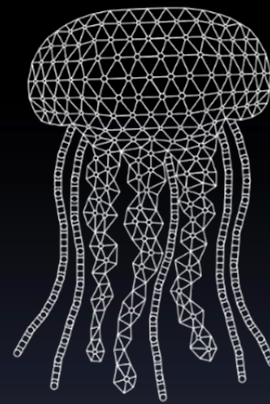




Ocean Vision AI (OVAI): Accelerating observations of marine life using artificial intelligence



Kakani Katija • Lilli Carlsen • Katy Croff Bell • Megan Cromwell • Joost Daniels • Angus Forbes
Eric Orenstein • Geneviève Patterson • Susan Poulton • Henry Ruhl • Gautam Shah • Ben Woodward



OCEAN
DISCOVERY
LEAGUE



CENTRAL & NORTHERN
CALIFORNIA OCEAN
OBSERVING SYSTEM



PURDUE
UNIVERSITY



cVision



INTERNET OF
ELEPHANTS



Climate Change AI

&RANU

Collaborators and supporting institutions:



NATIONAL
GEOGRAPHIC



Impact
Observatory



Monterey Bay
Aquarium



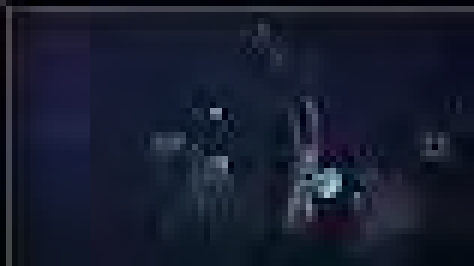
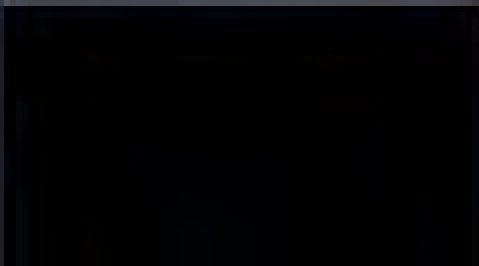
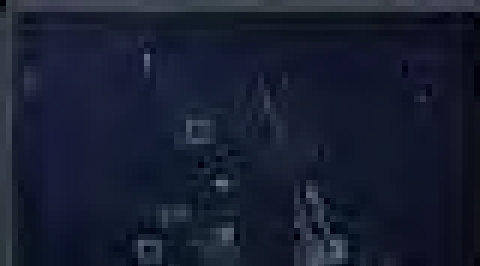
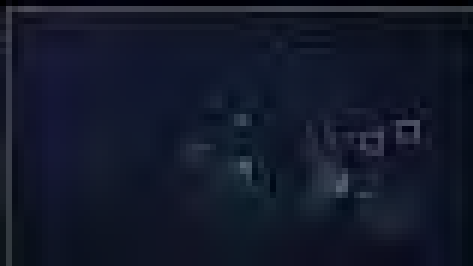
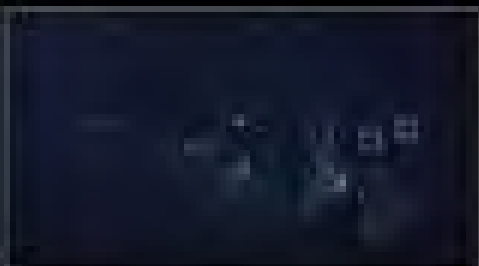
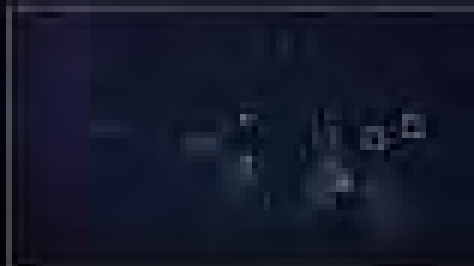
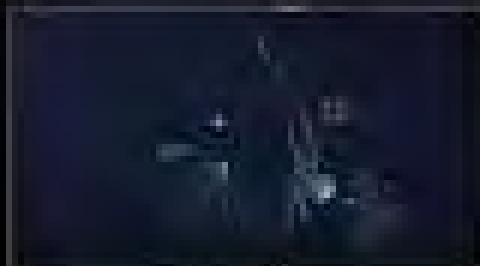


A vision for the Blue Economy

Growing the blue economy requires understanding of its impact on the ocean environment, particularly the life that lives there.

