Supplementary Material for NOAA Technical Memorandum NMFS-PIFSC-145: Larval ecology of *Aprion virescens*: a review from historical data.

Supplement 1: tables of Records

Table S1.1: Searches specifically at museum collection websites corresponds to section A.1. of the appendix in the Technical Memorandum on page 35.

Search date	museum	link	hits	filtering	search terms	notes	Larval catalog number	environmental data searches
6/24/21	MCZBASE:The Database of the Zoological Collections Museum of Comparative Zoology - Harvard University	MCZBASE	0	none	*"Aprion kanekonis" OR "Sparopsis latifrons" OR "Mesoprion microchir" OR "Aprion virescens placidus"*			
6/24/21	MCZBASE	MCZBASE	0	none	*"Aprion virescens"*			
6/24/21	Burke Museum	Burke	1	advanced search: genus	Aprion	wrong fish		
6/24/21	Burke Museum	Burke	0	advanced search: genus	Sparopsis OR Mesoprion			
6/24/21	Smithsonian	NMH	44	none	"Aprion virescens"	3 larvae! see search 3 on main tab		Inport!
6/24/21	Tokyo Museum of Natural History	Kahaku	131	none	"Aprion virescens" OR "アオチビキ"	only 73 are preserved, none from Hawaii		
6/24/21	Universität Hansastadt Hamburg		0	all UHH sites	*"Aprion kanekonis" OR "Sparopsis latifrons" OR "Mesoprion microchir" OR "Aprion virescens placidus"*			
6/24/21	Senckenberg, Dresden		0	none	"Aprion"			

6/25/21	Carnegie Museum-Natural History Collections			none	did not search, no ichthyology collection			
6/28/21	OZCAM	OZCAM	11	Exclude Australian museum, exclude specimens without a date	"Aprion virescens"	only the Australian Museum has specimens from hawaii		
6/29/21	Royal Ontario Museum	GBIF	4	none	Aprion viresecens	all from the Indian Ocean (not hawaii), does have coordinates		
9/8/21	South African Museum	iziko	0	none	Aprion			
	LACM	VertNet	1		Aprion viresecens, life stage: larva			
	LACM	VertNet	0	"has length" 0-30mm	Aprion viresecens			
	UCSD	SIO apps	0		Aprion viresecens			
	Field Museum	Field	13		aprion virescnes	adults		
	Bishop	GBIF	9		aprion virescens	sampling protocol= hook& line or fish market, thus not larvae		
	Leibnitz Institute Bonn	Bonn Lieb.de	1		aprion virescens	Result did not match green jobfish		

Table S1.2: Summary of museum records that correspond to raw data sheets collected by T.A. Clarke. This is referenced in Appendix A section A7 on page 37 of the Technical Memorandum.

sample_record_identifier	collected_by_person	Museum record or observation record?	Where can the record be found?
I.24998-003	Clarke, Dr. Thomas A.	Museum record	Australian Museum
I.24998-004	Clarke, Dr. Thomas A.	Museum record	Australian Museum
I.24998-005	Clarke, Dr. Thomas A.	Museum record	Australian Museum

I.24998-006	Clarke, Dr. Thomas A.	Museum record	Australian Museum
I.24998-012	Clarke, Dr. Thomas A.	Museum record	Australian Museum
I.24998.015	Clarke, Dr. Thomas A.	Museum record	Australian Museum
I.25362-005	Clarke, Dr. Thomas A.	Museum record	Australian Museum
I.25362-006	Clarke, Dr. Thomas A.	Museum record	Australian Museum
I.25650-001	Clarke, Dr. Thomas A.	Museum record	Australian Museum
I.25650-004	Clarke, Dr. Thomas A.	Museum record	Australian Museum
I.25650.019	Clarke, Dr. Thomas A.	Museum record	Australian Museum
770802_1	Clarke, Dr. Thomas A.	Observation record	In scans below
770802_2	Clarke, Dr. Thomas A.	Observation record	In scans below
770802_3	Clarke, Dr. Thomas A.	Observation record	In scans below
770803_1	Clarke, Dr. Thomas A.	Observation record	In scans below
770808_1	Clarke, Dr. Thomas A.	Observation record	In scans below
780804_1	Clarke, Dr. Thomas A.	Observation record	In scans below
780804_2	Clarke, Dr. Thomas A.	Observation record	In scans below

Scans of T.A. Clarke‘s notes, shared with permission from D. Kobayashi

591
16 (3 - 10) + ? 1 (0 - 3.5) 7708-36
30 (3.5 - 7) + ? 0 (0 - 0) 06-11 only
3 (0 - 5) + ? 1 (0 - 4)

595
ıae
1 0 (0 - 0) + ? 1 (3.5 - 3.5)
1 0 (0 - 0) + ? 1 (4 - 4)
1 2 (4.5 - 5) + ? 0 (0 - 0) 7708

596
Aprion
IK: 3 6 (3.5 - 4.5) + ? 0 (0 - 0) 08 only
BB: 1 1 (5 - 5) + ? 1 (4 - 4)
SB: 0 0 (100 - 0) + ? 0 (100 - 0)

598
Pristopomoides
IK: 4 9 (3.5 - 15) + ? 1 (0 - 4) 08+7810
BB: 1 1 (14 - 14) + ? 0 (0 - 0)
SB: 1 0 (0 - 0) + ? 1 (4 - 4)

