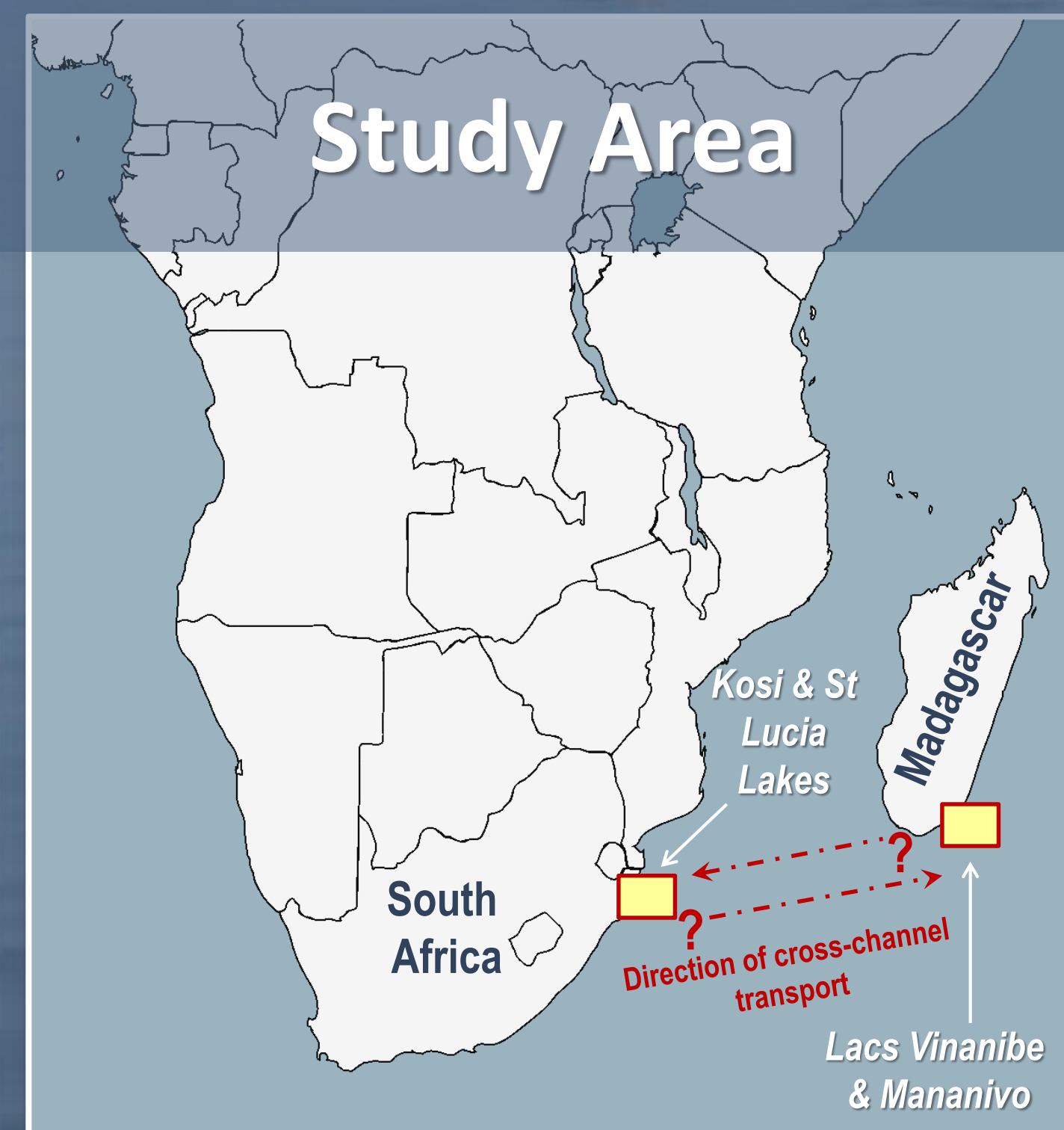


Estuarine lakes: linkages and lineages across longitudes in the Western Indian Ocean

