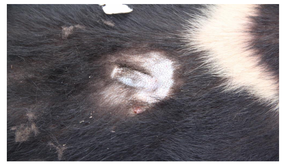
How does Japanese black bear get over summer period when food resources are limited? –Progress Report-

Koji Yamazaki[1], Monica K.H. Bando[2], Alina Evans[3], Toshio Tsubota[4], and Shinsuke Koike[5]

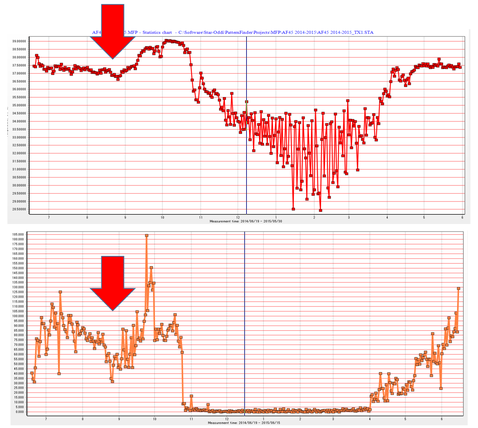
[1]Laboratory of Forest Ecology, Department of Forest Science, Faculty of Regional Environmental Science, Tokyo University of Agriculture, Japan
[2]Department of Veterinary Clinical Sciences, College of Veterinary Medicine, Washington State University, USA
[3] Faculty of Applied Ecology and Agricultural Sciences, Hedmark University, Norway
[4]Laboratory of Wildlife Biology and Medicine, Graduate School of Veterinary Medicine, Hokkaido University, Japan
[5]Tokyo University of Agriculture and Technology, Japan

- Japanese black bears, *Ursus thibetanus japonicus*, rapidly accumulate fat in autumn feeding on acorns which is well known as their hyperphagic period. However, their ecology and physiology from early spring (i.e., just after hibernation) to late summer is not well documented. There were just snap shots that the bear activity level increased gradually from early spring to mid-summer but then sharply declined in late summer (middle to end of August) for most bears (Kozakai et al. 2013) and bears stayed at the same location for several days without moving in summer (Yamazaki et al. 2012), and fat reserves in the bone marrow declined in summer (Hazumi et al. unpublished data).

- We therefore hypothesized that the bears get through the limited food resources of summer by utilizing stored energy reserves (e.g. reduced metabolic rate) similar to a hibernation status



Implanting (left) and retrieving (right) of HRT.

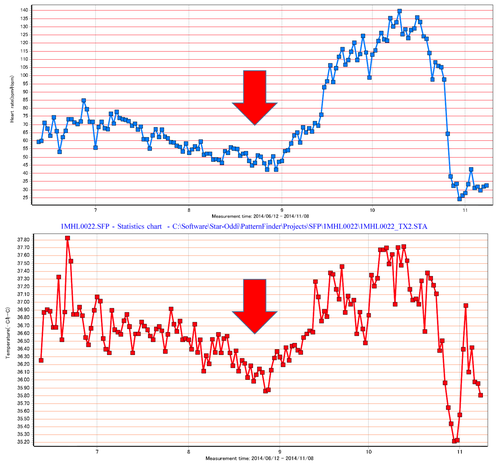


24 hr. average of deep body temperature and activity Level by MIT and 2 axis activity sensor (5 min. interval).
Adult female (AF45) during 2014 to 2015

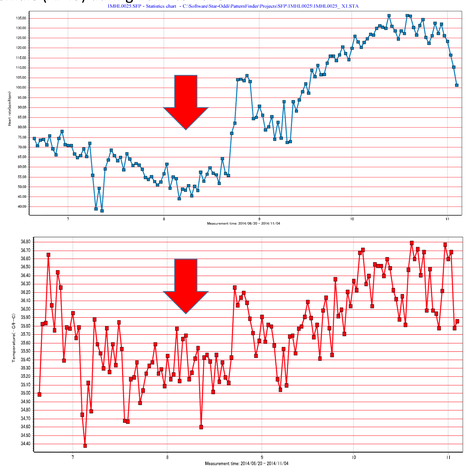
A list of bears which were deployed the loggers during 2014 – 2015.

