Introduction

10 January 2017

OCN 623 – Chemical Oceanography

TR 10:30 – 11:45am in MSB 315

Brian Glazer
glazer@hawaii.edu
Biogeochemistry & microbial geochemistry

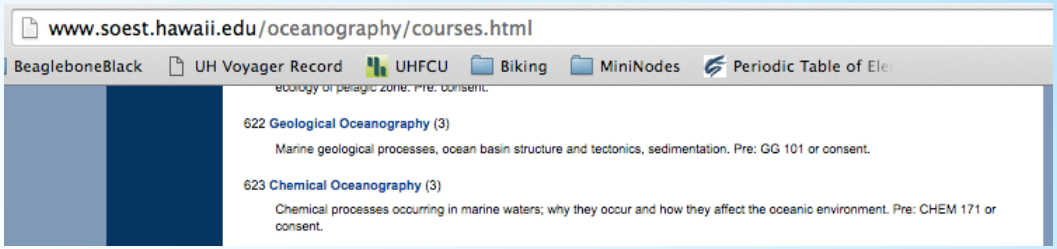
Chris Measures
chrism@soest.hawaii.edu
Chemistry review & trace elements

Frank Sansone
sansone@soest.hawaii.edu
Gases & tracers

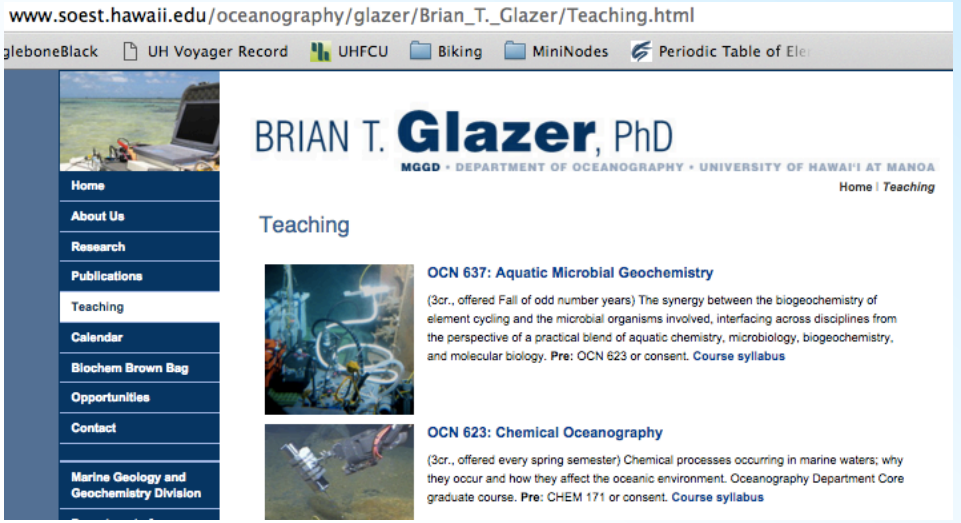
Mariko Hatta
mhatta@hawaii.edu
Ocean Data View

