

# ENHANCING THE RESILIENCE OF SMALL HIGH-LATITUDE FISHING COMMUNITIES TO CLIMATIC AND ECOSYSTEM CHANGE

## A CASE STUDY FROM SOUTHWEST ALASKA

*by*

James R. McGoodwin

Institute of Arctic and Alpine Research

University of Colorado

[james.mcgoodwin@colorado.edu](mailto:james.mcgoodwin@colorado.edu)



# The Bristol Bay Region of Southwest Alaska



## *Bristol Bay, Alaska*



## **ATTRIBUTES OF BRISTOL BAY'S COMMUNITIES THAT WEAKEN THEIR RESILIENCE**

- small population size**
- relatively isolation**
- low economic diversity**
- a highly seasonal economy**
- a high degree of dependence on local ecosystems**
- low individual incomes, low standards of living, and low educational levels**
- higher costs for many basic necessities**
- lower revenues from taxation, weaker infrastructures, and poor access to government services, education, and health care**
- vulnerability to social and economic colonization**

# Dillingham





The Peter Pan fish processing plant, established in 1883, is one of Alaska's oldest fish-processing plants



## FIELD WORK SITES

Nushagak River

Koliganek ●

● New Stuyahok

● Ekwok

Aleknagik ●

Dillingham ●

Bristol Bay



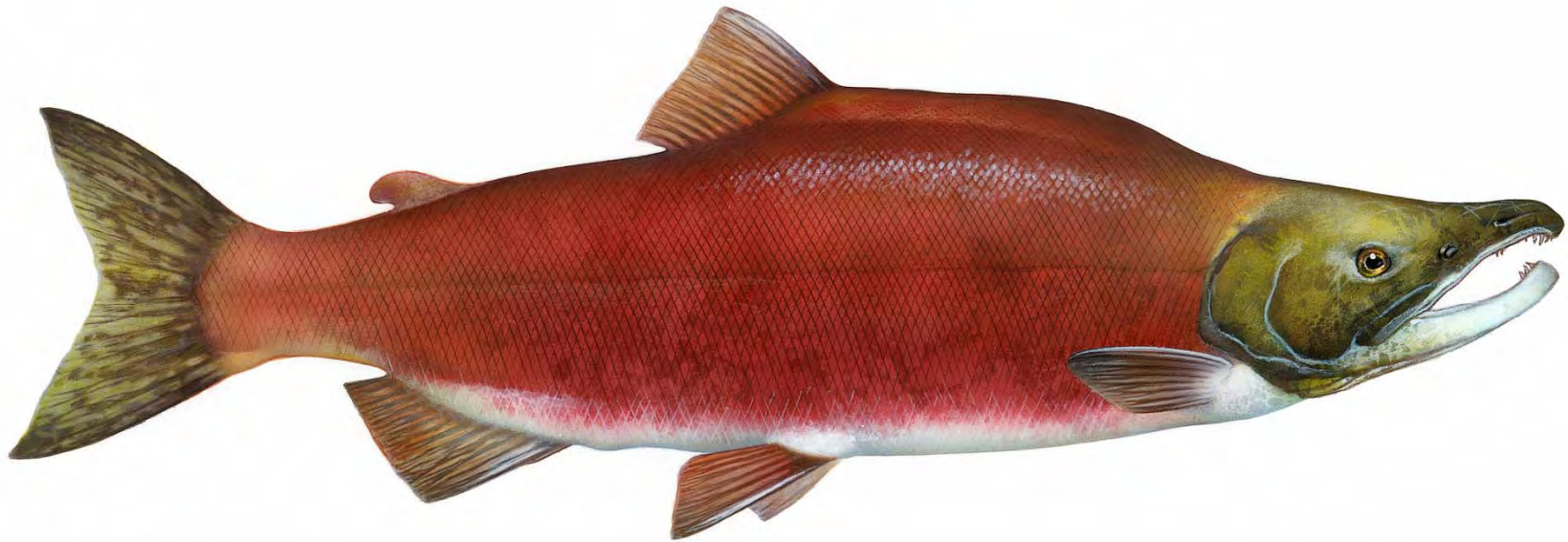
Image © 2006 MDA EarthSat

© 2005 Google

## SOCKEYE (or “Red”) SALMON

-Bristol Bay is site of **the largest wild salmon run in the world**

-sockeye salmon have been **the leading subsistence and economic resource in the region since prehistoric times**



