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JANUARY 2014

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The EBM-DPSER model: integrating ecosystem services into the DPSIR framework

Projections of atmospheric mercury levels and their effect on air quality in the United States

Interdecadal ENSO modulation: Is it predictable?

Increasing frequency of extreme El Nino events due to greenhouse warming

Submerged aquatic vegetation communities of western Biscayne Bay, Miami, Florida, USA: human and natural drivers of seagrass and macroalgae abundance and distribution along a continuous shoreline

Tropospheric ozone trends at Mauna Loa Observatory tied to decadal climate variability

Case studies of the impact of high-speed solar wind streams on the electron radiation belt at geosynchronous orbit: Flux, magnetic field, and phase space density

Mechanistic insight into the effects of climate change on larval cod

Simulation testing the robustness of stock assessment models to error: some results from the ICES Strategic Initiative on Stock Assessment Methods

Cumulative human impacts on marine predators

Eastern Pacific reef fish responses to coral recovery following El Niño disturbances

Kemp's ridley (*Lepidochelys kempii*) nesting abundance in Texas: a novel approach using genetics to improve population census.

Vertebral bomb radiocarbon suggests extreme longevity in white sharks

Minke whale genome and aquatic adaptation in cetaceans

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Modeling and forecasting Malaria in Tripura, India using NOAA/AVHRR-based vegetation health (VH) indices

Impacts of assimilation of ATMS data in HWRF on track and intensity forecasts of 2012 four landfall hurricanes

Integration of a road surface model into NWS operations

Historical versus contemporary climate forcing on the annual nesting variability of loggerhead sea turtles in the Northwest Atlantic Ocean

The Global Invertebrate Genomics Alliance (GIGA): Developing community resources to study diverse invertebrate genomes

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Measuring the economic value of increased precision in scientific estimates of marine mammal abundance and bycatch: harbor porpoise *Phocoena phocoena* in the northeast US gillnet fishery

Uncertainty in Annual Rankings from NOAA's Global Temperature Time Series

A proposed, tested, and applied adjustment to account for bias in growth parameter estimates due to selectivity

Elevated Temperatures Increase the Toxicity of Pesticide Mixtures to Juvenile Coho Salmon

Evaluation of the National Weather Service's Extreme Cold Warning experiment in North Dakota during the 2012 winter season

Distribution of demersal fishes along the U.S. west coast (Canada to Mexico) in relation to spatial fishing closures (2003 2011)

Fatalities in the United States from Atlantic tropical cyclones - new data and interpretation

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Observed decline of the Atlantic Meridional Overturning Circulation 2004 to 2012

Health of common bottlenose dolphins *(Tursiops truncatus)* in Barataria Bay, Louisiana following the Deepwater Horizon oil spill

Geographic patterns of genetic variation in a broadly distributed marine vertebrate: new insights into loggerhead turtle stock structure from expanded mitochondrial DNA sequences

Extinction risk and conservation of the world's sharks and rays

ADDITIONAL ARTICLES

Ratiometric measurements of adiponectin by mass spectrometry in bottlenose dolphins *(Tursiops truncatus)* with iron overload reveal an association with insulin resistance and glucagen

Integrating Bayesian statistics, novel concentration methods and real-time PCR in quantifying human adenoviruses in source water

Growth and maximum size of tiger sharks in Hawaii

Granular hemocytes are phagocytic, but agranular hemocytes are not, in the Eastern Oyster *Crassostrea virginica*

Heat Stress and Light Stress Induce Different Cellular Pathologies in the Symbiotic Dinoflagellate during Coral Bleaching

Anthropogenic and environmental influence on population structure for Eastern USA inshore bottlenose dolphins

Subarctic cetaceans in the southern Chukchi Sea: Evidence of recovery or response to a changing ecosystem

Influence of collection and storage conditions on ACTH measurements in dolphins (Tursiops truncatus)

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Tradeoffs between bias, robustness, and common sense when choosing selectivity forms

Accuracy assessment of test flights using the Turnkey Airborne Gravity System over Alabama in 2008

ALB evaluation for NOAA charting requirements—creating acceptance test for Airborne Lidar Bathymetry data application to NOAA charts in shallow waters

Organic and metal contamination in marine surface sediments of Guánica Bay, Puerto Rico

Caspase-like activity during aging and cell death in the toxic dinoflagellates, *Karenia brevis*

Contaminants in Surficial Sediment in Coral and Fish Bays (St. John, U.S. Virgin Islands)

Severe thunderstorm reanalysis environments and collocated radiosonde observations

Evaluating the consequences of adjusting fish stock assessment estimates of biomass for retrospective patterns using Mohn's rho

Climate-mediated changes in zooplankton community structure for the eastern Bering Sea

Fishery and hatchery effects on an endangered salmon population with low productivity

Energetic electron precipitation characteristics observed from Antarctica during a flux dropout event

Variability in rockfish (Sebastes spp.) fecundity: species contrasts, maternal size effects, and spatial differences

Oxygen- and prey-mediated range expansion of a marine predator: Humboldt squid (*Dosidicus gigas*) in the California Current System

Changes in California Chinook Salmon diet over the past 50 years: relevance to the recent population crash

Parasites in subyearling Chinook Salmon (*Oncorhynchus tshawytshca*) suggest increased habitat usage in wetlands compared to sandy beach habitats in the Columbia River Estuary

NOAA Scientific Publications Report
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Genetic Variation in Bacterial Kidney Disease Susceptibility in Lake Michigan Chinook Salmon and its Progenitor Population from the Puget Sound

A Long-Term and Reproducible Passive Microwave Sea Ice Concentration Data Record for Climate Studies and Monitoring

Modeling summer circulation and thermal structure of Lake Erie

Sediment resuspension in Saginaw Bay

Stable isotope analysis of Humboldt squid prey: comment on Miller et al. (2013)

Taxonomic status of two subspecies of South American fur seals: *Arctocephalus australis australis* vs. *A. a. gracilis*

Giant shoulders 15 years later: lessons, challenges, and guidelines in fisheries meta-analysis

Spatio-temporal patterns of beaked whale echolocation signals in the North Pacific

Inter-annual variation of persistent organic pollutants (POPS) concentrations in an Antarctic predator, *Arctocephalus gazella*

Gene flow between sympatric life history forms of Oncorhynchus mykiss located above and below migratory barriers

Spawning phenology and geography of Aleutian Islands and eastern Bering Sea Pacific cod (*Gadus macrocephalus*)

Evaluation of the VIIRS and MODIS LST products in an arid area of Northwest China

Reconciling alternative approaches to projecting hydrologic impacts of climate change

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Life history of *Bathyraja trachura* from the eastern Bering Sea, with evidence of latitudinal variation in a deep-sea skate species

Description of sounds associated with Sowerby's beaked whales (*Mesoplodon bidens*) in the western North Atlantic Ocean

Juvenile steelhead distribution, migration, growth, and feeding in the Columbia River estuary, plume, and coastal waters

New view on precipitation variability and extremes in Central Europe from a German high resolution daily precipitation dataset: results from the STAMMEX project

GOES-R Advanced Baseline Imager: spectral response functions and radiometric biases with the NPP Visible Infrared Imaging Radiometer Suite evaluated for desert calibration sites

Fishes of Bermuda

High male reproductive success in a low-density Antarctic fur seal (*Arctocephalus gazella*) breeding colony

Tracing the flow of organic matter from the Muskegon River estuary system to nearshore Lake Michigan

Predicting natural channel patterns based on landscape and geomorphic controls in the Columbia River Basin, USA

Demonstration of a spatially-explicit, tag-integrated stock assessment model with application to three interconnected stocks of yellowtail flounder off of New England

Post-smolt growth and thermal regime define the marine survival of steelhead trout *(Onchorynchus mykiss)* from the Keogh River, B.C.

Impact of predation by the invasive crab, *Hemigrapsus sanguineus,* on survival of juvenile blue mussels in western Long Island Sound, USA

NOAA Scientific Publications Report
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Mark-resight abundance estimation under incomplete identification of marked individuals

Investigating interconnected fisheries: a coupled model of the lobster and herring fisheries in the Northeast US

Spatial and social connectivity of fish-eating "Resident" killer whales *(Orcinus orca)* in the northern North Pacific

Ecosystem externalities in fisheries

Zappaichthys harzhauseri gen. et sp. nov, a new Miocene toadfish (Teleostei, Batrachoidiformes) from the Paratethys (St. Margarethen in Burgenland, Austria) with comments on the fossil record of batrachoidiform fishes

Why is data sharing in collaborative natural resource studies so hard and what can we do to improve it?

Consistent trends in modified climate extremes index in the U.S.A., Europe and Australia

Environmental factors that influence the distribution, size, and biotic relationships of Christmas tree corals (*Antipathes dendrochristos*) in the Southern California Bight

Oceanographic influences on patterns in North Pacific salmon abundance

The ability of two age composition error distributions to estimate selectivity and spawning stock biomass in simulated stock assessments

Redescription of *Alatina alata* (Reynaud 1830) (Cnidaria: Cubozoa) from Bonaire, Dutch Caribbean

HyMeX-SOP1, the field campaign dedicated to heavy precipitation and flash flooding in the northwestern Mediterranean

Recovery potential of smalltooth sawfish, *Pristis pectinata*, in the United States determined using

population viability models

Twenty five novel microsatellite markers for English sole, *Parophrys vetulus*

Simulation testing the robustness of stock assessment models to error: some results from the ICES Strategic Initiative on Stock Assessment Models

Ribbed mussel, *Geukensia demissa*, responses to the harmful algae *Aureococcus anophagefferens* and *Heterosigma akashiwo*

Does temporal and spatial segregation explain the complex population structure of humpback whales on the coast of West Africa?

Examining the utility of alternative video monitoring metrics for indexing reef fish abundance

Induced bacteriovory in a declining culture of the mixotrophic dinoflagellate *Prorocentrum minimum* (Pavillard) Schiller

Interannual variation in the at-sea behavior of California sea lions *(Zalophus californianus)*

Ontogeny of critical swimming speeds for larval and pelagic juvenile rockfishes (*Sebastes spp.*, family *Scorpaenidae*)

Multivariate random forest models of estuarine-associated fish and invertebrate communities

Temporal variability of the Meridional Overturning Circulation at 34.5°S: results from two pilot boundary arrays in the South Atlantic

Bounds on biomass estimates and energetic consequences of Ctenophora in the northeast U.S. shelf ecosystem

The effects of disease-induced juvenile mortality on the transient and asymptotic population dynamics of chinook salmon *(Oncorhynchus tshawytscha)*

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Application of diversity indices to quantify early life-history diversity for chinook salmon

Spatial and temporal patterns of growth and consumption by juvenile chinook salmon

OTHER REPORTS, BOOK CHAPTERS, AND INTERNAL PUBLICATIONS

Climate sensitivity of the National Estuarine Research Reserve System

Fish movement patterns in Virgin Islands National Park, Virgin Islands Coral Reef National Monument and adjacent waters

Ecological condition of coastal ocean waters of the Northwestern Gulf of Mexico: 2011

A baseline assessment of coral and fish bays (St. John, USVI) in support of ARRA watershed restoration activities

Chapter 6: Diseases of King Crabs and Other Anomalies

Comment on temperature-dependent stock–recruit modeling for Pacific sardine *(Sardinops sagax)* in Jacobson and MacCall (1995), McClatchie et al. (2010), and Lindegren and Checkley (2013)

Comment on 'Bayesian parentage analysis with systematic accountability of genotyping error, missing data and false matching'

Conserving our oceans one place at a time

National standards for a protected species observer and data management program: A model using geological and geophysical surveys

Sailing through Time: A Historical Examination of the Explorations and Expeditions of the Papahānaumokuākea Marine National Monument

Baseline characterization of fish and benthic communities in the Flower Garden Banks National Marine

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Sanctuary

Marine cage culture and the environment: twenty-first century science informing a sustainable industry

SPECIAL SECTION IN *CONSERVATION BIOLOGY*

Climate change, marine environments, and the U.S. Endangered Species Act

Choosing and using climate-change scenarios for ecological-impact assessments and conservation decisions

Interactive effects of water diversion and climate change for juvenile chinook salmon in the Lemhi River Basin (U.S.A.)

Estimating effects of tidal power projects and climate change on threatened and endangered marine species and their food web

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1. HIGHLIGHTED ARTICLES

The EBM-DPSER model: integrating Ecosystem Services into the DPSIR framework
PLoS ONE
C. R. Kelble, D. K. Loomis, **S. Lovelace (NOS/NCCOS),** W. K. Nuttle, P. B. Ortner, P. Fletcher, G. S. Cook, J. Lorenz, and J. N. Boyer

- There is a pressing need to integrate biophysical and human dimensions science to better inform holistic ecosystem management supporting the transition from single species or single-sector management to multi-sector ecosystem-based management.
- The authors propose a conceptual model that merges the broadly applied Driver, Pressure, State, Impact, and Response (DPSIR) conceptual model with ecosystem services yielding a Driver, Pressure, State, Ecosystem service, and Response (EBM-DPSER) conceptual model
- The EBM-DPSER model should be a useful operational tool for implementing EBM, in that it fully integrates our knowledge of all ecosystem components while focusing management attention upon those aspects of the ecosystem most important to human society and does so within a framework already familiar to resource managers.

Ecosystem-based management should focus upon ecosystem services, since they reflect societal goals, values, desires, and benefits. The inclusion of ecosystem services into holistic management strategies improves management by better capturing the diversity of positive and negative human-natural interactions and making explicit the benefits to society. To facilitate this inclusion, a conceptual model that merges the broadly applied Driver, Pressure, State, Impact, and Response (DPSIR) conceptual model with ecosystem services yielding a Driver, Pressure, State, Ecosystem service, and Response (EBM-DPSER) conceptual model is proposed. The impact module in traditional DPSIR models focuses attention upon negative anthropomorphic impacts on the ecosystem; by replacing impacts with ecosystem services the EBMDPSER model incorporates not only negative, but also positive changes in the ecosystem. Responses occur as a result of changes in ecosystem services and include inter alia management actions directed at proactively altering human population or individual behavior and infrastructure to meet societal goals. The EBMDPSER conceptual model was applied to the Florida Keys and Dry Tortugas marine ecosystem as a case study to illustrate how it can inform management decisions. This case study captures our system-level understanding and results in a more holistic representation of ecosystem and human society interactions; thus, improving our ability to identify trade-offs.
Published: August 2013

Projections of atmospheric mercury levels and their effect on air quality in the United States
Atmospheric Chemistry and Physics
H. Lei, D. J. Wuebbles, X.-Z. Liang, Z. Tao, S. Olsen**, R. Artz, X. Ren,** and **M. Cohen (OAR/ARL)**

- The paper presents unique results associated with modeling future atmospheric mercury levels; the sensitivity of atmospheric mercury to climate and industrial and natural emissions changes;

changes in the composition of atmospheric mercury compounds; and possible consequences and uncertainties.

- In all scenarios, reactive gaseous mercury, the form of mercury that is most likely to become bioavailable, increases.
- Understanding how future mercury emissions along with projected climate change will affect atmospheric mercury concentrations and deposition is critical information for policy-makers and regulators.

The primary pathway by which mercury enters most aquatic and terrestrial ecosystems is atmospheric deposition (in rain and snow and "dry" deposits), originating from mercury emissions. These emissions come from natural and human sources and may be in several forms. Once mercury enters sensitive watersheds and receiving waters, it can be converted to methylmercury, a highly toxic form that can bio-accumulate through the aquatic food chain. Humans and wildlife are primarily exposed to mercury from consuming contaminated fish. Methylmercury can adversely affect the nervous system, particularly those of fetuses and young children. As a result, fish consumption advisories due to mercury contamination are widespread throughout the United States. The paper focuses on the use of a global atmospheric mercury model to investigate the effects of projected global changes in climate and emissions on atmospheric mercury concentrations and deposition from 2000 to 2050. Three distinct climate/emissions pathways from the Intergovernmental Panel on Climate Change Special Report on Emissions Scenarios were considered to quantify the range for future climate and full chemical emissions changes. The projections of anthropogenic mercury emissions in 2050 are based on the energy use assumed in the specific scenario, while natural emissions are projected through dynamic schemes for mercury emissions driven by future climate and environmental data. Developed countries show a slow increase or even a decrease in future levels of mercury emissions, while developing countries show an increasing trend. Total mercury emissions are expected to increase by 2050. Emissions from land and oceans in 2050 increase due to the accumulation of net mercury deposition in surface storage reservoirs. The impact of anthropogenic emissions changes is relatively more significant than that of climate change on future atmospheric mercury. More mercury from industrial emissions will be deposited to water and further impact aquatic ecosystems.

Published: December 28, 2013
http://www.atmos-chem-phys-discuss.net/13/20165/2013/acpd-13-20165-2013.pdf

Interdecadal ENSO modulation: Is it predictable?
Journal of Climate
A. T. Wittenberg, A. Rosati, **T. L. Delworth, G. A. Vecchi,** and **F. Zeng (NOAA/OAR/GFDL)**

- The El Niño / Southern Oscillation (ENSO) is Earth's strongest interannual climate fluctuation, impacting weather, ecosystems, and economies around the world.
- These experiments show no clear evidence for predictability of ENSO's decadal-scale statistics, in

the absence of external forcings.

- The absence of decadal memory for ENSO would suggest an efficient, time-saving strategy for evaluating ENSO in models, using large ensembles of short parallel runs.

Observations and climate simulations exhibit epochs of extreme El Niño/Southern Oscillation (ENSO) behavior that can persist for decades. Previous studies have revealed a wide range of ENSO responses to forcings from greenhouse gases, aerosols, and orbital variations – but they have also shown that interdecadal modulation of ENSO can arise even without such forcings. The present study examines the predictability of this intrinsically-generated component of ENSO modulation, using a 4000-year unforced control run from a global coupled GCM (GFDL-CM2.1) with a fairly realistic representation of ENSO. Extreme ENSO epochs from the unforced simulation are reforecast using the same ("perfect") model, but slightly-perturbed initial conditions. These 40-member reforecast ensembles display potential predictability of the ENSO trajectory, extending up to several years ahead. However, no decadal-scale predictability of ENSO behavior is found. This indicates that multidecadal epochs of extreme ENSO behavior can arise not only intrinsically, but delicately, and entirely at random. Previous work had shown that CM2.1 generates strong, reasonably-realistic, decadally-predictable high-latitude climate signals, as well as tropical and extratropical decadal signals that interact with ENSO. However, those slow variations appear not to lend significant decadal predictability to this model's ENSO behavior, at least in the absence of external forcings. While the potential implications of these results are sobering for decadal predictability, they also suggest an expedited approach to model evaluation and development – in which large ensembles of short runs are executed in parallel, to quickly and robustly evaluate simulations of ENSO. Further implications are discussed for decadal prediction, attribution of past and future ENSO variations, and societal vulnerability.
Expected Publication Date: January 2014

Increasing frequency of extreme El Nino events due to greenhouse warming
Nature Climate Change
W. Cai, S. Borlace, M. Lengaigne, P. van Rensch, M. Collins, **G. Vecchi (OAR/GFDL)**, A. Timmermann, A. Santoso, **M. J. McPhaden (OAR/PMEL)**, L. Wu, M. H. England, G. Wang, E. Guilyardi, and F. Jin

- The chance of extreme El Niños, such as 1982-83 and 1997-98 events, will double in coming decades as the eastern equatorial Pacific Ocean warms faster than the surrounding regions.
- These findings imply that variability in airflow patterns must be considered when attributing observed ozone changes to human-induced trends in precursor emissions.

El Niño events are a prominent feature of climate variability with global climatic impacts. The 1997/98 episode, often referred to as "the climate event of the 20th century and the 1982/83 extreme El Niño featured a pronounced eastward extension of the west Pacific warm pool and development of atmospheric convection, hence a huge rainfall increase, in the usually cold and dry equatorial eastern Pacific. Such a massive reorganization of atmospheric convection, which we define as an "extreme El

Niño," severely disrupted global weather patterns, affecting ecosystems, agriculture, tropical cyclones, drought, bushfires, floods and other extreme weather events worldwide. Potential future changes in such extreme El Niño occurrences could have profound socio-economic consequences. Here we present climate modelling evidence for a doubling in the occurrences in the future in response to greenhouse warming. We estimate the change by aggregating results from climate models in the Coupled Model Intercomparison Project phases 3 (CMIP3)10 and 5 (CMIP5)11 multi-model databases, and a perturbed physics ensemble (PPE)12. The increased frequency arises from a projected surface warming over the eastern equatorial Pacific that occurs faster than the surrounding ocean waters facilitating more occurrences of atmospheric convection in the eastern equatorial region.
Expected Publication Date: February 2014

Submerged aquatic vegetation communities of western Biscayne Bay, Miami, Florida, USA: Human and natural drivers of seagrass and macroalgae abundance and distribution along a continuous shoreline
Estuaries and Coasts
D. Lirman, T. Thyberg, R. Santos, S. Schopmeyer, C. Drury , L. Collado-Valdes, S. Bellmund, and **J. E. Serafy (NOAA/SEFSC)**

- The consequences of the world's largest wetlands restoration project (the Comprehensive Everglades Restoration Plan) on coastal habitats is largely unknown.
- Study reveals differential success among local submerged aquatic vegetation taxa in the event that desired increases in freshwater flow are achieved.
- Study reveals that nearshore co-dominance in *Halodule* and *Thalassia* that occurs at salinities between 15 and 25 psu correlates with the highest submerged aquatic vegetation (SAV) coverage and thus should be a goal for resource managers.

Nearshore benthic habitats of Biscayne Bay fit the prediction of communities at risk due to their location adjacent to a large metropolitan center (Miami) and being influenced by changes in hydrology through the activities of the Comprehensive Everglades Restoration Plan (CERP). We examine whether the proposed expansion of mesohaline conditions through the introduction of additional fresh water would result in: 1) increases in seagrass cover; 2) expansion in the cover of *Halodule*; and 3) a reduction in the dominance of Thalassia, as hypothesized by CERP. Seagrasses were present at 98% of sites where they covered 23% of the bottom. Salinity was the only physical variable with a significant relationship to the occurrence of all SAV taxa. Occurrence of *Thalassia, Halimeda*, and *Penicillus* increased significantly with increasing salinity, but *Halodule*, *Syringodium*, *Laurencia*, *Udotea*, *Batophora*, *Caulerpa*, and *Acetabularia* showed a significant negative relationship with salinity. The salinity range in which both *Thalassia* and *Halodule* had similar frequency of occurrence was 15-25 psu. The combined cover of *Thalassia* and *Halodule* when both species are present (23%) is higher than the cover when only one of the species is present (17.4% for Thalassia and 19.7% for Halodule). The low abundance of *Thalassia* along the

shoreline is not only due to its exclusion from low-salinity environments but also by higher nutrient availability that favors *Halodule*. Percent N, P, and N:P ratios in seagrass tissue suggest that Biscayne Bay experiences high N inputs and is P limited. Thus, increased P availability may facilitate an expansion of *Halodule*. The data presented suggest that increased mesohaline conditions will increase seagrass abundance and support co-dominance by *Halodule* and *Thalassia* as hypothesized, but raise concern that current high N availability and the potential for increases in P may prompt a shift away from seagrass-dominated to algal-dominated communities under scenarios of enhanced freshwater inputs.
Acceptance date: January 4, 2014

Tropospheric ozone trends at Mauna Loa Observatory tied to decadal climate variability
Nature Geoscience
M. Lin, **L. W. Horowitz (OAR/GFDL)**, S. J. Oltmans, A. M. Fiore, and S. Fan

- Authors show that measurements of ozone are affected by changing wind patterns which mask the increase in pollution from Asia in the spring, but amplify the change in the autumn.
- These findings imply that variability in airflow patterns must be considered when attributing observed ozone changes to human-induced trends in precursor emissions.

Climate shifts have caused Asian ozone pollution reaching Hawaii to rise unexpectedly in autumn since the mid-1990s. The longest record of ozone in the U.S. goes back to 1974 in Hawaii. Ozone would be expected to increase in the spring, due to powerful springtime winds and tripling emissions from Asia since the 1980s. The 40-year Hawaiian record, however, has shown little change in spring but an increase in autumn.
Expected Publication Date: February 2014

Case studies of the impact of high-speed solar wind streams on the electron radiation belt at geosynchronous orbit: Flux, magnetic field, and phase space density
Journal of Geophysical Research
D. P. Hartley, M. H. Denton, **J. C. Green (NESDIS/NGDC), T. G. Onsager (NWS/SWPC), J. V. Rodriguez (NESDIS/NGDC),** and **H. J. Singer (NWS/SWPC)**

- Similar solar wind drivers can result in radiation belt dropout events with very different durations and magnitudes. Several contributory mechanisms are evident in the cases studied here.
- This is the first extensive scientific study of GOES(-13) MAGED electron fluxes and their pitch angles derived from GOES Magnetometer observations, and the first publication of pitch-angle distribution retrieval method developed with the support of the GOES-R Risk Reduction Program.

Investigation of electron radiation belt dropouts has revealed the importance of a number of loss processes, yet there remains a lack of quantitative detail as to how these processes wax and wane between events. The overarching aim of this study is to address the issue of electron radiation belt dropouts. This is achieved using in situ observations at geostationary orbit from GOES-13 (pitch angle-

resolved electron data and magnetic field measurements) to examine the outer electron radiation belt during three high-speed stream-driven storms. Analysis and interpretation are aided by calculation of the phase space density (PSD) as a function of the three adiabatic invariants. Our results confirm the importance of outward adiabatic transport as a mechanism for causing electron dropouts at geosynchronous orbit; however, study of the pitch angle distributions indicates that other loss mechanisms are also likely to be occurring during these high-speed solar wind stream (HSS)-driven storms. Two of the studied events exhibit similar evolutionary structure in their pitch angle distributions: (i) highly peaked distributions immediately prior to the dropout (ii) sharp transitions between peaked and isotropic and then subsequent butterfly distributions, and (iii) isotropic distributions at minimum flux shortly afterwards (dusk). We also address the difficulty in interpreting PSD calculations by comparing the T96 model magnetic field with that measured by GOES-13. Our results are intended as a first step in quantifying the timeline of events that occur in the radiation belts following the arrival of a HSS—particularly timely given the increase in HSS occurrence expected in the declining phase of the current solar cycle.
Expected Publication Date: 8 November 2013

Mechanistic insight into the effects of climate change on larval cod
Global Change Biology
T. Kristiansen, **C. Stock (OAR/GFDL)**, K. Drinkwater, and E. Curchitser

- If the biomass of predators of cod larvae remains constant, a decline in larval cod survival is projected.

This study uses climate projections from GFDL's Earth System Model (ESM2.1) to force an individual-based model (IBM) for the larval stages of North Atlantic Cod at each of 5 cod spawning sites across the North Atlantic. The behavioral and physiological state of thousands of cod larvae is modeled in response to projected physical and biological changes. The ESM-IBM coupling provides a unique means of exploring the mechanistic response of cod larvae to climate forcing. Projections using a high emissions scenario (SRES A2) show surface ocean temperatures increasing by > 1oC for 3 of the 5 regions and stratification is expected to increase at all sites in the latter half of this century. These changes are associated with decreased primary production by large phytoplankton and reduced mesozooplankton biomass (the primary prey for larval cod). Higher temperatures increase larval metabolic costs, which combine with decreased food resources to reduce larval weight at some sites and seasons, increase the probability of dying from starvation, and necessitate greater foraging in well-lit surface waters where larvae are more susceptible to predators.
Expected Publication Date: Spring 2014

NOAA SCIENTIFIC PUBLICATIONS REPORT
JANUARY 2014

Simulation testing the robustness of stock assessment models to error: some results from the ICES Strategic Initiative on Stock Assessment Methods
ICES Journal of Marine Science
J. J. Deroba (NOAA/NEFSC); D. S. Butterworth; **R. D. Methot, Jr. (NMFS/NWFSC)**; J. A. A. De Oliveira; C. Fernandez; A. Nielsen; S. X. Cadrin; M. Dickey-Collas; **C. M. Legault (NMFS/NEFSC)**; **J. Ianelli (NMFS/AKFSC)**; J. L. Valero; C. L. Needle; **Joseph M. O'Malley (NMFS/PIFSC)**; Y.-J. Chang; **G. G. Thompson (NMFS/AKFSC)**; C. Canales; D. P. Swain; D. C. M. Miller; N. T. Hintzen; M. Bertignac; L. Ibaibarriaga; A. Silva; A. Murta; L. T. Kell; C. L. de Moor; A. M. Parma; C. M. Dichmont; V. R. Restrepo; Y. Ye; E. Jardim; **P. D. Spencer (NMFS/AKFSC)**; **D. H. Hanselman (NMFS/AKFSC)**; J. Blaylock; M. Mood; and **P.-J. F. Hulson (NMFS/AKFSC)**.

