



Natural History of the California Current: Why it Matters

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California Coastal Commission





NATIONAL BESTSELLER

"A persuasive case for water's healing power." —*Elle*

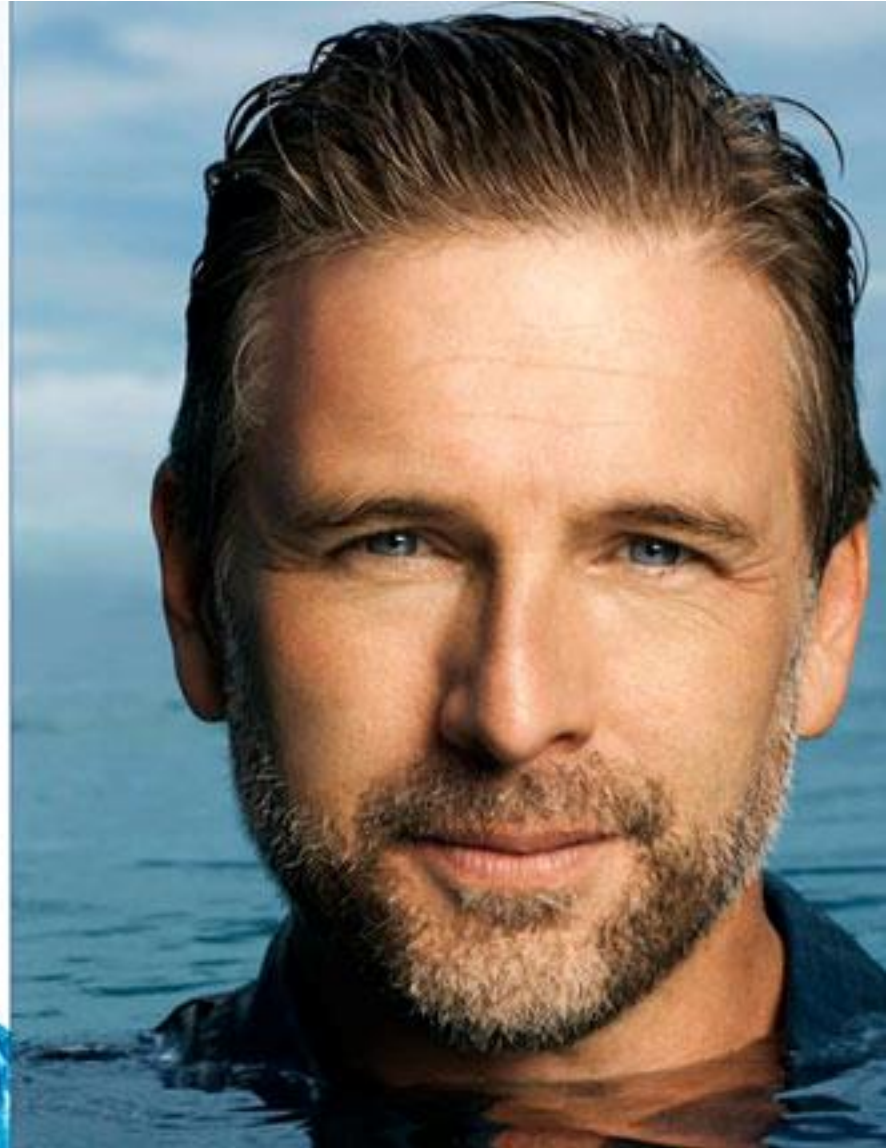
WALLACE J. NICHOLS

FOREWORD BY CÉLINE COUSTEAU

BLUE MIND

The Surprising Science That Shows
How Being Near, In, On, or Under Water
Can Make You Happier, Healthier,
More Connected, and Better at What You Do

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I ♥ Sea Turtles!
¡ Yo ♥ tortugas marinas!







“The Blue Marble”

- NASA

Earth's Surface Area

Saltwater

352,103,700 km² (69.03%)

Freshwater

9,028,300 km² (1.77%)

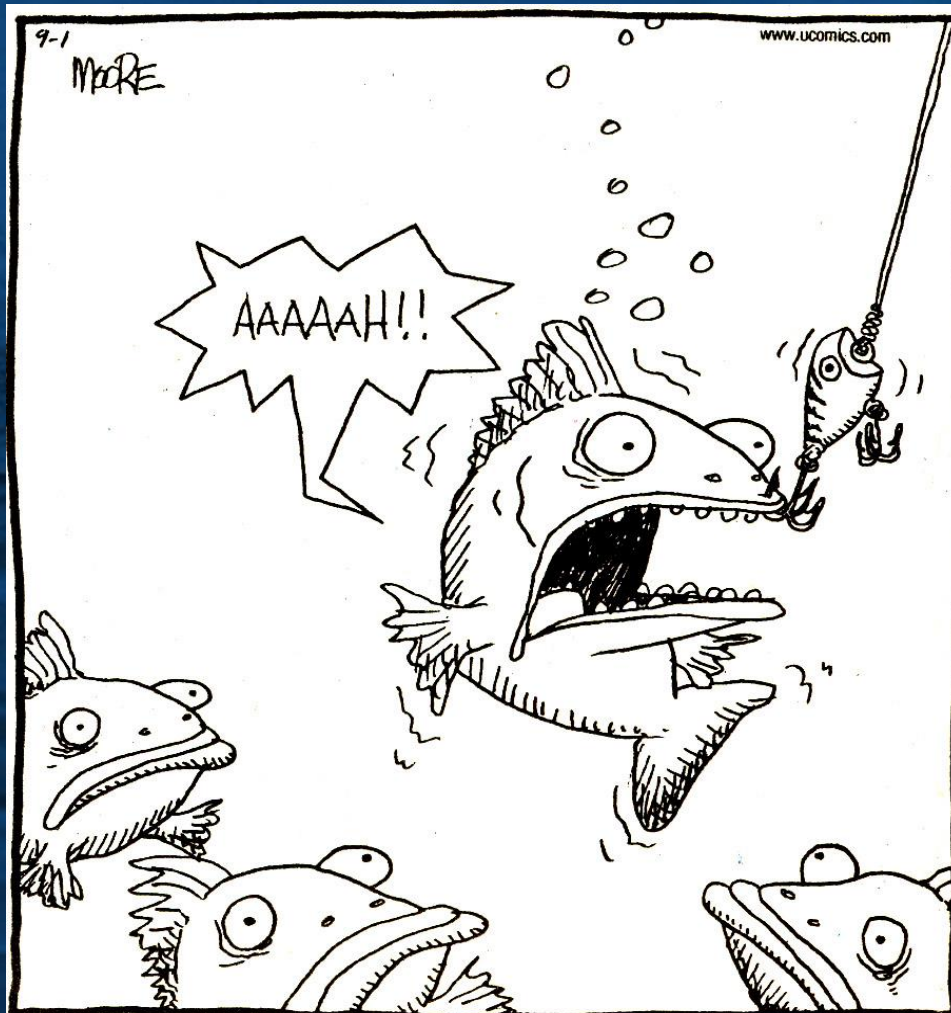
70.8% surface water

- Land that can be farmed
44,682,307 km² (8.76%)
- Mountains
29,788,205 km² (5.84%)
- Covered by snow land
29,788,205 km² (5.84%)
- Dry land
29,788,205 km² (5.84%)
- Land w/o topsoil
14,894,102 km² (2.92%)



- Entangled, dead leatherback sea turtle offshore of Marin County, September, 2015





Witnesses later told police that they didn't help the victim because they 'didn't want to get involved.'"



