Orientation to Delta smelt examples of the logic chain architecture

The following slides present examples of how the logic chain can be populated for DS using some Conservation Measures and metrics that have been proposed already. These are just examples – at any level of the logic chain there may be more examples that could be included (i.e. additional hypotheses, additional metrics, etc).

Important points include:

-each level flows from the level above

-metrics reflect back on two levels of hypothesis (those related to function of the conservation measure and those that link "desired change" with "objective"

-positive and negative outcomes must be projected to develop appropriate metrics and evaluate efficacy

- **Slide 2)** 30,000 foot view showing the various Delta smelt goals and objectives (pulled straight from the existing problem statement). Darkend line indicates path that we are following in the next three slides (abundance is limited by sub-adult survival as a result of food limitation in the pelagic zone)
- **Slide 3)** 3,000 foot focus on the DS abundance goal and three different hypotheses about what limits abundance
- **Slide 4)** 300 foot focus on one food related hypothesis --> increase DS sub-adult survival by increasing food in the pelagic zone by making tidal marsh.
  - NOTE: System level metrics for DS are now identified in brown boxes.
- **Slide 5)** 300 foot focus on another food-related hypothesis --> increase DS sub-adult survival by increasing food in the pelagic zone by altering operations (using Pete's examples + spring outflow)
  - NOTE: System-wide metrics remain the same regardless of which hypothesis you're working with
- **Slide 6)** Back to 30,000 feet level where we address another DS goal --spatial distribution
- **Slide 7)** 3000 ft to focus on hypotheses re: what limits DS spatial distribution (by which I mean spawning spatial distribution)
  - NOTE: One hypothesis re: what causes reduced DS spatial distribution is that abundance is so low. Two goals (abundance and dist) are linked at this level. So, while we take actions to increase abundance, we can study whether DS distribution (a separate and equally worthy goal) is increasing in response to Conservation Measures by using abundance as a covariate for distribution.
- **Slide 8)** 300 feet to focus on one of the hypotheses re: spatial distribution --> build more "habitat".
  - NOTE: Another CM is added here ("figure out what DS spawning habitat is through targeted research". By better characterizing DS spawning habitat we will now (a) have we created more of it and (b) is it really limiting DS production.
  - NOTE: There are other hypotheses re: spatial distribution that can/should be addressed using this framework (see previous slide) that involve CM's other than those presented here.

Elevation:
30,000 ft

Problem Statement (re: Delta smelt)
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Goal
Increase DS Abundance

Goal
Increase DS spatial dist.

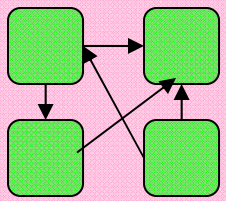
Goal
Improve DS Pop. Stability

Objective (10 yr period):
Annual FMWT index
≥100 every year,
≥ 500 in at least 3 years, and
≥ 1,000 in at least 1 year.

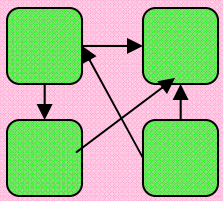
Objective:
Establish __ new spawning locations of by [date]

Objective:
No declines of ≥ __%
in 1 generation by [date]

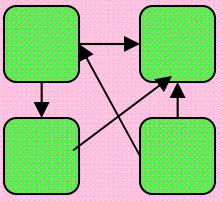
Conceptual Model
Delta smelt



Conceptual Model
Hydrodynamics



Conceptual Model
Tidal Marsh



Hypothesis:
South Delta h2o export limits pop. via (in)direct mort.

Hypothesis:
Food in the pelagic zone limits sub-adult survival

Hypothesis:
Toxic compounds limit pop. via (in)direct mort.

Desired Change

Desired Change

Desired Change

Conservation Measure

Conservation Measure

Projected Outcomes (+, -)

Outcomes (actual)

Projected Outcomes (+, -)

Metric

Metric

Analysis

Elevation: 3,000 ft

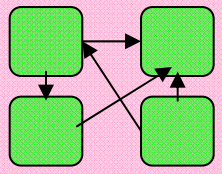
Objective: DS abundance

GOAL
Increase DS abundance

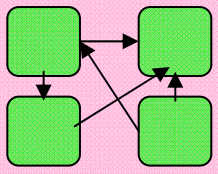
Objective (within a 10 yr period):
Annual FMWT index ≥100 every yr; ≥ 500 in at least 3 yrs, & ≥ 1000 in at least 1 yr.

