NOAA Scientific Publications Report
May 23, 2016

Highlighted Articles

Tropical cyclones, derelict traps, and the future of the Florida Keys commercial spiny lobster fishery
Marine Policy (2.610)

Significant discharge of CO2 from hydrothermalism associated with the submarine volcano of El Hierro Island
Scientific Reports (5.578)

Acclimatisation to high variance habitats does not enhance physiological tolerance of two key Caribbean corals to future temperature and pH
Proceeding of the Royal Society of London B (5.051)

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NMFS Publications

Genetic mixed stock analysis disentangles spatial and temporal variation in composition of the West Greenland Atlantic Salmon fishery
ICES Journal of Marine Science (2.525)

Marine ecosystem perspectives on Chinook salmon recruitment: A synthesis of empirical and modeling studies from the California upwelling system
Marine Ecology Progress Series (2.62)

Management implications of temporally and spatially varying catchability for the Gulf of Mexico menhaden fishery
Fisheries Research (1.843)

Brandt's cormorant diet (1994-2012) indicates importance of fall ocean conditions for northern anchovy in central California
Fisheries Oceanography (2.542)

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Distribution of the box jellyfish *Alatina alata*: circumtropical species or multiple invasions?
Biological Bulletin (1.942)

Using Antarctic blue whale photo-ID data from IDCR/SOWER: capture-recapture estimates of abundance
Journal of Cetacean Research and Management

Two-step decisions in a central-place forager
Royal Society Open Science

Hierarchical phylogeographic structure of Coho Salmon *Oncorhynchus kisutch* in California
Transactions of the American Fisheries Society (1.314)

Social bonds and recovery: an analysis of hurricane Sandy in the first year after landfall
Marine Policy (2.610)

NWS Publication

Challenging some contemporary views of coronal mass ejections. I: The case for blast waves.
Astrophysical Journal (11.22)

OAR Publications

Long-term observations of Alaska Coastal Current in the northern Gulf of Alaska
Journal of Deep Sea Research Part II (2.190)

Extreme noise–extreme El Niño: How state-dependent noise forcing creates El Niño-La Niña asymmetry
Journal of Climate (4.435)

The spectroscopic foundation of radiative forcing of climate by carbon dioxide
Geophysical Research Letters (4.456)

OTHER REPORTS, BOOK CHAPTERS, AND INTERNAL PUBLICATIONS

OAR PUBLICATION

The Atmospheric Radiation Measurement (ARM) Program: The First 20 Years - Introduction
Meteorological Monographs

HIGHLIGHTED ARTICLES

Tropical cyclones, derelict traps, and the future of the Florida Keys commercial spiny lobster fishery
Marine Policy (2.610)
A. V. Uhrin (NOS/NCCOS/CCFHR)

- Tropical cyclones result in lost fishing gear. Scenarios of tropical cyclone intensification and fishing effort were explored. Net increases in derelict traps will only be exacerbated under storm intensification.
- Trap retrieval programs cannot remove trap debris equal to the rate of accumulation. The importance of reducing derelict trap inputs is emphasized.

Derelict commercial spiny lobster (*Panulirus argus*) traps may move hundreds of meters during high wind events, resulting in tissue abrasion, breakage, and often complete removal of critical habitat elements such as seagrass, sponge, and coral. Ghost traps continue to confine lobsters, often resulting in mortality. The legacy of trap debris in the Florida Keys (USA) combined with possible increased inputs of trap debris resulting from tropical cyclone intensification presents an immediate challenge for this fishery where social, economic, and ecological vulnerabilities to disturbance are intrinsically linked. Here, predictions of percent monthly trap loss in relation to maximum wind speed (km/h) under three scenarios of tropical cyclone intensification were evaluated across four levels of fishing effort (number of traps used). Across all tropical cyclone scenarios, Historical fishing effort (986,000 traps) produced the greatest number of lost traps, followed in decreasing order by Existing (479,000), Target (400,000), and Maximum Economic Yield (MEY; 180,000) efforts. Under a Business-as-Usual scenario of intensification, converting from Existing fishing effort to MEY reduced trap loss by over 62%. The scenarios suggest that were Existing fishing effort to be maintained in the

coming decades, tropical cyclone-related trap loss could exceed 11 million over 60 years depending upon the rate of storm intensification. Existing programs for derelict trap removal cannot currently keep pace with accumulation; consequently, the proximal source of trap debris is increasing in the environment. The net increase in derelict traps and debris generated from their degradation will only be exacerbated under potential tropical cyclone intensification. This study underscores the need for using scenarios for future exploration of these issues, particularly incorporation of fisher responses to changes in climatic, economic, and management drivers (i.e., storms, market demand, gear reduction) that may affect trap deployment patterns.
Available online:
http://www.sciencedirect.com/science/article/pii/S0308597X16301762

