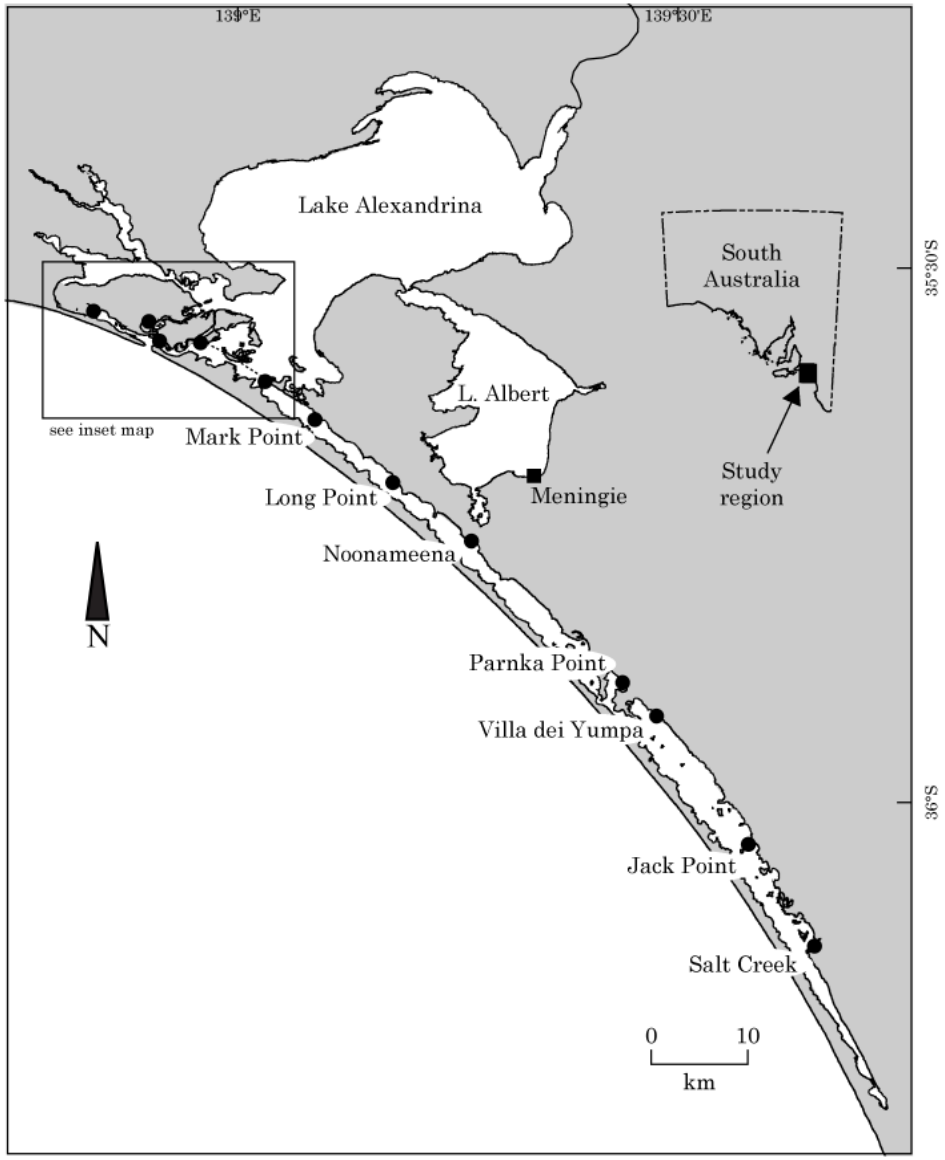
Modelling waterbird responses to ecological conditions

Coorong, Lower Lakes, & Murray Mouth Ramsar site.

Dr Jody O'Connor, Dr Dan Rogers, Dr Phil Pisanu.
Department of Environment, Water and Natural Resources, Adelaide

