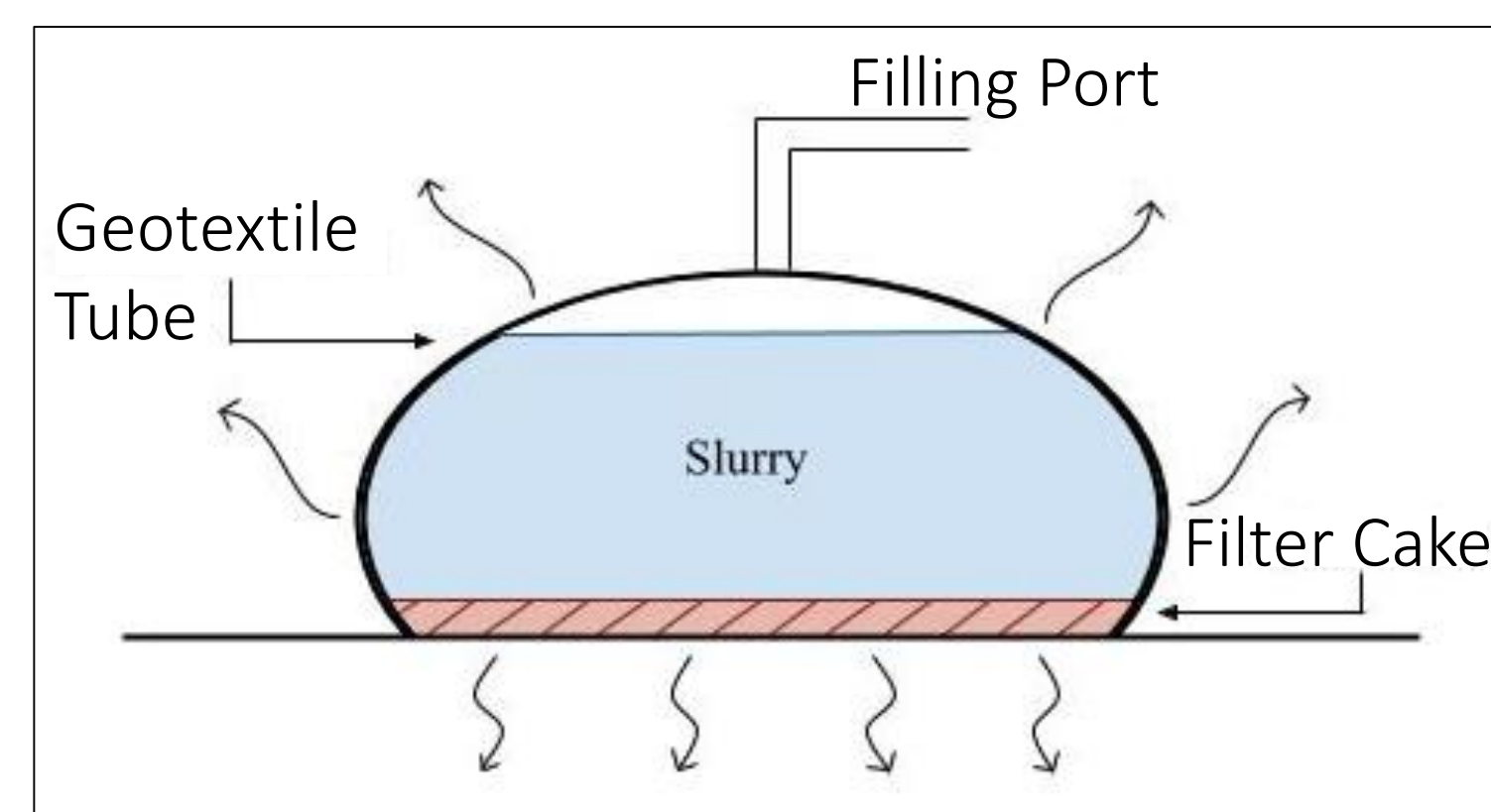


Introduction

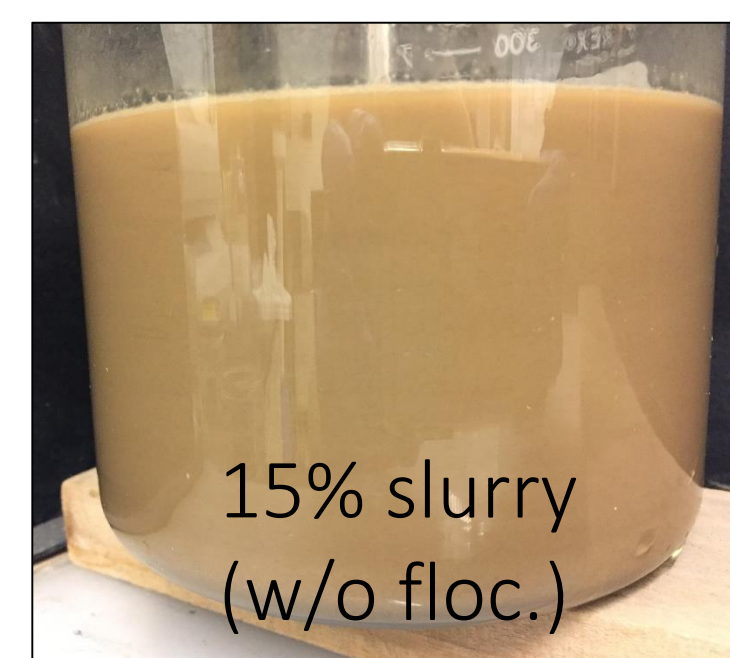
Geotextile Tube Dewatering:

- Geotextile tubes are used in dewatering applications to remove large amounts of fine particles.
- The permeable material retains fine soils and other material while allowing the water to pass.



Polymer Flocculation:

- Synthetic polymers are added to slurry material to bind fine particles together.
- This can accelerate the dewatering process and increase the percent of solids retained by the geotextile tube.
- Synthetic cationic polyacrylamide (CPAM) is used extensively in dewatering applications due to its high molecular weight and solubility in water.



