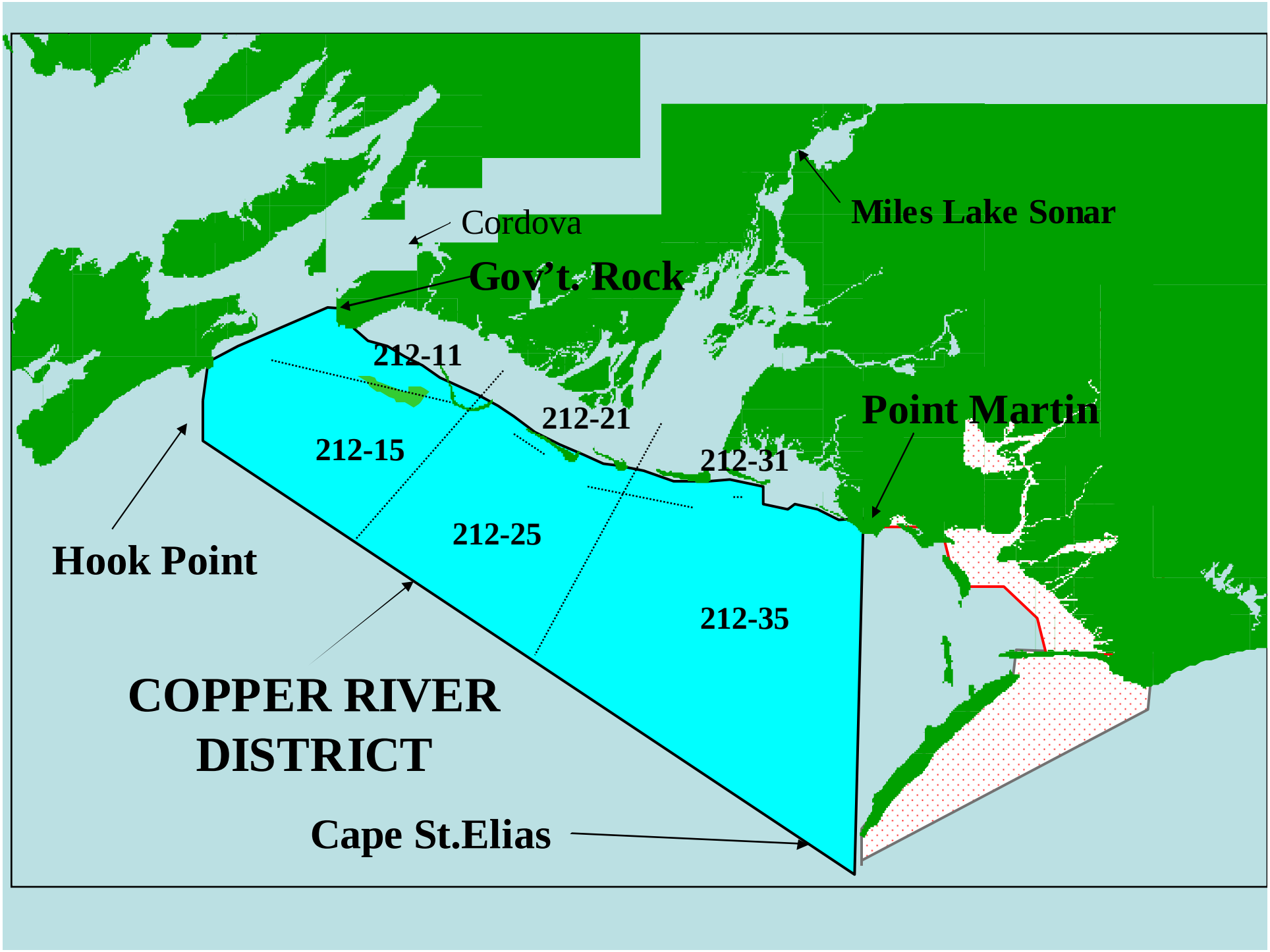
The role of sonar in Copper River salmon escapement monitoring and commercial fisheries management

Bert Lewis, Alaska Dept. of Fish and Game

COPPER RIVER DRAINAGE


Cordova
Miles Lake Sonar
Gov't. Rock
212-11
212-21
212-15
212-31
Point Martin
212-25
Hook Point
212-35
COPPER RIVER
DISTRICT
Cape St.Elias

Copper River Ten Year Average Commercial Salmon Harvest (1991-2000)

Sockeye salmon	1.5 Million
Chinook salmon	49,000
Coho salmon	300,000
Pink salmon	10,000
Chum salmon	18,000
Total	1.9 Million

Subsistence Salmon Harvest

Lower Copper River	**3-5,000**
Glennallen Subdistrict Subsistence	**60-75,000**
Chitina Subdistrict Subsistence	**100-150,000**

Copper River Salmon Management Difficulties

1) Glacially turbid water that prevents visual counts and

2) Lag time between fish passage through commercial fishery and their arrival at the spawning grounds

