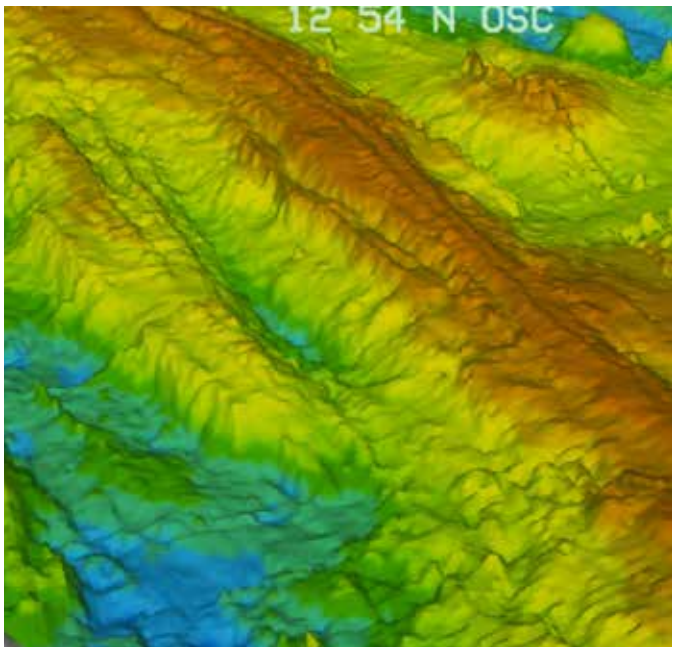


NOAA Scientific Publications Report

APRIL 25, 2013

HIGHLIGHTED ARTICLE

Comparison of coral reef ecosystems along a fishing pressure gradient

Does presence of a mid-ocean ridge enhance biomass and biodiversity?

Mitogenomic phylogenetics of fin whales (Balaenoptera physalus spp.): genetic evidence for revision of subspecies.

Fishery-induced changes in the subtropical Pacific pelagic ecosystem size structure: observations and theory

Climate change vulnerability of native and alien freshwater fishes of California: a systematic assessment approach

ADDITIONAL ARTICLES

Quantifying and simulating stormwater runoff in watersheds

Shifts in condition and distribution of eastern North Pacific flatfish along the U.S. west coast (2003-2010)

The semi-automated classification of acoustic imagery for characterizing coral reef ecosystems

Genetic and phenotypic effects on reproductive outcomes for captively-reared coho salmon, Oncorhynchus kisutch

Large-scale freshwater habitat features influence the degree of anadromy in eight Hood Canal Oncorhynchus mykiss populations

Overcoming the challenges of studying conservation physiology in large whales: a review of available methods

A model approach for estimating colony size, trends, and habitat associations of burrow-nesting seabirds

Performance of stock assessments with misspecified age- and time-varying natural mortality

When a trap is not a trap: converging entry and exit rates and their effect on trap saturation of black sea bass (Centropristis striata)

Drivers of circulation in a fringing coral reef embayment: a wave-flow coupled numerical modeling study of Hanalei Bay, Hawaii

Exploring impacts of development and climate change on stormwater runoff

Untangling the recreational value of wild and hatchery salmon

Endocrine disrupting chemicals in fish bile: a rapid method of analysis using English Sole (Parophrys vetulus) from Puget Sound, WA, USA

Tornado intensity estimation: past, present and future

HIGHLIGHTED ARTICLE

AUTHORS

M. Weijerman, E. A. Fulton, and **F. A. Parrish (NMFS)**

PUBLICATION DATE

Expected May-June 2013

TITLE

Comparison of coral reef ecosystems along a fishing pressure gradient

JOURNAL

PLoS One

SIGNIFICANCE

- Three trophic mass-balance models representing coral reef ecosystems along a fishery gradient were compared to evaluate the ecosystem-level effects of fishing pressure.
- Model outputs suggest that reef systems in the vicinity of high human populations (and higher fishing pressure) exhibited less stable systems with reduced ecosystem resilience and a more advanced state of transition towards algal-dominated communities.
- Ecosystem models, like the one reported here, can improve our understanding of the system's internal structure, and can also be used to support management practices that aim to reverse unfavorable conditions observed in reef ecosystems.

Coral reef

SUMMARY

Of the three trophic mass-balance models that were run, the majority of the biomass estimates came directly from a large-scale visual survey program and, therefore, data were collected in the same way for all three models, enhancing comparability. Model outputs—such as net system production, size structure of the community, total throughput, production, consumption, the production-to-respiration ratio, and Finn's cycling index and mean path length—indicate that the systems around the unpopulated French Frigate Shoals and along the relatively lightly populated Kona Coast of Hawai`i Island are mature, stable systems with a high efficiency in recycling of biomass. In contrast, model results show that the reef system around the most populated island in the State of Hawai`i, O`ahu, is in a transitional state with reduced ecosystem resilience and appears to shift to an algal-dominated system. Evaluation of the candidate indicators for fishing pressure showed that indicators at the community level (e.g., total biomass, community size structure, trophic level of the community) were most robust, i.e., showed the clearest trend and that multiple indicators are necessary to identify fishing perturbations. These indicators could be used as performance indicators when compared to a baseline for management purposes. This study shows that ecosystem models can be valuable tools in identifying the system state in terms of complexity, stability, and resilience and, therefore, complement biological metrics currently used by monitoring programs as indicators for coral reef status.

