Leiðandi vettvangur í tíu ár

Assessing the Degree of Maerl Habitat Affecting Fish Species Abundance & Richness

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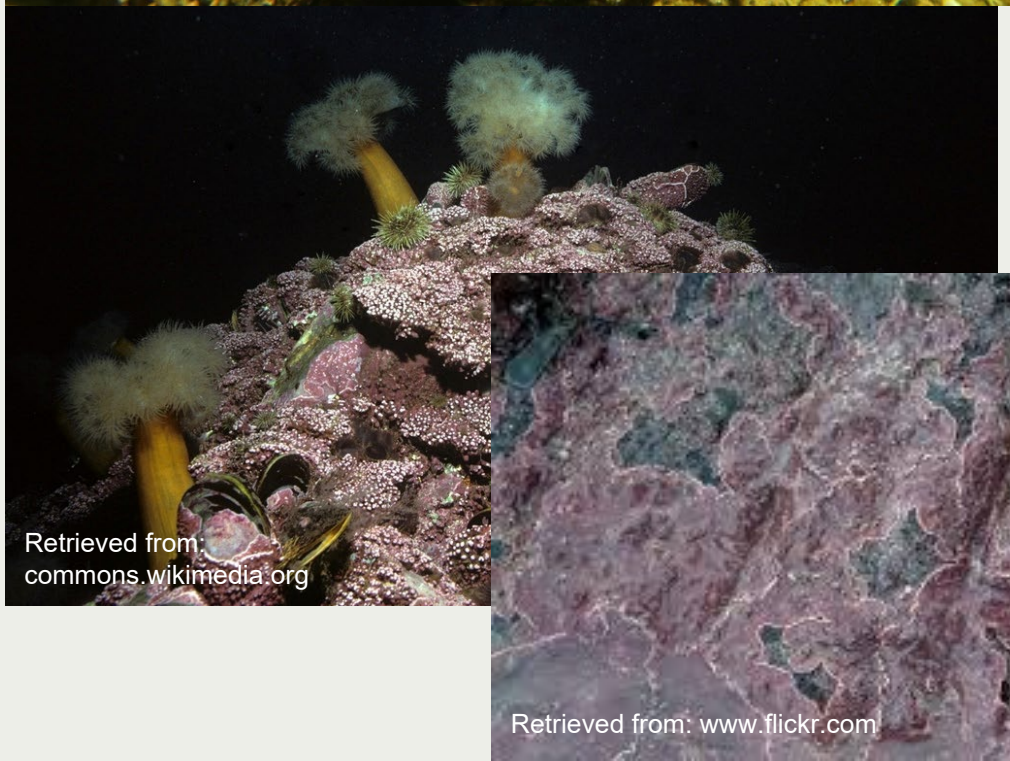
SJÁVARÚTVEGS RÁÐSTEFNAN

ISI ICELAND SEAFOOD · TM · iTUB · BRIM · HAMPIÐJAN · Hvítaþörungur

Maerl Beds

- Calcified algae: crust-like formation on bed of algal gravel
- Found from the surface to 100m deep
- Reported to be widely distributed to north Icelandic fjords