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COPPER RIVER DRAINAGE

Bendix Sonar

Transducers operate at 515 kHz with alternating beam widths of 2 and 4 degrees

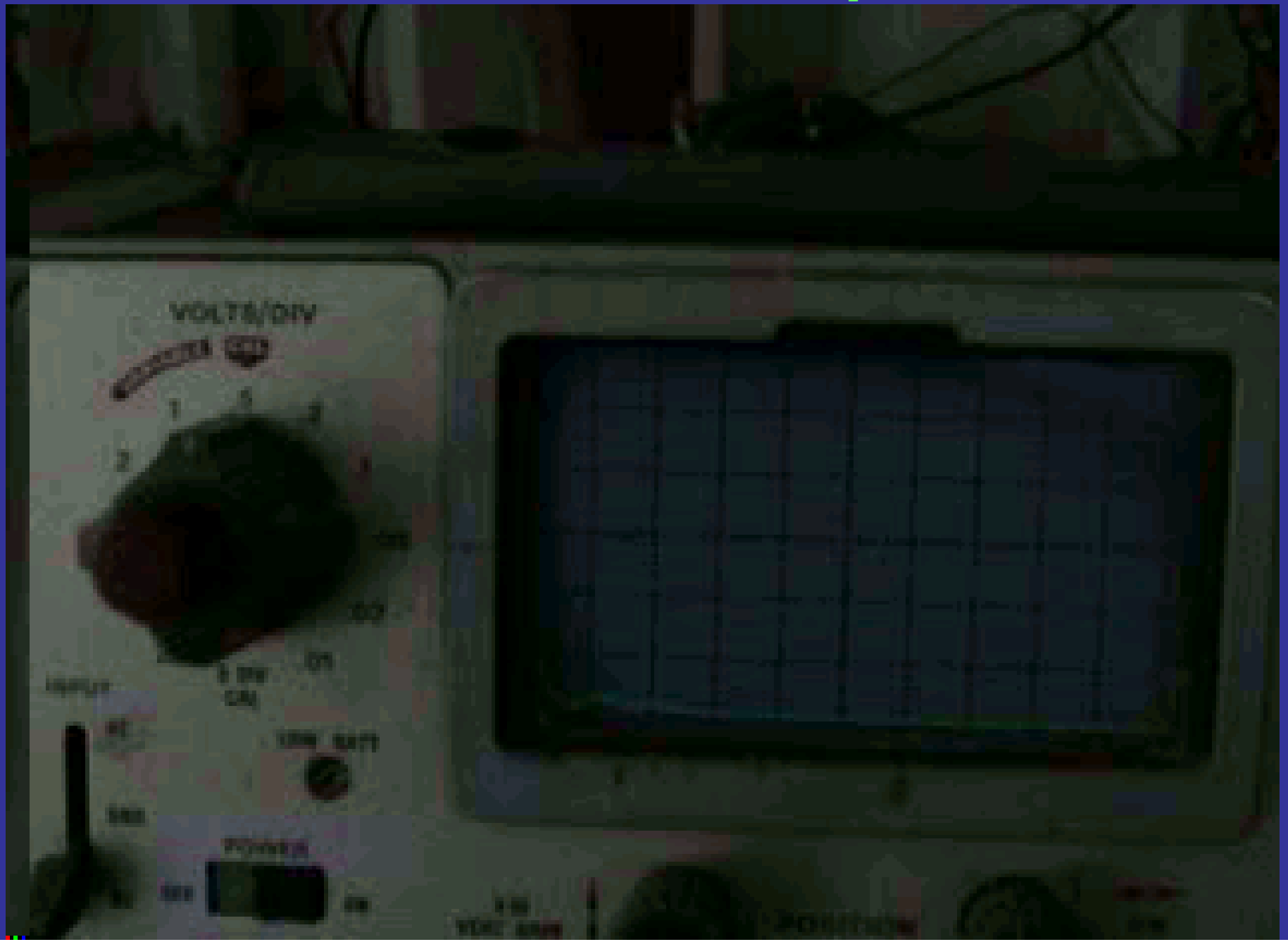
The system is powered by one 12-volt battery continuously recharged by a solar panel.

Side-looking Bendix Sonar deployed in 1978 second unit deployed across river in 1979

Continuous use since then as one of primary management tools


SIDE SCAN
SALMON COUNTER
US PATENT #4,034,331
FISH
DATA DYNAMICS
DDP-07
EKCO.

