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Opportunities for Master of Science by Research (MScRes) study at the School of Ocean Sciences at Bangor University

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Introduction

In this booklet you can find out more about current opportunities to undertake a self-funded Master of Science by Research (MScRes) degree at the School of Ocean Sciences, entirely focused on a research project of your choice.

The MSc by Research (MScRes) is a one-year full-time research programme (or 2 years part-time) that differs from a taught Masters programme by placing more emphasis on research, and by being examined much more like a PhD, by an internal and an external examiner, rather than by grading of coursework and dissertation. This degree will equip you with confidence and competence in the latest research skills (including generic skills such as literature searching, legal and ethical aspects, project planning, grant proposal writing, and statistical analysis of data) and allow you to apply for further research training (PhD) programmes, or to directly apply for research positions in universities or research institutes.

The list or projects in this document is not exhaustive; please feel free to contact individual members of staff whose research aligns with your own interests to discuss additional possibilities.

In addition to working on your research projects, as postgraduate researchers at Bangor you will have access to a range of research skills and professional development training opportunities as well as the chance to develop your teaching skills by undertaking paid demonstrating opportunities for modules on our undergraduate curriculum.

You will also present your work at the annual School and College Postgraduate Conferences and become part of the vibrant College research community. There are multiple research seminars that run across the three Schools within the College of Science and Engineering, and you'd be able to join any that relate to your research interests.

Successful applicants typically have a good first degree in a relevant subject (2:1 or above). While the minimum qualification that would allow you to apply for this programme of study at Bangor University is a 2:2, if that is the case we strongly encourage that you discuss your academic background with a potential supervisor before applying. If you have valuable non-academic experience that is relevant to your research plans, you may be in a good position to secure a place on this course, even if you do not have a First or a 2:1 degree from your undergraduate studies.

You would also need to have identified a way to fund your studies (tuition fees, bench fees, living expenses).

How to apply: The first step is to identify a project you are interested in then and contact the member of staff who is advertising it. They will then advise you if and how you should make a formal application to the University. When contacting potential

supervisors, you should briefly outline your academic background and explain your interest in the project you are contacting them about, as well as attach a CV.

Do not submit a direct application for a postgraduate research degree to Bangor University without first identifying a potential supervisor and discussing your research interests with them first.

In addition to contacting the individual members of staff who have advertised specific projects here, you may also contact the following staff with general inquiries:

School Director of Postgraduate Research Studies (School of Ocean Sciences): Dr James Waggitt (j.waggitt@bangor.ac.uk)

College Director of Postgraduate Research Studies (College of Science and Engineering): Dr Alexander Georgiev (a.georgiev@bangor.ac.uk)

MScRes in Ocean Sciences

https://www.bangor.ac.uk/courses/postgraduate-research/ocean-sciences-mscres

Benthic Ecology

Impact of future sea bottom heatwaves on benthic organisms

Subject area: Oceanography (modelling, climate projection, heatwaves)

Supervisor(s): Soizic Garnier (https://www.bangor.ac.uk/staff/sos/soizic-garnier-658279/en), Peter Robins (https://www.bangor.ac.uk/staff/sos/peter-robins-011021/en), Luis Gimenez (https://www.bangor.ac.uk/staff/sos/luis-gimenez-noya-016503/en)

Contact: s.garnier@bangor.ac.uk

Project description:

This project investigates the combined effect of a long-term projected warming as well as the behaviour and evolution of sea bottom heatwaves on benthic species. Using hydrodynamic outputs from a high-resolution climate model of the northwest European shelf seas under the high-emission RCP8.5 scenario (1991–2099), the research will analyse projected warming trends and heatwaves using a shifting baseline climatology approach. The student will identify focal benthic species with well-documented temperature sensitivities/thresholds and spatial distributions and explore how warming and heatwaves may impact them over varying timescales. Addressing the research gap

in how marine heatwaves influence deeper water regions, the study aims to provide critical insights into benthic species' ecological responses, with findings intended for publication.