600
Mullidae
IK: 12 39 (3.5 - 27) + ? 0 (0 - 0) 139 in 7708
BB: 10 68 (3 - 29) + ? 0 (0 - 0) 18 in 7810
SB: 9 105 (2.5 - 21) + ? 2 (0 - 2) 33 in 7811
2-1 2 TQ

611
Centropyge
IK: 6 7 (3 - 25) + ? 0 (0 - 0) 19 in 08
BB: 7 17 (2.5 - 4) + ? 0 (0 - 0) other in 10,11,05
SB: 4 4 (3.5 - 5) + ? 0 (0 - 0)

612
Centropyge 13
IK: 36 91 (4.5 - 22) + ? 9 (0 - 21) 33 in 03, 18 in 06
BB: 6 6 (5 - 16) + ? 0 (0 - 0) ? = fuchsi
SB: 3 5 (4 - 12.5) + ? 0 (0 - 0)
102 + 9.

613
Centropyge s3
IK: 11 17 (0 - 20) + ? 3 (0 - 21) 02-07 only
BB: 0 0 (100 - 0) + ? 0 (100 - 0) 12 in 03
SB: 0 0 (100 - 0) + ? 0 (100 - 0) ? = potte
17 + 5?

620
Priacanthidae
IK: 2 1 (0 - 10) + ? 1 (0 - 6.5) 7710
BB: 0 0 (100 - 0) + ? 0 (100 - 0)
SB: 0 0 (100 - 0) + ? 0 (100 - 0)

> Mala canthidae 605
IK: 1 1 (25-25) + 0 (0-0) 09+10 only
BB: 3 3 (10.5-34) + 1? (3.1-3.1)
SB: 0 0 (00) + 0 (0-0)

591

770801	4 (3 - 5) + 0 ?(0 - 0)
770802	3 (4 - 4) + 1 ?(3.5 - 3.5) ? prob OK
770807	4 (3.5 - 4) + 0 ?(0 - 0)
770808	24 (3.5 - 5.5) + 0 ?(0 - 0)
771001	1 (6 - 6) + 0 ?(0 - 0)
771002	1 (7 - 7) + 0 ?(0 - 0)
771008	1 (7 - 7) + 0 ?(0 - 0)
780603	1 (4 - 4) + 0 ?(0 - 0)
780803	2 (5.5 - 7) + 0 ?(0 - 0)
781003	1 (10 - 10) + 0 ?(0 - 0)
781004	1 (10 - 10) + 0 ?(0 - 0)
781102	2 (5.5 - 6) + 0 ?(0 - 0)
781112	1 (5 - 5) + 0 ?(0 - 0)
770809	1 (3 - 3) + 0 ?(0 - 0)
771009	1 (5 - 5) + 0 ?(0 - 0)
780708	1 (4 - 4) + 0 ?(0 - 0)
780709	0 (0 - 0) + 1 ?(4 - 4) - d prob OK

Σ=50 + 1?

595
Eliline

770807	0 (0 - 0) + 1 ?(4 - 4) ? prob not - also 900 - 1(5) - couldn't find!
~~780904~~	~~0 (0 - 0) + 1 ?(3.5 - 3.5)~~ couldn't find 900 - (5) 780511 - prob lit
770810	2 (4.5 - 5) + 0 ?(0 - 0) — both Aplum

900 - (3.5) 780802 couldn't find?
630 - (3) 781107 = Semanid OK?
630 - (4) 691128 = Semanid OK

596 Aplum

770802	3 (4 - 4.5) + 0 ?(0 - 0)
770803	1 (4.5 - 4.5) + 0 ?(0 - 0)
770808	1 (5 - 5) + 1 ?(4 - 4) - OK
780804	2 (3.5 - 4) + 0 ?(0 - 0)
	2 (4.5 - 5)
	9

598 Pentop

770802	2 (4.5 - 4.5) + 1 ?(4 - 4) - still not 100% +
780804	1 (15 - 15) + 0 ?(0 - 0)
780811	1 (14 - 14) + 0 ?(0 - 0)
781003	4 (4 - 8.5) + 0 ?(0 - 0)
781004	2 (3.5 - 4) + 0 ?(0 - 0)
780709	0 (0 - 0) + 1 ?(4 - 4) OK

10 + 1?

Bongo net tows – 5-7 July 1972 30 min @ 2½ kn/sec

Day

72-7-3 – 30m
72-7-4 – 55m
72-7-10 – 95m
72-7-1 – 115m
72-7-2 – 180m
72-7-11 – 195m

Night

72-7-8 – 30m
72-7-9 – 50m
72-7-12 – 65m
72-7-6 – 120m
72-7-7 – 150m
72-7-13 – 170m
72-7-14 – 235m

SHALLOW NIGHT STANDARD BONGO TOWS. LAUNCH AND TOW @ CA 1M/SEC.
WIRE OUT TO 300 M @ 10M/MIN. RETRIEVAL @ ALL STOP AND CA 50M/MIN.

