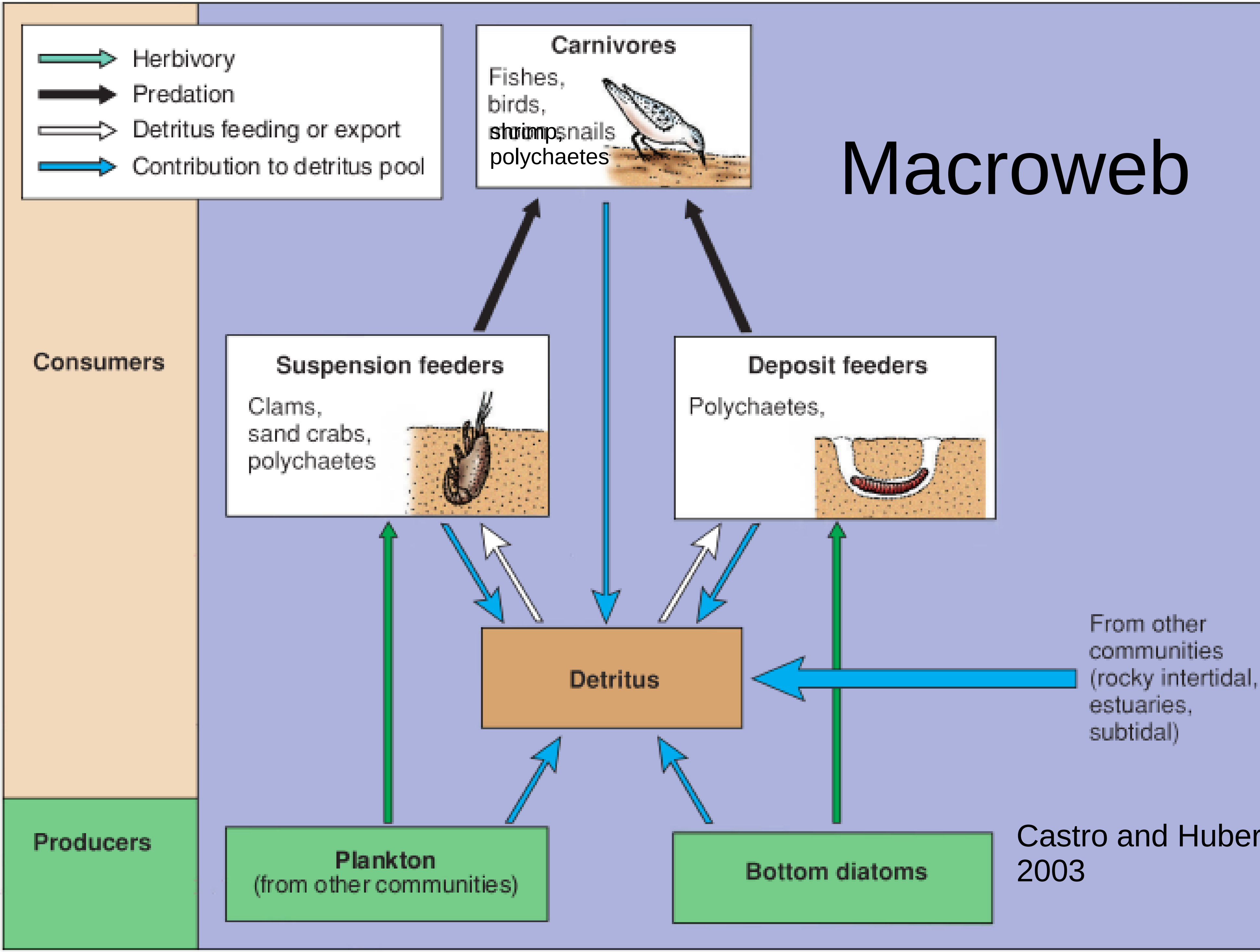
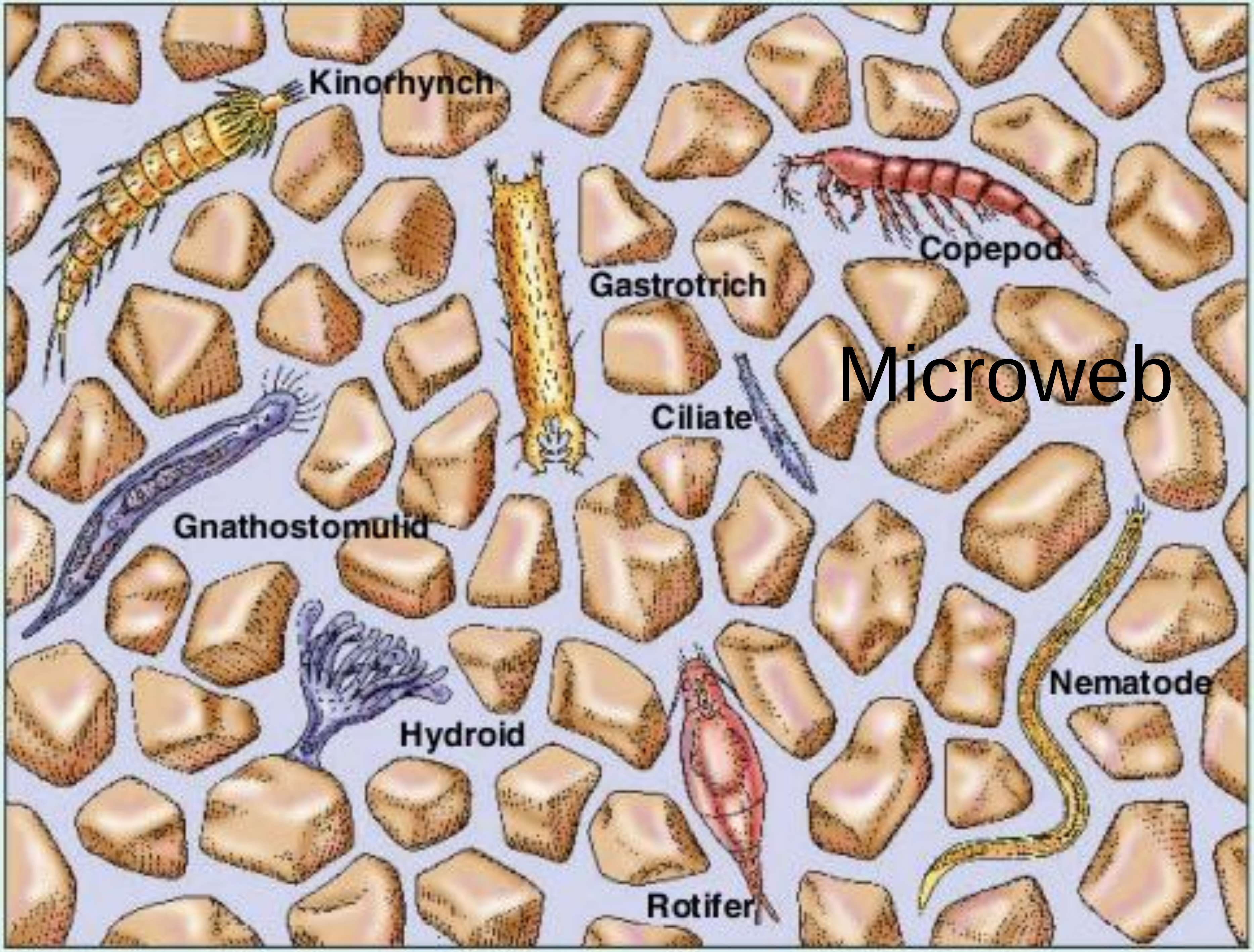
- What is sand?
- Where does it come from?
- Waves and wave energy
- How global climate change will influence waves and wave transport
- Dune types and formation
- Natural dune communities
- Introduced beachgrass and influence on beach and dunes
- Surf zone and sand dwelling organisms and food web
- Snowy plover biology
- Oregon beach law
- Field trip

Macroweb

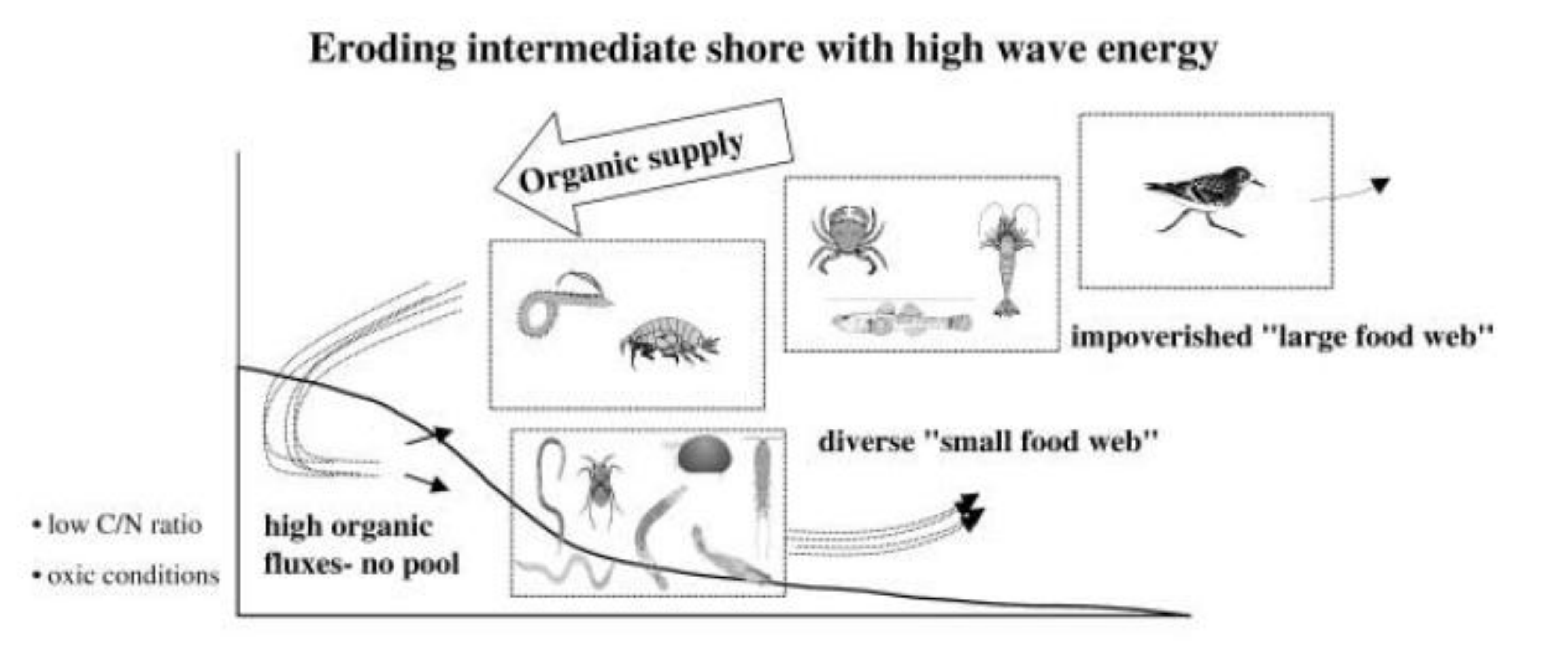


Castro and Huber, 2003

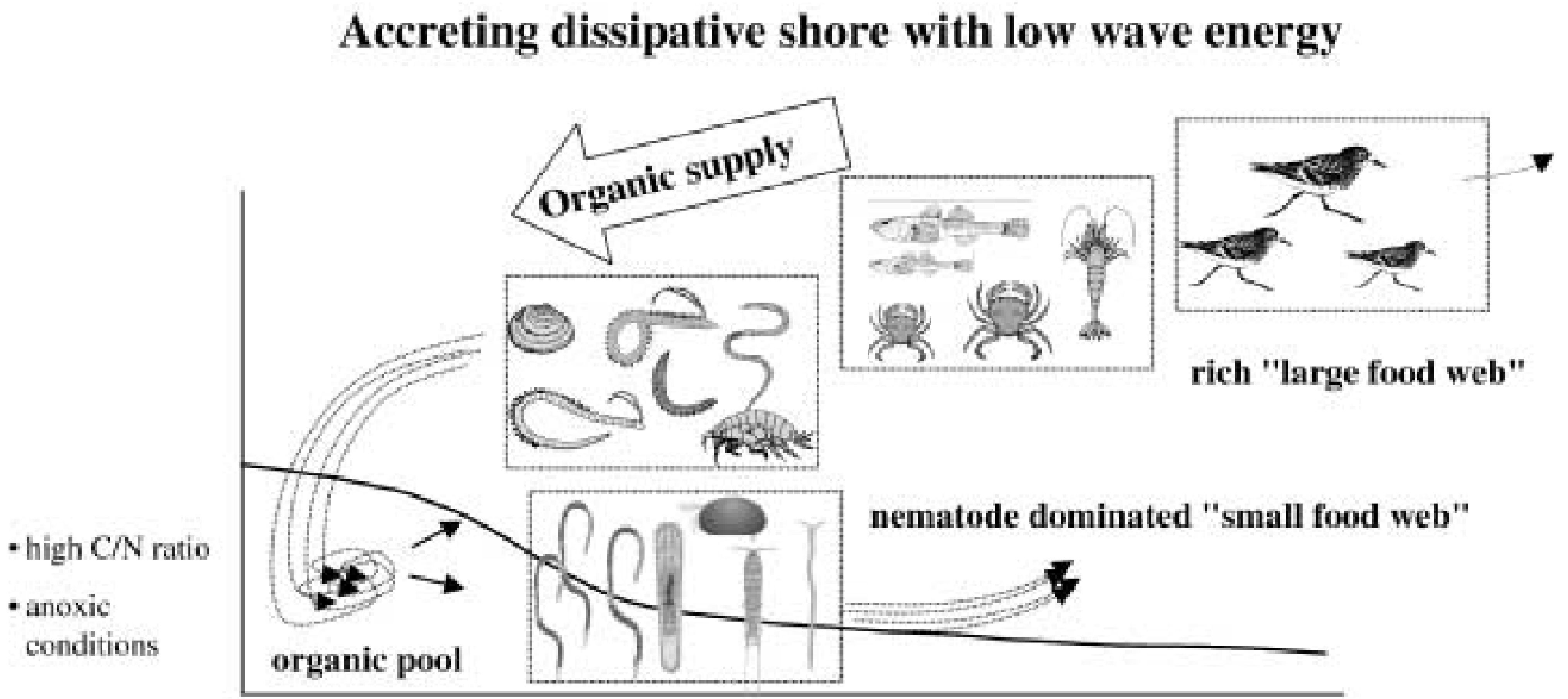


Examples of the meiofauna in sand.

