HIGHLIGHTED ARTICLES

Enhanced warming of the Northwest Atlantic Ocean under climate change
Journal of Geophysical Research - Oceans (3.44)

A vulnerability assessment of fish and invertebrates to climate forcing on the Northeast U.S. Continental Shelf
PLoS One (3.534)

Nutrient-controlled niche differentiation of western Lake Erie cyanobacterial populations revealed via metatranscriptomic surveys
Environmental Science and Technology (5.481)

Under high carbon emission rates: Atlantic sea level rise enhanced relative to the Pacific
Nature Geoscience (11.74)

Estimation of a killer whale (Orcinus orca) population’s diet using sequencing analysis of DNA from feces
PLoS ONE (3.534)

Deepwater Horizon oil spill impacts on sea turtles could span the Atlantic
Biology Letters (3.248)

Rapid and highly variable warming of lake surface waters around the globe
Geophysical Research Letters (4.196)

ADDITIONAL ARTICLES

NOS Publications
Climate relationships to fecal bacterial densities in Maryland shellfish harvest waters
Water Research (5.323)
Climate change and larval-transport in the ocean: Fractional effects from physical and physiological factors
Global Change Biology (8.224)

NMFS Publications
Growth dynamics of Saffron cod (*Eleginus gracilis*) and Arctic cod (*Boreogadus saida*) in the Northern Bering and Chukchi Seas
Deep Sea Research II (2.763)

The causes of large shifts in commercial landings of estuarine and bay mollusks, eastern United States after 1980
Marine Fisheries Review (N/A)

Skeletochronological estimation of age and growth of loggerhead sea turtles (*Caretta caretta*) in the western South Atlantic Ocean
Austral Ecology (1.837)

Population coherence and environmental impacts across spatial scales: A case study of Chinook salmon
Ecosphere (2.595)

The effects of weathering and chemical dispersion on Deepwater Horizon crude oil toxicity to mahi-mahi (*Coryphaena hippurus*) early life stages
Science of the Total Environment (3.163)

Examination of winter circulation in a northern Gulf of Mexico estuary
Estuaries and Coasts (2.245)

Baseline assessment of net calcium carbonate accretion rates on U.S. Pacific Reefs
PLoS One (3.534)

Methods for the preparation of Pacific spiny dogfish, *Squalus suckleyi*, fin spines and vertebrae and an overview of age determination
Marine Fisheries Review (N/A)
Differential toxicokinetics determines the sensitivity of two marine embryonic fish exposed to Iranian Heavy Crude Oil
Environmental Science & Technology (5.330)

Evidence that summer jellyfish blooms impact Pacific Northwest salmon production
Ecosphere (2.595)

Opportunities and challenges of integrating ecological restoration into assessment and management of contaminated ecosystems
Integrated Environmental Assessment and Management (1.377)

Management of acoustic metadata for bioacoustics
Ecological Informatics (1.727)

Ecosystem Model Skill Assessment: Yes we can!
PLoS ONE (3.534)

Vast assembly of vocal marine mammals from diverse species on fish spawning ground
Nature (41.456)

It's a bear market: evolutionary and ecological effects of predation on two wild sockeye salmon populations
Heredity (3.81)

A passive acoustic survey of fish sound production at Riley’s Hump within Tortugas South Ecological Reserve: implications regarding spawning and habitat use
Fishery Bulletin (1.783)

In what direction should the fishing mortality target change when natural mortality increases within an assessment?
Canadian Journal of Fisheries and Aquatic Sciences (2.276)
OAR Publications

The dual role of nitrogen supply in controlling the growth and toxicity of cyanobacterial blooms
Harmful Algae (3.874)

MRMS QPE performance during the 2013-14 cool season
Journal of Hydrometeorology (3.645)

Subantarctic and Polar fronts of the Antarctic Circumpolar Current and Southern Ocean heat and freshwater variability
Journal of Physical Oceanography (2.345)

PACES: Taking the Initiative on Arctic Air Pollution
Elementa (N/A)

Evaluation of a probabilistic forecasting methodology for severe convective weather in the 2014 hazardous weather testbed
Weather and Forecasting (1.788)

Foraging ecology of walleye and brown trout in a Great Lakes tributary
Journal of Great Lakes Research (1.77)

Effects of rising CO₂ and global warming on harmful cyanobacteria
Harmful Algae (3.874)

Cross Line Office Publications

Stratospheric temperature changes during the satellite era
Journal of Geophysical Research: Atmospheres (3.426)

OTHER REPORTS, BOOK CHAPTERS, AND INTERNAL PUBLICATIONS

NOS

Coastal ecosystem assessment of Chesapeake Bay watersheds: land use patterns and river conditions
NOAA Technical Memorandum
**Highlighted Articles**

*Enhanced warming of the Northwest Atlantic Ocean under climate change*

Journal of Geophysical Research - Oceans (3.44)

V. S. Saba (NMFS/SEFSC), S. M. Griffies (OAR/GFDL), W. G. Anderson (OAR/GFDL), M. Winton (OAR/GFDL), M. A. Alexander (OAR/ESRL), T. L. Delworth (OAR/GFDL), J. A. Hare (NMFS/NEFSC), M. J. Harrison (OAR/GFDL), A. Rosati (OAR/GFDL), G. A. Vecchi (OAR/GFDL), and R. Zhang (OAR/GFDL)

- Northwest Atlantic Ocean circulation bias (i.e. Gulf Stream position) is reduced in a high-resolution global climate model. Atmospheric CO₂ doubling over 70-80 years results in an enhanced warming of the Northwest Atlantic.
- The enhanced warming is associated with a weakening Atlantic Meridional Overturning Circulation (AMOC) and regional circulation change.
- Over the past 10 years, the Gulf of Maine has warmed at a rate faster than 99% of the global ocean. This enhanced warming of the Gulf of Maine is associated with a northerly shift in the Gulf Stream.
- Contemporary changes in the distribution and species composition of Northwest Atlantic living marine resources are already evident, but existing projections are based on warming scenarios from coarse resolution models. Warming on the scale of 3 to 4°C, as shown in GFDL’s high-resolution climate model, will cause more extreme effects on the ecosystem.

The Intergovernmental Panel on Climate Change (IPCC) fifth assessment of projected global and regional ocean temperature change is based on global climate models that have coarse (~100-km) ocean and atmosphere resolutions. In the Northwest Atlantic, the ensemble of global climate models has a warm bias in sea surface temperature due to a misrepresentation of the Gulf Stream position; thus, existing climate change projections are based on unrealistic regional ocean circulation. Here we compare simulations and an atmospheric CO₂ doubling response from four global climate models of varying ocean and atmosphere resolution. We find that the highest resolution climate model (~10-km ocean, ~50-km atmosphere) resolves Northwest Atlantic circulation and water mass distribution most accurately. The CO₂ doubling response from this model shows
that upper-ocean (0-300 m) temperature in the Northwest Atlantic Shelf warms at a rate nearly twice as fast as the coarser models and nearly three times faster than the global average. This enhanced warming is accompanied by an increase in salinity due to a change in water mass distribution that is related to a retreat of the Labrador Current and a northerly shift of the Gulf Stream. Both observations and the climate model demonstrate a robust relationship between a weakening Atlantic Meridional Overturning Circulation (AMOC) and an increase in the proportion of Warm-Temperate Slope Water entering the Northwest Atlantic Shelf. Therefore, prior climate change projections for the Northwest Atlantic may be far too conservative. These results point to the need to improve simulations of basin and regional-scale ocean circulation.

Publication date: 8 January 2016
Available online:

_A vulnerability assessment of fish and invertebrates to climate forcing on the Northeast U.S. Continental Shelf_

PLoS One (3.534)


- This paper identifies specific species which are likely to be negatively impacted by climate change including Atlantic Cod, Atlantic Sea Scallop, Alewife and Blueback Herring; species likely to be positively impacted by climate change are also identified including Black Sea Bass, Butterfish, and Atlantic Croaker.
50% of the species assessed are highly or very highly vulnerable to changes in productivity and abundance over the next 35 years in response to climate change.

65% of the species assessed have a high or very high potential to shift distribution over the next 35 years in response to climate change.

50% of the species assessed are likely to be negatively impacted by climate change over the 35 years.

Climate change and decadal variability are impacting marine fish and invertebrate species worldwide and these impacts will continue for the foreseeable future.

Quantitative approaches have been developed to examine climate impacts on distribution and productivity of various marine fish and invertebrate species. However, it is difficult to apply these approaches to large numbers of species owing to the lack of mechanistic understanding sufficient for quantitative analyses, as well as the lack of scientific infrastructure to support these more detailed studies. Vulnerability assessments provide a framework for evaluating climate impacts over a broad range of species with existing information. These methods combine the exposure of a species to a risk (climate change and decadal variability) and the sensitivity of species to the risk. These two components are then combined to estimate an overall vulnerability. Quantitative information is used when available, but qualitative and expert opinion is used when quantitative information is lacking. Here we conduct a climate vulnerability assessment on 82 fish and invertebrate species in the Northeast U.S. Shelf including exploited, forage, and protected species. We define climate vulnerability as the risk of a change in abundance or productivity resulting from climate forcing, including both climate change and decadal variability. We find that the overall climate vulnerability is high to very high for approximately half the species assessed; diadromous and invertebrate species exhibit the greatest vulnerability. In addition, a majority of species included in the assessment have a high potential for a change in species distribution in response to projected climate forcing. Negative effects of climate change are expected for approximately half of the species assessed, but some species are expected to increase in productivity or move into the region. These results will inform research and management activities related to
understanding and adapting marine fisheries and conservation to climate change and decadal variability.