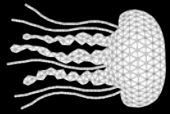
Image credit: *The Ocean Economy in 2030*, OECD (2016)





Can artificial intelligence (AI) and broad community engagement address this big data challenge?





OCEAN VISION AI

Strategic Partnerships

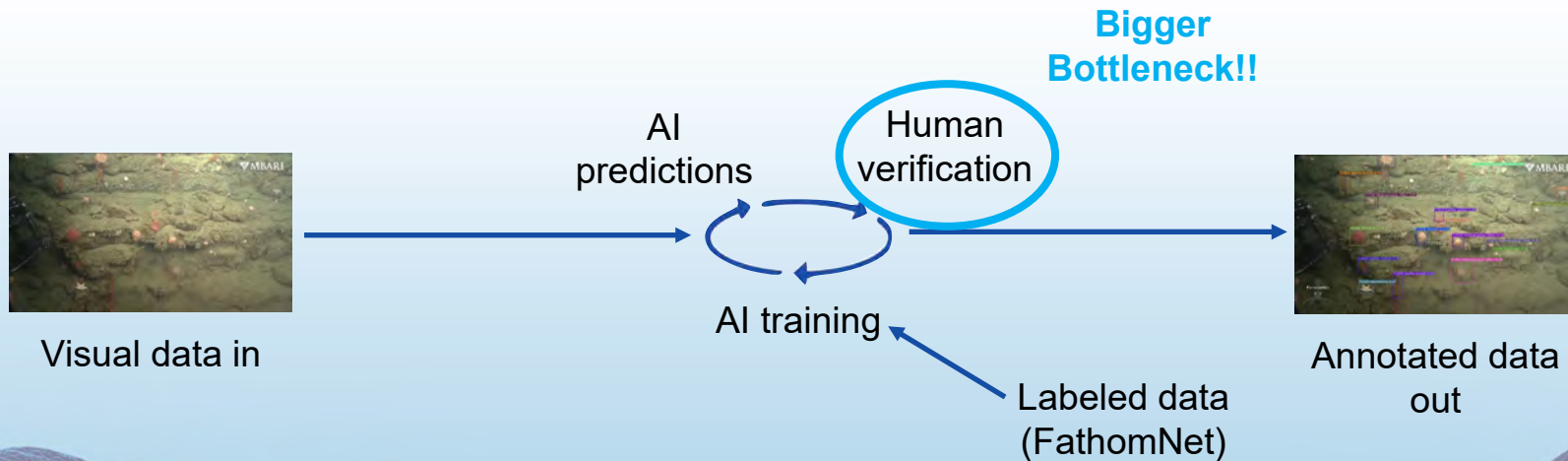


NSF's Convergence Accelerator



OCEAN VISION AI

The Challenge

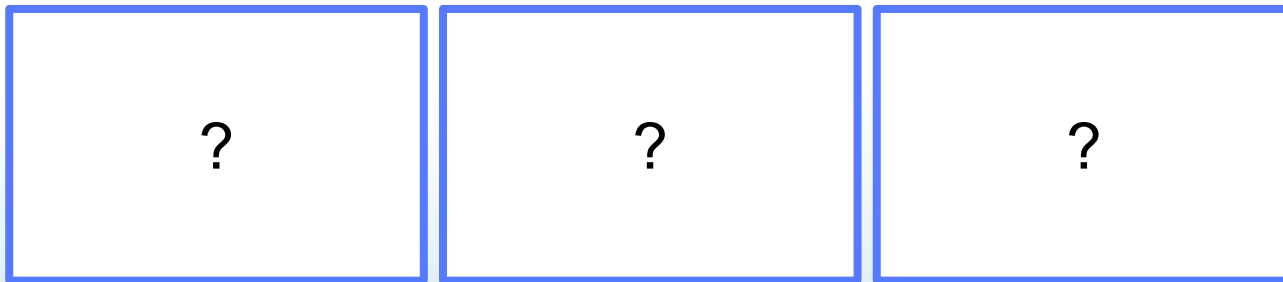




OCEAN VISION AI

The Approach

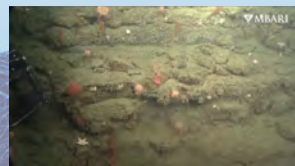
FathomNet



EXPERTS

ENTHUSIASTS

Human-AI interfaces



Visual data in

AI
predictions

Human
verification

AI training

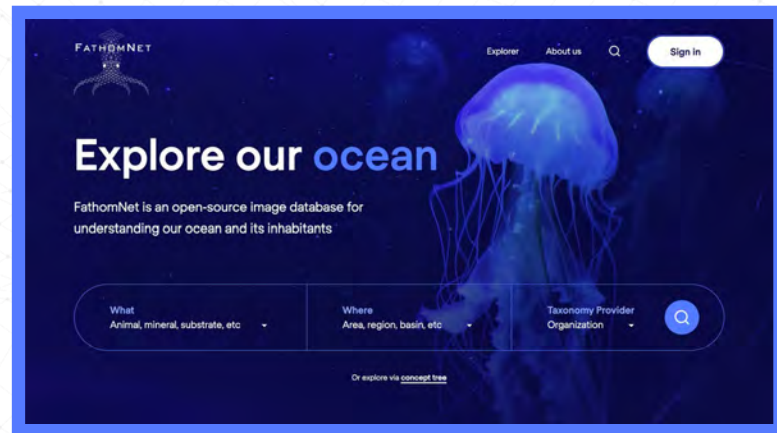


Annotated data
out

FathomNet

Global image and ML model repository

- Upload, host visual data and ML models
