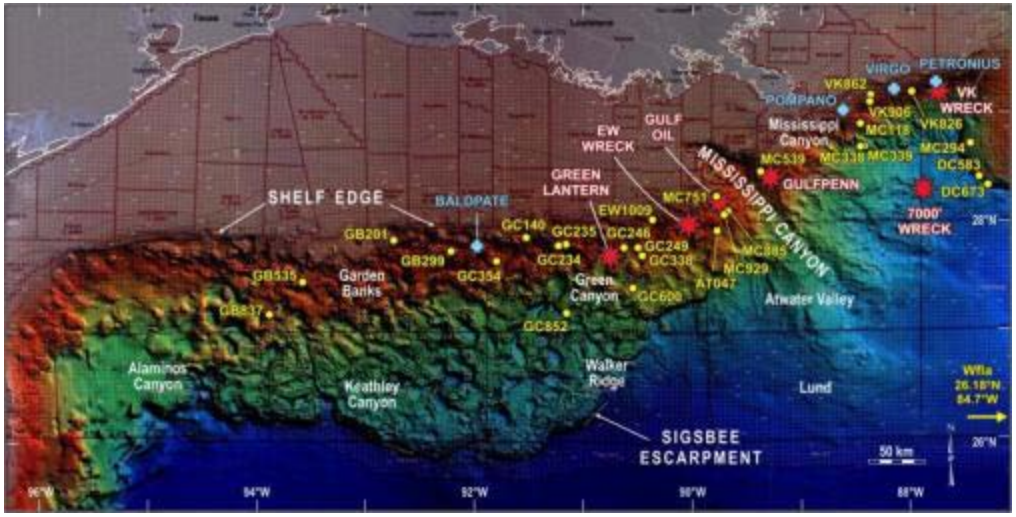
Population Genetic Analysis of *Leiopathes glaberrima* in the GOM

- **Dannise Ruiz Ramos & Iliana Baums**
- **Pennsylvania State University**

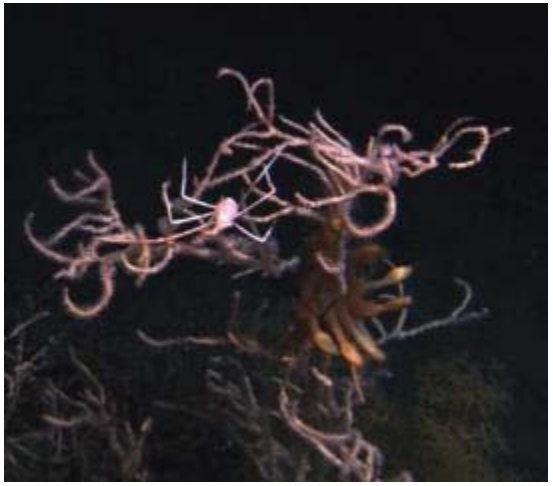
Objectives

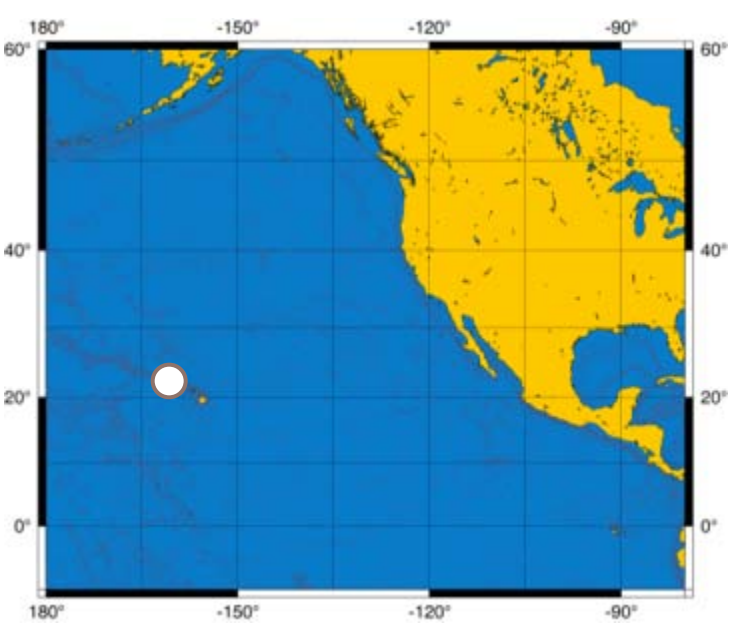
- Determine dispersal potential and levels of genetic connectivity among populations of antipatharians
  - How the populations in the GOM are related?
- Study gene flow patterns
  - Which populations are isolated? Most vulnerable…
  - Which reefs are contributing to the genetic diversity of the Gulf? Larval sources to other populations …

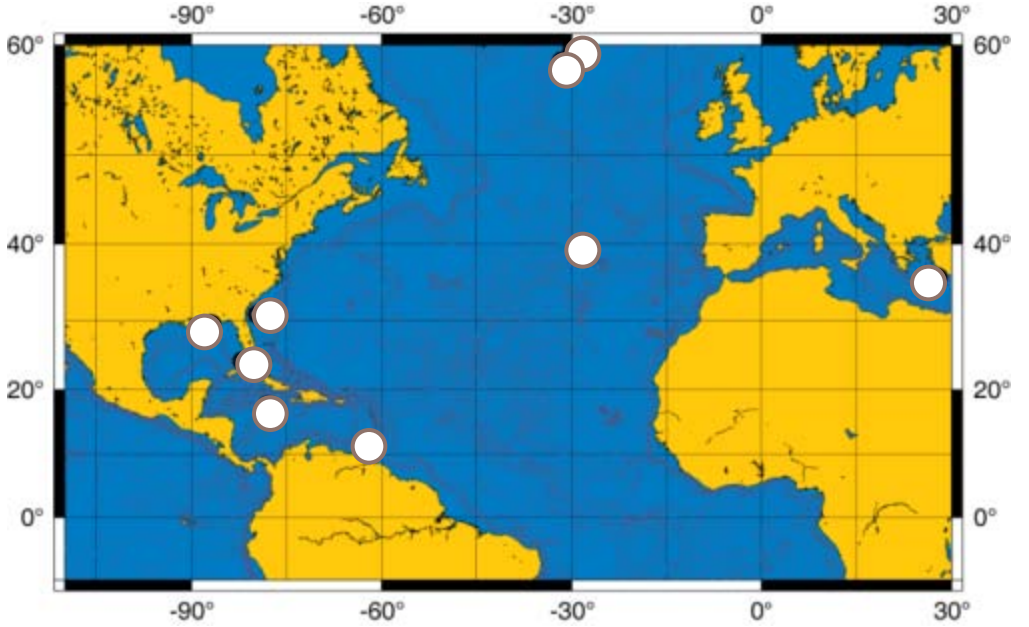


Black coral: *Leiopathes glaberrima*

- Wide geographic distribution
- Abundant and spans wide depth range
- Ecosystem engineer (habitat)