Earth's Ocean Surface Temperature - temperature gradients drive movement

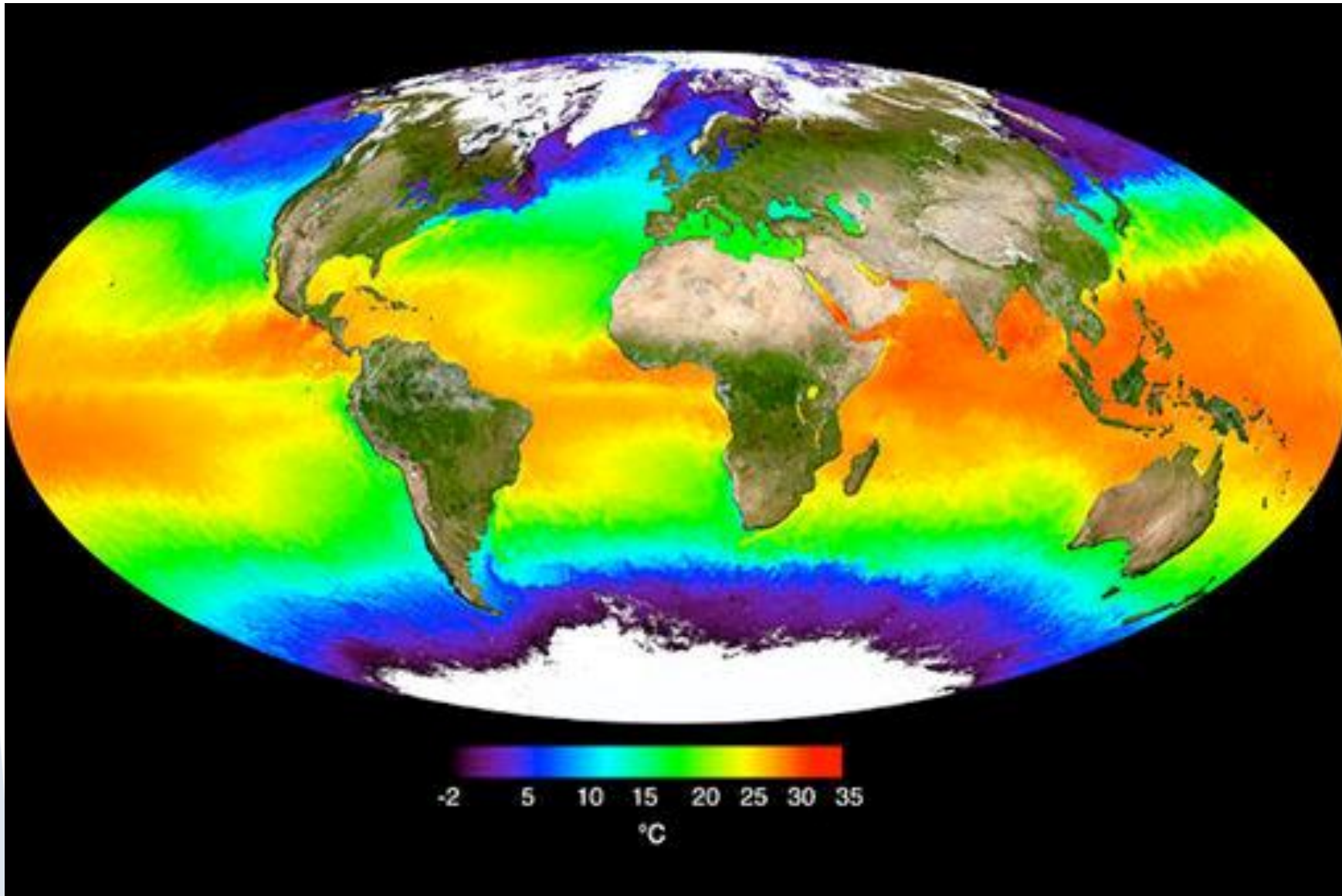


Image map © Jacques Descloitres, MODIS Land Rapid Response Team, NASA/GSFC , 2010

<http://www.sciencelearn.org.nz/Contexts/The-Ocean-in-Action/Sci-Media/Images/Sea-surface-temperature>



CALIFORNIA REPUBLIC



Global Ocean Circulation - circular gyres big and small

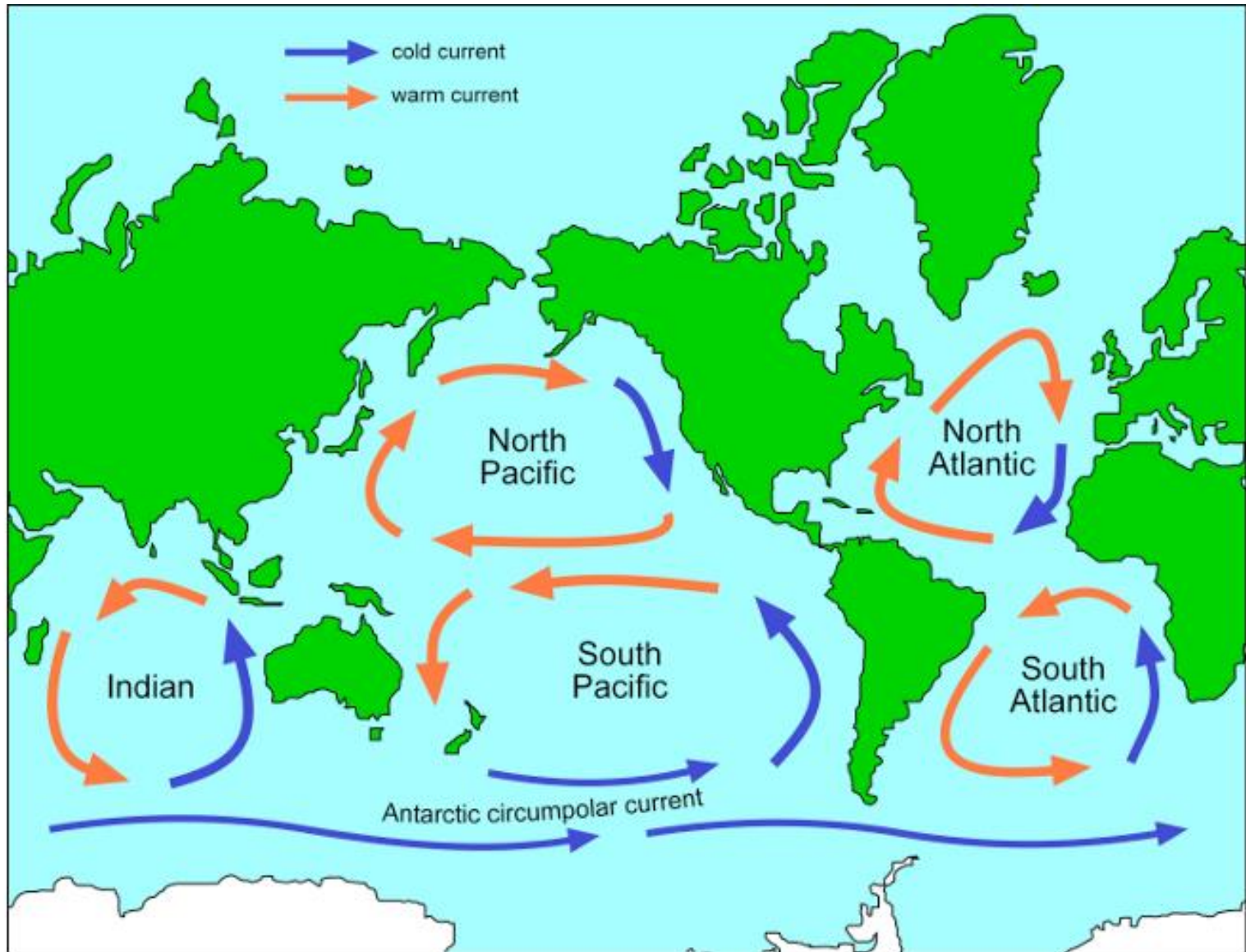


Image map © The University of Waikato, 2010

<http://www.sciencelearn.org.nz/Contexts/The-Ocean-in-Action/Sci-Media/Images/Map-of-ocean-gyres>

Physical Processes

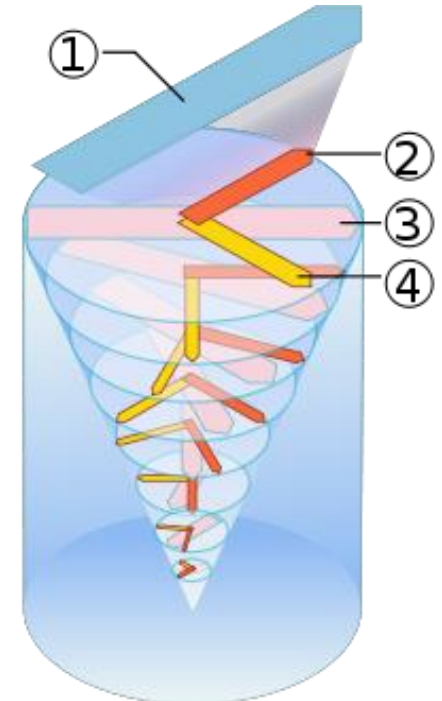
The Earth rotates, but the atmosphere and ocean resist!

The Coriolis effect is caused by the rotation of the Earth and the inertia of the mass experiencing the effect.