Metric[1]

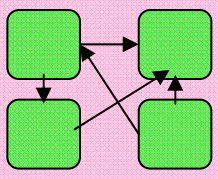
Conceptual Model
Delta smelt



Conceptual Model
Wetlands



Conceptual Model
Hydrodynamics



Hypothesis:
South Delta h2o export limits pop. via (in)direct mort.

Hypothesis:
Food in the pelagic zone limits sub-adult survival

Hypothesis:
Toxic compounds limit pop. via (in)direct mort.

Desired Change

Desired Change
Increase DS late-spring food abundance/ availability in Delta and Suisun Bay w/i 20 yrs of BDCP implementation by __ %.

Desired Change

Metric[2]

Conservation Measure(s)
Tidal Marsh Restorations

Conservation Measure(s)
Floodplain restoration

Conservation Measure(s)
Operations

Hypotheses
Re: CM effects

Hypotheses
Re: CM effects

Outcomes
(actual)

Projected Outcomes
(+, -)

Projected Outcomes
(+, -)

Metrics

Analysis

Slide 3

jr2 Proposed stations:
knights landing
Vernalis
South delta pumps (two locations)
Freeport
Lower ybp
Suisun Marsh
Suisun Bay
jonathan rosenfield, 10/26/2009

Elevation: 300 ft

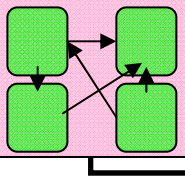
Hyp: Food limits sub-adult survival

CM: Tidal Marsh Restorations

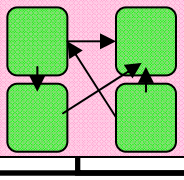
Metric
FMWT
index

Objective (within a 10 yr period):
Annual FMWT index ≥100 every yr;
≥ 500 in at least 3 yrs, &
≥ 1000 in at least 1 yr.

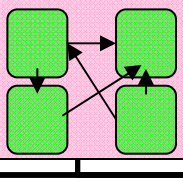
Conceptual Model
Delta smelt



Conceptual Model
Wetlands



Conceptual Model
Hydrodynamics



Hypothesis:
Food in the pelagic zone limits sub-adult survival

Larval to Adult survival

Body fat content

Suisun/Delta Zoop density

Desired Change
Increase DS late-spring food abundance/availability in Delta and Suisun Bays w/i 20 yrs of BDCP implementation by __%.

Conservation Measure
Cache Slough Tidal Marsh Restoration (HRCM 4)

CM HRCM 5

CM HRCM 6

CM HRCM 7

CM HRCM 8

CM HRCM 9

Projected Outcomes (+, -)

Outcomes (actual)