Significant discharge of CO_2 from hydrothermalism associated with the submarine volcano of El Hierro Island
Scientific Reports (5.578)
J.M. Santana-Casiano, E. Fraile-Nuez, M. González-Dávila, **E. T. Baker, J. A. Resing, and S. L. Walker (NOAA-PMEL)**

- The emitted CO_2 from residual hydrothermalism associated with submarine volcanoes increases the acidity of seawater.
- The submarine volcano El Hierro, in its degasification stage, provided an excellent opportunity to study the effect of volcanic CO_2 on the seawater carbonate system, the global carbon flux, and local ocean acidification.
- The CO_2 emitted by El Hierro was found to increase the acidity above the volcano by ~20%.

The residual hydrothermalism associated with submarine volcanoes, following an eruption event, plays an important role in the supply of CO_2 to the ocean. The emitted CO_2 increases the acidity of seawater. The submarine volcano of El Hierro, in its degasification stage, provided an excellent opportunity to study the effect of volcanic CO_2 on the seawater carbonate system, the global carbon flux, and local ocean acidification. A detailed survey of the volcanic edifice was carried out using seven CTD-pH-ORP tow-yo studies, localizing the redox and acidic changes, which were used to obtain surface maps of anomalies. In order to investigate the temporal variability of the system, two CTD-pH-ORP yo-yo studies were

conducted that included discrete sampling for carbonate system parameters. Meridional tow-yos were used to calculate the amount of volcanic CO_2 added to the water column for each surveyed section. The inputs of CO_2 along multiple sections combined with measurements of oceanic currents produced an estimated volcanic CO_2 flux = 6.0 105 ± 1.1 105 kg d^{-1} which is ~0.1% of global volcanic CO_2 flux. Finally, the CO_2 emitted by El Hierro increases the acidity above the volcano by ~20%.
Publication Date: 9 May 2016
Available online: http://www.nature.com/articles/srep25686

Acclimatisation to high variance habitats does not enhance physiological tolerance of two key Caribbean corals to future temperature and pH
Proceeding of the Royal Society of London B (5.051)
E. Camp, D. Smith, C. Evenhuis, **I. C. Enochs (OAR/AOML), D. P. Manzello (OAR/AOML)**, S. Woodcock, D. Suggett

- This study shows that two coral species living in environmentally variable habitats in Little Cayman Island were not more resilient to future climate change stress, suggesting that acclimatization to present-day warmer and lower pH conditions did not afford increased tolerance to further warming and ocean acidification.
- Coral scientists and managers hope that some coral species will be resilient enough to thrive and adapt to warmer oceans and decreasing pH, so that reefs will persist as CO2 levels increase in the atmosphere and ocean. This study showed that, unfortunately, a known resilient species did not seem to be more tolerant of simulated future temperature and pH conditions.

Corals are acclimatized to populate dynamic habitats that neighbour coral reefs. Habitats, such as seagrass beds, exhibit broad diel changes in temperature and pH that routinely expose corals to conditions predicted for reefs over the next 50–100 years. However, whether such acclimatization effectively enhances physiological tolerance to, and hence provides refuge against, future climate scenarios remains unknown. Also, whether corals living in low variance habitats can tolerate present-day high-variance conditions remains untested. We experimentally examined how pH and temperature predicted for the year 2100 affects the growth and physiology of two dominant Caribbean corals (Acropora palmata and Porites astreoides) native to habitats with intrinsically low (outer-reef

terrace, LV) and/or high (neighbouring seagrass, HV) environmental variance. Under present-day temperature and pH, growth and metabolic rates (calcification, respiration and photosynthesis) were unchanged for HV versus LV populations. Superimposing future climate scenarios onto the HV and LV conditions did not result in any enhanced tolerance to colonies native to HV. Calcification rates were always lower for elevated temperature and/or reduced pH. Together, these results suggest that seagrass habitats may not serve as refugia against climate change if the magnitude of future temperature and pH changes is equivalent to neighbouring reef habitats.
Expected publication date: in press.

