alm tutorial

What are article level metrics?

Glad you asked. The canonical URL for this is perhaps [altmetrics.org](). Basically it is a metric that measures something about an article. This is in stark contrast to journal level metrics, like the Journal Impact Factor.

Are there other altmetrics data providers?

Yes indeedy.

- [ImpactStory]()
- [Altmetric.com]()
- [PlumAnalytics]()

Authentication

You aren't currently not required to use an API key to access the PLoS ALM API, but soon will need to.

Get your PLoS API key [here]()

Put your API key in your .Rprofile file using exactly this: options(PlosApiKey = "YOUalmAPIKEY"), and the functions within this package will be able to use your API key without you having to enter it every time you run a search.

Install and load

You can get this package by installing via `install_github()` within Hadley Wickham's devtools package.

```
install.packages("devtools")
require(devtools)
install_github("alm", "rOpenSci")
```

```
library(alm)
```

The default call with either doi, pmid, pmcid, or mdid without specifying an argument for info

(We'll not print a few columns so the table prints nicely)

```
alm(doi = "10.1371/journal.pone.0029797")[, -c(6:8)]
```

```
          .id  pdf  html shares groups total
1    bloglines   NA   NA     NA     NA     0
2    citeulike   NA   NA      1     NA     1
3     connotea   NA   NA     NA     NA     0
4     crossref   NA   NA     NA     NA     7
5       nature   NA   NA     NA     NA     4
6   postgenomic   NA   NA     NA     NA     0
7       pubmed   NA   NA     NA     NA     1
```

```
8           scopus   NA    NA    NA    NA     4
9          counter 2274 26410    NA    NA 28790
10 researchblogging   NA    NA    NA    NA     1
11            biod    0     0    NA    NA    21
12             pmc   57   334    NA    NA   391
13        facebook   NA    NA   147    NA   228
14        mendeley   NA    NA    50     0    50
15         twitter   NA    NA    NA    NA     9
16       wikipedia   NA    NA    NA    NA    49
17     scienceseeker  NA    NA    NA    NA     0
18    relativemetric  NA    NA    NA    NA 46986
19            f1000   NA    NA    NA    NA     0
20         figshare   NA    NA    NA    NA     0
```

Details for a single DOI

```r
out <- alm(doi = "10.1371/journal.pone.0029797", info = "detail")
## totals
out[["totals"]][, -c(6:8)]
```

```
                .id  pdf  html shares groups total
1          bloglines   NA    NA    NA    NA     0
2          citeulike   NA    NA     1    NA     1
3            connotea   NA    NA    NA    NA     0
4            crossref   NA    NA    NA    NA     7
5              nature   NA    NA    NA    NA     4
6         postgenomic   NA    NA    NA    NA     0
7              pubmed   NA    NA    NA    NA     1
8              scopus   NA    NA    NA    NA     4
9             counter 2274 26410    NA    NA 28790
10 researchblogging    NA    NA    NA    NA     1
11               biod    0     0    NA    NA    21
12                pmc   57   334    NA    NA   391
13           facebook   NA    NA   147    NA   228
14           mendeley   NA    NA    50     0    50
15            twitter   NA    NA    NA    NA     9
16          wikipedia   NA    NA    NA    NA    49
17       scienceseeker  NA    NA    NA    NA     0
18      relativemetric  NA    NA    NA    NA 46986
19               f1000   NA    NA    NA    NA     0
20            figshare   NA    NA    NA    NA     0
```

```r
## history
head(out[["history"]])
```

```
        .id      dates totals
1 citeulike 2013-09-16      1
2 citeulike 2013-08-15      1
3 citeulike 2013-07-13      1
4 citeulike 2013-06-10      1
5 citeulike 2013-05-08      1
6 citeulike 2013-04-05      1
```

Search using various identifiers, including pubmed id, pmc id, and mendeley id

```
# A single PubMed ID (pmid)
alm(pmid = 22590526)[, -c(6:8)]
```

	.id	pdf	html	shares	groups	total
1	bloglines	NA	NA	NA	NA	0
2	citeulike	NA	NA	5	NA	5
3	connotea	NA	NA	NA	NA	0
4	crossref	NA	NA	NA	NA	3
5	nature	NA	NA	NA	NA	1
6	postgenomic	NA	NA	NA	NA	0
7	pubmed	NA	NA	NA	NA	1
8	scopus	NA	NA	NA	NA	2
9	counter	909	13050	NA	NA	13995
10	researchblogging	NA	NA	NA	NA	1
11	biod	NA	NA	NA	NA	0
12	wos	NA	NA	NA	NA	2
13	pmc	23	113	NA	NA	136
14	facebook	NA	NA	59	NA	161
15	mendeley	NA	NA	39	0	39
16	twitter	NA	NA	NA	NA	118
17	wikipedia	NA	NA	NA	NA	0
18	scienceseeker	NA	NA	NA	NA	1
19	relativemetric	NA	NA	NA	NA	27039
20	f1000	NA	NA	NA	NA	0
21	figshare	NA	NA	NA	NA	0

```
# A single PubMed Central ID (pmcid)
alm(pmcid = 212692)[, -c(6:8)]
```

	.id	pdf	html	shares	groups	total
1	bloglines	NA	NA	NA	NA	0
2	citeulike	NA	NA	8	NA	8
3	connotea	NA	NA	NA	NA	0
4	crossref	NA	NA	NA	NA	143
5	nature	NA	NA	NA	NA	0
6	postgenomic	NA	NA	NA	NA	0
7	pubmed	NA	NA	NA	NA	143
8	scopus	NA	NA	NA	NA	318
9	counter	2447	19698	NA	NA	22292
10	researchblogging	NA	NA	NA	NA	0
11	biod	NA	NA	NA	NA	0
12	pmc	2305	4752	NA	NA	7057
13	facebook	NA	NA	0	NA	0
14	mendeley	NA	NA	71	0	71
15	twitter	NA	NA	NA	NA	0
16	wikipedia	NA	NA	NA	NA	0
17	scienceseeker	NA	NA	NA	NA	0
18	relativemetric	NA	NA	NA	NA	2192654
19	f1000	NA	NA	NA	NA	0
20	figshare	1	2	NA	NA	3

```r
# A single Mendeley UUID (mdid)
alm(mdid = "35791700-6d00-11df-a2b2-0026b95e3eb7")[, -c(6:8)]
```

```
               .id  pdf  html shares groups    total
1         bloglines   NA    NA     NA     NA        0
2         citeulike   NA    NA      8     NA        8
3          connotea   NA    NA     NA     NA        0
4          crossref   NA    NA     NA     NA      143
5            nature   NA    NA     NA     NA        0
6        postgenomic   NA    NA     NA     NA        0
7            pubmed   NA    NA     NA     NA      143
8            scopus   NA    NA     NA     NA      318
9           counter 2447 19698     NA     NA    22292
10 researchblogging   NA    NA     NA     NA        0
11             biod   NA    NA     NA     NA        0
12              pmc 2305  4752     NA     NA     7057
13         facebook   NA    NA      0     NA        0
14         mendeley   NA    NA     71      0       71
15          twitter   NA    NA     NA     NA        0
16        wikipedia   NA    NA     NA     NA        0
17      scienceseeker   NA    NA     NA     NA        0
18    relativemetric   NA    NA     NA     NA  2192654
19            f1000   NA    NA     NA     NA        0
20          figshare    1     2     NA     NA        3
```

