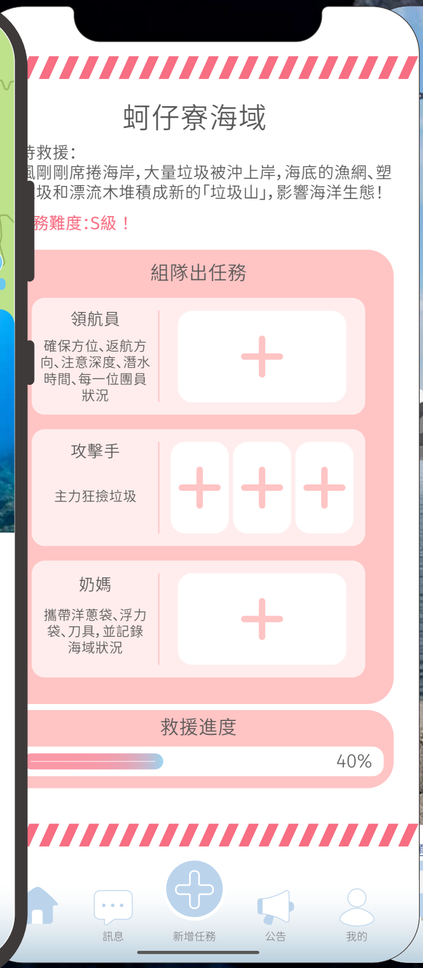
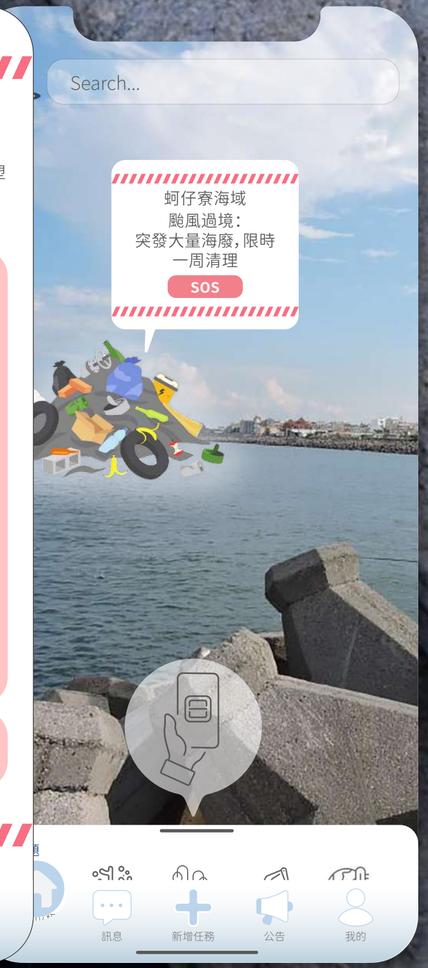
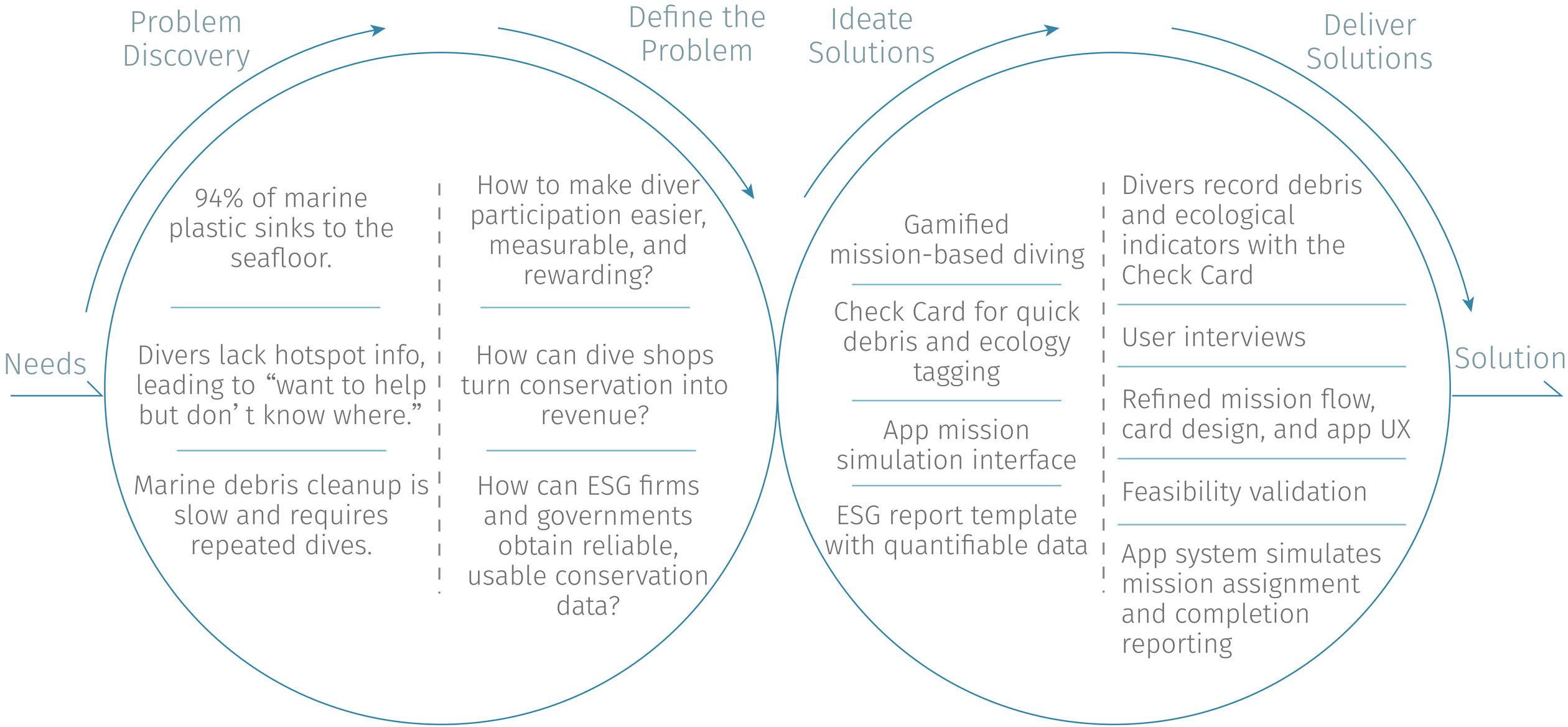
Blue Sense Lab

Underwater Check Card × Ocean Cleanup Mission Action





Double Diamond Research Method:



Background:

Where does marine debris end up?

