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Advances in machine vision scanning

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Whooshh Innovations

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Whooshh Innovations

Machine Vision in Fisheries Management

Machine vision in Fisheries Management

- Review of data needs
- Historical approaches
- Requirements driving new approach
- The Whooshh Scanner
  - Overview
  - Applications
  - Future development
- Summary

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Data needs

- Fish counts
- Time of day/date
- Size
  - fork length, weight typical
- Species
- Hatchery vs wild
- Fish condition – damage and predation assessment

- Also
  - Flow rate, DO, water temperature etc.

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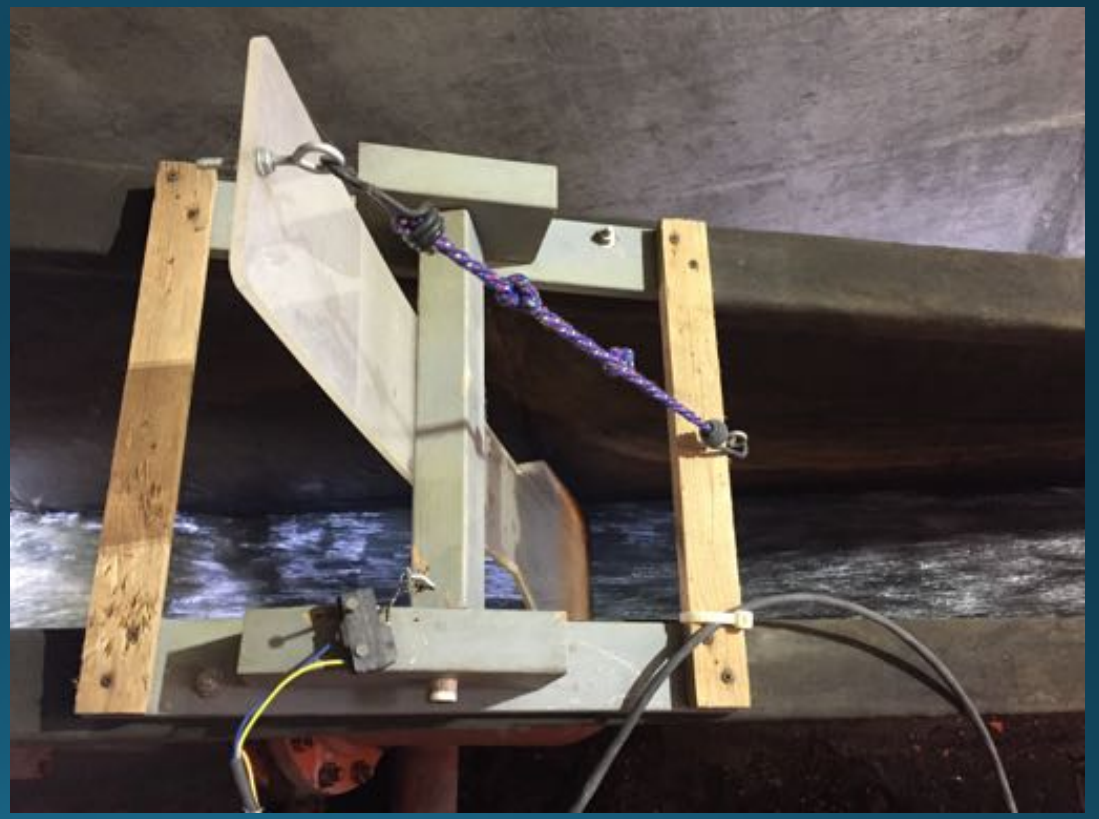
Historical approaches for data gathering

Automated

- Resistive counters
- Optical (break beam) counters

Manual

- Count window
- Sorting box



Black River Pump Station WA. Fish counter

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Adding operators, cameras and computers

- Batch
  - Camera records all transits
  - Addition of time of day tags
  - In swim-channel reference marks for measurement estimates
  - Post analysis by biologists
- Human assist
  - Count window
  - Camera records for validation and break-time extrapolation
  - Operator counts fish manually by “clicker” or keyboard

