Science Research: Sea Lion Tracking

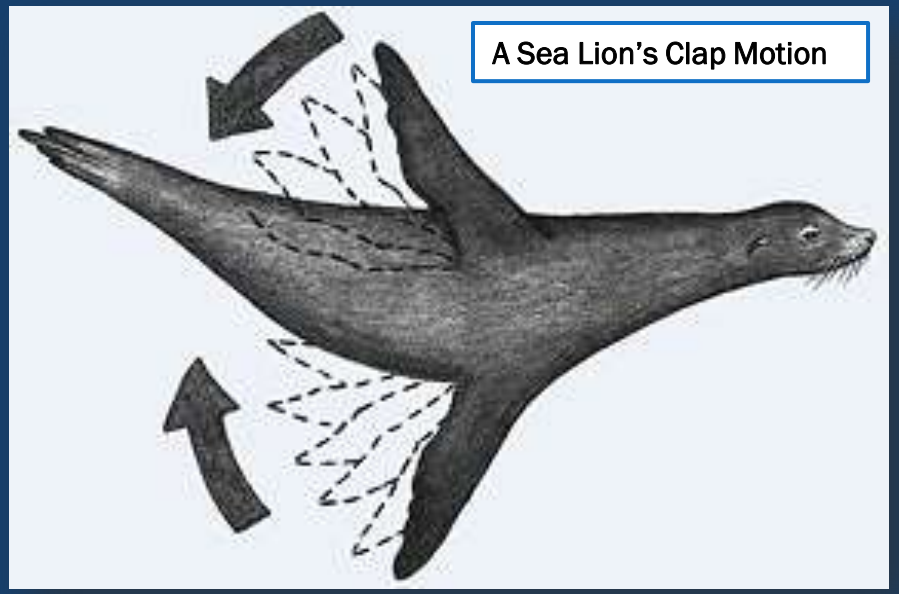
Presentation: Christine Baca

Overview

- Where?
  - George Washington University
- When?
  - June 20th – August 5th (~7 weeks)
- What?
  - Tracking Sea Lion claps using MATLAB technology, along with a few other side projects.

Sea Lion Project Overview

- Fluid dynamic research within recent years has discovered that sea lion claps (i.e. the way sea lions move through the water by clapping their fins) produces a substantial amount of propulsion force but almost no resulting wake within the water.



- The lab's goal is to analyze a sea lion's claps with the use of 3D tracking and dye visualization then to create a **robotic flipper** that replicates that movement.

What Programs Did I Use?

- Within the internship, I learned and used MATLAB, SolidWorks, and LabVIEW,

Tracking a Sea Lion's Motion Using MATLAB

IN 4 STEPS

Step One: Organize and Trim the Videos

- Sea Lion Clap Chart in Google Drive

Clap Information Final

File Edit View Insert Format Data Tools Form Add-ons Help Last edit was made on August 5 by Raina M

