2015 NMFS-SG Fellowship Symposium
Miami, FL
June 9-11, 2015

Katelyn Bosley
Oregon State University, 2013
Faculty Advisor: Brett Dumbauld
NMFS Mentor: Thomas Wainwright
Presentation - Remote

Investigation into age and growth for burrowing shrimps in Yaquina Bay, Oregon: an integrated approach

Surveys for the burrowing shrimps, *Neotrypaea californiensis* and *Upogebia pugettensis,* demonstrated significant declines in populations of both species over the last decade. Efforts are currently underway to develop a cohort-based matrix population model which will include estimates for rates of growth, recruitment and mortality with data collected through annual population monitoring surveys conducted in Yaquina Bay, Oregon from 2011 through 2014. Because previous work has shown body size to be weakly correlated with actual age in burrowing shrimp, age structure within these populations was obtained using analysis of the aging pigment, lipofuscin, as an alternative to size-based aging methods. In addition to population surveys, field and controlled mesocosm growth experiments are being conducted to validate the lipofuscin aging method and determine how environmental parameters affect shrimp growth and aging rates. Preliminary data show growth rate may be influenced by food and temperature. Once verified these models can be used to predict changes in Yaquina Bay shrimp populations and may be applied to other estuaries, particularly Willapa Bay, WA where they cause oyster mortality. The novel methods developed in this study may also assist in building successful harvest plans for other commercially important crustaceans that don't currently have reliable aging methods.

Background: I earned a B.S. from the College of Charleston with a dual major in Marine Biology and Biology. After college I decided to take a break from academic studies and focused on my enjoyment of the outdoors. I spent time working as a guide for a kayak company in South Carolina and developed eco-tours and marine biology camps for adults and children. In 2004 I took a position as a Marine Fisheries Observer based out of New Bedford, MA. During my year spent working alongside fisherman on Georges Bank I developed a keen interest in fisheries science and focused my career goals toward this specific field. In 2005 I was accepted into a Master's program at Oregon State University in Fisheries Science. My research involved developing and applying biochemical aging techniques for assessing the age structure of burrowing shrimp populations in west coast estuaries. After graduating in 2008 I started working on a PhD, and continued to work on age determination in crustaceans. My research covers a variety of topics, including: population assessment methods, alternative aging techniques, environmental effects on growth and aging rates, and application of population models to burrowing shrimps in Pacific Northwest estuaries. I have been honored with several awards and scholarships including the NMFS/Sea Grant Population Dynamics Fellowship in 2013. When I am not out in the field, in the laboratory or crunching numbers at my desk, I enjoy playing with my two young daughters, cooking, gardening, traveling, and hitting the water on my paddleboard as much as possible

Allison Dedrick
UC Davis, 2014
Faculty Advisor: Lou Botsford
NMFS Mentor: Mandy Karnauskas
Poster – On site

Quantifying the interactions among ocean acidification, temperature, and fishing for marine invertebrates

Rising atmospheric concentrations of carbon dioxide will alter both ocean temperature and pH. Ocean acidification (OA) and changing temperatures could change the spatial distribution and persistence of marine invertebrate populations through their effects on the survival, growth, and development of larvae, particularly those that calcify. Understanding the interactions among OA, temperature, and fishing in a spatial context is necessary for determining the overall population-level effects and the potential fishery impacts and response. Using a spatially-explicit population model, this project develops a framework to explore and quantify the relative population-level consequences of OA and temperature effects and their interaction with fishing for marine invertebrates.

OA effects on larval survival, growth, and development cause equilibrium population sizes to drop. Through effects on development and survival, OA reduces the number of larvae reaching habitat to settle, which can shift populations from persistent to non-persistent due to a shortage of arriving larvae. Temperature effects on development can have the reverse effect. Higher levels of fishing mortality increase the likelihood of a population becoming larval-limited. Species already close to being limited by larval supply and those that experience OA effects on larval survival, particularly with long development times, look to be the most vulnerable.

Background: I am a PhD candidate at the University of California Davis, in the labs of Louis Botsford and Marissa Baskett, where I use models to study the effects of climate change and management on marine population dynamics. Prior to coming to graduate school, I worked on the fish crew at Point Reyes National Seashore, surveying steelhead trout and coho salmon. Outside of marine ecology, I enjoy choral singing and sing with a group in San Francisco.

Meagan Dunphy-Daly
Duke, 2012
Faculty Advisor: Andrew Read
NMFS Mentor: Jeff Polovina
No presentation or poster

Background: I recently completed my Ph.D. in Marine Science and Conservation at the Nicholas School of the Environment at Duke University. For my dissertation research, I focused on the effectiveness of marine reserves for pelagic predators, such as sharks, tuna, and billfish. During my time at Duke, I also carried out a field project investigating the abundance and habitat use of bull sharks in the Neuse River Estuary and studies cetacean diving behavior in Antarctica and off Cape Hatteras, North Carolina. Prior to beginning my doctoral studies at Duke, my Master's Degree research focused on the spatio-temporal variation in dwarf sperm whale habitat use and group size off of Abaco Island in the Bahamas. After completing my Master's Degree fieldwork, I conducted research in the seagrass ecosystem of Shark Bay, Western Australia to study the non-lethal effects of tiger sharks on multiple prey species (dolphins, marine turtles, dugongs, stingrays, cormorants, sea snakes). Additionally, I carried out research in the Florida Everglades to study factors driving the distribution of bull sharks. I also conducted a laboratory study of the influence of predation risk on the diving behavior of red-eared slider turtles.

