Canadian National Committee for SCOR
Comité national canadien pour SCOR

Scientific Committee on Oceanic Research

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LE BULLETIN CANADIEN DES SCIENCES DE L'OCÉAN

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Highlights from the 2018 State of the Pacific Ocean meeting.

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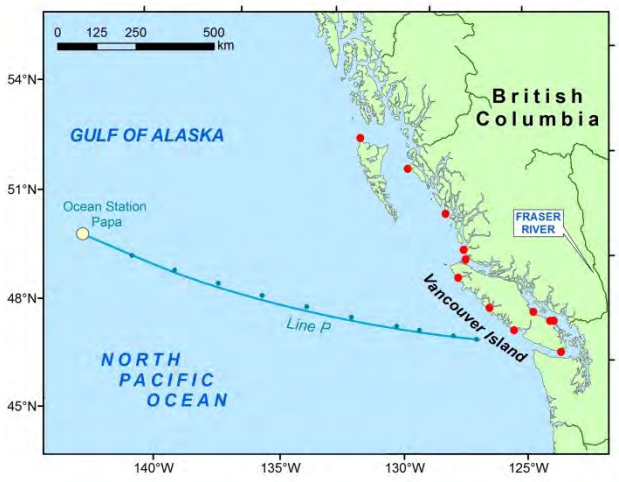
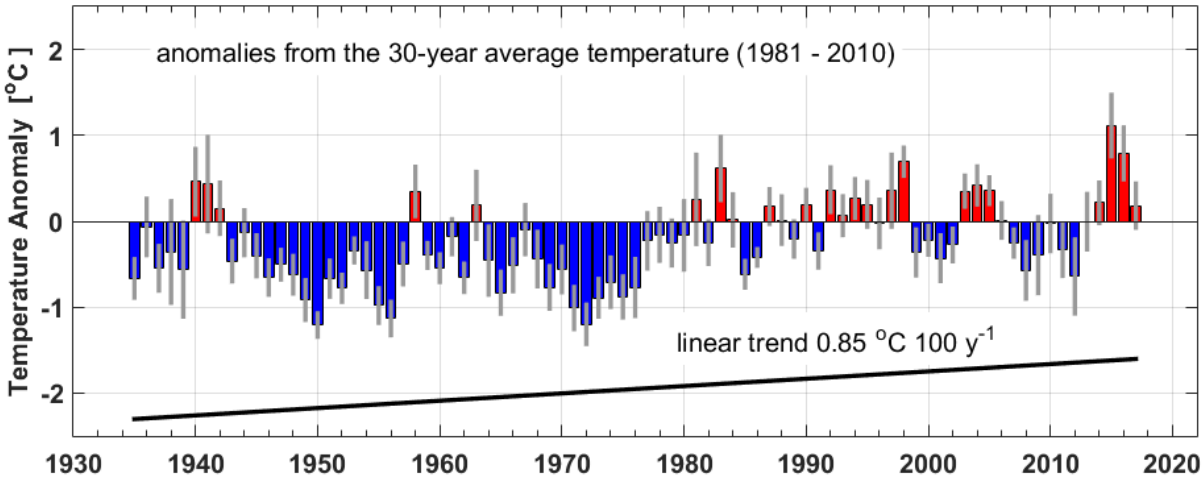
Fisheries and Oceans Canada (DFO) is responsible for the management and protection of marine resources on the Pacific coast of Canada. Oceanographically, some areas are characterised by their direct exposure to conditions in the Northeast Pacific Ocean, and others are influenced by the strong tides and significant freshwater sources typical of coastal inlets. Overall the region supports ecologically and economically important resident and migratory populations of invertebrates, groundfish, pelagic fishes, marine mammals and seabirds.



Map of the west coast of Canada, red dots show lighthouse locations contributing to the British Columbia Shore Station Oceanographic Program.

Since 1999 an annual State of the Pacific Ocean meeting has been organized by DFO to review physical, chemical and biological conditions on the west coast of Canada, to develop a picture of how the ocean is changing and to help provide advance identification of important changes. Scientists from federal and provincial governments, academia, non-profits, and private companies met in March 2018 to present the results of 2017 monitoring in the context of previous observations and expected future conditions. Reports from the meeting are compiled into a DFO technical report and are available online.

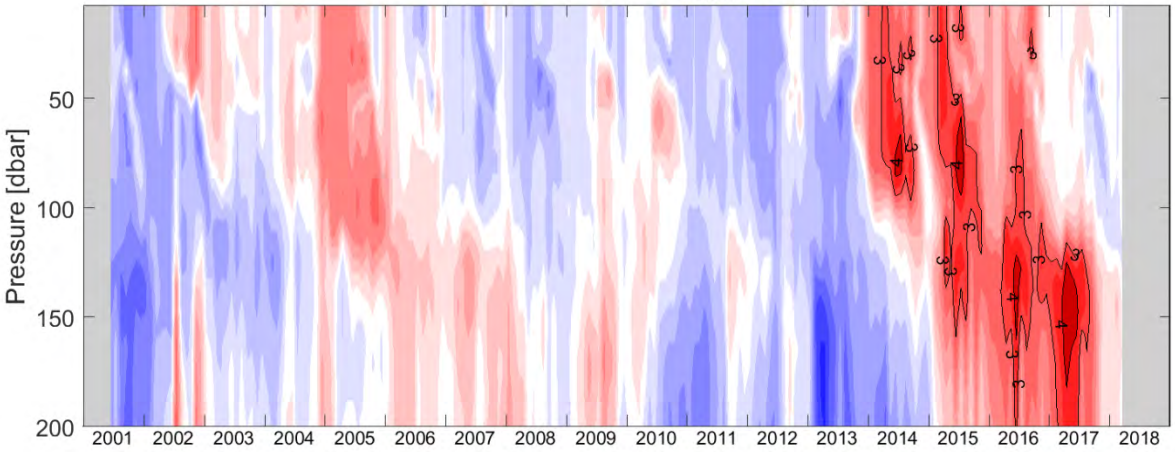
Since 2014 the waters off the BC coast have been characterised by surface and subsurface temperatures well above normal which are unfavourable for the productivity and growth of species that typically inhabit these waters. Conditions in 2017 were closer to those consistent with the 1981-2010 climatology due to the cooling effects of La Niña, although persistent global temperature rise is still evident in the long-term trend of sea surface temperature data collected at lighthouses along the BC coast.



