Cambodia biodiversity paper notes – August 6, 2022

Plots of diversity at different levels (system, catch, consumption, sold)

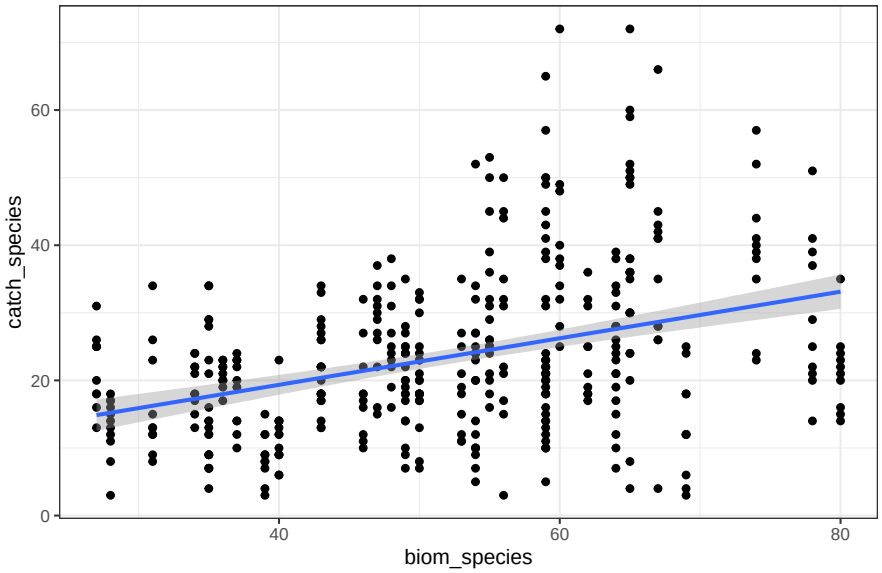
In the figures below, diversity is represented by total number of species present in each CFR and household, aggregated over time. It does not account for abundance or variation over time. Each dot represents a household. Below each figure is the Pearson correlation coefficient and pvalue.

Liz's interpretation:

- A: System diversity and catch diversity are positively correlated (coeff = 0.38) & estimates are very precise.
- B: System diversity and consumption diversity are positively correlated (coeff = 0.35) & estimates are very precise.
- C: Catch diversity and consumption diversity are very strongly positively correlated (coeff = 0.98!) & estimates are very precise. People are eating at least a little bit of virtually all of the fish they catch. Later graphs explore this.
- D: Catch diversity and sold diversity are positively correlated (coeff 0.40) & estimates are very precise.
- E: There is no statistically significant relationship between system diversity and diversity of fish that are sold. **Does this implicitly rule out a the market pathway for diversity to impact nutrition?**

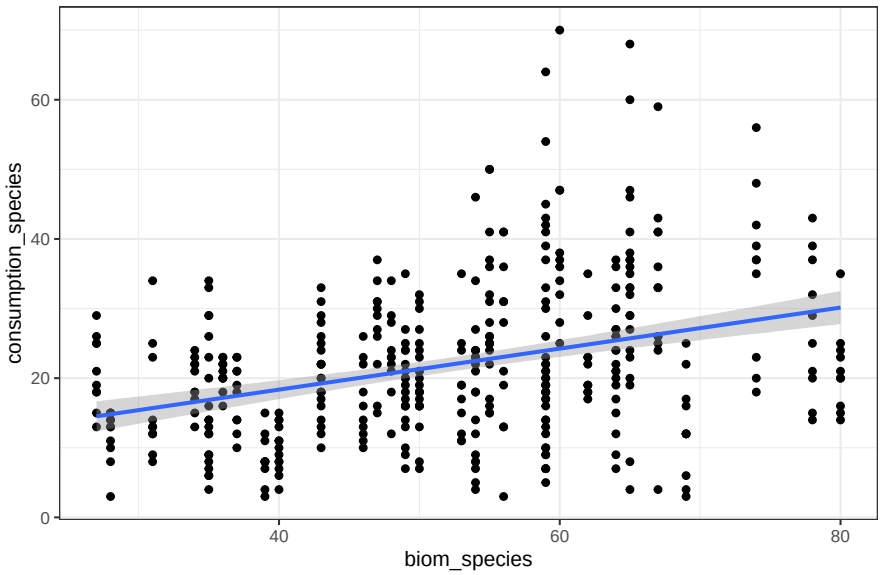
Fishing households appear to be consuming a portfolio of fish that is very similar to what they are catching (correlation coeff = 0.98). This is just in terms of presence/absence and does not account for the amount of each species. The similarity in catch and consumption portfolio could be explained by a general preference for diversity among fishing households, or a lack of marketing opportunities for many types of fish (either to buy or to sell), or some combination of both. The decision about which fish to market could be a function of which fish species it is possible to sell, or it could be a function of which fish species are left over after the household has selected a diversity of fish for consumption.