Ekman spiral effect

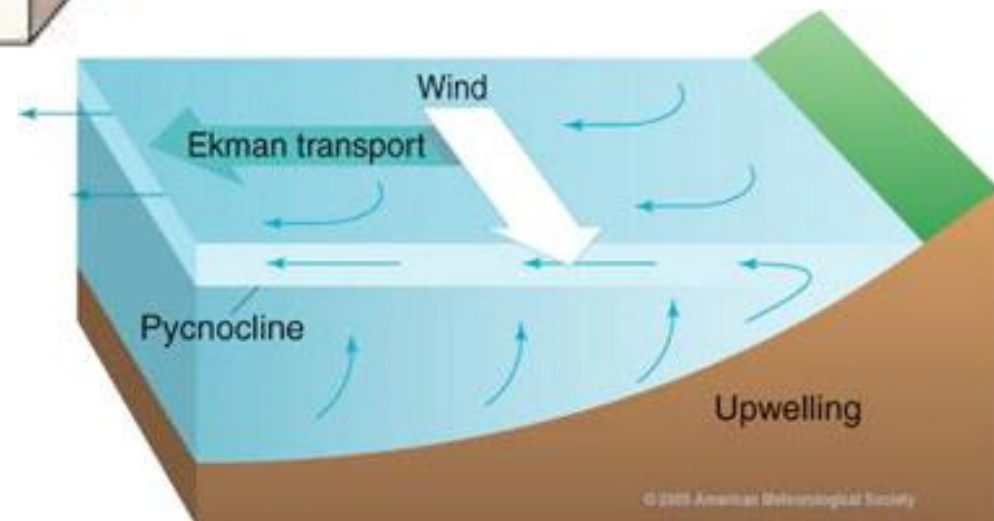
- 1: Wind
- 2: Force from above
- 3: Effective direction of the current
- 4: Coriolis effect

Combined Result: ocean surface currents move 45 -**90** degrees relative to wind direction!



West Coast Upwelling

A schematic of the California Current Ecosystem displays the dynamic forces at play offshore, including wind at the sea surface (black arrows), upwelling at the coast (large blue arrows), upwelling due to the wind stress curl (small blue arrows) and food web dynamics (circular gray arrows).



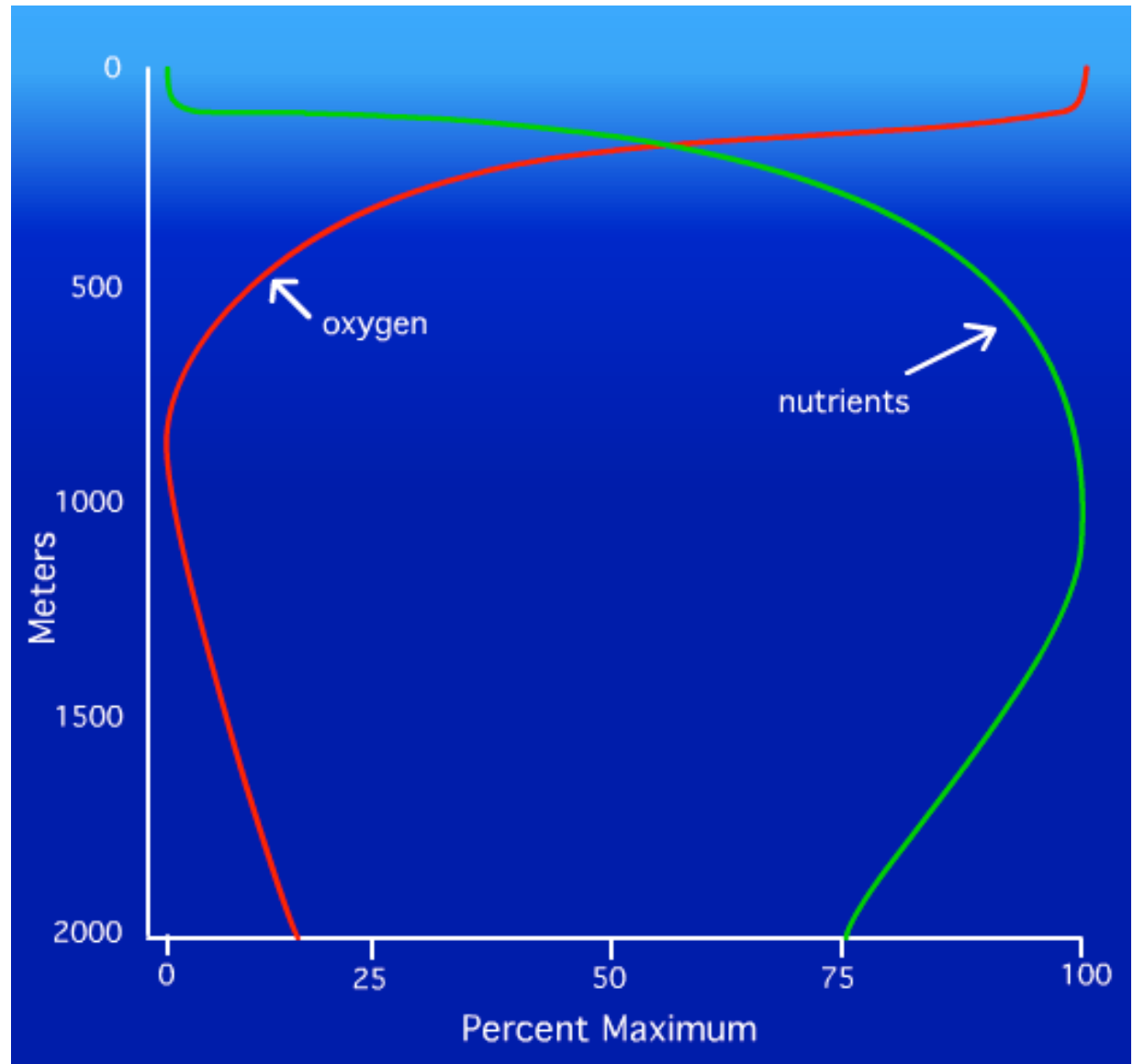
Coast Upwelling

Oxygen at the ocean surface is created by **phytoplankton**, the microscopic plants of the sea.

Phytoplankton produce more than half of the world's oxygen.

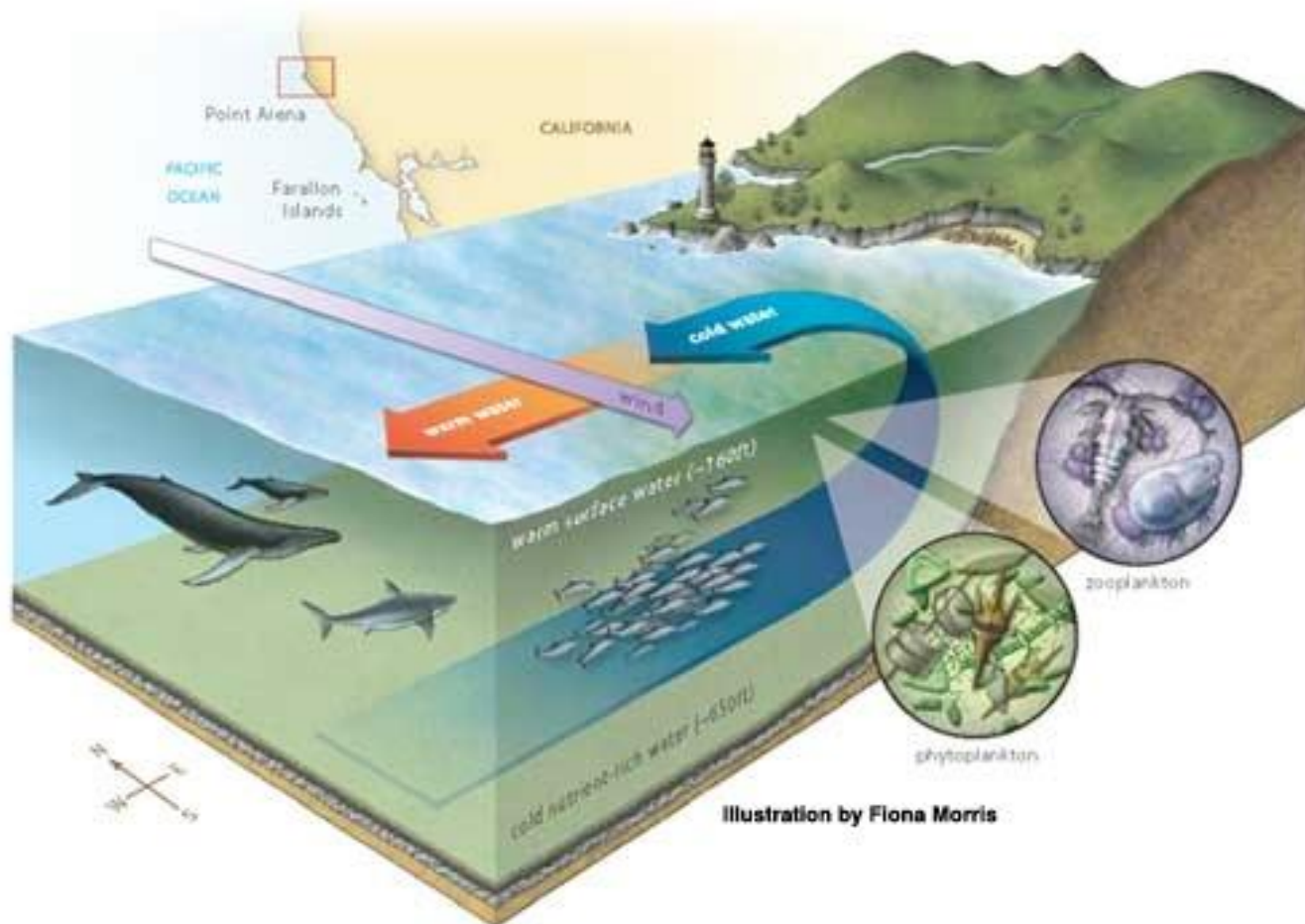
Upwelling brings the nutrients toward the surface.

