# Subisistence Fishing on Cape Fear River ¶

Going through the data from intercept surveys, WIC clinic visits and online surveys collected during fall / winter 2019-2020 as part of the Steven Yang and Martin Dietz's master's project available here (https://dukespace.lib.duke.edu/dspace/handle/10161/20557)

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# Setup

I do a few things here to setup for exploring our dataset:

1. Import the library I used for programming ('pandas')
2. Read in the data set. This data is from a 'master' csv file in which I combined the responses from intercept surveys, online surveys and WIC clinic surveys.
3. Write a couple of helper functions that will be used throughout.
4. Clean up the data, keeping only complete responses by filtering out our trial runs through the surveys and the responses from participants who don't eat fish from the river and therefore didn't go through all the questions.

In [261]:
```
import pandas as pd
```

In [262]:
```
# not read_csv has many paramaters you can specify. First tring with no
 specifications
df = pd.read_csv('master.csv')
df.shape  # tells us that there are 103 rows and 96 columns in this data
set
```

Out[262]:
```
(103, 95)
```

### Useful functions

Now I'll define a couple functions that will be useful for interpreting our data. **Please ignore this if you're not interested in the programming I did on the backend!** The first function aggregates across multiple choice responses. When people selected many things, like many different cooking or preparation methods, this goes through and aggregates how many times each option was chosen. The second function filters out blanks and then prints a list of free form responses under a title starting with '>>>'

In [263]:
```
def aggregate_mult_choice(column_header):
    mask = df_completed[column_header].notna()  # This creates a mask we
use to filter out blank responses
    resp_list = df_completed[column_header][mask].tolist()
    response_dict = {}
    for resp in resp_list:
        for choice in resp.split(','):
            choice = choice.strip().lower()
            if choice not in response_dict:
                response_dict[choice] = 0
            response_dict[choice] += 1
    return response_dict
def print_freeform_columns(list_of_headers):
    for header in list_of_headers:  # This goes through each column in t
he list, filters blanks, and prints the responses
            mask = df_completed[header].notna()
            resp_list = df_completed[mask][header].tolist()
            print('>>> ' + header[10:] + ' (verbal responses): ')   # th
is removes the 'FREE FORM ' from column head and prints the rest/
            for resp in resp_list:
                print(resp)
```

### Cleaning the Data

We mostly completed intercept surveys with some activity online and a few from WIC clinics. Still, the above dataframe ('df_answered') includes some respondents who didn't eat fish and also some tests of the survey that Steven and I completed. A condition for taking the whole survey was that the individual eats fish from the river, so I'll make a dataframe of qualified responses by keeping only the responses in which the respondent said 'Yes' to eating fish from the river, and therefore qualified to take the survey.

In [264]:
```
df_answered = df[df.finished == True]  # filtering out the responses whi
ch qualtrics determined were unfinished
df_answered.shape # lets look at the shape of the new data set
```

Out[264]:
```
(76, 95)
```

In [265]:
```
df_qualifies = df_answered[df_answered['resp_eat_fish'] == 'Yes']  # kee
ping only responses in which the respondent eats fish from CFR
locationMask = df_qualifies.location.notna()  # making a mask for respon
ses that are not blank ('NaN')
df_completed = df_qualifies[locationMask]  # Now we create the modified
 database with complete responses
df_completed.shape  # now we've kept only 45 rows (each representing a r
esponse) but still 96 columns (fields)
```

Out[265]:
```
(45, 95)
```

To start lets see counts of responses by source (intercept, online, WIC)

In [266]:
```
df_completed['source'].value_counts()
```

Out[266]:
```
intercept    37
online        6
WIC           2
Name: source, dtype: int64
```

So most of our completed surveys were intercept surveys, with a few online and a couple WIC

# Presenting our Results

## Demographics

In the survey we asked people's gender identification, education level, and age. We also observed and recorded race, but those numbers can be seen in our presentation and write-up and are not in this dataset.

In [267]:
```
df_completed['age'].value_counts().sort_index()
```

Out[267]:
```
18-20           1
21-29           6
30-39          11
40-49           4
50-59          10
60 or older    12
Name: age, dtype: int64
```

In [268]:
```
df_completed['gender'].value_counts()
```

Out[268]:
```
Male      36
Female     8
Name: gender, dtype: int64
```

In [269]:
```
df_completed['educ'].value_counts()
```

Out[269]:
```
High school diploma, or equivalent (for example, GED)    14
Some college, no degree                                   9
Bachelor degree                                           6
Associate degree                                          6
Less than high school degree                              5
Graduate degree                                           2
Name: educ, dtype: int64
```

This shows how we got our demographic figures, and it's clear that we reached mostly men of varying ages but of predominantly lower education levels.

