

# DANIEL SAMBOLD

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## EDUCATION

### California State University, Monterey Bay

Graduated Spring 2026

B.S. Marine Science, Minor in Biology

- UROC Innovation Scholar (funded by CSUN HSI Equity Innovation Hub & Apple)

## TECHNICAL SKILLS

**Languages:** Python, R, Java 21, SQL/T-SQL, JavaScript/TypeScript, MATLAB, Bash/Unix

**ML & Computer Vision:** PyTorch, YOLO detection and YOLOv8-pose keypoints, SAM 2 / SAM 3 / SlimSAM segmentation, DINOv2 embeddings, ArcFace metric learning, XGBoost, scikit-learn, CNN-LSTM, positive-unlabeled learning, active learning and human-in-the-loop annotation, leakage-aware subject-level validation, ONNX Runtime

**Data Engineering:** Microsoft SQL Server, PostgreSQL, SQLite, Flyway migrations, Hibernate ORM/Envers, JPA, JPQL; schema design with composite and filtered indexes; Quarkus, JAX-RS/REST, Flask REST APIs; Docker; AWS (EC2, S3, SageMaker); distributed work-queue orchestration (lease-based claiming, crash recovery, multi-GPU worker pools); Celery/Redis

**Data Formats & Standards:** COCO (compressed-RLE / pycocotools interoperability), YOLO, Pascal VOC, Darwin Core, CF-1.8 NetCDF, Movebank, GeoTIFF, GeoJSON, Parquet

**Ocean & Geospatial Data:** NOAA VIIRS / ERDDAP satellite data, NDBC buoy data, GIS spatial analysis, Shapely, pyproj, rasterio; acoustic, accelerometer and magnetometer bio-logging tags; VHF telemetry; adaptive signal processing; water quality monitoring; BRUV deployment; CFD modeling (OpenFOAM)

**Statistics:** GAMs, Bayesian hierarchical modeling, Gaussian process regression, bootstrap confidence intervals, sequential Monte Carlo particle filtering and FFBS smoothing

**Marine Operations:** AAUS Scientific Diver; NAUI Divemaster (143 logged dives); MOTC Certified Vessel Operator

## RESEARCH & ENGINEERING EXPERIENCE

### Summer Intern, Bioinspiration Lab (FathomNet)

Jun – Aug 2026

Monterey Bay Aquarium Research Institute (MBARI), Moss Landing, CA

- Designed and prototyped a 10-migration SQL Server schema evolution with rollback scripts, restructuring annotations into an observation → localization → geometry hierarchy so multiple contributors' geometries attach to one animal while license, observer and review state stay per contribution.
- Extended FathomNet's annotation data model and REST API from bounding boxes only to point and COCO compressed-RLE segmentation geometry across JPA entities, repositories, services and resources, porting pycocotools' RLE codec to Java with 17 unit tests so masks from SAM or COCO tooling round-trip byte for byte with no new dependency.
- Extended MBARI's open-source FathomNet Python client to export point and segmentation annotations alongside bounding boxes across COCO, YOLO and Pascal VOC, with per-record license propagation and a gate for datasets whose terms are unknown.
- Converted existing bounding-box annotations into graded segmentation masks across the FathomNet database, scaling from a SAM 2 pilot to a full-corpus SAM 3 run. Built the sharded, crash-safe orchestrator: shard by image, a WAL-mode SQLite manifest as a lock-free work queue with BEGIN IMMEDIATE lease claims so a dead worker's shards are reclaimed automatically, temp-and-rename commits so a crash never marks a half-written shard complete, and one long-lived worker per GPU with the model loaded once.
- Graded every mask rather than accepting it: best-of-three multimask selection by SAM's predicted IoU, a stability score computed from mask logits, and AUTO\_ACCEPT / REVIEW / REJECT tiers on dual thresholds, with rejects routed to a sidecar carrying an explicit deferred count so accept rate could not be inflated.
- Built a loopback ONNX segmentation service (SlimSAM-77-uniform, ONNX Runtime / CoreML) filling FathomNet's SegmentationProvider seam so the editor's Smart Select returns real object masks instead of the shipped stub's disc.
- Built a dataset planning tool that characterizes a proposed ML training slice of an annotated survey imagery corpus from bounded SQL aggregates: an exclusion waterfall attributing every dropped annotation to one named stage, per-concept trainability thresholds and the untrainable long tail, train/test leakage counts under four candidate split keys, and unlabelled-positive contamination.

