Communicating Resource Status

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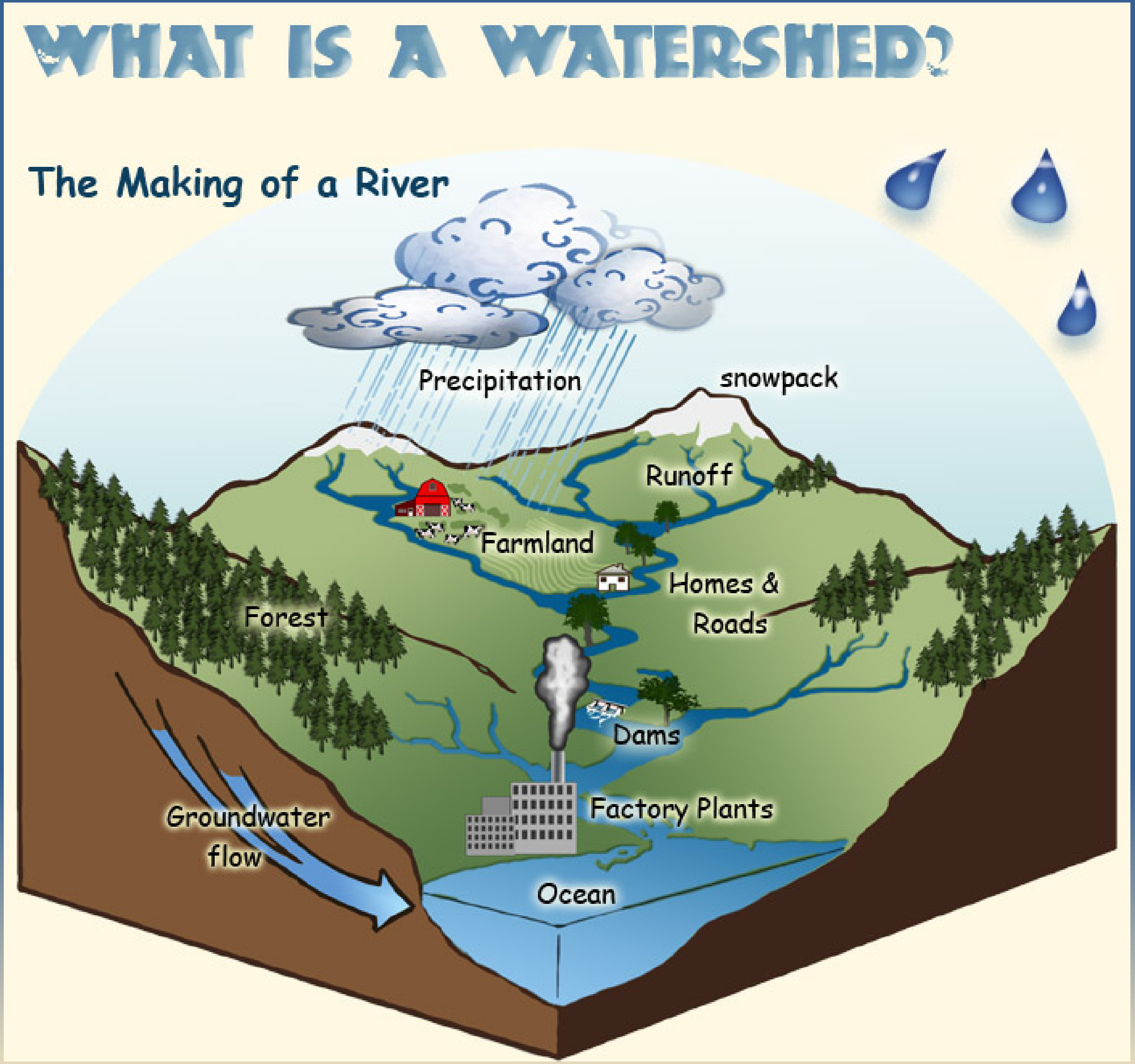
Outline

- Resource Status (What? Watershed Heath)
- Communication (Why and to Whom)
- Methods for developing a reporting structure
- Examples -- California and other watersheds
- Conclusions and Lessons Learned

