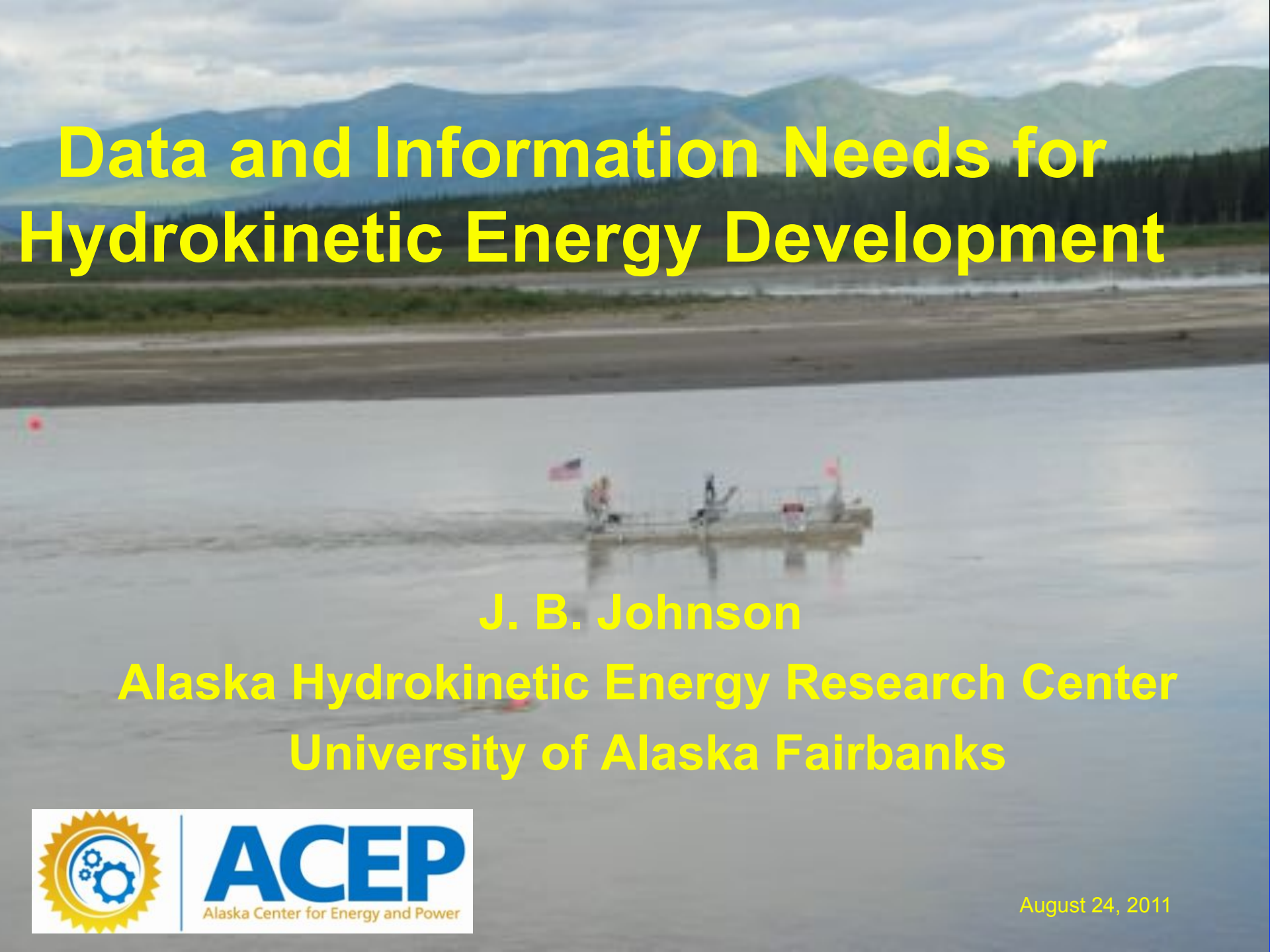
Data and Information Needs for Hydrokinetic Energy Development



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August 24, 2011

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Outline

- AHERC goals and objectives
- AHERC projects in-progress and in-development
  - Project activities and findings
- Information and data needs to facilitate development of hydrokinetic energy in Alaska