Count window

Sorting Box PGE Clackamas OR – Youtube Video

Sorting Box – hatchery vs wild

Count window at Winchester Dam, Roseburg OR

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Requirements driving new approach

- Increased accuracy - less human error
- Management possibilities
  - Exclusion of invasives
  - 24/7 Separation of hatchery or tagged fish
  - Faster automated decision making
- Data completeness -> continuous collection
- Operable in highly turbid water
- Additional real time data integration
  - PIT tags
  - CWT detection
  - Floy tag detection

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System overview

- Block diagram and overview
- Fish slide
  - Partially dewatered gravity slide
- Accurate outline detection
- Coaxial cameras, visible and infra red
- Fish detection
- Timers
- Image processing and decision making

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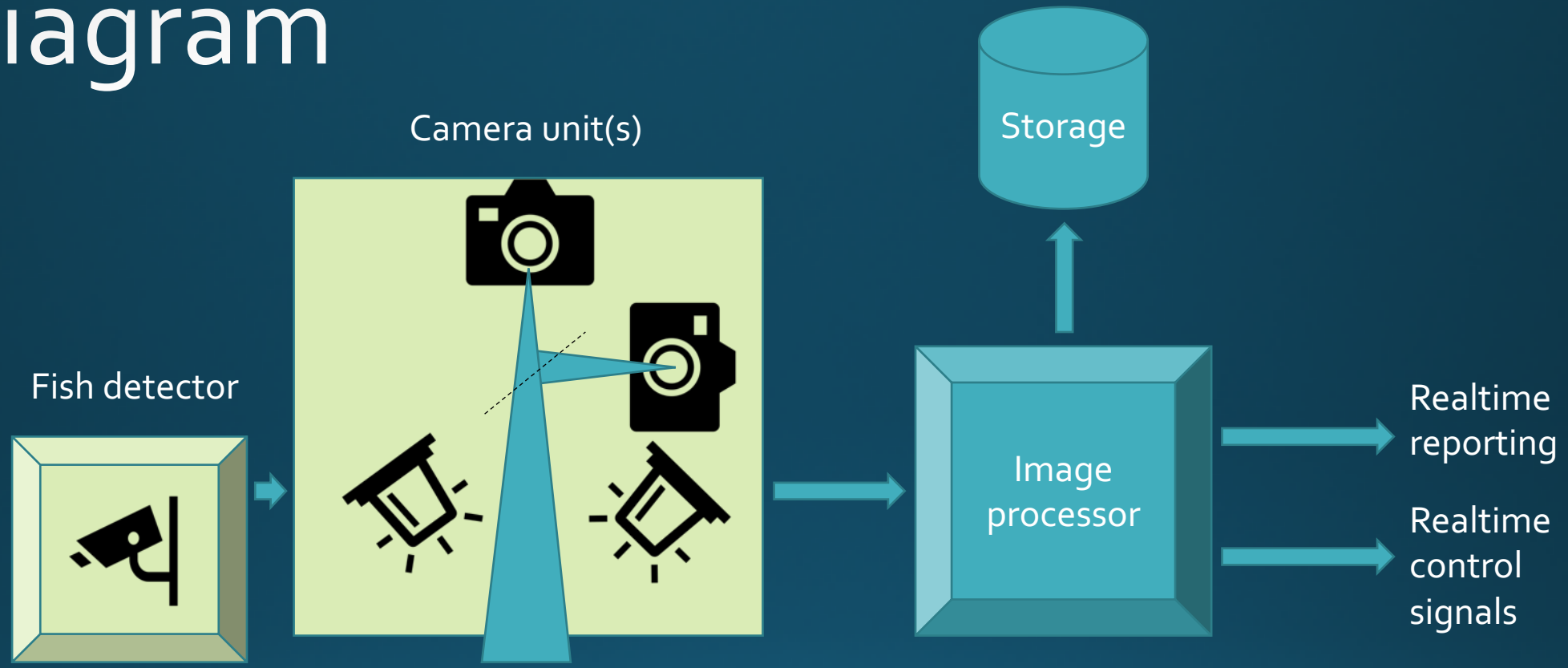
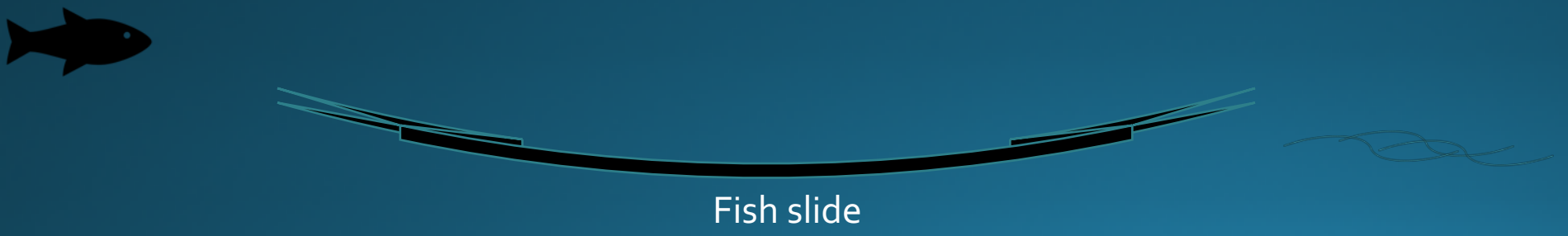
Block diagram

