Assessment of the stock status of small-scale and multi-gear fisheries resources in the tropical Eastern Pacific region

Small-scale multi-gear fisheries contribute half of global fisheries landings but are generally data-poor, hindering their assessment and management. Aiming to overcome various existing challenges, we used two complementary length-based approaches to assess the status of three main target species in the small-scale fisheries of Eastern Pacific countries: Spotted rose snapper Lutjanus guttatus, Pacific sierra Scomberomorus sierra, and Pacific bearded Brotula clarkae, using length-frequency catch data (LFCD) from the Colombian Pacific coast. Two data sources – official governmental data and community-based monitoring from a non-government organization – were used to estimate two sets of stock indicators: one based on the derivation of growth and mortality parameters from modal progression, catch curve analysis and a yield-per-recruit model using TropFishR; and the second based on the relative contribution of fish sizes with regard to proposed reference values for healthy stocks. Growth estimates differed between data sources and exhibited large confidence intervals, indicating an overall high uncertainty underlying the LFCD revealed through a novel bootstrapped approach. Estimated values of stock indicators, exploitation rate, fishing mortality and size-proportions converged in suggesting a state of heavy to over-exploitation for the three assessed species, although differences were observed among data sources that we attribute mainly to fisheries selectivity and sampling design. In order to improve future assessments of stocks in multi-gear and data-poor contexts, estimations of fleet-specific selectivity should be used to reconstruct LFCD prior to analyses. Additionally, sampling design should be based on fishing effort distribution among gears and areas and, when feasible, fishery-independent data on stock conditions should be included.

General information
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Organisations: National Institute of Aquatic Resources, Technical University of Denmark, Section for Ecosystem based Marine Management, Leibniz Center for Tropical Marine Ecology (ZMT), Bremen, University of Bremen, CEMarin — Corporation Center of Excellence in Marine Sciences, Fundación Ecomares, Universidad Nacional de Colombia, Fundación Marviva
Contributors: Herrón, P., Mildenberger, T. K., Díaz, J. M., Wolff, M.
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Publication date: 1 Nov 2018
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Preparation and Characterization of an Oral Vaccine Formulation Using Electrosprayed Chitosan Microparticles
Chitosan particles loaded with the antigen ovalbumin (OVA) and the adjuvant Quil-A were produced by electrospray, using mixtures of water/ethanol/acetic acid as a solvent. Three different chitosans designed as HMC+70, HMC+85, and HMC+90 (called as 705010, 855010, and 905010) were tested and its efficacy to be used in oral vaccine delivery applications was investigated. The morphology, size, and zeta potential of the produced particles were investigated, together with the encapsulation efficiency and release of OVA from the three chitosan formulations. Moreover, the mucoadhesion and cytotoxicity of the chitosan microparticles was examined. All the three formulations with OVA and Quil-A were in the micrometer size range and had a positive zeta potential between 46 and 75 mV. Furthermore, all the three formulations displayed encapsulation efficiencies above 80% and the release of OVA over a period of 80 h was observed to be between 38 and 47%. None of the developed formulations exhibited high mucoadhesive properties, either cytotoxicity. The formulation prepared with HMC+70, OVA, and Quil-A had the highest stability within 2 h in buffer solution, as measured by dynamic light scattering. The electrosprayed formulation consisting of HMC+70 with OVA and Quil-A showed to be the most promising as an oral vaccine system.

General information
State: Accepted/In press
Organisations: National Food Institute, Research Group for Nano-Bio Science, Department of Micro- and Nanotechnology, Nanoprobes, Center for Intelligent Drug Delivery and Sensing Using Microcontainers and Nanomechanics, Technical
Making the otolith magnesium chemical calendar-clock tick: Plausible Mechanism and Empirical Evidence

The incorporation of a number of readily measured trace elements into otoliths is considered to be under some sort of physiological control, but rarely are explicit mechanisms proposed. Studies of the incorporation of the trace element magnesium reveal that in some taxa there exists strong seasonal patterning, taking on the characteristics of a "chemical calendar-clock." However, Mg/Ca and the isotopic ratio 26/24Mg are less "clock-like" in taxa that are not as metabolically active. Herein, it is hypothesized that Mg uptake and incorporation are related to metabolic activity. Further, a two-step process of Mg incorporation is proposed: (1) limited entry into the otolith-bearing chamber through ion channels and (2) association with water-soluble proteins within the chamber. Supporting data from a range of taxa and life histories are provided; the authors' aim is to stimulate discussion and encourage physiologists to test these and alternative mechanistic hypotheses.
New insights into the spatial genetic structure of the Indian riverine buffalo populations

