Disease and abnormal behavior in fish farms

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INTRODUCTION

- Fish is a major component in global food supply. It makes a big impact in economy. It is considered to be one of the main resources for countries income. As a living organism, fish suffer from various diseases. Diseases are the most major cause for fish death.

- Prediction and detection of fish disease is always related to fish behaviors, that's why it is important to analyze these behaviors [11]

MAPS

Top Countries five For Aquaculture Production[1]
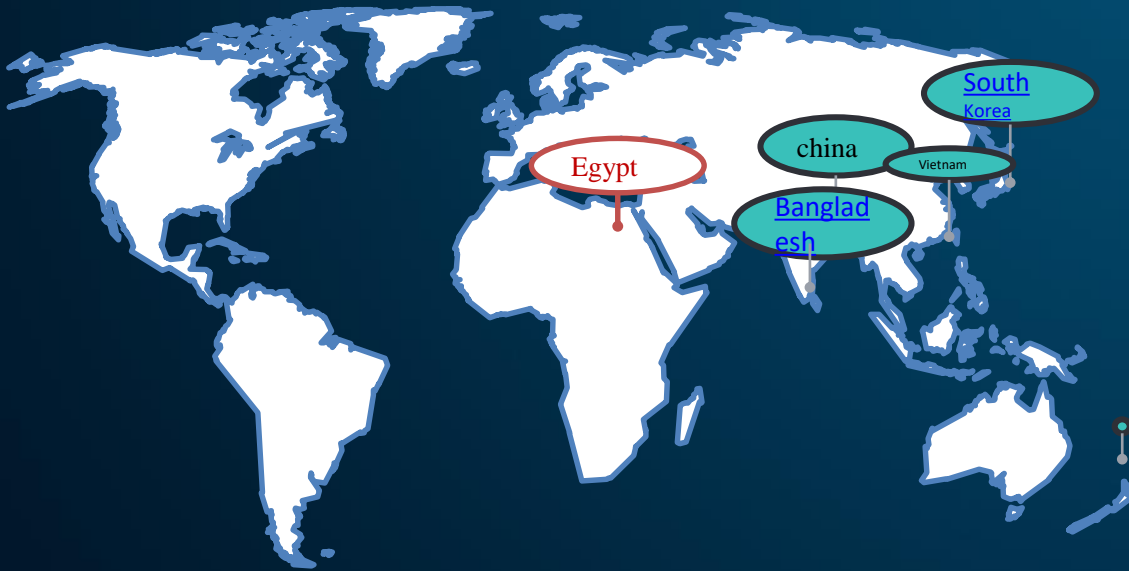
China	63.7 million metric tons produced.
Vietnam	has an output of about 3.6 million metric tons of aquaculture produce annually
Bangladesh	about 2.2 million metric tons of aquaculture produce annually
South Korea	about 2.2 million metric tons of aquaculture produce annually
Egypt	about 1.4 million metric tons of aquatic farming produce.

Background 1/8

There are difference types of ponds are earthen ponds, concrete ponds, floating cages. These ponds are categorized to either extensive or intensive.[2]

Extensive pond

Intensive pond

1)Earthen ponds

2)Tank – indoor systems

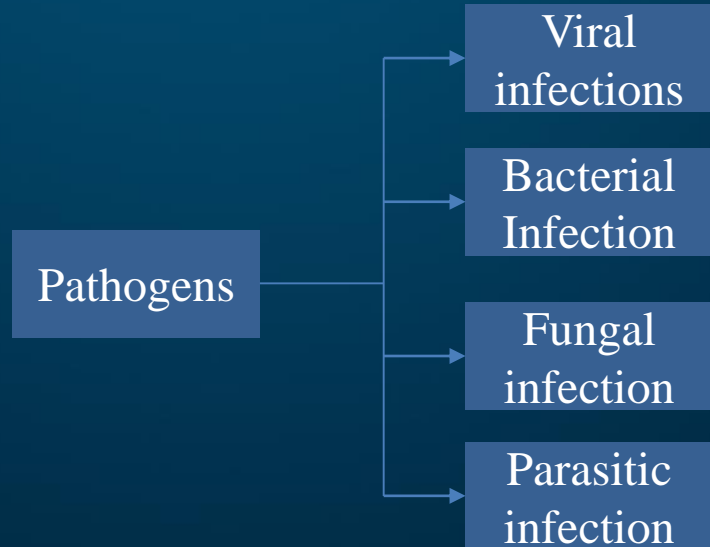3)Integrated recycling system

4)Cage ponds

Background 2/8

Fish diseases are classified into two categories[4]:

