

## Supporting Information

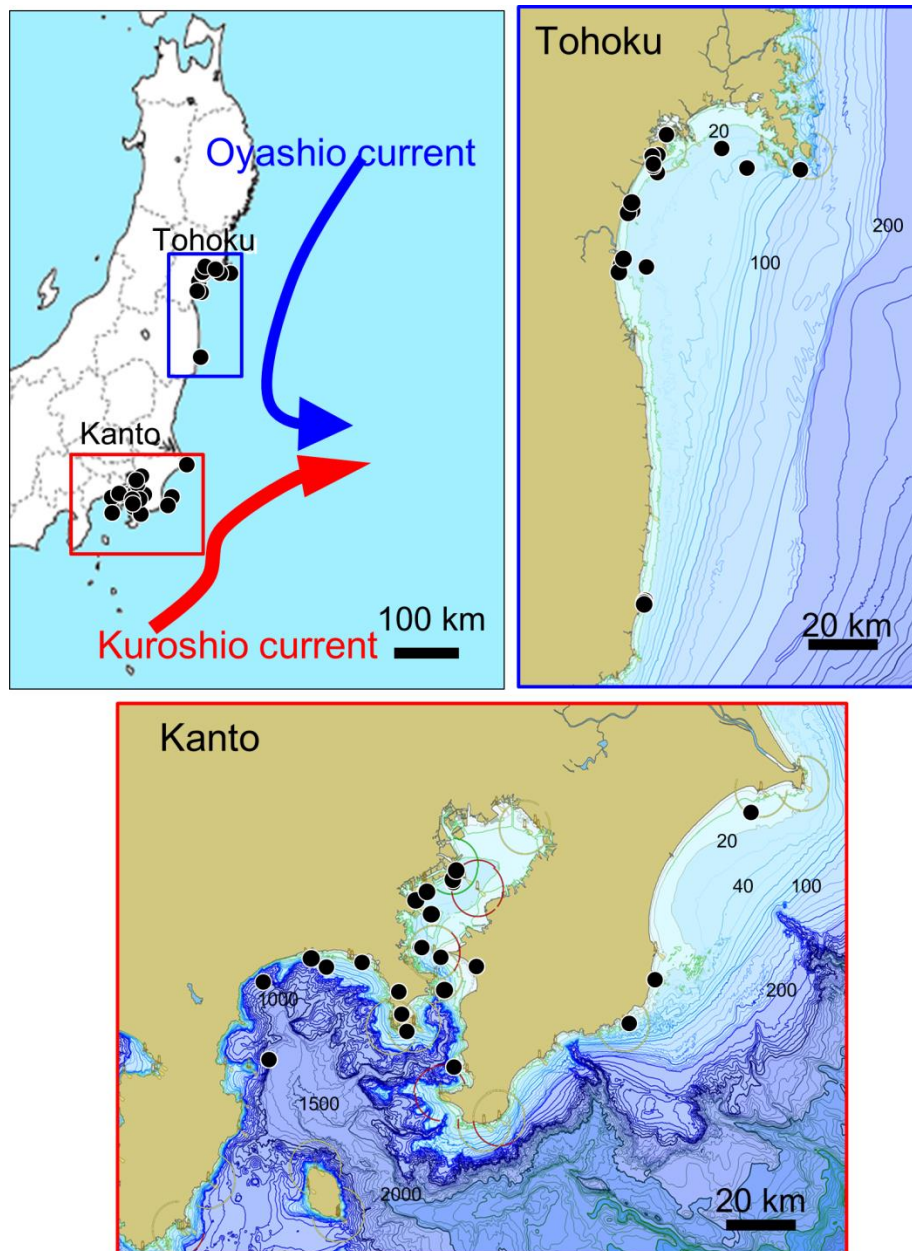
### **Chemoecological network analysis of regional fish habitats using variations in chemical and microbial signatures**

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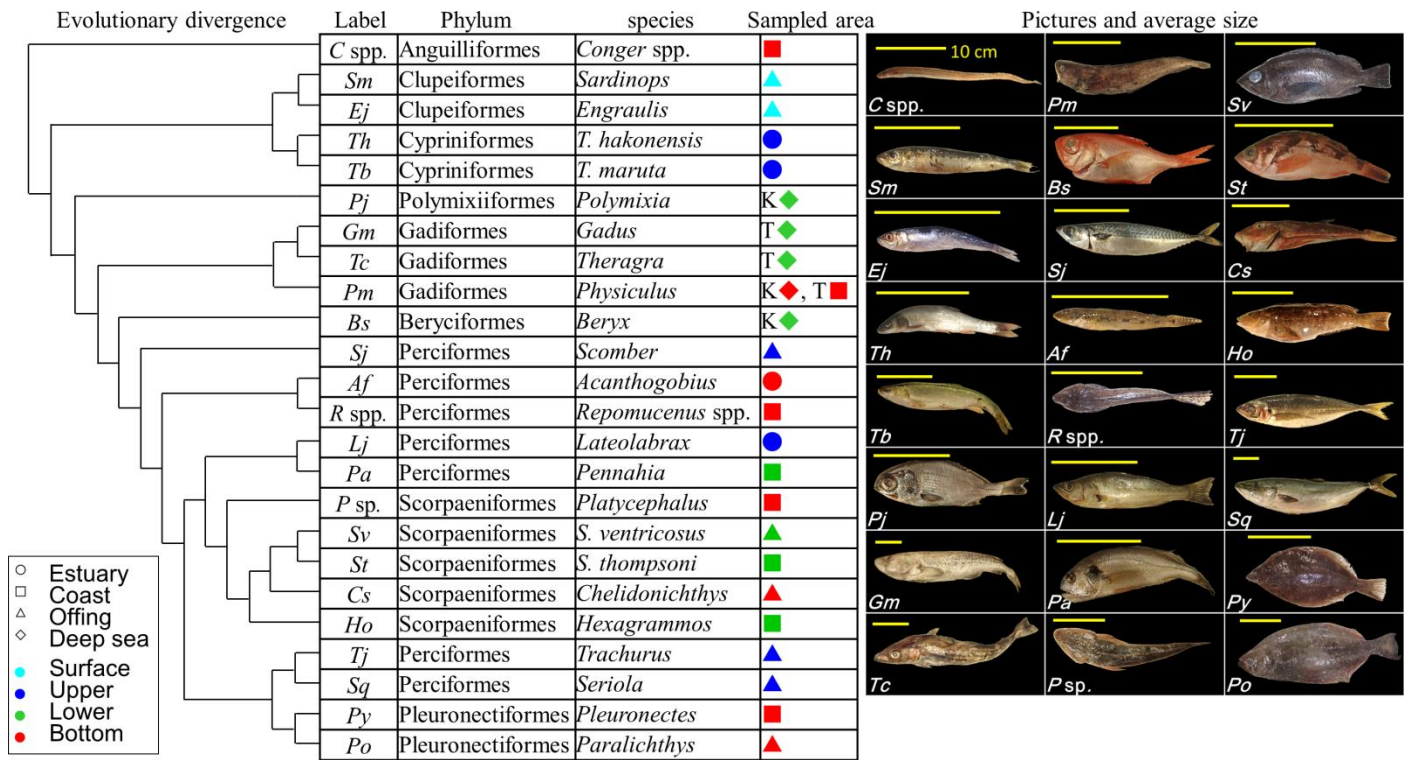
### Supplemental Figure S1. Sampling regions and sampling points

The arrows indicate the major ocean currents. The species of fish that were sampled at each point are shown in Table S1.

The Large-scale map is created by Keisuke Inoue and distributed under license of CC BY 4.0

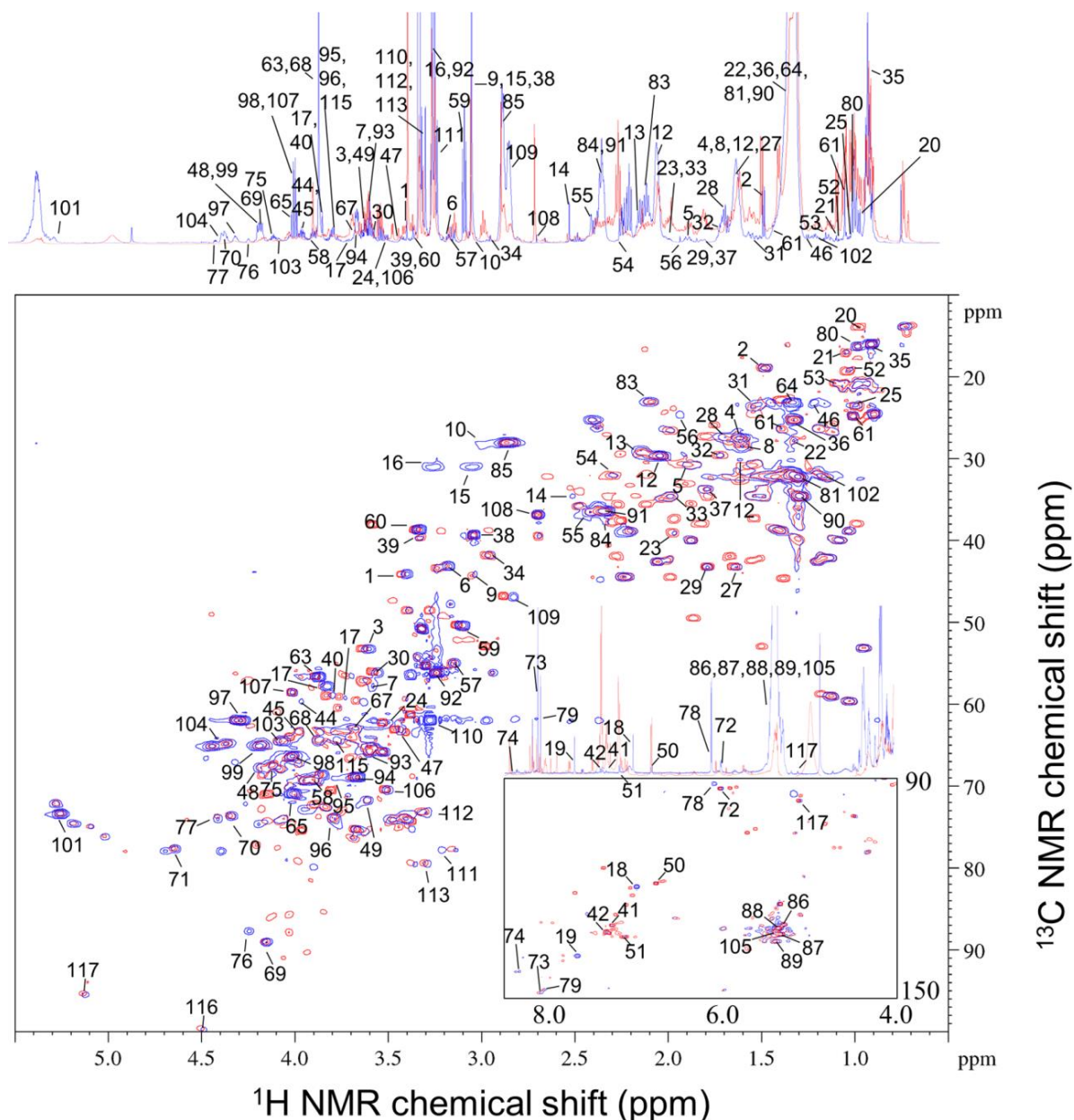
(<https://creativecommons.org/licenses/by/4.0/>) on (<http://www.freemap.jp/item/japan/japan1.html>) and modified by Taiga Asakura.

Maps of enlarged bathymetric charts were obtained from the New Pec software version 2.30 (<http://www.jha.or.jp/>).



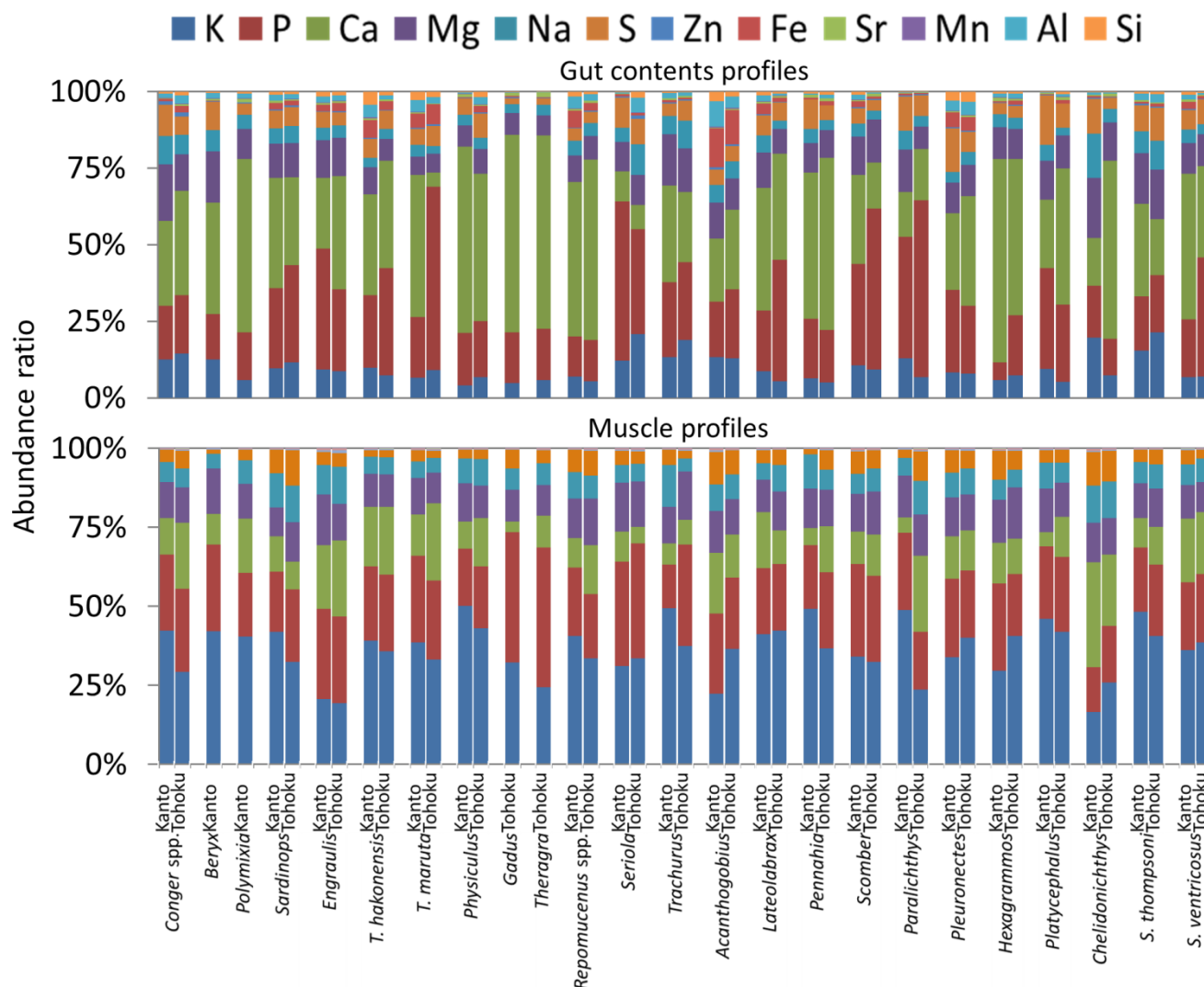
**Supplemental Figure S2. Phylogenetic position and habitat labels of sampled fishes**

Schematic tree diagram was depicted by published phylogenetic analyses. Fish species abbreviations and habitat labels used in other figures. The photo shows representative fish species; the yellow bar indicates a 1-cm scale. All photographs were taken by T. Asakura.



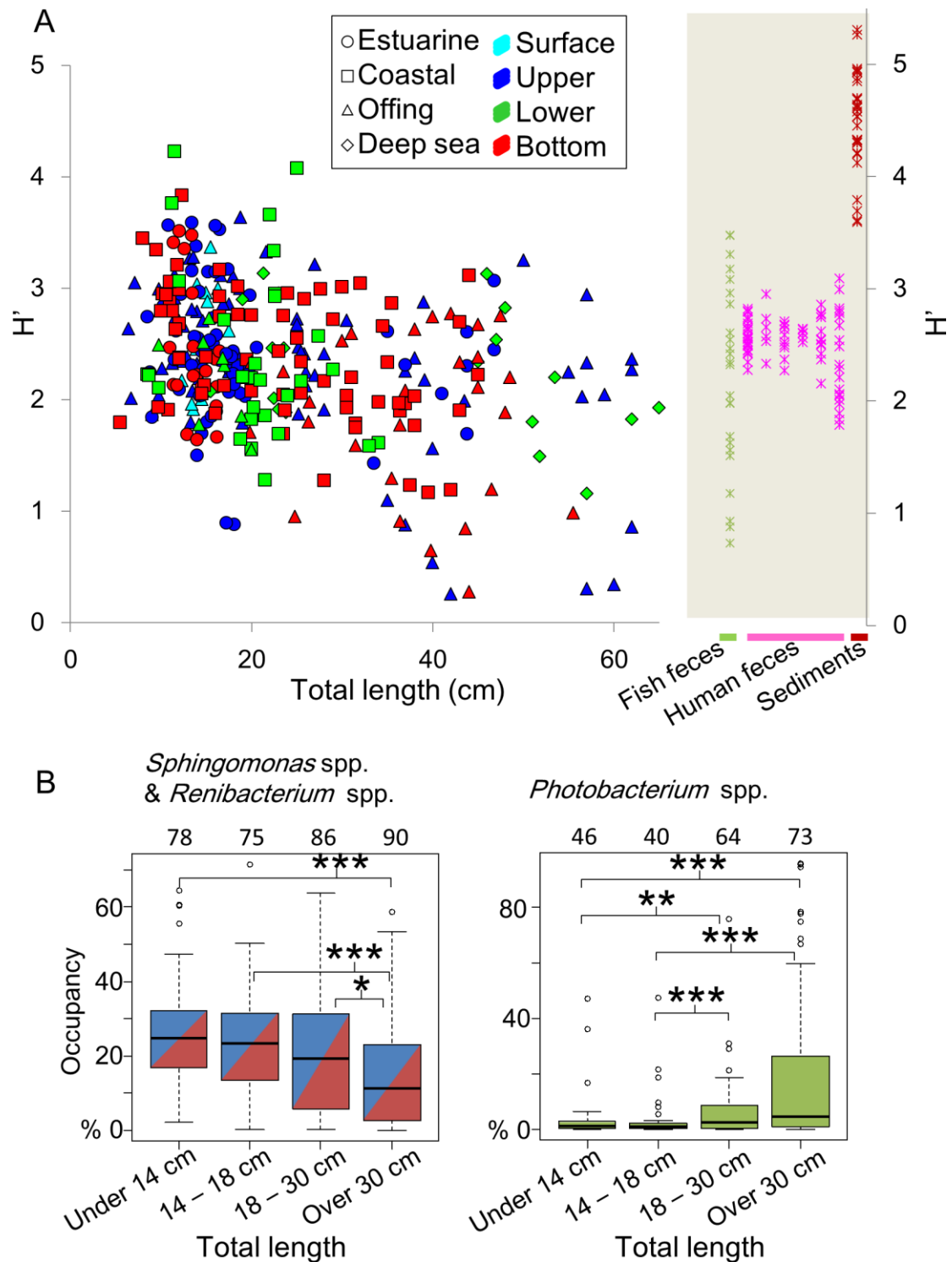
**Supplemental Figure S3. Phylogenetic position and habitat labels of sampled fishes**

$^1\text{H}$ - $^{13}\text{C}$  HSQC spectra of methanol-soluble component profiles from muscle tissue (blue) and gut contents (red). Peak numbers and annotated metabolites are listed in Supplementary Table S2.



