

Water quality data and trends

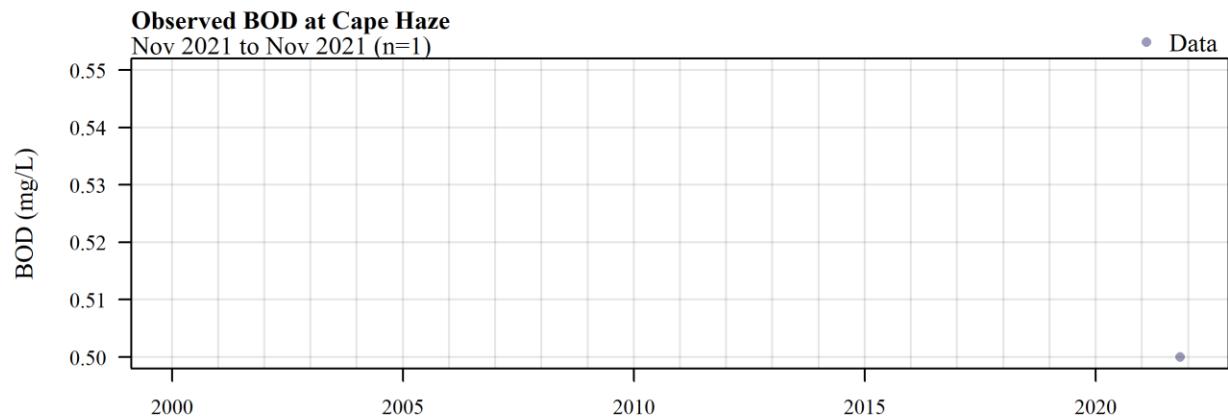
Supplementary figures for “Water Quality Trends and Eutrophication Indicators in a Large Subtropical Estuary: A Case Study of the Greater Charlotte Harbor System in Southwest Florida”
(<https://doi.org/10.1007/s12237-025-01488-2>).

Each page in this document visualizes the following results for one of 11 water quality parameters at one of 13 monitoring strata.

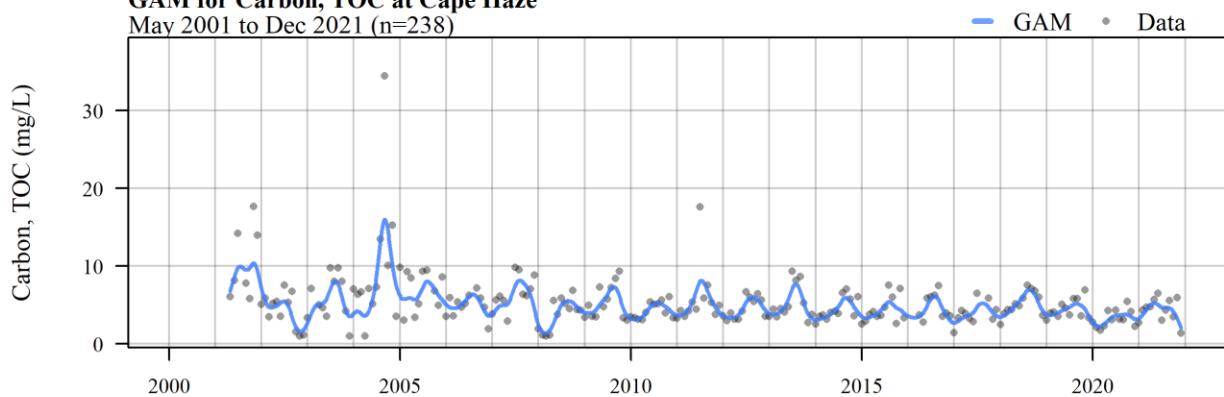
Top panel: Water quality data (as available between 2000–2021) with the GAM fit.

Middle panel: Annual mean values (with 95% CI) and 10-year trend with 95% CI (2012–2021).

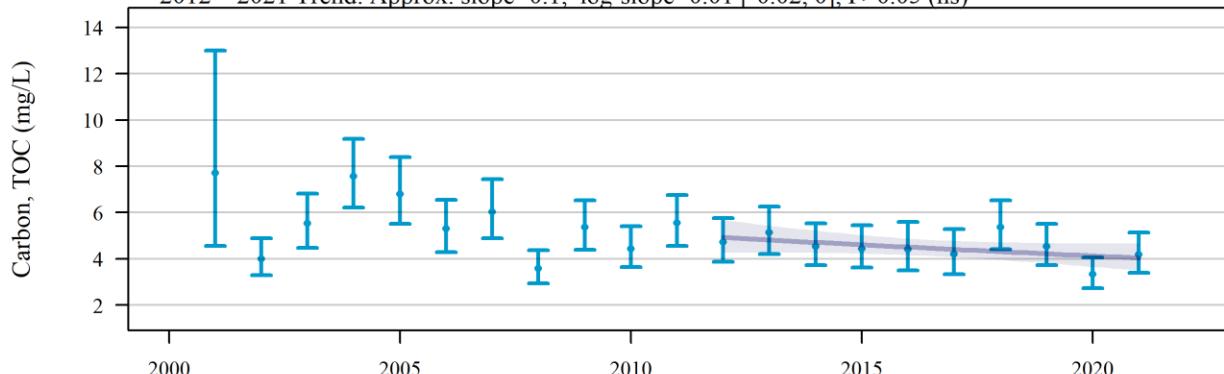
Bottom panel: Annual mean values (with 95% CI) and 5-year trend with 95% CI (2017–2021).



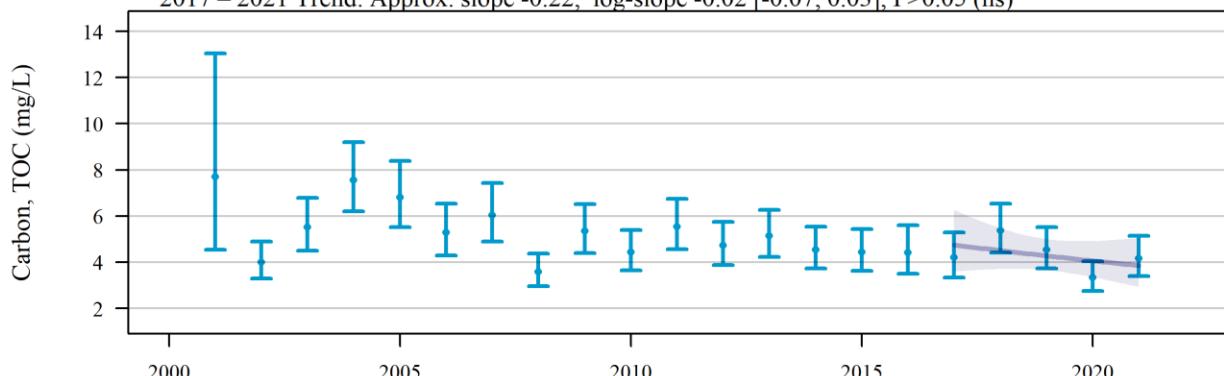
GAM for Carbon, TOC at Cape Haze
May 2001 to Dec 2021 (n=238)

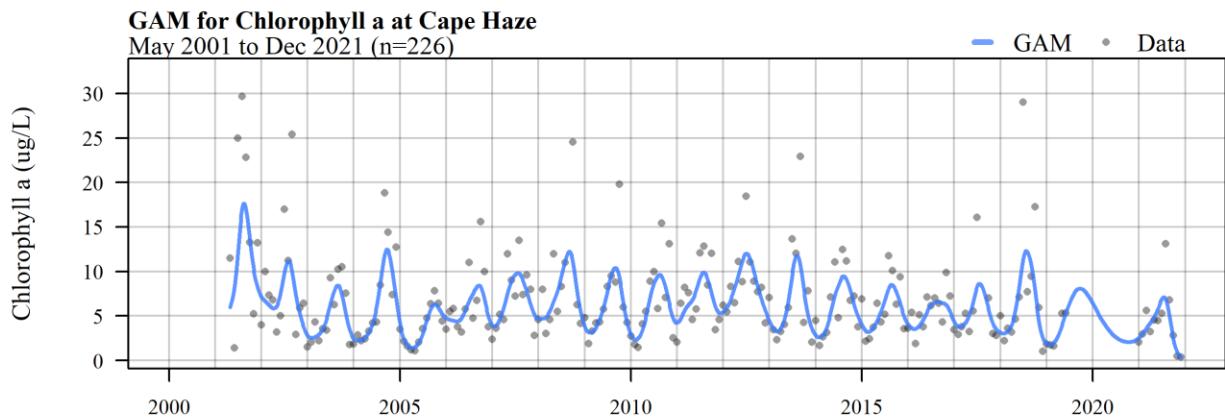


Est. mean with 95% CI (Jan 1 – Dec 31)
2012 – 2021 Trend: Approx. slope -0.1, log-slope -0.01 [-0.02, 0], P>0.05 (ns)

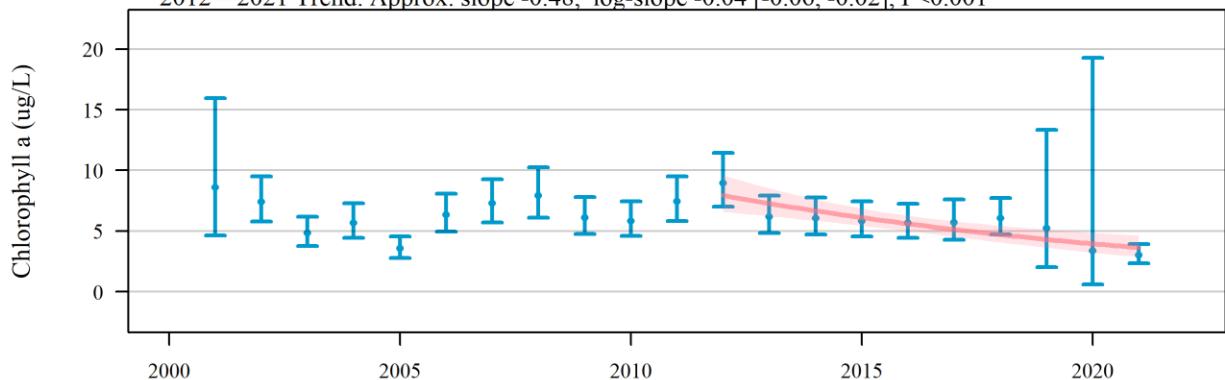


Est. mean with 95% CI (Jan 1 – Dec 31)
2017 – 2021 Trend: Approx. slope -0.22, log-slope -0.02 [-0.07, 0.03], P>0.05 (ns)

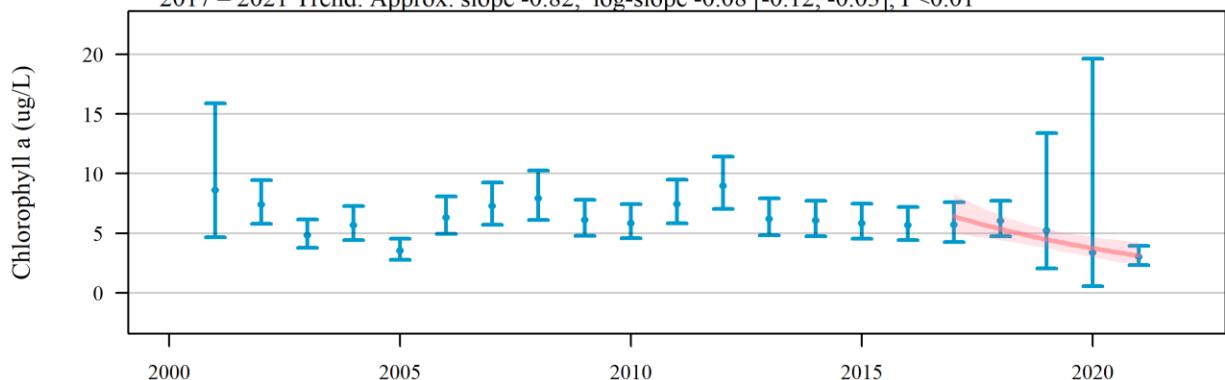


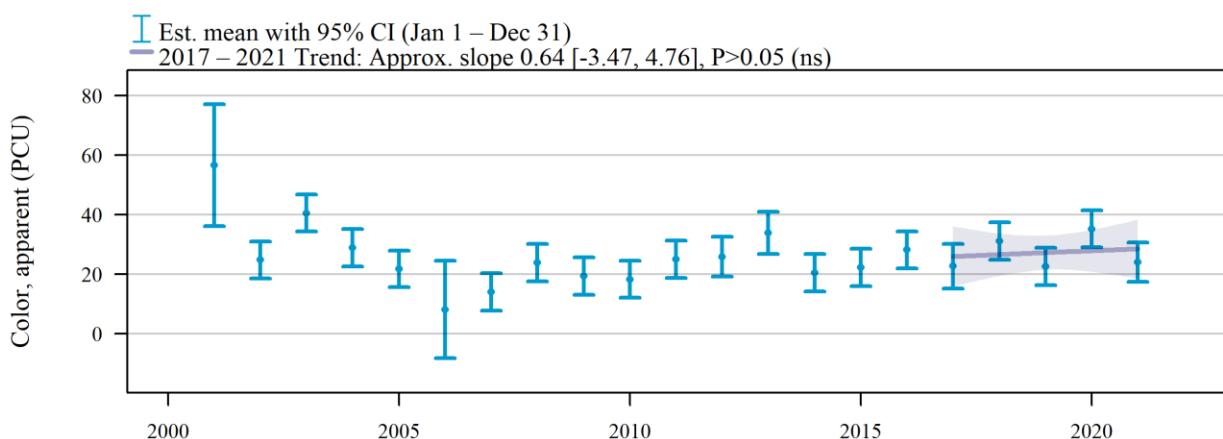
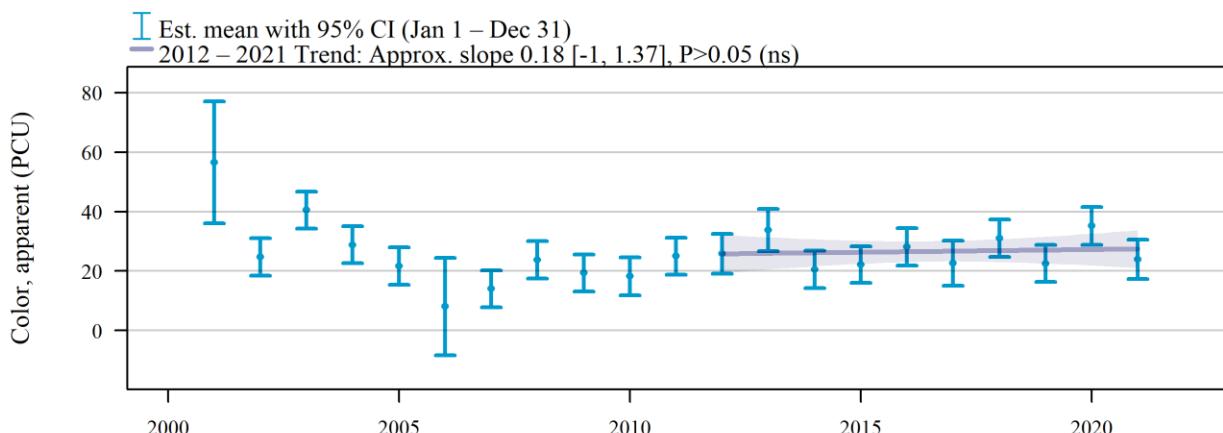
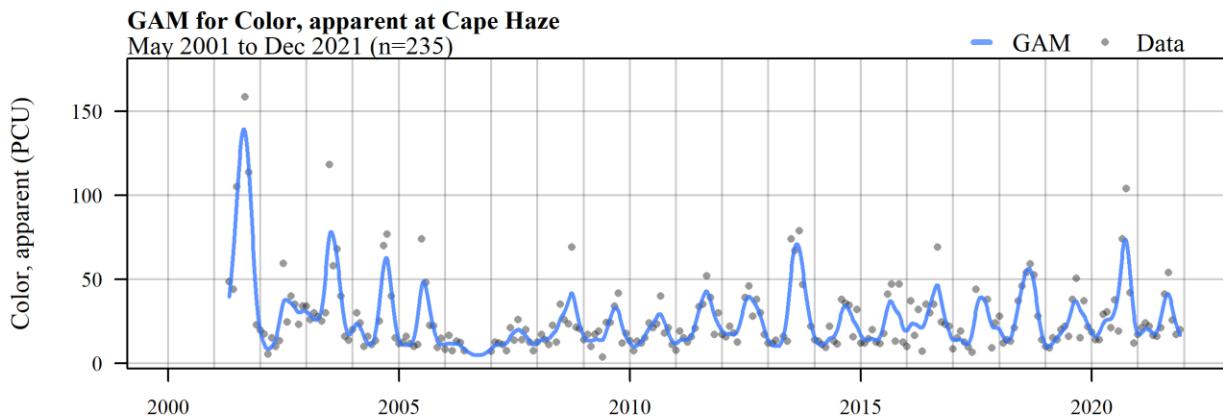


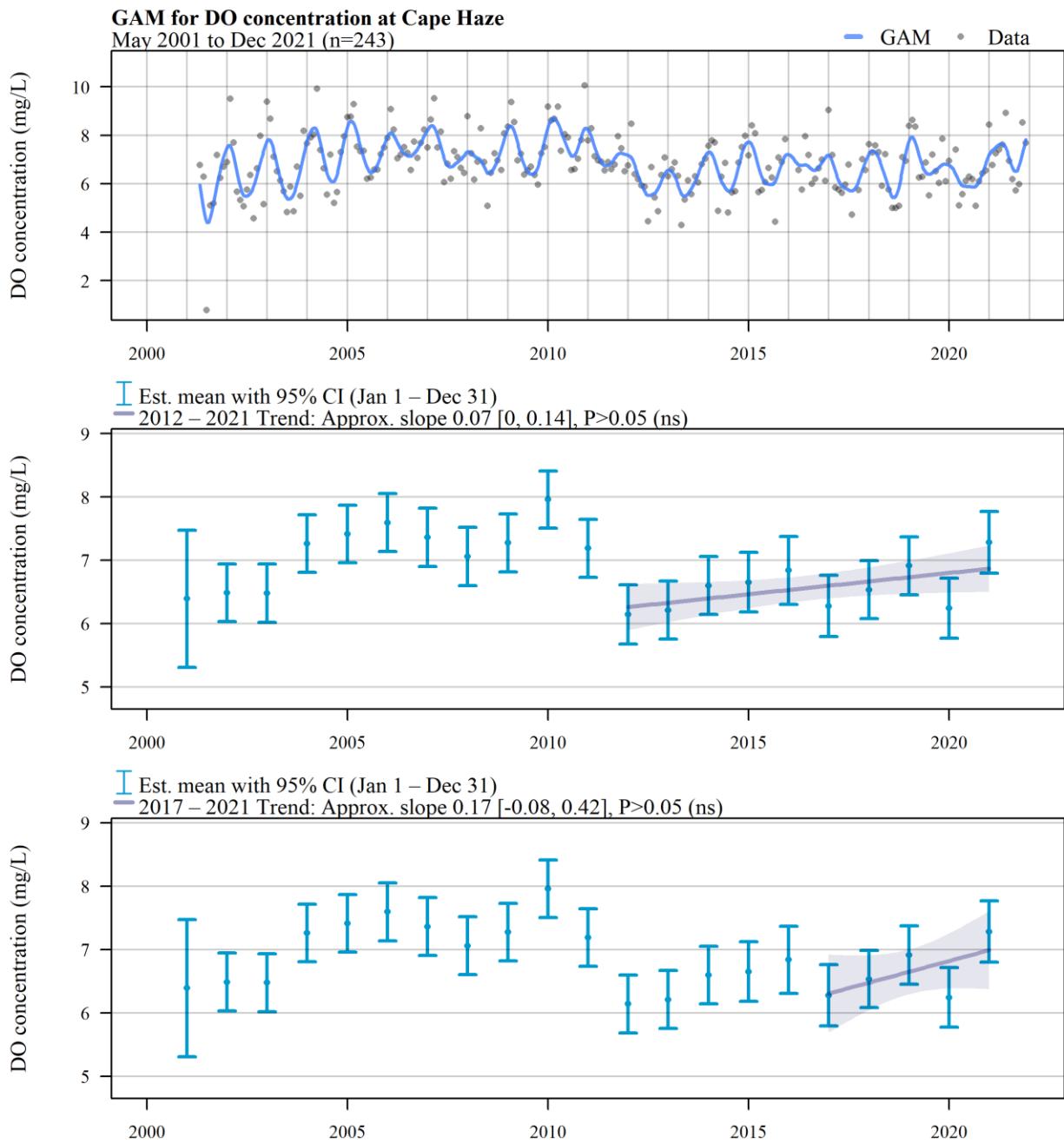
Est. mean with 95% CI (Jan 1 – Dec 31)
2012 – 2021 Trend: Approx. slope -0.48, log-slope -0.04 [-0.06, -0.02], P<0.001

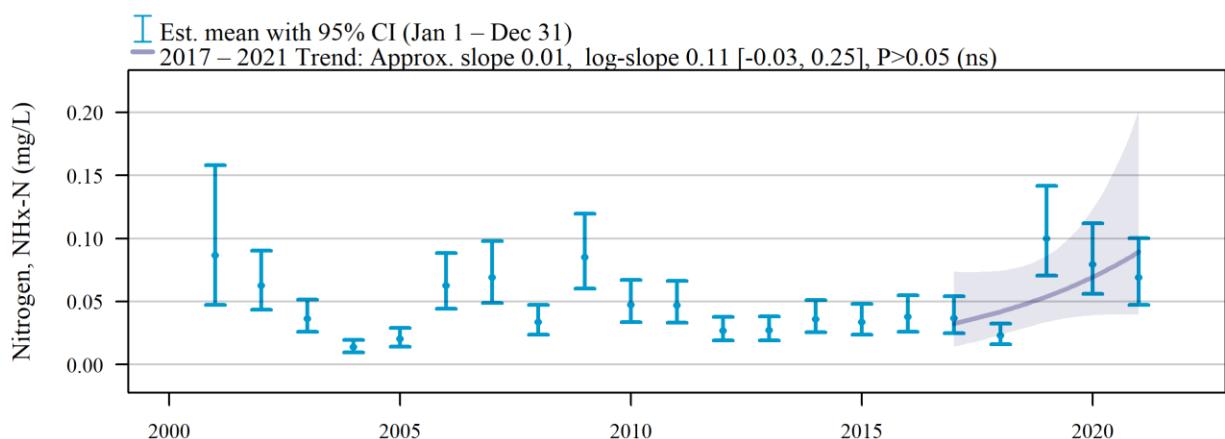
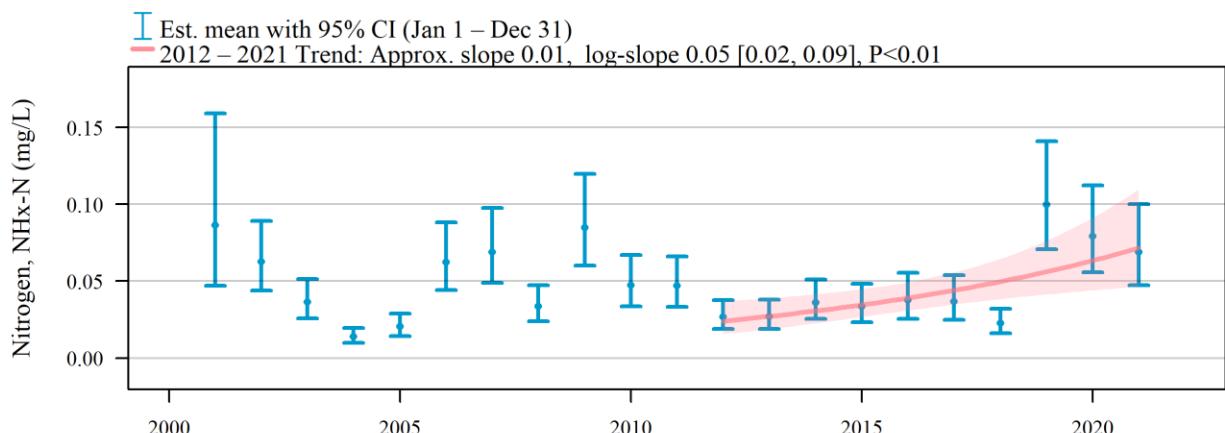
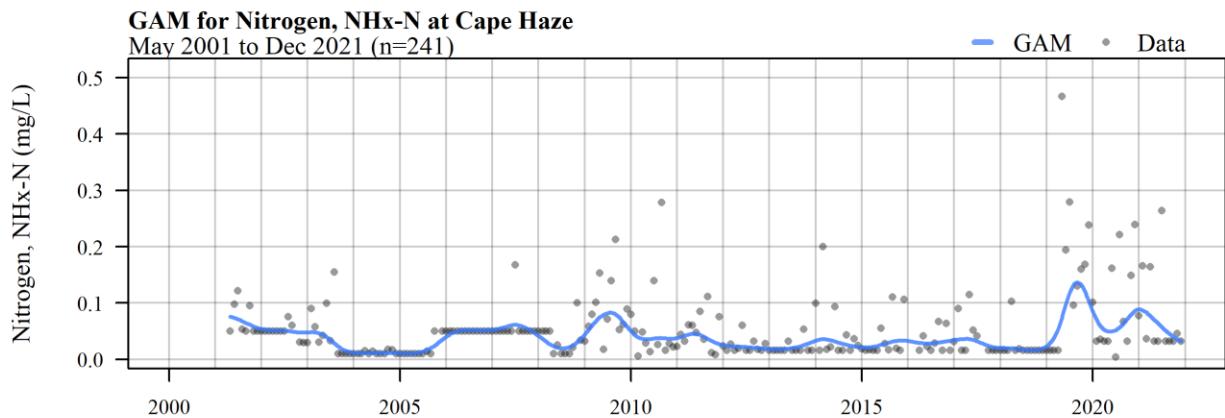


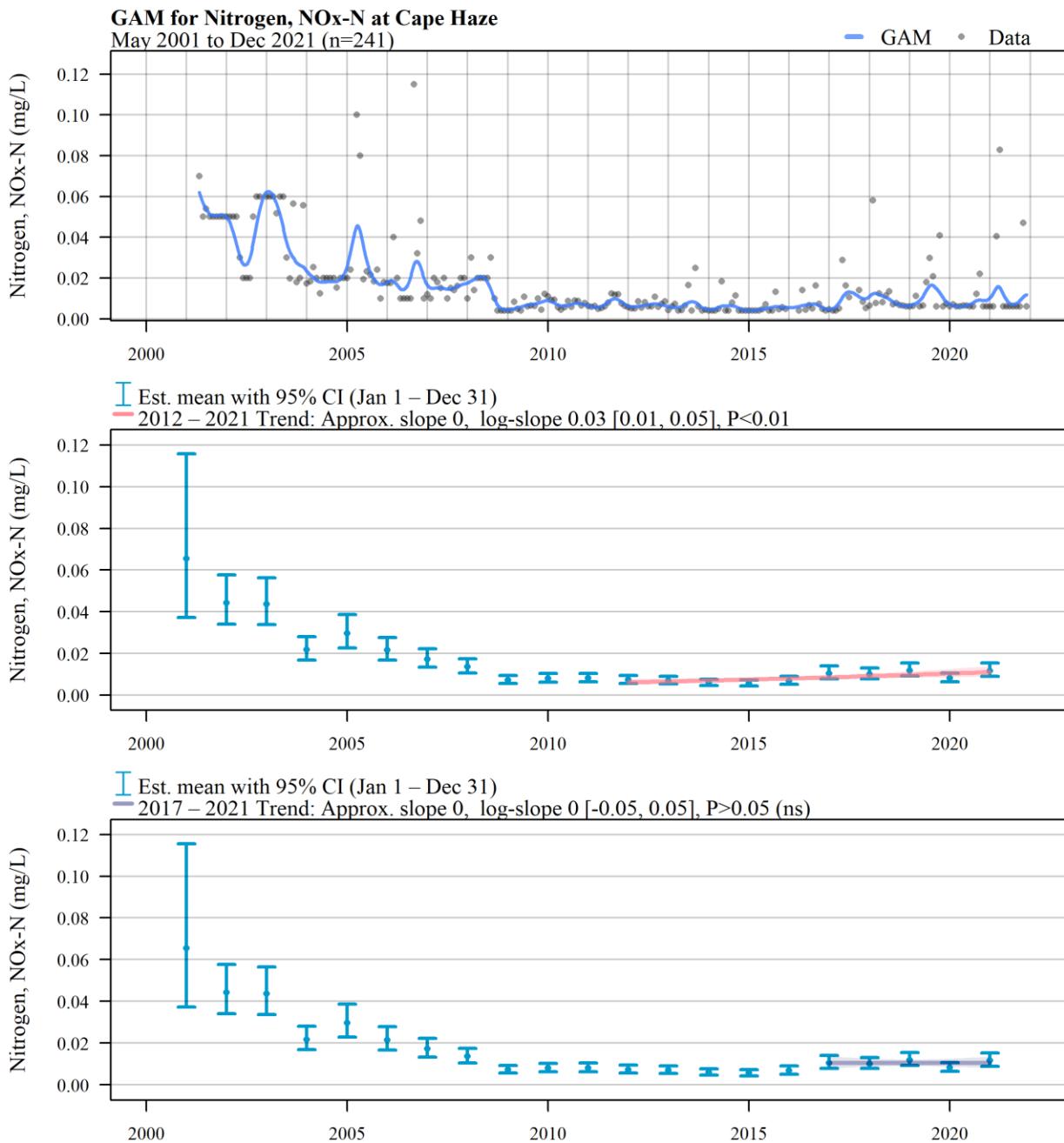
Est. mean with 95% CI (Jan 1 – Dec 31)
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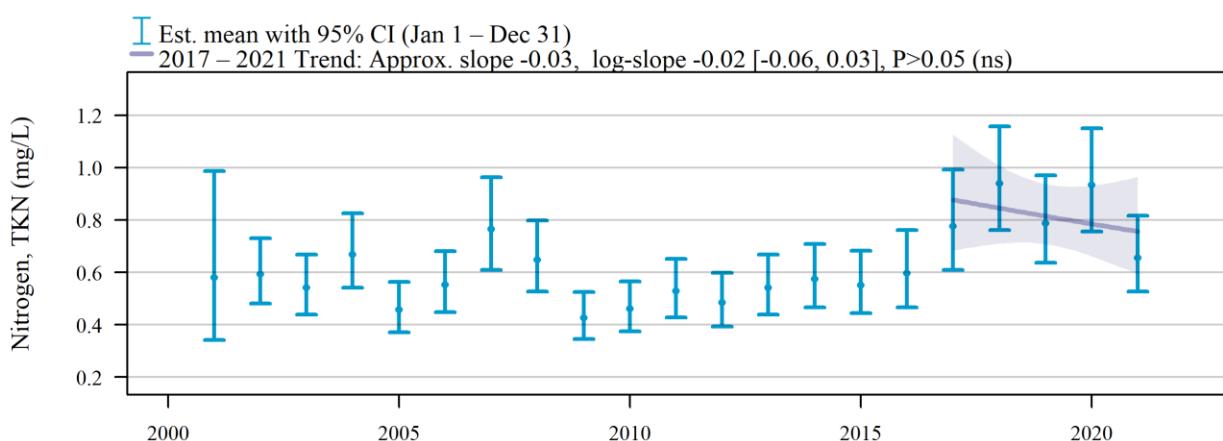
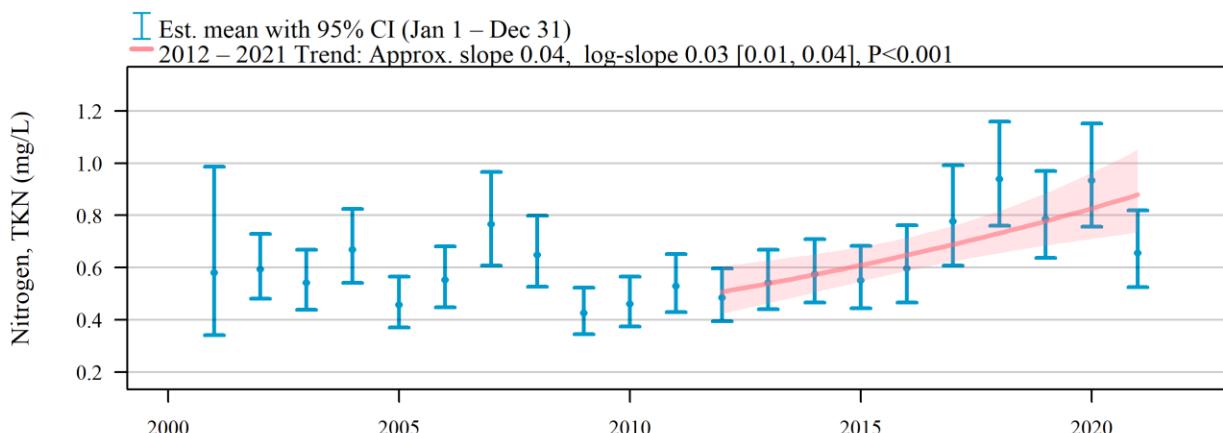
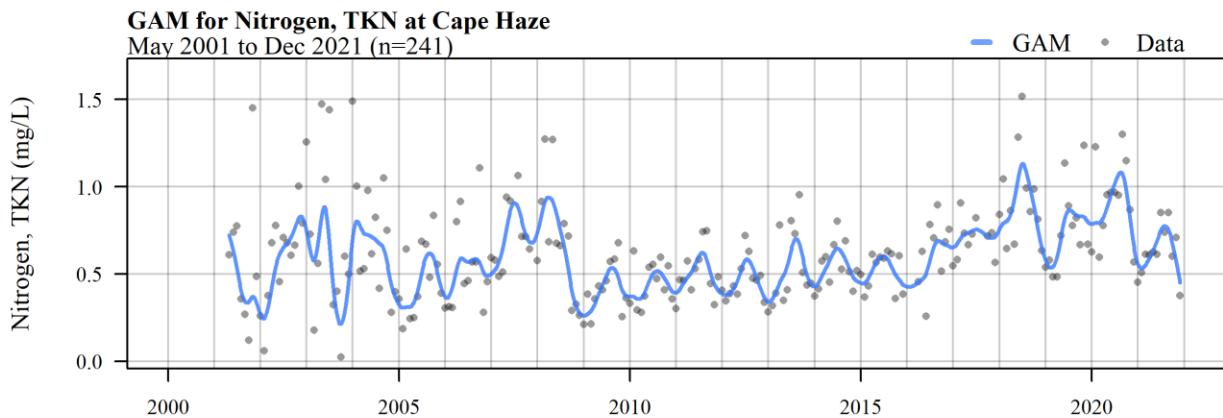


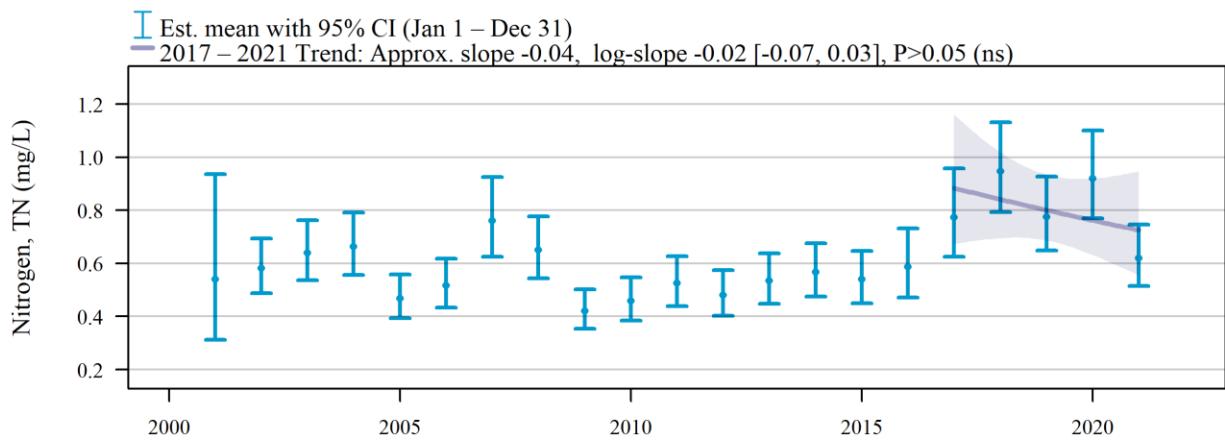
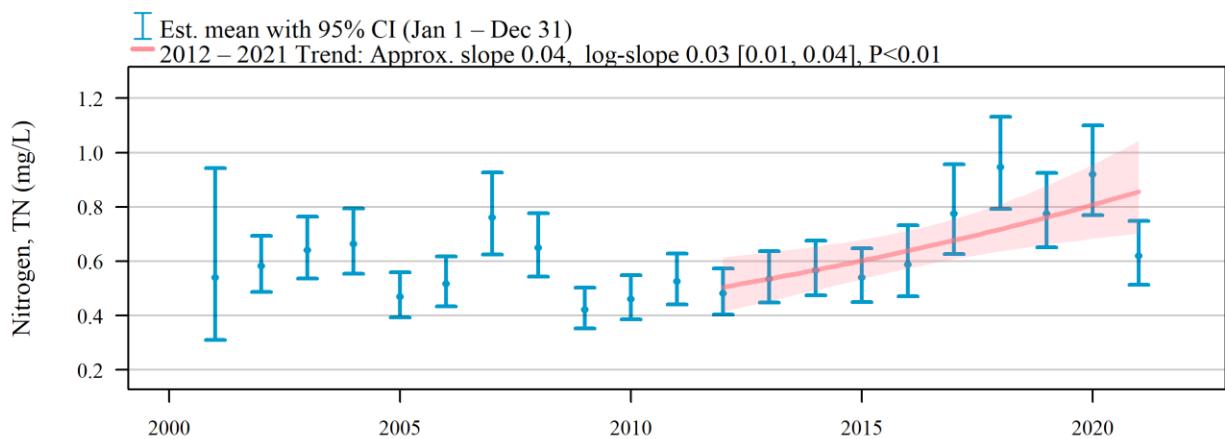
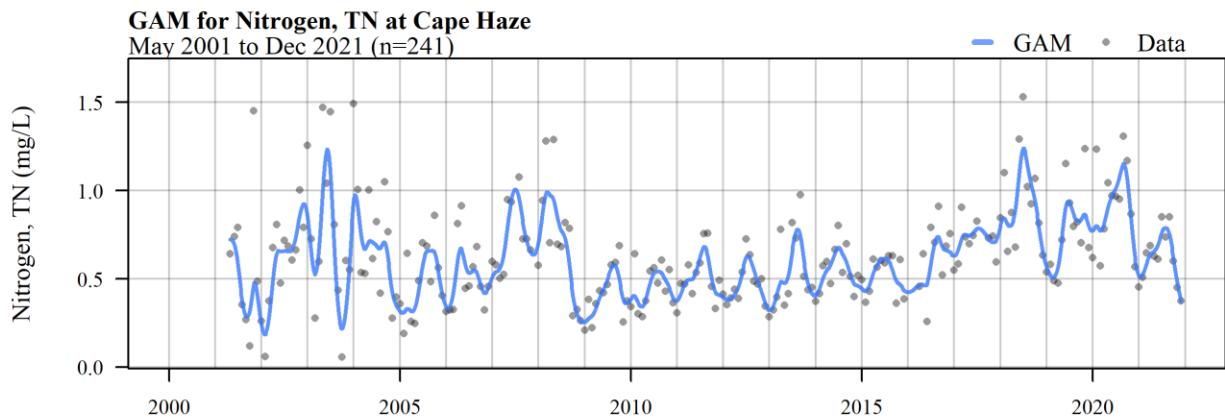


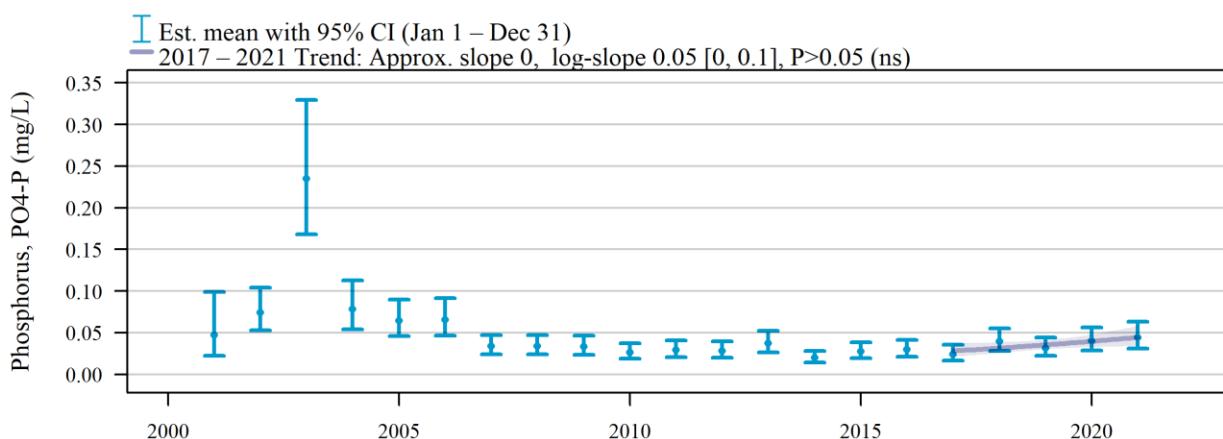
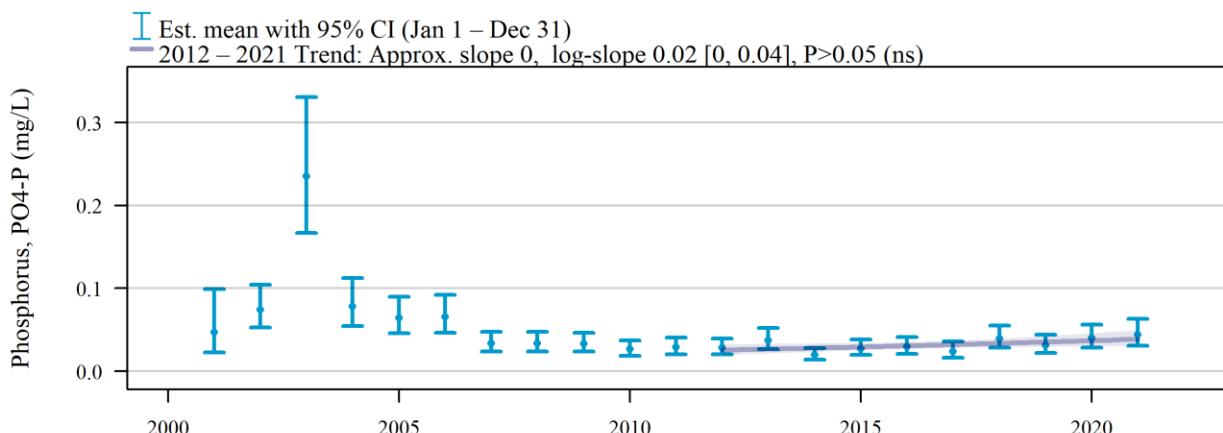
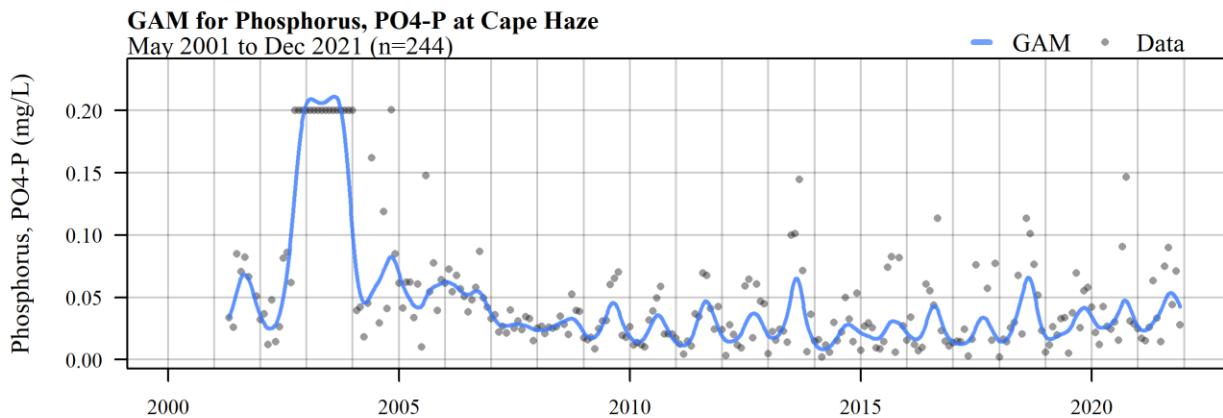


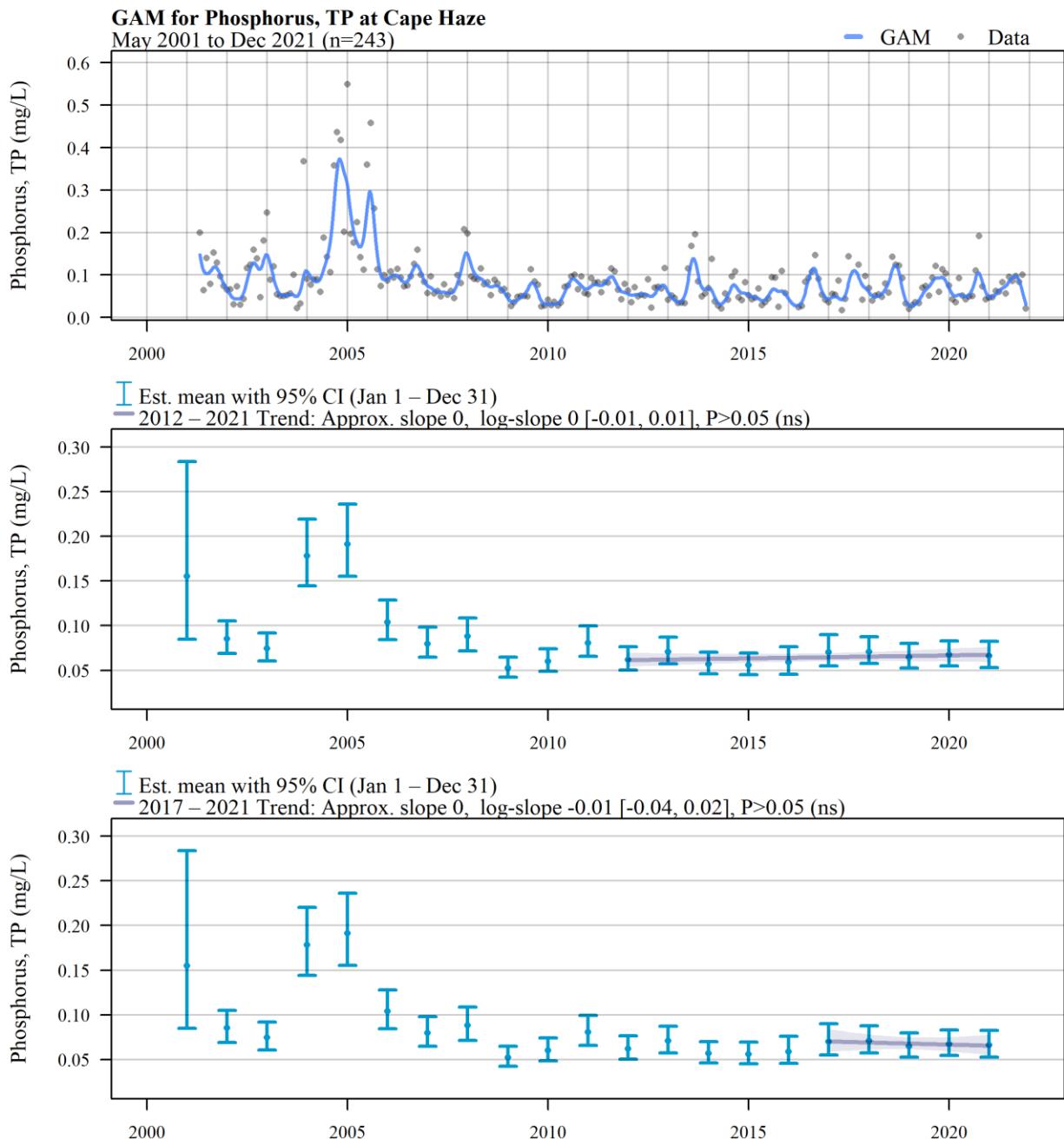












BOD at East Wall Charlotte Harbor

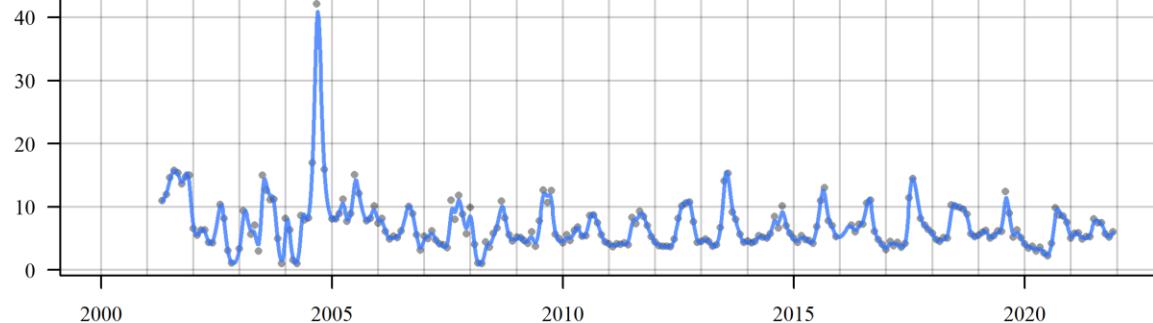
No data
(Jan 2000 to Dec 2021)

2000 2005 2010 2015 2020

GAM for Carbon, TOC at East Wall Charlotte Harbor
May 2001 to Dec 2021 (n=237)

— GAM • Data

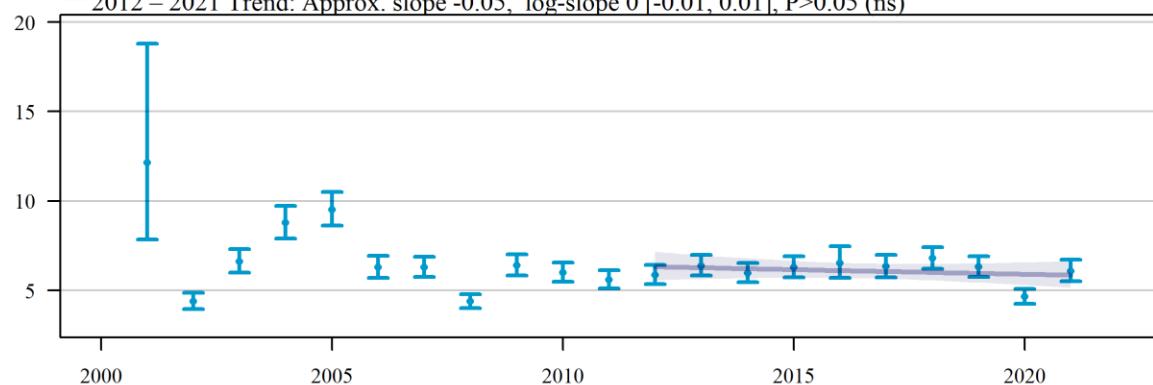
Carbon, TOC (mg/L)



Est. mean with 95% CI (Jan 1 – Dec 31)

2012 – 2021 Trend: Approx. slope -0.05, log-slope 0 [-0.01, 0.01], P>0.05 (ns)

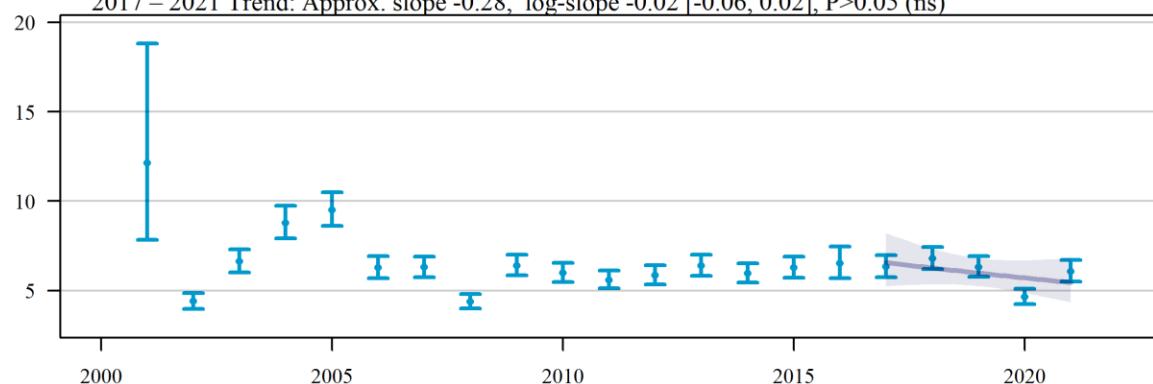
Carbon, TOC (mg/L)

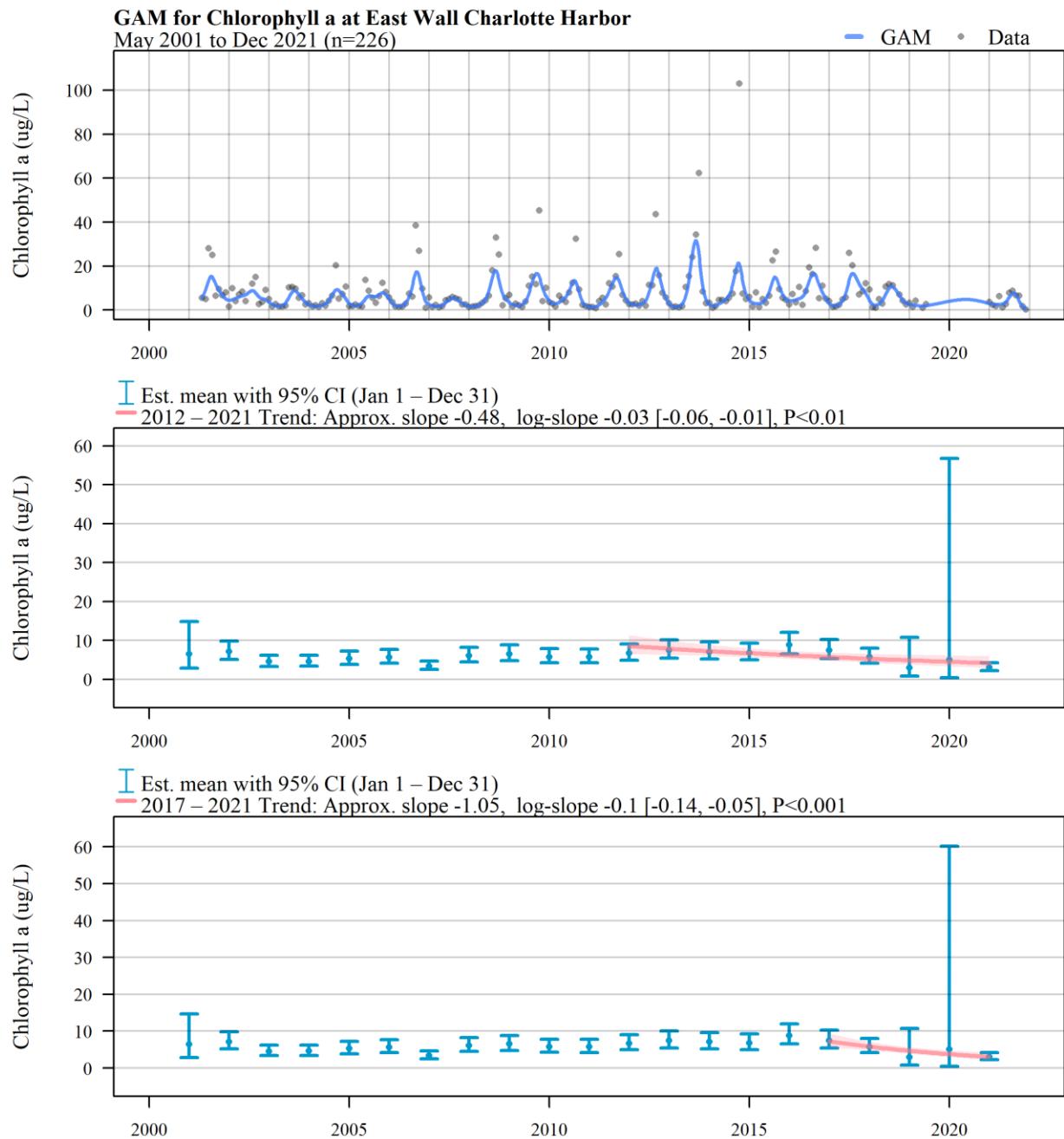


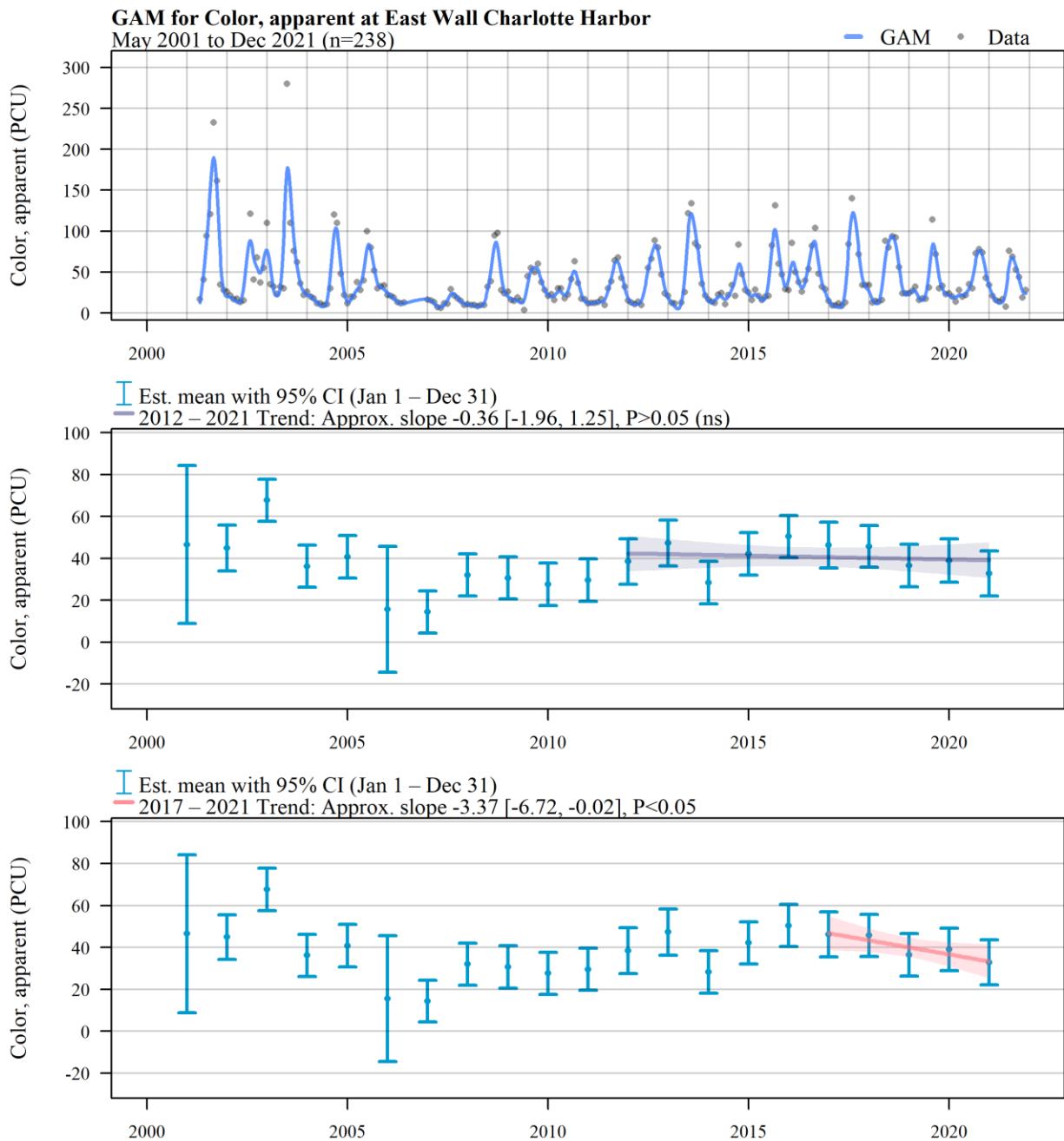
Est. mean with 95% CI (Jan 1 – Dec 31)

