

Problem Statement and Key Questions

Problem definition

The population of the invasive signal crayfish is increasing rapidly which is harming the ecosystem and biodiversity as they consume the surrounding aquatic life. They also damage public infrastructure by burrowing into the riverbanks. Current crayfish trapping methods are not very effective. Therefore, it would be beneficial if scientists had a reliable way to locate and monitor the female signal crayfish.

Impact

Increase in the population of the invasive signal crayfish species is harming the biodiversity of the ecosystems. As these signal crayfish carry the “crayfish plague”, the population of the native white claw crayfish has drastically reduced since this disease is lethal to them (UCL, 2020). The population of white claw crayfish has already been reduced by 90% in several English counties, making them vulnerable to extinction (Pritchard, 2020). Furthermore, it has been observed that 90% of the periphyton biomass has been reduced in areas where the density of the signal crayfish is only 1.8/m². As a result, many scientists and wildlife conservationists are desperately trying to keep the numbers of signal crayfish under control and stop them from harming the environment (Vaeßen and Hollert, 2015).

Another ongoing global issue is that there is a demand for more sustainable fishing. According to an article by the Marine Conservation Society, every year around 207 million tonnes of CO₂ is emitted into the atmosphere by fishing vessels (Marine Conservation Society, 2021). Therefore, many fishermen need to know where certain types of crayfish are located as well as the best method to catch them.

Timeframe, location, trend

American signal crayfish were introduced to Britain during the 1970s for commercial breeding. The crayfish managed to escape the farms and spread throughout the British rivers (www.britishfoodinamerica.com, n.d.). Since then, they have been increasing in population at an alarming rate due to female signal crayfish laying between 200 and 400 eggs (Inland Waterways, 2017).

Goals

Scientists want to reduce the number of signal crayfish as much as possible so that the existing ecosystem is not harmed and help increase the population of the native, white-clawed crayfish. Furthermore, helping fishermen catch the signal crayfish will also reduce the overall population of the signal crayfish. Reducing the population of invasive crayfish will help the government financially as there will be less damage to riverbanks thus they do not need to be mended as frequently.

Vision and future needs

Scientists and fisherman can use the data analysis tool to track other species of marine wildlife if suitable data is provided. Fisherman, in particular, can make good use of it because they would have an easier time catching fish if they knew beforehand where specific types of fish are located. This would also improve the sustainability of their fishing because they would use less fuel and reduce their carbon footprint. Furthermore, scientists can apply the same tool to prevent extinction of other species.

Techniques

A key part of solving this problem involves identifying which fish in the data set are signal crayfish. For this reason, a cluster analysis can be used to first identify key features of signal crayfish and then discover which sites these crayfish are likely to be located in. This analysis should make use of a validation and test set as well as a clustering algorithm. Utilizing machine learning tools such as these will make analysis easier, and help our stakeholders find the answers quicker. Additionally, these tools can be replicated in future projects that scientists take on, further emphasizing the importance and long-term impact solving this problem would have.

Limitations

In order to have the most up-to-date monitoring tool, there is a need for frequent updates on the data, which may mean sourcing data from third party organizations. Furthermore, it would be useful to have crayfish data collected from multiple sites across the globe, instead of just a few sites.

Persona 1

Lisa Dafif

age: 37
residence: London
education: PHD in Ecology
occupation: Researcher at UCL
marital status: Single



“Let’s preserve our ecosystem!”

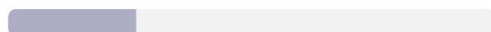
Spends most of their time in the lab and doing research on sites.

Comfort With Technology

INTERNET



SOFTWARE



MOBILE APPS



SOCIAL NETWORK



Criteria For Success:

- Carrying out research that has a positive impact on the environment
- Protecting the endangered creatures
- Change the world for the better
- Controlling the population of signal crayfish

Needs

- Easy model for data analysis
- Easy collaborations with other experts
- Giving useful advice the government to tackle problems

Wants

- Focus on theoretical research
- Work from a lab
- Giving useful advice the government to tackle problems
- locating areas in the uk with high population of female crayfishes

Values

- Using time effectively
- Data which is easy to be obtained

Fears

- Letting signal crayfish get out of control
- Signal crayfish making native crayfish extinct
- Coding



Persona 2

Alex

age: 48
residence: London
education: GCSE
occupation: Crayfishermen
marital status: Married

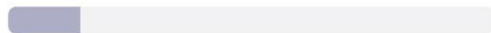


"I want more crayfishes!!"

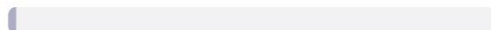
24/7 trapping crayfishes

Comfort With Technology

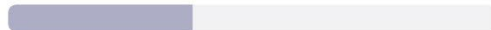
INTERNET



SOFTWARE



MOBILE APPS



SOCIAL NETWORK



Criteria For Success:

- Making a large enough profit for my business
- Minimising resources used for catching crayfish

Needs

- Catching enough crayfishes which meets the standards for selling
- Identifying the white-clawed crayfish which is legally protected

Wants

- Catching more crayfishes
- Catching bigger crayfishes
- The most effective trapping method

Values

- Money
- Quality of crayfishes
- Catching fish sustainably

Fears

- Not having enough crayfishes for selling

**The Crayfish
Company**

Key questions

- 1) Which sites are at a high risk due to large populations of signal crayfish?
- 2) What is the best method to capture female signal crayfish?
- 3) What is the average size and weight of these crayfish?
- 4) What percentage of crayfish are female? (the demographic)
- 5) Where is the best site to catch specific types of signal crayfish?

References

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www.britishfoodinamerica.com. (n.d.). The Crawfish Problem in England - British Food in America. [online] Available at: <https://www.britishfoodinamerica.com/A-Seasonal-Number/the-lyrical/The-Crawfish-Problem-in-England/#.Y1vwJHbMKUk> [Accessed 28 Oct. 2022]

Inland Waterways. (2017). Crayfish in canals and rivers. [online] Available at: <https://waterways.org.uk/about-us/news/signal-crayfish>.

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Vaeßen, S. and Hollert, H. (2015). Impacts of the North American signal crayfish (*Pacifastacus leniusculus*) on European ecosystems. *Environmental Sciences Europe*, 27(1). doi:10.1186/s12302-015-0065-2.

Marine Conservation Society. (2021). Climate smart fisheries: our new report. [online] Available at: <https://www.mcsuk.org/news/getting-climate-smart-our-new-fishery-report/#:~:text=Directly%20from%20fishing%20vessels%20%2D%20globally> [Accessed 28 Oct. 2022].