Christopher Free
Rutgers, 2013
Faculty Advisor: Olaf Jensen
NMFS Mentor: Jonathan Deroba
Poster – Remote

Illegal fishing for the endangered endemic Hovsgol grayling

Christopher Free[1], Olaf Jensen[1], Bud Mendsaikhan[2]

[1] *Department of Marine and Coastal Sciences, Rutgers University*
[2] *Institute of Geoecology, Mongolian Academy of Science*

Managers must know as much as possible about illegal fishing to effectively develop regulations but illegal activity is difficult to quantify. We used a mixed-method approach to evaluate the extent, character, and motivations of illegal fishing in Lake Hovsgol National Park, Mongolia and its impact on fish populations, especially that of the endangered endemic Hovsgol grayling (*Thymallus nigrescens*). We used: (1) surveys for derelict fishing gear to indirectly describe the extent, distribution, and character of illegal fishing; (2) interviews with herders and park rangers to contextualize these surveys; (3) long-term biological monitoring to identify species vulnerable to gillnet fishing and evaluate population-level impacts potentially caused by fishing; and (4) data-poor stock assessment methods to estimate the effort required to overexploit the grayling population. Surveys for derelict fishing gear indicate that gillnet fishing is widespread and increasing. Interviews suggest that locals, non-locals, and foreigners participate in subsistence, commercial, and recreational fishing, fishing primarily targets grayling during the spring spawning migration, and fish population sizes are decreasing. Biological monitoring indicates that gillnets efficiently target grayling and grayling, burbot, and roach populations are declining. Data-poor stock assessment methods demonstrate the plausibility of current or future fishing pressure to overexploit grayling.

Background: I am a PhD candidate with Olaf Jensen at Rutgers University and in the second year of my NMFS-SG fellowship. I am interested in using interdisciplinary and quantitative tools to inform fisheries management decisions. Currently, I am working to quantify the extent, motivations, and impact of illegal fishing in Mongolia and to evaluate the performance of the ORCS Working Group data-poor fisheries management method in the US. I am an avid runner and enjoy outdoor adventures, sports/games, brewing beer, and playing trombone.

Steven Garner
U of South Alabama, 2013
Faculty Advisor: Will Patterson
NMFS Mentor: Clay Porch
Presentation – On site

Modeling the effects of gear selectivity on the northern Gulf of Mexico recreational red snapper fishery

Steven B. Garner[1], William F. Patterson III[1], Clay E. Porch[2]
[1]Department of Marine Sciences, University of South Alabama, Dauphin Island Sea Lab
[2]National Marine Fisheries Service, Southeast Fisheries Science Center

Changes in fishery selectivity can influence stock assessment results used to valuate stock status and implement effective management. In the northern Gulf of Mexico (nGOM), the red snapper (*Lutjanus campechanus*) fishery is composed of multiple fleets targeting different size classes using a variety of hook-and-line gears. The recreational sector primarily impacts smaller, younger individuals (< age-10) and the selectivity pattern was estimated to be strongly dome-shaped in recent stock assessments. In 2008, circle hooks were mandated when fishing for reef fishes to reduce release mortality, but the impact of circle hooks on catch rates and selectivity had not been tested empirically. We conducted multiple fishing experiments to assess the effect of hook size and type (circle or J hook) on catch metrics for red snapper (as well as gray triggerfish) in the nGOM. We estimated hook (contact) selectivity directly by conditioning catch length distributions on the *in situ* length distributions observed at artificial reef sites with micro remotely operated vehicles equipped with a laser scaler. Selection nature and peak were estimated using fixed- (asymptotic) and flexible-form (asymptotic or dome-shaped) equations in each fishing experiment. Catch rates decreased significantly with hook size but were similar between hook types. Exponential-logistic models estimated dome-shaped selection for all hook size and type combinations for both species. Selection peaks increased with increasing hook size but only slightly and smaller individuals (<500 mm) were still captured with larger hooks. Empirical results are currently being used to inform the red snapper stock assessment model in Stock Synthesis III. Specifically, different selectivity and retention vectors associated with shifts in fisher behavior to circle hook gear are being input into the model framework to test their effect on parameter estimates and model fit.

Background: I began my career in fisheries science as an undergraduate at the University of West Florida. I had an internship at the NMFS lab in Panama City, FL under the guidance of Dr. Will Patterson. Upon completing my Bachelor's degree in Marine Biology, I was very grateful to accept a master's student position in the graduate program at Louisiana State University under the guidance of Drs. Rick Shaw and James Cowan. Jim offered me a position on a project examining the potential to increase juvenile fish productivity in Louisiana marshes by adding artificial reefs. My dissertation research with Dr. Will Patterson focuses on the selectivity of different hooks commonly used in the northern Gulf of Mexico recreational reef fish fishery. I understand the psychological attachment to being on the water, fishing, and the experience as a whole, and want to contribute as best I can to help sustain the fisheries that were so critical in shaping who I am today.

Katherine Kaplan
Cornell, 2014
Faculty Advisor: Patrick Sullivan
NMFS Mentor: Dvora Hart
Poster - Remote

Applying geostatistics to evaluate the effect of marine protected areas on competitive interactions between the invasive tunicate *Didemnum vexillum* and the Atlantic sea scallop *Placopecten magellanicus*

The Atlantic sea scallop (*Placopecten magellanicus)* has recently become the highest valued fishery in New England due to dramatic increases in fishery yields after areas protected from bottom-fishing were put in place in Georges Bank in 1994. While the success of protected areas in promoting high fish biomass in some fisheries has been well-documented, less well known is the ability of MPAs to protect from invasive species. In 2002 an invasive tunicate*Didemnum vexillum* was discovered on Georges Bank and the population has since experienced high growth rates in the region. We hypothesized that the Atlantic sea scallop competes with *D.vexillum* for habitat and a spatially explicit relationship exists between the two species. Our results indicate a spatially-explicit repulsion effect occurs between the Atlantic sea scallop and *D. vexillum* in areas open to fishing, which contain greater proportional densities of *D.vexillum*as compared to areas protected from bottom-fishing. It has been suggested that bottom-fishing may facilitate the spread of *D.vexillum*, which is also supported by our data indicating higher densities of *D.vexillum* are found in areas open to fishing. This research highlights the benefit of areas closed to bottom-fishing in protecting essential fish habitat from degradation due to invasive species.

