



Submit by Monday 2 December 2013

### DARWIN INITIATIVE APPLICATION FOR GRANT FOR ROUND 20: STAGE 2

Please read the Guidance Notes before completing this form. Where no word limits are given, the size of the box is a guide to the amount of information required.

Information to be extracted to the database is highlighted blue.

#### ELIGIBILITY

**1. Name and address of organisation** (NB: Notification of results will be by email to the Project Leader)

<b>Name of organisation:</b> University of Stirling (UoS)	<b>Address:</b> University of Stirling, Institute of Aquaculture, Stirling, FK9 4LA, UK
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**2. Stage 1 reference and Project title**

(max 10 words)

Alternative livelihood opportunities for Marine Protected Areas fisherwomen (Ref 2314)

**3. Project dates, and budget summary**

<b>Start date:</b> 1 April 2014		<b>End date:</b> 31 March 2017		<b>Duration:</b> 3 years
<b>Darwin request</b>	2014/15 £97,447	2015/16 £70,235	2016/17 £79,582	Total £247,264
<b>Proposed (confirmed and unconfirmed) matched funding as percentage of total Project cost:</b> £24,000 (9%)				
<b>Are you applying for DFID or Defra funding?</b> (Note you cannot apply for both)		DFID		

**4. Define the outcome of the project. This should be a repetition of Question 24, Outcome Statement.**

(max 30 words)

Incomes of oyster-fisherwomen in at least 40 households of the Sherbro MPA increased by 45% pa and abundance/ mean-size of adjacent wild-oyster populations increased by at-least 18% over base-line levels.

**5. Country(ies)**

Which eligible host country(ies) will your project be working in. You may copy and paste this table if you need to provide details of more than four countries.

<b>Country 1:</b> Sierra Leone	<b>Country 2:</b>
<b>Country 3:</b>	<b>Country 4:</b>

**6. Biodiversity Conventions**

Which of the three conventions supported by the Darwin Initiative will your project be

supporting? Note: projects supporting more than one convention will not achieve a higher scoring

Convention On Biological Diversity (CBD)	Yes
Convention on Migratory Species (CMS)	No
Convention on International Trade in Endangered Species (CITES)	No

### 6b. Biodiversity Conventions

Please detail how your project will contribute to the objectives of the convention(s) your project is targeting. You may wish to refer to Articles or Programmes of Work here.

Note: No additional significance will be ascribed for projects that report contributions to more than one convention

**(Max 200 words)**

The project will reduce pressure on the mangrove forests of Sierra Leone. The majority of mangrove forests have been degraded by over harvesting for firewood and timber, damaged by unsustainable harvest of products such as oysters or converted into rice fields, shrimp ponds and salt pans. Mangroves within the Sherbro River Estuary remain in remarkably good condition with good stands of all four main species. There are reliable reports of a range of threatened species including manatees and crocodiles as well as dolphins and marine turtles in the main channel. The area is an important bird area with extensive areas of sand and mud banks exposed at low tide. Like all mangroves they act as nursery for many species of finfish and shellfish. The Sherbro River Estuary mangroves have been given general protection under the "Marine Protected Area" by a Gazetted Cabinet Conclusion (CSF/394/CP (2012)19), the enforcement of these regulations relies almost entirely on "local management committees" (LMCs). The success of these committees will rely in large part on there being alternative livelihoods available to those prevented from harvesting aquatic resources in strictly protected areas.

**Is any liaison proposed with the CBD/CITES/CMS focal point in the host country?**

Yes  No      if yes, please give details:

If successful we will coordinate our activities with those of the MPA and with the CBD/CITES focal point in the Ministry.

7. Principals in project. Please identify and provide a one page CV for each of these named individuals. You may copy and paste this table if you need to provide details of more personnel or more than one project partner.

Details	Project Leader	Project Partner 1	Project Partner 2	Project Partner 3
<b>Surname</b>	Murray	Sankoh	Wadsworth	Stephen
<b>Forename (s)</b>	Francis	Salieu	Richard	Akester
<b>Post held</b>	Lecturer	Research Fellow/ Lecturer	Professor	Fisheries Specialist/consultant and Director
<b>Institution</b> (if different to above)	University of Stirling (UoS)	Fourah Bay College, University of Sierra Leone	Njala Univeristy (NJU)	Macalister Elliott and Partners (MEP)
<b>Department</b>	Institute of Aquaculture (IoA)	Inst. of Marine Biology and Oceanography (IMBO)	School of Environmental Science	Macalister Elliott and Partners
<b>Telephone</b>				
<b>Email</b>				

**8. Has your organisation been awarded a Darwin Initiative award before (for the purposes of this question, being a partner does not count)? If so, please provide details of the most recent awards (up to 6 examples).**

Reference No	Project Leader	Title
[DEFRA No 13/011]	Professor Lindsay G Ross and Dr Carlos A Martínez Palacios	Sustaining livelihoods and protecting biodiversity through development of 'pez blanco' aquaculture <a href="http://www.aqua.stir.ac.uk/GISAP/native-species/darwin/">http://www.aqua.stir.ac.uk/GISAP/native-species/darwin/</a>
Fellowship EIDPS014	Mr. Anton Immink	MSc in Sustainable Development in support of project work at Koshi Tappu Wetland Reserve, Nepal

**9a. If you answered 'NO' to Question 8 please complete Question 9a, b and c. NA**  
**If you answered 'YES', please go to Question 10 (and delete the boxes for Q9a, 9b and 9c)**

**10. Please list all the partners involved (including the Lead Institution) and explain their roles and responsibilities in the project. Describe the extent of their involvement at all stages, including project development. This section should illustrate the capacity of partners to be involved in the project. Please provide written evidence of partnerships. Please copy/delete boxes for more or fewer partnerships.**

<p><b>Lead institution and website:</b>            Institute of Aquaculture, Stirling University (UoS)   <a href="http://www.aqua.stir.ac.uk/">http://www.aqua.stir.ac.uk/</a></p>	<p><b>Details (including roles and responsibilities and capacity to engage with the project): (max 200 words)</b></p> <p>Lead responsibility for financial administration, project oversight, reporting and dissemination (WP1)</p> <p>Provision of technical advice on alternative methods of culturing oysters. Identify a range of sites with different hydrographic characteristics, (tidal range, influence of freshwater, turbidity etc.) and propose the most appropriate systems (rafts, long lines, trays) using materials locally available in Sierra Leone.</p> <p>Conduct of livelihoods analyses &amp; research sample-design, capacity building for collective management of multiple-use aquatic resources (WP2) and marketing support (WP3).</p> <p>The Sustainable Aquaculture Research Group (SARG) has considerable experience coordinating research and development projects in West/East Africa and Asia. Current projects include Sarnissa, an African regional aquaculture-research networking initiative now in its ninth year (<a href="http://www.sarnissa.org">http://www.sarnissa.org</a>) and two large-scale collaborative EU FP7 projects; PROteINSECT (<a href="http://www.proteinsect.eu/">http://www.proteinsect.eu/</a>) and Sustaining Ethical Aquaculture Trade (<a href="http://www.SEATglobal.eu">www.SEATglobal.eu</a>). Dr Murray has trained certification auditing companies on the recently released WWF/ASC bivalve aquaculture standards. <a href="http://www.asc-aqua.org/upload/ASC%20Bivalve%20Standard_v1.0.pdf">http://www.asc-aqua.org/upload/ASC%20Bivalve%20Standard_v1.0.pdf</a></p>	
<p><b>Have you included a Letter of Support from this institution?</b></p>		<p>Yes</p>

<p><b>Partner Name and website:</b>  Institute of Marine Biology and Oceanography (IMBO)  <a href="http://www.fbc.usl.edu.sl/">http://www.fbc.usl.edu.sl/</a></p>	<p><b>Details (including roles and responsibilities and capacity to engage with the project): (max 200 words)</b></p> <p>IMBO will lead local coordination and implementation of field-work in the Sherbro MPA. Through its established networks it will also be the project liason with the following project affiliates: the West African Regional Fisheries Project, the Ministry of Fisheries and Marine Resources (MFMR) and with the MPA management and devolved Local Management Committees (LMCs). Based on previous reconnaissance work in the MPA (in collaboration with Njala University) Dr Sankoh will also liaise with oyster fisherwomen groups – the principle intended beneficiaries of the project.</p> <p>IMBO will conduct baseline studies on biodiversity and levels of community dependence on the ecosystems goods and services in target areas. It will also conduct project impact assessment surveys in collaboration with Njala University and lead the supply-chain development activity (WP3).</p> <p>As part of the University of Sierra Leone. IMBO is a research and teaching institute, specialising in oceanographic research including fisheries exploitation relevant to the needs of West African Maritime Nations. Dr Sankoh’s recent project coordination responsibilities include DelPhe and Edulink (CODWAP) capacity-building projects. He is also highly familiar with Sherbro MPA and its statutes. Dr Sankoh is a graduate of the UoS Institute of Aquaculture.</p>
<p><b>Have you included a Letter of Support from this institution?</b></p>	<p>Yes</p>

<p><b>Partner Name and website:</b>  Njala University (NJU)  <a href="http://njalauniversity.edu.sl/">http://njalauniversity.edu.sl/</a></p>	<p><b>Details (including roles and responsibilities and capacity to engage with the project): (max 200 words)</b></p> <p>NJU will contribute to the development of the research design and impact assessment through GIS mangrove mapping, integration and interrogation of geographic data from the MPA. It will also be responsible for statistical analysis and verification of project outcomes based on environmental, social and economic sustainability indicators (WP2).</p> <p>NJU will also lead on market promotion (WP4) though the staging of regional followed by a national competition for local oyster recipes, through its Home Economics Department.</p> <p>Dr Wadsworth has conducted reconnaissance survey work in the Sherbro MPA as a component of a previous Darwin Project (Wadsworth 2009a).</p>
<p><b>Have you included a Letter of Support from this institution?</b></p>	<p>Yes</p>

