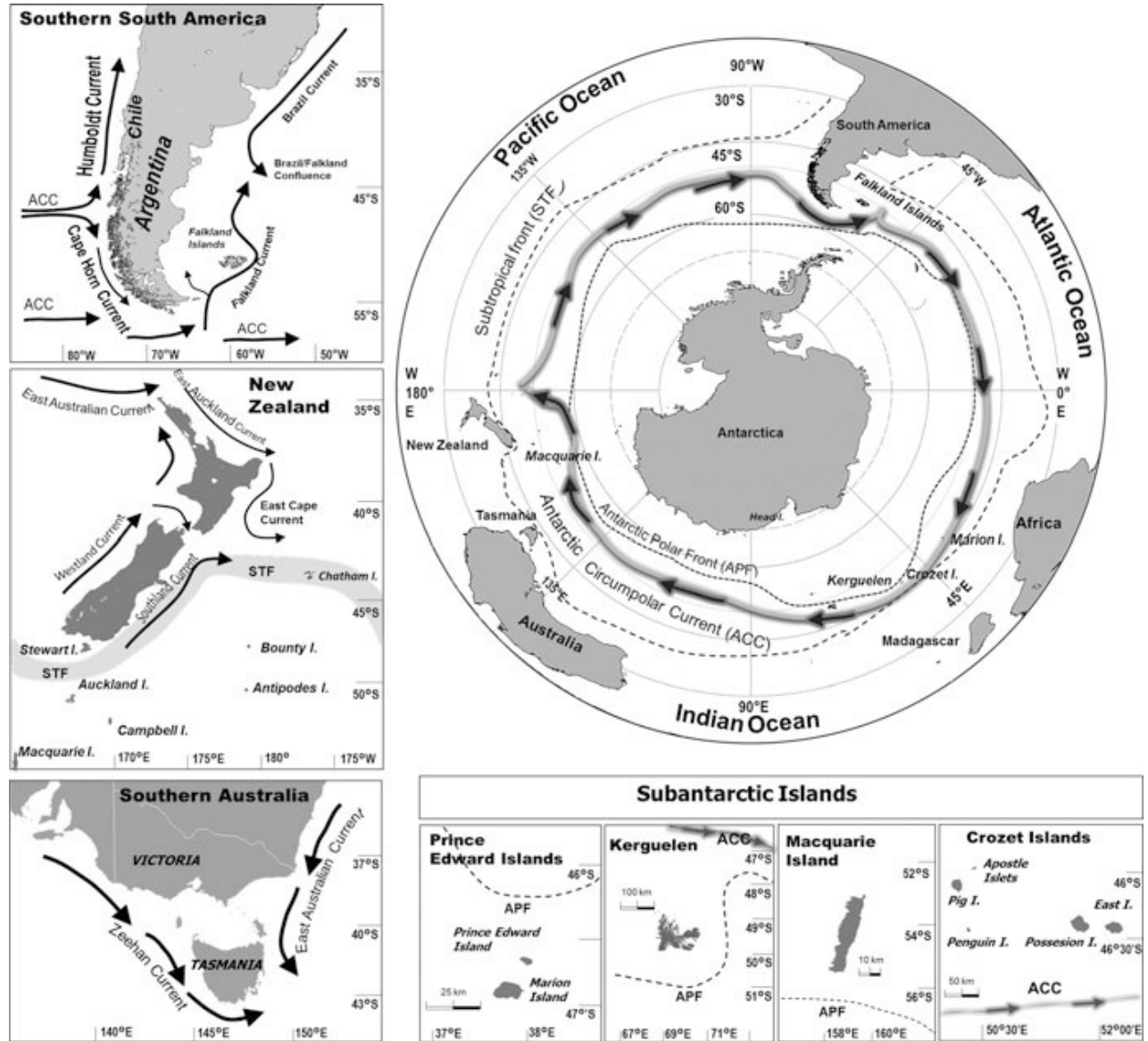


# cold and warm temperate regions of the Southern hemisphere

Antarctic Circumpolar Current (ACC) separates the temperate region from Antarctic seaweed region

Subtropical Front (STF) is a border between the subtropical waters further to the north and the cold temperate region (cca 15°C in summer and 10°C in winter)

there are basically **six** separate cold temperate regions in S.H. (incl. SW Africa which lies north of STF but is cold due to Benguela upwelling)



**Fig. 14.1** The five cold-temperate regions of the southern hemisphere: southwestern South America, southeastern South America, Victoria-Tasmania, southern New Zealand, and the sub-Antarctic islands. Major oceanographic fronts, the Subtropical Front (STF; also known as Subtropical Convergence), the Antarctic Polar Front (APF; also known as Antarctic Convergence), and the Antarctic Circumpolar Current (ACC; called also West Wind Drift), are presented

