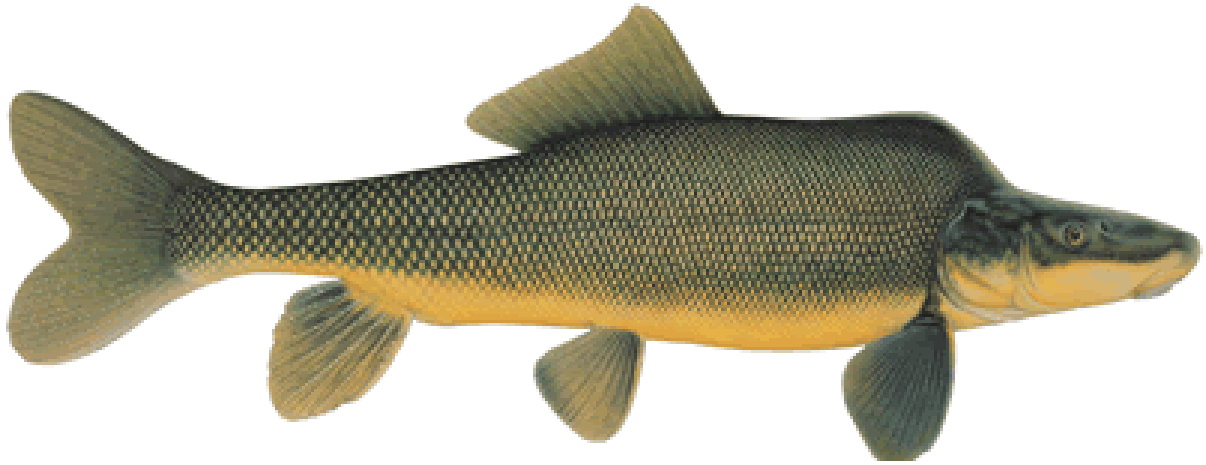
Using shape to identify Razorback Flannelmouth Sucker hybrids

Pilar Wolters

Arizona Game and Fish Department / Northern Arizona University

Razorback Sucker

- *Xyrauchen texanus*
- IUCN: Endangered
- Robust body with keel



Flannelmouth Sucker

- *Catostomus latipinnis*
- IUCN: Least concern
- Slender torpedo shaped body

Hybrids

Management Concerns

- Loss of pure genetics
  - Hybrid swarms
  - Hybrid zones

Management Concerns

- Loss of pure genetics
  - Hybrid swarms
  - Hybrid zones

Hybrid Viability

Viability Study

No difference in early life stage viability between hybrids and parental species

Viability Study

No difference in early life stage viability between hybrids and parental species

Where are the wild juvenile hybrids?

- Misidentification?

- Geometric morphometrics to analyze shapes

Questions

1. Can we use shape to determine the maternal parent of a hybrid?
2. At what length can we begin to differentiate Razorbacks, Flannelmouths, and hybrids based on shape?

Methods

Progeny

2016

- Razorback
- Razorback ♀ x Flannelmouth ♂ hybrid (Razormouth hybrid)

2017

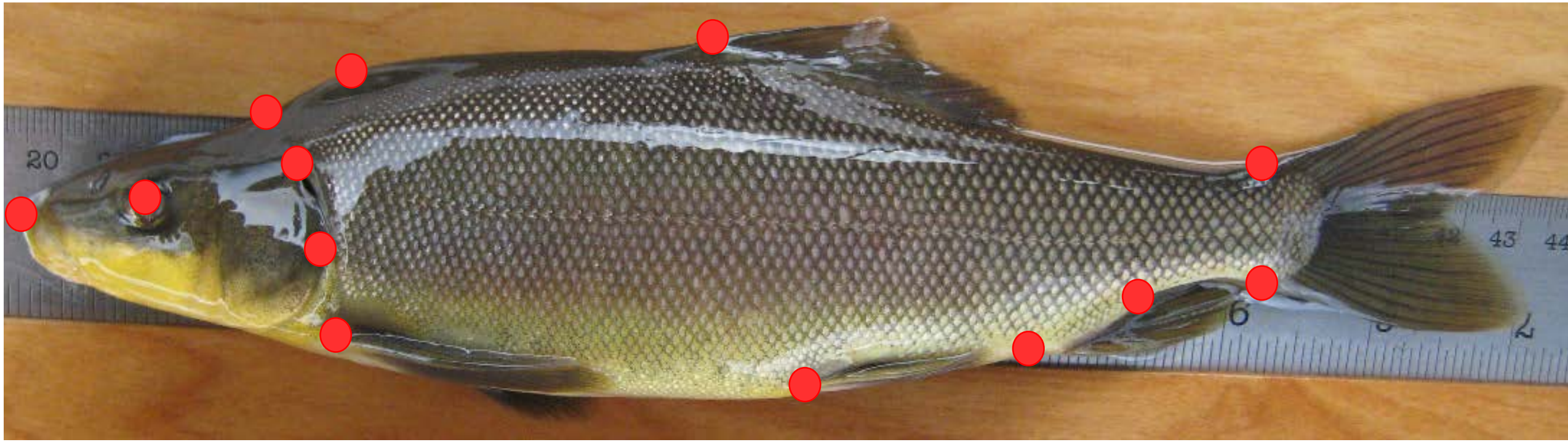
- Flannelmouth
- Flannelmouth ♀ x Razorback ♂ hybrid (Flannelback hybrid)

Geometric morphometrics

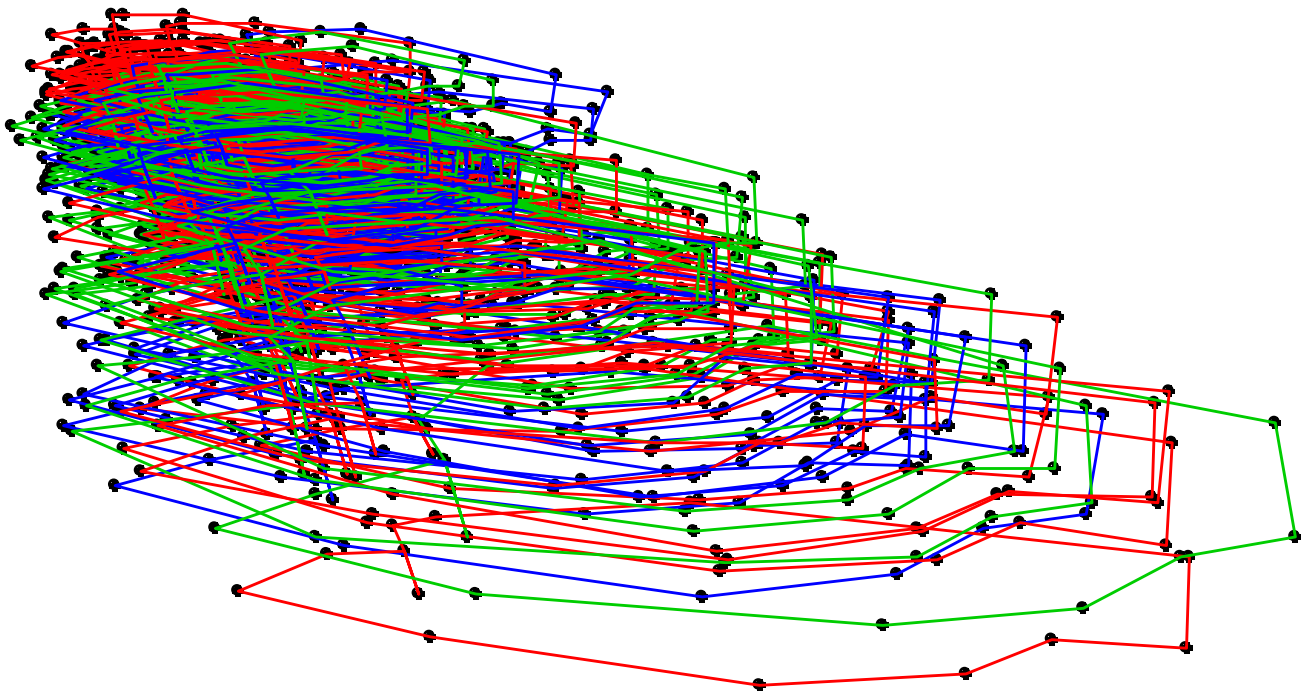
- Flannelmouth Sucker
  - Wild: n = 70
  - lab reared: n = 14
- Razorback Sucker
  - Hatchery: n = 35
  - lab reared: n = 60
- Hybrids: lab reared
  - Razormouth : n = 73
  - Flannelback: n = 30