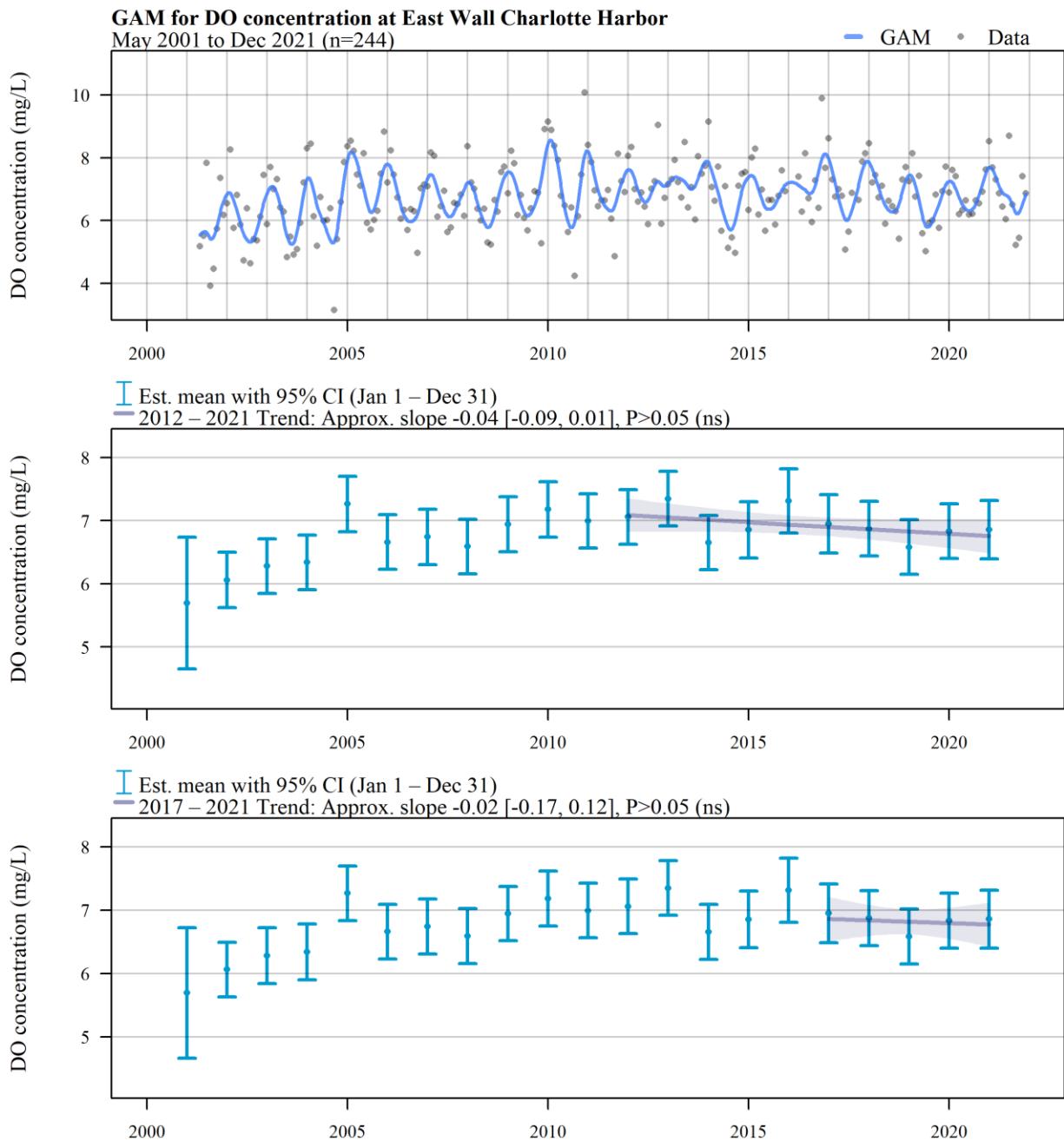
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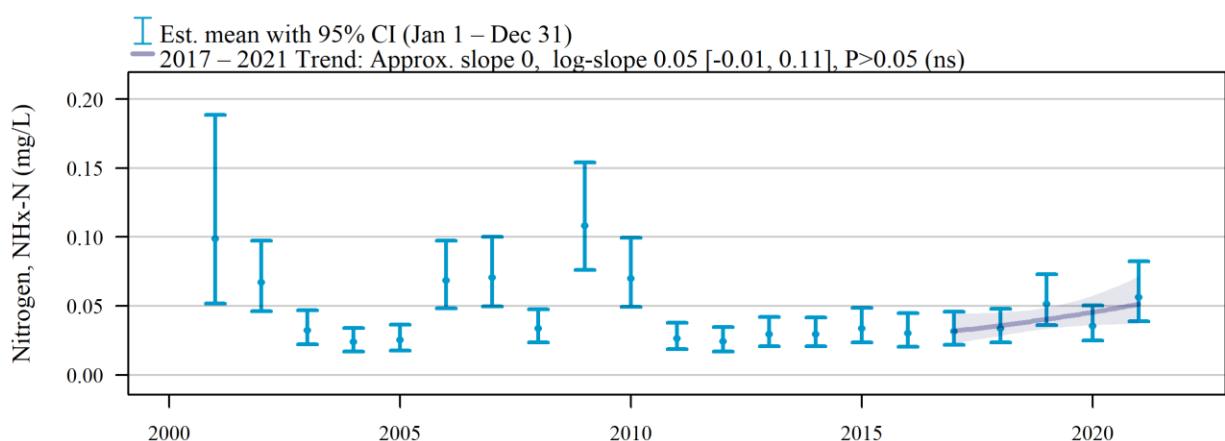
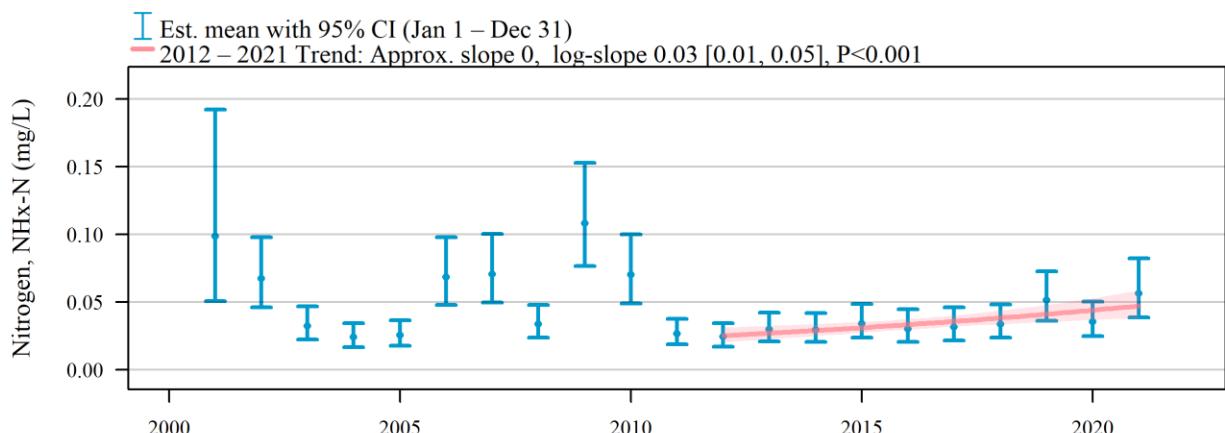
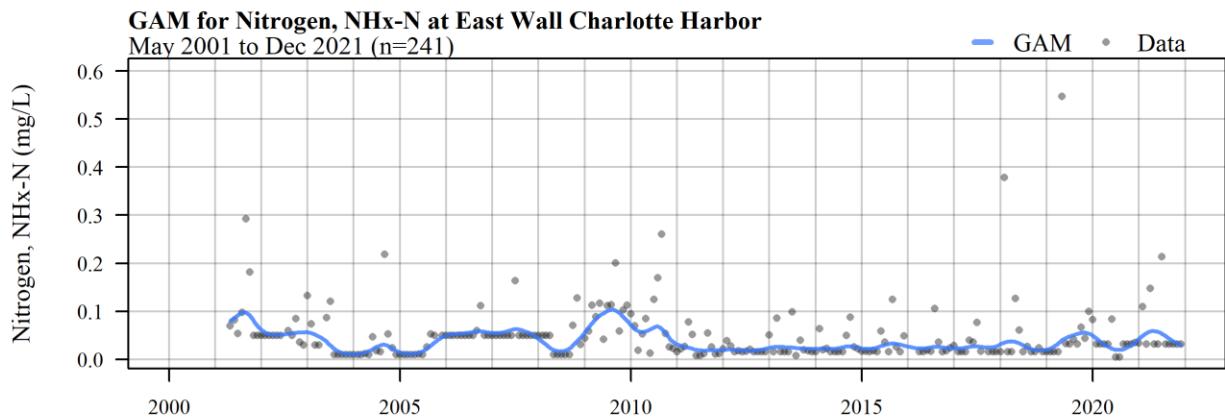
Carbon, TOC (mg/L)

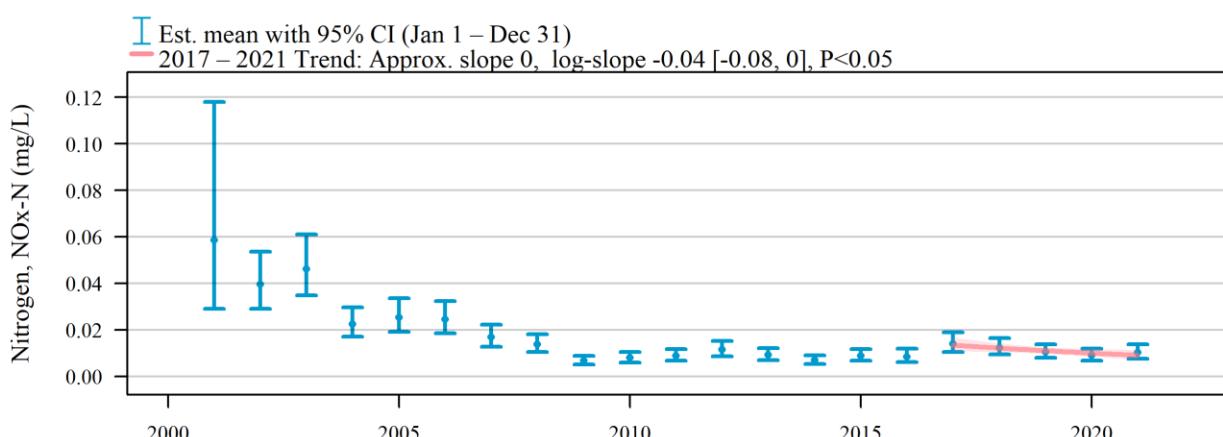
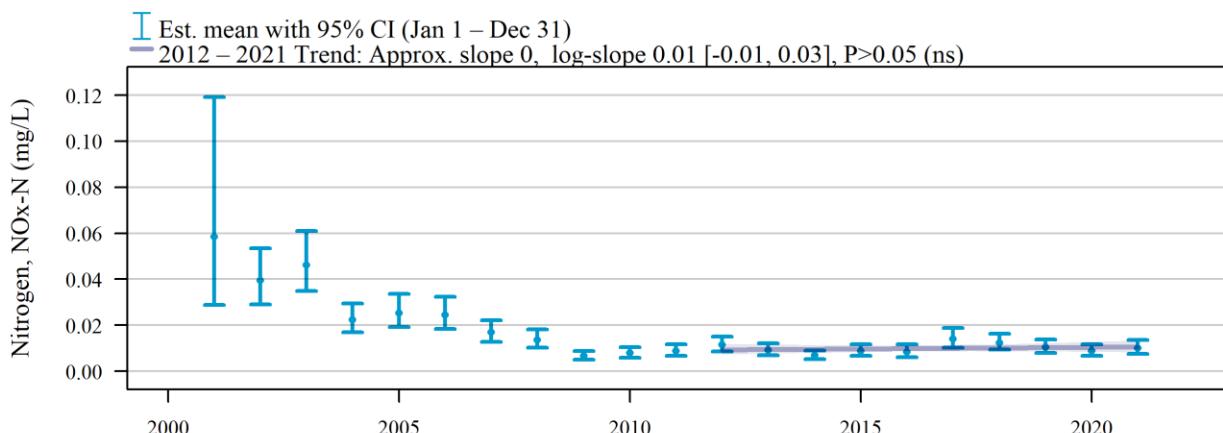
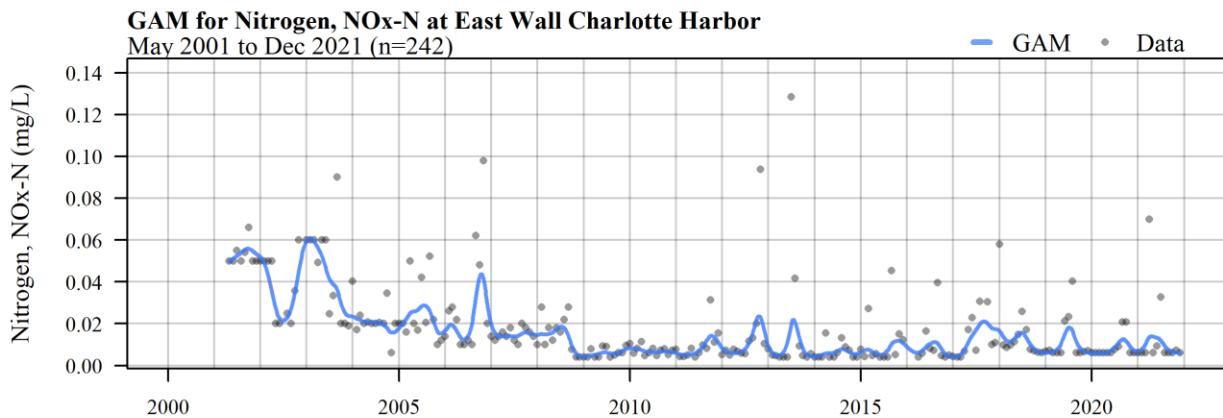


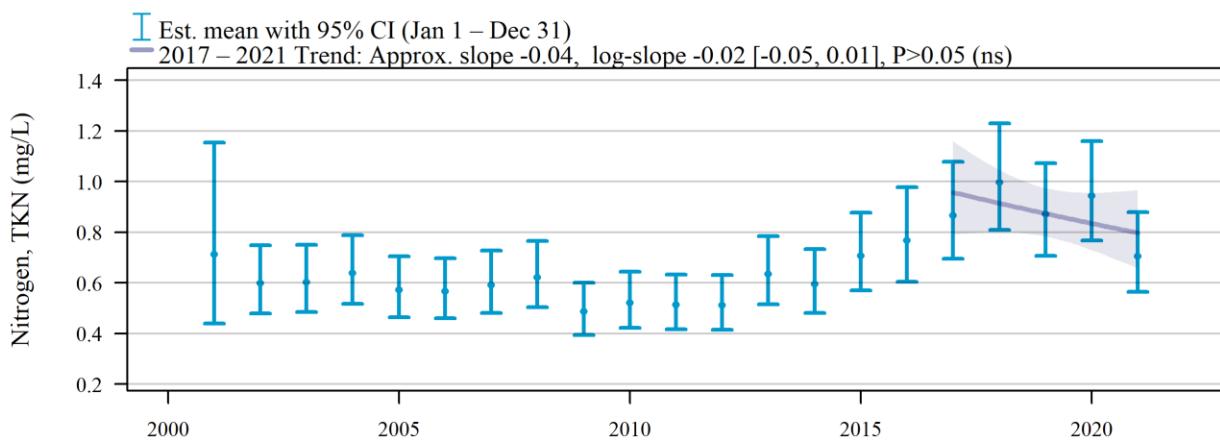
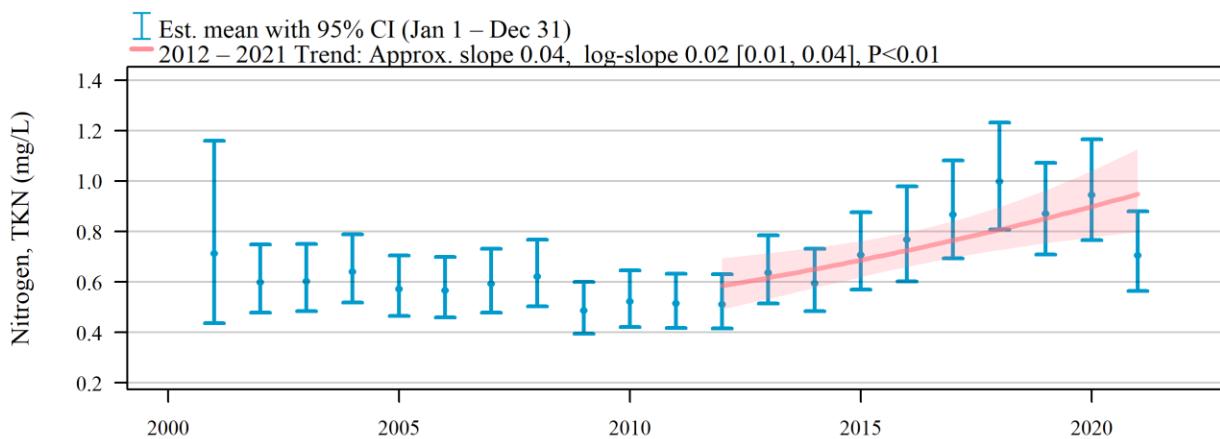
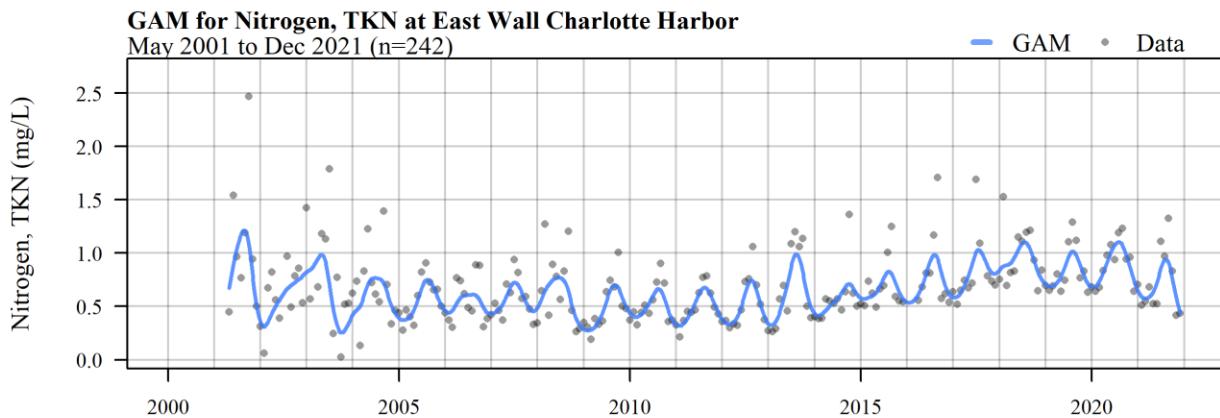




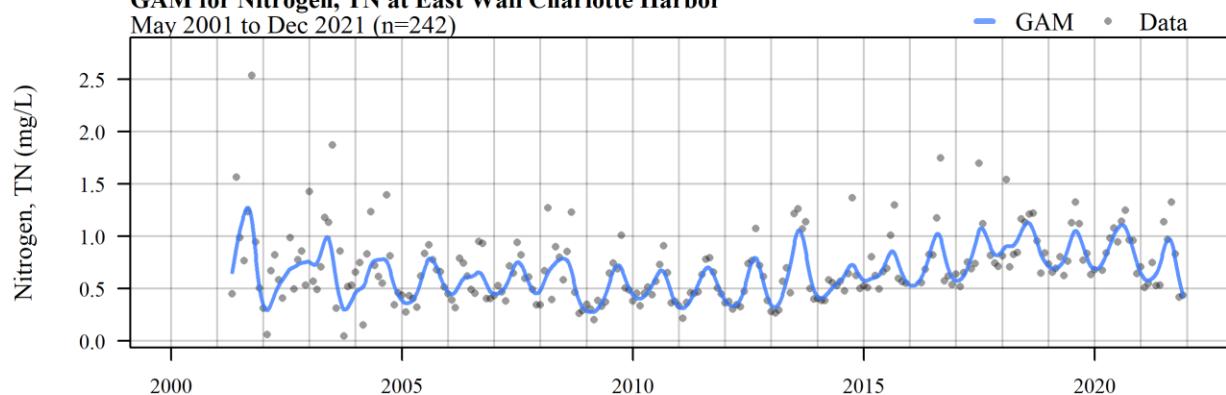




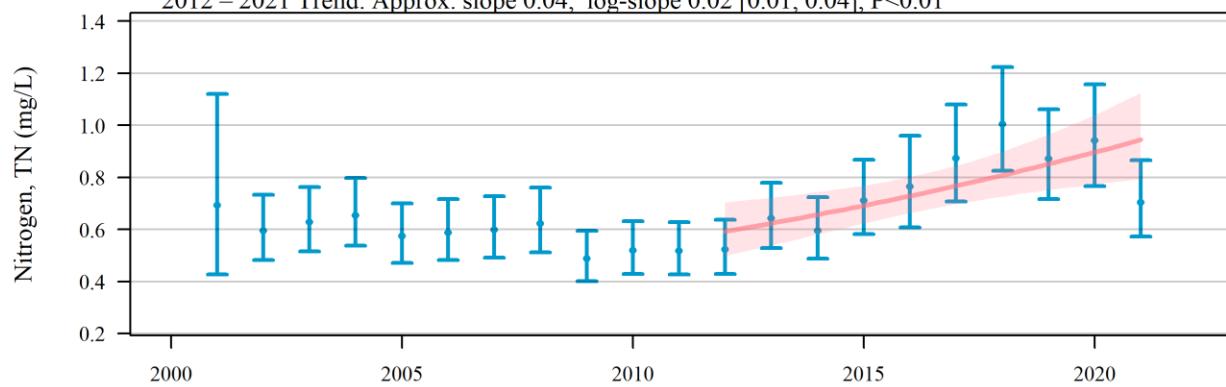




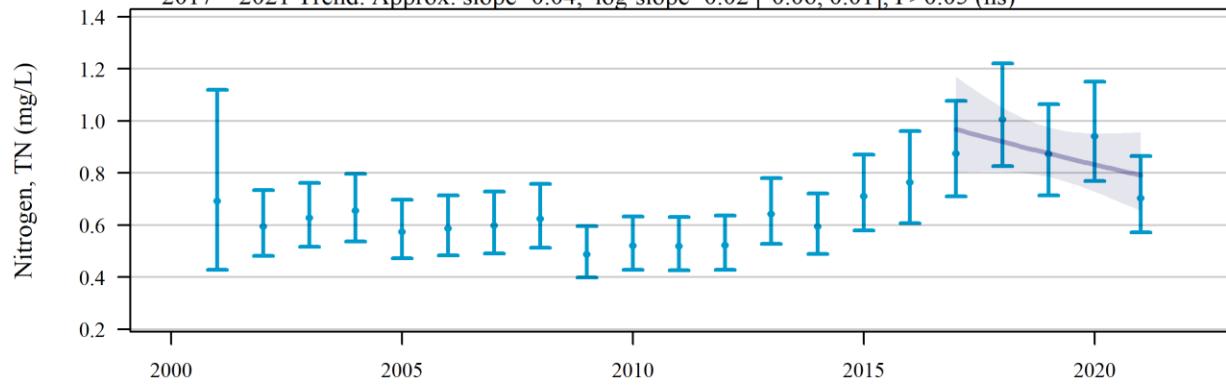
GAM for Nitrogen, TN at East Wall Charlotte Harbor
May 2001 to Dec 2021 (n=242)

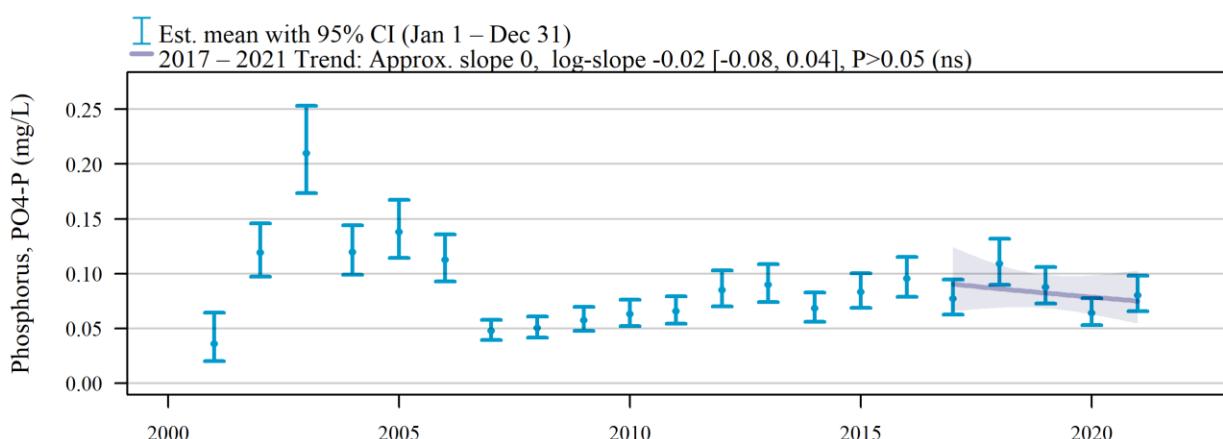
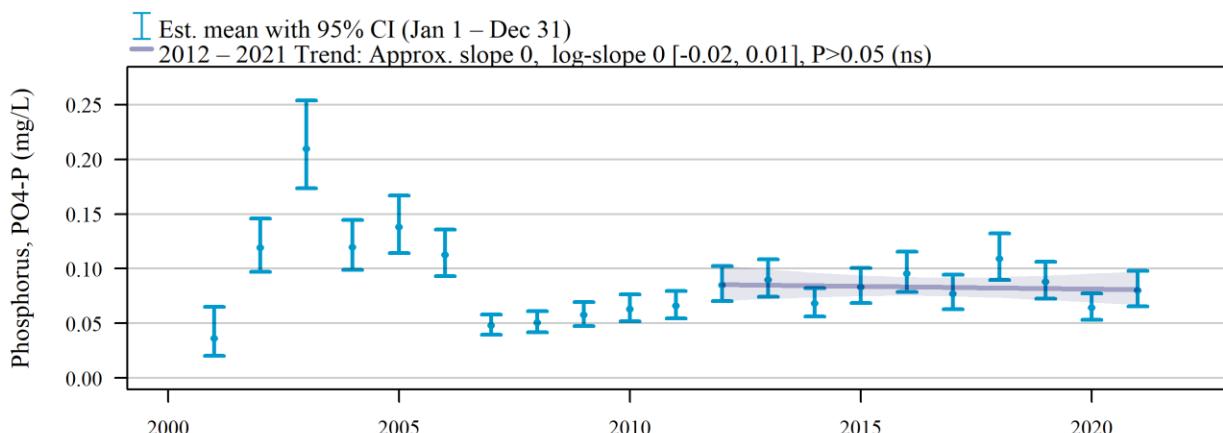
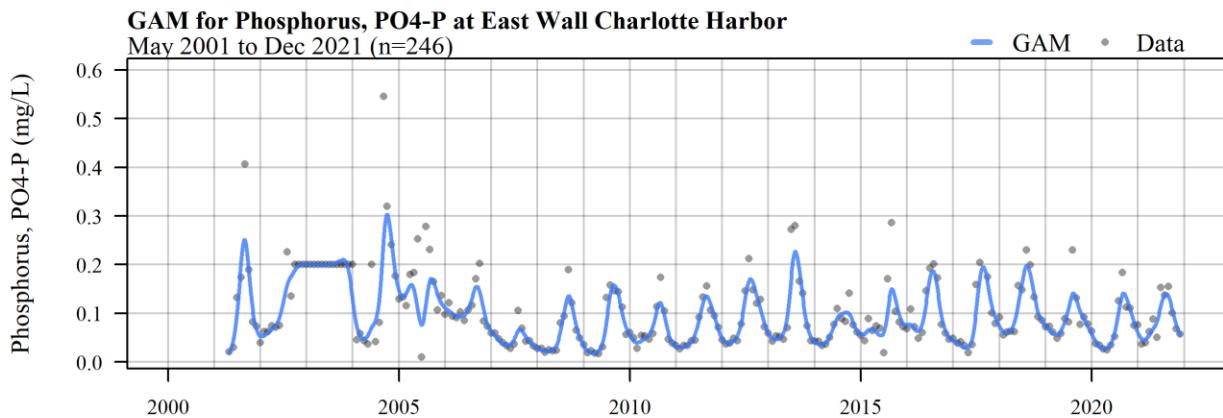


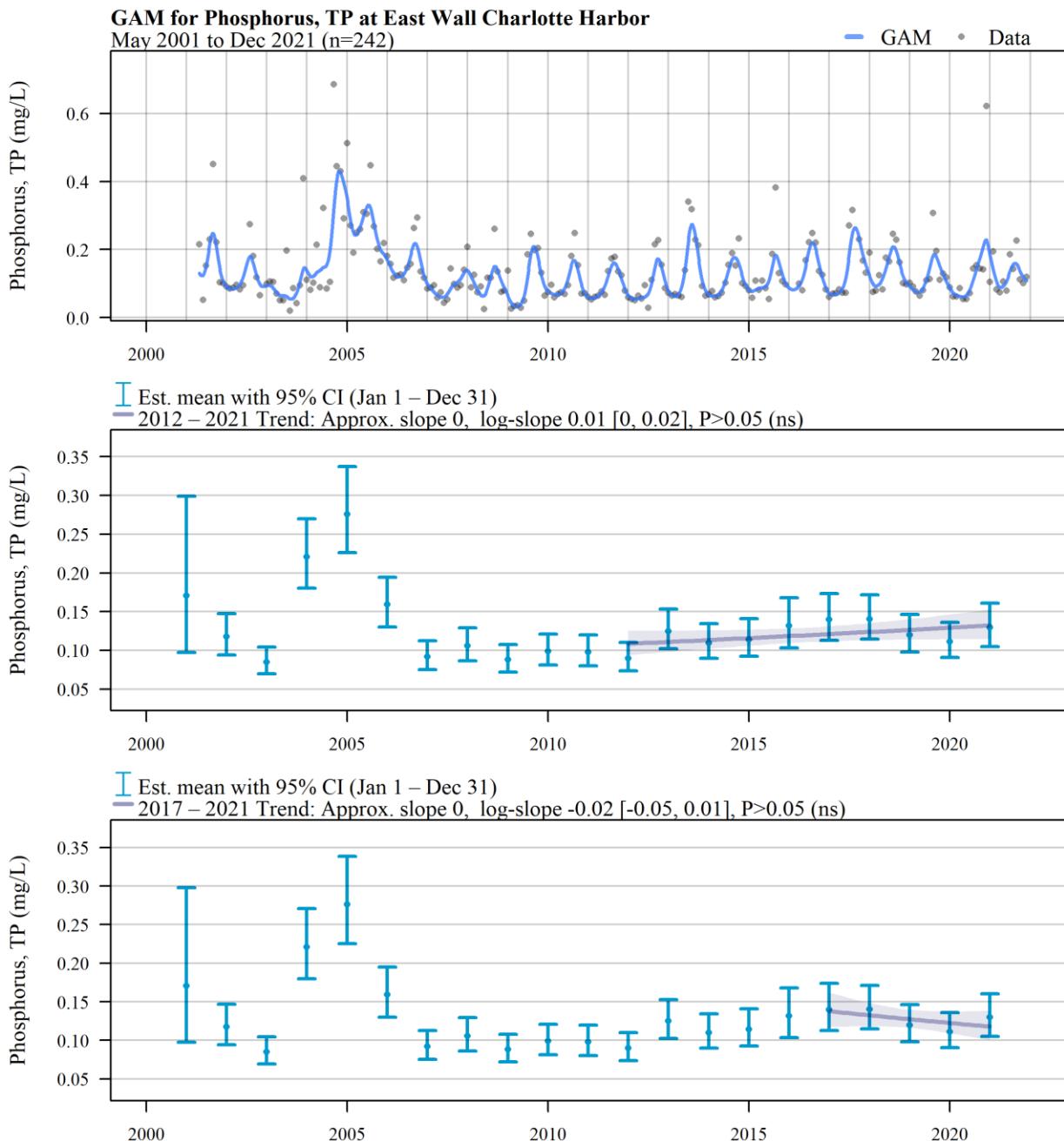
Est. mean with 95% CI (Jan 1 – Dec 31)
2012 – 2021 Trend: Approx. slope 0.04, log-slope 0.02 [0.01, 0.04], P<0.01

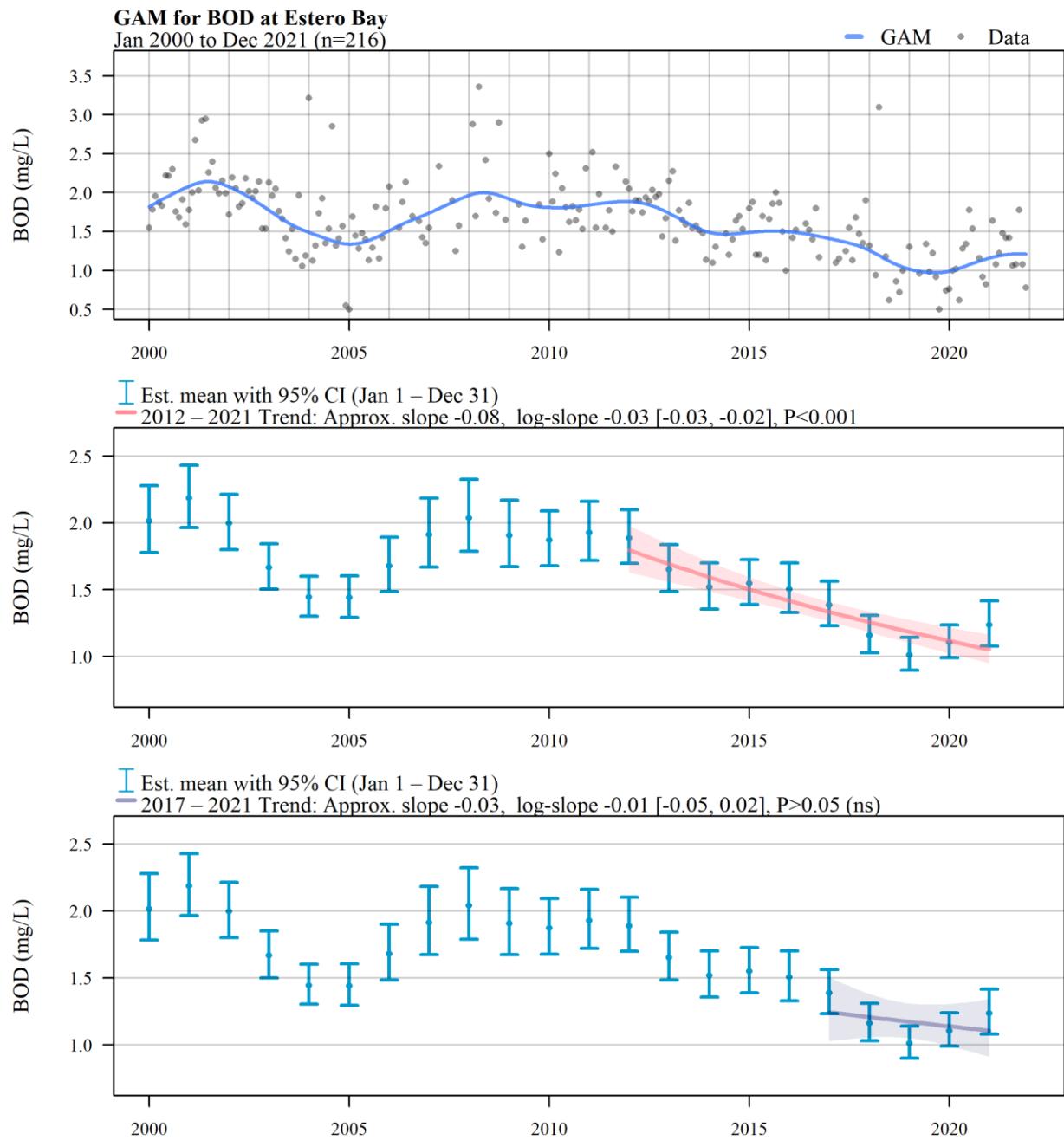


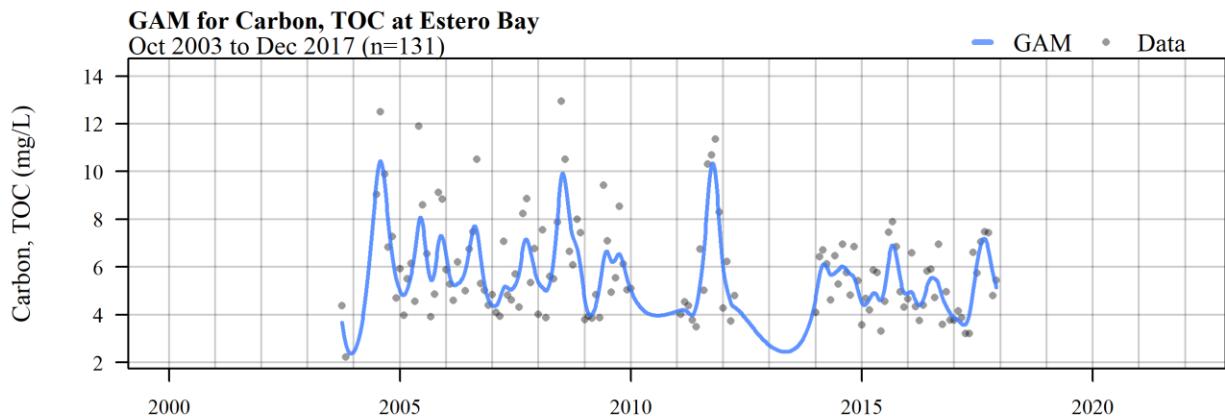
Est. mean with 95% CI (Jan 1 – Dec 31)
2017 – 2021 Trend: Approx. slope -0.04, log-slope -0.02 [-0.06, 0.01], P>0.05 (ns)

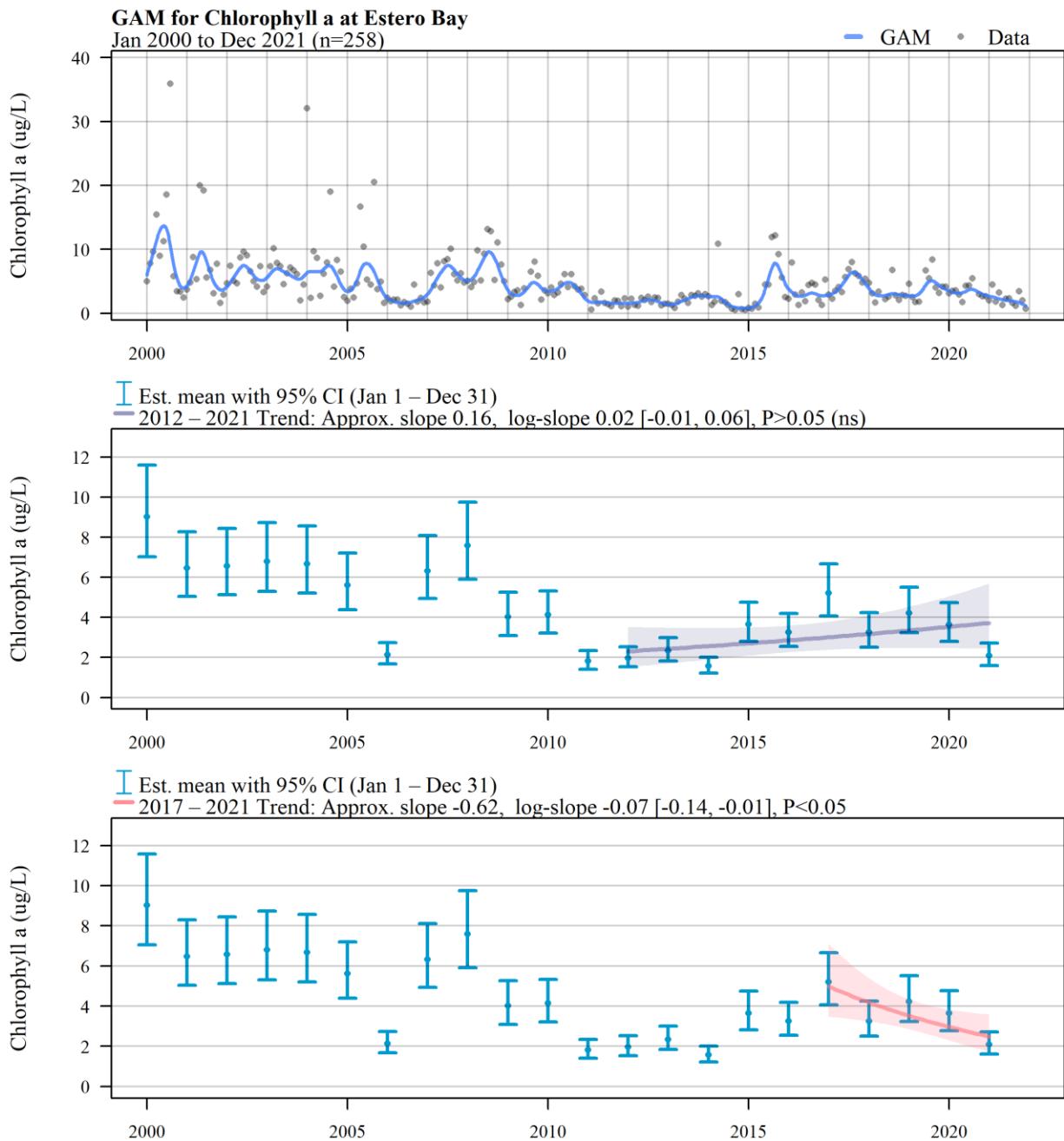








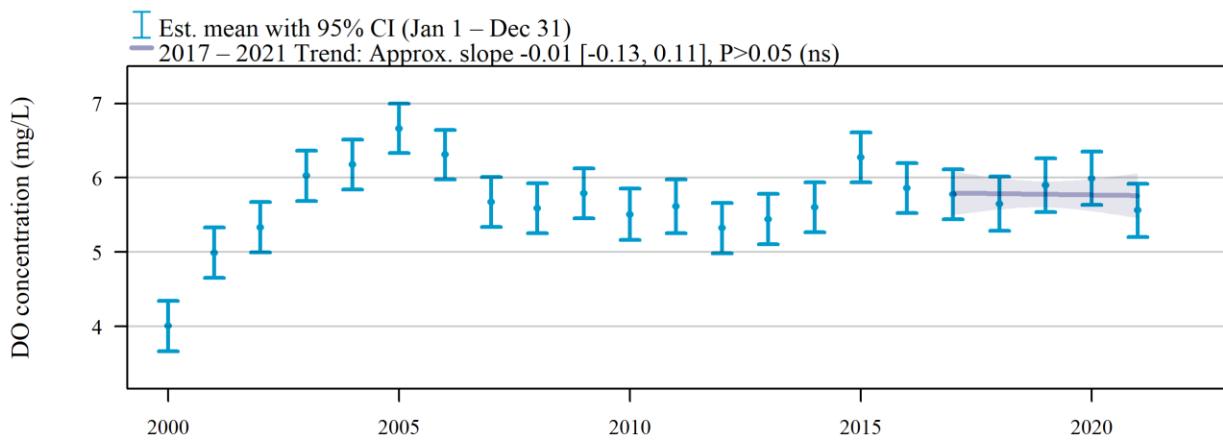
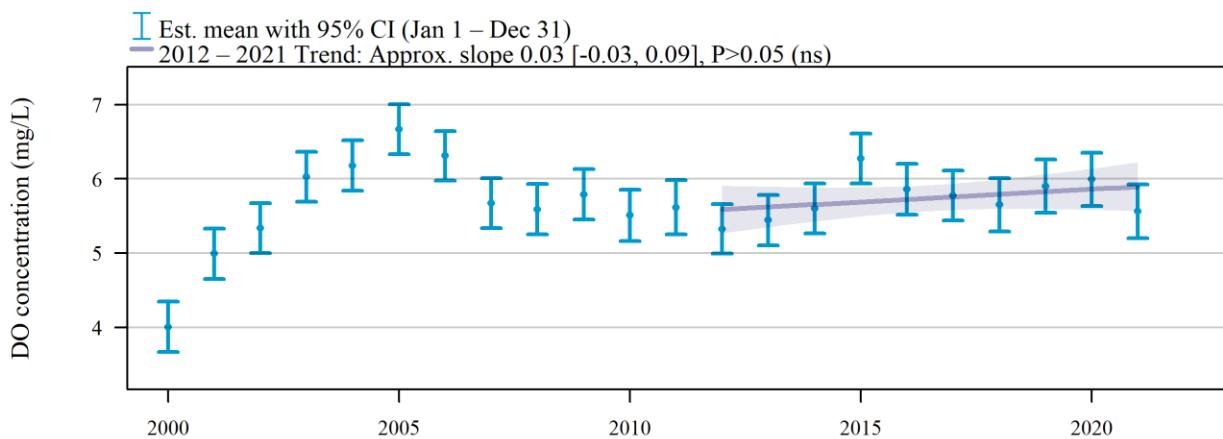
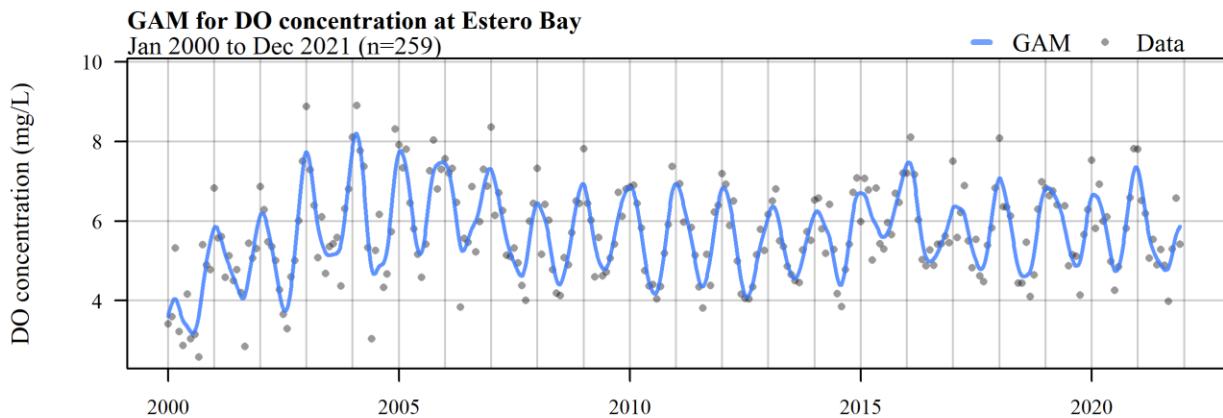


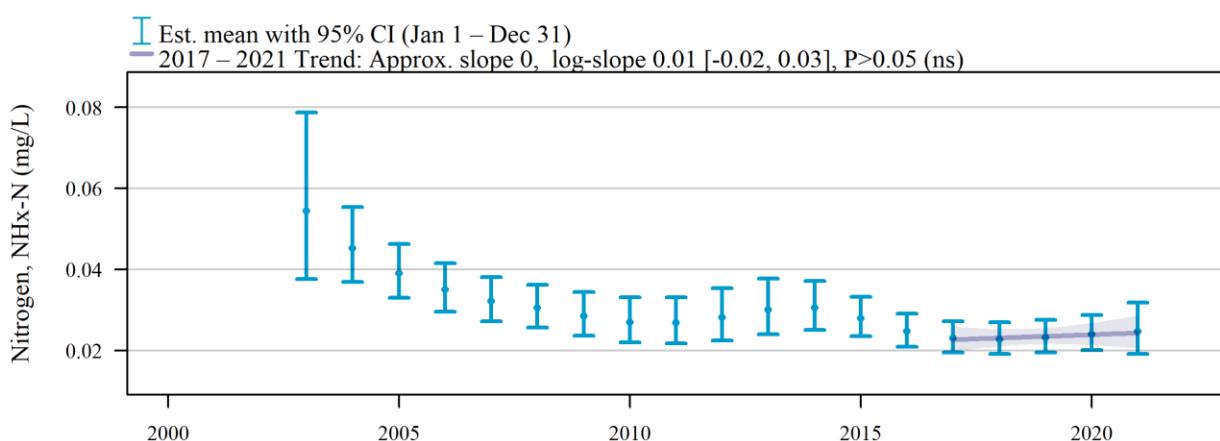
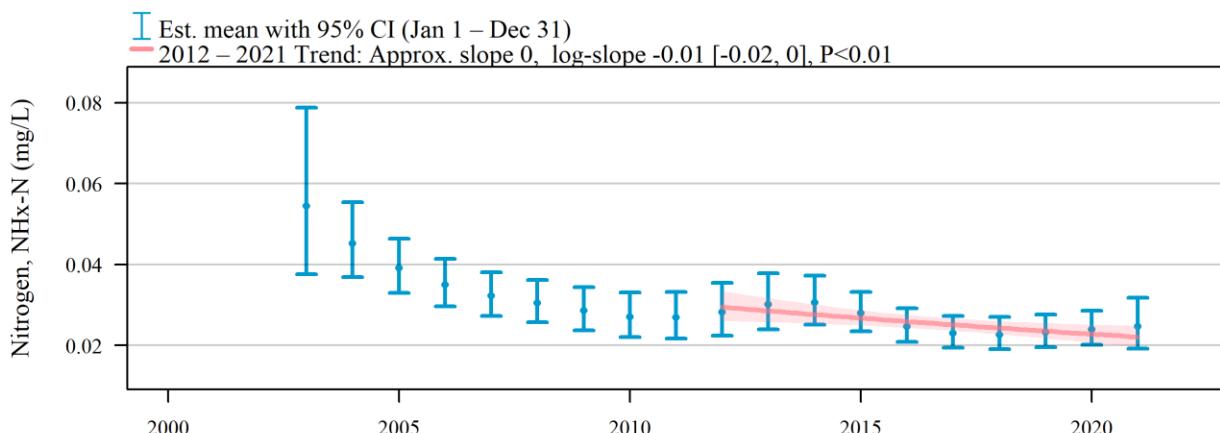
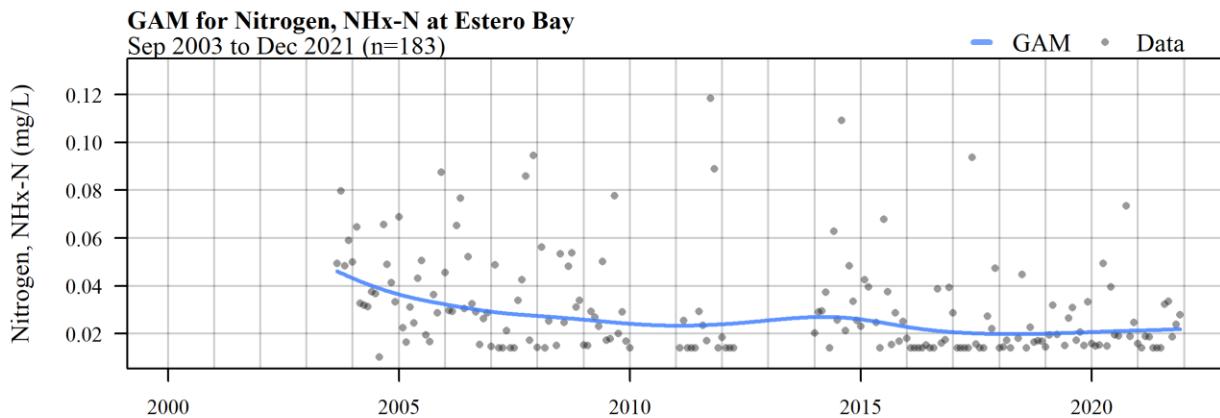


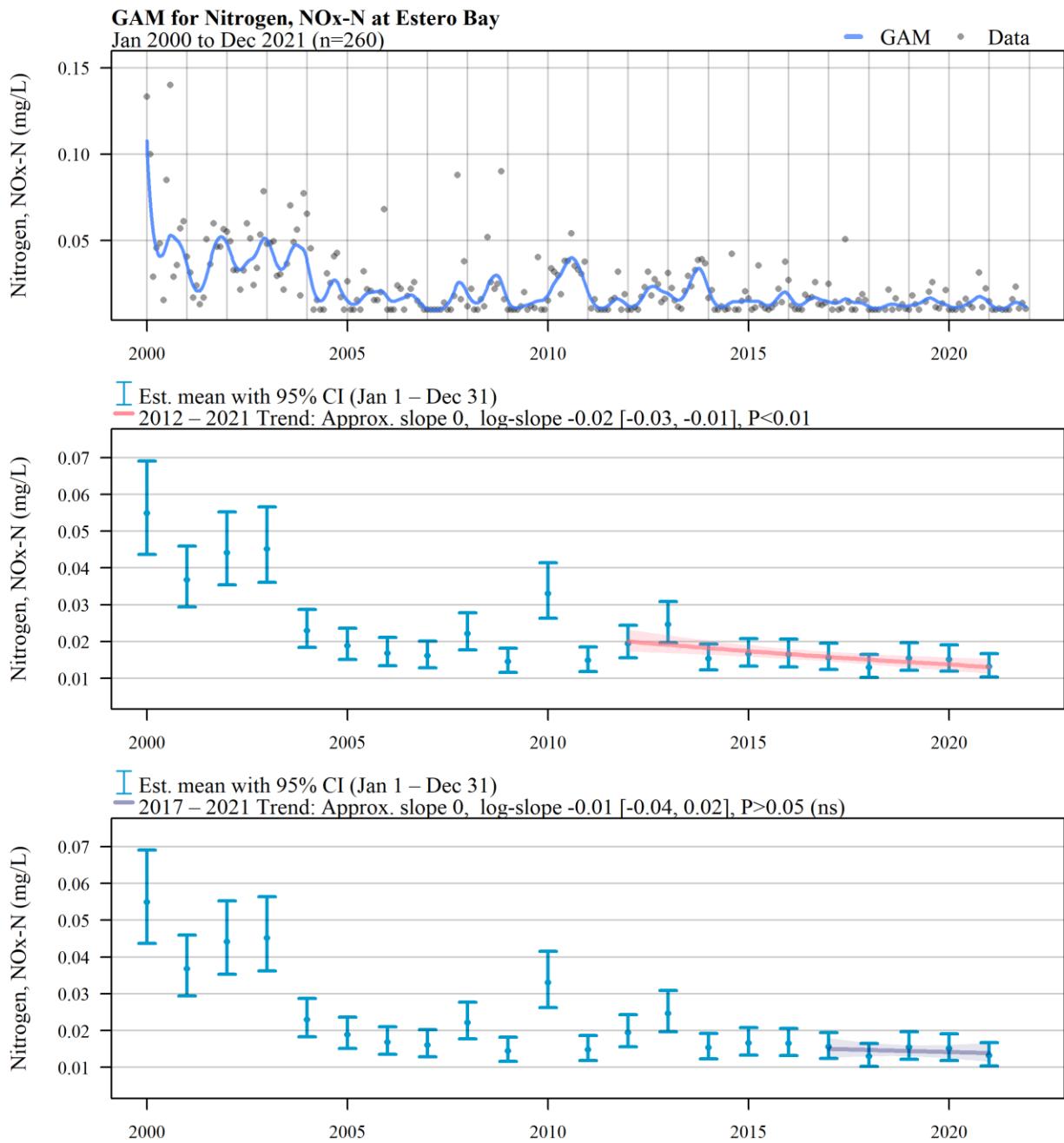
Color, apparent at Estero Bay

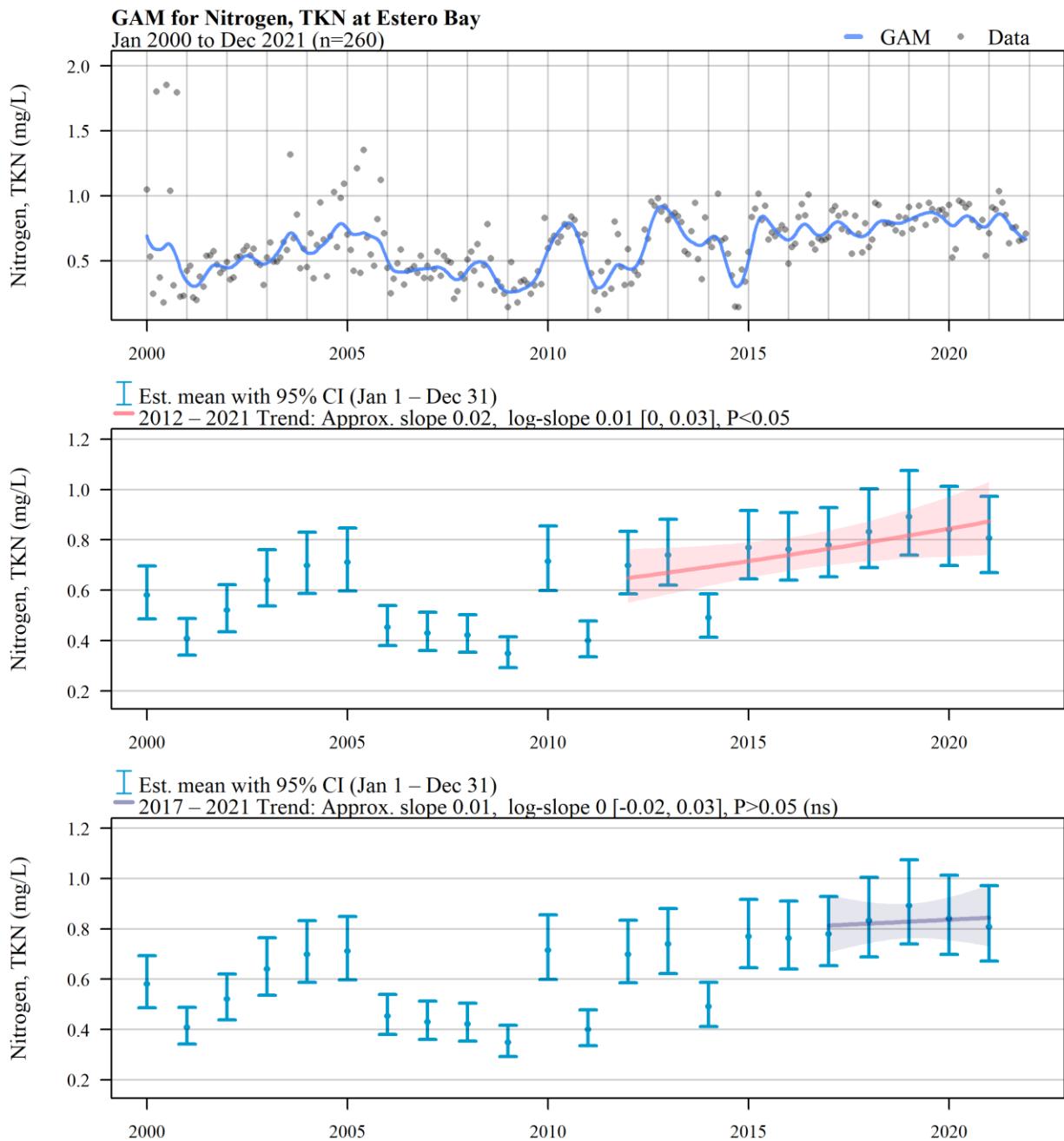
No data
(Jan 2000 to Dec 2021)

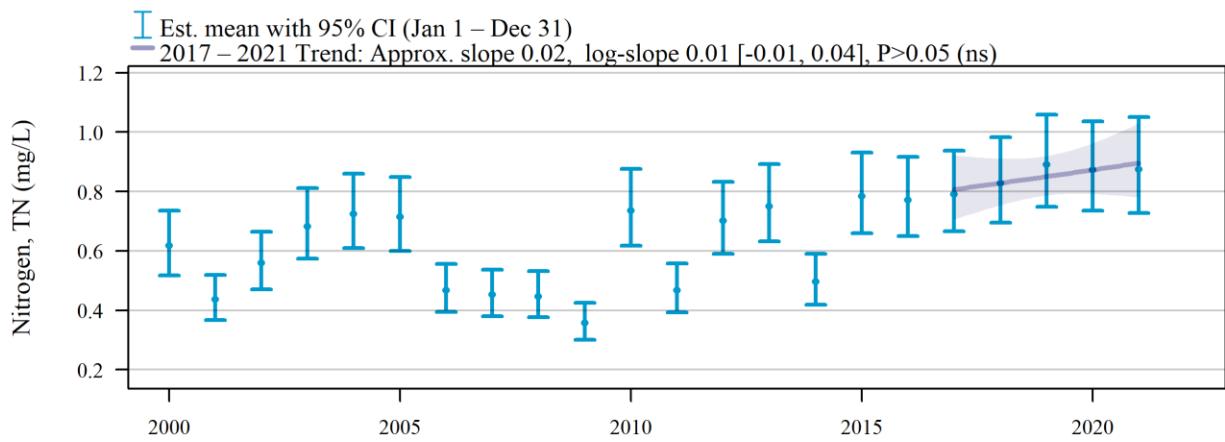
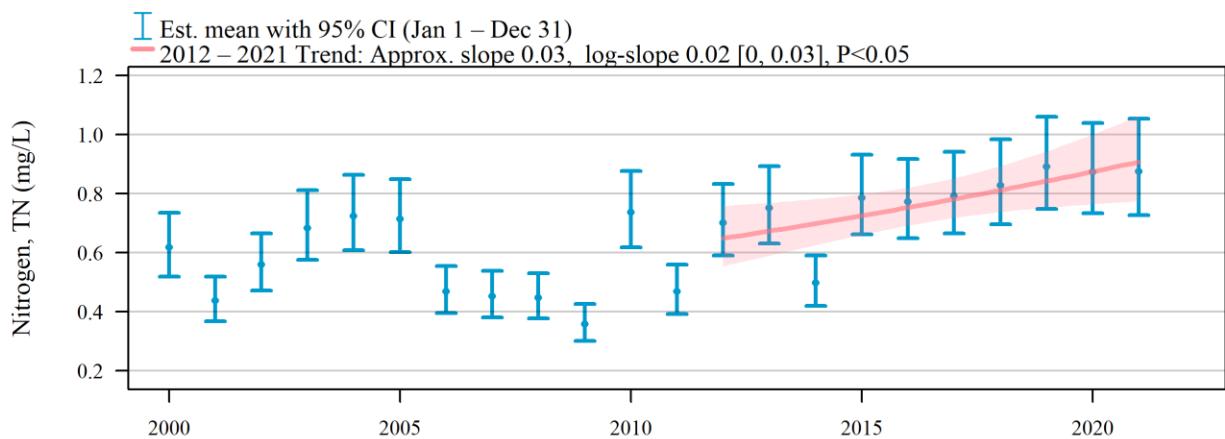
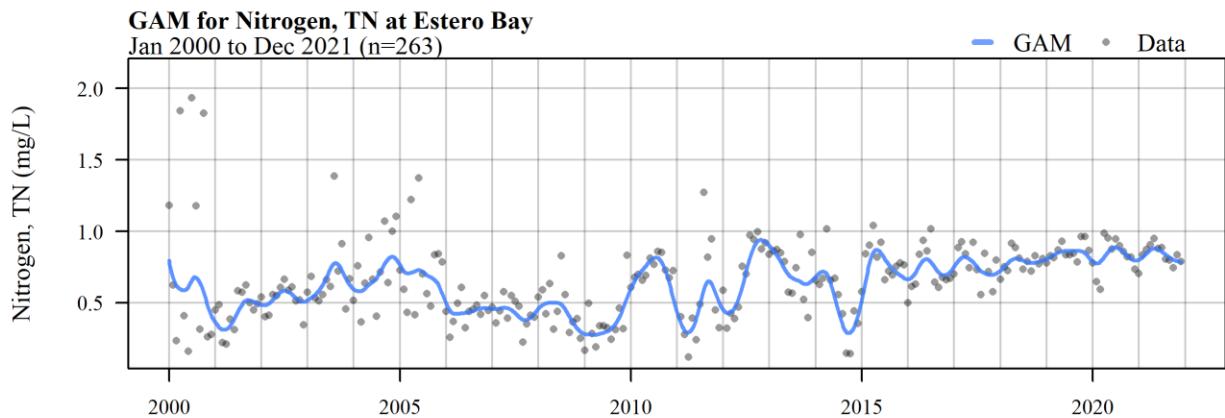
2000 2005 2010 2015 2020

