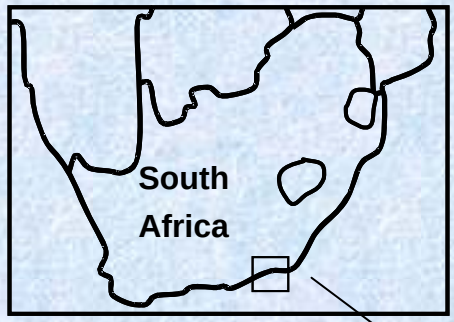
Delivery of macronutrients to the sea from two altered South African estuaries

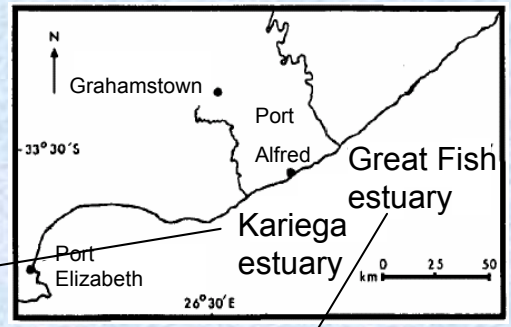
Mike Jennings, William Froneman
and Howard Waldron

INTRODUCTION

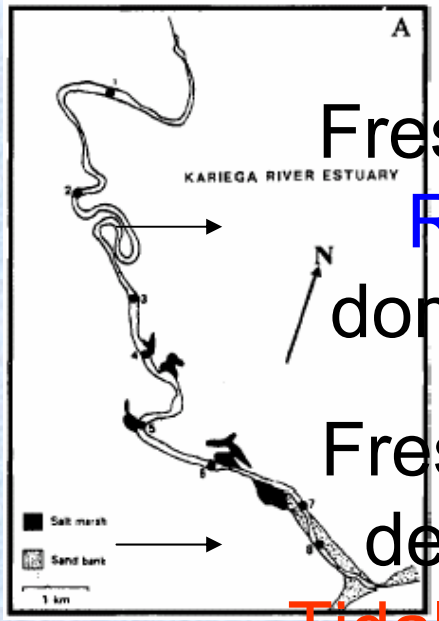
- Nutrient dynamics of estuaries well understood
- Exchange of dissolved macronutrients between estuaries and the marine nearshore environment?
- AIM: Investigate role estuaries play in delivery of macronutrients to the marine nearshore environment and what influence anthropogenic induced changes in flow have on this relationship

ESTUARIES





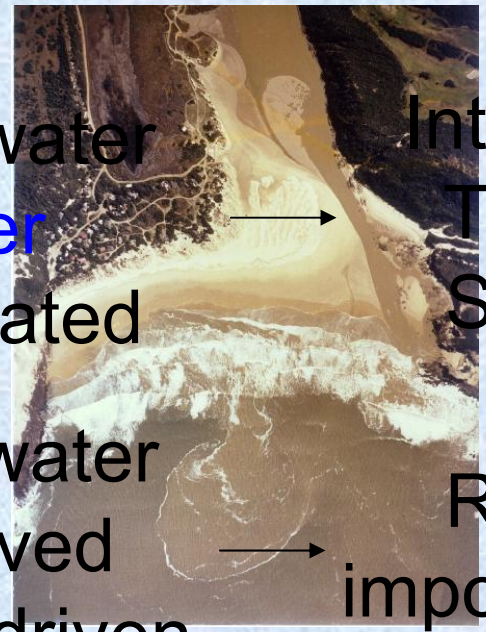
- 2 permanently open estuaries of contrasting freshwater inflow selected
- Vastly different flow regimes