The Importance Of Maerl

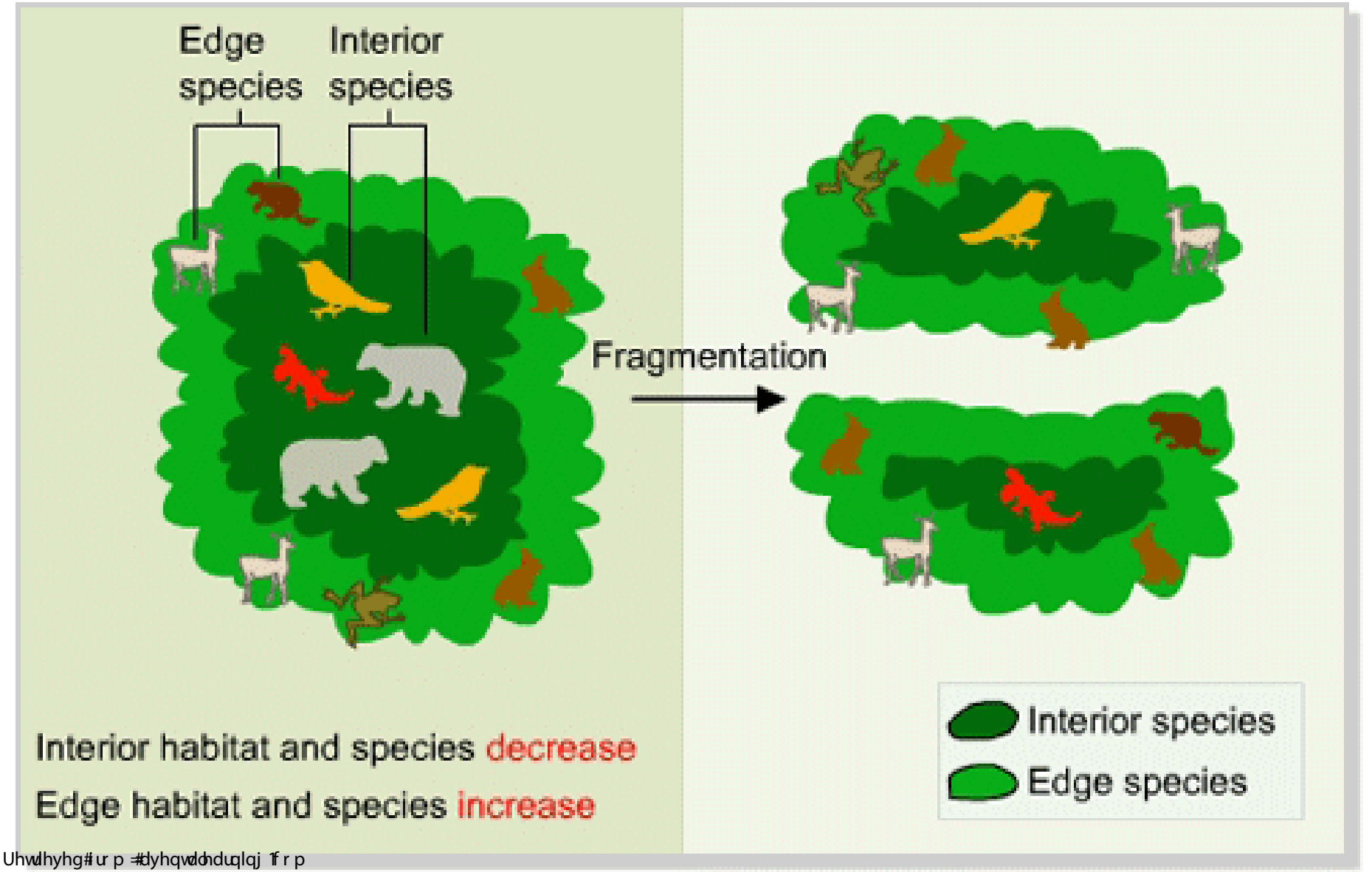
- Populations of most gadoid species depend on near shore areas (i.e. within maerl habitat)
- Provide physical refuge and predation protection
- Nursery grounds have high population of juveniles

Maerl Habitat In Iceland

- Gunnarsson et al. 1997 found maerl in Arnarfjörður and Hvammsfjörður, Hvalfjörður

- 170 million cubic meters found in Ísafjarðardjúp and Jökulfirðir (Kjartan Thor 2019)