VISIT THE SCIENTIFIC PUBLICATIONS REPORT ARCHIVE

HIGHLIGHTED ARTICLE

AUTHORS

I.G. Priede, O.A. Bergsta, P.I. Mille, **M. Vecchione (NMFS/NSL),** A. Gebruk, T. Falkenhaug, D.S.M. Billett, J. Craig, A.C. Dale, M.A. Shields, G.H. Tilstone, T.T. Sutton, A.J. Gooday, M.E. Inall, D.O.B. Jones, V. Martinez-Vicente, G.M. Menezes, T. Niedzielski, Þ. Sigurðsson, N. Rothe, A. Rogacheva, C.H.S. Alt, R. Abell, A.S. Brierley, N.J. Cousins, D. Crockard, A.R. Hoelzel, Å. Høines, T.B. Letessier, J.F. Read, T. Shimmield, M.J. Cox, **J.K. Galbraith (NMFS/NEFSC),** J.D.M. Gordon, T. Horton, F. Neat, and P. Lorance

PUBLICATION DATE

Accepted: 3 April 2013

TITLE

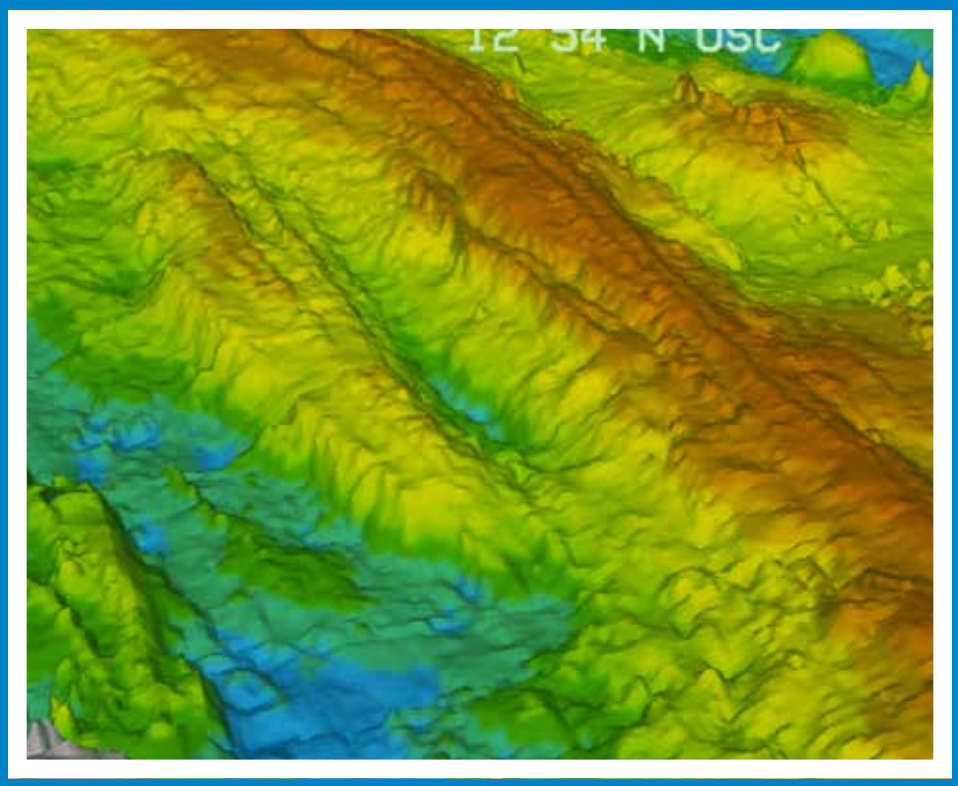
Does presence of a mid-ocean ridge enhance biomass and biodiversity?

JOURNAL

PLoS One

SIGNIFICANCE

- Globally, sea floor elevation has no effect on deep sea biomass; pelagic plus benthic biomass is constant within a given surface productivity regime.
- The fauna is dominated by species known from continental margins with no evidence of greater biodiversity on this seamount.



SUMMARY

In contrast to generally sparse open ocean conditions, seamounts and ridges are perceived as areas of elevated biological productivity and biodiversity capable of supporting commercial fisheries. To determine the origin of apparent biological enhancement we investigated a segment of the North Mid-Atlantic Ridge (MAR) to define habitat, biomass and biodiversity using sonar, corers, trawls, traps and a remotely operated vehicle. Satellite remote sensing provided information on regional flow patterns, thermal fronts and primary production while sediment traps measured export flux during 2007-2010. The MAR, 3,704,404 km2, accounts for 44.7% of lower bathyal (800-3500 m depth) habitat in the North Atlantic dominated by fine soft sediment substrate (95% of area) on a series of flat terraces with intervening slopes either side of the ridge axis contributing to spatial and temporal habitat heterogeneity. The fauna is dominated by species known from continental margins with no evidence of greater biodiversity on the MAR. Primary production and export flux over the MAR were not enhanced compared with a reference station over the Porcupine Abyssal Plain. Biomasses of benthic macrofauna and megafauna are similar to global averages at the same depths totaling 258.9 kt C over the entire lower bathyal north MAR. A hypothetical flat plain at 3500 m depth in place of the MAR would contain 85.6 kt C, implying an increase of 173.3 kt C attributable to the presence of the MAR. This is approximately equal to 167 kt C of estimated pelagic biomass displaced by the volume of the MAR. There is no enhancement of biological productivity over the MAR; oceanic bathypelagic species are replaced by benthic fauna otherwise unable to survive in the mid ocean. We propose that globally sea floor elevation has no effect on deep sea biomass; pelagic plus benthic biomass is constant within a given surface productivity regime.