Background: I am originally from New Rochelle. NY and currently a Ph.D. candidate in the department of Natural Resources at Cornell University. My adviser is Patrick Sullivan, a statistician and full professor in the department of Natural Resources who has worked extensively in fisheries research across the United States. I started my Ph.D. program in Fall of 2012. Before Cornell, I completed a Master's of Science degree in Marine Ecology at Universidad San Francsico de Quito in Ecuador, for which I studied vulnerable fish species' habitat in the Galapagos Marine Reserve. My Bachelor of Arts degree is from Grinnell College, in Grinnell, Iowa where I majored in Biology and did a concentration in Global Development Studies.

Ian Kroll
U of North Carolina, 2013
Faculty Advisor: Joel Fodrie
NMFS Mentor: Kevin Craig
Poster - Remote

Linking juvenile habitat to adult stock dynamics of the black sea bass (*Centropristis striata*)

Ian Kroll[1], F. Joel Fodrie[1], C. Kevin Craig[2]
[1]Institute of Marine Sciences, University of North Carolina-Chapel Hill
[2]NOAA, National Marine Fisheries Service, Beaufort Laboratory

Degradation of coastal systems has threatened juvenile habitat availability and may impact the stability of fish populations. However, it is unknown how specific nursery habitats influence post-juvenile life history (e.g., sexual succession) and resulting stock structure and production. Our research utilizes otolith elemental analysis to quantify the function of estuarine and offshore juvenile habitats as a source contributing to the spawning, adult population. Furthermore, we introduce a demographic modeling approach to the management of black sea bass (*Centropristis striata*) using nursery-specific variables. Elemental analysis of juvenile otoliths from both estuarine and open-coast habitats from the years 2009-2014 indicates significant differences in habitat signatures between putative nursery alternatives. Using discriminant function analysis, we correctly identified 95% of all juveniles to the habitat where they were captured. Signatures from hundreds of adult fish otoliths are being analyzed to determine the proportional contributions of estuarine versus offshore habitats in maintaining black sea bass stock. Between-nursery comparisons of adult growth rates and proportion of males at age will also help to identify the presence of any carry-over effects resulting from juvenile habitat. Finally, this data will be used to explore the applicability of stage-based population matrices for the assessment of black sea bass.

Background: My interest in population biology began as an undergraduate at Vassar College and has led me to pursue a PhD in the Coastal Fisheries Oceanography and Ecology Lab at UNC-Chapel Hill's Institute of Marine Sciences. My research explores the intersection of conservation biology, fisheries management, and population dynamics, primarily through two model organisms, the eastern oyster (*Crassostrea virginica*) and black sea bass (*Centropristis striata*). Generally, I am interested in using a combination of geochemical tagging techniques, field-collected demographic rates, and stage-based population models to examine connectivity and habitat contributions to adult spawning stocks. I am also interested in developing intuitive habitat-explicit population models for use in stock assessments. When I am not in the lab (or out to sea), you can find me off trail running, eating cheese, napping on the beach or gearing up for my next adventure!

Peter Kuriyama
U of Washington, 2014
Faculty Advisor: Trevor Branch
NMFS Mentors: Alan Hicks and John Harms
Presentation – On site

Abstract: Fisheries stock assessments typically assume fish grow according to a theoretical growth curve (e.g., von Bertalanffy, Richards, or Gompertz). In some cases, such as Pacific hake (Merluccius productus), growth is empirically incorporated into stock assessments with weight-at-age data from research surveys or fishery observations. Estimating growth and incorporating weight-at-age data into stock assessments may each bias fisheries reference points, provided to decision makers, but these biases have not been well studied. Monte Carlo simulations were used to identify conditions under which using empirical weight-at-age in stock assessments provide more robust estimations of stock status and management reference points than when growth is internally estimated. Results of this research will provide guidance to fisheries scientists regarding under what circumstances (i.e., fishing pattern, life-history type, and data availability) it is most beneficial to estimate growth within a stock assessment rather than empirically incorporate growth data.

Background: I grew up in Solana Beach, CA and have a BA in Biology from the College of Creative Studies at UC Santa Barbara. I used to surf and lifeguard in the summers, but in Seattle I swim and play pick-up basketball. I expend too much emotional energy on the LA Clippers and coffee optimization.

Ben Marcek
Virginia Institute of Marine Science, 2014
Faculty Advisor: Mary Fabrizio
NMFS Mentors: Richard Brill and Kevin Craig
Poster – Remote

Influence of Temperature on the Metabolic Scope and Critical Oxygen Saturation of Two Demersal Fishes in Chesapeake Bay

Both hypoxia and temperature have been increasing in Chesapeake Bay over the last 50 years. For fishes, the cost of maintaining homeostasis increases with temperature while the availability of oxygen to support metabolic processes decreases, creating synergistic effects of temperature and hypoxia on their metabolic processes. It is critical to understand the effects of increasing temperature and hypoxia on fishes for effective management. We used stop-flow respirometry to investigate the effect of temperature on metabolic scope, the amount of energy available for metabolic processes outside of maintaining homeostasis, and critical oxygen saturation, the oxygen saturation at which homeostasis can no longer be maintained, of Atlantic Croaker (Micropogonias undulatus) and Spot (Leiostomus xanthurus). Preliminary results suggest that metabolic scope is larger for Spot than for Atlantic Croaker at 25oC, but critical oxygen saturation is similar among species. Additionally, Spot at 20oC had a larger metabolic scope but a lower critical oxygen saturation than at 25oC. These results suggest that increasing temperatures in Chesapeake Bay may decrease the metabolic scope of Atlantic Croaker and Spot and their resilience to hypoxia. Decreased metabolic scope may have serious implications at the individual and population levels, such as decreased reproductive capacity and lower recruitment.