Currents and monsoons bring massive marine debris to Taiwan each year: 94% of plastic sinks to the seafloor, 1% stays on the surface, and 5% washes onto beaches.

Seafloor

Fibers, fabrics, film plastics, large fishing nets, gear

Beaches

Single-use plastic utensils

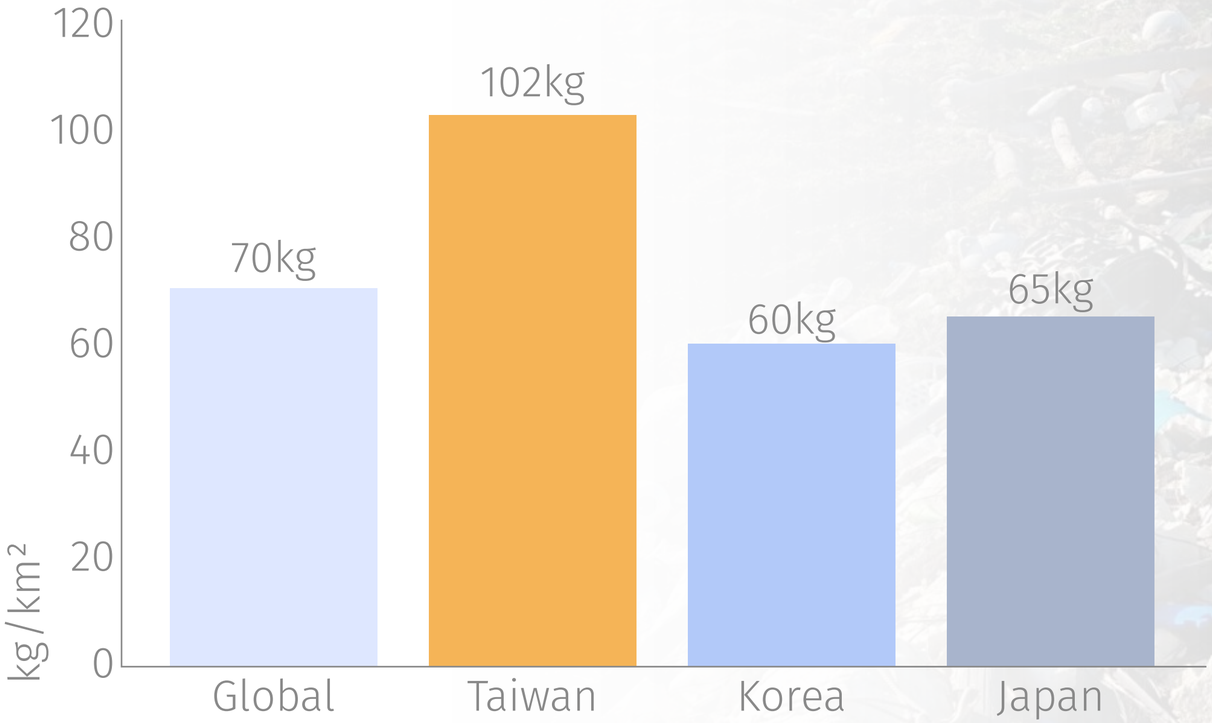
Surface

Styrofoam, bottles, plastic bags

Background:

Taiwan’s coastal seafloor debris density exceeds global levels

The global average seafloor debris density is 70 kg/km², while Taiwan reaches 102 kg/km²—higher than Japan and Korea, and nearly 1.5× the global average.



Background:

Taiwan’ s nationwide marine cleanup reporting system

iOcean encourages citizen scientists to report cleanup work, covering ship-based removal, underwater cleanup, and beach cleanups.

Start | Apr 2020 – ongoing
Participation | Onshore, offshore, underwater
Recording | Photos, hours, participants, date, location, debris types & weight

Number of participants

17,780 people

Amount of debris removed

57,515kg

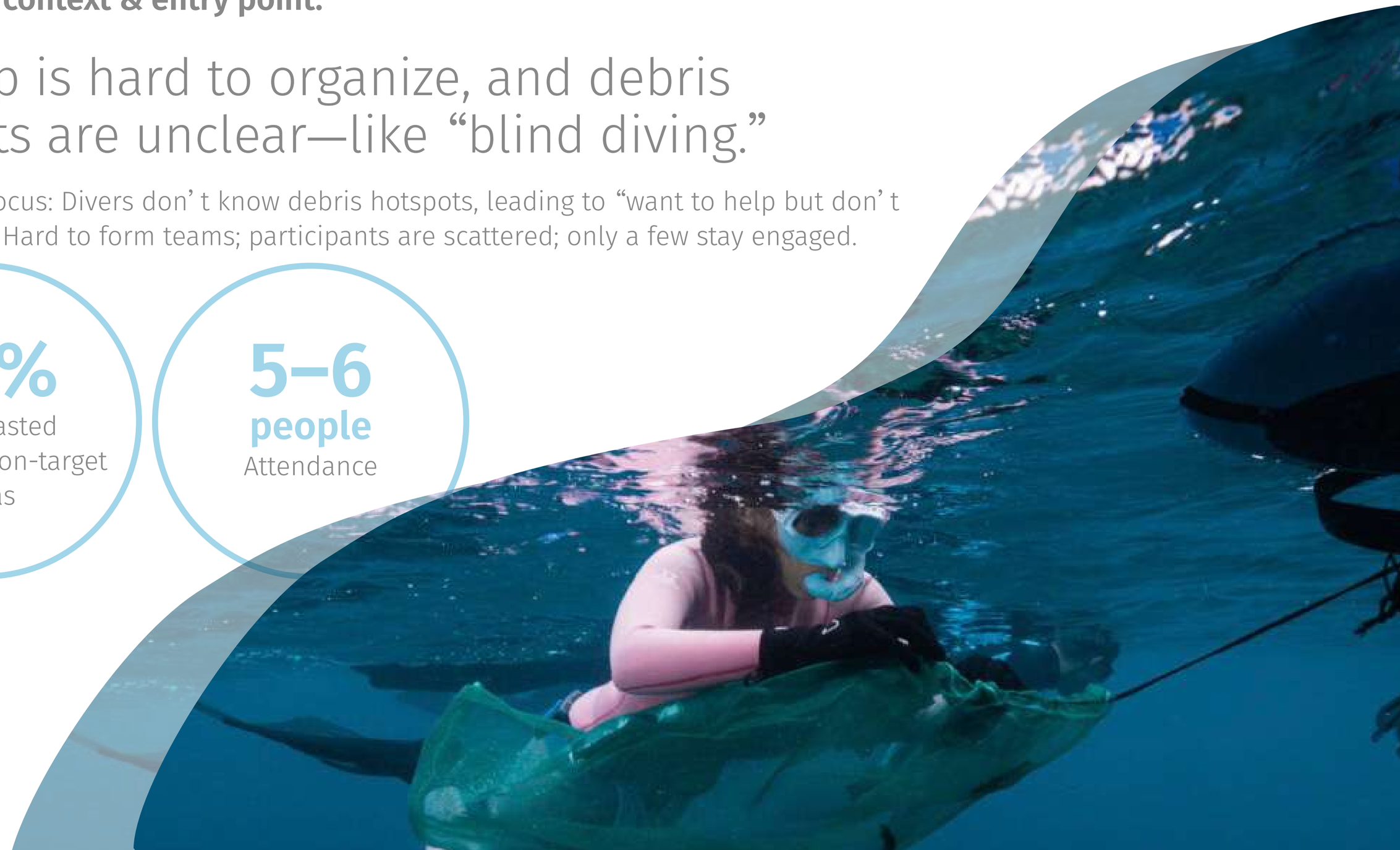
Problem context & entry point:

Cleanup is hard to organize, and debris hotspots are unclear—like “blind diving.”

Actions lack focus: Divers don’ t know debris hotspots, leading to “want to help but don’ t know where.” Hard to form teams; participants are scattered; only a few stay engaged.

30%
Time wasted searching non-target areas

5–6
people
Attendance



Problem context & entry point:

Large debris is found but can’ t be tracked, delaying cleanup for days.

Divers lack real-time location and reporting tools; lost positions and broken info mean heavy removal takes days and requires repeated dives.

Regular debris

1 Day

5 people

Large debris

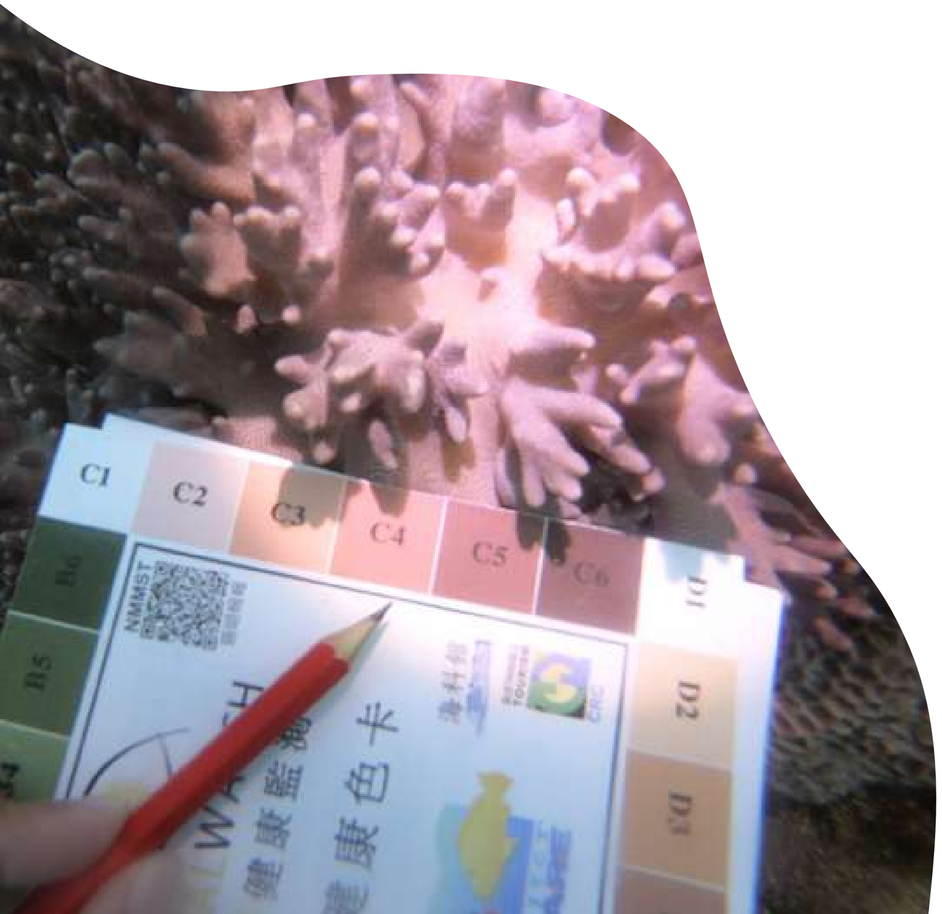
5-7 Day

10 people+

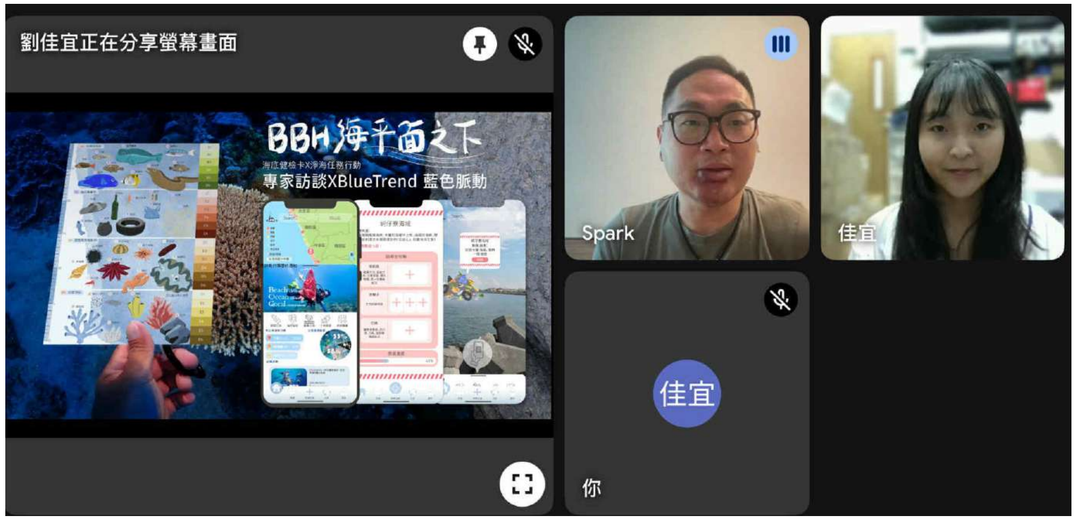
Problem context & entry point:

Coral monitoring has a high barrier and corals are major victims of marine debris.

