

Personal Dataset

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```
Fish <- read.csv("VO_FISH_REA_HAWAII_2019.csv")
head(Fish)
```

##	OBJECTID	ROUNDID	MISSIONID	REGION_NAME	ISLAND	SITE				
## 1	2437299	133	SE1902_MHI_LEG1	Main Hawaiian Islands	Kahoolawe	KAH-479				
## 2	2437300	133	SE1902_MHI_LEG1	Main Hawaiian Islands	Kahoolawe	KAH-439				
## 3	2437301	133	SE1902_MHI_LEG1	Main Hawaiian Islands	Kahoolawe	KAH-439				
## 4	2437302	133	SE1902_MHI_LEG1	Main Hawaiian Islands	Kahoolawe	KAH-439				
## 5	2437303	133	SE1902_MHI_LEG1	Main Hawaiian Islands	Kahoolawe	KAH-439				
## 6	2437304	133	SE1902_MHI_LEG1	Main Hawaiian Islands	Kahoolawe	KAH-439				
##	LATITUDE	LONGITUDE	REEF_ZONE	DEPTH_BIN	SITEVISITID	DATE_	OBS_YEAR	DIVER		
## 1	20.51488	-156.6041	Forereef	Shallow	12907	6-May-19	2019	PMA		
## 2	20.51461	-156.6167	Forereef	Mid	12902	6-May-19	2019	JMA		
## 3	20.51461	-156.6167	Forereef	Mid	12902	6-May-19	2019	JMA		
## 4	20.51461	-156.6167	Forereef	Mid	12902	6-May-19	2019	JMA		
## 5	20.51461	-156.6167	Forereef	Mid	12902	6-May-19	2019	JMA		
## 6	20.51461	-156.6167	Forereef	Mid	12902	6-May-19	2019	JMA		
##	REPLICATEID	REP	METHOD	PHOTOGRAPHER	TRAINING_YN	DEPTH	SURVEY_RADIUS_M			
## 1	1845967740	A	nSPC	-1	0	5.2	7.5			
## 2	1845967739	A	nSPC	-1	0	10.2	7.5			
## 3	1845967739	A	nSPC	-1	0	10.2	7.5			
## 4	1845967739	A	nSPC	-1	0	10.2	7.5			
## 5	1845967739	A	nSPC	-1	0	10.2	7.5			
## 6	1845967739	A	nSPC	-1	0	10.2	7.5			
##	HARD_CORAL	SOFT_CORAL	MA	CCA	TA	SAND	TUNICATE	ZOANTHID	CORALLIMORPH	CLAM
## 1	3	NA	1	3	NA	1	NA	NA	NA	NA
## 2	5	NA	0	0	NA	10	NA	NA	NA	NA
## 3	5	NA	0	0	NA	10	NA	NA	NA	NA
## 4	5	NA	0	0	NA	10	NA	NA	NA	NA
## 5	5	NA	0	0	NA	10	NA	NA	NA	NA
## 6	5	NA	0	0	NA	10	NA	NA	NA	NA
##	CYANO	SPONGE	OTHER	OTHER_TYPE	HABITAT_CODE	HABITAT_TYPE	CURRENT_STRENGTH			
## 1	NA	NA	92	NA	ROB	Rock/Boulder	None			
## 2	NA	NA	85	NA	ROB	Rock/Boulder	None			
## 3	NA	NA	85	NA	ROB	Rock/Boulder	None			
## 4	NA	NA	85	NA	ROB	Rock/Boulder	None			
## 5	NA	NA	85	NA	ROB	Rock/Boulder	None			
## 6	NA	NA	85	NA	ROB	Rock/Boulder	None			
##	VISIBILITY	MIN_DEPTH	MAX_DEPTH	SUBSTRATE_HEIGHT_0	SUBSTRATE_HEIGHT_20					
## 1	25	4.5	6.8		25					
## 2	30	9.4	12.3		35					
## 3	30	9.4	12.3		35					
## 4	30	9.4	12.3		35					

```

## 5      30      9.4      12.3      35      25
## 6      30      9.4      12.3      35      25
## SUBSTRATE_HEIGHT_50 SUBSTRATE_HEIGHT_100 SUBSTRATE_HEIGHT_150 MAX_HEIGHT
## 1      30      20      0      1.1
## 2      20      20      0      1.4
## 3      20      20      0      1.4
## 4      20      20      0      1.4
## 5      20      20      0      1.4
## 6      20      20      0      1.4
## URCHIN_DACOR BORING_URCHIN_DACOR SPECIES TAXONNAME
## 1      C      C      ZEVE      Zebrasoma veliferum
## 2      R      R      BOAL      Bodianus albotaeniatus
## 3      R      R      CEPO      Centropyge potteri
## 4      R      R      CHAG      Chromis agilis
## 5      R      R      CHAG      Chromis agilis
## 6      R      R      CHVE      Chromis verater
## COMMONNAME COMMONFAMILYALL FAMILY SCIENTIFIC_NAME
## 1      Sailfin tang      Surgeonfish Acanthuridae      Zebrasoma veliferum
## 2      Hawaiian Hogfish      Wrasse      Labridae      Bodianus albotaeniatus
## 3      Russet angelfish      Angelfish Pomacanthidae      Centropyge potteri
## 4      Agile chromis      Damselfish Pomacentridae      Chromis agilis
## 5      Agile chromis      Damselfish Pomacentridae      Chromis agilis
## 6      Threespot chromis      Damselfish Pomacentridae      Chromis verater
## RANK TROPHIC TROPHIC_MONREP LW_A LW_B LMAX LENGTH_CONVERSION_FACTOR
## 1 Species      H      PRIMARY 0.03425 2.86581 40.0      1.00
## 2 Species      MI      SECONDARY 0.01202 3.05000 55.0      1.00
## 3 Species      H      PRIMARY 0.07450 2.57700 12.7      1.00
## 4 Species      Pk      PLANKTIVORE 0.00350 3.00000 11.0      1.00
## 5 Species      Pk      PLANKTIVORE 0.00350 3.00000 11.0      1.00
## 6 Species      Pk      PLANKTIVORE 0.02290 3.17500 22.0      0.95
## COUNT SIZE_ OBS_TYPE OBS_DESC
## 1      1      18      I      Instantaneous
## 2      1      33      N Non-Instantaneous
## 3      2      9      I      Instantaneous
## 4      5      5      I      Instantaneous
## 5      6      6      I      Instantaneous
## 6      6      14      I      Instantaneous

```

```

fish2 = subset(Fish, select = -c(OBJECTID,ROUNDID, MISSIONID, SITE, LATITUDE, LONGITUDE, SITEVISITID, D
head(fish2)

```

```

## REGION_NAME ISLAND REEF_ZONE DEPTH_BIN DATE_ DEPTH HARD_CORAL
## 1 Main Hawaiian Islands Kahoolawe Forereef Shallow 6-May-19 5.2 3
## 2 Main Hawaiian Islands Kahoolawe Forereef Mid 6-May-19 10.2 5
## 3 Main Hawaiian Islands Kahoolawe Forereef Mid 6-May-19 10.2 5
## 4 Main Hawaiian Islands Kahoolawe Forereef Mid 6-May-19 10.2 5
## 5 Main Hawaiian Islands Kahoolawe Forereef Mid 6-May-19 10.2 5
## 6 Main Hawaiian Islands Kahoolawe Forereef Mid 6-May-19 10.2 5
## MA CCA SAND OTHER HABITAT_CODE HABITAT_TYPE VISIBILITY MIN_DEPTH MAX_DEPTH
## 1 1 3 1 92 ROB Rock/Boulder 25 4.5 6.8
## 2 0 0 10 85 ROB Rock/Boulder 30 9.4 12.3
## 3 0 0 10 85 ROB Rock/Boulder 30 9.4 12.3
## 4 0 0 10 85 ROB Rock/Boulder 30 9.4 12.3
## 5 0 0 10 85 ROB Rock/Boulder 30 9.4 12.3
## 6 0 0 10 85 ROB Rock/Boulder 30 9.4 12.3

```

```

## SUBSTRATE_HEIGHT_0 SUBSTRATE_HEIGHT_20 SUBSTRATE_HEIGHT_50
## 1 25 25 30
## 2 35 25 20
## 3 35 25 20
## 4 35 25 20
## 5 35 25 20
## 6 35 25 20
## SUBSTRATE_HEIGHT_100 SUBSTRATE_HEIGHT_150 MAX_HEIGHT URCHIN_DACOR
## 1 20 0 1.1 C
## 2 20 0 1.4 R
## 3 20 0 1.4 R
## 4 20 0 1.4 R
## 5 20 0 1.4 R
## 6 20 0 1.4 R
## BORING_URCHIN_DACOR COMMONNAME COMMONFAMILYALL FAMILY RANK
## 1 C Sailfin tang Surgeonfish Acanthuridae Species
## 2 R Hawaiian Hogfish Wrasse Labridae Species
## 3 R Russet angelfish Angelfish Pomacanthidae Species
## 4 R Agile chromis Damselfish Pomacentridae Species
## 5 R Agile chromis Damselfish Pomacentridae Species
## 6 R Threespot chromis Damselfish Pomacentridae Species
## TROPHIC TROPHIC_MONREP LW_A LW_B LMAX LENGTH_CONVERSION_FACTOR COUNT
## 1 H PRIMARY 0.03425 2.86581 40.0 1.00 1
## 2 MI SECONDARY 0.01202 3.05000 55.0 1.00 1
## 3 H PRIMARY 0.07450 2.57700 12.7 1.00 2
## 4 Pk PLANKTIVORE 0.00350 3.00000 11.0 1.00 5
## 5 Pk PLANKTIVORE 0.00350 3.00000 11.0 1.00 6
## 6 Pk PLANKTIVORE 0.02290 3.17500 22.0 0.95 6
## SIZE_ OBS_TYPE OBS_DESC
## 1 18 I Instantaneous
## 2 33 N Non-Instantaneous
## 3 9 I Instantaneous
## 4 5 I Instantaneous
## 5 6 I Instantaneous
## 6 14 I Instantaneous

```

```
summary(fish2)
```

```

## REGION_NAME ISLAND REEF_ZONE DEPTH_BIN
## Length:23425 Length:23425 Length:23425 Length:23425
## Class :character Class :character Class :character Class :character
## Mode :character Mode :character Mode :character Mode :character
##
##
##
## DATE_ DEPTH HARD_CORAL MA
## Length:23425 Min. : 1.20 Min. : 0.000 Min. : 0.000
## Class :character 1st Qu.: 6.10 1st Qu.: 2.000 1st Qu.: 0.000
## Mode :character Median :11.80 Median : 4.000 Median : 1.000
## Mean :12.58 Mean : 9.009 Mean : 3.713
## 3rd Qu.:19.20 3rd Qu.:10.000 3rd Qu.: 3.000
## Max. :26.80 Max. :90.000 Max. :70.000
## CCA SAND OTHER HABITAT_CODE
## Min. : 0.000 Min. : 0.000 Min. : 5.00 Length:23425
## 1st Qu.: 1.000 1st Qu.: 0.000 1st Qu.: 67.00 Class :character