- Bias in self-tests was common and this type of consistency check should be conducted whenever possible and should become a standard method when considering an assessment model for management advice.
- Institutions involved in scientific advice should add such tests to their practices or guidelines for long-term methods development.
- Further strategic investments are needed for the advancement of stock assessment methods for supporting management of sustainable fisheries.

The World Conference on Stock Assessment Methods (July 2013) included a workshop on testing of assessment methods. We report on a simulation exercise used for that testing. The exercise was made up of three steps that were applied to data sets from 14 representative fish stocks from around the world. Steps one and two involved scientists applying stock assessments to some data sets with varying degrees of effort dedicated to optimizing fit. Step three was only applied to a subset of the stocks and involved characteristics of given model fits being used to generate pseudo-data with error. These pseudo-data were then provided to assessment modelers, and fits to the pseudo-data provided consistency checks within (self-tests) and among (cross-tests) assessment models. Although trends in biomass were often similar across models, the scaling of absolute biomass was not consistent across models. Similar types of models tended to perform similarly (e.g., age-based or production models). Self-testing and cross-testing of models is a useful diagnostic approach and suggested that most bias occurred in the most recent years of time series. Results from the simulation exercise provide a basis for guidance on future large-scale simulation experiments and demonstrate the need for strategic investments in the evaluation and development of stock assessment methods.
Expected Publication Date: January – February 2014

NOAA SCIENTIFIC PUBLICATIONS REPORT
JANUARY 2014

Cumulative human impacts on marine predators
Nature Communications
S. M. Maxwell, E. L. Hazen, S. J. Bograd, B. S. Halpern, G. A. Breed, B. Nickel, N. M. Teutschel, L. B. Crowder, S. Benson, P. H. Dutton, H. Bailey, M. A. Kappes, **C. E. Kuhn (NMFS/AKFCS)**, M. J. Weise, B. Mate, S. A. Shaffer, J. L. Hassrick, R. W. Henry, L. Irvine, B. I. McDonald, P. W. Robinson, B. A. Block, D. P. Costa

- This study is the first attempt to create a spatially explicit understanding of potential cumulative impacts of human activities on marine predators
- By examining 8 species across 3 guilds, this study found that in the California Current Ecosystem regions of high potential impact to marine predators were concentrated along the continental shelf and within previously established marine sanctuaries

Stressors associated with human activities interact in complex ways to impact marine ecosystems, yet we lack spatially explicit assessments of cumulative effects on ecologically and economically key components such as marine predators. Here we develop a metric of cumulative utilization and impact (CUI) on marine predators by combining electronic tracking data of eight protected predator species (n=685 individuals) in the California Current Ecosystem with 24 anthropogenic stressors. We show significant variation in CUI with some of the highest impacts within US National Marine Sanctuaries. High variation in underlying species and cumulative impact distributions means that neither alone is sufficient for effective spatial management. Instead, comprehensive management approaches accounting for both cumulative human impacts and tradeoffs among multiple stressors must be applied in planning the use of marine resources.
Expected Publication Date: November 4, 2013
http://www.nature.com/ncomms/2013/131028/ncomms3688/full/ncomms3688.html

Eastern Pacific reef fish responses to coral recovery following El Niño disturbances
Marine Ecology Progress Series
P.W. Glynn, I.C. Enochs, J.A. Afflerbach, V.W. Brandtneris, and **J.E. Serafy (NMFS/SEFSC)**

- A rare study given its long (27 yr) duration and that fish community changes were tracked as coral cover increased (as opposed to numerous studies examining situation of coral decline)
- Study reveals nature of relationships among coral cover, fish abundance and diversity and the densities of several trophic groups
- Provides insight into the sequence of fish community responses along a trajectory of coral reef recovery

NOAA SCIENTIFIC PUBLICATIONS REPORT
JANUARY 2014

This study examines fluctuations in an eastern Pacific reef fish assemblage as it varies with coral recovery over 27 years. Concurrent fish and coral monitoring were conducted at Uva Island reef, which lies within the boundaries of Coiba National Park, Panama, in an area that has received virtually no fishing pressure or watershed development over the past 80 years. Coral and fish monitoring spanned the 1982-83 and 1997-98 El Niño (ENSO) disturbances, anomalous warming events that selectively killed reef-building corals. While no fish mortalities were observed during the 1982-83 El Niño event, live coral cover was reduced to nearly 0% at the study reef. From 1984 to 1990, live coral (Pocillopora spp.) cover was extremely low (< 5%), but demonstrated steady recovery to 35% by 2010. By quantifying disturbance-related, long-term changes in coral reef resources and relating these to fish trophic group responses, several functional relationships emerged. A total of 63 fish taxa were observed and reef fish density (all taxa combined) remained relatively stable. Fish diversity (species richness) increased significantly as live coral cover rose from near 0% to 15-20% then demonstrated a decreasing trend to 35% cover. Benthic invertivores showed a significant parabolic increase in density peaking at about 20% live coral cover. A pattern of decline was apparent for the mixed diet feeders guild as coral cover increased, whereas a linear relationship with coral cover emerged for the facultative corallivore guild. The above three trophic guild responses to coral recovery were largely reversals of changes during coral decline in other studies. No clear patterns in herbivore, piscivore and planktivore abundance were apparent with increasing coral cover. The varying responses of invertivore, corallivore and mixed diet feeding guilds demonstrated strong associations with coral cover, probably reflecting changes in availability of their respective trophic resources during reef recovery. Thus, variations in coral cover likely influence fish communities through trophic pathways involving invertebrate food sources. Multivariate analysis of species abundances revealed strong overlap between seasons and a clustering of community composition in the years following bleaching.
Accepted: October 9, 2013

Kemp's ridley (Lepidochelys kempii) *nesting abundance in Texas: a novel approach using genetics to improve population census.*
Endangered Species Research
A. Frey, P.H. Dutton, D.J. Shaver, J.S. Walker, and C. Rubio (**NMFS/SWFSC**)

- This paper presents a novel approach to census nesting marine turtles using genetics to associate females to nests.
- It provides an alternative method for identifying nests laid by unknown mothers, especially in areas where direct observation of nesting females is not possible.

- Results indicate that traditional methods, based on observed tagged turtles, have underestimated the number of Kemp's ridleys nesting in Texas.

Accurate estimates of the annual numbers of nesting females are critical for assessing sea turtle populations. There has been a significant increase in nesting by Kemp's ridley (Lepidochelys kempii) turtles at Padre Island National Seashore (PAIS) and nearby beaches in Texas, USA. There were 4 nests observed in Texas during 1995 and a record of 209 in 2012. However, it is unclear how many clutches are laid by the same female turtles. We use a genetic approach to infer the number of individual nesters from genotypes determined from dead embryos and hatchlings sampled from clutches. Mitochondrial DNA sequencing was combined with nuclear DNA analysis at 10 microsatellite loci to match genotypes for nesters and offspring of unknown parentage in over 50% of the unassigned nests. Our results indicate that traditional methods, based on observed tagged turtles, have underestimated the number of Kemp's ridleys nesting in Texas. We demonstrate how genetic approaches can be incorporated into population assessments when direct census of adult animals is not feasible. This approach also provides a basis to apply Capture-Mark-Recapture techniques to impact assessment of events, such as the recent oil spill, on the population via sampling of nests to identify and track individual nesters over time.
Expected Publication Date: January 2014

Vertebral bomb radiocarbon suggests extreme longevity in white sharks
PlosOne
L. L. Hamady, **L. J. Natanson (NMFS/NEFSC**), G. B. Skomal, S. R. Thorrld

- Increased longevities for the white shark may be significant in terms of overall fecundity and productivity
- Vertebral bomb radiocarbon suggests extreme longevity in white sharks

Conservation and management efforts for white sharks (*Carcharodon carcharias*) remain hampered by a lack of basic demographic information including age and growth rates. Sharks are typically aged by counting growth bands sequentially deposited in their vertebrae, but the assumption of annual deposition of these bands requires testing. We compared radiocarbon (Δ14C) values in vertebrae from four female and four male white sharks from the northwestern Atlantic Ocean (NWA) with reference chronologies documenting the marine uptake of 14C produced by atmospheric testing of thermonuclear devices to generate the first radiocarbon age estimates for adult white sharks. Age estimates were up to 40 years old for the largest female (fork length [FL]: 526cm) and 73 years old for the largest male (FL: 493cm). Our results dramatically extend the maximum age and longevity of white sharks compared to earlier studies,

hint at possible sexual dimorphism in growth rates, and raise concerns that white shark populations are considerably more sensitive to human-induced mortality than previously thought.
Accepted: 11 November 2013

Minke whale genome and aquatic adaptation in cetaceans
Nature Genetics
H. Yim, Y.S. Cho, X. Guang, S.G. Kang, J. Jeong, S. Cha, H. Oh, J. Lee, E.C. Yang, K.K. Kwon, Y.J. Kim, T.W. Kim, W. Kim, J.H. Jeon, S. Kim, D.H. Choi, S. Jho, H. Kim, J. Ko, H. Kim, Y. Shin, H. Jung, Y. Zheng, Z. Wang, Y. Chen, M. Chen, A. Jiang, E. Li, S. Zhang, H. Hou, T.H. Kim, L. Yu, S. Liu, K. Ahn, J. Cooper, S. Park, C.P. Hong, W. Jin, H. Kim, C. Park, K. Lee, S. Chun, **P.A. Morin** (**NMFS/SWFSC**), S.J. O'Brien, H. Lee, J. Kimura, D.Y. Moon, A. Manica, J. Edwards, B.C. Kim, S. Kim, J. Wang, J. Bhak, H.S. Lee, and J. Lee

- The authors of this study assembled the minke whale genome to improve the understanding of the evolutionary changes in cetaceans necessary to survive in an aquatic environment.
- This study provides genomic resources for several cetacean species, and comparative genomics analysis among cetaceans.
- This study also identifies genes and gene families that have undergone selection in the evolution of cetaceans from their terrestrial ancestors

The shift from terrestrial to fully aquatic life by whales represents a dramatic evolutionary event in the mammalian lineage. Here we present a de novo assembly of the minke whale genome, with additional genomic sequences of three minke whales, a fin whale, a bottlenose dolphin, and a finless porpoise, to improve our understanding of the evolutionary changes necessary to survive in an aquatic environment. We found that the whale's adaptation to aquatic life was notably marked by resistance to physiological stresses caused by a lack of oxygen, increased reactive oxygen species, and high salt level. Gene families associated with stress-responsive proteins and anaerobic metabolism were expanded, whereas gene families related to body hair and sensory receptors were contracted. Whale-specific mutations were also identified in genes encoding antioxidants and enzymes controlling blood pressure and salt concentration. Overall, the whale genomes exhibited distinct features that are associated with the physiological and morphological changes needed for life in an aquatic environment.
Expected Publication Date: December 2013

Modeling and forecasting malaria in Tripura, India using NOAA/AVHRR-based vegetation health (VH) indices
International Journal of Remote Sensing Applications

M. Nizamuddin (NESDIS/CREST), **F. Kogan (NESDIS/STAR)**, R. Dhiman, **W. Guo (NESDIS)**, and L. Roytman

- The authors used an established algorithm that uses Vegetation Health (VH) Indices (Vegetation Condition Index (VCI) and Temperature Condition Index (TCI)) computed from Advance Very High Resolution Radiometer (AVHRR) data flown on NOAA afternoon polar orbiting satellite to monitor malaria epidemics in Tripura.
- Tha authors further attempted to develop malaria incidence-VH models using the Principal component analysis (PCA) and apply the models to early detection of malaria start, prediction of itsdynamics and resultant malaria cases.
- Malaria transmission in Tripura state is sensitive to both thermal and moisture conditions, which can be estimated from NOAA/AVHRR-based Vegetation health indices data.

Improved forecasting, prevention and control of epidemics are the key technical elements for malaria eradication program. The objective is to use NOAA/AVHRR environmental satellite data to produce weather seasonal forecasts for using as a proxy for predicting malaria epidemics in Tripura state, India which has one of the highest endemic of malaria cases in the country. An algorithm has been reported that uses Vegetation Health (VH) Indices (Vegetation Condition Index (VCI) and Temperature Condition Index (TCI)) computed from Advance Very High Resolution Radiometer (AVHRR) data flown on NOAA afternoon polar orbiting satellite. A significant relationship between satellite data and annual malaria incidences is found at least three months before the major malaria transmission period. Principal component regression (PCR) method was used to develop a model to predict malaria as a function of the TCI. The simulated results were compared with observed malaria statistics showing that the error of estimation of malaria is insignificant. Optical remote sensing therefore is a valuable tool to estimate malaria well in advance so that preventive measures can be taken.
Published: September 2013

Impacts of assimilation of ATMS data in HWRF on track and intensity forecasts of 2012 four landfall hurricanes
Journal of Geophysical Research
X. Zou, **F. Weng (NESDIS/STAR)**, B. Zhang, L. Lin, Z. Qin, and **V. Tallapragada (NESDIS/NCEP)**

- From the current research, it is encouraging to conclude that the direct assimilation of ATMS data can improve the hurricane track and intensity forecasts using the HWRF system.

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This study demonstrates the added benefits of assimilating the Advanced Technology Microwave Sounder (ATMS) radiances in the Hurricane Weather Research and Forecasting (HWRF) system to forecasts of four Atlantic hurricane cases that made landfall in 2012. In the National Centers for Environmental Prediction (NCEP) Gridpoint Statistical Interpolation data assimilation system, the HWRF model top is raised to ~0.5 hPa and the cold start embedded in the HWRF system is changed to a warm start. The ATMS data quality control (QC) procedure is examined and illustrated for its effectiveness in removing cloudy radiances of all the 22 ATMS channels using primarily the information from ATMS channels 1 and 2. For each hurricane case, two pairs of data assimilation and forecasting experiments are carried out and compared with and without including ATMS data. The only difference between the two pairs of experiments is that the second pair also includes data from several other polar-orbiting satellite instruments. It is shown that ATMS data assimilation in HWRF results in a consistent positive impact on the track and intensity forecasts of the four landfall hurricanes.
Published Online: 28 October 2013
Link to paper: http://onlinelibrary.wiley.com/doi/10.1002/2013JD020405/pdf

Integration of a road surface model into NWS operations
Bulletin of the American Meteorology Society
J.J. Rutz (NWS/WRH) and **C.V. Gibson (NWS/WFO - Missoula, MT)**

- Initial verification suggests that output from the Model of the Environment and Temperature of Roads (METRo) can provide useful information with regard to the timing and severity of hazardous road surface conditions, allowing NWS forecasters to more effectively highlight the impacts associated with impending meteorological events.
- This information enhances the decision support services that the NWS is able to provide to government partners, local emergency management, and the public during high-impact winter weather events.

Today's winter weather headlines are based on the meteorological strength of an event with the assumption that stronger events produce larger public impacts. In reality, public impacts involve many factors, such as whether or not snow will accumulate on roads and affect traffic. Along with numerous environmental factors, decisions are further complicated by societal factors (e.g., timing of the commute). The National Weather Service Strategic Plan calls for increased emphasis on decision support services to our partners, especially during high-impact events. However, determining when events will produce high-impact conditions often remains a challenge. While forecasters should be aware of the relevant societal factors, they also need objective tools capable of integrating over the wide range of

environmental factors that intersect in producing high-impact weather. This is particularly true in the case of road surface conditions, where complex interactions between temperature, moisture, and the road surface play a key role in determining what hazards might develop during wintry weather.
Published: October 2013

Historical versus contemporary climate forcing on the annual nesting variability of loggerhead sea turtles in the Northwest Atlantic Ocean
PLoS One
M. Arendt, J. Schwenter, B. Witherington, A. Meylan, and **V. Saba (NMFS/NEFSC)**

- Contemporary climate forcing, as opposed to historical climate forcing, drives the predominant portion of interannual and multidecadal variability of loggerhead sea turtle nesting numbers in the Northwest Atlantic.
- Remigrant nesters (older females) appear to have a stronger influence on nesting variability than do neophytes (younger females).
- Suggests that there is a potential recovery trend in the Northwest Atlantic loggerhead population and recovery criteria could be attained by the late 2020's if anthropogenic mortality remains unchanged.

A recent analysis suggested that historical climate forcing on the oceanic habitat of neonate sea turtles explained two-thirds of interannual variability in contemporary loggerhead (*Caretta caretta*) sea turtle nest counts in Florida, where nearly 90% of all nesting by this species in the Northwest Atlantic Ocean occurs. Here, we show that associations between annual nest counts and climate conditions decades prior to nest counts and those conditions one year prior to nest counts were not significantly different. Examination of annual nest count and climate data revealed that statistical artifacts influenced the reported 31-year lag associated with nest counts. The projected importance of age 31 neophytes to annual nest counts between 2020 and 2043 was modeled using observed nest counts between 1989 and 2012. Assuming consistent survival rates among cohorts and that one third of the mature female population nests annually, the 41% decline in annual nest counts observed during 1998–2007 was not projected for 2029–2038. This finding suggests that annual nest count trends are more influenced by re-migrants than neophytes. Provided that the population was growing at 5% annually, our projections suggest that the Peninsular Recovery Unit could attain the demographic recovery criteria of 106,100 annual nests by 2027 if nest counts in 2019 are at least comparable to 2012. Because the first year of life represents only 4% of the time elapsed through age 31, cumulative survival at sea across decades explains most cohort variability, and thus, re-migrant population size. Pursuant to the U.S. Endangered

Species Act, staggered implementation of protection measures for all loggerhead life stages has taken place since the 1970s. We suggest that the 1998–2007 nesting decline represented a lagged perturbation response to historical anthropogenic impacts, and that subsequent nest count increases since 2008 reflect a potential recovery response.
Expected Published Date: December 2013

The Global Invertebrate Genomics Alliance (GIGA): Developing community resources to study diverse invertebrate genomes
Journal of Heredity
Coauthor Committee Chairs: H. Bracken-Grissom, **A. G. Collins (NMFS/NEFSC)**, T. Collins, K. Crandall, D. Distel, C. Dunn, G. Giribet, S. Haddock, N. Knowlton, M. Martindale, M. Medina, C. Messing, S. J. O'Brien, G. Paulay, N. Putnam, T. Ravasi, G. W. Rouse, J. F. Ryan, A. Schulze, G. Wörheide
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- This article encourages collaborative efforts to sequence the genomes of thousands of invertebrate species.
- It highlights the utility of the study of genomes and thus elucidating biodiversity.

More than 95% of all metazoan (animal) species comprise the "invertebrates," but very few genomes from these organisms have been sequenced. We have, therefore, formed a "Global Invertebrate Genomics Alliance" (GIGA). Our intent is to build a collaborative network of diverse scientists to tackle major challenges (e.g., species selection, sample collection and storage, sequence assembly, annotation, analytical tools) associated with genome/transcriptome sequencing across a large taxonomic spectrum. We aim to promote standards that will facilitate comparative approaches to invertebrate genomics and collaborations across the international scientific community. Candidate study taxa include species from Porifera, Ctenophora, Cnidaria, Placozoa, Mollusca, Arthropoda, Echinodermata, Annelida, Bryozoa, and Platyhelminthes, among others. GIGA will target 7000 noninsect/nonnematode species, with an emphasis on marine taxa because of the unrivaled phyletic diversity in the oceans. Priorities for selecting invertebrates for sequencing will include, but are not restricted to, their phylogenetic placement; relevance to organismal, ecological, and conservation research; and their importance to fisheries and human health. We highlight benefits of sequencing both whole genomes (DNA) and transcriptomes and

also suggest policies for genomic-level data access and sharing based on transparency and inclusiveness. The GIGA Web site (http://giga.nova.edu) has been launched to facilitate this collaborative venture.
Expected Published Date: Unknown

Greenland surface albedo changes in July 1981–2012 1 from satellite observations
Journal of Environmental Research Letters
T. He, S. Liang, **Y. Yu**, D. Wang, F. Gao, and Q. Liu **(NESDIS)**

- The paper gives a comprehensive analysis of surface albedo variation in Greenland using a long time series (32 years) of the albedo data obtained from the Global Land Surface Satellite (GLASS) project.
- Results show a large decrease in surface albedo after 2000 (-0.0024 yr^{-1}), while the albedo change before 2000 is not statistically significant.
- Discrepancies in magnitude and trend were found between satellite albedo products and data output from the Intergovernmental Panel on Climate Change 5th Assessment Report (IPCC AR5) general circulation models (GCMs).

The significant melting events over Greenland have been observed during the last several decades. Instead of using reanalysis data and model simulations, this study presents an analysis of surface albedo change over Greenland by using a 32-year consistent satellite albedo product from the Global Land Surface Satellite (GLASS) project and ground measurements. Results show a large decrease in surface albedo after 2000 (-0.0024 yr^{-1}), while the albedo change before 2000 is not statistically significant. The most significant decrease after 2000 occurred at elevations 1000–1500 m (-0.0059 yr^{-1}) and may be associated with surface temperature increases. Changes in surface albedo may have offset the dimming in the shortwave range over Greenland mostly caused by the increased cloudiness. Discrepancies in magnitude and trend were found between satellite albedo products and data output from the Intergovernmental Panel on Climate Change 5th Assessment Report (IPCC AR5) general circulation models (GCMs).
Accepted: November 2013

Measuring the economic value of increased precision in scientific estimates of marine mammal abundance and bycatch: harbor porpoise Phocoena phocoena *in the northeast US gillnet fishery*
North American Journal of Fisheries Management
K. D. Bisack (NMFS/NEFSC) and G. Magnusson

- Authors present a framework that demonstrates methods and data exist to assess the economic tradeoffs associated with funding for biological assessments and to estimate an economic value for scientific information.
- Empirical results for harbor porpoise showed underfunding of surveys can result in a net economic loss to society. In the case study presented, the cost to fund scientific data collection for higher precision estimates, leading to a higher Potential Biological Removal (PBR) under the MMPA, is less than the benefit to the fishing industry of the higher PBR, which is enabled by the higher precision estimates. This suggests the private industry may want to contribute to funding the collection of scientific data for marine mammals to reduce uncertainty and allow for a higher PBR.
- The results of this study could inform the budget process and lead to a more efficient allocation of resources for the public sector with respect to biological assessments.

Marine mammal stock assessments provide information that is valuable to public sector management and the private fishing sector; however, data are costly to collect. The precautionary approach, widely used in fishery and marine mammal management, advocates a conservative management decision with priority to the resource when there is uncertainty regarding the impact on the resource from human activity. The Potential Biological Removal (PBR) control rule of the U.S. Marine Mammal Protection Act explicitly incorporates uncertainty in input variables in the determination of allowable levels of human-induced mortality for a stock. Less uncertainty results in higher PBR values for a given stock level. Variations in government funding levels can disrupt scientific data collection necessary for the PBR calculation. We present an economic net benefit framework that examines the indirect value of information from marine mammal stock assessments to the commercial fishing industry. The difference between total public sector data collection costs and total private sector benefits from increased profits are estimated, using harbor porpoise and the U.S. Atlantic sink gillnet fishery as a case study. Net benefits is a measure of the value of information to society, while the difference in profits measures the value of the information to the private sector. Several results are forthcoming. First, the optimal allocation of funding shows abundance surveys are a more cost-effective means to reduce uncertainty in PBR input variables than increasing observer coverage of the fishing industry. Second, for all levels of PBR in this empirical example, total benefits to the private sector for a higher PBR exceed the costs of collecting additional scientific data to increase the precision of input variables and thus PBR. Since net benefits are positive, the private sector may consider funding of scientific data collection for marine mammals to reduce uncertainty, which would allow a higher PBR value.

Accepted: November 14, 2013

NOAA SCIENTIFIC PUBLICATIONS REPORT
JANUARY 2014

Uncertainty in Annual Rankings from NOAA's Global Temperature Time Series
Geophysical Research Letters
A. Arguez, **T. Karl**, **M. Squires**, and **R. Vose (NOAA/NESDIS/NCDC)**

- Annual rankings of global temperature time series have a degree of uncertainty, hampering our ability to irrefutably pinpoint the warmest year(s) from 1880 to 2012.
- The authors apply a Monte Carlo uncertainty analysis to the National Oceanic and Atmospheric Administration's (NOAA) National Climatic Data Center's global land-ocean surface temperature (NOAATMP) time series to detect the highest probabilities for the warmest years over that time period.
- The authors concluded with sufficient statistical confidence that each year between 1997 and 2012 was warmer than the vast majority of all other years since 1880.

Annual rankings of global temperature are an important component of climate monitoring. However, there is some degree of uncertainty for every yearly value in the global temperature time series, which leads to uncertainty in annual rankings as well. This study applies a Monte Carlo uncertainty analysis to the National Oceanic and Atmospheric Administration's (NOAA) National Climatic Data Center's global land-ocean surface temperature (NOAATMP) time series. Accounting for persistence between years does not materially affect the results versus presuming statistical independence. The highest probabilities for the warmest year analysis (1880-2012) are associated with the years 2010 (~36%), 2005 (~28%), and 1998 (~11%). The current separation among the warmest observed years is relatively small compared to the standard errors of the NOAATMP time series. However, each year between 1997 and 2012 was warmer than the vast majority of all other years since 1880 at the 95% confidence level.
Expected publication date: March 31, 2014

A proposed, tested, and applied adjustment to account for bias in growth parameter estimates due to selectivity
Fisheries Research
A. M. Schueller, E. H. Williams, and **R. T. Cheshire (NMFS/SEFSC)**

- Bias in growth curve parameters can be reduced when accounting for selectivity of the gear used to sample the population, and the reduction in bias has direct impacts on growth and stock status in stock assessment models.

- The Method proposed and tested with simulation modeling can be used to account for minimum size limits, maximum size limits, and dome-shaped selectivity when estimating growth curve parameters.
- The significance could be quite large for both management and policy for the case study species in the paper, as well as other fisheries.

Growth information is important for stock assessments because it gives an indication of spawning stock biomass in the form of weight or fecundity, which is an important indicator of stock status, as well as being important if fitting to length composition data. Sampling for growth characteristics should include all ages and sizes in the population, but data are often only available from fishery-dependent sampling, which can lead to biased estimates of true underlying population growth parameters because of selectivity, which includes both gear selectivity and availability. Two stock assessments with the potential for biased growth because of dome-shaped selectivity and lack of fishery-independent age data are the Gulf and Atlantic menhaden assessments. The objectives of our study were 1) to develop and test a method to estimate unbiased growth parameters regardless of the selectivity of the gear used to sample ages and lengths and 2) to apply the proposed method to fit unbiased population growth parameters for Gulf and Atlantic menhaden. We propose a method to adjust for the bias in the growth curve parameters and account for missing samples at smaller and larger lengths. The proposed method was tested on simulated data and applied to data for Gulf and Atlantic menhaden. Use of the adjustments was robust and resulted in reduced bias in the growth parameter estimates with accuracy being affected by both sample size and variability in mean length at age. Increasing the sample sizes increased the accuracy of the adjustments (i.e., as the coefficient of variation (*CV*) for length at age increased, the accuracy of the estimates decreased). For Gulf menhaden, the parameters estimated for the unadjusted growth curve were L_∞ = 240.8, k = 0.38, t_0 = -1.14, and CV of length at age = 0.06 (assumed constant) with a total sample size of 366,710 from 1977-2011. For Atlantic menhaden, the parameters estimated for the unadjusted growth curve were L_∞ = 350.9, k = 0.32, t_0 = -0.83, and CV of length at age = 0.12 (assumed constant) with a total sample size of 480,668 from 1955-2011. The adjustment for a maximum length of capture had a large impact on the overall growth parameters for both species, while the adjustment for a minimum length of capture had less impact. Bias in the growth curve parameter estimates can be reduced by using the method outlined to account for selectivity.

Expected Publication Date: Fall 2013 or Winter 2014

Elevated Temperatures Increase the Toxicity of Pesticide Mixtures to Juvenile Coho Salmon

Aquatic Toxicology

NOAA SCIENTIFIC PUBLICATIONS REPORT
JANUARY 2014

K. Laetz (NMFS/NWFSC), D. Baldwin (NMFS/NWFSC), S. Herbert, and **N. Scholz (NMFS/NWFSC)**

- This study demonstrates an interaction between elevated surface water temperatures and pesticide synergistic neurotoxicity to juvenile salmon.
- Relatively modest increases in temperature significantly enhance the toxicity of simple chemical mixtures to Coho salmon juveniles.

