

An aerial photograph of a pound net in a large body of water during sunrise. The sun is low on the horizon, creating a bright, hazy glow over the water and the surrounding landscape. The net consists of several vertical posts connected by a line, forming a rectangular enclosure. A small boat is visible near the net. The background shows a line of trees and a distant shoreline.

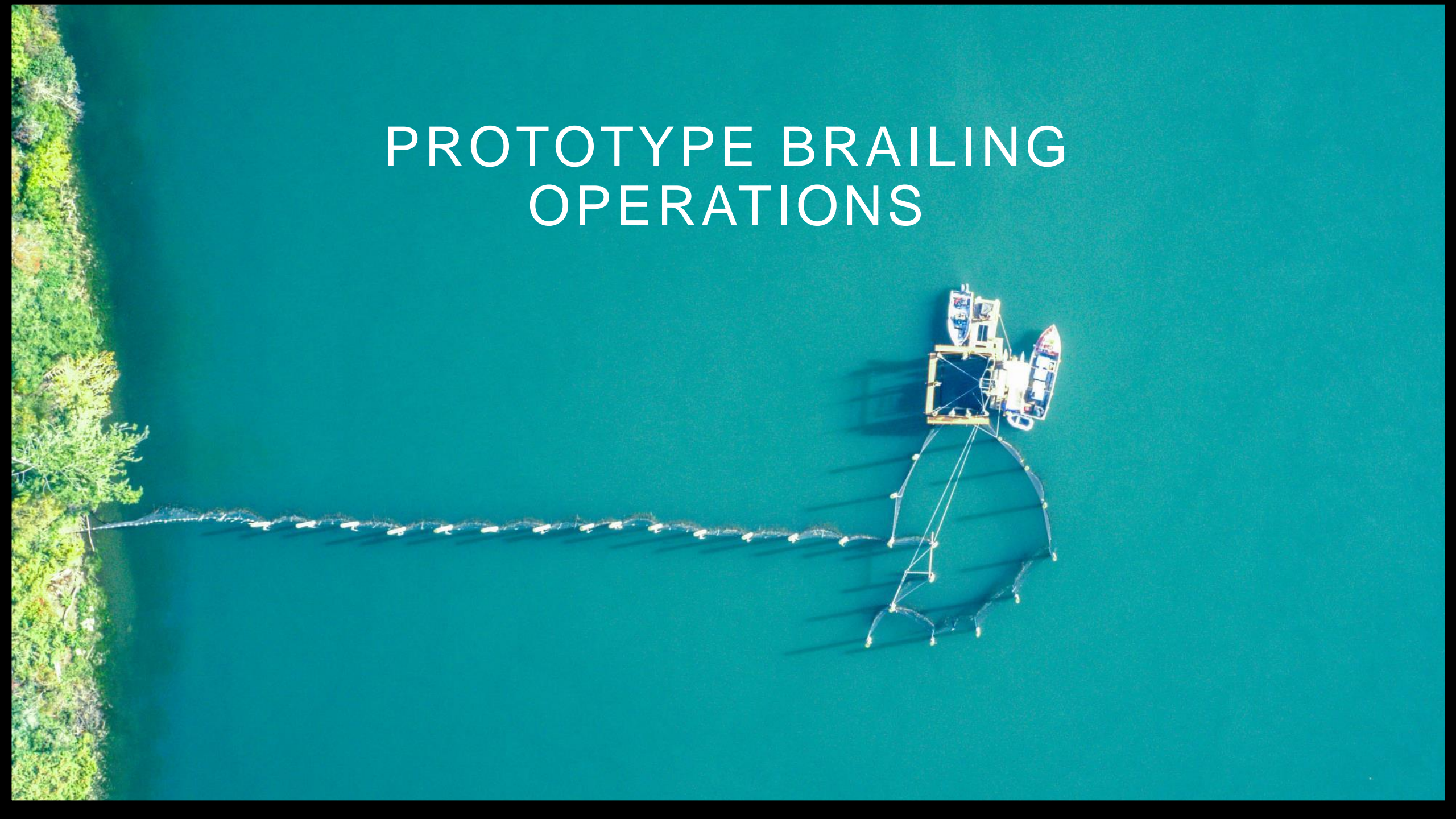
# Latest Data and Science for Passively Operated Pound Nets