Freshwater River dominated

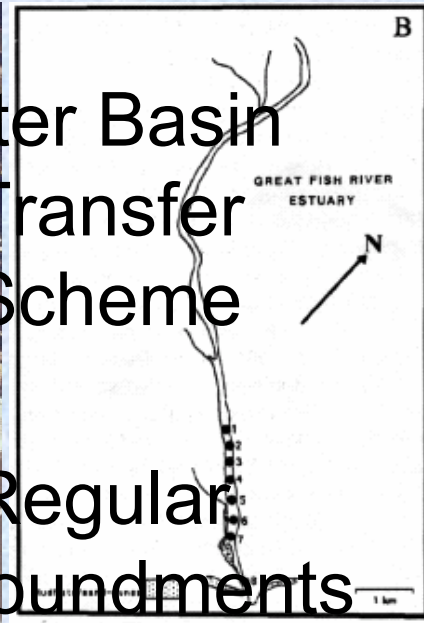
Freshwater deprived

Tidally driven



Inter Basin Transfer Scheme

Regular impoundments



METHODS

- Collect and analyse samples

  - March = autumn = wet

  - samples taken along the length of estuaries and in a grid in the marine nearshore environment adjacent to the estuaries

  - NO_3 + NO_2 + NH_4 = Dissolved Inorganic Nitrogen (DIN)

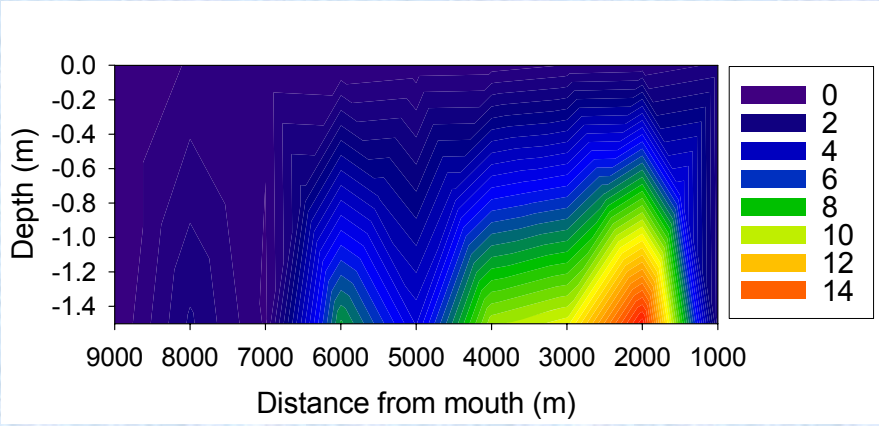
  - PO_4 = Dissolved Inorganic Phosphorus (DIP)

- Apply LOICZ budgeting techniques

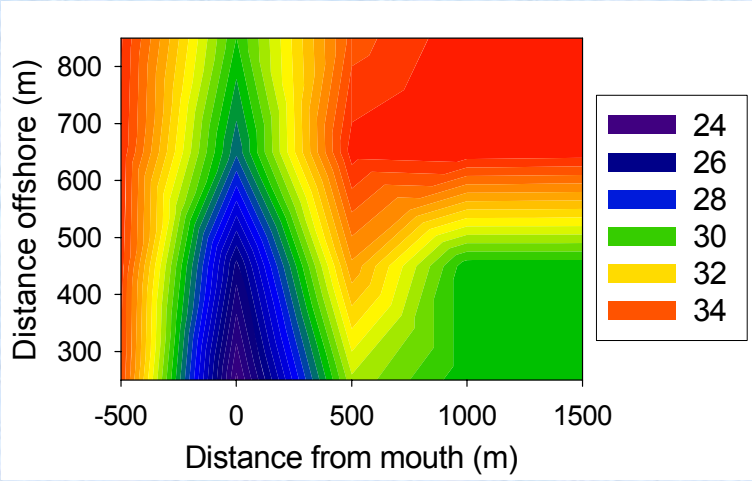
  - 1 Box model

MARCH – SALINITY (psu)