- Publicly available labeled image dataset
- Search, view metadata, augment labels
- Taxonomic expertise aggregator
- MBARI-NOAA agreement to host submitted data for up to 75 years from contributors all over the world
- FathomNet-Kaggle Competition on out-of-sample distribution at CVPR-FGVC



www.fathomnet.org

 @fathomnet

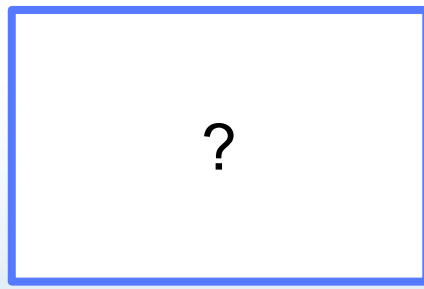
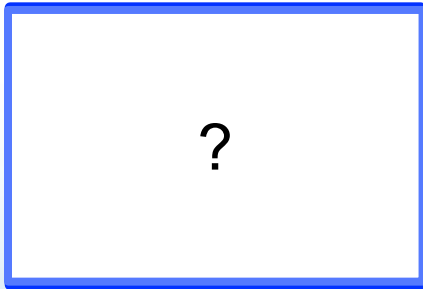
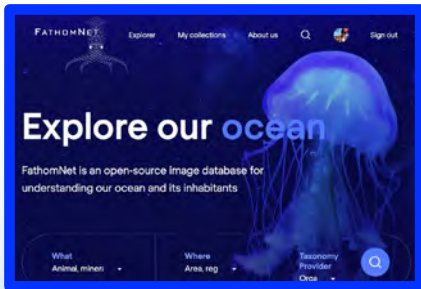


OCEAN VISION AI

The Approach

FathomNet

OVAI Portal



EXPERTS

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Human-AI interfaces



Visual data in

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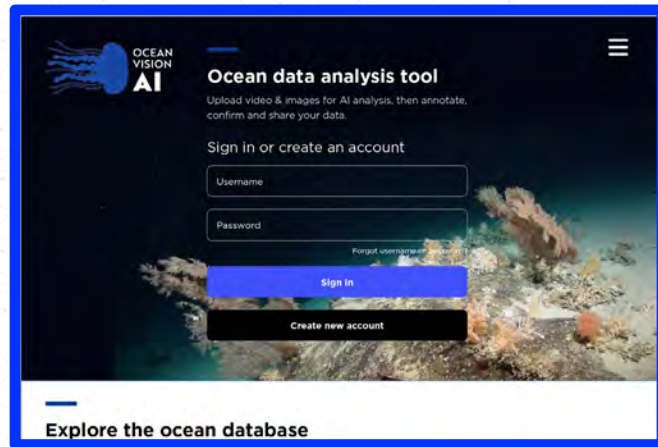


