Phylogeny of female biased body size in Owls

My exercise was a comparison of eleven owl species according to their body size differences between the male and the female. The body size data were reverse sexual dimorphism (male/female) in wing and the cube root of weight in Europen owl species. The goal of this study is to identify phylogenetic relatonships among owl species in the context of female biased body size using reverse sexual dimorphism (RSD). In the source article body size samples were selected with the following guidelines: that an adequate sample be obtained, where possible, weights from the breeding season were avoided because of the great changes that occur in the weights of females at this time, and where possible, weights and wing measurements were from the same locality or region because RSD in wing and weight appear to vary geographically. These samples were extracted from Cramp (1985).

This article provides further information on female dominance in intra-pair interactions. The species listed in descending order of estimated relative female dominance: (1) Eurasian Pygmy-Ow (*Glaucidium passerinum*): If the male is next to the nest without food when the young are hungry, the female will drive him away. In small cages, females will kill males. (2) Boreal Owl (*Aegolius funereus)*: When food deliveries are insufficient, the female will leave the nest and chase the male for minutes. (3) Northern Eagle-Owl (*Bubo bubo*): No intersexual aggression has been recorded in the wild. But if only one female and male are in a cage, the female will kill the male. (4) Ural Owl (*Strix uralensis*): No observations of intrapair aggression in the field, but in captivity the female will show a threat display to her male if he is slow to deliver food. (5) Northern Hawk-Owl (*Surnia ulula*): Females react to courting males with aggressive vocalisations and with high intensity threat displays in captivity. (6) Little Owl (*Athene noctua*): In small cages, a female strikes strangers of both sexes and will even strike her own male. (7) Eurasian Scops-Owl (*Otus scops*): Females will strike strangers of both sexes, males will not attack strange females. Rankings for the female dominance (Mueller 1986) were correlated with RSD in weight (r=0.934, P=0.01, Spearman Rank correlation coefficient), and in wing (r=0.829, Spearman Rank correlation coefficient). It should be an iteresting question: Is there a phylogenetic relationship among owls in the context of female dominance according to these ranks? Unfortunately, I couldn't work with ranks in the phylogenetic analysis. In addition I need considerably more, and better, data on behaviors of pairs before I can evaluate the connection of female dominance with evolution.

There is a prediction (Jehl and Murray 1986) that reversed sexual dimorphism evolved as a result of selection for small size in males for agility in aerial displays. Aerial displays would be found in owls. The European owls have been well-studied to permit a comparison of the correlation between RSD and the agility of aerial displays. The species were ranked in order of the complexity, variety and frequency of aerial displays. Spearman rank correlations between the ranks for aerial displays and RSD: weight (r=-0.146); wing (r=-0.017). None of these approach statistical significance and both are negative. This suggests that the hypothesis isn't a viable explanation for the evolution of RSD in owls.

More data is needful on all aspects of the biology of owls before we can attempt to resolve the question of the evolution of the female biased body size in owls. Additional data should be environmental factors like prey size and prey variability. According to the hypothesis that in birds of prey and owls the two sexes deliver food for the chick from different prey size range. The female has a big benefit from the bigger body size because she can lay bigger eggs. If there isn't competition among males, and the two sexes save the territory together, the pair is more successful with a bigger female.

In the analysis I used the following reversed sexual dimorphism (male/female) in wing: Eurasian Scops-Owl (*Otus scops*): 0.994, Northern Eagle-Owl (*Bubo bubo*): 0.921, Snowy Owl *(Nyctea scandiaca*): 0.913,Northern Hawk-Owl (*Surnia ulula*): 0.983, Eurasian Pygmy-Owl (*Glaucidium passerinum*): 0.926, Little Owl (*Athene noctua*): 0.982,Eurasian Twany Owl (*Strix aluco*): 0.96, Ural Owl (*Strix uralensis*): 0.986, Long-eared Owl (*Asio otus*): 0.983, Short-eared Owl (*Asio flammeus*): 0.988, Boreal Owl (*Aegolius funereus*): 0.977; in the cube root of weight: Eurasian Scops-Owl (*Otus scops*): 0.975, Northern Eagle-Owl (*Bubo bubo*): 0.927, Snowy Owl (*Nyctea scandiaca*): 0.847,Northern Hawk-Owl (*Surnia ulula*): 0.945, Eurasian Pygmy-Owl (*Glaucidium passerinum*): 0.926, Little Owl (*Athene noctua*): 0.978, Eurasian Twany Owl (*Strix aluco*): 0.947, Ural Owl (*Strix uralensis*): 0.879, Long-eared Owl (*Asio otus*): 0.950, Short-eared Owl (*Asio flammeus*): 0.991, Boreal Owl (*Aegolius funereus*): 0.857.

I used a phylogenetic tree, which included members of the genera: *Otus, Bubo, Asio, Aegolius, Athene, Glaucidium, Surnia, Nyctea, Scotopelia, Strix, Phodilus,Tyto and Ninox.* The source article reported about the taxonomic place of a new *Ninox* species (*Ninox subaensis*). In that study a 900 bp section of the mitochondrial cytochrome b gene was sequenced and phylogenetic relationships were calculated with maximum-likelihood phylogram. Genetic distances among taxa were given from a neighbour-joining analysis (bootstrap values above 65%).