Bendix Oscilloscope



Bendix Sonar

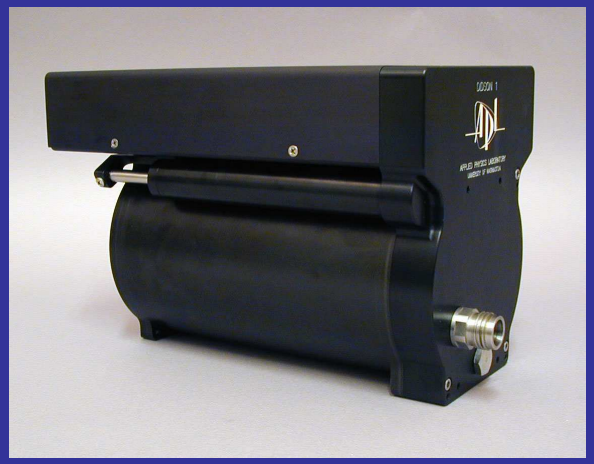
- The Bendix systems have become outdated
- Difficult to repair and maintain
- System cannot store raw acoustic data

Bendix Replacement

ADF&G began evaluating possible replacements

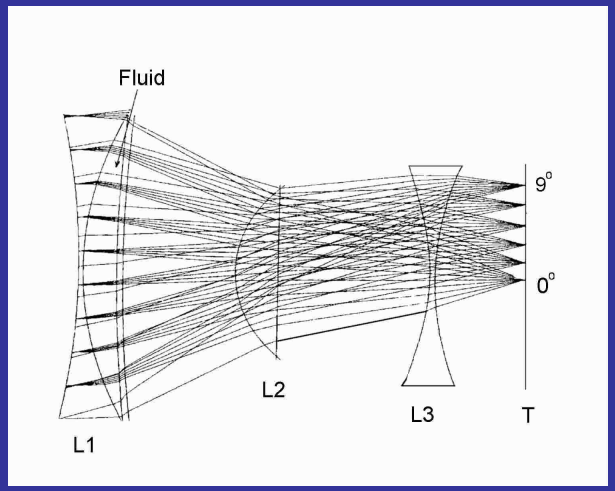
DIDSON

2 Frequency Multi-Beam Acoustic Lens Sonar

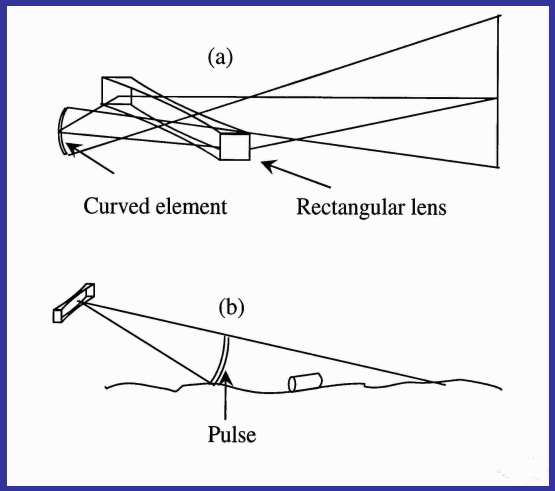


- 1.8 MHz freq: 96 - 0.3x12° beams
- 1 MHz freq: 48 - 0.6x12° beams
- Field of view: 29°
- Frame rate: 5-20 frames/s
- Weight in air: 15.4 lbs