Hypotheses
Re: Tidal Marsh effects

Metrics
Net dissolved Org Carbon export

Metrics
Predator dens.
In Marsh

Metrics
Net monthly export of specific DS prey species from restored marshes

Analysis

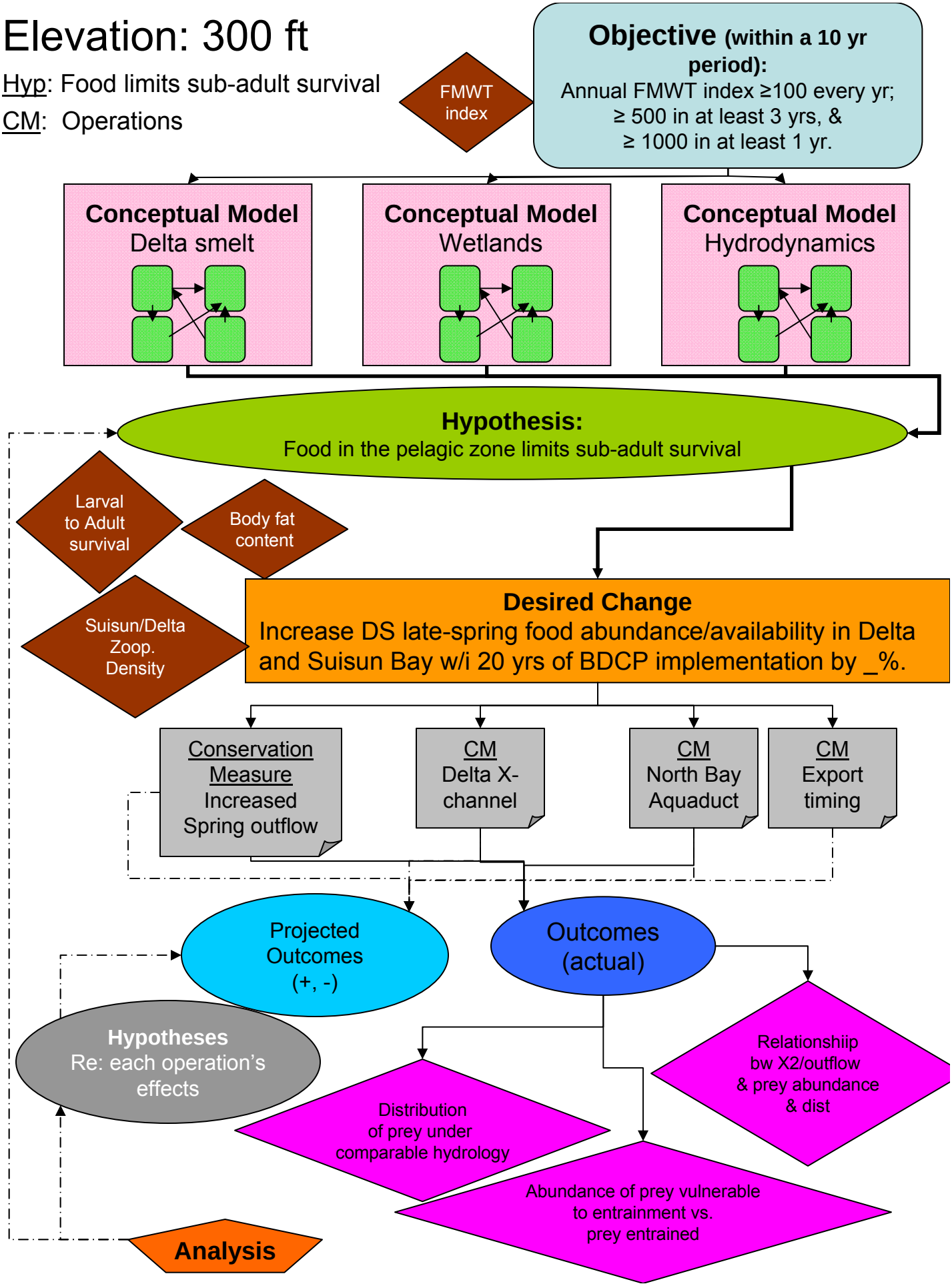
Slide 4

jr5 Proposed stations:
knights landing
Vernalis
South delta pumps (two locations)
Freeport
Lower ybp
Suisun Marsh
Suisun Bay
jonathan rosenfield, 10/26/2009

