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Case Study: Alaska Department of Fish and Game Uses DIDSON to Count Salmon Swimming Up-River to Spawn

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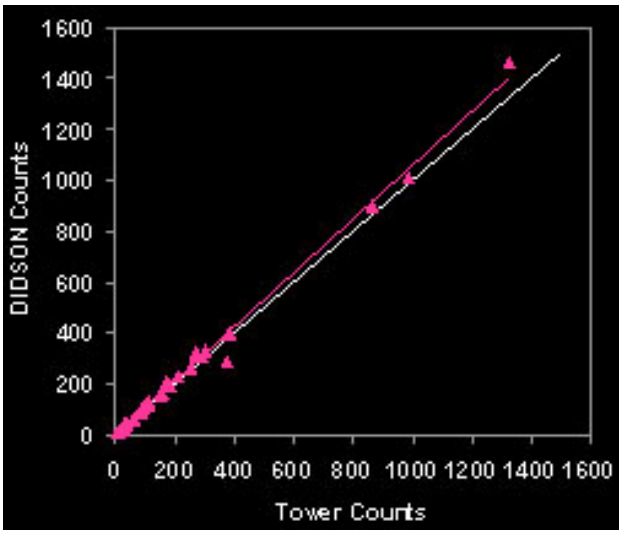
Introduction

The Alaska Department of Fish and Game (ADF&G) purchased five Dual-Frequency Identification Sonars (DIDSONs) and placed them on five different rivers during salmon runs in 2003. Debbie Burwen and Suzanne Maxwell of ADF&G, made a Power Point presentation of the ADF&G experience with DIDSON on the Wood, Anchor, and Kenai rivers. The following summarizes their presentation.

Wood River

The Wood River is a clear-water system in Alaska. ADF&G has a tower set up for visual counting using a tally whacker for 15 minutes each hour. This river also has one of the highest hourly rates of fish passage - up to 40,000 fish/hour. Maxwell tested the accuracy of DIDSON by setting it up at the foot of the tower along with a Bendix unit and a split-beam unit. The “gold-standard” counts were those made by a technician on the tower with the tally whacker. Counts from three sonar systems and a video tape were compared with the visual counts.



The counts made from the DIDSON data are on the y-axis and the tower counts are on the x-axis. The fish passage/hour is four times the count listed on the axis. Thus the maximum fish/hour on each axis is 6400. All four methods: DIDSON, split-beam, Bendix, and video compared favorably with the tower counts (Only DIDSON results are shown here).

Anchor River

The Anchor River is a small river (less than 50 m wide and no more than 2 feet deep). The rocky, very shallow river did not allow acoustic assessment before DIDSON. From 2000-2002, assessment of the chinook run was done by aerial surveys and concluded that there were less than 700 fish in the run during each of the three years. Burwen set up a new project on this river in 2003 to count chinook salmon using a DIDSON. The following conclusions were made by Burwen:

- DIDSON allowed ADF&G to pick the most strategic site appropriate both biologically and politically. Other acoustic systems did not work on this river.
- The project was up and operational in a short period of time. DIDSON was washed out in a flood, set up again quickly, and was tolerant to the new environment.
- The crew was trained and comfortable within a very short time period.
- ADF&G obtained a far more accurate assessment of the chinook escapement – over 7000 fish counted with the DIDSON compared with only 700 fish counted via their aerial surveys.
- ADF&G did not have a single equipment failure or problem during the six-week period of operation.
- The project with DIDSON was an economical program to run.

Kenai River

The Kenai is a glacially fed river that is over 100 m wide. It sustains a large run of sockeye salmon that supports some of Alaska's most important commercial and sport fisheries. There is a smaller (50,000 fish) concurrent run of chinook (king) salmon. In general chinook are larger and prefer swimming in deeper water farther from shore while sockeye are more bank-oriented often swimming within 5 m of shore. The river carries a heavy load of suspended glacial silt. A major concern was that the silt would significantly attenuate the sound and generate backscatter to cloud the image.

Maxwell made this observation after deploying a DIDSON on the Kenai River

- DIDSON monitored fish passing over a rocky and uneven substrate as far as 20 m from the sonar. The fish had a high passage rate (up to 5000 fish/hour) and almost all of them were within a 5 m range band (1m to 6 m range) from the sonar.

Burwen and Maxwell made the following observations regarding the DIDSON's performance on various Alaskan Rivers:

Advantages of DIDSON:

- DIDSON beams get larger faster in the vertical direction than the conventional fish assessment sonars. This means fish do not have to be pushed out as far with weirs to be counted. Minimizing influence on fish behavior is always a good thing.

- DIDSON is robust and easy to use. This allows much flexibility in site placement and considerably less training (and less technical expertise) for the personnel.

- DIDSON output is much more intuitive and understandable. As a result, ADF&G found a greater willingness among other biologists, managers, and the public in general to have confidence in the data produced by the DIDSON. That made the job of ADF&G assessment team much easier.

- The river silt did attenuate the sonar return and generated a bit of backscatter. However the effects were not significant. The sonar collected very good data in this environment.

Disadvantages of DIDSON:

- The standard version is range limited to 20 m. When rivers are large and fish of interest are not swimming near shore, this range limitation is serious. Sound Metrics is making a DIDSON-LR that has less resolution but a longer range (60 m – 80 m) for fish detection. ADF&G purchased one of these systems and will test it in 2004.

- The high resolution images with refresh rates of 6 frames per second generate 1 GB of data each hour. ADF&G has found that external hard drives and DVDs meet their storage needs so far. One method to reduce data storage requirements is to sample 10 or 15 minutes each hour. Sound Metrics and other researchers are developing data compression schemes.

- Currently the counts are made by hand. Sound Metrics has trial algorithms that automatically count and size fish. ADF&G correctly did not want to depend on these algorithms initially. They replayed the data, sometimes at 10xreal-time, and counted fish by clicking a tally whacker as fish passed across the display. The trial algorithms need to process the same stored data with automated counts compared against the tally whacker counts. Additional refinements to the auto-count and size routines will certainly need to be made.

Conclusions

Fisheries Managers now have a technology to reliably count fish in shallow rivers with rocky and uneven substrates (within reason). DIDSON is simple to run. DIDSON data are accurate and easy to understand. DIDSON hardware and software are reliable. DIDSON works well on an unprecedented number of sites.

The standard DIDSON range of 20 m is a limitation. Data collection requires large storage capacity. Only experimental automated counting and sizing are available.

The almost-video-quality of DIDSON images allows one to watch images of fish swimming across the field-of-view. Please check out the website www.soundmetrics.com **for dynamic views of swimming fish and other objects of interest.**