So what's the problem?

- Studies have shown that a fraction of this polymer remains in the supernatant due to varying slurry concentrations. This could be harmful to aquatic life. ¹

What's being done?

- Researchers are looking for alternative, natural flocculants that are equally effective but less harmful to aquatic life. ³

Objectives

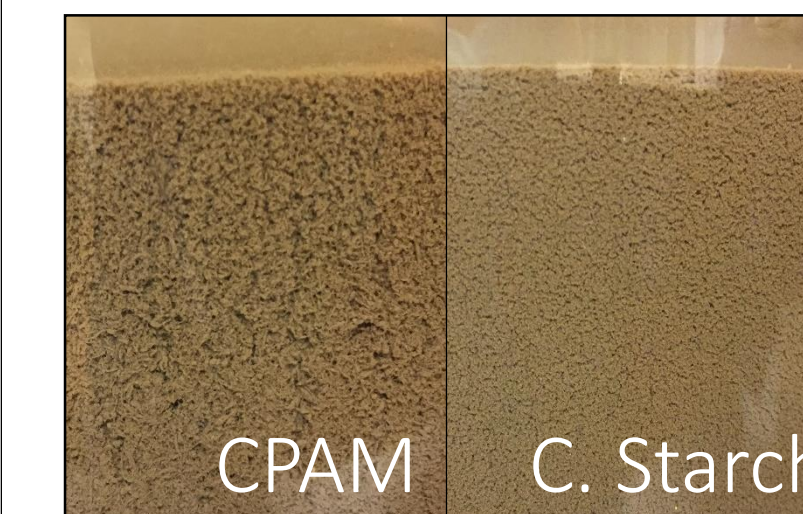
- To measure the concentration of residual CPAM and cationic starch (C. Starch) left in the supernatant of dewatered slurry
- To analyze the toxicity of CPAM and C. Starch on aquatic life