Maerl Habitat Fragmentation



Research Questions

1) Is fragmentation of maerl habitat patches likely to affect fish species richness?

2) How accurate is the Gemini 720im Sea Tec system to count fish abundance and determine species richness compared to underwater dive surveying?

Aims

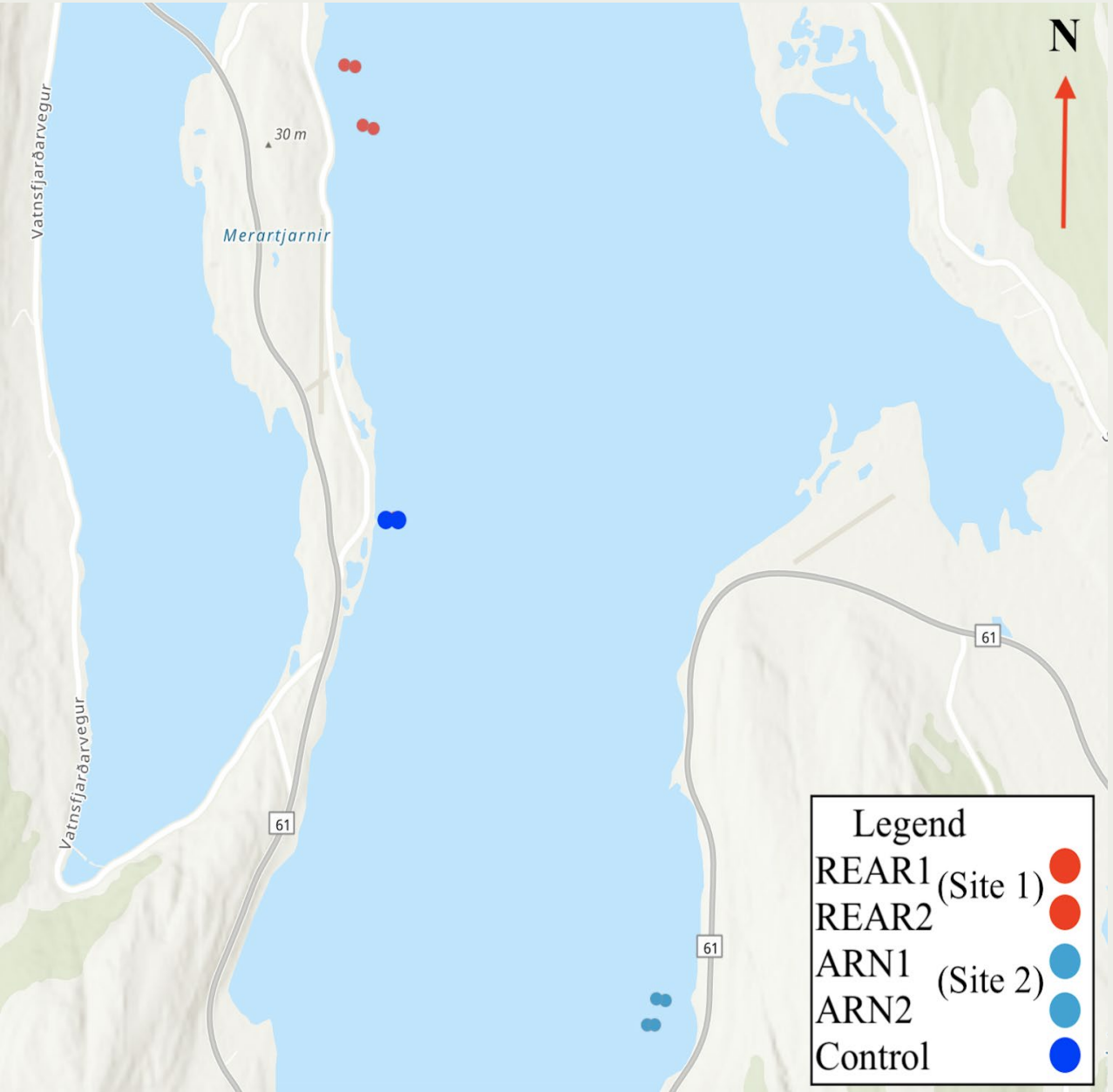
1. To demonstrate if maerl habitats are of importance as nursery grounds for various demersal and pelagic fish.