Non-infectious disease

- Pollution of water
- Other environmental diseases may occur due to the low dissolved oxygen, high alkali, high nitrite

Infectious diseases[3]

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                              ┌─ Viral infections
                              │
                              ├─ Bacterial Infection
Pathogens ────────────────────┤
                              ├─ Fungal infection
                              │
                              └─ Parasitic infection
```

Viral Infections

Carp pox

koi herpesvirus (KHV)

Viral hemorrhagic septicemia (VHS)

Fungal Infections

Saprolegniasis

Ichthyophonus (ICH)

Epizootic ulcerative syndrome (EUS)

Background 5/8

Bacterial Infections

Motile aeromonas septicemia (MAS)
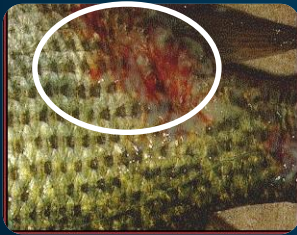
Columnaris disease
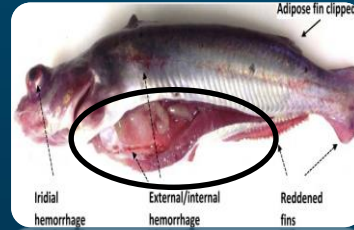
Vibriosis

Streptococcus

Background 6l8

Parasitic Infections

Trichodiniasis
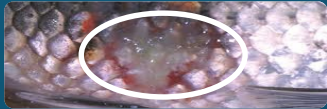
Metazoan parasites

[5]

Disease	Description	Symptoms	Figure
Ichthyophthirius (Ich)	It affects fish that are stressed.	It appears on the body, fins and gills of fish as white nodules of up to 1 mm.	
Motile Aeromonas septicemia (MAS)	MAS is almost appears in freshwater.	Hemorrhage at fins and on the skin	