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## Median : 2.000 Median : 2.000 Median : 83.00 Mode :character
## Mean : 4.071 Mean : 6.702 Mean : 76.51
## 3rd Qu.: 5.000 3rd Qu.: 8.000 3rd Qu.: 91.00
## Max. :80.000 Max. :90.000 Max. :100.00
## HABITAT_TYPE VISIBILITY MIN_DEPTH MAX_DEPTH
## Length:23425 Min. : 7.50 Min. : 0.00 Min. : 1.20
## Class :character 1st Qu.:19.00 1st Qu.: 5.80 1st Qu.: 6.80
## Mode :character Median :23.00 Median :11.40 Median :12.70
## Mean :22.95 Mean :11.92 Mean :13.36
## 3rd Qu.:30.00 3rd Qu.:17.70 3rd Qu.:20.10
## Max. :30.00 Max. :26.20 Max. :27.40
## SUBSTRATE_HEIGHT_0 SUBSTRATE_HEIGHT_20 SUBSTRATE_HEIGHT_50
## Min. : 1.00 Min. : 0.00 Min. : 0.00
## 1st Qu.: 25.00 1st Qu.:10.00 1st Qu.: 5.00
## Median : 40.00 Median :25.00 Median :15.00
## Mean : 46.36 Mean :24.65 Mean :16.32
## 3rd Qu.: 70.00 3rd Qu.:30.00 3rd Qu.:25.00
## Max. :100.00 Max. :95.00 Max. :80.00
## SUBSTRATE_HEIGHT_100 SUBSTRATE_HEIGHT_150 MAX_HEIGHT URCHIN_DACOR
## Min. : 0.000 Min. : 0.00 Min. :0.100 Length:23425
## 1st Qu.: 0.000 1st Qu.: 0.00 1st Qu.:0.900 Class :character
## Median : 5.000 Median : 0.00 Median :1.490 Mode :character
## Mean : 8.323 Mean : 4.35 Mean :1.622
## 3rd Qu.:15.000 3rd Qu.: 5.00 3rd Qu.:2.000
## Max. :60.000 Max. :60.00 Max. :7.000
## BORING_URCHIN_DACOR COMMONNAME COMMONFAMILYALL FAMILY
## Length:23425 Length:23425 Length:23425 Length:23425
## Class :character Class :character Class :character Class :character
## Mode :character Mode :character Mode :character Mode :character
##
##
##
## RANK TROPHIC TROPHIC_MONREP LW_A
## Length:23425 Length:23425 Length:23425 Min. :0.00000
## Class :character Class :character Class :character 1st Qu.:0.01230
## Mode :character Mode :character Mode :character Median :0.01650
## Mean :0.02260
## 3rd Qu.:0.02637
## Max. :0.40816
## LW_B LMAX LENGTH_CONVERSION_FACTOR COUNT
## Min. :0.000 Min. : 2.90 Min. :0.770 Min. : 1.00
## 1st Qu.:2.990 1st Qu.: 15.00 1st Qu.:0.930 1st Qu.: 1.00
## Median :3.022 Median : 24.00 Median :1.000 Median : 1.00
## Mean :3.038 Mean : 30.35 Mean :0.969 Mean : 3.46
## 3rd Qu.:3.125 3rd Qu.: 38.00 3rd Qu.:1.000 3rd Qu.: 3.00
## Max. :4.120 Max. :999.00 Max. :1.000 Max. :300.00
## SIZE_ OBS_TYPE OBS_DESC
## Min. : 1.00 Length:23425 Length:23425
## 1st Qu.: 6.00 Class :character Class :character
## Median :11.00 Mode :character Mode :character
## Mean :13.65
## 3rd Qu.:18.00
## Max. :260.00

```

```
fish2[fish2$COUNT>250,]
```

##	REGION_NAME	ISLAND	REEF_ZONE	DEPTH_BIN	DATE_	DEPTH		
## 1849	Main Hawaiian Islands	Maui	Forereef	Deep	6-Aug-19	19.8		
## 4114	Main Hawaiian Islands	Maui	Forereef	Deep	6-Aug-19	19.8		
## 21536	Main Hawaiian Islands	Kahoolawe	Forereef	Mid	6-May-19	8.2		
##	HARD_CORAL	MA	CCA	SAND	OTHER	HABITAT_CODE	HABITAT_TYPE	VISIBILITY
## 1849	30	2	1	0	67	AGR	Aggregate Reef	23
## 4114	30	2	1	0	67	AGR	Aggregate Reef	23
## 21536	5	0	3	2	90	ROB	Rock/Boulder	30
##	MIN_DEPTH	MAX_DEPTH	SUBSTRATE_HEIGHT_0	SUBSTRATE_HEIGHT_20				
## 1849	19.8	19.8		96			3	
## 4114	19.8	19.8		96			3	
## 21536	8.8	13.4		30			25	
##	SUBSTRATE_HEIGHT_50	SUBSTRATE_HEIGHT_100	SUBSTRATE_HEIGHT_150	MAX_HEIGHT				
## 1849		1		0			0	0.75
## 4114		1		0			0	0.75
## 21536		25		15			5	2.40
##	URCHIN_DACOR	BORING_URCHIN_DACOR		COMMONNAME				
## 1849	R		R	Common bluestripe snapper				
## 4114	R		R	Common bluestripe snapper				
## 21536	R		R	Mackerel scad				
##	COMMONFAMILYALL	FAMILY	RANK	TROPHIC	TROPHIC_MONREP	LW_A	LW_B	
## 1849	Snapper	Lutjanidae	Species	MI	SECONDARY	0.00842	3.24696	
## 4114	Snapper	Lutjanidae	Species	MI	SECONDARY	0.00842	3.24696	
## 21536	Jack	Carangidae	Species	Pk	PLANKTIVORE	0.00780	3.14000	
##	LMAX	LENGTH_CONVERSION_FACTOR	COUNT	SIZE_	OBS_TYPE	OBS_DESC		
## 1849	40		0.95	300	17	I	Instantaneous	
## 4114	40		0.95	300	15	I	Instantaneous	
## 21536	35		1.00	300	22	T	After 10 minutes	

