Mitigation for Desalination Plant Intake Impacts: A Fee-Based Approach ($/Million Gallons (MG)

SWRCB Expert Review Panel
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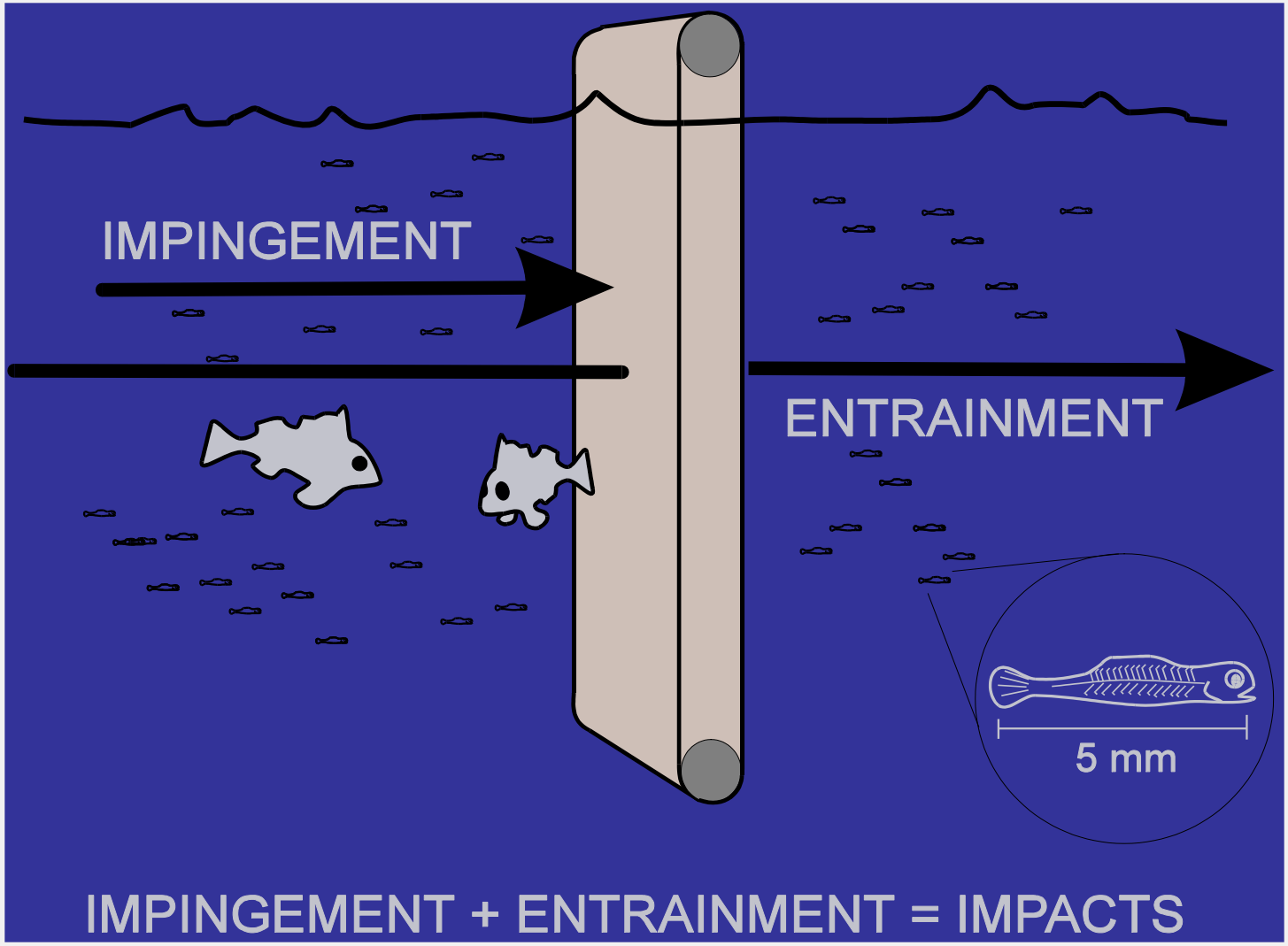
To Recommend Answers to the Questions:

1. If there is remaining impingement and entrainment after the best site, design and technology are determined for a new desalination plant, how should this remainder best be mitigated?

2. Are there desalination intake technologies and designs that can reduce impingement and entrainment?

Note: Did not consider discharge impacts such as mortality of organisms exposed to turbulence from a diffuser. Assumed entrainment mortality from the intake would be greater than mortality due to brine exposure at the discharge.

Intake Impacts



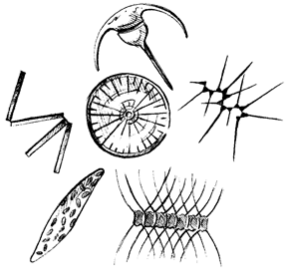
(from Steinbeck)