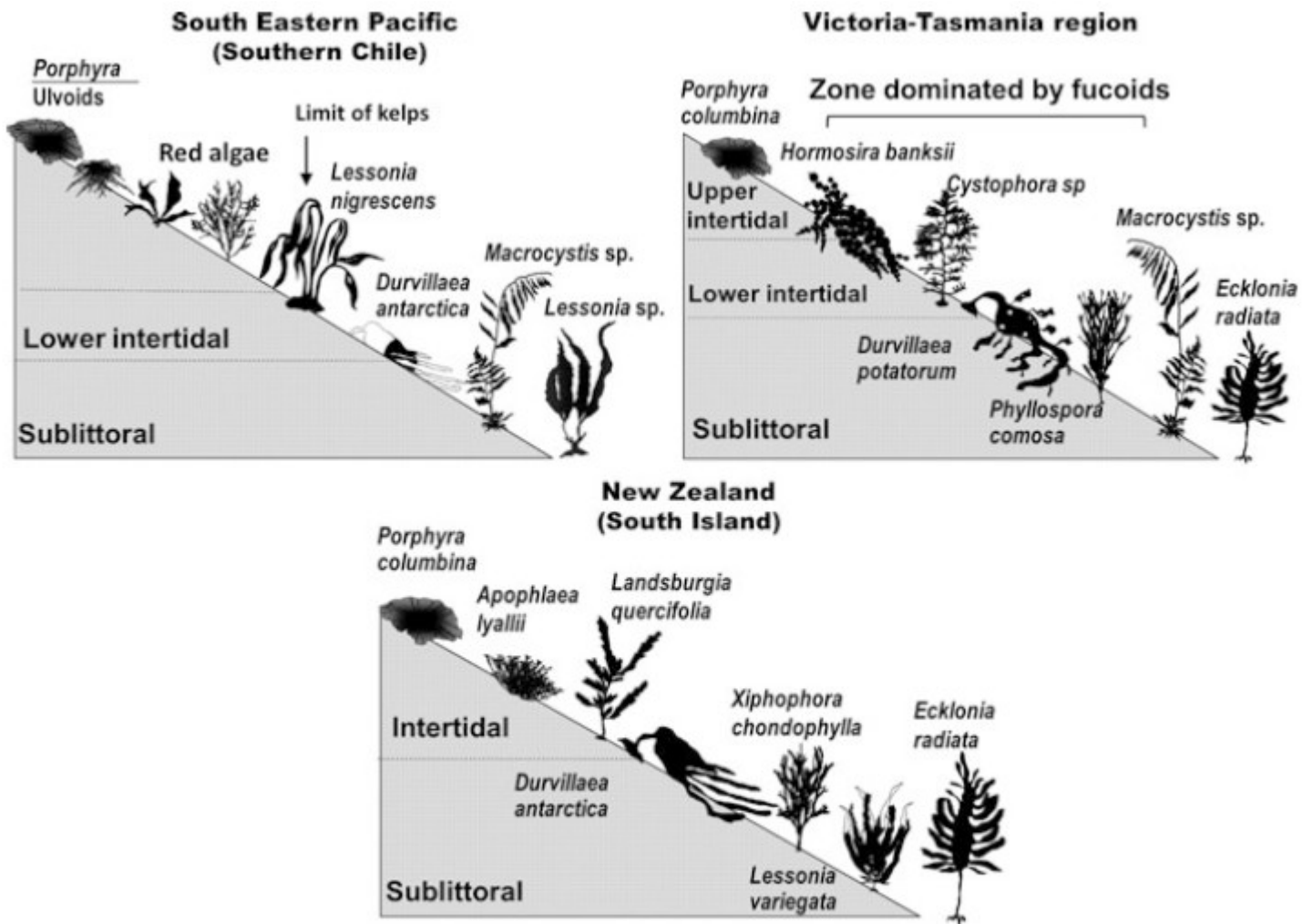


Fig. 14.2 General patterns of seaweed zonation, with dominant species in each littoral zone, in southern Chile, Victoria-Tasmania, and New Zealand (South Island) (the schemes represent a compilation of the literature revised in the text)

four kelp genera of southern hemisphere: *Macrocystis*, *Lessonia*, *Ecklonia* and *Laminaria*  
 a principal fucoid "pseudokelp": *Durvillaea* (bull kelp)