1. To demonstrate how maerl fragmentation affects fish abundance and species diversity.

1. To test the use of the Gemini 720im Sea Tec System as a method to determine abundance, size and diversity of fish species within maerl patches compared to dive surveys.

1. To determine if the percent cover of maerl habitat is related to fish abundance and species richness within habitats.

Materials and Methods



Study Site Description in Isafjordur

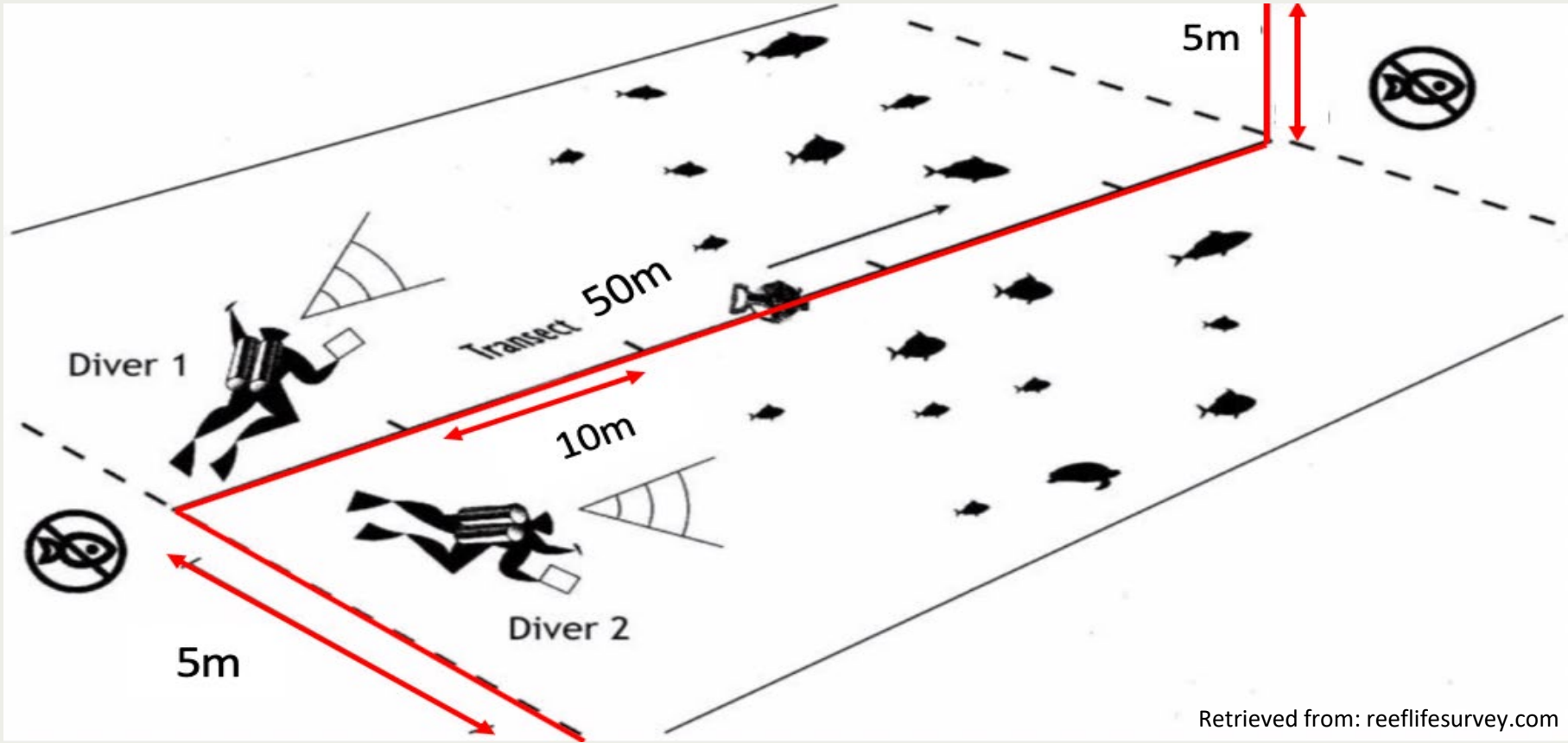
- 4 transect lines and 1 control line
  - Length of 50m
- Between depths of 5m to 20m
- Along the transect line 10m intervals are marked
- 30 survey dives in total
  - one dive per transect line