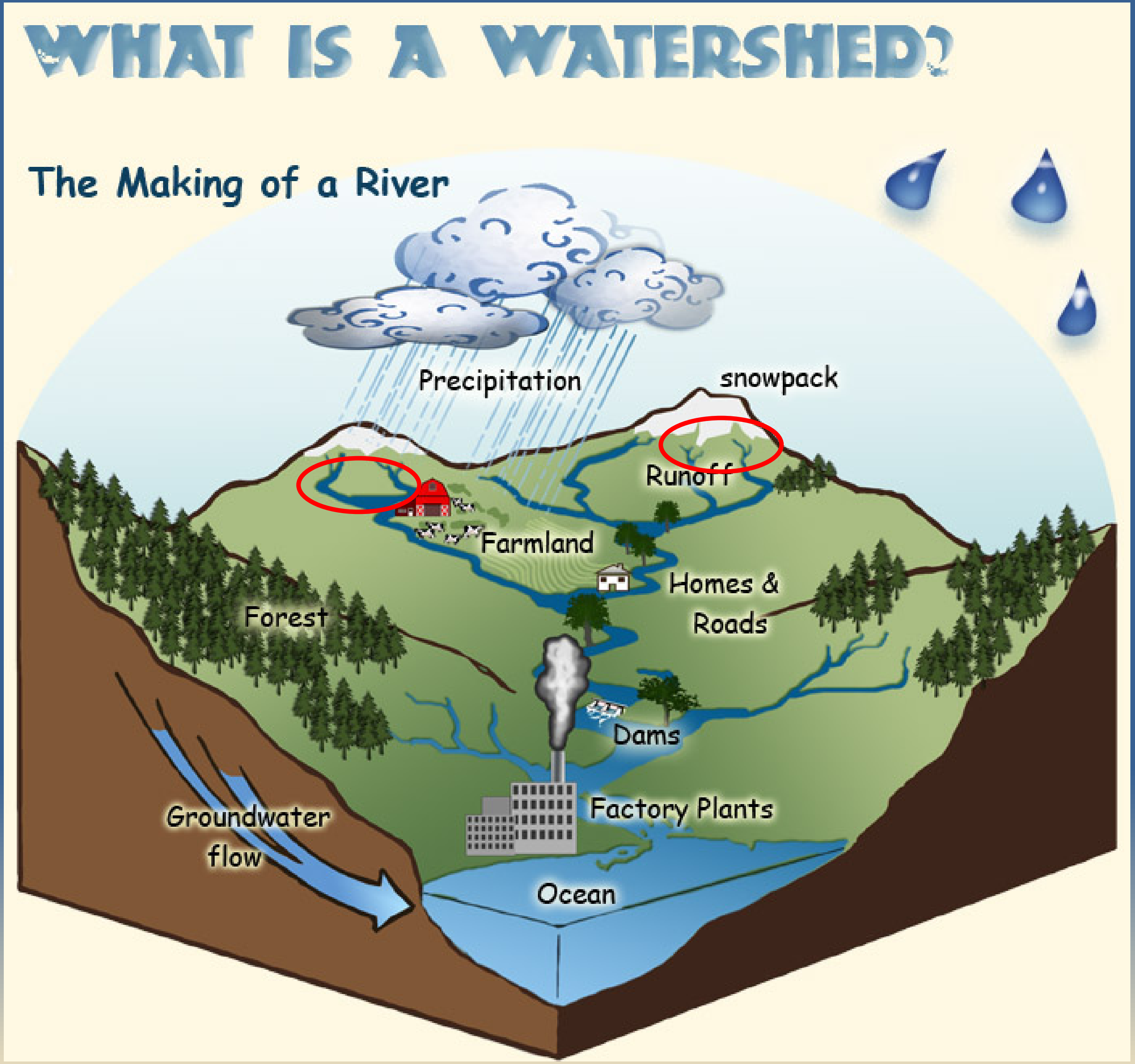
Watershed Health =

Condition relative to historic, undegraded or future condition



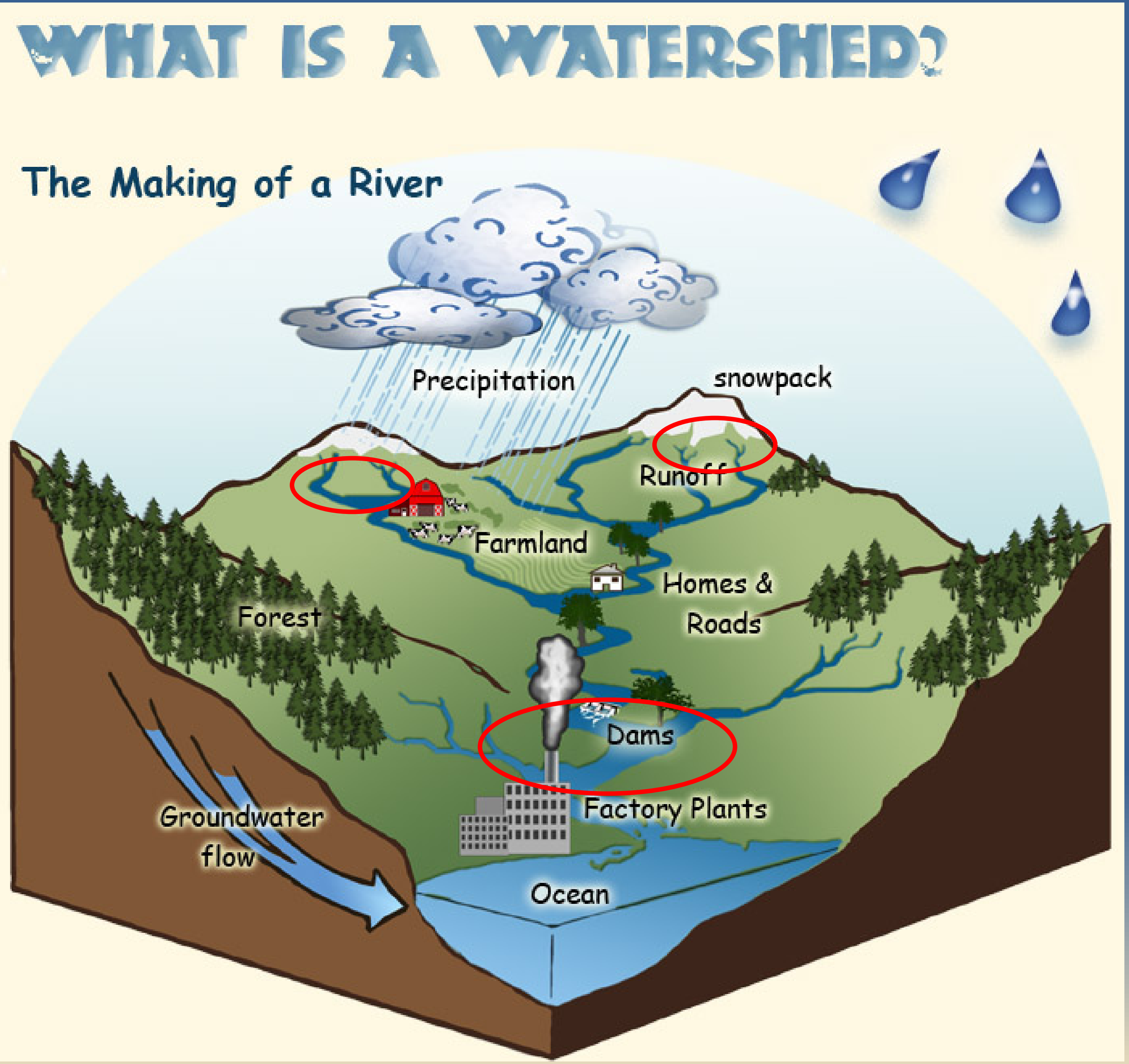
Boundaries may be difficult to define….

Location affects the attributes you select and the things you measure…



Reporting Frameworks allow comparisons between watersheds

Allow prioritization of management actions



Communication – Why ?

We want to know how things are doing and trends
"Is the watershed getting better or worse?"

Identify problems and how to solve them

Is management is working ?

Acquire resources and know if they are working

We care and want others to care

Communication – to Whom?

Layperson -- Informed public -- Policy maker
Scientist

Method - Some Definitions…

- **Ecosystem Health – condition in which a system realizes its inherent potential, maintains a stable condition, preserves its capacity for self repair, and needs minimal external support for management Karr (1993).**
- **Reporting Structure (Report Card) –** summary of the status and trends of key indicators in the watershed to measure watershed condition.
- **Framework - a method to organize information/indicators to provide a comprehensive summary of watershed condition**
- **Indicators – measurable characteristics related to attributes that relate the structure, composition and function of ecosystems**
- **Metric – is a measure related to the indicator**

Method - Steps

- Define the geographic scope and sub-areas
- Define organizing framework and attributes
- Identify goals and objectives
- Identify a range of possible indicators
- Select indicators
- Evaluate indicators and method of aggregation
- Develop benchmarks/targets
- Develop reporting structure

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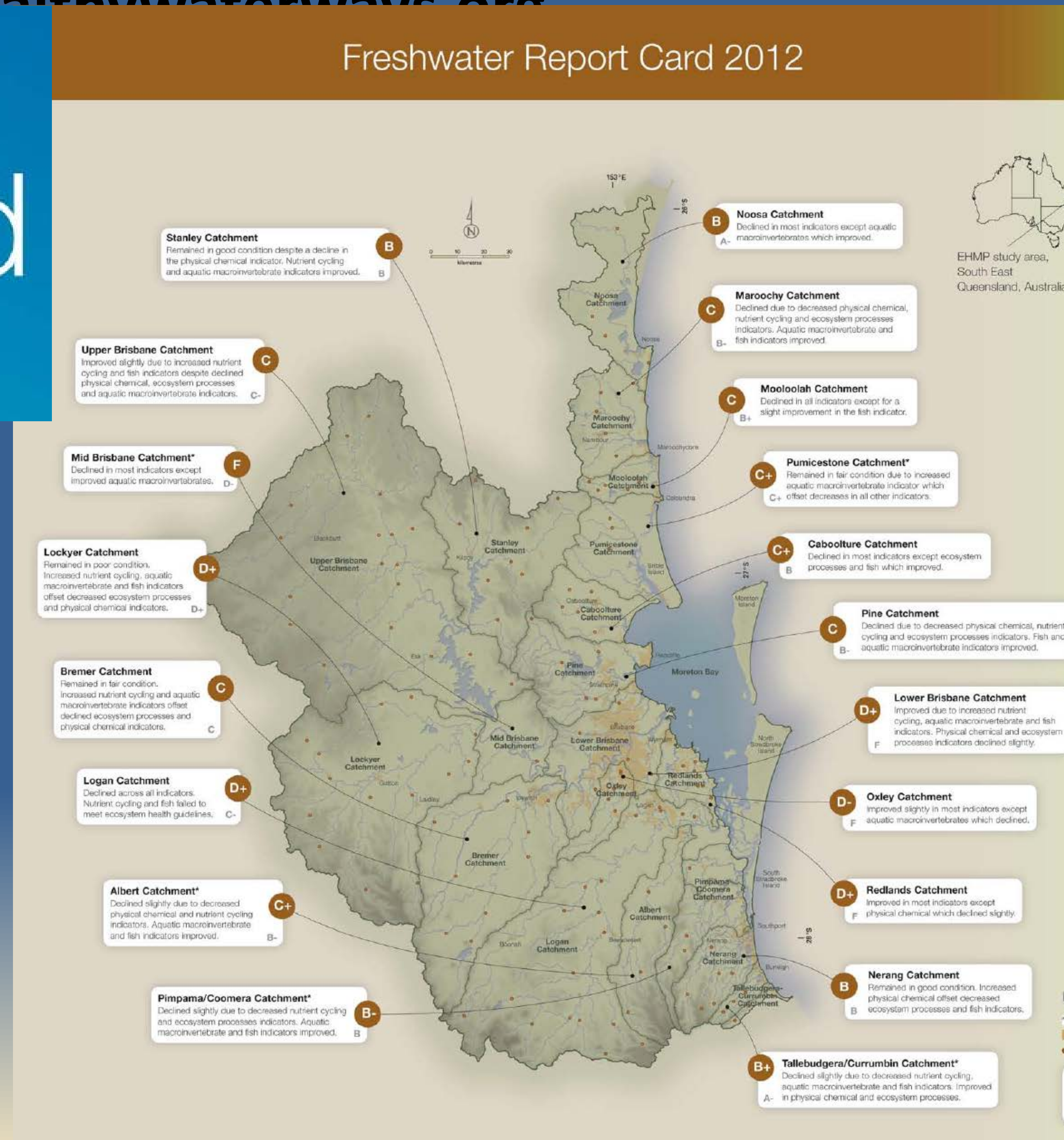
Australia: Healthy Waterways Assessments and Report Cards

www.healthywaterways.org



A — **Excellent:** Conditions meet all set ecosystem health values. All key processes are functional and all critical habitats are in near pristine condition.

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D — **Poor:** Conditions meet few set ecosystem health values in most of the reporting region. Many key processes are not functional and many critical habitats are impacted.

F — **Fail:** Conditions do not meet set ecosystem health values. Most key processes are not functional and most critical habitats are severely impacted.