Materials/Methods



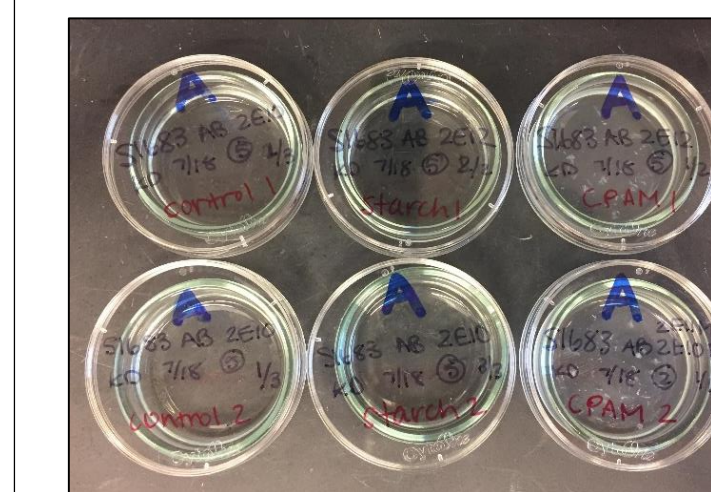
- Commercially available synthetic CPAM
- Custom prepared cationic wheat starch ²

- Polymers were added to well-graded Tully Sand and Tully Fines (22% clay-sized) in jar tests to find optimum dose.



- Samples were treated with optimum dose and a 50% overdose to measure residual polymer.

- Zebrafish (AB wild-type) were paired for mating. Embryos were collected and sorted into petri dishes (30 each).



- Dishes were treated with 3mL of either Embryo Medium (EM) or a 30 ppm solution of EM + CPAM or C. Starch.

- Embryos were examined by microscope once a day for 7 days. All phenotypes and deaths were recorded.



Results/Discussion

Optimum Dose:

Tully Fines	CPAM	55 ppm
	C. Starch	240 ppm
Tully Sand	CPAM	1.1 ppm
	C. Starch	11.6 ppm

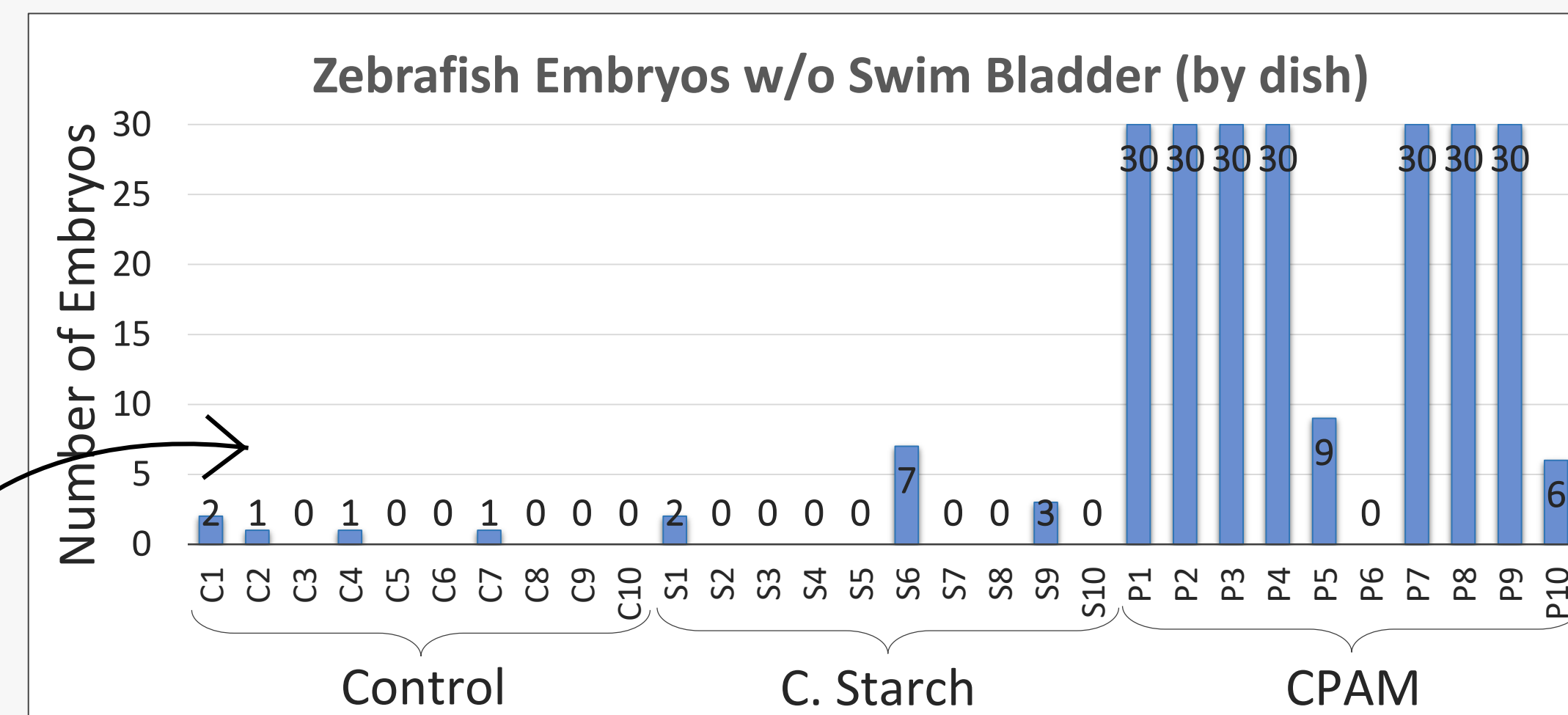
- Tully Sand requires little to no flocculant due to the very low percent of fines.
- C. Starch requires a much higher dose than CPAM. Cost, availability, and environmental impact are important parameters to consider.