Several programmes for the genetic improvement and conservation Indian buffalo breeds have been implemented by various agencies since 1970. These programmes may have shaped the present genetic diversity and thereby the evolutionary potential of buffalo populations across India. In this study, we attempted to provide an insight into the contemporary genetic structure of buffaloes by simultaneously analyzing the genetic and geospatial data. A battery of 100 microsatellite markers was genotyped across 1055 buffalo samples representing different geographical regions of the country. Bayesian and multivariate approaches were used for analyses. Although the clustering results from the different approaches were not convergent, these methods were able to identify sub-structuring within the UP buffalo population. In our study BAPS was able to distinguish most of the buffalo breeds with better spatial distribution. The genetic structuring detected in our study is mainly characterised by isolation by distance and also reflects the effect of improvement programmes. Our analysis suggested genetic connectivity of Murrah and Nili-Ravi with several buffalo breeds, as they have been used for breed improvement. The information may be useful in identifying ecologically distinct or connected populations for future improvement and conservation programmes.

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BFI (2017): BFI-level 1
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Web of Science (2017): Impact factor 1.204
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.58 SJR 0.817 SNIP 1.095
Web of Science (2016): Impact factor 1.377
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 1.35 SJR 0.838 SNIP 0.994
Web of Science (2015): Impact factor 1.293
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 1.56 SJR 0.827 SNIP 1.211
Web of Science (2014): Impact factor 1.171
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 1.4 SJR 0.733 SNIP 1.049
Web of Science (2013): Impact factor 1.1
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 1.46 SJR 0.847 SNIP 1.172
Web of Science (2012): Impact factor 1.249
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 1.59 SJR 1.001 SNIP 1.243
Occupant response to different correlated colour temperatures of white LED lighting

Correlated Colour Temperature (CCT) of lighting may affect not only occupant visual perception, but also other indoor environment perceptions, such as perceptions of the thermal environment or the air quality. This study aimed at quantifying the association between CCT of white LED lighting and subjective perceptions and performance at operative temperatures at the upper and lower borders and in the middle of the comfort range. Higher CCT was significantly associated with decreasing thermal sensation, but only at the thermally neutral condition. Female subjects responded stronger to changes in CCT than male subjects. Under all temperature conditions, CCT was clearly associated with the perceived brightness of the light, and at 22 °C also with the perceived air quality and with subjectively assessed alertness.

CCT had no effect on the measured performance of a d2 task. At 22 °C, the observed decrease in thermal sensation when CCT went from 2700 K to 6200 K was equivalent to a difference in operative temperature of 1.7 °C. With an assumed neutral CCT of 4500 K (middle of range), a decreased heating set point in an office building, corresponding to an equivalent shift in CCT from 4500 K to 2700 K, resulted in a reduction of around 8% of the building’s total annual energy use. However, this assumes ideal conditions without influence from daylight, light from PC monitors, or coloured surfaces and other potentially disturbing factors.