OCN623 Web Presence

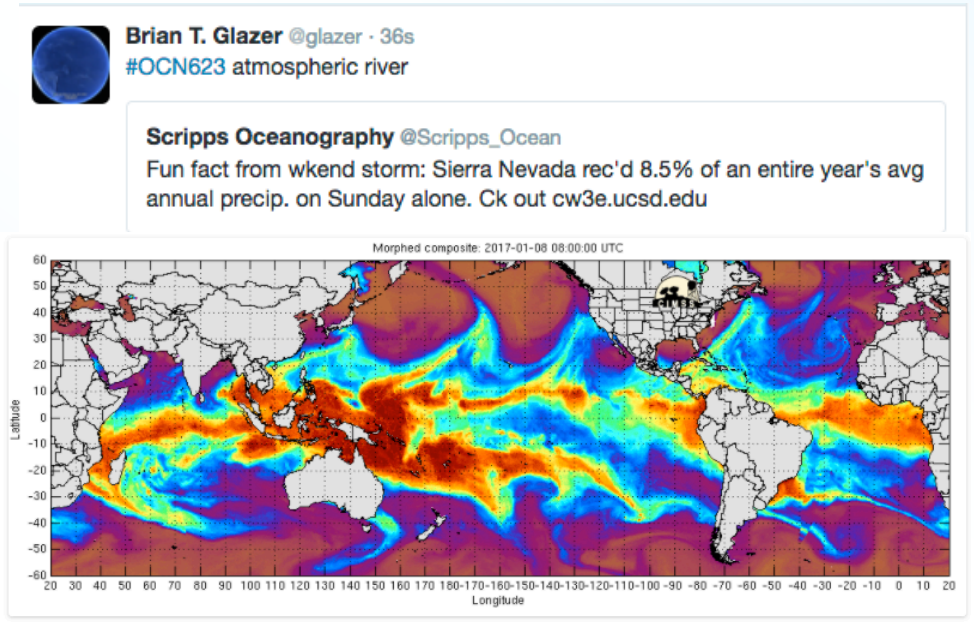
OCN Dept Courses Page



Glazer 'Teaching' Page



Twitter: @glazer, #OCN623



Course Philosophy

Every oceanographer needs to have a fundamental understanding of all of the disciplines of oceanography. This is not just because we desire to turn out well rounded oceanographers -- it is extremely important to your career & moving fields forward.

Like any science, the most interesting discoveries are often waiting to be made at the interface between disciplines; it is the application of knowledge in one area to problems in another that leads to fundamental improvements in our understanding.

Further, “skills” from one branch of oceanography can frequently be useful to research efforts in the other branches.

Finally, all of us need to know enough about the other fields of oceanography so that we are literate in them and are thus capable of understanding the literature in those areas and able to talk other researchers.

Each of the other oceanographic sub-disciplines interact with chemical oceanography on some spatial/temporal scale:

- **Physical oceanography** uses the chemical parameters provided by chemical oceanography to provide constraints on the origin and circulation of the water masses.

- **Geological oceanography** and chemical oceanography are related through both the chemical cycles and the interaction between rocks and water in the weathering cycle at both high and low temperature.

- **Biological oceanography** is highly affected by the chemical dependency of organisms and the inverse, their effect on the distribution of chemicals.

Therefore, upon successful completion of this course, students are expected to be able to:

- Explain the underlying principles of chemical and biogeochemical cycling in marine systems;

- Identify marine chemical and biogeochemical processes that impact the students' areas of oceanographic interest, and know how to access and understand information on these processes;

- Use written and oral communication to clearly explain marine chemical and biogeochemical processes and related contemporary research

Course Structure

- ***Fundamental Concepts*** – Equations, redox, thermodynamics, ion speciation (*break out the freshman chem books for review*)

- ***Chemical properties*** – Trace elements, dissolved gases, pH, alkalinity, the CO_2/carbonate system, organic matter, isotopes

- ***Geochemical reservoirs and fluxes*** –
  - Origin of the earth, comparing it to other nearby planets
  - Origin of the oceans on Earth, and the concept of separate identifiable geological reservoirs
  - The cycling of materials within and between these reservoirs
  - Fluxes of materials into the oceans from land, marine sediments, and the interaction between sea water and the crust
  - Fluxes of materials both into and out of the oceans at the sea surface

• ***Biogeochemical transformations*** – These lectures will demonstrate the fundamental processes (input, removal and recycling) that govern the behavior of chemicals in sea water. We will look at:

- The nature and reactivity of gases, organic compounds, nutrients, trace metals and stable and radio-isotopes
- The distributions of these chemicals, which will help us understand the processes that produce them
- The sinks of chemical materials in the oceans
- The biogeochemical processes that occur in estuaries, and the role that these processes have in modifying the fluxes of materials from the continents to the oceans
- The ocean-atmosphere interactions and the importance of the sea-surface microlayer
- The feedback mechanisms that exist between the oceans and atmosphere
- The importance of these feedbacks to global climate and the evolution of the chemical cycles
- The role that these cycles have played in maintaining the temperature and conditions at the surface of the Earth over geologic time
- Lessons that can be learned from the fossil record of these cycles in terms of predicting the future climatic consequences of anthropogenic activity