Geometric morphometrics

Landmarks (X,Y) → Procrustes fit

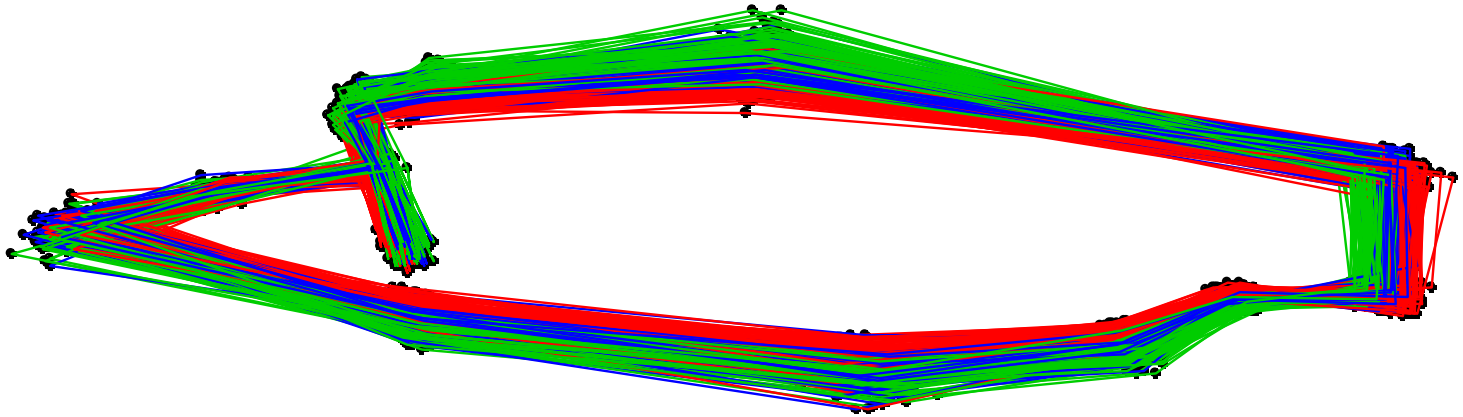


Before Procrustes fit



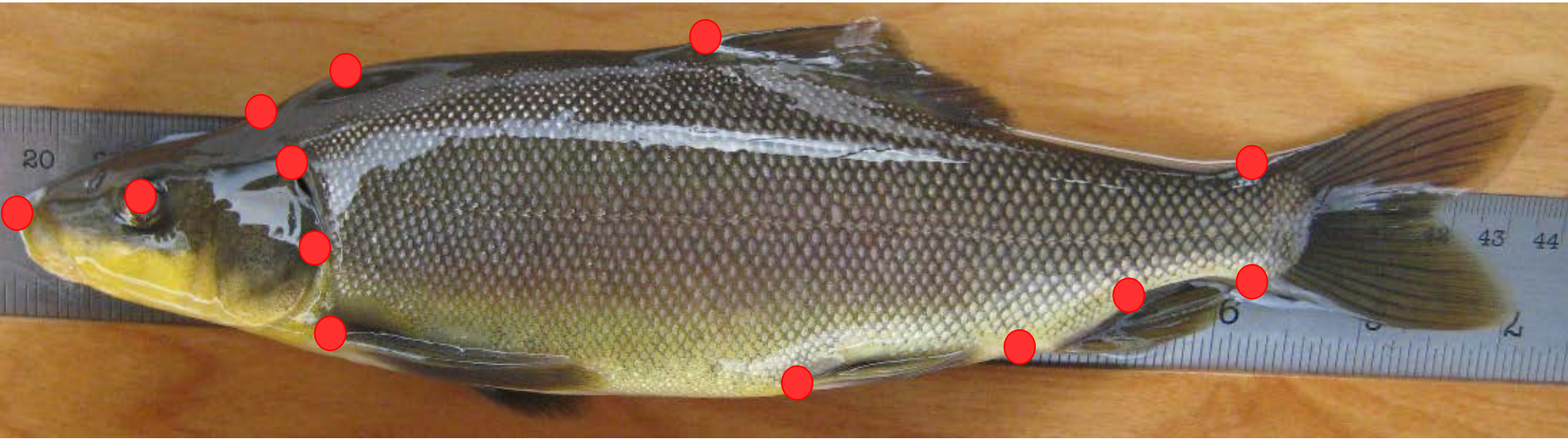
After

- Rotated
- Translated
- Scaled

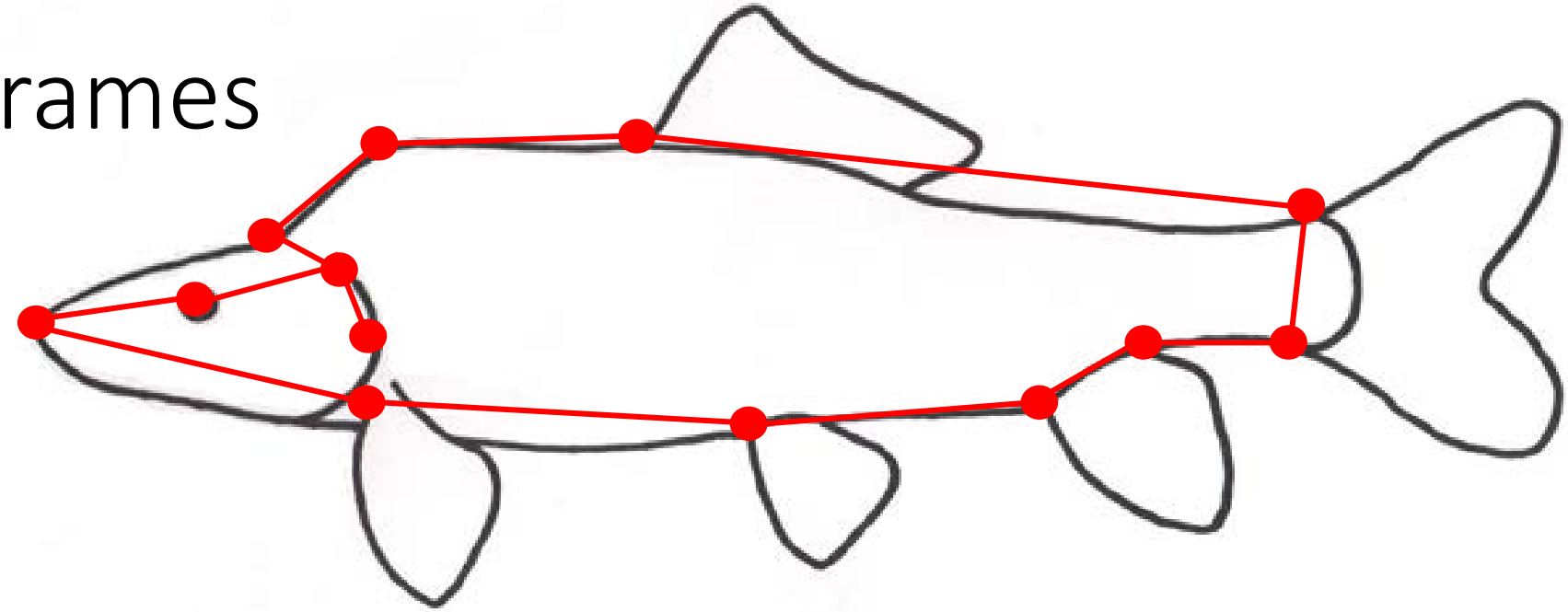


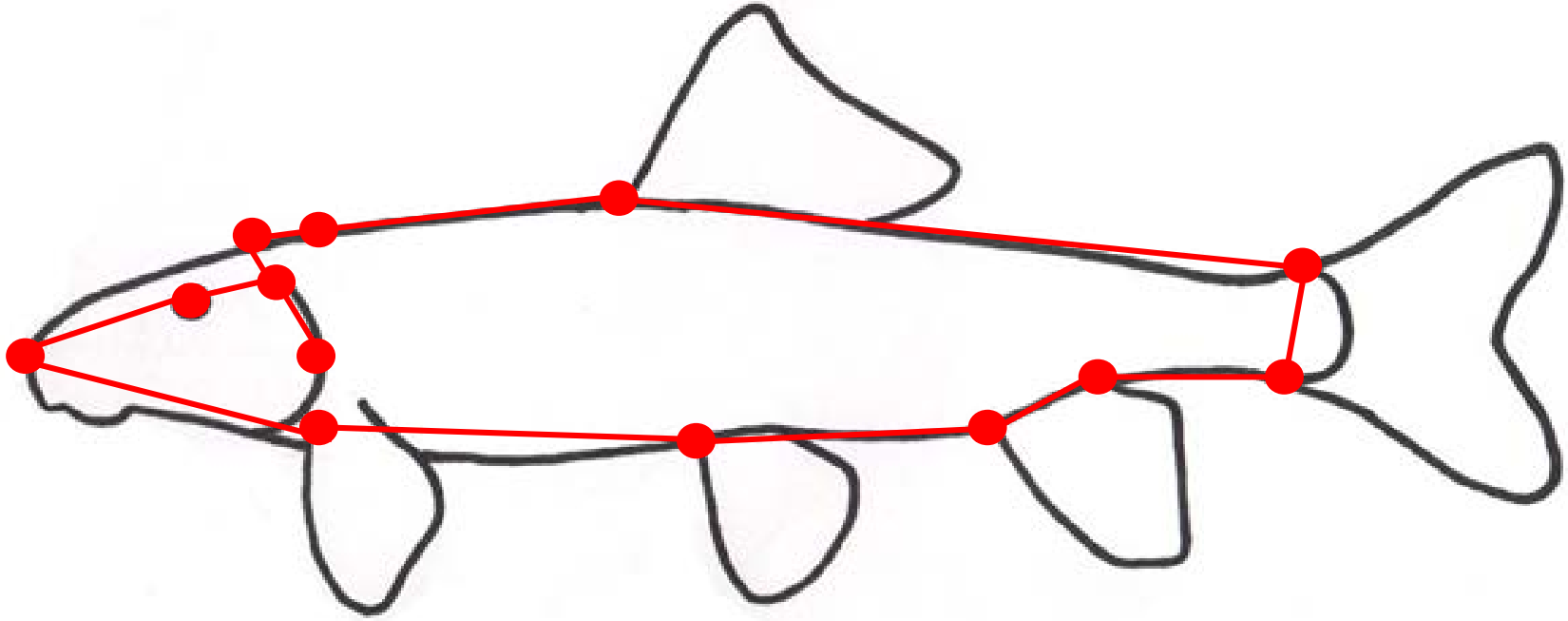
Geometric morphometrics

Landmarks (X,Y) → Procrustes fit (shape variables) → Shape analyses

