100 must-reads for Santos lab members

To be successful in academia, you must read a lot. This is a good overview of topics important to the Santos lab. Aim to read everything on this list before your comprehensive exams. Any books on here are found in the library in room 1527 or in Teams.

Last updated June 27, 2026

Papers by Liz herself. Get familiar with the ethos of the lab you've just joined.

1. Miller, E. C. 2021. Comparing diversification rates in lakes, rivers, and the sea. Evol 75:2055–2073. ***Roadmap for explaining species richness differences among habitats.***

2. Miller, E. C., R. Faucher, P. B. Hart, M. Rincón-Sandoval, A. Santaquiteria, W. T. White, C. C. Baldwin, M. Miya, R. Betancur-R, L. Tornabene, K. Evans, and D. Arcila. 2025. Reduced evolutionary constraint accompanies ongoing radiation in deep-sea anglerfishes. Nat Ecol Evol 9:474–490. ***Shows the trials and tribulations of building a new tree for a rare taxon and pairing it with complex morphological datasets. There's a reason there are 12 authors on this paper!***

3. Miller, E. C., C. M. Martinez, S. T. Friedman, P. C. Wainwright, S. A. Price, and L. Tornabene. 2022. Alternating regimes of shallow and deep-sea diversification explain a species-richness paradox in marine fishes. Proceedings of the National Academy of Sciences 119:e2123544119. ***The distribution of deep-sea lineages across the ray-finned fish phylogeny, plus a review of what happened in the ocean over the past 200 million years.***

4. Miller, E. C., S. L. Mesnick, and J. J. Wiens. 2021. Sexual Dichromatism Is Decoupled from Diversification over Deep Time in Fishes. The American Naturalist 198:232–252. ***A cautionary tale of broad-scale phylogenetic comparative analyses.***

5. Santos, E. C., S. T. Friedman, and C. M. Martinez. 2026. Distinct evolutionary signatures underlie body shape diversity across deep sea habitats. Evol 80:85–96. ***Why deep-sea fishes are not one homogeneous group***

Papers by Liz's Ph.D. advisor John Wiens (so you know where I came from and why I think the way I do)

6. Wiens, J. J. 2012. Why biogeography matters: historical biogeography vs. phylogeography and community phylogenetics for inferring ecological and

evolutionary processes. Frontiers of Biogeography 4.

7. Wiens, J. J. 2017. What explains patterns of biodiversity across the Tree of Life?: New research is revealing the causes of the dramatic variation in species numbers across branches of the Tree of Life. BioEssays 39:1600128.

8. Wiens, J. J., and M. J. Donoghue. 2004. Historical biogeography, ecology and species richness. Trends in Ecology & Evolution 19:639–644.

9. Wiens, J. J., and C. H. Graham. 2005. Niche Conservatism: Integrating Evolution, Ecology, and Conservation Biology. Annual Review of Ecology, Evolution, and Systematics 36:519–539.

Papers on adaptive radiation. You must know what an adaptive radiation is (and isn't), why the AR concept is important, and approaches to detecting AR.

10. Dolph Schluter's book *The Ecology of Adaptive Radiations* (a small yellow book). ***Read at least the first couple of chapters where he develops the concept of an adaptive radiation, especially the form-function-ecology links.***

11. Givnish, T. J. 2015. Adaptive radiation versus 'radiation' and 'explosive diversification': why conceptual distinctions are fundamental to understanding evolution. New Phytologist 207:297–303. ***What an adaptive radiation is NOT.***

12. Glor, R. E. 2010. Phylogenetic Insights on Adaptive Radiation. Annual Review of Ecology, Evolution, and Systematics 41:251–270. ***A roadmap to using phylogenetic comparative methods to detect adaptive radiation.***

13. Mahler, D. L., T. Ingram, L. J. Revell, and J. B. Losos. 2013. Exceptional Convergence on the Macroevolutionary Landscape in Island Lizard Radiations. Science 341:292–295. ***The linked concepts of convergent evolution, determinism, and adaptive radiation.***