The trend in the annual temperature based on daily observations at BC lighthouses. The data shown are the anomalies from the average temperature (1981-2010). The bars represent the anomalies averaged

over all stations (a coast wide indicator), (red – above average, blue – below average), the vertical grey lines show the variability in the lighthouse data for each year. Source: British Columbia Shore Station Oceanographic Program.

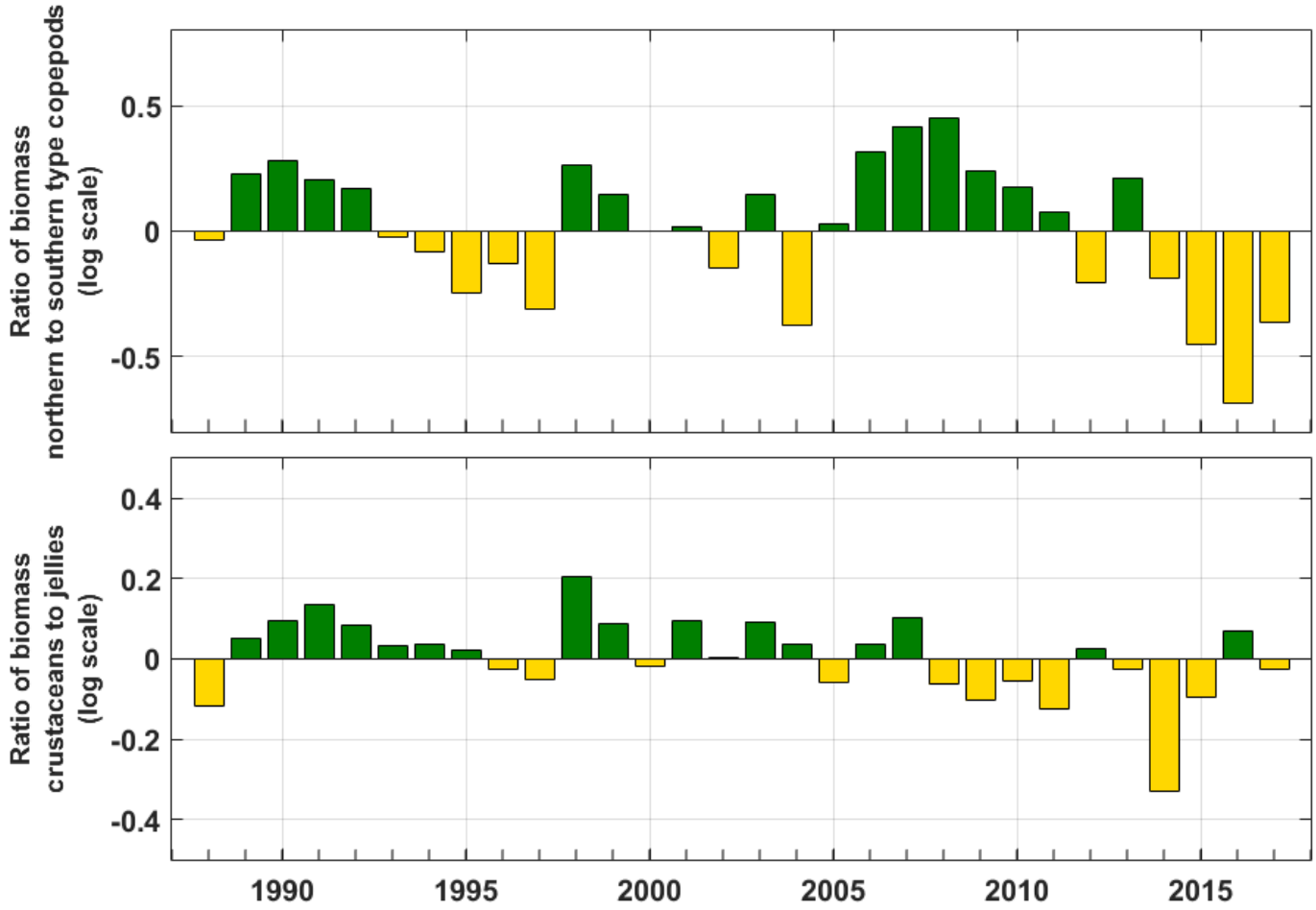
While surface temperatures in 2017 were near normal the subsurface temperatures (based on the interpolation of Argo float data onto the location of Station Papa) show a strong warm anomaly between 100 and 200 m until about November 2017. The stronger than usual stratification of surface waters near Station Papa evident during the 2013-2015 marine heat wave was not observed in 2017, and the return to normal surface mixing suggests an improvement of the nutrient supply from deep waters.



False colour plot of temperature anomalies relative to the 1956-2012 seasonally-corrected mean and standard deviation (from the Line P time series), as observed by Argo floats near Station Papa (P26: 50°N, 145°W).); red – above average, blue – below average with darker colours corresponding to larger anomalies. The black lines highlight regions with anomalies that are 3 and 4 standard deviations above the mean. Source: Tetjana Ross, DFO.