General information
State: Published
Organisations: Department of Civil Engineering, Indoor Environment, Department of Photonics Engineering, Technical University of Denmark, Diode Lasers and LED Systems, Aalborg University
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Scopus rating (2016): CiteScore 4.51 SJR 1.998 SNIP 2.215  
Web of Science (2016): Impact factor 4.053  
Web of Science (2016): Indexed yes  
BFI (2015): BFI-level 1  
Scopus rating (2015): CiteScore 4.37 SJR 2.067 SNIP 2.463  
Web of Science (2015): Indexed yes  
BFI (2014): BFI-level 1  
Scopus rating (2014): CiteScore 4.14 SJR 1.887 SNIP 2.742  
Web of Science (2014): Impact factor 3.341  
Web of Science (2014): Indexed yes  
BFI (2013): BFI-level 1  
Scopus rating (2013): CiteScore 3.57 SJR 1.547 SNIP 2.551  
Web of Science (2013): Impact factor 2.7  
ISI indexed (2013): ISI indexed yes  
Web of Science (2013): Indexed yes  
BFI (2012): BFI-level 1  
Scopus rating (2012): CiteScore 3.06 SJR 1.293 SNIP 2.857  
Web of Science (2012): Impact factor 2.43  
ISI indexed (2012): ISI indexed yes  
Web of Science (2012): Indexed yes  
BFI (2011): BFI-level 1  
Scopus rating (2011): CiteScore 2.76 SJR 1.127 SNIP 2.279  
Web of Science (2011): Impact factor 2.4  
ISI indexed (2011): ISI indexed yes  
Web of Science (2011): Indexed yes  
BFI (2010): BFI-level 1  
Scopus rating (2010): SJR 1.245 SNIP 2.058  
Web of Science (2010): Impact factor 2.131  
Web of Science (2010): Indexed yes  
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Scopus rating (2009): SJR 1.025 SNIP 1.889  
Web of Science (2009): Indexed yes  
BFI (2008): BFI-level 1  
Scopus rating (2008): SJR 0.938 SNIP 1.413  
Web of Science (2008): Indexed yes  
Scopus rating (2007): SJR 0.826 SNIP 1.771  
Web of Science (2007): Indexed yes  
Scopus rating (2006): SJR 1.016 SNIP 1.716  
Scopus rating (2005): SJR 0.933 SNIP 1.296  
Web of Science (2005): Indexed yes  
Scopus rating (2004): SJR 0.572 SNIP 1.259  
Scopus rating (2003): SJR 0.898 SNIP 0.963  
Web of Science (2003): Indexed yes
The uptake and diffusion of solar power in Africa: Socio-cultural and political insights on a rapidly emerging socio-technical transition

This special issue focusses on the now rapidly growing solar photovoltaics markets across various geographies and scales in Africa. Herein we summarise the contributions of the component papers and position them within the context of the sustainable energy access literature. We argue that there is an urgent need for greater attention to the neglected socio-cultural and political dimensions of sustainable energy access, dimensions that are vital to understand if ambitious global commitments to sustainable energy for all by 2030 are to be achieved. Included in this special issue are papers on the systemic and socio-technical nature of energy access transitions; their politics and political economy; gendered dimensions; critiques of their technologically determinist framing and the implications for marginalising local actors; and, perhaps for the first time in the energy access literature, application of social practice perspectives to the energy access challenge. The result is a diverse range of empirically-grounded, theoretically and methodologically novel approaches, providing new insights into and understandings of the neglected socio-cultural and political dimensions of sustainable energy access.

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Organisations: Department of Management Engineering, UNEP DTU Partnership, University of Sussex
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BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 5.14 SJR 1.845 SNIP 2.025
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Scopus rating (2015): CiteScore 6.12 SJR 2.239 SNIP 1.375
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Organisations: Department of Applied Mathematics and Computer Science, Dynamical Systems, Statistics and Data Analysis
Contributors: Hedlund, F. H.
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Cavity-waveguide interplay in optical resonators and its role in optimal single-photon sources
Interfacing solid-state emitters with photonic structures is a key strategy for developing highly efficient photonic quantum technologies. Such structures are often organized into two distinct categories: nanocavities and waveguides. However, any realistic nanocavity structure simultaneously has characteristics of both a cavity and waveguide, which is particularly pronounced when the cavity is constructed using low-reflectivity mirrors in a waveguide structure with good transverse light confinement. In this regime, standard cavity quantum optics theory breaks down, as the waveguide character of the underlying dielectric is only weakly suppressed by the cavity mirrors. By consistently treating the photonic density of states of the structure, we provide a microscopic description of an emitter including the effects of phonon scattering over the full transition range from waveguide to cavity. This generalized theory lets us identify an optimal regime of operation for single-photon sources in optical nanostructures, where cavity and waveguide effects are concurrently exploited.

