152nd ANNUAL MEETING
Spokane
AUGUST 21-25, 2022

Advances in Ecosystem & Population Dynamics, and Marine Resource Economics - Day 1

Mon, August 22
8:00 AM - 5:00 PM
102CD
Symposium

Behavior · Early Life History · Ecology · Estuarine · Fish Reproduction/Development · Fisheries Oceanography · Fisheries/Habitat · Genetics · Genetics · Human Dimensions · Human Dimensions · Marine · Marine · other (please describe) · other (please describe) · Population Dynamics · Population Dynamics · Recruitment

Description

Supported by: NOAA National Sea Grant College Program
This symposium will highlight the current NMFS-Sea Grant Fellows' graduate research. Fellows will share their project progression in either Ecosystem & Population Dynamics or Marine Resource Economics as they work to better understand and improve the data that feeds into management of both our ocean resources and habitats.

Presentations

8:00 AM
8:40 AM

Stock-Recruit Relationship for Spotted Seatrout in Texas Bays

Gary Matlock, National Oceanic and Atmospheric Administration

Estuarine · Population Dynamics

Info

Presentation Type and Format:
Oral

Abstract:
Spotted seatrout (*Cynoscion nebulosus*) are economically important and have supported sport and commercial fisheries in Gulf of Mexico estuaries for over 100 years. However, increased commercial landings in the 1970's and 1980's led to regulations to reduce fishing mortality, including prohibition of sale of fish caught in several Gulf states. The implicit assumption was that stock abundance was low and on the ascending limb of a stock-recruit curve. But, the shape and quantification of the curve were unknown. Standardized collections in Texas bays with gill nets and bag seines during 1980 through 1991 were used to estimate the relationship between indices of abundance of parents (P) and recruits (R) during a period of reported overfhishing. A simple linear model (R = -2.208 + 34.86 P) explained 51.7% of variation in the data. The estimated linear regression represents the slope of the unknown average recruitment curve near the origin (i.e., density-independent component of post-hatching mortality) and may overestimate the slope of the recruitment curve at equilibrium.

Keywords:
Estuarine,Population Dynamics

8:40 AM

9:00 AM

A Framework to Assess and Forecast Spatio-Temporal Dynamics of Fish Stocks in a Changing Environment

Cameron Hodgdon, Stony Brook University, Stony Brook University

Fisheries/Habitat

Info

Presentation Type and Format:
Oral

Abstract:
The Gulf of Maine ecosystem is experiencing some of the highest magnitude warming events of the oceans and is home to a plethora of highly valuable fisheries: American lobster (*Homarus americanus*) being the most valuable single species fishery in the United States. As ocean temperatures rise, management needs to be prepared for the changes that these events will have on fish stocks. This means considering abiotic effects on biology inside of existing stock assessment and forecasting frameworks. The principal objective of this work to develop a modeling framework to assess and forecast spatio-temporal dynamics of fish populations in a changing ecosystem and apply the framework to quantify the influence that thermal habitat has on American lobster population dynamics. This goal is broken down into three components: 1) incorporation of effects of bottom temperature on both American lobster growth and recruitment directly into an existing lobster stock assessment framework: the UMaine Lobster Stock Assessment model; 2) development of a stock-wide projection model for American lobster; and 3) projections of American lobster population distributions in the Gulf

of Maine and Southern New England using a bioclimate modelling framework. This presentation serves as an update to an ongoing project funded by the NMFS/Sea Grant Population & Ecosystem Dynamics Fellowship.

Keywords:
Fisheries/Habitat

9:00 AM

9:20 AM

Spatiotemporal Modeling of Nursery Habitat Using Bayesian Inference: Environmental Drivers of Juvenile Blue Crab Abundance

Alexander Hyman, VIMS/ NMFS

Info

Abstract:
Nursery grounds are favorable for growth and survival of juvenile fish and crustaceans through abundant food resources and refugia, and enhance secondary production of populations. While small-scale studies remain important tools to assess nursery value of habitats, targeted applications that unify survey data over large spatiotemporal scales are vital to generalize inference of nursery function, identify highly productive regions, and inform management strategies. Using 21 years of GIS and spatiotemporally indexed field survey data on potential nursery habitats, we constructed five Bayesian models with varying spatiotemporal dependence structures to infer nursery habitat value for juveniles of the blue crab C. sapidus within three tributaries in lower Chesapeake Bay. Out-of-sample predictions of juvenile counts from a fully nonseparable spatiotemporal model outperformed predictions from simpler models. Salt marsh surface area, turbidity, and their interaction showed the strongest associations (and positively) with abundance. Relative seagrass area, previously emphasized as the most valuable nursery in small spatial-scale studies, was not associated with abundance. Hence, we argue that salt marshes should be considered a key nursery habitat for blue crabs, even amidst extensive seagrass beds. Moreover, identification of nurseries should be based on investigations at broad spatiotemporal scales incorporating multiple potential nursery habitats, and on rigorously addressing spatiotemporal dependence.