Life flourishes!



California Current Coast Upwelling

Coastal upwelling brings nutrient-rich water from the depths of the ocean up into the photic zone, where phytoplankton can harness sunlight to convert the nutrients into oxygen and biomass (primary producers), which supports large blooms of zooplankton (primary consumers) and abundant marine wildlife.



Ocean Circulation along the West Coast of North America

The California
Current is
influenced by the
eastern edge of the
North Central
Pacific Gyre

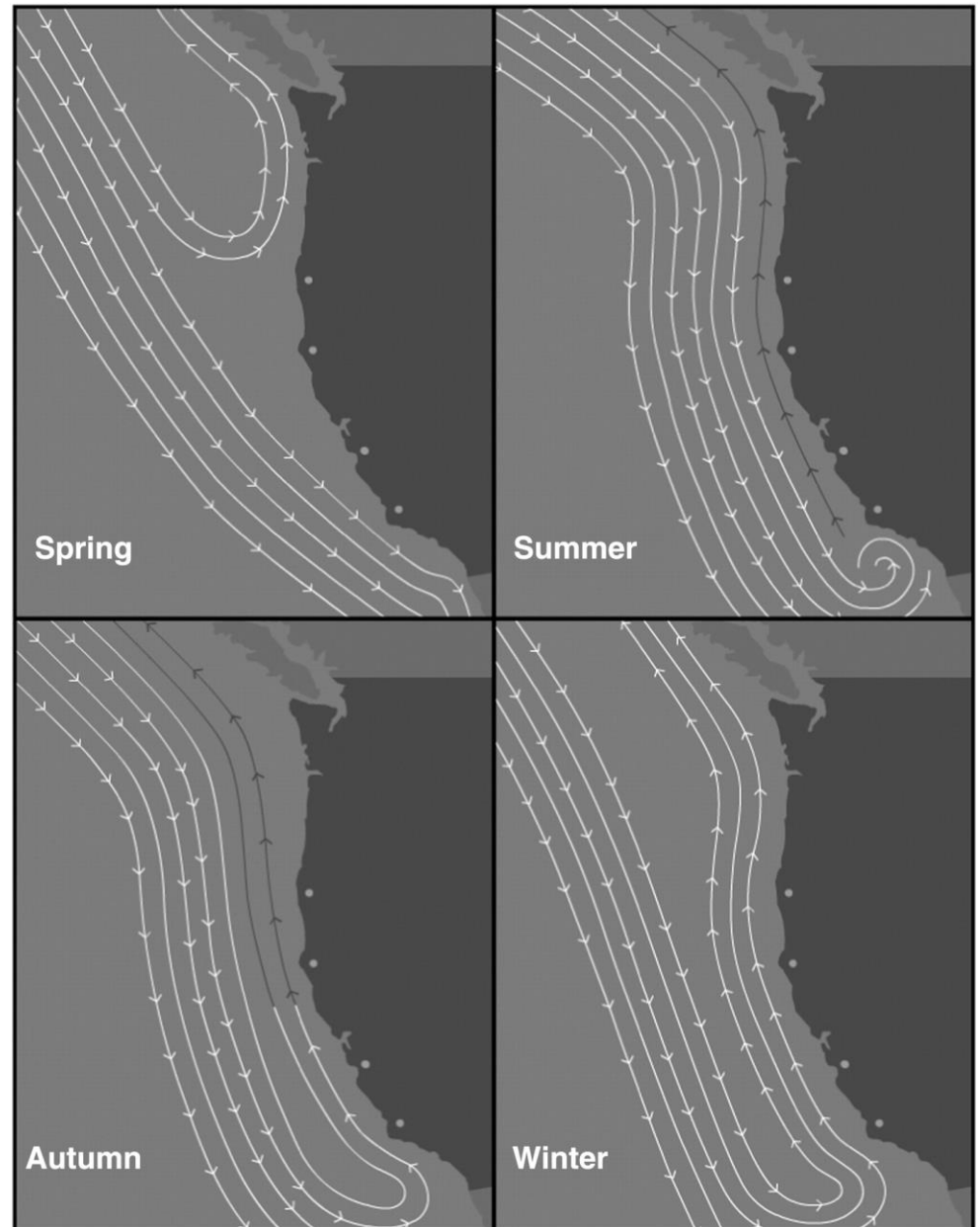


Seasonal Changes in the California Current

Schematic diagram illustrating mean seasonal circulation of large-scale boundary currents off the US west coast.

Surface currents in white, subsurface in black.

(Figure 2. from Femia, 2003, based on Hickey, 1998)



California Current Ecosystem

The geographical scope of the California Current Large Marine Ecosystem (LME) reaches along the entire US West Coast to beyond the tip of Baja California, Mexico.

Ekstrom, J. 2009. California Current Large Marine Ecosystem: publicly available database of state and federal laws and regulations.
Marine Policy 33:528-53.

