

## Abundance of Diseases in Food Fishes of North East Region of India With Reference To Economic Loss

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**Abstract:** Aquaculture is the fastest growing food producing sector in the world. The inland fishery resources of India have a rich production potential. North Eastern Region of the country is located between 21.570N – 29.300N latitude and 89.460E – 97.300E longitude. The fishery resources of the region fall within all three types of climate i.e. tropical, sub-tropical and temperate and represent a strong biodiversity. Two principal rivers Brahmaputra, Barak and their numerous tributaries harbor varieties of fish species. The threat of diseases has now become a risk to the growth of the aquaculture sector which significantly affects both economic and socio economic development. A list of 197 species and 25 families of fish is given in the paper with the diseases reported in them.

**Key words:** Diseases, Inland fishery, North East region, Threat.

### I. Introduction

The North East region has about 19,150 km of rivers; 23,972 ha. of reservoirs; 1,43,740 ha. of lakes; 40,809 ha. of ponds and 2,780 ha. of rice-cum-fish culture area. The State Assam which forms about 30% of the North Eastern region has Brahmaputra and Barak river systems and their numerous tributaries (combined length 4820 km) and a large number of flood plain wet lands (Beel). The North East India is considered as one of the hot spots of fresh water fish biodiversity in the world (Kottelat and Whitten, 1996).

The North Eastern Region shares its fish fauna predominantly with that of the Indo-Gangetic fauna and to a small extent with the Burmese and South China fish fauna (Yadav and Chandra, 1994). Goswami *et al.* (2012) listed 422 fish species from north east India, belonging to 133 genera and 38 families. The seven North Eastern states of India: Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland and Tripura are blessed with diversified fish fauna. The region has been ranked sixth among the top 25 biodiversity spots in the world. The region has about 19,150 km of rivers; 23,972 ha. of reservoirs; 1,43,740 ha. of lakes; 40,809 ha. of ponds and 2,780 ha. of rice-cum-fish culture area (Kiran: A report by ICAR). A list of Rivers, Lakes, and waterfalls of the north east region is given below:

#### Rivers

Bhogdoi, Siang/ Dihang/ Brahmaputra, Dhansiri, Dihing, Diphlu, Feni, Gumti, Haor, Iril, Kaladan, Kameng, Boreli, Karnaphuli, Khowai, Kolong, Lohit, Manas, Manu, Mora Dhansiri, Muhuri, Myntdu, Mora diphlu, Sankosh or Puna Tsang Chhu, Simsang or Someshwari, Surma, Thega River, Tirap.

#### Lakes

Kamalasagar, Lohtak and Umiam.

#### Waterfalls

Bishop, Kynrem, Langshiang.

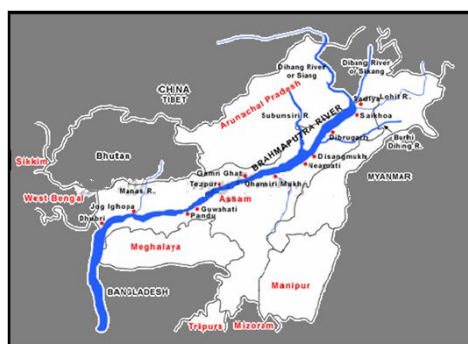


Fig.1-Map showing rivers and tributaries flowing in North East region.

Riverine fishery resources of the states of North East region have diversified fish fauna but still the old traditional methods of fishing are being used and primitive and outdated practices are followed for fishing. A large number of diseases occur in fishes, due to nutritional deficiency or unhygienic condition of water or attack

of parasites. Among the parasites that infect freshwater fishes, helminths- represented by 5 taxonomic units i.e. Monoginoidea, Trematoda, Cestoda, Nematoda and Acanthocephala, they often cause veterinary problems worldwide (Williams and Jones, 1994)

**List of some common parasites of fishes is given below (S.S. Khanna and H.R. Singh)**

<i>Costia</i>	Flagellated Protozoan
<i>Ichthyophthirius</i>	Ciliated Protozoan
<i>Trichodina</i>	Ciliated Protozoan
<i>Lerneae</i>	Copepod Crustacean
<i>Argulus</i>	Crustacean
<i>Ergasilus</i>	Copepod
<i>Cercaria of Bucephalus</i>	Trematode
<i>Diplozoon</i>	Monogenea
<i>Gyrodactylus</i>	Monogenea
<i>Dactylogyrus</i>	Monogenea
<i>Saprolegnia</i>	Fungus

It must to be mentioned that reports of fish mortalities occurring in the water bodies of India are infrequent. Fisheries management practices are not working properly in the region. However, with the outbreak of epizootic ulcerative syndrome (a disease caused by the fungus, *Aphanomyces invadans*, red spots develop on the skin which later on becomes ulcers and then followed by the development of granulomas on the internal organs which becomes the cause of mortality in fishes) a system of disease surveillance and monitoring was initiated in a structured manner, and reports have been obtained.