VISIT THE SCIENTIFIC PUBLICATIONS REPORT ARCHIVE

HIGHLIGHTED ARTICLE

AUTHORS

F.I. Archer, P.A. Morin, B.L. Hancock-Hanser, K.M. Robertson, M.S. Leslie, M. Bérubé, S. Panigada, **B.L. Taylorn (NMFS/SWFSC)**

PUBLICATION DATE

Accepted: 3 April 2013

TITLE

Mitogenomic phylogenetics of fin whales (Balaenoptera physalus spp.)*: genetic evidence for revision of subspecies.*

JOURNAL

PLoS One

SIGNIFICANCE

- This paper presents evidence for naming of a new subspecies of cetacean in the North Pacific.
- A North Pacific subspecies would allow separation of DPSs within the North Pacific and advance potential down or de-listing from the ESA.
- The paper also presents evidence for periodic trans-equatorial migration and gene flow in a large whale species.

Fin whale at full size

SUMMARY

There are three described subspecies of fin whales *(Balaenoptera physalus)*: *B. p. physalus* Linnaeus, 1758 in the Northern Hemisphere, B. p. quoyi Fischer, 1829 in the Southern Hemisphere, and a recently described pygmy form, *B. p. patachonica* Burmeister, 1865. The discrete distribution in the North Pacific and North Atlantic raises the question of whether a single Northern Hemisphere subspecies is valid. We assess phylogenetic patterns using ~16K base pairs of the complete mitogenome for 154 fin whales from the North Pacific, North Atlantic - including the Mediterranean Sea - and Southern Hemisphere. A Bayesian tree of the resulting 136 haplotypes revealed several well-supported clades representing each ocean basin, with no haplotypes shared among ocean basins. The North Atlantic haplotypes (n = 12) form a sister clade to those from the Southern Hemisphere (n = 42). The estimated time to most recent common ancestor (TMRCA) for this Atlantic/Southern Hemisphere clade and 81 of the 97 samples from the North Pacific was approximately 2 Ma. 14 of the remaining North Pacific samples formed a well-supported clade within the Southern Hemisphere. The TMRCA for this node suggests that at least one female from the Southern Hemisphere immigrated to the North Pacific approximately 0.37 Ma. These results provide strong evidence that North Pacific and North Atlantic fin whales should not be considered the same subspecies, and suggest the need for revision of the global taxonomy of the species.

VISIT THE SCIENTIFIC PUBLICATIONS REPORT ARCHIVE

HIGHLIGHTED ARTICLE

AUTHORS

J. J. Polovina and **P. A. Woodworth-Jefcoats (NMFS/PIFSC)**

PUBLICATION DATE

19 April 2013

TITLE

Fishery-induced changes in the subtropical Pacific pelagic ecosystem size structure: observations and theory

JOURNAL

PLoS One

SIGNIFICANCE

- Catch per unit effort of both target and bycatch species should be routinely monitored, preferably on a basin-wide scale, and reported to managers to provide a broad view of ecosystem status.
- In an ecosystem context, the exploitation rate that achieves maximum sustainable yield should be considered an upper limit rather than a management target.
- Joint impacts of climate change and increased fishing effort are projected to accelerate a shift of pelagic ecosystem size structure to smaller sizes.

SUMMARY

The authors analyzed a 16-year (1996-2011) time series of catch and effort data for 23 species with mean weights ranging from 0.8kg to 224kg, recorded by observers in the Hawaii-based deep-set longline fishery. Over this time period, domestic fishing effort, as numbers of hooks set in the core Hawaii-based fishing ground, has increased fourfold. The standardized aggregated annual catch rate for 9 small (<15kg) species increased about 25% while for 14 large species (>15kg) catch rate decreased ~50% over the 16-year period. A size-based ecosystem model for the subtropical Pacific captures this pattern well as a response to increased fishing effort. Further, the model projects a decline in the abundance of fishes larger than 15kg resulting in an increase in abundance of animals from 0.1-15kg, but with minimal subsequent cascade to sizes smaller than 0.1kg. These results suggest that size-based predation plays a key role in structuring the subtropical ecosystem. These changes in ecosystem size structure show up in the fishery in various ways. The non-commercial species lancetfish (mean weight 7kg) has now surpassed the target species, bigeye tuna, as the species with the highest annual catch rate. Based on the increase in snake mackerel (mean weight 0.8kg) and lancetfish catches, the discards in the fishery are estimated to have increased from 30 to 40% of the total catch.

LINK TO PAPER

http://www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0062341

HIGHLIGHTED ARTICLE

AUTHORS

P. B. Moyle, **J. D. Kiernan,** P. K. Crain, and R. M. Quiñones
(NMFS/SWFSC)

PUBLICATION DATE

Expected 15 May 2013

TITLE

Climate change vulnerability of native and alien freshwater fishes of California: a systematic assessment approach

JOURNAL

PLoS One

SIGNIFICANCE

- Predicted climate change effects on freshwater environments will dramatically change the fish fauna of California.
- Fifty percent of California's native fish fauna was assessed as having critical or high baseline vulnerability to extinction whereas all alien species were classified as being less or least vulnerable.
- For vulnerability to climate change, 82% of native species were classified as highly vulnerable, compared with only 19% of alien species.

SUMMARY

Freshwater fishes are highly vulnerable to human-caused climate change. Because quantitative data on status and trends are unavailable for most fish species, a systematic assessment approach that incorporates expert knowledge was developed to determine status and future vulnerability to climate change of freshwater fishes in California, USA. The method uses expert knowledge, supported by literature reviews of status and biology of the fishes, to score ten metrics for both (1) current status of each species (baseline vulnerability) and (2) likely future impacts of climate change (climate change vulnerability). Baseline and climate change vulnerability scores were derived for 121 native and 43 alien fish species. The two scores were highly correlated and were concordant among different scorers. Native species had both greater baseline and greater climate change vulnerability than did alien species. Most native fishes will suffer population declines and become more restricted in their distributions; some will likely be driven to extinction. Fishes requiring cold water (<22°C) are particularly likely to go extinct. In contrast, most alien fishes will thrive, with some species increasing in abundance and range. However, a few alien species will likewise be negatively affected through loss of aquatic habitats during severe droughts and physiologically stressful conditions present in most waterways during summer. Our method has high utility for predicting vulnerability to climate change of diverse fish species and should be useful for setting conservation priorities in many different regions.