```
fish2[fish2$MA>60,]
```

##	REGION_NAME	ISLAND	REEF_ZONE	DEPTH_BIN	DATE_	DEPTH
## 1521	Main Hawaiian Islands	Oahu	Forereef	Deep	30-Jul-19	26.8
## 1522	Main Hawaiian Islands	Oahu	Forereef	Deep	30-Jul-19	26.8
## 3087	Main Hawaiian Islands	Kauai	Forereef	Mid	28-Jul-19	7.6
## 6976	Main Hawaiian Islands	Kauai	Forereef	Mid	28-Jul-19	7.6
## 6977	Main Hawaiian Islands	Kauai	Forereef	Mid	28-Jul-19	7.6
## 6978	Main Hawaiian Islands	Kauai	Forereef	Mid	28-Jul-19	7.6
## 6979	Main Hawaiian Islands	Kauai	Forereef	Mid	28-Jul-19	7.6
## 6980	Main Hawaiian Islands	Kauai	Forereef	Mid	28-Jul-19	7.6
## 6981	Main Hawaiian Islands	Kauai	Forereef	Mid	28-Jul-19	7.6
## 6982	Main Hawaiian Islands	Kauai	Forereef	Mid	28-Jul-19	7.6
## 7236	Main Hawaiian Islands	Kauai	Forereef	Mid	28-Jul-19	7.6
## 7237	Main Hawaiian Islands	Kauai	Forereef	Mid	28-Jul-19	7.6
## 7238	Main Hawaiian Islands	Kauai	Forereef	Mid	28-Jul-19	7.6
## 7239	Main Hawaiian Islands	Kauai	Forereef	Mid	28-Jul-19	7.6
## 7240	Main Hawaiian Islands	Kauai	Forereef	Mid	28-Jul-19	7.6
## 7241	Main Hawaiian Islands	Kauai	Forereef	Mid	28-Jul-19	7.6
## 7242	Main Hawaiian Islands	Kauai	Forereef	Mid	28-Jul-19	7.6
## 7243	Main Hawaiian Islands	Kauai	Forereef	Mid	28-Jul-19	7.6
## 7244	Main Hawaiian Islands	Kauai	Forereef	Mid	28-Jul-19	7.6
## 7245	Main Hawaiian Islands	Kauai	Forereef	Mid	28-Jul-19	7.6

##	7246	Main Hawaiian Islands	Kauai	Forereef	Mid	28-Jul-19	7.6
##	11642	Main Hawaiian Islands	Oahu	Forereef	Deep	30-Jul-19	26.8
##	16581	Main Hawaiian Islands	Oahu	Forereef	Deep	30-Jul-19	26.8
##	16582	Main Hawaiian Islands	Oahu	Forereef	Deep	30-Jul-19	26.8
##	16583	Main Hawaiian Islands	Oahu	Forereef	Deep	30-Jul-19	26.8
##	16584	Main Hawaiian Islands	Oahu	Forereef	Deep	30-Jul-19	26.8
##	16585	Main Hawaiian Islands	Oahu	Forereef	Deep	30-Jul-19	26.8
##	16586	Main Hawaiian Islands	Oahu	Forereef	Deep	30-Jul-19	26.8
##	16587	Main Hawaiian Islands	Oahu	Forereef	Deep	30-Jul-19	26.8
##	16588	Main Hawaiian Islands	Oahu	Forereef	Deep	30-Jul-19	26.8
##	16589	Main Hawaiian Islands	Oahu	Forereef	Deep	30-Jul-19	26.8
##	16590	Main Hawaiian Islands	Oahu	Forereef	Deep	30-Jul-19	26.8
##	16591	Main Hawaiian Islands	Oahu	Forereef	Deep	30-Jul-19	26.8
##	16592	Main Hawaiian Islands	Oahu	Forereef	Deep	30-Jul-19	26.8
##	16593	Main Hawaiian Islands	Oahu	Forereef	Deep	30-Jul-19	26.8
##		HARD_CORAL	MA	CCA	SAND	OTHER	HABITAT_CODE
##	1521		1 70	0	20	9	PAV Pavement
##	1522		1 70	0	20	9	PAV Pavement
##	3087		3 70	2	0	25	PSC Pavement with Sand Channels
##	6976		3 70	2	0	25	PSC Pavement with Sand Channels
##	6977		3 70	2	0	25	PSC Pavement with Sand Channels
##	6978		3 70	2	0	25	PSC Pavement with Sand Channels
##	6979		3 70	2	0	25	PSC Pavement with Sand Channels
##	6980		3 70	2	0	25	PSC Pavement with Sand Channels
##	6981		3 70	2	0	25	PSC Pavement with Sand Channels
##	6982		3 70	2	0	25	PSC Pavement with Sand Channels
##	7236		3 70	2	0	25	PSC Pavement with Sand Channels
##	7237		3 70	2	0	25	PSC Pavement with Sand Channels
##	7238		3 70	2	0	25	PSC Pavement with Sand Channels
##	7239		3 70	2	0	25	PSC Pavement with Sand Channels
##	7240		3 70	2	0	25	PSC Pavement with Sand Channels
##	7241		3 70	2	0	25	PSC Pavement with Sand Channels
##	7242		3 70	2	0	25	PSC Pavement with Sand Channels
##	7243		3 70	2	0	25	PSC Pavement with Sand Channels
##	7244		3 70	2	0	25	PSC Pavement with Sand Channels
##	7245		3 70	2	0	25	PSC Pavement with Sand Channels
##	7246		3 70	2	0	25	PSC Pavement with Sand Channels
##	11642		1 70	0	20	9	PAV Pavement
##	16581		1 70	0	20	9	PAV Pavement
##	16582		1 70	0	20	9	PAV Pavement
##	16583		1 70	0	20	9	PAV Pavement
##	16584		1 70	0	20	9	PAV Pavement
##	16585		1 70	0	20	9	PAV Pavement
##	16586		1 70	0	20	9	PAV Pavement
##	16587		1 70	0	20	9	PAV Pavement
##	16588		1 70	0	20	9	PAV Pavement
##	16589		1 70	0	20	9	PAV Pavement
##	16590		1 70	0	20	9	PAV Pavement
##	16591		1 70	0	20	9	PAV Pavement
##	16592		1 70	0	20	9	PAV Pavement
##	16593		1 70	0	20	9	PAV Pavement
##		VISIBILITY	MIN_DEPTH	MAX_DEPTH	SUBSTRATE_HEIGHT_0	SUBSTRATE_HEIGHT_20	
##	1521		9	26.2	26.8	95	5
##	1522		9	26.2	26.8	95	5

## 3087	13	7.6	7.6	65	35
## 6976	13	7.6	7.6	65	35
## 6977	13	7.6	7.6	65	35
## 6978	13	7.6	7.6	65	35
## 6979	13	7.6	7.6	65	35
## 6980	13	7.6	7.6	65	35
## 6981	13	7.6	7.6	65	35
## 6982	13	7.6	7.6	65	35
## 7236	13	7.6	7.6	65	35
## 7237	13	7.6	7.6	65	35
## 7238	13	7.6	7.6	65	35
## 7239	13	7.6	7.6	65	35
## 7240	13	7.6	7.6	65	35
## 7241	13	7.6	7.6	65	35
## 7242	13	7.6	7.6	65	35
## 7243	13	7.6	7.6	65	35
## 7244	13	7.6	7.6	65	35
## 7245	13	7.6	7.6	65	35
## 7246	13	7.6	7.6	65	35
## 11642	9	26.2	26.8	95	5
## 16581	9	26.2	26.8	95	5
## 16582	9	26.2	26.8	95	5
## 16583	9	26.2	26.8	95	5
## 16584	9	26.2	26.8	95	5
## 16585	9	26.2	26.8	95	5
## 16586	9	26.2	26.8	95	5
## 16587	9	26.2	26.8	95	5
## 16588	9	26.2	26.8	95	5
## 16589	9	26.2	26.8	95	5
## 16590	9	26.2	26.8	95	5
## 16591	9	26.2	26.8	95	5
## 16592	9	26.2	26.8	95	5
## 16593	9	26.2	26.8	95	5
##	SUBSTRATE_HEIGHT_50 SUBSTRATE_HEIGHT_100 SUBSTRATE_HEIGHT_150 MAX_HEIGHT				
## 1521		0	0	0	0.20
## 1522		0	0	0	0.20
## 3087		0	0	0	0.49
## 6976		0	0	0	0.49
## 6977		0	0	0	0.49
## 6978		0	0	0	0.49
## 6979		0	0	0	0.49
## 6980		0	0	0	0.49
## 6981		0	0	0	0.49
## 6982		0	0	0	0.49
## 7236		0	0	0	0.49
## 7237		0	0	0	0.49
## 7238		0	0	0	0.49
## 7239		0	0	0	0.49
## 7240		0	0	0	0.49
## 7241		0	0	0	0.49
## 7242		0	0	0	0.49
## 7243		0	0	0	0.49
## 7244		0	0	0	0.49
## 7245		0	0	0	0.49

##	7246		0		0		0		0.49
##	11642		0		0		0		0.20
##	16581		0		0		0		0.20
##	16582		0		0		0		0.20
##	16583		0		0		0		0.20
##	16584		0		0		0		0.20
##	16585		0		0		0		0.20
##	16586		0		0		0		0.20
##	16587		0		0		0		0.20
##	16588		0		0		0		0.20
##	16589		0		0		0		0.20
##	16590		0		0		0		0.20
##	16591		0		0		0		0.20
##	16592		0		0		0		0.20
##	16593		0		0		0		0.20
##		URCHIN_DACOR	BORING_URCHIN_DACOR			COMMONNAME			
##	1521	R		R		Common bluestripe snapper			
##	1522	R		R		Orangespot surgeonfish			
##	3087	R		R		Brown surgeonfish			
##	6976	R		R		Orangespot surgeonfish			
##	6977	R		R		Masked triggerfish			
##	6978	R		R		Wedge-tail triggerfish			
##	6979	R		R		Boomerang triggerfish			
##	6980	R		R		Saddle wrasse			
##	6981	R		R		Saddle wrasse			
##	6982	R		R		Saddle wrasse			
##	7236	R		R		Elegant coris			
##	7237	R		R		Elegant coris			
##	7238	R		R		Vanderbilt's chromis			
##	7239	R		R		Vanderbilt's chromis			
##	7240	R		R		Brighteye damselfish			
##	7241	R		R		Arc-eye hawkfish			
##	7242	R		R		Arc-eye hawkfish			
##	7243	R		R		Ewa blenny			
##	7244	R		R		Whitespotted filefish			
##	7245	R		R		Belted wrasse			
##	7246	R		R		Bluefin trevally			
##	11642	R		R		Hawaiian whitespotted toby			
##	16581	R		R		Masked triggerfish			
##	16582	R		R		Boomerang triggerfish			
##	16583	R		R		Gilded triggerfish			
##	16584	R		R		Manybar goatfish			
##	16585	R		R		Manybar goatfish			
##	16586	R		R		Sidespot goatfish			
##	16587	R		R		Sidespot goatfish			
##	16588	R		R		Two-spot wrasse			
##	16589	R		R		Two-spot wrasse			
##	16590	R		R		Two-spot wrasse			
##	16591	R		R		Elegant coris			
##	16592	R		R		Smalltail wrasse			
##	16593	R		R		Quakerfish			
##		COMMONFAMILYALL		FAMILY	RANK	TROPHIC	TROPHIC_MONREP		LW_A
##	1521	Snapper		Lutjanidae	Species	MI	SECONDARY	0.00842000	
##	1522	Surgeonfish		Acanthuridae	Species	H	PRIMARY	0.03839000	

##	3087	Surgeonfish	Acanthuridae	Species	H	PRIMARY	0.02637000
##	6976	Surgeonfish	Acanthuridae	Species	H	PRIMARY	0.03839000
##	6977	Triggerfish	Balistidae	Species	MI	SECONDARY	0.02881318
##	6978	Triggerfish	Balistidae	Species	MI	SECONDARY	0.05220000
##	6979	Triggerfish	Balistidae	Species	MI	SECONDARY	0.02160000
##	6980	Wrasse	Labridae	Species	MI	SECONDARY	0.01230000
##	6981	Wrasse	Labridae	Species	MI	SECONDARY	0.01230000
##	6982	Wrasse	Labridae	Species	MI	SECONDARY	0.01230000
##	7236	Wrasse	Labridae	Species	MI	SECONDARY	0.00650000
##	7237	Wrasse	Labridae	Species	MI	SECONDARY	0.00650000
##	7238	Damselfish	Pomacentridae	Species	Pk	PLANKTIVORE	0.02580000
##	7239	Damselfish	Pomacentridae	Species	Pk	PLANKTIVORE	0.02580000
##	7240	Damselfish	Pomacentridae	Species	MI	SECONDARY	0.06120000
##	7241	Hawkfish	Cirrhitidae	Species	MI	SECONDARY	0.01650000
##	7242	Hawkfish	Cirrhitidae	Species	MI	SECONDARY	0.01650000
##	7243	Blenny	Blenniidae	Species	MI	SECONDARY	0.00180000
##	7244	Filefish	Monacanthidae	Species	Om	SECONDARY	0.04060000
##	7245	Wrasse	Labridae	Species	MI	SECONDARY	0.01500000
##	7246	Jack	Carangidae	Species	Pisc	PISCIVORE	0.02866000
##	11642	Pufferfish	Tetraodontidae	Species	H	PRIMARY	0.04240000
##	16581	Triggerfish	Balistidae	Species	MI	SECONDARY	0.02881318
##	16582	Triggerfish	Balistidae	Species	MI	SECONDARY	0.02160000
##	16583	Triggerfish	Balistidae	Species	Pk	PLANKTIVORE	0.02770000
##	16584	Goatfish	Mullidae	Species	MI	SECONDARY	0.01136000
##	16585	Goatfish	Mullidae	Species	MI	SECONDARY	0.01136000
##	16586	Goatfish	Mullidae	Species	MI	SECONDARY	0.01190000
##	16587	Goatfish	Mullidae	Species	MI	SECONDARY	0.01190000
##	16588	Wrasse	Labridae	Species	MI	SECONDARY	0.09300000
##	16589	Wrasse	Labridae	Species	MI	SECONDARY	0.09300000
##	16590	Wrasse	Labridae	Species	MI	SECONDARY	0.09300000
##	16591	Wrasse	Labridae	Species	MI	SECONDARY	0.00650000
##	16592	Wrasse	Labridae	Species	MI	SECONDARY	0.01070000
##	16593	Tilefish	Malacanthidae	Species	MI	SECONDARY	0.00490000
##		LW_B	LMAX	LENGTH_CONVERSION_FACTOR	COUNT	SIZE_	OBS_TYPE
##	1521	3.246960	40	0.95	18	7	I
##	1522	3.055000	40	0.86	3	5	I
##	3087	3.028370	23	0.91	1	12	I
##	6976	3.055000	40	0.86	1	25	N
##	6977	3.034828	38	1.00	1	22	I
##	6978	2.641000	25	1.00	1	18	N
##	6979	3.000000	28	1.00	1	14	N
##	6980	3.097000	26	0.90	12	7	I
##	6981	3.097000	26	0.90	3	10	I
##	6982	3.097000	26	0.90	2	12	I
##	7236	3.254000	20	1.00	2	9	I
##	7237	3.254000	20	1.00	1	8	I
##	7238	3.000000	15	1.00	32	3	I
##	7239	3.000000	15	1.00	14	2	I
##	7240	2.691000	6	1.00	1	5	I
##	7241	3.125300	14	1.00	3	7	I
##	7242	3.125300	14	1.00	2	6	I
##	7243	3.581000	10	0.95	1	7	F
##	7244	2.792000	38	1.00	1	8	F
##	7245	3.000000	15	1.00	1	8	T

##	7246	2.974000	117	0.89	2	27	T
##	11642	2.822000	9	1.00	2	6	I
##	16581	3.034828	38	1.00	2	22	I
##	16582	3.000000	28	1.00	1	15	I
##	16583	2.932100	22	1.00	1	18	I
##	16584	3.210820	38	0.90	2	8	I
##	16585	3.210820	38	0.90	3	10	I
##	16586	3.000000	33	1.00	30	7	I
##	16587	3.000000	33	1.00	6	10	I
##	16588	2.168000	15	1.00	2	8	I
##	16589	2.168000	15	1.00	1	10	I
##	16590	2.168000	15	1.00	3	12	I
##	16591	3.254000	20	1.00	3	10	I
##	16592	3.178000	12	1.00	2	10	I
##	16593	3.000000	30	1.00	1	24	N

OBS_DESC

##	1521	Instantaneous
##	1522	Instantaneous
##	3087	Instantaneous
##	6976	Non-Instantaneous
##	6977	Instantaneous
##	6978	Non-Instantaneous
##	6979	Non-Instantaneous
##	6980	Instantaneous
##	6981	Instantaneous
##	6982	Instantaneous
##	7236	Instantaneous
##	7237	Instantaneous
##	7238	Instantaneous
##	7239	Instantaneous
##	7240	Instantaneous
##	7241	Instantaneous
##	7242	Instantaneous
##	7243	After 5 minutes
##	7244	After 5 minutes
##	7245	After 10 minutes
##	7246	After 10 minutes
##	11642	Instantaneous
##	16581	Instantaneous
##	16582	Instantaneous
##	16583	Instantaneous
##	16584	Instantaneous
##	16585	Instantaneous
##	16586	Instantaneous
##	16587	Instantaneous
##	16588	Instantaneous
##	16589	Instantaneous
##	16590	Instantaneous
##	16591	Instantaneous
##	16592	Instantaneous
##	16593	Non-Instantaneous