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AHERC Structure & Purpose

- Resides within ACEP which reports to the INE director
- Focused on developing technology, methods, and information to facilitate the development of an environmentally compatible hydrokinetic power industry in Alaska
  - Hydrokinetic power resource assessment
  - Evaluation of interactions between aquatic environment and hydrokinetic turbines.
  - Develop technology and methods to mitigate challenges
  - Develop and disseminate data and information needed by stakeholders to make informed decisions
- Provide a statewide research and information resource
- Strategic plan developed and creating an advisory council
  - Industry, resource agencies, regulatory agencies, utilities and power advocates

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AHERC Projects and Activities

- Projects in-progress
  - Tanana River characterization at Nenana (AEA)
    - The river environment & its potential impact on hydrokinetic devices (hydrodynamics, debris, fish, sediment, ice, river bed morphology)
  - Debris mitigations study and technology development (AP&T/ Denali Commission)
    - Debris characterization and mitigation technology development
    - Fish
    - New Energy Turbine technology assessment (with ABS)
  - Subsurface debris flow characterization in the Tanana River at Nenana (ORPC/ Denali Commission)
- Projects in-development
  - Hydrokinetic power generation device technology development, assessment, and demonstration
    - Vortex Hydro
    - Pulse Tidal
    - Boschma Engineering
    - Baker Hughes

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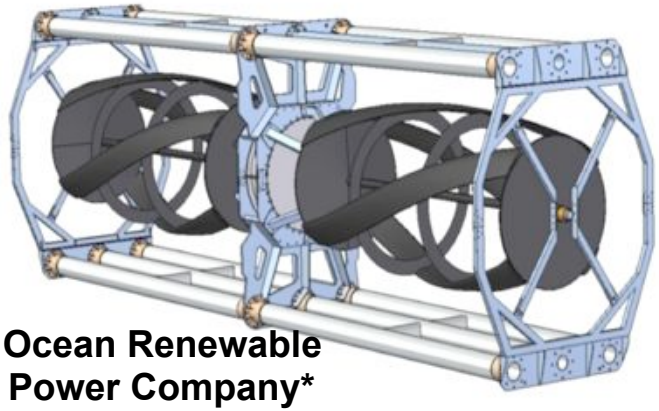
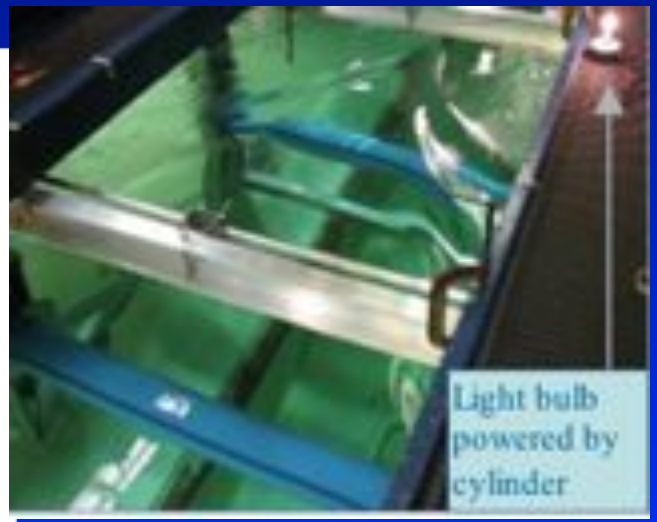
Hydrokinetic Generation Devices