A. Biomonitoring (CFR−level) X Catch (HH−level)



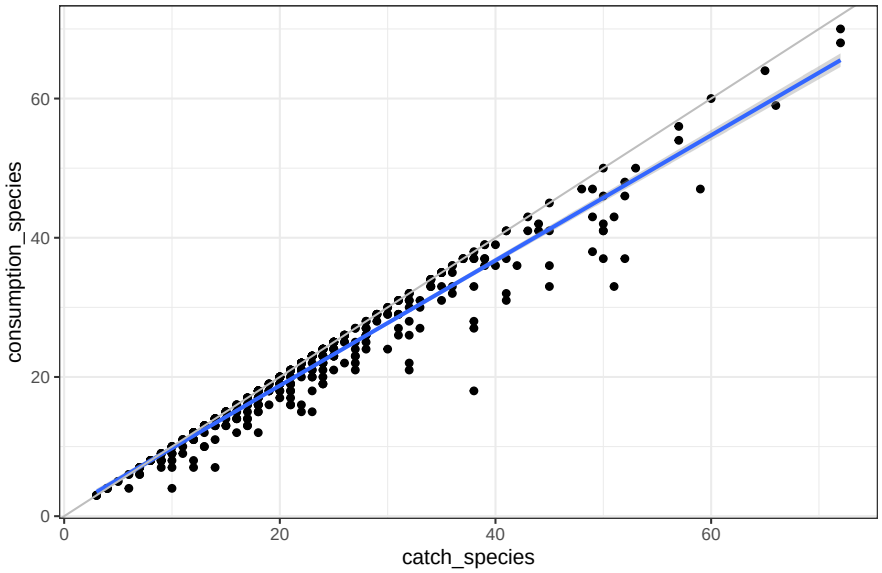
column1	column2	estimate	n	p.value
catch_species	biom_species	0.3845435	413	0

B. Biomonitoring (CFR−level) X Consumption (HH−level)



column1	column2	estimate	n	p.value
consumption_species	biom_species	0.3546168	413	0

C. Catch (HH−level) X Consumption (HH−level)



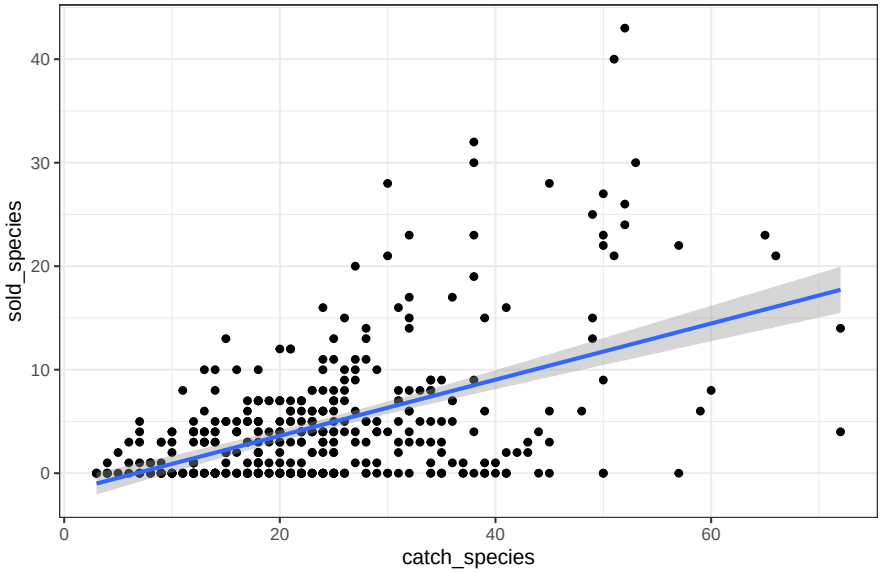
column1	column2	estimate	n	p.value
consumption_species	catch_species	0.9793263	413	0

This is aggregated over time.