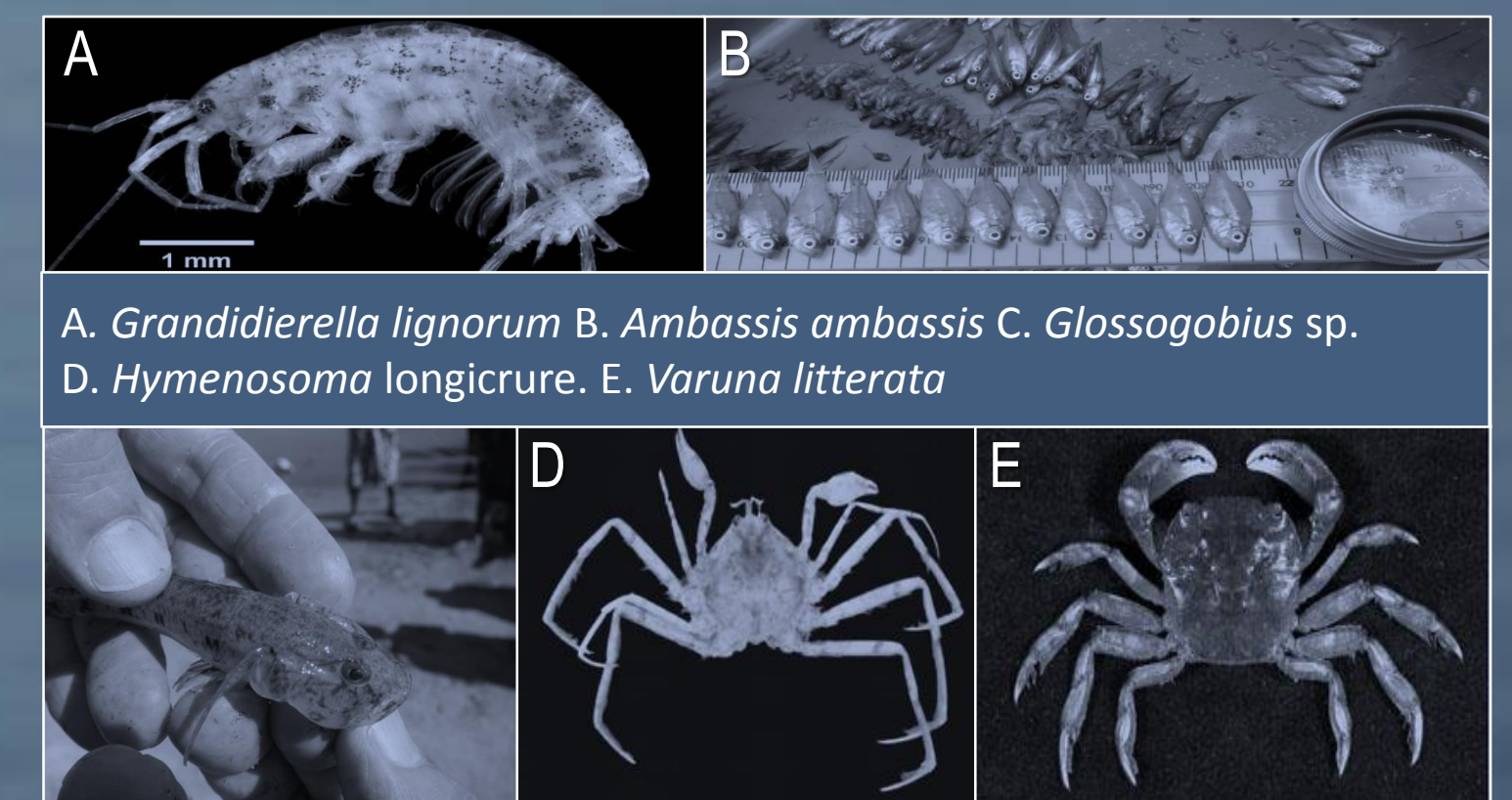
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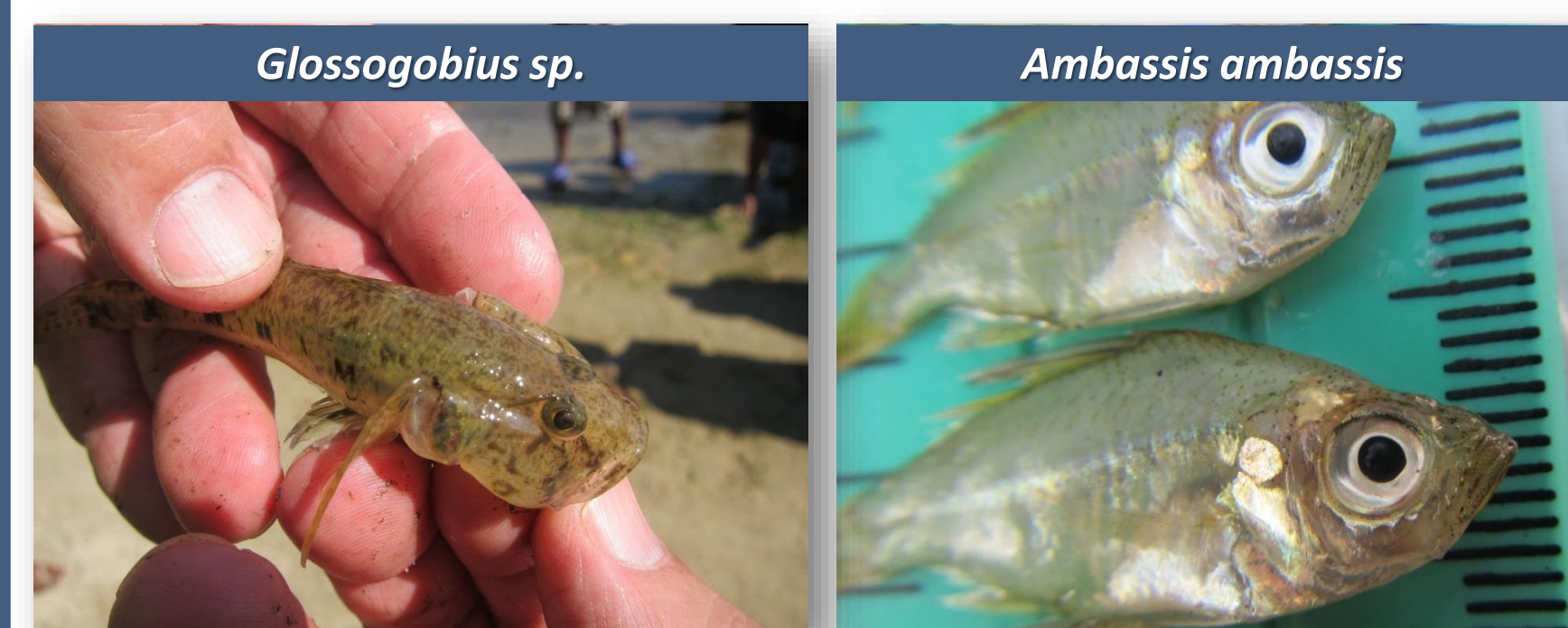
Comparative littoral ecology of estuarine linked lakes in SE Madagascar and NE South Africa



