EBM and Coastal Fisheries: *The California Experience*

What EBM is and where it came from

Brief history of EBM…

1. **Neolithic Times- traditional EBM including reverent acknowledgement of ecosystem and trial-and-error adaptive management. (Actual practice varied).**

2. **Enlightenment to Industrial Era- 400 year transition to technological mass extraction.**

3. **20th Century population-based single-species resource extraction principles, MSY.**

4. **Return to traditional wisdom now aided by technology-rich tools for EBFM, EBM and AM.**

What's wrong with EBM?

- Vaguely defined.
- Requires more data than we can afford to get.
- When we have the data, we don't understand it.
- To understand it we'd need big experiments with lots of closed areas.
- The law does not require that we bother with EBM

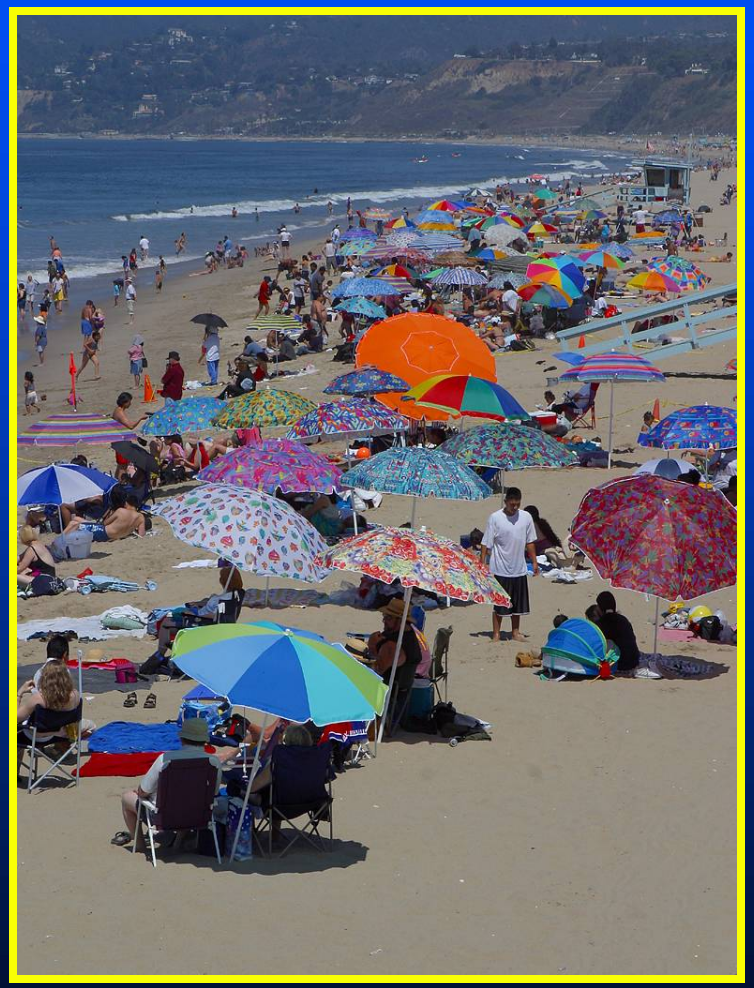
So…um…we just model some more?

…But, what if the law *required* EBM?

Marine Life Management Act

California's legislation to conserve the nearshore ecosystem and all of the economic resources that it provides.

California's Ocean Economy: $46 Billion/Year



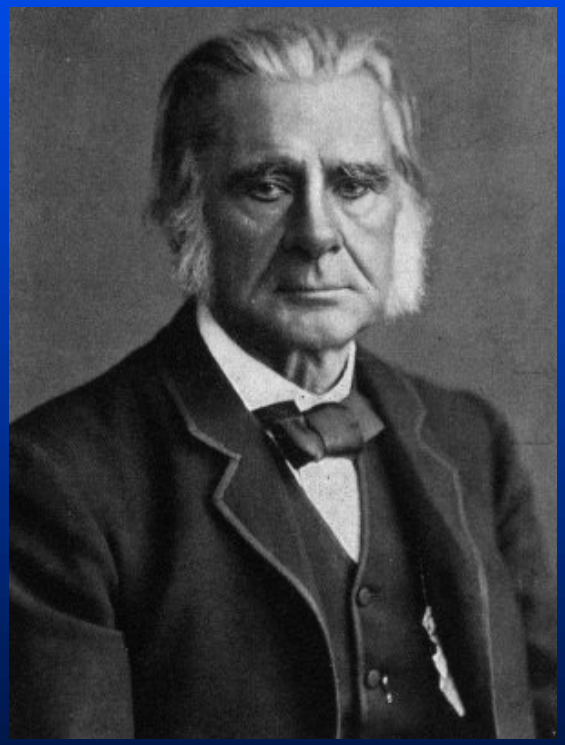
Evolution of Fishery Management in California