SAMPLE NUMBER	DATE	TIME	MESH SIZE	MAXIMUM DEPTH (m)	VOLUME FILTERED (m^3)	ZM/V (m^{-3})
77-08-09	AUG. 11, 1977	0057-0133	183	225	895	.251
77-08-10	AUG. 11, 1977	0202-0239	333	240	794	.302
77-09-09	SEPT. 10, 1977	0135-0215	183	250	832	.300
77-09-10	SEPT. 10, 1977	0230-0307	333	212	825	.256
77-09-11	SEPT. 10, 1977	0330-0408	333	220	1013	.217
77-10-09	OCT. 10, 1977	0030-0107	183	250	680	.367
77-10-10	OCT. 10, 1977	0135-0212	333	190	973	.195
77-10-11	OCT. 10, 1977	0230-0305	333	185	997	.185
77-11-09	NOV. 02, 1977	2350-0030	183	220	857	.256
77-11-10	NOV. 02, 1977	0150-0227	333	220	946	.232
77-12-37	DEC. 19, 1977	1937-2015	183	200	1041	.192
77-12-38	DEC. 19, 1977	2024-2101	333	195	1032	.188
77-12-39	DEC. 19, 1977	2114-2151	333	150	1202	.124
78-02-07	FEB. 22, 1978	1940-2017	333	195	1074	.181
78-02-08	FEB. 22, 1978	2025-2102	333	150	1193	.125
78-02-09	FEB. 22, 1978	2115-2152	183	150	1153	.130
78-02-10	FEB. 22, 1978	2200-2236	183	145	1116	.129
78-03-07	MAR. 03, 1978	1945-2022	333	160	1283	.124
78-03-08	MAR. 03, 1978	2035-2112	333	150	1100	.136
78-03-09	MAR. 03, 1978	2125-2202	183	185	1183	.156
78-03-10	MAR. 03, 1978	2215-2252	183	155	1087	.142
78-04-07	APR. 06, 1978	2005-2044	333	250	771	.324
78-04-08	APR. 06, 1978	2053-2135	333	250	770	.324
78-04-09	APR. 06, 1978	2150-2227	183	250	629	.397
78-04-10	APR. 06, 1978	2300-2330	183	240	786	.305
78-05-07	MAY 02, 1978	2012-2050	333	255	780	.327
78-05-08	MAY 02, 1978	2105-2143	333	255	633	.403
78-05-09	MAY 02, 1978	2204-2242	183	255	656	.388
78-05-10	MAY 02, 1978	2304-2342	183	255	605	.421

SHALLOW NIGHT STANDARD BONGO TOWS. p.2

SAMPLE NUMBER	DATE	TIME	MESH SIZE	MAXIMUM DEPTH	VOLUME FILTERED	ZN/V
78-06-07	JUNE 06, 1978	2020-2058	333	210	880	.239
78-06-08	JUNE 06, 1978	2115-2152	333	210	820	.256
78-06-09	JUNE 06, 1978	2200-2237	183	210	824	.255
78-06-10	JUNE 06, 1978	2253-2330	183	210	827	.254
78-07-07	JULY 04, 1978	2030-2108	333	230	761	.302
78-07-08	JULY 04, 1978	2123-2200	333	230	786	.293
78-07-09	JULY 04, 1978	2217-2254	183	230	751	.306
78-07-10	JULY 04, 1978	2305-2342	183	230	730	.315
78-08-06	AUG. 03, 1978	2025-2102	333	240	680	.353
78-08-07	AUG. 03, 1978	2110-2146	333	235	658	.357
78-08-08	AUG. 03, 1978	2200-2237	183	240	628	.382
78-08-09	AUG. 03, 1978	2300-2337	183	250	600	.417
78-09-07	AUG. 31, 1978	2020-2057	333	250	608	.411
78-09-08	AUG. 31, 1978	2115-2151	333	250	617	.405
78-09-09	AUG. 31, 1978	2200-2236	183	250	600	.417
78-09-10	AUG. 31, 1978	2155-2231	183	240	542	.443
78-10-07	SEPT. 28, 1978	2015-2053	333	250	617	.405
78-10-08	SEPT. 28, 1978	2110-2148	333	250	517	.484
78-10-09	SEPT. 28, 1978	2200-2238	183	240	442	.543
78-10-10	SEPT. 28, 1978	2250-2328	183	250	408	.613
78-11-07	OCT. 26, 1978	2010-2048	333	235	731	.321
78-11-08	OCT. 26, 1978	2100-2137	333	235	721	.326
78-11-09	OCT. 26, 1978	2150-2227	183	250	570	.439
78-11-10	OCT. 26, 1978	2240-2317	183	250	529	.473

Cruise: Luna I -- 17-19-Sept-71; Luna II -- 4-6-Oct-71

Area of operations: Leeward Oahu, ca. 21°20-30' N; 158°20'W

All tows with a 10' Isaacs-Kidd trawl; shot and towed at about 4 knots, hauled at about 2 knots.