Fig. 2-EUS (Epizootic Ulcerative Syndrome) disease in fish

**Table 1:**Data for outbreaks of EUS in India.

Range in Prevalence (%) by Affected Fish Species		Range in Prevalence (%) by Geographic Area (in All Species Affected)	
Species	Prevalence	State	Prevalence
<i>Channa spp.</i>	20-100	Assam	30-60
<i>Puntius spp.</i>	5-100	Tripura	35-70
<i>Glossogobius spp.</i>	10-60	Meghalaya	10-35
<i>Mystus sp.</i>	5-75	West Bengal	15-65
<i>Notopterus spp.</i>	3-25	Bihar	20-30
<i>Wallago attu</i>	7-20	Orissa	20-45
<i>Mastacembelus spp.</i>	10-35	Uttar Pradesh	15-20
<i>Anabas testudineus</i>	10-55	Tamil Nadu	5-25
<i>Amblypharyngodon mola</i>	5-10	Maharashtra	5-10
<i>Rhinomugil corsula</i>	1-5	Kerala	30-65
<i>Clarias batrachus</i>	10-30		
<i>Heteropneustes fossilis</i>	10-20		
<i>Catla catla</i>	5-15		
<i>Labeo rohita</i>	5-10		
<i>Cirrhinus cirrhosus</i>	5-20		
<i>Cyprinus carpio</i>	10-25		
<i>Ctenopharyngodon idellus</i>	2-5		

<sup>1</sup>Data from Das (1994).

Table 2: A list of food species of North east region and the diseases reported is given below

Family	Name of Fishes	Diseases
Anabantidae	1. <i>Anabas cotojiu</i>	DD
	2. <i>Anabas testudineus</i>	Anchor worm Disease, Procerovum Infestation, Gnathostoma Infestation, Procerovum Infestation, Centrocestus Infestation, Camallanus Infection, Stellantchasmus Infestation, Lernaea Infestation, Dactylogyrus Gill Flukes Disease, Contracaecum Disease, Tripartiella Disease, Gnathostoma Infestation, Camallanus Infection, Allocreadium Infestation, Neopecoelina Infestation, Camallanus Infection, Paragendria Infestation, Lernaea Infestation, Parasitic infestations (protozoa, worms, etc.)
Anguillidae	1. <i>Anguilla bengalensis</i>	DD
	2. <i>Gonialosamanmina</i>	DD
	3. <i>Gudusiachapra</i>	DD
Bagridae	1. <i>Batasiofasciolatus</i>	DD
	2. <i>Batasioniger</i>	DD
	3. <i>Batasiospilurus</i>	DD
	4. <i>Batasiotengana</i>	DD
	5. <i>Chandramarachandramara</i>	DD
	6. <i>Hemibagrusmenoda</i>	DD
	7. <i>Hemibagrusmicrophthalmus</i>	Gnathostoma Infestation, Parasitic infestations (protozoa, worms, etc.)
	8. <i>Hemibagruspeguensis</i>	DD
	9. <i>Mystusarmatus</i>	DD
	10. <i>Mystusbleekeri</i>	DD
	11. <i>Mystuscavasius</i>	Procammallanus Infection, Isoparorchis Infestation, Allocreadium Infestation, Buckleynema Disease, Cucullanus Disease, Parasitic infestations (protozoa, worms, etc.)
	12. <i>Mystusfalcarius</i>	DD
	13. <i>Mystushorai</i>	DD
	14. <i>Mystusmontanus</i>	DD
	15. <i>Mystuspulcher</i>	DD
	16. <i>Mystusrufescens</i>	DD
	17. <i>Mystustengara</i>	Euclinostomum Infestation, Procammallanus Infection, Procammallanus Disease, Isoparorchis Infestation, Neoechinorhynchus Disease, Allocreadium Infestation, Procammallanus Infection, Parasitic infestations (protozoa, worms, etc.)
	18. <i>Mystusvittatus</i>	Procammallanus Infection, Isoparorchis Infestation, Pallisentis Disease, Palaeorchis Disease, Buckleynema Disease, Neoechinorhynchus Infestation, Parasitic infestations (protozoa, worms, etc.), Aphanomyces Infestation, Saprolegnia Infestation, Saprolegnia Infestation (Fungal diseases)
	19. <i>Olyraburmanica</i>	DD
	20. <i>Rama rama</i>	DD
	21. <i>Rita rita</i>	Contracaecum Disease, Cucullanus Disease, Opisthorchis Disease, Phyllodistomum Infestation, Rhabdochona Infestation, Parasitic infestations (protozoa, worms, etc.)
	22. <i>Sperataacicularis</i>	DD
	23. <i>Sperataaor</i>	Isoparorchis Infestation, Bucephalus Infestation, Bucephalus Disease, Prosohynchoides Disease, Coitocaecum Disease, Caryophyllaeus Infestation, Contracaecum Infestation, Paragendria Disease, Pingus Infestation, Parasitic infestations (protozoa, worms, etc.)
Chacidae	24. <i>Sperataseenghala</i>	DD
	1. <i>Rhinomugilcorsula</i>	DD
Channidae	1. <i>Channaamphibeus</i>	DD
	2. <i>Channaaurantimaculata</i>	DD