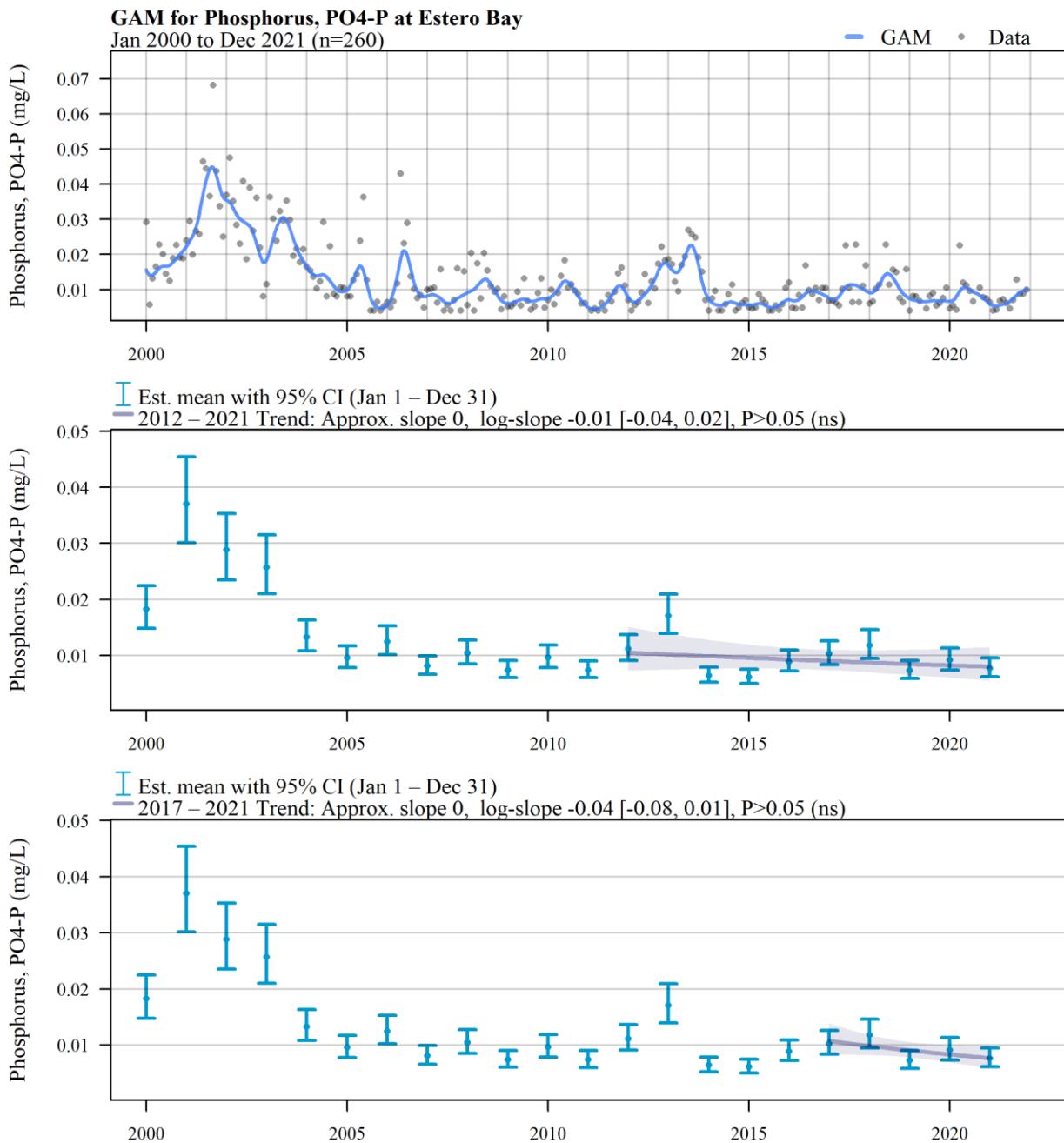


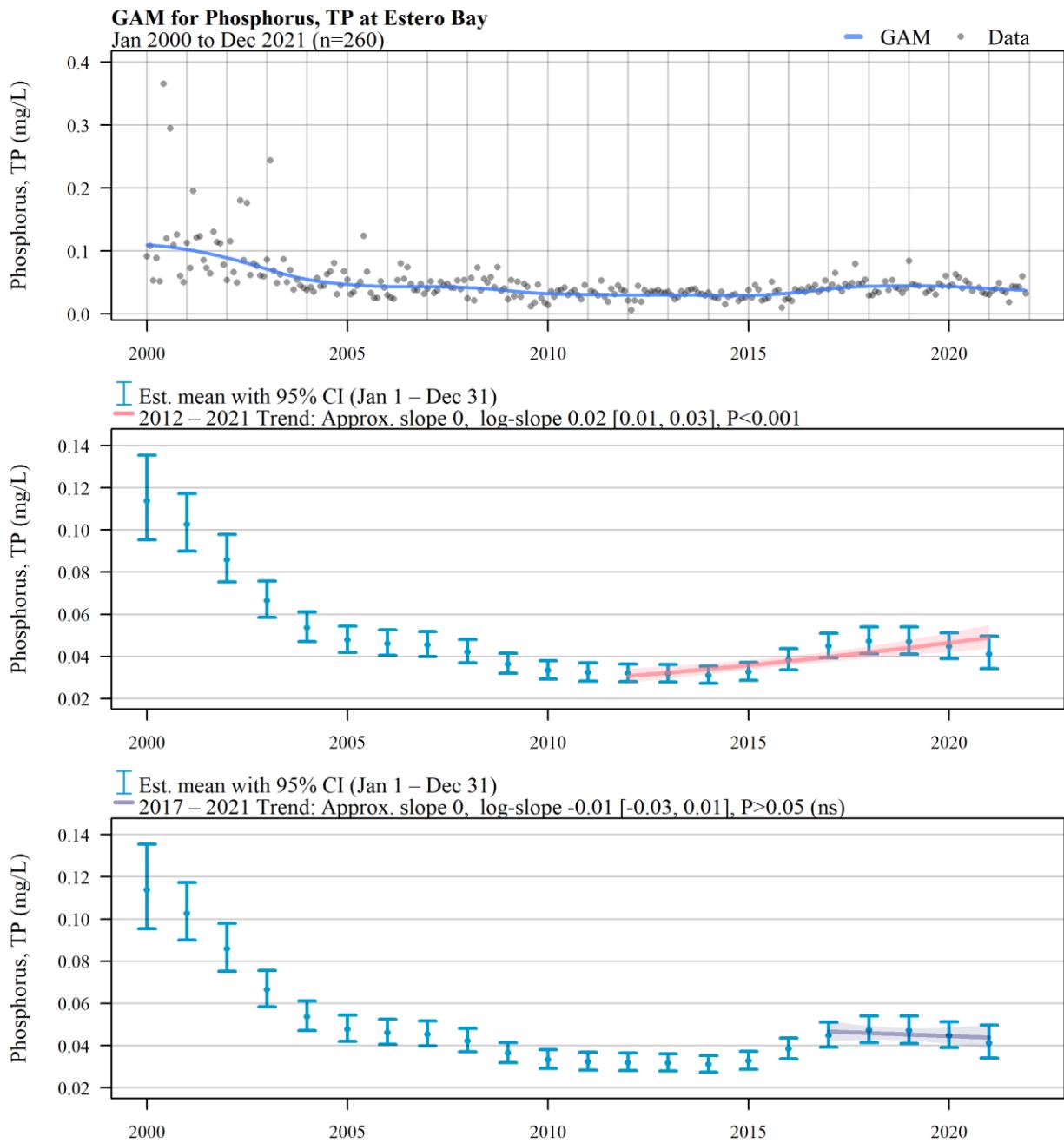


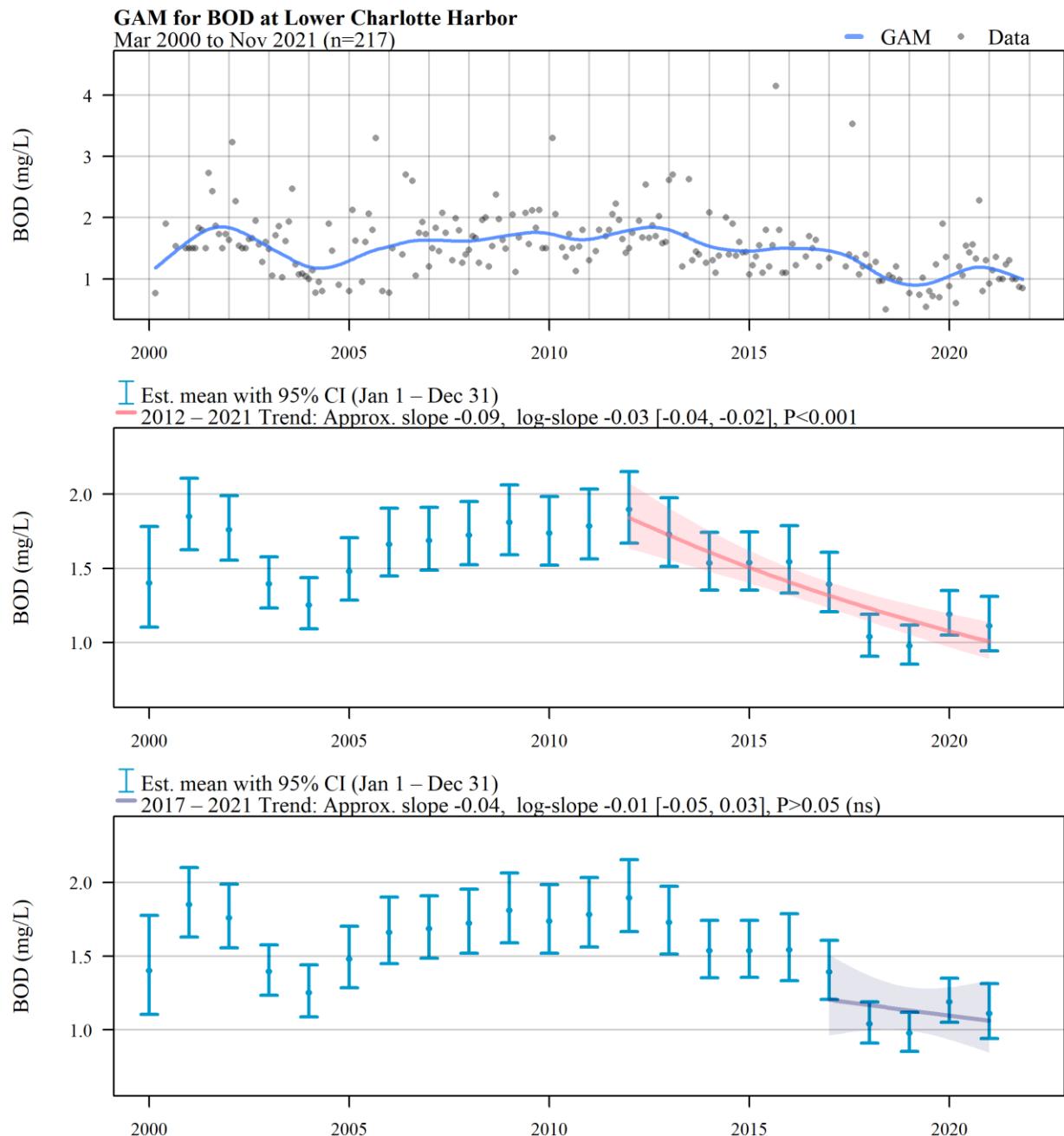


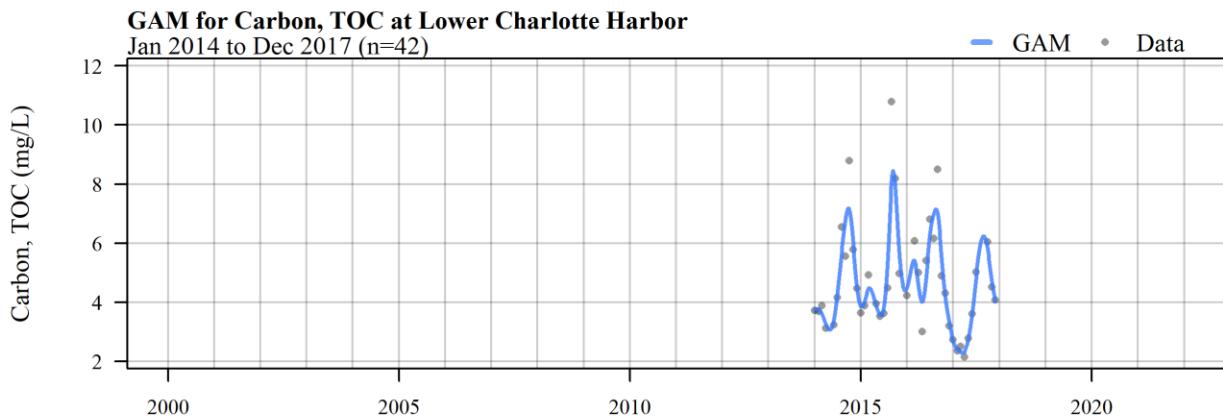


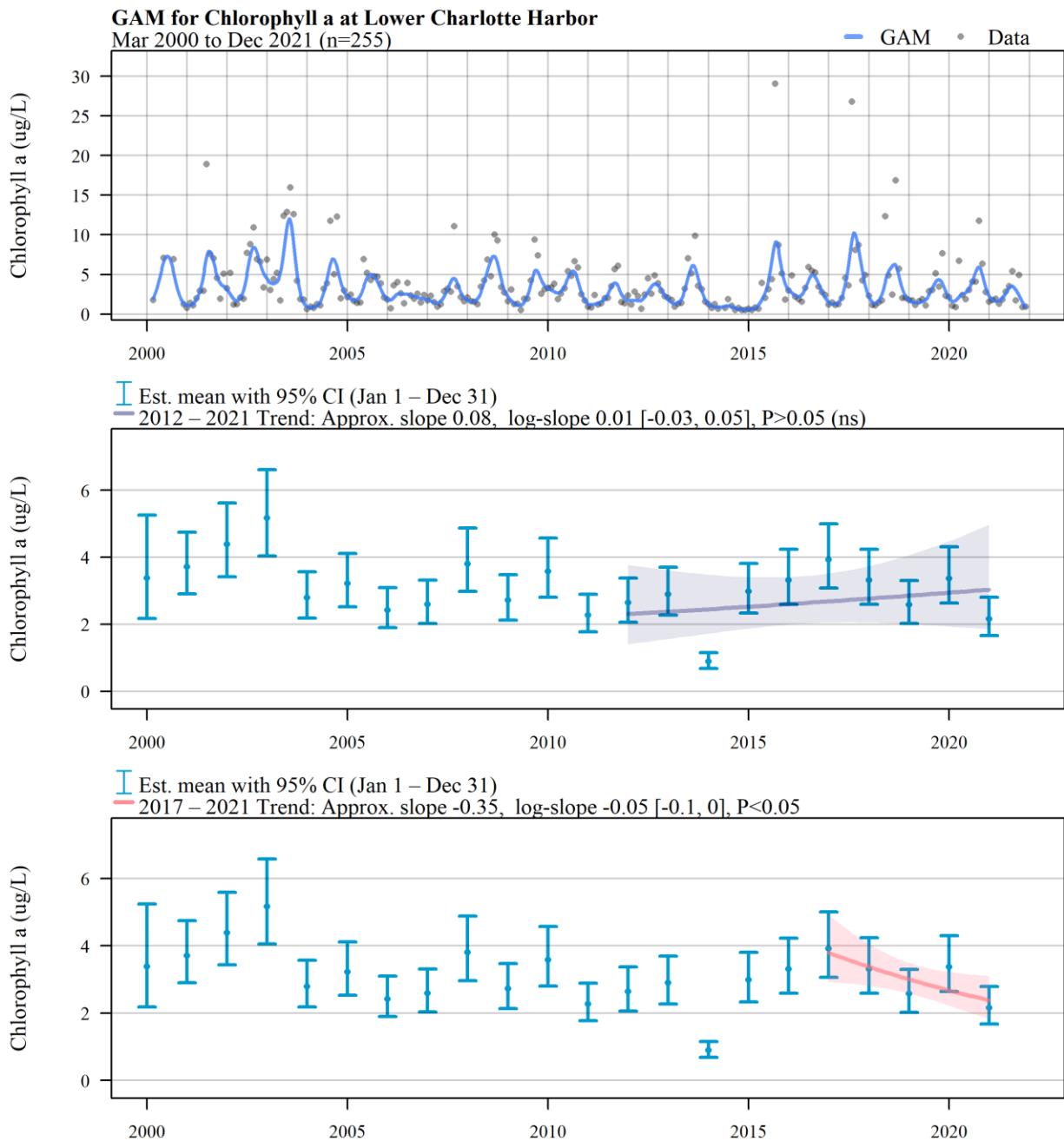


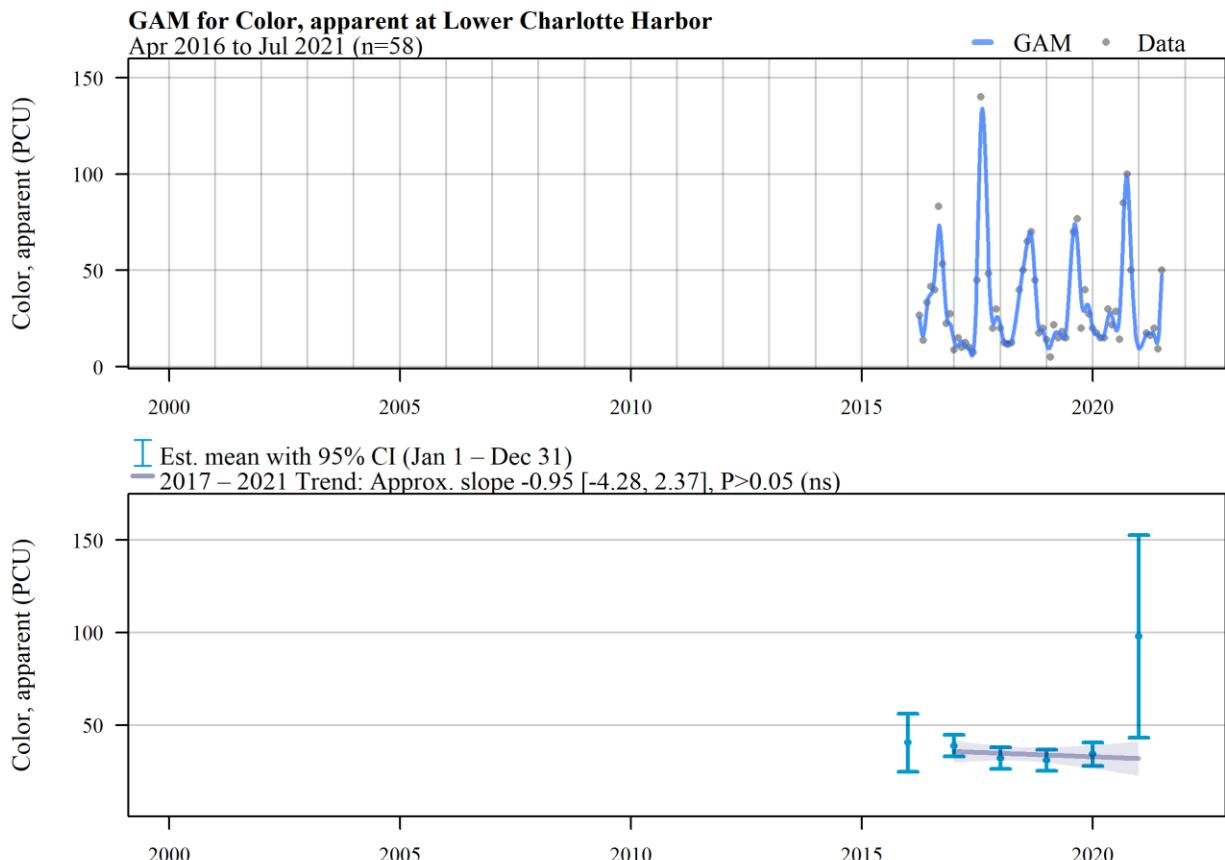




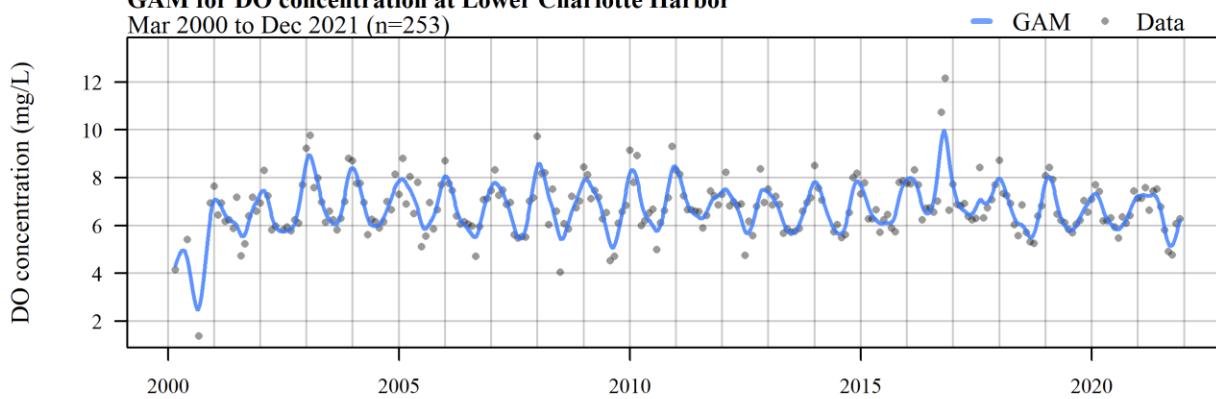




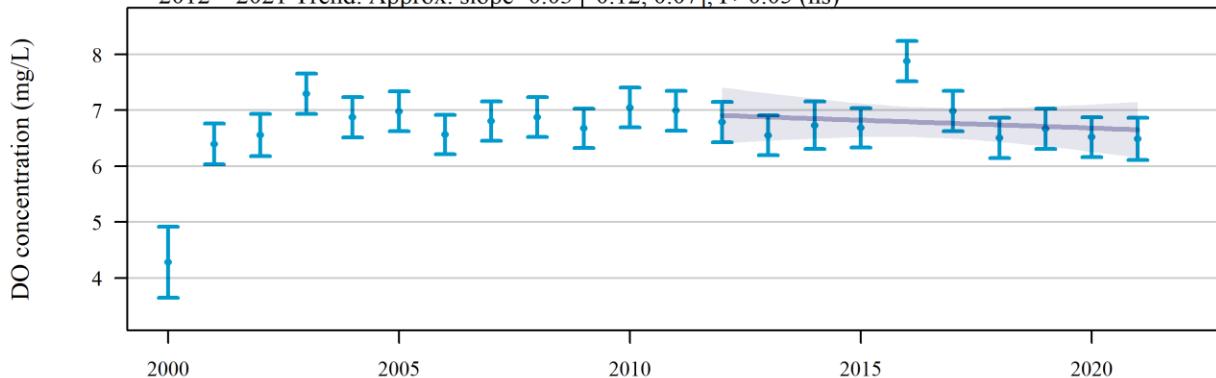




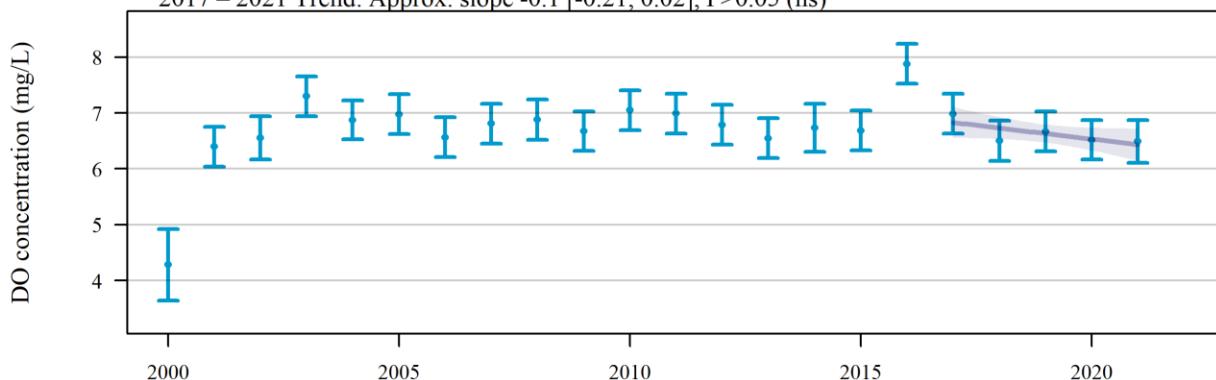
GAM for DO concentration at Lower Charlotte Harbor
Mar 2000 to Dec 2021 (n=253)

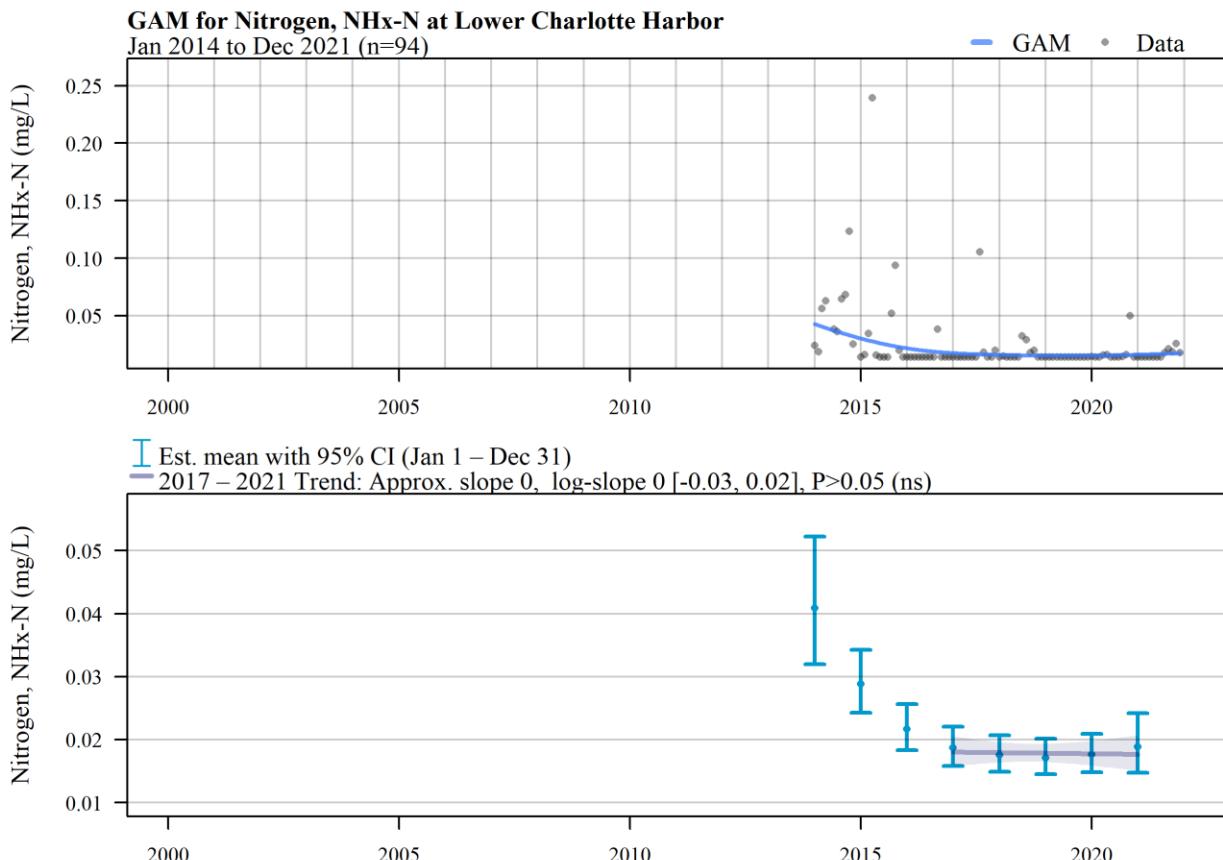


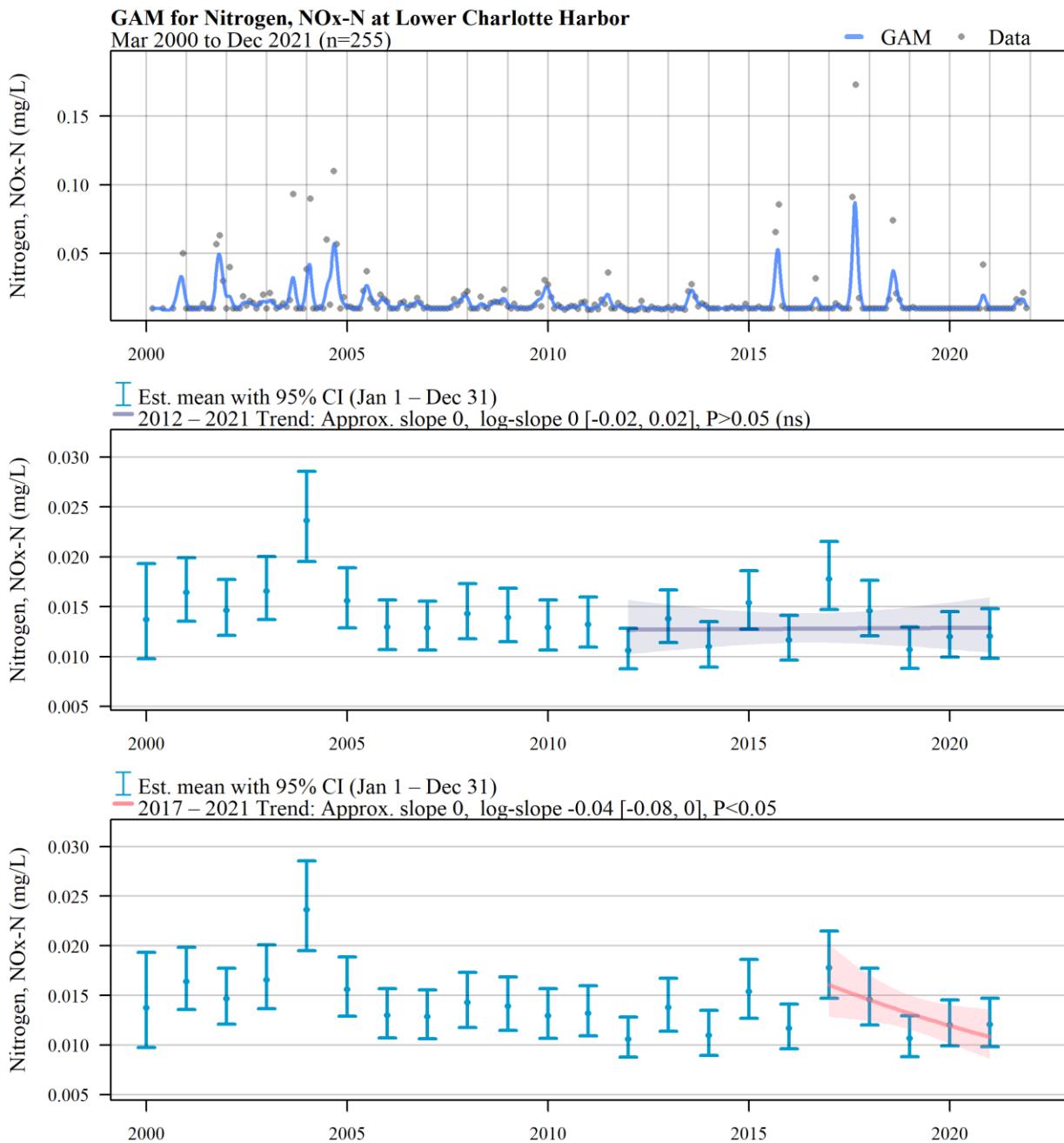
Est. mean with 95% CI (Jan 1 – Dec 31)
2012 – 2021 Trend: Approx. slope -0.03 [-0.12, 0.07], P>0.05 (ns)



Est. mean with 95% CI (Jan 1 – Dec 31)
2017 – 2021 Trend: Approx. slope -0.1 [-0.21, 0.02], P>0.05 (ns)

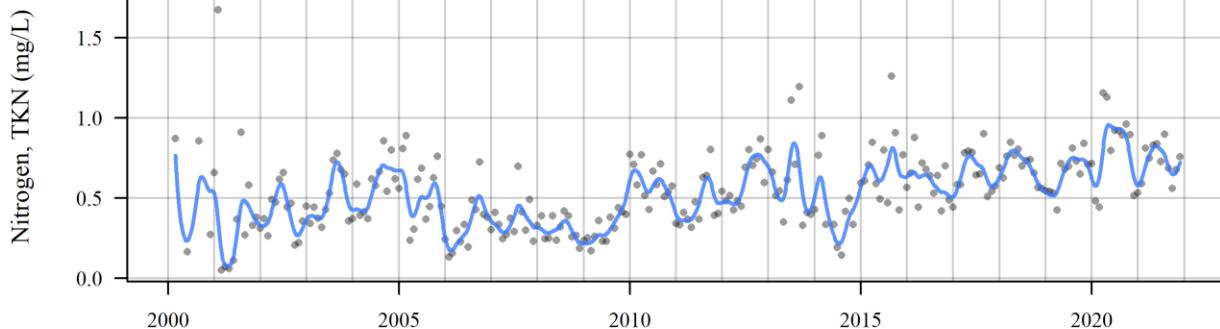




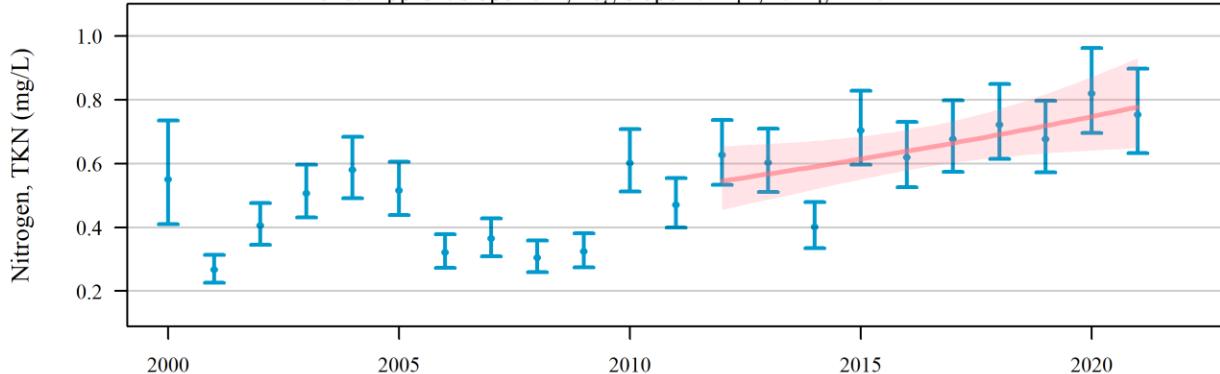


GAM for Nitrogen, TKN at Lower Charlotte Harbor
Mar 2000 to Dec 2021 (n=254)

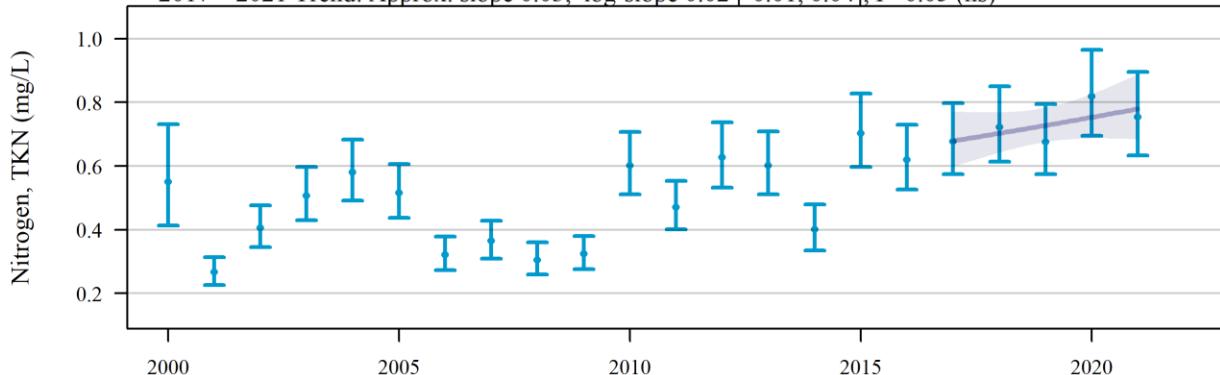
— GAM • Data

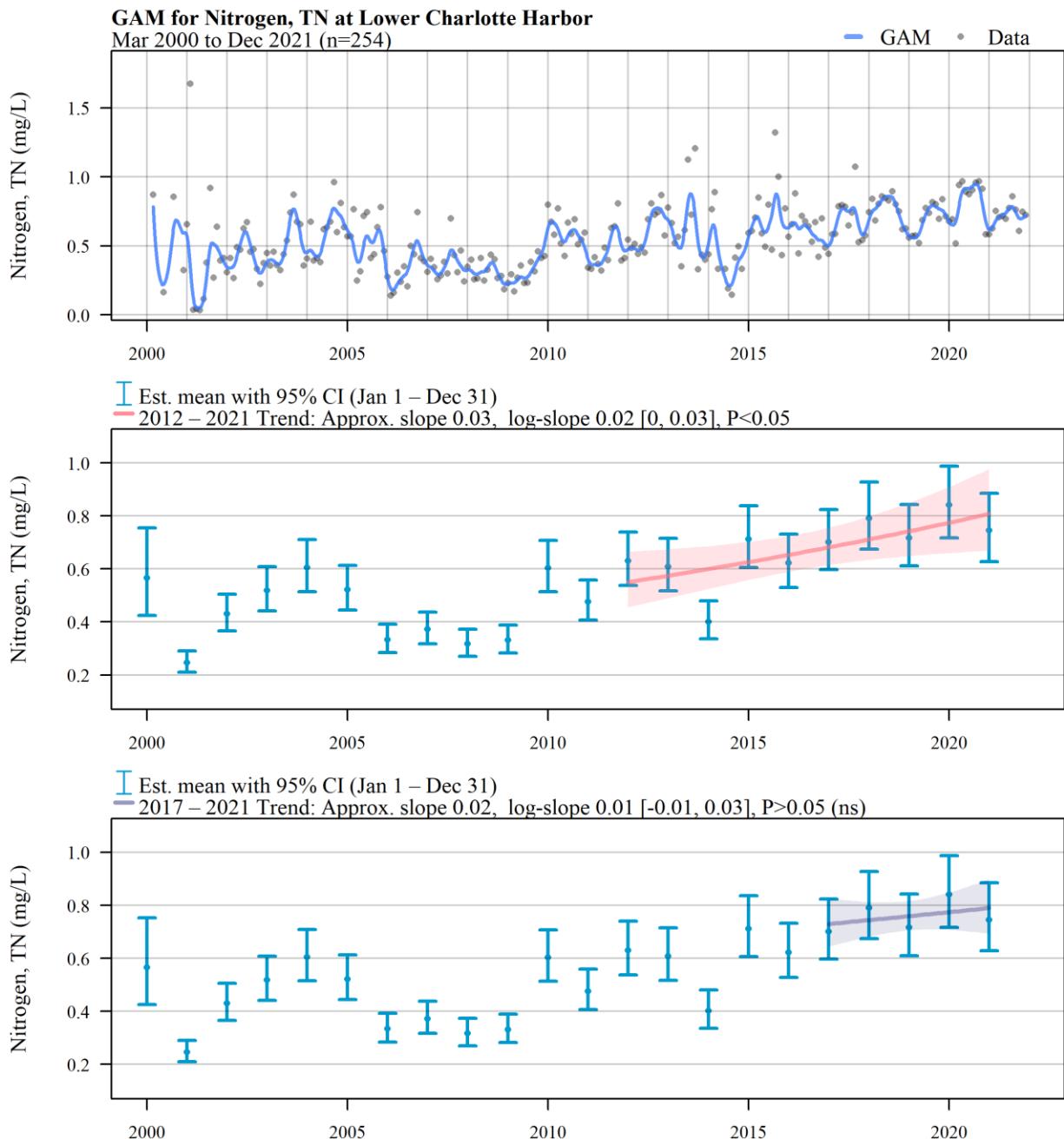


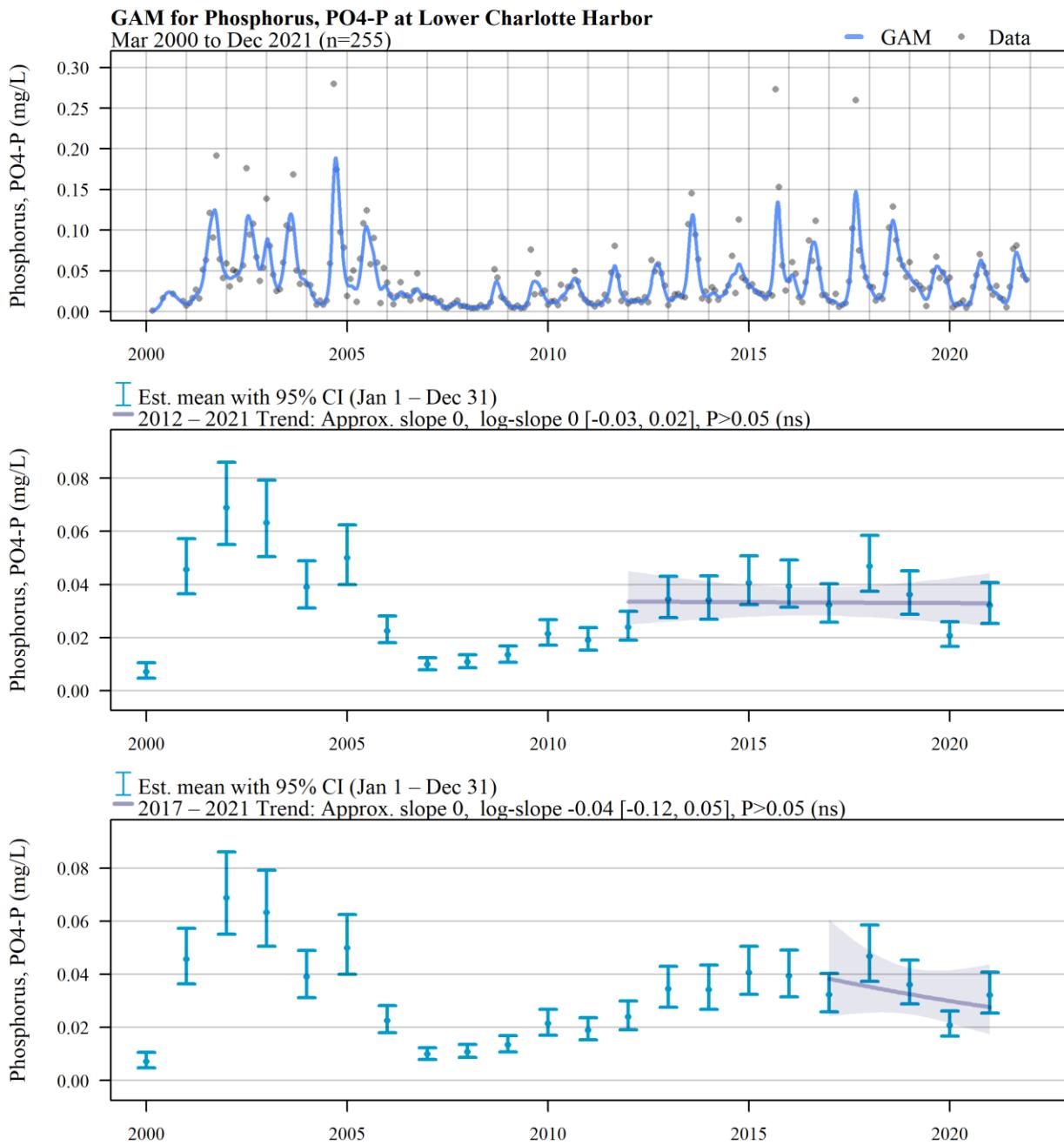
Est. mean with 95% CI (Jan 1 – Dec 31)
2012 – 2021 Trend: Approx. slope 0.03, log-slope 0.02 [0, 0.03], P<0.05

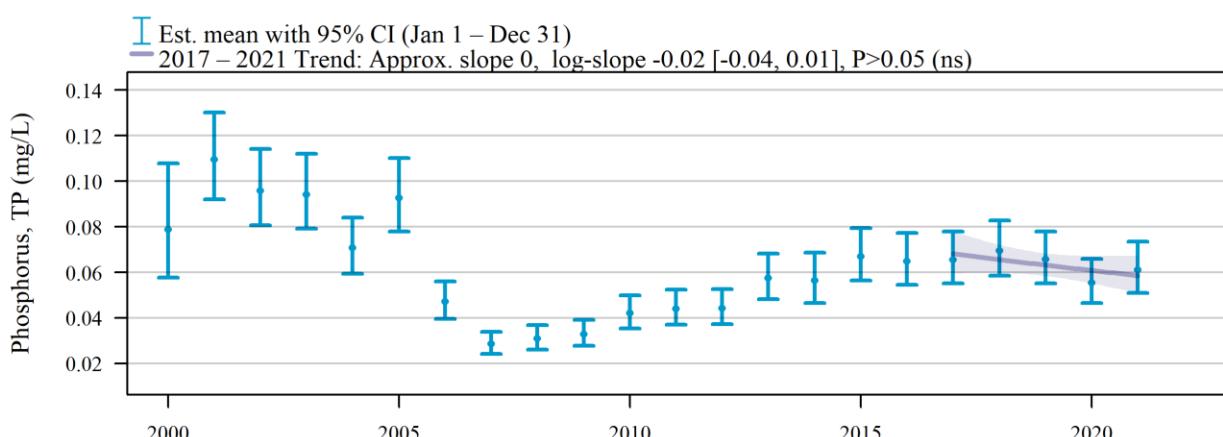
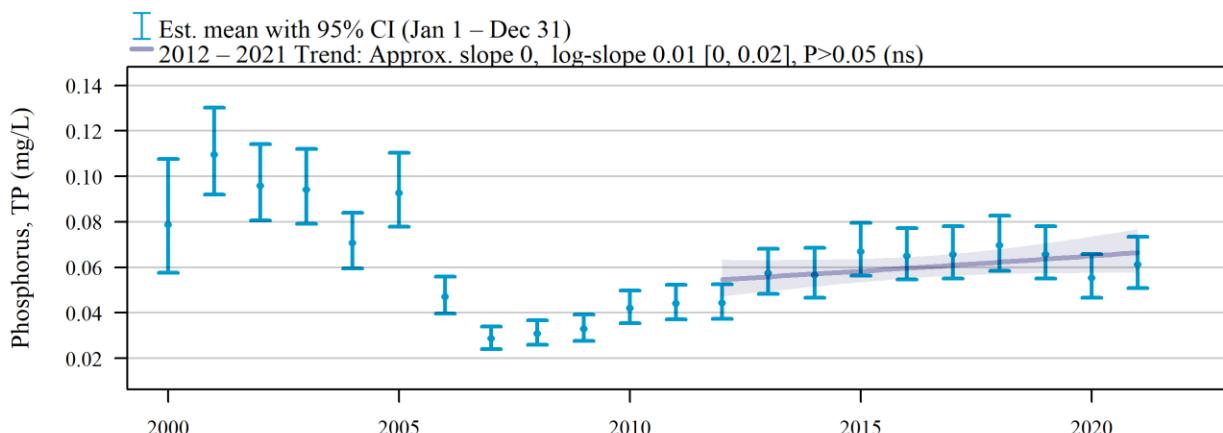
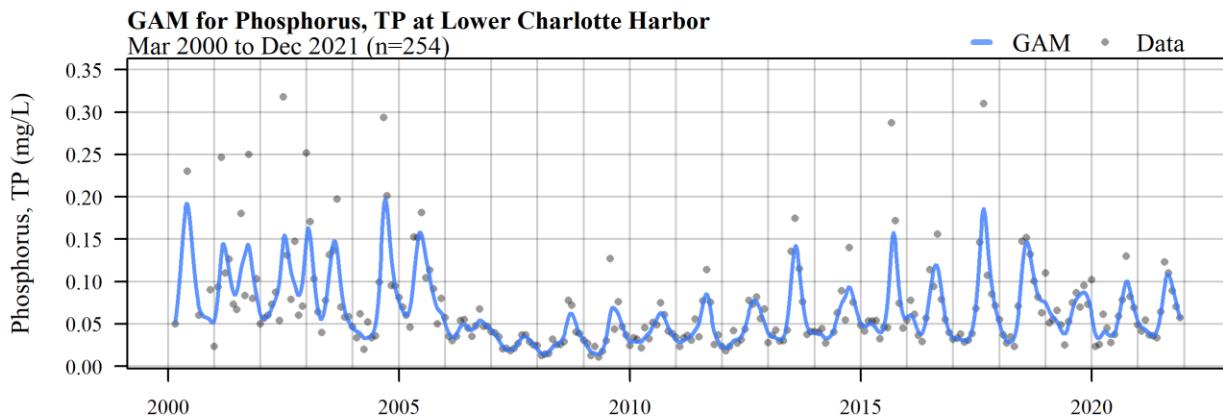


Est. mean with 95% CI (Jan 1 – Dec 31)
2017 – 2021 Trend: Approx. slope 0.03, log-slope 0.02 [-0.01, 0.04], P>0.05 (ns)





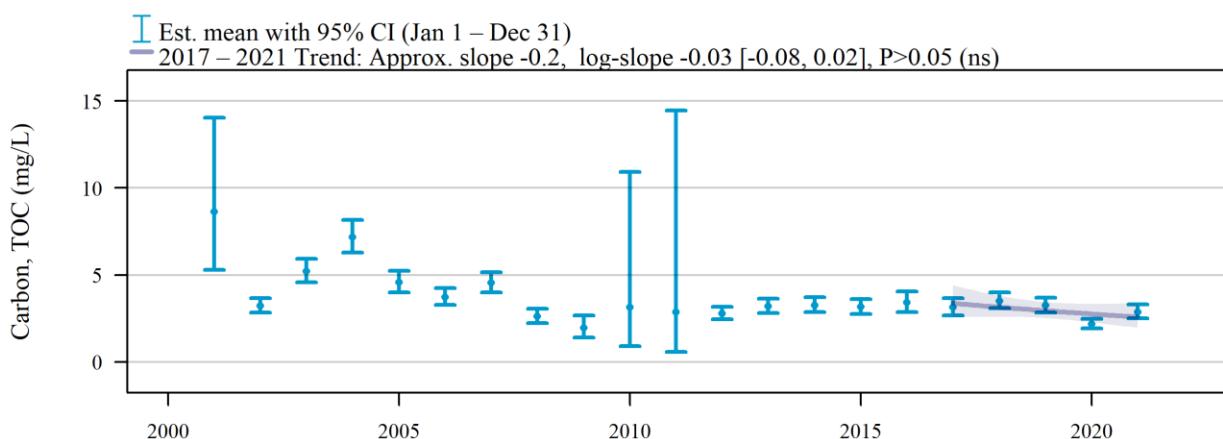
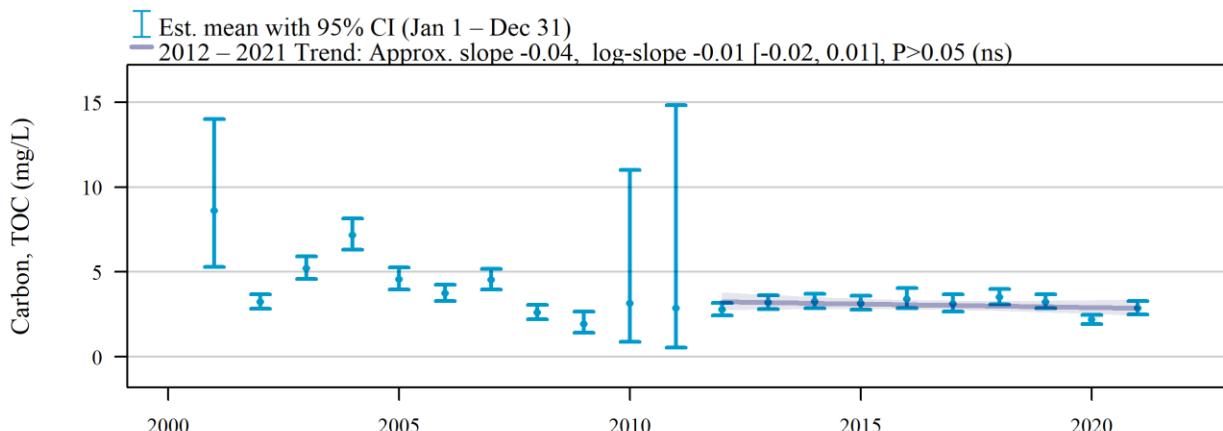
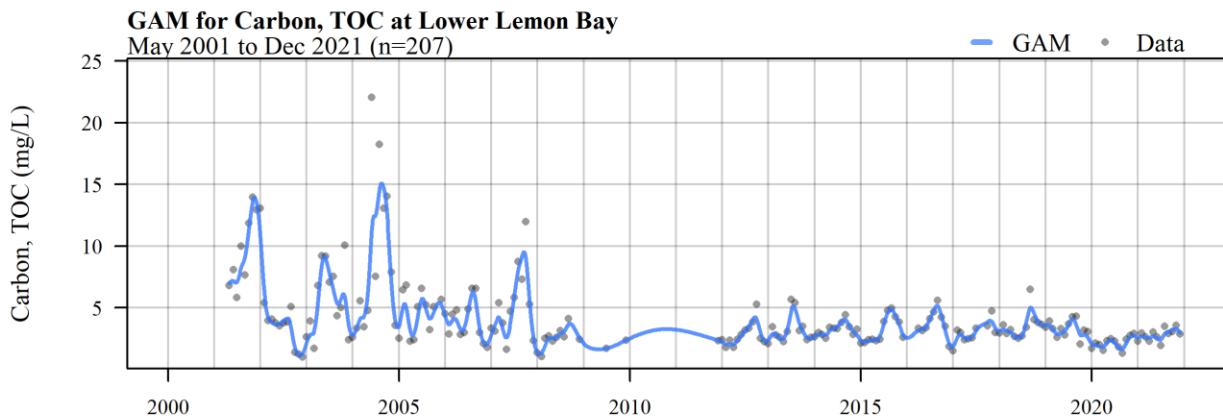


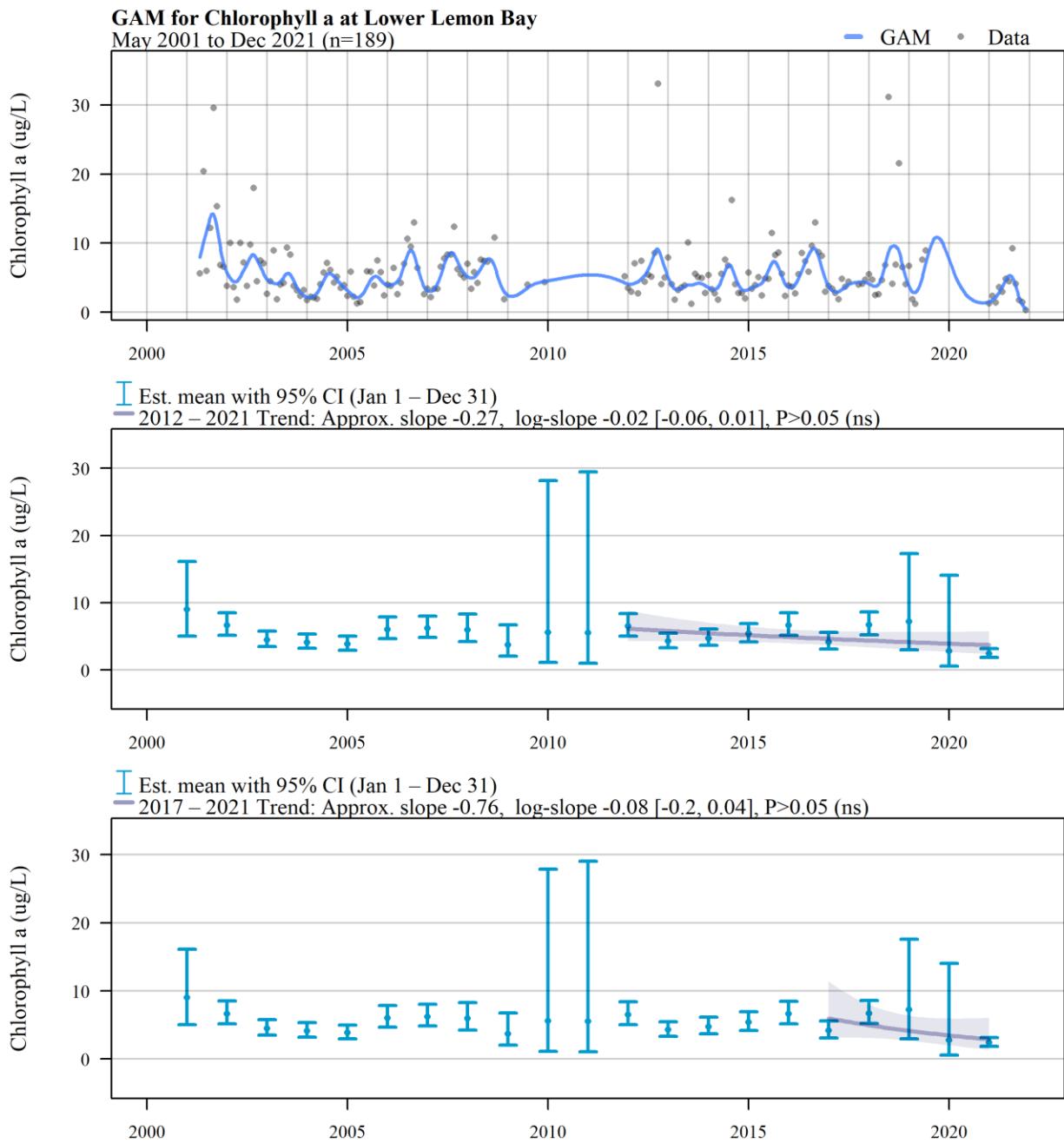


BOD at Lower Lemon Bay

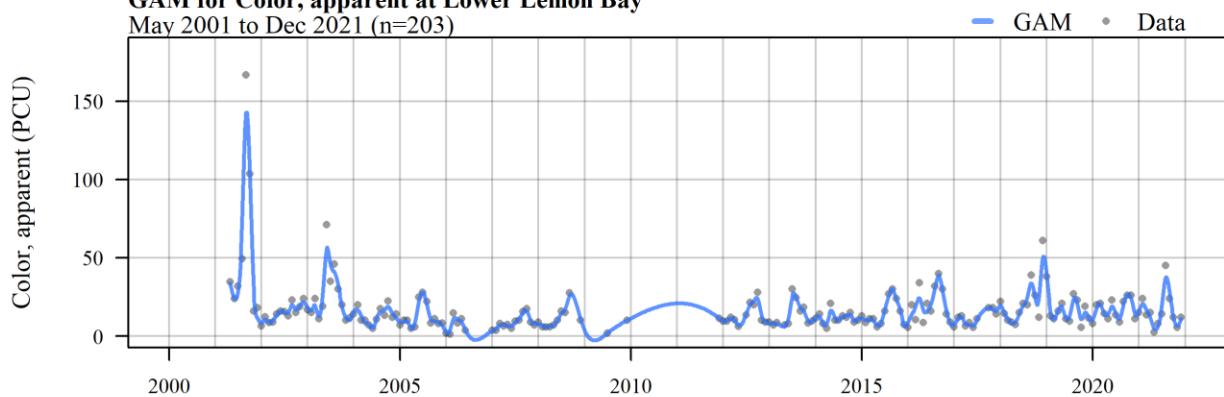
No data
(Jan 2000 to Dec 2021)

2000 2005 2010 2015 2020

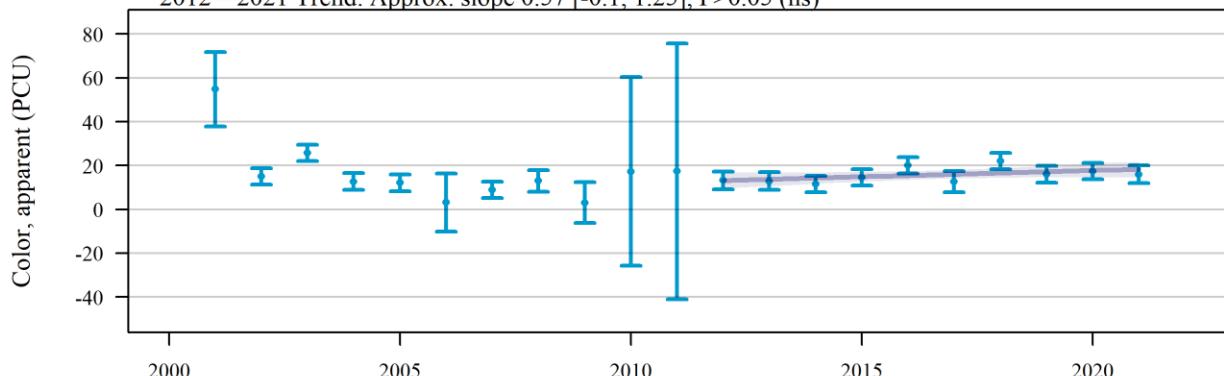




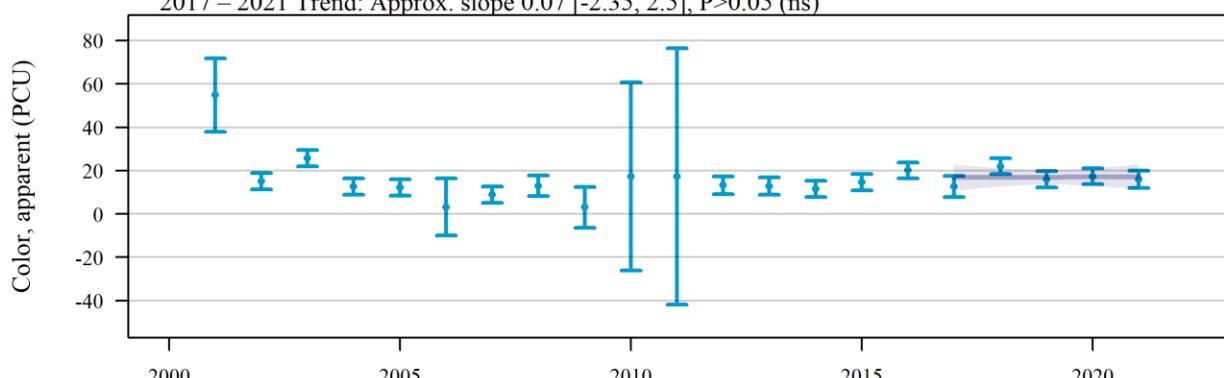
GAM for Color, apparent at Lower Lemon Bay
May 2001 to Dec 2021 (n=203)