Adrian Tuohy, M.S. | Wild Fish Conservancy

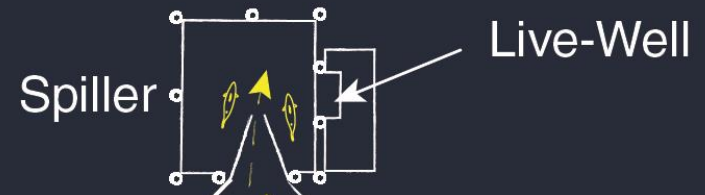
# TWO METHODS OF POUND NET OPERATION



# PROTOTYPE BRAILING OPERATIONS



Shore Line



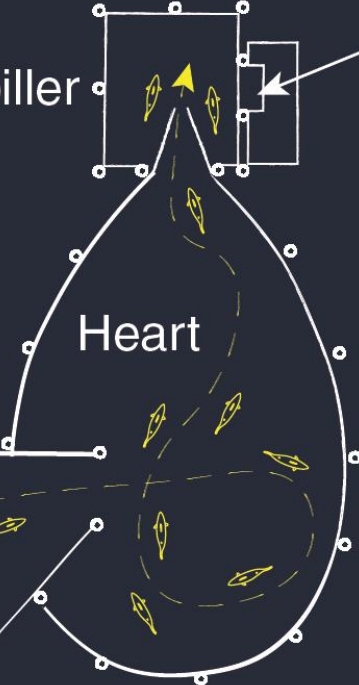
Lead

Heart

Fish Movement

Jigger

River Flow









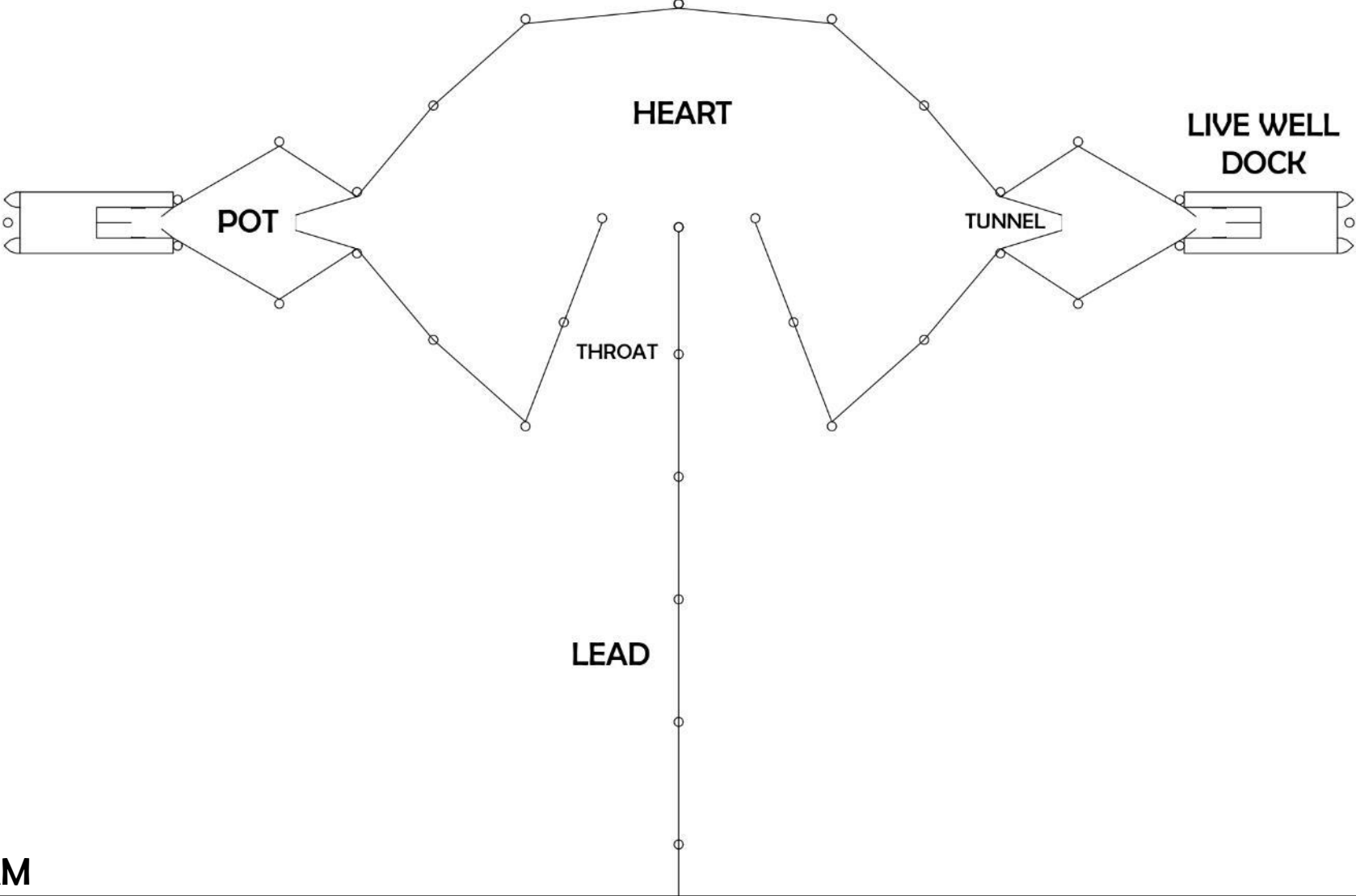




# PASSIVE OPERATIONS



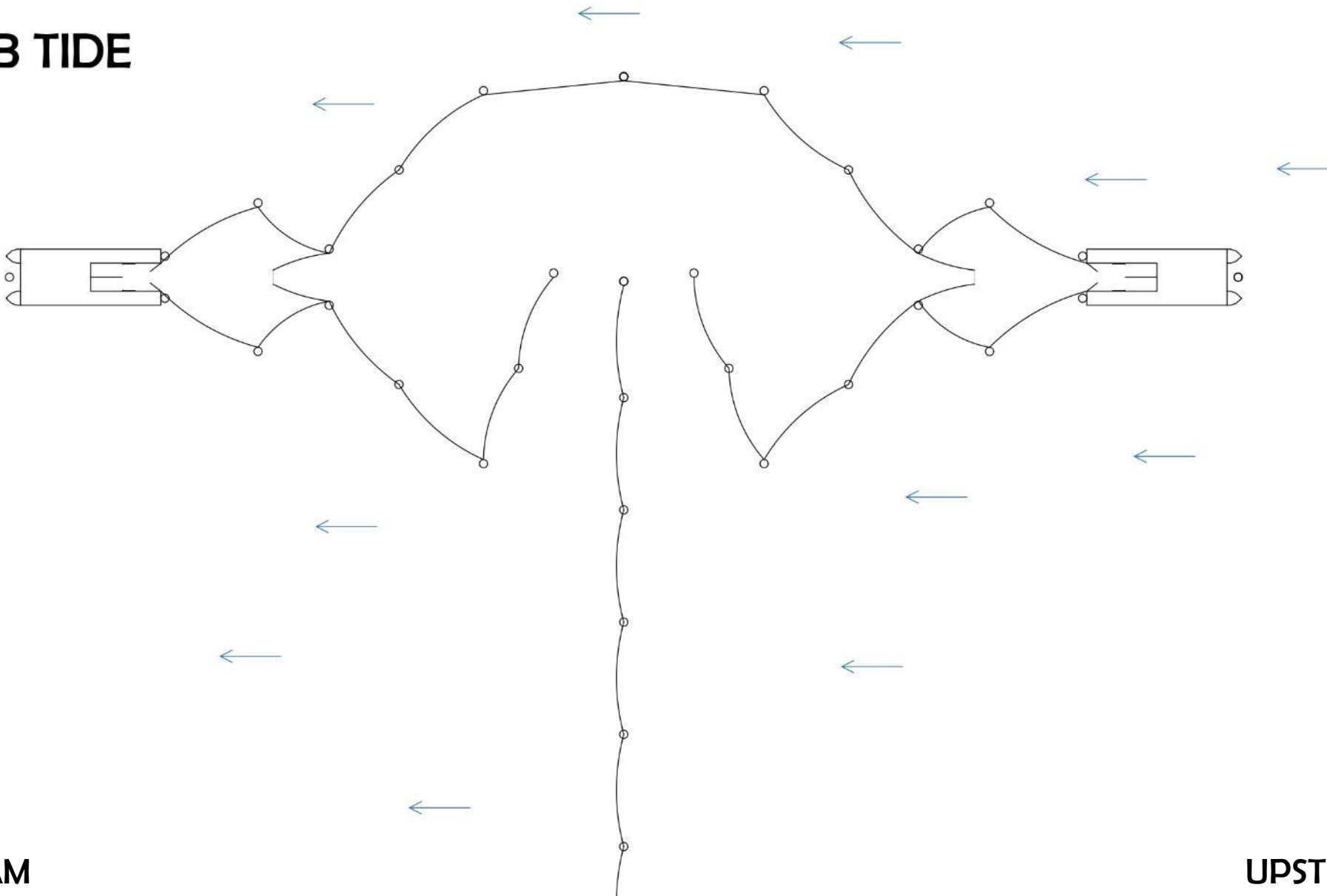
# TRAP LAYOUT



DOWNSTREAM

UPSTREAM

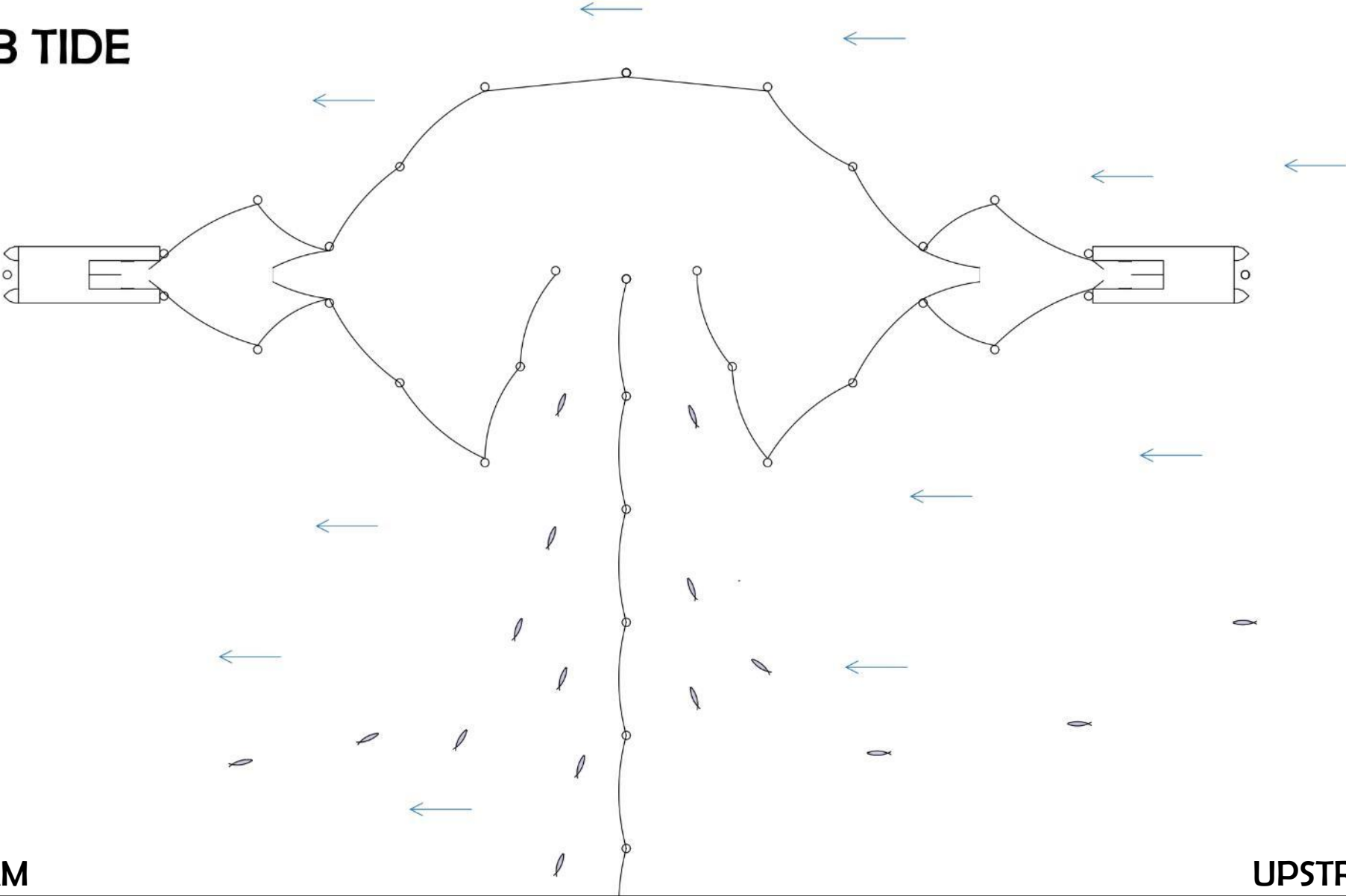
**EBB TIDE**



**DOWNSTREAM**

**UPSTREAM**

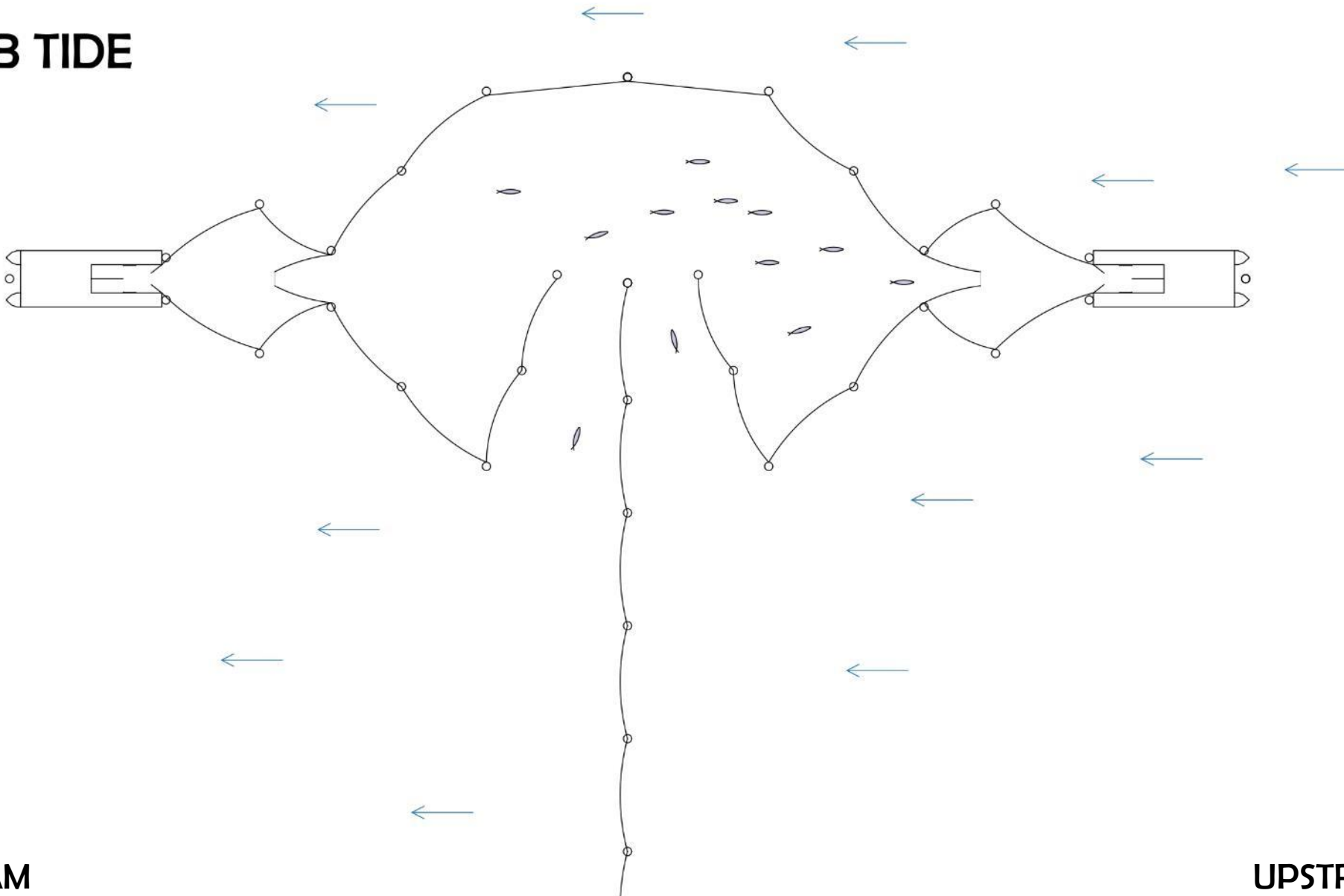
**EBB TIDE**



**DOWNSTREAM**

**UPSTREAM**

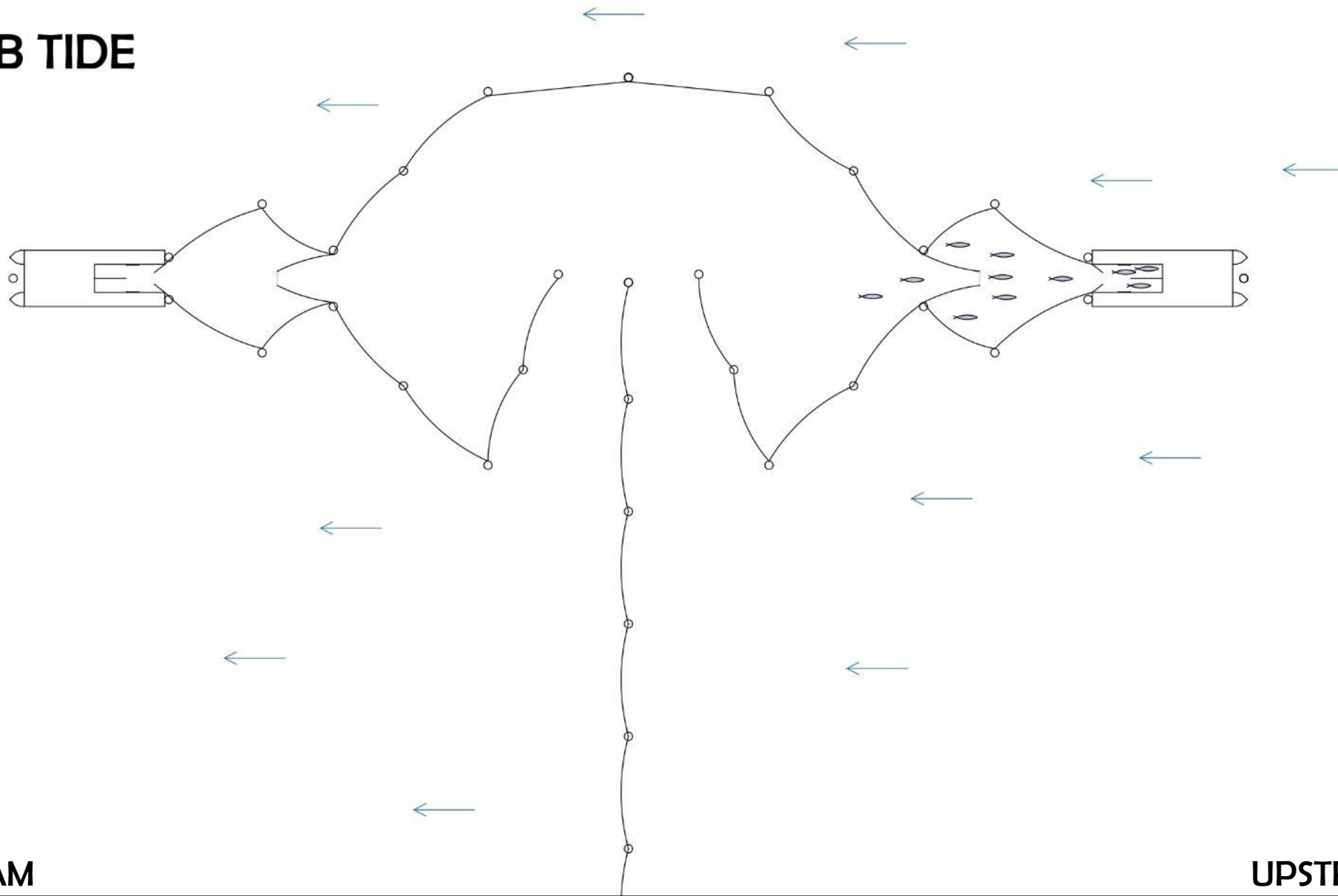
**EBB TIDE**



**DOWNSTREAM**

**UPSTREAM**

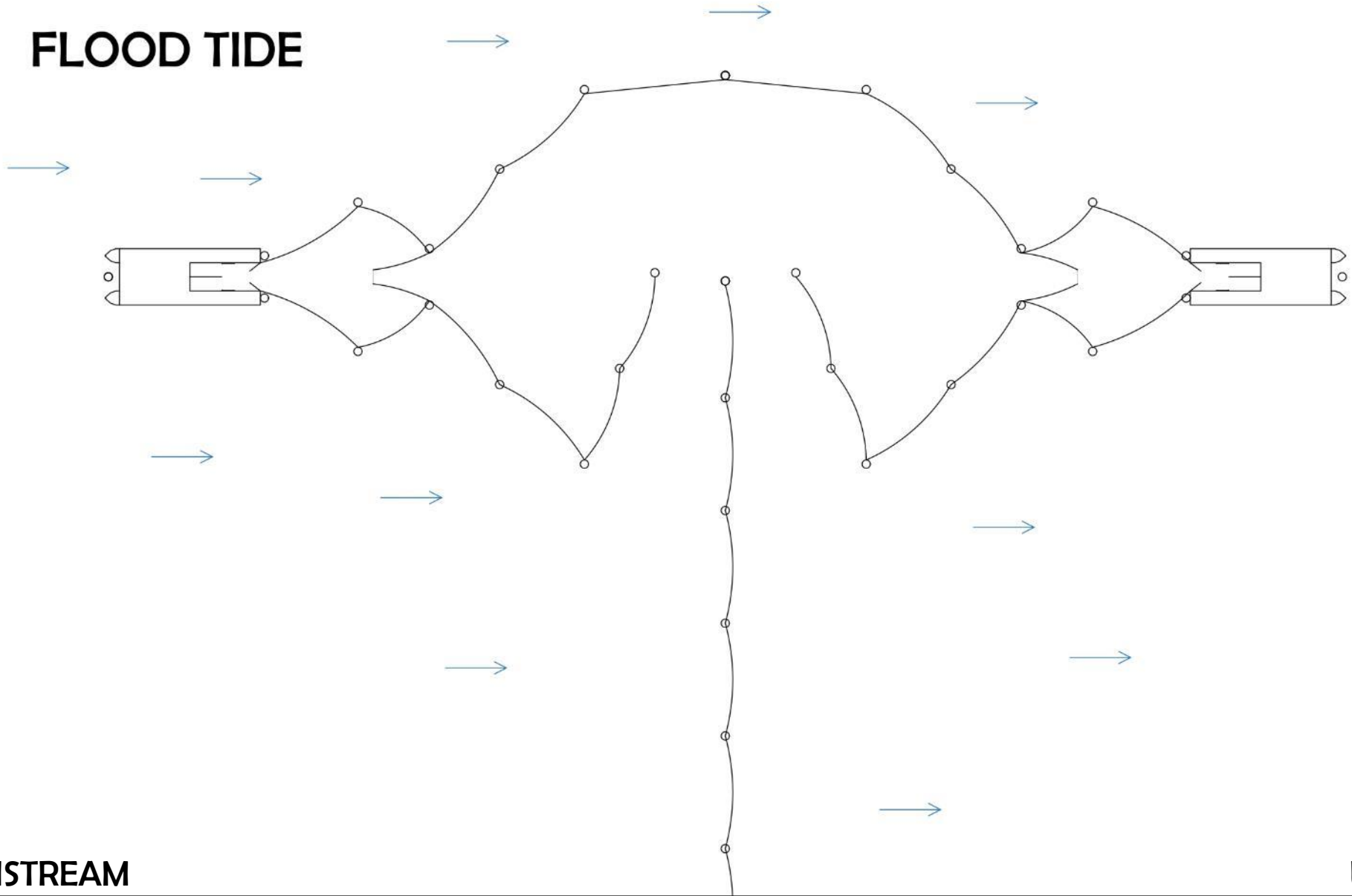
**EBB TIDE**



**DOWNSTREAM**

**UPSTREAM**

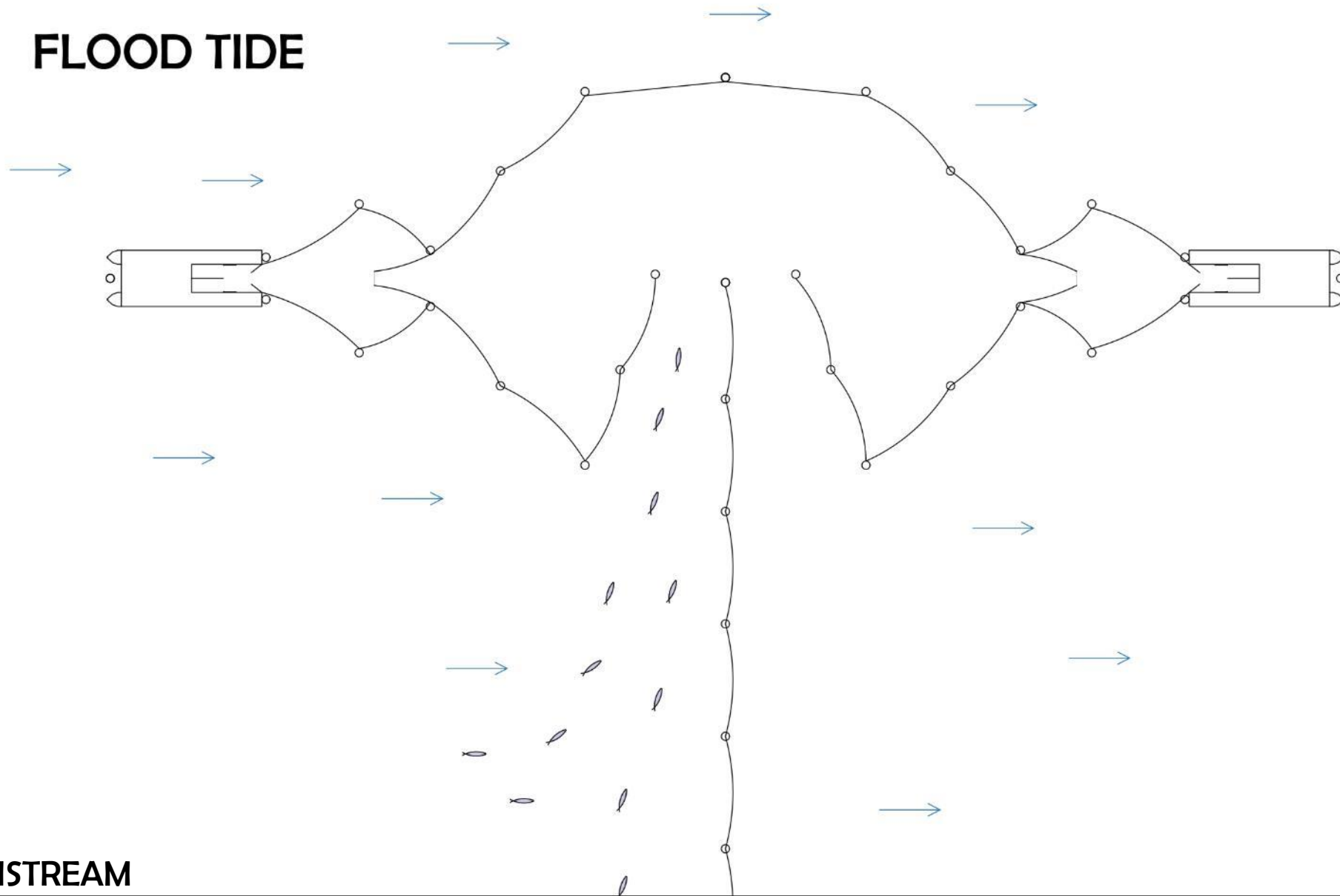
