NOAA SCIENTIFIC PUBLICATIONS REPORT
December 7, 2015

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Industrial era global ocean heat uptake doubles in recent decades
Nature Climate Change (14.547)

Future atmospheric abundances and climate forcings from scenarios of global and regional hydrofluorocarbon (HFC) emissions
Atmospheric Environment (3.281)

Phylogeography, genetic diversity, and management units of hawksbill turtles in the Indo-Pacific
Journal of Heredity (2.088)

Humidity trends imply increased sensitivity to clouds in a warming Arctic
Nature Communications (11.470)

Recovery potential of the world's coral reef fishes
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Uncertainty, Irreversibility and the Optimal Timing of Large-Scale Investments in Protected Species Habitat Restoration
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An integrated coral reef ecosystem model to support resource management under a changing climate
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Assessment of known impacts of unmanned aerial systems (UAS) on marine mammals: data gaps and recommendations for researchers in the United States
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The presence of *Heteroteuthis dagamensis* in the Gulf of Mexico
Bulletin of Marine Science (1.306)

Phylogenetic analysis of higher-level relationships within Hydroidolina (Cnidaria: Hydrozoa) using mitochondrial genome data and insight into their mitochondrial transcription
PeerJ (2.1)

Drag from fishing gear entangling North Atlantic right whales
Marine Mammal Science (1.94)

Effects of high pCO2 on Tanner crab reproduction and early life history, Part I: long-term exposure reduces hatching success and female calcification, and alters embryonic development
ICES Journal of Marine Science (2.525)

Conservation science and policy applications of the marine vessel automatic identification system (AIS)-A review
Bulletin of Marine Science (1.457)

The Influence of the Sustainable Seafood Movement in the US and UK capture fisheries supply chain and fisheries governance
Frontiers in Marine Science, Marine Affairs and Policy (n/a)

Somatic growth dynamics of West Atlantic hawksbill sea turtles: a spatio-temporal perspective
Ecosphere (2.595)

Habitat alterations and a non-native predator, Striped Bass, increase native Chinook Salmon mortality in the California Central Valley, USA
North American Journal of Fisheries Management (1.110)

Partially observed epidemics in wildlife hosts: Modeling an outbreak of dolphin morbillivirus in the northwestern Atlantic, June 2013-2014
Journal of the Royal Society Interface (3.917)

Stakeholder attitudes toward ecosystem-based fisheries management
Marine Fisheries Review (N/A)

Retrospective forecasting - evaluating performance of stock projections for New England groundfish stocks
Canadian Journal of Fisheries and Aquatic Sciences (2.276)

The Affordable Care Act and Opportunities for Change in North Carolina's Commercial Fisheries
Marine Resource Economics (1.159)

Multi-decadal decline of reef fish abundance and species richness in the southeast United States assessed by standardized trap catches
Marine Biology (2.393)

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A high resolution coupled hydrologic-hydraulic model (HiResFlood-UCI) for flash flood modeling
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Informing Deep Argo array design using Argo and full-depth hydrographic section data
Journal of Atmospheric and Oceanic Technology (1.82)

HIGHLIGHTED ARTICLES

Industrial era global ocean heat uptake doubles in recent decades
Nature Climate Change (14.547)
P. J. Gleckler, P. J. Durack, **R. J. Stouffer, G. C. Johnson**, and C. E. Forest **(OAR/PMEL)**

- The multi-model mean of historically forced climate models for ocean heat content (OHC) changes is consistent with the historical OHC changes from this diverse collection of observational systems.
- The model-based analysis suggests that nearly half of the industrial era increases in global ocean heat content have occurred in recent decades, with over a third of the accumulated heat occurring below 700 m.

The study examines surface-to-bottom ocean heat content changes from observations and climate models in the context of the Earth's global energy budget since early in the industrial era (circa 1865–2015). It uses observational ocean heat content change estimates from a diverse collection of measurement systems including data from the 19th century Challenger expedition, a multidecadal record of ship-based, *in situ* mostly upper ocean measurements, the more recent near-global Argo floats profiling to intermediate (2000 m) depths, and recent full-depth repeated transoceanic sections. It compares these observational findings to a multi-model mean constructed from the current generation of historically forced climate models.
Expected publication date: Unknown

Future atmospheric abundances and climate forcings from scenarios of global and regional hydrofluorocarbon (HFC) emissions
Atmospheric Environment (3.281)
G. J. M. Velders, **D. W. Fahey (OAR/ESRL/CSD)**, **J. S. Daniel (OAR/ESRL/CSD)**, S. O. Andersen, and M. McFarland

- Hydrofluorocarbons (HFC) emissions are projected to contribute significantly to future climate forcing.
- New scenarios are formulated for 10 HFCs, 11 geographic regions, and 13 categories.
- In November, Montreal Protocol discussions occurred in Dubai where all 197 nations negotiated proposals related to the use of HFCs.

Hydrofluorocarbons (HFCs) are manufactured for use as substitutes for ozone-depleting substances that are being phased out globally under Montreal Protocol regulations. While HFCs do not deplete ozone, many are potent greenhouse gases that contribute to climate change. Here, new global scenarios show that baseline emissions of HFCs could reach 4.0–5.3 $GtCO_2$-eq yr^{-1} in 2050. The new baseline (or business-as-usual) scenarios are formulated for 10 HFC compounds, 11 geographic regions, and 13 use categories. The scenarios rely on detailed data reported by countries to the United Nations; projections of gross domestic product and population; and recent observations of HFC atmospheric abundances. In the baseline scenarios, by 2050 China (31%), India and the rest of Asia (23%), the Middle East and northern Africa (11%), and the USA (10%) are the principal source regions for global HFC emissions; and refrigeration (40–58%) and stationary air conditioning (21–40%) are the major use sectors. The corresponding radiative forcing could reach 0.22–0.25 W m^{-2} in 2050, which would be 12–24% of the increase from business-as-usual CO_2 emissions from 2015 to 2050. National regulations to limit HFC use have already been adopted in the European Union, Japan and USA, and proposals have been submitted to amend the Montreal Protocol to substantially reduce growth in HFC use. Calculated baseline emissions are reduced by 90% in 2050 by implementing the North America Montreal Protocol amendment proposal. Global adoption of technologies required to meet national regulations would be sufficient to reduce 2050 baseline HFC consumption by more than 50% of that achieved with the North America proposal for most developed and developing countries.
Publication date: 2 November 2015
Available online:
http://www.sciencedirect.com/science/article/pii/S135223101530488X

Phylogeography, genetic diversity, and management units of hawksbill turtles in the Indo-Pacific
Journal of Heredity (2.088)
S. M. Vargas, **M. P. Jensen (SWFSC)**, S. Y. W. Ho, A. Mobaraki, D. Broderick, J. A. Mortimer, S. Whiting, J. Miller, R. I. T. Prince, I. P. Bell, X. Hoenner, C. J. Limpus, F. R. Santos, and N. N. FitzSimmons

- This is the first dataset to describe hawksbill population structure and phylogeography across a broad region.
- Eight Management Units across the Indo-Pacific region were identified, which can be incorporated in conservation plans of this critically endangered species.
- This dataset will allow mixed-stock analyses of hawksbill turtle feeding grounds in the Indo-Pacific by providing baseline data needed for conservation efforts in the region.

Hawksbill turtle (*Eretmochelys imbricata*) populations have experienced global decline because of a history of intense commercial exploitation for shell and stuffed taxidermied whole animals, and harvest for eggs and meat. Improved understanding of genetic diversity and phylogeography is needed to aid conservation. This study analysed the most geographically comprehensive sample of hawksbill turtles from the Indo-Pacific Ocean, sequencing 766 bp of the mitochondrial control region from 13 locations (plus Aldabra, n=4) spanning over 13,500 km. The analysis of 492 samples revealed 52 haplotypes distributed in five divergent clades. Diversification times differed between the Indo-Pacific and Atlantic lineages and appear to be related to the sea-level changes that occurred during the Last Glacial Maximum. Signals of demographic expansion exist only for turtles from the Persian Gulf region, which can be tied to a more recent colonization event. The analyses revealed evidence of transoceanic migration, including connections between feeding grounds from the Atlantic Ocean and Indo-Pacific rookeries. Hawksbill turtles appear to have a complex pattern of phylogeography, showing a weak isolation by distance and evidence of multiple colonization events. Our novel dataset will allow mixed-stock analyses of hawksbill turtle feeding grounds in the Indo-Pacific by providing baseline data needed for conservation efforts in the region. Eight Management Units are proposed in our study for the Indo-Pacific region that can be incorporated in conservation plans of this critically endangered species.