Indicators used for assessing ecosystem health

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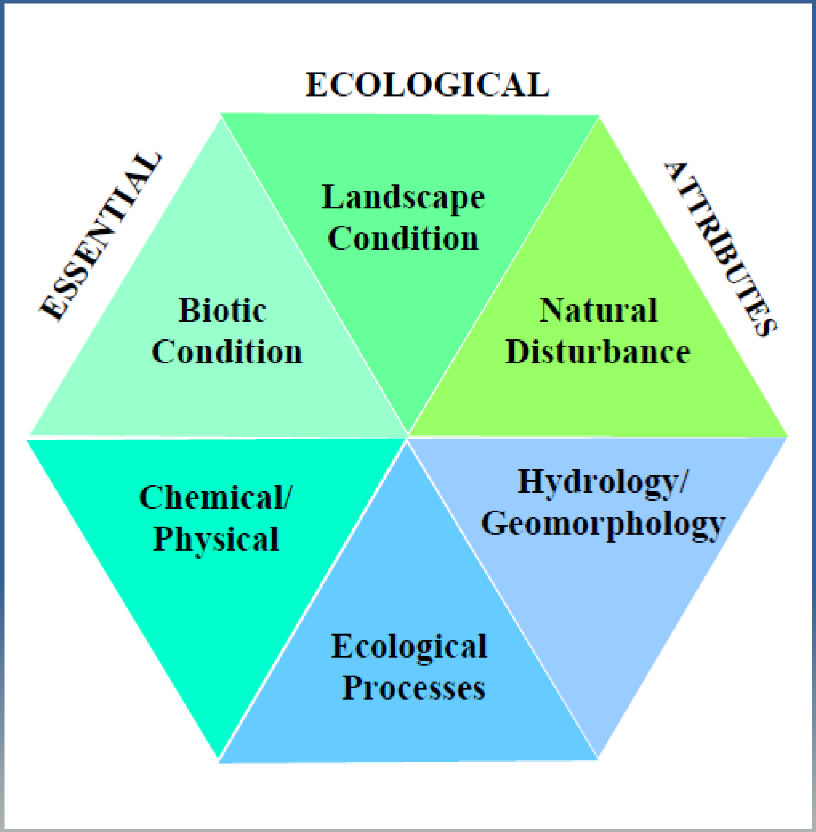
EPA SAB Framework: Assessing Ecosystem Condition

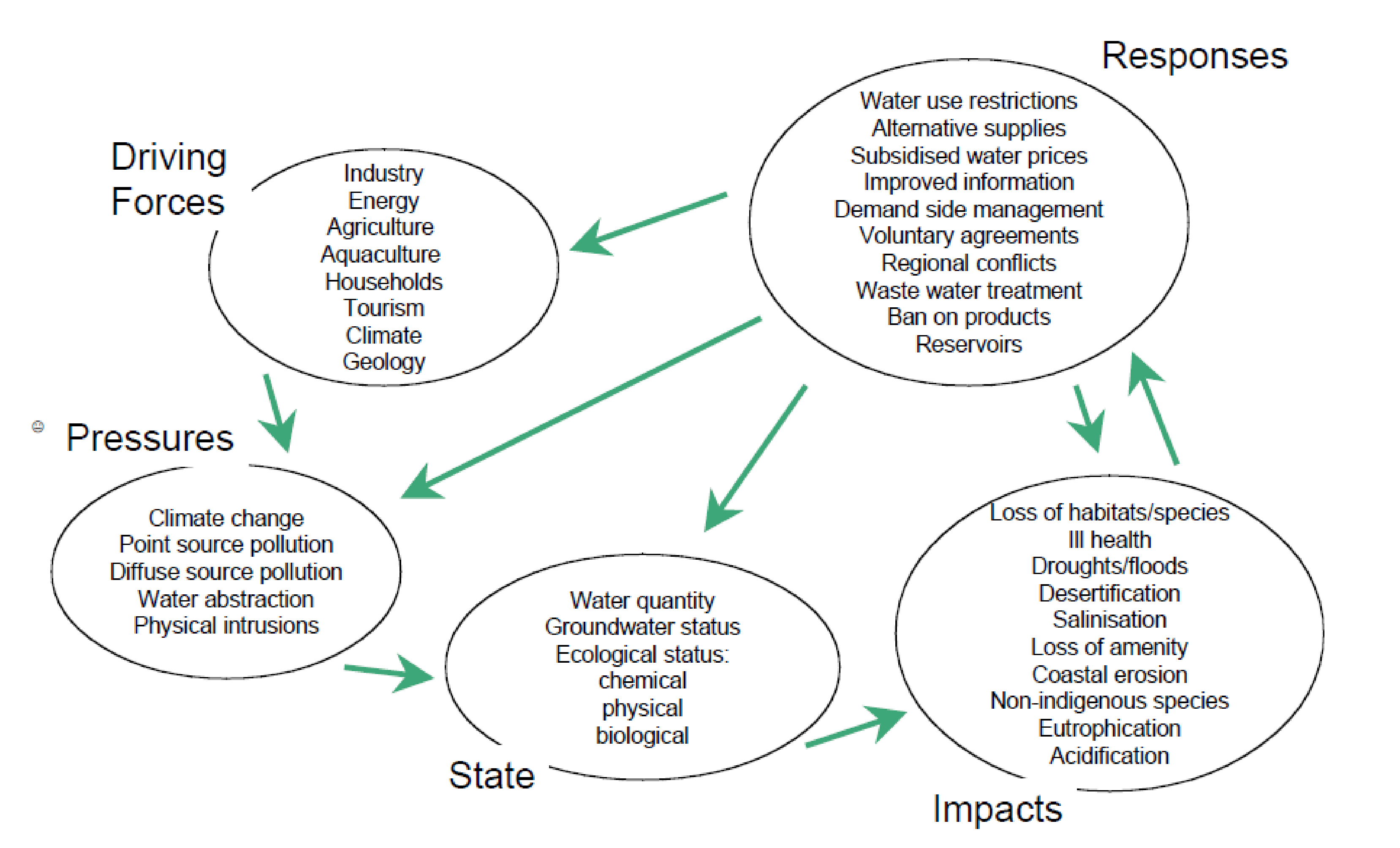
- Foster consistent and comprehensive assessment & reporting
- Ecological characteristics assembled, synthesized into scientifically defensible categories

EPA SAB Framework: Assessment Architecture

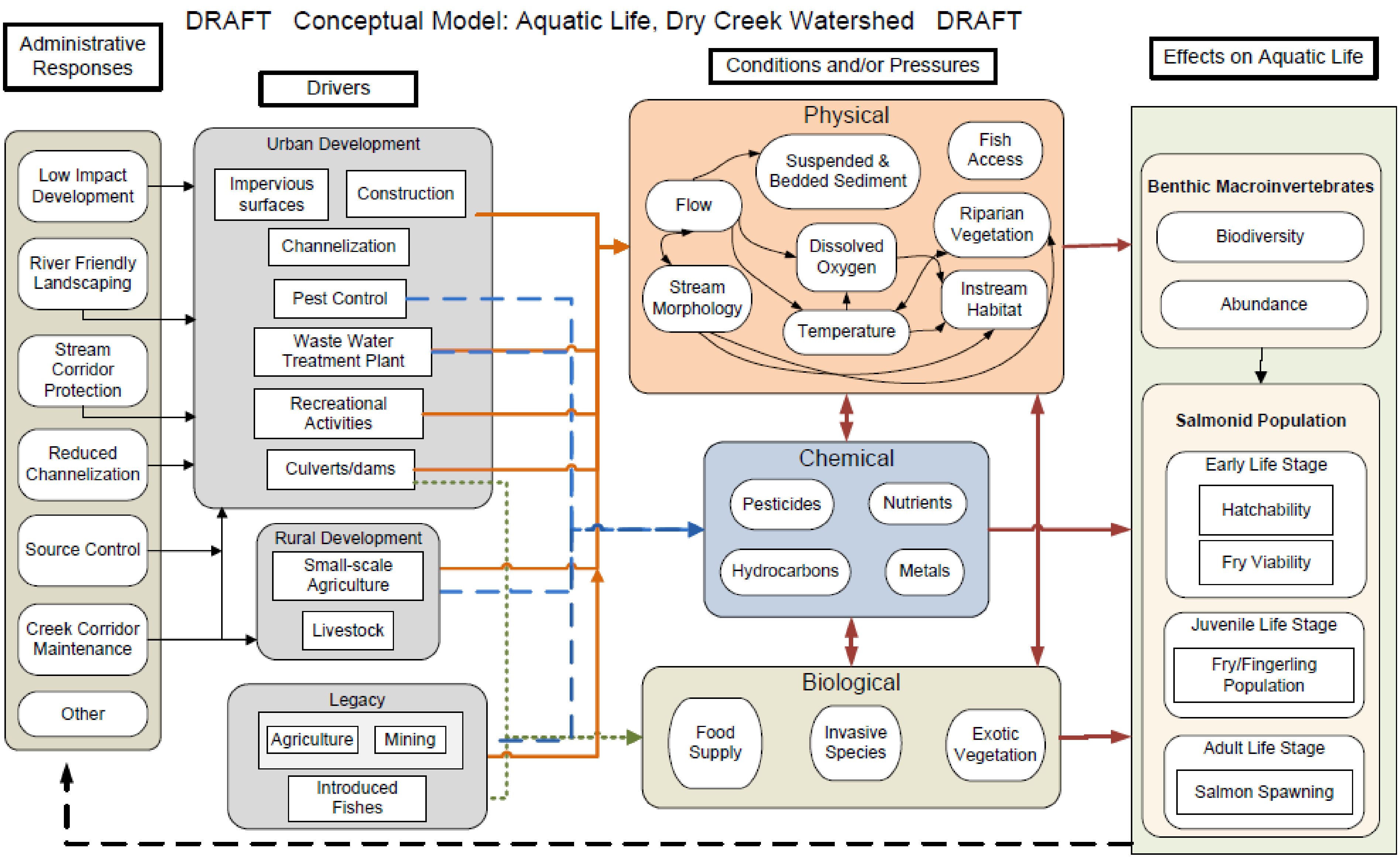
- Essential Ecological Attributes
  - Measures of condition
  - A guide to organizing and aggregating information
  - A check list for designing management schemes
- SAB Framework doesn't include
  - Drivers, Pressures, Impacts, Responses