<p><b>Partner Name and website:</b>  Macalister Elliott and Partners (MEP)  <a href="http://macalister-elliott.com">http://macalister-elliott.com</a></p>	<p>Details (including roles and responsibilities and capacity to engage with the project): (max 200 words)</p> <p>MEP will provide advice on how to become accredited as a “marine sustainable” supplier based on assessment of the resultant value-chains against principle market-based fisheries and aquaculture standards (e.g. MSC, GlobalGap, WWF/ASC, GAA/ACC, Fairtrade and Organic) and international codes on responsible aquaculture (e.g. FAO Code of Conduct for Responsible Fisheries, FAO Principles for Promoting Aquaculture in Africa). This assessment will also contribute to the development of policy recommendations for incorporation of bivalve-aquaculture zoning and management principles in MPA statutes.</p>
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<p><b>Have you included a Letter of Support from this institution?</b></p>	<p><b>Yes</b></p>
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<p><b>11. Have you provided CVs for the senior team including the Project Leader</b></p>	<p><b>Yes</b></p>
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## 12. Problem the project is trying to address

Please describe the problem your project is trying to address. For example, what biodiversity and challenges will the project address? Why are they relevant, for whom? How did you identify these problems?

### (Max 200 words)

Many oyster fisherwomen are trapped in a vicious downward spiral of environmental destruction and resource depletion. Because they are poor, lacking capital and alternative sources of income, they are compelled to harvest oysters throughout the year. Consequently the harvested oysters become smaller and less valuable, so they have to harvest more exacerbating the problem. It is a hard and dangerous life, injuries such as infected cuts from roots and shells are common. Mangrove trees are damaged by the harvesting and habitat for other species is disturbed. If the oysters are exterminated from an area one of the few options left for the women will be to cut the trees for firewood. Most of the commercial fish species in Sierra Leone depend on the mangroves as spawning and nursery area. We aim to support the work of the Marine Protected Area by providing alternative livelihoods based on extensive culture and value-added marketing of native mangrove oysters. The problem was first identified during 2006/7 by a previous Darwin Initiative project under which two reconnaissance surveys (Wadsworth 2009a & 2009b) were undertaken to consider the possibility of including the mangrove forests as a "biodiversity offset" to a Rutile-mineral mining concession (NACE 2009).

## 13. Methodology

Describe the methods and approach you will use to achieve your intended outcomes and impact. Provide information on how you will undertake the work (materials and methods) and how you will manage the work (roles and responsibilities, project management tools etc.).

(Max 500 words – repeat from Stage 1 with changes *highlighted in italic*)

The project will adopt an integrated ecosystem approach to aquaculture development (Soto et al 2007) with activities distributed across four work packages:

**WP1- Project management & dissemination:** *UoS will be responsible for financial administration and project management in close-partnership with IMBO.* Partners in Sierra Leone will meet face-to-face at 3 monthly intervals, overseas partners joining by Skype. A wiki will be used to share documents. All partners will collaborate in developing an external communication strategy including a project web-site.

**WP2- Sustainable production:** *Lead by IMBO.* The MPA will provide a sample-frame for 'short-listing' intervention-communities with final-selection stratified across a range of key social and environmental variables. Three phases of iterative action research/ adaptive learning will be conducted in 6-8 communities over 3-years (lead by IMBO with UoS and Njala support). An initial rapid livelihoods appraisal (resource mapping, semi-structured interviews, focus groups etc.) will contribute to an evaluation of alternative methods for culture (& depuration) of at least 2 species of native mangrove-oysters (*Crassostrea gasar* and *C. tulipa*) on artificial substrates. 'Off-bottom' culture will produce a faster-growing/ flesh-yielding, premium-quality product contributing to a value-added marketing strategy (WP3&4).

Outcomes will be evaluated against economic, social, institutional and environmental sustainability-indicators. The latter to include (i) pre and post-intervention assessments of mangrove cover and diversity (ii) abundance/length/age structure of associated wild-oyster populations. Results (including change-perceptions of different aquatic-resource user-groups) will be presented back to the communities to build consensus and drive continuous improvement in an action-research cycle. Two 'farmer field-schools' (SUSTAINET 2010) will be conducted to promote lateral adoption by other (non-intervention) communities with support of LMCs. Potential for LMC coordination of collective management activities (marketing, depuration, procurement) will also be assessed.

Management systems will be promoted to comply as far as possible with existing fisheries/aquaculture certification schemes (MSC, GAA, ACC, GlobalGap) with a view to encouraging policy-makers to incorporate such recommendations within MPA statutes.

**WP3- Supply chain:** Led by IMBO, this WP will evaluate how to get perishable processed/ depurated products from the mangrove-swamps to the capital. As local demand for raw-fresh oysters is low, our value-addition strategy will focus on processed ready-meals (WP4) necessitating freezer cold-chain capacity. Whereas generators have high running costs and are prone to failure, a successful cold-chain business in Masiaka has demonstrated that solar powered freezers are reliable even in the rainy season. We will use temperature-sensitive "tags" to check temperatures are maintained in a safe range during transportation. Trial deliveries will be made to evaluate alternative transport methods for reliability and cost-effectiveness at different times of year.

**WP 4- Promotion and value-addition:** In years 2&3 NJU (Home Economics Dept.) will coordinate regional contests to find the best cooked oyster recipes using local ingredients (cash prize of Le,1,000,000 to winners and Le 500,000 to runners-up). Winners and runners-up will be brought to Freetown for a grand-final. The five best recipes will be offered to local supermarkets initially on a "sale or return" basis and to hotels and beach bars. Potential for international marketing will then be investigated (MEP & UoS).



#### 14. Change Expected

Detail what the expected changes this work will deliver. You should identify what will change and who will benefit.

- If you are applying for Defra funding this should specifically focus on the changes expected for biodiversity conservation and its sustainable use.
- If you are applying for DFID funding you should in addition refer to how the project will contribute to reducing poverty. Q19 provides more space for elaboration on this.

(Max 250 words)

- Forty households (in 6-8 communities under at least two LMC's), headed by, or containing oyster-fisherwomen will be direct beneficiaries. Fisherwomen cultivating oysters are expected to increase their net income by at least 45%<sup>1</sup> (70% of the population is on/below the UN's "\$2 a day" threshold - a "typical" extended fishing family household in Southern Province averages 11.2 members).
- The project will create alternative employment opportunities in construction/maintenance of oyster culture, cold-storage facilities (2 households/ community) and in processing and logistics along the supply-chain to Freetown.
- It will ensure gender-specific worker health and safety standards are met (fewer oyster fisherwomen will be injured or drown).
- It will ensure acceptable food-safety standards are met through appropriate depuration strategies whilst providing a highly-nutritious product to consumers.
- It will support objectives of the MPA, assisting mangroves to sustainably supply their potential ecosystem goods and services by supporting regeneration of wild-oyster stocks and mangrove nursery areas (production systems will be designed to avoid adverse effects e.g. felling of mangroves for piles or oyster smoking). This will also help mitigate conflicts between extractive users of mangrove areas e.g. increased fish recruitment will sustain landings for fishermen in and around the MPA.
- LMCs have struggled to fulfil the decentralised fisheries-management role envisioned for them in the MPA, in part due to lack of technical capacity and inadequate recognition of traditional authorities (EJF 2012). The project will explore roles for the LMC in zonal-regulation and collective/cooperative management functions including regional-marketing in order to develop institutional capacity.

<sup>1</sup> Recent culture-trials of *C. gaspar* in the Mono River, Benin generated an annual yield of 30kg/m<sup>2</sup> worth US\$330 per participant (Adite et al 2013).

#### 15a. Is this a new initiative or a development of existing work (funded through any source)? Please give details (Max 200 words):

This is a new initiative; however, there was an IDRC funded programme on oyster cultivation active during the 1970's which failed due to poor marketing and problems with the supply chain. Since submitting our Stage 1 application we have met with someone active in the 1970's project who has clarified some issues not obvious in the reports. The design of this project reflects short-comings of this effort and also builds on best-practices learned from a successful community-based native mangrove-oyster (*C. rhizophorae*) culture/ marketing project successfully implemented in Brazil (Percorar et al 2013). The consortium is in contact with the principles of this project. The project will also coordinate with and build on outcomes two other recent regional mangrove-oyster initiatives; technical culture trials (of *C. gasar*) in Benin (Adite et al 2013) and the 'TRY' Women's Oyster-harvesting Association who are reviving a degraded mangrove-oyster fishery and associated mangrove assemblages in in Gambia's Rasaan listed Tanbi National Park through innovative collective marketing and area -management agreements (Zaleski 2013).

**15b. Are you aware of any other individuals/organisations/projects carrying out or applying for funding for similar work?**  Yes  No

If yes, please give details explaining similarities and differences, and explaining how your work will be additional to this work and what attempts have been/will be made to co-operate with and learn lessons from such work for mutual benefits:

In late-November we become aware of a small Environmental Justice Foundation (EJF) project (funded by Foundation Ensemble) also aimed at promoting the mangrove oyster trade. Scheduled to commence next year this will be focussed around a single pilot-site in the Sherbro River Estuary. Fortunately, there appears to be considerable synergy between our proposal and their planned activities which include replanting of mangroves and bottom-culture of lower-premium mussels intended for local consumption. Our project could also backstop the EJF project with aquaculture expertise. We have therefore suggested that we explore collaboration to avoid duplication and optimise complementarities in the conduct and location of our efforts. Should our proposal be successful, we have agreed to meet in Freetown in 2014 to establish a memorandum of understanding.