9:20 AM

10:00 AM

Morning Break

10:00 AM

12:00 PM

Plenary Session

12:00 PM

Lunch

1:20 PM

1:20 PM

1:40 PM

Environmental Conditions Influence Distribution Patterns of Forage Species

Janelle Morano, Cornell University; Patrick Sullivan, Patrick J Sullivan, Cornell University; Kevin Friedland, National Marine Fisheries Service

Ecology Fisheries Oceanography Fisheries/Habitat Marine Population Dynamics

Info

Presentation Type and Format:
Oral

Abstract:
As climate change transforms ocean habitat and conditions supporting productivity are found in new locations, species ranges are changing in size and distribution. These distributional shifts are not equivalent across species, leading to changes in prey availability and competition within the ecosystem. Forage species are an important link in the ecosystem because they are consumers of plankton and prey to fishes, marine mammals, and birds, but they are not commonly targeted in capture fisheries and instead, often as by-catch. Therefore, there is a knowledge gap concerning important taxa consumed by managed and protected species. We are using multi-scale spatio-temporal species distribution models to integrate data sources and link models to identify the seasonal patterns of distribution and the primary drivers of decadal distribution trends. Using Atlantic menhaden, *Brevoortia tyrannus*, as a case-study, spatio-temporal species distribution models demonstrate seasonal and inter-annual differences in the patterns of abundance and distribution, as predicted by bottom temperature and other environmental conditions. Additionally, the size and location of regions with the highest abundance differs between seasons. Increasing abundance and patterns of distribution is consistent with a preferred temperature range for spawning and migration behavior in menhaden. This information will inform forecasting models of distribution under future climate scenarios.

Keywords:
Ecology,Marine,Fisheries Oceanography,Fisheries/Habitat,Population Dynamics

1:40 PM

2:00 PM

State-Dependent Life History Theory Predicts Optimal Reproductive Decisions in California Rockfishes

Sabrina Beyer, University of California Santa Cruz; John Field, NOAA/NMFS Southwest Fisheries Science Center; Suzanne Alonzo, University of California Santa Cruz

Behavior Ecology Fish Reproduction/Development Marine Population Dynamics

Info

Presentation Type and Format:
Oral

Abstract:
Reproductive success is critical to the growth, persistence, and sustainable management of exploited fishes. However, predicting reproductive success in relation to variable environments and future environmental change is not straightforward. The economically important rockfishes (*Sebastes* spp.) of the California Current Ecosystem have a complex, live-bearing reproductive strategy. Females exhibit intra- and inter-specific phenotypic plasticity in reproductive traits in response to environmental change affecting female energetic reserves. Females in poor body condition may delay maturation, reduce fecundity, or skip reproduction entirely. Conversely, females increase fecundity when conditions allow, and at least 15 species are capable of producing multiple broods to increase annual fecundity. The phenomenon of multiple brooding is not well-understood but generally occurs in species with southern distributions and is more common in females (of species-capable) that reside south of Point Conception, a major biogeographic break in the California Current. We hypothesize that phenotypic plasticity in the reproductive traits of rockfishes is influenced by spatiotemporal variability in ocean conditions influencing female energetic reserves and allocation of energy to reproduction. To better understand reproductive plasticity, we developed state-dependent life history theory using Stochastic Dynamic Programming. This approach predicts optimal reproductive decisions, including skipped spawning, multiple brooding, and variable brood fecundity, given the environment and a female's age, length, and fat reserves. We show how seasonality in food availability and temperature, along with trade-offs in the allocation of energy reserves to other life history traits, such as growth, over-winter survival, and the expectation of future reproductive opportunities, influence reproductive decisions in these long-lived species. The development of state-dependent theory improves knowledge of how total egg production varies in response to the environment and importantly how declines in reproductive output are likely during periods of poor ocean conditions in the California Current.