Points on the diagonal line are cases where a household consumes all of a given species. There is a surprisingly large number of species that are exclusively consumed.

Species that are exclusively sold would points located at 0 on the y axis—we do not see any in this figure.

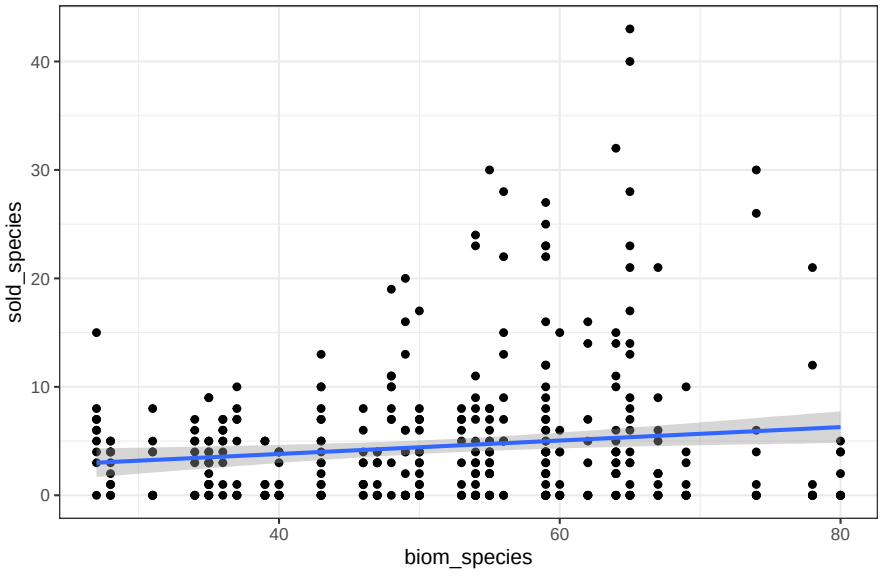
D. Catch (HH−level) X Sold (HH−level)



column1	column2	estimate	n	p.value
sold_species	catch_species	0.3974983	413	0

X

E. Biomonitoring (CFR−level) X Sold (HH−level)



column1	column2	estimate	n	p.value
sold_species	biom_species	0.0109531	413	0.8243727

Plots of quantities caught, eaten and sold

- All plots below are on a log scale.
- The gray diagonal line represents the points at which fishers each their entire catch of a given species.
- Each point on these plots represents a given species, aggregated across households and time.
- For total length plots, the color and size both correspond to total length (e.g. lighter and larger dot –> larger fish).
- Size is measured by total length from FishBase (or other sources)
- Nutritional value is the number of child-under-5 RDAs met by 100g of a given species (total possible is 6: protein, vitamin A, zinc, calcium, iron, omega-3).
- For RDAs met plots, the color and size both correspond to the number of RDAs met (e.g. lighter and larger dot –> more RDAs met)

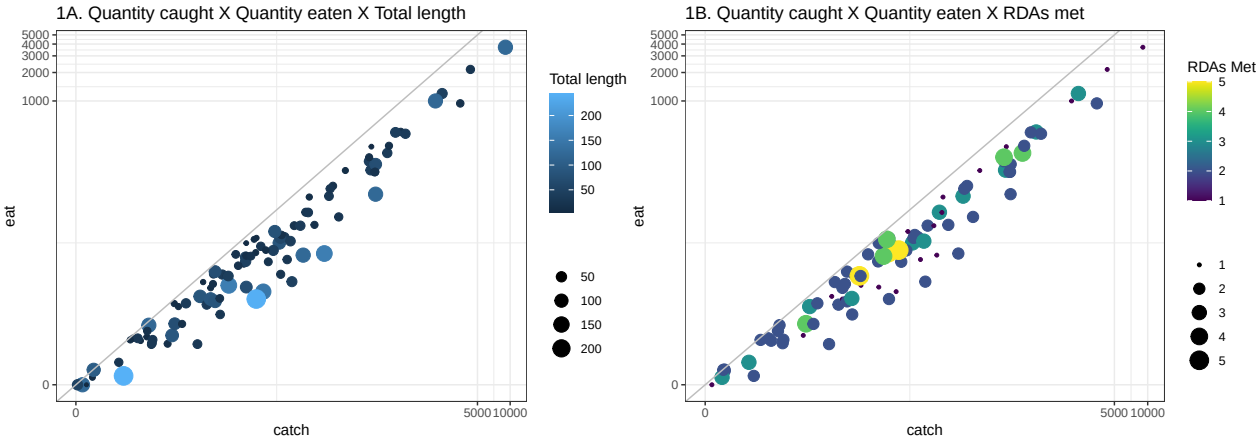
Of the fish they catch, what fish are people choosing to eat?