## Fish Species Consumed

In [270]:
```
# This gives me a list of the columns with data on the fish people eat.
 I'll use it to make another smaller dataframe
col_list = []
for col in df_completed.columns:
    if col[0:3] == 'eat':
        col_list.append(col)
df_complete_fish = df_completed[col_list]
```

'On' values means that the respondent selected that fish as a species they consume. I'd like to aggregate how many are 'On' in each column and present that.

In [271]:
```
# To make it easier to add, I want to replace 'On' with 1 and 'Off' with
0:
df_complete_fish = df_complete_fish.replace({'On': 1, 'Off': 0})  # had
 to reassign it to a new df to avoid modifying df in place errors
```

In [272]:
```
# Now to sum up each column and then present the ordered results
df_complete_fish = df_complete_fish.append(df_complete_fish.sum().rename
('Total'))
headers = list(df_complete_fish.columns.values)
totals = df_complete_fish.values.tolist()
species_and_totals = {}
for i in range(len(headers)):
    species_and_totals[headers[i][5:]] = str(totals[-1][i])
sorted(species_and_totals.items(), key = lambda x: x[1], reverse = True)
```

Out[272]:
```
[('Blue Catfish', '9'),
 ('Flathead Catfish', '8'),
 ('Striped Bass', '7'),
 ('White Catfish', '5'),
 ('Bluegill', '4'),
 ('Black Crappie', '3'),
 ('Largemouth Bass', '3'),
 ('Redear Sunfish', '3'),
 ('American Shad', '2'),
 ('Warmouth', '2'),
 ('Channel Catfish', '10'),
 ('Redbreast Sunfish', '1'),
 ('White Crappie', '1'),
 ('Hickory Shad', '1'),
 ('Bowfin (Blackfish)', '0'),
 ('Carp', '0'),
 ('Green Sunfish', '0')]
```

This shows the total number of times people reported eating each species in order from most to least consumed!
NOTE: the above totals exclude the write-in responses! Our chart showed mostly freshwater fish, but it turns out the people eat many brackish water species.
Also NOTE: we didn't make it clear that we were also asking about shellfish. More people than reported might eat blue crab.
Final NOTE: bluegill showed up twice in survey's menu of options (maybe intentional to show two different types?). In cleaning up the data I combined the responses in to one column for bluegill.

Now let's take a look at the verbal responses that Steven and I recorded:

In [214]:
```
verbal_fish_dict = aggregate_mult_choice('FREE FORM other fish')
sorted(verbal_fish_dict.items(), key = lambda x: x[1], reverse = True)
# This prints the dictionary in order - lots of drum!
```

Out[214]:
```
[('red drum', 21),
 ('black drum', 19),
 ('speckled trout', 15),
 ('flounder', 8),
 ('croaker', 7),
 ('spot', 6),
 ('sheepshead', 6),
 ('blue fish', 5),
 ('whiting', 4),
 ('pig fish', 2),
 ('blue crab', 2),
 ('chipre black and white', 1),
 ('gar', 1),
 ('mojarra', 1),
 ('gray fish', 1),
 ('sand perch', 1),
 ('red snapper', 1),
 ('la chipa', 1),
 ('redfish', 1),
 ('tripletail', 1),
 ('puffer fish', 1),
 ('not sure', 1),
 ('smaller fish', 1)]
```

Here we've seen our verbal and our recorded responses in the survey! Amidst the recorded responses, people often selected various types of catfish, primarily channel catfish. In the verbal responses red and black drum were most commonly mentioned.