Annotated data
out

OVAI Portal

Providing access to ML data pipelines

- Upload, host visual data
- Public/private repositories
- Select, train, deploy machine learning models
- Verify, augment labels generated by models
- Annotations exported to OBIS/GBIF, searchable database, FathomNet



www.oceanvisionai.org



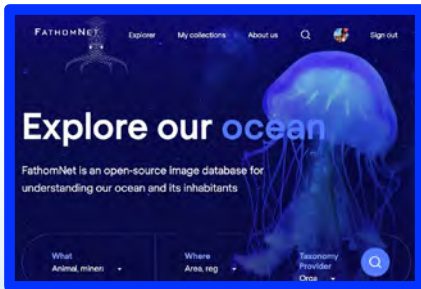
@oceanvisionai



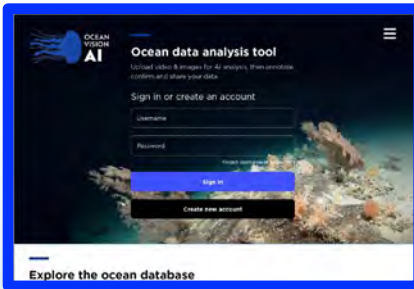
OCEAN VISION AI

The Approach

FathomNet



OVAI Portal



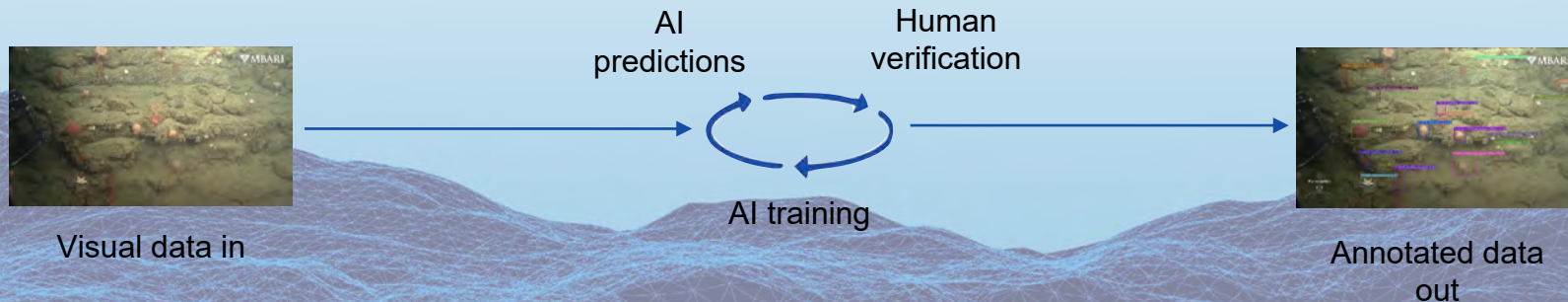
FathomVerse



EXPERTS

ENTHUSIASTS

Human-AI interfaces



FathomVerse

Exploring the final frontier on Earth

- Audience:
 - Primary: Ocean lovers, animal lovers, armchair explorers
 - Secondary: Underserved communities in ocean science
- High school age and up
- Mobile phone app (IOS and Android)
- Driven by interests: love animals and facts about the ocean



www.fathomverse.game

 @playfathomverse

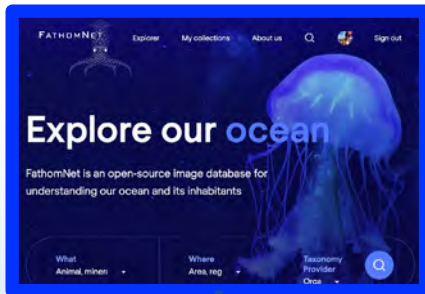
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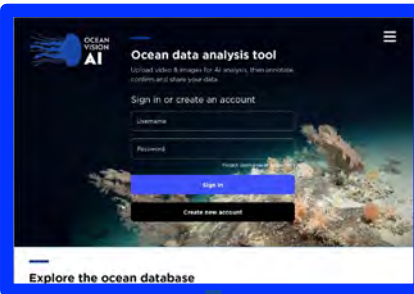
OCEAN VISION AI