Ray Diagram Top View

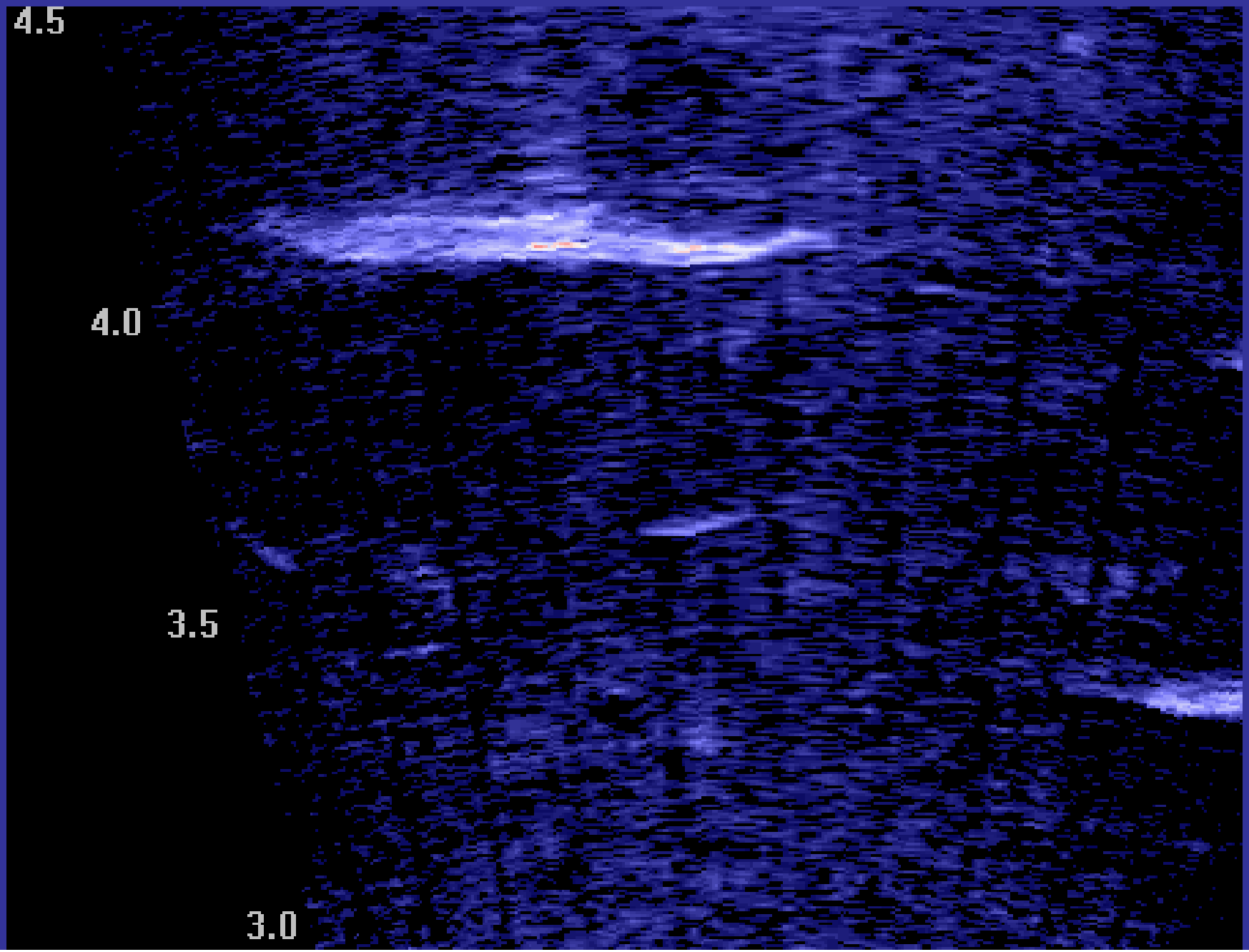


Beams formed by lens and curved element



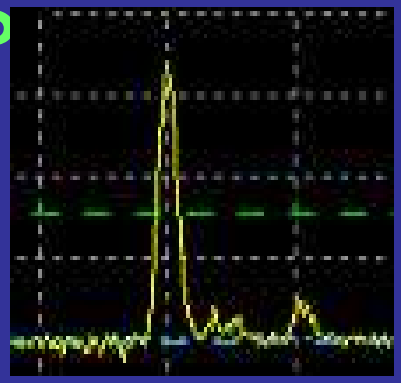

DELL
COM
w.dell.com

DIDSON View Of Salmon



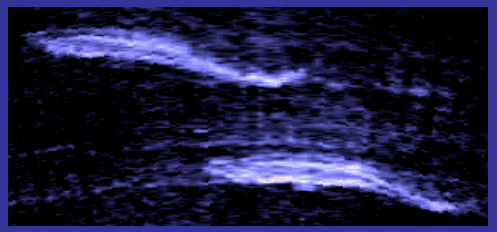
DIDSON Advantages

- High resolution
  - Moving targets easier to detect
- Simpler to aim
- Simpler to operate
- Accurate upstream/downstream target resolution
- Better coverage of water column
- Provides length and width of fish at short ranges
- Less multi-pathing