## Fishing Locations

NOTE: We have a heat map that qualtrics created from a map in our survey that users could click on! I won't present that data here b/c it's well presented in qualtrics, our write-up, and our presentation. But here's the list of verbal responses for places people fish that they couldn't find on the map:

In [215]:
```
print_freeform_columns(['FREE FORM fishing locations'])
```

```
>>> fishing locations (verbal responses):
Beaches like wrightsville. Kerr. Carolina.
Fort Fischer. Wrightsville Beach in Bridge. Red man creek by Wilmington
Snows cut
Snows cut, wrightsville beach, NC wildlife ramp under bridge
River road st Park and up and down stream
Cure beach
snows cut, Carolina beach inlet
Resize map
Princess Place, Carolina beach st park, snows cut
Belville
Curry beach
I Intercostal waters. Mouth of river
Roanoke rapids
Solomon towers, chamber of commerce, love grove
Snows cut
Black river
Eagle island bait shop on 421. Talk to people there
Beaches and piers
```

## Quantity of Fish Consumed

In [216]:
```
df_completed['portions in a meal'].value_counts().sort_index()
```

Out[216]:
```
About 1 portion         17
About 2 portions        17
About 3 portions         6
About 4 portions         2
About 5 portions         2
More than 5 portions     1
Name: portions in a meal, dtype: int64
```

In [217]:
```
df_completed['meals per month'].value_counts().sort_index()
```

Out[217]:
```
1-3 meals            34
4-6 meals             6
7-9 meals             1
More than 9 meals     4
Name: meals per month, dtype: int64
```

The above indicates that 1 to 2 portions in a meal are most common, and that overwhelmingly our respondents report eating just one to three meals per month.

### Fish Sharing Behaviors

NOTE: In the original survey we included an option for people to say "Both: I eat it myself and share with others." We've since realized this was unnecessary b/c we ask at the beginning of the survey if people eat the fish themselves, so if a respondent is at this point in the survey then we know that they eat fish! So, in this dataset I replaced all the "Both" options with "Yes"

In [218]:
```
df_completed['shares fish with others'].value_counts()
```

Out[218]:
```
Yes    41
No      4
Name: shares fish with others, dtype: int64
```

In [219]:
```
df_completed['number of people <15 '].value_counts().sort_index()
```

Out[219]:
```
0            25
1 to 3       12
4 to 6        2
6 or more     1
Name: number of people <15 , dtype: int64
```

In [220]:
```
df_completed['number of fem 15-44'].value_counts().sort_index()
```

Out[220]:
```
0            13
1 to 3       24
4 to 6        1
6 or more     3
Name: number of fem 15-44, dtype: int64
```

From this it is clear that sharing is very common. It mostly occurs with women of childbearing age, but a substantial number of respondents also report sharing with children.

## More Detailed Results

Now, we'll go beyond our basic questions about who is eating what fish from where on the river to look deeper at what people do with the fish other than eating, how they prepare it before eating, and how people receive and interpret information on whether or not it is safe to eat fish from the river.

### What do People do With Fish Other Than Eating?

In [221]:
```
other_resp_dict = aggregate_mult_choice('fish use other than eating')
other_resp_dict
```

Out[221]:
```
{'catch and release': 29, 'other': 8}
```

And let's take a look at some of the verbal responses we noted:

In [222]:
```
print_freeform_columns(['FREE FORM other use'])
```

```
>>> other use (verbal responses):
Give away too
Share with friends and family
Share an old couple
Share fish with neighbors
Compartir
Cut up shad for bait
Share it, use for bait
Give away free. Neighbors family friends.
```

This question shows that catch and release is very common, and the verbal responses indicate a high degree of sharing fish out in the community.

## How are People Preparing and Cooking the Fish?

In [223]:
```
cooking_methods = aggregate_mult_choice('cooking methods')
cooking_methods
```

Out[223]:
```
{'fried': 38,
 'baked': 17,
 'grilled': 15,
 'other (explain):': 10,
 'steamed': 3,
 'smoked': 4,
 'stewed': 2,
 'boiled': 2}
```

There were some interesting verbal responses to preparation methods. Here they are:

In [224]:
```
print_freeform_columns(['FREE FORM cooking'])
```

```
>>> cooking (verbal responses):
Blackened
Sopa
Blackened
Almost entirely catch and release
Ceviche con limon, parrillar con limon, estofado
Cast iron skillet
Broil
Flour and cornmeal in hot grease
Grill with wood chips
Already spiced with genes
```

^^^ Note that the last verbal response has a typo. This person said 'Already spiced with genex'.