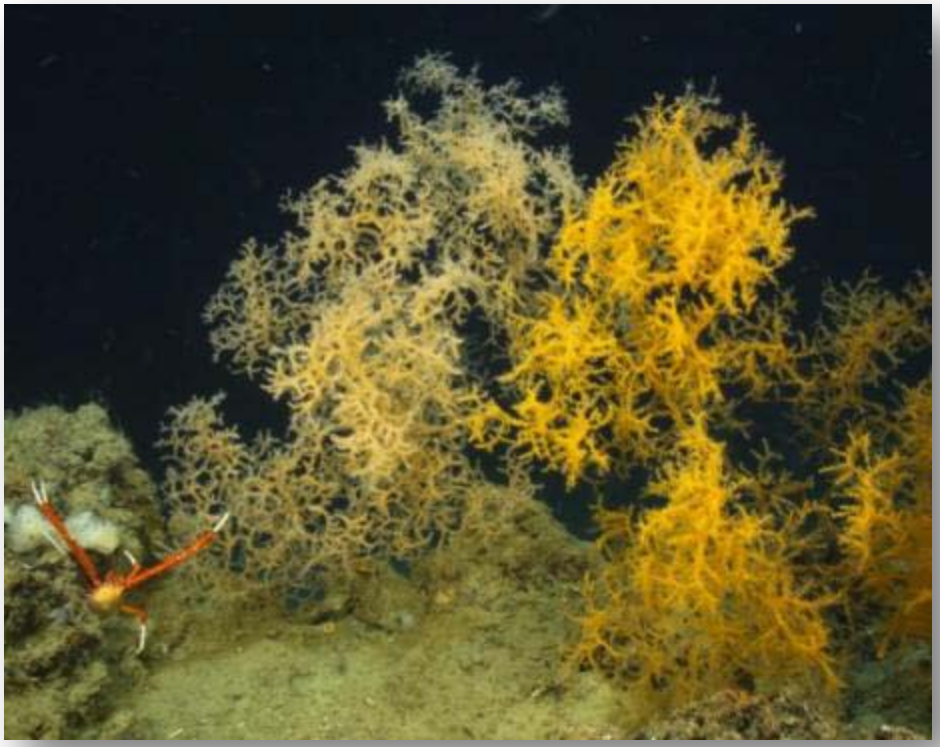






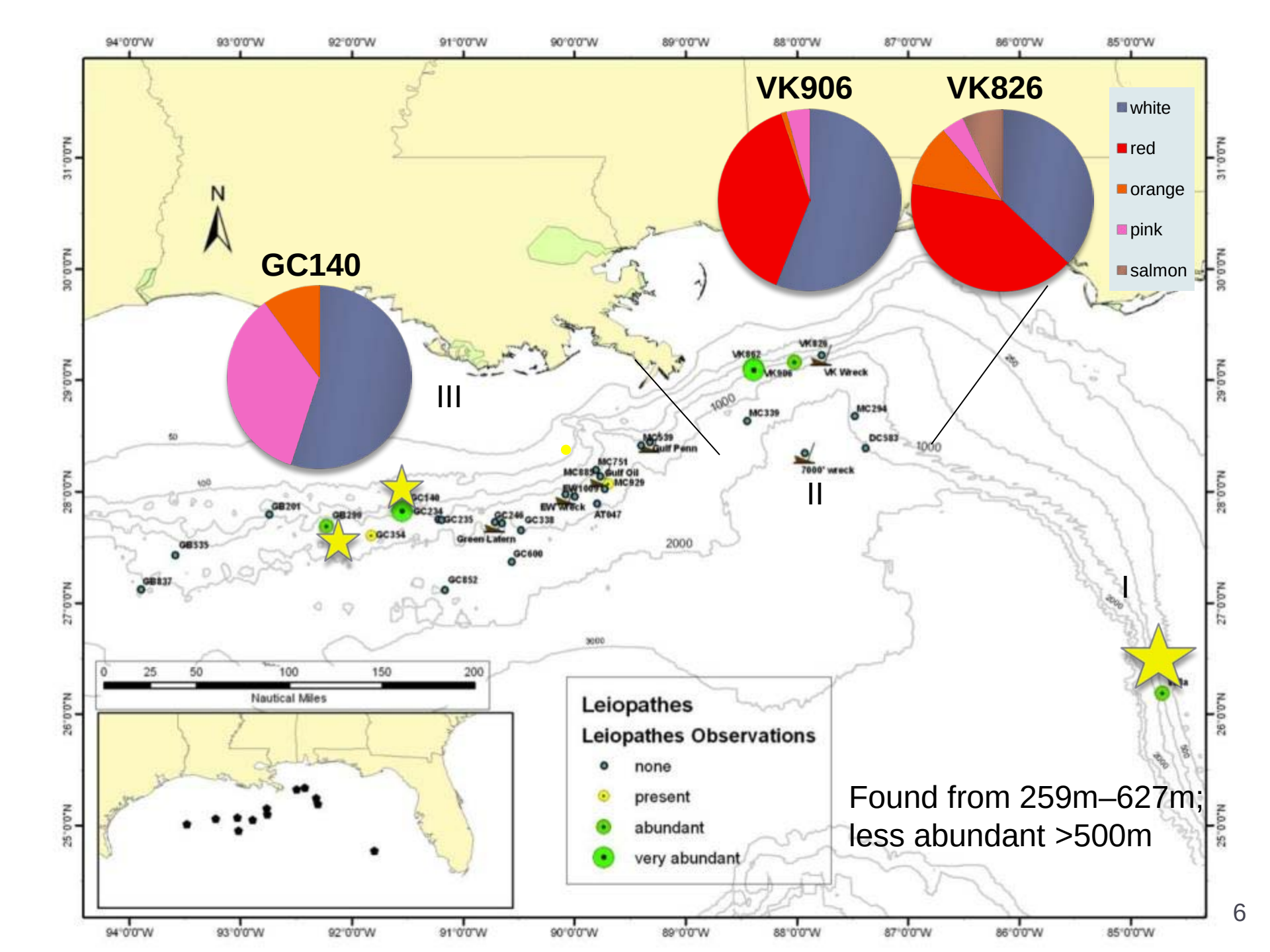
Leiopathes glaberrima

- Life span: 200 to 500 years, recent reports 4,000 years
- Growth rate: <10μm/yr (radial)
- Variations in color and tentacle size



