-plover.

**Materials & Methods**

There are 48 Pacific Golden-Plover skeletal specimens from Brigham Young University-Hawaii Museum of Natural History examined. The five linear measurements taken were humerus length, ulna length, radius length, carpometacarpus length, and deltoid crest to bicipital crest (Figures 1-3). The measurements were observed using a digital caliper and recorded to the nearest 0.01 mm. Of the 51 available specimens only 48 contained the skeletal structures necessary for the study. All specimens were adult birds of at least one year of age based on complete cranial ossification. The data was analyzed by two-way ANOVA.

**Results**

P-value, means, and variance (Figure 4) between males and females for measurements of the humerus, ulna, radius, carpometacarpus, and deltoid crest-bicipital crest.

<table>
<thead>
<tr>
<th>Measurement</th>
<th>Means with Standard Deviation and P-Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>P-Value</td>
<td>P=0.2</td>
</tr>
<tr>
<td>P=2.25</td>
<td>P=2.23</td>
</tr>
<tr>
<td>P=2.23</td>
<td>P=1.77</td>
</tr>
<tr>
<td>P=0.42</td>
<td></td>
</tr>
</tbody>
</table>

**Figure 4. The P-value, means, and variance of the five linear skeletal measurements.**

**Conclusions**

No significant difference was found between males in female Pacific Golden-Plovers with respect to humerus, ulna, radius, carpometacarpus, and deltoid crest-bicipital crest measurements. As bones of the wing have not been used as a measurement for sexual dimorphism, further research would need to be performed to determine if wing bones are normally dimorphic. The large variance in the carpometacarpus in both male and females suggest that using this measurement would not give accurate data in regards to sexual dimorphism even though the mean was the largest deviation between male and female. The findings contrast with earlier research in which the male tibiotarsus, craniol width, and tarsusmetatarsus measurements are sexually dimorphic factors in Pacific Golden-Plovers (Figure 5).

**Figure 5. Pacific Golden Plover (Pluvialis fulva).**

---

**References**


**Acknowledgements**

I would like to thank my Mentor Phillip Bruner for his guidance in conducting my research and the staff at the BYU-H Natural History Museum for the use of their specimens. Randy Day was very helpful with analyzing my data. I would also like to thank Shane Gold and the biology faculty for their comments on the paper.