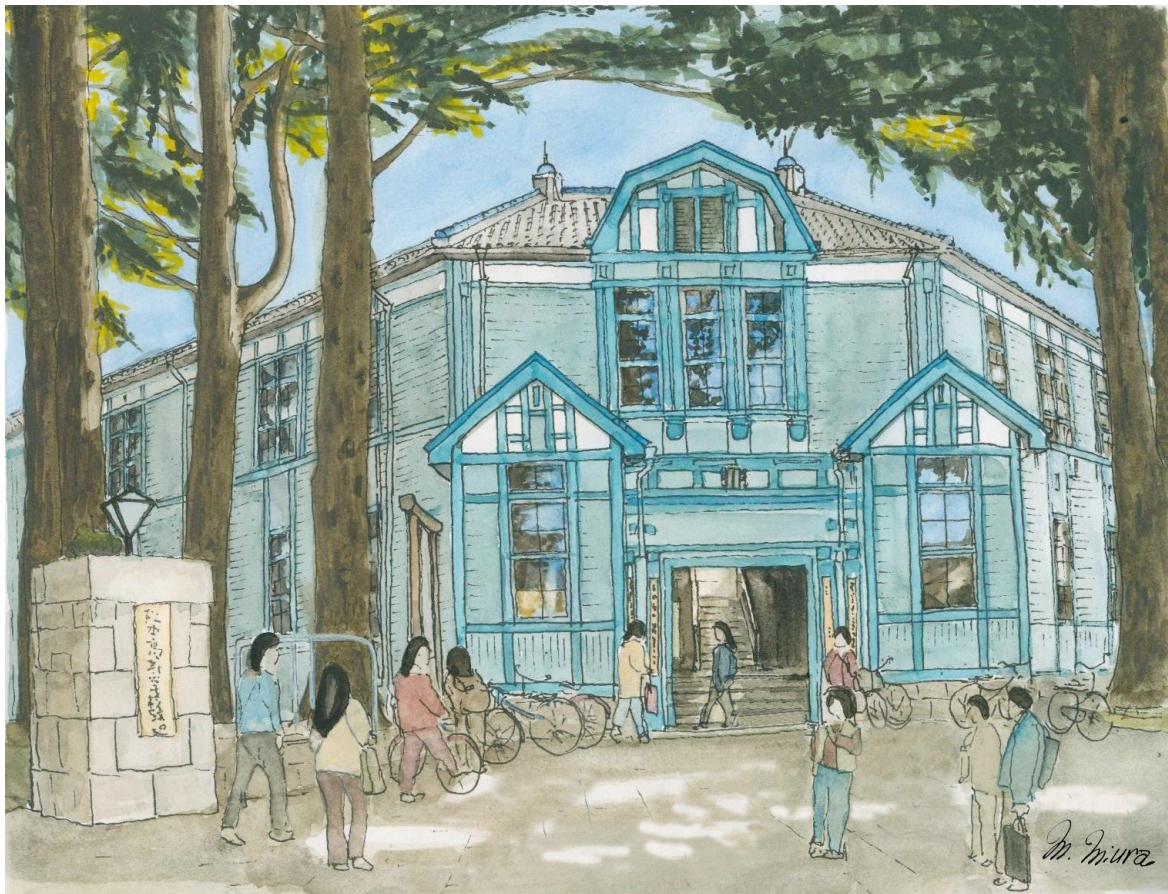


Program and Abstract Book

The First Symposium of the Benthological Society of Asia

The 5th Symposium of the Aquatic Entomologists Societies
of East Asia (AESEA)



**Benthological
Society of
Asia**

**June 11-14, 2012
Matsumoto, Japan**



The First Symposium of the Benthological Society of Asia

The 5th Symposium of the Aquatic Entomologists Societies of East Asia (AESEA)

June 11-14, 2012 Matsumoto, Japan



**Benthological
Society of
Asia**



Society President

Kazumi TANIDA

Local Congress's Management Committee

Kazumi TANIDA, Koji TOJO, Kimio HIRABAYASHI,
Masamichi YAMAMOTO, Hideshige TODA, Ho-Dong PARK,
Hiroshi NAKAMURA, Takayuki HANAZATO, Takao NOZAKI

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All Members of the Koji Tojo's Laboratory

Welcome Address

A personal overview and some prospects on Aquatic Entomological Society of Japan (AESJ) and Benthological Society of Asia (BSA)

Kazumi TANIDA, Society President

The first meeting of AESJ was held in June, 1977 at the forest research station of Utsunomiya University at Senjyogahara in Nikko, north-west of Tokyo with less than 30 persons. At that time I was a PhD student of Kyoto University.

I started my study on aquatic insects following an undergraduate field class of my university. I was much impressed by the biodiversity of insects within a small area of 0.25 m², which was actually very poor at a sandy stream in Kyoto Mountains. Some students and I started an additional survey on aquatic insects at Kibune Stream in northern Kyoto City. The mountain area is famous in the species richness of terrestrial insects, butterflies and beetles, and the stream is well known among Japanese ecologists. Since Tokichi Kani studied stream insects at Kibune and compiled his famous book, “The Ecology of Stream Insects”. I was surprised by the species richness and abundance of aquatic insects at the stream.

I also conducted the faunal study of aquatic insects of Ryukyu Islands in the summer of 1974. During that time, Japanese aquatic entomology was guided by Nara School (Nara Women’s University), Professors Matunae Tsuda and Teiji Kawai. I asked them to train the basic identification of aquatic insects of Kyoto and Ryukyu. They already compiled the big famous book on Japanese aquatic insects, “Aquatic Entomology” in 1962. The book seemed to me as a complete textbook of aquatic entomology in Japan. Many teachers and researchers gathered at Nara Women’s University. A Korean entomologist, Kim Jae Won, also visited the university and was staying at a mountain stream in Yoshino Mountains. Unfortunately, he died fairly young, but he conducted some excellent studies on Trichoptera of Korea and Japan.

After the sudden death of Professor Tsuda at the age of 63, Professor Kawai succeeded the laboratory of NWU. Dr. Ikuko Morishita established an institute, Institute of Freshwater Biology, and actively advertised the river health monitoring using stream macro-benthic animals. A good number of researches on applied ecology had been conducted, but basic taxonomical and ecological studies on aquatic insects were limited in number and quality.

Considering these situations, I personally called some students, professors and researchers to gather at the first meeting of AESJ. The annual meeting of AESJ had been conducted just after or before the annual meeting of Limnological Society of Japan and 35th meeting was achieved in 2011. The society has been supported by elder Japanese scientists, such as Professor Kawai, Dr. Morishita and Dr. Noboru Nishimura. The society has not any publication but produced several major textbook on Japanese aquatic insects, “Aquatic Insects of Japan –Speciation and Habitat Partitioning (Shibatani and Tanida, 1989)”, “Aquatic Insects of Japan with Keys and Manuals (Kawai and Tanida, 2005)” etc.

In 1998, the society got a big chance of receiving some Korean scientists here in Matsumoto,

including Professors Chon and Bae. We had visitors from Korea continuously and the plan for the first joint meeting of aquatic entomologists was launched at the annual meeting.

The first symposium of aquatic entomological societies of East Asia (AESEA) was opened at Chiaksan, Korea in 2000. Professor Yoon Il Byong welcomed Chinese, Mongolian, Japanese, and Korean participants. We enjoyed the stay at a beautiful mountain stream. The second symposium was conducted in Gifu, Japan hosted by Professor S. Uchida. Another two symposiums were followed these two at Nankai University, Tianjin, China in 2005 and Khon Kaen University, Thailand in 2009. Thus I had some urgent business in Japan, I could not attend these two symposiums. The first meeting of BSA in Matsumoto becomes the fifth symposium of AESEA.

I am very glad to open the fifth AESEA and the first BSA in Matsumoto, where we had the first open gate of international cooperation of aquatic entomology in East Asia.

As already addressed by Professor Y. Bae in the preface to the first symposium of AESEA: “The 21st Century and Aquatic Entomology in East Asia”, this meeting should be open to any aquatic entomologists, “to professional and amateurs,” “to students and employed,” as long as she or he is fond of aquatic insects. In addition to these persons, we have to add non-employed or retired persons who still have passion for aquatic insects. We also welcome researchers, students and amateurs of non-insect benthic organisms in freshwaters.

Short term prospects of BSA

Here, I propose some short-term targets of our new society, Benthological Society of Asia.

We already have basic key books or text books on aquatic insects and other freshwater macro-invertebrates of Asian Region in English (Dudgeon, 1999), in Korean, Chinese, Russian and Japanese. But we do not have any comprehensive book covering Asia or East Asia. We need such books covering wider area of Asia. Some books must be separate ones covering each order or some orders, but they should contain not only adults but also immature stages. And we have to use common science language, English.

Many laboratories of universities or colleges in East Asia treat freshwater invertebrates. However, mutual relationships or interchanges between students are not frequent. This meeting is a good chance to collaborate each other. In addition to the formal meetings, summer schools or other informal activities including training courses would be preferable. To promote and encourage young scientists is an important and urgent business of our society.

The journal or publications of our society must be discussed at the relating committee.

Thank you for your patience with the extension of this meeting for one year and your deep inquiry for the East Japan Earthquake and Tsunami Disasters.

Welcome Address

Welcome to the First Symposium of the Benthological Society of Asia (BSA), from the Local Congress's Management Committee:

Koji TOJO

Dear Colleagues,

The Benthological Society (The Aquatic Entomologists' Society) of Japan and the local management committee for the 1st Symposium of the Benthological Society extend our warmest welcome to you for this significant event in Matsumoto, Japan.

As a result of the March 11th Earthquake and the subsequent Tsunami, which hit East Japan, and in consideration of resulting Fukushima nuclear accident, we were forced to postpone our initial plans for this BSA symposium for one year.

We deeply regret the inconvenience this resulted in to a number of those who planned to participate. In addition, we would like to express our deep gratitude for your many warm messages of concern and encouragement. And now, we are very pleased that at long last this congress can be finally held here in Matsumoto.

Matsumoto is one of the few cities having a well preserved historic streetscape, particularly around one of the few remaining authentic castles in Japan; the Matsumoto-jo Castle (the 450-year old). The venue to this BSA congress, the "Agatanomori Bunka Kaikan (Agatanomori Cultural Center)" is also significant being the historic building, built in 1920, which was in fact the original home of our faculty. This has been designated as "Nationally Important Cultural Property". Moreover, Matsumoto is a city surrounded on all sides with the abundant richness of nature including the Japan-Alps. This rich environment is reflected in the high level of fauna endemic to the region amongst those inhabiting the benthos of the Japanese archipelago. So, we hope you will enjoy such surroundings during the BSA congress held here in Matsumoto, Japan. And, as you enjoy the natural surroundings here, you may also have in depth discussions with colleagues about the various topics and studies, you each individually pursue.

We hope your time here is fruitfull and enjoyable. Once again, we warmly welcome you to the 1st Symposium of the BSA.



Program

June 11, 2012

16:00-18:00 Registration @ Agatanomori Bunka-Kaikan (Cultural Center)

18:00-21:00 Light Trap @ The Susuki-gawa River (several minutes by walk)

June 12, 2012

08:30-09:30 Registration @ Agatanomori Bunka-Kaikan

09:30-09:40 Opening Ceremony

09:45-10:30 Plenary Lecture (Chair: Prof. Kazumi TANIDA)

Vincent H. RESH*, Bruce C.
CHESSMAN and Ian CAMPBELL

An Assessment of the Ecological Health of the
Lower Mekong River, Southeast Asia

10:40-11:40 Oral Session I (Chair: Prof. John C. MORSE)

OR01 10:40 Woon-Seok CHO*, Tuyen
VAN NGUYEN, Hungsoo KIM,
Young-Seuk PARK and Tae-Soo
CHON

Species Tolerance Range and Community
Response to Disturbances in Evaluation of
Biological Indicators

OR02 10:55 Tuyen VAN NGUYEN, Rupert
MAZZUCCO, Dong-Hwan KIM,
Ulf DIECKMANN and Tae-Soo
CHON*

Biodiversity Dynamics in Macroinvertebrate
Communities in Streams Based on Individual
Based Model

OR03 11:10 Tatyana S. VSHIVKOVA*, J.B.
STRIBLING, J.E. FLOTEMERSCHE
and John C. MORSE

Biological Assessment Protocols for the Streams
and Rivers of Asia and the Russian Far East:
International Experience and Strengthening
Comparability

OR04 11:25 Yeon Jae BAE* and Sang Woo JUNG

Current Status of Benthic Macroinvertebrates in
Korea

11:50-12:50 Oral Session II (Chair: Prof. Tae-Soo CHON)

OR05 11:50 Mi-Jung BAE*, Tae-Soo CHON,
Fengqing LI, Namil CHUNG,
Yongsoo KWON and Young-Seuk
PARK

The Effects of Water Temperature on
Freshwater Snail *Pomacea canaliculata*
(Caenogastropoda: Ampullariidae): Activity and
Daily Rhythm

OR06 12:05 Yumiko HAYASHI*, Tetuo
MURAKAMI,
Motoyasu MINAMI, Junbo WANG,
Takaaki TORII, Toshihito FUJITANI,
Gyo YOSHINARI, Liping ZHU and
Mitsuqu NISHIMURA

Physical and Biological features of glacier-fed
rivers in Tibet, China

OR07 12:20 YoungHun JIN

The Influence of Mine Waste Water on Benthic
Macroinvertebrates Community in Korea

OR08 12:35 Hnin WITYI*, Saumya N.,
SENAVIRATHNA and Takeshi
FUJINO

Comparison of Heavy Metal Accumulation with
Life History for Three Aquatic Insect Species

12:50-15:30 Lunch and Poster Session

* Please take lunch by yourself, refer to restaurants map

* Please keep posting the poster until the last day (June 14, 2012)

15:30-16:45 Oral Session III (Chair: Tatyana S. VSHIKOVA)

- OR09** 15:30 Hyo Jeong KANG and Yeon Jae BAE* Taxonomy of South Korean Orthocladiinae (Diptera: Chironomidae)
- OR10** 15:45 Min Woo OH, Jung Hoon HWANHG, Sun Jin PARK and Dongsoo KONG* Checklist of Caddisflies (Trichoptera) from Korea
- OR11** 16:00 Ryoichi B. KURANISHI Everting Method of Male Reproductive Organ of Two Caddisfly Species
- OR12** 16:15 Takeshi FUJINO*, Hnin WITYIi, Takeshi NOMOTO, Koichi NISHIGAKI, Tadashi KONDO, Atsamon LIMAKUL and Supatra DAVISON Application of Genome Profiling Method for Closely-Related Species of Stenopsychidae in Japan and Thailand
- OR13** 16:30 Akikazu TAIRA*, Mayumi YOSHIMURA and Kazumi TANIDA Life Cycle and Habitat Characteristics of the Larvae of *Rhyacophila kuramana* (Trichoptera, Rhyacophilidae)

17:00-18:15 Oral Session III (Chair: Prof. Akekawat VITHEEPRAKIT)

- OR14** 17:00 Decha THAPANYA*, Pensri BUNLUE and Pornpip CHANTARAMONGKOL Adult Caddisflies Assemblages form Upstream and Downstream of Mae Ngat Dam, Chiang Mai, Northern Thailand
- OR15** 17:15 Xiaoming JIANG and Zhicai XIE* Season Patterns in Macroinvertebrate Community in a Southwestern Chinese River System
- OR16** 17:30 Dong Gun KIM, Min Jeong BAEK, Hyo Jeong KANG, Song Ji LEE, Lak Jung CHOE, Cha Young LEE and Yeon Jae BAE* Succession of Benthic Macroinvertebrate Communities in an Experimental Wetland in Korea
- OR17** 17:45 Kazuki SEKINE and Koji TOJO* The Origin and Expansion of Unisexual Populations for the Geographically Parthenogenetic Mayfly *Ephoron shigae* (Ephemeroptera: Polymitarcyidae)
- OR18** 18:00 Koji TOJO Evolutionary Origin of the Insect Wing: Approach from Ephemeropteran Embryology

19:00- Banquet @ Restaurant "SAY" in the "Matsumoto Shimin-Geijutsu-Kan (Matsumoto Performing Arts Center)"

* Please move to the venue of the banquet before 19:00. Approximately 5-10 minutes walk from the venue of the BSA symposium

June 13, 2012

08:30-19:00 Field Excursion

Field Excursion to the Kiso and Azumino Areas

1st Site: Mizuki-zawa stream (Kiso Village)

2nd Site: Narai-juku / Narai-gawa River (Shiojiri City)

* Please take lunch by yourself in the Narai-jyuku Area

3rd Site: Daio Wasabi (Japanese horseradish) Farm / Yoro-zui-gawa and Tade-gawa streams (Azumino City)

June 14, 2012

9:00-10:15 Oral Session III (Chair: Prof. Beixin WANG)

- OR19** 9:00 Supawadee KHEOWKAE, Anchana THANCHAEON* and Praneet DAMRONGPHOL Toxicity of Herbicide Glyphosate to Aquatic Firefly Larvae, *Luciola aquatilis* Thancharoen
- OR20** 9:15 La-Au NAKTHONG*, Akekawat VITHEEPRADIT and Robert W. SITES The montane aquatic bugs (Hemiptera: Nepomorpha) of Phetchabun Mountain Range, Thailand
- OR21** 9:30 Akekawat VITHEEPRADIT* and Robert W. SITES The Laccocorinae (Hemiptera: Naucoridae) of Central and Eastern Mountain Ranges of Thailand
- OR22** 9:45 Sajeemat RARUANYSONG, Akekawat VITHEEPRADIT* and Robert W. SITES Aquatic Nepomorpha (Hemiptera: Heteroptera) of the northern part of Tennaserim Mountain Range
- OR23** 10:00 Jun Shik BAE, Dong Gun KIM and Jeong Mi HWANG* Biodiversity of Aquatic Insects in the Upo Wetland, Korea

10:30-11:45 Oral Session IV (Chair: Prof. Vincent H. RESH)

- OR24** 10:30 Namil CHUNG, Yong-Su KWON, Fengqing LI, Mi-Jung BAE, Eu Gene CHUNG, Kyunghyun KIM and Young-Seuk PARK* Effects of Global Warming on the Habitats of Endemic Freshwater Fish Species in Korea
- OR25** 10:45 Jeong-Ho HAN* and Kwang-Guk AN Fish Sampling Gear 's Efficiencies as a Preliminary Study for a Health Assessment Methodology Development in Korean Reservoirs
- OR26** 11:00 Yong-Su KWON, Namil CHUNG, Mi-Jung BAE, Fengqing LI, SoonJin HWANG and Young-Seuk PARK* Patterning and Predicting Fish Community in National Scale Relation to Environmental Variables
- OR27** 11:15 Jae Hoon LEE* and Kwang-Guk AN Ecological Health Assessments of Korean River Watersheds Using Multimetric Fish Model, Physical Habitat Model and Chemical Water Quality Parameters
- OR28** 11:30 Yi-Kuang WANG The Roles of *Bufo bankorensis* Tadpoles in a Subtropical Stream