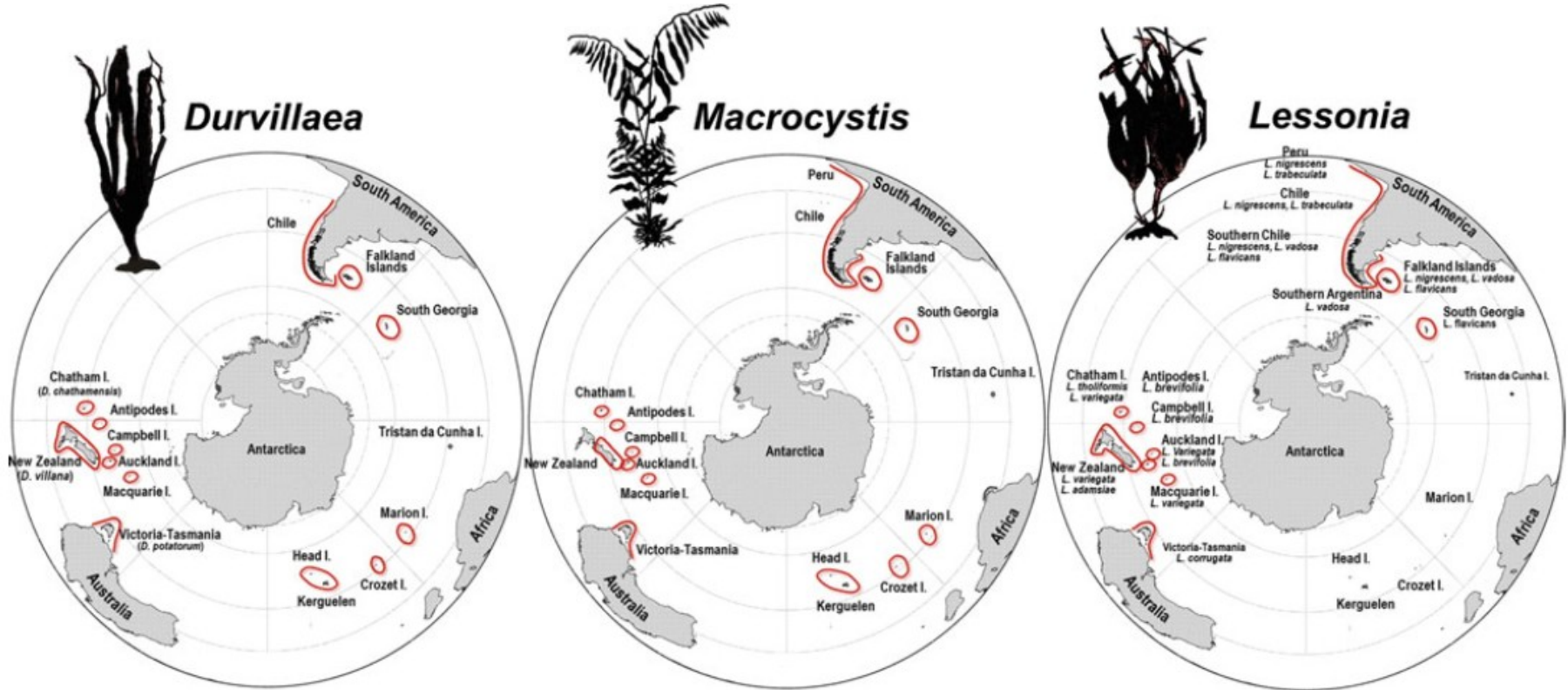
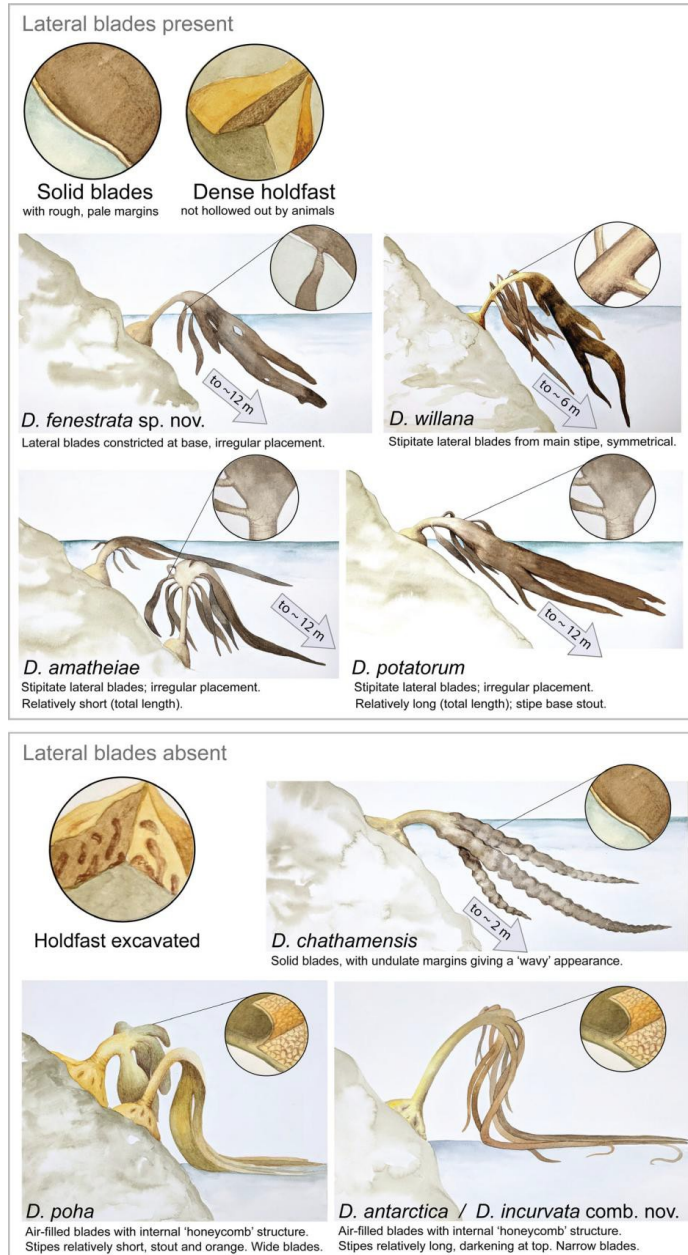


Fig. 14.3 Distribution of the large brown algal genera *Durvillaea* and laminariales *Macrocystis* and *Lessonia* in the southern hemisphere. Different species of *Durvillaea* and *Lessonia* are presented. As the current evidence indicates the existence of only one species of *Macrocystis* (*M. pyrifera*) (see the text), this information is presented as *Macrocystis* sp. Note: *Macrocystis* is also present in the northern hemisphere in the Pacific coast from Baja California, Mexico, to Alaska (the schemes represent a compilation of the literature revised in the text)