Keywords:
Behavior,Ecology,Marine,Fish Reproduction/Development,Population Dynamics

2:00 PM

2:20 PM

Linked Site Choice, Trip Duration, and On-Site Cost Model for Non-Resident Alaskan Anglers

Russel Dame, Oregon State University; Dan Lew, Ph.D.; David Kling, Ph.D.

Marine other (please describe)

Info

Presentation Type and Format:
Oral

Abstract:
In the study of recreation behavior, economists commonly use site choice models to inform welfare effects from site-level closures or quality changes. However, applications focused on site choices often make simplifying assumptions about the length of trips, frequently assuming they are the same length. This oversimplification can bias welfare estimates. We relax the restrictive trip length assumption using a linked site-choice, trip duration, and on-site cost model to analyze non-resident angler fishing trip data from the 2017 Alaska Saltwater Sport Fishing Survey. The linked model framework endogenizes the trip duration decision and provides the opportunity for calculating the impact of changing harvest rates on fishing trip duration, as well as on the site choice decision, which can be important for providing a fuller assessment of potential policy impacts. We estimate site choice using a multinomial logit model. The site choice model and trip duration model are linked through the expected utility of visiting a site, calculated as the log sum. Trip duration is modeled as a negative binomial model that accounts for the strictly positive discrete nature of the data and allows for overdispersion. Total daily on-site costs are modeled using a simple linear regression that considers observed on-site costs. The on-site cost model is substituted into the trip duration model to break the potential endogeneity between trip duration and on-site costs. Preliminary results suggest that the linked model provides a better goodness-of-fit for trip duration and provides significantly different welfare estimates compared to a traditional site choice model that ignores trip duration.

Keywords:
Marine,other (please describe)

2:20 PM

2:40 PM

An Empirical Dynamic Modeling Framework for Missing Data

Bethany Johnson, University of California, Santa Cruz; Stephan B. Munch

Population Dynamics

Info

Presentation Type and Format:
Oral

Abstract:
Empirical dynamic modeling (EDM) is a powerful method for forecasting and analyzing nonlinear dynamics, and it shows substantial promise for contributing to fisheries management. Standard implementation of EDM, however, assumes that samples are evenly spaced through time. This presents problems in fisheries applications because varying degrees of sampling effort often result in missing samples or data being collected at irregular intervals. Standard methods for handling irregularity in EDM suffer under conditions that are common in ecology, such as short time series and large dynamic fluctuations, so there is a need to adapt the framework to cope with these

challenges more effectively. Here I will introduce a variable step-size extension of EDM, which incorporates the temporal spacing between samples into EDM delay-coordinate vectors. I will compare the forecast accuracy of the variable step-size method with that of two other methods using simulated data from three ecological models with various amounts and patterns of missing data. I will also demonstrate results on California market squid dynamics. This analysis demonstrates that variable step-size EDM is an effective method for coping with missing or irregular samples and expands the number of datasets to which EDM can be applied.

Keywords:
Population Dynamics

2:40 PM

3:00 PM

Estimating Striped Bass Abundance in the Chesapeake Bay Using Spatially Explicit Population Models

Samara Nehemiah, University of Maryland Center for Environmental Science; , Virginia Institute of Marine Science; Adena Schonfeld, Virginia Institute of Marine Science; Katie Drew, Atlantic States Marine Fisheries Commission; Gary Nelson; David Secor, University of Maryland Center for Environmental Science; Michael Wilberg, University of Maryland Center for Environmental Science

Marine **Population Dynamics**

Info

Presentation Type and Format:
Oral

Abstract:
Many stock assessments inform management decisions that operate at spatial units different from the assessments. There is a need to develop population models with spatial structure for ecologically and economically important fish species in order to estimate biological parameters at the same spatial scale as management decisions. Population models typically assume a well-mixed fishery and population, though populations may experience spatially varying abundance and mortality. Violations of these assumptions can result in biased model estimates. Currently, population estimates of Striped Bass (*Morone saxatilis*) are assessed as a single Atlantic Coast stock from Maine to North Carolina, although the population is known to be composed of several biologically distinct stocks, including the Chesapeake Bay stock. Additionally, fishery regulations are implemented at the state level. Spatial population estimates are particularly beneficial for Striped Bass because in addition to the mixed stock dynamics, this species is thought to have experienced increased disease prevalence and mortality in the Chesapeake Bay. The main objectives of this project are to 1) develop a spatially explicit statistical catch-at-age model to estimate abundance of Striped Bass in the Chesapeake Bay and along the Atlantic coast; and 2) evaluate the performance of this model using simulation studies. The population