14. Harmon, L. J., et al. 2010. Early bursts of body size and shape evolution are rare in comparative data. Evol 64:2385–2396. ***It's all fun and games until you get real data in your hands.***

15. Slater, G. J., and A. R. Friscia. 2019. Hierarchy in adaptive radiation: A case study using the Carnivora (Mammalia). Evol 73:524–539. ***A perfect follow-up to the "Early Bursts are Rare" paper by Harmon et al. 2010.***

16. Stroud, J. T., and J. B. Losos. 2016. Ecological Opportunity and Adaptive Radiation. Annual Review of Ecology, Evolution, and Systematics 47:507–532. ***A clear and accessible review.***

17. Yoder, J. B., E. Clancey, S. Des Roches, J. M. Eastman, L. Gentry, W. Godsoe, T. J. Hagey, D. Jochimsen, B. P. Oswald, J. Robertson, B. A. J. Sarver, J. J. Schenk, S. F. Spear, and L. J. Harmon. 2010. Ecological opportunity and the origin of adaptive radiations. J. Evol. Biol. 23:1581–1596. ***The best breakdowns of "ecological opportunity" and "ecological release" I've seen anywhere.***

18. Gillespie, R. G., et al. 2020. Comparing Adaptive Radiations Across Space, Time, and Taxa. J Hered 111:1–20. ***A more modern take than the other references here.***

19. McCune, A. R. 1990. Evolutionary novelty and atavism in the *Semionotus* complex: Relaxed selection during colonization of an expanding lake. Evolution 44:71–85. ***An under-the-radar paper that utilized fossils to demonstrate effects of relaxed selection on diversity. Very influential on our work on deep-sea fishes.***

Phylogenetics/ phylogenomics/ genomics:

20. Baum, D. A., S. D. Smith, and S. S. S. Donovan. 2005. The Tree-Thinking Challenge. Science 310:979–980. ***Do you know how to read a tree? Are you sure? Just take the test anyways. This is also great to give to new undergrad mentees.***

21. The Tree Thinking Book by Baum and Smith. ***An accessible overview of how trees are made. No one in my lab should touch a tree without understanding where it came from. Read this cover-to-cover before your comprehensive exams.***

22. Liu, L., and S. V. Edwards. 2009. Phylogenetic Analysis in the Anomaly Zone. Syst Biol 58:452–460. ***Forget everything you thought you knew about phylogenies***

23. Duchêne, D. A. 2021. Phylogenomics. Current Biology 31:R1177–R1181. ***A great, accessible explanation of phylogenomics.***

24. Hughes, L. C., C. M. Nash, W. T. White, and M. W. Westneat. 2023. Concordance and Discordance in the Phylogenomics of the Wrasses and Parrotfishes (Teleostei: Labridae). Syst Biol 72:530–543. ***Just an exemplary phylogenomics study***

25. Felsenstein, J. 1985. Phylogenies and the Comparative Method. The American Naturalist 125:1–15. ***The moment when phylogenetic comparative methods was born (=the application of phylogenies beyond systematics)***

26. Maddison, W. P., and R. G. FitzJohn. 2015. The Unsolved Challenge to Phylogenetic Correlation Tests for Categorical Characters. Systematic Biology 64:127–136. ***What phylogenetic replication is and why it's important***

27. O'Meara, B., and J. Beaulieu. 2021. Potential survival of some, but not all, diversification methods. EcoEvoRxiv. ***What we can and can't learn from phylogenetic comparative methods.***

28. Smith, S. D., M. W. Pennell, C. W. Dunn, and S. V. Edwards. 2020. Phylogenetics is the New Genetics (for Most of Biodiversity). Trends in Ecology & Evolution 35:415–425. ***A think piece on how comparative biologists like us can learn from traditional genetics***

29. Sackton, T. B., P. Grayson, A. Cloutier, Z. Hu, J. S. Liu, N. E. Wheeler, P. P. Gardner, J. A. Clarke, A. J. Baker, M. Clamp, and S. V. Edwards. 2019. Convergent regulatory evolution and loss of flight in paleognathous birds. Science 364:74–78. ***Macroevolution meets genomics.***

Fish biology, systematics, and important milestones. Fish are unique among vertebrates in how little we knew about their higher-level relationships until the past decade. The literature reflects this- get used to inconsistency in the names of orders and higher ranks.