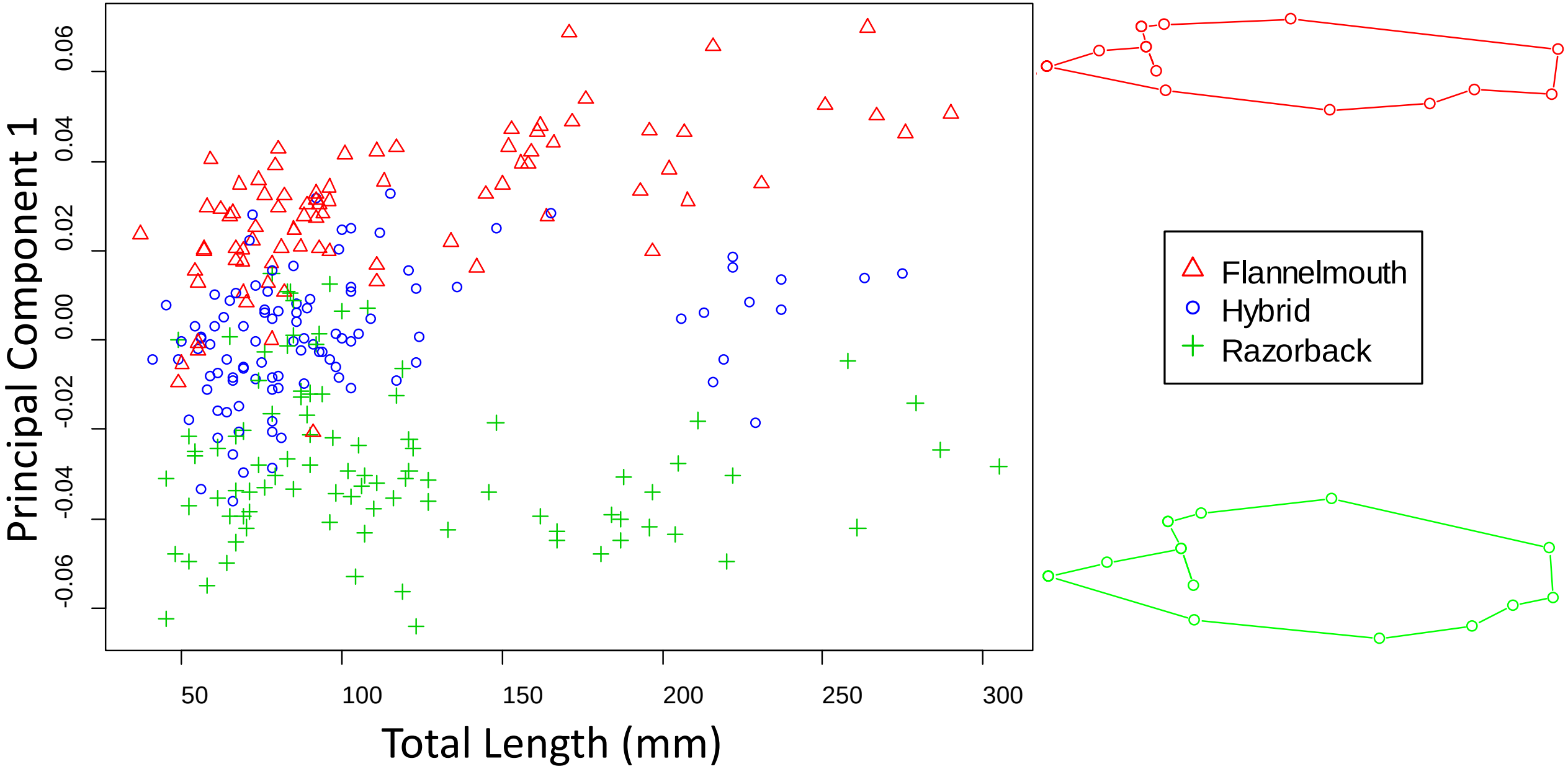


Wireframes





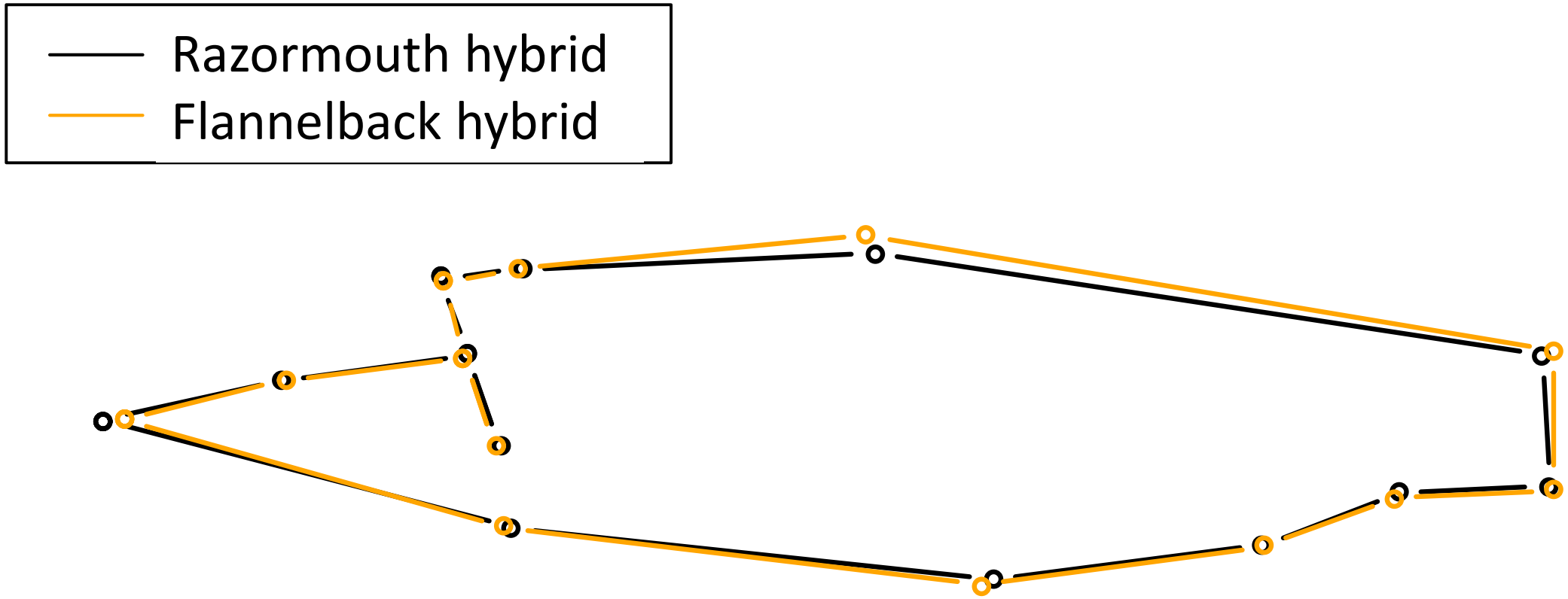
Hybrids are intermediate in shape



Questions

1. Can we use shape to determine the maternal parent of a hybrid?
2. At what length can we begin to differentiate Razorbacks, Flannelmouths, and hybrids based on shape?