11:45-12:00 Meeting of BSA

(Chair: Prof. Kazumi TANIDA and Prof. Yeon Jae BAE)
Closing Ceremony

Poster Presentations

- P01 Kiyoshi AOKI** The Species of Genus *Ameletus* (Ephemeroptera, Ameletidae) Collected from Nagara and Kiso Rivers in Central Japan
- P02 Kyung Seok BAE*, Gui Cheol LIM, Kuyng Hee KIM, Kwang Sik LEE and Hyun Seok CHO** The Effects of Rest Year System and Restoration Project on the Benthic Macroinvertebrate Community at Ui Creek of Seoul, Korea
- P03 Min Jeong BAEK, Tae Joong YOON and Yeon Jae BAE*** Environmental Effects of Road Deicer on Benthic Macroinvertebrates in Streams
- P04 Ji-Woong CHOI, Jeong-Ho HAN* and Kwang-Guk AN** Acoustic Tagging Telemetry as a Tool for Fish Movements and Migrations Tracking in Yeongsan River
- P05 Seoyun CHOI, Ji-Woong CHOI, Jae Hoon LEE* and Kwang-Guk AN** Chemical Tolerance and Trophic Gradient Analysis of *Zacco temminckii* vs. *Zacco platypus*
- P06 Soon Ah HAM** Molecular Biological Approach for Comparing the Four Genera in Korean Nemouridae (Plecoptera)
- P07 Jeong-Ho HAN* and Kwang-Guk AN** An Introduction of Echo-Sounder Methodology for Fish Distribution and Abundance Surveys
- P08 Zhenghai FU, Kazuya YOSHIZAWA, Norihiko YOSHIDA, Futaba KAZAMA and Kimio HIRABAYASHI*** Benthic Fauna of Lake Motosu, Japan (Pre-report)
- P09 Jeong Mi HWANG, Tae Joong YOON and Yeon Jae BAE*** Phylogenetic Relationship between *Drunella* and Related Genera (Ephemeroptera: Ephemerellidae) on the Basis of Sequence Analysis of Mitochondrial Cytochrome c Oxidase I Gene
- P10 Tomiko ITO** The Genus *Orthotrichia* Eaton (Trichoptera, Hydroptilidae) in Japan
- P11 Jae Ick JO and Dongsoo KONG*** Checklist of the Tipulidae (Insecta: Diptera) of Korea

- P12** Seung Gu KANG, Ji-Woong CHOI, Jeong-Ho HAN, Jae Hoon LEE and Kwang-Guk AN*
Conventional Fish Sampling Methods in Lotic Ecosystems and Their Sampling Implications for Fish-Way Evaluations
- P13** Yuto KATO and Koji TOJO*
Molecular phylogenetic relationships of East Asian *Yoraperla* stoneflies (Plecoptera, Peltoperlidae)
- P14** Yuto KATO and Koji TOJO*
Molecular Phylogenetic Relationships of East Asian *Cryptoperla* Stoneflies (Plecoptera, Peltoperlidae)
- P15** Chang-Bae KIM, Jeong-Ho HAN, Jae Hoon LEE and Kwang-Guk AN*
Environmental Impact Assessments of Periphytons and Fish Assemblages in Limestone Mine Streams
- P16** Hungsoo KIM*, Yuedan LIU, Zongming REN, Sangsuk YOON and Tae-Soo CHON
Analysis of Response Behaviors of Indicator Species after Exposure to Chemical Stressors by the Method of Fourier Transformation
- P17** Hungsoo KIM, Han-Seok YOON*, Bo-Moon KIM, Woon-Seok CHO and Tae-Soo CHON
The Line-Shaped Movement of Indicator Species in Oligochaeta in Response to Environmental Conditions
- P18** Ja-Hyun KIM, Dong-Hyuk YEOM, Jae Hoon LEE, Jeong-Ho HAN and Kwang-Guk AN*
Fish Biomarkers and Bioindicators for Stream Risk Assessments
- P19** Ji Yoon KIM, Jae Hoon LEE* and Kwang-Guk AN
Chemical, Physical, and Biological Stressors on Freshwater Fish in Stream Ecosystems
- P20** Dong-Hwan KIM*, Woon-Seok CHO, Nguyen VAN TUYEN and Tae-Soo CHON
Effect of Natural and Anthropogenic Variability on Community Structure of Benthic Macroinvertebrates
- P21** Dae-Geun KO, Jeong-Ho HAN* and Kwang-Guk AN
Fish Population Analysis of *Zacco platypus* in Korean Reservoirs and Its Trophic Gradients
- P22** Azusa KUME, Atsushi C. SUZUKI and Koji TOJO*
A Study into the Dispersion Pattern of a Cosmopolitan Distributed *Milnesium* cf. *tardigradum*: A Molecular Phylogenetic Approach
- P23** Sang-Do KWAK, Jeong-Ho HAN* and Kwang-Guk AN
Effects of an Exotic Species, *Micropterus salmoides* on Fish Communities in Lake Ecosystems

- P24 **Yuta MORII, Miyuki YOSHII, Toru KISHIMOTO and Koji TOJO*** Molecular Biogeography of the Scopurid Stoneflies (Plecoptera, Scopuridae)
- P25 **Yuta MORII, Miyuki YOSHII, Toru KISHIMOTO and Koji TOJO*** The parapatric distribution pattern derived from reproductive interference between two closely related scopurid stoneflies (Plecoptera, Scopuridae)
- P26 **John C. MORSE*, Govindapillai Achuthan NAIR and Satyanarayanan SENTHIL KUMARAN** Caddisflies (Trichoptera) from the Southern Western Ghats, India
- P27 **Christy J. GERACI, John C. MORSE* and Mohammed A. AL-SAFFAR** DNA Barcoding Caddisflies in the Upper Tigris River Basin, Iraq
- P28 **Bolortsetseg ERDENE, John C. MORSE* and Bayartogtokh BADAMDORJ** A Gynandromorph Subimago Specimen of *Baetis* sp. (Ephemeroptera: Baetidae) from Mongolia
- P29 **Goro KIMURA, Eiso INOUE and Kimio HIRABAYASHI*** Recovery of Aquatic Insect Communities from Riverbed Excavation Work in the Middle Reaches of the Shinano River, Japan
- P30 **Takao NOZAKI and Noriyosh SHIMURA** Two Polycentropodid Caddisflies (Trichoptera, Insecta) Collected from Yonaguni-jima, Westernmost Japan
- P31 **Chan-Seo PARK, Ji-woong CHOI, Jae Hoon LEE, Jeong-Ho HAN and Kwang-Guk AN*** Long-term Spatial and Temporal Variations of Fish Fauna and Compositions in Yeongsan-River Watershed
- P32 **Hyang-Mi PARK, Jae Hoon LEE* and Kwang-Guk AN** Urban Stream Restorations and Their Effects on the Ecological Health
- P33 **Rie SAITO and Koji TOJO*** Genetic Structures of the Isonychiid Mayfly *Isonychia japonica* (Ephemeroptera, Isonychiidae)
- P34 **Hiroki SATO*, Yousuke DEGAWA and Takamichi ORIHARA** Gut-Living Fungi of Aquatic Insects in Japan: *Harpellales* (Zygomycota) Collected in 2011-2012
- P35 **Eun Ju SHIN, Jae Hoon LEE* and Kwang-Guk AN** Spatial Distributions of Fish Guilds and Mercury Contents in Various Fish Tissues

- P36** Masanao Sueyoshi*, Nobuo Ishiyama* and Futoshi Nakamura Homogenization of Macroinvertebrate Community Structures Caused by Agricultural Land Use
- P37** Tomoya SUZUKI and Koji TOJO* Phylogeography of Two Japanese Giant Water Bugs, *Appasus japonicus* and *Appasus major* (Heteroptera: Belostomatidae)
- P38** Masaki TAKENAKA and Koji TOJO* Genetic Structures of Dipteromimid Mayflies Endemic to Japan (Ephemeroptera, Dipteromimidae)
- P39** Jaruwat THOWTHAMPITAK*, Surasak JAIKAR, Siva NOPPARAT, Anchana THANCHAREON, Akekawat VITHEEPRADIT and Sutruedee PRATHUANGWONG Products of Benefit Bacteria for Sustainable Rice Production and Safety for Aquatic insect (Notonectidae)
- P40** Zhen LI and Xiaoli TONG* Using Leaf Litter Breakdown Rates to Assess River Ecosystem Health : A Case Study in Dongjiang River, Guangdong Province, China

Abstract Plenary Lecuture

Plenary Lecture

An Assessment of the Ecological Health of the Lower Mekong River, Southeast Asia

Vincent H. RESH^{1*}, Bruce C. CHESSMAN² and Ian CAMPBELL³

¹Department of Environmental Science, Policy & Management, University of California, Berkeley 94720, USA; ²New South Wales Department of Environment, Climate Change and Water, POB 3720 Parramatta, NSW 2124, Australia;

³School of Biological Sciences, Monash University, Victoria 3800, Australia

A biological monitoring program was established for the lower Mekong River and its major tributaries to complement previously established monitoring programs on physical-chemical water quality and to determine whether harmful effects on aquatic ecosystems are resulting from the development and use of the water resources of the Lower Mekong Basin. The groups of organisms to be monitored in the program include diatoms, zooplankton, littoral macroinvertebrates, and benthic macroinvertebrates. Pilot studies were conducted in 2003. Data collection with standardized methods began in 2004 when 20 sites were sampled, with 16 sites sampled in 2005, 21 in 2006, and 20 in 2007. In total, 51 sites were sampled, with some sites being sampled in two or more years. All sampling was done in the dry season (March).

Specific indicators of ecological harm were calculated for each sample for all groups: species richness; abundance; and average tolerance, which is a measure of how resistant the species in the sample are to stresses caused by humans. Data from reference sites were used to define thresholds of harm and were selected based on chemical water quality data, and human activity at the site and in upstream areas. Data from 14 reference sites were used to generate 12 interim biological guidelines and data from all sites were compared with guideline values. Potentially harmful effects at a sampling site were inferred if the average richness or abundance of a group of organisms was below the applicable guideline. For tolerance, potential harm was inferred if the average value calculated for a site was above the applicable guideline. In order to produce an overall assessment, each site was classified for each sampling occasion according to the number of guidelines met.

Of the 77 sampling events conducted over four years, 28 sites were scored as excellent quality, 32 as good, and 17 as moderate, and none as poor. This rating suggests that the principal rivers of the Lower Mekong Basin have not yet suffered severe harm from the development of water resources or waste disposal although, some sites show signs of stress.

Keywords: biomonitoring, diatoms, macroinvertebrates, zooplankton, Mekong

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Abstracts

Oral Presentations

Species Tolerance Range and Community Response to Disturbances in Evaluation of Biological Indicators

**Woon-Seok CHO^{1*}, Tuyen VAN NGUYEN^{1,2}, Hungsoo KIM^{1,3},
Young-Seuk PARK⁴ and Tae-Soo CHON¹**

¹Department of Biological Sciences, Pusan National University, Busan 609-735, Republic of Korea;

²Department of Mathematics, Pusan National University, Busan 609-735, Republic of Korea; ³National Robotics Research Center, Pusan National University, Busan 609-735, Republic of Korea;

⁴Department of Biology, Kyung Hee University, Seoul 130-701, Republic of Korea

Benthic macroinvertebrates are considered as an important indicator group in presenting ecological integrity in freshwater ecosystems. In this study, tolerance ranges of individuals were regarded as attributes in Individual Based Models (IBMs). Life events of each species, including movement, response to disturbance (e.g., hypoxia), death and reproduction, were incorporated into IBMs. Species Abundance Distributions (SADs) at the community level were produced as model outputs. The results from simulation were fitted to the field data across different levels of pollution. In addition, biological indicators (e.g., Average Score Per Taxon) were also addressed from the model result. Subsequently the structure property residing in SADs and biological indicators was cross evaluated along with increase in pollution impacts. The model results accordingly reflected changes in SADs in response to pollution: geometric series in polluted sites and lognormal distribution in less polluted sites. The IBMs were suitable in evaluating community responses to disturbances and to elucidate the individual-community relationships in estimating ecosystem quality.

Keywords: individual-based model, species abundance distribution, ASPT, individual-community relationship, biotic index

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Biodiversity Dynamics in Macroinvertebrate Communities in Streams Based on Individual Based Model

**Tuyen VAN NGUYEN^{1,2}, Rupert MAZZUCCO³, Dong-Hwan KIM¹,
Ulf DIECKMANN³ and Tae-Soo CHON^{1*}**

¹Department of Biological Science, Pusan National University, Busan 609-735, Republic of Korea; ²Department of Mathematics, Pusan National University, Busan 609-735, Republic of Korea; ³Evolution and Ecology Program, International Institute for Applied System Analysis, Schlossplatz 1 A-2361 Laxenburg, Austria

Aquatic ecosystems are extremely vulnerable to anthropogenic disturbances (e.g., pollution), which fundamentally threaten community structure, ecological integrity, and water quality. Emergence and stabilization of communities of aquatic macroinvertebrates was simulated through an eco-evolutionary, individual-based model that considers the essential life events of aquatic insects (e.g., birth, death, movement, drift, and adult flight). The individuals were exposed to various biological (i.e., competition) and abiological (i.e., water velocity, dissolved oxygen, temperature, substrate size, organic matter, and pollution) constraints in the model. Effects of point-source pollutions were elucidated on community structure. The species–abundance distributions (SADs) were consequently obtained from the models and the results were generally in good agreement with the SADs obtained from field surveys. We demonstrated that this type of the simple individual-based model could efficiently elucidate individual–population–community relationships and would constitute a stepping stone towards objective prediction and management policy establishment by linking micro- and macro-aspects of eco-evolutionary phenomena in a unified model.

Keywords: macroinvertebrates, speciation, eco-evolutionary processes, species abundance distribution

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OR03

Biological Assessment Protocols for the Streams and Rivers of Asia and the Russian Far East: International Experience and Strengthening Comparability

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The resilience and adaptability of society to on-going global change is enhanced by healthy ecosystems, making the monitoring, assessment, and understanding of ecological resource conditions important to global well-being, human health, and economic stability. Successful management of water resources on a global scale, by definition, necessitates international collaboration and cooperation; this is especially true in cases of large trans-boundary waterways, such as those that exist in East and North-East Asia (ENEA). The United States (U.S.), Europe, Australia, and many Latin American countries have established bioassessment protocols and share technology and data. In Asia, the on-going effort in the Hindu-Kush Himalayan (HKH) Region, called “The ASSESS-HKH Project,” is focused on biological monitoring of the river systems of Nepal, Pakistan, India, Bangladesh, and Bhutan. This collaborative effort has increased the ability of participating nations to manage, or begin to manage, aquatic resources on large geographic scales.

One of the highest priorities in expanding global water resource management is integration of ecological and biological monitoring and assessment efforts among countries and regions of eastern and northeastern Asia (ENEA), which includes China, Russia, Mongolia, Japan, and North and South Korea. This kind of collaborative monitoring, using comparable technical procedures and programmatic frameworks among countries, is considered critical for the Russian Far East (RFE) having several large transboundary water bodies in Siberia and the RFE along the border of the People’s Republic of China (China) – the Amur River (also shared with Mongolia), the Ussuri River, the Razdolnaya (*Suifen* or *Suifen Hé*) River, and the Khanka (*Xingkai Hú*) Lake Basins; the Tumangan (*Tumen* or *Tumyntszyan*) River borders three countries – Russia, N Korea, and China. To monitor waters of the RFE effectively, scientists and water managers in the RFE need “to speak the same language” as the governments and experts of these neighboring countries. This will require coordinated efforts to develop and implement consistent and comparable biological monitoring protocols for evaluating status and trends of water resources conditions in the face of water pollution. That language can be provided by using an agreed-upon framework for documenting and tracking different aspects of data quality (quality assurance/quality control [QA/QC]), as well as linking sampling design to the questions being addressed. Under the Russian Clean Water Project (2003), some collaborative work has already occurred based on the biological knowledge of former Russian hydrobiologists, recent studies, and substantial national and international experience. However, these efforts achieved limited success mostly due to differences in sampling methods and overall monitoring designs. As a result of the lessons learned during this pioneering work, scientists in the RFE are well-positioned to 1) assume a leadership role in coordinating international efforts to develop and introduce a system for enhancing comparability of biological assessments among European and Asian countries, and 2) help scientists and bioassessment experts communicate the importance of biological monitoring of streams and watersheds to governments and water resources managers in these countries. Relating these results to parallel efforts in other parts of the world will serve to inform decision makers on aquatic resources conditions, and refine priorities globally in support of safe and sustainable freshwater and human communities.

Keywords: stream monitoring, watersheds, benthic macroinvertebrates

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Current Status of Benthic Macroinvertebrates in Korea

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We conducted a literature review of the status of Korean freshwater macroinvertebrates. Early descriptive and faunistic studies before the 1960s include Martens (1883-1884) for Mollusca, Imanish (1940) for Ephemeroptera, Cho (1946) for Hemiptera, etc. During the 1960s–1970s, faunistic studies, standing crop comparisons, community studies for water quality assessment, and taxonomic studies on diverse groups of freshwater macroinvertebrates were initiated. Kim (1974) comprehensively studied Korean Trichoptera larvae. During the 1980s–1990s, intensive taxonomic studies of aquatic insects resulted in a monograph (Yoon, 1988) that included 387 species and a key book (Yoon, 1995) that included 340 species. Bae and Yoon (1999) compiled checklist of 638 species of freshwater benthic macroinvertebrates including 491 species of aquatic insects. Since the 1980s, nation-wide government projects such as “National Ecosystems Survey (1986–current: Ministry of Environment, MOE),” “KLTER (2004–current: MOE),” “Korean Native Species Survey (2007–current: NIBR),” “Korean Flora and Fauna Project (2007–current: NIBR),” and diverse conservation, restoration, and education programs largely supported the research on freshwater macroinvertebrates in the country. Currently, 1,283 species of freshwater macroinvertebrates including 988 aquatic insects, have been identified in Korea: Cnidaria (1 sp.), Plathyhelminthes (3 spp.), Nematomorpha (8 spp.), Bryozoa (11 spp.), Mollusca (63 spp.), Annelida (52 spp.), Crustacea (42 spp.), Aranea (1 sp.), Ephemeroptera (81 spp.), Odonata (117 spp.), Plecoptera (102 spp.), Hemiptera (83 spp.), Megaloptera (4 spp.), Coleoptera (131 spp.), Hymenoptera (1 sp.), Diptera (334 spp.), Trichoptera (236 spp.), and Lepidoptera (13 spp.). A comprehensive keybook of Korean freshwater macroinvertebrates is under editing process by the senior author.