I completed my Bachelor's degree in 2010 in Marine and Freshwater Biology at the University of New Hampshire. I began my Master's work on the post-release mortality of juvenile Bluefin Tuna the fall of 2010 at the Virginia Institute of Marine Science under Dr. John Graves and finished in the summer of 2013. My dissertation is focused on investigating the effects of temperature and hypoxia on the abundance, distribution, and reproductive capabilities of two demersal fishes in Chesapeake Bay, Atlantic Croaker (Micropogonias undulatus) and Spot (Leiostomus xanthurus). I am currently working on the first chapter of my dissertation which focuses on how temperature affects the metabolic scope and critical oxygen saturation for these species using stop-flow respirometry. I plan to investigate how the abundance of Atlantic Croaker and Spot is related to hypoxia and temperature using generalized additive models. I also intend to investigate how the distribution of Atlantic Croaker and Spot changes relative to temperature and hypoxia in Chesapeake Bay using an individual-based model and data collected in the respirometry trials. The last chapter of my dissertation will investigate the relationship between hypoxia and reproductive capacity of Atlantic Croaker and Spot. Atlantic Croaker and Spot will be sampled, with environmental data, throughout the lower Chesapeake Bay and its major tributaries prior to their migration out of the bay for spawning. I will calculate the gonadosomatic index and examine the ovaries of individuals from both species histologically to determine the dominant egg stage and the proportion of atretic oocytes. These metrics should allow me to determine if exposure to hypoxic areas has deleterious effects on the reproductive capacity of Atlantic Croaker and Spot. I hope that my work will help fisheries managers to understand the effects of hypoxia and temperature on demersal fishes and aid in fisheries management in the face of changing environmental conditions.

Lisa McManus
Princeton University, 2014
Faculty Advisor: Simon Levin
NMFS Mentor: Rusty Brainard
Poster – On site

Linking dispersal scales, genetic differentiation and persistence in corals

Recent work suggests that warming ocean waters will increase local retention of coral larvae. Such changes in dispersal patterns will have varying effects on the persistence of corals: while isolated reefs may thrive from an increase in available larvae, reefs that are reliant on external larval contributions may be more susceptible to local extirpations. In addition, the scale of coral dispersal remains an open question in marine ecology: there is evidence of both short- and long-range larval connectivity of corals that is likely affected by life history traits.

In light of these issues, it is important that we understand the dispersal patterns of major reef-building species as well as how these patterns are likely to be altered. To do so, I plan to (A) estimate present-day dispersal distances that will be used as input parameters in (B) simulations that project climate change scenarios. With three coral species on two Philippine islands, I will address Part A with a population genetics study that will test for isolation by distance patterns and assess population substructure. In Part B, I will incorporate data from Part A into biophysical simulations that include ocean circulation and the effects of warming on coral recruitment and mortality.

Background: I earned my Bachelor's degree in Marine and Atmospheric Science from the University of Miami in 2010. After graduating, I was employed there for two years as a lab technician conducting mangrove fish behavioral studies. At the same time, I worked as a naturalist teaching K-12 groups about coastal ecology at the Biscayne Nature Center. I'm currently a PhD candidate in the Ecology and Evolutionary Biology Department at Princeton University. As part of Prof. Simon Levin's lab, I use mathematical models and population genetics to answer questions regarding the effects of coral dispersal on coral reef metacommunity dynamics. Most of my research experience has been in Florida and the Caribbean, although I have just recently started a project in the Philippines, where I'm originally from.

Jennifer Meredith
U of Washington, 2014
Faculty Advisor: Chris Anderson
NMFS Mentor: Amber Himes-Cornell
Presentation – On site

Fish or Flight: Modeling the Migration Decisions of Fish Harvesters in Rural Alaska

This research incorporates the commercial fishery and discrete changes in fisheries management in order to analyze the drivers of declining fishery participation and outmigration in communities that traditionally depend on fisheries for income. Although there is evidence that a transition to rights-based management decreases the degree of local participation as rural residents sell their allocations to outsiders with higher capital endowments, little is known about how these large lump-sum payments affect migration. The implementation of a limited entry permit system in the Alaska salmon fishery allows us to examine how harvesters who reside in rural Alaskan communities respond to such allocations and to test whether these management shifts generate an outflow of migration, potentially undermining the resilience of small communities. A model of interregional migration that integrates fluctuations in fishery abundance and transactions within the permit markets is tested using regional data on rural Alaskan migration flows. Although the early impact of the transition to rights-based management appears to be negligible, there is evidence that the long run effect of declining fishery participation is an increase in rural outmigration, particularly from the most rural regions.

Background: I am a graduate student in the economics department at the University of Washington. I am in love with Seattle and when I am not working on my dissertation I spend my time biking to Mariners games, backpacking in the Olympics, brewing beer, and walking my Labrador retriever. My research interests are at the intersection of marine resource economics and development economics. This includes examining the role of property rights, risk, social networks, and access to credit within rural Alaskan fisheries and fisheries in developing countries. After growing up in the great state of Alaska, I sought out warmer climes in Santa Barbara as an undergraduate and then went to University of San Francisco for a master's in development economics. Before returning to graduate school for my PhD, I spent a year living in Kenya and Uganda conducting household survey research and being arrested for refusing to bribe the police. My NMFS fellowship has allowed me to return to the field and I spent the last month flying around in small planes outside Dillingham and Nome, Alaska making preparations for a household survey.

