

## Empowering stakeholders for monitoring biodiversity in the Indian Himalayan region

It is necessary to properly use public funds towards development of the nation as well as reduce stress to local biodiversity and mitigate climate change issues. In this context, the Ministry of Environment, Forest and Climate Change (MoEF&CC), Government of India (GoI) has formulated the National Mission on Himalayan Studies (NMHS) for sustenance and enhancement of the ecological, natural, cultural and socio-economic capital assets and values of the Indian Himalayan Region (IHR)<sup>1</sup> through involvement of different government agencies, private institutions and local non-governmental organizations to empower local stakeholders for monitoring biodiversity and *in situ* conservation of the Himalayan resources.

The Zoological Survey of India (ZSI) under MoEF&CC, GoI is not only a premier institution on taxonomy, but also endeavours conserving the faunal resources of India. Towards this, ZSI has started a project since April 2016 on biodiversity assessment through long-term monitoring plots in the Indian Himalayan landscape, sponsored by NMHS in collaboration with the Botanical Survey of India. The project was designed broadly to focus on evaluating the present status and trend of biodiversity in the IHR, and to understand the local stakeholders' needs for sustainable utilization of bioresources.

This was channelized through consultative capacity-building workshops that were organized in different parts of the IHR.

According to the objectives and target envisaged, participants from different sectors of the society, including scientists from various organizations, Government officials, frontline staff of Forest Department, civic authorities, students (undergraduate, postgraduate and research scholars) participated in these workshops to discuss the current status of biodiversity and provide suggestions on the potential for opening new avenues to involve stakeholders as well as their roles in conserving native biodiversity.

Capacity-building exercise conducted involved familiarizing stakeholders, most importantly, the frontline forest staff and students with the field-based knowledge and methods for monitoring forest resources. Several training manuals were developed and detailed presentations were made about biodiversity conservation strategies for the IHR. Moreover, several events like wildlife week celebration, talks on the current status of native diversity of floral and faunal groups and their conservation, effect on the ecosystem and addressing climate change in the IHR were also part of the capacity-building activities. Subject experts on the topics related to IHR biodiversity exerted

their views on the improvement in approach, raising the standards and better documentation and subsequent monitoring of bio-resources, creating a common platform for scientific research, better transparency and harmonizing efforts toward a better, ecologically significant habitat for future biodiversity. Efforts of governmental and non-governmental organizations along with research work from different universities were highlighted for interoperating bio-resource conservation, where local stakeholders and native people play a significant role exploiting alpha diversity through their traditional knowledge. As a foreseen measure, the government in close coordination with multi-stakeholders desires to monitor biodiversity of the IHR and formulate better conservation strategies for future generations.

1. Anon., VISION, <https://nmhs.org.in/mission.php>

**Dibyajyoti Ghosh, Sheikh Sajan\*, Paromit Chatterjee, Basudev Tripathy and Kailash Chandra**, Zoological Survey of India, Prani Vigyan Bhawan, M-Block, New Alipore, Kolkata 700 053, India.

\*e-mail: sksajan.sajan@gmail.com

## MEETING REPORT

### Risk–Benefit Assessment for alien fishes\*

A consultation was organized to discuss the issues of alien fish species and develop an appropriate model for their

\*A report of the consultation on 'Invasive Alien Fish Species: Need for a Risk–Benefit Assessment and Management Framework for Healthy Freshwater Ecosystems' jointly organized by ICAR-National Bureau of Fish Genetic Resources, Lucknow and World Wide Fund for Nature-India (WWF-India), New Delhi and held at WWF-India, New Delhi on 19 December 2018.

risk–benefit assessment. It was aimed to bring together senior fishery experts and policy departments of the country. Besides senior fishery experts from India, the consultation was attended by representatives from international organizations like the Network of Aquaculture Centres in the Asia-Pacific (NACA), Bangkok and the South Asian Association for Regional Cooperation (SAARC); researchers from different fishery institutions across the country, Wildlife Institute of India, National Biodiversity

Authority, Marine Products Export Development Authority and representatives from the Department of Animal Husbandry, Dairy and Fisheries, Government of India; Chief Conservator of Forest, Chandigarh and a few universities.