DPSIR Model


Responses
Water use restrictions
Alternative supplies
Subsidised water prices
Improved information
Demand side management
Voluntary agreements
Regional conflicts
Waste water treatment
Ban on products
Reservoirs
Driving Forces
Industry
Energy
Agriculture
Aquaculture
Households
Tourism
Climate
Geology
Pressures
Climate change
Point source pollution
Diffuse source pollution
Water abstraction
Physical intrusions
Water quantity
Groundwater status
Ecological status:
chemical
physical
biological
State
Loss of habitats/species
Ill health
Droughts/floods
Desertification
Salinisation
Loss of amenity
Coastal erosion
Non-indigenous species
Eutrophication
Acidification
Impacts

D-P-S-I-R Model



DRAFT Conceptual Model: Aquatic Life, Dry Creek Watershed DRAFT
Administrative Responses
Drivers
Conditions and/or Pressures
Effects on Aquatic Life
Low Impact Development
River Friendly Landscaping
Stream Corridor Protection
Reduced Channelization
Source Control
Creek Corridor Maintenance
Other
Urban Development
Impervious surfaces
Construction
Channelization
Pest Control
Waste Water Treatment Plant
Recreational Activities
Culverts/dams
Rural Development
Small-scale Agriculture
Livestock
Legacy
Agriculture
Mining
Introduced Fishes
Physical
Flow
Suspended & Bedded Sediment
Fish Access
Riparian Vegetation
Dissolved Oxygen
Stream Morphology
Instream Habitat
Temperature
Chemical
Pesticides
Nutrients
Hydrocarbons
Metals
Biological
Food Supply
Invasive Species
Exotic Vegetation
Benthic Macroinvertebrates
Biodiversity
Abundance
Salmonid Population
Early Life Stage
Hatchability
Fry Viability
Juvenile Life Stage
Fry/Fingerling Population
Adult Life Stage
Salmon Spawning

Method - Steps

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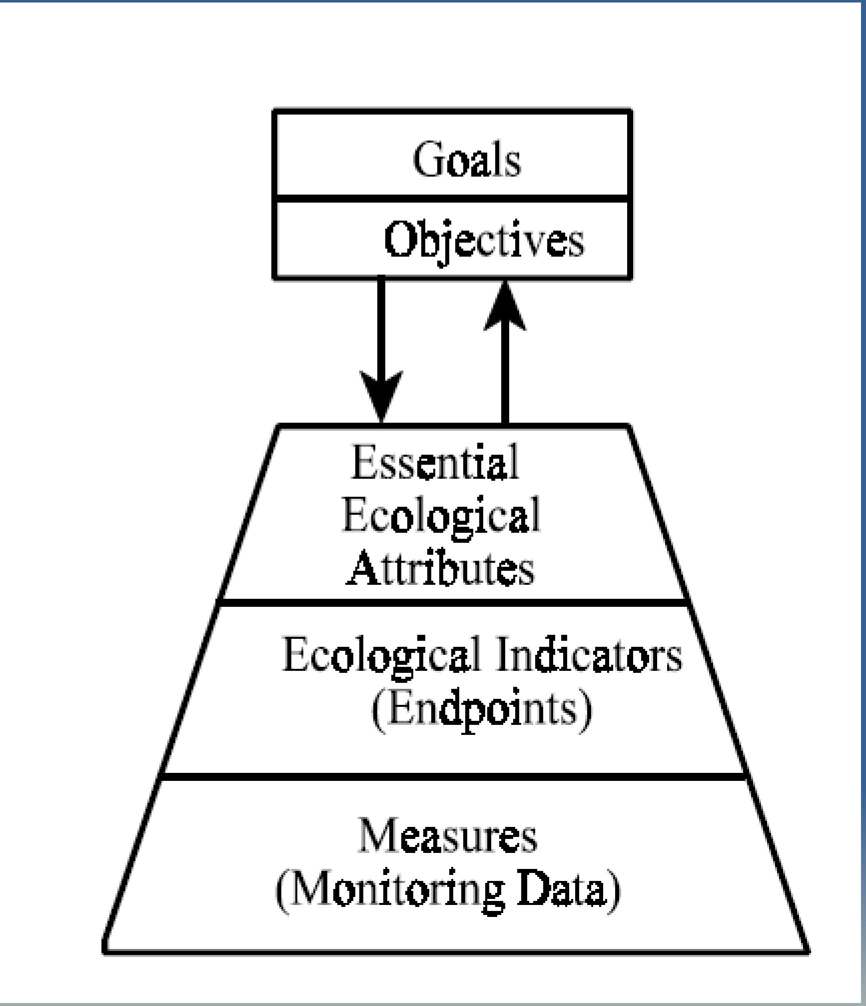
Establishing Goals and Objectives

- Evaluate existing literature (plans, policies, research)
- Gather experts
- Make decisions and be selective
- Example:
  - CALFED, Bay Delta Authority, Young and Fujita 1998, Pawley et. al. 2000, Bay Institute 2003, 2005
  - Delta Plan 2013, Bay Delta Conservation Plan 2013



Method - Steps

- Define the geographic scope and sub-areas
- Define organizing framework and attributes
- Identify goals and objectives
- Identify a range of possible indicators (endpoints) & data sources
- Select indicators
- Evaluate indicators and method of aggregation
- Develop targets
- Develop reporting structure

Indicators Selection Criteria

- Availability of high-quality data
- Data affordability
- System representation
- Ability to detect change over time
- Independence of indicators from one another
- Supports management decisions and actions
- Can be reported and understood in public arenas

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Examples: Upper Watershed to Estuary

- San Francisco Bay Index

http://www.bay.org/assets 2003, 2005

- State of the Bay 2011

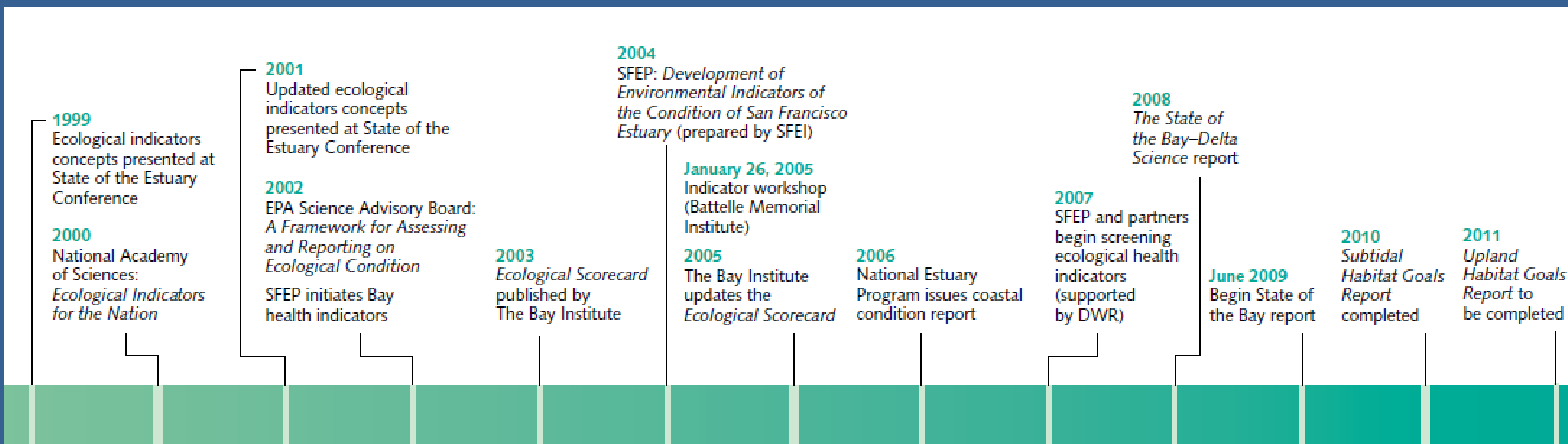
http://sfep.sfei.org/about-the-estuary/sotb