Expected publication date: February 2016

Nutrient-controlled niche differentiation of western Lake Erie cyanobacterial populations revealed via metatranscriptomic surveys

Environmental Science and Technology (5.481)

M. J. Harke, T. W. Davis (OAR/GLERL), S. B. Watson, and C. J. Gobler

- Given continued threats to drinking water supplies emanating from Lake Erie and elsewhere, understanding the genetic underpinnings of dominance and toxin production by cyanobacteria is of fundamental importance.
- We present an ecosystem-based evaluation of the transcriptomic responses of *Microcystis* and other potentially toxic cyanobacteria to natural and manipulated nutrient gradients in western Lake Erie.
- The expression of genes that facilitate the adaptation of *Anabaena* and *Planktothrix* to high P regions and *Microcystis* low P zones suggest that management schemes that reduce the delivery of P to western Lake Erie may alter the composition, but not the persistence of cyanobacterial blooms.

While toxic cyanobacterial blooms in Lake Erie threaten drinking water supplies and are promoted by nutrient loading, the precise nutrient regime that selects specific cyanobacteria populations is poorly understood. Here, we assess shifts in cyanobacterial abundances and global gene expression patterns in response to natural and manipulated gradients in nitrogen (N) and phosphorus (P) in western Lake Erie to identify gene pathways that facilitate dominance by different genera. Gradients in orthophosphate concentrations played a key role in shaping cyanobacteria communities and had the largest effect on transcriptomic responses. Under high P conditions, *Anabaena* and *Planktothrix* were the dominant cyanobacterial populations and P promoted nifH expression in *Anabaena*. While additions of P elicited the up regulation of genes involved in phage infection defense, genomic rearrangement, and nitrogen acquisition in *Microcystis*, these conditions also led to lower *Microcystis* abundances. In the presence of low levels of P, however, *Microcystis* became the dominant cyanobacteria as it upregulated genes associated with P scavenging (pstSCAB, phoX) and storage (ppk1).
Nitrogen did not alter *Microcystis* abundances but did increase the expression of protease inhibitors (aer, mcn genesets) that may deter zooplankton grazing as well as microcystin synthetase genes (mcy) with urea enrichment yielding significant increases in microcystin concentrations. The expression of genes that facilitate the adaptation of *Anabaena* and *Planktothrix* to high P regions and *Microcystis* low P zones suggest that management schemes that reduce the delivery of P to western Lake Erie may alter the composition, but not the persistence of cyanobacterial blooms.

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Available online:
http://pubs.acs.org/doi/abs/10.1021/acs.est.5b03931?journalCode=esthag

*Under high carbon emission rates: Atlantic sea level rise enhanced relative to the Pacific*

*Nature Geoscience* (11.74)

**J. P. Krasting, J. P. Dunne, R. J. Stouffer, and R. W. Hallberg (OAR/GFDL)**

- This study demonstrates that basin scale differences in heat uptake and sea level rise are a forced response from increasing atmospheric carbon dioxide concentrations, and the inter-basin differences vary with emission rate.
- Emission rates greater than 5 GtC yr\(^{-1}\) enhance Atlantic sea level rise relative to the Pacific on centennial time scales. For reference, present day carbon emission rates are \(\sim 10\) GtC yr\(^{-1}\).
- Low emission rates (2 and 3 GtC yr\(^{-1}\)) produce more uniform sea level rise during the first several centuries before the Pacific sea level rise overtakes the Atlantic on millennial time scales.

Recent observational studies indicate that more than 90% of the anthropogenically-generated heat anomaly generated between 1971 and 2010 has gone into warming the oceans. Furthermore, the Atlantic basin is warming faster than the Pacific. Weaker overturning circulations in the Atlantic in the higher emission scenarios make the ocean interior both warmer and less ventilated and are associated with enhanced Atlantic sea level rise, relative to the Pacific.

The authors used an Earth System Model (GFDL’s ESM2G) forced with 7 different idealized carbon emission rates ranging between 2 and 25 GtC yr. These
were similar to the range of carbon emissions at year 2100 across all of the
Representative Concentration Pathways (RCPs) used in IPCC AR5. Three
ensemble members of each scenario were integrated to at least a doubling of
atmospheric preindustrial CO2 concentrations. Combined with a 1200 year control
run, a total of 120,000 model years were analyzed in this study. The basin scale
differences in sea level rise that vary with emission rate are relevant to climate
adaptation efforts because they illustrate the relative vulnerability of the Atlantic to
high emission rates and demonstrate that global average metrics of sea level rise
could become less representative of regional scale changes.
Expected publication date: 18 January 2016

Estimation of a killer whale (Orcinus orca) population’s diet using sequencing
analysis of DNA from feces
PLoS ONE (3.534)
M. J. Ford, J. Hempelmann, B. B. Hanson, K. L. Ayres, R. W. Baird, C. K.
(NMFS/NWFSC)

● Analysis of DNA from killer whale feces confirm that salmon are the
dominant component of the whales' summer diet.
● Chinook salmon made up 79.5% of all sequenced samples, followed by
  Coho salmon.
● Chinook salmon were more prevalent early in the summer, while Coho were
dominated late summer samples.

Estimating diet composition is important for understanding interactions between
predators and prey and thus illuminating ecosystem function. However, diets of
many species are difficult to observe directly. Genetic analysis of fecal material
collected in the field is therefore a useful tool for gaining insight into wild animal
diets. In this study, the authors used high-throughput DNA sequencing to
quantitatively estimate the diet composition of an endangered population of wild
killer whales (Orcinus orca) in their summer range in the Salish Sea. They
combined 175 fecal samples collected between May and September between 2006
and 2011 into 13 sample groups. Two known DNA composition control groups
were also created, and each group was sequenced at a ~330bp segment of the 16s
gene in the mitochondrial genome using an Illumina MiSeq sequencing system. After several quality controls steps, 4,987,107 individual sequences were aligned to a custom sequence database containing 19 potential fish prey species and the most likely species of each fecal-derived sequence was determined. Based on these alignments, salmonids made up >98.6% of the total sequences and thus of the inferred diet. Of the six salmonid species, Chinook salmon made up 79.5% of the sequences, followed by coho salmon (15%). Over all years, a clear pattern emerged with Chinook salmon dominating the estimated diet early in the summer, and coho salmon contributing an average of >40% of the diet in late summer. Sockeye salmon appeared to be occasionally important, at >18% in some sample groups. Non-salmonids were rarely observed. These results are consistent with earlier results based on surface prey remains, and confirm the importance of Chinook salmon in this population’s summer diet.

Available online: http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0144956

Deepwater Horizon oil spill impacts on sea turtles could span the Atlantic
Biology Letters (3.248)
N. F. Putman, F. A. Abreu-Grobois, I. Iturbe-Darkistade, E. M. Putman, P. M. Richards (NMFS/SEFSC), and P. Verley

- Several hundred thousand juvenile turtles from populations throughout the Gulf of Mexico, Caribbean, northern South America, and western Africa were present during the DWH event; more than 95% of turtles at the spill site likely originating from outside of the U.S.
- Therefore, the spill’s impacts may extend far beyond the current focus on the northern Gulf of Mexico.
- This new method can be broadly applied to numerous situations where data is limited but estimates of turtle abundance are needed (for example, in certain fisheries or sites of marine energy extraction).

Effective restoration and mitigation of damages requires knowing which populations were impacted by a disturbance, so that the remedies can be appropriately tailored. Most plans for sea turtle restoration related to Deepwater Horizon (DWH) oil spill have been made without consideration of which
populations were present at the time of the spill, which has caused restoration efforts to be overly focused on populations that nest in the US. Here the authors investigate the extent that the 2010 Deepwater Horizon oil spill potentially affected oceanic-stage sea turtles from populations across the Atlantic. Within an ocean-circulation model, particles were backtracked from the Gulf of Mexico spill site to determine the probability of young turtles arriving in this area from major nesting beaches. The abundance of turtles in the vicinity of the oil spill was derived by forward-tracking particles from focal beaches and integrating population size, oceanic-stage duration and stage-specific survival rates. Simulations indicated that 321,401 (66,199–397,864) green (Chelonia mydas), loggerhead (Caretta caretta), and Kemp's ridley (Lepidochelys kempii) turtles were likely within the spill site. These predictions compared favourably with estimates from in-water observations recently made available to the public; though our initial predictions for Kemp's ridley were substantially lower than in-water estimates, better agreement was obtained with modifications to mimic behaviour of young Kemp's ridley turtles in the northern Gulf. Simulations predicted about 75% of these turtles originated in Mexico, 15% from Costa Rica, 6% from countries in northern South America, 3% from the United States, and less than 2% from West African countries. Thus, the spill's impacts may extend far beyond the current focus on the northern Gulf of Mexico.