model incorporates two sub-annual time steps to consider abundance and movement into and out of the Chesapeake Bay. Acoustic and conventional tagging data will be integrated to the population model to better inform mortality and movement rates. The spatial population model will estimate abundance, biomass, recruitment, and fishing mortality within the Bay, as well as movement rates into and out of the Bay. This project will serve to evaluate methods used to estimate population abundance for ecologically and economically valuable fish species in the Chesapeake Bay with the goal to better inform fisheries management decisions at appropriate spatial scales.

Keywords:
Marine,Population Dynamics

3:00 PM
3:20 PM

Afternoon Break

3:20 PM
3:40 PM

Metamodeling for Bias Estimation of Reference Points Under Two-Parameter Productivity Models

Nicholas Grunloh, UCSC, SWFSC, NMFS

Population Dynamics Recruitment

Info

Presentation Type and Format:
Oral

Abstract:
Stock assessments often assume a two-parameter functional form (e.g. Beverton-Holt or Ricker) for the expected recruitment produced by a given level of spawning output. Mangel et al. (2013), and others, have shown that many biological reference points (RP) are largely determined by a single parameter (steepness) when using two-parameter relationships. These functions introduce strong correlations between RPs that are pre-determined by the functional form, rather than a biological characteristic of the stock. Mangel et al. note that use of a three-parameter stock-recruitment relationship allows for independent estimation of these RPs. This work seeks to understand the nature of biases in RPs resulting from fitting a two-parameter production model when the true relationship is more complicated (e.g. three parameters). We demonstrate the useful limits of commonly misspecified models such as the Beverton-Holt and Schaefer models in the production model setting. These results demonstrate the foundational mechanisms of model failure as a basis for understanding productivity model misspecification more generally.

Keywords:

Recruitment,Population Dynamics

3:40 PM

4:00 PM

Quantifying the Effects of Assortative Mating on Population Recruitment and Viability

Samuel May, PhD, University of Alaska Fairbanks; Eric Ward, PhD, NOAA

Genetics Population Dynamics

Info

Presentation Type and Format:
Oral

Abstract:
Extensive empirical research has shown that fine-scale eco-evolutionary processes such as local adaptation, dispersal between populations, and mating structures within populations play an important role in population recruitment, fitness, and viability. For example, the adaptive landscape and resiliency of a metapopulation relies on connectivity within and between populations. Yet, these processes are rarely incorporated in population dynamic models. Additionally, human perturbations such as harvest, climate change, and supportive breeding can greatly affect these fine-scale processes. Hatcheries in particular often randomly mate broodstock and release large numbers of individuals relative to wild populations, thus reducing mate choice and fitness, and influencing structure within and between populations. Here, we introduce an individual-based risk-assessment model to investigate the role of assortative mating on recruitment and fine scale structure, and hence population productivity and viability in both wild and supplemented populations. We parameterize this model with empirical data from multi-generation pedigrees of wild salmon populations and show how assortative mating systems can affect wild population recruitment. Our findings challenge common assumptions in population dynamic models, such as random mating in wild populations, by showing how non-random mating may better represent wild population dynamics. We aim to expand this model to investigate how hatchery supplementation practices might influence eco-evolutionary dynamics within and between populations, and thus affect their long-term persistence.

Keywords:
Genetics,Population Dynamics

4:00 PM

4:20 PM

Impacts of Marine Heatwaves on the Spatiotemporal Distribution of U.S. Pelagic Fisheries

Nima Farchadi, San Diego State University; Heather Welch, NOAA; Camrin Braun, Woods Hole Oceanographic Institution; Katherine Mills, Gulf of Maine Research Institute; Andrew Allyn, Gulf of Maine

Research Institute; Elliott Hazen, NOAA - Southwest Fisheries Science Center; Stephanie Brodie, NOAA; Nerea Lezama-Ochoa, NOAA; Steven Bograd, NOAA; Riley Young-Morse, Gulf of Maine Research Institute; Alex Kerney, Gulf of Maine Research Institute; Dylan Pugh, Gulf of Maine Research Institute; Rebecca Lewison, San Diego State University