30. Mank, J. E. 2007. Mating preferences, sexual selection and patterns of cladogenesis in ray-finned fishes. J. Evol. Biol. 20:597–602. ***This is what phylogenetic comparative studies of fishes looked like before the Rabosky tree hit the scene.***

31. Alfaro, M. E., et al. 2018. Explosive diversification of marine fishes at the Cretaceous–Palaeogene boundary. Nat Ecol Evol 2:688–696. ***One of the first splashy UCE trees for fishes.***

32. Hughes, L. C., et al. 2018. Comprehensive phylogeny of ray-finned fishes (Actinopterygii) based on transcriptomic and genomic data. Proceedings of the National Academy of Sciences 115:6249–6254. ***Came out same year as the Alfaro tree, above, but for all ray-finned fishes. The precursor to trees that use FishLife markers today.***

33. Rabosky, D. L., J. Chang, P. O. Title, P. F. Cowman, L. Sallan, M. Friedman, K. Kaschner, C. Garilao, T. J. Near, M. Coll, and M. E. Alfaro. 2018. An inverse latitudinal gradient in speciation rate for marine fishes. Nature 559:392–395. ***The "Rabosky tree" has enabled hundreds of comparative studies for its sheer***

number of sampled species.

34. Ghezelayagh, A., et al. 2022. Prolonged morphological expansion of spiny-rayed fishes following the end-Cretaceous. Nat Ecol Evol 6:1211–1220. ***A milestone in which phylogenomic-scale trees start to resemble the Rabosky tree in species sampling.***

35. Dornburg, A., and T. J. Near. 2021. The Emerging Phylogenetic Perspective on the Evolution of Actinopterygian Fishes. Annual Review of Ecology, Evolution, and Systematics 52:427–452. ***Shows how far we've come in our understanding of the Fish Tree of Life.***

36. Hughes, L. C., G. Ortí, H. Saad, C. Li, W. T. White, C. C. Baldwin, K. A. Crandall, D. Arcila, and R. Betancur-R. 2021. Exon probe sets and bioinformatics pipelines for all levels of fish phylogenomics. Molecular Ecology Resources 21:816–833. ***The "FishLife" markers are our preferred choice for building fish trees.***

37. Price, S. A., S. T. Friedman, K. A. Corn, C. M. Martinez, O. Larouche, and P. C. Wainwright. 2019. Building a Body Shape Morphospace of Teleostean Fishes. Integr Comp Biol 59:716–730. ***The "Price dataset" is analogous to the Rabosky tree for fish morphometrics.***

38. Seehausen, O. 2015. Process and pattern in cichlid radiations – inferences for understanding unusually high rates of evolutionary diversification. New Phytologist 207:304–312. ***Anyone in my lab studying marine fishes should also think about life in freshwater habitats by comparison. This is a great overview of evolution in rivers and lakes.***

39. Brandl, S. J., C. H. R. Goatley, D. R. Bellwood, and L. Tornabene. 2018. The hidden half: ecology and evolution of cryptobenthic fishes on coral reefs. Biological Reviews 93:1846–1873. ***Why taxonomy is important. Also, a good reminder that while the deep sea has many undescribed species, so do shallow waters.***

40. Briggs, J. C., and B. W. Bowen. 2012. A realignment of marine biogeographic provinces with particular reference to fish distributions. Journal of Biogeography 39:12–30. ***How the world's oceans are divided up***

41. Horn, M. H. 1972. The amount of space available for marine and freshwater fishes. Fishery Bulletin US 70:1295–1297. ***How fish species are distributed among aquatic habitats.***

42. Wainwright, P. C., and S. J. Longo. 2017. Functional Innovations and the Conquest of the Oceans by Acanthomorph Fishes. Current Biology 27:R550–R557. ***Cool adaptations of spiny-rayed fishes.***