Cole Monnahan
U of Washington, 2013
Faculty Advisor: Trevor Branch
NMFS Mentor: James Thorson
Presentation – Remote

The effect of hook spacing in the standardization of Pacific halibut CPUE

Catch per unit effort (CPUE) data provide important information about the trend in status to a stock assessment, and are simply catch standardized by effort and other factors. In the Pacific halibut (*Hippoglossus stenolepis*) fishery the ostensible unit of effort is a longline hook, which can be spaced anywhere from 4-36ft. However, a rudimentary analysis in the 1970s based on empirical data suggests that hook spacing affects catch rates in a non-linear way, with smaller spacing leading to less effective hooks due to saturation, leading to the determination of an 'effective' hook as the unit of effort. That definition remains unchanged, despite additional data and the availability of more advanced statistical methods. Here I discuss updating the hook spacing relationship using two approaches. First, I reanalyze the original empirical data with a non-linear Bayesian hierarchical model, which formally accounts for space and local depletion, propagates uncertainty, and allows for testing of the functional relationship. The second approach estimates the hook spacing relationship simultaneously with the CPUE standardization as either a non-linear model or a non-parametric smoother on hook spacing. The updated definition of effective hook will be used to improve the commercial CPUE series and incorporated into the stock assessment.

Background: Cole earned his B.S. in Mathematics and B.A. in German Language from Western Washington University in 2006. After college he worked as an agricultural statistician in a USDA dairy chemistry lab until moving on to graduate school in Quantitative Ecology and Resource Management at the University of Washington. In 2013 he received his master's degree for his research on the population trends of the endangered eastern North Pacific blue whale. Since then he has been using simulation testing to explore and learn about single species stock assessments. His research focuses on their statistical properties, in particular improving the efficiency of Bayesian algorithms and comparing inference to frequentist approaches. He also will work closely with scientists at the International Pacific Halibut Commission to analyze their commercial logbook data and help with the assessment.

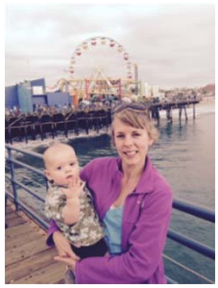
Matt Nuttall
U of Miami, 2014
Faculty Advisor: Elizabeth Babcock
NMFS Mentor: John Walter III
Poster – On site

The Influence of Environmental and Ecological Processes on the Dynamics and Assessment of Gulf Menhaden (*Brevoortia patronus*) within the Gulf of Mexico

Gulf of Mexico (GOM) Gulf menhaden (GM) *Brevoortia patronus* play a key ecological role in energy transfer from primary producers to upper consumers and support the second largest fishery (by weight) in the US. While the latest assessment suggests this stock is not overfished and overfishing is not occurring, a number of recommendations identified a need to better understand GMs interaction with its ecosystem, which may prove essential to managers facing growing demands for seafood/fishmeal and whose decisions influence not only GM, but the many species that rely upon them. Within this dissertation, we will (1) identify which aspects of the GOM environment are responsible for the temporal dynamics and spatial patterns of GM abundance, (2) conduct a meta-analysis on diet studies of piscivores observed to prey upon GM, using a Poisson-multinomial regression to predict feeding habits at a particular place, time, and/or for particular prey groups and that incorporates any residual variability unexplained by these factors, (3) input these dietary predictions, and their uncertainty, into an ecosystem model to assess the sensitivity of GMs trophic role to these inputs, and (4) assess whether the current GOM GM assessment model adequately captures stock dynamics and is robust to environmental variability.

Background: Admittedly, my early years were as dynamic as some of the stocks we assess. While I grew up in south Florida, it was around age 12 that my father's job began transferring us across the nation, living in places such as California, Tennessee, North Carolina, and Ohio; we even lived in Canada for a year. For college, I returned to south Florida and obtained a Bachelors in Marine Science and Biology from the University of Miami (FL). I joined the Marine Mammal Stranding Team, enjoyed an internship at the Reef Environmental Education Foundation, and took every available opportunity for a snorkeling trip. After a brief stint at NOVA Southeastern University (FL), I joined the lab of Dr. Michael Frisk at Stony Brook University (NY) to obtain my Masters of Science, which involved the development of an ecosystem model for the Great South Bay to assess changes to ecosystem functioning that have occurred over the last century and ample field work including bottom trawls, beach seines, long-lines, and gillnets.
After graduating, I worked for two years at the New York State Department of Environmental Conservation. Responsible for much of the day-to-day operations of the Crustaceans department, I was also an observer aboard commercial lobster vessels, aided biologists with various aspects of the NY lobster and horseshoe crab assessments, and took on the extra responsibility of assessing the status of NY blue crabs. I also volunteered as science crew aboard the NOAA Ship *Henry B. Bigelow* for the Georges Bank section of the NMFS bottom trawl survey. I am now pursuing my Doctorate degree at the University of Miami (FL) where I work with Dr. Elizabeth Babcock on assessing the influence of environmental and ecological processes on the dynamics, assessment, and management of gulf menhaden (*Breevortia patronus*) within the northern Gulf of Mexico ecosystem, work that will be conducted under this NMFS-Sea Grant Population and Ecosystem Dynamics Fellowship.