Materials & Methods

Fish Abundance & Richness

- Record crabs and fish species

- Large school of fish or crabs counted as a subset



Retrieved from: reeflifesurvey.com

Materials & Methods

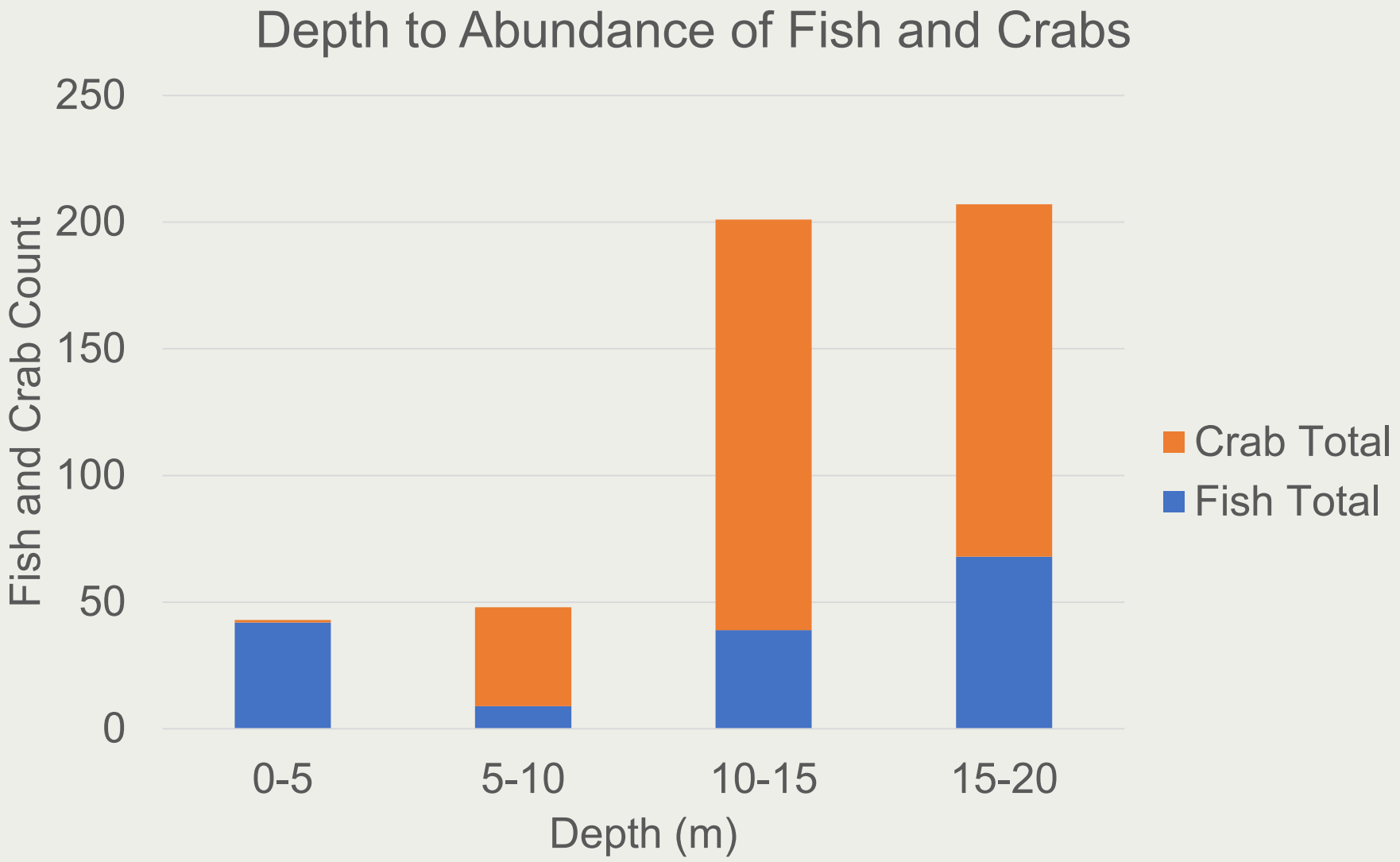
Maerl Percentage Coverage

- Only maerl is recorded for vegetation coverage and not specified by species
  - Estimated percentage coverage by observation per 10m interval
  - If maerl 100%, then “NONE” recorded for no substrate coverage

