NOAA SCIENTIFIC PUBLICATIONS REPORT
JUNE 20, 2016

HIGHLIGHTED ARTICLES

Population status assessment and restoration modeling of white abalone (*Haliotis sorenseni*) in California
Journal of Shellfish Research (0.791)

Mitigating effects of an invasive fish: integrating control efforts with management of native predators
Applied Ecology (4.740)

Hydrological drivers of record-setting water level rise on Earth's largest lake system
Water Resources Research (3.709)

Evidence of successful spawning and other life history aspects of *Alosa sapidissima* (American Shad) in the Penobscot River and estuary
Northeastern Naturalist (0.550)

Connecting the dots: a communications model of the North Texas integrated warning team during the 15 May 2013 tornado outbreak
Weather, Climate, and Society (1.696)

Multi-year persistence of the 2014/15 North Pacific marine heatwave
Nature Climate Change (14.547)

Forty years of fishing: Changes in age structure and stock mixing in northwestern Atlantic bluefin tuna (*Thunnus thynnus*) associated with size-selective and long-term exploitation
ICES Journal of Marine Science (2.626)

Reply to Safina and Walter et al.: Multiple lines of evidence for size-structured spawning migrations in western Atlantic bluefin tuna
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Currents and transport on the Eastern Bering Sea shelf—An integration of over 20 years of data
Deep Sea Research Part II (2.190)

A difficult Arctic science issue—Midlatitude weather linkages
Polar Science (0.952)

Consideration of coastal carbonate chemistry in understanding biological calcification
Geophysical Research Letters (4.212)

Consistent estimates of tsunami energy show promise for improved early warning
Pure and Applied Geophysics (1.618)

Aircraft observations of dry air, the ITCZ, convective cloud systems, and cold pools in MJO during DYNAMO
Bulletin of the American Meteorological Society (11.08)

NMFS Publications

Projected asymmetric response of Adélie penguins to Antarctic climate change
Scientific Reports (5.578)

Evaluation of nucleic acids and plasma IGF1 levels for estimating short-term responses of postsmolt Atlantic salmon (*Salmo salar*) to food availability
Fishery Bulletin (1.783)

Surface and bottom temperature and salinity climatology along the continental shelf off the Canadian and U.S. East Coasts
Continental Shelf Research (1.892)

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A framework for incorporating species, fleet, habitat, and climate interactions into fishery management
Frontiers in Marine Science (N/A)

Inactivation of cone-specific phototransducftion genes in rod monochromatic cetaceans
Frontiers in Ecology and Evolution (7.615)

Optimal environmental conditions and anomalous ecosystem responses: constraining bottom-up controls of phytoplankton biomass in the California Current system
Scientific Reports (5.578)

Non-lethal batch identification of Atlantic salmon *Salmo salar* using coded wire tags
North American Journal of Fisheries Management (1.110)

Synthesis of common management concerns associated with dam removal
Journal of the American Water Resources Association (1.348)

What is a 'significant portion' of a range? Reply to Nelson et al. (2016)
Endangered Species Research (2.259)

Climate impacts on sea turtle breeding phenology in Greece and associated foraging habitats in the wider Mediterranean Region
PLoS One (3.234)

Genet-specific spawning patterns in *Acropora palmata*
Coral Reefs (3.324)

Improving the estimation of transect length and width for underwater visual surveys of targets on or near the seabed
ICES Journal of Marine Science (2.576)

NOAA SCIENTIFIC PUBLICATIONS REPORT
JUNE 20, 2016

HIGHLIGHTED ARTICLES

Population status assessment and restoration modeling of white abalone (Haliotis sorenseni) *in California*
Journal of Shellfish Research (0.791)
C.A. Catton, **K.L. Stierhoff**, and L. Rogers-Bennett **(NMFS/SWFSC)**

- White abalone populations in southern CA are critically endangered and at high-risk of going extinct within 15 years.
- Active restoration efforts will likely be required to stop the decline of this species to extinction.
- The number of captive-bred white abalone necessary to conduct a successful stock enhancement exercise is quite high.

White abalone (*Haliotis sorenseni*) was listed as endangered in 2001 because of severe declines throughout southern California due to overfishing. Populations continue to decline despite the closure of the fishery in 1996. There has been little to no evidence of recruitment in southern California from population surveys and in artificial reefs targeting white abalone recruitment since the listing of the species. Using a 13-year time-series of white abalone abundance in prime habitat, surveyed with a remote-operated vehicle (ROV), we conduct a population viability analysis to quantify: 1) the population decline, and 2) the time to reach a quasi-extinction threshold. The annual decline in the population is 12%, which is comparable to adult natural mortality rates for abalone species. The quasi-extinction threshold of 1000 individuals is met within 15 years. These results confirm the white abalone populations in southern California are at high risk of extinction, and highlight the importance of active stocking and restoration for the species. To inform restoration, we develop a deterministic density-dependent size-based matrix model to investigate different stocking scenarios. We incorporate an innovative method for modeling low populations by setting the reproductive term as a function of adult density to mimic a reproductive Allee Effect. A minimum density of 0.14 abalone m^{-2} of stocked juveniles led to a maximum population growth rate (λ) ≥ 1 for the model population within ten years but that recovery was poor (mean $\lambda_{15\text{-}20} \leq 1.0$) over time if the level of juvenile stocking was < 0.23 abalone m^{-2} in the model population. The innovative approach of incorporating adult density into the reproductive term in the model quantitatively shows how low population densities can impact threatened and endangered species, and may be widely used for other species. These results can not only help guide stocking strategies but also allow for the quantitative evaluation of white abalone under the

guidance of the IUCN Red List of Threatened Species, suggesting that white abalone should be considered Critically Endangered.
Accepted: April 30, 2016

Mitigating effects of an invasive fish: integrating control efforts with management of native predators
Applied Ecology (4.740)
D. Chagaris, S. Binion-Rock, **A. Bogdanoff (NOS/NCCOS/CCFHR)**, K. Dahl, H. Harris, J. Mohan, M. B. Rudd, M. Swenarton, R. Ahrens, W. F. Patterson, **J. A. Morris, Jr. (NOS/NCCOS/CCFHR/AERRB)**, M. Allen

- The results show that development of a lionfish fishery, combined with rebuilding of overfished reef fish stocks, show the most promise for controlling lionfish and minimizing impacts at the ecosystem level.
- The model showed that lionfish populations will continue to increase through 2020 with potentially severe effects on small reef fishes and modest effects on predatory reef fish that support valuable fisheries.
- The model can be used to identify target lionfish densities and associated removal efforts and to assess how regional fisheries management policies can influence, and are influenced by the invasion.