Keywords: benthic macroinvertebrates, aquatic insects, freshwater organisms, literature review, taxonomy, Korea

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The Effects of Water Temperature on Freshwater Snail *Pomacea canaliculata* (Caenogastropoda: Ampullariidae): Activity and Daily Rhythm

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Pomacea canaliculata (golden apple snail) is a freshwater snail native to South America. It was introduced to Asia as a food source or green farming techniques. However, it has become a serious agricultural pest, especially in young rice, and facilitates the expansion of the parasite, *Angiostrongylus cantonensis*. The objective of this study was to examine the changes in the activity and daily rhythm of *P. canaliculata* in experimental aquaria according to temperature changes which is an important factor limiting the distribution of *P. canaliculata*. The snails were acclimated at 25°C and 12 ethograms as well as feeding rate were examined in each temperature regime (25°C to 30°C, 25°C to 20°C, and 25°C to 15°C). The snails in the treatment of elevated temperature showed increasing activity in terms of ingestion and crawling behavior. The diurnal activity rhythm of *P. canaliculata* was disturbed during the temperature changes, which was apparent in the rearing conditions. Feeding rate increased with the increase in temperature.

Keywords: *Pomacea canaliculata*, temperature, daily rhythm, activity, feeding rate

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Physical and Biological features of glacier-fed rivers in Tibet, China

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We examined benthic compositions of 6 glacier-fed rivers, located at an altitude of over 4,000 m in the Southern Tibetan Plateau, China, in the summer of 2010. The aquatic insect community was poor both in diversity and density. Dominant life form was collectors (*Baetis* spp. and Chironomidae), a functional feeding group that rely on allochthonous organic matter. Scrapers and grazers that depend on autochthonous algal production were scarce. We speculated that this characteristic is related with the diurnal changes in water environment. The study sites are located at altitudes above the forest limit, where sparse grasslands distribute over the crumbling bedrocks below the glacier caps. Strong solar radiation, at high altitudes and without forest shades, generates stream flows from melting glaciers in the daytime. Originating rivers thus showed significant diurnal changes in water temperature, water level, and turbidity. The flow volume doubled in the afternoon in some rivers, and the increased flow transported a large amount of sediment, which would dislocate and scour substrates. This is not a favorable condition for scrapers and grazers that mainly depend on periphytic algae. Algal productivity was actually low, and pH and dissolved oxygen saturation, which showed no diurnal fluctuations, confirmed this tendency. On the other hand, the increased flow washed over riverbanks where a larger amount of algal production was observed in marginal pools temporarily formed along the mainstream. It is likely that diurnal increases in flow, and possibly seasonal high waters, transport organic matters from these marginal pools into the mainstream. We suggest that the benthic community characterized by collector species rely on the achievements of diurnally fluctuating water flow from glacier.

Keywords: benthic invertebrates, collectors, organic matter, high altitudes, water level

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The Influence of Mine Waste Water on Benthic Macroinvertebrates Community in Korea

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Water environment such as water quality and physical habitats sometimes become worse by mine wastes(tailings). In Korea, there are many mine waste dams near old mines, and which was normal method to treat mine wastes. Therefore, yellow-colored streambed often appears in mountain area. Although it was thought that mine waste water from its dam has a bad influence upon the habitat of benthic macroinvertebrates, the specific evidence was not presented in Korea.

To monitor the detail influence of mine waste water on benthic macroinvertebrate community, 24 samples were collected within 800m by 30*30cm² Surber net in a small mountain creek, which is a tributary of the Samcheok-osypcheon stream in July 2005.

At the downstream of inlet point of mine waste water, the number of species and the amount of individuals were reduced from 13~19 to 4~10 species and from 55~277 to 4~30 individuals. At 200~500m downstream of inlet point, they were recovered to 11~19 species and 64~201 individuals. At the view point of functional feed groups, the amount of individuals of scrapers such as *Epeorus*, *Glossosma* were reduced whereas net-spinning filterers such as *Hydropsyche* were somewhat increased in the recovered downstream communities.

Keywords: mine waste water, benthic macroinvertebrate, functional feeding groups

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Comparison of Heavy Metal Accumulation with Life History for Three Aquatic Insect Species

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This study is a part of dam impact assessment of Takizawa Dam located in downstream side of Nakatsu River in the Ara river basin (Saitama, Japan). Impoundment of the reservoir was started in October 1st, 2005 after the completion of dam body. That investigation was done monthly in the location of upstream and downstream of the dam from 2005 April before impoundment up to 2008 March. For macroinvertebrates samples, sorting and identification was done and biomass-body length measurement, life history and secondary production study was also performed for some selected species.

Now our concern is bioaccumulation of heavy metals in macroinvertebrates. There was copper mining activity in the upstream of Nakatsu River. From those two year study period, we have monthly data of heavy metal (Arsenic, Copper, Zinc, and Manganese, etc) contents in river water but lack of information of those contents in sediments and organic matter or periphyton which are food sources of macroinvertebrates. Arsenic concentration range in water was from 0.001 mg/L to 0.008 mg/L. We selected three dominating species, *Ephemera strigata*, *Stenopsyche marmorata* and one Corydalidae species, which can be found throughout the year with larger biomass and population to check bioaccumulation of arsenic. Moreover, these species are of different habitat groups: burrowers and clingers. For burrowing species, possible route of metal is from the water through the cutaneous and respiratory barriers and absorption in the gut from the sediments. Burrowing species ingest large quantities of sediments (Andres et al. 1998). For net spinning caddis fly, *Stenopsyche marmorata*, the preferred uptake route is from the food (Tochimoto et al. 2003). Larval stage of Corydalidae species is long for several years and it can be ideal species for long term study (Takeuchi and Yamada, 2000). From literature, *Ephemera strigata* can have one generation per year or two year depending on the water temperature. From our Takizawa dam impact assessment study, it was found that *S. marmorata* has two generations in a year after impoundment of reservoir, whereas, it was not clear life cycle pattern for Corydalidae species. Using these species for bioaccumulation, we expected that information for the contamination of metals in sediments and food can be known without direct measurement. The following table is the maximum dry body weight of selected species

Keywords: bioaccumulation, *E.strigata*, *S.marmorata*, Corydalidae

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Taxonomy of South Korean Orthoclaadiinae (Diptera: Chironomidae)

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The family Chironomidae (Diptera) has a worldwide distribution and is frequently the most abundant group of aquatic insects in fresh or brackish waters. The family is divided into 11 subfamilies and nominally into 22 tribes and is estimated to consist of as many as 15,000 species globally. Nakayama (1935) reported *Chironomus oryzae* Matsumura for the first time in Korea, and Paik (1963) included this species in “A list of pests in Korea”. Reiss (1980) reported 70 species of North Korean Chironomidae. Ree (1981) comprehensively studied Korean Chironomidae fauna and identified 110 species in 4 subfamilies. To date, approximately 123 species and 52 genera that belong to 5 subfamilies have been identified in Korea. Orthoclaadiinae is the second largest subfamily, followed by the subfamily Chironominae. Orthoclaadiinae contains approximately 1,000 species distributed worldwide, including 606 Japanese, 118 Chinese, and 166 Far East Russian species. Since the 1980s, 25 Orthoclaadiinae species have been recorded in Korea (Ree and Kim, 1981, 1998; Ree, 2007, 2009a, 2009b; Na *et al.*, 2010; Ree and Jeong, 2010). In this study, we studied Korean species of Orthoclaadiinae, including three new species, *Microcricotopus* A n. sp., *Orthoclaidus cylindarius* n. sp., and *Smittia quadrata* n. sp. and four species, *Corynoneura longipennia* Tokunaga, *Neobrillia longistyla* Kawai, *Smittia akanduodecima* Sasa and Kamimura, and *Smittia pratora* (Goetghebuer), new to Korea. Descriptions of male adults, line drawings of key characters, and biological notes are also included.

Keywords: Orthoclaadiinae, Chironomidae, new species, description, Korea

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Checklist of Caddisflies (Trichoptera) from Korea

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The early study on caddisflies in Korea was mainly achieved by foreign researchers, concerning the fauna of Democratic People's Republic of Korea (North Korea) mostly. In South Korea, the study of the larvae was first conducted in 1970's~1980's by Korean researchers. And the comprehensive study of the adults has been performed from the early 1990's.

As a result of above investigation, total 201 species of Trichoptera in 65 genera and 25 families have known in the Korean peninsula. 46 species were recorded in South Korea and 75 species were from North Korea (The localities of 3 species are unknown). And 77 species were known in both South and North Korea. The 3 families, Rhyacophilidae (32 species), Leptoceridae (30 species) and Limnephilidae (25 species) included 43% of the species.

In this study, the present status of study on caddisflies in Korea is shown and the checklist of Trichoptera from the Korean peninsula is also provided.

Keywords: caddisflies, Korea, taxonomy, Trichoptera

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Everting Method of Male Reproductive Organ of Two Caddisfly Species

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The endotheca (or endophallus) is a reliable character for separating the species. In this presentation, I would like to introduce everting method of male copulatory organs of two caddisfly species. On *Stenopsyche marmorata*, I tried two methods, (1) pick and extending by a fine forceps, from outside of phallosome, (2) put dissected abdomen into 3% hydrogen peroxide solution. Both methods succeed in fresh condition material. In the case of *Eubasilissa regina*, fresh material is not necessary, firstly dissected abdomen was put into hot 8% KOH solution (over 40 minutes) and transferred to hot lactic acid (10 minutes), finally washed in a distilled water and put a water pressure into the abdomen by syringe.

Keywords: endotheca, endophallus, morphology, *Stenopsyche*, *Eubasilissa*

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Application of Genome Profiling Method for Closely-Related Species of Stenopsychidae in Japan and Thailand

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We examined to use genome profiling (GP) method to identify and analyze DNA fragments of Stenopsychidae in Japan and South-East Asia for the purpose of taxonomic classification in genotype and the genome distance as a hamming distance derived from the pattern similarity score (PaSS).

GP is a strategy that can identify genomic DNA fragments common to closely related species without prior knowledge of the DNA sequence. Random PCR, one of the key technologies of GP, is used to produce fragments and may be used even when there are mutations at the priming site. These fragments can then be distinguished based on the information of mobility and melting pattern when subjected to temperature gradient gel electrophoresis (TGGE).

We carried out sampling of *S.marmorata* in Saitama (Japan), *S.sauteri* in Akita (Japan), and *S.siamensis* in Hat yai (Southern Thailand), and random PCR was carried out using conventional primers pfM12 and pfM19, respectively. We confirmed that the genome distance within the same location for *S.marmorata* was less than 0.05. It was less than 0.10 for the same species in different sampling location. And it was around 0.10-0.22 among different species.

Identical band patterns were observed by TGGE for two or more samples among both same and different species. It showed that corresponding fragments among several species, designated as commonly conserved genetic fragments (CCGFs), likely have the same genetic origin or correspond to the same gene. The criteria for identification of CCGFs has been defined and presented. To assess this prediction, some of the fragments are sequenced and are confirmed to be CCGFs. It is shown that genome profiles bearing evolutionarily conserved CCGFs can be used to classify organisms and trace evolutionary pathways, among other profound applications.

Keywords: Stenopsychidae, classification, Genome Profile method, CCGFs

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Life Cycle and Habitat Characteristics of the Larvae of *Rhyacophila kuramana* (Trichoptera, Rhyacophilidae)

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Rhyacophila kuramana belongs to the *Karutatica* species group and its larvae inhabit on spring seepage areas on rock surfaces of small spring runs in Japan. However, their behavior and life history are poorly known. In this study, the life cycle and habitat of *R. kuramana* were clarified. We recorded water condition, temperature and incline toward the surface of rock as habitat characters.

One year field observation was conducted from Oct. 2010 to Oct. 2011 to reveal their life cycle. This species had bivoltine life cycle, pupae and egg batches were observed in October and June to July. The wintering generation, starting from October, reached final instar in March to June and the non-wintering generation, starting from June, reached fourth or final instar in September to October.

Their egg batches, larvae and pupae were frequently observed in the weak flowing water on rock surface but scarcely in the wetted rock surface. In the weak flowing water, temperature on the rock surface fluctuates within a smaller range than wetted and dry rock surface.

Preferences for incline of rock surface were different among egg batches, larvae and pupae. The egg batches were frequently found at the “overhang” area of rock surface. The larvae were observed at any inclination of rock surface, where many larvae of the third to fifth instars were found on the steep rock surface with the inclination of 80 to 100 degrees from the horizontal surface. On the other hand, the pupae were scarcely found on steep rock surface but frequently found on gentle rock surface with less than 60 degree inclination.

Keywords: Trichoptera, *Rhyacophila kuramana*, bivoltine life cycle, habitat preference

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**Adult Caddisflies Assemblages form Upstream and
Downstream of Mae Ngat Dam, Chiang Mai,
Northern Thailand**

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Adult caddisflies were sampled using light traps in May, July and November 2009 from two sites upstream and two sites downstream of Mae Ngat Dam in northern Thailand. Water quality differed among sites. Conductivity and total dissolved solid were higher at upstream sites than downstream sites. Downstream site were high dissolved oxygen, pH and BOD. There were 13 families and 69 species of male caddisflies. The species richness of adult caddisflies at upstream was lower than downstream sites. The species compositions of upstream and downstream sites were differed that was evaluated from a cluster analysis. The common species that found in all study sites were *Cheumatopsyche criseyde*, *C. lucida* and *Oecetis empusa*. The example of upstream specific species were *Hydromanicus serubabel*, *Agapetus halong*, *Anisocetropus pan*, *Cochliophylax angusta*. The downstream specific species were *Amphipsyche meridiana*, *Dipseudopsis robustior*, *D. varians*, *Leptocerus posticus*, *L. lanzenbergeri*.

Keywords: Mae Ngat dam, caddisflies, northern Thailand

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Season Patterns in Macroinvertebrate Community in a Southwestern Chinese River System

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We measured seasonal changes of macroinvertebrate communities in Chishui River system, one of the largest un-dammed, primary tributaries upstream of Yangtze River, China. 16 sites were sampled at four seasons from April of 2007 to January of 2008. A total of 192 taxa were identified, of which aquatic insects were dominant group. The relative abundance of 12 species was more than 5% early or later at different seasons, but only *Bateis* sp1. was dominant taxon in all seasons. One-way ANOVA showed the density, biomass and richness of macroinvertebrate communities were higher in the winter and spring, middle in the autumn and lower in the summer. Most taxa and functional feeding groups had the similar trends. These reflected the summer flood influences on macroinvertebrate communities. The result of Canonical Correspondence Analysis (CCA) indicated that the environmental factors structuring the macroinvertebrate communities were somewhat different among different seasons: channel width, water depth, altitude, silt and clay, and cobble were significant environmental factors in the spring; channel width, water temperature, hardness, cobble and sand in the summer; $\text{NH}_4\text{-N}$, channel width, altitude, silt and clay, and cobble in the autumn; and $\text{PO}_4\text{-P}$, channel width, water depth and silt and clay in the winter.

Keywords: macroinvertebrate community; seasonal changes; Canonical Correspondence Analysis; environment factors; Chishui River system

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Succession of Benthic Macroinvertebrate Communities in an Experimental Wetland in Korea

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This study was conducted to investigate the initial succession pattern of benthic macroinvertebrate communities in a newly created experimental wetland. From May 2009 to October 2010, benthic macroinvertebrates were monthly sampled from 2 types (planted and non-planted) of habitats in the blocked experimental wetland and a nearby reference wetland. Vegetation composition was monitored bimonthly. The colonization index (CI) was adopted to determine the degree of succession; nonmetric multidimensional scaling (NMS), multiple responses permutation procedure (MRPP), and indicator species analysis (ISPAN) were used to demonstrate the rate of succession speed and compositional changes. The species richness of benthic macroinvertebrates increased through time in both habitats, whereas the species richness of the reference wetland remained unchanged. CI was shown to decrease through time in both habitats. In particular, CI decreased more rapidly in the planted habitat than in the non-planted habitat, and CI and species composition of the planted habitat showed similar values to those of the reference wetland after 400 Julian days. NMS and MRPP showed that benthic macroinvertebrate communities were significantly different with respect to habitat-types (planted, non-planted, and reference) ($p = 0.000$), season ($p = 0.001$), and year ($p = 0.014$). The ISPAN showed that *Ephemera orientalis* served as an indicator species in the non-planted habitat and *Ischnura asiatica*, in the planted habitat. Our results suggest that initial planting in a newly created or restored wetland may facilitate succession of benthic macroinvertebrate communities and that CI is a useful index for evaluating the succession of benthic macroinvertebrate communities.

Keywords: benthic macroinvertebrates, wetland, community succession, colonization index, restoration, Korea

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The Origin and Expansion of Unisexual Populations for the Geographically Parthenogenetic Mayfly *Ephoron shigae* (Ephemeroptera: Polymitarcyidae)

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The burrowing polymitarcyid mayfly *Ephoron shigae* (Takahashi) is distributed widely in Japan, while it is also reported from Korea and the Far East Russia. Some populations are bisexual, and others are unisexual (solely females), so that *E. shigae* is a geographically parthenogenetic mayfly (Watanabe & Ishiwata, 1997; Tojo *et al.*, 2006). In general, parthenogenetic populations are often found in harsh environments such as at high latitudes and altitudes, in xeric as opposed to mesic conditions (Suomalainen *et al.*, 1987), in isolated habitats such as islands and island-like areas, and at the peripheral regions of the taxon's range (Cuellar, 1977). In *E. shigae*, however, the distributions of bisexual and unisexual populations overlap broadly in their respective geographic ranges. *E. shigae* therefore, provides a uniquely well-suited model to study the differentiation of unisexual and bisexual populations, the establishment of parthenogenesis, and the dispersal of parthenogenetic individuals.

In this study, we have examined whether the origin of unisexual populations are polyphyletic or monophyletic, inferred from the partial sequences of the mitochondrial 16S rRNA (373-bp) and COI (636-bp) regions. As the results, although various haplotypes (16S rRNA: 27 haplotypes, COI: 58) were observed from the bisexual populations, while only one haplotype (16S rRNA: 1, COI: 1) was observed from all of the examined widespread unisexual populations. And the unisexual population's specific haplotype was allocated to be within the western Japanese clade. Therefore, the unisexual populations were certainly monophyletic in origin and recently differentiated somewhere in the western Japan. Furthermore, it was revealed that the distribution range of parthenogenetic strains have expanded rapidly across Japan.

In fact, we observed the transformation of the Abukuma-gawa population in Fukushima City from being bisexual to unisexual. Watanabe *et al.* (1998) recorded that the sample ratios of male to female were 181 to 289 and 383 to 476, in the years 1991 and 1992, respectively. However, in our recently study, these came to be 0 to 100 and 1 to 105, in the years 2009 and 2010, respectively. From the results of haplotype analyses, we observed that female individuals present in this population, which contributed to the parthenogenetic strain, were of western Japanese origin. Therefore, it is suggested that the bisexual reproductive strains were overwhelmed by the parthenogenetic strain in the Abukuma-gawa population with in such a short a period as twenty years. Such transformations observed in as the Abukuma-gawa population probably have occurred in the other unisexual populations across Japan.