Search on many identifiers

```r
dois <- c("10.1371/journal.pone.0001543", "10.1371/journal.pone.0040117", "10.1371/journal.pone.0029797",
    "10.1371/journal.pone.0039395")
out <- alm(doi = dois)
lapply(out, head)
```

```
[[1]]
          .id pdf html shares groups comments likes citations total
1   bloglines  NA   NA     NA     NA       NA    NA         0     0
2   citeulike  NA   NA      0     NA       NA    NA        NA     0
3    connotea  NA   NA     NA     NA       NA    NA         0     0
4    crossref  NA   NA     NA     NA       NA    NA         1     1
5      nature  NA   NA     NA     NA       NA    NA         0     0
6  postgenomic  NA   NA     NA     NA       NA    NA         0     0

[[2]]
          .id pdf html shares groups comments likes citations total
1   bloglines  NA   NA     NA     NA       NA    NA         0     0
2   citeulike  NA   NA      0     NA       NA    NA        NA     0
3    connotea  NA   NA     NA     NA       NA    NA         0     0
4    crossref  NA   NA     NA     NA       NA    NA         0     0
5      nature  NA   NA     NA     NA       NA    NA         0     0
6  postgenomic  NA   NA     NA     NA       NA    NA         0     0

[[3]]
          .id pdf html shares groups comments likes citations total
```

```
1    bloglines   NA    NA     NA     NA       NA    NA          0      0
2    citeulike   NA    NA      1     NA       NA    NA         NA      1
3     connotea   NA    NA     NA     NA       NA    NA          0      0
4     crossref   NA    NA     NA     NA       NA    NA          7      7
5       nature   NA    NA     NA     NA       NA    NA          4      4
6  postgenomic   NA    NA     NA     NA       NA    NA          0      0


[[4]]
            .id pdf html shares groups comments likes citations total
1    bloglines   NA    NA     NA     NA       NA    NA          0      0
2    citeulike   NA    NA      0     NA       NA    NA         NA      0
3     connotea   NA    NA     NA     NA       NA    NA          0      0
4     crossref   NA    NA     NA     NA       NA    NA          5      5
5       nature   NA    NA     NA     NA       NA    NA          0      0
6  postgenomic   NA    NA     NA     NA       NA    NA          1      1
```

Get altmetrics by year

You can also get metrics by day (`sum_metrics='day'`) or month (`sum_metrics='month'`)

```r
alm(doi = "10.1371/journal.pone.0036240", sum_metrics = "year")[, -c(6:8)]
```

```
                 .id   x year pdf   html likes citations total
1          bloglines  NA   NA  NA     NA    NA        NA    NA
2          citeulike  NA 2012  NA     NA    NA        NA     5
3           connotea  NA   NA  NA     NA    NA        NA    NA
4           crossref  NA 2013  NA     NA    NA         3     3
5             nature  NA   NA  NA     NA    NA        NA    NA
6        postgenomic  NA   NA  NA     NA    NA        NA    NA
7             pubmed  NA   NA  NA     NA    NA        NA    NA
8             scopus  NA   NA  NA     NA    NA        NA    NA
9            counter  NA 2012 699  10502    NA        NA 11234
10           counter  NA 2013 210   2548    NA        NA  2761
11 researchblogging  NA 2013  NA     NA    NA         1     1
12              biod  NA   NA  NA     NA    NA        NA    NA
13               pmc  NA 2012  16     53    NA        NA    69
14               pmc  NA 2013   7     60    NA        NA    67
15          facebook  NA   NA  NA     NA    NA        NA    NA
16          mendeley  NA   NA  NA     NA    NA        NA    NA
17           twitter  NA 2012  NA     NA    NA        NA   103
18           twitter  NA 2013  NA     NA    NA        NA    15
19         wikipedia  NA   NA  NA     NA    NA        NA    NA
20       scienceseeker  NA 2013  NA     NA    NA       1     1
21    relativemetric  NA   NA  NA     NA    NA        NA    NA
22             f1000  NA   NA  NA     NA    NA        NA    NA
23          figshare  NA   NA  NA     NA    NA        NA    NA
```

Output an-easy-to-combine-with-other-results data.frame

```r
alm(doi = "10.1371/journal.pone.0035869", total_details = TRUE)[, 3:10]
```

```
        publication_date bloglines_pdf bloglines_html bloglines_shares
```

```
1 2012-05-11T07:00:00Z              NA              NA              NA
  bloglines_groups bloglines_comments bloglines_likes bloglines_citations
1           NA              NA              NA                 0
```

Get altmetrics data for a single paper, and visualize the total data across dates

```
out <- alm(doi = "10.1371/journal.pone.0001543", info = "detail")
almplot(out, type = "totalmetrics")
```
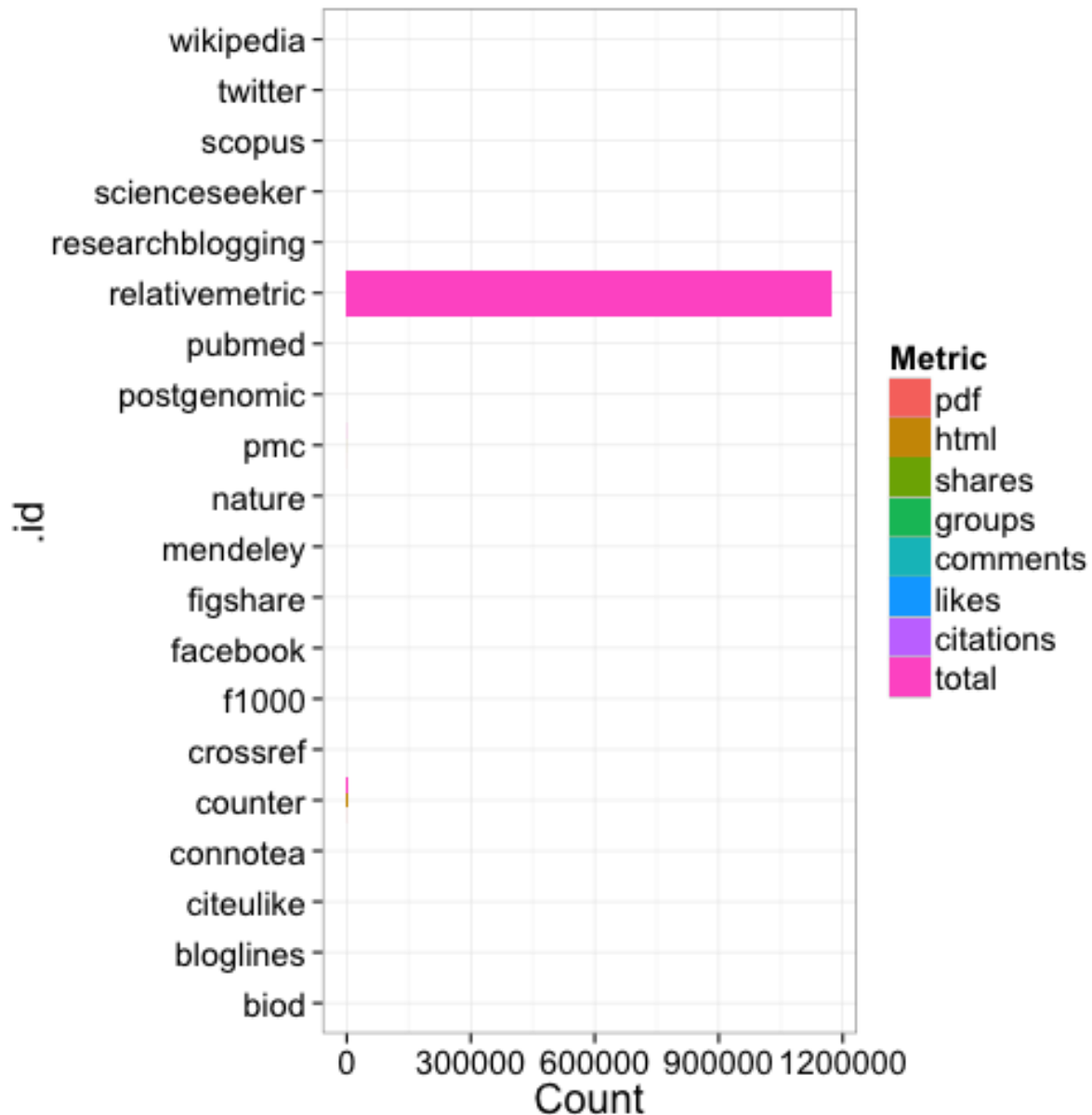