	3.	<i>Channabarca</i>	DD
	4.	<i>Channableheri</i>	DD
	5.	<i>Channagachua</i>	Genarchopsis Infestation, Pallisentis Disease, Camallanus Infection, Parasitic infestations (protozoa, worms, etc.)
	6.	<i>Channahatcourtbutleri</i>	DD
	7.	<i>Channamarulius</i>	Camallanus Disease, Contraecaecum Disease, Phyllodistomum Infestation, Neocamallanus Infestation, Isoparorchis Infestation, Pallisentis Disease, Pallisentis Infestation, Allogomtiorema Infestation, Paracamallanus Infection, Crowcrocaecum Infestation, Anchistrocephalus Disease, Bothriocephalus Infestation, Polyonchobothrium Disease, Taphrobothrium Infestation, Heliconema Infestation, Neocamallanus Disease, Pallisentis Infestation, Parasitic infestations (protozoa, worms, etc.)
	8.	<i>Channaorientalis</i>	DD
	9.	<i>Channapunctata</i>	Anchor worm Disease, Trichodinosis, Contraecaecum Disease, Neocamallanus Infestation, Procammallanus Disease, Euclinostomum Infestation, Ascaris Disease, Isoparorchis Infestation, Genarchopsis Infestation, Pallisentis Disease, Palaeorchis Disease, Allocreadium Infestation, Phyllodistomum Infestation, Ascaridia Disease, Pallisentis Infestation, Euclinostomum Infestation, Neopecoelina Infestation, Neopecoelina Disease, Philopinna Disease, Pallisentis Infestation, Anchistrocephalus Disease, Neocamallanus Disease, Pallisentis Infestation, Camallanus Infection, Eucreadium Infestation, Parasitic infestations (protozoa, worms, etc.)
	10.	<i>Channastewartii</i>	DD
	11.	<i>Channastrata</i>	Anchor worm Disease, Fish louse Infestation, Trichodinosis, Skin Flukes, Yellow Grub, Camallanus Disease, Cercaria Disease, Clinostomum Infestation (metacercaria), False Fungal Infection ( <i>Apiosoma</i> sp.), False Fungal Infection ( <i>Epistylis</i> sp.), Haplorchis Infestation, Procerovum Infestation, Posthodiplostomum Infestation, Turbidity of the Skin (Freshwater fish), Anchorworm Disease ( <i>Lernaea</i> sp.), Haplorchis Infestation, Clinostomoides Infestation, Neodiplostomum Disease, Opegaster Infestation, Gnathostoma Infestation, Neocamallanus Infestation, Centrocestus Infestation, Fish Louse Infestation, Clinostomum Infestation, Euclinostomum Infestation, Posthodiplostomum Disease, <i>Piscicola</i> Infestation ( <i>Piscicola</i> sp.), Fish louse Infestation, Contraecaecum Disease, Phyllodistomum Disease, <i>Acanthogyrus</i> Infestation, Gnathostoma Infestation, Neocamallanus Infestation, Euclinostomum Infestation, Procammallanus Infection, Isoparorchis Infestation, Pallisentis Disease, Procammallanus Infection, Echinocephalus Disease, Pallisentis Infestation, Euclinostomum Infestation, Pallisentis Infestation, Allogomtiorema Infestation, Paracamallanus Infection, Anchistrocephalus Disease, Bothriocephalus Infestation, Polyonchobothrium Disease, Taphrobothrium Infestation, Neocamallanus Disease, Pallisentis Infestation, <i>Lernaea</i> Infestation, Camallanus Infection, Parasitic infestations (protozoa, worms, etc.), Epizootic Ulcerative Syndrome, Epizootic Ulcerative Syndrome, (Viral diseases), Aeromonosis, Bacterial diseases.
Cichlidae	1.	<i>Oreochromisniloticus</i>	Yellow Grub, Dactylogyrus Gill Flukes Disease, Trichodinosis, Dactylogyrus Gill Flukes Disease, Trichodinosis, Skin Flukes, Cichlidogyrus Disease, Cryptobia Infestation, False Fungal Infection ( <i>Apiosoma</i> sp.), False Fungal Infection ( <i>Epistylis</i> sp.), <i>Transversotrema</i> Infestation, <i>Caligus</i> Infestation, <i>Alitropus</i> Infestation, Trichodina Infection, <i>Tripartiella</i> Infestation, Trichodina Infection, <i>Cristaria</i> Infestation, Cichlidogyrus Infestation, <i>Ichthyophthirius</i> Disease, <i>Tripartiella</i> Infestation, Cichlidogyrus Infestation, Cichlidogyrus Infestation, Cichlidogyrus Infestation, Trichodina Infestation, Trichodina Infestation, Trichodina Infestation, Enterogyrus Infestation, <i>Gyrodactylus</i> Infestation, <i>Gyrodactylus</i> Infestation, <i>Lamproglana</i> Infestation, Fish louse Infestation, Turbidity of the Skin (Freshwater fish), <i>Ergasilus</i> Disease, <i>Trypanosoma</i> Infection, Sporozoa-infection ( <i>Myxobolus</i> sp.), Contraecaecum Disease (larvae), Fish Tuberculosis, <i>Amplicaeum</i> Infection (Larvae), Cichlidogyrus Infestation, Gnathostoma Disease (larvae), Cichlidogyrus Infestation, Cichlidogyrus Disease, <i>Acanthogyrus</i> Infestation, Cichlidogyrus Infestation, Cichlidogyrus Infestation, Cichlidogyrus Infestation, <i>DilepidCestode</i> larvae Infestation (general sp.), Cichlidogyrus Infestation, <i>Trypanosoma</i> Infestation, <i>Dactylosoma</i> Infection, Parasitic infestations (protozoa, worms, etc.), Aeromonosis, Myxobacterial Infections, Aeromonosis, <i>Edwardsiellosis</i> , <i>Epitheliocystis</i> (Bacterial diseases), Iridovirus, Whirling Viral Disease of Tilapia Larvae, (Viral diseases).
Clariidae	1.	<i>Clariasmagur</i>	DD
	2.	<i>Clariasgaripepinus</i>	Trichodinosis, <i>Piscicola</i> Infestation ( <i>Piscicola</i> sp.), <i>Sanguinicola</i> Disease, Fish Louse Infestation, Procammallanus Infection, <i>Dolops</i> Infestation, <i>Chilodonella</i> Infection, <i>Henneguya</i> Infection, <i>Gyrodactylus</i> Infestation, Phyllodistomum Infestation, <i>Neodactylogyrus</i> Infestation, <i>Astiotrema</i> Infestation, <i>Quadriacanthus</i> Infestation, Polyonchobothrium

