Mining or Fish -
A False Choice

Co-existence of Fish and Mining is not only Possible it's Essential

- **Bristol Bay Fishery**
  - Food for families
  - Cultural focal point

Economic Development

Benefits for Bristol Bay Communities

- Jobs/Cash income
- Slow or Reverse Outmigration of Communities
- Stop School Closures

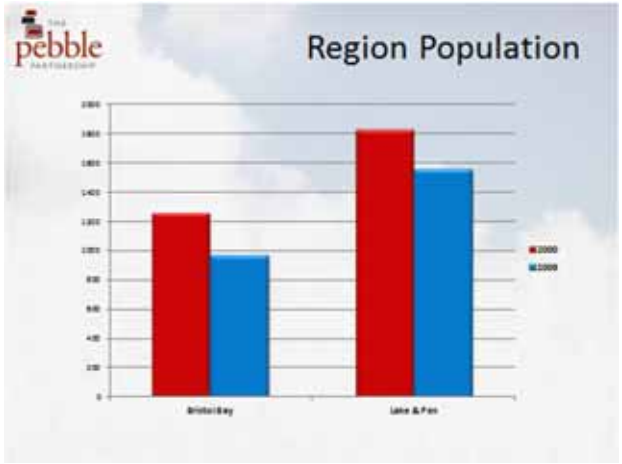
Individuals below poverty level:

Alaska…7%

Bristol Bay Borough…10%

Lake and Penn Borough …19%

Dillingham……..21%



Present Day Co-Existence of Fish and Mining

Historic industrial practices – including mining – have been harmful to fish.

Present Day mining, has evolved technologically and in its environmental awareness.

Mining does co-exist with fish, sometimes even improving on natural conditions.

Red Dog Mine

Ikalukrok Creek downstream of the mine

- Quick response to startup problems (1989) led to recovery of the fishery and improvement over baseline conditions
- Fish have lower concentrations of trace metals in their tissues than pre-mining
- New resident population of Arctic grayling in Mainstem Red Dog Creek
- Attend Bill Morris/ADF&G presentation @ 10:15 today for more information

Greens Creek

- **ADF&G biomonitoring reports mention anomolies and trends they are watching carefully but repeatedly state:**