Arial 10

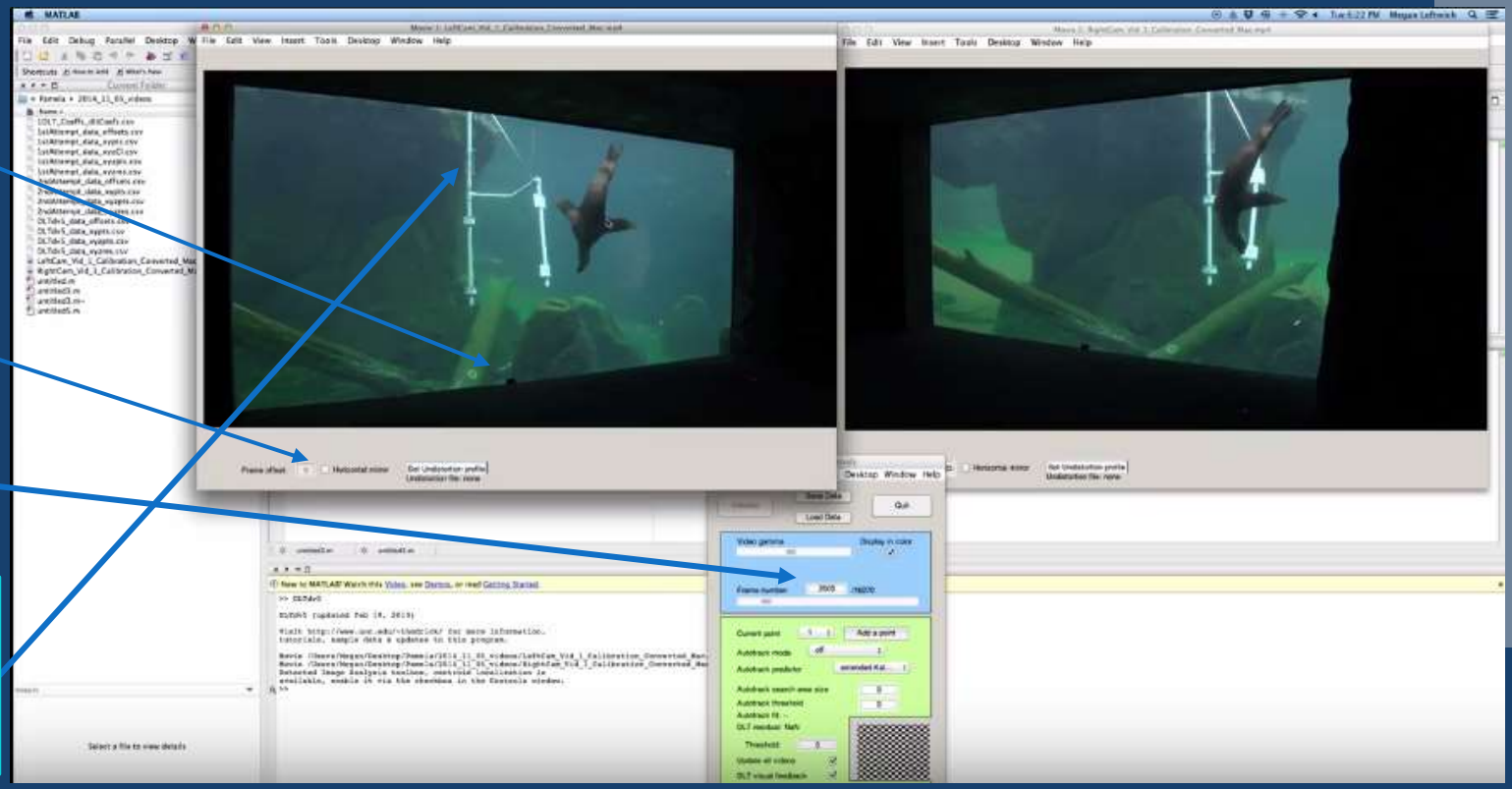
fx Tag number

	A	B	C	D	E	F	G
1	Tag number	file name	4/30/15 VIDEOS	out of ten	from motion or rest	left time cut	right time cut
2			Left1/Right1				
3			1:15/1:08	7.25/10	mo		
4			1:18/1:12	9/10, clear view	mo		
5			1:53/1:48	8/10. view from back, poor lighting but good angle,	check left		
6			2:38/2:33	8.25/10	turn		
7			3:23/3:18(half clap)		slow start, half clap	3:21.23/3:25.01	3:15.50/3:19.05
8		2015_4_30_Clap1	6:16/6:10	dark but eh	mo, half turn	6:14.55/6:18.54	6:08.92/6:12.43
9			12:27/12:42	10/10.			
10			15:25/15:28	9.5/10			
11		not right video	Left2/Right2				
12			12:14/13:11	eh facing away	motion	12:11.40/12:54.09	13:09.58/13:51

- Convert videos with an Adobe program

Step Two: Upload Camera Videos onto MATLAB

- Open MATLAB and ‘RUN’ the sea lion tracking program.
- **Calibrate** the left and right videos:



Step Three: Find the Clap Frames and Track

- Adjust frames to pinpoint clap and input points that outline the fin for every other frame of the clap's motion.

- The mathematical coefficient inputted into the program helps to define where the points align together from the two angles.