	3.	<i>Heteropneustesfossilis</i>	Infestation, Macrogyrodactylus Infestation, Parasitic infestations (protozoa, worms, etc.) Fish louse Infestation, Intestinal Ligulosis, Dactylogyrus Gill Flukes Disease, Yellow Grub, Contraecum Disease, Clinostomum Infestation (metacercaria), Orientocreadium Infestation, Gnathostoma Infestation, Procamallanus Infection Procamallanus Disease, Euclinostomum Infestation, Procamallanus Infection Procamallanus Disease, Genarchopsis Infestation, Macrolecithus Disease, Palaeorchis Disease, Allocreadium Infestation, Procamallanus Infection, Lytocestus Disease, Pseudocaryophyllaeus Infestation, Pseudocaryophyllaeus Disease, Ascaridia Disease, Allocreadium Infestation, Aphallus Disease, Euclinostomum Disease, Eumasenia Disease, Macvicaria Infestation, Neopecoelina Infestation, Neopecoelina Disease, Opegaster Infestation, Philopinna Disease, Bialovarium Disease, Lernaocera Disease (Lernaocera sp.), Parasitic infestations (protozoa, worms, etc.).
Clupeidae	1.	<i>Gudusia variegata</i>	DD
	2.	<i>Nematalosanasus</i>	DD
	3.	<i>Tenualosailisha</i>	Aphanurus Infestation, Faustula Infestation, Lecithocladium Infestation, Lecithocladium Infestation, Gymnorhynchus Disease, Ilisha Infestation, Poecilancistrum Infestation, Pterobothrium Infestation, Pallisentis Disease, Parasitic infestations (protozoa, worms, etc.).
Cobitidae	1.	<i>Acantopsismultistigmatus</i>	DD
	2.	<i>Pangiopangia</i>	DD
	3.	<i>Pangiolongipinnis</i>	DD
Cyprinidae	1.	<i>Amblypharyngodonmola</i>	DD
	2.	<i>Aspidopariajaya</i>	DD
	3.	<i>Aspidopariamorar</i>	DD
	4.	<i>Aspidopariakhrulensis</i>	DD
	5.	<i>Banganadero</i>	DD
	6.	<i>Banganadevdevi</i>	DD
	7.	<i>Bariliusbakeri</i>	DD
	8.	<i>Bariliusbabila</i>	DD
	9.	<i>Bariliusbarna</i>	DD
	10.	<i>Bariliusbarnoides</i>	DD
	11.	<i>Bariliusbendelisis</i>	DD
	12.	<i>Bariliuschatricensis</i>	DD
	13.	<i>Bariliusdimorphicus</i>	DD
	14.	<i>Bariliusdogarsinghi</i>	DD
	15.	<i>Bariliusgatensis</i>	DD
	16.	<i>Bariliuslairokensis</i>	DD
	17.	<i>Bariliusngawa</i>	DD
	18.	<i>Bariliusradiolatus</i>	DD
	19.	<i>Bariliusshacra</i>	DD
	20.	<i>Bariliustileo</i>	DD
	21.	<i>Bariliusvagra</i>	DD
	22.	<i>Chaguniuschagunio</i>	DD
	23.	<i>Chaguniusnicholsi</i>	DD
	24.	<i>Chela cachiuis</i>	DD
	25.	<i>Chela fasciatus</i>	DD
	26.	<i>Chela khujairokensis</i>	DD
	27.	<i>Chela laubuca</i>	DD
	28.	<i>Cirrhiniusariza</i>	DD
	29.	<i>Cirrhinius cirrhosis</i>	DD
	30.	<i>Cirrhinusmrigala</i>	DD
	31.	<i>Cirrhinusreba</i>	DD
	32.	<i>Crossocheilusburmanicus</i>	DD
	33.	<i>Crossocheiluslatius</i>	DD
	34.	<i>Ctenopharyngodomidella</i>	Fish louse Infestation, Myxidium Infection, Trichodina Infection, Tripartiella Infestation, Bothriocephalus Infestation,