Acceptance date: 9 November 2015

Humidity trends imply increased sensitivity to clouds in a warming Arctic

Nature Communications (11.470)

C. J. Cox, V. P. Walden, P. M. Rowe, and **M. D. Shupe (OAR/ESRL/PSD)**

- Clouds can contribute to increased regional warming in the Arctic region more than previously expected.
- Conditions in the Arctic permit increased insulation by clouds, allowing them to retain their ability to warm the surface and amplify regional warming, especially in autumn and winter.
- Model analysis suggests that this effect will increase significantly as Arctic change accelerates due to future regional warming.

Clouds are a complex component of climate change, sometimes cooling the planet's surface by reflecting sunlight and cooling the surface, while other times insulating it creating a warming effect. In a recent study, scientists found that clouds can contribute to increased regional warming in the changing Arctic region more than scientists expected. Previous research has suggested that as the atmosphere itself warms and becomes more moist it becomes a better insulator, so the clouds themselves have a diminishing contribution to warming. This is likely true on a global scale. However, this study found a different behavior when temperature and humidity increase in the Arctic. There, due to cold and dry conditions, clouds can retain their ability to warm the surface, and actually appear to amplify regional warming. The effect, strongest in autumn and winter, is related to the way that temperature and moisture are changing relative to each other in the region. Because there is little sunlight in the Arctic in autumn and winter, the insulating properties of clouds far outweigh their shading properties, making this result all the more important. The findings of this study highlight the need to monitor Arctic clouds and their properties, as well as the need to focus on accurate modeling of cloud properties. Obtaining widespread measurements of surface conditions and clouds in the Arctic continues to be a significant challenge.
EMBARGOED until 10 December 2015

Recovery potential of the world's coral reef fishes
Nature (41.456)
M. A. MacNeil, N. Graham, J. Cook University; J. Cinner, S. Wilson, **I. Williams (NMFS/PIFSC)**, J. Maina Mbui, S. Newman, A. Friedlander, S. Jupiter, N. Polunin, and T. R. McClanahan

- This paper examines coral reef recovery from excessive fishing based on global information from marine reserves and remote reefs.

- Researchers estimate that the time required for reef fish biomass to recover to 90% of unfished levels ranges from ~80 years for heavily fished sites to less than 20 years for lightly fished.
- Guidelines are provided of reef fish recovery time and functional returns under alternate management options that can be tailored to local contexts.
- Joint use of remote areas and marine reserves to characterize changes in fish community function shows that substantial ecosystem gains can be made where some form of local fisheries management is present.

Ongoing declines in coral reef condition have generated substantial interest in local management to support reef resilience. Excessive fishing is a major local source of reef degradation, yet selecting the right management approach to recover reef fish biomass and function to desired levels requires knowing the state of the system, outcomes of management alternatives, and timeframes for success. Here, incorporating global information from marine reserves, remote reefs and priors from previous studies, researchers quantify a global estimate of unfished reef fish biomass of ~1049 kg/ha. The researchers use this information to estimate that the time required for reef fish biomass to recover to 90% of unfished levels ranges from ~80 years for heavily fished sites to less than 20 years for lightly fished, regulated areas. Importantly, reef fish functional returns were non-linear over this gradient, and management alternatives such as gear and access restrictions achieved critical returns in function, allowing coral reef managers to develop recovery plans that meet near term conservation and livelihood objectives.

Accepted: 14 February 2015
Expected Publication Date: Early 2016

***see attached PDF*

ADDITIONAL ARTICLES

Cross Line Office Publications

Exploration of the canyon-incised continental margin of the Northeastern United States reveals dynamic habitats and diverse communities

PLoS ONE (3.534)

A. M. Quattrini, **M. S. Nizinski (NMFS/NSL/NMNH)**, J. D. Chaytor, A. W. J. Demopoulos, E. B. Roark, S. C. France, J. A. Moore, T. Heyl, P. J. Auster, **B. Kinlan (NOS/NCCOS/CCMA)**, C. Ruppel, **K. P. Elliott (OAR/OER/OEP)**, **B.**

R. C. Kennedy (OAR/OER/OEP), **E. Lobecker (OAR/OER/OEP)**, A. Skarke, and T. M. Shank

- Biodiversity assessments of topographically complex features in the continental margin off the northeastern United States using Remotely-Operated Vehicle (ROV) dives revealed the importance of both depth and broad-scale habitat features in shaping patterns of species richness and composition.
- How and where factors that co-vary with depth (like pressure, temperature, salinity) impact community structure depend upon the taxonomic group.
- Data collected in mid-Atlantic canyons were incorporated into the dataset used by the Mid-Atlantic Fisheries Management Council in deliberations on alternatives for the deep-sea coral closure areas.
- Data for canyons in the New England Fisheries Management Council jurisdiction will be reviewed by the council when they revisit coral closure areas in the Northeast region later this year.

The continental margin off the northeastern United States (NEUS) contains numerous, topographically complex features that increase habitat heterogeneity across the region. However, the majority of these rugged features have never been surveyed, particularly using direct observations. During summer 2013, 31 Remotely-Operated Vehicle (ROV) dives were conducted from 494 to 3271 m depth across a variety of seafloor features to document communities and to infer geological processes that produced such features. The ROV surveyed six broad-scale habitat features, consisting of shelfbreaching canyons, slope canyons, inter-canyon areas, open-slope/landslide-scar areas, hydrocarbon seeps, and Mytilus Seamount. Four previously unknown chemosynthetic communities dominated by *Bathymodiolus* mussels were documented. Seafloor methane hydrate was observed at two seep sites. Multivariate analyses indicated that depth and broad-scale habitat significantly influenced megafaunal coral (58 taxa), demersal fish (69 taxa), and decapod crustacean (34 taxa) assemblages. Species richness of fishes and crustaceans significantly declined with depth, while there was no relationship between coral richness and depth. Turnover in assemblage structure occurred on the middle to lower slope at the approximate boundaries of water masses found previously in the region. Coral species richness was also an important variable explaining variation in fish and crustacean assemblages. Coral diversity may serve

as an indicator of habitat suitability and variation in available niche diversity for these taxonomic groups. Notably, at least 24 putative coral species were added to the known coral fauna in the region, including the black coral *Telopathes magna* and the octocoral *Metallogorgia melanotrichos*. The fishes *Gaidropsarus argentatus*, *Guttigadus latifrons*, and *Lepidion guentheri*, also not previously known to occur, were documented. Marine litter was observed on 81% of the dives, with at least 12 coral colonies entangled in debris. While initial exploration revealed the NEUS region to be both geologically dynamic and biologically diverse, further research into the abiotic conditions and the biotic interactions that influence species abundance and distribution is needed.
Publication date: 28 October 2015
Available online:
http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0139904

Environmental conditions and catch rates of predatory fishes associated with a mass mortality on the West Florida Shelf
Estuarine, Coastal, and Shelf Science (2.06)
W. B. Driggers III (NMFS/SEFSC), M.D. Campbell (NMFS/SEFSC), A.J. Debose (NMFS/SEFSC), K.M. Hannan(NMFS/SEFSC), M.D. Hendon(NMFS/SEFSC), T.L. Martin (OMAO) and C.C. Nichols (OMAO)

- Describes a fish mortality event observed in the northern Gulf of Mexico in August 2014, most likely caused by a bloom of *Karenia brevis*.