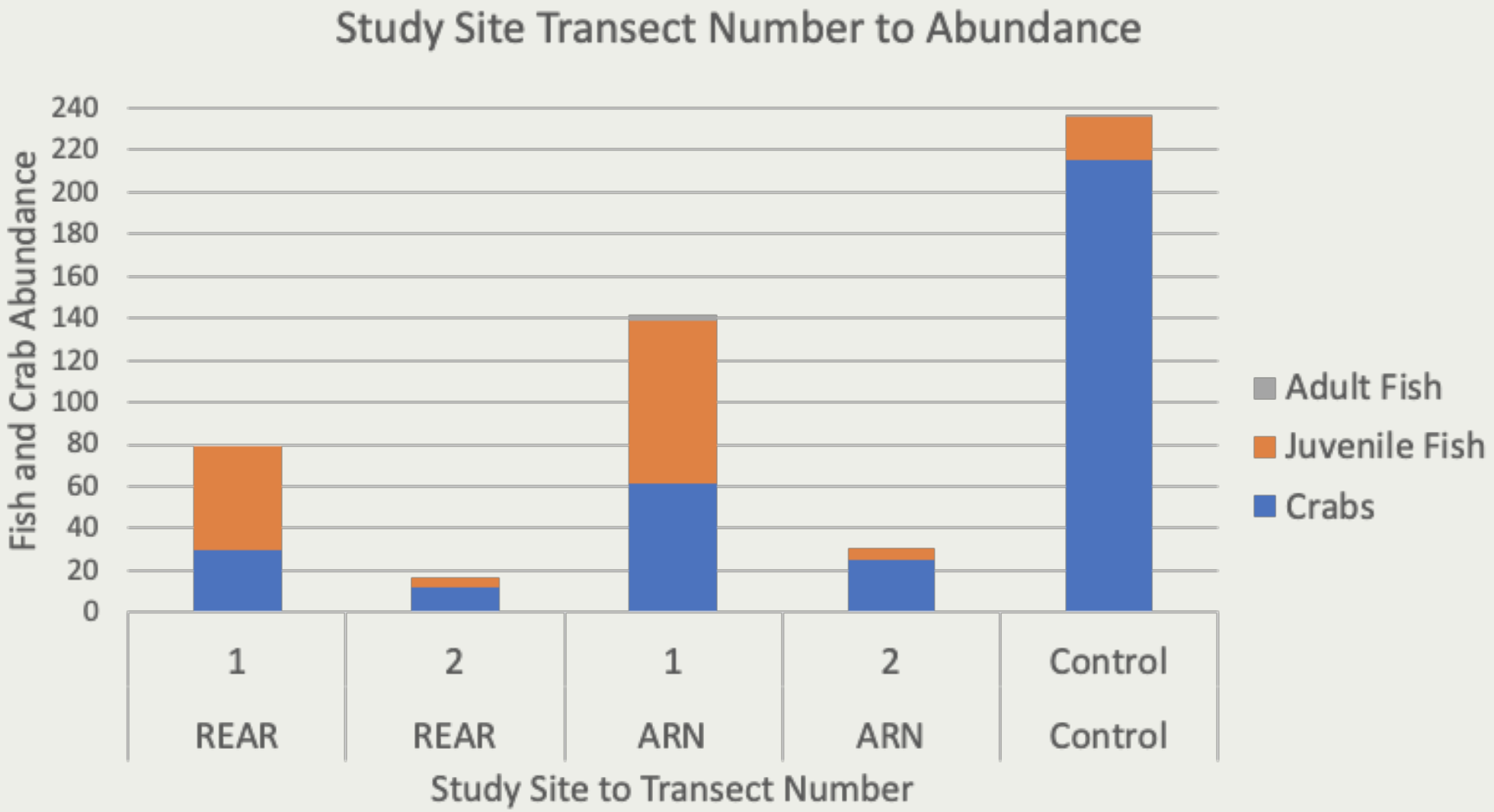
- Estimated substrate percent coverage type: Coarse Sand, Cobble, Silt, Gravel, and Mud
  - Recorded for comparison of maerl (Wentworth scale 1922)

- Videography used as backup for substrate classification and percent coverage after diving