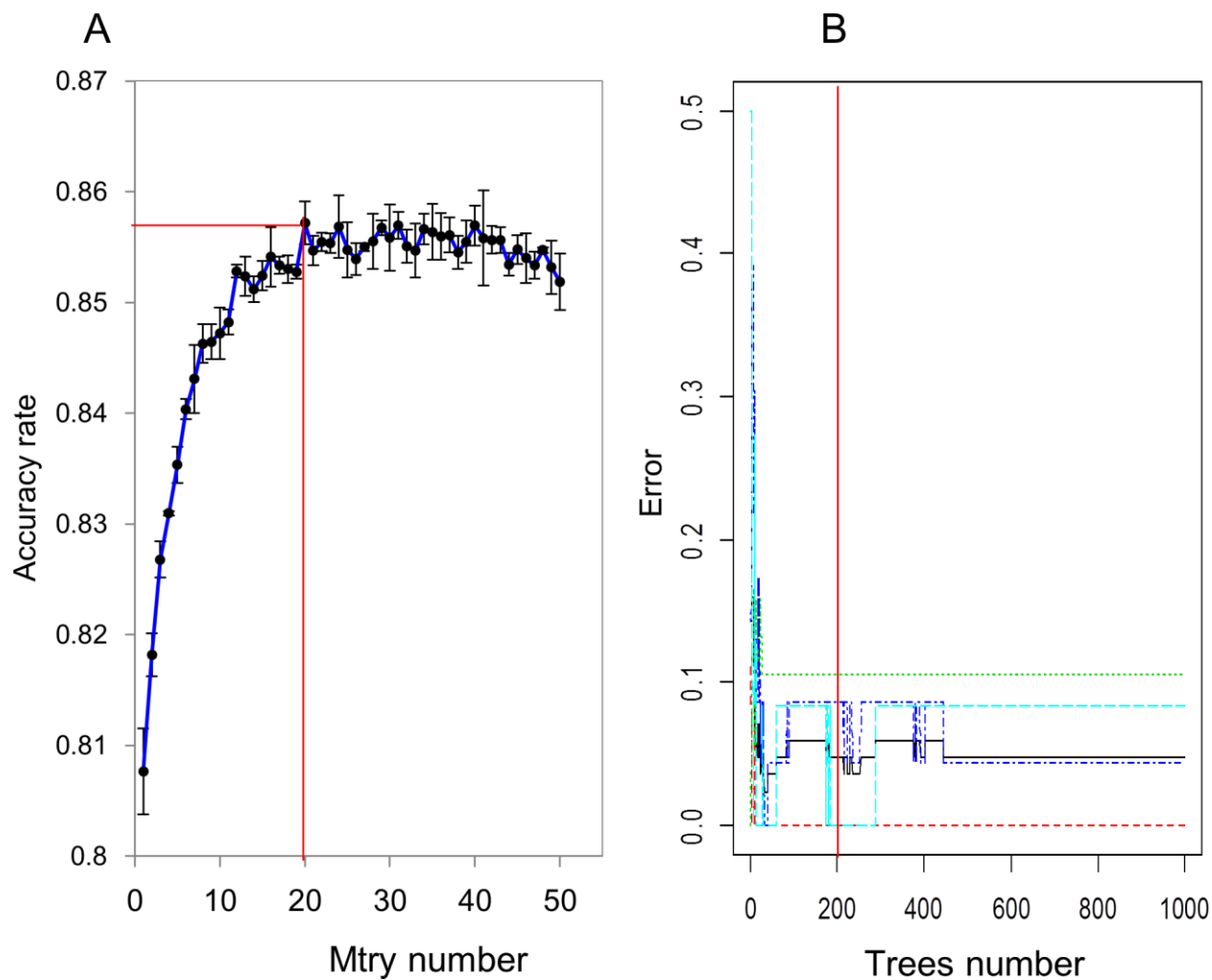
**Supplemental Figure S4. The inorganic profiles of muscle and gut contents of individual species**

The inorganic ion ratio of muscle and gut contents were measured by inductively coupled plasma-optical emission spectrometry (ICP-OES). Upper panel shows gut contents whereas the lower panel shows muscle profile.



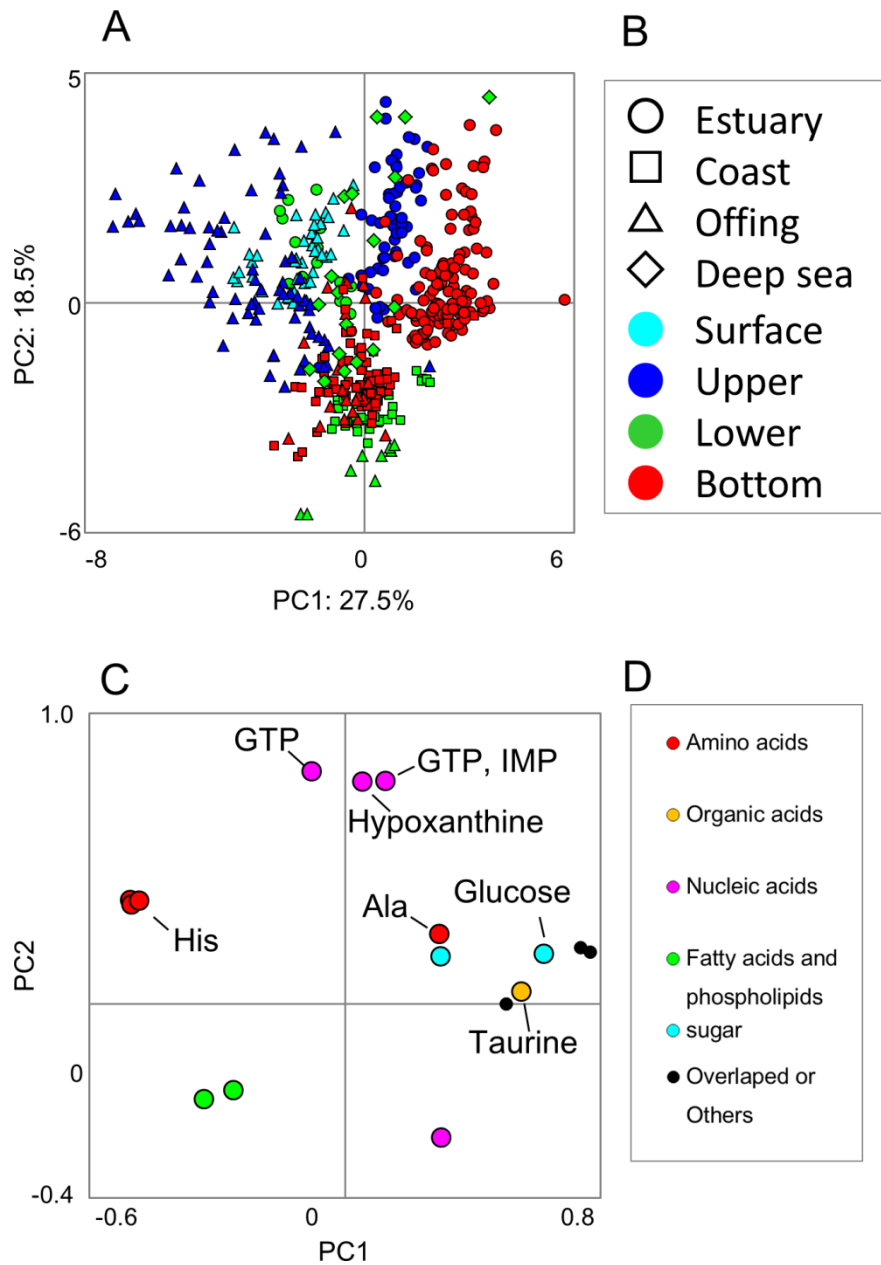
**Supplemental Figure S5. The Shannon diversity index ( $H'$ ) of gut microbiota profiles analyzed using a MiSeq sequencer**

(A) Plot of the total length of fish samples versus the diversity index. For comparisons, microbiota diversity indices of fish feces, human feces, and sediment measured under the same MiSeq machine were also shown. (B) The relationships between bacterial occupancy and the size (total length) of sequenced fish species.



**Supplemental Figure S6. Hyperparameter estimations for random forest analysis.**

(A) Determination of the Mtry number. (B) Determination of tree number.

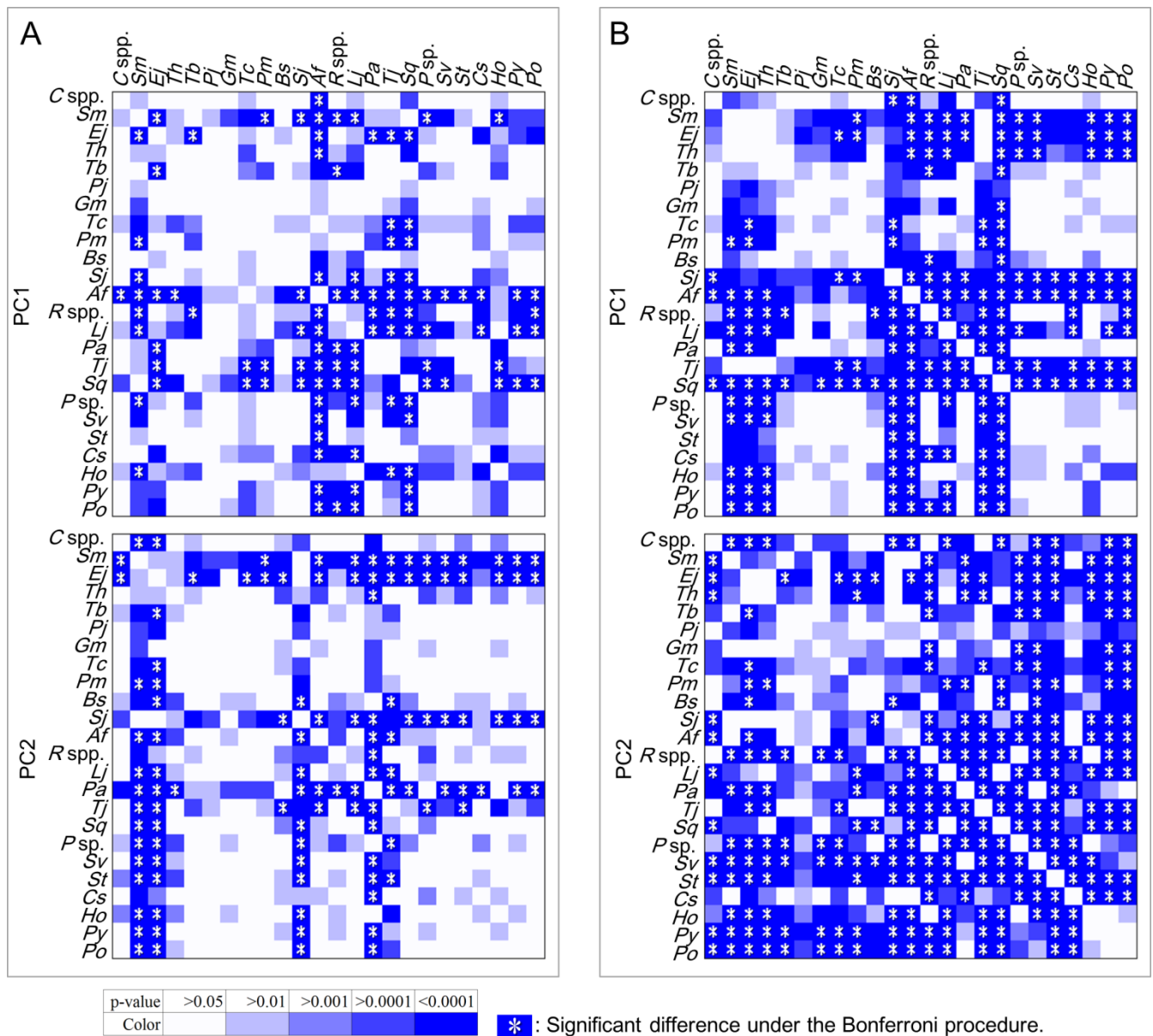


**Supplemental Figure S7. Principle component analysis (PCA) of muscle metabolic profiles based on  $^1\text{H}$ -NMR spectra using selected importance variables.**

Metabolic profiles of muscle tissue ( $n = 286$ ,  $k = 16$ ) were evaluated by: (A) a plot of PCA scores and (C) plot of loadings.

(B) The symbols on PCA plot express differences in distance from land by the shape and differences of the depth by color.

(D) The colors on PCA loadings plot indicate characteristic metabolites.



**Supplemental Figure S8. Significant test of species performed using principal components of all or selected importance variables obtained from the muscle metabolic profile.**

(A) Result of significant difference test for each species along principal components 1 and 2 using all variables. (B) Result of significant difference test for each species of principal components 1 and 2 using selected variables. Degree of significance was obtained using the Mann-Whitney U test, and the p-value is shown by variations in color. The asterisk indicates a specimen in which a significant difference was observed under the Bonferroni procedure ( $0.05 / 276 <$ ). Species abbreviations are provided in Figure S2.

# A

## Kanto

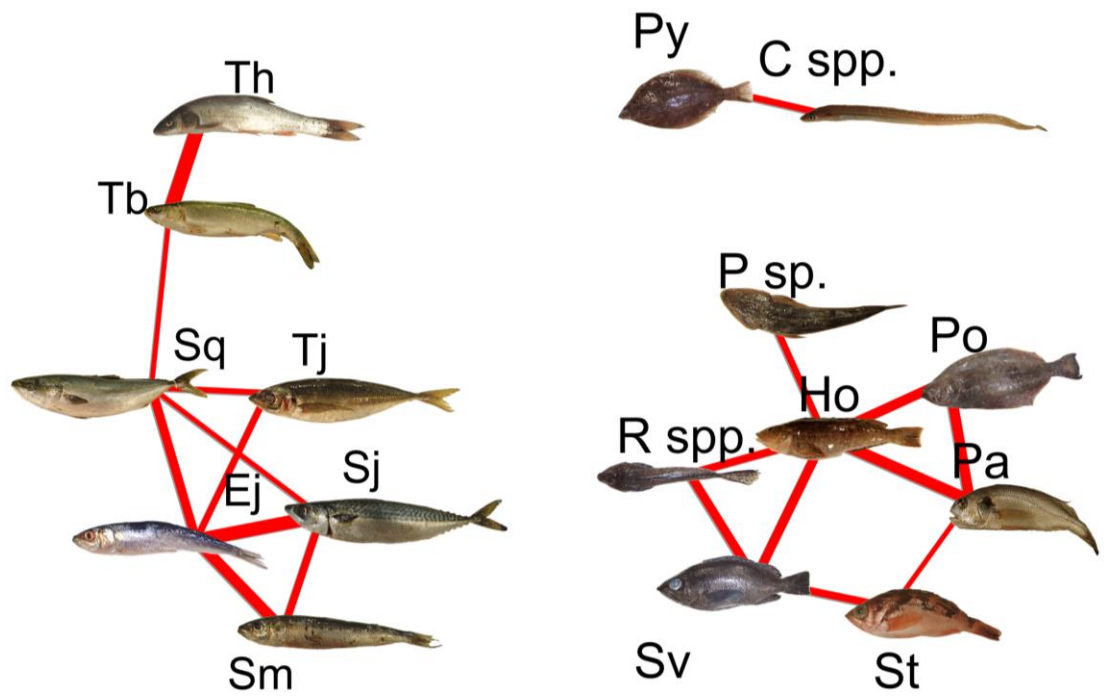
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$r = 0.6$

$r = 0.7$

$r = 0.8$

$r = 0.9$



## Tohoku

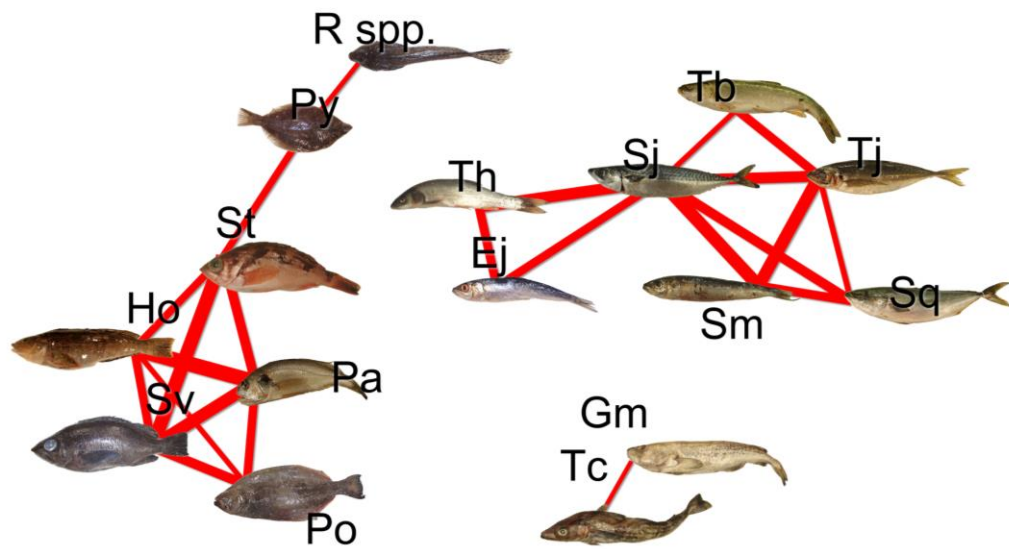
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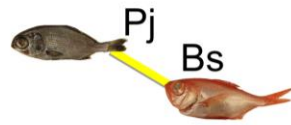
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# B

Kanto

$r = 0.5$



$r = 0.6$

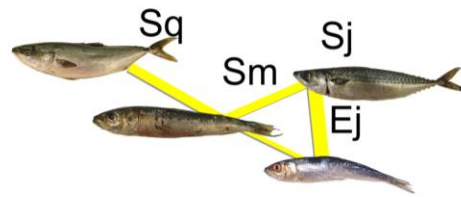
R spp. Pm



$r = 0.7$

$r = 0.8$

$r = 0.9$



Tohoku

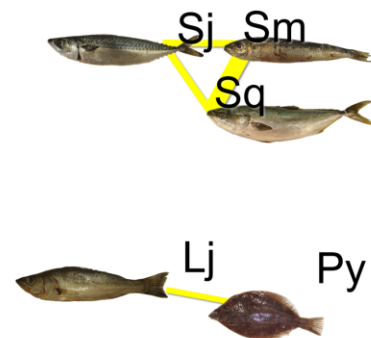
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$r = 0.6$