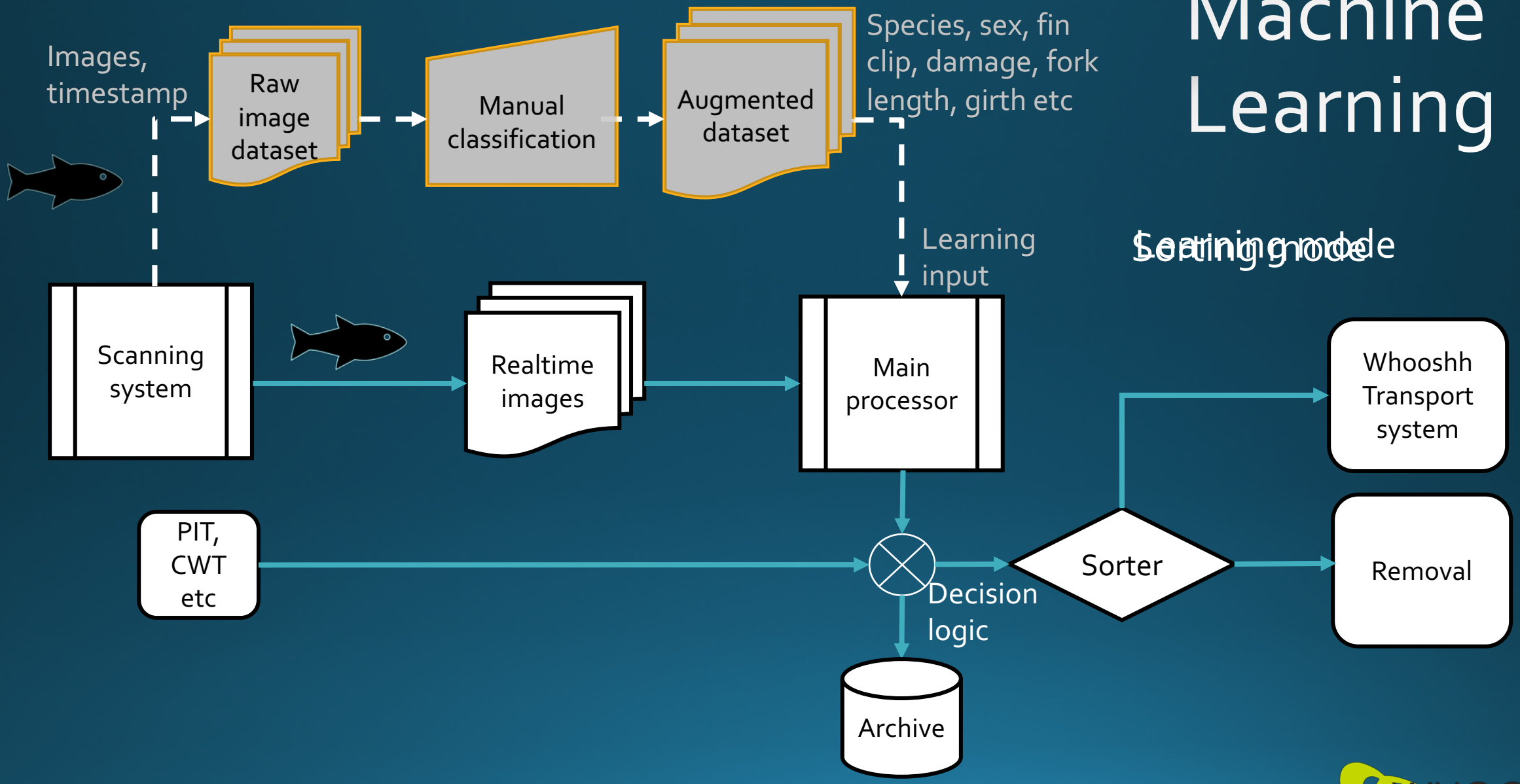




Machine learning process

1. Scanning of learning set
2. Manual analysis/identification
3. Machine "teaching" using learning set
4. Machine analysis of test set
5. Manual analysis of test set
6. Verification/feedback