Taxa common to NE South Africa and SE Madagascar coastal lakes, to be used to investigate linkages by CO1 and Cytochrome B genetic analysis

Fish species used as connectivity indicators:

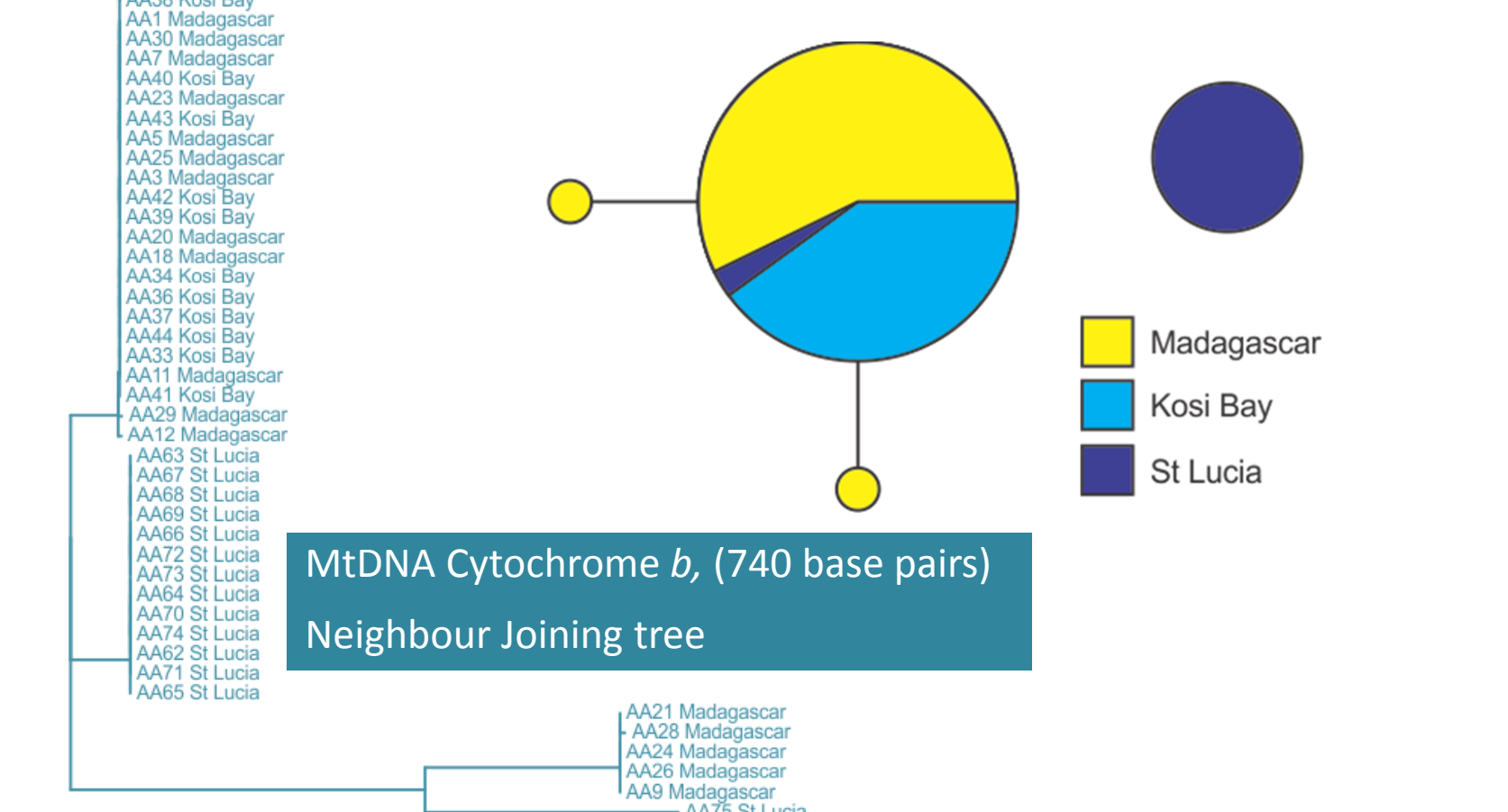
There were co-occurring species, but in some cases species were replaced by morphologically similar congeneric or confamilial forms. At ecological guild level, community structures were comparable suggesting similar ecological processes and function across the study systems. A noted exception was the low abundance of grey mullet (*Mugilidae*) in Madagascar compared with South African estuaries. Perhaps natural, but is likely linked to high fishing pressure on Madagascar lakes.



Genetic linkages:

Genetic analysis of the gobies (*Glossogobius*) indicated complexity in the genus taxonomy, supporting recent work done in South Africa (3). Our findings indicate that there is a need to investigate *Glossogobius* taxonomy at a wider regional scale. Although a small fish with relatively little fisheries value, *Glossogobius* is often the most abundant benthic species and plays an important ecological role in WIO estuarine lakes.

	Madagascar	Kosi Bay	St Lucia
Madagascar	---	1.07×10^{14}	1.07×10^{14}
Kosi Bay	0.000	---	1.07×10^{14}
St Lucia	0.935*	0.923*	---



Analyses of *Ambassis ambassis* specimens suggested connectivity between Madagascan estuarine lake populations and the Kosi system in South Africa. Remarkable, is the apparent lower genetic connectivity between populations of *Ambassis* in adjacent South African estuarine lakes (Kosi and St Lucia) which are separated by less than 200 km.

Further Work

Thus far, results indicate (recent or historical?) connectivity of estuarine lakes in SE Madagascar and South Africa. The direction and mechanism of gene flow is to be further investigated. Future work will entail:

- Continuation with morpho-taxonomy and CO1 barcoding for species of interest
- Population study on crab *Varuna litterata* that occurs in all systems to investigate cross-longitude linkages
- Using *Ambassis* to use genetic microsatellite nuclear markers for recent perspectives on connectivity
- Additional sampling of *Glossogobius* sp. to elucidate complicated taxonomy and to generate Cytochrome b and microsatellite data