$r = 0.7$

$r = 0.8$

$r = 0.9$



# C

Kanto

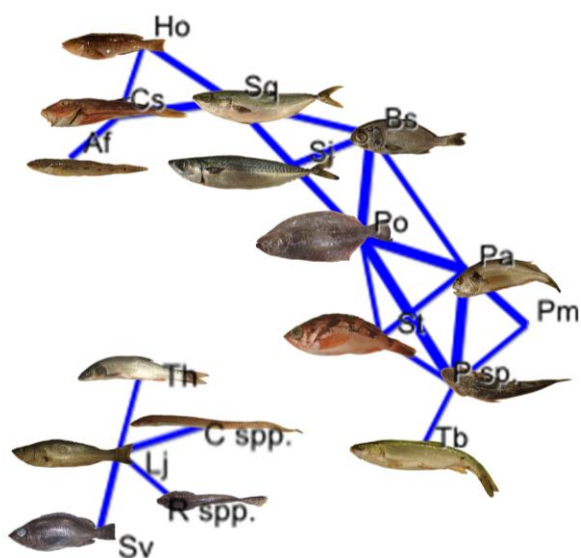
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$r = 0.7$

$r = 0.8$

$r = 0.9$



Tohoku

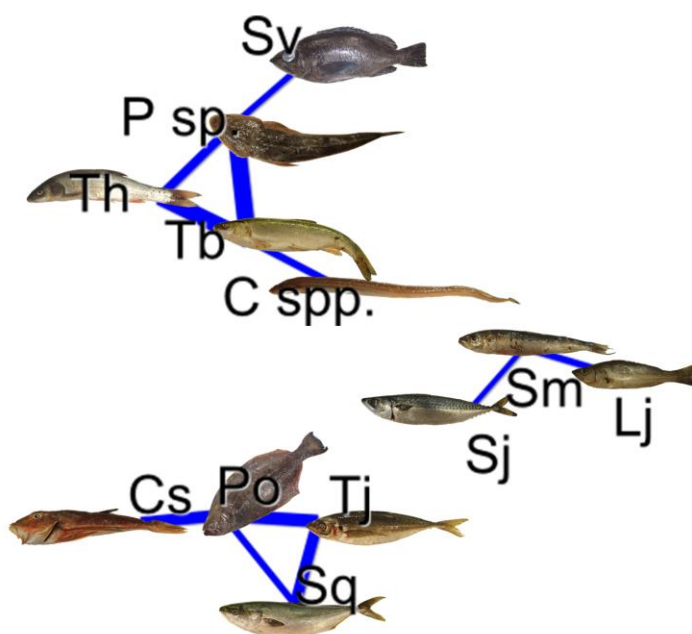
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$r = 0.6$

$r = 0.7$

$r = 0.8$

$r = 0.9$



# D

Kanto

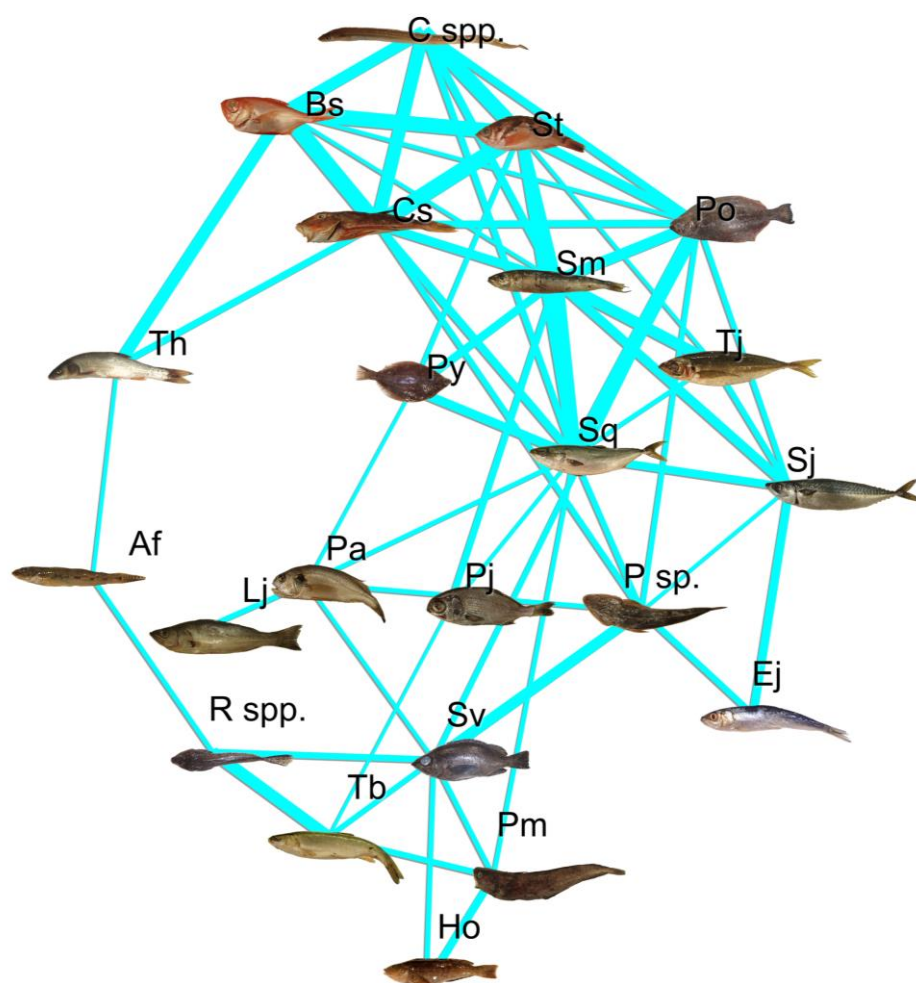
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$r = 0.6$

$r = 0.7$

$r = 0.8$

$r = 0.9$



Tohoku

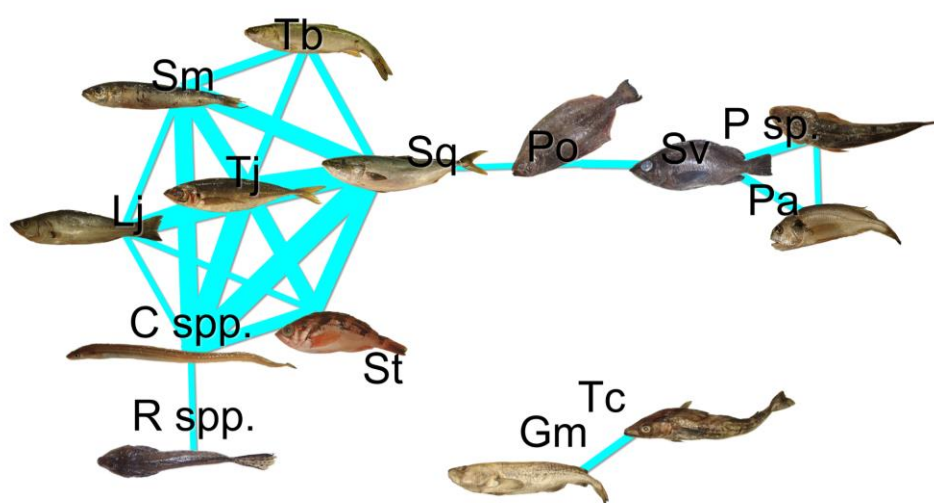
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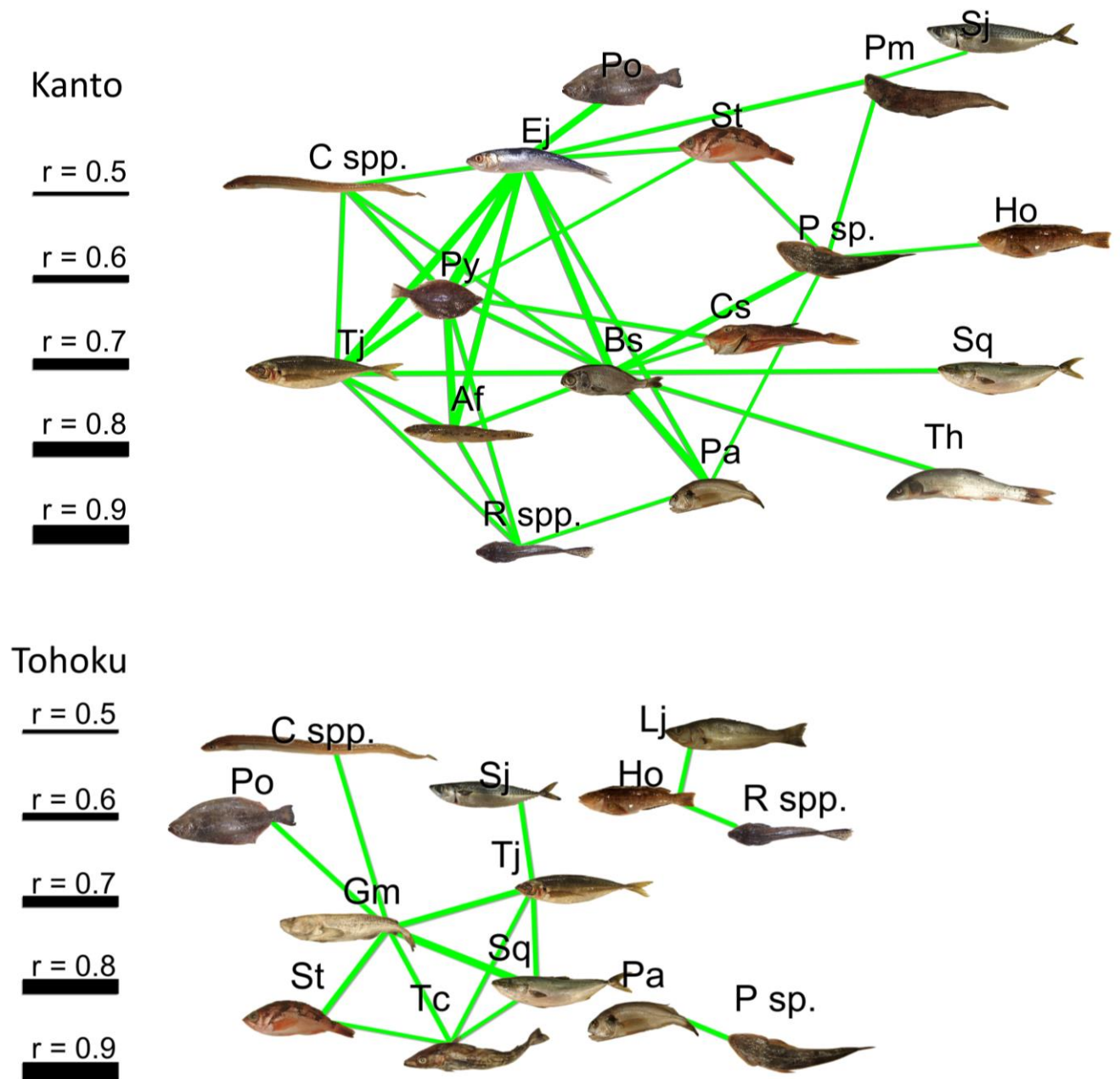
$r = 0.7$

$r = 0.8$

$r = 0.9$



# E



**Supplemental Figure S9. correlation networks of fishes in Kanto and Tohoku regions.**

Line thicknesses show the correlation coefficients ( $r =$ ) of the respective profiles. (A) Muscle metabolic profile network with red line. (B) Gut content metabolic profile network with yellow line. (C) Muscle mineral profile network with blue line. (D) Gut content mineral profile network with cyan line. (E) Gut microbiome profile network with green line.

**Supplemental table S1.** List of fish species, sampling region, size, and numbers of collected samples.

| Order             | Family          | Genus                  | Species                          | Label         | Sampled region   | Size (cm) | (SD)    | Number of<br>muscle<br>Kanto | Number of<br>muscle<br>Tohoku | Number of<br>gut contents<br>Kanto | Number of<br>gut contents<br>Tohoku |
|-------------------|-----------------|------------------------|----------------------------------|---------------|------------------|-----------|---------|------------------------------|-------------------------------|------------------------------------|-------------------------------------|
| Anguilliformes    | Congridae       | <i>Conger</i>          | <i>Conger</i> spp.               | <i>C spp.</i> | Kanto and Tohoku | 27.5      | (3.17)  | 5                            | 5                             | 4                                  | 5                                   |
| Clupeiformes      | Clupeidae       | <i>Sardinops</i>       | <i>Sardinops melanostictus</i>   | <i>Sm</i>     | Kanto and Tohoku | 15.7      | (14.82) | 6                            | 6                             | 5                                  | 3                                   |
| Clupeiformes      | Engraulidae     | <i>Engraulis</i>       | <i>Engraulis japonicus</i>       | <i>Ej</i>     | Kanto and Tohoku | 14        | (2.92)  | 9                            | 21                            | 6                                  | 6                                   |
| Cypriniformes     | Cyprinidae      | <i>Tribolodon</i>      | <i>Tribolodon hakonensis</i>     | <i>Th</i>     | Kanto and Tohoku | 13.4      | (4.77)  | 3                            | 8                             | 3                                  | 8                                   |
| Cypriniformes     | Cyprinidae      | <i>Tribolodon</i>      | <i>Tribolodon brandti maruta</i> | <i>Tb</i>     | Kanto and Tohoku | 29.1      | (2.62)  | 5                            | 5                             | 5                                  | 5                                   |
| Polymixiiformes   | Polymixiidae    | <i>Polymixia</i>       | <i>Polymixia japonica</i>        | <i>Pj</i>     | Kanto            | 18.6      | (5.44)  | 3                            | -                             | 3                                  | -                                   |
| Gadiformes        | Gadidae         | <i>Gadus</i>           | <i>Gadus macrocephalus</i>       | <i>Gm</i>     | Tohoku           | 55.9      | (0.67)  | -                            | 5                             | 5                                  | 5                                   |
| Gadiformes        | Gadidae         | <i>Theragra</i>        | <i>Theragra chalcogramma</i>     | <i>Tc</i>     | Tohoku           | 47.6      | (5.60)  | -                            | 5                             | 5                                  | 5                                   |
| Gadiformes        | Moridae         | <i>Physiculus</i>      | <i>Physiculus maximowiczi</i>    | <i>Pm</i>     | Kanto and Tohoku | 24.1      | (1.84)  | 5                            | 6                             | 4                                  | 5                                   |
| Beryciformes      | Berycidae       | <i>Beryx</i>           | <i>Beryx splendens</i>           | <i>Bs</i>     | Kanto            | 22.9      | (3.01)  | 5                            | -                             | 5                                  | -                                   |
| Perciformes       | Scombridae      | <i>Scomber</i>         | <i>Scomber japonicus</i>         | <i>Sj</i>     | Kanto and Tohoku | 20.8      | (10.70) | 24                           | 5                             | 10                                 | 5                                   |
| Perciformes       | Gobiidae        | <i>Acanthogobius</i>   | <i>Acanthogobius flavimanus</i>  | <i>Af</i>     | Kanto and Tohoku | 13.7      | (4.13)  | 86                           | 38                            | 11                                 | 7                                   |
| Perciformes       | Callionymidae   | <i>Repomucenus</i>     | <i>Repomucenus</i> spp.          | <i>R spp.</i> | Kanto and Tohoku | 10.2      | (5.39)  | 9                            | 8                             | 6                                  | 5                                   |
| Perciformes       | Lateolabracidae | <i>Lateolabrax</i>     | <i>Lateolabrax japonicus</i>     | <i>Lj</i>     | Kanto and Tohoku | 22.7      | (6.55)  | 41                           | 5                             | 9                                  | 5                                   |
| Perciformes       | Sciaenidae      | <i>Pennahia</i>        | <i>Pennahia argentata</i>        | <i>Pa</i>     | Kanto and Tohoku | 22.7      | (3.16)  | 5                            | 5                             | 5                                  | 5                                   |
| Scorpaeniformes   | Platycephalidae | <i>Platycephalus</i>   | <i>Platycephalus</i> sp.         | <i>P sp.</i>  | Kanto and Tohoku | 36.7      | (8.04)  | 11                           | 5                             | 5                                  | 5                                   |
| Scorpaeniformes   | Sebastidae      | <i>Sebastes</i>        | <i>Sebastes ventricosus</i>      | <i>Sv</i>     | Kanto and Tohoku | 16.8      | (6.24)  | 7                            | 9                             | 5                                  | 5                                   |
| Scorpaeniformes   | Sebastidae      | <i>Sebastes</i>        | <i>Sebastes thompsoni</i>        | <i>St</i>     | Kanto and Tohoku | 15.8      | (6.48)  | 4                            | 5                             | 4                                  | 5                                   |
| Scorpaeniformes   | Triglidae       | <i>Chelidonichthys</i> | <i>Chelidonichthys spinosus</i>  | <i>Cs</i>     | Kanto and Tohoku | 35.3      | (5.27)  | 5                            | 5                             | 5                                  | 5                                   |
| Scorpaeniformes   | Hexagrammidae   | <i>Hexagrammos</i>     | <i>Hexagrammos otakii</i>        | <i>Ho</i>     | Kanto and Tohoku | 22.3      | (10.46) | 5                            | 5                             | 5                                  | 4                                   |
| Perciformes       | Carangidae      | <i>Trachurus</i>       | <i>Trachurus japonicus</i>       | <i>Tj</i>     | Kanto and Tohoku | 33.3      | (9.34)  | 17                           | 6                             | 5                                  | 7                                   |
| Perciformes       | Carangidae      | <i>Seriola</i>         | <i>Seriola quinqueradiata</i>    | <i>Sq</i>     | Kanto and Tohoku | 56.8      | (5.27)  | 14                           | 5                             | 12                                 | 5                                   |
| Pleuronectiformes | Pleuronectidae  | <i>Pleuronectes</i>    | <i>Pleuronectes yokohamae</i>    | <i>Py</i>     | Kanto and Tohoku | 17.2      | (10.46) | 5                            | 25                            | 5                                  | 10                                  |
| Pleuronectiformes | Paralichthyidae | <i>Paralichthys</i>    | <i>Paralichthys olivaceus</i>    | <i>Po</i>     | Kanto and Tohoku | 42.8      | (9.34)  | 7                            | 8                             | 5                                  | 5                                   |