Published: 23 December 2015
Available online: [http://rsbl.royalsocietypublishing.org/content/11/12/20150596](http://rsbl.royalsocietypublishing.org/content/11/12/20150596)

*Rapid and highly variable warming of lake surface waters around the globe*  
Geophysical Research Letters (4.196)  
C. M. O'Reilly and G.A. LESHKEVICH (among 56 others) (OAR/GLERL)  
- The heterogeneity in surface warming rates underscores the importance of considering interactions among climate and geomorphic factors that are driving lake responses.  
- Widespread warming reported suggests that large changes in Earth’s freshwater resources and their processes are not only imminent, but already underway.

In this first worldwide synthesis of in situ and satellite-derived lake data, we find
that lake summer surface water temperatures rose rapidly (global mean= 0.34 deg C decade-1) between 1985-2009. Our analyses show that surface water warming rates are dependent on combinations of climate and local characteristics, rather than just lake location, leading to the counterintuitive result that regional consistency in lake warming is the exception, rather than the rule. The most rapidly warming lakes are widely geographically distributed, and their warming is associated with interactions among different climatic factors- from seasonally ice-covered lakes in areas where temperature and solar radiation are increasing while cloud cover is diminishing (0.72 deg C decade-1) to ice-free lakes experiencing increases in air temperature and solar radiation (0.53 deg C decade-1). The pervasive and rapid warming observed here signals the urgent need to incorporate climate impacts into vulnerability assessments and adaptation efforts for lakes. Published: 16 December 2015
Available online: http://onlinelibrary.wiley.com/journal/10.1002/(ISSN)1944-8007/

ADDITIONAL ARTICLES
NOS Publications
Climate relationships to fecal bacterial densities in Maryland shellfish harvest waters
Water Research (5.323)
A.K. Leight, R. Hood, R. Wood, and K. Brohawn (NOS/NCCOS)
• This paper examines the role climate variables, include runoff and temperature, in large-scale fecal coliform trends for Maryland shellfish waters.
• The strength of the relationship between climate variables and fecal coliform trends are not uniform seasonally or geographically, suggesting that management criteria may be altered by season and location.
• This study suggests the importance of considering climate trends when managers of shellfish harvest areas make decisions about restricting access.

Coastal states in the U.S. routinely monitor shellfish harvest waters for types of bacteria that indicate the potential presence of fecal pollution. The densities of these indicator bacteria in natural waters may be related to climate in several ways, including runoff from precipitation and survival related to water temperatures. The
relationship between interannual precipitation and air temperature patterns and the densities of fecal indicator bacteria in shellfish harvest waters in Maryland’s portion of the Chesapeake Bay was quantified using 34 years of data (1979-2013). Annual and seasonal precipitation totals had a strong positive relationship with average fecal coliform levels ($R^2=0.69$) and the proportion of samples with bacterial densities above the FDA regulatory criteria ($R^2=0.77$). Fecal coliform levels were also significantly and negatively related to average annual air temperature ($R^2=-0.43$) and the average air temperature of the warmest month ($R^2=-0.57$), while average seasonal air temperature was only significantly related to fecal coliform levels in the summer. River and regional fecal coliform levels displayed a wide range of relationships with precipitation and air temperature patterns, with stronger relationships in rural areas and mainstem Bay stations. Continental-scale sea level pressure analysis revealed an association between atmospheric patterns that influence both extratropical and tropical storm tracks and very high fecal coliform years, while regional precipitation was found to be significantly correlated with the Atlantic Multidecadal Oscillation and the Pacific North American Pattern. These findings indicate that management of shellfish harvest waters should account for changes in climate conditions and that sea level pressure patterns may be particularly important for predicting years with extremely high levels of fecal coliforms.

Accepted: 23 November 2015
Expected publication date: Unknown

**Climate change and larval-transport in the ocean: Fractional effects from physical and physiological factors**

Global Change Biology (8.224)

**M. S. Kendall, M. Poti (NOS/NCCOS), and K. Karnauskas**

- Islands that presently export large numbers of larvae and are also expected to maintain or enhance this role into the future should be the focus of conservation measures that promote long term resilience of larval supply.
- MPA networks and islands that exchange larvae and are connected by ocean currents today may not be connected in the future.
Increased self-seeding means that each island has a greater stake in managing its own resources sustainably rather than depending on island neighbors. Changes in larval import, export, and self-seeding will affect the resilience of coral reef ecosystems. Climate change will alter the ocean currents that transport larvae and also increase sea surface temperatures (SST), hastening development and shortening planktonic larval durations (PLD). Here, the authors used transport simulations to estimate future larval connectivity due to: 1) physical transport of larvae from altered circulation alone, and 2) the combined effects of altered currents plus physiological response to warming. Virtual larvae from islands throughout Micronesia were moved according to present-day and future-ocean circulation models. The Hybrid Coordinate Ocean Model (HYCOM) spanning 2004-2012 represented present-day currents. For future currents, HYCOM was altered using analysis from the National Center for Atmospheric Research’s (NCAR) Community Earth System Model, version 1-Biogeochemistry, Representative Concentration Pathway 8.5 experiment. Based on the NCAR model, regional SST is estimated to rise 2.74° C which corresponds to a ~17% decline in larval duration for some taxa, and an increase in self-seeding over the next 100 years. Self-seeding was predicted to increase at 62-76% of islands, there was an average domain-wide increase of ~1-3 percentage points in self-seeding, and increases of up to 25 percentage points for several individual islands were found. When changed currents alone were considered, approximately half of all island pairs experienced decreased connectivity but when reduced PLD was added as an effect, ~65% of connections were weakened. Orientation of archipelagos relative to currents determined the directional bias in connectivity changes. There was no universal relationship between climate change and connectivity applicable to all taxa and settings. Islands that presently export large numbers of larvae but that also maintain or enhance this role into the future should be the focus of conservation measures that promote long term resilience of larval supply.

Expected publication date: February 2016

NMFS Publications

*Growth dynamics of Saffron cod (Eleginus gracilis) and Arctic cod (Boreogadus saida) in the Northern Bering and Chukchi Seas*
Deep Sea Research II (2.763)

T. Helser, J. Colman, D. Anderl, and C. Kastelle (NMFS/AFSC)

- This paper examines the first robust documentation of Arctic and saffron cod growth dynamics in the northern Bering and Chukchi Seas
- There comparisons of growth between two periods 30 years apart using otoliths indicate that both species show a decline in maximum size

Saffron cod (*Eleginus gracilis*) and Arctic cod (*Boreogadus saida*) serve as critically important species responsible for energy transfer in Arctic food webs of the northern Bering and Chukchi Seas. To understand the potential effects of sea ice loss and warming temperatures on these species’ basic life history, information such as growth is needed. Yet to date, limited effort has been dedicated to the study of their growth dynamics. Based on a large sample of otoliths collected in the first comprehensive ecosystem integrated survey in the northern Bering and Chukchi Seas, procedures were developed to reliably estimate age from otolith growth zones and were used to study the growth dynamics of saffron and Arctic cod. Annual growth zone assignment was validated using oxygen isotope signatures in otoliths and otolith morphology analyzed and compared between species. Saffron cod attained larger asymptotic sizes ($L_\infty = 363$ mm) and achieved their maximum size at a faster rate ($K = 0.378$) than Arctic cod ($L_\infty = 209$ mm; $K = 0.312$). For both species, regional differences in growth were found ($p < 0.01$). Saffron cod grew to a significantly larger size at age in the northern Bering Sea when compared to the Chukchi Sea, particularly at younger ages. Arctic cod grew to smaller asymptotic size but at faster rates in the more northerly central ($L_\infty = 197$ mm; $K = 0.324$) and southern Chukchi Sea ($L_\infty = 221$ mm; $K = 0.297$) when compared to the northern Bering Sea ($L_\infty = 266$ mm; $K = 0.171$), suggesting a possible cline in growth rates with more northerly latitudes. Comparison of growth to two periods separated by 30 years indicate that both species exhibited a decline in maximum size accompanied by higher instantaneous growth rates in more recent years.

Accepted: 12 December 2015

*The causes of large shifts in commercial landings of estuarine and bay mollusks, eastern United States after 1980*
This paper examines how environmental factors contributed to the decline in bivalve mollusk commercial landings along the Atlantic coast. By the early 2000s, molluscan landings had fallen on average by 85%. Researchers show evidence the the switch in the North Atlantic Oscillation to positive resulted in warmer winters and decreased recruitment.