Bendix

Split Beam



DIDSON

DIDSON Start-up Issues

Expensive

Power supply

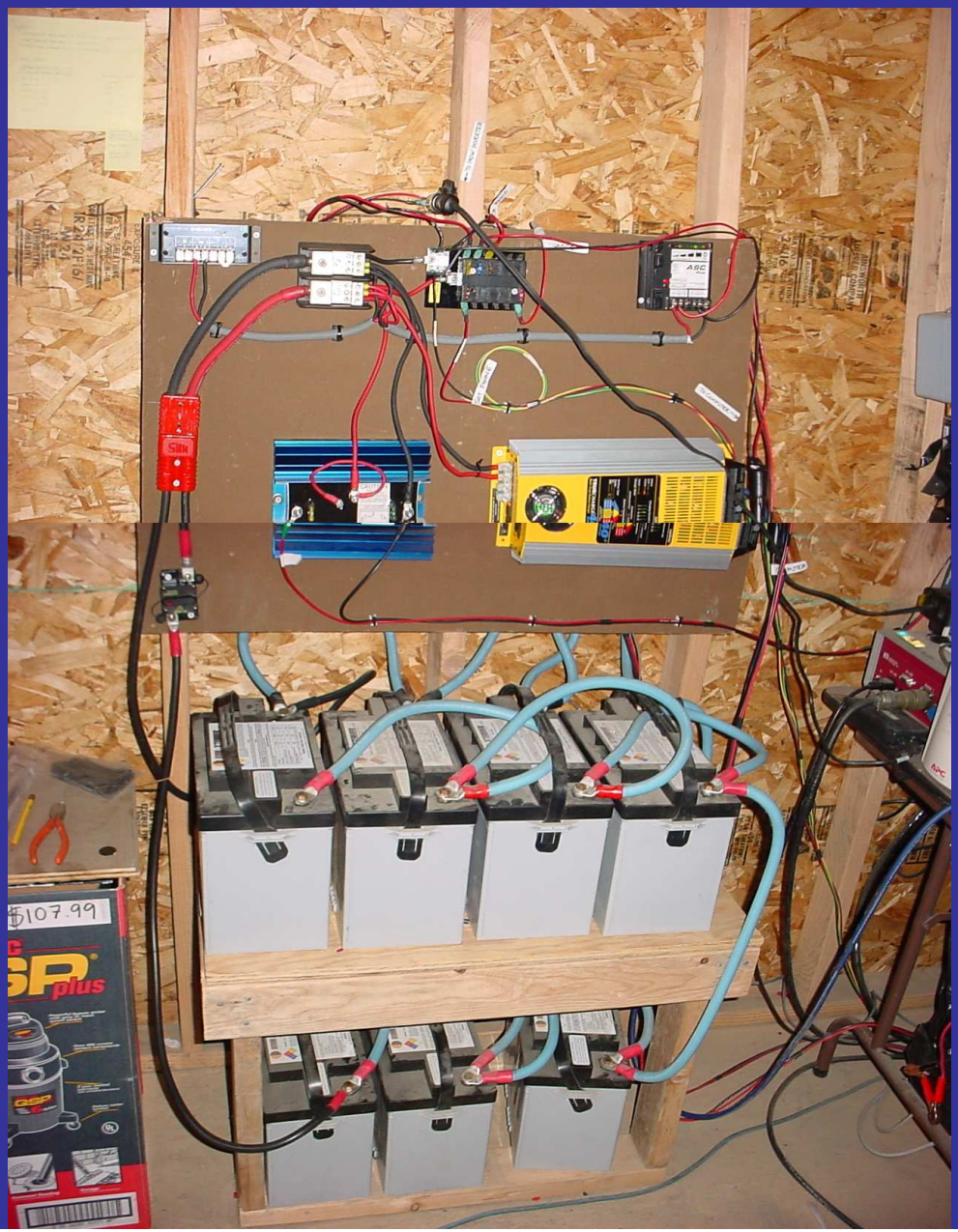
Memory storage

Miles Lake Sonar Site

Power Supply

Power Supply

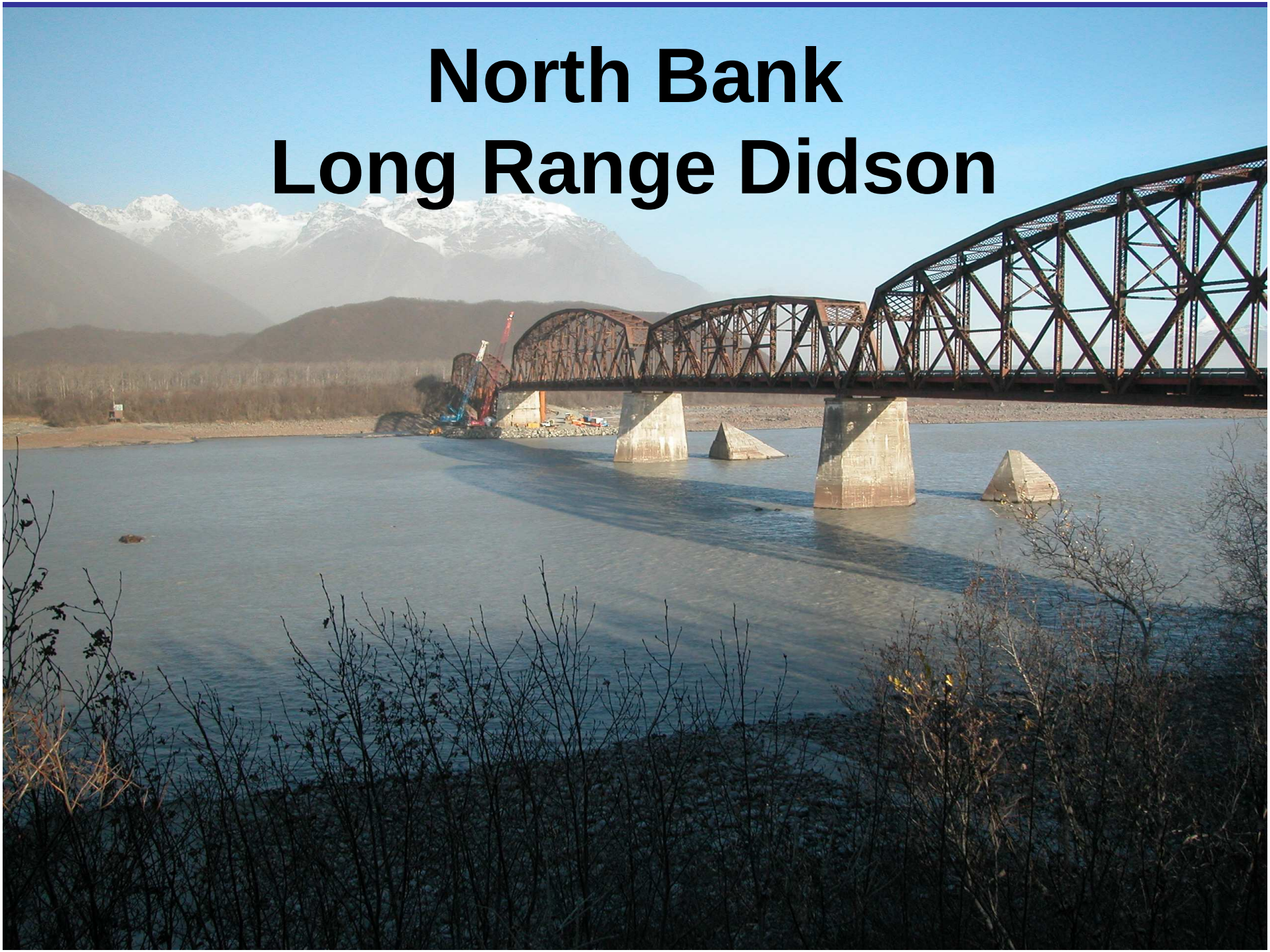
