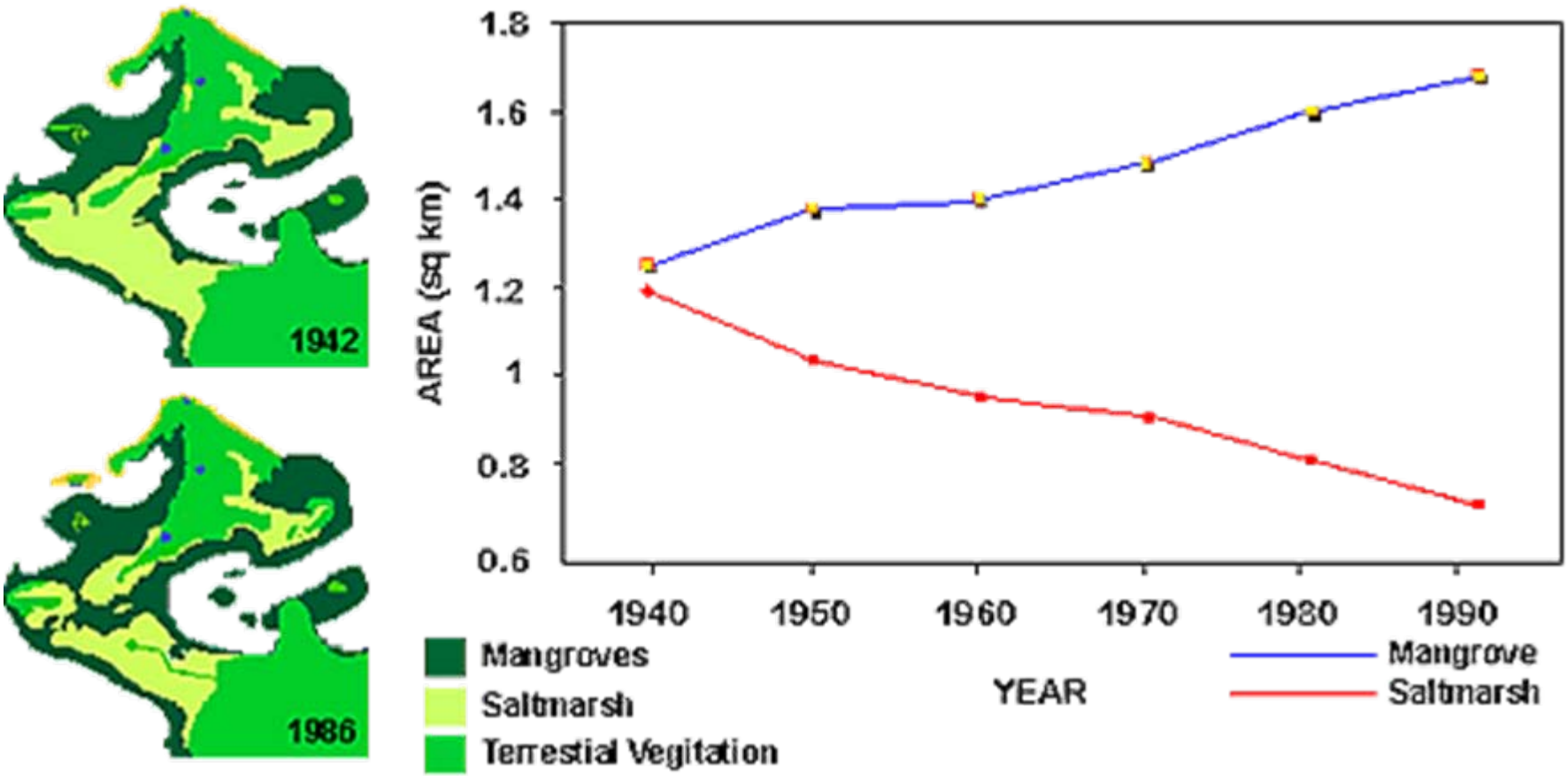
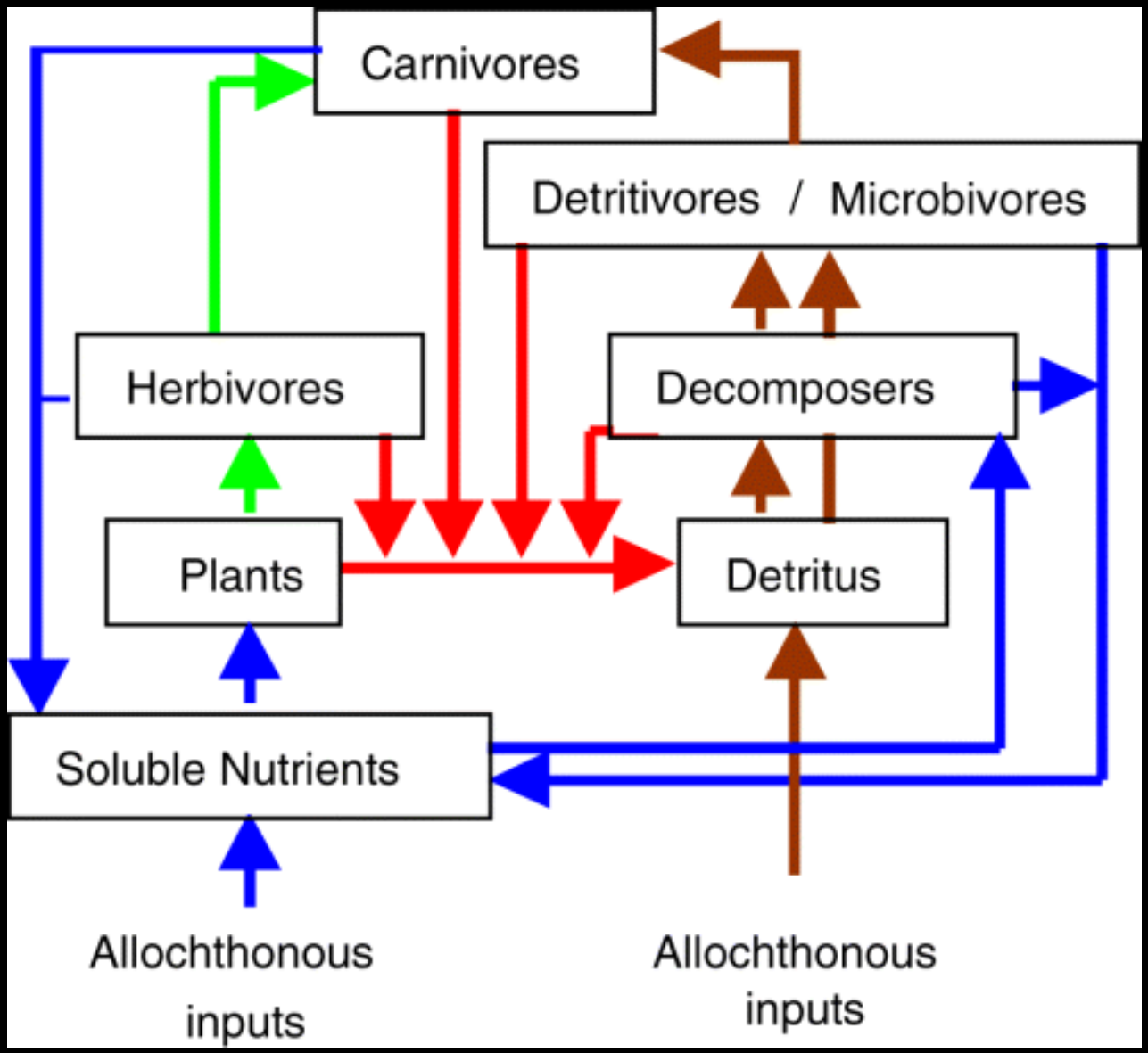
# Compositional changes in aquatic macrophytes propagate through detrital food-webs