VISIT THE SCIENTIFIC PUBLICATIONS REPORT ARCHIVE

ADDITIONAL ARTICLE

AUTHORS

A. Blair, D. Sanger, D. White, A.F. Holland , **L. Vandiver,** C. Bowker, and S. White **(NOS/NCCOS)**

PUBLICATION DATE

Accepted 8 October 2012

TITLE

Quantifying and simulating stormwater runoff in watersheds

JOURNAL

Hydrological Processes

SIGNIFICANCE

- The Stormwater Runoff Modeling System (SWARM) provides a first assessment tool to compare relative differences in runoff in order to evaluate current and potential impacts of development and climate change
- SWARM is based on the long established and well respected runoff curve number and unit hydrograph methods of the U.S. Department of Agriculture, Natural Resources Conservation Service and provides estimates and simulations of stormwater runoff for small watersheds in the Southeast U.S. coastal plain.

SUMMARY

The authors developed the Stormwater Runoff Modeling System (SWARM) based on curve number and unit hydrograph methods of the U.S. Department of Agriculture, Natural Resources Conservation Service. SWARM models single events, targets watersheds fitting easily within hydrologic units with 12-digit codes, and has been calibrated for low- gradient topography of the Southeast coastal plain. They established protocols; made changes related to peak rate factors, travel time formulas, curve numbers, and the initial abstraction ratio; and then tested the output with multi- site validation using U.S. Geological Survey measurements of discharge and rainfall. These results were validated from both undeveloped and developed watersheds, thus supporting the robustness of the system in quantifying and simulating runoff. Rainfall to runoff differences between measured and simulated volumes ranged from 3 to 11% and r2 for hydrograph curves ranged from 0.82 to 0.98. SWARM can be a useful tool for scientific research and for coastal resource management and decision making in the Southeast coastal plain specifically and also may be applied to other areas by recalibrating parameters and modifying calculation templates.

ADDITIONAL ARTICLE

AUTHORS

A. A. Keller, M. J. Bradburn, and V. **H. Simon (NMFS/NWFSC)**

PUBLICATION DATE

Online 12 April 2013

TITLE

Shifts in condition and distribution of eastern North Pacific flatfish along the U.S. west coast (2003-2010)

JOURNAL

Deep Sea Research I

SIGNIFICANCE

- Environmental changes and variation in biomass play significant roles in flatfish distribution along the U.S. west coast.
- Changes in fish distribution and condition due to both environmental effects and biomass levels should be considered in the management of west coast flatfish species, which include some of the most important commercial species along the coast.
- Understanding the mechanisms underlying the observed relationships between condition indices, distribution, climate, and biomass should become more apparent as the length of the NWFSC west coast groundfish bottom trawl survey time series increases.

SUMMARY

Flatfish condition indices and distribution were examined along the U.S. west coast (55–1280m) in relation to environmental variability and biomass using data from ten frequently occurring species collected in annual groundfish surveys from 2003-2010. The study was conducted during a period characterized by a cooling trend in the northern California Current system and by declining biomass for flatfish in general. Annual condition indices for six species (arrowtooth flounder, Dover sole, English sole, Pacific sanddab, petrale sole, and rex sole) were significantly related either to large-scale climatic indices (Pacific Decadal Oscillation, Multivariate El Niño–Southern Oscillation Index, North Pacific Gyre Oscillation) and/or annual biomass levels. Condition was most closely related to environmental effects rather than either biomass alone or both variables, with condition typically higher during cool climatic conditions. A similar analysis revealed that changes in distribution (measured as variation in annual catch-weighted mean latitude, longitude, depth and temperature) tended to be best described by models incorporating environmental effects and biomass rather than either variable alone in seven species (arrowtooth flounder, deepsea sole, Dover sole, flathead sole, Pacific sanddab, petrale sole, and slender sole). Linear trends in the center of distribution of these species along a southeast-northwest axis were significant, with a tendency for flatfish to be displaced towards the southeast as environmental conditions shifted from warm to cooler conditions and biomass declined. A spatial distribution analysis indicated that for 80% of species the greatest magnitude of displacement (km) occurred when the centers of biomass were compared between environmental-phases (average annual displacement 34km) rather than changing biomass levels (average displacement 24km). Taken together both approaches revealed that environmental changes and variation in biomass play significant roles in flatfish distribution.

LINK TO PAPER

http://www.sciencedirect.com/science/article/pii/S0967063713000770

VISIT THE SCIENTIFIC PUBLICATIONS REPORT ARCHIVE

ADDITIONAL ARTICLE

AUTHORS

B. Costa and **T. Battista (NOS/NCCOS)**

PUBLICATION DATE

Expected July 2013

TITLE

The semi-automated classification of acoustic imagery for characterizing coral reef ecosystems

JOURNAL

International Journal of Remote Sensing

SIGNIFICANCE

- The new, hybrid semi-automated classification technique presented here successfully created a thematically resolved and highly accurate benthic habitat map from multibeam echosounder imagery, of which almost half of the areas analyzed were delineated and classified by the computer alone.
- While this method still needs improvement, it does show promise for increasing the amount of automation with which thematically accurate benthic habitat maps can be generated from acoustic imagery.