Figure 1: plot of chunk totalmets

Get detailed data for altmetrics using `almevents`

```r
out <- almevents(doi = "10.1371/journal.pone.0029797")
names(out)  # names of sources
```

```
 [1] "bloglines"        "citeulike"       "connotea"
 [4] "crossref"         "nature"          "postgenomic"
 [7] "pubmed"           "scopus"          "counter"
[10] "researchblogging" "biod"            "pmc"
[13] "facebook"         "mendeley"        "twitter"
[16] "wikipedia"        "scienceseeker"   "relativemetric"
[19] "f1000"            "figshare"
```

```r
out <- out[!out %in% c("sorry, no events content yet", "parser not written yet")]  # remove those with 
out[["pmc"]]  # get the results for PubMed Central
```

```
   abstract cited-by figure full-text month pdf scanned-page-browse
1         1        0      9        51     1   8                    0
2         0        0     11        15     2   4                    0
3         0        0      0        11     3   4                    0
4         1        0      0         6     4   2                    0
5         0        0      0         5     5   1                    0
6         0        0      2         7     6   2                    0
7         1        0      3         6     7   3                    0
8         1        0      0         5     8   0                    0
9         0        0      3        14     9   5                    0
10        1        0      1        20    10   4                    0
11        0        0      1        13    12   1                    0
12        1        0      0        10    11   1                    0
   scanned-summary supp-data unique-ip year
1                0         0        42 2012
2                0         2        11 2012
3                0         0        12 2012
4                0         0         6 2012
5                0         0         5 2012
6                0         0         9 2012
7                0         0         8 2012
8                0         0         4 2012
9                0         0        13 2012
10               0         0        16 2012
11               0         0        12 2012
12               0         0         9 2012
```

```r
out[["twitter"]]  # get the results for twitter (boo, there aren't any)
```

```
                  id
1 237088032224849920
2 237088322290331648
3 263798980054487041
4 263799348842872832
5 263960642589949953
6 282528931503038464
7 282528931612082177
```

```
8 284131287810338818
9 313850610174799873


1                                          #PLOS: Ecological Guild Evolution and the Discovery of the World's Sm
2                                          #PLOS: Ecological Guild Evolution and the Discovery of the World's Sm
3      Happy #Halloween from Maria @PLOSONE, dressed as a tiny frog, complete with dime for scale! ht
4 RT @multidiscipl1ne: Happy #Halloween from Maria @PLOSONE, dressed as a tiny frog, complete with dime
5 RT @multidiscipl1ne: Happy #Halloween from Maria @PLOSONE, dressed as a tiny frog, complete with dime
6            2012: Discovery of the World's Smallest Vertebrate: a frog http://t.co/BwkxRTdm in @PLOS(
7             2012: Descubrimiento del vertebrado más pequeño: una rana http://t.co/BwkxRTdm in @PLOS(
8
9                                    Ecological Guild Evolution and the Discovery of the World's Smal
                     created_at            user
1 Sun Aug 19 07:26:06 +0000 2012        opdebult
2 Sun Aug 19 07:27:15 +0000 2012       forestalis
3 Thu Nov 01 00:25:53 +0000 2012    multidiscipl1ne
4 Thu Nov 01 00:27:20 +0000 2012      BernScience
5 Thu Nov 01 11:08:16 +0000 2012    mattjhodgkinson
6 Sat Dec 22 16:52:01 +0000 2012   sferrebenedicto
7 Sat Dec 22 16:52:01 +0000 2012   sferrebenedicto
8 Thu Dec 27 02:59:12 +0000 2012       LeeAnaconda
9 Tue Mar 19 03:13:11 +0000 2013        didicikit
                                                                          user_profile_imag
1                                     http://a0.twimg.com/profile_images/1741153180/Tidan_normal.j|
2                                   http://a0.twimg.com/profile_images/654250700/ForestalisIco_normal.j|
3 http://a0.twimg.com/profile_images/1910116023/261235_920680811178_6708085_43508969_7138379_n_normal.j|
4                                      http://a0.twimg.com/profile_images/1788875907/new_normal.j|
5                       http://a0.twimg.com/profile_images/2595571976/bc2za9tnyui0wxobreb0_normal.jp|
6            http://a0.twimg.com/profile_images/2935384666/94c858315bbf621ae3916019026a6c24_normal.jp|
7            http://a0.twimg.com/profile_images/2935384666/94c858315bbf621ae3916019026a6c24_normal.jp|
8            http://a0.twimg.com/profile_images/2765018809/5b540749006aaf85c5661c67d93b68e7_normal.jp|
9                                      http://a0.twimg.com/profile_images/1809269429/hop_normal.j|
```

```r
out[c("twitter", "crossref")]  # get the results for two sources
```

```
$twitter
                 id
1 237088032224849920
2 237088322290331648
3 263798980054487041
4 263799348842872832
5 263960642589949953
6 282528931503038464
7 282528931612082177
8 284131287810338818
9 313850610174799873


1                                          #PLOS: Ecological Guild Evolution and the Discovery of the World's Sm
2                                          #PLOS: Ecological Guild Evolution and the Discovery of the World's Sm
3      Happy #Halloween from Maria @PLOSONE, dressed as a tiny frog, complete with dime for scale! ht
4 RT @multidiscipl1ne: Happy #Halloween from Maria @PLOSONE, dressed as a tiny frog, complete with dime
5 RT @multidiscipl1ne: Happy #Halloween from Maria @PLOSONE, dressed as a tiny frog, complete with dime
6            2012: Discovery of the World's Smallest Vertebrate: a frog http://t.co/BwkxRTdm in @PLOS(
7             2012: Descubrimiento del vertebrado más pequeño: una rana http://t.co/BwkxRTdm in @PLOS(
```

```
8
9                                            Ecological Guild Evolution and the Discovery of the World's Smal
                   created_at          user
1 Sun Aug 19 07:26:06 +0000 2012       opdebult
2 Sun Aug 19 07:27:15 +0000 2012      forestalis
3 Thu Nov 01 00:25:53 +0000 2012 multidiscipl1ne
4 Thu Nov 01 00:27:20 +0000 2012     BernScience
5 Thu Nov 01 11:08:16 +0000 2012 mattjhodgkinson
6 Sat Dec 22 16:52:01 +0000 2012 sferrebenedicto
7 Sat Dec 22 16:52:01 +0000 2012 sferrebenedicto
8 Thu Dec 27 02:59:12 +0000 2012     LeeAnaconda
9 Tue Mar 19 03:13:11 +0000 2013       didicikit
                                                                      user_profile_imag
1                              http://a0.twimg.com/profile_images/1741153180/Tidan_normal.jj
2                               http://a0.twimg.com/profile_images/654250700/ForestalisIco_normal.jj
3 http://a0.twimg.com/profile_images/1910116023/261235_920680811178_6708085_43508969_7138379_n_normal.jj
4                                http://a0.twimg.com/profile_images/1788875907/new_normal.jj
5                  http://a0.twimg.com/profile_images/2595571976/bc2za9tnyui0wxobreb0_normal.jpe
6           http://a0.twimg.com/profile_images/2935384666/94c858315bbf621ae3916019026a6c24_normal.jpe
7           http://a0.twimg.com/profile_images/2935384666/94c858315bbf621ae3916019026a6c24_normal.jpe
8           http://a0.twimg.com/profile_images/2765018809/5b540749006aaf85c5661c67d93b68e7_normal.jpe
9                              http://a0.twimg.com/profile_images/1809269429/hop_normal.jj

$crossref
              issn                       journal_title
1 1439-6092; 1618-1077        Organisms Diversity & Evolution
2 1313-2970; 1313-2989                             ZooKeys
3            00218790            Journal of Animal Ecology
4 1936-6426; 1936-6434      Evolution: Education and Outreach
5 0018-0831; 1938-5099                         Herpetologica
6            10557903      Molecular Phylogenetics and Evolution
7            00244066 Biological Journal of the Linnean Society
               journal_abbreviation
1                   Org Divers Evol
2                           ZOOKEYS
3                         J Anim Ecol
4                     Evo Edu Outreach
5                        Herpetologica
6 Molecular Phylogenetics and Evolution
7                 Biol J Linn Soc Lond

1 New insights into the systematics and molecular phylogeny of the Malagasy snake genus Liopholidophis s
2                                                                                            Acceler
3
4
5                                            A New Species of Miniaturized Toadlet, GenusBrachyceph
6                               Genetic diversity, phylogeny and evolution of alkaloid se
7                                                                             Are dim
                                                                         contribu
1          Frank Glaw; Christoph Kucharzewski; Zoltán T. Nagy; Oliver Hawlitschek; Miguel Vend
2                                Terry Erwin; Lyubomir Penev; Pavel Stoev; Teodor Georg
3                               Andrew D. C. MacColl; Aliya El Nagar; Job de Roij; Tom W
4                                                                        Kenneth J. McNama
5 Rute B. G Clemente-Carvalho; Ariovaldo A Giaretta; Thais H Condez; Célio F. B Haddad; Sergio F. dos R

                                       9
```

```
6                       Ariel Rodríguez; Dennis Poth; Stefan Schulz; Marcelo Gehara; Miguel Ven
7                                       Kenneth D. Angielczyk; Chris R. Feldr
  year publication_type                       doi fl_count volume
1 2013       full_text       10.1007/s13127-013-0152-4        0   <NA>
2 2012       full_text         10.3897/zookeys.251.4516        1    251
3 2013       full_text        10.1111/1365-2656.12028        0     82
4 2012       full_text       10.1007/s12052-012-0420-3        1      5
5 2012       full_text 10.1655/HERPETOLOGICA-D-11-00085.1      0     68
6 2013       full_text      10.1016/j.ympev.2013.04.031        0     68
7 2013       full_text              10.1111/bij.12010         0    108
  issue first_page
1  <NA>       <NA>
2     0          1
3     3        642
4     2        203
5     3        365
6     3        541
7     4        727
```