Machine Learning



Typical Installation

- Installing scanner in existing ladder

Scanned images

Chum salmon

Scanned images

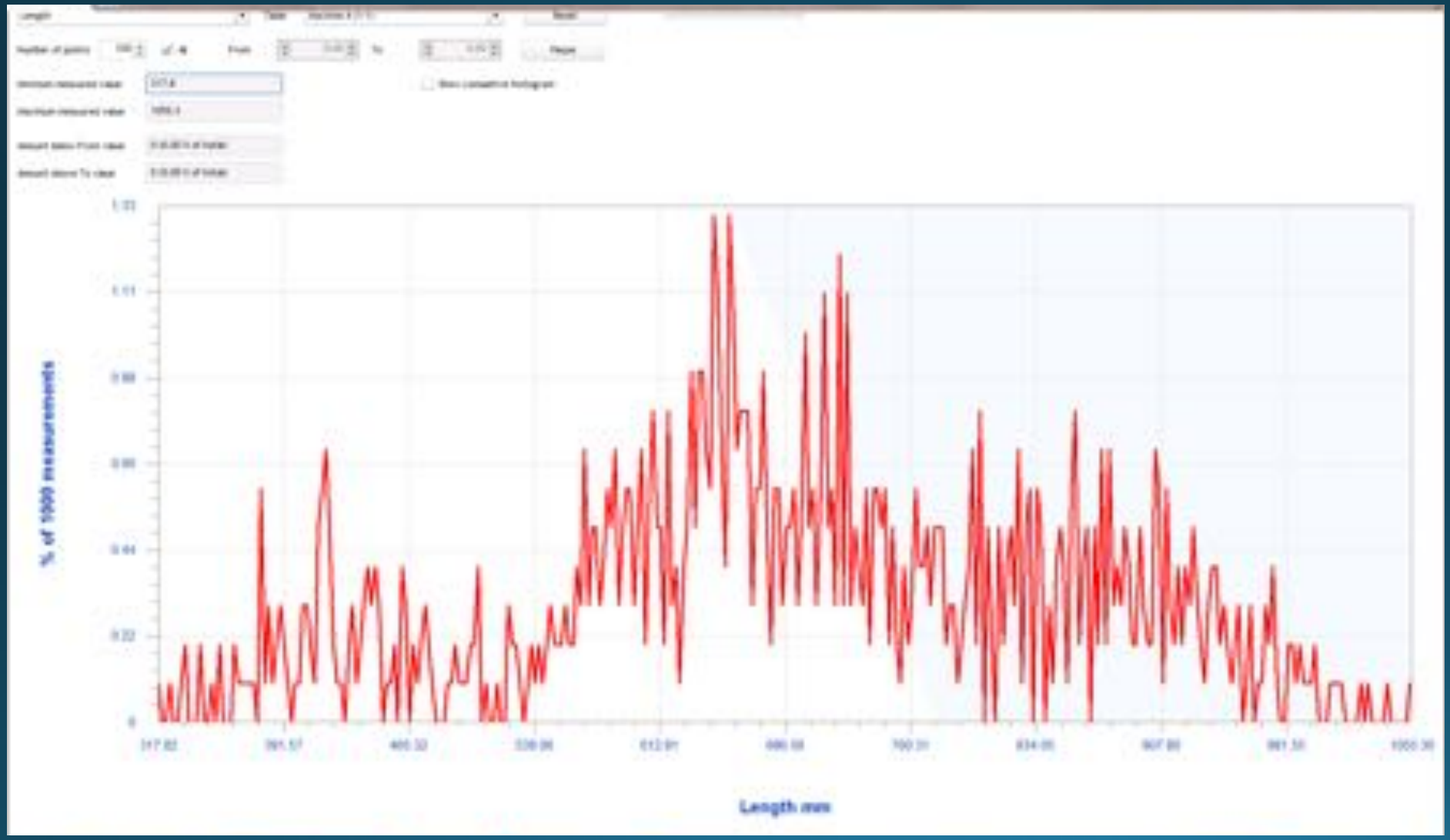
Steelhead

Scanned images

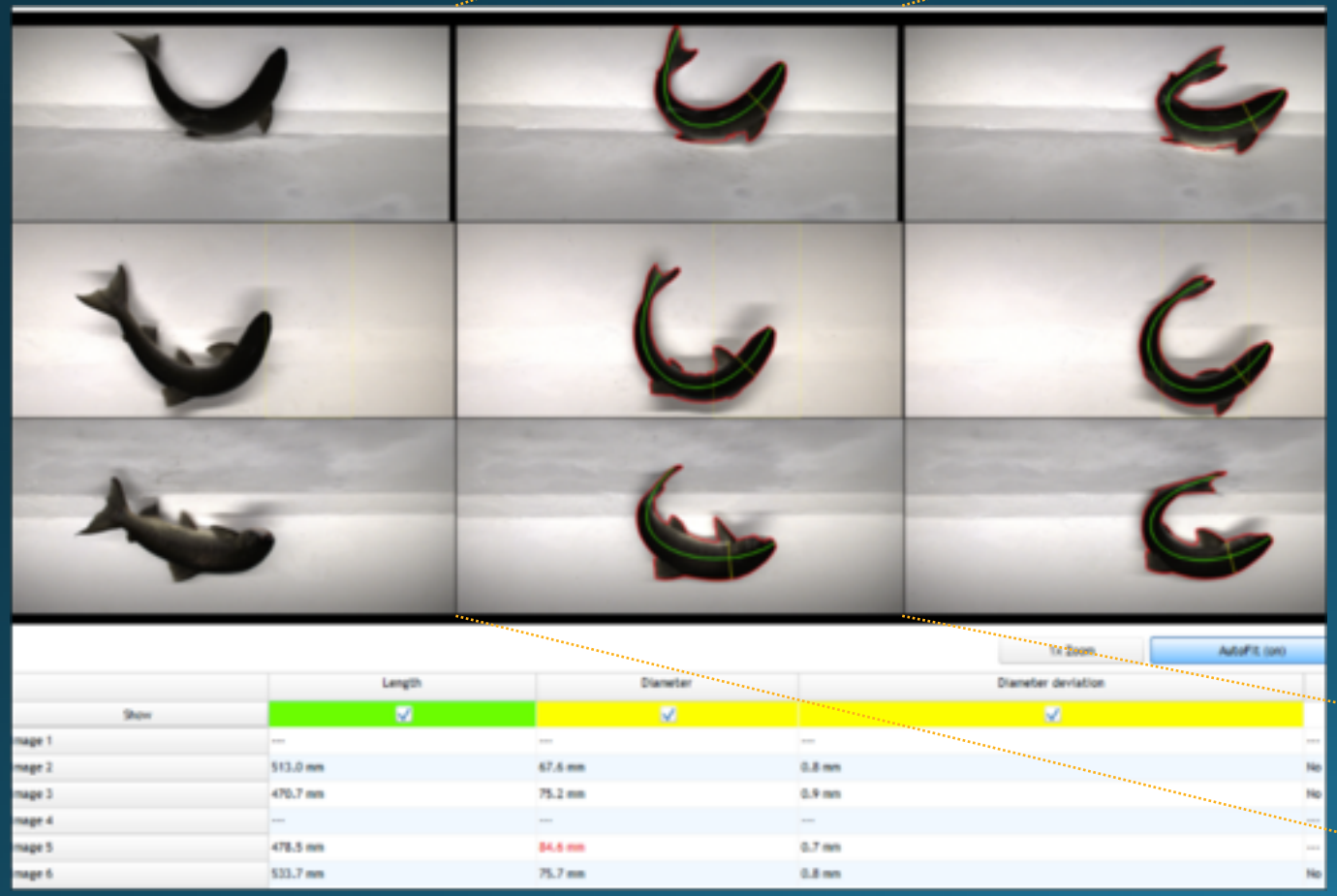
Chinook salmon

- detail and silhouette

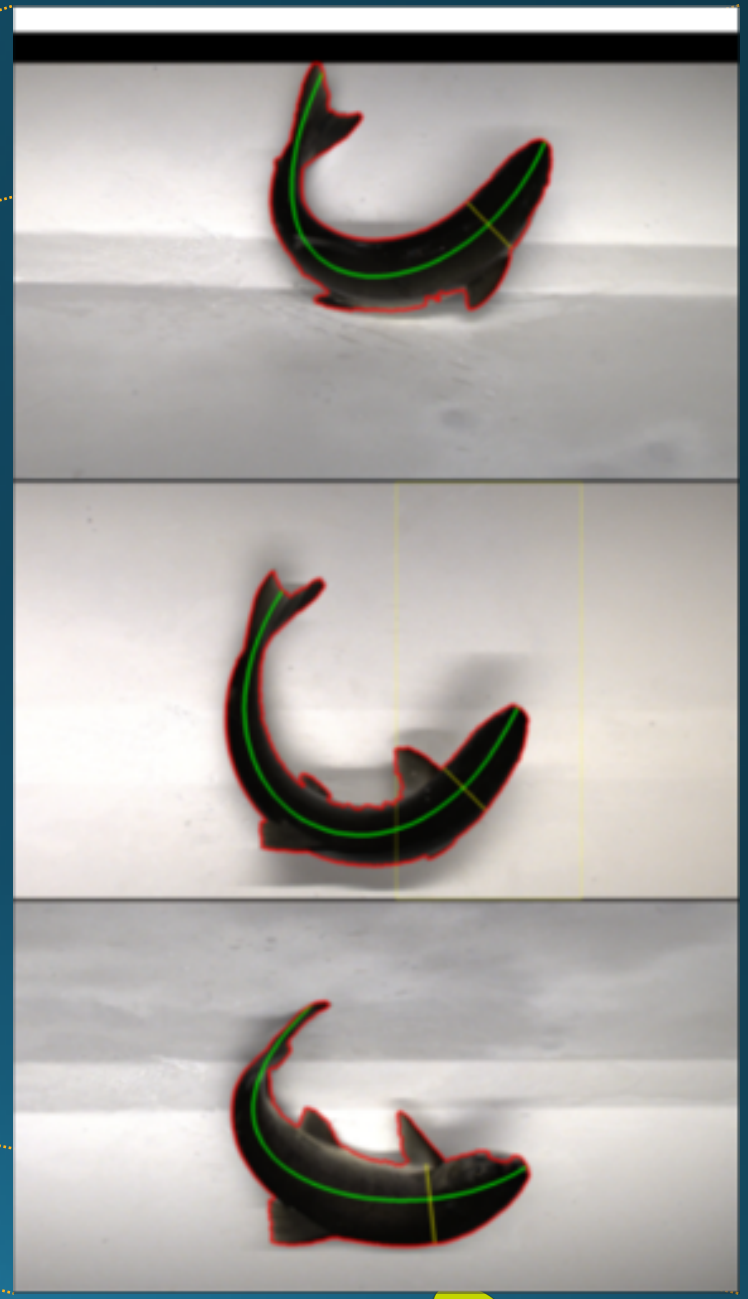
Fish length distribution



Length and girth

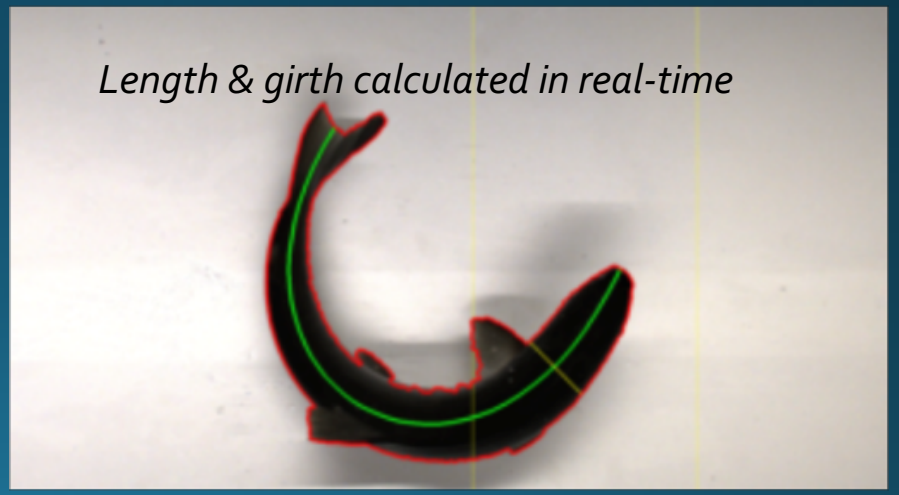


