

**Semester at Sea, Course Syllabus
Colorado State University, Academic Partner**

Voyage: Spring 2017
Discipline: Natural Resources
Course Number and Title: NR 370 Coastal Environmental Ecology
Division: Upper
Faculty Name: Ursula Quillmann
Semester Credit Hours: 3

Prerequisites: One general or fundamentals of chemistry course

COURSE DESCRIPTION

This interdisciplinary course will examine different stressors and their impacts on the ecology of coastal environments. We will investigate stressors on coastal environments, such as urban development, overfishing, mining for oil, gas and sand, pollution, ocean acidification, eutrophication, and changes in sea level and in climate. We will analyze the how these stressors affect various coastal ecosystems and environments, such as wetlands, mangrove forests, sea grass beds, coral reefs, sand dunes, and kelp forests.

Coastal environments are changing right in front of our eyes, affecting both marine and terrestrial ecosystems. SAS will provide real life teaching moments. We will witness first hand the state of the different coastal ecosystems and assess the measures (if any) different countries implement to protect their coastal ecosystems and environments. Over half the world's population lives concentrated in coastal areas and coastal population is expected to rise, further intensifying the pressure human activity has on coastal zones. It is urgent to call for global measures to be taken to help protect and restore natural coastal environments that are still remaining.

LEARNING OBJECTIVES

- To provide fundamental understanding of oceanic processes and interaction between oceans, atmosphere, and coast lines.
- To assess the extent of global coastal changes (natural and human-caused) and their effects on coastlines.
- To reason how coastal areas should be best managed to balance human interest with protecting valuable habitats for wildlife and fisheries.

REQUIRED TEXTBOOKS: NONE

Students can access course material and required readings on the intranet.

Required material: a waterproof field lab book (Rite in the Rain), pencils, colored pencils, eraser, sharpener, one pair of plastic gloves (puncture proof). One 3-ring binder (2") and page dividers.

TOPICAL OUTLINE OF COURSE

Depart Ensenada – January 5

- B1 – January 8: Introductions, Syllabus
Mapping the course: Overview of the various ports and countries we will be visiting.
- B2 – January 10: Lecture: Plate tectonics and dynamic coastlines (Part I)
Student-led discussion on Hawaiian ecosystems

*Preparation for Hawaii:
Evolution of the Hawaiian Islands
and their coastlines.*

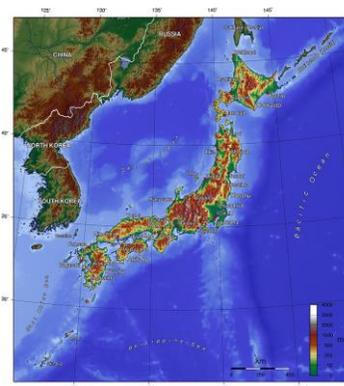
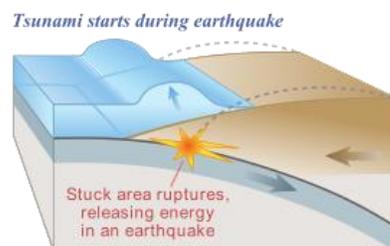


Figure: Hawaiian islands and undersea terrain (Wiki commons)

Honolulu – January 12

- B3 – January 13: Debriefing
Lecture: Coral ecosystems
Student-led discussion on warm-water corals and climate change
- B4 – January 15: Lecture: Protecting our coastlines
Student-led discussion: copying nature to protect coastlines
- B5 – January 18: Lecture: Plate tectonics and dynamic coastlines (Part II)
- January – No class
- B6 – January 21: Lecture: Dispersion of plastics across ocean basins via gyres: effects on coastal environments (including the effects of plastic pollution on the ecosystems)
- B7 – January 23: Lecture: Fishing practices and effects on coastal ecosystems
Student-led discussion: The role fish and marine ecosystems

*Preparation for Japan:
Tectonic setting and tsunamis*



Figures: The interaction of two oceanic plate boundaries created Japanese island arc and makes Japan prone to tsunamis (Wiki commons)

Kobe – January 24-28

B8 – January 30:

Debriefing

Lecture: Damming of rivers and effects on coastlines and coastal ecosystems.