SOCKEYE SALMON

TIM KNEPP eci



# MINERALS



copper



molybdenum



gold





# OIL and GAS



**DIRECT EXPENDITURES FOR ALL BRISTOL BAY RENEWABLE RESOURCES**

<u>TOTAL (2005)</u>	million of \$	%
<b>Commercial fishing</b> , harvesting and processing (average of low estimates for highly variable Harvests over the 20-yr period 1985-2005)	\$226 .0	70%
<b>Recreational fishing</b>	\$ 61.2	19%
Wildlife viewing/ tourism	\$ 17.1	5%
Sport hunting	\$ 12.4	4%
<u><b>Subsistence fishing</b></u>	\$ 7.2	2%
<b>Total</b>	<b>\$ 323.9</b>	<b>100%</b>

*(from Duffield, Patterson, and Neher, 2007, "Revised final report, economics of wild salmon watersheds, Bristol Bay, Alaska")*

Recreational fishing lodge





Recreational fishing lodge















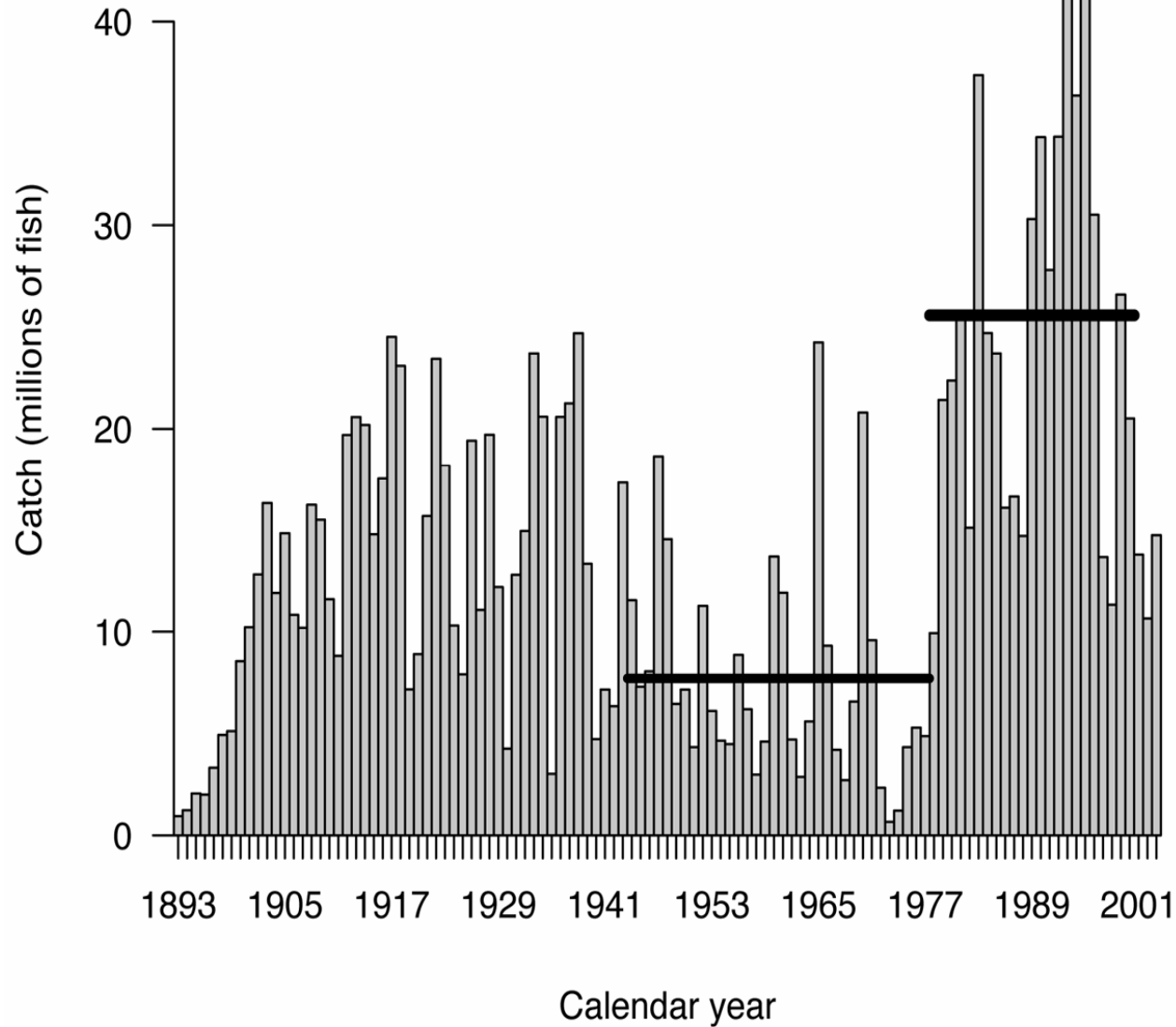
Drift-gillnet vessels tied up at the processing plant dock