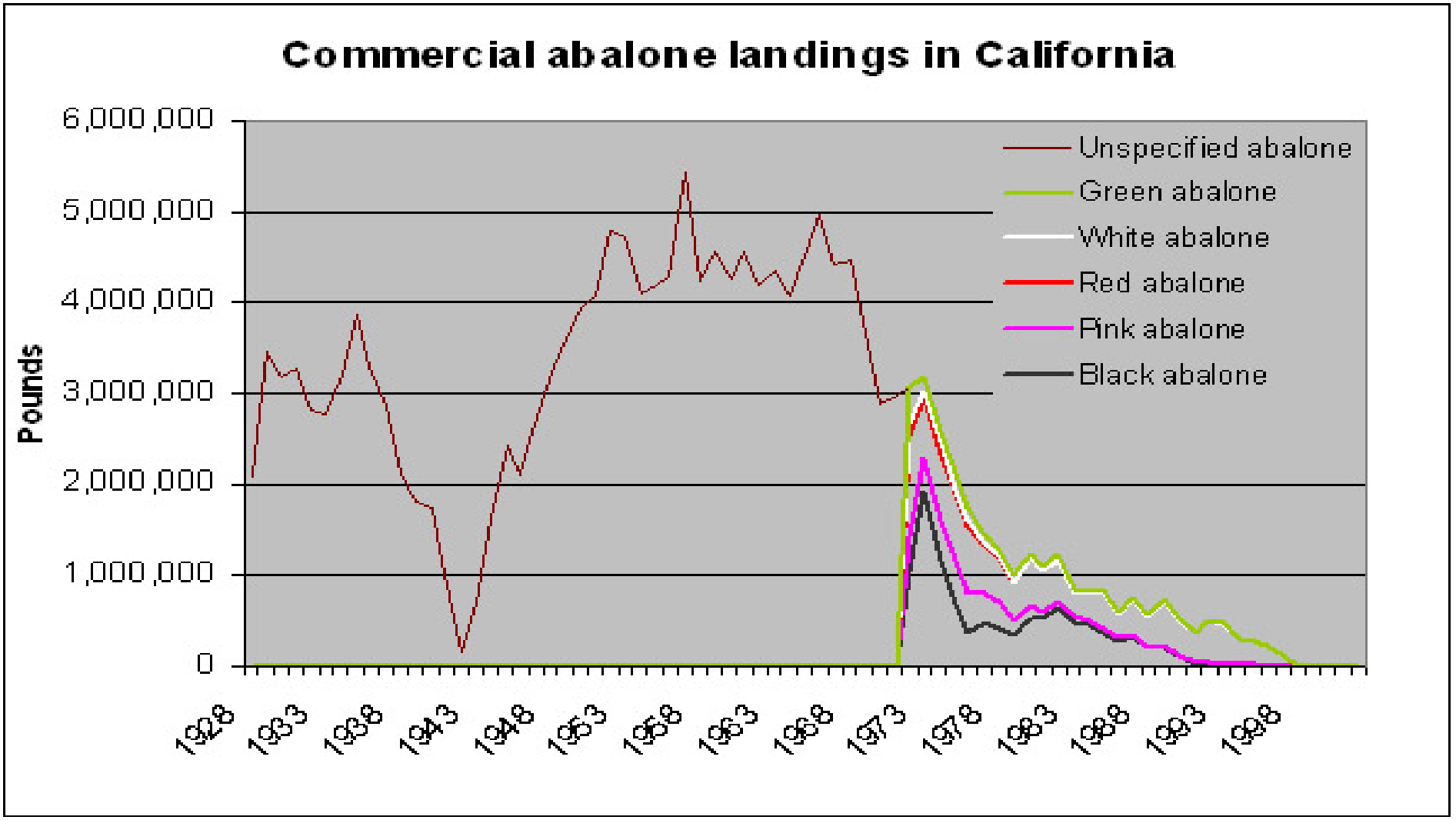
- Perception of inexhaustibility
- Maximizing extraction and wealth
- Diversification-intensification of fisheries and markets
- Serial depletion kicks in
- System of acts (MLMA, MLPA, COPA) that require EBM.

Early Era

…probably all the great sea-fisheries, are inexhaustible; that is to say that nothing we do seriously affects the number of fish ... given our present mode of fishing. And any attempt to regulate these fisheries consequently ... seems to be useless.

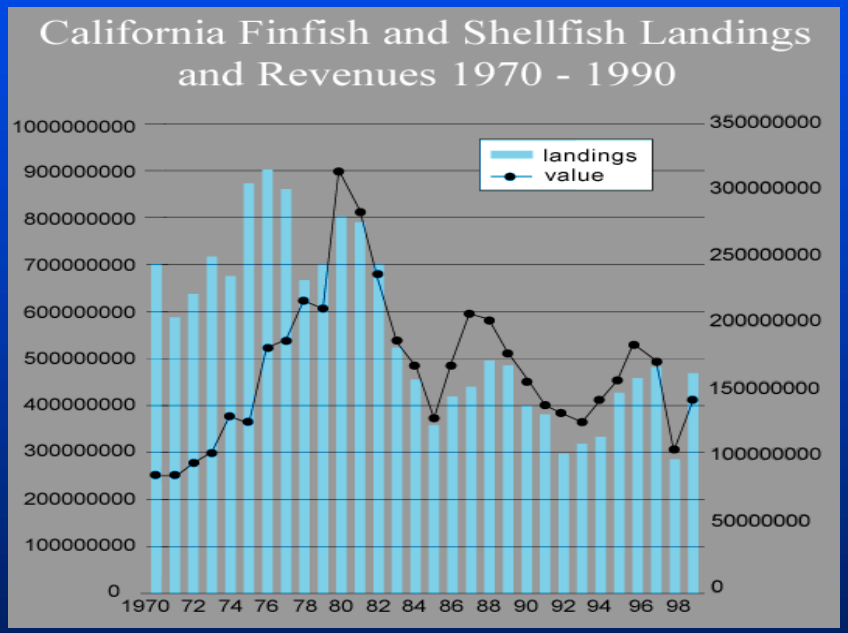
- Thomas H. Huxley, 1884

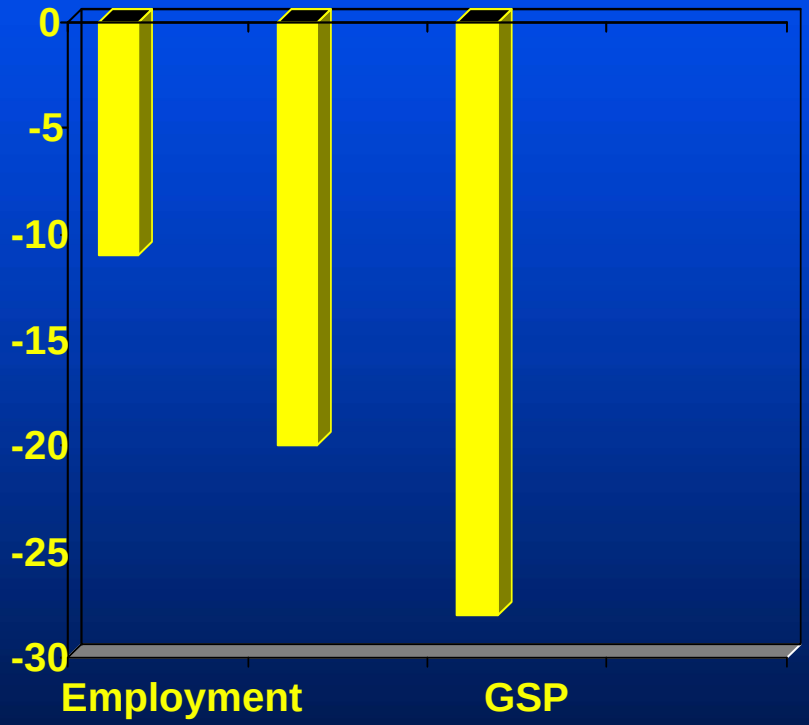



Commercial abalone landings in California
Pounds
6,000,000
5,000,000
4,000,000
3,000,000
2,000,000
1,000,000
0
Unspecified abalone
Green abalone
White abalone
Red abalone
Pink abalone
Black abalone