Saprolegniasis	1)Saprolegnia is a genus of water moulds . It effects on fish and fish eggs	Cotton moulds(white or grey fibrous patches they form like "Wool)	
Columnaris	Its a fungal infection. Results from an infection caused by the "Gram-negative".	Causing frayed and ragged fins.	
Epizootic ulcerative syndrome (EUS)	It is a disease caused by a fungal pathogen called Aphanomyces invadans.	Red spots appear and are hardly identified	

Background 8/8

Sign of abnormal behaviors[6]:

- Trouble Swimming
- Flashing
- Fast Movement
- Heaving at the Surface

Challenges

1) Previous approaches:
- Concerns on diagnosing one disease at time or on one odd behavior.
- Without specification of diseases.

2) There is no published public dataset → Fish4knowledge [] only
and the site is for sale.
3) Color segmentation approaches→ Specify 1 odd color
4) Limited human vision due to earthen ponds.
5) A lot of measurements should be controlled.
6) Inaccurate Segmentation (As Color Segmentation).

Problem Statement

- Building hybrid system

Track different behaviors and classification of five different diseases

- Embedded System

The world market control fish farms manually, the market is in bad need to automatic system
 Send notification to ponds farmers

- Support of computer vision techniques to solve any limitation due to earthen ponds / fast movement.