ADDITIONAL ARTICLES

NMFS PUBLICATIONS

Genetic mixed stock analysis disentangles spatial and temporal variation in composition of the West Greenland Atlantic Salmon fishery
ICES Journal of Marine Science (2.525)
I. R. Bradbury, L. C. Hamilton, **T. F. Sheehan (NEFSC)**, G. Chaput, M. J. Robertson, J. B. Dempson, D. Reddin, V. Morris, T. King, and L. Bernatchez

- US Atlantic salmon stocks contribute ~1% of the harvest at West Greenland, but the impacts of this fishery could be significant given their continued low abundance and protected status
- Results suggest significant spatial/temporal mixing of the contributing stocks, thereby minimizing the potential of spatial/temporal oriented management measures providing increased protection to weaker or depressed stock

The West Greenland Atlantic Salmon (*Salmo salar*) fishery represents the largest remaining mixed-stock fishery for Atlantic Salmon and targets multi-sea winter salmon from throughout North America and Europe. We evaluated stock composition of salmon harvested in the waters off West Greenland (n = 5684 individuals) using genetic mixture analysis and individual assignment to inform conservation of North American populations, many of which are failing to meet management targets. Regional contributions to this fishery were estimated using 2169 individuals sampled throughout the fishery between 2011–2014. Of these, 22% were identified as European in origin. Major North American contributions

were detected from Labrador (~20%), the Southern Gulf / Cape Breton (29%), and the Gaspe Peninsula (29%). Minor contributions (~5%) were detected from Newfoundland, Ungava, and Quebec regions. Region specific catches were extrapolated using estimates of composition and fishery catch logs and harvests ranged from 300–600 and 2000–3000 individuals for minor and major constituents, respectively. To evaluate the temporal stability of the observed fishery composition, we extended the temporal coverage through the inclusion of previously published data (1995–2006, n = 3095) and data from archived scales (1968–1998, n = 420). Examination of the complete time series (47 yrs) suggests relative stability in stock proportions since the late 1980's. Genetic estimates of stock composition were significantly associated with model-based estimates of returning multi-sea winter salmon (individual years r = 0.69, and overall mean r = 0.96). This work demonstrates that the analysis of both contemporary and archived samples in a mixed stock context can disentangle levels of regional exploitation and directly inform assessment and conservation of Atlantic Salmon in the West Greenland interceptory Atlantic Salmon fishery.
Acceptance date: April 7, 2016
Expected publication date: unknown

Marine ecosystem perspectives on chinook salmon recruitment: A synthesis of empirical and modeling studies from the California upwelling system
Marine Ecology Progress Series (2.62)
B. K. Wells, J. A. Santora, I. D. Schroeder, N. Mantua, W. J. Sydeman, D. D. Huff, **J. C. Field (SWFSC)**

- Ecosystem models were used to understand the biophysical factors that related to central California chinook salmon growth and survival in the ocean.
- Based on model results the authors hypothesize that early salmon growth and survival are positively related to intensity of early-season upwelling and associated (forage) nekton production and retention on the shelf during spring and summer.
- Parameterization of ecosystem models is useful to ecosystem management

We review the suite of biophysical factors in the Northeast Pacific Ocean Basin and California Current shelf ecosystem that directly or indirectly relate to central California Chinook salmon (*Oncorhynchus tshawytscha*) growth

and survival upon ocean entry, a critical life-history period for this population. Our synthesis provides a framework for integrating ecosystem process studies with empirical hypothesis testing to benefit fisheries management. Our hypothesis includes seasonality (phenology) as a key element of early salmon growth and survival. The strength and location of the North Pacific High Pressure System in winter influences salmon growth and survival via "bottom-up" productivity and retention of key prey (euphausiid crustaceans and juvenile rockfishes, *Sebastes* spp.) in nearshore habitats prior to and during salmon emigration to sea in spring. Prey retention is associated with increased consumption of krill and juvenile rockfishes and is positively correlated with juvenile salmon body condition and ocean survival, and appears to set cohort strength and return rates. We examined these mechanistic relationships by reviewing the results of a biophysical model coupled to an individual-based model for salmon. Our review results in a final hypothesis stating that early salmon growth and survival are positively related to intensity of early-season upwelling and associated (forage) nekton production and retention on the shelf during spring and summer.
Expected publication date: December 2016

