Desalination Plant Entrainment Impacts and Mitigation

SWRCB Expert Review Panel
Michael Foster - marine ecology (panel chair), Gregor Cailliet - marine fishes, John Callaway - restoration, Kristina Mead Vetter - biomechanics, Peter Raimondi - marine ecology, Philip Roberts - diffuser engineering

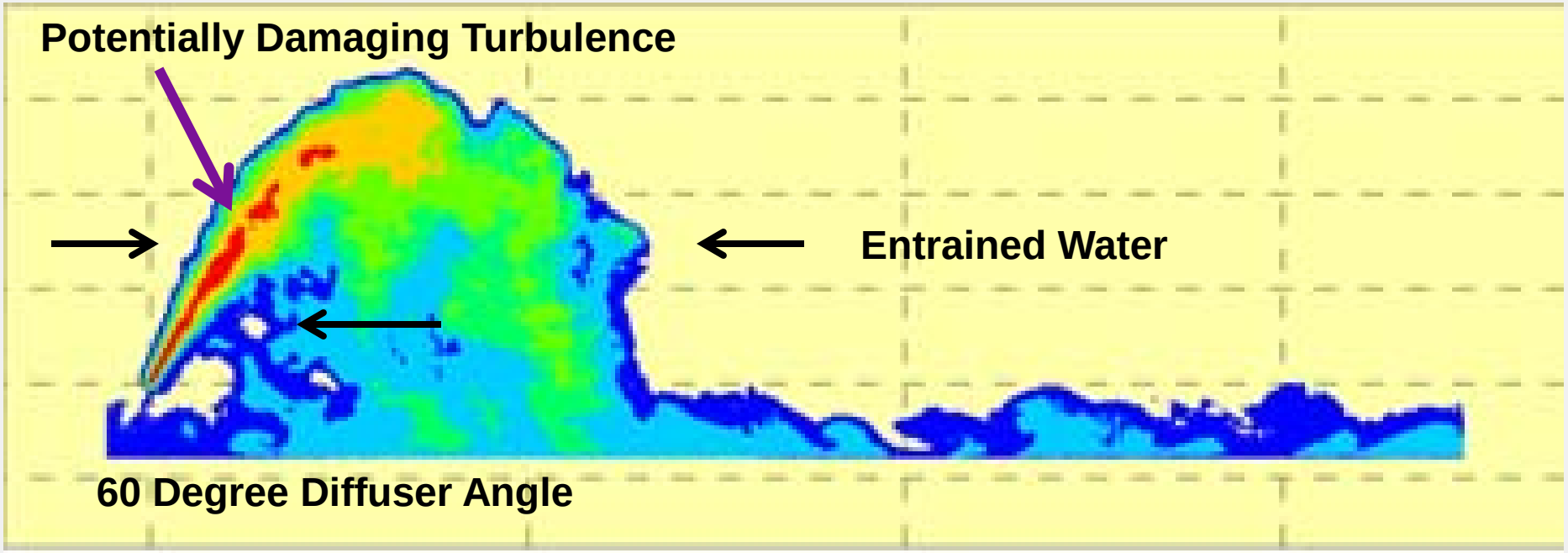
Panal Tasks:

1. **Evaluate the potential effects of diffusers on**
   A. **organisms entrained into the diffuser plume, and**
   B**. turbidity**.

2. **Provide further explanation of the 'fee' approach to the cost of mitigation for intake entrainment impacts, including possible fee reductions from using wedge wire screens on the intake.**

Note: Evaluations and explanations based on desalination plants that intake unfiltered, natural sea water (surface water), and discharge undiluted brine water through diffusers into the ocean.