A = Time (min) to pay out cable and adjust depth.
B = Time spent at depth
C = Time for retrieval

Sample #	Date	Time	Wire out(m)	Depth(m)	A - B - C
71-9-1	17-S-71	1958-2135	180	75-80	02-90-05
71-9-2	17-S-71	2150-2321	120	60	02-89-03
71-9-3	17-18-S-71	2342-0115	50	15	01-92-02
71-9-4	18-S-71	0131-0308	235	100	04-93-08
71-9-5	18-S-71	1955-2138	300	125	04-91-08
71-9-6	18-S-71	2154-2327	365	145	03-90-08
71-9-7	19-S-71	0012-0148	80	45	01-92-03
71-9-8	19-S-71	0155-0330	420	160-170	07-88-05
71-9-9	19-S-71	0350-0800	3700	ca. 1600	69-61-120
71-10-1	4-0-71	2008-2149	180	75	03-92-06
71-10-2	4-0-71	2200-2333	120	50	03-90-04
71-10-3	4-5-0-71	2345-0121	50	20	02-92-02
71-10-4	5-0-71	0131-0312	235	100	03-91-07
71-10-5	5-0-71	1953-2142	420	190	07-90-12
71-10-6	5-0-71	2150-2337	300	130	04-93-10
71-10-7	5-6-0-71	2346-0135	365	170	06-89-14
71-10-8**	6-0-71	0143-0403	75-600	0-250	122-00-18
71-10-9*	6-0-71	0430-0635	75-600	0-225	125-00-10

** Stepped oblique; wire was paid out at 75m every 15 minutes
* same as for 71-10-8 only using a Bongo net towed at 5knots

Table S1.3 Informative uku character matrix developed by JW and ALS using Leis and Lee (1994) and Mundy's Monster Book of Monsters to help distinguish uku from other etelinae. This corresponds to pages 5 and 6 of the Technical Memorandum where identification of wet archived individuals is described.

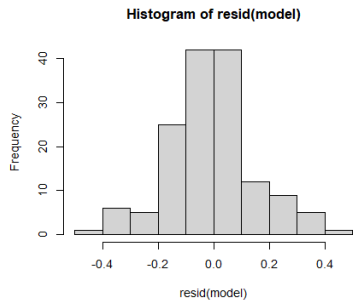
Species/ character	**noteable bump/2nd dorsal spine around 3mm**	**long 2nd dorsal fin**	**ventral side pigment on tail**	**forebrain pigment**	**pigment on tip of lower jaw**	**long pelvic fin ray**	**opercal spines**	**Supra-opercal spine**	**serrations on trailing edge of fin spines**	**clethrial symphisys pigment**	**dorsal fin pigment**	**post operculum dorsal pigment**
Aphareaus rutilans flexion		X		X	X		X	X			X	
Aphareaus rutilans preflexion		X					X	X				
Aphareaus Rutilans preflexion under 4 mm		X										
Etelis sp. flexion		X		X			X	X				
Etelis sp. preflexion		X		X			X	X				
Etelis sp. Preflexion under 4mm		X	1 dot (near anal fin base)									
Lutjanus kasmira <4mm												
Lutjanus kasmira>4mm			4-7ish melanophores									x
Pristipomoides filamentosus under +5mm		X										
Pristipomoides filamentosus under 4mm	yes bump, no spine											
uku (flexion)		X	(3-4 dots)			X	X	X	X			
uku (preflexion under 4mm)	X		(3-4 dots)		X		X	X	X			
Uku (preflexion)		X	(3-4 dots)		X	X	X	X	X			

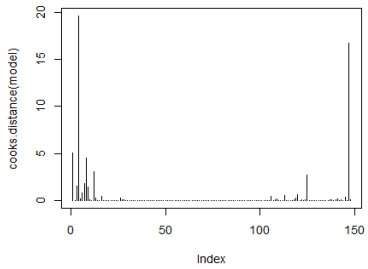
Supplement 2: Statistical Modeling

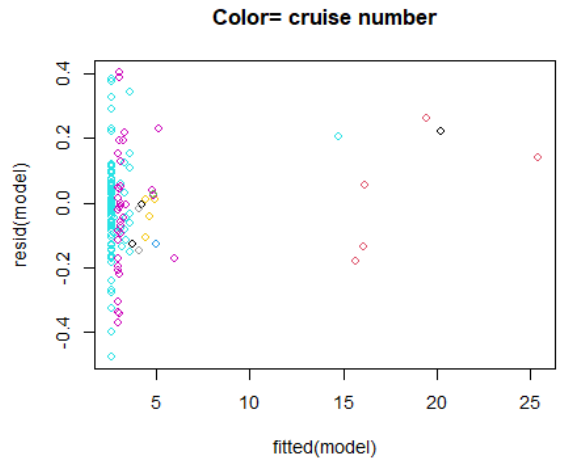
References to Supplement 2 and Supplement S2 exist in the Technical Memorandum, they both refer to this section below.

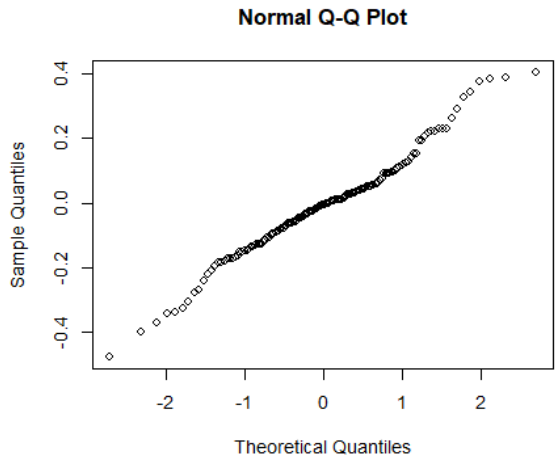
Page 13 in TM: "Preliminary data show a positive relationship (Figure 5, B, C) between size and distance from shore (glmer, 0.00766>|z|), model diagnostic plots Supplement 2."