Management implications of temporally and spatially varying catchability for the Gulf of Mexico menhaden fishery
Fisheries Research (1.843)
B. Langseth (PIFSC); A. Schueller (SEFSC); K. Shertzer (SEFSC); J. K. Craig (SEFSC); and J. Smith (SEFSC)

- The Gulf menhaden stock assessment model is robust to possible hypoxia-induced changes in catchability provided catchability is modelled as a random walk. We therefore recommend modeling catchability as a random walk.
- The spatial extent over which catchability varies is important. Incorrectly assuming catchability is constant when it is not biases parameter estimates and that bias increases with the area over which catchability changes and the magnitude of those changes. The bias can be decreased if catchability is modeled as a random walk

Catchability relates fishing effort to fishing mortality, and is an important component in fishery stock assessment models. Mis-specifying catchability can lead to inaccurate estimation of model parameters and bias in the determination of stock status. The Gulf of Mexico has one of the largest seasonal occurrences of hypoxia in the world and it overlaps in time and space with the Gulf menhaden *Brevoortia patronus* fishery, potentially leading to temporal and spatial patterns in stock distribution and thus catchability. These patterns are not currently modelled in the Gulf of menhaden stock assessment. To better understand the implications of spatial and temporal patterns in catchability due to hypoxia, we constructed an operating model of Gulf menhaden fishery dynamics under various assumptions of spatial coverages and temporal patterns, and used the output from the operating model as input into estimation models with alternative approaches on modelling catchability. Under the most extreme assumptions about the spatial coverage and magnitude of variation in catchability, median absolute error in estimates of fishing mortality and spawning stock reference points ($F_{30\%}$ and $S_{30\%}$) was 73% and 29%, respectively, and median absolute error in estimates of fishing mortality and spawning stock based stock status was 23% and 79%, supporting the notion that errors in catchability are important. Under more reasonable assumptions, median absolute error declined to 20% and 2.9% for $F_{30\%}$ and $S_{30\%}$, respectively, and to 3.8% and 2.4% for fishing mortality and spawning stock-based stock status, respectively. Modeling catchability as a random walk further reduced median absolute error to 5.0% for $F_{30\%}$ and 1.4% for $S_{30\%}$, but slightly increased median absolute error for stock status indicators to 4.0% and 3.3%. Our results show generally that the spatial coverage, temporal pattern, and estimation approach of catchability affects the influence of mis-specifying catchability; and show specifically that the Gulf menhaden stock assessment is robust to the effects of hypoxia on catchability if assuming random-walk catchability.
Acceptance date: April 19, 2016
Expected publication date: May 2016

Brandt's cormorant diet (1994-2012) indicates importance of fall ocean conditions for northern anchovy in central California
Fisheries Oceanography (2.542)

M. Elliott, A. Schmidt, S. Acosta, R. Bradley, P. Warzybok, **K. Sakuma, J. Field (SWFSC)**, and J. Jahncke

- Useful for understanding interactions between protected species (seabirds) and the forage community, and for evaluating potential drivers of population changes for a seabird species that appears to fluctuate substantially, and out of phase with other co-occurring seabird species.

Effective ecosystem-based management requires a comprehensive understanding of the functional links in the system. In many marine systems, forage species constitute a critical link between primary production and upper trophic level marine predators. As top-predators, seabirds can be indicators of the forage species they consume and the ocean processes that influence these populations. We analyzed the diet and breeding success for years 1994-2012 of the Brandt's cormorant (*Phalacrocorax penicillatus*), a piscivorous diving seabird, breeding in central California, to evaluate the extent to which cormorant diet composition relates to prey availability, and how diet composition relates to breeding success and ocean conditions. Cormorant diet was primarily composed of age 0 northern anchovy (*Engraulis mordax*), young-of-the-year (YOY) rockfish (*Sebastes* spp.), and several species of small flatfish (order Pleuronectiformes). YOY rockfish consumption was positively related to their abundance as measured in a late spring pelagic midwater trawl survey. Northern anchovy appeared to be the most important prey as its consumption was positively related to cormorant breeding success. More northern anchovy were consumed in years where warm-water conditions prevailed in the fall season prior to cormorant breeding. Thus, warm ocean conditions in the fall appear to be an important contributing factor in producing a strong year-class of northern anchovy in central California and consequently a strong-year class of Brandt's cormorant on the Farallon Islands.
Acceptance date: May 3rd, 2016