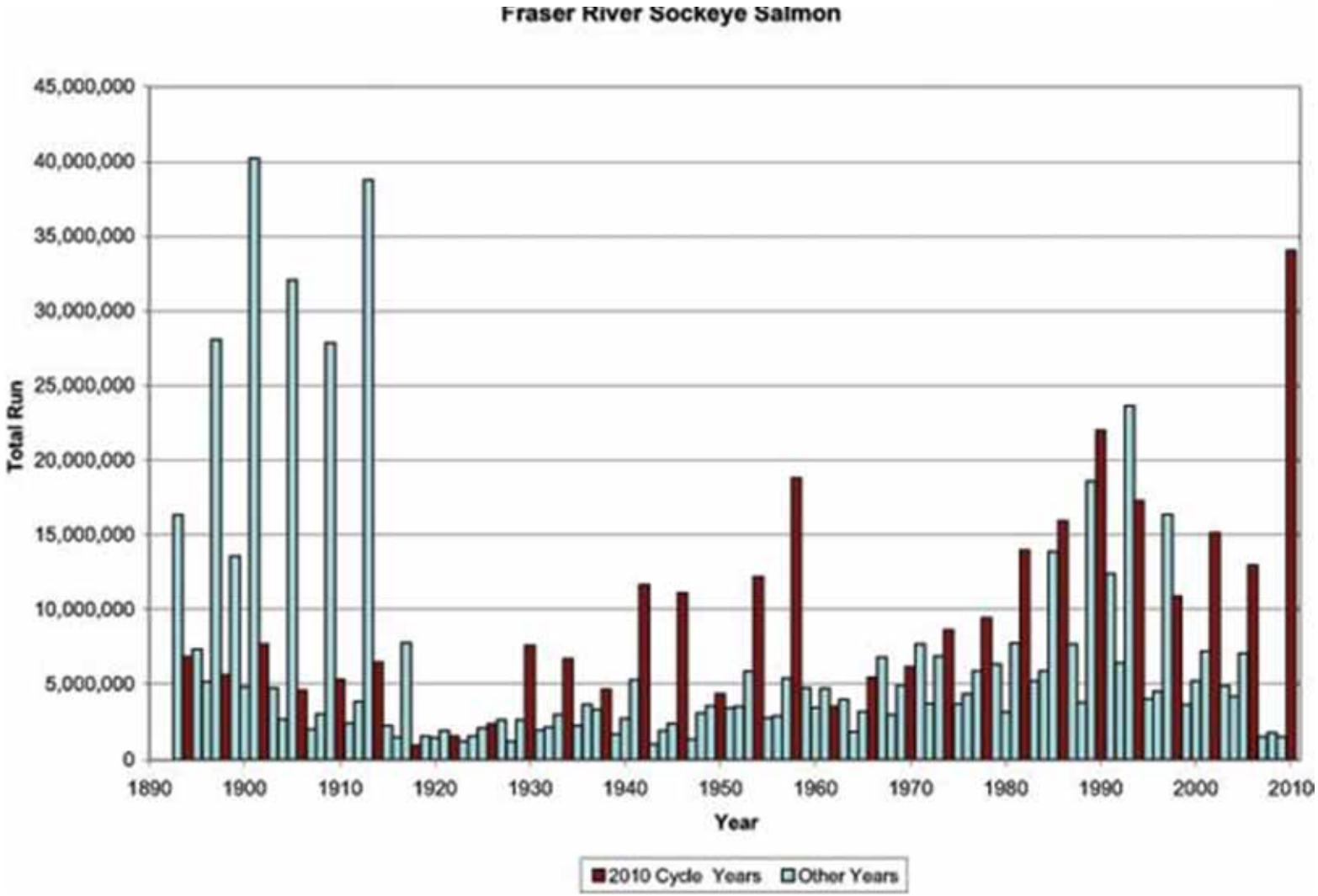
"In general the aquatic communities (at Upper Greens Creek Site 48, Greens Creek below Pond D Site 54, and Tributary Creek) have remained fairly diverse, robust, and moderately abundant during the nine years of bio-monitoring sampling"

Fraser River

- Populated/Industrialized for over 100 years

- Serious setback during early 1900's railroad construction, other setbacks over time.
- Environmental awareness, regulations and technological improvements have mitigated many of the historical impacts.
- Fishery has been making a comeback in the presence of numerous metal mines along the mainstem and tributaries

Fraser River Sockeye Salmon



Pacific Salmon Commission/ http://www.nature.com/news/2010/100903/full/news.2010.449.html

Fort Knox

- The Fort Knox Fisheries Project was initiated prior to mine construction
- Mitigation of fish habitat in several small and historically mined creeks and ponds in the area of a proposed fresh water reservoir
- Has led to the creation of viable Arctic grayling spawning habitat and high value wetlands in the previously mined areas in the presence of upstream mining

Other Projects

- Kensington – Clyde Gillespie will be presenting at 9:05 this morning
- Kennecott Mines and Copper River Salmon – Jim Munter will be presenting at 10:55 this morning

Ensuring Successful Co-existence

Regulations

- Set the parameters for design and operations
- Require compliance
  - Fish Passage
  - Anadromous Fish Act
  - Water Withdrawal Permits
  - CWA
  - Wetlands protection
- Require well funded environmental agencies
  - Understand mining to produce well reasoned regulations and permit requirements: protective and practical
  - Conduct frequent inspections to provide industry with a set of ‘fresh’ eyes

Ensuring Successful Co-existence

Baseline Studies

- Guide Engineering
  - Stable Enduring Structures
    - Seismic
    - Hydrology
    - Geology