In between 1980 to 2010, documented commercial landings of the four most important bivalve mollusks declined sharply in the U. S. estuaries and bays, from Maine to North Carolina. Landings of the following species declined: eastern oysters (*Crassostrea virginica*) by 93%; northern quahogs (*Mercenaria mercenaria*) by 62%; softshell clams (*Mya arenaria*) by 66%; northern bay scallops (*Argopecten irradians irradians*) by 93%; and southern bay scallops (*A. I. concentricus*) by 91%. The average decline is 85%, but in the previous three decades (1950 to 1980) annual landings of the same species did not decline. The declines deprived fishermen of their livelihood, and waterfronts that had once been dedicated by commercial fishing interests are now dominated by private and tourist housing, restaurants, and sporting vessels. This investigation shows that the declines in landings of the bivalve mollusks were a consequence of declines in their abundances due to falling recruitments of their juveniles. Researchers suggest that the declines took place after the molluscan environments were changed adversely for the bivalves when the North Atlantic Oscillation switched its phase from negative to positive in about 1982 and remained there until 2003, causing winters to become substantially warmer. Researchers used evidence from other studies to show the temperature increases in winter and spring probably forced the adult mollusks to spawn fewer eggs, ultimately preventing good recruitment. Moreover, predation on the juvenile recruits may have increased to precipitate the declines, while from Long Island Sound through Chesapeake Bay, diseases caused large mortalities in oysters. In some waters, higher temperatures combined with eutrophication and in others loss of eelgrass (*Zostera marina*) probably contributed to degradation of habitats. This paper brings out the important roles that crustaceans, i.e., pelagic copepods, shrimps, and crabs, play in the productivity of bivalve mollusk stocks. Predation by shrimp on tiny bivalve recruits is suggested...
as an important factor that controls bivalve abundances. The common perception that bivalve landings declined due to overfishing should be reconsidered because separate environmental factors have a much larger effect upon bivalve productivity.
Accepted: 11 December 2015
Expected publication date: Unknown

*Skeletochronological estimation of age and growth of loggerhead sea turtles (Caretta caretta) in the western South Atlantic Ocean*

Austral Ecology (1.837)

A. J. Lenz, **L. Avens** (NMFS/SEFSC), C. C. Trigo, and M. Borges-Martins

- This paper examines loggerhead sea turtles found dead along the coast of Brazil between 1994-2010.
- Researchers use skeletochronology to look at age and growth rates in order to better understand life history and population dynamics.
- The results demonstrated that the southern coast of Brazil is an important area for the development of juveniles loggerhead sea turtles.

Age and growth are important parameters for better understanding life history and population dynamics of animal species and formulating management strategies. However, these data are difficult to obtain for sea turtles due to overall slow growth, delayed maturation, and highly migratory behavior. The loggerhead sea turtle, *Caretta caretta*, is a widely distributed species, globally listed as endangered. Although the species has been well-studied in some regions, little is known about various aspects of its biology in other populations, such as those in the waters of the western South Atlantic Ocean, especially outside nesting areas.

To address age and growth, loggerhead turtles found dead stranded on the northern coast of the state of Rio Grande do Sul during a period of 16 years (1994-2010) were utilized for estimation of age and growth rates using skeletochronology. The individuals analyzed were predominantly neritic juveniles, ranging from 53 to 101 cm curved carapace length (CCL; mean = 71 cm), with estimated ages between 10 and 29 years (mean = 15 yr). Mean estimated annual growth rate was 2.1 cm CCL year\(^{-1}\) (1.9 cm SCL yr\(^{-1}\)), showing large variation among individuals and between successive years in the same individual. GAMM analysis indicated that growth
response was influenced by age, CCL, and year. The results demonstrated that the southern coast of Brazil is an important area for the development of neritic juveniles of this species, which appear to recruit to this environment beginning at about 12 years of age and sizes greater than 55 cm CCL.

Accepted: 3 January 2016
Expected publication date: Unknown

Population coherence and environmental impacts across spatial scales: A case study of Chinook salmon
Ecosphere (2.595)
J. Ohlberger, M. D. Scheuerell (NMFS/NWFSC), and D. E. Schindler

- This paper examines how to address the challenge of integrating data across multiple populations and times using a dataset of 15 populations of Chinook salmon in the eastern North Pacific.
- The findings show that productivity dynamics of Chinook salmon populations strongly covary at the regional scale, and less at the global scale.
- The results show how Dynamic Factor Analysis (DFA) can be used to estimate temporal coherence in population dynamics across spatial scales, and to distinguish local, regional and global environmental drivers.

A central problem in understanding how species respond to global change is in parsing the effects of local drivers of population dynamics from regional and global drivers that are shared among populations. Management and conservation efforts that typically focus on a particular population would benefit greatly from being able to separate the effects at local, regional and global scales. One way of addressing this challenge is to integrate data across multiple populations and use multivariate time series approaches to estimate shared and independent components of dynamics among neighboring populations. Here, researchers use a remarkable dataset of 15 populations of Chinook salmon (Oncorhynchus tshawytscha) covering a broad geographical range in the eastern North Pacific Ocean to show how Dynamic Factor Analysis (DFA) can be used to estimate temporal coherence in population dynamics across spatial scales, and to distinguish local, regional and global environmental drivers. The findings show that productivity dynamics of Chinook salmon populations strongly covary at the
regional scale, and less at the global scale. In addition, the timing of river ice break-up in spring was identified as an important driver of regional productivity dynamics, whereas broad-scale variability in population productivity was linked to the North Pacific Gyre Oscillation (NPGO), a dominant pattern of sea surface height variability. These broad-scale patterns in productivity dynamics may be associated with recent regime shifts in the Northeast Pacific Ocean. However, the results also demonstrate that populations within regions do not always respond consistently to the same environmental drivers, thus suggesting location-specific impacts. Overall, this study illustrates the use of DFA for quantifying the spatial and temporal complexity of multiple population responses to environmental change, thereby providing insights to processes that affect populations across large geographic scales, but that might be filtered by local habitat conditions.

Accepted: 6 December 2015
Expected publication date: Unknown

The effects of weathering and chemical dispersion on Deepwater Horizon crude oil toxicity to mahi-mahi (Coryphaena hippurus) early life stages
Science of the Total Environment (3.163)

- Embryos of mahi mahi (Coryphaena hippurus) are sensitive to low levels of Deepwater Horizon-MC252 crude oil.

To better understand the impact of the Deepwater Horizon (DWH) incident on commercially and ecologically important pelagic fish species, a mahi-mahi spawning program was developed to assess the effect of embryonic exposure to DWH crude oil with particular emphasis on the effects of weathering and dispersant on the magnitude of toxicity. Acute lethality (96h LC50) ranged from 45.8 (28.4-63.1) μgl⁻¹ ΣPAH for wellhead (source) oil to 8.8 (7.4-10.3) μgl⁻¹ ΣPAH for samples collected from the surface slick, reinforcing previous work that weathered oil is more toxic on a ΣPAH basis. Differences in toxicity appear related to the amount of dissolved 3 ringed PAHs. The dispersant Corexit 9500 did not influence acute lethality of oil preparations. Embryonic oil exposure resulted in
cardiotoxicity after 48h, as evident from pericardial edema and reduced atrial contractility. Whereas pericardial edema appeared to correlate well with acute lethality at 96h, atrial contractility did not. However, sub-lethal cardiotoxicity may impact long-term performance and survival. Dispersant did not affect the occurrence of pericardial edema; however, there was an apparent reduction in atrial contractility at 48h of exposure. Pericardial edema at 48h and lethality at 96h were equally sensitive endpoints in mahi-mahi.

Publication date: 1 February 2016
Available online: http://www.sciencedirect.com/science/article/pii/S0048969715310494

Examination of winter circulation in a northern Gulf of Mexico estuary
Estuaries and Coasts (2.245)
J. Lin, C. Li, K. Boswell, M. Kimball, and L. Rozas (NMFS/SEFSC)
● The paper describes how human changes (e.g., presence of navigation channel) and environmental factors affect the circulation patterns of an estuary in winter.
● These circulation patterns influence changes in water depth and salinity, which in turn may affect the recruitment, distribution, and vital rates of fishery species that use estuarine nursery areas.

Numerical model experiments were conducted to examine how estuarine circulation and salinity distribution in the Calcasieu Lake Estuary (CLE) of southwest Louisiana respond to the passage of cold fronts. River runoff, local wind stress, and tides from December 20, 2011, to February 1, 2012, were included as input. The experiments showed an anticyclonic circulation in the eastern CLE, a cyclonic circulation in West Cove, and a saltwater conduit in the navigation channel between these circulation cells. Freshwater from the river and wetlands tends to flow over the shallow shoals toward the ocean, presenting a case of the conventional estuarine circulation with shallow water influenced by river discharge and with weak tidally-induced motion, enhanced by wind. The baroclinic pressure gradient is important for the circulation and saltwater intrusion. The effect of remote wind-driven oscillation plays an important role in circulation and salinity distribution in winter. Unless it is from the east, wind is found to inhibit saltwater
intrusion through the narrow navigation channel, indicating the effect of Ekman setup during easterly wind. A series of north-south oriented barrier islands in the lake uniquely influenced water level and salinity distribution between the shallow lake and deep navigation channel. The depth of the navigation channel is also crucial in influencing saltwater intrusion: the deeper the channel, the more saltwater intrusion and the more intense estuarine circulation. Recurring winter storms have a significant accumulated effect on the transport of water and sediment, saltwater intrusion, and associated environmental and ecosystem effects.

