



## FINAL PROJECT REPORT EVALUATION FORM

<u>Project Number:</u> SARF098	<u>Completion Date:</u> 18 Dec 2015
<u>Project Title:</u> A statistical analysis of sea-lice medicine use and benthic monitoring at Scottish marine salmon farms (2002-2014)	
<p>1. In your view have the scientific objectives been achieved. If not, does this need to be addressed by SARF?</p> <p>In the opinion of this Reviewer, Scientific Objective #1 (literature review) has been completed, but Objective 2 (selection of sub-set of sites) and Objective 3 (determine evidence of effects) were limited in their ability. The authors are to be commended for re-purposing and linking existing datasets to conduct their retrospective analysis. Since those databases were noted not to always have absolute alignment of grab dates and treatment, did not contain untreated fish farms in near proximity to treated sites, and did contain pre-treatment baselines at treated sites to evaluate the effects of added medicine, the conclusions drawn by the authors for Objective 4 (Provide expert advice on whether present regulation and practices provide good protection) are limited in achievement.</p>	
<p>2. Comment on the overall results of the project, including their significance for SARF.</p> <p>The authors conducted a complex retrospective analysis across multiple databases. Many correlations and hypotheses were generated that have value in further exploring. This modelling, however, is devoid of data evaluating the direct contribution of EMB; rather, it confounds EMB with other aspects of fish farming. This limits the value of the report's conclusions which were based on an unfounded conclusion of causation.</p> <ol style="list-style-type: none"> <li>1) To establish "causation," a baseline is classically established to identify the crustacean richness and abundance for that specific region in order to detect changes after medicinal product is administered. This would capture same-site changes from pre-treatment to post-treatment, and could alternatively be an evaluation of regionally similar non-treated control sites v treated sites. Unfortunately, the retrospective analyses conducted evaluated the richness and abundance after farming with EMB. It is challenging to retrospectively be conclusive that any changes at that site actually occurred, and if associated with regional differences, there is no ability to parse out the contribution from each farming activity. The analysis was very good in raising questions which need to be answered with prospective studies.</li> <li>2) The Authors contend that the crustacean richness and abundance has diminished down-current from the fish farm. Not included in the database, however, was the simultaneous evaluation of up-current and side-current locations. General environmental changes could be occurring with broad effects to flora and fauna, and those factors need to be parsed from the effects of fish farming. The Authors' conclusions are based on the assumption that all changes were uni-directionally down-current from the medicine application site.</li> <li>3) The Authors findings were internally consistent during modelling of all grab sites (cage end, variable allowable zone of effects, and reference [REF] sites &gt;400m), and when considering only the REF sites by itself. Since EMB is typically not detected after 25m, the Authors concluded that the assay must be insufficient to detect EMB down-current, and the established no-effect level of EMB must be re-determined. This Reviewer concurs that establishing a more sensitive assay would be a precursor to evaluating if lower levels of EMB are carried down-current. However, the Authors' extrapolation to conclude "toxic effects occur at levels much lower than those that are currently detectable" are as yet unsubstantiated.</li> <li>4) The conclusions of the Authors are based on the Bayesian credible intervals. As demonstrated most clearly for richness, the relative importance of the EMB variable, however, is questioned as it was the</li> </ol>	