- Earthquake offshore Maule, Chili February 7, 2010
- Magnitude 8.8, 169 Aftershocks
- No structural damages to the Anglo American Mantos Blancos Mine

Geotechnical and Seismic Investigations for Pebble

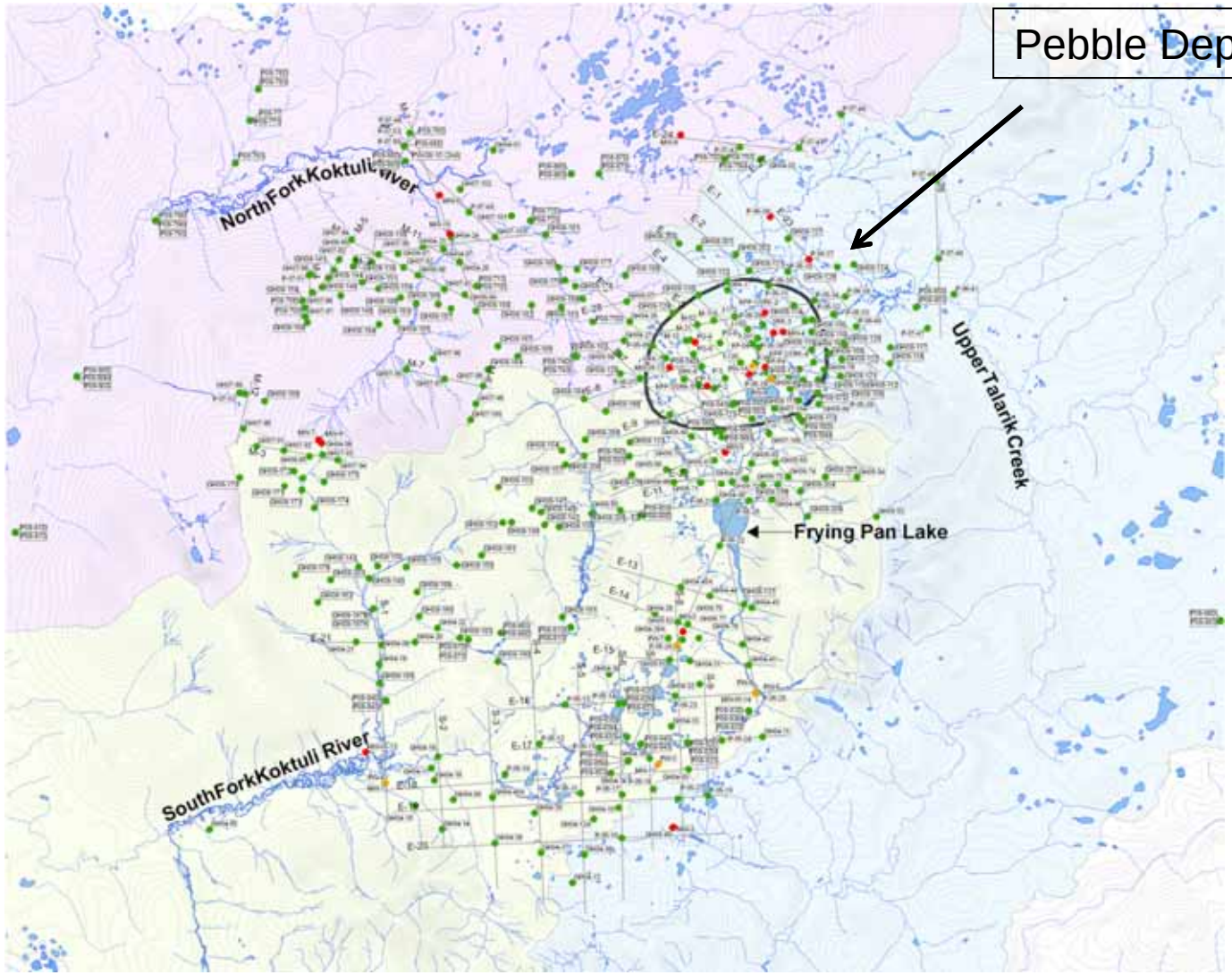
- 2004 – 2008, with studies ongoing:
- 239 Geotechnical holes, 500’ – 5000’
- 544 Exploration holes
- 317 Test pits
- 214 Piezometers/ hydraulic conductivity
- 36 Seismic refraction traverses