### Lead Developer, anchor: Biologging Trajectory Reconstruction & Behavior Classification

May – Aug 2026

Jorgensen Lab, CSUMB | co-developed with D. Moran

- Built the validation framework checking biologist-derived kinematics against independent optical ground truth, converting DeepLabCut and SLEAP keypoint exports into tailbeat frequency, amplitude and body lengths per second across four species, with drone and aquarium video speed calibration and paired multi-tag runs scored by Cohen's kappa.
- Rebuilt behavior-classifier evaluation for subject-level leave-one-out cross-validation with per-class precision/recall/F1, balanced accuracy and macro-F1, replacing an evaluation path that leaked individual-animal signal between train and test.
- Implemented verified-position correction threading GPS and acoustic fixes through a particle filter and FFBS smoother to arrest dead-reckoning drift, reported with held-out drift RMSE; added CF-1.8 NetCDF, Movebank and GeoJSON interchange.

### Undergraduate Researcher, Ocean Predator Ecology Lab, CSUMB

Spring 2023 – Present

Mentor: Dr. Salvador Jorgensen

- Developed multiple computer vision pipelines for pose detection and automated shark morphometric analysis across 4,850 archival videos (661 GB, 2012–2026, 4 sites), reaching 0.96 box mAP50, with a SQLite backend structured around Darwin Core concepts.
- Built an active learning pipeline with an iterative human-in-the-loop platform for pose, segmentation and 3D interpretation tasks.
- Built SharkScarAnnotator, a multi-annotator platform whose 15-point labelling skeleton feeds the 16-keypoint pose model, with consensus scoring weighted by annotator experience and confidence.
- Processing accelerometer and magnetometer sensor data alongside dorsal-mounted camera video to correlate movement signatures with observed white shark behaviors.
- Performed computational fluid dynamics analysis (OpenFOAM) of acoustic tags mounted to shark dorsal fins, iterating tag geometry to minimize hydrodynamic drag.

## Research Assistant, Jue Lab, CSUMB

Spring 2025 – Present

Mentor: Dr. Nathaniel Jue

- Built a 11-stage automated analysis pipeline for TECAN plate reader data covering 92 bacterial strains across 6 experimental groups, assessing pesticide bioremediation potential.
- Implemented modified Gompertz growth modeling, Haldane substrate inhibition kinetics, a HistGBT classifier for automated curve quality screening, and Bayesian hierarchical modeling with bootstrap confidence intervals; trained the curve-quality classifier on 480 synthetic and 85 audited real curves, then validated it against an independent 555-curve synthetic suite at 98.7% accuracy.

## Lead Technician, Aquaculture Lab, Moss Landing Marine Laboratories

Spring 2024 – Present

Mentor: Dr. Luke Gardner

- Independently designing and managing two purple sea urchin (*Strongylocentrotus purpuratus*) aquaculture experiments, stocking density optimization and finishing feed roe enhancement, across the full lifecycle from hypothesis through manuscript; two manuscripts in review.
- Performing Texture Profile Analysis (TPA) to assess gonad quality and commercial viability; contributing to kelp forest restoration through sustainable urchin ranching.

## SELECTED PROJECTS

### HABHub: Harmful Algal Bloom Forecasting Platform

1st Place, NOAA SatHack 2025

- Real-time HAB monitoring integrating NOAA VIIRS satellite imagery via ERDDAP, NDBC buoy data and CalHABMAP toxin records for Monterey Bay; 47-feature XGBoost model behind 3 custom REST APIs, with dual dashboards, one for growers and one for public safety, plus automated alerting; containerized production deploy.

### Individual Re-Identification Across Species

2025 – Present

- One re-identification approach applied to more than one animal: SAM 2 segmentation, feature embedding through an ArcFace metric head, and cosine-similarity ranking against a gallery of known individuals, so photographic sightings support mark-recapture without physical tags.
- Harbor porpoise, by dorsal fin outline. MegaDescriptor-L-384 embeddings across 198 individuals (2,393 sightings, 2,153 images), after benchmarking MegaDescriptor-L-384, DINOv2-base and a two-backbone ensemble. Unbiased temporal split (train  $\leq$  2022, test 2023+): 30.5% rank-1, 57.4% rank-5. Leave-one-out on 94 individuals with at least 5 sightings reaches 93.0% rank-1 but is inflated by design and reported only for the gallery-size experiment.
- Broadnose sevengill shark (*Notorynchus cepedianus*), by spot constellation rather than outline: 1,099 images catalogued, 51 individuals labelled, three tracks in parallel (a fine-tuned MiewID head-crop embedding, a spot-graph GNN, and ALFRE-ID zero-shot local features). At this data scale local-feature aggregation outperforms fine-tuned metric learning, so the zero-shot track leads.
- Catalogue platform built to host any patterned marine species, with leopard sharks and eagle rays as the next candidates. Gradio interface, SQLite catalog, Docker deployment.