Castro and Huber, 2003


Eroding intermediate shore with high wave energy
Organic supply
impoverished "large food web"
diverse "small food web"
• low C/N ratio
• oxic conditions
high organic
fluxes- no pool

Menn, 2002


Accreting dissipative shore with low wave energy
Organic supply
rich "large food web"
nematode dominated "small food web"
• high C/N ratio
• anoxic conditions
organic pool

Menn, 2002

Mclachlan, 1990

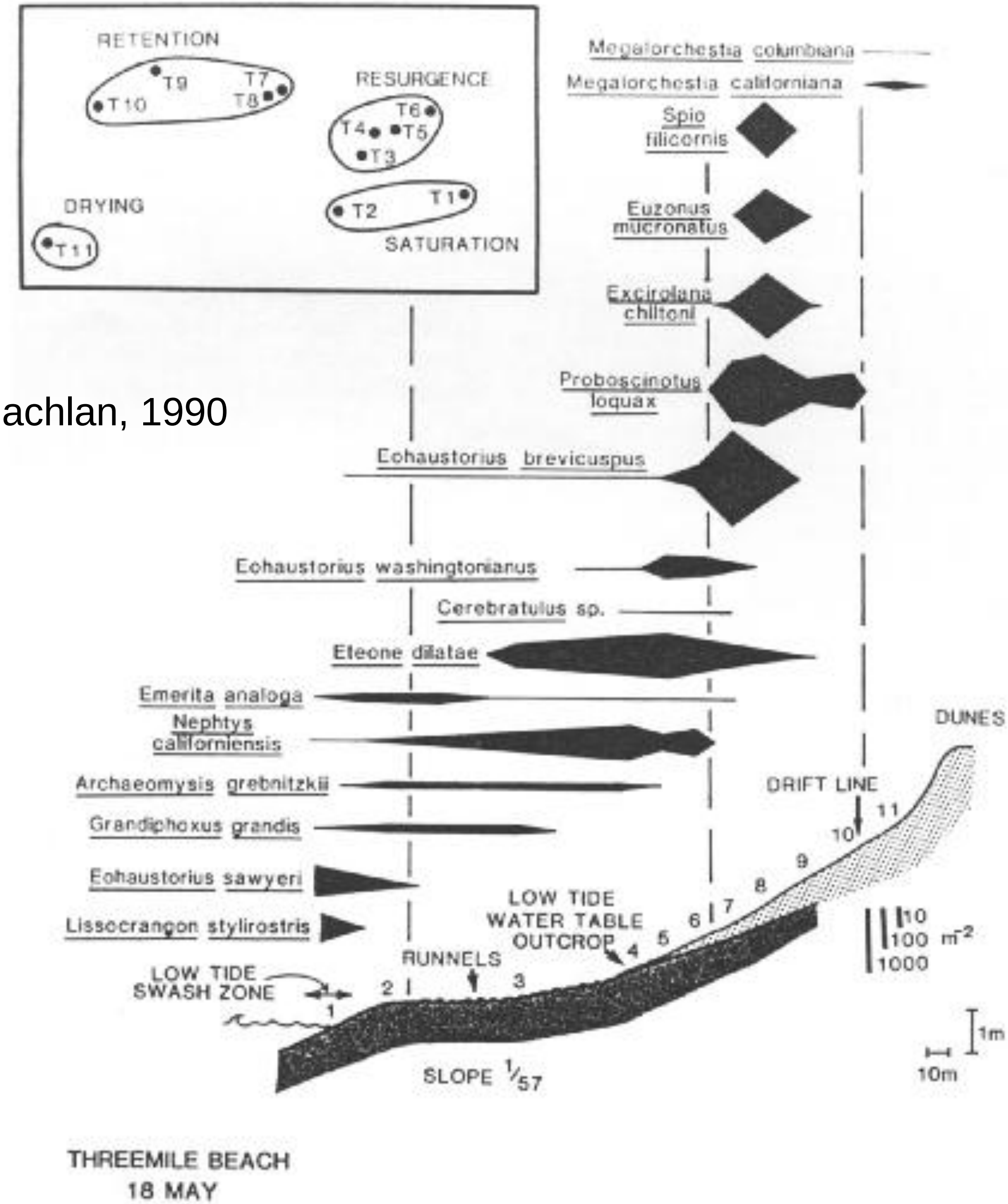
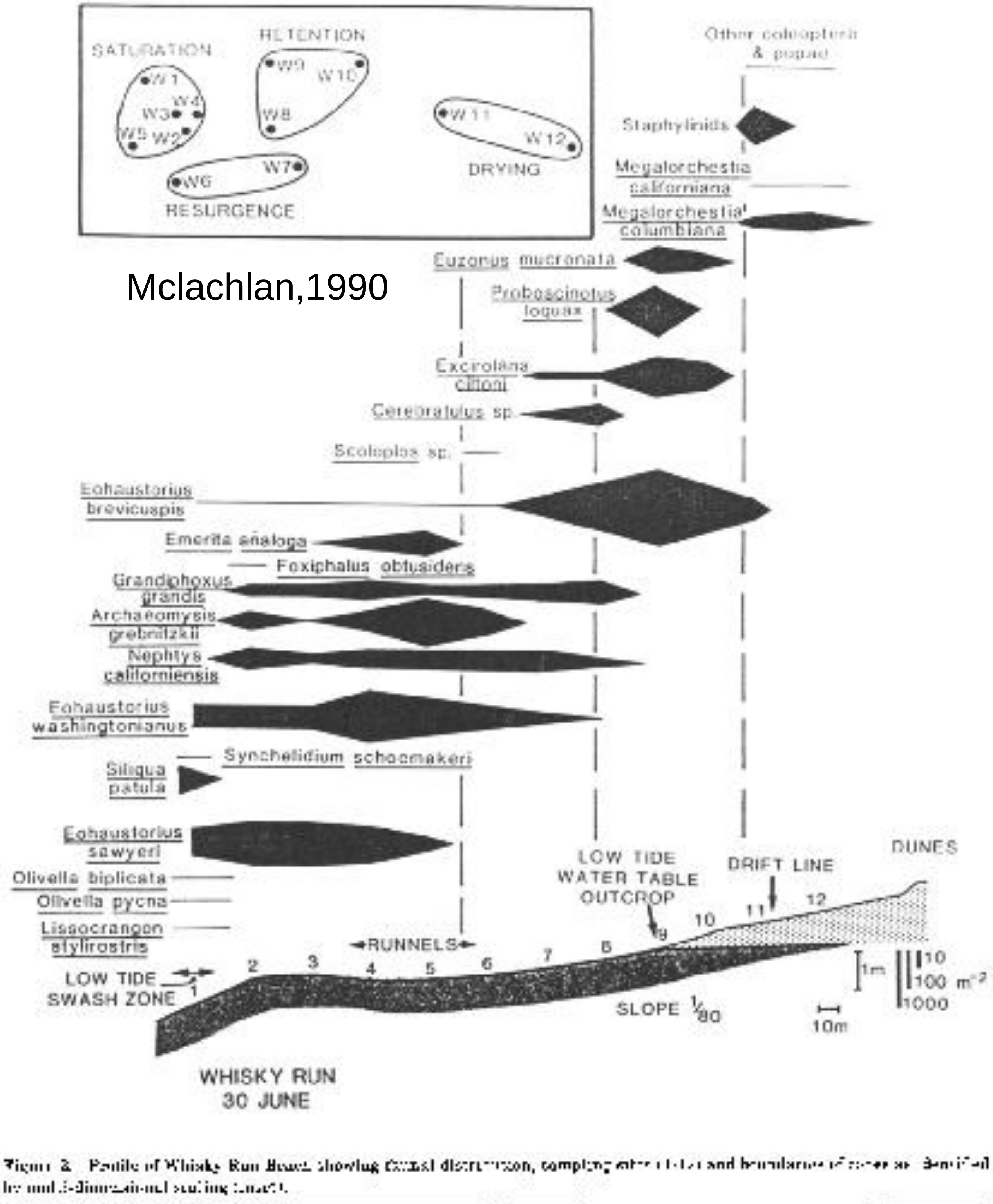


Figure 1. Profile of Threemile Beach showing faunal distribution, sampling sites (1-11) and boundaries of zones as identified by multi dimensional scaling (inset)



Mclachlan,1990

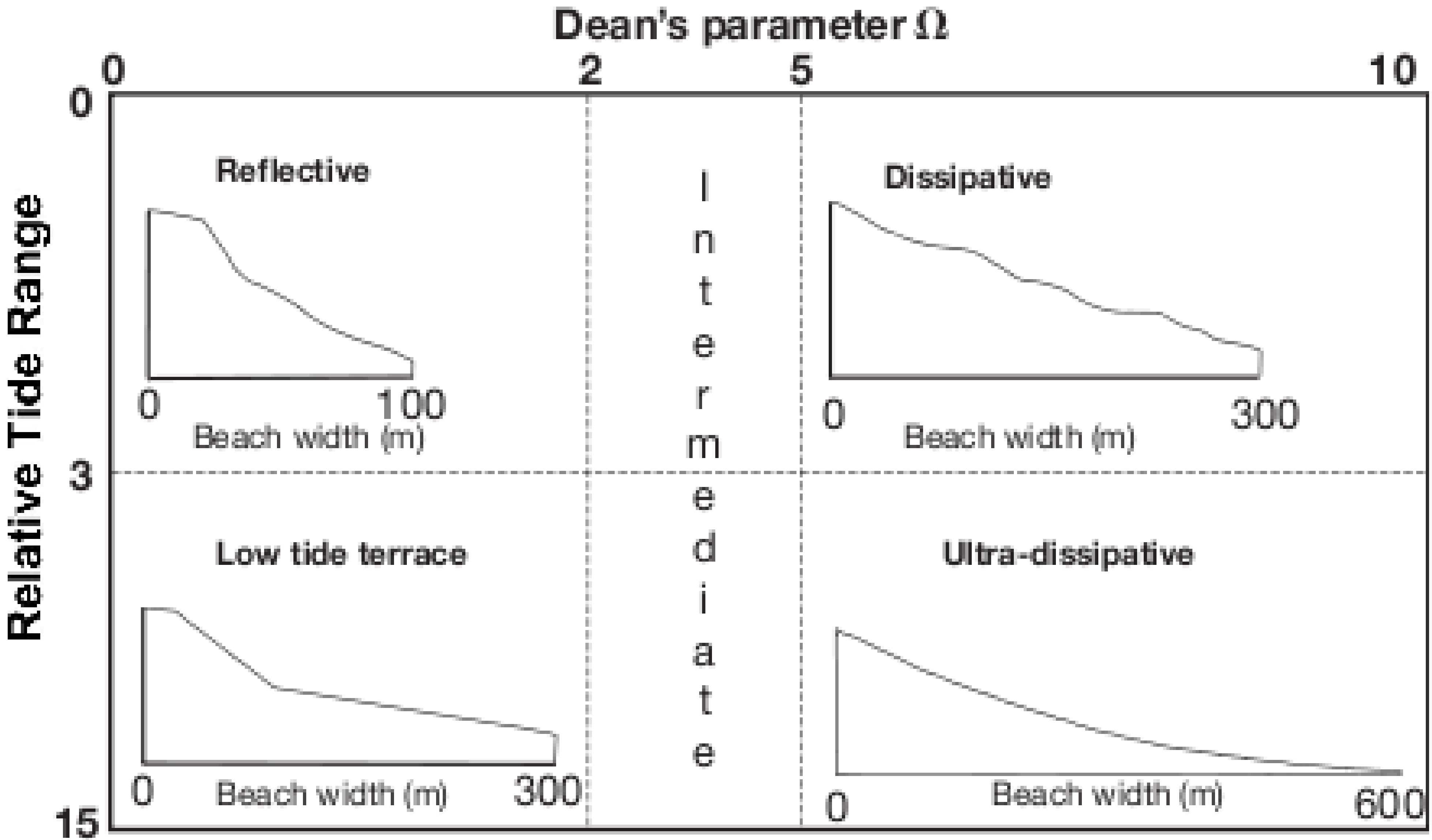


Fig. 1. Beach classification based on 2 composite indices developed for sandy shores: Dean's parameter (Ω) and the Relative Tide Range. Dissipative, intermediate and reflective domains are defined for microtidal open beaches where tide range <2 m (after Short 1996)

$$\Omega = \frac{Hb}{Ws \cdot T}$$

$$BI = \log_{10}\left(\frac{Mz \cdot TR}{S}\right)$$

Beach Index

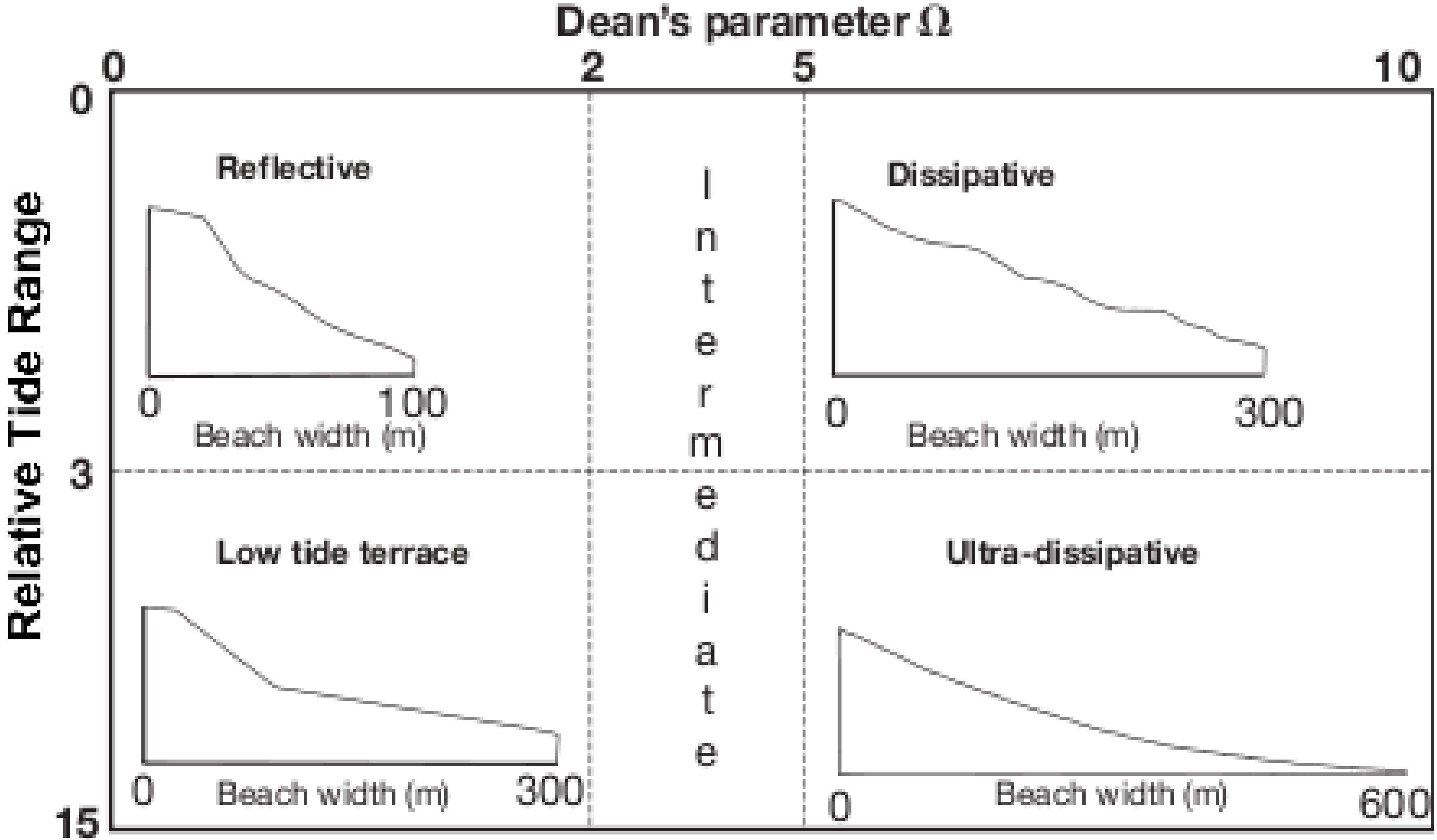
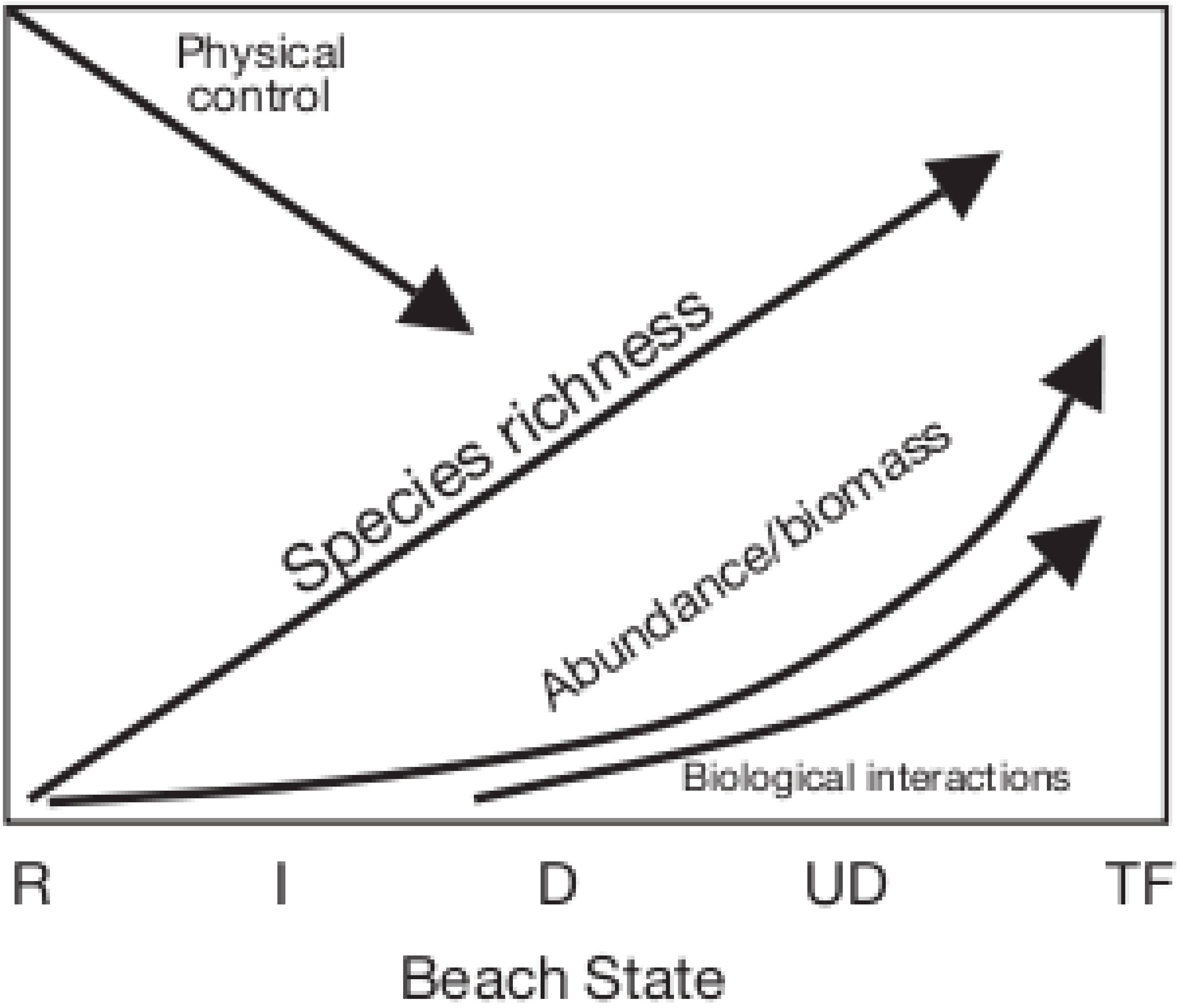