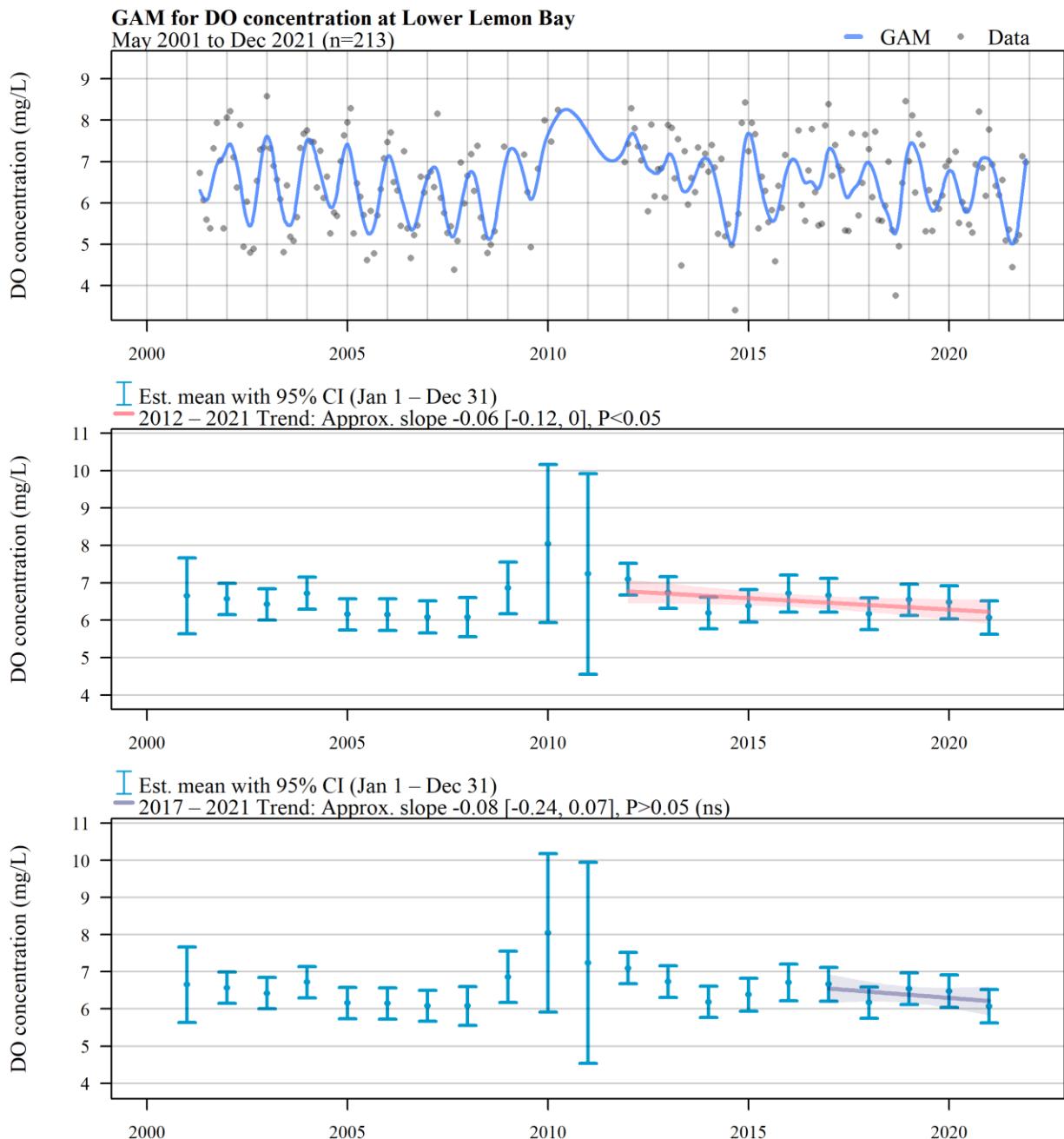


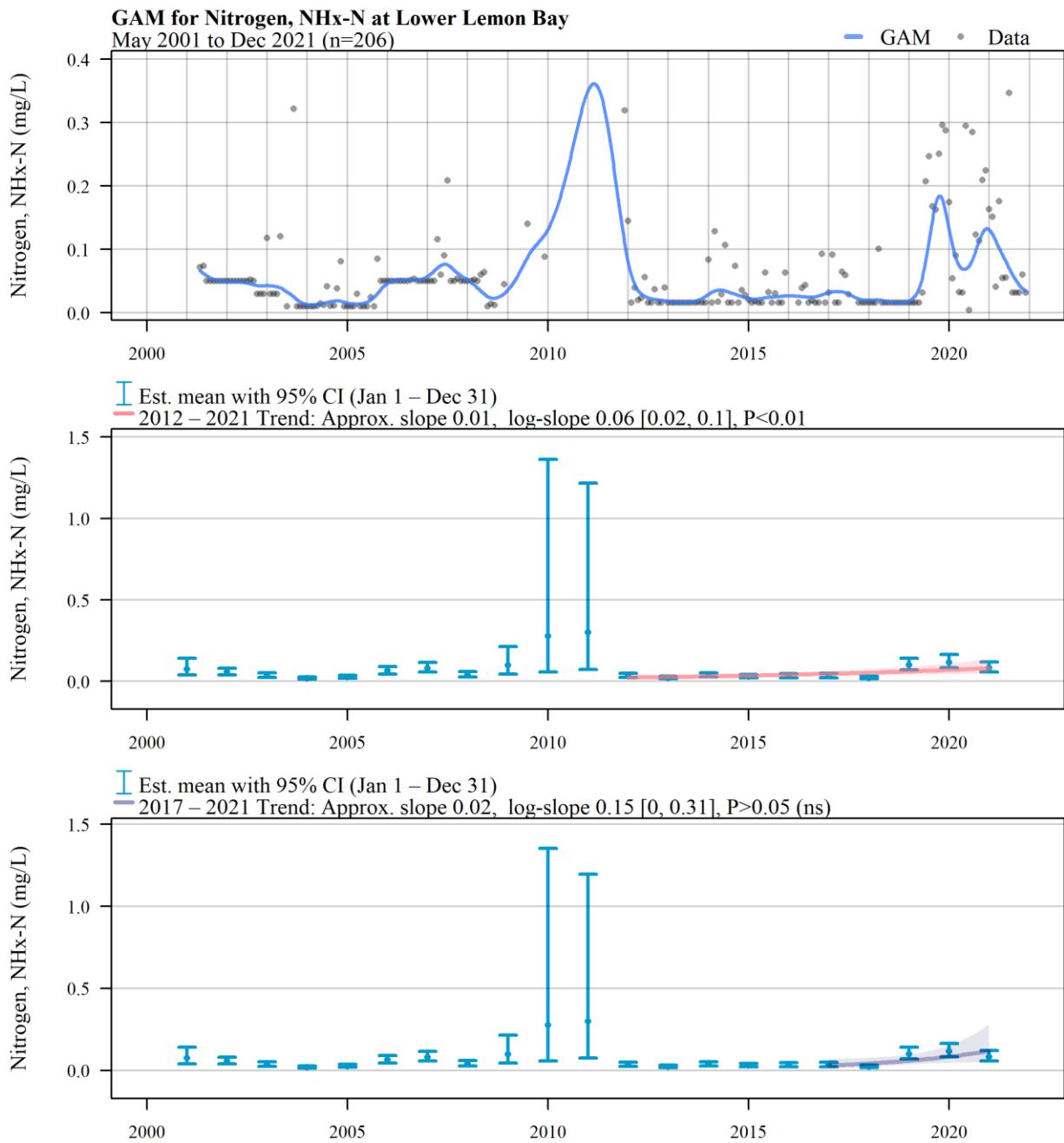
Est. mean with 95% CI (Jan 1 – Dec 31)
2012 – 2021 Trend: Approx. slope 0.57 [-0.1, 1.25], P>0.05 (ns)

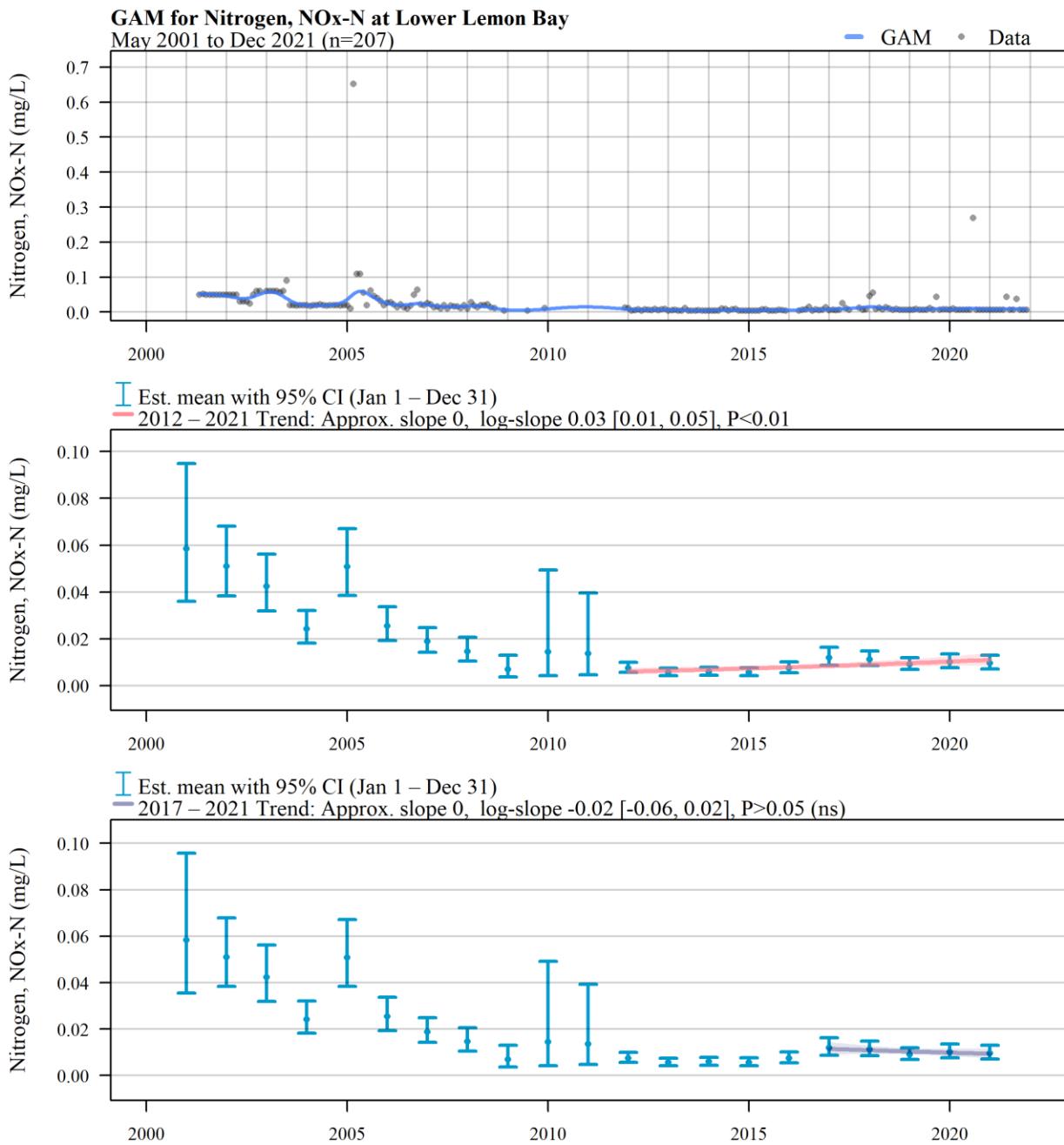


Est. mean with 95% CI (Jan 1 – Dec 31)
2017 – 2021 Trend: Approx. slope 0.07 [-2.35, 2.5], P>0.05 (ns)

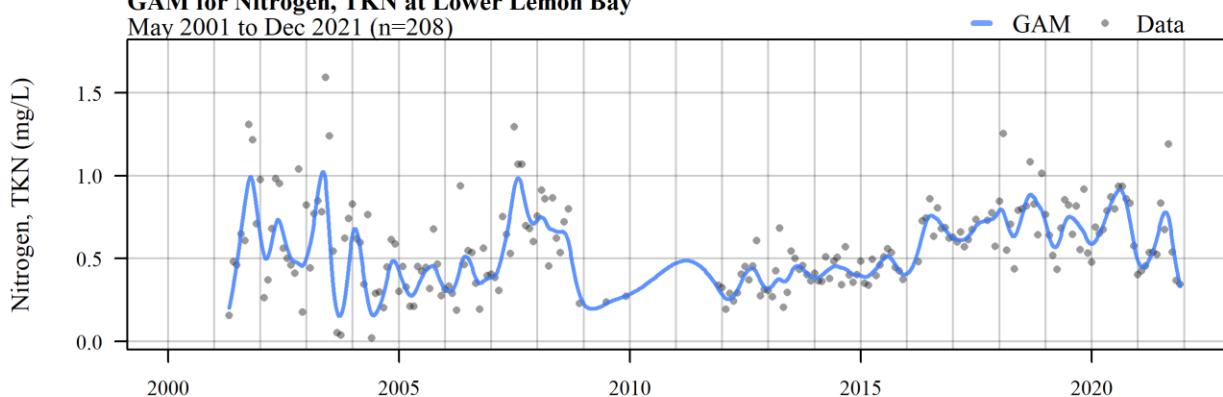




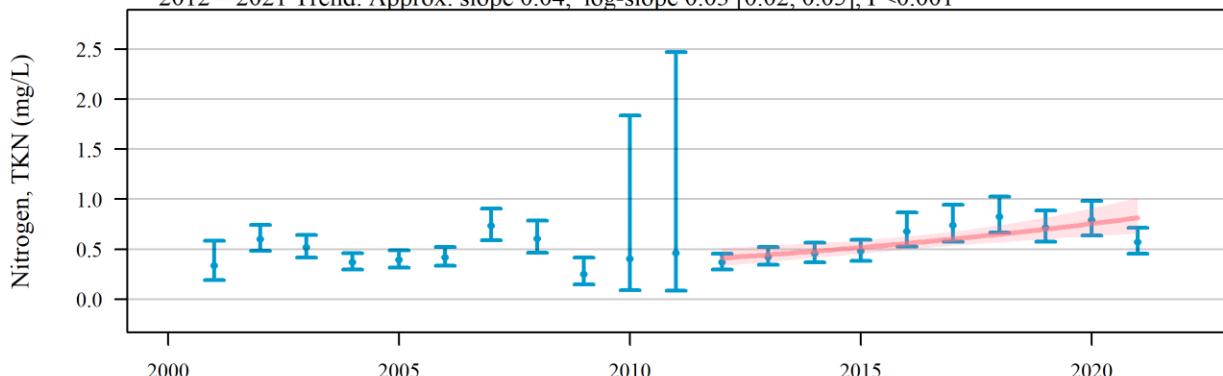




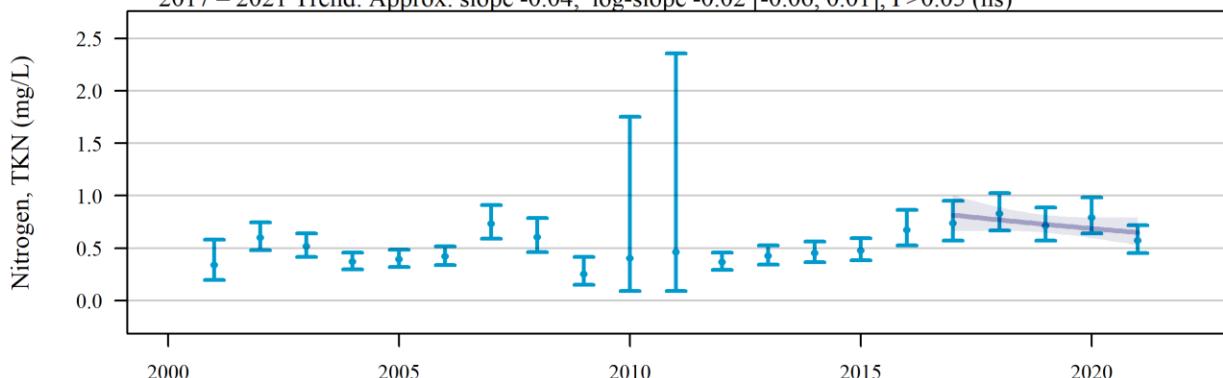
GAM for Nitrogen, TKN at Lower Lemon Bay
May 2001 to Dec 2021 (n=208)

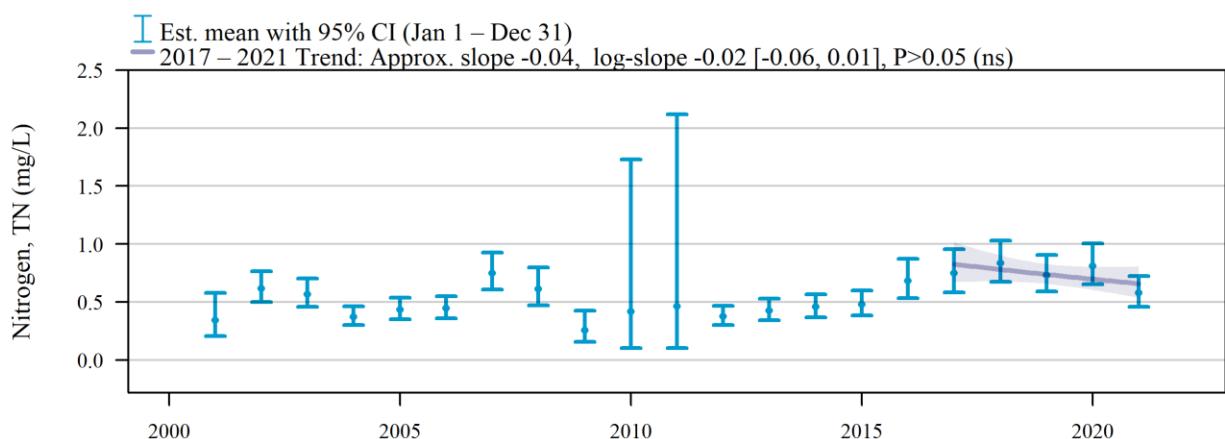
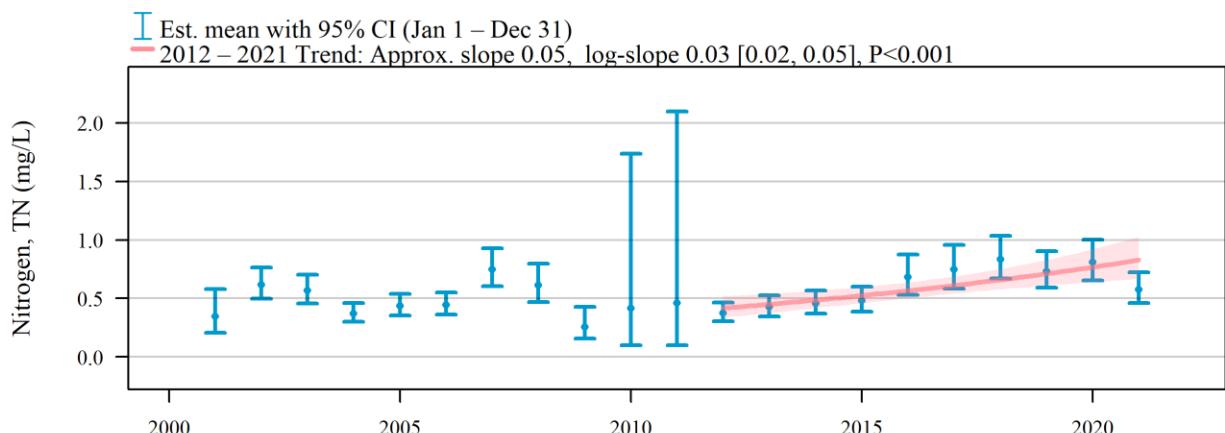
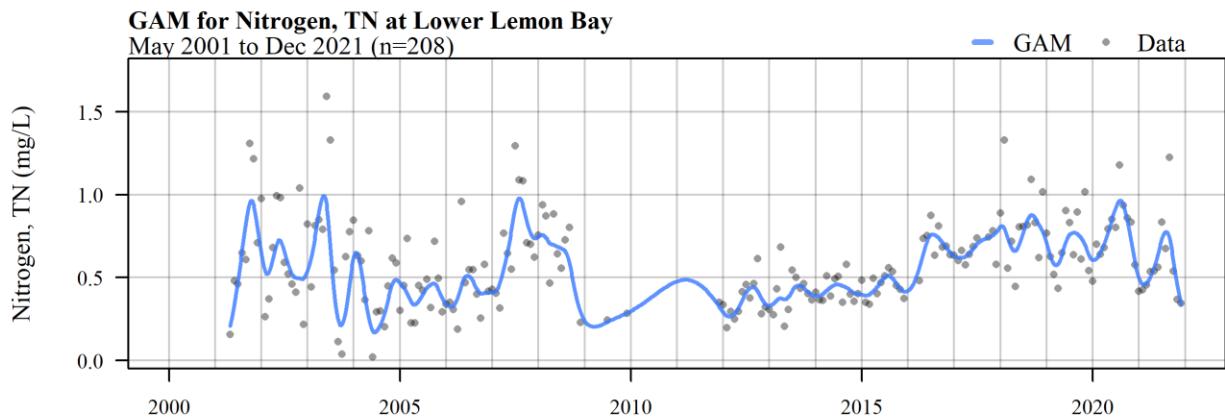


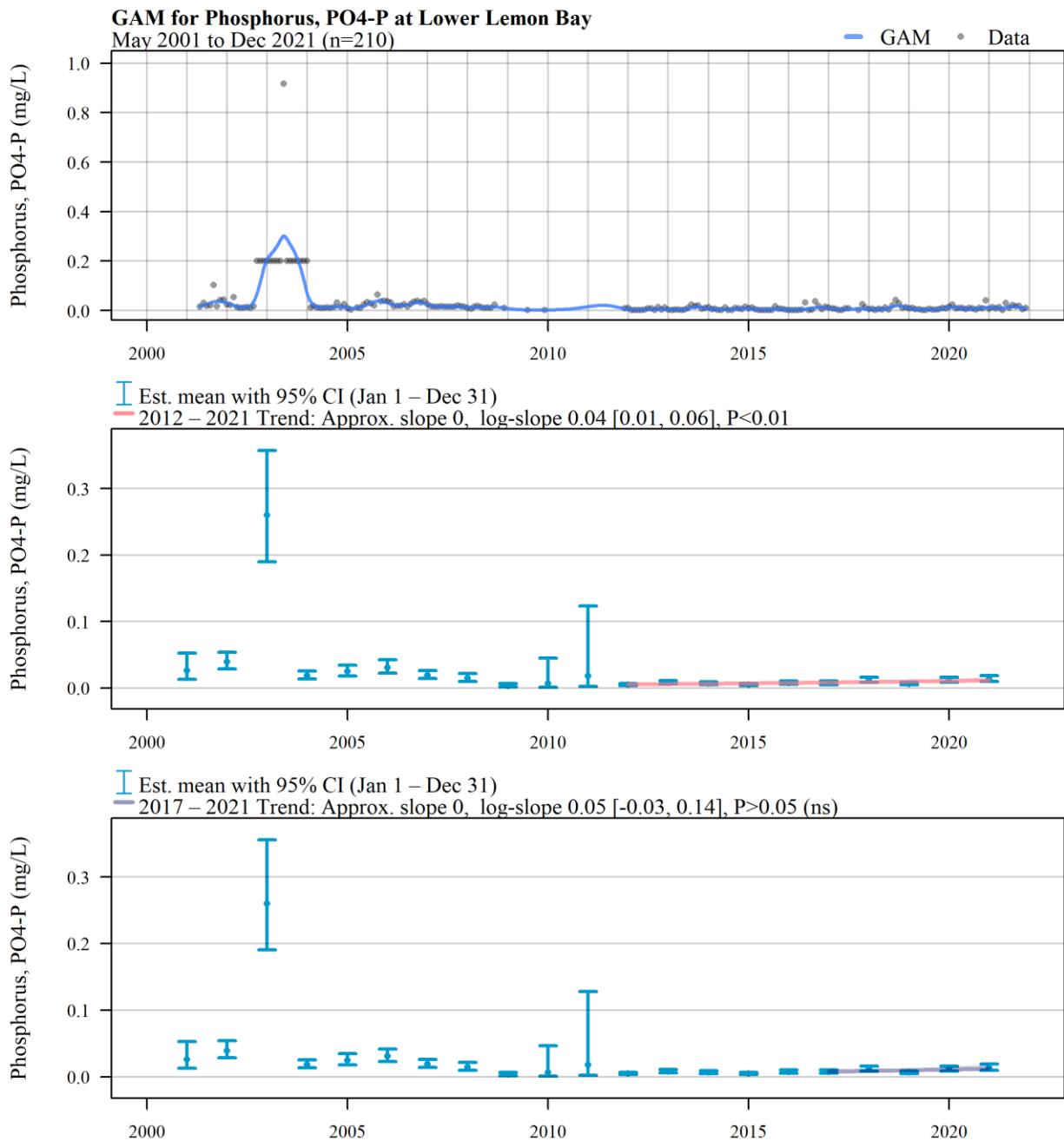
Est. mean with 95% CI (Jan 1 – Dec 31)
2012 – 2021 Trend: Approx. slope 0.04, log-slope 0.03 [0.02, 0.05], P<0.001



Est. mean with 95% CI (Jan 1 – Dec 31)
2017 – 2021 Trend: Approx. slope -0.04, log-slope -0.02 [-0.06, 0.01], P>0.05 (ns)

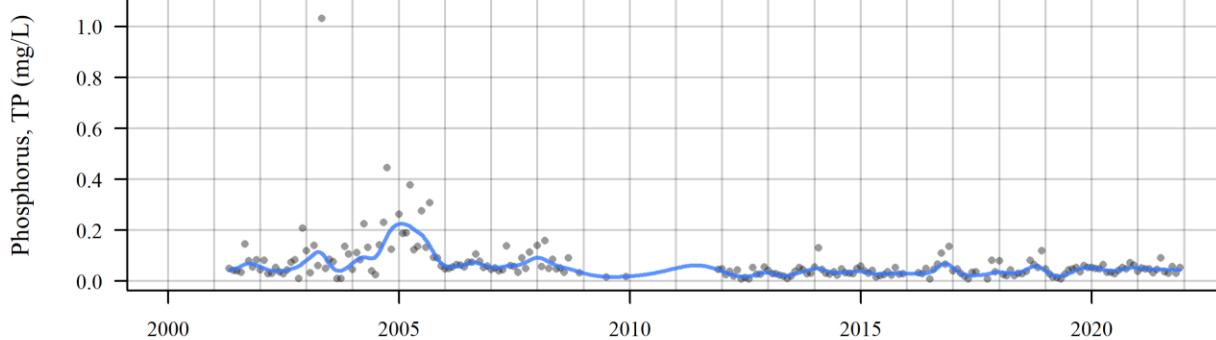




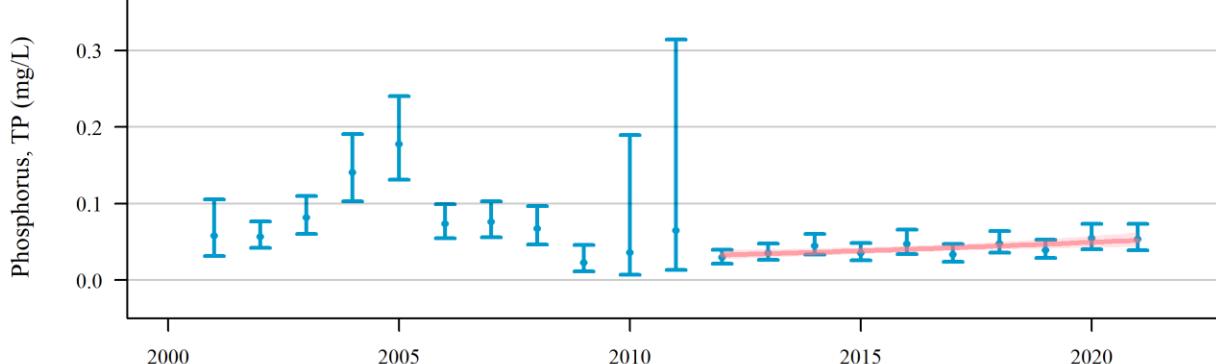


GAM for Phosphorus, TP at Lower Lemon Bay
May 2001 to Dec 2021 (n=206)

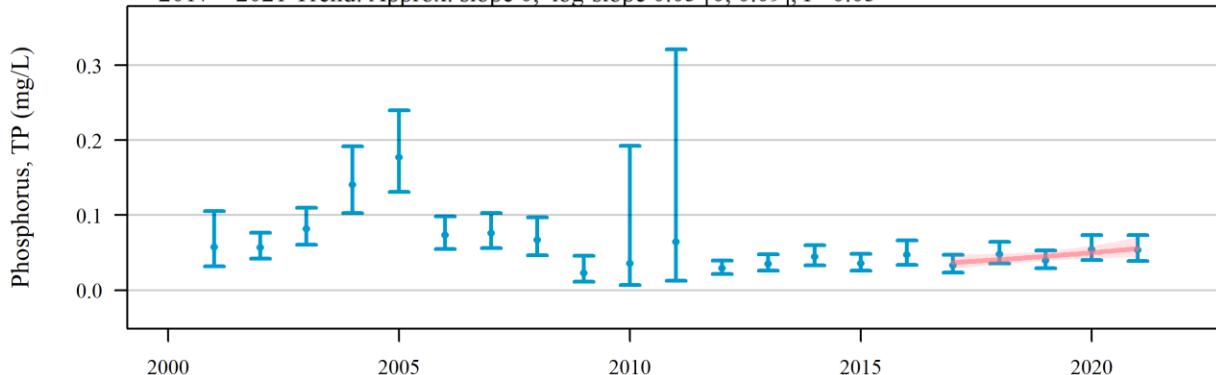
— GAM • Data

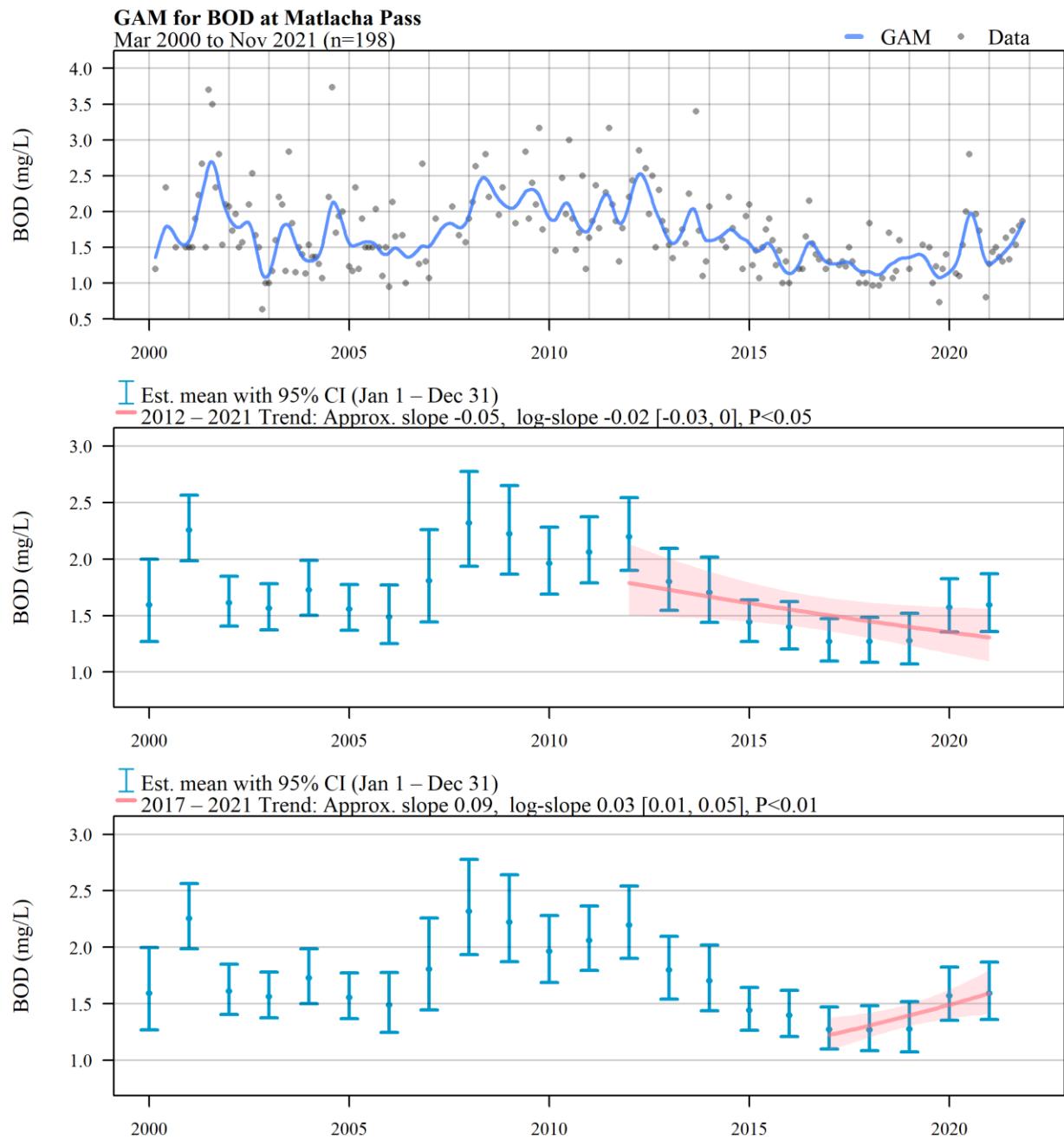


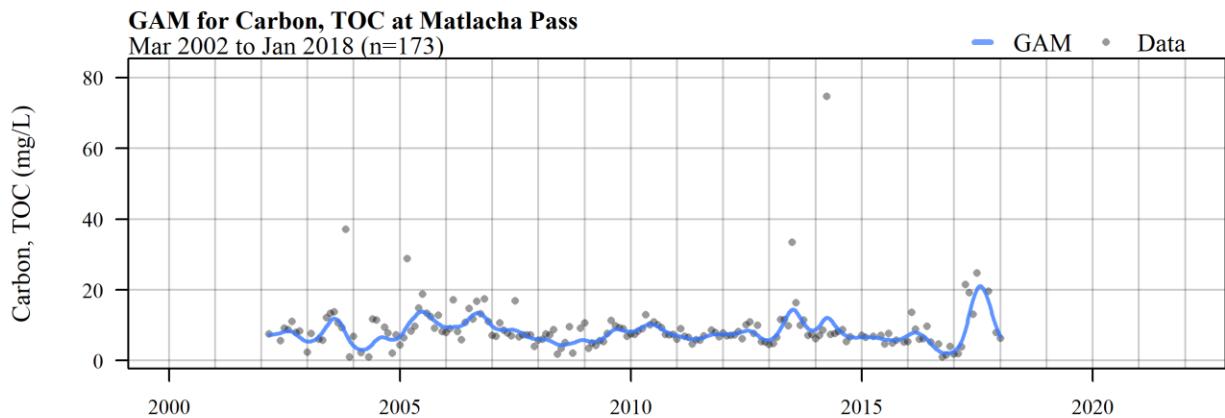
— Est. mean with 95% CI (Jan 1 – Dec 31)
— 2012 – 2021 Trend: Approx. slope 0, log-slope 0.02 [0.01, 0.04], P<0.01

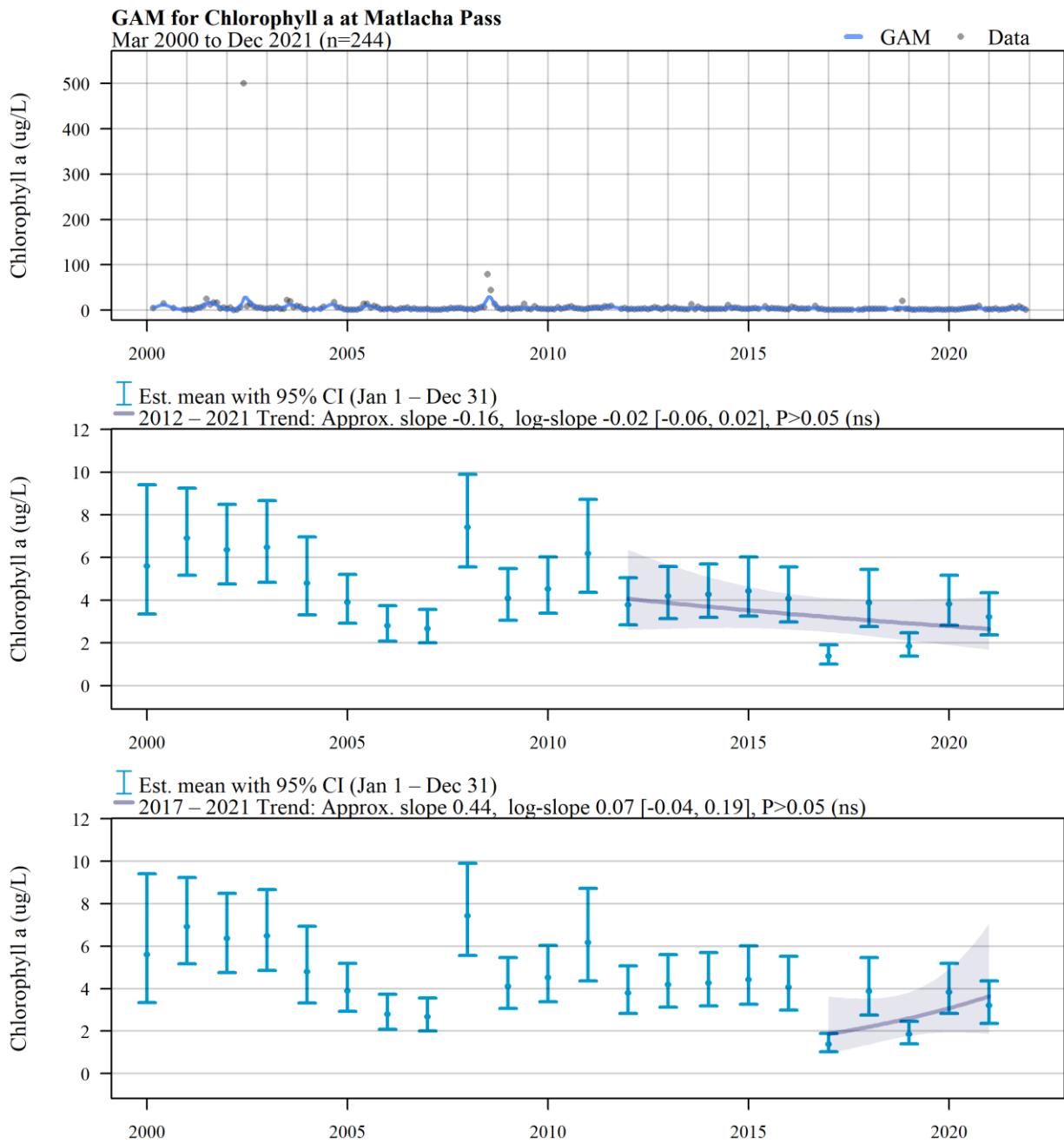


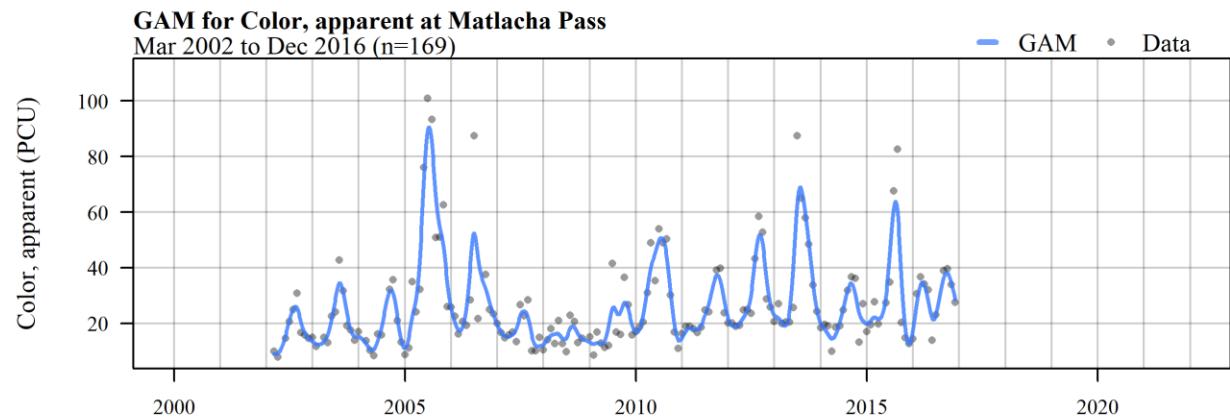
— Est. mean with 95% CI (Jan 1 – Dec 31)
— 2017 – 2021 Trend: Approx. slope 0, log-slope 0.05 [0, 0.09], P<0.05

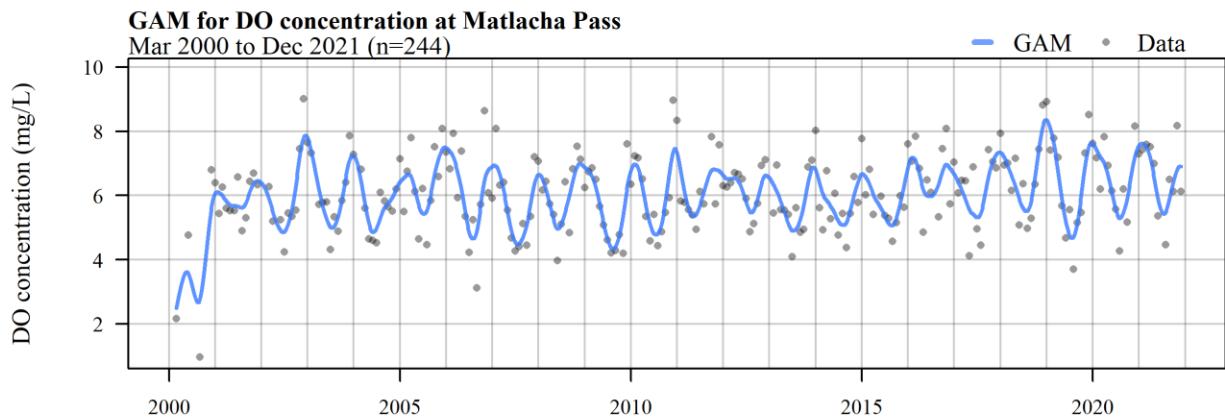




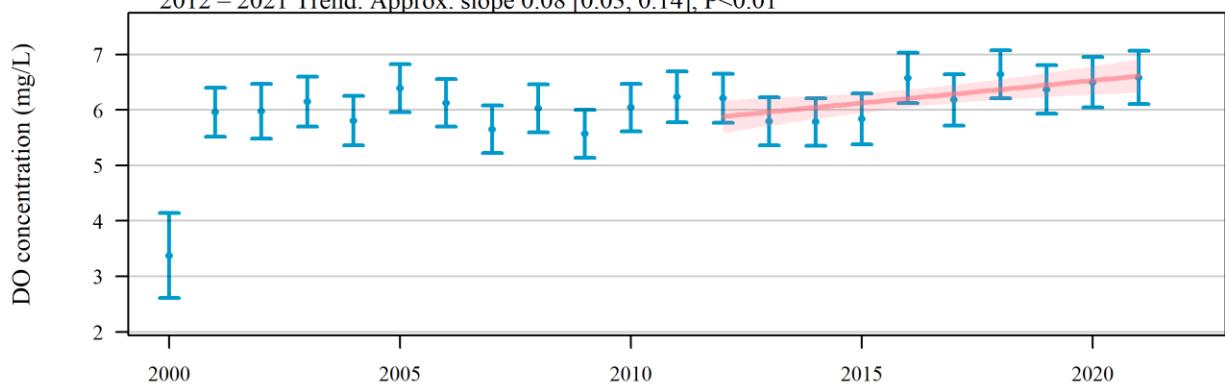




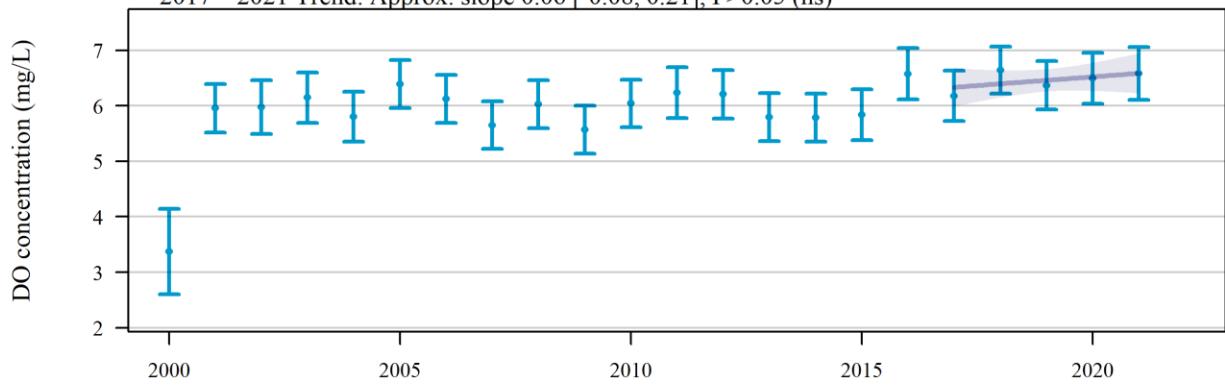


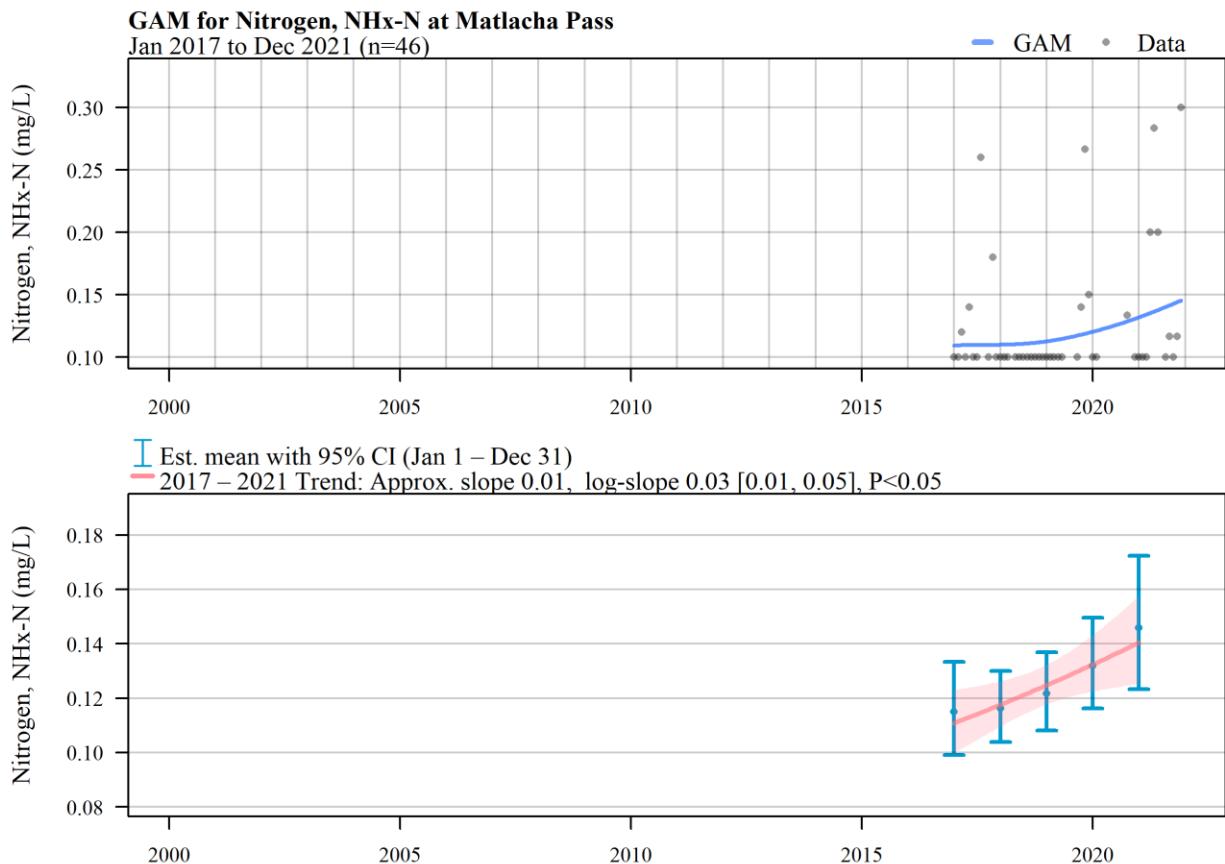


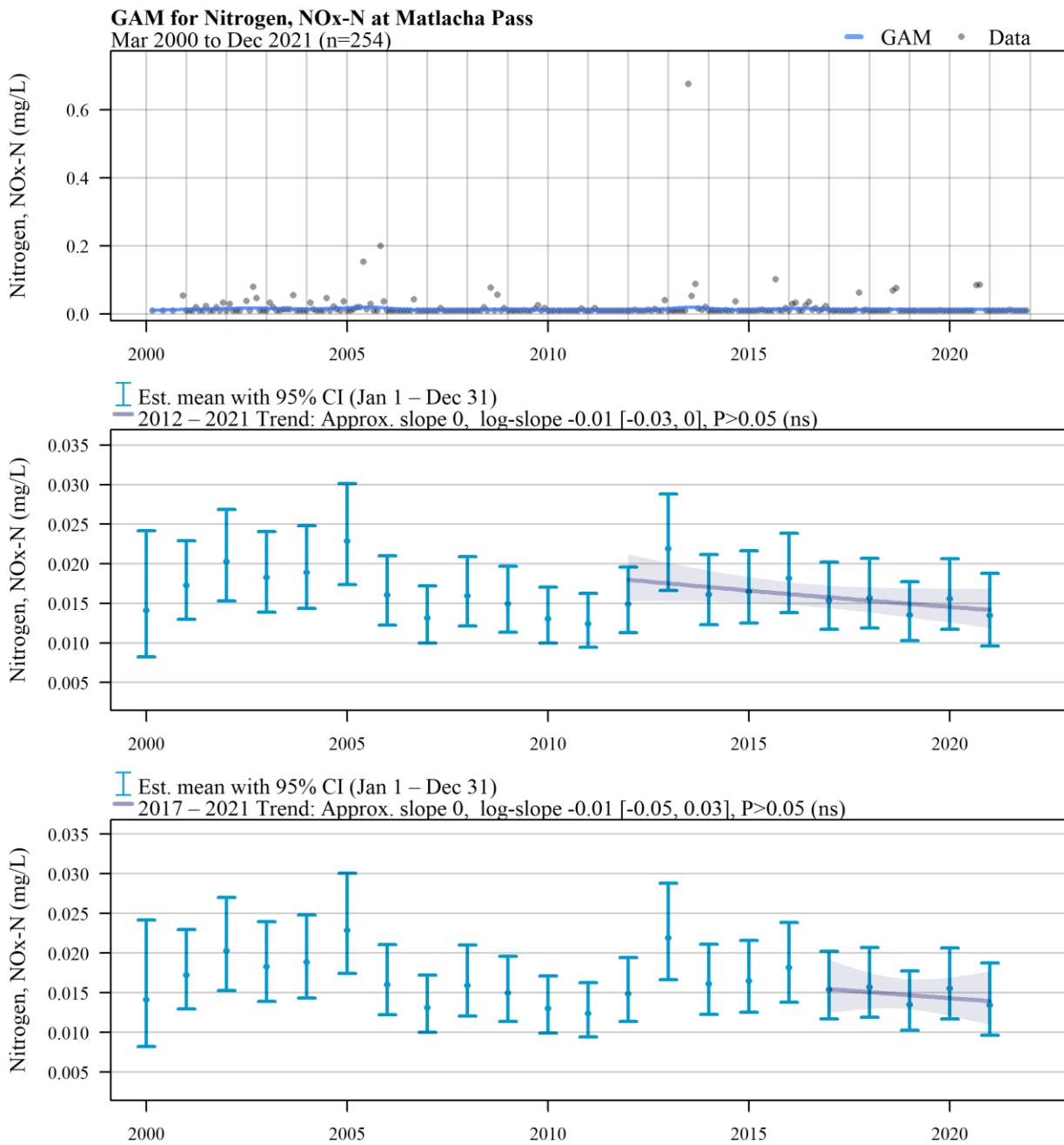
Est. mean with 95% CI (Jan 1 – Dec 31)
2012 – 2021 Trend: Approx. slope 0.08 [0.03, 0.14], P<0.01

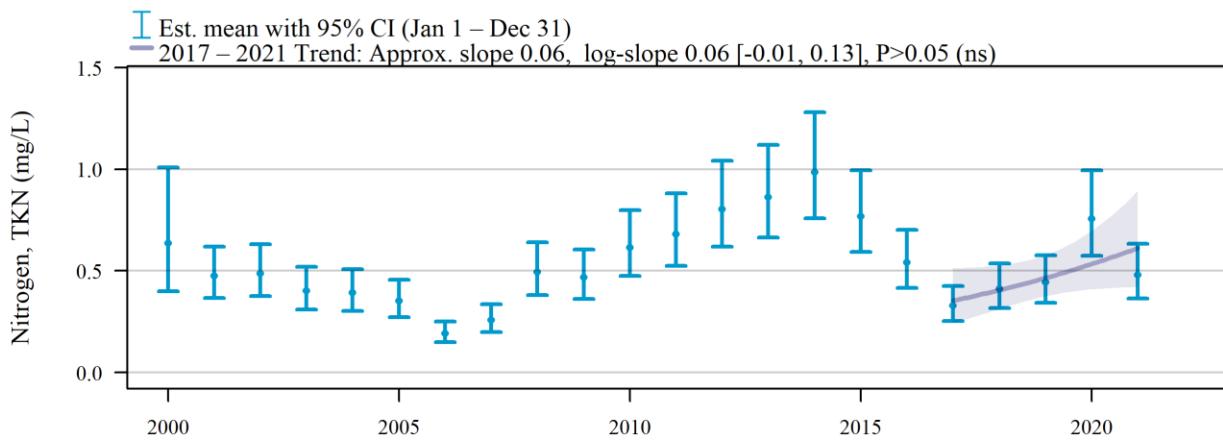
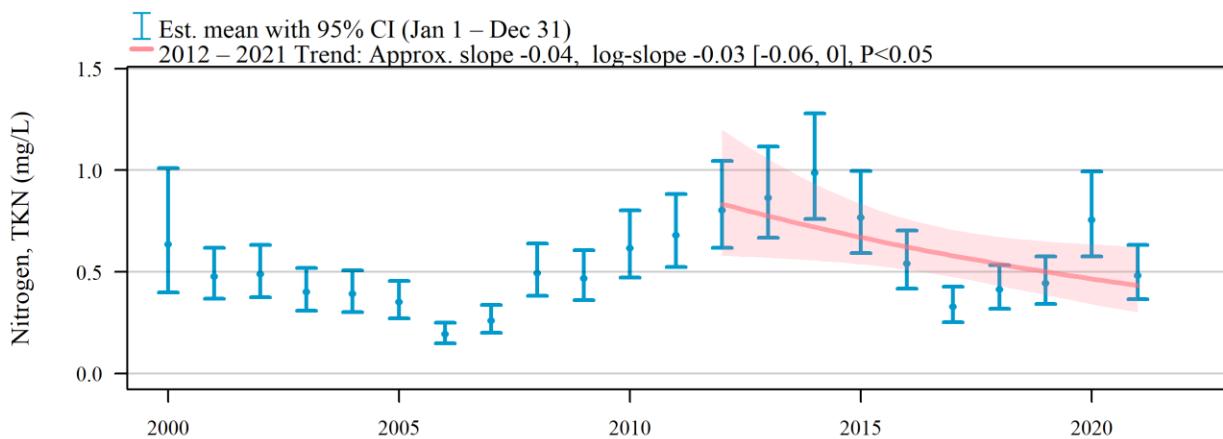
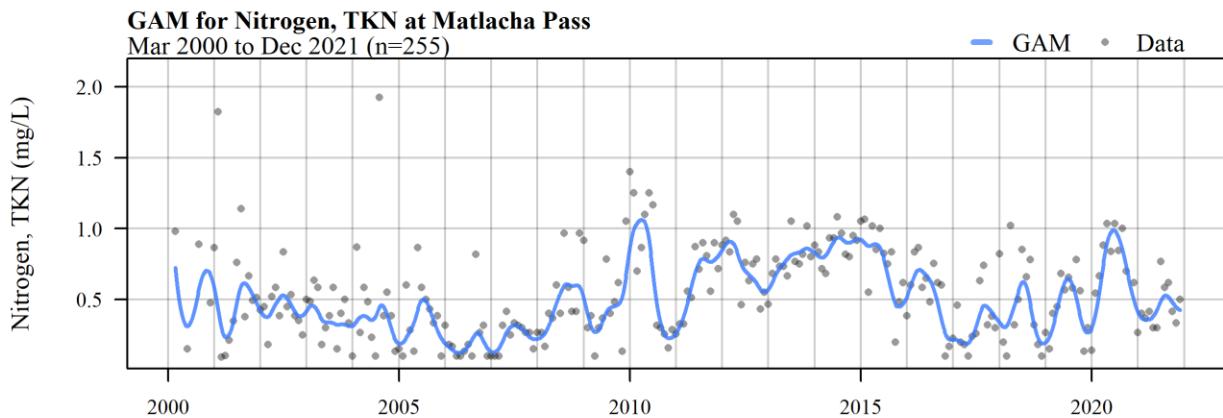


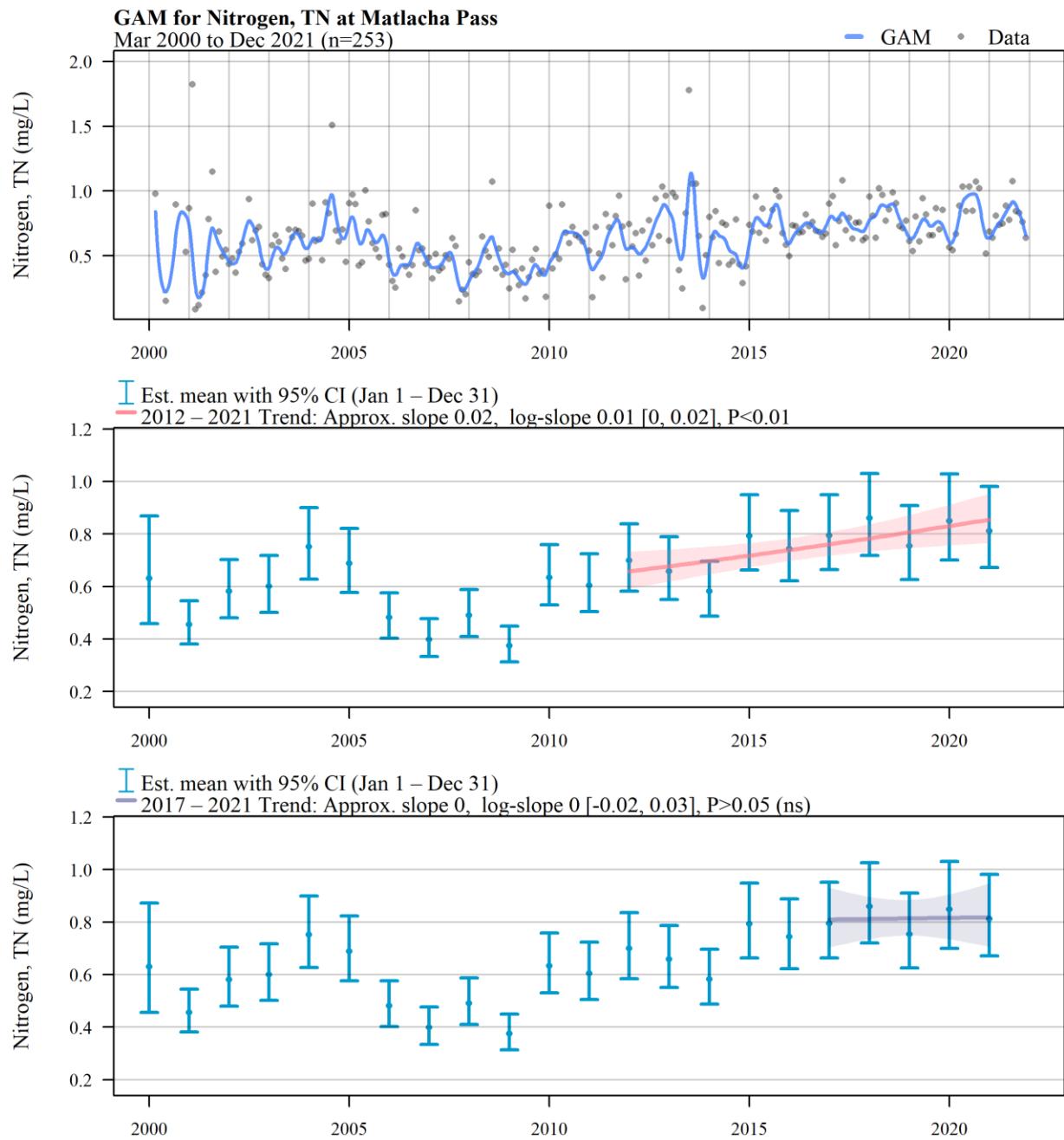
Est. mean with 95% CI (Jan 1 – Dec 31)
2017 – 2021 Trend: Approx. slope 0.06 [-0.08, 0.21], P>0.05 (ns)

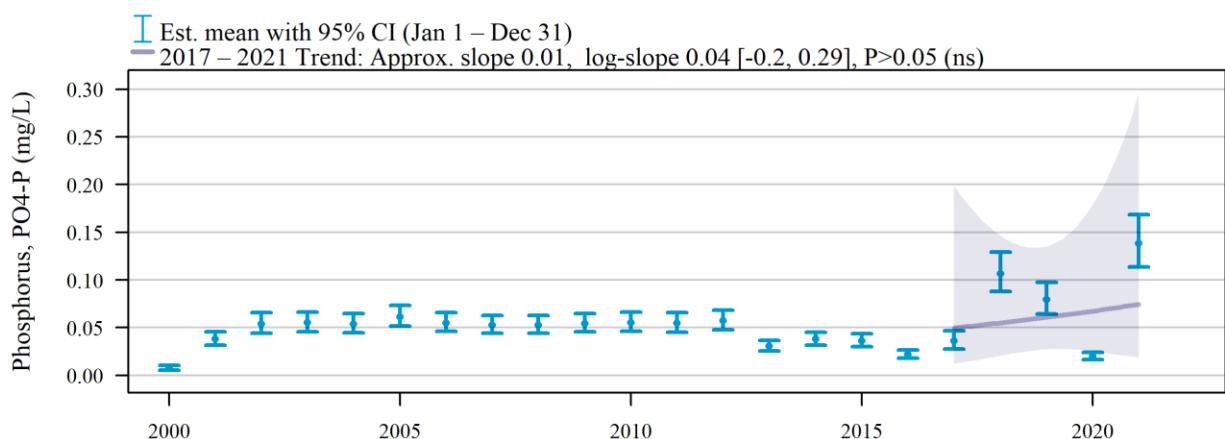
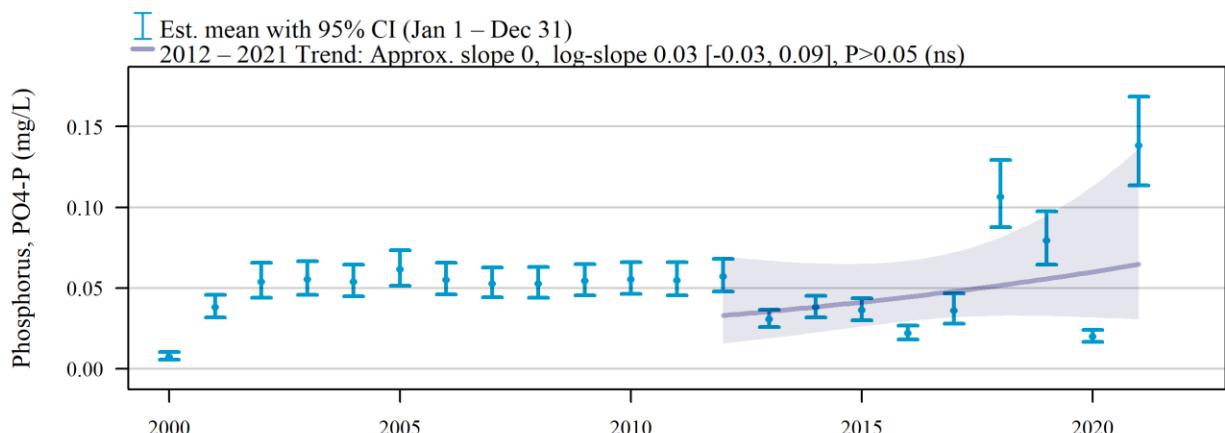
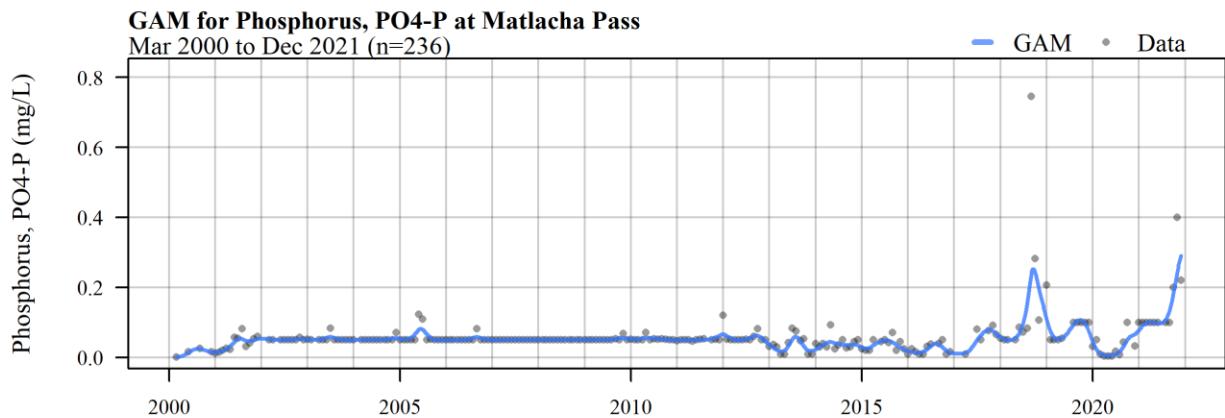