Susan Piacenza
Oregon State U, 2012
Faculty Advisor: Selina Heppell
NMFS Mentors: George Balazs and Paul Richards
Poster – On site



Which Data and For How Long? Monitoring Strategy Evaluation to Identify Priorities for Sea Turtle Population Assessment

Susan Piacenza[1], Paul Richards[2], Selina S Heppell[1]
[1] Oregon State University
[2] NOAA SEFSC

Using sea turtle nesting beach surveys as a population index for assessment is problematic. The exact relationship between trends on the nesting beach and the entire population is unknown, and obscured by both process and observation error. To assess which monitoring data yield the most useful information for trend and status determination, we propose a new simulation-based tool: Monitoring Strategy Evaluation (MSE). This tool is based on management strategy evaluation, but rather than experimenting with management alternatives, our MSE experiments with monitoring. Using individual-based models (IBMs) as "true" populations and including potential environmental and individual variability, we sample the virtual population, with observation error, to test if the data provide a correct diagnosis of population change. Our IBM captures the emergent patterns of interannual nesting variation, adult recruitment, and realistic population growth rates. Preliminary results indicate a high probability of a positive bias in the population trend estimate with data from monitored nesting females; and when nesters are perfectly known there is still a substantial probability of misdiagnosis. Our analysis addresses the integration of demographic rate data and the length of time it takes to accurately detect a trend. Our framework is designed to provide an evaluation of monitoring program effectiveness to assist conservation groups in planning future programs for sea turtles.

Background: I am a Ph.D. candidate in the Department of Fisheries and Wildlife at Oregon State University and my advisor is Dr. Selina Heppell. My dissertation is on "Developing Quantitative Tools to Evaluate Recovery in Green Sea Turtles, *Chelonia mydas.*" My interests in the field of marine ecology include population ecology and conservation biology, and species and community responses to and recovery from disturbance. I am interested in applying quantitative and empirical methods to better understand marine species and ecosystems and ultimately to improve our conservation and management of them. I have worked in a variety of marine ecosystems including the Caribbean, Gulf of Mexico, the US West Coast, and Hawaii. I received a MS in coastal marine ecology from the University of South Florida and a BS in Ecology from the University of Minnesota. I am the graduate student lead for the Dimensions of Biodiversity Distributed Graduate Seminar OSU team. On a personal note, I grew up in Minnesota and lived in Florida for seven years before moving to Oregon. I love the outdoors, and enjoy many outdoor activities, such as bike-riding, hiking and nature watching, surfing, and snorkeling. I have a one year old son, Fletcher, who is quickly coming to appreciate the natural world as well.

Jeff Rutter
U of Washington, 2012
Faculty Advisor: James Anderson
MNFS Mentor: Richard Zabel
No poster or presentation

Background: I have now spent so much time on the west coast, that I sometimes forget that I grew up in Michigan. I studied math at UC Berkeley, then went into software engineering, specializing in writing code to implement practical mathematical models for business problems. After a number of years I returned to school and have been studying ecology and fishery sciences at the University of Washington--using mathematics to describe growth and mortality in the "early ocean" life history phase of Pacific salmon. In addition to my research work, I devote my time to my two amazing daughters who often surprise me with their inquisitive and caring natures. I've also been known to indulge in board games, birding, and bicycling.

Jeff Shrader
UC San Diego, 2014
Faculty Advisor: Joshua Zivin
NMFS Mentor: Dale Squires
Presentation – On site

Forecasts and Adaptation

For many environmental problems, economic adaptation will likely be the primary means by which potential damages are avoided. How and by how much humans adapt to environmental risks, therefore, is a question of paramount importance. This paper introduces a method for estimating total adaptation using forecasts as proxies for the expectations of agents. I apply this method to the North Pacific Albacore industry, using a novel dataset of forecasts of an important, global driver of climate variation---El Niño/Southern Oscillation (ENSO)---to derive the first well identified estimates of total adaptation in a climate exposed industry. The primary results indicate that for this setting, risks from ENSO events can be almost entirely mitigated given 3 months of advance warning. This adaptation comes from a combination of daily and annual actions. The results point to the ability for individuals in some settings to mitigate their own environmental risks given high quality information. The method can be used to estimate adaptation potential in alternative settings to aid understanding of general adaptability of economic systems.

Background: Jeffrey Shrader is an economics PhD candidate at UC San Diego working on topics in environmental and labor economics. His two primary research agendas are empirical estimation of environmental adaptation and investigation of the labor market interactions of non-labor time. In 2008, Jeff graduated from Columbia University with a B.A. in Economics and Mathematics. During the financial crisis, he worked at the New York Federal Reserve Bank, first as a Research Associate, then as an Assistant Economist, in the Money and Payments Studies function of the Research and Statistics group. Between working at the Fed and going to graduate school, he spent five months hiking from Glacier National Park to the Grand Canyon.

Christine Stawitz
U of Washington, 2014
Faculty Advisor: Tim Essington
NMFS Mentor: Melissa Haltuch
Poster – Remote

The relative importance of somatic growth and recruitment in population production.

Fisheries researchers have long documented variability in recruitment as a significant driver of production in marine stocks. Recently, there is an increasing awareness that somatic growth variation also can drive productivity, yet few studies have compared the relative and combined effects of variability in these demographic processes on production across stocks. In this study, we use a simulation approach to contrast these relative effects across several life history types. Realistic growth and recruitment variability time series are generated across a number of scenarios (i.e. low and high coefficient of variation [CV] for each process) and input into a standard age-structured fisheries population model parameterized using fisheries stock assessment estimates. We quantify and compare variability in the output surplus production across life history and fishing rate. We find that life history governs the relative effect of recruitment and growth variability on production. For example, life histories experiencing periodic strong recruitment events and determinate growth (i.e. rockfish) are more responsive to recruitment variability, while stocks with a low recruitment CV and relatively indeterminate growth (i.e. flatfish) show a stronger response to growth variability. Our results highlight the importance of both somatic growth and recruitment in inducing variability in population production.