Surface Hydrology Field Activities for Pebble

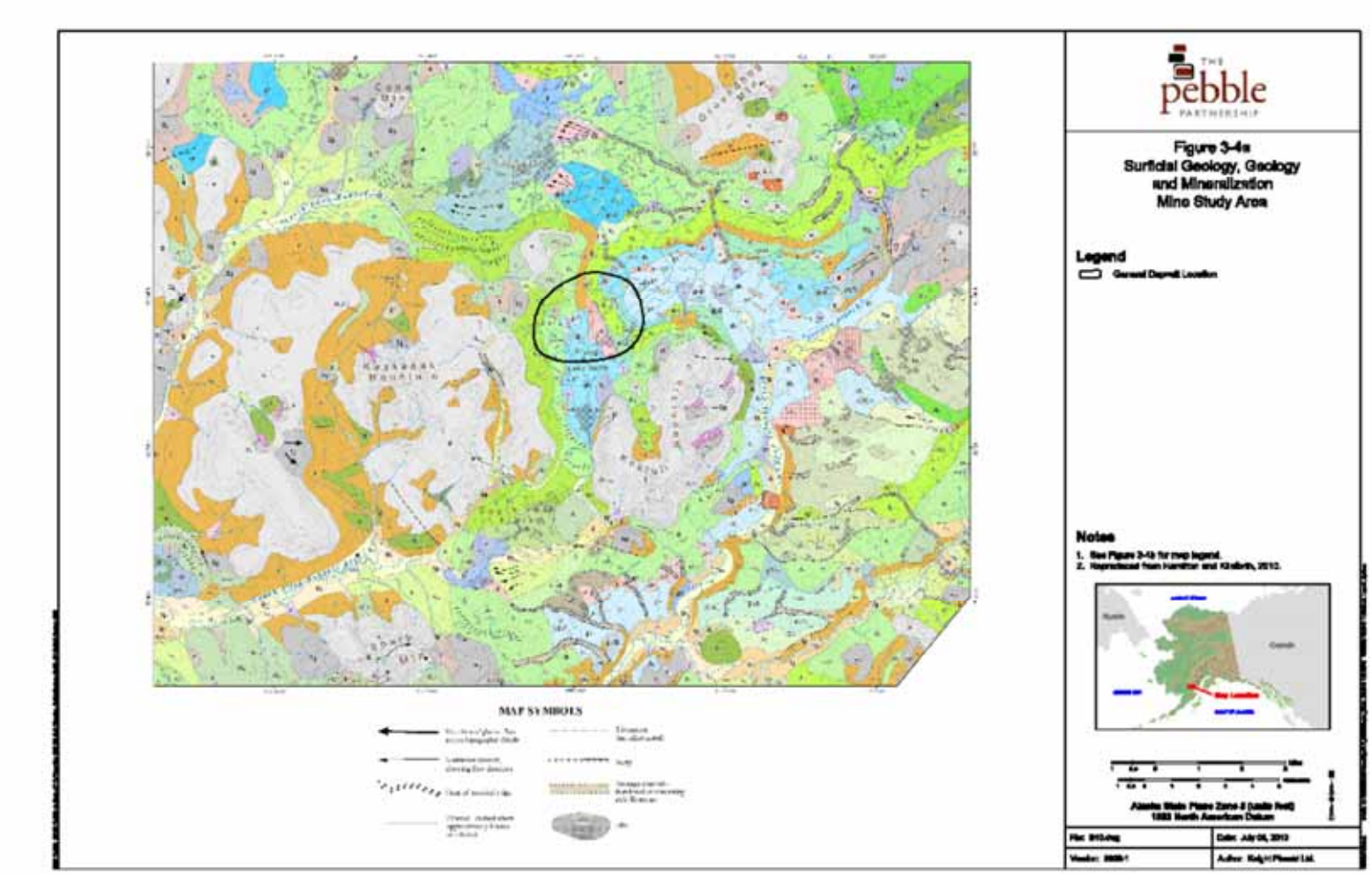
- Continuously Gaged Stations
  - During Ice-Free Months
  - Provide data on daily fluctuations
  - Coordination with USGS adds credibility
- 8 USGS stations
- 29 Pebble Stations