While conducting a standardized fisheries-independent longline survey in the northern Gulf of Mexico on August 20-21, 2014, dead and/or moribund fishes, estimated to number in the thousands, were observed within a well-defined area of the West Florida Shelf. Fishes from 15 families were identified; however, numerous individuals of relatively large-bodied serranid species were decomposed beyond a state that would allow for identification below the family level. Based on survey catch data from previous years and morphological characteristics associated with the decomposing fishes, it was determined that most of the large unidentified fishes were red grouper (*Epinephelus morio*). Water profiler cast data collected within the area demonstrated that when compared to previous years (1995-2013) bottom temperature and salinity were consistent with what would be expected; however, dissolved oxygen concentration was lower than normal, and in some

cases, hypoxic and chlorophyll a and transmissivity values were anomalously high and low, respectively. Hypoxia, high chlorophyll a concentrations and low transmissivity are thought to have resulted from a bloom of *Karenia brevis*, which was documented to have occurred in close proximity to the sampling area. As necropsies were not performed, it was not possible to state a definitive cause of death as the effects of brevetoxins are species-specific. However, numerous individuals of most impacted species were observed floating incapacitated, yet alive, in normoxic surface waters suggesting that the impacts we observed were due to the neurotoxicological and/or hemolytic effects of a harmful algal bloom.
Accepted: 10 November 2015

Visualizing Long-range Severe Thunderstorm Environment Guidance from CFSv2
Bulletin of the American Meteorological Society (11.57)
G. W. Carbin (NWS/NCEP), M. Tippett, S. Lillo, and **H. Brooks (OAR/NSSL)**

- Longer range severe weather predictions in the 10-30 day time frame are being investigated by forecast agencies and researchers.
- It is possible this work will lead the way to operational guidance in the next couple of years.

This paper describes two novel approaches to extending the range of prediction for environments conducive to severe thunderstorm events. One approach charts Climate Forecast System version 2 (CFSv2) run-to-run consistency of the areal extent of severe thunderstorm environments using grid counts of the Supercell Composite Parameter (SCP). Visualization of these environments was charted for each 45-day CFSv2 run initialized at 0000 UTC. CFSv2 ensemble mean forecast maps of SCP coverage over the contiguous United States are also produced for those forecasts meeting certain criteria for high impact weather. The applicability of this approach to the severe weather prediction challenge is illustrated using CFSv2 output for a series of severe weather episodes occurring in March and April 2014. Another approach, possibly extending severe weather predictability from CFSv2, utilizes a run-cumulative time-averaging technique of SCP grid counts. This process is described and subjectively verified with severe weather events from early 2014. Important conclusions: Longer range severe weather predictions in the 10-30 day time frame are being investigated by forecast agencies and researchers.

It is possible this work will lead the way to operational guidance in the next couple of years.
Acceptance date: August 2015

Projected future biophysical states of the Bering Sea
Deep-Sea Res. Pt. II (2.19)
A.J. Hermann (OAR-PMEL), G.A. Gibson**, N.A. Bond (OAR-PMEL),** E.N. Curchitser, K. Hedstrom, **W. Cheng, M. Wang, E.D. Cokelet**, **P.J. Stabeno (OAR-PMEL), and K. Aydin (NMFS-AFSC)**

- The magnitude of presently observed interannual variability of bottom temperatures and ice cover is found in the models to be maintained out to at least 2040, with a steadily increasing probability of warm years with less ice on the southern shelf.
- The overall trends indicate warmer temperatures and a retreat of ice in the southeastern Bering Sea, but continued ice cover in the northeastern Bering Sea. Sensitivity analyses suggest both increasing air temperature and northward wind stress as primary drivers of higher water column temperatures.
- Warming trends on the outer shelf may lead to decreased production of large crustacean zooplankton at that location, but may increase such production on the inner shelf.

Three global climate simulations from the Intergovernmental Panel on Climate Change Fourth Assessment (AR4) were used as physical forcing to drive a regional model that includes both physical and biological elements of the Bering Sea. Although each downscaled projection indicates a warming of 1–2 °C between 2010 and 2040 on the Bering Sea shelf, the interannual and interdecadal details of this trend vary considerably among the three realizations. In each case, the magnitude of presently observed interannual variability of bottom temperatures and ice cover is found in the models to be maintained out to at least 2040, but with a steadily increasing probability of warm years with less ice on the southern shelf. The overall trends indicate warmer temperatures and the retreat of ice in the southeastern Bering Sea, but continued ice cover in the northeastern Bering Sea. Sensitivity analyses suggest both increasing air temperature and northward wind stress as primary drivers of higher water-column temperatures. Based on currently

available models, changes in shortwave radiation are not likely to have a significant role in this warming. Warming trends on the outer shelf may lead to decreased production of large crustacean zooplankton at that location, but could increase such production on the inner shelf.
Published: 10 November 2015
Link to article online:
http://www.sciencedirect.com/science/article/pii/S0967064515003410?np=y

NOS Publications

Phosphorus physiological ecology and molecular mechanisms in marine phytoplankton
Journal of Phycology (2.844)
S. Lin, **R. W. Litaker (NOS/NCCOS),** and W. G. Sunda

- This review article addresses what is currently known about the role of phosphorus in regulating phytoplankton productivity, species diversity and carbon cycling in the present day ocean.
- Novel insights concerning the impact of P on the biology of a warmer, more highly stratified, and acidified ocean in future decades and centuries are provided.
- Also covered are how improved analytical methods will help address how the oceans are responding to P-limitation, particularly in regions where human inputs of nitrogen are so large that they are changing from N-limited to P-limited ecosystems, and the profound impacts this shift may have on the functioning of affected ecosystems.

Phosphorus (P) is an essential nutrient for marine phytoplankton and indeed all life forms. Current data show P availability is growth-limiting in certain marine systems and can have a major impact on algal species composition. Available P occurs in marine waters as dissolved inorganic phosphate (composed primarily of orthophosphate [Pi]) or as a myriad dissolved organic phosphorus (DOP) compounds. Despite numerous studies on the physiology and ecology of P in marine phytoplankton, and on its molecular biology and genomics, there have been few attempts to synthesize information from these different disciplines. A primary goal of this paper is to integrate the physiological and molecular information on the acquisition, utilization, and storage of P in marine phytoplankton and the strategies used by these organisms to acclimate and adapt to variations in P availability.

Where applicable, we endeavor to identify gaps in our current knowledge that warrant further research. Physical and chemical limitations governing cellular P uptake are explored along with physiological and molecular mechanisms used by different species to adapt and acclimate to temporal and spatial variations in P nutrient regimes. Topics covered include cellular Pi uptake and feedback regulation of Pi uptake systems by extracellular Pi and cellular P pools, enzymatic utilization of DOP via alkaline phosphatase, P acquisition by phagotrophy, P-limitation of phytoplankton growth in oceanic and coastal waters, and the role of P-limitation in regulating cell size and toxin levels in phytoplankton. Finally, we examine the role of P and other nutrients in the transition of phytoplankton communities from early successional species (diatoms) to late successional ones (e.g., dinoflagellates).
Published online: 2 November 2015
Available online: http://onlinelibrary.wiley.com/doi/10.1111/jpy.12365/abstract

NMFS Publications

Bioconversion of ^{13}C-labeled microalgal phytosterols to cholesterol by the northern bay scallop, Argopecten irradians irradians
Comparative Biochemistry and Physiology Part B (1.551)
J.-L. Giner, H. Zhao, **M. S. Dixon**, and **G. H. Wikfors (NMFS/NEFSC)**

- This is the first, unequivocal proof of bioconversion of phytosterols to cholesterol by a bivalve mollusk.
- As cholesterol is a dietary requirement in bivalves, this knowledge will enable formulation of nutritionally-complete hatchery and nursery diets.
- This scallop is capable of synthesis of provitamin D, a metabolic capability previously unknown in mollusks.