**FLOOD TIDE**



**DOWNSTREAM**

**UPSTREAM**

**FLOOD TIDE**

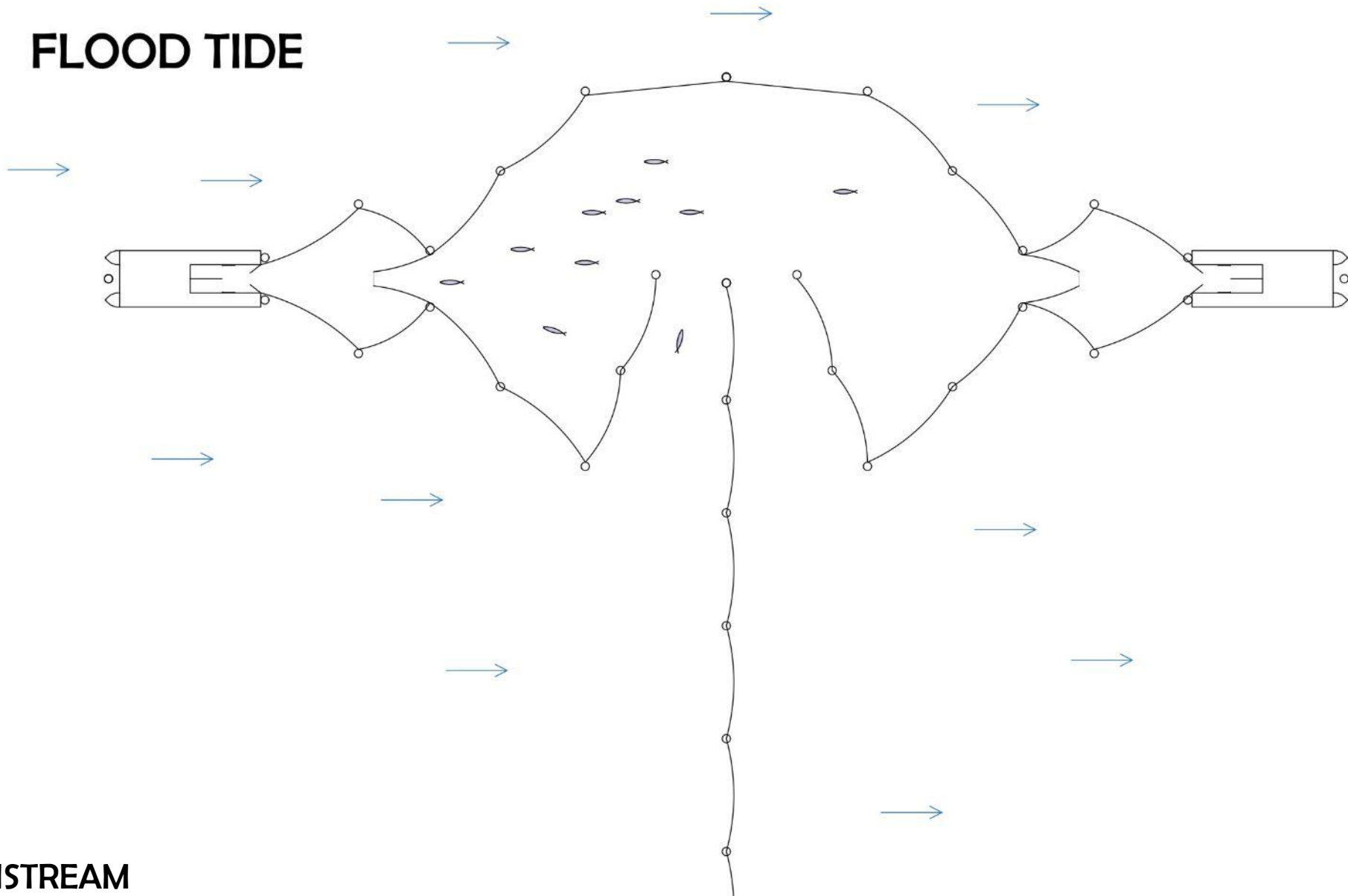


**DOWNSTREAM**

**UPSTREAM**



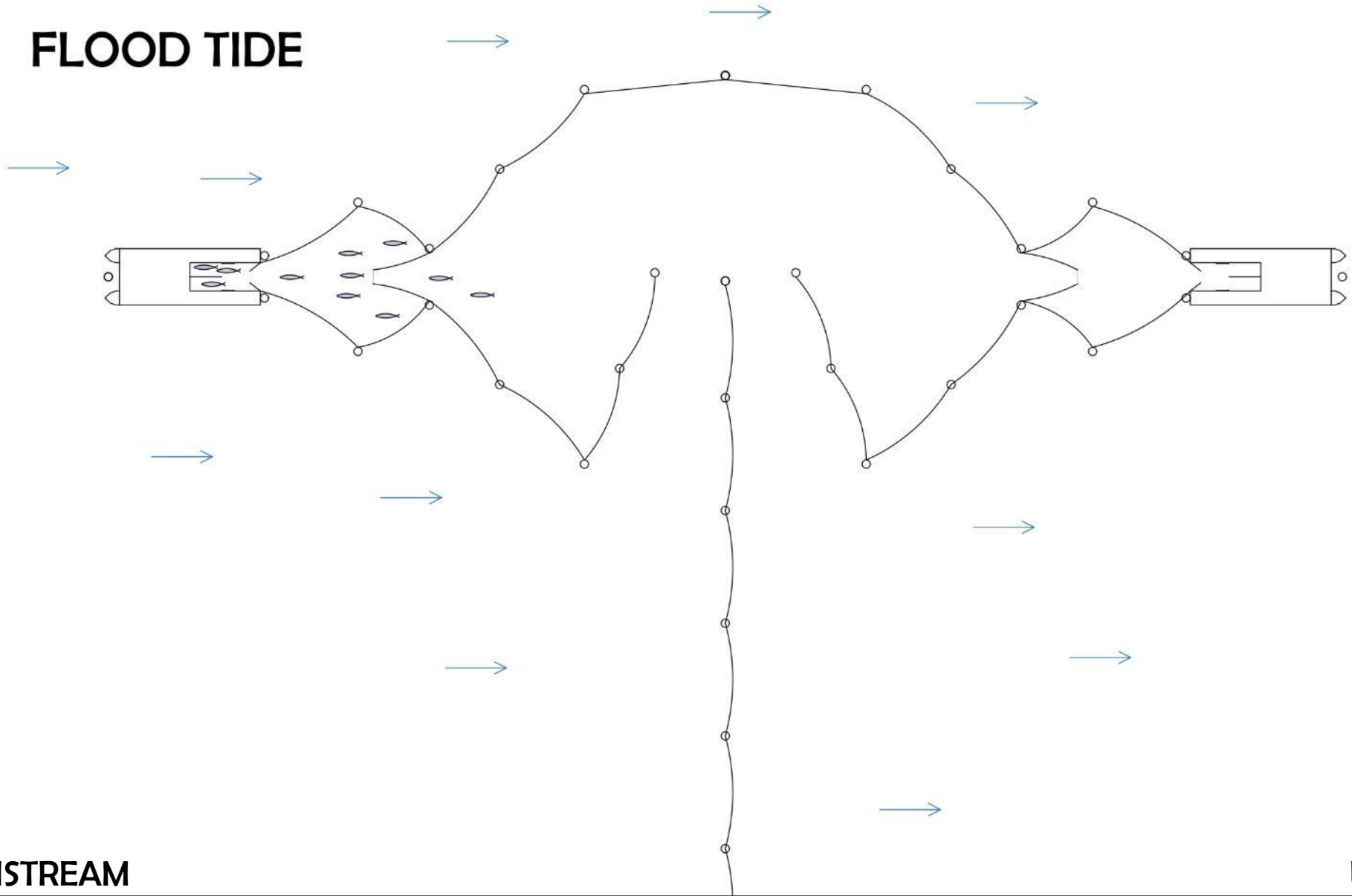
**FLOOD TIDE**



**DOWNSTREAM**

**UPSTREAM**

**FLOOD TIDE**



**DOWNSTREAM**

**UPSTREAM**

# BENEFITS OF PASSIVE OPERATIONS

- No Brailing.
- Reduced Net Contact.
- Zero Air Exposure.
- Zero Handling of Bycatch.
- No Overcrowding.
- No Burst Swimming.
- Passive Bycatch Release.



A photograph of a salmon swimming in a tank, viewed through a glass partition. The fish is positioned in the center-left of the frame, facing right. The tank's interior is visible, showing a metal grate and some equipment. The lighting is somewhat dim, and the water appears slightly murky. The right side of the image is overlaid with a green gradient containing text.