Melanie J. Bishop
Brendan P. Kelaher

Australian Government
Australian Research Council
UNIVERSITY OF TECHNOLOGY SYDNEY
THE HERMON SLADE FOUNDATION
MACQUARIE UNIVERSITY ~ SYDNEY




Mitchell & Adam 1989


Carnivores
Detritivores / Microbivores
Herbivores
Decomposers
Plants
Detritus
Soluble Nutrients
Allochthonous inputs
Allochthonous inputs


$\neq$

# Effects of species identity

Fast-growing Macroalgae

≠

Seagrass

Low fiber

Low C:N, C:P

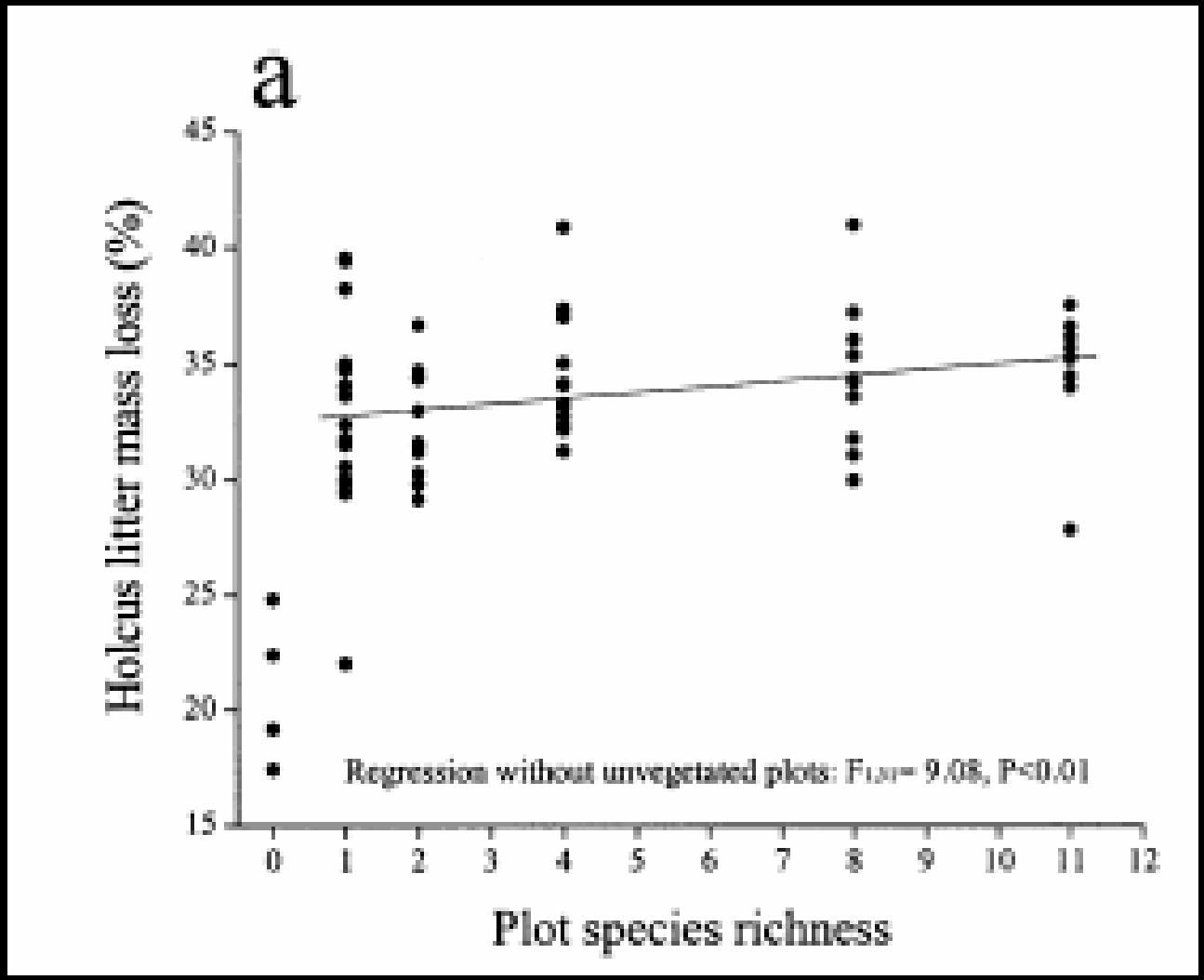
High fiber

High C:N, C:P

RAPID DECOMPOSITION

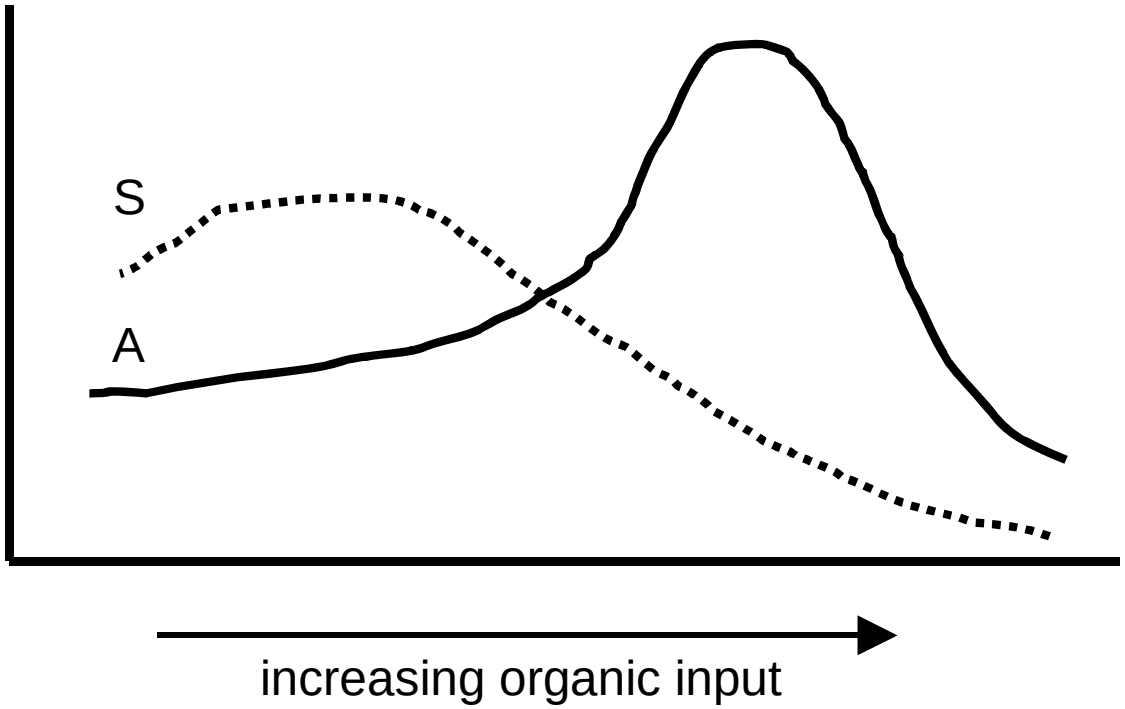
SLOW DECOMPOSITION

# Effects of species richness

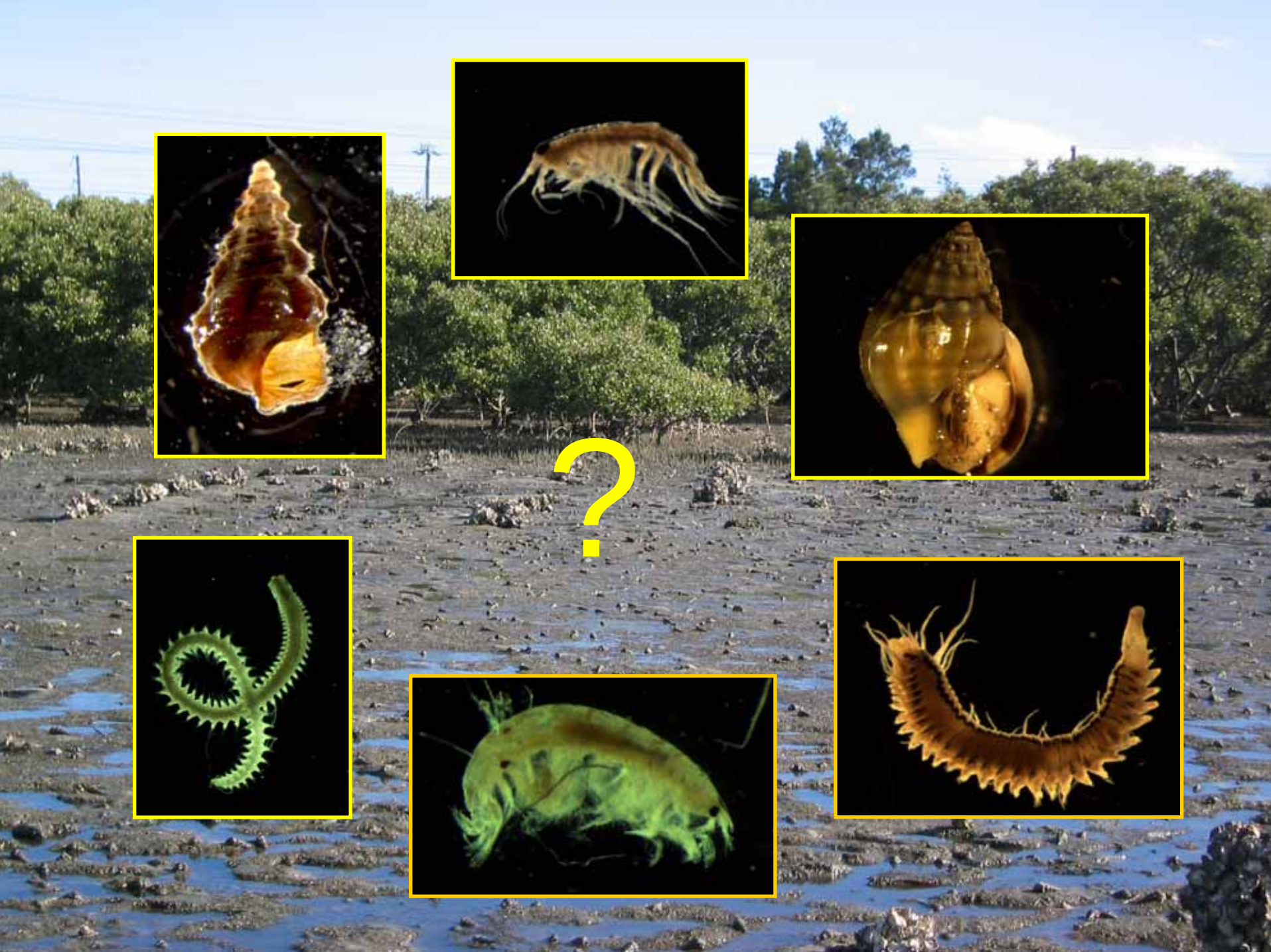



Hector et al. 2000

# Effects of detrital quantity




Pearson-Rosenberg (1978) model of organic enrichment




Sydney


S


A


P