Plastic blocks light, chemicals disrupt water quality, and nets/ropes break corals, leading to bleaching and death.Most dive missions focus only on debris removal, lacking easy coral check tools and long-term monitoring data.



Expert Interview:



BLUETREND

Interviewee: Founder of Blue Pulse

Diving experience: 10 years

Q1 Do you often encounter large debris while diving?

Tourist sites have little trash; large debris requires targeted search. In Sept, a big net in Penghu was found only because partner shops knew the hotspot.

Q2 How do divers usually handle found debris?

Large nets → high risk, not always removable.
Some report it, but channels and tracking are weak.
Most ignore it due to high effort and danger.

Q3 How are cleanup activities usually organized?

Mostly through social media calls by individuals or shops.
Occasional corporate support but not sustained.
Government subsidies exist but feel formalistic, so shops act only when funding is available.

Expert Interview:

Interviewee: Experienced Diver

Diving experience: 7–8 years

certified diver：AIDA3

Q1 Do divers organize group cleanups? How?

A1 Yes, usually after typhoons, but only about 5–6 people join.

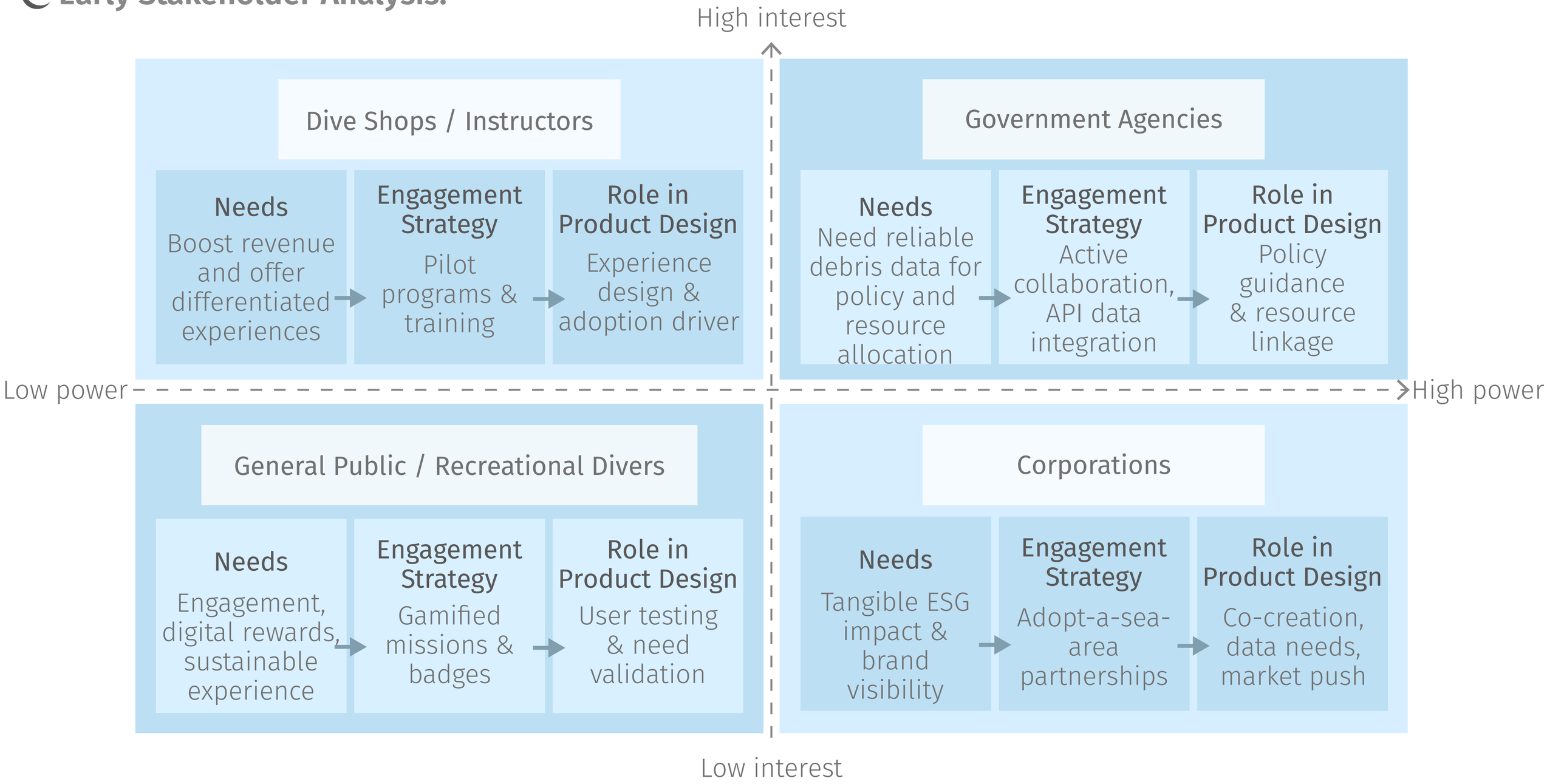
Q2 Is there a platform tracking debris hotspots?

A2 No unified platform; currents change often, making hotspots hard to track.

Q3 Your thoughts on coral restoration?

A3 I support it, but as a freediver, I can mostly only watch and can’ t assist much.

Early Stakeholder Analysis:



Early Customer Journey Map:

? =Actions =Emotions ——=Experience Curve

User

Name: Shark Diver
Experience: 7–8 years freediving

?

Diver enters the water to explore

Finds large nets or debris but can’ t handle them immediately

Helpless

?

Reports the issue to local authorities after surfacing

Unsure if debris will be removed in time

Doubtful

?

Returns with professionals days later to remove it

Wants to contribute to ocean conservation

Hopeful

?

Net has drifted to another location

Worried the net won’ t be retrieved

Anxious

?