Keywords: evolutionary ecology, geographic parthenogenesis, mass emergence, phylogeography, thelytokous reproduction

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Evolutionary Origin of the Insect Wing: Approach from Ephemeropteran Embryology

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Insect wing is a key evolutionary innovation for insect radiation, but its origins and intermediate forms are absent from the fossil record. To understand the ancestral state of the wing, expression of three key regulatory genes in insect wing development, *wingless* (*wg*), *vestigial* (*vg*), and *apterous* (*ap*) was studied in a mayfly, *Ephoron ephilum* (Polymitarcyidae). This mayfly develops tracheal gills that have been considered candidates for wing origin. *wg* and *vg* are expressed in primordia for tracheal gills. Those primordia are all located in the lateral body region marked by down-regulation of early segmental *wg* stripes, but differ in their dorsal-ventral position, indicating their positions drifted within the lateral body region. On the other hand, *ap* expression was detected in terga of mayfly. In this presentation, I will discuss the origin of the insect wing, with comparing the expression patterns of these three genes.

Keywords: insect wing, origin, genetic regulation, mayflies

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Toxicity of Herbicide Glyphosate to Aquatic Firefly Larvae, *Luciola aquatilis* Thancharoen

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Herbicide glyphosate is currently used for weed controls in agricultural areas in Thailand because of its high efficiency in controlling weeds and long-lasting ability. Contamination of glyphosate in the environments shows serious impacts to many animal species especially aquatic animals. The aquatic firefly, *Luciola aquatilis*, generally inhabits freshwater areas such as ponds, marshes and wetlands, including agricultural ditches which are frequently contaminated with herbicides. Glyphosate contamination may thus affect firefly populations. This study was undertaken to examine acute toxicity of glyphosate on all six larval stages of *L. aquatilis* by exposing them to glyphosate concentrations ranged from 10 to 400 ppm for 24 to 96 h. The 96-h LC₅₀ values of first to sixth instar larvae ranged from 39.50–128.48 ppm. Glyphosate was more toxic ($p < 0.05$) to the third–sixth instars larvae than the younger ones at 24 h exposure but did not exert much different effect ($p > 0.05$) on different larval stage at 96 h of exposure. Although the third to sixth instar larvae were highly sensitive to glyphosate, they displayed a behavioral response of survival by climbing out of the containers that had high glyphosate concentrations by 24 h of exposure. Therefore, the first and the second larval stages seem to be more vulnerable to glyphosate contamination than other larval stages.

Keywords: acute toxicity, larvae, firefly, *Luciola aquatilis*, glyphosate

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The montane aquatic bugs (Hemiptera: Nepomorpha) of Phetchabun Mountain Range, Thailand

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Aquatic bugs, Nepomorpha, are commonly found in freshwater habitats. Despite its abundance in both lotic and lentic habitats throughout Thailand, the taxonomic knowledge of this infraorder remains poor. Twelve families are recognized for this infraorder throughout the world; however eleven families were reported from Thailand. In this study, 17 species representing 6 families (i.e. Belostomatidae, Corixidae, Helotrephidae, Micronectidae, Notonectidae, and Nepidae) were collected from streams and waterfalls in Phetchabun Mountain Range. Furthermore, a new species of *Enithares* (Notonectidae) was collected from a small forested stream in Phu Hin Rongkhla National Park. Ecological, distributional, and taxonomic data of members of this infraorder found in Phetchabun Mountain Range are presented herein.

Keywords: Nepomorpha, Phetchabun Mountain Range, Thailand

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The Laccocorinae (Hemiptera: Naucoridae) of Central and Eastern Mountain Ranges of Thailand

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Members of the family Laccocorinae are common in montane lotic habitats throughout Southeast Asia. Extensive distributional data are given for the eight species representing three genera collected from Tennaserim, Phetchabun, and Khao Soi Doa mountain ranges in Thailand. Further, an undescribed species of *Namtokocoris* was recently discovered from Krathing Waterfall in Khao Soi Dao Mountain Ranges. Biogeographical, ecological, and taxonomic information on this family in Thailand are presented herein.

Keywords: Naucoridae, mountain ranges, Thailand

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Aquatic Nepomorpha (Hemiptera: Heteroptera) of the northern part of Tennaserim Mountain Range

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Nepomorpha belongs to of suborder Heteroptera, which consists of members that live in freshwater (e.g., stream, ponds, rock pools), except several families that are semiaquatic and found along aquatic habitats. More than 120 species of Nepomorphans have been reported from Thailand and numerous new species have been discovered in the last decade, nevertheless the taxonomic knowledge of this suborder in Thailand is still at an infant stage. In this study, 15 species representing five families of Nepomorphans were collected from lotic and lentic habitats of the northern part of Tennaserim Mountain Range. Cluster Analysis was employed to assess the species compositional similarity of streams based on a matrix computed by Jaccard's similarity index. Correlation Analysis was used to determine the relationships of species richness of Nepomorpha and physio-chemical characters of water quality.

Keywords: Nepomorpha, Tennaserim Mountain Range, Thailand

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Biodiversity of Aquatic Insects in the Upo Wetland, Korea

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Wetlands are common habitats for various animals and plants that belong to the food web of an ecosystem. The Upo Wetland is the largest riverine wetland in South Korea, and it is located in the lower Nakdong River in the southern part of the Korean Peninsula. It consists of 4 small wetlands, namely, Upo, Sajipo, Mokpo, and Jjokjibeol. The wetland area is protected by law by the Ministry of Environment of Korea, and it is also designated as Ramsar wetland site. Aquatic insects play an important role in the wetland food web as primary or secondary consumers. Therefore, the essential purpose of this research was to determine the importance of aquatic insects in maintaining the wetland ecosystem and to investigate the level of diversity, as compared to that of other wetlands. Previous literature was reviewed, and a field survey was conducted in April 2012. Hand nets were used to collect aquatic insects, and the collected specimens were identified in the laboratory by using available keybooks and references. As a result of the field survey, approximately 30 species of aquatic insects were identified such as *Diplonychus esakii*, Corixidae spp., *Ilyocoris exclamationis*, *Laccotrephes japonensis*, *Ranatra unicolor*, *Ranatra chinensis*, Coenagrionidae spp., *Orthetrum albistylum speciosum*, *Anax pathenope julius*, Dytiscidae spp., and Chironomidae spp. The first dominant species was Corixidae sp., and the second dominant species was *Diplonychus esakii*. Hemiptera was the most abundant group of aquatic insects in the wetland. Currently, a total of 135 species, 105 genera, and 59 families of aquatic insects and other benthic macroinvertebrates have been reported in the wetland area. Rare species such as *Boyeria maclachlani*, *Rhyothemis fulignos*, and *Ilyocoris exclamationis* have also been reported. Aquatic insect diversity in the Upo Wetland, which is the highest in South Korea, was compared with that of other wetlands in Korea.

Keywords: aquatic insects, Upo wetland, biodiversity, species composition, Korea

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Effects of Global Warming on the Habitats of Endemic Freshwater Fish Species in Korea

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Recent studies have revealed that water temperature increase in rivers is directly related to global warming. If current rate of increase in river temperature is maintained for longer term, this could affect the biodiversity and geographical distribution of freshwater fishes through decreased dissolved oxygen and/or eutrophication. Since freshwater fishes are highly sensitive to change in water temperature, it is essential to estimate the thermal tolerance limits of the organisms and the potential changes in habitat suitability of each species in a given watershed to mitigate the adverse effect of global warming on riverine fishes. The community data of 39 endemic fish species including 11 endangered species were collected from 478 sites in four major river systems in Korea. Weighted average regression model was applied to determine the optimum temperature and thermal tolerance range of each species based on fish abundance and temperature in the sampling sites. The estimated air temperature was converted to water temperature using air-and-water temperature relationship to estimate the minimum mean water temperature based on climate change scenario from 2010 to 2090. The maximum thermal tolerance of each species was compared to the estimated minimum mean water temperature to determine the thermal suitability of each habitat. The average increases in the minimum water temperature ranged 0.29- 2.39°C during the study period, and the maximum thermal tolerance of the fishes ranged 9.80-12.46°C. The effect of global warming on fishes' habitat initially appeared in the Geum River, but was the greatest in the Yeongsan River (98.9 % habitat affected) followed by the Geum River (94.6 %) and the Han River (31.9 %). None of the fish habitats was affected by the global warming in the Nakdong River. The percentage of species affected followed the order of the proportion of habitats affected: 95.2 % in the Yeongsan River, 59.1 % in the Geum River and 7.1 % in the Han River.

Keywords: global warming, water temperature, endemic fish, thermal tolerance, habitat

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Fish Sampling Gear's Efficiencies as a Preliminary Study for a Health Assessment Methodology Development in Korean Reservoirs

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The key objectives of this research were to establish fish monitoring methodologies and sampling efficiency strategies. National reservoirs within four Korean river watersheds were included in the analysis. Fish sampling gears applied were six types of fyke net (FN), gill net (GN), trammel net (TN), casting net (CN), minnow trap (MT), and kick net (KN), and the sampling efficiencies on each gears were tested using number of species and individuals sampled. During the study, fishes of 81 species and 53,792 individuals were sampled from 24 reservoirs. Comparisons of sampling gears showed that CN was greatest sampling gear with high species richness (69 species) while minnow trap was worst gears with low richness (16 species). Fish sampling efficiency, based on the number of individual CPUE, was best in the FN and worst in the MT. When we compared two gears of TN and KN vs. two gears of FN and CN, former one was were useful in the aspect of the number of fish individuals but not in terms of the number of fish species. Both gears of GN and MT had lowest sampling efficiencies in the number of species and number of individuals. In the meantime, when we tested efficiency of combined multiple sampling gears, two combined gears of CN and KN was most cost-effective, based on the sampling time lapsed and total cost used for the sampling. Two combined gears of CN and KN (1st choice method) sampled 74 fish species and 21,321 individuals and showed even better than the combined method (2nd choice method) of four sampling gears including CN, FN, TN, and KN. Overall, our preliminary data suggest that two combined gears of CN and KN were more cost-effective than the combined method (2nd choice method) of four sampling gears (CN, FN, TN, and KN). This study was supported by the Center for Aquatic Ecosystem Restoration of the Eco-STAR project of the Ministry of Environment, Republic of Korea.

Keywords: sampling efficiency, fish monitoring, sampling gears

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Patterning and Predicting Fish Community in National Scale Relation to Environmental Variables

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Fishes are widely used for measuring aquatic ecosystem quality, because fish community pattern is affected by various environmental variables. This study was conducted to pattern and predict fish community on national scale in Korea. Fish community data including 100 hundred species from 691 sites were patterned using SOM. The effect of environmental gradient on fish community was assessed using 6 physicochemical and 4 geographical factors as well as 4 land cover types. Random Forest (RF) was applied to predict the pattern of fish community related to environmental factors. SOM classified the sampling sites into five clusters based on similarity in fish community, and it revealed the longitudinal gradient of fish assemblage and environmental factors from headstream to downstream, especially cluster I, III and IV. The sampling sites in cluster I (located in small streams) had higher altitude (210.3 m) and shorter distance from source (33.8 km), whereas sampling sites in cluster IV (located large streams) had lower altitude (55.6 m) and longer DFS (71.1 km). RF showed relatively higher predictability with all of 14 environmental variables. The sensitivity analysis of the RF showed that altitude and distance from the source were the important factors to predict fish community patterns.

Keywords: fish assemblage, longitudinal distribution, SOM, stream gradient, random forest

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Ecological Health Assessments of Korean River Watersheds Using Multimetric Fish Model, Physical Habitat Model and Chemical Water Quality Parameters

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This study was conducted to assess river health conditions in South Korea based on a modified IBI model (K-IBIF). We selected 52 mainstream sites in four major Korean river watersheds. The ecological distribution of the tolerance and the trophic guilds were associated with the water quality parameters. Sensitive and insectivore species rapidly decreased ($r < -0.42$, $p < 0.01$, $n = 52$) with degradation in water quality (BOD), while tolerant and omnivore species increased ($r > 0.27$, $p < 0.05$, $n = 52$). Physical habitat condition based on a QHEI model indicated a “good” condition (mean 68.9, range 45 to 105, $n = 52$) in three of the major watersheds, except the Yeongsan River Watershed. The QHEI values were significantly associated with the nutrient levels ($R^2 > 0.4$, $p < 0.01$) in all the major watersheds. K-IBIF values varied from 34 to 8 in the watershed depending on the location during the study (mean: 18.2; $n = 52$), judged as in a “fair” condition. None of the study sites showed “excellent” condition. Total 13 (25%) sites were judged as a “good” condition, 20 (38.5%) sites were as a “fair” condition and 19 sites (36.5%) as “poor” condition. The ecological health of the Yeongsan river watershed (mean 14.4; “poor”) was significantly lower ($t < -3.9$, $p < 0.006$) compared to all the other watersheds due to the influx of nutrients from polluted tributaries surrounded by agricultural areas.

Keywords: K-IBIF, water quality, physical habitat, ecological health

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The Roles of *Bufo bankorensis* Tadpoles in a Subtropical Stream

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Aquatic vertebrates can have strong effects on stream ecosystems and their reduction may have great consequences. The tadpoles of *Bufo bankorensis* can appear in high densities in mountain streams of Taiwan. However, no study of their ecological roles is present. The goal of this study was to understand roles of tadpoles of *Bufo bankorensis* in a subtropical stream of Central Taiwan. The grazing effects of tadpoles were studied, the food sources, trophic position, and necrophagous were investigated, and the algal uptake of N released by tadpoles was analyzed. Tadpoles occur primarily from Fall through Spring. The enclosure treatment with tadpoles had lower AFDM and algal biomass than the exclosure. The enclosure had lower % *Gomphonema* than the exclosure. ^{13}C indicated the preference of algae, especially diatoms, by tadpoles. ^{15}N , however, indicated that the trophic level of tadpoles was close to that of predatory *Calopteryx* and higher than that of grazing *Goera*. Lab experiment confirmed their feedings of carcasses of tadpoles but not on live animals. Tadpoles released nutrients which was then absorbed by algae as indicated by a ^{15}N experiment. These tadpoles had strong effects and played multiple roles in this subtropical stream.

Keywords: tadpole, grazing effect, necrophagous, nutrient cycling

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Abstracts
Poster Presentations

P01

**The Species of Genus *Ameletus* (Ephemeroptera, Ameletidae)
Collected from Nagara and Kiso Rivers in Central Japan**

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I collected ten species of *Ameletus* from the two large rivers in central Japan, Nagara and Kiso Rivers in Gifu and Nagano Prefectures. The species were identified basing on adult males reared from nymphs collected at the rivers. Four species were described species, *A. costalis*, *A. kyotensis*, *A. montanus*, and *A. subalpinus*, but other six species seem to be undescribed ones. I will provide the list of the species and morphology of male genitalia which are useful to distinguish the ten species.

Keywords: *Ameletus*, Nagara River, Kiso River

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The Effects of Rest Year System and Restoration Project on the Benthic Macroinvertebrate Community at Ui Creek of Seoul, Korea

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This study was conducted to examine the variations of benthic macroinvertebrate community at Ui Creek in Seoul from June, 1992 to October, 2011. Ui creek rises in Bukhan Mountain National Park of Seoul, Korea. Stream water and bed of upper and middle reaches of the Creek have been improved and are in good condition. The Creek had been protected by system of stream rest year (Jun., 1992 - Dec., 1994) and latest restoration project. Number of benthic macroinvertebrates have been increased gradually until now. The benthic macroinvertebrates at upper and middle reaches of the Creek were 54 species(Jun., '92 - Mar., '93), 70 species(Jun., '93 - Mar., '94), 73 species(Jun., '94 - Mar, '95) and 94 species(Mar., '2011 - Oct., 2011). BOD values were 1a and 1b levels(1mg/L - 1.6mg/L) by Korea water quality standard. The latest water quality reaches to a very good levels compared to the previous years(Jun., '92 - Mar., 1995). The latest ecological score of benthic macroinvertebrates(ESB) is in very good condition, the level of biological water quality by ESB is 1 - 2 levels(Mar., 2100 - Oct., 2011). Number of benthic macroinvertebrates in Ui Creek have been increased and major dominant species have been changed as clean water indicator. Therefore, health of Ui Creek ecosystem has been recovered by the previous induction of rest year system and the latest restoration project.

Keywords: benthic macroinvertebrates, Ui creek, stream rest year

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Environmental Effects of Road Deicer on Benthic Macroinvertebrates in Streams

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Calcium chloride (CaCl₂) is a common antifreeze agent used for protection against road freezing. Although effective in keeping roads ice-free, CaCl₂ runoff into neighboring freshwater ecosystems can disrupt the ecosystems and pollute surface and ground waters. The use of deicer during winter season has rapidly increased in the recent years. In this study, we investigated the effects of deicer on benthic macroinvertebrates in the laboratory and in the field. Acute exposure examinations were conducted to obtain data on the lethal effects of CaCl₂ (96%) and road deicer (CaCl₂, 74%) on 5 test species, *Gammarus sobaegensis* (Amphipoda: Gammaridae), *Caridina denticulata denticulata* (Decapoda: Atyidae), *Glyptotendipes tokunagai* (Diptera: Chironomidae), *Cloeon dipterum* (Ephemeroptera: Baetidae), and *Ecdyonurus levis* (Ephemeroptera: Heptageniidae). Field sampling was quantitatively conducted using a Surber sampler (50 × 50 cm; mesh, 0.2 mm) at 5 stream sites (Mandae, Bangnae, Buk, Hangye, and Soyang Streams) in which road deicer point-source inputs were observed during the season of heavy snowfall from December 2009 to February 2010. As a result of acute exposure experiments, the mortality of the test species increased with higher CaCl₂ concentrations. The 50% lethal concentration (LC₅₀) of CaCl₂ and the deicer on *G. sobaegensis*, *C. denticulata*, *G. tokunagai*, *C. dipterum*, and *E. levis* were estimated to be 0.354% and 0.585%, 1.888% and 2.073%, 0.384% and 0.569%, 0.614% and 0.650%, and 0.632% and 0.834%, respectively. For all the species, the LC₅₀ of the deicer was higher than that of CaCl₂, because the deicer had relatively lower CaCl₂ content. After snowfall, a high chlorine-ion concentration was detected at the Hangye Stream site (24.63 mg/L), and the species richness and density at that site were remarkably lower than those before snowfall. Species richness was also shown to decrease at the other study sites after snowfall. The benthic macroinvertebrate communities may have been affected by the deicer for at least several decades, although the chlorine-ion concentrations at the Hangye Stream were much lower than the LC₅₀ of the test species. The results of this study can be used in the preparation of guidelines for road deicer use.