Diagnostic plots for larval size versus distance to shore





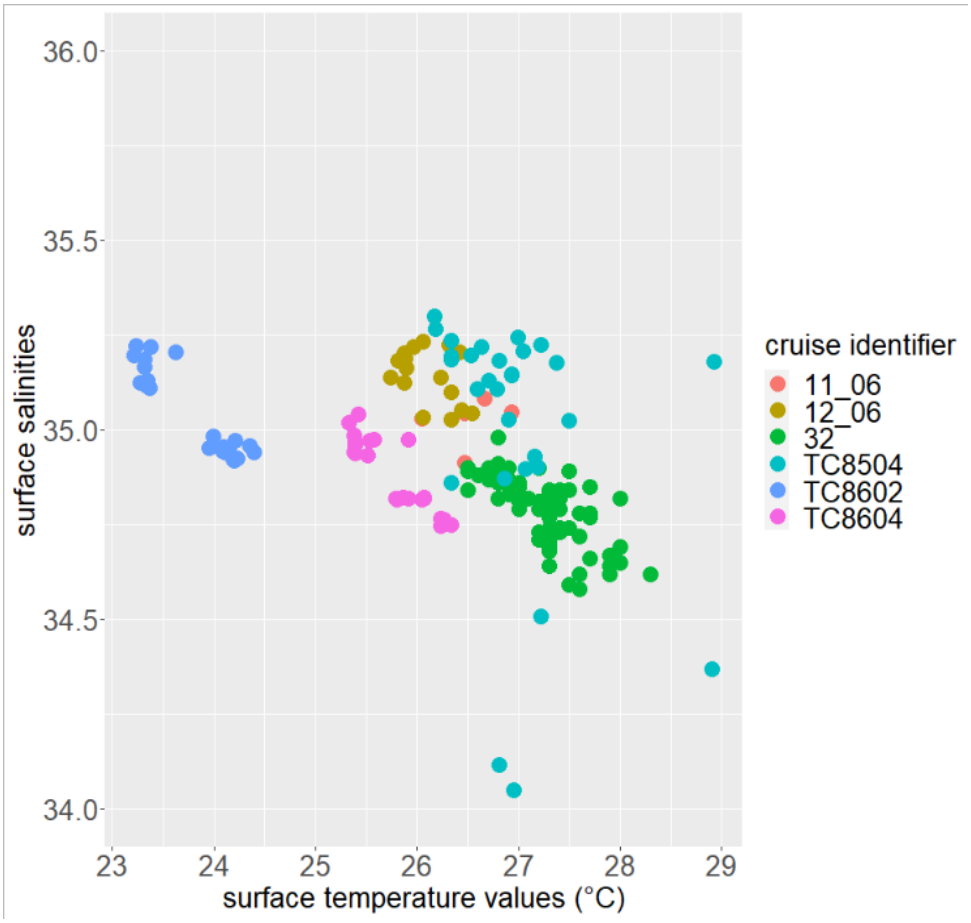





```
> summary(model)
Generalized linear mixed model fit by maximum likelihood (Laplace Approximation) ['glmerMod']
 Family: Gamma ( log )
Formula: length_mm ~ log(Dist2Shore_m) + (1 | cruise) + (1 | cruise:sampling_method:tow)
  Data: sizes2

   AIC   BIC  logLik deviance df.resid
 277.9  292.9  -134.0  267.9   143

Scaled residuals:
   Min    1Q  Median    3Q   Max
-2.17140 -0.59087 -0.03104 0.35929 2.39191

Random effects:
 Groups            Name    Variance Std.Dev.
 cruise:sampling_method:tow (Intercept) 0.03215 0.1793
```

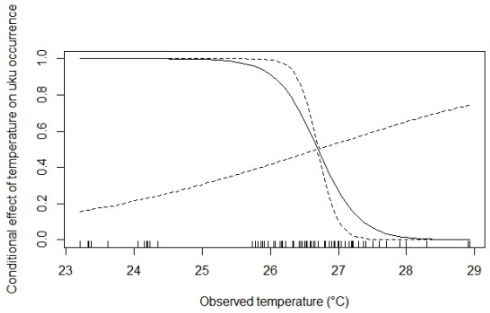
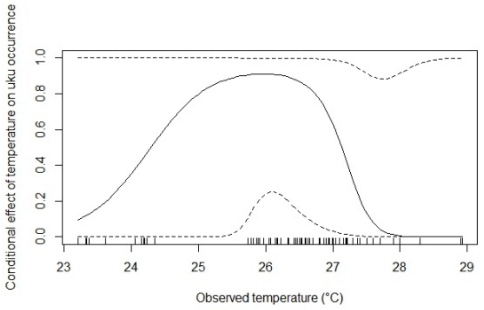
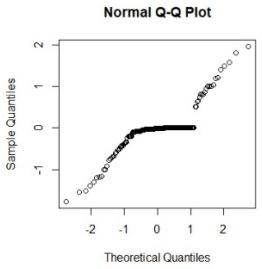
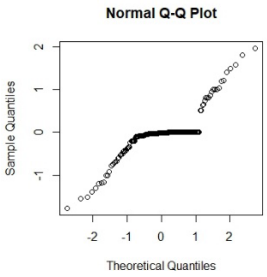
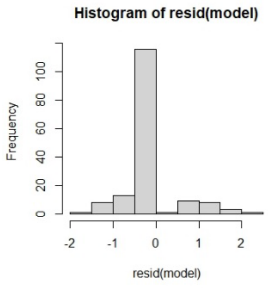
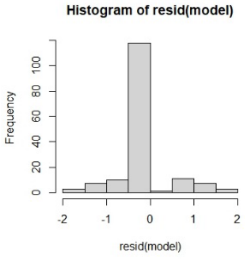
```
 cruise           (Intercept) 0.10736 0.3277
 Residual                     0.03439 0.1854
Number of obs: 148, groups: cruise:sampling_method:tow, 33; cruise, 10

Fixed effects:
                 Estimate Std. Error t value Pr(>|z|)
(Intercept)      1.16829    0.42709   2.735 0.00623 **
log(Dist2Shore_m) 0.08836   0.03314   2.667 0.00766 **
---
Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Correlation of Fixed Effects:
            (Intr)
lg(Dst2Sh_) -0.731
```