The Approach

FathomNet



OVAI Portal



FathomVerse



Visual data in

AI
predictions

Human
verification

AI training



Annotated data
out

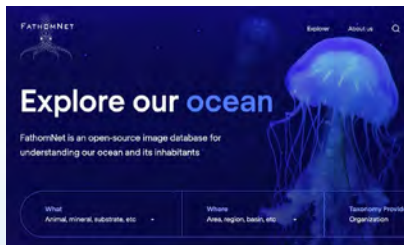


OCEAN VISION AI

Program Timeline

Evaluate sustaining funding models

Implement sustaining funding model



Launch
FathomNet
v1.0

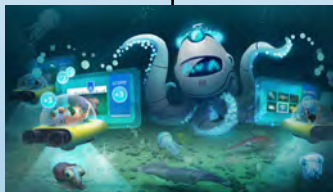
Launch
Portal beta1



Launch
Portal v1.0



Launch
FathomVerse
MVP



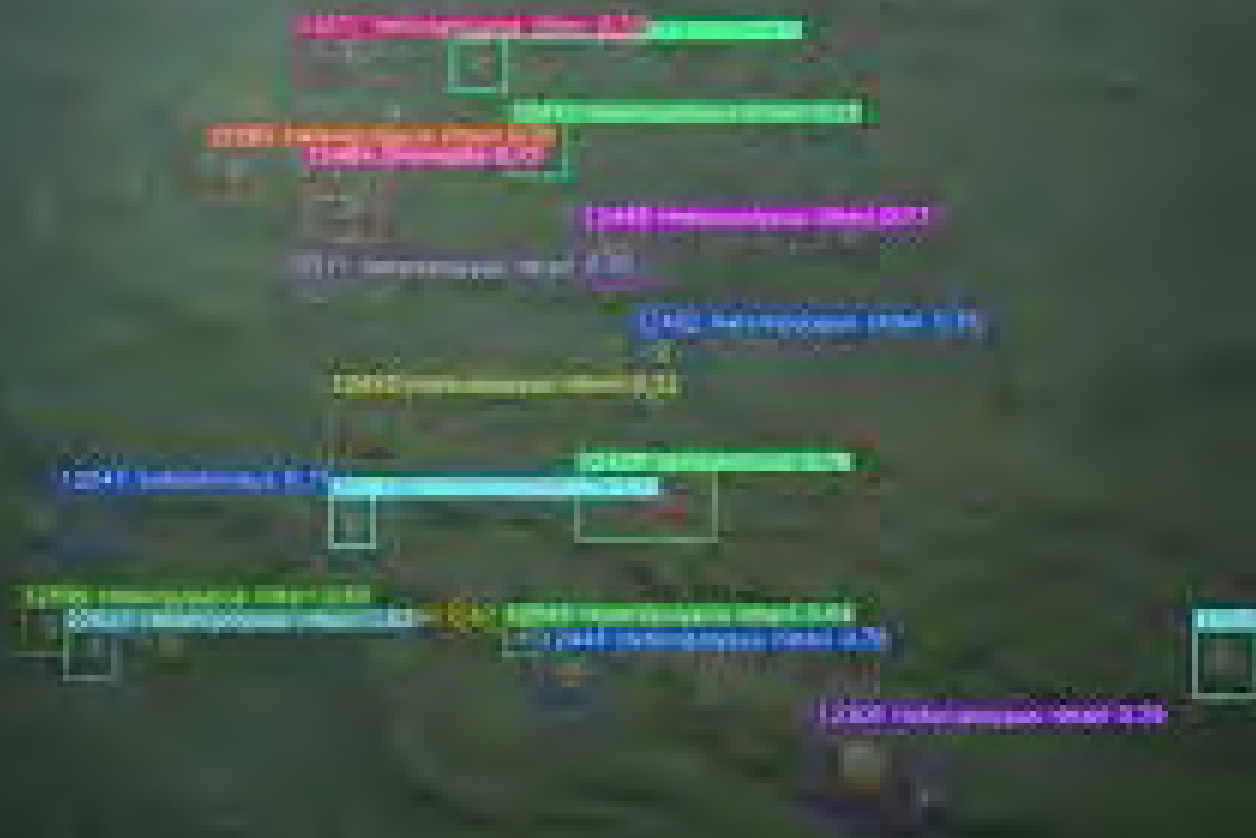
Launch
FathomVerse
v1.0

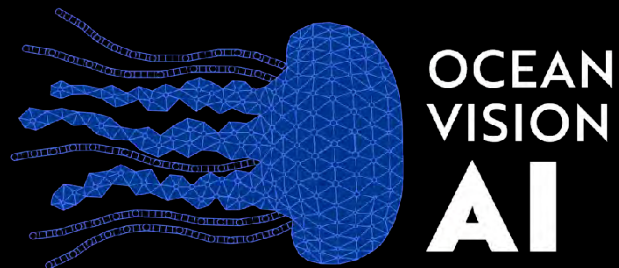
Launch FathomNet
Model Zoo v1.0

Launch
FathomVerse
v2.0

Engagement activities (e.g., workshops, social media, working groups)

FathomNet-Kaggle Competition (CVPR-FGVC): Distribution shifts





Accelerating ocean discovery



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CALIFORNIA OCEAN
OBSERVING SYSTEM