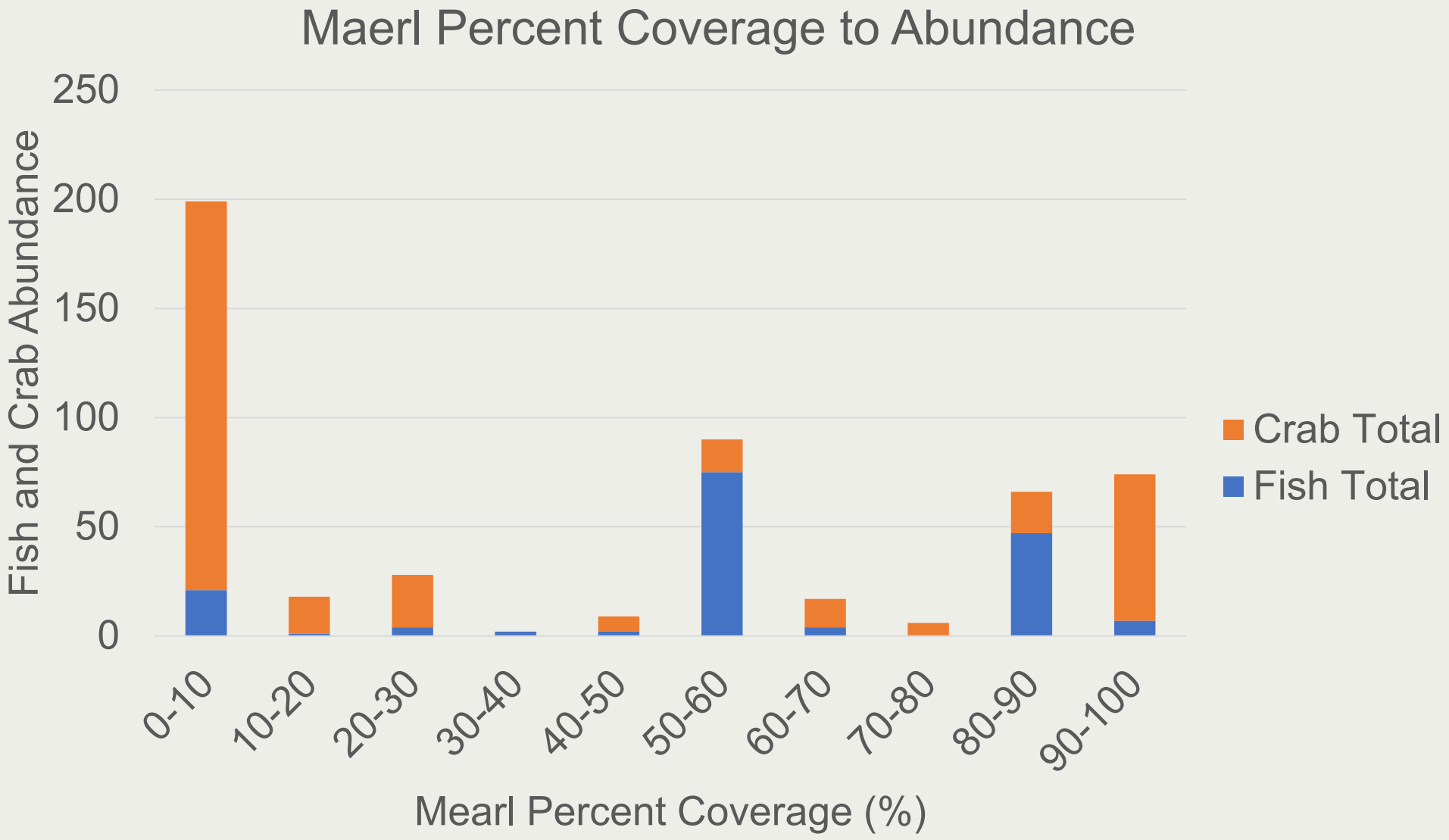
Preliminary Results



Preliminary Results



Preliminary Results



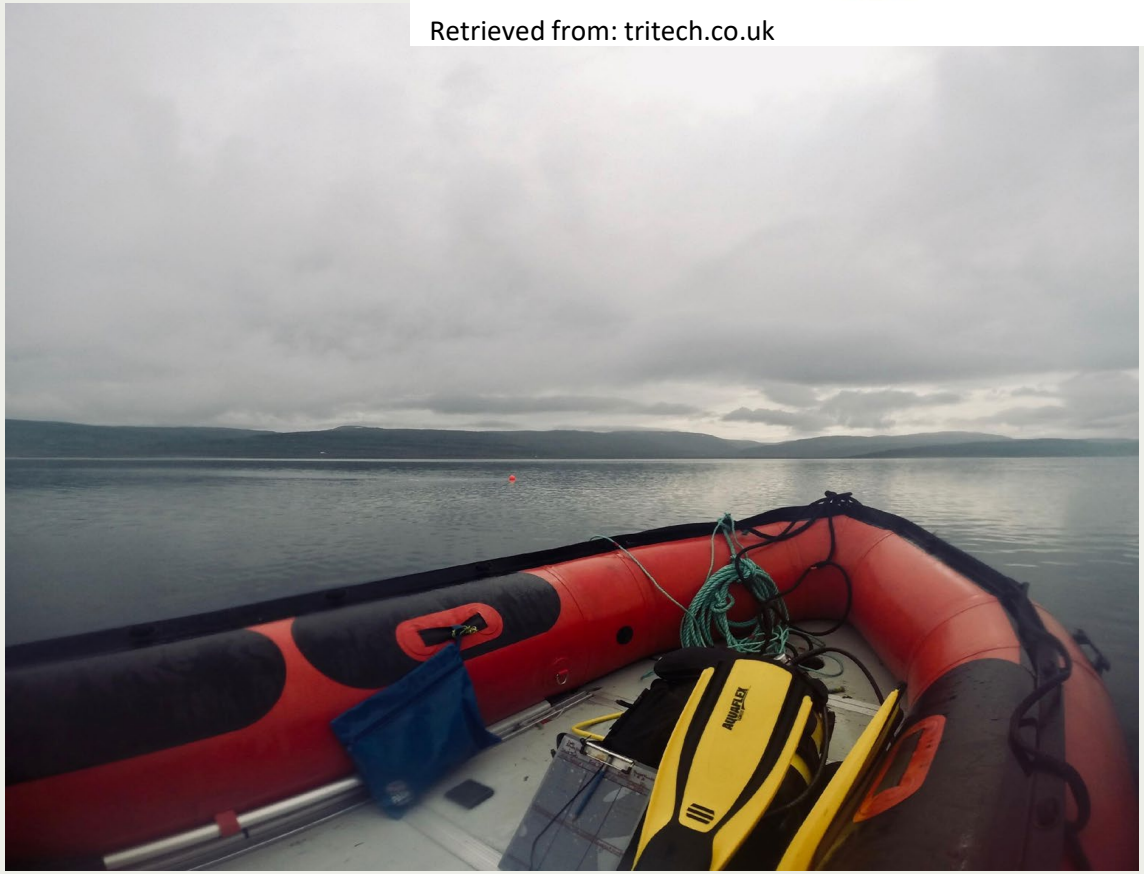
Next Steps…

Gemini 720im Sea Tec System & Side Scan Sonar System Scanner

Retrieved from: tritech.co.uk

- Scan the bottom to determine bottom texture and classification of substrate

- Test Gemini 720im Sea Tec System for fish distribution and size



The Negatives of Fragmentation to Nursery Grounds

Retrieved from: marinephoto.co.uk

Retrieved from: helfordmarineconservation.co.uk

- Non-renewable resources where destruction can be long-lasting
- Proposed maerl mining in Ísafjarðardjúp may also increase fragmentation
- Important to understand maerl beds to life stages of valuable fish and also effects of fragmentation

Future Implementation Of Coastal Management


Sveinbjorn Hjalmarsson

- Important to focus on maerl nursery grounds to push for implementation of MPA development
- Understand the function of habitats affected by fragmentation due to cohort size of marine fishes may determine first years survival rate

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- University of Iceland (Háskóli Íslands)