**Supplemental table S2.** <sup>1</sup>H and <sup>13</sup>C chemical shifts (ppm). Peak numbers are referred

| Peak number | Class      | Metabolite   | <sup>1</sup> H (ppm) | <sup>13</sup> C (ppm) |
|-------------|------------|--------------|----------------------|-----------------------|
| 1           | Amino acid | Glycine      | 3.41                 | 44.1                  |
| 2           | Amino acid | L-Alanine    | 1.47                 | 19.1                  |
| 3           |            |              | 3.63                 | 53.6                  |
| 4           | Amino acid | L-Arginine   | 1.61                 | 27.5                  |
| 5           |            |              | 1.88                 | 30.8                  |
| 6           |            |              | 3.22                 | 43.5                  |
| 7           |            |              | 3.62                 | 57.2                  |
| 8           | Amino acid | L-Citrulline | 1.60                 | 28.6                  |
| 5           |            |              | 1.88                 | 30.8                  |
| 9           |            |              | 3.04                 | 42.5                  |
| 7           |            |              | 3.62                 | 57.2                  |
| 12          | Amino acid | L-Glutamate  | 2.10                 | 29.4                  |
| 13          |            |              | 2.14                 | 29.3                  |
| 14          |            |              | 2.50                 | 34.1                  |
| 7           |            |              | 3.62                 | 57.2                  |
| 15          | Amino acid | L-Histidine  | 3.06                 | 31.1                  |
| 16          |            |              | 3.22                 | 31.1                  |
| 17          |            |              | 3.84                 | 57.9                  |
| 18          |            |              | 7.00                 | 119.1                 |
| 19          |            |              | 7.69                 | 138.2                 |
| 20          | Amino acid | L-Isoleucine | 0.96                 | 14.0                  |
| 21          |            |              | 0.98                 | 17.3                  |
| 22          |            |              | 1.34                 | 27.8                  |
| 4           |            |              | 1.61                 | 27.5                  |
| 23          |            |              | 1.97                 | 39.1                  |
| 24          |            |              | 3.50                 | 62.3                  |
| 25          | Amino acid | L-Leucine    | 1.00                 | 23.4                  |
| 26          |            |              | 1.01                 | 24.7                  |
| 27          |            |              | 1.63                 | 43.2                  |
| 28          |            |              | 1.71                 | 27.2                  |
| 29          |            |              | 1.79                 | 43.2                  |
| 30          |            |              | 3.56                 | 56.1                  |

| Peak number | Class        | Metabolite      | <sup>1</sup> H (ppm) | <sup>13</sup> C (ppm) |
|-------------|--------------|-----------------|----------------------|-----------------------|
| 31          | Amino acid   | L-Lysine        | 1.49                 | 24.5                  |
| 32          |              |                 | 1.71                 | 29.7                  |
| 33          |              |                 | 1.87                 | 33.1                  |
| 34          |              |                 | 2.95                 | 42.0                  |
| 7           |              |                 | 3.62                 | 57.2                  |
| 38          | Amino acid   | L-Phenylalanine | 3.03                 | 39.7                  |
| 39          |              |                 | 3.34                 | 39.7                  |
| 40          |              |                 | 3.82                 | 59.2                  |
| 41          |              |                 | 7.28                 | 130.2                 |
| 42          |              |                 | 7.30                 | 132.2                 |
| 43          |              |                 | 7.35                 | 131.7                 |
| 11          | Amino acid   | L-Serine        | 3.73                 | 59.2                  |
| 44          |              |                 | 3.83                 | 63.5                  |
| 45          |              |                 | 3.96                 | 63.5                  |
| 46          | Amino acid   | L-Threonine     | 1.22                 | 23.1                  |
| 47          |              |                 | 3.46                 | 63.4                  |
| 48          |              |                 | 4.15                 | 68.8                  |
| 49          | Amino acid   | L-Tyrosine      | 3.63                 | 73.2                  |
| 11          |              |                 | 3.73                 | 59.2                  |
| 50          |              |                 | 6.78                 | 118.2                 |
| 51          |              |                 | 7.14                 | 133.0                 |
| 52          | Amino acid   | L-Valine        | 1.01                 | 19.4                  |
| 53          |              |                 | 1.06                 | 20.9                  |
| 54          |              |                 | 2.28                 | 32.2                  |
| 47          |              |                 | 3.43                 | 63.2                  |
| 55          | Amino acid   | beta-Alanine    | 2.41                 | 36.5                  |
| 38          |              |                 | 3.03                 | 39.7                  |
| 10          | Amino acid   | D-Cysteine      | 3.00                 | 28.0                  |
| 40          |              |                 | 3.81                 | 59.1                  |
| 56          | Organic acid | Acetate         | 1.94                 | 24.6                  |
| 57          | Organic acid | Betaine         | 3.17                 | 56.0                  |
| 58          |              |                 | 3.91                 | 69.2                  |

| Peak number | Class         | Metabolite           | <sup>1</sup> H (ppm) | <sup>13</sup> C (ppm) |
|-------------|---------------|----------------------|----------------------|-----------------------|
| 59          | Organic acid  | Taurine              | 3.10                 | 50.3                  |
| 60          |               |                      | 3.34                 | 38.7                  |
| 38          | Organic acid  | Creatine             | 3.03                 | 39.7                  |
| 63          |               |                      | 3.87                 | 56.6                  |
| 64          | Organic acid  | L-Lactate            | 1.34                 | 23.1                  |
| 65          |               |                      | 4.09                 | 71.0                  |
| 52          | Organic acid  | alpha-Ketovalline    | 1.01                 | 19.4                  |
| 38          |               |                      | 3.04                 | 39.3                  |
| 67          | Nucleic acid  | GTP                  | 3.69                 | 64.1                  |
| 68          |               |                      | 3.87                 | 64.4                  |
| 69          |               |                      | 4.16                 | 89.0                  |
| 70          |               |                      | 4.33                 | 73.6                  |
| 71          |               |                      | 4.65                 | 77.7                  |
| 72          |               |                      | 6.03                 | 92.0                  |
| 73          |               |                      | 8.10                 | 148.3                 |
| 74          |               |                      | 8.36                 | 142.6                 |
| 75          | Nucleic acid  | IMP                  | 4.12                 | 67.4                  |
| 76          |               |                      | 4.25                 | 87.7                  |
| 77          |               |                      | 4.42                 | 73.9                  |
| 71          |               |                      | 4.65                 | 77.7                  |
| 78          |               |                      | 6.11                 | 90.8                  |
| 73          |               |                      | 8.10                 | 148.3                 |
| 74          |               |                      | 8.36                 | 142.6                 |
| 79          | Nucleic acid  | Hypoxanthine         | 8.05                 | 147.6                 |
| 80          | Fatty acid ω3 | alpha-Linolenic acid | 0.98                 | 16.2                  |
| 81          |               |                      | 1.30                 | 32.2                  |
| 82          |               |                      | 1.56                 | 27.4                  |
| 83          |               |                      | 2.11                 | 23.0                  |
| 13          |               |                      | 2.14                 | 29.3                  |
| 84          |               |                      | 2.34                 | 37.4                  |
| 85          |               |                      | 2.87                 | 28.1                  |
| 86          |               |                      | 5.32                 | 129.7                 |
| 87          |               |                      | 5.36                 | 132.3                 |
| 88          |               |                      | 5.39                 | 130.5                 |
| 89          |               |                      | 5.42                 | 134.2                 |

| Peak number | Class                   | Metabolite            | <sup>1</sup> H (ppm) | <sup>13</sup> C (ppm) |
|-------------|-------------------------|-----------------------|----------------------|-----------------------|
| 35          | Fatty acid ω6           | gamma-Linolenic acid  | 0.92                 | 15.9                  |
| 90          |                         |                       | 1.30                 | 34.6                  |
| 81          |                         |                       | 1.30                 | 32.2                  |
| 82          |                         |                       | 1.56                 | 27.4                  |
| 12          |                         |                       | 2.05                 | 29.6                  |
| 91          |                         |                       | 2.34                 | 36.5                  |
| 85          |                         |                       | 2.87                 | 28.1                  |
| 36          |                         |                       | 1.33                 | 25.3                  |
| 80          | Fatty acid ω6           | Linoleate             | 0.98                 | 16.2                  |
| 90          |                         |                       | 1.30                 | 34.6                  |
| 81          |                         |                       | 1.30                 | 32.2                  |
| 36          |                         |                       | 1.33                 | 25.3                  |
| 82          |                         |                       | 1.56                 | 27.4                  |
| 12          |                         |                       | 2.09                 | 29.3                  |
| 84          |                         |                       | 2.34                 | 37.4                  |
| 87          |                         |                       | 5.36                 | 132.3                 |
| 88          |                         |                       | 5.39                 | 130.5                 |
| 92          | Fatty acid phospholipid | Glycerophosphocholine | 3.24                 | 56.1                  |
| 93          |                         |                       | 3.60                 | 65.5                  |
| 94          |                         |                       | 3.66                 | 68.9                  |
| 95          |                         |                       | 3.77                 | 68.9                  |
| 96          |                         |                       | 3.79                 | 73.9                  |
| 58          |                         |                       | 3.91                 | 69.2                  |
| 97          |                         |                       | 4.29                 | 62.0                  |
| 80          | Fatty acid phospholipid | Phosphatidylcholine   | 0.98                 | 16.2                  |
| 81          |                         |                       | 1.30                 | 32.2                  |
| 90          |                         |                       | 1.30                 | 34.6                  |
| 36          |                         |                       | 1.33                 | 25.3                  |
| 4           |                         |                       | 1.61                 | 27.5                  |
| 55          |                         |                       | 2.41                 | 36.5                  |
| 92          |                         |                       | 3.24                 | 56.1                  |
| 94          |                         |                       | 3.66                 | 68.9                  |
| 98          |                         |                       | 4.02                 | 66.3                  |
| 99          |                         |                       | 4.20                 | 65.1                  |
| 97          |                         |                       | 4.29                 | 62.0                  |
| 100         |                         |                       | 4.44                 | 65.1                  |
| 101         |                         |                       | 5.26                 | 73.3                  |

| Peak number | Class                   | Metabolite               | <sup>1</sup> H (ppm) | <sup>13</sup> C (ppm) |
|-------------|-------------------------|--------------------------|----------------------|-----------------------|
| 35          | Fatty acid phospholipid | Phosphatidylethanolamine | 0.92                 | 15.9                  |
| 102         |                         |                          | 1.18                 | 32.1                  |
| 81          |                         |                          | 1.30                 | 32.2                  |
| 90          |                         |                          | 1.30                 | 34.6                  |
| 36          |                         |                          | 1.33                 | 25.3                  |
| 82          |                         |                          | 1.56                 | 27.4                  |
| 4           |                         |                          | 1.61                 | 27.5                  |
| 12          |                         |                          | 2.05                 | 29.6                  |
| 91          |                         |                          | 2.34                 | 36.5                  |
| 55          |                         |                          | 2.41                 | 36.5                  |
| 85          |                         |                          | 2.87                 | 28.1                  |
| 6           |                         |                          | 3.22                 | 43.5                  |
| 98          |                         |                          | 4.02                 | 66.3                  |
| 103         |                         |                          | 4.06                 | 64.5                  |
| 99          |                         |                          | 4.20                 | 65.1                  |
| 104         |                         |                          | 4.38                 | 64.8                  |
| 101         |                         |                          | 5.26                 | 73.3                  |
| 87          |                         |                          | 5.36                 | 132.3                 |
| 88          |                         |                          | 5.39                 | 130.5                 |
| 105         |                         |                          | 5.40                 | 131.7                 |
| 92          | Other compounds         | Choline                  | 3.24                 | 56.1                  |
| 106         |                         |                          | 3.50                 | 70.5                  |
| 107         |                         |                          | 4.02                 | 58.5                  |
| 108         | Other compounds         | Dimethylamine            | 2.73                 | 37.2                  |
| 109         | Other compounds         | Trimethylamine           | 2.83                 | 46.9                  |
| 110         | Other compounds         | Trimethylamine N-oxide   | 3.28                 | 62.0                  |
| 111         | Sugar                   | D-Glucose                | 3.21                 | 77.9                  |
| 112         |                         |                          | 3.30                 | 73.2                  |
| 113         |                         |                          | 3.30                 | 79.5                  |
| 114         |                         |                          | 3.38                 | 75.2                  |
| 67          |                         |                          | 3.69                 | 64.1                  |
| 115         |                         |                          | 3.77                 | 64.4                  |
| 68          |                         |                          | 3.87                 | 64.4                  |
| 116         |                         |                          | 4.49                 | 99.7                  |
| 117         |                         |                          | 5.13                 | 95.5                  |

**Supplemental table S3.** Confusion matrix of species and geographical classification model evaluated by leave-one-out cross-validation.

[illegible]

**Supplemental table S4.** Importance variables.

|                         |      |                               |               |
|-------------------------|------|-------------------------------|---------------|
| Muscle metabloites      | 1.45 | Amino acids                   | Ala           |
|                         | 3.36 | Amino acids                   | Gly           |
|                         | 3.78 | Amino acids                   | His           |
|                         | 6.96 | Amino acids                   | His           |
|                         | 7.63 | Amino acids                   |               |
|                         | 0.95 | Fatty acids and phospholipids |               |
|                         | 0.96 | Fatty acids and phospholipids |               |
|                         | 5.99 | Nucleic acids                 | GTP           |
|                         | 8.33 | Nucleic asids                 | GTP, IMP      |
|                         | 8.05 | Nucleic asids                 | Hypoxanthine  |
|                         | 8.01 | Nucleic asids                 | Nucleic asids |
|                         | 3.05 | Organic acids                 | Taurine       |
|                         | 5.09 | Sugar                         | D-Glucose     |
|                         | 6.43 | Overlaped or Others           |               |
|                         | 7.41 | Overlaped or Others           |               |
|                         | 8.04 | Overlaped or Others           |               |
| Gut content metabloites | 3.63 | Amino acids                   | Ala           |
|                         | 6.96 | Amino acids                   | His           |
|                         | 3.78 | Amino acids                   | His           |
|                         | 3.51 | Amino acids                   | Lys           |
|                         | 3.57 | Amino acids                   | Lys           |
|                         | 7.63 | Amino acids                   |               |
|                         | 2.22 | FA                            |               |
|                         | 5.99 | Nucleic asids                 | GTP           |
|                         | 6.07 | Nucleic asids                 | GTP           |
|                         | 8.33 | Nucleic asids                 | GTP, IMP      |
|                         | 8.05 | Nucleic asids                 | Hypoxanthine  |
|                         | 3.05 | Organic acids                 | Taurine       |
|                         | 3.2  | Phospholipids                 |               |
|                         | 3.94 | Phospholipids                 |               |
|                         | 3.76 | Fatty acids and phospholipids |               |
|                         | 3.36 | Sugar                         |               |
|                         | 4.45 | Sugar                         |               |
|                         | 0.68 | Overlaped or Others           |               |
|                         | 2.49 | Overlaped or Others           |               |
|                         | 5.68 | Overlaped or Others           |               |
|                         | 8.81 | Overlaped or Others           |               |
|                         | 8.92 | Overlaped or Others           |               |
|                         | 9.05 | Overlaped or Others           |               |
|                         | 9.22 | Overlaped or Others           |               |

|                                 |    |
|---------------------------------|----|
| Muscle inorganic substance      | B  |
|                                 | Ca |
|                                 | Fe |
|                                 | Hf |
|                                 | K  |
|                                 | Mg |
|                                 | Mn |
|                                 | Na |
|                                 | P  |
|                                 | S  |
|                                 | Sr |
|                                 | Ta |
|                                 | V  |
|                                 | Zn |
| Gut content inorganic substance | Ba |
|                                 | Er |
|                                 | Fe |
|                                 | K  |
|                                 | Mn |
|                                 | P  |
|                                 | S  |
|                                 | V  |
|                                 | Zn |

Gut microbiome

|                |                          |
|----------------|--------------------------|
| Actinobacteria | f__Actinomycetaceae      |
| Actinobacteria | f__Bifidobacteriaceae    |
| Actinobacteria | f__Coriobacteriaceae     |
| Actinobacteria | f__Corynebacteriaceae    |
| Actinobacteria | f__Microbacteriaceae     |
| Actinobacteria | f__Micrococcaceae        |
| Actinobacteria | f__Mycobacteriaceae      |
| Actinobacteria | f__Propionibacteriaceae  |
| Actinobacteria | o__Actinomycetales       |
| Bacteroidetes  | f__Bacteroidaceae        |
| Bacteroidetes  | f__Chitinophagaceae      |
| Bacteroidetes  | f__Flavobacteriaceae     |
| Bacteroidetes  | f__Prevotellaceae        |
| Bacteroidetes  | f__Weeksellaceae         |
| Cyanobacteria  | c__Chloroplast           |
| Cyanobacteria  | f__Synechococcaceae      |
| Firmicutes     | f__Bacillaceae           |
| Firmicutes     | f__Clostridiaceae        |
| Firmicutes     | f__Lachnospiraceae       |
| Firmicutes     | f__Peptostreptococcaceae |
| Firmicutes     | f__Ruminococcaceae       |
| Firmicutes     | f__Staphylococcaceae     |
| Firmicutes     | f__Streptococcaceae      |
| Firmicutes     | f__Tissierellaceae       |
| Firmicutes     | f__Veillonellaceae       |
| Firmicutes     | o__Clostridiales         |
| Fusobacteria   | f__Fusobacteriaceae      |
| Planctomycetes | f__Pirellulaceae         |
| Proteobacteria | c__Alphaproteobacteria   |
| Proteobacteria | c__Gammaproteobacteria   |
| Proteobacteria | f__Aeromonadaceae        |
| Proteobacteria | f__Alteromonadaceae      |
| Proteobacteria | f__Bradyrhizobiaceae     |
| Proteobacteria | f__Caulobacteraceae      |
| Proteobacteria | f__Comamonadaceae        |
| Proteobacteria | f__Coxiellaceae          |
| Proteobacteria | f__Enterobacteriaceae    |
| Proteobacteria | f__Methylobacteriaceae   |
| Proteobacteria | f__mitochondria          |
| Proteobacteria | f__Moraxellaceae         |
| Proteobacteria | f__Oxalobacteraceae      |
| Proteobacteria | f__Phyllobacteriaceae    |
| Proteobacteria | f__Pseudomonadaceae      |
| Proteobacteria | f__Rhodobacteraceae      |
| Proteobacteria | f__Shewanellaceae        |
| Proteobacteria | f__Sphingomonadaceae     |
| Proteobacteria | f__Vibrionaceae          |
| Proteobacteria | f__Xanthobacteraceae     |
| Proteobacteria | o__Alteromonadales       |
| Proteobacteria | o__Rhizobiales           |
| Proteobacteria | o__Vibrionales           |
| Proteobacteria | -                        |
| Spirochaetes   | f__Brevinemataceae       |
| Tenericutes    | c__Mollicutes            |
| Tenericutes    | f__Mycoplasmataceae      |
| Thermi         | f__Deinococcaceae        |

Supplemental table S5. Spearman correlation value of each profile.