Distribution of the box jellyfish Alatina alata: circumtropical species or multiple invasions?
Biological Bulletin (1.942)
J. W. Lawley, C. Lewis Ames, B. Bentlage, A. Yanagihara, R. Goodwill, E. Kayal, K. Hurwitz and **A. G. Collins (NEFSC)**

- Elucidating biodiversity through sound systematics is of foundational importance to ecosystem management.
- This paper shows that different populations of a venomous box jellyfish that have been classified as distinct species are actually all one large circum-tropical to subtropical species. This species has been implicated in serious stings of US Army soldiers (in Florida at training sites), Puerto Rico, Hawaii and elsewhere.

Species of the box jellyfish (Cubozoa) genus *Alatina* are notorious for their sting along beaches in several localities in the Atlantic and Pacific, including the Dutch Caribbean Island of Bonaire as *Alatina alata*, Hawai'i as *A. moseri* and Australia as *A. mordens*. Most cubozoans inhabit coastal waters, but *Alatina* is unusual in that specimens have also been collected in the open ocean at great depths. *Alatina* is notable in that populations form monthly aggregations for spermcast mating in conjunction with the lunar cycle. Nominal species are difficult to differentiate morphologically, and it has been unclear whether they are distinct or a single species with worldwide distribution. Here we report the results of a population genetic study using nuclear and mitochondrial sequence data from four geographical localities. Our analyses reveal a general lack of geographic structure among *Alatina* populations, and slight though significant isolation by distance. These data corroborate morphological and behavioral similarities observed in the geographically disparate localities, and indicate the presence of a single pantropically distributed species, *Alatina alata*. While repeated human-mediated introductions of *A. alata* could explain the patterns we have observed, it seems more likely that genetic metapopulation cohesion is maintained via dispersal through the swimming medusa stage, and perhaps via dispersal of encysted embryo stages, which are described here for the first time in *Alatina*.
Acceptance date: May 5, 2016

Using Antarctic blue whale photo-ID data from IDCR/SOWER: capture-recapture estimates of abundance
Journal of Cetacean Research and Management
P.A. Olson and **D. Kinzey (SWFSC)**

- A photo-identification catalog of Antarctic blue whale photos collected during International Whaling Commission IWC IDCR/SOWER cruises has been established.

- A pilot mark-recapture study using these data to estimate circumpolar and area-specific abundance of Antarctic blue whales is described.
- The Antarctic blue whale catalog will provide a baseline for subsequent photo-identification studies of Antarctic blue whale abundance, residency, and movement.

Identification photographs of Antarctic blue whales were collected during IWC IDCR/SOWER cruises from 1987/88 to 2008/09. Photo-ID data from 15 of these cruises were used in a pilot study conducting capture-recapture analysis to produce estimates of super-population abundance for the circumpolar Antarctic during 1992/93 to 2008/09 and for IWC Management Area III during 2004/05 to 2006/07. The circumpolar estimates are 3,178 (95% CI 534 to 24,239) Antarctic blue whales (left side photographs) and 1,109 (95% CI 451 to 3,215) (right side photographs) for the years 1991/92 to 2008/09. Estimates of super-population abundance for Area III are 1,318 (95% CI 515 to 3,716) (left side photographs) and 939 (95% CI 421 to 2,323) (right side photographs). The IWC IDCR/SOWER photo-ID database provides a starting point for improved estimates of population trends in the future as photographs of new individuals and additional recaptures of Antarctic blue whales are obtained.

Accepted: 25 April 2016

Two-step decisions in a central-place forager

Royal Society Open Science

A. Friedlaender, D. Johnston, R. Tyson, A. Kaltenberg, J. Goldbogen, A. Stimpert, **E. Hazen (SWFSC/ERD)**, P. Halpin, A. Read, D. Nowacek

- Antarctic humpback whale feeding occurred when prey was shallowest, and not when prey densities were highest
- This strategy may minimize diving and searching time, allowing for more efficient feeding
- Increased understanding of the foraging behavior of humpback whales can lead to improved conservation protocols.