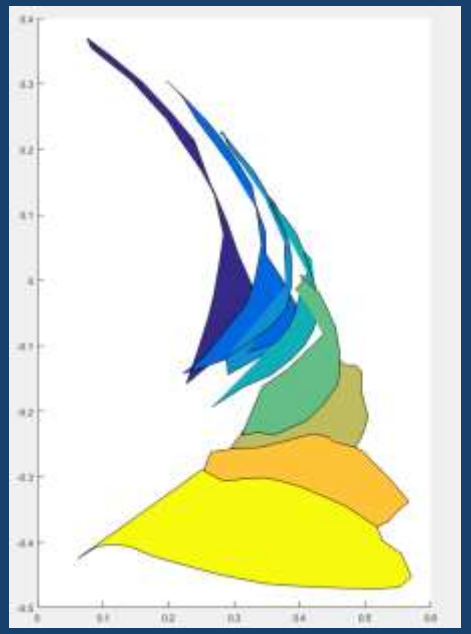
Step Four: MATLAB 3D Modeling

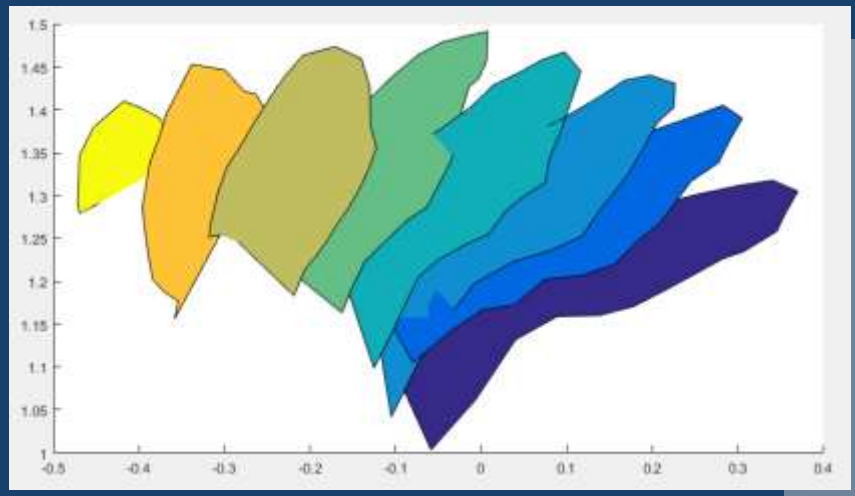
1	0.34697	-0.0586	1.003218	0.326302	-0.00631	1.062047	0.306125	0.040018	1.131865	0.289033	0.0887
2	0.413266	-0.07972	1.104956	0.394053	-0.03774	1.140304	0.373307	0.001214	1.166449	0.348167	0.0398
3	0.36083	-0.10505	1.041741	0.36181	-0.07349	1.105285	0.368101	-0.03904	1.157408	0.378799	-0.008
4	0.338255	-0.12534	1.098549	0.357145	-0.10829	1.131716	0.367261	-0.0903	1.169859	0.382172	-0.072
5	0.342833	-0.16267	1.163324	0.360522	-0.15091	1.192712	0.382428	-0.13561	1.2236	0.408018	-0.110
6	0.322095	-0.2187	1.183086	0.3596	-0.20604	1.213732	0.379964	-0.19266	1.229821	0.399648	-0.180
7	0.264601	-0.26231	1.333183	0.300981	-0.25696	1.344929	0.338084	-0.25547	1.350897	0.366816	-0.248
8	0.251184	-0.2893	1.37225	0.282557	-0.30677	1.375955	0.317196	-0.30335	1.372372	0.344233	-0.30

- Save Data as an Excel File
- Load into MATLAB 3D Modeling Program
- Convert!

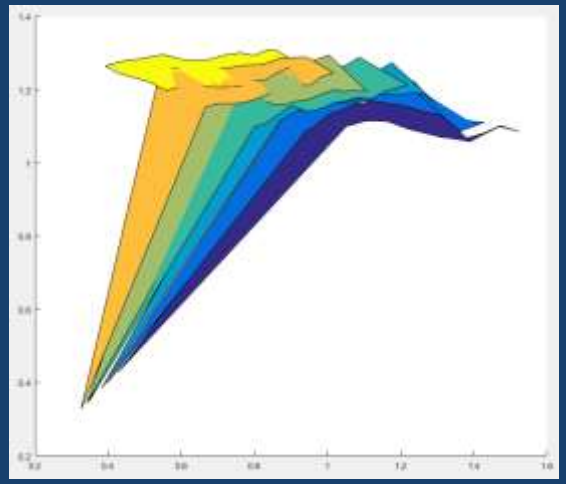
Step Four [Part Two]: THE RESULT! A Good Clap vs. Bad Clap