Keywords: road deicer, calcium chloride (CaCl₂), benthic macroinvertebrates, acute toxicity test, Korean stream

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Acoustic Tagging Telemetry as a Tool for Fish Movements and Migrations Tracking in Yeongsan River

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The objective of this study was to evaluate integrative impacts of fish distributions (fauna) and fish movement changes along with artificial weir construction in the Yeongsan River watershed. For this research, we traced the passage of migratory and non-migratory fish using acoustic tagging telemetry methodology (ATTM). We applied this methodology to several fish species and then released to the Yeongsan River. We found that transmitter (frequency: 76kHz, 3-6-6-8, #158) injected crucian carp was active during three months (6th Sep. - 5th Dec. 2011) and this fish had moved only around 1 km ranges from the releasing point. It could be 11 m day⁻¹ in migration speed reflecting relatively narrow action radius for this species. In the meantime, transmitter (frequency: 76 kHz, 4-5-6, #143) in eel (*Anguilla japonica*) was active during 6th Sep. - 5th Dec. 2011 as similar as the carp. This species migrated to the 22.5 km ahead from the Juksan weir, indicating a long-period of survival rate with long-range migrations with 223 m day⁻¹ of the migration speed. However, migration to upper stream was still impossible because the fishway in Seungchon wier were still under construction so that fish migration was in severance because fishway in artificial weir did not work at all in this moment. Afterward completing fishway construction to operate, we could regard that migratory fishes such as eel could be possible to move through fishway. This research was supported by environmental fundamental survey projects of Yeongsan and Seomjin river watersheds in Yeongsan river environment research center, Yeongsan river water management committee in National Institute of Environmental Research, Korea.

Keywords: acoustic tagging telemetry, fish movement, fishway, artificial weir

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Chemical Tolerance and Trophic Gradient Analysis of *Zacco temminckii* vs. *Zacco platypus*

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Trophic and tolerance gradients on the ranges of ambient nutrients (N, P) and other water quality were tested on two species of *Zacco temminckii* (Z_t) and *Zacco platypus* (Z_p). For water chemistry, trophic gradients and BIM model analysis, 76 streams and rivers were sampled during 2004 - 2005. The populations of Z_t had a narrow tolerance with a low limit ($< 300 \mu\text{g L}^{-1}$) over a phosphorus gradient, whereas the Z_p occurred in high TP up to $1180 \mu\text{g L}^{-1}$. There was a 4-fold difference in mean TP between two species and the tolerance range of phosphorus in Z_p was significantly greater than in Z_t ($t = 5.25$, $p < 0.001$). The chemical tolerance of two species had a similar pattern in nitrogen and other chemical parameters. The proportion of insectivores co-occurred with Z_t was $> 40\%$ and was nearly two times greater ($p < 0.001$) than was that co-occurred with Z_p . The omnivores co-occurred with Z_p were significantly greater ($t = 9.74$, $p < 0.001$) than those co-occurred with Z_t . The model values of BIM co-occurred with Z_t were significantly greater ($t = 13.67$, $p < 0.001$) than those of Z_p . Overall data suggested that Z_p have a wide range of chemical tolerance as tolerant species, trophic preference of omnivores, and survived even in degraded environments, whereas Z_t have other trophic extremes of sensitive species, trophic preference of insectivores, and the low-nutrient regions with high BIM model values. This study was supported by the CAER (Center for Aquatic Ecosystem Restoration) of Eco-STAR project from MEK (Ministry of Environment, Korea).

Keywords: trophic gradient, tolerance range, bioindicator, *Zacco*, water chemistry

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Molecular Biological Approach for Comparing the Four Genera in Korean Nemouridae (Plecoptera)

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In many fauna molecular biological approaches for genetic identification are actively being attempted, and among the fields of aquatic insects Order Plecoptera also is being investigated increasingly. Especially small-sized groups faced to difficulties of identification need to introduce alternative method to identify, in particular in females with similar characters.

This research was conducted for molecular comparison on larvae and adults of four genera *Nemoura*, *Amphinemura*, *Protonemura*, and *zapada* in Korean Nemouridae.

Cytochrome Oxidase subunit one (COI), Cytochrome Oxidase subunit two (COII), 12S rRNA and 16S rRNA sequences of other species uploaded on GenBank belonged to these genera were assembled and compared and the common sequences of them were searched. Primers were made properly on the common sequences, and each sequence was amplified by PCR. On the result of PCR pattern larvae and adults in four genera were compared. Presently suitable methodological tools for species identification and matching larvae with males or females are studying dynamically, and the results will be base for genetic identification. The procedures are introduced and features on PCR patterns of the four genera in Nemouridae are showed and the comparative results are described.

Keywords: Nemouridae, Plecoptera, molecular, COI, COII

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An Introduction of Echo-Sounder Methodology for Fish Distribution and Abundance Surveys

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Echo-sounder (E_s) monitoring methodology was tested environmental impacts from artificial weirs (Seungchon and Juksan weirs) in Yeongsan River and was compared with conventional fish sampling methodologies (C_s). For the E_s monitoring in the fields, parallel transect methods was employed in determining the survey distance interval with every 125 m within the upper-lower 2km of the weirs. Four different fish sampling gears such as casting nets, hand nets, fyke nets, and gill nets were used for applications of C_s monitoring methodology. From the Echo-sounder monitoring, fish density, expressed as individual numbers per square meter, along the longitudinal axis of the weir was significantly greater (JSW, $t = -3.506$, $p < 0.001$) in the down-river reach of the weir. Also, fish density along the vertical water column was highest at mid-depths of Seungchon weir, which has simple habitat substrates, while fish density was highest at hypolimnetic depth of Juksan weir. According to fish sampling by the C_s methodology, the fish compositions decreased as the river goes upward, and significant differences (JSW, $t = -0.248$, $p < 0.05$) in the compositions of fish species occurred between up-reach and down-reach of the weirs. The dominant species near the two weirs were *Opsarichthys uncirostris amurensis*, *Hemiculter eigenmanni* and *Coilia nasus*. Overall, our fish and habitat data, based on E_s and C_s monitoring methodologies, suggest that the weirs disturbed the rivers due to initial habitat disturbances by the weir constructions as well as the barrier roles of weirs on fish passage and migrations. More long-term scientific and systematic fish impact monitoring and assessments (E_s and C_s) are required in the future to predict changes of ecological structures and functions on the constructions of the weirs. This research was supported by environmental fundamental survey projects of Yeongsan and Seomjin river watersheds in Yeongsan River Environment research center, Yeongsan river water management committee in National Institute of Environmental Research, Korea.

Keywords: echo-sounder, fish monitoring, habitat structure, weir construction

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Benthic Fauna of Lake Motosu, Japan (Pre-report)

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Lake Motosu (35°28' N, 138°35' E at the center of the lake; surface area 4.83 km²; maximum depth 122.1 m; mean depth 67.9 m; altitude above sea level 900.5 m; oligotrophic lake) located at the north foot of Mt. Fuji, is one of the Fuji Five Lakes (comprising Lake Kawaguchi, Lake Motosu, Lake Saiko, Lake Shoji and Lake Yamanaka), which are especially familiar to the Japanese people for their beautiful landscapes. In this paper, in order to clarify the current status of the benthic community of Lake Motosu and examine the difference with the last set of quantitative data by Kitagawa (1973), the distribution of benthic macroinvertebrates was studied in this lake, and a comparison of the benthic fauna and density was made between the present and previous studies. On March 1, 2010 sampling surveys were carried out using a standard Ekman - Birge grab (15 × 15 cm), taking one sample at each of 3 stations in the southwest parts of Lake Motosu. The average density of benthic community was 1,852±1,403 ind./m², comprised of chironomid larvae, oligochaetes and Asellidae (Isopoda): *Asellus hilgendorfi*. Their densities were 1,348±970 (72.8%), 489±412 (26.4%) and 15±21 (0.8%), respectively. On the other hand, the average biomass (wet weight) of these benthic macroinvertebrates was 1.52±0.95 (74.5%), 0.47±0.42 (23.0%) and 0.05±0.07 (2.5%) g/m², respectively. *Micropsectra* sp. and *Procladius* sp. of chironomid larvae were the dominant genera, and make up 56.0% and 16.8%, respectively, of the total benthic macroinvertebrates in density, and 55.9% and 18.6% in biomass. *Micropsectra* sp. was 5.5 times and oligochaete was 18 times greater than that in 1973. The densities of *Micropsectra* sp. and oligochaetes were closely related to water depth. *A. hilgendorfi* was only collected in the deepest station (60 m<).

Keywords: bathymetric distribution, chironomid larvae, deep lake, oligochaete, oligotrophic lake

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Phylogenetic Relationship between *Drunella* and Related Genera (Ephemeroptera: Ephemerellidae) on the Basis of Sequence Analysis of Mitochondrial Cytochrome c Oxidase I Gene

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The mayfly family Ephemerellidae is an abundant and widespread group of aquatic organisms distributed throughout the Palearctic, Oriental, and Nearctic regions. The larvae abundantly inhabit torrential streams, although they can also be found in rivers or lentic habitats such as the edge waters of lakes. Most studies on Ephemerellidae have been geographically limited, and thus, the relationships among Ephemerellidae taxa remain unclear, especially with regard to the widespread Asian genera *Drunella*, *Ephemerella*, *Serratella*, and *Uracanthella*. In this study, we conducted a molecular analysis of Northeast Asian Ephemerellidae taxa concentrating on the genus *Drunella* to establish their phylogenetic relationships. Sixteen Ephemerellidae species, *Cincticostella levanidovae*, *C. nigra*, *C. tshernovae*, *Drunella aculea*, *D. cryptomeria*, *D. ishiyamana*, *D. latipes*, *D. lepnevae*, *D. triacantha*, *D. trispina*, *Ephemerella dentate*, *E. kozhovi*, *Serratella ignita*, *S. setigera*, *S. zapekinae*, and *Uracanthella punctisetae*, were examined. The 630-bp partial segment of the mitochondrial cytochrome c oxidase I gene was sequenced, and a phylogenetic tree based on maximum parsimony analysis and a neighbor-joining tree were constructed. The ingroup Ephemerellidae was divided into 2 major clades, namely, *Serratella-Uracanthella* and *Cincticostella-Drunella-Ephemerella* clades, although *Drunella* showed a polyphyletic group attributable to its phylogenetic proximity of *D. lepnevae* to *C. nigra*.

Keywords: Ephemerellidae, Ephemeroptera, Northeast Asia, cytochrome c oxidase subunit I (*COI*) gene, molecular phylogeny

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**The Genus *Orthotrichia* Eaton (Trichoptera, Hydroptilidae)
in Japan**

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I review Japanese species of the genus *Orthotrichia* Eaton (Trichoptera, Hydroptilidae) and confirm two species, *O. tragetti* Mosely and *O. costalis* (Curtis). For clear comparison, males and females of the two species are redescribed. They are distributed all over the East Asia including Japan.

Keywords: *Orthotrichia*, male, female, Japan, Asia

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Checklist of Tipulidae (Insecta: Diptera) from Korea

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Tipulidae is one of the largest family of Diptera, but not been well studied in Korea. Total 83 species in 10 genera and 3 subfamilies have known in the Korean peninsula. 10 species were recorded in South Korea, 31 species were from North Korea (from Democratic People's Republic of Korea), and 42 species were known in both North and South.

Since Alexander first recorded 1 new species in 1934, most of studies on Tipulidae were mainly achieved by foreign researchers from North Korea. Only some studies on the larvae were carried out by Korean researchers.

This study is pre-research for further comprehensive taxonomic studies on Tipulidae in Korea, and checklist of the Tipulidae from the Korea peninsula is provided.

Keywords: Diptera, Tipulidae, Checklist, Korea

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Conventional Fish Sampling Methods in Lotic Ecosystems and Their Sampling Implications for Fish-Way Evaluations

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Conventional fish sampling technique was compared with visual fish monitoring technique to test the sampling efficiency in stream ecosystems. Casting net and kick net for the conventional fish sampling method were used in the sampling, and the sampling distance and time lapsed were 200m and 50 minutes, respectively. The visual fish monitoring technique has been accomplished by direct observation through skin scuba diving into the river and has been counted species and individual numbers, moving 200m distance of each site during 50 minutes as similar as conventional sampling methods. From result of this research, total 24 species and 1788 individuals were collected. In detail, 19 species and 664 individuals were sampled through conventional sampling methods using nets. Also, 20 species and 1124 individuals were sampled by visual fish monitoring technique. It showed almost 2 fold difference in individual number. However, total sampled species did not show any significant difference in both sampling methods. During the survey, it was difficult to survey using casting net and kick net for some sites because obstacles in substrate might bother to apply conventional sampling gear. In this case, the efficiency of visual fish monitoring technique was better. In opposite, some sites where showed high turbidity and fast flow velocity, showed the complete reverse. Combination between visual monitoring and gear sampling could be effective to monitor aquatic ecosystem to assess ecological health. This research was supported by environmental fundamental survey projects of Yeongsan and Seomjin river watersheds in Yeongsan river environment research center, Yeongsan river water management committee in National Institute of Environmental Research, Korea.

Keywords: visual fish monitoring, conventional sampling, fish, sampling efficiency

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Molecular phylogenetic relationships of East Asian *Yoraperla* stoneflies (Plecoptera, Peltoperlidae)

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The genus *Yoraperla* is a small group of stoneflies, and this is a unique and an interesting group in terms of a zoogeographical viewpoints. Two disjunct subgroups are represented, one in coastal mid-latitude eastern Asia and the other in coastal mid-latitude western North America. They inhabit mountainous headwaters, especially in the seepage zones, the petri madicolous, hygropetric zones, or splash zones of small waterfalls. Since their habitats are restricted to mountainous headwaters, it is expected that their genetic differentiation have been accelerated in their local population level. In this study, we examined and discussed the genetic relationships of East Asian three *Yoraperla* stoneflies; *Yoraperla uenoi*, *Yoraperla uchidai* and *Yoraperla han*, inferred from the partially sequences of the mitochondrial large ribosomal subunit (16S rRNA) and cytochrome oxidase subunit I (COI), genes, and the nuclear histone 3 gene. From these genetic analysis, *Y. uenoi* was suggested to be a sister group of the clade of *Y. han* and *Y. uchidai*. Consequently, the result of our molecular phylogenetic analyses is well consistent with the results of the morphological analyses by Stark and Nelson (1994).

Keywords: phylogeography, mitochondrial DNA, nuclear DNA, geohistory

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Molecular Phylogenetic Relationships of East Asian *Cryptoperla* Stoneflies (Plecoptera, Peltoperlidae)

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Cryptoperlan stoneflies inhabit the headwater or upper stream areas of rivers. A molecular phylogeographic study of the cryptoperlans in the Japanese archipelago and Taiwan has been conducted. Altogether the mtDNA 16S rRNA region of 71 individuals from 62 populations, the mtDNA COI region of 44 individuals from 41 populations, and the nDNA Histone 3 region of 56 individuals from 52 populations were sequenced and analyzed. The respective ML/MP/NJ/Bayesian dendrograms were proposed from the sequencing data. Based upon that data and the resulting dendrograms, it has become clear that examined cryptoperlan stoneflies consist of two major clades. The first of these two major clades consists of a number of OTUs [*Cryptoperla japonica* (Honshu, Shikoku and Kyushu Islands) + *C. ishigakiensis* (Ishigaki Island) + *Cryptoperla* spp. (Okinawa Island and Taiwan)]. The other clade consists of the species *Cryptoperla kawasawai* inhabiting only Shikoku Island. Of particular note, *C. kawasawai* was observed to be significantly genetically differentiated from all other examined cryptoperlans. Furthermore, even within the species *C. kawasawai*, it was revealed that this group was composed of two significantly genetically differentiated subclades. It is considered that such genetic structure amongst cryptoperlans largely reflects the geological history of the Japanese archipelago and Taiwan.

Keywords: phylogeography, mitochondrial DNA, nuclear DNA, geohistory

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Environmental Impact Assessments of Periphytons and Fish Assemblages in Limestone Mine Streams

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The ecosystem health, based on multi-metric biological models of periphyton and fish was evaluated in streams influenced by drainage of limestone mine along with ecological impacts of biological taxa and water chemistry. Chemical water quality was in good condition except for the two parameters of TN and TSS. Ecological health assessments based on Trophic Diatom Index (TDI) and Index of Biological Integrity (IBI), showed that ecological health was judged as an excellent to good conditions (A-B) and from the result of the 4th survey at the N1 point, the nutrient salt index value was 74.96 due to effect of the dominant *Nitzschia amphibia*, the D grade (poor). According to correlation analysis Qualitative Habitat Evaluation Index (QHEI) with the two biological indexes of IBI and TDI, the IBI became higher, the rank also became higher but when TDI decreased, the rank becomes higher, the negative correlation should be appeared, but positive correlation also occurred partially. Periphyton was the effective methods due to high sensitivities and rapid response to the water quality. The wastewater from the limestone mine did not highly influence on the stream water chemistry and biota. The limestone-mine streams, however, were influenced continuous chemical or sediment disturbances. In this study, periphyton was better taxa to reflect the influence than the fish-based bioassessment. Overall, all data suggest that these bioassessment approach, based on the multi-metric models, may be used as a key tool to detect some ecological disturbances in the limestone mine streams.

Keywords: limestone mine drainage, periphyton, fish, ecological health

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Analysis of Response Behaviors of Indicator Species after Exposure to Chemical Stressors by the Method of Fourier Transformation

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We analyzed the time development of behavioral responses of indicator species using the discrete Fourier transformation. Movement of indicator species (*Daphnia magna* and *Danio rerio*) was continuously recorded in response to chemical stressors (e.g., diazinon, formaldehyde) at low concentrations (less than 1ppm). The parameters (e.g., speed) were extracted from the time series data. Different modes in frequencies were evaluated as the time progressed. Behavioral responses varied accordingly in time domain after exposure to chemicals. Subsequently, changes in the evident internal rhythm were demonstrated on the frequency domain before and after the treatments. The time series outputs of amplitude of each mode elucidated the subtle changes of internal status of the test species, consequently addressing stepwise responses of indicator species to stressors.

Keywords: behavioral monitoring, computational analysis, toxic effects, *Daphnia*, risk assessment

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The Line-Shaped Movement of Indicator Species in Oligochaeta in Response to Environmental Conditions

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Oligochaeta occupies an important position in aquatic ecosystem functioning and has been considered as a suitable indicator taxon in detecting disturbances in environment. Behavior responses of indicator species have been reported to be an efficient means of *in situ* monitoring. However, movement has been mainly dependent upon the points (e.g., centroid of body images) of indicator species in expression of response behaviors. In this study, we demonstrate changes in the line-shaped movement of indicator species. Individuals of Oligochaeta including *Limnodrilus variegatus* were exposed to environmental changes, and continuous line-movements were accordingly patterned through the line-tracking and image processing systems. Typical changes in parameters including speed, stop and twisting were observed at individual levels in response to changes in temperature and water velocity. Aggregation behaviors (e.g., individual-group, group-group) were subsequently analyzed to express changes in behavioral states at the population level. Abnormal behaviors such as curling were more frequently observed as environmental conditions were in the limited ranges. Aggregated population size was also variable in response to different degrees of environmental changes. The line-shaped movements could be an efficient indicating means to monitor disturbances in environment and to address ecological integrity in aquatic ecosystems.