K.Wing, NRDC

Yield Declines Despite Intensification

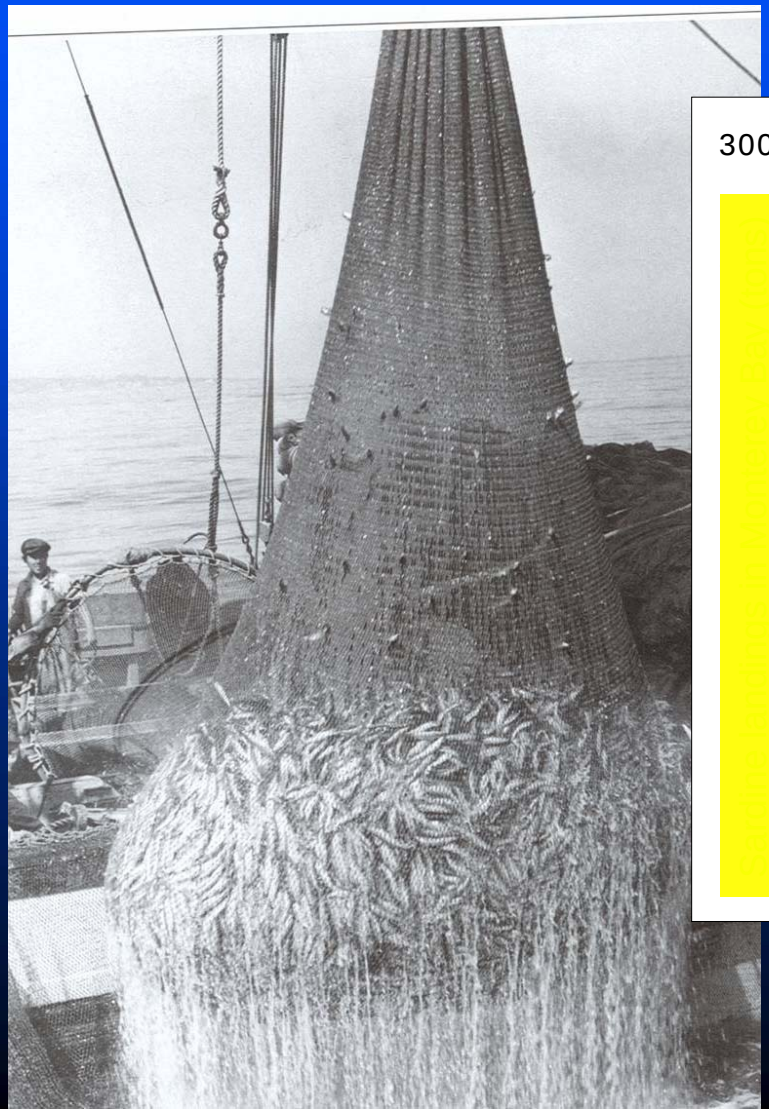


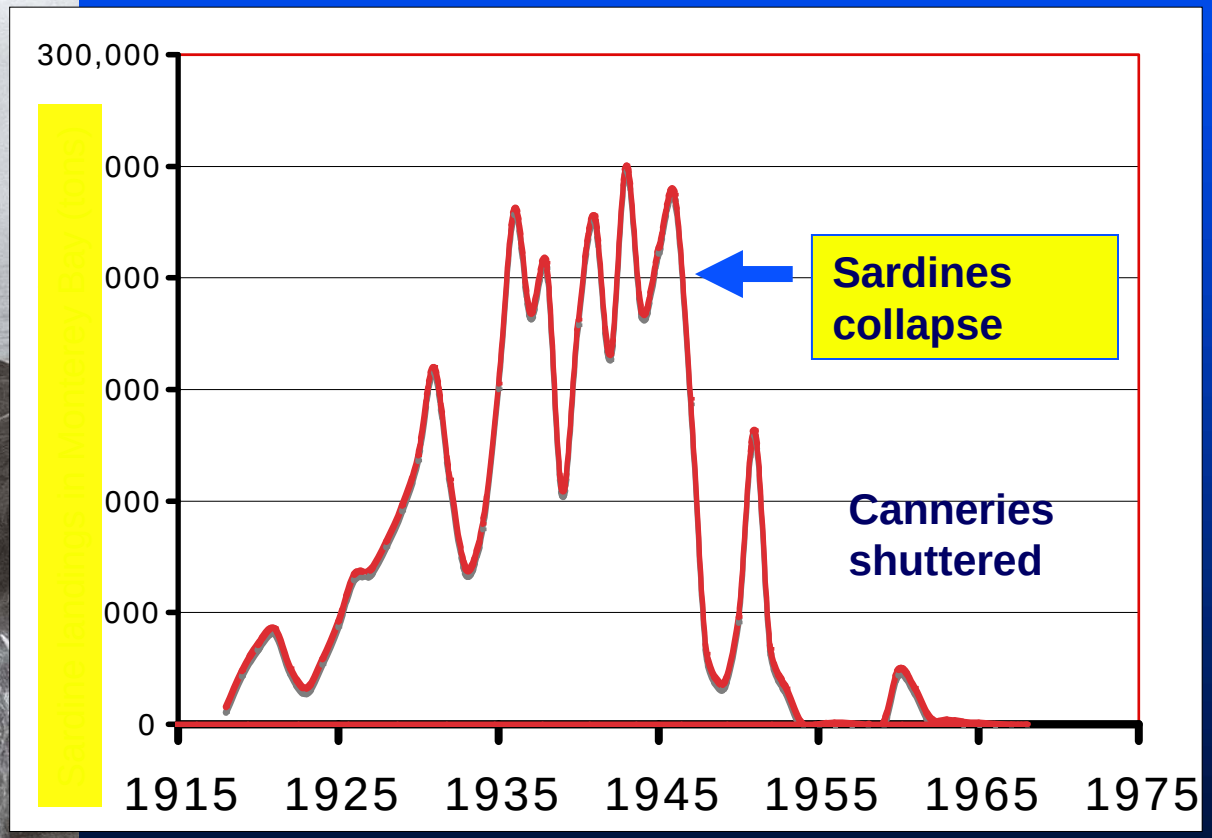


Decline of 90% in total landings 1979 - 2009 (CFG Commission)