Salmon coming into the processing plant

# INTER-ANNUAL VARIABILITY OF CATCHES (from Hilborn 2006).



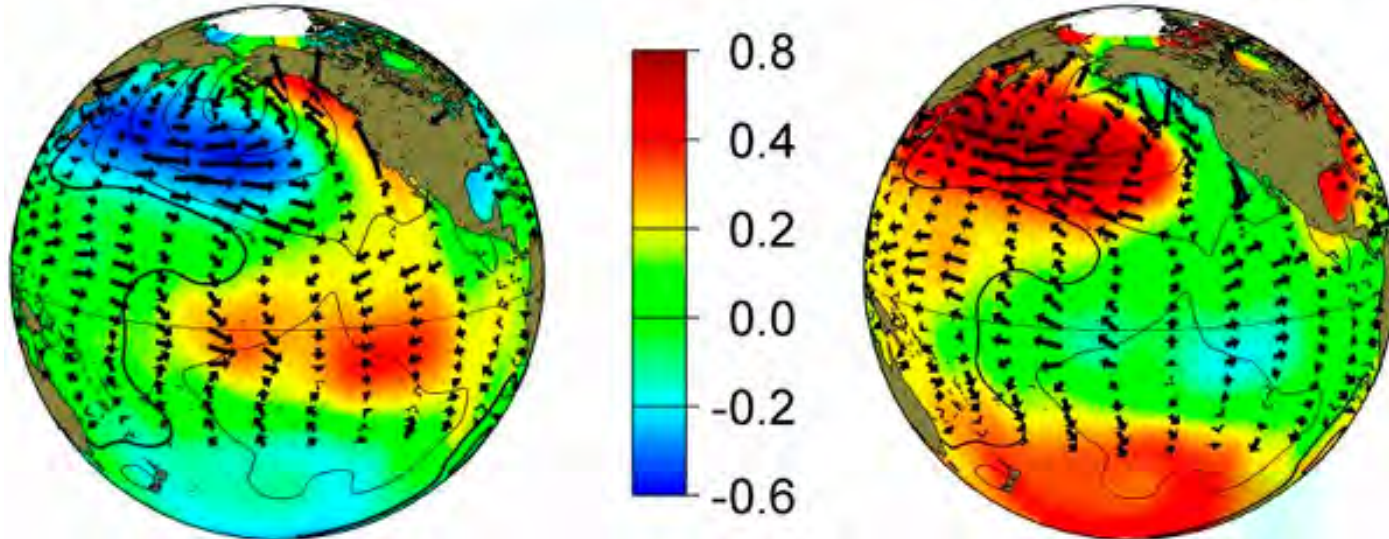
Catch history of Bristol Bay sockeye salmon (*Oncorhynchus nerka*). Horizontal black lines show average catch for the two recent periods of the low and high production associated with ocean climate shifts known as the Pacific decadal oscillation.