Publication date: 2 December 2015

Baseline assessment of net calcium carbonate accretion rates on U.S. Pacific Reefs
PLoS One (3.534)

- This study documents the variation in carbonate accretion rates, primarily by crustose coralline algae, at dozens of sites across American Samoa and the Pacific Remote Islands, and offers a unique perspective to contextualize the effects of ocean acidification (OA).
- Because crustose coralline algae precipitate a highly soluble polymorph of \( \text{CaCO}_3 \), changes in ocean water acidity will likely result in lower coralline algae accretion rates.
- Under acidified conditions, crustose coralline algae may lose their competitive advantage as the dominant calcifying taxa of the early reef successional community, which in turn may have adverse implications for the settlement and development of other important reef calcifying taxa.

This paper presents a comprehensive quantitative baseline assessment of *in situ* net calcium carbonate accretion rates \( (\text{g} \, \text{CaCO}_3 \, \text{cm}^{-2} \, \text{yr}^{-1}) \) of early successional recruitment communities on Calcification Accretion Unit (CAU) plates deployed on coral reefs at 78 discrete sites, across 11 islands in the central and south Pacific Oceans. Accretion rates varied substantially within and between islands, reef zones, levels of wave exposure, and island geomorphology. For forereef sites, mean accretion rates were the highest at Rose Atoll, Jarvis, and Swains Islands, and the lowest at Johnston Atoll and Tutuila. A comparison between reef zones
showed higher accretion rates on forereefs compared to lagoon sites; mean accretion rates were also higher on windward than leeward sites but only for a subset of islands. High levels of spatial variability in net carbonate accretion rates reported herein draw attention to the heterogeneity of the community assemblages. Percent cover of key early successional taxa on CAU plates did not reflect that of the mature communities present on surrounding benthos, possibly due to the short deployment period (2 years) of the experimental units. Yet, net CaCO₃ accretion rates were positively correlated with crustose coralline algae (CCA) percent cover on the surrounding benthos and on the CAU plates, which on average represented >70% of the accreted material. For forereefs and lagoon sites combined CaCO₃ accretion rates were statistically correlated with total alkalinity and Chlorophyll-a; a GAM analysis indicated that SiOH and Halimeda were the best predictor variables of accretion rates on lagoon sites, and total alkalinity and Chlorophyll-a for forereef sites, demonstrating the utility of CAUs as a tool to monitor changes in reef accretion rates as they relate to ocean acidification. This study underscores the pivotal role CCA play as a key benthic component and supporting actively calcifying reefs; high Mg-calcite exoskeletons makes CCA extremely susceptible changes in ocean water pH, emphasizing the far-reaching threat that ocean acidification poses to the ecological function and persistence of coral reefs worldwide.

Publication date: 7 December 2015
Available online:
http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0142196

Methods for the preparation of Pacific spiny dogfish, Squalus suckleyi, fin spines and vertebrae and an overview of age determination

Marine Fisheries Review

C. A. Tribuzio, M. E. Matta, C. Gburski (NMFS/AFSC), N. Atkins, and W. Bubley

- This study examines ageing methods for a difficult to age shark, the Pacific spiny dogfish (Squalus suckleyi), and provides a description of the biology and challenges to aging.
The authors provide a clear description of lab methods that will increase consistency between ageing labs and provide links to reference specimen collections to share with other labs.

The Pacific spiny dogfish, *Squalus suckleyi*, is a small shark species commonly found in the North Pacific Ocean. Age determination for this species has historically been conducted by examination of the dorsal fin spine with little change in methodology since the 1930’s. Despite extensive use, there are two major caveats associated with fin spines as age structures: 1) fin spines protrude from the body and are subject to damage, requiring estimation of annuli contained in missing portions of the fin spine and 2) there is a high degree of inter- and intra-reader variability due to difficulty in interpreting fin spine growth patterns. A new method was recently developed for *S. acanthias*, a North Atlantic Ocean congener of *S. suckleyi*, using histologically stained thin sections of vertebrae instead of dorsal fin spines for age estimation. Here, we apply this histological method to vertebrae of *S. suckleyi* and describe the historic methodology for dorsal fin spines. This document presents detailed procedures for both methods, including sample collection, sample preparation, and age estimation criteria for each structure. Accepted: 3 December 2015

Expected publication date: Unknown

*Differential toxicokinetics determines the sensitivity of two marine embryonic fish exposed to Iranian Heavy Crude Oil*

Environmental Science & Technology (5.330)

J. Jung, M. Kim, U. H. Yim, S. Y. Ha, W. J. Shim, Y. S. Chea, H. Kim, T.L. Linbo, J. P. Incardona (NMFS/NWFSC), and J. H. Kwon

- This study demonstrates important interspecies differences in detoxification of polynuclear aromatic hydrocarbons (PAHs).
- The results imply that oil spill impacts need to be assessed on actual species of concern, not surrogates.

Interspecific difference in the developmental toxicity of crude oil to embryonic fish allows the prediction of injury extent to a number of resident fish species in oil spill sites. This study clarifies the comparative developmental effects of Iranian heavy crude oil (IHCO) on the differences of biouptake and toxic sensitivity
between embryonic spotted sea bass (*Lateolabrax maculates*) and olive flounder (*Paralichthys olivaceus*). From 24 h after exposure to IHCO, several morphological defects were observed in both species of embryonic fish, including pericardial edema, dorsal curvature of the trunk, developmental delay, and reduced finfolds. The severity of defects was greater in flounder compared to that in sea bass. While flounder embryos accumulated higher embryo PAH concentrations than sea bass, the former showed significantly lower levels of CYP1A expression. Although bioconcentration ratios were similar between the two species for some PAHs, phenanthrenes and dibenzothiophenes showed selectively higher bioconcentration ratios in flounder, suggesting that this species has a reduced metabolic capacity for these compounds. While consistent with a conserved cardiotoxic mechanism for petrogenic PAHs across diverse marine and freshwater species, these findings indicate that species-specific differences in toxicokinetcis can be an important factor underlying species’ sensitivity to crude oil.

Publication date: 17 November 2015

*Evidence that summer jellyfish blooms impact Pacific Northwest salmon production*

Ecosphere (2.595)

J. J. Ruzicka, E. A. Daly, and R. D. Brodeur (NMFS/NWFSC)

- Juvenile salmon have high spatial overlap with large jellyfish in the Northern California Current Food web, and models show that high abundance of jellyfish can have negative effects on outmigrating salmon juveniles.
- Salmon feeding and returns are lower when jellyfish are abundant

Interannual variability of salmon (*Oncorhynchus* spp.) production in the northeast Pacific is understood to be driven by oceanographic variability and bottom-up processes affecting prey availability to juvenile salmon. Scyphozoan jellyfish have an important role shaping the pathways of energy flow through pelagic food webs. While jellyfish obtain high production rates and biomasses as major consumers of zooplankton production, they have few predators and may divert plankton production away from higher trophic levels. Although jellyfish are planktivorous and juvenile coho (*O. kisutch*) and Chinook (*O. tshawytscha*) salmon are mainly
piscivorous, they may be indirect competitors for plankton production. Ecosystem model simulations suggest that among all trophic interactions within the Pacific Northwest coastal food web, juvenile salmon are particularly sensitive to jellyfish blooms, and that salmon production will be suppressed in years of high summer jellyfish biomass. Pelagic surveys off Oregon and Washington (1999 - 2012) were used to examine the interannual relationship between salmon production and the dominant jellyfish species off the Pacific Northwest coast, the sea nettle *Chrysaora fuscescens*. There was a significant, negative correlation between sea nettle biomass and the strength of adult coho and Chinook salmon returns to the Columbia River. Examination of spatial distributions across years showed a positive association between sea nettles and salmon. Within individual years, significant differences between the distribution of sea nettles and yearling coho and Chinook salmon generally occurred during cooler ocean summers, perhaps due to the greater expanse of optimal salmon habitat resulting from more upwelling. Whether the association is behavioral or a product of oceanographic processes, association enhances the opportunity for indirect competition. Examination of feeding incidence in September showed that salmon stomachs were less full at locations with higher sea nettle biomass.

Acceptance date: 11 December 2015
Expected publication date: Spring 2016

*Opportunities and challenges of integrating ecological restoration into assessment and management of contaminated ecosystems*

Integrated Environmental Assessment and Management (1.377)

- This article represents 1 of 6 articles in the special series “Restoration of Impaired Ecosystems: An Ounce of Prevention or a Pound of Cure?”
- The articles result from a Technical Workshop organized by SETAC and the Society for Ecological Restoration, held June 2014 in Jackson, Wyoming, that focused on advancing the practice of restoring ecosystems that have been contaminated or impaired from industrial activities.
Conclusions relate to agencies or other parties willing to integrate restoration early in the remedial process.