Course Outline – 10 Jan 2017

1	10-Jan	Introduction to course, scientific literature searches	syllabus	BG	
2	12-Jan	Balancing reaction equations, oxidation state, redox reactions	Handout	CM	
3	17-Jan	Chemical equilibrium, redox and pE-pH diagrams	L ch. 7	CM	
4	19-Jan	Ion speciation	L ch. 5	CM	
5	24-Jan	Chemical composition of sea water; major constituents	L ch. 2, 3, 4	CM	
6	26-Jan	Trace elements in sea water	L ch. 11	CM	
7	31-Jan	GEOTRACES	Handout	CM	
8	2-Feb	Ocean Data View	Websites & handouts	CM/MH	
9	7-Feb	Nutrients; Aerobic carbon production and consumption	L ch 8 & 9	BG	
10	9-Feb	Biogenic production, carbonate saturation and sediment distributions	L ch 15 & 16	BG	
11	14-Feb	Diagenesis in sediments and resulting sediment-seawater fluxes	L ch. 12	BG	
12	16-Feb	Dissolved gases other than carbon dioxide in sea water	L ch. 6 (1st half)		FS
13	21-Feb	Carbon dioxide, alkalinity and pH	L ch. 15		FS
14	23-Feb	Global CO2; air-sea gas exchange	L ch. 6 (2nd half)		FS
15	28-Feb	No Class - ASLO - Mountains to the Sea			
16	2-Mar	No Class - ASLO - Mountains to the Sea			
17	7-Mar	*** Mid-Term Exam ***		BG	
18	9-Mar	Hydrothermal Systems	L ch. 19	BG	
19	14-Mar	*** Student reports - ODV visualization challenge ***		BG	
20	16-Mar	Oceanic water mass tracers	L ch. 10 & 24		FS
21	21-Mar	Stable isotopic tracers	Handout		FS
22	23-Mar	Radio-isotopic tracers	Handout		FS
	28-Mar	*** Spring Break - No Class ***			
	30-Mar	*** Spring Break - No Class ***			
23	4-Apr	Estuarine structure and function	L ch. 28	BG	
24	6-Apr	Estuarine coastal biogeochemistry	Handout	BG	
25	11-Apr	*** Discussion of peer reviews ***		BG	
26	13-Apr	Geochemical reservoirs and transfer processes	L ch. 21	BG	
27	18-Apr	Atmosphere, the water cycle, climate change	Handout	BG	
28	20-Apr	People, oceans, climate change	L ch. 25	BG	
29	25-Apr	Electrons, life, and the evolution of Earth's chemical cycles	Handout	BG	
30	27-Apr	*** Student Presentations I ***		all	
31	2-May	*** Student Presentations II ***		all	
32	4-May	*** Final Exam Week ***		BG	

Readings from Libes, Marine Biogeochem 2nd edition, handouts, web links

ASLO 2017 AQUATIC SCIENCES MEETING

About The Meeting

In 2017, ASLO will return to one of its most popular locations – Honolulu, Hawai'i. This is an important meeting to address water issues and promot scientific exchange across the freshwater to marine continuum. The meeting will also embrace the Hawaiian cultural perspective linking land, water, and peoples. ASLO invites you to participate in this biennial meetin and to take part in the dialogue among limnologists and oceanographers from around the world.

What's New?

