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Fish species association using data-mining of selected species, waters of India

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Abstract
A data-mining is a combination of database, statistics and heuristic applications. We are able to determine species association of giant prawn using this data-mining technique i.e. association rule mining in inland water-bodies. In West Bengal region species existence and some cases species abundance of *M. rosenbergii* is found in the rivers of Ganges, Ichhamati, Rupnarayan, Churni and even in Damodar. In case of lower stretch of river Ganges species associations of Giant prawn are found *as A. aor R. rita, E. vacha, R. corsula, G. guris, W. attu, L. rohita, L. bata, C. catla, C. mrigala, A. coila, C. garua, N. (Chitala) chitala, N. notopterus, T. ilisha, P. paradisius, M. vittatus, P. saphore, P pama.* However in culture based capture fisheries species association of the *Macrobrachium rosenbergii* is derived using data-mining ie. Association rule mining. It is felt that *M rosenbergii* in river may be escaped from such other predatory species for ecological gains. This article also describes fish species associations specially in natural *Beel* water to protect the fisheries gene pool.

Keywords: Fish species association, Data mining technique, Inland fisheries

1. Introduction
A data mining is a combination of database, statistics and heuristic applications. It is to determine species association of a particular / any species using this technique i.e. association rule mining in inland water-bodies. This method is applicable for identification of species association of other species of inland waters.

2. Materials and Method
Species association with n fields of whose all n fields may not be filled or entered having not null values. In this database possible fields are field1, field2. fieldn. M rosenbergii is species name of whose association needs to be derived with heuristic approach. Here in above statement we have considered association of at the most 10 species in a single association. By gathering data of netting practices example either of Scoop net/ Cast net / Drag net / Chinese net etc we can get associated catches of single or multiple species in a same effort. Multiple species we obtain can be termed as existing species association of that water bodies. Thus we may develop species association database.
Catch 1: SN 1
Catch 2: SN2
…..…
Catch I: SN i
Catch n: SN n
Catch (1, 2,….n) catch of multiple netting/ water bodies/ availed from baskets etc. whereas SN species number is variable 1...10 (Say)
Beside above two desired technicalities we apply some artificial intelligence or knowledge of heuristics for giving human like thinking is performed. These are some computer algorithm or model statements with conditions based on water qualities and feed habit of individual fish species. Some logical statements like if <> then <> else <> is to be applied. As for example total number of species may depends on dimension of water bodies. Small sized water bodies has minimum associated species whereas larger water bodies have more number of associated species. In case of river cited in this abstract, maximum number associated species might be existing. Species association mention in this communication is most comprehensive that can be termed as total possible association for a particular species. Knowledge of species association is more important than the concept of poly-culture in culture based capture

fisheries. In tropical beels and wet lands conventional poly-culture practices fails owing to lack of water depth. Whereas species association is always applicable. A mere depth of water below one metre is found in many cases. In such cases column feeder, top feeder and sometime bottom feeder too may not have much options since there is shallow water bodies and fishes should survive and grow without much harming to other species. Thus ideal species association is desired for the shake of sustainable inland fisheries.

Table 1: *Macrobrachium* species existence in river lower Ganges and river streams

River	Fry of M rosenbergii	Adults of M rosenbergii
Lower Ganges	Available	Available
Ichhamati	Available	Available
Rupnarayan	Available	Available
Churni	Not available	Available
Damodar	Available	Available

It has been found that in rivers migration of M rosenbergii could be existing even in lowly-silted and low to medium depth of waters as found in the river Damodar.

3. Results and Discussion

Ideal species association (Table 1 and Table 2) is presented based on amount of stock of associated different species and respective catches from the database. In ideal species association there should be harmony in proportionate catches we stock already and respective catches we get species wise. Ratio between stock and catch of associated species i.e. Stock $_{(i)}$ / Catch $_{(i)}$ of i^{th} species of associated n species should be closer, whose value usually remains (0 to 1). Factors related to determining species association are natural feed like plankton, zoo plankton, hydrophytes, detritus, periphyton, depth of water bodies, their qualities and bottom soil. It is assumed that all these parameters are suited and fisheries are performed by natural way.