	Myxobolus Infection, Fish louse Infestation, Dactylogyrus Gill Flukes Disease, Trichodinosis, Sporozoa-infection (Myxobolus sp.), Anchorworm Disease (Lernaea sp.), Piscinoodinium Infection, Capillaria Infestation, Gonad Nematodosis Disease, Spiroxys Infestation, Sanguinicola Infection, Anchor worm Disease, Parasitic infestations (protozoa, worms, etc.), Water mold Disease, Fungal diseases, Columnaris Disease, Bacterial diseases, SVC, Grass Carp Picornavirus, Grass Carp Haemorrhagic, Unclassified Grass Carp Virus (Viral diseases).
35. <i>Cyprinionsemplotum</i>	DD
36. <i>Cyprinus carpio</i>	Anchor worm Disease, Fish louse Infestation, Coccidiosis (intestine), Boil Disease, Costia Disease, Dactylogyrus Gill Flukes Disease, Fish leech Infestation, Trichodinosis, Skin Flukes, Chilodonella Disease, Worm Cataract, White spot Disease, Trichodinosis, Skin Flukes, Trichodinella Infection, Trichodina Infection, Myxobolus Infection, Thelohanellus Infection, Anchorworm Disease (Lernaea sp.), Dactylogyrus Gill Flukes Disease, Trichodinosis, Turbidity of the Skin (Freshwater fish), Pallisentis Disease, Hole-in-the-Head Disease, Turbidity of the Skin (Freshwater fish), Parasitic infestations, Capillaria Infestation, Pseudocapillaria Infestation, Anchor worm Disease, Myxobolus Infection, Velvet Disease (protozoa, worms, etc.), Fin-rot Disease (late stage), Red spot Disease, Fin Rot (early stage), Columnaris Disease, Aeromonosis, Infectious ascites (Ornament.), Bacterial Infections (general), Enteric Redmouth Disease, Edwardsiellosis, Epitheliocystis, (Bacterial diseases), Fungal Gill Rot (sanguinis), Water mold Disease (Fungal diseases), Lymphocystis Disease, Lymphocystis Disease (dark), Koi Herpes Virus, Fish Pox Disease, Fish Pox Disease, Carp Iridovirus, Carp Coronavirus Infection, Carp Reovirus, (Viral diseases), Unspecified tumors, Neoplasia (tumors of unknown origin), Congenital Deformities, Others.
37. <i>Danio jaintianensis</i>	DD
38. <i>Garra flavatra</i>	DD
39. <i>Garra gotyla</i>	DD
40. <i>Garra lissorhynchus</i>	DD
41. <i>Garra rupecula</i>	DD
42. <i>Gibelion catla</i>	DD
43. <i>Gymnocypris dobula</i>	DD
44. <i>Gymnocypris scleracanthus</i>	DD
45. <i>Horallabiosajoshuai</i>	DD
46. <i>Hypophthalmichthys molitrix</i>	Bothriocephalus Infestation, Myxobolus Infection, Myxobolus Infection, Anchorworm Disease (Lernaea sp.), Dactylogyrus Gill Flukes Disease, Trichodinosis, Anchorworm Disease (Lernaea sp.), Parasitic infestations (protozoa, worms, etc.), Enteric Redmouth Disease (Bacterial diseases).
47. <i>Hypophthalmichthys nobilis</i>	White spot Disease, Dactylogyrus Gill Flukes Disease, Trichodinosis, Cryptobia Infestation, False Fungal Infection (Apiosoma sp.), Turbidity of the Skin (Freshwater fish), Myxidium Infection, Trichodina Infection, Tripartiella Infestation, Trichodinella Infection, Ichthyobodo Infection, Bothriocephalus Infestation, Fish Louse Infestation, Piscinoodinium Infection, Sanguinicola Infection, Dactylogyrus Infestation, Anchor worm Disease, Parasitic infestations (protozoa, worms, etc.), Enteric Redmouth Disease (Bacterial diseases), SVC (Viral diseases).
48. <i>Labeo angra</i>	DD
49. <i>Labeo ariza</i>	DD
50. <i>Labeo bata</i>	Hemiclepsis infestations, Parasitic infestations (protozoa, worms, etc.),
51. <i>Labeo boga</i>	DD
52. <i>Labeo calbasu</i>	DD
53. <i>Labeo dyocheilus</i>	DD
54. <i>Labeo fimbriatus</i>	DD
55. <i>Labeo gonius</i>	DD
56. <i>Labeo andina</i>	DD
57. <i>Labeo pangusia</i>	DD
58. <i>Labeo rohita</i>	White spot Disease, Fish louse Infestation, Dactylogyrus Gill Flukes Disease, Trichodinosis, Sporozoa-infection (Myxobolus sp.), Ichthyophthirius Disease, Neascus Disease, Thelohanellus Infection, Sachalinorhynchus Disease, Parasitic infestations (protozoa, worms, etc.), Aeromonosis (Bacterial diseases), Water mold Disease (Fungal diseases).
59. <i>Megarasbora elanga</i>	DD
60. <i>Neolissochilus blythii</i>	DD
61. <i>Neolissochilus hexagonolepis</i>	DD