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ELEPHANTS

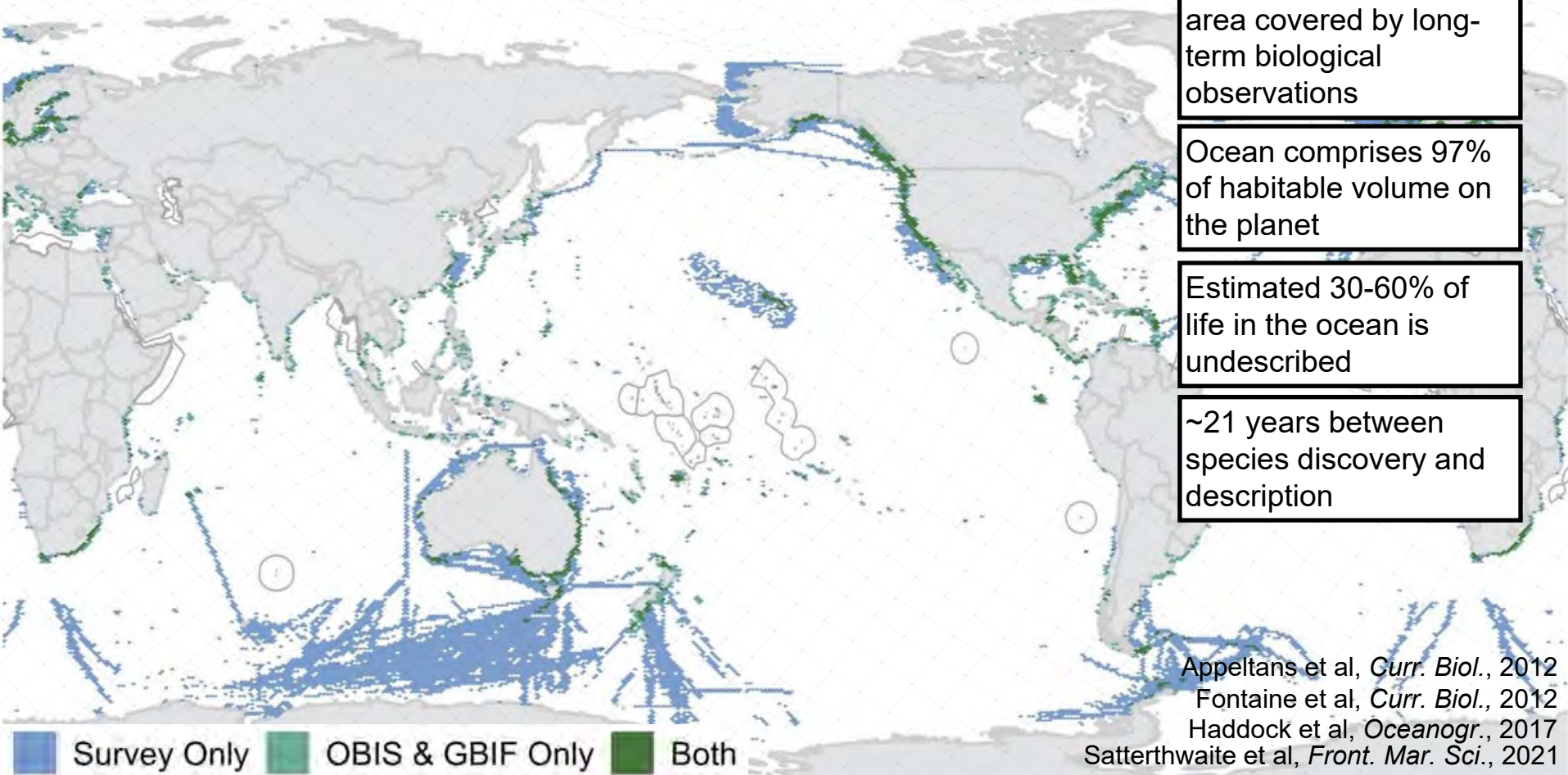


Climate Change AI

&RANJ

Collaborators and
supporting institutions:





~7% of ocean surface area covered by long-term biological observations

Ocean comprises 97% of habitable volume on the planet

Estimated 30-60% of life in the ocean is undescribed

~21 years between species discovery and description

Appeltans et al, *Curr. Biol.*, 2012

Fontaine et al, *Curr. Biol.*, 2012

Haddock et al, *Oceanogr.*, 2017

Satterthwaite et al, *Front. Mar. Sci.*, 2021

We are facing a deluge of visual data

Current: >300k hrs of video with $\leq 15\%$ processed
Future: exponential increase of visual data collection

Use-inspired research: Interviews



Participants

Academic or research

Industry or for-profit

Government or management

NGO or non-profit

Data (observatory, governing bodies)

Education

Engagement

Enthusiast

Analogous

38 user interviews

>35 participants in game development workshops,