Additional Preliminary Results

```
> summary(poismodF)
Generalized linear mixed model fit by maximum likelihood (Laplace Approximation) [
glmerMod]
 Family: poisson  ( log )
Formula: FishAmnt ~ TransNumF + DepthF + MaerlPF + (1 | ObsF)
   Data: ThesisSurveyFishTotal2

     AIC      BIC   logLik deviance df.resid
   792.0    823.1   -386.0    772.0      155

Scaled residuals:
    Min      1Q  Median      3Q     Max
-2.2884 -1.0988 -0.5795 -0.2418 28.0014

Random effects:
 Groups Name        Variance Std.Dev.
 ObsF   (Intercept) 0.08699  0.2949
Number of obs: 165, groups:  ObsF, 2

Fixed effects:
              Estimate Std. Error z value Pr(>|z|)
(Intercept)    -3.27471    0.74186  -4.414 1.01e-05 ***
TransNumFARN1   1.79439    0.87940   2.040  0.04130 *
TransNumFARN2   0.15853    1.00279   0.158  0.87439
TransNumFREAR1  2.57999    0.99513   2.593  0.00953 **
TransNumFREAR2  0.48594    1.00713   0.483  0.62945
DepthF          0.17638    0.04145   4.255 2.09e-05 ***
MaerlPF25-50    1.24893    0.84918   1.471  0.14136
MaerlPF50-75    0.22867    0.85630   0.267  0.78943
MaerlPF75-100  -1.77420    0.98209  -1.807  0.07083 .
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Correlation of Fixed Effects:
            (Intr) TNFARN1 TNFARN2 TNFREAR1 TNFREAR2 DepthF MPF25- MPF50-
TrnsNmFARN1 -0.301
TrnsNmFARN2 -0.331  0.900
TrnsNFREAR1 -0.083  0.830   0.775
TrnsNFREAR2 -0.226  0.865   0.804   0.833
DepthF      -0.915  0.293   0.331   0.061    0.217
MarlPF25-50 -0.092 -0.887  -0.781  -0.805   -0.784    0.055
MarlPF50-75  0.052 -0.934  -0.847  -0.820   -0.834   -0.098  0.949
MrlPF75-100  0.020 -0.812  -0.759  -0.966   -0.818   -0.059  0.841  0.857
convergence code: 0
Model failed to converge with max|grad| = 0.00199075 (tol = 0.001, component 1)
```

```
> summary(poismodJ)
Generalized linear mixed model fit by maximum likelihood (Laplace Approximation) [
glmerMod]
 Family: poisson  ( log )
Formula: JuvAmnt ~ TransNumJ + DepthJ + MaerlPJ + (1 | ObsJ)
   Data: ThesisSurveyJuvTotal2

     AIC      BIC   logLik deviance df.resid
   771.8    802.6   -375.9    751.8      151

Scaled residuals:
    Min      1Q  Median      3Q     Max
-2.3288 -1.0983 -0.5614 -0.2476 27.6876

Random effects:
 Groups Name        Variance Std.Dev.
 ObsJ   (Intercept) 0.06331  0.2516
Number of obs: 161, groups:  ObsJ, 2

Fixed effects:
              Estimate Std. Error z value Pr(>|z|)
(Intercept)    -3.58077    0.74452  -4.810 1.51e-06 ***
TransNumJARN1   2.10517    0.86568   2.432   0.0150 *
TransNumJARN2   0.48182    0.99009   0.487   0.6265
TransNumJREAR1  2.83811    0.98054   2.894   0.0038 **
TransNumJREAR2  0.80274    0.99416   0.807   0.4194
DepthJ          0.19396    0.04181   4.640 3.49e-06 ***
MaerlPJ25-50    1.35739    0.83108   1.633   0.1024
MaerlPJ50-75    0.04390    0.83985   0.052   0.9583
MaerlPJ75-100  -1.99142    0.96746  -2.058   0.0396 *
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Correlation of Fixed Effects:
            (Intr) TNJARN1 TNJARN2 TNJREAR1 TNJREAR2 DepthJ MPJ25- MPJ50-
TrnsNmJARN1 -0.319
TrnsNmJARN2 -0.345  0.897
TrnsNJREAR1 -0.092  0.826   0.769
TrnsNJREAR2 -0.238  0.862   0.799   0.827
DepthJ      -0.925  0.307   0.340   0.067    0.226
MarlPJ25-50 -0.106 -0.873  -0.767  -0.795   -0.771    0.067
MarlPJ50-75  0.058 -0.929  -0.841  -0.814   -0.828   -0.106  0.944
MrlPJ75-100  0.022 -0.805  -0.751  -0.964   -0.810   -0.064  0.834  0.853
```

```
> summary(poismodC)
Generalized linear mixed model fit by maximum likelihood (Laplace Approximation) [
glmerMod]
 Family: poisson  ( log )
Formula: CrabAmnt ~ TransNumC + DepthC + MaerlPC + (1 | ObsC)
   Data: ThesisSurveyCrabTotal2

     AIC      BIC   logLik deviance df.resid
   873.5    905.3   -426.7    853.5      169

Scaled residuals:
    Min      1Q  Median      3Q     Max
-3.1502 -0.8656 -0.6107  0.3578 14.1447

Random effects:
 Groups Name        Variance Std.Dev.
 ObsC   (Intercept) 0.1049   0.3239
Number of obs: 179, groups:  ObsC, 2

Fixed effects:
              Estimate Std. Error z value Pr(>|z|)
(Intercept)    -0.08990    0.43787  -0.205 0.837321
TransNumCARN1  -2.16508    0.30045  -7.206 5.75e-13 ***
TransNumCARN2  -2.51479    0.39331  -6.394 1.62e-10 ***
TransNumCREAR1 -3.01882    0.42391  -7.121 1.07e-12 ***
TransNumCREAR2 -3.26036    0.44412  -7.341 2.12e-13 ***
DepthC          0.10401    0.02313   4.496 6.93e-06 ***
MaerlPC25-50    1.61204    0.25664   6.281 3.36e-10 ***
MaerlPC50-75    1.19600    0.37156   3.219 0.001287 **
MaerlPC75-100   1.36878    0.38250   3.579 0.000346 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Correlation of Fixed Effects:
            (Intr) TNCARN1 TNCARN2 TNCREAR1 TNCREAR2 DepthC MPC25- MPC50-
TrnsNmCARN1 -0.100
TrnsNmCARN2 -0.107  0.757
TrnsNCREAR1  0.192  0.674   0.662
TrnsNCREAR2 -0.052  0.674   0.664   0.693
DepthC      -0.834  0.115   0.122  -0.242    0.053
MarlPC25-50 -0.364 -0.599  -0.449  -0.567   -0.425    0.393
MarlPC50-75 -0.185 -0.769  -0.750  -0.677   -0.604    0.187  0.644
MrlPC75-100 -0.212 -0.748  -0.734  -0.885   -0.764    0.227  0.657  0.777
```

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