

Evaluation of the relationships between characteristics of the vertebral column of different cetaceans and their ecology: A preliminary study.

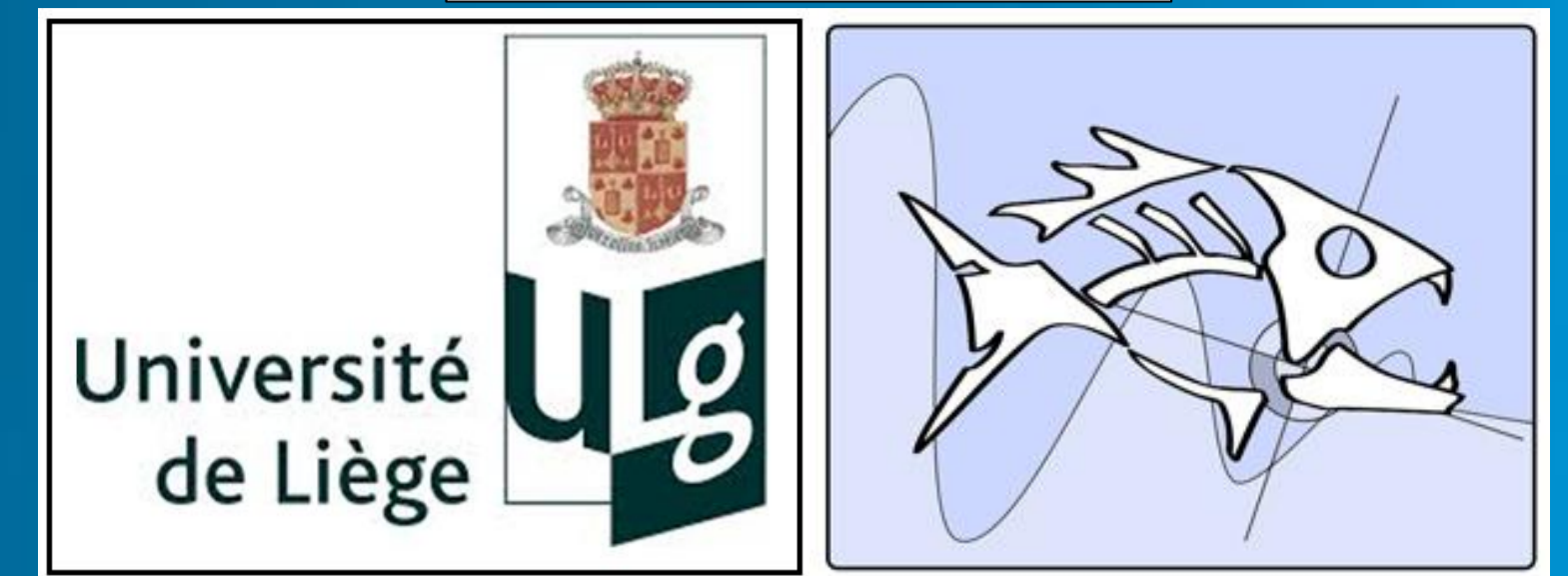


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Introduction

- Number & shape of vertebrae
→ Impact on body stiffness and swimming style.
- Different species have different ecology.
- Hypothesis:
Relationships between vertebra characteristics and ecology of species?

Material and methods

- **12 species:** whales and dolphins.
- 12 measurements on each vertebra: digital caliper & photogrammetry.
- Measurement **aspect ratio** fluke & flipper on pictures.
- **Standardized** measurements.
- Literature review for ecology.