# Durvillaea



notable island endemism in NZ region

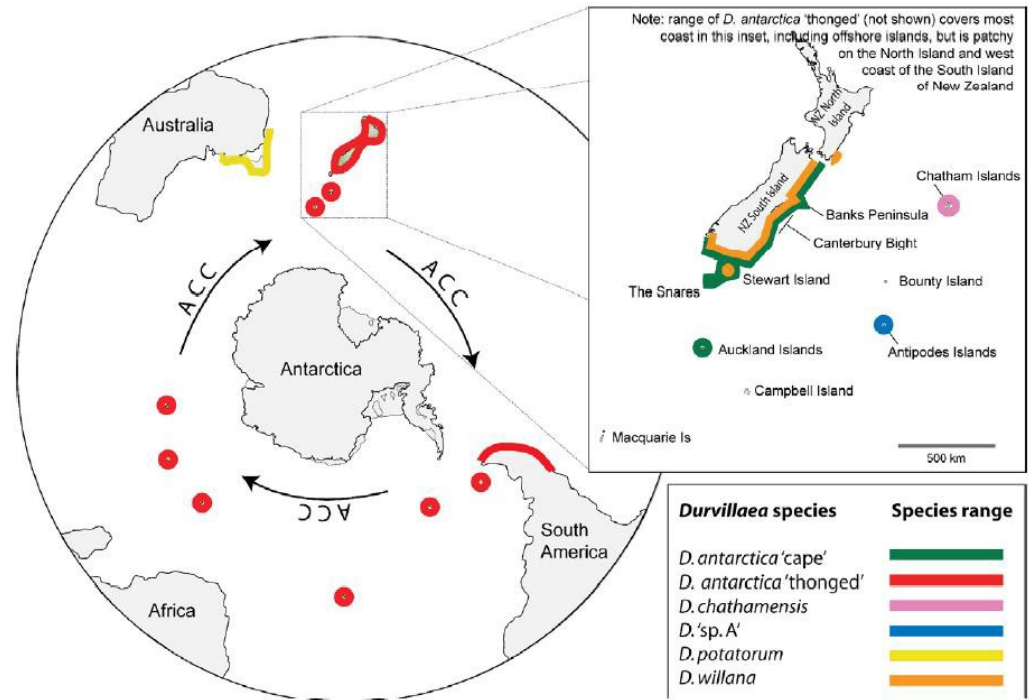
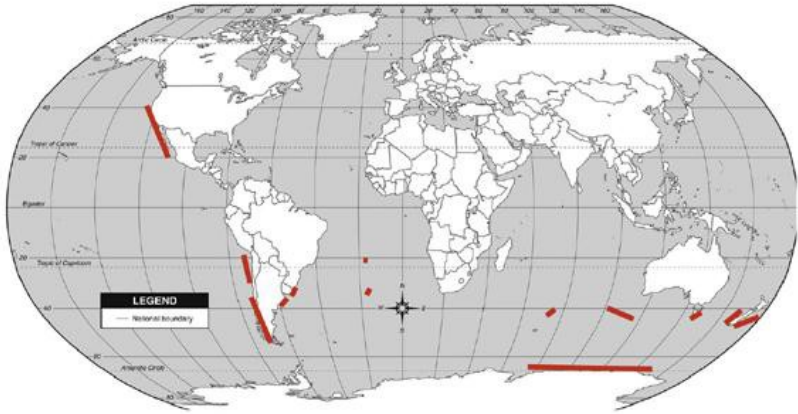
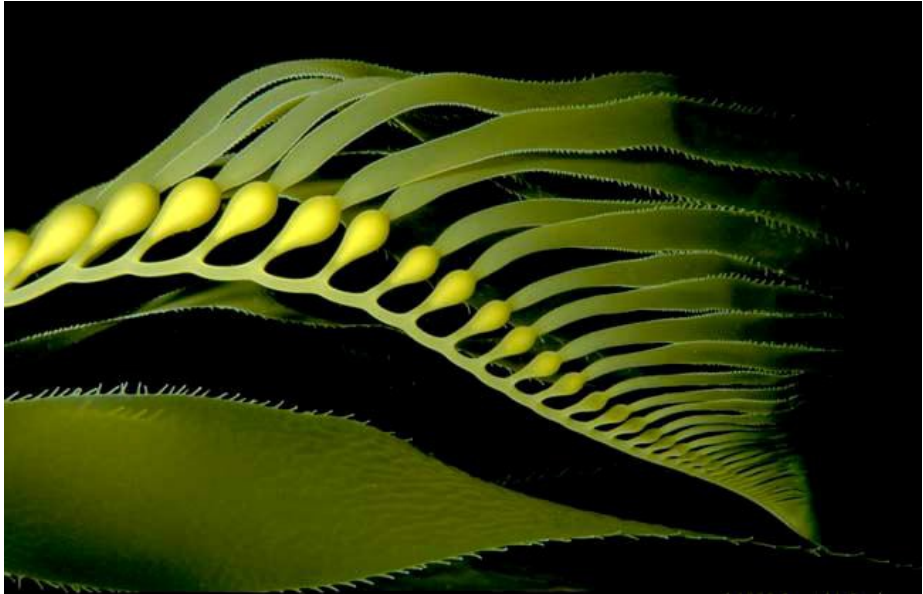
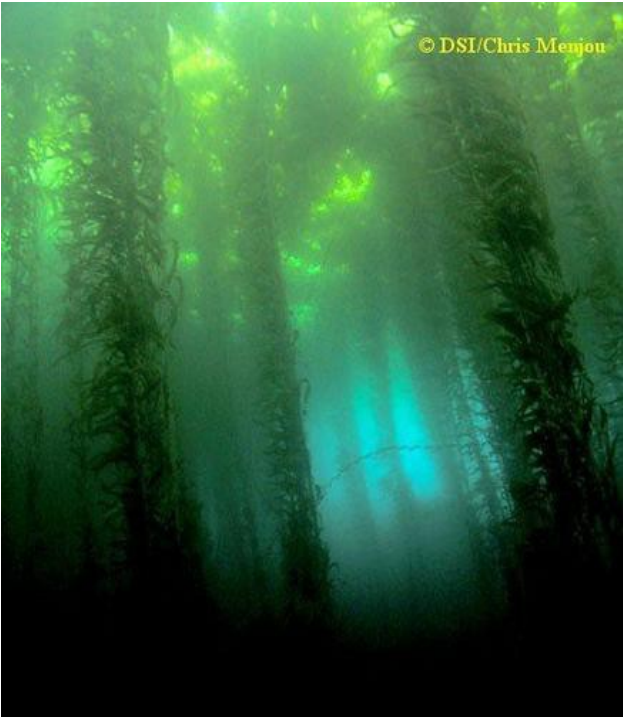