Pesticide mixtures and elevated temperatures are parallel freshwater habitat stressors for Pacific salmon in the western United States. Certain combinations of organophosphate (OP) insecticides are known to cause synergistic neurotoxicity in juvenile salmon. The chemicals interact within mixtures to potentiate the inhibition of brain acetylcholinesterase (AChE) and disrupt swimming behavior. The metabolic activation and detoxification of OPs involve temperature-sensitive enzymatic processes. Salmon are ectothermic, and thus the degree of synergism may vary with ambient temperature in streams, rivers, and lakes. Here we assess the influence of water temperature (12-21 degC) on the toxicity of ethoprop and malathion, alone and in combination, to juvenile coho salmon (*Oncorhynchus kisutch*). A mixture of ethoprop (0.9 µg/L) and malathion (0.8 µg/L) produced synergistic AChE inhibition at 12 oC, and the degree of neurotoxicity approximately doubled with a modest temperature increase to 18 degC. Slightly lower concentrations of ethoprop (0.5 µg/L) combined with malathion (0.4 µg/L) did not inhibit brain AChE activity but did produce a temperature-dependent reduction in liver carboxylesterase (CaE). The activity of CaE was very sensitive to the inhibitory effects ethoprop alone and both ethoprop-malathion combinations across all temperatures. Our findings are an example of how non-chemical habitat attributes can increase the relative toxicity of OP mixtures. Surface temperatures currently exceed water quality criteria in many western river segments, and summer thermal extremes are expected to become more frequent in a changing climate. These trends reinforce the importance of pollution reduction strategies to enhance ongoing salmon conservation and recovery efforts.
Expected publication date: Winter 2014

Evaluation of the National Weather Service's Extreme Cold Warning experiment in North Dakota during the 2012 winter season
Bulletin of the American Meteorological Society
C. H. Chiu, R. S. Noe, **J. P. Martin (NWS/WFO)**, A. F. Wolkin, and S. J. Vagi

- This study finds the NWS Extreme Cold Warning product well-understood and received in the 2nd largest county (population) in North Dakota.
- This is one of the first times that NWS has worked together with public health agencies to assess effectiveness of warming products, and may set the stage for future collaborative efforts.

NOAA SCIENTIFIC PUBLICATIONS REPORT
JANUARY 2014

Dangerously cold weather threatens life and property. During periods of extreme cold due to wind chill, the National Weather Service (NWS) issues Wind Chill Warnings to prompt the public to take action to mitigate risks. Wind Chill Warnings are based on ambient temperatures and wind speeds. Beginning in the 2011 winter, NWS piloted a new Extreme Cold Warning that was issued for cold temperatures for both wind and non-wind conditions. The North Dakota Department of Health, NWS, and Centers for Disease Control and Prevention collaborated in conducting household surveys in Burleigh County, North Dakota to evaluate this new warning. The objectives of the evaluation were to assess whether residents understood the new warning and determine if protective behaviors were prompted by the warning. This was a cross-sectional study design using the Community Assessment for Public Health Emergency Response (CASPER) methodology to select a statistically representative sample of households from Burleigh County. From April 10–11, 2012, 188 door-to-door household interviews were completed. The CASPER method uses weighted analysis to project the number and percentage of households with a specific response within Burleigh County. The majority of households reported having heard both the Extreme Cold and Wind Chill Warnings; both warnings prompted appropriate protective behaviors. The results suggest this community heard the new warning and took appropriate protection based on the warning.
Acceptance Date: 17 May 2013
http://journals.ametsoc.org/doi/pdf/10.1175/BAMS-D-12-00123.1
http://journals.ametsoc.org/doi/pdf/10.1175/WCAS-D-13-00023.1

Distribution of demersal fishes along the U.S. west coast (Canada to Mexico) in relation to spatial fishing closures (2003 2011)
Marine Ecology Progress Series
A. A. Keller, **W. W. Wakefield**, **C. E. Whitmire**, **B. H. Horness**, **M. A. Bellman**, and **K. L. Bosley (NMFS/NWFSC)**

- Authors found that for 27 species and five subgroups of demersal fishes, mean catch was significantly greater within the Rockfish Conservation Area continuously closed to commercial bottom trawling relative to areas periodically closed or open.
- Mean species richness was greatest and a higher proportion of larger fish were most often (~65%) present in the area that was continuously closed to commercial bottom trawling.
- These finding suggest that the Rockfish Conservation Area is an effective management tool for conserving not only rockfish, but other demersal fish species.

A temporally and spatially variable Rockfish Conservation Area (RCA) was established along the U.S. west coast in 2002 to protect long-lived rockfish stocks (*Sebastes* spp.) by restricting commercial trawling in regions where depleted stocks were most abundant. Since the RCA falls within the region sampled annually by the Northwest Fisheries Science Center's West Coast Groundfish Bottom Trawl Survey (32º30′ – 48º10′ N Lat.), the authors utilized data collected from 2003 to 2011 to evaluate the impact of

the RCA on catch per unit effort (CPUE, kg ha-1), species richness, and size distribution of demersal fish. Authors compared catch and species richness among three management areas (continuously closed, periodically closed, and open to commercial bottom trawling) using analysis of covariance models that account for variability due to area, year, and depth. The most appropriate models for catch (35 species treated individually and aggregated into six subgroups) and species richness were selected using Akaike's information criteria (AIC). All of the best fit models were highly significant ($P < 0.0001$), explaining 3 to 76% of the variation in catch and the majority (19 of 35) included both area and depth. For 27 species and five subgroups of demersal fish, the mean CPUE (based on Tukey's multiple comparison test) was significantly greater within the area continuously closed to commercial bottom trawling relative to areas periodically closed or open. The most appropriate model for species richness included area and year and mean richness was greatest in the area continuously closed to commercial bottom trawling. Species-specific length composition distributions were calculated from subsampled individual lengths which were available for 31 species. Significant differences in length frequency distributions (Kolmogorov-Smirnov asymptotic test statistic, $P < 0.001$) were observed for these 31 demersal fish species, with a higher proportion of larger fish most often (~65%) present in areas continuously closed to commercial bottom trawling (20 of 31 species) relative to other areas. The data suggest that the RCA is an effective management tool for conserving not only rockfish, but other demersal fish species. Although no increases in CPUE occurred over the time examined, both catch and species richness were greater in the closed portion of the RCA and a higher proportion of larger fish occurred there.
Expected Publication Date: March 2014

Fatalities in the United States from Atlantic tropical cyclones-new data and interpretation
Bulletin of the American Meteorological Society
E. Rappaport (NWS/NCEP)

- From 1970-1999 about 2,500 fatalities (~50 per year on average) occurred due to Atlantic tropical cyclones. Katrina was responsible for almost half of them.
- While rainfall-related deaths occurred in more storms than any other hazard, storm surge took more lives than any other hazard (49%). Roughly 90% of the deaths occurred in water-related incidents, most by drowning. Rainfall-induced freshwater floods and mudslides accounted for about one quarter of the deaths (27%).
- The results of this study support NOAA's increasing operational, outreach, and research efforts directed at minimizing loss of life and property associated with storm surge.

This paper updates a *Bulletin of the American Meteorological Society* study that discussed loss of life in the United States from Atlantic tropical cyclones during the period 1970-99. The update extends the analysis period and brings it forward to span the most recent 50 years, providing for a more robust sample while retaining contemporary relevance. The extended period adds the casualties inflicted by such catastrophic hurricanes as Betsy (1965), Camille (1969), Katrina (2005) and Sandy (2012). The analysis finds that

about 2,500 fatalities occurred over the study period, around 50 per year on average. Katrina was responsible for almost half of them. As indicated in the prior study, a large majority of the deaths were due to drowning. The additional data, however, lead to some important revisions to the analysis and interpretation. Among these, storm surge deaths accounted for about half of the fatalities. Rainfall-induced flood deaths are the second most numerous, at about a quarter of the total, but occur in more storms than any other hazard. These data support NOAA's increasing operational, outreach and research efforts directed at minimizing loss of life and property associated with storm surge.
Expected Publication Date: March 2014
Early Online: http://journals.ametsoc.org/doi/pdf/10.1175/BAMS-D-12-00074.1

Observed decline of the Atlantic Meridional Overturning Circulation 2004 to 2012
Ocean Science
D. A. Smeed, G. McCarthy, S. A. Cunningham, E. Frajka-Williams, D. Rayner, W. E. Johns, **C. S. Meinen**, **M. O. Baringer**, B. I. Moat, A. Duchez, and H. L. Bryden

- The observations indicate that there has been an overall slight weakening trend to the MOC during this eight-year record.
- The observed downward trend is driven nearly entirely by changes in the mid-ocean circulation, although the Gulf Stream and direct wind forcing (Ekman) have played a small role.
- The observed trend is statistically significant, however it greatly exceeds any predicted changes associated with long-term climate change, and it seems likely to be associated with interannual and/or decadal variability.

The Meridional Overturning Circulation (MOC) dominates the north-south transport of heat in the world oceans, and variations in the MOC have been shown to correlate to changes in societally important quantities such as precipitation patterns, sea surface temperatures, and hurricane intensification. The 'gold-standard' of MOC observing systems over the past decade has been the 26.5°N international array supported by the United States (NOAA & NSF) and the United Kingdom (NERC). In this new paper, daily estimates of the MOC collected at 26.5°N from 2004 through 2012 are analyzed to study the interannual trends in the Atlantic MOC variability.
Publication Date: 13 September 2013
http://www.aoml.noaa.gov/phod/docs/Smeed_2013.pdf

Health of common bottlenose dolphins (Tursiops truncatus) *in Barataria Bay, Louisiana following the Deepwater Horizon oil spill*
Environmental Science and Technology
L. H. Schwacke (NOS/NCCOS), C. R. Smith, F. I. Townsend, R. S. Wells, **L. B. Hart (NOS/NCCOS)**, B. C. Balmer, T. K. Collier, S. De Guise, M. M. Fry, L. J. Guillette Jr., S. V. Lamb, **S. M. Lane (NOS/NCCOS), W. E. McFee (NOS/NCCOS)**, N. J. Place, M. C. Tumlin, **G. M. Ylitalo (NMFS/NWFSC)**, **E. S. Zolman (NOS/NCCOS)**, **T. K. Rowles (NMFS/OPR)**

- The study provides the first line of evidence that dolphins in heavily oiled coastal areas exhibit health effects, and the effects are consistent with those that might be expected from oil exposure.
- The health issues are significant and likely will lead to reduced survival and fecundity for the population.
- This is the first peer-reviewed study from the dolphin DWH NRDA; subsequent reports will describe additional lines of evidence for decreased survival and fecundity and compare health results from this study with pathology findings from the ongoing Gulf of Mexico Unusual Mortality Event.

The oil spill resulting from the explosion of the *Deepwater Horizon* drilling platform initiated immediate concern for marine wildlife, including common bottlenose dolphins in sensitive coastal habitats. To evaluate potential sublethal effects on dolphins, health assessments were conducted in Barataria Bay, Louisiana, an area that received heavy and prolonged oiling, and in a reference site, Sarasota Bay, Florida, where oil was not observed. Dolphins were temporarily captured, received a veterinary examination, and were then released. Dolphins sampled in Barataria Bay showed evidence of hypoadrenocorticism, consistent with adrenal toxicity as previously reported for laboratory mammals exposed to oil. Barataria Bay dolphins were 5 times more likely to have moderate-severe lung disease, generally characterized by significant alveolar interstitial syndrome, lung masses and pulmonary consolidation. Of 29 dolphins evaluated from Barataria Bay, 48% were given a guarded or worse prognosis, and 17% were considered poor or grave, indicating that they were not expected to survive. Disease conditions in Barataria Bay dolphins were significantly greater in prevalence and severity than those in Sarasota Bay dolphins, as well as those previously reported in other wild dolphin populations. Many disease conditions observed in Barataria Bay dolphins are uncommon, but consistent with petroleum hydrocarbon exposure and toxicity.

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http://pubs.acs.org/doi/pdf/10.1021/es403610f

Geographic patterns of genetic variation in a broadly distributed marine vertebrate: new insights into loggerhead turtle stock structure from expanded mitochondrial DNA sequences
PLoS ONE
B. M. Shamblin, A. B. Bolten, F. A. Abreu-Grobois, K. A. Bjorndal, L. Cardona, C. Carreras, M. Clusa, C. Monzón-Argüello, C. J. Nairn, J. T. Nielsen, R. Nel, L. S. Soares, **K. R. Stewart,** S. T. Vilaça, O. Türkozan, C. Yilmaz, **P. H. Dutton (NMFS/SWFSC)**

- This paper is the product of an international expert working group convened by NMFS and presents a much anticipated synthesis of data available for all key nesting populations of loggerhead turtles in the Atlantic, Mediterranean, and western Indian Ocean.

- The study identified 18 demographically independent Management Units (rookery stocks) and now provides a baseline dataset to enable meaningful stock identification (Mixed Stock Analysis) of feeding aggregations and fisheries bycatch to be carried out.
- This study represents a valuable model for conducting comprehensive international cooperative data management and research in marine ecology.

Previous genetic studies have demonstrated that natal homing shapes the stock structure of marine turtle nesting populations. However, widespread sharing of common haplotypes based on short segments of the mitochondrial control region often limit resolution of the demographic connectivity of populations. Recent studies employing longer control region sequences to resolve haplotype sharing have focused on regional assessments of genetic structure and phylogeography. Here we synthesize available control region sequences for loggerhead turtles from the Mediterranean Sea, Atlantic, and western Indian Ocean basins. These data represent six of the nine globally significant regional management units (RMUs) for the species and include novel sequence data from Brazil, Cape Verde, South Africa and Oman. Genetic tests of differentiation among 42 rookeries represented by short sequences (380 bp haplotypes from 3,486 samples) and 40 rookeries represented by long sequences (~800 bp haplotypes from 3,434 samples) supported the distinction of the six RMUs analyzed as well as recognition of at least 18 demographically independent management units (MUs) with respect to female natal homing. A total of 59 haplotypes were resolved. These haplotypes belonged to two highly divergent global lineages, with haplogroup I represented primarily by CC-A1, CC-A4, and CC-A11 variants and haplogroup II represented by CC-A2 and derived variants. Geographic distribution patterns of haplogroup II haplotypes and the nested position of haplotype CC-A11.6 from Oman among Atlantic haplotypes invoke recent colonization of the Indian Ocean from the Atlantic for both global lineages. The haplotypes we confirmed for western Indian Ocean RMUs allow reinterpretation of previous mixed stock analysis and further suggest that contemporary migratory connectivity between the Indian and Atlantic Oceans occurs on a broader scale than previously hypothesized.
Expected Publication Date: February 2014

Extinction risk and conservation of the world's sharks and rays
E-Life
N. Dulvy, S. Fowler, J. Musick, R. Cavanagh, P. Kyne, L. Harrison, **J. Carlson (NMFS/SEFSC)**, L. Davidson, S. Fordham, M. Francis, C. Pollock, C. Simpfendorfer, G. Burgess, K. Carpenter, L. Compagno, D. Ebert, C. Gibson, M. Heupel, S. Livingstone, J. Sanciangco, J. Stevens, S. Valenti, and W. White

- This paper highlights the perilous status of the world's elasmobranch fisheries, with one-quarter of elasmobranchs threatened with extinction due to overfishing (targeted and incidental).

- Using IUCN redlist global status assessment of sharks and rays reveals the principal causes and severity of global marine biodiversity loss and the threat level they face exposes a serious shortfall in the conservation management of commercially-exploited aquatic species.
- Population depletion has occurred throughout the world's ice-free waters, but is particularly prevalent in the Indo-Pacific Biodiversity Triangle and Mediterranean Sea.

The rapid expansion of human activities threatens ocean-wide biodiversity loss. Numerous marine animal populations have declined, yet it remains unclear whether these trends are symptomatic of a chronic accumulation of global marine extinction risk. We present the first systematic analysis of threat for a globally distributed lineage of 1,041 chondrichthyan fishes - sharks, rays, and chimaeras. We estimate that one-quarter are threatened according to IUCN Red List criteria due to overfishing (targeted and incidental). Large-bodied, shallow- water species are at greatest risk and five out of the seven most threatened families are rays. Overall chondrichthyan extinction risk is substantially higher than for most other vertebrates, and less than one-quarter of species are considered safe. Population depletion has occurred throughout the world's ice-free waters, but is particularly prevalent in the Indo-Pacific Biodiversity Triangle and Mediterranean Sea. Improved management of fisheries and trade is urgently needed to avoid extinctions and promote population recovery.
Expected Publication Date: January 2014

2. ADDITIONAL ARTICLES

Ratiometric measurements of adiponectin by mass spectrometry in bottlenose dolphins (Tursiops truncatus) *with iron overload reveal an association with insulin resistance and glucagen*
Frontiers in Endocrinology
B. A. Neely, K. P. Carlin, J. M. Arthur, **W. E. McFee (NOS/NCCOS),** and M. G. Janech

- This study examines dolphin adiponectin (a protein which regulates glucose levels and is involved in fatty acid breakdown) levels in 'healthy' (control) dolphins (N=5) and dolphins with a hepatic iron overload (N=4).
- Total and percent unmodified adiponectin correlated well with control dolphins, but not with the hepatic iron overload group, which is possibly a reflection of insulin resistance.
- Although total adiponectin levels were not significantly different, the elevated percent unmodified adiponectin follows a trend similar to HMW adiponectin reported for humans with metabolic disorders. In humans, high molecular weight (HMW) adiponectin levels are reduced in disorders that lead to metabolic syndrome, including type 2 diabetes and liver disease.

Bottlenose dolphins diagnosed with hemochromatosis-like pathology (iron overload) have demonstrated significantly higher levels of plasma insulin 2 hours after feeding than healthy controls, suggesting a pathologic form of insulin resistance. A parallel reaction monitoring assay for dolphin serum adiponectin was developed based on identified tryptic peptides. Post-translational modifications of dolphin adiponectin were also discovered by mass spectrometry and a differential measurement was

constructed. Total and unmodified adiponectin levels were measured in sera from dolphins with hepatic iron overload (N=4) and 'healthy' control dolphins (N=5) to examine associations between adiponectin and hepatic iron overload. This measurement yielded total adiponectin levels as well as site specific percent unmodified adiponectin that may inversely correlate to HMW adiponectin. Differences in plasma insulin levels between hepatic iron overload cases and controls were observed 2 hours after feeding, but not during the fasting state. Thus, 2 hours after feeding as well as fasting serum adiponectin levels were measured for cases and controls to determine whether adiponectin and insulin would follow similar patterns. There was no difference in total adiponectin or percentage unmodified adiponectin in fasting animals. There was no difference in total adiponectin levels between the 2 hours after feeding case and control dolphins (mean ± S.D.) at 763.25 ± 297.6 and 726.69 ± 290.5 pmol/ml, respectively ($p = 0.91$); however, the percentage of unmodified adiponectin was significantly higher in dolphins with hepatic iron overload than those without (30 ± 6.3 versus 17 ± 6.6%, respectively; $p = 0.016$).
Published: November 2013

Integrating Bayesian statistics, novel concentration methods and real-time PCR in quantifying human adenoviruses in source water
Science of the Total Environment
J. Wu, **A. D. Gronewold (OAR/GLERL)**, R. Rodriguez, J. R. Stewart, and M. D. Sobsey

- Rapid and accurate quantification of viral pathogens in water is needed to reduce waterborne disease risk and to improve drinking water safety.
- Current methods used to quantify pathogens are limited.
- The authors apply a Bayesian model that quantifies uncertainty and provides a better understanding of potential risks to public health, particularly in cases when pathogens may present a threat but are not detected using current detection methods.

Rapid quantification of viral pathogens in drinking and recreational water can help reduce waterborne disease
risks. For this purpose, samples in small volume (e.g. 1 L) are favored because of the convenience of collection, transportation and processing. However, the results of viral analysis are often subject to uncertainty. To overcome this limitation, the authors propose an approach that integrates Bayesian statistics, efficient concentration methods, and quantitative PCR (qPCR) to quantify viral pathogens in water. Using this approach, human adenoviruses (HAdVs) were quantified in eighteen samples of source water collected from six drinking water treatment plants. HAdVs were found in seven samples. In the other eleven samples, HAdVs were not detected by qPCR, but might have existed based on Bayesian inference. This integrated approach that quantifies uncertainty provides a better understanding than conventional assessments of potential risks to public health, particularly in cases when pathogens may present a threat but cannot be detected by traditional methods.
Expected Publication Date: January 2014

NOAA SCIENTIFIC PUBLICATIONS REPORT
JANUARY 2014

Growth and maximum size of tiger sharks in Hawaii
PLoS ONE
C. G. Meyer, **J. M. O'Malley (NMFS/PIFSC)**, Y. P. Papastatiou, J. J. Dale, M. R. Hutchinson, J. M. Anderson, M. A. Royer, and K. N.
Holland

- The authors of this study use empirical mark-recapture data to estimate growth rates and maximum size for tiger sharks in Hawaii
- Results indicate tiger sharks in Hawaii grow twice as fast as previously believed, thus exhibiting growth rates consistent with those seen in several other regions (e.g., the Atlantic).
- Rapid growth may be a strategy for reducing juvenile predation risk.
- Tiger sharks larger than 450 cm TL are rare, and tiger sharks that exceed 450 cm TL are very small in number.

Tiger sharks (*Galecerdo cuvier*) are apex predators characterized by their broad diet, large size and rapid growth. Tiger shark maximum size is typically between 380 & 450 cm Total Length (TL), with a few individuals reaching 550 cm TL, but the maximum size of tiger sharks in Hawaii waters remains uncertain. A previous study suggested tiger sharks grow rather slowly in Hawaii compared to other regions, but this may have been an artifact of the method used to estimate growth (unvalidated vertebral ring counts) compounded by small sample size and narrow size range. Since 1993, the University of Hawaii has conducted a research program aimed at elucidating tiger shark biology, and to date 420 tiger sharks have been tagged and 50 recaptured. All recaptures were from Hawaii except a single shark recaptured off Isla Jacques Cousteau (24°13′17″N 109°52′14″W), in the southern Gulf of California (minimum distance between tag and recapture sites = approximately 5,000 km), after 366 days at liberty (DAL). These empirical mark-recapture data were used to estimate growth rates and maximum size for tiger sharks in Hawaii. Tiger sharks in Hawaii were found to grow twice as fast as previously thought, on average reaching 340 cm TL by age 5, and attaining a maximum size of 403 cm TL. The model indicates the fastest growing individuals attain 400 cm TL by age 5, and the largest reach a maximum size of 444 cm TL. The largest shark captured during this study was 464 cm TL, but individuals > 450 cm TL were extremely rare (0.005% of sharks captured). The authors conclude that tiger shark growth rates and maximum sizes in Hawaii are generally consistent with those in other regions, and hypothesize that a broad diet may help them to achieve this rapid growth by maximizing prey consumption rates.
Expected publication date: 8 January 2014

Granular hemocytes are phagocytic, but agranular hemocytes are not, in the Eastern Oyster Crassostrea virginica
Invertebrate Immunity
G. H. Wikfors and **J. H. Alix (NMFS/NEFSC)**

- Roles of granular and agranular hemocytes in bivalve shellfish immune functions have eluded definitive description for a century.

- Advances in flow cytometry allowed us to identify granular hemocytes as the sole phagocytes in the eastern oyster.
- This finding will improve health assessments of oysters in natural, restored, and aquacultured populations.

Hemocytes in oysters are known to be involved in the innate immune response to pathogenic bacteria and parasitic protozoa; some hemocytes are phagocytic and capable of killing invading microorganisms through intracellular ROS and proteolytic enzyme release into phagosomes. Although this activity has been associated for some time with granular hemocytes – cells with ROS- and enzyme-producing granules – the possible roles of agranular hemocytes in oysters have remained obscure. One hypothesis, that agranular hemocytes are phagocytic despite the lack of granules, was tested in the present study by sorting granular and agranular hemocytes from adult oysters into separate test tubes with a sorting flow cytometer and conducting a routine phagocytosis assay using analytical flow cytometry. Sorting of functional granular hemocytes was necessary, because in a mix, phagocytic agranular cells could become granular after incorporation of bacterial or other particles. Granular hemocytes were phagocytic before and after sorting, and agranular hemocytes were not phagocytic before or after sorting. We relate this finding to developing hypotheses about the origins and roles of different hemocyte types in oysters.
Expected Publication Date: March 1, 2014

Heat stress and light stress induce different cellular pathologies in the symbiotic dinoflagellate during coral bleaching
PLoS ONE
C. A. Downs, K. E. McDougall, **C. M. Woodley (NOS/NCCOS)**, J. E. Fauth, R. Richmond, A. Kushmaro, S. W. Gibb, Y. Loya, G. K. Ostrander, and E. Kramarsky-Winter

- Heat stress and light stress induce different pathologies in the symbiotic dinoflagellates during the early onset of coral bleaching, indicating that these stressor act via different mechanisms.
- The sources of oxidative stress and the final receptors of its damage differ when bleaching is induced by heat stress or light stress.

Coral bleaching is a key cause of coral reef degradation worldwide and is indicative of the termination of symbiosis between the coral host and its symbiotic algae (dinoflagellates; Symbiodinium sp. complex). Bleaching results in an uncoupling of the coral-dinoflagellate symbiosis and can occur via dinoflagellates expulsion or by their "digestion" through the xenophagic (symbiophagic) pathway. The uncoupling of this symbiosis occurs at least in part as a result of pathomorphological changes occurring in the symbiont.
Acceptance date: September 2, 2013

Anthropogenic and environmental influence on population structure for Eastern USA inshore bottlenose dolphins
Journal of Heredity

NOAA SCIENTIFIC PUBLICATIONS REPORT
JANUARY 2014

V. P. Richards, **T. W. Greig**, **P. A. Fair,** S. D. McCulloch, C. Politz, A. Natoli, C. A. Driscoll, A. R. Hoelzel, V. David, G. D. Bossart, and J. V. Lopez **(NOS/NCCOS)**

- Authors show for the first time that the Indian River Lagoon Estuarine System Stock (IRLES) of bottlenose dolphins is comprised of two distinct genetic populations and that are partially sympatric and strongly differentiated from other eastern US coastal populations and stocks.
- The authors' findings emphasize the role of habitat and the consequence of its modification in shaping bottlenose dolphin population structure, and highlight the possibility of multiple management units existing in discrete inshore habitats along the entire eastern U.S. shoreline.
- Consideration of these inshore population characteristics and the potential detrimental effects of anthropogenic disturbance can contribute to the long-term success of bottlenose dolphin management strategies.

Globally distributed, the bottlenose dolphin (*Tursiops truncatus*) is found in a range of offshore and coastal habitats. Using fifteen microsatellite loci and mtDNA control region sequences, the authors investigated patterns of genetic differentiation among putative populations along the eastern United States shoreline (the Indian River Lagoon, Florida and Charleston Harbor, South Carolina). Authors further utilized the mtDNA to compare these populations to those from the Northwest Atlantic, Gulf of Mexico, and Caribbean. Results showed strong differentiation among inshore, alongshore, and offshore habitats. In addition, Bayesian clustering analyses revealed the presence of two genetic clusters (populations) within the 250 km Indian River Lagoon. Habitat heterogeneity is likely an important force diversifying bottlenose dolphin populations through its influence on social behavior and foraging strategy. The authors propose that the spatial pattern of genetic variation within the lagoon reflects both its steep longitudinal transition of climate and also its historical discontinuity and recent connection as part of Intracoastal Waterway development. These findings have important management implications as they emphasize the role of habitat and the consequence of its modification in shaping bottlenose dolphin population structure, and highlight the possibility of multiple management units existing in discrete inshore habitats along the entire eastern U.S. shoreline.

Accepted: May 3, 2013

Subarctic cetaceans in the southern Chukchi Sea: evidence of recovery or response to a changing ecosystem
Oceanography

J. Clarke, K. Stafford, **S. E. Moore (NMFS/OST), B. Rone (NMFS/AKFSC),** L. Aerts, and **J. Crance (NMFS/AKFSC)**

- By comparing compiled visual sightings and acoustic detections of subarctic cetaceans in the southern Chukchi Sea during summer and early autumn, 2009-2012 and historical records, authors found that the incidence of subarctic cetaceans may be increasing in the southern Chukchi Sea.
- This increase in cetacean sightings may be due to recovery or may reflect cetacean responses to ongoing climate change.

- Additional research is needed to understand how climate change and an increase in anthropogenic activities may impact these species.