Both hybrids have similar shape <70mm

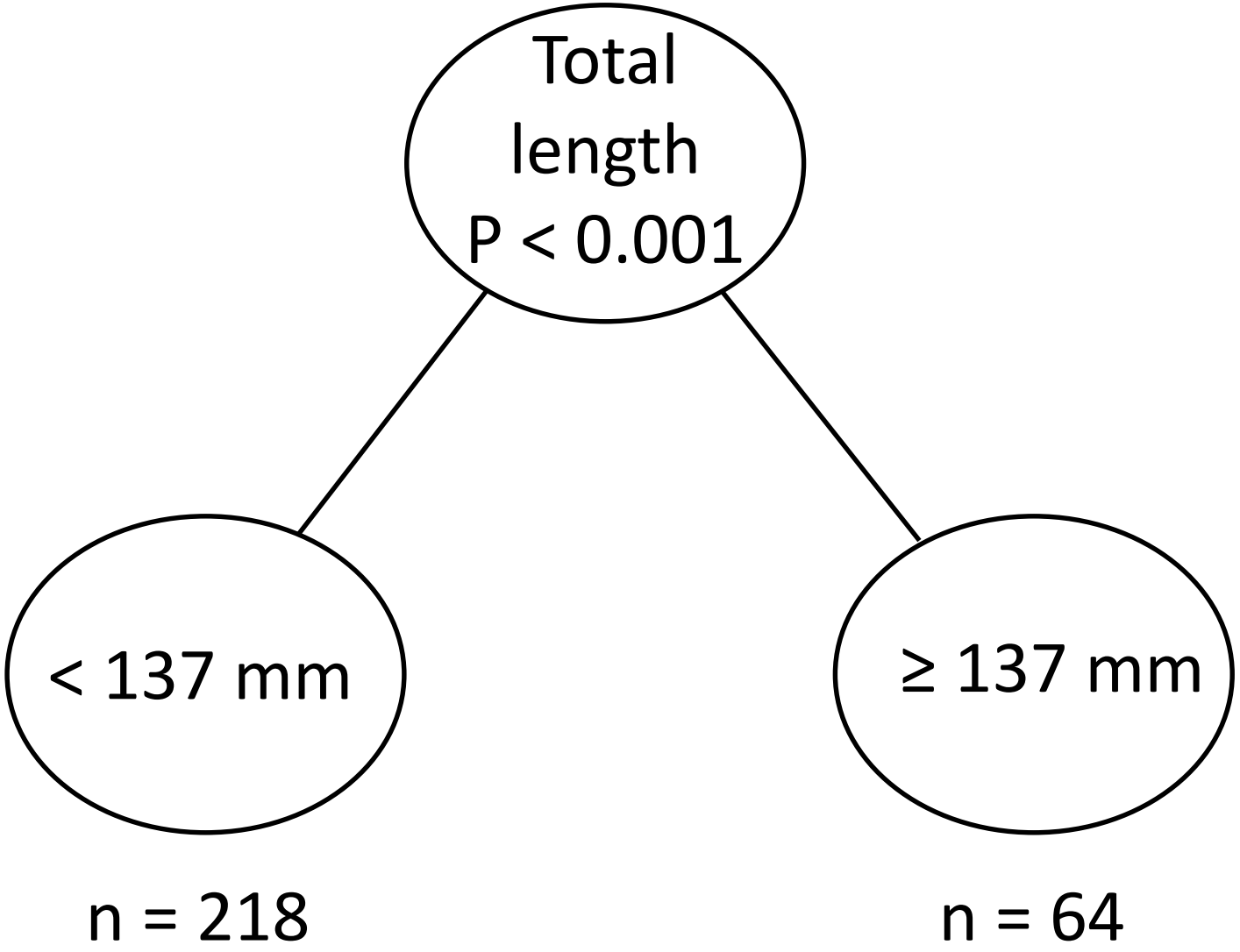


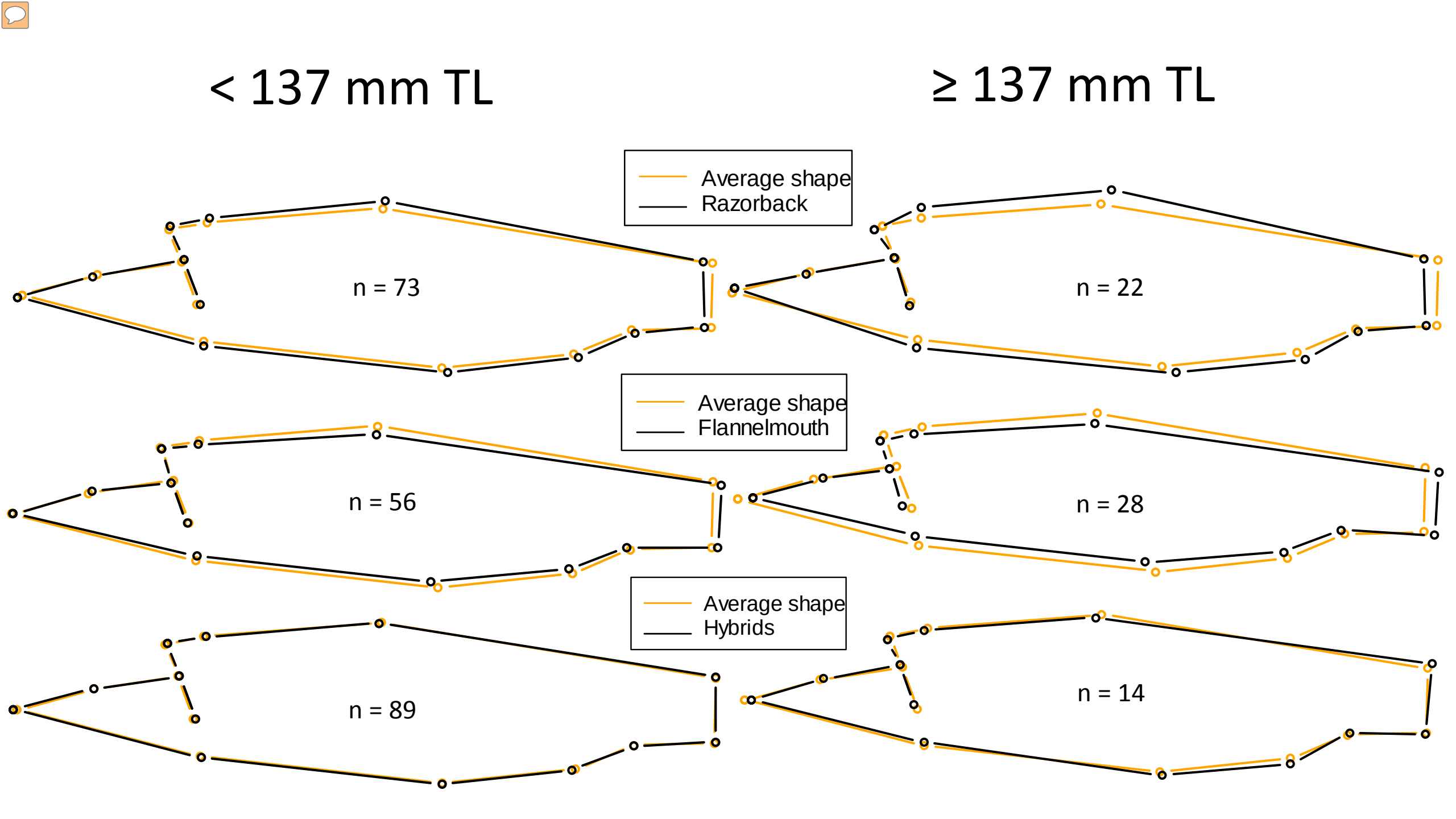
P-value = 0.128

Questions

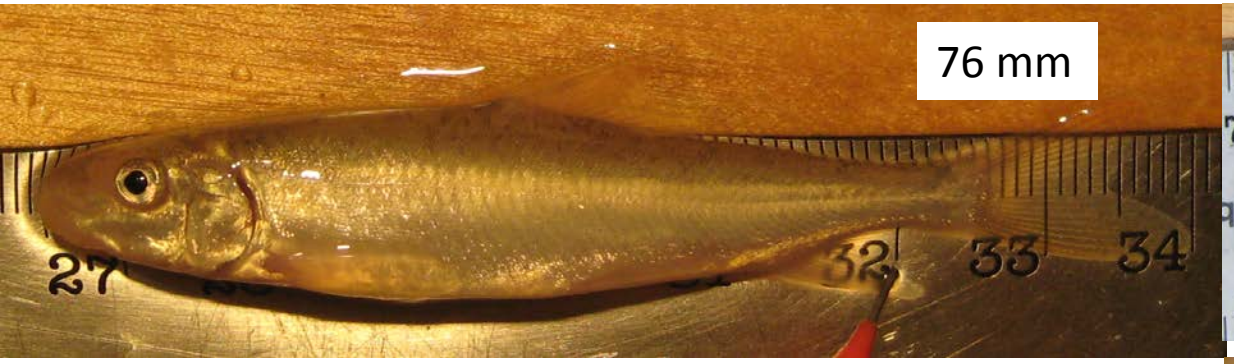
1. Can we use shape to determine the maternal parent of a hybrid?
2. At what length can we begin to differentiate Razorbacks, Flannelmouths, and hybrids based on shape?