Finally locates and removes the net

Cleanup succeeds, but lack of tracking wastes time

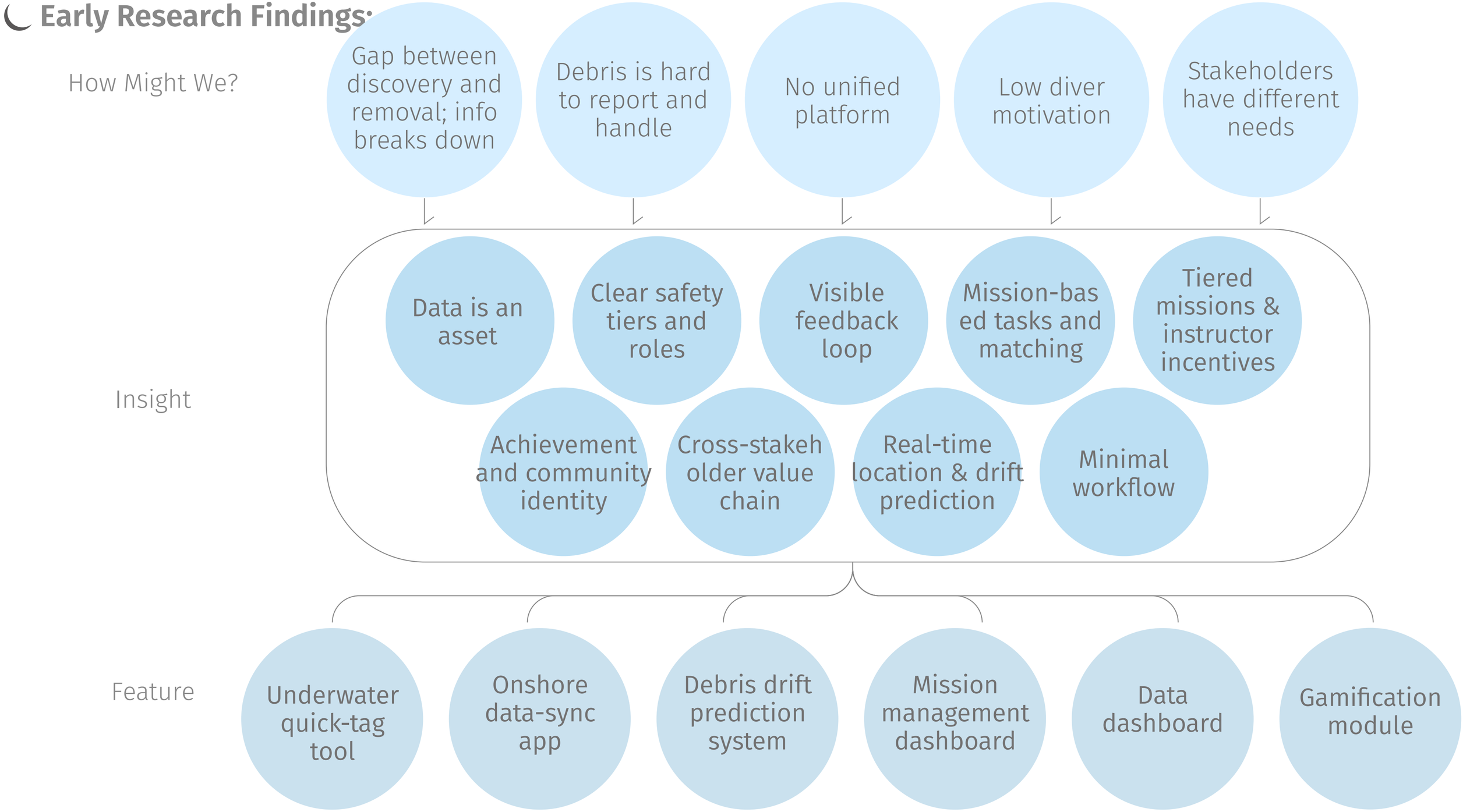
Happy

Spot & report debris

Remove debris

Cleanup completed

Early Research Findings·



Core Concept Overview:

Blue Sense Lab is a marine conservation system designed for underwater use.

It pairs an AR mission app with an Underwater Check Card, letting divers scan for debris hotspots, log debris and ecology, and join data-driven timed missions.AI analyzes dive paths and debris in real time to predict hotspots and optimize mission efficiency.After missions, divers scan their card and debris to convert impact into achievement points.Action generates data, gamification drives conservation—leading to cleaner coasts and sustainable tourism.

Feature Description:

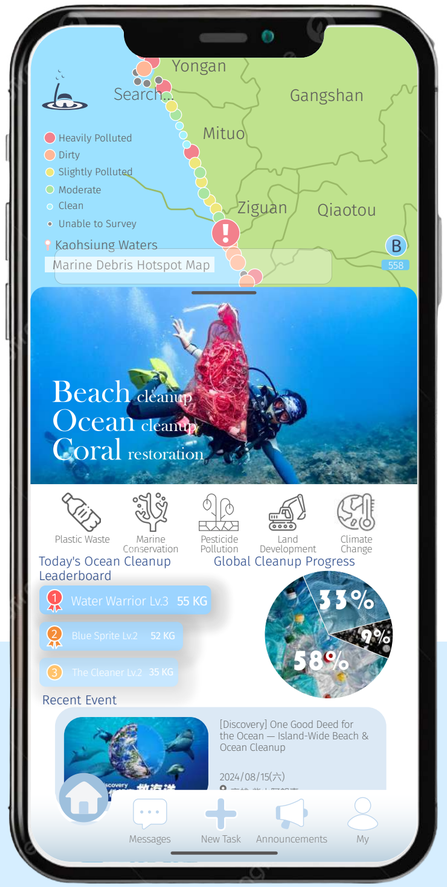
Underwater Check Card

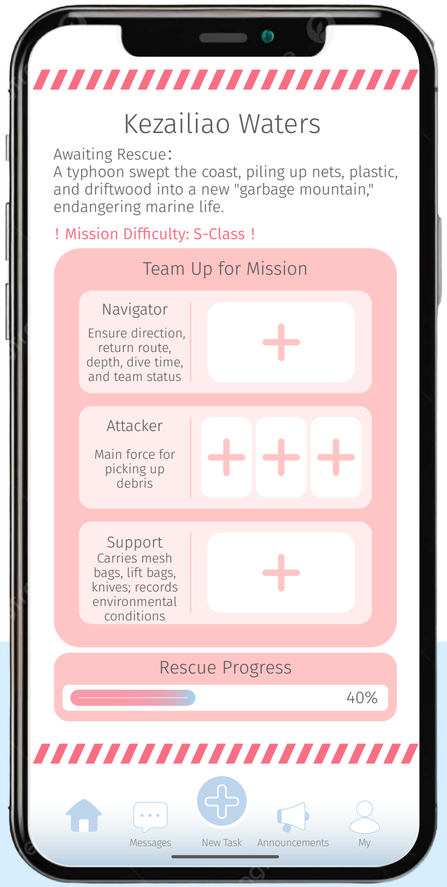
“One card to power your underwater action!”