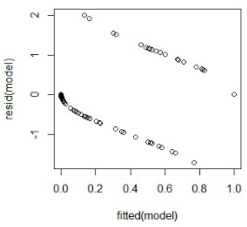
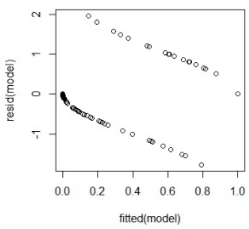
Page 16 in TM: "During tests of collinearity (Supplement 2) temperature and salinity were found to be collinear and thus were tested in separate multivariate analyses (Table 3), those models with salinity had higher AIC values (and lower deviance explained) than those with temperature." Here is the plot in question that indicated collinearity between salinity and temperature.



Page 16 in TM: “Surface temperature and distance to shore, best explained the variation in larval uku occurrence and yielded the best fit model, determined by AICc (Table 3). Model four, with the next closest AICc value (ΔAIC from best model= 3.07271, Table 3) yielded poorer fit smooth terms, with weak support for lunar illumination and the tensor product of longitude and latitude (Supplement S2).”

Model equations and diagnostic plots for the best and second best statistical models are included here:

	Model 7 (best)	**Model 4 (second best)**
	`model7<-mgcv::gam(data=larvah, uku_present1_absent0~(sampling_style)+ cruise_number+ s(this_temp, k=4)+ te(latitude_start_dd,longitude_start_dd)+ s((log(Dist2Shore_m)), k=4)+ offset(log10(volume)),family = binomial)`	`model4<-mgcv::gam(data=larvah, uku_present1_absent0~(sampling_style)+cruise_number+ s(this_temp, k=4)+ s(moon_date$phase, k=4)+ te(latitude_start_dd,longitude_start_dd)+ s((log(Dist2Shore_m)), k=4)+ offset(log10(volume)),family = binomial)`
plot.gam		
qq		
Histogram of residuals		

Model residuals v.s. model fitted values		

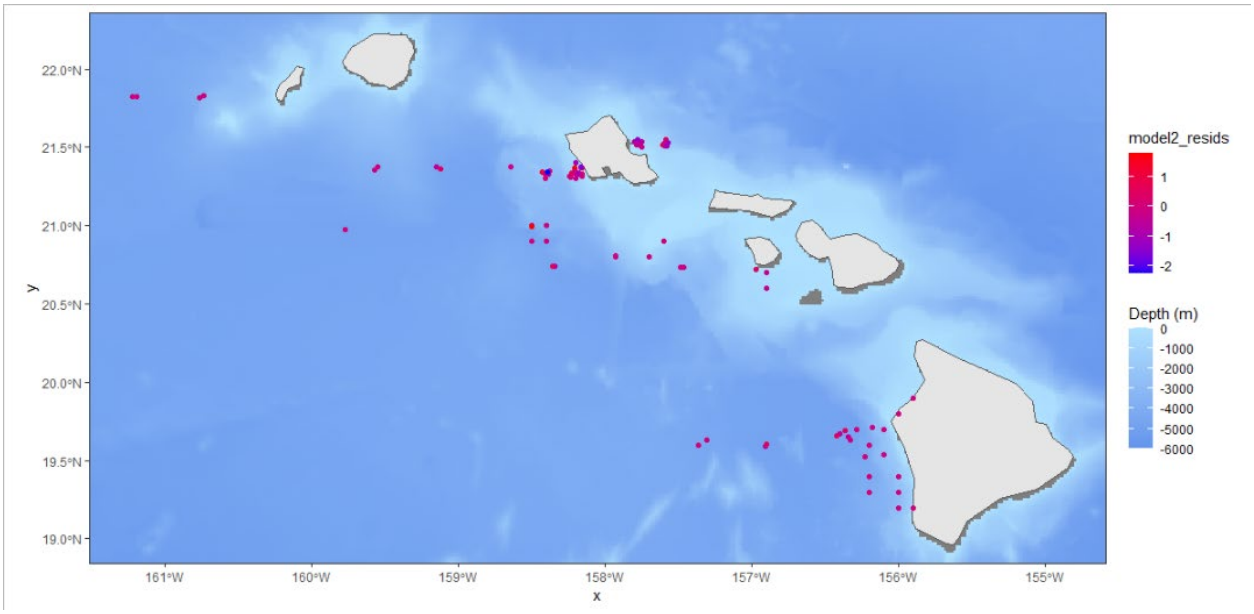
Summary(model7)

