

## Obituary

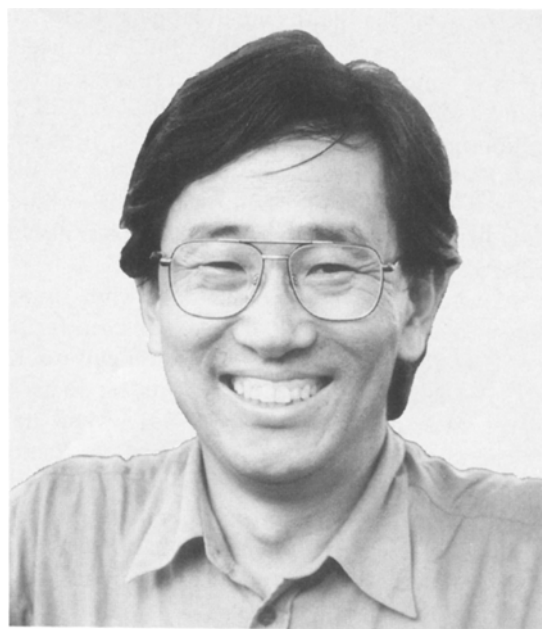
### Tamiji Inoue, 1947–1997

Tamiji Inoue, Professor of Tropical Ecology at Kyoto University and Executive Committee Member of the Society of Population Ecology, died in an airplane crash at Lambir Hills National Park, Sarawak, Malaysia, on Sept. 6, 1997. He was on the way to visit his field station newly established in the very same Lambir Park for an international project CBPS, the Canopy Biology Program in Sarawak.

Inoue was born Sept. 22, 1947 in Awaji-shima, Hyogo Prefecture, Japan. After graduating from high school in his hometown, he moved to Kyoto in 1966 to enter Kyoto University, where he spent the latter 31 years of his life, with a brilliant academic career initially as a distinguished theoretical ecologist and later as a leading field ecologist in Japan with a world-wide perspective.

Inoue's contribution to population ecology began as early as his undergraduate study at Entomological Laboratory in Kyoto University, guided by the late Professor Syun'iti Iwao. The topic was mathematical analysis of dispersal of the horsefly, *Tabanus iyoensis*, in a Toyama Prefecture project to control this nuisance pest of forest workers. After publication in *Researches on Population Ecology* (*RPE* 14: 206–233), this work received international attention as being one of few studies in which mathematical models were successfully applied with extensive mark-and-recapture census data to quantitative description of insect dispersal in the field. Later he made an important extension of this earlier work by developing a comprehensive regression method for analyzing animal movement patterns (*RPE* 20: 141–163).

After going on to the Graduate School of Kyoto University, Inoue changed his major study topic to the foraging strategy of the praying mantis, *Paratenodera angustipennis*. In cooperation with a close classmate, T. Matura, he first made intensive observations of the foraging behaviour of the mantid in both field and laboratory, and found that the predator can switch its tactic between ambush and active search for efficient hunting, depending on the time-to-time frequency of encountering prey (*Oecologia* 56: 264–271). Inoue extended the study further in his doctoral thesis (1979) to mathematical modeling of the foraging strategy of varying types of predators. Incorporating this switching mechanism with varying parameters, he succeeded in composing a novel foraging model that can describe comprehensively the strategies of a wide spectrum of predators from ambush-type (such as



mantids) to search-type (such as birds) (*RPE* 25: 81–104; 264–279).

During the 1970's, Inoue also made notable contributions to another field in applied population ecology, namely pest management in agriculture. In collaboration with R. Ohgushi at Nagasaki Horticultural Experiment Station, he constructed a large-scale computer model that could describe and predict the field dynamics of both the population level and the amount of injury caused by the arrowhead scale, *Unaspis yanonensis*, a destructive pest of citrus orchards in Japan (*RPE* 18: 302–318). The study has received high praise among applied entomologists as one of the pioneer studies that established and promoted modern ideas of Integrated Pest Management (IPM) for agriculture in Japan.

After these eminent achievements as a population ecologist, Inoue devoted his passion and genius in the next decade to a new subject, the population biology of stingless bees or eusocial hymenopterans of the subfamily Melliponinae inhabiting tropical forests. Starting with the Sumatra Nature Study Project (1980–1984), this study continued in close collaboration with the late Professor S. F. Sakagami of Hokkaido University and Dr. D. W.

Roubik of the Smithsonian Tropical Research Institute. In this research, Inoue first introduced a population ecological approach to the study of the bees such as *Trigona minankabau*, and obtained an insight into disclosing the regulation mechanisms of their socially organized populations in natural habitats (e.g. *Biotropica* 16: 100–111). The study made further progress in Panama in 1989 when he stayed at Baro-Colorado Island as an invited senior scientist at the Smithsonian Tropical Research Institute. The most important of the results attained there by intensive mark-and-recapture investigation of field populations will be the finding and detailed analysis of kin recognition in these insects which was so far little studied (*Insectes Sociaux*, in press). In these studies during the 1980's, Inoue thus brought about remarkable progress in the study of these stingless bees, a very important but less studied group of social insects.