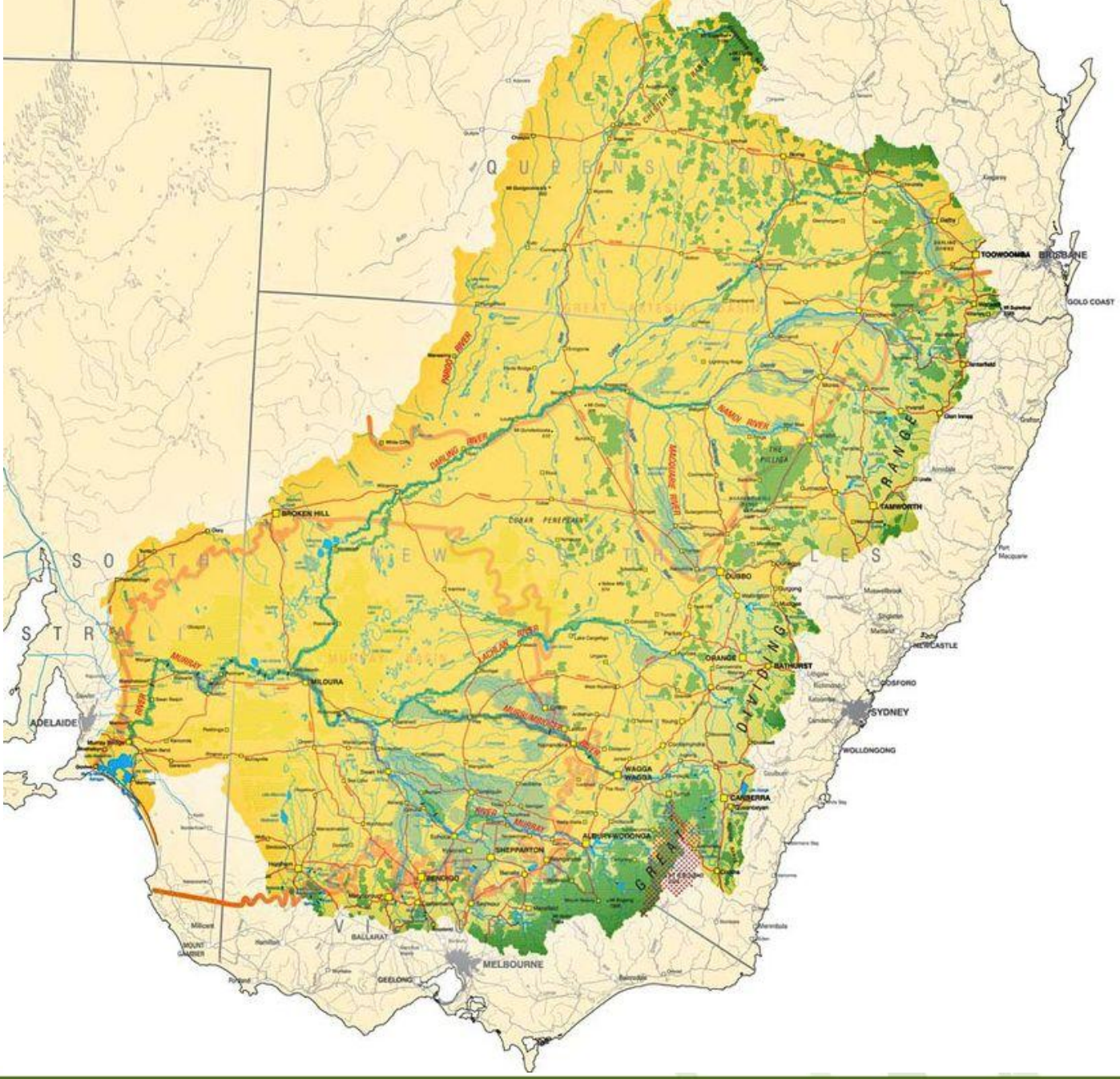
Ramsar "Wetland of International Importance"



Map: Craig Noell, SARDI, from Lester & Fairweather 2009

Common Greenshank-migratory wader

Banded Stilt- continentally nomadic


QUEENSLAND
NEW SOUTH WALES
VICTORIA
BROKEN HILL
MILDURA
ADELAIDE
MURRAY RIVER
DARLING RIVER
PARROO RIVER
BARWON RIVER
MACQUARIE RIVER
LACHLAN RIVER
MURRUMBIDGEE RIVER
COOPER PEDIEAKE
THE PILLIGA
NARRAN LAKE
TOOWOOMBA
BRISBANE
GOLD COAST
TAMWORTH
DUBBO
ORANGE
BATHURST
NEWCASTLE
GOSFORD
SYDNEY
WOLLONGONG
WAGGA WAGGA
CANBERRA
ALBURY-WODONGA
SHEPPARTON
BENDIGO
BALLARAT
MELBOURNE
GEELONG
MOUNT GAMBIER
GREAT DIVIDING RANGE


2002


Acid sulphate soils

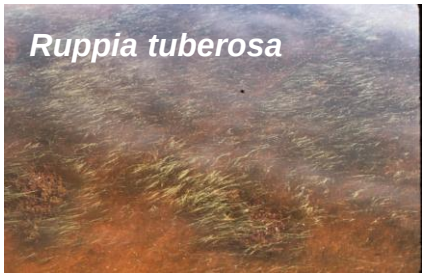

Dredges kept the mouth open

e Albert
MENINGIE

Fish

Macroinvertebrates

Submerged Vegetation



North Lagoon

150ppt

South Lagoon

Natural: 80ppt

>200ppt

Response to ecological change?

