

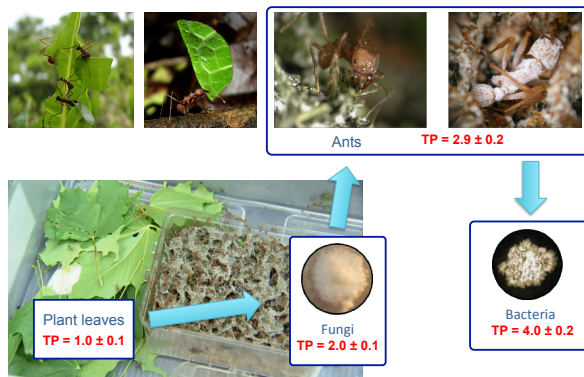
Advances in compound-specific stable isotope analysis of amino acids

Yoshito Chikaraishi and Yuko Takizawa

Applications to invisible food webs

(1-1) Ant's fungus garden

We revealed that this symbiosis is a discrete four level food chain, wherein bacteria function as the apex carnivores, animals and fungi are meso-consumers, and the sole herbivores are fungi.



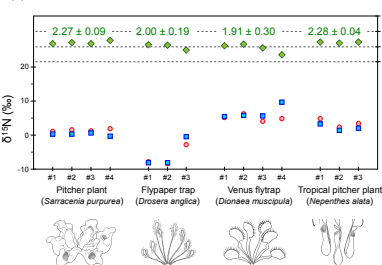
Steffan et al., 2015, PNAS

(1-2) Insectivores

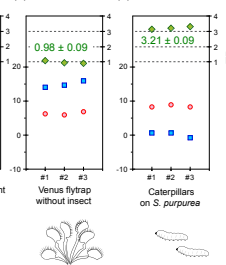
We revealed that Insectivores are really carnivores. Like animals, they assimilate and digest diets (i.e., insect-derived amino acids) that is frequently accounts to >50% of proteins in the plant biomass.



(1) Four wild insectivores

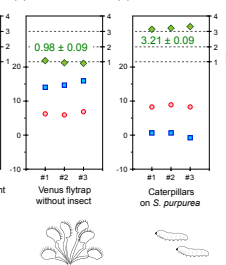


(2) Without insect



Unpublished data

(3) Their consumers

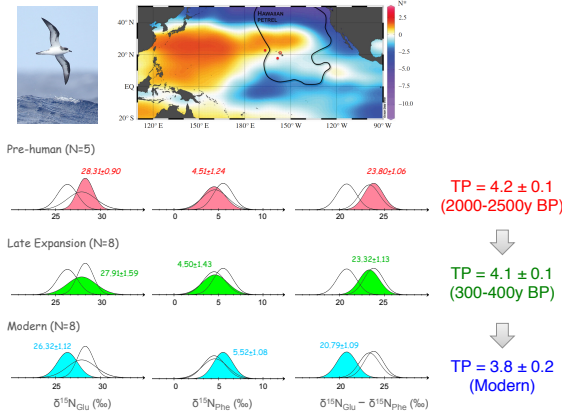


Unpublished data

Trophic adequacy & habitability

(2-1) Trophic shift in Hawaiian petrel

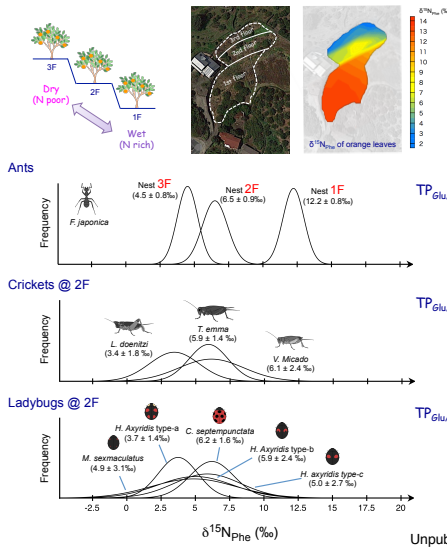
We revealed millennial-scale trophic shift of AAs in bone collagen in a wide-ranging oceanic seabird, the Hawaiian petrel (*Pterodroma sandwichensis*), a phenomenon potentially related to the conflict within industrial fishing.



Ostrom et al., 2017, Proceedings of the Royal Society B

(2-2) Isoscape in a terraced field

We can illustrate spatial (and temporal) gradient in $\delta^{15}\text{N}_{\text{Phe}}$ of environments, which is useful for identifying the habitat preference among organisms.

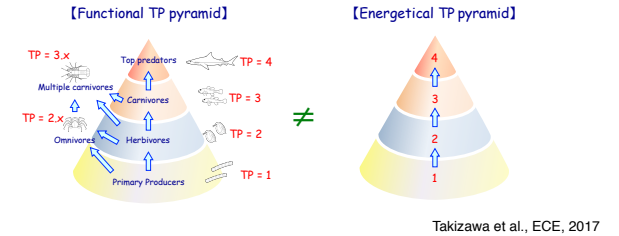


Unpublished data

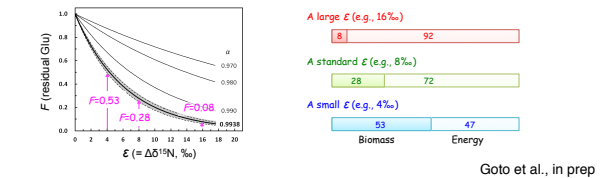
Perspectives on the isotope analysis

(3-1) Energetic vs. functional position in food webs

Isotopic discrimination in N mirrors "How much metabolic energy is produced" in organisms, implying that δ -values tell us "energetic" hierarchy among organisms in food web, but "energetic" does not always equal to "functional".



[Rayleigh model for the enzymatic deamination of Glu]

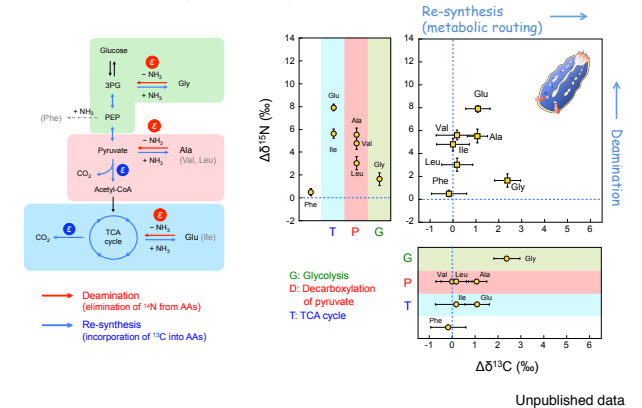


Goto et al., in prep

(3-2) Metabolic flux via CSIA N & C

Deamination preferentially eliminates ^{14}N as ammonia, leaving behind the enriched ^{15}N in the residual pool of amino acids. Decarboxylation preferentially eliminates ^{12}C as CO_2 , leaving behind the enriched ^{13}C on intermediates (e.g., pyruvic acid and α -ketoglutaric acid), which can be propagated into amino acids via re-biosynthesis (or metabolic routing).

[Δδ¹⁵N-Δδ¹³C of Sea slug feeds on Sponge]



Unpublished data