Air-breathing marine animals face a complex set of challenges associated with diving that affect the decisions of how to optimize feeding. Baleen whales (Mysticeti) have evolved bulk-filter feeding mechanisms to efficiently feed on dense prey patches. Baleen whales are central-place foragers where oxygen at the

surface represents the central place and depth acts as the distance to prey. Although hypothesized that baleen whales will target the densest prey patches anywhere in the water column, how depth and density interact to influence foraging behavior is poorly understood. We used multi-sensor archival tags and active acoustics to quantify Antarctic humpback whale foraging behavior relative to prey. Our analyses reveal multi-stage foraging decisions driven by both krill depth and density. During daylight hours when whales did not feed, krill were found in deep high-density patches. As krill migrated vertically into larger and less dense patches near the surface, whales began to forage. During foraging, feeding rates (number of feeding lunges per hour) were greatest when prey was shallowest, and feeding rates decreased with increasing dive depth. This strategy is consistent with previous models of how air-breathing diving animals optimize foraging efficiency. Thus, humpback whales forage mainly when prey is more broadly distributed and shallower, presumably to minimize diving and searching costs and to increase feeding rates overall and thus foraging efficiency. Using direct measurements of feeding behavior from animal-borne tags and prey availability from echosounders our study demonstrates a multi-stage foraging process in a central place forager that we suggest acts to optimize overall efficiency by maximizing net energy gain over time. These data reveal a previously unrecognized level of complexity in predator-prey interactions and underscores the need to simultaneously measure prey distribution in marine central-place forager studies.
Published: 11 May 2016
Link to article online: http://rsos.royalsocietypublishing.org/content/3/5/160043

Hierarchical phylogeographic structure of Coho Salmon Oncorhynchus kisutch *in California*
Transactions of the American Fisheries Society (1.314)
E. A. Gilbert-Horvath (SWFSC), K. A. Pipal (UCSC & SWFSC), B. C. Spence (SWFSC), T. H. Williams (SWFSC), J. C. Garza (SWFSC)
Demonstrates strong genetic support for current boundary between the CCC and SONCC coho salmon ESUs. Describes significant differentiation of Klamath River basin populations, nearly as distinct as the two ESUs. Evaluation of population genetic structure and variation is an important part of planning for the recovery and management of protected species. Data from 18 polymorphic microsatellite DNA markers were used to analyze

phylogeographic structure of protected Coho Salmon *Oncorhynchus kisutch* from populations throughout California, USA. Fish from thirty locations in two evolutionarily significant units (ESUs), representing most extant populations in the state, were studied. Multiple analyses indicated a hierarchical pattern of population structure: the greatest divergence was found at the broadest geographic scale (ESU-level), followed by between-basin structure, and then between populations within the same basin. Populations of the large Klamath River basin were consistently identified as a distinct phylogenetic group, nearly as divergent from all other populations as the two ESUs were from each other. All populations in different basins were differentiated from each other and a pattern of isolation by distance was found at a California-wide scale, but not at smaller spatial scales. Similarly, most individuals were accurately assigned to population of origin, and almost all mis-assignments were to an adjacent or geographically proximal basin, indicating that there is substantial gene flow within each region, but much less between regions. The number of parents contributing to each population was highly variable and reflected larger patterns of genetic variation, which was found to be generally higher in the southerly low-elevation coastal populations than in the northern, interior and higher-elevation populations. The results strongly support the current boundary between the two ESU regions and the detailed understanding of phylogeographic structure provided here will help to guide management and recovery of Coho Salmon at the southern end of their geographic range.
Acceptance date: 4 May 2016

Social bonds and recovery: an analysis of hurricane Sandy in the first year after landfall
Marine Policy (2.610)
P. M. Clay, **L. L. Colburn (NEFSC)**, and T. Seara

- Discusses the importance of social bonds to disaster recovery/community resilience in fishing communities after Hurricane Sandy, one of the most devastating hurricanes to hit U.S. shores.
- Few social bonds studies exist for fishing communities.

- Fishermen's well-documented independence creates an interesting area to study the theory of social bonds and may even provide arguments against the importance of social bonds.
- Important to policy because community resilience is a key element of the NOAA Next Generation Strategic Plan and the GARFO Strategic Plan.