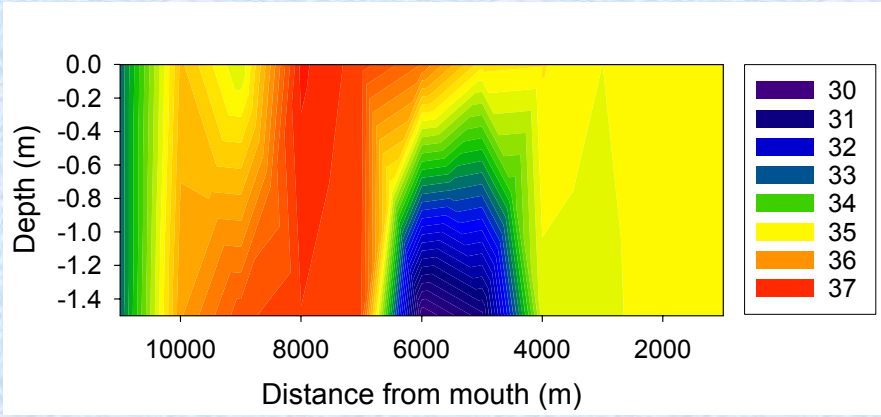
Great Fish Estuary



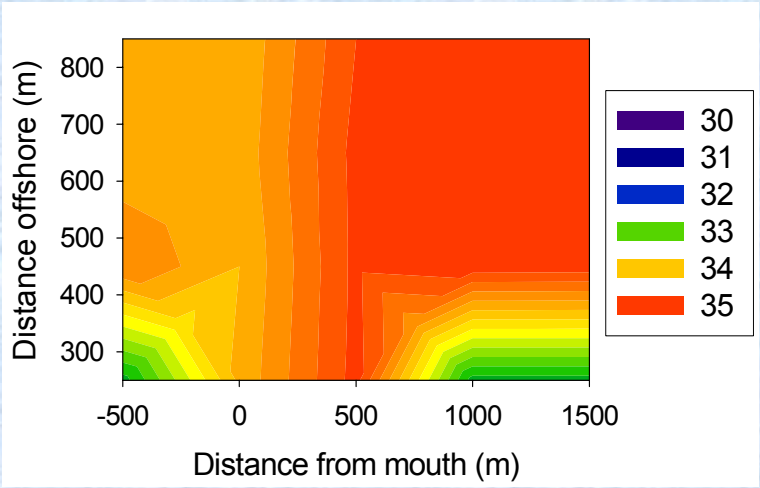
Great Fish Marine (surface)



Kariega Estuary



Kariega Marine (surface)