Fish smaller than 137 mm TL are similar in shape

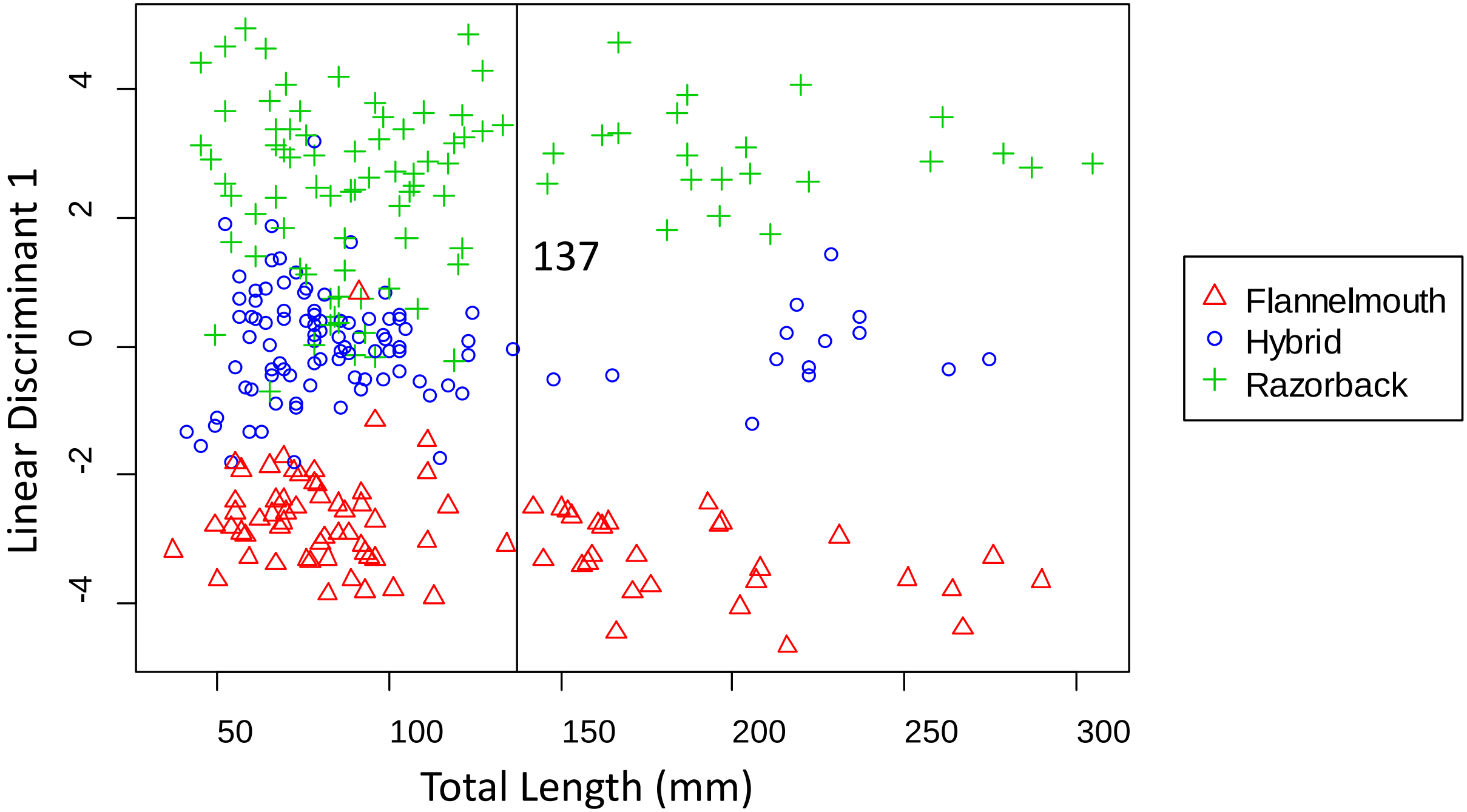



< 137 mm TL
≥ 137 mm TL
Average shape
Razorback
n = 73
n = 22
Average shape
Flannelmouth
n = 56
n = 28
Average shape
Hybrids
n = 89
n = 14

< 137 mm TL

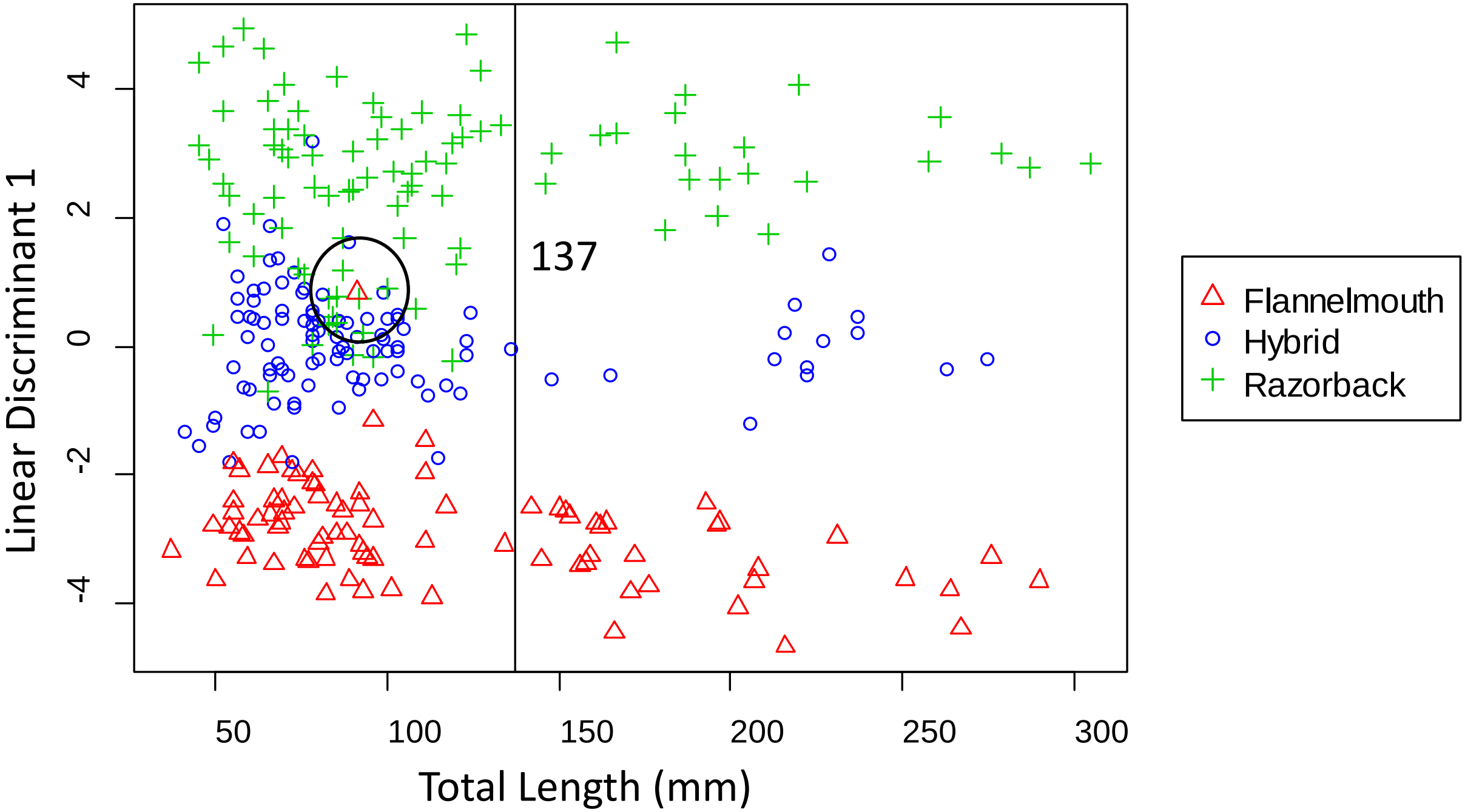


≥ 137 mm TL


Linear Discriminant 1
4
2
0
-2
-4
137
50
100
150
200
250
300
Total Length (mm)
Flannelmouth
Hybrid
Razorback

Large fish are classified more accurately

		Classified			
	Class Correctness	**Razorback**	**Flannelmouth**	**Hybrid**	**n**
Small Fish					
Razorback	71.2%	52	0	21	73
Flannelmouth	76.8%	1	43	12	56
Hybrid	71.9%	14	11	64	89
Large Fish					
Razorback	95.5%	21	0	1	22
Flannelmouth	92.9%	0	26	2	28
Hybrid	78.6%	1	2	11	14


Linear Discriminant 1
4
2
0
-2
-4
137
50
100
150
200
250
300
Total Length (mm)
Flannelmouth
Hybrid
Razorback

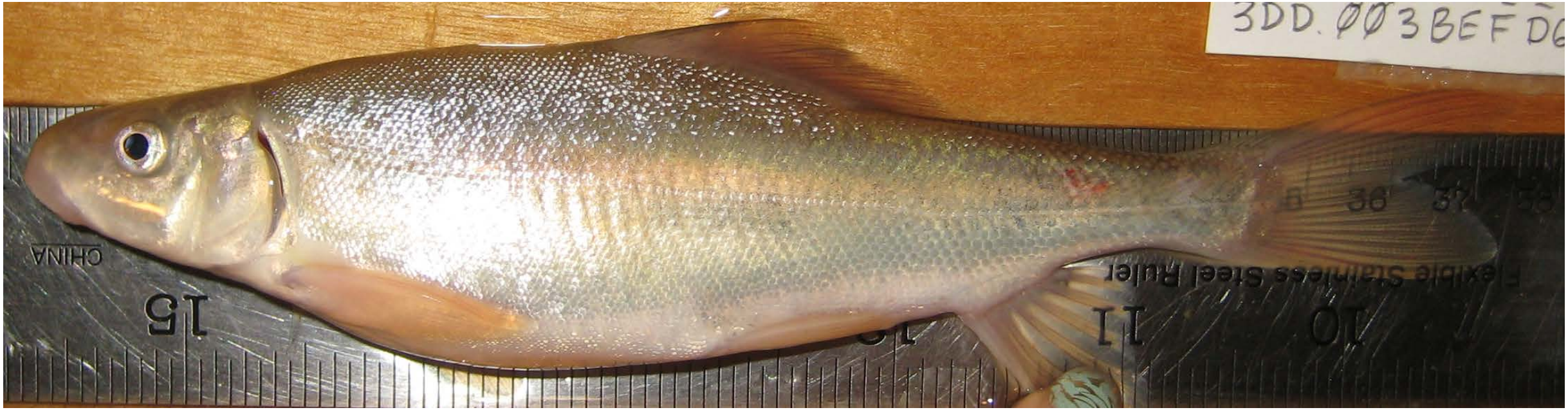
Problematic “Flannelmouth”