# HYPOTHESIS

Post-release survival of salmonids from passive operations with pound nets is greater than that of prototype brailing operations.

FEATURE

# Survival of Salmonids from an Experimental Commercial Fish Trap



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**John R. Skalski** | School of Aquatic and Fishery Sciences, University of Washington, Seattle, WA

**Nick J. Gayeski** | Wild Fish Conservancy, Duvall, WA

# CHINOOK SURVIVAL FROM BRAILING OPERATIONS

River Reach	Survival Point Estimate	Profile Likelihood 95% Confidence Interval
Gear to Bonneville Dam ( $\tau_1$ )	0.970	0.901 – 1.044
Bonneville Dam to The Dalles Dam ( $\tau_2$ )	1.060	0.965 – 1.166
The Dalles Dam to McNary Dam ( $\tau_3$ )	0.968	0.877 – 1.070
<b>Post-Release over 400 km Migration (<math>\tau_1*\tau_2*\tau_3</math>)</b>	<b>0.995</b>	<b>0.924 – 1.071</b>

\*Immediate Survival was 0.999,  $n=2234$

Tuohy et al. (2019)

# STEELHEAD SURVIVAL FROM BRAILING OPERATIONS

River Reach	Survival Point Estimate	Profile Likelihood 95% Confidence Interval
Gear to Bonneville Dam ( $\tau_1$ )	0.977	0.911 – 1.048
Bonneville Dam to The Dalles Dam ( $\tau_2$ )	0.983	0.935 – 1.032
The Dalles Dam to McNary Dam ( $\tau_3$ )	0.983	0.939 – 1.028
<b>Post-Release over 400 km Migration (<math>\tau_1*\tau_2*\tau_3</math>)</b>	<b>0.944</b>	<b>0.880 – 1.012</b>

\*Immediate Survival was 1.000,  $n=921$

Tuohy et al. (2019)

# WDFW / TAC ANALYSIS OF BRAILING OPERATIONS

“Median cumulative survival was estimated to be 93.5% and 94.7% for Chinook [Brights] and Steelhead respectively for the brailed treatment group.”

–WDFW/TAC (2020)

Cox and Sippel (2020)  
TAC (2020)



# SURVIVAL RESULTS FOR BRAILING OPERATIONS

<b>Study</b>	<b>Summer Steelhead</b>	<b>Fall Chinook Salmon</b>