Retrieve and plot PLOS article-level metrics signposts.

```
dat <- signposts(doi = "10.1371/journal.pone.0029797")
plot_signposts(input = dat)
```

Or plot many identifiers gives a line chart

```
dois <- c("10.1371/journal.pone.0001543", "10.1371/journal.pone.0040117", "10.1371/journal.pone.0029797
    "10.1371/journal.pone.0039395")
dat <- signposts(doi = dois)
plot_signposts(input = dat)
```

Or make an interactive chart by doing `plot_signposts(input=dat, type="multiBarChart")`. Try it out!
It should open in your browser and you can interact with it.

Density and histogram plots from PLOS Article Level Metrics data

Note: Do you the key below in the `searchplos` call in this example, but if you plan to use rplos more, get
your own API key here.

```
library(rplos)
library(plyr)
dois <- searchplos(terms = "*:*", fields = "id", toquery = list("cross_published_journal_key:PLoSONE",
    "doc_type:full", "publication_date:[2010-01-01T00:00:00Z TO 2010-12-31T23:59:59Z]"),
    limit = 100, key = "WQcDSXml2VSWx3P")
alm <- alm(doi = do.call(c, dois$id), total_details = TRUE)
alm <- ldply(alm)
```

The default plot

```
plot_density(alm)
```
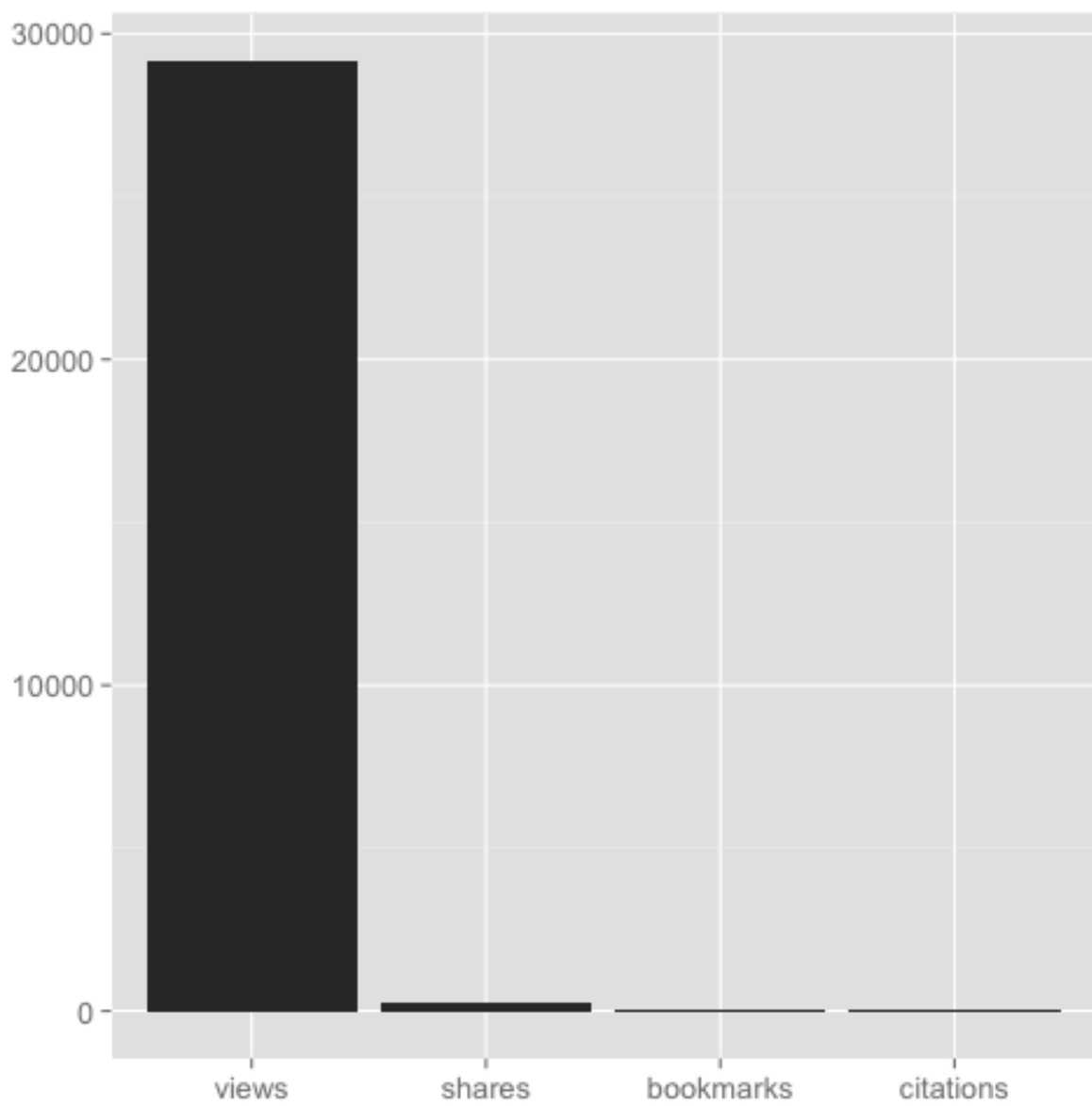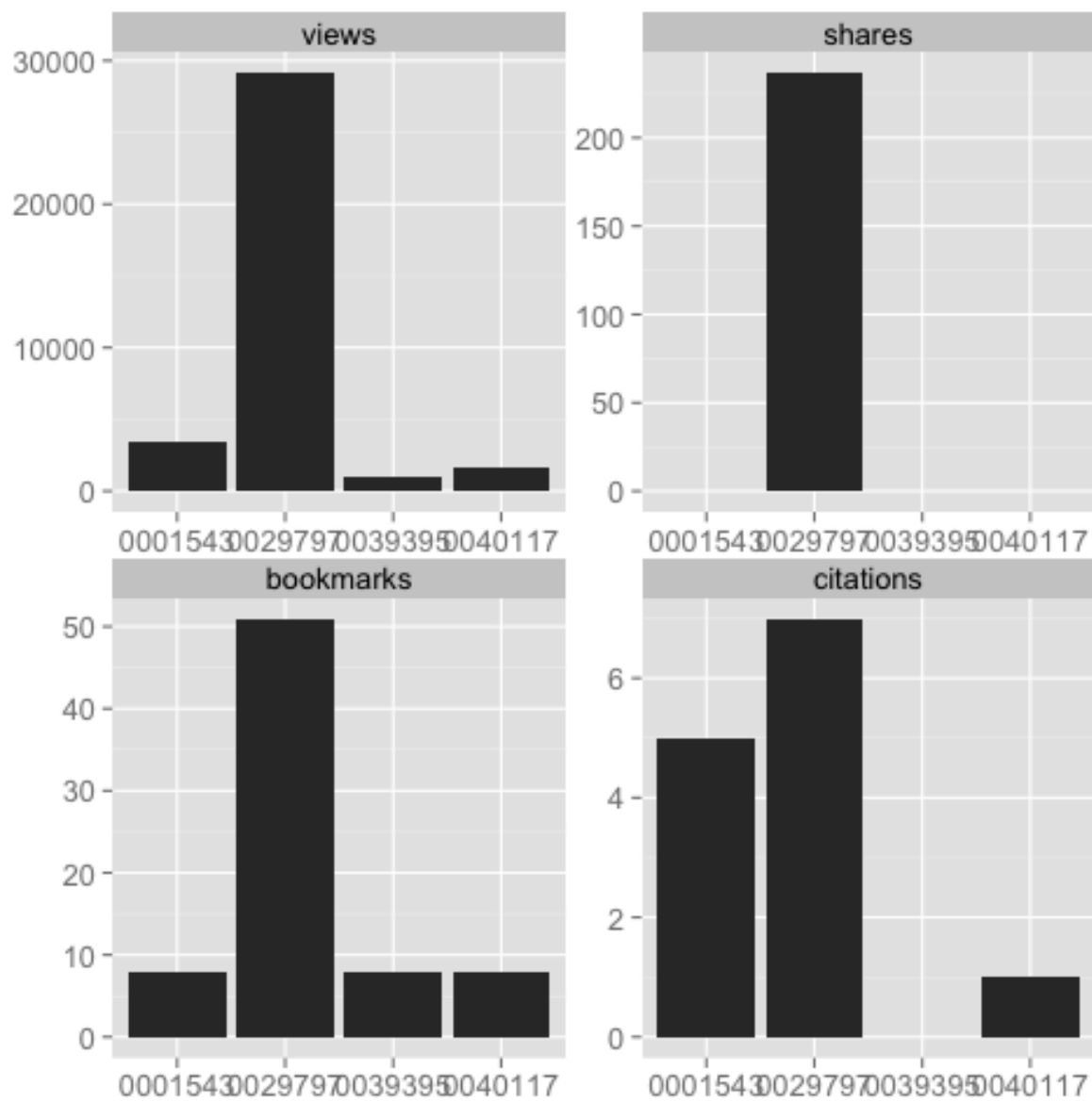
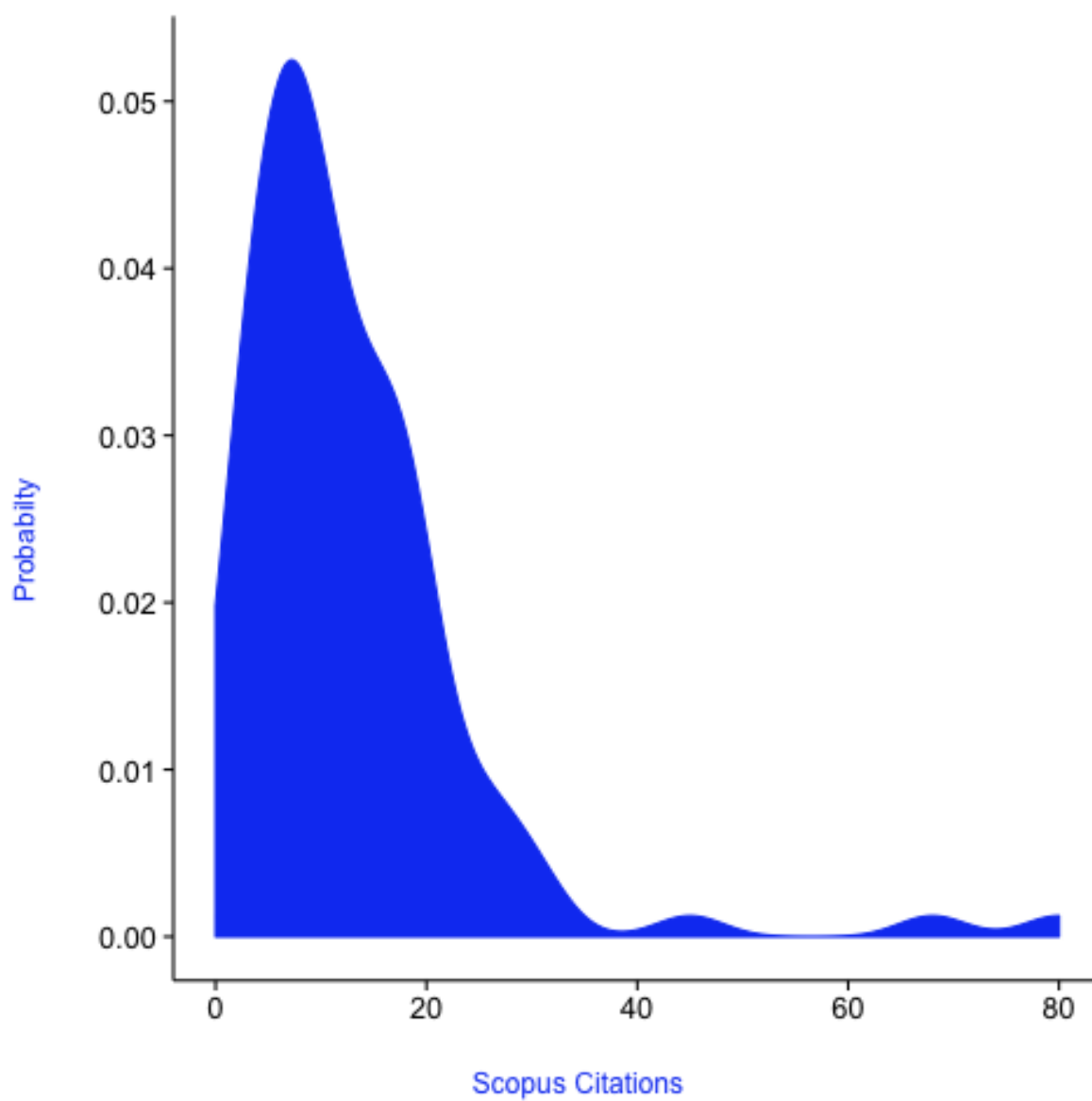Figure 2: plot of chunk signposts1