```
fish2[fish2$SIZE_>100,]
```

##	REGION_NAME	ISLAND	REEF_ZONE	DEPTH_BIN	DATE_	DEPTH
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## 84	Main Hawaiian Islands	Kahoolawe	Forereef	Mid	6-May-19	13.1	
## 962	Main Hawaiian Islands	Lanai	Forereef	Mid	20-Jul-19	13.4	
## 974	Main Hawaiian Islands	Kauai	Forereef	Shallow	24-Jul-19	4.3	
## 1115	Main Hawaiian Islands	Kahoolawe	Forereef	Deep	25-Apr-19	19.5	
## 4443	Main Hawaiian Islands	Kahoolawe	Forereef	Mid	6-May-19	18.0	
## 4448	Main Hawaiian Islands	Kahoolawe	Forereef	Mid	6-May-19	18.0	
## 5350	Main Hawaiian Islands	Oahu	Forereef	Shallow	2-Aug-19	8.2	
## 5658	Main Hawaiian Islands	Lanai	Forereef	Mid	10-Jul-19	8.5	
## 7077	Main Hawaiian Islands	Kahoolawe	Forereef	Mid	6-May-19	14.0	
## 7777	Main Hawaiian Islands	Hawaii	Forereef	Deep	4-May-19	20.7	
## 8349	Main Hawaiian Islands	Molokai	Forereef	Mid	29-Apr-19	11.6	
## 8868	Main Hawaiian Islands	Oahu	Forereef	Mid	5-Aug-19	17.7	
## 9278	Main Hawaiian Islands	Hawaii	Forereef	Mid	12-Jul-19	10.6	
## 10361	Main Hawaiian Islands	Lanai	Forereef	Deep	20-Jul-19	22.7	
## 11224	Main Hawaiian Islands	Lanai	Forereef	Mid	20-Jul-19	13.7	
## 11368	Main Hawaiian Islands	Maui	Forereef	Deep	27-Apr-19	17.6	
## 12504	Main Hawaiian Islands	Molokai	Forereef	Deep	29-Apr-19	24.0	
## 12549	Main Hawaiian Islands	Molokai	Forereef	Deep	29-Apr-19	24.0	
## 12855	Main Hawaiian Islands	Molokai	Forereef	Mid	1-May-19	14.5	
## 16809	Main Hawaiian Islands	Oahu	Forereef	Mid	5-Aug-19	17.7	
## 17047	Main Hawaiian Islands	Maui	Forereef	Mid	6-Aug-19	10.3	
## 18121	Main Hawaiian Islands	Hawaii	Forereef	Mid	16-Jul-19	15.2	
## 18339	Main Hawaiian Islands	Niihau	Forereef	Deep	25-Jul-19	21.9	
## 20567	Main Hawaiian Islands	Molokai	Forereef	Mid	29-Apr-19	11.6	
## 20602	Main Hawaiian Islands	Molokai	Forereef	Mid	1-May-19	14.6	
## 22020	Main Hawaiian Islands	Kahoolawe	Forereef	Mid	6-May-19	10.2	
## 22853	Main Hawaiian Islands	Oahu	Forereef	Mid	3-Aug-19	15.5	
## 23339	Main Hawaiian Islands	Oahu	Forereef	Deep	4-Aug-19	21.3	
##	HARD_CORAL	MA	CCA	SAND	OTHER	HABITAT_CODE	HABITAT_TYPE
## 84	10.0	1	1	1	87.0	AGR	Aggregate Reef
## 962	2.0	0	1	5	92.0	ROB	Rock/Boulder
## 974	5.0	5	0	40	50.0	AGR	Aggregate Reef
## 1115	1.0	5	0	70	24.0	SCR	Sand with Scattered Coral/Rock
## 4443	10.0	1	2	5	82.0	ROB	Rock/Boulder
## 4448	10.0	1	2	5	82.0	ROB	Rock/Boulder
## 5350	1.0	1	0	1	97.0	PAV	Pavement
## 5658	20.0	10	20	2	48.0	AGR	Aggregate Reef
## 7077	5.0	2	1	2	90.0	ROB	Rock/Boulder
## 7777	3.0	1	1	10	85.0	ROB	Rock/Boulder
## 8349	2.0	0	0	0	98.0	ROB	Rock/Boulder
## 8868	0.5	2	0	10	87.5	ROB	Rock/Boulder
## 9278	10.0	0	10	3	77.0	AGR	Aggregate Reef
## 10361	15.0	5	5	0	75.0	AGR	Aggregate Reef
## 11224	2.0	1	0	1	96.0	ROB	Rock/Boulder
## 11368	3.0	1	1	10	85.0	ROB	Rock/Boulder
## 12504	1.0	1	2	1	95.0	ROB	Rock/Boulder
## 12549	1.0	1	2	1	95.0	ROB	Rock/Boulder
## 12855	30.0	2	3	5	60.0	AGR	Aggregate Reef
## 16809	0.5	2	0	10	87.5	ROB	Rock/Boulder
## 17047	2.0	1	1	10	86.0	ROB	Rock/Boulder
## 18121	2.0	5	4	2	87.0	AGR	Aggregate Reef
## 18339	1.0	1	1	15	82.0	ROB	Rock/Boulder
## 20567	2.0	0	0	0	98.0	ROB	Rock/Boulder
## 20602	30.0	10	0	0	60.0	AGR	Aggregate Reef

## 22020	5.0	0	0	10	85.0	ROB	Rock/Boulder
## 22853	2.0	10	1	2	85.0	PAV	Pavement
## 23339	10.0	5	0	0	85.0	PAV	Pavement
##	VISIBILITY	MIN_DEPTH	MAX_DEPTH	SUBSTRATE_HEIGHT_0	SUBSTRATE_HEIGHT_20		
## 84	23	11.9	14.3	48	30		
## 962	28	12.9	14.0	20	30		
## 974	12	4.0	4.5	70	24		
## 1115	29	19.5	19.5	95	3		
## 4443	30	18.0	18.0	30	40		
## 4448	30	18.0	18.0	30	40		
## 5350	30	8.2	9.5	99	0		
## 5658	14	6.7	10.0	20	30		
## 7077	30	13.0	15.7	70	25		
## 7777	21	19.8	21.9	20	5		
## 8349	22	10.7	11.6	40	30		
## 8868	28	16.4	19.8	70	10		
## 9278	19	10.3	10.9	50	15		
## 10361	30	20.5	23.1	45	30		
## 11224	28	12.8	13.7	20	30		
## 11368	30	17.5	17.7	15	30		
## 12504	23	23.9	26.0	29	25		
## 12549	23	23.9	26.0	29	25		
## 12855	23	14.5	14.5	30	40		
## 16809	28	16.4	19.8	70	10		
## 17047	18	9.0	11.3	25	50		
## 18121	23	15.2	15.2	90	7		
## 18339	26	17.7	24.2	5	20		
## 20567	22	10.7	11.6	40	30		
## 20602	23	14.6	14.6	20	30		
## 22020	30	9.4	12.3	35	25		
## 22853	19	15.5	15.5	45	50		
## 23339	19	20.4	25.9	99	1		
##	SUBSTRATE_HEIGHT_50	SUBSTRATE_HEIGHT_100	SUBSTRATE_HEIGHT_150	MAX_HEIGHT			
## 84	10.0	10.0	2	2.30			
## 962	15.0	15.0	20	4.70			
## 974	5.9	0.1	0	1.40			
## 1115	2.0	0.0	0	0.60			
## 4443	20.0	10.0	0	1.49			
## 4448	20.0	10.0	0	1.49			
## 5350	0.0	0.0	1	2.00			
## 5658	40.0	10.0	0	1.49			
## 7077	3.0	2.0	0	1.30			
## 7777	50.0	20.0	5	5.00			
## 8349	20.0	5.0	5	2.40			
## 8868	20.0	0.0	0	0.90			
## 9278	10.0	10.0	15	3.50			
## 10361	10.0	10.0	5	1.90			
## 11224	20.0	10.0	20	3.50			
## 11368	20.0	20.0	15	4.00			
## 12504	25.0	20.0	1	1.60			
## 12549	25.0	20.0	1	1.60			
## 12855	30.0	0.0	0	0.80			
## 16809	20.0	0.0	0	0.90			
## 17047	25.0	0.0	0	0.80			

##	18121	2.0	1.0	0	1.10			
##	18339	30.0	40.0	5	2.50			
##	20567	20.0	5.0	5	2.40			
##	20602	50.0	0.0	0	1.00			
##	22020	20.0	20.0	0	1.40			
##	22853	5.0	0.0	0	0.60			
##	23339	0.0	0.0	0	0.20			
##	URCHIN_DACOR	BORING_URCHIN_DACOR	COMMONNAME	COMMONFAMILYALL				
##	84	0	R	Giant trevally	Jack			
##	962	R	R	Whitetip reef shark	Requiem			
##	974	R	R	Bluespotted cornetfish	Cornetfish			
##	1115	R	R	Yellow-edged moray	Moray			
##	4443	0	C	Grey reef shark	Requiem			
##	4448	0	C	Giant trevally	Jack			
##	5350	R	C	Spotted eagle ray	Eagle Rays			
##	5658	0	R	Yellow-edged moray	Moray			
##	7077	0	R	Grey reef shark	Requiem			
##	7777	R	R	Yellow-edged moray	Moray			
##	8349	R	R	Yellow-edged moray	Moray			
##	8868	R	R	Monk seal	Monk Seal			
##	9278	D	C	Whitetip reef shark	Requiem			
##	10361	R	R	Undulated moray	Moray			
##	11224	R	R	Grey reef shark	Requiem			
##	11368	R	R	Undulated moray	Moray			
##	12504	R	R	Bluespotted cornetfish	Cornetfish			
##	12549	R	R	Bluespotted cornetfish	Cornetfish			
##	12855	R	R	Galapagos shark	Requiem			
##	16809	R	R	Yellow-edged moray	Moray			
##	17047	R	R	Bluespotted cornetfish	Cornetfish			
##	18121	0	R	Giant manta	Manta Ray			
##	18339	R	0	Grey reef shark	Requiem			
##	20567	R	R	Yellow-edged moray	Moray			
##	20602	R	R	Galapagos shark	Requiem			
##	22020	R	R	Whitetip reef shark	Requiem			
##	22853	R	R	Yellow-edged moray	Moray			
##	23339	R	R		Requiem			
##		FAMILY	RANK	TROPHIC	TROPHIC_MONREP	LW_A	LW_B	LMAX
##	84	Carangidae	Species	Pisc	PISCIVORE	0.02300	2.97700	165
##	962	Carcharhinidae	Species	Pisc	PISCIVORE	0.00180	3.34393	213
##	974	Fistulariidae	Species	Pisc	PISCIVORE	0.00050	3.04800	160
##	1115	Muraenidae	Species	Pisc	PISCIVORE	0.00040	3.35000	240
##	4443	Carcharhinidae	Species	Pisc	PISCIVORE	0.00230	3.37300	240
##	4448	Carangidae	Species	Pisc	PISCIVORE	0.02300	2.97700	165
##	5350	Myliobatidae	Species	MI	SECONDARY	0.00590	3.13000	350
##	5658	Muraenidae	Species	Pisc	PISCIVORE	0.00040	3.35000	240
##	7077	Carcharhinidae	Species	Pisc	PISCIVORE	0.00230	3.37300	240
##	7777	Muraenidae	Species	Pisc	PISCIVORE	0.00040	3.35000	240
##	8349	Muraenidae	Species	Pisc	PISCIVORE	0.00040	3.35000	240
##	8868	Phocidae	Species	X		0.00000	0.00000	999
##	9278	Carcharhinidae	Species	Pisc	PISCIVORE	0.00180	3.34393	213
##	10361	Muraenidae	Species	Pisc	PISCIVORE	0.00160	3.00000	150
##	11224	Carcharhinidae	Species	Pisc	PISCIVORE	0.00230	3.37300	240
##	11368	Muraenidae	Species	Pisc	PISCIVORE	0.00160	3.00000	150
##	12504	Fistulariidae	Species	Pisc	PISCIVORE	0.00050	3.04800	160

##	12549	Fistulariidae Species	Pisc	PISCIVORE	0.00050	3.04800	160
##	12855	Carcharhinidae Species	Pisc	PISCIVORE	0.00230	3.37300	370
##	16809	Muraenidae Species	Pisc	PISCIVORE	0.00040	3.35000	240
##	17047	Fistulariidae Species	Pisc	PISCIVORE	0.00050	3.04800	160
##	18121	Myliobatidae Species	Pk	PLANKTIVORE	0.01640	3.00000	800
##	18339	Carcharhinidae Species	Pisc	PISCIVORE	0.00230	3.37300	240
##	20567	Muraenidae Species	Pisc	PISCIVORE	0.00040	3.35000	240
##	20602	Carcharhinidae Species	Pisc	PISCIVORE	0.00230	3.37300	370
##	22020	Carcharhinidae Species	Pisc	PISCIVORE	0.00180	3.34393	213
##	22853	Muraenidae Species	Pisc	PISCIVORE	0.00040	3.35000	240
##	23339	Carcharhinidae Family	Pisc	PISCIVORE	0.00096	3.56556	500
##		LENGTH_CONVERSION_FACTOR	COUNT	SIZE_	OBS_TYPE		OBS_DESC
##	84	0.89	1	120	T		After 10 minutes
##	962	0.80	1	110	N		Non-Instantaneous
##	974	1.00	1	110	I		Instantaneous
##	1115	1.00	1	110	I		Instantaneous
##	4443	0.85	1	110	F		After 5 minutes
##	4448	0.89	1	110	P		Presence
##	5350	1.00	1	130	P		Presence
##	5658	1.00	1	120	I		Instantaneous
##	7077	0.85	1	140	P		Presence
##	7777	1.00	1	110	F		After 5 minutes
##	8349	1.00	1	130	T		After 10 minutes
##	8868	1.00	1	160	T		After 10 minutes
##	9278	0.80	1	115	I		Instantaneous
##	10361	1.00	1	140	T		After 10 minutes
##	11224	0.85	2	137	T		After 10 minutes
##	11368	1.00	1	120	I		Instantaneous
##	12504	1.00	1	110	T		After 10 minutes
##	12549	1.00	1	110	T		After 10 minutes
##	12855	0.85	1	120	P		Presence
##	16809	1.00	1	140	T		After 10 minutes
##	17047	1.00	1	110	I		Instantaneous
##	18121	1.00	1	260	P		Presence
##	18339	0.85	1	110	N		Non-Instantaneous
##	20567	1.00	1	130	T		After 10 minutes
##	20602	0.85	1	110	T		After 10 minutes
##	22020	0.80	1	110	P		Presence
##	22853	1.00	1	110	F		After 5 minutes
##	23339	0.84	2	108	P		Presence