**15c. Are you applying for funding relating to the proposed project from other sources?**

Yes  No

If yes, please give brief details including when you expect to hear the result. Please ensure you include the figures requested in the spreadsheet as Unconfirmed funding.

We have confirmed and unconfirmed contributions from three organisations, in addition to the collaboration with EJF mentioned above:

West Africa Regional Fisheries Program – has offered support in kind on; planned and actual changes in MPA legislation, liaison with MPAs, logistical support from outstation fisheries officers and community organisers, advice and warnings on water quality issues such as red tides and microbial analysis for assurance of depuration standards. The value of this contribution will be approximately £5,000 pa.

RE4Food (renewable energy for food and EPSRC funded project 2013-2016) has provisionally offered a contribution in kind to look at the use of renewable energy in preserving marine products (possibly improved solar driers, or improved smoke oven (“bandas”) and depuration plant. The Value of this contribution will be about £1,000 pa.

SLIEP (Sierra Leone Investment and Export Promotion Agency) has offered a contribution in kind of advice on export markets and in obtaining investment for large scale uptake of oyster cultivation. The value of this contribution will increase year on year as products get closer to market to about £1,500 pa in years 2 and 3.

**16. Value for money**

Please describe why you consider your application to be good value for money including justification of why the measures you will adopt will secure value for money?

(Max 250 words)

The project would contribute to biodiversity conservation, improved socioeconomic conditions of poor rural households that principally depend on natural resources.

If our proposal is successful, we plan to transfer knowledge and skills to a sizable number of wild oyster harvesters (through farmer-field schools; WP2) that would transform into oyster culturists, thus reducing pressure on wild oysters, enhancing fish stocks recruitment and reducing pressure mangroves.

By engaging a bottom-up adaptive-learning approach combined with farmer-field schools the project maximise the chances of sustainable adoption and organic-spread of the technology to other communities in the MPA.

The project will also offer a constructive-role for LMCs which should increase their management capacity and credibility with local communities.

Protection of wider mangrove environment could help in the conservation of manatees, marine turtles and migratory birds that could provide for the further development of tourism, which in turn could boost the local economy.

## 17. Ethics

Outline your approach to meeting the Darwin Initiative's key principles for research ethics as outlined in the guidance notes.

(Max 300 words)

The Establishment of Marine Protected Areas in Sierra Leone has been done through a consultative process with local communities and with the understanding and agreement that the management process is going utilise a co-management process.

The management of the project from a technical point of view is going to be led by IMBO and Njala. Administrative and Financial management would be handled by Stirling, because IMBO and Njala cannot provide audited accounts for the last two years.

The traditional/local technical knowledge, already proven to be very useful in the design and planning of the project would continued to be utilised throughout implementation of the project.

Wild mangrove oyster harvested have been reported to be unsafe, with several deaths by drowning. Culture of oysters is safer if well designed using appropriate technologies

Beneficiary communities would be selected based on prior, informed consent. As the project will adopt an action-research/ adaptive-learning framework they will also be active participants in setting and refining the research agenda and evaluating the results.

The project leaders are aware of tensions between the recently devolved Local Management Committees (LMCs) and traditional local authorities – and will take appropriate steps to broker consensus whilst mitigating risk of resource capture.

Project leaders and partners would ensure that health and safety regulations are followed, and equipment such as life jackets and protective clothing are available and used.

All project staff would be professionals in their own fields with high integrity.

Project plans and objectives are gender-focussed and geared towards reducing poverty levels in targeted communities, at the same time conserving biodiversity in the mangrove wetlands.

We will encourage reflective observation of gender, social and ethical issues encountered during the project implementation as well as those raised by research. Arising issues to be documented and included in periodic activity reports

## 18. Legacy

Please describe what you expect will change as a result of this project with regards to biodiversity conservation/sustainable use and poverty alleviation (for DFID funded projects). For example, what will be the long term benefits (particularly for biodiversity and poor people) of the project in the host country or region and have you identified any potential problems to achieving these benefits?

(Max 300 words)

- The exploitation rate for wild oysters and mangrove resources would reduce
- Fish stock biomass would increase
- Incomes of targeted households would increase
- Potential problems include the isolated and dispersed nature of the site, use of the WARFP boat allows easy access but the 48HP outboard engine uses a lot of fuel; we have tried to be realistic in transport costs but the number of supervision visits by project team are as low as we think feasible for a successful project.
- Cost of transporting products to Freetown per kilogram is relatively high; the use of cool boxes should allow our product to be included with other general produce in commercial vessels and still remain in optimum condition.
- Increased fish landing as a result of healthy mangrove habitats may lead to increased harvesting of fuel-wood, and mangrove is the preferred wood for smoking, if a MoU can be signed with EJJ then their activities at replanting mangroves and establishment of woodlots would be complementary.

### **19. Pathway to poverty alleviation**

Please describe how your project will benefit poor people living in low-income countries. All projects funded through DFID in Round 20 must be compliant with the OECD Overseas Development Assistance criteria. Projects are therefore required to indicate how they will have a positive impact on poverty alleviation in low-income countries.

(Max 300 words)

The intended beneficiaries of the project are among the poorest and most neglected section of Sierra Leone society living in a remote and sparsely-populated area (most discrete communities consist of a small number of large extended-family fisher households). The introduction of oyster aquaculture should increase income (we are aiming for at least a 45% increase) to those directly involved in cultivation, in addition there will be increased employment opportunities in processing, especially for “ready meals”, for the servicing of the rafts and associated equipment, the solar powered freezers and in logistics and hospitality trade. In the long run (post-project) the number of tourists (especially ‘eco-tourists’ interested in non-consumptive uses of biodiversity) will help raise the status and self-esteem of the inhabitants (i.e. being proud that people want to come to their area) as well as providing further employment opportunities.

### **20. Exit strategy**

State whether or not the project will reach a stable and sustainable end point. If the project is not discrete, but is part of a progressive approach, give details of the exit strategy and show how relevant activities will be continued to secure the benefits from the project. Where individuals receive advanced training, for example, what will happen should that individual leave?

(Max 200 words)

Based on our integrated and market-orientated project-design we expect the technology for cultivating oysters will have become widespread enough to be self-sustaining. We intend to source all materials locally to ensure they remain available. It is difficult to envisage sufficient profit being made to replace the 12V solar-powered freezers at their current price. However, the units are very robust and should last many years. The trend in costs for solar panels and associated equipment is also downward. Batteries can also be ruined quite quickly if repeatedly run “flat”; experience at Masiaka will be used to train the “ancillary staff” how to treat the equipment with respect. The logistic chain (getting food stuffs from Bonthe to market) already exists so if our product is profitable it will continue to operate. Alternative cold-chain options are also likely to become available; the Manx Government’s IDC will sponsor a passenger ferry services between Sherbro Island and Freetown creating potential for live transport. Oysters are already a local delicacy so we believe the market will continue grow post-project. We are negotiating for a contribution-in-kind from SLIEPA (Sierra Leone Investment and Export Promotion Agency) for advice on the long term export potentials and business partners.

## 21. Raising awareness of the potential worth of biodiversity

If your project contains an element of communications, knowledge sharing and/or dissemination please provide a description of your intended audience, how you intend to engage them, what the expected products/materials there will be and what you expect to achieve as a result. For example, are you expecting to directly influence policy in your host country or is your project a community advocacy project to support better management of biodiversity?

(Max 300 words)

Our target communities are within the MPA (Marine Protected Area) and the main role of communicating the value of biodiversity lies with them; our project will support the MPA’s long-term efforts and objectives. We expect our project to introduce many in the communities to modern concepts of how species live and grow and interact with each other and the environment. At the moment tourism in the area is limited to some seasonal sports fishing for tarpon. We believe that the area has the potential for non-consumptive eco-tourism (whale and bird watching etc) that indirectly communicate the value of biodiversity. The EJV project (with whom we plan to sign an MoU) also has a very strong “awareness-raising” component within their project.

## 22. Access to project information

Please describe the project’s open access plan and detail any specific costs you are seeking from Darwin to fund this. (See Section 9 of the Guidance Notes for further information)

(Max 250 words)

Project information will be made publicly available through a project web-site hosted on the Institute of Aquaculture’s web page at Stirling (<http://www.aqua.stir.ac.uk/>). The ‘Sarnissa’ regional African research network site (<http://www.sarnissa.org>) with over 2200 online members is also hosted by Stirling, allowing regular (weekly) dissemination by UoS of project outputs throughout West and sub Saharan Africa. This will allow access to the international community but will be of more limited use in Sierra Leone where the reliability of internet communication even at the universities is poor. Based on its prior experience and the capacity built in this project we aim to position IMBO as a repository of aquaculture development expertise and an essential contact-point for anyone interested in aquaculture development in the country. Access to project information in the project area is a challenge; literacy rates are low and the communities small, poor and dispersed. In other projects, we have found a good response from radio broadcasts and the community radio stations very receptive to development news. We also intend to hold “open days” to encourage other communities to come and see what we are doing and to talk to the people actually benefiting from the project.

## 23. Importance of subject focus for this project

If your project is working on an area of biodiversity or biodiversity-development linkages that has had limited attention (both in the Darwin Initiative portfolio and in conservation in general) please give details.