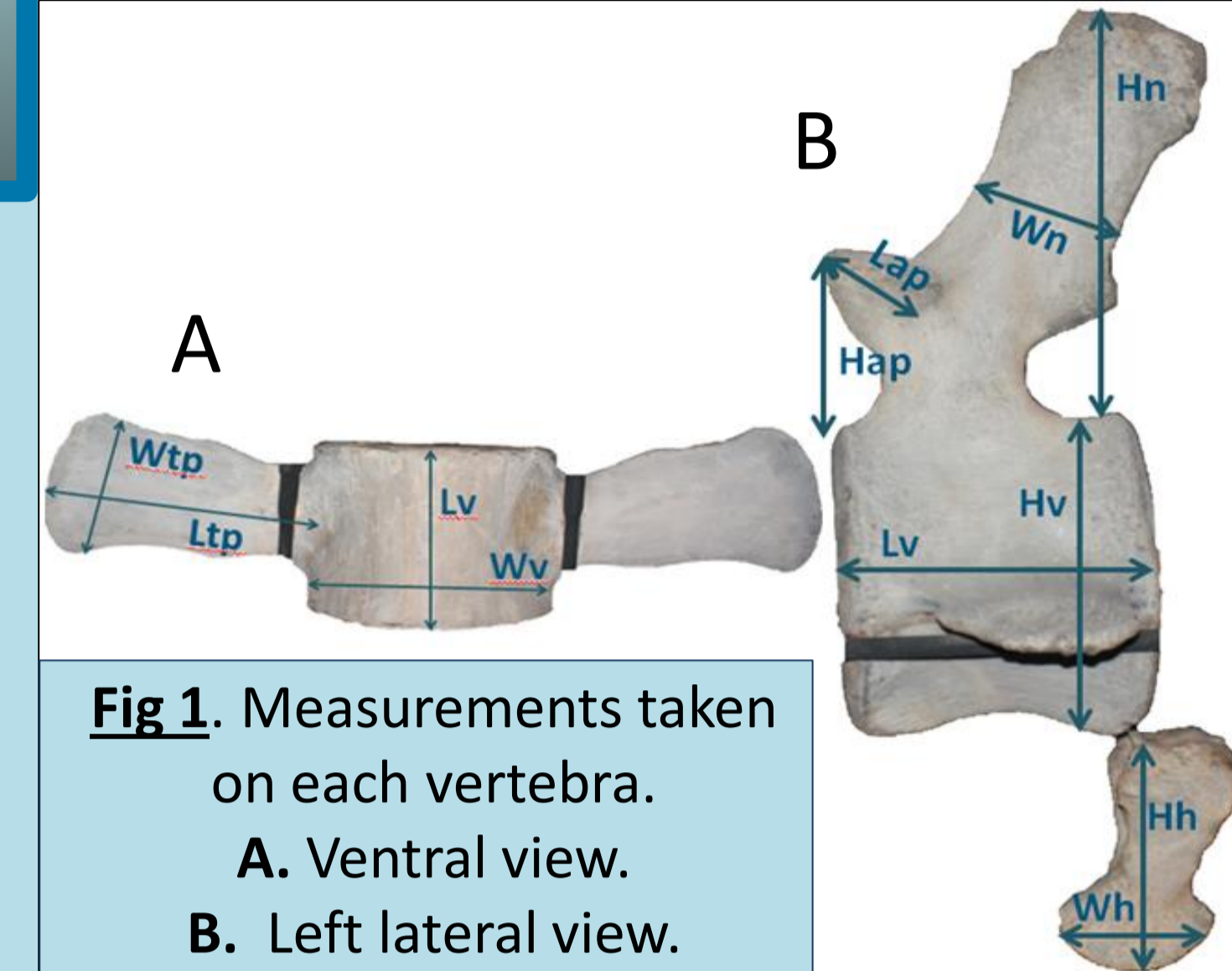


Fig 1. Measurements taken on each vertebra. A. Ventral view. B. Left lateral view.