The southern Chukchi Sea is one of the most productive areas among the world's oceans. The region has experienced dramatic changes in sea ice cover and Bering Strait inflow over the past decade, and is in the path of trans-polar shipping and destinational ship traffic including vessels supporting arctic offshore oil and gas development and tourism, all of which are anticipated to increase with decreasing seasonal sea-ice cover. Little research on cetaceans has been conducted in the southern Chukchi Sea, and most information on the occurrence of subarctic species (humpback whale, *Megaptera novaeangliae*; fin whale, *Balaenoptera physalus*; minke whale, *B. acutorostrata*; and killer whale, *Orcinus orca*), comes from the ship's logs of commercial whalers in the mid-late 20th century and from observers stationed along the Chukotka Peninsula. Information on cetacean seasonal occurrence east of the International Date Line (IDL) in US waters is particularly scarce. To address this information gap, the authors compiled visual sightings and acoustic detections of subarctic cetaceans in the southern Chukchi Sea during summer and early autumn, 2009-2012. Humpback whales were common on both sides of the IDL in August and September. Fin and minke whales were widely distributed east of the IDL from July to September, and killer whales were seen sporadically but were the most widely dispersed of the four species. Comparisons of the results with historical records indicate that the incidence of subarctic cetaceans may be increasing in the southern Chukchi Sea. An increase in occurrence may simply be a post-commercial whaling recovery of whale numbers and seasonal range by each species, or may reflect responses to ongoing climate change. Understanding current stock identity, spatial and temporal distribution, habitat preference, relative abundance, and potential impacts of climate change on these species will require cetacean-focused research in this region of the Arctic.
Expected Publication Date: January 2014

Influence of collection and storage conditions on ACTH measurements in dolphins (Tursiops truncatus)
Aquatic Mammals
L. Lewis, S. Lamb, A. M. Schaefer, J. S. Reif, G. D. Bossart, and **P. A. Fair (NOS/NCCOS)**

- Authors examined factors that influence the pre-analytical stability of ACTH in bottlenose dolphins contributing important knowledge of the effects of anticoagulants, serum and temperature on ACTH in bottlenose dolphins.
- The study provides recommendations for developing and standardizing best collection practices, and will allow a better understanding of previously analyzed samples and comparisons of data sets using differing protocols.

Identifying the effects of stressors on marine mammal health is critical for species conservation and collection. Adrenocorticotropic Hormone (ACTH) is a key indicator of peracute stress; however, handling methods may affect results. Thus, the aim of this study was to examine the effects of collection methods and storage temperature on the stability of dolphin ACTH measurements. Blood was collected from five managed-care bottlenose dolphins in four vacutainers in the following sequence: EDTA, sodium heparin,

serum separator, and 2nd EDTA. The specimens were centrifuged, processed immediately, aliquoted into plasma and serum and divided into 4 equal volumes. These aliquots were immediately stored at either 4 degrees C or -80 degrees C for 24 h prior to ACTH assay. ACTH concentrations were compared between the collection tube types and the storage temperatures. There was a significant difference in ACTH concentration across collection tube types. ACTH concentrations were highest in ethylenediaminetetraacetic acid (EDTA) tubes and lowest in serum separator tubes at both temperatures. Twenty-four h storage temperature did not have a statistically significant impact on mean ACTH concentration. There was no significant difference in ACTH concentration between the first and last drawn EDTA tubes. Bottlenose dolphin whole blood should be collected in EDTA for ACTH measurement. Samples may be refrigerated and shipped on cold packs if assayed within 24 h of collection or immediately frozen and shipped. When multiple samples are collected in various collection tubes at the same time, the order in which tubes are filled does not affect the ACTH measurement.
Accepted: August 2, 2013

Tradeoffs between bias, robustness, and common sense when choosing selectivity forms
Fisheries Research
P. J. F. Hulson and **D. H. Hanselman (NMFS/AKFSC)**

- Authors conducted simulations across two life history types to test whether allowing more complicated selectivity (a combination of gear vulnerability and fish availability) forms is both estimable and justified when compared to simpler selectivity curves with a lower number of parameters.
- Results indicated that in general, uncertainty and bias in final year spawning biomass was not consistent across the life history types, the parameterizations employed, or fishing to the left or right side of the maturity curve.
- Authors found that long-lived species, because of their wide age distribution, may not have sufficient data to estimate complicated selectivity shapes.

Selectivity, as a combination of gear vulnerability and fish availability, can be modeled in age-structured assessment models with simple functions that range from those that employ a small number of parameters to those that use complex and highly parameterized functions. The authors conducted simulations across two life history types to test whether allowing more complicated selectivity forms is both estimable and justified when compared to simpler selectivity curves with a lower number of parameters. Operating models were constructed with asymptotic and dome-shaped fishery and survey selectivity and estimation models were evaluated that used a range of complexity in fishery selectivity from the 2-parameter logistic to the highly parameterized double normal function. Results indicated that in general, uncertainty and bias in final year spawning biomass was not consistent across the life history types, the parameterizations employed, or fishing to the left or right side of the maturity curve. For instance, estimating a dome shaped selectivity for the survey when the true selectivity was asymptotic did not result in positive bias in all cases, and, estimating asymptotic fishing selectivity was not always

conservative. Overall, we find that more complex selectivity functions and even time-dependent parameterizations of selectivity may be robust for short-lived species, but may not be robust when applied to long-lived species.
Accepted: December 20, 2013

Accuracy assessment of test flights using the Turnkey Airborne Gravity System over Alabama in 2008
Journal of Geodetic Science
Y. Wang, S. Preaux, T. Diehl, V. Childers, D. Roman, and **D. Smith (NOS/NGS)**
The National Geodetic Survey (NGS) performed a few test flights using Micro-g's Turnkey Airborne Gravity System (TAGS) at altitude of 1700, 6300 and 11000 meters over Alabama in 2008. The cross-track spacing was 10 km for the two lower flights and 5 km for the highest flight. The test flights not only provided important information regarding the precision and accuracy of the TAGS but also revealed the impact of flight altitudes and track spacing on the collected gravity data. The gravity anomalies at three altitudes were modeled using 3-dimensional Fourier series, then compared at the three altitudes. The agreement was excellent - the gravity anomalies agree with each other from 1.4 to 3.3 mGal RMS at the three altitudes. When the bias was removed, the agreement was improved to better than 1.1 mGal. On the ground (h =0), the three gravity models agree from 1.9 to 3.8 mGal RMS. After removing the mean, the agreement improved to better than 1.7 mGal. Similar results were obtained in comparison with recent surface gravity which was of sub-mGal accuracy. The overall agreement between the downward continued airborne gravity and the surface gravity was better than 1.7 mGal after removing the mean values.
As expected, the flight altitude had a direct impact on accuracy of the values of gravity downward continued to the Earth's surface. The comparisons with terrestrial gravity show that gravity collected at 11000 m has an accuracy of ±3 mGal on the ground. This accuracy is slightly worse than the other two altitudes, most probably due to smaller signal/noise ratios and larger downward continuation effects. The RMS values of differences between the downward continued airborne gravity at altitude 1700 and 6300 meters and the surface gravity are 2.0 and 1.6 mGals, respectively. Based on these comparisons, airborne gravity data collected at altitudes below 6300 meters should result in accuracy better than ±2 mGals on the ground. Note, however, that the test area is flat and the accuracy of airborne gravity would likely be worse in more rugged mountainous regions.
Expected Publication Date: 9/7/13

ALB evaluation for NOAA charting requirements—creating acceptance test for Airborne Lidar Bathymetry data application to NOAA charts in shallow waters
Hydro International
G. Imahori (NOAA), S. Peeri, and **C. Parrish (NOAA/NGS)**

- This research aids the development of future operating procedures with workflows to incorporate the outside source datasets into NOAA's current workflows for updating the Nautical Charts and

other products.

- NGS's Remote Sensing Division collected ALB data using their new VQ-820-G ALB system this September in one of the Sandy Impacted areas (Barnegat Bay). RSD and Coast Survey will meet at the beginning of the year to discuss the processed data and how to get it applied to the chart.
- The USACE National Coastal Mapping Program (NCMP) ALB datasets investigated were relatively consistent with NOAA hydrographic data between 3 and 10 meters depth.

NOAA acquires hydrographic data around the coasts of the United States and its territories using in-house surveys and contracting resources. Hydrographic data are primarily collected using sonar systems, while a small percent is acquired via Airborne Lidar Bathymetry (ALB) for nearshore areas. NOAA has an ongoing requirement, as per the Coast and Geodetic Survey Act of 1947, to survey nearshore areas as part of its coastal mapping activities, including updating nautical charts, creating hydrodynamic models and supporting coastal planning and habitat mapping. NOAA has initiated a project to investigate the potential use of ALB data from non-hydrographic survey programs (i.e., programs designed to support objectives other than nautical charting and with specifications and requirements that differ from those of NOAA hydrographic surveys) in order to increase the amount of data available to meet these nearshore mapping requirements.

Published: 28 November 2013

Organic and metal contamination in marine surface sediments of Guánica Bay, Puerto Rico
Marine Pollution Bulletin
D. Whitall, A. Pait, A. Mason, M. Fulton, E. Wirth, L. Vandiver, and **L. Brune (NOS/NCCOS)**

- This dataset serves as an important baseline for a USCRTF priority watershed (Guanica Bay) which will allow managers to measure change over time. Additionally, these data identify multiple pollutants of concern (total chlordane, total PCBs, total DDT, total PAHs, arsenic, copper, mercury, zinc, nickel and chromium).

Land based sources of pollution have the potential to adversely impact valuable coral reef ecosystems. In Guánica Bay, Puerto Rico sediment samples collected and analyzed in 2009 demonstrate unusually high concentrations of total chlordane, total PCBs, nickel and chromium. A variety of other contaminants (total DDT, total PAHs, As, Cu, Hg, and Zn) were also at levels which may indicate sediment toxicity. With the exception of chromium, all of these contaminants were detected in coral tissues (*Porites asteroides*), although it is unclear at what level these contaminants affect coral health. PCBs and chlordane are extremely persistent in the environment and likely represent legacy sources from close geographic proximity to the Bay. We hypothesize that the high nickel and chromium levels are due to a combination of naturally high Ni and Cr in rock and soils in the watershed, and enhanced (human driven) erosional rates.

Accepted: August 2013

Caspase-like activity during aging and cell death in the toxic dinoflagellates, Karenia brevis

NOAA SCIENTIFIC PUBLICATIONS REPORT
JANUARY 2014

Harmful Algae
J.G. Johnson, M.G. Janech, and **F.M. Van Dolah (NOS/NCCOS)**

- This paper addresses cellular mechanisms that play a role in the termination of harmful algal blooms. Specifically, the paper identifies the presence of a programmed cell death pathway in the Florida red tide dinoflagellate, *Karenia brevis*, and identifies candidate proteins responsible for the caspase-like activity that mediates this death mechanism.
- Molecular targets identified by this study will enable the development of much-needed biomarkers of terminating blooms, which can improve monitoring and model validation.

The observation of caspase-like activity during cell death has provided a new framework for understanding the evolutionary and ecological contexts of programmed cell death in phytoplankton. However, additional roles for this caspase-like activity, the enzymes responsible, and the targets of this enzyme activity in phytoplankton remain largely undefined. In the present study, the role of caspase-like activity in aging and ROS-mediated cell death were investigated and death programs both dependent on and independent of caspase-like activity were observed in the toxic dinoflagellate, *Karenia brevis*. The dual use of *in situ* caspase 3/7 and TUNEL staining identified previously undescribed death-associated morphotypes in *K. brevis*. In silico motif analysis identified several enzymes with predicted caspase-like activity in the *K. brevis* transcriptome, although bona fide caspases are absent. Lastly, computational prediction of downstream caspase substrates, using sequence context and predicted secondary structure, identified proteins involved in a wide range of biological processes including regulation of protein turnover, cell cycle progression, lipid metabolism, coenzyme metabolism, apoptotic and autophagic death. To confirm the computational predictions, a short peptide was designed around the predicated caspase cleavage site in a predicted novel *K. brevis* caspase 3/7-like target, S-adenosylmethionine synthetase (KbAdoMetS). Cleavage of the peptide substrate with recombinant caspase 3 enzyme was determined by MALDI-TOF MS, confirming that KbAdoMetS is indeed a bona fide caspase substrate. These data identify the involvement of caspase-like activity in both aging and cell death in *K. brevis* and identify novel executioner enzymes and downstream targets that may be important for bloom termination. In *K. brevis* this enzyme activity appears to be activated both under oxidative stress as well as during programmed cell death (PCD). However, we found that *K. brevis* does not have bona fide caspases, nor are the obvious candidates for this activity, metacaspases, responsible. Rather, subtilisin-like proteases appear to be responsible.
Accepted: 27 August 2013

Contaminants in Surficial Sediment in Coral and Fish Bays (St. John, U.S. Virgin Islands)
Marine Environmental Research
D. Whitall, A. Pait, I. Hartwell (NOS/NCCOS)

- The study will allows managers to monitor change in contaminant levels.

Chlordane and copper were elevated in Coral Harbor at levels that suggest possible sediment toxicity. Coral Harbor was general more contaminated that other portions of Coral or Fish bays. This dataset

serves as an important baseline for these two priority watersheds which will allow managers to measure change over time. Additionally, these data identify two contaminants of concern (copper and chlordane) and a portion of the study area (Coral Harbor) which demonstrates a higher level of contaminant concern than the rest of the study area.
Accepted: October 2013

Severe thunderstorm reanalysis environments and collocated radiosonde observations
Journal of Applied Meteorology and Climatology
V. A. Gensini, T. L. Mote, and **H. E. Brooks (OAR/NSSL)**

- Results provide researchers with potential strengths and limitations of using NARR data for the purposes of depicting hazardous convective weather climatologies and initializing model simulations.

This research compares reanalysis derived proxy soundings from the North American Regional Reanalysis (NARR) to collocated observed radiosonde data across the central and eastern United States during the period 2000–2011. Specifically, 23 important parameters used for forecasting severe convection are examined. Some important conclusions are that kinematic variables such as 0–6-km bulk wind shear are best represented by this reanalysis, while thermodynamic variables such as convective available potential energy exhibit regional biases and are generally overestimated by reanalysis. For thermodynamic parameters, parcel ascent choice is an important consideration, owing to large differences in reanalysis vs. observed low-level moisture fields. Similar studies should be considered for other reanalysis datasets.
Early Online: 6 December 2013

Evaluating the consequences of adjusting fish stock assessment estimates of biomass for retrospective patterns using Mohn's rho
North American Journal of Fisheries Management
J. Deroba (NMFS/NEFSC)

- Managers should more clearly specify their preferences for short- and long-term fishery objectives to aid in decision making about treating retrospective patterns.
- Consequences for different treatments of retrospective patterns depend on the direction of the pattern, and some consequences may not be intuitive and depend on harvest control rules.

A retrospective pattern exists when estimates of some assessment parameter for a given time period (*e.g.*, biomass in a given year) trend in a systematic way as additional periods of data (*i.e.*, typically a year) are added. Causes of such patterns are difficult to determine and the pattern does not necessarily indicate the direction of the parameter bias. Mohn's rho measures the severity of retrospective patterns and has been used to adjust estimates of biomass and quotas. The consequences of applying Mohn's rho rather than ignoring the pattern are unclear. This study used an age-structured simulation based on Atlantic herring to evaluate the consequences of ignoring retrospective patterns versus applying Mohn's rho.

When applying Mohn's rho produced more accurate estimates of biomass, subsequent spawning stock biomass and yields were near target levels. When applying Mohn's rho produced less accurate estimates of biomass, results depended on the direction of the pattern. With a positive retrospective pattern (*i.e.,* estimates of biomass for a given year decline as additional years of data added), applying Mohn's rho lowered estimates of biomass and this cost little in long-term yield relative to the subsequent increases in biomass, but this came at the short-term cost of lower annual quotas. With a negative retrospective pattern (i.e., estimates of biomass for a given year increase as additional years of data are included) applying Mohn's rho increased estimates of biomass and this resulted in long-term costs in yield and biomass, but this came at the short-term benefit of higher annual quotas. Deciding on whether to ignore retrospective patterns or apply Mohn's rho should depend on the direction of the pattern and the relative weight of short- and long-term fishery objectives. Performance may also depend on the shape of control rules used to define annual quotas.
Expected Publication Date: Early 2014

Climate-mediated changes in zooplankton community structure for the eastern Bering Sea
Deep Sea Research II - 3rd Bering Sea Special Issue
L. B. Eisner, **J. M. Napp**, **K. L. Mier**, A. I. Pinchuk, **A. G. Andrews III (NMFS/AKFSC)**

- Potential changes in zooplankton composition due to climate change are suggested, with larger crustacean taxa increasing in cold yeas and small taxa in higher abundance in warm years in the south eastern Bering Sea.
- The north eastern Bering Sea also showed changes in zooplankton composition, but changes were smaller than in south.
- Changes in availability of zooplankton prey, particularly large crustacean zooplankton, can affect growth and survival at higher trophic levels (e.g. fisheries, marine mammals, and birds).

Zooplankton are critical to energy transfer between higher and lower trophic levels in the eastern Bering Sea ecosystem. Previous studies from the southeastern Bering Sea shelf documented substantial differences in zooplankton taxa in the Middle and Inner Shelf Domains between warm and cold years. Our investigation expands this analysis into the northern Bering Sea and the south Outer Domain, looking at zooplankton community structure during a period of climate-mediated, large-scale change. Elevated air temperatures in the early 2000s resulted in regional warming and low sea ice extent in the southern shelf whereas the late 2000s were characterized by cold winters, extensive spring sea ice, and a well-developed pool of cold water over the entire Middle Domain. The abundance of large zooplankton taxa such as *Calanus* spp. (*C. marshallae* and *C. glacialis*), and *Parasagitta elegans*, increased from warm to cold periods, while the abundance of gelatinous zooplankton (Cnidaria) and small taxa decreased. Biomass followed the same trends as abundance, except that the biomass of small taxa in the southeastern Bering Sea remained constant due to changes in abundance of small copepod taxa (increases in *Acartia* spp. and *Pseudocalanus* spp. and decreases in *Oithona* spp.). Statistically significant changes in zooplankton community structure and individual species were greatest in the Middle Domain, but were evident in all

shelf domains, and in both the northern and southern portions of the eastern shelf. Changes in community structure did not occur abruptly during the transition from warm to cold, but seemed to begin gradually and build as the influence of the sea ice and cold water temperatures persisted. The change occurred one year earlier in the northern than the southern Middle Shelf. These and previous observations demonstrate that lower trophic levels within the eastern Bering Sea respond to climate-mediated changes on a variety of time scales, including those shorter than the commonly accepted quasi-decadal time periods. This lack of resilience or inertia at the lowest trophic levels affects production at higher trophic levels and must be considered in management strategy evaluations of living marine resources.
Expected Publication Date: March 2014

Fishery and hatchery effects on an endangered salmon population with low productivity
Transactions of the American Fisheries Society
A. Winship, **M. O'Farrell**, **M. Mohr (NMFS/SWFSC)**

- Endangered Sacramento River winter chinook were estimated to have low productivity primarily due to low fecundity and high juvenile survival rates.
- Sustainable fishing mortality rates in the absence of hatchery supplementation are relatively low compared to other Chinook salmon.
- Hatchery supplementation increases the fishing mortality rate that can be sustained.

We estimated the natural spawner-fry stock-recruitment relationship and juvenile survival rates for Sacramento River winter chinook salmon *Oncorhynchus tshawytscha* in California and used these estimates to examine the expected numbers of spawners and fishing mortality under different fishing mortality rates and levels of hatchery supplementation. A stochastic, age-structured population dynamics model was fit to fry and female spawner abundance data for years 1996-2010. Estimated survival rates of fry through the end of the first year in the ocean were generally < 0.5%. Estimated survival rates of hatchery-origin fish from egg to the end of the first year in the ocean were on average about four times greater than the estimated maximum rate for natural-origin fish. The hatchery program was estimated to increase the number of spawners returning to natural spawning areas, and thereby increase the fishing mortality rate that could be sustained. Assessing the past or future net effect of the hatchery on the size of the natural population would require quantifying any potential reduction in the productivity of the natural population as a result of reduced fitness of hatchery-origin fish spawning in natural spawning areas.
Expected Publication Date: March 2014

Energetic electron precipitation characteristics observed from Antarctica during a flux dropout event
Journal of Geophysical Research
M. A. Clilverd, N. Cobbett, C. J. Rodger, J. B. Brundell, M. H. Denton, D. P. Hartley, **J. V. Rodriguez (NESDIS/NGDC)**, D. Danskin, T. Raita, E. L. Spanswick

- Pitch-angle resolved observations of electron fluxes at geostationary orbit (GOES) and low-earth orbit (POES) in combination with ground-based (VLF) sensing methods can provide a powerful method for identifying the different mechanisms that cause electron precipitation into the upper atmosphere.
- Differences between POES and VLF observations of electron precipitation remain to be fully understood although plausible explanations are put forward.

Data from two autonomous VLF radio receiver systems installed in a remote region of the Antarctic in 2012 is used to take advantage of the juxtaposition of the $L = 4.6$ contour, and the Hawaii-Halley, Antarctica, great circle path as it passes over thick Antarctic ice shelf. The ice sheet conductivity leads to high sensitivity to changing *D* region conditions, and the quasi constant L shell highlights outer radiation belt processes. The ground-based instruments observed several energetic electron precipitation events over a moderately active 24 h period, during which the outer radiation belt electron flux declined at most energies and subsequently recovered. Combining the ground-based data with low and geosynchronous orbiting satellite observations on 27 February 2012, different driving mechanisms were observed for three precipitation events with clear signatures in phase space density and electron anisotropy. Comparison between flux measurements made by Polar-orbiting Operational Environmental Satellites (POES) in low Earth orbit and by the Antarctic instrumentation provides evidence of different cases of weak and strong diffusion into the bounce loss cone, helping to understand the physical mechanisms controlling the precipitation of energetic electrons into the atmosphere. Strong diffusion events occurred as the <600 keV fluxes began to recover as a result of adiabatic transport of electrons. One event appeared to have a factor of about 10 to 100 times more flux than was reported by POES, consistent with weak diffusion into the bounce loss cone. Two events had a factor of about 3 to 10 times more >30 keV flux than was reported by POES, more consistent with strong diffusion conditions.
Published: November 2013

Variability in rockfish (Sebastes spp.) *fecundity: species contrasts, maternal size effects, and spatial differences*
Environmental Biology of Fishes
S.G. Beyer, J.C. Field, C.J.Harvey, and **S.M. Sogard (NMFS/SWFSC)**

- Rockfish off of central and southern California showed variability in larval production as a function of species, location, year, and maternal size.
- Accounting for these differences affects key outputs of rockfish stock assessments.

We investigated the reproductive ecology of three rockfish species residing in the California Current System: chilipepper, *Sebastes goodei*, yellowtail, *S. flavidus* and speckled rockfish, *S. ovalis*. Females were sampled from four locations along the coast of California in the winter spawning seasons (November through March) of 2009, 2010 and 2011 to assess temporal and spatial effects on fecundity. Maternal size

and age were positively correlated with relative fecundity ($rel, larvae per g somatic weight) for all three species and indicated a disproportionately greater reproductive output by older, larger females. Yellowtail rockfish had the highest absolute and $rel, the greatest maternal size effect, and produced the smallest eggs. Size-dependent $rel relationships were incorporated into published stock assessment models that originally assumed egg production to be directly proportional to spawning biomass. The updated models showed a reduction in larval output when large, old females were removed from the population by fishing for both chilipepper and yellowtail rockfish. In addition, fecundity varied spatially among sampling sites (chilipepper and yellowtail) and by year (chilipepper). Speckled rockfish lacked adequate sample size to assess spatiotemporal trends in fecundity. Chilipepper and speckled rockfish produced multiple broods annually in Southern California and to a lesser extent in Central California, complicating estimates of annual fecundity. Egg production was positively correlated with female condition, indicating environmental variability in oceanographic conditions and productivity may drive changes in fecundity and reproductive strategy (i.e. single versus multiple broods) in these species.
Expected Publication Date: Spring 2013

Oxygen- and prey-mediated range expansion of a marine predator: Humboldt squid (Dosidicus gigas) in the California Current System
Global Change Biology
J. S. Stewart, **E. Hazen, S. Bograd,** J. Byrnes, **David Foley,** W. Gilly, B. Robison, and **J. Field**
(NMFS/SWFSC)

- The manuscript presents and synthesizes an analysis of the abundance, diving behavior, habitat associations and trophic interactions the jumbo squid (*Dosicicus gigas*), linking the recent range expansion to physical and biological changes in the physical environment. Specifically, these changes include the shoaling of the Oxygen Minimum Zone and subsequent vertical compression of available habitat for mesopelagic fishes.

Climate-driven range shifts are ongoing in pelagic marine environments, and ecosystems must respond to combined effects of altered species distributions and environmental drivers. Hypoxic oxygen minimum zones (OMZs) in the midwater environment are shoaling globally; this can affect distributions of species both geographically and vertically along with predator-prey dynamics in trophic webs. Humboldt squid (*Dosidicus gigas*) are highly migratory predators adapted to hypoxic conditions that may be deleterious to their competitors and predators; consequently, OMZ shoaling may facilitate their foraging opportunities. With two separate modeling approaches using unique, long-term data based on in situ observations of predator, prey, and environmental variables, our analyses suggest that Humboldt squid

are indirectly affected by OMZ shoaling through effects on a primary food source, myctophid fishes. Our results suggest that this indirect linkage between hypoxia and foraging is an important driver of the ongoing range expansion of Humboldt squid in the northeastern Pacific Ocean.
Expected publication date: January, 2014

Changes in California chinook salmon diet over the past 50 years: relevance to the recent population crash
Marine Ecology Progress Series
J. A. Thayer, **J. C. Field (NMFS/SWFSC)**, and W. J. Sydeman

- Authors present recent and historical food habits data for Chinook salmon in Central California waters and demonstrate a relationship between decreased diet diversity and prey abundance.
- Diet composition was related to the Sacramento Index of Chinook ocean abundance with a lag of one or two years and reflected the importance of prey availability during the smolt ocean-entry period and second ocean year.
- These findings suggest that declining prey diversity, specifically in May-June in the mid 2000s, may be related to recent population crashes, and highlight the importance of understanding predator-prey interactions at appropriate temporal resolutions to aid in salmon management.

Salmon are affected by variation in ocean productivity, thus improved understanding of mechanisms behind variability in ocean survival should help management of these ecologically and economically important populations. Based on a cooperative fisheries research program, we compared central California Chinook salmon (*Oncorhynchus tshawytscha*) adult food habits from spring/summer in the mid 2000s with historical records from 1955 and the 1980s. Diet diversity decreased through time. Previously important prey including juvenile rockfish (*Sebastes spp*.), krill (*Euphausiidae*), Pacific herring (*Clupea pallesi*) and market squid (*Doryteuthis opalsecens*) declined or disappeared from the diet, while Pacific sardine (*Sardinops sagax*) became very important prey in the 2000s; anchovy (*Engraulis mordax*) remained important throughout the studies. Diet composition was correlated with regional mid-water trawls of prey abundance and also local sea surface temperature, though this relationship broke down in the 2000s, linked to low diet diversity in May-June. Diet composition was related to the Sacramento Index of Chinook ocean abundance with a lag of two years as well as one year and reflected the importance of prey availability during the smolt ocean-entry period and second ocean year. Spring is peak ocean entry for fall-run Chinook smolts so declining prey diversity, specifically in May-June in the mid 2000s, may be related to recent population crashes. Seasonally, winter and fall diet data further demonstrated the significance of temporal variation in specific prey. This study highlights the importance of marine

predator-prey interactions at an appropriate temporal resolution for understanding salmonid population dynamics.
Expected Publication Date: January 2014

Parasites in subyearling chinook salmon (Oncorhynchus tshawytshca) *suggest increased habitat usage in wetlands compared to sandy beach habitats in the Columbia River estuary*
Hydrobiologia
A. Claxton, **K.C. Jacobson,** M. Bhuthimethee, **D.J. Teel,** and **D.L. Bottom (NMFS/NWFSC)**

- Authors examine the presence of parasites acquired through prey items in salmon and confirm the importance of estuarine wetlands as feeding grounds for juvenile salmon.
- This study is the first to directly compare any measure of prey utilization among wetlands and sandy bottom habitats of the lower Columbia River estuary.
- Studies such as this can aid in the identification of important habitats for restoration.