Reproduction in shallow water Antarctic marine invertebrates

Subject area: Marine ecology

Supervisor(s): Dr Laura Grange (https://www.bangor.ac.uk/staff/sos/laura-grange-479754/en) and Professor Lloyd Peck (British Antarctic Survey)

Contact: l.grange@bangor.ac.uk

Project description:

Human driven environmental forcing is producing broad-scale change in marine ecosystems. Although climate change affects marine organism physiology and behaviour, the impacts of environmental variation on fundamental biological functions such as reproduction remain poorly understood. The waters round the Antarctic Peninsula are the most rapidly warming marine environments on Earth, with many shallow-water species nearing the upper limit of their thermal tolerance. For 20 years we have collected samples of the sea star *Odontaster validus*, brittlestar *Ophionotus victoriae*, and sea urchin *Sterechinus neumayeri* to examine the long-term reproductive biology of these species. Using this globally unique time-series, this project aims to use gonad index and standard wax histology techniques to elucidate how environmental variability has impacted the reproductive success of these shallow-water, marine invertebrates.

Investigating reproductive trait variability in Arctic benthic marine invertebrates

Subject area: Marine ecology

Supervisor(s): Dr Laura Grange (https://www.bangor.ac.uk/staff/sos/laura-grange-479754/en), Senior Scientist Lis Jorgensen (Institute of Marine Research, Norway) and Dr Terri Souster (UiT, The Arctic University of Norway)

Contact: l.grange@bangor.ac.uk

Project description:

Interest in trait-based approaches – such that consider morphological, physiological, behavioural, and life history characteristics – in the marine environment has grown over recent decades. Against a backdrop of rapid environmental change, these methods

present opportunities to inform our understanding of a species' potential vulnerability to change and climate impacts on ecosystem function. Environmental forcing in the northern high latitudes is now widely acknowledged as driving rapid change in Arctic marine ecosystems, but the effects of climate variability on the persistence of species in the Arctic is lacking. By quantifying a range of morphometric and reproductive traits across a collection of pan-Arctic marine invertebrates, this study aims to determine whether a species' reproductive traits are phylogenetically constrained or vary with environmental forcing.

Reproduction in an Antarctic ascidian

Subject area: Marine ecology

Supervisor(s): Dr Laura Grange (https://www.bangor.ac.uk/staff/sos/laura-grange-479754/en), and Professor Lloyd Peck (British Antarctic Survey)

Contact: l.grange@bangor.ac.uk

Project description:

Human driven environmental forcing is producing broad-scale change in marine ecosystems. Although climate change affects marine organism physiology and behaviour, the impacts of environmental variation on fundamental biological functions such as reproduction remain poorly understood. The waters round the Antarctic Peninsula are the most rapidly warming marine environments on Earth, where the inability to move and avoid local stress conditions renders sessile, suspension feeding organisms particularly vulnerable to ongoing environmental forcing. Suspension feeders are also constrained in respiration and growth succumbing to die outs owed to sedimentary smothering of their filtration surfaces caused by climate-induced glacial melt. Using a globally unique time-series of ascidians, this project aims to use wax histology to elucidate how environmental change has impacted long-term reproductive success.

Marine underwater monitoring in the 21st century

Subject area: marine ecology, marine monitoring, machine learning, bivalves

Supervisor(s): Dr Svenja Tidau (https://www.bangor.ac.uk/staff/sens/svenja-tidau-497222/en), Dr Marianna Chimienti https://www.bangor.ac.uk/staff/sos/marianna-chimienti-684036/en , Dr Christian Berger (industry partner) www.pebl-cic.co.uk

Contact: s.tidau@bangor.ac.uk

Project description:

Sessile marine invertebrates like corals and bivalves are important ecosystem engineers and build biogenic reefs that provide habitats and ecosystem services like food provisioning and water filtration. Understanding their behaviour, species-specific traits, population dynamics, and the community they support is vital for marine conservation. Traditionally, these animals have been studied through labour-intensive and disruptive manual surveying with low temporal resolution. Advances in automated underwater imaging and passive acoustics now enable more feasible, affordable, and non-intrusive monitoring, allowing detailed data collection over long periods. This project will use high-resolution underwater imaging systems and passive acoustic monitoring to explore sessile invertebrate communities over 24-hour cycles, providing insights into night-time ecology and environmental factors influencing ecosystem services.