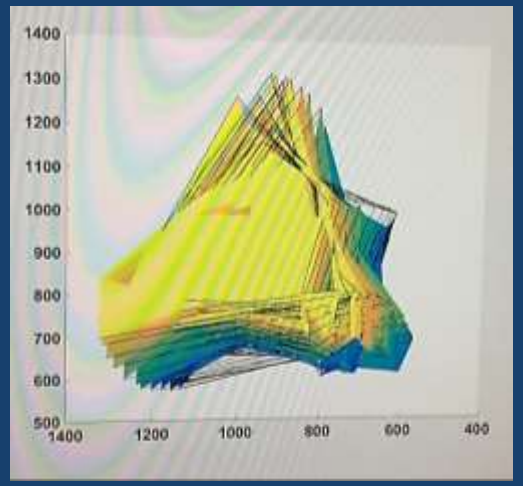
Good Clap





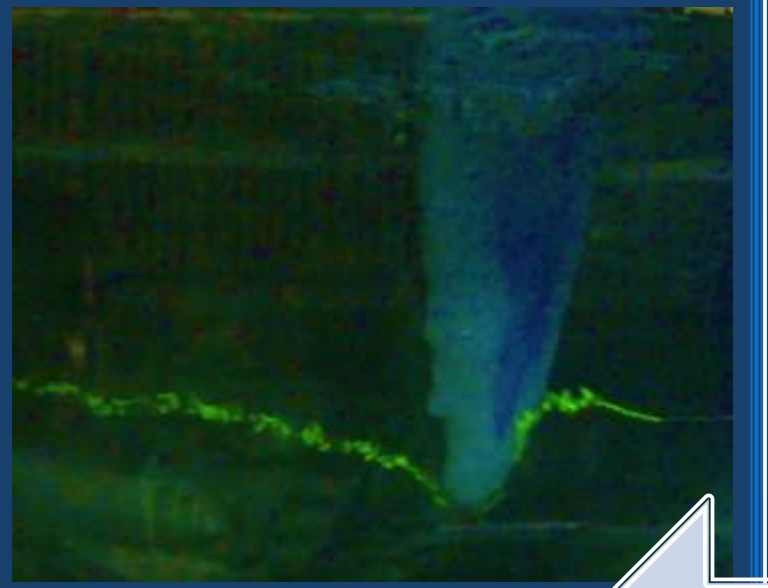
BAD Clap

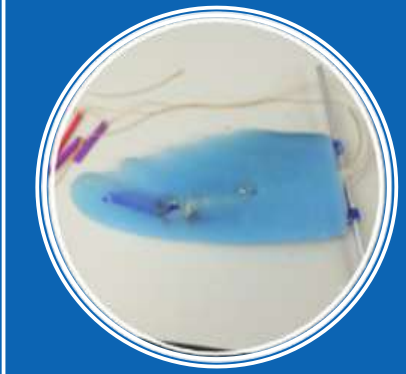




Dye Visualization & Making a Sea Lion Flipper

Dye Visualization: "a method for investigating biomechanical flows"





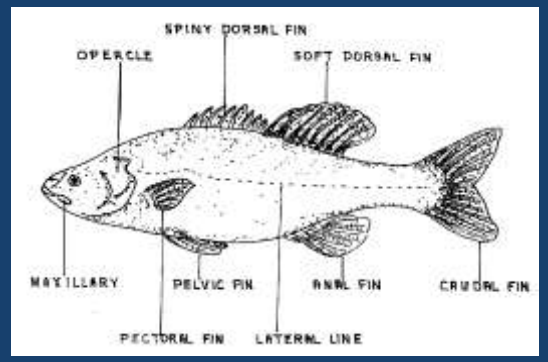
Flipper!

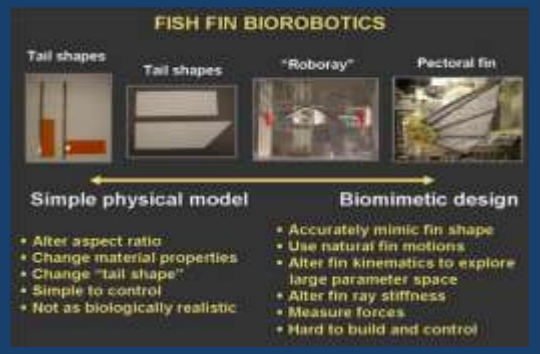
Mold

Coating Material

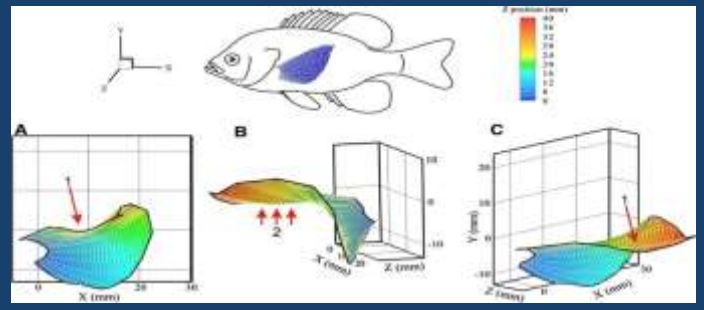
Skeleton

Side Projects:





- Used LabVIEW and SolidWorks to tinker with Dynamic Simulator on Human Birth, a mechanical uterus used to test and simulate the fluid dynamics of childbirth.
- Created a power point overview of a research paper about swimming hydrodynamics research
- Adventured in GW's Machine Shop



Lessons Learned

- Be flexible, diligent, and be sure to go back and fix mistakes
- Be **open-minded** to learn different things
- Do not be afraid to go to IT

- **Communicate** with your co-workers (i.e. grad students, fellow interns, and post-doc)
- Write good lab reports!
- *Love sea lions!*

Thank you!

- Dr. Megan Leftwich
- Graduate Students: Aditya and Alexa
- Fellow Intern: Raina
- George Washington University
- Holton-Arms STEM Scholars program