The discussion was held with the objective to draft a framework to regulate the import of candidate species in view of their emerging demands and likely impacts. The assessment targeted matrix of biological, ecological and socio-economic attributes of the species in question. Such

consultation is highly relevant because India already harbours rich fish diversity comprising 3535 fish species, including 1016 in freshwater, 113 from brackish water and 1906 from marine water; 14.14% (500) are alien species. In India, efforts for the introduction of alien fish species date back to 1863, with import of brown trout (*Salmo trutta fario*) eggs from England, which succeeded in later attempts. The alien fish species were imported for aquaculture, sport, larval control and ornamental purpose.

The consultation started with a brief introduction of the topic by Suresh Babu (World Wide Fund for Nature-India, New Delhi). This was followed by a talk on 'Context setting: key issues, alien fish species in the country and need for a risk and management framework' by Kuldeep K. Lal (National Bureau of Fish Genetic Resources (NBFGR), Lucknow). Lal emphasized that selected introduction of exotic species is required for growth of the aquaculture sector. He mentioned that production of white-leg shrimp *Litopenaeus vannamei*, outside its native range is 400%. He also mentioned that 23% of the production of *Pangasianodon hypophthalmus* comes from outside its native range. He also highlighted the negative impacts of exotic species such as Nile perch in Lake Victoria, genetic introgression in wild *Clarias macrocephalus* from farm-escaped hybrid (*C. gariepinus* cross), horizontal expansion of golden apple snail in Mekong region, common carp and tilapia in River Yamuna and other places. Lal expressed concern on the culture of *C. gariepinus* in different parts of the country despite a ban. He stressed the need for developing a framework for risk assessment of potential exotic species likely to be introduced in the near future in India. He felt the need to deliberate on scoring methodology for risk assessment.

J. K. Jena (Indian Council of Agriculture Research, New Delhi) explained about the role of some alien fish species like rainbow trout, brown trout and white-leg shrimp in production enhancement from aquaculture. He also highlighted the importance of grass carp in pond aquaculture. Jena mentioned about recent import proposals for sea bass and milkfish, and also highlighted the growth potential of another alien species – *Catlo carpio*. He suggested measures for curb on expansion of invasive species like African magur.

Kenton Morgan (University of Liverpool, UK) spoke on the importance of alien fish species. He mentioned that epizootic ulcerative syndrome and white spot disease have changed biodiversity and the species being cultured. He further felt that risk analysis of exotic aquatic animals is a big opportunity for successful aquaculture.

M. V. Gupta (World Food Prize Laureate), Hyderabad stated that the issue of risk assessment has been discussed for more than a decade, but there has not been much headway at the implementation level. He expressed the view that certain promising alien species like *C. carpio* and *Pangasianodon gigas* are likely to enter the country. Hence we need secure risk assessment.

The technical session started with talk by K. D. Joshi (NBFGR) on 'Status of exotic aquatic species in India'. He stated that exotic species have been introduced in India for varied purposes, including aquaculture, sport, ornamental and biological control. He also highlighting the beneficial impacts of exotic species and the importance of *P. hypophthalmus* and *L. vannamei* in aquaculture. Joshi mentioned invasion of some alien species into open waters of the country, including rivers Ganga, Yamuna, Ken, Betwa, Sone and their tributaries. He spoke about the massive increase in catch of exotic species in the middle stretch of River Yamuna. Joshi also expressed concern on the gradual appearance of sucker mouth catfish and African catfish in catches. He added that African catfish is available in temple ponds of Kerala and sucker mouth catfish is a menace in West Bengal. He also highlighted attributes of invasive species which include fast growth, high dispersal ability, wide temperature tolerance, omnivorous feeding behaviour, etc.