# Pacific Decadal Oscillation

positive phase

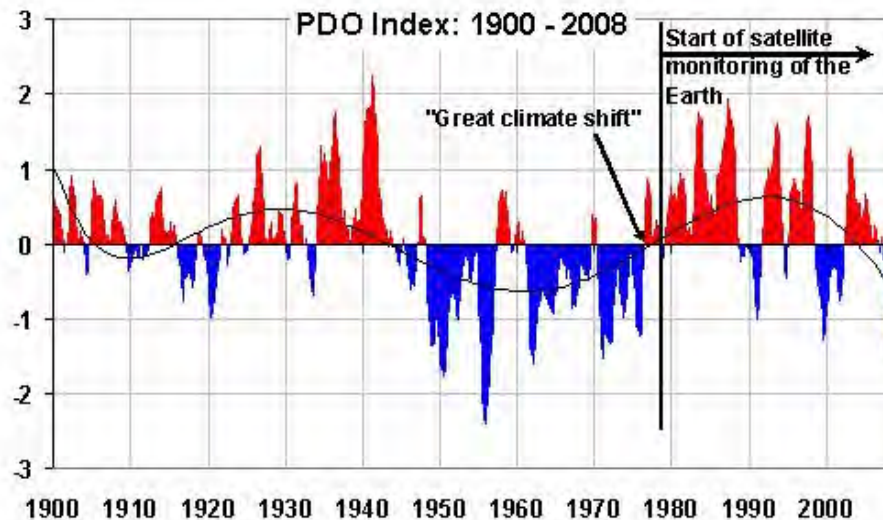
negative phase

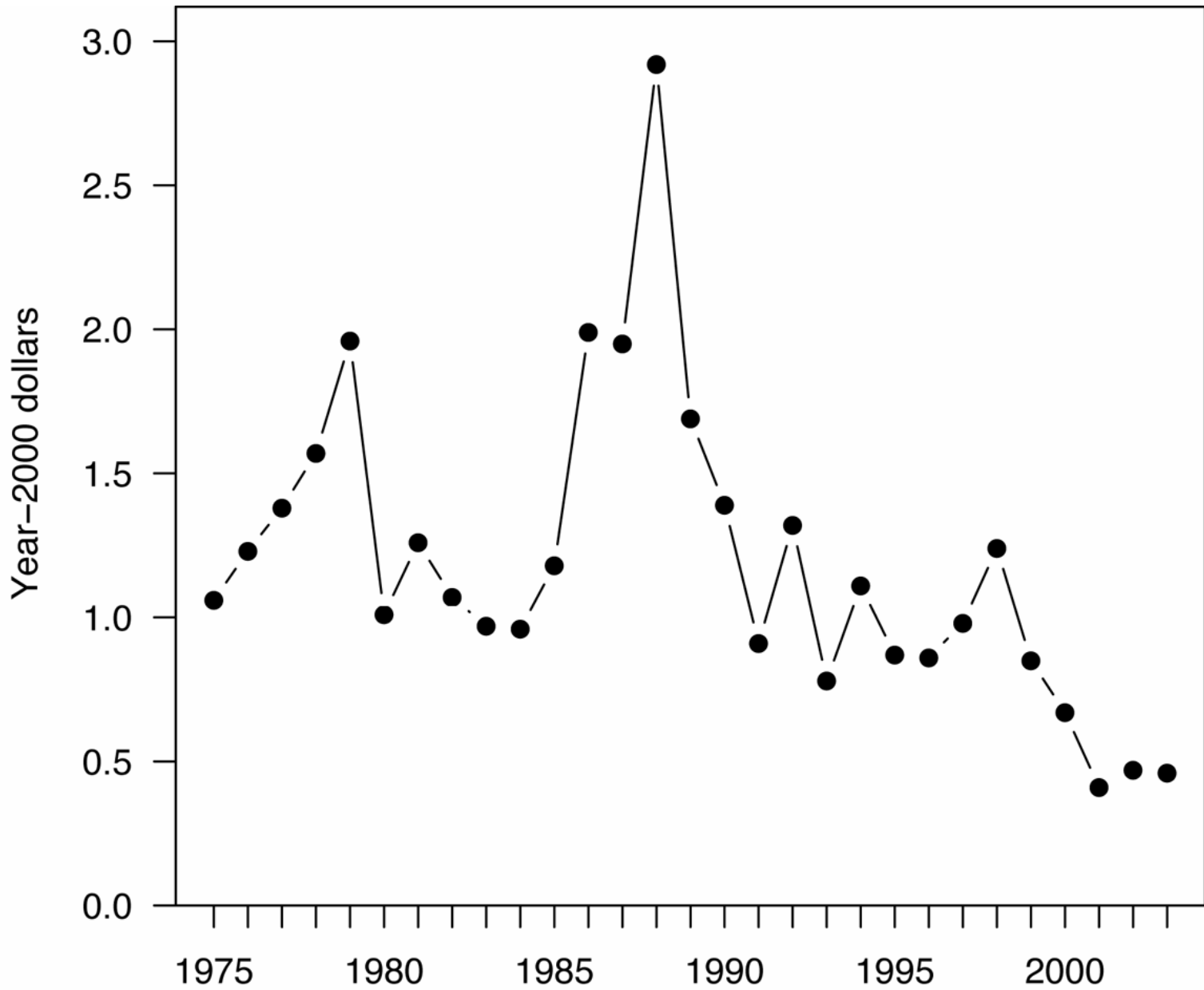


*Major changes in northeast Pacific marine ecosystems have been correlated with phase changes in the PDO.*

*-warm eras (negative phase) have seen enhanced coastal ocean biological productivity in Alaska and inhibited productivity off the west coast of Canada and the contiguous United States*

*-cold eras (positive phase) have seen the opposite north-south pattern of marine ecosystem productivity.*





**Price per pound paid to fishermen in Bristol Bay sockeye salmon fishery (from Link et al., 2003).**

## GENETICALLY ENGINEERED SALMON



A genetically engineered AquAdvantage Salmon (background)  
alongside an Atlantic salmon of the same age (foreground).







