

CALIFORNIA SCIENCE & ENGINEERING FAIR 2018 PROJECT SUMMARY

Name(s)	Project Number
Kenneth Bevens; Dean Braza; Daniel Perez	
	38757
Project Title	
Fractal Patterns: Fish Movements	$\mathcal{N}(\mathcal{M})$
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Objectives/Goals Abstract	
Fish have been used as the test subject in many scientific psychological studies	They are used as a base of
animal behavioral research. The objective of our project is to determine what the movements, commonly known as repeated movements, is to the number of sish	e relation of fractal
light as to why fish are used so commonly in animal behavioral spearces.	. The goal is to shed more
Methods/Materials	7
The experiment was conducted by filming one-minute videos of various fish so numbers in order to observe their repeating movements. Each fish was observed	ecies and in various
period and the number of times that a fish repeated a movement was documented	ed. A variety of graphs
were made to find the best representation of the pattern. The material included	the fish in the fish tanks, a
recording device (iPad), and graphing software (Desmos). Results	
Upon analyzing the graphs, it was found that the quadratic graph fit the pattern the amount of repeated movements (fractal patterns) increased exponentially co	the best. This meant that
the amount of repeated movements (fractal patterns) increased exponentially co fish.	mpared to the number of
Conclusions/Discussion	
Based on the information gathered, the conclusion had been hade that fish repe	at their movements more
when more fish are present. Scientists have been using fish as a source of anima decades. This experiment shows the extent of the behavior of fish which has no	t been seen before. Since it
is now known that the amount of fractal movements increases exponentially wi of fish, scientists and mathematicians alike can now use this data to make equat	th the increasing number
of fish, scientists and mathematicians alike can now use this data to make equat behavior and the patterns they make.	ions regarding fish
behavior and the patterns they make.	
Summary Statement	stal natterns in fish
The observation of fish movements in relation to fractal patterns shows that frac movements exponentially increase with the number of fish.	ctal patterns in fish
Help Received	
We obtained help from our Algebra/Trigonometry teacher, Kristina Horan. She	offered advice on how to
display and represent our data.	