Bivalve mollusks lack *de novo* cholesterol biosynthesis capabilities and therefore rely upon dietary sources of sterols for rapid growth. Microalgae that constitute the main source of nutrition for suspension-feeding bivalves contain a diverse array of phytosterols, in most cases lacking cholesterol. Rapid growth of bivalves on microalgal diets with no cholesterol implies that some phytosterols can satisfy the dietary requirement for cholesterol through metabolic conversion to cholesterol, but such metabolic pathways have not been rigorously demonstrated. In the present study, stable isotope-labeled phytosterols were used to supplement a unialgal diet of *Rhodomonas* sp. and their biological transformation to cholesterol within scallop

tissues was determined using ^{13}C-NMR spectroscopy. Scallops efficiently dealkylated Δ^5 C_{29} (24-ethyl) sterols to cholesterol, and the only C_{28} sterol that was dealkylated efficiently possessed the 24(28)-double bond. Non-metabolized dietary phytosterols accumulated in the soft tissues. Observed formation of $\Delta^{5,7}$ sterols (provitamin D) from Δ^5 sterols may represent initiation of steroid hormone (possibly ecdysone) biosynthesis. These findings provide a key component necessary for formulation of nutritionally complete microalgal diets for hatchery production of seed for molluscan aquaculture.
Expected publication date: February 2016
Available online:
http://www.sciencedirect.com/science/article/pii/S1096495915001906

Environmental attitudes in the aftermath of the Gulf Oil Spill
Ocean and Coastal Management (1.748)
K. Farrow (NMFS/OST), **A. Brinson (NMFS/OST)**, **K. Wallmo (NMFS/OST),** and **D. Lew (NMFS/AKFSC)**

- This paper examines public environmental opinion prior to and following the Gulf Oil Spill.
- Results indicate no significant change across the time periods.
- The analysis suggests that the Gulf Oil Spill may not have been significant enough to alter attitudes in the face of large shifts in the economy.

In the 1960s and 1970's, prominent environmental disasters seemed to mobilize the U.S. public, and many key environmental laws were subsequently enacted. Theories surrounding public opinion formation, however, generally regard single events as unlikely to impact attitudes in a major way. Given the conflicting evidence provided by anecdotal accounts and public opinion theory, we explore whether the Deepwater Horizon oil spill (Gulf Oil Spill) impacted public concern for the environment in the United States. In this study we use data from a national-level survey implemented before and after the Gulf Oil Spill to examine pre- and post-spill environmental attitudes as measured by a subset of the New Ecological Paradigm scale. We find that there is insufficient evidence to suggest that the recent Gulf Oil Spill had a significant impact on environmental attitudes, a result consistent with theories concerning the influence of individual events on public

opinion. Additional findings imply that some types of messages are likely to be more effective than others in public communications about the environment.
Publication date: January 2016
Avaliable online:
http://www.sciencedirect.com/science/article/pii/S0964569115300363

Age and growth of olive ridley sea turtles (Lepidochelys olivacea) in the main Brazilian nesting ground
Marine Ecology Progress Series (2.64)
R. Petitet, **L. Avens (NMFS/SEFSC),** J. C. Castilhos, P. G. Kinas, and L. Bugoni

- Results of this study provide the first information regarding range and variability for age and size at maturation for olive ridley sea turtles in the Atlantic.
- Novel information regarding age at maturation for this protected species will improve understanding of population dynamics and management needs.

Olive ridleys (*Lepidochelys olivacea*) are the most abundant sea turtles in the world and their early life and adulthood offshore distributions make them less prone to anthropogenic coastal threats. However, primary use of oceanic habitat also results in olive ridley life history being the least studied of all sea turtle species. Here, age at maturation and growth rates of 68 olive ridleys washed ashore dead in northeastern Brazil were estimated through skeletochronological analysis of humerus bones. Turtles ranged from 58.0 to 77.0 cm CCL (curved carapace length) with estimated ages between 14 and 26 yr old. As the sample comprised mostly adults, it was necessary to apply a correction factor from skeletochronological analysis of north-central Pacific olive ridley sea turtles to estimate the number of skeletal growth marks lost (resorbed) at the bone's core. Mean age at sexual maturation was estimated to be 16 yr, for a mean size at sexual maturation of 66.0 cm CCL. Growth models fit to the data showed a clear plateau of growth at 15 yr of age, which likely coincides with the time when turtles begin directing energy toward reproduction instead of somatic growth. These estimates have implications for conservation strategies for the species in the Atlantic Ocean. The olive ridley population in the study area is threatened in oceanic and neritic waters by longline and trawl fisheries, respectively. Despite this current threat, the number of nests has increased sharply for the past 16 yr, a time frame coincident

with initiation of conservation actions on the beaches in 1982 and which corresponds with the mean age at maturation found in the current study.
Expected publication date: Winter 2015/2016

Understanding non-compliance with protected species regulations in the northeast USA gillnet fishery
Frontiers in Marine Science (NA)
K. D. Bisack (NMFS/NEFSC), and C. Das

- Model results indicate fishermen who previously violated pinger regulations, who are not completely dependent on gillnet gear and face a lower chance of being detected by an observer, are more likely to violate.
- Results suggest observer data can be used to support compliance and enforcement mechanisms in this fishery and possibly other fisheries as well.

Marine mammals and sea turtles in the United States are protected from commercial fishery interactions under the Marine Mammal Protection Act and the Endangered Species Act. To reduce harbor porpoise bycatch in the northeast sink gillnet fishery, fishermen are mandated to attach pingers to their nets in regulated areas. Although, pinger regulations have been in place for over a decade, in practice, enforcement is weak and the penalty for a violation is almost non-existent. In this scenario, the presence of normative factors may motivate a fisherman to comply with the pinger regulation. This study considers both economic and normative factors within a probit framework to explain a fisherman's compliance decision. Model results indicate fishermen who previously violated pinger regulations, who are not completely dependent on gillnet gear and face a lower chance of being detected by an observer, are more likely to violate. Understanding the influence of normative factors on compliance decisions is a key component for higher compliance. That is, incorporation of these factors in the design of policy instruments may achieve higher compliance rates and thus more success in protecting these species. Our model findings were ground-truthed by conducting focus group research with fishermen using pingers; some preliminary findings are shared in the discussion in support of our model results. Finally, these results also suggest observer data can be used to support compliance and enforcement mechanisms in this fishery and possibly other fisheries as well.
Publication date: 17 November 2015

Available online:
http://journal.frontiersin.org/article/10.3389/fmars.2015.00091/abstract

The role of Mississippi River discharge on offshore phytoplankton blooming in the Northeastern Gulf of Mexico in August 2010
Remote Sensing of Environment (6.393)
B. S. O'Connor, F. E. Muller-Karger, **R. W. Nero (NMFS/SEFSC),** C. Hu, and E. B. Peebles

- This paper examined the cause of an uncommon phytoplankton bloom in the NE Gulf of Mexico in August 2010.
- The authors conclude that nutrients and other materials from the discharge from the Mississippi River and adjacent marshes and wind-driven currents caused the offshore bloom in August 2010.

A phytoplankton bloom covering an area N11,000 km^2 has been reported in the northeastern Gulf of Mexico east of the Mississippi River Delta in August 2010 (30°–28° N, 90°–86° W) based on NASA Moderate Resolution Imaging Spectrometer (MODIS) chlorophyll fluorescence line height (FLH) images. The bloom appeared to be anomalous relative to a historical monthly chlorophyll FLH mean (August 2002 to 2010), and was attributed by others to the Deepwater Horizon (DWH) oil spill accident. Here we tested an alternative hypothesis that the eastward dispersal of the Mississippi River plume entrained in wind-driven currents contributed to the development of this phytoplankton bloom. We examined Mississippi River discharge and nutrient records, ship-based surface salinity data, and the time-series of MODIS ocean color and FLH images. Wind measurements from buoys showed winds N6 m s^{-1} first in a southerly (northward) direction August 8–10, and then in a northerly (southward) direction until August 26. Results from the American Seas-Navy Coastal Ocean Model (AmSeas-NCOM) show how coastal water was advected in wind-driven currents into the area of the northeastern Gulf of Mexico where the bloom was documented.
Between July 9 and September 8, 2010, the discharge of the Mississippi River exceeded the 20-year mean. During this time, the northeastern Gulf received an estimated excess volume of approximately 8.3 × 10 9 m^3 relative to the 20-year mean. Together with findings from a particle trajectory model, we conclude that nutrients and other materials (e.g., sediments) from the excessive discharge of the

Mississippi River and adjacent marshes and wind-driven currents, likely contributed to the anomalous bloom observed during August 2010 and to the anomalously high organic matter sedimentation rates observed in the northeastern Gulf of Mexico in the aftermath of the Deepwater Horizon oil spill.
Acceptance date: 10 November 2015
Expected publication date: late 2015 or early 2016

Uncertainty, irreversibility and the optimal timing of large-scale investments in protected species habitat restoration
Frontiers in Marine Science (NA)
C. Speir (NMFS/SWFSC), S. Pittman, and **D. Tomberlin (NMFS/OST)**

- Extends cost-benefit analysis of species recovery actions to include biological uncertainty.
- Formalizes the incentives decision-makers face when deciding on when to incur recovery costs.