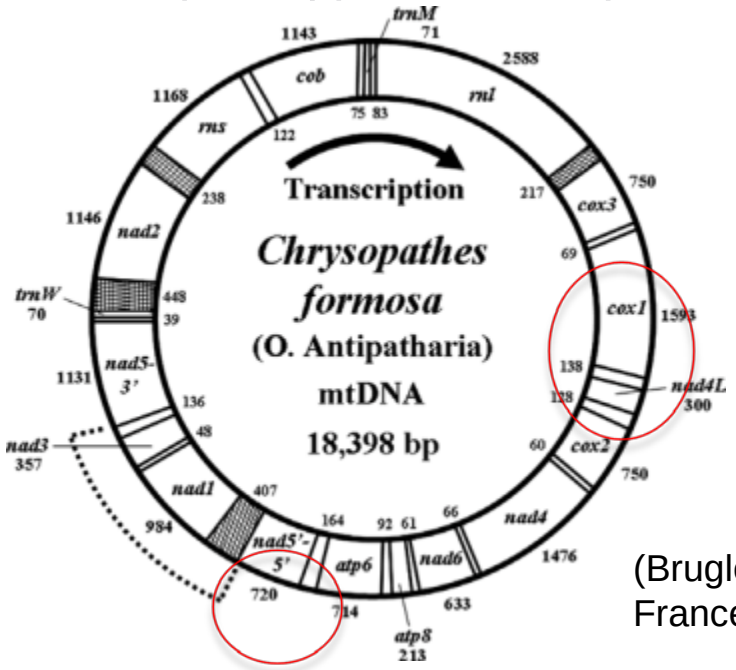
Samples Collected

Region	Sites	Total	Red	White	Orange	Pink	color uk.
III	GB299	2	0	0	0	0	2
III	GC140	24	0	11	2	7	4
II	VK826	80	30	24	8	10	8
II	VK862	3	1	1	1	0	0
II	VK906	76	30	43	1	2	0
I	WFLS	4	0	2	0	0	2

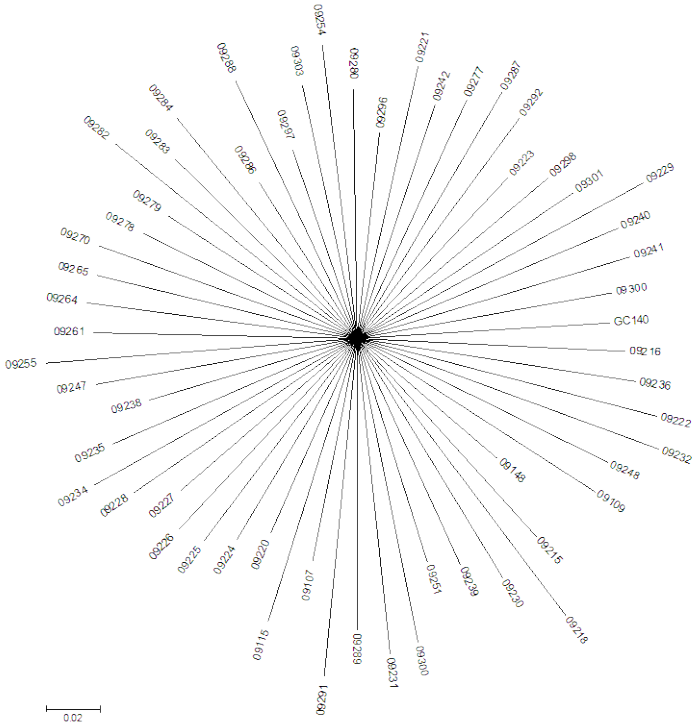

VK906
VK826
white
red
orange
pink
salmon
N
GC140
III
II
I
VK862
VK826
VK906
VK Wreck
MC339
MC294
DC583
7000' wreck
MC539
Gulf Penn
MC751
MC885
Gulf Oil
MC929
EW Wreck
AT047
GC140
GC234
GC235
GC246
GC338
GC354
Green Lafern
GC600
GC852
GB201
GB299
GB535
GB837
1000
2000
3000
0 25 50 100 150 200
Nautical Miles
Leiopathes
Leiopathes Observations
none
present
abundant
very abundant
Found from 259m–627m;
less abundant >500m

Species-level analysis

- Determine species status of collected specimens as a prerequisite for population genetics
- *Leiopathes* specific mtDNA primers on the color morphs from VK826 and VK 906 populations
  - COI (740bp) and ND5 (660 bp)

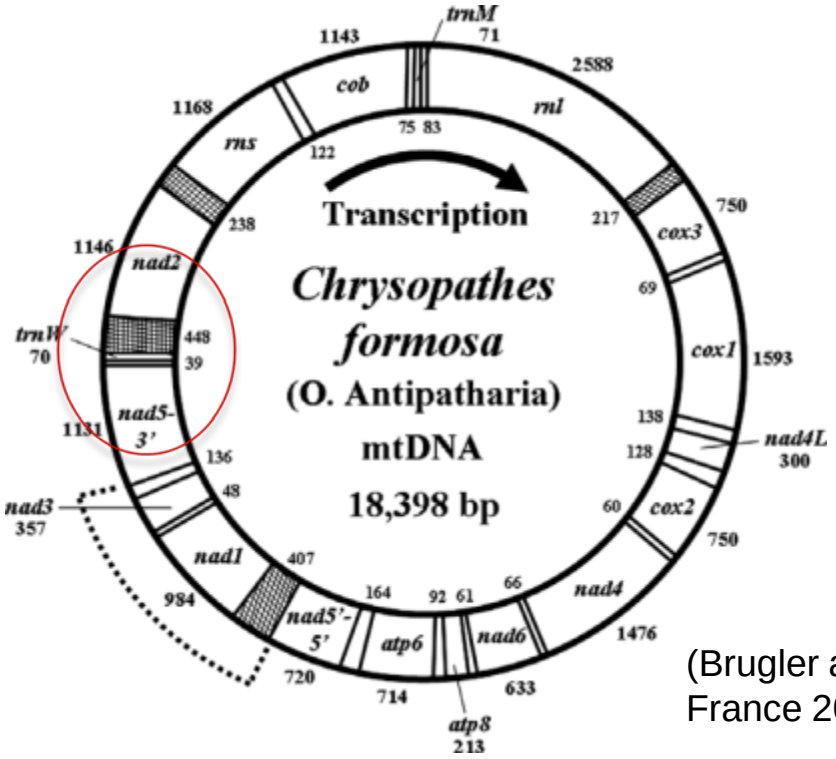


(Brugler and France 2007)