VIEW ALL ›

TUESDAY, 28 FEBRUARY 2017

ASLO 2017 Aquatic Sciences Meeting

Room		301 B	302 A/B	304 A/B	305 A/B	306 A	306 B	308 A/B
Theater Set (Max.)		199	168	258	162	150	168	194
9:00 - 9:50		MORNING PLENARY - Lionel Guidi - 9:00 to 9:50						
9:50 - 10:00		*Transition Time*						
	Session	71	69	12	68	3	63	41
10:00	Orals	Molecular Insights into Adaptive Microbial Physiology	Aquatic Transitions: Tracking the nature and trajectories of change using paleolimnological approaches	The Biogeochemistry of Dissolved Organic Matter	Spatial and Temporal Dynamics of Aquatic Microbial Communities	Phosphorus Along the Soil-Freshwater-Ocean Continuum	Microbial Ecosystem Services and Interactive Effects on Organic Matter Processing Along the Land-Sea Continuum	Sediments with Hydrodynamically Driven Flow, from Stream to Shelf
10:15								
10:30								
10:45								
11:00 - 12:00		POSTER SESSION AND COFFEE BREAK						
	Session#	71	69	12	68	3	63	41
12:00	Orals	Molecular Insights into Adaptive Microbial Physiology	Aquatic Transitions: Tracking the nature and trajectories of change using paleolimnological approaches	The Biogeochemistry of Dissolved Organic Matter	Spatial and Temporal Dynamics of Aquatic Microbial Communities	Phosphorus Along the Soil-Freshwater-Ocean Continuum	Microbial Ecosystem Services and Interactive Effects on Organic Matter Processing Along the Land-Sea Continuum	Sediments with Hydrodynamically Driven Flow, from Stream to Shelf
12:15								
12:30								
12:45								
1:00 - 2:30		LUNCH - WORKSHOPS AND ANCILLARY MEETINGS (ASLO Student Workshop)						
	Session#	27	106	12	2	3	82	41
2:30	Orals	Transitioning Ecological Forecasting Research to Operational Applications	Fish	The Biogeochemistry of Dissolved Organic Matter	ASLOMP Student Symposium	Phosphorus Along the Soil-Freshwater-Ocean Continuum	Coupling and exchange across the sediment-water interface	Sediments with Hydrodynamically Driven Flow, from Stream to Shelf
2:45								
3:00								
3:15								
3:30 - 4:30		POSTER SESSION AND COFFEE BREAK						
	Session#	27	106	12	2	26	82	24
4:30	Orals	Transitioning Ecological Forecasting Research to Operational Applications	Fish	The Biogeochemistry of Dissolved Organic Matter	ASLOMP Student Symposium	Undergraduate Research in the Aquatic Sciences	Coupling and exchange across the sediment-water interface	Supporting Data-intensive Freshwater and Marine Research: Integrating Informatics,Infrastructure, Databases, and Open Science
4:45								
5:00								
5:15								
5:30 - 5:40		*Transition Time*						
5:40 - 6:30		Award Talk Session - 5:40 to 6:30						
6:30 - 7:30		Pau Hana/ Happy Hour Get Together						
7:30 - 10:00		Evening Workshops, Town Halls, and Meetings - Times/Locations to be determined						

Homework: The homework will give you a chance to develop chemical skills used in oceanography. Problems sets are due one week after they are assigned (*e.g.*, homework assigned on Tuesday is due at the start of class on the following Tuesday). If homework is not handed in by the deadline, you will get a zero.