The authors present a model of the optimal timing of a large-scale habitat restoration project. This model is a dynamic benefit optimization that includes ecosystem costs caused by the presence of a large dam that used a single stochastic variable to incorporate two sources of uncertainty: uncertainty about how ecosystem costs will evolve over time and the possibility of the ecosystem jumping to an undesirable state. The model was used to illustrate two main results. First, variability in ecosystem costs creates an incentive to delay a project intended to restore ecosystem health. The uncertainty regarding ecosystem costs creates an option value to waiting to invest in restoration at a later date. Second, the possibility of jumping to an irreversible and unacceptably bad ecosystem state (such as species extinction) creates an incentive to hasten restoration. These results formalize the countervailing incentives faced by policymakers when multiple uncertainties and irreversibilities are present in managed ecosystems.
Accepted: 9 November 2015

An integrated coral reef ecosystem model to support resource management under a changing climate
PLoS ONE (3.534)

M. Weijerman, E. A. Fulton, **I. Kaplan (NMFS/NWFSC)**, R. Gorton, R. Leemans, W. Mooij, and **R. E. Brainard (NMFS/PIFSC)**

- Ecosystem models can be a useful tools to support planning and implementation of ecosystem-based management, and can quantify effect size and interactive effect size of particular stressors in an ecosystem context and provide guidance to managers.
- For example, for Guam's coral reefs ocean warming and ocean acidification showed the largest overall effect on a suite of ecosystem metrics under the current climate change projections.
- The stressor that had the highest impact on the current condition of the reef was fishing, which negatively impacted five out of six ecosystem metrics.

Millions of people rely on the ecosystem services provided by coral reefs, but sustaining these benefits requires an understanding of how reefs and their biotic communities are affected by local human-induced disturbances and global climate change. Ecosystem-based management that explicitly considers the indirect and cumulative effects of multiple disturbances has been recommended and adopted in policies in many places around the globe. Ecosystem models that give insight into complex reef dynamics and their responses to multiple disturbances are useful tools to support planning and implementation of ecosystem-based management. The Atlantis Ecosystem Model was adapted to incorporate and predict key dynamics for a coral reef ecosystem around Guam in the tropical western Pacific, and then used to quantify the effects of predicted climate and ocean changes, current land-based sources of pollution, and fishing. The following six ecosystem metrics were used as indicators of ecosystem state, resilience, and harvest potential: 1) ratio of calcifying to non-calcifying benthic groups, 2) the trophic level of the community, 3) the biomass of apex predators, 4) the biomass of herbivorous fishes, 5) total biomass of living groups, and 6) the end-to-start ratio of exploited fish groups. Simulation tests of the effects of each of the three drivers separately suggest that by mid-century climate change will have the largest overall effect on this suite of ecosystem metrics due to substantial negative effects on reef benthos (loss of coral cover). The effects of fishing were also important, negatively influencing five out of the six metrics. Results indicate that, to date, fishing has had the largest cumulative effect on the reef ecosystems around Guam, followed by effects from land-based sources of pollution. Over longer time spans (i.e., 65 year

simulations), climate change impacts have a slight positive interaction with other drivers, generally meaning that declines in ecosystem metrics are not quite as steep as the sum of individual effects of the drivers. These analyses offer one way to quantify impacts and interactions of particular stressors in an ecosystem context and to provide guidance to managers. For example, the model showed that improving water quality, rather than prohibiting fishing, appeared to extend the timescales over which corals can maintain high abundance by 5–8 years. This result, in turn, provides more scope for corals to adapt or for resilient species to become established and for local and global management efforts to reduce or reverse stressors.

Acceptance date: 16 November 2015
Expected publication date: Early 2016

Assessment of known impacts of unmanned aerial systems (UAS) on marine mammals: data gaps and recommendations for researchers in the United States

Journal of Unmanned Vehicle Systems (NA)

C. Smith, S. Sykora-Bodie, B. Bloodworth, S. M. Pack, T. Spradlin, N. R. LeBoeuf (NMFS/OPR)

- Provides first review of published data of unmanned vehicle system impacts on marine mammals.
- Provides guidance for researchers to report data of most importance to US regulators.

The development of advanced technologies to enhance conservation science often outpaces the abilities of wildlife managers to assess and ensure such new tools are safely used in proximity to wild animals. Recently, unmanned aerial systems (UAS) have become more accessible to civilian operators and are quickly being integrated into existing research paradigms to replace manned aircraft. Several Federal statutes require scientists to obtain research permits to closely approach protected species of wildlife such as marine mammals, but the lack of available information on the effects of UAS operations on these species has made it difficult to evaluate and mitigate potential impacts. Here, we present a synthesis of the current state of scientific understanding of the impacts of UAS usage near marine mammals. We also identify key data gaps that are currently limiting the ability of marine resource managers to develop appropriate guidelines, policies or

regulations for safe and responsible operation of UAS near marine mammals. We recommend researchers prioritize collecting, analyzing, and disseminating data on marine mammal responses to UAS when using the devices to better inform the scientific community, regulators and hobbyists about potential effects and assist with the development of appropriate mitigation measures.
Accepted: 12 November 2015

The presence of Heteroteuthis dagamensis *in the Gulf of Mexico*
Bulletin of Marine Science (1.306)
H. Judkins, **M. Vecchione (NMFS/OST/NSL)**, and K. Rosario

- The authors correct the identity of a midwater cephalopod species in the western North Atlantic.

Published records indicate that *Heteroteuthis dispar* is found in the North Atlantic Ocean and that *Heteroteuthis dagamensis* lives in the South Atlantic Ocean. However, specimens recently collected in the northern Gulf of Mexico (n = 123) show that *H. dagamensis* is the only species of the genus common in the Gulf of Mexico based on identification of male specimens. Comparison of DNA barcodes for three morphologically similar species of *Heteroteuthis*, *H. dispar*, *H. dagamensis*, and *Heteroteuthis hawaiiensis*, confirm that all are distinct species and indicate that *H. dagamensis* and *H. hawaiiensis* are closer genetically than either is to *H. dispar*.
Acceptance date: 30 October 15

Phylogenetic analysis of higher-level relationships within Hydroidolina (Cnidaria: Hydrozoa) using mitochondrial genome data and insight into their mitochondrial transcription
PeerJ (2.1)
E. Kayal, B. Bentlage, P. Cartwright, A.Yanagihara, D. J. Lindsay,
R. R. Hopcroft, and **A. G. Collins (NMFS/OST/NSL)**

- Elucidating biodiversity through sound systematics is of foundational importance to ecosystem management.
- This paper advances systematics of hydrozoans, one of the most abundant and ecologically important groups of benthic and planktonic animals.