Acknowledgements: ACEP Suitcase Project, SAAMBR, CSIR, WIOMSA

Introduction

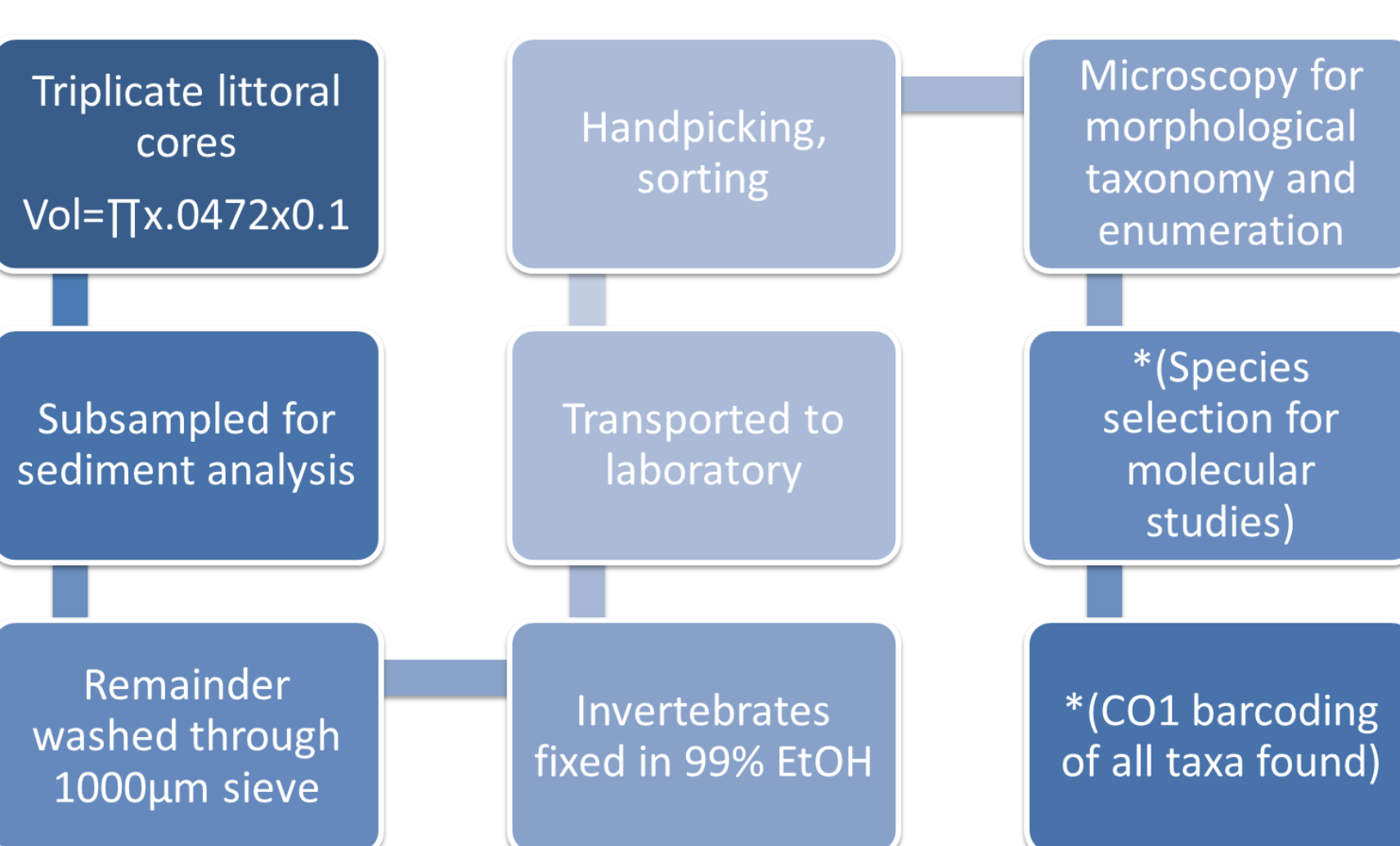
Recent observations (1) of purported South African endemic species from south east Madagascar prompted the "Suitcase" programme, supported by the African Coelacanth Ecosystem Programme (ACEP), to investigate regional genetic connectivity of fauna from various coastal marine habitats. Work presented here focusses on estuarine fauna (invertebrates and fishes). There are strong morphological and habitat similarities in estuarine lakes in SE Madagascar (Vinanibe and Mananivo) and NE South Africa (Kosi). Local people use these systems in similar ways in both countries, deriving similar ecosystem benefits. However, no physicochemical or biological surveys have been conducted of estuarine lakes in SE Madagascar, and no comparative ecological assessment has been made between systems across the island state and mainland Africa. Typically, coastal lakes are inhabited by relatively short lived species with high life cycle dependence on estuaries and genetic connectivity across longitude (the Mozambique Channel) could be expected to be minimal in these systems.