Correlation of Kanto muscle metabolic profile

|        | C spp. | Sm   | Ej   | Th   | Tb   | Pj   | Pm   | Bs   | Sj   | Af   | R spp. | Lj   | Pa   | Tj   | Sq   | P sp. | Sv   | St   | Cs   | Ho   | Py   | Po   |
|--------|--------|------|------|------|------|------|------|------|------|------|--------|------|------|------|------|-------|------|------|------|------|------|------|
| C spp. | NA     | 0.23 | 0.36 | 0.13 | 0.17 | 0.26 | 0.21 | 0.24 | 0.34 | 0.13 | 0.19   | 0.07 | 0.35 | 0.40 | 0.45 | 0.13  | 0.21 | 0.47 | 0.02 | 0.13 | 0.55 | 0.23 |
| Sm     | 0.23   | NA   | 0.65 | 0.38 | 0.39 | 0.09 | 0.33 | 0.21 | 0.57 | 0.17 | NA     | 0.13 | 0.07 | 0.43 | 0.48 | 0.29  | NA   | 0.13 | 0.38 | NA   | 0.17 | 0.14 |
| Ej     | 0.36   | 0.65 | NA   | 0.36 | 0.44 | 0.08 | 0.10 | 0.25 | 0.70 | 0.11 | 0.08   | 0.04 | 0.10 | 0.55 | 0.60 | 0.21  | 0.01 | 0.19 | 0.15 | NA   | 0.23 | 0.14 |
| Th     | 0.13   | 0.38 | 0.36 | NA   | 0.72 | 0.18 | NA   | 0.12 | 0.32 | 0.19 | NA     | 0.29 | 0.07 | 0.26 | 0.46 | 0.12  | NA   | NA   | 0.31 | NA   | 0.14 | 0.01 |
| Tb     | 0.17   | 0.39 | 0.44 | 0.72 | NA   | 0.11 | NA   | 0.19 | 0.38 | 0.12 | NA     | 0.17 | 0.16 | 0.27 | 0.51 | 0.07  | NA   | 0.06 | 0.48 | NA   | 0.22 | 0.15 |
| Pj     | 0.26   | 0.09 | 0.08 | 0.18 | 0.11 | NA   | 0.26 | 0.44 | 0.14 | 0.19 | 0.10   | 0.08 | 0.41 | 0.28 | 0.23 | 0.35  | 0.11 | 0.20 | 0.25 | 0.17 | 0.46 | 0.32 |
| Pm     | 0.21   | 0.33 | 0.10 | NA   | NA   | 0.26 | NA   | 0.43 | 0.17 | 0.18 | 0.16   | 0.26 | 0.44 | 0.28 | 0.08 | 0.36  | 0.23 | 0.27 | 0.48 | 0.49 | 0.25 | 0.39 |
| Bs     | 0.24   | 0.21 | 0.25 | 0.12 | 0.19 | 0.44 | 0.43 | NA   | 0.26 | 0.11 | 0.07   | 0.14 | 0.39 | 0.45 | 0.24 | 0.31  | 0.07 | 0.27 | 0.25 | 0.22 | 0.23 | 0.31 |
| Sj     | 0.34   | 0.57 | 0.70 | 0.32 | 0.38 | 0.14 | 0.17 | 0.26 | NA   | 0.24 | 0.19   | 0.10 | 0.19 | 0.49 | 0.51 | 0.26  | 0.18 | 0.24 | 0.23 | 0.11 | 0.28 | 0.19 |
| Af     | 0.13   | 0.17 | 0.11 | 0.19 | 0.12 | 0.19 | 0.18 | 0.11 | 0.24 | NA   | 0.32   | 0.35 | 0.16 | 0.14 | 0.13 | 0.32  | 0.20 | 0.18 | 0.25 | 0.36 | 0.19 | 0.21 |
| R spp. | 0.19   | NA   | 0.08 | NA   | NA   | 0.10 | 0.16 | 0.07 | 0.19 | 0.32 | NA     | 0.11 | 0.29 | 0.17 | 0.06 | 0.42  | 0.60 | 0.36 | NA   | 0.57 | 0.38 | 0.49 |
| Lj     | 0.07   | 0.13 | 0.04 | 0.29 | 0.17 | 0.08 | 0.26 | 0.14 | 0.10 | 0.35 | 0.11   | NA   | NA   | 0.16 | 0.19 | 0.18  | 0.16 | 0.16 | 0.46 | 0.13 | 0.14 | 0.13 |
| Pa     | 0.35   | 0.07 | 0.10 | 0.07 | 0.16 | 0.41 | 0.44 | 0.39 | 0.19 | 0.16 | 0.29   | NA   | NA   | 0.36 | 0.19 | 0.39  | 0.31 | 0.51 | NA   | 0.65 | 0.45 | 0.63 |
| Tj     | 0.40   | 0.43 | 0.55 | 0.26 | 0.27 | 0.28 | 0.28 | 0.45 | 0.49 | 0.14 | 0.17   | 0.16 | 0.36 | NA   | 0.53 | 0.26  | 0.11 | 0.24 | 0.21 | 0.16 | 0.36 | 0.30 |
| Sq     | 0.45   | 0.48 | 0.60 | 0.46 | 0.51 | 0.23 | 0.08 | 0.24 | 0.51 | 0.13 | 0.06   | 0.19 | 0.19 | 0.53 | NA   | 0.14  | NA   | 0.27 | 0.18 | NA   | 0.44 | 0.19 |
| P sp.  | 0.13   | 0.29 | 0.21 | 0.12 | 0.07 | 0.35 | 0.36 | 0.31 | 0.26 | 0.32 | 0.42   | 0.18 | 0.39 | 0.26 | 0.14 | NA    | 0.34 | 0.31 | 0.26 | 0.55 | 0.26 | 0.39 |
| Sv     | 0.21   | NA   | 0.01 | NA   | NA   | 0.11 | 0.23 | 0.07 | 0.18 | 0.20 | 0.60   | 0.16 | 0.31 | 0.11 | NA   | 0.34  | NA   | 0.57 | 0.01 | 0.61 | 0.18 | 0.47 |
| St     | 0.47   | 0.13 | 0.19 | NA   | 0.06 | 0.20 | 0.27 | 0.27 | 0.24 | 0.18 | 0.36   | 0.16 | 0.51 | 0.24 | 0.27 | 0.31  | 0.57 | NA   | NA   | 0.37 | 0.45 | 0.43 |
| Cs     | 0.02   | 0.38 | 0.15 | 0.31 | 0.48 | 0.25 | 0.48 | 0.25 | 0.23 | 0.25 | NA     | 0.46 | NA   | 0.21 | 0.18 | 0.26  | 0.01 | NA   | NA   | NA   | NA   | 0.03 |
| Ho     | 0.13   | NA   | NA   | NA   | NA   | 0.17 | 0.49 | 0.22 | 0.11 | 0.36 | 0.57   | 0.13 | 0.65 | 0.16 | NA   | 0.55  | 0.61 | 0.37 | NA   | NA   | 0.25 | 0.62 |
| Py     | 0.55   | 0.17 | 0.23 | 0.14 | 0.22 | 0.46 | 0.25 | 0.23 | 0.28 | 0.19 | 0.38   | 0.14 | 0.45 | 0.36 | 0.44 | 0.26  | 0.18 | 0.45 | NA   | 0.25 | NA   | 0.41 |
| Po     | 0.23   | 0.14 | 0.14 | 0.01 | 0.15 | 0.32 | 0.39 | 0.31 | 0.19 | 0.21 | 0.49   | 0.13 | 0.63 | 0.30 | 0.19 | 0.39  | 0.47 | 0.43 | 0.03 | 0.62 | 0.41 | NA   |

Correlation of Tohoku muscle metabolic profile

|        | C spp. | Sm   | Ej   | Th   | Tb   | Gm   | Tc   | Pm   | Sj   | Af   | R spp. | Lj   | Pa   | Tj   | Sq   | P sp. | Sv   | St   | Cs   | Ho   | Py   | Po   |
|--------|--------|------|------|------|------|------|------|------|------|------|--------|------|------|------|------|-------|------|------|------|------|------|------|
| C spp. | NA     | 0.00 | 0.05 | NA   | 0.07 | 0.18 | 0.17 | 0.27 | NA   | 0.24 | 0.19   | 0.16 | 0.29 | NA   | 0.17 | 0.19  | 0.38 | 0.38 | 0.20 | 0.33 | 0.29 | 0.27 |
| Sm     | 0.00   | NA   | 0.49 | 0.47 | 0.36 | 0.11 | 0.17 | 0.12 | 0.69 | 0.06 | 0.10   | 0.16 | NA   | 0.68 | 0.60 | 0.12  | 0.18 | 0.06 | 0.42 | NA   | 0.08 | 0.21 |
| Ej     | 0.05   | 0.49 | NA   | 0.60 | 0.20 | 0.45 | 0.35 | 0.25 | 0.59 | 0.14 | 0.19   | 0.28 | NA   | 0.20 | 0.32 | 0.04  | 0.10 | 0.15 | 0.31 | 0.05 | 0.14 | 0.15 |
| Th     | NA     | 0.47 | 0.60 | NA   | 0.47 | 0.36 | 0.27 | 0.31 | 0.66 | 0.14 | 0.15   | 0.31 | NA   | 0.30 | 0.40 | 0.04  | 0.08 | 0.09 | 0.35 | NA   | 0.13 | 0.15 |
| Tb     | 0.07   | 0.36 | 0.20 | 0.47 | NA   | 0.16 | 0.19 | 0.33 | 0.52 | 0.08 | NA     | 0.28 | 0.01 | 0.60 | 0.32 | 0.11  | 0.10 | NA   | 0.28 | 0.01 | 0.09 | 0.08 |
| Gm     | 0.18   | 0.11 | 0.45 | 0.36 | 0.16 | NA   | 0.50 | 0.32 | 0.18 | 0.16 | 0.08   | 0.36 | 0.14 | 0.14 | 0.18 | 0.13  | 0.17 | 0.15 | 0.30 | 0.16 | 0.15 | 0.27 |
| Tc     | 0.17   | 0.17 | 0.35 | 0.27 | 0.19 | 0.50 | NA   | 0.40 | 0.20 | 0.14 | 0.07   | 0.34 | 0.06 | 0.08 | 0.21 | 0.17  | 0.14 | 0.11 | 0.39 | 0.04 | 0.14 | 0.18 |
| Pm     | 0.27   | 0.12 | 0.25 | 0.31 | 0.33 | 0.32 | 0.40 | NA   | 0.25 | 0.34 | 0.19   | 0.21 | 0.27 | 0.10 | 0.27 | 0.27  | 0.29 | 0.36 | 0.29 | 0.45 | 0.30 | 0.30 |
| Sj     | NA     | 0.69 | 0.59 | 0.66 | 0.52 | 0.18 | 0.20 | 0.25 | NA   | 0.06 | 0.07   | 0.27 | NA   | 0.65 | 0.62 | 0.06  | 0.06 | NA   | 0.45 | NA   | 0.06 | 0.12 |
| Af     | 0.24   | 0.06 | 0.14 | 0.14 | 0.08 | 0.16 | 0.14 | 0.34 | 0.06 | NA   | 0.33   | 0.19 | 0.33 | 0.10 | 0.08 | 0.28  | 0.19 | 0.27 | 0.20 | 0.39 | 0.31 | 0.21 |
| R spp. | 0.19   | 0.10 | 0.19 | 0.15 | NA   | 0.08 | 0.07 | 0.19 | 0.07 | 0.33 | NA     | 0.27 | 0.35 | NA   | 0.07 | 0.10  | 0.29 | 0.47 | 0.19 | 0.43 | 0.51 | 0.21 |
| Lj     | 0.16   | 0.16 | 0.28 | 0.31 | 0.28 | 0.36 | 0.34 | 0.21 | 0.27 | 0.19 | 0.27   | NA   | 0.14 | 0.32 | 0.27 | 0.17  | 0.14 | 0.05 | 0.35 | 0.27 | 0.11 | 0.20 |
| Pa     | 0.29   | NA   | NA   | NA   | 0.01 | 0.14 | 0.06 | 0.27 | NA   | 0.33 | 0.35   | 0.14 | NA   | 0.06 | 0.23 | 0.49  | 0.68 | 0.62 | 0.15 | 0.74 | 0.40 | 0.59 |
| Tj     | NA     | 0.68 | 0.20 | 0.30 | 0.60 | 0.14 | 0.08 | 0.10 | 0.65 | 0.10 | NA     | 0.32 | 0.06 | NA   | 0.53 | 0.18  | 0.15 | NA   | 0.44 | 0.09 | 0.09 | 0.18 |
| Sq     | 0.17   | 0.60 | 0.32 | 0.40 | 0.32 | 0.18 | 0.21 | 0.27 | 0.62 | 0.08 | 0.07   | 0.27 | 0.23 | 0.53 | NA   | 0.13  | 0.22 | 0.07 | 0.35 | 0.16 | 0.21 | 0.21 |
| P sp.  | 0.19   | 0.12 | 0.04 | 0.04 | 0.11 | 0.13 | 0.17 | 0.27 | 0.06 | 0.28 | 0.10   | 0.17 | 0.49 | 0.18 | 0.13 | NA    | 0.39 | 0.30 | 0.11 | 0.36 | 0.25 | 0.40 |
| Sv     | 0.38   | 0.18 | 0.10 | 0.08 | 0.10 | 0.17 | 0.14 | 0.29 | 0.06 | 0.19 | 0.29   | 0.14 | 0.68 | 0.15 | 0.22 | 0.39  | NA   | 0.71 | 0.11 | 0.59 | 0.42 | 0.62 |
| St     | 0.38   | 0.06 | 0.15 | 0.09 | NA   | 0.15 | 0.11 | 0.36 | NA   | 0.27 | 0.47   | 0.05 | 0.62 | NA   | 0.07 | 0.30  | 0.71 | NA   | 0.11 | 0.57 | 0.56 | 0.47 |
| Cs     | 0.20   | 0.42 | 0.31 | 0.35 | 0.28 | 0.30 | 0.39 | 0.29 | 0.45 | 0.20 | 0.19   | 0.35 | 0.15 | 0.44 | 0.35 | 0.11  | 0.11 | 0.11 | NA   | 0.02 | 0.24 | 0.14 |
| Ho     | 0.33   | NA   | 0.05 | NA   | 0.01 | 0.16 | 0.04 | 0.45 | NA   | 0.39 | 0.43   | 0.27 | 0.74 | 0.09 | 0.16 | 0.36  | 0.59 | 0.57 | 0.02 | NA   | 0.42 | 0.52 |
| Py     | 0.29   | 0.08 | 0.14 | 0.13 | 0.09 | 0.15 | 0.14 | 0.30 | 0.06 | 0.31 | 0.51   | 0.11 | 0.40 | 0.09 | 0.21 | 0.25  | 0.42 | 0.56 | 0.24 | 0.42 | NA   | 0.30 |
| Po     | 0.27   | 0.21 | 0.15 | 0.15 | 0.08 | 0.27 | 0.18 | 0.30 | 0.12 | 0.21 | 0.21   | 0.20 | 0.59 | 0.18 | 0.21 | 0.40  | 0.62 | 0.47 | 0.14 | 0.52 | 0.30 | NA   |

Correlation of Kanto gut contents metabolic profile

|        | C spp. | Sm   | Ej   | Th   | Tb   | Pj   | Pm   | Bs   | Sj   | Af   | R spp. | Lj   | Pa   | Tj   | Sq   | P sp. | Sv   | St   | Cs   | Ho   | Py   | Po   |
|--------|--------|------|------|------|------|------|------|------|------|------|--------|------|------|------|------|-------|------|------|------|------|------|------|
| C spp. | NA     | 0.15 | 0.15 | 0.14 | 0.31 | 0.26 | 0.20 | 0.22 | 0.15 | 0.13 | 0.19   | 0.16 | 0.10 | 0.15 | 0.19 | 0.25  | 0.19 | 0.10 | 0.23 | 0.17 | 0.16 | 0.30 |
| Sm     | 0.15   | NA   | 0.52 | 0.30 | 0.28 | 0.20 | 0.11 | NA   | 0.63 | NA   | 0.28   | 0.16 | 0.07 | 0.49 | 0.65 | 0.25  | 0.09 | 0.01 | 0.17 | 0.06 | 0.29 | 0.12 |
| Ej     | 0.15   | 0.52 | NA   | 0.41 | 0.13 | 0.10 | 0.07 | 0.14 | 0.77 | 0.21 | 0.17   | NA   | 0.01 | 0.38 | 0.33 | 0.28  | 0.03 | NA   | 0.16 | 0.08 | 0.13 | 0.17 |
| Th     | 0.14   | 0.30 | 0.41 | NA   | 0.24 | 0.42 | 0.23 | 0.40 | 0.33 | 0.31 | 0.27   | 0.21 | 0.06 | 0.35 | 0.13 | 0.37  | 0.13 | 0.18 | 0.27 | 0.25 | 0.33 | 0.28 |
| Tb     | 0.31   | 0.28 | 0.13 | 0.24 | NA   | NA   | 0.05 | NA   | 0.24 | 0.31 | 0.03   | 0.19 | NA   | 0.21 | 0.36 | 0.12  | 0.29 | 0.22 | 0.16 | 0.29 | 0.25 | 0.31 |
| Pj     | 0.26   | 0.20 | 0.10 | 0.42 | NA   | NA   | 0.45 | 0.60 | 0.12 | 0.13 | 0.34   | 0.18 | 0.37 | 0.09 | 0.12 | 0.14  | 0.08 | NA   | 0.30 | 0.41 | 0.20 | 0.20 |
| Pm     | 0.20   | 0.11 | 0.07 | 0.23 | 0.05 | 0.45 | NA   | 0.29 | 0.10 | 0.12 | 0.50   | 0.31 | 0.35 | 0.18 | 0.04 | 0.34  | 0.27 | 0.17 | 0.15 | 0.26 | 0.23 | 0.18 |
| Bs     | 0.22   | NA   | 0.14 | 0.40 | NA   | 0.60 | 0.29 | NA   | 0.13 | 0.13 | 0.20   | 0.17 | 0.45 | NA   | NA   | NA    | 0.12 | 0.19 | 0.40 | 0.32 | 0.36 | 0.12 |
| Sj     | 0.15   | 0.63 | 0.77 | 0.33 | 0.24 | 0.12 | 0.10 | 0.13 | NA   | 0.10 | 0.15   | NA   | 0.04 | 0.39 | 0.48 | 0.23  | 0.11 | 0.03 | 0.15 | NA   | 0.12 | 0.18 |
| Af     | 0.13   | NA   | 0.21 | 0.31 | 0.31 | 0.13 | 0.12 | 0.13 | 0.10 | NA   | 0.13   | 0.35 | 0.08 | 0.16 | NA   | 0.04  | 0.22 | 0.23 | 0.20 | 0.22 | 0.21 | 0.12 |
| R spp. | 0.19   | 0.28 | 0.17 | 0.27 | 0.03 | 0.34 | 0.50 | 0.20 | 0.15 | 0.13 | NA     | 0.33 | 0.36 | 0.32 | 0.12 | 0.40  | 0.33 | 0.26 | 0.23 | 0.18 | 0.25 | 0.11 |
| Lj     | 0.16   | 0.16 | NA   | 0.21 | 0.19 | 0.18 | 0.31 | 0.17 | NA   | 0.35 | 0.33   | NA   | 0.42 | 0.16 | 0.02 | 0.15  | 0.33 | 0.40 | 0.21 | 0.30 | 0.27 | 0.16 |
| Pa     | 0.10   | 0.07 | 0.01 | 0.06 | NA   | 0.37 | 0.35 | 0.45 | 0.04 | 0.08 | 0.36   | 0.42 | NA   | 0.04 | 0.02 | 0.16  | 0.35 | 0.33 | 0.29 | 0.22 | 0.36 | 0.29 |
| Tj     | 0.15   | 0.49 | 0.38 | 0.35 | 0.21 | 0.09 | 0.18 | NA   | 0.39 | 0.16 | 0.32   | 0.16 | 0.04 | NA   | 0.32 | 0.14  | 0.11 | 0.04 | 0.26 | NA   | 0.26 | 0.03 |
| Sq     | 0.19   | 0.65 | 0.33 | 0.13 | 0.36 | 0.12 | 0.04 | NA   | 0.48 | NA   | 0.12   | 0.02 | 0.02 | 0.32 | NA   | 0.30  | 0.11 | NA   | 0.13 | NA   | 0.31 | 0.23 |
| P sp.  | 0.25   | 0.25 | 0.28 | 0.37 | 0.12 | 0.14 | 0.34 | NA   | 0.23 | 0.04 | 0.40   | 0.15 | 0.16 | 0.14 | 0.30 | NA    | 0.27 | 0.12 | 0.17 | 0.16 | 0.33 | 0.29 |
| Sv     | 0.19   | 0.09 | 0.03 | 0.13 | 0.29 | 0.08 | 0.27 | 0.12 | 0.11 | 0.22 | 0.33   | 0.33 | 0.35 | 0.11 | 0.11 | 0.27  | NA   | 0.35 | 0.18 | 0.24 | 0.34 | 0.28 |
| St     | 0.10   | 0.01 | NA   | 0.18 | 0.22 | NA   | 0.17 | 0.19 | 0.03 | 0.23 | 0.26   | 0.40 | 0.33 | 0.04 | NA   | 0.12  | 0.35 | NA   | 0.20 | 0.28 | 0.25 | 0.18 |
| Cs     | 0.23   | 0.17 | 0.16 | 0.27 | 0.16 | 0.30 | 0.15 | 0.40 | 0.15 | 0.20 | 0.23   | 0.21 | 0.29 | 0.26 | 0.13 | 0.17  | 0.18 | 0.20 | NA   | 0.23 | 0.20 | 0.22 |
| Ho     | 0.17   | 0.06 | 0.08 | 0.25 | 0.29 | 0.41 | 0.26 | 0.32 | NA   | 0.22 | 0.18   | 0.30 | 0.22 | NA   | NA   | 0.16  | 0.24 | 0.28 | 0.23 | NA   | 0.12 | 0.32 |
| Py     | 0.16   | 0.29 | 0.13 | 0.33 | 0.25 | 0.20 | 0.23 | 0.36 | 0.12 | 0.21 | 0.25   | 0.27 | 0.36 | 0.26 | 0.31 | 0.33  | 0.34 | 0.25 | 0.20 | 0.12 | NA   | 0.31 |
| Po     | 0.30   | 0.12 | 0.17 | 0.28 | 0.31 | 0.20 | 0.18 | 0.12 | 0.18 | 0.12 | 0.11   | 0.16 | 0.29 | 0.03 | 0.23 | 0.29  | 0.28 | 0.18 | 0.22 | 0.32 | 0.31 | NA   |