Curlew Sandpiper

\–

Fairy Tern

\–

Banded Stilt

\+

Common Greenshank

\–

Fairy Tern

Coorong South Lagoon

Data source: D.Paton Adelaide Uni

Banded Stilt

Coorong South Lagoon

Data source: D.Paton Adelaide Uni

Response to ecological change?

Curlew Sandpiper

\–

Fairy Tern

\–

Banded Stilt

\+

Common Greenshank

\–

Conceptual Modelling

- Relationships between ecological components
- Visual
- Drivers of change
- Management levers

Small-mouthed Hardyhead

Fairy Tern

Fairy Tern Chick

Model species that are representative of a functional group of birds

Wading birds

Reed-dependent

Herbivores

Piscivores

Shorebirds

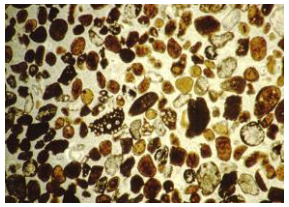
Sharp-tailed Sandpiper

Sharp-tailed Sandpiper

Bathymetry Water Levels

Water Depth

Macroalgal Blooms



Sediment Grain Size

Salinity

Amphipod + Polychaete Prey

Freshwater Chironomid

Saline Chironomid

Submerged Veg

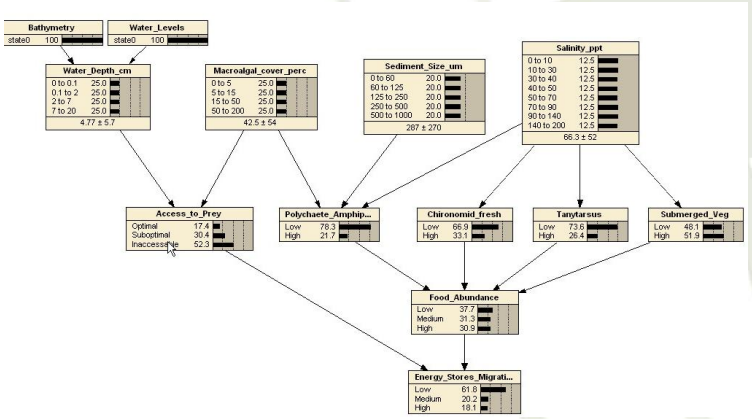
Access to Prey

Food Abundance

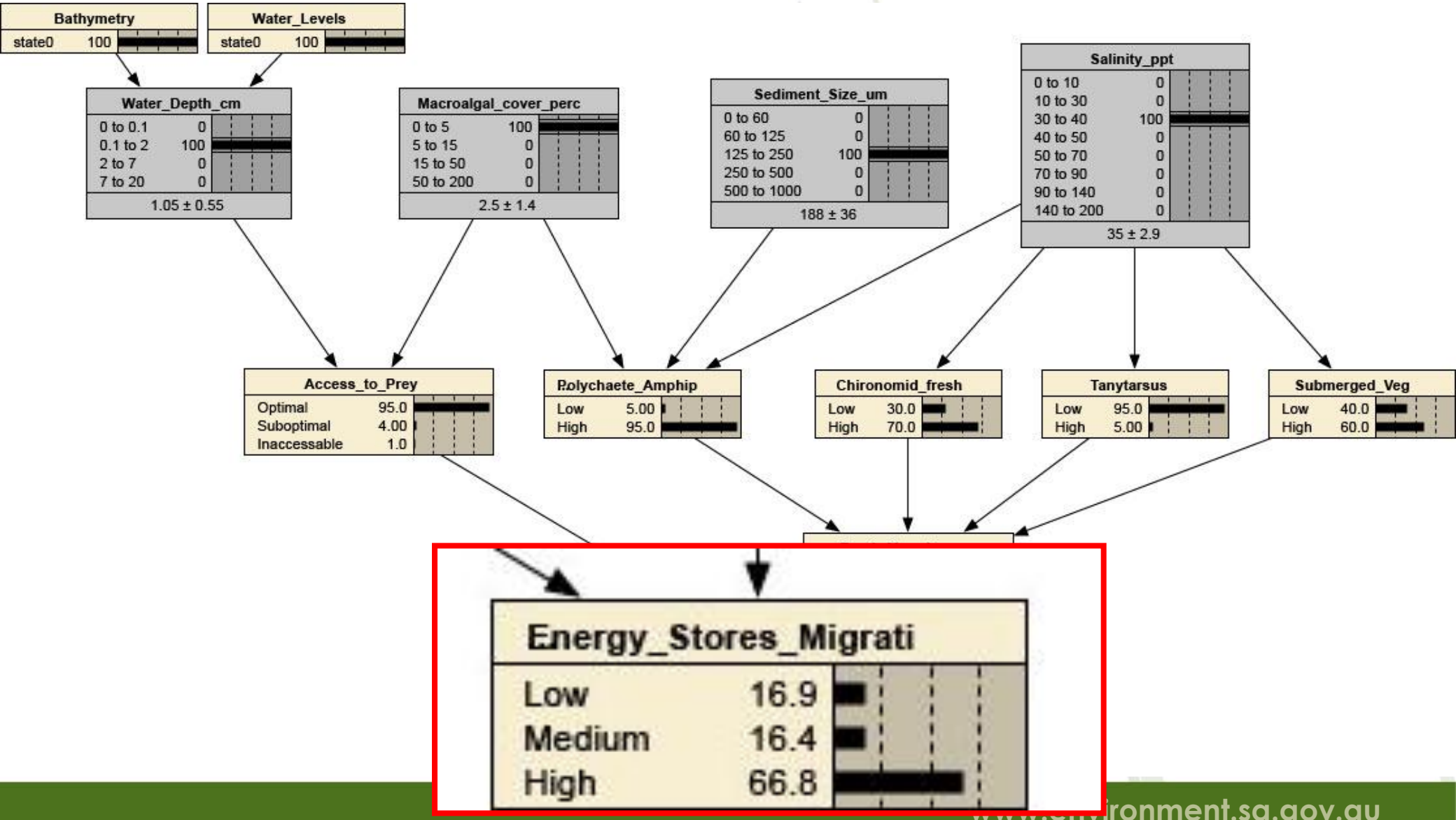
Adequate Energy Stores

Bayesian Models

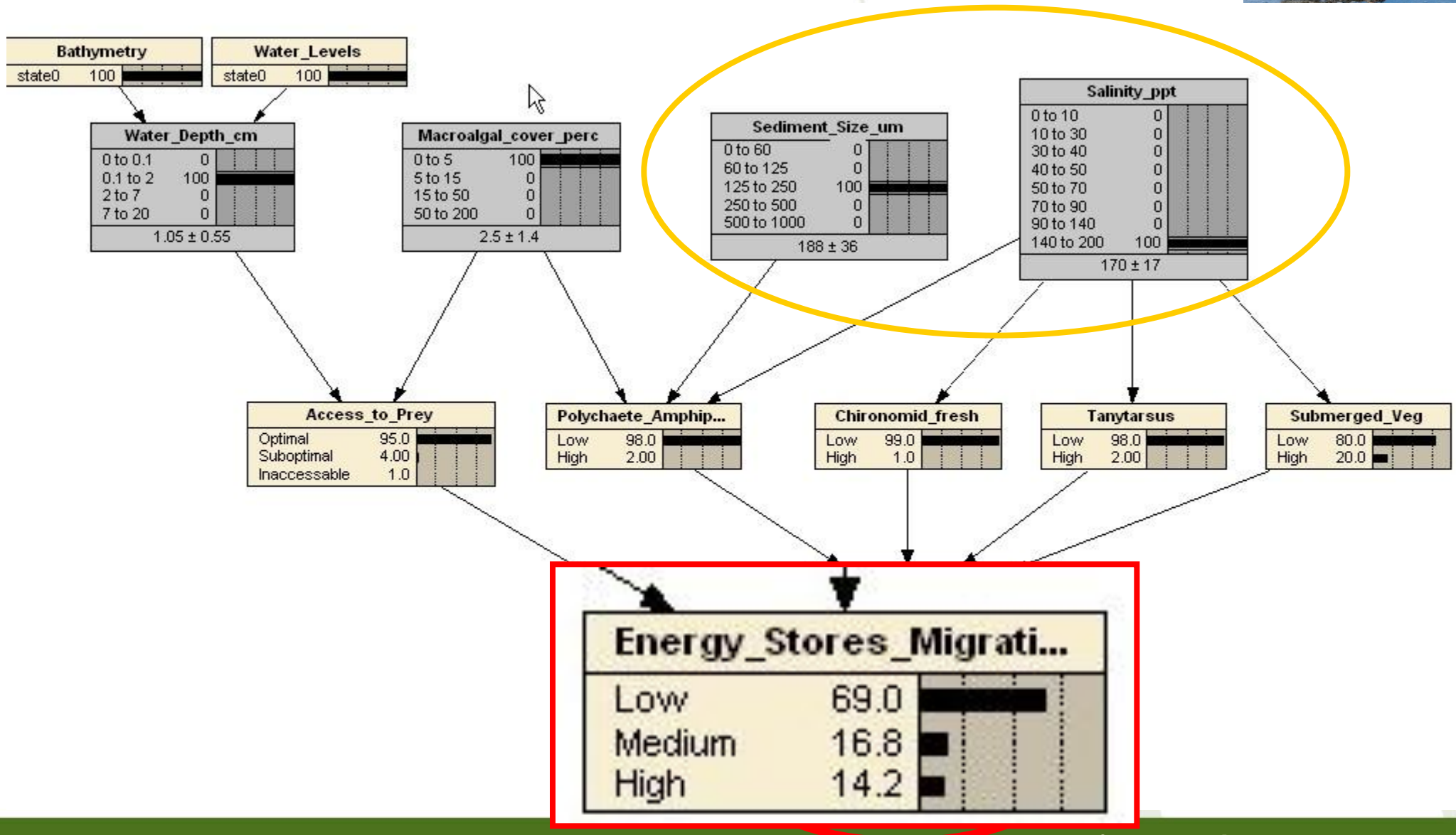
- **Bayesian Belief Network (Netica)**
  - Quantify relationships
  - Monitoring data + expert opinion
    - *Elicitation of expert knowledge*
  - Incorporate new data + update predictions