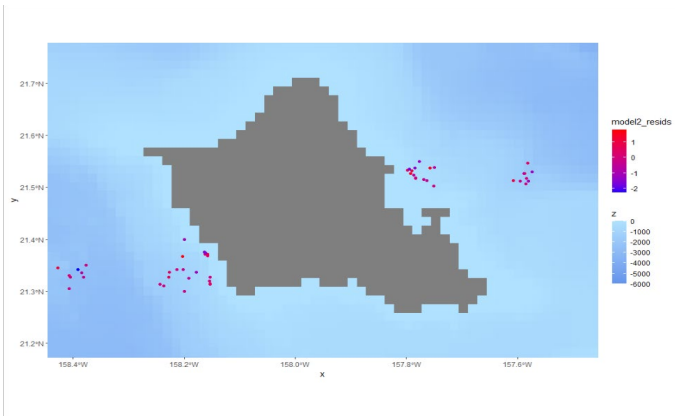
```
> summary(model)

Family: binomial
Link function: logit

Formula:
uku_present1_absent0 ~ (sampling_style) + cruise_number + s(this_temp,
    k = 4) + te(latitude_start_dd, longitude_start_dd) + s((log(Dist2Shore_m)),
    k = 4) + offset(log10(volume))

Parametric coefficients:
                    Estimate Std. Error z value Pr(>|z|)
(Intercept)         0.000e+00  0.000e+00     NaN      NaN
sampling_style     -7.708e+00  2.868e+00  -2.687   0.0072 **
cruise_number12_06 -7.236e-01  2.150e+00  -0.337   0.7365
cruise_number32    -2.617e-01  5.297e+00  -0.049   0.9606
cruise_numberTC8504 -1.278e+01  6.640e+00  -1.925   0.0543 .
cruise_numberTC8602 -7.726e+01  2.023e+07   0.000   1.0000
cruise_numberTC8604  4.120e+01  2.536e+07   0.000   1.0000
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Approximate significance of smooth terms:
                                      edf Ref.df Chi.sq p-value
s(this_temp)                        1.000  1.000  3.052  0.0806 .
te(latitude_start_dd,longitude_start_dd) 7.662  8.154  8.521  0.3995
s(log(Dist2Shore_m))                1.678  1.974  3.632  0.1776
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Rank: 36/37
R-sq.(adj) =    0.6   Deviance explained = 72.9%
UBRE = -0.4693  Scale est. = 1         n = 160
>
```

Summary(model4)

```
> model<-model4
> summary(model)

Family: binomial
Link function: logit

Formula:
uku_present1_absent0 ~ (sampling_style) + cruise_number + s(this_temp,
    k = 4) + s(moon_date$phase, k = 4) + te(latitude_start_dd,
    longitude_start_dd) + s((log(Dist2Shore_m)), k = 4) + offset(log10(volume))

Parametric coefficients:
                    Estimate Std. Error z value Pr(>|z|)
(Intercept)         0.000e+00  0.000e+00     NaN      NaN
sampling_style     -8.812e+00  2.678e+00  -3.291 0.000999 ***
cruise_number12_06 -1.003e+00  2.278e+00  -0.440 0.659746
cruise_number32    -4.242e+00  6.162e+00  -0.688 0.491222
cruise_numberTC8504 -1.812e+01  9.630e+00  -1.881 0.059941 .
cruise_numberTC8602 -9.917e+01  2.023e+07   0.000 0.999996
cruise_numberTC8604  6.611e+01  2.536e+07   0.000 0.999998
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Approximate significance of smooth terms:
                                       edf Ref.df Chi.sq p-value
s(this_temp)                         1.488  1.750  1.372 0.32801
s(moon_date$phase)                   1.000  1.000  0.022 0.88135
te(latitude_start_dd,longitude_start_dd) 8.728  8.964 10.772 0.29620
s(log(Dist2Shore_m))                 1.000  1.000  7.937 0.00485 **
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Rank: 39/40
R-sq.(adj) =  0.603   Deviance explained = 73.8%
UBRE = -0.45635  Scale est. = 1         n = 160
```

Page 9 in TM: “To check for spatial autocorrelation, a bubble plot of the residual values were set on a spectrum of blue to red (-2 to 2) and these colored points were mapped atop the MHI, we looked for strong clustering of colors of points.” No reference to Supplement was made in TM but this step was part of variable selection for the model in the above section.




21.7°N
21.6°N
21.5°N
21.4°N
21.3°N
21.2°N
y
158.4°W
158.2°W
158.0°W
157.8°W
157.6°W
x
model2_resids
1
0
-1
-2
z
0
-1000
-2000
-3000
-4000
-5000
-6000

Supplement 3: R Code

Different statistical analyses were applied to the presence-absence and the presence only data sets. All scripts can be found at https://github.com/a-larval-schmidt/uku_efh. There is a reference to the .MOC function on page 38 in Appendix A of the Technical Memorandum, this is included here for the sake of continuity. In the text this is referred to as “Supplement 3.c”, this is a minor error, the script below is the only content in Supplement 3. Please see the aforementioned github page for any other code used as part of this project.