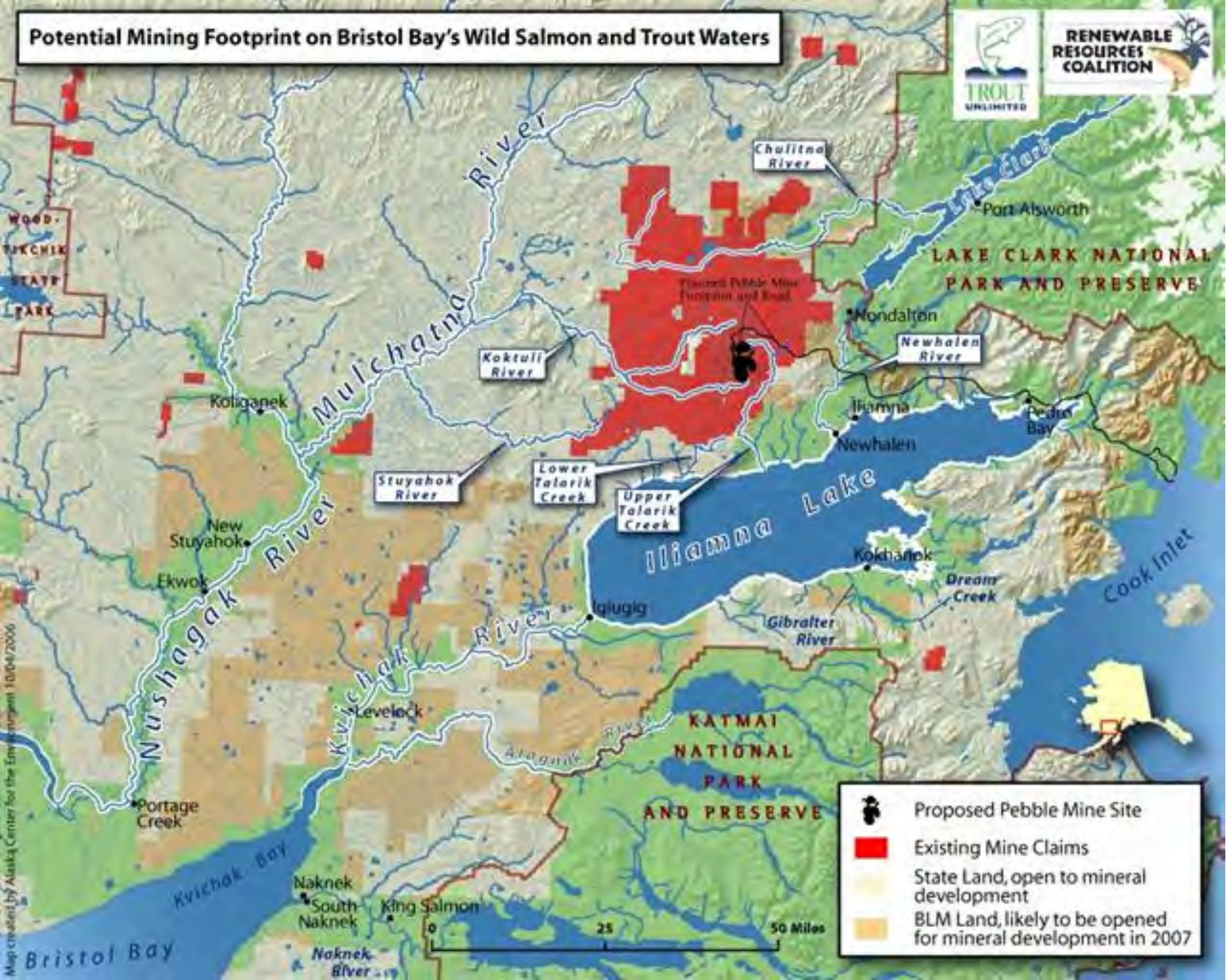








# Potential Mining Footprint on Bristol Bay's Wild Salmon and Trout Waters



- Proposed Pebble Mine Site
- Existing Mine Claims
- State Land, open to mineral development
- BLM Land, likely to be opened for mineral development in 2007