- AIM 1:** Compare species occurrence, diversity and the ecology of SE Madagascan estuarine lakes with that of a similar NE South African system
- AIM 2:** Investigate genetic connectivity amongst co-occurring estuarine dependent invertebrate and fish species from these estuarine lakes

Methods

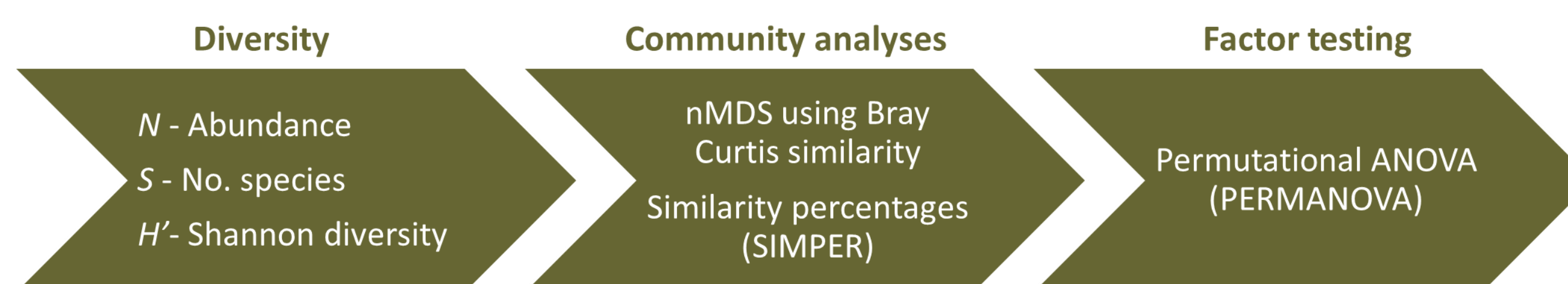
Littoral infauna, lake sediments & CTD:

11-20 littoral infauna & CTD stations sampled from lake perimeters of Vinanibe, Mananivo and Kosi in 2013 and 2016. Physico-chemistry measured at each station (salinity, temperature (°C) and depth (m)). Community analyses on quantified cores. * Still to be analysed.