Student-led discussion: ecological role of tidal flats of the Changjiang (Yangtze) estuary

*Preparation for China:
Damming of the
Yangtze River,
pressure of humans
and infrastructure on
coastlines*



Figures: Two satellite maps (upper right) compare the upper Yangtze river before (1987) and after (2006) the Three Gorges Dam was built. Shanghai is the largest Chinese city by population. The image above shows the skyline of Shanghai. The satellite image on the right shows the urban area of Shanghai in 2005.

(Wiki Commons)

Shanghai – January 31-February 5

B9 – February 7:

Debriefing

Lecture: Tides

Student-led discussion: shrimp aquaculture in mangrove ecosystems

B10 – February 9:

Student-led discussion: land-use changes and effect on mangrove ecosystems

*Preparation for Vietnam:
Mangrove forest ecosystems*



Figure: View of an above and below the waterline mangrove habitat.

(Wiki Commons)

Ho Chi Minh City – February 1-14

February 17— No class

B11 – February 16: Debriefing
Lecture: Earth's radiation balance and Greenhouse gases and aerosols
Student-led discussion: Status quo IPCC Report

B12 – February 19: Lecture: Atmospheric and Oceanic coupled systems
Case study: Southern Oscillation and El Nino (ENSO)
Student-led discussion: Monsoon extremes and effects on societies on Southeast Asia

Preparation for Rangoon:
Monsoon

Figure: The wet monsoon season is vital for growing rice, the largest agricultural product of Myanmar (Wiki Commons)



Yangon – February 20-14

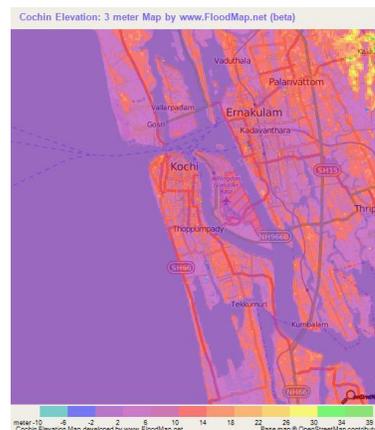
B13 – February 26: Debriefing
Lecture: River deltas and Changes in sea levels along delta-dominated coasts
Student-led discussion: Status quo IPCC Report
Student-led discussion: Human influence on deltas

B14 – February 26: Lecture: Estuarine coastlines
Student-led discussion: Implications of sea level rise on the coastal zones of Cochin, India

*Preparation for Cochin:
Heavy metal enrichment
in the Cochin estuary*

Figure: Elevation map of Cochin and the area around Cochin. Note the vast network of channels of the backwaters of Cochin.

(<http://www.floodmap.net/Elevation/ElevationMap/?gj=1273874>)



Cochin – March 1-6

B15 – March 8: Debriefing
Lecture: Ocean acidification (OA)
Student-led discussion: The effects of OA on marine fauna and ecosystems

B16 – March 11: Lecture: Marine light pollution
Student-led discussion: case studies of marine light pollution (e.g. on sea turtle, migrating sea birds, coral spawning)

*Preparation for Mauritius:
Invasive species*

Figure: The dodo (Raphus cucullatus) is an extinct flightless bird endemic to Mauritius. The dodo was hunted by humans and invasive species (Wiki Commons)



Mauritius – March 12

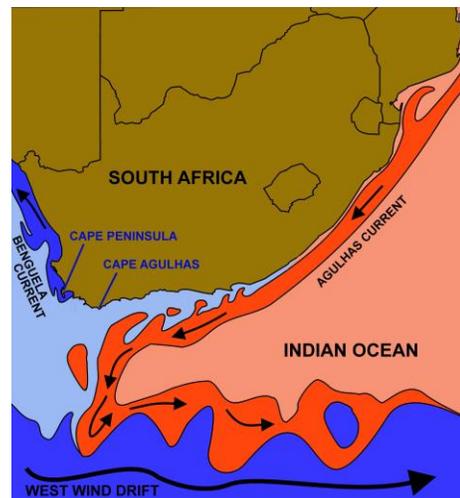
B17– March 14: Debriefing
Lecture: Eutrophication and Hypoxia; Documentary: Aliwal shoal

March 15 – No class

B18 – March 17: Finishing up the documentary: Aliwal shoal
Lecture: Seasonal nutrient-rich and nutrient-poor ocean surface currents and their effects on coastal ecosystems.
Student-led discussion: population dynamics and conservation of the African penguins
Student-led discussion: releasing formerly captive raggedtooth sharks in South African waters