```
fish2[fish2$SAND>80,]
```

##		REGION_NAME	ISLAND	REEF_ZONE	DEPTH_BIN	DATE_	DEPTH
##	1461	Main Hawaiian Islands	Kauai	Forereef	Mid	28-Jul-19	16.8
##	1462	Main Hawaiian Islands	Kauai	Forereef	Mid	28-Jul-19	16.8
##	2646	Main Hawaiian Islands	Kauai	Forereef	Mid	28-Jul-19	16.8
##	10987	Main Hawaiian Islands	Kauai	Forereef	Mid	28-Jul-19	16.8
##	10988	Main Hawaiian Islands	Kauai	Forereef	Mid	28-Jul-19	16.8
##	10989	Main Hawaiian Islands	Kauai	Forereef	Mid	28-Jul-19	16.8
##	20778	Main Hawaiian Islands	Kauai	Forereef	Mid	28-Jul-19	16.8
##		HARD_CORAL	MA	CCA	SAND	OTHER	HABITAT_CODE
##	1461	0.5	1	0	90	8.5	SCR Sand with Scattered Coral/Rock
##	1462	0.5	1	0	90	8.5	SCR Sand with Scattered Coral/Rock
##	2646	0.5	1	0	90	8.5	SCR Sand with Scattered Coral/Rock

##	10987	0.5	1	0	90	8.5	SCR Sand with Scattered Coral/Rock
##	10988	0.5	1	0	90	8.5	SCR Sand with Scattered Coral/Rock
##	10989	0.5	1	0	90	8.5	SCR Sand with Scattered Coral/Rock
##	20778	0.5	1	0	90	8.5	SCR Sand with Scattered Coral/Rock
##		VISIBILITY	MIN_DEPTH	MAX_DEPTH	SUBSTRATE_HEIGHT_0	SUBSTRATE_HEIGHT_20	
##	1461	28	16.8	16.8	100	0	
##	1462	28	16.8	16.8	100	0	
##	2646	28	16.8	16.8	100	0	
##	10987	28	16.8	16.8	100	0	
##	10988	28	16.8	16.8	100	0	
##	10989	28	16.8	16.8	100	0	
##	20778	28	16.8	16.8	100	0	
##		SUBSTRATE_HEIGHT_50	SUBSTRATE_HEIGHT_100	SUBSTRATE_HEIGHT_150	MAX_HEIGHT		
##	1461	0	0	0	0.19		
##	1462	0	0	0	0.19		
##	2646	0	0	0	0.19		
##	10987	0	0	0	0.19		
##	10988	0	0	0	0.19		
##	10989	0	0	0	0.19		
##	20778	0	0	0	0.19		
##		URCHIN_DACOR	BORING_URCHIN_DACOR	COMMONNAME	COMMONFAMILYALL		
##	1461	R	R	Green jobfish	Snapper		
##	1462	R	R	Green jobfish	Snapper		
##	2646	R	R	Masked triggerfish	Triggerfish		
##	10987	R	R	Quakerfish	Tilefish		
##	10988	R	R	Quakerfish	Tilefish		
##	10989	R	R	Arc-eye hawkfish	Hawkfish		
##	20778	R	R	Green jobfish	Snapper		
##		FAMILY	RANK	TROPHIC	TROPHIC_MONREP	LW_A	LW_B LMAX
##	1461	Lutjanidae	Species	Pisc	PISCIVORE	0.02297000	2.886270 112
##	1462	Lutjanidae	Species	Pisc	PISCIVORE	0.02297000	2.886270 112
##	2646	Balistidae	Species	MI	SECONDARY	0.02881318	3.034828 38
##	10987	Malacanthidae	Species	MI	SECONDARY	0.00490000	3.000000 30
##	10988	Malacanthidae	Species	MI	SECONDARY	0.00490000	3.000000 30
##	10989	Cirrhitidae	Species	MI	SECONDARY	0.01650000	3.125300 14
##	20778	Lutjanidae	Species	Pisc	PISCIVORE	0.02297000	2.886270 112
##		LENGTH_CONVERSION_FACTOR	COUNT	SIZE_	OBS_TYPE	OBS_DESC	
##	1461	0.9	1	65	T	After 10 minutes	
##	1462	0.9	1	60	T	After 10 minutes	
##	2646	1.0	2	18	I	Instantaneous	
##	10987	1.0	1	20	I	Instantaneous	
##	10988	1.0	1	25	I	Instantaneous	
##	10989	1.0	1	8	I	Instantaneous	
##	20778	0.9	1	58	T	After 10 minutes	