The upwelling of nutrient rich water off the west coast of Vancouver Island is an indicator of marine coastal productivity across trophic levels from plankton to fish to birds. Variability in the upwelling index corresponds to the strength and east-west position of the Aleutian low-pressure system in the Gulf of Alaska. Above average productivity is associated with an early and strong upwelling. While the intensity of the upwelling in 2017 was near normal there was a later than average start to the season resulting in a neutral index of upwelling productivity.

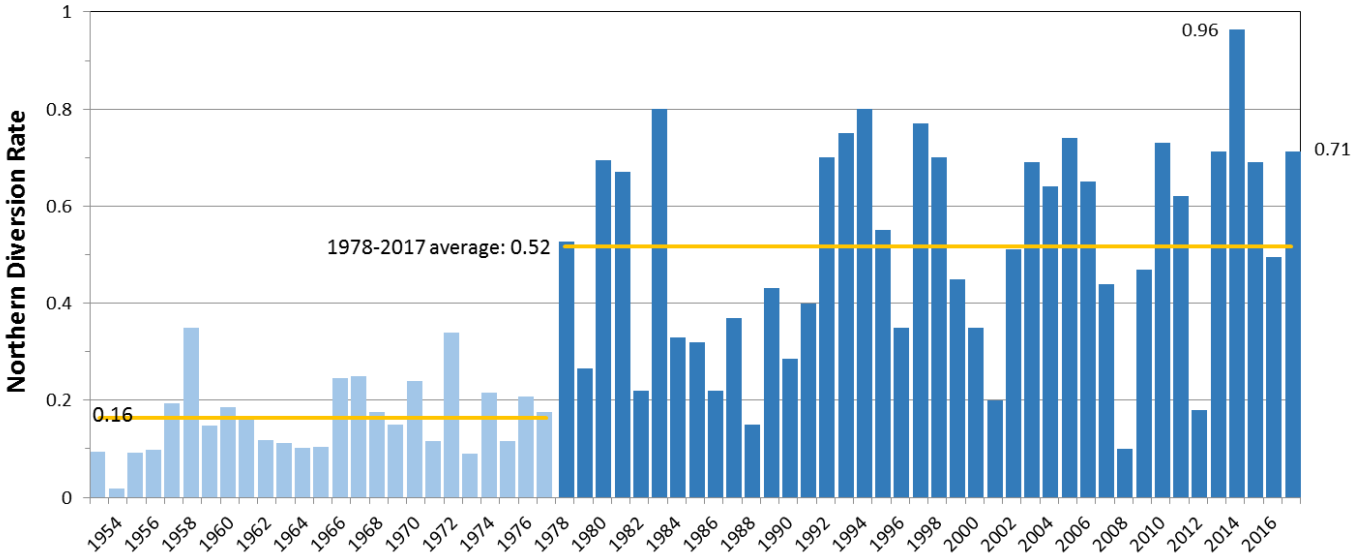
The zooplankton surveys off the Southwest Coast of Vancouver Island revealed near normal abundances of the lipid-rich northern species that are favourable for fish growth, as well as higher abundances of southern copepods. The large number of gelatinous Doliodids observed in 2016 was not as evident in 2017, but there were remarkable numbers of pyrosomes and salps along the entire BC coast. Not typically seen in BC waters until a few years ago pyrosomes impact on the ecosystem is unclear, but the ‘invasion’ of 2017 was unmistakably evident in clogged fishing and research gear.



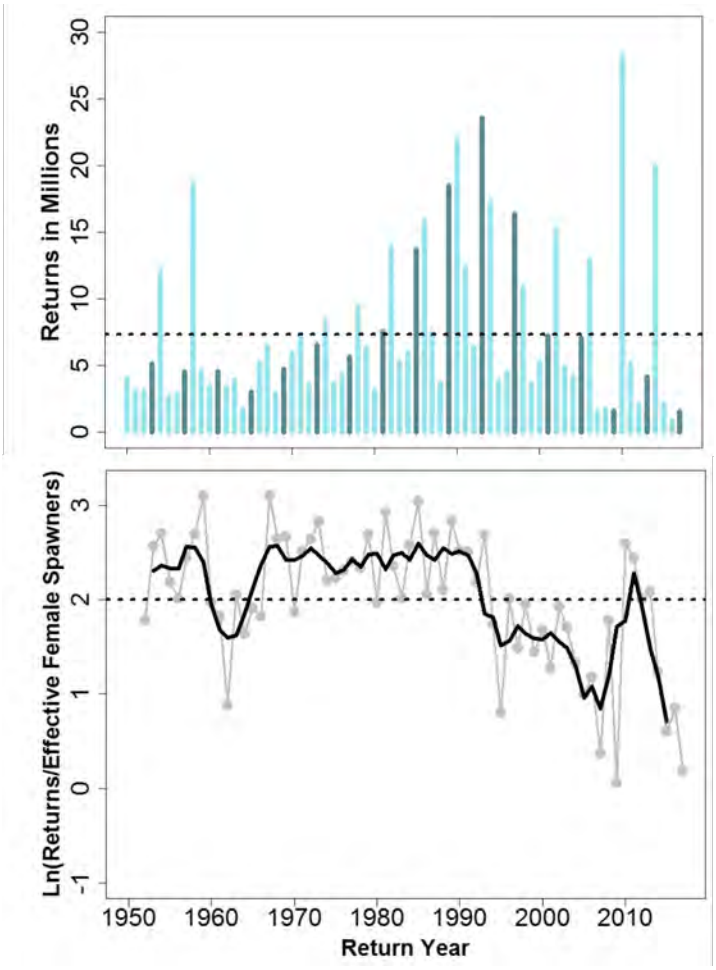
The 1988-2017 time series of yearly averaged anomalies of zooplankton biomass off southern Vancouver Island. (a) the ratio of northern to southern species of copepods; (b) the ratio of crustaceans to jellies.); green – fish food favourable, amber - less favourable fish food conditions. Source: Moira Galbraith, DFO

A pyrosome, made up of thousands of individual "zooids" connected to form a jelly-like hollow tube that is open at one end, caught in a bongo net during a vertical net tow off southern Vancouver Island. Photo: Moira Galbraith, DFO.