Tuohy et al. (2019)	0.944	0.995
Cox and Sippel (2020)	0.947	0.935
<b>Mean</b>	<b>0.946</b>	<b>0.965</b>

**HYPOTHESIS: Post-release survival from passive operations with pound nets should be greater than that of brailing operations.**

ARTICLE

# Modified Commercial Fish Trap to Help Eliminate Salmonid Bycatch Mortality

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**Aaron T. Jorgenson**

*Wild Fish Conservancy, 15629 Main Street Northeast, Duvall, Washington 98019, USA*

# SOCKEYE SURVIVAL - PASSIVE OPERATIONS

River Reach	Survival Point Estimate	Profile Likelihood 95% Confidence Interval
Gear to Bonneville Dam ( $\tau_1$ )	0.983	0.942 – 1.024
Bonneville Dam to The Dalles Dam ( $\tau_2$ )	1.008	0.974 – 1.041
The Dalles Dam to McNary Dam ( $\tau_3$ )	1.033	0.995 – 1.072
<b>Post-Release over 400 km Migration (<math>\tau_1*\tau_2*\tau_3</math>)</b>	<b>1.017</b>	<b>0.974 – 1.059</b>

\*Immediate Survival was 0.994,  $n=896$

# SOCKEYE SURVIVAL - CRITFC ANALYSIS

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Treatment	Detection Rate	Relative Survival
Bonneville AFF (Control)	0.856	--
Rock Island (Control)	0.900	1.002
Pound Net (All Treatments)	0.902	1.054

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Fryer et al. (2021)

237 km, 5 day migration between Bonneville Dam (rkm 233) and McNary Dam (rkm 470)

# COHO SURVIVAL - PASSIVE OPERATIONS 2019

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<b>Holding Period</b>	<b>Survival Point Estimate</b>	<b>Sample Size</b>
Immediate ( $\tau_0$ )	1.000	$n = 3521$
48 h Post-Release Study ( $\tau_1$ )	1.000	$n = 121$

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# COHO SURVIVAL - PASSIVE OPERATIONS 2020