Keywords: line tracking system, interaction, behavior response, indicating behavior, aggregation behavior

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Fish Biomarkers and Bioindicators for Stream Risk Assessments

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Various biomarkers and bioindicators of pale chub (*Zacco platypus*), as an indicator species, were evaluated for risk assessments of urban stream. The biomarkers and bioindicators were compared among three sites of control (Reference, C_z), transition (T_z), and the urban zones (U_z). The EROD activity, DNA damage, acetylcholinesterase (AChE) activity, and vitellogenin (VTG) were more significantly increased in the zone of U_z, than the C_z. Also, physiological markers such as condition factor (CF), liver somatic index (LSI), visceral somatic index (VSI), and gonad somatic index (GSI) were significantly increased in the U_z, than the C_z. For the health assessments, three categorized parameters of blood chemistry, molecular biomarkers, and physiological bioindicators were standardized and calculated as a star-plot, representing values of Integrated Health Response (IHR). Values of IHR had more significantly ($P < 0.05$) increases in the U_z, than any other zones, indicating an impairment of ecological health by organic matter, nutrients (N, P), and toxic chemicals. Current this study is based on low-levels of biological organization (L-LBO) approach of molecular and physiological biomarkers and bioindicators, so further study of high-levels of biological organization (H-LBO) approach such as community and population is required for overall-range health assessments.

Keywords: ecological health, biomarker, bioindicator, blood chemistry, multi-metric model

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Chemical, Physical, and Biological Stressors on Freshwater Fish in Stream Ecosystems

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This research identified multiple stressors on fish health throughout biological, chemical, and physical habitat analysis. Three sites (Up-, mid- and down-streams) were selected for the research. In the biological factors, we applied Comet assay and EROD and TOSC assay to evaluate DNA level damages and physiological impacts using *Zacco platypus* as sentinel species. Also, the Necropsy-based Health Assessment Index (NHAI) was applied to recognize individual level effects. For population level, we analyzed total length, weight and condition factor of sentinel species. For the analysis of community level stressor evaluation, Multi-metric Fish Assessment Index (MFAI), adopted 10 metric IBI model for regional application, was applied to evaluate the integrative fish community health. Also, we analyzed fish fauna associated with their community and guild structures and compared to physicochemical water quality parameters such as organic matters (BOD, COD), nutrients (TP, NH₃-N), pathological effect (MPN of coliform) and turbidity (SS) to identify the relations among multiple stressor effects. In the physical level analysis of habitat condition, Quantitative Habitat Evaluation Index (QHEI) model was applied. Most parameters applying this study indicated that degradation was occurring along with longitudinal gradient from up to downstream. Downstream, especially was impacted by various pollutants including nutrient enrichment and toxicant exposure from two major point sources, wastewater treatment plant and industrial complex located near the site. Overall results could suggest that our approaches applying various parameters can be effective to reflect the integrative stream health condition and can be useful tools in the face of water pollution.

Keywords: stressors, nutrient enrichment, wastewater treatment plant

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Effect of Natural and Anthropogenic Variability on Community Structure of Benthic Macroinvertebrates

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Benthic macroinvertebrates were collected with a Surber sampler in the southern part of the Korean peninsula from 1997 to 2002. The self-organizing map (SOM) and species abundance distributions (SADs) were applied to the surveyed data to present community responses to natural (e.g., geographic location) and anthropogenic (e.g., pollution) variability. According to the SOM benthic macroinvertebrates were spatially associated (e.g., the same tributary) at less polluted area but were similarly identified when the sample sites were severely polluted. Based on the models of SADs log normal distribution was mainly observed at less polluted sites and geometric series was found at polluted sites. Persistence in community compositions was further addressed according to identification of species in the ranks of SADs. SOM was also useful for presenting species variability and consistency across different levels of disturbance through ordination and clustering. The SADs were additionally suitable in presenting structural property in the sampled communities based on species rank and abundance. The use of SOM and SAD in combination is suitable in addressing community property and in establishing reference systems for water quality evaluation in streams.

Keywords: species abundance distribution, self-organizing map, community response, persistence, stability

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Fish Population Analysis of *Zacco platypus* in Korean Reservoirs and Its Trophic Gradients

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This study was carried out to determine the relations of fish weight-length relations to lake trophic state in reservoir ecosystems. Six reservoirs such as Buan reservoir (BA), Yangyang reservoir (YY), Jinyang reservoir (JY), Geumpung reservoir (GP), Yedang reservoir (YD), and Masan reservoir (MS) had been chosen. Seasonal variations of fish fauna occurred between the premonsoon (June) and postmonsoon (October). We chose *Zacco platypus* population, commonly sampled species in every six reservoirs and analyzed relationships between length and weight as well as length and condition factor (K). We also applied 5 year dataset of physico-chemical water quality parameters through the database from rural agricultural water resource information system and water information system during 2006 - 2010. According to the analysis of TSI (TP) and TSI (Chl-a) as eutrophication index, it was classed oligotrophy (30 - 40) for YY and BA, mesotrophy (40 - 50) for JY and GP and eutrophy (50 - 70) for YD and MS respectively, showing significant difference among trophic states in reservoirs. The condition factor (K) analysis suggested that condition factor slope value of *Z. platypus* population showed positive value in most MS, YD, JY, and GP but negative in YY and BA, significantly similar pattern against length and weight relation equation. These results suggest that trophic state of reservoirs influenced the condition factor of fish population. This study was supported by the CAER (Center for Aquatic Ecosystem Restoration) of Eco-STAR project from MEK (Ministry of Environment, Korea).

Keywords: fish population, eutrophication, length-weight relations, condition factor

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A Study into the Dispersion Pattern of a Cosmopolitan Distributed *Milnesium cf. tardigradum*: A Molecular Phylogenetic Approach

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Typical habitats of many terrestrial tardigrades (*i.e.*, the spaces within the structures of mosses and lichens) are generally unstable environments, subject to variations such as repeated wetting and drying, sun scorching heat in summer, cold, freezing and thawing in winter. Under the unsuitable environmental conditions that periodically come upon such habitats, many tardigrades enter into a dormant state by almost eliminating most of their metabolic activity (*i.e.*, the so-called the “cryptobiosis” condition), in order to avoid succumbing to the unsuitable situation for their own survival. While in the cryptobiotic condition, they roll up their body and shorten their all appendages, which is the so-called “tun status”. When they are in the “tun state”, it is considered that they achieve a high passive airborne dispersal potential. So far, however, any direct evidence of such wind facilitated dispersal potential has not been obtained.

From this background, we have been conducting a molecular phylogeographic analysis of a tardigrade in order to clarify the extent of the dispersion, utilizing the world wide distributed species *Milnesium cf. tardigradum*. Based on the comparison of genetic structure within and among local populations, we tried to examine the state of gene flow and the degree of genetic differentiation at both the intra- and inter-population levels.

About 230 *Milnesium cf. tardigradum* specimens were collected from 40 localities throughout the Japanese Archipelago and the Korean Peninsula, and the total genomic DNA was extracted from each individual. As the result of the analysis of their nuclear DNA ITS2 region and the mitochondrial DNA COI region, nine genotypes and twelve haplotypes have been detected, respectively. It has been confirmed that the differentiation pattern of ITS2 genotypes and the COI haplotypes almost completely matched. Although the three identified clades were clearly genetically differentiable, the degree of genetic diversity within each clade was extremely low. The dominant genotype was detected in about 78% of all of the examined specimens. This dominant genotype was found among 35 populations, separated geographically by up to 1,300km or more. That is, the same genotype was detected widely across East Asia. Furthermore, very little genetic differentiation between populations at each region level was not observed. Though these tardigrades inhabiting such large geographic scales, their notably low level of genetic differentiation is presumed to be a result of their very high passive airborne dispersal capacity. As a specific example, the genotype detected in some tardigrades collected from Asahikawa (Hokkaido Isl.) and Tendo, Yamagata (Honshu Isl.) populations was a perfectly match to the sequence registered in GenBank of a specimen collected in Tübingen, Germany. Although this must be an extremely rare situation, it seems to be apparent that such an inter-continental long-range dispersal mechanism exists.

Keywords: tardigrads, cryptobiosis, nuclear and mitochondrial DNA, Biogeography, dispersion pattern

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Effects of an Exotic Species, *Micropterus salmoides* on Fish Communities in Lake Ecosystems

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Largemouth bass (*Micropterus salmoides*) is a piscivorous exotic fish in Korea, which influence population and community dynamics. We tested effects of the predation by the exotic fish in lake ecosystems. Fish survey was conducted from four reservoirs including Byeokgye reservoirs (BR), Youngdeok reservoirs (YR), Geumpung reservoirs (GR), and Masan reservoirs (MR). The results of fish sampled was 3 species and 96 individuals (BR), 9 species and 2775 individuals (YR), 7 species and 1104 individuals (GR), and 15 species and 7,513 individuals (MR), respectively. Among these reservoirs, largemouth bass were approximately 80% in BR and GR, showing the most dominant species in these reservoirs. According to community index analysis, species richness was higher in MR and YR where largemouth bass does not inhabit but BR and GR appeared the low species richness. From tolerance guild analysis, sensitive species ratio was the highest in YR, while the ratio of tolerant species was the highest in GR and MR. However, BR and YR showed low ratio of tolerant species. According to trophic guild analysis, omnivores were low in GR but high in MR. Low ratio of omnivore species in BR and GR was significantly influenced by the effect of top predator, largemouth bass which dominated in these reservoirs. Consequently, as trophic state in reservoirs usually reflected the tolerant and trophic guild of inhabited fishes, inhabitation of largemouth bass had been collapsed all these guild system and ultimately, it was considered that major health deterioration and ecological disturbance in aquatic ecosystem were influenced by largemouth bass inhabitation. This study was supported by the CAER (Center for Aquatic Ecosystem Restoration) of Eco-STAR project from MEK (Ministry of Environment, Korea).

Keywords: exotic fish, largemouth bass, ecological disturbance

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Molecular Biogeography of the Scopurid Stoneflies (Plecoptera, Scopuridae)

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Plecoptera is a small order of insects of which its nymphs are aquatic. They probably diverged well over 300 million years ago, and there are over 2000 species in 16 families worldwide, distributed across all continents except Antarctica. Two suborders, Arctoperlaria and Antarctoperlaria are generally accepted to be within this order. Each suborder is primarily distributed within the northern and the southern hemispheres, respectively. The vicariance pattern between these suborders is believed to be linked to Pangea's break up into Laurasia and Gondwanaland during the Late Jurassic (170 MYA). This relationship between these suborders has also been basically supported by morphological, molecular phylogenetical and ethological studies. However, there is a problem in the phylogenetic position of the smallest family, Scopuridae. Scopurids are endemic to East Asia (*i.e.*, the Japanese Archipelago and the Korean Peninsula). Eight species belong to the sole genus *Scopura*. In previous morphological studies, Scopuridae are placed within Arctoperlaria. However, according to molecular phylogenetic studies it belongs to Antarctoperlaria. Furthermore, 'drumming' behavior, which is recognized as being a typical and functionally important mating behavior in arctoperlarian stoneflies, has not been observed in the scopurid stoneflies, despite their distribution within the northern hemisphere. So, Scopuridae is a 'key taxon' in understanding the sequence of evolutionary paths and diversity in Plecoptera. In these previous studies, it was reckoned that Scopuridae originated in the cold regions of Eurasia and migrated to Japan about 0.6 million years ago. However, their actual path of migration and precise origin remains unclear. A more accurate estimation of the evolutionary history of scopurids will contribute valuable information to the discussion concerning the higher level phylogeny of the order Plecoptera. In this present study, the phylogenetic relationships of 7 species of the scopurid stoneflies, collected from an area covering their almost all distributional range, were analyzed using nuclear Histone 3 DNA and mitochondrial 16S ribosomal DNA. Almost identical affinity relationships were supported by both the analysis of nDNA and mtDNA. Scopurid stoneflies were clearly separated into two discrete clades, a pattern suggesting that scopurid stoneflies immigrated to Japan from two directions; 1) from Far East Russia into northern Japan and 2) from the Korean peninsula into western-central Japan.

Keywords: Scopuridae, molecular phylogeny, biogeography

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The Parapatric Distribution Pattern Derived from Reproductive Interference between Two Closely Related Scopurid Stoneflies (Plecoptera, Scopuridae)

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The two closely related scopurid stoneflies, *Scopura longa* and *Scopura montana* inhabiting Japan's Honshu Island, are distributed in clear parapatry. Although there are no geological barriers as separating the distribution of them, *S. longa* is distributed in the Northeast, and *S. montana* is distributed in the Central Honshu. At the boundary area, it has been confirmed that these two species cohabitate. It is unlikely that these parapatric relationships are caused by resource competition, because these stoneflies are polyphagous and have similar habitats. The distinct differences have been observed in terms of some morphological characteristics, and no individuals have been identified as exhibiting hybrid or intermediate characteristics between them, so far. Furthermore, our DNA analyses also indicated that there is no gene flow between them. However, we observed interspecific mating and oviposition of the egg mass in the breeding conditions. This result suggests the existence of reproductive interference between these two stoneflies. We also found interspecific difference of sex-based emergence timing between these two species. This may have contributed to the avoidance of interspecific hybridization by a temporal reproductive isolation. We will discuss about the process that lead to parapatric distribution of them in terms of reproductive interference and reproductive isolation.

Keywords: Scopuridae, parapatry, reproductive interference, reproductive isolation

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Caddisflies (Trichoptera) from the Southern Western Ghats, India

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The known Trichoptera fauna of India, comprising more than 1,100 species, has been studied mainly by foreigners. A week-long light-trapping expedition in the southern Western Ghats, India, in June and July 2007 yielded a modest number of caddisfly specimens, many of which are new for science. Descriptions of new species of Ecnomidae, Hydropsychidae, Leptoceridae, and Psychomyiidae will be provided with reviews of known Indian species in each of the relevant genera. Clearly this region of India still has some mostly unpolluted streams with diverse and unexplored caddisfly communities.

Keywords: Ecnomidae, Hydropsychidae, Leptoceridae, Psychomyiidae, Western Ghats, Kerala

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DNA Barcoding Caddisflies in the Upper Tigris River Basin, Iraq

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The Tigris River is a critical natural resource in the Middle East. As one of two major sources of water for the Mesopotamian Marshlands (which were drained by the Hussein regime in the 1990's), preserving its water quality and quantity is important to marsh recovery efforts. Despite its importance, the Trichoptera fauna of the Iraqi portion of the Tigris watershed has been little studied. Comparative morphological and DNA barcode data from caddisfly larvae and identifiable adults collected between 2007 and 2010 provide evidence for the identity of the larvae and reveal 8 species putatively new to science.

Keywords: mtCOI, Trichoptera, water quality, Mesopotamian Marshlands, larval identification, new species

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**A Gynandromorph Subimago Specimen of *Baetis* sp.
(Ephemeroptera: Baetidae) from Mongolia**

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The order Ephemeroptera is the one of the groups of aquatic insects for which several gynandromorph specimens have been recorded. The families Baetidae, Heptageniidae and Leptophlebiidae each includes several gynandromorphs. There are 21 species of 5 genera for which gynandromorphs have been recorded. A subimago specimen of *Baetis* sp. was collected along the Sagsai Gol, Bayan-Ulgii Province in July 2008 and preserved in 70-80% ethanol. The gynandromorph specimen has both female and male body parts arranged with bilateral symmetry. The left eye is male and the right eye is female. The fore wings and hind wings are similar. Antennae and legs are broken. Penes are present on the abdomen, but the abdomen is filled with eggs of the same size as for normal females. Digital images of the specimen was taken using a Leica EZ4 D dissecting microscope equipped with a digital camera.

Keywords: male, female, mosaic, Heptageniidae, Leptophlebiidae, eyes, penes, eggs

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Recovery of Aquatic Insect Communities from Riverbed Excavation Work in the Middle Reaches of the Shinano River, Japan

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A riverbed excavation work was conducted in the middle reaches of the Shinano River from December 15, 2005 to March 27, 2006. We have been reported recovery of Trichoptera assemblage after the excavation work in the river. However, recovery of other aquatic insect taxa after the excavation work has never been reported. The objective of our study was to evaluate the time required for recovery of the aquatic insect as representative taxa after an excavation work in the river and compared the results between the excavated area and a natural riffle. We sampled excavated area on days 1, 3, 5, 8, 11, 14, 19, 22, 28, 35, 43, 51, 59, 69, 85 and 98 after the riverbed excavation work. On the other hand, the sample was taken at the control site on days -6, 1, 14, 28, 43, 59, 69, 85, 98 and 126 after the riverbed excavation work. We identified 6 orders, Coleoptera, Diptera, Ephemeroptera, Odonata, Plecoptera and Trichoptera, at the two study sites. At control site, Diptera was the most abundant accounting 61.4% of the mean density during the study, followed by Trichoptera (21.6%) and Ephemeroptera (16.9%). On the other hand, the three most abundant orders at treatment site were Diptera (68.4%), Trichoptera (17.3%) and Ephemeroptera (14.2%). The density of Chironomidae increased rapidly than Ephemeroptera and Trichoptera densities. However, the density of Chironomidae never exceeded the density at control site during the study period. The density of Ephemeroptera at control site was always higher than at treatment site. On the other hand, the density at treatment site was extremely low just after the end of excavation work and increased gradually. On Day 98, the density of Ephemeroptera at treatment site was the highest and reached the density at control site. An excessively strong flood that occurred 2 weeks after the last sampling prevented us to continue the monitoring of aquatic insect community at treatment site, but it was suggested that the flood canceled out the impact of the excavation work.

Keywords: Chironomidae, Ephemeroptera, Trichoptera, large-scale substrate removal, recovery

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Two Polycentropodid Caddisflies (Trichoptera, Insecta) Collected from Yonaguni-jima, Westernmost Japan

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Yonaguni-jima is the westernmost island in Japan and very close to Taiwan. Shimura (2010) provided a fauna list of Ephemeroptera, Plecoptera and Trichoptera of this island for the first time, and recorded 16 caddisfly species including two unidentified polycentropodids (*Plectrocnemia* sp. and *Polyplectropus* sp.). After the precise examination of these two species, we recognized that they are the same species as *Polycentropus nigrospinus* and *Polycentropus unicus*, respectively, both described from Taiwan by Hsu & Chen (1996). Based on characters of wing venation and male genitalia, the former belongs to the genus *Plectrocnemia* Stephens, and the latter does to the genus *Polyplectropus* Ulmer (new combinations). They have a related species, *Plectrocnemia divisa* Ohkawa & Ito, 2007 and *Polyplectropus malickyi* Nozaki et al, 2010, respectively, both of which are distributed in Japanese main islands. In this paper, we redescribe males and females of these two species, and describe the immature stages for the first time. Informations of larval habitats are also provided.