Adult Fraser Sockeye Salmon returning to the Fraser River to spawn migrate either north or south of Vancouver Island. The proportion returning via the northern route is referred to as the northern diversion rate and is evaluated each year by the Pacific Salmon Commission. Prior to 1978 the majority of Fraser River sockeye returned via the southern route. Since 1978 most salmon follow the northern route, although there is significant variability in the diversion rate. Following a record high of 96% at the height of the warm water anomaly in the NE Pacific the diversion rate in 2017 was 71%.



The northern diversion rate of Sockeye Salmon returning to spawn in the Fraser River. Source: Pacific Salmon Commission.



There was a coast-wide synchronous decline of sockeye salmon indicator stock returns in 2017. As discussed at previous DFO State of the Pacific Ocean meetings the warm ocean conditions in 2015-2016 were unfavourable for the survival of BC's central to south coast salmon returning in 2017 and 2018. Also freshwater conditions (high temperatures, early freshets, and summer drought) likely negatively impacted smolt production in 2015, affecting adult returns two years later in 2017.

Top panel: Total Fraser Sockeye annual returns (dark blue vertical bars for the 2017 cycle and light blue vertical bars for the three other cycles). Recent returns from 2012 to 2017 are preliminary, and 2017 (the last data point) is an in-season estimate only. Bottom panel: Total Fraser Sockeye productivity ($\log_e$ (returns/total spawner)) up to the 2017 return year. The grey dots and lines represent annual productivity estimates and the black line represents the smoothed four year running average. For both figures, the dashed line is the time series average. (Source: Sue Grant, DFO).

Reference: Chandler, P.C., King, S.A., and Boldt, J. (Eds.). 2018. State of the physical, biological and selected fishery resources of Pacific Canadian marine ecosystems in 2017. Can. Tech. Rep. Fish. Aquat. Sci. 3266: in press.

Daniel Boyce – Recipient of 2018 CNC-SCOR Early Career Ocean Scientist Award

Daniel Boyce (left) receives the CNC-SCOR Early Career Ocean Scientist Award from CNC Chair Paul Myers at the CMOS congress in Halifax

Daniel Boyce (Ocean Frontier Institute & Dalhousie University) has been awarded the CNC-SCOR Early Career Scientist award foe 2018. Quoting from just one of the several supporting documents for his nomination: "... [Daniel is] an extraordinary young researcher who has made several ground-breaking discoveries in the field of marine biological oceanography, documenting previously unrecognized changes in marine food webs." "... [H]is Ph.D. thesis saw a real breakthrough. [He] was able to demonstrate a previously unrecognized global decline in phytoplankton abundance by assembling a comprehensive database of plankton measurements from 1890-2010, and analysing it using state-of-the-art statistical models. He was also able to attribute most of this decline to warming ocean waters, and as such added a new dimension to our understanding of the effects of long-term climate change on marine ecosystems. This was a major discovery, with wide ramification that extent far outside its discipline." "[His] thesis' most important chapter 'Global phytoplankton decline over the past century' was published as an Article in Nature. ... [It] has since gathered 738 citations (according to Google Scholar, accessed 15 February 2018) which makes it a citation classic." "Daniel's work is exemplary not only in that it made a large initial impact, but also because it provided very careful and dedicated follow-up."

Among the accomplishments Daniel has already made are the following:

- Recipient of the Canadian Association of Graduate Studies and University Microfilms International (CAGS/UMI) distinguished dissertation award for the top doctoral thesis in the engineering, medical, and natural sciences across Canada in 2013.
- Recipient of the Dalhousie University top doctoral thesis award in the natural and medical sciences and engineering in 2013.
- 2nd chapter of doctoral thesis was published as an article in *Nature* and selected as *Discover* Magazines top 100 science stories of the year (#30).
- 1540 citations to date with publications in *Nature, Science, PNAS, Nature Ecology and Evolution* and *Ecology Letters.*
- Undergraduate Honours bachelor's degree in marine biology with minor in Oceanography from Dalhousie University.
- Doctoral degree in Marine biology from Dalhousie University working with Drs. Boris Worm, Marlon Lewis, and Ransom Myers.
- NSERC postdoctoral researcher at Queens University and the Bedford Institute of Oceanography working with Drs. Ken Frank and William Leggett (2013-2017).

Daniel Boyce

Daniel outlines some of his research in the article that follows.

Macroecological patterns of marine phytoplankton change

Daniel Boyce
Ocean Frontier Institute & Dalhousie University

(Daniel is the recipient of 2018 CNC-SCOR Early Career Ocean Scientist Award. See the prceeding article.)