Cross-flow turbines


Ocean Renewable Power Company*



VIVACE*: vortex induced vibration

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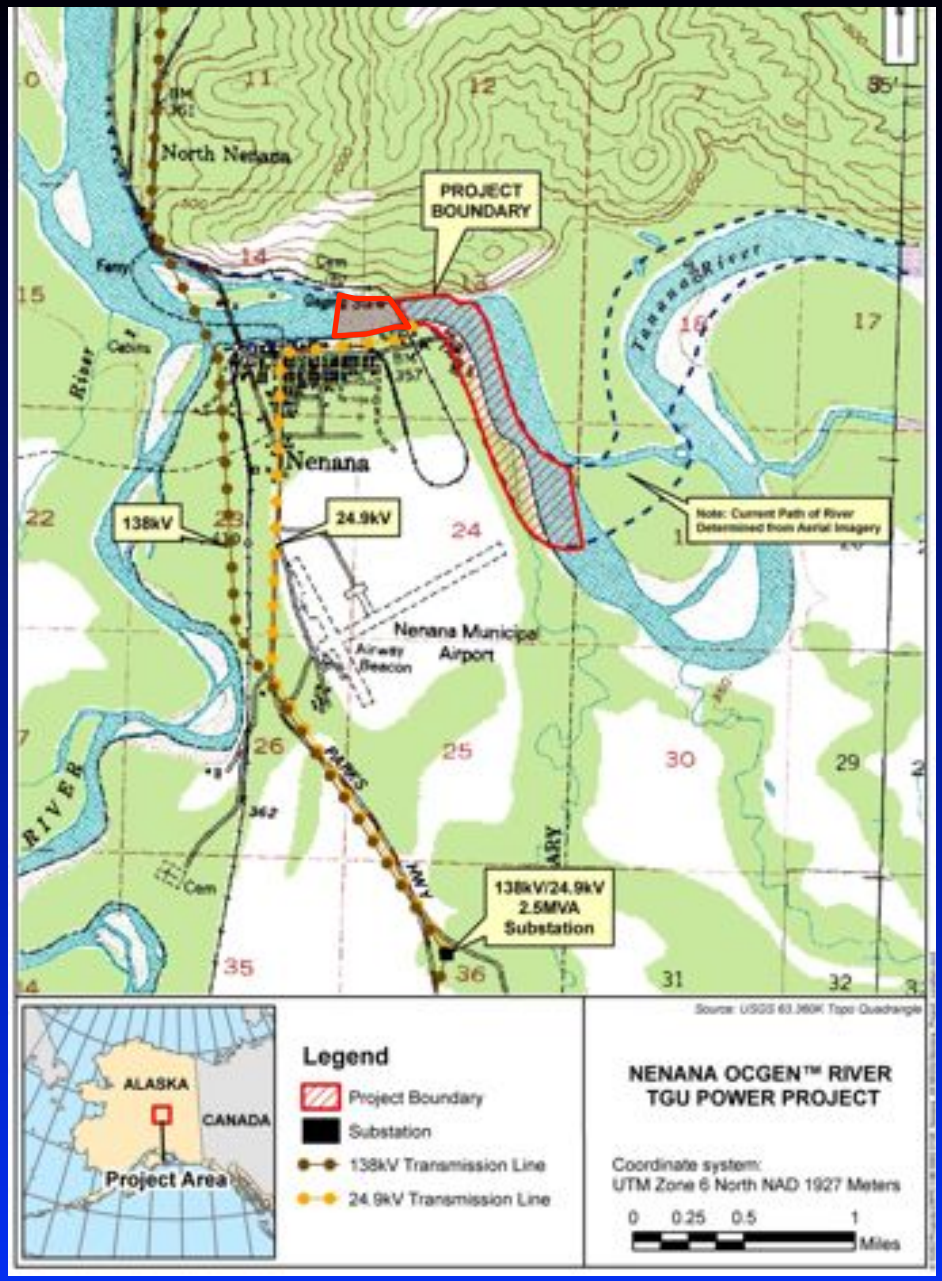
*Turbine images used with permission

- **Tanana River Test Site Development** (Nenana, AK)
  - In collaboration with ORPC

- Goals: Assess river conditions prior to - and after - installation of a hydrokinetic turbine
  - The river power resource: summer & winter
  - The river environment
  - River debris conditions
  - Fish behavior and mortality
  - Turbine technology test site