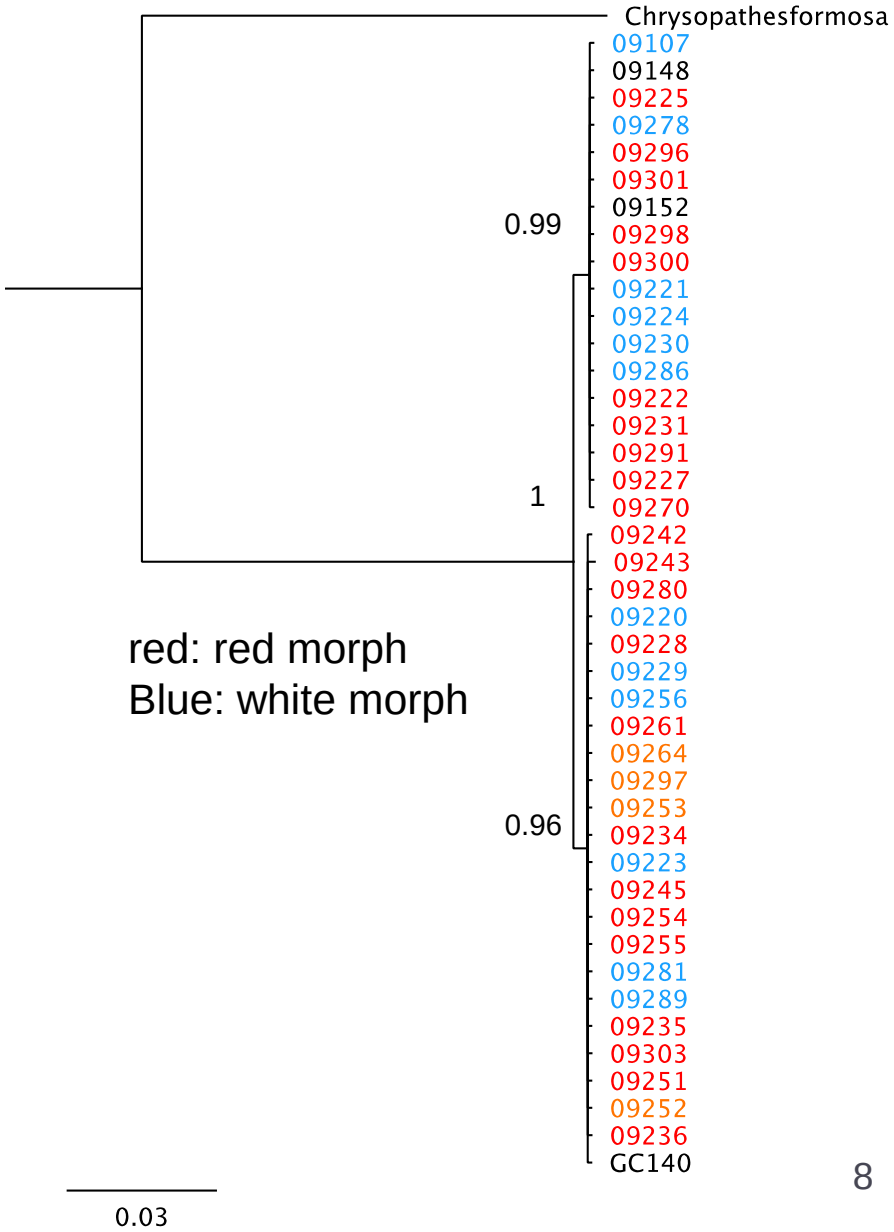


Species-level analysis

- Trp fragment: partial Trp (trnW) gene,its, partial NADH
  - Product size ~730bp
- 2 lineages in *L. glaberrima*



(Brugler and France 2007)