SUMMARY

Coral reef habitat maps describe the spatial distribution and abundance of tropical marine resources, making them essential for ecosystem-based approaches to planning and management. Typically, these habitat maps have been created from optical and acoustic remotely sensed imagery using manual, pixel and object-based classification methods. However, none of these classification methods alone are optimal for characterizing coral reef habitats for multiple management applications because the maps they produce: (1) are not comprehensive over large scales (synoptic), (2) are time consuming to develop, (3) have low thematic resolutions (i.e., number of classes) or (4) have low overall thematic accuracies. To address these deficiencies, a novel, hybrid object and pixel-based technique was applied to multibeam echosounder imagery to determine its utility for characterizing coral reef ecosystems. This technique used a combination of Principal Components Analysis, edge- based segmentation, and Quick Unbiased and Efficient Statistical Trees to successfully partition the acoustic imagery into 35 unique combinations of: (1) major and (2) detailed geomorphological structure, (3) major and (4) detailed biological cover and (5) live coral cover types. Thematic accuracies for these classes (corrected for proportional bias) were: (1) 95.7%, (2) 88.7%, (3) 95.0%, (4) 74.0% and (5) 88.3%, respectively. Approximately half of the habitat analyzed were manually edited (hence the name "semi-automated") due to noise in the acoustic data, indicating the need to collect high quality imagery and develop uniform data collection standards for habitat mapping. While this method did not generate a map that was entirely reproducible, it does move the process of habitat mapping forward by increasing the automation (and possibly, efficiency) with which thematically accurate benthic habitat maps can be produced from acoustic imagery. The ability to efficiently and accurately create habitat maps will help transform the process of mapping from a static, resource inventory tool to a dynamic, resource monitoring tool.

VISIT THE SCIENTIFIC PUBLICATIONS REPORT ARCHIVE

ADDITIONAL ARTICLE

AUTHORS

J. L. Conrad, **E. Gilbert-Horvath,** and **J. C. Garza (NMFS/SWFSC)**

PUBLICATION DATE

Accepted: 9 April 2013

TITLE

Genetic and phenotypic effects on reproductive outcomes for captively-reared coho salmon, Oncorhynchus kisutch

JOURNAL

Aquaculture

SIGNIFICANCE

- Low level inbreeding, below the level of sibling crosses, significantly affects survival of juvenile coho salmon at multiple life stages in a captive broodstock program for this ESA endangered stock.
- The results validate the value and necessity of genetic broodstock management techniques in captive broodstock and other small artificial propagation programs to reduce inbreeding and consequent inbreeding depression.

Coho salmon

SUMMARY

Captive breeding programs are a common approach to preventing extinction and rehabilitating endangered stocks of Pacific salmonids. To minimize inbreeding in these typically small populations, genetic data from microsatellite loci have been used to estimate relatedness and choose spawning pairs. Phenotypic attributes (e.g., body size), that result at least in part from environmental conditions during rearing likely affect reproductive outcome as well. However, the combined effects of individual phenotype and genetic broodstock management have not been previously evaluated. This study assessed the influence of genetic background (source of original broodstock collection, and heterozygosity of both male and female parents), the molecular genetic-derived relatedness coefficient of mated pairs, and phenotypic attributes of female parents (body size, ovulation rate) on reproductive outcome for three brood years of endangered coho salmon, Oncorhynchus kisutch, from the Russian River, California. Over 1200 full-sibling family groups were created in total, whose survival was tracked individually from fertilization through the swim-up fry stage. Strong maternal influence on reproductive outcome was found, as increased female body mass resulted in lower progeny survival rates, and higher ovulation rates predicted improved progeny survival. Male and female heterozygosity was generally positively related to embryo survival, but this effect was not consistently observed across brood years or early life stages. The relatedness coefficient between mated pairs had a significant and negative effect on progeny survival, particularly after hatching, even though the most inbred matings were prevented. Thus, use of genetic broodstock management to guide selection of salmon breeding pairs increases offspring survival, in addition to reducing inbreeding.

VISIT THE SCIENTIFIC PUBLICATIONS REPORT ARCHIVE

ADDITIONAL ARTICLE

AUTHORS

B. A. Berejikian, L. A. Campbell, and **M. E. Moore**
(NMFS/NWFSC)

PUBLICATION DATE

Accepted: 10 April 2013

TITLE

Large-scale freshwater habitat features influence the degree of anadromy in eight Hood Canal Oncorhynchus mykiss *populations*

JOURNAL

Canadian Journal of Fisheries and Aquatic Sciences

SIGNIFICANCE

- The anadromous form of Rainbow trout *(Oncorhynchus mykiss)* in Puget Sound are listed as Threatened under the ESA and this paper provides a baseline for quantifying the effects of new hatchery programs on life history diversity, which is an important viability parameter.
- This paper provides improved ability of managers to predict how freshwater conditions in other Pacific Northwest watersheds will favor the listed (anadromous) versus non-listed (resident) life history forms.

Rainbow trout *(Oncorhynchus mykiss)*

SUMMARY

Juvenile Rainbow trout *(Oncorhynchus mykiss)* maternity was determined from otolith strontium:calcium ratios to investigate the degree of anadromy in eight freshwater streams draining to a common fjord. The proportions of O. mykiss parr (young actively feeding in freshwater) produced by anadromous females ranged from an annual average of 41.3 percent (Hamma Hamma River) to 100 percent (Dewatto River). The proportion of stream habitat available to resident *O. mykiss* upstream of barriers to anadromous migration explained a significant portion of the variability in maternal life history below barrier falls and was included in each of the five logistic regression models with the lowest AIC scores. Transitional hydrologic profiles, low mean annual temperatures and high mean annual stream flow, common to Olympic Peninsula streams, were each associated with greater proportions of offspring from resident females. Only 2 out of 234 parr from the lowland, rain-driven, low-flow streams of the Kitsap Peninsula were produced by resident females. Thus, large-scale habitat features, and primarily the presence or absence of resident populations above natural barriers to anadromous migration, appeared to shape the degree of anadromy among populations.