*Sargassum* sp.

C:N ratio: 13.14 ± [1 S.E.] 0.24

Polyphloroglucinol phenolics


*Sargassum* sp.

C:N ratio: 13.14 ± [1 S.E.] 0.24

Polyphloroglucinol phenolics


*Avicennia marina*

C:N ratio: 23.04 ± 0.11

Rich in tannins


*Sargassum* sp.

C:N ratio: 13.14 ± [1 S.E.] 0.24

Polyphloroglucinol phenolics


*Avicennia marina*

C:N ratio: 23.04 ± 0.11

Rich in tannins


*Posidonia australis*

C:N ratio: 26.30 ± 0.06

# Mixing and Identity

| Sp. richness | Composition | Dry weight (g) |
|---|---|---|
| 0 | | 0 |
| 1 | A | 30 |
| 1 | P | 30 |
| 1 | S | 30 |
| 2 | A + P | 60 |
| 2 | P + S | 60 |
| 2 | A + S | 60 |
| 3 | A + P + S | 90 |

$n = 7$

# Mixing and Identity

| Sp. richness | Composition | Dry weight (g) |
|---|---|---|
| 0 | | 0 |
| 1 | A | 30 |
| 1 | P | 30 |
| 1 | S | 30 |
| 2 | A + P | 60 |
| 2 | P + S | 60 |
