Aquarium Project Questions

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2017-10-05

Question 1

How effective are trade regulations in controlling aquarium export? Compare aquarium exports from countries with strong vs weak regulations/governance, based on CITES membership, n. years since joining CITES, and GDP (CITES information: https://www.cites.org/eng/disc/parties/chronolo.php).

Data: CITES, UN human development indicators, World Bank Governance Indicators

Expectation: countries with poor governance have higher trade export volume + diversity (standardised to reef area/coastline/regional richness).

Consider temporal aspect here as well - does good/bad governance in year 1 reduce/increase fish trade in year 2?

Caveats How to use the governance indicators when they are yearly and the data is from multiple years and months within certain years?
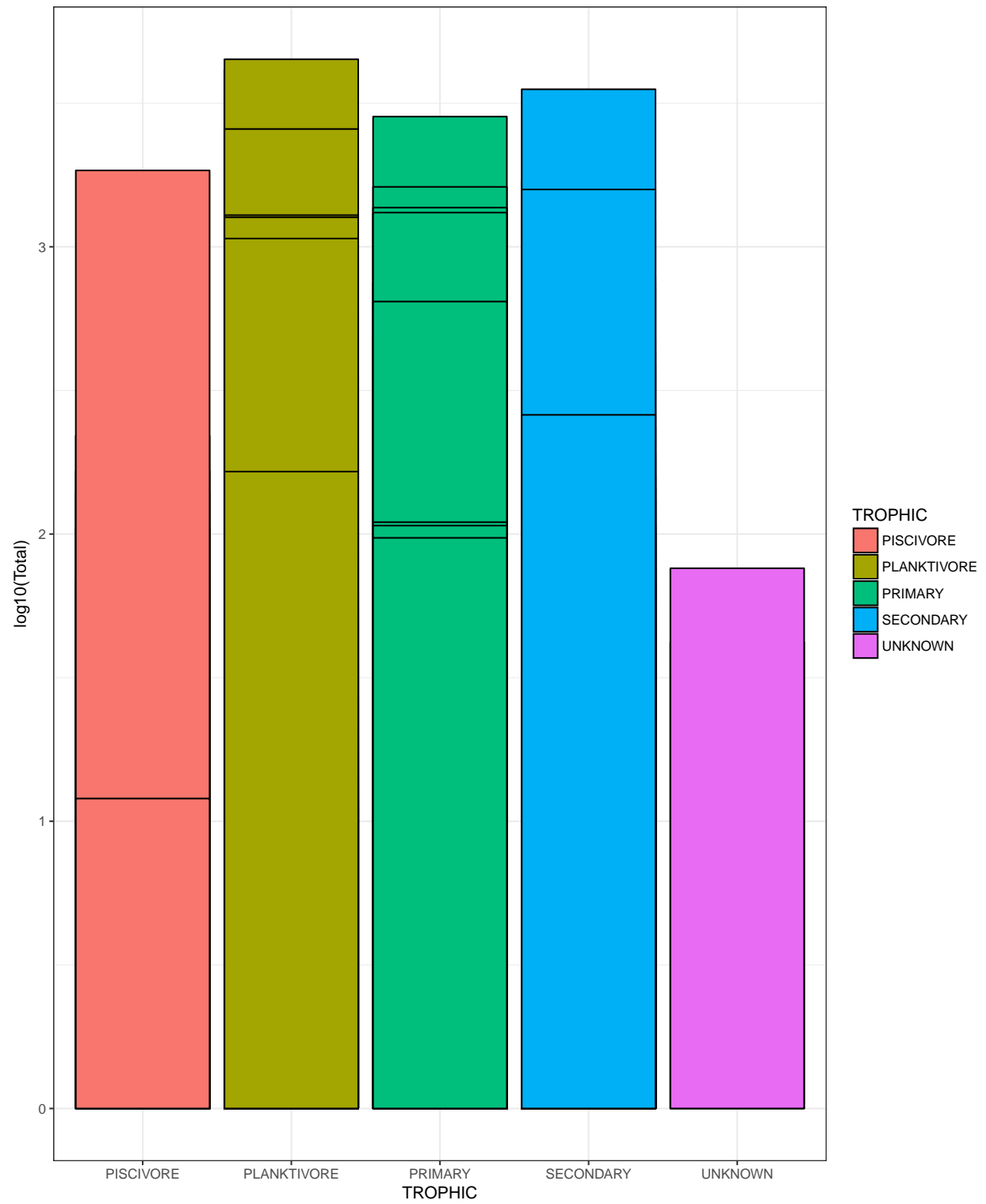
Question 2

Are certain trophic levels or functional groups disproportionately targeted by aquarium trade, and does this pattern vary regionally? Examine size, diet, and functional group structure of exported species by country.