MOC function to convert .MOC files into user friendly CSVs

```
#this will turn .MOC files into .csvs with appropriately named columns,
#and conduct quality control,
#and filter CTD data down to most necessary columns
library(tidyverse)
library(lubridate)
#For TC8604########
setwd("~/M&B_larval_dist_1996/MOCNESS Data/TC-86-04")
files<-list.files(path=".", pattern = "*.MOC")
#files<-list.files(path="~/M&B_larval_dist_1996/MOCNESS Data/test", pattern = "*.MOC") #test
is.wholenumber<-function(x, tol = .Machine$double.eps^0.5) abs(x - round(x)) < tol
moc_read_8604 = function(input) {
 d<-read.table(input)
 index=which(files==input)
 d<-d %>%filter(str_detect(string=d$V1,negate=T,pattern="\"") &
str_detect(string=d$V1,negate=T,pattern="^[[:upper:]]"))
 discrep<-ifelse(is.wholenumber((nrow(d)/10)-3), 0,((nrow(d)/10-3)%%1)*10)
 d<-d %>% head(d,n=floor(-discrep))
 V1<-matrix(d[1,], nrow=(nrow(d)/10), ncol = 1)
 V2<-matrix(d[2,], nrow=(nrow(d)/10), ncol = 1)
 V3<-matrix(d[3,], nrow=(nrow(d)/10), ncol = 1)
 num_offset<-10
 V4<-matrix(d[seq(from=4, by = num_offset,to=nrow(d)),], nrow=(nrow(d)/10), ncol=1)
 V5<-matrix(d[seq(from=5, by = num_offset,to=nrow(d)),], nrow=(nrow(d)/10), ncol=1)
 V6<-matrix(d[seq(from=6, by = num_offset,to=nrow(d)),], nrow=(nrow(d)/10), ncol=1)
 V7<-matrix(d[seq(from=7, by = num_offset,to=nrow(d)),], nrow=(nrow(d)/10), ncol=1)
 V8<-matrix(d[seq(from=8, by = num_offset,to=nrow(d)),], nrow=(nrow(d)/10), ncol=1)
 V9<-matrix(d[seq(from=9, by = num_offset,to=nrow(d)),], nrow=(nrow(d)/10), ncol=1)
 V10<-matrix(d[seq(from=10, by = num_offset,to=nrow(d)),], nrow=(nrow(d)/10), ncol=1)
 V11<-matrix(d[seq(from=11, by = num_offset,to=nrow(d)),], nrow=(nrow(d)/10), ncol=1)
 V12<-matrix(d[seq(from=12, by = num_offset,to=nrow(d)),], nrow=(nrow(d)/10), ncol=1)
 V13<-matrix(d[seq(from=13, by = num_offset,to=nrow(d)),], nrow=(nrow(d)/10), ncol=1)
 max.len = max(length(V1), length(V2),length(V3),length(V4),length(V5),length(V6),length(V7),
```

```
      length(V8),length(V9),length(V10),length(V11),length(V12),length(V13))#set max length
based on longest vector here
 #pad nas to fill space discrepancies between shortest and longest
 V1=c(V1,rep(NA, max.len-length(V1)))
 V2=c(V2,rep(NA, max.len-length(V2)))
 V3=c(V3,rep(NA, max.len-length(V3)))
 V4=c(V4,rep(NA, max.len-length(V4)))
 V5=c(V5,rep(NA, max.len-length(V5)))
 V6=c(V6,rep(NA, max.len-length(V6)))
 V7=c(V7,rep(NA, max.len-length(V7)))
 V8=c(V8,rep(NA, max.len-length(V8)))
 V9=c(V9,rep(NA, max.len-length(V9)))
 V10=c(V10,rep(NA, max.len-length(V10)))
 V11=c(V11,rep(NA, max.len-length(V11)))
 V12=c(V12,rep(NA, max.len-length(V12)))
 V13=c(V13,rep(NA, max.len-length(V13)))
 newdf<-as.data.frame(cbind(V1,V2,V3,V4,V5,V6,V7,V8,V9,V10,V11,V12,V13)) #CREATE
DATAFRAME WITH CBIND
 newdf[,5:13]<-lapply(c(newdf[,5:13]), as.numeric)
 newdf<-rename(newdf,"cruise"="V1", "date"="V2","station_number"="V3","sal"="V7",
"temp_DegC"="V6","depth_m"="V5", "time"="V4", "net_number"="V13",
"record_number"="V9","time_bins_in_sec"="V12","net_angle"="V8")
 newdf$date<-mdy(newdf$date)#as.Date(newdf$date, format="%m-%d-%Y")#turns date to
YMD format
 newdf$date<-ifelse(str_starts(newdf$time,"00", negate = F),(newdf$date+days(1)),newdf$date)
 newdf$date<-as_date(newdf$date)
 newdf<-unite(newdf, "date_time", c("date","time"), remove = F)
 newdf$date_time<-as.POSIXct(newdf$date_time,format="%Y-%m-%d_%H:%M:%OS")
 newdf<-unite(newdf, "moc_id", c(cruise,station_number,net_number),sep="_", remove=F)
 newdf$moc_id<-gsub("-","",as.character(newdf$moc_id))
 newdf$moc_id<-str_to_upper(newdf$moc_id, locale = "en")
 newdf<-unite(newdf, "moc_id_noNet", c(cruise,station_number),sep="_", remove=F)
 newdf$moc_id_noNet<-gsub("-","",as.character(newdf$moc_id_noNet))
 newdf$moc_id_noNet<-str_to_upper(newdf$moc_id_noNet, locale = "en")
 outname = paste("TC",input, '.csv', sep = "")
 write.csv(x=newdf, file=outname)
}

for (i in 1:length(files)) {
 moc_read_8604(files[i])
}
```