Movement of Dolly Varden and Cutthroat in High-Gradient Headwater Streams

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Purpose

- Section 33, Code of Federal Regulations 323.3(b), Clean Water Act (1987) states; “the design, construction and maintenance of the road crossing shall not disrupt the migration or other movement of those species of aquatic life inhabiting the water body.” The Tongass Forest Plan Standards and Guidelines state: “maintain, improve, and restore the opportunities for fish migration” in Class I and II streams.

Approximately 1,200 Culverts
in Dolly Varden and cutthroat streams
do not meet the fish passage standards.
Cost to repair is estimated to be over
$70 million.
(As of a few years ago)

Goals

- **Determine when fish move (season) and at what stream stages –discharge**
- **Provide quantitative data for the design of culvert to meet fish passage standards**

Objectives

- Describe the size and species of fish that move
- Identify seasonal movement
- Determine the relationship between fish movement and discharge

Approach to the Problem

- Focus on Dolly Varden and cutthroat trout
- Intensive effort in one stream
- Use PIT tags and a fixed antenna system
- Relate movement to stream stage

Location

Figure 1. Map of Hobo Creek

Study site: Hobo Creek

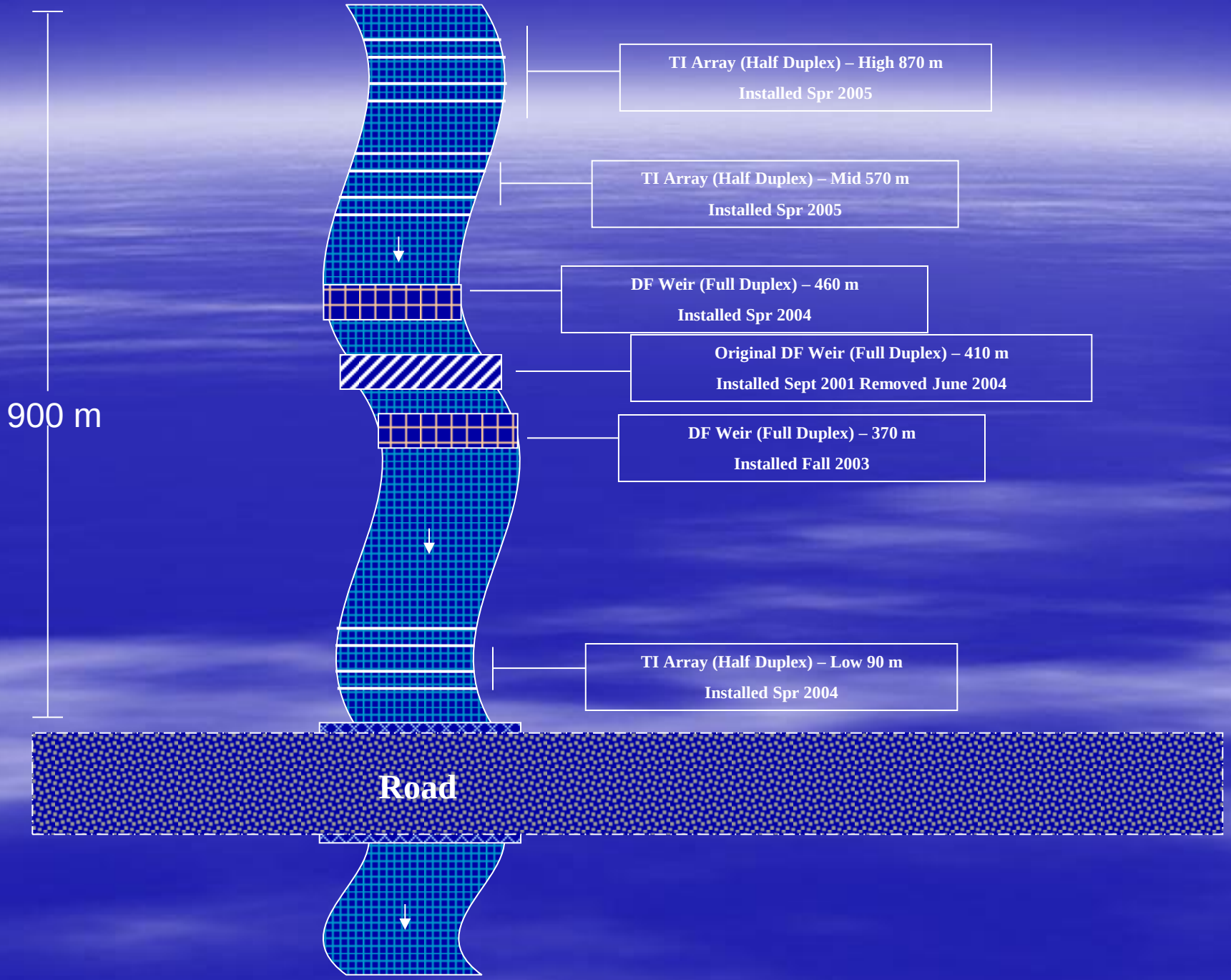
- Small 2nd order stream
- Population of Dolly Varden & cutthroat trout
- High gradient (2% - 10%)

Methods

- Identify location where fish were tagged within 10 m intervals.
- Periodically sample fish population to record movement, size, and tag additional fish.

Methods

- Place PIT tags in Dolly Varden and cutthroat trout >65mm.
- Use weirs with paired antennas to record time fish moved upstream or downstream


900 m
TI Array (Half Duplex) – High 870 m
Installed Spr 2005
TI Array (Half Duplex) – Mid 570 m
Installed Spr 2005
DF Weir (Full Duplex) – 460 m
Installed Spr 2004
Original DF Weir (Full Duplex) – 410 m
Installed Sept 2001 Removed June 2004
DF Weir (Full Duplex) – 370 m
Installed Fall 2003
TI Array (Half Duplex) – Low 90 m
Installed Spr 2004
Road

Methods

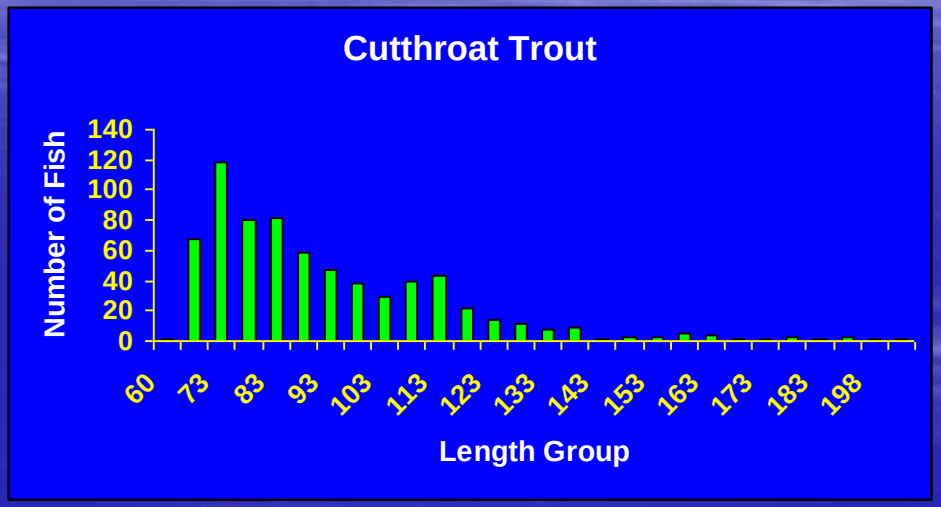
- As fish pass through antenna
  - Tag number recorded
  - Date and time recorded
- Direction determined by time sequence at paired antenna
- Stream stage and date and time recorded at stage recorder located at about 20m
- Fish data and stage (converted to discharge) data merged

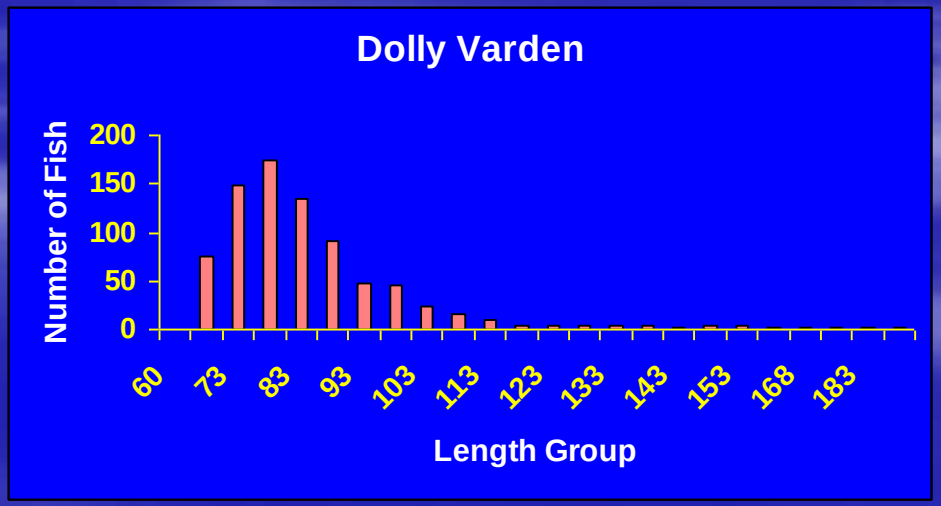
Results

- How big are the fish?
- What proportion moves vs. stays?
- How far do they move?
- How does discharge affect movement?

