**Outline for Echolocation chapter/paper**

**Overall story:**

* Simple – description of call structures and frequency ranges
* If the maze tests work – evidence for navigation by echolocation

**Possible Journal:** Behavioural Ecology?

**Introduction**

* Usually think of bats and cetaceans but shrews also echolocate ([Siemers et al., 2009](#_ENREF_6), [Gould et al., 1964](#_ENREF_4), [Tomasi, 1979](#_ENREF_7))
* Morphological/ecological convergence between shrews and tenrecs
* Echolocating tenrecs ([Gould, 1965](#_ENREF_3)) but only three species and problems with equipment, method etc.
* No acoustic studies of echolocation tenrecs (but some studies of spine stridulation in Hemicentetes ([Eisenberg and Gould, 1969](#_ENREF_1), [Endo et al., 2010](#_ENREF_2))
* Now there’s renewed interest in echolocation – genomic convergence([Parker et al., 2013](#_ENREF_5))
* Assessing evidence for behavioural capabilities is a first step before looking for genetic convergence
* Three main questions

1. Do tenrecs produce ultrasonic frequencies?
2. What’s the range and structure of tenrec calls?
3. Do tenrecs use acoustic cues for navigation? – this appears to be true for shrews so I want to test whether the same is true for tenrecs

**Method**

Echolocation field tests – direct measurements and maze experiments

**Results**

* Yes/no for echolocation
* Call structures
* Change in calls for navigating through gaps/ different light conditions/maze complexity

**Discussion**

* Tie in with an overall convergence story – important to look beyond conventional study groups
* Multiple levels of convergence – morphological/ecological/behavioural
* Obvious next step is to look for genomic convergence

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Gould, E. 1965. Evidence for echolocation in the Tenrecidae of Madagascar. *Proceedings of the American Philosophical Society,* 109**,** 352-360.

Gould, E., Negus, N. & Novick, A. 1964. Evidence for echolocation in shrews. *The Journal of Experimental Zoology,* 156**,** 19-37.

Parker, J., Tsagkogeorga, G., Cotton, J. A., Liu, Y., Provero, P., Stupka, E. & Rossiter, S. J. 2013. Genome-wide signatures of convergent evolution in echolocating mammals. *Nature*.

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Tomasi, T. E. 1979. Echolocation by the short-tailed shrew *Blarina brevicauda*. *Journal of Mammalogy,* 60**,** 751-759.