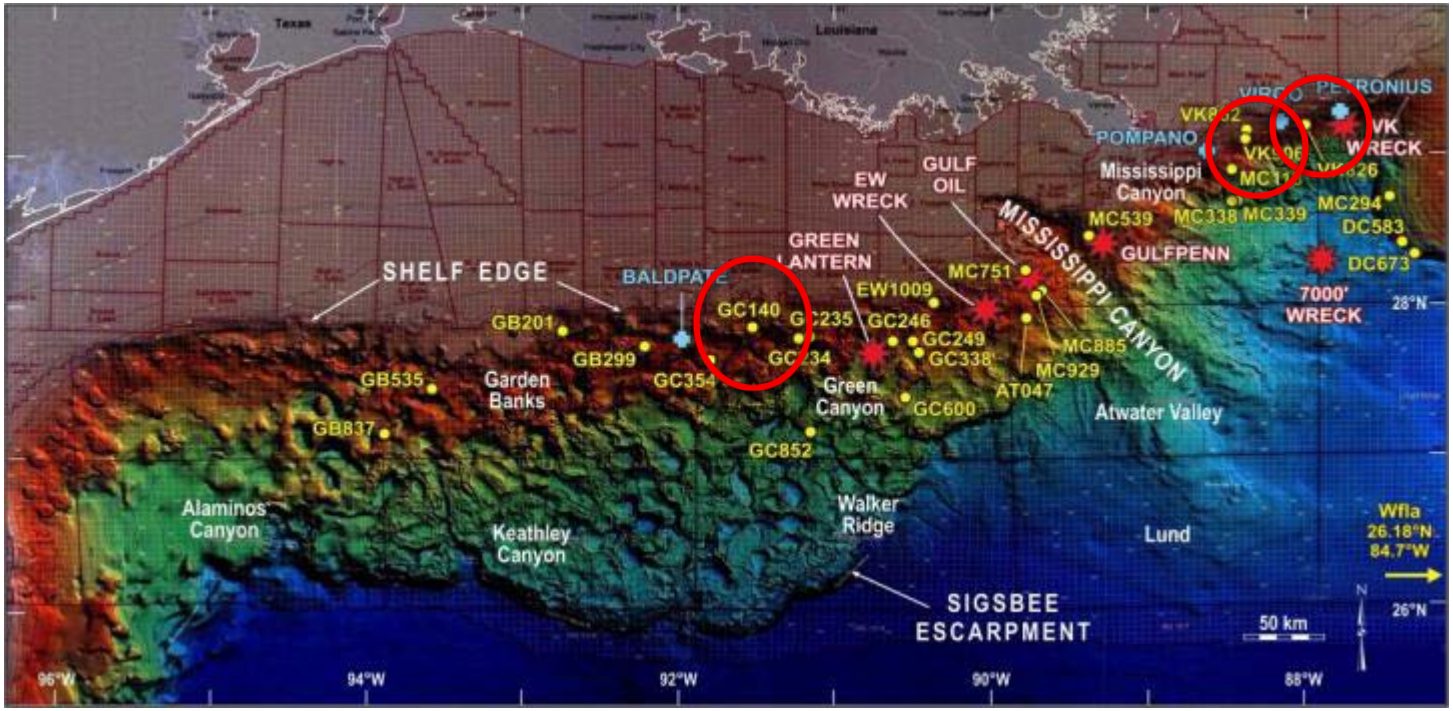


red: red morph
Blue: white morph

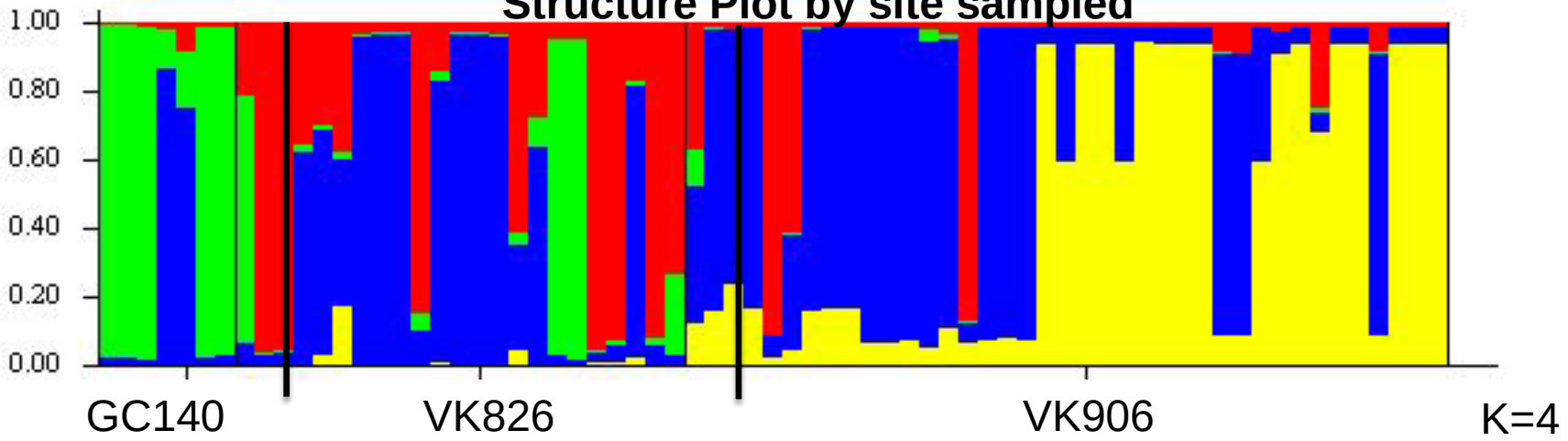
Population genetics (microsatellites preliminary)

- 8 loci designed, 2 dropped
- 6 loci analyzed
- 3 populations analyzed: GC140, VK826,VK906
- 121 samples amplified, 75 complete genotypes
- 75 complete genotypes: 67% of the multilocus genotypes are unique, suggesting that 1/3 of the samples are clones
  - Most “clones” found in VK906
  - No clones found among sites
  - Fragmentation or asexual larvae?
- High resolution with small data set

Population Genetics (preliminary)