Data: CREP trophic groups (lots of data missing for our species), FishBase (only two of our species matched), JPWR looking for another dataset

Expectation: planktivores are primarily targeted. Are there 1) countries that export more herbs/piscs than expected? 2) Which non-planktivore species are exported in high volumes?

Caveats: 1) Standardise countries by estimating proportional volume of functional groups for each country; 2) determining the baseline community structure is very difficult, probably impossible.

Question 3

Geographic analysis of range distributions - where are species exported from? Are small or large range size fishes exported more or less? small range - which species? large range - lots of export countries?

Data: OBIS range sizes (how to calculate range size from lat/long presence data?), Luis et al. 2013 range size data. The figures below are for EOO

Expectation: linear relationship between export volume ~ range size. But any species that falls off the line is of interest: 1) smaller range size for volume = high risk; 2) larger range size than volume = low risk?

Caveat: This question is country-independent - ranges cross borders, data point = fish species.

Problem 1) Each point is one species volume and range size (i.e. averaged by years and summed by country), however when doing this I noticed that there aren't any fish taax that have exports in one country for multiple years? This seems odd.

Problem 2) There are lots of fish species that have 0 calculated as the range size, not NA (those were already filtered out). Should we get rid of these species because maybe they have only been picked up by OBIS in one area so thats why they have an EOO of zero?
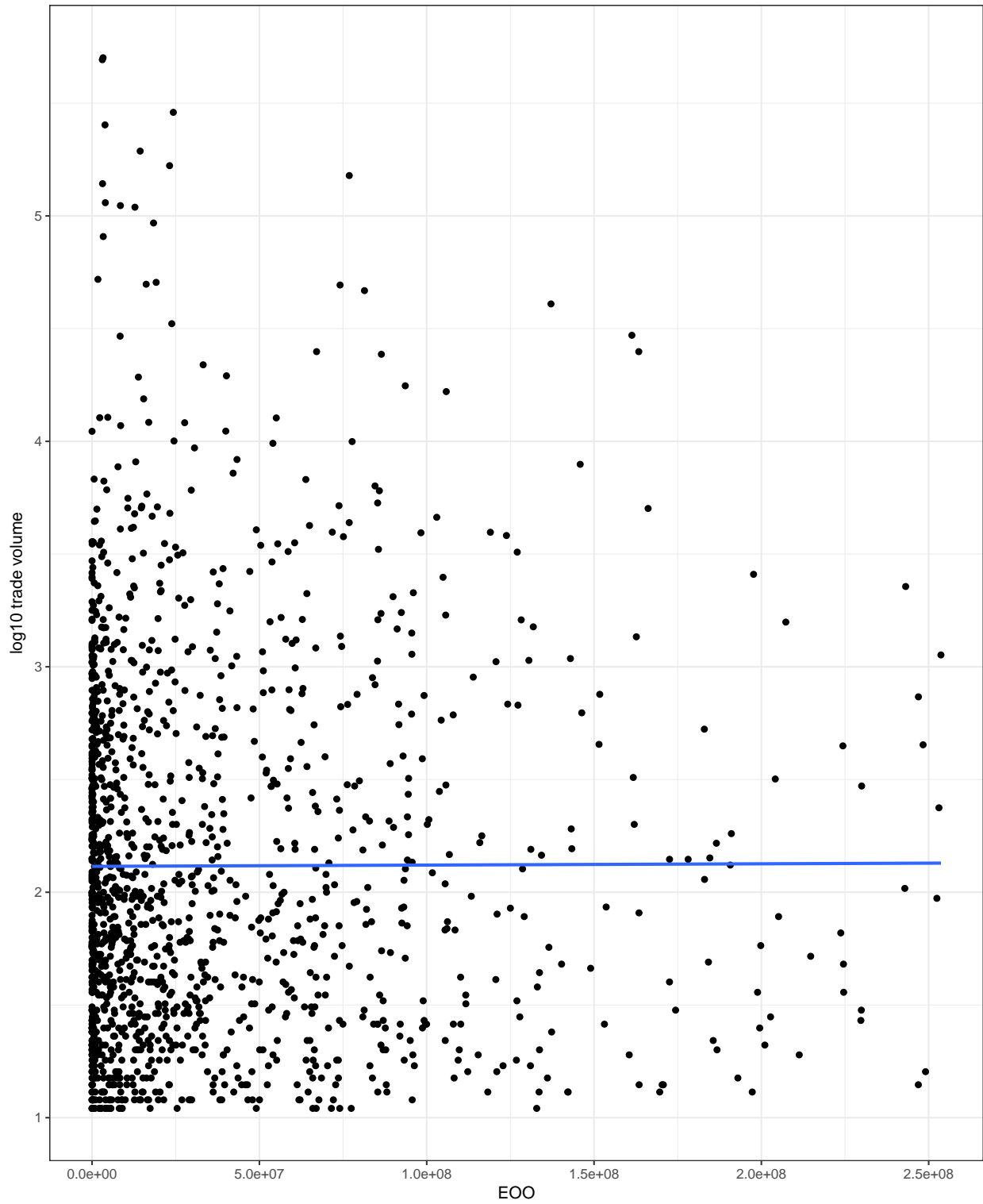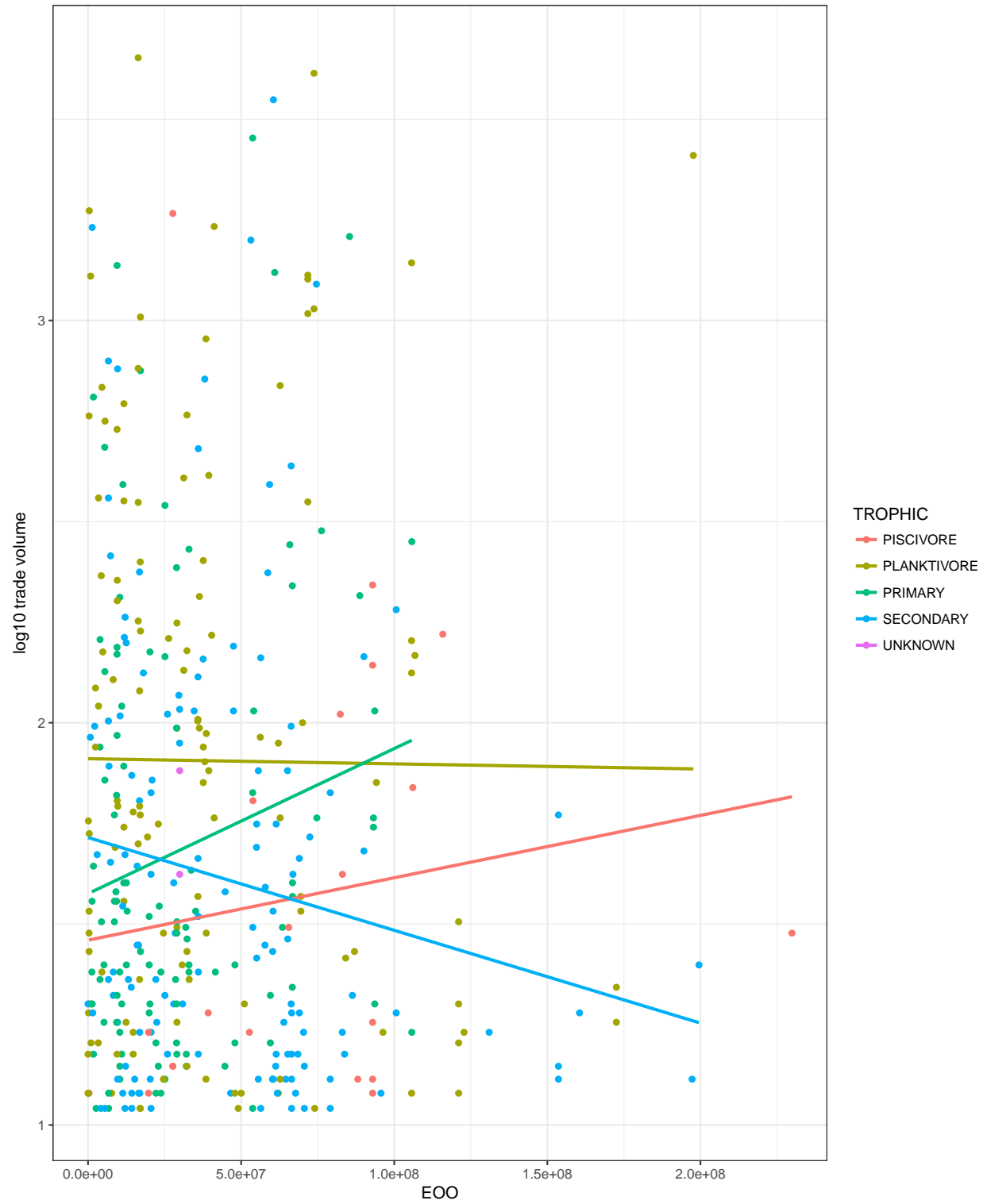
Data Decisions

- subsetted to full years of data only (2008, 2009, 2011)

Modeling Ideas

glmer(volume ~ range size + (1 + range size | year / country), data=trade, family = Gamma(link=log))

- random slope for country, random intercept for year

- Gamma distribution= volume is positive non-integer, maybe compare with log(volume) and normal distribution

- or could try gls() variance structures? (varfixed, varpower) instead of transforming

glmer(volume ~ range size + (1| year / country), data=trade, family = Gamma(link=log))

- random intercept for year

So then the full model would be (depending on which random structure is best):
glmer(volume ~ range size + CITES + gov.indicator + (1 + range size | year / country), data=trade, family = Gamma(link=log))