Introduction to Lab

Scientific Method Review: practice lab with marine theme – (rescuing a gummy worm adrift on a ship this year)

Map Fundamentals Review: latitude, longitude, distance, headings; Rubber Ducky or Nike Shoe data

ArcGIS & Google Earth Basic Skills: online mapping and imagery, (possibly story maps)

Ocean History

Navigation- celestial, GPS, dead reckoning; ship routing

Evolution of Ocean Science: research and presentation of scientists, tools, landmark discoveries (social science connections)

Ship Building (if resources/time permit – new for 2018-19): design/build/test student ship designs

Geology

Exploring the Ocean Floor: compute/build features to scale based on a sonar data set, create a profile from a mystery box, or create vertical profile from maps (arcgis); feature identification and determination of passive or active margins

Ocean Crust: Continent Crust: rock type identification and characteristics (appearance, density)

Sea Floor Activity: graham cracker plate tectonic; age of sea floor, boundary motion, active/passive margins

Ocean Volcano: Ring of Fire mapping, evidence of past activity, island building (process and plotting data)

Sediments: core analysis (including JOIDES core), sedimentation, sediments types, sampling, role of carbonates

Chemistry

Traditional Chemistry Lab/Problem Set: water, salt, salinity of solutions

Salinity: Osmosis: Understanding fresh water -salt water differences (relate to animals internal balance)

pH- ocean acidification: experimenting with different solutions, pH testing, and shells

Boyles Law: effect of ‘pressure changes in ocean

Oceanography- Atmosphere Interactions


Mapping Gyres and Currents: (GIS or paper depending on resources next year)

Ocean Circulation (wind-driven & Coriolis): draw, calculate, observe

Ocean Circulation (density driven): experimenting with temperature and salinity density layers, turn table
Ekman Spiral: construct a model to show changes in circulation with depth

Exploring Upwelling: El Nino connections, Nutrient Source

(Hurricane: tracking, role of ocean, impact of hurricane on ocean environment and shore; will shift around in course to focus on an active storm)

**Oceanography – Waves & Currents**

Wave tank Experiments: creating different waves with different forcing, calculating wave properties, exploring wave energy (bobbing object), tsunami generation and shoreline, (rip current, long shore current)

**Physical Oceanography--- Tides**

Tides around the world: Use Tide Tables, plotting, calculation, and mapping to see patterns in tides and compare tides from different regions and coastal shapes

(Tidal energy – design a machine –new lab under development for 2018-19)

**Marine Ecology**

Photosynthesis (if lab not done already in Biology class)

Mapping Chlorophyll and Sea Surface Temperature: connecting biomass and upwelling (mapping, satellite imagery, and calculation)

Plankton Observation: observe, draw, identify plankton based on microscope work

Porifera Type Identification: exploration/classification of sponge types using real sponges and specimen slides with microscope

Marine Phyla: Identify Compare Contrast structures of organisms in different phyla based on preserved specimens and internet resources

Starfish Dissection: traditional dissection lab examining structure of an echinoderm

Shark or Squid Dissection (funding dependent and if not covered in Biology class)

Classification and New Organism Discovery: sorting a random collection of organisms into existing classification scheme, then student defined groupings, classifying a newly discovered (student designed) organism using the traditional and student schemes.

Design/Build a new fish: exploration of adaptations for an existing habitat (adaptive strategies, interaction, predator/prey)

Animal Tracking: mapping migrations, hot spots (this year: turtle and albatross), calculations

Habitat (Data Nuggets): invasive species data analysis, species preservation

Ecosystem: energy flow, population considerations (plankton or other) density, carrying capacity, nutrient cycles, biomass calculations

Ecosystems Considered: Salt March, Estuary, Coral Reef, Open Ocean, Hydrothermal Vents, Polar, Sandy Beach, Rocky Shore, Kelp Forest, Mangrove Swamp, Sea Grass Meadow, etc. – processes and organisms
Polar Regions Adaptations: Blubber Adaptations: exploring thermal regulation in extreme conditions: combinations of fur, blubber, bare skin and ice water, temperature measurement; representing whale, otter, polar bear

**Human Impacts (topics may vary within standards umbrella based on student interests)**

Sustainable fisheries (Ocean to Plate MBARI or commons): role play with calculations, open ended results, student-driven fishing management plans; exploration of commercial fisheries operations

Oil Spill: oil dispersion in salt water, effect on feathers, different cleaning options

Plastics: mapping passage and associated calculations/estimates related to the Pacific Garbage Patch

Biomagnification/bioaccumulation: role simulation of intensification plastic toxins through the food chain and calculations

Shore Processes: experimenting with different scenarios of water, sand, “development” objects, Google Earth, images, and accompanying materials

Sea Level Change: modeling land ice/sea ice role in sea level rise using ice, water, clay land

Simple Climate Model: exploring changes in ocean & global climate based on adjusting ocean-atmosphere parameters in online climate model simulation

**Special Topics**

Robotics: ROV’s

Planetary Oceans: evidence of “oceans” on other planets, comparison with Earth’s ocean.

Field Trip: Aquarium, Biosphere2, or University Lab (maybe California for small group of students)

Guest Speakers/Activity: professional in a marine field (this year was Fin Foundation with shark artifacts to explore and compare)

**Lab Hours:** 50+ hours of lab depending on student understanding, pace, complexity. Based on 180 days in class, ~160 days available (excluding end of term exams, interim tests; school day events), 160 days/5day weeks = 32 weeks, 1-2 labs per week.

**Sources of Labs and/or Data:** teacher’s personal collection --developed or adapted, teacher’s personal contacts in professional field, MBARI, Bridge VIMS, COSEE, NOAA, NASA, ESRI, SCRIPPS, Teach Ocean Science, Oregon State, Smithsonian Ocean Portal, NSTA, SERC Carleton, OceanTracks/Oceans of Data, JOIDES, UCAR, CRU/UEA-UK, PSU, Monash, NSIDC and similar.