Satellite Tracking of Birds Over the Past 20 Years

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My colleagues and I started satellite tracking birds in the early 1990s. The PTTs that we first used were Japanese-made for our migration research, weighed about 80 g with a battery life less than 1.5 months (below photo, left). We deployed them on four whistling swans *Cygnus columbianus* that migrated from the northernmost area of Japan. Three of the PTTs stopped functioning before the swans finished migrating, but one remained active to the mouth of the Kolyma River, a tundra habitat in Russia and the breeding area of the swans. I remember how excited we were looking at the computer screen tracking the daily movements of the swans. Every day, we marked the satellite locations on a map using pins with colorful heads.

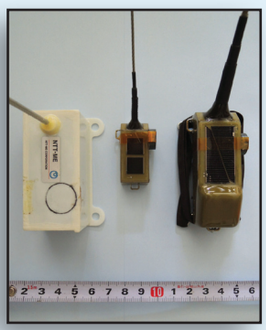
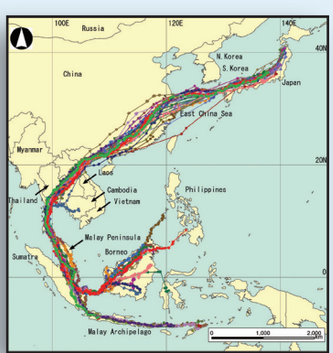


Photo by Hiroyoshi Higuchi

Type of satellite transmitters used during Dr. Higuchi's career thus far.

This success encouraged Japanese scientists to move further. The PTTs were getting smaller in size, and we succeeded in showing the migrations of white-naped crane *Grus vipio*, hooded crane *G. nonacha*, red-crowned crane *G. japonensis*, Siberian crane *G. leucogeranus*, demoiselle crane *Anthropoides virgo*, and whooper swans *Cygnus cygnus* between Japan and Russia. As a result, we identified some important stopover sites in East Asia. They included the Korean DMZ, Kumya in North Korea, and Lake Khanka on the Russia-China border. The main problem was the length of battery life. It was always worrisome when deciding to deploy PTTs, because if we deployed the PTTs months before the start of migration, the battery may be exhausted before the birds arrived at the destinations. On the other hand, capture time is limited and cannot be decided immediately before the migration start.



Autumn migration routes of 28 oriental honey-buzzards tracked between 2003 and 2009. Each color in the migration routes indicates the migration of the same individual.

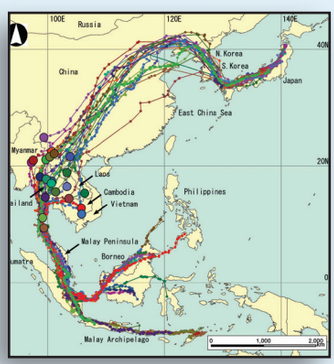
The Japanese companies stopped producing PTTs in the early 2000s probably in association with an economic collapse in Japan. We were disappointed with this situation, but by that time, American PTTs were easily available to us. The size was small enough to deploy on medium-sized birds such as hawks and ducks, and the battery was solar-powered, which enabled us to track for more than 2 years. Thanks to these technological developments, we were successful in tracking the migration of grey-faced buzzards *Butastur indicus*, which could not be managed with Japanese battery-powered PTTs even in several trials over the years.

The most exciting results came from tracking the migration of oriental honey-buzzards *Pernis ptilorhynchus* (Higuchi 2012: Journal of Ornithology 153:3-14), another migratory hawk species in Japan with unknown migratory routes. We used 20 Microwave Telemetry 30g solar-powered Argos/GPS PTTs, and succeeded in showing the detailed migration routes and patterns of about 30 individuals over several seasons. Their migration is summarized as follows: in autumn, after departing their breeding areas in Japan, they migrated west across about 700 km of the East China Sea, then moved through inland China, Vietnam, Laos and Thailand until reaching the Malay Peninsula. All the birds continued moving away from the Malay Peninsula, but the directions and terminal points differed among individuals. After reaching Sumatra, 18 birds changed their travel direction to the northeast. Only two individuals arrived in the Philippines, through Borneo, and 16 individuals ended their migration on Borneo and the other surrounding islands. The other 10 moved along the Malay Archipelago and ended their migrations at Bankga Island, central Java, and Flores Island, respectively.

Photo by Takanobu Mishima

Oriental honey-buzzard.

In spring, the oriental honey-buzzard mainly followed the same routes used during their autumn migration from their wintering sites to the end of the Malay Peninsula. They migrated northwestward along the Malay Archipelago and the Malay Peninsula, then moved to inland China after going north through Thailand, Laos, and Vietnam. The routes in inland China were located north of those used during the autumn migration, before the birds reached the end of Korean peninsula. During the autumn migration, the birds detoured around the East China Sea by migrating through the Korean peninsula and crossing the Korean/Tsushima Strait to reach Japan. Before travelling to China, all the birds stopped for several weeks in southeast Asia. Consequently, individual honey-buzzards visited most or sometimes all East Asian countries during their complete migration cycle of autumn and spring.



Spring migration routes of 28 oriental honey-buzzards tracked between 2003 and 2009. Each color in the migration routes indicates the migration of the same individual. The sites where the honey-buzzards stayed for more than seven days are shown by larger circles.

We have now opened our Hachikuma Project to the general public: http://hachi.sfc.keio.ac.jp/. Hachikuma is the Japanese name of the oriental honey-buzzard. The purpose of this project is to make public the real-time status of bird migration via satellite tracking, to show it to many people in Japan and other parts of the world, deepening their understanding of bird migration, and also of how nature works. To be able to observe on the internet how the birds' migration is proceeding every moment is very stimulating and, we believe will significantly contribute to social education, school education, and environmental conservation. As expected, lots of people have enjoyed watching the migration of the birds on the website.

I hope that satellite-tracking technology progresses further, which will enable us to track smaller birds in more detail for longer periods of time. My dream is to study the migration of passerines such as paradise flycatchers *Terpsiphone atrocaudata* and ashy minivets *Pericrocotus divaricatus*. As they are endangered species, if we could track them lots of important information would be obtained in terms of their conservation. Such information will greatly contribute to our understanding of the ecology and behavior as well as migration of these species. I really look forward to further development of the relevant technology. Thank you very much Microwave Telemetry for your great efforts.