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Motivation 1/3

- Fish have great importance in the annual revenues of the country. Global fish production reached about 171 million tons in 2016.

- Huge loss of production in aquaculture is occurring. For instance, in Egypt. The annual loss of revenues because of fish disease reaches up to 6 billion dollars. [12]

Motivation 2/3

Between 1961 and 2016, the average annual increase in global food fish consumption (3.2 percent) and population growth (1.6 percent)[7].
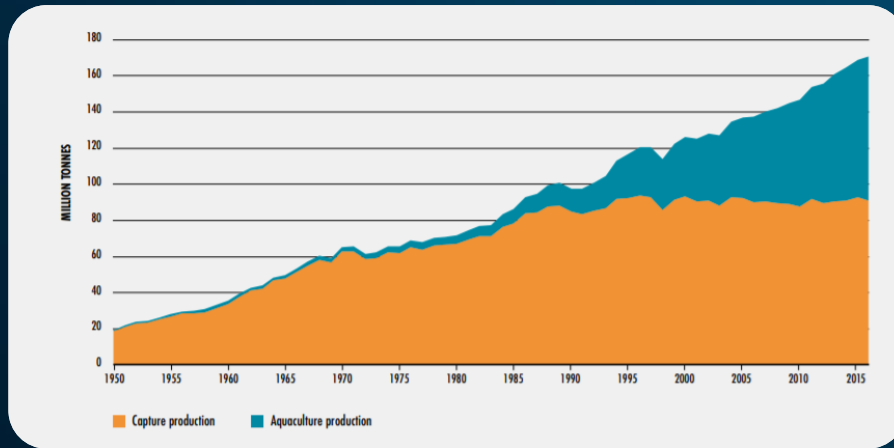
Motivation 3/3

In Egypt, The intensive aquaculture farming has grown increasingly, especially in the deserts of northern Sinai. Fish farms are distributed through the Nile Delta region and concentrated mainly in the Northern lakes[8].
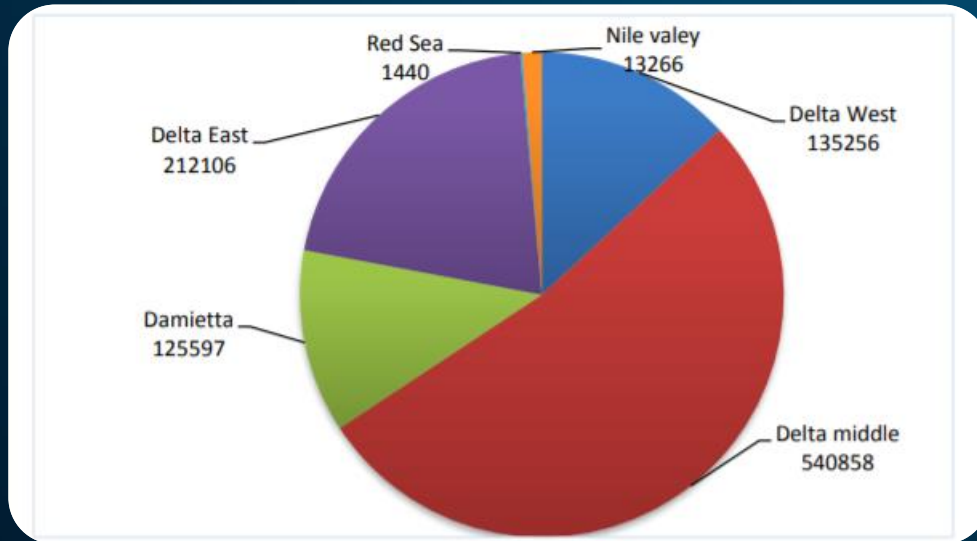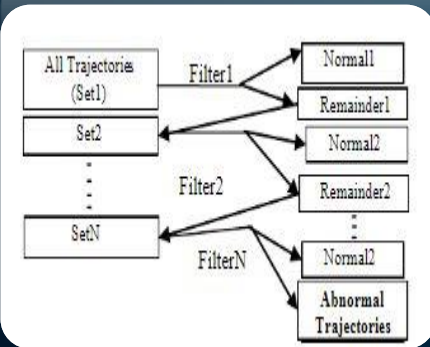
Similar System Description

[13]
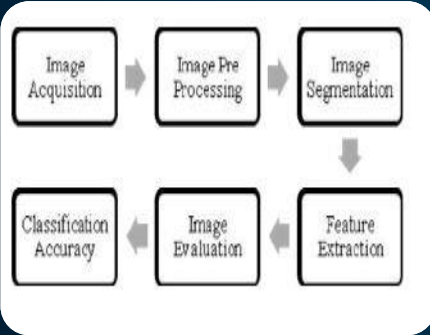
[15]
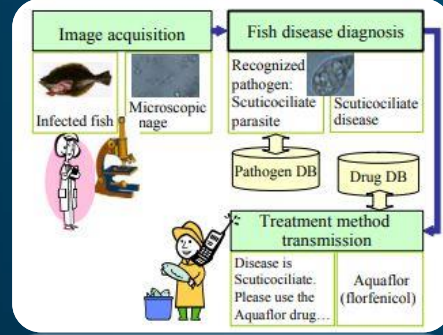
[14]
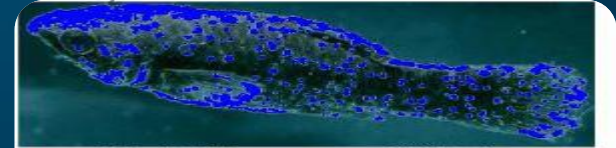
Fig. 5a Disease area on fish body
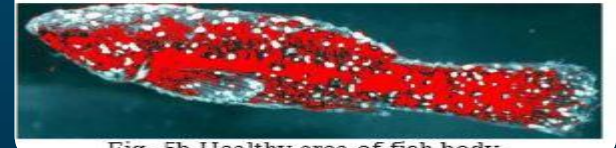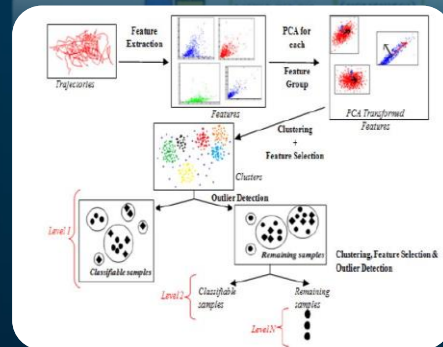
Fig. 5b Healthy area of fish body

[16]

[17]

| System	Function	Data	Algorithms	Accuracy
[13]	Automatically detects or diagnoses the EUS diseased fish	Images of the EUS infected fish collected from sources as NGRF, Lucknow and CIFRI.	1)Canny's edge detection algorithm 2)Fast algorithm 3)PCA 4)Neural Network	86 %