(Max 250 words)

There is almost universal acknowledgement that mangroves are important for people and the environment. It is acknowledged that mangroves are under threat and Sierra Leone is not an exception. Our project offers the prospect of reducing the pressure on the mangroves while increasing the livelihood opportunities of one of the most disadvantaged sections of a poor country.

Coastal Mangroves wetlands habitats are important spawning and nursery grounds for commercial species of fish and shellfish. This project hopes to preserve these important habitats as a means of replenishing overexploited stocks of fish and shellfish, thus enhancing and sustaining livelihoods of fishers and fishing related livelihoods.

We do realise that increased fish landings could result from increased harvesting of mangrove as fuel wood for fish smoking. This domino effects would be mitigated by integration of planting of woodlots on degraded savana planes inland of the Sherbro island.

## 24. Leverage

### a) Secured

Provide details of all funding successfully levered (and identified in the Budget) towards the costs of the project, including any income from other public bodies, private sponsorship, donations, trusts, fees or trading activity.

#### Confirmed:

**Two Stirling MSc students per year** will support conduct of the initial situational analyses and subsequent sustainability impact studies over the 3 years of the project.

**Contribution-in-kind from WARFP** for advice on water quality (including warnings of red tides etc.), notification of legislation, policy, statutory instruments and other activities that may affect the project and access to strategic decision making in the MPA's

**Contribution-in-kind from RE4Food** a project concerned with promoting the use of renewable energy they are currently using fish processing as a case study and have offered help with that aspect of the value chain.

### b) Unsecured

Provide details of any matched funding where an application has been submitted, or that you intend applying for during the course of the project. This could include matched funding from the private sector, charitable organisations or other public sector schemes.

Date applied for	Donor organisation	Amount	Comments
	SLIEPA (Sierra Leone Investment and Export Promotion Agency)	Contribution in kind	Advice on export potentials. Advice on marketing partners. Advice on quality
Nov 2013	Environment Justice Foundation (EJF)	Contribution in kind through a MoU	They have funding for a single site where they want to encourage the local oyster trade and to replant mangroves in cleared / degraded areas. They also have an extensive "awareness raising" component

## PROJECT MONITORING AND EVALUATION

### MEASURING IMPACT

#### 25. LOGICAL FRAMEWORK

Darwin projects will be required to report against their progress towards their expected outputs and outcomes if funded. This section sets out the expected outputs and outcomes of your project, how you expect to measure progress against these and how we can verify this. Further detail is provided in Annex C of the guidance notes which you are encouraged to refer to. The information provided here will be transposed into a logframe should your project be successful in gaining funding from the Darwin Initiative. The use of the logframe is sometimes described in terms of the Logical Framework Approach, which is about applying clear, logical thought when seeking to tackle the complex and ever-changing challenges of poverty and need. In other words, it is about sensible planning.

#### Impact

The Impact is not intended to be achieved solely by the project. This is a higher-level situation that the project will contribute towards achieving. All Darwin projects are expected to contribute to poverty alleviation and sustainable use of biodiversity and its products.

(Max 30 words)

Environmentally sustainable and pro-poor livelihood opportunities created in Sierra Leone through enablement of community-managed, mangrove-based oyster culture systems with value-added marketing attributes.

#### Outcome

There can only be one Outcome for the project. The Outcome should identify what will change, and who will benefit. The Outcome should refer to how the project will contribute to reducing poverty and contribute to the sustainable use/conservation of biodiversity and its products. This should be a summary statement derived from the answer given to question 14.

(Max 30 words)

Incomes of oyster-fisherwomen in at least 40 households of the Sherbro MPA increased by 45% pa and abundance/ mean-size of adjacent wild-oyster populations increased by at-least 18% over base-line levels.

#### Measuring outcomes - indicators

Provide detail of what you will measure to assess your progress towards achieving this outcome. You should also be able to state what the change you expect to achieve as a result of this project i.e. the difference between the existing state and the expected end state. You may require multiple indicators to measure the outcome – if you have more than 3 indicators please just insert a row(s).

Indicator 1	Annual income of oyster-fisherwomen increased by at least 45% above baseline levels through oyster culture
Indicator 2	Contribution of wild-oyster culture to annual income of target-beneficiaries decreased by 50% during first culture cycle and 100% by the second cycle
Indicator 3	Adjacent abundance and mean shell-size of wild-oyster populations increased by 18% (along with stable or increased cover of associated mangrove assemblages)

#### Verifying outcomes

Identify the source material the Darwin Initiative (and you) can use to verify the indicators provided. These are generally recorded details such as publications, surveys, project notes, reports, tapes, videos etc.

Indicator 1	Project reports & publications detailing cost-benefit analyses from baseline and evaluation household-surveys
Indicator 2	Project reports & publications based on baseline and evaluation household surveys (including control households)
Indicator 3	Project report, publications, videos detailing results of environmental impact surveys and community-perception surveys

### Outcome risks and important assumptions

You will need to define the important assumptions, which are critical to the realisation of the *outcome and impact* of the project. It is important at this stage to ensure that these assumptions can be monitored since if these assumptions change, it may prevent you from achieving your expected outcome. If there are more than 3 assumptions please insert a row(s).

Assumption 1	Reliable spat-falls of the target species occur over the project-cycle
Assumption 2	Oyster-culture will reduce overall community-dependency on wild oyster populations adjacent to culture sites
Assumption 3	Devolved MPA Local Management Committees have the capacity and will to support collective management aspects of oyster production/ marketing without marginalising the intended primary female beneficiaries

### Outputs

Outputs are the specific, direct deliverables of the project. These will provide the conditions necessary to achieve the Outcome. The logic of the chain from Output to Outcome therefore needs to be clear. If you have more than 3 outputs insert a row(s). It is advised to have less than 6 outputs since this level of detail can be provided at the activity level.

<b>Output 1</b>	Sustainable systems for culture of premium mangrove-oysters on artificial substrates developed for adoption by at least 40 target-households in 6 communities in 2 LMC-zones
<b>Output 2</b>	Cold-chain systems developed and implemented for reliable transport of frozen-products to regional markets under a range of seasonal conditions
<b>Output 3</b>	Demand for value-added oyster ready-meals increased above baseline levels through promotional activities in regional markets
<b>Output 4</b>	Extension of livelihood options to neighbouring MPA communities and wider dissemination of project outputs

### Measuring outputs

Provide detail of what you will measure to assess your progress towards achieving these outputs. You should also be able to state what the change you expect to achieve as a result of this project i.e. the difference between the existing state and the expected end state. You may require multiple indicators to measure each output – if you have more than 3 indicators please just insert a row(s).

<b>Output 1</b>	
Indicator 1	Technical and economic efficiency of alternative culture systems for at least two mangrove-oyster species (annual yield > 20kg/m <sup>2</sup> substrate area)



Indicator 2	Spatial mapping and field surveys of wild oyster and mangrove assemblage abundance/ diversity indicating specified improvement above baseline levels
Indicator 3	LMC and/ or community area-management and collective production activity agreements formalised and documented

<b>Output 2</b>	
Indicator 1	Solar-freezer systems procured, adapted, maintained and operated by target-community-groups
Indicator 2	Supply-chain systems operate effectively under seasonal conditions most associated with demand for value-added oyster products
Indicator 3	

<b>Output 3</b>	
Indicator 1	Sales inventories of producer-groups and buyers increased Freetown compared to baseline levels
Indicator 2	Project and media reports of outcomes of the oyster recipe competitions documented
Indicator 3	

<b>Output 4</b>	
Indicator 1	Documentation of curricula <b>and</b> attendance at 2 Farmer Field Schools (FFS) and final project workshop
Indicator 2	Relevant decision-makers as identified by stakeholder analysis rate usefulness of policy briefs on a five point scale.
Indicator 3	At least 2 peer-reviewed primary research papers made available in open access format.

### Verifying outputs

Identify the source material the Darwin Initiative (and you) can use to verify the indicators provided. These are generally recorded details such as publications, surveys, project notes, reports, tapes, videos etc.

Indicator 1	Project reports & peer reviewed publications (at least 2)
Indicator 2	Local media coverage of project initiatives
Indicator 3	Testimonials of supermarket and food service-sector stakeholders

### Output risks and important assumptions

You will need to define the important assumptions, which are critical to the realisation of the achievement of your outputs. It is important at this stage to ensure that these assumptions can be monitored since if these assumptions change, it may prevent you from achieving your expected outcome. If there are more than 3 assumptions please insert a row(s).

Assumption 1	Sustained & sufficient demand will be exist for value-added ready-meals by consumers in Freetown
Assumption 2	

Assumption 3	
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## Activities

Define the tasks to be undertaken by the research team to produce the outputs. Activities should be designed in a way that their completion should be sufficient and indicators should not be necessary. Risks and assumptions should also be taken into account during project design.

Output 1	
Activity 1.1	Multi-stage sample-design for selection of 6-8 intervention-communities according to social & environmental criteria (e.g. harvesting mangrove oysters along salinity and primary-productivity gradients)
Activity 1.2	Environmental, rapid rural appraisal (RRA) and household livelihood surveys for selection of target-households and establishment of intervention baselines.
Activity 1.3	Development of initial oyster artificial-substrate based culture-technology and depuration options
Activity 1.4	LMC and/or community agreements brokered on collective-production activities and extractive-restrictions in adjacent mangrove oyster-nursery areas
Activity 1.5	Initial training of 40 wild-oyster harvesters on oyster-spat collection and culture techniques
Activity 1.6	Adaptation of artificial-substrate based oyster culture techniques (e.g. post, tray, raft, long-line) through two full iterative phases of action research

Output 2	
Activity 2.1	Procurement and adaptation of solar powered freezers for transport of oysters from the Sherbro MPA to free town under variable seasonal conditions
Activity 2.2	Training staff/ beneficiaries in operation and maintenance of freezer plant
Activity 2.3	Seasonal testing of freezer systems & cold-chain implementation

Output 3	
Activity 3.1	Analysis of markets for premium oyster-based products (and their substitutes) in Freetown and other regional markets
Activity 3.2	Staging of regional and national oyster recipe competitions
Activity 3.3	Development and testing of value-added oyster ready meals with super-markets, restaurants and beach-bars in Freetown
Activity 3.4	Evaluation of wider international demand & market-based certification potentials & statutory recommendations for MPA policy-makers

Output 4	
Activity 4.1	Establishment of project web-site (with links to partner web-sites and the regional Sarnissa research network
Activity 4.2	Extension to neighbouring communities through 2 'Farmer Field-Schools' (in each case for separate female and male groups).