We developed a trophic-dynamic model to quantify the effects of invasive Indo-Pacific lionfish (*Pterois volitans*) on native reef fish communities in the eastern Gulf of Mexico. We used the model to evaluate mitigation strategies by simulating lionfish removals along with management of native predatory reef fishes. Strong negative effects were predicted for lionfish prey groups such as small-bodied reef fishes, small non-reef fishes, and shrimp. Several large bodied predators that support valuable commercial and recreational fisheries were also negatively affected by lionfish through competition for prey. Simulations demonstrated that increased harvest of native reef fish predators is associated with increased lionfish biomass. This supports the hypothesis of biotic control by native predators and suggests that historical overfishing of reef fish may have made the system more vulnerable to species invasions.
Expected publication date: June-July, 2016

Hydrological drivers of record-setting water level rise on Earth's largest lake system
Water Resources Research (3.709)

A. D. Gronewold, J. Bruxer, D. Durnford, **J. P. Smith**, **A. H. Clites**, F. Seglenieks, S. S. Qian, **T. S. Hunter**, V. Fortin**(OAR/GLERL)**

- Scientists at NOAA's Great Lakes Environmental Research Laboratory, in collaboration with both Canadian and other US agencies, developed a new water balance model for the North American Great Lakes. The model provides definitive guidance on the hydrologic drivers behind the recent record-setting surge in water levels on Lakes Superior and Michigan-Huron.
- In addition to differentiating between changes in runoff, over-lake precipitation, and over-lake evaporation, their findings offer insight into the hydrologic impacts of the back-to-back extreme cold winters of 2013-2014 and 2014-2015, as well as impacts of the 2015-2016 strong El Niño.

Between January 2013 and December 2014, water levels on Lake Superior and Lake Michigan-Huron, the two largest lakes on Earth by surface area, rose at the highest rate ever recorded for a 2 year period beginning in January and ending in December of the following year. This historic event coincided with below-average air temperatures and extensive winter ice cover across the Great Lakes. It also brought an end to a 15 year period of persistently below-average water levels on Lakes Superior and Michigan-Huron that included several months of record-low water levels. To differentiate hydrological drivers behind the recent water level rise, we developed a Bayesian Markov chain Monte Carlo (MCMC) routine for inferring historical estimates of the major components of each lake's water budget. Our results indicate that, in 2013, the water level rise on Lake Superior was driven by increased spring runoff and over-lake precipitation. In 2014, reduced over-lake evaporation played a more significant role in Lake Superior's water level rise. The water level rise on Lake Michigan-Huron in 2013 was also due to above-average spring runoff and persistent over-lake precipitation, while in 2014, it was due to a rare combination of below-average evaporation, above-average runoff and precipitation, and very high inflow rates from Lake Superior through the St. Marys River. We expect, in future research, to apply our new framework across the other Laurentian Great Lakes, and to Earth's other large freshwater basins as well.
Available Online:
http://onlinelibrary.wiley.com/doi/10.1002/2015WR018209/abstract

Evidence of successful spawning and other life history aspects of Alosa sapidissima (American Shad) in the Penobscot River and estuary
Northeastern Naturalist (0.550)

C. A. Lipsky (NMFS/NEFSC), R. Saunders (NMFS/GARFO), J. R. Stevens (NMFS/GARFO)

- American Shad are successfully spawning in the Penobscot River, Maine.
- These results demonstrate prolonged and persistent use of the lower Penobscot River and estuary by juvenile American Shad (including larger juveniles 150 - 225 mm). This adds to the body of knowledge suggesting that the lower river and estuary habitat is potentially more than just migratory habitat for juvenile alosines.

Diadromous fish populations in Maine are near historically low levels. In the Penobscot River, Maine, USA, annual runs of *Alosa sapidissima* (American Shad) numbered in the millions prior to collapsing in the late 19th century. Today, the vast majority of historical American Shad spawning habitat is inaccessible causing uncertainty in terms of origin of the few extant American Shad that remain in the Penobscot. We used several types of sampling gear in the lower Penobscot River and Penobscot estuary as part of a community survey, which documented the presence of juvenile American Shad throughout the estuary from July through August 2012. Our surveys indicated the presence of premetamorphic American Shad upstream of a salinity barrier, and therefore we conclude that there is a population of American Shad successfully spawning in the Penobscot River. Such evidence of a local stock is vitally important as managers weigh restoration options, such as stocking with donor stocks, enhancement of existing stocks, or natural recolonization.

Accepted: June 1, 2016
Expected publication date: September 2016

Connecting the dots: a communications model of the North Texas integrated warning team during the 15 May 2013 tornado outbreak

Weather, Climate, and Society (1.696)

D. Cavanaugh (NWS Fort Worth, TX), M. Huffman (NWS Houston, TX), J. Dunn (NWS Fort Worth, TX), M. Fox (NWS Fort Worth, TX)

- The analysis of integrated warning team (IWT) communication during the 15 May 2013 tornado outbreak reveals complex interactions among IWT members.
- The NWS plays an important role as an originator of hazardous weather information but is not frequently disseminating this information directly to the public.

- When members of the IWT do not share information with one another, there is an increased risk of an inconsistent or incomplete message of hazardous weather being communicated to the public.
- Survey results indicate that most members of the public become aware of a severe weather threat through environmental cues, TV or call from a trusted source; very few individuals become aware of the threat via cell phone apps or social media.