[14]	Detect infected areas on fish body	Images of diseased fish as White Spot disease which are available for public internet access	Color image segmentation	28.93%
[15]	Extract pathogen area from the microscopic images of infected fish and sending notification about diagnosed disease and treatment to the fish farmers	Microscopic images of diseased fishes collected from National Bureau of Fish Genetic Resources (NBFGR, Lucknow) and ICAR-Central Inland Fisheries Research Institute (CIFRI), Kolkata.	1)3x3 mean filter and edge sharpening filter 2)Morphological erosion and dilation operations 3)Polar and geometric feature 4)PCA	90%
[16]	Understanding fish behaviors by extracting normal behavior and then identifying abnormal behaviors	Videos of normal and abnormal behavior from fish4knowledge		38% Normal 13% Abnormal

System	Function	Data	Algorithms	Accuracy
[17]	Present an approach to detect abnormal fish trajectories	93 different videos from fish4knowledge.	Hierarchical method using outlier detection, CSS feature , Moment Descriptors feature	TBR: 0.88±0.02 TNR: 0.94±0.1 Gro.MeanTPNR: 0.91±0.05
[18]	Detects or diagnoses the EUS disease fish	Fish effected with (EUS) were collected from the different part	1)PCA 2)K-Means Clustering 3)HSV	Greater than 90% using PCA