| 2 | A + S | 60 |
| 3 | A + P + S | 90 |

$n = 7$

# Mixing and Identity

| Sp. richness | Composition | Dry weight (g) |
|---|---|---|
| 0 | | 0 |
| 1 | A | 30 |
| 1 | P | 30 |
| 1 | S | 30 |
| 2 | A + P | 60 |
| 2 | P + S | 60 |
| 2 | A + S | 60 |
| 3 | A + P + S | 90 |

$n = 7$

# Mixing and Identity

| Sp. richness | Composition | Dry weight (g) |
|---|---|---|
| 0 | | 0 |
| 1 | A | 30 |
| 1 | P | 30 |
| 1 | S | 30 |
| 2 | A + P | 60 |
| 2 | P + S | 60 |
| 2 | A + S | 60 |
| 3 | A + P + S | 90 |

$n = 7$

# Biomass compensation

| Sp. richness | Composition | Dry weight (g) |
|---|---|---|
| 1 | A | 30 |
| 1 | P | 30 |
| 1 | S | 30 |
| 1 | A | 60 |
| 1 | P | 60 |
| 1 | S | 60 |
| 2 | A + P | 30 |
| 2 | P + S | 30 |
| 2 | A + S | 30 |
| 2 | A + P | 60 |
| 2 | P + S | 60 |
| 2 | A + S | 60 |