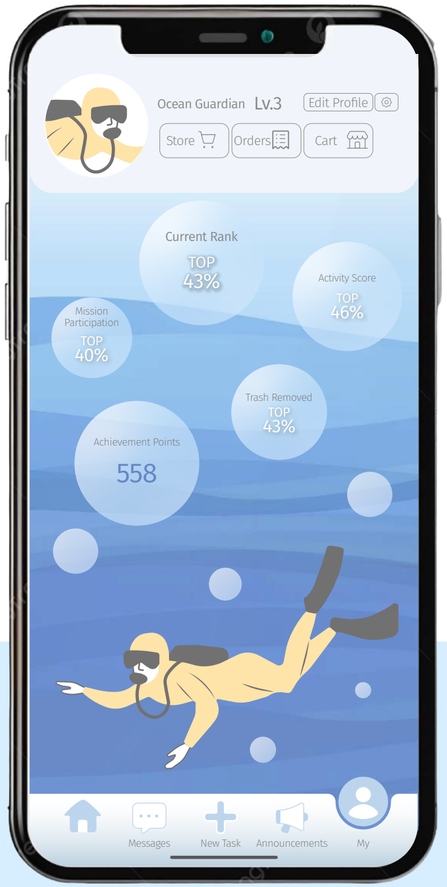
Velcro markers let divers quickly log debris and ecology, and tag large debris for later removal.After missions, scan the card with the app to upload observations and update environmental data.

1. Coral color indicator
2. Indicator fish
3. Seafloor debris
4. Indicator invertebrates
5. Substrate cover types
6. Coral size measurement

User Flow:







STEP 1 Explore Hotspots

Open the app to view marine debris hotspots, sorted by severity and reports.

STEP 2 Accept Mission

Choose time-limited or staged missions, solo or team mode.

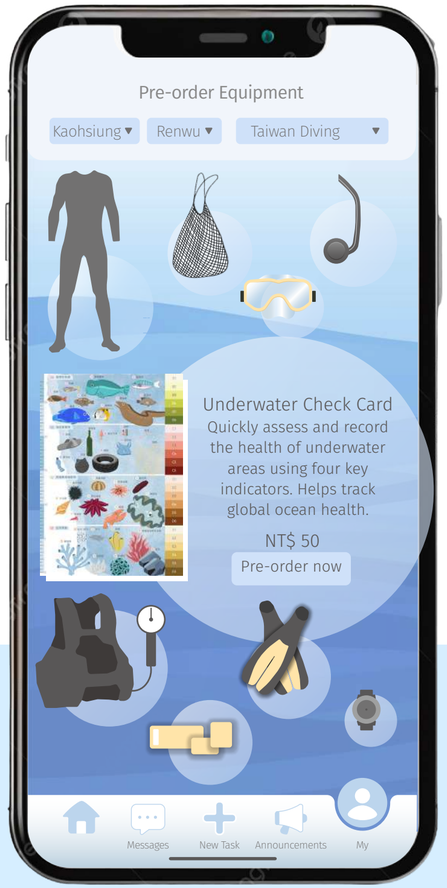
STEP 3 Form Rescue Teams

Start or join a team; the system matches complementary skills.

STEP 4 Check Equipment

Divers can verify their gear on a personal page and pre-order missing items from the in-app store for pickup.

User Flow:



STEP 5 Preorder Dive Card

Purchase the "Underwater Check Card" online and pick it up at partner stores.

STEP 6 View Mission Details

Each mission page includes local marine ecosystem data, tidal forecasts, and a Google Maps link.

STEP 7 Smart Navigation Map

Maps suggest the fastest routes based on marine debris hotspots.

STEP 8 AR Training

Scan the card to launch AR tutorials and learn basic ecology.

User Flow:

STEP 9 Preorder Dive Card

The app uses story-based lessons to help divers avoid unintentionally harming marine ecosystems.

STEP 10 AR Scan for Targets

At the site, use AR to locate debris hotspots quickly.

STEP 11 Execute Mission

Record seabed, coral, fish, and trash data; mark large debris locations.

User Flow:

STEP 13

Post-Mission Reporting & Supplementary Notes

Fill out mission outcomes: dive conditions, ocean changes, unusual finds. Generate reports to share with the community or partner organizations.

STEP 12 Report and Earn Points

After surfacing, scan the card and collected trash;
AI analyzes and generates achievement points.

AI System Diagram:

Diver spots marine debris hotspot.Take photo and scan via app to report location.

App generates mission.

Diver accepts mission.

Scan surrounding area with app.

AR scans to identify hotspots and assign zones.

Marine Cleanup Mission & AI Debris Identification Cloud System

Divide cleanup areas to reduce overlap.

Diver collects marine debris.

Track dive path and movement hotspots.

Learn debris patterns; predict new hotspots. Optimize mission zones and difficulty in real time.

Diver surfaces.

Scan check card and debris.

Report underwater data.

Research centers, conservation groups, and eco-restoration teams

Uncollected debris updates and creates new missions.

Upgrade debris map database.

Convert debris volume and rarity into achievement points.

Use data for better mission generation and hotspot prediction.