Declines in jobs, wages, and GDP since1990-2000

1925-1945 Monterey sardines were the world's largest fishery





Challenges

- Insatiable demand
- No feedback on whether policies work
- Non-precautionary policy
- Lack of governance
- Ineffective single-species approach in climate-forced, species diverse system

San Jose Mercury News

November 13, 2003

Coast ranks No. 1 in poll

PROTECTING ENVIRONMENT, RESTRICTING DEVELOPMENT ALONG 1,100-MILE SHORELINE RECEIVE-STRONG BACKING

San Francisco Chronicle

November 13, 2003

Residents like healthy oceans and beaches, poll finds

But respondents nearly split on offshore drilling

By *Jane Kay*
CHRONICLE ENVIRONMENT WRITER

protect the ocean and beaches in California, according to a new poll released today.

Eighty-eight percent of those polled said the condition of the ocean and beaches was personally important to them. Indeed, Californians are far more likely than Americans as a whole - 72 per-

lems are: ocean and beach pollution from *streets* and storm drains, contamination of fish and seafood, declining numbers of whales and sea otters, too much coastal development and overfishing.

The Public Policy Institute of California, a nonpartisan public interest group, conducted the sur-

is plus or minus two percentage points.

When

percent o

San Diego Union-Tribune

November 13, 2003

Californians firm on coastline protection

Terry Rodgers

sacrifices to keep coastal waters clean, to prevent

and ocean resources is revealed in a public opinion
Policy Institute.of California.

nsive utility bills to reducee water pol-
higher gasoline prices to stop new
l drilling.

Los Angeles Times

November 13, 2003

The State

Coastline Is a Priority, Poll Finds

By KENNETH R. WEISS
Times *Staff Writer*

Particularly concerned about the declining condition of the coast and ocean, most Californi-

The pro-environmental consensus was strongly bipartisan, except on one issue. Many more Democrats than Republicans

the decline in marine mammals commercial overfishing and coastal development.

Contra Costa Times

November 13, 2003

Environment key concern for state

Nine out of 10 residents surveyed say protecting the land should be a high priority for the new governor

By Mike Taugher
STAFF

Californians are optimistic about Gov.-elect Arnold Schwarzenegger's plans and overwhelmingly say he should place environmental protection at or near the top of his list of priorities, according to a, new poll scheduled to be released today.

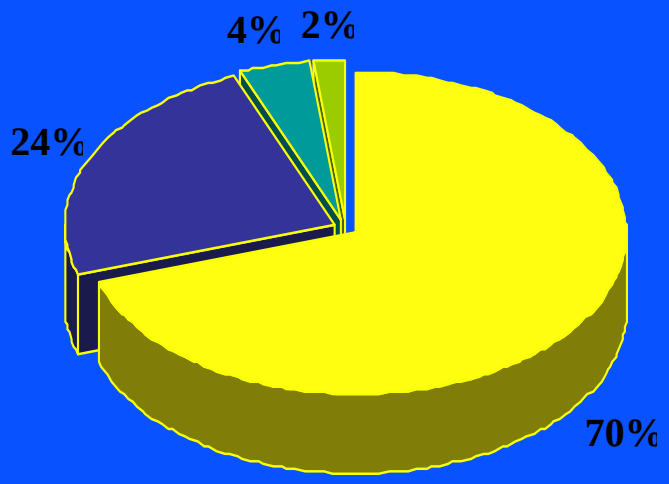
The latest one focuses on attitudes toward the coast and ocean.

Overall, the surveys are showing that Californians are what they seem to be - nearly 35 million people who by and large place a high priority on the environment.

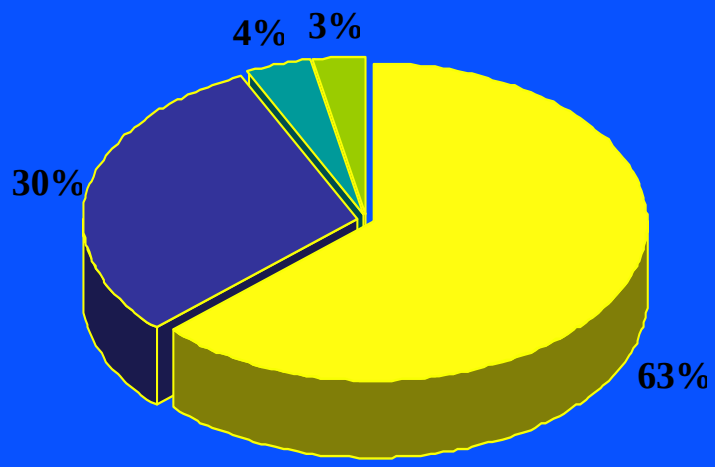
The latest installment shows Californians say the state's 1,100-mile coastline, its beaches, and the Pacific area central part of their lives. They say the state government - not the federal government and not cities or counties - should protect it. And they say the state Coastal Commission should go further';

Californians Believe the Ocean & Coast are Important

How important is the condition of the ocean and beaches to the quality of life in California?