Year	Sex	Age	ID	Body weight (kg)	Status of the loggers: HRT	MIT	Activity sensor
2014	Female	5	AF45	41	Applied (data retrieved in 2015)	Applied (data retrieved in 2015)	Applied (data retrieved in 2015)
	Male	6	AM69	81	Applied (HRT disappeared in 2015)	Applied (data retrieved in 2015)	Applied (data retrieved in 2015)
	Male	4	AM68	63	Applied (HRT disappeared in 2015)	Applied (data retrieved in 2015)	Applied (sensor did not worked)
	Female	4	AF55	44	Applied (data retrieved in 2015)	Not applied	Not applied
	Female	7	AF19	42	Applied (HRT disappeared in 2015)	Not applied	Not applied
	Male	3	AM70	42	Applied	Not applied	Not applied
	Male	2	AM65	29	Applied	Not applied	Not applied
	Female	5	AF35	51	Applied	Not applied	Not applied
2015	Female	5	AF55	44	Applied	Applied	Applied
	Female	9	AF18	56	Applied	Applied	Applied
	Female	8	AF19	44	Applied	Applied	Applied
	Female	7	AF45	35	Applied (HRT disappeared in 2016)	Applied (battery finished in May 2015)	Not applied

MIT (above) and GPS Plus collar (below).



24 hr. average of heart rate and subcutaneous body temperature by HRT (5 min. interval).
Adult female (AF45) in 2014 until her hibernation



24 hr. average of heart rate and subcutaneous body temperature by HRT (5 min. interval).
Adult female (AF55) in 2014 until her hibernation

- We deployed a combination of heart rate and body temperature logger (i.e., in subcutaneous) (DST milli-HRT, Star-Oddi LTD., Iceland), two-axis activity sensor (GPS Plus collar, Vectronic Aerospace GmbH, Germany) and body temperature logger (i.e., in adornment) (MIT, Vectronic Aerospace GmbH, Germany) on free ranging bears in Ashio-Nikko Mts. during 2014-2015. The MIT data is stored into an internal memory of the GPS Plus collar via UHF communication. We also carried out a supplemental study at a bear zoo, Ani Bear Park, for captive bears in same period.

- We deployed a total of 12 HRTs on bears, and also deployed both MIT and activity sensor on 7 of 12 bears in Ashio-Nikko Mts. We also deployed HRT, MIT and activity sensor on three captive bears at the bear zoo.

- So far, we succeeded to re-capture 6 of 12 bears in the Mts., but only 2 HRTs have found in their bodies. We suppose the 4 bears might remove the HRT just after the surgical operation using their paws. During our main capturing season (i.e., Spring to early Summer), most of bears are very skinny due to limitation of their food resources, and therefore the bears might worry about existence of unwanted object under their skins. We also retrieved 4 GPS Plus collars which have stored the MIT and activity sensor data, but one activity sensor had mechanical trouble. For the supplemental study, we had to remove all of the GPS Plus collar due to rapid fatness of the bears, therefore only HRT data have available.

- Because we have not yet got good enough data set for detailed analysis, we here just show a part of the results in this time.

- In the results, all the logger values declined during late summer, especially in August, for those solitary adults. This phenomenon was not observed for captive bears outfitted with the same set of data loggers (Tsubota et al. unpublished data). This could be because of the trade-off between searching for food and energy intake. Assuming the hypothesis was correct, the bears utilize fat that was reserved from the previous autumn until the following autumn. In future, we need to obtain more data sets for different social status of bears such as nursing females and growing subadults.

- We acknowledge Dr. Jon M. Arnemo, Hedmark University, for his technical cooperation.

- **Reference**

Kozakai K, Yamazaki K, Nemoto Y, Nakajima A, Umemura Y, Koike S, Goto Y, Kasai S, Abe S, Masaki T, Kaji K (2013) Fluctuation of daily activity time budgets of Japanese black bears: relationship to sex, reproductive status, and hardmast availability. Journal of Mammalogy 94(2): 351-360.
Yamazaki K, Kozakai C. Koike S, Morimoto H, Goto Y, Furubayashi K (2012) Myrmecophagy of Japanese black bear in the grasslands of the Ashio area, Nikko National Park, Japan. Ursus 23(1): 52-64.