VISIT THE SCIENTIFIC PUBLICATIONS REPORT ARCHIVE

ADDITIONAL ARTICLE

AUTHORS

K. E. Hunt, M. J. Moore, R. M. Rolland, **N. M. Kellar (NMFS/SWFSC),** A. J. Hall, J. Kershaw, S. A. Raverty, C. E. Davis, L. C. Yeates, **T. K. Rowles (NMFS/OPR),** and S. D. Kraus

PUBLICATION DATE

Expected June 2013

TITLE

Overcoming the challenges of studying conservation physiology in large whales: a review of available methods

JOURNAL

Conservation Physiology

SIGNIFICANCE

- This paper reviews and compares all current practices to study the physiology of large whales.

SUMMARY

Large whales are subjected to a variety of conservation pressures that could be better monitored and managed if physiological information could be gathered readily from free-swimming whales. However, traditional approaches to studying physiology have been impractical for large whales, since there is no routine method for capture of the largest species and there is presently no practical method of obtaining blood samples from free-swimming whales. We review the currently available techniques for gathering physiological information on large whales using a variety of nonlethal and minimally invasive (or noninvasive) sample matrices. We focus on methods that should produce information relevant to conservation physiology, e.g. measures relevant to stress physiology, reproductive status, nutritional status, immune response, health, and disease. Four types of samples are discussed: fecal samples, respiratory samples ("blow"), skin/blubber samples, and photographs. Fecal samples have historically been used for diet analysis but increasingly are also used for hormonal analyses, as well as for assessment of exposure to toxins, pollutants, and parasites. Blow samples contain many hormones as well as respiratory microbes, a diverse array of metabolites, and a variety of immune-related measures. Biopsy dart samples are widely used for genetic, contaminant, and fatty acid analyses and are now being used for endocrine studies along with proteomic and transcriptomic approaches. Photographic analyses have benefited from recently developed quantitative techniques allowing assessment of skin condition, ectoparasite load, and nutritional status, along with wounds and scars from ship strikes and fishing gear entanglement. Field application of these techniques has the potential to greatly improve our understanding of the physiology of large whales, better enabling assessment of the relative impacts of many anthropogenic and ecological pressures.

Finback whale

VISIT THE SCIENTIFIC PUBLICATIONS REPORT ARCHIVE

ADDITIONAL ARTICLE

AUTHORS

S. F. Pearson, P. J. Hodum, T. P. Good (NMFS/NWFSC), M. Schrimpf, and S. M. Knapp

PUBLICATION DATE

Expected May 2013

TITLE

A model approach for estimating colony size, trends, and habitat associations of burrow-nesting seabirds

JOURNAL

The Condor

SIGNIFICANCE

- This work identifies habitat qualities predicting burrow density, which provides valuable information for restoration/protection activities and insights into observed colony trends.
- It also informs monitoring strategies for burrow-nesting seabirds in Puget Sound and northern California Current and highlights statistical and methodological issues associated with historical comparisons.

SUMMARY

The authors present a prototype monitoring strategy for estimating the density and number of occupied burrows of burrow-nesting seabirds. They use data and management questions from Washington State as an example that can be applied to diverse burrow-nesting seabirds at single- or multi-island scales. They also demonstrate how habitat assessments can be conducted concurrently. Specifically, they compared the density and occupancy of burrows of the Rhinoceros Auklet *(Cerorhinca monocerata)* at nesting colonies in the California Current and the Salish Sea from in the 1970s, 1980s, and today. They were able to estimate 36 152, 1546, and 6494 occupied burrows on Protection and Smith islands (Salish Sea), and Destruction Island (California Current), respectively. Their estimates for the Salish Sea are 52% greater than those from the 1970s and 1980s, while that for the California Current is 60% less than that of 1975. This suggests that the Salish Sea population has increased, despite greater human effects on that ecosystem. However, some of the estimated changes between the periods could be the result of methodological and analytical differences. To address these issues the authors recommend an unbiased and representative sampling approach and an approach for optimally allocating the samples among strata within and among islands, depending on the scale of the question being addressed. Optimally allocating the sample would save a great deal of field effort; using this approach, the authors were able to achieve relatively high accuracy and were able to detect moderate changes in population density despite sampling fewer plots than previous studies that were not optimally allocated.

VISIT THE SCIENTIFIC PUBLICATIONS REPORT ARCHIVE

ADDITIONAL ARTICLE

AUTHORS

J. J. Deroba (NMFS/NEFSC) and **A. M. Schueller (NMFS/SEFSC)**

PUBLICATION DATE

Expected Summer 2013

TITLE

Performance of stock assessments with misspecified age- and time-varying natural mortality

JOURNAL

Fisheries Research

SIGNIFICANCE

Natural mortality is a very uncertain input into all stock assessment models. This study demonstrated that bias in parameter estimates was not reduced by including age-varying natural mortality, and that focus should shift from discussing age-varying natural mortality to time-varying natural mortality.

SUMMARY

Natural mortality (M) in fish likely varies with age (size) and from one year to the next, however M is traditionally assumed constant over these factors in stock assessments. Recently, several methods have been applied to correct for age- or year-specific values, however despite the increased realism, they still may not be producing less biased parameter estimates. Two generic fish populations (long- and short-lived) subject to size- and year-varying M were simulated, along with data used to fit statistical catch-at-age (SCAA) models. The SCAA models assumed three scenarios for M; 1) M was constant, 2) M varied with age, 3) M varied by year. The model also accounted for the bias in estimates of spawning stock biomass (SSB), fully selected fishing mortality (F), and recruitment. The scale and trends among years in the bias of parameter estimates were generally driven by how the true values of M varied among years and how M was treated in the SCAA model. Bias was unaffected by how fishing mortality rates varied among years. The scale and trends among years in the bias of parameter estimates were generally similar when specifying a constant M and an age-varying M in the SCAA model. Using an annually varying M in the SCAA model generally improved the scale, and reduced trends among years in the bias of parameter estimates relative to constant M and age-varying M. Trends among years in bias were generally more pronounced for estimates of SSB than recruitment for long-lived life history simulations, but the opposite was true for short-lived life history simulations. These results suggested that the biases induced by not accounting for age-variation in M are likely secondary to those caused by the misspecification of temporal trends (trend and annual fluctuations in this case) in M. More time should be dedicated to accounting for temporal shifts in M than accounting for age-variation in M. The consequences of misspecification of M may also partially depend on life history.