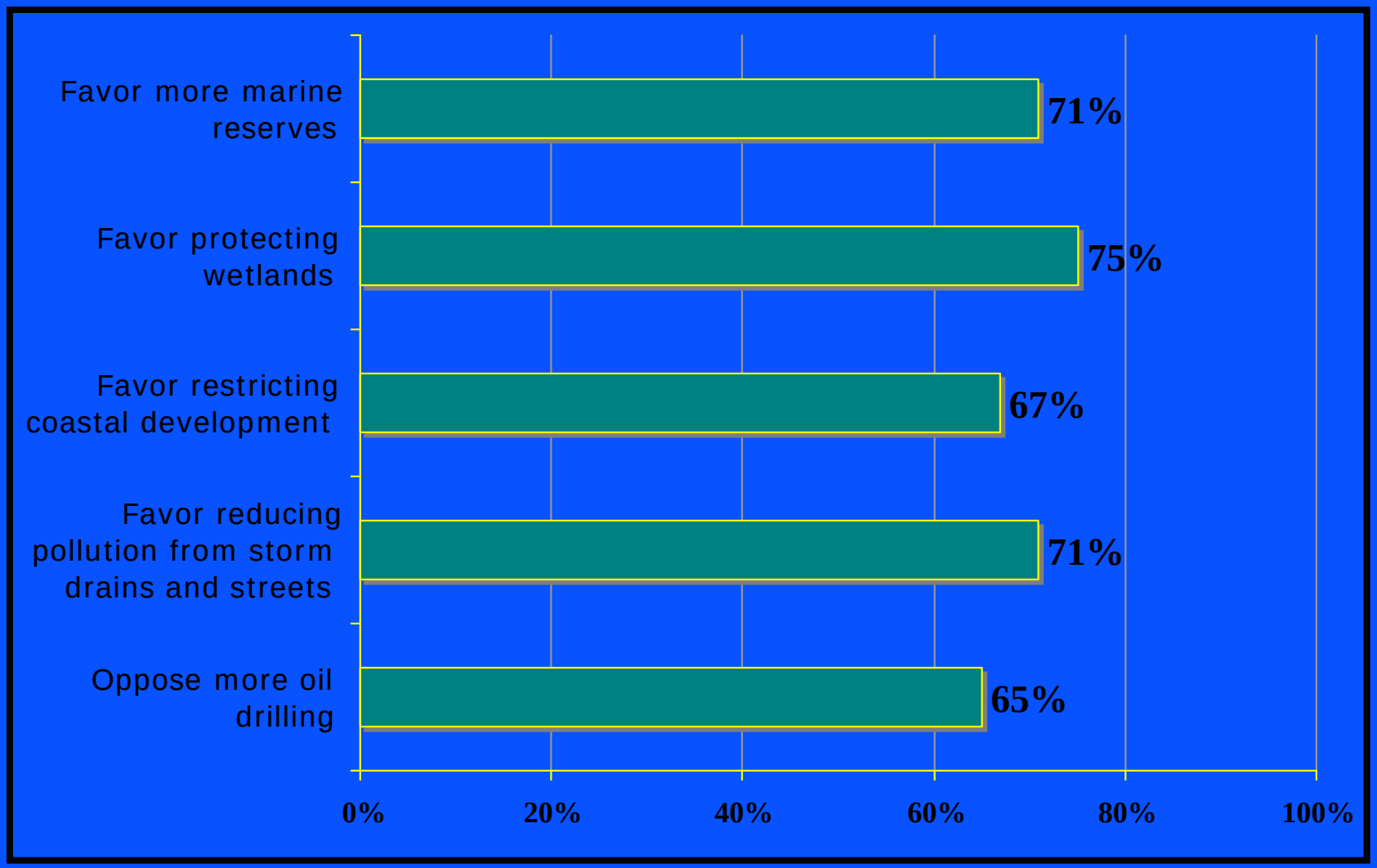


How important is the condition of the ocean and beaches to the economy in California?



- Very Important
- Somewhat Important
- Not Too Important
- Not Important At All / Don't

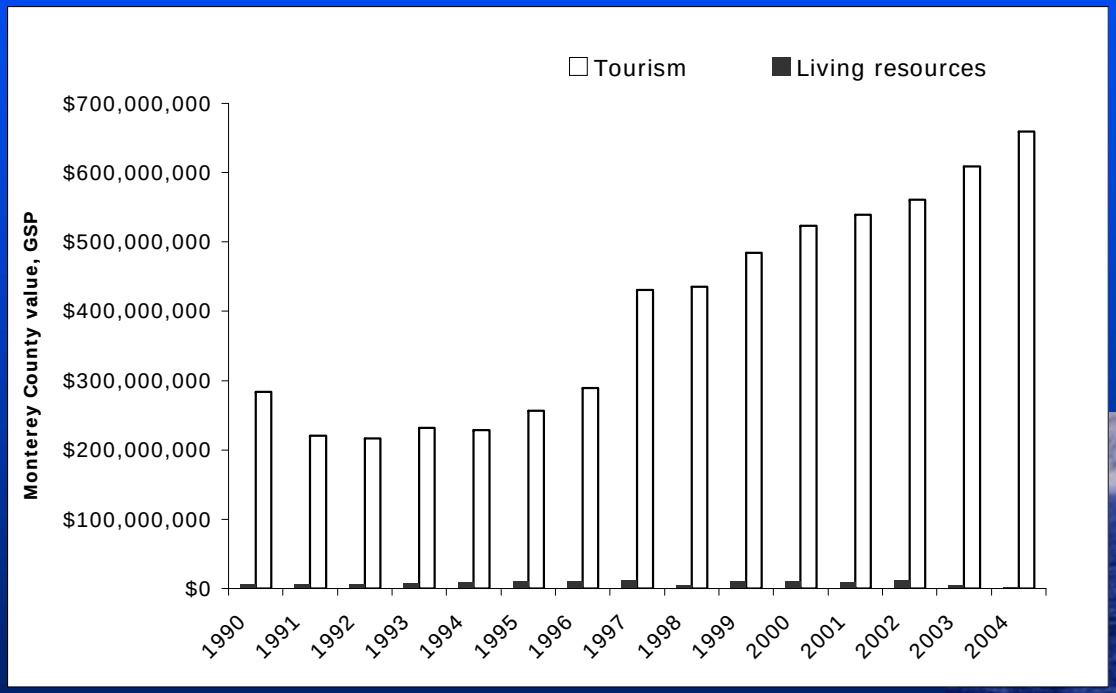
Californians Favor More Ocean Protection



Factors of Change

- **Legislation:** MLMA, MLPA, COPA
- **Science:** PISCO, CRANE, new tools
- **Governance:** participatory, collaborative
- **Management:** adaptive, science-driven
- **Communications:** media/NGO/fishermen/scientists
- **Economics:** rise of competing values-
  a. ecotourism
  b. wildlife conservation
  c. bioregulation