Hurricane Sandy was one of the most devastating hurricanes to hit U.S. shores. The brunt of the impact was felt in New York and New Jersey, especially among coastal towns such as fishing communities. A survey of these two states assessed social and economic impacts to 958 commercial and recreational fishermen and fishing-related business owners 12 months post-storm. Many businesses and communities were still struggling not only due to heavy infrastructure damages and revenue losses with low insurance coverage, but also due to disrupted fishing patterns for some species. Social bonds were credited by many as a key aid to recovery. Social bonds (sometimes called bonding social capital) have been shown to be critical for evacuation and recovery in other disasters. However, few studies examine social bonds and disasters within the context of fisheries; this paper expands upon that topic.

Acceptance date: 27 April 2016

NWS PUBLICATIONS

Challenging Some Contemporary Views of Coronal Mass Ejections. I: The Case for Blast Waves

Astrophysical Journal (11.22)

Timothy Howard and **V. J. Pizzo (SWPC)**

- Many coronal eruptions heretofore regarded as consisting entirely of an expulsion of gas and magnetic fields from the Sun are in fact Blast waves involving only minor expulsion of mass from the Sun.
- In preparing space weather forecasts of oncoming "CME" activity, it is important to distinguish whether the coronagraph observations are indicating a true CME, as opposed to a blast wave. In general, blast waves can be expected to have lesser effects upon the Earth environment.

Since the closure of the "solar flare myth" debate in the mid-1990s, a specific narrative of the nature of coronal mass ejections (CMEs) has been widely accepted by the solar physics community. This narrative describes structured magnetic flux ropes at the CME core that drive the surrounding field plasma away from the Sun.

This narrative replaced the "traditional" view that CMEs were blast waves driven by solar flares. While the flux rope CME narrative is supported by a vast quantity of measurements made over five decades, it does not adequately describe every observation of what have been termed CME-related phenomena. In this paper we present evidence that some large-scale coronal eruptions, particularly those associated with EIT waves, exhibit characteristics that are more consistent with a blast wave originating from a localized region (such as a flare site) rather than a large-scale structure driven by an intrinsic flux rope. We present detailed examples of CMEs that are suspected blast waves and flux ropes, and show that with our small sample of 22 EIT wave-related CMEs, 91% of them involve a blast wave as at least part of the eruption, and 50% are probably blast waves exclusively. We conclude with a description of possible signatures to look for in determining the difference between the two types of CME and with a discussion on modeling efforts to explore this possibility.
Acceptance date: 15 April 2016
Expected publication date: July 2016

OAR PUBLICATIONS

Long-term observations of Alaska Coastal Current in the northern Gulf of Alaska
Journal of Deep Sea Research Part II (2.190)
P. J. Stabeno, S. Bell, W. Cheng, S. Danielson, **N. B. Kachel, C. W. Mordy (PMEL)**

- Total current transfer was calculated for the Alaska Coastal Current over a 30 year period.
- This current mixing with tidal currents results in prolonged primary productivity throughout the summer.

The Alaska Coastal Current is a continuous, well-defined system extending for ~1700 km along the coast of Alaska from Seward, Alaska to Samalga Pass in the Aleutian Islands. The currents in this region are examined using data collected at >20 mooring sites and from >400 satellite-tracked drifters. While not continuous, the mooring data span a 30 year period (1984–2014). Using current meter data collected at a dozen mooring sites spread over four lines (Seward, Gore Point, Kennedy and Stevenson Entrances, and the exit to Shelikof Strait) total transport was calculated. Transport was significantly correlated with alongshore winds, although the correlation at the Seward Line was weak. The largest mean transport

in the Alaska Coastal Current occurred at Gore Point (1.4×106 m3 s−1 in winter and 0.6×106 m3 s−1 in summer), with the transport at the exit to Shelikof Strait (1.3×106 m3 s−1 in winter and 0.6×106 m3 s−1 in summer) only slightly less. The transport was modified at the Seward Line in late summer and fall by frontal undulations associated with strong river discharge that enters onto the shelf at that time of year. The interaction of the Alaska Coastal Current and tidal currents with shallow banks in the vicinity of Kodiak Archipelago and in Kennedy-Stevenson Entrance results in mixing and prolonged primary production throughout the summer.