Background: I was born and raised in Staten Island, New York, then attended the University of Virginia (UVa), where I majored in Systems Engineering and Computer Science. After several years of working in the tech industry, my interest in the effects of ocean change on marine species led me to seek a way to apply my technical skills to marine ecology problems.
The Quantitative Ecology and Resource Management (QERM) program at the University of Washington was a perfect fit for my interests and skill set. Through the program curriculum, I supplemented my knowledge of computer programming with rigorous training in statistics, applied mathematics, and optimization. I am working on my doctoral degree with Dr. Timothy Essington in the School of Aquatic and Fishery Sciences, where I study how variability in growth rates of commercially-valuable marine fish impacts overall population status and management decisions. More broadly, I'm interested in building statistical models which incorporate the effects of both ecosystem dynamics, climate change, and human impacts on marine populations. As part of my fellowship work, I am currently conducting a simulation analysis to assess whether reproductive or growth variability is most responsible for changes in fish population productivity. Next, I will examine how fisheries stock assessment models handle these sources of variability and how different assumptions about fish growth rate impact management decisions. While I have a broad set of interests, a common thread throughout my research is a establishing a better understanding of marine ecosystem dynamics in order to inform and improve management of marine species.

Mark Stratton
VIMS, 2014
Faculty Advisor: Rob LaTour
NMFS Mentor: Rick Hart
Poster – On-site

Ecosystem drivers of U.S. South Atlantic coastal fish abundances

Abstract: Effective implementation of an ecosystem approach to fisheries (EAF) requires thorough scientific understanding of a multitude factors that influence fisheries. We will meet two objectives towards our goal of assessing the influence of ecosystem factors (environmental, trophic, and fishing effects) on the abundances of U.S. South Atlantic coastal stocks. For objective 1, we will quantify the influence of ecosystem factors on up to 100 populations of fishes and invertebrates well-sampled by a coastal bottom trawl survey – the Southeast Area Monitoring and Assessment Program (SEAMAP – U.S. South Atlantic). Using multivariate autoregressive state-space modeling, we will collectively analyze annual population abundance trends to infer the effects of density-dependence, food web interactions, environmental conditions, and harvests on population growth rates. For objective 2, we will build a regional stock assessment model for white shrimp (*Litopenaeus setiferus*) using catch-multiple survey analysis. We will modify the model to allow specification of predation mortality, significant environmental variables known to impact local abundances of this species, and time-varying (non-predation) natural mortality. Because our approach is at the population level and based on traditional assessment parameters (i.e., abundance, mortality), results could be readily applied toward the development of ecosystem-oriented stock assessments needed in the region.

Background: Mark is a PhD candidate in the Fisheries Science Department at the Virginia Institute of Marine Science, College of William & Mary. His primary research interest is to refine and apply quantitative techniques toward synthesizing ecological impacts to managed fish populations. For his doctoral research, he is investigating how various ecosystem factors affect the distribution, abundance, and interactions between demersal fish and invertebrate populations inhabiting the nearshore coastal zone of the U.S. East Coast from Florida to New York. Mark received his BS in Biology from Rhodes College and his MS in Marine Biology at the College of Charleston, where he studied the community and trophic dynamics of the U.S. South Atlantic continental shelf reef fish assemblage. For fun, he likes to eat veggies from his garden and mushrooms from the forest (the legal variety), and play Frisbee and golf.

Marysia Szymkowiak
U of Delaware, 2013
Faculty Advisor: Lee Anderson
NMFS Mentor: Ron Fenthoven
No Poster or Presentation - Remote

Background: Marysia is a PhD candidate in Marine Studies at the University of Delaware, and her dissertation focuses on the costs and benefits of specific provisions in the halibut and sablefish IFQ program, which were intended to protect small operators and coastal communities from the adverse impacts of a catch share program. She has applied econometric modeling tools to examine these costs and benefits, including discrete choice models, count regression models, relational contingency table analysis, and linear programming. Prior to starting this PhD degree, Marysia was an Oak Ridge Institute for Science and Education fellow for two years at the Environmental Protection Agency in Washington, D.C., where she worked on the National Coastal Condition Report IV. Marysia also has a Master's in Global Environmental Policy from American University and a Bachelor's in Sociology from Rutgers University. Marysia lives in Juneau, Alaska, where she enjoys playing in the mountains and watching the wildlife.

Laura Urbisci
UC Santa Barbara, 2014
Faculty Advisor: Hunter Lenihan
NMFS Mentor: Kevin Piner
Poster – On-site

Developing a new ecosystem-based management approach: using ecosystem models to calculate a better estimate of population scale for single-species models

Abstract: Single species stock assessment models are the current standard for managing exploited fish stocks, however these models usually only implicitly include broader ecosystem and climate processes. More recently, ecosystem models have been developed that included a more holistic view of population regulation. The objectives of my research are to examine the limitations and advantages of the integrated ecosystem model approach by examining the robustness of the results from these two classes of models. I will be attempting to use each model's outputs to better inform aspects for the other class of model. As a test case, I will be creating an age-structured single species model of Pacific Ocean common thresher shark (*Alopias vulpinus*) and an integrated ecosystem model for the Eastern North Pacific Ocean. My goal is to utilize information from the ecosystem model to generate a robust estimate of population abundance ("scale") for use in the single-species model. Population scale in single species models is typically very uncertain and dependent on strong assumptions.

Background: Laura Urbisci is a PhD student in the Bren School of Environmental Science & Management and a master's student in the Probability and Statistics Department at the University of California, Santa Barbara. She is advised by Hunter Lenihan, and Kevin Piner is her NMFS-Sea Grant mentor. Laura also holds a BS degree from University of California, Davis and completed an internship at the Southwest Fisheries Science Center. She likes to keep active and when not working is frequently running or at the gym. She also loves puns and lattes high-quality coffee.