Overall: Fishers are eating more than half of virtually all species caught.

- Panel 1A: Of the fish they catch, people ate a larger share of smaller fish and are doing something else (probably selling–see below) with some of the larger fish. Points that are on the 1:1 line (gray line) are cases where all catch is eaten, which seems to be the case more often for rarely caught species. There are no (or very few) species that appear to be caught and never eaten (located at Y = 0, X != 0)

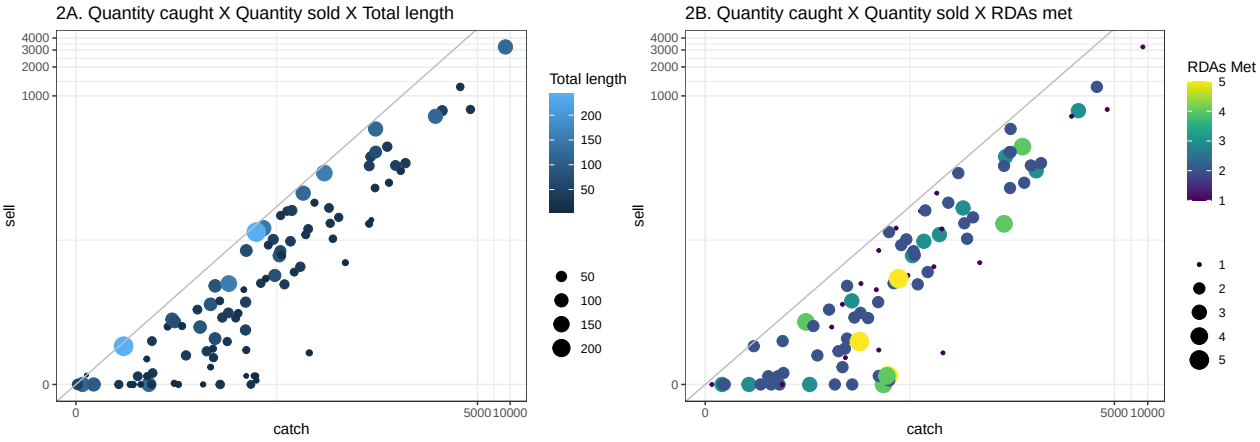
Technical question: If a point is halfway between the X axis and the gray line, is it correct to say that half of the species caught is being eaten, or are the proportions different because of the log scale? I think they're different but haven't been able to work out how to draw the "halfway" line, which I think would be useful to see on these graphs to get a sense of how much of catch is being eaten vs. sold. I bet there's a simple way to do this that I'll think of when I walk away from my computer.

- Panel 1B: When people catch more nutritious fish, they eat a relatively large share of it relative to (some) less nutritious fish that they catch. However, since people seem to be eating a lot of all of the fish they catch, so the differentiation is maybe not as exciting.



Of the fish they catch, what species are people choosing to sell?