Correlation of Tohoku gut contents metabolic profile

|        | C spp. | Sm   | Ej   | Th   | Tb   | Gm   | Tc   | Pm   | Sj   | Af   | R spp. | Lj   | Pa   | Tj   | Sq   | P sp. | Sv   | St   | Cs   | Ho   | Py   | Po   |
|--------|--------|------|------|------|------|------|------|------|------|------|--------|------|------|------|------|-------|------|------|------|------|------|------|
| C spp. | NA     | 0.21 | 0.23 | 0.46 | 0.21 | 0.11 | 0.01 | 0.15 | 0.24 | 0.06 | 0.16   | 0.46 | 0.15 | 0.17 | 0.28 | 0.32  | 0.14 | 0.15 | 0.19 | NA   | 0.10 | 0.25 |
| Sm     | 0.21   | NA   | 0.33 | 0.26 | 0.01 | NA   | NA   | 0.28 | 0.55 | 0.01 | 0.09   | 0.26 | 0.15 | 0.39 | 0.78 | 0.21  | 0.10 | 0.06 | 0.33 | 0.31 | 0.17 | 0.19 |
| Ej     | 0.23   | 0.33 | NA   | 0.30 | 0.30 | 0.16 | 0.21 | 0.23 | 0.44 | 0.22 | 0.27   | 0.32 | 0.31 | 0.24 | 0.29 | 0.16  | 0.22 | 0.31 | 0.20 | 0.18 | 0.22 | 0.18 |
| Th     | 0.46   | 0.26 | 0.30 | NA   | 0.14 | 0.06 | 0.18 | 0.15 | 0.40 | 0.24 | 0.16   | 0.29 | 0.30 | 0.19 | 0.32 | 0.14  | 0.22 | 0.15 | 0.12 | NA   | 0.24 | 0.21 |
| Tb     | 0.21   | 0.01 | 0.30 | 0.14 | NA   | 0.28 | 0.17 | 0.35 | 0.13 | 0.22 | 0.45   | 0.26 | 0.38 | 0.15 | 0.04 | 0.27  | 0.20 | 0.16 | 0.30 | 0.24 | 0.28 | 0.38 |
| Gm     | 0.11   | NA   | 0.16 | 0.06 | 0.28 | NA   | 0.44 | 0.29 | 0.03 | 0.04 | 0.20   | 0.34 | 0.15 | 0.08 | NA   | 0.08  | 0.19 | 0.15 | 0.12 | 0.11 | 0.20 | 0.08 |
| Tc     | 0.01   | NA   | 0.21 | 0.18 | 0.17 | 0.44 | NA   | 0.16 | 0.12 | 0.26 | 0.24   | 0.30 | 0.05 | 0.09 | NA   | NA    | 0.23 | 0.21 | 0.20 | 0.25 | 0.16 | 0.23 |
| Pm     | 0.15   | 0.28 | 0.23 | 0.15 | 0.35 | 0.29 | 0.16 | NA   | 0.23 | 0.21 | 0.37   | 0.31 | 0.25 | 0.21 | 0.30 | 0.37  | 0.31 | 0.23 | 0.29 | 0.36 | 0.37 | 0.04 |
| Sj     | 0.24   | 0.55 | 0.44 | 0.40 | 0.13 | 0.03 | 0.12 | 0.23 | NA   | NA   | 0.14   | 0.27 | 0.21 | 0.35 | 0.56 | 0.16  | NA   | NA   | 0.23 | 0.14 | NA   | 0.18 |
| Af     | 0.06   | 0.01 | 0.22 | 0.24 | 0.22 | 0.04 | 0.26 | 0.21 | NA   | NA   | 0.33   | 0.31 | 0.07 | 0.10 | NA   | 0.09  | 0.30 | 0.32 | 0.19 | 0.19 | 0.31 | 0.27 |
| R spp. | 0.16   | 0.09 | 0.27 | 0.16 | 0.45 | 0.20 | 0.24 | 0.37 | 0.14 | 0.33 | NA     | 0.24 | 0.34 | 0.27 | 0.06 | 0.31  | 0.17 | 0.15 | 0.30 | 0.23 | 0.28 | 0.15 |
| Lj     | 0.46   | 0.26 | 0.32 | 0.29 | 0.26 | 0.34 | 0.30 | 0.31 | 0.27 | 0.31 | 0.24   | NA   | 0.26 | 0.17 | 0.25 | 0.25  | 0.30 | 0.17 | 0.26 | 0.24 | 0.53 | 0.11 |
| Pa     | 0.15   | 0.15 | 0.31 | 0.30 | 0.38 | 0.15 | 0.05 | 0.25 | 0.21 | 0.07 | 0.34   | 0.26 | NA   | 0.17 | 0.07 | 0.34  | 0.28 | 0.10 | 0.19 | 0.09 | 0.37 | 0.12 |
| Tj     | 0.17   | 0.39 | 0.24 | 0.19 | 0.15 | 0.08 | 0.09 | 0.21 | 0.35 | 0.10 | 0.27   | 0.17 | 0.17 | NA   | 0.38 | 0.21  | 0.14 | 0.19 | 0.30 | 0.19 | 0.12 | 0.10 |
| Sq     | 0.28   | 0.78 | 0.29 | 0.32 | 0.04 | NA   | NA   | 0.30 | 0.56 | NA   | 0.06   | 0.25 | 0.07 | 0.38 | NA   | 0.19  | 0.06 | 0.05 | 0.38 | 0.19 | 0.10 | 0.17 |
| P sp.  | 0.32   | 0.21 | 0.16 | 0.14 | 0.27 | 0.08 | NA   | 0.37 | 0.16 | 0.09 | 0.31   | 0.25 | 0.34 | 0.21 | 0.19 | NA    | 0.19 | 0.19 | 0.19 | 0.32 | 0.27 | 0.31 |
| Sv     | 0.14   | 0.10 | 0.22 | 0.22 | 0.20 | 0.19 | 0.23 | 0.31 | NA   | 0.30 | 0.17   | 0.30 | 0.28 | 0.14 | 0.06 | 0.19  | NA   | 0.44 | 0.24 | 0.27 | 0.39 | 0.28 |
| St     | 0.15   | 0.06 | 0.31 | 0.15 | 0.16 | 0.15 | 0.21 | 0.23 | NA   | 0.32 | 0.15   | 0.17 | 0.10 | 0.19 | 0.05 | 0.19  | 0.44 | NA   | 0.22 | 0.21 | 0.25 | 0.29 |
| Cs     | 0.19   | 0.33 | 0.20 | 0.12 | 0.30 | 0.12 | 0.20 | 0.29 | 0.23 | 0.19 | 0.30   | 0.26 | 0.19 | 0.30 | 0.38 | 0.19  | 0.24 | 0.22 | NA   | 0.27 | 0.20 | 0.15 |
| Ho     | NA     | 0.31 | 0.18 | NA   | 0.24 | 0.11 | 0.25 | 0.36 | 0.14 | 0.19 | 0.23   | 0.24 | 0.09 | 0.19 | 0.19 | 0.32  | 0.27 | 0.21 | 0.27 | NA   | 0.18 | 0.21 |
| Py     | 0.10   | 0.17 | 0.22 | 0.24 | 0.28 | 0.20 | 0.16 | 0.37 | NA   | 0.31 | 0.28   | 0.53 | 0.37 | 0.12 | 0.10 | 0.27  | 0.39 | 0.25 | 0.20 | 0.18 | NA   | 0.23 |
| Po     | 0.25   | 0.19 | 0.18 | 0.21 | 0.38 | 0.08 | 0.23 | 0.04 | 0.18 | 0.27 | 0.15   | 0.11 | 0.12 | 0.10 | 0.17 | 0.31  | 0.28 | 0.29 | 0.15 | 0.21 | 0.23 | NA   |

Correlation of Kanto muscle inorganic profile

|        | C spp. | Sm   | Ej   | Th   | Tb   | Pj   | Pm   | Bs   | Sj   | Af   | R spp. | Lj   | Pa   | Tj   | Sq   | P sp. | Sv   | St   | Cs   | Ho   | Py   | Po   |
|--------|--------|------|------|------|------|------|------|------|------|------|--------|------|------|------|------|-------|------|------|------|------|------|------|
| C spp. | NA     | 0.24 | 0.12 | 0.42 | 0.47 | 0.39 | 0.33 | 0.42 | 0.32 | 0.13 | 0.32   | 0.62 | 0.37 | 0.27 | 0.22 | 0.42  | 0.41 | 0.35 | NA   | 0.29 | 0.38 | 0.40 |
| Sm     | 0.24   | NA   | 0.07 | 0.09 | 0.48 | 0.25 | 0.16 | NA   | 0.29 | 0.31 | 0.42   | 0.23 | 0.14 | 0.51 | 0.21 | 0.12  | 0.14 | 0.24 | 0.24 | 0.26 | 0.39 | 0.10 |
| Ej     | 0.12   | 0.07 | NA   | 0.17 | 0.27 | 0.13 | 0.19 | 0.20 | 0.32 | 0.13 | 0.06   | 0.14 | 0.16 | 0.49 | 0.29 | 0.15  | 0.15 | 0.16 | 0.09 | 0.16 | 0.08 | 0.15 |
| Th     | 0.42   | 0.09 | 0.17 | NA   | 0.44 | 0.35 | 0.35 | 0.39 | 0.40 | 0.11 | 0.15   | 0.56 | 0.32 | 0.14 | 0.45 | 0.40  | 0.43 | 0.33 | NA   | 0.22 | 0.37 | 0.45 |
| Tb     | 0.47   | 0.48 | 0.27 | 0.44 | NA   | 0.27 | 0.29 | 0.49 | 0.47 | 0.34 | 0.31   | 0.45 | 0.45 | 0.34 | 0.41 | 0.56  | 0.32 | 0.29 | 0.43 | 0.29 | 0.44 | 0.47 |
| Pj     | 0.39   | 0.25 | 0.13 | 0.35 | 0.27 | NA   | 0.50 | 0.39 | 0.15 | 0.20 | 0.18   | 0.45 | 0.41 | 0.19 | 0.33 | 0.35  | 0.47 | 0.39 | 0.05 | 0.13 | 0.17 | 0.36 |
| Pm     | 0.33   | 0.16 | 0.19 | 0.35 | 0.29 | 0.50 | NA   | 0.41 | 0.29 | 0.04 | 0.23   | 0.23 | 0.69 | 0.32 | 0.34 | 0.57  | 0.38 | 0.43 | NA   | 0.26 | 0.17 | 0.51 |
| Bs     | 0.42   | NA   | 0.20 | 0.39 | 0.49 | 0.39 | 0.41 | NA   | 0.63 | 0.14 | 0.15   | 0.26 | 0.60 | 0.34 | 0.62 | 0.48  | 0.24 | 0.44 | NA   | 0.31 | 0.35 | 0.75 |
| Sj     | 0.32   | 0.29 | 0.32 | 0.40 | 0.47 | 0.15 | 0.29 | 0.63 | NA   | 0.32 | 0.40   | 0.34 | 0.32 | 0.27 | 0.60 | 0.40  | 0.22 | 0.31 | 0.46 | 0.39 | 0.34 | 0.58 |
| Af     | 0.13   | 0.31 | 0.13 | 0.11 | 0.34 | 0.20 | 0.04 | 0.14 | 0.32 | NA   | 0.26   | 0.20 | NA   | 0.21 | 0.33 | 0.07  | 0.21 | 0.11 | 0.60 | 0.35 | 0.36 | 0.14 |
| R spp. | 0.32   | 0.42 | 0.06 | 0.15 | 0.31 | 0.18 | 0.23 | 0.15 | 0.40 | 0.26 | NA     | 0.57 | 0.27 | 0.31 | 0.23 | 0.31  | 0.26 | 0.24 | 0.23 | 0.36 | 0.33 | 0.26 |
| Lj     | 0.62   | 0.23 | 0.14 | 0.56 | 0.45 | 0.45 | 0.23 | 0.26 | 0.34 | 0.20 | 0.57   | NA   | 0.21 | 0.43 | 0.09 | 0.21  | 0.62 | 0.21 | 0.18 | 0.11 | 0.45 | 0.21 |
| Pa     | 0.37   | 0.14 | 0.16 | 0.32 | 0.45 | 0.41 | 0.69 | 0.60 | 0.32 | NA   | 0.27   | 0.21 | NA   | 0.36 | 0.42 | 0.77  | 0.24 | 0.60 | NA   | 0.26 | 0.16 | 0.78 |
| Tj     | 0.27   | 0.51 | 0.49 | 0.14 | 0.34 | 0.19 | 0.32 | 0.34 | 0.27 | 0.21 | 0.31   | 0.43 | 0.36 | NA   | 0.41 | 0.35  | 0.17 | 0.30 | 0.17 | 0.23 | 0.45 | 0.26 |
| Sq     | 0.22   | 0.21 | 0.29 | 0.45 | 0.41 | 0.33 | 0.34 | 0.62 | 0.60 | 0.33 | 0.23   | 0.09 | 0.42 | 0.41 | NA   | 0.44  | 0.20 | 0.29 | 0.70 | 0.65 | 0.45 | 0.64 |
| P sp.  | 0.42   | 0.12 | 0.15 | 0.40 | 0.56 | 0.35 | 0.57 | 0.48 | 0.40 | 0.07 | 0.31   | 0.21 | 0.77 | 0.35 | 0.44 | NA    | 0.30 | 0.59 | NA   | 0.23 | 0.35 | 0.78 |
| Sv     | 0.41   | 0.14 | 0.15 | 0.43 | 0.32 | 0.47 | 0.38 | 0.24 | 0.22 | 0.21 | 0.26   | 0.62 | 0.24 | 0.17 | 0.20 | 0.30  | NA   | 0.28 | 0.34 | 0.24 | 0.39 | 0.19 |
| St     | 0.35   | 0.24 | 0.16 | 0.33 | 0.29 | 0.39 | 0.43 | 0.44 | 0.31 | 0.11 | 0.24   | 0.21 | 0.60 | 0.30 | 0.29 | 0.59  | 0.28 | NA   | NA   | 0.22 | 0.20 | 0.56 |
| Cs     | NA     | 0.24 | 0.09 | NA   | 0.43 | 0.05 | NA   | NA   | 0.46 | 0.60 | 0.23   | 0.18 | NA   | 0.17 | 0.70 | NA    | 0.34 | NA   | NA   | 0.56 | 0.32 | NA   |
| Ho     | 0.29   | 0.26 | 0.16 | 0.22 | 0.29 | 0.13 | 0.26 | 0.31 | 0.39 | 0.35 | 0.36   | 0.11 | 0.26 | 0.23 | 0.65 | 0.23  | 0.24 | 0.22 | 0.56 | NA   | 0.24 | 0.34 |
| Py     | 0.38   | 0.39 | 0.08 | 0.37 | 0.44 | 0.17 | 0.17 | 0.35 | 0.34 | 0.36 | 0.33   | 0.45 | 0.16 | 0.45 | 0.45 | 0.35  | 0.39 | 0.20 | 0.32 | 0.24 | NA   | 0.52 |
| Po     | 0.40   | 0.10 | 0.15 | 0.45 | 0.47 | 0.36 | 0.51 | 0.75 | 0.58 | 0.14 | 0.26   | 0.21 | 0.78 | 0.26 | 0.64 | 0.78  | 0.19 | 0.56 | NA   | 0.34 | 0.52 | NA   |