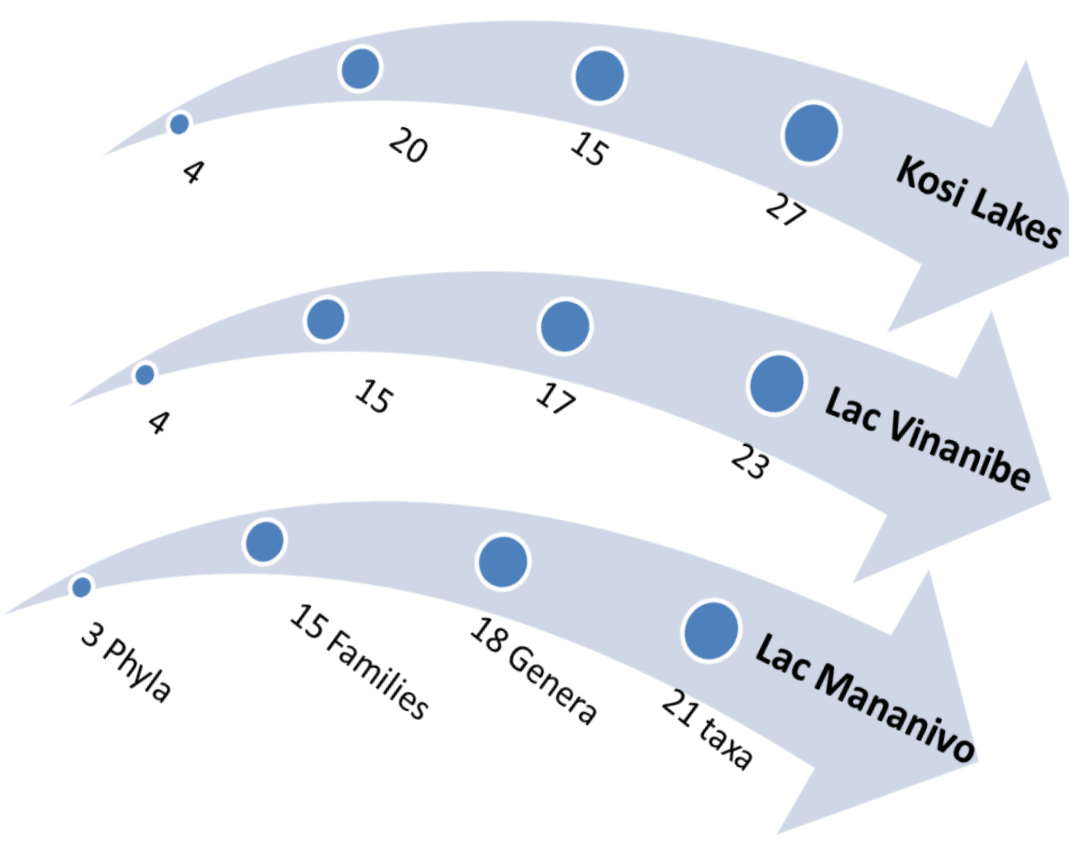


Estuarine dependent fish representatives:

Gobiidae *Glossogobius callidus* (SA endemic), *G. tenuiformis*, *G. giurus* and the longspine glassy *Ambassis ambassis* (an Indian Ocean species) were sampled from all coastal lakes and St Lucia in South Africa.