Hydrozoans display the most morphological diversity within the phylum Cnidaria. While recent molecular studies have provided some insights into their evolutionary

history, sister group relationships remain mostly unresolved, particularly at mid-taxonomic levels. Specifically, within Hydroidolina, the most speciose hydrozoan subclass, the relationships and sometimes integrity of orders are highly unsettled. Here we obtained the near complete mitochondrial sequence of twenty-six hydroidolinan hydrozoan species from a range of sources (DNA and RNA-seq data, long-range PCR). Our analyses confirm previous inference of the evolution of mtDNA in Hydrozoa while introducing a novel genome organization. Using RNA-seq data, we propose a mechanism for the expression of mitochondrial mRNA in Hydroidolina that can be extrapolated to the other medusozoan taxa. Phylogenetic analyses using the full set of mitochondrial gene sequences provide some insights into the order-level relationships within Hydroidolina, including siphonophores as the first diverging clade, a well-supported clade comprised of Leptothecata-Filifera III-IV, and a second clade comprised of Aplanulata-Capitata s.s.-Filifera I-II. Finally, we describe our relatively inexpensive and accessible multiplexing strategy to sequence long-range PCR amplicons that can be adapted to most high throughput sequencing platforms.
Acceptance date: 30 October 30 2015

Drag from fishing gear entangling North Atlantic right whales
Marine Mammal Science (1.936)
J. M. van der Hoop, **P. Corkeron (NMFS/NEFSC)**, **J. Kenney (NMFS/GARFO)**, S.Landry, **D. Morin (NMFS/GARFO)**, **J. Smith (NMFS/GARFO)**, and M. J. Moore

- The authors discuss lethal and non-lethal effects of gear entanglement on North Atlantic right whales.
- In short, removing some gear during disentanglement efforts is better than nothing.

Lethal and sublethal fishing gear entanglement is pervasive in North Atlantic right whales (*Eubalaena glacialis*). Entanglement can lead to direct injury and is likely to incur substantial energetic costs. This study (1) evaluates drag characteristics of entangled right whales, (2) contextualizes gear drag measurements for individual whales, and (3) quantifies the benefits of partial disentanglement. A load cell measured drag forces on 15 sets of fishing gear removed from entangled right whales, a towed satellite telemetry buoy, and 200 m of polypropylene line as it was

shortened to 25 m, as they were towed behind a vessel at ~0.77, 1.3, and 2.1 m/s (~1.5, 2.5, and 4 knots) and ~0, 3, and 6 m depth. Mean drag ranges from 8.5 N to 315 N, and can be predicted from the dry weight or length of the gear. Combining gear drag measurements with theoretical estimates of drag on whales' bodies suggests that on average, entanglement increases drag and propulsive power by 1.47 fold. Reducing trailing line length by 75% can reduce parasitic gear drag by 85%, reinforcing current disentanglement response practices. These drag measurement can be incorporated into disentanglement response, serious injury determination, and evaluation of sublethal effects on population dynamics.
Accepted: 26 October 2015

Effects of high pCO2 on Tanner crab reproduction and early life history, Part I: long-term exposure reduces hatching success and female calcification, and alters embryonic development
ICES Journal of Marine Science (2.525)
K. M. Swiney, W. C. Long, and R. J. Foy (NMFS/AKFSC)

- Results of this study enhance our knowledge of the effects of ocean acidification on Tanner crab, a commercially important species in Alaska.
- Studies like this highlight the potential effects of ocean acidification and how such effects can begin being considered in stock assessments.

Tanner crab embryos and larvae from oocytes developed under ambient conditions appear resilient to high pCO2. Oocyte development appears to be sensitive to high pCO2 and effects carryover and altered embryonic development and reduced hatching success. Calcification was reduced among females in the highest pCO2 treatment. The results from this long-term study suggest that projected ocean pH levels within the next two centuries will likely have a pronounced impact on Tanner crab populations unless the crab are able to acclimatize or adapt to changing conditions.
EMBARGOED

Conservation science and policy applications of the marine vessel automatic identification system (AIS)-A review
Bulletin of Marine Science (1.457)
M. D. Robards**, G. K. Silber, J. D. Adams (NMFS/OPR),** J. Arroyo, D. Lorenzini, K. Schwehr, and J. Amos

- Improving utilization of Automatic Identification System to track ships for marine resource conservation.
- Use of, and pitfalls in using, an existing technology for conservation purposes.

The continued development of maritime transportation around the world, and increased recognition of the direct and indirect impacts of vessel activities to marine resources has prompted interest in better understanding vessel operations and their effects on the environment. Such an understanding has been facilitated by Automatic Identification Systems (AIS), a mandatory vessel communication and navigational safety system that was adopted by the International Maritime Organization (IMO) in 2000 for use in collision avoidance, coastal surveillance, and traffic management. AIS is an effective tool for accomplishing navigational safety goals, and by doing so can provide critical pre-emptive maritime safety benefits, but also provides a data opportunity with which to understand and help mitigate the impacts of maritime traffic on the marine environment and wildlife. However, AIS was not designed with research or conservation planning in mind, leading to significant challenges in fully benefiting from use of the data for these purposes. We review current experiences using AIS data for strategic conservation applications, and then focus on efforts to ensure archived and real-time AIS data for key variables reflect the best available science (of known limitations and biases). We finish with a suite of recommendations for users of the data and for policy makers.
Expected publication date: Spring 2016

The Influence of the Sustainable Seafood Movement in the US and UK capture fisheries supply chain and fisheries governance
Frontiers in Marine Science, Marine Affairs and Policy (n/a)
A. Gutierrez (NMFS, OPR)

- A diverse coalition of 10 actor groups (ENGOs, foundations, media, fishing industry, retailers, chefs, certification schemes, verification experts, academics and consumers) has formed to create the Sustainable Seafood Movement.

- This movement seeks to improve the sustainability of the seafood supply chain, improve the practices of the fishing industry and improve the sustainability of fisheries management.
- To achieve this goals the movement has developed non-market driven governance tools (rating systems, certification schemes, buying policies) to reform the seafood supply chain.

Over the last decade, a diverse coalition of actors has come together to develop and promote sustainability initiatives ranging from seafood eco-labels, seafood guides, traceability schemes, and sourcing policies in Western seafood supply chains. Based on a literature review, we trace the development of the Sustainable Seafood Movement, which has been working to reform sustainability practices in the seafood supply chain. Focusing on capture fisheries in the US and in the UK, we explore the roles of key actors and analyze the dynamics within and between actor groups through a cultural model derived from semi-structured interviews. We argue that the Sustainable Seafood Movement is different from previous social movements in that, in addition to actors advocating for government reform, it has motivated supply chain actors to participate in non-state market driven governance regimes. The movement and its actors have leveraged their legitimacy and authority garnered within the supply chain to increase their legitimacy and authority in public governance processes. As the movement continues to evolve, it will likely need to address several emerging issues to maintain its position of legitimacy and authority in both the supply chain and public governance processes.
Link to full text paper:
http://journal.frontiersin.org/article/10.3389/fmars.2015.00072/abstract

Somatic growth dynamics of West Atlantic hawksbill sea turtles: a spatio-temporal perspective
Ecosphere (2.595)
K. A. Bjorndal, M. Chaloupka , **V. S. Saba (NMFS/NEFSC),** C. E. Diez, R. P. van Dam, B. H. Krueger, J. A. Horrocks, A. J. B. Santos, C. Bellini, M. A. G. Marcovaldi, M. Nava, S. Willis, Br. J. Godley, S. Gore, L. A. Hawkes, A. McGowan, M. J. Witt, T.s B. Stringell, A. Sanghera, P. B. Richardson, A. C. Broderick, Q. Phillips, M. C. Calosso, J. A. B. Claydon, J. Blumenthal, F. Moncada, G. Nodarse, Y. Medina, S. G. Dunbar, L. D. Wood, C. J. Lagueux, C.L.