RESULTS: DIFFUSER ENTRAINMENT IMPACTS

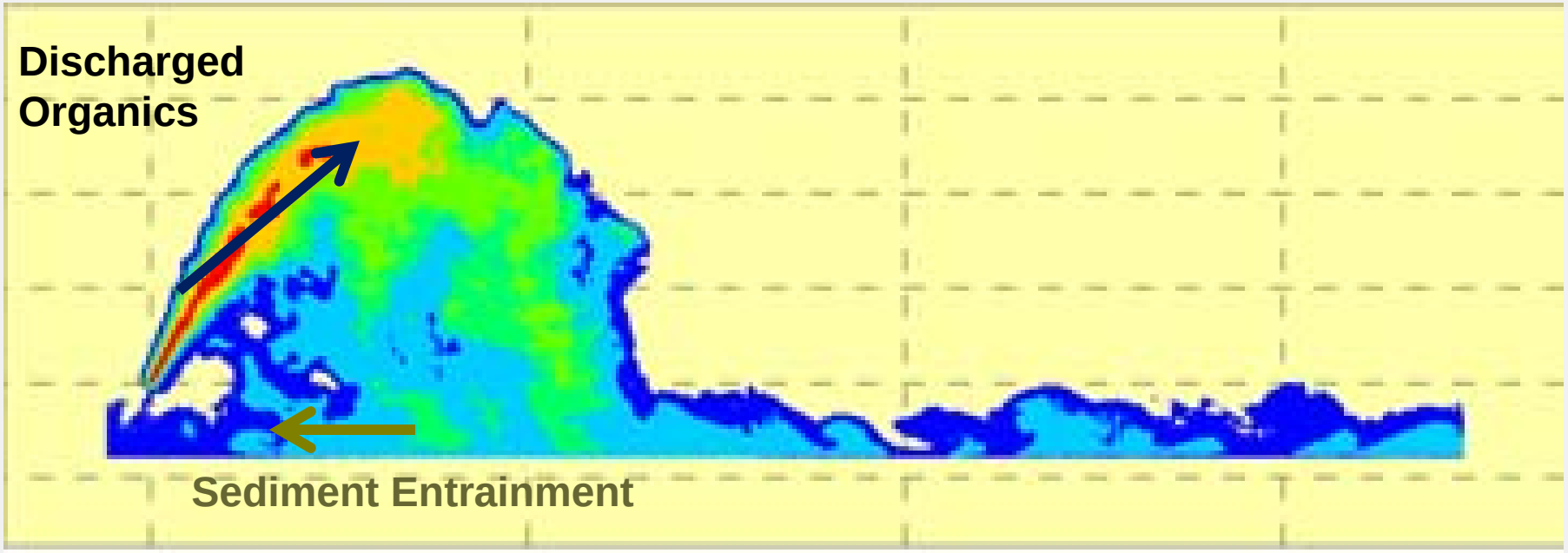


- Only 23-38% of entrained water is exposed to potentially damaging turbulence
- Exposure time to such turbulence is on the order of seconds

CONCLUSION: ENTRAINMENT IMPACTS FROM DIFFUSERS ARE LIKELY TO BE LOW,

and likely lower than impacts from yet to be demonstrated in-plant dilution where impacts can occur from passing through pipes and pumps, during in-plant mixing with brine water, and from possible discharge into unfavorable environments. Need field measurements.