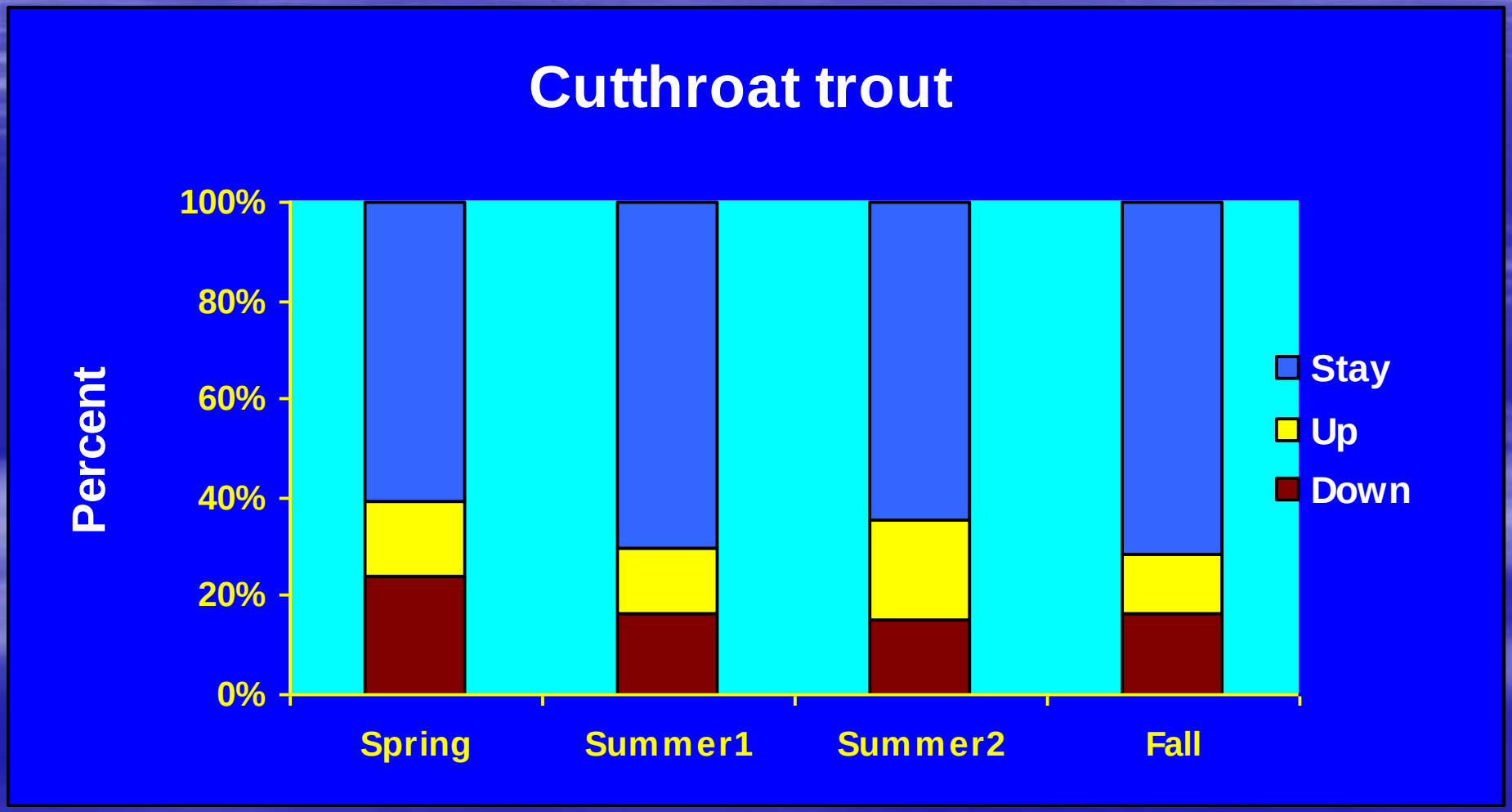
Length Frequency Distribution

- Fish less than 65 mm were not tagged
- Few fish greater than 150 mm captured
- Cutthroat mode about 110 mm.
- Dolly Varden mode about 90 mm