Activity 4.3	Regional best-practice/ policy workshop (inviting participants from comparable initiatives in Benin, The Gambia, local EJV project, MPA representatives)
Activity 4.4	Project reports & publications (x2) on environmental social and economic sustainability outcomes in international peer-reviewed journals

26. Provide a project implementation timetable that shows the key milestones in project activities. Complete the following table as appropriate to describe the intended workplan for your project.

Activity	No of Months	Year 1				Year 2				Year 3			
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Output 1 Development of sustainable culture systems													
1.1 Multi-stage sample-design for selection of target-communities		■											
1.2 Baseline livelihood surveys & selection of target-households		■	■				■				■		
1.3 Development initial oyster culture-technology & depuration options				■									
1.4 Brokerage of LMC/ community management agreements			■				■				■		
1.5 Training on oyster spat-collection and culture techniques			■				■				■		
1.6 Implementation of two iterative action research cycles				■	■	■	■	■	■	■	■	■	■
Output 2 Establishment of cold-chain to supply premium regional markets													
2.1 Procurement and adaptation of solar powered freezers			■										
2.2 Training staff/ beneficiaries in plant operation and maintenance				■									
2.3 Seasonal testing of freezer systems & cold-chain implementation					■	■	■	■	■	■	■	■	■
Output 3 Promotion of demand for value-added products													
3.1 Analysis of markets for oyster-based products and their substitutes		■	■	■									
3.2 Staging of regional and national oyster recipe competition						■	■						
3.3 Development and testing of value-added oyster ready meals							■	■	■				
3.4 Evaluation of wider international demand & certification potentials										■	■	■	
Output 4 Extension and dissemination													
4.1 Establishment of project web-site		■											
4.2 'Farmer field-school' extension to neighbouring communities												■	■
4.3 Regional best-practice/ policy workshop													■
4.5 Reports & publications (x2) in international peer-reviewed journals													■

## 27. Project based monitoring and evaluation (M&E)

Describe, referring to the Indicators above, how the progress of the project will be monitored and evaluated, making reference to who is responsible for the projects M&E. Darwin Initiative projects are expected to be adaptive and you should detail how the monitoring and evaluation will feed into the delivery of the project including its management. M&E is expected to be built into the project and not an 'add' on. It is as important to measure for negative impacts as it is for positive impact.

(Max 500 words)

The Sierra Leone project lead, Dr Sankoh, has extensive experience of M&E through his role as the Country Coordinator for the World Bank funded WARFP project. The intention is to run the project using the standard methodology used by the World Bank. He will be supported in this effort by Dr. Francis Murray (UoS) who has previously given training in the WorldBank 'results-based monitoring and evaluation' framework (Kusek & Rist 2004) to development practitioners (<http://www.dipherent.com/MandE/trainers.html>) based on his own experience in the development sector (including CARE International Sri Lanka). The Logical Framework initiated above will provide the basis for this RBM&E strategy; research assistant will be trained in the approach as part of our inception activity. Primary responsibility for collection of data against the specified indicators will be assigned to the lead partners on specific work-packages as identified in Section 13 (Methodology).

## FUNDING AND BUDGET

Please complete the separate Excel spreadsheet which provides the Budget for this application. Some of the questions earlier and below refer to the information in this spreadsheet.

**NB:** Please state all costs by financial year (1 April to 31 March) and in GBP. **Budgets submitted in other currencies will not be accepted.** Use current prices – and include anticipated inflation, as appropriate, up to 3% per annum. The Darwin Initiative cannot agree any increase in grants once awarded.

### 28. Value for Money

Please explain how you worked out your budget and how you will provide value for money through managing a cost effective and efficient project. You should also discuss any significant assumptions you have made when working out your budget.

(max 300 words)

The budget is informed by reconnaissance work in the Sherbro MPA conducted in by Dr. Wadsworth and Dr. Sankoh, their long-standing familiarity with regional seafood markets and knowledge of existing supply-chains for perishable food commodities between the MPA and Freetown. Dr Wadsworth is knowledgeable regarding local commercial experience of the proposed cold-chain technology. Dr Murray provided advice on 'appropriate-technology' culture systems based on personal experience and knowledge successful initiatives of this kind implemented elsewhere (e.g. Percora et al 2013) which were then priced according to knowledge of local material costs by Dr. Wadsworth and Dr. Sankoh. The overall budget has increase significantly over the original estimate as consequence of the increased duration (from 2 to 3yrs) and scope of the project (from 10 to 40 direct beneficiaries of culture systems). We consider this was necessary to increase the probability of sustainable adoption through the implementation of 3 iterative cycles of adaptive-learning with a larger group. This will also permit a much more ambitious research-design accounting for effects of a range of environmental and social variables. Our dissemination strategy has also been enhanced e.g. through addition of Farmer Field Schools, a secondary stakeholder dissemination workshop, online platform and MPA policy outcomes.

## FCO NOTIFICATIONS

Please check the box if you think that there are sensitivities that the Foreign and Commonwealth Office will need to be aware of should they want to publicise the project's success in the Darwin competition in the host country.

Please indicate whether you have contacted your Foreign Ministry or the local embassy or High Commission (or equivalent) directly to discuss security issues (see Guidance Notes) and attach details of any advice you have received from them.

**Yes (no written advice)**  **Yes, advice attached**  **No**



## CERTIFICATION

On behalf of the trustees of

The University of Stirling

I apply for a grant of £247,264 in respect of **all expenditure** to be incurred during the lifetime of this project based on the activities and dates specified in the above application.

I certify that, to the best of our knowledge and belief, the statements made by us in this application are true and the information provided is correct. I am aware that this application form will form the basis of the project schedule should this application be successful.

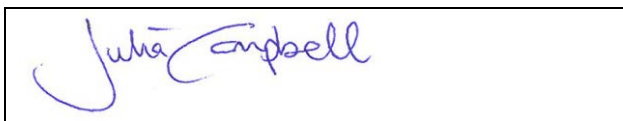
*(This form should be signed by an individual authorised by the applicant institution to submit applications and sign contracts on their behalf.)*

- I enclose CVs for project principals and letters of support.

**Our most recent audited/independently verified accounts and annual report are also enclosed/can be found at: <http://www.finance.stir.ac.uk/publications/index.php>**

<b>Name (block capitals)</b>	<b>Julia Campbell</b>
<b>Position in the organisation</b>	<b>Research and Development Manager</b>

Signed



Date:

28 Nov 13



## Stage 2 Application - Checklist for submission

	Check
Have you <b>read the Guidance Notes</b> ?	Y
Have you provided <b>actual start and end dates</b> for your project?	Y
<b>Have you indicated whether you are applying for DFID or Defra funding. NB: you cannot apply for both</b>	Y
Have you provided your <b>budget based on UK government financial years</b> i.e. 1 April – 31 March and in GBP?	Y
Have you checked that your <b>budget is complete</b> , correctly adds up and that you have included the correct final total on the top page of the application?	Y
Has your application been <b>signed by a suitably authorised individual?</b> (clear electronic or scanned signatures are acceptable in the email)	Y
Have you included a <b>1 page CV for all the Principals</b> identified at Question 7?	Y
Have you included a <b>letter of support from the <u>main</u> partner(s) organisations</b> identified at Question 10?	Y
Have you <b>been in contact with the FCO</b> in the project country/ies and have you included any evidence of this?	Y
Have you included a <b>copy of the last 2 years annual report and accounts</b> for the lead organisation? An electronic link to a website is acceptable.	Y
Have you <b>checked the Darwin website</b> immediately prior to submission to ensure there are no late updates?	Y

Once you have answered the questions above, please submit the application, not later than midnight GMT on Monday 2 December 2013 to [Darwin-Applications@ltsi.co.uk](mailto:Darwin-Applications@ltsi.co.uk) using the application number (from your Stage 1 feedback letter) and the first few words of the project title **as the subject of your email**. If you are e-mailing supporting documentation separately please include in the subject line an indication of the number of e-mails you are sending (eg whether the e-mail is 1 of 2, 2 of 3 etc). You are not required to send a hard copy.

DATA PROTECTION ACT 1998: Applicants for grant funding must agree to any disclosure or exchange of information supplied on the application form (including the content of a declaration or undertaking) which the Department considers necessary for the administration, evaluation, monitoring and publicising of the Darwin Initiative. Application form data will also be held by contractors dealing with Darwin Initiative monitoring and evaluation. It is the responsibility of applicants to ensure that personal data can be supplied to the Department for the uses described in this paragraph. A completed application form will be taken as an agreement by the applicant and the grant/award recipient also to the following:- putting certain details (ie name, contact details and location of project work) on the Darwin Initiative and Defra websites (details relating to financial awards will not be put on the websites if requested in writing by the grant/award recipient); using personal data for the Darwin Initiative postal circulation list; and sending data to Foreign and Commonwealth Office posts outside the United Kingdom, including posts outside the European Economic Area. Confidential information relating to the project or its results and any personal data may be released on request, including under the Environmental Information Regulations, the code of Practice on Access to Government Information and the Freedom of Information Act 2000.