- Instantaneous Measurement Sites
  - 55 sites for widespread data collection and spatial variation
  - Allows for winter field measurements

Groundwater Hydrology Monitoring for Pebble 2004-2008



Surficial Geology Map for Pebble



Ensuring Successful Co-existence
Baseline Studies - Geochemistry

Addresses acid generation and metal leaching concerns

Allows for design for:

- best placement
- buffering
- capture and treatment

Geochemistry Test Types

Acid Base Accounting

- Determines neutralization potential and acid generation potential based in bulk chemistry of sulfur and carbon
- X-ray defraction and other methods provide mineralogy data

Humidity Cells

- Estimate reaction rates under aerobic conditions
- Simulate wetting and drying cycles
- Relevant to waste rock , pitwalls, stockpiles

Subaqueous Cells

- Estimate reaction rates under saturated conditions
- Relevant for subaqueous disposal such as tailings

Field weathering tests

- Evaluate leaching behavior under field conditions and
- compare with laboratory conditions

Geochemistry at Pebble 2004-2008:

- 68 rock and 18 representative tailings samples have been or continue to be tested (some for more than 4 years)

Ensuring Successful Co-existence Baseline Studies of Sensitive Areas

- Identification of Sensitive Areas and their Function
  - Habitat, Wetlands
  - Design For Avoidance, Minimization, Mitigation

Wetlands Studies at Pebble 2004-2008

- 16,947 data collection locations
  - 865 jurisdictional wetlands plots
  - 194 functional assessment plots
  - 669 representative non-wetland photo points
  - 529 representative wetland photo points
  - 360 stream photo points
  - 375 waterbody photo points