Sharp-tailed Sandpiper- "Ideal"

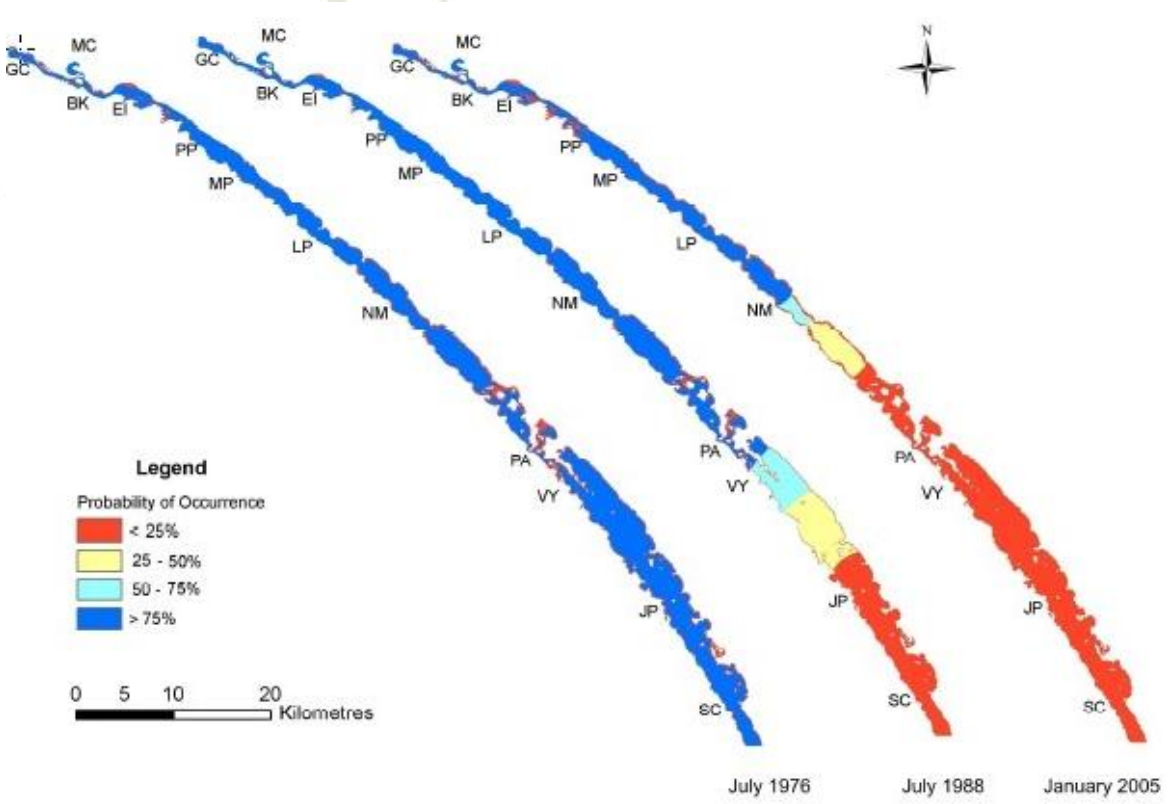


Sharp-tailed Sandpiper- "Adverse"