Quantifying the role of natural and anthropogenic light and sound on temperate marine ecosystems

Subject area: marine ecology, global change research, sensory pollution, larval ecology

Supervisor(s): Svenja Tidau (https://www.bangor.ac.uk/staff/sens/svenja-tidau-497222/en), Stuart R Jenkins (https://www.bangor.ac.uk/staff/sos/stuart-jenkins-008971/en)

Contact: s.tidau@bangor.ac.uk

Project description:

Sessile marine invertebrates are crucial ecosystem engineers. They develop through complex life cycles, with larvae relying on environmental cues like light and sound for movement and settlement. While the importance of natural light cycles is well-known, studies on natural soundscapes are rather recent. Anthropogenic light (ALAN) and noise can disrupt these processes, yet their combined effects are rarely studied.

This project will experimentally quantify the impact of natural and anthropogenic light and sounds on benthic fauna. We will measure settlement success, growth, biomass,

and community composition of sessile invertebrates in manipulated light and sound conditions.

Understanding the combined effects of ALAN and noise can inform aquaculture, shellfish industries, and the restoration of benthic habitats, benefiting native oysters, and horse mussels.

Oceanography

How do met-ocean conditions influence rogue wave probabilities?

Subject area: Oceanography

Supervisor(s): Prof. Simon Neill https://www.bangor.ac.uk/staff/sos/simon-neill-010526/en, Edward Roome https://www.bangor.ac.uk/research-students/sos/edward-roome-486253/en

Contact: s.p.neill@bangor.ac.uk

Project description: Rogue waves are wind-generated surface waves that are much larger than the surrounding sea state. Despite decades of research, an accurate operational rogue wave forecasting system is yet to be developed. In recent years however, large quality-controlled wave datasets have been developed, leading to advancements in understanding of rogue waves. This project will combine observations from the Channel Coastal Observatory (CCO) dataset with hindcasts of met-ocean parameters in order to investigate the impact of meteorological (e.g. wind speeds) and oceanographic (e.g. surface currents) conditions on rogue wave probability. The CCO dataset contains over 500 years of combined quality-controlled wave measurements from 40 sites situated across the UK coast (e.g. North Sea, English Channel). For each site, over 40 sea state and wave parameters have been computed using a state-of the-art wave-by-wave processing tool. These quantities have been used to identify sea states which encourage the formation of rogue waves. You will expand on this work by extracting outputs from global ocean and atmospheric models, in an attempt to identify specific met-ocean conditions which may increase the likelihood of a rogue wave. In this project, you will develop a strong ability to manipulate, analyse, and visualise large datasets whilst improving your understanding of ocean wave physics and statistics.

Start date: Any

High latitude tidal energy resource

Subject area: Ocean Renewable Energy/Oceanography

Supervisor(s): Prof. Simon Neill https://www.bangor.ac.uk/staff/sos/simon-neill-010526/en

Contact: s.p.neill@bangor.ac.uk

Project description:

The Arctic Ocean could become ice free during the summer months as early as 2030. Although this has devastating consequences for the planet, including reduced albedo (and so further absorption of sunlight), sea-level rise and changing weather patterns, there are some aspects that could be exploited. These include new shipping routes and access to resources. One of these resources is tidal energy conversion (kinetic energy and potential energy), as there are numerous energetic inter-island channels (e.g. Baffin Island) and regions of relatively high tidal range such as the Barents Sea. These resources have never been quantified, and so the aim of the project is to "investigate the high latitude tidal range and tidal stream resource". Within the project you will analyse high-resolution Arctic tidal models from the Arctic Data Center, including 1 km Greenland and 2 km Arctic models. You will calculate theoretical tidal range and stream resource, estimating technical potential by assessing suitable technologies and seasonal ice-related downtime, and evaluating practical constraints such as proximity to ports and appropriate water depths for installation and maintenance. You will also set up and run your own models of selected areas at higher resolution using the Delft3D-FM modelling framework to investigate candidate regions in more detail.

Start date: Any

HOOFBEATS (**HO**tspots **OF BE**nthic productivity **A**rising from **Tidal** modulation of light in the **S**hallow sub-tidal zone): the return of the 'optical depth of the bed'.