QUESTION 1. IMPINGEMENT FEE

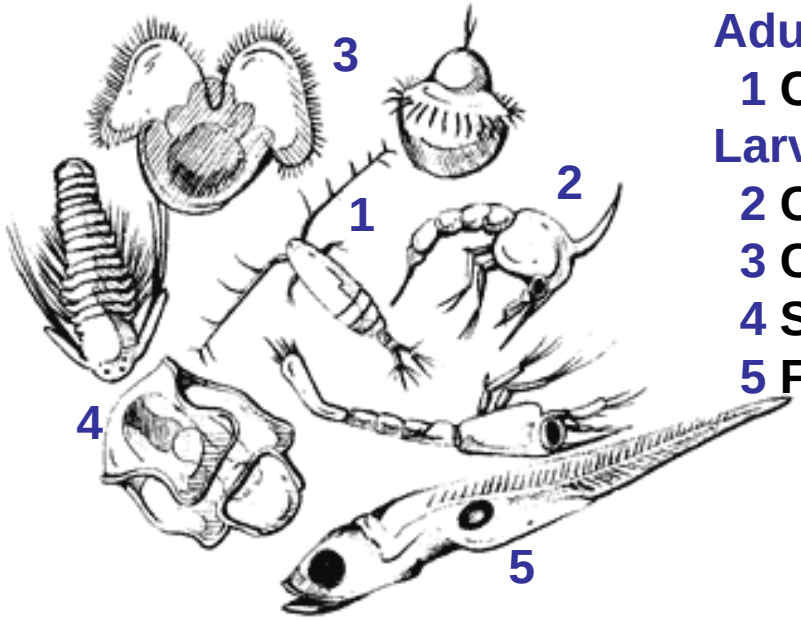
Count, Weigh, Use Market Values + Economic Multipliers

PLANKTON DIVERSITY (SPP= # species) & ABUNDANCE (# = # /10^3 m^3 = ~ #/ .25 x 10^6 gal) IN CALIFORNIA COASTAL WATERS

Phytoplankton 10^2 SPP 10^9 #



Zooplankton



	SPP	#
Adults		
1 Copepods and related animals	~10^2	10^6
Larvae		
2 Crabs	8	3x10^3
3 Clams & mussels	> 5	1.8x10^6
4 Sea urchins	2	6x10^2
5 Fish	44-200	400 – 600

OTHER LARVAE???

Data from: phyto, Petipa et al 1970; 1. Hopcroft et al 2002; all other, recent CA entrainment studies.

Entrainment Impacts – APF/HPF and AEL

Sample At Intake

ALSO Sample Source Water

Adult Equivalent Losses (AEL)
-Compare to price of fish. – BUT no mitigation for impacts to organisms other than fish.

1. Using Empirical Transport Model (ETM), determine Proportional Mortality (**PM**)
   = proportion of larvae lost from entrainment that could be entrained (larvae in source population)
2. Determine the area of the source population
3. Determine the average of 1. and 2. for species assessed ("target species").
4. Average PM X average area = area equivalent to 100% loss =

Area of Production Foregone (APF) or
Habitat Production Foregone (HPF),
Representative of all species lost to entrainment.

Mitigation cost = $ required to create or restore this amount of habitat.

Entrainment Fee $/MG

Approaches

Area of Production Foregone (APF) or Habitat Production Foregone (HPF)

- **Used prior APF determinations and mitigation cost for five intakes (4 power, 1 desal) and divide this by intake vol. in million gallons/year (MG) to determine a mitigation fee as $/MG.**

- **Increase for inflation and assume mitigation half-life of 50 years.**

- **Mitigation fee = $\frac{\text{(total cost of mitigation)(inflation escalator)}}{\text{(intake vol. in MG/yr)(50)}}$ = $/MG**

- **Result: Fee ranged from $1.66 – $3.28/MG with average = $2.45/MG. Does not include mitigation for impingement or for monitoring success of mitigation. If add these costs = ~ $3.00/MG?**

Adult Equivalent Losses (AEL) – Fish Only

- Determine adult equivalents of fish larvae killed by entrainment/MG

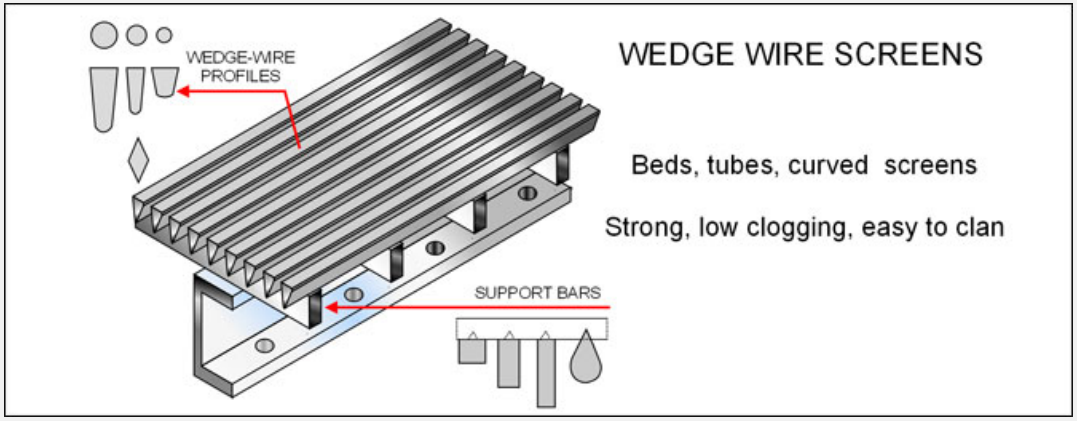
- Use market price + economic multipliers to determine $/MG

- For comparison, the fee using AEL based on price/pound of fish and associated economic losses to mitigate for the Huntington Beach Power Plant would be about $0.77/MG. <u>This mitigation fee, however, only compensates for impacts to fish.</u>

Technology and Designs to Reduce Intake Impacts

Subsurface Intakes
Construction Effects?

Surface Intakes
Impingement
Entrainment



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Use of Mitigation Fees:

- ► pay into a fund administered by ?
- ► aggregate fees to enable projects with maximum environmental benefit
- ► minimize administrative costs and maximize environmental benefits
- ► strive for projects that compensate in-kind and at site or in region of impacts.