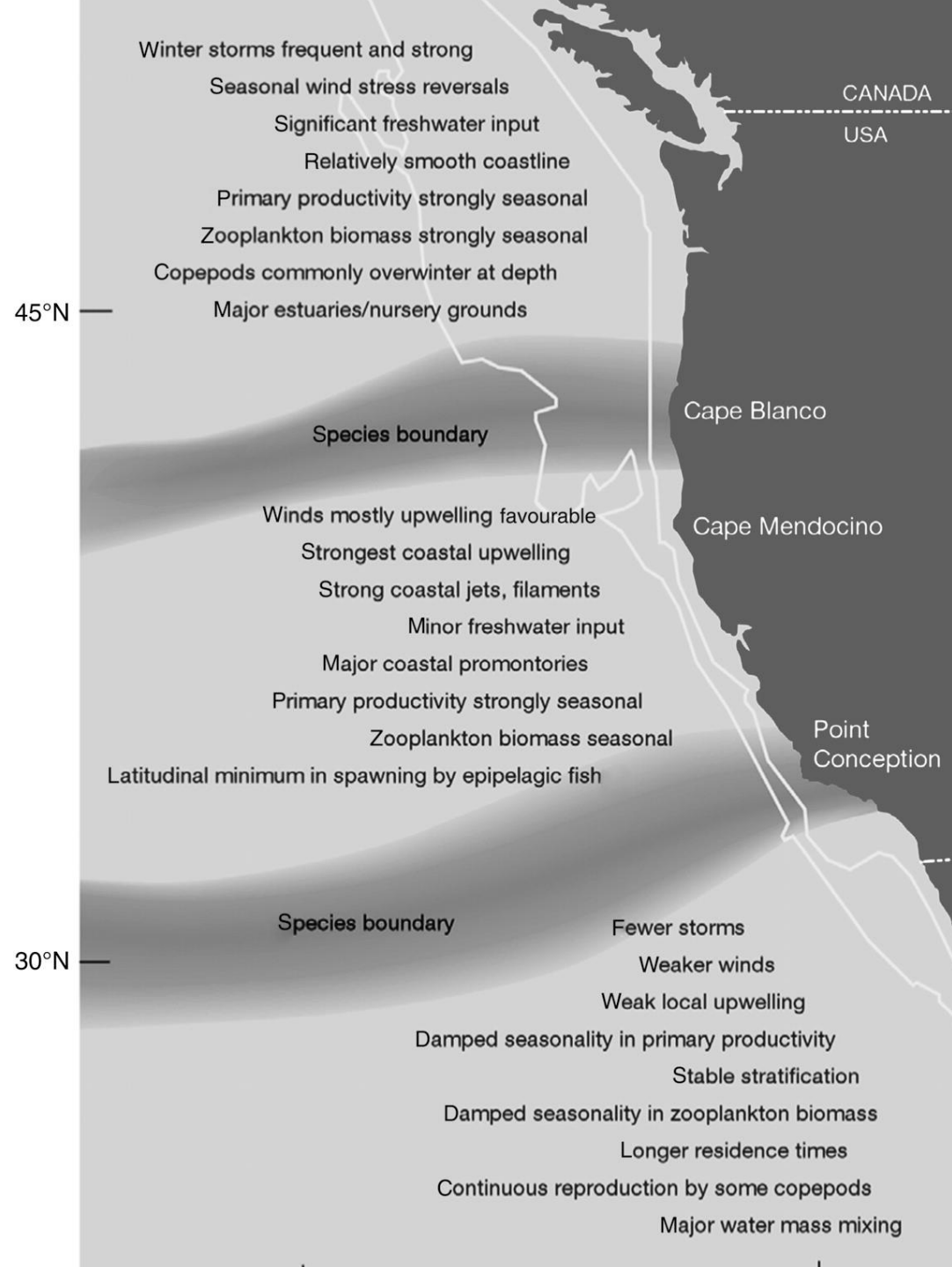


California Current Ecosystem

Generalized regional variations in physical and biological processes within the California Current Ecosystem.

The boundaries between regions are only approximate and vary over time.

(Figure 3. from [Agostini, 2005](#))



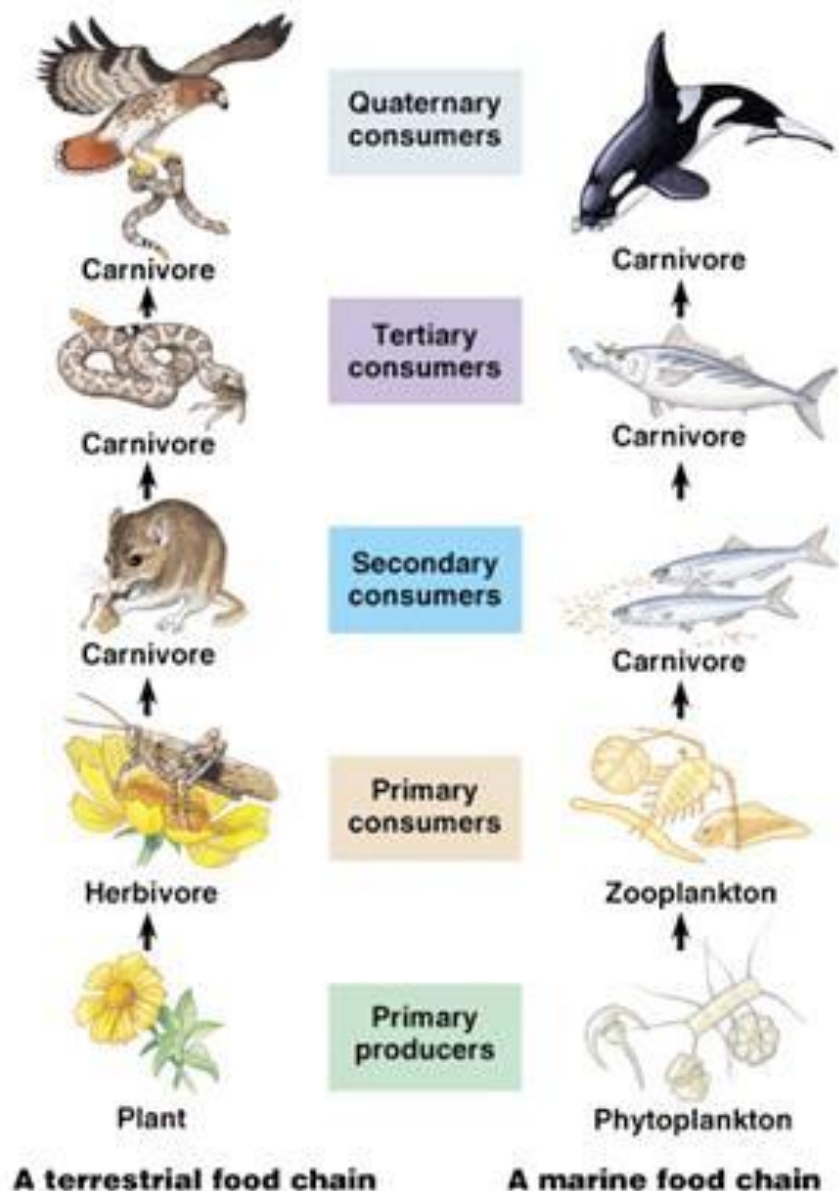
Terrestrial & Marine Food Web

Marine food webs rely on

Phytoplankton (algae)

Zooplankton (krill)

Plankton is a general term for very small pelagic life forms.



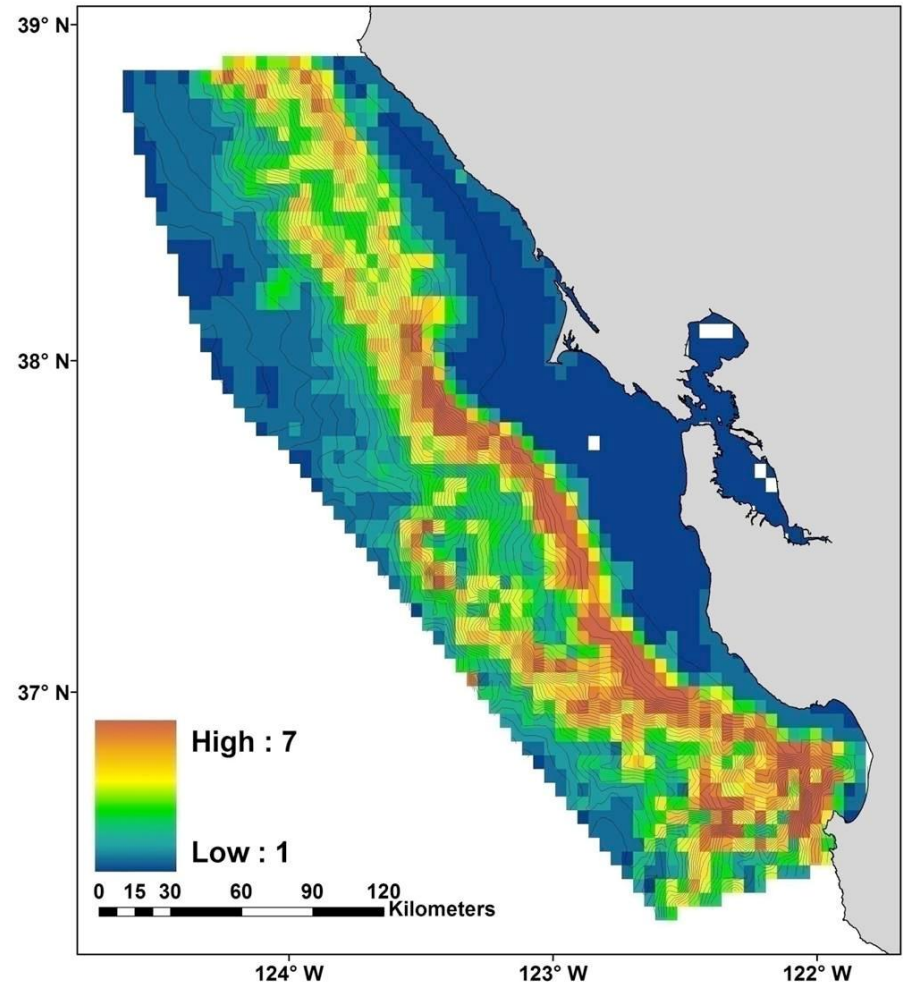
California Current Ecosystem

Krill habitat suitability

Krill are zooplankton

Secondary consumers

Food for salmon, seabirds, whales,
and more!



http://www.faralloninstitute.org/Images/stockphotos/krill_habitat_suitability.jpg

<http://www.csgc.ucsd.edu/NEWSROOM/NEWSRELEASES/2012/SearchableMarineLawDatabase.html>