Phytoplankton are the unseen powerhouses of the ocean. Aptly named as “plant-wanderers,” phytoplankton are microscopic algae that drift through the upper sunlit layers of the global oceans, harnessing the energy of the sun to generate the primary production that sustains almost all marine life. They contribute approximately half of all primary production on Earth, produce much of the oxygen in our contemporary atmosphere, have strong effects on the cycling of carbon dioxide (with consequent effects on Earth’s climate), and support valuable fisheries and ecosystems. Over deep timescales, oxygen production by growing phytoplankton has shaped our modern atmosphere, while their death and fossilization has produced the oil used to power our cars, ships, and planes. They’re microscopic but are abundant enough that their growth and distribution patterns affect the very colour of the upper oceans, and their changing abundance patterns are now routinely monitored from space.

My research began by asking the seemingly simple question: are the oceans becoming more, or less green with phytoplankton? This fundamental question had been intensively studied and debated but remained unanswered for reasons related to the ecology of phytoplankton, the vastness of the oceans, and the consequent lack of consistently sampled time-series of their abundance. Marine phytoplankton has been monitored using a changing array of observational approaches, but most published analyses have used short-term and recent satellite data (1978-1986 or 1997-2018), which has yielded conflicting results. To extend the record further into the past, I began by analyzing a unique compilation of historical measurements of ocean transparency collected with the standardized Secchi disk going back to the late 1800s and combining these with direct measurements of phytoplankton pigment (‘chlorophyll’) from ocean-going research vessels (Figure 1). By combining historical with more recent data, me and my co-authors, Drs Boris Worm and Marlon Lewis, were able to create a database of just under half a million chlorophyll observations that we used to estimate global phytoplankton trends over unprecedented timescales.

Figure 1: (A) Scientists collecting plankton ca. 1929 using a vertical net (Hurley, F., Part of B.A.N.Z. Antarctic Research Expedition photographs, 1929-1931, photo courtesy of the National Library of Australia) (B) Scientists measuring water transparency using a Secchi disk, ca. 1928. Historical Secchi disc measurements are one of the main data sources in this analysis (Yonge, C.M., Part of Album of the Great Barrier Reef Expedition in the Low Islands region, Queensland, 1928-1929, photo courtesy of the National Library of Australia).

Our findings indicated that marine phytoplankton concentration had declined across local, regional, and global scales over the past century and that most declines have occurred at polar and tropical latitudes and in the open oceans where most phytoplankton production occurs. Rising sea surface temperatures were found to have negative effects on phytoplankton over most of the globe but were particularly apparent close to the equator. Phytoplankton requires sunlight and nutrients, and warm oceans are strongly stratified, which limits the amount of nutrients that are transported from deeper waters. Rising temperatures are making the tropical oceans increasingly stratified, leading to increasing nutrient limitation and phytoplankton declines. Results further indicated that basin-scale climate fluctuations, such as El-Niño Southern Oscillation (ENSO), affect phytoplankton on a year-to-year

basis, by changing short-term oceanographic conditions.

After publishing this study in *Nature (Boyce et al., 2010)*, the validity of our findings was called into question by some in the research community, leading my co-authors and I to undertake several follow-up studies to test the robustness and processes underlying our conclusions. Taking into account the criticisms of our colleagues and collaborating with statistician Dr. Michael Dowd, we produced an expanded publicly-available database of phytoplankton observations *(Boyce et al., 2012)* and then re-estimated time-trends in phytoplankton concentration while testing a range of different model assumptions and ecological dynamics *(Boyce et al., 2014)*. These studies also suggested that global phytoplankton levels had declined, but at more modest rates than previously reported and provided additional sensitivity checks that provided increased confidence in the conclusions. I next collaborated with experimentalists and ocean modelers at GEOMAR in Germany to run a six-week mesocosm experiment to test the effects of ocean warming on a temperate planktonic ecosystem (Figure 2). The experiments were initialized with simulated ocean warming predictions across the North Atlantic over the 21st century and revealed negative effects of warming on phytoplankton but suggested that the effects operated *via* different pathways depending on ocean mixing and nutrient regimes *(Lewandowska et al., 2014)*. Finally, I extracted and analyzed all available published estimates of past and future phytoplankton change to quantitatively synthesize the accumulated body of scientific knowledge regarding the causes and consequences of phytoplankton change. This meta-analysis also suggested that phytoplankton has declined across most of the global ocean, but that trends were variable particularly in the Northeast Atlantic and when using short time-series *(Boyce & Worm, 2015)*. A clear majority (83%) of published studies reported that global phytoplankton levels would continue to decline over the 21st century.

Figure 2: Me, tending to one of the 12 mesocosms during our ocean warming experiments conducted at GEOMAR in Kiel, Germany.

Together, these studies formed the basis for my Doctoral research and provided new evidence that sustained declines in marine phytoplankton over the past century have occurred across multiple spatial scales and that rising ocean temperatures have contributed to this trend. The conclusions contribute to a mounting body of scientific evidence indicating that global warming, is altering the fundamentals of marine ecosystems. The possible implications of this sustained decline are far-ranging, with probable impacts on climate, geochemical cycling, fisheries, and ecosystem structure. Phytoplankton are a critical part of our planetary life support system, and an ocean with less phytoplankton will function in a different and largely unknown manner, and this needs to be accounted for in our management efforts.

Building on this research, I have more recently been working with Drs Ken Frank, Brian Petrie, William Leggett, and Boris Worm, studying phytoplankton changes occurring over short-term cyclic seasonal scales (phenology). Whereas the year-to-year changes in phytoplankton that we were studying are relatively small, seasonal changes are far larger and can account for up to 95% of the total phytoplankton variability in some parts of the ocean. This huge seasonal variability can have profound effects on nutrient cycles, climate and weather, as well as the movement patterns, reproduction, and survivorship of marine consumers. Although several studies have studied the phenology of primary producers on land, surprisingly little is known about the phenology of marine phytoplankton and what factors drive it, particularly globally.