Movers and Stayers



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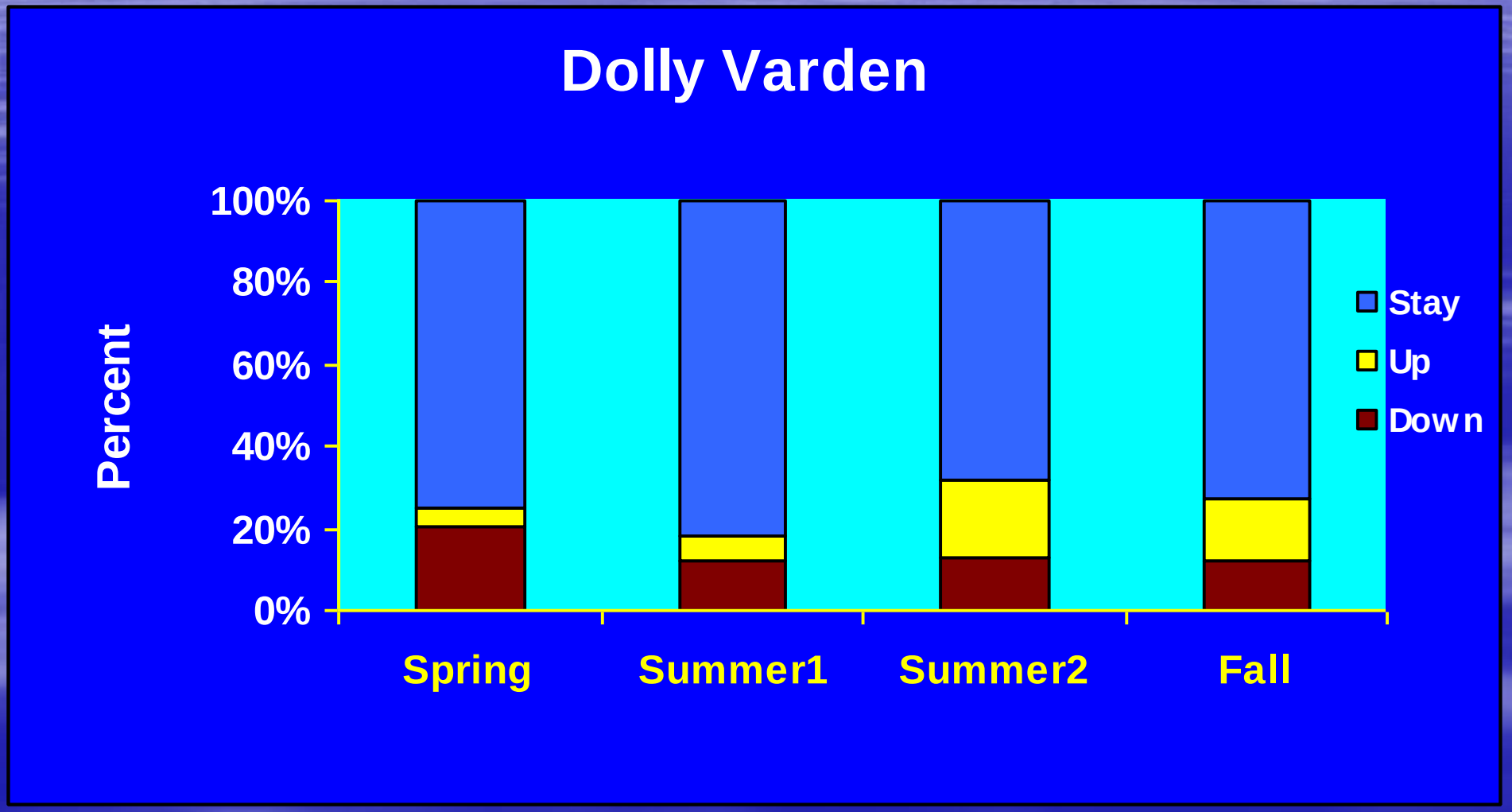
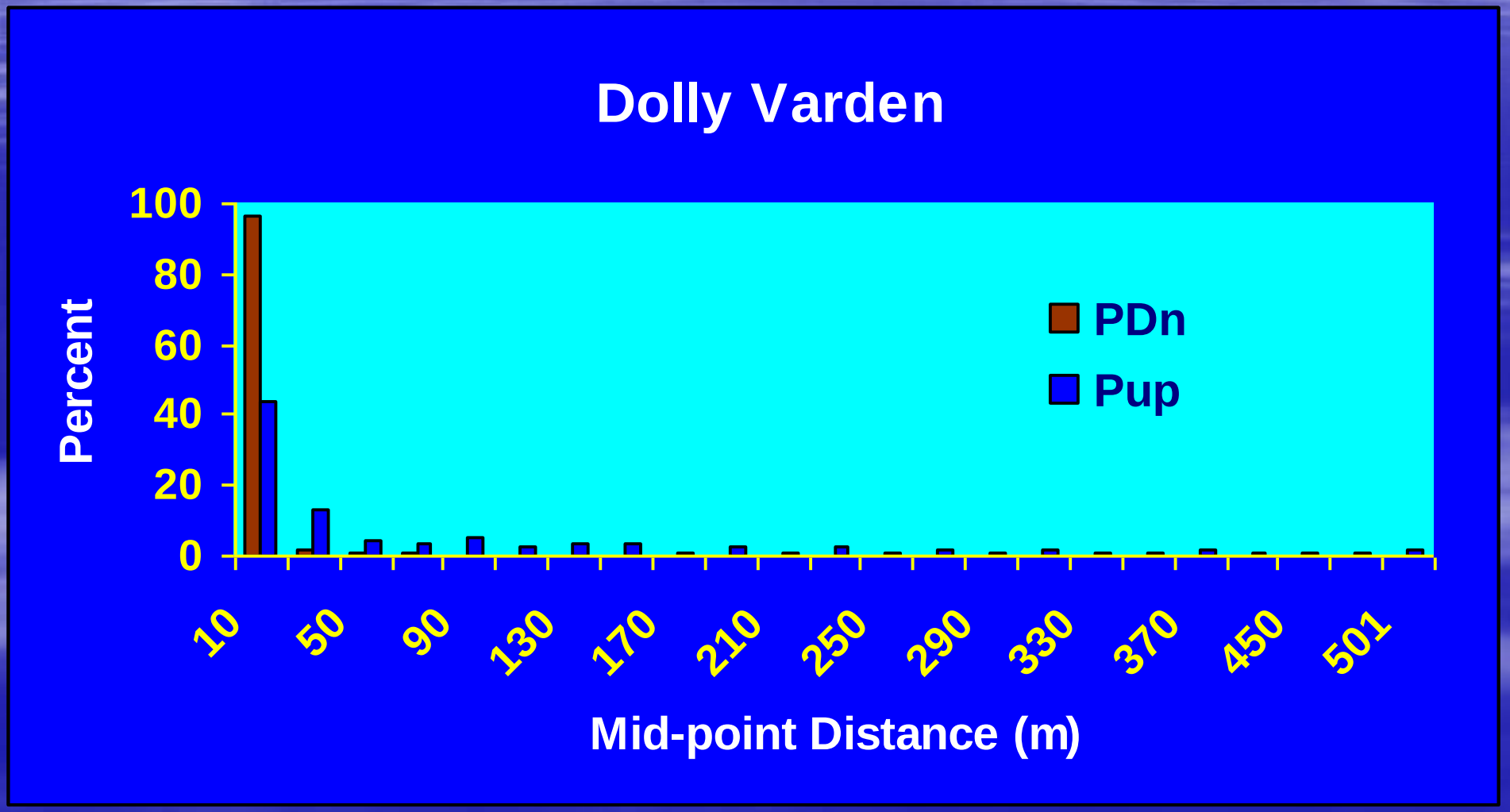


How far do they move?