Tourism exceeds commercial fishing in revenues



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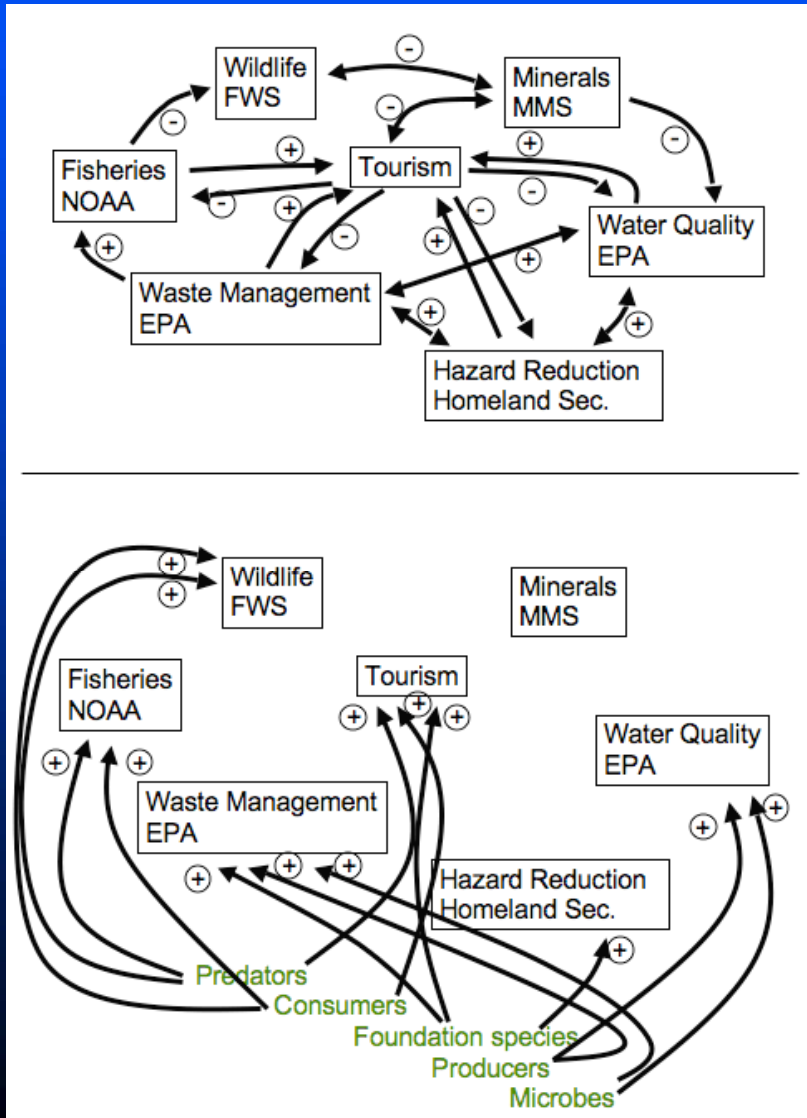
are needed to see this picture.

This means that commercial fishing is not the only important economic stakeholder

Biodiversity supports a variety of ecosystem services

- Biodiversity promotes economic diversity and quality of life.
- Biodiversity is central to an ecosystem's ability to sustain and renew itself.
- Biodiversity is essential to fishery sustainability.



New Paradigm: Quality of Life

- Reduce overall effort (seasons, bag limits) to levels compatible with multiple services, fishing industry job stability
- Ensure sustainable extraction (Nearshore FMP)
- Safeguard diversity (MPAs and MLPA)
- Monitor reserves as wildlife refugia and fisheries reference areas (MLMA)

A California Reality Check

- The MLMA demanded that we figure out how to move toward ecosystem-based management, IMMEDIATELY.
- The definition of EBM will be adaptive, defined by the science and by policy decisions as we move along.
- For science to be used it must be presented to policy makers in the right way and at the right time.
- Science that is related *clearly* to management objectives and to required actions is the most likely to be used.

The California nearshore hosts a *very* multispecies fishery

Three Stages

Developed Initially for Nearshore FMP

- Stage I – Data-poor. Precaution is the primary basis for setting total allowable catches (TACs).
- Stage II – Data-moderate. Improved single-species or multi-species management and a transition from blind precautionary management to informed risk management.
- Stage III – Data-rich. Ecosystem-based management that minimizes risks from *all* nearshore impacts to the *entire* nearshore ecosystem.

(Kaufman, Heneman, Fujita & Barnes 2003)

Policy As Successive Experiments

1. Designate experimental management regimes.
2. Establish replicate MPA's as reference sites.
3. Explore new diagnostic markers for system change.
4. Launch monitoring protocol.
5. Adapt markers as biological reference points.
6. Link management control rules to BRP values

Stage I: Establishing Control Rules Under Precautionary Management in a Data-Poor Environment

- Catch history (not necessarily very accurate) the only available data.
- Subdivide coast into 3 to 4 management regions (see "New Science").
- TAC = 1/2 last sustained catch level *for each of the 19 species.*
  - If this was MSY, then TAC = MSY/2 = .25 ($B_{unfished}$)
- If rare species must be pooled, then must use *weakest-link management.*

NOTE: WLM is a weak link in the approach itself, and could be obviated by moving closer to EBM.

Stage II: Improved Single- and Multi-Species Management in a Data-Moderate Environment

- Stage II begins when essential datastreams are ready and population models are built on their basis.
- Regional TACs set for each of the 19 target species.
- Begin Stage II management for each species as soon as data are adequate, adjust TACs down *or* up accordingly.
- TACs based on concept of variable $B_{unfished}$.
- $B_{unfished}$ varies with primary productivity, climate regime, etc., reflected in production rates and LH parameters for target species.

Stage III: Ecosystem-Based Management in a Data-Rich Environment

- Reference reserves mature into reliable estimators of $B_{unfished}$ and bulk community properties in absence of fishing.
- TACs set based on differentials between reference and open areas.
- Additional caution in establishment of MPA's apart from system of reference reserves.
- All interventions are ***controlled experiments***.
  Every management action is an ***experimental intervention***.

Getting Beyond MSY

1. To begin, switch to a well-informed OY.

2. Use multiple indicators: age structure, food web dynamics, market dynamics, valuation shifts, climate flux, balance of ecosystem services, etc.

3. Develop ability, acceptance in society of making decisions about values, and then stick to them.

4. Develop capacity for compassionate transitions in work force and ways of life: social resilience.

5. Set TACs to maximize ecosystem resilience and the ecosystem service called “biological regulation”.

Getting to Data-Rich

Connectivity- PISCO

Experimental Design- CRANE

Survey methods- CDFG, Commonweal

Collaborative monitoring- Commonweal

Pop bio/Life history-

universities

CDFG, NOAA (Fisheries, Sanctuaries +)

PISCO Principals

Palumbi

QuickTime™ and a
TIFF (Uncompressed) decompressor
are needed to see this picture.