Power Supply



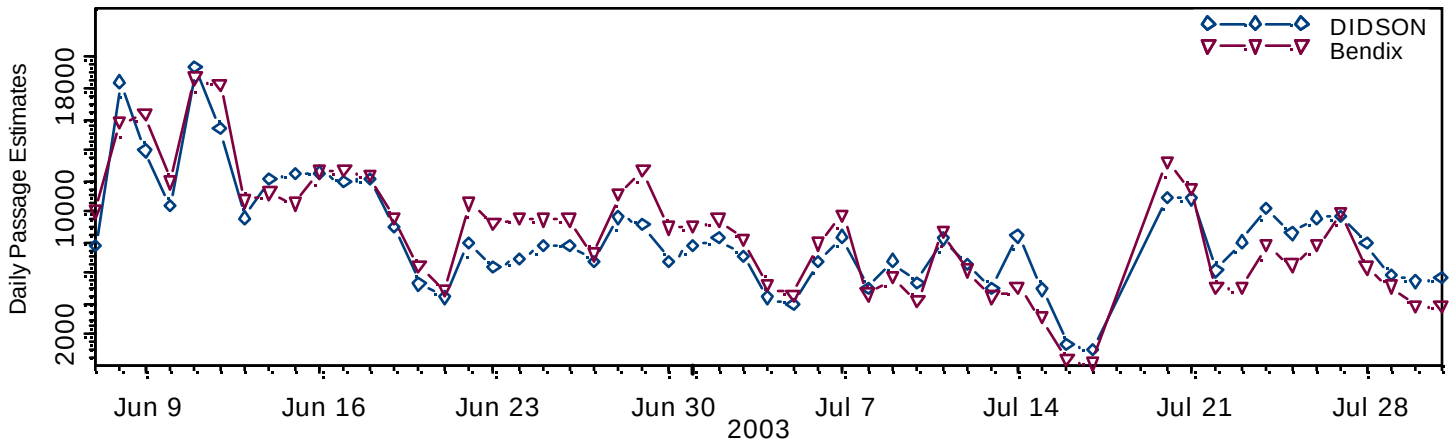
Data Management

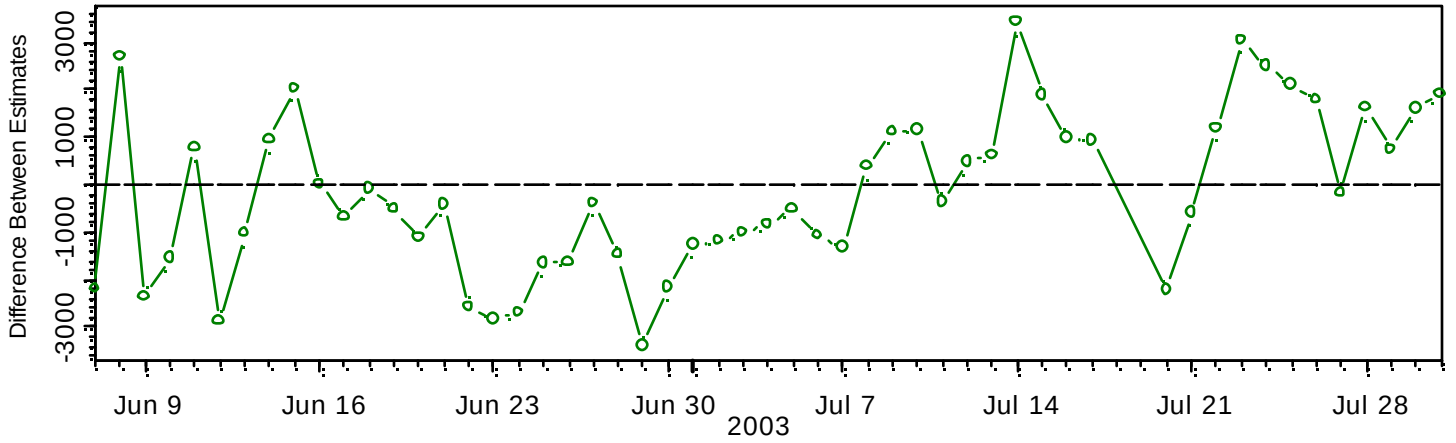
South Bank Side-by-side Sonars

North Bank
Long Range Didson

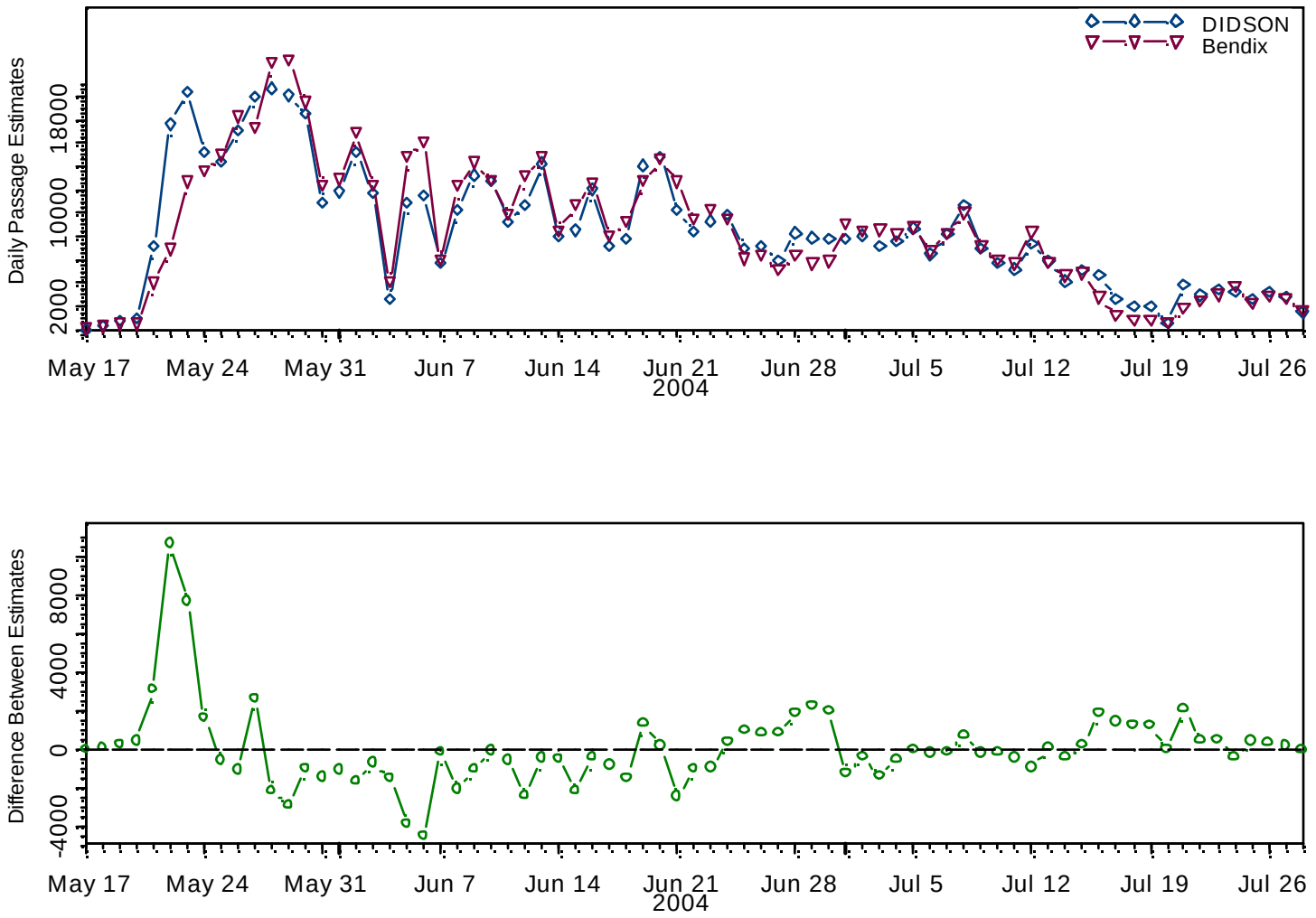


PROMISING PRELIMINARY COMPARISON





- Timeseries plots of DIDSON and Bendix passage estimates (top) and the difference between the estimates, DIDSON minus Bendix, (bottom), Copper River 2003.