Fig. 1. Beach classification based on 2 composite indices developed for sandy shores: Dean's parameter (Ω) and the Relative Tide Range. Dissipative, intermediate and reflective domains are defined for microtidal open beaches where tide range <2 m (after Short 1996)


Physical control
Species richness
Abundance/biomass
Biological interactions
R
I
D
UD
TF
Beach State

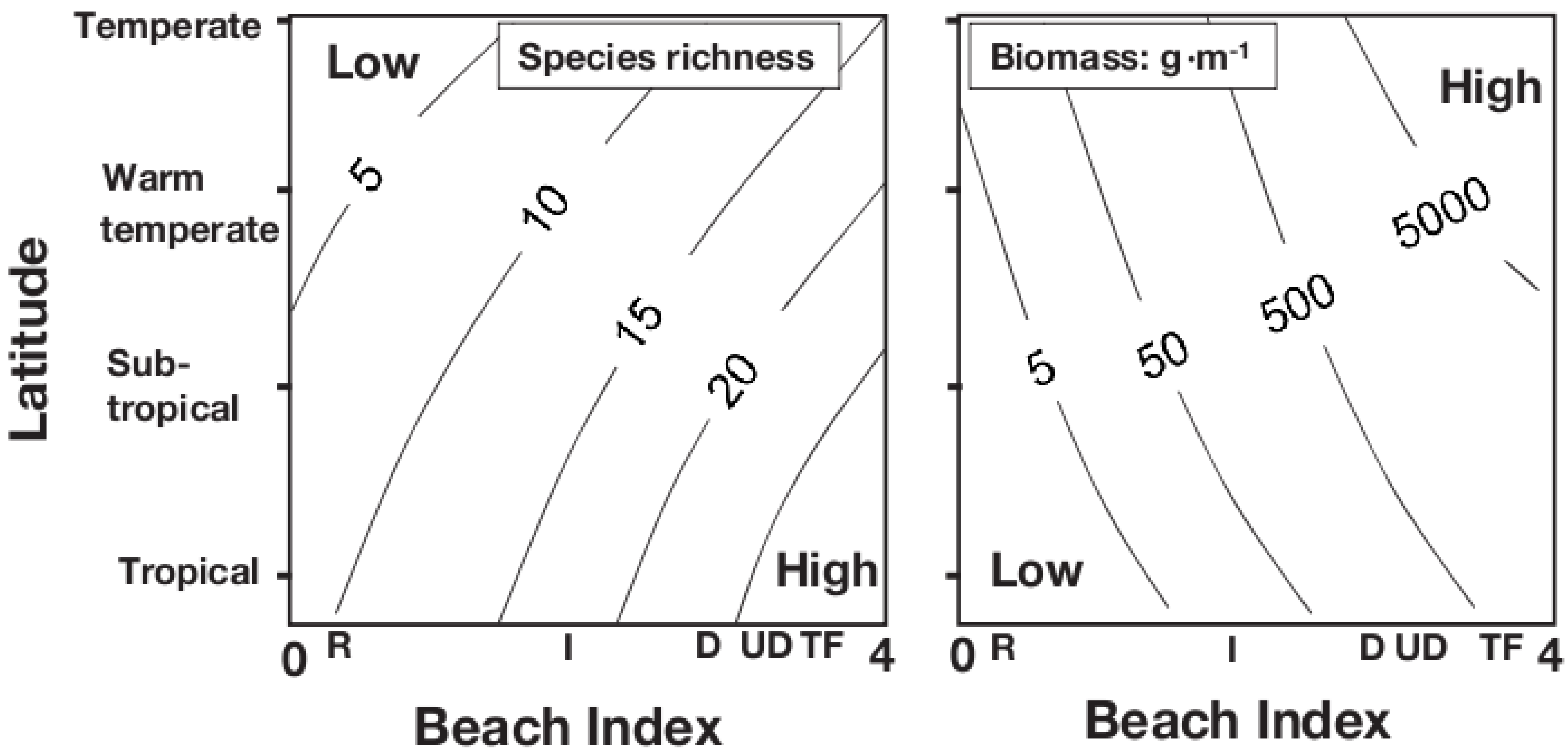


Fig. 2. Conceptual model of latitudinal variations in species richness (number of species per transect survey) and biomass (g m^{-1}) as a function of beach type, as categorized by the Beach Index. The number of species increases at low latitudes under conditions of (1) fine sands and flatter slopes, (2) benign swash climates, and (3) increasing tide range. Biomass is also highest towards tidal flats and increases from tropical to temperate sandy beaches (R = reflective, I = intermediate, D = dissipative, UD = ultradissipative, TF = tidal flat)

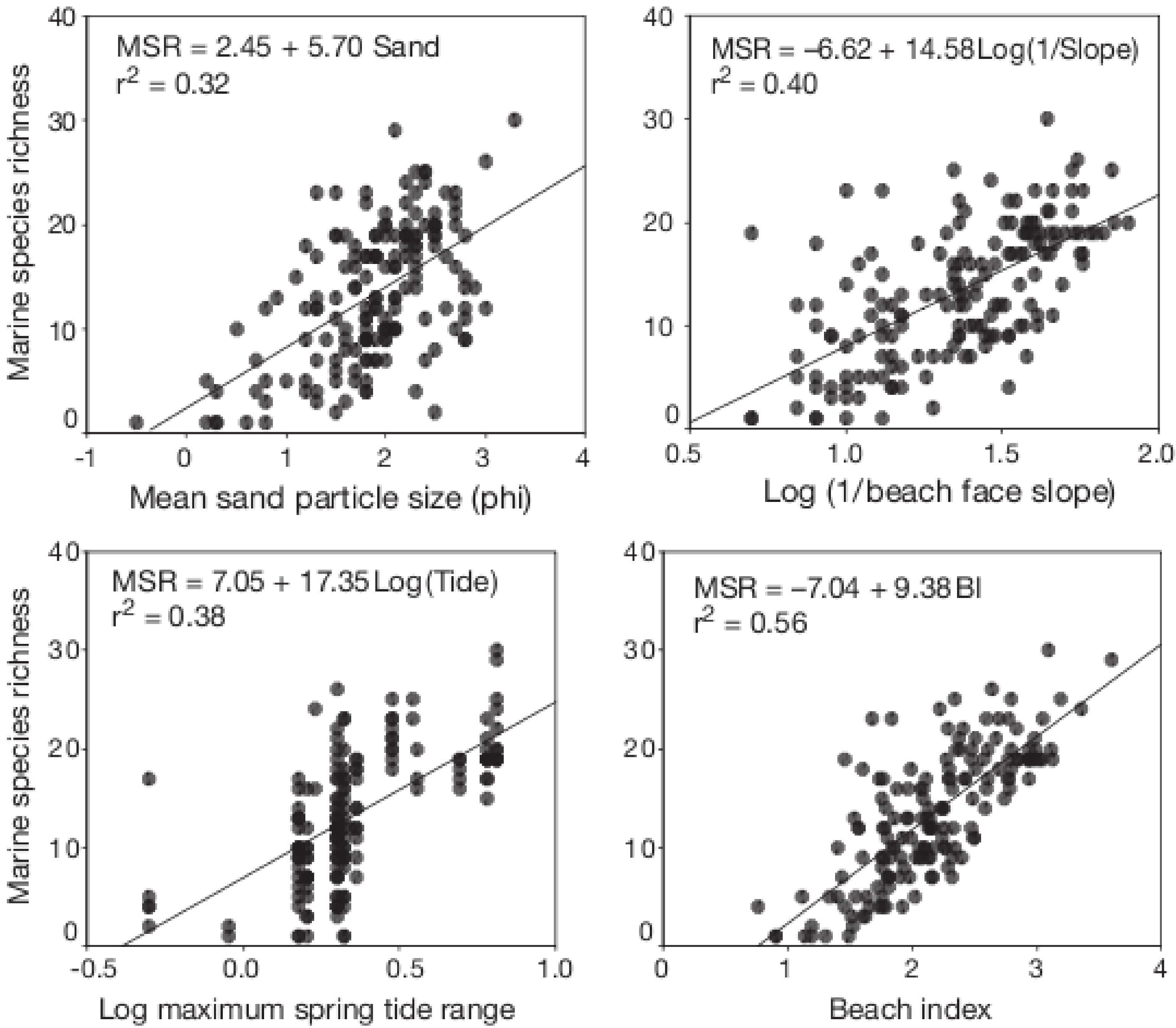
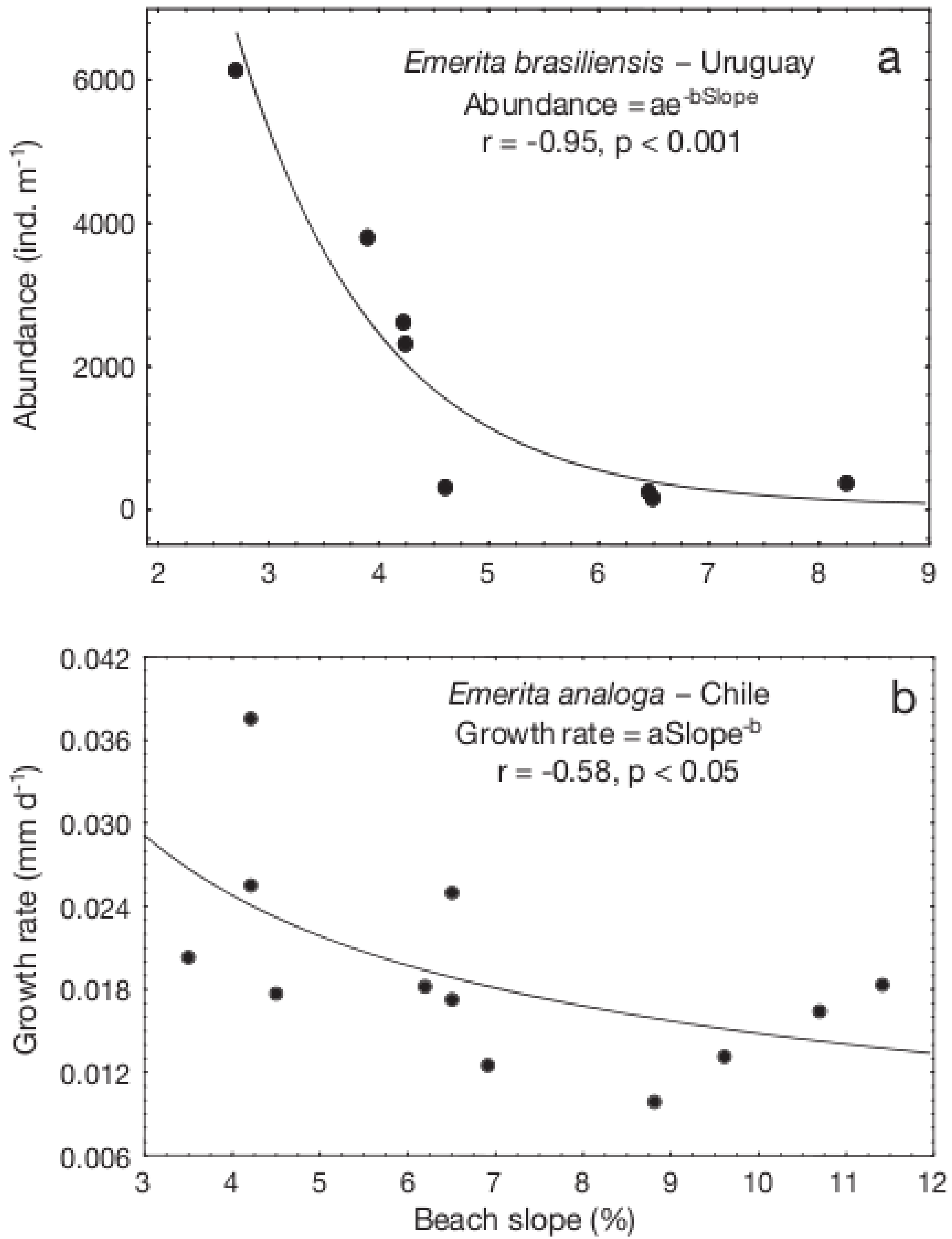