VISIT THE SCIENTIFIC PUBLICATIONS REPORT ARCHIVE

ADDITIONAL ARTICLE

AUTHORS

N. M. Bacheler, Z. H. Schobernd, D. J. Berrane, C. M. Schobernd, W. A. Mitchell, and **N. R. Geraldi (NMFS/SEFSC)**

PUBLICATION DATE

Expected 2013

TITLE

When a trap is not a trap: converging entry and exit rates and their effect on trap saturation of black sea bass (Centropristis striata)

JOURNAL

ICES Journal of Marine Science

SIGNIFICANCE

- Chevron fish traps saturated over very short time frames (< 1 hour), and the reason for saturation was novel (i.e., entry rates declined and exit rates increased to a point where they reached an equilibrium).
- Several lines of evidence suggests that trap catch of black sea bass at saturation is likely positively related to true abundance, validating chevron traps as a fishery-independent survey methodology.

SUMMARY

Catch rates are often used to index the abundance of marine organisms, but catch saturation (i.e., declining catch rate as fishing time increases) can decouple catch and abundance. Researchers have struggled to account for saturation when using trap catch to infer population dynamics. We used underwater video to document entries and exits of black sea bass *(Centropristis striata)* from chevron traps (n = 26) to quantify catch saturation. Black sea bass catch varied between 3 and 188 individuals for soak times of approximately 90 min. Overall, 3564 black sea bass entered the traps and 1826 exited; therefore, over half (51%) of black sea bass entering traps exited before traps were retrieved. Black sea bass catch rates were nonlinear and asymptotic for most (81%) trap samples, despite short soak times. Moreover, catch saturation occurred at 50 min, when the entry rate declined and exit rate increased to a point where their confidence intervals overlapped. Several lines of evidence suggest that the level of black sea bass catch once saturation occurred may be positively related to true abundance, but additional research is needed to more fully test this hypothesis.

ADDITIONAL ARTICLE

AUTHORS

R. K. Hoeke (NMFS/PIFSC), C. D. Storlazzi, and P. V. Ridd

PUBLICATION DATE

Expected May or June 2013

TITLE

Drivers of circulation in a fringing coral reef embayment: a wave-flow coupled numerical modeling study of Hanalei Bay, Hawaii

JOURNAL

Continental Shelf Research

SIGNIFICANCE

- Sediment deposition and flushing in reef systems associated with steepsided watersheds are dictated by episodic storm-driven flooding and large waves.

SUMMARY

A coupled wave-circulation numerical model of Hanalei Bay, Hawaii, was constructed to investigate controls on nearshore hydrodynamics and overall circulation of a bathymetrically complex coral reef embayment that is exposed to large waves and river floods several times per annum. The model was calibrated using in situ data representative of the two conditions that dominate the region's wave climate: one associated with local trade winds and associated tradewind waves, and the other with distant-source episodic large swells. The model results were improved by including spatially-varying hydrodynamic bed roughness and making the semiempirical wave-breaking parameter dependent on incident wave steepness and reef slope. During trade-wind conditions, circulation was primarily wind-driven and volume flux-based flushing times of the bay were on the order of 35 hours. Under the episodic swell conditions, circulation was dominated by wave-driven flows and flushing times decreased to as little as 2 hours. The vigorous hydrodynamics that occur during the upper 10% most energetic swell conditions indicate that only a few (0-10) events each year are likely capable of exporting significant volumes of sediment from the bay. Like many fringing reef areas backed by steepsided watersheds on tropical and sub-tropical high islands worldwide, Hanalei Bay receives high episodic fluvial sediment load during a similarly low number of flood events. These similarly episodic but decoupled processes of sediment delivery and removal identified here suggest that the water quality and sedimentary environment of Hanalei Bay and similar linked watershed-reef systems are sensitive to changes in annual storm frequency and intensity.

LINK TO PAPER

http://dx.doi.org/10.1016/j.csr.2013.03.007

ADDITIONAL ARTICLE

AUTHORS

A. Blair, S. Lovelace, D. Snager, A. F. Holland, **L. Vandiver,** and **S. White (NOS/NCCOS)**

PUBLICATION DATE

Acceptance Date: March 25, 2013

TITLE

Exploring impacts of development and climate change on stormwater runoff

JOURNAL

Hydrological Processes

SIGNIFICANCE

- The Stormwater Runoff Modeling System (SWARM) was developed to enhance understanding of impacts of development and climate change on stormwater runoff in small watersheds.
- One development scenario showed the amount of rainfall converted to runoff was 27% for an undeveloped area and 67% for a highly developed area.
- A climate scenario showed the amount of rainfall converted to runoff in a medium developed area was 25% in drought conditions and 76% in wet conditions.