Many estuaries in the Pacific Northwest have been severely altered reducing wetlands habitat, resulting in an interest in their importance as rearing areas for juvenile salmon. To examine differences in habitat use during residency in the Columbia River estuary, we examined parasite communities acquired through food web interactions in subyearling Chinook salmon (*Oncorhynchus tshawytscha*) collected from four different habitat types in May and July of 2004 and 2005. Collections were made from two sandy bottom habitat types in the tidal freshwater and marine mixing areas of the estuary. These were compared to two wetlands types: one composed of scrub and shrub vegetation and another with emergent vegetation. Parasite assemblages differed among habitats suggesting differences in salmon feeding opportunities and rearing behaviors. In both years, the nematode, *Hysterothylacium aduncum,* and the acanthocephalan, *Echinorhynchus lageniformis*, which use intermediate hosts found in the estuary, were more prevalent in lower wetlands suggesting increased feeding by salmon in these habitats. The differences in parasite assemblages among habitats suggests a variety of rearing and migration patterns through the Columbia River estuary and the increased prevalences of some parasites in the wetlands show that these habitats can be important feeding grounds for salmon.
Published: 31 May 2013
Link to paper: http://link.springer.com/article/10.1007%2Fs10750-013-1564-z#page-1

Genetic variation in bacterial kidney disease susceptibility in Lake Michigan chinook salmon and its progenitor population from the Puget Sound
Journal of Aquatic Animal Health

NOAA SCIENTIFIC PUBLICATIONS REPORT
JANUARY 2014

M.K. Purcell, **J.J. Hard**, **K.G. Neely**, **L.K. Park,** J.R. Winton, and D.G. Elliott **(NMFS/NWFSC)**

- The authors evaluated whether the phenotypic divergence of two salmon populations in Bacterial Kidney Disease (BKD) susceptibility was due to selection rather than genetic drift.
- Comparison of the overall magnitude of quantitative trait divergence to neutral marker divergence between the populations strongly suggested selection had occurred but a direct test of quantitative trait divergence was not significant.
- The results indicated that if selection had acted on the WI population there was no evidence of a concomitant loss of genetic variation in quantitative traits associated with BKD susceptibility and evolutionary changes in BKD susceptibility in this population would be little affected by different temperature regimes.

Mass mortality events due to infectious disease agents in wild fish populations are troubling, but it is the long-term, population-level consequences which may be of more significance. Evolutionary theory predicts that populations with sufficient genetic variation will adapt in response to pathogen pressure. Chinook salmon were introduced into Lake Michigan in the late 1960s from a Washington State (WA) hatchery population. In the late 1980s, collapse of the forage base in Lake Michigan was thought to contribute to die-offs of Chinook salmon (Oncorhynchus tshawytscha) due to Renibacterium salmoninarum, the causative agent of bacterial kidney disease (BKD). Previously, the authors demonstrated that Chinook salmon from Lake Michigan, Wisconsin (WI) have greater survival following BKD challenge relative to its progenitor population. Estimates of phenotypic variation (VP), additive genetic variation (VA) and narrow-sense heritability (h2) were consistently higher in the WI relative to the WA population. The R. salmoninarum exposures were conducted at both 14 and 9°C and the warmer temperature accelerated time to death consistently in both populations. There was no evidence of phenotypic plasticity or a genotype by environment (G X E) interaction in mortality or time course of death. Significant levels of additive genetic variation in BKD susceptibility in the WI population are indicative of future adaptive potential and our results suggest that evolutionary changes in BKD susceptibility in this population would be little affected by different temperature regimes.
Accepted: October 2013

A long-term and reproducible passive microwave sea ice concentration data record for climate studies and monitoring
Earth System Science Data
G. Peng, W.N. Meier, **D.J. Scott**, and **M. H. Savoie (NOAA/NSIDC)**

NOAA SCIENTIFIC PUBLICATIONS REPORT
JANUARY 2014

- A long-term, consistent, and reproducible satellite-based passive microwave sea ice concentration climate data record is available for climate studies, monitoring, and model validation with an initial operation capability.
- The description and basic characteristics of the NOAA/NSIDC passive microwave sea ice concentration climate data record are presented here.
- The NOAA/NSIDC sea ice concentration climate data record provides similar spatial and temporal variability as the heritage fields (i.e., NASA Goddard sea ice concentration products) to the user communities with the additional documentation, traceability, and reproducibility that meet current standards and guidelines for climate data records.

The daily and monthly sea ice concentration data are on the National Snow and Ice Data Center (NSIDC) polar stereographic grid with nominal 25 km x 25 km grid cells in both the Southern and Northern Hemisphere Polar Regions from 09 July 1987 to 31 December 2007. The data files are available in the NetCDF data format and archived by NOAA's National Climatic Data Center under the satellite climate data record program. The climate data record provides similar spatial and temporal variability as the heritage products to the user communities with the additional documentation, traceability, and reproducibility that meet current standards and guidelines for climate data records. The dataset, along with detailed data processing steps and error source information, can be found at:
http://dx.doi.org/10.7265/N5B56GN3
Publication Date: October 2013

Modeling summer circulation and thermal structure of Lake Erie
Limnology and Oceanography
D. Beletsky, N. Hawley, and Rao **(OAR/GLERL)**

- The authors applied a 3D primitive equation numerical model to Lake Erie on a 2 km grid to study its summer circulation and thermal structure.
- They found unusual temperature and circulation patterns in Lake Erie that are driven by anticyclonic vorticity in the surface wind and model results are sensitive to the specification of the wind field.
- This study demonstrates the link between meteorology, limnology, and human and environmental health.

Model results were compared to long-term observations of currents and temperature made in 2005 at several locations, mostly in its central basin. In the shallow and mostly unstratified western basin, circulation is driven by Detroit River inflow and is from west to east. In the deep eastern basin, the

thermocline is dome-shaped and circulation is cyclonic -- a configuration typical for other large deep lakes. On the other hand, in the central basin (which is of intermediate depth and has a relatively flat bottom), both the observed and the modeled thermocline has an unusual "depressed" or "bowl-shaped" structure in late summer, with a greater depth in the middle of the lake and a shallower depth near shore. Both the observations and the model also show an anticyclonic circulation pattern in the central basin. We show that the unusual temperature and circulation patterns are driven by anticyclonic vorticity in the surface wind and that the model results are quite sensitive to the specification of the wind field. Anticyclonic wind vorticity leads to thinning of the hypolimnion in the central basin and earlier destratification in the fall.
Expected Publication Dated: November 2013

Sediment resuspension in Saginaw Bay
Journal of Great Lakes Research - Special Section on Saginaw Bay
N. Hawley, T. Redder, **R. Beletsky**, V. Verhamme, **D. Beletsky**, and J. DePinto **(OAR/GLERL)**

- A model of sediment resuspension was applied to Saginaw Bay for 2009-2010.
- Results show that resuspension occurs most frequently during the fall of each year.

An integrated hydrodynamic and sediment transport model was applied to Saginaw Bay during the ice-free portions of 2009 and 2010. Observations of surface waves and suspended sediment concentration made during the spring of both years were used to constrain the model and to validate the model output. Although the model accurately predicted the occurrence of resuspension events, it did not accurately simulate the amount of material resuspended. The results show that sediment resuspension in both the inner and outer bay is almost entirely due to surface wave action, and that the bulk of the resuspension events occur during the fall of each year. Since resuspension remixes bottom sediment into the water column and makes it - and any associated nutrients - available to the biota, the effects of sediment resuspension need to be accounted for in any water quality model of the bay. Better specification of both the surface waves and the initial specification of the bottom sediment would improve the performance of the model.
Expected Publication Date: December 2013

Stable isotope analysis of Humboldt squid prey: comment on Miller et al. (2013)
Marine Ecology Progress Series
J.C. Field (NMFS/SWFSC), S.Y. Litvin, A. Carlisle, J.S. Stewart, W.F. Gilly, and R.I. Ruiz-Cooley

NOAA Scientific Publications Report
January 2014

- This article questions conclusions of a previously published manuscript regarding the food habits of Humboldt squid in the California Current.
- The paper highlights some of the constraints of stable isotope analysis with respect to complicating factors of movement and food habits.

Miller et al. (2013; Mar Ecol Prog Ser 477:123–134) used bulk stable isotope analysis (SIA) and a Bayesian isotope-mixing model (SIAR) to assess the diet of the Humboldt squid *Dosidicus gigas* in the Northern California Current. Their conclusions starkly contrast decades of food habits and other research on this organism. The methods they employed are sensitive to a range of assumptions and parameter estimates, and the trophic model they used is confounded by the interactive effects of movement and diet on *D. gigas* isotopic values. This is compounded by the sensitivity of the migratory model to critical assumptions of the trophic level of *D. gigas*, (specifically, the assumption that large *D. gigas* are approximately 1 trophic level above copepods), which are inconsistent with the literature. Therefore, Miller et al.'s (2013) conclusions regarding the contribution of specific prey to *D. gigas* in the northern California Current are unsupported.
Expected Publication Date: December 2013

Taxonomic status of two subspecies of South American fur seals: Arctocephalus australis australis *vs*. A. a. gracilis
Marine Mammal Science
L.R. de Oliveira and **R.L. Brownell Jr. (NFMS/SWFSC)**

- This paper proposes that *A. a. gracilis* is a junior synonym of *A. a. australis*.

Morphology, genetics, and distribution indicate differences in fur seals at the ESU, subspecies or species level between Peru (and northern Chile) and the western South Atlantic (Brazil, Uruguay, Argentina, and the Falkland Islands) and eastern South Pacific (southern Chile) populations. The English common name should remain the South American fur seal on the South Atlantic mainland and the Falkland Islands. Following Berta and Churchill (2012) the Peru/northern fur seal is an unnamed subspecies with the Peruvian fur seal as its English common name.Additional studies are needed on Peruvian and Galapagos fur seals to determine their taxonomic status and relationship to other fur seals.
Expected Publication Date: 2014

Giant shoulders 15 years later: lessons, challenges, and guidelines in fisheries meta-analysis
Fish and Fisheries
J.T. Thorson, J. Cope, K.M. Kleisner, **J.M. Samhouri, A.O. Shelton,** and **E.J. Ward (NMFS/NWFSC)**

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- This review paper proposes a list of best practices for meta-analyses in fisheries science.
- The paper goes on to explore whether these practices are followed in five topics using meta-analysis, and shows that there is much room for improvement in current meta-analytic studies.

Meta-analysis has been an integral tool for fisheries researchers since the late 1990s. However, there remain few guidelines for the design, implementation, or interpretation of meta-analyses in the field of fisheries. Here we provide the necessary background for readers, authors, and reviewers, including a brief history of the use of meta-analysis in fisheries, an overview of common model types and distinctions, and an illustration of different study goals. We outline the primary challenges in implementing meta-analyses, including difficulties in discriminating between alternative hypotheses that can both explain the data, the importance of validating results using multiple lines of evidence, the trade-off between complexity and sample size, and problems associated with the use of model output. For each of these challenges, we also provide suggestions, such as the use of propensity scores for dealing with selection bias and the use of covariates to control for confounding effects. These challenges are then illustrated with examples from diverse sub-fields of fisheries, including (1) the analysis of the stock-recruit relationship, (2) fisheries management, rebuilding, and population viability, (3) habitat-specific vital rates, (4) life history theory, and (5) the evaluation of marine reserves. We conclude with our reasons for believing that meta-analysis will continue to grow in importance for these and many other research goals in fisheries science, and argue that standards of practice are therefore essential.
Expected Publication Date: Winter 2014

Spatio-temporal patterns of beaked whale echolocation signals in the North Pacific
PLoS One
S. Baumann-Pickering, M. Roch, **R. L. Brownell, Jr. (NMFS/SWFSC),** A. Simonis, M. McDonald, A. Solsona-Berga, **E. Oleson (NMFS/PIFSC),** S. Wiggins, and J. Hildebrand

- Identification of cetacean species occurring in our marine ecosystems is critical to assessing their status and the potential or realized effects of human activity on the whale populations.
- Passive acoustic monitoring is a feasible technique for studying the distribution and relative density of beaked whales in the North Pacific. Additional monitoring with passive acoustics would be beneficial, particularly in combination with visual survey.

Ten species of beaked whales inhabit the North Pacific, but little is known about their abundance, ecology, and behavior, as they are elusive and difficult to visually distinguish at sea. Acoustic methods have established that six of these species produce species-specific frequency modulated (FM) echolocation pulses: Baird's, Blainville's, Cuvier's, Longman's, Deraniyagala's, and Stejneger's beaked

whales. Additionally, one described FM pulse (BWC) from Cross Seamount, Hawai'i, and three previously undescribed FM pulses (BW40, BW43, BW70) have been identified from almost 11 cumulative years of autonomous recordings at 24 sites throughout the North Pacific. Most sites had a dominant FM pulse type with other types being either absent or limited. There was not a strong seasonal influence on the occurrence of these signals at any site, but longer time series may reveal smaller, consistent fluctuations. Only the species producing BWC signals, detected throughout the Pacific Islands region, consistently showed a diel cycle with nocturnal foraging. By comparing stranding and sighting information with acoustic findings, we hypothesize that BWC signals are produced by ginkgo-toothed beaked whales. BW43 signal encounters were restricted to Southern California and may be produced by Perrin's beaked whale, known only from Californian waters. BW70 signals were detected in the southern Gulf of California, which is known habitat for Pygmy beaked whales. Hubb's beaked whale may have produced the BW40 signals encountered off central and southern California; however, these signals were also recorded off Pearl and Hermes Reef and Wake Atoll, which are well south of their known range.
Expected Publication Date: December 2013

Inter-annual variation of persistent organic pollutants (POPS) concentrations in an Antarctic predator, Arctocephalus gazella
Environmental Science & Technology
E. Brault, **M. Goebel (NMFS/SWFSC)**, H. Geisz; E. Canuel, and R. Dickhut

- Antarctic fur seals are an important upper trophic level consumer in the Antarctic pelagic and coastal marine environments.
- Fur seals in the South Shetland Islands are undergoing a dramatic decline as a result of both top-down (i.e. predation) and bottom-up (changing and diminished prey base) processes.
- Climate shifts and corresponding availability of krill over the past decade were not consistent with trends observed in POP concentrations in fur seal milk, suggesting that climate may not be a key factor in declining populations.

Persistent organic pollutants (POPs), contaminants that may bioaccumulate in upper trophic level organisms, were detected in the milk of a top predator, the Antarctic fur seal (*Arctocephalus gazella*). Multiparous females had significantly lower concentrations of certain POPs (*trans*-nonachlor, *p,p'* DDE, and several PCBs) in their milk than primiparous females, likely due to the annual lactational transfer of the POP burden from mother to pup. Furthermore, there were significant inter-annual differences in POP concentrations in multiparous females' milk from five breeding seasons between 2000 and 2011. Decreasing trends in concentrations of certain POPs over the recent decade coincide with declining global

emissions, yet atmospheric concentrations in the Antarctic are not always consistent with global trends, suggesting that additional factors may contribute to temporal trends of POPs in fur seals. Climate shifts and corresponding availability of krill over the past decade were not consistent with trends observed in POP concentrations in fur seal milk, suggesting that climate may not be a key factor. Additional mechanisms, such as variability in the geographic ranges of individual seals during over-wintering migrations are discussed and should be explored further.
Expected Publication Date: December 2013

Gene flow between sympatric life history forms of Oncorhynchus mykiss *located above and below migratory barriers*
PLoS ONE
D. M. Van Doornik (NMFS/NWFSC), **B. A. Berejikian**, and L.A. Campbell **(NMFS/NWFSC)**

- The population structure of the *O. mykiss* (rainbow trout) in three rivers in Washington state appears to be influenced more by the presence of a barrier to upstream migration than by life history type.
- The authors also found that resident *O. mykiss* produce offspring that can become anadromous, and female *O. mykiss* juveniles are more likely to migrate to salt water than males.

Oncorhynchus mykiss have a diverse array of life history types, and understanding the relationship among types is important for management of the species. Patterns of gene flow between sympatric freshwater resident *O. mykiss*, commonly known as rainbow trout, and anadromous *O. mykiss*, commonly known as steelhead, populations are complex and poorly understood. In this study, we attempt to determine the occurrence and pathways of gene flow and the degree of genetic similarity between sympatric resident and anadromous *O. mykiss* in three river systems, and investigate whether resident *O. mykiss* are producing anadromous offspring in these rivers, two of which have complete barriers to upstream migration. We found that the population structure of the *O. mykiss* in these rivers appears to be influenced more by the presence of a barrier to upstream migration than by life history type. The sex ratio of resident *O. mykiss* located above a barrier, and smolts captured in screw traps was significantly skewed in favor of females, whereas the reverse was true below the barriers, suggesting that male resident O. mykiss readily migrate downstream over the barrier, and that precocious male maturation may be occurring in the anadromous populations. Through paternity analyses, we also provide direct confirmation that resident *O. mykiss* can produce offspring that become anadromous. Most (89%) of the resident *O. mykiss* that produced anadromous offspring were males. Our results add to the growing body of evidence that shows that gene flow does readily occur between sympatric resident and anadromous *O.*

mykiss life history types, and indicates that resident *O. mykiss* populations may be a potential repository of genes for the anadromous life history type.
Expected Publication Date: Fall 2013

*Spawning phenology and geography of Aleutian Islands and eastern Bering Sea Pacific cod (*Gadus macrocephalus*)*
Deep Sea Research II
Sandi Neidetcher, **Thomas P. Hurst**, Lorenzo Ciannelli, and **Elizabeth A. Logerwell (NMFS/AKFSC)**

- Spawning of Pacific cod in the Bering Sea appears to be more widespread than has previously been recognized, including along the shelf break near Zemchug Canyon.
- Spatial and temporal patterns in spawning were relatively consistent across years.
- The fine-scale documentation of spawning areas across the basin will improve understanding of the spatial dynamics of recruitment in this harvested population.

Pacific cod (*Gadus macrocephalus*) is an economically and ecologically important species in the southeastern Bering Sea and Aleutian Islands, yet little is known about the spawning dynamics of Pacific cod in these regions. To address this knowledge gap, we applied a gross anatomical maturity key for Pacific cod to describe temporal and spatial patterns of reproductive status over three winter spawning seasons: 2005, 2006, and 2007. Maturity status of female Pacific cod was assessed by fishery observers during sampling of commercial catches and used to construct maps showing spawning activity in the Bering Sea and Aleutian Islands. Most spawning activity was observed on the Bering Sea shelf and Aleutian Island plateaus between 100 and 200 m depth. Data for those days when a high percentage of spawning stage fish were observed were used to identify areas with concentrations of spawning fish. Spawning concentrations were identified north of Unimak Island, in the vicinity of the Pribilof Islands, at the shelf break near Zhemchug Canyon, and adjacent to islands in the central and western Aleutian Islands along the continental shelf. The spawning season was found to begin in the last days of February or early March and extend through early to mid-April. Variation in spawning time (averaging ~10 days between years) may have been associated with a change from warm (2005) to cold (2007) climate conditions during the study period. Our information on Pacific cod spawning patterns will help inform fishery management decisions, models of spawning and larval dispersal and the spatial structure of the stock.
Expected Publication Date: January 31, 2014

Evaluation of the VIIRS and MODIS LST products in an arid area of Northwest China

NOAA SCIENTIFIC PUBLICATIONS REPORT
JANUARY 2014

Journal of Remote Sensing of Environment
H. Li, D. Sun, **Y. Yu**, H. Wang, **Y. Liu**, Q. Liu, Y. Du, H. Wang, and B. Cao **(NESDIS/STAR)**

- This study provides meaningful significance to the improvement of satellite products for our current on-going satellite missions.

In this study, the Visible Infrared Imager Radiometer Suite (VIIRS) land surface Temperature (LST) Environmental Data Record (EDR) and Moderate Resolution Imaging Spectroradiometer (MODIS) L2 swath LST products (collection 5) from both the Terra and Aqua satellites were evaluated against ground observations in an arid area of northwest China during the Heihe Watershed Allied Telemetry Experimental Research (HiWATER) experiment. Four barren surface sites were chosen for the evaluation, which took place from June 2012 to April 2013. The results show that the current VIIRS LST products demonstrate a reasonable accuracy, with an average bias of 0.36 K and -0.58 K and an average root mean square error (RMSE) of 2.74 K and 1.48 K for the four sites during daytime and nighttime, respectively. The accuracy of the nighttime LST is much better than that of daytime. Furthermore, it was also found that the VIIRS split-window (SW) algorithm provides better performance than the VIIRS dual split-window (DSW) algorithm during both daytime and nighttime. For MODIS LST products, the results show that both Terra and Aqua MODIS C5 LST products underestimate the LST for the four barren surface sites at daytime, and the biases and RMSEs are much larger for Aqua, with biases varies from -0.91 K to -3.13 K for Terra and from -1.31 K to -3.76 K for Aqua.
Accepted: November 2013

Reconciling alternative approaches to projecting hydrologic impacts of climate change
Bulletin of the American Meteorological Society
B.M. Lofgren and **A.D. Gronewold (OAR/GLERL)**

- This meeting summary paper is important for further understanding and projecting issues and impacts of climate change in the Laurentian Great Lakes.

This meeting summary paper synthesizes the set of presentations at the Workshop on Methodology for Projection of Hydrologic Impacts of Climate Change, held August 27-29, 2012 in Muskegon, JI. It covers topics including the importance of energy budgets interacting with hydrologic dynamics, inclusion of various runoff mechanisms, the important eof potential land use change in addition to climate change, and special considerations based on location, such as Arctic regions.
Expected Publication Date: February or March 2014

NOAA SCIENTIFIC PUBLICATIONS REPORT
JANUARY 2014

Life history of Bathyraja trachura *from the eastern Bering Sea, with evidence of latitudinal variation in a deep-sea skate species*
Journal of the Marine Biological Association of the United Kingdom
M.V. Winton, L.J. Natanson, J. Kneebone, G.M. Cailliet, and D.A. Ebert **(NMFS/NEFSC)**

- This paper provides life history parameter estimates for a poorly known skate species that is often encountered as bycatch in the Bering Sea.
- Also described is the regional variation in life history parameter estimates that is important for the appropriate management of the species throughout its range.

Although many skates possess life history characteristics that may make them vulnerable to exploitation, the detailed biological information needed to enact effective management schemes is lacking for most species. The objectives of this study were to provide age, growth, and maturity estimates for the roughtail skate, *Bathyraja trachura*, from the eastern Bering Sea. Maximum age was estimated at 36 years based on band pair counts in vertebral centra. Of the four growth models applied, the logistic model provided the best description of growth (asymptotic total length = 911 mm; growth coefficient = 0.131 yr^{-1}). There was no evidence of difference in growth between males and females. Females attained maturity at larger sizes and older ages than males. The median size-at-maturity was estimated at 741 mm total length (TL) for males and 796 mm TL for females; median age-at-maturity was estimated at 21.1 years and 24.7 years for males and females, respectively. The results of this study may indicate a latitudinal pattern in size and growth, with individuals from the eastern Bering Sea growing more slowly and reaching higher maximum ages than previously reported for specimens collected off the western coast of the continental United States.
Expected Publication Date: Unknown

Description of sounds associated with Sowerby's beaked whales (Mesoplodon bidens) *in the western North Atlantic Ocean*
Journal of the Acoustical Society of America
D. Cholewiak, S. Baumann-Pickering, and **S. Van Parijs (NMFS/NEFSC)**

- This paper presents the first description of the acoustic characteristics of sounds associated with this species

Several groups of Sowerby's beaked whales (Mesoplodon bidens) were encountered on July 4, 2011, during a shipboard cetacean survey conducted off the eastern seaboard of the United States. Acoustic recordings were collected using a three-element towed hydrophone array. Many echolocation clicks were recorded during the encounter, but no tonal sounds were detected. A total of 2969 echolocation clicks

were included in analyses of frequency and temporal characteristics. A Gaussian mixture model with four mixtures was fitted to the histogram of peak frequencies; four subsets of clicks were designated. The majority of clicks (n¼2048) contained a median peak frequency of 33 kHz, while the others contained a median peak frequency of 25 kHz (n¼324), 51 kHz (n¼304), or 67 kHz (n¼293). Most clicks did not contain a clear frequency-modulated upsweep, though some clicks exhibited a slight sweep from 30–36 kHz. Seven burst pulses were detected in the encounter, two of which were of high enough quality for detailed analysis. The acoustic characteristics of Sowerby's beaked whales have not previously been described; the current study will facilitate incorporation of these data into passive acoustic monitoring programs in the North Atlantic Ocean.
Accepted: 12 September 2013
Link to paper: http://dx.doi.org/10.1121/1.4823843

Juvenile steelhead distribution, migration, growth, and feeding in the Columbia River estuary, plume, and coastal waters
Marine and Coastal Fisheries: Dynamics, Management, and Ecosystem Science
E.A. Daly, J.A. Scheurer, **R.D. Brodeur, L.A. Weitkamp, B.R. Beckman,** and **J.A. Miller (NMFS/NWFSC)**

- The authors analyzed distribution, diet, and growth data of juvenile steelhead collected during Columbia River estuary and ocean surveys conducted during in May, June, and September from 1998 to 2011.
- This study provides the first comprehensive look at distribution, feeding and growth of Columbia River steelhead in the estuary and ocean.
- Understanding the estuarine and ocean ecology of steelhead smolts may assist in the management of these populations.

Relative to the extensive research on the freshwater stage of steelhead (*Oncorhynchus mykiss*), there has been little research on the estuarine and early marine phases of juvenile steelhead despite the decline of numerous steelhead populations including several from the Columbia River. Understanding the estuarine and ocean ecology of steelhead smolts may assist in the restoration of these populations. Almost all of the juvenile steelhead caught in the ocean were caught during the May surveys (96%). Juvenile steelhead were consistently caught at our westernmost stations (>55 km from shore) indicating that we are sampling the innermost part of their distribution they were distributed further offshore. Based on otolith structure and chemistry, we determined that the juveniles had been in marine waters an average of only 10 days (±11), and when collected. A portion of the steelhead that had been in marine waters less than three days were captured at the westernmost edge of our survey transects, indicating a very rapid

offshore migration. Estuary-caught fish, particularly of hatchery origin, ate few prey taxa and consumed very little food relative to ocean-caught fish. Ocean-caught steelhead ate a wide variety of prey including juvenile fishes, euphausiids, and crab megalopae. Estuary and ocean unmarked fish had higher feeding intensities and fewer empty stomachs than hatchery fish, and were in better condition. Growth hormone levels (IGF-1) of unmarked and hatchery fish varied annually, with unmarked fish having slightly higher overall values. In general, ocean-caught steelhead increased in fork length, condition, stomach fullness, and IGF-1growth hormone levels increased in the ocean-caught fish as they moved offshore. Unlike other juvenile salmon species, steelhead appear to quickly migrate westward from their coastal rivers, and showed patterns of increased feeding and growth in offshore waters.
Expected publication date: Winter 2014

New view on precipitation variability and extremes in Central Europe from a German high resolution daily precipitation dataset: results from the STAMMEX project
Bulletin of the American Meteorology Society
O. Zolina, C. Simmer, A. Kapala, P. Shabanov, P. Becker, H. Maechel, S. Gulev, and **P. Groisman (NESDIS/NCDC)**

- In the paper, it is shown that not all gridding procedures are equal and that not every network can be used for analyses of extreme precipitation.
- The updatable dataset can be further used as a testbed for precipitation mechanisms studies, remote sensing products and atmospheric model output verification and calibration.
- This paper is less optimistic regarding the ability of existing observing networks and “global data sets” to report actual extreme rainfall events worldwide.

The STAMMEX project (Spatial and Temporal Scales and Mechanisms of Extreme Precipitation Events over Central Europe) has developed a high-resolution gridded long-term precipitation dataset based on the daily-observing precipitation network of the German Weather Service DWD, which runs one of the World's densest rain gauge networks comprising more than 7500 stations. Several quality-controlled daily gridded products with homogenized sampling were developed covering the periods 1931-onwards (with 0.5 resolution), 1951-onwards (0.5 and 0.25), and 1971-2000 (0.5, 0.25 and 0.1). Different methods were tested to select the best gridding methodology that minimizes errors of integral grid estimates over hilly terrain. Besides daily precipitation values with uncertainty estimates, the STAMMEX data sets include a variety of statistics that characterize temporal and spatial dynamics of the precipitation distribution (quantiles, extremes, wet/dry spells, etc.). Comparisons with existing continental-scale daily precipitation grids (e.g., CRU, ECA E-OBS, GCOS) which include considerably less observations compared

to those used in STAMMEX, demonstrate the added value of high-resolution grids for extreme rainfall analyses. These data exhibit spatial variability pattern and trends in precipitation extremes, which are missed or incorrectly reproduced over Central Europe from coarser resolution grids based on sparser networks. The STAMMEX dataset can be used for high-quality climate diagnostics of precipitation variability, as a reference for reanalyses and remotely-sensed precipitation products (including the upcoming Global Precipitation Mission products), and for input into regional climate and operational weather forecast models.
Expected publication date: Spring 2014

GOES-R Advanced Baseline Imager: spectral response functions and radiometric biases with the NPP Visible Infrared Imaging Radiometer Suite evaluated for desert calibration sites
Applied Optics
A. Pearlman, D. Pogorzala, and **C. Cao (NESDIS/STAR)**

- This work aids in preparing NOAA for post-launch vicarious validation efforts for ABI to ensure high data quality and consistency for the numerical weather prediction community and other data users.