Ensuring Successful Co-existence Baseline Studies - Fish

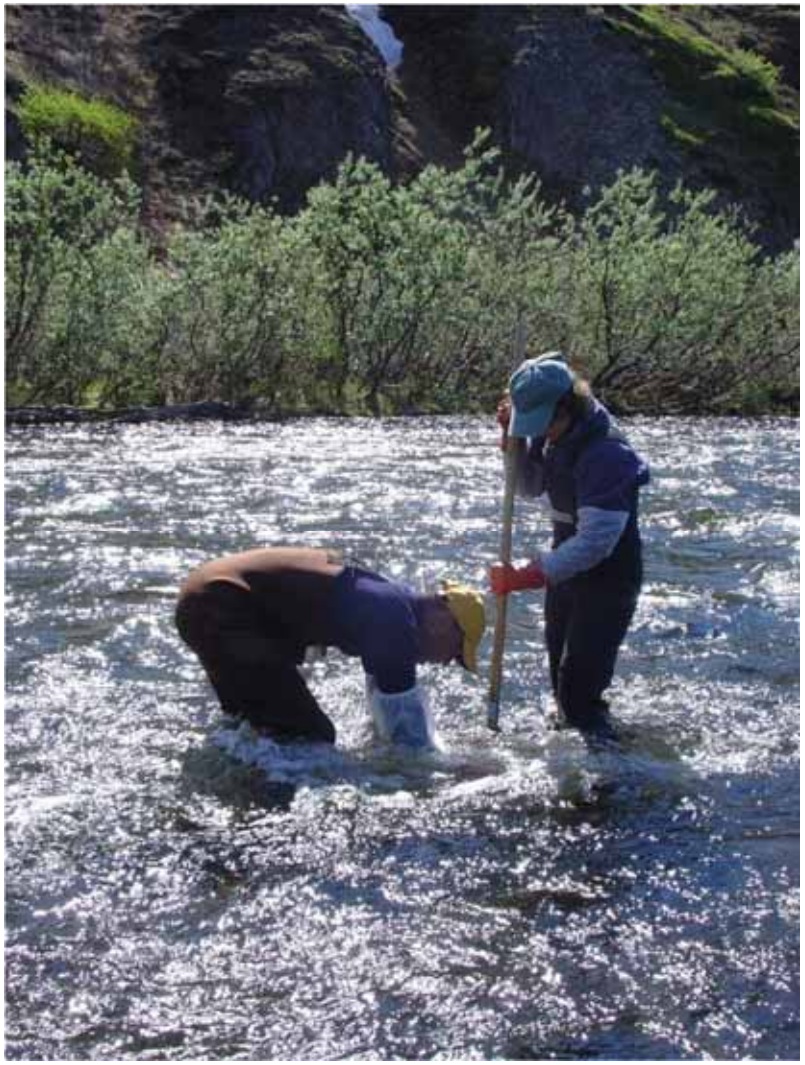
- Fish Presence, Timing, and Distribution
- Habitat Availability and Use
- Relationship of Habitat to Flow
  - Dudley Reiser Presentation to Follow