$n = 7$

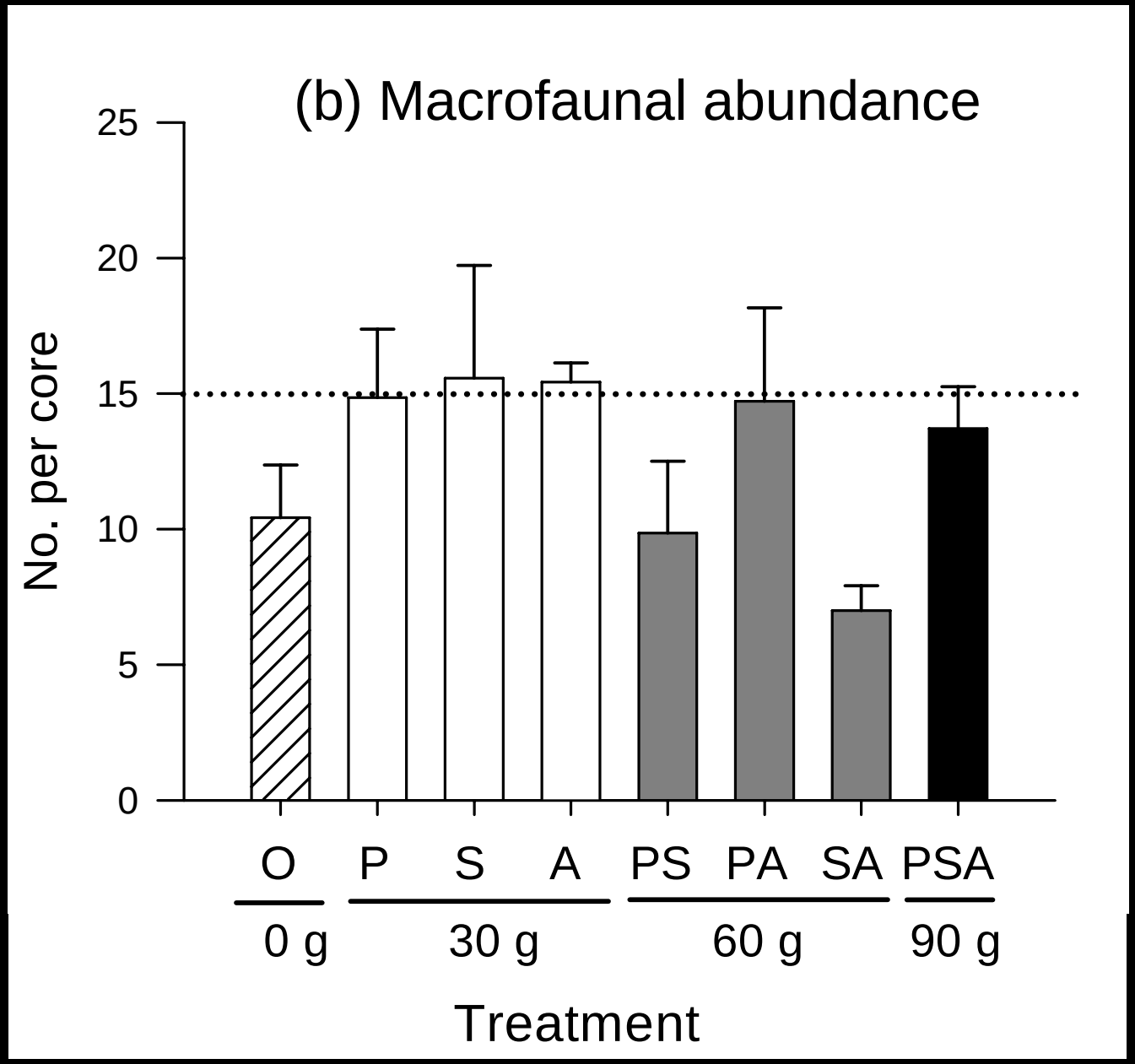
# Biomass compensation

| Sp. richness | Composition | Dry weight (g) |
|---|---|---|
| 1 | A | 30 |
| 1 | P | 30 |
| 1 | S | 30 |
| 1 | A | 60 |
| 1 | P | 60 |
| 1 | S | 60 |
| 2 | A + P | 30 |
| 2 | P + S | 30 |
| 2 | A + S | 30 |
| 2 | A + P | 60 |
| 2 | P + S | 60 |
| 2 | A + S | 60 |