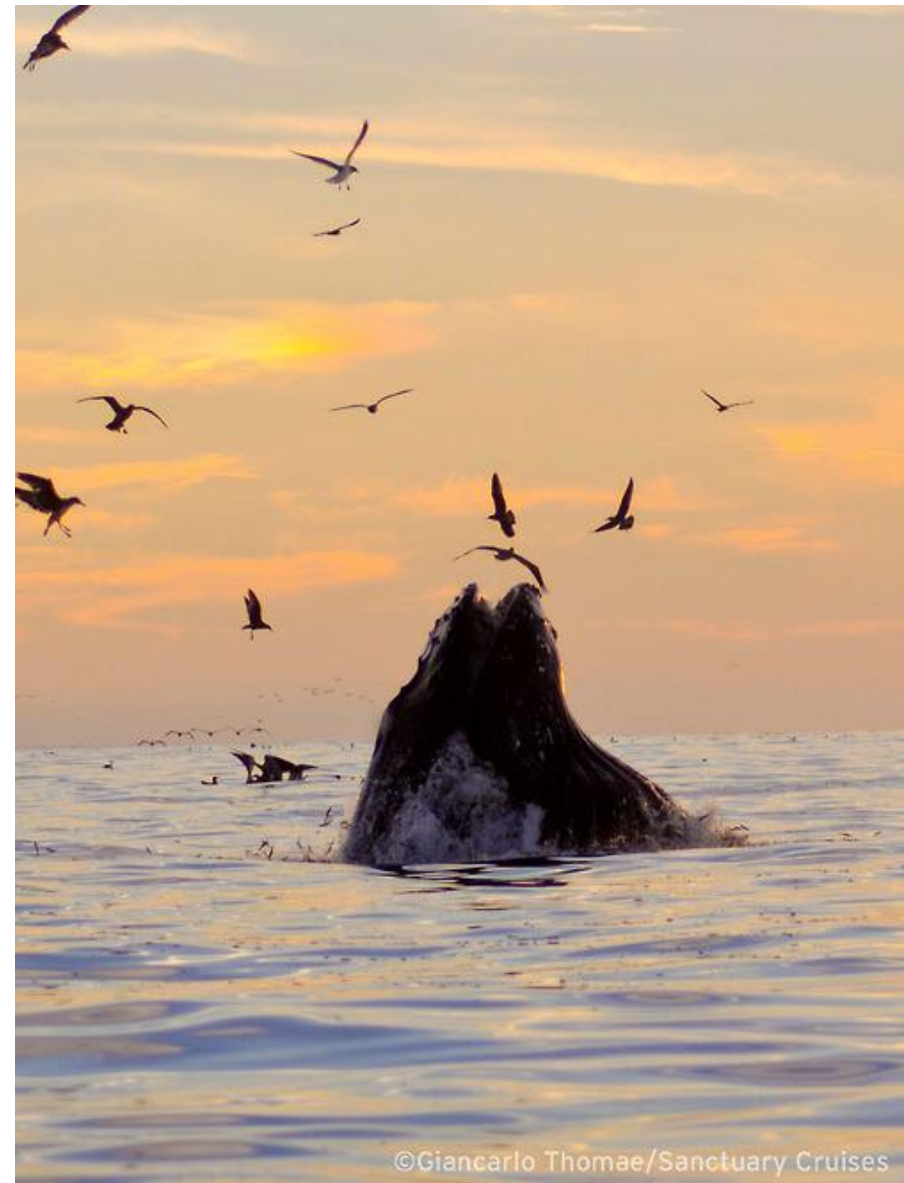
California Current Ecosystem

Seasonal upwelling drives massive primary production in Spring and Summer

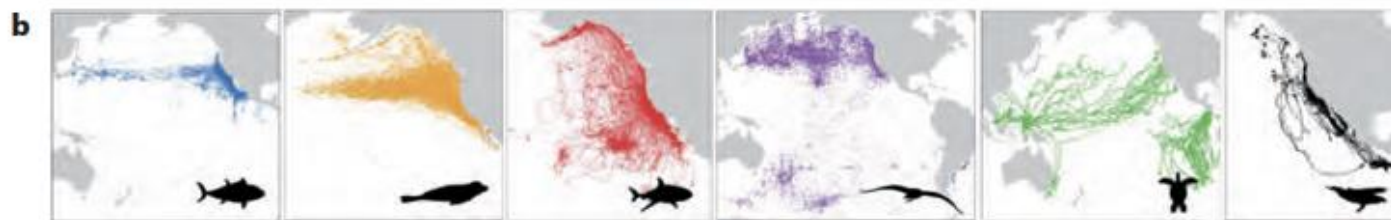
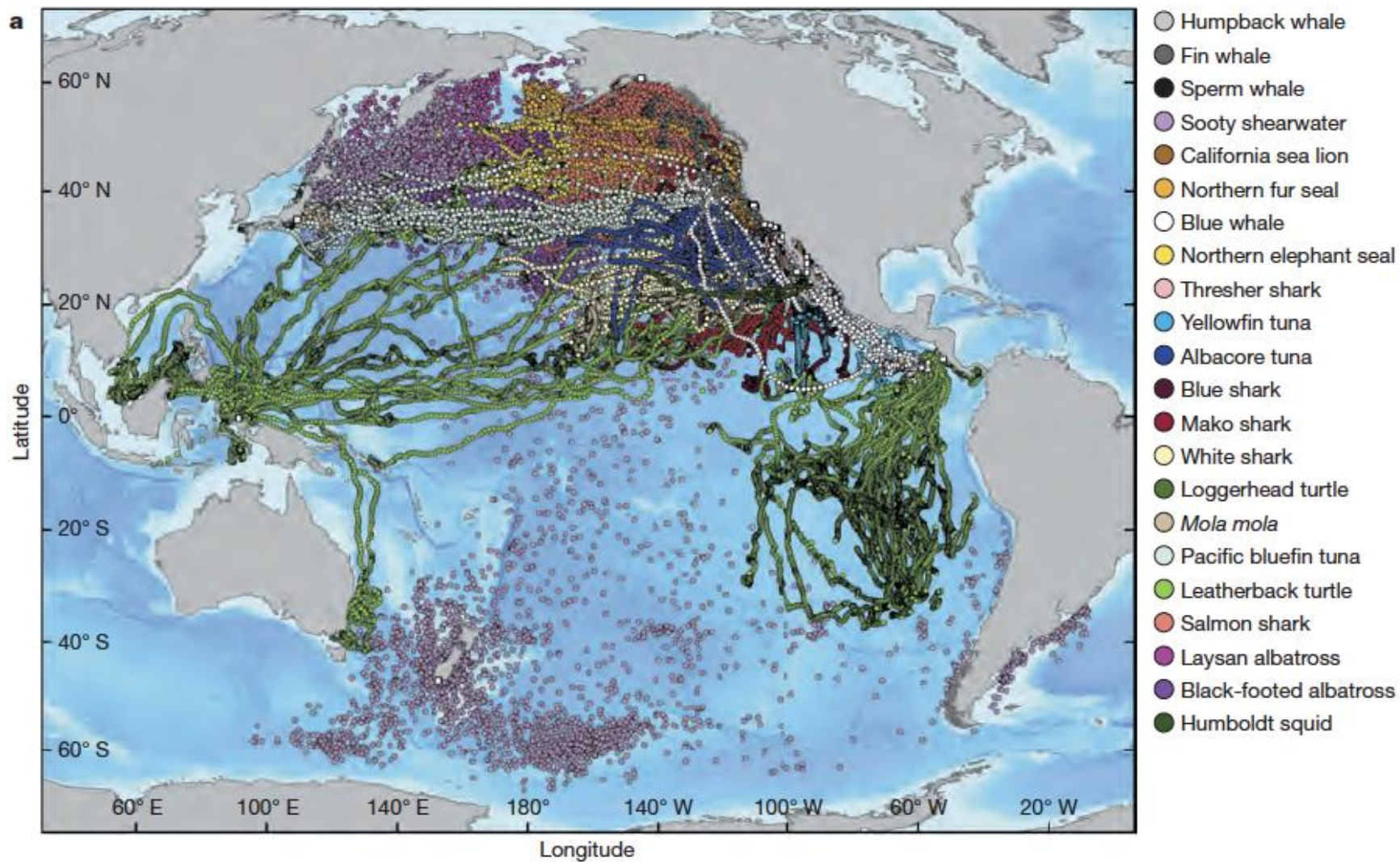
Secondary consumers exploit algal blooms to grow their populations in Spring, Summer, and Fall