SUMMARY

Stormwater runoff is a leading cause of non-point source pollution in urbanizing areas, and runoff effects will be exacerbated by climate's changing patterns of precipitation. To enhance understanding of impacts of development and climate change on stormwater runoff in small watersheds (< 65,000 ha), we developed the Stormwater Runoff Modeling System (SWARM), a simple modeling system based on U.S. Department of Agriculture, Natural Resources Conservation Service curve number and unit hydrograph methods. The objective of this paper is to describe the applications possible with SWARM and to demonstrate its usefulness in exploring the impacts of development and climate change on runoff. Results encompass a range of impact scenarios. User-friendly templates make SWARM a good tool for scientific research, for resource management and decision making, and for community science education. The modeling system also supports the investigation of social and economic impacts to communities as they adapt to increased development and climate change. Although we calibrated SWARM specifically to the southeast coastal plain, it can be applied to other regions by recalibrating parameters and modifying calculation templates, and can be used to compare runoff among watersheds representing different environmental settings, evaluate and illustrate (singularly or in combination) effects of primary drivers of runoff amount and flashiness including development level, soil type, ARC, rainfall amount, predict runoff under a range of development scenarios within a watershed; and, of key significance, and integrate effects of urbanization and projected climate change scenarios.

ADDITIONAL ARTICLE

AUTHORS

L. Anderson and **S. T. Lee (NMFS/NWFSC)**

PUBLICATION DATE

Expected June 2013

TITLE

Untangling the recreational value of wild and hatchery salmon

JOURNAL

Marine Resource Economics

SIGNIFICANCE

- This paper examines how the value of recreational fishing is affected by changes in wild and hatchery salmon regulations and catch rates in the Northwest region of the US.
- There were statistically significant differences in preferences for hatchery and wild salmon.
- Anglers see a very real difference between the required release of wild salmon and the required release of hatchery salmon.

SUMMARY

Many Pacific salmon populations have declined to levels that have prompted their listing under the Endangered Species Act. In order to protect these populations and provide harvest opportunities for recreational anglers, the fishery is often managed with separate regulations for wild and hatchery salmon. Using a discrete choice experiment, we estimate saltwater fishing trip preferences. We integrate the estimated preferences with auxiliary creel data in order to conduct simulations of willingness to pay that vary in bag limits and catch rates, conditioning on current fishery conditions. We find statistically significant differences between the recreational values for wild and hatchery salmon, and our simulations highlight the fact that these differences depend on baseline levels of catch rates and bag limits.

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ADDITIONAL ARTICLE

AUTHORS

D. A. M. da Silva (NMFS/NWFSC), J. Buzitis , W. L. Reichert (NMFS/NWFSC) J. E. West, **S. M. O'Neill, L. L. Johnson (NMFS/NWFSC), T. K. Collier (NOS/NOAA Oceans and Human Health Initiative),** and **G. M. Ylitalo (NMFS/NWFSC)**

PUBLICATION DATE

Expected Unknown

TITLE

Endocrine disrupting chemicals in fish bile: a rapid method of analysis using English Sole (Parophrys vetulus) from Puget Sound, WA, USA

JOURNAL

Chemosphere

SIGNIFICANCE

- This study describes a recently developed rapid method to measure hormone disrupting chemicals (aka Endocrine Disrupting Chemicals - EDC) in bile of fish.
- Concentrations of these EDCs in fish bile are unknown in U.S. marine waters.
- This study presented, for the first time in United States coastal waters, biliary environmental concentrations of these compounds in male English sole collected from Puget Sound, a region of increasing urbanization.

SUMMARY

The EDCs bisphenol A (BPA), 17b-estradiol (E2) and 17a-ethynylestradiol (EE2) in bile of fish were measured using enzymatic hydrolysis of samples followed by solid-phase extraction and ultra-performance liquid chromatography with tandem mass spectrometry. These compounds were analyzed in bile of male English sole *(Parophrys vetulus)* collected from urban and non-urban sites in Puget Sound, WA, USA. The BPA and E2 concentrations (and occurrence) ranged from < LOQ - 52 ng/mL (10-100%) and < LOQ - 310 ng/mL (10-70%), respectively. EE2 levels were below the LOQ in all samples. Urban sites were significantly different than non-urban sites, demonstrating the environmental applicability of this analytical method.

ADDITIONAL ARTICLE

AUTHORS

R. Edwards (NWS/SPC), J. G. LaDue (NWS/WDTB), J. T. Ferree (NWS/OClWWS), K. Scharfenberg (NWS/OCIWWS), C. Maier (NWS/OCIWWS), and W. L. Coulbourne

PUBLICATION DATE

Expected May 2013

TITLE

Tornado intensity estimation: past, present and future

JOURNAL

Bulletin of the American Meteorological Society

SIGNIFICANCE

- During the early to middle 2000s, in response to demand for more detail in wind damage surveying and recordkeeping, a team of atmospheric scientists and wind engineers developed the Enhanced Fujita (EF) Scale.
- This paper documents the historical evolution of the F- and EF- Scales for tornado damage ratings, and emphasizes the need for community maintenance, further development and management of the EF-Scale.

SUMMARY

The EF Scale, codified officially into National Weather Service (NWS) use in February 2007, offers wind speed estimates for a range of degrees of damage (DoD) across each of 28 damage indicators (DI). In practice, this has increased precision of damage surveys for tornado and thunderstorm-wind events. Still, concerns remain about both the representativeness of DoDs and the sufficiency of DIs, including: How dependable are the wind speed ranges for certain DoDs? What other DIs can be included? How can recent advances in mapping and documentation tools be integrated into the surveying process and the storm records? What changes should be made to the existing scale--why, how, and by whom? What alternative methods may be included or adapted for estimating tornado intensity? To begin coordinated discussion on these and related topics, interested scientists and engineers (including some involved in EF Scale development) organized a national EF Scale Stakeholders' Meeting, held on 2–3 March 2010 in Norman, OK. The manuscript presents more detailed background information, summarizes the meeting, presents possibilities for the future of the EF Scale and damage surveys, and solicits ideas from the engineering and atmospheric science communities.

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