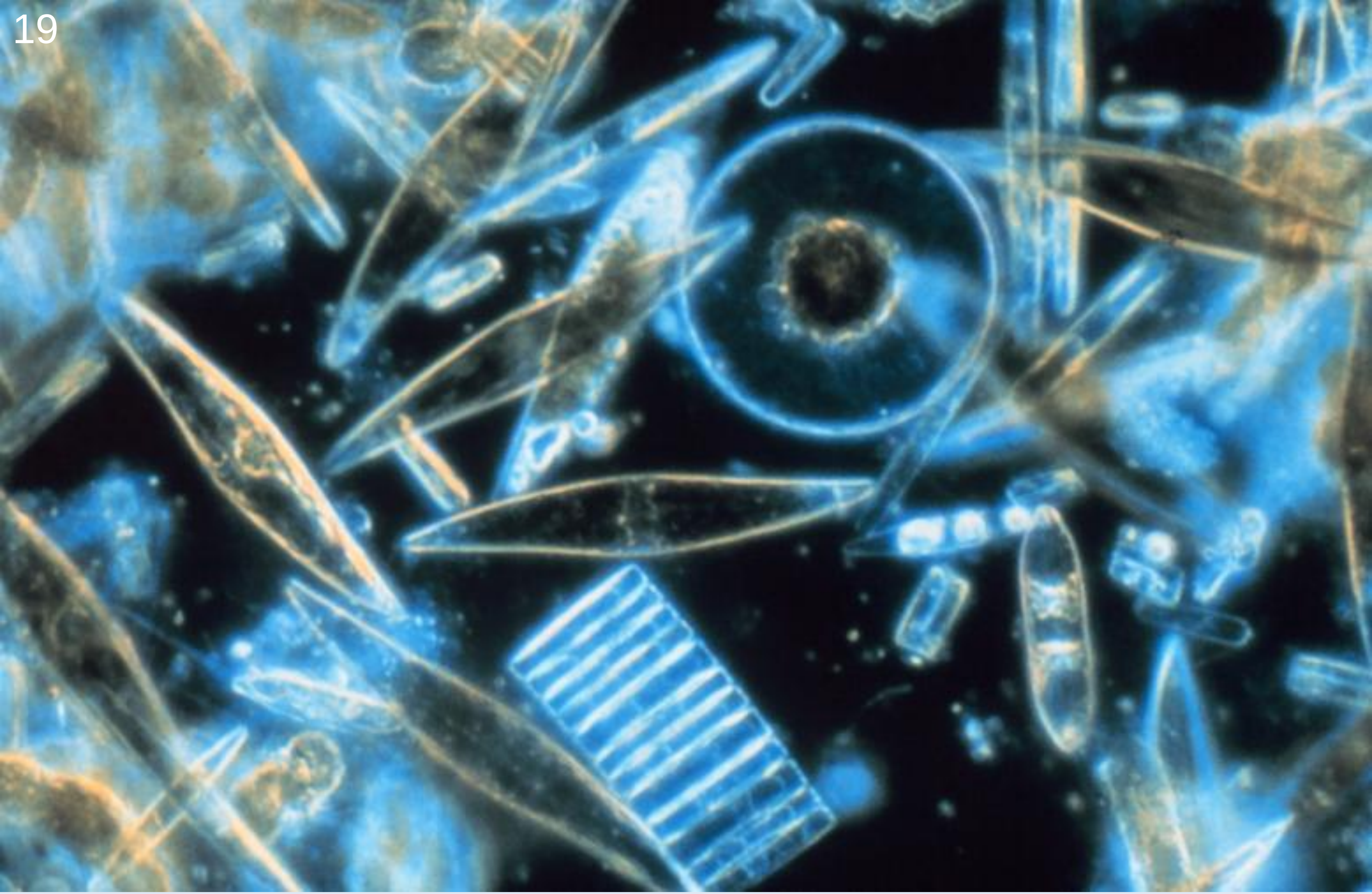
Fig. 3. Significant relationships ($p < 0.01$) between marine species richness, and sand particle size, beach face slope, tide range and the Beach Index (after McLachlan & Dorvlo 2005)



Emerita brasiliensis – Uruguay
Abundance = ae^-bSlope
r = -0.95, p < 0.001
a
Abundance (ind. m-1)
6000
4000
2000
0
2
3
4
5
6
7
8
9
Emerita analoga – Chile
Growth rate = aSlope^-b
r = -0.58, p < 0.05
b
Growth rate (mm d-1)
0.042
0.036
0.030
0.024
0.018
0.012
0.006
3
4
5
6
7
8
9
10
11
12
Beach slope (%)

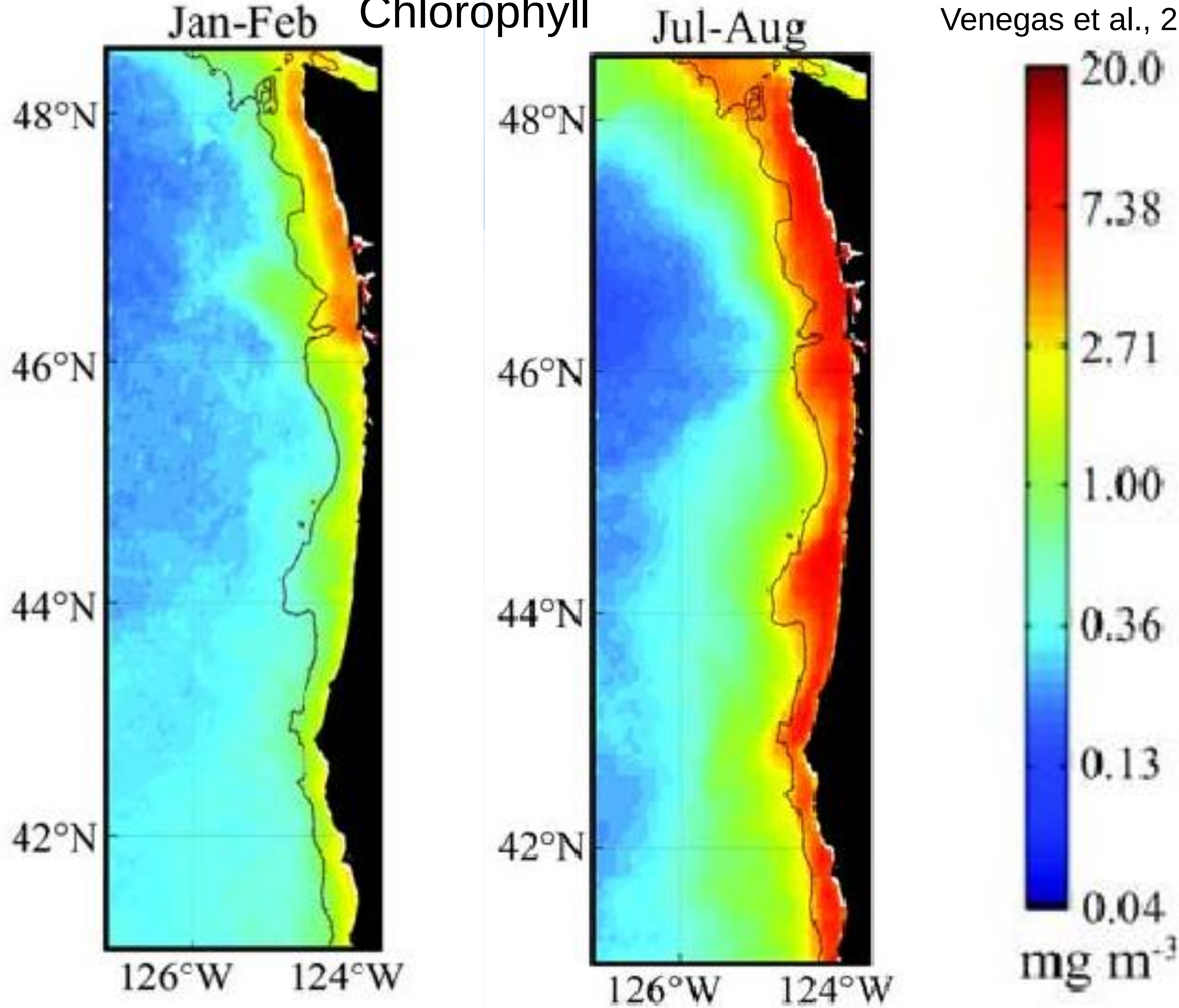
Food web: based on

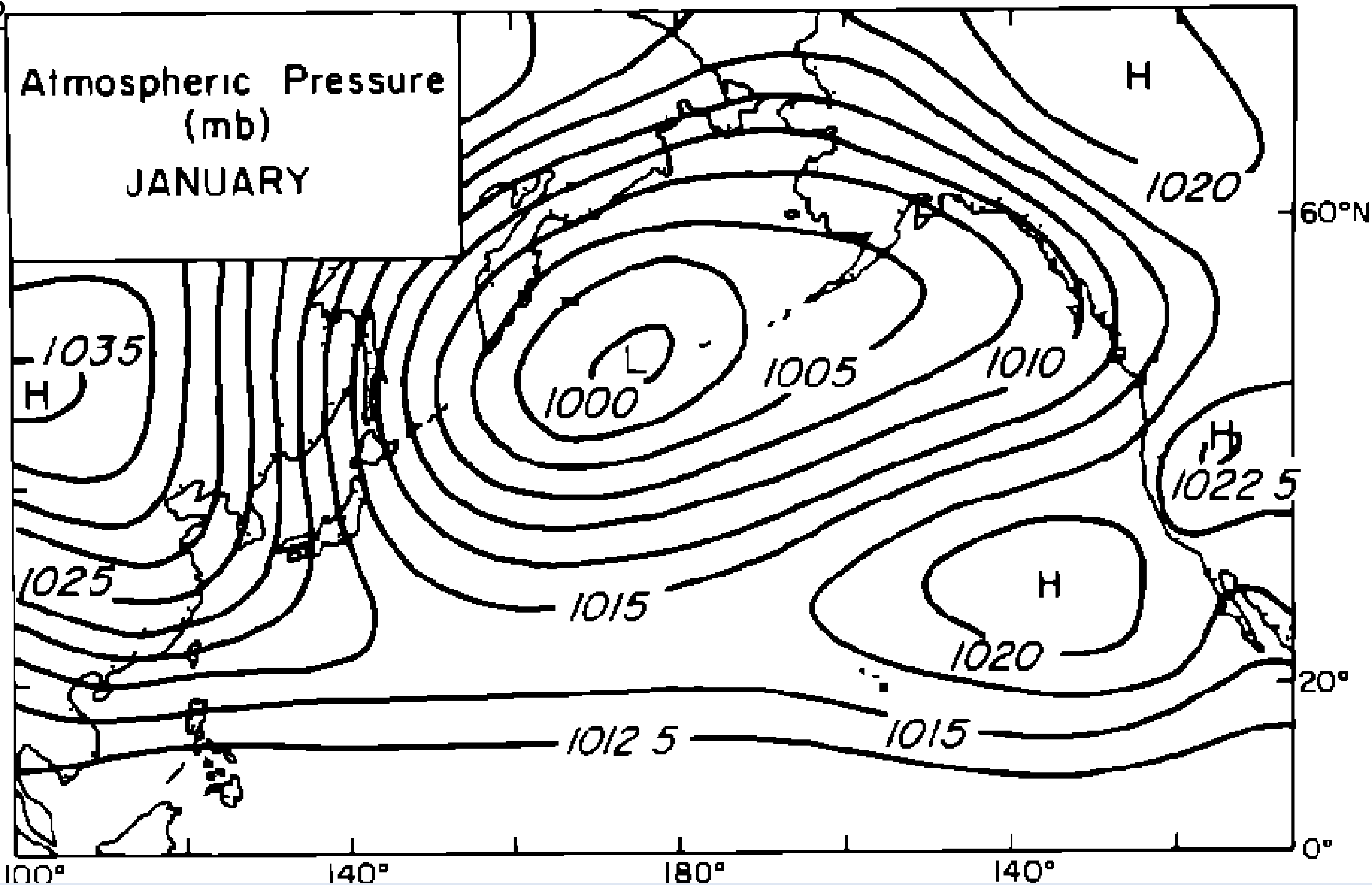
- Diatoms (swash, resurgence, retention)
- Detritus (throughout)