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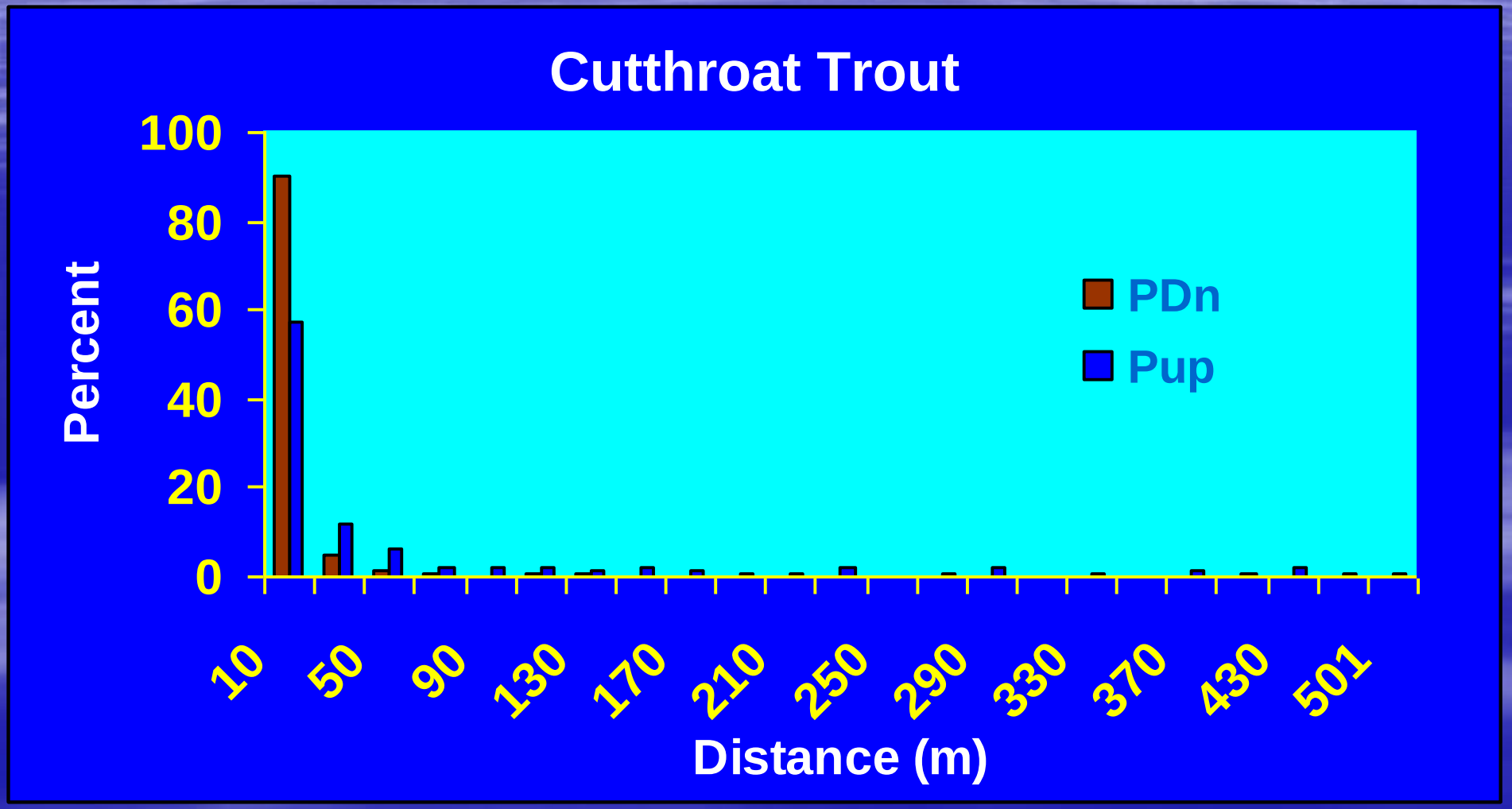
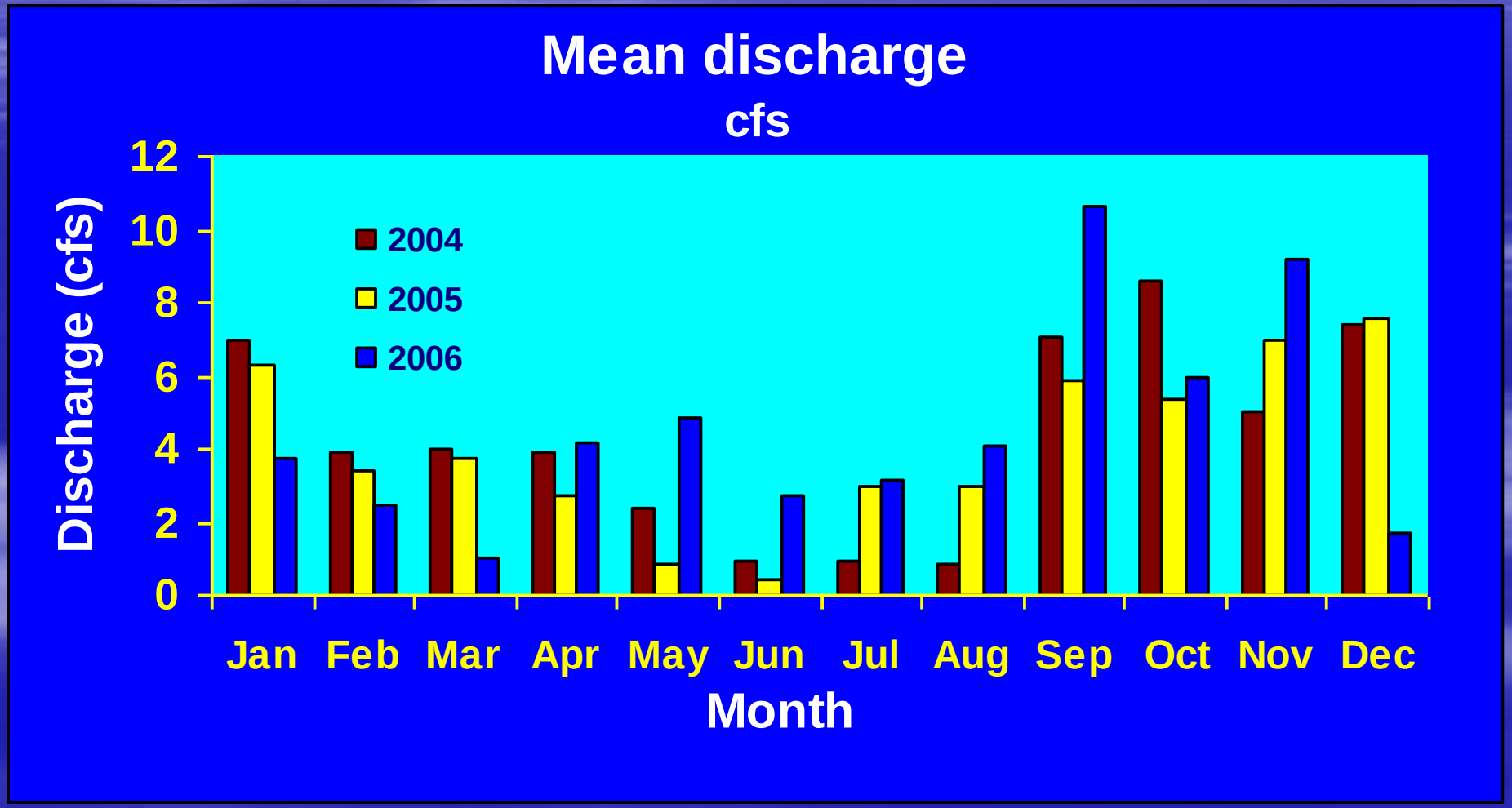
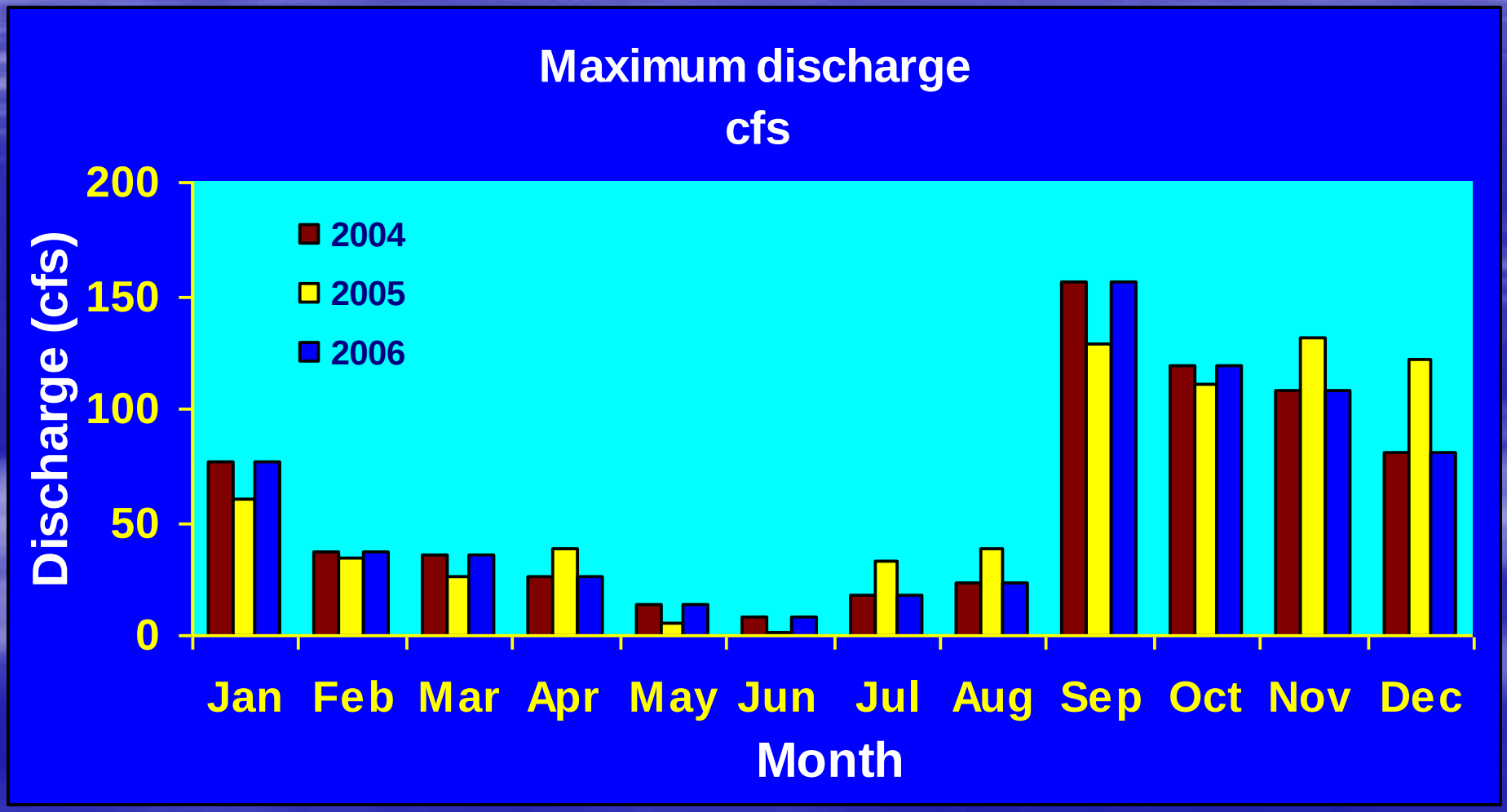