Elevation: 300 ft

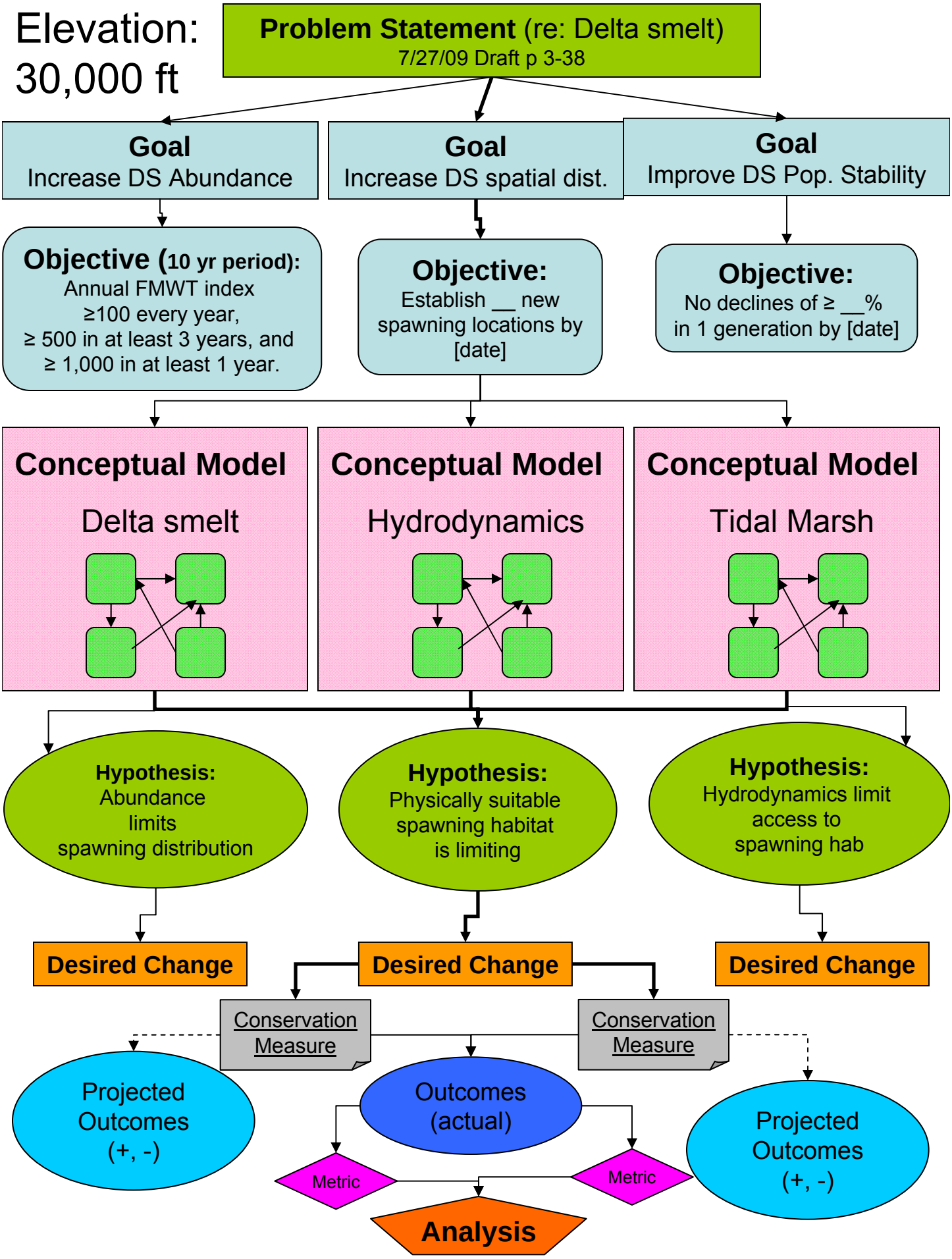
Hyp: Food limits sub-adult survival

CM: Operations



Slide 5

jr6 Proposed stations:
knights landing
Vernalis
South delta pumps (two locations)
Freeport
Lower ybp
Suisun Marsh
Suisun Bay
jonathan rosenfield, 10/26/2009


Elevation:
30,000 ft
Problem Statement (re: Delta smelt)
7/27/09 Draft p 3-38
Goal
Increase DS Abundance
Goal
Increase DS spatial dist.
Goal
Improve DS Pop. Stability
Objective (10 yr period):
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≥100 every year,
≥ 500 in at least 3 years, and
≥ 1,000 in at least 1 year.
Objective:
Establish __ new spawning locations by [date]
Objective:
No declines of ≥ __%
in 1 generation by [date]
Conceptual Model
Delta smelt
Conceptual Model
Hydrodynamics
Conceptual Model
Tidal Marsh
Hypothesis:
Abundance limits spawning distribution
Hypothesis:
Physically suitable spawning habitat is limiting
Hypothesis:
Hydrodynamics limit access to spawning hab
Desired Change
Desired Change
Desired Change
Conservation Measure
Conservation Measure
Projected Outcomes (+, -)
Outcomes (actual)
Projected Outcomes (+, -)
Metric
Metric
Analysis

Elevation: 3,000 ft

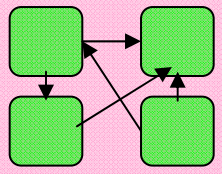
Objective: DS distribution

GOAL
Increase DS spatial distribution

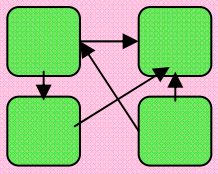
Objective:
Establish __ new spawning locations by [date]

Metric[1]

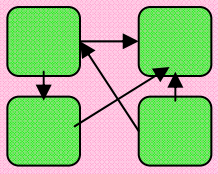
Conceptual Model
Delta smelt



Conceptual Model
Wetlands



Conceptual Model
Hydrodynamics



Hypothesis:
Abundance limits spawning distribution

Hypothesis:
Physically suitable spawning habitat is limiting

Hypothesis:
Hydrodynamics limit access to spawning hab

Desired Change
(see abund. Goal. Use abund as covariate for other hypotheses)

Desired Change
Increase area of suitable spawning habitat in Delta and Suisun Marsh w/i 20 yrs of BDCP implementation by __ percent.