RESULTS: DIFFUSER EFFECTS ON TURBIDITY

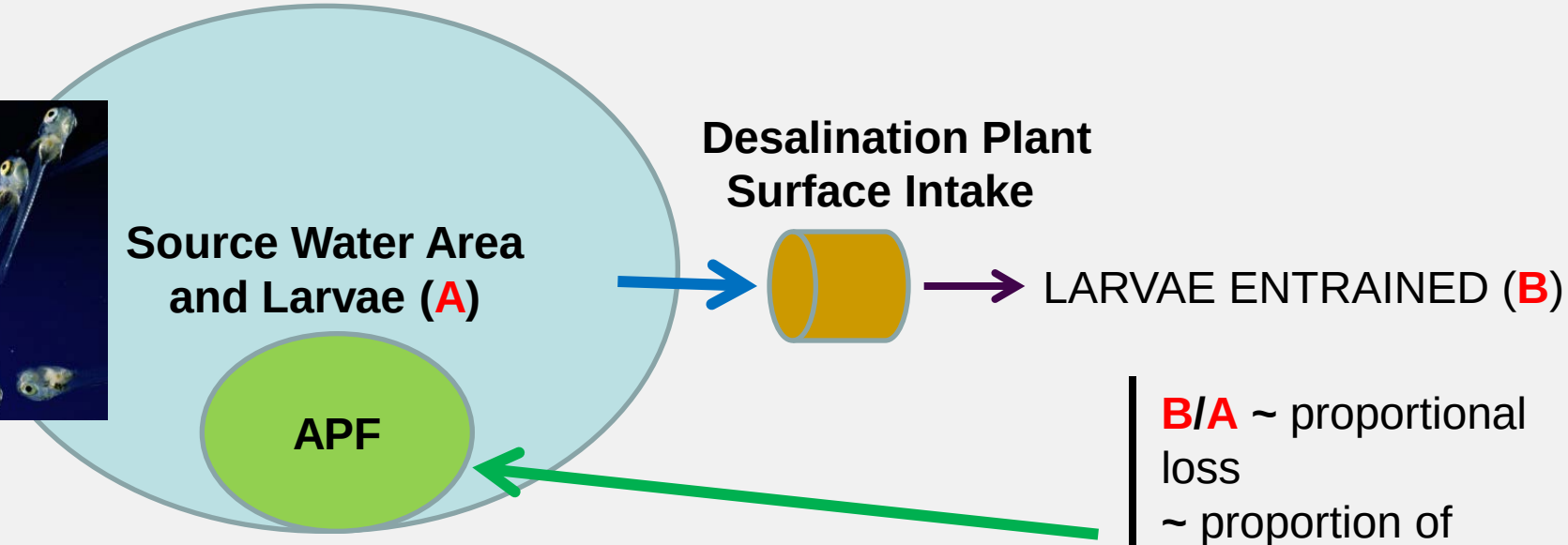


- Entrainment of sediment along the bottom is likely low as velocities ~ 2 cm/sec within 1 meter, and rapidly fall below that beyond 1 meter.
- Volume of brine water and rapid mixing suggest effects of discharged organics on turbidity are likely to be small.

CONCLUSION: EFFECTS OF DIFFUSERS ON TURBIDITY ARE LIKELY TO BE SMALL. Need field measurements.

Note: Effects of SONGS diffusers are not comparable because of differences in design and volume.

EXPLANATION: FEE APPROACH TO INTAKE ENTRAINMENT IMPACTS
Using Area of Production Foregone (APF)

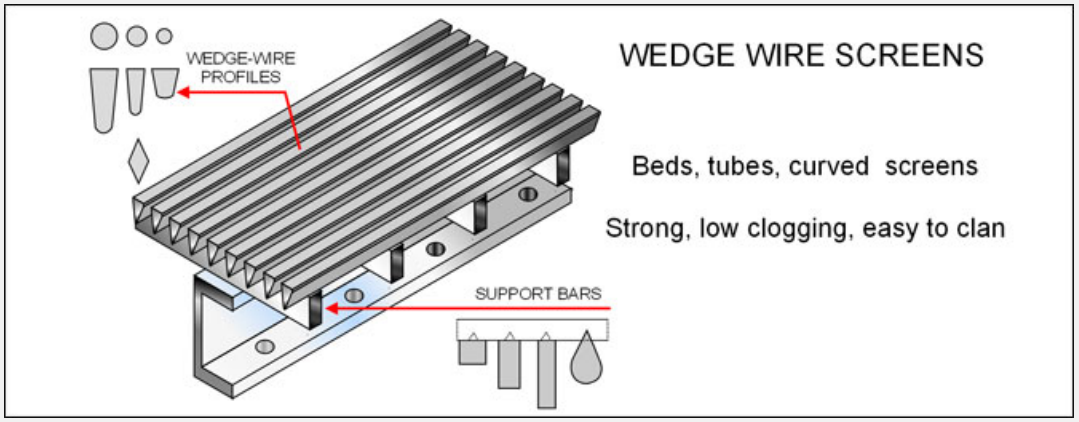


B/A ~ proportional loss
~ proportion of source water habitat needed to replace larvae lost from entrainment

FOR A DESALINATION PLANT MITIGATION FEE:
Use existing studies, resulting APFs and cost of replacement to determine mitigation 'fee' per MGD. Increase for inflation, and cost of management and monitoring. Example:

- Average mitigation for estuaries ~ $40,000/MGD
- Mitigation Fee for a desalination plant using 10 MGD of estuarine water = $40,000 X 10 = $400,000 plus

EVALUATION: EFFECT OF REDUCED ENTRAINMENT OF LARGE LARVAE ON APF



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- Wedge wire screens with 1-2 mm slots will only exclude large larvae.
- Large larvae are a very small proportion of the total larvae used for APF determination.

CONCLUSION: USE OF WEDGE WIRE SCREENS WILL PROBABLY RESULT IN A REDUCION OF LESS THAN 1% IN APF.

Such screens will eliminate impingement.