The Advanced Baseline Imager (ABI), which will be launched in late 2015 on NOAA's Geostationary Operational Environmental Satellite R-series satellite, will be evaluated in terms of its data quality postlaunch through comparisons with other satellite sensors such as the recently launched Visible Infrared Imaging Radiometer Suite (VIIRS) aboard the Suomi National Polar-orbiting Partnership satellite. The ABI has completed much of its prelaunch characterization and its developers have generated and released its channel spectral response functions (response versus wavelength). Using these responses and constraining a radiative transfer model with ground reflectance, aerosol, and water vapor measurements, we simulate observed top of atmosphere (TOA) reflectances for analogous visible and near infrared channels of the VIIRS and ABI sensors at the Sonoran Desert and White Sands National Monument sites and calculate the radiometric biases and their uncertainties. We also calculate sensor TOA reflectances using aircraft hyperspectral data from the Airborne Visible/Infrared Imaging Spectrometer to validate the uncertainties in several of the ABI and VIIRS channels and discuss the potential for validating the others. Once on-orbit, calibration scientists can use these biases to ensure ABI data quality and consistency to support the numerical weather prediction community and other data users. They can also use the results for ABI or VIIRS anomaly detection and resolution.
Published: 31 October 2013
http://dx.doi.org/10.1364/AO.52.007660

NOAA SCIENTIFIC PUBLICATIONS REPORT
JANUARY 2014

Fishes of Bermuda
Aqua, International Journal of Ichythyology
W. F. Smith-Vaniz and **B. B. Collette (NMFS/NSL)**

- This work updates the existing list of fishes in Bermuda and corrects the 2003 FAO guide to western central Atlantic living marine resources.
- This paper publishes relevant scientific illustrations newly uncovered in an ongoing inventory of such illustrations at the Smithsonian Institution.

Here we add a recently described species of *Hyporhamphus* (Hemiramphidae), recognize *Chromis bermudae* (Pomacentridae) as valid, and remove *Parasphyraenops atrimanus* (Serranidae) from the list of Bermuda endemics,changing the total number of Bermuda endemic fishes to *s*even species, eight if *Clepticus* sp. (Labridae) proves to be new, excluding from consideration several land-locked species of *Fundulus*. First Bermuda records are documented for 24 species but five others, *Carcharodon carcharias*, *Hyporhamphus unifasciatus*, *Rypticus subbifrenatus Clepticus parrae* and *Eleotris pisonis*, based on misidentifications, are removed. Biological or distributional notes are included for 22 species and nomenclatural changes apply to another 12 species. Reproductions of recently discovered historical watercolors or pencil sketches by Colonel Drummond-Hay are provided for 14 species of Bermuda fishes.
Published: 25 October 2013

*High male reproductive success in a low-density Antarctic fur seal (*Arctocephalus gazella*) breeding colony*
Behavioral Ecology and Sociobiology
C. A. Bonin, **M. E. Goebel (NMFS/SWFSC)**, J. I. Hoffman, and R. S. Burton

- The Antarctic fur seal was driven to local extinction in the 19th century fur trade. Studying the recolonization and population recovery process and the underlying genetics of such events gives conservation biologists and managers important information about the resiliency of particular types of exploited animals.
- Such research can also provide important insight into making management decisions (e.g. setting up MPAs and the rules governing MPAs to protect vulnerable species).
- Research suggests that the top territorial males are able to remain successful for more seasons at lower density populations.

Understanding how population dynamics influences mating systems may lead to important insights into the plasticity of sexual selection. Few natural systems allow for such investigations. Previous mating system studies have shown that population density can strongly affect the degree of polygyny, and

reproductive skew may either increase or decrease with density. In order to investigate this relationship in Antarctic fur seals, *Arctocephalus gazella*, we sampled most breeding adults and every pup born at a low-density breeding site at Livingston Island (LI), Antarctica, during four austral summers (2006/07-2009/10). A total of 151 individuals (97 pups, 23 males and 31 females) were genotyped for 13 highly polymorphic microsatellite loci. We used a full likelihood pedigree inference method to obtain data on male reproductive success and compared our results to published findings from the extremely high-density colony of Bird Island, South Georgia (SG). Surprisingly, we did not detect significant differences between LI and SG regarding reproductive skew nor the maximum number of pups sired by a male per season. However, the overall reproductive success of top territorial males was significantly higher at LI, suggesting that at lower densities these males may be able to remain successful for more seasons. Our study demonstrates that while some aspects of male reproductive behavior (e.g. skew, harem size) remain extraordinarily consistent across populations, others (e.g. years of tenure) may vary locally.
Expected Publication Date: January 2014

Tracing the flow of organic matter from the Muskegon River estuary system to nearshore Lake Michigan
Journal of Great Lakes Research
K.M., Marko, **E.S. Rutherford, B.J. Eadie, T.H. Johengen,** and **M.B. Lansing (OAR/GLERL)**

- Nutrients, surficial sediment, and seston were measured to track the delivery of riverine-derived materials from the lower Muskegon River Watershed (MRW) into the nearshore area of southeast Lake Michigan.
- The extent of nutrient uptake in Muskegon Lake has altered the organic matter flowing into Lake Michigan from Muskegon River.
- However, the authors found that there was no traceble impact of the carbon and nitrogen content of organic matter from the Muskegon River watershed to nearshore Lake Michigan despite substantial nutrient loads.

Drowned river mouth lakes are major features of coastal Great Lakes habitats and may influence nutrient and organic matter contributions from watersheds to near shore coastal zones. In May through October 2003, we measured loads of nutrients, surficial sediment, and seston to track the delivery of riverine-derived materials from the lower Muskegon River Watershed (MRW) into the nearshore area of southeast Lake Michigan. Nutrient flux data indicated that seasonal loads of 1800 metric tons (MT) of particulate organic carbon, 3400 MT of dissolved organic carbon, and 24 MT of total phosphorus were discharged from the lower Muskegon River, with approximately 33% of TP load and 53% of the POC load intercepted within the drowned river mouth terminus, Muskegon Lake. Carbon: phosphorus molar ratios

of seston in Muskegon River (C:P = 187) and Muskegon Lake (C:P = 176) were lower than in Lake Michigan (C:P = 334), indicating phosphorus limitation of phytoplankton in nearshore Lake Michigan. Isotopic signatures of seston collected in Muskegon Lake were depleted in δ13C (−30.8 ± 1.6‰) relative to the isotope signatures of seston from Lake Michigan (−26.2 ± 1.3‰) or the mouth of the Muskegon River (−28.1 ± 0.5‰), likely due to the presence of biogenic methane in Muskegon Lake. Seston δ15N increased on a strong east-to-west gradient within Muskegon Lake, indicating significant microbial processing of nutrients. The extent of nutrient uptake in Muskegon Lake altered the chemical and isotopic characterization of seston flowing into Lake Michigan from Muskegon River.
Expected Publication Date: December 2013

Predicting natural channel patterns based on landscape and geomorphic controls in the Columbia River Basin, USA
Water Resources Research
T. Beechie and **H. Imaki (NMFS/NWFSC)**

- This study provides maps of areas of the Columbia River basin with high restoration potential for salmon listed under the ESA.

Based on known relationships of slope, discharge, valley confinement, sediment supply, and sediment calibre in controlling channel patterns, we developed multivariate models to predict natural channel patterns across the 674,500 km2 Columbia River basin, USA. We used readily available geospatial data sets to calculate reach slopes, 2-year flood discharge, and valley confinement, as well as to develop hypothesized landscape-level surrogates for sediment load and calibre (relative slope, percent of drainage area in alpine terrain, and percent of drainage area in erosive fine-grained lithologies). Using a support vector machine (SVM) classifier, we found that the four channel patterns were best distinguished by a model including all variables except valley confinement (82% overall accuracy). We then used that model to predict channel pattern for the entire basin and found that the spatial distribution of straight, meandering, anabranching, and braided patterns were consistent with regional topography and geology. A simple slope-discharge model distinguished meandering channels from all other channel patterns, but did not clearly distinguish braided from straight channels (68% overall accuracy). Addition of one or more of the hypothesized sediment supply surrogates improved prediction accuracy by 4 to 14% over slope and discharge alone. Braided and straight channels were most clearly distinguished on an axis of relative slope, whereas braided and anabranching channels were most clearly distinguished by adding percent alpine area to the model.
Expected Publication Date: Spring 2014

NOAA SCIENTIFIC PUBLICATIONS REPORT
JANUARY 2014

Demonstration of a spatially-explicit, tag-integrated stock assessment model with application to three interconnected stocks of yellowtail flounder off of New England
ICES Journal of Marine Science (Special Issue)
D. Goethel, **C. Legault (NMFS/NEFSC)**, and S. Cadrin

- Movement rates among stocks can be estimated within statistical catch-at-age stock assessment framework.
- Movement rates for yellowtail flounder are estimated to be low.
- Movement among stocks is not the "silver bullet" for assessment issues.

Ignoring population structure and connectivity in stock assessment models can introduce bias into important management quantities, such as terminal year spawning stock biomass and fishing mortality. The development of tag-integrated models has allowed the incorporation of spatially-explicit population dynamics directly into the stock assessment framework. Tag-integrated approaches simultaneously model the tagged and untagged portions of the population, while incorporating raw tagging data directly into the combined objective function. We demonstrate the tag-integrated approach with an application to three stocks of yellowtail flounder (*Limanda ferruginea*) off the New England coast that are connected through adult movement. Over the last decade the unknown degree of movement amongst stocks has been proposed as a potential source of uncertainty in the closed population assessment of each stock. In order to investigate connectivity among stocks a large-scale tagging study was implemented from 2003 to 2006 with over 45,000 tags released in the region. The release and recapture data was incorporated into the tag-integrated framework. The results indicated that movement between stocks was low, estimates of stock size and fishing mortality were similar to those from conventional stock assessments, and allowing for stock connectivity did not resolve residual patterns. Despite the low estimates of movement, coincident strong region-wide recruitment events were no longer predicted in the tag-integrated model, and the associated reduction in the long-term recruitment of the Georges Bank and Cape Cod-Gulf of Maine stocks has important implications for regional fisheries management.
Expected Publication Date: Unknown

Post-smolt growth and thermal regime define the marine survival of steelhead trout (Oncorhynchus mykiss) *from the Keogh River, B.C.*
Marine and Coastal Fisheries: Dynamics, Management, and Ecosystem Science
K.D. Friedland (NMFS/NEFSC), B.R. Ward, D.W. Welch, and **S.A. Hayes (NMFS/SWFSC)**

- This paper suggests a relationship between increasing water temperatures and post-smolt growth and recruitment of Pacific salmonids.

The population of anadromous steelhead trout (*Oncorhynchus mykiss)* in the Keogh River has been studied intensively in part because of their pattern of declining recruitment which is largely attributed to poor marine survival. Climate variability has changed the productivity of salmonid species in all regions of the North Pacific, with areas alternately shifting between periods of enhanced and depressed productivity. The mechanisms governing marine survival and adult recruitment are central to contemporary concerns related to resource management, but are also of concern in regard to the long term prospects of managing biodiversity. We provide evidence that post-smolt growth contributes to the pattern of marine survival of Keogh River steelhead over the period corresponding to the 1977-1999 smolt years. Size at ocean entry does not appear to have sufficient contrast to affect survival significantly. However, assessment of scale growth suggests that the initial growth of the fish at sea is not as important as the sustained growth conditions during the summer and fall of the post-smolt year. The distribution of sea surface temperature (SST) in the ocean domains assumed to provide post-smolt nursery habitat for steelhead show that return rate has been negatively correlated with SST, suggesting that growth is either directly affected by warming conditions or that ocean warming affects the food web steelhead depend upon. Steelhead appear to respond to changing climate and growth regimes in a similar fashion to their North Atlantic analog, Atlantic salmon (*Salmo salar*). These comparative data show that eastern basin populations are negatively affected by a thermal regime of increasing temperature during the post-smolt year, suggesting a relationship between post-smolt growth and survival.
Expected Publication Date: December 2013

Impact of predation by the invasive crab, Hemigrapsus sanguineus*, on survival of juvenile blue mussels in western Long Island Sound, USA*
Northeastern Naturalist
D.J. Brousseau, **R. Goldberg (NMFS/NEFSC)**, and Corey Garza

- Predation by Asian crabs plays a minor role in blue mussel mortality compared to other factors at the experimental study sites.
- Demonstrates that the impact of invaders should be assessed within different habitat types and geographic regions.

The Asian shore crab, *Hemigrapsus sanguineus*, has shown a remarkable ability to colonize rocky intertidal communities along the east coast of the United States since its introduction in the late 1980s and is an important predator of juvenile blue mussels, *Mytilus edulis,* in invaded habitats. In this study we

used two field caging experiments and the Kaplan-Meier model to assess the impact of predation by *H. sanguineus* on the survival of juvenile blue mussels in an intertidal habitat of western Long Island Sound along the Connecticut coastline. Five treatment levels (high density enclosure, low density enclosure, exclosure, partial and open plot) were used in the 2007 experiment. The high density enclosure treatment was omitted in the 2010 experiment since there was no statistically significant difference in the proportion of mussels surviving between low and high density crab treatments in 2007. In 2007 no statistically significant difference in mussel mortality between exclosure and crab enclosure cages was measured although the presence of crabs lowered the median survival time for mussels from 15.4 to 7.6 days. In 2010 a statistically significant difference in mussel mortality between exclosure and crab enclosure cages occurred suggesting a crab effect on mussel survival. In the 2010 experiment approximately 25% of the mussel mortality was attributable to crab predation which reduced median survival time from mussels from 12.8 to 5.6 days. The median survival time for mussels exposed to the full complement of factors affecting survival (open plots and partial cages) was only 2-3 days. Our study shows that predation by Asian crabs may account for up to 25% of the blue mussel mortality in the intertidal zone at Black Rock Harbor. Further studies focusing on the importance of other biotic and abiotic factors are needed to understand the apparent declines in blue mussel populations and the interannual variability in recruitment success in this area.
Expected Publication Date: Spring 2014

Mark-resight abundance estimation under incomplete identification of marked individuals
Methods in Ecology and Evolution
B.T. McClintock, J.M. Hill, **L. Fritz, K. Chumbley, K. Luxa,** and D.R. Diefenbach **(NMFS/AKFSC)**

- In terms of estimator performance, our simulation experiments and examples demonstrated advantages of our proposed approach over previous methods, particularly when marked individual identification probabilities are low and individual heterogeneity levels are high.
- Our methodology can also reduce field effort requirements for marked individual identification, thus allowing potential investment into additional marking events or resighting surveys.

Often less expensive and less invasive than conventional mark-recapture, so-called ``mark-resight'' methods are popular in the estimation of population abundance. These methods are most often applied when a subset of the population of interest is marked (naturally or artificially), and noninvasive sighting data can be simultaneously collected for both marked and unmarked individuals. However, it can often be difficult to identify marked individuals with certainty during resighting surveys, and incomplete identification of marked individuals is potentially a major source of bias in mark-resight abundance

estimators. Previously proposed solutions are ad hoc and will tend to underperform unless marked individual identification rates are relatively high (>90%) or individual sighting heterogeneity is negligible. Based on a complete data likelihood, we present an approach that properly accounts for uncertainty in marked individual detection histories when incomplete identifications occur. The models allow for individual heterogeneity in detection, sampling with (e.g., Poisson) or without (e.g., Bernoulli) replacement, and an unknown number of marked individuals. Using a custom Markov chain Monte Carlo algorithm to facilitate Bayesian inference, we demonstrate these models using two example datasets and investigate their properties via simulation experiments. We estimate abundance for grassland sparrow populations in Pennsylvania when sampling was conducted with replacement and the number of marked individuals was either known or unknown. To increase marked individual identification probabilities, extensive territory mapping was used to assign incomplete identifications to individuals based on location. Despite marked identification probabilities as low as 67% in the absence of this territorial mapping procedure, we generally found little return (or need) for this time-consuming investment when using our proposed approach. We also estimate rookery abundance from Alaskan Steller sea lion counts when sampling was conducted without replacement, the number of marked individuals was unknown, and individual heterogeneity was suspected as non-negligible.
Expected Publication Date: Unknown

Investigating interconnected fisheries: a coupled model of the lobster and herring fisheries in the Northeast US
Canadian Journal of Fisheries and Aquatic Sciences
S. Lehuta, **D.S. Holland (NMFS/NWFSC)**, and A. Pershing

- This model demonstrated the importance of taking into account the impacts that the lobster and herring fisheries have on each other when evaluating management measures.

Fisheries are often linked through ecological, environmental and human mediated processes that can impact their productivity, profitability and resilience. However, despite increasing calls for ecosystem-based fishery management (EBFM), managers rarely explicitly account for the linkages between fisheries. We present a coupled bioeconomic model of the American lobster *(Homarus americanus)* fishery in Maine and the Atlantic herring *(Clupea harengus)* fishery in the Northeast US that we use to explore the interdependency of these two fisheries. The fisheries are strongly linked through the use of herring bait by the lobster fishery which provides the primary market for the herring fishery. These fisheries provide a test case for how changes in management or ecosystem conditions in one fishery can propagate to another. The model builds upon existing stock assessment models and includes key characteristic of both

fisheries including size- or age-structured populations, seasonal patterns of lobster exploitation, and seasonal-spatial patterns of herring exploitation. The models are linked through a bait market module that drives behavior of the herring fleet and affects catches, costs and revenues in both fisheries.
Expected Publication Date: Spring 2014

Spatial and social connectivity of fish-eating "Resident" killer whales (Orcinus orca) *in the northern North Pacific*
Marine Biology
H. Fearnbach (NMFS/AKFSC), **J.W. Durban (NMFS/AKFSC),** D.K. Ellifrit, **J.M. Waite (NMFS/AKFSC),** C.O. Matkin, **C.R. Lunsford (NMFS/AKFSC),** M.J. Peterson, **J. Barlow (NMFS/SWFSC),** and **P.R. Wade (NMFS/AKFSC)**

- Resident-type fish-eating killer whales in the Aleutian Islands, Bering Sea, and western Gulf of Alaska show high site fidelity in summer.
- Four large social networks were identified within this region, which is broadly consistent with proposed population stock structure from a recent genetic study.
- The large-scale connectivity of these killer whale populations has likely facilitated the spread of depredation of commercial longline fisheries.

The productive North Pacific waters of the Gulf of Alaska, Aleutian Islands, and Bering Sea support a high density of fish-eating "Resident" type killer whales (*Orcinus orca*), which overlap in distribution with commercial fisheries, producing both direct and indirect interactions. To provide a spatial context for these interactions, we analyzed a 10-year dataset of 3,058 whale photo-identifications from 331 encounters within a large (linear ~4,000 km) coastal study area to investigate the ranging and social patterns of 532 individually identifiable whales photographed in more than one encounter. Although capable of large-scale movements (maximum 1,443 km), we documented ranges generally <200 km, with high site fidelity across summer sampling intervals and also re-sightings during a winter survey. Bayesian analysis of pair-wise associations identified four defined clusters, likely representing groupings of stable matrilines, with distinct ranging patterns, that combined to form a large network of associated whales that ranged across most of the study area. This provides evidence of structure within the Alaska stock of Resident killer whales, important for evaluating ecosystem and fisheries impacts. This network included whales known to depredate ground fish from longline fisheries, and we suggest that such large-scale connectivity has facilitated the spread of depredation.
Published: November 2013
Link to paper: http://link.springer.com/article/10.1007/s00227-013-2351-0

NOAA SCIENTIFIC PUBLICATIONS REPORT
JANUARY 2014

Ecosystem externalities in fisheries
Marine Resource Economics
R. Ryan and **D.S. Holland (NMFS/NWFSC)**

- This paper demonstrates how environmental externalities can be incorporated in theoretical bioeconomic models of fisheries

The economics literature on fisheries has focused primarily on stock externalities and, to a lesser degree, on crowding externalities. Yet, for many fisheries, harvesting activities may affect the underlying biological productivity of the fish stock by impacting the forage or habitat quantity or quality. We refer to this as an "ecosystem externality." Ecosystem externalities may be positive as well as negative. While fishing may damage habitat in ways that reduce productivity, in some cases it may increase food availability and thereby increase productivity of the target species of a fishery. Extending the model of Smith (1968), we use three equations to characterize dynamics of a resource stock, profit-maximizing individual behavior, and vessel entry/exit. We use this simple model to show how ecosystem externalities, in conjunction with stock externalities and crowding externalities, affect system dynamics, open-access equilibria, and optimal fishery regulation implemented through a tax.
Publication Date: March 2014

Zappaichthys harzhauseri *gen. et sp. nov, a new Miocene toadfish (Teleostei, Batrachoidiformes) from the Paratethys (St. Margarethen in Burgenland, Austria) with comments on the fossil record of batrachoidiform fishes*
Journal of Vertebrate Paleontology
G. Carnevale and **B. B. Collette (NMFS/NEFSC)**

- Authors describe a new genus and species of toadfish, a benthic fish, from the Middle Miocene in Austria.
- This new genus/species is believed to be the oldest member of the Batrachoidiformes known to date based on articulated skeletal remains.

Toadfishes (Batrachoidiformes) are benthic fishes, often burying in the sand or under rocks, that occur worldwide in tropical to temperate marine and brackish waters. The Batrachoididae, the only known family of the order Batrachoidiformes, includes 25 extant genera and about 80 species arranged in four subfamilies. A new genus and species of toadfish, *Zappaichthys harzhauseri* n. gen., n. sp., is described from the Middle Miocene (Late Badenian) Leitha Limestone of St. Margarethen in Burgenland, Eisenstadt-Sopron Basin, Austria. It is based on three partially complete well-preserved articulated skeleton plus a

neurocranium that display a unique combination of characters [possession of 29 (10+19) vertebrae; dorsal fin with three solid spines and 16 rays; anal fin with 11 rays; pectoral fin with 20-25 rays; interorbital region of the neurocranium wide; postorbital sector of the neurocranium longer than the orbital one; four ossified pectoral-fin radials; opercle with a strong pointed spine; subopercle bearing two spines and two short filaments; scales absent] that support its recognition as a new genus of the family Batrachoididae. *Zappaichthys harzhauseri* n. gen., n. sp., is the oldest member of the Batrachoidiformes known to date based on articulated skeletal remains. The fossil record of batrachoidiform fishes is discussed in detail.
Accepted: October 9, 2013

Why is data sharing in collaborative natural resource studies so hard and what can we do to improve it?
Environmental Management
C. Volk, Y. Lucero, and **K. Barnas (NMFS/NWFSC)**

- Data management is integral to natural resource jobs, yet most survey respondents had little or no training in data management
- Five tools for data management are suggested.

Increasingly, research and management in natural resource science relies on very large datasets compiled from multiple sources. While it is generally good to have more data, utilizing large, complex datasets has introduced challenges in data-sharing, especially for collaborating researchers in disparate locations ("distributed research teams") and scientific collaborations are frequently plagued by data handling inefficiencies. We surveyed natural resource scientists about common data-sharing problems. The major issues identified by our survey respondents (n=118) when providing data was lack of clarity in the data request (including format of data requested). When receiving data survey responded reported various insufficiencies in metadata documentation (e.g. no data collection description/no protocol, data aggregated or summarized without explanation). We advocate for all researchers, but especially those involved in distributed teams to alleviate these problems with the use of data dictionaries, data catalogues, read-me files, data flow diagrams, data request forms and organizational charts to facilitate communication. In particular, we argue that distributed research teams magnify data-sharing challenges. If natural resource scientists fail to overcome communication and metadata documentation issues, then negative data-sharing experiences will likely continue to undermine the success of many large-scale, collaborative projects.
Published: Winter 2014

NOAA SCIENTIFIC PUBLICATIONS REPORT
JANUARY 2014

Consistent trends in modified climate extremes index in the U.S.A., Europe and Australia
Journal of Climate
A. Gallant, D. Karoly, and **K. Gleason (NESDIS/NCDC)**

- This paper illustrates the global coherence of the observed changes/increase in climate extremes across the CONUS.
- Communities should anticipate observing more consistent bouts of extreme warmth and heavy rainfall events.

The utility of a combined modified Climate Extremes Index (mCEI) is presented for monitoring coherent trends in multiple types of climate extremes across large regions. Its usefulness lies in its ability to distil complex spatio-temporal fields into a simple, flexible non-parametric index. Two versions of the mCEI are computed that incorporate changes in several annual or daily-scale temperature-related and moisture-related extremes. Applying data from the contiguous United States, Europe and Australia detects consistent and statistically significant increases in the spatial prevalence of climate extremes from 1950 to 2012. All three continental-scale regions show increasingly widespread warm annual and daily-scale minimum and maximum temperature extremes; a decreasing spatial extent of cool annual and daily-scale minimum and maximum temperature extremes; and increasing areas where the proportion of annual total precipitation falls on heavy rain days. There were no statistically significant trends towards more widespread, annual-scale drought or moisture surplus in any region. The dependence of annual extremes on the frequency of daily-scale extremes is highlighted by the strong covariations between annual and daily-scale extremes in all regions. By the nature of construction of the combined indices, the differences in the trends of the mCEI and dmCEI suggest that extremes in more areas are changing primarily because of a shift of temperature and daily rainfall distributions towards warm extremes and heavy rainfall extremes.
Expected Publication Date: Early 2014

Environmental factors that influence the distribution, size, and biotic relationships of Christmas tree corals (Antipathes dendrochristos) *in the Southern California Bight*
Marine Ecology Progress Series
D. D. Huff, **M. M. Yoklavich**, M. S. Love, **D. L. Watters**, F. Chai F, and **S. T. Lindley (NMFS/SWFSC)**

- Authors found that persistent surface primary productivity in combination with depth and January bottom currents are important predictors of Christmas tree coral density. Higher coral density coincided with greater chlorophyll persistence and optimal depths. Surface productivity increasingly was associated with Christmas tree corals at shallower depths.

- Several predicted Christmas tree coral hotspots remain unprotected from fishing, particularly in areas adjacent to highly populated portions of the Southern California Bight. Authors suggest that these areas be targeted by future studies.

The Christmas tree coral (*Antipathes dendrochristos*) is a recently discovered black coral species that represents a habitat associated with numerous sensitive taxa in the Southern California Bight. The authors evaluated whether broad-scale oceanographic features influence coral density and size by selecting from among generalized additive models (GAMs) and generalized linear models (GLMs) that represented competing hypotheses. Authors constructed models to predict coral density and size using depth, seafloor slope, surface primary productivity, bottom currents, ocean temperature, salinity, and dissolved oxygen as candidate covariates. Specifically, they evaluated hypothesized links between pelagic production and benthic coral utilization and between bottom currents and larval coral dispersal. The analysis revealed that high surface primary productivity in combination with depth and January currents are important predictors of Christmas tree coral density. Higher coral density coincided with greater chlorophyll persistence and optimal depths near 400m. Surface productivity increasingly was associated with Christmas tree corals at shallower depths. Results supported the hypothesis that ocean currents affect coral density via larval dispersal mechanisms. The selected coral size models responded to similar covariates, corroborating coral density results. Fish and invertebrate ordinations indicated that Christmas tree corals were widely distributed across environmental gradients and that Christmas tree corals co-occurred with several demersal fish and invertebrates. Several predicted coral hotspots remain unprotected from fishing, particularly in areas adjacent to highly populated portions of the Southern California Bight. These regions should be targeted by future studies to confirm the presence of Christmas tree coral communities and to evaluate their vulnerability.
Expected Publication Date: January 2014

Oceanographic influences on patterns in North Pacific salmon abundance
Canadian Journal of Fisheries and Aquatic Sciences
M. Stachura, **N. Mantua (NMFS/SWFSC)**, and **M. Scheuerell (NWFSC/NWFSC)**

- Three dominant patterns of temporal variation (1951-2002) in the abundance of 34 stock groups of wild North American and Asian pink salmon (*Oncorhynchus gorbuscha*), chum salmon (*O. keta*), and sockeye salmon (*O. nerka*) were related directly to patterns of oceanographic variability.
- Changes in SST associated with the leading pattern of salmon abundance was found to be closely related to low-frequency, oscillatory temperature changes in the SST of the North Pacific, captured in part by the Pacific Decadal Oscillation (PDO).