Fig. 1. Geographic range of each *Durvillaea* species recognized by Hay (1994), as well as the 'cape' form of *D. antarctica* (South and Hay, 1979; Fraser et al., 2009a). The general path of the Antarctic Circumpolar Current (ACC) is indicated on the global projection. Inset: New Zealand and NZ subantarctic region, where most diversity within the genus is found.

# Macrocystis pyrifera



bipolar seaweeds (= crossing the equator as part of the evolutionary history of the taxon)

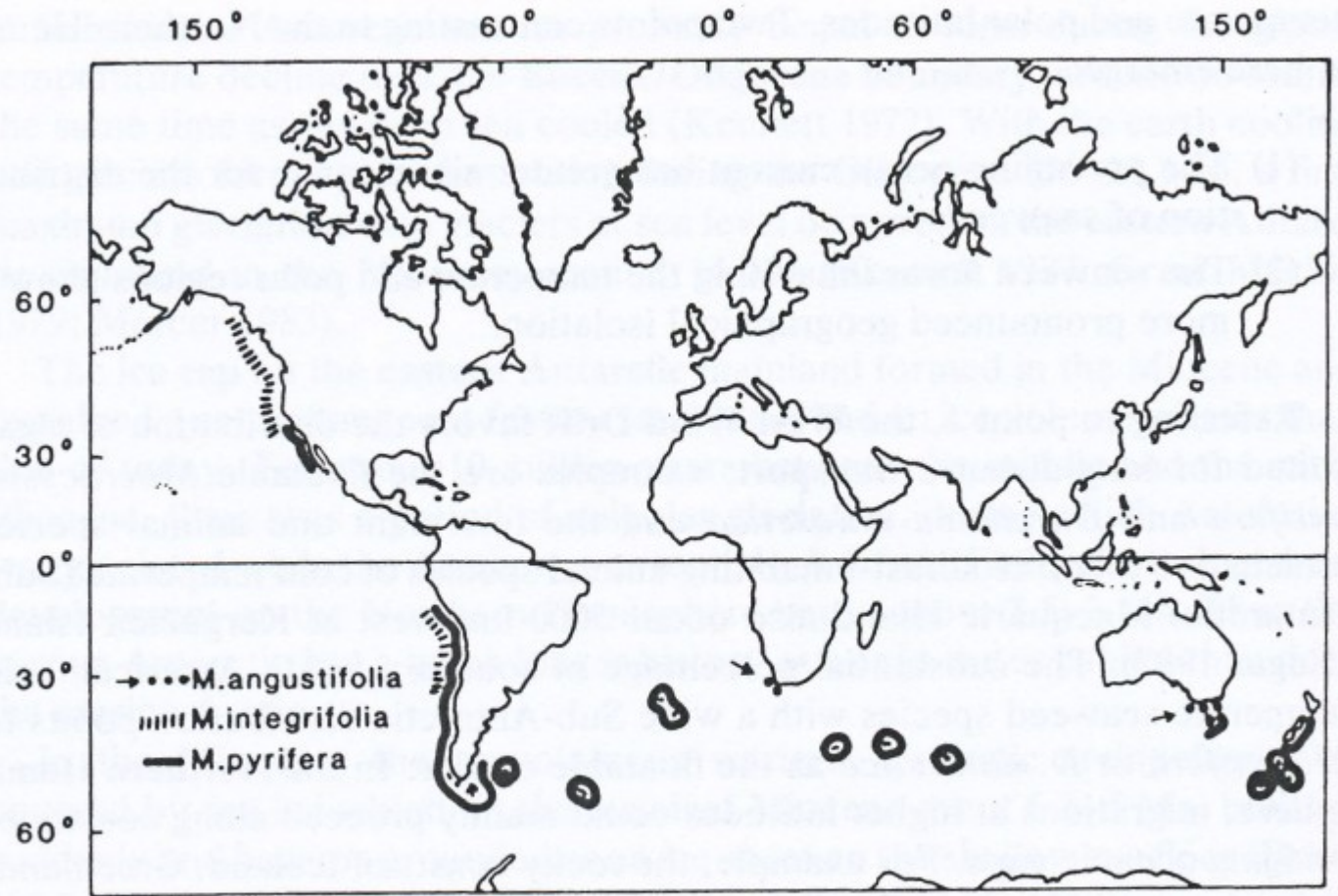


Fig. 5.3 Amphiequatorial distribution of the kelp genus *Macrocystis*. (From Foster and Schiel 1985; after Womersley 1954.)