In [225]:
```
preparation_methods = aggregate_mult_choice('preparation methods')
sorted(preparation_methods.items(), key = lambda x: x[1], reverse = True
)  # This prints the dictionary in order
```

Out[225]:
```
[('remove scales', 32),
 ('remove fish organs', 30),
 ('fillet (only meat with no fat skin or bones)', 29),
 ('remove head', 27),
 ('remove skin', 18),
 ('remove fat', 8),
 ('other (explain):', 6)]
```

There were also some verbal responses about preparation methods, lets check those out:

In [226]:
```
print_freeform_columns(['FREE FORM preparation'])
```

```
>>> preparation (verbal responses):
Limon para evitar bacteria,
Butterfly it and grill it with onions
Every once in a while pan fry whole fish no head
A veces piel y cabeza
Stuff with shrimp, crab, red pepper, yellow
Soak in sea salt water 24 hours. Takes fish taste out
```

These results show the popular cooking methods (primarily frying) and the most common means of preparation as well as some interesting verbal explanations

## Are Fishing Advisories Visible and Easy to Understand?

In [227]:
```
df_completed['seen fish advisories'].value_counts()
```

Out[227]:
```
Yes    30
No     15
Name: seen fish advisories, dtype: int64
```

## Pollution Concerns

We asked people whether or not they were concerned about pollution in the river, and got some insightful follow up verbal responses!

In [228]:
```
df_completed['pollution concerns'].value_counts()
```

Out[228]:
```
Yes    37
No      7
Name: pollution concerns, dtype: int64
```

In [229]:
```
print_freeform_columns(['FREE FORM pollution concerns'])
```

```
>>> pollution concerns (verbal responses):
People need to stop dumping in the river
Mercury , sewage
Checks but nothing really. Checks for worms
Fish population are low, hard to reproduce with limited fish. Health ef
fects from chemicals.
La basura contamina el río. Every time I see trash I pick it up
Cancer and health issues. Gen X , coal ash, dead fish kills
sewage. More salt now cuz its better
unsure whats in it...so thats why. Something is wrong with cfr
Down the river sewage discharge from norchase. Just knowing what's on t
he river. A chemical plant producing chromium. Hog farms and chicken fa
rms
Plastic and waste goes in.
pollution in river gets him worried
Littering at fishing spots and water
Don't know what's in water. Gasoline, genex
Que los peces están muriendo
Bacteria, salmonela, but ceviche helps
Mercury and lead . Fish eating trash and parasites.
Contamination. Dumping in water. Not just trash
Sewage outlet at wrightsville beach. And genex
Dead fish, plastic trash
Concerned but doesn't know what to think.
Sometimes. Striped bass. No complaints about taste
Very aware of pollution. Concerned that government allows corporations
to get away with it.
Trash, and oil
Genex
Worried about shit pumping plants, dumping raw sewage. Smith creek Hewl
ett-Packard creek.
Water quality pollution concerns.
In the freshwater he's worried
Upriver from here 5eres genex so they don't eat the fish
Coal ash and gen x. Gen x been around for a while. Since 1970s
Black spots on the skin. Doesn't know what it is
Poision fish, toxins in fish
I had kidney cancer at age 39. I
heavy metal content
Effect of pollutants/hurricanes/runoff on fish meat
mercury
Que no va haber pescaditos
```

Indicates that people are overwhelmingly concerned about pollution in the river and in the fish. The verbal responses shed light on the many forms that these concerns take!

## Sources of Information

### Where do people get information on which fish are safe to eat?

In [230]:
```
sources_of_info = aggregate_mult_choice('sources of information')
sorted(sources_of_info.items(), key = lambda x: x[1], reverse = True)  # This prints the dictionary in order
```

Out[230]:
```
[('news', 21),
 ('other', 17),
 ('internet', 15),
 ('other people that are fishing', 11),
 ('family or friends', 8),
 ('signs and posters', 5),
 ('government', 4),
 ('bait and fishing shops', 3),
 ('schools', 1),
 ('radio', 1)]
```

In [231]:
```
# And now for a look at the verbal responses that we got, clarifying the
se selections:
list_of_columns = ['FREE FORM bait and tackle shops', 'FREE FORM news so
urces', 'FREE FORM internet sources',
                   'FREE FORM government sources', 'FREE FORM sign sourc
es', 'FREE FORM other sources']
print_freeform_columns(list_of_columns)
```

```
>>> bait and tackle shops (verbal responses):
tex's tackle
all I visit
>>> news sources (verbal responses):
Channel 6
Local channel 26.1. Local tv not cable
Carolina outdoor (tv program)
Morningstar, google for waste entering smith creek
Tv local
wilmington newspaper
local (wect, wway)
>>> internet sources (verbal responses):
Tide table website
Science
NC wildlife resources commission
>>> government sources (verbal responses):
Nc dept of wildlife
state
marine fisheries, noaa, samfc
north carolina public health and DEQ website, EPA
>>> sign sources (verbal responses):
Signs that say don’t leave trash
boat ramps
all posted signage
>>> other sources (verbal responses):
Wildlife officer
Fish Rules
Personal knowledge.
Commercial fishermen that are out there alll the time
license vendors
Work
I see it
Fisherman’s post. Distributed in bait shops and restaurants in the summ
er
Magazines
fishing magazine available at store that sells licenses. Also people bu
y licenses online
The internet
Trust yourself. Experience.
Personal experience
He just knows, looks unsafe
Own research
Never have this kind of information
```

Now a look at the verbal responses for when we asked, "what would be the best way of sharing such information?"