General information
State: Published
Organisations: Department of Photonics Engineering, Nanophotonics Theory and Signal Processing
Contributors: Denning, E., Iles-Smith, J., Osterkryger, A. D., Gregersen, N., Mork, J.
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Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 3.34 SJR 1.604 SNIP 1.04
Multi-stage generation of extreme ultraviolet dispersive waves by tapering gas-filled hollow-core anti-resonant fibers

In this work, we numerically investigate an experimentally feasible design of a tapered Ne-filled hollow-core anti-resonant fiber and we report multi-stage generation of dispersive waves (DWs) in the range 90-120 nm, well into the extreme ultraviolet (UV) region. The simulations assume a 800 nm pump pulse with 30 fs 10 µJ pulse energy, launched into a 9 bar Ne-filled fiber with a 34 µm initial core diameter that is then tapered to a 10 µm core diameter. The simulations were performed using a new model that provides a realistic description of both loss and dispersion of the resonant and anti-resonant spectral bands of the fiber, and also importantly includes the material loss of silica in the UV. We show that by first generating solitons that emit DWs in the far-UV region in the pre-taper section, optimization of the following taper structure can allow re-collision with the solitons and further up-conversion of the far-UV DWs to the extreme-UV with energies up to 190 nJ in the 90-120 nm range. This process provides a new way to generate light in the extreme-UV spectral range using relatively low gas pressure.

General information
State: Published
Organisations: Department of Photonics Engineering, Fiber Sensors and Supercontinuum Generation, Plasmonics and Metamaterials, Ultrafast Infrared and Terahertz Science, University of Central Florida
Contributors: Selim Habib, M. D., Markos, C., Enrique Antonio-Lopez, J., Correa, R. A., Bang, O., Bache, M.
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BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 3.74 SJR 1.519 SNIP 1.567
Web of Science (2017): Impact factor 3.356
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 3.48 SJR 1.532 SNIP 1.544
Web of Science (2016): Impact factor 3.307
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 3.78 SJR 1.91 SNIP 1.674
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 4.18 SJR 2.313 SNIP 2.124
Web of Science (2014): Impact factor 3.488
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): CiteScore 4.38 SJR 2.337 SNIP 2.196
Web of Science (2013): Impact factor 3.525
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): CiteScore 3.85 SJR 2.562 SNIP 2.108
Web of Science (2012): Impact factor 3.546
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
High similarity between EEG from subcutaneous and proximate scalp electrodes in patients with temporal lobe epilepsy

Subcutaneous recording using electroencephalography (EEG) has the potential to enable ultra-long-term epilepsy monitoring in real-life conditions because it allows the patient increased mobility and discreteness. This study is the first to compare physiological and epileptiform EEG signals from subcutaneous and scalp EEG recordings in epilepsy patients. Four patients with probable or definite temporal lobe epilepsy were monitored with simultaneous scalp and subcutaneous EEG recordings. EEG recordings were compared by correlation and time-frequency analysis across an array of clinically relevant waveforms and patterns. We found high similarity between the subcutaneous EEG channels and nearby temporal scalp channels for most investigated electroencephalographic events. In particular, the temporal dynamics of one typical temporal lobe seizure in one patient were similar in scalp and subcutaneous recordings in regard to frequency distribution and morphology. Signal similarity is strongly related to the distance between the subcutaneous and scalp electrodes. On the basis of these limited data, we conclude that subcutaneous EEG recordings are very similar to scalp recordings in both time and time-frequency domains, if the distance between them is small. As many electroencephalographic events are local/regional, the positioning of the subcutaneous electrodes should be considered carefully to reflect the relevant clinical question. The impact of implantation depth of the subcutaneous electrode on recording quality should be investigated further. NEW & NOTEWORTHY This study is the first publication comparing the detection of clinically relevant, pathological EEG features from a subcutaneous recording system designed for out-patient ultra-long-term use to gold standard scalp EEG recordings. Our study shows that subcutaneous channels are very similar to comparable scalp channels, but also point out some issues yet to be resolved.
Complementary analyses of aging in a commercial LiFePO$_4$/graphite 26650 cell