### VHF Wildlife Tag Detection System

2024 – Present

- Raspberry Pi 5, RTL-SDR Blog V4 and SIM7028 NB-IoT receiver with adaptive pulse detection, auto-calibration and field-tested gain sweep optimization. Measured 1,700 ft maximum range at a 62% detection rate for under \$100 in components, against a \$695 commercial receiver, adding autonomous logging and cellular relay.

### Autonomous Aerial Platform for Marine Survey

2024 – Present

- Custom FPV aircraft for testing computer vision detection from aerial imagery; flight controller programming, motor/ESC configuration and radio telemetry systems.

## PUBLICATIONS

- Sambold, D., & Gardner, L. Effects of Stocking Density on Gonad Development and Survival in Purple Sea Urchin (*Strongylocentrotus purpuratus*) Aquaculture. In review.
- Sambold, D., & Gardner, L. Examining Finishing Feed Applications for Purple Urchin (*Strongylocentrotus purpuratus*) Roe Enhancement. In review.

## PRESENTATIONS

- Sambold, D., Gupta, I., & Jorgensen, S. "Assessing Shark Body Condition." Poster, NEPSS, March 2026, Newport, OR.
- Sambold, D., & Gardner, L. "Optimizing Urchin Aquaculture: Carotenoid Application & Pellet Processing." Aquaculture America, February 2026, Las Vegas, NV.
- Sambold, D., Gupta, I., & Jorgensen, S. "Assessing White Shark Body Condition." Poster, Western Society of Naturalists, November 2025, San Diego, CA.
- Sambold, D., & Jorgensen, S. "Classifying White Shark Behaviors from Sensor Packages." UROC Summer Symposium, CSUMB, Summer 2025.
- Sambold, D. "From Fins to Frames: An AI-Powered Tool for Morphometric Shark Analysis." UROC Spring Showcase, CSUMB, Spring 2025.
- Sambold, D. "HAB Hub: Integrating Satellite, Buoy, and Toxin Data for Real-Time HAB Monitoring in Monterey Bay." ESIP, January 2026, Online.

## FIELD EXPERIENCE & CERTIFICATIONS

### Research & Diver Development Program, South Africa

July – August 2024

- 31 hours of scientific diving: nudibranch population surveys, swell shark egg casing measurement, BRUV deployments, fish dissections and quadrat-based invertebrate counts, microplastic sampling.
- Advanced vessel operations: docking, loading, anchoring, navigation, and equipment deployment and recovery at sea.

### AAUS Scientific Diver, CSUMB

Spring 2024

- Designed and conducted "Thermal Thresholds: The Role of Temperature Fluctuations in Shaping Kelp Forest Health at San Carlos Beach, Monterey, CA."

### NAUI Divemaster, 143 logged dives

July 2024 – Present

- Certified professional dive leader; dive planning, safety management and underwater research coordination.

### MOTC Certified Vessel Operator, CSUMB

2024

### CITI Certified, Responsible Conduct of Research

**LEADERSHIP & OUTREACH**

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| <b>Trail Committee Chair, Advocates for Nisene Marks State Park</b>                                                                                                                                                                          | <i>2024 – 2025</i>    |
| <ul style="list-style-type: none"><li>• Led hazard assessments with 30+ volunteers; developed GIS-based stewardship mapping for park management.</li></ul>                                                                                   |                       |
| <b>Educational Aide, Elkhorn Slough Foundation</b>                                                                                                                                                                                           | <i>2024 – 2025</i>    |
| <ul style="list-style-type: none"><li>• Led environmental education programs for students in grades 4–10; habitat restoration and community science.</li></ul>                                                                               |                       |
| <b>Relay Station Training Program, Galápagos &amp; California</b>                                                                                                                                                                            | <i>2024 – Present</i> |
| <ul style="list-style-type: none"><li>• Designed and built a low-cost VHF telemetry relay station, deployed it in the Galápagos and multiple California coastal sites, and taught local teams to build, site and repair their own.</li></ul> |                       |