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Holding Period	Survival Point Estimate	Sample Size
Immediate ( $\tau_0$ )	1.000	<i>n</i> = 2075
96 h Post-Release Study ( $\tau_1$ )	1.000	<i>n</i> = 105

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# COHO SURVIVAL - PASSIVE OPERATIONS 2021

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Holding Period	Survival Point Estimate	Sample Size
Immediate ( $\tau_0$ )	0.999	<i>n</i> = 1790
144 h Post-Release Study ( $\tau_1$ )	0.965	<i>n</i> = 200

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# CHINOOK AND STEELHEAD SURVIVAL WDFW / TAC ANALYSIS

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River Reach	Median Relative Survival Estimate and 95% Confidence Interval	
	Bright Chinook	Steelhead
Trap Site – Bonneville	1.03 (0.89 -1.23)	1.02 (0.86-1.38)
Bonneville – The Dalles	1.01 (0.95-1.09)	1.01 (0.95-1.13)
The Dalles – John Day	1.03 (0.89-1.22)	1.00 (0.98-1.06)
John Day – McNary	1.00 (0.98-1.03)	1.00 (0.98-1.05)

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400 km, ~15 day migration between the trap site (rkm 70) and McNary Dam (rkm 470)



# CHINOOK AND STEELHEAD SURVIVAL WDFW / TAC ANALYSIS

“Median relative survival for the passively released pound net treatment was  $>1$  for both species in each interval from the pound net to McNary Dam, because passively released fish had higher apparent survival than the PD-7 control...

For passively released Chinook and steelhead, the recommended release mortality rate is 0%.”

–WDFW/TAC (2020)

Cox and Sippel (2020)  
TAC (2020)

# **RELEVANT SURVIVAL RESULTS FOR PASSIVE POUND NET OPERATIONS**

<b>Species</b>	<b>Post-Release &amp; Immediate Survival Data Collected?</b>	<b>Studies Completed</b>	<b>Immediate Survival</b>	<b>Post- Release Survival</b>	<b>Cumulative Survival</b>
Coho	Yes	3 Post-Release; 6 Immediate	0.9997	0.988	0.988
Sockeye	Yes	2 Post-Release; 1 Immediate	0.994	1.000	0.994
Summer Steelhead	Yes	1 Post-Release; 6 Immediate	1.000	1.000	1.000
Fall Chinook	Yes	1 Post-Release; 6 Immediate	0.9997	1.000	0.9997



The best available data and science supports the hypothesis that survival from passive operations exceeds that of obsolete brailing operations.

For combined adult salmonids, cumulative survival exceeds 99% (< 1% mortality).

This suggests that alternative gear can help address fishery constraints, improve wild salmonid survival, and remove excess hatchery fish.



# GEAR STATISTICS WITH CURRENT TAC RATES

Fishery	Data Years	Chinook			Coho			Steelhead		Harvest:Impact
		Handled	Kept	Released	Handled	Kept	Released	Handled	Wild Mortalities	Harvest Per Wild Steelhead Mortality
Gill Net	2018-2020	16,394	16,394	0	1,138	1,138	0	312	24.1	727
Tangle Net	2019-2020	794	794	0	4,498	3,733	765	77	3.3	1,372
Gill + Tangle Net	2018-2020	17,188	17,188	0	5,636	4,871	765	389	27.4	805
Pound Net	2018-2020	1,108	437	671	3,177	1,333	1,844	401	5.2	340

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# GEAR STATISTICS WITH LATEST SCIENCE

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# GEAR STATISTICS

- With a 1% mortality rate for passively operated pound nets, ~31 total pound nets could operate with the equivalent amount of impacts allocated to gillnet and tangle net fleets.
- While staying within defined impact constraints for steelhead, a fleet of 31 pound nets would:
  - Dramatically reduce mortality of wild Chinook Salmon (also ESA-listed)
  - Reduce mortality of wild Coho Salmon (also ESA-listed)
  - Remove more hatchery Chinook Salmon than the conventional fishery
  - Dramatically increase removal of hatchery Coho Salmon
- Across the board, this transition would result in conservation gains for the recovery of wild salmon and steelhead.

# GEAR ECONOMICS

Year	Fishery	Days Fished	Harvest		Total Ex-Vessel Value	Fishers (Deliveries as proxy)	Ex-Vessel Value Per Fisher
			Chinook	Coho			
2018	Zone 4-5 Gillnet	4	8320	380	\$378,454	72	\$5,256
	Zone 1-3 Tangle Net						
	Zone 2 Pound Net	32	648	509	\$24,901	1	\$24,901
2019	Zone 4-5 Gillnet	5	8148	220	\$322,144	51	\$6,317
	Zone 1-3 Tangle Net	11	676	2492	\$41,118	17	\$2,419
	Zone 2 Pound Net	36	186	1830	\$21,990	1	\$21,990
2020	Zone 4-5 Gillnet	15	32714	2813	\$1,272,433	40	\$31,811
	Zone 1-3 Tangle Net	13	911	4974	\$67,987	15	\$4,532
	Zone 2 Pound Net	25	379	1269	\$26,435	1	\$26,435

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# GEAR ECONOMICS

- With a 1% mortality rate for passively operated pound nets, ~31 total pound nets could operate with the equivalent amount of impacts allocated to gillnet and tangle net fleets.
- In the absence of added-value, 31 pound nets increases total mean ex-vessel value relative to the conventional gillnet + tangle net fishery by 9%.
- With added-value from improvements in product quality and eco-labeling certifications, a pound net fishery could result in dramatic increases in total ex-vessel value of the fishery (by doubling prices, total mean ex-vessel value would increase by ~118% annually).
- While benefiting wild salmon recovery (worth millions of dollars to taxpayers of the state), this transition would result economic gains for fishermen and coastal fishing communities.

# FUTURE RESEARCH



- Test traps in new locations:
  - Evaluate changes in bycatch encounters.
- More research of passive design:
  - Fill any remaining data gaps for post-release mortality.



# NEED FROM THE COMMISSION

- Future research has been fully funded by the WA State RCO.
- Permitting is complete at nearly all levels.
- Partnerships are established with local commercial fishers.
- Final Hurdle: WDFW support for research take coverage for fish collection and release during tagging and net pen holding studies.
- For alternative gear research to advance, we need the Commission's support for research take coverage in 2023.

# COLUMBIA RIVER SALMON FISHERY MANAGEMENT POLICY

"The Department shall seek funding, as appropriate, to support efforts to develop and implement alternative gears, and work with partners as appropriate to experiment with alternative gear, conduct any necessary studies (in such areas as release mortality, stock compositions, and economic viability), and otherwise facilitate the development of options for alternative gear use."