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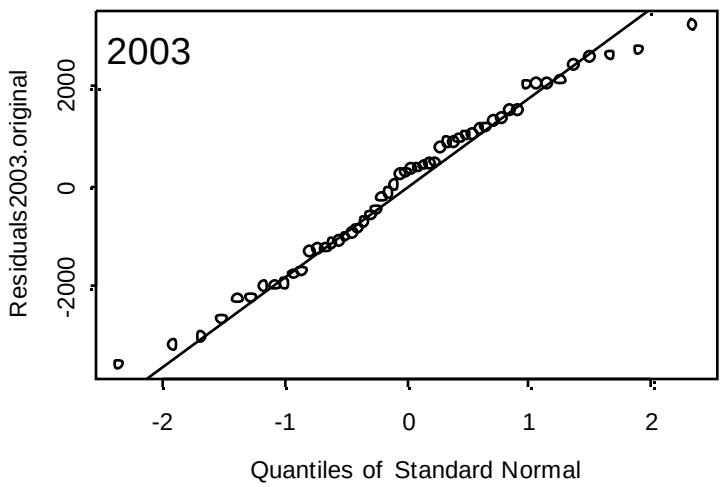

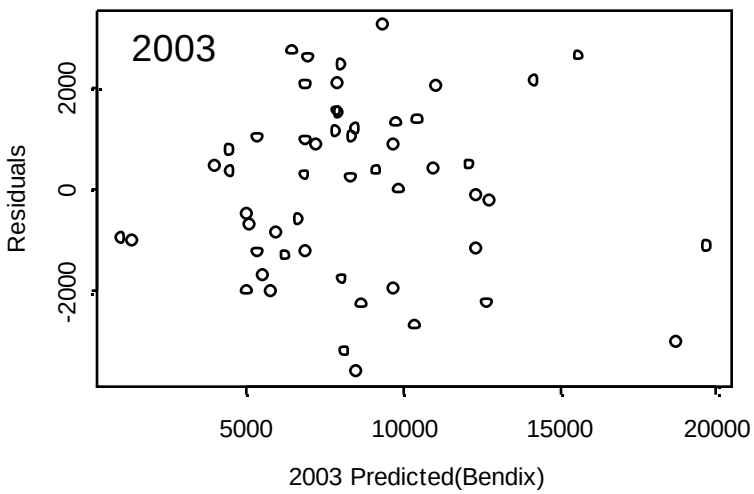

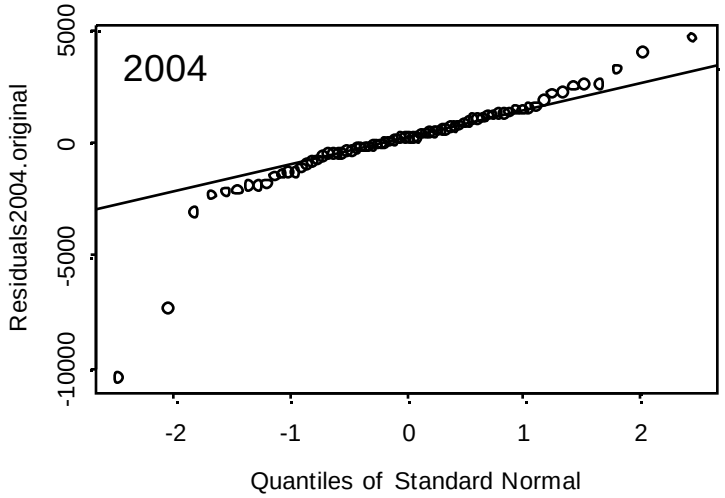

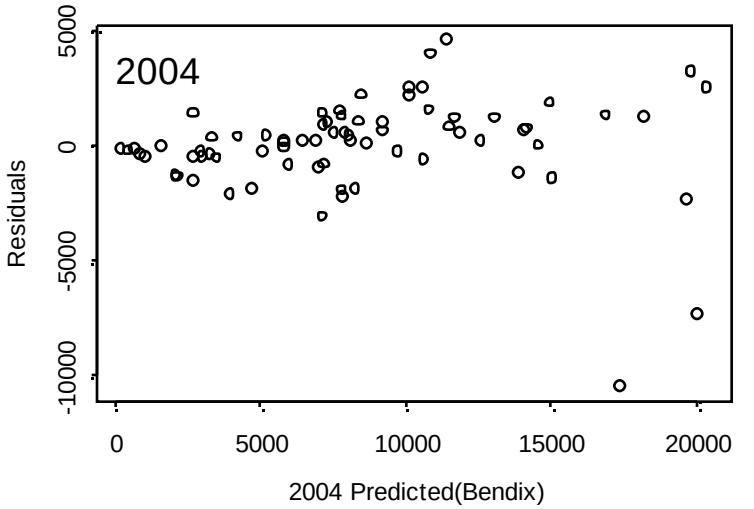

- **Residuals compared against quantiles of the standard normal (left) and fitted versus residual plots from the regressions of DIDSON and Bendix passage estimates with DIDSON used as the predictor variable (right)**

CONCLUSION

Promising DIDSON/Bendix comparison
Transition of equipment
Validation of past escapement counts

ACKNOWLEDGEMENTS

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