- Sacramento River Watershed Health 2011

http://www.sacriver.org/

These efforts can be perfected over time …

For example, for San Francisco Bay…



These efforts are complex …

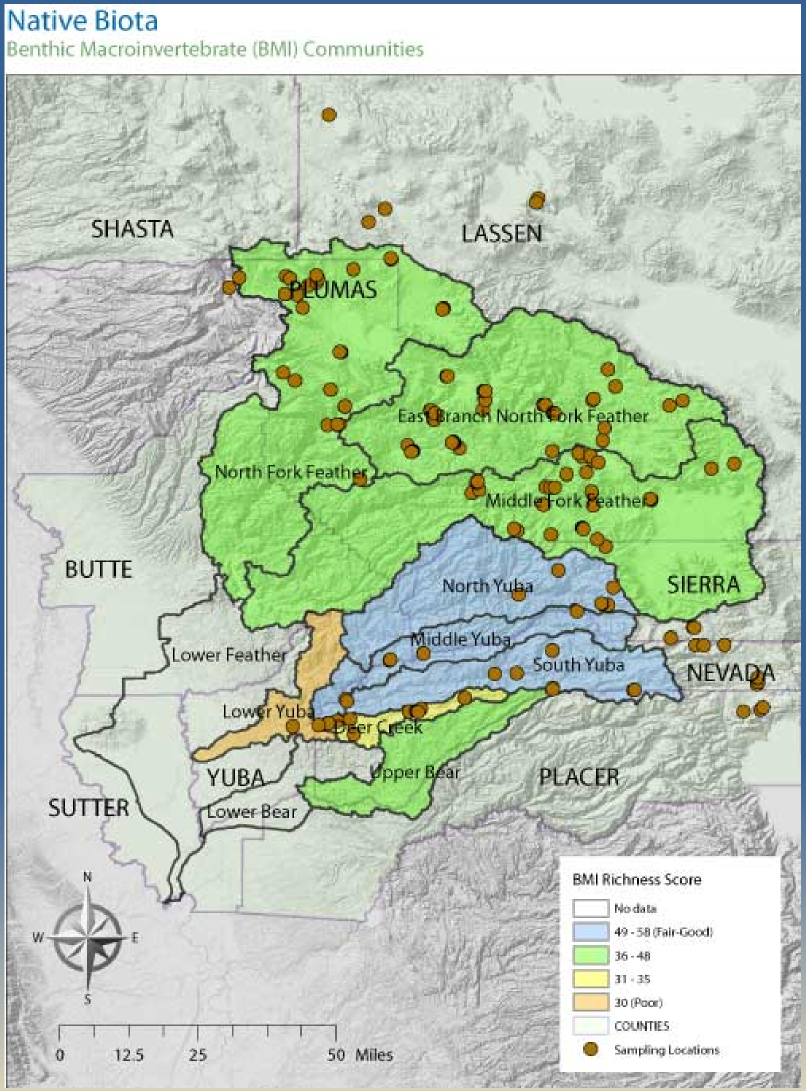
San Francisco Bay Index – 8 indices, 39 indicators

Sacramento River WHIP - 17 indices

Sacramento River: Lower trophic levels

Monitoring of living organisms (biomonitoring) provides information about past and/or episodic pollution and cumulative effects

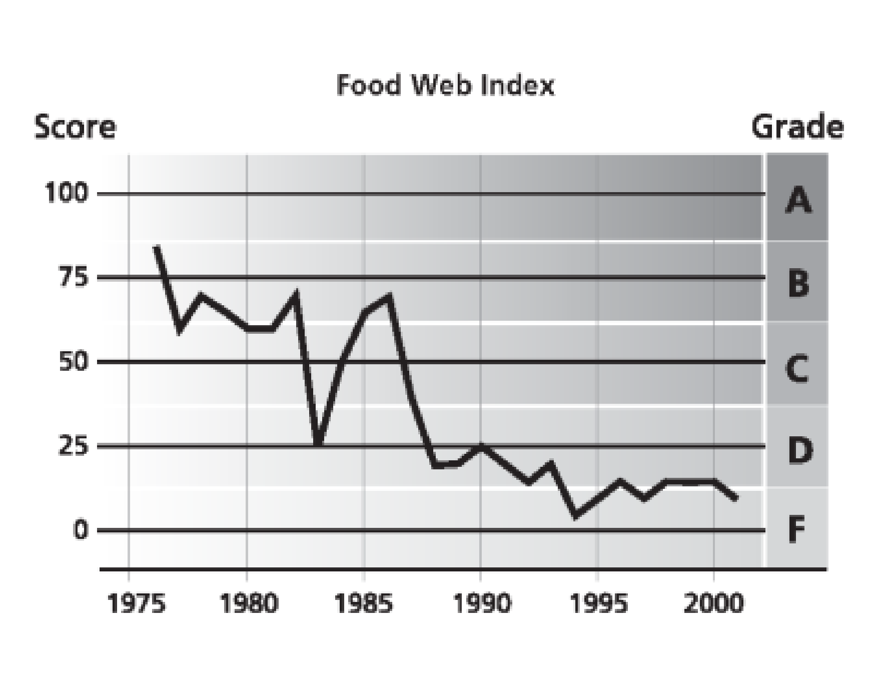
- BMI-related metrics (e.g., taxa richness, diversity, abundance of specific taxa --"bioindicators" of water quality and important base of food chain



SF Bay: Lower trophic levels

Food Web Index (2003, 2005)

- Suisun Bay focus
- Phytoplankton, Zooplankton, Mysids.
- Plankton levels in Suisun Bay critically low, reducing food resources for fish and birds.
- Phytoplankton levels in all other parts of the Bay are improving.

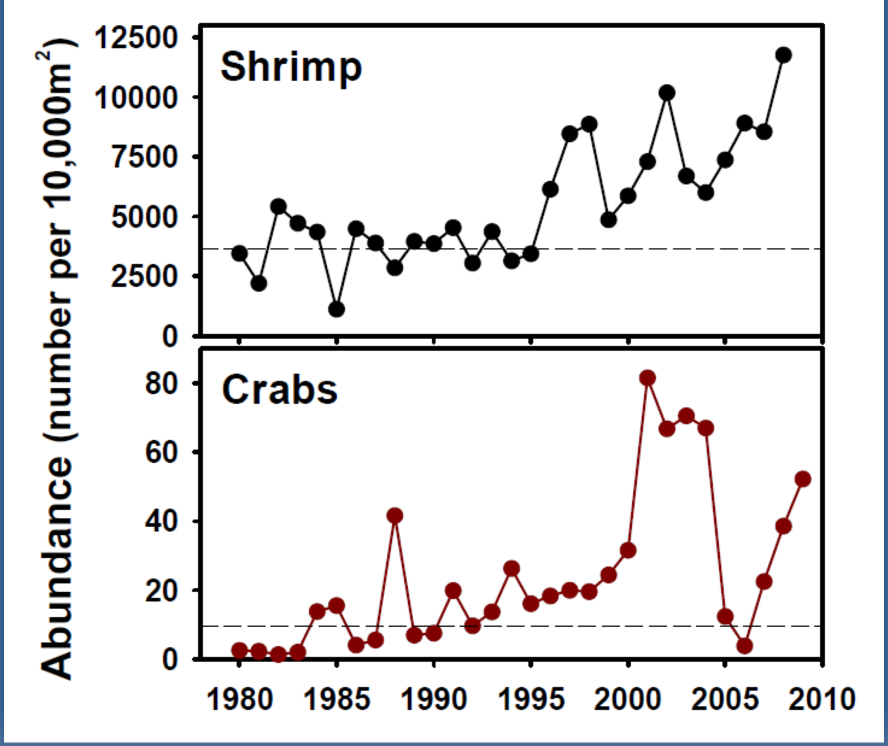


SF Bay: Lower trophic levels

Shrimp and Crab Index (2003, 2005, 2011)

Abundance Native Species, Percent Native Species, Regional Comparisons

- Abundance has increased
- Dominated by native species
- Abundance and trends differ among the four sub-regions of the estuary