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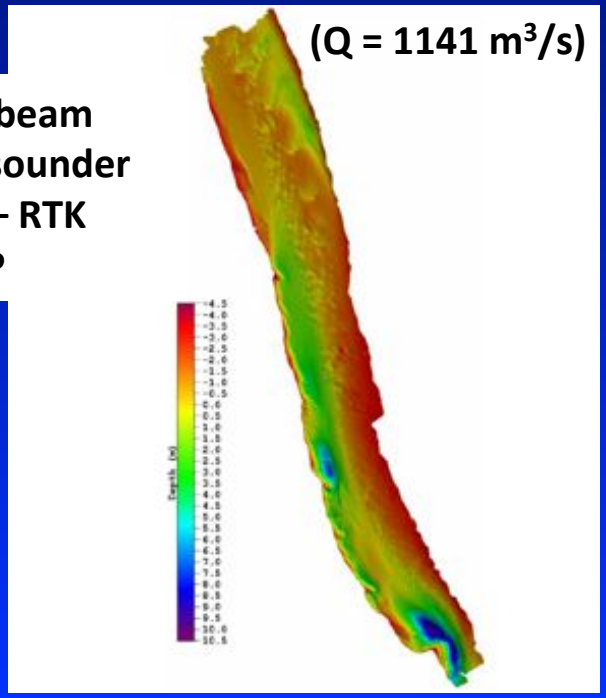
Bathymetric, hydrodynamic, & sediment Surveys

Conducted by Terrasond

MV Irish Eyes

- Multibeam Echo sounder
- GPS – RTK
- ADCP



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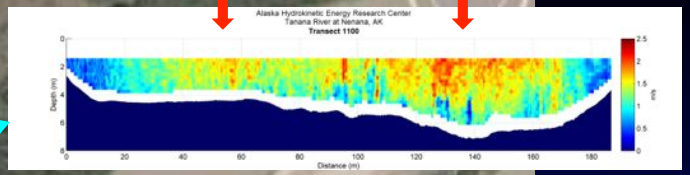
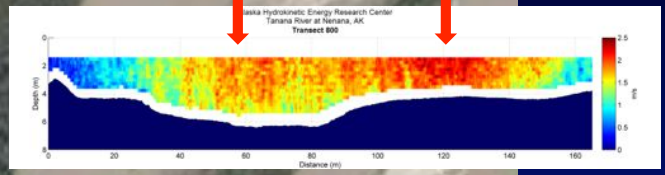
Study site