Subject area: Oceanography/Marine Optics; Marine Ecology

Supervisor(s): Dr. Emyr Martyn Roberts (https://www.bangor.ac.uk/staff/sos/martyn-roberts-056696/en); Prof. Mattias Green (https://www.bangor.ac.uk/staff/sos/mattias-green-009325/en); Dr. Martyn Kurr (https://www.bangor.ac.uk/staff/sos/martyn-kurr-045170/en)

Contact: martyn.roberts@bangor.ac.uk

Project description:

Hear HOOFBEATS and think 'horses', not 'zebras', or so goes the old adage. And yet sometimes even the most obvious conclusions have not been tested: light is fundamental to most primary production in the ocean; tides modulate the light reaching the seabed in our shallow shelf seas; therefore, geographical variations in tidal

characteristics should structure the productivity of the seabed spatially around coastlines globally. The aim of this project is to predict the distribution of hotspots in benthic productivity, arising from the tide's influence on light at the seabed. This project invokes a parameter called 'the optical depth of the bed', which will capture the combined influence of water depth and clarity (both often tidally modulated) on the light levels to which macrophytes (e.g., kelps, seagrasses) are exposed. You will use large, gridded data products, such as outputs from tidal models and satellite Earth observation missions to predict likely hotspots of benthic productivity from the prevailing underwater light climate. You will use discrete underwater light observations, seabed sediment (substrate) maps, and estimates of biological productivity, where available, to validate/explore your predictions, their strengths and limitations. This project will result in spatial maps and recommendations that could inform benthic conservation strategies. Candidates must be proficient in a coding language, such as MATLAB or Python, and be able to manipulate and make computations using geospatial datasets.

Start date: Jan / Apr / Oct

Impacts of climate change on estuary water quality

Subject area: Oceanography, Ocean Modelling

Supervisor: Peter Robins (https://www.bangor.ac.uk/staff/sos/peter-robins-011021/en)

Contact: p.robins@bangor.ac.uk

Project description:

Estuaries regulate global nutrient cycles that drive the biodiversity and ecology of coastal wildlife and provide ecosystem services such as food security and tourism that sustain the livelihoods and wellbeing of coastal communities (Fulford 2020). Estuaries are, however, potential pollution sinks for sewage containing water-borne pathogens (Robins 2019) and plastics, and susceptible to environmental degradation from, e.g., harmful algal blooms and hypoxia (Hannaford 2021) that pose serious environmental and human health risks (Freeman 2019).

The aim of this project is to characterise the variability and potential change in estuary health across Welsh estuaries, being the first study to analyse new hourly-resolution climate projections for the UK this century. Changes in water temperatures and salinities will be explored, as well as shifts in the behaviour, timing, and co-dependence

of river flows and sea levels, during episodic events and over longer time scales. Indicators and tipping-points of water quality degradation will be identified, for example, the changing behaviour of droughts and heatwaves, residence times, and flash flood events that carry turbid and polluted waters, as well as variabilities due to estuary shape. This project is supported by Natural Resources Wales and compliments a current England-wide study led by the Environment Agency, to deliver a pan England-Wales (~75 estuaries) vulnerability assessment that will inform a UK Government policy gap to manage UK estuaries in the face of climate change.

Marine Ecology

What Determines Seafloor Recovery? Identifying Drivers of Benthic Community Regeneration

Subject area: Marine ecology

Supervisor(s): Prof Jan Geert Hiddink https://www.bangor.ac.uk/staff/sos/jan-geert-hiddink-009786/en

Contact: j.hiddink@bangor.ac.uk

Project description:

Human activities such as bottom trawling and aggregate dredging can leave lasting impacts on the seabed, disrupting the complex communities of organisms that live there. Yet, given time and the right conditions, these ecosystems can recover. How fast they do so—and what drives that recovery—remains a critical question for marine conservation and restoration.

This project will uncover the key factors that shape how quickly benthic invertebrate communities bounce back after disturbance. Using data from published studies across a range of environments—including marine protected areas, artificial substrates like settlement panels, deep-sea mining sites, and areas recovering from natural impacts such as iceberg scouring and storms—you will quantify and compare recovery trajectories.

By fitting logistic recovery models to these datasets, you will estimate recovery rates and use statistical modelling to identify their main drivers, such as water depth, species life span, and substrate type. These insights will enable predictions of recovery in areas where it has not yet been observed, providing a powerful evidence base for ecosystem-based management.

The findings of this project will directly inform marine restoration and conservation strategies—supporting smarter design of marine protected areas and accelerating progress toward sustainable ocean recovery.