*Preparation for Cape Town:
Annual migration patterns of
marine fauna*

Figure: The ocean currents that influence the marine environment off the coast of South Africa. (Wiki commons)

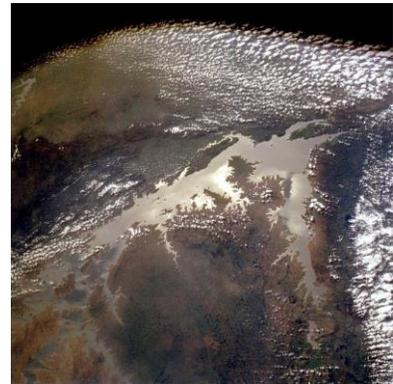


Cape Town – March 19-24

- B19 – March 25: Debriefing
Trophic structure of marine food webs
Student-led discussion: Krill fisheries and the effect on food webs
- B20 – March 27: Nutrient-profiles, downwelling and upwelling.
- March 29 – No class
- B21 – March 30: Student-led discussion: Consequences of the Akosombo Dam on Lake Volta and coastal ecosystems

*Preparation for Ghana:
Water quality, nutrients and pollutants
in the sediments of Lake Volta and
implications for coastal ecosystems;
harvest of submerged timber from
flooded forests under Lake Volta.*

*Figure: Lake Volta as seen from the
International Space Station
(Wiki commons)*

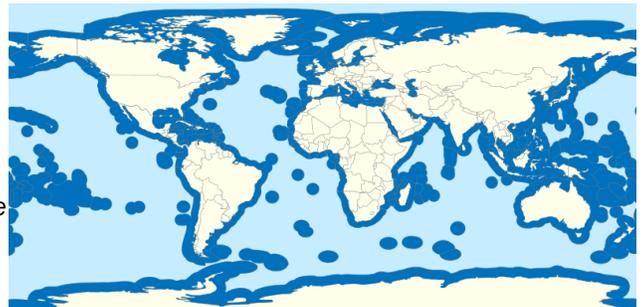


Tema – March 31-April 3

- B22 – April 5: Debriefing
Are we heading towards a jelly-dominated ocean?
Student-led discussion: The empty sea
- B23 – April 7: Presentations and discussions of field class journals
- B24 – April 9: Lecture: Sand: an unlimited resource?
Student-led discussion: Migration and the high mortality of European seabirds in Morocco

*Preparation of Morocco:
Foreign fisheries offshore
and their effect on local
food security*

*Figure: The exclusive economic zone
(in dark blue) as determined by the
“United Nations Convention on the
Law of the Sea”
(Wiki commons)*



Study Day – April 10

Casablanca – April 11-14

B25 Final – April 16: Presentations and discussions of voyage journals

Arrive Hamburg – April 19

READINGS LIST

Herr 2009 Ocean and Climate Change
Marine Ecozones
Tar1_The Climate System: an Overview

January 10 & 18: Plate Tectonics

Historical perspective [This Dynamic Earth, USGS]
Inside the Earth [This Dynamic Earth, USGS]
What is a tectonic plate? [This Dynamic Earth, USGS]
Alfred Lothar Wegener [This Dynamic Earth, USGS]
Developing the theory [This Dynamic Earth, USGS]
Magnetic stripes and isotopic clocks [This Dynamic Earth, USGS]
Exploring the deep ocean floor [This Dynamic Earth, USGS]
Understanding plate motions [This Dynamic Earth, USGS]
The Himalayas [This Dynamic Earth, USGS]
Hotspots [This Dynamic Earth, USGS]
Prominent hotspots on world map [This Dynamic Earth, USGS]
Hawaiian hotspot [This Dynamic Earth, USGS]
Some unanswered questions [This Dynamic Earth, USGS]

January 10 & 13: Student-led discussion on Hawaiian ecosystems Coral ecosystems and climate change

Marine ecosystem-based management in the Hawaiian Islands
2016-hawaii-spring-newsletter_nature conservancy
2015-hawaii-fall-newsletter-nature conservancy
Using Corals of Opportunity for a Nursery in Hawaii
Patterns of Coral Disease across the Hawaiian Archipelago: Relating Disease to Environment
Hawaiian Ecosystems
Coral reef ecology
Ecology Hawaii
Researchers look to explain why Hawaii has a diverse ecosystem despite barren ocean landscape |
Daily Mail Online
Hawaii Is Now Home to an Ocean Reserve Twice the Size of Texas
NOAA declares third ever global coral bleaching event
U.S.'s Longest Cat-Proof Fence Protects Endangered Birds