The above-described studies were done while Inoue had been engaged as Instructor (1975–1985) or Lecturer (1985–1991) of Entomology in the Faculty of Agriculture, Kyoto University. The door for the third major leap in his scientific career was opened in April, 1991, when he was transferred to the newly established Center for Ecological Research of Kyoto University as Professor of Tropical Ecology. The new mission given to him was to organize comprehensive research of plant-animal interactions in tropical forest ecosystems from the viewpoints of community and evolutionary ecology. With his rich experience as a theoretical and behavioural ecologist, Inoue flung himself into this difficult work with the greatest passion and activity that one can imagine for a naturalist. From the beginning his interest had been concentrated on the canopy biology in general, or the mutualistic interactions occurring there between flowering plants and their pollinators in particular. The aforementioned international project CPBS was thus established in 1992 by Inoue and his colleagues in both Japan and Malaysia. A modern canopy observation system with large towers and walkways was then established in Lambir Hills Park. Following the occurrence of general flowering in 1996, the project has just begun producing plentiful fruits with a number of novel findings on plant-insect mutualism in tropical rain forests (CPBS Reports Series II, 1997).

Inoue's scientific activities were not restricted to research alone; he devoted much of his energy to education and the promotion of academic societies as well. To our Society of Population Ecology he contributed much by serving as Executive Committee Member for as long as 18 years since 1980, and furthermore as Managing Editor from 1992 to 1994. Throughout his too-short lifetime many people loved Inoue for his friendly and reliable personality. Indeed he looked very happy while surrounded by young colleagues and students adoring his genius and warm character as an academic leader. His sudden death

brought about not only a great loss to the academic world of ecology, but also a deep sorrow among all of us who were familiar with his versatile talent wrapped in friendly smile. It is consoling to think that those young ecologists Inoue had enthusiastically trained up will succeed and accomplish his magnificent life's dream which should have been realized in the on-going CBPS project.

Tamiji Inoue is survived by his wife Eiko, a daughter and a son.

Eiji Kuno

28 December 1997

### *Inoue-san*

Tamiji wanted to do the most interesting things he could imagine. Occasionally I also enjoyed calling him *Inoue-san* in Japanese style.

We became friends one day in 1983 when he waited for me patiently at the Padang airport in Sumatra, although I had been held up at the Halim airport in Jakarta, and had missed my flight. Nonetheless, Tamiji had been there at the airstrip in Padang, hours later, and we had gone immediately to his hotel to see about my schedule with him and the Sumatra Nature Study group during the next three weeks. His postdoctoral professor, Dr. Sakagami (whom I had visited in Sapporo in November, on the way to meeting Tamiji in December), had brought us together. I believe this was through communication between Michener in Kansas (my previous advisor) who had, with Sakagami, constituted the two most prolific and widely studied bee biologists in the world. Thus, I guess we were well introduced. In Sumatra on a humid and hot afternoon, we had already been introduced in any case. Both of us were tropical biologists.

The next three weeks were an ideal procession of tropical biology, students and friends, local culture, and a general willingness to live and work in the tropics, looking to the stingless bees and honey bees for inspiration and insight. I was struck by the fact that here, on the face of this earth, was another person trying to do essentially what I had been trying to do in the American tropics. To study tropical bees on their own terms, and with a population biology and ecological perspective — we both had this going on in our minds during the days and months in the tropical landscape. I liked Tamiji immediately because 1) he was completely sincere, 2) he worked hard at what he did and with obvious intelligence, and 3) he meant what he said. It was really the first time in my life (other than when I met and married my wife) that I felt completely confident in what another human being said to me. If Tamiji said he was going to look at tropical bees in Panama, one day, that was exactly what he meant. I could count on Tamiji.

The way to Panama was not so rough, after all. Tamiji had applied for one of the Smithsonian Institution's fellowships, with the Smithsonian Tropical Research Institute (STRI) as a target. He had aimed for the prestigious 'senior postdoctoral fellowship' (which was worth about \$29,000 at the time). I remember going to bat for his application during our annual fellowship meeting in March of 1988, in Panama, at STRI. I told my staff that he was 'as fluent in English as you or I', but whether they believed me or not, they voted to support him with our limited funds. Perhaps they could see that this was the beginning of a 'beautiful friendship'.

On the way to Panama, Tamiji and his family met my family in Maryland, USA, where we were living during the summer of 1988. At this time, Panama had become a rather burdensome place to live. If one could get through the roadblocks on the streets, find a way to obtain money (all banks had closed), find a gas station with gas, and find a store with food, then one might get through the next few days. In the meantime, the phone and the electricity might not work, and the tap water might disappear completely for several hours. Things were not all that good, given the activities of the U.S. government and the antics of General Noriega and his 'Dignity Battalion', which generally got away with murder in Panama. Both parties had made life very difficult for those of us in the middle — like the tropical biologists trying to pursue their research through STRI.

After being together for one month in Maryland, Tamiji and his family, wife Eiko, son Takeshi and daughter Ayako, all came with us (we were a family of five) and arrived in Panama. We had just purchased a new house (a trailer) and went there together. The Inoues camped on the floor in one large room (as they had in our Maryland home) and we took to our rooms, with many presentiments about what the coming months were to bring.