On 15 May 2013, 19 tornadoes occurred across north and central Texas, killing 6, injuring over 50, and causing more than $100 million in property damage. The majority of the impacts to life and property were the direct result of category-3 and category-4 enhanced Fujita scale (EF-3 and EF-4) tornadoes that affected the communities of Cleburne and Granbury, Texas. This study focuses on an examination of the north Texas integrated warning team (IWT) communications through a thorough analysis of interactions between IWT members during this event. Communications from all members of the IWT were collected and organized so that a quantitative analysis of the IWT communications network could be performed. The results of this analysis were used to identify strengths and weaknesses of current IWT communications to improve the consistency of hazardous weather messaging for future high-impact weather events. The results also show how effectively communicating within an IWT leads not only to more consistent messaging but also to broader dissemination of hazardous weather information to the public. The analysis techniques outlined in this study could serve as a model for comprehensive studies of IWTs across the country.
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Available Online:
http://journals.ametsoc.org/doi/abs/10.1175/WCAS-D-15-0047.1

Multi-year persistence of the 2014/15 North Pacific marine heatwave
Nature Climate Change (14.547)
E. Di Lorenzo and **N. Mantua (NMFS/SWFSC/FED)**

- We show that the 2013/14 development of the warm blob was dynamically linked with the weak El Niño of 2014/15 through a common atmospheric forcing pattern associated with the North Pacific Gyre Oscillation (NPGO), and that the weak El Niño favored changes in North Pacific winds that caused the warm blob to evolve into an extreme pattern of the Pacific Decadal Oscillation (PDO)

- Simulations predicts that the winter variance of the NPGO- and PDO-like patterns increases under greenhouse forcing, which suggests northeast Pacific marine heatwaves like that observed in 2014/15 will become more common

Between the winters of 2013/14 and 2014/15 during the strong North American drought, the northeast Pacific Ocean experienced the largest marine heatwave ever recorded. Here we combine observations with an ensemble of climate model simulations to show that teleconnections between the North Pacific and the weak 2014/2015 El Niño linked the atmospheric forcing patterns of this event. These teleconnection dynamics from the extra-tropics to the tropics during winter 2013/14 and then back to the extra-tropics during winter year 2014/15 are a key source of multi-year persistence of the North Pacific atmosphere and ocean. The corresponding ocean anomalies map onto known patterns of North Pacific decadal variability, specifically the North Pacific Gyre Oscillation (NPGO) in 2014 and the Pacific Decadal Oscillation (PDO) in 2015. A large ensemble of climate model simulations predicts that the winter variance of the NPGO- and PDO-like patterns increases under greenhouse forcing, consistent with other studies suggesting an increase in the atmospheric extremes that lead to drought over North America.
Accepted: May 31, 2016

*Forty years of fishing: Changes in age structure and stock mixing in northwestern Atlantic bluefin tuna (*Thunnus thynnus*) associated with size-selective and long-term exploitation*
ICES Journal of Marine Science (2.626)
M. R. Siskey, M. J. Wilberg, and **R. J. Allman (NMFS/SEFSC/SFD/PCB)**

- Recent evidence of reduced stock mixing and a slightly expanded age structure in northwestern Atlantic bluefin tuna (*Thunnus thynnus*) could suggest recovery.
- To evaluate the hypothesized cycle of collapse and modest recovery more rigorously, an integrative assessment framework is needed to consider the dynamic nature of stock productivity, trans-oceanic migrations, and fishing selectivity.

Over the past 40 years, northwestern Atlantic bluefin tuna (*Thunnus thynnus*) have experienced high rates of exploitation, targeted fishing on the largest size classes of the population, and an unknown degree of Mediterranean-stock contribution. Lack of recovery despite targeted rebuilding efforts by management prompted an evaluation of the population for changes in age-structure, size-at-age, and stock

mixing over three samples (1974-1978, 1996-2002, 2009-2014) coinciding with a cycle of exploitation that initially targeted smaller fish, but then showed strong selectivity for the largest and oldest members of the population. Ages and mixing levels were estimated using port- and observer-sampled otoliths collected by the United States National Marine Fisheries Service. A comparison of age structure between the 1970s sample and two later samples indicated strong age truncation had occurred, where both mean age (13, 4, and 7 years) and mean length (191, 166, and 159 cm CFL) declined among samples. In addition, minor changes in size-at-age were detected among the three samples. Otolith stable isotope analysis indicated fluctuating stock composition, with a substantially higher contribution of Mediterranean-origin fish in the 1990s (48% eastern stock contribution) than in the 1970s (0% contribution) and the most recent sample (4% contribution). Higher mixing and severe age truncation in the 1990s indicated that the northwestern Atlantic population was at a depressed state. Reduced mixing and a slightly expanded age structure in the most recent sample could suggest recovery. Still, to evaluate the hypothesized cycle of collapse and modest recovery more rigorously, an integrative assessment framework is needed to consider the dynamic nature of stock productivity, trans-oceanic migrations, and fishing selectivity.
Accepted: May 26, 2016

Reply to Safina and Walter et al.: Multiple lines of evidence for size-structured spawning migrations in western Atlantic bluefin tuna
Proceedings of the National Academy of Sciences (9.674)
D. E. Richardson (NMFS/NEFSC), K. E. Marancik, **J. R. Guyon (NMFS/AFSC),** M. E. Lutcavage, **B. Galuardi (NMFS/GARFO),** C. H. Lam, **H. J. Walsh (NMFS/NEFSC), S. Wildes (NMFS/AFSC), D. A. Yates (NMFS/AFSC), J. A. Hare (NMFS/NEFSC)**

- This letter was in response to comments from Carl Safina and John Walter et al. of the SEFSC on the Richardson et al. paper published in March describing a spawning ground for bluefin tuna off the northeast U.S.
- The hypothesis that Western Atlantic bluefin tuna spawn only in the Gulf of Mexico is refuted by our finding of very young larvae in the Slope Sea.
- The hypothesis that Western Atlantic bluefin tuna mature at age-9 or older is refuted by direct reproductive studies. We encourage those interested to determine the value of this evidence by reading the maturity studies cited in our work (4, 5) and Mather et al. (6), rather than relying on the edited quote in Safina (2).

- We emphasize the benefits of advancing collaborative scientific approaches that value the insights of fishermen, many of whom had deduced Slope Sea spawning from their own observations.