In [232]:
```
print_freeform_columns(['FREE FORM best sources'])
```

```
>>> best sources (verbal responses):
News and bait shops
Seminar with local fishermen. They'd be happy to attend if it's about w
ater quality or fish. County arboretum. Or county natural resources dep
t.
Tackle shop near Wrightsville beach, tackle shops
Boat landings.
Radio in Spanish, hablar con personas
Word of mouth
Televisión y radio. Radio la grande, El patrón
tackle shops. Island bait and tackle.
Advisories and information when you get licens
Through talking to other fishers
Tackle shops
No idea
Social media. Bait shops. Word of mouth. Academy.
Bait shops.
Word of mouth and internet
No se
sea view
Word. Mouth
Post at dock (behind glass)
Johnny Mercer pier, curry beach pier, state, signs or wallet,
Online is good
Bait shop
Bait shops
Facebook follow cape fear river watch
YouTube, fishbrain
Talk to people
Personal experience to get info.
Que tengan cuidado y laven bien. Radio. Videos.
If we can get signs, that's best
Bait shops. Walmart. Rural people drawn in
Fisherman's.com. Has weather could also have advisor
Local media including internet, facebook, etc.  Governors statement wou
ld be authoritative.  However some of us love fish and love to fish and
ignore the risk
newspaper, bait shops, NC wildlife resources comm
Flyers in tackle shops or sporting goods depts, informational sponsored
ads online geared towards fishermen, commercials on local tv / radio, s
pokesman present at educational seminars/boat shows/fishing clubs aroun
d the state
Stores, at the public ramps all Wilmington schools no just around the r
iver
Churches, community events.
The clinic
Internet
```

**Where do people get trusted health information?**

Also regarding sources of information, we asked where people get trusted health information:

In [233]:
```
health_info = aggregate_mult_choice('health information sources')
sorted(health_info.items(), key = lambda x: x[1], reverse = True)  # Thi
s prints the dictionary in order
```

Out[233]:
```
[('health clinic', 13),
 ('internet', 12),
 ('other', 8),
 ('family/friends', 4),
 ('church', 1)]
```

In [234]:
```
freeform_health_sources = ['FREE FORM internet health sources', 'FREE FO
RM other health sources']
print_freeform_columns(freeform_health_sources)
```

```
>>> internet health sources (verbal responses):
Fishing sites
Fisherman's guide
Epa, fisheries division, state of nc
Pub med
Government Websites - I used EPA website a lot but there is not much in
formation there anymore.  I use the NC public health website now most o
ften
>>> other health sources (verbal responses):
Dept of wildlife resource.
news. Like genx
Work and learning chrmicals.
Stores or someone who works at international paper
Healthdept
Postings on dock, fishing magazine cautions
News
physician
```

We see that people refer to many sources of information! The follow up on selections in the verbal responses shows some reliance on personal knowledge and also the specific news sources, websites and government agencies that people learn from. Finally, the verbal responses we recorded about best sources of information frequently mention tackle shops, signage, and many other creative information sources that this project might leverage.

**Fish Advisories: Are they useful, why or why don't they affect people's decisions?**

In [235]:
```
columns = ['seen fish advisories', 'fish advisories easy to understand',
'fish advisories affect decision']
for header in columns:
    fish_advisory_resp = aggregate_mult_choice(header)
    print(header + ': ')
    print(fish_advisory_resp)
```

```
seen fish advisories:
{'yes': 30, 'no': 15}
fish advisories easy to understand:
{'yes': 27, 'no': 2}
fish advisories affect decision:
{'yes': 15, 'no': 13}
```

We asked for follow-up information on whether or not fish advisories affected individual choices ot eat fish:

In [236]:
```
# And now for a look at the verbal responses that we got, clarifying the
se selections:
list_of_columns = ['FREE FORM affected decision', 'FREE FORM did not aff
ect decision']
print_freeform_columns(list_of_columns)
```

```
>>> affected decision (verbal responses):
Stay away from high mercury fish
A little bit. Health reasons, good to know what’s In my body
Si hay una señal que dice no comer, no lo haria
Not very specific but they work
Taking no chances.
If posted yes
Coming from New York you only want to eat one fish a month. Still learn
ing down here. Thinks it’s pretty bad here
Somewhat. In a way cuz she doesn’t eat them every day.
Because of the risk
Yes.  I always follow those guidelines
>>> did not affect decision (verbal responses):
doesn't care. Worry about Kids."Gonna die anyway"
Do my thing
Picky eater
Only on tv did they see that there’s a type of fish not to eat
Not really. Taste matters. If taste bad then not eat
No beacuse he just cooks it well
No because going after particular fish that the signs don’t talk about
Don’t read a whole lot of it
Catfish there’s no limit on what you can eat
Brother does fishing
Different fish
```

These responses suggest that people see and mostly understand fishing advisories. Responses are mixed with regards to whether or not these advisories influence decisions. For those that were influenced by fishing advisories, the reason was often to err on the side of caution or just trusting that if a sign is posted it is in their best interest to follow its advice. For those that were influenced by signage, responses exhibited self-reliance or instances where the fish mentioned on signs don't correspond to what they catch.

## Feedback on Informational Materials:

### Wallet Card

First we had a multiple choice question about what people took away from the card:

In [237]:
```
wallet_card_message = aggregate_mult_choice('wallet card takeaway')
sorted(wallet_card_message.items(), key = lambda x: x[1], reverse = True
)  # This prints the dictionary in order
```

Out[237]:
```
[('other', 24),
 ('some fish may have more contaminants than others', 22),
 ('some fish are safer to eat than others', 18),
 ('pregnant women and women between age 15-44 should not eat fish that
may have mercury',
  10)]
```

People followed up on their 'other' takeaways verbally. Here are those responses:

In [238]:
```
print_freeform_columns(['FREE FORM other takeaway'])
```

```
>>> other takeaway (verbal responses):
Check what your eating
Por algunos pescados hay que leer avisos antes de comer
Stop and check for contamination, where?
fish variety
website was noticeable.
Catfish are bottom feeders
Shrimps not a fish. Humans are the cause of the contamination
motto. Two different messages . To eat and to catch
Got Tv news about fish contaminants
I would think they’re all polluted the same
Striped mullet run
Stop and check
Interesting that striped bass is on there. Wouldn’t think high levels o
f mercury, disturbing to see blue crab.
Don’t eat too many of the same
Good public advisory
Saltwater fish safe to eat except catch fish. Catfish everyone knows ha
ve lots of mercury
The safest ones are saltymp
Freshwater. Comment on blue crabs.
Can’t read
Catfish and blue crab are scavengers
Where I can call
We have a problem
Interesting
```

We also asked whether or not the wallet card seemed useful:

In [239]:
```
wallet_card_useful = aggregate_mult_choice('wallet card useful')
sorted(wallet_card_useful.items(), key = lambda x: x[1], reverse = True)
# This prints the dictionary in order
```

Out[239]:
```
[('yes', 31), ('no', 10)]
```

And finally we collected some free form responses on why or why not the respondent found it useful, and what we could do to improve it:

In [240]:
```
list_of_columns = ['FREE FORM wallet card useful', 'FREE FORM wallet car
d not useful', 'FREE FORM improve wallet card']
print_freeform_columns(list_of_columns)
```