91 mm

95 mm

Conclusions

- Both hybrid progeny have similar shape (>70mm)
- We can not accurately discriminate between Razorbacks, Flannelmouths, and hybrids < 137



Implications

- Field biologists need to be cautious in identifying small suckers
- Another method of identification for small fish needs to be explored

Acknowledgements

<u>The Committee</u>

Alice Gibb

Linn Montgomery

Tad Theimer

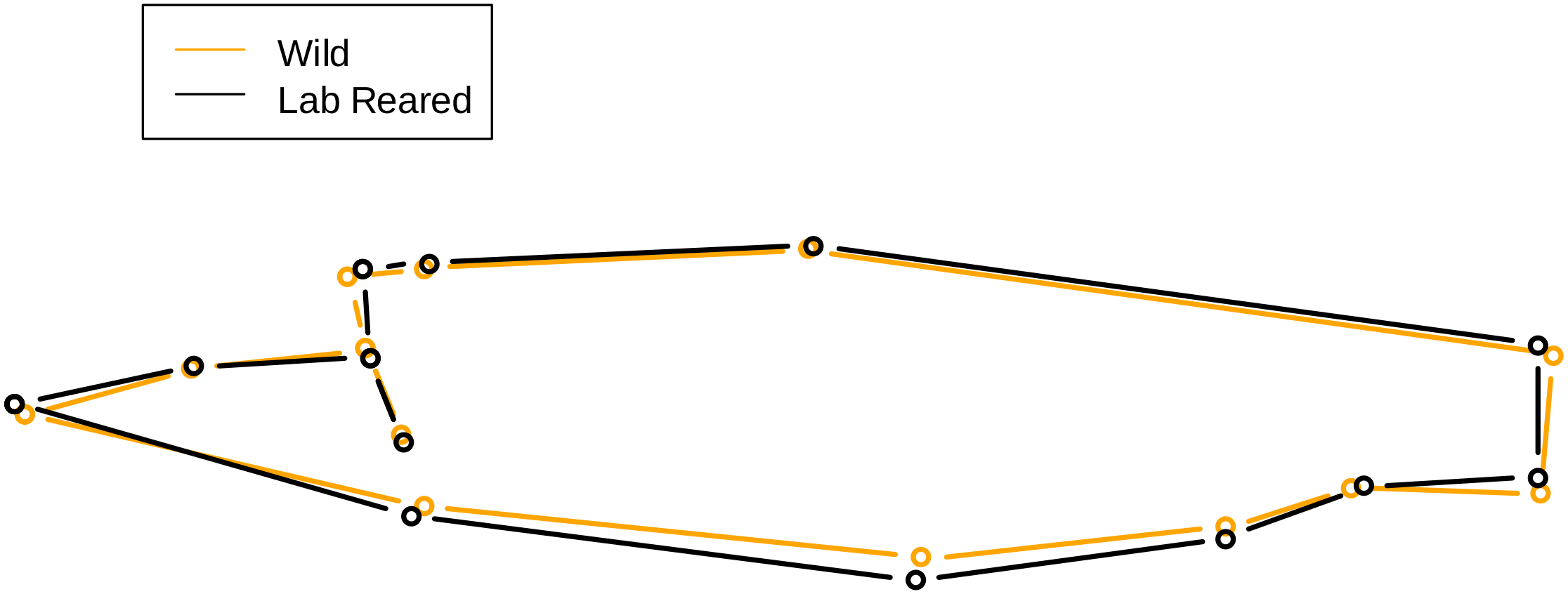
David Ward

Dave Rogowski

<u>Funding</u>

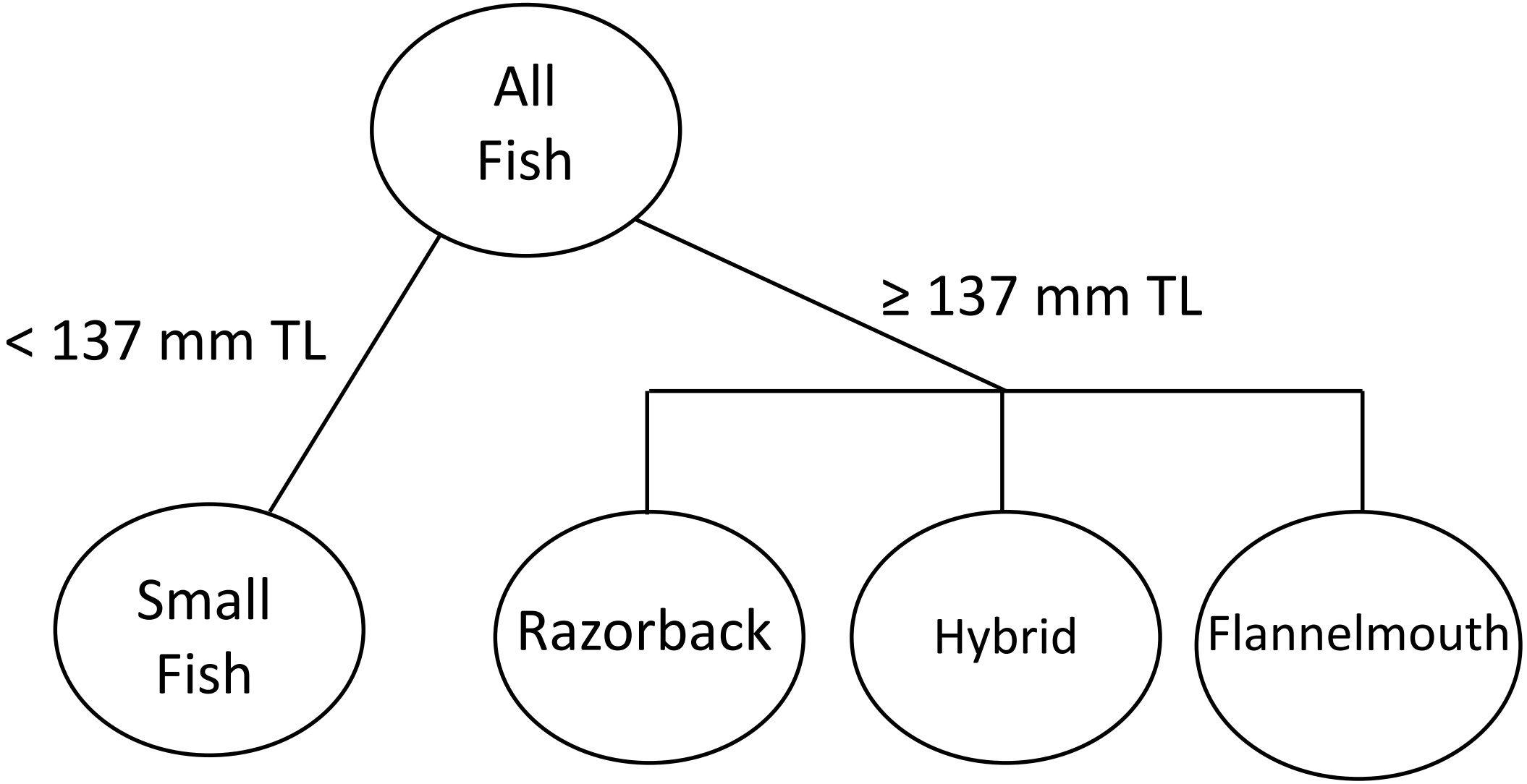
Mark McKinstry, BOR

Lab Flannelmouths are well fed >70mm TL

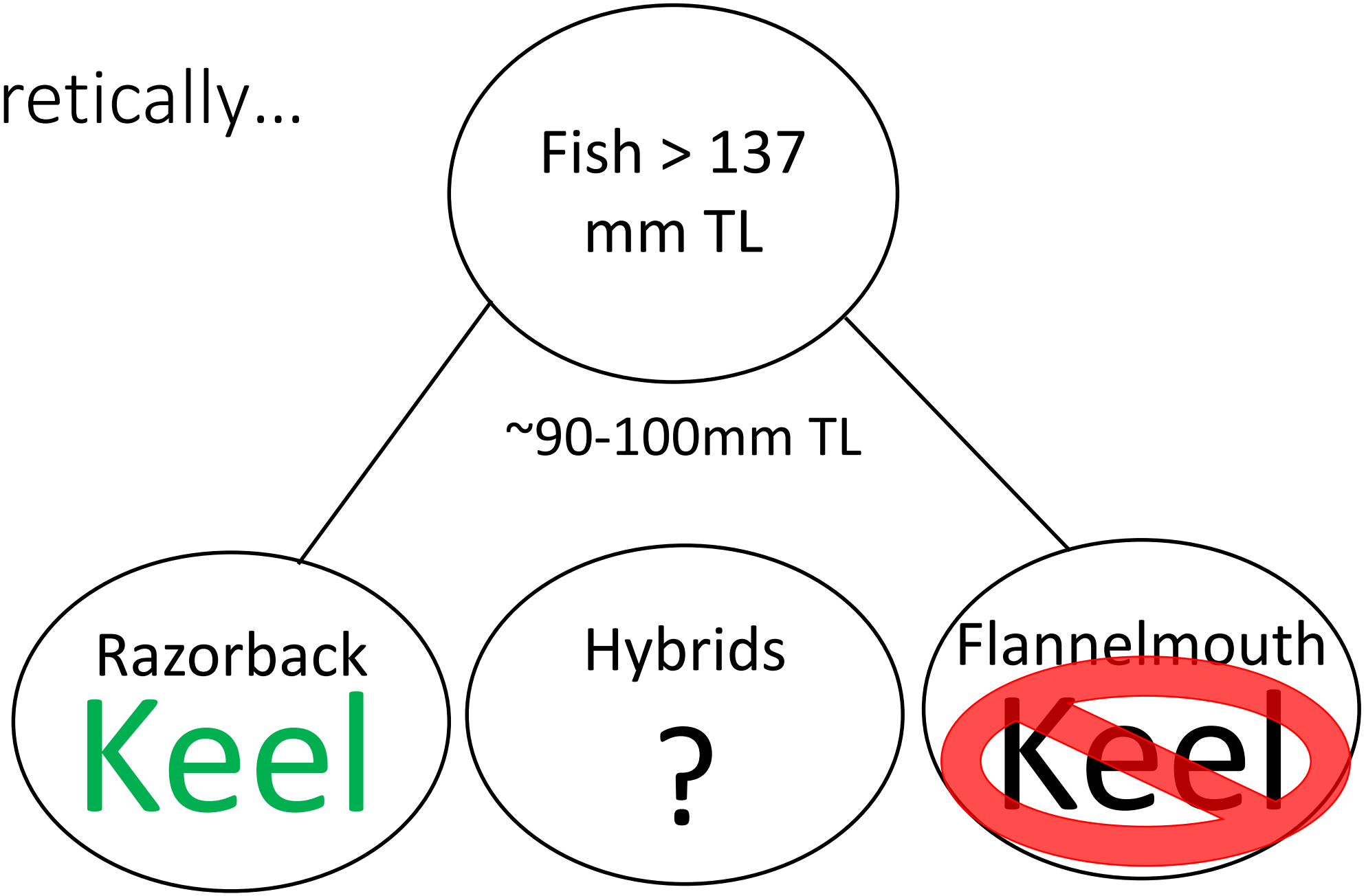


P = 0.02

Field identification

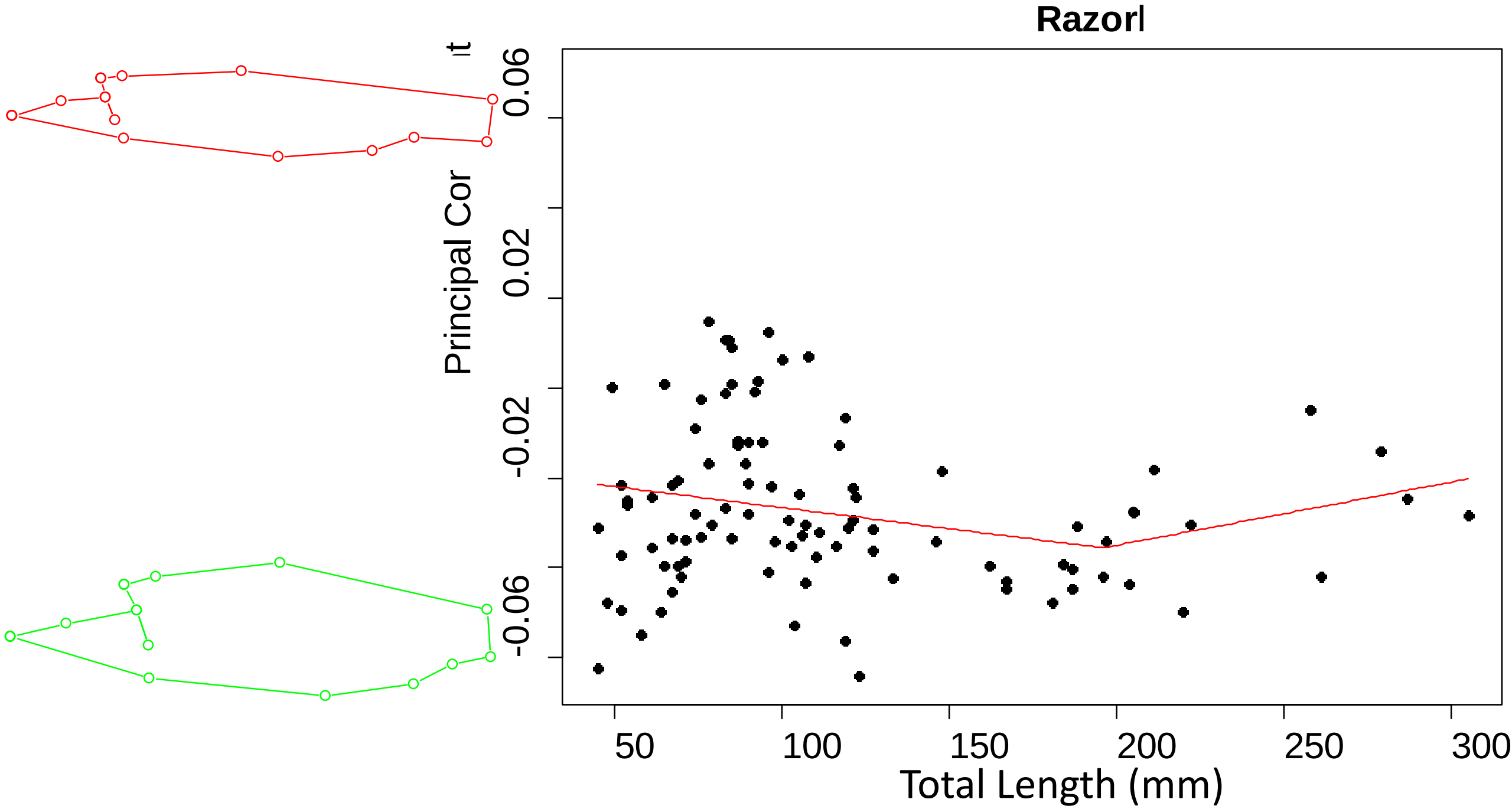


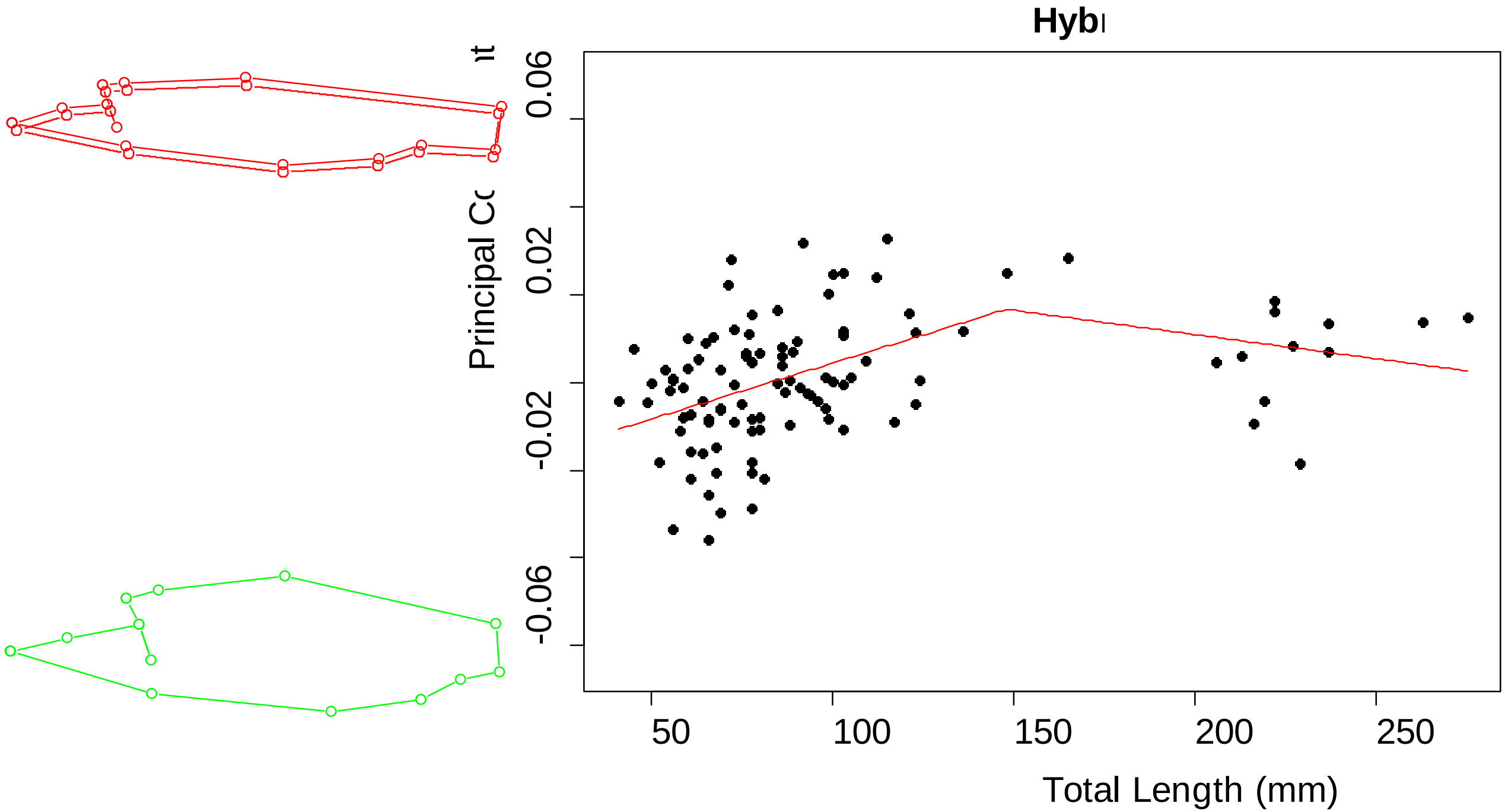
Theoretically…