Abstract: N/A
Accepted: June 7, 2016

ADDITIONAL ARTICLES

OAR Publications

Currents and transport on the Eastern Bering Sea shelf—An integration of over 20 years of data
Deep Sea Research Part II (2.190)
P.J. Stabeno, S. Danielson, **D. Kachel, N.B. Kachel,** and **C.W. Mordy (PMEL)**

- The authors integrated data from moorings, drifters, and hydrographic surveys to estimate currents and transport on the eastern Bering Sea shelf
- The found the source of most heat transport into the Arctic through the Bering Strait is a result of air-sea interactions local to the northern Bering Sea.
- Analysis of the currents and water properties on the southern shelf indicates that ~50% of the shelf water is exchanged with slope water during October–January each year.

More than 20 years of data from moorings, satellite-tracked drifters and hydrographic surveys are integrated to provide a comprehensive view of currents and transport on the eastern Bering Sea shelf. The major sources of water onto the eastern Bering Sea shelf are North Pacific water flowing through Unimak Pass and Bering Slope water flowing onto the shelf usually via the canyons that intersect the shelf break. Absolute geostrophic transport through Unimak Pass varies from an average of 0.25 × 106 $m^3 s^{-1}$ (Sv) in the warm months to 0.43 Sv in the cold months. Flow along the 50-m isobath is weak, with a transport of < 0.1 Sv (calculated from current meters) in summer and fall. The transport along the 100 m isobath measured at two locations is more than twice that along 50-m isobaths; in the summer at the Pribilof Islands it was 0.2 Sv and during spring and summer at 60 °N the northward geostrophic transport (referenced to the bottom) was 0.31 Sv. Northward transport along the 100-m and 50-m isobaths accounts for approximately half of the transport through Bering Strait. A typical transit time from Unimak Pass to Bering Strait is >13 months and from Amukta Pass to Bering

Strait via the Bering Slope Current is >8 months. Consequently, the source of most of the heat transported into the Arctic through Bering Strait is a result of air-sea interactions local to the northern Bering Sea. Analysis of the currents and water properties on the southern shelf indicates that ~50% of the shelf water is exchanged with slope water during October–January each year. This elevates the October mid-shelf average nitrate level from 6 μM to 14–16 μM by the end of January.
Available Online:
http://www.sciencedirect.com/science/article/pii/S0967064516301254

A difficult Arctic science issue—Midlatitude weather linkages
Polar Science (0.952)
J. E. Overland (PMEL)

- Linkage events between Arctic air temperatures and midlatitude variability are examined.
- In improving forecasts, Arctic change impact on midlatitude weather should be considered as an important research challenge.

There is at present unresolved uncertainty whether Arctic amplification (increased air temperatures and loss of sea ice) impacts the location and intensities of recent major weather events in midlatitudes. There are three major impediments. The first is the null hypothesis where the shortness of time series since major amplification (∼15 years) is dominated by the variance of the physical process in the attribution calculation. This makes it impossible to robustly distinguish the influence of Arctic forcing of regional circulation from random events. The second is the large chaotic jet stream variability at midlatitudes producing a small Arctic forcing signal-to-noise ratio. Third, there are other potential external forcings of hemispheric circulation, such as teleconnections driven by tropical and midlatitude sea surface temperature anomalies. It is, however, important to note and understand recent emerging case studies. There is evidence for a causal connection of Barents-Kara sea ice loss, a stronger Siberian High, and cold air outbreaks into eastern Asia. Recent cold air penetrating into the southeastern United States was related to a shift in the long-wave atmospheric wind pattern and reinforced by warmer temperatures west of Greenland. Arctic Linkages is a major research challenge that benefits from an international focus on the topic.
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http://www.sciencedirect.com/science/article/pii/S187396521630024X

NOAA SCIENTIFIC PUBLICATIONS REPORT
JUNE 20, 2016

Consideration of coastal carbonate chemistry in understanding biological calcification
Geophysical Research Letters (4.212)
A.J. Fassbender, C.L. Sabine (OAR-PMEL), and K.M. Feifel

- This work helps further the understanding of how marine organisms will respond to ocean acidification.
- Recent research suggests that calcification in some marine calcifiers may be controlled by the ratio of bicarbonate to hydrogen ion, rather than the aragonite saturation state.

Correlations between aragonite saturation state (ΩAr) and calcification have been identified in many laboratory manipulation experiments aiming to assess biological responses to ocean acidification (OA). These relationships have been used with projections of ΩAr under continued OA to evaluate potential impacts on marine calcifiers. Recent work suggests, however, that calcification in some species may be controlled by the ratio of bicarbonate to hydrogen ion, or the substrate-to-inhibitor ratio (SIR), rather than ΩAr. SIR and ΩAr are not always positively correlated in the natural environment, which means that ΩAr can be a poor indicator of the calcifying environment when ΩAr->1. Highly variable carbonate chemistry in the coastal zone challenges our ability to monitor fluctuations in ΩAr, SIR, and the ΩAr-SIR relationship making it difficult to assess biological OA exposures and vulnerability. Careful consideration of natural variability throughout ocean environments is required to accurately determine the influence of OA on biological calcification.
Publication: May 7, 2016
Available Online:
http://onlinelibrary.wiley.com/doi/10.1002/2016GL068860/full

Consistent estimates of tsunami energy show promise for improved early warning
Pure and Applied Geophysics (1.618)
V. Titov (OAR-PMEL), Y. T. Song, L. Tang, E. N. Bernard, Y. Bar-Sever, and **Y. Wei (OAR-PMEL)**

- The authors assessed two approaches to determining tsunami source energy
- Both approaches lead to consistent energy scales for previously studied tsunamis

Early tsunami warning critically hinges on rapid determination of the tsunami hazard potential in real-time, before waves inundate critical coastlines. Tsunami

energy can quickly characterize the destructive potential of generated waves. Traditional seismic analysis is inadequate to accurately predict a tsunami's energy. Recently, two independent approaches have been proposed to determine tsunami source energy: one inverted from the Deep-ocean Assessment and Reporting of Tsunamis (DART) data during the tsunami propagation, and the other derived from the land-based coastal global positioning system (GPS) during tsunami generation. Here, we focus on assessing these two approaches with data from the March 11, 2011 Japanese tsunami. While the GPS approach takes into consideration the dynamic earthquake process, the DART inversion approach provides the actual tsunami energy estimation of the propagating tsunami waves; both approaches lead to consistent energy scales for previously studied tsunamis. Encouraged by these promising results, we examined a real-time approach to determine tsunami source energy by combining these two methods: first, determine the tsunami source from the globally expanding GPS network immediately after an earthquake for near-field early warnings; and then to refine the tsunami energy estimate from nearby DART measurements for improving forecast accuracy and early cancelations. The combination of these two real-time networks may offer an appealing opportunity for: early determination of the tsunami threat for the purpose of saving more lives, and early cancelation of tsunami warnings to avoid unnecessary false alarms.
Available Online:
http://link.springer.com/article/10.1007/s00024-016-1312-1