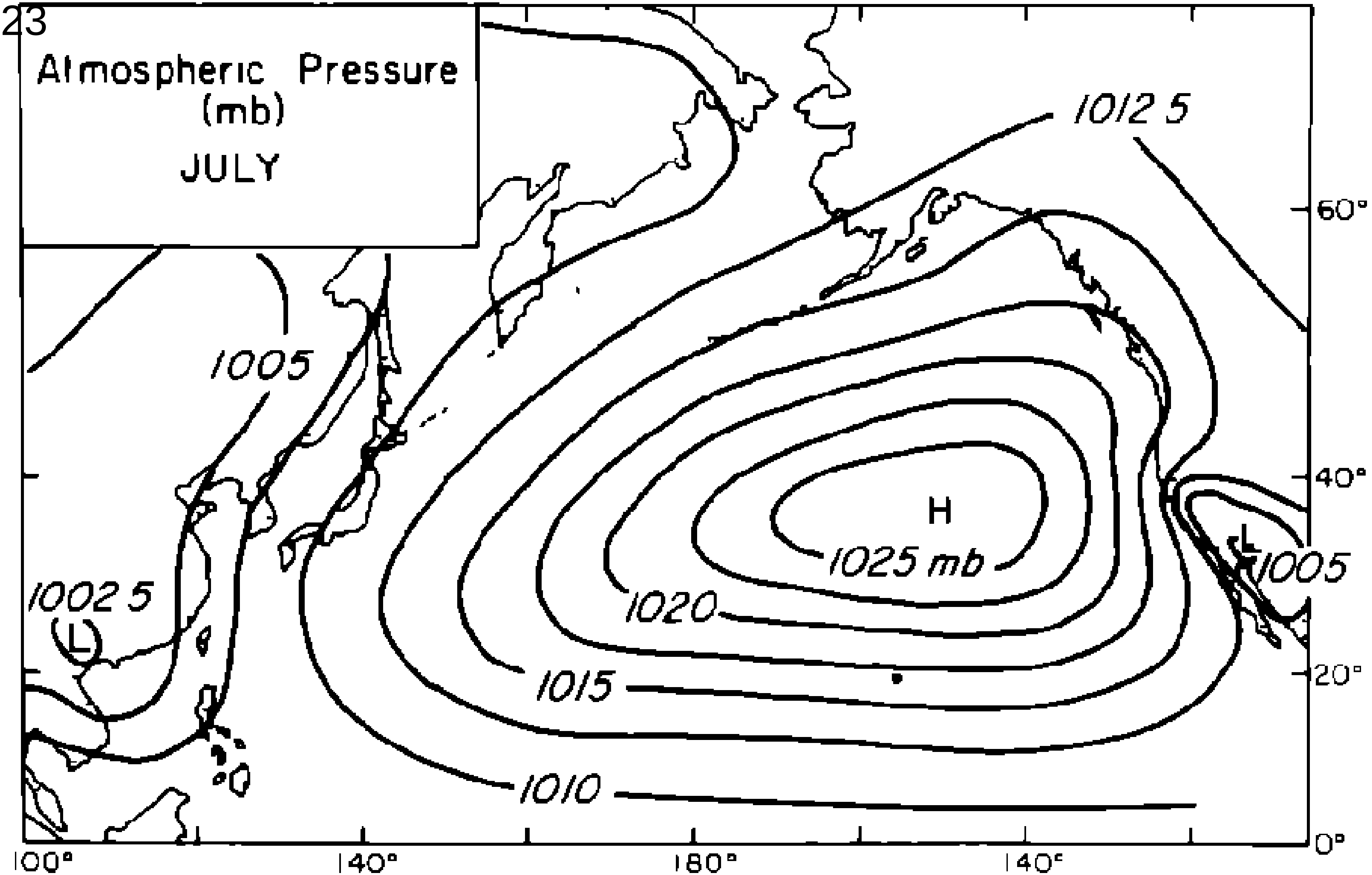
Chlorophyll

Venegas et al., 2008



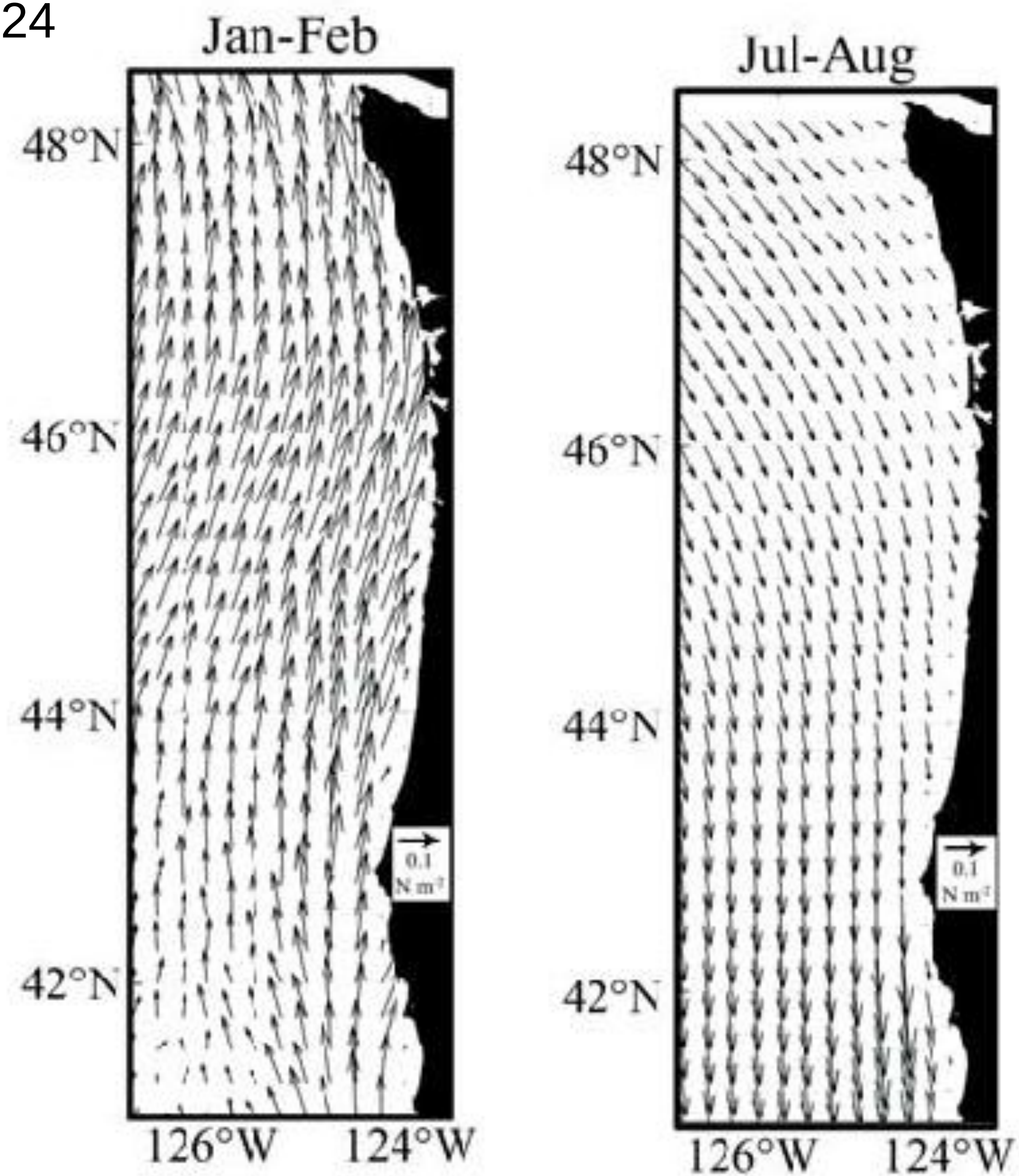

Atmospheric Pressure (mb)
JANUARY
1035
H
1025
1000
L
1005
1010
1020
H
60°N
H
1022 5
H
1015
1020
20°
1012 5
1015
0°
100°
140°
180°
140°

Huyer, 1983



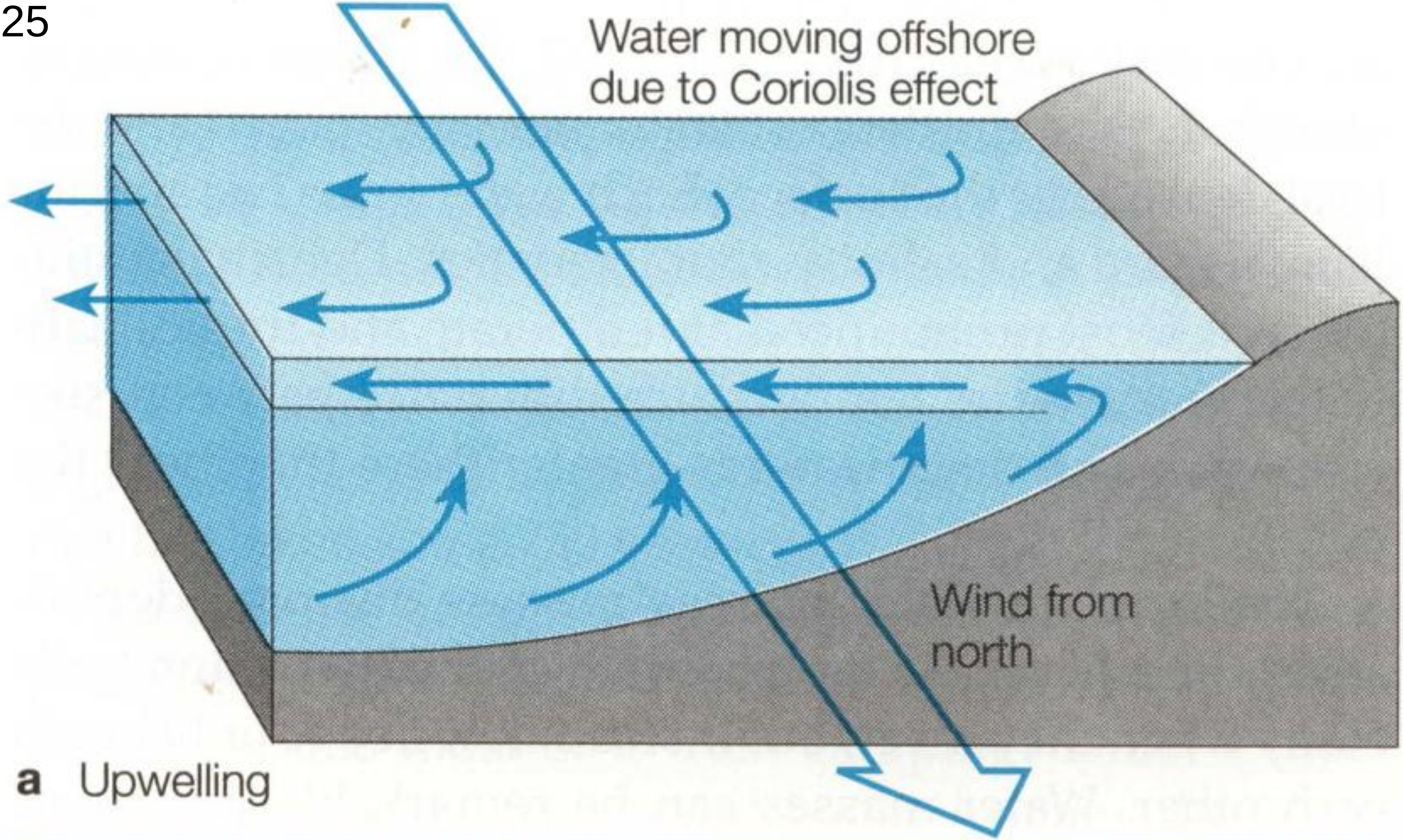
Atmospheric Pressure
(mb)
JULY
1012 5
1005
1002 5
L
H
1025 mb
1020
1015
1010
L
1005
60°N
40°
20°
0°
100°
140°
180°
140°