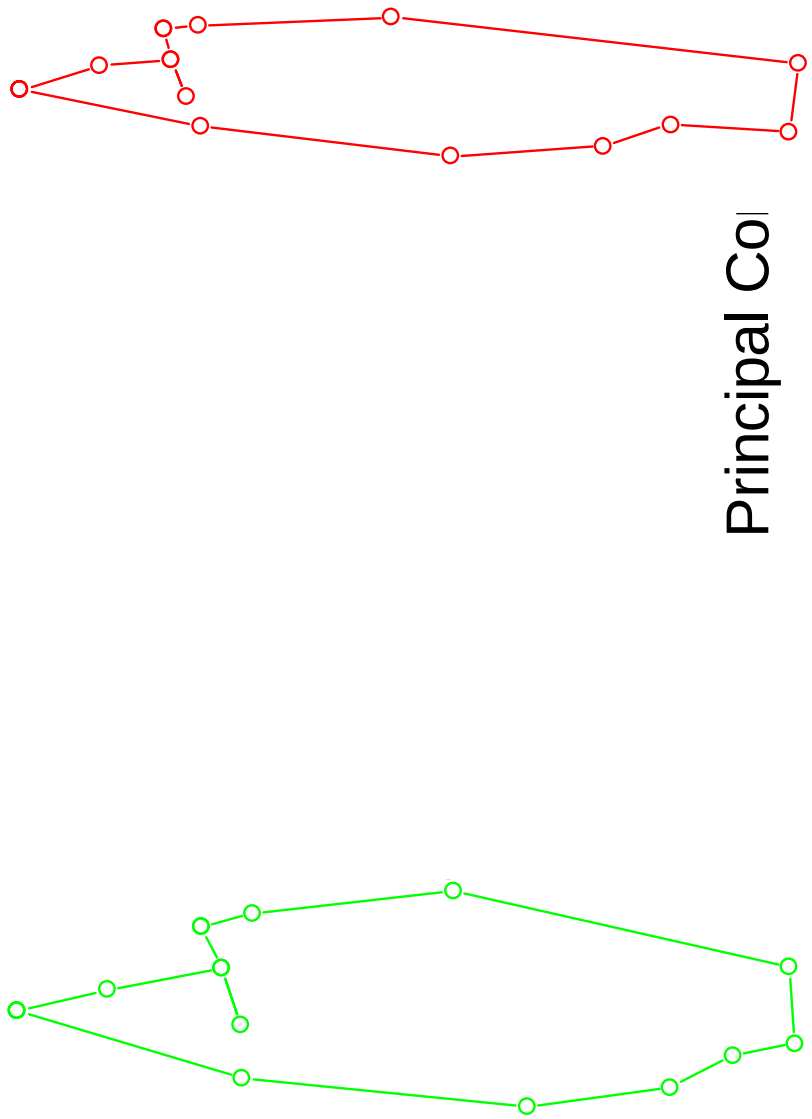


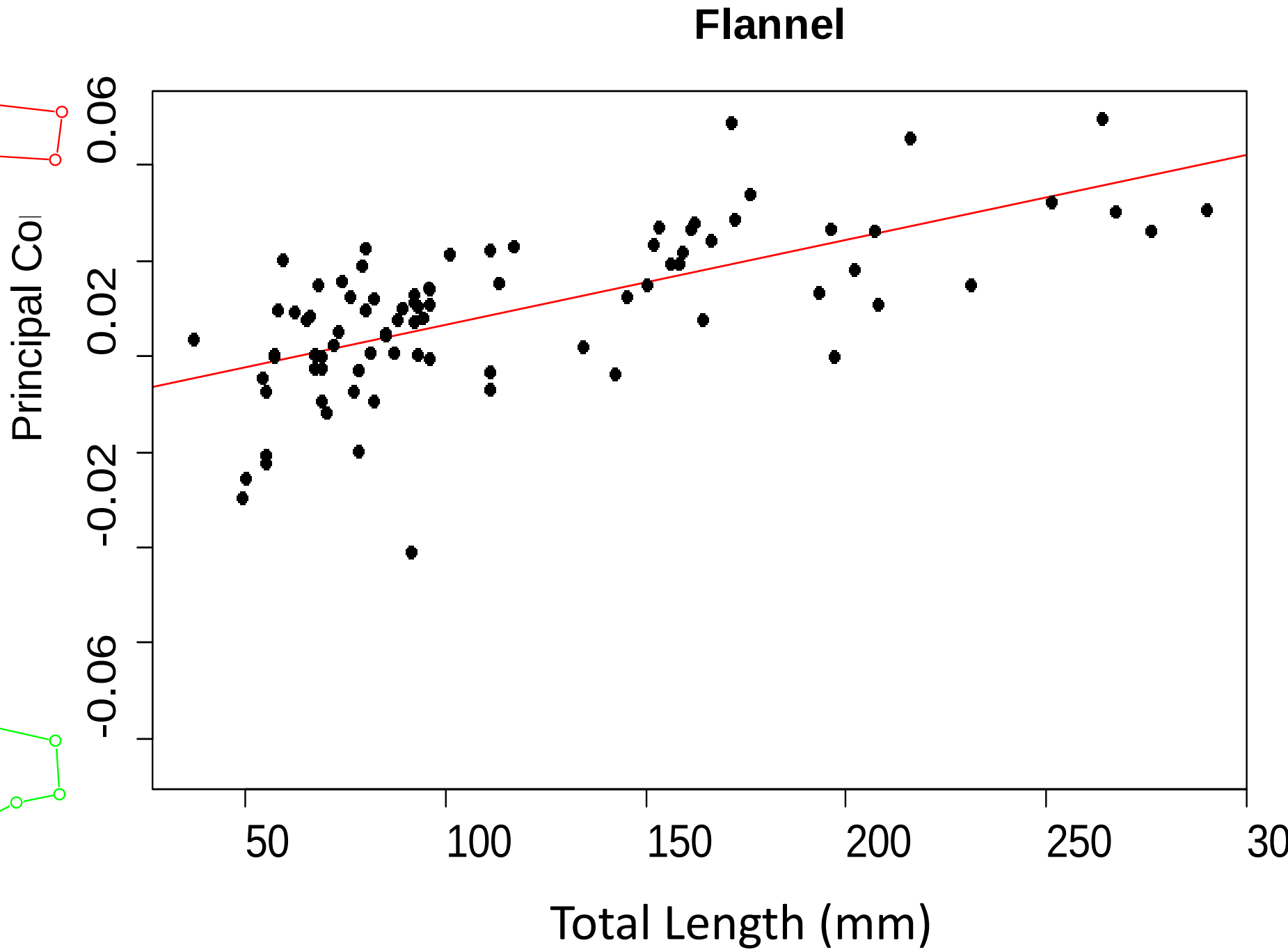
Question

- As the fish types grow, how do their shapes change?


Razorl
Principal Cor
0.06
0.02
-0.02
-0.06
50
100
150
200
250
300
Total Length (mm)


Hyb
Principal Co
0.06
0.02
-0.02
-0.06
50
100
150
200
250
Total Length (mm)




Flannel
Principal Co
0.06
0.02
-0.02
-0.06
50
100
150
200
250
30
Total Length (mm)

Why Procrustes?