Aircraft observations of dry air, the ITCZ, convective cloud systems, and cold pools in MJO during DYNAMO
Bulletin of the American Meteorological Society (11.08)
Chen, S., B. W. Kerns, N. Guy, **D. P. Jorgensen**, J. Delanoe, N. Viltard, C. Zappa, F. Judt, C. Y. Lee, and A. Savarin **(OAR/NSSL)**

- Dry air intrusions from the subtropics may suppress convection in the equatorial Indian Ocean, which is favorable for the onset of the convection during MJO initiation.
- Distinct characteristics were found in the convective structure and microphysical properties of Mesoscale weather systems during the suppressed, transition/ onset, and active phases of the MJO.
- Convective cold pools are deeper and stronger in convective systems surrounded by the low–midlevel dry air in the suppressed phase, which prolong the atmosphere boundary layer recovery time.

- The atmospheric boundary layer depth and upper ocean temperature are higher during the suppressed phase than during the active phase, and the air–sea temperature difference and sensible fluxes are larger during the suppressed phase of the MJO.

One of the most challenging problems in predicting the Madden–Julian oscillation (MJO) is the initiation of large-scale convective activity associated with the MJO over the tropical Indian Ocean. The lack of observations is a major obstacle. The Dynamics of the MJO (DYNAMO) field campaign collected unprecedented observations from air-, land-, and ship-based platforms from October 2011 to February 2012. Here we provide an overview of the aircraft observations in DYNAMO, which captured an MJO initiation event from November to December 2011. The National Oceanic and Atmospheric Administration (NOAA) WP-3D aircraft was stationed at Diego Garcia and the French Falcon 20 aircraft on Gan Island in the Maldives. Observations from the two aircraft provide a unique dataset of three-dimensional structure of convective cloud systems and their environment from the flight level, airborne Doppler radar, microphysics probes, ocean surface imaging, global positioning system (GPS) dropsonde, and airborne expendable bathythermograph (AXBT) data. The aircraft observations revealed interactions among dry air, the intertropical convergence zone (ITCZ), convective cloud systems, and air–sea interaction induced by convective cold pools, which may play important roles in the multiscale processes of MJO initiation. This overview focuses on some key aspects of the aircraft observations that contribute directly to better understanding of the interactions among convective cloud systems, environmental moisture, and the upper ocean during the MJO initiation over the tropical Indian Ocean. Special emphasis is on the distinct characteristics of convective cloud systems, environmental moisture and winds, air–sea fluxes, and convective cold pools during the convectively suppressed, transition/onset, and active phases of the MJO.
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http://journals.ametsoc.org/doi/abs/10.1175/BAMS-D-13-00196.1

NMFS Publications

Projected asymmetric response of Adélie penguins to Antarctic climate change
Scientific Reports (5.578)
M. Cimino, H. Lynch, **V. S. Saba (NEFSC)**, M. Oliver

- During the contemporary period, declining Adélie penguin populations experienced more years with warm sea surface temperature compared to populations that are increasing.
- We project that one-third of current Adélie penguin colonies, representing ~20% of their current population, may be in decline by 2060. However, climate model projections suggest refugia may exist in continental Antarctica beyond 2099, buffering species-wide declines.

The contribution of climate change to shifts in a species' geographic distribution is a critical and often unresolved ecological question. Climate change in Antarctica is asymmetric, with cooling in parts of the continent and warming along the West Antarctic Peninsula (WAP). The Adélie penguin (*Pygoscelis adeliae*) is a circumpolar meso-predator exposed to the full range of Antarctic climate and is undergoing dramatic population shifts coincident with climate change. We used true presence-absence data on Adélie penguin breeding colonies to estimate past and future changes in habitat suitability during the chick-rearing period based on historic satellite observations and future climate model projections. During the contemporary period,declining Adélie penguin populations experienced more years with warm sea surface temperature compared to populations that are increasing. Based on this relationship, we project that one-third of current Adélie penguin colonies, representing ~20% of their current population, may be in decline by 2060. However, climate model projections suggest refugia may exist in continental Antarctica beyond 2099, buffering species-wide declines. Climate change impacts on penguins in the Antarctic will likely be highly site specific based on regional climate trends, and a southward contraction in the range of Adélie penguins is likely over the next century.
Accepted: June 8, 2016

*Evaluation of nucleic acids and plasma IGF1 levels for estimating short-term responses of postsmolt Atlantic salmon (*Salmo salar*) to food availability*
Fishery Bulletin (1.783)
E. M Caldarone (NEFSC**), S. A. MacLean (**NEFSC), **B. R. Beckman (**NWFSC)

- Nutritional condition of field caught postsmolt salmon can be determined by nonlethal sampling for RNA/DNA
- Point estimate of nutritional condition allows investigation of the connectivity between nutritional state and environmental parameters on relevant temporal and spatial scales.

We evaluated 4 potential indices obtained by nonlethal sampling for use in determining nutritional state and short-term growth rate in postsmolt Atlantic salmon (*Salmo salar*): the ratio of RNA to DNA, both RNA and DNA normalized to protein, and plasma levels of insulin-like growth factor 1 (IGF1). Fish reared in the laboratory for 27 days were fed, fasted, or refed. Short-term growth rates (7 to 23 day intervals) were calculated on a wet-weight basis. RNA/DNA values were highly correlated to growth rates, responded rapidly to changes in food availability and were the best able to consistently distinguish between the fasted and fed treatments. RNA/protein values were also well correlated with growth rate; however, within any one sampling day, feeding groups could not be differentiated with this index. DNA/protein increased during fasting but was neither strongly correlated with growth rate nor an accurate discriminator of nutritional state. IGF1 values were positively correlated with growth rates and responded rapidly with refeeding but changed little during the 3 weeks of fasting—a result that may have been influenced by sampling serially. We propose that RNA/DNA is a useful nonlethal technique for estimating recent growth rates and for identifying the nutritional condition of individual postsmolt Atlantic salmon exposed to short-term changes in food availability.