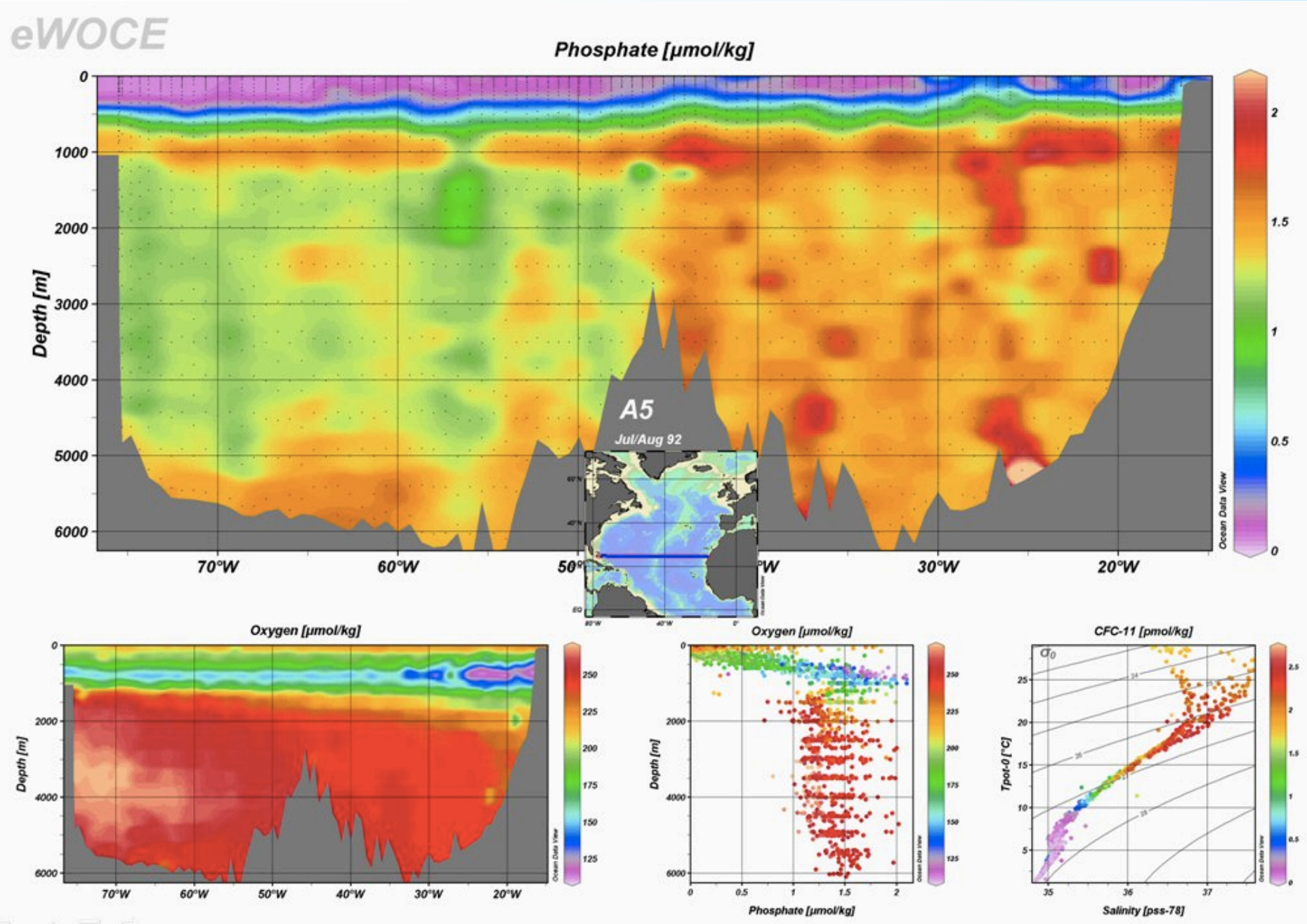
Readings are important! They are listed on the Course Outline. **DO** expect reading material to be covered on the exams, even if it isn't specifically addressed in the lectures!!

Lectures: Nominally they are from 10:30 - 11:45, but realize that classroom discussion can cause the end of class to extend to 11:50 or, occasionally, 11:55. Please plan accordingly.

Exams: The mid-term and final exams will focus on the lectures from the first and second halves of the course, respectively, but not exclusively so: the use of knowledge gained in the first half of the course may be required to answer questions on the final exam. Both exams will be "open book" & "open notes" -- you can bring any written material you wish, but no WiFi devices are allowed.

Final Grade: 25% Final Exam; 25% Mid-term Exam; 30% Term Papers (peer review, final draft, oral presentation); 10% homework assignments, 10% ODV project

The great ODV visualization extravaganza of 2017 begins 2/2/17!!