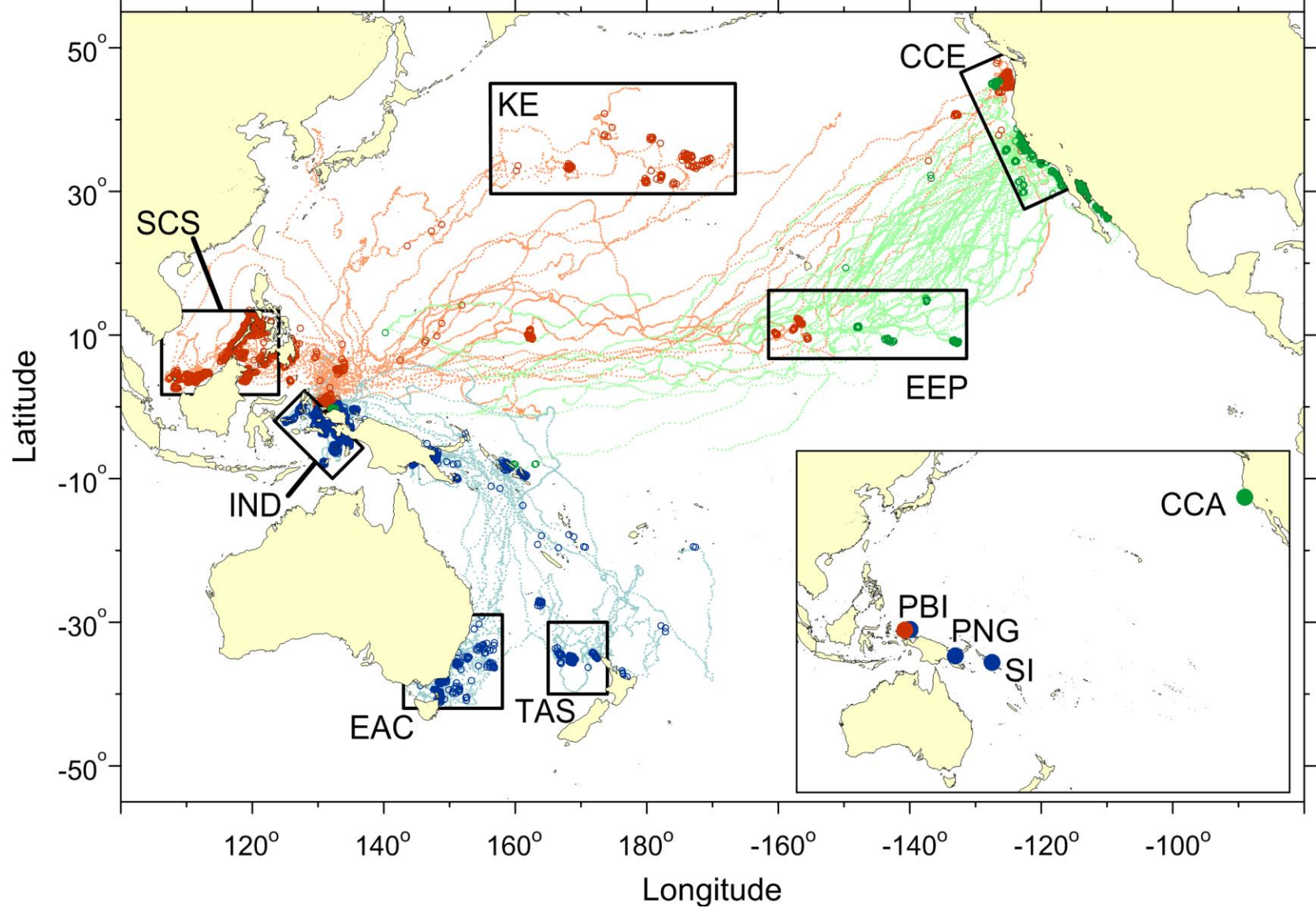
Summer and Fall prey abundance brings migrant whales, sea turtles, and seabirds from across the globe to the California Current Ecosystem

Satellite tracking of migratory animals reveals their seasonal foraging and breeding grounds offshore of California



©Giancarlo Thomae/Sanctuary Cruises





Leatherback sea turtle migrations in the Pacific

CCE = California Current Ecosystem

National Marine Sanctuaries

Northern California

- Monterey Bay
- Gulf of the Farallones
- Cordell Bank

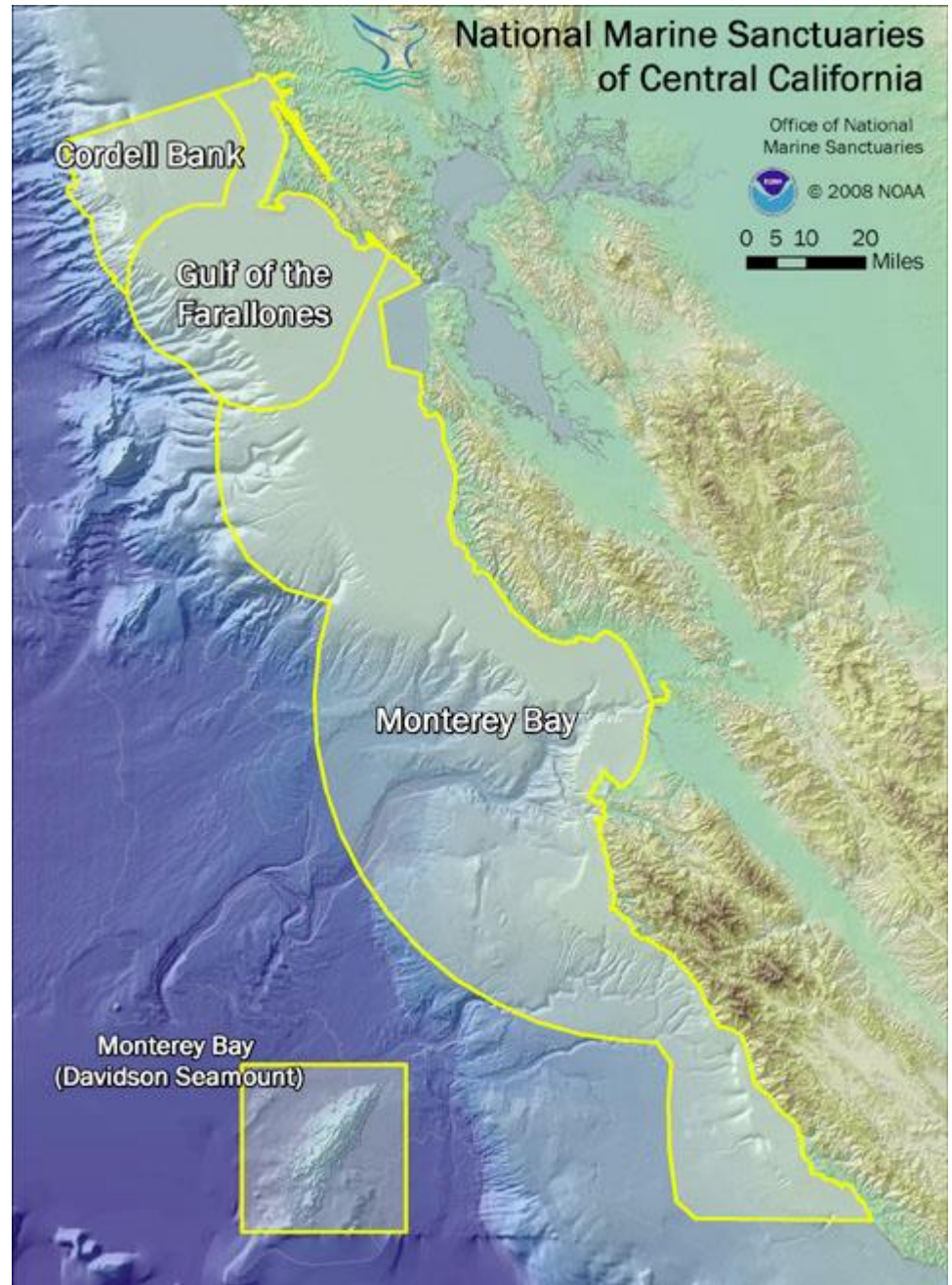
Southern California

- Channel Islands

National Marine Sanctuaries protect against oil drilling, energy exploration, dumping, and pollution.

They do NOT impact commercial or recreational fishing and hunting

Increase education and research efforts!