248 participants in database workshops from 35 countries and 28 US states



OCEAN VISION AI

Integrated Pipeline

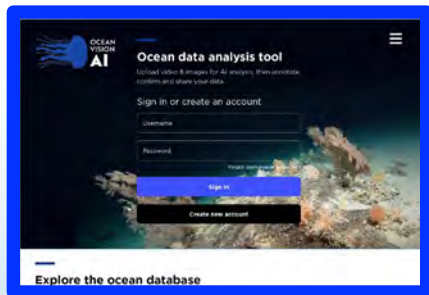




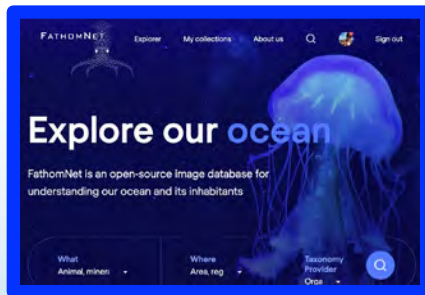
OCEAN VISION AI

Non-profit model

OVAI Portal



FathomNet



FathomVerse



Users • Marine researchers, labs, institutions, contractors

Access • Open-source, public, pay-to-play features

Market Size • 500

• Marine/CV/AI researchers, applications

• Open-source, public

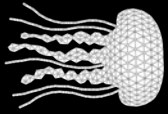
• 10,000

• Armchair explorers, ocean enthusiasts, animal lovers

• Free download




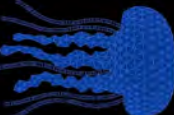
• >100,000

Revenue: Pay-to-play, subscription, enterprise-level partners, grants / organizational / corporate sponsorship, in-game purchases / donations



OCEAN VISION AI

Competitive landscape

Platform	Web-based	Annot.	Local.	Deploy AI	Train AI	Data hosting	Gaming	Public Collab.
 BIIGLE	✓	✓	✓	✓				
 IMOS-UMI SQUIDLE+	✓	✓	✓	✓				
 VIAME	✓	✓	✓	✓	✓			
 OCEAN VISION AI	✓	✓	✓	✓	✓	✓	✓	✓



NSF's Convergence Accelerator