- Design to avoid, minimize, mitigate

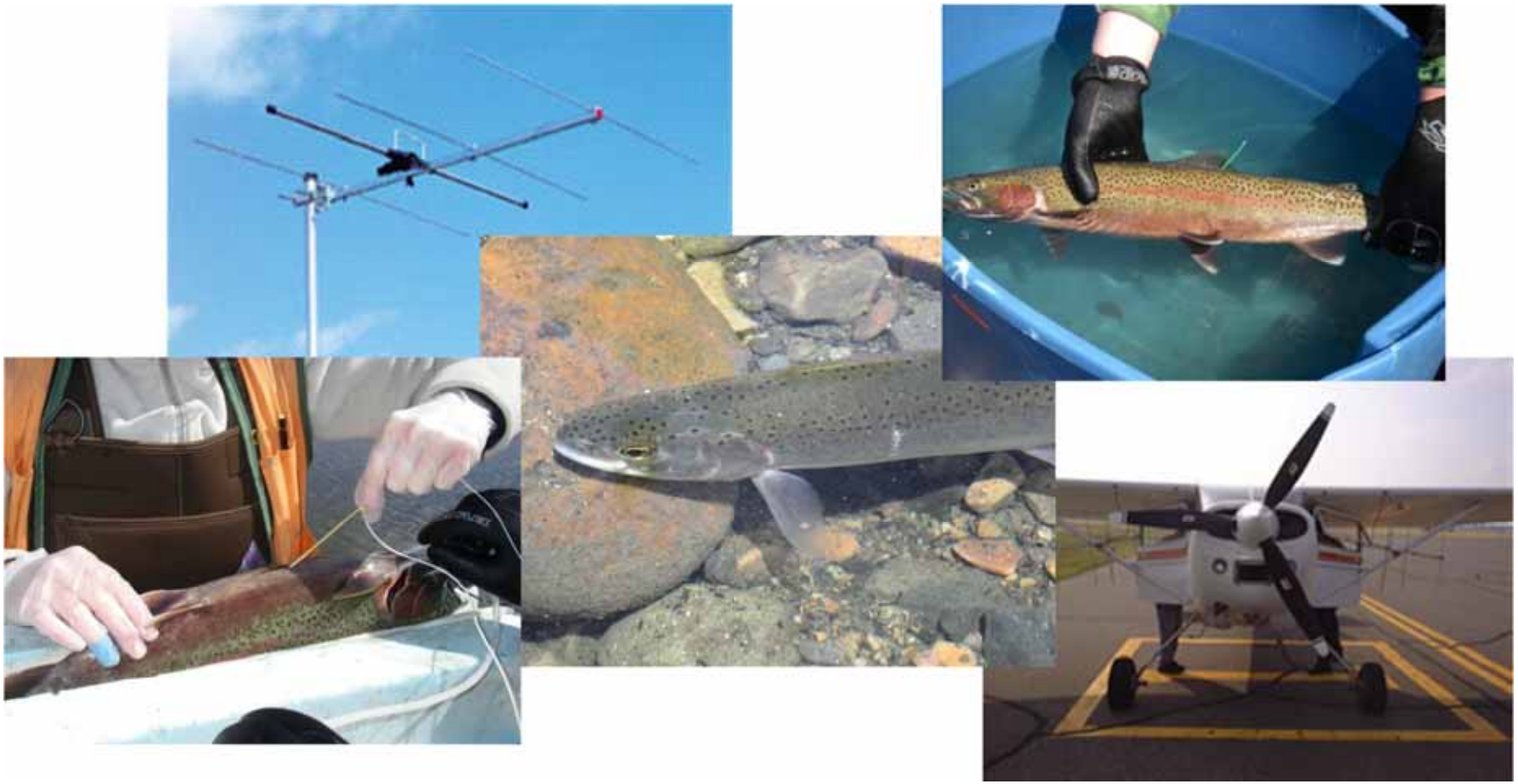
Fish Studies at Pebble 2004-2008

- 236 miles of stream habitat in 3 watersheds
- 19,295 fish observations at 3, 550 distinct sites
  - Species diversity
  - Relative abundance
  - Distribution
  - Spawning
  - Rearing
  - Migration
  - Escapement
  - Habitat use

Video Surveys, Electroshocking



Telemetry Studies



Aerial Spawning Surveys

Fish Habitat Study Area

Anadromous Stream Nominations

- Pebble Documented and delivered fish data to ADF&G as nominations to the State's Anadromous Waters Catalog
  - 22 new streams and
  - extended in 14 streams

- The Nature Conservancy also did studies with field support from Pebble from 2008-2010 resulting in additional nominations to the Catalog

Ensuring Successful Co-existence Monitoring to Protect Fish

Immediate indication of environmental change

- Strong baseline data set
- Indicator species:
  - Highly sensitive
  - Quick presentation of symptoms of impact
  - Resident species that provide a simpler connection between cause and effect

Limitations of fish as their own indicator species

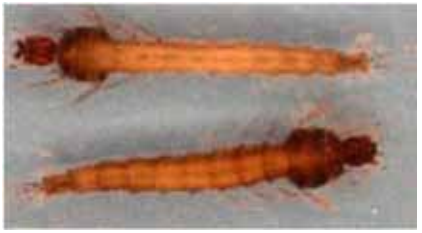
- Symptoms do not always present right away
- Difficult to connect symptoms to the causative factor(s) due to migration (exposed to downstream and marine pollutants)
- Migration returns are multiyear cycles - feedback can be delayed by several years
- Populations are affected by non-local factors

Ensuring Successful Co-existence Most Effective Monitoring Tools

- Water quality
  - immediate physical parameter
- Periphyton/Macroinvertebrates
  - indicator species that are particularly sensitive to changes in water quality
- Water flow
  - relating flow measurements to prepared curves to determine habitat availability
- Physical habitat observations







To Ensure Successful Co-existence of Fish and Mining:

- Fish must remain a focal point of regulations, design, operations and closure
- Regulations – adequate funding and programs for monitoring, compliance, enforcement
- Baseline must be adequate to provide a solid base for comparison
- Monitoring must be effective and immediate to allow early detection and quick response