Results and discussion

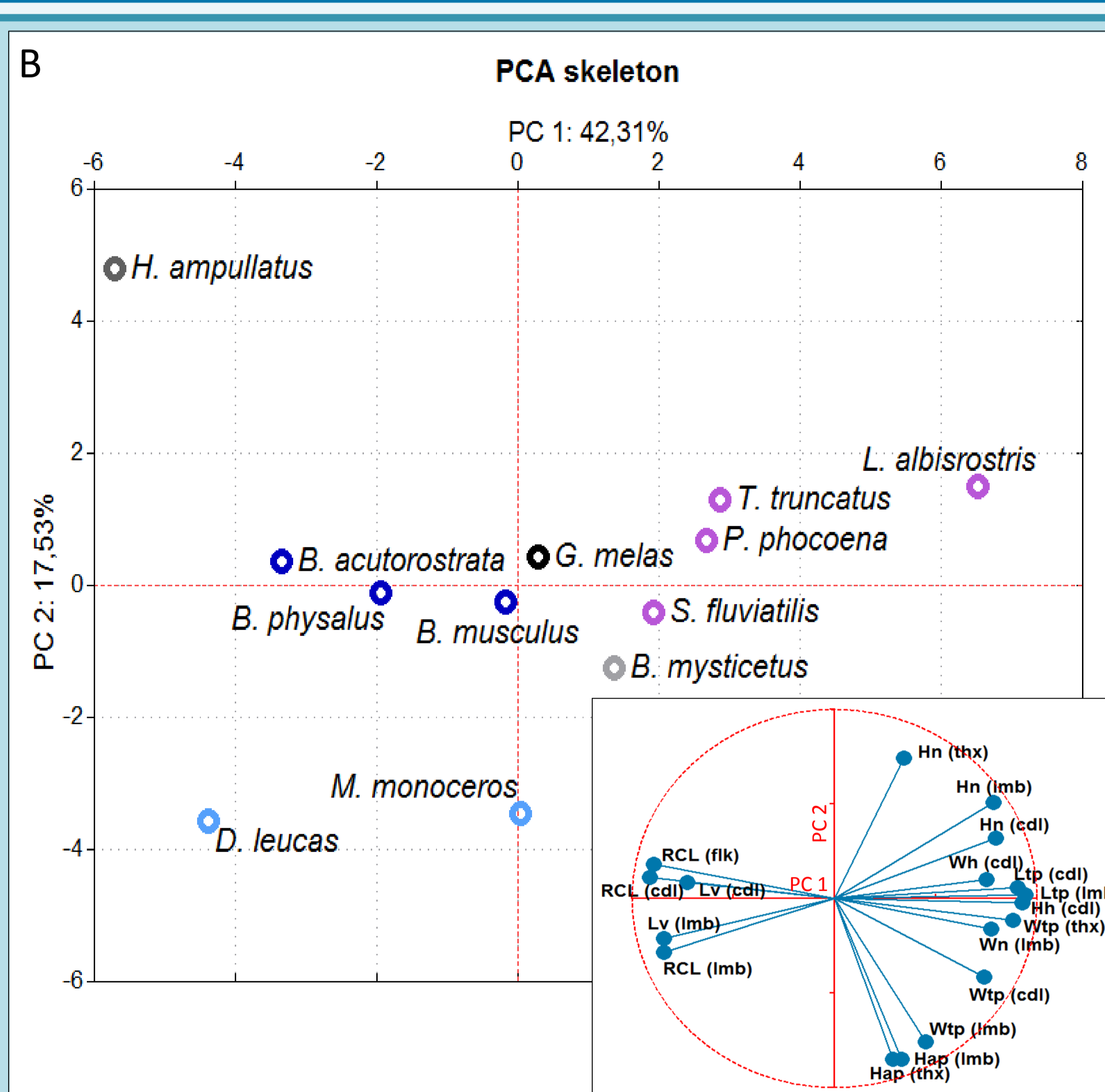
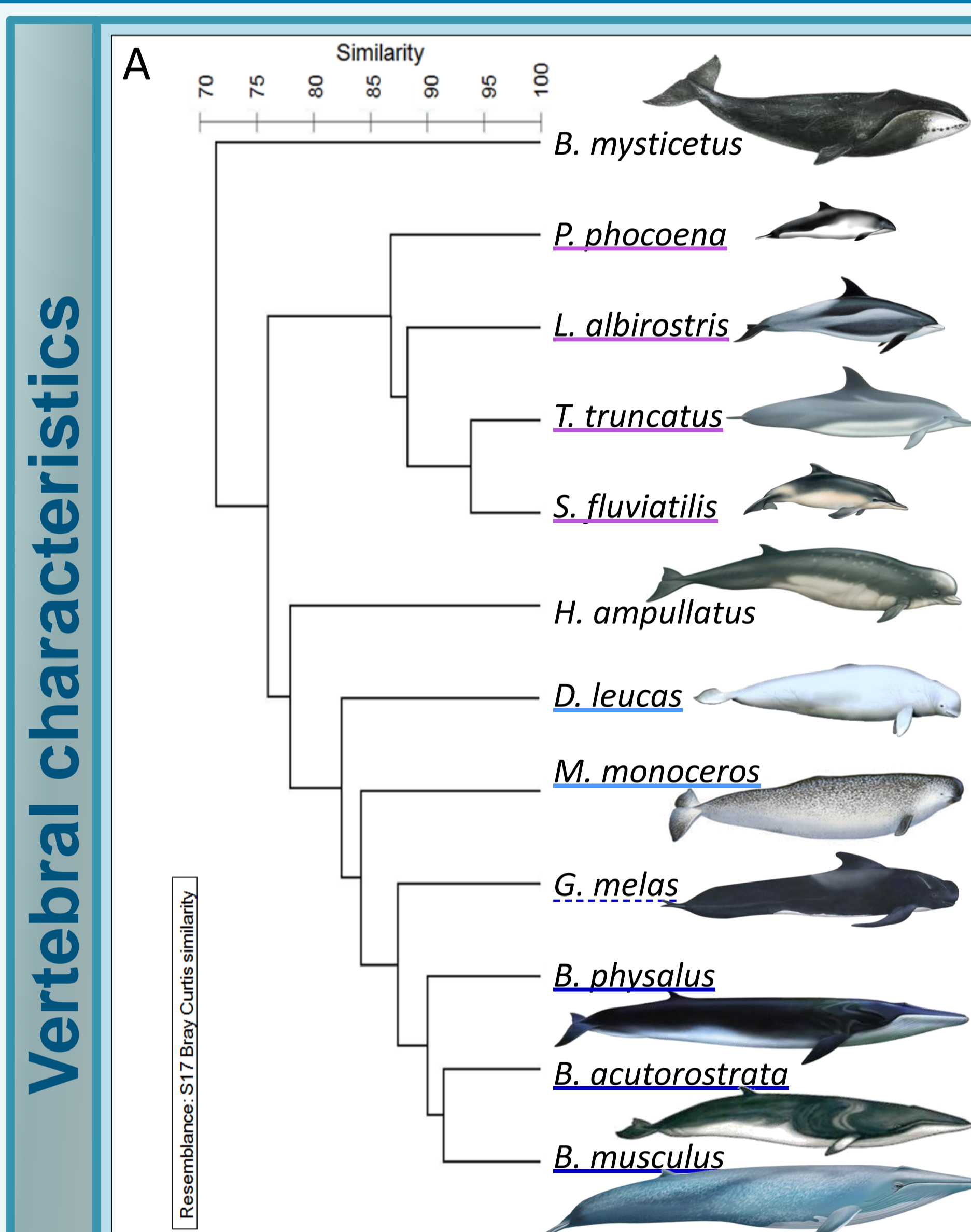