To advance our understanding of how phytoplankton phenology is structured across the oceans, I analyzed a global collection of over 1 billion phytoplankton observations using a novel statistical approach that estimated phenology trends from the different data types independently and then integrated them using a multi-model ensemble approach. Our findings suggested that the 2,822 individual phenology cycles that were estimated across the global seascape can be separated into five distinct patterns, which are predominantly driven by abiotic factors controlling irradiance, mixing, and nutrients rather than by zooplankton grazing. We found that seasonal patterns were well identified at mid- and high-latitudes, but those at tropical latitudes were highly spatially variable and didn't easily fit into any of the five primary patterns that were identified. Excluding the tropics, the phenology patterns of phytoplankton in the Northern and Southern Hemispheres were virtually identical, emphasizing the overarching effect of irradiance. To compare phenology patterns across the biosphere, we also estimated spatial phenology patterns of terrestrial primary producers using the Normalized Difference Vegetation Index (NDVI). Despite huge differences between the ecology of marine phytoplankton and terrestrial primary producers, their seasonal patterns of growth were very similar, suggesting that they are governed by common underlying dynamics.

This study was recently published in *Nature Ecology and Evolution (Boyce et al., 2017)* and provides a validated framework that I am now using to investigate the vulnerability of fisheries and ecosystems to climate-driven phenological changes, how climate change will seasonal patterns of across the 21st century, and how phytoplankton phenology drives the spatial movement patterns of marine species across the global ocean. More information about my research activities and publications can be found on my website (www.danielboyce.ca).

References

Boyce DG, Worm B (2015) Patterns and ecological implications of historical marine phytoplankton change. *Marine Ecology Progress Series*, **534**, 251–272.

Boyce D, Lewis MR, Worm B (2010) Global phytoplankton decline over the past century. *Nature*, **466**, 591–596.

Boyce DG, Lewis M, Worm B (2012) Integrating global chlorophyll data from 1890 to 2010. *Limnology and Oceanography: Methods*, **10**, 840–852.

Boyce DG, Dowd M, Lewis MR, Worm B (2014) Estimating global chlorophyll changes over the past century. *Progress in Oceanography*, **122**, 163–173.

Boyce DG, Petrie B, Frank KT, Worm B, Leggett WC (2017) Environmental structuring of marine plankton phenology. *Nature Ecology & Evolution*, 0–1.

Lewandowska AM, Boyce D, Hofmann M, Matthiessen B, Sommer U, Worm B (2014) Effects of sea surface warming on marine plankton. *Ecology Letters*, **17**, 614–623.

This section of your newsletter provides an opportunity to highlight your research programs to the Ocean Science Community. *Your are invited to send contributions to David Greenberg,* *david.greenberg@dfo-mpo.gc.ca*	*Mettez en valeur vos programmes de recherche en publiant un article dans cette première section de votre bulletin.* *Faites parvenir vos contributions à David Greenberg,* *david.greenberg@dfo-mpo.gc.ca*

CMOS Congress 2019 with IUGG

July 8-18, 2019, Palais des Congrès, Montréal

The next CMOS Congress will be very different from any of the preceding congresses. CMOS and

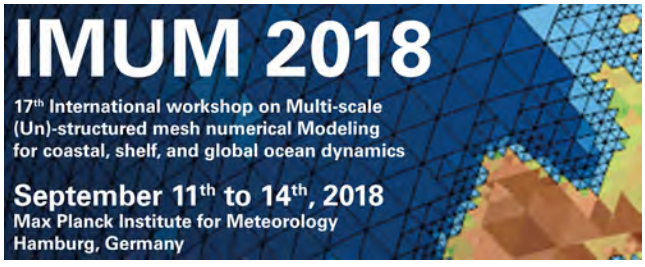
CGU are collaborating with the IUGG as they hold their 27th General Assembly in Montreal. In addition to the mid summer date, the size of the meeting will be an order of magnitude larger than any past CMOS congress. Held every four years, the last general assembly in Prague, 2015, hosted over 4000 attendees. The meeting will be a full 9 days of scientific presentations and several shoulder events already planned, including field trips and business meetings. It is expected that there will be CMOS specific events (awards and meetings), but the form of those has yet to be determined. These activities will be coordinated to be synchronous with the ocean and atmosphere sessions of IUGG.

The website is now up with information to help in planning. Check out the Palais des Congrès website.

IMUM 2018

September 11-14, Max Planck Institute for Meteorology, Hamburg

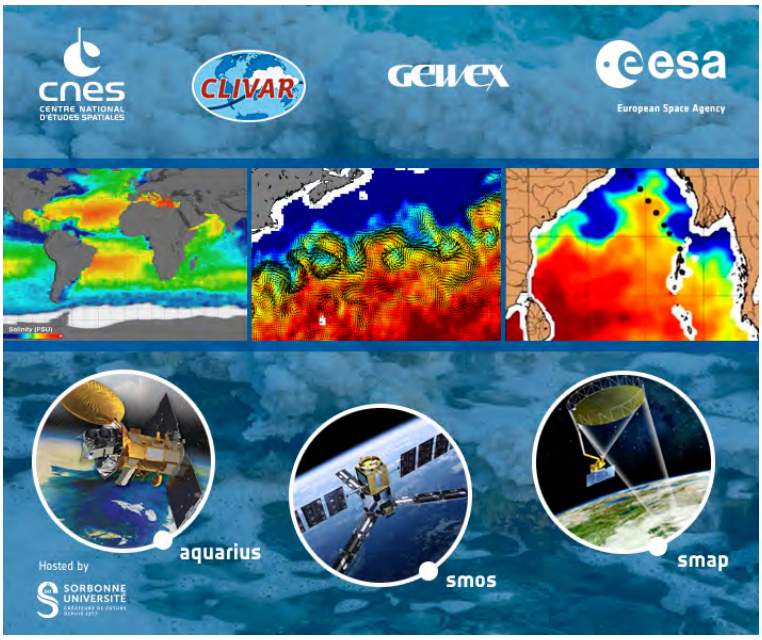
The 17th International workshop on Multi-scale (Un)-structured mesh numerical Modeling for coastal, shelf, and global ocean dynamic will be held in Hamburg, Germany, from September 11th to 14th, 2018. The workshop is organized by the Max Planck Institute for Meteorology (Hamburg) and the Alfred-Wegener-Institut for Polar and Marine Research (Bremerhaven).