Mechanism & Technical Overview:

Establish the initial location of marine debris

Divers identify debris accumulation hotspots

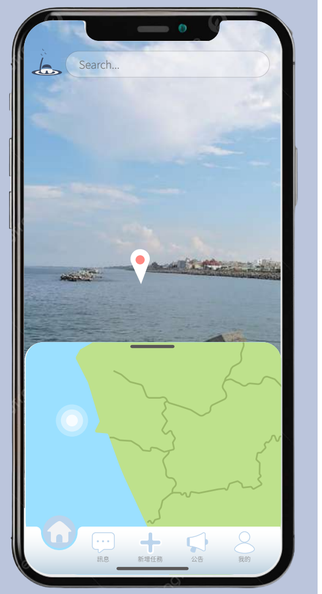
Divers scan and mark debris

Method 1: Using existing tools

Capture photos/videos with GoPro/DJI Action

Dive computer logs depth, time, and entry point

Upload footage and GPS after surfacing; the app auto-creates a dive task record



Method 2: In-app tagging

AR scan：Aim at debris to auto-generate a map marker.Manual pin drag available for adjustments

Connect to Central Weather Bureau data import

Open APIs / Data Sources:

Tides, currents, wind, temperature, salinity

測站	潮高(m)	浪高(m)	浪向	波浪週期(秒)	風力(m/s)(級)	風向	最大風速(m/s)(級)	海溫(℃)	氣溫(℃)	海流流向	流速(m/s)(節)
龍洞潮位站 29日11時	0.08				5.3 3	-	9.2 5	23.3	22.4		
龍洞資料浮標 29日11時		1.0	東北	4.6	6.2 4	北	9.8 5	23.7	22.5	西南西	0.17 0.33
富貴角資料浮標 29日11時		2.6	北北東	6.4	8.7 5	東北	12.6 6	25.2	23.5	東北	0.61 1.19
淡海潮位站 29日11時	1.32							27.4			

Large drifting marine debris

Large marine debris that is stuck

Create static mission targets

Mechanism & Technical Overview:

Simulate marine debris drifting paths

Initial parameter modeling

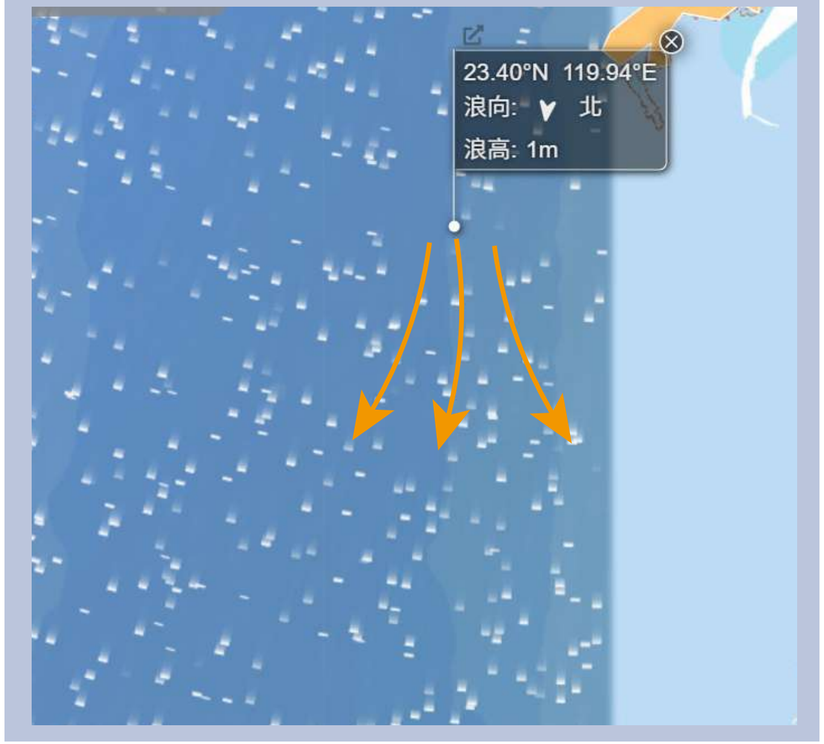
Type of marine debris
→ Corresponding buoyancy, drag, and degree of influence by ocean currents

Fluid dynamics simulation

Simulate ocean current changes within 12–72 hours
Combine wind speed and tidal rhythms to perform "marine debris trajectory simulation"

Generate "marine debris hotspot prediction layers"

Current reporting points / high probability drifting zones / recommended cleaning times



Mechanism & Technical Overview:

Enhance mission assignment and dive planning

Mission creation and area allocation:

The system automatically generates "time-limited missions" based on predicted hotspots:
For example: "Go to XX area within 48 hours to collect drifting debris"
Provide area allocation suggestions for multiple dive teams to avoid overlap

Continuously optimize the model

Each reported actual marine debris location becomes new training data.Strengthen the accuracy of the prediction model

User Interview:

BLUETREND

Interviewee: Founder of Blue Pulse
Diving Experience: 10 years (Scuba)

Q1 Would you trust an APP-generated debris drift simulation?

ANS:

Useful, but large debris often gets stuck. GPS helps, but divers rely more on relative markers.

Q2 Do points and data increase willingness to use?

ANS:

Yes—rewards, certifications, and visualized stats boost motivation. Likes gamification.

Q3 Would you use AR to locate debris?

ANS:

Yes—AR is fast and helpful, especially for shore dives.

Q4 What incentives drive shop/instructor adoption?

ANS:

Financial support needed; without revenue shops won’ t commit. ESG sponsorship improves adoption.

Q5 Are divers willing to contribute data?

ANS:

Yes, but grouping and liability reduce participation. Clear organizers, insurance, and rewards improve willingness.

User Interview：

User Interview – Experienced Divers

“It’ s really helpful to know which areas haven’ t been cleaned yet!”

“Getting a certificate of participation motivates me.”

“I’ d recommend this to dive shops or scuba instructors.”

“Unlocking cleanup achievements and rewards would attract me.”

Expected Benefits：

40% Increase in Cleanup Efficiency

90% Improvement in Data Completeness

2.5× Increase in Participation Rate

Mid-Stage Journey After Product Adoption :

? =Actions =Emotions ——=Experience Curve

Stage	Exploration & Discovery	Recording & Tagging	Mission Execution	Outcome Reporting	Ongoing Engagement
Action	Diver explores the site	Reports debris after surfacing	Returns with team to remove debris	Finds net has drifted	Finally removes the net
Need	Quickly locate debris & assess risk	Fast, simple logging	Track debris location & progress	Clear impact visibility	Long-term motivation & community belonging
Solution	AI predicts debris hotspots and prioritizes missions	Quick tagging via Check Card with instant data upload	Platform tracks debris using current and drift analysis	AI generates cleanup results, personal scores, and team rankings	Rewards, community interaction, and educational content
Pain Point	Helpless Finds large nets or debris but can’ t remove them immediately	Doubtful Uncertain whether debris will be handled in time	Hopeful Wants to contribute to ocean conservation	Anxious Worried the net won’ t be removed	Happy Debris is eventually cleared, but poor tracking causes wasted time searching

Market Size:

2019–2031 Global Scuba Diving Equipment Market

In 2023, the scuba diving equipment market was valued at USD 2.9 billion, with a projected CAGR of over 6.1% from 2024 to 2031.