Correlation of Tohoku muscle inorganic profile

|        | C spp. | Sm   | Ej   | Th   | Tb   | Gm   | Tc   | Pm   | Sj   | Af   | R spp. | Lj   | Pa   | Tj   | Sq   | P sp. | Sv   | St   | Cs   | Ho   | Py   | Po   |
|--------|--------|------|------|------|------|------|------|------|------|------|--------|------|------|------|------|-------|------|------|------|------|------|------|
| C spp. | NA     | 0.10 | 0.15 | 0.47 | 0.55 | 0.14 | 0.28 | 0.26 | 0.11 | 0.23 | 0.23   | 0.21 | 0.31 | 0.15 | 0.15 | 0.36  | 0.27 | 0.49 | 0.15 | 0.20 | 0.25 | 0.21 |
| Sm     | 0.10   | NA   | 0.18 | 0.11 | NA   | 0.38 | 0.23 | 0.20 | 0.51 | 0.44 | 0.41   | 0.54 | 0.20 | 0.05 | 0.13 | 0.44  | 0.13 | 0.16 | 0.45 | 0.18 | 0.27 | 0.42 |
| Ej     | 0.15   | 0.18 | NA   | 0.22 | 0.18 | 0.49 | 0.24 | 0.14 | 0.34 | 0.15 | 0.07   | 0.12 | 0.17 | 0.13 | 0.12 | 0.13  | 0.18 | 0.14 | 0.36 | 0.11 | 0.14 | 0.19 |
| Th     | 0.47   | 0.11 | 0.22 | NA   | 0.75 | 0.54 | 0.26 | 0.36 | 0.27 | 0.23 | 0.29   | 0.32 | 0.23 | 0.34 | 0.21 | 0.59  | 0.47 | 0.35 | 0.11 | 0.43 | 0.33 | 0.18 |
| Tb     | 0.55   | NA   | 0.18 | 0.75 | NA   | NA   | 0.31 | 0.48 | 0.28 | 0.17 | 0.13   | 0.34 | 0.20 | 0.19 | 0.10 | 0.76  | 0.47 | 0.26 | NA   | 0.32 | 0.27 | NA   |
| Gm     | 0.14   | 0.38 | 0.49 | 0.54 | NA   | NA   | 0.36 | 0.20 | 0.33 | 0.40 | 0.23   | 0.17 | 0.11 | 0.28 | 0.26 | 0.36  | 0.08 | 0.07 | 0.43 | 0.41 | 0.21 | 0.15 |
| Tc     | 0.28   | 0.23 | 0.24 | 0.26 | 0.31 | 0.36 | NA   | 0.16 | 0.30 | 0.31 | 0.28   | 0.10 | 0.21 | 0.16 | 0.18 | 0.25  | 0.28 | 0.17 | 0.13 | 0.27 | 0.12 | 0.11 |
| Pm     | 0.26   | 0.20 | 0.14 | 0.36 | 0.48 | 0.20 | 0.16 | NA   | 0.31 | 0.33 | 0.23   | 0.29 | 0.26 | 0.24 | 0.11 | 0.33  | 0.37 | 0.25 | 0.21 | 0.32 | 0.34 | 0.11 |
| Sj     | 0.11   | 0.51 | 0.34 | 0.27 | 0.28 | 0.33 | 0.30 | 0.31 | NA   | 0.44 | 0.39   | 0.22 | 0.27 | 0.36 | 0.20 | 0.28  | 0.21 | 0.19 | 0.34 | 0.29 | 0.21 | 0.27 |
| Af     | 0.23   | 0.44 | 0.15 | 0.23 | 0.17 | 0.40 | 0.31 | 0.33 | 0.44 | NA   | 0.39   | 0.33 | 0.20 | 0.20 | 0.25 | 0.30  | 0.28 | 0.12 | 0.37 | 0.42 | 0.31 | 0.32 |
| R spp. | 0.23   | 0.41 | 0.07 | 0.29 | 0.13 | 0.23 | 0.28 | 0.23 | 0.39 | 0.39 | NA     | 0.29 | 0.21 | 0.36 | 0.33 | 0.31  | 0.25 | 0.21 | 0.37 | 0.41 | 0.26 | 0.41 |
| Lj     | 0.21   | 0.54 | 0.12 | 0.32 | 0.34 | 0.17 | 0.10 | 0.29 | 0.22 | 0.33 | 0.29   | NA   | 0.37 | 0.38 | 0.38 | 0.34  | 0.38 | 0.35 | 0.40 | 0.16 | 0.32 | 0.37 |
| Pa     | 0.31   | 0.20 | 0.17 | 0.23 | 0.20 | 0.11 | 0.21 | 0.26 | 0.27 | 0.20 | 0.21   | 0.37 | NA   | 0.49 | 0.35 | 0.31  | 0.37 | 0.39 | 0.38 | 0.22 | 0.25 | 0.46 |
| Tj     | 0.15   | 0.05 | 0.13 | 0.34 | 0.19 | 0.28 | 0.16 | 0.24 | 0.36 | 0.20 | 0.36   | 0.38 | 0.49 | NA   | 0.64 | 0.40  | 0.34 | 0.29 | 0.19 | 0.43 | 0.41 | 0.67 |
| Sq     | 0.15   | 0.13 | 0.12 | 0.21 | 0.10 | 0.26 | 0.18 | 0.11 | 0.20 | 0.25 | 0.33   | 0.38 | 0.35 | 0.64 | NA   | 0.40  | 0.29 | 0.26 | 0.28 | 0.38 | 0.38 | 0.54 |
| P sp.  | 0.36   | 0.44 | 0.13 | 0.59 | 0.76 | 0.36 | 0.25 | 0.33 | 0.28 | 0.30 | 0.31   | 0.34 | 0.31 | 0.40 | 0.40 | NA    | 0.53 | 0.41 | 0.38 | 0.37 | 0.30 | 0.41 |
| Sv     | 0.27   | 0.13 | 0.18 | 0.47 | 0.47 | 0.08 | 0.28 | 0.37 | 0.21 | 0.28 | 0.25   | 0.38 | 0.37 | 0.34 | 0.29 | 0.53  | NA   | 0.46 | 0.11 | 0.26 | 0.29 | 0.28 |
| St     | 0.49   | 0.16 | 0.14 | 0.35 | 0.26 | 0.07 | 0.17 | 0.25 | 0.19 | 0.12 | 0.21   | 0.35 | 0.39 | 0.29 | 0.26 | 0.41  | 0.46 | NA   | 0.22 | 0.19 | 0.29 | 0.36 |
| Cs     | 0.15   | 0.45 | 0.36 | 0.11 | NA   | 0.43 | 0.13 | 0.21 | 0.34 | 0.37 | 0.37   | 0.40 | 0.38 | 0.19 | 0.28 | 0.38  | 0.11 | 0.22 | NA   | 0.19 | 0.31 | 0.65 |
| Ho     | 0.20   | 0.18 | 0.11 | 0.43 | 0.32 | 0.41 | 0.27 | 0.32 | 0.29 | 0.42 | 0.41   | 0.16 | 0.22 | 0.43 | 0.28 | 0.37  | 0.26 | 0.19 | 0.19 | NA   | 0.26 | 0.24 |
| Py     | 0.25   | 0.27 | 0.14 | 0.33 | 0.27 | 0.21 | 0.12 | 0.34 | 0.21 | 0.31 | 0.26   | 0.32 | 0.25 | 0.41 | 0.38 | 0.30  | 0.29 | 0.29 | 0.31 | 0.26 | NA   | 0.44 |
| Po     | 0.21   | 0.42 | 0.19 | 0.18 | NA   | 0.15 | 0.11 | 0.11 | 0.27 | 0.32 | 0.41   | 0.37 | 0.46 | 0.67 | 0.54 | 0.41  | 0.28 | 0.36 | 0.65 | 0.24 | 0.44 | NA   |

Correlation of Kanto gut contents inorganic profile

|        | C spp. | Sm   | Ej   | Th   | Tb   | Pj   | Pm   | Bs   | Sj   | Af   | R spp. | Lj   | Pa   | Tj   | Sq   | P sp. | Sv   | St   | Cs   | Ho   | Py   | Po   |
|--------|--------|------|------|------|------|------|------|------|------|------|--------|------|------|------|------|-------|------|------|------|------|------|------|
| C spp. | NA     | 0.62 | 0.19 | 0.41 | 0.31 | 0.37 | 0.19 | 0.74 | 0.38 | 0.10 | 0.11   | 0.11 | 0.24 | 0.44 | 0.59 | 0.29  | 0.34 | 0.83 | 0.78 | 0.04 | 0.37 | 0.62 |
| Sm     | 0.62   | NA   | 0.42 | 0.20 | 0.30 | 0.60 | 0.44 | 0.51 | 0.67 | 0.05 | 0.05   | 0.22 | 0.44 | 0.73 | 0.83 | 0.41  | 0.37 | 0.73 | 0.66 | 0.02 | 0.64 | 0.72 |
| Ej     | 0.19   | 0.42 | NA   | 0.29 | 0.29 | 0.44 | 0.43 | 0.29 | 0.65 | 0.16 | 0.27   | 0.36 | 0.35 | 0.39 | 0.37 | 0.58  | 0.46 | 0.27 | 0.31 | 0.15 | 0.27 | 0.34 |
| Th     | 0.41   | 0.20 | 0.29 | NA   | 0.46 | 0.24 | 0.45 | 0.75 | 0.28 | 0.52 | 0.39   | 0.29 | 0.37 | 0.23 | 0.13 | 0.39  | 0.38 | 0.48 | 0.60 | 0.39 | 0.43 | 0.22 |
| Tb     | 0.31   | 0.30 | 0.29 | 0.46 | NA   | 0.50 | 0.57 | 0.26 | 0.24 | 0.47 | 0.74   | 0.31 | 0.28 | 0.20 | 0.28 | 0.07  | 0.56 | 0.35 | 0.41 | 0.46 | 0.46 | 0.24 |
| Pj     | 0.37   | 0.60 | 0.44 | 0.24 | 0.50 | NA   | 0.48 | 0.26 | 0.34 | 0.30 | 0.43   | 0.31 | 0.28 | 0.45 | 0.52 | 0.23  | 0.31 | 0.37 | 0.32 | 0.44 | 0.18 | 0.38 |
| Pm     | 0.19   | 0.44 | 0.43 | 0.45 | 0.57 | 0.48 | NA   | 0.34 | 0.44 | 0.29 | 0.44   | 0.42 | 0.36 | 0.27 | 0.54 | 0.48  | 0.55 | 0.29 | 0.32 | 0.63 | 0.30 | 0.49 |
| Bs     | 0.74   | 0.51 | 0.29 | 0.75 | 0.26 | 0.26 | 0.34 | NA   | 0.43 | 0.06 | 0.24   | 0.09 | 0.36 | 0.38 | 0.49 | 0.46  | 0.32 | 0.83 | 0.87 | 0.18 | 0.29 | 0.52 |
| Sj     | 0.38   | 0.67 | 0.65 | 0.28 | 0.24 | 0.34 | 0.44 | 0.43 | NA   | 0.19 | 0.21   | 0.24 | 0.32 | 0.57 | 0.63 | 0.52  | 0.39 | 0.49 | 0.49 | 0.21 | 0.37 | 0.56 |
| Af     | 0.10   | 0.05 | 0.16 | 0.52 | 0.47 | 0.30 | 0.29 | 0.06 | 0.19 | NA   | 0.54   | 0.28 | 0.13 | 0.08 | NA   | NA    | 0.41 | 0.09 | 0.13 | 0.34 | 0.33 | 0.12 |
| R spp. | 0.11   | 0.05 | 0.27 | 0.39 | 0.74 | 0.43 | 0.44 | 0.24 | 0.21 | 0.54 | NA     | 0.40 | 0.34 | NA   | NA   | 0.26  | 0.59 | 0.17 | 0.25 | 0.48 | 0.41 | 0.02 |
| Lj     | 0.11   | 0.22 | 0.36 | 0.29 | 0.31 | 0.31 | 0.42 | 0.09 | 0.24 | 0.28 | 0.40   | NA   | 0.56 | 0.27 | 0.23 | 0.41  | 0.45 | 0.23 | 0.16 | 0.34 | 0.44 | 0.28 |
| Pa     | 0.24   | 0.44 | 0.35 | 0.37 | 0.28 | 0.28 | 0.36 | 0.36 | 0.32 | 0.13 | 0.34   | 0.56 | NA   | 0.29 | 0.54 | 0.54  | 0.52 | 0.36 | 0.36 | 0.35 | 0.51 | 0.39 |
| Tj     | 0.44   | 0.73 | 0.39 | 0.23 | 0.20 | 0.45 | 0.27 | 0.38 | 0.57 | 0.08 | NA     | 0.27 | 0.29 | NA   | 0.54 | 0.35  | 0.34 | 0.51 | 0.49 | 0.04 | 0.31 | 0.42 |
| Sq     | 0.59   | 0.83 | 0.37 | 0.13 | 0.28 | 0.52 | 0.54 | 0.49 | 0.63 | NA   | NA     | 0.23 | 0.54 | 0.54 | NA   | 0.57  | 0.45 | 0.68 | 0.63 | NA   | 0.66 | 0.82 |
| P sp.  | 0.29   | 0.41 | 0.58 | 0.39 | 0.07 | 0.23 | 0.48 | 0.46 | 0.52 | NA   | 0.26   | 0.41 | 0.54 | 0.35 | 0.57 | NA    | 0.72 | 0.45 | 0.57 | 0.07 | 0.38 | 0.56 |
| Sv     | 0.34   | 0.37 | 0.46 | 0.38 | 0.56 | 0.31 | 0.55 | 0.32 | 0.39 | 0.41 | 0.59   | 0.45 | 0.52 | 0.34 | 0.45 | 0.72  | NA   | 0.32 | 0.39 | 0.55 | 0.43 | 0.57 |
| St     | 0.83   | 0.73 | 0.27 | 0.48 | 0.35 | 0.37 | 0.29 | 0.83 | 0.49 | 0.09 | 0.17   | 0.23 | 0.36 | 0.51 | 0.68 | 0.45  | 0.32 | NA   | 0.86 | 0.12 | 0.55 | 0.67 |
| Cs     | 0.78   | 0.66 | 0.31 | 0.60 | 0.41 | 0.32 | 0.32 | 0.87 | 0.49 | 0.13 | 0.25   | 0.16 | 0.36 | 0.49 | 0.63 | 0.57  | 0.39 | 0.86 | NA   | 0.21 | 0.42 | 0.61 |
| Ho     | 0.04   | 0.02 | 0.15 | 0.39 | 0.46 | 0.44 | 0.63 | 0.18 | 0.21 | 0.34 | 0.48   | 0.34 | 0.35 | 0.04 | NA   | 0.07  | 0.55 | 0.12 | 0.21 | NA   | 0.32 | NA   |
| Py     | 0.37   | 0.64 | 0.27 | 0.43 | 0.46 | 0.18 | 0.30 | 0.29 | 0.37 | 0.33 | 0.41   | 0.44 | 0.51 | 0.31 | 0.66 | 0.38  | 0.43 | 0.55 | 0.42 | 0.32 | NA   | 0.42 |
| Po     | 0.62   | 0.72 | 0.34 | 0.22 | 0.24 | 0.38 | 0.49 | 0.52 | 0.56 | 0.12 | 0.02   | 0.28 | 0.39 | 0.42 | 0.82 | 0.56  | 0.57 | 0.67 | 0.61 | NA   | 0.42 | NA   |

Correlation of Tohoku gut contents inorganic profile

|        | C spp. | Sm   | Ej   | Th   | Tb   | Gm   | Tc   | Pm   | Sj   | Af   | R spp. | Lj   | Pa   | Tj   | Sq   | P sp. | Sv   | St   | Cs   | Ho   | Py   | Po   |
|--------|--------|------|------|------|------|------|------|------|------|------|--------|------|------|------|------|-------|------|------|------|------|------|------|
| C spp. | NA     | 0.80 | 0.35 | 0.40 | 0.38 | 0.33 | 0.40 | 0.32 | 0.40 | 0.42 | 0.54   | 0.54 | 0.30 | 0.88 | 0.92 | 0.20  | 0.23 | 0.68 | 0.37 | 0.37 | 0.18 | 0.39 |
| Sm     | 0.80   | NA   | 0.24 | 0.36 | 0.60 | 0.30 | 0.44 | 0.23 | 0.49 | 0.16 | NA     | 0.55 | 0.18 | 0.78 | 0.79 | 0.18  | 0.34 | 0.57 | 0.25 | 0.30 | 0.09 | 0.44 |
| Ej     | 0.35   | 0.24 | NA   | 0.45 | 0.13 | 0.48 | 0.46 | 0.28 | 0.47 | 0.16 | 0.40   | 0.41 | 0.38 | 0.24 | 0.19 | 0.29  | 0.36 | 0.17 | 0.36 | 0.34 | 0.23 | 0.43 |
| Th     | 0.40   | 0.36 | 0.45 | NA   | 0.36 | 0.36 | 0.32 | 0.22 | 0.36 | 0.11 | 0.35   | 0.43 | 0.42 | 0.41 | 0.39 | 0.40  | 0.45 | 0.35 | 0.23 | 0.25 | 0.30 | 0.48 |
| Tb     | 0.38   | 0.60 | 0.13 | 0.36 | NA   | 0.24 | 0.32 | 0.30 | 0.28 | 0.11 | 0.29   | 0.40 | 0.28 | 0.59 | 0.59 | 0.29  | 0.21 | 0.38 | 0.12 | 0.20 | 0.48 | 0.41 |
| Gm     | 0.33   | 0.30 | 0.48 | 0.36 | 0.24 | NA   | 0.58 | 0.44 | 0.45 | 0.26 | 0.47   | 0.29 | 0.32 | 0.42 | 0.26 | 0.20  | 0.24 | 0.34 | 0.40 | 0.46 | 0.22 | 0.34 |
| Tc     | 0.40   | 0.44 | 0.46 | 0.32 | 0.32 | 0.58 | NA   | 0.40 | 0.46 | 0.23 | 0.46   | 0.31 | 0.36 | 0.36 | 0.45 | 0.33  | 0.23 | 0.25 | 0.38 | 0.39 | 0.24 | 0.43 |
| Pm     | 0.32   | 0.23 | 0.28 | 0.22 | 0.30 | 0.44 | 0.40 | NA   | 0.33 | 0.36 | 0.41   | 0.32 | 0.34 | 0.20 | 0.20 | 0.33  | 0.30 | 0.15 | 0.29 | 0.45 | 0.36 | 0.40 |
| Sj     | 0.40   | 0.49 | 0.47 | 0.36 | 0.28 | 0.45 | 0.46 | 0.33 | NA   | 0.16 | 0.29   | 0.37 | 0.44 | 0.41 | 0.37 | 0.32  | 0.43 | 0.35 | 0.30 | 0.28 | 0.27 | 0.45 |
| Af     | 0.42   | 0.16 | 0.16 | 0.11 | 0.11 | 0.26 | 0.23 | 0.36 | 0.16 | NA   | 0.39   | 0.11 | 0.17 | 0.01 | 0.08 | 0.06  | NA   | 0.07 | 0.17 | 0.32 | 0.19 | NA   |
| R spp. | 0.54   | NA   | 0.40 | 0.35 | 0.29 | 0.47 | 0.46 | 0.41 | 0.29 | 0.39 | NA     | 0.32 | 0.42 | NA   | NA   | 0.25  | 0.15 | NA   | 0.40 | 0.48 | 0.28 | 0.19 |
| Lj     | 0.54   | 0.55 | 0.41 | 0.43 | 0.40 | 0.29 | 0.31 | 0.32 | 0.37 | 0.11 | 0.32   | NA   | 0.44 | 0.73 | 0.78 | 0.47  | 0.45 | 0.54 | 0.22 | 0.34 | 0.42 | 0.46 |
| Pa     | 0.30   | 0.18 | 0.38 | 0.42 | 0.28 | 0.32 | 0.36 | 0.34 | 0.44 | 0.17 | 0.42   | 0.44 | NA   | 0.14 | NA   | 0.53  | 0.60 | NA   | 0.35 | 0.29 | 0.36 | 0.46 |
| Tj     | 0.88   | 0.78 | 0.24 | 0.41 | 0.59 | 0.42 | 0.36 | 0.20 | 0.41 | 0.01 | NA     | 0.73 | 0.14 | NA   | 0.90 | 0.16  | 0.37 | 0.76 | 0.32 | 0.20 | 0.10 | 0.49 |
| Sq     | 0.92   | 0.79 | 0.19 | 0.39 | 0.59 | 0.26 | 0.45 | 0.20 | 0.37 | 0.08 | NA     | 0.78 | NA   | 0.90 | NA   | 0.01  | 0.29 | 0.76 | 0.46 | 0.26 | 0.03 | 0.53 |
| P sp.  | 0.20   | 0.18 | 0.29 | 0.40 | 0.29 | 0.20 | 0.33 | 0.33 | 0.32 | 0.06 | 0.25   | 0.47 | 0.53 | 0.16 | 0.01 | NA    | 0.61 | 0.07 | 0.23 | 0.24 | 0.48 | 0.48 |
| Sv     | 0.23   | 0.34 | 0.36 | 0.45 | 0.21 | 0.24 | 0.23 | 0.30 | 0.43 | NA   | 0.15   | 0.45 | 0.60 | 0.37 | 0.29 | 0.61  | NA   | 0.28 | 0.34 | 0.14 | 0.34 | 0.58 |
| St     | 0.68   | 0.57 | 0.17 | 0.35 | 0.38 | 0.34 | 0.25 | 0.15 | 0.35 | 0.07 | NA     | 0.54 | NA   | 0.76 | 0.76 | 0.07  | 0.28 | NA   | 0.36 | 0.13 | 0.30 | 0.45 |
| Cs     | 0.37   | 0.25 | 0.36 | 0.23 | 0.12 | 0.40 | 0.38 | 0.29 | 0.30 | 0.17 | 0.40   | 0.22 | 0.35 | 0.32 | 0.46 | 0.23  | 0.34 | 0.36 | NA   | 0.42 | 0.28 | 0.34 |
| Ho     | 0.37   | 0.30 | 0.34 | 0.25 | 0.20 | 0.46 | 0.39 | 0.45 | 0.28 | 0.32 | 0.48   | 0.34 | 0.29 | 0.20 | 0.26 | 0.24  | 0.14 | 0.13 | 0.42 | NA   | 0.21 | 0.29 |
| Py     | 0.18   | 0.09 | 0.23 | 0.30 | 0.48 | 0.22 | 0.24 | 0.36 | 0.27 | 0.19 | 0.28   | 0.42 | 0.36 | 0.10 | 0.03 | 0.48  | 0.34 | 0.30 | 0.28 | 0.21 | NA   | 0.26 |
| Po     | 0.39   | 0.44 | 0.43 | 0.48 | 0.41 | 0.34 | 0.43 | 0.40 | 0.45 | NA   | 0.19   | 0.46 | 0.46 | 0.49 | 0.53 | 0.48  | 0.58 | 0.45 | 0.34 | 0.29 | 0.26 | NA   |