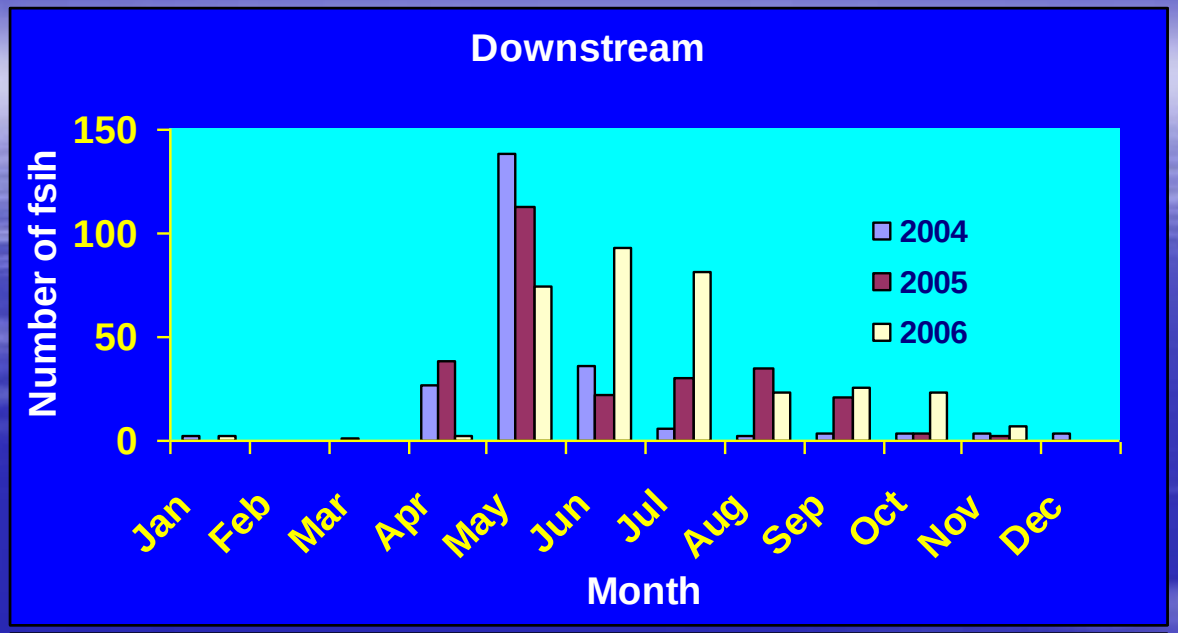
Mean Monthly Discharge
Hobo Creek

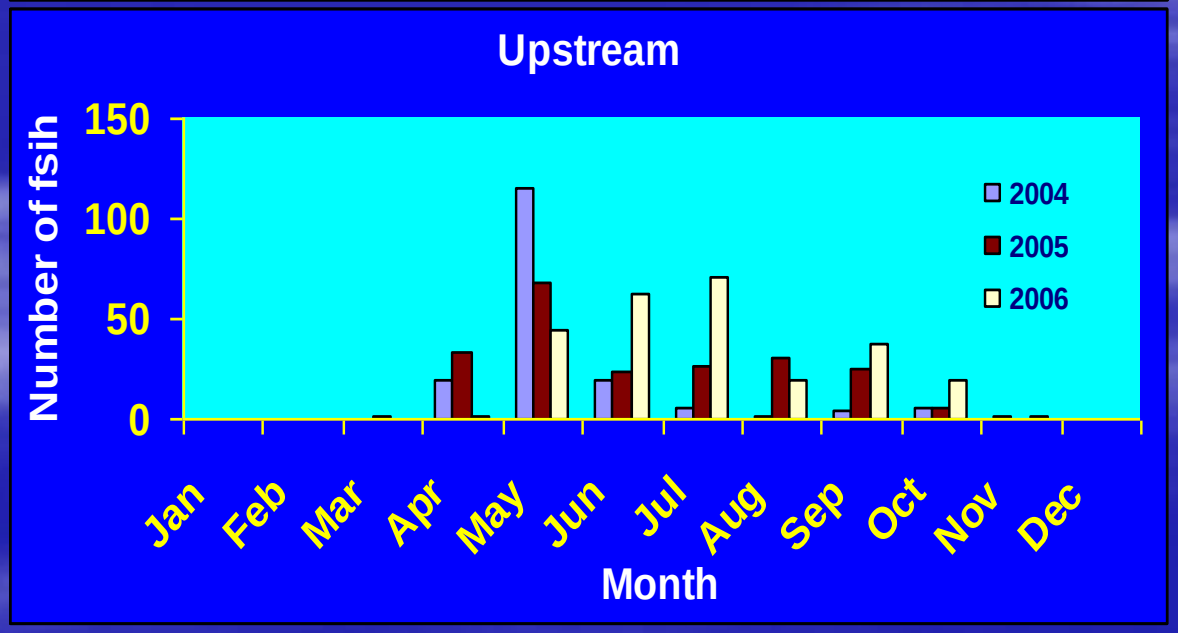


Peak Monthly Discharge
Hobo Creek