```
fish2[fish2$LMAX>500,]
```

##		REGION_NAME	ISLAND	REEF_ZONE	DEPTH_BIN	DATE_	DEPTH
##	8868	Main Hawaiian Islands	Oahu	Forereef	Mid	5-Aug-19	17.7
##	18121	Main Hawaiian Islands	Hawaii	Forereef	Mid	16-Jul-19	15.2
##		HARD_CORAL	MA	CCA	SAND	OTHER	HABITAT_CODE
##	8868	0.5	2	0	10	87.5	ROB Rock/Boulder
##	18121	2.0	5	4	2	87.0	AGR Aggregate Reef
##		MIN_DEPTH	MAX_DEPTH	SUBSTRATE_HEIGHT_0	SUBSTRATE_HEIGHT_20		
##	8868	16.4	19.8	70	10		

```
## 18121      15.2      15.2      90      7
##      SUBSTRATE_HEIGHT_50 SUBSTRATE_HEIGHT_100 SUBSTRATE_HEIGHT_150 MAX_HEIGHT
## 8868      20      0      0      0.9
## 18121      2      1      0      1.1
##      URCHIN_DACOR BORING_URCHIN_DACOR  COMMONNAME COMMONFAMILYALL      FAMILY
## 8868      R      R  Monk seal      Monk Seal      Phocidae
## 18121      0      R Giant manta      Manta Ray Myliobatidae
##      RANK TROPHIC TROPHIC_MONREP  LW_A LW_B LMAX LENGTH_CONVERSION_FACTOR
## 8868 Species      X      0.0000      0 999      1
## 18121 Species      Pk      PLANKTIVORE 0.0164      3 800      1
##      COUNT SIZE_ OBS_TYPE      OBS_DESC
## 8868      1 160      T After 10 minutes
## 18121      1 260      P      Presence
```

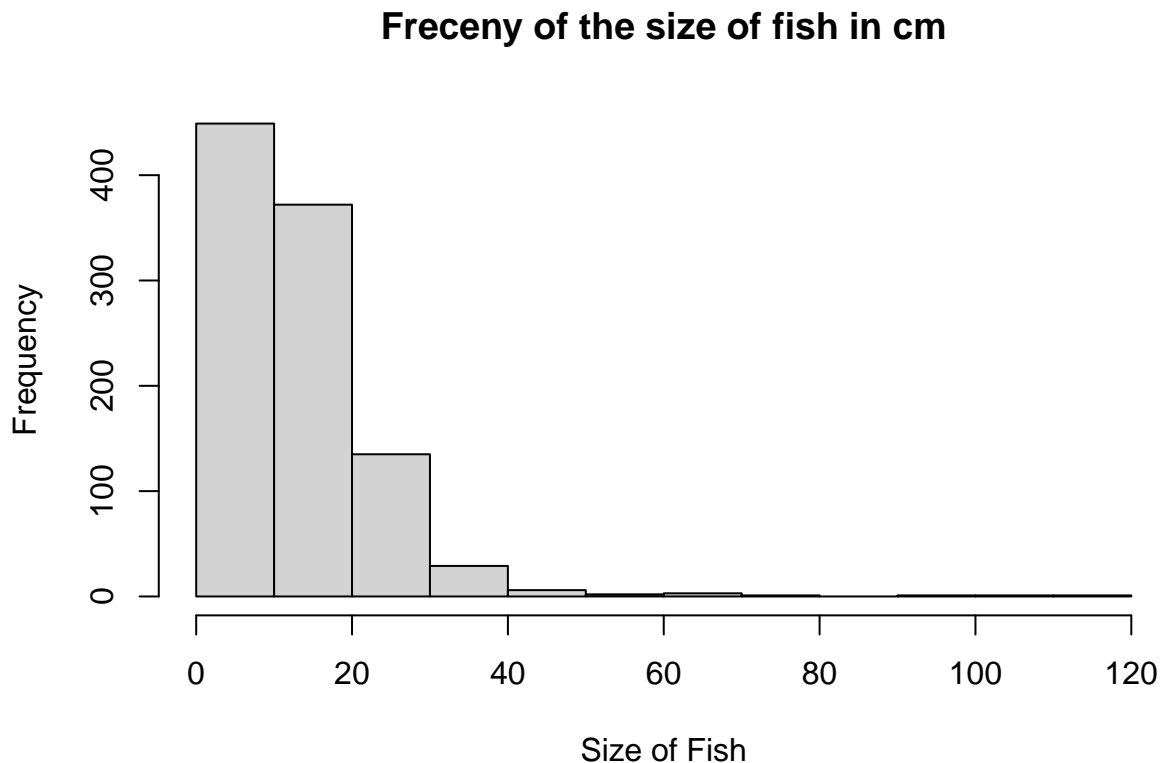
```
fish3<-sample_n(fish2, 1000)
head(fish3)
```

```
##      REGION_NAME ISLAND REEF_ZONE DEPTH_BIN      DATE_ DEPTH HARD_CORAL
## 1 Main Hawaiian Islands Maui Forereef Shallow 21-Apr-19 3.9      20
## 2 Main Hawaiian Islands Niihau Forereef Deep 25-Jul-19 20.9      2
## 3 Main Hawaiian Islands Maui Forereef Shallow 27-Apr-19 5.8      3
## 4 Main Hawaiian Islands Hawaii Forereef Deep 14-Jul-19 20.6      0
## 5 Main Hawaiian Islands Hawaii Forereef Deep 4-May-19 20.7      3
## 6 Main Hawaiian Islands Molokai Forereef Shallow 2-May-19 2.1      10
## MA CCA SAND OTHER HABITAT_CODE  HABITAT_TYPE VISIBILITY MIN_DEPTH MAX_DEPTH
## 1 3 2 10 65      AGR Aggregate Reef      17      3.3      3.65
## 2 0 0 46 52      ROB Rock/Boulder      30      19.1      21.80
## 3 1 2 0 94      ROB Rock/Boulder      18      3.7      5.80
## 4 0 0 0 100      RRB Reef Rubble      12      17.6      23.60
## 5 1 1 10 85      ROB Rock/Boulder      21      19.8      21.90
## 6 0 5 20 65      AGR Aggregate Reef      14      2.4      2.40
## SUBSTRATE_HEIGHT_0 SUBSTRATE_HEIGHT_20 SUBSTRATE_HEIGHT_50
## 1      5      5      80
## 2      5      80      10
## 3      30      10      20
## 4      99      1      0
## 5      20      5      50
## 6      60      20      15
## SUBSTRATE_HEIGHT_100 SUBSTRATE_HEIGHT_150 MAX_HEIGHT URCHIN_DACOR
## 1      10      0      1.2      0
## 2      5      0      1.2      R
## 3      20      20      2.5      R
## 4      0      0      0.3      R
## 5      20      5      5.0      R
## 6      5      0      1.4      R
## BORING_URCHIN_DACOR  COMMONNAME COMMONFAMILYALL      FAMILY
## 1      R      Saddle wrasse      Wrasse      Labridae
## 2      R  Millet butterflyfish  Butterflyfish Chaetodontidae
## 3      R  Brown surgeonfish      Surgeonfish  Acanthuridae
## 4      R  Sleek unicornfish      Surgeonfish  Acanthuridae
## 5      R Blotcheye soldierfish  Soldierfish  Holocentridae
## 6      R      Bird wrasse      Wrasse      Labridae
##      RANK TROPHIC TROPHIC_MONREP  LW_A LW_B LMAX
## 1 Species      MI      SECONDARY 0.01230000 3.09700 26
## 2 Species      Pk      PLANKTIVORE 0.02960000 2.98950 16
```



```
## 3 Species      H      PRIMARY 0.02637000 3.02837    23
## 4 Species      Pk     PLANKTIVORE 0.04244108 2.85400    75
## 5 Species      Pk     PLANKTIVORE 0.02769000 3.00336    33
## 6 Species      MI     SECONDARY 0.02437000 2.70269    32
##  LENGTH_CONVERSION_FACTOR COUNT SIZE_ OBS_TYPE      OBS_DESC
## 1              0.90      3    10      I      Instantaneous
## 2              1.00      2    12      I      Instantaneous
## 3              0.91      4    12      I      Instantaneous
## 4              0.88      1    30      F After 5 minutes
## 5              0.92      1    27      I      Instantaneous
## 6              1.00      1    12      I      Instantaneous
```

```
hist(as.numeric(fish3$SIZE_), xlab = "Size of Fish", main = "Freceeny of the size of fish in cm")
```



```
unique(fish2[c("HABITAT_TYPE", "HABITAT_CODE")])
```

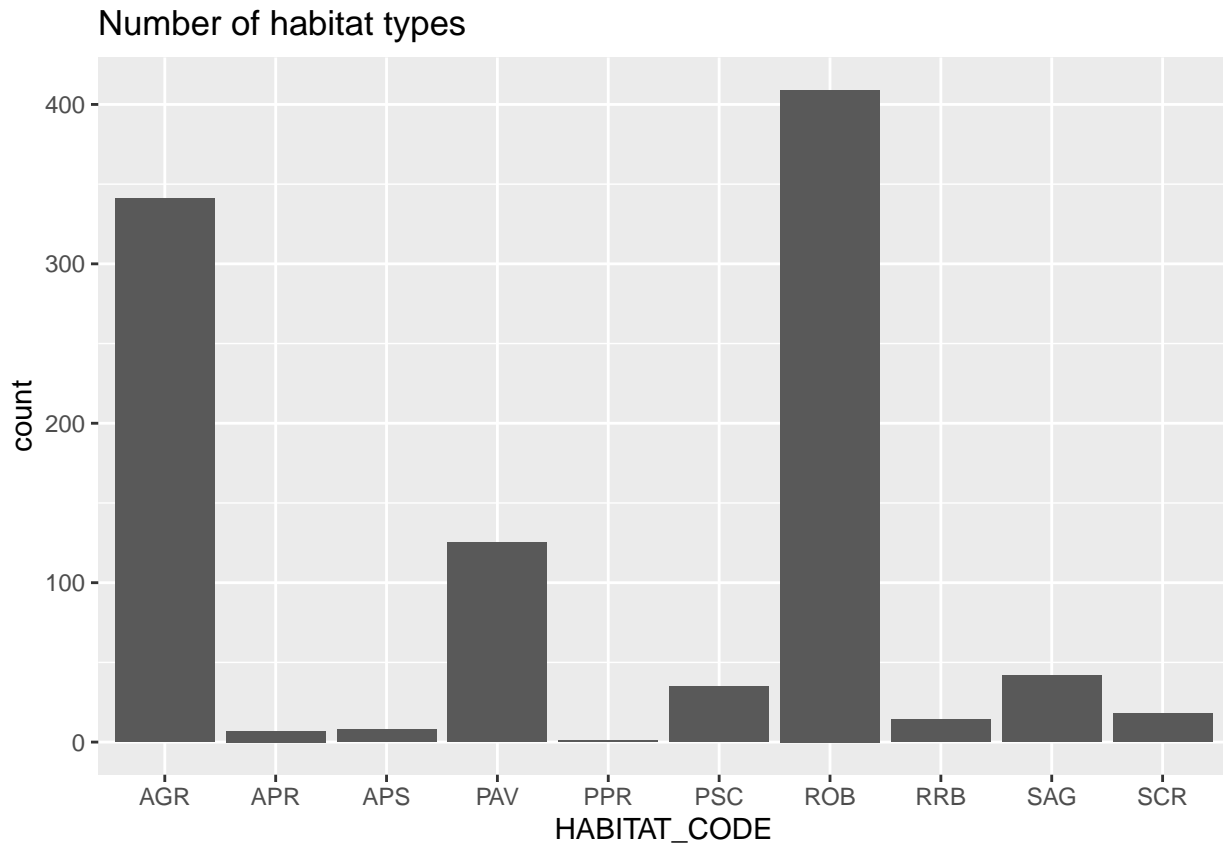
```
##          HABITAT_TYPE HABITAT_CODE
## 1          Rock/Boulder          ROB
## 53             Pavement          PAV
## 54      Aggregate Reef          AGR
## 61 Pavement with Patch Reefs        PPR
## 215      Aggregate Patch Reefs        APS
## 224 Sand with Scattered Coral/Rock        SCR
## 229             Reef Rubble          RRB
## 264      Aggregate Patch Reef          APR
## 786             Spur and Groove          SAG
## 1315 Pavement with Sand Channels          PSC
```

