Evaluating California's Mitigation System for Entrainment from Open-water Desalination Intake Structures

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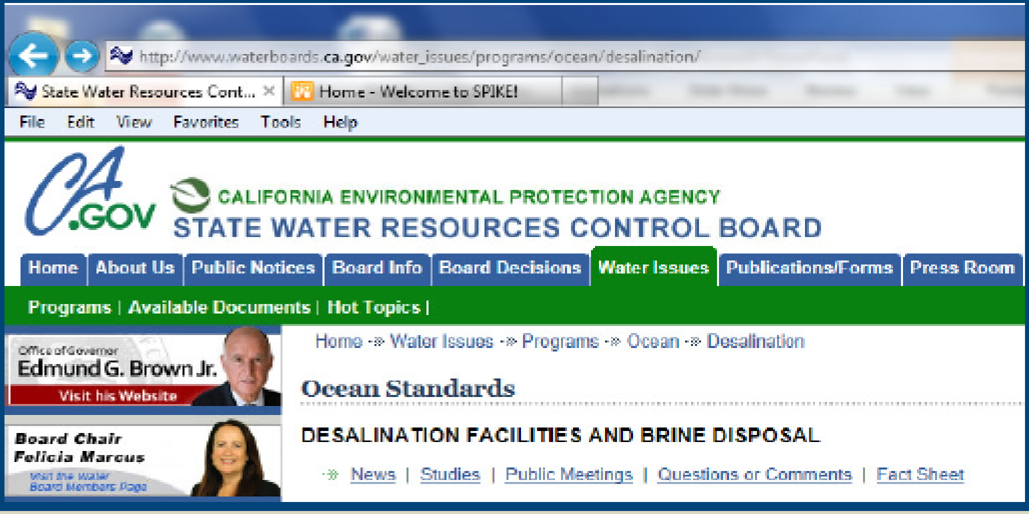
Outline

- The setting for mitigation at CA desalination plants
- Review of the proposed ETM/APF method
- ETM/APF considerations and recommendations
- Next steps

The Regulatory Setting

- The California State Water Resources Control Board (SWRCB) is considering compensatory mitigation options for fishery impingement and entrainment (I&E) impacts at new desalination plants
- Expert panels have provided recommendations and information in reports and public presentations
- Final recommendations report dated October 9, 2013



Regulatory Setting (continued)

- Mitigating I&E at desalination plants builds off a similar state effort for coastal power plants
- This recognizes there can be an adverse resource impact with the use of coastal waters
- Implicitly the mitigation will:
  - Recognize the nature of these losses
  - Scale compensation requirements accordingly