Residual Polymer:

Flocculant	Optimum Dose	50% Overdose
CPAM	1.2 ppm	17.4 ppm
C. Starch	1.7 ppm	1.9 ppm

- Coarse material does not typically require dredging. Residual polymer was measured using only the Tully Fines.
- The low residual polymer at optimum dose verifies that the dose is close, but not exact.
- A 50% overdose of CPAM results in over 1/5 of the dose that was originally added (82.5 ppm).

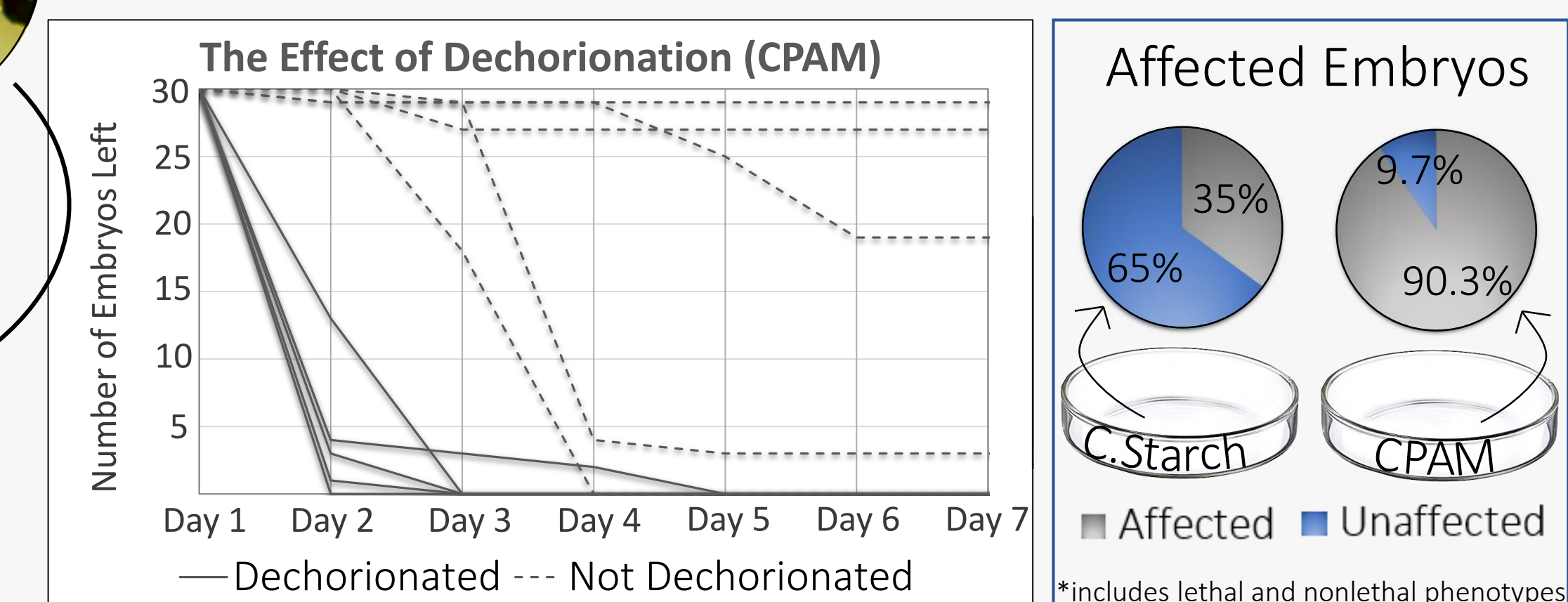
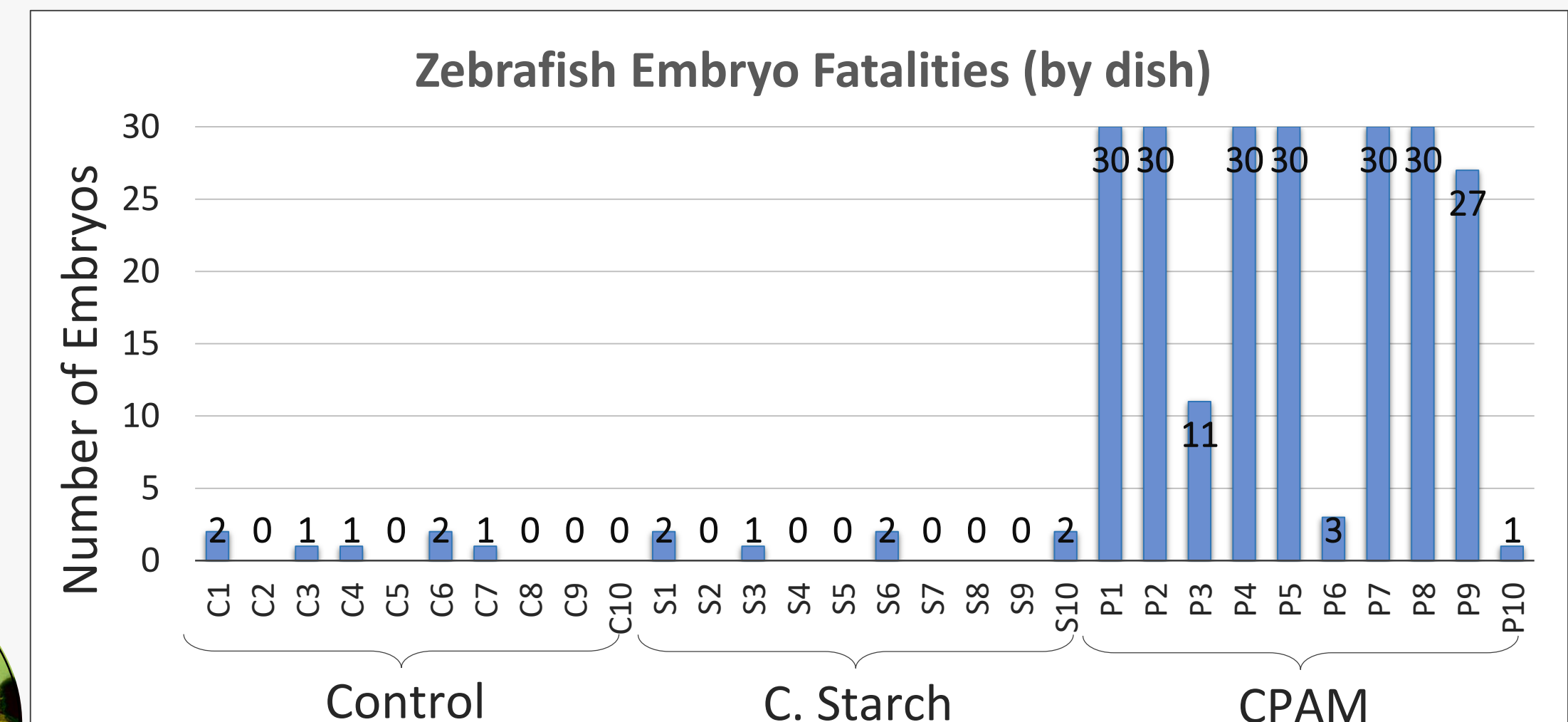