Accepted: March 31, 2016
Available Online:
http://fishbull.noaa.gov/1143/1143toc.htm

Surface and bottom temperature and salinity climatology along the continental shelf off the Canadian and U.S. East Coasts

Continental Shelf Research (1.892)

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- Provision of a new hydrographic climatology spanning the continental shelf region from Labrador to the Middle Atlantic Bight
- Significant first step toward characterizing the spatial coherence of shelf hydrography and toward identifying mechanisms that might be responsible for driving coherent variability

A new hydrographic climatology has been created for the continental shelf region, extending from the Labrador shelf to the Mid-Atlantic Bight. The 0.2-degree climatology combines all available observations of surface and bottom temperature and salinity collected between 1950 and 2010 along with the location, depth and date of these measurements. While climatological studies of surface and bottom temperature and salinity have been presented previously for various regions along

the Canadian and U.S. shelves, studies also suggest that all these regions are part of one coherent system. This study focuses on the coherent structure of the mean seasonal cycle of surface and bottom temperature and salinity and its variation along the shelf and upper slope. The seasonal cycle of surface temperature is mainly driven by the surface heat flux and exhibits strong dependency on latitude ($r \approx -0.9$). The amplitude of the seasonal cycle of bottom temperature is rather dependent on the depth, while the spatial distribution of bottom temperature is correlated with latitude. The seasonal cycle of surface salinity is influenced by several components, such as sea-ice on the northern shelves and river discharge in the Gulf of St. Lawrence. The bottom salinity exhibits no clear seasonal cycle, but its spatial distribution is highly correlated with bathymetry, thus Slope Water and its intrusion on the shelf can be identified by its relatively high salinity compared to shallow, fresher shelf water. Two different regimes can be identified, especially on the shelf, separated by the Laurentian Channel: advection influences the phasing of the seasonal cycle of surface salinity and bottom temperature to the north, while in the southern region, river runoff and air-sea heat flux forcing are dominant, especially over the shallower bathymetry.
Available Online:
http://www.sciencedirect.com/science/article/pii/S0278434316303181

A framework for incorporating species, fleet, habitat, and climate interactions into fishery management
Frontiers in Marine Science (N/A)
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- This framework was originally presented to the Mid-Atlantic Fishery Management Council in February 2016 as part of their Ecosystem Approach to Fisheries Management initiative. A significant portion of this is now contained in the MAFMC's draft Ecosystem Approach to Fisheries Management Guidance Document, presented in April 2016. Therefore this represents near real-time direct input of science to management in the region.
- This is considered a practical approach to incorporating species interactions and other factors such as climate, habitat, and fleet interactions that are currently difficult to address within Council management processes.

Marine ecosystems are characterized by many complex interactions. Fisheries managers face the challenge of maintaining or restoring sustainability for individual living resources which are affected by both ecological and economic interactions with other species, through processes like predation and fishing fleet interactions. These species interactions are further complicated by interactions with habitats that are changing due to both human activities and climate change. Often, fishery management systems designed to promote sustainability of individual resources have few tools or processes that also address interactions between species, fleets, habitat, and climate. Here, we review existing and potential fishery assessment and management information and tools, and we develop a potential framework for addressing interactions in management at the request of the U.S. Mid-Atlantic Fishery Management Council. The structured framework can be used to first prioritize interactions, second specify key questions regarding high priority interactions, and third tailor appropriate analyses to address them. The primary tools for the initial steps in the framework are risk assessment and Management Strategy Evaluation (MSE). Finally, implemented management would be evaluated to ensure that objectives are being met, or to adjust measures as conditions change. In the final section, we outline an example to illustrate how a structured decision making process within the framework could work.
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Inactivation of cone-specific phototransduction genes in rod monochromatic cetaceans
Frontiers in Ecology and Evolution (7.615)
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- Use of genomics methods to show that cetacean vision has evolved a spectacular array of adaptations in association with the diversity of aquatic habitats

Vertebrate vision is mediated by two types of photoreceptors, rod and cone cells. Rods are highly sensitive and confer vision in dim-light, whereas cones are used in bright-light conditions and enable high acuity color vision. Most mammals have dichromatic color vision and employ two cone pigment genes (SWS1, LWS). Cone monochromacy occurs when one of the cone opsins (usually SWS1) is inactivated and is present in assorted subterranean, nocturnal, and aquatic mammals. Rod monochromacy occurs when both cone photoreceptors are inactivated, resulting in a pure rod retina. The latter condition is extremely rare in mammals and has only

been confirmed with genetic evidence in five cetacean lineages, golden moles, armadillos, and sloths. Cetacean taxa with rod monochromacy include Balaenidae (bowhead and right whales), *Balaenopteroidea* (rorquals plus gray whale), *Mesoplodon bidens* (Sowerby's beaked whale), *Physeter macrocephalus* (sperm whale), and *Kogia breviceps* (pygmy sperm whale). The first genetic evidence for rod monochromacy in these taxa consisted of inactivated copies of both of their cone pigment genes (SWS1, LWS). However, other components of the cone phototransduction cascade are also predicted to accumulate inactivating mutations (frameshifts, premature stop codons, splice site mutations) in rod monochromats. Here, we employ genome sequences and exon capture data from four baleen whales (bowhead, two minke whales, fin whale) and five toothed whales (sperm whale, Yangtze River dolphin, beluga, killer whale, bottlenose dolphin) to test the hypothesis that rod monochromacy is associated with the inactivation of seven genes (GNAT2, GNB3, GNGT2, PDE6C, PDE6H, CNGA3, CNGB3) in the cone phototransduction cascade. Cone-monochromatic toothed whales that retain a functional copy of LWS (beluga, Yangtze River dolphin, killer whale, bottlenose dolphin) also retain intact copies of other cone-specific phototransduction genes, whereas all rod monochromats that were investigated (Antarctic minke whale, common minke whale, fin whale, bowhead whale, sperm whale) have inactivating mutations in five or more genes in the cone phototransduction cascade. The only shared inactivating mutations that were discovered occur in the three Balaenoptera species (two minke whales, fin whale), further suggesting that rod monochromacy evolved independently in two clades of baleen whales, *Balaenopteroidea and Balaenidae*. We estimate that 3 rod monochromacy evolved first in *Balaenopteroidea* (~28.8 Ma) followed by *P. macrocephalus* (~19.5 Ma) and Balaenidae (~13.0 Ma).
Available Online:
http://journal.frontiersin.org/article/10.3389/fevo.2016.00061/full