Ecology **Fisheries Oceanography** **Fisheries/Habitat** **Marine**

Info

Presentation Type and Format:
Oral

Abstract:
Persistent extreme oceanic warm events, also referred to as marine heatwaves (MHWs), are already impacting marine ecosystems and the ecosystem services to fisheries and the communties that rely on them. Many marine species are highly mobile and may shift their spatial distributions during anomalous events in response to unfavorable conditions; however, the degree of impact MHWs have on the spatiotemporal distribution of fishing fleets remains porrly understood. Using vessel Automatic Identification System (AIS) data, data-assimilated oceanographic data, and predictive habitat model, we developed dynamic vessel distribution models (dVDMs) for the U.S. Northwest Atlantic pelagic longline fleet to better understand how anomalous environmental conditions (e.g. MHWs) influence the spatiotemporal distribution of fishing effort. Using pelagic longline fisheries in the Atlantic as a case study, our results show that under MHW conditions, suitable fishing habitat in southern regions, south of Cape Hatteras, diminishes whereas northern regions experience gains in suitable habitat. Furthermore, center of gravity analysis on monthly predictions demonstrated variation in the distance and direction of shifts in fleet distributions among regions either shifting poleward, closer to longeline ports, or negligable changes. Since fish populations and fishing fleets may respond to anomalous conditions in divergent ways, the results from this study can help accurately describe and understand the variations in fleet distributions, a key requirement for managers and policy makers to develop management strategies that will support climate-readiness and resilience in U.S. fisheries.

Keywords:
Ecology,Marine,Fisheries Oceanography,Fisheries/Habitat

4:20 PM

4:40 PM

Identifying Mechanisms Influencing Eastern Pacific Ichthyoplankton Using a Bayesian Framework

Katherine Dale, PhD, University of California, Santa Cruz / East Carolina University; Andrew Thompson, NOAA SWFSC; M. Tim Tinker

Early Life History **Ecology** **Marine** **Population Dynamics**

Info

Presentation Type and Format:
Oral

Abstract:
Understanding how species distributions change through space and time is central to ecological studies. For marine fishes, continued dispersal or retention of larvae is important for population persistence and maintaining genetic connectivity. The survival and movement of fish in their early life history stage is strongly dependent on both environmental factors as well as species' characteristics, but it is not always clear how environmental variation influences species from diverse habitats. Further, many fisheries management plans and stock assessments for California fisheries do not account for spatial variation in larval abundance. For this project, we developed a spatially-explicit hierarchical model to examine how larval abundances in the California Current region vary with environmental factors. We applied this model to five data-moderate, underassessed, cryptic, or threatened California fisheries: Pacific sanddab (*Citharichthys sordidus*), California sheephead (*Semicossyphus pulcher*), cabezon (*Scorpaenichthys marmoratus*), rockfishes (*Sebastes* spp.) and sablefish (*Anoplopoma fimbria*). We found that oceanographic conditions, particularly sea surface height, best describe larval abundances. Results align with prior understanding of species' biology. Outputs from this model are highly interpretable and can provide estimates of larval abundances at specific spatial scales.

Keywords:
Early Life History,Ecology,Marine,Population Dynamics

4:40 PM

5:00 PM

Participation, Diversification, and Emerging Opportunities in Virginia's Small-Scale Fisheries

Shelby White, Virginia Institute of Marine Science; Andrew Scheld, Virginia Institute of Marine Science