>>> wallet card useful (verbal responses):
Especially tourists
Easy to remember content
Yes. Add this to license purchases.
Especially people that don’t know about mercury
For people not from around here this would be useful.
If they don’t know. Experienced angler should know what to eat.
People with kids probs will.
Maybe.  May check it
fits in wallet
If they are interested in food safety they would check the cards.  If t
hey are not interested in water quality and its effects then they are
n't going to have this wallet card.
If those are with chemicals and contamination is probably
I have one for ticks so I would use this one too.
>>> wallet card not useful (verbal responses):
Probably not fisherman make mind up after catching fish and examining
When you get your permit you get all that info. Also he doesn’t know th
e name ps of all the fish
Nice but ppl do what they want to do. If he had family he'd be concerne
d.
not sure
If they’re gonna catch fish they’ll eat them
Upon getting info don’t need card
We eat what we catch
>>> improve wallet card (verbal responses):
Southern kingfish, potentially change name. Not as common neither.
Include size limits
Red drum.
Emphasizing which not to eat
Red drum, black drum, flounder ?what about them.
number to wildlife commission
Traducción
Sponsorship. Discount at cold stone or something
Distinguish more between salt fresh and both.
Add size limits and have it responsive to what you can keep
Cual no comer
Jaiba
Add it to license purchases.
Writing is small
Make the images bigger, combine the pages with fish to eat and not to
Should have periodic updates.
What does stop and check mean?
Nothing . Striped bass you can’t keep anyway
Add crawfish, add croakers, add black drum and sheepshead
Write cape fear river on top more clearly
Include more brackish
Post more of it around the river.
For the stop and check fish what to look for, what are the high contami
nants?
Get more freshwater fish on there
Get crappie on there
Get flounder on there opening in next few months?
Freshwater fish not as applicable.
Más visual
Striped bass you can’t catch anyways
More pictures of different kinds of fish, publicize

```
How do you check for it?
less small writing and use larger font for main points on types of fish
okay vs not okay.
The wallet card with the 'safe fish to eat' message was the clearest &
most direct to me (card that is lower left in the pics above).  It got
my attention and told which were the safest.
To have the reference on hand
Brochures less useful
Traducir
```

#### Refrigerator Magnet

Only the people who reported not knowing how to fillet were shown the magnet, so we only got a few responses since the overwhelming majority of respondents reported knowing how to fillet

In [241]:
```
magnet_message = aggregate_mult_choice('magnet main message')
sorted(magnet_message.items(), key = lambda x: x[1], reverse = True)  #
 This prints the dictionary in orderT
```

Out[241]:
```
[('fish contaminants are stored in their fat', 2),
 ('other', 1),
 ('it is healthier to fillet a fish before eating it', 1)]
```

There were a couple follow up responses on the magnets, just saying its useful and that filleting seems to be better for their health but not worth printing here. Also, our two responses from the WIC clinics were providing this feedback on the brochures, but didn't have much feedback other than the need to translate!

## Likelihood, barriers, and motivations for different behaviors

In [242]:
```
columns = ['would eat fewer polluted fish', 'would eat more lower pollut
ion fish', 'would fillet fish',
           'would buy fish from market', 'would grill or bake rather tha
n fry', 'would stop eating fish']
for header in columns:
    behavior_likelihood = aggregate_mult_choice(header)
    print('>>> ' + header + ': ')
    print(sorted(behavior_likelihood.items(), key = lambda x: x[1], reve
rse = True))
```

```
>>> would eat fewer polluted fish:
[('probably will do', 12), ('definitely will do', 11), ('probably not d
o', 9), ('definitely not do', 5), ('neutral', 4)]
>>> would eat more lower pollution fish:
[('probably will do', 19), ('definitely will do', 12), ('probably not d
o', 7), ('definitely not do', 2), ('neutral', 1)]
>>> would fillet fish:
[('definitely will do', 17), ('probably will do', 16), ('neutral', 5),
('probably not do', 3)]
>>> would buy fish from market:
[('probably will do', 16), ('definitely not do', 10), ('probably not d
o', 6), ('neutral', 5), ('definitely will do', 4)]
>>> would grill or bake rather than fry:
[('probably will do', 15), ('definitely will do', 11), ('probably not d
o', 10), ('neutral', 3), ('definitely not do', 2)]
>>> would stop eating fish:
[('definitely not do', 19), ('probably will do', 8), ('probably not d
o', 7), ('neutral', 3), ('definitely will do', 1)]
```

Please note, this output can be seen in a much more visually appealing format in our presentation! But this does show how we aggregated the responses. For the above, I print out the most commonly selected choice first, next to the number of times it was chosen.

We got a ton of clarification on people's choices. Here I'll list what we recorded from people's free form responses by which behavior they were responding to:

In [243]:
```
list_of_columns = ['FREE FORM other risk reduction option', 'FREE FORM e
at less polluted fish', 'FREE FORM eat more fish with lower pollution',
'FREE FORM fillet fish', 'FREE FORM grocery store fish', 'FREE FORM othe
r cooking methods', 'FREE FORM stop eating fish']
print_freeform_columns(list_of_columns)
```