Optimal environmental conditions and anomalous ecosystem responses: constraining bottom-up controls of phytoplankton biomass in the California Current system
Scientific Reports (5.578)
M. Jacox, E. Hazen, S. Bograd (NMFS/SWFSC)

- This study provides a framework for understanding physical drivers of primary production in the California Current by identifying an 'optimal window' of wind-forcing and nutrient concentration.

- The authors quantify the dependence of phytoplankton biomass (the base of the marine food web) on wind as well as subsurface nutrient conditions in the central and northern California Current system.
- The results explain observed dynamics during several highly anomalous past events (1998-1999, 2002, 2005) and provide a basis for understanding future ecosystem change.

In Eastern Boundary Current systems, wind-driven upwelling drives nutrient-rich water to the ocean surface, making these regions among the most productive on Earth. Regulation of productivity by changing wind and/or nutrient conditions can dramatically impact ecosystem functioning, though the mechanisms are not well understood beyond broad-scale relationships. Here, we explore bottom-up controls during the California Current System (CCS) upwelling season by quantifying the dependence of phytoplankton biomass (as indicated by satellite chlorophyll estimates) on two key environmental parameters: subsurface nitrate concentration and surface wind stress. In general, moderate winds and high nitrate concentrations yield maximal biomass near shore, while offshore biomass is positively correlated with subsurface nitrate concentration. However, due to nonlinear interactions between the influences of wind and nitrate, bottom-up control of phytoplankton cannot be described by either one alone, nor by a combined metric such as nitrate flux. We quantify optimal environmental conditions for phytoplankton, defined as the wind/nitrate space that maximizes chlorophyll concentration, and present a framework for evaluating ecosystem change relative to environmental drivers. The utility of this framework is demonstrated by (i) elucidating anomalous CCS responses in 1998-1999, 2002, and 2005, and (ii) providing a basis for assessing potential biological impacts of projected climate change.

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http://www.nature.com/articles/srep27612?WT.feed_name=subjects_earth-and-environmental-sciences

Non-lethal batch identification of Atlantic salmon Salmo salar using coded wire tags

North American Journal of Fisheries Management (1.110)

G. S Goulette, C. A Lipsky (NEFSC)

- Alternative method to mark fish with CWT in a non-lethal manner – batch identification of endangered or threatened populations

Hatchery fish are a valuable asset to and often an essential component of endangered species recovery programs. The Penobscot River, Maine, USA Atlantic Salmon *Salmo salar* recovery program uses multiple life stages of hatchery fish. Correct identification of returning adults is vital to assess the contribution of each stocked life stage to overall Atlantic Salmon returns. We investigated the use of coded wire tags (CWTs) implanted into various body locations of salmon parr to determine if the tags could be used as a non-lethal batch identifier after recapture. We tagged 200 (four groups of ~ 50) Atlantic Salmon parr with CWTs in four different anatomical locations (right and left dorsal and right and left adipose areas) using a Northwest Marine Technology (NMT) Handheld Multishot Injector. We used an additional 51 non-tagged parr as a control. We examined fish for CWTs using a NMT blue Handheld Wand and kept track of individuals using passive integrated transponder tags. We monitored CWT recovery, correct identification of CWT location, and growth rates for all tagged groups, and growth rates for the control group. Tag recovery was 94.7% at 28 months post-tagging. Correct identification of CWT location improved with each sampling event to 88.3% at 28 months. Tag location did not affect growth rates but we found a significant difference between tag location and tag recovery. The left dorsal and left adipose areas had the highest recovery rates. Tagging fish in different anatomical locations with CWTs can provide a minimally invasive batch mark when benign recovery is desired.
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Synthesis of common management concerns associated with dam removal
Journal of the American Water Resources Association (1.348)
D. D. Tullos, **M. J. Collins (OHC/HCD)**, J. R. Bellmore, J. A. Bountry, P. J. Connolly, P. B. Shafroth, and A. C. Wilcox

- Our investigation is the first systematic review of available data for these CMCs.
- The CMC occurrence data we reviewed, combined with established knowledge of relevant processes, reveal important biophysical phenomena that contribute to their occurrence.
- Dam removal practitioners should evaluate CMCs in the context of risk whereby both the likelihood of the contributing biophysical phenomena and their intersections with management implications are evaluated.

Managers make decisions regarding if and how to remove dams in spite of uncertainty surrounding physical and ecological responses, and stakeholders often raise concerns about certain negative effects, regardless of whether or not these concerns are warranted at a particular site. We used a newly-available dam-removal science database supplemented with other information sources to explore seven frequently-raised concerns, herein Common Management Concerns (CMCs). We investigate the occurrence of these concerns and the contributing biophysical controls. The CMCs addressed are: degree and rate of reservoir sediment erosion, excessive channel incision upstream of reservoirs, downstream sediment aggradation, elevated downstream turbidity, drawdown impacts on local water infrastructure, colonization of reservoir sediments by non-native plants, and expansion of invasive fish. Biophysical controls emerged for some of the concerns, providing managers with information to assess whether a given concern is likely to occur at a site. To fully assess CMC risk, managers should concurrently evaluate site conditions and identify the ecosystem or human uses that will be negatively affected if the biophysical phenomenon producing the CMC occurs. We show how many CMCs have one or more controls in common, facilitating the identification of multiple risks at a site, and demonstrate why CMC risks should be considered in the context of other factors like natural watershed variability and disturbance history.
Accepted: June 3, 2016