# New Zealand / Southern Australia provinces

Pacific origin of the N.Z. algal flora

cold temperate – Victoria/Tasmania, South Island/south part of the North Island

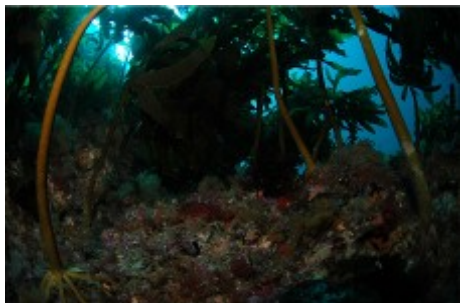
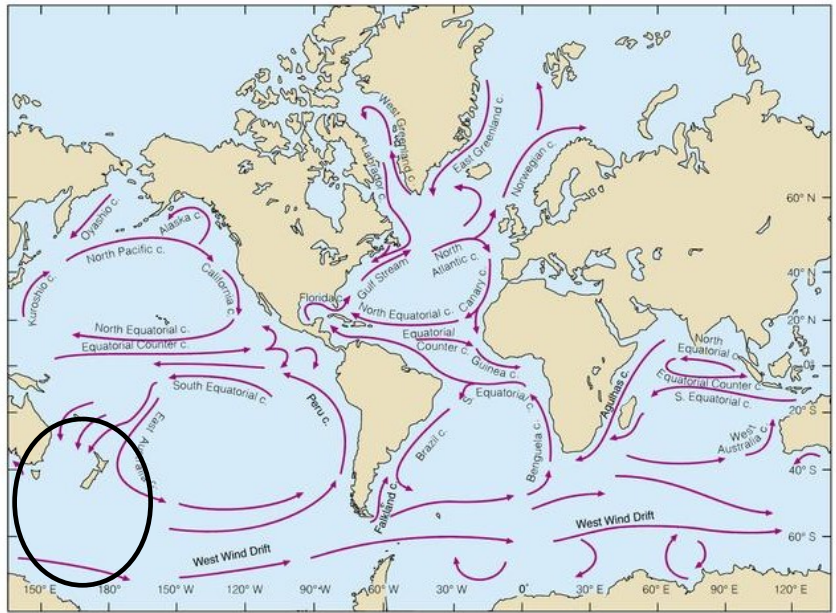
warm temperate – Northern N.Z. region, Southern Australia

(but *E. radiata* occurs as far as northern coast of N. Island of NZ)

biogeographic importance of Abrolhos Islands – W Australia

(S most coral reefs, incl. *Turbinaria*,

*Sargassum* + *Ecklonia radiata* (!) )



important taxa:

*Ecklonia radiata* – up to Queensland and Kalbarri in WA

*Cystophora* spp. (endemic fuclean genus)

southern cold species:

*M. pyrifera*, *Durvillea antarctica*

*Adenocystis utricularis*

*Desmarestia* spp.





*Hormosira banksii*  
(Neptune's necklace)  
the habitat forming species in  
the intertidal of S Aus (+ NZ)



*Lessonia variegata*  
both NZ islands  
plants only up to 1 m  
(like *Ecklonia radiata*)



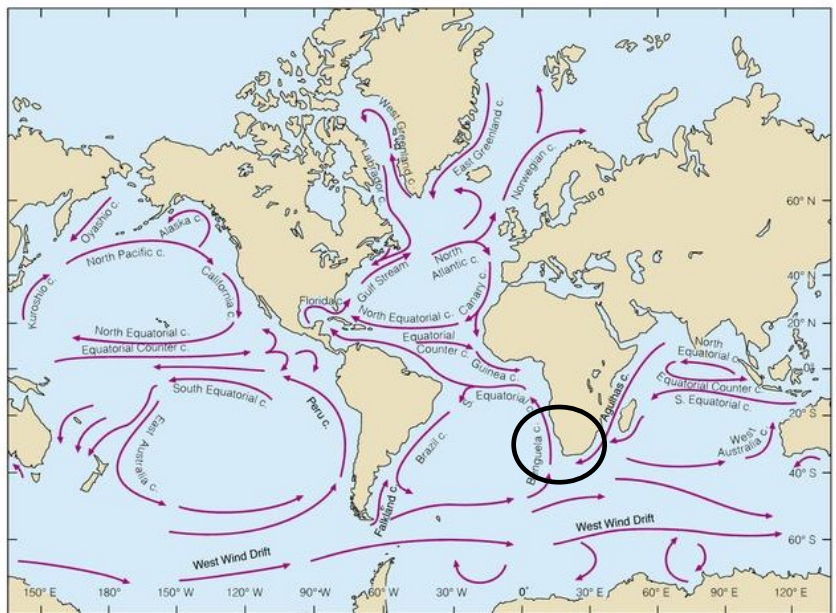
*Sargassum scabridum* – northern half of N Island of NZ,  
typical warm temperate / subtropical species