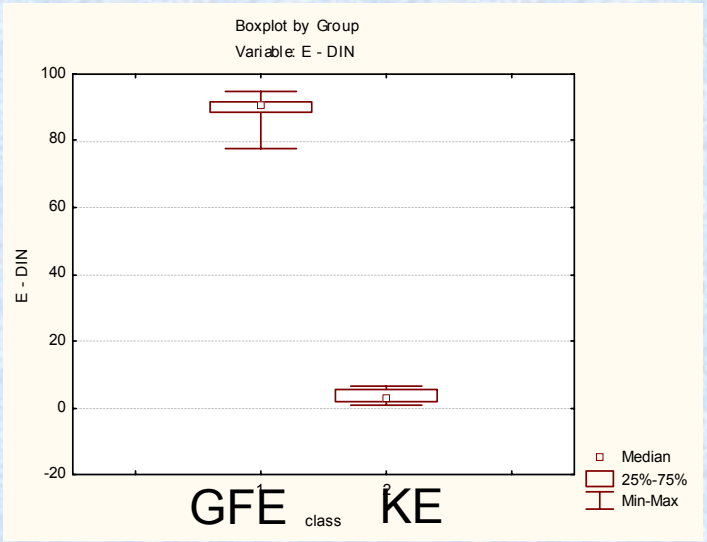


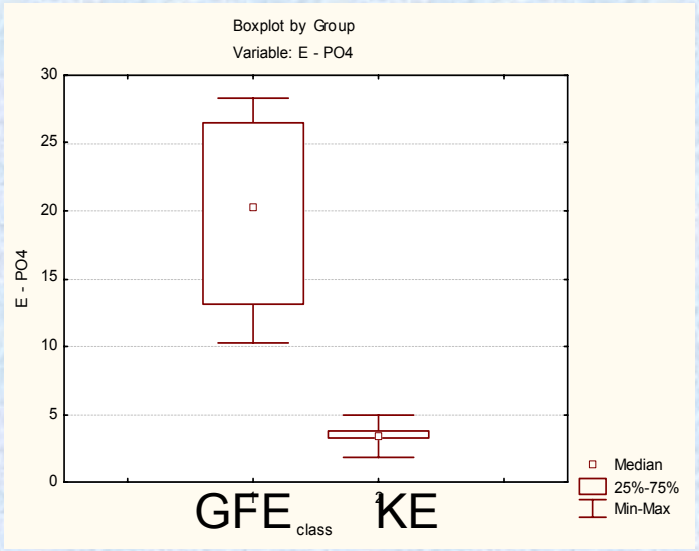
STATS - BOX AND WHISKER PLOTS (µmol/l)