Figure 3: plot of chunk signposts2

Figure 4: plot of chunk plot_densityplot1

You can change the color of the density plot

```
plot_density(alm, color = "#EFA5A5")
```


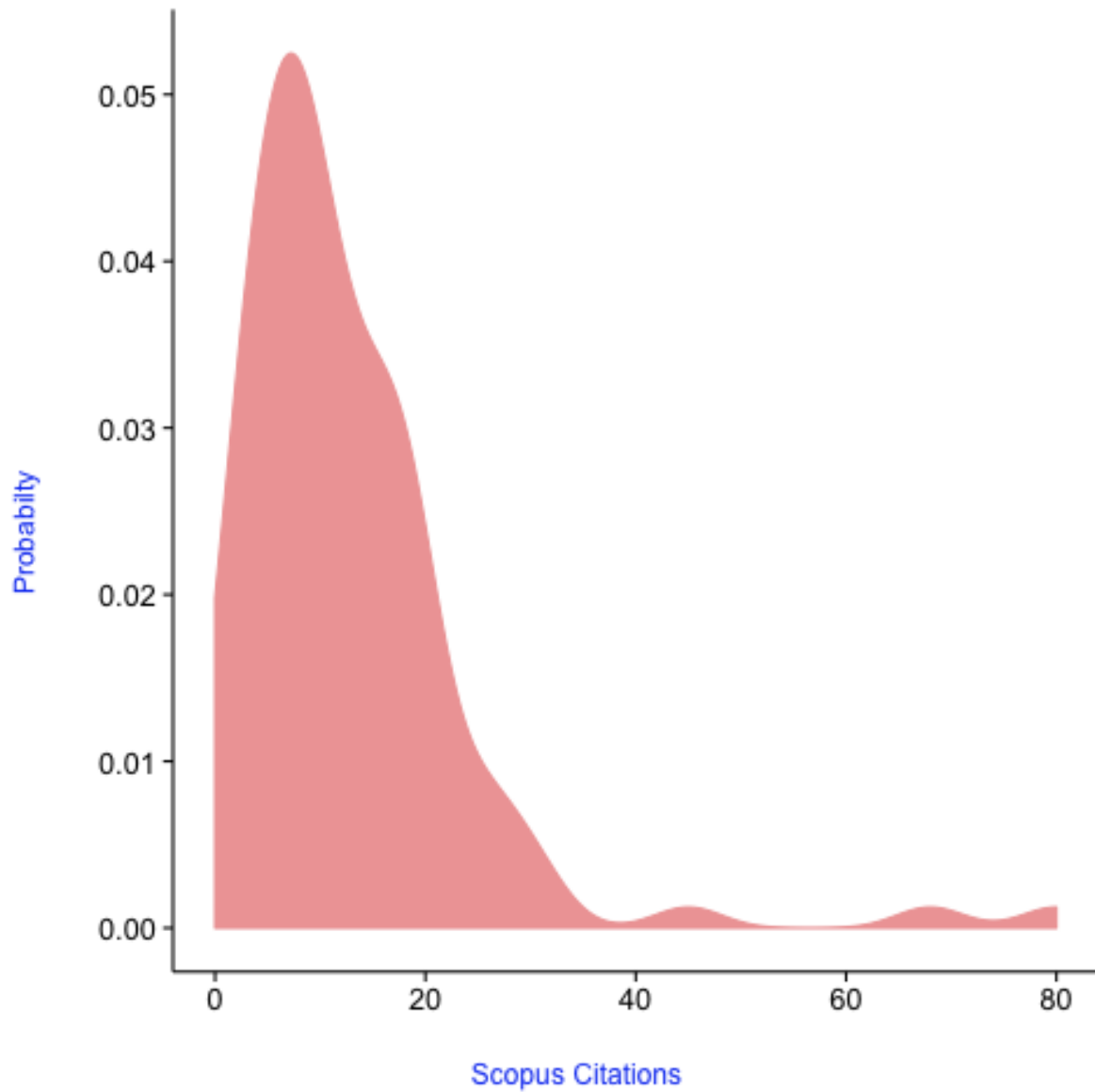Figure 5: plot of chunk plot_densityplot2