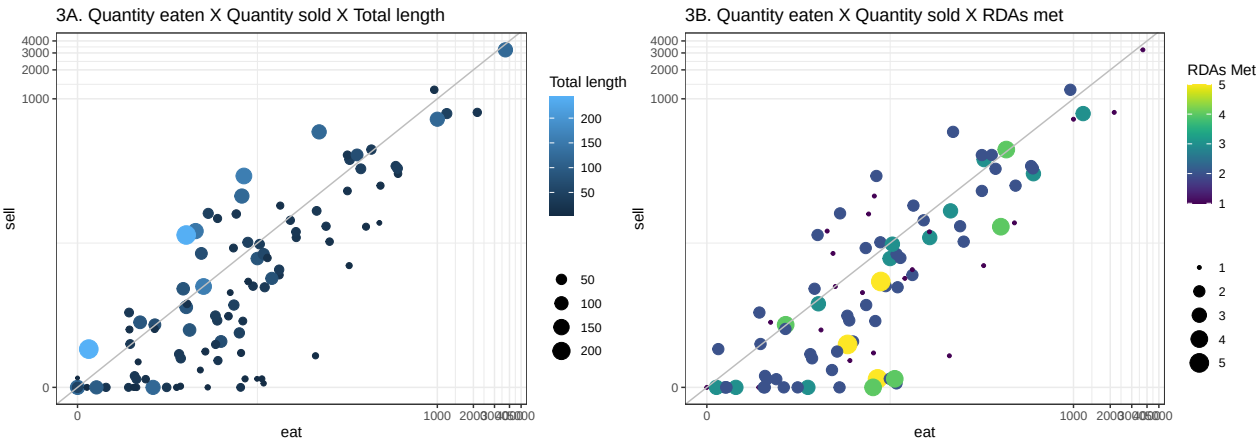
- Panel 2A: People sell a larger share of their catch of larger species relative to smaller ones, but I'm not sure it's inverse. Species located on the diagonal (gray) line are those where quantity caught = quantity sold. The closer to the gray line, the more they sell. Some species (located at Y = 0) are only eaten and not sold at all. They tend to be smaller species. *I expected this to look like the inverse of Plot 1A, in that people should be mostly selling what they don't eat (since other categories–processing, lost, other) are usually relatively small amounts, but I think this relates to the location of the "halfway" line I mention above.*
- Panel 2B: People are selling a smaller share of their catch of more nutritious species (corresponding to species that they are eating nearly all of in Panel 1B?).There are some moderately nutritious fish that are being sold in larger shares (e.g. they're closer to the gray line), but there's a cluster of more nutritious fish that are hardly/never sold. This corresponds to the cluster of smaller fish in Panel 2A.



How are people dividing the species they catch between selling and eating?

- Panel 3A: There are some species that are exclusively eaten (Y = 0) but there are maybe few species that are exclusively sold (X = 0, Y != 0). For most species, people are eating at least some. The largest species are sold slightly more than eaten.
- Panel 3B: More nutritious species tend to be eaten almost exclusively or eaten more than sold. These are also smaller species, which seems logical.

