

Trial of riverine estuary environment classification on first class rivers throughout Japan

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(Key words) Riverine estuary, environment, classification

1. Aims of the research

At river mouths where rivers reach the ocean, riverine estuaries are formed by the mixing of fresh water with salt water. In riverine estuaries, complex physical and chemical phenomena occur as a result of external forces including tides, waves, floods, sediment supply, and addition of pollutants from both the sea and from the river, and the combinations of these external forces produce diverse environmental properties. Living organisms adapted to this environment inhabit these waters.

These complex and diverse riverine estuary environments are often strongly impacted by man-made disruptions, so it is difficult to set goals when planning the conservation of their environments. If riverine estuaries can be classified according to environmental properties, it will be possible to evaluate the environmental impacts of specified man-made changes by selecting and comparing rivers with different degrees of man-made change from among multiple rivers in the same classification. And if we select a river where relatively little man-made change occurs as a reference, it might be possible to set environmental conservation goals for riverine estuaries on rivers in the same class with considerable objectivity. For these motives, we classified riverine estuaries on rivers nationwide by abstracting natural environment elements presumed to determine the properties of riverine estuary environments.

2. Physical environment classification of riverine estuaries on 109 first class river systems throughout Japan

Riverine estuary environments were classified using the river flow rate, riverbed gradient, tidal range, and wave height, as the physical environmental indices which determine riverine estuary environments. For the concept guiding the selection of indices, we referred to a past report¹⁾. Riverine estuaries were classified by performing principal component analysis of the above indices, obtaining the principal components and principal component scores, then performing cluster analysis of principal component scores for principal components with an eigenvalue of 1 or more.

Figure 1 shows the distribution of riverine estuaries classified into five classes based on indices values at normal time. It established five classifications: a group where the tidal range is a little large distributed widely on the Pacific Ocean side (Tide Class I), Flow Rate Class I where the river flow rate is a little high distributed widely throughout Japan, Tide Class II where the tidal range is extremely large and which is distributed on part of the Ariake and Seto Inland Seas, Gradient Class where the riverbed gradient is steep distributed on the Hokuriku Tokai coast, and Flow Rate Class II where the gradient is mild and flow rate is high located mainly at large rivers on the Japan Sea side.

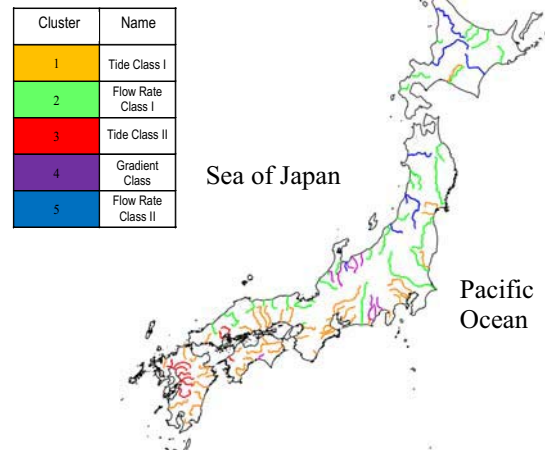


Figure 1. National Distribution of Classification Based on Indices at Normal Time

3. Summary

This classification clearly demonstrated for the first time relationships showing that in tidal type riverine estuaries strongly impacted by the sea, salt-water and brackish water fish species are numerous, and that in flow rate type riverine estuaries strongly impacted by rivers, fresh water fish species are numerous¹⁾. In the future, we will do further study of environmental classifications and their properties to contribute to the conservation of riverine estuary environments.

[Reference]

1) Kishida, Amano, Onuma, Endo: Riverine estuary classification for the sake of environmental conservation, Journal of Hydraulic Engineering, JSCE, Vol. 55, 2011. (in Japanese with English abstract)