What is a 'significant portion' of a range? Reply to Nelson et al. (2016)
Endangered Species Research (2.259)
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- This is a reply to a comment by Nelson et al. (2016) on the paper *When is a species at risk in 'all or a significant portion of its range'?* (Waples et al. 2016)
- The original paper is available online here: http://www.int-res.com/abstracts/esr/v27/n2/p189-192/
- The Nelson et al (2015) comment is available here: http://www.int-res.com/abstracts/esr/v30/p187-190/

Contrary to the claim by Nelson et al. (2016; Endang Species Res 30:187–190), no court has rejected the biological framework we proposed for interpreting the 'significant portion of its range' (SPOIR) language in the US Endangered Species Act. The relative importance placed on current vs. historical range during

implementation will be important in determining the success of the new ESA SPOIR policy.
Publication date: May 31, 2016
Available Online:
http://www.int-res.com/articles/esr2016/30/n030p191.pdf

Genet-specific spawning patterns in Acropora palmata
Coral Reefs
M.W. Miller, D.E. Williams, and J. Fisch **(NMFS/SEFSC)**

- ESA Threatened elkhorn coral populations in the Florida Keys were already known to possess a low density of genetic individuals and outcrossing between genotypes is needed for successful larval production.
- This paper documents extremely inconsistent spawning among years as well as a significant degree of variation in spawning night between adjacent genotypes.
- These observations further reduce the expected larval production by this population and reinforce the importance of overcoming depensation as a primary concern for recovery.

The broadcast spawning elkhorn coral, Acropora palmata, requires outcrossing among different genets for effective fertilization. Hence, a low density of genets in parts of its range emphasizes the need for precise synchrony among neighboring genets as sperm concentration dilutes rapidly in open-ocean conditions. We documented the genet-specific nightly occurrence of spawning of Acropora palmata over eight years in a depauperate population in the Florida Keys to better understand this potential reproductive hurdle. The observed population failed to spawn within the predicted monthly window (nights 2–6 after the full moon in August) in three of the eight years of observation; negligible spawning was observed in a fourth year. Moreover, genet-specific patterns are evident in that 1) certain genets have significantly greater odds of spawning overall and 2) certain genets predictably spawn on the earlier and others on the later lunar nights within the predicted window. Given the already low genet density in this population, this pattern implies a substantial degree of wasted reproductive effort and supports the hypothesis that depensatory factors are impairing recovery in this species.
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http://link.springer.com/article/10.1007%2Fs00338-016-1472-6

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Climate impacts on sea turtle breeding phenology in Greece and associated foraging habitats in the wider Mediterranean Region
PLoS One (3.234)
S. H. Patel, S. J. Morreale, **V. S. Saba (NEFSC/EcoAP)**, A. Panagopoulou, D. Margaritoulis, and J. R. Spotila

- The authors project that temperature at key foraging and breeding sites for loggerhead turtles nesting in Greece will rise by 3° - 5° C by 2100.
- The projected rise in air and ocean temperature at Zakynthos, Greece could cause the nesting season in this major rookery to shift to an earlier date by as much as 50 – 74 days by 2100.

Sea turtles are vulnerable to climate change impacts in both their terrestrial (nesting beach) and oceanic habitats. From 1982 to 2012, air and sea surface temperatures at major high use foraging and nesting regions (n = 5) of loggerhead turtles (*Caretta caretta*) nesting in Greece have steadily increased. Here, we update the established relationships between sea surface temperature and nesting data from Zakynthos, while also expanding these analyses to include precipitation and air temperature and additional nesting data from two other key beaches in Greece, Kyparissia Bay and Crete Island. We confirmed that nesting phenology has continued to be impacted by breeding season temperature at Zakynthos; while nest numbers continue to decline at Zakynthos and Crete, but not Kyparissia, in relation to increasing temperatures. Then using statistically downscaled outputs of 14 climate models assessed by the Intergovernmental Panel on Climate Change (IPCC), we projected future shifts in nesting for this population. Based on the climate models, we projected that temperature at these key foraging and breeding sites for loggerhead turtles nesting in Greece will rise by 3° - 5° C by 2100. Our calculations indicate that the projected rise in air and ocean temperature at Zakynthos could cause the nesting season in this major rookery to shift to an earlier date by as much as 50 – 74 days by 2100. Although an earlier onset of the nesting season may provide minor relief for nest success as temperatures rise, the overall climatic changes to the various important habitats will most likely have a negative impact on this population.
Expected publication date: July 2016

Improving the estimation of transect length and width for underwater visual surveys of targets on or near the seabed
ICES Journal of Marine Science (2.576)

NOAA SCIENTIFIC PUBLICATIONS REPORT
JUNE 20, 2016

K.L Stierhoff, **D.W. Murfin**, **D.A. Demer**, **S.A. Mau**, and **D. Pinkard-Meier (NMFS/SWFSC)**

- Transect distance and width may be frequently, accurately, and precisely determined during remotely operated vehicle (ROV) surveys to minimize errors in population estimates related to poor estimates of survey effort.
- A new, simple approach to estimating transect width is described and compared to results from more labor-intensive image-based methods.

Demersal marine organisms may be surveyed visually using cameras deployed on a submersible vehicle, e.g. a remotely operated vehicle (ROV). For estimating animal densities along visual transects, the sampled area may be calculated from the products of transect distance and width. In this study, distance was measured relative to submerged pipeline features of known length using: 1) speed estimates from a Doppler velocity log (DVL); and 2) position estimates from an ultra-short baseline (USBL) acoustic system. DVL estimates of distance were within 0.8 to 1.0% of known feature lengths ranging from 6.01 to 1520.53 m, respectively. USBL estimates of distance were less accurate, ranging from 3.2 to 5.0% over the same distances, and positively biased compared to DVL estimates. Also, transect-width estimates were compared using: 1) calibrated laser metrics; and 2) measurement of camera orientation and optical properties. Both methods produced similar estimates of transect width, and thus area ($r^2 = 0.81$), but width varied with camera altitude and orientation, and increased with seabed relief. Therefore, an assumption of constant transect width may bias estimates of sampled area, and estimates of animal density and abundance, particularly when surveying over seabeds with variable relief. To minimize these biases, practical methods are described to quantify transect distance and width throughout surveys using standard survey equipment and analytical methods.

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