Human Dimensions

Info

Presentation Type and Format:
Oral

Abstract:
As part of a sustainable livelihoods approach, many fishers employ diversification strategies within and outside of the fishing sector. Diversifying across income sources is found to stabilize revenues and reduce the impact of adverse events and vulnerability in fishery dependent communities. The ability to diversify can be constrained by management, lack of knowledge, geographic location, market forces, investment costs, potential revenues, and possibly other factors. Fishing communities will likely face new diversification opportunities and challenges in response to growing species invasions and shifting stock distributions due to ongoing environmental changes. This research uses state license and landings data to investigate diversification by constructing Herfindahl-Hirschman Indices (HHI) and discrete choice models of diversification decisions. A fisher survey and ethnographic interviews will be used to further contextualize individual diversification decisions, including participation in marine-related industries (aside from commercial fishing) and emerging fisheries. The survey and interviews also address socio-demographics of Virginia's fishing fleet. Despite the suggested benefits of diversification, average fleet HHI values for income and landings across species indicate that diversification in Virginia's small-scale commercial fisheries is not common, with less than half of fishermen diversifying into more than one wild species fishery. Levels of diversification differ across species groups and license and permit holdings. Discrete choice modeling indicates that individual decision-making to diversify may be influenced by expected incomes, currently targeted species, and availability of licenses and permits. A better understanding of diversification behavior and the potential benefits of income diversification into both established and emerging fisheries would help to characterize intra-industry dynamics and predict how fishers will respond to management or exogenous factors (e.g. markets, environment) in the future, thus increasing the ability of coastal communities to adapt to emerging stressors.

Keywords:
Human Dimensions

5:00 PM

5:00 PM

Common Dolphinfish in the Western Central Atlantic: Population Trends, Stock Assessment and MSE (VIRTUAL)

Matthew Damiano, MS, North Carolina State University; Jie Cao, North Carolina State University; Mandy Karnauskas, NOAA; Wess Merten, Beyond Our Shores Foundation

Marine **Population Dynamics**

Info

Presentation Type and Format:
Oral

Abstract:
commercial and recreational fisheries throughout the East Coast United States, Caribbean Island nations and US territories. Mark-recapture and genetic marker studies suggest that dolphinfish caught in the Western Central Atlantic (WCA) comprise a single population, however, they are currently

managed by regional fishery management organizations (RFMOs) as discrete, regional sub-stocks. Stock assessments require a reliable index of abundance to estimate changes in the population over time and are ideally derived from a fishery-independent research survey. Although no such survey exists for dolphinfish, the US pelagic longline (PLL) fishery targets dolphinfish throughout the WCA and keeps detailed logbook information. We fit seasonal Vector Autoregressive Spatiotemporal (VAST) models to PLL catch-per-unit-effort (CPUE) data during 1991-2019 to standardize a spatiotemporal index of abundance for the WCA population. We observed seasonal dynamics in dolphinfish abundance with peak densities occurring during spring months; a declining trend in relative biomass; and potentially a northward shift in distribution. This analysis is part of a larger project to conduct a spatially explicit stock assessment for dolphinfish in the WCA and a management strategy evaluation (MSE) for the Southeast United States (SE US). We estimated indices of relative biomass at regional and SE US state scales for the assessment and MSE, respectively. At the regional scale, the SE US had a highest biomass with no obvious trend; the WCA north of North Carolina showed increasing biomass during 2005-2016; the Caribbean Sea index showed a negative trend; all regional biomass visibly declined after 2016. SE US state-level indices, an update on development of the assessment framework and MSE will also be presented.

Keywords:
Marine,Population Dynamics

152nd ANNUAL MEETING
Spokane
AUGUST 21-25, 2022

Advances in Ecosystem & Population Dynamics, and Marine Resource Economics - Day 2

Tue, August 23
8:00 AM - 9:40 AM
102CD
Symposium

Ecology | Fish Reproduction/Development | Fisheries Oceanography | Genetics | Genetics | Marine | Marine | Multi-Species Interactions | Multi-Species Interactions | Population Dynamics | Population Dynamics | Recruitment | Recruitment

Description

Supported by: NOAA National Sea Grant College Program
This symposium will highlight the current NMFS-Sea Grant Fellows' graduate research. Fellows will share their project progression in either Ecosystem & Population Dynamics or Marine Resource Economics as they work to better understand and improve the data that feeds into management of both our ocean resources and habitats.

Presentations

8:00 AM
8:20 AM

How Local Oceanography Influences Black Rockfish Biological and Functional Maturity Schedules

Claire Rosemond, Oregon State University; Scarlett Arbuckle, Oregon State University; Scott Heppell, Oregon State University

Fish Reproduction/Development | Fisheries Oceanography | Marine | Population Dynamics

