



Optimizing for a CleanSweep of the Greek Coastline

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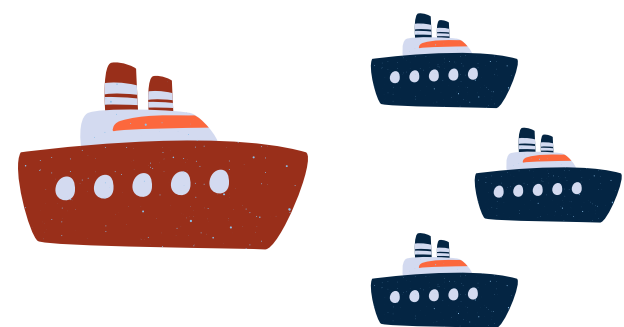


Bria Weisblat

Project Overview

ABOUT ACLCF

The Athanasios C. Laskaridis Charitable Foundation (ACLCF) is a nonprofit organization dedicated to **social and environmental good**.



They clean the Greek coastline with **Project Typhoon**: one large ship, 3 smaller tenders, and a crew of 35.

PROJECT MOTIVATION

Current Process: manual routing, visit every beach

3 years

to clean the full coastline

60%

of visited beaches had 0 waste

\$2.6 M

Typhoon's annual operating cost



How can we optimize Typhoon's route to ensure more effective cleanup?

DATA OVERVIEW

TABULAR DATA

2 Excel sheets
beach and cleanup information
for all cleanups from 2018-2026



Before Cleanup



After Cleanup



DRONE IMAGERY

3 TB
closeup & aerial photos
*required hand-labelling

Approach

METHODOLOGY

Typhoon Routing Optimization App: **CleanSweep**

How much would it benefit us to visit each beach?

How far is each beach from the others?

How can we balance rewards and distance to optimize the route?

4 Typhoon Embarks



How can we know whether waste is truly present before disembarking?

1 Reward Calculation

$$\text{Reward}_i = r_i \times \min(d_i, 365)$$

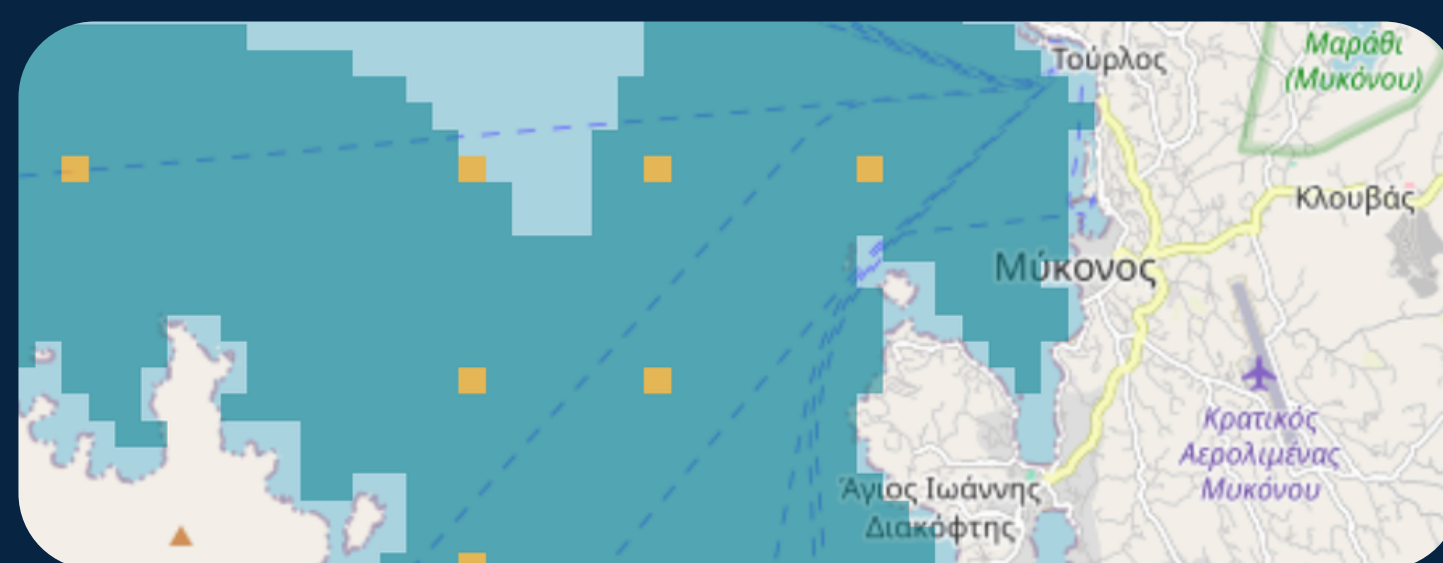
r_i high repollution probability

d_i days since last cleanup

The reward for visiting each beach is calculated as the **probability** the beach will become polluted again times the **days** since it was last cleaned (capped at 1 year).