Priority one for the Inoue family in Panama was to locate an apartment to rent, near the Japanese school. Priority two was to purchase a second-hand Toyota Landcruiser (it was a 1985 'special' model, I believe). With these two goals accomplished, Tamiji could work as a tropical biologist, and could also see what was going on in Panama and with the people at STRI.

We went to the field often, searching for the nests of stingless bee colonies, which are usually found high in living trees. We also began to work on a 'bee room' to be constructed as an attachment to our re-modelled trailer-house. Tamiji contributed not only to financing the room, but to installing the bees. With his traditional Japanese woodworking tools, he fashioned some of the most beautiful stingless bee hives I have ever seen. Especially welcome was the innovation of sloping side walls of the hives, so that an observer could watch the bees within their nests without having to crane the neck in an

awkward position for hours on end. It was often that Tamiji would work eight hours observing the colonies of stingless bees that we installed in this room — *Trigona (Tetragona) dorsalis*, *Melipona micheneri*, *Melipona panamica* (then called '*fasciata*'), and *Scaptotrigona barrocoloradensis*.

Sometime during Tamiji's stay, his friend and colleague from Kyoto, Makoto Kato, came to work in the Panamanian forests. We had interesting experiences in the pursuit of Panamanian bees, and also in the pursuit of 'orchid bees', perhaps the most beautiful bees on earth. Kato-san was content to launch a project with a large flight cage and captive bees, to study how often they fed and with what concentrations of sugar in an experimental nectar feeding survey they were most satisfied. Tamiji and Kato-san explored the Panamanian forest and, once because the door to Tamiji's Toyota had remained open during their absence along a road well-traversed by field biologists, had somewhat prematurely rallied a small army of field biologists to look for them, fearing for the worst. Tamiji and Kato-san emerged from the forest the next day, were greatly chagrined by the efforts expended in their pursuit, and rapidly set about thanking the participants.

During the years that followed Tamiji's time with his family in Panama (they got out before our small war occurred in late 1989), I have good and clear memories of re-uniting with my friend at various times and places. We had the chance to meet in Asia in the early 1990s, then did not see each other until 1994, in Paris. It was at the IUSSI (International Union for the Study of Social Insects) meeting that I found what a deep friend I had with Tamiji. He walked across to me in the courtyard of the Sorbonne, extended his hand warmly, and said "my friend". He was wearing a suit, like the usual conformist Japanese businessman.

Shortly after the Paris meeting, I began to perceive that Tamiji was no longer a conformist in his pursuit of tropical biology and ecology. A new project had been devised in Sarawak, with Tamiji taking the role of implementing a canopy walkway and tree-towers that would allow students to observe pollination during a 'mass-flowering' year, which precedes the 'mast fruiting' occurring every four or five years in southeast Asia — and upon which most of the biological community depends. A new scientific venture had arrived in Japan, with a goal of extending its research to southeast Asia and the tropics. The Center for Ecological Studies was now my friend's academic home in Japan. With his pursuit of tropical themes, he had begun to investigate one of the largest ecological relationships in the tropical world. The periodic flowering of the forest trees and their reproductive performance, which produces the fruit, flowers, leaves and seeds in this vertically extensive realm (trees in Borneo reach 70 meters in height) were the subject of this organiz-

ed study. Life, including most of the local animals, bees included, was maintained solely by this process, which never had been the subject of a systematic research project.

The flowering came to pass during 1996, and Tamiji along with students from Kyoto and other collaborators worked hard to study the pollinators and their behavior and ecology in Sarawak at Lambir Hills field station, where the canopy project had been implemented. The mass flowering was filmed to be shown on NHK in Japan, with Tamiji as an articulate guide. His presentation was personal, and so was his project to make such a biological spectacle into something for educational use in Japan. His "treasure of the earth" series, as I witnessed it before formal presentation, emphasized the symbiotic cooperation in the tropical forest as one of the truly great messages coming at us, as it were, from nature. That is, survival, competition and predation all have their place, but the really great truth to the natural world is that in the struggle for Darwinian fitness, and indeed in the struggle for existence, the best solution involves cooperation — rather than violent struggles depicted in popular television shows and

perceived in the minds of many people. Cooperation, not competition and 'survival of the strongest' are guiding principles exhibited by life on earth.

Now it is almost 14 years since I met Tamiji. Our interaction still involved airplanes and small airports in the humid equatorial tropics of southeast Asia. Except my friend is not going to arrive. I look forward to his ready smile and enthusiastic handshake. I find them in my store of memories, but not on this earth. I have read the newspapers on the plane from Kuala Lumpur to Kuching, and it is 9 September, 1997. Three days before this, when I was leaving Panama, Tamiji was on a fatally ill-equipped charter plane flying from Brunei to Miri. The plane stove into Bukit Lambir, near the very place that my friend had realized one of his largest dreams — to see the general flowering year of the great southeast Asian forests, from the canopy, and to understand its inner workings. He and his students realized this dream, but he now sleeps a deeper sleep than any of us here on the ground.

David W. Roubik

*10 November 1997*