Accepted: In Press

Extreme noise–extreme El Niño: How state-dependent noise forcing creates El Niño-La Niña asymmetry

Journal of Climate (4.435)

A. Levine, F.F. Jin, **M. J. McPhaden (PMEL)**

- The authors seeked to address the question of what causes ENSO amplitude asymmetry.
- They found that the magnitude of westerly-wind burst state-dependence and ENSO asymmetry holds true for observations and coupled climate models.

A major open question about El Niño-Southern Oscillation (ENSO) is what causes ENSO amplitude asymmetry, with strong El Niños generally larger than strong La Niñas. We examine a leading hypothesis, that the ENSO state modifies the fetch and/or wind speed of westerly wind bursts that create asymmetric forcing and an asymmetric ENSO response. Further, in El Niño forecasts, the number of westerly wind bursts (WWBs) expected increases in the month following a strong WWB when compared with the month preceding it. Using a conceptual model, we derive a relationship between the magnitude of the westerly wind burst state-dependence on ENSO and ENSO asymmetry. We find that this relationship between the magnitude of the state-dependence and ENSO asymmetry holds in both the observations and the 21 coupled climate models. Westerly wind burst state-dependence also links the relationship of eastern Pacific El Niño events and extreme El Niño events.

Expected Publication Date: June 2016
Available online: http://journals.ametsoc.org/doi/abs/10.1175/JCLI-D-16-0091.1

The spectroscopic foundation of radiative forcing of climate by carbon dioxide
Geophysical Research Letters (4.456)
M.G. Mlynczak, T.S. Daniels, D.P. Kratz, D.R. Feldman, W.D. Collins, E.J. Mlawer, M.J. Alvarado, J.E. Lawler, L.W. Anderson, **D.W. Fahey (ESRL/CSD),** L.A. Hunt, and J.C. Mast

- Accurate computation of radiative forcing (RF) due to increasing abundances of carbon dioxide (CO2) forms the foundation of climate change modeling.
- Based on a detailed spectroscopic analysis, the uncertainty in present-day CO2 radiative forcing is less than one percent, indicating a robust foundation in our understanding of how rising CO2 warms the climate system.

Accurate computation of radiative forcing (RF) due to increasing abundances of carbon dioxide (CO2) forms the foundation of climate change modeling. RF is the change in net radiative flux at the tropopause for differing abundances of CO2 and is often computed relative to pre-industrial abundances. Uncertainties in RF lead to uncertainties in determination of climate sensitivity and in prediction of future climate. The uncertainty in computed RF depends on the evaluation of atmospheric transmittance in the spectral regions where CO2 absorbs infrared radiation. The new results, which are the first to include all spectroscopic absorption parameters, show that CO2 RF in a variety of atmospheres is remarkably insensitive to known uncertainties in the three main CO2 spectroscopic parameters. Overall, the spectroscopic uncertainty in present-day CO2 RF is less than one percent.
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OTHER REPORTS, BOOK CHAPTERS, AND INTERNAL PUBLICATIONS

OAR PUBLICATION

The Atmospheric Radiation Measurement (ARM) Program: The First 20 Years - Introduction
Meteorological Monographs
D. D. Turner (NSSL), R. G. Ellingson

- This paper is the introduction to the American Meteorological Society's Meteorological Monograph entitled "The Atmospheric Radiation Measurement Program: The First 20 Years."
- This monograph is a history of the origins of the Department of Energy's Atmospheric Radiation Measurement (ARM) program, its programmatic maturation, and its primary scientific accomplishments.
- It consists of 4 general overview chapters, 8 chapters on the development of the program's infrastructure, and 18 chapters that cover the various scientific accomplishments of the program. The chapters were authored by selected participants from the ARM program

The ARM program is the DOE's primary observationally-based climate research program. The ARM program set a new paradigm by operating a large number of instruments, including many that were previously considered laboratory-only instruments, operationally in different climatic regimes around the world. The program developed several new instruments, including the first autonomous 8-mm cloud radar and water vapor Raman lidar. ARM data have been been used for a large number of different scientific studies including: development of cloud overlap statistics, improving detailed radiative transfer models and their parameterization in global climate and numerical weather prediction models, a better understanding of cloud phase microphysical processes, aerosol-cloud interactions, and more.

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