## Annexe 1. 1-Page CV's of consortium lead staff:

### Curriculum Vitae

**Francis Joseph MURRAY**

Date of Birth: 27<sup>th</sup> February 1965    Nationality: Dual British/ Irish Citizen  
Email: [fjm3@stir.ac.uk](mailto:fjm3@stir.ac.uk)    Mob. +44 (0)758 7243823  
Address: 4 Glebe Place, Springfield Terrace, Dunblane, FK15 9AD

### Education:

- 2004 **PhD** Potential for aquaculture in community-managed irrigation systems of the Dry-Zone Sri Lanka: Impacts on livelihoods of the poor, University of Stirling, UK.  
1999 **MsC** Aquaculture, Potential for integrated aquaculture in farmer managed micro-irrigation systems in Karnataka State India, University of Stirling, UK.

### Key Experience and Skills

- Interdisciplinary research and project management with focus on action-research in community-based aquatic resource management, international seafood trade. Project coordination and consultancy in Europe, Sri Lanka, South & West, India, Bangladesh, Thailand, Lao PDR, Cambodia, Vietnam, China, Yemen, East & West Africa.
- Structured survey and relational database design, parametric & non-parametric multivariate statistical techniques, participatory impact monitoring & evaluation, PRA practitioner, application of rural livelihoods, rights-based & watershed development frameworks, market and global value chain (GVC) analyses, seafood eco-labelling & certification, hydrology, water quality, fish nutrition, Life Cycle Analysis (LCA).
- Lecturing and supervision PhD & MSc students.
- Commercial aquaculture production and consultancy inc. RAS system design, nutrition trials, hatchery management, aquaculture feasibility studies.
- Member Fairtrade technical advisory committee on farmed shrimp standards
- Auditor trainer WWF/ASC bivalve aquaculture standards [http://www.asc-aqua.org/upload/ASC%20Bivalve%20Standard\\_v1.0.pdf](http://www.asc-aqua.org/upload/ASC%20Bivalve%20Standard_v1.0.pdf)

### Recent Employment:

- 2008 – 2013 Lecturer & coordinator/ PI, EU-FP7 large-scale collaborative project; Sustaining Ethical Aquaculture Trade ([www.SEATglobal.eu](http://www.SEATglobal.eu) 2009-2013), Sustainable Aquaculture Research Group, Institute of Aquaculture, University of Stirling  
2006 - 2007 Post Doctoral Fellow, World Fish Center, Policy, Economics and Social Science, WorldFish Center, Penang, Malaysia  
2000 - 2003 Project Director, CARE International, Sri Lanka. Fisheries enhancements in multiple-use village reservoirs  
1999 - 2008 Consultant, Stirling Aquaculture (STAQ), Institute of Aquaculture, UoS  
1990 - 1997 Area Manager, Marine Harvest McConnell, Salmon Farms Scotland.

### Selected Publications:

- Bush, S.R. Hall, D., Vandergeest, P., Murray, F.J., et al Kusumawati, R. 2013 Certify Sustainable Aquaculture? Science. Policy Forum; Global Food Supply, Science, 341 – 6150, pp.1067-1068.  
Rico, A., Tran, M. P., Satapornvanit, K., Min, J., Shahabuddin, A.M., Henriksson, Murray, F.J., et al, 2013 Use of veterinary medicines, feed additives and probiotics in four major internationally traded aquaculture species farmed in Asia. *Aquaculture*, 412-413, pp. 231-243.  
Little, D.C., Bush, S.R., Belton, B., Nguyen, T.P., Young, J.A., Murray, F.J. Whitefish wars: Pangasius, politics and consumer confusion in Europe. 2012 *Marine Policy*. 36, 3, pp 738–745.  
Lewins, R., Murray F. J., Coupe S., 2006 Voices from the margins: consensus building with the poor in Bangladesh. Practical Action Publishing (formally ITDG) ISBN 13:9781853396243. 80pp

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*Institute of Aquaculture, University of Stirling, Stirling FK9 4LA, Tel: 01786 46 7926*

## CV\_Salieu Kabba Sankoh

Date of Birth	4 <sup>th</sup> April 1966
Profession	Research Fellow/Lecturer, Marine Biology and Oceanography
Current occupation	Research Fellow/Lecturer
Gender	Male
E-mail	<a href="mailto:salieusankoh@hotmail.com">salieusankoh@hotmail.com</a> / <a href="mailto:salieusankoh@yahoo.co.uk">salieusankoh@yahoo.co.uk</a>

### Summary of Qualifications

2004-2009	PhD. Sustainable Aquaculture and Aquatic Resources Management, Stirling University. Thesis title: Aquaculture in Sierra Leone: Traditional systems and the prospect for market oriented development
1993-1995	M.Sc. Marine Biology and Oceanography. University of Sierra Leone. Thesis: DDT and PCBs Levels in the muscle tissues of the most commonly eaten marine fish of Sierra Leone
1986-1992	B.Sc. (Hons.) Marine Science. University of Sierra Leone. Final year project: Marine Pollution State of the Sierra Leone River Estuary

### Career

<b>2010 to date:</b>	National Coordinator, West Africa Regional Fisheries Programme in Sierra Leone
<b>2009 to date:</b>	Senior Research Fellow/Lecturer, Institute of Marine Biology and Oceanography, Fourah Bay College, University of Sierra Leone
<b>2000-2009</b>	Research Fellow/Lecturer, Institute of Marine Biology and Oceanography, and Biological Sciences Department, Fourah Bay College, University of Sierra Leone
<b>1995 – 2000</b>	Research/Teaching Assistant, Institute of Marine Biology and Oceanography, and Biological Sciences Department, Fourah Bay College, University of Sierra Leone

### Publications/Reports

- Sankoh S.K., Ndomahina E.T., Karim A.B., Redwood-Sawyer J.A.S. and Wadsworth R. A. (in Press)** urban solid waste management in Freetown, Sierra Leone: an environmental and social framework study
- Sankoh, S.K.; Ross, L.; Van Brakel, M.; Wadsworth R. A. & Rana, K. J., (in Press):** GIS models for subsistence and commercial aquaculture development in Sierra Leone
- Sankoh, S.K.; Wadsworth R. A. & Rana, K. J., (in Press):** The economic importance and social values of traditional aquaculture rural Sierra Leone
- Sankoh, S.K.; Wadsworth R. A. & Rana, K. J., (in Press):** Fish markets in Sierra Leone: Size, structure, distribution networks and opportunities for aquaculture development
- Sankoh, S.K.; Wadsworth R. A. & Rana, K. J., (in Press):** Socio-economic factors and how they influence access to physical resources and aquaculture inputs in rural Sierra Leone
- Sankoh, S.K.; Ross, L.; Van Brakel, M.; & Rana, K. J., (2007)** Traditional Aquaculture Systems in Sierra Leone: Potential for Development of Inland Aquaculture. Poster presented at the European Conferences for Integrated Coastal Management and Geo-Information Research (ECO-IMAGINE) Training Workshop, Aberdeen (UK), July 23<sup>rd</sup> to 28<sup>th</sup>, 2007
- Wadsworth R.A., Karim A.B., Morgan H.G., Conteh A., and Sankoh S. (2005)** Land cover change and civil unrest: the case of Sierra Leone. Session 03 Land Cover Dynamics. *Proceedings of GIS Planet 2005*, Estoril Portugal 30th May - 2nd June 2005. ISBN 972-97367-5-8. 18pp
- Rana, K. Sankoh S., Madalla, N., Salie, K. (2008).** Fish from Africa for Africa: Shifting supplies from fishing to fish farming. *Insight Africa*. Vol 2 (in press).

## Curriculum vitae – Richard A. Wadsworth

**Date of birth** 21<sup>st</sup> January 1960  
**Qualifications** BSc (Hons) Land Surveying Science, Newcastle University, 1981.  
MSc Irrigation Engineering, IIS, Southampton University, 1986.  
PhD, Agriculture and Environmental Science, Newcastle University, 1995.  
MBA, Loughborough University, 2001.

### Career

2012-date Adjunct Professor, School of Environmental Science, Njala University  
2008-2011 Mathematical Modeller / Biometrician, Shore Section, CEH Lancaster  
2007-2008 Mathematical Modeller, Environmental Informatics Programme, CEH  
1994-2006 Head GIS Group / Ecological Systems Modelling Group, CEH  
1989-1994 Research Associate, NELUP, Newcastle University.  
1987-1989 Research Associate, CLUWRR, Newcastle University.  
1986-1987 Research Assistant Hydraulics Research Ltd. Wallingford, Oxon.  
1984-1985 Land surveyor, Longdin & Browning. Surveys in Kuwait, Sudan and Oman.  
1981-1984 Swamp Development Officer, Magbosi IADP, Sierra Leone.

Provision of statistical and mathematical modeling advice. Teaching research methods. Previously advised on the use of mathematical models; process and individual based models, Monte Carlo methods, parallel Genetic Algorithms, non-numeric methods such as endorsement theory. Use of semantics and ontologies as tools to reconcile inconsistent data sets. Spatial modeling and integration; remotely sensed data (multi-spectral, lidar, photogrammetry). Projects include: understanding land cover change (UK and Sierra Leone); climate change and coastal environments; spread of invasive alien weeds along river; releases of pollutants to the atmosphere; identifying PCB pollution "hot spots" from the remains of birds of prey; long-term population stability in dynamic landscape patterns, renewable energy etc. Co-author of 45 journal papers, a book on GIS and several dozen contract reports and conference proceedings. Associate editor Journal of Applied Ecology (remote sensing applications).

