RTD01　Birds as monitors of environmental contamination in Asia

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1　Issues

The meeting discussed methods, ongoing projects, and opportunities for investigating environmental contamination in Asia, using birds as biomonitors. It was opened by M. Fasola who, noting that Asian environments were subject to increasing pollution from industrial, urban and agricultural sources, stressed the need to monitor contaminant levels and assess their effects as a matter of urgency. Such studies, however, had been very scanty (Table 1). Convener Leonzio then discussed methods for assessing contaminants in wildlife, with special emphasis on biomarkers that can be used to assess both persistent and nonpersistent contaminants. The use of noninvasive methods for monitoring the health of species and populations at risk was also reviewed.

2　Outcomes

Case histories from recently completed research by X. Ruiz and Y. Dong ("Coastal and inland wetlands in China and Pakistan: colonial waterbirds as bioindicators of pollutant levels and effects", funded by the European Union, IC18-CT98-0294) were presented to illustrate the current state of information. Three study areas (one with presumed low contamination, one contaminated from industrial sources, and one contaminated from agricultural sources) were sampled in China, and these were compared with three analogous sites in Pakistan. Bioindicator samples comprised eggs, feathers and prey of little egrets (*Egretta garzetta*), and sediments from their foraging habitats. Analyses of chlorinated hydrocarbons, PCBs, and trace elements from the study sites in both countries revealed that concentration levels in these pollutants were generally lower than thresholds harmful to wildlife, except for high, localized contamination in several trace elements reported below.

The results from Pakistan, in press in *Archives Environmental Contamination and Toxicology*, were summarized as follows. Environmental pollution was assessed in three Pakistani wetlands — Taunsa Barrage, Haleji Lake and Karachi Harbor — presumed to be affected by different pollution regimes: Taunsa Barrage mainly by agricultural pollutants, Karachi Harbor by supposed exposure to industry-related POPs, and Haleji Lake the unaffected control, because, isolated in a stony desert, it is relatively pristine.

Taunsa Barrage and Haleji Lake are wetlands of international importance under the Ramsar Convention, while the Karachi Harbor is of concern because of its large human population.

For organic contaminants, there were significant differences in egg pollutants (HCB, HCHs, cyclodienes, DDTs and PCBs) between sites. Overall, organochlorine pollutant in eggs from the Haleji Lake and Karachi were at respective lowest and highest levels of detection and concentration. Biomagnification of pollutants from sediments in prey and eggs of little egrets was carried out in the three sites, together with the proportions of different compounds. Between-site differences in biomagnification were small, even when differences in pollutant concentration were high. This indicates that eggs are reliable environmental indicators of POPs. The values found were generally lower than reported in eggs of large herons from North America or the Mediterranean basin, yet are of the same order of magnitude as those for medium-sized egrets from other parts of the world.

For trace elements, concentrations of As, Cd, Cr, Pb, Hg, Mn, Se, and Zn were found generally to be within the "normal background" level, and mostly below thresholds that might affect bird survival or reproduction. However, high concentrations of Pb and Hg were found in fish from Karachi, the first at concentrations harmful to fish reproduction, and the second at the limit of concentration for human consumption. Alarming concentrations of Cr and Se, above the critical level for soil contamination, were also found in sediments from Karachi, perhaps enough to affect reproduction in egrets. Even so, overall differences among the three wetlands were less marked than hypothesized. The species of egrets within a given area differed in the concentration of certain elements in their eggs, possibly because the females of each species had foraged in different habitats before breeding. In contrast, no between-species differences were found in chick feathers, presumably because young had been fed prey collected in similar habitats around the colony. High bioaccumulation was recorded for Hg, and lower but still significant for Cd, Se and Zn; for all these elements, feathers of predatory birds such as the egrets were considered the best indicators of environmental contamination. On the other hand, As and Cr did not accumulate in the birds screened, and sediments or organ-

isms low in the food chain were found to be better indicators of their presence.

Participants also reported on other ongoing projects, particularly in relation to the collapse of vulture populations (RTD 09), and to persistent organic contaminants in egrets in Hong Kong.

3 Conclusion

Using eggs, feathers, excreta and other such material, effective biomonitoring and chemical analyses for pollutants can be conducted on biological materials with little or no disturbance to the animals themselves. Through analyses of such material, useful information can be obtained about the presence and concentrations of organochlorines, trace metals and porphyrins (copro-, uro- and proto-porphyrins). Further information may also be obtained by nondestructive bleeding. J. Burger and M. Gochfeld pointed out that, despite the work already completed, the studies on contamination in Asian wildlife remain insufficient for adequate environmental assessment. Such research, the meeting agreed, should focus as a matter of priority on (i) aquatic birds and raptors as biomonitors, and (ii) areas of intensive industrial and agricultural development as sources of contamination.

Table 1 Numbers of publications combining the keywords "Asia and contamination in wildlife", from 1990 to 2001

From citations in *Current Contents* and the *Science Citation Index*

Country	Main study material					
	Water	Air	Sediments	Birds	Aquatic biota	Humans
China	2	2	5	3		4
Korea	1			1		
India	1			1		1
Japan			1	2		2
Pakistan	5				3	
Russia	1			1		
Rest of S Asia					1	
Rest of W Asia	1		1		1	3