```
unique(fish3[c("HABITAT_TYPE", "HABITAT_CODE")])
```

```
##          HABITAT_TYPE HABITAT_CODE
```

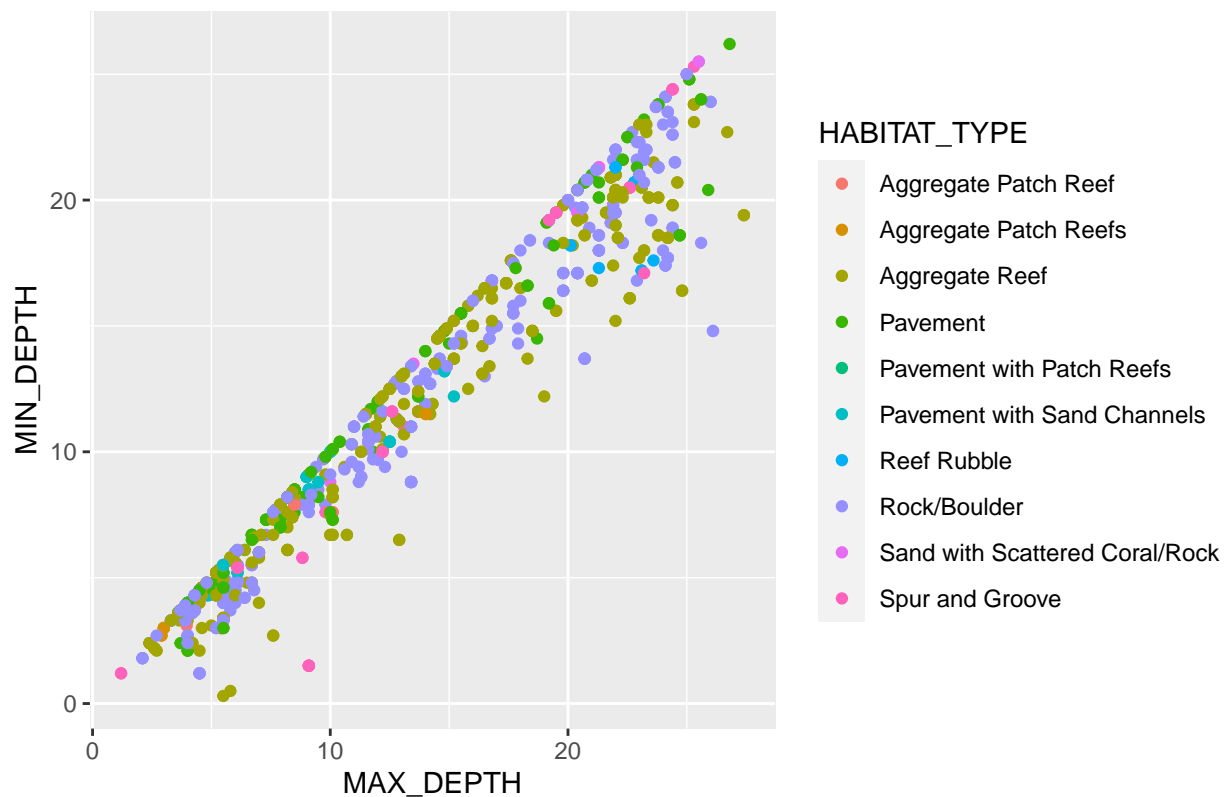
```
## 1          Aggregate Reef      AGR
## 2          Rock/Boulder       ROB
## 4          Reef Rubble        RRB
## 10         Spur and Groove     SAG
## 12         Pavement           PAV
## 15         Aggregate Patch Reef APR
## 29         Pavement with Sand Channels PSC
## 61         Pavement with Patch Reefs PPR
## 93         Sand with Scattered Coral/Rock SCR
## 135        Aggregate Patch Reefs APS
```

```
fishPlot <-ggplot(fish3, aes(x = HABITAT_CODE)) +
  geom_bar()
print(fishPlot + ggtitle("Number of habitat types"))
```



```
fishPlot1 <-ggplot(fish3, aes(x=MAX_DEPTH,y=MIN_DEPTH, color=HABITAT_TYPE)) +geom_point()
print(fishPlot1 + ggtitle("Compare min and max water depth with habit type"))
```

Compare min and max water depth with habit type



```
unique(fish2[c("COMMONNAME")])
```

```
##          COMMONNAME
## 1      Sailfin tang
## 2    Hawaiian Hogfish
## 3    Russet angelfish
## 4      Agile chromis
## 6    Threespot chromis
## 7 Hawaiian bicolor chromis
## 10   Hawaiian dascyllus
## 11   Spotted surgeonfish
## 14   Black triggerfish
## 17   Pinktail triggerfish
## 18   Greater amberjack
## 19   Masked triggerfish
## 20   Bluefin trevally
## 21   Ornate butterflyfish
## 22   Whitecheek surgeonfish
## 23   Longnose butterfly fish
## 24   Pebbled butterflyfish
## 25   Fourspot butterflyfish
## 26   Twosaddle goatfish
## 27   Blue lined squirrelfish
## 28   Peacock hind
## 31
## 32   Hawaiian cleaner wrasse
## 33   Saddle wrasse
```

## 37	Ornamented wrasse
## 38	Indo-Pacific sergeant
## 41	Vanderbilt's chromis
## 43	Johnston Island damsel
## 44	Green damselfish
## 45	Brighteye damselfish
## 46	Arc-eye hawkfish
## 48	Hawaiian whitespotted toby
## 49	Whitespotted filefish
## 50	Moorish idol
## 52	Whitespotted surgeonfish
## 53	Boomerang triggerfish
## 54	Sleek unicornfish
## 56	Manybar goatfish
## 57	Whitebar surgeonfish
## 59	Orangespine unicornfish
## 61	Orangespot surgeonfish
## 66	Sunburst butterflyfish
## 69	Humpnose big-eye bream
## 70	Brown surgeonfish
## 71	Ringtail surgeonfish
## 72	Blacktail snapper
## 74	Common bluestripe snapper
## 77	Blackside hawkfish
## 80	Ringtail maori wrasse
## 81	Bluespine unicornfish
## 83	Raccoon butterflyfish
## 84	Giant trevally
## 89	Gilded triggerfish
## 91	False moorish idol
## 96	Redbarred hawkfish
## 101	Striated wrasse
## 105	Blacktail goby
## 110	Crowned puffer
## 112	Quakerfish
## 114	Green jobfish
## 122	Carolines parrotfish
## 128	Small toothed jobfish
## 129	Ember parrotfish
## 130	Yellow tang
## 140	Bird wrasse
## 147	Hawaiian gregory
## 149	Chinese trumpetfish
## 150	Blotcheye soldierfish
## 157	Goldsaddle goatfish
## 162	Daisy parrotfish
## 172	Flame angel
## 191	Eight-lined wrasse
## 197	Common parrotfish
## 208	Finescale triggerfish
## 216	Elegant coris
## 217	Smalltail wrasse
## 219	Redspotted sandperch
## 220	Biting blenny

## 228	Yellowbar parrot
## 232	Sidespot goatfish
## 239	Threadfin butterflyfish
## 253	Two-spot wrasse
## 266	Bluelined surgeonfish
## 269	Convict surgeonfish
## 288	Hawaiian chromis
## 307	Chevron tang
## 323	Belted wrasse
## 330	Spider-eye puffer
## 332	Bluespotted cornetfish
## 340	Wedge-tail triggerfish
## 359	Spotted unicornfish
## 360	Undulated moray
## 362	Eyestripe surgeonfish
## 386	Titan scorpionfish
## 390	Blackbar triggerfish
## 435	Blackspot sergeant
## 438	Whitespotted boxfish
## 439	Orangetail filefish
## 441	Yellowtail coris
## 452	Rockmover wrasse
## 491	Millet butterflyfish
## 494	Bluestriped butterflyfish
## 499	Ewa blenny
## 507	Yellowfin surgeonfish
## 517	Dwarf moray
## 523	Sandwich isle file
## 535	Spot-fin porcupinefish
## 552	Orange angelfish
## 578	Yellowstripe coris
## 583	Four-lined wrasse
## 591	Turkey moray
## 593	Fantail filefish
## 597	Apogonidae species
## 613	Thompson's surgeonfish
## 667	Oval butterflyfish
## 719	Yellowstripe goatfish
## 743	Hawaiian flagtail
## 784	Blacktail wrasse
## 789	Yellowfin goatfish
## 791	Scarface blenny
## 868	Brick soldierfish
## 879	Thompson's butterflyfish
## 883	Sammara squirrelfish
## 903	Doublespotted queenfish
## 911	Acanthurus species
## 952	Yellow-edged moray
## 961	Whitetip reef shark
## 996	Saddle butterflyfish
## 1007	Hawaiian orbicular velvetfish
## 1157	Leopard blenny
## 1184	Pearl wrasse
## 1303	Parrotfish species

## 1305	Variegated lizardfish
## 1365	Shoulderbar soldierfish
## 1366	Achilles tang
## 1387	Surge wrasse
## 1389	Mackerel scad
## 1393	Rock damselfish
## 1405	Regal parrot
## 1408	Great barracuda
## 1437	Giant moray
## 1549	Geoffroy's wrasse
## 1589	Sabre squirrelfish
## 1654	Teardrop butterflyfish
## 1678	Milkfish
## 1900	Longnose butterflyfish
## 1926	Pacific gregory
## 1964	Bicolor anthias
## 1966	African pompano
## 2088	Scrawled filefish
## 2127	Spotted knifejaw
## 2292	Hawaiian squirrelfish
## 2297	Island trevally
## 2307	Crown squirrelfish
## 2325	Banded angelfish
## 2351	Humpback nohu
## 2383	Midget chromis
## 2450	Blenny species
## 2483	Whitetail chromis
## 2489	Lizardfish species
## 2492	Curious wormfish
## 2518	Yellow-brown wrasse
## 2640	Red tail wrasse
## 2985	Hawaiian morwong
## 3067	Stocky hawkfish
## 3243	Mailed butterflyfish
## 3331	Apogon species
## 3382	Rainbow runner
## 3564	Iridescent cardinalfish
## 3649	Peacock wrasse
## 3752	Delicate round herring
## 3988	Whitesaddle goatfish
## 4011	Surgeonfish species
## 4106	Cigar wrasse
## 4108	Hawaiian bigeye
## 4253	Flowery flounder
## 4443	Grey reef shark
## 4788	Spotted coral croucher
## 4807	Christmas wrasse
## 5176	Spotted cardinalfish
## 5350	Spotted eagle ray
## 5513	Fivestripe wrasse
## 5622	Viper moray
## 6097	Heller's barracuda
## 6214	Randall's pufferfish
## 6680	Valentinni's sharpnosepuffer