43. Friedman, M., and G. Carnevale. 2018. The Bolca Lagerstätten: shallow marine life in the Eocene. Journal of the Geological Society 175:569–579. ***Why most fossil calibrations on fish trees come from Monte Bolca. See also: "Hopping hotspots" paper by Renema et al. 2008***

Deep-sea biology:

44. Anything by N. B. Marshall. He wrote several books, they're all great. *Explorations in the Life of Fishes* is the shortest and most accessible, and the PDF is in Teams. ***You must read at least one of his books before your comprehensive exams.***

45. Deep-Sea Fishes by Priede (book). ***I have both hard copy and PDF in Teams.***

46. Book chapter in The Diversity of Fishes called "Special Habitats". ***A short-and-sweet overview of deep-sea fish adaptations.***

47. Angel, M. V. 1990. Life in the benthic boundary layer: connections to the mid-water and sea floor. Philos Trans A Math Phys Eng Sci 331:15–28.

48. Drazen, J. C., and T. T. Sutton. 2017. Dining in the Deep: The Feeding Ecology of Deep-Sea Fishes. Annual Review of Marine Science 9:337–366.

49. Eduardo, L. N., M. M. Mincarone, T. Sutton, and A. Bertrand. 2024. Deep-Pelagic Fishes Are Anything But Similar: A Global Synthesis. Ecology Letters 27:e14510. ***Important reminder that vertical migration is a big separator for deep-sea fishes***

50. Friedman, S. T., and M. M. Muñoz. 2023. A latitudinal gradient of deep-sea invasions for marine fishes. Nat Commun 14:773. ***The solution to the paradox of the 'inverse latitudinal speciation gradient' by Rabosky.***

51. Martinez, C. M., S. T. Friedman, K. A. Corn, O. Larouche, S. A. Price, and P. C. Wainwright. 2021. The deep sea is a hot spot of fish body shape evolution. Ecology Letters 24:1788–1799. ***Also check out the references list for papers by Childress. Get ready to forget what you thought you knew about deep-sea organisms!***

52. Myers, E. M. V., M. J. Anderson, L. Liggins, E. S. Harvey, C. D. Roberts, and D. Eme. 2021. High functional diversity in deep-sea fish communities and increasing intraspecific trait variation with increasing latitude. Ecology and Evolution

11:10600–10612. ***Functional morphology of whole communities of deep-sea fishes.***

53. Neat, F. C., and N. Campbell. 2013. Proliferation of elongate fishes in the deep sea. Journal of Fish Biology 83:1576–1591.

54. Ramirez-Llodra, E., A. et al. Deep, diverse and definitely different: unique attributes of the world's largest ecosystem. Biogeosciences 7:2851–2899. ***What the deep sea is and isn't.***

55. Sutton, T. T. 2013. Vertical ecology of the pelagic ocean: classical patterns and new perspectives. Journal of Fish Biology 83:1508–1527.

56. Warrant, E. J., and N. A. Locket. 2004. Vision in the deep sea. Biological Reviews 79:671–712.

57. Andriashev, A. P. 1953. Ancient deep-water and secondary deep-water fishes and their importance in zoogeographical analysis. Notes of Special Problems in Ichthyology, Moscow, Leningrad. ***An under-the-radar paper with big implications for deep-sea fish evolution.***

58. Oceanic Anglerfishes by Ted Pietsch (book). ***The wonderfully wacky world of anglerfishes. PDF in Teams.***

General concepts in macroevolution. Two names to know are David Jablonski and Michael Benton.

59. Benton, M. J. 2001. Biodiversity on land and in the sea. Geological Journal 36:211–230.

60. Benton, M. J. 2015. Exploring macroevolution using modern and fossil data. Proc Biol Sci 282:20150569.

61. Benton, M. J. 2009. The Red Queen and the Court Jester: Species Diversity and the Role of Biotic and Abiotic Factors Through Time. Science 323:728–732.

62. Felice, R. N., M. Randau, and A. Goswami. 2018. A fly in a tube: Macroevolutionary expectations for integrated phenotypes. Evol 72:2580–2594.