Lynn Waterhouse
UC San Diego, 2013
Faculty Advisor: Brice Semmens
NMFS Mentor: Tomo Eguchi
Poster – Remote

Population reconstruction using a Bayesian state-space model to assess the abundance of spawners at fish spawning aggregation

Lynn Waterhouse*[1], Brice X. Semmens[1], Christy Pattengill-Semmens[2], Croy McCoy[3], Bradley Johnson[3], Phillipe Bush[3], and Scott Heppell[4]

1. Scripps Institution of Oceanography, UCSD
2. REEF
3. Department of Environment, Cayman Islands Government
4. Oregon State University

This study presents a reconstruction of the abundance of an endangered species, the Nassau grouper, at a spawning aggregation in Little Cayman Island, Cayman Islands. We describe an *in situ* visual mark-resighting design which can be used to estimate total abundance of spawners at the aggregation site. Mark-resight data is used to estimate the population size during each spawning aggregation, which in turn can be fit using a state space model to obtain an estimate the population growth rate. Simulation methods are used to identify trade-offs between number of individuals tagged and number of subsequent surveys required in order to meet an acceptable level of uncertainty in population estimates. We evaluate the inclusion of covariates such as observer, date, and time. An estimate of the growth rate is found by fitting a state space model to the posterior distributions of Bayesian estimates for population abundance over time. Additional pieces of information in the form of length-frequency data and video pans can be used to increase the precision of the estimate of abundance and provide more information on the health of the population.

Background: Lynn Waterhouse is a 3rd year Biological Oceanography student in Brice Semmens lab at Scripps Institution of Oceanography, University of California, San Diego. Lynn works on projects in the fields of quantitative ecology and oceanography, focusing on population dynamics and stock assessment. She is currently working on projects related to the endangered Nassau grouper in the Caribbean, salmonids in the western US, and an assessment of white seabass for the state of California with Dr. Juan Valero of CAPAM (Center for Population Assessment and Methodology). At the 2015 AFS meeting in Portland, Lynn is co-hosting a workshop entitled “Monsters of Stock Assessment” featuring mini-lectures from faculty across the US on aspects of stock assessment. In August 2012, Lynn completed her Master’s degree in statistics from Pennsylvania State University with Dr. Michael G. Akritas, where she focused on evaluating the power of various tests to detect the nonlinear portion of a partially linear model. Prior to her work in statistics, she completed a MS in Marine Sciences co-advised by Dr. John Hoenig and Dr. Mary Fabrizio at the Virginia Institute of Marine Science in the Department of Fisheries Science. As part of her MS, Lynn did research with the Turks and Caicos Department of Environment and Coastal Resources (DECR). The work involved aspects of the economics, conservation, fisheries management, and population assessment of queen conch. Her thesis was based on advancements to tagging models, for both instantaneous rates and Brownie-type. In May 2007, she graduated with a B.S. in Biology and a minor in Economics from the University of Dayton as a John W. Berry Sr. Scholar.

Lauren Yamane
UC Davis, 2014
Faculty Advisor: Lou Botsford
NMFS Mentor: Steve Lindley
Poster – On-site

Quantifying the stabilizing effects of population diversity with the portfolio effect

Biodiversity loss threatens the integrity of marine and aquatic ecosystems by reducing community stability. The portfolio effect, the statistical phenomenon that reduces total variability with asset independence, provides a means to quantify the effects of changes in diversity on fish stocks. Portfolio effect theory is popularly applied to multi-population salmon fisheries. However, calculations of the portfolio effect will have limited management utility for salmon and other fisheries unless they estimate how much population diversity (independence) will reduce stock variability. Here we develop a new metric quantifying the maximum reduction in aggregate variability possible through increased diversity. We apply this metric to Sacramento River Fall-run Chinook (SRFC) salmon, a population complex that exhibited high variability prior to the fishery's 2008-2009 closure and for which diversity has diminished. We then identify the spatial (population) and temporal sources of reduced diversity evident in the SRFC portfolio effect. Our results indicate that one population in the mid-1980s was primarily responsible for the overall increase in covariability, and two other periods of increased covariance coincided with observed shifts in ocean climate and marine species survivals.

Background: I spent my childhood in Honolulu and Spokane and then traveled to California for a degree in Ecology at UC San Diego. My commitment to marine research developed following a position as an observer with the Pacific States Marine Fisheries Commission. Despite not having fished myself, I felt inspired by the diverse community engaged in the activity, which cut across age, race, and socioeconomic status. I also realized the importance of fish as a protein source for those in need. At the same time, I became interested in understanding the connections between the physiological responses of marine organisms to environmental changes and broader community dynamics. My academic interests led me to a Masters degree with Brian Helmuth at the University of South Carolina. There, I focused on the impacts of climate change on rocky intertidal predator-prey interactions. Following the collapse of California's Chinook salmon fishery, I became intrigued by the implications of variable ocean conditions and fishing for marine population responses. I decided to return to fisheries and recognized the importance of modeling and quantitative approaches to inform management decisions. My dissertation research, guided by Loo Botsford, thus applies theoretical approaches to address questions in marine resource management. I am particularly interested in the causes of observed variability in fish populations over space and time. Much of my work uses mathematical models to explore how fishing and hatchery supplementation alter the sensitivity of fish populations to environmental signals. Another facet quantifies how variability in and covariabilities among salmon populations scale up to the aggregate stock level through the portfolio effect. I look forward to drawing on the expertise of NOAA and Sea Grant scientists and gaining insight into fisheries management as a Population Dynamics Fellow.