Business Model·

To Business

Dive Shops

ESG Corporations

Subscribe to mission system; integrate training content

ESG proof-of-action, marketing exposure, sustainability report content

Happy tourists → shops willing to pay

Valuable ESG impact → they pay for missions and gain trust

To Government

Government & Local Agencies

Government procurement, data licensing, collaboration

Mission participation → data supports policy funding

We sell sustainable tourism to dive shops, quantifiable conservation data to governments, and tangible impact to ESG brands.

Service Operation Model:

Dive Shops

Higher revenue & stronger customer loyalty

Mission Subscription / Promotion

Rewards, engagement, and upcycled ocean-waste gifts

Divers

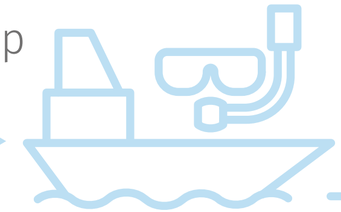
Turned into reward items

Ocean waste delivered to recycling facilities

Cleaning → Melting/processing → Upcycled product prototyping

Financial Sponsorship

Debris data & cleanup routes



Boost cleanup efficiency & expand marine data

ESG Brands

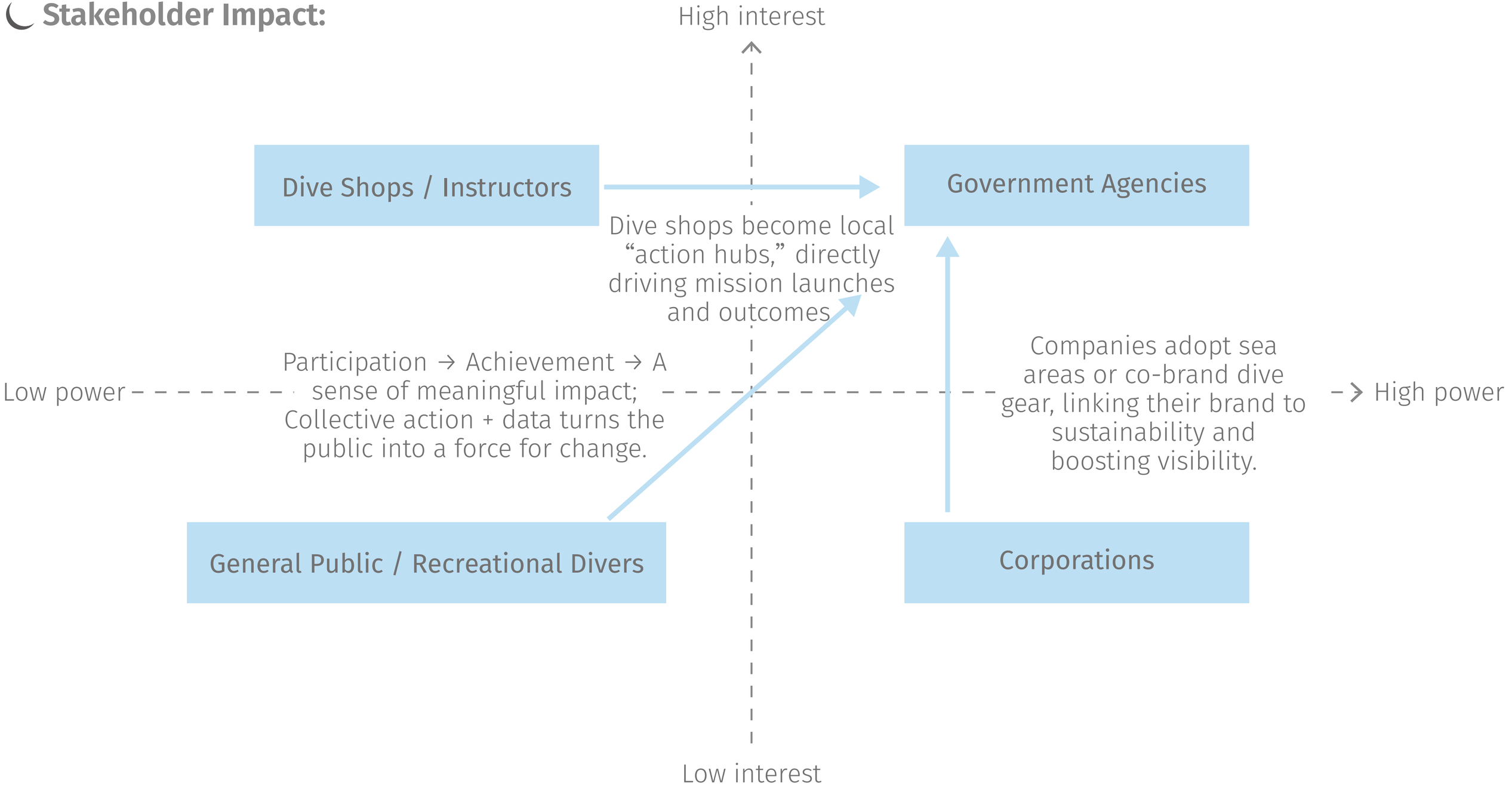
Marine Service Companies

Subsidies / Public Procurement

Improved local image, policy insights, sustainable tourism

Government

Stakeholder Impact:



Quantitative Impact

Divers  X20= 50–80 kg of removed seafloor debris

50–80kg of removed seafloor debris X10/年= 500–800 kg of removed seafloor debris

=tens of thousands fewer microplastics entering the food chain

Qualitative Impact

Reduces coral entanglement and smothering, supporting ecosystem recovery.

Creates a debris removal database and tracking system for continuous management.

Promotes sustainable tourism by turning diving into a conservation-driven experience.

SDGS:

Improve coastal cleanliness and dive tourism.

Engage more divers and communities in conservation.

Record debris and ecology with the Check Card to build long-term data.

AI predicts debris trends for faster response.

Future Expansion:

Regional Expansion

Starting with Kaohsiung, Kenting, Penghu, and Northeast Coast dive sites.

Cross-sector Integration

Combine data from ocean agencies, coast guard, and aquaculture for debris and risk alerts.

International Collaboration

Export data standards to Southeast Asia and Pacific island nations, positioning Taiwan as a leader in smart marine conservation tech.

Blue Sense Lab

Underwater Check Card ×
Ocean Cleanup Mission Action