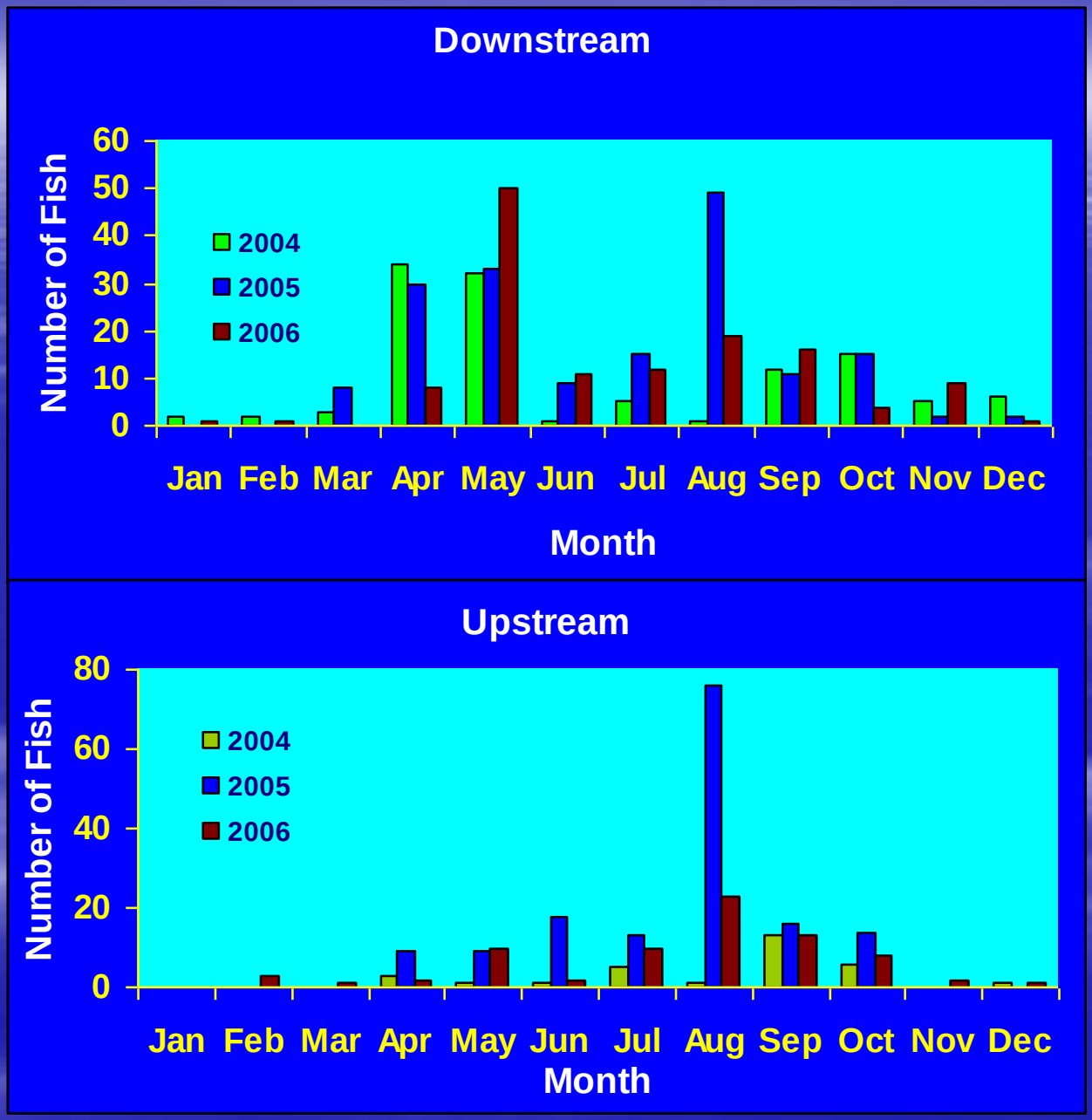


Cutthroat trout

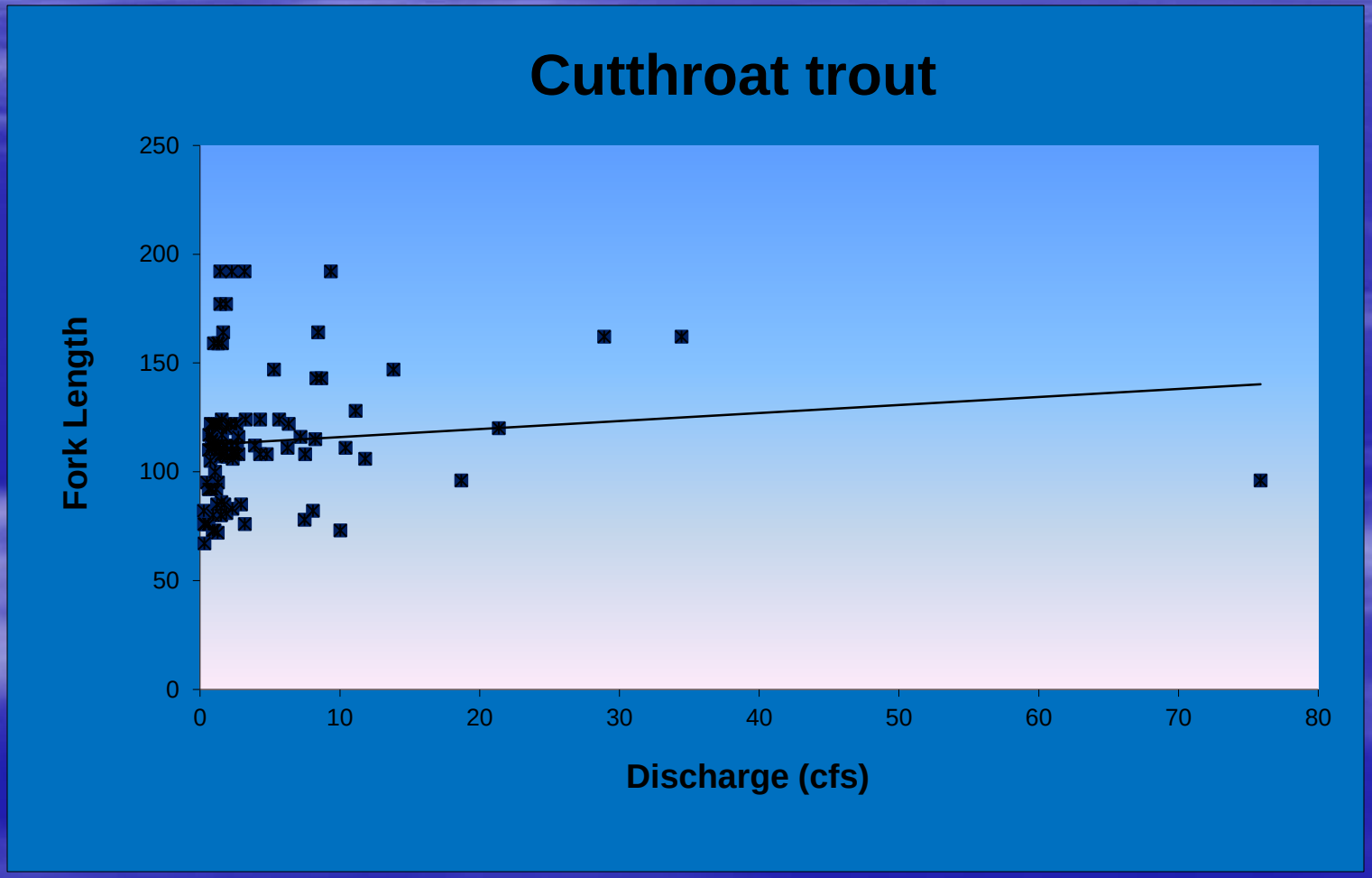




Dolly Varden



Movement
Length and Discharge



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