The deadline for abstract submission has been **extended to July 31, 2018**.

Ocean Salinity Science Conference

6-9 November 2018, Paris, France



Ocean salinity is a key parameter that links various elements of the water cycle to ocean circulation dynamics and climate. Furthermore, salinity is a key dynamical parameter that influences oceans dynamics. Through the advent of new observing technologies, remote sensing and in situ, salinity research has gained much attention over the recent years, now leading to rapidly growing new insights. The conference intends to bring together communities working on all aspects of ocean salinity investigations, including analyses undertaken from in situ and satellite observations, numerical models, and data assimilation. This will review most recent results and discuss further progress that is required. The conference will review progress and ongoing work and will identify next frontiers in the fields of ocean salinity science. In doing so it will focus on recent progress in:

1. Observing ocean salinity
2. Process-based insights from field observations
3. Ocean dynamics and salinity assimilation in ocean models
4. Global freshwater cycle and climate variability
5. Biogeochemistry
6. Surface freshwater fluxes, run off, and sea ice.
7. Challenges and requirements for future salinity observing, remote sensing and in situ.

Website Different from most meetings, there is **no conference fee**.

PIRATA 23 and 2nd TAOS Review Workshop

October 22-26, Marseille, France

The 23rd PIRATA meeting and the 2nd TAOS REVIEW meeting will be organized in Marseille, France from October 22 to 26, 2018. The Tropical Atlantic climate has important socio-economic consequences, but our understanding about its variability, its predictability and its impacts is still limited. The “Prediction and Research Moored Array in the Tropical Atlantic” (PIRATA) program provides in situ observations and data time-series since 1997.

Website

Deadline for abstract submission is: **8 September, 2018**

Deadline for registration is: **6 October, 2018**

SCOR-InterRidge Meeting on Indian Ocean

November 14-16, Goa, India

The workshop will focus on the geological, geophysical, geochemical and physical aspects of the mid ocean ridges and the other geological features in the Indian Ocean and provide forum for exchange of ideas and results. Both the Ridge community and the Marine Geology and Geophysics community are only marginally involved in the International Indian Ocean Expedition - 2 (IIOE-2) and therefore one of the major goal is to develop new international collaboration and programmes on geology and geophysics of the Indian Ocean, under IIOE-2.
Workshop Brochure
Deadlines - Registration and abstract submission: **August 10, 2018**

Please send meeting announcements to David Greenberg, david.greenberg@dfo-mpo.gc.ca	*SVP faites parvenir vos annonces de réunion à David Greenberg, david.greenberg@dfo-mpo.gc.ca*

POSITIONS AVAILABLE

Postdoc UBC, Oil Spill Modelling with MEOPAR

The Department of Earth, Ocean & Atmospheric Sciences at the University of British Columbia invites applications for a Postdoctoral Fellow in the field of numerical modelling of oil spills in the

coastal ocean. The successful applicant will conduct research as part of MIDOSS (Model of Impact of Dilbit and Oil Spills in the Salish sea). MIDOSS is a three year project funded by MEOPAR to improve our scientic knowledge and tools to support evidence-based planning both in preparation for, and in response to, an oil spill in the Salish Sea. The position is for one-year, renewable for a second year, and preferred start date is September 2018. Applications are being assessed now and the position will remain open until a suitable candidate is found.

Information

PhD physical oceanography

Geophysical Institute, University of Bergen, Norway

There is a vacancy for a PhD position at the Geophysical Institute, University of Bergen within the field of physical oceanography. The position is for a fixed term period of 4 years with 25% compulsory duties (e.g. operational, administrative or teaching related). The position is connected to the research project The Nansen Legacy (http://nansenlegacy.org).

The PhD study aims to use advanced technology and autonomous platforms (underwater gliders and autonomous underwater vehicles, AUV) to sample environmental parameters to address the vertical and lateral mixing processes at high latitudes, in the marginal ice zone, and in ocean front systems. The study will concentrate on two sites: north of Svalbard, with particular focus on the warm Atlantic boundary current, and the central Barents Sea, with particular focus on the thermohaline polar front.

Details

Deadline for applications: **August 1, 2018**

Postdoc Positions, Sediment Transport and Hydrodynamic Modeling

The College of William & Mary Williamsburg, VA, USA

The College of William & Mary is advertising two postdoctoral positions:

Sediment Transport:

The Postdoctoral Research Associate – Sediment Transport position is to conduct numerical modeling studies to explore sediment geochemical control on ocean acidification and the carbon budget for environments such as the northern Gulf of Mexico. The Postdoctoral Scholar will join a project focused sediment geochemistry in the northern Gulf of Mexico, and will be expected to both lead independent modeling projects and work as part of a team comprised of field scientists and numerical modelers.