Next Steps

- **Spatial data**
- **Test models**
  - Collect data
  - Predicted/actual



Habitat predictions for Yelloweye mullet: Coorong
Source: CLAMMecology final report 2009

Outcomes

- **Mechanistic understanding**
- **Knowledge gaps**
  - Inform monitoring programs
- **Ability to make predictions**
  - Identify triggers for intervention (managers)
    - *When intervene + response*
  - Complement hydrological models

Government of South Australia

Department of Environment and Natural Resources

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8 Experts

Workshop

High level local experience in bird ecology (current)

- 4 experts 3-10 years
- 4 experts 11-36 years

Qualifications

- Postgraduate (4), Undergraduate with honours (2)

Statistical knowledge

- Non existent to advanced understanding + some modelling

Elicitation protocol

1 week before workshop

- Preliminary briefing

22 Questions

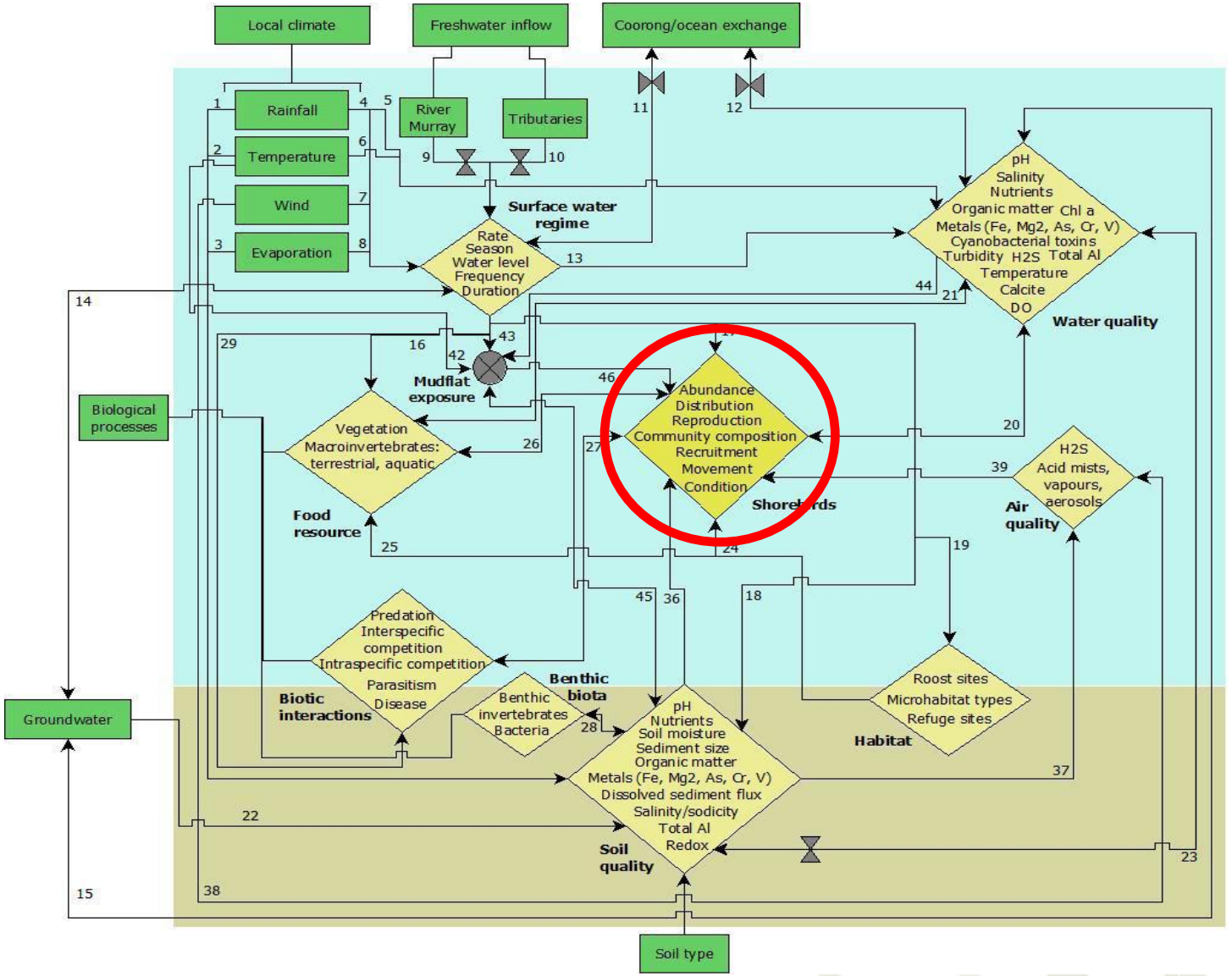
Probabilities, natural frequencies and quantities