Keywords: Trichoptera, Polycentropodidae, new combination, redescription, Yonaguni-jima, Japan, Taiwan

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Long-term Spatial and Temporal Variations of Fish Fauna and Compositions in Yeongsan-River Watershed

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This study was to analyze long-term characteristics of fish compositions and longitudinal distribution, based on trophic and tolerance guilds in Yeongsan River watershed since 1980s. The collected fishes, based on catch per unit effort (CPUE), were 44 species in the watershed and dominant fishes were *Zacco platypus*, *Acheilognathus macropeterus*, *Zacco temminckii*, and *Carassius auratus*. According to comparative analysis of fish in the non-polluted sites (NPS) relatively located in rural area vs. polluted sites (PS) relatively located in urban area, the number of species and individuals was lower in the PS than the NPS, indicating ecological degradations by chemical pollutions or/and habitat modifications. The relative abundance of sensitive and insectivore species decreased as the stream order increases, while tolerant and omnivore species increased with the stream order. In this survey, largemouth bass (*Micropterus salmoides*), which is a top-carnivore and exotic species, may influence trophic guild system throughout active predations on endemic species, resulting in modifications of ecological functions. The construction of estuary dam on Yeongsan River in 1981 resulted in wider lacustrine zone and desalinated through limitation of seawater input. These physical changes have caused increases of lentic dwelling species and limited fish migrations (i.e., eel). Overall, fish fauna and composition analyses showed that the number of species and individuals in this water body may be reduced due to inputs of pollutants from the watershed, habitat modifications, and increases of exotic species (largemouth bass). For these reasons, effective lake management strategies are required for the ecosystem conservation. This research was supported by environmental fundamental survey projects of Yeongsan and Seomjin river watersheds in Yeongsan river environment research center, Yeongsan river water management committee in National Institute of Environmental Research, Korea.

Keywords: Yeongsan River, fish fauna, species composition, ecological health

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Urban Stream Restorations and Their Effects on the Ecological Health

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This study was to analyze chemical water quality and physical habitat health during 2007 - 2011 along with biological health during before- and after-the-restoration in Daejeon Stream (DS), Yudeung Stream (YS), and Gap Stream (GS), Korea. Chemical analysis indicated that water quality of 4 parameters including nutrients and organic matters had no significant differences ($p > 0.05$) between before- and after-the restorations in three streams. Physical habitat health, based on QHEI model, averaged 121 (fair - good), 96.1 (fair) and 84.4 (fair), respectively, in GS, YS and DS streams. The species of *Iksookimia choii* which is a natural monument No. 454 and designated as an endangered species, was sampled from the Gap Stream, and *Pseudopungtungia nigra* which is designated as an endangered species, was also sampled from Yudeung Stream. Exotic species was sampled from all three streams and the number of individuals slightly increased after the construction (restoration). The biological health, based on IBI model, averaged 22.7, 21.6, and 19.0, respectively, in YS, GS and DS streams, indicating that the health in all three streams were judged as 'fair conditions'. Model values of IBI decreased along the longitudinal gradients from the headwaters to downstream. Our data suggest that the stream restoration works in three urban streams did not improve much the ecological health and more long-term monitoring strategies are required for evaluating the urban stream health. This study was supported by the research funds from Chungnam National University in 2011 - 2012.

Keywords: stream restoration, urban stream, ecological health, fish

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Genetic Structures of the Isonychiid Mayfly *Isonychia japonica* (Ephemeroptera, Isonychiidae)

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The isonychiid mayfly *Isonychia japonica* is distributed throughout the Japanese Archipelago, the Korean peninsula and the Russian Far East. Especially in Japan, they distribute wide areas; inhabiting almost all areas of Hokkaido, Honshu, Shikoku and the Kyushu Islands, and furthermore they also inhabit wide ranges of both the upstream and downstream areas. That is, this is a typically “generalist species”. Previous studies using genetic analysis of aquatic insects have tended to most often focus on specialist species and upon genetic differentiation at the population level. As a result, groups of species targeted tend to be those living in solely either the mountainous headwaters or upstream areas. However, understanding the geographic scale of gene flow and structure of the metapopulation of generalist species is also very important. Therefore, in this study, genetic analysis (mt DNA COI, 16S rRNA regions) was performed using samples of this typical generalist species from wide areas across Japan. As this result, it was revealed that this species is composed of two major significantly genetically differentiated clades, and that fairly large scaled gene flow could be observed within a single basin, between river basins and at even greater distances, between islands.

Keywords: geographic distribution, population structure, genetic structure, DNA, diversity

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Gut-Living Fungi of Aquatic Insects in Japan: Harpellales (Zygomycota) Collected in 2011-2012

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Many river assessments to investigate biodiversity have been conducted by using aquatic insect fauna in Japan. Generally, insects have parasitic organisms inside their bodies. Even though the same insect species are collected at different localities, different parasites can be detected in their bodies. This fact may suggest that the places are in different environmental condition for the parasites. The final goal of this study is to use parasitic organisms as indicators of biodiversity or environment.

Harpellales is a fungal order living in the gut of aquatic Arthropoda: *i.e.* juveniles of Ephemeroptera, Plecoptera, Trichoptera, Diptera and Isopoda. Ingested spores germinate in the gut, and are attached to the gut lining by an anchor structure called holdfast. Harpellales shows position specificity for attachment to midgut or hindgut.

A floristic study of Japanese Harpellales was conducted in 1960's, and only one species has been added thereafter. In total, thirteen species have been recorded. Moreover, in Japan, only dipteran insects have been investigated as the hosts. We conducted preliminary collecting of Harpellales to examine the diversity after an about 50-year interval, focusing not only on Diptera but also on Ephemeroptera and Plecoptera, in streams in Tsukuba, Kenkatsura, Odawara, Kawasaki and Kakuma. Collected insects were dissected with sharp forceps to derive midgut or hindgut under a stereo microscope. The specimens were observed by a light microscope.

During 2011-2012, we distinguished ten taxa of Harpellales, including the previously recorded four spp. (scientific name with [#]). The only parasitic species found in the midgut was *H. melusinae*[#] (Harpellaceae), and all other species (Legeriomycetaceae) were detected in the hindguts of various insects. Detected species are as follows; in Tsukuba, a *Zygoporalis*-like fungus (*Baetis thermicus* and *Baetiella japonica*), *Lancisporomyces* sp. (*Amphinemura* sp.), *Smittium simulii*[#] (*Simulium japonicum*), *Bojamyces repens* (*Paraleptophlebia* sp.), and *H. melusinae* (*Sim. japonicum*); in Kenkatsura, *Genistelloides* (Capniidae), and an unidentified species of the family Legeriomycetaceae (Capniidae); in Odawara, *Pennella angustispora*[#] and *H. melusinae* (*Sim. japonicum*); in Kakuma, *Capniomyces* sp. (*Obipterix* sp.); in Kawasaki, *Smittium culisetae*[#] (*Aedes albopictus*). While the larvae of *Simulium japonicum* collected from Tsukuba showed double infection with *H. melusinae* (midgut) and *S. simulii* (hindgut), those collected from Odawara were infected simultaneously by *H. melusinae* and *P. angustispora* (hindgut). This suggests a difference in habitat requirement for the hindgut fungi. This preliminary study also suggests a possibility of using Harpellales as an indicator for assessing the biodiversity or environmental factor of certain places.

Keywords: biodiversity, Harpellaceae, Legeriomycetaceae, Trichomycetes

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Spatial Distributions of Fish Guilds and Mercury Contents in Various Fish Tissues

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Fish guilds were examined in urban streams and total mercury contents of fish tissues using Direct Mercury Analyzer (DMA-80, US EPA Method 7473) were determined. The dominant species was *Zacco platypus* (61.3% of the total) and mercury concentrations were ranged from 55.0 to 137.8 $\mu\text{g kg}^{-1}$ depending on the type of the tissues such as liver, kidney, gill, vertebrae and muscles. The level of total mercury was shown the highest in muscle but lowest in gill. Also, it showed the Gap stream showed the highest average (104.4 $\mu\text{g kg}^{-1}$) but the least in the Daejeon stream (71.6 $\mu\text{g kg}^{-1}$). According to guilds Analysis, relative abundance of tolerant species and omnivores was shown as the highest in Daejeon Stream (93.3%, 93.5%), and then, Yudeung (67.5%, 69.9%) and Gap Stream (59.7%, 66.2%), respectively. Chemical water quality related to organic matters (BOD, COD) and nutrients (TN, TP) were resulted as similar as guild analysis. Biological health based on Index of Biological Integrity (IBI) was averaged 17.3 (Fair) in Gap-Stream, 20.6 (Fair) in Yudeung Stream and 19.0 (Fair) in Daejeon-Stream, respectively. Consequently, stream health was deteriorated toward downstream based on our biological and chemical approaches, reflecting characteristics of typical urban stream. These urban streams in Daejeon city have been under restoration construction so that stream restoration should be conducted through habitat and living biota restoration as well as chemical water quality. In addition, continuous monitoring should be required to confirm successful restoration and also configure how to maintain the ecological health well.

Keywords: total mercury, fish guild, urban stream, restoration

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Homogenization of Macroinvertebrate Community Structures Caused by Agricultural Land Use

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Global expanding of agricultural land use associated with population increase has altered riverine habitat structures and caused loss of biodiversity in river ecosystems. Most studies which assessed the impact of agricultural land use on macroinvertebrate assemblages focused on α species richness and α diversity (e.g. Shannon's H' and Simpson's D). However, in recent years, species turnover (β_1) has been considered to be more important indicator of ecosystems health. In addition, a novel method to evaluate heterogeneity of community structures using dissimilarity indexes has been developed (β_2). In this study, we first clarified which physical variables were affected by agricultural land use. Second, we clarified which physical variables affected α , β_1 species richness and heterogeneity of community structures (β_2).

27 stream reaches were selected from one watershed consisted by forests and pastures in Northern Japan. We measured 8 physical variables at 12 sampling point within each reach and calculated coefficient of variation (C.V.) of velocity, depth, substrate size score and channel width as habitat heterogeneity indexes. 13 physical variables were analyzed using principal component analysis (PCA) and 3 axes of PCA were selected. Higher PC1 axis showed high habitat heterogeneity and water quality, while PC2 axis was positively associated with water velocity and PC3 axis was negatively correlated with water depth and width.

As a result, the percentage of agricultural land within each drainage area showed negative correlation only with PC1 axis. The slope of river bed showed positive correlation only with PC2 and PC3 axes. Next, β_1 and β_2 strongly correlated with PC1, while α species richness strongly correlated with above PC1 and PC2. These results indicated that agricultural land use homogenized macroinvertebrate assemblages by decrease of habitat heterogeneity and degradation of water quality.

Keywords: agricultural land use, β diversity, habitat heterogeneity, heterogeneity of community structures

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Phylogeography of Two Japanese Giant Water Bugs, *Appasus japonicus* and *Appasus major* (Heteroptera: Belostomatidae)

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Distributed in part of East Asia, are two belostomatid species of giant water bugs of the genus *Appasus*, i.e., *Appasus japonicus* and *A. major*. These two giant water bugs are morphologically very similar, and their habitats often overlap. In consideration of this, it has been suggested that their morphological similarity and distributional overlapping may be the result of interspecific hybridization (Hoshikawa, 2001). However, in our present study utilising molecular phylogenetic analyses of the mitochondrial and nuclear DNA, it has been revealed that these two species exhibit large genetical difference, and the possibility of interspecific hybridization is extremely low. In this study, in order to compare the phylogenetic relationships between these two species of *Appasus*, we collected 143 specimens of *A. japonicus* from 67 populations and 96 specimens of *A. major* from 50 populations in Japanese Archipelago (from Hokkaido to Kyushu) and on the Korean Peninsula, and then we conducted molecular analyses of COI (658 bp) and 16S rRNA (435 bp). As the result *A. japonicus*, specimens from Korean populations are observed to constitute a single monophyletic clade, and were evaluated as a sister group of *A. japonicus* Kyushu and Western areas of Honshu. It is revealed that the other Eastern Japanese clade is clearly differentiated from the clade consisting specimens: ((Western Honshu + Kyushu) + Korea). That is, Japanese *A. japonicus* is considered to be paraphyletically related to the Korean *A. japonicus*.

The results relating to the *A. major*, specimens from Japanese and Korean populations indicate that they consist of two distinct monophyletic clades. *A. major* is differentiated from three major demarcations of these three lineages is observed to be according to the east and west of Median Tectonic Line, and also the natural barrier of the Tohoku-Ou mountains range.

Despite these two species being morphologically very similar, significant differentiation between their genetic structures is clearly observed. In addition, when applying the most widely assumed substitution rate of the mitochondrial gene region (i.e., 2.3% per million years), it is estimated that these two species had already become differentiated about 16.4 MYA. Therefore, it is considered that the separation between *A. japonicus* and *A. major* occurred in the era before the Japanese archipelago was still connected with the edge of the Eurasian continent. And, the differentiation of clades in each species is related to the geological events such as the formation of the Japanese archipelago and its mountains formation. The differences in the phylogeographic patterns between species may suggest that there is a difference in their respective dispersal abilities.

Keywords: biogeography, geological history, nuclear and mitochondrial DNA, Korean Peninsula, Japanese Archipelago

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Genetic structures of dipteromimid mayflies endemic to Japan (Ephemeroptera, Dipteromimidae)

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The family Dipteromimidae, endemic to Japan, consists of one genus and two species (Tojo and Matsukawa, 2003). They specifically inhabit the headwater areas, especially splash zones, and have very limited dispersal ability. Thus, their populations are distributed sporadically. So as would be expected they exhibit a high degree of genetic differentiation between their respective populations. In fact, under mtDNA 16S rRNA analysis such a trend was recognized (Tojo, 2005). Furthermore, Tojo and Matsukawa (2003) have described the new species; *Dipteromimus flavipterus*, in terms of the results of morphological and genetic analysis (16S rRNA). In the present study, we analyzed the mtDNA COI, and nuclear DNA Histone 3 regions of these dipteromimid mayflies. As a result, the validity of *D. flavipterus* as being a distinct species is also supported by the nuclear DNA analysis. The COI region, it is not suitable for phylogenetic analysis at the special level, as their substitutions are fully saturated. However, the data of this region is strictly limited to being effective for genetic differentiation at an intra-special level. Especially for Shikoku Island, significant genetic differentiation was observed at the inter population level, such as closely reflecting the geological history.

Keywords: biogeography, geographic distribution, genetic structure, DNA, genetic diversity and fixation

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Products of Benefit Bacteria for Sustainable Rice Production and Safety for Aquatic insect (Notonectidae)

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Most Thai farmers use synthetic fungicides and insecticides to control the diseases and insects of rice. Excessive application of synthetic pesticides leads to the human health and environmental effect. The plant growth promoting rhizobacteria-PGPRs (*Pseudomonas fluorescens* SP007s and entomopathogenic bacteria (*Bacillus thuringiensis* KU52) reported to control several diseases and insects on multiple crops can be use as alternative strategy for resolve these problem. The innovation-combined products between SP007s, KU52, and manures have been developed for rice production at Thongcock, Suphanburi Province, Thailand. These products increased disease incidence reduction, plant growth promotion, and marketable yield compared with conventional routine practice of chemicals. The finally, product did not inhibit naturally enemy and effect with aquatic insect (Hemiptera ; Notonectidae and Odonata ; immature stage) in the rice field.

Keywords: Notonectidae, Beneficial bacteria, Rice production, Thailand

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Assessing the Ecosystem Health Condition of Large River Based on Leaf Breakdown Rates: A Case Study in Dongjiang River, China

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The assessment methods of river ecosystem health and the principles of benthic macroinvertebrate ecology have been developed primarily from the study of easily accessible streams. However, the problems associated with sampling the river health evaluations in deep and large rivers have limited by the information based on macroinvertebrate or algae assembles. Leaf breakdown is an integrative process since it links riparian vegetation, microbial and invertebrate activities as well as physical and chemical features of the river, therefore, leaf decomposition could be used as a measurement to assess river ecosystem health.

To evaluate the ecosystem health of the Dongjiang River, one of largest river in South China, we used a tentative framework proposed by Gessner & Chauvet (2002) for assessing functional river integrity of Dongjiang River from leaf-litter processing rates at three sites (Sujiawei: upper reach site; Huizhou: middle reach site and Xiancun: down reach site). This study started in October 2010 and ran over three months. Leaves of *Phyllostachys heterocycla*, *Syzygium jambos*, *Nerium oleander* and *Lantana camara* were collected just before abscission, stored air dried, weighed into 10 g-groups and placed in fine-mesh (0.1 mm mesh) and coarse-mesh (5 mm mesh) bags (30 x 20 cm). A total of 15 bags of each mesh size were sealed and distributed at the sampling sites. Triplicate fine-mesh and coarse-mesh bags were retrieved from each sampling site at day 7, 21, 42, 70 and 105. The leaves were rinsed individually with water from the corresponding stream to remove fine particulate matter and invertebrates and were air-dried to constant mass and ashed for 4 h at 550°C to relate air dry mass to ash-free dry mass (AFDM). Leaf breakdown rates (k) were estimated by fitting the AFDM data to the exponential model, $Y_t = Y_0 e^{-kt}$, where Y_t is the AFDM remaining at time t in days, and Y_0 the AFDM at the beginning of the experiment. The results showed the ratio (k_c : k_f) of breakdown coefficients in coarse (k_c) and fine (k_f) mesh bags of four leaf species at Sujiawei site is 1.2~1.5 (Score=2), which indicate that there is no evidence of an impact on ecosystem function at upper reach of Dongjiang River. The ratio (k_c : k_f) is 1.0~1.1 (Score=1) both at Huizhou site and Xiancun site, which means there are mild effect on ecosystem function at mid and down reaches of Dongjiang River.

Keywords: leaf breakdown, functional integrity, river health, Dongjiang River

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Life cycle and biology of an aquatic firefly species, *Luciola aquatilis* Thancharoen (Coleoptera: Lampyridae) and application for firefly conservation in Thailand

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The life cycle, biology and rearing technique of *Luciola aquatilis* Thancharoen, a common Thai aquatic firefly species was investigated in order to provide basic knowledge for firefly conservation as well as for providing fireflies for laboratory studies. The fireflies were successfully reared in laboratory at 13L: 11D at 24°C to 29°C on golden apple snails *Pomacea canaliculata*. Developmental time took about 3-5 months under laboratory conditions. Females were found to oviposit about 400-600 eggs under leaves of the aquatic plant, *Spirodella* sp. After hatching, the 6 stages of aquatic larvae allow fed on golden apple snails, *Pomacea canaliculata*. When the larvae became mature, they climbed out of the water to pupate underground in earthen cells, and then emerged to adults. Size differences between males and females of mature larvae, pupae and adults indicated that sex determination occurs since the larval stages. The females often have larger size in larval stages, while the smaller one has high probability to be the male. In addition, an application for conservation of *L. aquatilis* was discussed.

Keywords: *Luciola aquatilis*, life cycle, laboratory culture, firefly, conservation

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Banquet @ Restaurant "SAY"

in the "Matsumoto Shimin-Geijutsu-Kan
(Matsumoto Performing Arts Center)"

* Please move to the venue of the banquet before 19:00.

Approximately 5-10 minutes walk from the venue of the BSA symposium.