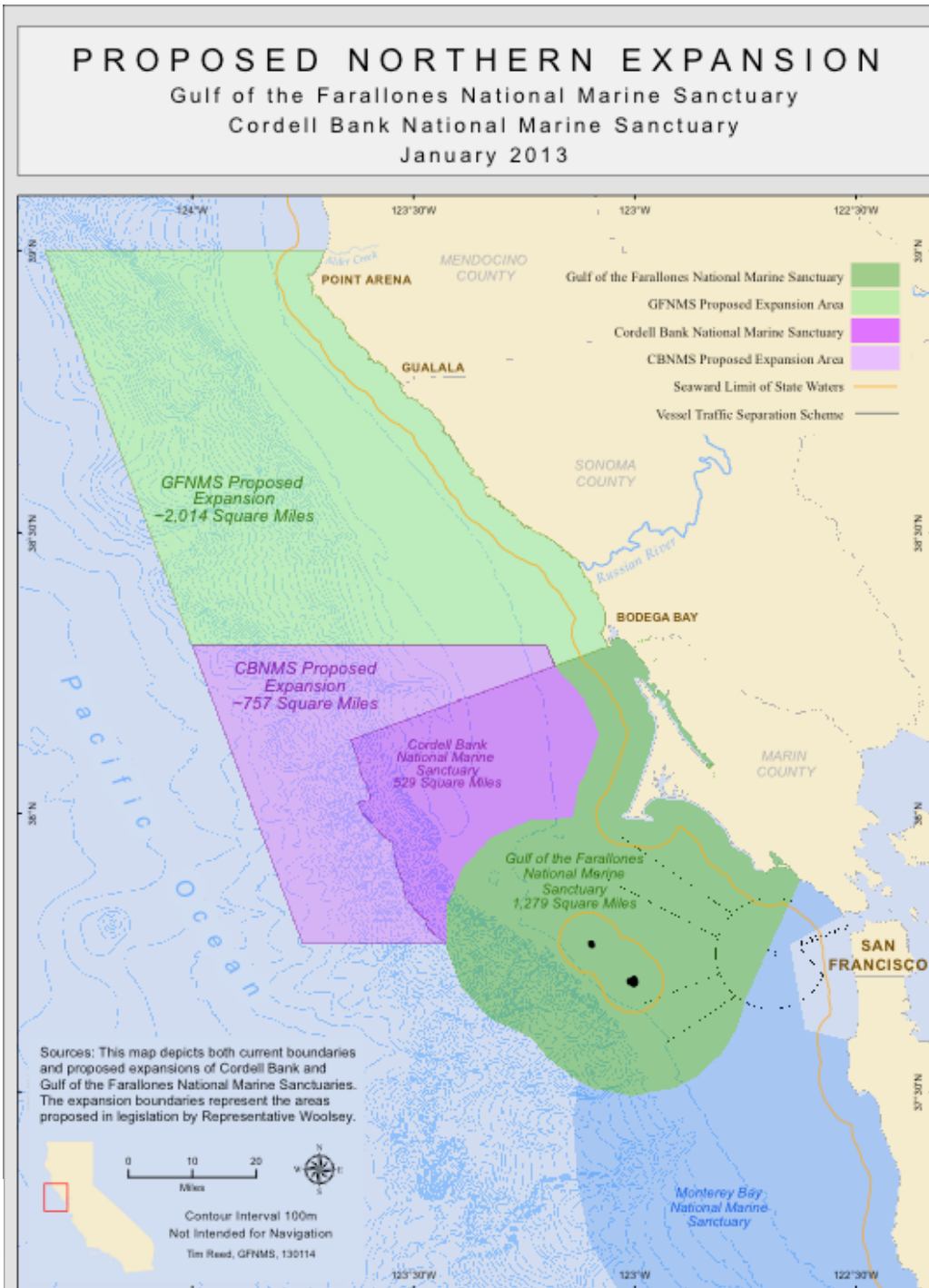


Gulf of the Farallones and Cordell Bank National Marine Sanctuaries Expanded June, 2015!

Now called the
Greater Farallones National Marine
Sanctuary

Another new proposal could close
a gap offshore of San Francisco!

Keep informed and activated!

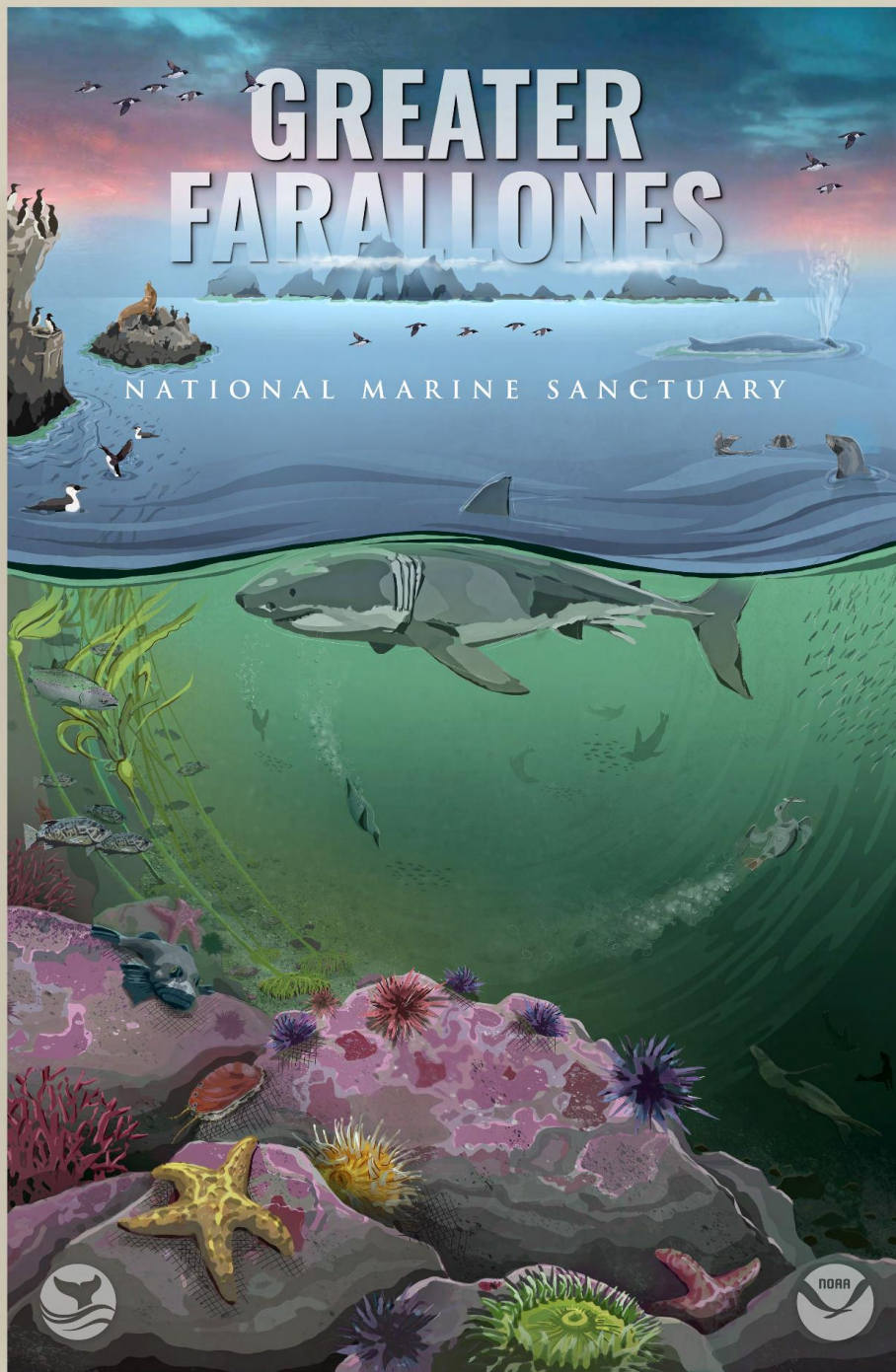


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California Coastal Commission



PROTECTED AREA

3,295 square miles

DESIGNATION

January 1981

HABITATS

Bays and estuaries

Continental shelf and slope

Deep benthos

Deep rocky reefs

Islands

Kelp forests (bull kelp)

Open ocean

Sandy and rocky shores

KEY SPECIES

Tufted puffin

Blue whale

Common murre

Dungeness crab

Harbor seal

Krill

Steller sea lion

Red abalone

White shark

Chinook salmon



Oceanic Society

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Whale Watching Season is Now

JOIN US ON A DAY TRIP TO THE FARALLON ISLANDS
FROM SAN FRANCISCO OR SAUSALITO.

[SIGN UP](#)

Creating a more oceanic society since 1969.







Farallon
National
Wildlife
Refuge



Farallon
Islands Game
Refuge

Farallon
Islands/Fanny
Shoal Essential
Fish Habitat...

Farallon
Islands

Southeast
Farallon Island
State Marine
Reserve

Southeast
Farallon Island
State Marine...

Google





Fisherman Bay

Maintop Bay

Great West Arch

Southeast
Farallon
Special
Closure A

Maintop Island

The Golden Gate

Farallon Islands

Farallon Island
Lighthouse

South Farallon
Islands

Water Catchment Pad

Seal Rock

Google















Thank You!