### Refereed Papers (last five years)

- Heywood E., Whyatt J.D., Hall J.R., Wadsworth R.A. & Page T. 2006. Alternative methods of representing the impact of deposition uncertainties on acidity. *Environmental Science and Policy*, 9(1), 32-45.
- Fisher P.F., Arnot C, Wadsworth R.A. & Wellens J. 2006. Detecting change in vague interpretations of landscapes. *Ecological Informatics*. 1 163-178
- Angold PG, Sadler JP, Hill MO, Pullin A, Rushton S, Austin K, Small E, Wood B, Wadsworth R, Sanderson R, Thompson K. 2006. Biodiversity in urban habitat patches. *Science of the Total Environment* 360: 196-204.
- Culshaw M.G., Nathanail C.P., Leeks G.J.L., Alker S., Bridge D., Duffy T., Fowler D., Packman J.C., Swetnam R.D., Wadsworth R.A. & Wyatt B. 2006. The role of web-based environmental information in urban planning - the environmental information system for planners. *Science of the Total Environment*, 360: 233-245.
- Thomson, A.G., Manchester, S.J., Swetnam, R.D., Smith, G.M., Wadsworth, R.A., Gerard, F.F. The use of digital aerial photography and CORINE-derived methodology for monitoring recent and historic changes in land cover near UK Natura 2000 sites for the BIOPRESS project. *International Journal of Remote Sensing* (accepted January 2006).
- Wadsworth R.A. & Hall J.R. 2007 Setting site specific critical loads: an approach using Endorsement Theory and Dempster-Shafer. *WASP: Focus*. 7 399-405
- Comber A.J. Fisher P.F. & Wadsworth R.A. 2008 Using semantics to clarify the conceptual confusion between land cover and land use: the example of 'forest'. *Journal of Land Use Science* 3(2-3) 185-198
- Wadsworth R.A. Balzter H., Gerard F., George C., Comber A. & Fisher P.F. 2008. An environmental assessment of land cover and land use change in Central Siberia using quantifier conceptual overlaps to reconcile inconsistent datasets. *Journal of Land Use Science*. 3(4) 251-264
- Sparks, T.H., Aasa, A., Huber, K. & Wadsworth, R.A., 2009. Changes and patterns in biologically relevant temperatures in Europe 1941-2000 *Climate Research* 39 191-207 doi 10.33541/cr00814
- Howard, D.C., Wadsworth, R.A., Whitaker, J.W., Hughes, N. & Bunce, R.G.H. (in press) The impact of sustainable energy production on land use in Britain through to 2050 *Land Use Policy* 26S S284-S292
- Rowland A.P., Lawlor A.J., Guyatt H.K., & Wadsworth R.A. 2010 Rural wet deposition of mercury in Great Britain. *Journal of Environmental Monitoring*. 12, 1747–1755 DOI: 10.1039/c0em00086h
- Hall J.R. & Wadsworth R.A. 2010. Estimating the Effect of Abiotic Factors on Modifying the Sensitivity of Vegetation to Nitrogen Deposition: An Application of Endorsement Theory. *Water, Air, & Soil Pollution*: 212(1), 441-459. DOI 10.1007/s11270-010-0359-3

## 1 STEPHEN AKESTER

<b>Family name:</b>	Akester
<b>First names:</b>	Stephen
<b>Date of birth:</b>	1950
<b>Nationality:</b>	British
<b>Civil status:</b>	Widow
<b>Key Qualifications:</b>	<ul style="list-style-type: none"> <li>● Director MacAlister Elliott &amp; Ptns Fisheries Management consultants and Marine Stewardship Council Certification Body</li> <li>● Thirty five years experience of project management, project coordination and team leadership in fisheries sector</li> <li>● Project director with experience in project identification, preparation and appraisal, proposal preparation, project management (technical and financial), networking and team building in the fields of fisheries management, commercial fisheries, marine environmental management</li> <li>● Experience with working in the UN (World Bank, FAO, UNEP) EU, Asian Development Bank, African Development Bank and bilateral agencies DFID, GTZ, SIDA</li> <li>● Advanced PADI diver</li> <li>● Master offshore</li> </ul>
<b>Computer Literacy:</b>	Apple systems OS 10, PC systems MS office,
<b>Present position:</b>	Director of MacAlister Elliott and Partners, International Fisheries and Environmental Management Consultants

### Current Activities

Fisheries Adviser West African Regional Fisheries project in Sierra Leone, Liberia, Ghana and Mauritania, assistance to project implmenettation units and World Bank task leaders. Fisheries Adviser FAO Somalia responsible for TCP project preparation and completion of Fisheries Policy, Law and Regulations development and supervision of program for fisheries development and management.

Supervision of MEP Marine Stewardship Council fisheries assessments world wide ([www.MSC.org](http://www.MSC.org)) chain of custody and associated fisheries improvement plans

Current supervision of MEP projects in fisheries management in Mozambique, Yemen, Mauritania, Black Sea, Maldives and UK. Contributor to fisheries management forums.

## Annexe 2. Institutional Support Letters

**Subject: Darwin Round 20 Grant Proposal:**

**'Alternative livelihood opportunities for Marine Protected Areas fishermen' (Ref 2314)**



**UNIVERSITY OF  
STIRLING**

SCHOOL OF  
NATURAL SCIENCES

Institute of Aquaculture  
University of Stirling  
Stirling, FK9 4LA  
Scotland, UK

T: + 44 (0) 1786 467878  
F: + 44 (0) 1786 462133  
E: [aquaculture@stir.ac.uk](mailto:aquaculture@stir.ac.uk)

[www.stir.ac.uk](http://www.stir.ac.uk)

**Letter of Support**

**27 Nov 13**

Dear Sir, Madam

The Institute of Aquaculture, University of Stirling is pleased to be a partner and lead institution in the above-named project proposed in response to the Darwin Initiative Round 20. We are confident that our partnership can make a significant contribution towards the achievement of the goals of this announcement.

The Institute of Aquaculture (IoA) of the University of Stirling is the leading international center in its field bringing together cross-disciplinary, world-class researchers to meet the wide range of challenges faced as aquaculture grows to meet global demands. Research focuses on fundamental questions relating to strategies for sustainable aquaculture, whether in modern commercial markets or in feeding poor communities in developing countries. Fundamental research on environments, reproduction, genetics, aquatic health, nutrition and feed supplies, on production systems, on markets, and on social and economic impacts all play significant roles. The Sustainable Aquaculture Research Group (SARG) have considerable experience leading collaborative international projects including two recent EU-FP7 large-scale collaborative projects: Sustaining Ethical Aquaculture Trade Project ([www.SEATglobal.eu](http://www.SEATglobal.eu), 2009-2013) evaluating sustainability of trade in farmed seafood commodities between Asia and 'Proteinsect' promoting smaller-holder insect-production for aquaculture feeds using agricultural waste-streams ([www.proteinsect.eu](http://www.proteinsect.eu)) in Ghana, China and the UK. Based on his extensive project management, commercial, research and development experience in collective management of multiple use commons in Asia and Africa, Dr Francis Murray (SARG) will lead project coordination.

We are pleased to partner with Njala University and the Institute of Marine Biology and Oceanography (IMBO) in this initiative and look forward to collaboration on the proposed research activities.

Yours sincerely

Prof. Brian Austin, Head of the Institute of Aquaculture, University of Stirling.



INSTITUTE OF MARINE BIOLOGY  
& OCEANOGRAPHY (I.M.B.O)

FOURAH BAY COLLEGE  
MOUNT AUREOL  
UNIVERSITY OF SIERRA LEONE



Director's Office → Dr. Ernest T. Ndomahina (Associate Professor) → →  
Our Ref.: IMBO/FBC/01  
Your Ref.: →

27<sup>th</sup> November, 2013

Dear Sir,

**Re: Application to the Darwin Initiative for the project  
"Alternative livelihood opportunities for Marine Protected Areas fishermen (Ref 2314)"**

The institute of Marine Biology and Oceanography (IMBO) is pleased to be part of this proposal and if successful will endeavor to fulfill all its financial and research obligations.

IMBO played a central role in the advocacy and setting up of the Marine Protected Area (MPA) network in Sierra Leone as we believe that MPAs offer the best chance for protecting the biodiversity and economic value of the coastal zone. The mangrove forests play a crucial role on the life cycle of many fish species of commercial interest and Sierra Leone is heavily dependent on fish protein to maintain the health of the human population. Mangroves are also crucial for many species of conservation concern; the Sherbro River Estuary and its mangrove forests are still home to manatees, crocodiles, dolphins, turtles and are visited by many species of migratory birds. One important aspect of the MPA is to control the fishing effort by artisanal fishermen and to that end a licensing system is being introduced this year that will limit artisanal fishermen (along the whole coast) to just 11,000 boats (from single person dugouts to motorized "Ghana Boats"). The indirect effect of this cap of fishermen's numbers may be to put additional stress on the mangroves as they could be utilized by "disenfranchised" fishermen for fire wood, building materials, cleared for rice or salt production or otherwise damaged. Collecting mangrove oysters is the sole source of income for some fisherwomen and a major supplement to many others; in some areas overharvesting is already evident in the small size and consequently low financial value of the harvested oysters, but low financial return causes the fisherwomen to harvest even more (to meet their modest income target). Farming shellfish should reduce some of the pressure on the wild stocks while allowing an increased income to the farmers; however, this benefit will only be realized if the product is processed and marketed in ways that allow the value to accrue to the farmers and not to middlemen.