```

## 7099          Dusky driftfish
## 7410          Blue seachub
## 7502    Whitemargin unicornfish
## 7567          Pyramid butterflyfish
## 7785          Guineafowl puffer
## 7924          Lantern toby
## 8014          Sharp-headed wrasse
## 8086          Blue trevally
## 8129          Lined butterflyfish
## 8504          Snowflake moray
## 8751    Spectacled parrotfish
## 8868          Monk seal
## 9517    Abbott's moray eel
## 9571          Zebra moray
## 9773          Lined surgeonfish
## 10028         Conger eel species
## 10309         Glasseye
## 12125    White-spotted puffer
## 12162    Honeycomb filefish
## 12232    Brown-lined puffer
## 12855    Galapagos shark
## 13264    Bluestripe pipefish
## 13766    Speckled squirrelfish
## 15087    Orange goatfish
## 15248          Kawakawa
## 17317    Leaf scorpionfish
## 18121          Giant manta
## 19671          Black jack
## 21650    Houndneedlefish

```

```
unique(fish3[c("COMMONNAME")])
```

```

##          COMMONNAME
## 1          Saddle wrasse
## 2    Millet butterflyfish
## 3          Brown surgeonfish
## 4          Sleek unicornfish
## 5    Blotcheye soldierfish
## 6          Bird wrasse
## 8    Longnose butterfly fish
## 10         Yellow tang
## 11         Achilles tang
## 12    Sunburst butterflyfish
## 13         Peacock hind
## 14    Hawaiian whitespotted toby
## 15         Black triggerfish
## 16         Two-spot wrasse
## 17    Goldsaddle goatfish
## 18    Fourspot butterflyfish
## 19    Orangespine unicornfish
## 20         Milkfish
## 21    Spotted surgeonfish
## 22    Small toothed jobfish
## 24    Whitebar surgeonfish
## 25    Arc-eye hawkfish

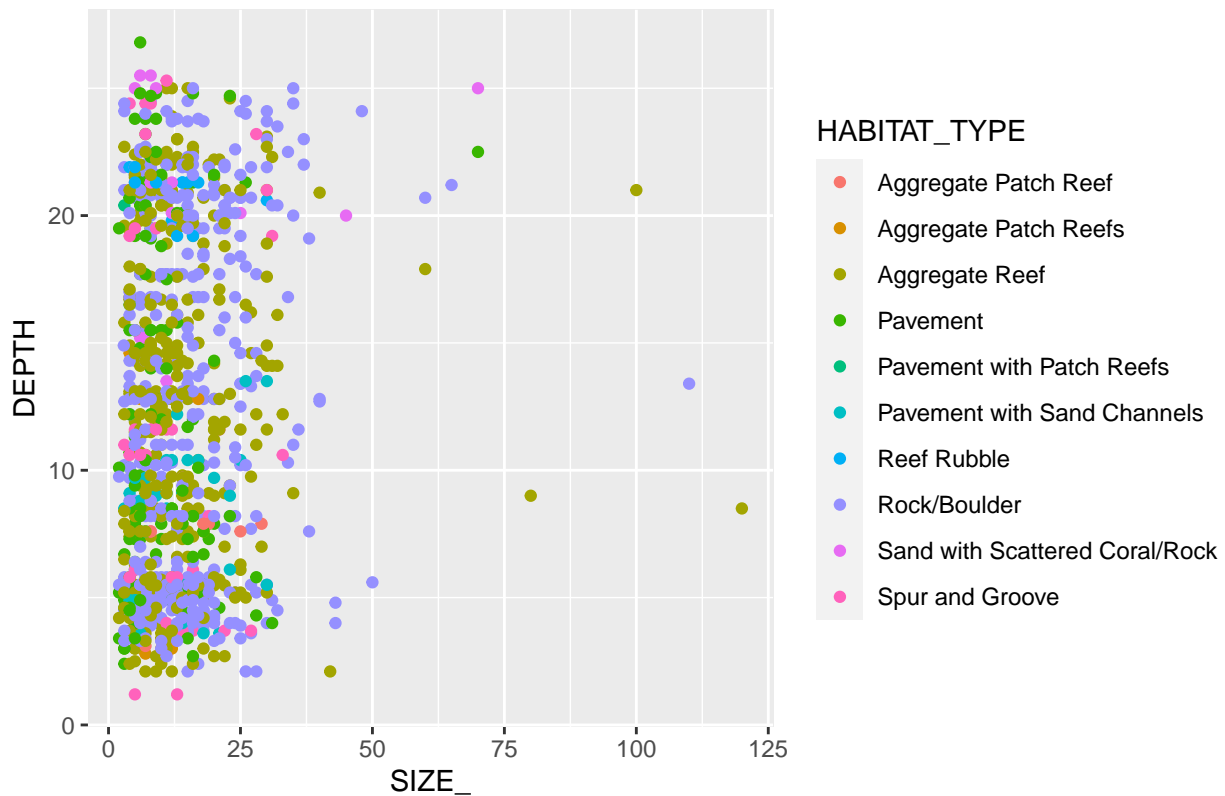
```

## 26	Raccoon butterflyfish
## 29	Pinktail triggerfish
## 30	Vanderbilt's chromis
## 32	Boomerang triggerfish
## 33	Orangespot surgeonfish
## 35	Daisy parrotfish
## 36	Pebbled butterflyfish
## 37	Bluespine unicornfish
## 39	Masked triggerfish
## 40	Manybar goatfish
## 41	Hawaiian bicolor chromis
## 45	Ember parrotfish
## 48	Belted wrasse
## 49	Yellowtail coris
## 52	Bluefin trevally
## 55	Ringtail maori wrasse
## 59	Threespot chromis
## 60	Leopard blenny
## 62	Russet angelfish
## 65	Hawaiian Hogfish
## 73	Ornamented wrasse
## 75	Eyestripe surgeonfish
## 85	Thompson's surgeonfish
## 86	Gilded triggerfish
## 88	Blacktail snapper
## 90	Brighteye damselfish
## 93	Bicolor anthias
## 96	Shoulderbar soldierfish
## 104	Moorish idol
## 108	Ewa blenny
## 111	Pearl wrasse
## 117	Hawaiian dascyllus
## 119	Elegant coris
## 122	Green jobfish
## 124	Hawaiian cleaner wrasse
## 125	Striated wrasse
## 128	Red tail wrasse
## 130	Convict surgeonfish
## 131	Biting blenny
## 132	Blackside hawkfish
## 133	Johnston Island damsel
## 134	Chevron tang
## 138	Indo-Pacific sergeant
## 145	Twosaddle goatfish
## 158	Hawaiian gregory
## 173	Ornate butterflyfish
## 174	Spotted unicornfish
## 177	Yellowfin goatfish
## 184	Scarface blenny
## 187	Agile chromis
## 189	Common parrotfish
## 193	Whitetip reef shark
## 198	Smalltail wrasse
## 199	Stocky hawkfish

## 203	Sidespot goatfish
## 208	Humpnose big-eye bream
## 217	Regal parrot
## 230	Common bluestripe snapper
## 231	Ringtail surgeonfish
## 246	Chinese trumpetfish
## 249	Wedge-tail triggerfish
## 260	Spot-fin porcupinefish
## 287	Geoffroy's wrasse
## 289	Green damselfish
## 291	Whitespotted boxfish
## 293	Four-lined wrasse
## 295	Apogon species
## 305	Redbarred hawkfish
## 307	Christmas wrasse
## 310	Curious wormfish
## 315	False moorish idol
## 320	Carolines parrotfish
## 348	Mackerel scad
## 369	Blacktail wrasse
## 370	Eight-lined wrasse
## 374	Longnose butterflyfish
## 389	Blackspot sergeant
## 392	Bluelined surgeonfish
## 402	Spider-eye puffer
## 423	Blue lined squirrelfish
## 441	Bluestriped butterflyfish
## 471	
## 472	Yellowstripe goatfish
## 542	Sandwich isle file
## 572	Yellow-edged moray
## 575	Teardrop butterflyfish
## 581	Redspotted sandperch
## 615	Midget chromis
## 617	Threadfin butterflyfish
## 670	Humpback nohu
## 682	Banded angelfish
## 717	Whitespotted filefish
## 731	Saddle butterflyfish
## 733	Iridescent cardinalfish
## 737	Spotted eagle ray
## 748	Parrotfish species
## 767	Finescale triggerfish
## 776	Crowned puffer
## 783	Delicate round herring
## 792	Sailfin tang
## 841	Snowflake moray
## 910	Lantern toby
## 911	Hawaiian orbicular velvetfish
## 915	Orange angelfish
## 940	Apogonidae species
## 943	Greater amberjack
## 953	Rockmover wrasse

```
sizePlot1 <-ggplot(fish3, aes(x=SIZE_,y=DEPTH, color=HABITAT_TYPE)) +geom_point()
print(sizePlot1 + ggtitle("Compare size of fish and depth with habit type"))
```

Compare size of fish and depth with habit type



```
sizePlot1 <-ggplot(fish3, aes(x=SIZE_,y=HARD_CORAL, color=HABITAT_TYPE)) +geom_point()
print(sizePlot1 + ggtitle("Compare size of fish and Hard coral percentage with habit type"))
```

Compare size of fish and Hard coral percentage with habit type