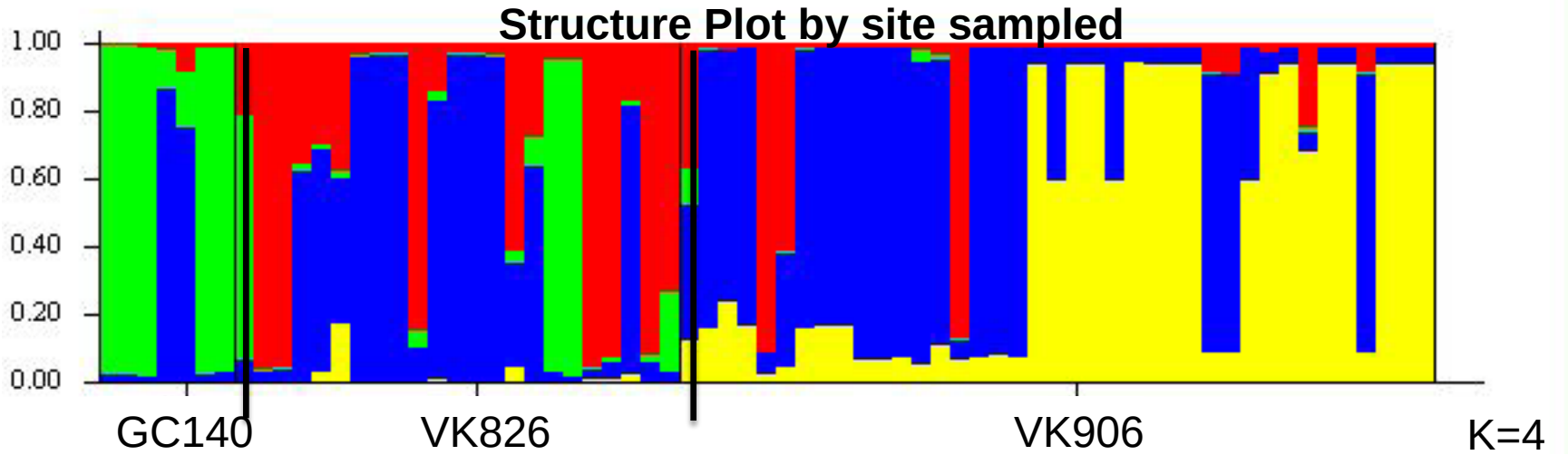


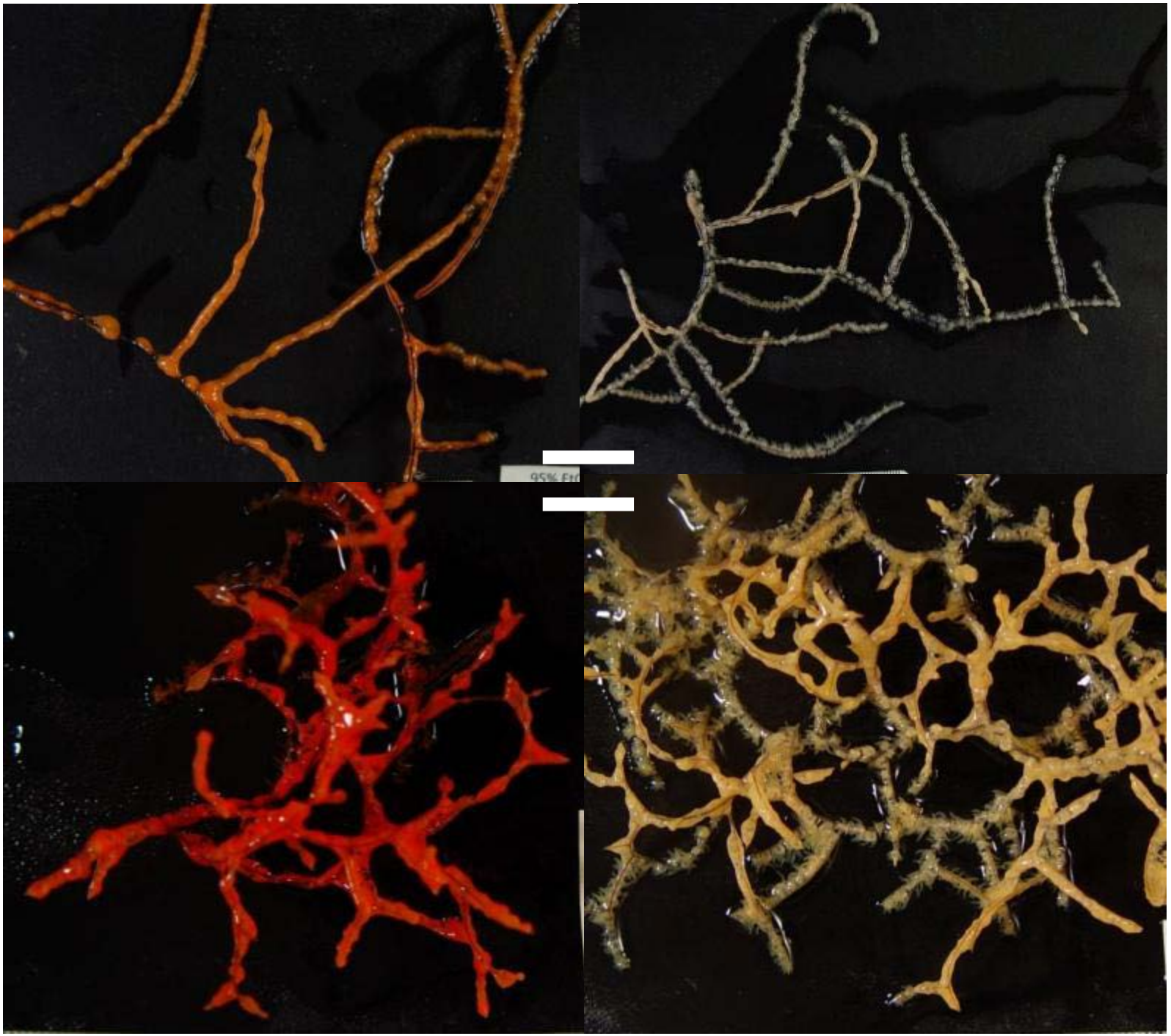
Structure Plot by site sampled



Population Genetics (preliminary)

- 4 cryptic species?
  - unrelated to morphology
- Population subdivision?
  - Geography
- Temporal subdivision?
  - Long-lived species, generation overlap





=

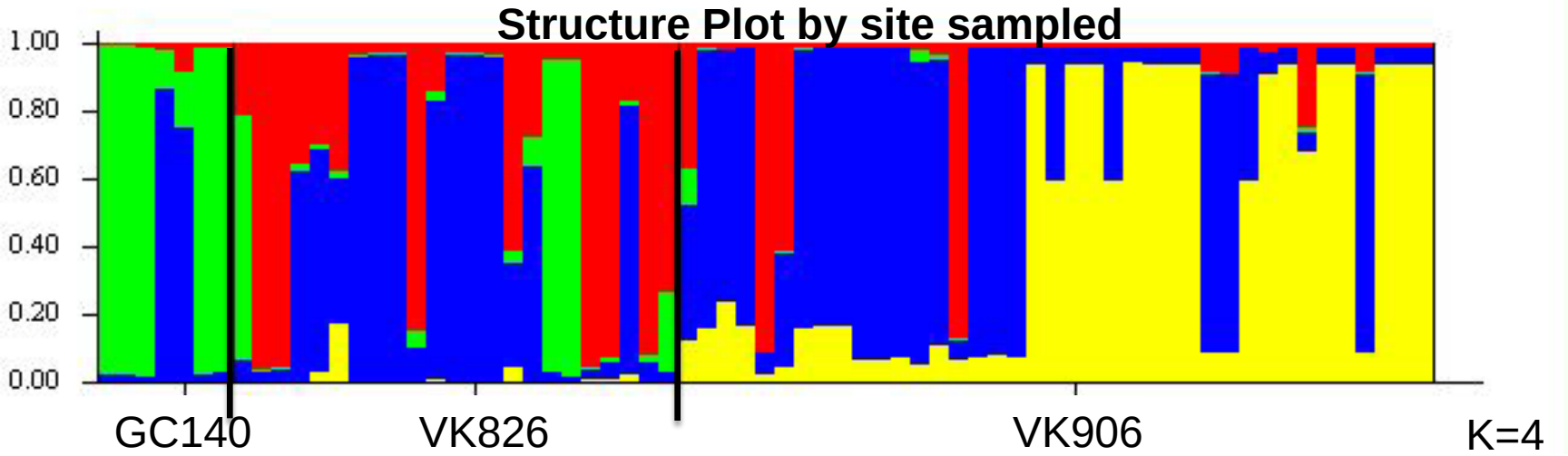
(Machenko et al. 1993)

≠

(Dawson and Jacobs 2001)

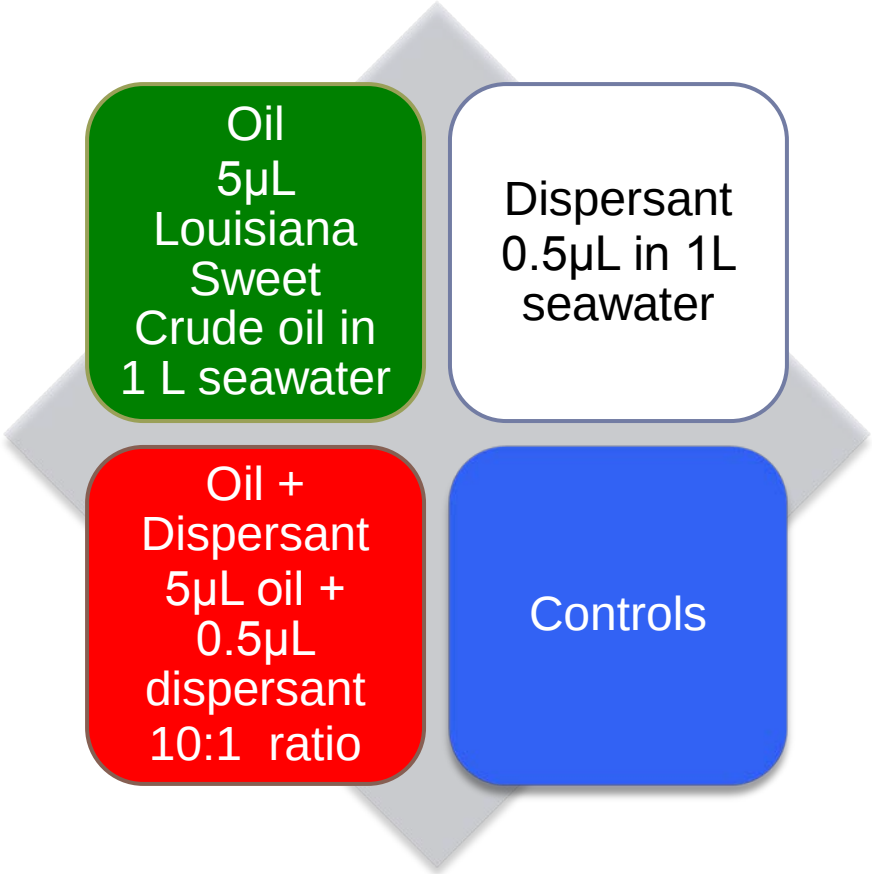
Population Genetics (preliminary)

- 4 cryptic species?
  - unrelated to morphology
- Population subdivision?
  - Geography
- Temporal subdivision?
  - Long-lived species, generation overlap



Effects of crude oil and the dispersant Corexit 9500A on the black coral *Leiopathes glaberrima*