DIN

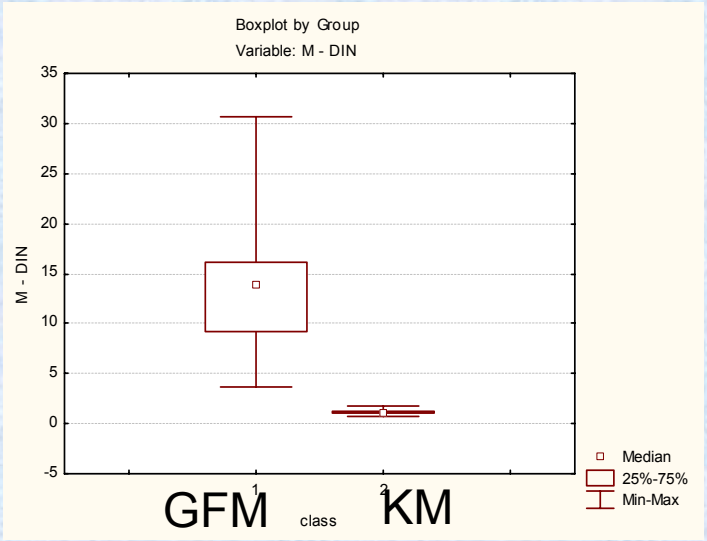
DIP

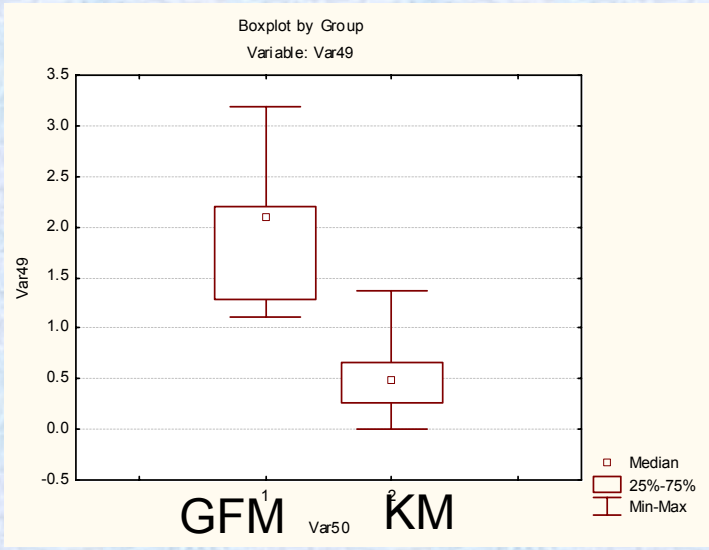
Great Fish Estuary vs Kariega Estuary





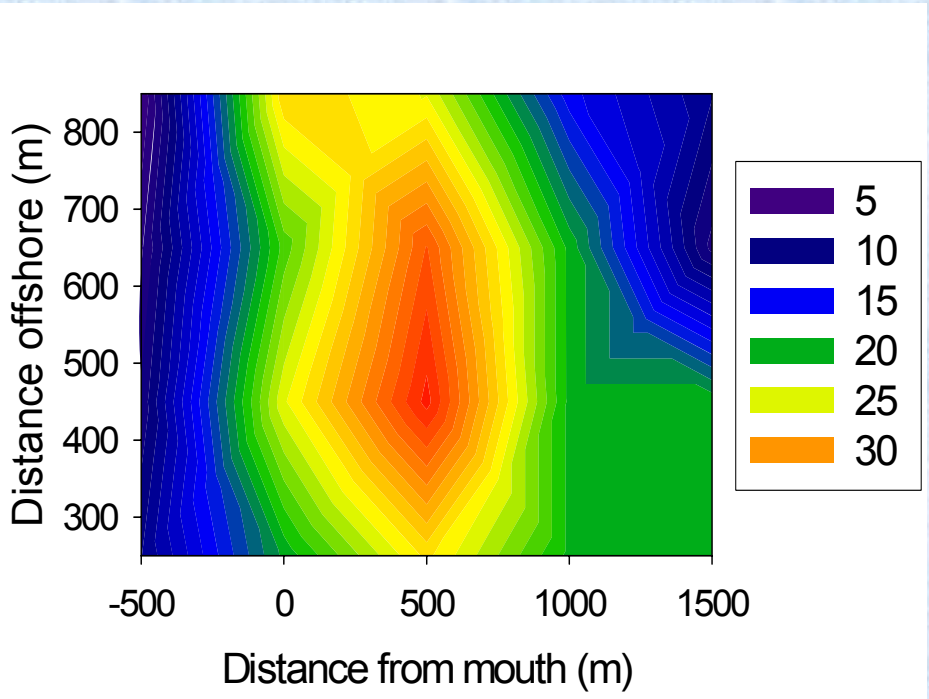
Great Fish Marine vs Kariega Marine



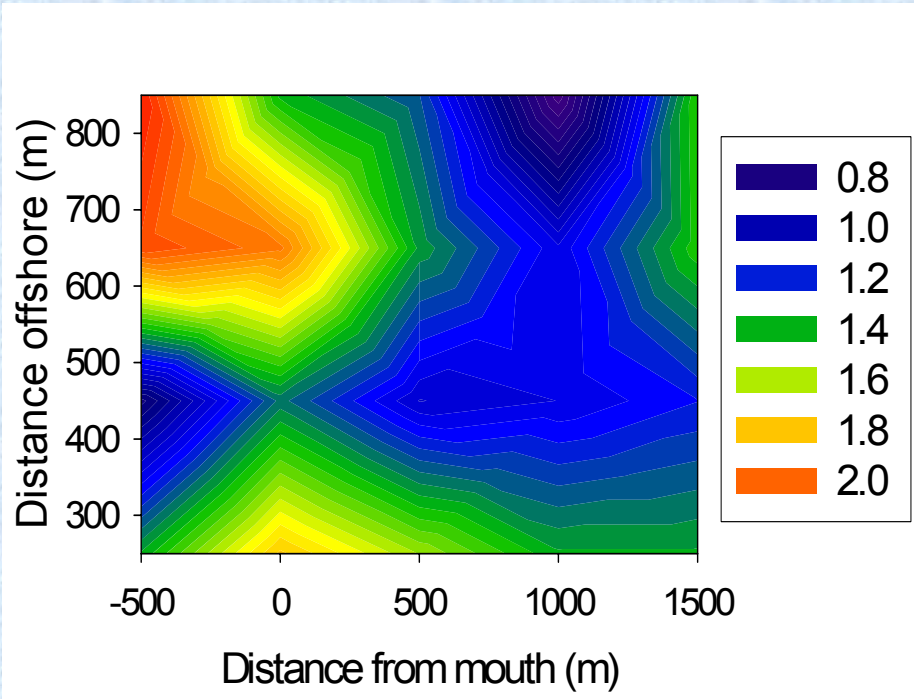


DIN SURFACE PROFILES (µmol/l)