Map created by Alaska Center for the Environment 10/04/2006



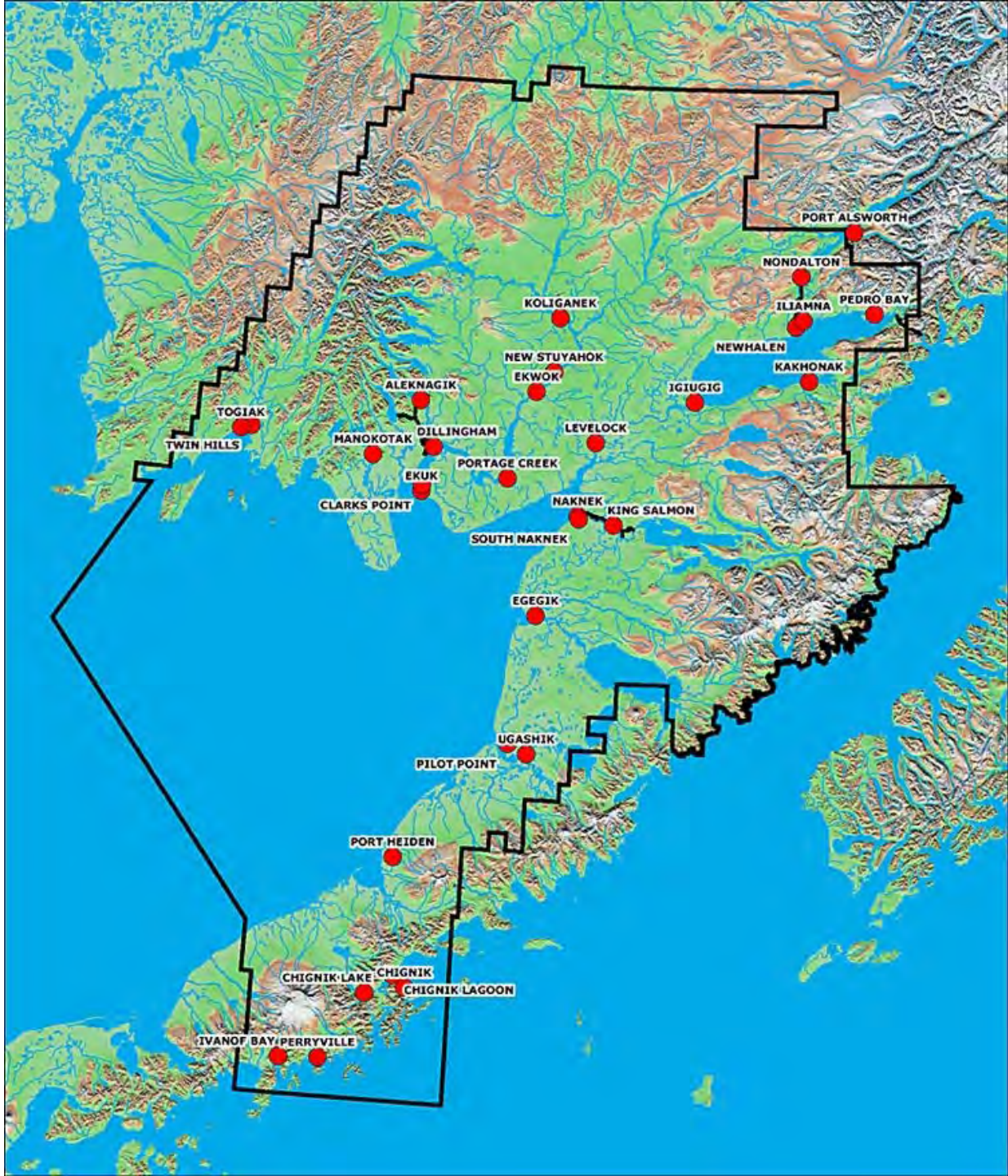
The Fort Knox gold mine near Fairbanks, Alaska, where gold is recovered through the cyanide vat leach process and cyanide heap leaching

The Pebble Mine would be *much larger*





Purview of the Bristol Bay Native Corporation









## **ACKNOWLEDGMENTS**

### **Support for Research**

**National Science Foundation  
University of Colorado-Boulder**

### **Institute of Arctic and Alpine Research**

**Astrid E. J. Ogilvie  
E. James Dixon**

### **Yup'ik**

**Andrew Petla, New Stuyahok  
Wassillie Andrews, New Stuyahok**

### **In Dillingham**

**Bristol Bay Native Corporation  
George and Noi Guthridge  
Peter Pan Seafoods, Inc.**

### **Alaska Department of Fish and Game - Division of Subsistence**

**Molly Chythlook, Dillingham  
Ted Krieg, Dillingham  
James A. Fall, Region Dir., Anchorage  
Terry Haynes, Fairbanks**