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Editorial

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Contribution of Coastal Macrophytobenthos to Blue Carbon

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Human emission of carbon dioxide (CO_2) has been accelerated, and greenhouse effect and ocean acidification are known as serious CO_2-induced climate changes. There has been recently great interest in the ability of marine autotrophs as a sink for CO_2, and such role was named as "Blue Carbon" [1]. One of the focused environments for the capacity of Blue Carbon is coastal area where there are a variety of benthic organisms due to inhabitation of macrophytobenthos.

Calculation on the capacity of Blue carbon in coastal environment included mangrove forest, seagrass meadow and salt marsh [1]. These communities are located in sandy or muddy bottom, and burial of their plant detritus into sediment would contribute to Blue Carbon. On the other hand, macroalgae are also important primary producer in coastal ecosystems [2], though their contribution was sometimes overlooked. Macroalgal habitat is rocky shore area and they do not have sandy or muddy substrates, implying that their detritus is not buried just below their community as pointed out by the report of recent PICES Workshop [3].

Studies on Blue carbon have been mainly focused on the burial process of plant detritus as described above, but other form of organic carbon might be also important in the processes of carbon sink. One of the overlooked fates of macroalgal organic matter is dissolved organic matter (DOM). Although most of the estimate on the fate of macroalgal products did not include this fate [4], macroalgae would release a considerable fraction of their productivity as DOM (20-40%) [5].

Since the role of DOM in carbon sink strongly depends on bioavailability [6], bio-refractory fraction of macroalgal DOM should be considered in the process of Blue Carbon. Bioavailability of macroalgal DOM has been examined by Wada et al. [7] with dark incubation experiment in which they showed relatively bio-refractory property of macroalgal DOM for microbial decomposition compared with phytoplanktonic DOM. Although such information has been still limited, it provides possibility that macroalgal DOM acts as a carbon sink in marine environment. In addition to the microbial activity, photo decomposition is also important factor controlling DOM decomposition. It has been known that a part of marine bio-refractory DOM is readily decomposed by UV radiation [8], and macroalgal DOM also has UV-sensitive characteristics [9]. In addition, macroalgal DOM would be exposed to strong solar radiation immediately after the release, because UV is able to penetrate to shallow region. Considering these facts, further experiment for microbial availability and photoreactivity will show the contribution of macroalgal DOM to Blue Carbon. DOM is also released from other coastal community such as salt marsh [10], mangrove forest [11] and seagrass meadows [12], and they have been also less considered in the processes of Blue Carbon. It might be necessary to take into consideration the role of DOM derived from the macrophytobenthos in the processes in Blue Carbon as well as macroalgae.

For evaluation of the role of macrophytobenthos in Blue Carbon, there is another unresolved issue, heterogeneous distribution of coastal organisms. Although the global estimate for productivity of coastal organisms is essential to know their contribution to Blue Carbon, there is just rough estimate for their distribution in global ocean. For example, only two literature have been referred in respect to the macroalgal productivity in global ocean [13,14], but difference between these two reports is about two orders of magnitude (0.03 and 2.55 Pg C y^{-1}) probably due to evaluation methods. In future, detailed investigation for the global distribution of macrophytobenthos will provide reliable estimate of their contribution to Blue Carbon.

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Top