Preliminary experiments



3 colonies
8 fragments
2 replicates

Sampled for RNA at hrs:
6, 24, 48, 72

Survivals

5 fragments in Oil + Dispersant

4 fragments in Oil

4 fragments in Dispersant

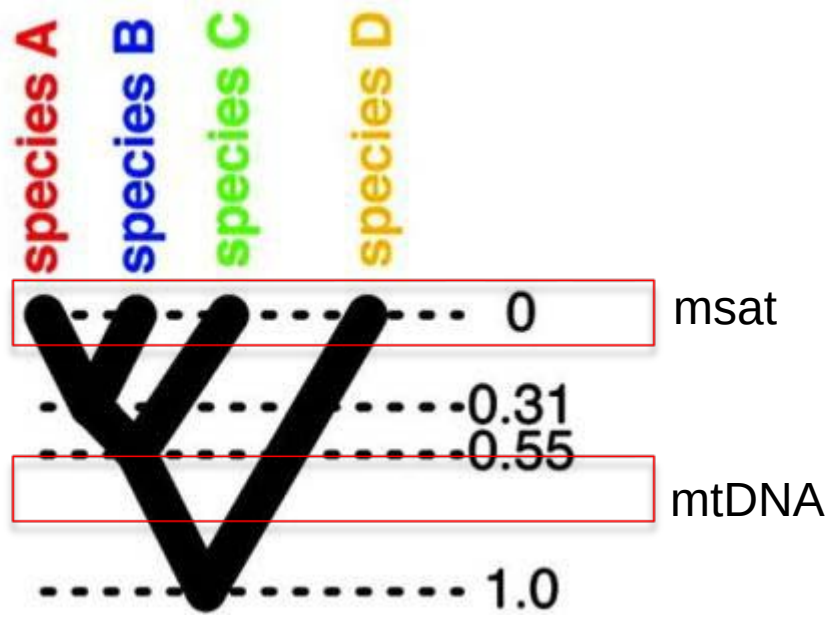
6 fragments in Controls

Future work

- Species status
  - Nuclear primers, species tree
- Population genetics
  - 12 microsatellite loci
  - Connectivity patterns
    - Isolation with migration analysis
    - Isolation by distance analysis
  - Small scale genetic structure
    - Exact location of collection known (± 2m)
    - Distinguish between asexual larvae and fragmentation
    - Asexual reproduction is a common strategy in cnidarians
    - Asexual larvae are known from *A. fiordensis* (Miller 1998)
  - Samples from the GOM Region 1 needed (West Florida Slope)
- Effects of oil and dispersant
    - *Leiopathes* transcriptome
    - Microarray design and experiment

Summary

- mtDNA data suggest two lineages of *L. glaberrima*
- Microsatellites suggest 4 lineages