https://odv.awi.de/

TERM PAPER INSTRUCTIONS

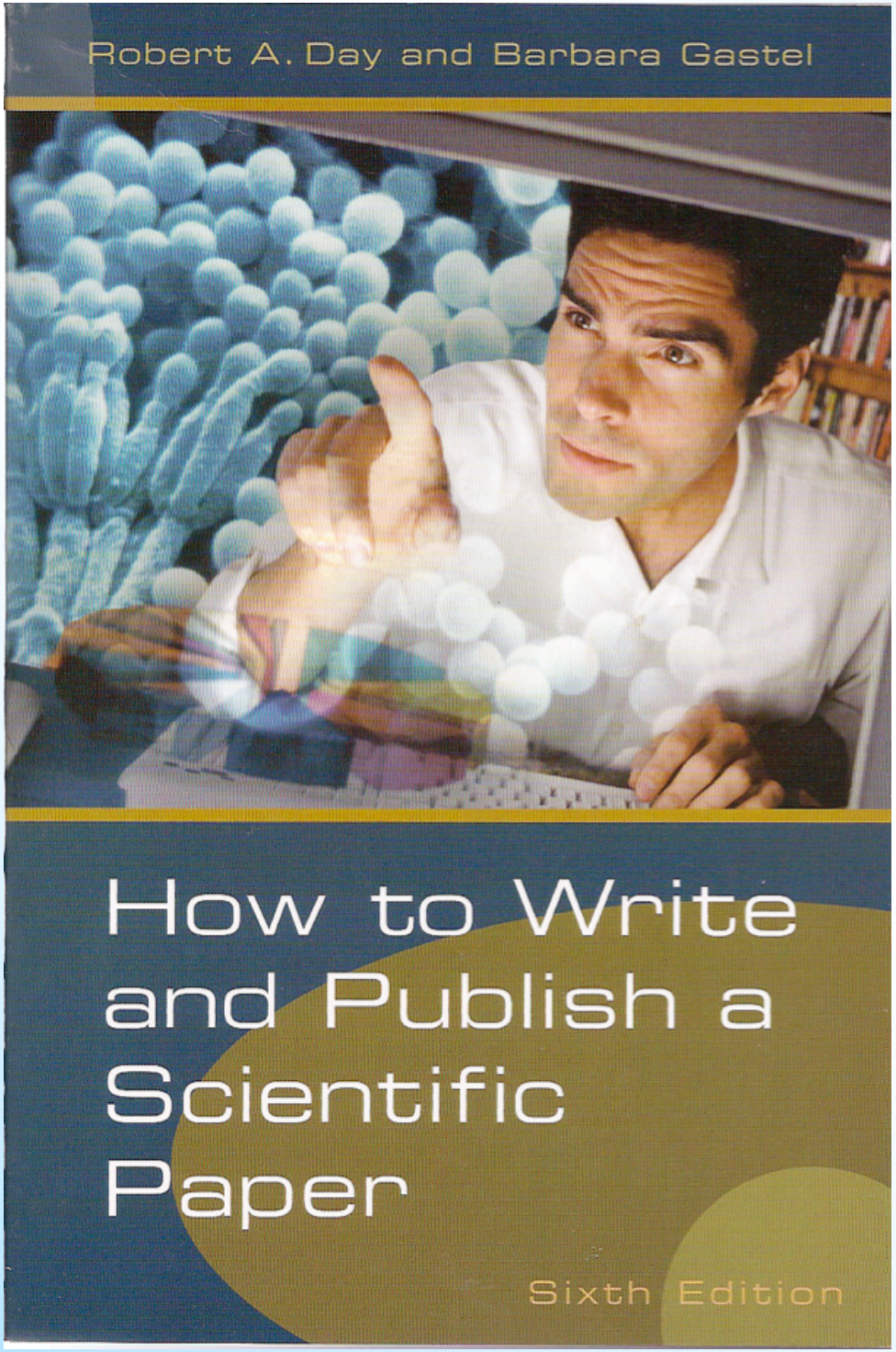
Term Papers and Presentations– Each student will be required to write a term paper on a topic of their choice, and to give an oral presentation based on the paper.

Why a term paper??

- Make concepts covered in the course more “concrete”
- Refine technical writing skills
- Provide experience in finding biogeochemical oceanographic info and references

Topics:

- You are free to choose a topic that interests you. They must be chosen by **February 9**.
- Must be a topic of *current* interest in Chemical Oceanography
- Unfortunately, research from Station ALOHA and HOT is primarily "off-limits" -- due to the fact that all of the relevant papers are listed on the ALOHA/HOT web sites. (These convenient lists short circuit your opportunity to dig into the scientific literature and find relevant papers on your own.)
- It can NOT be the **primary** topic of your thesis/dissertation research. (At least “an arm’s length away--we hope that the term paper will be used to *expand* your scientific horizons.)
- Topics used in the past three years cannot be used