Huyer, 1983

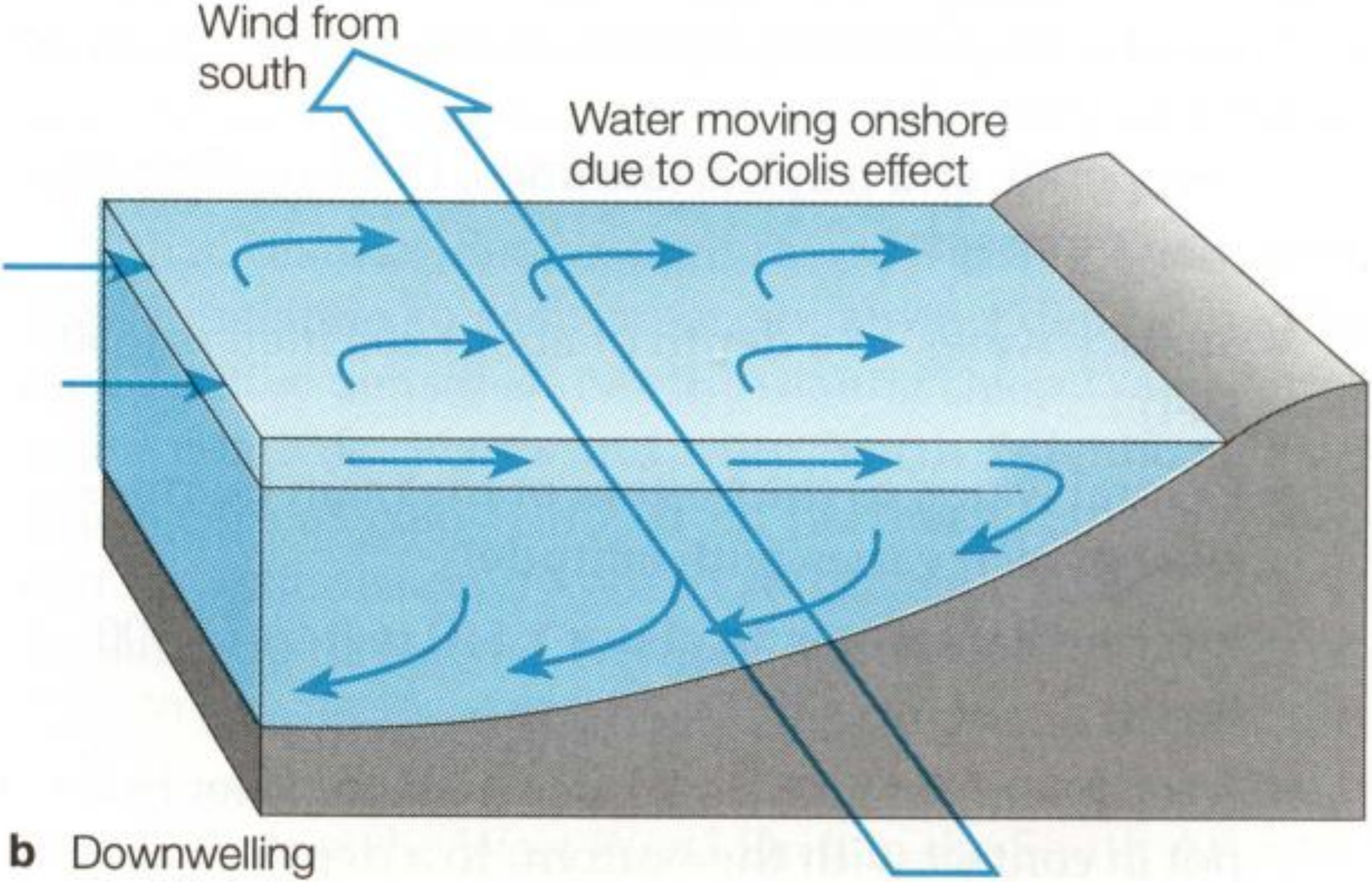


Wind stress field

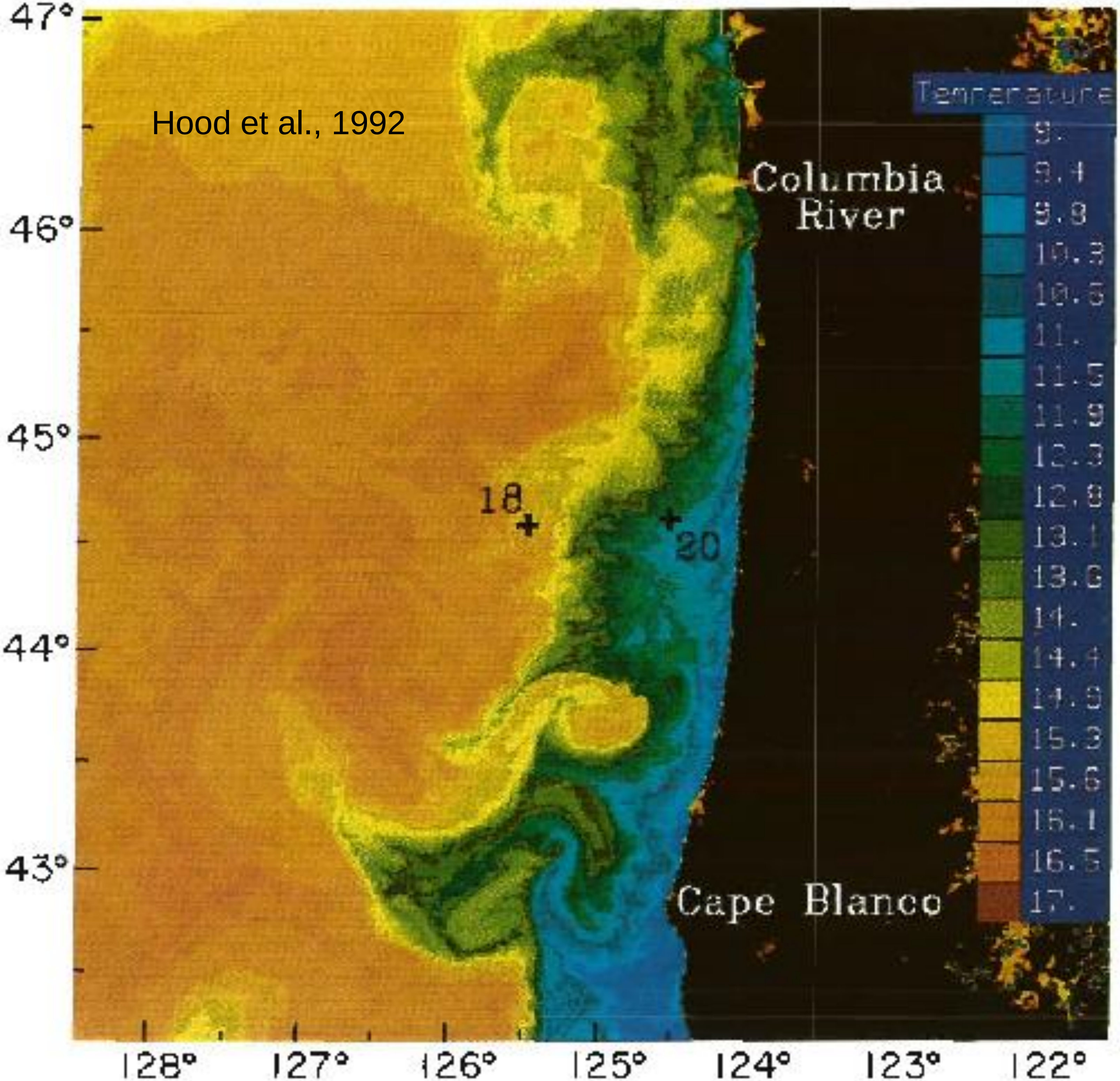
Venegas et al., 2008


Water moving offshore
due to Coriolis effect
Wind from
north

a Upwelling



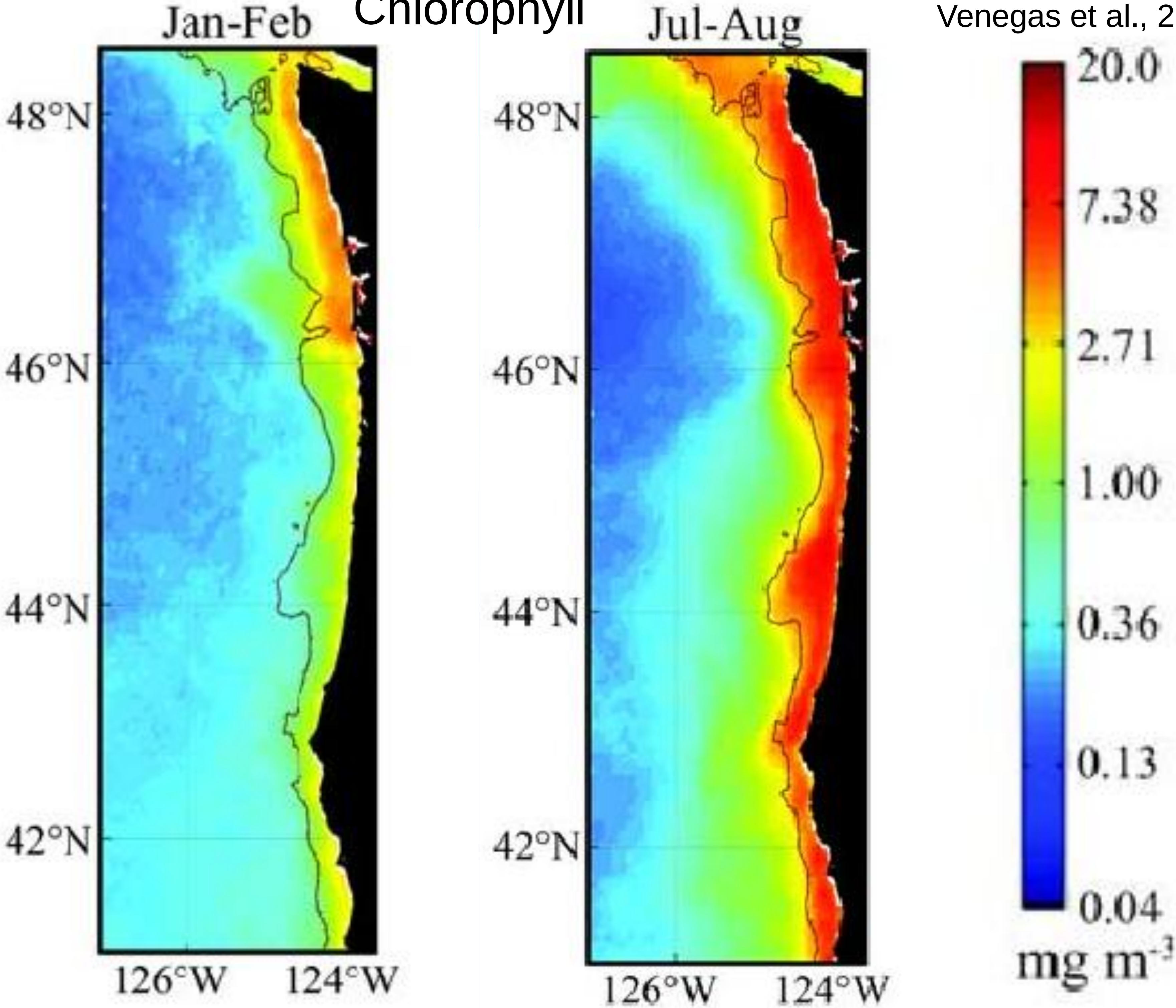
b Downwelling



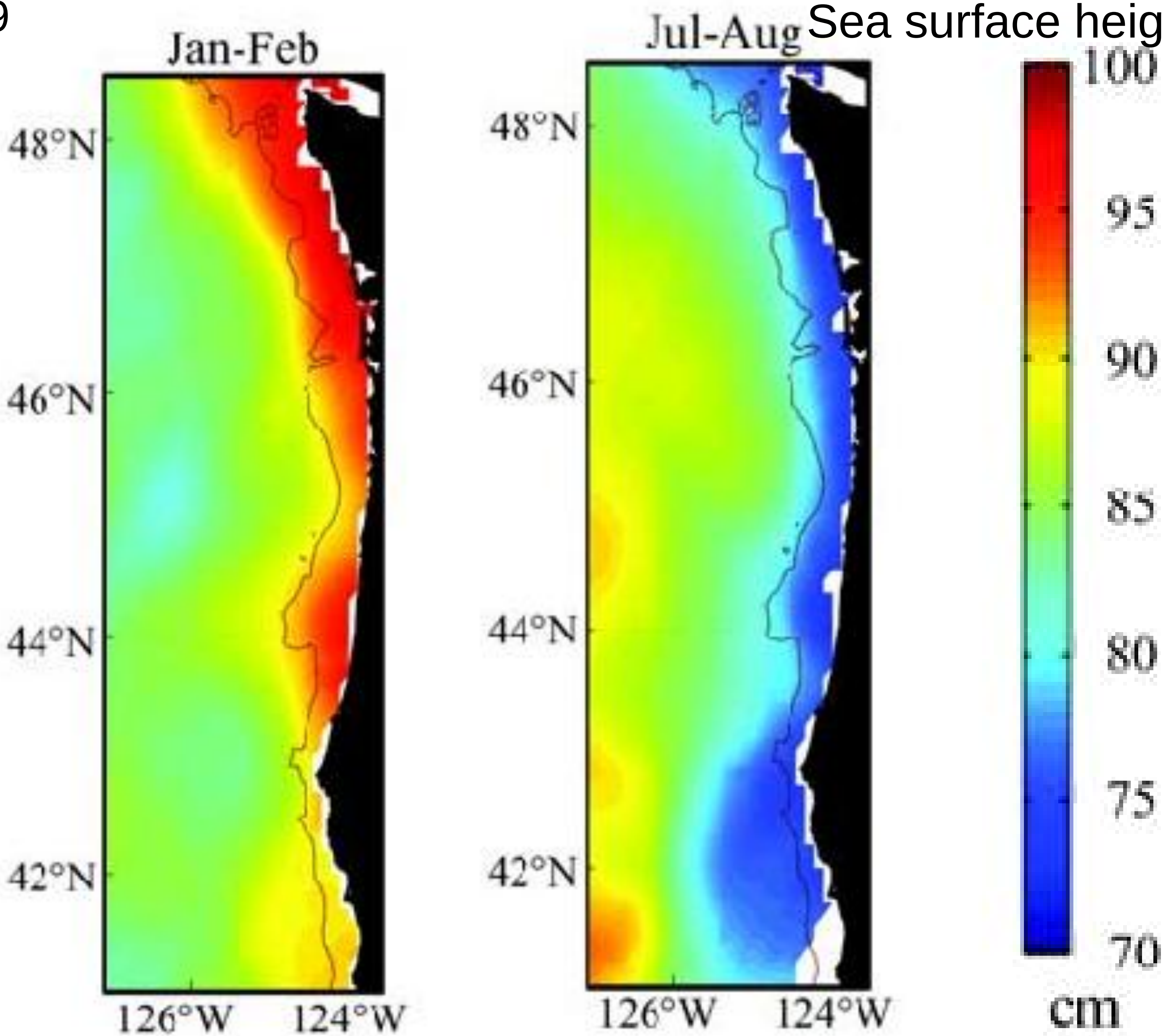
Hood et al., 1992

Chlorophyll

Venegas et al., 2008



Sea surface height



Venegas et al., 2008

TABLE 2. *Estimates of annual production in areas off the Washington and Oregon coasts, 1961*

Area	Annual production (g C m^{-2} yr^{-1})	Range (g C m^{-2} yr^{-1})	Mean daily production (g C m^{-2} day^{-1})
1 (Oceanic)	61	43–78	0.17
2 (Plume)	60	46–73	0.16
3 (River mouth)	88		0.24
4 (Upwelling)	152		0.42

Anderson, 1964

TABLE 4. Number of Common Murres at six colonies in Oregon determined by aerial censuses conducted by USFWS.

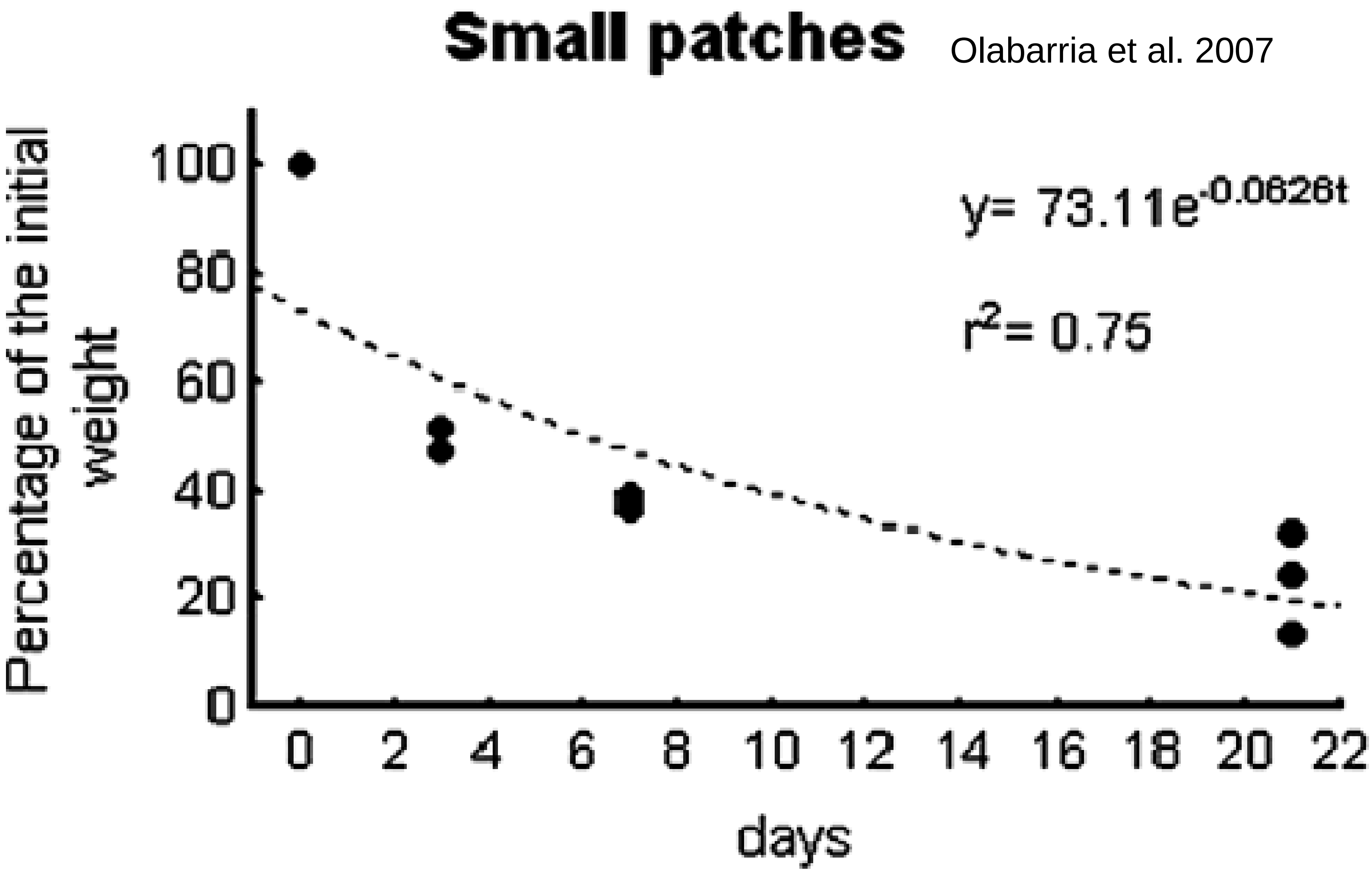
Colony	No. of birds	
	1979 (date)[a]	1983 (date)
Bird Rocks	3,750 (7/16)	4,500 (7/3)
Gull Rock	3,200 (7/16)	2,000 (7/3)
Yaquina Head	3,000 (7/16)	2,769 (7/3)
Face Rock	3,500 (5/21)	800 (7/3)
Island Rock	6,600 (7/11)	133 (7/3)
Goat Island	1,850 (7/11)	0 (7/3)

[a] Data from Pitman et al. (in press).