63. Gould, S. J., and R. C. Lewontin. 1979. The spandrels of San Marco and the Panglossian paradigm: a critique of the adaptationist programme. Proc Biol Sci 205:581–598. ***A reminder that not everything is adaptive.***

64. Graham, C. H., D. Storch, and A. Machac. 2018. Phylogenetic scale in ecology and evolution. Global Ecology and Biogeography 27:175–187.

65. Jablonski, D. 2017a. Approaches to Macroevolution: 1. General Concepts and Origin of Variation. Evol Biol 44:427–450. ***Pair with:***
66. Jablonski, D. 2017b. Approaches to Macroevolution: 2. Sorting of Variation, Some Overarching Issues, and General Conclusions. Evol Biol 44:451–475.

67. Moen, D., and H. Morlon. 2014. Why does diversification slow down? Trends in Ecology & Evolution 29:190–197. ***A reminder that diversification rate slowdowns need not be caused by ecological limits***

68. Beaulieu, J. M., and B. C. O'Meara. 2018. Can we build it? Yes we can, but should we use it? Assessing the quality and value of a very large phylogeny of campanulid angiosperms. American Journal of Botany 105:417–432. ***Pair with:***
69. Donoghue, M. J., and E. J. Edwards. 2019. Model clades are vital for comparative biology, and ascertainment bias is not a problem in practice: a response to Beaulieu and O'Meara (2018). American J of Botany 106:327–330. ***A thoughtful exchange on how we choose which clades to study, and the implications of our choices.***

Studying morphological and/or functional evolution:

70. Book chapter in Methods for Fish Biology 2nd edition (blue book) by Diego Vaz, Chris Martinez, and Sarah Friedman. ***A great roadmap of how to study fish morphology. PDF in Teams.***

71. Wainwright, P. C. 2007. Functional Versus Morphological Diversity in Macroevolution. Annual Review of Ecology, Evolution, and Systematics 38:381–401.

72. Wainwright, P. C., and S. A. Price. 2016. The Impact of Organismal Innovation on Functional and Ecological Diversification. Integr Comp Biol 56:479–488. ***Not every innovation is a key innovation***

73. Goswami, A., and J. Clavel. 2025. Morphological evolution in a time of phenomics. Paleobiology 51:195–213.

74. Rhoda, D., M. Segall, O. Larouche, K. Evans, and K. D. Angielczyk. 2021. Local Superimpositions Facilitate Morphometric Analysis of Complex Articulating Structures. Integr Comp Biol 61:1892–1904. ***Creative solution to a challenge brought on by phenomics***

Just some really great comparative studies:

75. Betancur-R, R., G. Ortí, and R. A. Pyron. 2015. Fossil-based comparative analyses reveal ancient marine ancestry erased by extinction in ray-finned fishes. Ecology Letters 18:441–450. ***A reminder for why we need fossils***

76. Burress, E. D., and P. B. Hart. 2024. Pelagic zone is an evolutionary catalyst, but an ecological dead end, for North American minnows. Evol 78:1396–1404.

77. Cooney, C. R., J. A. Bright, E. J. R. Capp, A. M. Chira, E. C. Hughes, C. J. A. Moody, L. O. Nouri, Z. K. Varley, and G. H. Thomas. 2017. Mega-evolutionary dynamics of the adaptive radiation of birds. Nature 542:344–347. ***One of the first big 3-D datasets before CT scanning was widespread***

78. Morinaga, G., J. J. Wiens, and D. S. Moen. 2023. The radiation continuum and the evolution of frog diversity. Nat Commun 14:7100.

79. Brennan, I. G., D. G. Chapple, J. S. Keogh, and S. Donnellan. 2024. Evolutionary bursts drive morphological novelty in the world's largest skinks. Current Biology 34:3905-3916.e5.

80. Huang, S., K. Roy, J. W. Valentine, and D. Jablonski. 2015. Convergence, divergence, and parallelism in marine biodiversity trends: Integrating present-day and fossil data. Proceedings of the National Academy of Sciences 112:4903–4908. ***Different evolutionary routes to the same outcome***

Community assembly and biogeography: While we don't do ecology *per se* in my lab, these more ecological-focused papers were quite influential on my work.