Great Fish Marine

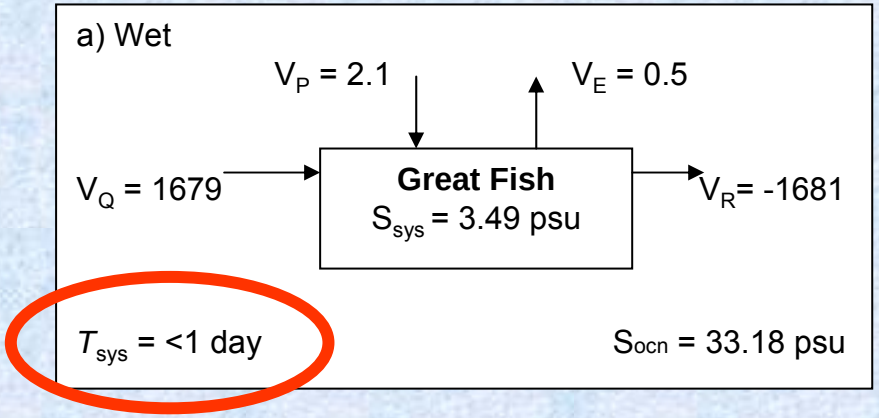


Kariega Marine

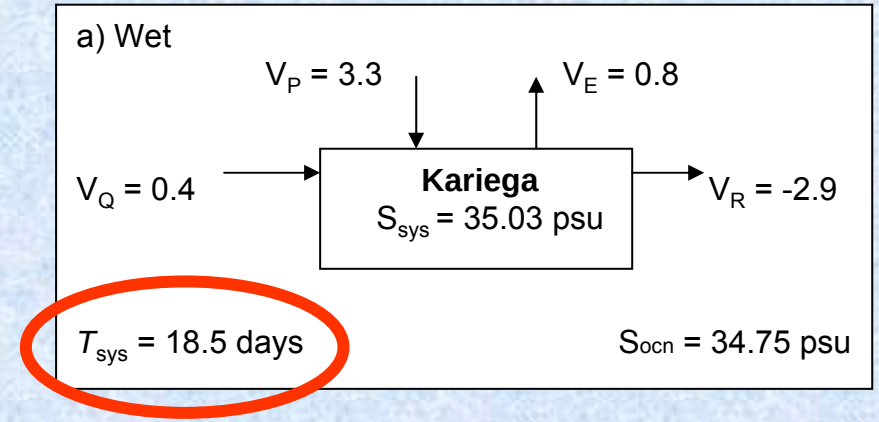


LOICZ BUDGETS – March water ($10^3 m^3$/day) and salt (10^3psu-m^3/day) balance

Great Fish Estuary



Kariega Estuary



NONCONSERVATIVE FLUX AND NET ECOSYSTEM METABOLISM RESULTS (μmol/m²/day)

		Great Fish Estuary	Kariega Estuary
MARCH	ΔDIN	**30**	**-0.29**
	ΔDIP	**17**	**-0.32**
	(p-r)	**-1845**	**34**
	(n-d)	**-248**	**4.86**

CONCLUSIONS

GFE = source DIN & DIP, heterotrophic, denitrifyer

KE = sink DIN & DIP, autotrophic, nitrogen fixer

GFM = evidence of macronutrient rich water flowing out mouth and into marine nearshore environment

KM = no evidence to suggest estuary has any influence

IN FACT….. KM < MC (DIN, DIP) !!