Objective

Provide a good review (at minimum) of a current topic of interest in the field of chemical oceanography

Guidelines

A good paper has two key points: good ideas and good writing

Find references
Take notes
Organize topic/subtopics
Incorporate class material
Generate outline
Write draft
Revise
Proof

Communicate efficiently and effectively

Requirements for the term paper:

- Double-spaced, 8-10 pages in length (including figures & tables, not including references).
- References must only be from the original (primary) scientific literature. Please, no textbooks or web pages!
- You should strive to present a coherent story, hopefully interjected with novel observations and conclusions. We are looking for a synthesis/integration of information.
- Please use a spell-checker & **self-edit before submitting each version**.
- Each line and page of the draft should be numbered for easy peer reviewing/editing. 3 hard copies of the draft are due **March 23**.
- Each student will peer "review" 2 drafts; reviews are due **April 11**. That class period will be used to discuss drafts & reviewer comments/suggestions.

FINAL DRAFT (with previous versions/comments) are due April 27.

(Do independent work on drafts & revisions prior to the final version.)

STUDENT TERM PAPER REVIEW

Please provide answers to the following questions for the paper you are reviewing. Also, feel free to attach any other comments you may have, and to write comments/suggestions onto the text.

~~~~~~

Who wrote the paper you are reviewing? _____

1. Is the subject of the paper clear from the beginning? Does the reader have a sense as to where the paper is going?

2. Has the author made an attempt to interest the reader in the topic?

3. Are the paper's arguments presented in a clear and logical fashion?

4. Are the conclusions clearly and concisely presented?

5. Are there sufficient and appropriate references to support the concepts discussed? Are the references from the primary literature (i.e., scientific journals instead of encyclopedias, etc.)?

6. Is the paper easy to read? If not, why?

7. What specific suggestions can you make to improve the paper?

8. What is your overall evaluation of the paper?
~~~~~~

Grading of the term papers will be based on the following criteria:

- Comprehensive coverage of the topic, synthesis of the information presented and indication of critical thinking by the author
- Use of references, judged by quality and type (primary vs. secondary)
- Use of figures to illustrate ideas, judged by quality and appropriateness
- Written presentation, judged by writing skills, spelling, grammar, adherence to the rules

Grading of the presentations will be based on the following criteria:

- Quality and comprehensiveness of the material covered
- Organization of talk, including the quality of the conclusions given
- Quality and use of figures
- Keeping within the allotted time
- Quality of speaking style
- Participation in discussions

Past Term Project Topics - OCN 623

2016:

Antropogenic radiotracers in marine environments

Geochemical evidence for basin-wide anoxic events during the Jurassic & Cretaceous Periods

Chromophoric dissolved organic matter in estuaries

The distribution and geochemical processes involved in the formation of manganese nodules

O-18 as a tracer of changing climate

Nutrient input and cycling in coastal estuarine river plumes

Artificial augmentation of the biological pump to mitigate anthropogenic CO_2 emissions

How the chemistry of the ocean affects the preservation of underwater archaeological sites

Past Term Project Topics - OCN 623

2015:

Sea surface salinity & climate change

Climate feedback due to air-sea exchange with ice-nucleating particles

Carbonate chemistry variability & benthic community dynamics on coral reefs

Using mercury isotopes to study the distribution of methyl-mercury in the marine environment

Biogeochemistry of the nitrogen cycle

Connecting dark & light oceans: hydrothermal plume chemistry

Ocean acidification: the other CO2 problem, implications for ecosystems

Chromophoric dissolved organic matter

ENSO, in an ENSO year

Otolith microchemistry for fisheries management: recent applications of trace element & stable isotope analysis

Past Term Project Topics - OCN 623

2014:

Ocean acidification and biophysical modeling

Using corals as a proxy for natural and anthropogenic environmental contamination

In situ bio-geochemistry of dissolved gases and redox microbial mediation of available gases

Mercury and gold

Potential uses of nanotechnology in methane hydrate reservoir characterization and production