81. Germain, R. M., et al. 2021. On the Origin of Coexisting Species. Trends in Ecology & Evolution 36:284–293.

82. Ricklefs, R. E. 1987. Community Diversity: Relative Roles of Local and Regional Processes. Science 235:167–171.

83. Moen, D. S., D. J. Irschick, and J. J. Wiens. 2013. Evolutionary conservatism and convergence both lead to striking similarity in ecology, morphology and performance across continents in frogs. Proc Biol Sci 280:20132156. ***Link between phylogenetic comparative methods and community ecology***

84. Moen, D. S., S. A. Smith, and J. J. Wiens. 2009. Community assembly through evolutionary diversification and dispersal in Middle American treefrogs. Evol 63:3228–3247. ***Link between phylogenetic comparative methods and community ecology x2***

85. Tsuji, K., and T. Fukami. 2020. Sexual Dimorphism and Species Diversity: from Clades to Sites. Trends in Ecology & Evolution 35:105–114. ***Link between phylogenetic comparative methods and community ecology x3***

86. Pinto-Sánchez, N. R., A. J. Crawford, and J. J. Wiens. 2014. Using historical biogeography to test for community saturation. Ecology Letters 17:1077–1085. ***Link between phylogenetic comparative methods and community ecology x4***

How the planet has changed over the Phanerozoic. If you study evolution in time scales of millions of years (instead of, say, thousands of years) you must be aware of the history of Earth.

87. Bush, A. M., and R. K. Bambach. 2011. Paleoecologic Megatrends in Marine Metazoa. Annu. Rev. Earth Planet. Sci. 39:241–269.

88. Mannion, P. D., P. Upchurch, R. B. J. Benson, and A. Goswami. 2014. The latitudinal biodiversity gradient through deep time. Trends in Ecology & Evolution 29:42–50.

89. Norris, R. D., S. K. Turner, P. M. Hull, and A. Ridgwell. 2013. Marine Ecosystem Responses to Cenozoic Global Change. Science 341:492–498.

90. Scotese, C. R. 2021. An Atlas of Phanerozoic Paleogeographic Maps: The Seas Come In and the Seas Go Out. Annual Review of Earth and Planetary Sciences 49:679–728. ***The bible- I refer to this all the time.***

91. Sibert, E. C., and R. D. Norris. 2015. New Age of Fishes initiated by the Cretaceous–Paleogene mass extinction. Proceedings of the National Academy of Sciences 112:8537–8542.

Museums:

92. Card, D. C., B. Shapiro, G. Giribet, C. Moritz, and S. V. Edwards. 2021. Museum Genomics. Annual Review of Genetics 55:633–659. ***If you requests loans of tissues from museums to make trees, then you are doing museum genomics.***

93. Lendemer, J., B. et al. 2020. The Extended Specimen Network: A Strategy to Enhance US Biodiversity Collections, Promote Research and Education. BioScience 70:23–30.

94. Blackburn, D. C., et al. 2024. Increasing the impact of vertebrate scientific collections through 3D imaging: The openVertebrate (oVert) Thematic Collections Network. BioScience 74:169–186. ***The reason CT scanning took off in popularity was because of oVert.***

95. There is a book chapter in Methods for Fish Biology 2nd edition (blue book) by Brian Sidlauskas about curating a fish collection. ***Read if you use museum resources at all, to get into the mind of the curator in charge of those resources. PDF in Teams.***

Lab culture:

96. I love the "Ten Simple Rules" series for all manner of topics in academia: https://collections.plos.org/collection/ten-simple-rules/

97. Chaudhary, V. B., and A. A. Berhe. 2020. Ten simple rules for building an antiracist lab. PLOS Computational Biology 16:e1008210.

Writing:

98. The Scientist's Guide to Writing by Stephen Heard (book)

99. Sargent, E. H. 2022. 10 tips on how we write papers. Matter 5:3562–3564. ***There's a lot of advice out there on how to write papers, but I think this is the best.***

Coda:

100. The Princeton Guide to Evolution (book with seahorse on cover). ***Anything in this book is fair game for your comprehensive exams.***