- If environmental conditions related to SST in this region are causing changes in this salmon production pattern, the recent cool period may cause declines in salmon abundance for many pink, chum, and sockeye salmon stocks in Alaska and northern British Columbia.

Oceanographic influences on patterns in North Pacific salmon abundance

Abstract from paper: We identified three dominant patterns of temporal variation (1951-2002) in the abundance of 34 stock groups of wild North American and Asian pink salmon (*Oncorhynchus gorbuscha*), chum salmon (*O. keta*), and sockeye salmon (*O. nerka*) that were related to patterns of oceanographic variability. We identified these patterns using three different ordination methods and found consistent patterns across these methods. Alaskan salmon dominated the most prominent pattern, which exhibited a positive abundance shift in the mid-1970s. In general, warm (cold) periods in the Gulf of Alaska and eastern Bering Sea corresponded with high (low) abundance years for these stock groups. The second abundance pattern captured differences between Asian, northern North American, and southern North American population groups and was associated with an intense, large-scale Aleutian Low. To our knowledge, this is the first analysis that identifies regional patterns of covariation in salmon abundance around the entire North Pacific Rim, and it highlights the existence of basin-wide covariations in wild salmon abundance that are associated with spatially coherent and regionally distinct patterns in North Pacific climate.

Expected Publication Date: unknown, early online release on 22 Oct 2013

The ability of two age composition error distributions to estimate selectivity and spawning stock biomass in simulated stock assessments

Fisheries Research

C. Legault (NMFS/NEFSC)

- Authors conducted a simulation study to examine two different error distributions for age composition data for fish spawning stock biomass.
- Both error distributions had a tendency to overestimate spawning stock biomass. Authors suggest that stock assessments that estimate domed selectivity patterns should have simulations conducted to evaluate if estimator biases are present.

A simulation study was conducted that examined two different error distributions for age composition data; the multinomial and the adjusted lognormal. Across 24 different simulation cases, and 4,800 total data inputs, the multinomial error distribution consistently outperformed the adjusted lognormal error distribution, even when the true error was generated from the adjusted lognormal distribution. Both error distributions had a tendency to overestimate spawning stock biomass, but the bias was more

severe for the adjusted lognormal. The only scenario in which the adjusted lognormal performed better was when selectivity was mis-specified; in this circumstance, the strong positive bias associated with the adjusted lognormal compensated for model runs that forced flat selectivity when selectivity was truly domed. Model selection criteria were overly sensitive when using the adjusted lognormal error. The utility of the adjusted lognormal error distribution in stock assessments is significantly diminished by the biased nature of the estimator, high variability of estimates, and inability to properly identify the correct selectivity pattern. Stock assessments that estimate domed selectivity patterns should have simulations conducted to evaluate if this bias is present. This can be accomplished by simulating data according to the error distributions used within the stock assessment and evaluating biases in estimates of selectivity and spawning stock biomass.
Accepted: November 15, 2013

Redescription of Alatina alata *(Reynaud 1830) (Cnidaria: Cubozoa) from Bonaire, Dutch Caribbean*
Zootaxa
C. Lewis, B. Bentlage, A. Yanagihara, W. Gillan, J. Van Blerk, D. Keil, A. E. Bely, and **A. G. Collins (NMFS/NEFSC)**

- Elucidating biodiversity through sound systematics is of foundational importance to ecosystem management.
- This paper advances systematics of Cubozoa (box jellyfish) and clarifies the identity of an emerging model organism.

Authors establish a neotype for *Alatina alata* (Reynaud, 1830) from the Dutch Caribbean island of Bonaire. The species was originally described one hundred and eighty three years ago as *Carybdea alata* in La Centurie Zoologique—a mono-graph published by Ren–Primevère Lesson during the age of worldwide scientific exploration. While monitoring monthly reproductive swarms of *A. alata* medusae in Bonaire, authors documented the ecology and sexual reproduction of this cubo-zoan species. Examination of forty six *A. alata* specimens and additional archived multimedia material in the collections of the National Museum of Natural History, Washington, DC revealed that *A. alata* is found at depths ranging from surface waters to 675 m. Additional studies have reported it at depths of up to 1607 m in the tropical and subtropical Atlantic Ocean. Authors resolve the taxonomic confusion long associated with *A. alata* due to a lack of detail in the original description and conflicting statements in the scientific literature. A new cubozoan character, the velarial lappet, is de-scribed for this taxon. The complete description provided here serves to stabilize the taxonomy of the second oldest box jellyfish species, and provide a thorough description of the species.

NOAA SCIENTIFIC PUBLICATIONS REPORT
JANUARY 2014

HyMeX-SOP1, the field campaign dedicated to heavy precipitation and flash flooding in the northwestern Mediterranean
Bulletin of the American Meteorological Society
V. Ducrocq, I. Braud, S. Davolio, R. Ferretti, C. Flamant, A. Jansa, N. Kalthoff , E. Richard, I. Taupier-Letage, P.-A. Ayral, S. Belamari , A. Berne, M. Borga, B. Boudevillain, O. Bock, J.-L. Boichard, M.-N. Bouin, O. Bousquet, C/ Bouvier, J. Chiggiato, D. Cimini, U. Corsmeier, L. Coppola, P. Cocquerez, E. Defer, J. Delanoë, P. Di Girolamo, A. Doerenbecher, P. Drobinski, Y. Dufournet, N. Fourrié, **J. J. Gourley (OAR/NSSL),** L. Labatut, D. Lambert, J. Le Coz, F. S. Marzano, G. Molinié, A. Montani, G. Nord, M. Nuret , K. Ramage, B. Rison, O. Roussot, F. Said, A. Schwarzenboeck, P. Testor, J. Van Baelen, B. Vincendon, M. Aran, J. Tamayo

- HyMeX-SOP1 collected unprecedented observations of atmosphere, ocean, land, and rivers to improve our knowledge and prediction of the most damaging natural hazards in the Mediterranean.
- This wealth of observations will be used to improve our understanding of complex interactions that govern the location and severity of heavy precipitation and flash floods.

More than 200 research instruments were deployed during the Hydrological cycle in the Mediterranean Experiment (HyMeX) to collect data on high-impact heavy precipitation and flash floods over the northwestern Mediterranean Sea and its surrounding coastal regions in France, Italy, and Spain. More than 200 research instruments, including NSSL's mobile dual-polarized radar, were deployed and collected an unprecedented dataset.
Publication Date (online): 20 November 2013

Recovery potential of smalltooth sawfish, Pristis pectinata*, in the United States determined using population viability models*
Aquatic Conservation: Marine and Freshwater Systems
J. K. Carlson (NMFS/SEFSC) and C. A. Simpendorfer

- This paper suggests that effective management and recovery of smalltooth sawfish can only be achieved by keeping fishing-related mortality low and also recommends that the exploration of habitat loss on the recovery potential be explored in future PVA simulations.
- Using the most optimistic estimates of current population size, lower age-at-maturity and the lower level of fisheries-related mortality, smalltooth sawfish in US waters appear to have the ability to recover within the foreseeable future.

Determining the recovery potential of endangered species is an important component for developing strategies necessary to return populations to healthy levels. Many species of endangered marine animals have been regarded as having low productivity and therefore, an inherent inability to rapidly recover from severe depletion. An age-structured Leslie matrix model was constructed for the U.S. population of smalltooth sawfish to determine their ability to recover under scenarios using different life history inputs

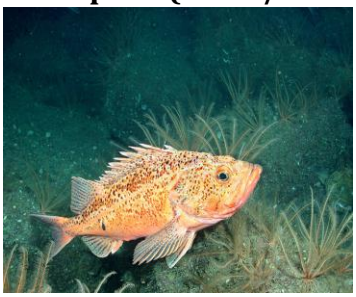
and the effects of bycatch mortality and catastrophes. Population growth was highest (l=1.237 yr^{-1}) when age-at-maturity was 7 years and decreased to 1.150 yr^{-1} when age-at-maturity was 11 years. Despite a high level of variability throughout the model runs, in the absence of fishing mortality or climate catastrophic effects, the population grew at a relatively rapid rate approaching carrying capacity in 40 or 50 years when the initial population was 600 or 2,250 females, respectively. Population projections under various levels of fishing mortality resulted in extinction when mortality was highest, initial population size was small, and age-at-maturity was 11 years. Scenarios testing the potential effects of extreme cold exposure showed little difference to those scenarios testing the effects of fishing mortality. Using the optimistic estimates of population size, lower age-at-maturity and the lower level of fisheries-related mortality, smalltooth sawfish in US waters appear to have the ability to recover within the foreseeable future. Effective management and recovery of this species can only be achieved by keeping fishing-related mortality low.
Accepted: 2 December 2013

Twenty five novel microsatellite markers for English sole, Parophrys vetulus
Conservation Genetics Resources
G. Winans and **L. Baker (NMFS/NWFSC)**

- This paper isolated and characterized a total of 25 microsatellite loci from English sole from Whidbey Island, Washington, USA.
- The new loci will be used to study genetic variability within and among populations in the Salish Sea to help monitor effects of near shore urbanization, and establish and monitor marine protected areas.

Although English sole *Parophrys vetulus* has been used extensively as a bioindicator of anthropogenic pollution in the U.S. Pacific Northwest, little is known about its genetic population structure. We isolated and characterized a total of 25 microsatellite loci from 23 individuals from Whidbey Island, Washington. The number of alleles per locus ranged from 5 to 19, observed heterozygosity ranged 0.091 to 0.957, and the probability of identity values ranged from 0.009 to 0.157. These new loci will be used to study genetic variability within and among populations in the Salish Sea (Puget Sound and Strait of Georgia) to help monitor effects of near shore urbanization, and establish and monitor marine protected areas.
Expected Publication Date: Spring 2014

Simulation testing the robustness of stock assessment models to error: some results from the ICES Strategic Initiative on Stock Assessment Models
ICES Journal of Marine Science
J. J. Deroba (NMFS/NEFSC), D. S. Butterworth, **R. D. Methot Jr. (NMFS/NWFSC),** J. A. A. De Oliveira, C. Fernandez, A. Nielsen, S. X. Cadrin, M. Dickey-Collas, **C. M. Legault (NMFS/NEFSC), J. Ianelli (NMFS/AKFSC),** J. L. Valero, C. L. Needle, **J. M. O'Malley (NMFS/PIFSC), Y.-J. Chang (NMFS/PIFSC), G. G. Thompson (NMFS/AKFSC),** C. Canales, D. P. Swain, D. C. M. Miller, N. T. Hintzen, M. Bertignac, L.



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Ibaibarriaga, A. Silva, A. Murta, L. T. Kell, C. L. de Moor, A. M. Parma, C. M. Dichmont, V. R. Restrepo, Y. Ye, E. Jardim, **P. D. Spencer (NMFS/AKFSC), D. H. Hanselman (NMFS/AKFSC), J. Blaylock (NMFS/NEFSC), M. Mood (NMFS/NEFSC), P.-J. Hulson (NMFS/PIFSC)**

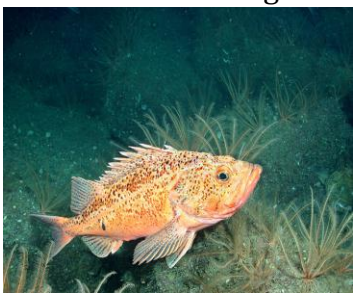
- It is recommended that the methods used in this paper become standard practice in evaluation of stock assessment.
- Work revealed the need for greater investment in the evaluation of stock assessment methods.

The World Conference on Stock Assessment Methods (July 2013) included a workshop on testing assessment methods through simulations. The exercise was comprised of two steps applied to datasets from 14 representative fish stocks from around the world. Step one involved applying stock assessments to datasets with varying degrees of effort dedicated to optimizing fit. Step two was applied to a subset of the stocks and involved characteristics of given model fits being used to generate pseudo-data with error. These pseudo-data were then provided to assessment modellers and fits to the pseudo-data provided consistency checks within (self-tests) and among (cross-tests) assessment models. Although trends in biomass were often similar across models, the scaling of absolute biomass was not consistent across models. Similar types of models tended to perform similarly (e.g. age based or production models). Self-testing and cross-testing of models is a useful diagnostic approach and suggested that estimates in the most recent years of time series were the least robust. Results from the simulation exercise provide a basis for guidance on future large-scale simulation experiments and demonstrate the need for strategic investments in the evaluation and development of stock assessment methods.
Expected Publication Date: Early 2014

Ribbed mussel, Geukensia demissa*, responses to the harmful algae* Aureococcus anophagefferens *and* Heterosigma akashiwo
Journal of Molluscan Studies
E. Galimany, J. M. Rose, J. Alix, M. S. Dixon, G. H. Wikfors (NMFS/NFSC)

- This is the first report of susceptibility of ribbed mussels to harmful-algal damage
- Two harmful-algal species found in salt-marsh habitats of ribbed mussels decreased mussel filtration rates and were cytotoxic to mussel hemocytes
- Blooms of the two harmful algal species studied can be expected to disrupt ecological function of ribbed mussels in salt-marsh ecosystems

The ribbed mussel (*Geukensia demissa*) is a keystone species in the salt marshes of the North American Atlantic Coast. We investigated the clearance rates and pathology of ribbed mussels exposed to cultures of two toxic algae, *Aureococcus anophagefferens* or *Heterosigma akashiwo*, for five days and contrasted the results with mussels fed the non-toxic alga *Tetraselmis chui*. We also conducted a separate, *in vitro* experiment in which we exposed extracted mussel hemocytes to the three different algae, their respective media, and seawater, as a toxicity bioassay. Results show that mussels exposed to either of the toxic algae had significantly-decreased clearance rates during the entire exposure period. Histopathology revealed thinner digestive tubules, gonad reabsorption, and a decrease in gill ciliates in response to both



toxic algal species. There was a significant increase in mortality of hemocytes exposed *in vitro* to both toxic algae compared to seawater controls. Results suggest that ribbed mussel feeding behavior and physiology can be impacted in several ways by harmful algae, which could undermine their contribution to pelagic-benthic coupling processes.
Expected Publication Date: Spring 2014

Does temporal and spatial segregation explain the complex population structure of humpback whales on the coast of West Africa?
Marine Biology
I. Carvalho, J. Ay-Ling Loo, T. Collins, J. Barendse, C. Pomilla, **M. S. Leslie (NMFS/SWFSC),** P. Best, and H. Rosenbaum

- Authors explored spatial and temporal population structure of humpback whales on the west coast of Africa using inherited genetic markers.
- The study revealed some temporal and spatial population segregation, largely between whales sampled off Gabon in winter and those in west South Africa in spring/summer.
- The results suggest a portion of the whales feeding off west South Africa are breeding and calving in an unknown area.

Humpback whales (*Megaptera novaeangliae*) in the Southeastern Atlantic Ocean (BSB stock) are distributed in winter along the western coast of the African continent, from Gulf of Guinea to western South Africa. Recent data suggest that this stock is sub-structured with a sub-stock that breeds in Gabon and possibly in other areas of Gulf of Guinea through Angola (B1), and a sub-stock using the west coast of South Africa as a winter migration corridor and summer feeding ground (B2). The location of the breeding ground for B2 whales remains unknown. This work re-evaluates the spatial and temporal population structure of humpback whales on the west coast of Africa using a combination of maternally and bi-parentally inherited markers. A total of 2018 samples representing B1 and B2 regions were amplified, sexed, genotyped and sequenced. The results revealed a subtle but significant genetic differentiation at spatial and temporal scales between B1 and B2, even with high gene flow and current interchange between the two regions. Differences in site fidelity and sex ratio between the two sub-stocks were found. The existence of some spatial and/or temporal segregation for the breeding grounds in the Gulf of Guinea together with the possible maternally directed site-fidelity to specific feeding grounds, some animals from Gabon travelling offshore to feeding grounds and others travelling coastwise to feed off west South Africa could be an explanation for the nature of the genetic differentiation found in this study. Further genetic sampling in other areas of the winter range and the strategic deployment of satellite tags could help clarify the situation.
Expected Publication Date: Early 2014

Examining the utility of alternative video monitoring metrics for indexing reef fish abundance
Canadian Journal of Fisheries and Aquatic Sciences

NOAA SCIENTIFIC PUBLICATIONS REPORT
JANUARY 2014

Z. H. Schobernd (NMFS/SEFSC), **N. M. Bacheler (NMFS/SEFSC)**, and **P. B. Conn (NMFS/AKFSC)**

- The authors' findings suggest that the most commonly used metric to count fish on videos from underwater camera surveys may not accurately represent changes in the actual population abundance.
- Authors present a viable alternative metric, MeanCount, that better tracks changes in true abundance.
- This study serves as an important reference for the development of underwater video surveys, as very little research is currently published on the relative advantages and drawbacks of different video metrics.

Underwater video has become an important tool for monitoring reef fish populations worldwide because it is non-extractive and not strongly selective. A variety of approaches have been developed to enumerate fish on videos, but to our knowledge these metrics have not been tested to determine if they are proportional to true abundance. Authors compared the most commonly used metric, MaxN (i.e., the maximum number of fish in a single frame during the viewing interval), to a newly developed metric, MeanCount (i.e., the mean number of fish observed in a series of snapshots over a viewing interval), using simulations, a laboratory experiment, and an empirical study. MaxN was nonlinearly related to true abundance using all three approaches, providing increasingly dampened estimates of abundance with increasing true abundance (i.e., hyperstability). Therefore, MaxN may result in positively biased indices of abundance for declining fish stocks or negatively biased abundance indices when fish stocks are increasing. Alternatively, MeanCount was generally linearly related to true abundance and its variability was similar to MaxN, suggesting that MeanCount can be useful for indexing abundance of fish in underwater video surveys.

Expected Publication Date: Spring 2014

http://www.nrcresearchpress.com/doi/pdf/10.1139/cjfas-2013-0086

Induced bacteriovory in a declining culture of the mixotrophic dinoflagellate Prorocentrum minimum *(Pavillard) Schiller*

International Journal of Ecology

G.H.Wikfors and **E. Fernandez (NMFS Northeast Fisheries Science Center)**

- Toxicity of the dinoflagellate *Prorocentrum minimum* to shellfish is sporadic and poorly understood
- Increased toxicity is coincident with a shift from autotrophic to heterotrophic status
- This finding helps to explain variable toxicity of *Prorocentrum minimum* blooms

Bacteriovory was reported previously in the dinoflagellate *Prorocentrum minimum*, but it was unclear if this was constitutive or induced under certain conditions. We tested the hypothesis that phosphate deficiency, or cessation of autotrophic growth for other reasons, would induce bacteriovory in a culture of *P. minimum* that is harmful to shellfish. Phosphate-starved cells did not ingest fluorescently-labeled bacteria and died. In stationary-phase, full-enrichment cultures, more than half of

viable *P. minimum* cells showed declines in chlorophyll coincident with incorporation of fluorescently-labeled bacteria. Declining populations of *P. minimum* increase in toxicity to suspension-feeding shellfish; this suggests a possible association between bacteriovory and toxicity.
Accepted: 2 December 2013

Interannual variation in the at-sea behavior of California sea lions (Zalophus californianus)
Marine Mammal Science
C. E. Kuhn (NMFS/AKFSC) and D. P. Costa

- This study details the foraging behavior of California sea lions from San Nicolas Island, California and examines how behavior changes in response to typical interannual environmental variation.
- The authors found that sea lions modify foraging behavior in response to even modest environmental fluctuations in the California Current System, which may help populations buffer against future environmental change.

To be successful, marine predators must alter their foraging behavior in response to changes in their environment. To understand the impact and severity of environmental change on a population it is necessary to first describe typical foraging patterns and identify the underlying variability that exists in foraging behavior. Therefore, the authors characterized the at-sea behavior of adult female California sea lions (n = 32) over three years (2003, 2004, and 2005) using satellite transmitters and time-depth recorders and examined how foraging behavior varied among years. In all years, sea lions travelled on average 84.7 ± 11.1 km from the rookery during foraging trips that were 3.2 ± 0.3 d. Sea lions spent 42.7% ± 1.9% of their time at sea diving and displayed short (2.2 ± 0.2 min), shallow dives (58.5 ± 8.5 m). Among individuals, there was significant variation in both dive behavior and movement patterns, which was found in all years. Among years, differences were found in trip durations, distances traveled, and some dive variables (*e.g.*, dive duration and bottom time) as sea lions faced moderate variability in their foraging habitat (increased sea-surface temperatures, decreased upwelling, and potential decreased prey abundance). The flexibility found in the foraging behavior of California sea lions may be a mechanism to cope with environmental variability among years and could be linked to the continuing growth of sea lion populations.
Accepted: 19 November 2013

Ontogeny of critical swimming speeds for larval and pelagic juvenile rockfishes (Sebastes *spp., family* Scorpaenidae)
Marine Ecology Progress Series
N. S. Kashef**, S. M. Sogard (NMFS/SWFSC)**, R. Fisher and J. L. Largier

- Understanding the mechanisms that affect larval dispersal is critical to management of marine populations.

- Results of this study provide quantitative information on swimming capabilities for rockfish from different larval stages through to settlement.
- These data are valuable for determination of behavioral capacity of the larvae to modify dispersal, and therefore the data are applicable to estimates of connectivity.

Rockfishes (*Sebastes* spp.) do not settle to benthic habitats immediately after metamorphosis, but instead remain in the water column for weeks to months. Movements of larvae and pelagic juveniles during their months at sea are largely unknown. It is traditionally thought that young rockfishes are planktonic, moving at the mercy of ocean currents, but this assumption is unverified. In this study swimming capabilities (critical speed) of larval and pelagic juvenile stages of six rockfish species (blue (*S. mystinus*), yellowtail (*S. flavidus*), brown (S. *auriculatus*), kelp (*S. atrovirens*), gopher (*S. carnatus*), and splitnose (S. *diploproa*)) are evaluated to determine their ability to behaviorally influence dispersal. Rockfish larvae have critical speeds of 0.5 – 1.8 cm s^{-1} (1-3 body lengths per second (bl s^{-1})) at parturition, whereas newly settled juveniles are capable of swimming 8.6 – 53.5 cm s^{-1} (5-9 bl s^{-1}). Swimming ability increases throughout ontogeny and postflexion rockfishes can swim faster than mean current speeds in waters off central California. Critical speeds for *Sebastes* spp. are substantially lower than those for larvae and juveniles of tropical species at similar body sizes. Rockfishes, however, have comparable swimming speeds to some tropical species at settlement, as rockfishes settle at larger sizes. The increasing ability of rockfishes to outswim currents during their pelagic phase, acting as nekton rather than plankton, may promote individual survival as well as enhance retention and long-distance dispersal – and thus swimming has important implications for population connectivity and sustainability.
Accepted: 28 November 2013

Multivariate random forest models of estuarine-associated fish and invertebrate communities
Marine Ecology Progress Series
K. Miller, B. Norcross, F. Heuttmann, and **M. Lorenz (NMFS/AKFSC)**

- Knowledge of the environmental factors affecting community composition can guide research and management strategies
- The authors used a new approach, Multivariate Random Forests (MRF), to estimate the estuarine assemblage composition along habitat gradients in Southeast Alaska using landscape-scale habitat variables
- Multivariate machine learning algorithms like MRF were shown to effectively model spatial variability in community composition in estuaries

Models that evaluate species habitat relationships at the community level have been gaining attention with increasing interest in ecosystem management. Developing models that can incorporate both a large number of predictor variables and a multivariate response (a vector of individual species occurrences or abundances) is challenging. One promising new approach is Multivariate Random Forests (MRF), a method that combines multivariate regression trees with bootstrap resampling and predictor subsampling from traditional Random Forests. Random Forest models have been shown to be highly

accurate and powerful in their predictive ability in a wide variety of applications. They can effectively model nonlinear and interacting variables. Our research evaluated change in estuarine assemblage composition along habitat gradients in Southeast Alaska using landscape-scale habitat variables and MRF. For 541 estuaries, we identified 24 predictor variables describing the geomorphic and habitat environment on land and in the estuary. MRF models were constructed in R for combined fish and invertebrate assemblages. Cluster analysis of model proximities revealed strong spatial variation in community composition in relation to differences in tidal range, precipitation, percent of eelgrass, and amount of intertidal habitat. This research presents a new science-based management template that can be used to inform and assess species management and protection strategies, as well to guide future research on species distributions.
Acceptance date: November 21, 2013

Temporal variability of the Meridional Overturning Circulation at 34.5°S: results from two pilot boundary arrays in the South Pacific
Journal of Geophysical Research: Oceans
C. S. Meinen (OAR/AOML), S. Speich, **R. C. Perez (CIMAS)**, **S. Dong (CIMAS)**, A. R. Piola, **S. L. Garzoli (CIMAS)**, **M. O. Baringer (OAR/AOML)**, S. Gladyshev, and E. J. D. Campos

- The measured MOC over the ~20 months of observations at 34.5°S is highly variable on time scales ranging from a few days to a few months; the observed variability is roughly on par with that observed at 26.5°N.
- For the time scales observable within the 20-month record, the observed MOC variability is driven roughly equally by changes at both the western and eastern sides of the basin at 34.5°S.
- The direct wind forcing (Ekman) has the largest impact on MOC variations at 34.5°S for periods less than 20 days, however at longer time scales the gyre (geostrophic) and direct wind forcing (Ekman) both play roughly equivalent roles.

The Meridional Overturning Circulation (MOC) dominates the north-south transport of heat in the world oceans, and variations in the MOC have been shown to correlate to changes in societally important quantities such as precipitation patterns, sea surface temperatures, and hurricane intensification. To date, daily time series estimates of the MOC have only been available in the North Atlantic (most notably at 26.5°N in the North Atlantic). In this new paper, data collected as part of the NOAA Southwest Atlantic MOC ("SAM") project is combined together with data from a parallel French project to produce the first daily time series of MOC variability at 34.5°S in the South Atlantic.
Publication Date (online): 3 December 2013
http://onlinelibrary.wiley.com/doi/10.1002/2013JC009228/abstract

Bounds on biomass estimates and energetic consequences of Ctenophora in the Northeast U.S. shelf ecosystem

NOAA SCIENTIFIC PUBLICATIONS REPORT
JANUARY 2014

International Journal of Oceanography
M. Ford (NMFS/OST) and **J. Link (NMFS/NEFSC)**

- The approaches presented in this paper highlight a few possible ways to estimate the abundance and biomass, and reasonably place bounds on those estimates, for hard to sample gelatinous zooplankton (ctenophores).
- Abundance and biomass estimates were on the order of 10^8 to 10^{13} individuals and 10^1 and 10^5 thousand MT in the Northeast U.S.
- This work in many ways represents a rudimentary sensitivity analysis among different methods and serves to provide a bound about the true ctenophore abundance, outside of which most estimates are likely to be ecologically unfeasible.

Previous descriptions have noted that the stomach samples of spiny dogfish, *Squalus acanthias*, showed a major increase in the overall occurrence and hence implied abundance of Ctenophora. This apparent and persistent gelatinous zooplankton outbreak is increasingly more common in the world's oceans. We briefly explore the energetic ramifications of ctenophores in the spiny dogfish diet, inferring that the presence of gelatinous zooplankton represents an ambient feeding strategy. Relative to other prey, ctenophores are not a high energy density prey item. However, given varying assumptions of the amount of ctenophores consumed, they may be an important staple in the diet of spiny dogfish. We also examine the utility of using spiny dogfish as a gelatinous zooplankton sampling device. Using five calculation methodologies, we provide bounds on potential abundance and biomass estimates of ctenophores in the Northeast U.S. Shelf ecosystem. We then contextualize these findings relative to the implications for the Northeast U.S. and any large marine ecosystem.
Expected Publication Date: Early 2014
http://www.hindawi.com/journals/ijocean/aip/851809/

The effects of disease-induced juvenile mortality on the transient and asymptotic population dynamics of chinook salmon (Oncorhynchus tshawytscha)
PLoS ONE
M. Fujiwara, **M. S. Mohr (NMFS/SWFSC)**, A. Greenberg

- An increase in disease mortality likely has an effect on fishery yield under a fluctuating environment, not only because the mean equilibrium adult spawning abundance has likely been reduced, but also because the resilience has likely decreased and the variance in adult spawning abundance has likely increased.
- We also infer the importance of incorporating finer-scale spatiotemporal information into population models and demonstrate a means for doing so within a matrix population modeling framework.