Table 1: A few existing species associations in Beels of lower belt of Gangetic West Bengal

1.	*Catla catla, L rohita, P javanicus, L bata. Cirrhinus mrigala*
2.	*Silvercarp, L rohita, P Javanicus, L bata. Cirrhinus mrigala*
3.	*Catla catla, Silvercarp, L. rohita, P javanicus, L bata. Cirrhinus mrigala*
4.	*P pungacius*
5.	*Puntius sarana, Mystus tengra, Channa spp, Nandus nandus, Pabda ompack, Macrobrachium sp, Mastacembelus sp, mud eel*
6.	*C Catla, P javanicus, L rohita, L bata, C. mrigala, Ctenopharyngodon idella, Cyprinus carpio*
7.	*Channa spp, Singhi, Amblypharyngodon mola*
8.	*C catla, L. rohita, L bata, C mrigala, Ctenopharyngodon idella*
9.	*Mystus tengra, Glossogobius giuris, Channa sp, khaira, Mastocembelus sp Tilapia (nilotica), P javanicus*
10.	*C catla, L rohita, Ctenopharyngodon idella, C. mrigala, Cyprinus carpio*

Table 2: A few existing species associations in inundated land /Beels of upper Ganges belt of West Bengal.

1.	*Catla catla, Hypophthalmichthys molitrix, Labeo rohita, Labeo bata, Tilapia mossambica, Cyprinus carpio, Cirrhinus mrigala*
2.	*Aristichthys nobilis, Amblypharyngodon mola, Ambassis ranga, Anabas testudineus, Arichtys aor, Botia sp, Channa sp, Cirrhinus reba, Colisa chuna, Colisa fasciatus, G giuris, Gudusia chapra, Mastocembelus sp, Mystus vittatus, Mystus cavasius, N notopterus, P ethenoides, P conchorius, P sarana, P ticto*
3.	*Labeo calbasu, Catla catla, Hypophthalmichthys molitrix, Labeo rohita, Labeo bata, Tilapia mossambica, Cyprinus carpio, Cirrhinus mrigala*
4.	*Puntius javanicus, Catla catla, Hypophthalmichthys molitrix, Labeo rohita, Labeo bata, Tilapia mossambica, Cyprinus carpio, Cirrhinus mrigala*
5.	*Pangasius sutchi*
6.	*Notopterus chitala, Colisa chuna, Colisa fasciatus, G giuris, Gudusia chapra, Mastocembelus sp, Mystus vittatus, Mystus cavasius, N notopterus, P ethenoides, P conchorius, P sarana, P ticto*
7.	*Clarius battrchus, Amblypharyngodon mola, Ambassis ranga, Anabas testudineus, Arichtys aor, Botia sp, Channa sp, Cirrhinus reba, Colisa chuna, Colisa fasciatus, G giuris, Gudusia chapra, Mastocembelus sp, Mystus vittatus, Mystus cavasius, N notopterus, P ethenoides, P conchorius, P sarana, P ticto*
8.	*Amblypharyngodon mola, Anabas testudineus, Arichtys aor, Botia sp, Channa sp, Cirrhinus reba, Colisa chuna, Colisa fasciatus, G giuris, Gudusia chapra, Mastocembelus sp, Mystus vittatus, Mystus cavasius, N notopterus, P ethenoides, P conchorius, P sarana, P ticto, Wallago attu, Xenontoden cancila, Gang koi*
9.	*Ctenopharyngodon idella, Catla catla, Hypophthalmichthys molitrix, Labeo rohita, Labeo bata, Tilapia mossambica, Cyprinus curpio, Cirrhinus mrigala*

Ideal species association is estimated based on approximated fish catch. However, identifying actual ideal species association is not a simple task owing to difficulties in record keeping species wise and shortage of human courage.

4. Acknowledgement

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5. Reference

1. www.fishbase.org