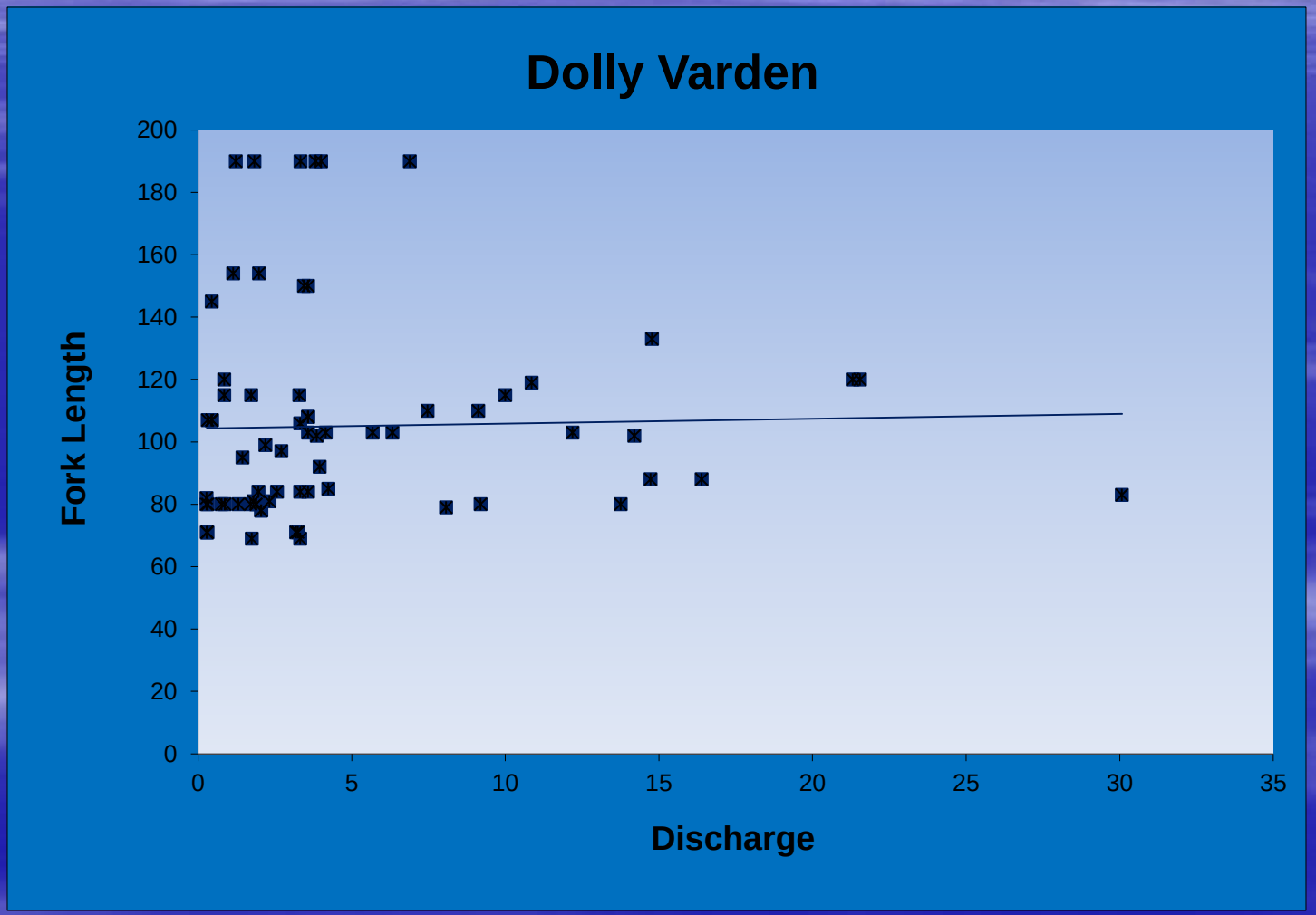
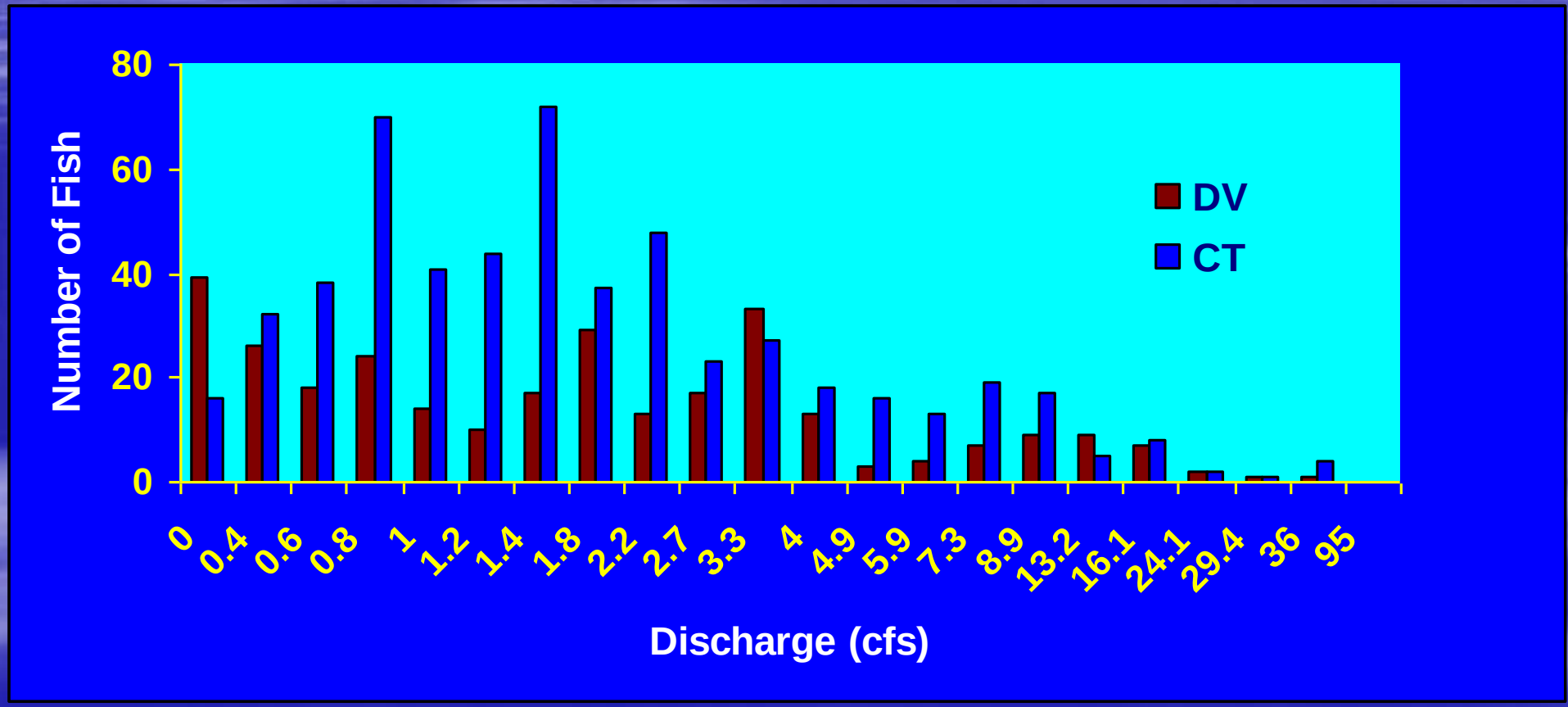
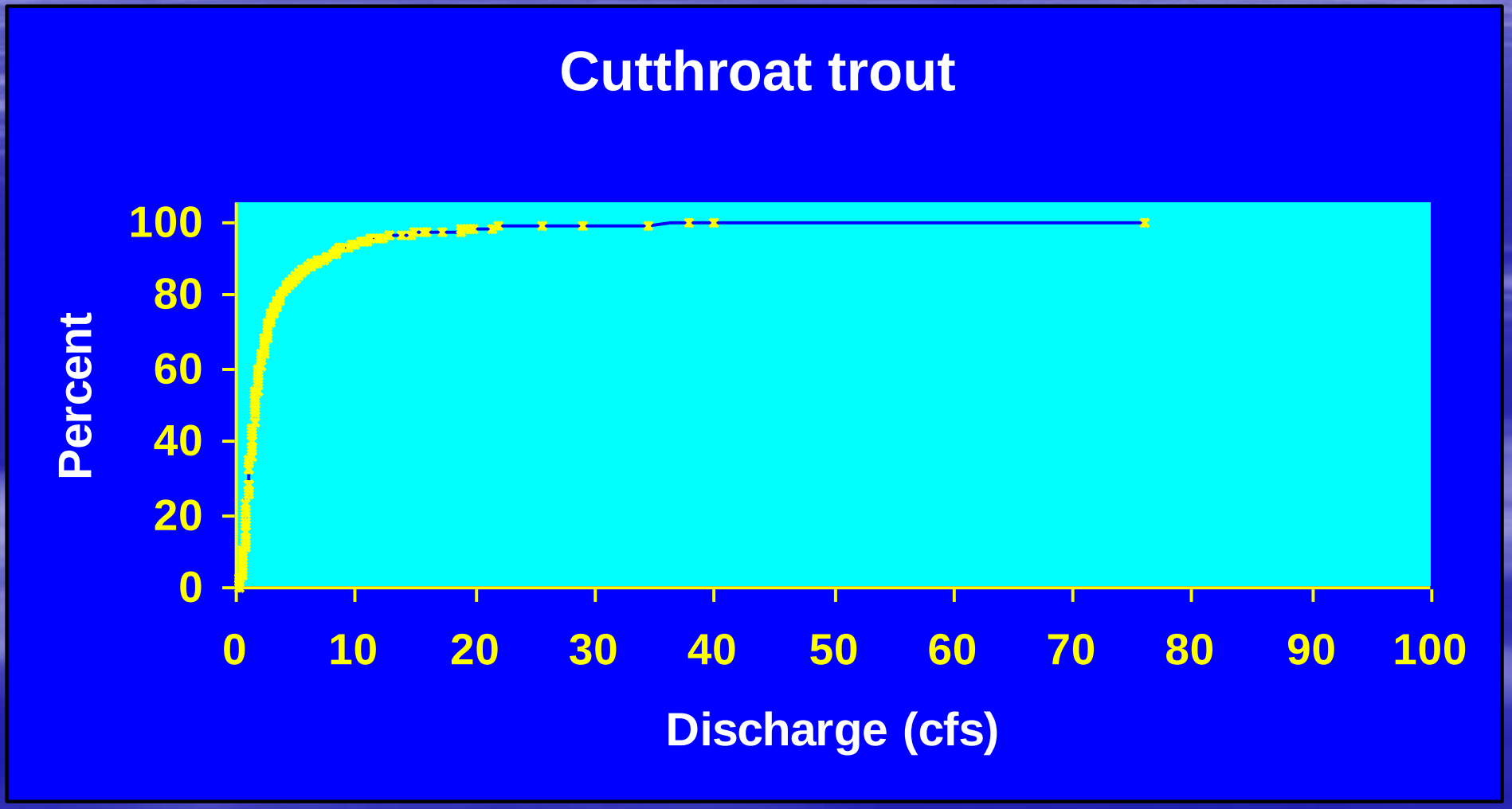
Length and Discharge