Ecosystem restoration planning near the beginning of the site assessment and management process (“early integration”) involves consideration of restoration goals from the outset in developing solutions for contaminated ecosystems. There are limitations to integration that stem from institutional barriers, few successful precedents and limited availability of guidance. Challenges occur in integrating expertise from various disciplines and multiple, sometimes divergent interests and goals. The more complex process can result in timing, capacity, communication and collaboration challenges. On the other hand, integrating the two approaches presents new and creative opportunities. For example, integration allows early planning for expanding ecosystem services on or near contaminated lands or waters that might otherwise have been unaddressed by remediation alone. Integrated plans can explicitly pursue ecosystem services that have market value, which can add to funds for long-term monitoring and management. Early integration presents opportunities for improved and productive collaboration and co-ordination between ecosystem restoration, and contaminant assessment and management. Examples exist where early integration facilitates liability resolution and generates positive public relations. Restoration planning and implementation prior to the completion of the contaminated site assessment, remediation or management process (“early restoration”) could facilitate coordination with off-site restoration options and a regional approach to restoration of contaminated environments. Integration of performance monitoring, for both remedial and restoration actions, can save resources and expand the interpretive power of results. Early integration may aid experimentation, which may be more feasible on contaminated lands than in many other situations. The potential application of concepts and tools from adaptive management is discussed as a way of avoiding pitfalls and achieving benefits in early integration. In any case, there will be challenges with early integration of restoration concepts for contaminated ecosystems, but the benefits are likely to outweigh them.

Publication date: 3 December 2015
Management of acoustic metadata for bioacoustics

Recent expansion in the capabilities of passive acoustic monitoring of sound-producing animals is providing expansive data sets in many locations. These long-term data sets will allow the investigation of questions related to the ecology of sound-producing animals on time scales ranging from diel and seasonal to interannual and decadal. Analyses of these data often span multiple analysts from various research groups over several years of effort, and as a consequence have begun to generate large amounts of scattered acoustic metadata. It has therefore become imperative to standardize the types of metadata being generated. A critical aspect of being able to learn from such large and varied acoustic data sets is providing consistent and transparent access that can enable the integration of various analysis efforts. This is juxtaposed with the need to include new information for specific research questions that evolve over time. Hence, a method is proposed for organizing acoustic metadata that addresses many of the problems associated with the retention of metadata from large passive acoustic data sets. A structure was developed for organizing acoustic metadata in a consistent manner, specifying required and optional terms to describe acoustic information derived from a recording. A client-server database was created to implement this data representation as a networked data service that can be accessed from several programming languages. Support for data import from a wide variety of sources such as spreadsheets and databases is provided. The implementation was extended to access Internet-available data products, permitting access to a variety of environmental information types (e.g. sea surface temperature, sunrise/sunset, etc.) from a wide range of sources as if they were part of the data service. This metadata service is in use at several institutions and has been used to track and analyze millions of acoustic detections from marine mammals, fish, elephants, and anthropogenic sound sources.
Ecosystem Model Skill Assessment: Yes we can!
PLoS ONE (3.534)
E. Olsen, G. Fay, S. Gaichas, R. Gamble, S. Lucey, and J. S. Link
(NMFS/NEFSC)

- Skill assessment is possible for end to end models.
- Multiple metrics are necessary to assess model skill.
- Assessing skill during model calibration is recommended.

Accelerated changes to global ecosystems call for holistic and integrated analyses of past, present and future states under various pressures to adequately understand current and projected future system states. Ecosystem models can inform management of human activities in a complex and changing environment, but are these models reliable? Ensuring that models are reliable for addressing management questions requires evaluating their skill in representing real-world processes and dynamics. Skill has been evaluated for just a limited set of some biophysical models. A range of skill assessment methods have been reviewed but skill assessment of full marine ecosystem models has not yet been attempted. We assessed the skill of the Northeast U.S. (NEUS) Atlantis marine ecosystem model by comparing 10-year model forecasts with observed data. Model forecast performance was compared to that obtained from a 40-year hindcast. Multiple metrics (average absolute error, root mean squared error, modeling efficiency, and Spearman rank correlation), and a suite of time-series (species biomass, fisheries landings, and ecosystem indicators) were used to adequately measure model skill.

Overall, the NEUS model performed above average and thus better than expected for the key species that had been the focus of the model tuning. Model forecast skill was comparable to the hindcast skill, showing that model performance does not degenerate in a 10-year forecast mode, an important characteristic for an end-to-end ecosystem model to be useful for strategic management purposes. We identify best-practice approaches for end-to-end ecosystem model skill assessment that would improve both operational use of other ecosystem models and future model development. We show that it is possible to not only assess the skill of a
complicated marine ecosystem model, but that it is necessary do so to instill confidence in model results and encourage their use for strategic management. Our methods are applicable to any type of predictive model, and should be considered for use in fields outside ecology (e.g. economics, climate change, and risk assessment).

Accepted: 18 December 2015
Expected publication date: Unknown

_Vast assembly of vocal marine mammals from diverse species on fish spawning ground_

_Nature_ (41.456)

- Mapped the spatial and temporal distributions of more than 10 species of marine mammals concurrently with fish prey.

Observing marine mammal (MM) populations continuously in time and space over the immense ocean areas they inhabit is challenging but essential for gathering an unambiguous record of their distribution, understanding their behavior and interaction with prey species. Here the authors employ passive ocean acoustic waveguide remote sensing (POAWRS) in an important North Atlantic feeding ground to instantaneously detect, localize and classify MM vocalizations from diverse species over roughly 100,000 km² region. More than eight species of vocal MMs were found to spatially converge on fish spawning areas containing nighttime massive densely-populated herring shoals and daytime diffuse herring distributions. The vocal MMs divide the enormous fish prey field into species-specific foraging areas with varying degrees of spatial overlap, maintained for at least two weeks of the herring spawning period. The diel vocalization rates of all the MM species recorded vary, some are significantly more vocal at night and others more vocal during the day. The four key baleen whale species of the region - fin, humpback, blue, and minke - have vocalization rate trends that are highly correlated to trends in fish shoaling density and to each other over the diel cycle. These results reveal the temporal-spatial dynamics of multi-species MM combined foraging activity in the vicinity of an extensive fish prey field in a massive
ecological hotspot, unattainable with conventional methodologies. Understanding MM behavior and distributions is essential for management of marine ecosystems and for assessing anthropogenic impacts on these marine protected species.

Accepted: 21 December 2015
Expected publication date: Unknown

*It's a bear market: evolutionary and ecological effects of predation on two wild sockeye salmon populations*

Heredity (3.81)

J. E. Lin, D. Peterson, J. J. Hard (NMFS/NWFSC), K. A. Naish, R. Hilborn, and L. Hauser

- Predation on wild sockeye salmon can vary dramatically from year to year, with subsequent impacts on variation in productivity
- The evolutionary effects appear to be much weaker than the demographic effects in these systems
- The genetic covariation of morphology, phenology and lifespan appears to maintain variation in spawner body size and stream entry timing in the face of natural selection

Predation can affect both phenotypic variation and population productivity in the wild, but quantifying evolutionary and demographic effects of predation in natural environments is challenging. The aim of this study was to directly estimate selection coefficients associated with bear predation in wild salmon populations spawning in pristine habitat. Using genetic pedigrees reconstructed from wild spawners, individual reproductive success was estimated in two populations of sockeye salmon (*Oncorhynchus nerka*) for two consecutive brood years with very different predation intensities. In combination with the pedigree, phenotypic data on individual adult body length, body depth, stream entry timing, and reproductive lifespan were used to calculate selection coefficients and genetic variance components using regression and animal models. Brown bears (*Ursus arctos*) consistently killed larger and more recently arrived adults, although selection differentials were small. In both populations, mean reproductive success was higher in the brood year experiencing lower predation intensity. In contrast, selection coefficients were similar across brood years, often indicating stabilizing
selection on reproductive lifespan as well as directional selection for longer lifespan. Despite these selection pressures, genetic covariation of morphology, phenology and lifespan appears to have maintained variation in spawner body size and stream entry timing in both populations. Our results therefore suggest considerable demographic but limited evolutionary effects of bear predation in the two study populations.

Accepted: 18 December 2015
Expected publication date: Unknown

A passive acoustic survey of fish sound production at Riley’s Hump within Tortugas South Ecological Reserve: implications regarding spawning and habitat use
Fishery Bulletin (1.783)
J. Locascio and M. L. Burton (NMFS/SEFSC)

- At least three species of economically important groupers use Riley’s Hump as spawning habitat.
- This study emphasizes the importance of marine reserves in protecting vulnerable species of reef fishes in the southeast U. S.
- This study shows the value of using passive acoustic monitoring of reef fish populations to study long-term habitat use.