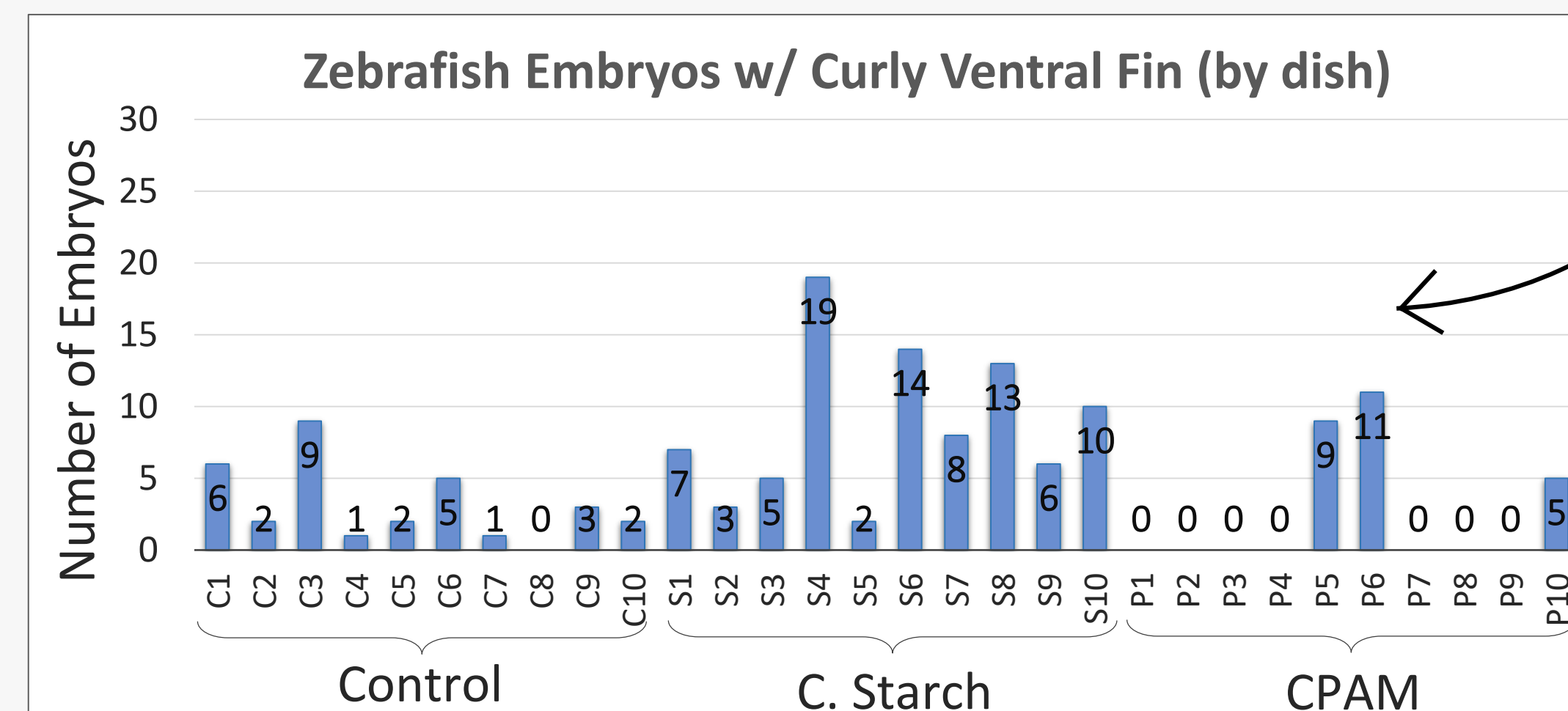
Toxicity:



- The swim bladder is used to maintain buoyancy (lateral stability). Without it, the embryo will likely not survive to adulthood (above).



- Further research is needed to determine if the curly ventral fin is a lethal phenotype (below).



- Embryos left in their chorion survive CPAM exposure longer, showing that species that do not have chorions could be more vulnerable to this polymer.

Conclusions & Future Work

- In over-dose situations, residual CPAM is present
 - Further testing for optimum dose and residual polymer should be performed (over-dose by percentages that are more common in the field)
- CPAM is highly toxic (74% of CPAM exposed embryos died, while only 2.3% for C. Starch)
 - Treat embryos with lower concentrations to locate the threshold and determine if changes need to be made in geotextile dewatering applications

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