[19]	Classification of fish species	Images from fish4knowledge	1)CNN 2)Gaussian Blurring, Morphological Operations, Otsu's Thresholding and Pyramid Mean Shifting	96.29%
Our System	Detect diseases through abnormal behavior	Collecting our own data (extract images from videos)	1) Hog 2) Fast 3) Color Segmentation 4) PHOG 5) K-NN 6) PCA 7) SVM or CNN	

Project overview
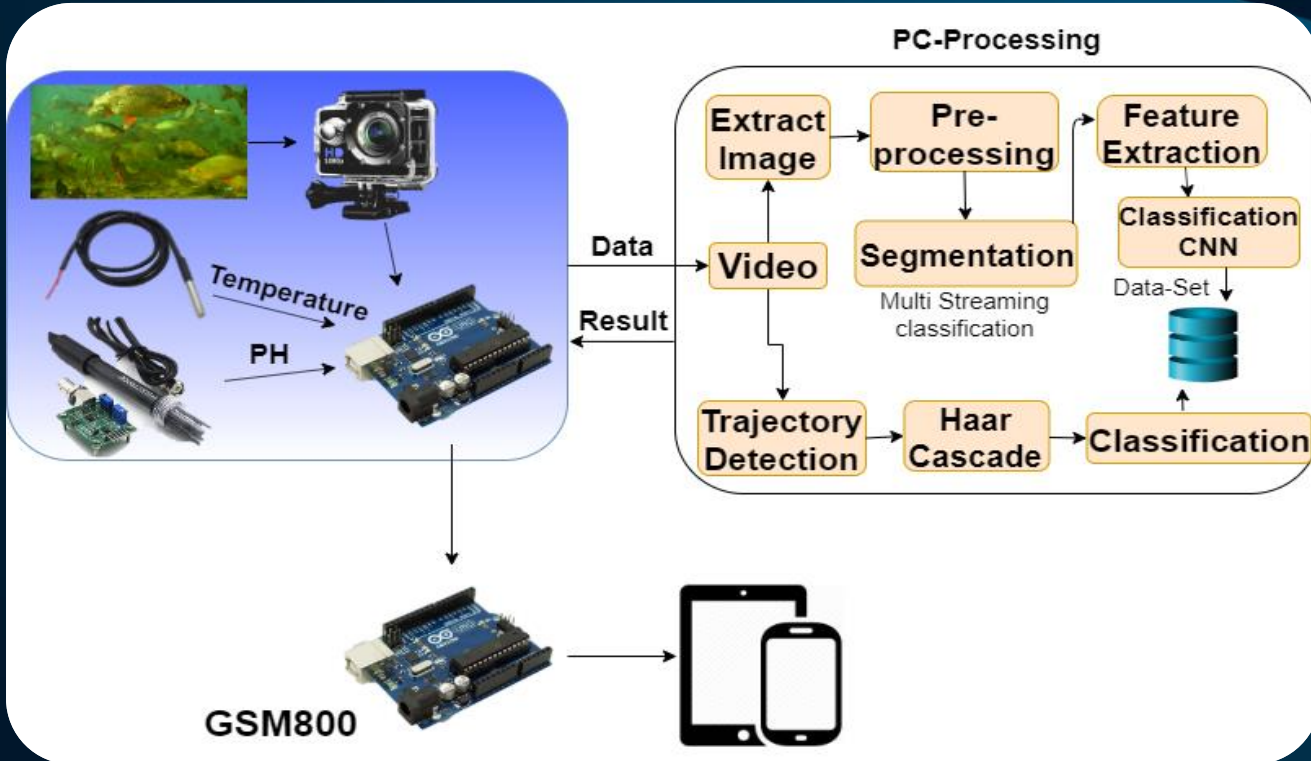
Sensors
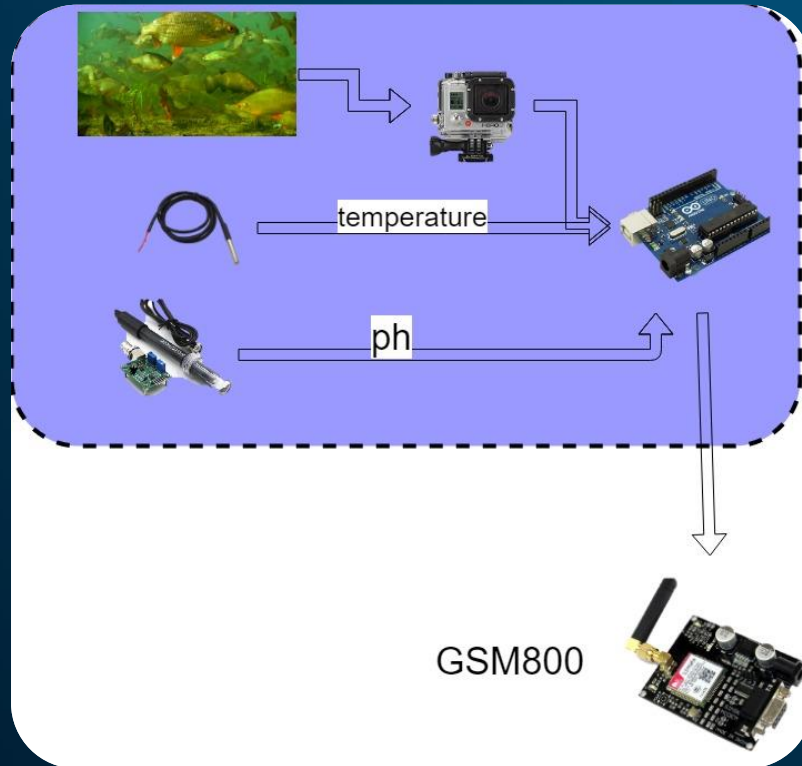
Data-set 1/2

- Data-set main inputs are videos.
- Images are extracted from videos.
- Data-set are collected from public images sources and Large videos fish ponds that are cut into small ones.
- We communicated with fish4knowledge trying to get their dataset.
- We have plan B to collect our own dataset.

Data-set 2/2

- We collected some images from "Africa Aquaculture Research and Training Center (AARTC), Abbassa, Egypt"[10]

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Egypt[9]
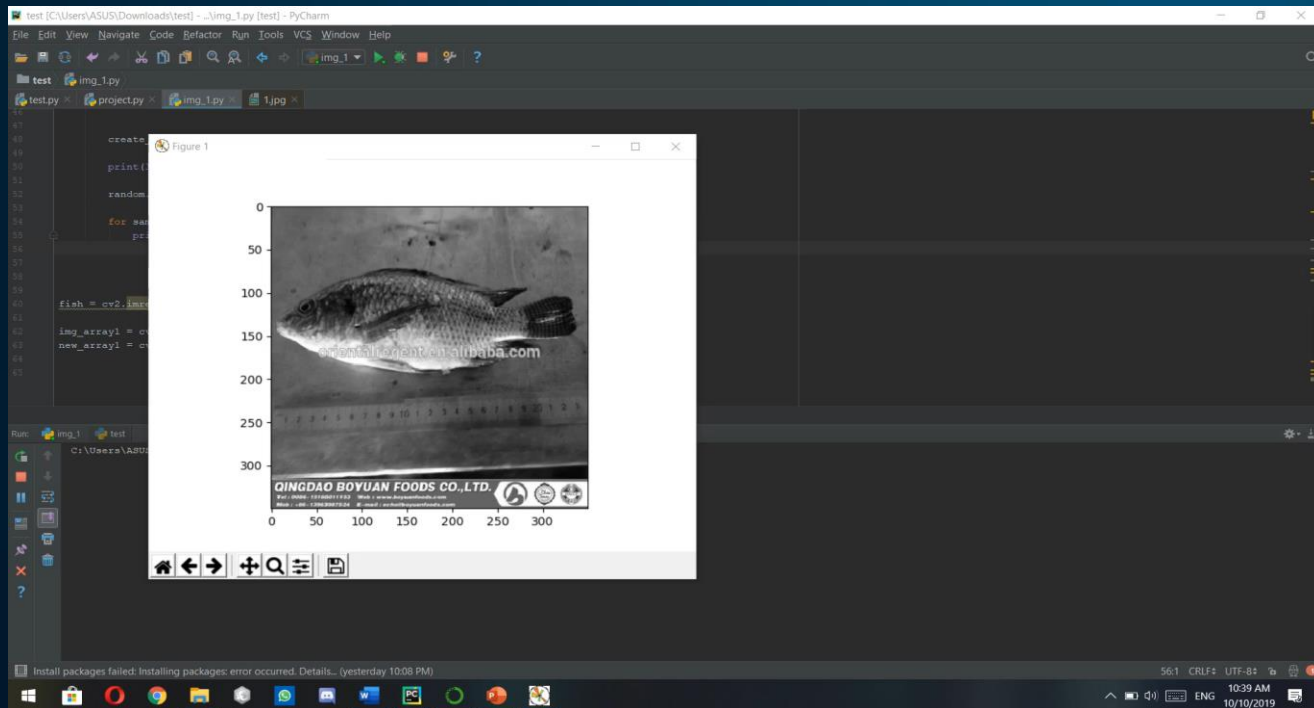
Sample of collected dataset:

There are still very few data samples to work on. Therefore, we decided to use Image data augmentation.

Demo

Demo

Demo

Reference

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5- https://modestfish.com/fish-disease-guide/

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