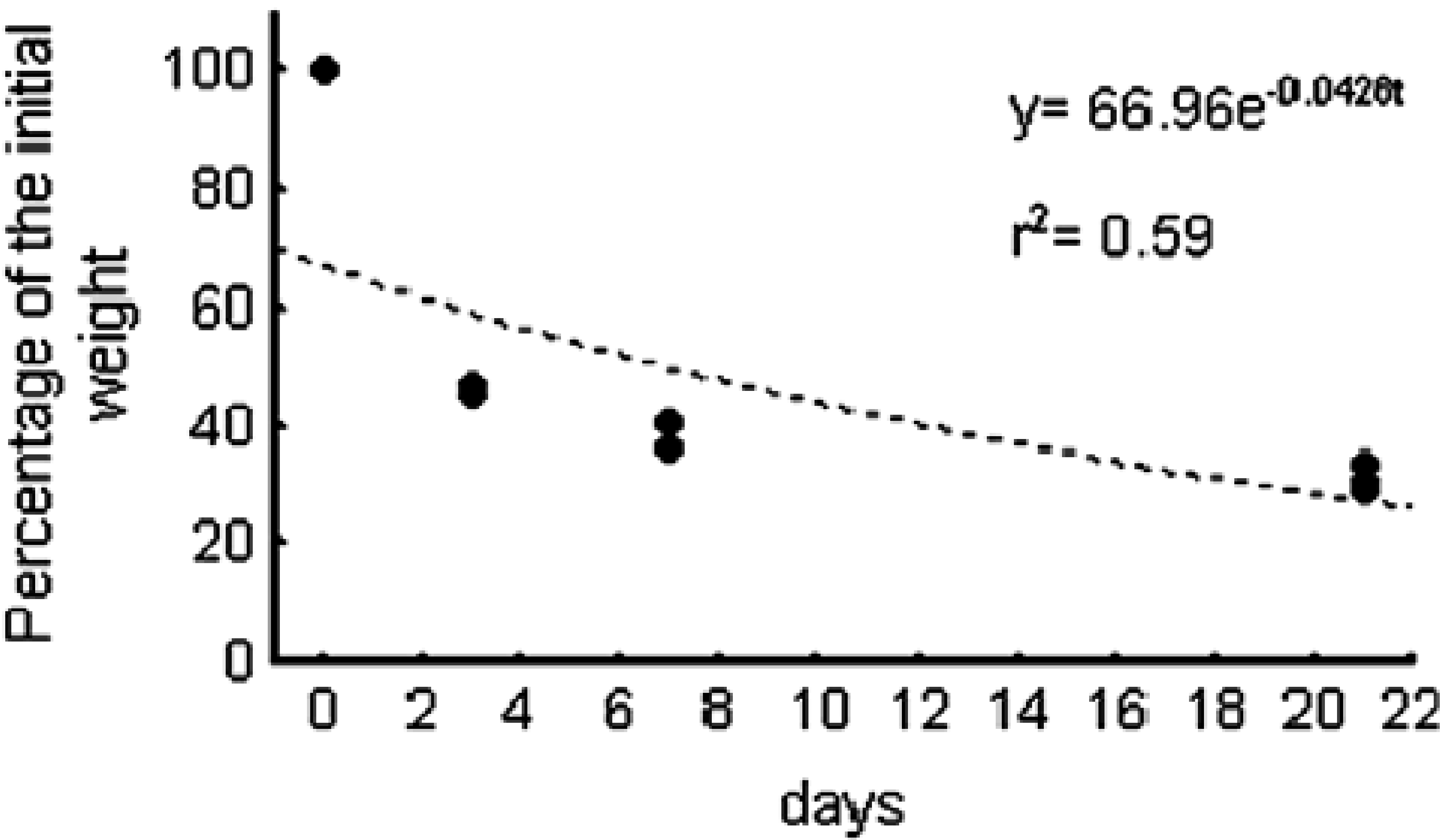
Hodder and Graybill, 1985

Food web: based on

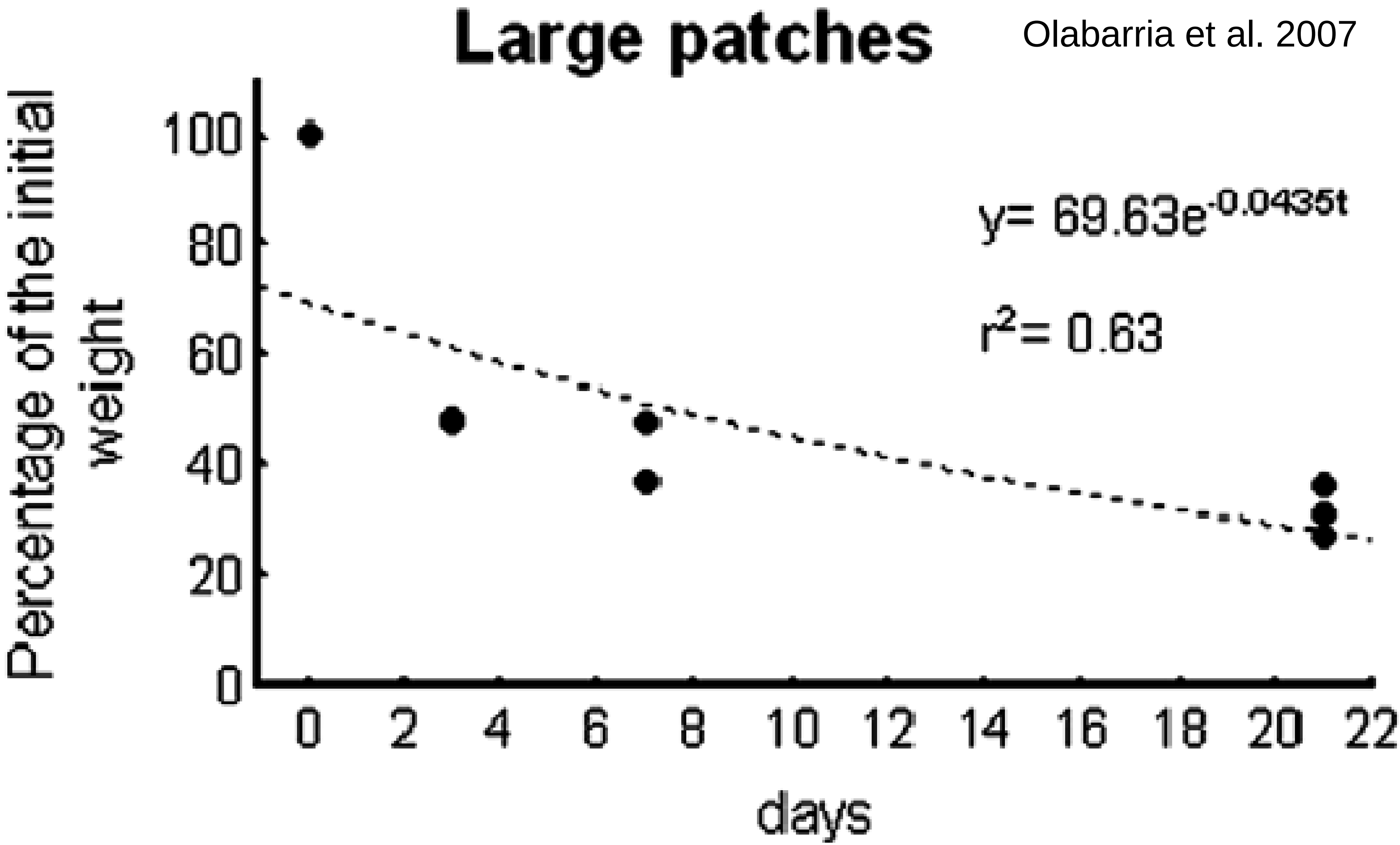
- Diatoms (swash, resurgence, retention)
- Detritus (throughout)


Small patches
Olabarria et al. 2007
y= 73.11e-0.0626t
r2= 0.75
Percentage of the initial weight
100
80
60
40
20
0
0
2
4
6
8
10
12
14
16
18
20
22
days

Medium patches Olabarria et al. 2007



Olabarria et al. 2007



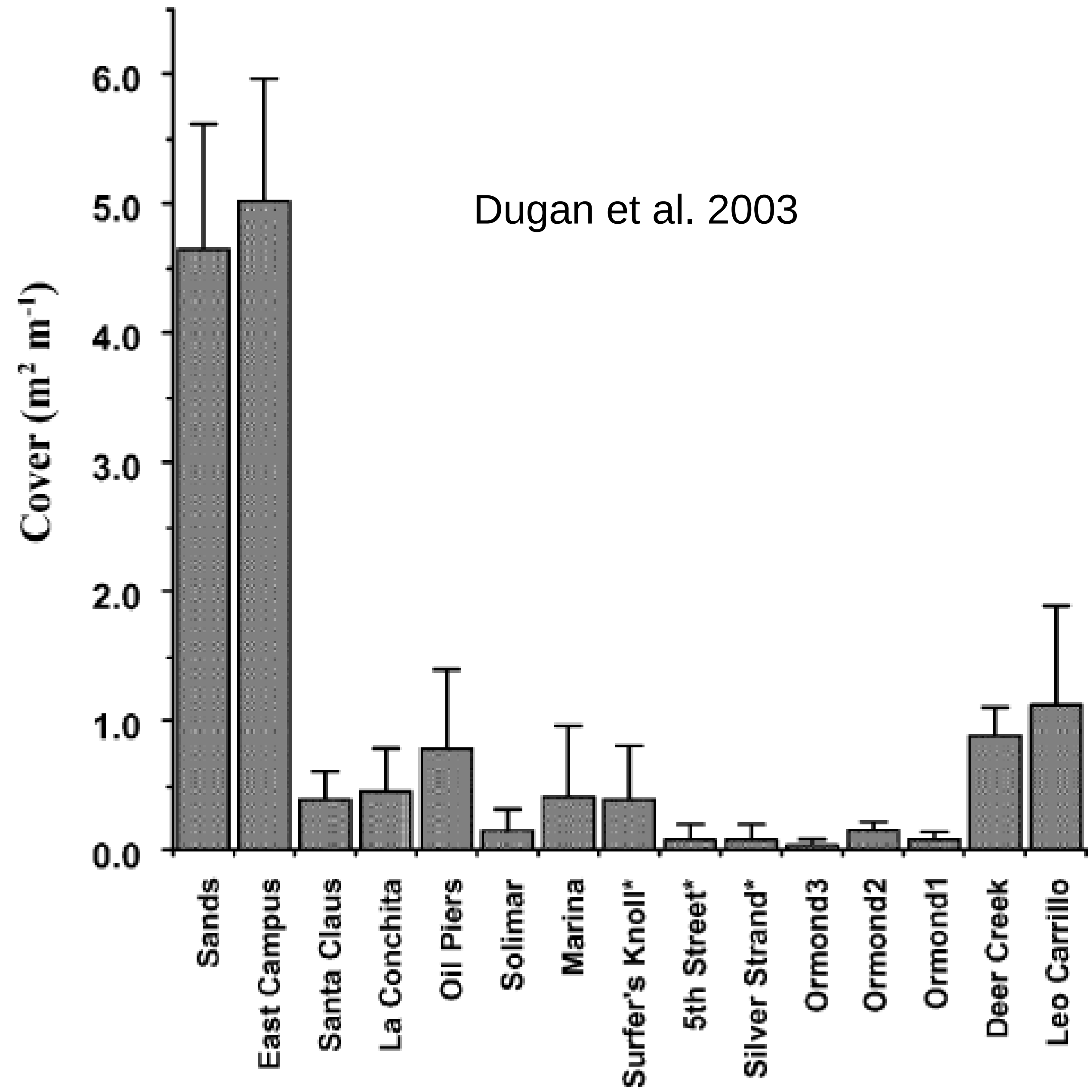


Fig. 2. Mean cover of macrophyte wrack on the beaches surveyed. Error bars represent standard deviations and * denotes the beaches subject to grooming.

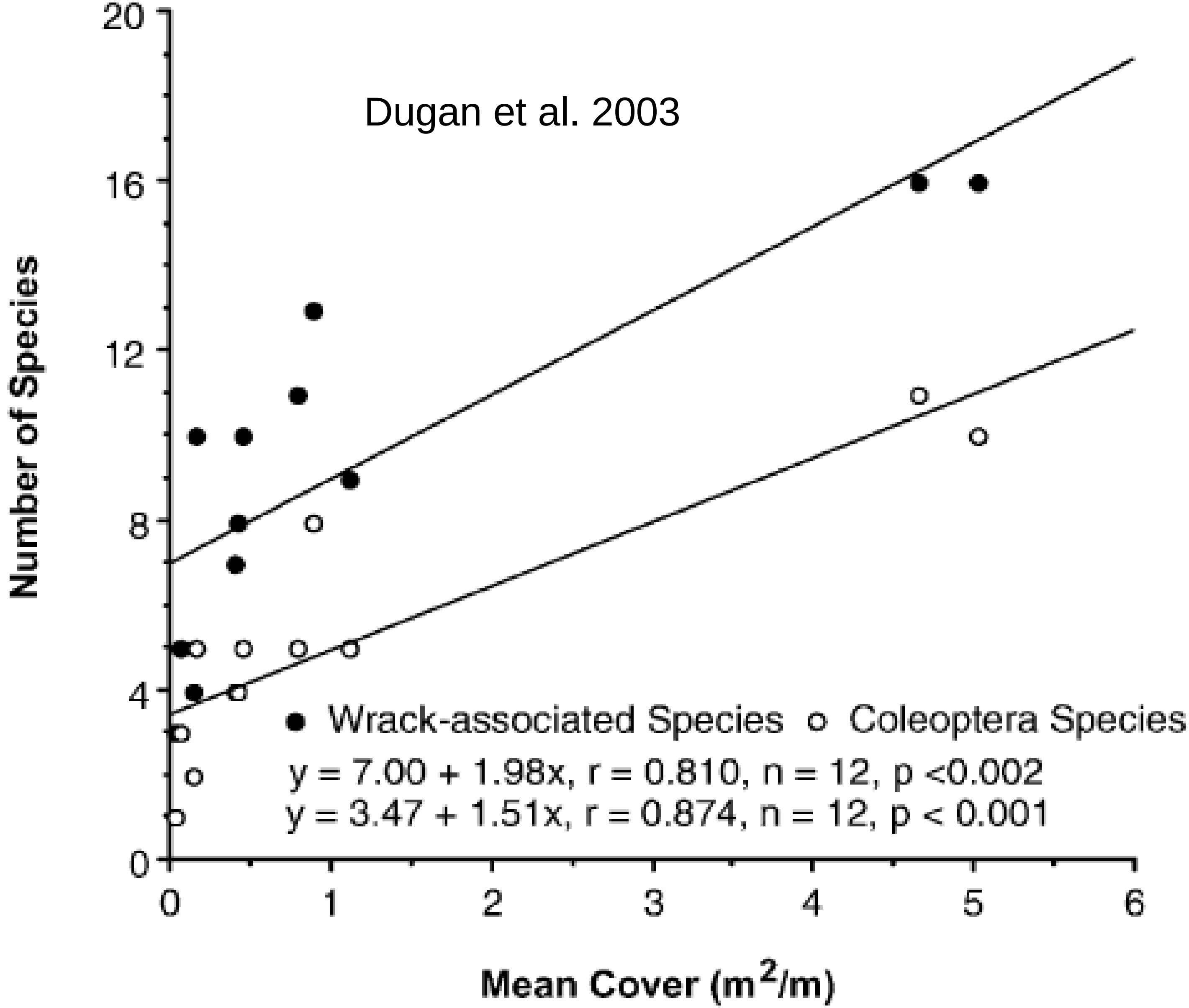
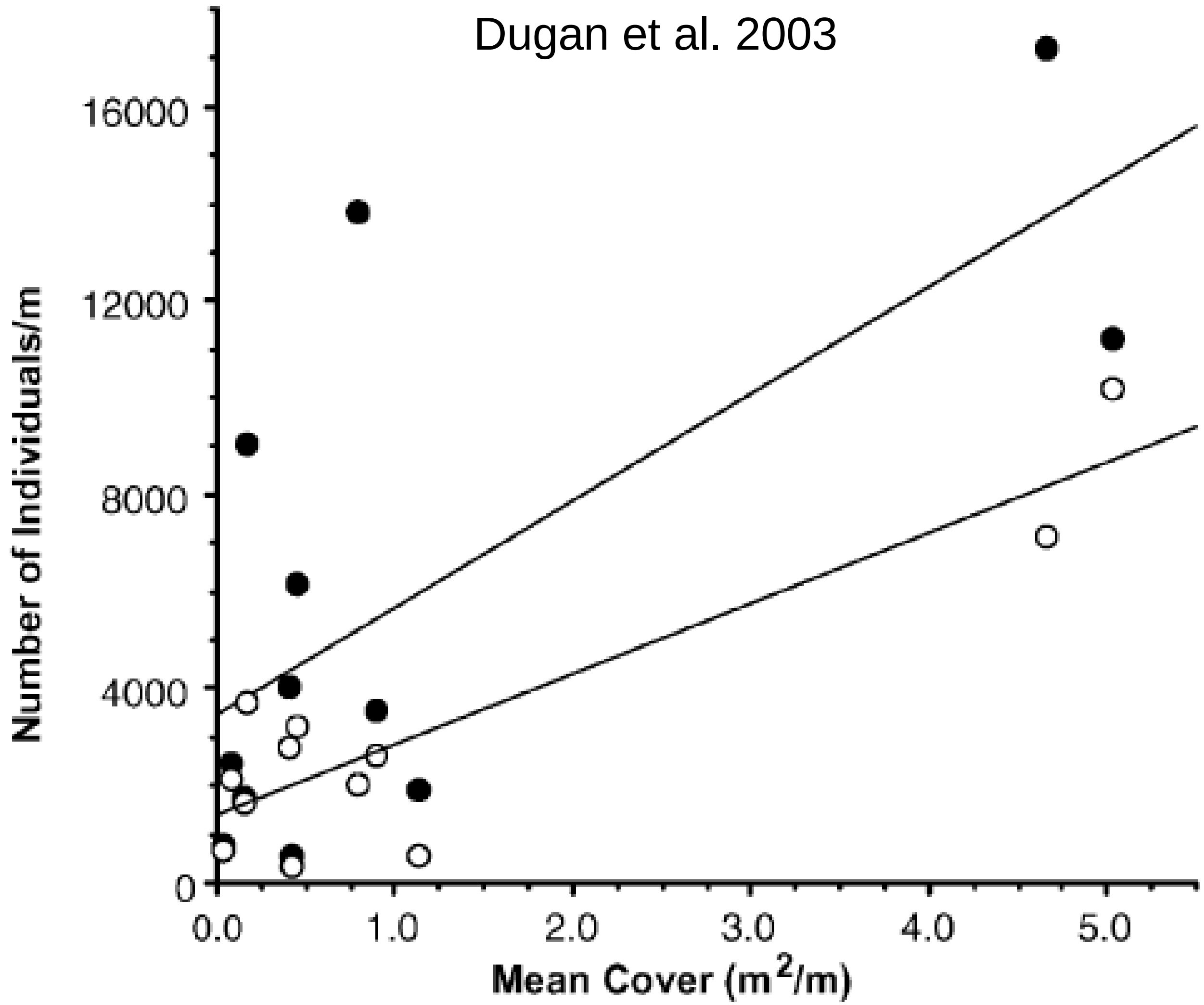