Passive acoustic recorders were used to monitor sound production indicative of the use of spawning habitat by groupers (Serranidae) at Riley’s Hump, which is located in the Tortugas South Ecological Reserve (TSER), part of the Florida Keys National Marine Sanctuary. Sound production by black grouper (Mycteroperca bonaci), red grouper (Epinephelus morio), and red hind (E. guttatus) was recorded year-round and at all times of day but occurred more often in the evening during the winter–spring spawning period than during other times of the day and year. This pattern for these species is consistent with results of previous studies that documented the association of sound production with reproductive behavior at spawning sites. Distinct diel and seasonal patterns of sound production by the longspine squirrelfish (Holocentrus rufus) and bicolor damselfish (Stegastes partitus) also were recorded. Riley’s Hump is documented spawning site for mutton snapper (Lutjanus analis), and the recordings of black grouper, red
grouper, and red hind indicate that it is used for reproductive purposes by these species as well. These results showed the importance of the TSER and the need for continued research to understand its role in the recovery and sustainability of managed fish populations.

Publication date: 10 December 2015
Available online:  http://fishbull.noaa.gov/1141/locascio.pdf

In what direction should the fishing mortality target change when natural mortality increases within an assessment?

Canadian Journal of Fisheries and Aquatic Sciences (2.276)

C. M. Legault and M. C. Palmer (NMFS/NEFSC)

- Provides guidance on setting biological reference points in situations when natural mortality rate (M) is variable over time in a stock assessment.
- Results emphasize the need for empirical evidence to support such a change in M.

Traditionally, the natural mortality rate (M) in a stock assessment is assumed to be constant. However, when M increases within an assessment, the question arises how to change the fishing mortality rate target (F_{Target}). Per recruit considerations generally lead to an increase in the F_{Target}, while limiting total mortality leads to a decrease in the F_{Target}. Application of either approach can result in nonsensical results. Short term gains in yield associated with high F_{Target} values should be considered in light of potential losses in future yield if the high total mortality rate leads to a decrease in recruitment. Examples using yellowtail flounder (Limanda ferruginea) and Atlantic cod (Gadus morhua) are used to demonstrate that F_{Target} can change when M increases within an assessment and to illustrate the consequences of different F_{Target} values. When a change in M within an assessment is contemplated, managers must first consider the amount and strength of empirical evidence to support the change. When the empirical evidence is not strong, the authors recommend using a constant M. If strong empirical evidence exists, then they recommend estimating F_{Target} for a range of stock-recruitment relationships and evaluating the tradeoffs between risk of overfishing and forgone yield.

Acceptance date: 9 December 2015
Expected publication date: Unknown
The dual role of nitrogen supply in controlling the growth and toxicity of cyanobacterial blooms

Harmful Algae (3.874)


- This paper synthesizes the available evidence that nitrogen is equally as important as phosphorus in driving cyanobacterial harmful algal blooms (HABs) in freshwaters, including the Great Lakes.

Historically, phosphorus (P) has been considered the primary limiting nutrient for phytoplankton assemblages in freshwater ecosystems. This review, supported by new ecosystem-level findings, highlights recent laboratory, molecular, and field evidence that the growth and toxicity of some non-diazotrophic blooms of cyanobacteria can be controlled by nitrogen (N). Blooms of common non-diazotrophic cyanobacteria such as Microcystis in temperate lakes typically occur when P inputs are maximal while external N loads are minimal. Cyanobacteria such as Microcystis possess physiological adaptations that allow them to dominate low-P surface waters, and in many north temperate lakes, cyanobacteria biomass can often be more strongly related to inorganic N than P concentrations. In addition, N loading has been shown to selectively promote the abundance of Microcystis and Planktothrix strains capable of synthesizing microcystins over strains that do not possess this ability. Among strains of cyanobacteria capable of synthesizing the N-rich microcystins, cellular toxin quotas have been found to correlate with exogenous N supplies. Herein, we present new observations from Lake Erie demonstrating that microcystin concentrations peak in parallel with nitrate, but not orthophosphate, concentrations. Collectively, this information underscores the importance of N as well as P in controlling toxic cyanobacteria blooms. Furthermore, it supports the premise that management actions to reduce P in the absence of concurrent restrictions on N loading may promote not only the growth, but also the toxicity of nondiazotrophic toxic cyanobacteria such as the cosmopolitan, toxin-producing genus, Microcystis.
**MRMS QPE performance during the 2013-14 cool season**
Journal of Hydrometeorology (3.645)
S. B. Cocks, S. M. Martinaitis, B. Kaney, **J. Zhang, and K. Howard**
(OAR/NSSL)

- First direct comparisons of the real-time MRMS radar-only QPE (Q3RAD)
- Highlights chief error contributions seen in the QPE evaluation.
- While the Stage IV QPE had the best performance, Q3RAD values were nearly comparable in some events, which is distinct achievement for the fully-automated, real-time MRMS system.

This paper documents the performance of the Multi-Radar Multi-Sensor (MRMS) radar-only Quantitative Precipitation Estimate (QPE) product (denoted as Q3RAD), mosaicked single-radar dual polarization QPE (Dual Pol), and the NCEP Stage II QPE against the benchmark forecaster quality-controlled NCEP Stage IV QPE for nine precipitation events during the 2013–2014 cool season over the United States. The study was limited to weather events east of the Rocky Mountains.

Results showed that Q3RAD, Dual Pol, and Stage II all had a tendency to underestimate precipitation, with Stage II having the most distinct underestimation bias. An evaluation of stratified rain gauge amounts when compared to those products also showed an increase in the underestimation bias with higher precipitation amounts. In contrast, the Dual Pol QPE and MRMS Q3RAD exhibited an overestimation bias for 24-hr precipitation totals less than 12.7 mm (0.50 in). There was a marked difference between Stage II and the other QPE products, which reflects the substantial progress in improving precipitation estimates over the last fifteen years.

Future evaluations will analyze warm season precipitation estimates, as well as assess precipitation events in the western United States. Future work with radar-based QPE will assess the integration of dual polarization information into the MRMS Q3RAD precipitation estimates and will examine the feasibility of improving Dual Pol estimates in the melting layer.

Publication date: 18 December 2015
Subantarctic and Polar fronts of the Antarctic Circumpolar Current and Southern Ocean heat and freshwater variability
Journal of Physical Oceanography (2.345)

D. Giglio and G. C. Johnson (OAR/PMEL)

- Data from Argo profiling floats was used to compare methods for locating fronts in the Antarctic Circumpolar Current.
- Variation in heat and freshwater content are described relative to the time-mean front locations in the Southern Ocean.

Argo profiling floats initiated a revolution in observational physical oceanography by providing numerous, high-quality, global, year-round in situ (0–2000 dbar) temperature and salinity observations. Here, the authors apply Argo’s unprecedented sampling of the Southern Ocean during 2006–2013 to describe the position of the Antarctic Circumpolar Current’s Subantarctic and Polar fronts, comparing and contrasting two different methods for locating fronts using the same data set. The first method locates three fronts along dynamic height contours, each corresponding to a local maximum in vertically integrated shear. The second approach locates the fronts using specific features in the potential temperature field, following Orsi et al. (1995). Results from the analysis of Argo data are compared to those from Orsi et al. (1995) and other more recent studies. Argo spatial resolution is not adequate to resolve annual and interannual movements of the fronts on a circumpolar scale, since they are on the order of 1° latitude, smaller than the resolution of the gridded product analyzed. Here, Argo’s four-dimensional coverage of the Southern Ocean equatorward of ~ 60°S was used to quantify variations in heat and freshwater content there with respect to the time-mean front locations. These variations are described in the Southern Ocean and in regions between fronts during 2006–2013, considering both pressure and potential density ranges (within different water masses) and relations to wind forcing (Ekman upwelling and downwelling).

Expected publication date: Unknown

PACES: Taking the Initiative on Arctic Air Pollution
Elementa (N/A)
The Arctic is a highly sensitive region that is often called the "sentinel" of global change, and air pollution is one important driver of Arctic change. PACES is a new international initiative on Arctic air pollution that will make advances over the next 10 years by taking a multi-disciplinary, collaborative approach involving atmospheric scientists, social scientists, and local Arctic communities. Important goals of the new PACES initiative are the provision of robust scientific knowledge to policy makers, and engagement with local communities to present findings and explore risks and benefits to Arctic communities regarding Arctic air pollution.

The paper describes the major science issues associated with Arctic air pollution and argues that the trans-disciplinary approach of PACES will be needed to address the complexities of this topic. The authors describe how environmental and societal issues are intertwined, for example with economic responses to warming (such as increased shipping when new water routes open up) leading to further warming. The PACES initiative will involve collaborative efforts between Earth system scientists (atmosphere, ocean, cryosphere, and land surface), social science researchers, and local Arctic communities. The new initiative is being launched within the framework of the International Global Atmospheric Chemistry (IGAC) project and will span the next decade (2016-2026). PACES will entail coordinated international field missions to gather atmospheric measurements in more detail and over more extended periods of time than existing data sets. Instruments at ground stations, on aircraft, and on satellites will be part of the array that probes the Arctic atmosphere. The enhanced research activities and observations of PACES will also foster the advancement of models to reflect the complexity of the Arctic, and also will capitalize on the recent development of Earth System Models that include interactions between the physical climate system and ecosystems. For more information on PACES, see [http://www.igacproject.org/PACES](http://www.igacproject.org/PACES). Expected publication date: January 2016
Evaluation of a probabilistic forecasting methodology for severe convective weather in the 2014 hazardous weather testbed
Weather and Forecasting (1.788)

- Describes a proposed methodology for issuing Probabilistic Hazard Information for severe convective weather.
- The findings from the Hazardous Weather Testbed experiments are summarized, along with descriptions of how this process has informed ongoing and future development.