SWRCB Expert Panel Recommendations

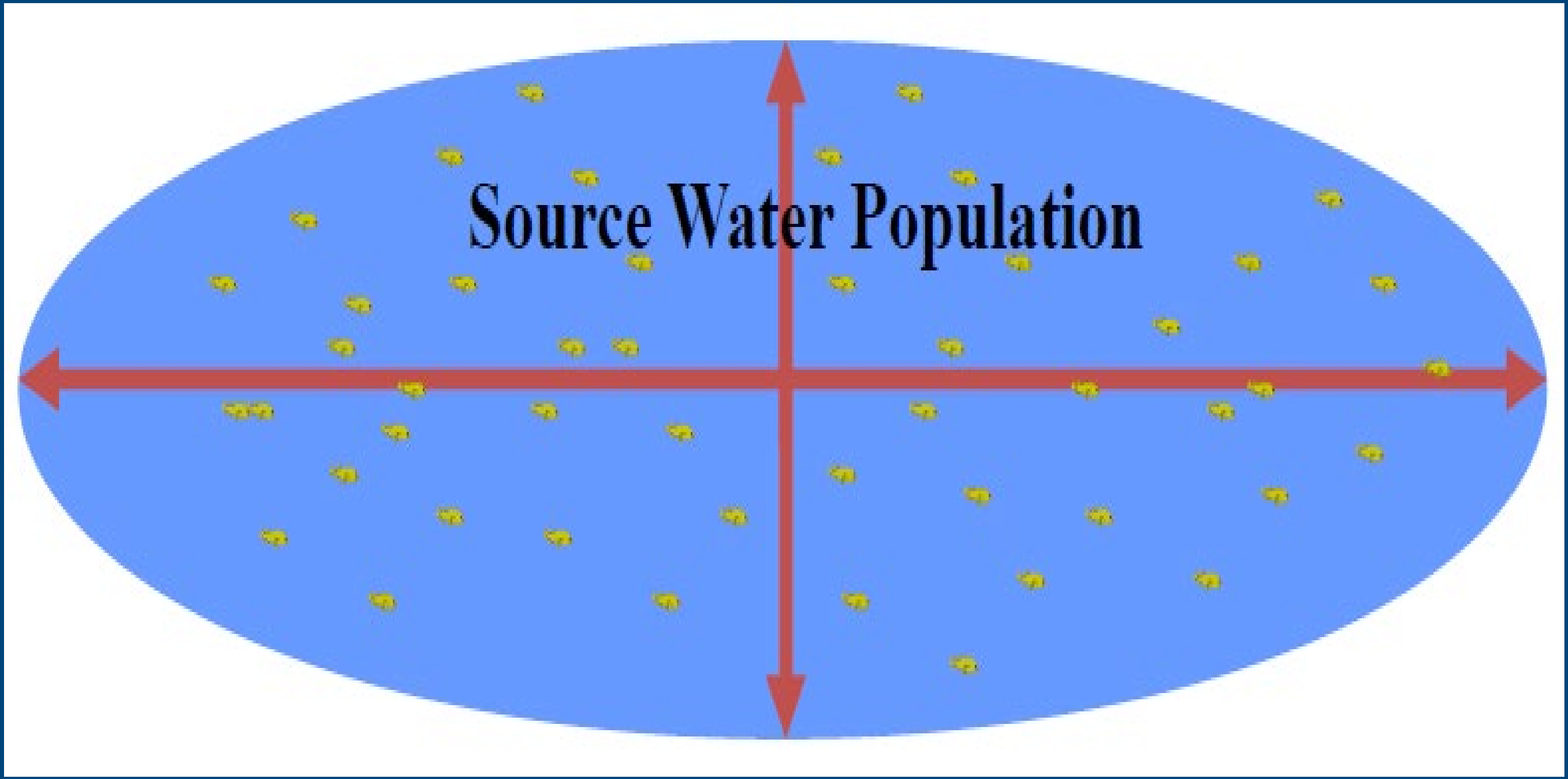
- The final expert report recommends:
  - A habitat-based compensation approach
  - Use the Empirical Transport Model/Area Production Foregone (ETM/APF) method to determine the type and extent of necessary habitat restoration
  - Develop a mitigation fee calculated by:
    - Multiplying habitat restoration costs per unit area restored by area of required habitat
    - Repeat for all required habitat types
    - Sum monetized results over all habitats

ETM/APF Review

- ETM/APF studies initially conducted to evaluate I&E at coastal power plant intake structures
- Critical ETM/APF concepts:
  - Source Water Population (SWP)
    - The species population at risk for I&E
  - Proportional Mortality (Pm)
    - The share of the at risk population lost to I&E
  - Source Water Body (SWB)
    - The habitat area affected by I&E losses