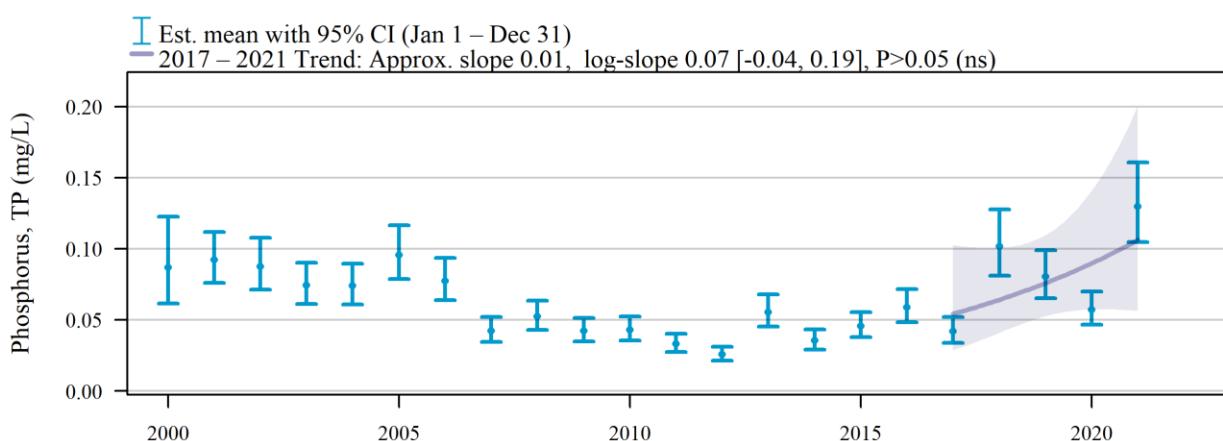
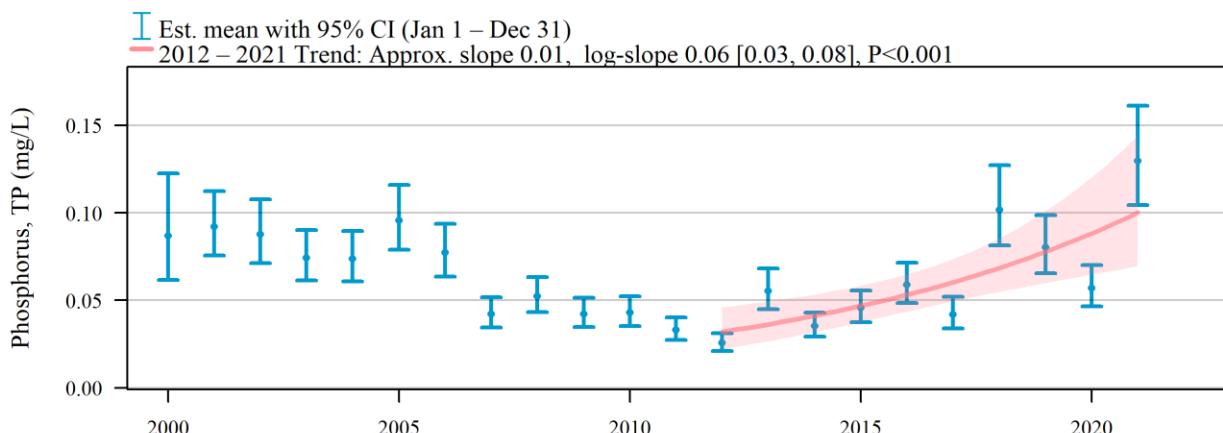
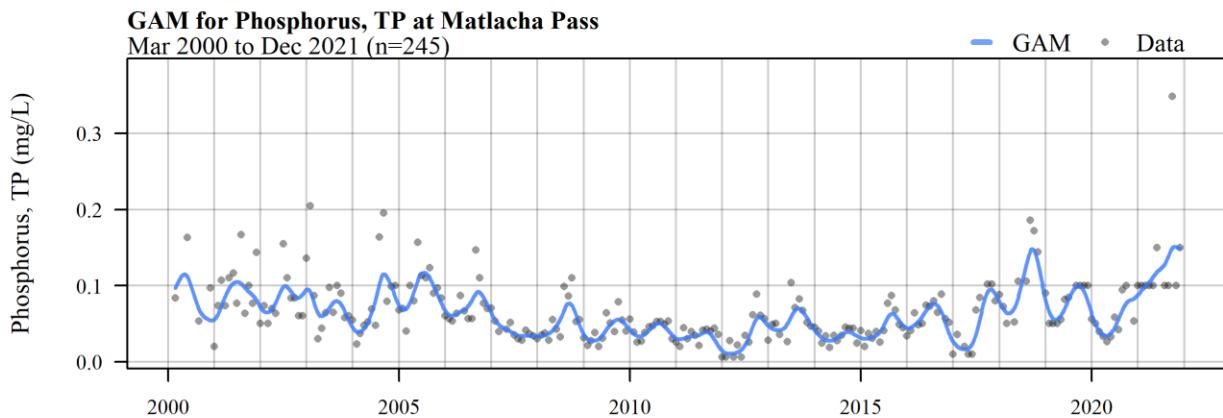


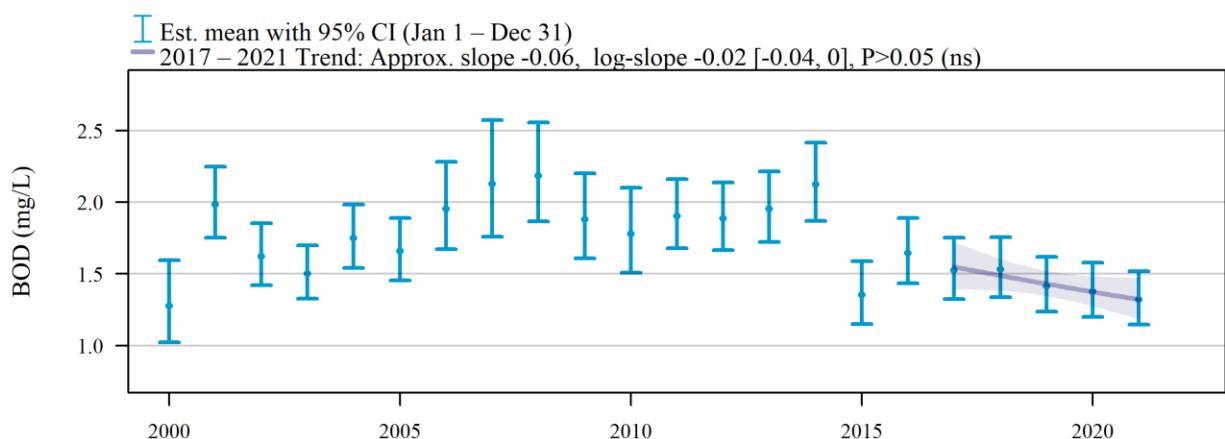
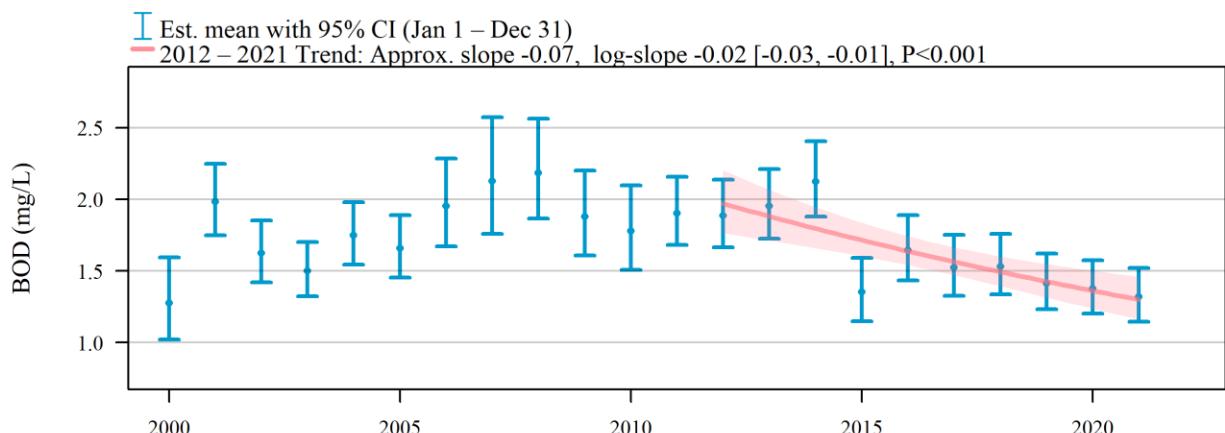
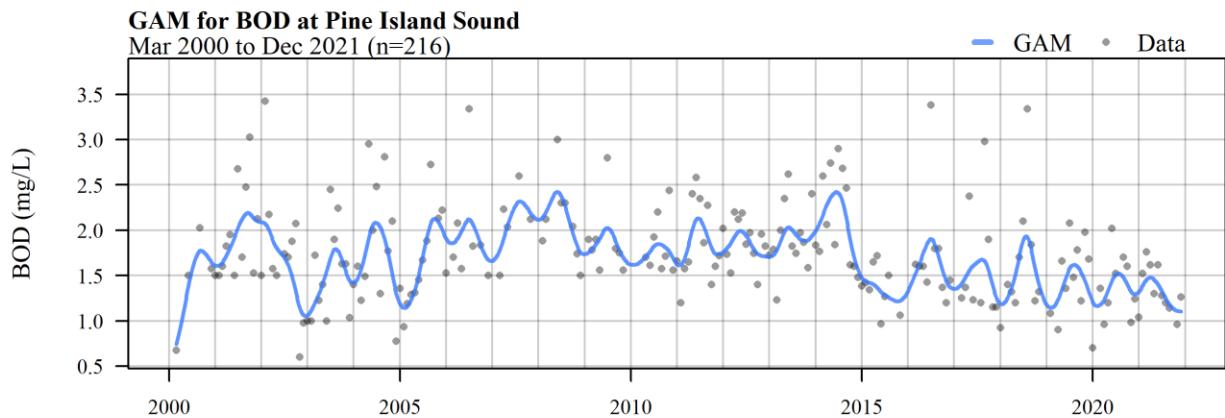




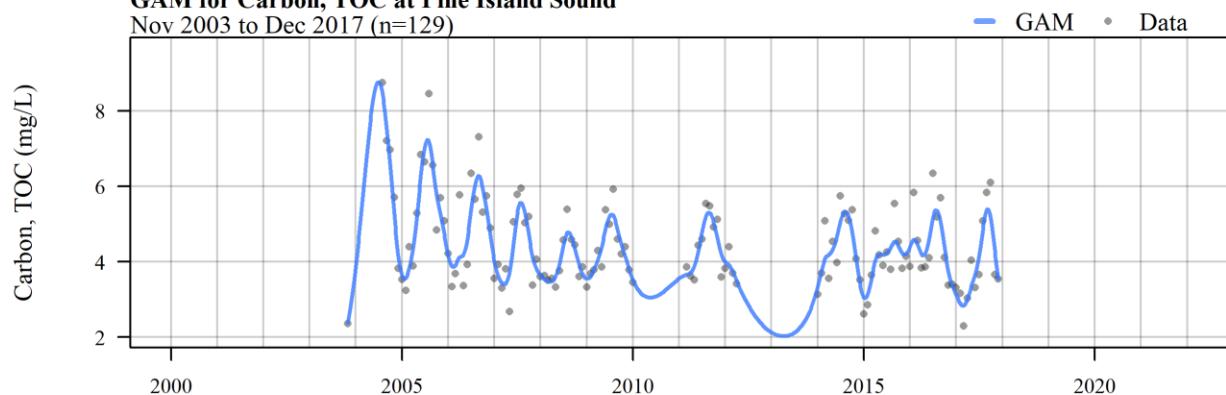


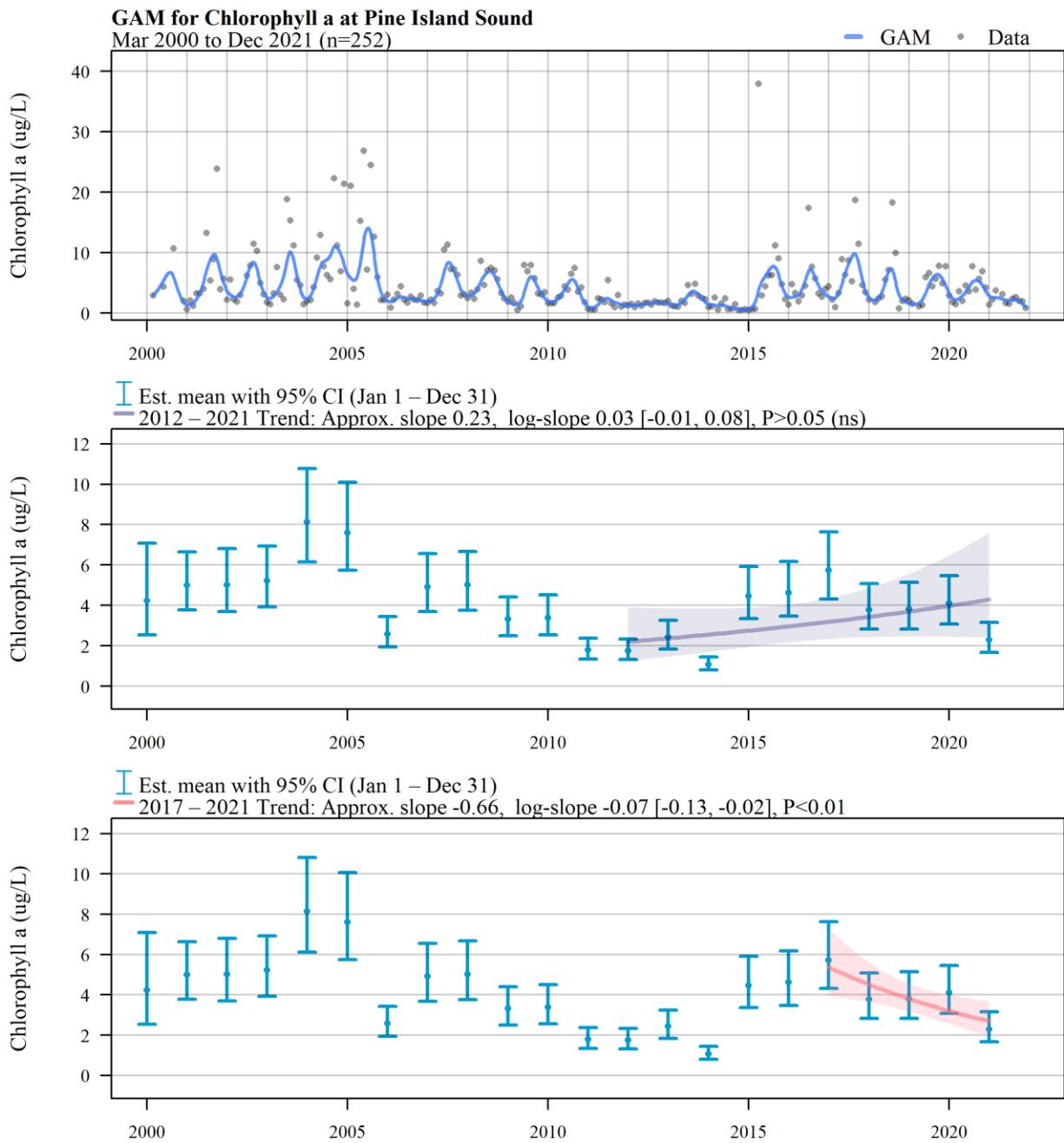






GAM for Carbon, TOC at Pine Island Sound
Nov 2003 to Dec 2017 (n=129)

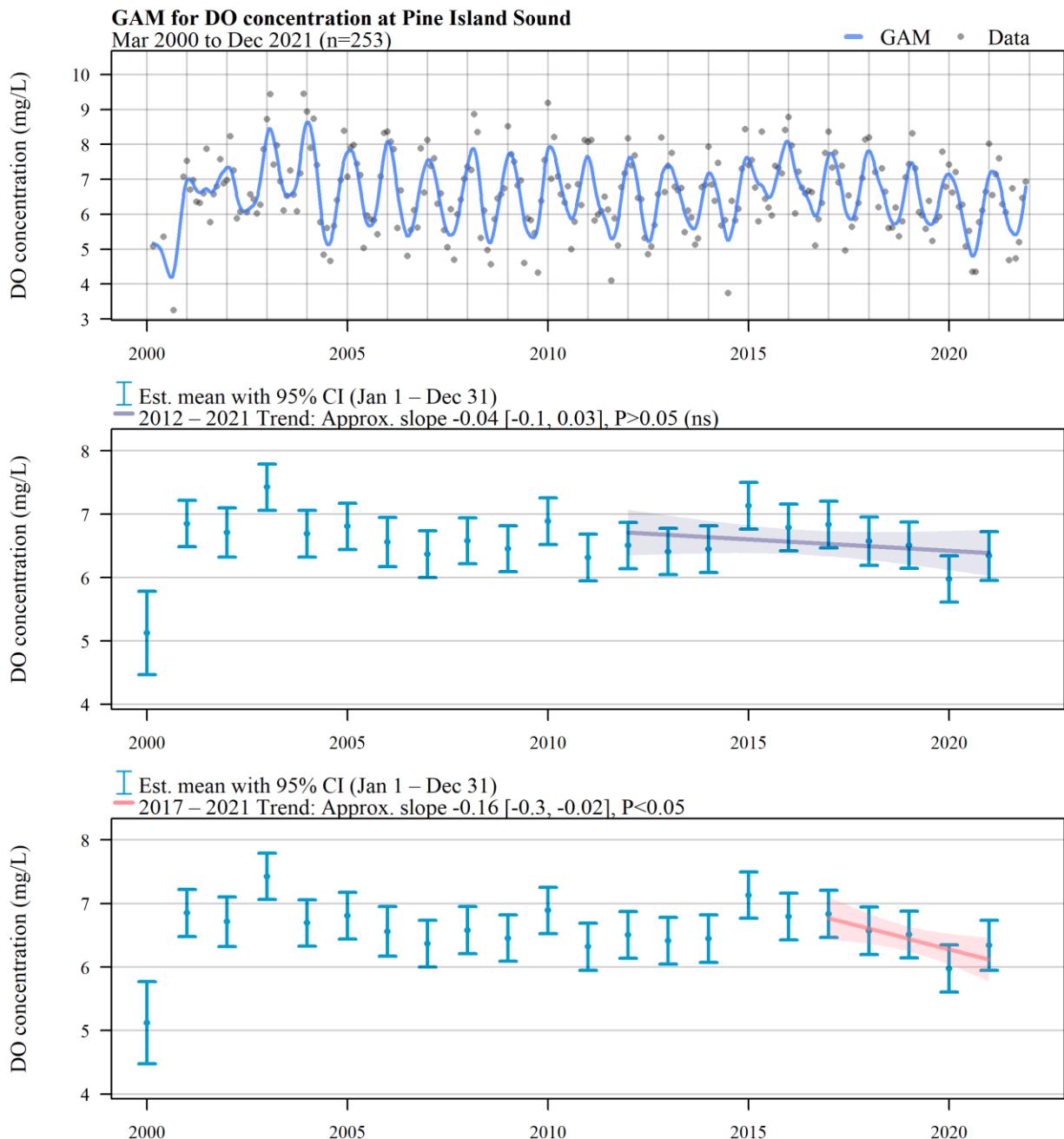




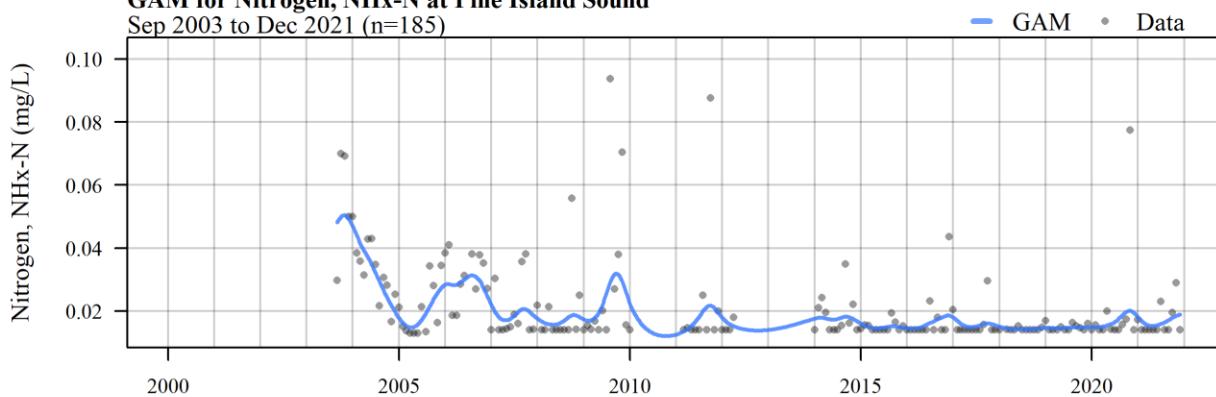
Color, apparent at Pine Island Sound

No data
(Jan 2000 to Dec 2021)

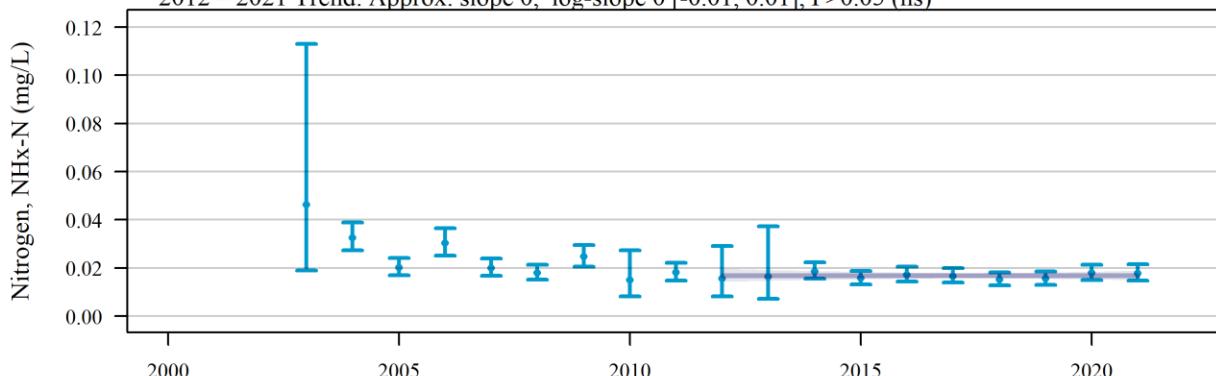
2000 2005 2010 2015 2020



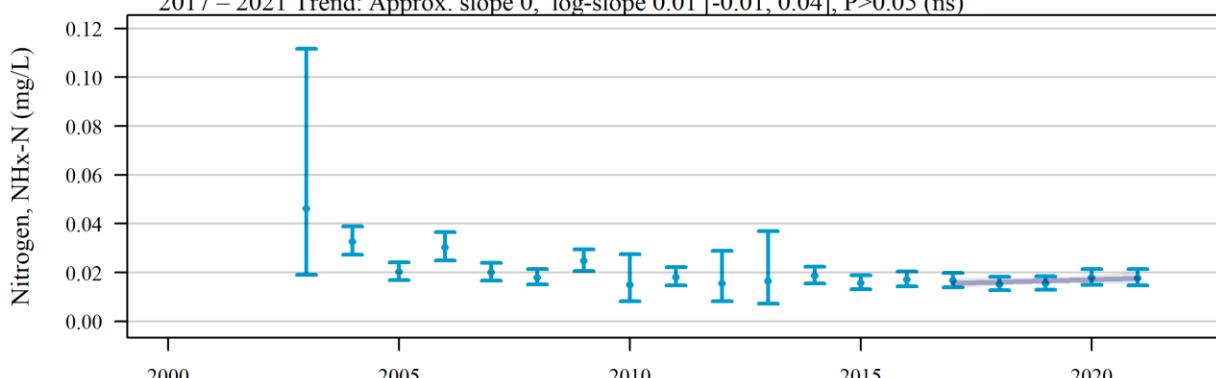
**GAM for Nitrogen, NH_x-N at Pine Island Sound
Sep 2003 to Dec 2021 (n=185)**

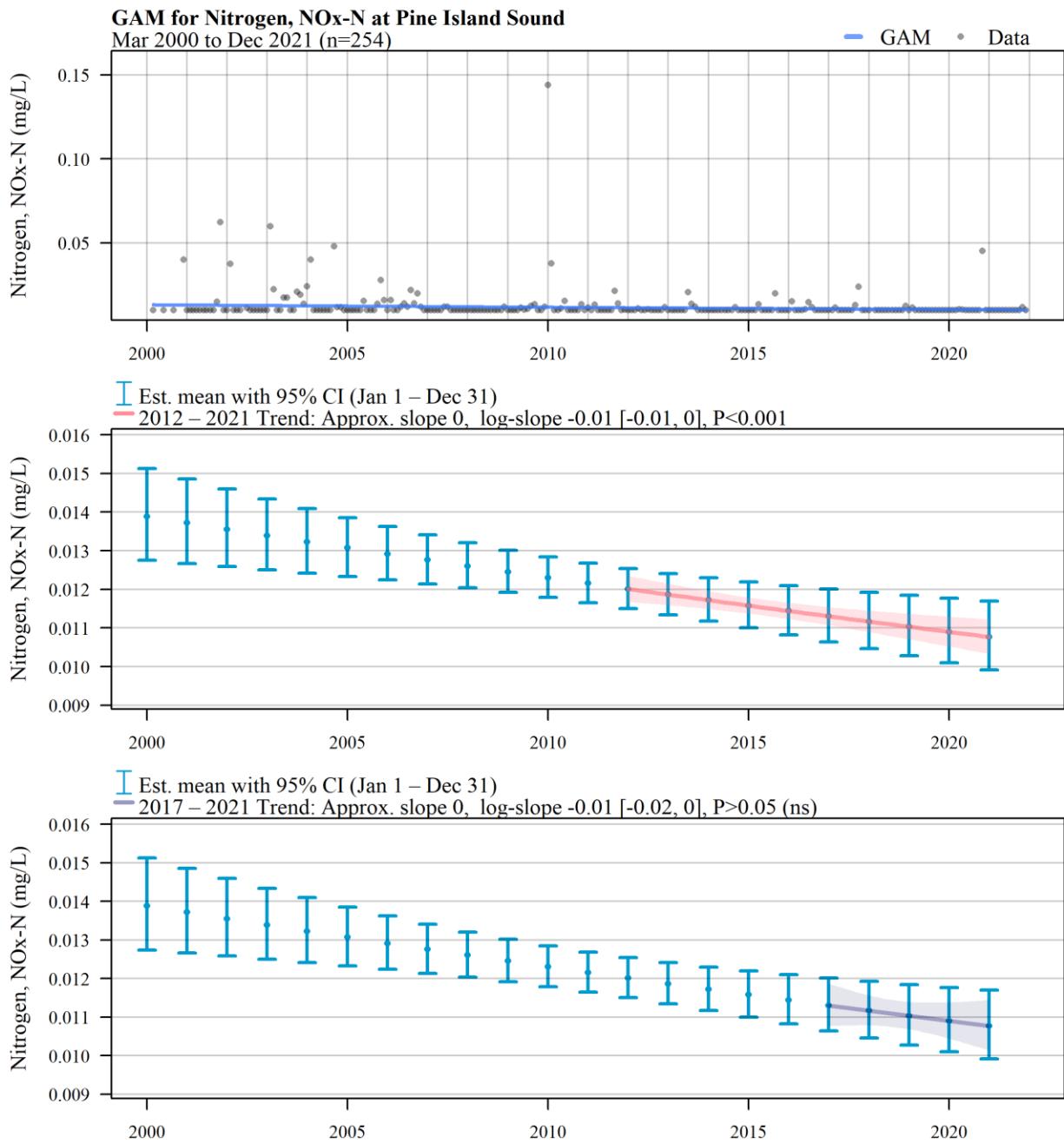


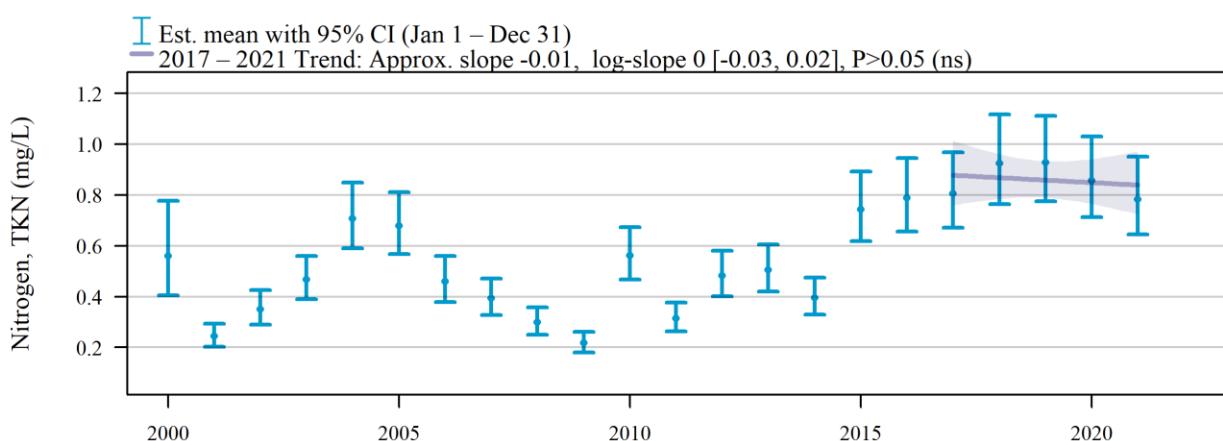
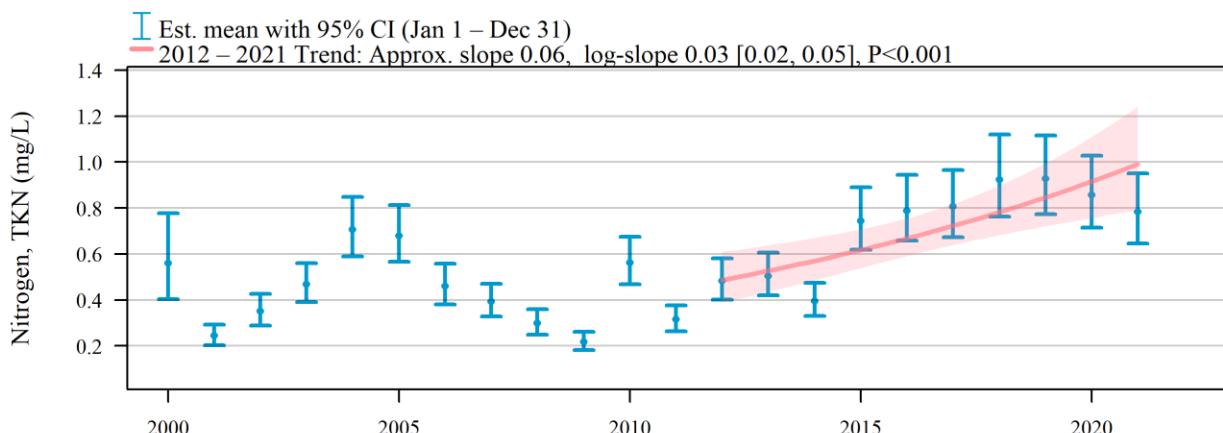
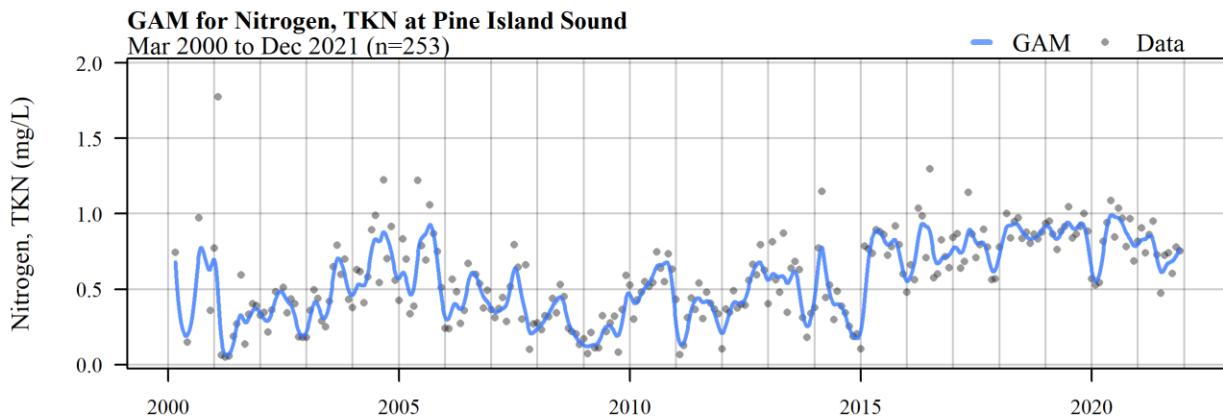
Est. mean with 95% CI (Jan 1 – Dec 31)
 2012 – 2021 Trend: Approx. slope 0, log-slope 0 [-0.01, 0.01], P>0.05 (ns)

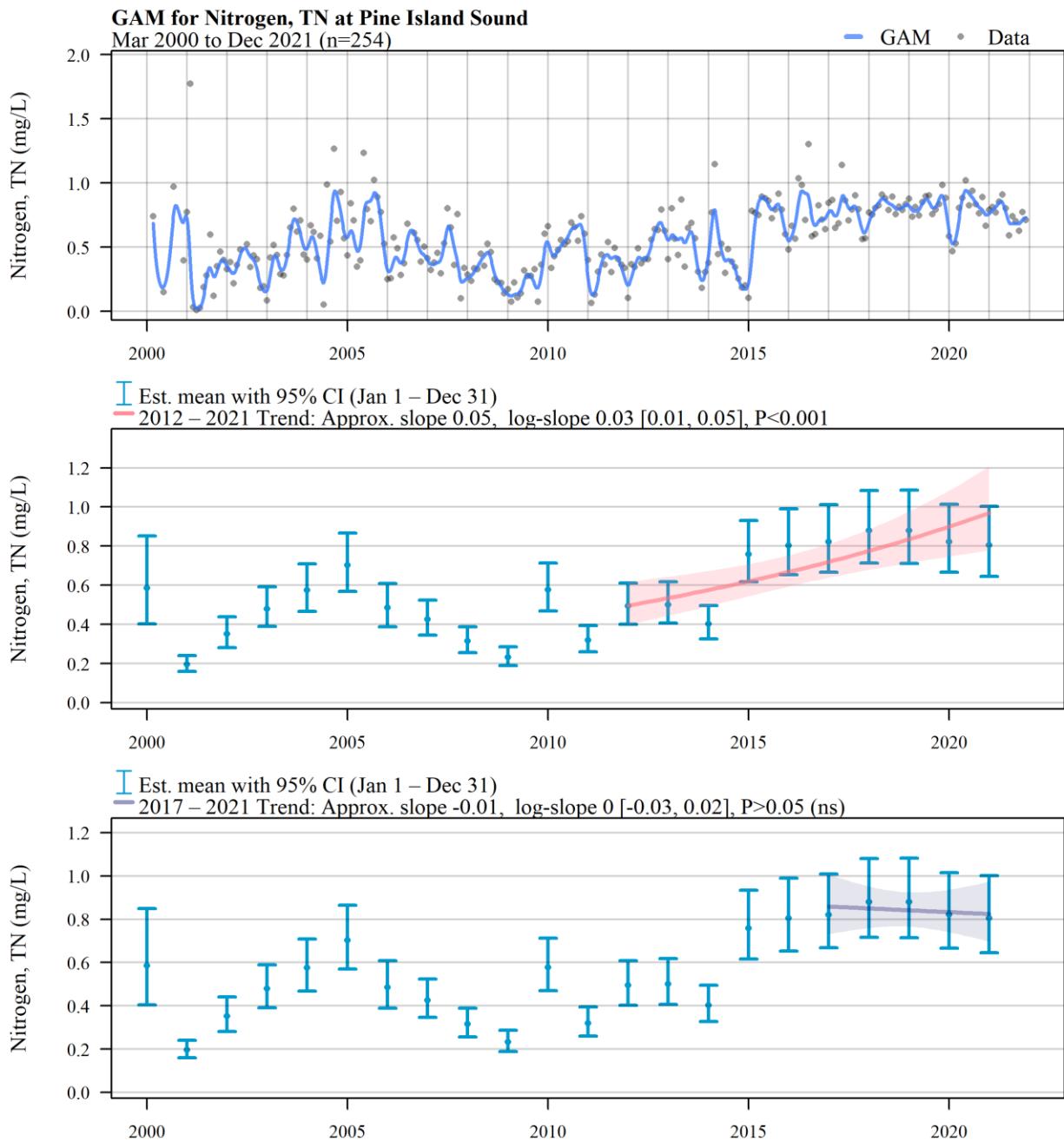


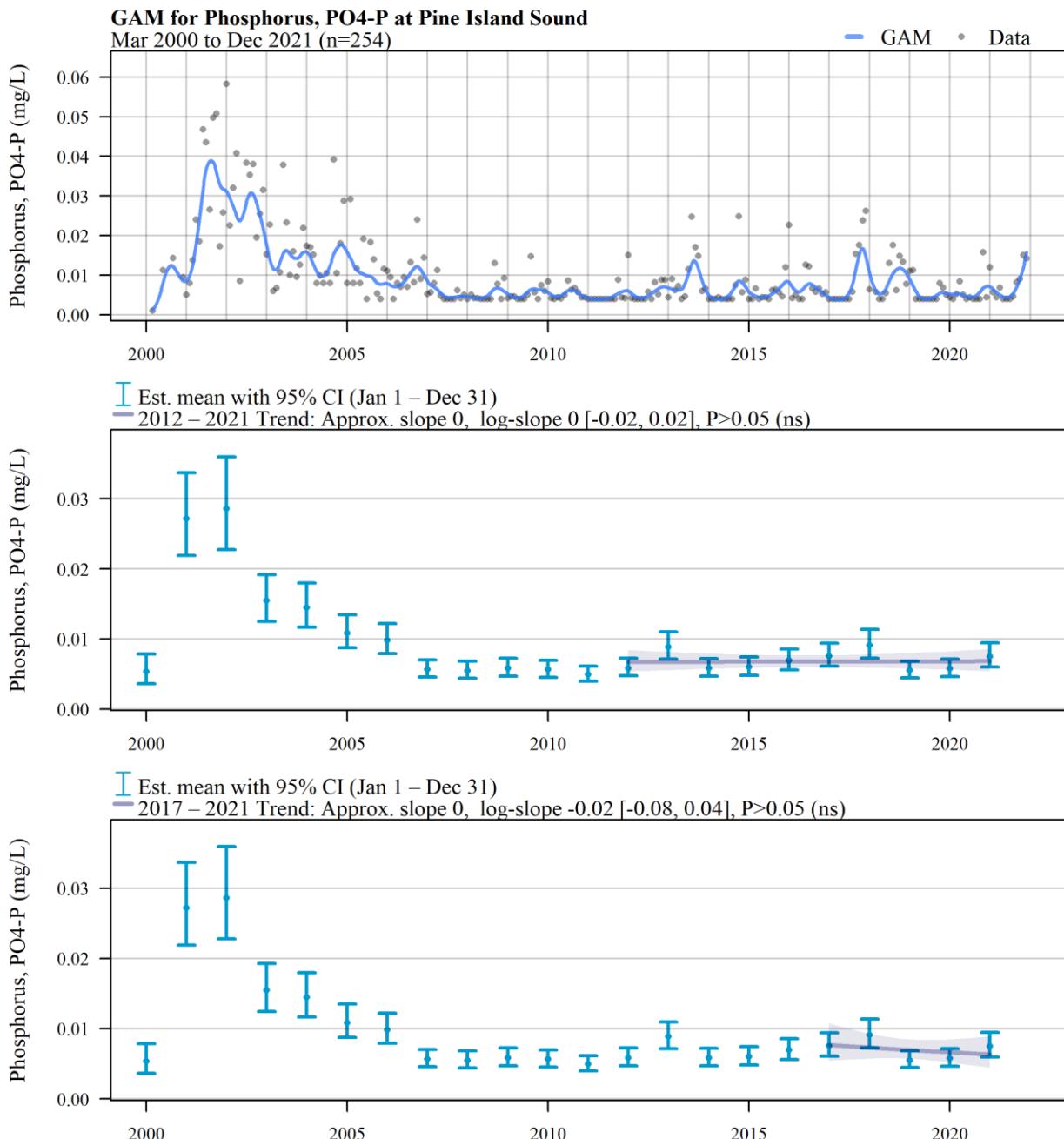
Est. mean with 95% CI (Jan 1 – Dec 31)
 2017 – 2021 Trend: Approx. slope 0, log-slope 0.01 [-0.01, 0.04], P>0.05 (ns)

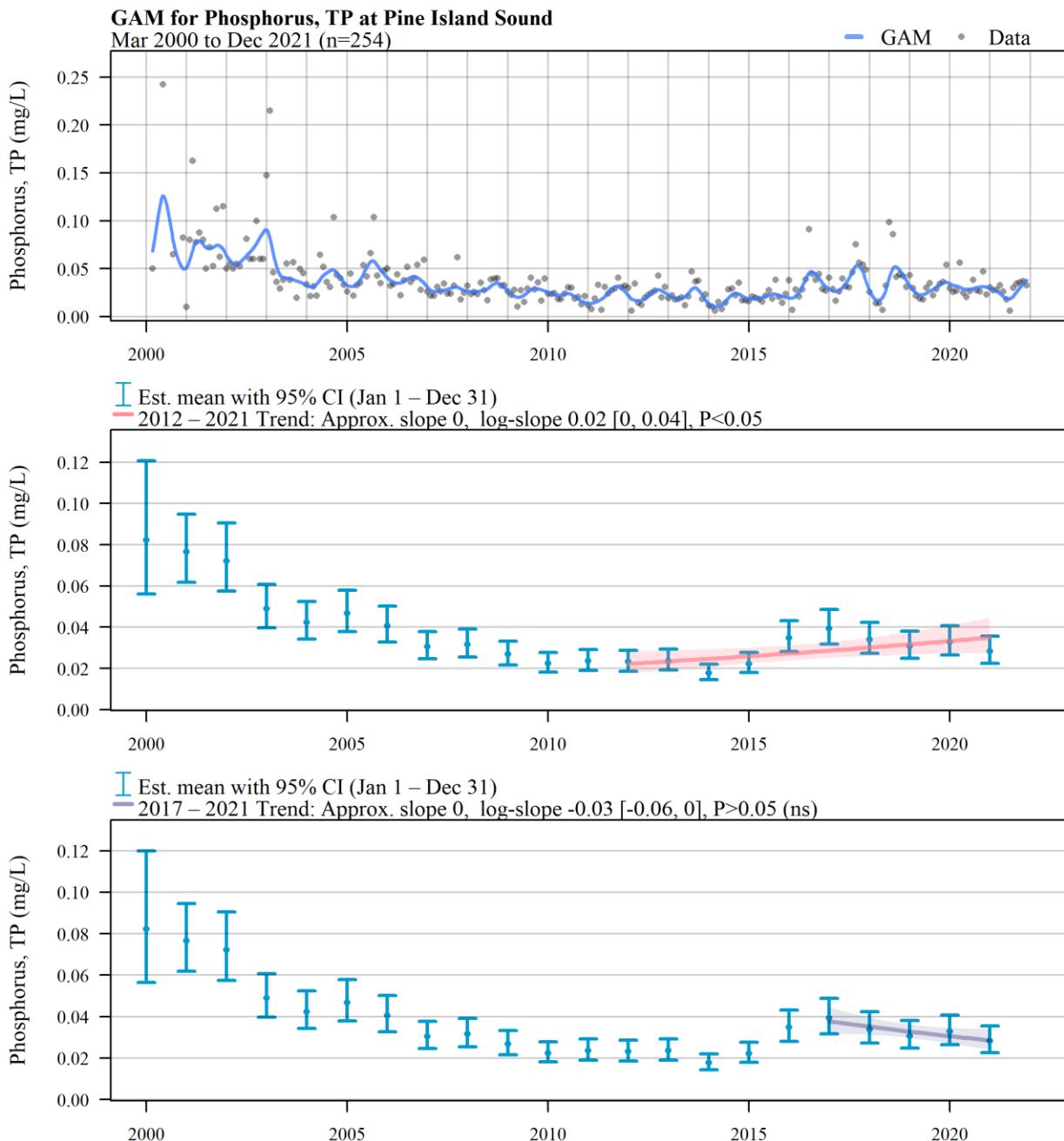


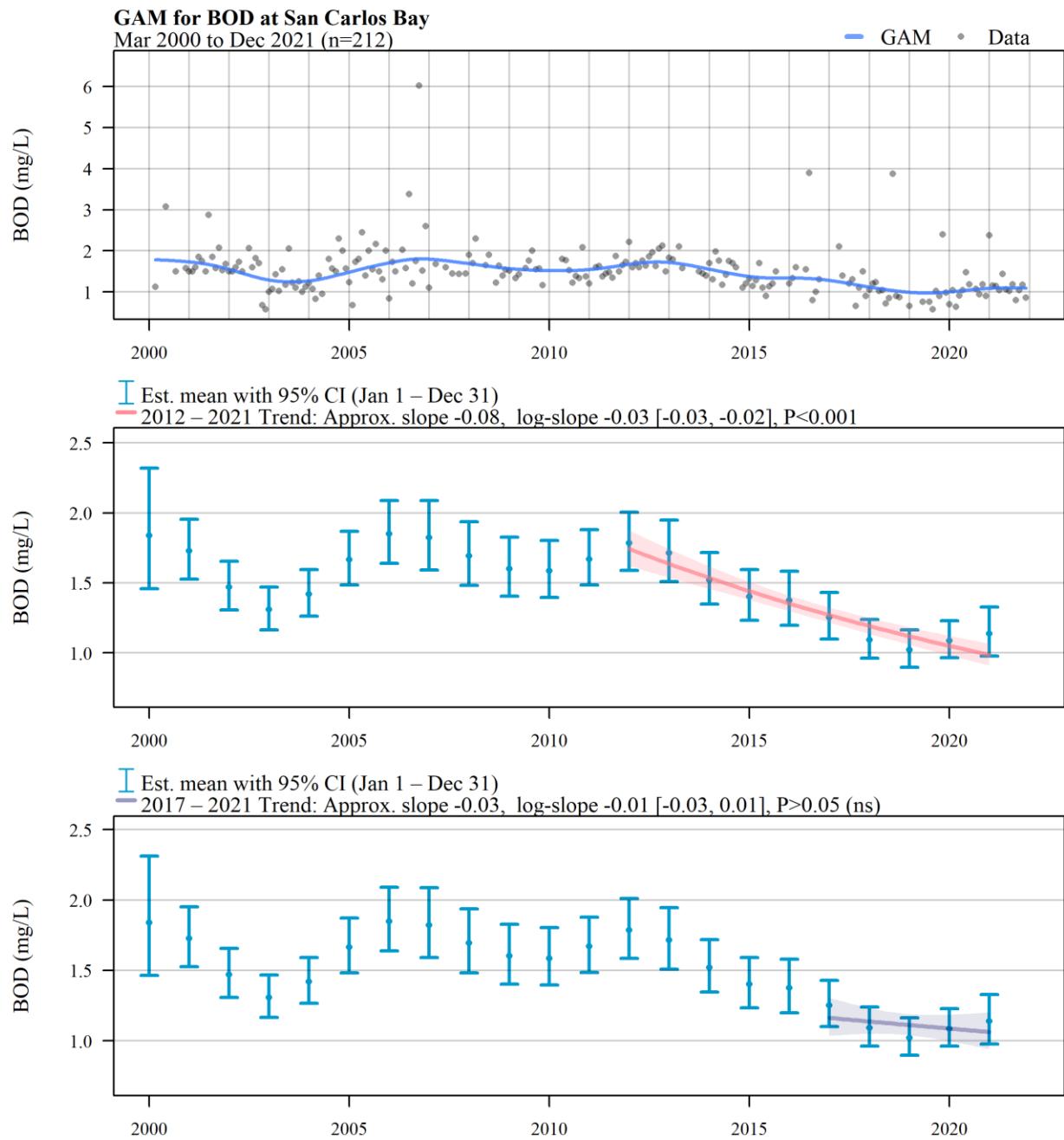


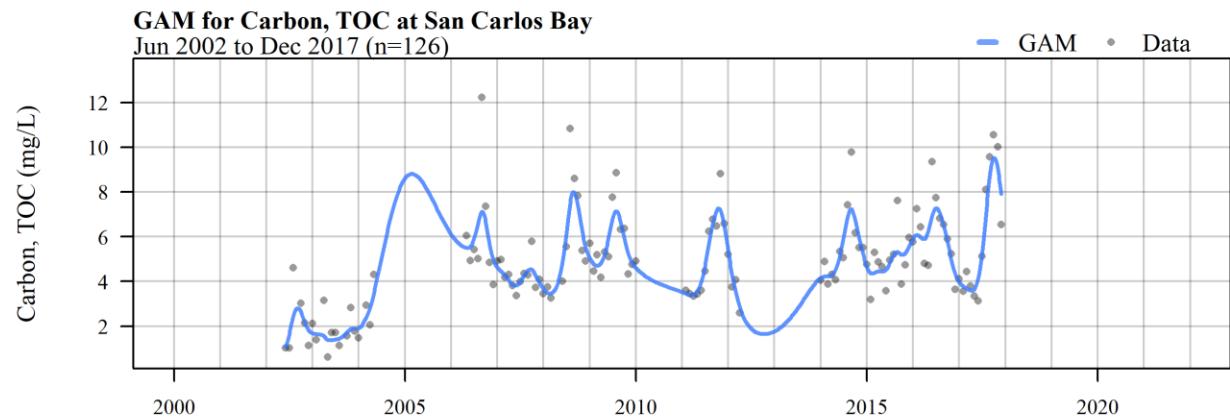


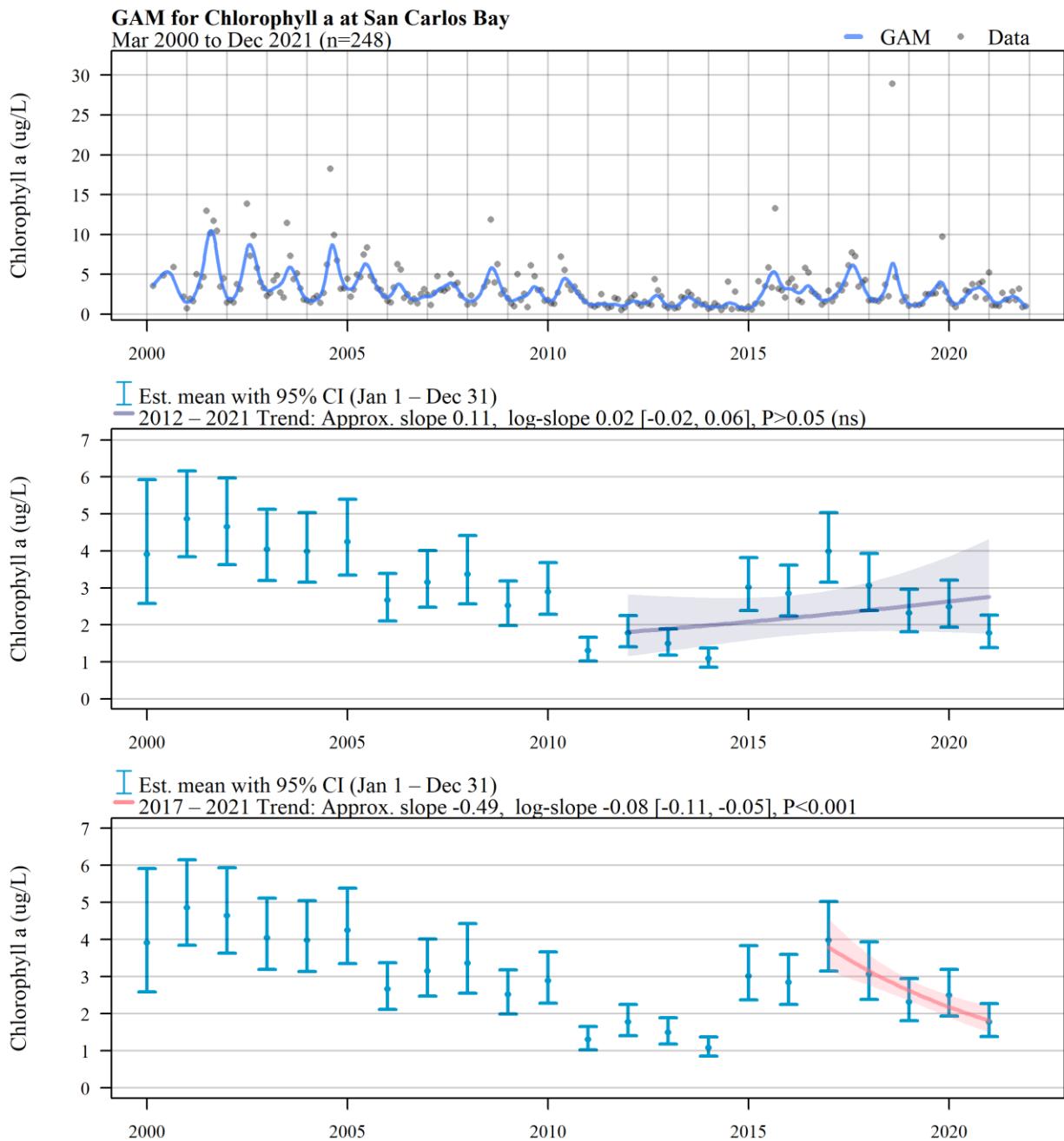








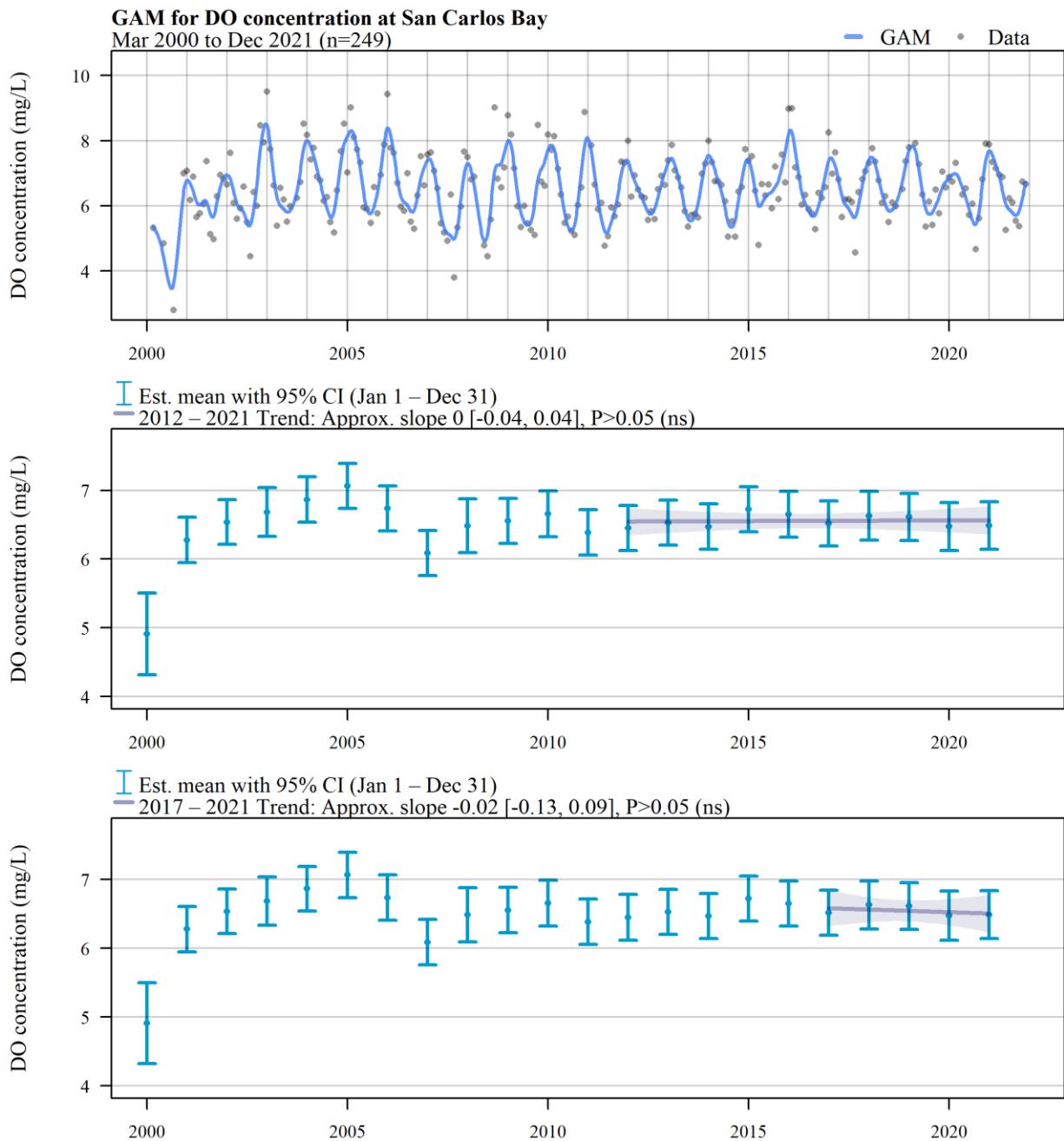


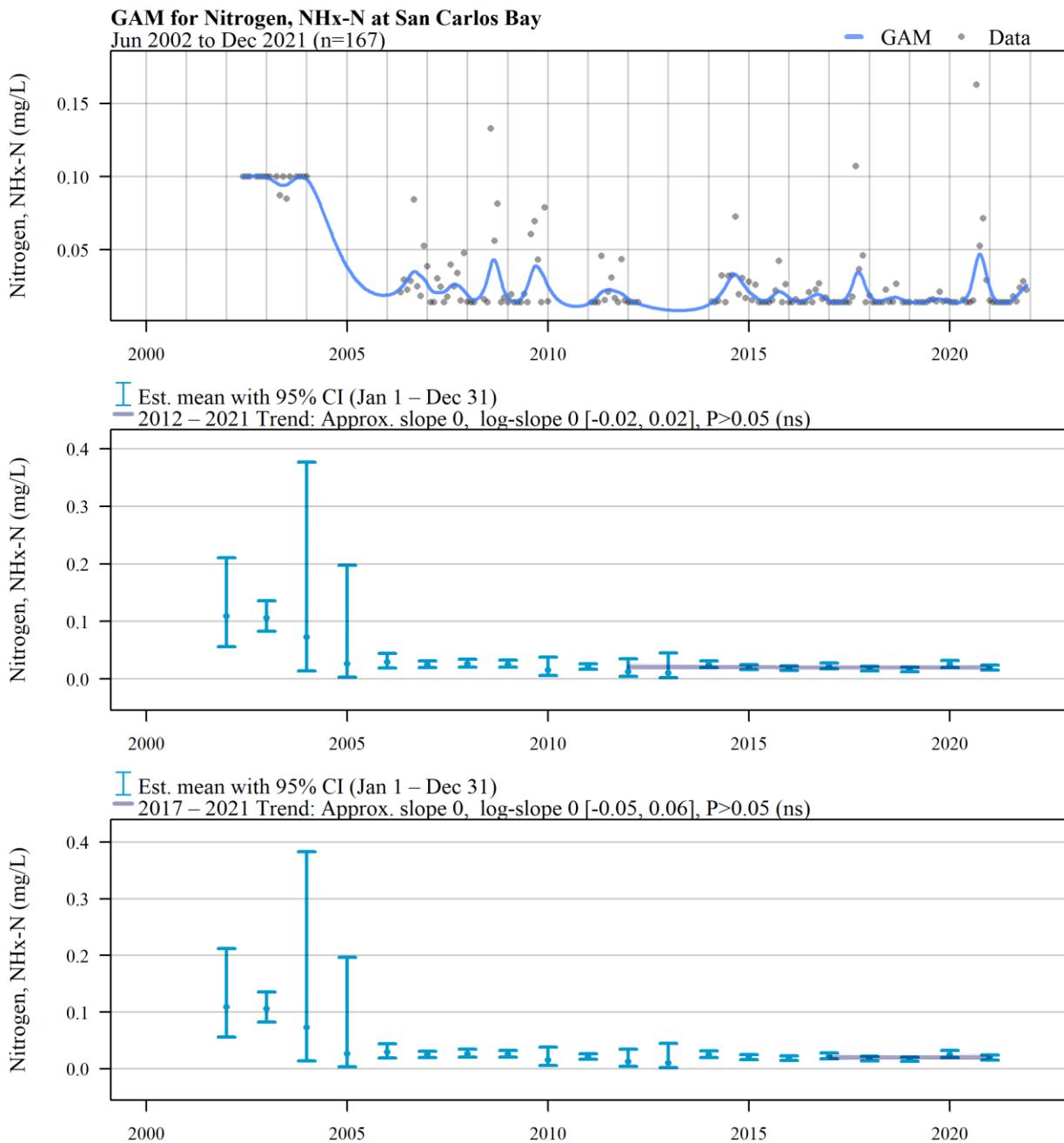


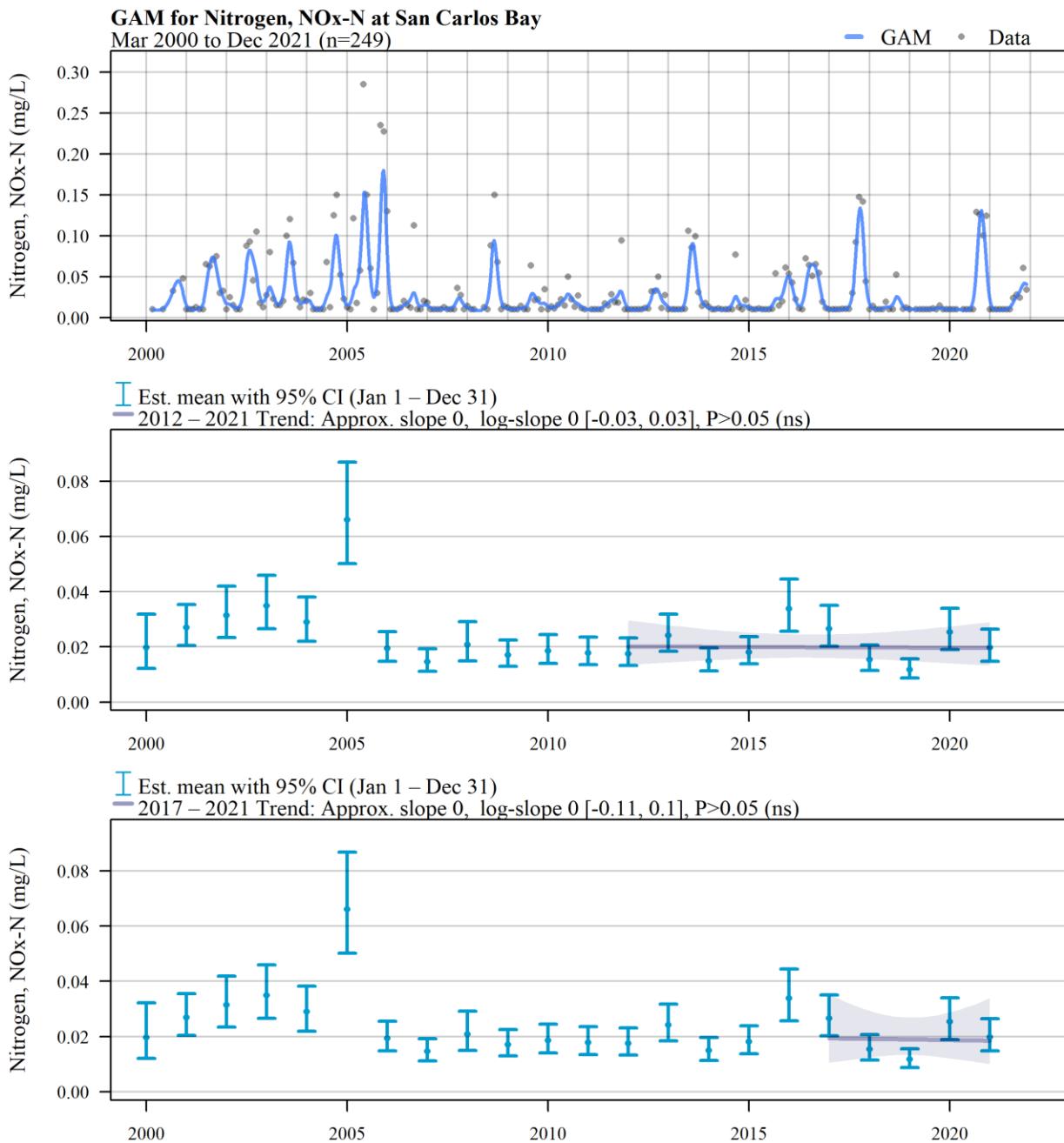
Color, apparent at San Carlos Bay

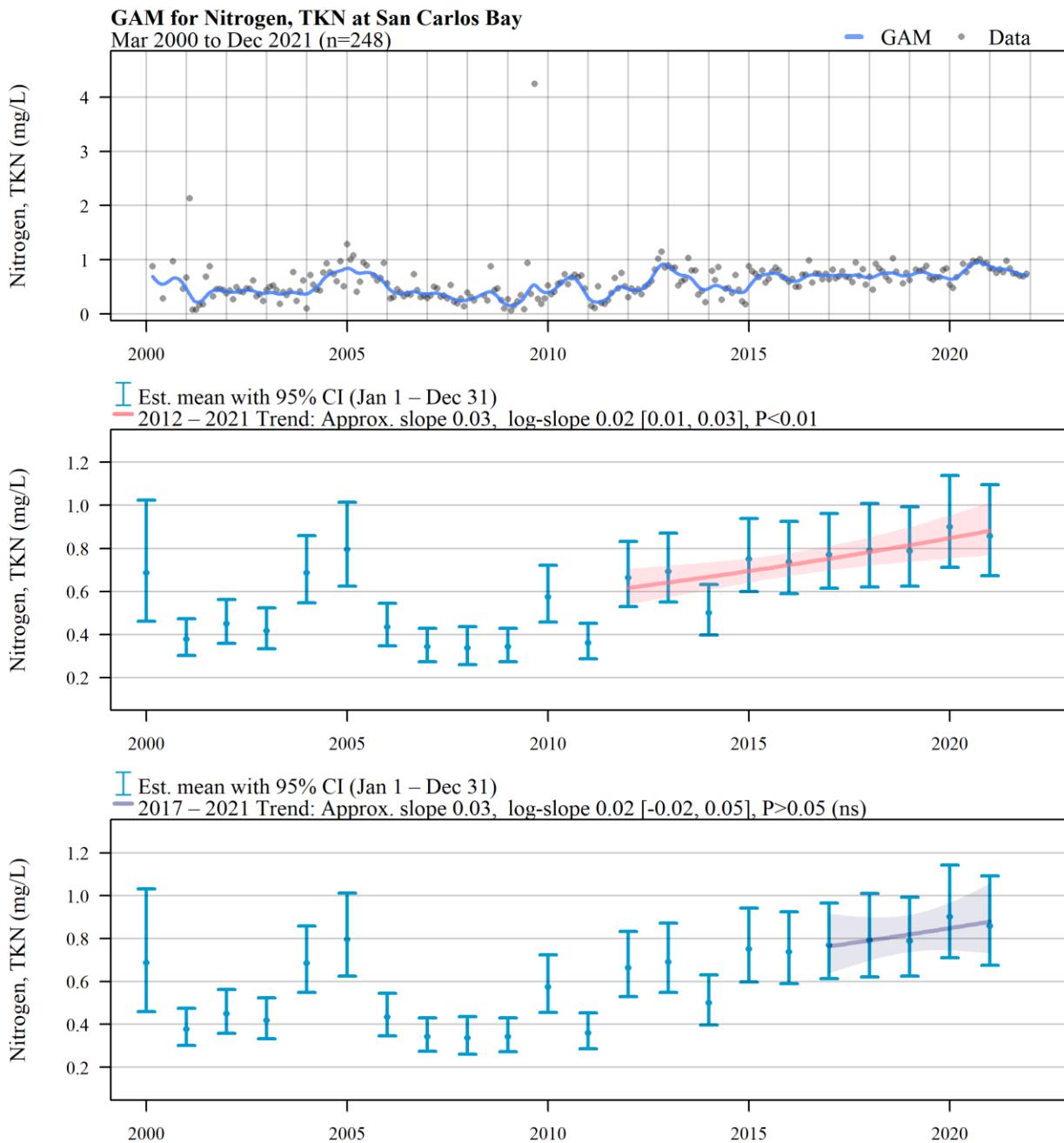
No data
(Jan 2000 to Dec 2021)