Coral Reefs Under Climate Change and Ocean Acidification: Challenges and Opportunities for Management and Policy

A framework for understanding climate change impacts on coral reef social-ecological systems

MARINE MICROBIOLOGY

Changing climate, changing plankton communities

- Ursula Hofer

Nature Reviews Microbiology 14, 2 (2016) doi:10.1038/nrmicro.2015.15

January 15:

Student-led discussion: copying nature to protect coastlines

January 21:

Plastics

From Giant Gray Whales to the Tiniest Corals- Marine Debris is an Everyday Problem with Real Impacts

Breakdown Rates

No island is an island

Plastic unwrapped

January 23:

Student-led discussion: Fishing and marine ecosystems (Japan)

The effects of fishing on sharks, rays, and chimaeras (chondrichthyans), and the implications for marine ecosystems

Marine Biodiversity in Japanese Waters

January 30:

Student-led discussion: ecological role of tidal flats of the Changjiang (Yangtze) estuary

Land claim and loss of tidal flats in the Yangtze Estuary

- Ying Chen, Jinwei Dong, Xiangming Xiao, Min Zhang, Bo Tian, Yunxuan Zhou, Bo Li & Zhijun Ma

Scientific Reports 6, Article number: 24018 (2016)

doi:10.1038/srep24018

Tidal flats of the Yellow Sea: A review of ecosystem status and anthropogenic threats

February 7:

Student-led discussion: shrimp aquaculture in mangrove ecosystems

Shrimp Fry Farmers of Sundarban Mangrove Forest (India): A Tale of Ecological Damage and Economic Hardship

February 9:

Student-led discussion: land-use changes and effect on mangrove ecosystems

Impacts of climate change on mangrove ecosystems: a region by region overview

The habitat function of mangroves for terrestrial and marine fauna: A review

February 16 & 26:

Student-led discussion: Status quo IPCC Report

Ar4_synthesis report

February 19:

Student-led discussion: Monsoon extremes and effects on societies on Southeast Asia

Effect of climate change on seasonal monsoon in Asia and its impact on the variability of monsoon rainfall in Southeast Asia

Monsoon extremes and society over the past millennium on mainland Southeast Asia

Why The Monsoon Is The Biggest Factor In The South Asian Economy

Why Monsoons Happen

Where Monsoons Are Found

Monsoons Impact People

The Aerosol-Monsoon Climate System of Asia: A New Paradigm

The Joint Aerosol-Monsoon Experiment

Mangroves - National Geographic Magazine

Myanmar_Sustainable Coastal Zone Management in Myanmar(2013)

February 26:

Student-led discussion: Human influence on deltas

The Mekong-Economist

World's River Deltas Sinking Due to Human Activity, Says New Study Led by CU-Boulder

Deltas Syvitski

Subsidence and human influences in mega deltas: The case of the Ganges–Brahmaputra–Meghna
Responding to rising sea levels in the Mekong Delta

- A. Smajgl, T. Q. Toan, D. K. Nhan, J. Ward, N. H. Trung, L. Q. Tri, V. P. D. Tri & P. T. Vu

Affiliations

Contributions

Corresponding author

Nature Climate Change 5, 167–174 (2015) doi:10.1038/nclimate2469

Received 23 March 2014 Accepted 17 November 2014 Published online 12 January 2015

The Impacts of Climate Change on the Mekong Delta

Mekong:

a river rising

Climate change: Protect the world's deltas

February 28:

Student-led discussion: Implications of sea level rise on the coastal zones of Cochin, India

Implications of sea level rise scenarios on land use /land cover classes of the coastal zones of Cochin, India

- R. Mani Murali^{a, . . .}, P.K. Dinesh Kumar^b.