Correlation of Kanto gut microbiome profile

|        | C spp. | Sm   | Ej   | Th   | Tb   | Pj   | Pm   | Bs   | Sj   | Af   | R spp. | Lj   | Pa   | Tj   | Sq   | P sp. | Sv   | St   | Cs   | Ho   | Py   | Po   |
|--------|--------|------|------|------|------|------|------|------|------|------|--------|------|------|------|------|-------|------|------|------|------|------|------|
| C spp. | NA     | 0.30 | 0.52 | 0.36 | 0.08 | 0.32 | 0.29 | 0.51 | 0.38 | 0.48 | 0.47   | 0.30 | 0.38 | 0.53 | 0.36 | 0.26  | 0.37 | 0.39 | 0.41 | 0.34 | 0.55 | 0.43 |
| Sm     | 0.30   | NA   | 0.20 | 0.42 | 0.34 | 0.05 | 0.22 | 0.20 | 0.12 | 0.02 | 0.06   | 0.16 | 0.35 | 0.34 | 0.22 | 0.03  | 0.10 | 0.22 | 0.01 | 0.22 | 0.20 | 0.35 |
| Ej     | 0.52   | 0.20 | NA   | 0.46 | 0.22 | 0.37 | 0.54 | 0.62 | 0.47 | 0.59 | 0.49   | 0.34 | 0.53 | 0.64 | 0.43 | 0.47  | 0.43 | 0.52 | 0.47 | 0.46 | 0.69 | 0.61 |
| Th     | 0.36   | 0.42 | 0.46 | NA   | 0.16 | 0.29 | 0.46 | 0.52 | 0.36 | 0.46 | 0.48   | 0.22 | 0.46 | 0.41 | 0.38 | 0.45  | 0.32 | 0.34 | 0.44 | 0.38 | 0.49 | 0.46 |
| Tb     | 0.08   | 0.34 | 0.22 | 0.16 | NA   | 0.11 | 0.17 | 0.03 | 0.20 | 0.06 | 0.14   | 0.38 | 0.21 | 0.11 | 0.26 | 0.23  | 0.36 | 0.28 | 0.01 | 0.17 | 0.03 | 0.20 |
| Pj     | 0.32   | 0.05 | 0.37 | 0.29 | 0.11 | NA   | 0.31 | 0.34 | 0.35 | 0.37 | 0.32   | 0.25 | 0.23 | 0.35 | 0.25 | 0.20  | 0.29 | 0.40 | 0.32 | 0.31 | 0.37 | 0.32 |
| Pm     | 0.29   | 0.22 | 0.54 | 0.46 | 0.17 | 0.31 | NA   | 0.42 | 0.50 | 0.36 | 0.35   | 0.32 | 0.43 | 0.39 | 0.42 | 0.52  | 0.44 | 0.37 | 0.48 | 0.40 | 0.45 | 0.40 |
| Bs     | 0.51   | 0.20 | 0.62 | 0.52 | 0.03 | 0.34 | 0.42 | NA   | 0.43 | 0.53 | 0.46   | 0.41 | 0.62 | 0.54 | 0.53 | 0.59  | 0.38 | 0.42 | 0.51 | 0.41 | 0.53 | 0.47 |
| Sj     | 0.38   | 0.12 | 0.47 | 0.36 | 0.20 | 0.35 | 0.50 | 0.43 | NA   | 0.37 | 0.39   | 0.32 | 0.44 | 0.45 | 0.44 | 0.45  | 0.45 | 0.32 | 0.45 | 0.38 | 0.45 | 0.33 |
| Af     | 0.48   | 0.02 | 0.59 | 0.46 | 0.06 | 0.37 | 0.36 | 0.53 | 0.37 | NA   | 0.52   | 0.34 | 0.47 | 0.55 | 0.38 | 0.45  | 0.35 | 0.45 | 0.42 | 0.36 | 0.62 | 0.44 |
| R spp. | 0.47   | 0.06 | 0.49 | 0.48 | 0.14 | 0.32 | 0.35 | 0.46 | 0.39 | 0.52 | NA     | 0.34 | 0.51 | 0.51 | 0.42 | 0.35  | 0.30 | 0.43 | 0.41 | 0.33 | 0.52 | 0.44 |
| Lj     | 0.30   | 0.16 | 0.34 | 0.22 | 0.38 | 0.25 | 0.32 | 0.41 | 0.32 | 0.34 | 0.34   | NA   | 0.30 | 0.26 | 0.25 | 0.24  | 0.41 | 0.25 | 0.29 | 0.36 | 0.40 | 0.32 |
| Pa     | 0.38   | 0.35 | 0.53 | 0.46 | 0.21 | 0.23 | 0.43 | 0.62 | 0.44 | 0.47 | 0.51   | 0.30 | NA   | 0.48 | 0.39 | 0.50  | 0.31 | 0.43 | 0.42 | 0.28 | 0.49 | 0.46 |
| Tj     | 0.53   | 0.34 | 0.64 | 0.41 | 0.11 | 0.35 | 0.39 | 0.54 | 0.45 | 0.55 | 0.51   | 0.26 | 0.48 | NA   | 0.42 | 0.48  | 0.29 | 0.48 | 0.41 | 0.33 | 0.59 | 0.42 |
| Sq     | 0.36   | 0.22 | 0.43 | 0.38 | 0.26 | 0.25 | 0.42 | 0.53 | 0.44 | 0.38 | 0.42   | 0.25 | 0.39 | 0.42 | NA   | 0.47  | 0.40 | 0.35 | 0.43 | 0.36 | 0.43 | 0.43 |
| P sp.  | 0.26   | 0.03 | 0.47 | 0.45 | 0.23 | 0.20 | 0.52 | 0.59 | 0.45 | 0.45 | 0.35   | 0.24 | 0.50 | 0.48 | 0.47 | NA    | 0.29 | 0.51 | 0.47 | 0.50 | 0.45 | 0.46 |
| Sv     | 0.37   | 0.10 | 0.43 | 0.32 | 0.36 | 0.29 | 0.44 | 0.38 | 0.45 | 0.35 | 0.30   | 0.41 | 0.31 | 0.29 | 0.40 | 0.29  | NA   | 0.30 | 0.42 | 0.38 | 0.43 | 0.30 |
| St     | 0.39   | 0.22 | 0.52 | 0.34 | 0.28 | 0.40 | 0.37 | 0.42 | 0.32 | 0.45 | 0.43   | 0.25 | 0.43 | 0.48 | 0.35 | 0.51  | 0.30 | NA   | 0.36 | 0.35 | 0.51 | 0.27 |
| Cs     | 0.41   | 0.01 | 0.47 | 0.44 | 0.01 | 0.32 | 0.48 | 0.51 | 0.45 | 0.42 | 0.41   | 0.29 | 0.42 | 0.41 | 0.43 | 0.47  | 0.42 | 0.36 | NA   | 0.38 | 0.52 | 0.38 |
| Ho     | 0.34   | 0.22 | 0.46 | 0.38 | 0.17 | 0.31 | 0.40 | 0.41 | 0.38 | 0.36 | 0.33   | 0.36 | 0.28 | 0.33 | 0.36 | 0.50  | 0.38 | 0.35 | 0.38 | NA   | 0.43 | 0.44 |
| Py     | 0.55   | 0.20 | 0.69 | 0.49 | 0.03 | 0.37 | 0.45 | 0.53 | 0.45 | 0.62 | 0.52   | 0.40 | 0.49 | 0.59 | 0.43 | 0.45  | 0.43 | 0.51 | 0.52 | 0.43 | NA   | 0.48 |
| Po     | 0.43   | 0.35 | 0.61 | 0.46 | 0.20 | 0.32 | 0.40 | 0.47 | 0.33 | 0.44 | 0.44   | 0.32 | 0.46 | 0.42 | 0.43 | 0.46  | 0.30 | 0.27 | 0.38 | 0.44 | 0.48 | NA   |

Correlation of Tohoku gut microbiome profile

|        | C spp. | Sm   | Ej   | Th   | Tb   | Gm   | Tc   | Pm   | Sj   | Af   | R spp. | Lj   | Pa   | Tj   | Sq   | P sp. | Sv   | St   | Cs   | Ho   | Py   | Po   |
|--------|--------|------|------|------|------|------|------|------|------|------|--------|------|------|------|------|-------|------|------|------|------|------|------|
| C spp. | NA     | 0.08 | 0.36 | 0.36 | 0.30 | 0.52 | 0.41 | 0.43 | 0.45 | 0.43 | 0.33   | 0.40 | 0.30 | 0.49 | 0.40 | 0.35  | 0.29 | 0.45 | 0.40 | 0.29 | 0.41 | 0.39 |
| Sm     | 0.08   | NA   | 0.19 | 0.42 | 0.39 | 0.38 | 0.12 | 0.28 | 0.05 | 0.28 | 0.35   | 0.38 | 0.26 | 0.31 | 0.23 | 0.17  | 0.18 | 0.37 | 0.29 | 0.08 | 0.39 | 0.32 |
| Ej     | 0.36   | 0.19 | NA   | 0.41 | 0.31 | 0.39 | 0.44 | 0.40 | 0.44 | 0.30 | 0.21   | 0.24 | 0.39 | 0.39 | 0.43 | 0.35  | 0.29 | 0.36 | 0.43 | 0.35 | 0.41 | 0.41 |
| Th     | 0.36   | 0.42 | 0.41 | NA   | 0.25 | 0.45 | 0.40 | 0.34 | 0.45 | 0.36 | 0.37   | 0.30 | 0.30 | 0.44 | 0.36 | 0.29  | 0.25 | 0.40 | 0.39 | 0.41 | 0.38 | 0.38 |
| Tb     | 0.30   | 0.39 | 0.31 | 0.25 | NA   | 0.38 | 0.19 | 0.39 | 0.01 | 0.29 | 0.25   | 0.33 | 0.38 | 0.10 | 0.34 | 0.07  | 0.38 | 0.11 | 0.21 | 0.38 | 0.01 | 0.20 |
| Gm     | 0.52   | 0.38 | 0.39 | 0.45 | 0.38 | NA   | 0.53 | 0.42 | 0.49 | 0.43 | 0.42   | 0.44 | 0.39 | 0.55 | 0.60 | 0.39  | 0.30 | 0.55 | 0.40 | 0.40 | 0.49 | 0.53 |
| Tc     | 0.41   | 0.12 | 0.44 | 0.40 | 0.19 | 0.53 | NA   | 0.38 | 0.45 | 0.36 | 0.40   | 0.44 | 0.35 | 0.51 | 0.50 | 0.36  | 0.22 | 0.50 | 0.39 | 0.40 | 0.39 | 0.48 |
| Pm     | 0.43   | 0.28 | 0.40 | 0.34 | 0.39 | 0.42 | 0.38 | NA   | 0.43 | 0.33 | 0.19   | 0.32 | 0.34 | 0.42 | 0.40 | 0.35  | 0.19 | 0.35 | 0.40 | 0.29 | 0.45 | 0.44 |
| Sj     | 0.45   | 0.05 | 0.44 | 0.45 | 0.01 | 0.49 | 0.45 | 0.43 | NA   | 0.39 | 0.35   | 0.44 | 0.43 | 0.53 | 0.48 | 0.40  | 0.27 | 0.35 | 0.39 | 0.33 | 0.43 | 0.49 |
| Af     | 0.43   | 0.28 | 0.30 | 0.36 | 0.29 | 0.43 | 0.36 | 0.33 | 0.39 | NA   | 0.39   | 0.41 | 0.29 | 0.36 | 0.38 | 0.22  | 0.31 | 0.36 | 0.40 | 0.40 | 0.31 | 0.38 |
| R spp. | 0.33   | 0.35 | 0.21 | 0.37 | 0.25 | 0.42 | 0.40 | 0.19 | 0.35 | 0.39 | NA     | 0.34 | 0.13 | 0.38 | 0.36 | 0.09  | 0.29 | 0.38 | 0.25 | 0.52 | 0.26 | 0.27 |
| Lj     | 0.40   | 0.38 | 0.24 | 0.30 | 0.33 | 0.44 | 0.44 | 0.32 | 0.44 | 0.41 | 0.34   | NA   | 0.36 | 0.41 | 0.41 | 0.27  | 0.18 | 0.43 | 0.33 | 0.52 | 0.38 | 0.40 |
| Pa     | 0.30   | 0.26 | 0.39 | 0.30 | 0.38 | 0.39 | 0.35 | 0.34 | 0.43 | 0.29 | 0.13   | 0.36 | NA   | 0.35 | 0.36 | 0.53  | 0.21 | 0.35 | 0.32 | 0.22 | 0.27 | 0.30 |
| Tj     | 0.49   | 0.31 | 0.39 | 0.44 | 0.10 | 0.55 | 0.51 | 0.42 | 0.53 | 0.36 | 0.38   | 0.41 | 0.35 | NA   | 0.53 | 0.39  | 0.28 | 0.43 | 0.41 | 0.30 | 0.43 | 0.47 |
| Sq     | 0.40   | 0.23 | 0.43 | 0.36 | 0.34 | 0.60 | 0.50 | 0.40 | 0.48 | 0.38 | 0.36   | 0.41 | 0.36 | 0.53 | NA   | 0.40  | 0.28 | 0.44 | 0.47 | 0.39 | 0.35 | 0.45 |
| P sp.  | 0.35   | 0.17 | 0.35 | 0.29 | 0.07 | 0.39 | 0.36 | 0.35 | 0.40 | 0.22 | 0.09   | 0.27 | 0.53 | 0.39 | 0.40 | NA    | 0.13 | 0.46 | 0.39 | 0.12 | 0.34 | 0.44 |
| Sv     | 0.29   | 0.18 | 0.29 | 0.25 | 0.38 | 0.30 | 0.22 | 0.19 | 0.27 | 0.31 | 0.29   | 0.18 | 0.21 | 0.28 | 0.28 | 0.13  | NA   | 0.41 | 0.25 | 0.40 | 0.27 | 0.27 |
| St     | 0.45   | 0.37 | 0.36 | 0.40 | 0.11 | 0.55 | 0.50 | 0.35 | 0.35 | 0.36 | 0.38   | 0.43 | 0.35 | 0.43 | 0.44 | 0.46  | 0.41 | NA   | 0.34 | 0.48 | 0.37 | 0.45 |
| Cs     | 0.40   | 0.29 | 0.43 | 0.39 | 0.21 | 0.40 | 0.39 | 0.40 | 0.39 | 0.40 | 0.25   | 0.33 | 0.32 | 0.41 | 0.47 | 0.39  | 0.25 | 0.34 | NA   | 0.28 | 0.36 | 0.39 |
| Ho     | 0.29   | 0.08 | 0.35 | 0.41 | 0.38 | 0.40 | 0.40 | 0.29 | 0.33 | 0.40 | 0.52   | 0.52 | 0.22 | 0.30 | 0.39 | 0.12  | 0.40 | 0.48 | 0.28 | NA   | 0.30 | 0.34 |
| Py     | 0.41   | 0.39 | 0.41 | 0.38 | 0.01 | 0.49 | 0.39 | 0.45 | 0.43 | 0.31 | 0.26   | 0.38 | 0.27 | 0.43 | 0.35 | 0.34  | 0.27 | 0.37 | 0.36 | 0.30 | NA   | 0.38 |
| Po     | 0.39   | 0.32 | 0.41 | 0.38 | 0.20 | 0.53 | 0.48 | 0.44 | 0.49 | 0.38 | 0.27   | 0.40 | 0.30 | 0.47 | 0.45 | 0.44  | 0.27 | 0.45 | 0.39 | 0.34 | 0.38 | NA   |