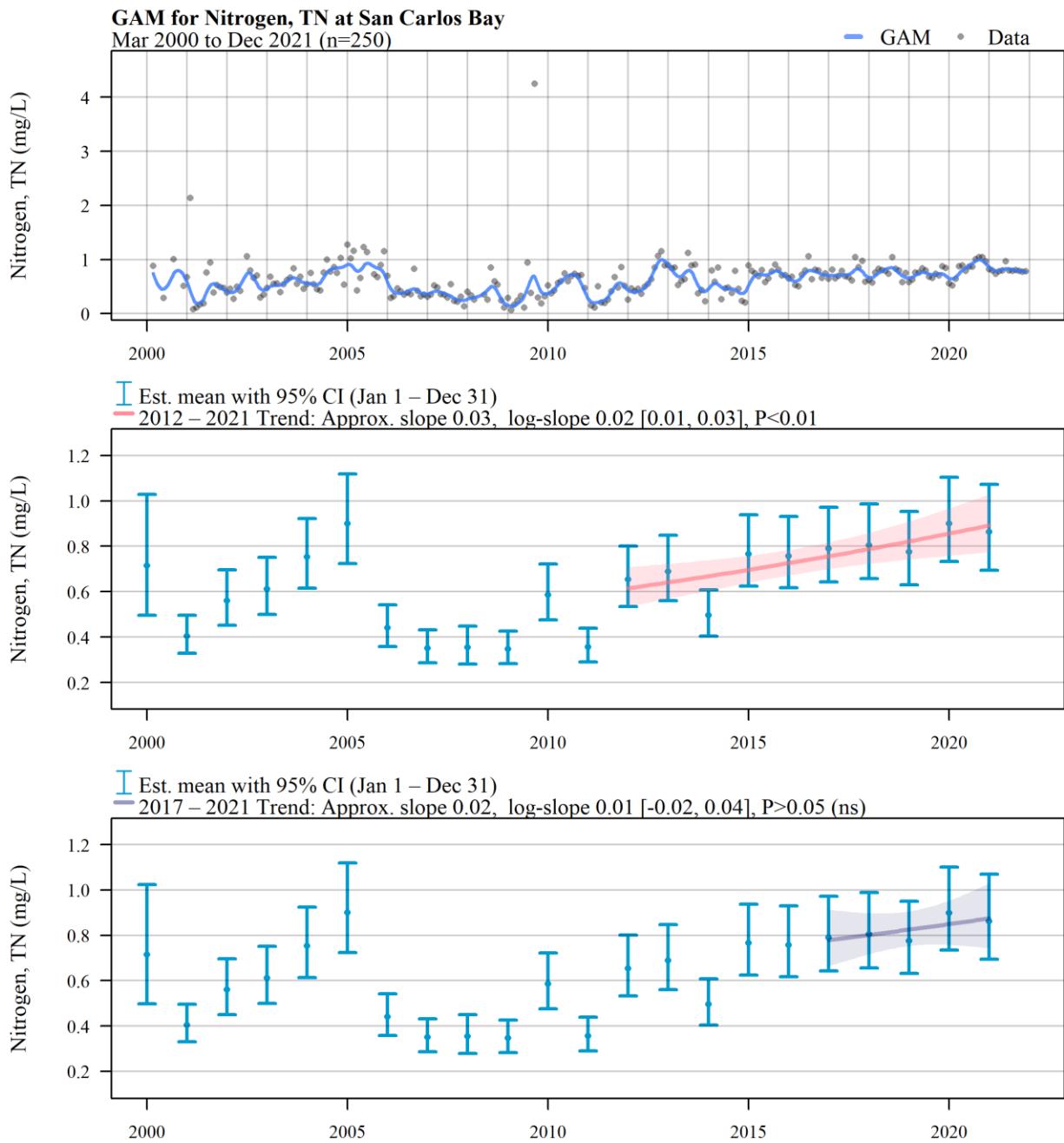
2000 2005 2010 2015 2020

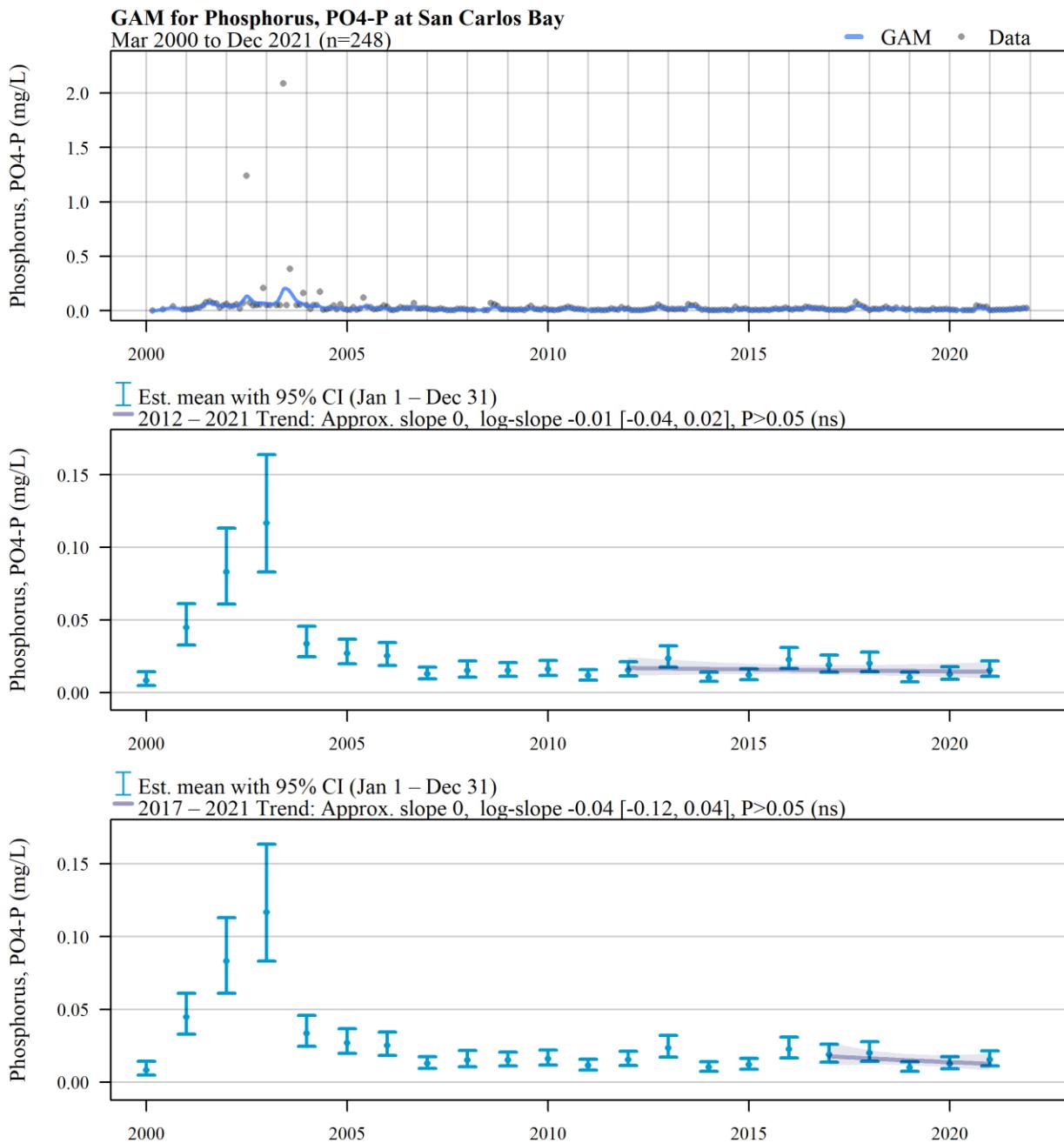


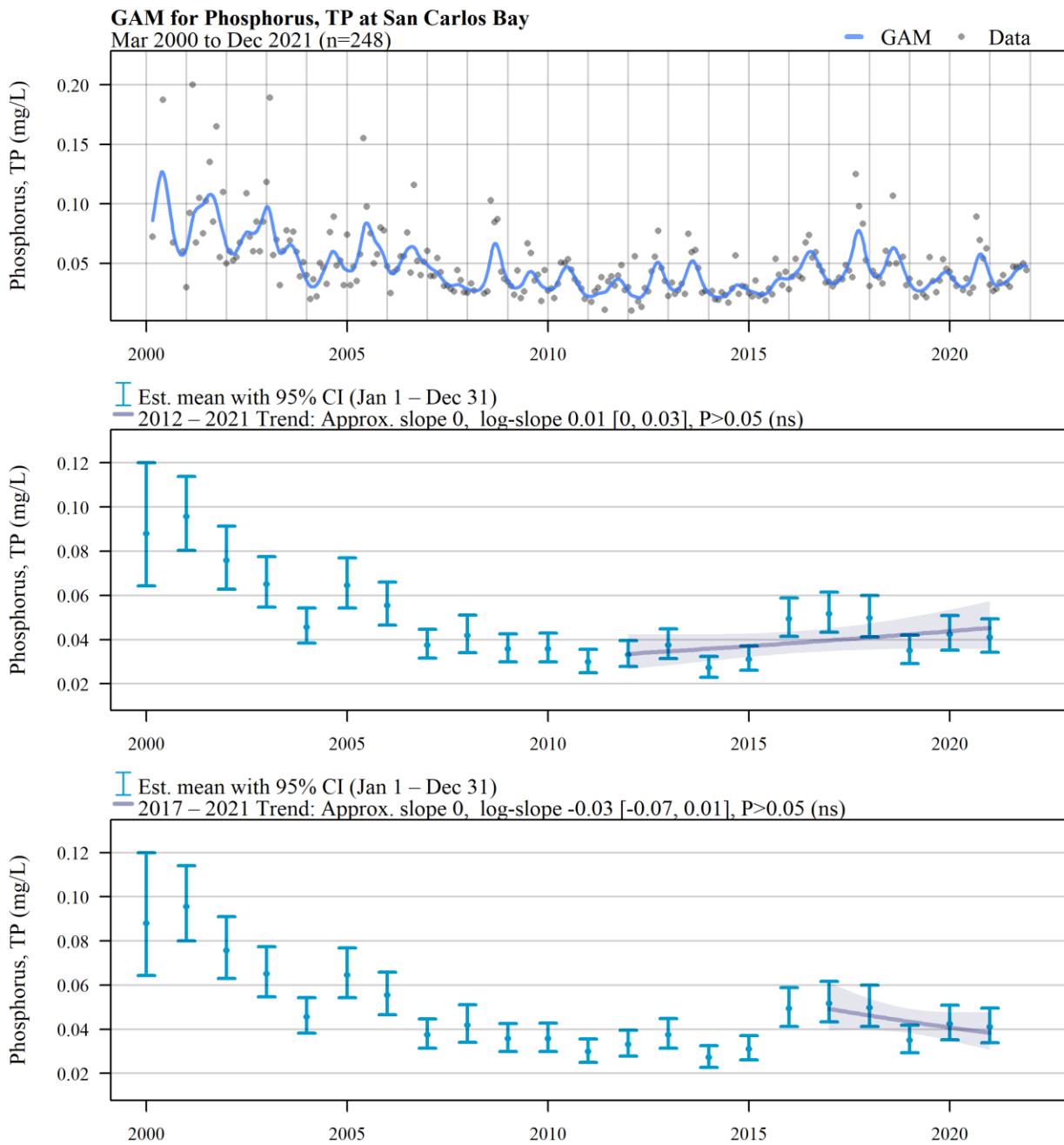


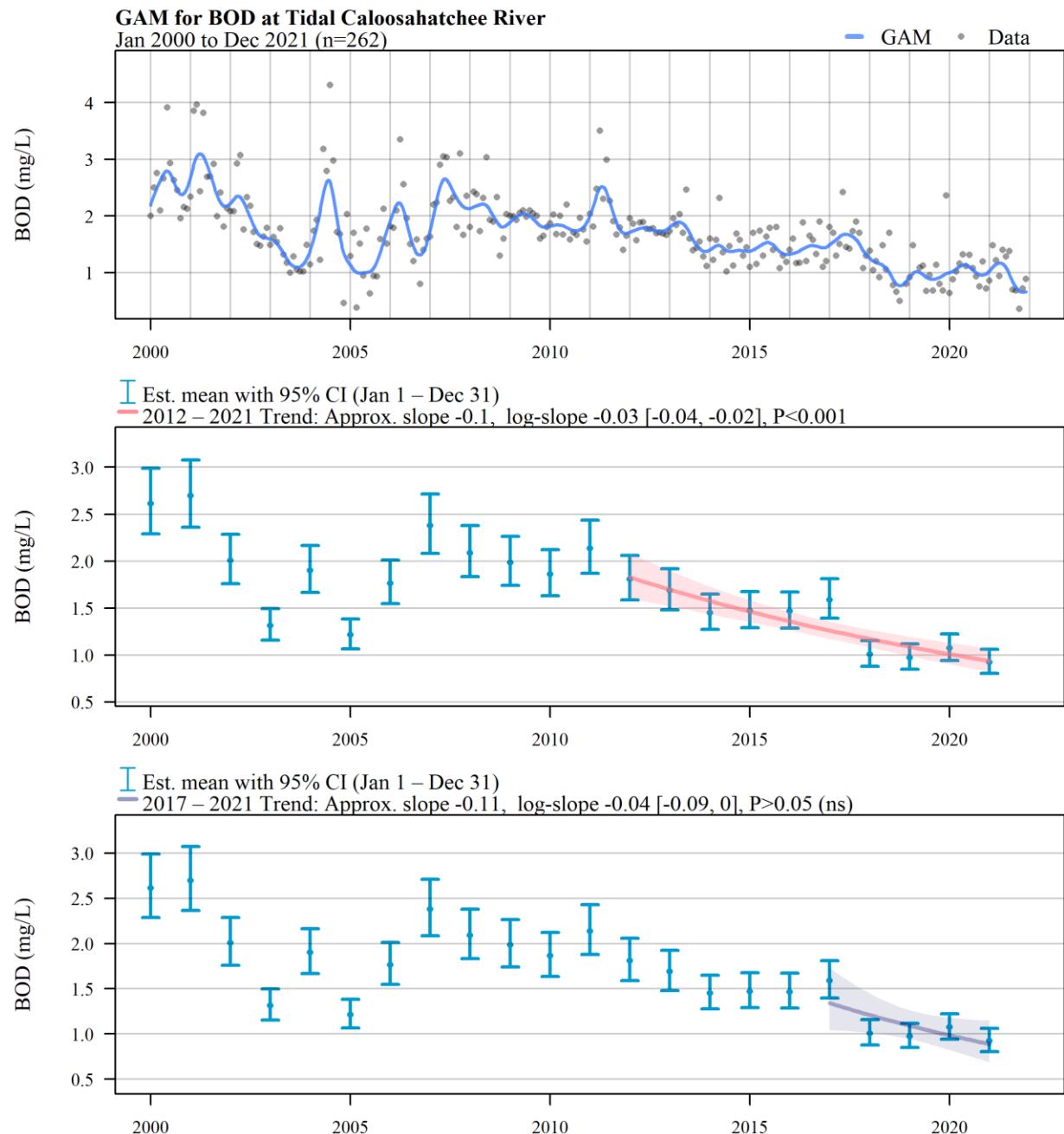


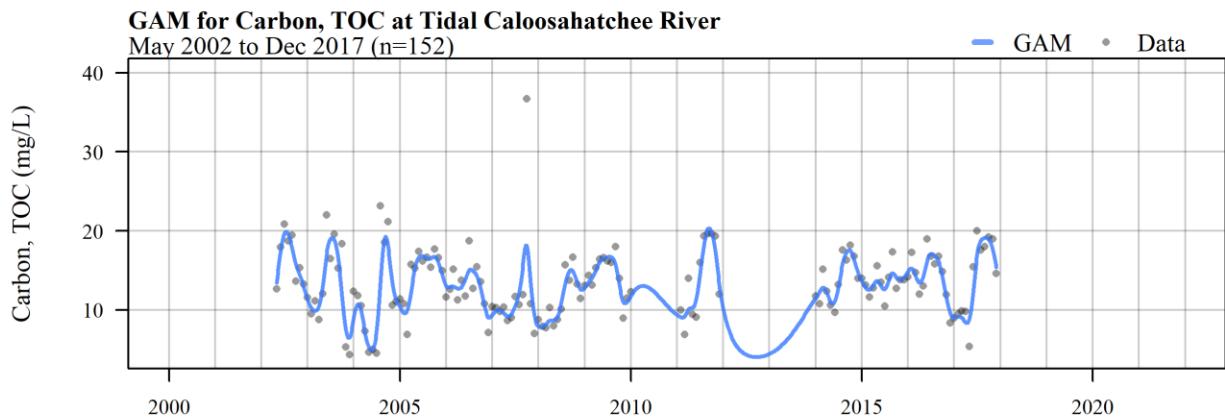


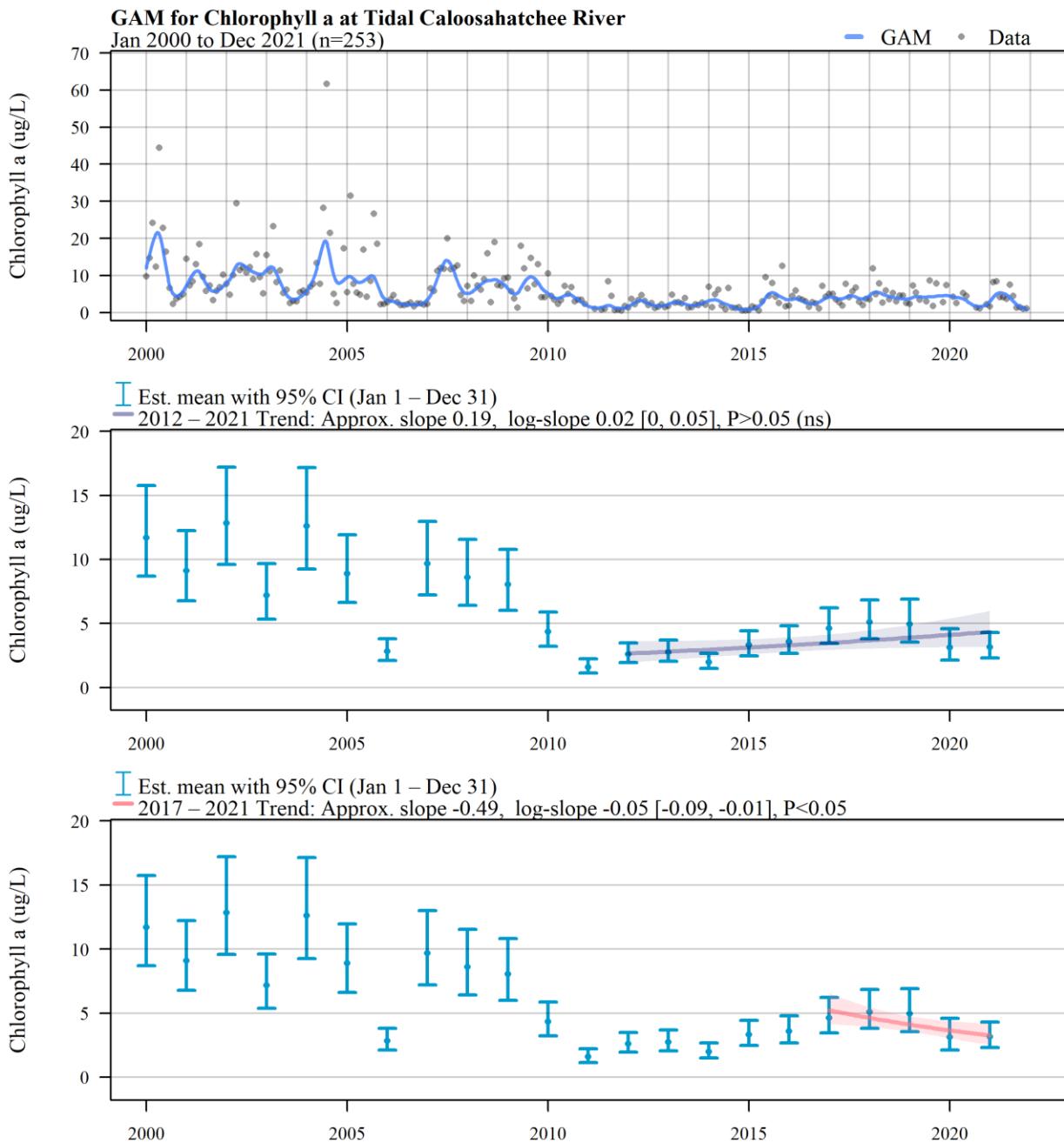








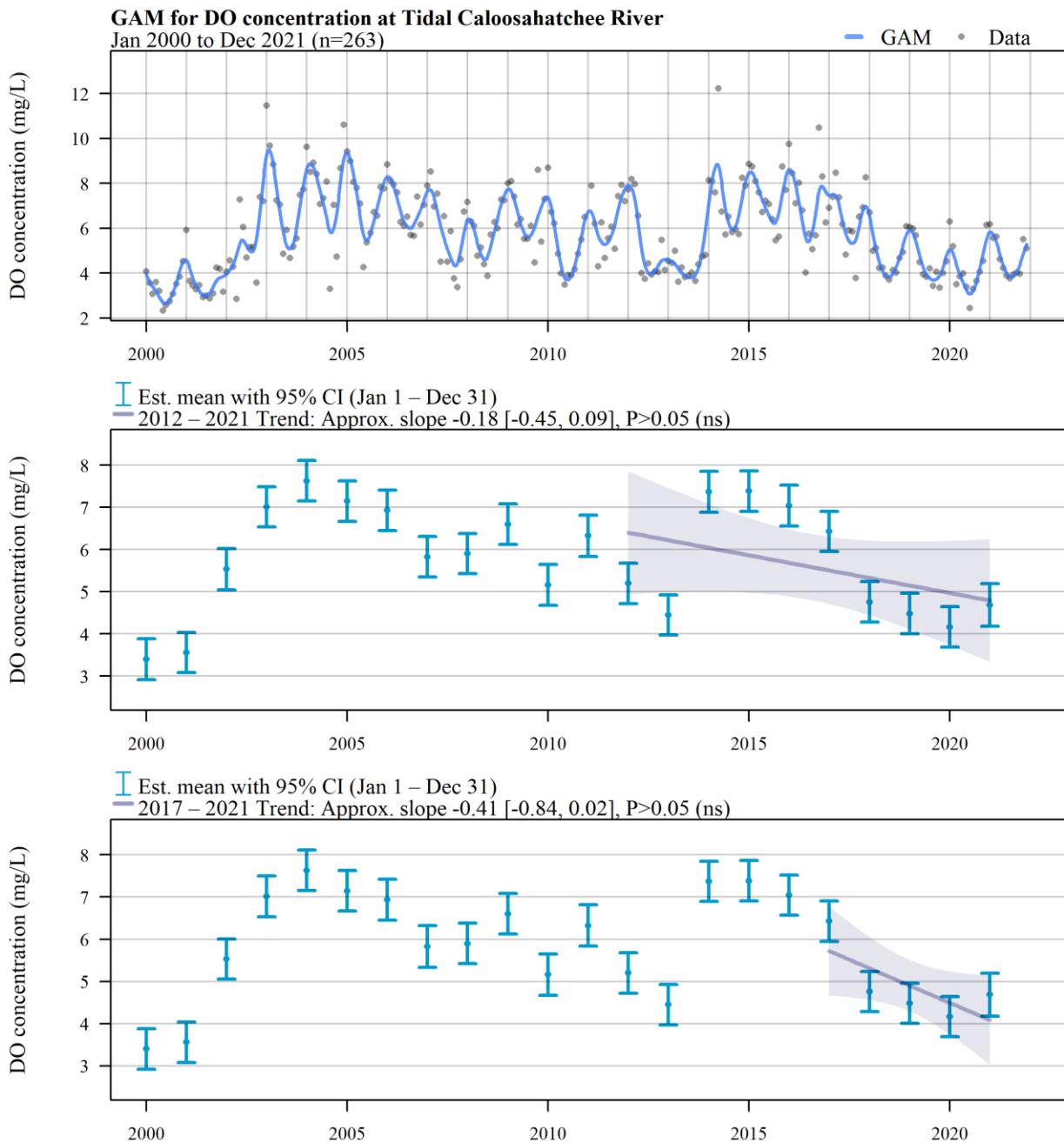




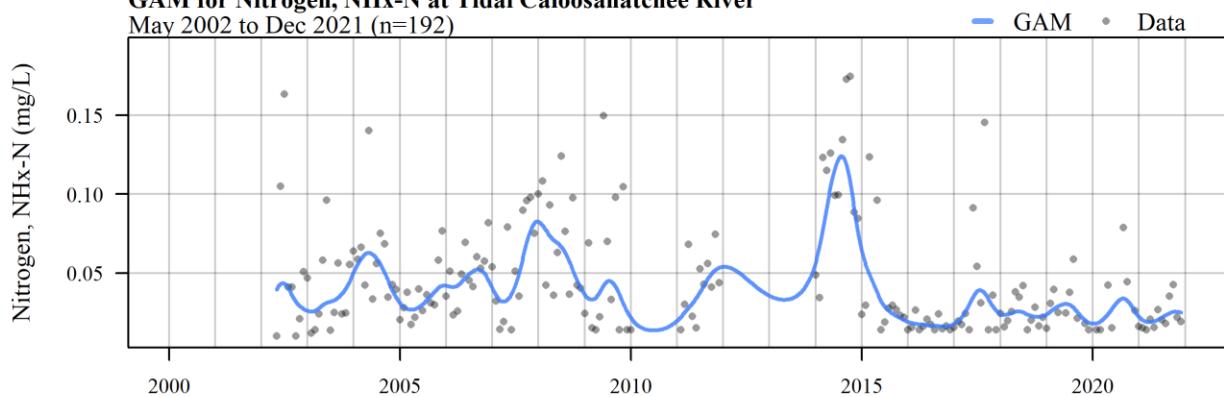
Color, apparent at Tidal Caloosahatchee River

No data
(Jan 2000 to Dec 2021)

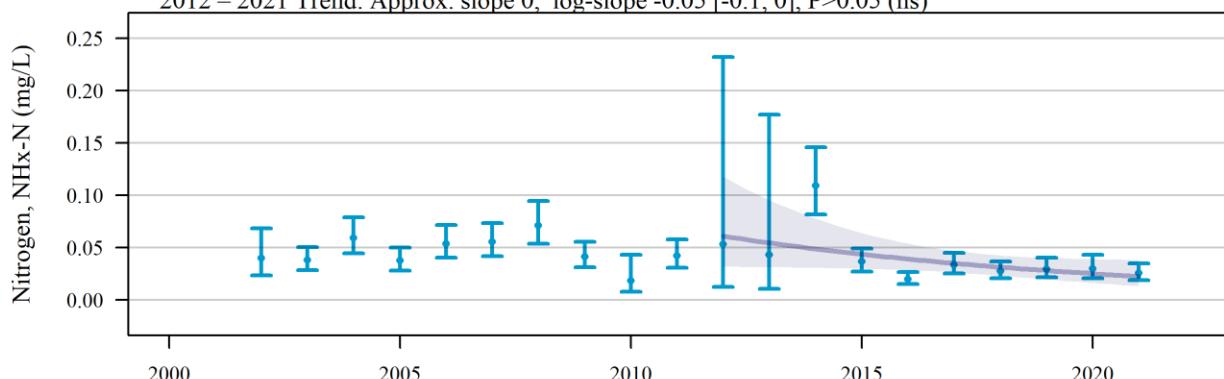
2000 2005 2010 2015 2020



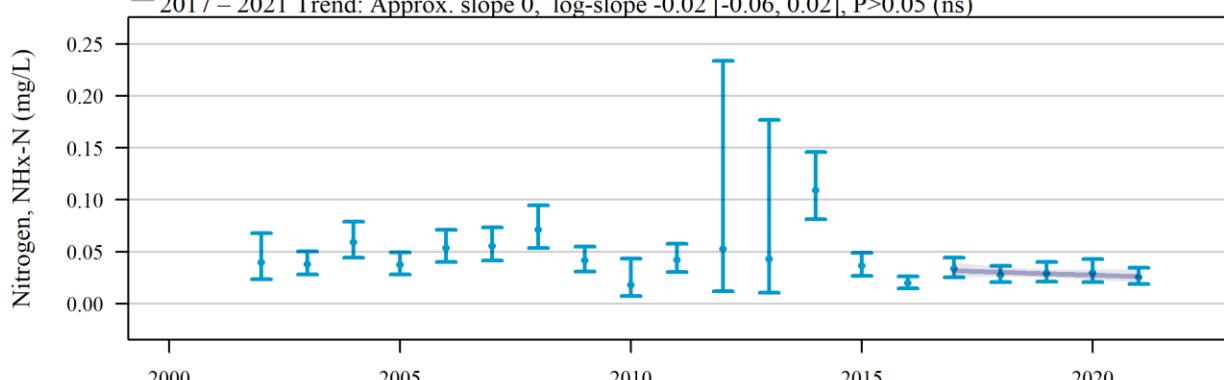
GAM for Nitrogen, NH_x-N at Tidal Caloosahatchee River
May 2002 to Dec 2021 (n=192)

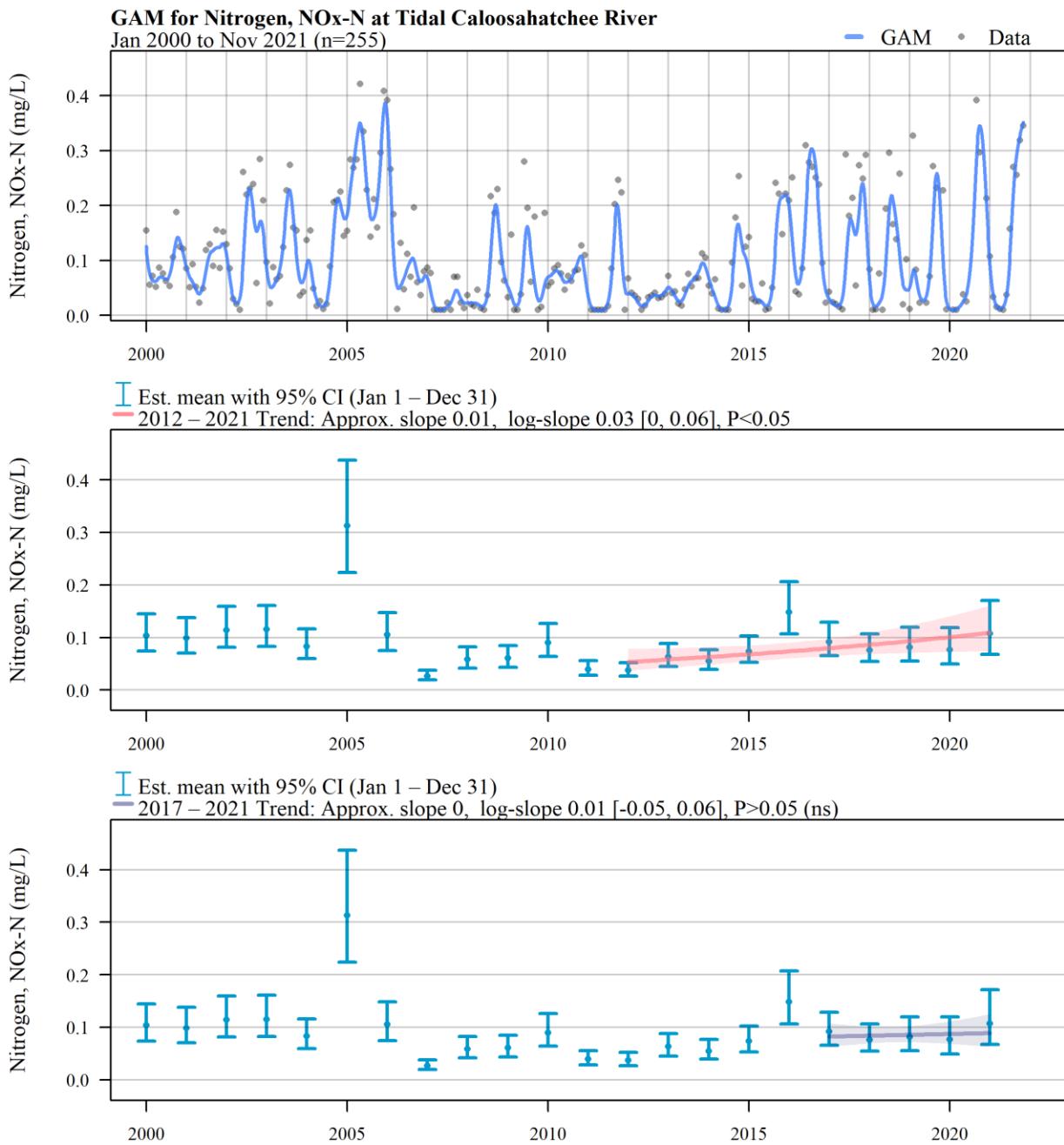


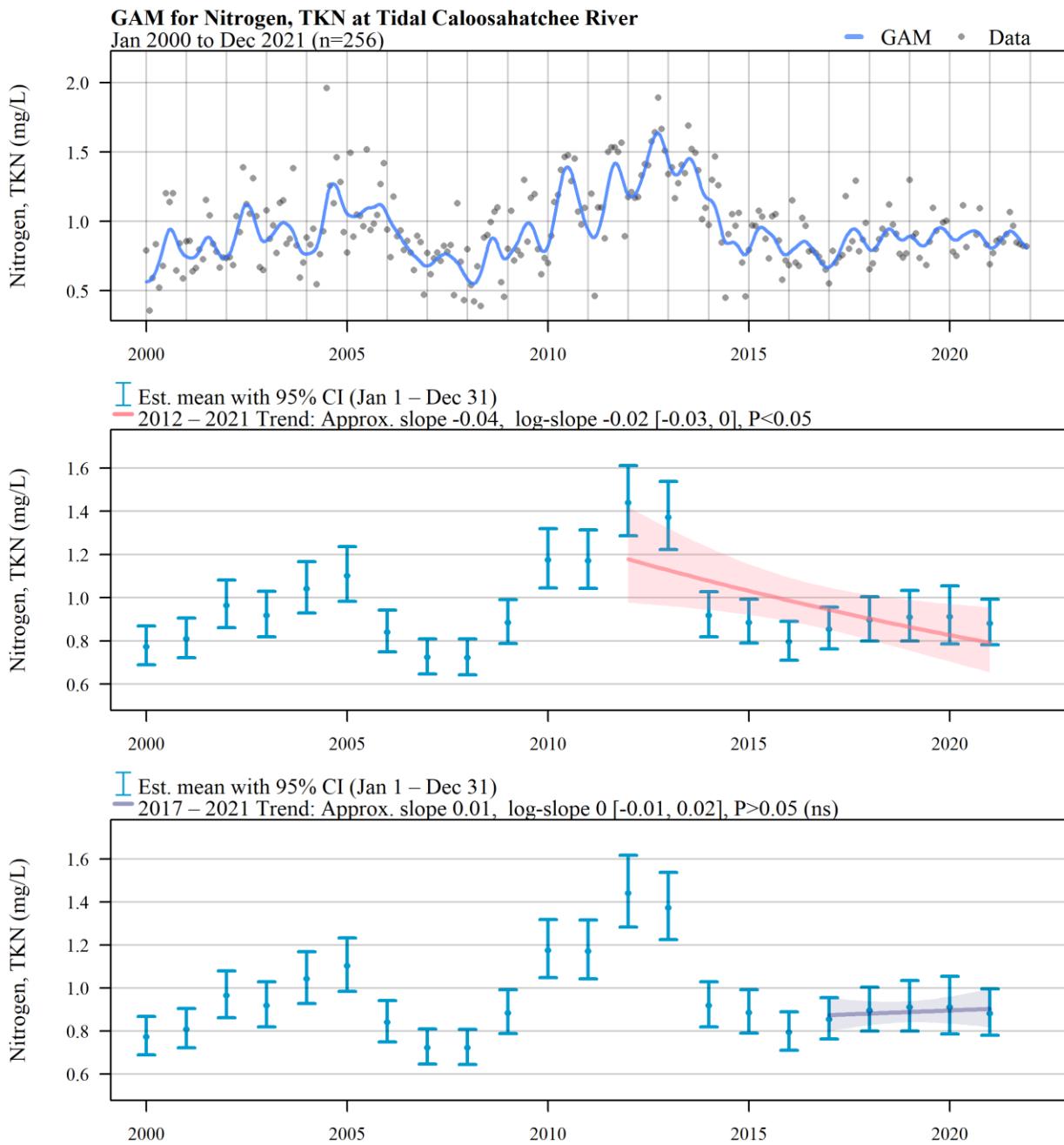
Est. mean with 95% CI (Jan 1 – Dec 31)
2012 – 2021 Trend: Approx. slope 0, log-slope -0.05 [-0.1, 0], P>0.05 (ns)



Est. mean with 95% CI (Jan 1 – Dec 31)
2017 – 2021 Trend: Approx. slope 0, log-slope -0.02 [-0.06, 0.02], P>0.05 (ns)

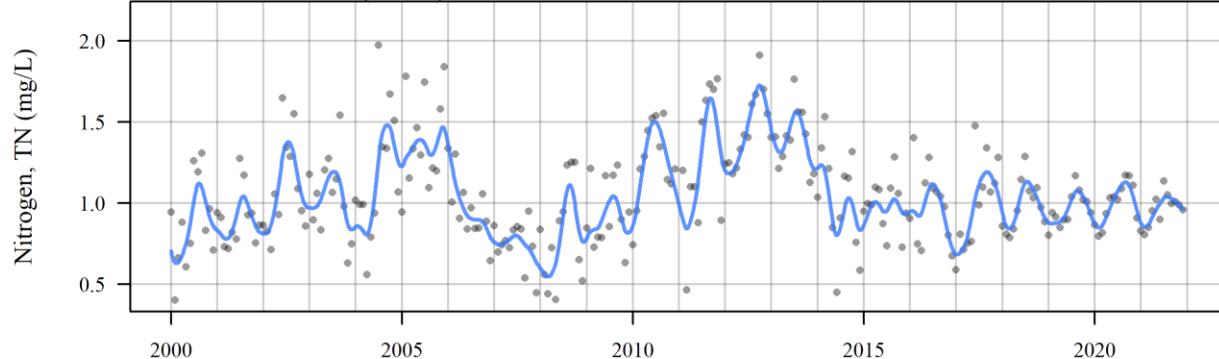




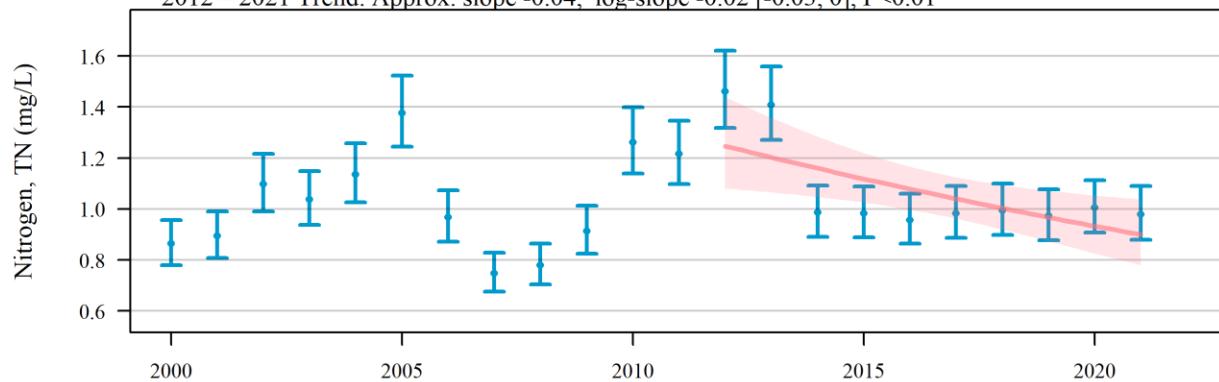


GAM for Nitrogen, TN at Tidal Caloosahatchee River
 Jan 2000 to Dec 2021 (n=263)

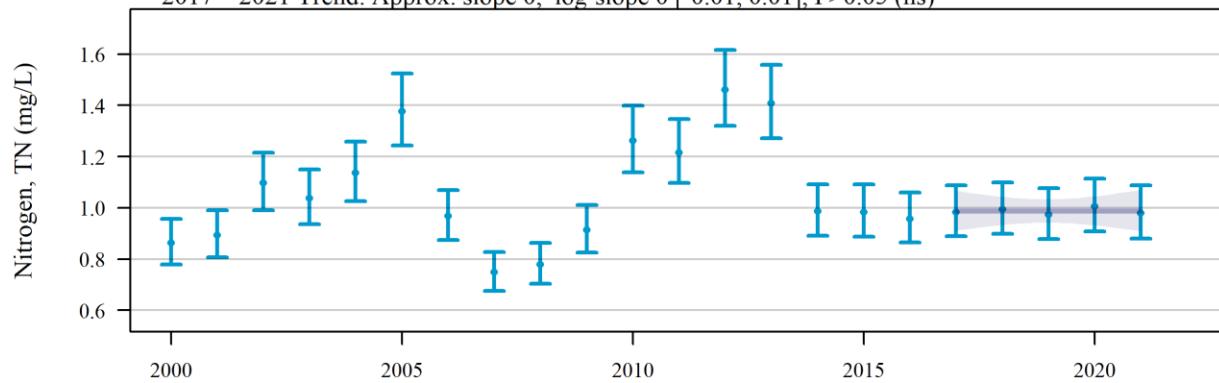
— GAM • Data

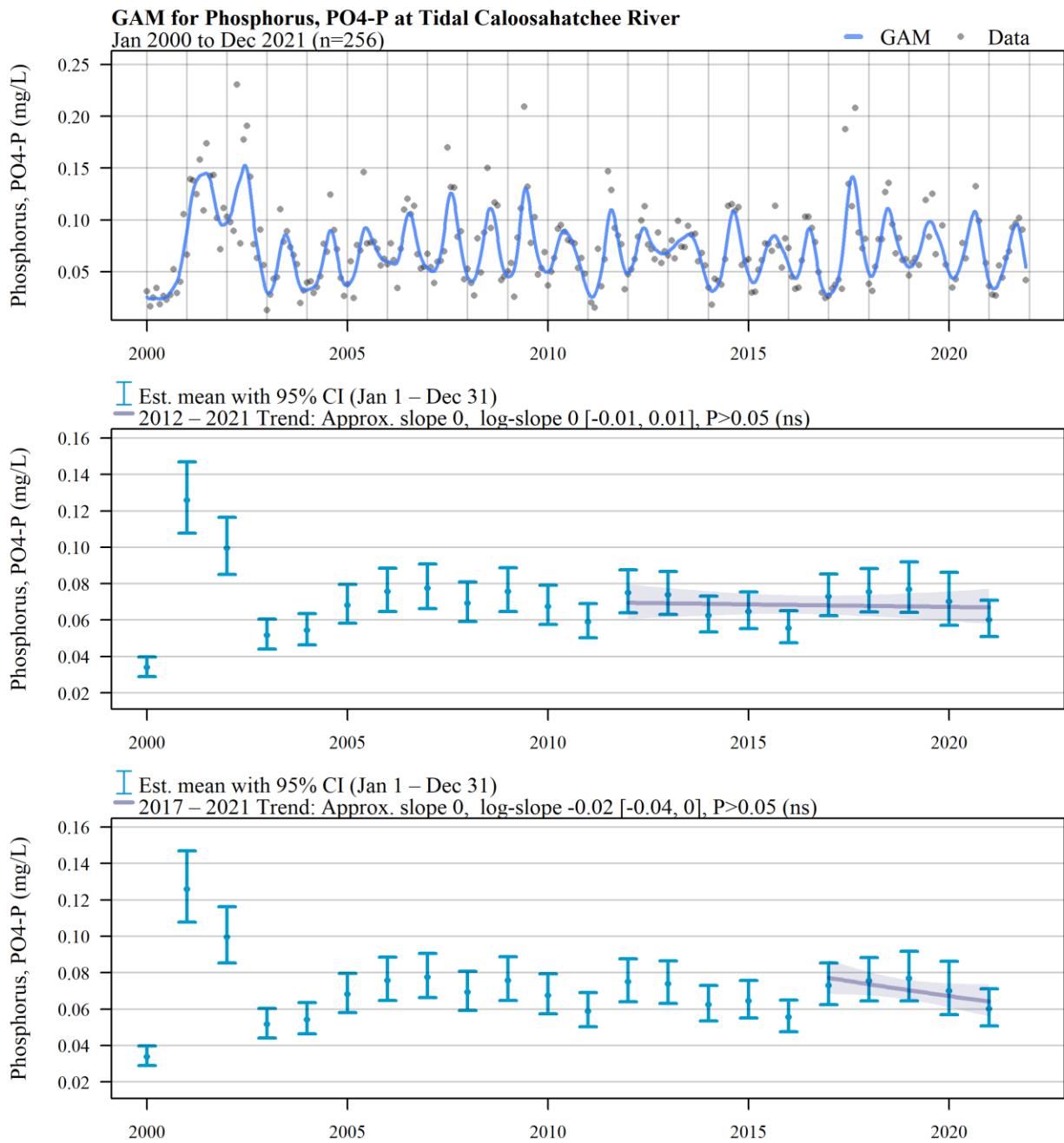


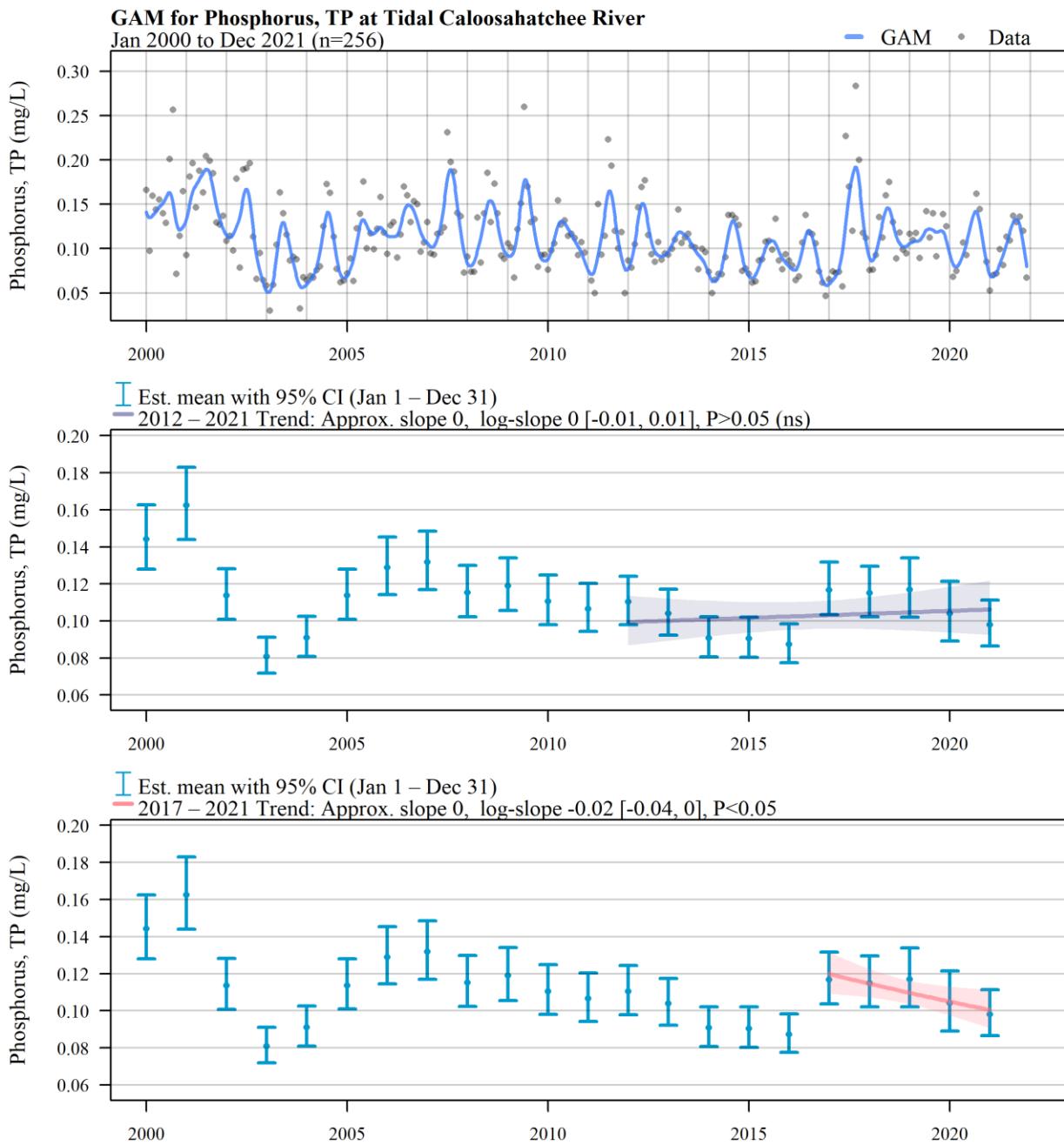
Est. mean with 95% CI (Jan 1 – Dec 31)
 2012 – 2021 Trend: Approx. slope -0.04, log-slope -0.02 [-0.03, 0], P<0.01



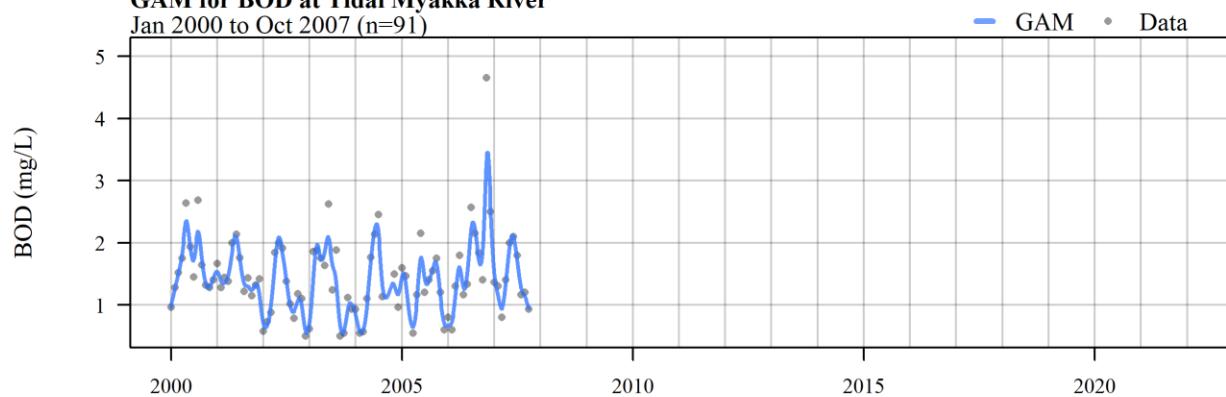
Est. mean with 95% CI (Jan 1 – Dec 31)
 2017 – 2021 Trend: Approx. slope 0, log-slope 0 [-0.01, 0.01], P>0.05 (ns)

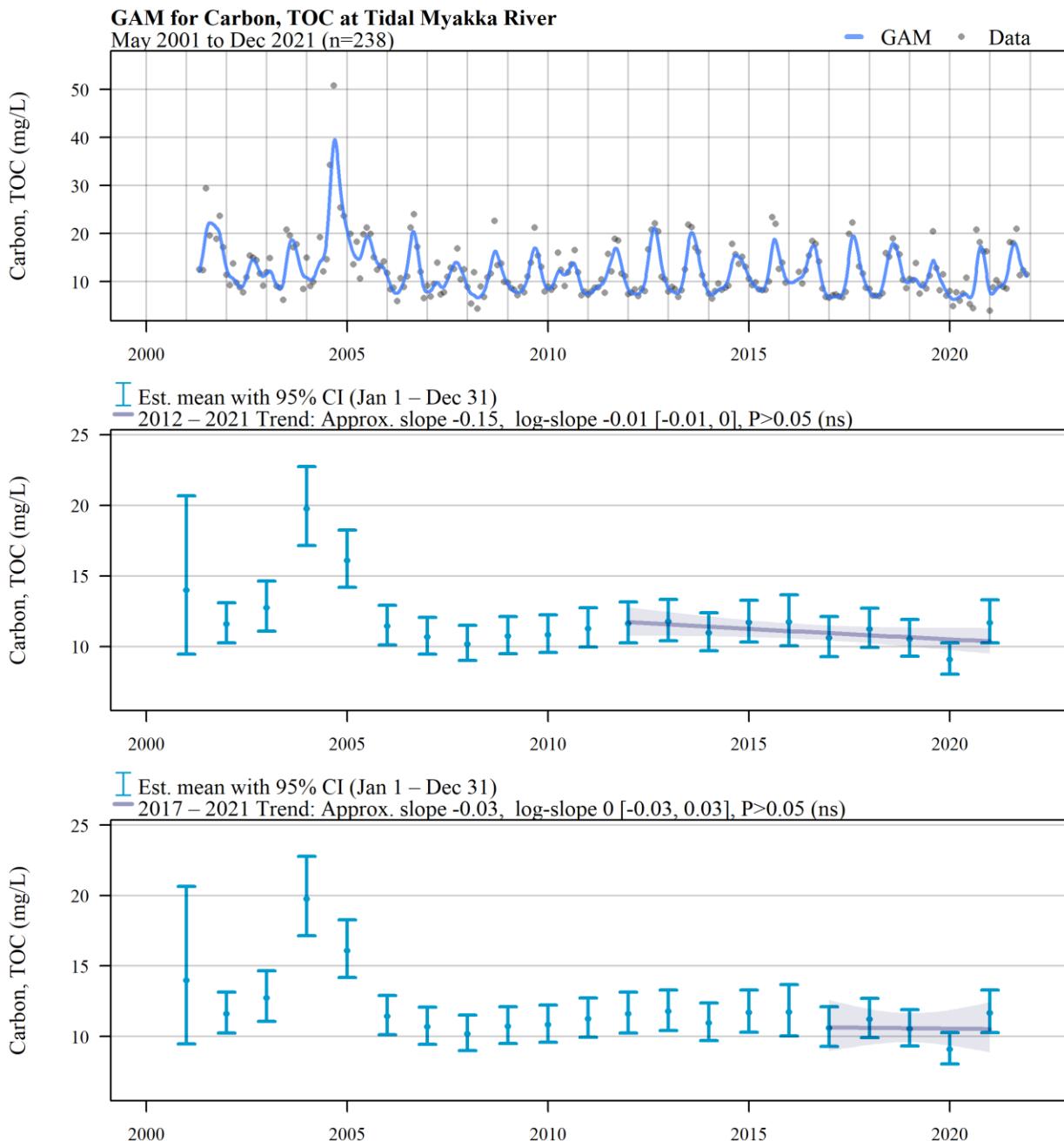


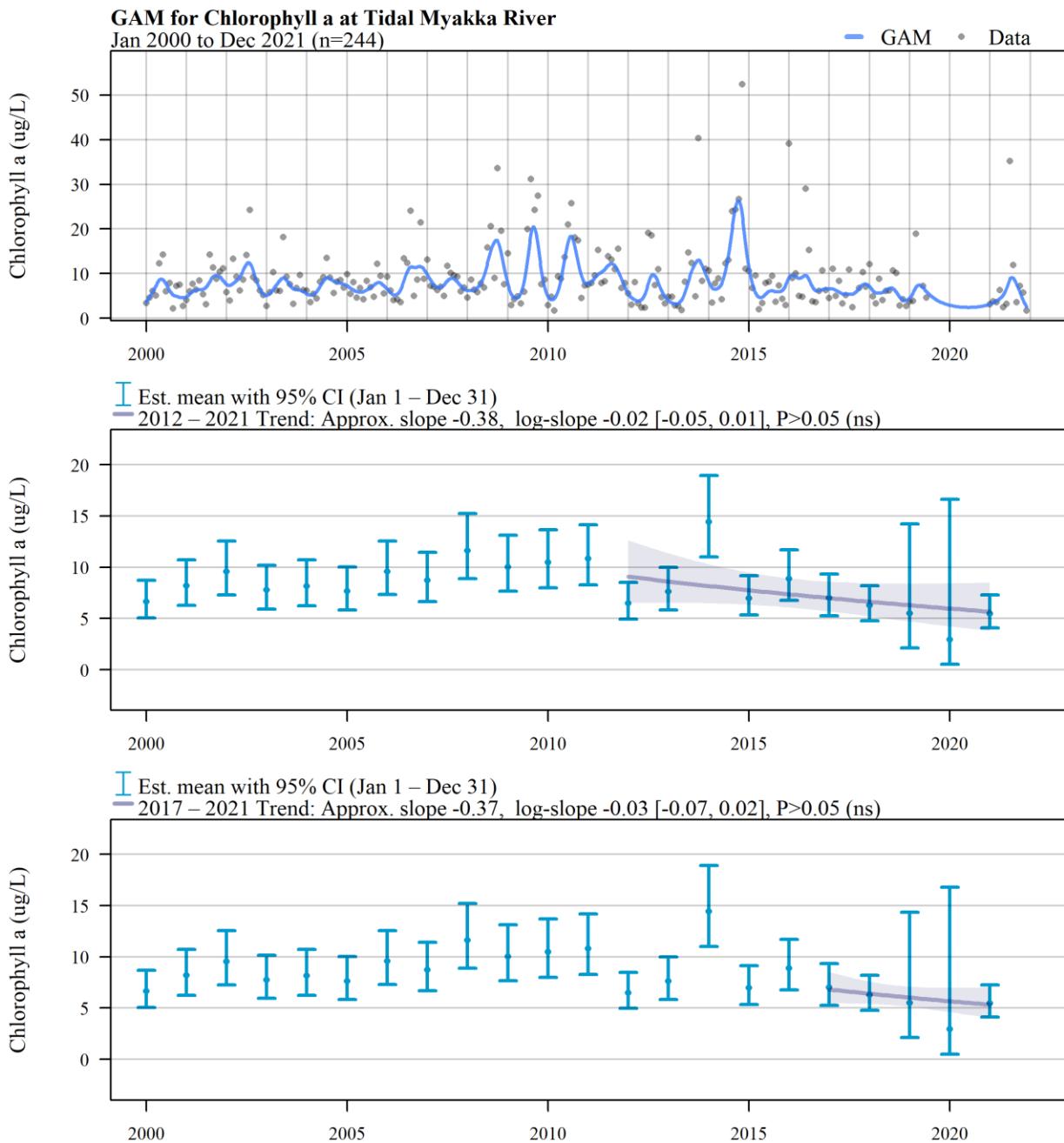


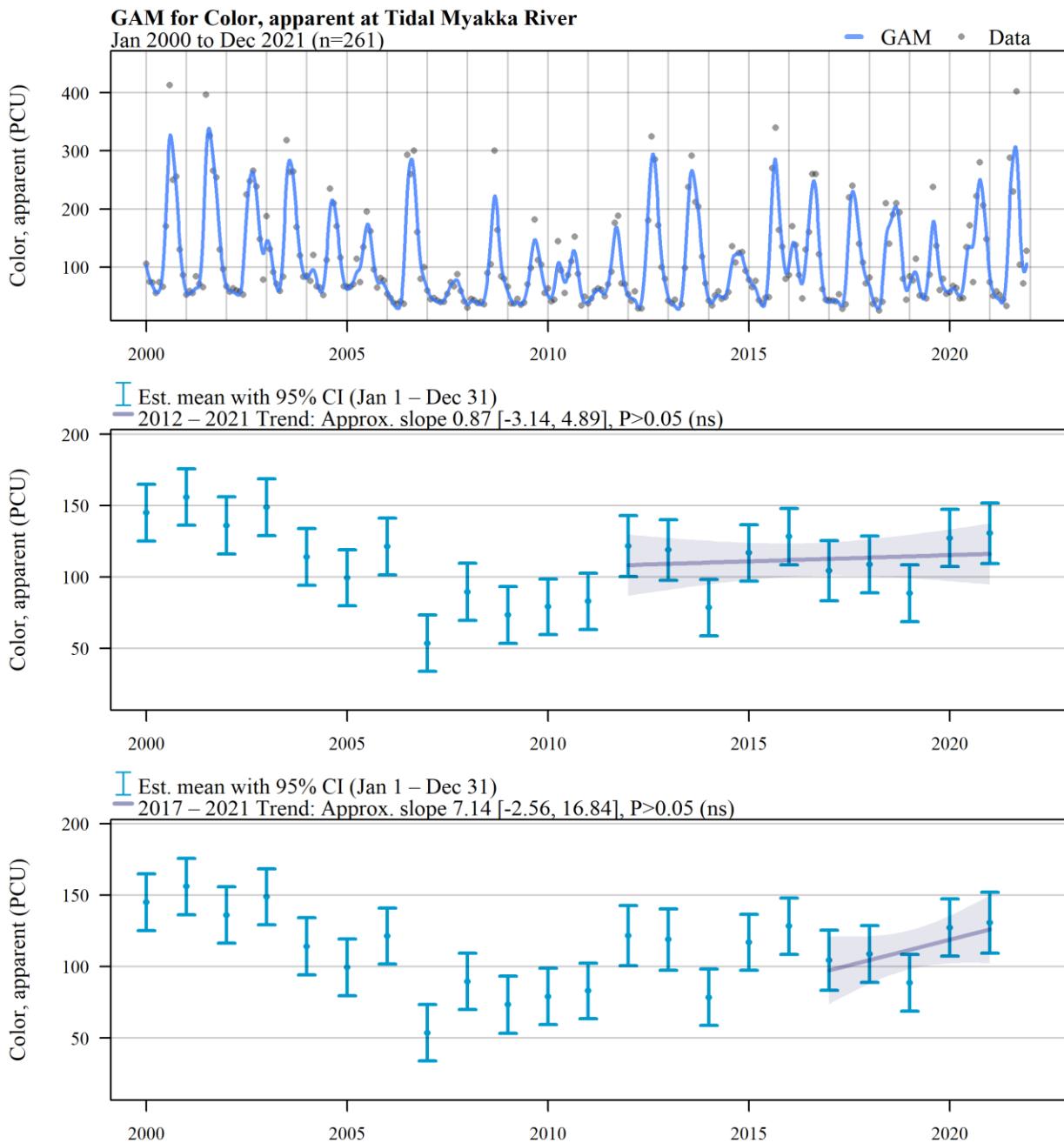


GAM for BOD at Tidal Myakka River
Jan 2000 to Oct 2007 (n=91)