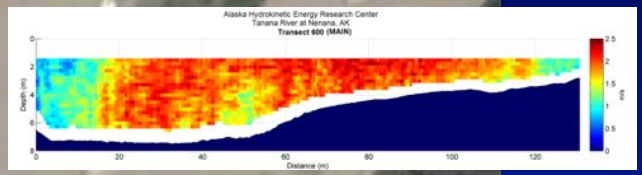
THALWEG PATH

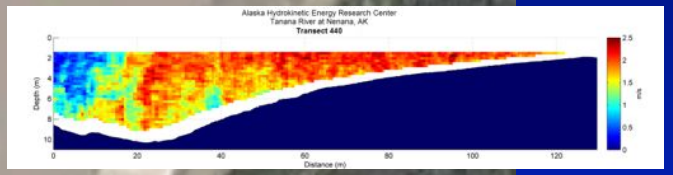
MAXIMUM PATH

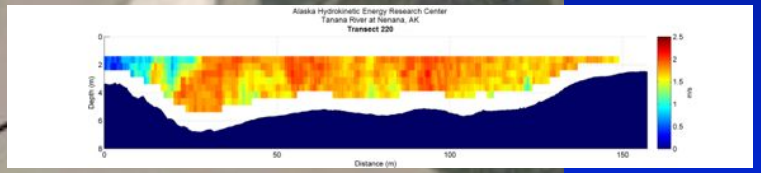
FLOW DIRECTION

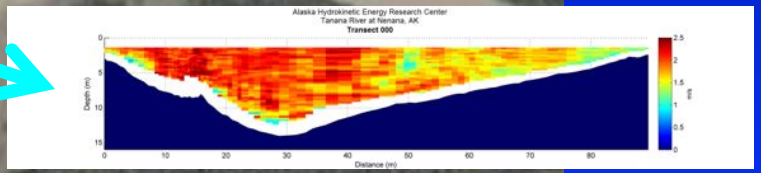




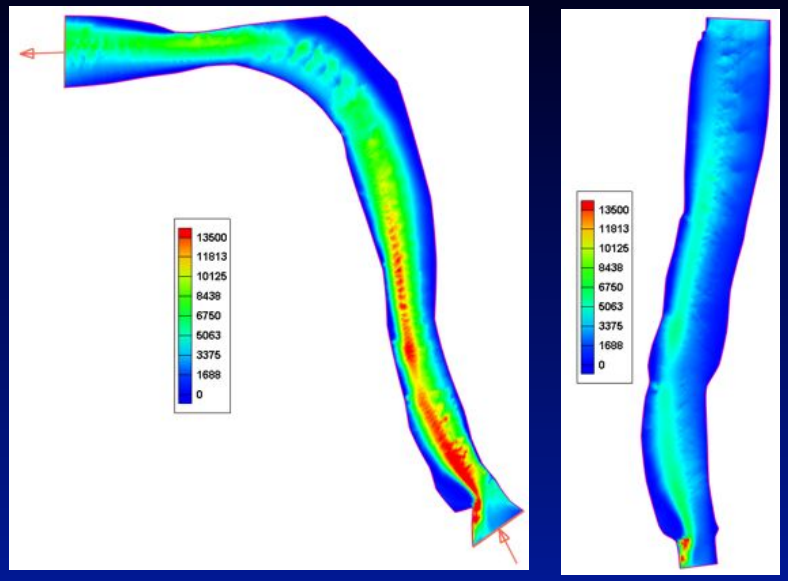




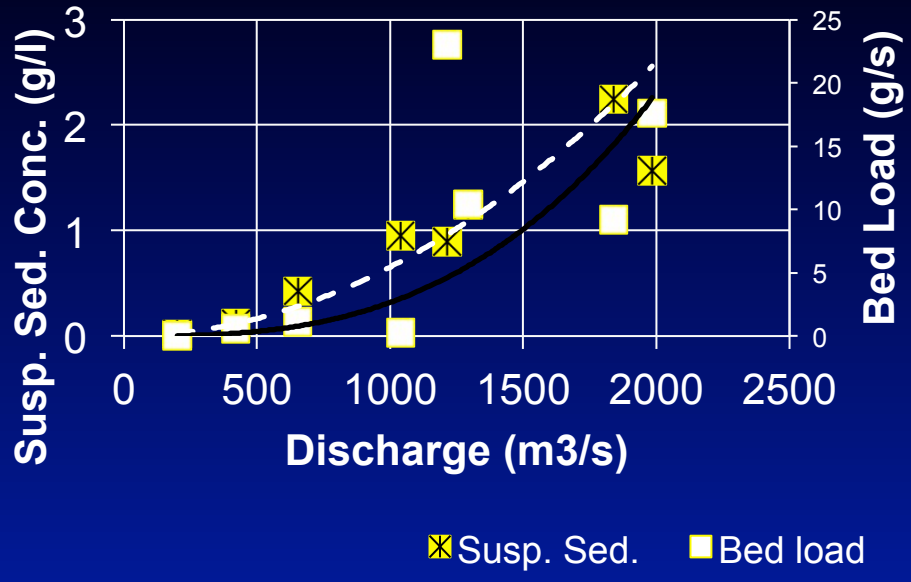




Power density (numerical modeling)