Possible Vulnerabilities of Cochin, India, to Climate Change Impacts and Response Strategies to Increase Resilience

Shrinking Indian Islets Spell Sea Change

March 8:

Student-led discussion: The effects of OA on marine fauna and ecosystems

Impacts of ocean acidification on marine fauna and ecosystem processes

Four Effects of Ocean Acidification on Marine Ecosystems

Impacts of Ocean Acidification on Marine Biodiversity

PRISTINE SEAS Ocean Acidification

March 11:

Student-led discussion: case studies of marine light pollution (e.g. on sea turtle, migrating sea birds, coral spawning)

Even Ocean Creatures Struggle With Light Pollution

The nature, extent, and ecological implications of marine light pollution

Light Pollution and Marine Turtle Hatchlings:

Scientists warn light pollution can stop coral from spawning

Signaling cascades and the importance of moonlight in coral broadcast mass spawning

March 17:

Student-led discussion: population dynamics and conservation of the African penguins

Adult survival declines as African Penguin population plummets

The African Penguin-The Boulders Colony

Africa's Penguins Still Reeling From "Guano Craze"

The African Penguin: On A Path to Extinction?

ADW/ Spheniscus demersus/ INFORMATION

African penguin | SANBI

Student-led discussion: releasing formerly captive raggedtooth sharks in South African waters

Migration and habitat use of formerly captive and wild raggedtooth sharks (*Carcharias taurus*) on the southeast coast of South Africa

Malcolm J. Smale , Anthony J. Booth , Michael R. Farquhar , Michael R. Meÿer & Lesley Rochat

Pages 115-128 | Received 14 May 2011, Accepted 22 Aug 2011, Published online: 01 Feb 2012

Download citation <http://dx.doi.org/10.1080/17451000.2011.617756>

Captive shark find new freedom

Suffering in silence/ The ignored plight of sharks | Nouse

March 25:

Student-led discussion: Krill fisheries and the effect on food webs

Human Impacts on Antarctica and Threats to the Environment – Fishing

Krill Conservation - Antarctic and Southern Ocean Coalition

Sea Shepherd Conservation Society - Krill Fisheries, the Next Collapse?

March 30:

Student-led discussion: Consequences of the Akosombo Dam on Lake Volta and coastal ecosystems

Environmental Impacts of Large Dams: African examples

Remediation of the environmental Impacts of the Akosombo and Kpong Dams in Ghana

Case Study Of The Akosombo Hydroelectric Dam Environmental Sciences Essay

The role of the Akosombo Dam on the Volta river in causing erosion in central and eastern Ghana (West Africa)

April 5:

Student-led discussion: The empty sea

April 9:

Student-led discussion: Migration and the high mortality of European seabirds in Morocco

Adult and juvenile European seabirds at risk from marine plundering off West Africa

FIELD WORK

Semester at Sea field experiences allow for an unparalleled opportunity to compare, contrast, and synthesize the different cultures and countries encountered over the course of the voyage. In addition to the one field class, students will complete independent field assignments that span multiple countries.

Field Class attendance is mandatory for all students enrolled in this course. Do not book individual travel plans or a Semester at Sea sponsored trip on the day of your field class. Field Classes constitute at least 20% of the contact hours for each course.

Field Class and Assignment

The Field Class for this course will take place on Tuesday, 14 February in Ho Chi Minh City, Viet Nam.

Mangrove Ecosystem in the Vietnam

Objectives:

Students will take notes about their observations throughout the field class

- To learn about the importance of mangrove ecosystems
- To study the different species of mangroves
- To study the rich biodiversity of mangrove ecosystems, including otter, turtles and tortoises, estuarine crocodiles, and many species of fish.
- To take into account the impact of humans on mangrove ecosystems
- To reflect on the restoration efforts

Field exercises

- Identifying different mangrove species
- Observing the multitude of functions mangrove provide for humans
- Assessing the effects of agriculture, aquaculture, and fishing on the natural habitats

- Taking census of the rich biodiversity, including monkeys, saltwater crocodiles, fish species, and birds.
- Trekking along wooden tracks through the forest
- Snorkeling in the mangroves (where safe)
- Stop at local markets to see products offered from the mangrove ecosystems

Assessment:

Students will be evaluated based on:

1. Field journal addressing the objectives as outlined above (80%): typed (photos and sketches are encouraged), due by _____ ,
2. 2-3 page typed essay (topics will be announced and students can choose a topic from the list)

Independent Field Assignments

Ports-of-call reports: Students in groups will be assigned three ports-of-calls countries. In the port and in the country, students should note anything they deem relevant to our course, which could include damming of rivers; coastal erosion; manmade structures to prevent erosion; seafood consumption and seafood offered in stores and markets; aquaculture; fishing practices; marine light pollution; algae blooms – just to name some examples.