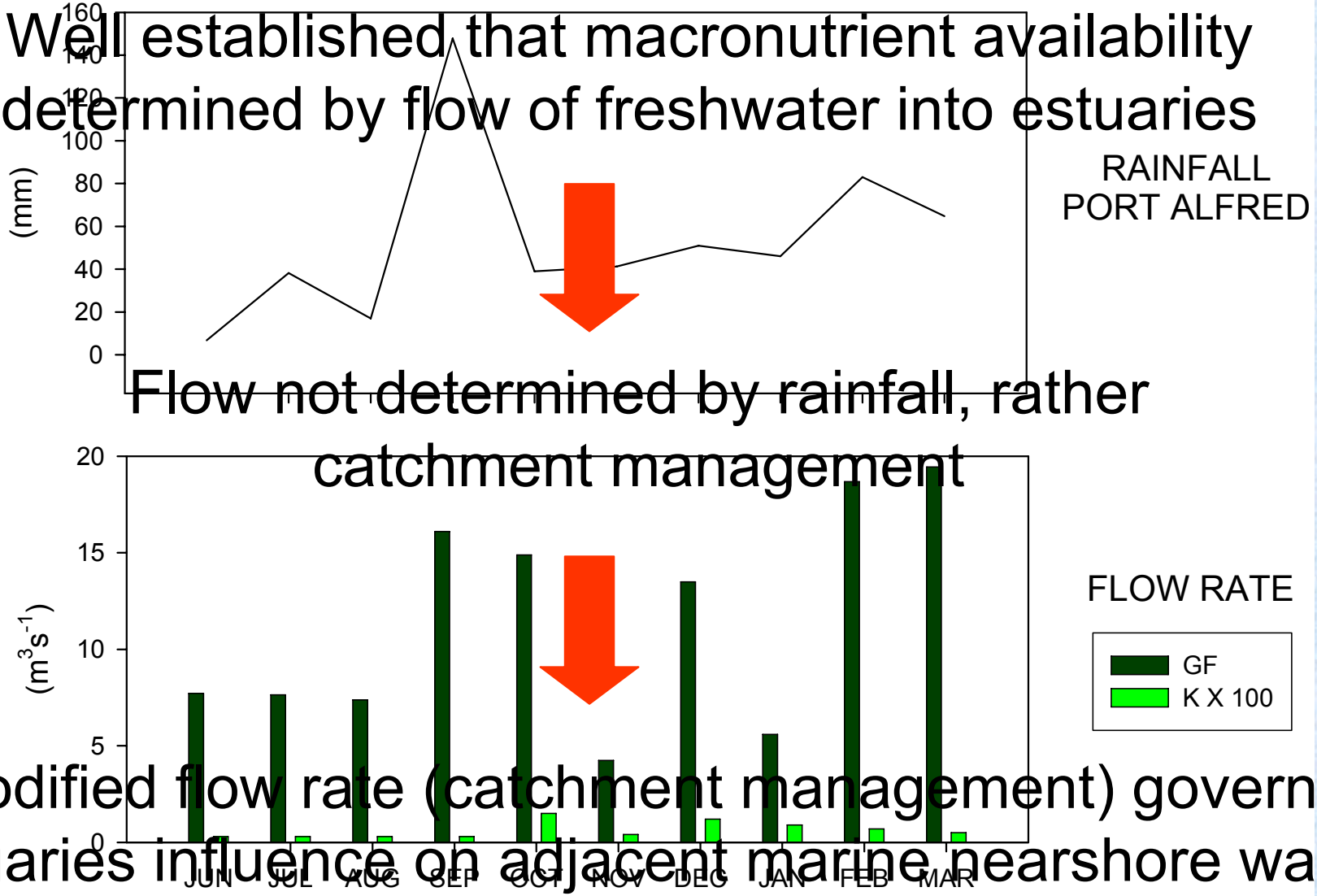
BUT……

Kariega Estuary can still potentially be important source of macronutrients for primary producers within the estuary

- farming practises
- ground water
- extensive saltmarshes

saltmarsh on the banks of the Kariega estuary

Well established that macronutrient availability determined by flow of freshwater into estuaries



Flow not determined by rainfall, rather catchment management

Modified flow rate (catchment management) governs estuaries influence on adjacent marine nearshore water

ACKNOWLEDGEMENTS

National Research Foundation and Rhodes University for funding my studies and the project

Paul Vorwerk and all those who helped collect water samples on the estuaries and the sea in often less than ideal conditions!