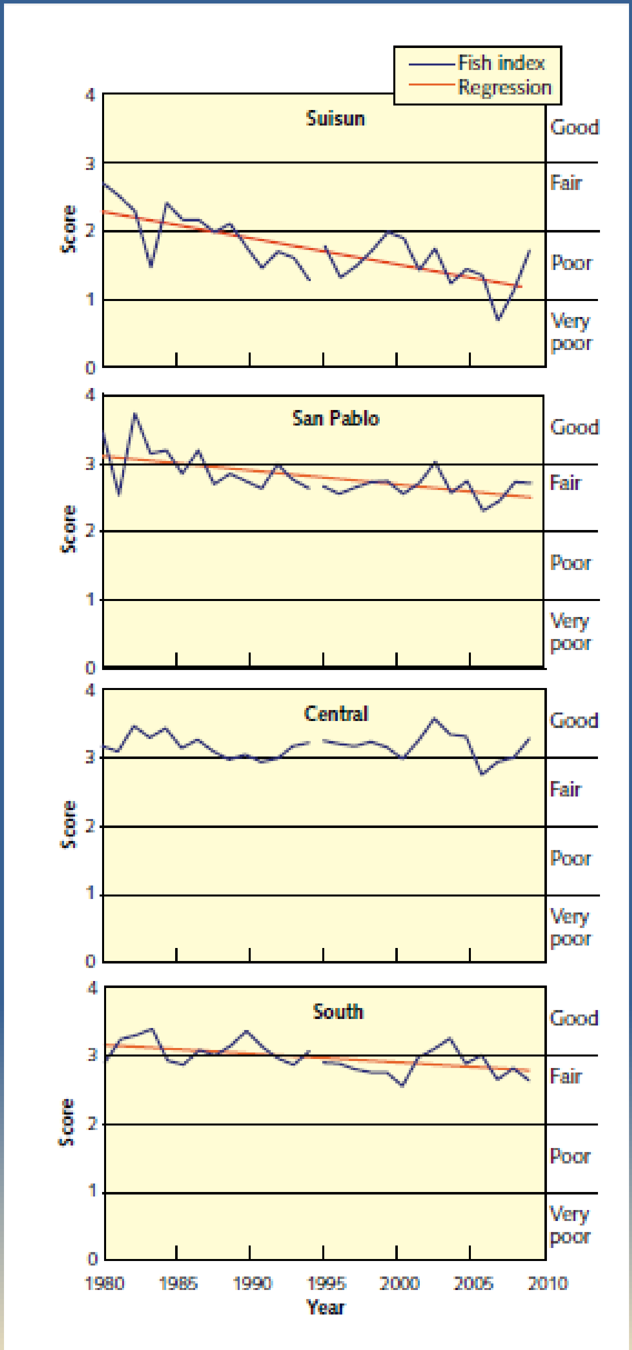
San Francisco Bay Fish Index

Ten Indicators

- Abundance (how many fish?) - 4
- Diversity (how many species?) - 2
- Composition native vs. invasive - 2
- Distribution of native fish (where are the fish?) – 2

Reference: Avg. 1980-1989

Source: San Francisco Bay Index (2003,2005), State of the Bay (2011)

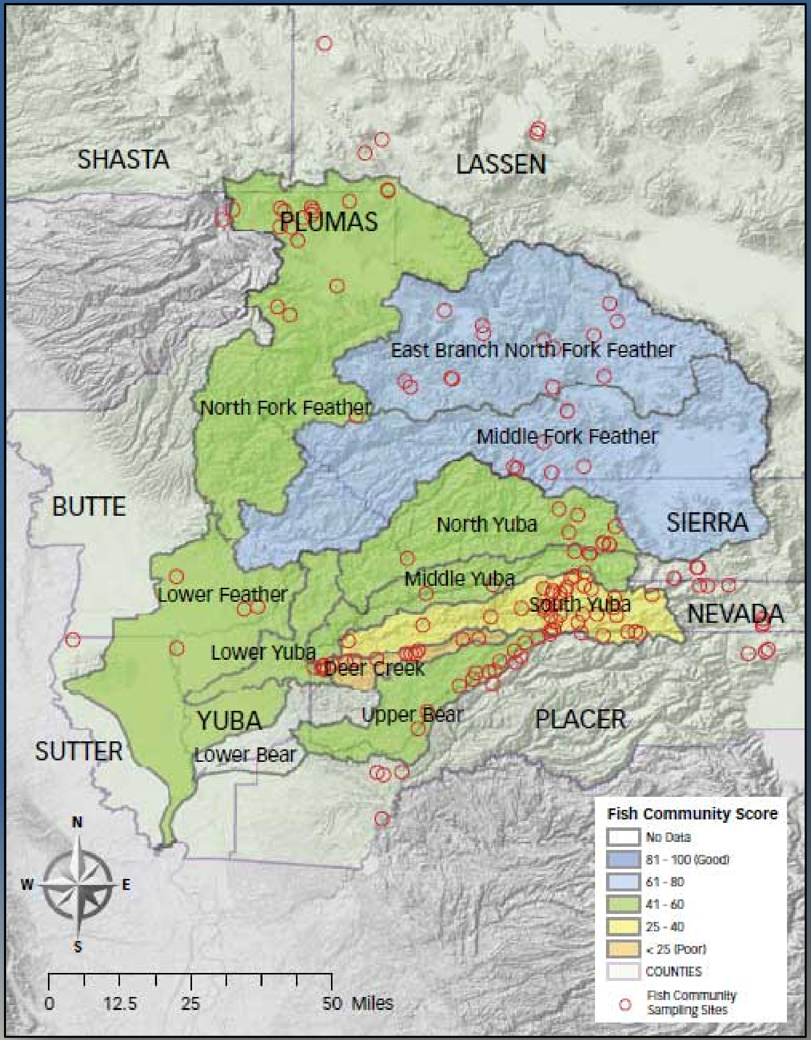


Feather River Fish Index (Sac River)

- Percentage Native Fish Species compared to expected (SNEP)
- Proportion of Native Fish Species
- Yuba Watersheds –
  - Proportion of returning Chinook salmon (DFG 88)

-> Comparison of watersheds enables prioritization of management

Source: Sacramento River Watershed Health Indicators 2011



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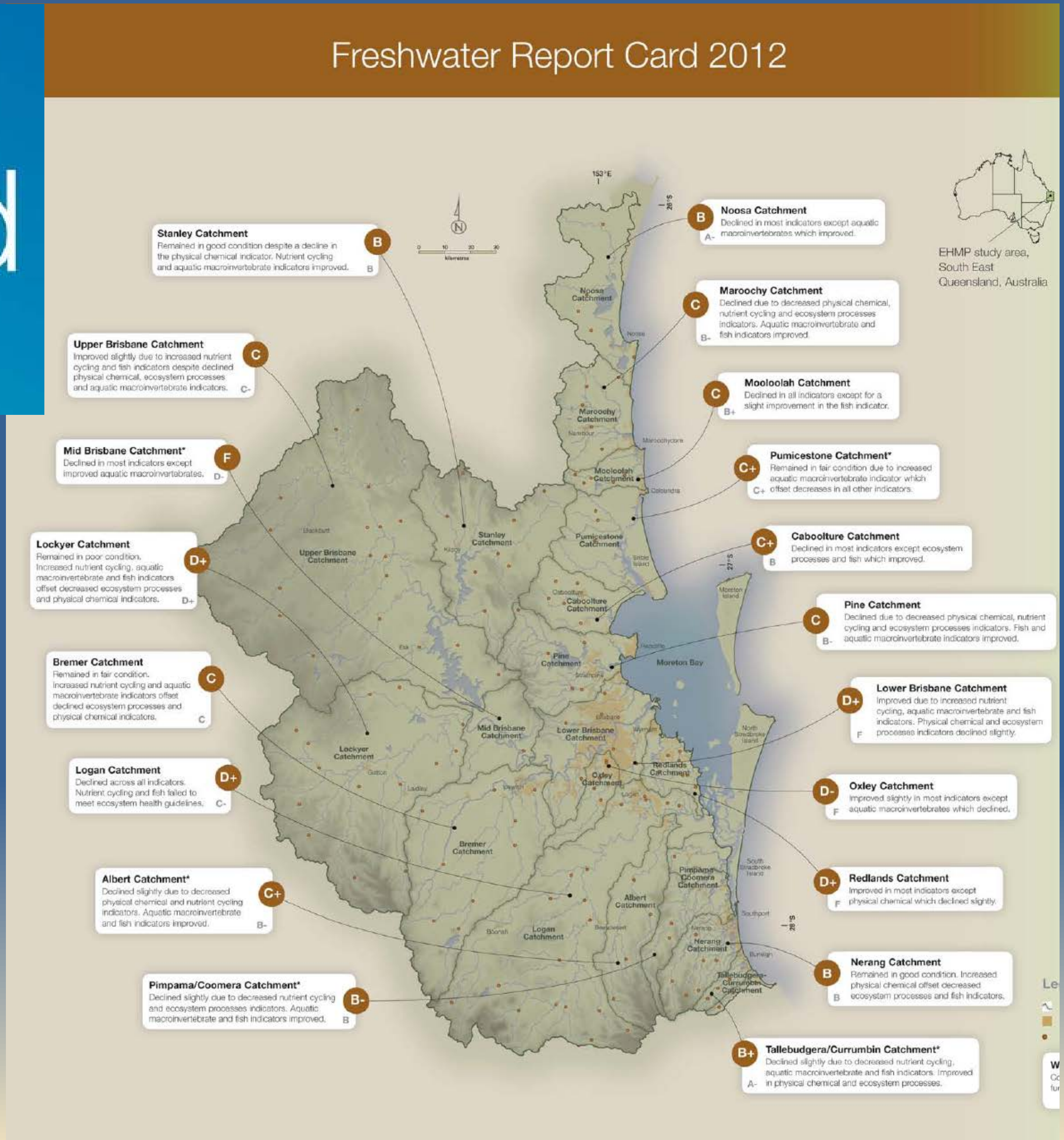
Indicators used for assessing ecosystem health