Start date: Jan / Apr / Oct

Ecology of intraspecific trait variation: Role of body size in modulating density-dependent survival in a marine barnacle

Subject area: Marine Ecology, Population dynamics, Theoretical ecology

Supervisor(s): Luis Gimenez https://www.bangor.ac.uk/staff/sos/luis-gimenez-noya-016503/en, Stuart Jenkins: https://www.bangor.ac.uk/staff/sos/stuart-jenkins-008971/en

Contact: l.gimenez@bangor.ac.uk

Project description:

Recruitment is the process by which young stages of organisms are incorporated in the adult cohorts. Quantifying the drivers of recruitment is central to understand the causes of fluctuations of natural populations of organisms and carry out appropriate management of natural resources. Most theories of recruitment assume that individuals of the same age are all equal and hence disregard the importance of phenotypic variation as a driver of fluctuations in natural populations. However, there is currently a growing number of studies showing that variations in important traits such as body size. In this project, we will use sessile barnacles as models to study how variations in body size modulate the effect of density-dependent survival and habitat quality on the spatial variations in local populations. Past studies have shown that populations are characterised by important variations in body size, which can modulate the effect of density-dependent mortality on the abundance of local populations (Giménez & Jenkins 2013, 2024). This project will collect data along the year through photographs taken in intertidal areas to quantify the role of barnacle body sizes and density in driving patterns of survival and fecundity at different sites of Anglesey. There scope for ideas, including the development and test of models predicting recruitment. REFS: Giménez L, Jenkins SR (2013) PLoS ONE 8(3): e57849. https://doi.org/10.1371/journal.pone.0057849; Giménez L, Jenkins SR (2024). Ecology and Evolution 14:270065. https://doi.org/10.1002/ece3.70065

Start date: April or October

Seagrass–Infauna Interactions: Biodiversity Effects on Ecosystem Function and Restoration Success

Subject area: Marine Ecology, Seagrass Ecology, Biodiversity-Ecosystem Function

Supervisor(s): Dr. Katie DuBois: https://www.bangor.ac.uk/staff/sos/katie-dubois-683533/en, Dr. Craig Robertson: https://www.bangor.ac.uk/staff/sos/craig-robertson-016770/en

Contact: k.dubois@bangor.ac.uk

Project description:

Seagrass meadows are vital coastal ecosystems that support biodiversity, store carbon, and stabilize sediments, yet they are declining worldwide. Dwarf eelgrass (*Zostera noltii*) provides essential habitat for diverse infaunal communities such as clams, cockles, and worms, but the role of these species in seagrass restoration remains poorly understood. This project investigates how infaunal biodiversity and functional traits influence seagrass growth, survival, and ecosystem functioning. Through field-based or mesocosm-based co-culture experiments, students will test whether increasing infaunal diversity enhances seagrass productivity and carbon cycling. By integrating seagrass–bivalve ecology with sediment biogeochemistry, this study will quantify how benthic biodiversity drives seagrass restoration success and blue carbon potential in marine systems impacted changing climates. Depending on student's specific interests and career goals, the student will have the opportunity to gain skills in experimental design, ecological fieldwork, culturing marine species in seawater tank systems, and data analysis while contributing to new understanding of biodiversity–ecosystem function relationships in marine habitats.

Start date: Jan / Apr / Oct

Resilience of Macroalgal Meadows: Assessing the Impacts of Ocean Warming on Coastal Ecosystem Function

Subject area: Marine Ecology, Phycology (Macroalgae), Ocean Warming

Supervisor(s): Dr. Katie DuBois: https://www.bangor.ac.uk/staff/sos/katie-dubois-683533/en, Dr. Luis Gimenez Noya: https://www.bangor.ac.uk/staff/sos/luis-gimenez-noya-016503/en, Prof Stuart Jenkins: https://www.bangor.ac.uk/staff/sos/stuart-

jenkins-008971/en, Dr. Martyn Roberts: https://www.bangor.ac.uk/staff/sos/martyn-roberts-056696/en

Contact: k.dubois@bangor.ac.uk

Project description:

Intertidal and subtidal macroalgal meadows are essential coastal ecosystems that support fisheries, aquaculture, and carbon sequestration. In Northern Wales, key habitat-forming species such as kelps (ex. *Laminaria hyperborea*) and rockweeds (ex. *Ascophyllum nodosum*) are increasingly vulnerable to ocean warming. Rising temperatures may reduce macroalgal productivity through physiological stress and alter community dynamics by intensifying herbivory. This project will investigate both the direct and indirect effects of ocean warming on the resilience and recovery of macroalgal meadows, as well as generating critical baseline data for Northern Wales. The project offers opportunities for training in ecological survey design, field and laboratory experimentation, and quantitative data analysis. Depending on the student's interests and career goals, the research can focus on physiological responses, species interactions, or ecosystem-scale implications of climate change for coastal resilience.

Start date: Jan / Apr / Oct

Environmental Pollution

Plastics in the poles: Investigating Microplastic Movement within the Antarctic Marine Food Web

Subject area: Microplastics, Marine pollution, Marine ecology, Antarctica

Supervisor(s): Dr Laura Grange (Bangor University), Dr Winnie Courtene-Jones (Bangor University) and Professor Davey Jones (Bangor University) in collaboration with Dr Ben Wigham (Newcastle University) and Professor Lloyd Peck (British Antarctic Survey)

Contact:; l.grange@bangor.ac.uk

Project description:

Microplastics are recognised as a pollutant of global concern due to their widespread distribution, reaching even the most isolated marine ecosystems such as the Southern Ocean and deep sea. Despite recognition of their prevalence, the dynamics of

microplastic movement through food webs and trophic hierarchies remain poorly resolved. However, their persistence and durability raise concerns about ecological impacts and potential for bioaccumulation in higher trophic levels. This study uses multi-year samples from shallow-water habitats adjacent to Rothera Research Station on Adelaide Island, off the West Antarctic Peninsula, to quantify microplastics within marine food webs—from primary consumers to higher trophic levels. UV microscopy and Laser Direct Infrared (LDIR) spectroscopy will be employed to characterise plastic particles by size, shape, and chemical composition. Data will provide insights into trophic transfer and contribute to ongoing research on microplastic ingestion in polar benthic species, including a suspension-feeding holothurian, an omnivorous scavenging sea star, and a giant predatory nemertean worm. Additionally, this work will improve understanding of the fate and types of microplastics in one of the most remote locations on Earth, which supports unique and vulnerable biodiversity. It will also generate insights that can be applied to global models of plastic pollution and its ecological consequences.

Start date: Jan / Apr / Oct

Microplastics in marine food chains: are seaweeds vectors for the transfer of microplastics to marine grazing species?

Subject area: Microplastics; environmental pollution; marine biology

Supervisor(s): Dr Winnie Courtene-Jones (https://www.bangor.ac.uk/staff/sos/winnie-courtene-jones-014870/en), Dr. Jaco Baas, https://www.bangor.ac.uk/staff/sos/jaco-baas-009331/en with assistance from: Caitlin Taylor-Robinson (https://www.bangor.ac.uk/research-students/sos/caitlin-taylor-robinson-110098/en)

Contact: w.courtenejones@bangor.ac.uk

Project description:

Plastic pollution is a pressing global challenge, with environmental quantities increasing over the last two decades. Microplastics are ingested by a diversity of marine organisms, often with adverse effects associated, yet major gaps remain in understanding their transfer between trophic levels.

On rocky shores, seaweeds provide habitat, food, and shelter for diverse communities. Seaweed biofilms and exuded polysaccharides may promote the adherence and retention of microplastics, providing a potential pathway for the ingestion of microplastics by grazing species, such as periwinkles and topshells.

This project investigates whether seaweeds act as vectors for microplastic transfer into the marine food chain. It will qualitatively and quantitatively assess the extent to which microplastics adhere to seaweed surfaces and are ingested by grazing organisms.

Wild-collected seaweeds will be exposed to microplastics in a series of laboratory and hydrodynamic flume experiments to assess surface adherence, and quantified via microscopy and analytical techniques. There is scope for the experiments to manipulate seaweed/seagrass species and environmental conditions (e.g. water flow, polysaccharide exudates and biofilm levels) to identify factors influencing adherence. Feeding trials with grazing invertebrates such as periwinkles and topshells will then evaluate trophic transfer of microplastics from seaweed to grazers.

Start date: Flexible and open to discussion.