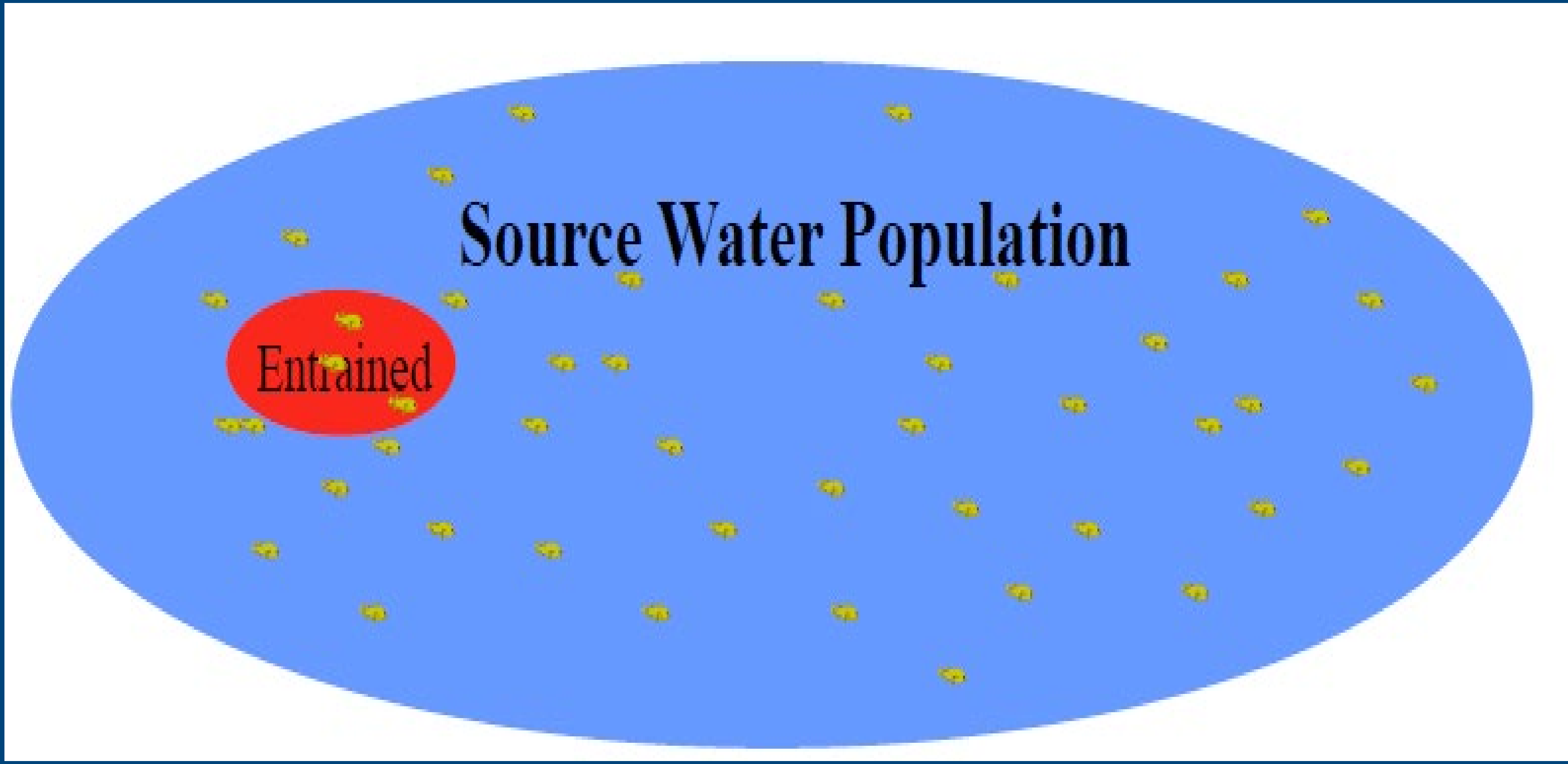
ETM/APF Review: Source Water Population

- The species population at risk for I&E



ETM/APF Review: Proportional Mortality

- The percent of the species population lost to I&E
  - Pm = number entrained/SWP
  - Pm calculated by species



ETM/APF Review: Source Water Body

- The area, for a species, that could be affected by I&E losses

ETM/APF Review: Calculating the APF by Species

Area of Production Foregone – a way to interpret loss

- Simple method allows for conversion of organismal loss to habitat

$$P_m \times SWB$$

ETM/APF Review: Calculating APF overall

- By species, the calculation is APF = Pm * SWB
  - Reflects equivalent portion of habitat supporting the species that is "lost" annually to I&E
- In the example, APFs are averaged across species

Taxon	Estimated Annual Entrainment	P_m Alongshore Extrapolation (Mean)	Length of Source Water Population (Miles)	Area (mi^2) of Production Foregone (Mean)
spotfin croaker	69,701,589	0.30%	10.1	0.085
Queenfish	17,809,864	0.60%	50.9	0.911
white croaker	17,625,263	0.70%	28.7	0.583
black croaker	7,128,127	0.10%	11.6	0.039
Salema	11,696,960	NA**		
Blennies	7,165,513	0.80%	7.7	0.170
diamond turbot	5,443,118	0.60%	10.1	0.170
California halibut	5,021,168	0.30%	18.5	0.131
rock crab	6,411,171	1.10%	15.9	0.486
AVERAGE (sq. miles)				0.325
AVERAGE (acres)				**208**

ETM/APF Review: Using the APF to Determine the Habitat Mix to Restore

- Theory:
  - The total habitat area in the APF result should be allocated to habitats in the same proportion they are found in the source water body
- Example from Expert Panel October 9, 2013 report
  - "…habitat should be created that represents the habitat for the populations at risk"
  - "If the habitat in the estuary was 60% subtidal eelgrass beds and 15% mudflats and 25% vegetated marsh then these same percentages should be maintained in the created habitat"

ETM/APF Review: Monetizing the Restoration

- Theory:
  – Calculate average restoration costs per MGD
  – Multiply by MGD in design/operation for fee
- Example from Expert Panel October 9, 2013 report

Facility	Intake Volume (MGD)	APF (acres)	Mitigation Type	Cost estimate	basis year	cost per daily intake (MG)
Moss Landing Combined cycle	360	840	wetland	$15,100,000	2000	$41,944
Morro Bay	371	760	wetland	$13,661,905	2001	$36,825
Poseidon	304	37	wetland	$11,100,000	2009	$36,513
Huntington Beach	127	66	wetland	$4,927,560	2009	$38,800
Diablo	2,670	543	Rocky reef	$67,875,000	2006	$25,421
				Average (wetland mitigation)		$38,520
				Rocky reef mitigation		$25,421