The effects of an increased disease mortality rate on the transient and asymptotic dynamics of chinook salmon (*Oncorhynchus tshawytscha*) were investigated. Disease-induced mortality of juvenile salmon has

become a serious concern in recent years. However, the overall effects of disease mortality on the asymptotic and transient dynamics of adult spawning abundance are still largely unknown. We explored various scenarios with regard to the density-dependent process, the distribution of survivorship over the juvenile phase, the disease mortality rate, and the infusion of stray hatchery fish. Our results suggest that the sensitivity to the disease mortality rate of the equilibrium adult spawning abundance and resilience (asymptotic return rate toward this equilibrium following a small perturbation) varied widely and differently depending on the scenario. The resilience and coefficient of variation of adult spawning abundance following a large perturbation were consistent with each other under the scenarios investigated. We conclude that the increase in disease mortality likely has an effect on fishery yield under a fluctuating environment, not only because the mean equilibrium adult spawning abundance has likely been reduced, but also because the resilience has likely decreased and the variance in adult spawning abundance has likely increased. We also infer the importance of incorporating finer-scale spatiotemporal information into population models and demonstrate a means for doing so within a matrix population modeling framework.
Accepted: 27 November 2013

Application of diversity indices to quantify early life-history diversity for chinook salmon
Ecological Indicators
G. E. Johnson, N. K. Sather, J. R. Skalski, **D. J. Teel (NMFS/NWFSC)**

- We developed an approach to quantify early life history diversity for chinook salmon.
- The early life history diversity index can support comparisons across like locales and examinations of trends through time at a given locale.
- It has application as a high-level indicator to track trends in the status of the recovery of salmon and steelhead populations in the Columbia River basin and elsewhere where salmon recovery efforts are under way.

Early life history diversity (ELHD) is the variation in morphological and behavioral traits expressed within and among populations by individual juvenile salmon during downstream migration. A standard quantitative method does not exist for this prominent concept in salmon biology. For chinook salmon *(Oncorhynchus tshawytscha)*, ELHD reflects the multitude of possible strategies undertaken during the juvenile (fry through smolt) phases of their life cycle, where a life history strategy (or pattern) describes the combination of traits exhibited by an organism throughout its life cycle. Increasing life history diversity to improve resilience and aid recovery of diminished salmon and steelhead populations is a common objective in fish population recovery efforts. In this paper, we characterized early life history traits and prioritize timing and fish size as two appropriate, measurable dimensions for an ELHD index. We studied diversity index literature, identified an indexing approach based on the effective number of time-size trait combinations, and tested several candidate indices for performance and usefulness in case studies using juvenile salmon catch data from the lower Columbia River and estuary. The recommended ELHD index is diversity expressed as the effective number of time-size trait combinations for the

Shannon Index, modified to include an adjustment for missing time-size trait combinations and a sample coverage factor. This index applies to multiple life history strategies of juvenile salmonids; incorporates fish abundance, richness, and evenness; and produces readily interpretable values.
Expected Publication Date: Winter 2014

Spatial and temporal patterns of growth and consumption by juvenile chinook salmon
Environmental Biology of Fishes
P. M. Chittaro, R. W. Zabel, K. Haught, B. L. Sanderson, and B. P. Kennedy **(NMFS/NWFSC)**

- This study highlights that ecosystem components, such as temperature, influence somatic growth in complex ways, thus potentially limiting the use of growth as a metric of habitat quality.
- Results of this study represent the first steps towards identifying factors that underlie important population level and habitat quality differences.

Somatic growth is often used as a metric of habitat quality, but such an approach has limitations because growth results from complex interactions between abiotic and biotic factors. In this study, we derived estimates of weekly growth (based on otolith growth increments) across several months for four populations of threatened chinook salmon, *Oncorhynchus tshawytscha*, from the Salmon River Basin, Idaho, USA. Although mean stream temperature varied by 2-5°C across populations, growth across the season did not vary significantly by population. To investigate this further, we applied a bioenergetics model that produced estimates of consumption rates. We then examined how growth and consumption rates varied according to rearing stream and day in the season. Using generalized least squares models, somatic growth (g×day-1) was best explained by stream and date, yet a model with only date had moderate support, and thus indicated limited support for stream effects. Specific consumption rate (g×g-1×day-1 and J×g-1×day-1) was best explained using a model that included main effects of stream and date. These findings are consistent with the hypothesis that higher temperatures confer higher metabolic costs that require greater consumption to produce similar growth rates in cooler streams. This highlights that similarity in growth rate among streams may mask changes in individual behavior and/or energetic acquisition associated with differences in temperatures among streams.
Expected Publication Date: Winter-Spring 2014

3. OTHER REPORTS, BOOK CHAPTERS, AND INTERNAL PUBLICATIONS

Climate Sensitivity of the National Estuarine Research Reserve System
Report to NOAA's Climate Program Office
P. Robinson, **A.K. Leight, D. Trueblood, B. Wood (NOS/NCCOS)**
All NERRS have some sensitivity to climate change, and the type and magnitude of sensitivity differs between reserves. This study provides NOAA with foundational understanding of climate change in the reserves and helps guide future research and monitoring efforts across the reserve system.
Published online:
http://www.nerrs.noaa.gov/Doc/PDF/Research/130725_climate%20sensitivity%20of%20nerrs_Final-

NOAA SCIENTIFIC PUBLICATIONS REPORT
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Fish Movement Patterns in Virgin Islands National Park, Virgin Islands Coral Reef National Monument and Adjacent Waters
NOAA Technical Memorandum
A. Friedlaner, M. Monaco, R. Clark and **S. Pittman (NOS/NCCOS/CCMA)**

- Results have aided the National Park Service in determining the efficacy of its marine protected areas within the USVI National Park and National Coral Reef Monument.

Biogeography Branch, National Park Service (NPS), US Geological Survey, and the University of Hawaii used acoustic telemetry to quantify spatial patterns and habitat affinities of reef fishes around the island of St. John, US Virgin Islands (Fig. 1). The objective of the study was to define the movements of reef fishes among habitats within and between the Virgin Islands Coral Reef National Monument (VICRNM), the Virgin Islands National Park (VIIS), and Territorial waters surrounding St. John. In order to better understand species' habitat utilization patterns among management regimes, we deployed an array of hydroacoustic receivers and acoustically tagged reef fishes. Thirty six receivers were deployed in shallow near-shore bays and across the shelf to depths of approximately 30 m. One hundred eighty four individual fishes were tagged representing 19 species from 10 different families with VEMCO V9-2L-R64K transmitters. The array provides fish movement information at fine (e.g., day-night and 100s meters within a bay) to broad spatial and temporal scales (multiple years and 1000s meters across the shelf). The long term multi-year tracking project provides direct evidence of connectivity across habitat types in the seascape and among management units. An important finding for management was that a number of individuals moved among management units (VICRNM, VINP, Territorial waters) and several snapper moved from near-shore protected areas to offshore shelf-edge spawning aggregations. However, most individuals spent the majority of their time with VIIS and VICRNM, with only a few wide-ranging species moving outside the management units.
Expected publication date: February 2014

Ecological condition of coastal ocean waters of the Northwestern Gulf of Mexico: 2011
NOAA Technical Memorandum
W. L. Balthis, J. L. Hyland, C. Cooksey, M. H. Fulton, and **E. F. Wirth (NOS/NCCOS)**

- Indications of stress in benthic infaunal assemblages appear to be related primarily to the well-documented hypoxic "Dead Zone" on the inner Louisiana continental shelf.

Low values of benthic infaunal richness and diversity were associated with poor water quality at some sites, which also had very low dissolved oxygen (DO) (< 0.1 mg/L) accompanied by high dissolved inorganic nitrogen (DIN). These stations were located in an area known for experiencing annual hypoxia from spring to early fall. However, this study found no evidence of biological impacts linked to poor sediment quality. These results suggest that sediments in the surveyed area of the northwest GOM seem to be in good condition with respect to contaminants and total organic carbon (TOC).

NOAA SCIENTIFIC PUBLICATIONS REPORT
JANUARY 2014

Published: May 2013

A baseline assessment of coral and fish bays (St. John, USVI) in support of ARRA watershed restoration activities
NOAA Technical Memorandum
D. Whitall, C. Menza, R. Hill, A. Pait, I. Hartwell, L. Wedding, R. Clark, C. Caldow, M. Monaco, J.C. Doerr, K.G. Ferran

- Chlordane and copper were elevated in Coral Harbor at levels that suggest possible sediment toxicity. Coral Harbor was general more contaminated that other portions of Coral or Fish bays.
- This dataset serves as an important baseline for these two priority watersheds which will allow managers to measure change over time.
- Additionally, these data identify two contaminants of concern (copper and chlordane) and a portion of the study area (Coral Harbor) which demonstrates a higher level of contaminant concern than the rest of the study area. We found that biomass and dominant components of the macroalgal assemblage varied with distance from stream inflows, as did percent cover of scleractinian corals.

This report provides a suite of data and analyses which will serve as an environmental baseline against which to measure future change in the ecosystem, including improvements resulting from watershed restoration activities. The suite includes: 1) An analysis of data acquired over ten years by the National Centers for Coastal Ocean Science in Coral Bay and Fish Bay on the island of St. John before watershed stabilization measures were undertaken in 2011. This data, collected as part of the NOAA's Caribbean Coral Reef Ecosystem Monitoring (CREM), will serve as an ecological baseline to assess the efficacy of watershed improvements on coral reefs within these bays. All CREM data presented here is available online free of charge at: http://www8.nos.noaa.gov/biogeo_public/query_main.aspx. 2) Contaminant analysis of surficial sediment samples in order to determine the pollutant stressors associated with sedimentation and land based sources of pollution. The contaminant levels are compared with other studies in the region, and against previously published sediment quality guidelines to put the levels of contamination in perspective. These data are available online free of charge at: http://egisws02.nos.noaa.gov/nsandt/ 3) Measures of biological parameters expected to respond to changes in water quality from reductions in sediment inflow and runoff. The parameters, measured across a distance gradient from inshore sources of runoff, include relative abundance and biomass of macroalgae, composition and cover of scleractinian corals and other benthic organisms, as well as distribution and abundance of fish and macroinvertebrates. 4) Measures of water quality (e.g., nutrient levels, salinity, chlorophyll, temperature). Sample collection and analysis are on-going to characterize Fish, Coral and Lameshur Bays, St. John; work has been conducted by partners at the Univ. of the Virgin Islands, cooperatively with EPA and USVI Division of Environmental Protection. Data are highlighted briefly in this report but full results will be available separately. As with other baseline characterizations, these results, plus results of sedimentation studies, will be critical to future analyses of environmental

conditions and an understanding of the biological findings of this work.
Accepted: October 2013

Chapter 6: Diseases of King Crabs and Other Anomalies
Book Title: King Crabs of the World: Biology and Fisheries Management.
J.F. Morado, **C.A. Shavey**, T.V. Ryazanova and **V.C. White (NMFS/AKFSC)**

- The entire publication is a compendium of research experts in king crab biology and management
- In this chapter the authors present all known diseases and anomalies of king crabs and discuss potential impacts on king crab populations

Emphasis will be placed upon diseases and anomalies of commercially important species, but diseases and parasites that could be of future interest will also be reviewed. Furthermore, the following discussion will focus upon diseases and anomalies of large juvenile and adult king crabs, because little is known of diseases of larvae or juveniles. However, an initiated king crab enhancement program (AKCRRAB: Alaska King Crab Research, Rehabilitation and Biology program) (http://seagrant.uaf.edu/research/projects/initiatives/king-crab/general) will likely contribute to a more complete understanding of lithodid crab health issues of all life history stages. The potential for disease epizootics greatly increase under aquaculture or captive conditions. Under such conditions, egg clutches come under the attack of various kinds of opportunistic pathogens. The types of pathogens historically encountered on crustacean eggs and larvae include the following: luminescent vibrios, shell disease, fungi, filamentous bacteria, filamentous diatoms, sessile and saprophytic protistans, and nematodes (http://rfdp.seafdec.org.ph/publication/manual/crab/chapter1.html). Infestations can be severe enough that entire clutches may be lost.
Expected Publication Date: January 2014

Comment on temperature-dependent stock–recruit modeling for Pacific sardine (Sardinops sagax) *in Jacobson and MacCall (1995), McClatchie et al. (2010), and Lindegren and Checkley (2013)*
Canadian Journal of Fisheries and Aquatic Sciences
L.D. Jacobson (NMFS/NEFSC) and S. McClatchie

- Spawning stock biomass has proven to be more important than changes in sea surface temperature when predicting Pacific sardine recruitment
- Results indicate that fishery managers should try to maintain adequate levels of spawning biomass while adjusting expectations for potential recruitment or reference points based on environmental data

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Published online: 17 September 2013
Link to paper: http://www.nrcresearchpress.com/doi/pdf/10.1139/cjfas-2013-0128

Comment on 'Bayesian parentage analysis with systematic accountability of genotyping error, missing data and false matching'
Bioinformatics
E. C. Anderson (NMFS/SWFSC) and T. C. Ng

- This is a short paper in which we show that a recently published method for parentage inference can be greatly improved with some straightforward statistical forethought. We implemented a new version of the algorithm which is considerably more accurate and also some 100 times faster.

We show the software SOLOMON is improved by using the likelihood ratio instead of an ad hoc statistic.
Expected Publication Date: November 2013

Conserving our oceans one place at a time
L. Wenzel, M. McIntosh, J. Gass, C. Wahle, M. Migliori, J. Flanders, B. Wolfe, C. McCreedy, R. Sparks **(NOS/ONMS)**

- Currently, MPAs focused on natural and cultural heritage cover approximately eight percent of U.S. waters.
- International targets for MPA coverage established through the Convention on Biological Diversity and other commitments call for 10 percent of ocean and coastal areas to be conserved within MPAs by the year 2020.
- Maintaining an accurate inventory of U.S. MPAs is an essential step toward meeting this goal.

On Nov. 15, NOAA's National Marine Protected Areas Center issued a new report on the state of marine protected areas in the United States. Titled "Marine Protected Areas of the United States: Conserving Our Oceans, One Place at a Time", the report provides a detailed snapshot of the coverage, level of protection, resources protected and ecological representativeness of MPAs in U.S. waters. It also features brief case studies in MPA management from around the country, including NOAA's Thunder Bay National Marine Sanctuary. For the first time, the report summarizes data on U.S. MPAs specifically protected for their natural heritage — ecosystems, biodiversity, habitats and species — as well as for their cultural resources and values. This focus on natural and cultural heritage MPAs provides greater comparability with the accepted international definition of MPAs established by the International Union for the Conservation of Nature (IUCN).

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Link to paper:
http://marineprotectedareas.noaa.gov/pdf/fac/mpas_of_united_states_conserving_oceans_1113.pdf

National standards for a protected species observer and data management program: a model using geological and geophysical surveys
NMFS Office of Protected Resources Series Tech Memo
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- The tech memo recommends the establishment of national standards for data collection and Protected Species Observer (PSO) qualifications for geological and geophysical (i.e., seismic) surveys.
- Solutions to existing issues in PSO programs are recommended, when possible. National standards will provide consistency in the training, performance, and qualifications of PSOs required for seismic surveys operating in the Gulf of Mexico, Atlantic, Pacific, Arctic, and international waters. A standardized approach will also yield more useful data to better inform decision makers on the effectiveness of monitoring and mitigation measures for protected species.
- The PSO standards and recommendations were developed by a working group of federal partners including NMFS, the Bureau of Ocean Energy Management (BOEM), and the Bureau of Safety and Environmental Enforcement (BSEE).

This report provides recommendations for the Protected Species Observer and Data Management Program (PSO program) for marine geological and geophysical (G&G) surveys, and recommended actions on key issues for the establishment and management of such a program. The contents of this report are the combined results of discussions held between staff from the National Oceanic and Atmospheric Administration's (NOAA) National Marine Fisheries Service (NMFS) and the Department of the Interior's Bureau of Ocean Energy Management (BOEM) and Bureau of Safety and Environmental Enforcement (BSEE). Improvement of the PSO program for G&G surveys was the topic of a BOEM and workshop on March 26, 2008, in New Orleans, Louisiana, with BOEM, BSEE, NMFS, PSOs, and G&G industry representatives. This workshop identified existing issues with the G&G PSO program, and potential solutions were discussed. As a result of identified federal actions at this workshop, NMFS formed an ad hoc Protected Species Observer Working Group (Working Group) comprised of personnel from NMFS, BOEM, and BSEE, and convened a workshop at the NMFS Southeast Regional Office on June 19, 2008, in St. Petersburg, Florida, to discuss PSO program issues on a national level, resulting in the preparation of this report. Since this report was drafted, BOEM has proposed leasing areas in the Northwest Atlantic

that include G&G surveying activities along the U.S. East Coast, as well as G&G activities associated with sand and gravel mining in federal waters. PSOs are expected to play a similar role in the Atlantic, as modeled after the Gulf of Mexico program, once G&G permitting begins. Improvements to PSO programs for G&G surveys would have benefits for stakeholders (NMFS, BOEM, BSEE, industry, and PSOs), enhance the effectiveness of mitigation and monitoring requirements, and increase the integrity of data collected and reported. This report provides recommendations of the Working Group for the development of a national PSO program. The core issues for the development of national standards and the foundation necessary for the successful development and management of a PSO program for G&G surveys are identified. When possible, prudent solutions to existing issues in PSO programs are recommended, and actions requiring further consideration are noted.
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Link to paper: http://www.nmfs.noaa.gov/pr/publications/techmemo/observers_nmfsopr49.pdf

Sailing through time: a Historical examination of the explorations and expeditions of the Papahānaumokuākea Marine National Monument
Smithsonian Institution Scholarly Press
C.S. Wiener and **D. Wagner (NOS/ONMS)**

- Research conducted by ONMS staff compiling the history of exploration of the NWHI reaches national and international audiences via publication in a prestigious peer-reviewed scientific journal.

Many decades of exploration and documentation of the Northwestern Hawaiian Islands (NWHI) have shown dynamic and pristine ecosystems that have been a source of cultural, economic and scientific wealth. Recent calls for large-scale and archipelagic-wide ecosystem management build upon this history, emphasizing holistic and integrated science and institutional collaboration. Given the successful experiences of the Papahānaumokuākea Marine National Monument (PMNM), the Hawaiian Islands serve as a commendable example of the value of scientific exploration in support of resource management. Past activities ranging from exploration, voyaging, monitoring and protection are all essential to these initiatives, contributing to an improved global understanding of ocean systems and environmental changes. This article draws on local knowledge, histories and scientific expeditions to reflect on past exploration and its importance to what we now know about the NWHI. The integration of previous expeditions and science initiatives is demonstrated through the increasingly successful ecosystem-based management of PMNM and support for archipelagic-wide marine managed areas. Reflections on how

these histories influence present day research questions and future management directions are also discussed.
Published: 12 November 2013

Baseline characterization of fish and benthic communities in the Flower Garden Banks National Marine Sanctuary
NOAA Technical Memorandum
R. Clark (NOS/NCCOS)
This baseline assessment can be used in comparative analyses with future assessments to track changes over time in the fish and benthic communities of the Flower Garden Banks National Marine Sanctuary.
Expected Publication Date: Early 2014

Marine Cage Culture and the Environment: Twenty-first Century Science Informing a Sustainable Industry
NOAA Technical Memorandum
C. S. Price and **J. A. Morris, Jr. (NOS/NCCOS)**

- This report aims to provide a comprehensive review of some predominant environmental risks that marine fish cage culture aquaculture, as it is currently conducted, poses in the marine environment and designs and practices now in use to address these environmental risks in the United States (U.S.) and elsewhere.
- This report provides a broad overview of the twenty-first century marine finfish aquaculture industry, with a targeted focus on potential impacts to water quality, sediment chemistry, benthic communities, marine life and sensitive habitats.
- These tools are instrumental for siting and managing farms, and a comparative analysis of these models is underway by NOAA.

Technological innovation has made it possible to grow marine finfish in the coastal and open ocean. Along with this opportunity comes environmental risk. As a federal agency charged with stewardship of the nation's marine resources, the National Oceanic and Atmospheric Administration (NOAA) requires tools to evaluate the benefits and risks that aquaculture poses in the marine environment, to implement policies and regulations which safeguard our marine and coastal ecosystems, and to inform production designs and operational procedures compatible with marine stewardship. Today's finfish aquaculture industry has learned, adapted and improved to lessen or eliminate impacts to the marine habitats in which it operates. What progress has been made? What has been learned? How have practices changed and what are the results in terms of water quality, benthic, and other environmental effects? To answer these questions we conducted a critical review of the large body of scientific work published since 2000 on the environmental impacts of marine finfish aquaculture around the world. Our report includes results, findings and recommendations from over 420 papers, primarily from peer-reviewed professional journals. Other environmental issues including fish health, genetic issues, and feed formulation were

beyond the scope of this report and are being addressed in other initiatives and reports. Also absent is detailed information about complex computer simulations that are used to model discharge and accumulation of nutrient waste from farms.
Publication Date: 13 December 2013

4. SPECIAL SECTION IN *CONSERVATION BIOLOGY*

Climate Change, Marine Environments, and the U.S. Endangered Species Act
Conservation Biology
E. E. Seney (NMFS/OST), M. J. Rowland (USEC/GC), R. A. Lowery (USEC/GC), R. B. Griffis (NFMS/OST) and **M. M. McClure (NMFS/NWFSC)**

- Climate change is a critical issue that requires developing new scientific and management approaches for imperiled species, including those related to NOAA NMFS' U.S. Endangered Species Act (ESA) responsibilities.
- Climate change may, depending on the specific situation, be a large factor in five key types of ESA decisions: listing determinations; critical habitat designations; recovery planning; interagency (ESA Section 7) consultations; and case-by-case issuance of permits to allow for exceptions to the ESA's "take" prohibition.
- Although agency and judicial guidance is still evolving, it is clear that climate change's effects necessitate new approaches to scientific analyses that underlie ESA and other conservation decisions, including identifying at-risk species, defining environmental baselines, predicting distribution and habitat shifts, and defining appropriate temporal and spatial scales.

Climate change is expected to be a top driver of global biodiversity loss in the 21st century. It poses new challenges to conserving and managing imperiled species, particularly in marine and estuarine ecosystems. The use of climate-related science in statutorily driven species management, such as under the U.S. Endangered Species Act (ESA), is in its early stages. This article provides an overview of ESA processes, with emphasis on the mandate to the National Marine Fisheries Service to manage listed marine, estuarine, and anadromous species. Although the ESA is specific to the United States, its requirements are broadly relevant to conservation planning. Under the ESA, species, subspecies, and "distinct population segments" may be listed as either endangered or threatened, and taking of most listed species (harassing, harming, pursuing, wounding, killing, or capturing) is prohibited unless specifically authorized via a case-by-case permit process. Government agencies, in addition to avoiding take, must ensure that actions they fund, authorize, or conduct are not likely to jeopardize a listed species' continued existence or adversely affect designated critical habitat. Decisions for which climate change is likely to be a key factor include: determining whether a species should be listed under the ESA, designating critical habitat areas, developing species recovery plans, and predicting whether effects of proposed human activities will be compatible with ESA-listed species' survival and recovery. Scientific analyses that underlie these critical conservation decisions include risk assessment, long-term recovery

planning, defining environmental baselines, predicting distribution, and defining appropriate temporal and spatial scales.
Publication Date: December 2013

Choosing and using climate-change scenarios for ecological-impact assessments and conservation decisions
Conservation Biology
A. K. Snover, **N. J. Mantua (NMFS/SWFSC)**, J. S. Littell, **M. A. Alexander (OAR/ESRL)**, **M. M. McClure (NMFS/NWFSC),** and J. Nye

- Guidelines were devised for choosing climate-change scenarios for ecological impact assessment that recognize irreducible uncertainty in climate projections and address common misconceptions about this uncertainty.
- The most appropriate scenarios for a particular analysis will not necessarily be the most appropriate for another due to differences in local climate drivers, biophysical linkages to climate, decision characteristics, and how well a model simulates the climate parameters and processes of interest.

Increased concern over climate change is demonstrated by the many efforts to assess climate effects and develop adaptation strategies. Scientists, resource managers, and decision makers are increasingly expected to use climate information, but they struggle with its uncertainty. With the current proliferation of climate simulations and downscaling methods, scientifically credible strategies for selecting a subset for analysis and decision making are needed. We devised guidelines for choosing climate-change scenarios for ecological impact assessment that recognize irreducible uncertainty in climate projections and address common misconceptions about this uncertainty. This approach involves identifying primary local climate drivers by climate sensitivity of the biological system of interest; determining appropriate sources of information for future changes in those drivers; considering how well processes controlling local climate are spatially resolved; and selecting scenarios based on considering observed emission trends, relative importance of natural climate variability, and risk tolerance and time horizon of the associated decision. The most appropriate scenarios for a particular analysis will not necessarily be the most appropriate for another due to differences in local climate drivers, biophysical linkages to climate, decision characteristics, and how well a model simulates the climate parameters and processes of interest. Given these complexities, we recommend interaction among climate scientists, natural and physical scientists, and decision makers throughout the process of choosing and using climate-change scenarios for ecological impact assessment.
Publication Date: December 2013

Estimating effects of tidal power projects and climate change on threatened and endangered marine species and their food web
Conservation Biology
D. S. Busch, C. M. Greene, and **T. P. Good (NMFS/NWFSC)**

- No effects of tidal power development on ESA-listed species were detected from the food web model output, but the effects of climate change on them and other members of the food web were large.
- The analyses exemplify how natural resource managers might assess environmental effects of marine technologies in ways that explicitly incorporate climate change and consider multiple ESA-listed species in the context of their ecological community.

Marine hydrokinetic power projects will operate as marine environments change in response to increased atmospheric carbon dioxide concentrations. We considered how tidal power development and stressors resulting from climate change may affect Puget Sound species listed under the U.S. Endangered Species Act (ESA) and their food web. We used risk tables to assess the singular and combined effects of tidal power development and climate change. Tidal power development and climate change posed risks to ESA-listed species, and risk increased with incorporation of the effects of these stressors on predators and prey of ESA-listed species. In contrast, results of a model of strikes on ESA-listed species from turbine blades suggested that few ESA-listed species are likely to be killed by a commercial-scale tidal turbine array. We applied scenarios to a food web model of Puget Sound to explore the effects of tidal power and climate change on ESA-listed species using more quantitative analytical techniques. To simulate development of tidal power, we applied results of the blade strike model. To simulate environmental changes over the next 50 years, we applied scenarios of change in primary production, plankton community structure, dissolved oxygen, ocean acidification, and freshwater flooding events.
Publication Date: December 2013

Interactive effects of water diversion and climate change for juvenile chinook salmon in the Lemhi River Basin (U.S.A.)
Conservation Biology
A. W. Walters,, K. K. Bartz, and **M. M. McClure (NMFS/NWFSC)**

- Authors used models to examine the potential effects of water diversion and climate change on juvenile chinook salmon, a species listed as threatened under the U.S. Endangered Species Act.
- Projected salmon survival was 42–58% lower when streamflows were diverted than when streamflows were undiverted. For diverted streamflows, 2040 climate-change scenarios resulted in an additional 11–39% decrease in survival.
- The authors' results indicate climate change will likely pose an additional stressor that should be considered when evaluating the effects of anthropogenic actions on salmon population status and encourage conducting these types of analyses when evaluating effects of specific actions on a particular species.

The combined effects of water diversion and climate change are a major conservation challenge for freshwater ecosystems. In the Lemhi Basin, Idaho (U.S.A.), water diversion causes changes in streamflow, and climate change will further affect streamflow and temperature. Shifts in streamflow and temperature

regimes can affect juvenile salmon growth, movement, and survival. The authors examined the potential effects of water diversion and climate change on juvenile Chinook salmon (*Oncorhynchus tshawytscha*), a species listed as threatened under the U.S. Endangered Species Act (ESA). To examine the effects for juvenile survival, they created a model relating 19 years of juvenile survival data to streamflow and temperature and found spring streamflow and summer temperature were good predictors of juvenile survival. Authors used these models to project juvenile survival for 15 diversion and climate-change scenarios. Projected survival was 42–58% lower when streamflows were diverted than when streamflows were undiverted. For diverted streamflows, 2040 climate-change scenarios (ECHO-G and CGCM3.1 T47) resulted in an additional 11–39% decrease in survival. Authors also created models relating habitat carrying capacity to streamflow and made projections for diversion and climate-change scenarios. Habitat carrying capacity estimated for diverted streamflows was 17–58% lower than for undiverted streamflows. Climate-change scenarios resulted in additional decreases in carrying capacity for the dry (ECHO-G) climate model. The results indicate climate change will likely pose an additional stressor that should be considered when evaluating the effects of anthropogenic actions on salmon population status. Thus, this type of analysis will be especially important for evaluating effects of specific actions on a particular species.
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