Details

Deadline **August 1 2018**

Hydrodynamic Modeling:

The Postdoctoral Research Associate – Coastal Resources Management is to conduct basic and applied research on the development and application of numeric models to coastal hydrodynamics, geomorphological and ecological processes. Research activities will contribute to development and implementation of the next generation seamless 'creek-to-ocean' forecasts based on the SCHISM modeling system.

Details

Deadline **August 1 2018**

Tenure-Track Faculty Position in Chemical Oceanography

University of South Florida, Tampa, Florida USA

The College of Marine Science at the University of South Florida invites applications for a tenure-track, nine-month academic appointment in Chemical Oceanography at the Assistant, Associate, or Professor level. Rank is dependent on qualifications and experience.

We seek a Chemical Oceanographer who will contribute to an understanding of the ocean/climate system, from basic disciplinary topics to ecosystems analyses. Qualified candidates will employ modern tools of multi-disciplinary science to understand regional and global issues critical to the ocean system. Candidates will be selected on the basis of their potential to conduct transformative research within their discipline, their productivity with respect to peer reviewed publications, acquisition of external research funding, and a potential for outstanding mentoring and teaching. The successful candidate would be expected to contribute to core courses in oceanography and teach specialty courses at the graduate level.

Details

Review of applications starts **August 1, 2018**. Appointment target August 1, 2019.

Looking for work? Try the CMOS site (click).	*Vous recherchez un emploi? Visitez le site SCMO (click).*

GENERAL

An introduction to rising risks from a warming, changing ocean

Explaining ocean warming : causes, scale, effects and consequences

Edited by D. Laffoley and J. M. Baxter

This report explores the hazards and risks associated with ocean warming worldwide. This report explores:

- the definition of ocean risk and its relationship to hazards and vulnerability, and acts to bring together the language the insurance industry uses for risk, with the understanding that the science and conservation community have of the scale, nature and intensity of ocean change;
- five examples of how ocean warming has an impact on our way of life and, as a result, why we believe that ocean warming should be considered as a key risk by international bodies such as the United Nation's Intergovernmental Panel on Climate Change;
- how, even though ocean warming may be a single phenomenon, it is already being felt across a surprisingly wide spread of social, environmental and economic settings, and why this matters; and
- why far more immediate action is now needed with far greater ambition if society is to 'get ahead of the curve' of the consequences from ocean warming and other ocean changes in the coming years, due to long lag times between cause and effect

Organization(s): IUCN World Commission on Protected Areas (WCPA), IUCN, Global Marine and Polar Programme, La Fondation d'enterprise Total, XL Catlin

www.sealevelrise.ca

The Ecology Action Centre has teamed up with the Department of Fisheries & Oceans until March 2019 to create an informative website – www.sealevelrise.ca - and sea-level rise resources for coastal residents, fishers, and communities about rising seas that are specific to Atlantic Canada and British Columbia. A big part of this project is engaging the public through sea-level rise workshops and engagement sessions. They have created partnerships in each of the Atlantic Provinces (Conservation Corps of NFLD, UPEI Climate Lab, and NB Environmental Network) and in BC (Living Oceans Society) to host similar sea-level rise information sessions. By the end of the project, over 40 sea level rise information sessions will have happened across Canada.

With this project they want to:

• Help communities learn about sea-level rise and how it impacts them
• Provide access to tools and resources that have been developed with the latest local climate change information available
• Illustrate where sea-level rise impacts are happening through interactive mapping
• Show the need for incorporating sea-level rise into future planning strategies

In support of this, Bras d'Or Lakes CEPI will be hosting a Sea Level Rise: Information open house, open to the public, 12 August, at 13:00–18:00 UTC-03, Sarah Denny Memorial Cultural Centre, 63 Mini Mall Dr, Eskasoni, Nova Scotia B1W 1A6.

SCOR Newsletter #37

SCOR International has released newsletter #37. Highlights include information about the working group proposals submitted for 2018, the 2018 SCOR Visiting Scholars, new publications from SCOR-related activities, a report from the launch of the Namibian SCOR Committee, and updates from SCOR working groups and research projects.

GEOTRACES e-Newsletter June 2018

GEOTRACES is an international programme which aims to improve the understanding of biogeochemical cycles and large-scale distribution of trace elements and their isotopes in the marine environment. Scientists from approximately 35 nations have been involved in the programme, which is designed to study all major ocean basins over the next decade. Its June Newsletter is now available. It includes highlights of recent research, data products, publications, dates of upcoming cruises,and meetings and related news.

Canadian Ocean Science Newsletter
Le Bulletin Canadien des Sciences de l'Océan

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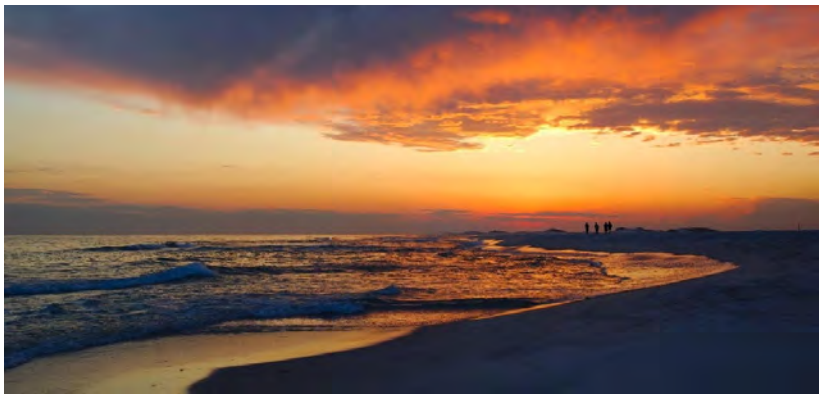

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