# cold temperate South Africa province – upwelling Benguela current

kelps: *Ecklonia maxima*, *E. biruncinata*, *L. pallida*  
cold water species: *Porphyra capensis*, *Splachnidium rugosum*

summer max.: 13-19°C, winter min.: 11-14°C



northern border lies as far as in southern Angola



*Gelidium vittatum* is a frequent epiphytic species on stipes of *E. maxima*



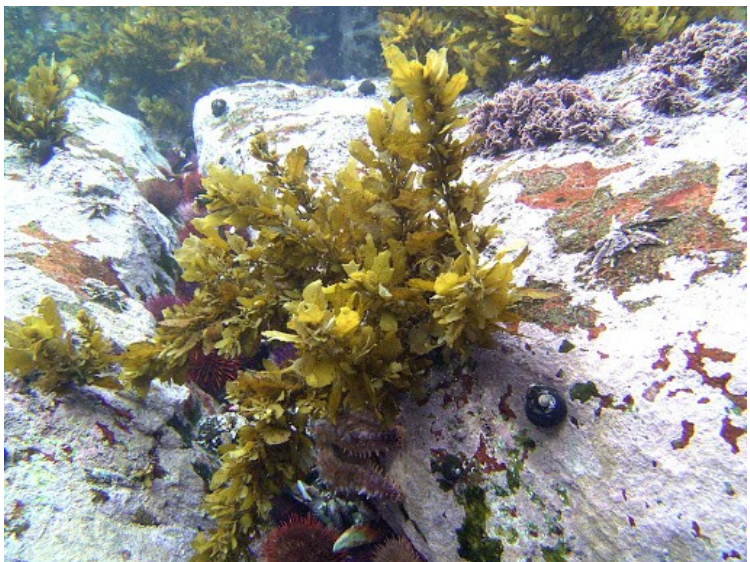
# warm temperate South African region – Agulhas province

(from Cape Agulhas to Natal)

- kelps are replaced by typical warm temperate canopy algae [Sargassaceae, Cystophora (S.H. equivalent of Cystoseira), agarophytes (e.g. Gelidium pristoides), Caulerpa, Corallinaceae, Peyssonnelia capensis, etc.]
- only *E. biruncinata* sporadically occurs up to Natal

<http://southafrseaweeds.uct.ac.za>

*Sargassum heterophyllum*  
*Caulerpa lentillifera*  
*Cystophora fibrosa*  
*Gelidium pristoides*



sub-antarctic islands (circumpolar cold temperate region)

3-11°C w.i., 5-14°C s.i.

both Antarctic and temperate taxa occur together:

Ant: *Iridaea obovata*, *H. grandifolius*, *Phaeurus antarcticus*  
cold temp.: *Durvillea antarctica*, *Macrocystis pyrifera*,  
*Lessonia flavicans*



*Adenocystis utricularis*  
-a typical species in the eulittoral of cold temp. S.H. regions



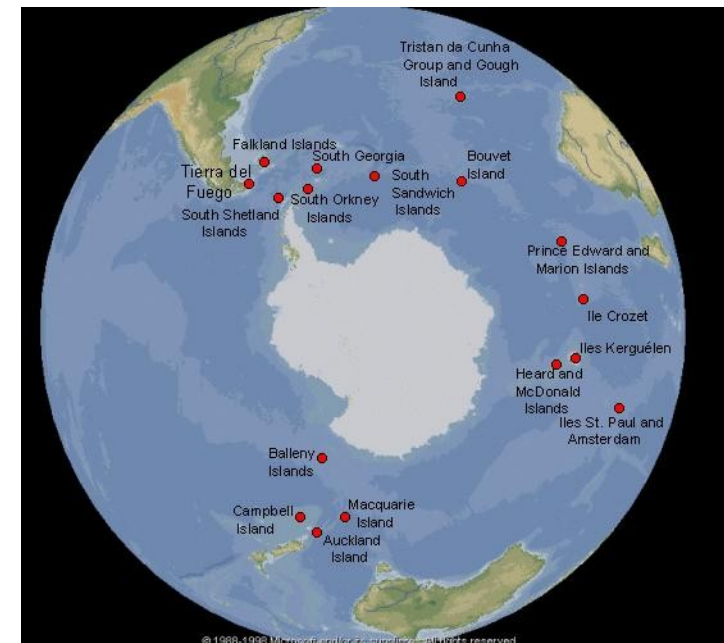
*Prasiola* sp. in the supralittoral

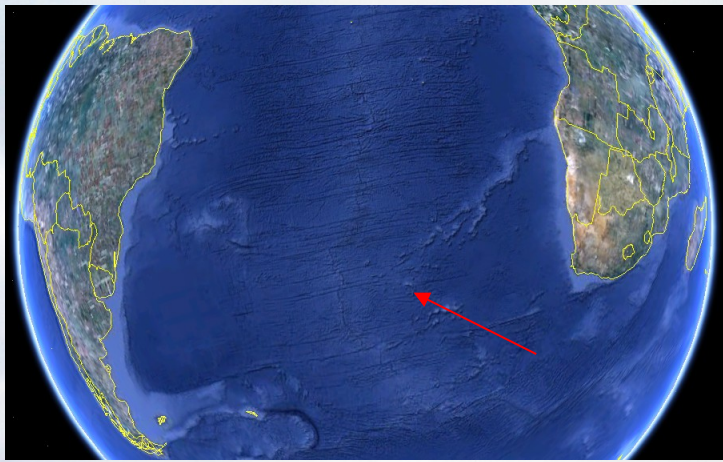


*D. antarctica* (bull kelp)