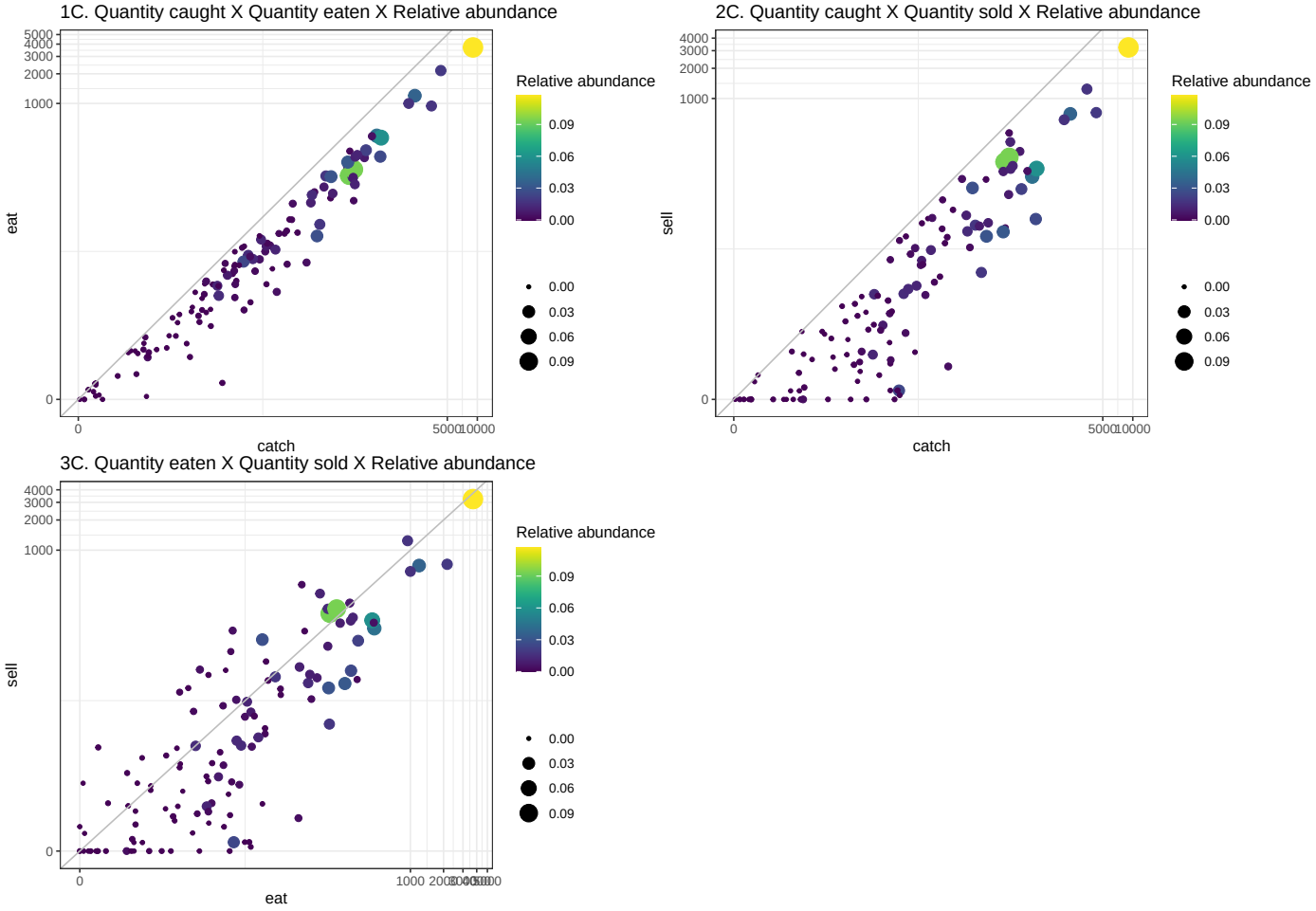
I guess this is another way of looking at the eat vs sold proportions I was thinking about above. For most species, people are eating more than they sell. A few species are sold more than eaten. They tend to be larger species, but not exclusively.



How do catch, consumption and sales relate to relative abundance of species?

Relative abundance is calculated from biomonitoring data by taking the total biomonitoring catch for each species and dividing it by the total biomonitoring catch across species. This is conceptually different than the quantity caught on the x axis of 1A, 1B, 2A, 2B, but in practice the figures below show that they correspond relatively well, with some mixing in the middle. People are catching more of the highly abundant species, as expected.

I don't see any obvious patterns around abundance, catch, consumption, sale.



Things we could explore:

- What species-specific analysis can we do next? How many and which species "make it through" from biomonitoring to catch to people's plates? Given that people are consuming some of virtually all of the species they catch, I suspect this is going to be a long list unless there are a lot of species that are simply never or hardly caught. Quantities might matter a lot if there are quite a few species that are rarely caught. There could be variation on other dimensions though–e.g., seasonally, by CFR type, by initial CFR diversity level (check variation in this), or by household characteristics.
- How seasonal are these dynamics? It may be that in certain seasons, some species are exclusively sold (or eaten), which we would not see here. It may also be that some species are completely non-existent in the data in some seasons, but not in others.
- How spatial are these dynamics? It may be that in certain CFR areas, some species are exclusively sold (or eaten), but we wouldn't see that in the aggregate analysis above. One starting point for exploring this would be to look at these graphs by the 4 CFR types and see how they differ.

- Are there species that we could identify (using other sources) as high-value in the market? Where do those species sit within these figures?
- Very difficult to know, but important: To what degree is the decision to eat vs. sell dependent on marketing opportunities vs. preferences. I'm not sure we can really get at this in these data, but we should be thinking about it.