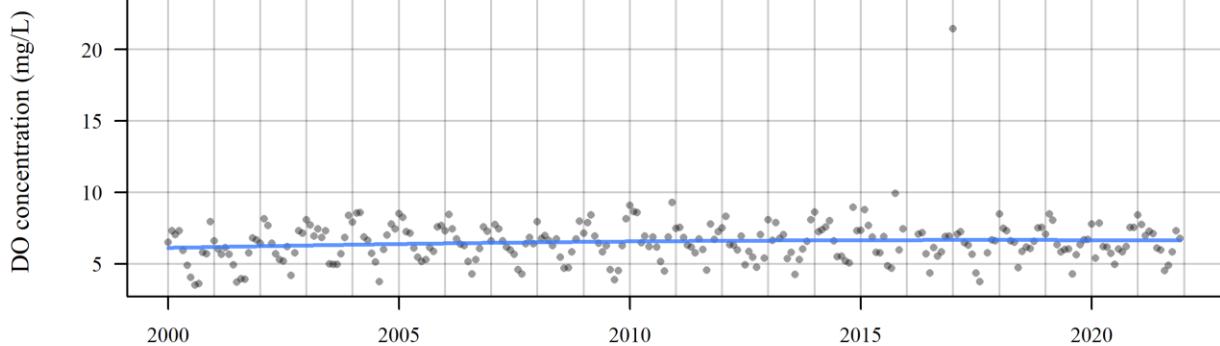




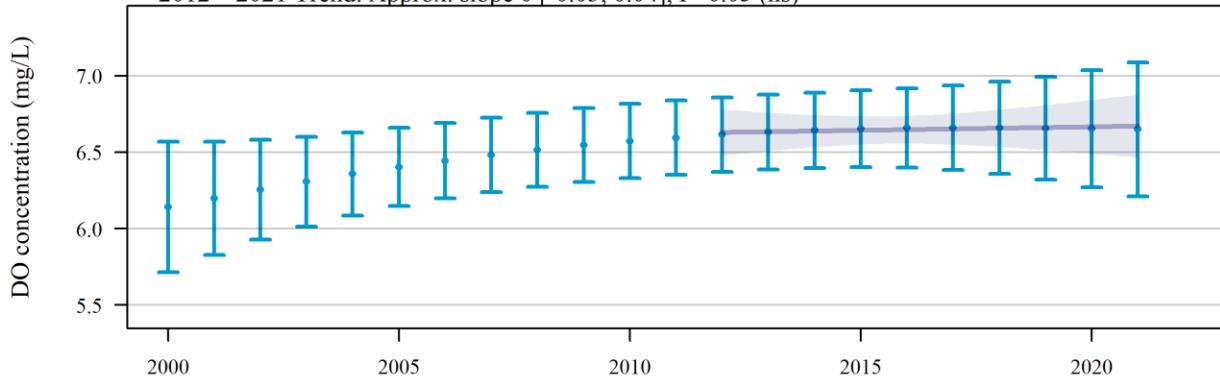


GAM for DO concentration at Tidal Myakka River
 Jan 2000 to Dec 2021 (n=260)

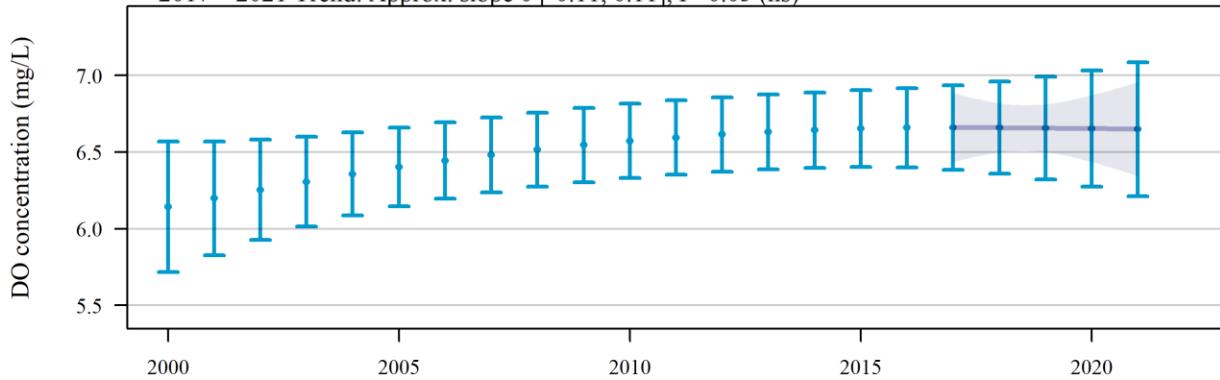
— GAM • Data

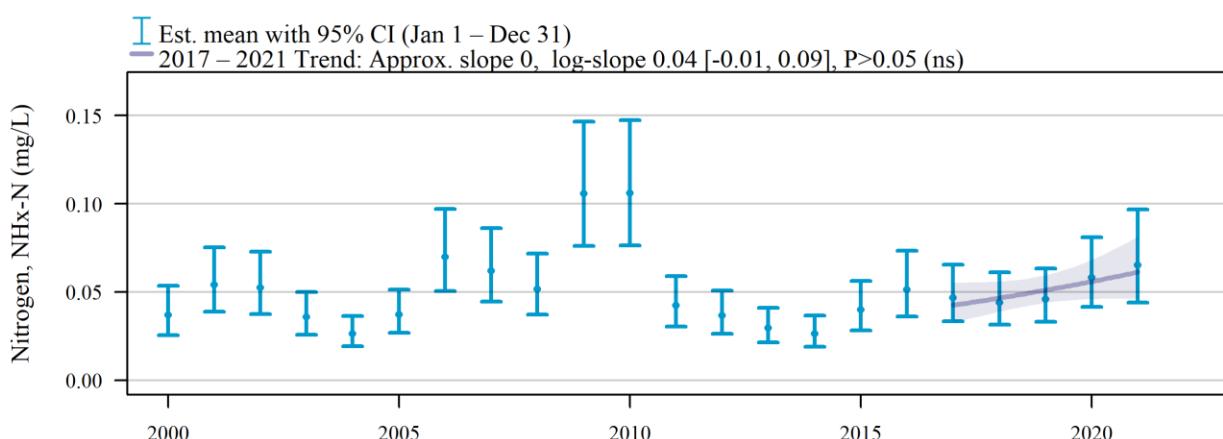
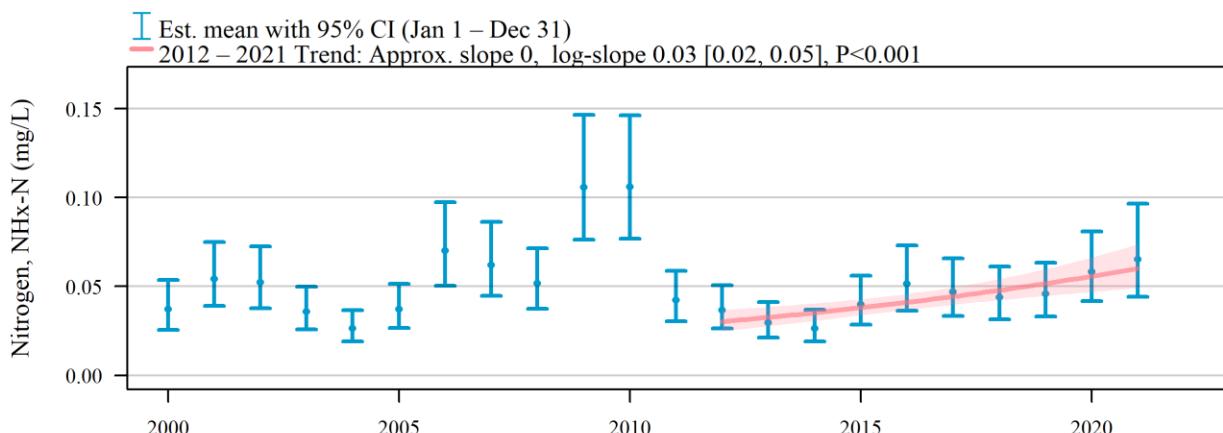
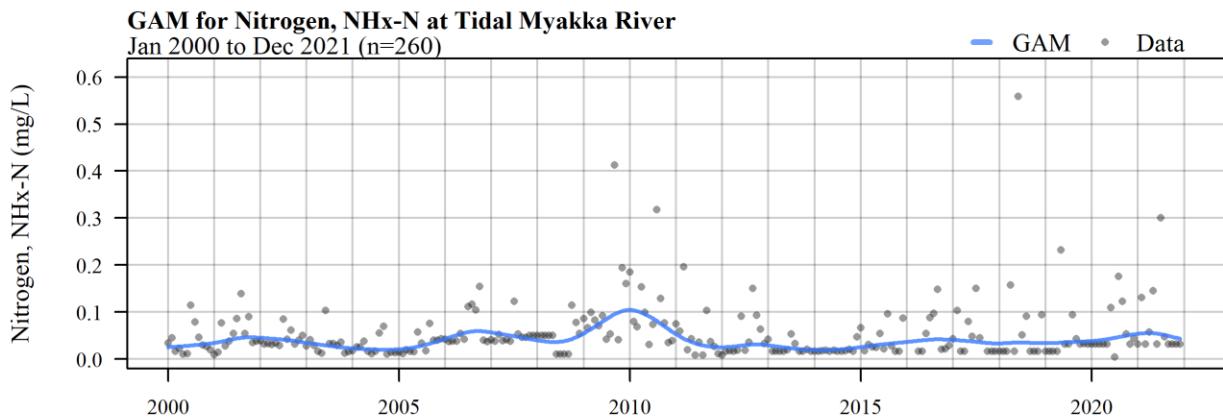


Est. mean with 95% CI (Jan 1 – Dec 31)
 2012 – 2021 Trend: Approx. slope 0 [-0.03, 0.04], P>0.05 (ns)

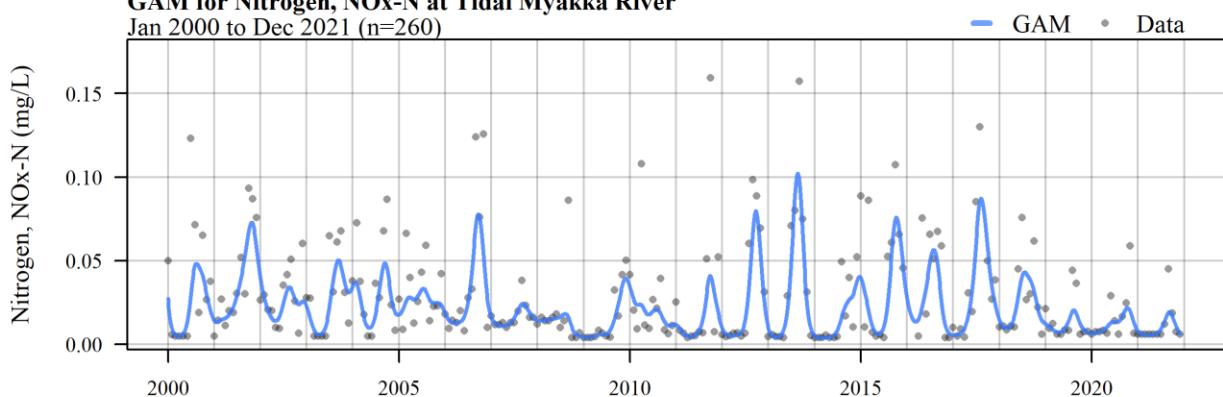


Est. mean with 95% CI (Jan 1 – Dec 31)
 2017 – 2021 Trend: Approx. slope 0 [-0.11, 0.11], P>0.05 (ns)

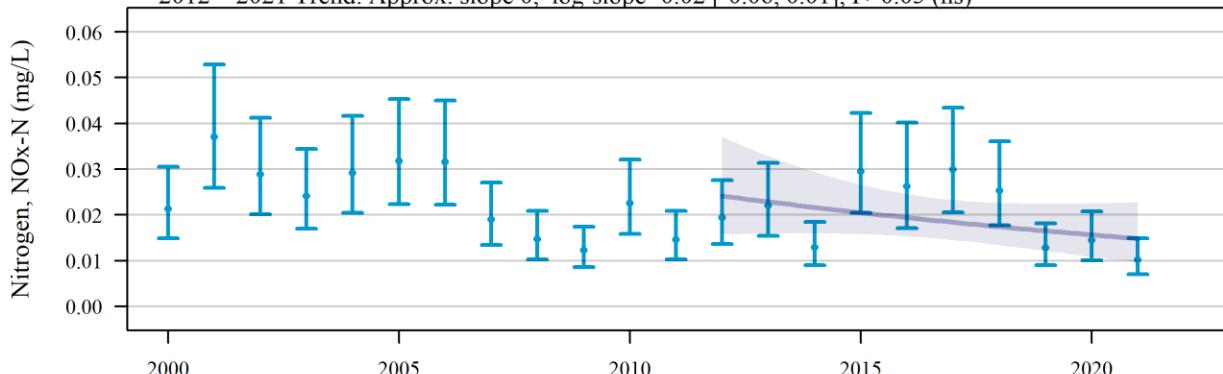




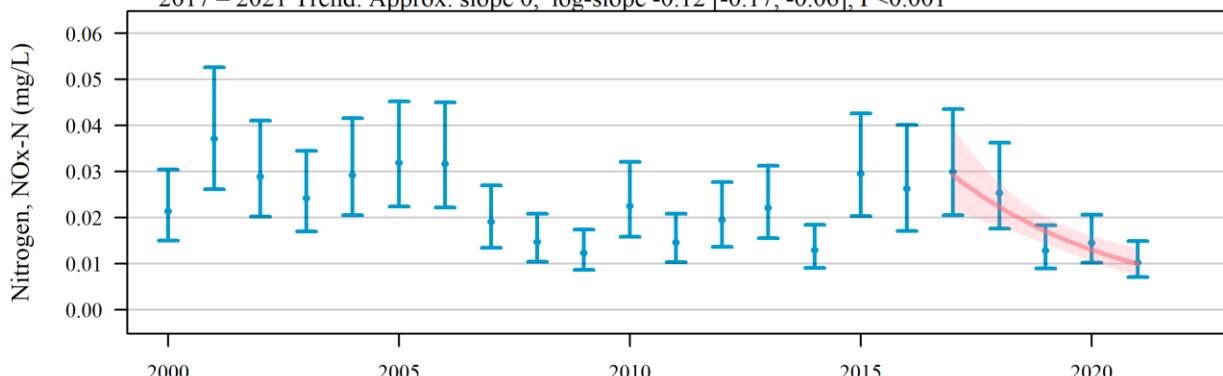
GAM for Nitrogen, NOx-N at Tidal Myakka River
 Jan 2000 to Dec 2021 (n=260)

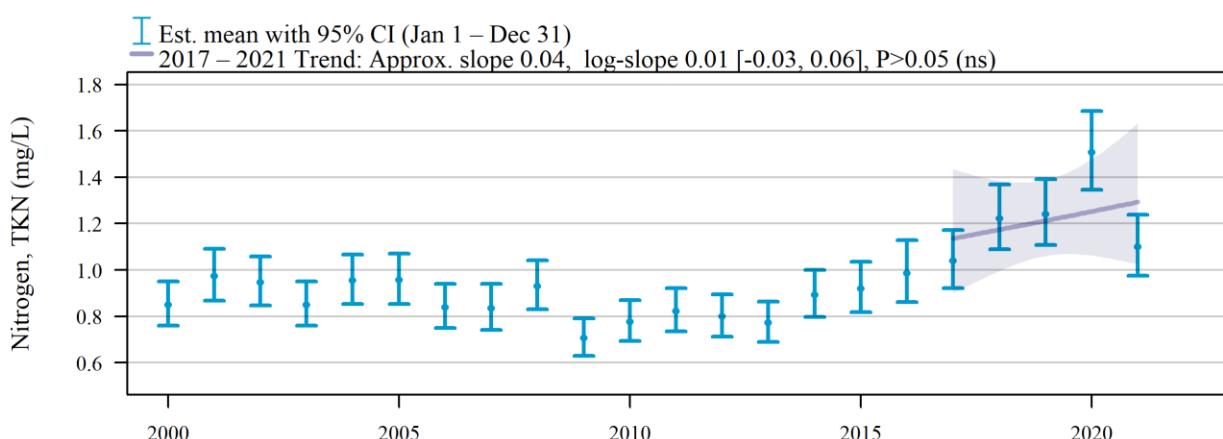
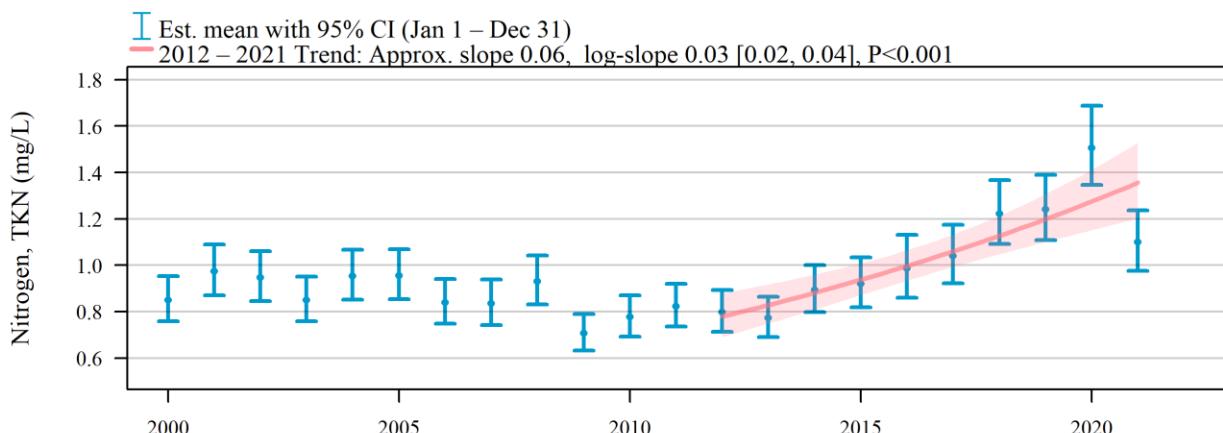
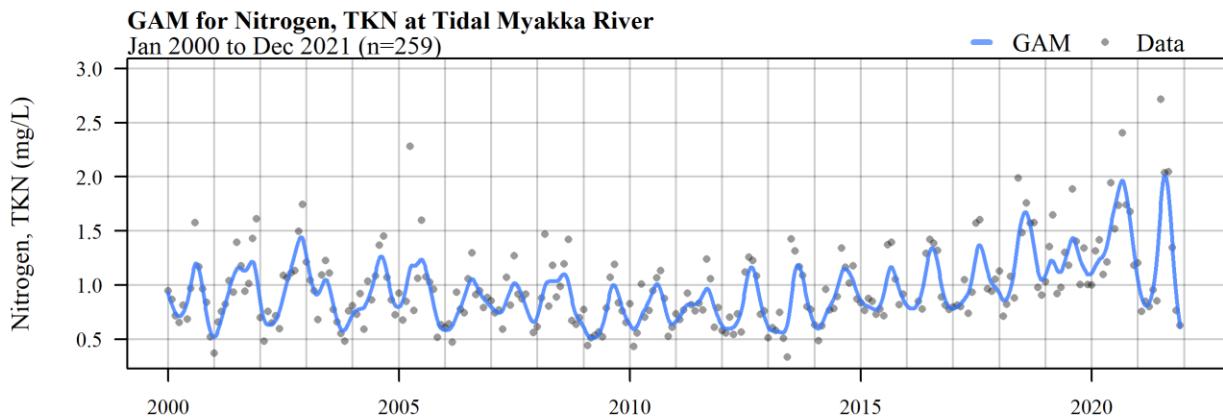


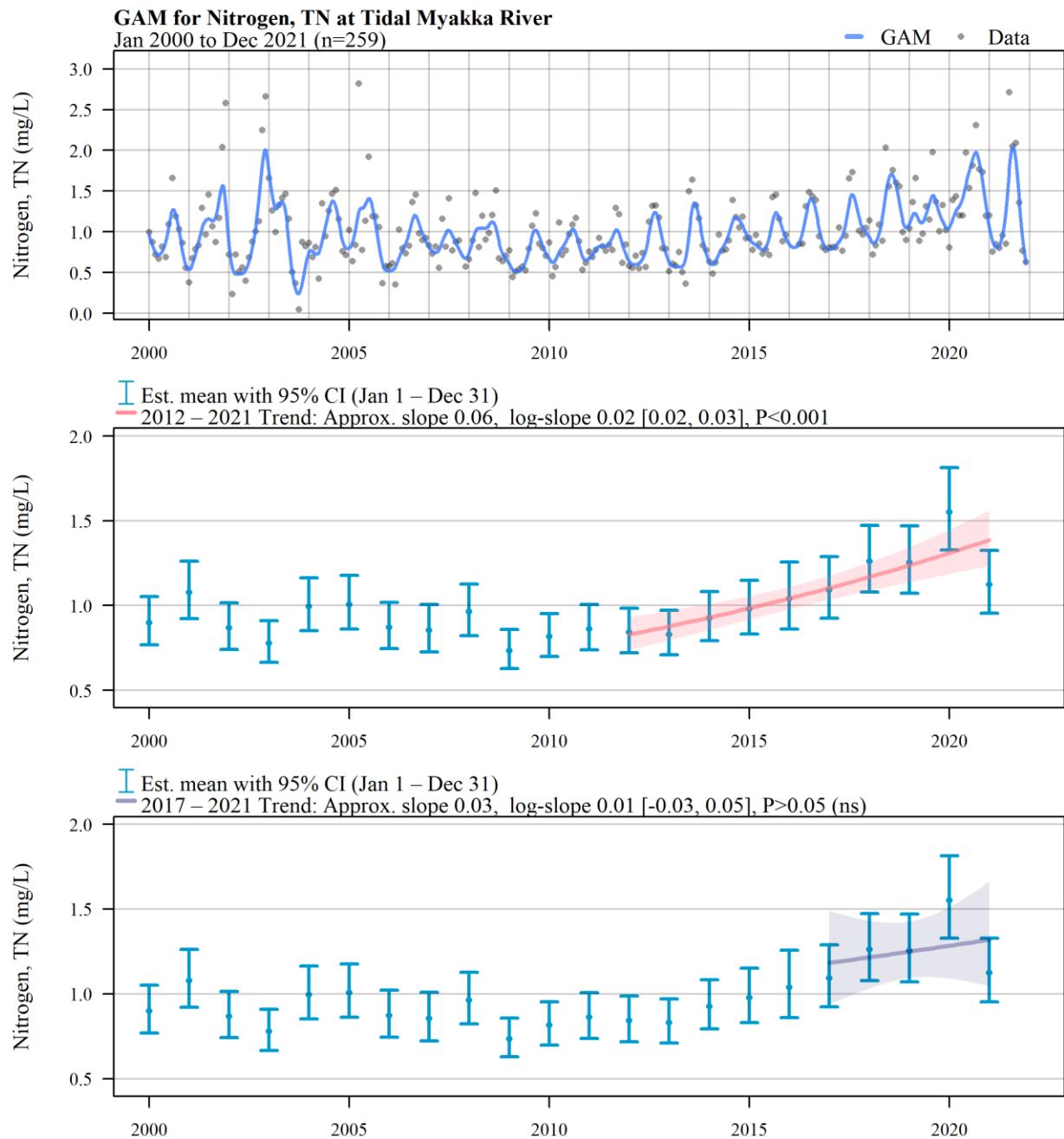
Est. mean with 95% CI (Jan 1 – Dec 31)
 2012 – 2021 Trend: Approx. slope 0, log-slope -0.02 [-0.06, 0.01], P>0.05 (ns)

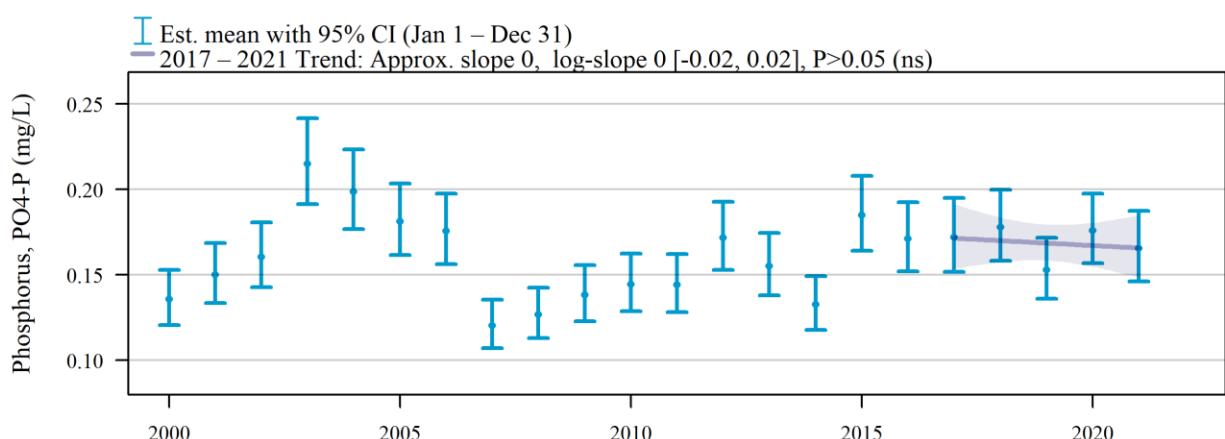
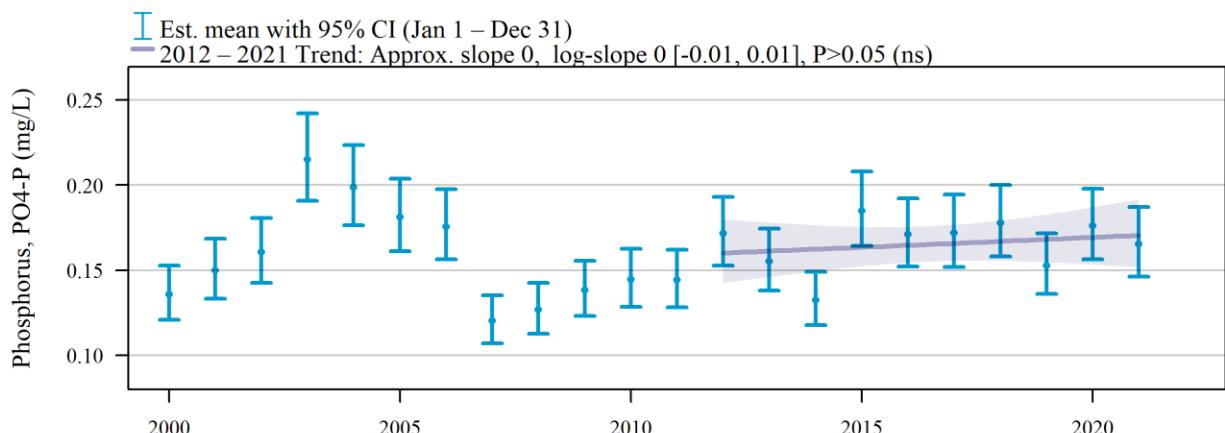
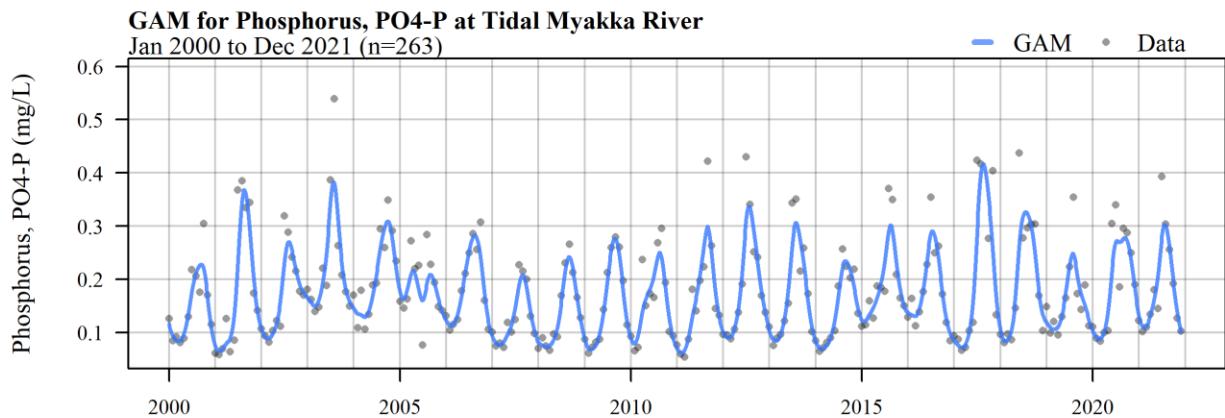


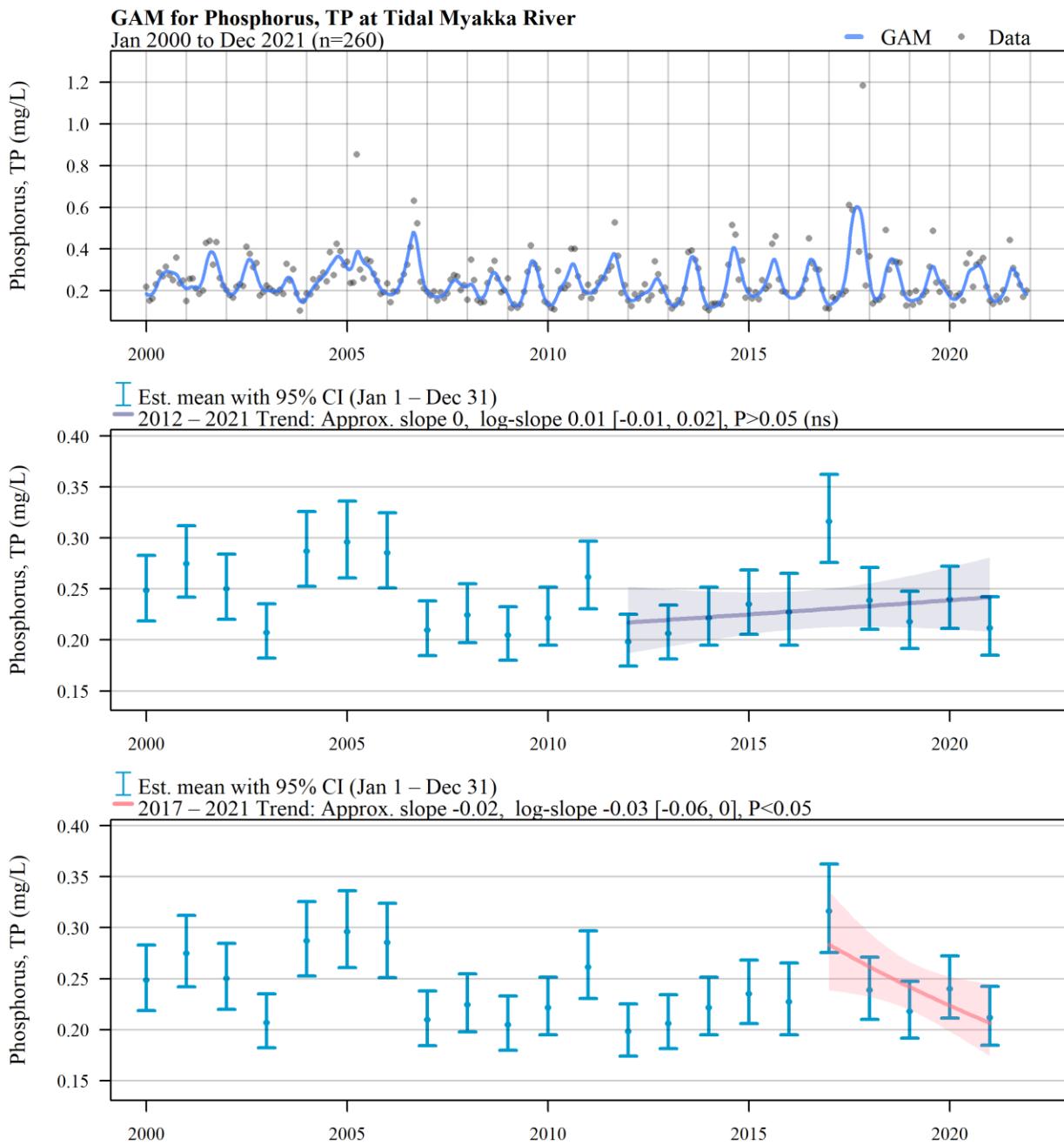
Est. mean with 95% CI (Jan 1 – Dec 31)
 2017 – 2021 Trend: Approx. slope 0, log-slope -0.12 [-0.17, -0.06], P<0.001







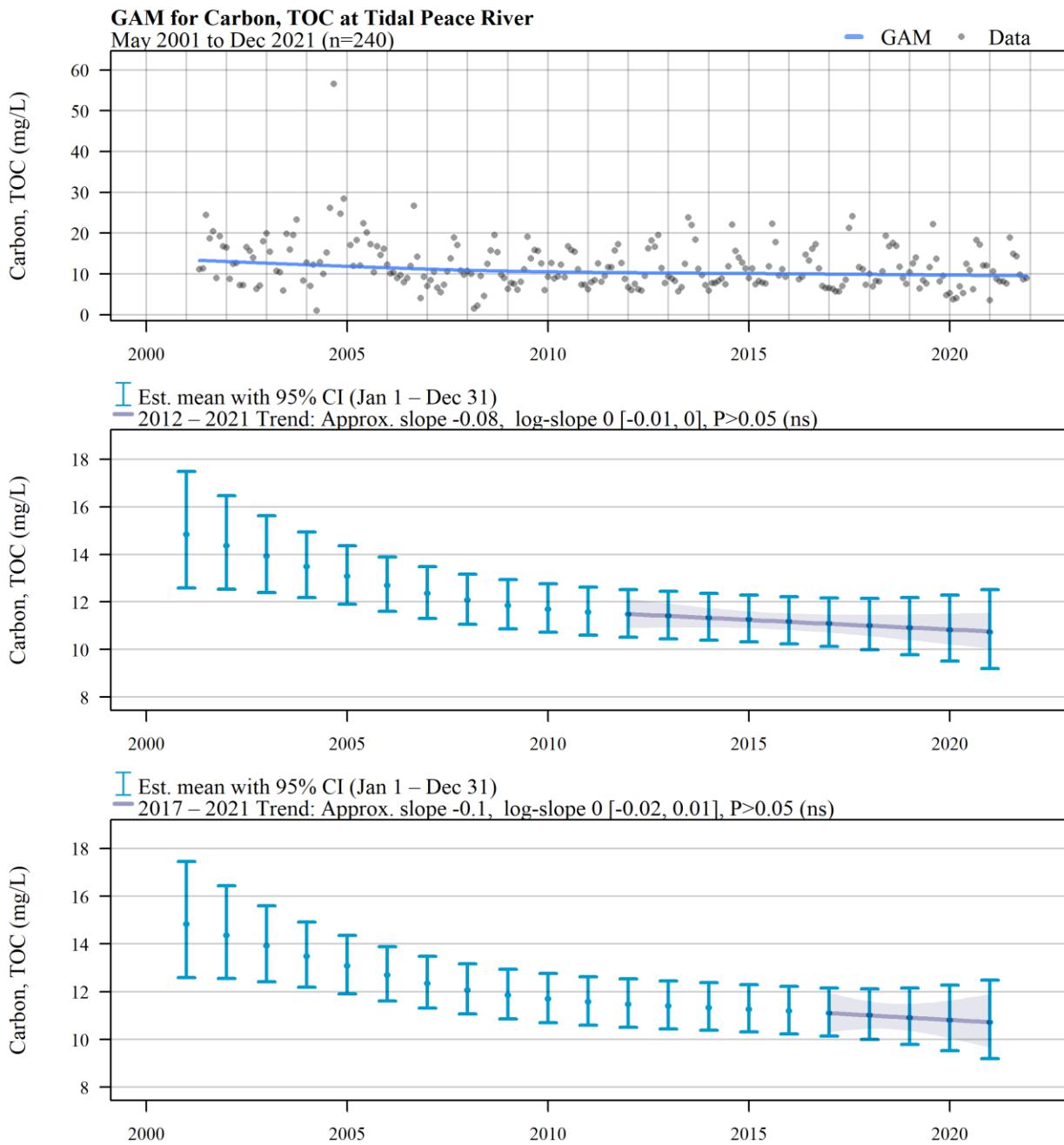


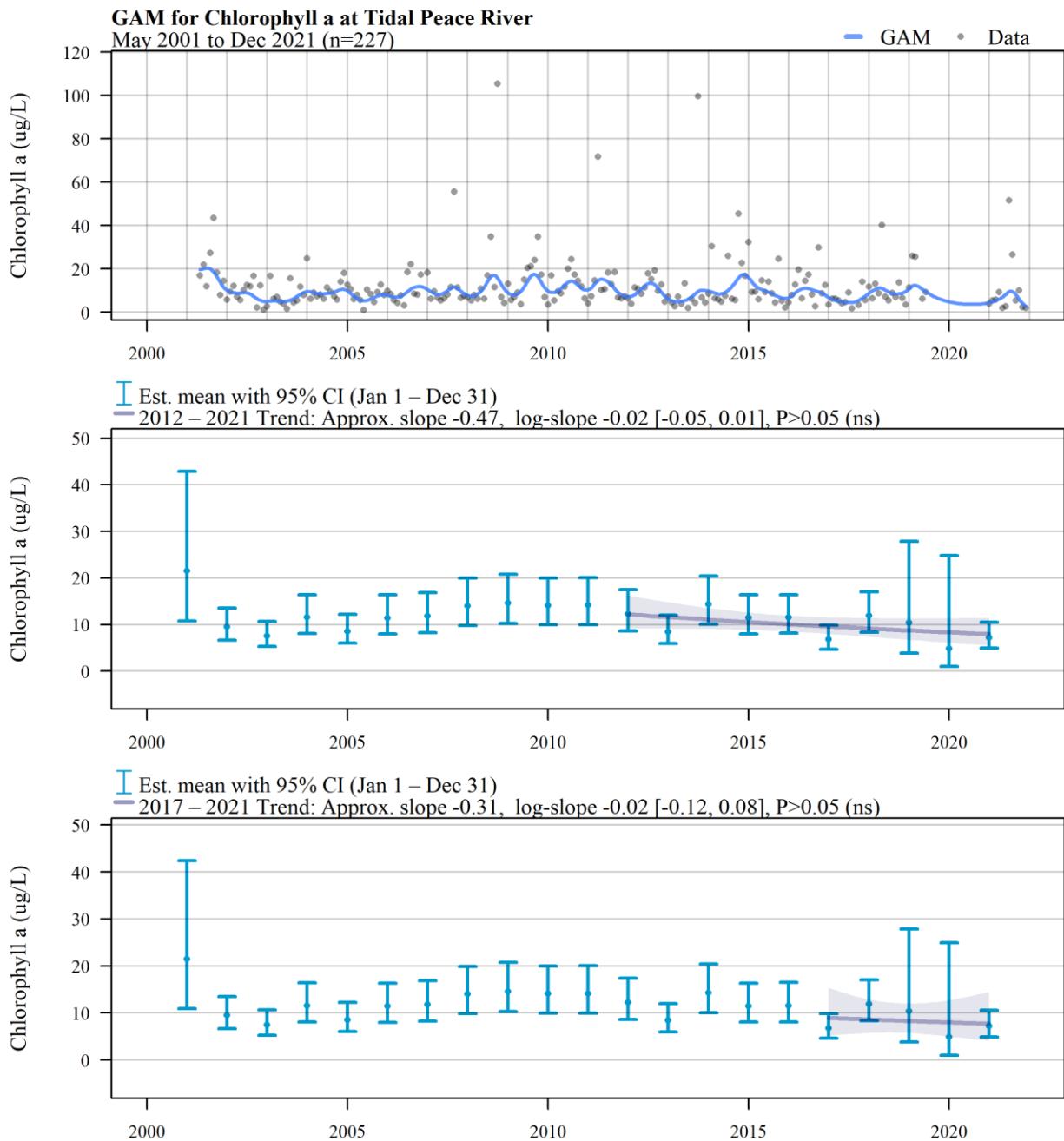


BOD at Tidal Peace River

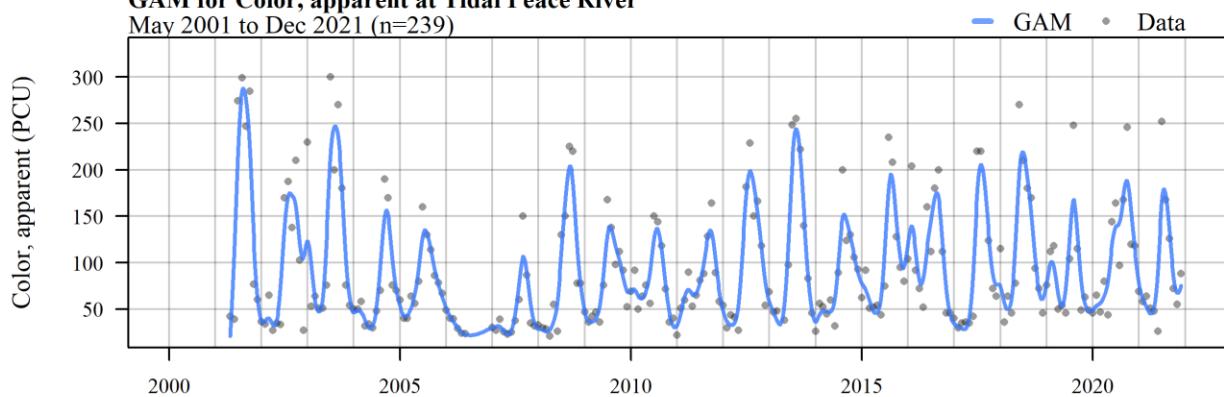
No data
(Jan 2000 to Dec 2021)

2000 2005 2010 2015 2020

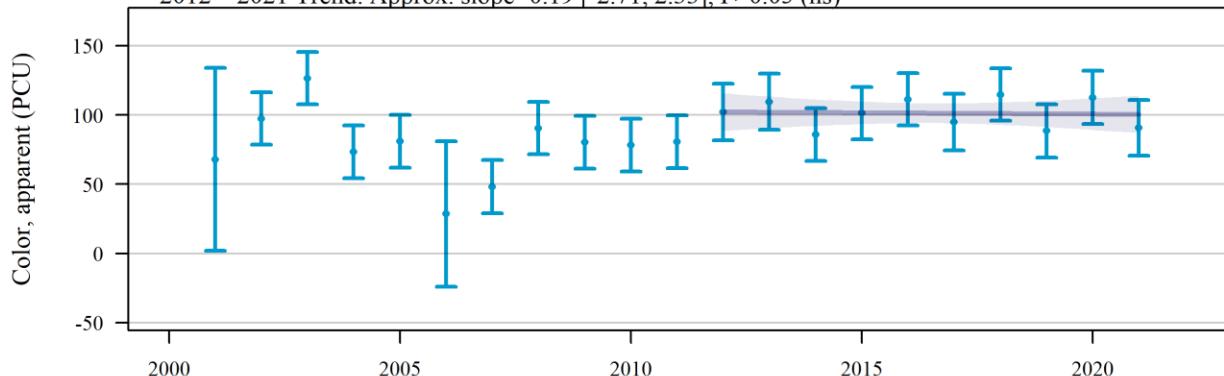




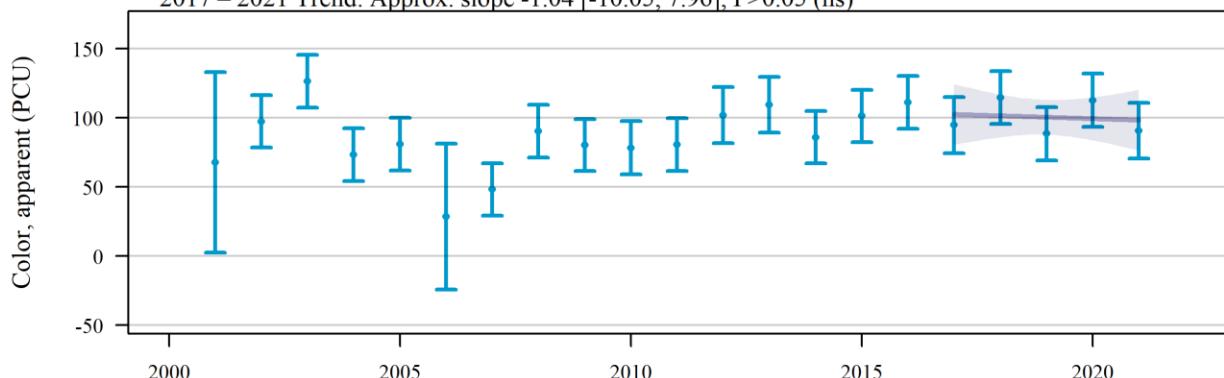
GAM for Color, apparent at Tidal Peace River
May 2001 to Dec 2021 (n=239)

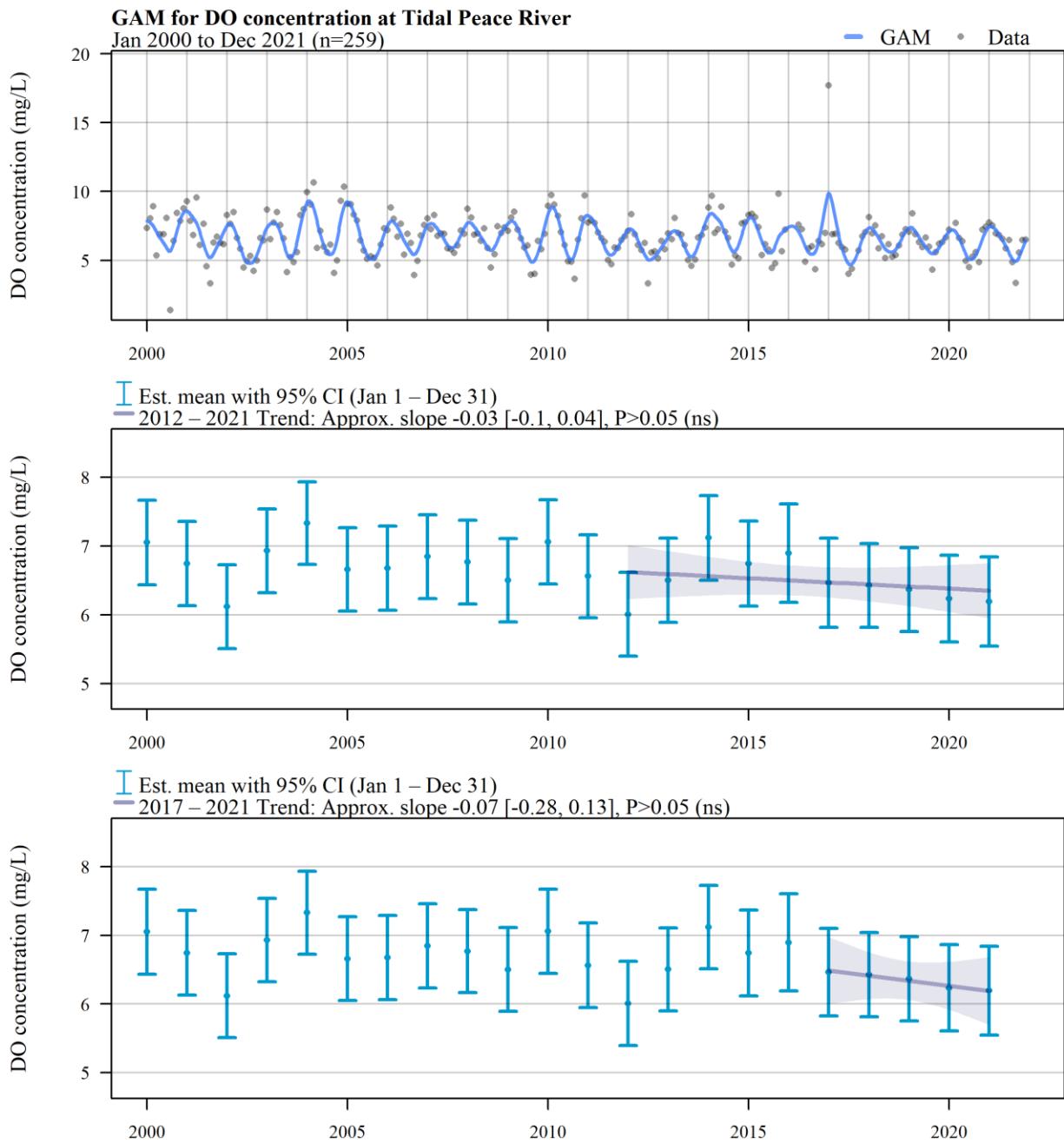


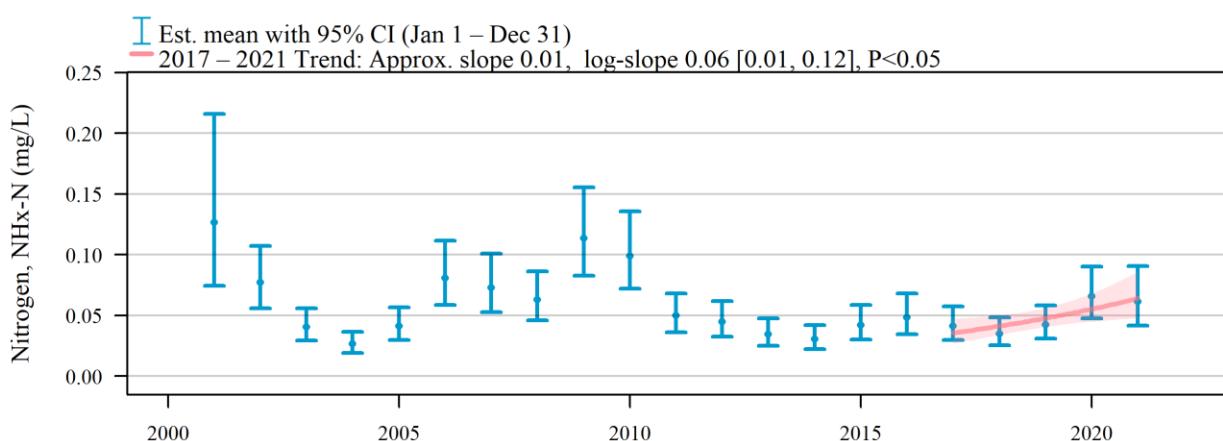
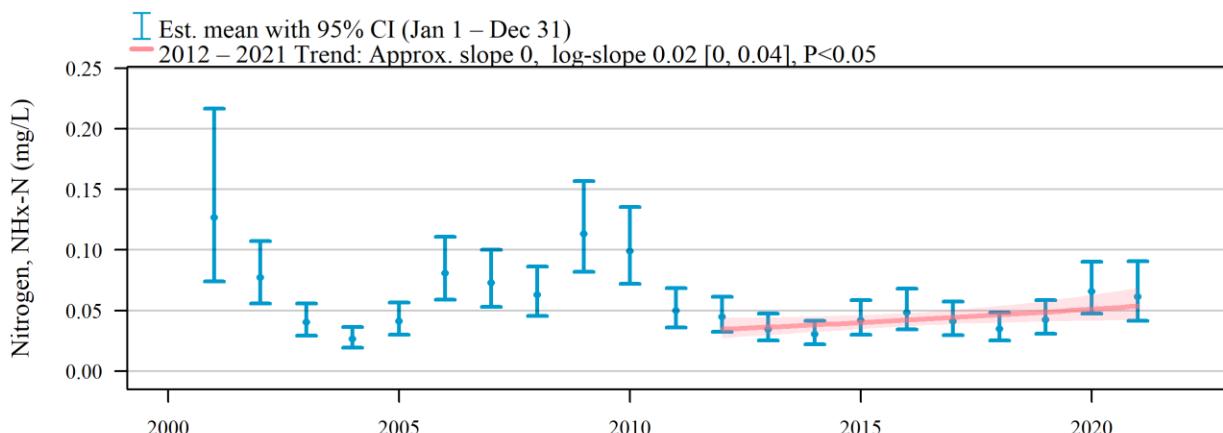
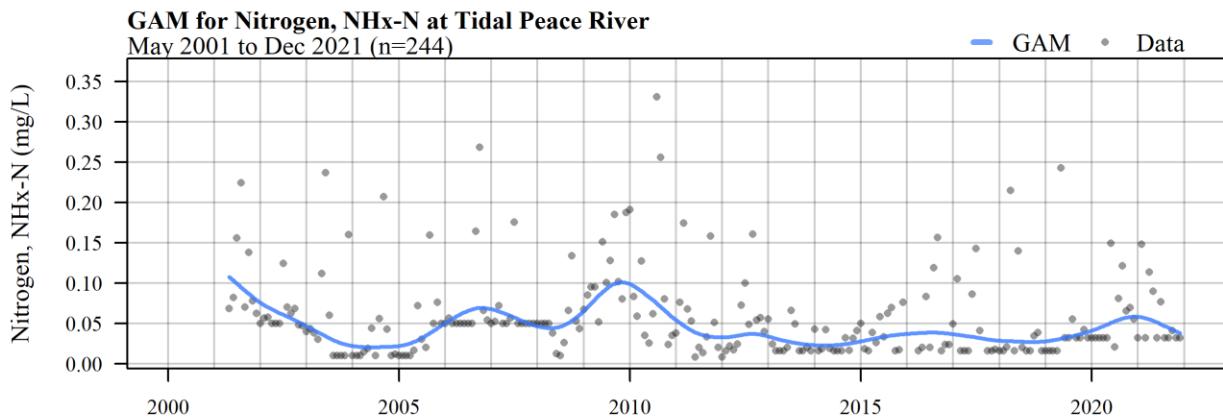
Est. mean with 95% CI (Jan 1 – Dec 31)
2012 – 2021 Trend: Approx. slope -0.19 [-2.71, 2.33], P>0.05 (ns)

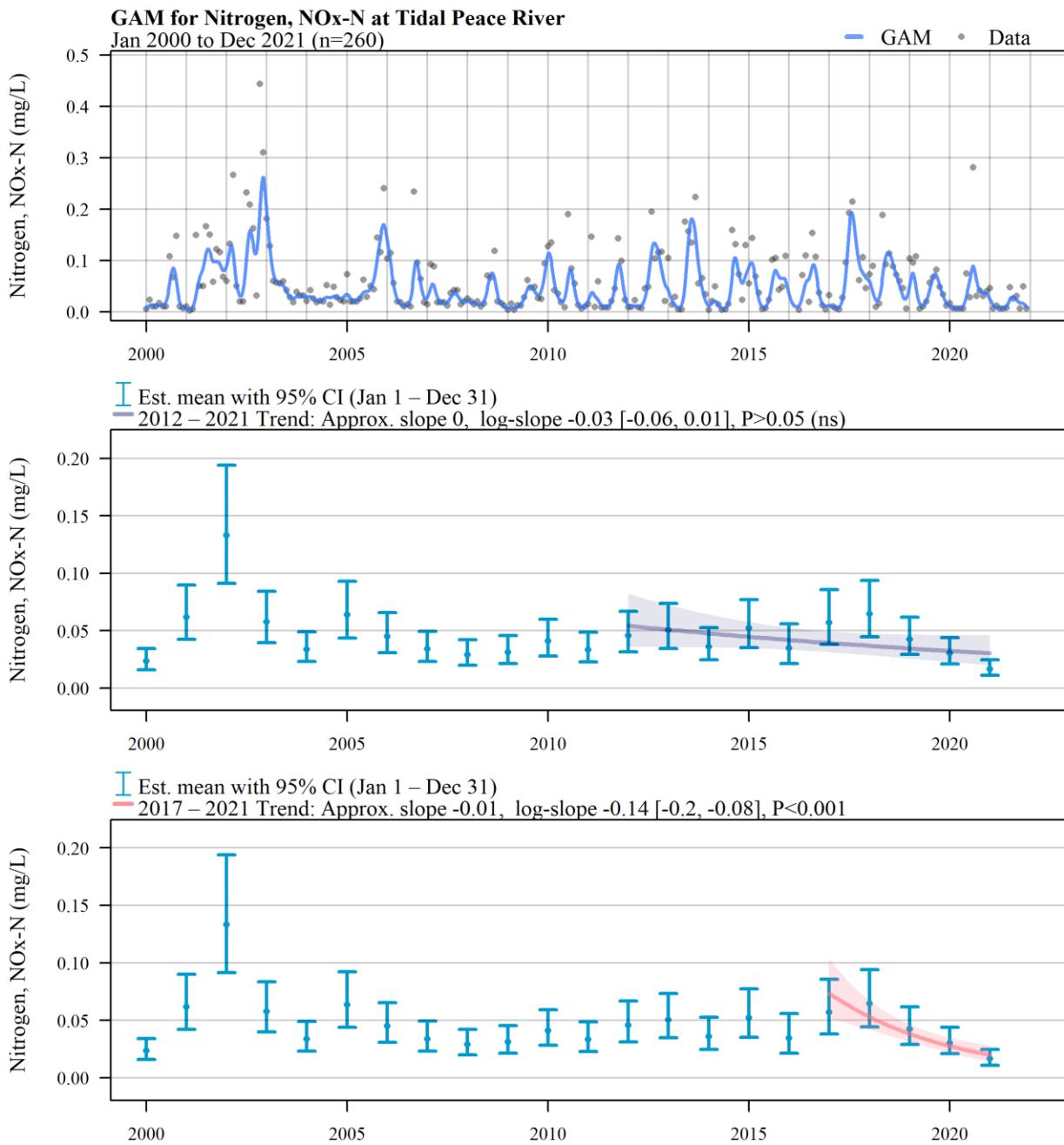


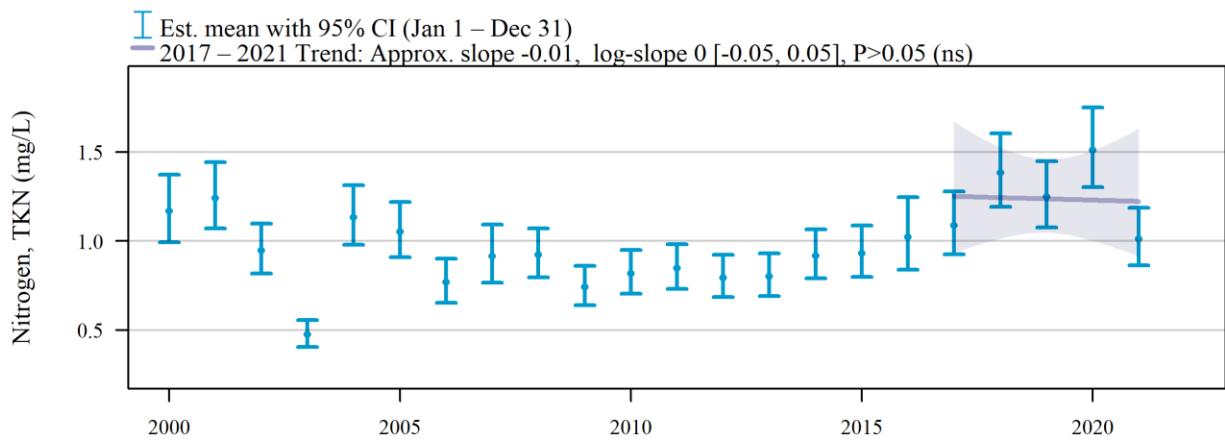
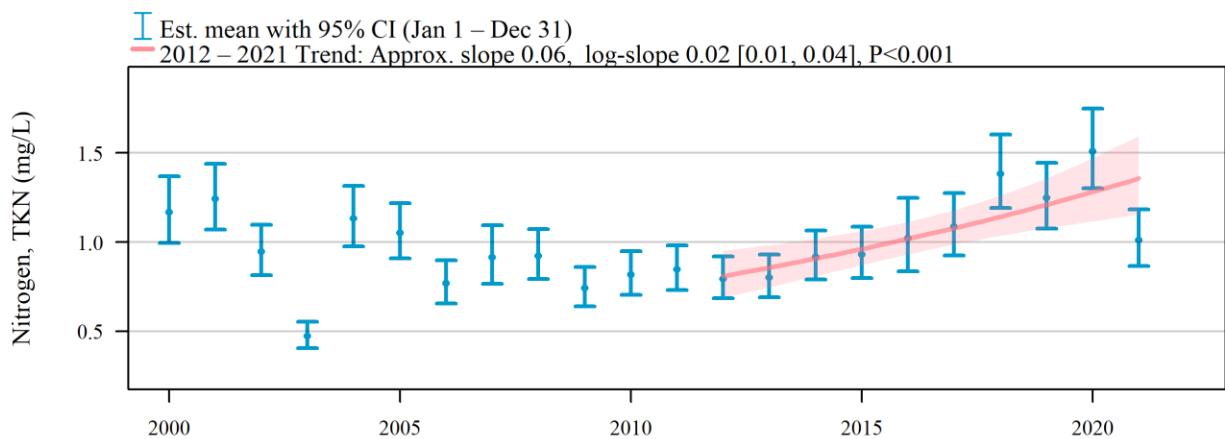
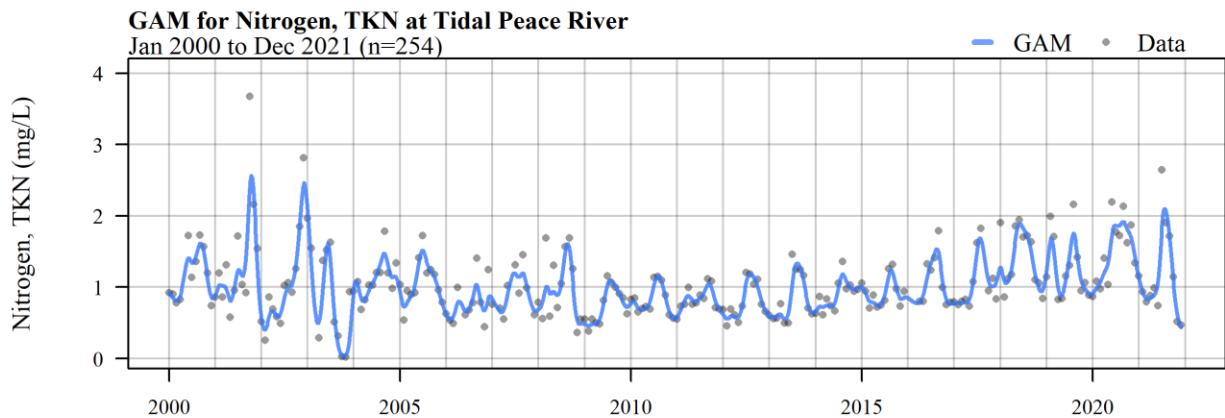
Est. mean with 95% CI (Jan 1 – Dec 31)
2017 – 2021 Trend: Approx. slope -1.04 [-10.05, 7.96], P>0.05 (ns)