Info

Presentation Type and Format:
Oral

Abstract:
The California Current Ecosystem (CCE) is highly dynamic, driven not only by natural climate oscillations and seasonal upwelling but also by anthropogenic, directional climate change. Anomalous events such as marine heat waves may modulate fish individual performance and long-term productivity of managed fish populations. The influence of oceanographic conditions on vital rates of fish populations are increasingly being included in stock assessment models, particularly for species in the CCE. The most recent Black Rockfish stock assessment included functional maturity to estimate spawning stock biomass, which accounts for the occurrence of skipped spawning, the rate of which may be driven by environmental stress. Our study investigates how local oceanography influences Black Rockfish (*Sebastes melanops*) biological versus functional maturity schedules. We sampled ovaries from 800 Black Rockfish caught on recreational fishing charters off the coast of central Oregon from 2015 to 2020. Ovaries were histologically assessed for stage of maturity and prevalence of atresia. We evaluated age at biological maturity and functional maturity for female Black Rockfish during a period that included years with marine heat waves and non-anomalous years. Quantifying the influence of temperature-driven variability on maturity schedules of Black Rockfish will allow stock assessment scientists to incorporate this environmental variability into the assessment process when calculating metrics used to manage the fishery and in developing ecosystem-based fishery management plans.

Keywords:
Marine,Fish Reproduction/Development,Fisheries Oceanography,Population Dynamics

8:20 AM

8:40 AM

Spatially Varying Catchability for Indices of Abundance That Include Fishery-Dependent Data

John Best, University of Washington

Marine Population Dynamics

Info

Presentation Type and Format:
Oral

Abstract:
Spatiotemporal index standardization methods are increasing in popularity. These methods are typically applied exclusively to fishery-independent data where they are available, even if spatially referenced fishery-dependent data are available. This potentially leaves substantial biomass information unutilized. Here, we model spatiotemporal variation in catchability of fishery-dependent observations and derive indices of abundance that use these observations in combination with

fishery-independent observations. Indices using both types of data were more precise compared to indices based on fishery-independent observations alone. Standardizing and including fishery-dependent data in this way opens the possibility of increasing the number of observations used to derive an index of abundance by an order of magnitude. Indices of abundance with increased precision will better inform stock assessments, allowing for improved scientific advice to managers.

Keywords:
Marine,Population Dynamics

8:40 AM

9:00 AM

Is Ignoring Predation Mortality Leading to An Inability to Achieve Management Goals in Alaska?

Grant Adams, University of Washington

Marine **Multi-Species Interactions** **Population Dynamics**

Info

Presentation Type and Format:
Oral

Abstract:
The majority of tactical fisheries management relies on the use of single-species population dynamics models that explicitly assume the dynamics of individual populations are independent of one another. This is despite a large body of research demonstrating that the life history of fishes is impacted by the dynamics of their predator populations. While time-varying predation mortality is thought to represent a large proportion of mortality for groundfish in Alaska, United States, assessment models, biological reference points, and harvest control rules do not explicitly account for time-varying predation and assume time-invariant (but perhaps age-specific) natural mortality. Previous research has demonstrated that ignoring predator-prey dynamics can lead to a biased perception of stock status and poor predictive performance of assessment models. However, further research is needed to identify the relevance of time-varying predation mortality to single-species management performance while also accounting for the feedback between management strategies and fish populations through continued data collection and assessment. Here we conduct a management strategy evaluation based on two multi-species population dynamics models developed for groundfish in Alaska, United States to assess whether ignoring predation inhibits the performance of single-species management. Specifically, we use the two multi-species models developed for the Gulf of Alaska and Eastern Bering Sea as operating models to evaluate the ability of single-species management strategies to achieve single-species biological reference points, maximize catch, minimize catch variability, and reduce bias in biomass estimates.

Keywords:
Marine,Multi-Species Interactions,Population Dynamics

9:00 AM

9:20 AM

State-Space Stock Assessment Model Performance Under Degrees of Process and Observation Error

Emily Liljestrand, Michigan State University; James Bence, Quantitative Fisheries Center, Department of Fisheries and Wildlife, Michigan State University; Justin Suca, NOAA NEFSC