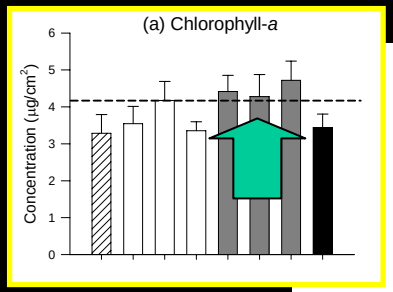
$n = 7$

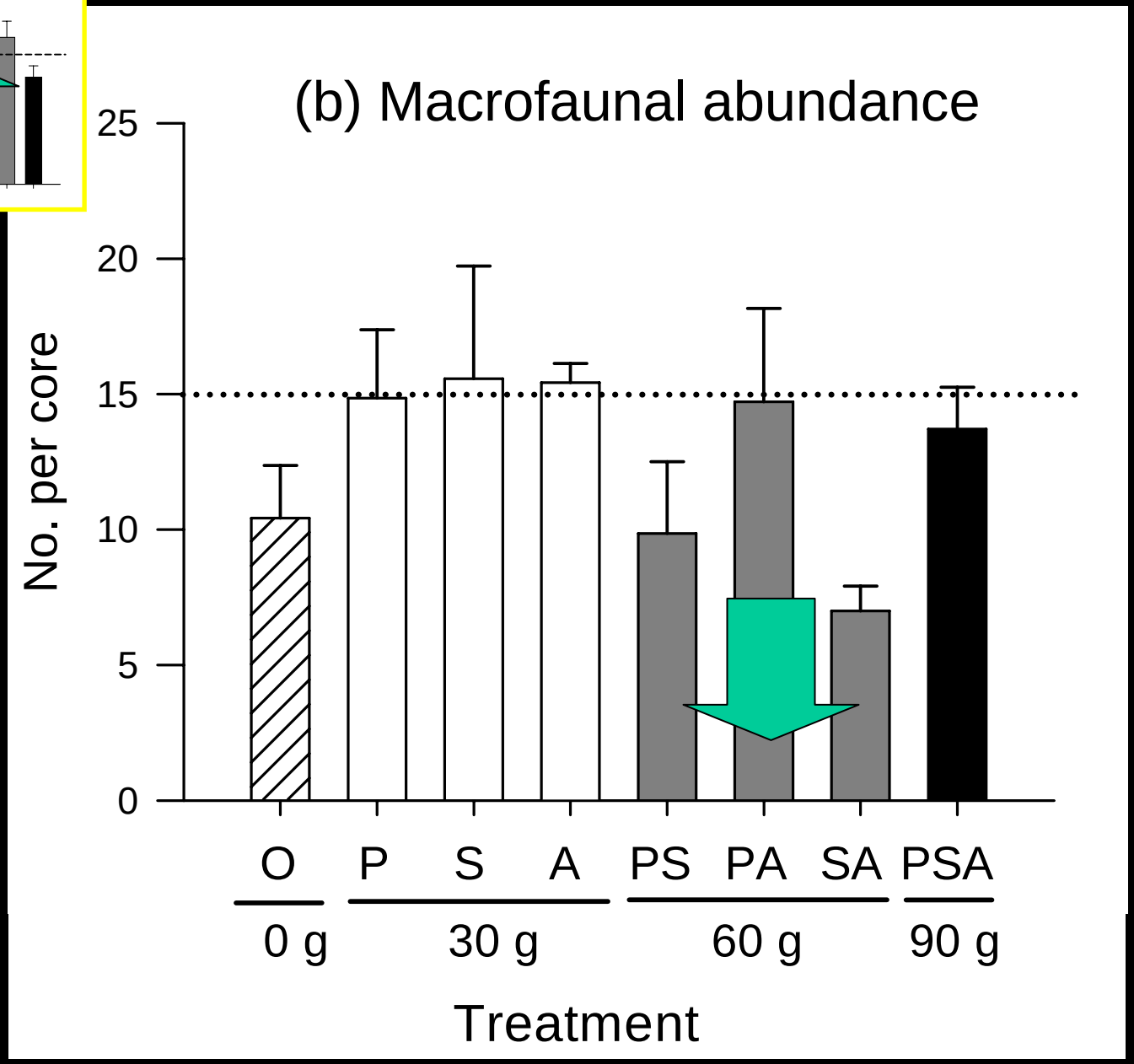
Experiment run for 3 mo

Sampled Chl *a*, macrobenthic community structure

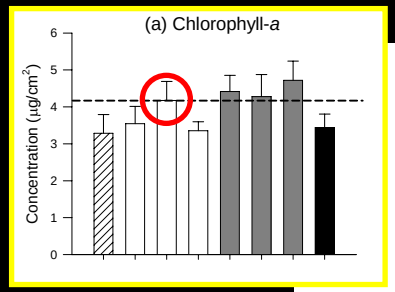


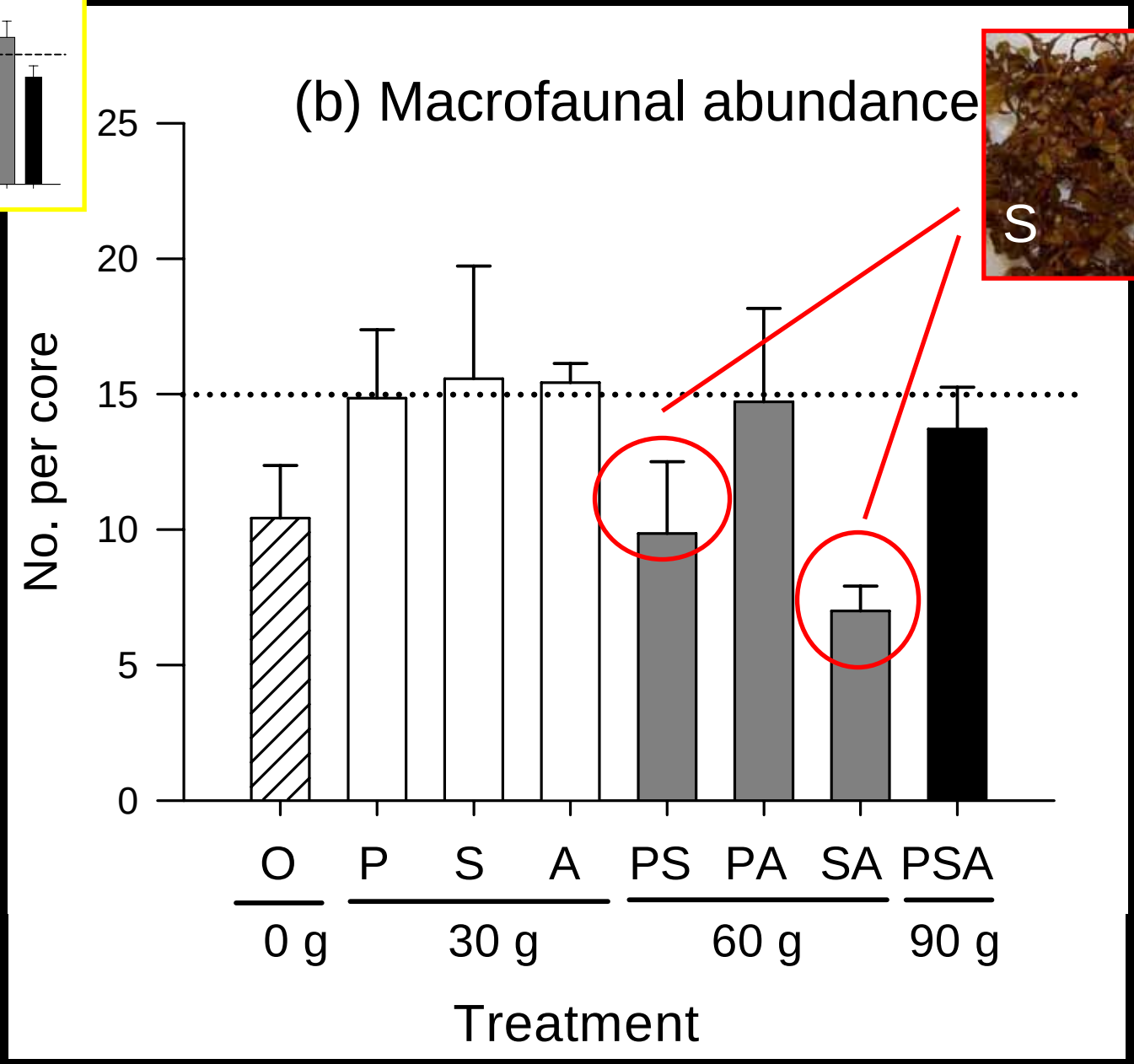

Bishop & Kelaher (2008) Oikos



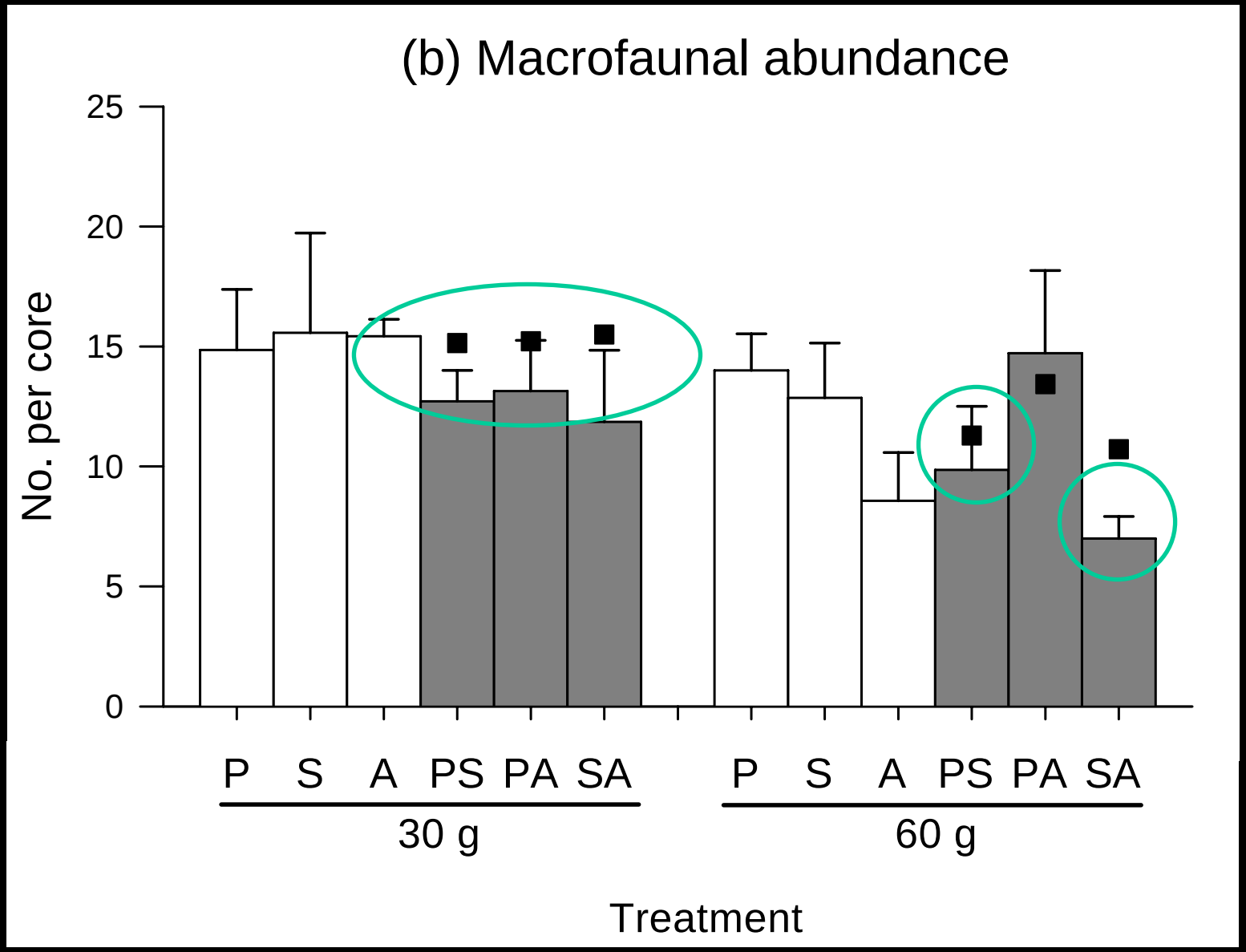

Bishop & Kelaher (2008) Oikos



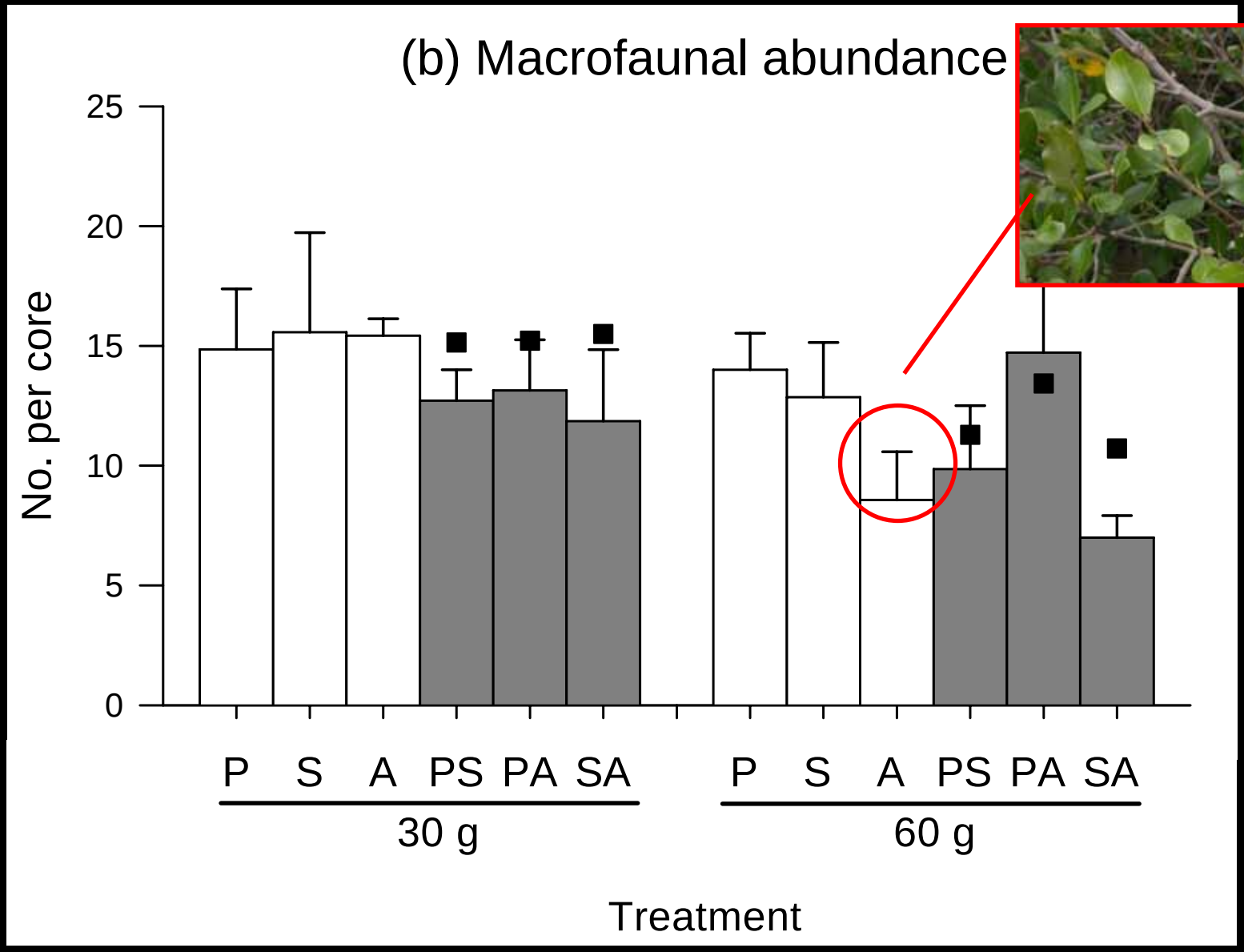





Bishop & Kelaher (2008) Oikos




Bishop & Kelaher (2008) Oikos




Bishop & Kelaher (2008) Oikos

# Macrofauna: summary

- Detrital sources not equivalent
  - -ve effects of *Avicennia* at high concentrations (tannins?)
  - Poor performance of mixtures with greater volume of *Sargassum* (speeds up decomposition?)

# Macrofauna: summary

- Detrital sources not equivalent
  - -ve effects of *Avicennia* at high concentrations (tannins?)
  - Poor performance of mixtures with greater volume of *Sargassum* (speeds up decomposition?)
- Non-additive effects of detrital mixing
  - Antagonistic effects of mixing 2 species
    - Releases top-down pressure on microphytobenthos?
  - 3-species mix performed poorly

Changes in the species composition of primary producers will have large implications for detrital food webs.

Because detrital mixing leads to non-additive effects, implications will not be easily predictable without further empirical study.