2 Distance Calculation

Proprietary coastline mesh $\rightarrow$ Dijkstra's shortest path



Example: fine and coarse mesh around Mykonos

3 Vessel Routing



- Rank beaches by reward
- Optimizer builds initial routes by testing **different pool sizes**

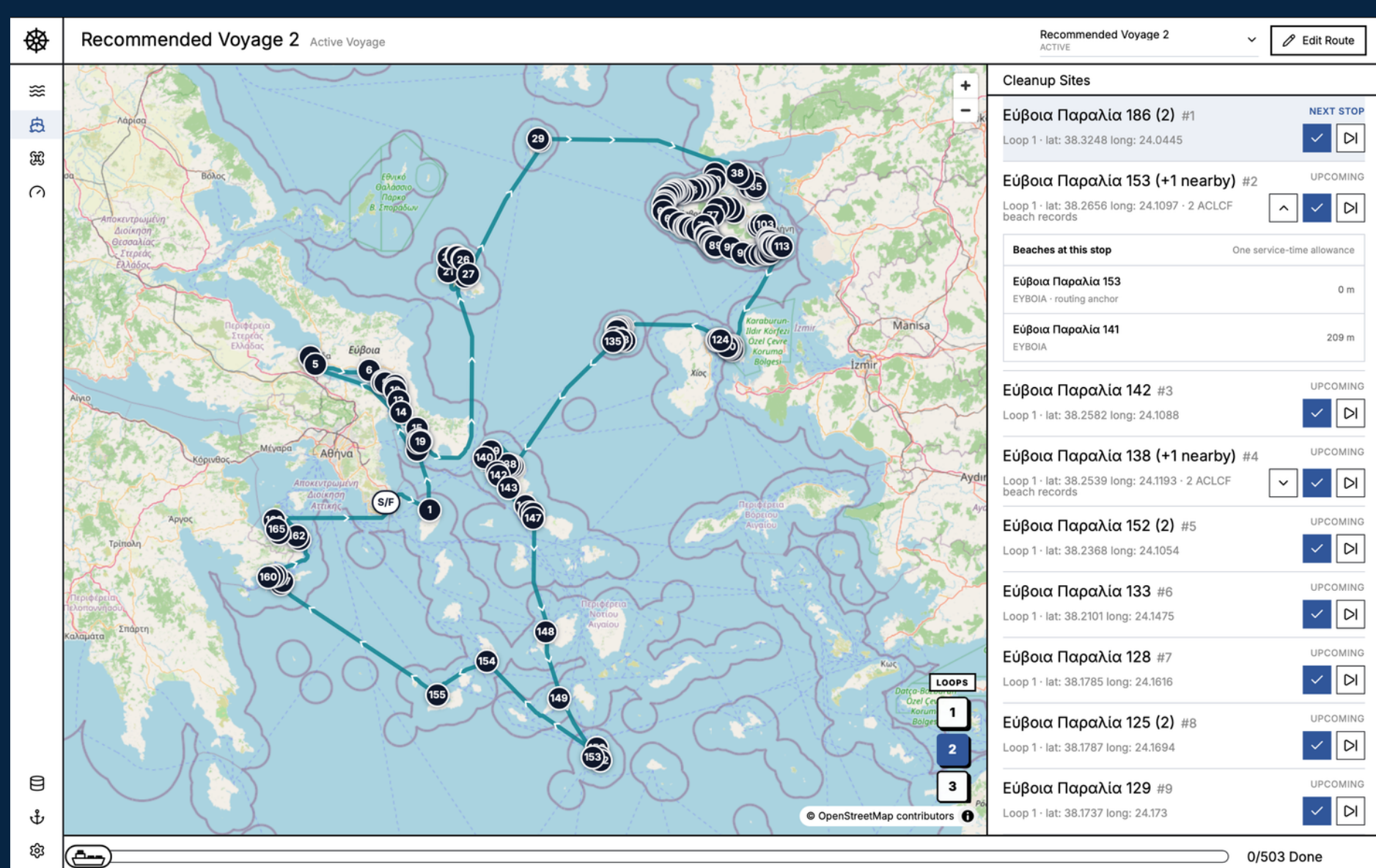


Balance **distance traveled versus reward** collected to construct one feasible route per pool



Use **2-opt local search** to untwist paths and ensure each route is as efficient as possible

CLEANSWEEP DASHBOARD



Example: generated recommended voyage based on selected parameters

Fill out parameters

Click run

Evaluate route

Send ship

Send drone

Cleanup!

5 Drone Verification

For each beach in the CleanSweep route:

✓ Typhoon arrives

Dispatch drone

Supervised vision model

✓ Dispatch tenders and clean beach

✗ Skip beach

YOLOV8n Vision Model

89% Accuracy

95% Precision

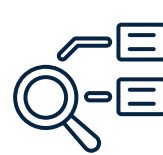
Once in close range of a beach in the route, send the **drone** to take a photo. Pass the photo through the **model** to determine whether or not the crew should **disembark**.

Results

PRODUCTS



Most precise and accurate **maritime map** of Greece publicly available



Repollution models: classification and imputation



Computer-vision model for drone image beach verification



Novel prize-collecting **routing optimizer**



Complete **database** of beaches



Interactive **desktop application**

IMPACTS

\$550,000

reduction in annual costs with the same waste collection

+28.96%

efficiency over the same duration

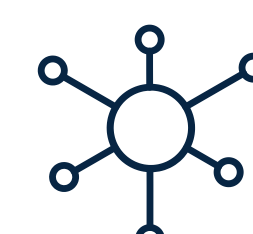
-69.3%

wasted days spent visiting 0-kg beaches

FUTURE WORK



Develop a **mobile app** for on-the-go cleanup updates



Use predicted **hotspots** to replace the large Typhoon ship with local tender hubs



Integrate **live weather and sea conditions** into routing