Marine Population Dynamics Recruitment

Info

Presentation Type and Format:
Oral

Abstract:
Quantitative stock assessment models often contend with noisy data, and errors in estimates can arise when the sources of variability that cause this “noise” are poorly understood or misspecified. Model error may result from oversimplifying complicated and varying processes or structuring the model such that it mismatches the true underlying dynamics. When stock assessment models do try to account for multiple sources of variation (e.g., time varying recruitment, catchability), in a fixed-effect context, the number of parameters can quickly exceed the number of data points themselves. State space modeling (SSM) offers a means to reduce misspecification by introducing more realistic population dynamics and reducing parameterization by using random effects. SSM can explicitly parse the error due to model processes (resulting from stochasticity in mortality, recruitment, etc.) and that arising from observation error (the mismatch between what is observed and what is “reality”). They assume dynamics follow an unobserved Markovian process, with independent observations drawn conditioned on the dynamics. This modeling framework can reduce bias and uncertainty, and has been increasingly employed to supplement or replace other fishery assessments in Europe and the United States. These efforts have been bolstered by the development of Template Model Builder (TMB) a modeling software that uses a Laplace approximation to calculate complex, multidimensional integrals at the heart of the SSM likelihood framework. Several modeling packages based on TMB (e.g. SAM and WHAM) have further streamlined the application of SSM. However, comprehensive testing to better understand the mechanics and utility of such models is still ongoing and needed. This presentation will highlight the results from some such model testing using a simulation-estimation experiment of state space stock assessment models under a range of process and observation error variances, using a model that mimics the dynamics and data of Gulf of Maine Haddock (*Melanogrammus aeglefinus*).

Keywords:
Marine,Recruitment,Population Dynamics

9:20 AM

9:40 AM

It's Getting Hot in Here: Marine Turtle Survival in a Warming World

Victoria Quennessen, COMES, Oregon State University; Will White, COMES, Oregon State University; Lisa Komoroske, University of

Massachusetts Amherst; Mariana Fuentes, Florida State University

Ecology Marine Population Dynamics

Info

Presentation Type and Format:
Oral

Abstract:
Marine turtles have temperature-dependent sex determination, such that sex is determined in the egg stage by the nest temperature during the middle third of incubation. Warmer nests produce more females, and cooler nests produce more males. As climate change progresses, nesting beaches are warming and producing increasingly more females and fewer males. Most population surveys and research on marine turtles in the past have focused on females and hatchlings, which are more easily accessible during the nesting and hatching season. As a result, the role of males in marine turtle population dynamics is not well understood. Specifically, the relationship between the breeding sex ratio and reproductive success (known as the 'mating function'), is unknown. We are collecting demographic and genetic information to better understand how many males are contributing to the population of green turtles that nest on Praia do Leão (Lion Beach) on Fernando de Noronha, Brazil. Using the data from this subpopulation, I have constructed an age based computational population dynamics model to explore the survival probabilities of this population into the warming future. Furthermore, I have run the analyses with a cumulative beta distribution of varying parameter values to estimate the mating function. While I await data to accurately describe the bounds of the function, I have preliminary results quantifying the effect of the shape of the mating function on those survival probabilities.

Keywords:
Ecology,Marine,Population Dynamics

9:40 AM

9:40 AM

Population Genomics of Red Grouper in the Western North Atlantic and Gulf of Mexico (VIRTUAL)

Nick Weber, Texas A&M University-Corpus Christi; Beverly Barnett, NOAA Fisheries; Christopher Hollenbeck, Texas A&M University-Corpus Christi; David Portnoy, Texas A&M University-Corpus Christi

Genetics

Info

Presentation Type and Format:
Virtual Poster

Abstract:
Understanding how genetic variation is partitioned within and among populations is critical to fisheries management because not accounting for independent populations can lead to overexploitation. In the western North Atlantic and Gulf of Mexico, the red grouper (*Epinephelus morio*) is an economically important reef-

associated species targeted extensively by commercial and recreational fisheries. Due to this importance, a rigorous assessment of genetic population structure is warranted. Therefore, patterns of population structure and genetic diversity within populations will be assessed using a reduced representation genomic sequencing approach. Preliminary results obtained from 198 individuals genotyped at 7,005 loci containing single nucleotide polymorphisms (SNPs) indicated significant heterogeneity among geographic samples (F_{ST} = 0.0013, $p < 0.0001$), though pairwise comparisons were only significant when they involved Cuba. Estimates of genetic diversity were significantly lower in the eastern Gulf of Mexico when compared to all other regions besides Cuba (i.e., Carolinas – Atlantic, Florida – Atlantic, northeastern Gulf of Mexico, and southern Gulf of Mexico; $p < 0.001$). Future research will involve the use of landscape genomic approaches (e.g., redundancy analysis) to disentangle the potential influence of geographic distance and environmental variables and assess their interaction on observed patterns of genomic variation among samples.

Keywords:
Genetics