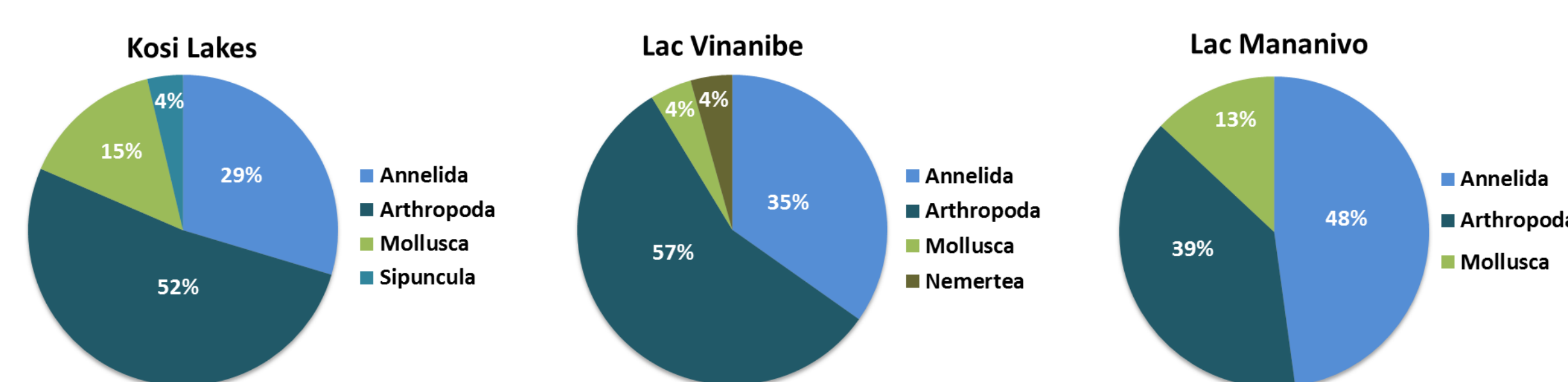


Preliminary Findings

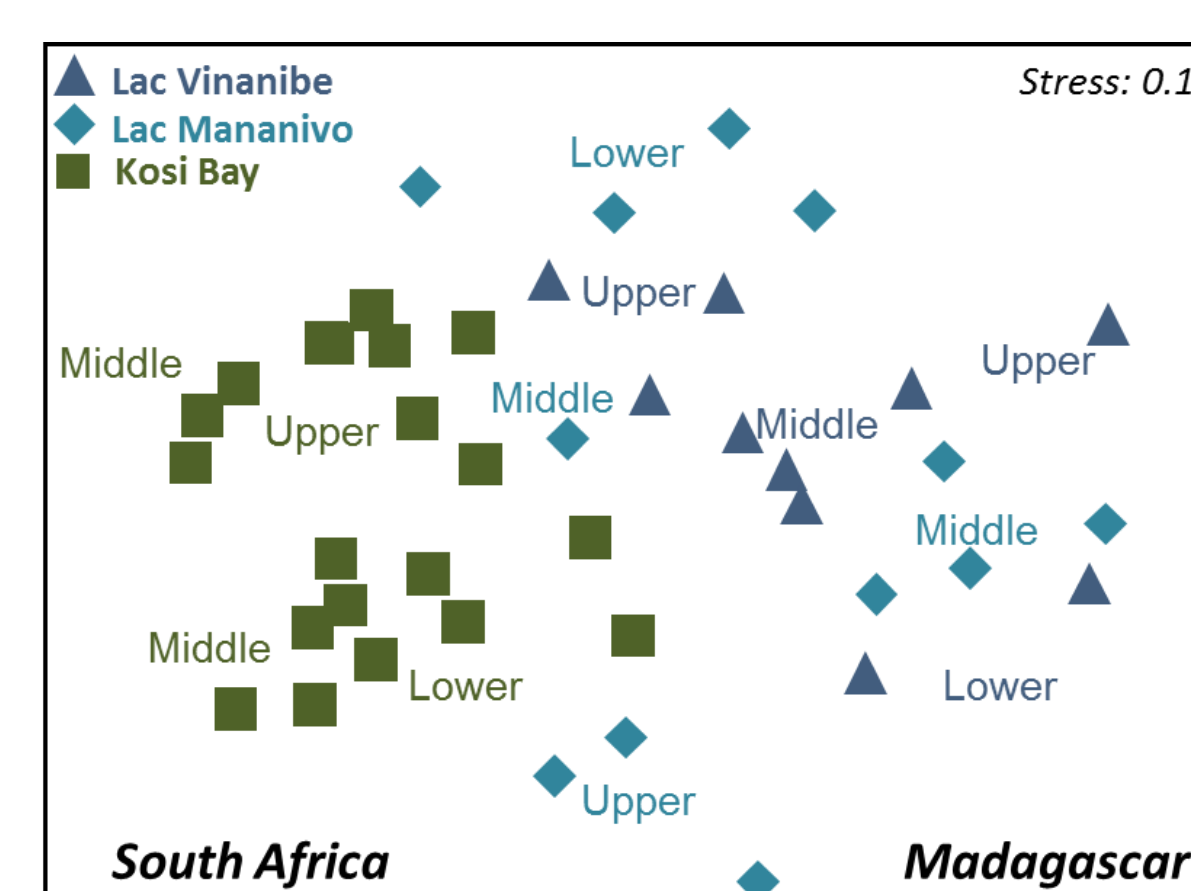


Invertebrate composition and diversity:

There was remarkable similarity in the abundances of Phyla in different taxonomic ranks from clear water, sandy estuarine lakes in SE Madagascar and NE South Africa. The relative contribution of invertebrates to Phyla showed that lakes are similarly supported by high numbers of Arthropoda and Annelida, with a comparable relative importance of Mollusca in Kosi and Mananivo lakes.



Overall diversity (H') showed slightly lower (0.8) and higher (1.2) values for Vinanibe and Kosi, respectively. Unlike Mananivo, with comparable diversity across all system reaches, these lakes are most diverse in the upper reaches (Vinanibe) or lower reaches (Kosi). These trends agree with the salinity distributions of Kosi which from mouth to upper reaches is poly- to oligohaline; the opposite is true of Vinanibe which has a reverse gradient.



nMDS analysis (2) revealed that Kosi littoral infauna communities are overall different from those sampled in SE Madagascar. Any comparability of systems lies at the individual taxon level.

Lakes	P-perm < 0.001	Pseudo-F = 4.886
Vinanibe & Mananivo	1.2451	0.1066
Vinanibe & Kosi	2.6604	0.0001
Mananivo & Kosi	2.3575	0.0001

Morpho-taxonomy study suggests that where similar taxa occur between lakes, there are differences in where they are located in a system. SIMPER analysis identifying characteristic species per lake, showed limited comparability, despite congeneric and family overlaps. A surprising finding was the co-occurrence of the amphipod *Grandidiarella lignorum* and the brachyuran *Hymenosoma longicirure*. Both were found in SE Madagascar but are reported as endemic to the warm temperate/sub tropical transition region of SE South Africa.

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