	62.	<i>Neolissochilus hexastichus</i>	DD
	63.	<i>Neolissochilus paucisquamata</i>	DD
	64.	<i>Neolissochilus stracheyi</i>	DD
	65.	<i>Osteobramabelangeri</i>	DD
	66.	<i>Osteobramacotio</i>	DD
	67.	<i>Osteobramacunma</i>	DD
	68.	<i>Osteobramafeae</i>	DD
	69.	<i>Poropuntius burtoni</i>	DD
	70.	<i>Poropuntius clavatus</i>	DD
	71.	<i>Puntius javanicus</i>	DD
	72.	<i>Puntius jayarami</i>	DD
	73.	<i>Puntius khugae</i>	DD
	74.	<i>Puntius sarana</i>	DD
	75.	<i>Puntius yuensis</i>	DD
	76.	<i>Raiamas bola</i>	DD
	77.	<i>Raiamas guttatus</i>	DD
	78.	<i>Salmophasia acinaces</i>	DD
	79.	<i>Salmophasia bacaila</i>	DD
	80.	<i>Salmophasia clupeoides</i>	DD
	81.	<i>Salmophasia phulo</i>	DD
	82.	<i>Salmophasia sardinella</i>	DD
	83.	<i>Salmophasia ladoni</i>	DD
	84.	<i>Schismatorhynchus nukta</i>	DD
	85.	<i>Schizopygeesocinus</i>	DD
	86.	<i>Schizopygopsis stoliczkae</i>	DD
	87.	<i>Schizothorax progastus</i>	DD
	88.	<i>Schizothorax richardsonii</i>	DD
	89.	<i>Securicula gora</i>	DD
	90.	<i>Semiplotus manipurensis</i>	DD
	91.	<i>Semiplotus modestus</i>	DD
	92.	<i>Semiplotus semiplotus</i>	DD
	93.	<i>Tor chelynooides</i>	DD
	94.	<i>Tor mosal</i>	DD
	95.	<i>Tor progeneius</i>	DD
	96.	<i>Tor putitora</i>	DD
	97.	<i>Tor tor</i>	DD
Engraulidae	1.	<i>Setipinnaphasa</i>	Acanthogyrus Infestation 3, Parasitic infestations (protozoa, worms, etc.)
Gobiidae	1.	<i>Apocryptes bato</i>	DD
	2.	<i>Glossogobius giuris</i>	Anchor worm Disease, Procerovum Infestation, Posthodiplostomum Infestation, Haplorchis Infestation, Opegaster Infestation, Gnathostoma Infestation, Ergasilus Disease, Centrocestus Infestation, Azygia Infestation, Echinochasmus Infestation, Erilepturus Infestation, Proserhynchus Infestation, Orientocreadium Disease, Neochasmus Infestation, Carneophallus Infestation, Bothriocephalus Disease, Proteocephalus Disease, Lernaea Infestation, Camallanus Disease, Contraeaeum Disease, Capillaria Infestation, Genarchopsis Infestation, Genarchopsis Disease, Pallisentis Disease, Allocreadium Infestation, Phyllodistomum Infestation, Dactylogyrus Infestation, Pallisentis Infestation, Allocreadium Infestation, Allocreadium Infestation, Opegaster Infestation, Opegaster Disease, Pallisentis Infestation, Echinorhynchus Infestation, Tetraerhynchus Disease, Lernaea Infestation, Parasitic infestations (protozoa, worms, etc.).
	3.	<i>Psammogobius biocellatus</i>	Anchor worm Disease, Opegaster Infestation, Neochasmus Infestation, Parasitic infestations (protozoa, worms, etc.)
Mastacembelidae	1.	<i>Macrogathus saral</i>	DD
	2.	<i>Macrogathus morehensis</i>	DD
	3.	<i>Macrogathus pancalus</i>	Macrolecithus Disease, Camallanus Infection, Parasitic infestations (protozoa, worms, etc.), Bacterial Infections