>>> other risk reduction option (verbal responses):
Deep fry the fish to kill bacteria and get rid of contaminant
Limit the fish I eat. From there.
>>> eat less polluted fish (verbal responses):
I like it fresh
Don’t eat catfish or bass
Does not
Fish is fish,
People will eat what they are going to eat
Recent immigrants don’t yet understand regulations or what’s safe vs, n
ot. Also maybe don’t care
People have preferences for fish
People eat what they catch
Catfish are what people want to catch
He likes them
People like to eat these
i don't like eating those types of fish
>>> eat more fish with lower pollution (verbal responses):
likes shrimp
Same as above
Kingfish looked good. People don’t like shad or spot or bluegill. Shrim
p is alright, so are specks.
People eat what they catch
Some people come to eat what they want but will follow signs
If they’re big enough. Otherwise bait. These are all bait!
May eat these
i like to eat speckled trout
>>> fillet fish (verbal responses):
Algunos prefieren freir
People just do what’s easy.
If frying not getting rid of skin
Fillet for bigger fish. Not for little ones
i always fillet and skin the fish i catch
>>> grocery store fish (verbal responses):
Like fresh fish and know where it’s from. And grocery store fish might
add chemicals
wants them fresh and local
Trust myself more than grocery stores
Muy caro
After the storm people knew not to eat
Likes fresh fish
Fresh fish preference.
Some people do
Fresh fish preference.
Tastes better fresh from river
It is not as fresh and is more expensive
i only like fresh fish
Our local grocery stores don't sell local caught fish. It's mostly fore
ign. If we want fresh local fish, the local seafood markets are usually
too expensive. It's cheaper to catch your own.
>>> other cooking methods (verbal responses):
Everybody wants fried catfish nuggets
Freír es facil
I don’t see what the difference would be
People prepare it how they are used to
Probably not, frying is easy
People like their cooking methods

Don’t think you can cook pollutants out
Frying is easy
He does bake
Frying does the same thing to remove contaminants. His is at 400
Somebfish are better fried.
i like all cooking methods
Asado si
>>> stop eating fish (verbal responses):
Daniel Boone complex. Getting own food. Self sustainability.
Close and fresh fish. Want to know the source.
Only if they’re all contaminated. Some more concerned than others
Will stop if he knows what exact pollutions are in here
been doing it for his whole life
No because it’s a key part of diet
Wants local fresh fish
If it got extreme enough. Feels safe here above chem plant
good and reliable source of food
If the fish are here it free food
Hay que comer
Es gratis, una manera de relajar
If the news said so
Unless something major happens, people will keep eating fish from the river and creek
People have been doing it their whole lives. You kill it you eat it
With enough warnings, though. Retain communities would not listen or bother
No matter where they go there will still find fish from river
Good source of food
Way of life
If it’s bad enough. People stopped fishing at smith creek
No. Easier to quit eating McDonald’s
People will follow signs
People like it
I always check for visible signs of defects on fish and never eat these
i enjoy fishing
We have not been sickened by fish we've caught and ate.
Porque

## Final Comments

That's it for the official data. Here were all the last things people had to say!

In [244]:
```
print_freeform_columns(['FREE FORM last comments'])
```

```
>>> last comments (verbal responses):
Nice meeting ya
Concerned about sewage in water.
Tratar de tener limpio los sitios que uno va a pescar para no tener pro
blema con nadie. Con la ley. Botar basura
When is more research gonna be done? They know these companies are her
e, and they should be the ones to do it.
would like to know more about the whole deal with CFR
Appreciate us doing this and working on this. Anything we can do to red
uce pollution.
You can see the pollution especially plástic and it’s impact on wildlif
e
In army
Good luck
Compartir más
Me encanto la pesca
Fishing is good for you. Relaxing and stress free.
Going further up the river
What we’re doing is important for the environment and for the people. P
eople only learn not to fish if people die. We need science to forewarn
us.
Fillet on the card. Put it at bait shops and grocery stores. Also aroun
d Southport . Keep talking to people
Glad we’re doing it
Nope
Good work
Glad there’s people out here working in the environment, being outside
is my favorite thing to do, we have to take care of it.
Everything messed up. Man has dominion over the earth. Water color has
changed.
Good luck to you
Channel 6, WCT reporter. Young guy would like to do story.
Main concern is about sewage. Needs to stop. Poison going in to river n
eeds to stop.
If fish in our area are indicated as unsafe (which all of them probably
are because of the gen-x and pollutants), it would hurt the economy and
big business. They are number one, not the people.
keep up the good work. GO HEELS!!!
Yikes!
Nope that’s it
No
```

In [ ]:
```

```