Thermohaline circulation and the marine carbon cycle

Past Term Project Topics - OCN 623

2013:

An isotopic look at the marine silicon cycle

CO_2 flux over the global oceans

Boron isotopes in association with calcium carbonate

The applications of Rn in chemical oceanography

Transport of deep water chemical constituents onto shelves due to internal waves

Biogeochemical drivers of CO_2 variability in coastal waters

The biogeochemical processing and tracing of organic matter

Past Term Project Topics - OCN 623

2012:

Osmium in the modern ocean

Exploiting sulfur in the dark ocean

Meridional overturning circulation, radioactive isotopes, and paleoclimate

Oceanic methane hydrate deposits and climate interactions

Nutrient cycling variability in high-Artic fjords

Effects of bottom trawl fisheries on diagenesis, nutrient fluxes, and potential implications for global biogeochemical cycles

Past Term Project Topics - OCN 623

2011:

The “Priming Effect”

Biogeochemical remediation of crude oil

Ocean acidification: Temperature, CO_2, O_2 may portend a metabolically reducing ocean

Iron cycling in subterranean groundwater estuaries

The nitrogen cycle: potential pathways, preferential uptake, and fixation

Influence of atmospheric deposition of transient iron and nitrogen on marine biogeochemistry

Lasting effects of antifouling methods and the future of less-toxic options

CO_2 water-rock interactions and considerations of geological sequestering

Variability of nutrients in North Atlantic

Effects of bottom water O_2 depletion on sediment biogeochemistry and nutrient cycling in Chesapeake Bay

Mechanisms for glacial/interglacial variations in atmospheric CO_2

Nutrients in a coastal upwelling system: Monterey Bay

Denitrification: A comparison between nitrate assimilation, dissimilatory nitrate metabolism, and abiotic nitrate reduction in the ocean

Literature Searches

guides.library.manoa.hawaii.edu/onesearch

UNIVERSITY OF HAWAI'I AT MĀNOA LIBRARY

Ask Us Research Tools Library Catalog

Library / LibGuides / Help with Specific Library Resources / OneSearch Manoa / Home

OneSearch Manoa: Home

Search this Guide Search

This guide explains how to use OneSearch Manoa and describes its content.

Home | Finding Books | Finding Journal Articles | Finding Electronic Resources | Advanced Searching | Your Account | FAQ & Help

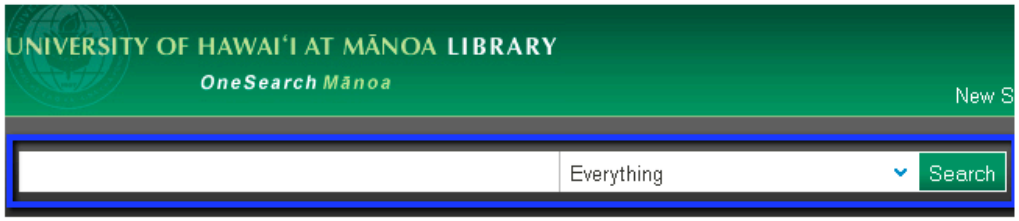
What is OneSearch Manoa?

UNIVERSITY OF HAWAI'I AT MĀNOA LIBRARY
OneSearch Mānoa

OneSearch Manoa is a discovery tool that searches the UH Catalog (Voyager), the Library's digital collections, and a huge index of academic journals, conference papers, maps, government documents, and more. OneSearch also links to full-text content in the Library's collections.

What is "Everything?"

The default search is "Everything" -- a basic search that searches all of the content in OneSearch -- books, videos, digital collections, journal articles, and other resources. It is a very broad search. The Advanced Searching tab and the Refine My Results tab in this LibGuide shows different ways to narrow search results.



Search OneSearch Manoa

Search books, media, articles, and e-books Search

Need More Help?

Ask Us

General Reference Assistance via E-mail
emailref@hawaii.edu

Main Reference Desk Telephone
(808) 956-7214

Last Updated: Dec 23, 2016 4:20 PM | **URL:** http://guides.library.manoa.hawaii.edu/onesearch | Print Page | Staff Login

Tags: catalog, onesearch