Pass in a title or description subtending the title

```
plot_density(alm, title = "Scopus citations from 2010")
```
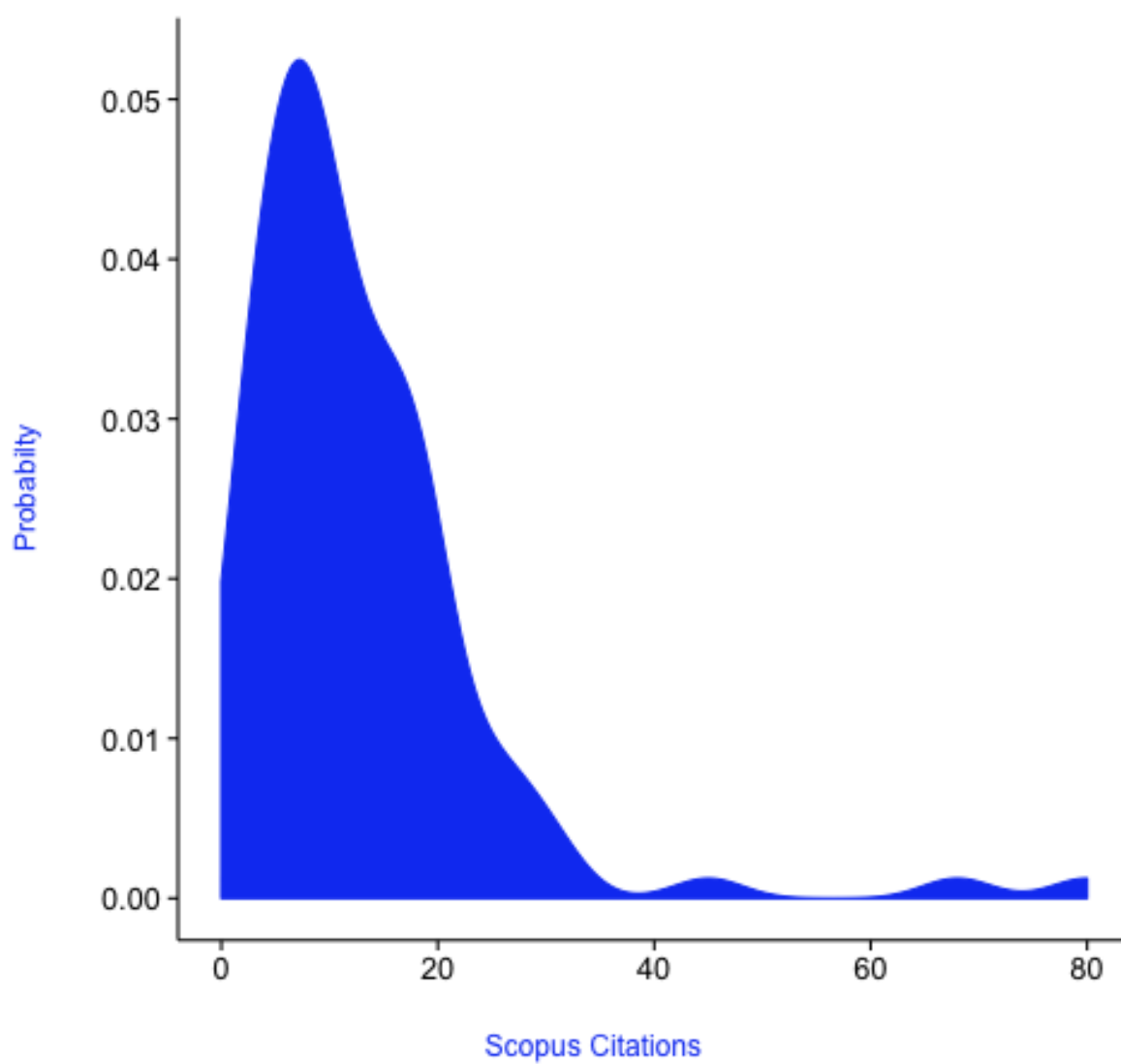
Plot a particular source

```
names(alm)[1:35]
```

Figure 6: plot of chunk plot_densityplot3

```
 [1] ".id"                 "doi"                  "title"
 [4] "publication_date"    "bloglines_pdf"        "bloglines_html"
 [7] "bloglines_shares"    "bloglines_groups"     "bloglines_comments"
[10] "bloglines_likes"     "bloglines_citations"  "bloglines_total"
[13] "citeulike_pdf"       "citeulike_html"       "citeulike_shares"
[16] "citeulike_groups"    "citeulike_comments"   "citeulike_likes"
[19] "citeulike_citations" "citeulike_total"      "connotea_pdf"
[22] "connotea_html"       "connotea_shares"      "connotea_groups"
[25] "connotea_comments"   "connotea_likes"       "connotea_citations"
[28] "connotea_total"      "crossref_pdf"         "crossref_html"
[31] "crossref_shares"     "crossref_groups"      "crossref_comments"
[34] "crossref_likes"      "crossref_citations"
```

```r
plot_density(input = alm, source = "crossref_citations")
```

Plot many sources in different panels in the same plot, and pass in colors just for fun

```r
plot_density(input = alm, source = c("counter_total", "crossref_citations",
    "twitter_total", "wos_citations"), color = c("#83DFB4", "#EFA5A5", "#CFD470",
    "#B2C9E4"))
```

Alt-metrics total citations from all sources.

```r
almtotals(doi = "10.1371/journal.pbio.0000012")
```

```
  views shares bookmarks citations
1 29349      0        79       143
```