We believe that the project design makes a careful balance between livelihood and biodiversity concerns in a way that should be replicable and extensible as well as being sustainable in the long term.

Yours faithfully

E. T. Ndomahina

cc. → Deputy Registrar, FBC  
→ Dean, FPAS

E-mail: [ernest\\_ndomahina@yahoo.co.uk](mailto:ernest_ndomahina@yahoo.co.uk) → Tel: 228580  
Cell: 076-613-980/033-855-244



Department of Biological Sciences  
Njala University  
Njala Campus  
Moyamba District

25<sup>th</sup> November 2013

Dear Sir,

Re: Application to the Darwin Initiative for the project “**Alternative livelihood opportunities for Marine Protected Areas fishermen (Ref 2314)**”

The Department of Biological Sciences is pleased to be included within this project proposal and intends to fulfil its financial and research obligation to the full.

The intended beneficiaries of the project are among the poorest and most marginalised section of society; even obtaining drinking water is a serious problem for them and schools and health centres are physically and conceptually distant. The introduction of Marine Protected Areas is vital for the long-term sustainable management of our inshore fisheries (which provide over 80% of the high grade protein consumed within Sierra Leone), but, the MPA's will only be successful if we can engage with oyster fishermen and fisherwomen and improve their livelihoods. Staff in the Department have been studying various aspects of the mangrove habitat for close to a decade now, and it seems remarkable that the mangrove forest has stayed in such good biodiversity status as it has managed to do so far. However, the introduction of limits on the number of boats that can be used for fishing will inevitably put increasing pressure on the mangroves (for oyster, fuel wood, conversion to rice fields etc). By promoting the cultivation of oysters on artificial substrates we should be able to improve the lives of the fisherfolk and protect the biodiversity value of the Shabro region. A key aspect to making cultivation profitable will be to add value along the supply chain so that more of the benefit can be delivered to the oyster farmer.

We trust that you will consider this proposal in a favourable manner.

Yours sincerely

Dr A. Lebbie  
Head of Department  
Biological Sciences





56 HIGH STREET LYMINGTON  
HAMPSHIRE SO41 9AH ENGLAND  
TELEPHONE (0)1590 679016  
FACSIMILE (0)1590 671573  
E-MAIL [mep@macalister-elliott.com](mailto:mep@macalister-elliott.com)  
WEBSITE [www.macalister-elliott.com](http://www.macalister-elliott.com)

29 November 2013

Application to the Darwin Initiative for the project “**Alternative livelihood opportunities for Marine Protected Areas fishermen (Ref 2314)**”

MacAlister Elliott and Partners Ltd (MEP) intend to fulfil all its obligations as set out in the proposal with its partners to achieve the declared objectives.

MEP is a specialist fisheries management organisation with extensive links in marine product processing and marketing and is a certification body for the Marine Stewardship Council standard.

As Oyster production develops in the project MEP would advise operators and managers on all aspects of the sustainability of the product and its treatment to enable future options for high value marketing in a range of markets. It would be anticipated that higher final sale values would be passed through the marketing channel to the producer in support of the projects aims of livelihood improvement for coastal communities in Sierra Leone.

MEP has more than 30 years of experience in the west African region and Sierra Leone and propose to act as advisers to all stages of the project development and management. MEP are advisers to the World Bank financed West African Regional Fisheries Project in Sierra Leone whose work plans include the establishment of the Marine Protected Areas that form the basis for the proposed Darwin Initiative activity.

We look forward to this proposal proceeding and assure Darwin Initiative of our firm support

Yours faithfully

A handwritten signature in black ink that reads 'S.J. Akester'.

S J Akester  
Director

### Annexe 3: Key References:

- Adite, A., Abou, Y., Sossoukpê, E. and Fiogbé, E. D. 2013 Oyster farming in the coastal ecosystem of southern benin (west africa): environment, growth and contribution to sustainable coastal fisheries management. International Journal of Development Research. Vol. 3, Issue, 10, pp.087-094,
- Ansa E.J. and Bashir R.M. 2007. Fishery and culture potential of the mangrove oyster (*Crassostrea gasar*) in Nigeria. Research Jo of Biol Sci 2(4) 392-394
- ASC 2012 Aquaculture Stewardship Council Bivalve Standard; Version 1.0 Jan 2012. [http://www.asc-aqua.org/upload/ASC%20Bivalve%20Standard\\_v1.0.pdf](http://www.asc-aqua.org/upload/ASC%20Bivalve%20Standard_v1.0.pdf)
- Cruver, P. 2011 Oyster Shellfish: Africa's Untapped Food Security? The African Executive. <http://www.africanexecutive.com/modules/magazine/articles.php?article=6061>
- Dabo, K.K. 1979. Development of aquaculture in Sierra Leone with a brief reference to oyster culture. Proceedings of the Int' Workshop on Pen Cage culture of fish. 11-12 Feb' Phillippines.
- EJF 2012 The Governance of Artisanal Fisheries in the Sherbro River Area of Sierra Leone. A report by the Environmental Justice Foundation <http://ejfoundation.org/oceans/governance-of-artisanal-fisheries-report>
- Haupt, T.M., Griffiths, C.L., Robinson, T.B., Tonin, A.F.G., De Bruyn, P.A. 2010 The History and Status of Oyster Exploitation and Culture in South Africa Journal of Shellfish Research 29(1):151-159. <http://www.bioone.org/doi/abs/10.2983/035.029.0109?journalCode=shre>
- Kamara A.B., and McNeil B. 1976. Preliminary oyster culture experiments in Sierra Leone. Occasional Paper No 1.
- Kusek, J.Z., Rist, R. 2004 Ten Steps to a Results-Based Monitoring and Evaluation System: A Handbook for Development Practitioners. WorldBank e-library. pp 284. e-ISBN: 978-0-8213-8289-9 <http://dx.doi.org/10.1596/0-8213-5823-5>
- Lapegue S., Boutet I, Leitoo A, Heurtebise S, Garcia P, Thiriote-Quievreax C and Boudry P 2002. Trans-Atlantic distribution of a mangrove oyster species revealed by 16S mtDNA and Karyological analysis. Biol Bul 202 232-242. (seems to throw some doubt as to what exists where).
- Lima de Freitas LE, Feltosa CV and de Arango ME. 2006. Mangrove oyster (*Crassostrea rhizophorae*) (Guilding 1928) farm area as artificial reefs for fish; a case study in the state of Ceara, Brazil. Brazilian Jo of Oceanography 54(1) 31-39. (tressels acting as fish attractors / habitat).
- Moehl, J. Brummet, R., Coche, A. 2006 Guiding principles for promoting aquaculture in Africa: benchmarks for sustainable development. Food and Agriculture Organization of the United nations. Regional Office for Africa, Accra, Ghana.
- NACE 2009 Sierra Leone at the crossroads: Seizing the chance to benefit from mining. National Advocacy Coalition On Extractives (NACE), Freetown. [www.nacesl.org](http://www.nacesl.org). <http://www.christianaid.org.uk/Images/sierra-leone-at-the-crossroads.pdf>
- Pecorar, I. L., Bertolazzi, J., Valente, W.C. 2013 Analysis of economic social sustainability in extensive production of oysters in a sub-tropical region. Presentation given at Aquaculture conference: To the Next 40 Years of Sustainable Global Aquaculture the 3rd -7th November 2013 Palacio de Congresos de Canarias, Las Palmas, Gran Canaria

Soto, D., Aguillar-Manjarrez (Eds) 2007 Building an ecosystem approach to aquaculture. FAO/Universitat de les Illes Balears Expert Workshop 7–11 May 2007 Palma de Mallorca, Spain. FAO and Aquaculture Proceedings 14. <ftp://ftp.fao.org/docrep/fao/011/i0339e/i0339e.pdf>

SUSTAINET EA 2010. Technical Manual for farmers and Field Extension Service Providers: Farmer Field School Approach. Sustainable Agriculture Information Initiative, Nairobi. [http://www.fao.org/ag/ca/CA-Publications/Farmer\\_Field\\_School\\_Approach.pdf](http://www.fao.org/ag/ca/CA-Publications/Farmer_Field_School_Approach.pdf)

Sutton AE, Yankson K and Wubah DA. 2012. The effect of salinity on particle filtration rates of the West African mangrove oyster. *Jo of Young Investigators* 24(4) 55-59

Trottier B. 1987 Women in aquaculture production in West Africa. In: Proceedings of the ADCP/NORAD Workshop on Women in Aquaculture Rome, FAO, 13-16 April 1987

UICN 2007 strategies for conservation and sustainable management of mangrove forest in sierra leone. 73pp.

Wadsworth, Richard A.; Sundufu, Abu; Jalloh, Abdul. 2009a Report on Inspection of Mangrove Forest Adjacent to Sierra Rutile Operational Areas 5th - 6th December 2007. NERC/Centre for Ecology and Hydrology, 6pp. (CEH Project Number: C03141 <http://nora.nerc.ac.uk/7022/3/N007022CR.pdf>)

Wadsworth, R. 2009b The voyage of the Ocean of Bliss, Planet Earth Online, NERC science of the Environment <http://planetearth.nerc.ac.uk/features/story.aspx?id=582&cookieConsent=A>

Wellesley-Cole C and Kamara AB. 1978. Studies of the condition factor in the Sierra Leone mangrove oyster *Crassastrea tulipa*.

Zaleski, C. 2013 Women Oyster Harvesters Revive Gambia's Degraded Fisheries. World Watch Institute. <http://www.worldwatch.org/node/6475>