Format:

- Realistically, what is the lowest the value could be?
- What is the highest the value could be?
- What is your best guess (the most likely value)?
- How confident are you that the interval you provided contains the truth (give a value between 50% and 100%)?

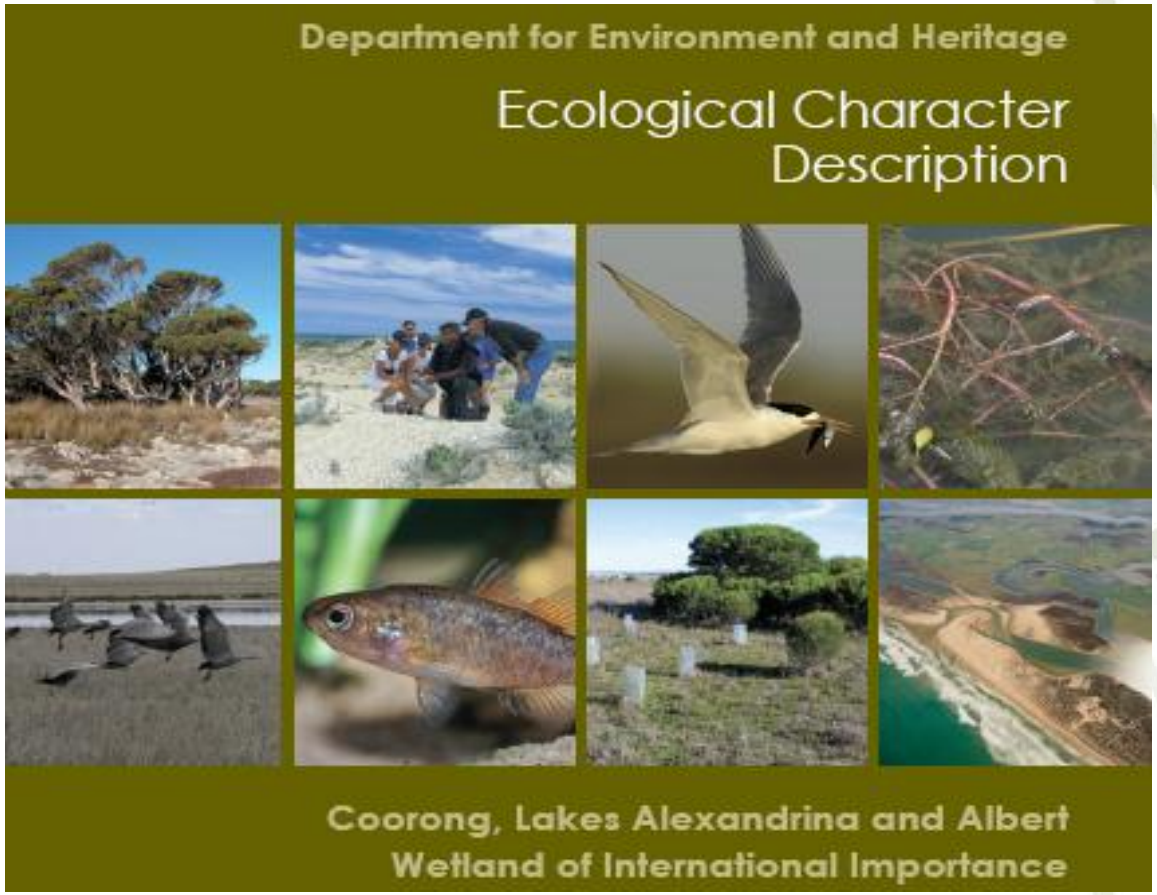
(adapted from Burgman et al. 2011).