Get title of article by inputting the doi for the article.

```r
almtitle(doi = "10.1371/journal.pbio.0000012")
```

```
[1] "Genome-Wide RNAi of C. elegans Using the Hypersensitive rrf-3 Strain Reveals Novel Gene Functions"
```
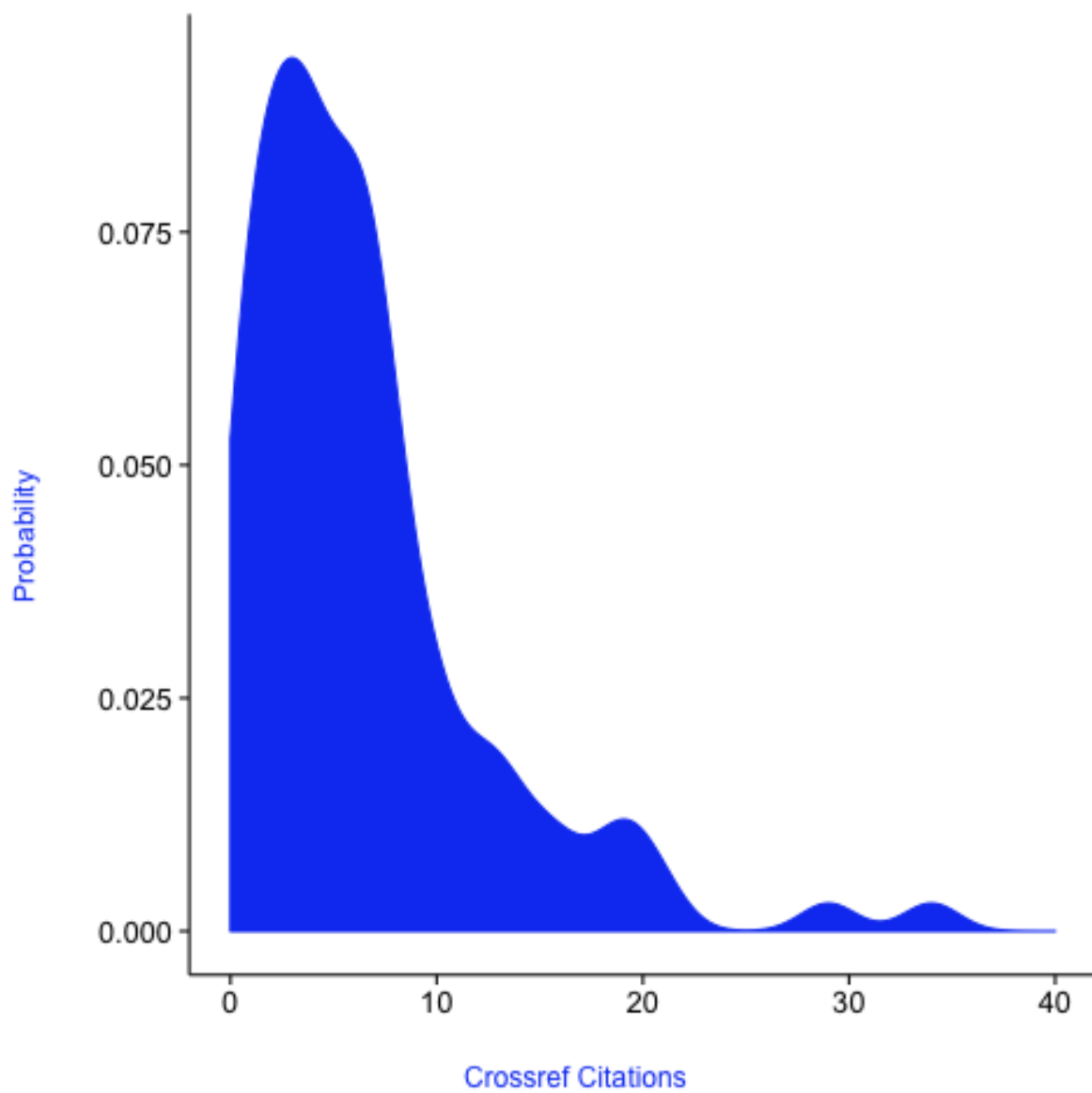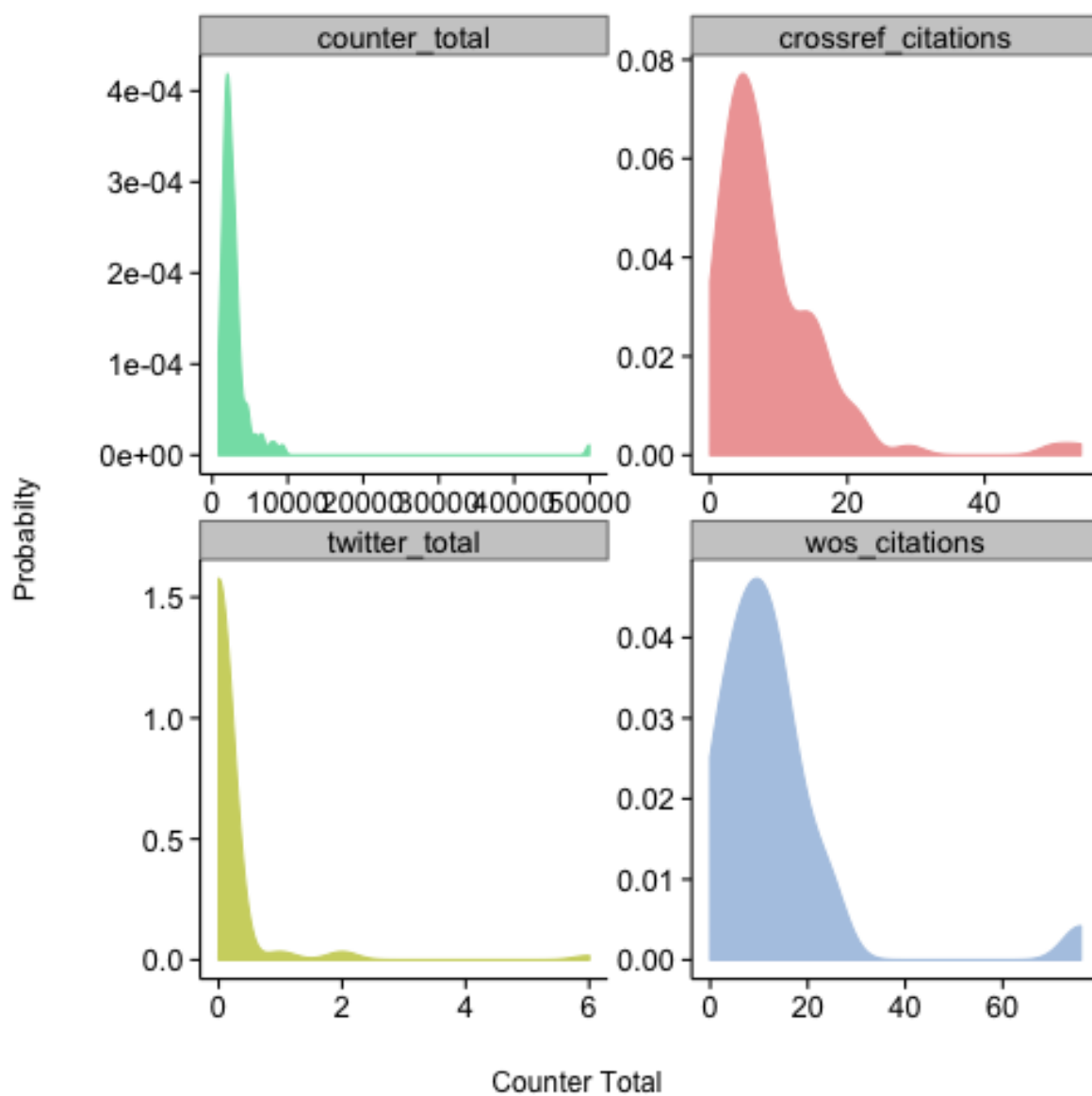
Figure 7: plot of chunk plot_densityplot4

Figure 8: plot of chunk plot_densityplot5