Eduardo Leano (NACA) made a presentation on 'Impacts of exotic aquatic species in ASEAN countries'. He mentioned that exotic fish species have been introduced mostly for aquaculture purpose and very few species have been introduced for ornamental purpose. He also mentioned that bio-security is important for the protection from invasive species, in addition to exotic pathogens. Leano stated that the major impacts of exotic species include competition, predation, and as carriers of diseases and parasites and genetic pollution. He also listed the importance and impact of exotic species

in Thailand, Cambodia, Vietnam, Philippines, Malaysia and Myanmar. He mentioned about the introduction of sucker mouth catfish (a native of South America) in 17 countries of America, Asia and Europe, and its established population in Thailand, Vietnam, Malaysia and Sri Lanka.

Shiba Shankar Giri (SAARC Agriculture Centre, Dhaka) delivered talk on 'Status of alien fish species in SAARC countries'. He mentioned that the global cost for management of invasive species is 5% of the global GDP (~US\$ 1.4 trillion) and 54% of species extinction has been linked to introduced aquatic species. He also informed about the establishment of 9 alien species in Pakistan, 14 in Nepal, 5 in Bhutan, 19 in Sri Lanka and 18 in Bangladesh. He highlighted the role of shared water bodies in the expansion of alien species in the region.

Basant Raj Kumar (Department of Forests, Punjab) expressed the need to control expansion of alien fishes in rivers and connected wetlands. J. A. Johnson (Wildlife Institute of India) stressed the need for preparation of distribution maps of each exotic species in the country to know their status as well as invasiveness. He also confirmed occurrence of sucker mouth catfish from River Ganga at Narora and Bijnor. He also mentioned about the presence of *O. mossambicus* and *Oreochromis niloticus* in River Cauvery. Jitender Sundaray (Central Institute for Freshwater Aquaculture) informed about the occurrence of sucker mouth catfish from Chilka lakes.

P. K. Pradhan (NBFGR) initiated presentations under another technical session dedicated to risk assessment and talked on 'Risk assessment modeling: globally available risk assessment tools – case study by NBFGR'. His presentation was based on the results of a project 'Risk and benefit assessment of pacu, *Piaractus brachyomus* in India'. Pradhan informed that pacu had been introduced to 20 countries all over the world, but there is confirmed report of its establishment from only one country. He also mentioned about expanding pacu culture in Andhra Pradesh and Kerala, and that pacu was not observed in catches from any of the rivers assessed by them. Furthermore, Pradhan presented two risk assessment models to assess the risks of introduction of pacu. Using fish risk assessment model for the importation and management of alien freshwater fish in New Zealand, it

was found that pacu has high risk of establishment and medium risk of impact. However, the risk due to pacu introduction was perceived to be low using the Australian risk assessment tool for live ornamental fish species.

After detailed presentations, the experts and planners were assigned group tasks in the subsequent sessions for in-depth discussion on the issues of risk assessment models for screening of import proposals and management strategies for already introduced exotic species. As opening remarks, A. G. Ponniah (Central

Marine Fisheries Research Institute, Kochi) mentioned that ecological risks of exotic species remain similar irrespective of the originating country, whereas disease risks associated with exotic species are related to the exporting country. He also cited an example of adverse ecological impacts of sea lamprey, which was observed after 120 years of introduction. He stressed that there is a need to consider the biology of candidate exotic species and ecology of the area of introduction. Experts discussed the merits and demerits of various globally available

models, and suggested some corrective changes and modifications on the matrix prepared by a team at NBFGR.

**K. D. Joshi\***, **Aditya Kumar**, **V. S. Basheer**, **Neeraj Sood**, **P. K. Pradhan** and **Kuldeep K. Lal**, ICAR-National Bureau of Fish Genetic Resources, Canal Ring Road, Lucknow 226 002, India; **Suresh Babu** and **Nitin Kaushal**, World Wide Fund for Nature-India (WWF-India), 172 B, Lodi Estate, New Delhi 110 003, India.

\*e-mail: kdjoshi.search@gmail.com

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