In this work we investigate the electrode degradation mechanisms in a commercial 2.5 Ah LiFePO$_4$/graphite 26650 cylindrical cell. Aged and fresh electrode samples were prepared by cycling two cells respectively five and 22 k times. Subsequently the cells were disassembled in a glovebox and the electrode samples were prepared for electrochemical testing in a 3-electrode setup, and for characterization with XRD, XPS and low-kV FIB/SEM tomography. A 1 μm thick CEI (cathode electrolyte interface) layer was observed at the electrode/electrolyte interface of the aged LiFePO$_4$ electrode. Relative to the fresh LiFePO$_4$ electrode, the aged electrode exhibited a larger series resistance which indicates the observed degradation layer increases the ionic resistance. In addition, micron-sized agglomerates, probably a mixture of carbonaceous material and decomposition products from the electrolyte, were observed at the electrode/electrolyte interface of the aged graphite electrode. These layers may contribute significantly to the loss of lithium inventory (LLI) in the cell, and to the loss of active material (LAM) in the graphite electrode. Low-voltage FIB/SEM tomography was used to detect local charging effects of graphite particles in the carbon electrode, an effect of poor dissipation of the electric charge to the ground after the sample interaction with the electron beam. The charging effects were primarily observed in the aged electrode and most of the locally charged particles were found to be close to the electrode/electrolyte interface, indicating a poorly percolating graphite network near this interface.

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Scopus rating (2017): CiteScore 5.01 SJR 1.439 SNIP 1.101
Web of Science (2017): Impact factor 5.116
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BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 4.74 SJR 1.355 SNIP 1.177
Web of Science (2016): Impact factor 4.798
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 4.86 SJR 1.321 SNIP 1.324
Web of Science (2015): Impact factor 4.803
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 4.59 SJR 1.378 SNIP 1.456
Web of Science (2014): Impact factor 4.504
The role of outer membrane proteins and lipopolysaccharides for the sensitivity of Escherichia coli to antimicrobial peptides

Bacterial resistance to classical antibiotics is emerging worldwide. The number of infections caused by multtdrug resistant bacteria is increasing and becoming a serious threat for human health globally. In particular, Gram-negative pathogens including multidrug resistant Escherichia coli are of serious concern being resistant to the currently available antibiotics. All Gram-negative bacteria are enclosed by an outer membrane which acts as an additional protection barrier preventing the
entry of toxic compounds including antibiotics and antimicrobial peptides (AMPs). In this study we report that the outer membrane component lipopolysaccharide (LPS) plays a crucial role for the antimicrobial susceptibility of E. coli BW25113 against the cationic AMPs Cap18, Cap11, Cap11-1-18m², melittin, indolicidin, cecropin P1, cecropin B, and the polypeptide antibiotic colistin, whereas the outer membrane protease OmpT and the lipoprotein Lpp only play a minor role for the susceptibility against cationic AMPs. Increased susceptibility toward cationic AMPs was found for LPS deficient mutants of E. coli BW25113 harboring deletions in any of the genes required for the inner part of core-oligosaccharide of the LPS, waaC, waaE, waaF, yaaG, and gmhA. In addition, our study demonstrates that the antimicrobial activity of Cap18, Cap11, Cap11-1-18m², cecropin B, and cecropin P1 is not only dependent on the inner part of the core oligosaccharide, but also on the outer part and its sugar composition. Finally, we demonstrated that the antimicrobial activity of selected Cap18 derivatives harboring amino acid substitutions in the hydrophobic interface, are non-active against wild-type E. coli ATCC29522. By deleting waaC, waaE, waaF, or yaaG the antimicrobial activity of the non-active derivatives can be partially or fully restored, suggesting a very close interplay between the LPS core oligosaccharide and the specific Cap18 derivative. Summarizing, this study implicates that the nature of the outer membrane component LPS has a big impact on the antimicrobial activity of cationic AMPs against E. coli. In particular, the inner as well as the outer part of the core oligosaccharide are important elements determining the antimicrobial susceptibility of E. coli against cationic AMPs.
A conceptual framework for developing the next generation of Marine OBservatories (MOBs) for science and society