Fig 2. Statistical analysis using the mean of each vertebral measurements (showed in fig 1) for each region of the body: thoracic (thx), lumbar (lmb), caudal (cdl) and fluke (flk). A. Hierarchical clustering based on average group linking method. B. Scatterplot from principal component analysis and projection of the variables on the factorial plane.

Combination of morphological data (fig 2B):
Lower left corner: Most flexible species (long and narrow vertebrae, short neurepines and hemepines).

Upper right corner: Species having the most rigid vertebral column.

Confrontation of both figures 2 shows:

The more rigid vertebral column are found in the smallest cetaceans (*P. phocoena*, *L. albirostris*, *T. truncatus*, *S. fluviatilis*)

The more flexible vertebral column are found in the longest species (*H. ampullatus*, *D. leucas*, *M. monoceros*, *G. melas*, *B. physalus*, *B. acutorostrata*, *B. musculus*)

3 distinct groups:

- 1. Maneuverer (slow swimming) odontocetes:**
D. leucas, *M. monoceros*.
 - 2. Cruiser (fast swimming) odontocetes:**
L. albirostris, *T. truncatus*, *P. phocoena*, *S. fluviatilis*, *H. ampullatus*.
 - 3. Cruiser whales:**
B. acutorostrata, *B. musculus*.
- Intermediate group:** *G. melas*, *B. physalus* and *B. mysticetus*.
Similar fluke shape but differences at the level of their maneuverability.