Field Excursion

**Field Excursion to the Kiso and Azumino Areas
on June 13th, 2012**

1st Site:

Mizuki-zawa streams (Kiso Village)

2nd Site:

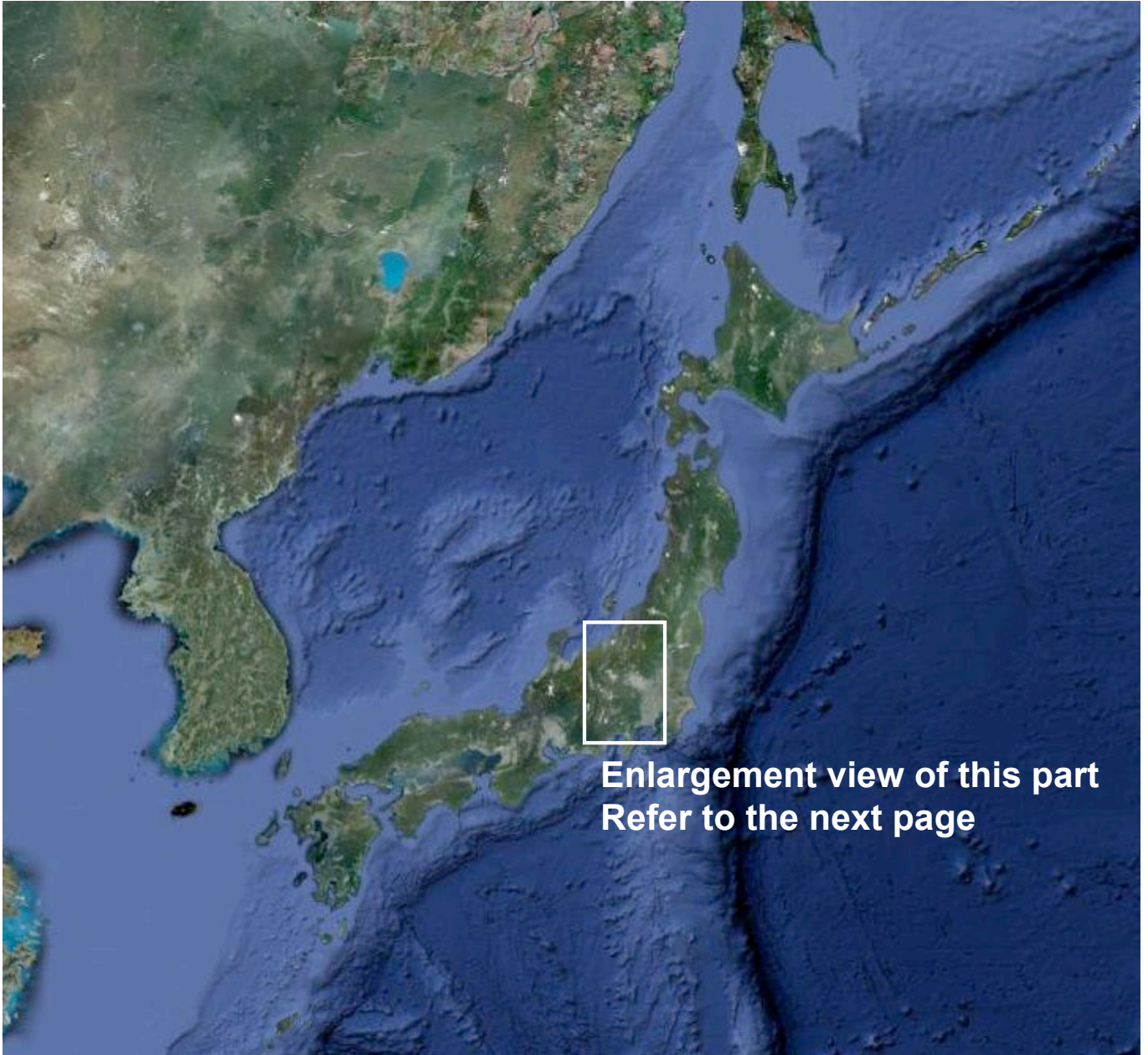
Narai-juku / Narai-gawa River (Shiojiri City)

3rd Site:

**Daio Wasabi (Japanese Horseradish) Farm /
Yorozui-gawa and Tade-gawa Streams
(Azumino City)**

Field Excursion and Light Trap Sites

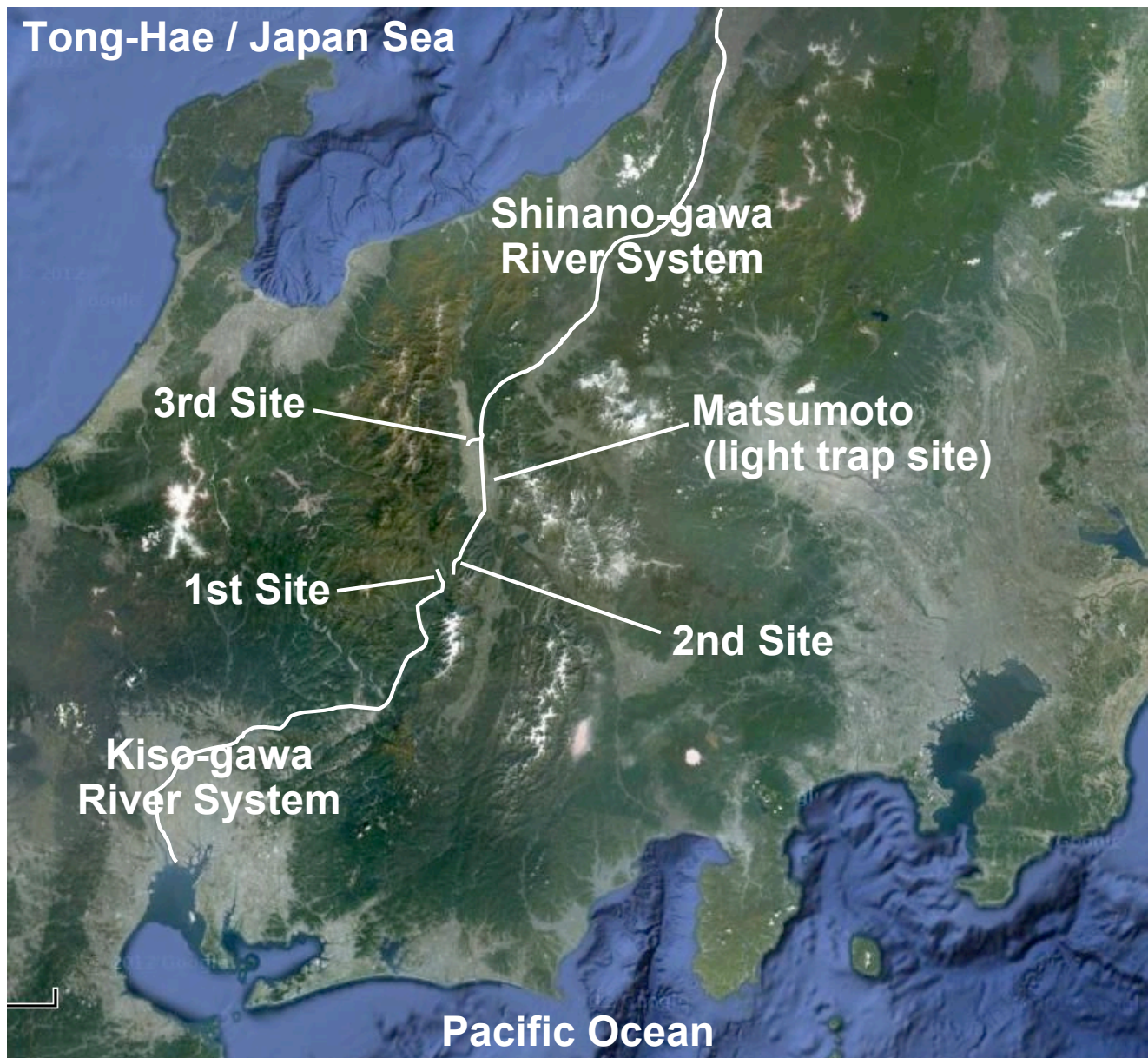
Field Excursion to the Kiso and Azumino Areas
on June 13th, 2012



Enlargement view of this part
Refer to the next page

Field Excursion to the Kiso and Azumino Areas on June 13th

- 1st Site: Mizuki-zawa streams (Kiso Village)
- 2nd Site: Narai-juku / The Narai-gawa River (Shiojiri City)
- 3rd Site: Daio Wasabi (Japanese Horseradish) Farm / The Yoro-zui-gawa and Tade-gawa Streams (Azumino City)



1st Site:

Mizuki-zawa streams (Kiso Village)

Parking site: N35°59' 48.6" E137°43' 55.3" 1,300m altitude



“Mizuki-zawa streams in the Tennen-rin (Mizuki-zawa Natural Forest)”

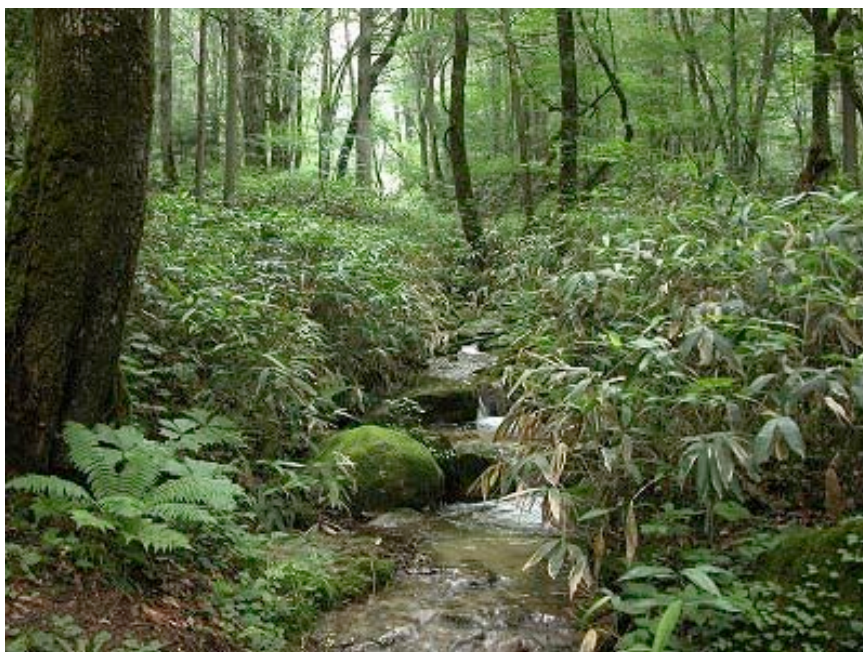
Kiso Village's “Mizuki-zawa Tennen-rin (Natural Forest)” having 98% of its trees over 200-years old is at the headwater of the Kiso River, it flows through the village, and along with other tributaries eventually into the Pacific Ocean.

This site is the habitat of several Japan's endemic insects species and salmonid fish (char): e.g., Plecopteran *Scopura montana* (endemic to Central Honshu Island, Japan), *Yoraperla uennoi* (endemic to Japan), *Cryptoperla japonica* (endemic to Japan), Ephemeropteran *Epeorus cumulus* (endemic species to Honshu Island, Japan), Ephemeropteran *Bleptus fasciatus* (endemic genus to East Asia), and *Salvelinus leucomaenis japonicus*.

<http://www.vill.kiso.nagano.jp/en/index.html>

<http://www.panoramio.com/photo/25511547>

<http://www.panoramio.com/photo/14451434>



2nd Site:

Narai-juku / The Narai-gawa River (Shiojiri City)

Parking site: N35°57' 57.8" E137°48' 50.3" 950m altitude



Narai-jyuku is located at the foot of the Torii Mountain Pass. It once flourished as a post town, and was referred to as “Narai of a Thousand buildings”. The village is designated as a Protected Area for the Preservation of Traditional Buildings by the government. A stream “Narai-gawa” flowing just beside “Narai-juku”, a tourist destination. This stream is inhabited by benthos of various species. This site is far from the Sea of Japan (about 360km).

The Narai-gawa River flows through the Narai-juku, and this Narai area is the good habitat and has maintained a high species diversity of aquatic insects. Several salmonid fishes (e.g., a char *Salvelinus leucomaenis leucomaenis*, a seama, *Oncorhynchus masou*) and an ayu fish, *Plecoglossus altivelis altivelis* also inhabiting.

http://www.tripadvisor.co.uk/Attraction_Review-g1021320-d1946094-Reviews-Naraijuku-Shiojiri_Nagano_Prefecture_Chubu.html

<http://www.panoramio.com/photo/859812>

http://flickrhivemind.net/flickr_hvmnd.cgi?method=GET&sorting=Interestingness&page=1&photo_type=250&search_domain=Tags&photo_number=50&tag_mode=all&sort=Interestingness&textinput=naraijuku&search_type=Tags



Narai-juku



Narai-juku was one of the post towns on the Nakasendo highway ruled by the Edo Shogunate. It was situated midway between Kyoto and Edo (now called Tokyo). As the buildings have been kept very much the same since the Edo period, it was designated as a Cultural Asset in 1978 and is maintained by the government grant system.

The conservation area is about 200m wide and 1 km long north to south, which consists of Kanmachi (uptown), Nakamachi (midtown) and Shimomachi (downtown). You can see that the buildings in Narai-juku have overhanging second floors and eaves. It is said that the structure was made to liven up the town and now makes it unique among the post towns. The once wooden rooftops have been replaced with more weather resistant steel sheets.

In the Edo period, Narai-juku flourished by providing travelers accommodation and transport facilities. It was once called "Narai of a Thousand Houses." At the time, resting in Narai-juku was especially refreshing for travelers crossing the highest pass on the Nakasendo highway "Torii Pass", which is to the south of Narai.

Narai-juku Attractions



Two Hundred Jizos (#1 on map)

Some two hundred stone Buddhist images stand in an orderly line. Deceased travelers with no one to tend their graves were brought together in this place. Their peaceful and rich expressions, washed by the wind and snow of many years, calm our minds.



Virgin Mary Jizo (#2 on map)

A statue of a headless Virgin Mary taking care of a child is enshrined in the graveyard of Taiho-ji. However, it has borrowed the name and figure of Jizo. The sad histories of hidden Christians are deeply etched in the image.



Water Fountains (※ on map)

These were water sources for travelers passing through Narai-juku. They were also important water supplies for Narai villagers. Though only six are left, these water fountains are still in common use nowadays.



The Nakamura House (#3 on map)

This was the residence of a wealthy comb wholesaler, Rihei Nakamura, back in the Tempō period (1830-1844). It would still be recognizable to travelers back then because of how well it has been preserved. The house and garden are open to the public.



Shizume Jinja (#4 on map)

The god of this shrine was invited to relieve a plague that spread throughout Narai-juku; shizume in English means to relieve. Since it is located at the entrance of Torii Pass, travelers often pray for safe journeys there. An annual festival is held on August 11th and 12th of each year.



Kiso Ohashi (#5 on map)

A large bridge in the shape of a Japanese drum crosses Narai River. It is considered to be one of a few large bridges without bridge support in Japan. Kiso Ohashi was built entirely with hinoki cypress that was more than 300 years old. Evening light-up from April to early November.



Kiso-Hirasawa

Japanese Lacquerware is called "Shikki." (It is also called "Japan" in reflection of its uniqueness.) Shikki was introduced to Kiso Hirasawa around 600 years ago. By the mid-Edo period, Hirasawa has become widely known as an excellent environment for Shikki production.

Winning Medals of the Nagano Winter Olympics in 1998

These were finished with the painstaking skills of Kiso's artisans. They are now in a standing exhibition at the Shiojiri-kiso District Original Industry Promotion Center.



3rd Site:

Daio Wasabi (Japanese Horseradish) Farm / The Yorozui-gawa and Tade-gawa Streams (Azumino City)

Parking site: N36°20' 18.5" E137°54' 28.4" 520m altitude



Daio Wasabi Farm (Daio Wasabi Nojo) is wasabi (Japanese horseradish) farm established in 1915 and located Hotaka, Azumino City. Daio is the Japan's largest wasabi farm - covering 15 hectares.

It is popular tourist spot due to its beautiful watermills and for the river that runs through it. Restaurants offer wasabi-flavoured ice cream and other wasabi-themed products. Outside of Japan, the site is best known for its appearance in the 1990 film *Dreams* by world famous director Akira Kurosawa in the segment called "Village of the Watermills".

The Yorozui-gawa and Tade-gawa are spring water origin streams, flow beside the parking site of the Daio wasabi farm. These are waterweeds rich streams, and two species of amphipods, some species of mayflies and caddisflies (e.g., *Stenopsyche marmorata*, *Phryganopsyche latipennis*), and several salmonid fishes and an endangered loach *Lefua echigonia* also inhabiting. And these streams are also one of the famous breeding sites of the endangered petromyzontid *Lethenteron reisseneri*. Beside rice paddies around the parking, a giant water bug *Appasus japonicus* also inhabiting.



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Banquet Venue on June 12 (Evening):

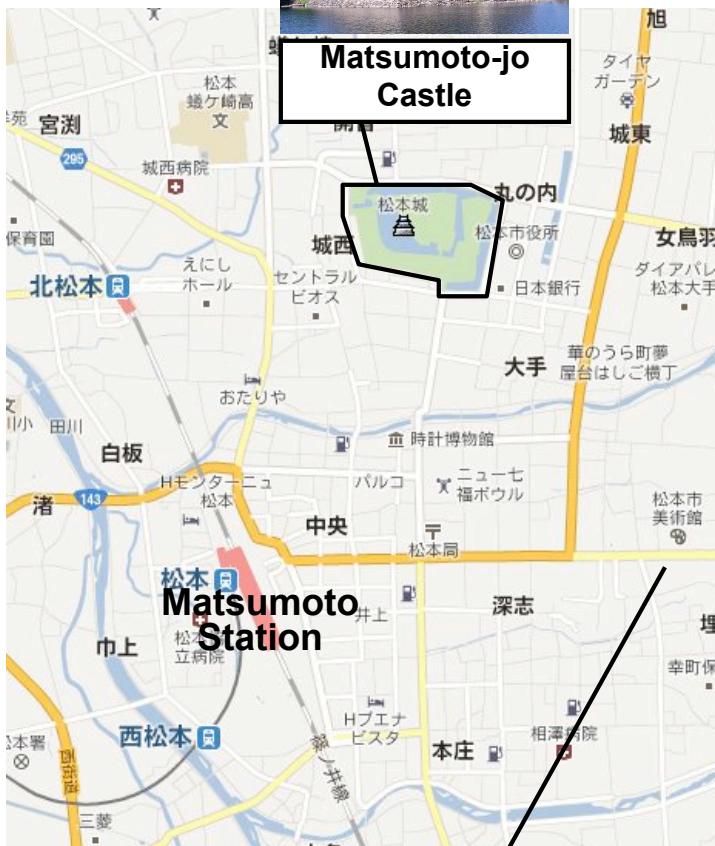
Light trap Site on June 11 (Evening):

The Susuki-gawa River (Matsumoto City)

N36°13′ 41.6″ E137°59′ 12.9″ 600m altitude



**Matsumoto-jō
Castle**



**Agatanomori-Bunka-kaikan
(Agatanomori Cultural Center)**

**Matsumoto
Station**

**Banquet Venue:
Matsumoto Shimin Geijutsu-Kan
(Matsumoto Performing Arts Center)**



Light trap Site

Smile Hotel





**Benthological
Society of
Asia**