In the field of ocean observing, the term of "observatory" is often used without a unique meaning. A clear and unified definition of observatory is needed in order to facilitate the communication in a multidisciplinary community, to capitalize on future technological innovations and to support the observatory design based on societal needs. In this paper, we present a general framework to define the next generation Marine OBservatory (MOB), its capabilities and functionalities in an operational context. The MOB consists of four interconnected components or "gears" (observation infrastructure, cyberinfrastructure, support capacity, and knowledge generation engine) that are constantly and adaptively interacting with each other. Therefore, a MOB is a complex infrastructure focused on a specific geographic area with the primary scope to generate knowledge via data synthesis and thereby addressing scientific, societal, or economic challenges. Long-term sustainability is a key MOB feature that should be guaranteed through an appropriate governance. MOBs should be open to innovations and good practices to reduce operational costs and to allow their development in quality and quantity. A deeper biological understanding of the marine ecosystem should be reached with the proliferation of MOBs, thus contributing to effective conservation of ecosystems and management of human activities in the oceans. We provide an actionable model for the upgrade and development of sustained marine observatories producing knowledge to support science-based economic and societal decisions.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Technical University of Denmark, Section for Oceans and Arctic, National Institute of Oceanography and Applied Geophysics, Stazione Zoologica Anton Dohrn Napoli, Hellenic Centre for Marine Research, National Oceanography Centre, University of Bremen
Contributors: Crise, A., d'Alcalà, M. R., Mariani, P., Petihakis, G., Robidart, J., Iudicone, D., Bachmayer, R., Malfatti, F.
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Scopus rating (2017): CiteScore 2.89 SJR 1.225 SNIP 0.862
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 0.53 SJR 1.425 SNIP 1.095
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.126 SNIP 0.812
BFI (2014): BFI-level 1
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Identifying Passive Message Fingerprint Attacks via Honey Challenge in Collaborative Intrusion Detection Networks
To enhance the detection capability of a single intrusion detection system (IDS), collaborative intrusion detection networks (CIDNs) have been exploited and developed via enabling a set of IDS nodes to exchange information with each other. In CIDNs, challenge-based trust mechanism has been considered as one promising solution to identify malicious nodes by evaluating the satisfaction levels between challenges and responses. However, such mechanism is still vulnerable to some advanced insider attacks like passive message fingerprint attack (PMFA), which is deemed as an advanced attack on challenge-based CIDNs by collecting messages and identifying normal requests in a passive way. In this work, we focus on PMFA and design Honey Challenge, an improved challenge mechanism for challenge-based CIDNs characterized by sending challenges in a similar way of sending normal requests, in such a way malicious nodes cannot accurately identify the normal requests. In the evaluation, we investigate the attack performance under both simulated and real network environments. Experimental results demonstrate that our proposed mechanism can identify malicious nodes under PMFA and decrease their trust values in a quick manner.

General information
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Organisations: Department of Applied Mathematics and Computer Science, Cyber Security, City University of Hong Kong, Guangzhou University, University of New Brunswick
Contributors: Li, W., Meng, W., Wang, Y., Kwok, L. F., Lu, R.
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Directional Statistics with the Spherical Normal Distribution
A well-known problem in directional statistics - the study of data distributed on the unit sphere - is that current models disregard the curvature of the underlying sample space. This ensures computationally efficiency, but can influence results. To investigate this, we develop efficient inference techniques for data distributed by the curvature-aware spherical normal distribution. We derive closed-form expressions for the normalization constant when the distribution is isotropic, and a fast and accurate approximation for the anisotropic case on the two-sphere. We further develop approximate posterior inference techniques for the mean and concentration of the distribution, and propose a fast sampling algorithm for simulating the distribution. Combined, this provides the tools needed for practical inference on the unit sphere in a manner that respects the curvature of the underlying sample space.

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Clinically-Relevant Rapamycin Treatment Regimens Enhance CD8⁺ Effector Memory T Cell Function In The Skin and Allow their Infiltration into Cutaneous Squamous Cell Carcinoma

Patients receiving immunosuppressive drugs to prevent organ transplant rejection exhibit a greatly increased risk of developing cutaneous squamous cell carcinoma (SCC). However, not all immunosuppressive drugs confer the same risk. Randomised, controlled trials demonstrate that switching renal transplant recipients receiving calcineurin inhibitor-based therapies to mammalian target of rapamycin (mTOR) inhibitors results in a reduced incidence of de novo SCC formation, and can even result in the regression of pre-existing premalignant lesions. However, the contribution played by residual immune function in this setting is unclear. We examined the hypotheses that mTOR inhibitors promote the enhanced differentiation and function of CD8⁺ memory T cells in the skin. Here, we demonstrate that the long-term oral administration of rapamycin to achieve clinically-relevant whole blood drug target thresholds, creates a "low rapamycin dose" environment in the skin. While both rapamycin and the calcineurin inhibitor tacrolimus elongated the survival of OVA-expressing skin grafts, and inhibited short-term antigen-specific CD8⁺ T cell responses, rapamycin but not tacrolimus permitted the statistically significant infiltration of CD8⁺ effector memory T cells into UV-induced SCC lesions. Furthermore, rapamycin uniquely enhanced the number and function of CD8⁺ effector and central memory T cells in a model of long-term contact hypersensitivity provided that rapamycin was present during the antigen sensitization phase.