	4.	<i>Mastacembelusarmatus</i>	(general), Bacterial diseases Contraceacum Disease, Capillaria Infestation, Procammallanus Infection, Isoparorchis Infestation, Allocreadium Infestation, Allocreadium Infestation, Cotylogonoporum Infestation, Paracamallanus Infection, Marsipometra Infestation, Proleptus Infestation, Pseudoproleptus Infestation, Parasitic infestations (protozoa, worms, etc.), Saprolegnia Infestation, Achlya Infestation, Saprolegnia Infestation (Fungal diseases).
Mugilidae	1.	<i>Rhinomugilcorsula</i>	DD
Notopteridae	1.	<i>Chitalachitala</i>	DD
	2.	<i>Notopterusnotopterus</i>	Fish louse Infestation, Procammallanus Infection, Pleurogenoides Infestation, Parasitic infestations (protozoa, worms, etc.)
Ophichthidae	1.	<i>Pisodonophisboro</i>	DD
Pangasiidae	1.	<i>Pangasiuspangasius</i>	Contraceacum Disease, Gymnorhynchus Disease, Allocreadium Disease, Cucullanus Infestation, Parasitic infestations (protozoa, worms, etc.).
	2.	<i>Pangasiussutchi</i>	DD
Pristigasteridae	1.	<i>Ilishamelastoma</i>	DD
Psilorhynchidae	1.	<i>Psilorhynchusgracilis</i>	DD
	2.	<i>Psilorhynchushomaloptera</i>	DD
	3.	<i>Psilorhynchusmicrophthalmus</i>	DD
Salmonidae	1.	<i>Salmotruttafario</i>	DD
	2.	<i>Oncorhynchusmykiss</i>	Whirling Disease, Hysterothylacium Infection ( <i>Hysterothylacium</i> sp.), Proliferative Kidney Disease, Aeromonosis, Bacterial diseases, Camallanus Infection, Camallanus Infection, Parasitic infestations (protozoa, worms, etc.), Enteric Redmouth Disease, Epitheliocystis, (Bacterial diseases).
Schilbeidae	1.	<i>Ailiacoila</i>	DD
	2.	<i>Ailia punctate</i>	DD
	3.	<i>Clupisomagarua</i>	Contraceacum Disease, Isoparorchis Infestation, Genarchopsis Disease, Palaeorchis Disease, Allocreadium Infestation, Caryophyllaeus Infestation, Prosorhynchoides Infestation, Spinitectus Infestation, Devendrosentis Infestation, Parasitic infestations (protozoa, worms, etc.).
	4.	<i>Clupisomamontana</i>	DD
	5.	<i>Eutropiichthysvacha</i>	Contraceacum Disease, Procammallanus Disease, Isoparorchis Infestation, Palaeorchis Disease, Caryophyllaeus Infestation, Phyllodistomum Infestation, Spinitectus Infestation, Neocammallanus Infestation, Fish Louse Infestation, Parasitic infestations (protozoa, worms, etc.).
	6.	<i>Eutropiichthysmurius</i>	Acanthogyryus Infestation, Procammallanus Infection, Procammallanus Disease, Prosorhynchoides Disease, Prosorhynchoides Infestation, Parasitic infestations (protozoa, worms, etc.).
	7.	<i>Neotropiusatherinoides</i>	Ichthyoxenus Infestation, Parasitic infestations (protozoa, worms, etc.).
	8.	<i>Siloniasilondia</i>	Contraceacum Disease, Genarchopsis Disease, Gymnorhynchus Disease, Pallisentis Disease, Bucephalus Disease, Caryophyllaeus Infestation, Devendrosentis Infestation, Parasitic infestations (protozoa, worms, etc.).
Scianenidae	1.	<i>Johniuscoitor</i>	DD
Siluridae	1.	<i>Ompokbimaculatus</i>	Contraceacum Disease, Capillaria Infestation, Gnathostoma Infestation, Procammallanus Infection, Isoparorchis Infestation, Gonocera Infestation, Phyllodistomum Infestation, Pallisentis Infestation, Allocreadium Infestation, Pleurogenes Infestation, Eustrongylides Infestation, Falcaustra Infestation, Parasitic infestations (protozoa, worms, etc.).
	2.	<i>Ompokpabda</i>	Fish louse Infestation, Contraceacum Disease, Gnathostoma Infestation, Procammallanus Infection, Euclinostomum Infestation, Procammallanus Infection, Isoparorchis Infestation, Euclinostomum Disease, Caryophyllaeus Infestation, Pleurogenes Infestation, Eustrongylides Disease, Pallisentis Infestation, Parasitic infestations (protozoa, worms, etc.).
	3.	<i>Ompokpabo</i>	DD
	4.	<i>Pterocryptisbarakensis</i>	DD
	5.	<i>Pterocryptisberdmorei</i>	DD
	6.	<i>Pterocryptisindicus</i>	DD
	7.	<i>Pterocryptis afghan</i>	DD
	8.	<i>Pterocryptistorrentis</i>	DD
	9.	<i>Pterocryptisangelica</i>	DD