Generalist shorebird models

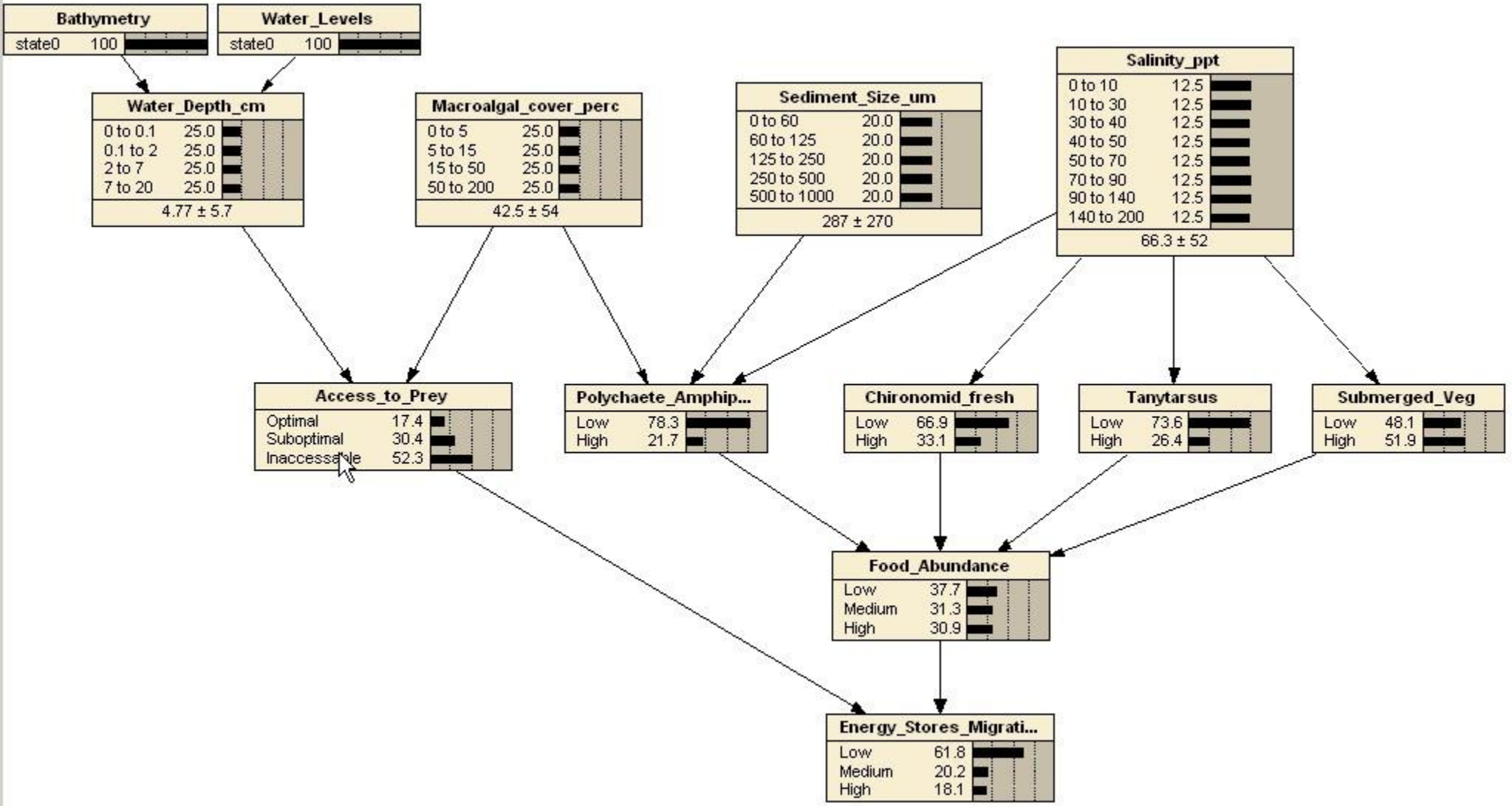


Souter NJ and Stead M, 2010, Lower Lakes seawater risk assessment conceptual models. EcoKnowledge report to the Department of Environment and Natural Resources.

Limits of Acceptable Change



Sharp-tailed Sandpiper model



Common Greenshank

Consider that there are 100 fairy tern nests within 1km of a sufficient food source

- What is the lowest number of nests that could be predated by avian predators under these conditions?
- What is the highest number of nests that could be predated by avian predators under these conditions?
- What is your best estimate (most likely value) of the number of Fairy Tern nests that would be predated by avian predators?
- How confident are you that this interval captures the truth (between 50% (as likely as not) and 100% (absolute certainty))?

Better management

- **Tools to predict impacts of environmental change for waterbirds**

Fairy Tern

- Sensitive to environmental change
- Depend on CLLMM wetland habitats
- Good response data

2007

2010

Fairy Tern- Draft Conceptual Model

Sharp-tailed Sandpiper

box + arrow conceptual model