Campbell, A. B. Meylan, P. A. Meylan, V. R. B. Perez, R. A. Coleman, S. Strindberg, V. Guzmán-H., K. M. Hart, M. S. Cherkiss, Z. Hillis-Starr, I. F. Lundgren, R. H. Boulon, Jr., S. Connett, M. E. Outerbridge, and A. B. Bolten

- Between 1997 and 2013, mean growth rates of West Atlantic hawksbills declined significantly and steadily by 18%.
- Regional climate indices have significant relationships with annual growth rates with 0- or 1-year lags: positive with the Multivariate El Niño Southern Oscillation Index (correlation = 0.99) and negative with Caribbean sea surface temperature (correlation = -0.85).
- Declines in growth rates between 1997 and 2013 throughout the West Atlantic most likely resulted from warming waters through indirect negative effects on foraging resources of hawksbills.

Somatic growth dynamics are an integrated response to environmental conditions. Hawksbill sea turtles (*Eretmochelys imbricata*) are long-lived, major consumers in coral reef habitats that move over broad geographic areas (hundreds to thousands of kilometers). We evaluated spatio-temporal effects on hawksbill growth dynamics over a 33-year period and 24 study sites throughout the West Atlantic and explored relationships between growth dynamics and climate indices. We compiled the largest ever dataset on somatic growth rates for hawksbills - 3541 growth increments from 1980 to 2013. Using generalized additive mixed model analyses, we evaluated 10 covariates, including spatial and temporal variation that could affect growth rates. Growth rates throughout the region responded similarly over space and time. The lack of a spatial effect or spatio-temporal interaction and the very strong temporal effect reveal that growth rates in West Atlantic hawksbills are likely driven by region-wide forces. Between 1997 and 2013, mean growth rates declined significantly and steadily by 18%. Regional climate indices have significant relationships with annual growth rates with 0- or 1-year lags: positive with the Multivariate El Niño Southern Oscillation Index (correlation = 0.99) and negative with Caribbean sea surface temperature (correlation = -0.85). Declines in growth rates between 1997 and 2013 throughout the West Atlantic most likely resulted from warming waters through indirect negative effects on foraging resources of hawksbills. These climatic influences are complex. With increasing temperatures, trajectories of decline of coral cover and availability in reef habitats of major prey species of hawksbills are not parallel. Knowledge of how choice of

foraging habitats, prey selection, and prey abundance are affected by warming water temperatures is needed to understand how climate change will affect productivity of consumers that live in association with coral reefs.
Expected publication date: December 2015

Habitat alterations and a non-native predator, Striped Bass, increase native Chinook Salmon mortality in the California Central Valley, USA
North American Journal of Fisheries Management (1.110)
M. Sabal, S. Hayes, J. Merz, and J. Setka **(NMFS/SWFSC)**

- This paper illustrates importance of synergistic interactions between stressors on juvenile salmon mortality.
- Results locate a predation hotspot for juvenile Chinook salmon on the Mokelumne River.

Human stressors are leading causes of species and biodiversity declines driving wide scale ecosystem changes. Additionally, synergistic effects of multiple anthropogenic modifications, including species introductions and habitat alterations, can have complex outcomes for native species. Researchers assessed how the non-native predator, Striped Bass *Morone saxatilis*, and habitat alterations (i.e. small diversion dam and other altered habitats) interact to influence mortality on native juvenile Chinook Salmon *Oncorhynchus tshawytscha* during their emigration from the lower Mokelumne River, CA. Relative abundance and diet surveys across natural and human-altered habitats were used to assess Striped Bass functional and aggregative responses. Researchers observed elevated consumption of juvenile salmon and behavioral aggregation [catch per unit effort (CPUE)] by Striped Bass at a small diversion dam (Woodbridge Irrigation District Dam) compared to other altered and natural habitats. Increased aggregative and functional predator responses created a localized area of heightened predation. At this predation hotspot experimental Striped Bass removals, diet energetic analysis, and before-after impact assessment estimated Striped Bass consumption of the emigrating juvenile salmon population to be between 8-29%. Striped Bass per capita consumption rates of juvenile salmon among the three approaches were 0.92%, 0.71-1.20% and 0.96-1.11% respectively. This study illustrates how the synergistic effect of habitat modification and a

non-native predator can exacerbate native juvenile salmon mortality during emigration. Our results highlight the importance of considering interactions among stressors when planning local management strategies and assessing population level impacts to salmon.
Accepted: 8 November 2015

Partially observed epidemics in wildlife hosts: Modeling an outbreak of dolphin morbillivirus in the northwestern Atlantic, June 2013-2014
Journal of the Royal Society Interface (3.917)
D. A. Fauquier (NMFS/OPR), T. K. Rowles (NMFS/OPR), and P. E. Rosel (NMFS/SEFSC)

- This paper examines the transmission of morbilliviruses using a statistical framework.
- Modeling suggests that dolphins are infectious with morbillivirus for at most 24 days and can transfer infection up to two latitude degrees (220km) within this time.
- These factors can be used in future modeling efforts to estimate the impact of this disease on naïve threatened or vulnerable cetacean populations.

Morbilliviruses cause major mortality in marine mammals, but the dynamics of transmission and persistence are not as well understood compared to terrestrial counterparts, such as measles, and is especially true for epidemics in cetaceans. However, the recent outbreak of dolphin morbillivirus in the northwestern Atlantic Ocean can provide new insights into the epidemiology and spatiotemporal spread of this pathogen. To deal with uncertainties surrounding the ecology of this system since only stranded animals were observed, researchers developed a statistical framework that can extract key information about the underlying transmission process given only sparse data. The researchers' Poisson process model suggests that individuals are infectious for at most 24 days, and can transfer infection up to two latitude degrees (220km) within this time. In addition, the effective reproduction number is generally below one, but reaches 2.6 during a period of heightened stranding numbers near Virginia Beach, VA in the 2013 summer. Network analysis suggests local movements dominate spatial spread, with seasonal migration facilitating wider dissemination along the coast. Finally, a low virus transmission rate or high levels of preexisting immunity can explain the lack of

viral spread into the Gulf of Mexico. More generally, the researchers' approach illustrates novel methodologies for analyzing very indirectly observed epidemics.
Accepted: 23 October 2015

Stakeholder attitudes toward ecosystem-based fisheries management
Marine Fisheries Review (N/A)
A. Brinson and K. Wallmo (NMFS/OST)

- This paper details the results of a survey of fisheries stakeholders from the East Coast and Gulf regions of the United States.
- Results indicate that respondents' knowledge of the status of fisheries resources is qualitatively similar to NMFS ratings, though generally respondents were less than satisfied with current fisheries management.
- Results also indicate that respondents are supportive of ecosystem based fisheries management.

The National Marine Fisheries Service (NMFS) conducted a survey of fisheries stakeholders on the Gulf and East Coasts of the United States seeking their views on ecosystem-based fisheries management (EBFM) of fisheries resources. The survey asked a series of attitude and opinion questions along with general environmental literacy and demographic questions to a sample of 7,850 fisheries stakeholders, stratified by region. Results indicate that respondents' knowledge of the status of fisheries resources is qualitatively similar to NMFS ratings, though generally respondents were less than satisfied with current fisheries management. Results also suggest that, despite concerns over several specific measures, respondents generally see potential in an EBFM approach to management.
Accepted: April 2015

Retrospective forecasting - evaluating performance of stock projections for New England groundfish stocks
Canadian Journal of Fisheries and Aquatic Sciences (2.276)
E. N. Brooks and C. M. Legault, (NMFS/NEFSC)

- The authors describe a new method for evaluating catch advice.
- Retrospective analysis suggest that bias in estimates of current populations are most important for short-term forecasts.
- Uncertainty in recruitment makes medium-term forecasts unreliable.