Fig. 6. Scatterplot and regressions of species richness as a function of the mean cover of macrophyte wrack for the ungroomed beaches surveyed. Closed circles are data for all wrack-associated species, and open circles are for species of Coleoptera.

Dugan et al. 2003



● Wrack-Associated Macrofauna ○ *Megalorchestia spp.*

y = 3484 + 2197x, r = 0.693, n = 12, p<0.02

y = 1398 + 1463x, r = 0.886, n = 12, p <0.001

Fig. 7. Scatterplot and regressions of macrofauna abundance as a function of the mean cover of macrophyte wrack for the ungroomed beaches surveyed. Closed circles are data for all wrack-associated species, and open circles are for species of talitrid amphipods, *Megalorchestia* spp.

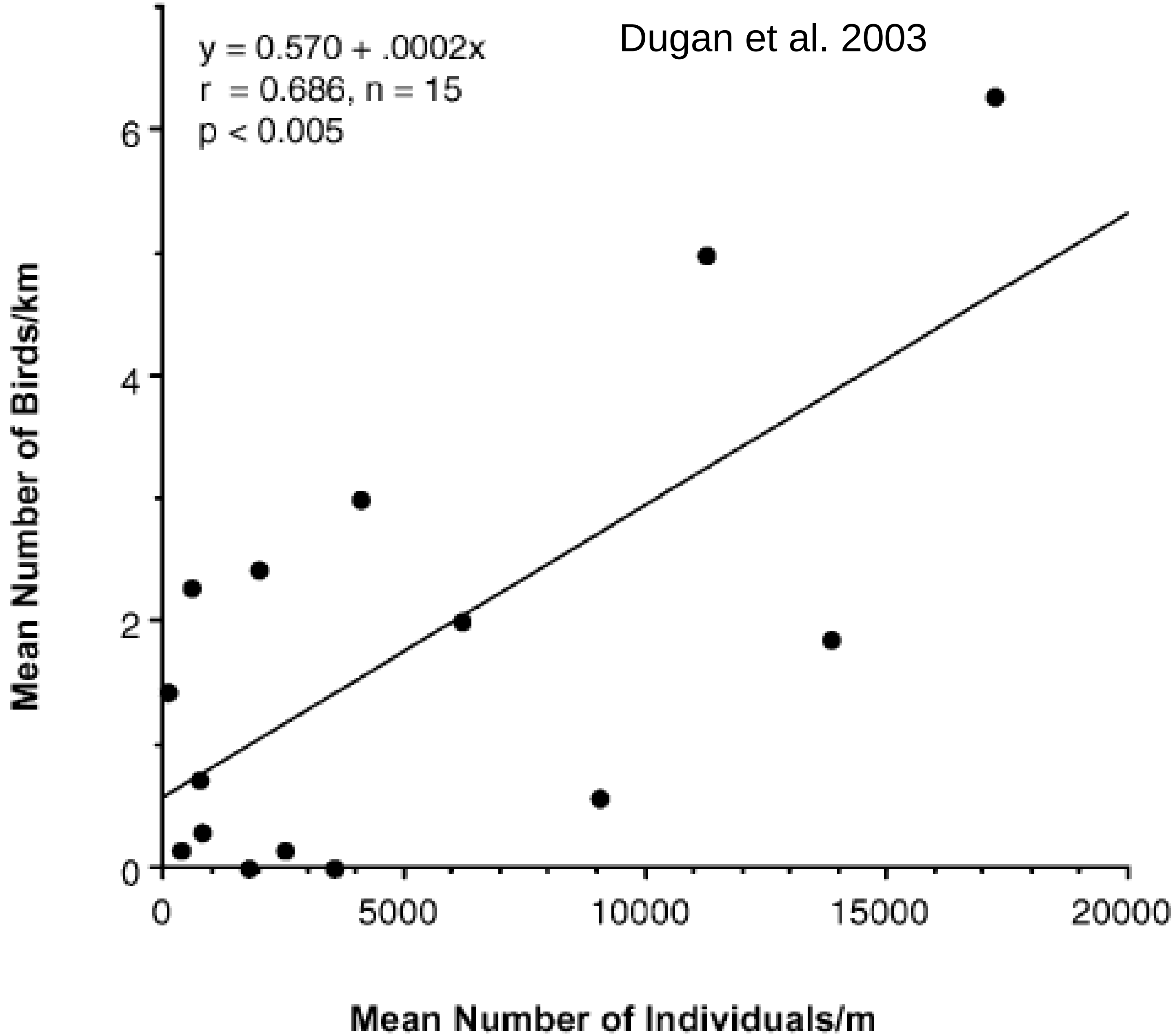


Fig. 8. Scatterplot and least squares regression of the abundance of wintering black-bellied plovers as a function of the mean abundance of wrack-associated macrofaunal prey for ungroomed beaches.

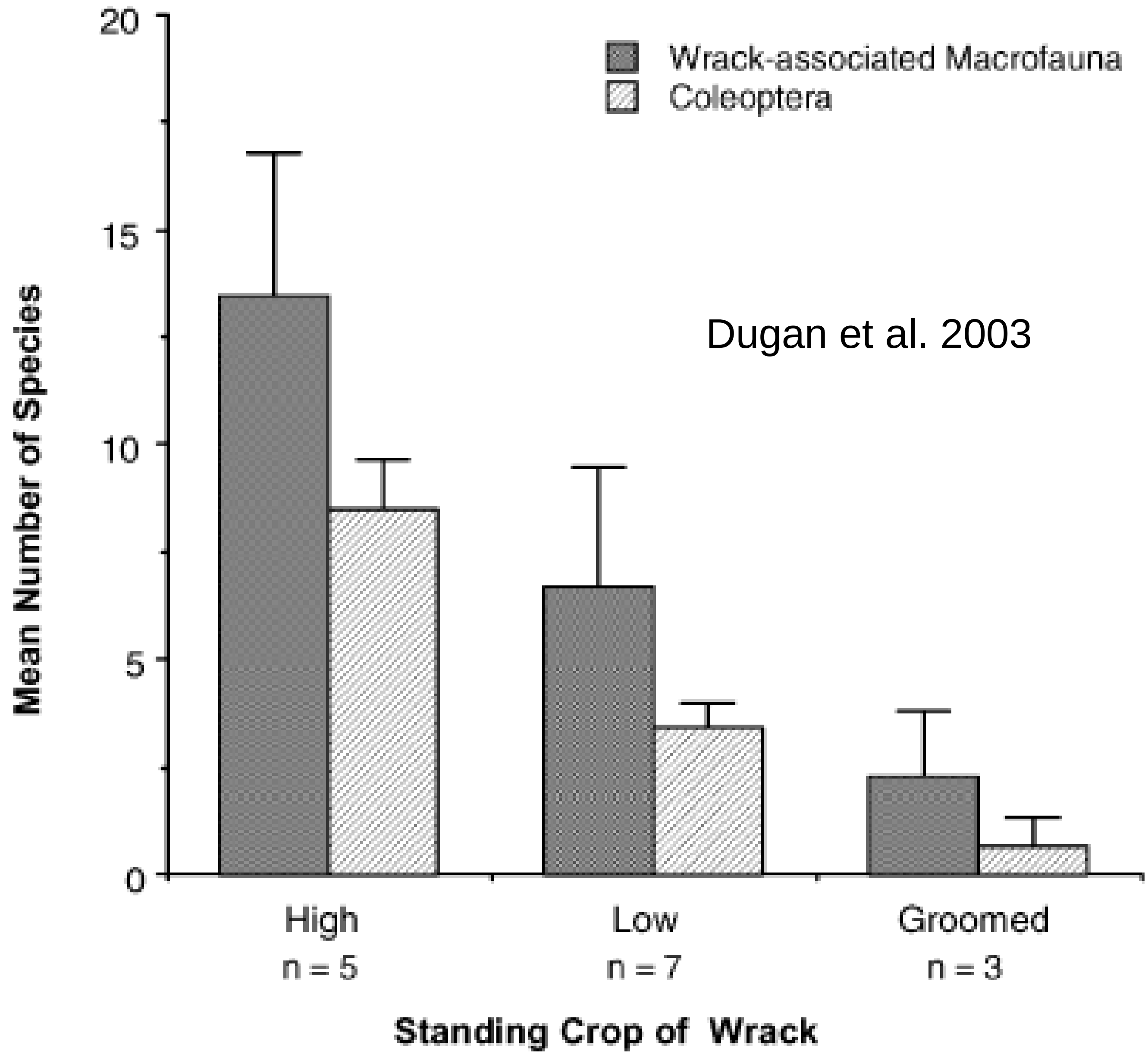


Fig. 9. Mean species richness of wrack-associated macrofauna (solid bars) and Coleoptera (hatched bars) for beaches with high and low standing crop of wrack, and for groomed beaches. Error bars represent standard errors.

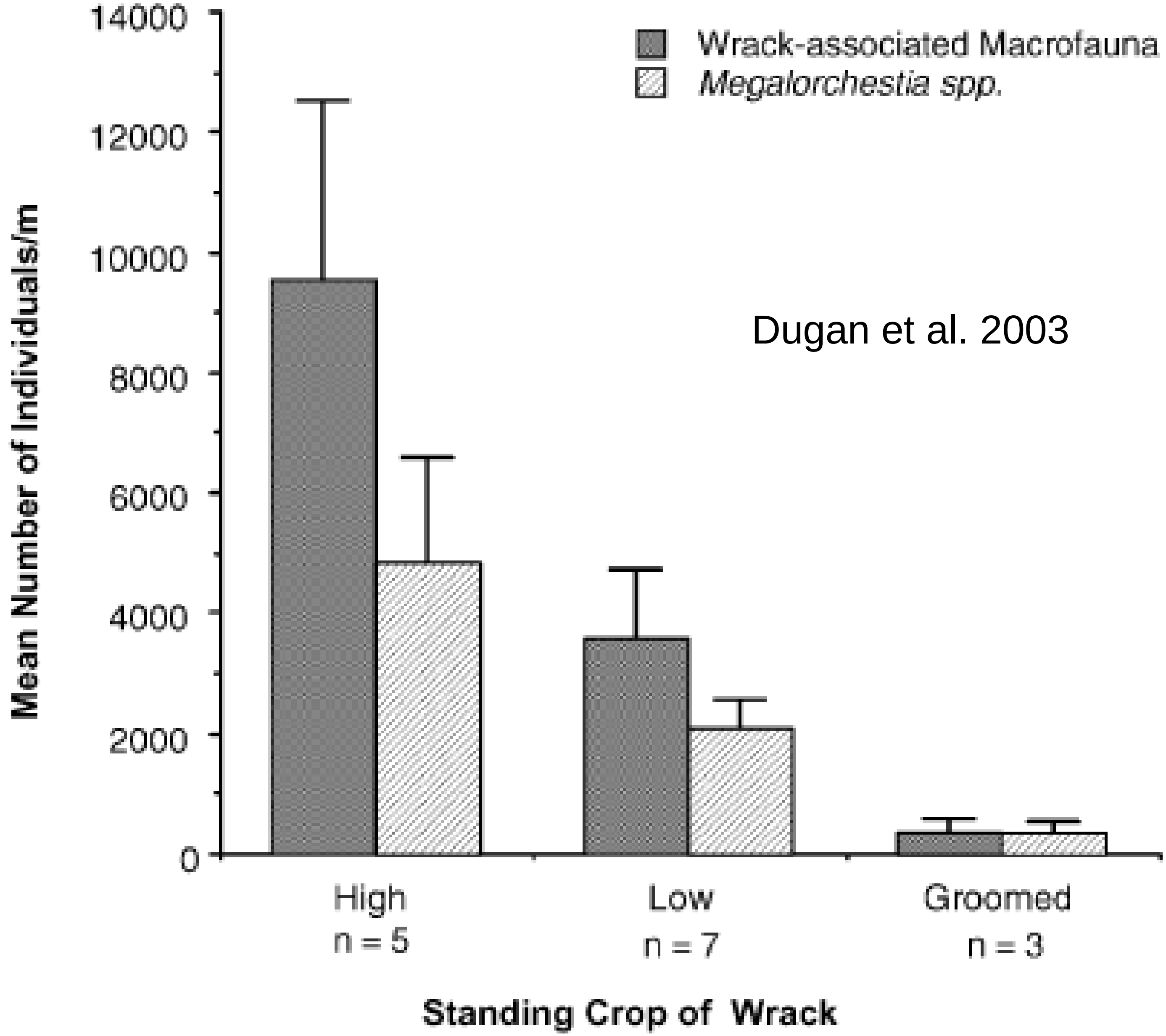


Fig. 10. Mean abundance of wrack-associated macrofauna (solid bars) and talitrid amphipods, *Megalorchestia* spp. (hatched bars) for beaches with high and low standing crop of wrack, and for groomed beaches. Error bars represent standard errors.

References

Castro, P. and M.E. Huber. 2003. Marine Biology. McGraw-Hill . New York, NY.

McLachlan, A. 1990. Dissipative beaches and macrofauna communities on expose intertidal sands. Journal of Coastal Research 6(1):57-71.