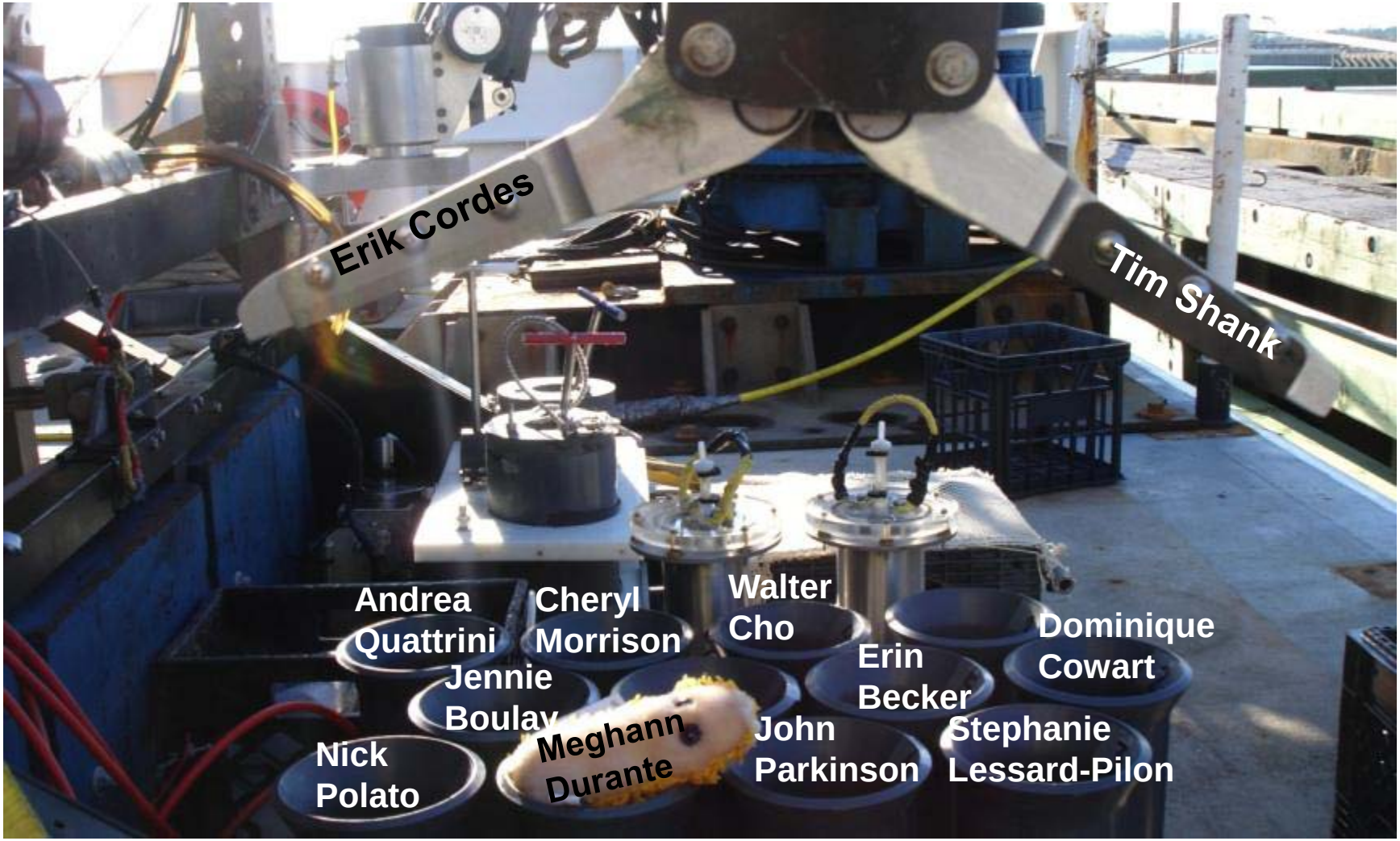


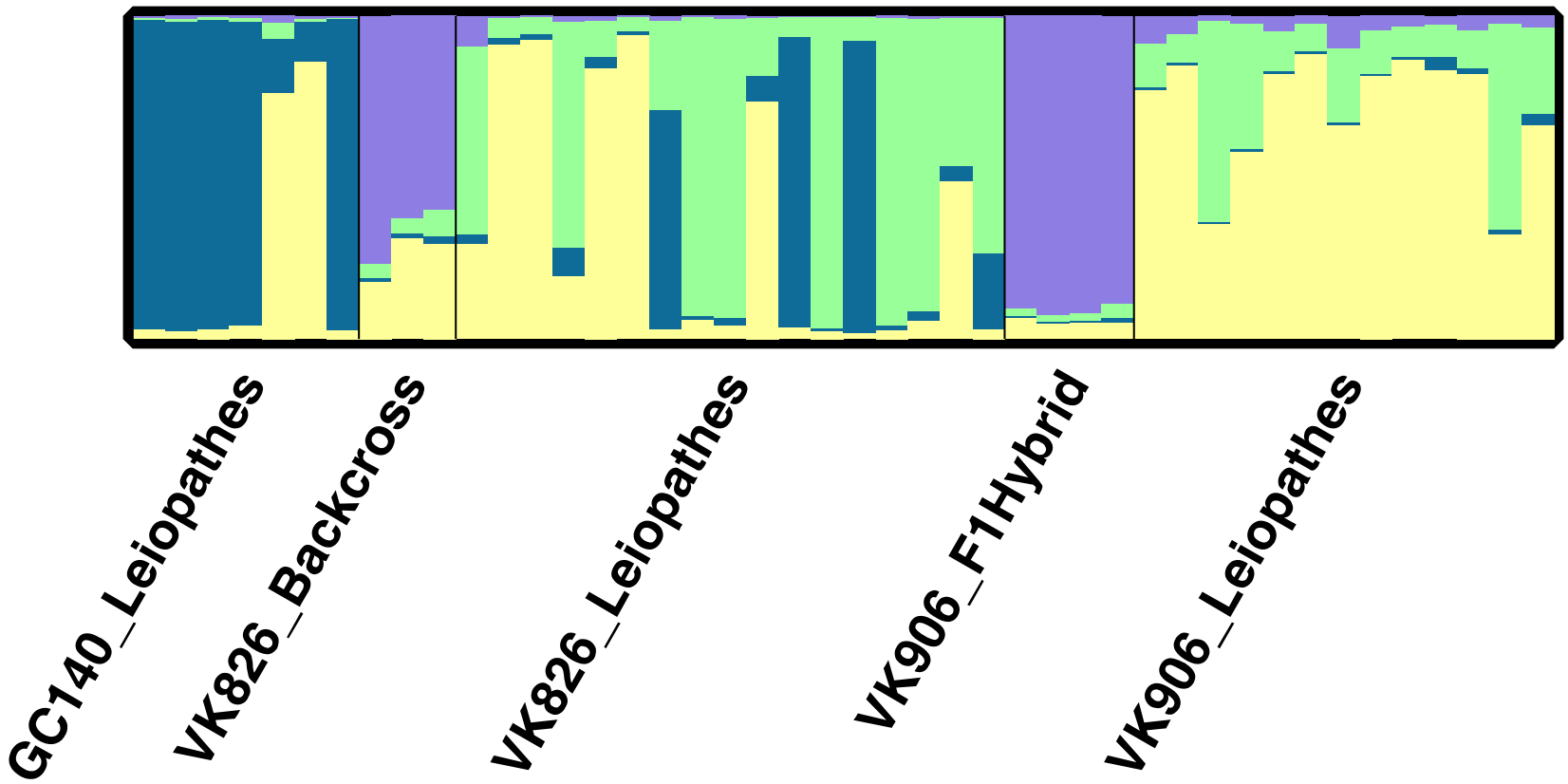
(Knowles and Carstens 2007)

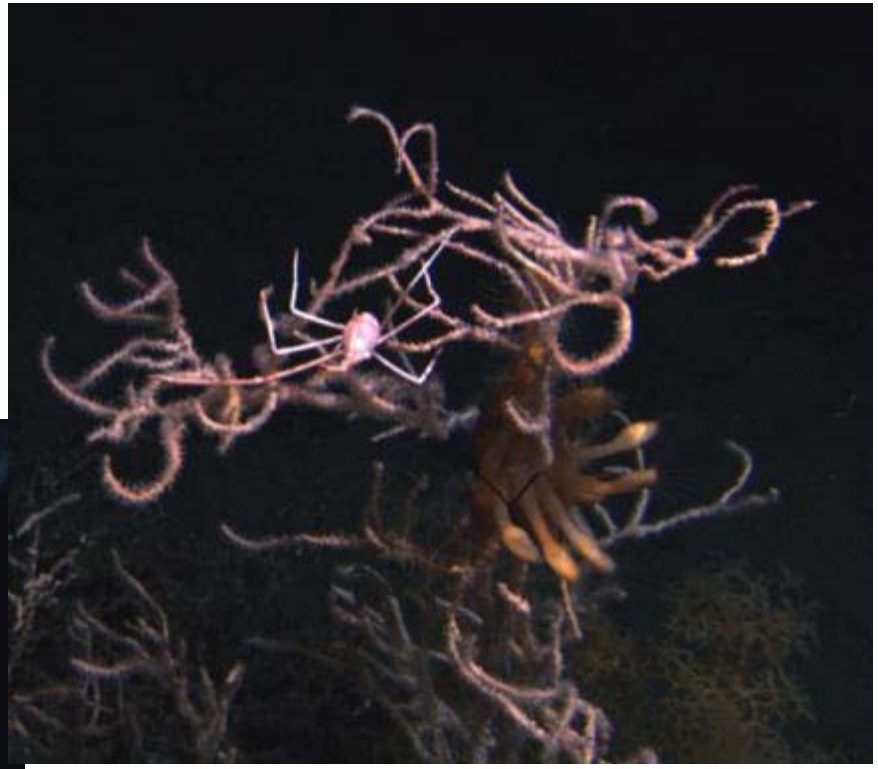
Summary…

- Color and/or branch pattern may not indicate genotype
- High genetic diversity within and among populations
- High clonality suggested
- Population structure in the GOM
  - Population differentiation between adjacent sites
  - Admixture between regions across the Mississippi Canyon

Thanks


Erik Cordes
Tim Shank
Andrea Quattrini
Cheryl Morrison
Walter Cho
Dominique Cowart
Erin Becker
Jennie Boulay
Meghann Durante
John Parkinson
Stephanie Lessard-Pilon
Nick Polato


GC140_Leiopathes
VK826_Backcross
VK826_Leiopathes
VK906_F1Hybrid
VK906_Leiopathes



References

Brugler, M.R. and S.C. France. 2007. The complete mitochondrial genome of the black coral *Chrysopathes formosa* (Cnidaria:Anthozoa:Antipatharia) supports classification of antipatharians within the subclass Hexacorallia. Molecular Phylogenetics and Evolution 42:776–788.

Dawson, M.N. and D.V. Jacobs. 2001. Molecular evidence for cryptic species of Aurelia aurita (Cnidaria, Scyphozoa). Biological Bulletin 200:92–96.

Knowles, L.L. and B.C. Carstens. 2007. Delimiting species without monophyletic gene trees. Systematic Biology 56(6):887–895.

Manchenko, G.P., A.V. Moschenko, and V.S. Odintsov. 1993. Biochemical genetics and systematics of *Millepora* (Coelenterata: Hydrozoa) from the shore of South Vietnam. Biochemical Systematics and Ecology 21(6/7):729–735.

Miller, K.J. 1998. Short-distance dispersal of black coral larvae: inference from spatial analysis of colony genotypes. Marine Ecology Progress Series 163:225–233.