Each group will prepare a 5-minute power point presentation per port, including own photos, and turn in one essay per group per port (1-2 pages). The students will be graded on their creativeness and ability to apply concepts we covered in class to their observations; quality of their essays and PPP.

GRADING:

Student-led discussions	30%
Class participation	6%
Journey observation	20%
Ports-of-call reports (photos and essays)	24%
Field Class: journal and essay	20%

Student-led discussions: Students will present papers available to students on the intranet. The tasks of the presenting students include showing the relevant figures on PPP, providing background information (if applicable), being familiar with the content, and posting questions for their peers beforehand. The presenting students can earn up to 20 points for the quality of the presentation and 10 points for the quality of the questions they post for their peers.

The non-presenting students will be evaluated on the quality of the answers (10 points) and their engagement in the discussions (5 points). Students can see on Canvas the maximum number of points they can earn in this category.

Class participation: Instructor will provide questions at each class session for students to answer. Student answers will provide feedback to the instructor.

Journey observation: Students will keep a journal. Maps will be provided for students to keep track of the voyage. Students will be assigned days on which they note the speed, weather, wind strength, wave height, cloud cover. If possible, we will take water samples and under a microscope we will identify the content of the samples.

The journal should include wildlife sightings, other ships we will see (fishing boats, cargo ships, etc.) We will cross the great Pacific garbage patch. Students should note what kind and size of plastic debris they see. A more complete list what students should watch out for will be handed out at the beginning of the class.

Description and grading schemes for the field class and for the port-of-call studies are outlined above.

METHODS OF EVALUATION / GRADING SCALE

The following Grading Scale is utilized for student evaluation. Pass/Fail is not an option for Semester at Sea coursework. Note that C-, D+ and D- grades are also not assigned on Semester at Sea in accordance with the grading system at Colorado State University (the SAS partner institution).

Pluses and minuses are awarded as follows on a 100% scale:

<u>Excellent</u>	<u>Good</u>	<u>Satisfactory/Poor</u>	<u>Failing</u>
97-100%: A+	87-90%: B+	77-80%: C+	Less than 60%: F
93-97%: A	83-87%: B	70-77%: C	
90-93%: A-	80-83%: B-	60-70%: D	

ATTENDANCE/ENGAGEMENT IN THE ACADEMIC PROGRAM

Attendance is mandatory. Students must inform their instructor prior to any unanticipated absence and take the initiative to make up missed work in a timely fashion (to be discussed with the instructor) to receive the participation points for the day and make up missed work. The student should get class notes from peers. The instructor will be available during office hours (or by appointment) to assist student to catch up. In the event of a conflict in regard to this policy, individuals may appeal using established CSU procedures.

LEARNING ACCOMMODATIONS

Semester at Sea provides academic accommodations for students with diagnosed learning disabilities, in accordance with ADA guidelines. Students who will need accommodations in a class, should contact ISE to discuss their individual needs. Any accommodation must be discussed in a timely manner prior to implementation. A memo from the student's home institution verifying the accommodations received on their home campus is required before any accommodation is provided on the ship. Students must submit this verification of accommodations pre-voyage as soon as possible, but no later than December 15, 2016 to academic@isevoyages.org.

STUDENT CONDUCT CODE

The foundation of a university is truth and knowledge, each of which relies in a fundamental manner upon academic integrity and is diminished significantly by academic misconduct. Academic integrity is conceptualized as doing and taking credit for one's own work. A pervasive attitude promoting academic integrity enhances the sense of community and adds value to the educational process. All within the University are affected by the cooperative commitment to academic integrity. All Semester at Sea courses adhere to this Academic Integrity Policy and Student Conduct Code.

"I have not given, received, or used any unauthorized assistance on this exam/assignment."

ELECTRONIC COURSE MATERIALS

DOCUMENTARY (FEATURE FILM):

Sand Wars

<http://sand-wars.com>

Nick Springer

SHORT PROGRAMS:

Changing Seas TV (~20-min documentaries)

Episode

803 Maug's caldera

802 manatees

801 sponges

704 secret sex life of fish

701 sea turtles

603 galapagos

602 biggest fish in the sea

503 creatures in the deep

302 reef revival

301 alien invaders

203 sea grasses and mangroves

103 corals of the deep

Blue Sphere media (5-min documentaries):

Mantas last dance <https://vimeo.com/59533577>

The making of "Mantas last Dance" <https://vimeo.com/60302086>

Befriending giants <https://vimeo.com/35675090>