Desired Change

Metric[2]

Conservation Measure(s)
Tidal Marsh Restorations

Hypotheses
Re: CM effects

Projected Outcomes (+, -)

Outcomes (actual)

Metrics

Analysis

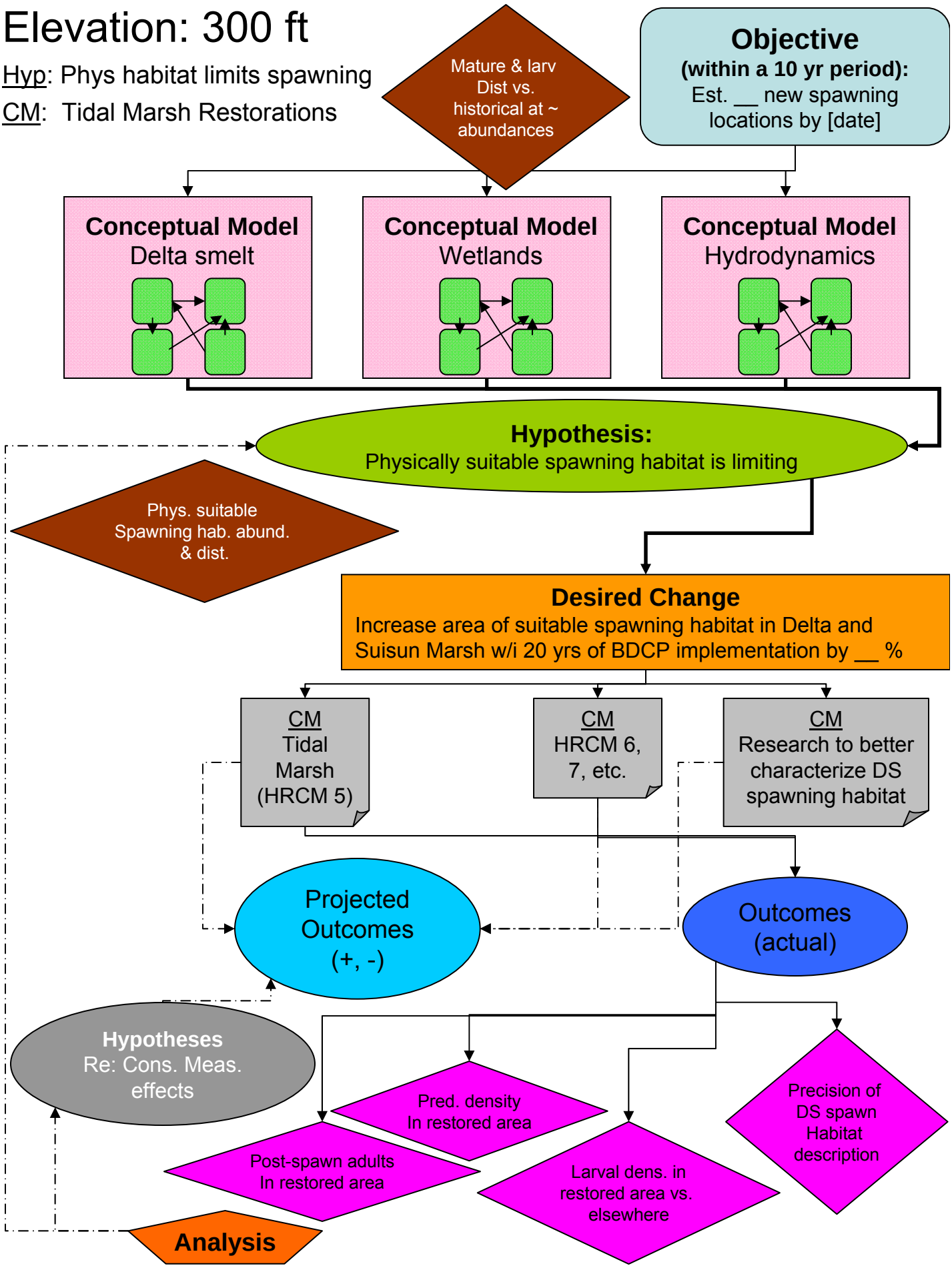
Slide 7

jr7 Proposed stations:
knights landing
Vernalis
South delta pumps (two locations)
Freeport
Lower ybp
Suisun Marsh
Suisun Bay
jonathan rosenfield, 10/26/2009

Elevation: 300 ft

Hyp: Phys habitat limits spawning

CM: Tidal Marsh Restorations



Slide 8

jr8 Proposed stations:
knights landing
Vernalis
South delta pumps (two locations)
Freeport
Lower ybp
Suisun Marsh
Suisun Bay
jonathan rosenfield, 10/26/2009