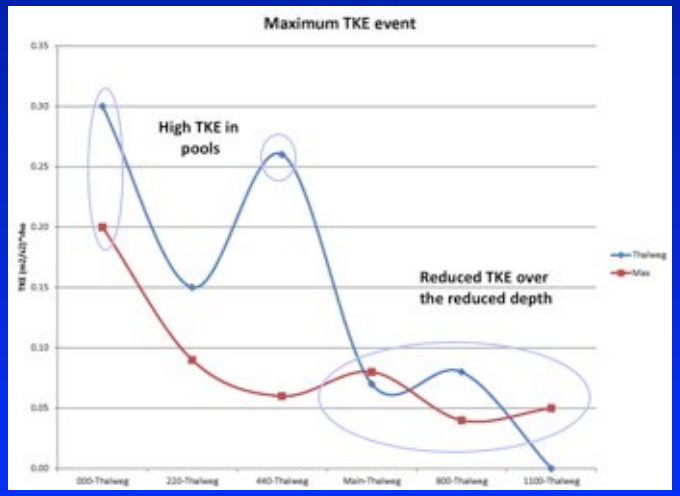


Sediment transport



Frazil ice accumulation

Turbulence



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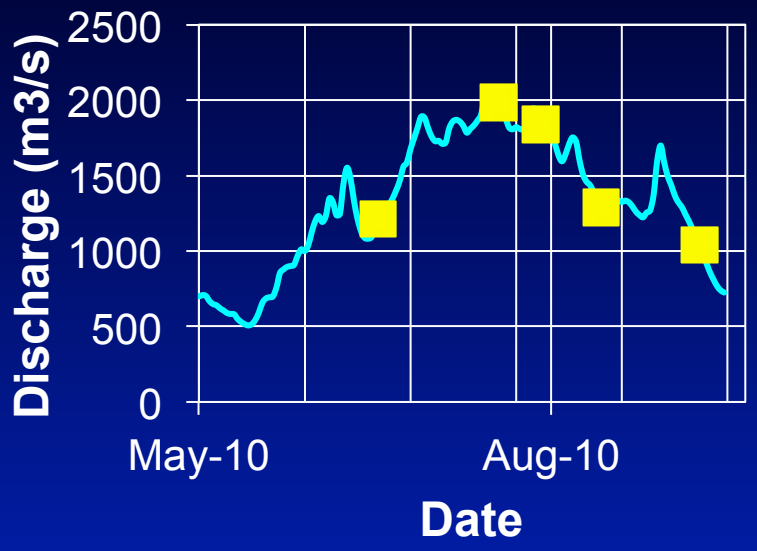
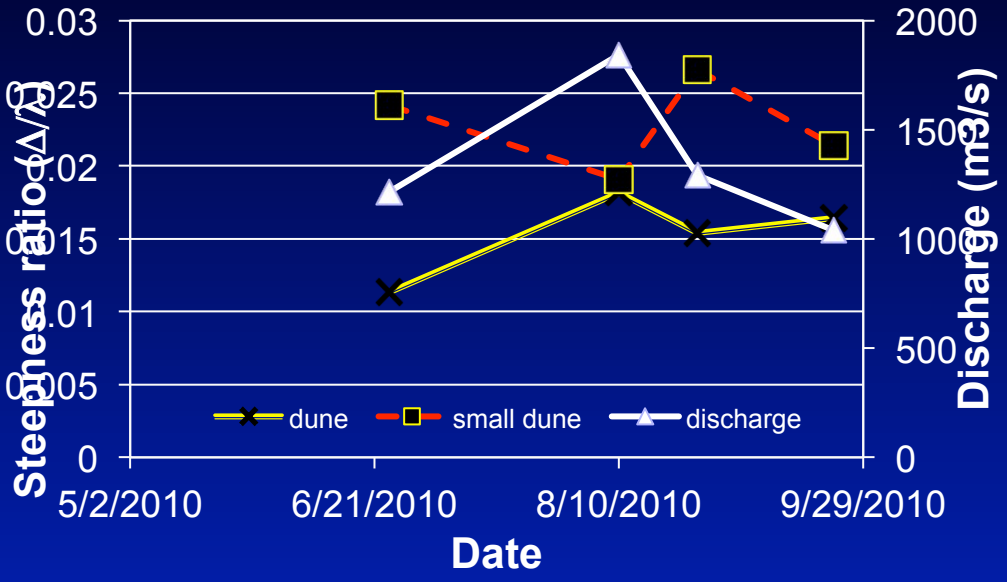
Seasonal discharge variation



Bed form stability



Fish Populations

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Factors Affecting the Hydrokinetic Resource

- **Current velocity** [site location; economic viability]
  - Power density
  - Seasonal & temporal variation
  - Bathymetric and channel effects
- **Turbulence** [engineering design & power recovery efficiency]
  - Recoverable power
  - Infrastructure stress
  - Variation with current and bathymetry
- **Suspended & bed load sediment transport** [operation & maintenance (O&M)]
  - deposition and erosion
  - Infrastructure abrasion and clogging
  - Channel stability
  - Infrastructure integrity – bed scour, foundation stability

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Factors Affecting the Hydrokinetic Resource

- Debris [Site location; O&M]
  - Type, size and frequency of occurrence, spatial location (lateral and depth)
- Ice [O&M]
  - Frazil ice accumulation
  - Depth & frequency of occurrence
  - Solid ice conditions
- Fish [permit approval; site location; O&M]
  - Seasonal populations and behavior
  - Spatial distribution

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