	Length	Diameter	Diameter deviation	
Show	☑	☑	☑	
Image 1	---	---	---	---
Image 2	513.0 mm	67.6 mm	0.8 mm	No
Image 3	470.7 mm	75.2 mm	0.9 mm	No
Image 4	---	---	---	---
Image 5	478.5 mm	84.6 mm	0.7 mm	---
Image 6	533.7 mm	75.7 mm	0.8 mm	No



Scanning Capabilities

- Current Capabilities:
  - Size *(Girth, Width, Length)*
  - Speciation by size (Girth, Length)
- Upcoming Developments:
- Hatchery vs. Wild
  - Adipose fin presence detection
- 2019 collection/learning programs
  - Great Lakes species
  - West coast US anadromous species



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Applications

- Basic monitoring
  - Collection of migration data (time, date, species, size)
- Sorting applications
  - For studies
  - Invasive removal
  - Selective passage
  - Sizing for passage solutions like WFTS

Summary

- Combine machine learning with high speed imagery
- Fish out of water
  - Turbidity no longer an issue
- More complete data
  - Timing
  - Girth and forklength
  - Weight estimates possible from species
  - Additional marking (fin clip, gill cover clip, floy tag etc)
  - Combine with PIT tag , CWT detection

Real time automated decision making now possible

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Questions?

At Whooshh, We are Serious About Moving Live Fish