Thus, our findings suggest that patients switched to mTOR inhibitor regimens likely experience enhanced CD8⁺ memory T cell function to new antigen-challenges in their skin, which could contribute to their lower risk of de novo SCC formation and regression of pre-existing premalignant lesions.
Role of the Raman gain in the noise dynamics of all-normal dispersion silica fiber supercontinuum generation

We theoretically and numerically study the influence of the Raman gain profile on the noise dynamics of the supercontinuum (SC) generation in a standard all-normal dispersion silica fiber using the scalar generalized nonlinear Schrödinger equation. In particular, we investigate the effect of the different secondary resonance gain peaks on the evolution of the SC coherence by comparing the coherence obtained when using the measured Raman gain of silica with that obtained using different analytical approximations. We demonstrate that the strongest secondary peak at 14.8 THz has a significant influence in that it leads to an early development of a decoherence band on the long wavelength side of the SC. In contrast, the decoherence is strongly dominated by the short wavelength side below the pump for all analytical models not taking this 14.8 THz gain peak into account. We demonstrate that this is due to the 14.8 THz peak being spectrally much narrower than the other gain peaks.

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Erratum to: Genome-wide association and HLA fine-mapping studies identify risk loci and genetic pathways underlying allergic rhinitis (Nature Genetics, (2018), 50, 8, (1072-1080), 10.1038/s41588-018-0157-1)
In the version of this article initially published, in Fig. 3, the y-axis numbering did not match the log scale indicated in the axis label. The error has been corrected in the HTML and PDF version of the article.

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Modelling of multi-lateral well geometries for geothermal applications

Well inflow modelling in different numerical simulation approaches are compared for a multi-lateral well. Specifically radial wells will be investigated, which can be created using Radial Jet Drilling (RJD). In this technique, powerful hydraulic jets are used to create small diameter laterals (25-50 mm) of limited length (up to 100 m) from a well. The laterals, also called radials, leave the backbone at a 90° angle. In this study we compare three numerical simulators and a semi-analytical tool for calculating inflow of a radial well. The numerical simulators are FE approaches (CSMP and GOLEM) and an FV approach with explicit well model (Eclipse®). A series of increasingly complex well configurations is simulated, including one with inflow from a fault. Although all simulators generally are reasonably close in terms of the total well flow (deviations &lt; 4% for the homogeneous cases), the distribution of the flow over the different parts of the well can vary significantly. Also, the FE approaches are more sensitive to grid size when the flow is dominated by radial flow to the well since they do not include a dedicated well model. In the FE approaches, lower dimensional elements (1-D for the well and 2-D for the faults) were superimposed into a 3-D space. In case the flow is dominated by fracture flow, the results from the FV approach in Eclipse deviates from the FE methods.

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Experimental investigation on ultimate strength and failure response of composite box beams used in wind turbine blades

This study focuses on the ultimate strength and failure response of composite box beams under three-point bending. The box beams consist of spar caps and shear webs and they are typically used in wind turbine blades as load-carrying members. Different spar cap configurations and loading directions are examined experimentally to investigate structural behavior associated with multiple nonlinearities leading to structural collapse. Global displacements, local strains and video images are recorded throughout the loading history to capture failure initiation, propagation and the strain state contributing to post-collapse characteristics. The failure mechanisms of the box beams involving geometric, material and contact nonlinearities are discussed in detail. The study shows that compressive crushing failure, driven by local buckling of shear webs, determines the ultimate strength of the box beams under flapwise loading, and adhesive joint debonding, initiated by local adhesive cracking and spar cap buckling, is the critical failure mode of the box beams under edgewise loading. The Brazier effect and shear nonlinearity contribute to the initial failure depending on the loading directions. Debonding rather than delamination characterizes post-collapse behavior of all box beams examined in this study.

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