	10. <i>Wallagoattu</i>	Contracecum Disease, Gnathostoma Infestation, Isoparorchis Infestation, Genarchopsis Infestation, Procamallanus Infection, Spinitectus Infestation, Goezia Disease, Parasitic infestations (protozoa, worms, etc.), Epizootic Ulcerative Syndrome (Viral diseases).
Sisoridae	1. <i>Bagariusbagarius</i>	Rhabdochona Infestation, Opisthorchis Infestation, Parasitic infestations (protozoa, worms, etc.).
	2. <i>Bagariusyarrelli</i>	DD
	3. <i>Glyptothoraxchintuipuiensis</i>	DD
	4. <i>Pseudecheneisukhrulensis</i>	DD
	5. <i>Pseudecheneissirenica</i>	DD
	6. <i>Pseudecheneiskoladynae</i>	DD
Synbranchidae	1. <i>Monopteralbus</i>	Trypanosoma Infection, Pallisentis Infestation, Dentiphilometra Infestation, Proleptinae Disease, Eustrongylides Disease (larvae), Parasitic infestations (protozoa, worms, etc.).
	2. <i>Monopterusuchia</i>	DD
	3. <i>Monopterushodgarti</i>	DD
	4. <i>Ophisternonbengalense</i>	DD

Impacts of diseases have been estimated in socioeconomic terms like losses in production, income, employment, market access or market share, investment and consumer confidence etc. (Melba, 2005). Inadequate implemented biosecurity measures have led to significant losses due to aquatic animal diseases in many countries around the world. Arthur and Subasinghe, (2002) reported the impact of aquatic diseases on wild population and biodiversity that can be measured in terms of:

- Impacts on aquatic community structure through changes in predator and prey population
- Changes in host abundance
- Reduction of intra specific genetic variation
- Possible extinction of species

There seems to be an urgent need to broaden the base of fisheries economics to meet the dynamic needs of fishing industry in respect of the following and the other related areas.

- Planning and management of fisheries.
- Economics (economic analysis) of fish culture, composite fish culture and integrated fish farming in respect of total investment, net production and profit (net income).
- Fish marketing and related problems.
- Socio-economic study of fishermen families.
- Manufacturing costs of crafts and gear and expenditure on fishing both in terms of human resources and other consumables.
- Economics of processing of fishery products and their export potential and related problems.

### **Conclusion**

The socio-economic circumstances of small scale aquaculture holders are poor. Diseases are one of the constraints of fish farming in the country. Considering the above following recommendations should be made:

- Awareness of disease problems of small scale aquaculture needs to be raised.
- Reports of any kind of mass mortality should reach to nearby fishery officer as soon as possible.
- Provide a range of services and assistance such as generalized support services and confirmatory diagnosis of both current and newly emerging diseases.
- Facilitate research and act as contact centers for advice and training.

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