Overview of Considerations and Recommendations

- Theory:
  - The ETM/APF approach is theoretically sound
  - Use habitat restoration to address I&E fish losses
- Details:
  - Adjust the APF calculation to make it consistent with existing restoration scaling frameworks
  - Adjust treatment of costs for consistency with standard practices
  - Discretionary choices need to be recognized for their impact and alternative options
  - Monitor to evaluate restoration performance

Recommendations: Explicitly Account for Timing and Impact Issues in the APF

- Issue:
  - Timing of I&E impacts and compensatory restoration affects the scale of required action
  - Need information on the effectiveness of the restoration over time for scaling
  - Formal discounting should be used to summarize impacts/benefits over multiple time periods

Importance of Timing and Level of Impact

- Example:
  - Develop scaling scenarios using the Habitat Equivalency Analysis framework
- Impact of I&E
  - Summarized for different periods of time assuming an initial APF = 10 acres of habitat
  - Results in discounted service acre years
- Impact of restoration
  - Assume different time periods to reach maturity
  - Assume benefits accrue over different periods
  - Results in discounted service acre years

HEA-APF Example

- Scaling:
  – Loss from I&E divided by per acre restoration credit to determine number of credits

		Discounted credit per restored acre (DSAYs)					
		Instant 100% over 20 yrs then stop	Instant 100% over 40 yrs then stop	5 year ramp to 90% over 20 yrs then stop	10 year ramp to 90% over 20 yrs then stop	5 year ramp to 90% over 60 yrs then stop	10 year ramp to 90% over 60 yrs then stop
		14.9	23.1	11.7	9.7	23.6	21.6
APF calculated to 10 acres	Discounted loss (DSAYs)	required acres of restoration					
100% APF loss annually for 20 yrs	148.8	10.0	6.4	12.7	15.3	6.3	6.9
100% APF loss annually for 40 yrs	231.1	15.5	10.0	19.8	23.7	9.8	10.7

Note: highlighted values where acres to restore equals assumed APF value

Habitat Restoration Costs

- Restoration costs need to be comprehensive
- Comprehensive costs useful for mitigation will account for the expenditures in the following actual/planned areas:
  - Design
  - Permitting
  - Land acquisition
  - Construction
  - Operations and Maintenance
  - Supervision and Oversight
  - Monitoring
- Available cost estimates rarely cover all these areas

Restoration Costs and Time

- When costs are being evaluated they need to be expressed in the same base year

Facility	Mitigation type	Basis year	Cost estimate	Intake Volume (MGD)	Cost per (MGD) unadjusted for year	Cost per (MGD) adjusted to $2013
Moss Landing Combined Cycle	Wetland	2000	$15,100,000	360	$ 41,944	$ 56,744
Morro Bay	Wetland	2001	$13,661,905	371	$ 36,825	$ 48,439
Poseidon	Wetland	2009	$11,100,000	304	$ 36,513	$ 39,648
Huntington Beach	Wetland	2009	$ 4,927,560	127	$ 38,800	$ 42,131
Diablo	Rocky Reef	2006	$67,875,000	2670	$ 25,421	$ 29,375
				average (wetland mitigation)	$ 38,520	$ 46,740
				acreage weighted average (wetland mitigation)		$ 48,023

Sources of Uncertainty in the ETM-APF

- There are multiple potential sources of uncertainty in the ETM-APF approach including:
  - Information used to calculate APF
  - Knowledge of habitat composition in the SWB
  - Performance of restored habitats to complete scaling

Addressing Uncertainty in the ETM-APF

- There are some options for responding to uncertainty including:
  - Evaluation of confidence limits in selecting ETM/APF data inputs
  - Establish a limited number of consistent habitat categories to help characterize for source water bodies and restoration opportunities
  - Ensure monitoring is completed to provide the information needed to better inform future decisions
  - Consider cumulative uncertainty adjustments (e.g., a APF scaling factor from 1-5)

Recommendations

- Incorporate nature, extent, and timing of impacts from I&E, measured as APF, and restoration performance to determine required restoration scale
- Adjust all costs to a common base year value
- Seek quantitative uncertainty adjustments where data allows
- Pursue a uncertainty adjustment factor to allow for additional expert-guided perspective for a project
- Ensure restoration projects are monitored to develop the critical information needed to adjust the program over time.

Conclusions

- Focus on the mitigation/compensation goals
  - Provide incentives to reduce I&E
  - Pursue scaled compensation to address losses
- The compensation story should be clear
  - Define the nature of the I&E losses over time
  - Define the benefits of different restoration actions
  - Scale so benefits offset losses
- Uncertainty should require additional restoration
- Monitoring can develop the data to reduce uncertainty

Conclusions (continued)

- A scaled restoration program is not punitive
  - Without impacts no restoration is required
- Seek to balance losses and improvements while accounting for site-specific factors
- This approach is commonly used in other causes of damages