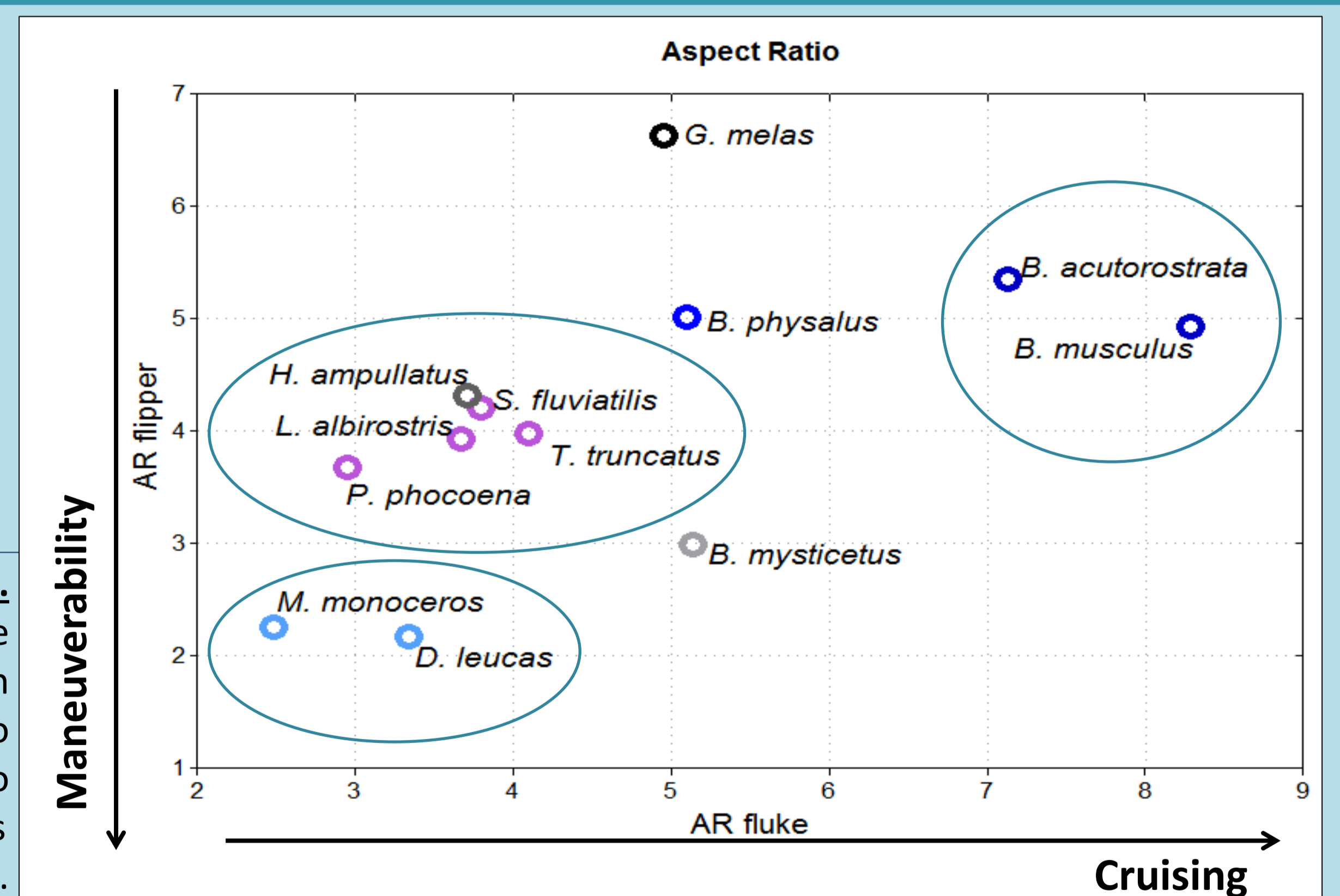


Fig 3.

Graph showing the position of each species according to the mean aspect ratio of its flipper and of its fluke.

Conclusion

3 distinct groups with intermediates:

- 1. Active, cruising & fast swimmers** with rigid body & only fluke oscillating.
 - 2. Maneuverers & slow swimmers** with flexible body undulating.
 - 3. Steady swimmers** with body undulating but fluke enhanced for cruising.
- Vertebral morphology can give a general idea of ecology but requires additional information.
 - Small species seem to be limited in their range of morphological adaptations.

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