Projections are used to explore scenarios for catch advice and rebuilding, and are an important tool for sustainably managing fisheries. Here ,the authors tested each projection specification for 12 groundfish stocks in the Northwest Atlantic to identify sources of bias and evaluate techniques for reducing bias. Projections were made from assessments using Virtual Population Analysis (VPA) with 1-7 years of recent data removed from the full time series, and were then compared to results from a VPA assessment on the full time series of data. The main source of bias in projections was the assessment model estimates of the numbers at age in the terminal model year+1 ($N_{a,T+1}$). Recruitment was responsible for more bias in projections beyond three years, when population numbers begin to be dominated by cohorts that were statistically generated. Retrospective analysis was performed and several adjustment factors to reduce bias were tested. Even after adjusting for bias, the remaining bias in projections was non-negligible. The direction of bias generally resulted in projected SSB and catch being overestimated, and the bias in catch was nearly always larger than in SSB. Scientists need to clearly communicate the direction and magnitude of this bias, managers need to consider this additional uncertainty when specifying future catch limits, and both scientists and managers need to develop more robust control rules so that objectives are achieved.
Acceptance date: 13 November 2015

The Affordable Care Act and Opportunities for Change in North Carolina's Commercial Fisheries
Marine Resource Economics (1.159)
S. Crosson (NMFS/SEFSC)

- This paper focuses on choices by commercial fishers to purchase health insurance on the pre--ACA markets.
- Modeling indicates that (at least in North Carolina) this choice largely was driven by fishing business- related factors.
- Thus, the ACA may impact profits margins, capital investment, and fisheries exit/entrance.

Commercial fishing is generally hazardous, but some types of commercial fishing are more dangerous than other types. Since much of the fishing industry is composed of small family-owned businesses, commercial fishermen often have to rely on the private health insurance markets. Do commercial fishermen working in

more dangerous areas or with more dangerous gear mitigate their risk by purchasing health insurance? Here, the relationship between the economics of the North Carolina commercial fishing fleet and private market health insurance purchases in the two years immediately preceding the passage of the Affordable Care Act (ACA) of 2010 were examined. Establishing this baseline is important, as the slow implementation of the Act's expanded coverage will take time to make meaningful impacts on commercial fishing fleets. The author concludes by considering which aspects of commercial fishing might be most affected by the ACA.

Acceptance date: 16 October 2015
Expected publication date: April 2016

Multi-decadal decline of reef fish abundance and species richness in the southeast United States assessed by standardized trap catches

Marine Biology (2.393)

N. M. Bacheler (NMFS/SEFSC) and T. Smart

- Non-targeted reef fish species along the southeast United States Atlantic coast have declined more drastically than fishery-targeted species using both raw and standardization modeling approaches.
- The abundance of non-targeted reef fish species has likely been influenced by invasive species and/or climate variability/change.

Reef fish species naturally fluctuate in abundance over various temporal and spatial scales, but recent broad-scale declines in abundance have been observed worldwide and attributed to various anthropogenic influences. Here, the authors used 25 years of fishery-independent trap data (N = 11,237 trap hauls) to examine the spatial and temporal variability in temperate reef fish abundance along the southeast coast of the United States, a relatively understudied region with many economically important reef fish species. Overall, 441,298 individuals from 118 species were caught in the trap survey. The number of species and total number of individuals caught in the trap survey declined over the 25 years, but when separated, non-targeted fish species declined more than fishery-targeted species. For instance, traps caught a median of 18 non-targeted individuals and a median of 2 – 3 non-targeted reef-fish species in the early 1990s, but by the 2010s, traps caught a median of fewer than 3 non-targeted individuals and a median of 1 non-

target species. Generalized additive model results suggested that the catch of fishery-targeted and non-targeted species was positively related to bottom water temperature, while depth influenced non-targeted and fishery-targeted species in opposite ways. The substantial and consistent decline of non-targeted fish species suggests that more research and management attention should be given to these often ignored species. These results suggest that the temperate reef fish community in the southeast United States is influenced by more than just fishing, perhaps including invasive species (e.g., lionfish *Pterois volitans*), decadal-scale environmental variability, or climate change.
Acceptance date: 23 October 2015

NWS Publications

A high resolution coupled hydrologic-hydraulic model (HiResFlood-UCI) for flash flood modeling
Journal of Hydrology (2.693)
P. Nguyen, A. R. Thorstensen, S. Sorooshian, K. Hsu, A. AghaKouchak, B. Sanders , **V. Koren, Z. Cui, and M. Smith (NWS/NWC)**

- This study demonstrated a coupled hydrologic-hydraulic system for flash flood modeling.
- The results show that care should be taken when defining channel and floodplain roughness values.
- The findings also suggest that it is important to use a high-quality digital elevation model, even at the expense of a leading to a coarser computational mesh.

HiResFlood-UCI was developed by coupling the NWS's hydrologic model (HL-RDHM) with the hydraulic model (BreZo) for flash flood modeling at decameter resolutions. The coupled model uses HL-RDHM as a rainfall-runoff generator and replaces the routing scheme of HL-RDHM with the 2D hydraulic model (BreZo) in order to predict localized flood depths and velocities. A semi-automated technique of unstructured mesh generation was developed to cluster an adequate density of computational cells along river channels such that numerical errors are negligible compared with other sources of error, while ensuring that computational costs of the hydraulic model are kept to a bare minimum. HiResFlood-UCI was implemented for a watershed (ELDO2) in the DMIP2 experiment domain in Oklahoma. Using synthetic precipitation input, the model was tested for various

components including HL-RDHM parameters (*a priori* versus calibrated), channel and floodplain Manning *n* values, DEM resolution (10 m versus 30 m) and computation mesh resolution (10 m+ versus 30 m+). Simulations with calibrated versus *a priori* parameters of HL-RDHM show that HiResFlood-UCI produces reasonable results with the *a priori* parameters from NWS. Sensitivities to hydraulic model resistance parameters, mesh resolution and DEM resolution are also identified, pointing to the importance of model calibration and validation for accurate prediction of localized flood intensities. HiResFlood-UCI performance was examined using 6 measured precipitation events as model input for model calibration and validation of the streamflow at the outlet. The Nash–Sutcliffe Efficiency (NSE) obtained ranges from 0.588 to 0.905. The model was also validated for the flooded map using USGS observed water level at an interior point. The predicted flood stage error is 0.82 m or less, based on a comparison to measured stage. Validation of stage and discharge predictions builds confidence in model predictions of flood extent and localized velocities, which are fundamental to reliable flash flood warning.

Acceptance date: October 17, 2015

OAR Publications

Informing Deep Argo array design using Argo and full-depth hydrographic section data

Journal of Atmospheric and Oceanic Technology (1.82)

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- The international Argo program reports over 100,000 upper-ocean profiles of temperature and salinity per year using 3000 freely drifting autonomous CTD-equipped floats that drift with currents and make periodic descents below the surface.
- Argo float data was analyzed to inform the design of a future Deep Argo array.
- Deep Argo would provide well-resolved temperature, salinity, and perhaps dissolved oxygen fields, allowing improved inventory estimates for ocean water properties when combined with the repeat hydrographic section data.

Data from full-depth closely sampled hydrographic sections and Argo floats are analyzed to inform the design of a future Deep Argo array. Here standard errors of local decadal temperature trends and global decadal trends of ocean heat content

and thermosteric sea level anomalies integrated from 2000–6000 dbar are estimated for a hypothetical 5º lat. × 5º long. × 15-day cycle Deep Argo array. These estimates are made using temperature variances from closely spaced, full-depth CTD profiles taken during hydrographic sections. The temperature data along each section are high-passed laterally at a 500-km scale, and the resulting variances averaged in 5º × 5º bins to assess temperature noise levels as a function of pressure and geographic location. A mean global de-correlation time scale of 62 days is estimated using temperature time series at 1800 dbar from Argo floats. The hypothetical Deep Argo array would be capable of resolving, at one standard error, local trends from < 1 mºC decade-1 in the quiescent abyssal North Pacific to about 26 mºC decade-1 below 2000 dbar along 50ºS in the energetic Southern Ocean. Larger decadal temperature trends have been reported previously in these regions using repeat hydrographic section data, but those very sparse data required substantial spatial averaging to obtain statistically significant results. Furthermore, the array would provide decadal global ocean heat content trend estimates from 2000–6000 dbar with a standard error of ±3 TW, compared to a trend standard error of ±17 TW from a previous analysis of repeat hydrographic data.
Expected publication date: November 2015
Available online: http://journals.ametsoc.org/doi/pdf/10.1175/JTECH-D-15-0139.1