Lubchenco

Warner

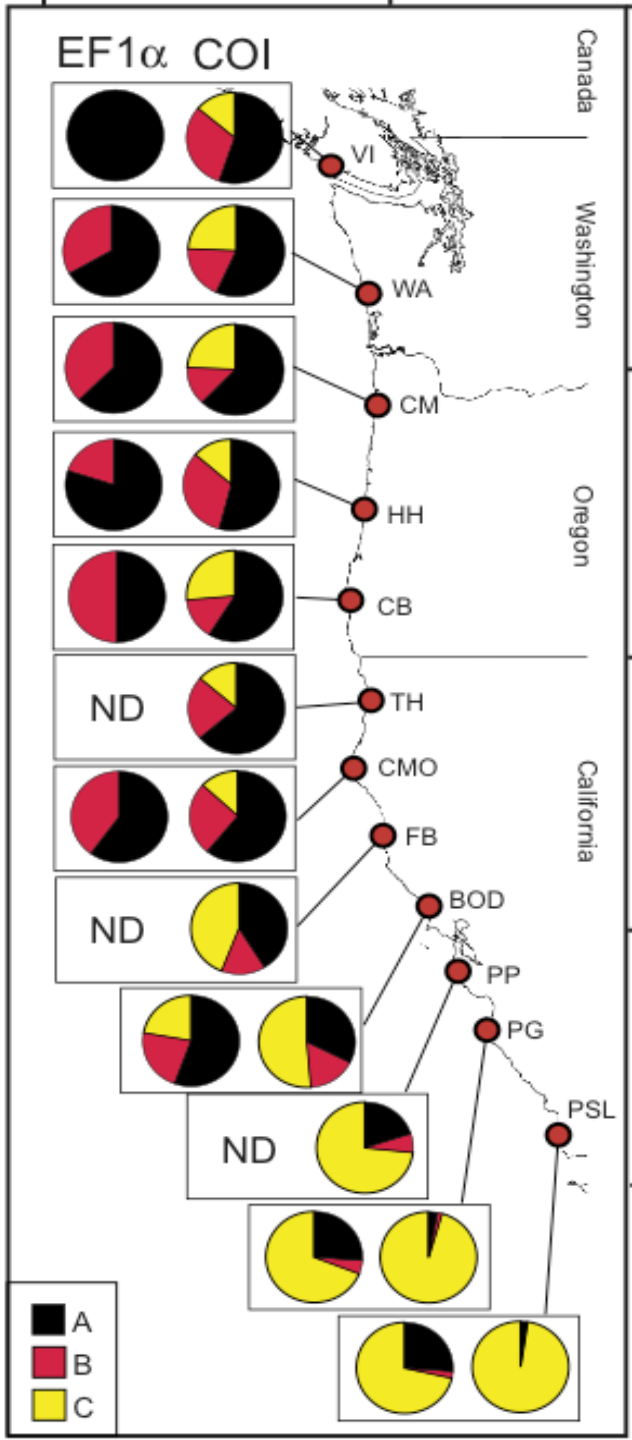
Gaines

PISCO= Partnership for Interdisciplinary Studies of Coastal Oceans

Connectivity: How much larval exchange is there among populations ?

The answer can tell us how management in one area impacts resources in another

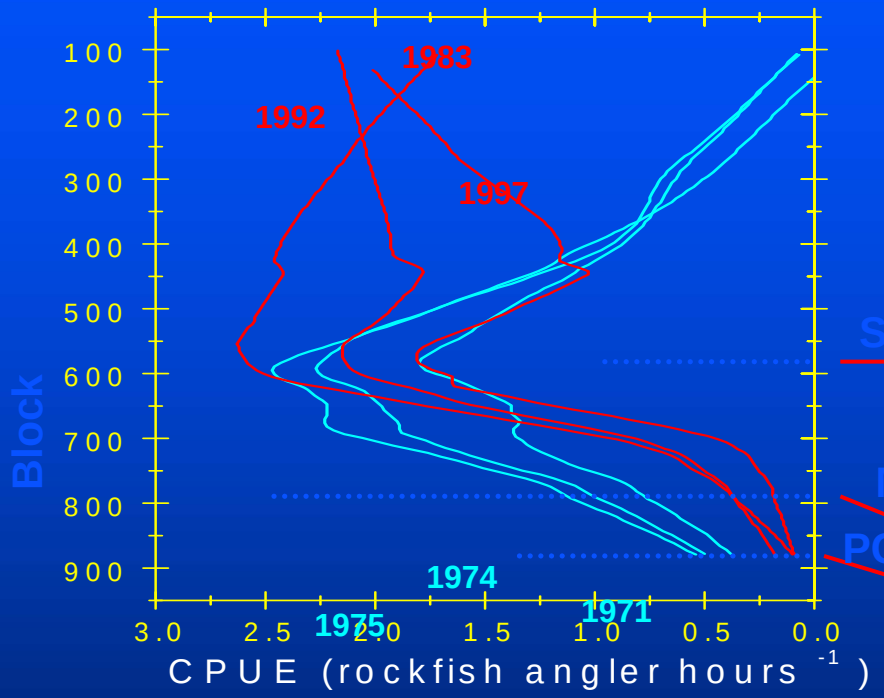
Three gene types in barnalces



From Palumbi et al.

Old Data To the Rescue: Climate and The Many Californias

El Nino and Total Rockfish CPUE



3 Regions
North: San Francisco – Oregon
Central: San Francisco – Pt. Conception
South: Pt. Conception - Mexico

From Bennett et al. 2004, Commonweal Ocean Policy Program

Chronology

1. 2002: 3-stage control rules to move toward EBM that cover extraction limits on 19 nearshore fish species and can easily encompass others.

2. 2003: Nearshore ecological monitoring system launched.
   a. Habitat mapping
   b. Life history research
   c. Physical processes and climate forcing
   d. MPA in/out assessments using visual census, CPUE, ROV, larval survey, other methods
   e. Develop new EBM diagnostics for in/out contrasts and Stage 3 reference points.

3. 2007: MPA network extended N, S of Channel Islands.

4. 2010 - ??: Marine reserves mature, shift to Stage 3 nearshore fishery management, EBFM in place, adaptive EBM engaged.