San Francisco Bay Index 2003 & 2005

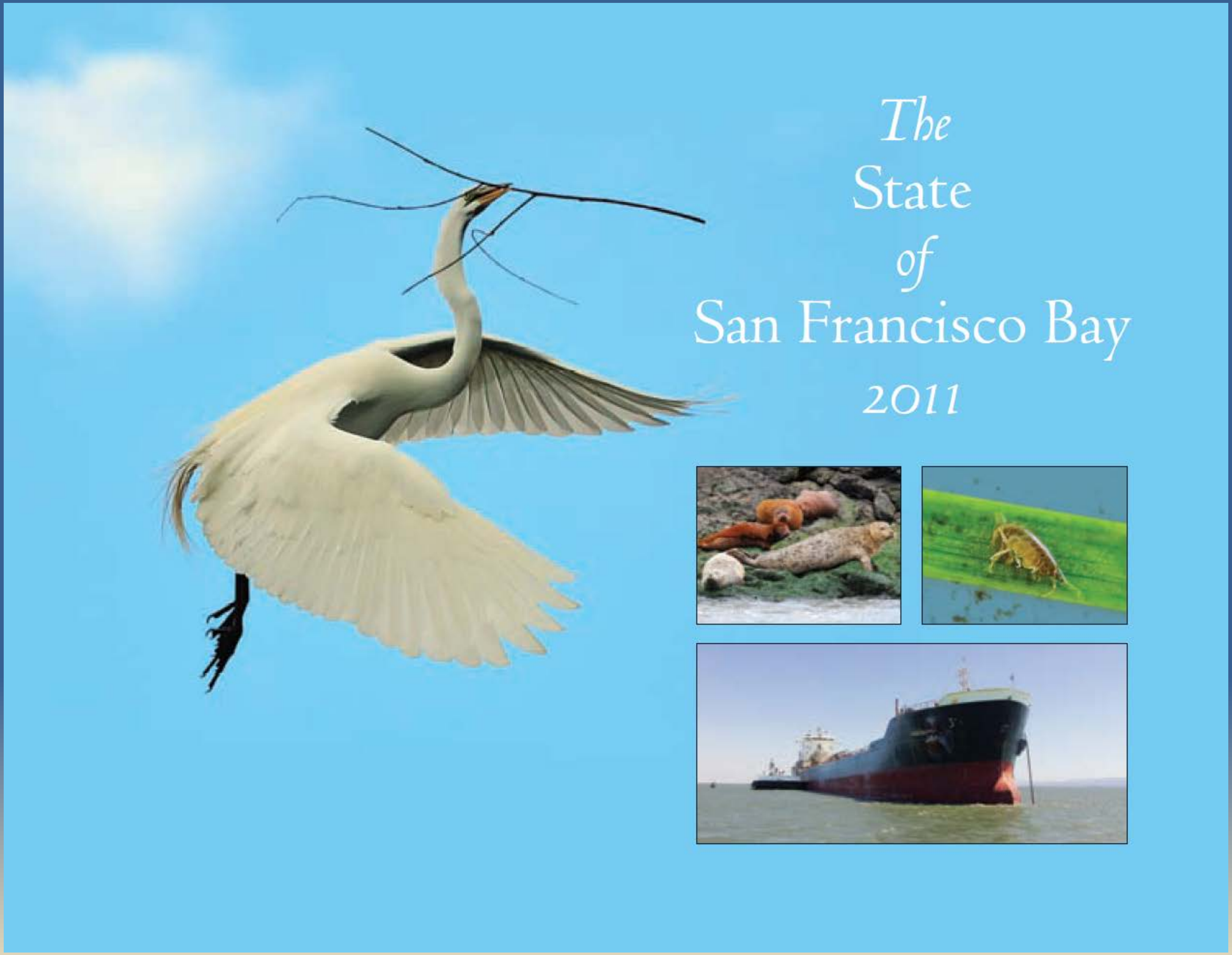
D+ Score = 32	**Habitat** Bay habitat loss is slowly being reversed, but it could take nearly 200 years to reach the tidal marsh restoration goal.	long-term ↓	short-term ↑
D Score = 29	**Freshwater Inflow** Reduced inflows are still degrading the Bay ecosystem, and recent gains from wetter years and new standards are being eroded	long-term ↓	short-term ↓
C Score = 55	**Water Quality** Open waters are cleaner, but standards are not met in parts of the Bay. Toxic sediments and storm runoff are a major problem.	long-term ↑	short-term ↔
F Score = 10	**Food Web** Plankton levels in the upper Bay have crashed, reducing food sources for fish and birds. Alien species are locally dominant.	long-term ↓	short-term ↔
B- Score = 63	**Shellfish** Crab and shrimp numbers are increasing, but commercial harvest is still down from previous high levels.	long-term ↓	short-term ↑
C- Score = 39	**Fish** After a long decline, fish populations are stable at low levels, but some species are still endangered.	long-term ↓	short-term ↔
D+ Score = 31	**Fishable-Swimmable-Drinkable** Fish are harder to catch, and unsafe to eat. Beach closures are up, drinking water violations are down.	long-term ↓	short-term ↔
C- Score = 43	**Stewardship** Water conservation, pollution limits, monitoring, and restoration efforts are finally underway, but progress is slow.	long-term ↓	short-term ↔

AREA	GRADE	SUMMARY	LONG-TERM	SHORT-TERM
	D+ Score = 31	**Habitat** Bay habitat loss is slowly being reversed, but pace of restoration unchanged since 2003 – at current rate, more than 150 years to reach tidal marsh restoration goal.	▼	▲
	C+ Score = 58	**Freshwater Inflow** Reduced inflows still degrade the Bay ecosystem – inflow improved in 2004, but overall conditions since 2000 are worse than two previous decades.	▼	◀▶
	B- Score = 65	**Water Quality** Open waters are cleaner than in 2003, but not all standards are met in parts of the Bay. Toxic sediments, stormwater runoff are major problems. South and San Pablo Bays are most polluted.	▲	▲
	F Score = 10	**Food Web** Plankton levels in Suisun Bay are still critically low, reducing food resources for fish and birds. Phytoplankton levels in all other parts of the Bay are improving.	▼	◀▶
	B Score = 73	**Shellfish** Crab and shrimp numbers rise in Central and South Bays, but not in the upper Bay. Estuarine species lose ground to marine shellfish.	▼	▲
	C- Score = 45	**Fish** Recent upward trend reverses, fish populations return to critically low levels. Estuarine species of the upper Bay are hardest hit.	▼	◀▶
	C- Score = 38	**Fishable-Swimmable-Drinkable** More fish were caught but most are still unsafe to eat. Beach closures continue to rise, drinking water violations hold steady.	▼	◀▶
	C- Score = 46	**Stewardship** Little progress towards conserving more water, reducing pesticide use, and restoring freshwater inflows, but some efforts to issue pollution limits move forward.	▼	◀▶

Grades are for the 2002-2005 period

A = Excellent
B = Good
C = Fair
D = Poor
F = Critical
▲ = improving
▼ = declining
◀▶ = stable

State of San Francisco Bay 2011



State of San Francisco Bay 2011

SUMMARY OF BAY HEALTH, 2011	STATUS	TREND	DETAILS
WATER			
Safe for aquatic life	Fair	Improving	Bay water quality is better than 40 years ago, but the rate of improvement has slowed. Mercury, exotic species, toxic sediments, and trash are still problems, with improvement expected for exotics and trash. Many potentially harmful chemicals have yet to be assessed.
Fish safe to eat	Fair	No change	Limited consumption of most popular Bay fish species is advised due to contamination from legacy pollutants. No signs of improvement since 1994.
Safe for swimming	Good	No change	Most Bay beaches are safe for swimming in summer, but bacterial contamination is still a problem at most beaches in wet weather.
Freshwater inflow	Poor	No change	Amounts and variability of freshwater inflows have been reduced, resulting in chronic drought conditions for the Estuary. Flow conditions have been predominantly poor for the last 10 years, with the Freshwater Inflow Index at a record low level in 2010.
HABITAT			
Estuarine open water	Fair to poor	Deteriorating	Quantity and quality of springtime habitat is declining. Since the 1980s, habitat conditions have generally been poor in all but wet years.
Baylands	Fair	Improving	Historic decline has ended; gradual restoration underway; there is a long way to go.
Watersheds	Fair	No change	Watersheds are largely stabilizing after damage from historical land use changes; monitoring in more watersheds is needed to improve assessment of status.
LIVING RESOURCES			
Fish	Mixed, mostly fair	Deteriorating	Fish abundance and diversity are declining in all regions of the Bay except near the Golden Gate. The fish community is in poor condition in Suisun Bay.
Shrimp/Crab	Good	Improving	Most shrimp and crab populations are increasing, but ocean species dominate in the Bay. The abundance of Dungeness crab juveniles fluctuates widely, but Bay shrimp are generally stable.
Birds	Mixed, mostly fair	Trends mixed	Some populations are increasing, some are static, and some are declining, with some earlier increases recently reversed. Tidal marsh birds are below desired levels. Reproductive success is generally low or has decreased since 1993.
ECOLOGICAL PROCESSES			
Flood events	Poor	Deteriorating	Dams and water diversions have cut frequency and duration of floods by more than half, reducing freshwater inflow variability and transport of sediment and nutrients to the Bay.
Food web	Fair	Deteriorating	Declines in reproduction of fish-eating birds suggest that less food is available.
STEWARDSHIP			
Individual/Community action	Fair	Improving	Active stewardship could be greater, but regional efforts appear to be increasing. Bay Area citizens are using water more efficiently, and we are gradually expanding our use of recycled water.
Management action (example)	Good	Improving	In-Bay disposal of dredged material has been greatly reduced since the Comprehensive Conservation and Management for the Estuary was adopted in 1993.