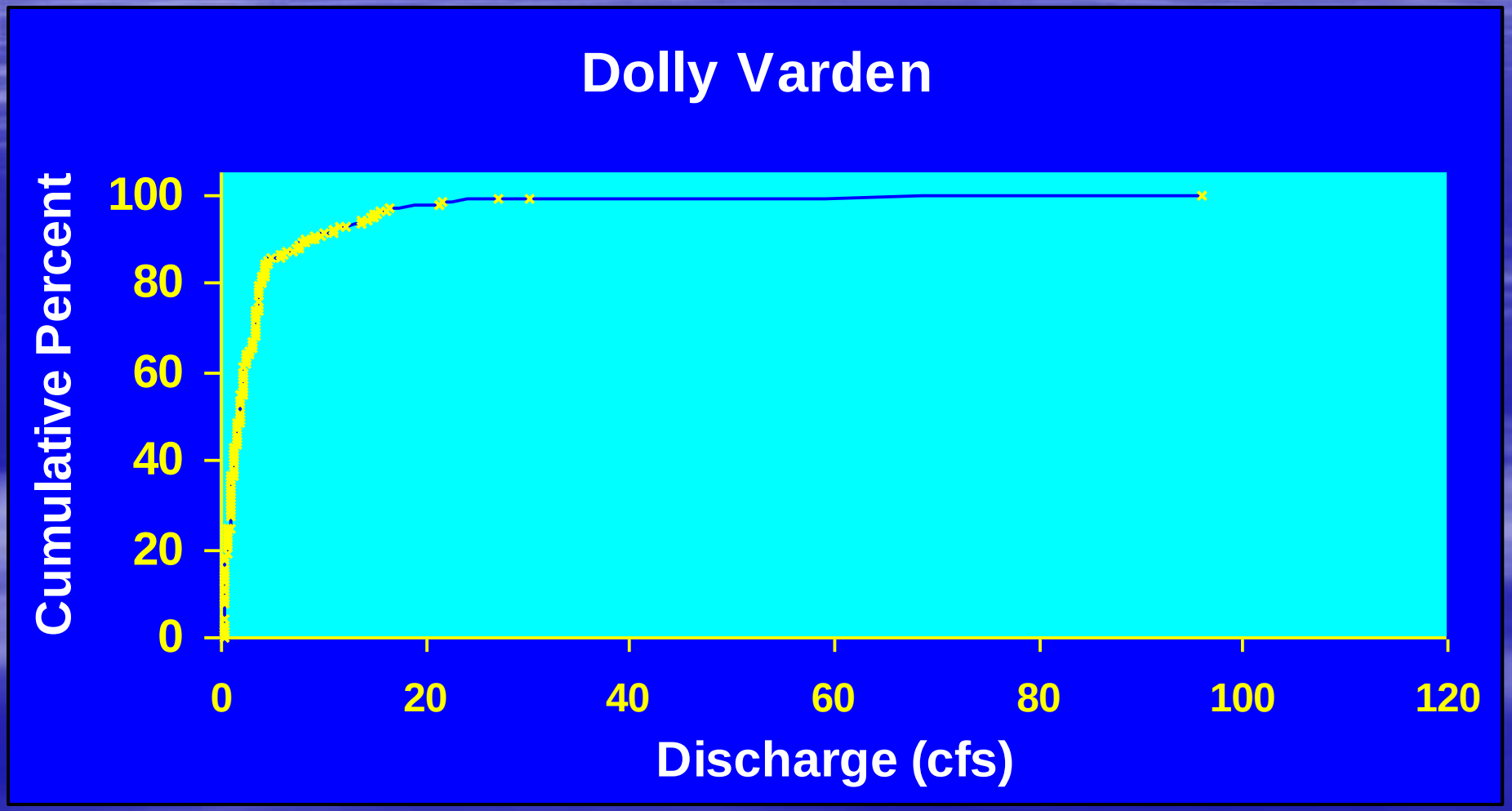
Movement by Discharge Intervals



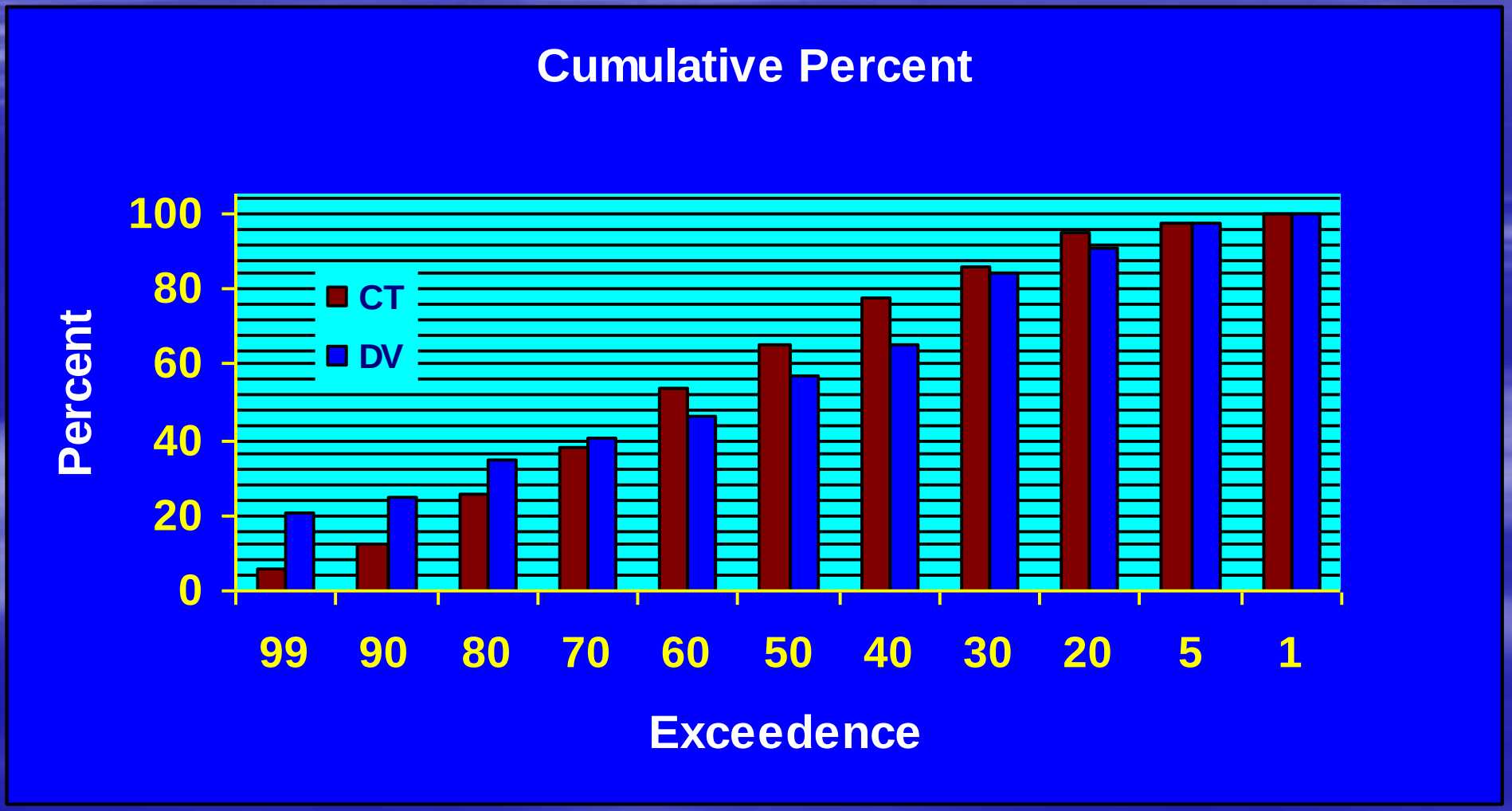
Cumulative Percent of cutthroat trout detected



Cumulative Percent of Dolly Varden detected



Movement
and
Exceedance Flows



Summary/Conclusions

- **Most Dolly Varden and cutthroat trout were < 100 mm**
- **Between 20 to 40 percent of Dolly Varden and cutthroat trout moved between sample periods**
- **Most fish moved a relatively short distance (<20 m), but a few moved > 200 m.**
- **Movement was seasonal.**

Summary/Conclusions

- **Movement clustered between 0.4 and 5.0 cfs (less than bankfull).**
- **Most fish were detected moving at discharge < 20 cfs.**
- **More than 95% of the fish detected moving upstream moved during flows that were exceeded 85 % of the time.**

Management Applications

- Reasonably confident that we can detect fish moving at high flows –monitoring methodology.
- Proportion of fish moving is relative to stream flow (Exceedance flows).
- Relatively few fish move at flow that are exceeded more than 5% of the time.
- Contribute to the design of new culverts.
- Prioritize culverts that may restrict movement.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