A proposed new method for hazard identification and prediction was evaluated with forecasters in the National Oceanic and Atmospheric Administration Hazardous Weather Testbed during 2014. This method combines hazard-following objects with forecaster-issued trends of exceedance probabilities to produce probabilistic hazard information, as opposed to the static, deterministic polygon and attendant text product methodology presently employed by the National Weather Service to issue severe thunderstorm and tornado warnings. Three components of the test bed activities are discussed: usage of the new tools, verification of storm-based warnings and probabilistic forecasts from a control–test experiment, and subjective feedback on the proposed paradigm change. Forecasters were able to quickly adapt to the new tools and concepts and ultimately produced probabilistic hazard information in a timely manner. The probabilistic forecasts from two severe hail events tested in a control–test experiment were more skillful than storm-based warnings and were found to have reliability in the low-probability spectrum. False alarm area decreased while the traditional verification metrics degraded with increasing probability thresholds. The latter finding is attributable to a limitation in applying the current verification methodology to probabilistic forecasts. Relaxation of on-the-fence decisions exposed a need to provide information for hazard areas below the decision-point thresholds of current warnings. Automated guidance information was helpful in combating potential workload issues, and forecasters raised a need for improved guidance and training to inform consistent and reliable forecasts.

Publication date: December 2015
Foraging ecology of walleye and brown trout in a Great Lakes tributary
Journal of Great Lakes Research (1.77)
D. M. Krueger, E. S. Rutherford, D. M. Mason (OAR/GLERL), and Y. K. Cha

- Brown trout can exert a controlling influence on chinook parr survival, and Walleye consume brown trout.
- A combination of reduced stocking of brown trout and walleye predation on brown trout can improve parr survival.
- Understanding fish recruitment processes develops and increases predictive capabilities.

The role of alternative prey on predator diet selection and survival of juvenile Chinook salmon *Oncorhynchus tshawytscha* (parr) is not well understood in the Laurentian Great Lakes. Therefore, measures of predator foraging ecology (prey species and size selection), prey densities, and functional response relationships were determined for adult walleye *Sander vitreus* and brown trout *Salmo trutta* (hatchery-reared) feeding on parr and alternate prey in the Muskegon River, a tributary of Lake Michigan, USA, from 2004 to 2007. Walleye selected for smaller than average brown trout and rainbow trout (hatchery-reared) but walleye prey size (within-prey) was independent of predator size. In general, walleye showed neutral selection for all prey species but in some years showed positive selection for rainbow trout and negative selection for parr. Hatchery-reared brown trout selected the smallest parr in the environment, although prey size was independent of predator size. Parr were positively selected by brown trout only in April.

Functional response curves were fit to describe the consumption of parr and other prey types by walleye (type II) and brown trout (type I). Interactions among rainbow trout, walleye, and brown trout favored parr survival: the presence of alternate prey (rainbow trout) significantly influenced walleye predation on parr, while brown trout appeared to become quickly limited by size or escape ability of parr. These results should enhance understanding of food web dynamics in Great Lakes tributary habitats.

Publication date: December 2015
Available online:
Effects of rising CO₂ and global warming on harmful cyanobacteria

Harmful Algae (3.874)

P.M. Visser, J.M.H. Verspagen, G. Sandrini, L.J. Stal, H.C.P. Matthijs, T.W. Davis (OAR/GLERL), H.W. Paerl, and J. Huisman

- This paper examines the effects of global warming and rising CO₂ on harmful cyanobacteria
- Analysis of results show that blooms can be intensified due to rising CO₂ and increasing temperatures, especially in eutrophic and hypertrophic lakes.

Climate change is likely to stimulate the development of harmful cyanobacterial blooms in eutrophic waters, affecting the water quality of many lakes, reservoirs and brackish ecosystems. In addition to effects of temperature and eutrophication, recent research sheds new light on the possible implications of rising atmospheric CO₂ concentrations. Cyanobacterial blooms in eutrophic waters can be intensified as the depletion of dissolved CO₂ by dense cyanobacterial blooms creates a concentration gradient across the air-water interface, with steeper gradients leading to more intense blooms at the surface. Bloom-forming cyanobacteria display an unexpected diversity in CO₂ responses, and the genetic composition of cyanobacterial blooms may therefore shift. In particular, strains with low-affinity uptake systems may benefit from the anticipated rise in inorganic carbon availability. Increasing temperatures also stimulate cyanobacterial growth. Many bloom-forming cyanobacteria and also green algae have temperature optima above 25°C. Indirect effects of elevated temperature, like an earlier onset and longer duration of thermal stratification, may also shift the competitive balance in favor of buoyant cyanobacteria while eukaryotic algae are impaired by higher sedimentation losses. Furthermore, cyanobacteria differ from eukaryotic algae in that they can fix dinitrogen, and new insights show that the nitrogen-fixation activity of diazotrophic cyanobacteria is strongly stimulated at elevated temperatures. However, models and lake studies indicate that the response of cyanobacterial growth to rising CO₂ concentrations and elevated temperatures can be suppressed by nutrient limitation. Hence, the greatest response of cyanobacterial blooms to climate change is expected to occur in eutrophic and hypertrophic lakes.
Despite recent efforts to understand and reconcile differences, discrepancies remain among stratospheric temperature climate data records.

Data for 1979-2013 reveal the time and space patterns of distinct stratospheric temperature signals associated with solar variations, El Nino-Southern Oscillation, volcanic aerosols, the stratospheric quasi-biennial oscillation, and multi-decadal trends.

Trend estimates indicate stratospheric cooling before 1995 and no trend thereafter, consistent with increases in atmospheric carbon dioxide and a slowdown in stratospheric ozone depletion (both of which cool the stratosphere).

The results provide an updated and more comprehensive basis for understanding past stratospheric change and for evaluating climate model simulations than was previously available.

Satellite-based layer-average stratospheric temperature (T) climate data records (CDRs) now span more than three decades and so can elucidate climate variability associated with processes on multiple time scales. We intercompare and analyze available published T CDRs covering at least two decades, with a focus on Stratospheric Sounding Unit (SSU) and Microwave Sounding Unit (MSU) CDRs. Recent research has reduced but not eliminated discrepancies between SSU CDRs developed by NOAA and the U.K. Meteorological Office. The MSU CDRs from NOAA and Remote Sensing Systems are in closer agreement than the CDR from University of Alabama in Huntsville. The latter has a previously unreported inhomogeneity in 2005, revealed by an abrupt increase in the magnitude and spatial variability of T anomaly differences between CDRs. Although time-varying biases remain in both SSU and MSU CDRs, multiple linear regression analyses reveal consistent solar, ENSO, QBO, aerosol and piecewise-linear trend signals. Together these predictors explain 80 to 90% of the variance in the near-global-
average T CDRs. The most important predictor variables (in terms of percent explained variance in near-global-average T) for lower stratospheric T measured by MSU are aerosols, solar variability, and ENSO. Trends explain the largest percentage of variance in observations from all three SSU channels. In MSU and SSU CDRs, piecewise-linear trends, with a 1995 break point, indicate cooling during 1979-1994, but no trend during 1995-2013 for MSU and during 1995-2005 for SSU. These observational findings provide a basis for evaluating climate model simulations of stratospheric temperature during the past 35 years.

Publication date: 23 December 2015

OTHER REPORTS, BOOK CHAPTERS, AND INTERNAL PUBLICATIONS

NOS PUBLICATIONS

Coastal ecosystem assessment of Chesapeake Bay watersheds: land use patterns and river conditions

NOAA Technical Memorandum

- Our findings support current efforts to reduce nutrient and sediment inputs, particularly in agricultural areas. Fish community size and health were correlated to river conditions and land uses.
- No strong chronological trends were detected but there were some weak correlations between air temperatures and both fish abundance and the intensity of macrophage aggregates in fish tissues.

In coastal and estuarine regions, land use can have a profound impact on aquatic ecosystem health. In the Chesapeake Bay watershed, agriculture and urbanization have transformed major portions of the landscape, though a significant area remains relatively untouched. This document assesses the health of six Bay tributaries with different land use profiles via a suite of water quality and biological condition variables. Linkages are then explored between these scored variables and land use in the various watersheds. Differences were detected between rivers related to land use that provide information to support decisions regarding the control of runoff from land into the Bay. Nutrients and suspended sediments were important stressors in the rivers examined, supporting current Bay-
wide restoration efforts emphasizing reductions of these compounds. Preservation of habitat to support diverse and healthy fish populations, especially in spawning areas, was also supported. Our findings also suggest a need to develop better indicators to assess the impact of crab health on population sizes and the implications for managing harvest. Unexpectedly, stressors in the forested and mixed-use rivers indicated that conditions there were less pristine than predicted, and that these areas also require management to improve conditions.

Publication date: 2015