Implementing the New Zealand Marine Protected Areas Policy – a Case Study from the South Island West Coast

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The West Coast Marine Protection Forum was established in 2005 to recommend marine areas for protection in the South Island West Coast inshore marine biogeographic region. The independent Forum comprised fourteen people who were representative of a range of stakeholders and users, including tangata whenua, commercial fishing, recreational fishing, environment and conservation, education, local community and local government. The Forum was advised and funded by New Zealand government agencies, the Department of Conservation and Ministry of Fisheries. The Forum was primarily guided by the New Zealand government's Marine Protected Area Policy and Implementation Plan, and its associated ecosystem classification and protection standards. Multiple users and diverse interests are a feature of mainland coasts such as the West Coast. Accordingly, the Forum had a strong focus on ensuring public and stakeholder input, and the use of the best available information. In accordance with the MPA Policy, the forum sought to recommend representative coverage of marine habitats within MPAs, while minimising adverse impacts on existing users.

The Forum succeeded in recommending marine protected areas at four "primary sites" (each with two or three options) and five smaller "educational showcase sites". In September 2011, the Minister of Conservation directed the Department to proceed with applying for highly protected marine reserves at the five sites, including the four primary sites. The Ministry of Fisheries is to proceed with proposals to prohibit bottom-impacting fishing methods adjoining two of the primary sites. In total, these MPA proposals cover 27085 hectares or 2.1% of the marine environment of the biogeographic region. If approved, they will include three of the four largest marine reserves on the mainland New Zealand coast. It is expected that the necessary legal processes for these proposals under the Marine Reserves Act 1971 and Fisheries Act 1996 will proceed during 2012.

Mitochondrial Dynamics underlying thermal Plasticity of Cuttlefish (*Sepia officinalis*) Hearts

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In the eurythermal cuttlefish *Sepia officinalis*, performance depends on hearts that ensure systemic oxygen supply over a broad range of temperatures. We therefore aimed to identify adjustments in energetic cardiac capacity and underlying mitochondrial function supporting thermal acclimation that could be critical for the cuttlefish's competitive success in variable environments. Two genetically distinct cuttlefish populations were acclimated to 11°C, 16°C and 21°C, respectively. Subsequently, skinned and permeabilised heart fibres were used to assess mitochondrial functioning by means of high-resolution respirometry and a substrate-inhibitor protocol, followed by measurements of cardiac citrate synthase and cytosolic enzyme activities. In cuttlefish hearts, thermal sensitivity of mitochondrial substrate oxidation was high for proline and pyruvate but low for succinate. Oxygen efficiency of catabolism rose from 11°C to 21°C via shifts to oxygen-conserving oxidation of proline and pyruvate as well as via reduced relative proton leak. Acclimation to 21°C decreased mitochondrial complex I activity in Adriatic cuttlefish and increased complex IV activity in English Channel cuttlefish. However, compensation of mitochondrial capacities did not occur during cold acclimation to 11°C. Moreover, temperate English Channel cuttlefish had larger hearts with lower mitochondrial capacities than subtropical Adriatic cuttlefish. The changes observed for substrate oxidation, mitochondrial complexes, relative proton leak or heart weights improve energetic efficiency and essentially seem to extend tolerance to high temperatures and reduce associated tissue hypoxia. We conclude that cuttlefish sustain cardiac performance and thus, systemic oxygen delivery over short and long-term changes of temperature and environmental conditions by multiple adjustments in cellular and mitochondrial energetics.