5. 3000: Residents of western North America joyously celebrate 1000 years of harmony with the coastal ocean. Not sure in what country, though.

MPA-Based Harvest Control

Option 1: Density Ratio Control Rule

$TAC_{(next\ year)} / TAC_{(this\ year)} = Rho_{(outside\ MPA)} / Rho_{(inside\ MPA)}$

CONDITIONS:

A- Species in question benefit from no-take protection

B- Target density ratio is appropriately precautionary

EXCLUDED SPECIES:

A- Highly motile (e.g. tunas)

B. Limited by factors other than fishing (e.g. some forage species)

MPA-Based Harvest Control

Option 1: Density Ratio Control Rule

MODEL RESULTS: (Babcock in prep)

Rule of thumb: DRCR = 80% total density is sustainable

DRCR = 60% of fishes at or above sexual maturity also sustainable.

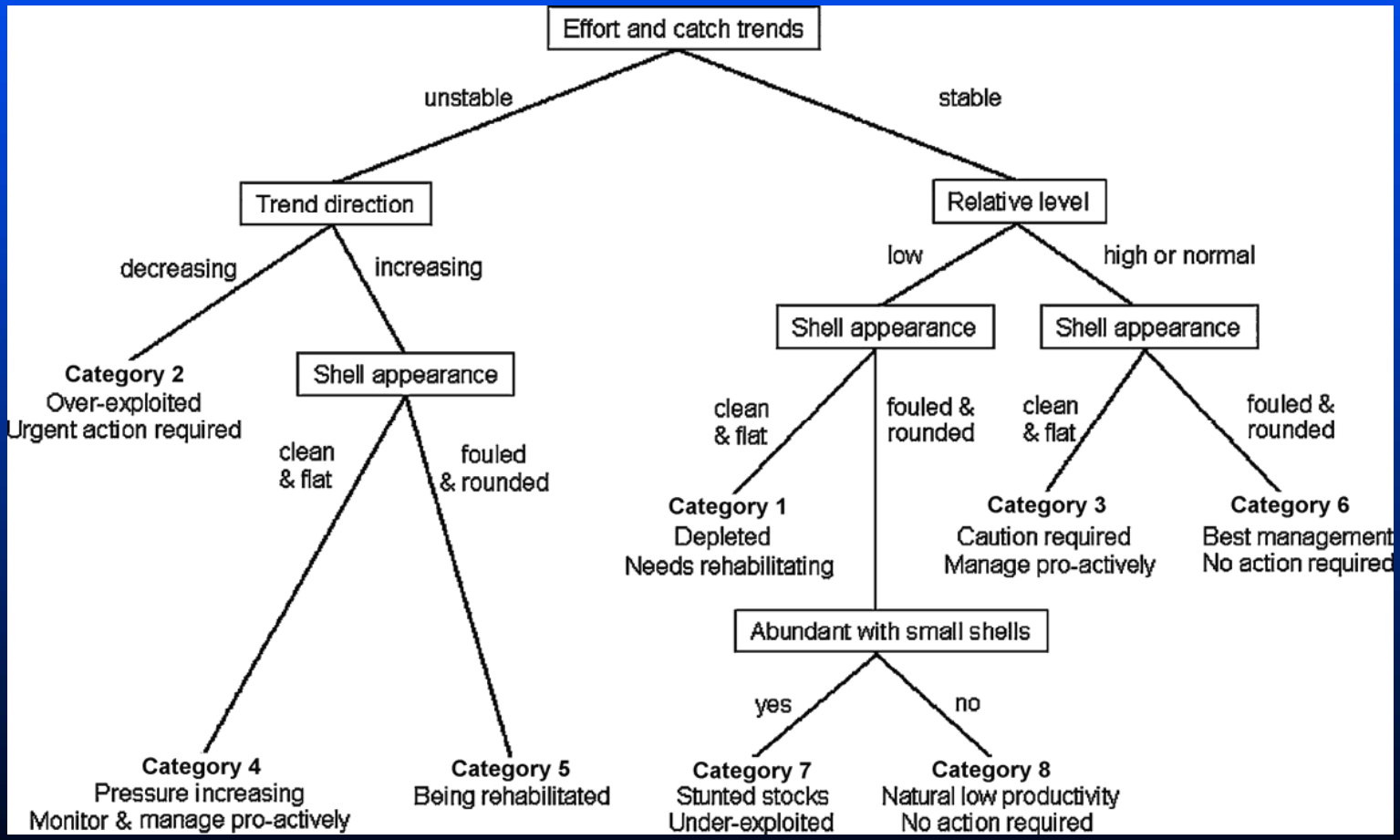
DRCR = 60% TD FAILS to prevent overfishing

Also in development: Length-Frequency based DRCRs.

MPA-Based Harvest Control

Option 2: Composite Decision Tree

(Jono Wilson adaptation of Prince et al. 2008)



What are California's lessons for New England EBM?

1. MLMA *unlike* federal M-S in emphasis on health of ecosystem, not just individual "stocks".

2. MLMA *requires* EBM, *requires* sustainability, not max yield, as primary goal: mSy.

The Burden of Sustainability:

"…there are uncertainties about marine ecosystems that will never be resolved. Consequently, the need for precaution in fishery management can be reduced with improved information, but never eliminated." (MLMA)

What are California's lessons for New England EBM?

Key Point: MLMA Shifted the burden of proof…

…from proving that too many fish have been harvested…
…to proving that too FEW fish have been harvested.

Fishermen no longer fear new information, they want it…
…they want it because it can prove the legitimacy of a higher TAC

Furthermore, fishermen can contribute to getting that information.

Through collaborative research, they are re-enfranchised and made fully participatory stakeholders.

Can we enter an era of stewardship?

- Reduce social and economic costs of conservation in order to reduce conflict, get better conservation, and empower local fishing economies and communities to become stewards

- Place fishing in its proper context with other ocean uses, and watershed/coastal development

- New to California, even newer to New England…but old, old hat in many other areas and countries

Crucial Management Tools

- **COLLABORATION: higher connectivity and accountability**
- **COMANAGEMENT: all species, all ecosystem services, all stakeholders; *one table***
- **INNOVATION: in management systems (whole-system ecology, economics) and tools (e.g., MPA-based harvest control rules)**

Acknowledgements

- Burr Heneman, Commonweal
- CRANE and PISCO teams
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- Pew Fellows in Marine Conservation