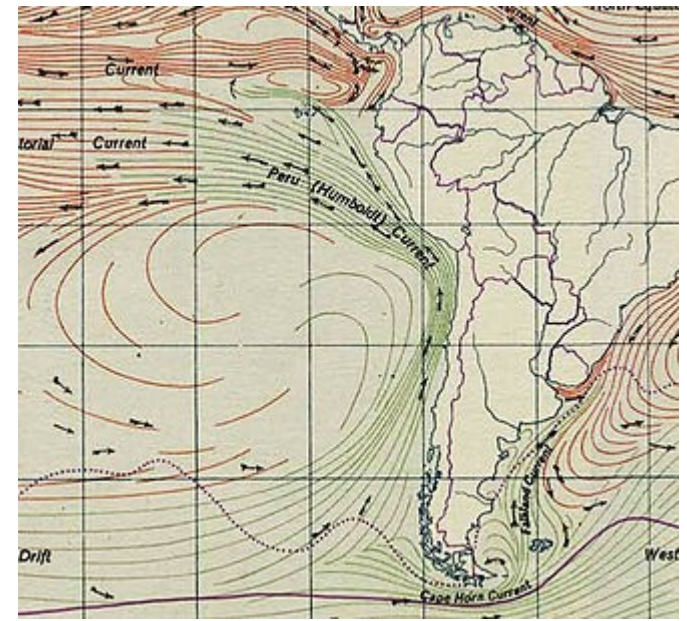
*Xiphophora chondrophylla* – cold temp. fucoid species of NZ province, also present in subantarct. islands close to NZ





<http://static.panoramio.com/photos/original/776916.jpg>

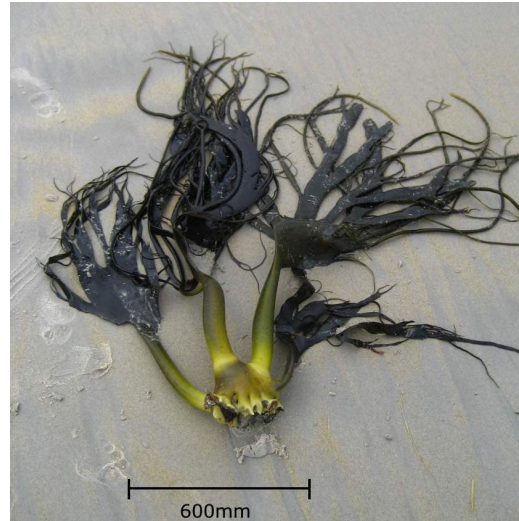
# cold and warm temperate regions of South America



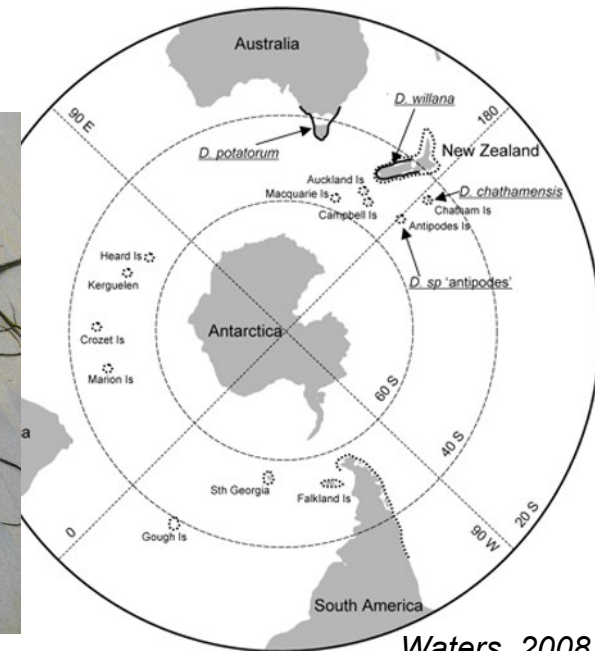
*Gracilaria chilensis* is an important agarophyte of warm temperate Chilean coast  
Chopin & Sawhney, 2009



intertidal *Lessonia nigrescens*  
(up to central Peru!)



*D. antarctica* (dotted line) goes as far as to central Chile



Waters, 2008



Patagonian intertidal - *Ulva* spp. and *Gracilaria* spp. are commercially widely utilized seaweeds; in subtidal – cultivated *Lessonia* and *Undaria pinnatifida* exported to Japan and China



continental shelf off SE Brazil – the world’s largest rhodolith beds (ca 2000 km<sup>2</sup>) in the lower sublittoral;  
main species: *Lithothamnion crispatum* + other probably less frequent taxa

*L. abyssalis* – single bladed, deep water SW Atlantic

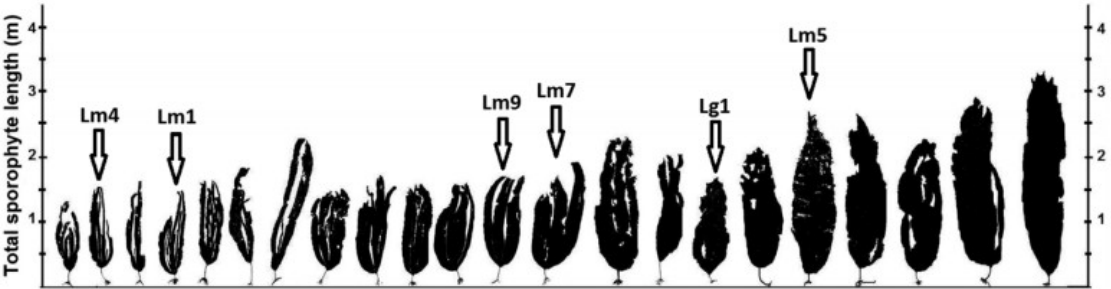


Fig. 1. Binarized images of Brazilian *Laminaria* sporophytes showing the morphological range of blade shape and the different forms of split blades (from left to right). Arrows indicate individuals that were used for molecular analyses.