Sacramento River Watershed Health Indicators

FEATHER RIVER REPORT CARD — Score (0 – 100)

Goals	Measurable Objective	Indicators	EBNFF	NFF	MFF	LF	NY	MY	SY	DC	LY	UB	LB	Trend	Confidence
Water quality and supply for natural and human communities	Water quality for aquatic health	Water temperature, algae, mercury in fish	73	75	38	50	53	47	39	35	13	40	61	↔	medium-high
	Maintain natural stream flows	Current flow vs. historical flow	69	n/a	n/a	54	n/a	n/a	n/a	63	40	60	41	n/a	medium
Protect and restore native animals and plants	Native birds	Bird species richness	100	n/a	100	100	100	100	100	n/a	100	100	100	↔	medium
	Protect native aquatic communities	Land disturbance, aquatic insects, fish	69	64	69	61	66	69	62	47	55	61	82	↔	high
Protect and enhance habitats, ecosystems, and watersheds	Protect aquatic connections	Barriers to aquatic organism movement	77	82	76	82	82	76	79	69	77	67	79	n/a	medium-high
	Protect landscape connections	Barriers to wildlife movement	23	81	44	5	54	27	100	5	11	14	2	n/a	high
	Maintain natural production and nutrient cycles	Carbon storage and sequestration, nitrogen loads	88	93	63	94	93	89	93	48	96	91	96	↓	medium
Maintain and restore natural disturbance	Restore natural fire regimes	Fire frequencies compared to expected frequency	2	9	14	39	2	3	4	12	15	0	4	↔	medium
	Encourage natural flooding, while protecting people	Floodplain access	n/a	n/a	n/a	43	n/a	n/a	n/a	n/a	70	n/a	38	n/a	low
Improve social and economic conditions & benefits from healthy watersheds	Enhance wildlife-friendly agriculture	Pesticide use and organic agriculture	100	99	100	51	n/a	98	100	100	17	100	62	↑	medium-high
	Improve community economic status	Poverty measure	49	52	54	34	64	32	40	73	35	70	61	↓	high

California: Water Quality Monitoring Council

Home

Welcome to My Water Quality

This web portal, supported by a wide variety of public and private organizations, presents California water quality monitoring data and assessment information that may be viewed across space and time. Initial web portal development concentrates on four theme areas, with web portals to be released one at a time. Click the Contact Us tab for more information.

The Monitoring Council seeks to provide multiple perspectives on water quality information and to highlight existing data gaps and inconsistencies in data collection and interpretation, thereby identifying areas for needed improvement in order to better address the public's questions. Questions and comments should be addressed through the Contact Us tab.

CALIFORNIA WATER QUALITY MONITORING COUNCIL

IS OUR WATER SAFE TO DRINK?

Safe drinking water depends on a variety of chemical and biological factors regulated by a number of local, state, and federal agencies. *[Future Portal]*

IS IT SAFE TO SWIM IN OUR WATERS?

Swimming safety of our waters is linked to the levels of pathogens that have the potential to cause disease. More >>

IS IT SAFE TO EAT FISH AND SHELLFISH FROM OUR WATERS?

Aquatic organisms are able to accumulate certain pollutants from the water in which they live, sometimes reaching levels that could harm consumers. More>>

ARE OUR AQUATIC ECOSYSTEMS HEALTHY?

The health of fish and other aquatic organisms and communities depends on the chemical, physical, and biological quality of the waters in which they live. More>>

WHAT STRESSORS AND PROCESSES AFFECT OUR WATER QUALITY?

Beneficial uses of our waters are affected by emerging contaminants, invasive species, trash, global warming, acidification, pollutant loads, and flow. *[Future Portal]*

http://www.waterboards.ca.gov/mywaterquality/

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Management Approaches, Simple Messages and Incentives

Plant vegetation along riverbanks

Protecting and planting native vegetation along the water's edge significantly reduces the amount of mud that enters our waterways.

Since European settlement, it is estimated that 80% of South East Queensland's native vegetation has been cleared for agriculture, industry and housing.

The roots of vegetation hold the soil of riverbanks in place and reduce erosion. Riverbank vegetation also filters rainwater and traps mud, nutrients and other debris.

Vegetation provides habitat for land-based animals, fallen branches provide habitat for fish and over-hanging trees provide shade to moderate water temperature.

Winner of the 2012 Healthy Waterways – Government Award

More than 80,000 trees have been planted in the Oxley Creek Catchment.

Project conducted by Brisbane City Council as part of the Lord Mayor's Oxley Creek Taskforce, a collaboration of local councils, business, community and water utilities.

Improve stormwater runoff

Using Water Sensitive Urban Design improves the quality of stormwater runoff and reduces the amount of mud entering local waterways.

In highly developed catchments, hard surfaces such as roads and roofs reduce the amount of rainfall that can soak into the ground. This excess rain becomes stormwater runoff which is carried by drains straight into the nearest creek. Stormwater contains a range of pollutants such as mud, chemicals and litter. Water Sensitive Urban Design seeks to minimise the impact of stormwater runoff by using an innovative approach to urban planning and development. For example, raingardens can be built in your backyard or new housing developments. Raingardens use native plants and soil to capture, filter and treat stormwater runoff.

In addition, careful management of construction sites can reduce the amount of mud washing off the land during development.

Winner of the 2012 Healthy Waterways – Water Sensitive Urban Design Award

At the Fitzgibbon Chase development (in the Pine Catchment), stormwater is captured through bioretention systems to supply 84% of water for residential gardens.

Project conducted by the Urban Land Development Authority in collaboration with developers, community and government.

Protect wetlands

Wetlands are important for maintaining waterway health because they capture mud, reduce the impact of floods and provide habitat for native plants and animals.

In the past, the role of wetlands in protecting waterway health was not well understood. As a result, approximately half of Australia's natural wetlands have been destroyed since European settlement.

Wetlands are often referred to as 'nature's kidneys' because they act as a sponge that soaks up and slowly releases rain water, therefore reducing the impact of flooding.

By slowing the movement of water travelling through the catchment, wetlands encourage mud and nutrients to settle out, therefore improving water quality downstream.

Finalist of the 2012 Healthy Waterways – Industry Award

The constructed wetlands at Brentwood Estate (in the Lower Brisbane Catchment) are designed to remove approximately 23,700 kg of mud per year from stormwater runoff.

Project conducted by AECOM (with Investa and Hyder).

Restore floodplains

Restoring our floodplains can slow the flow of water and reduce the amount of mud entering our waterways.

Floodplains are areas of low-lying land next to a waterway which are subject to flooding.

Many decades of urban development and vegetation clearing have altered the dynamics of floodplains.

Natural, vegetated floodplains provide a critical function during flood events because they spread and slow the flow of floodwater. By slowing the floodwater, they allow water and mud to soak into the ground. This reduces flooding downstream and reduces erosion associated with fast moving water.

Floodplain restoration involves planting native vegetation and incorporating parks, public spaces and buildings designed to withstand water inundation.

Finalist of the 2012 Healthy Waterways – Government Award

Over 20 hectares of land in the Mooloolah River floodplain were restored by planting a native vegetation corridor.

Project conducted by Sunshine Coast Council, in collaboration with local landholders.

Conclusions (Overall)

- A few powerful examples of reporting frameworks in other watersheds (e.g. Australia)
- Successes in California ; Efforts are converging : Examples SF Bay Estuary and Sacramento River
- Many of the most powerful examples start with small dedicated teams, technical expert review
- It takes time and dedication to develop these reporting frameworks
- Examples of reporting for multiple years is rare
- The best examples are simple but layered (hierarchichal) and rich in visuals

Conclusions (Lessons Learned)

- Use “standard methods” and record decisions along the way
- Process should be iterative
- Process should be transparent
- Information and reporting structure should be hierarchichal
- Keep reporting simple, complicated reports do not grab the attention of the media and public.
- Resource allocation needs to be made a priority