<u>Data</u>:

```
11 2
Otus_scops   0.994  0.975
Nyctea_sca   0.913  0.847
Bubo_bubo_   0.921  0.927
Stix_urale   0.986  0.879
Stix_aluco   0.960  0.947
Asio_otus_   0.983  0.950
Asio_flamm   0.988  0.991
Surnia_ulu   0.983  0.945
Glauc_pass   0.926  0.926
Athene_noc   0.982  0.978
Aegol_fune   0.977  0.857
```

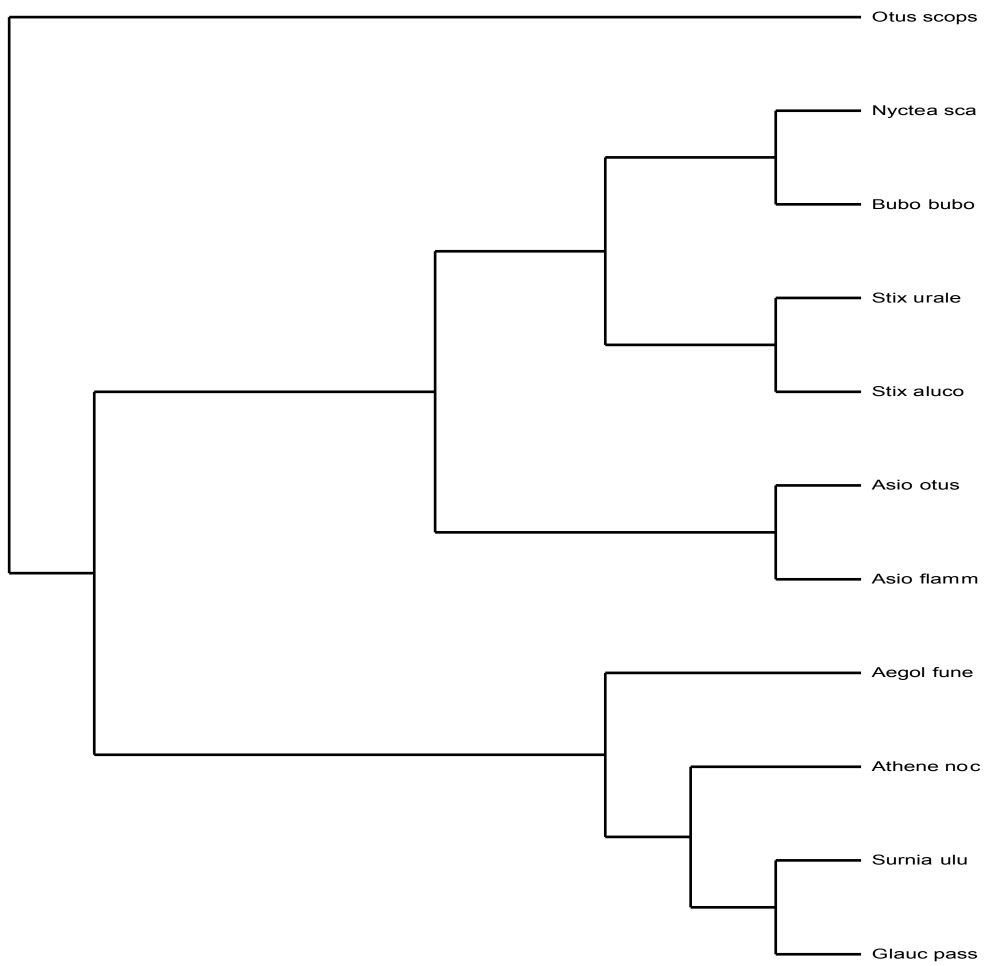
Tree:

```
(Otus_scops,((((Nyctea_sca:1,Bubo_bubo_:1):0.017,(Stix_urale:1,Stix_aluco:1
):0.046):0.008,(Asio_otus_:1,Asio_flamm:1):0.029):0.016,(Aegol_fune,(Athene
_noc,(Surnia_ulu:1,Glauc_pass:1):0.020):0.021)0.019):0.015):0.029;
```

Species	Ranks
Eurasian Pygmy-Ow (*Glaucidium passerinum*)	1
Boreal Owl (*Aegolius funereus)*	2
Northern Eagle-Owl (*Bubo bubo)*	3
Ural Owl (*Strix uralensis*	4
Northern Hawk-Owl (*Surnia ulula*)	5
Little Owl (*Athene noctua*)	6
Eurasian Scops-Owl (*Otus scops)*	7

Ranks of female dominance in intra-pair interactions.

Phylogenetic Tree:



<u>Results</u>:

```
Contrasts (columns are different characters)
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  -0.00566  -0.05657
   0.01838  -0.04808
  -0.05475  -0.02542
  -0.00354  -0.02899
  -0.04672  -0.07956
   0.04031   0.01344
   0.03814   0.05894
  -0.03450  -0.83498
  -0.04347   0.15060
   0.13880   0.96347

Covariance matrix
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    0.0031    0.0163
    0.0163    0.1665

Regressions (columns on rows)
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    1.0000    5.2739
    0.0982    1.0000

Correlations
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    1.0000    0.7195
    0.7195    1.0000
```

References:

Olsen J., Wink M., Sauer-Gürth H., Trost S. (2002): A new Ninox owl from Sumba, Indonesia. Emu 102: 223-231

Mueller C. H. (1989): The evolution of reversed sexual dimorphism in owls: corrections and further analyses. The Wilson Bulletin 101 (3): 486-491