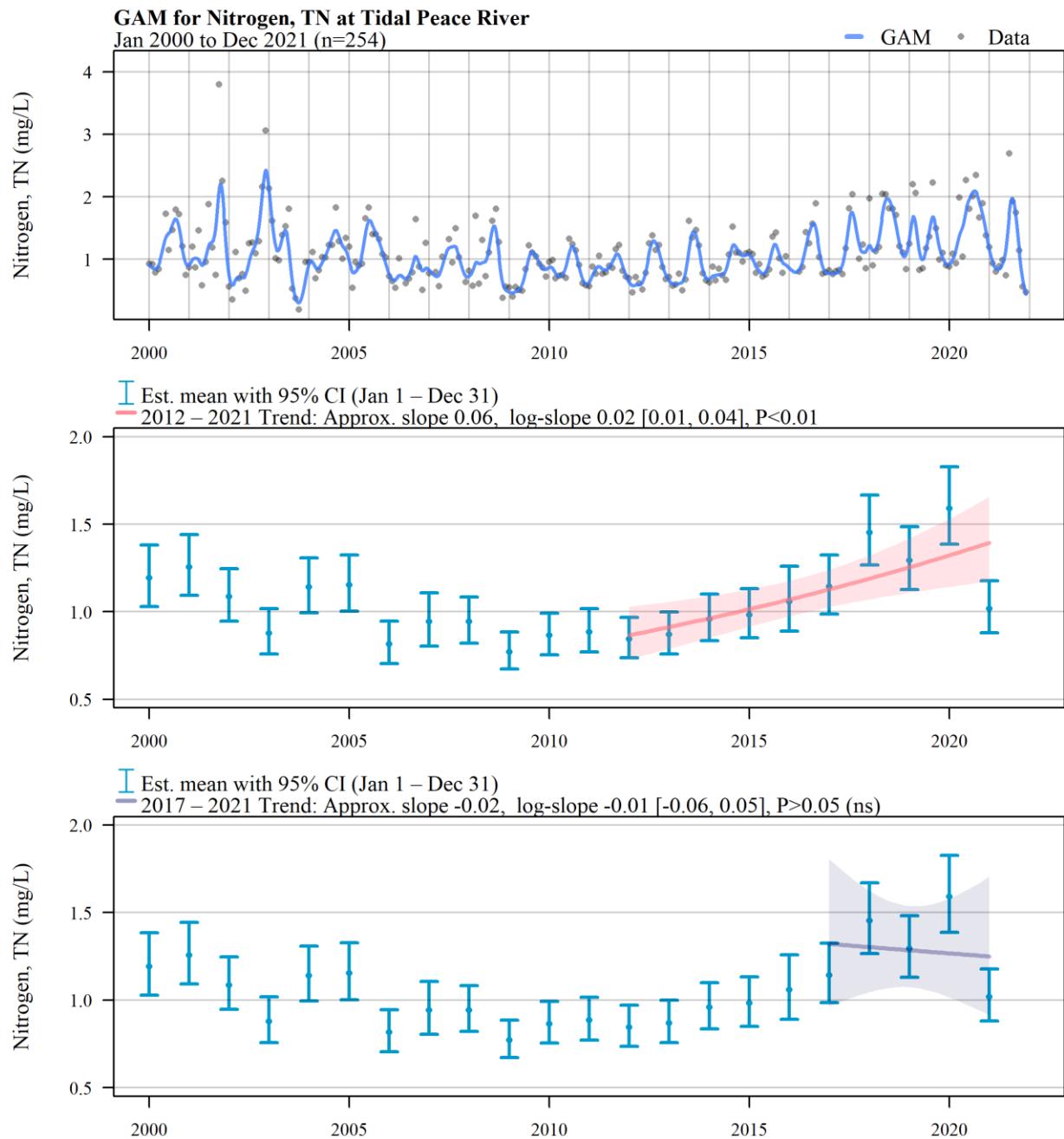


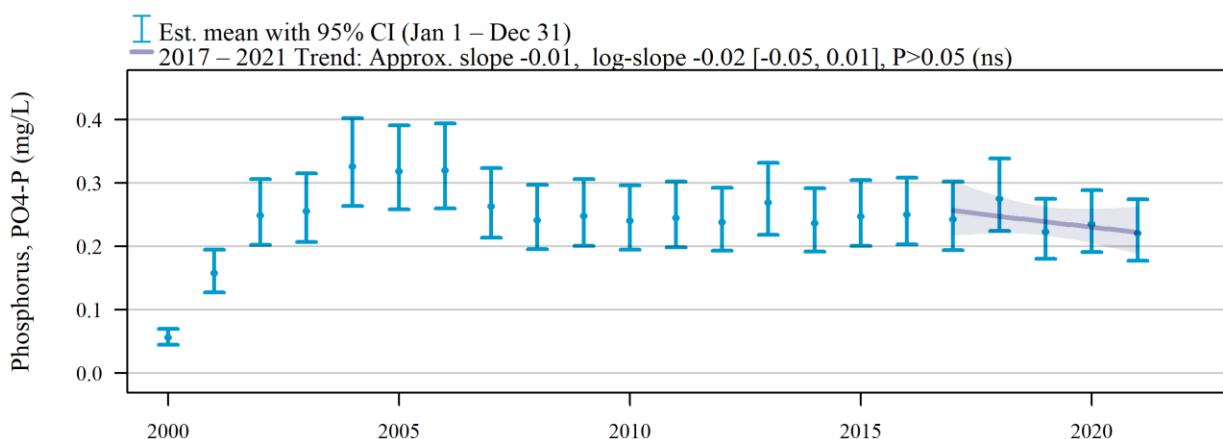
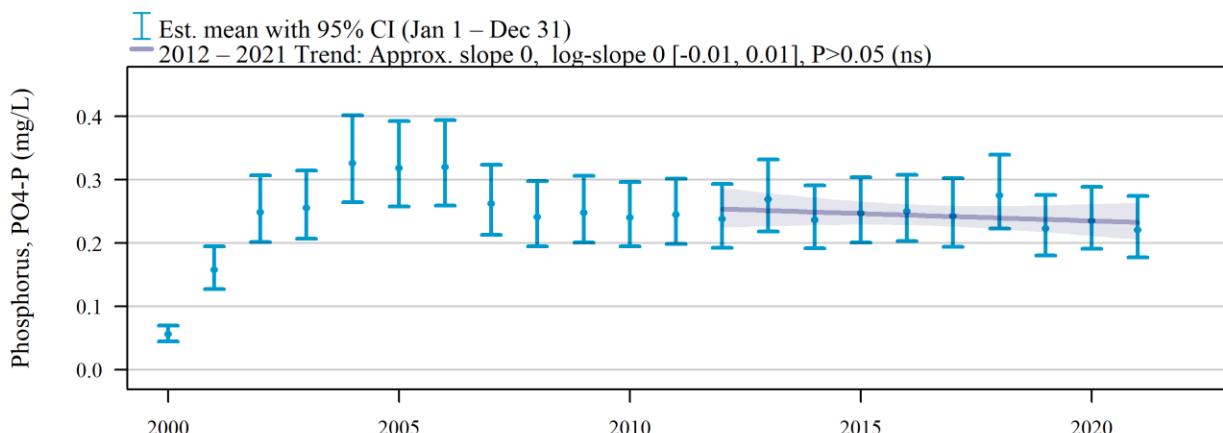
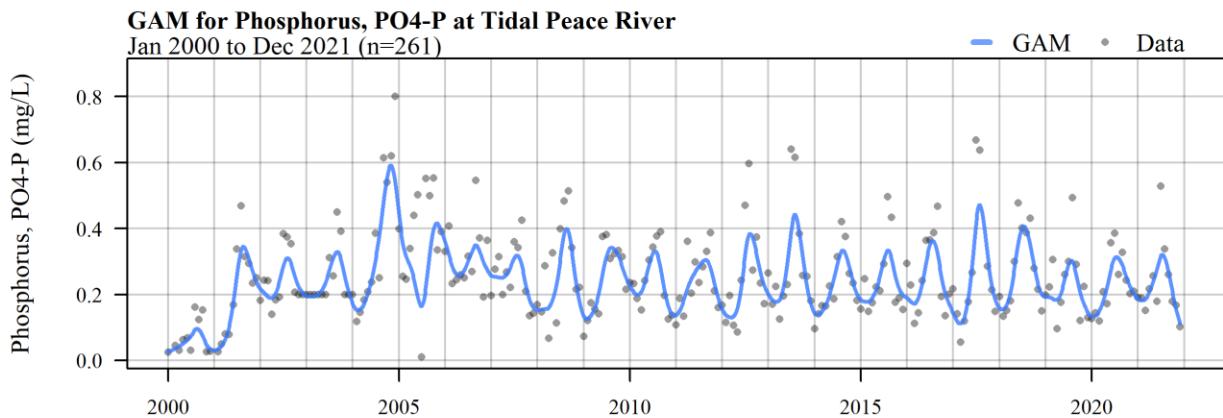


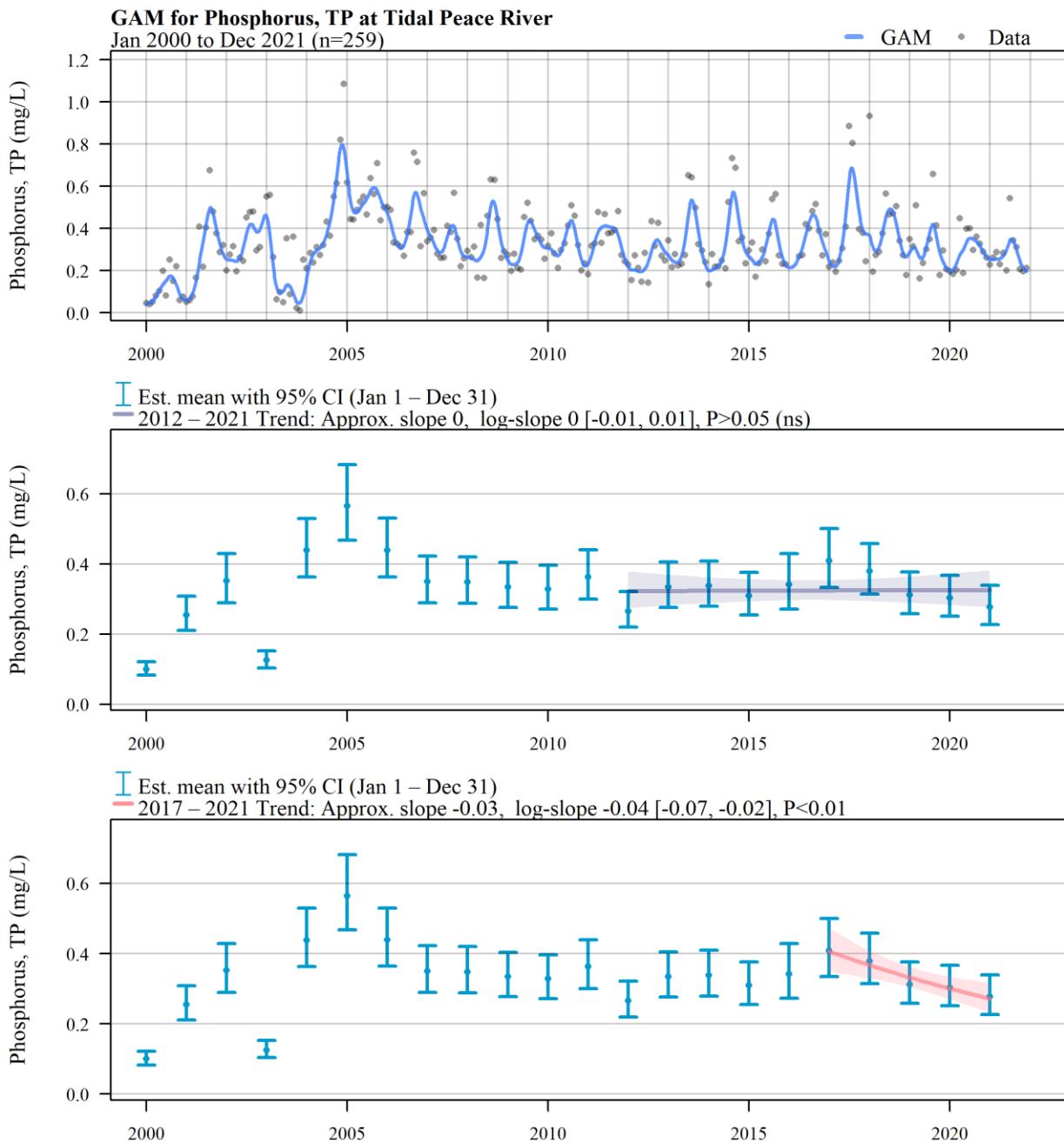


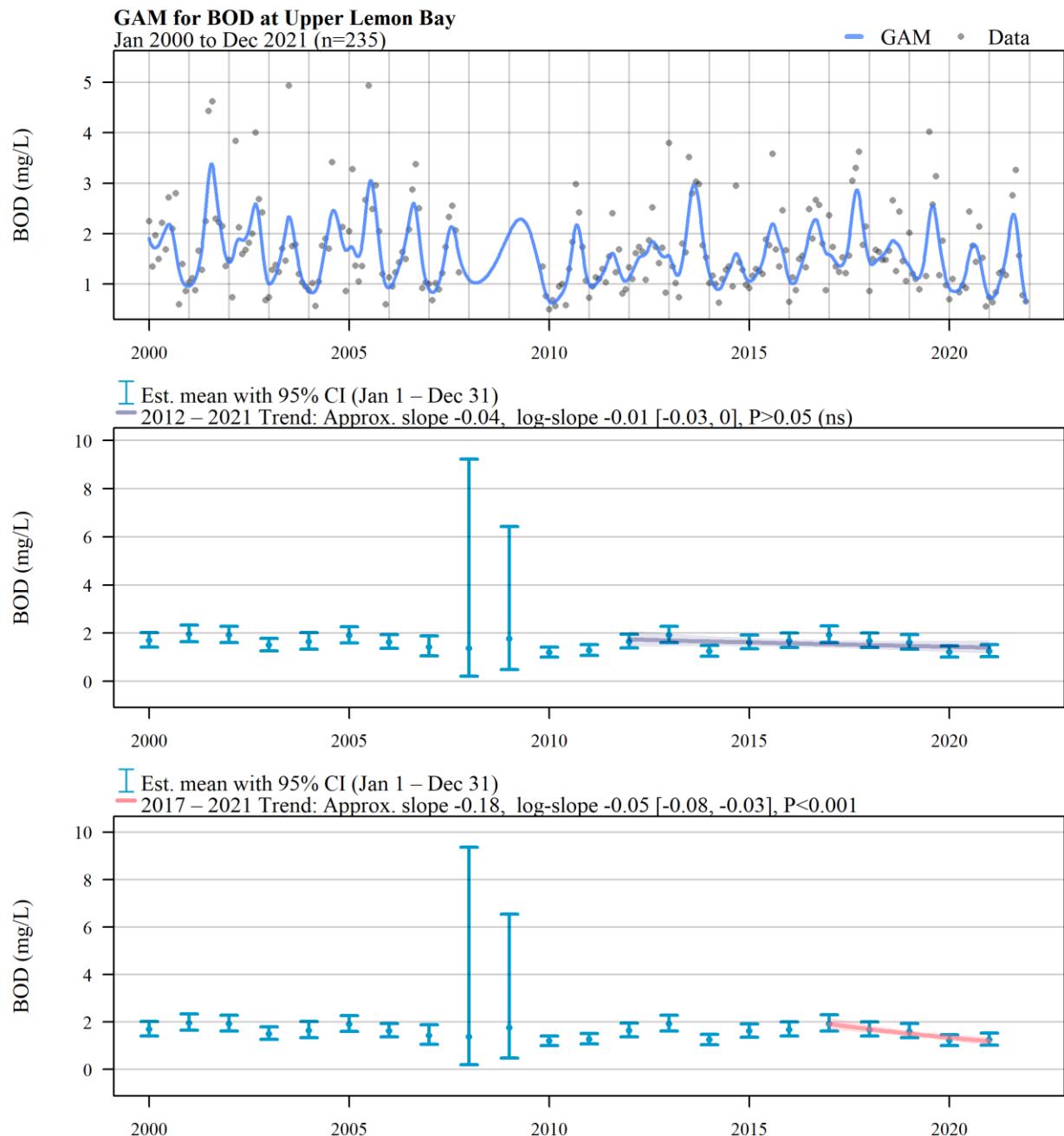








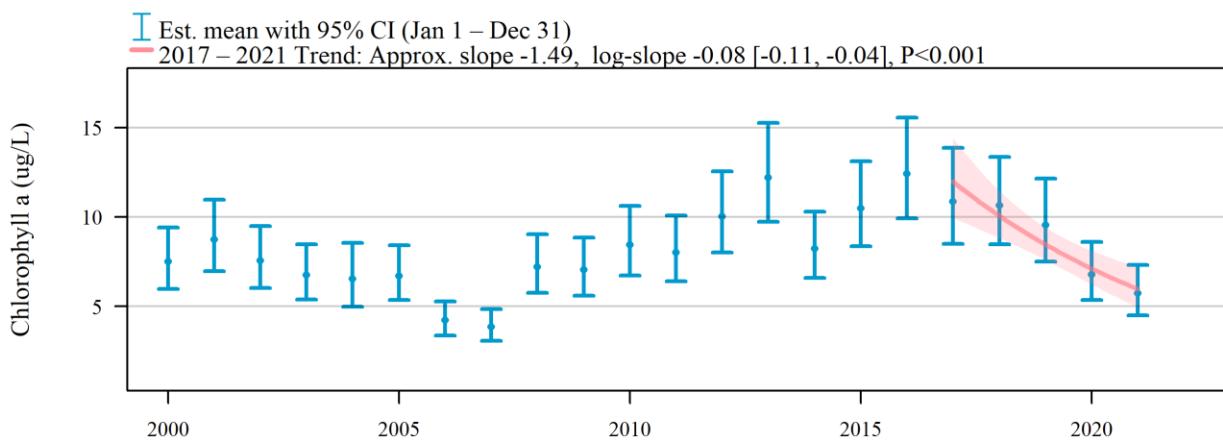
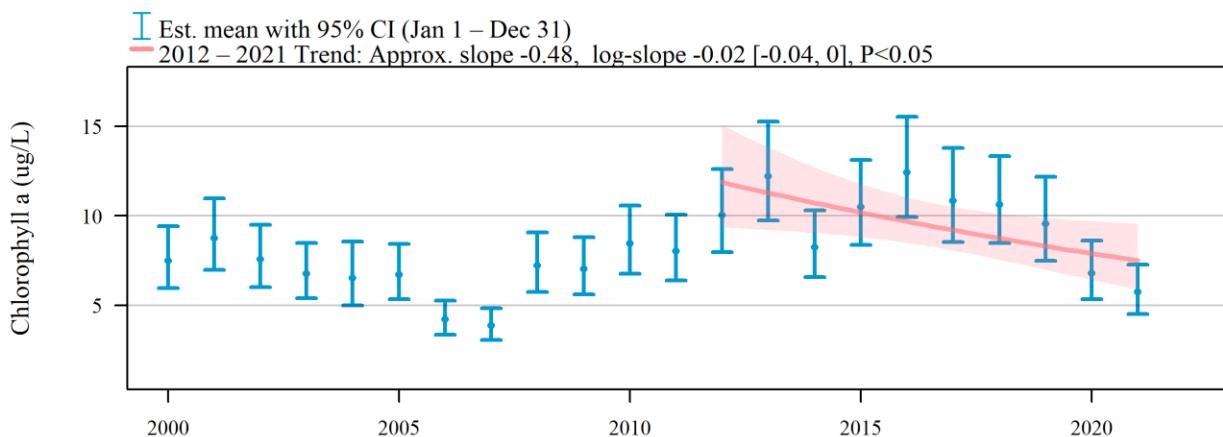
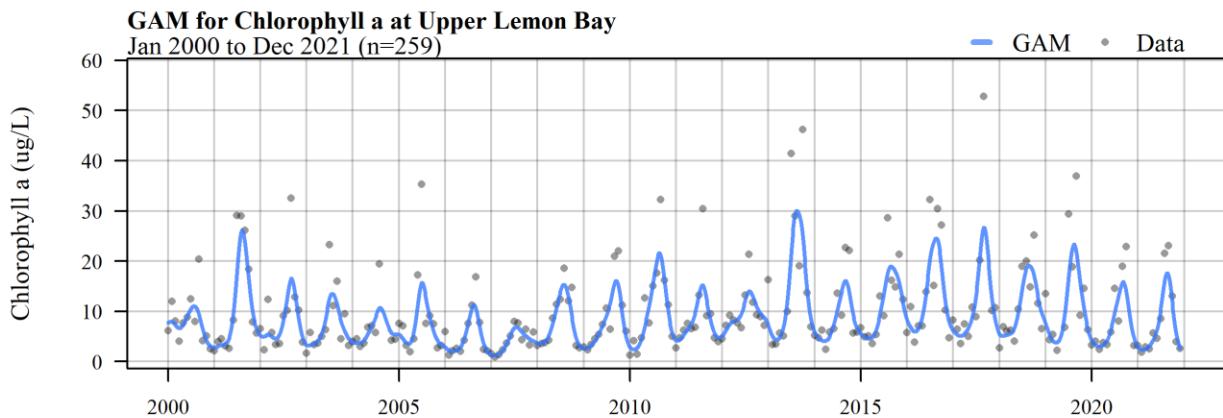




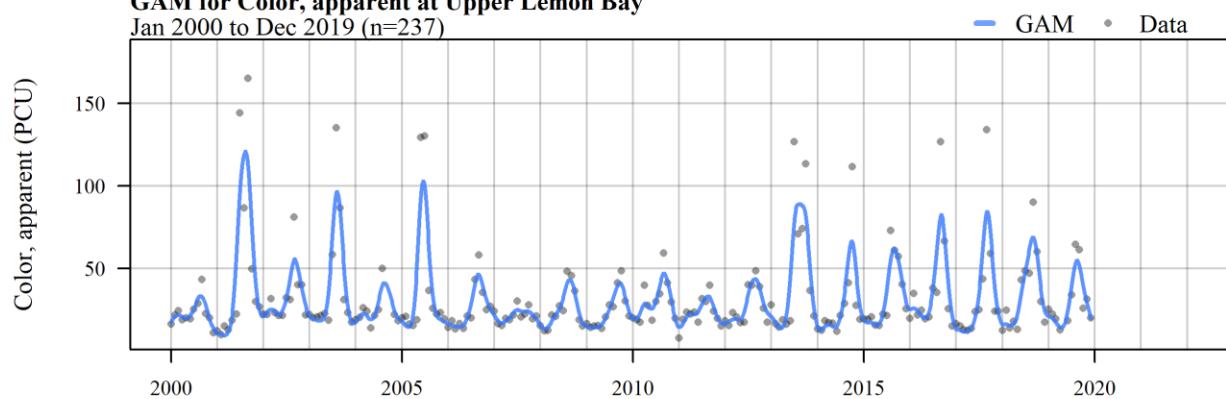
Carbon, TOC at Upper Lemon Bay

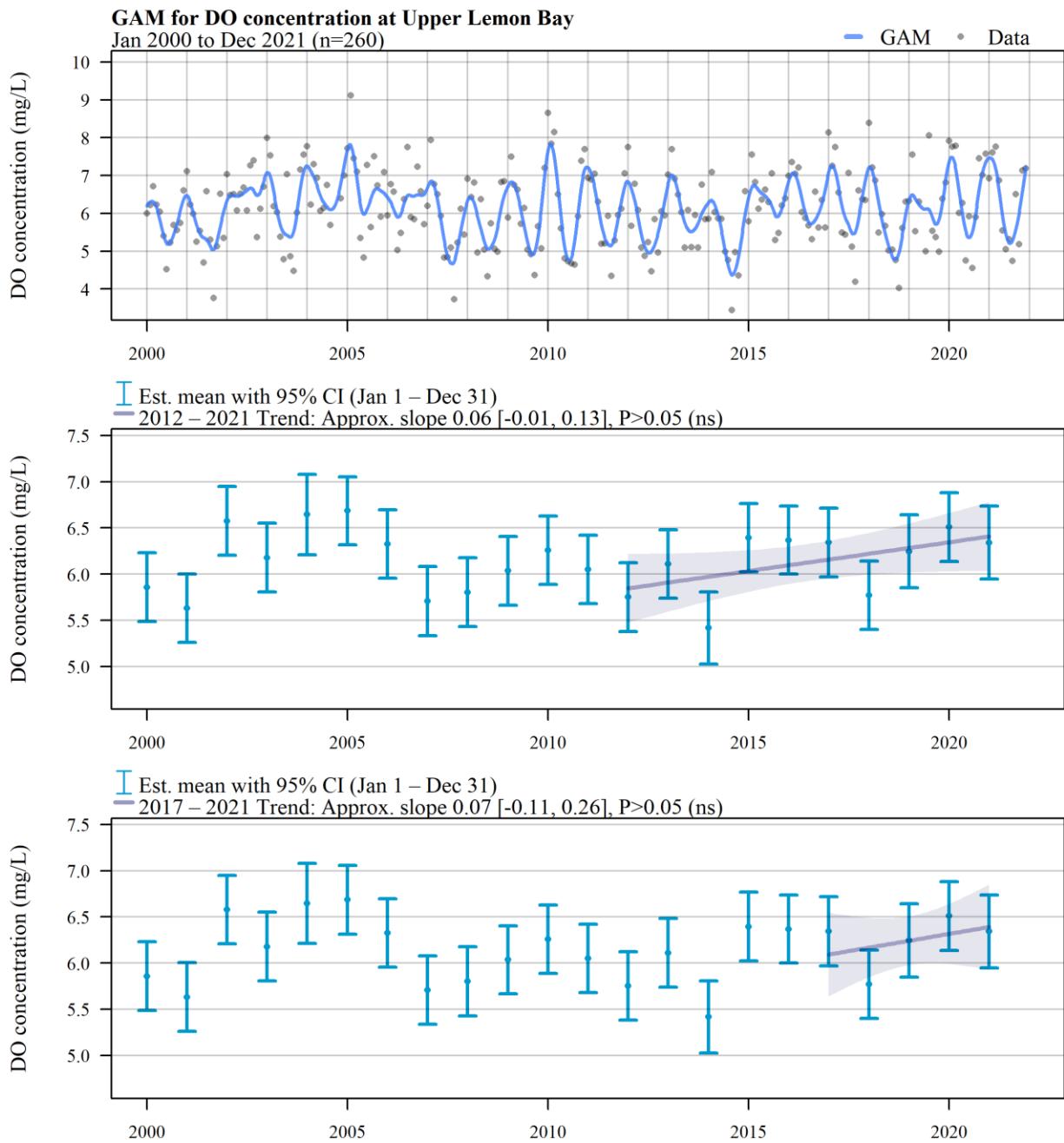
No data
(Jan 2000 to Dec 2021)

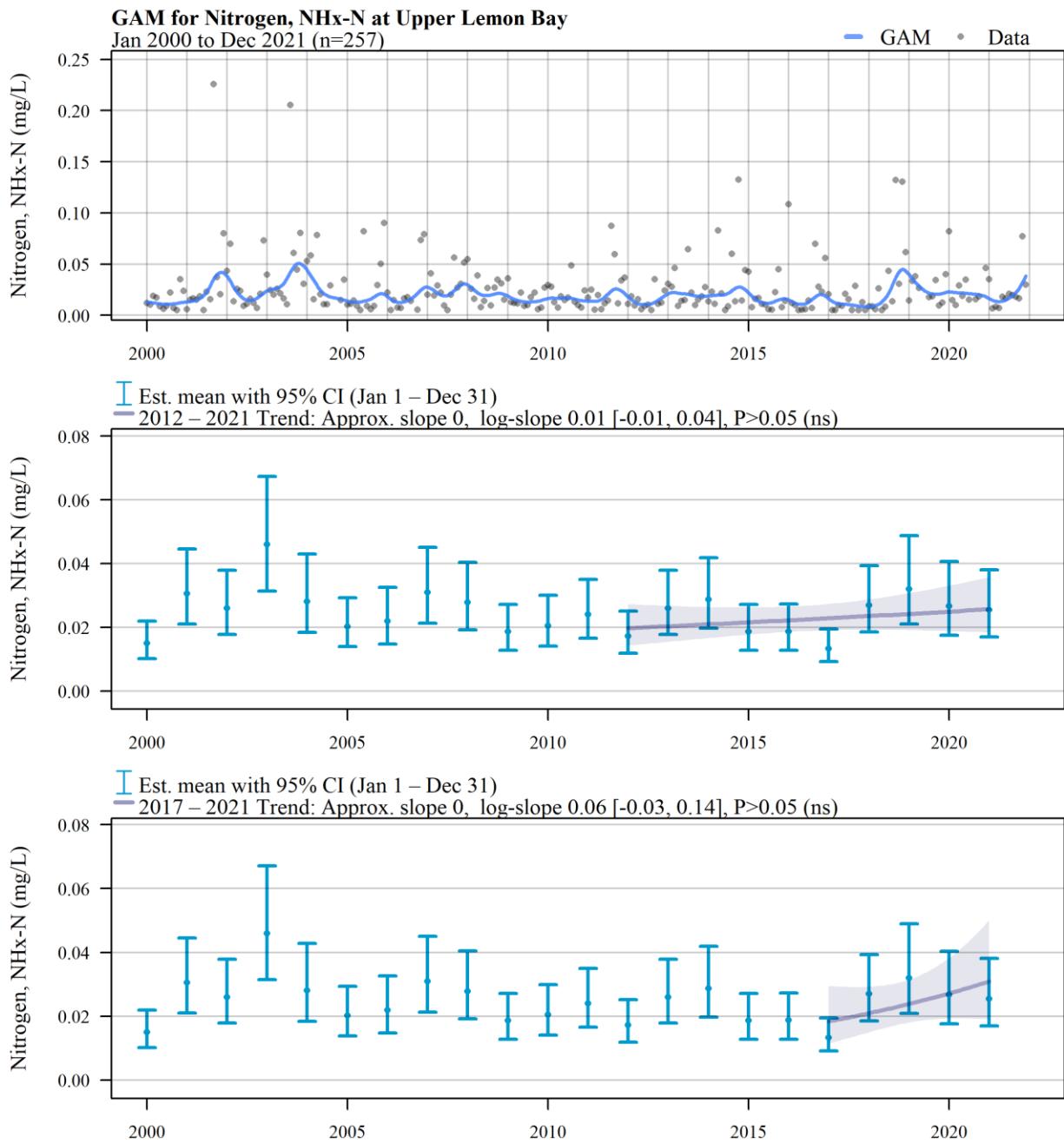
2000 2005 2010 2015 2020

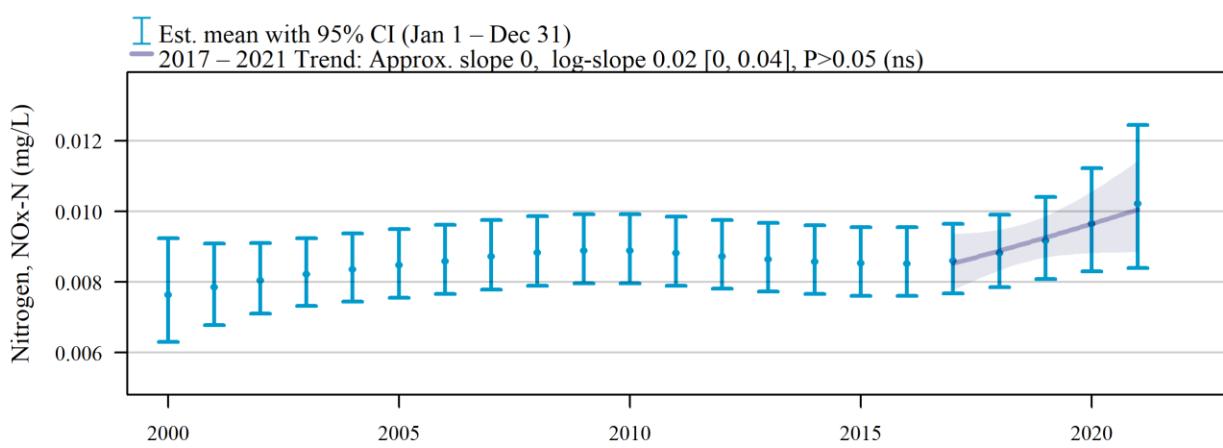
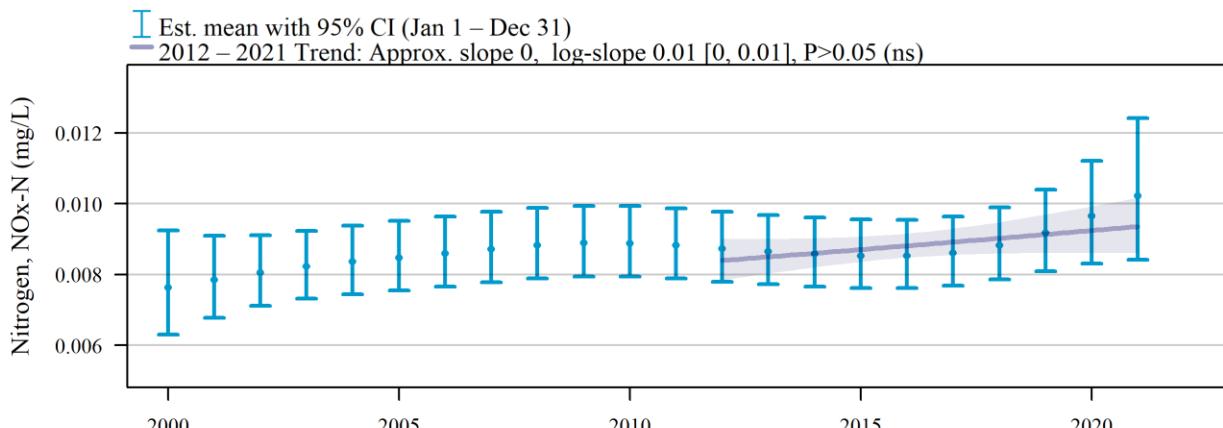
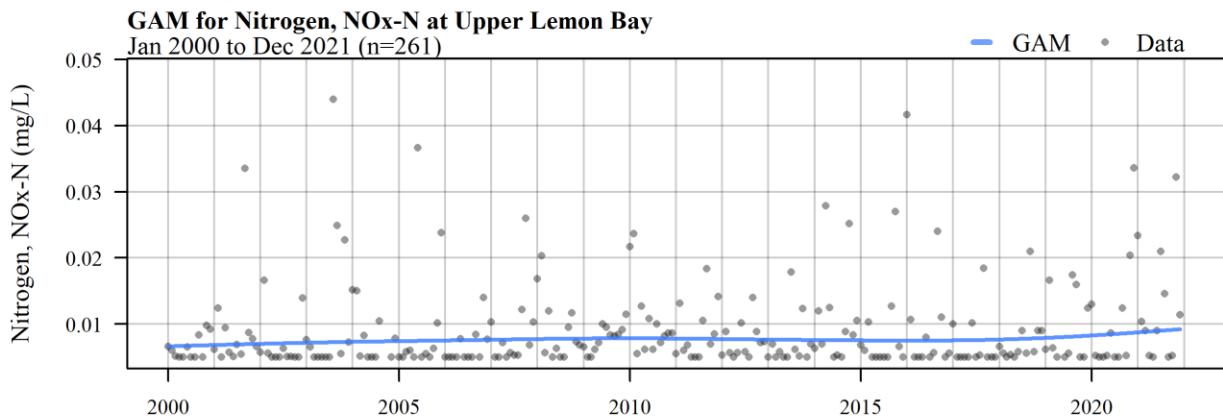


GAM for Color, apparent at Upper Lemon Bay
Jan 2000 to Dec 2019 (n=237)

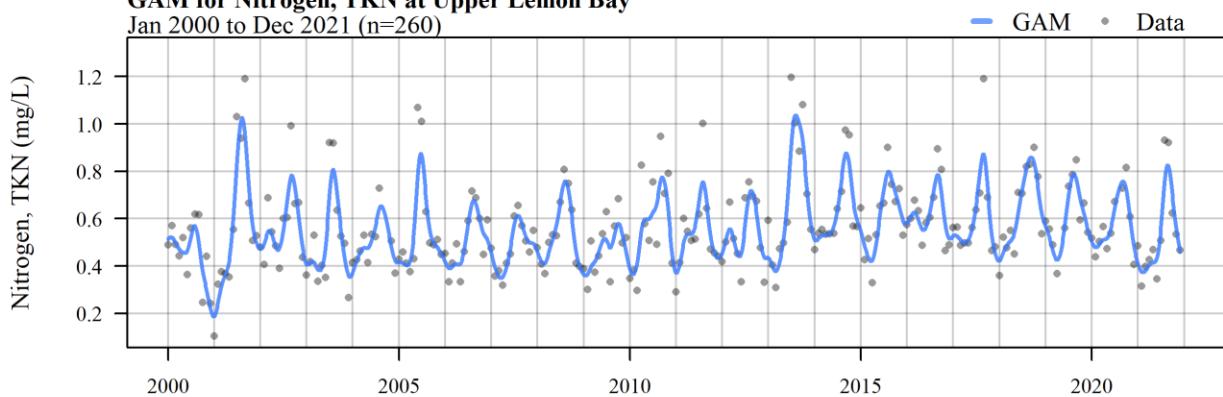




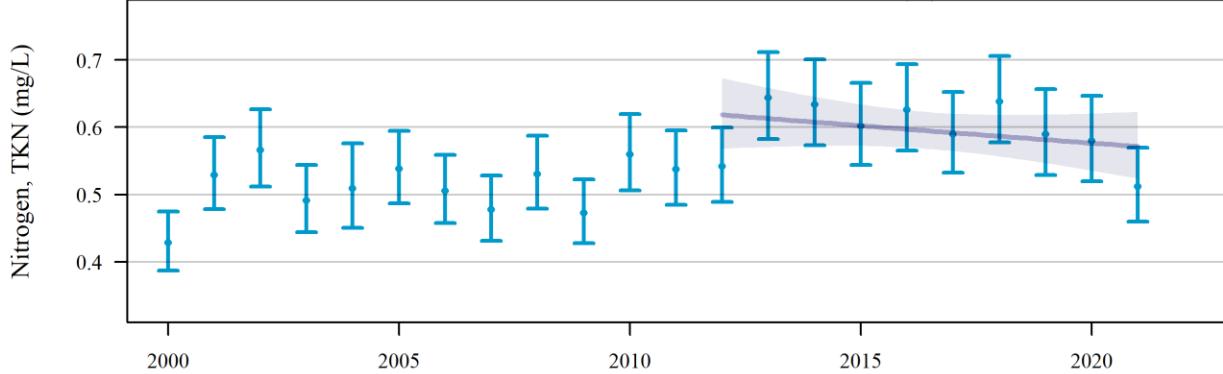




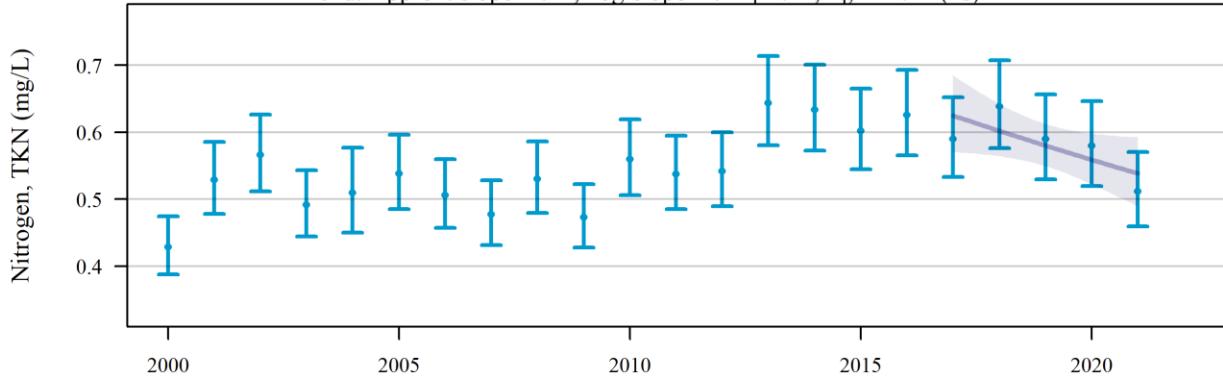
GAM for Nitrogen, TKN at Upper Lemon Bay
Jan 2000 to Dec 2021 (n=260)

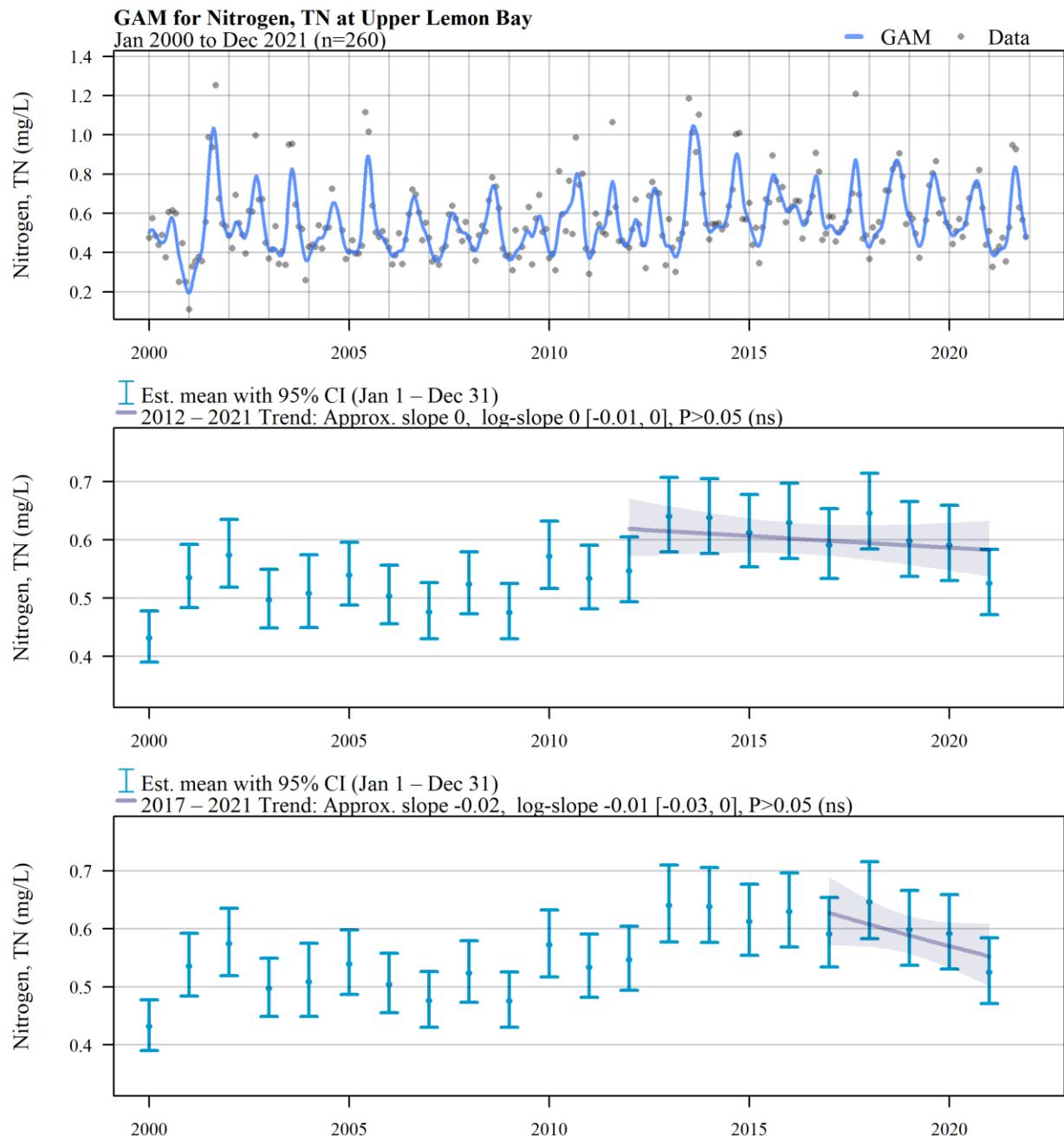


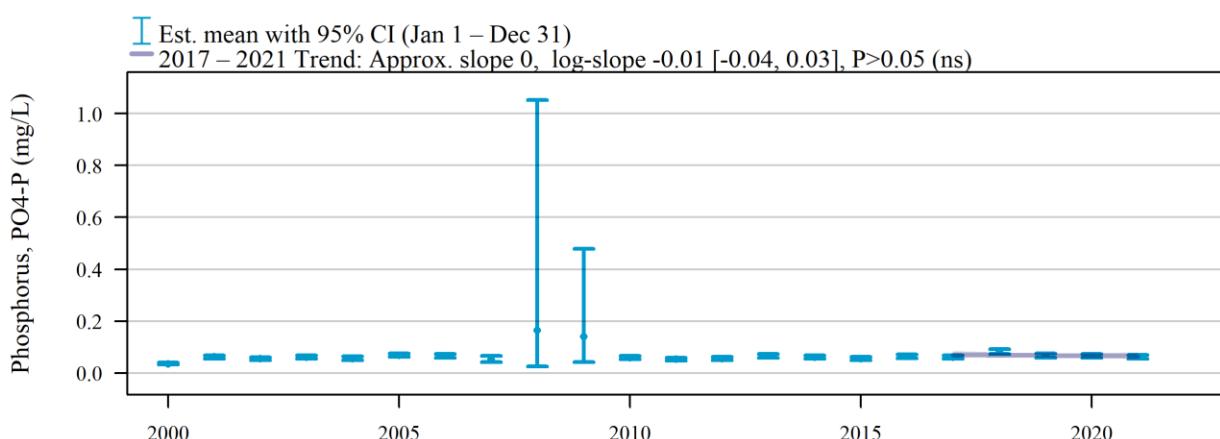
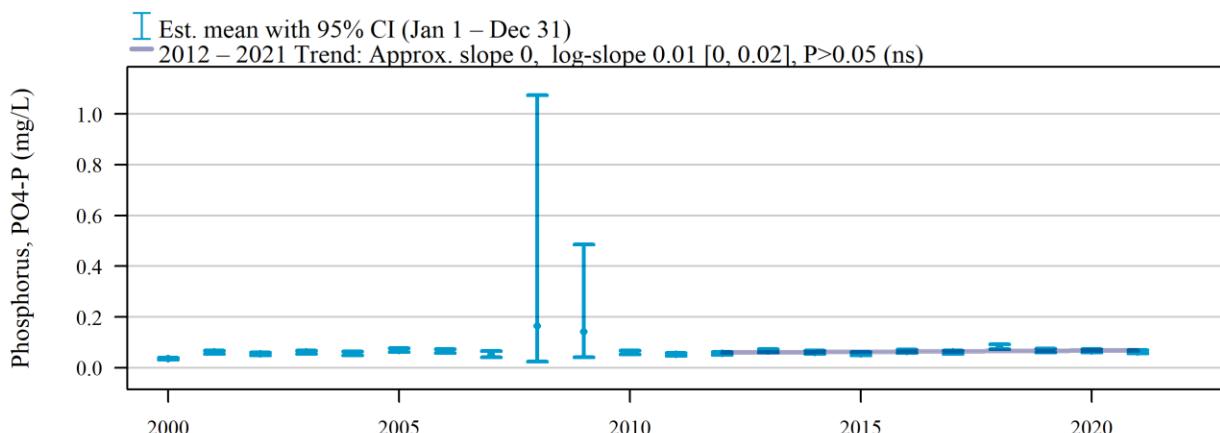
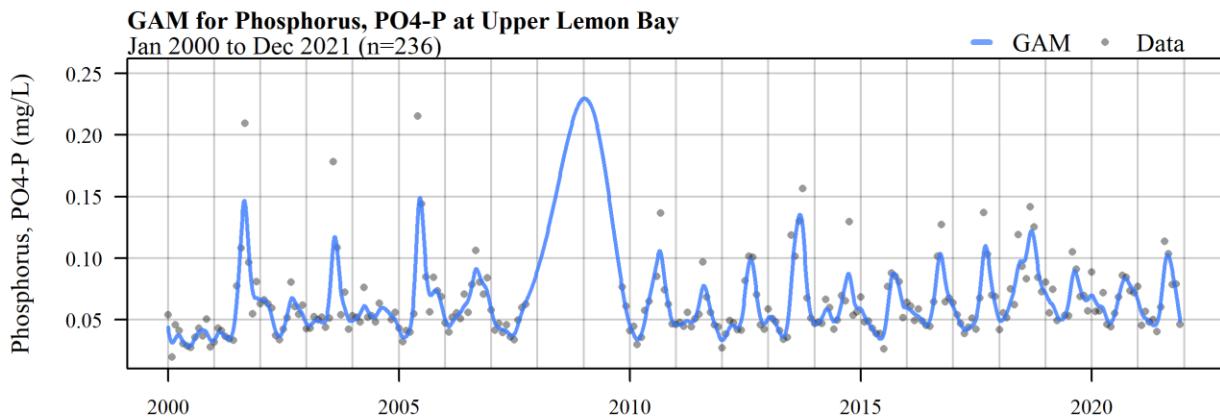
Est. mean with 95% CI (Jan 1 – Dec 31)
2012 – 2021 Trend: Approx. slope -0.01, log-slope 0 [-0.01, 0], P>0.05 (ns)

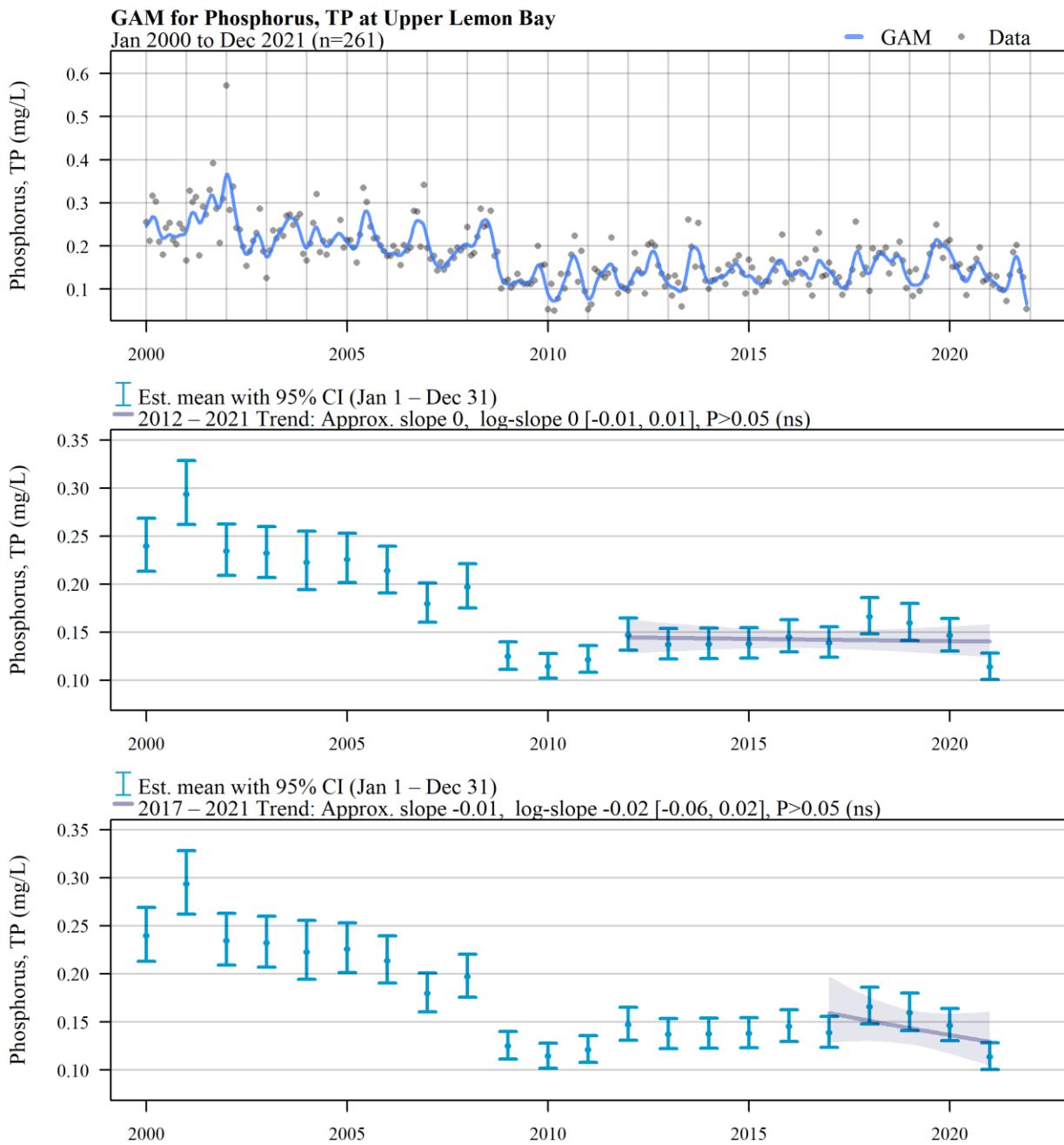


Est. mean with 95% CI (Jan 1 – Dec 31)
2017 – 2021 Trend: Approx. slope -0.02, log-slope -0.02 [-0.03, 0], P>0.05 (ns)





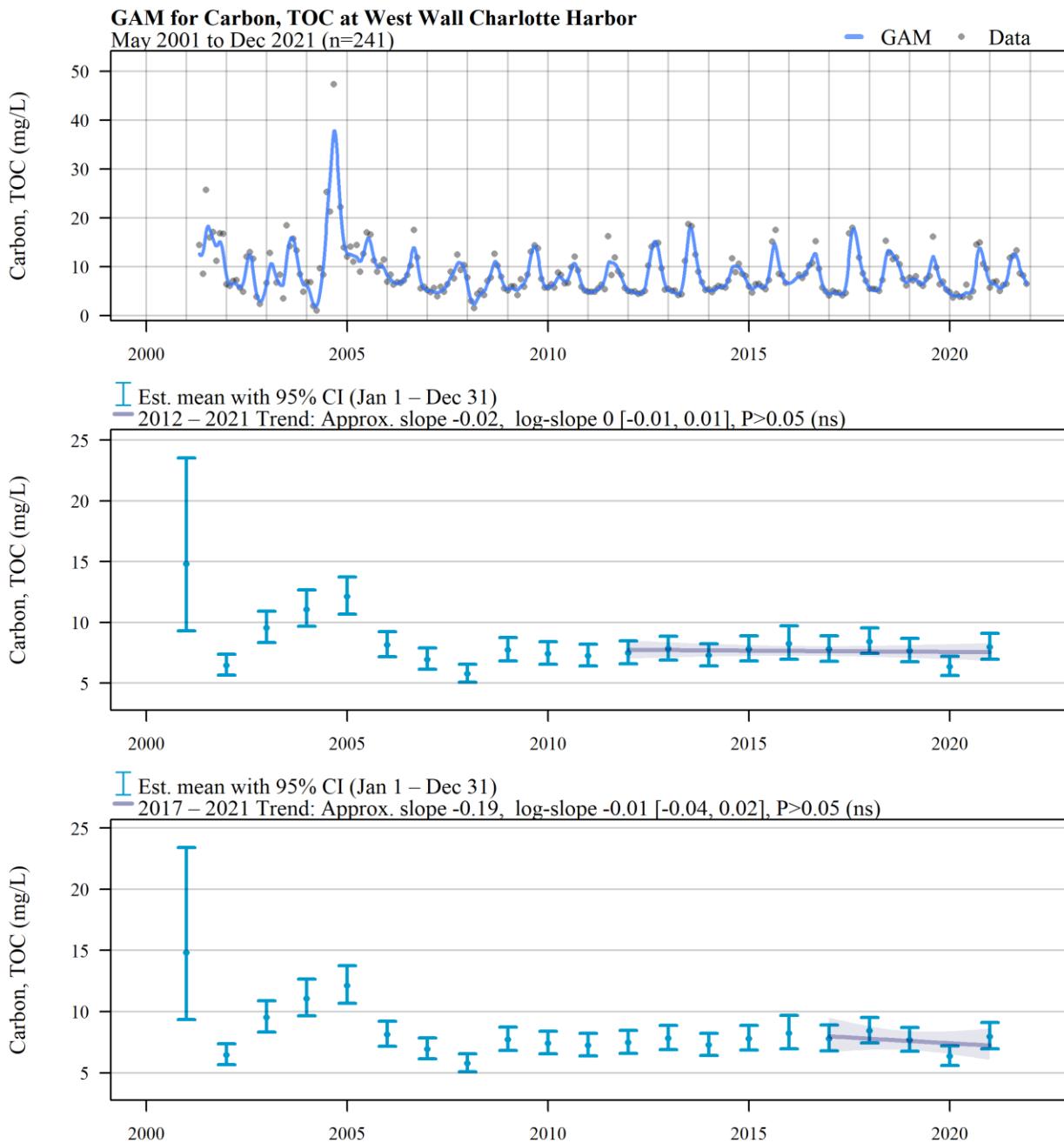


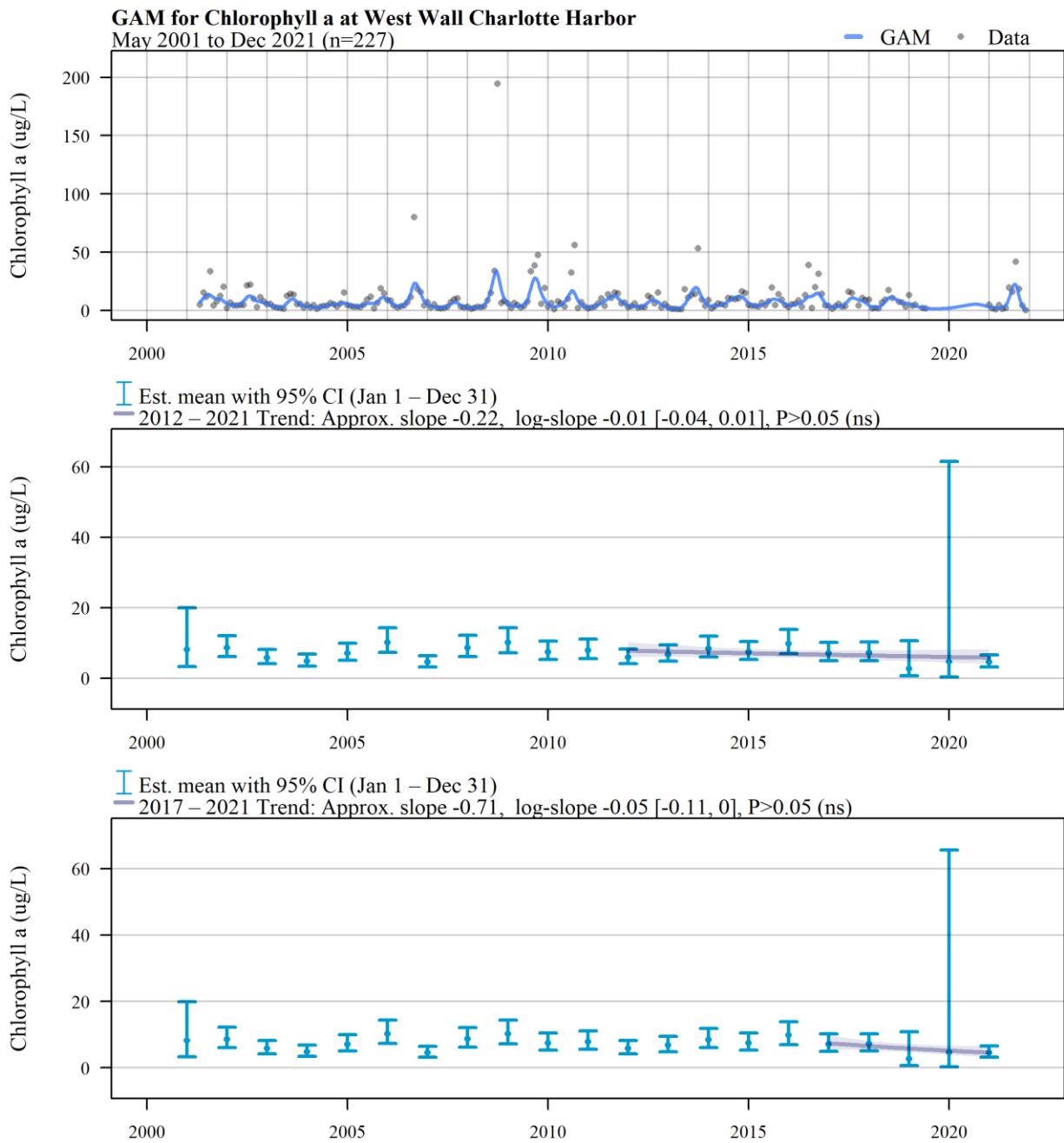


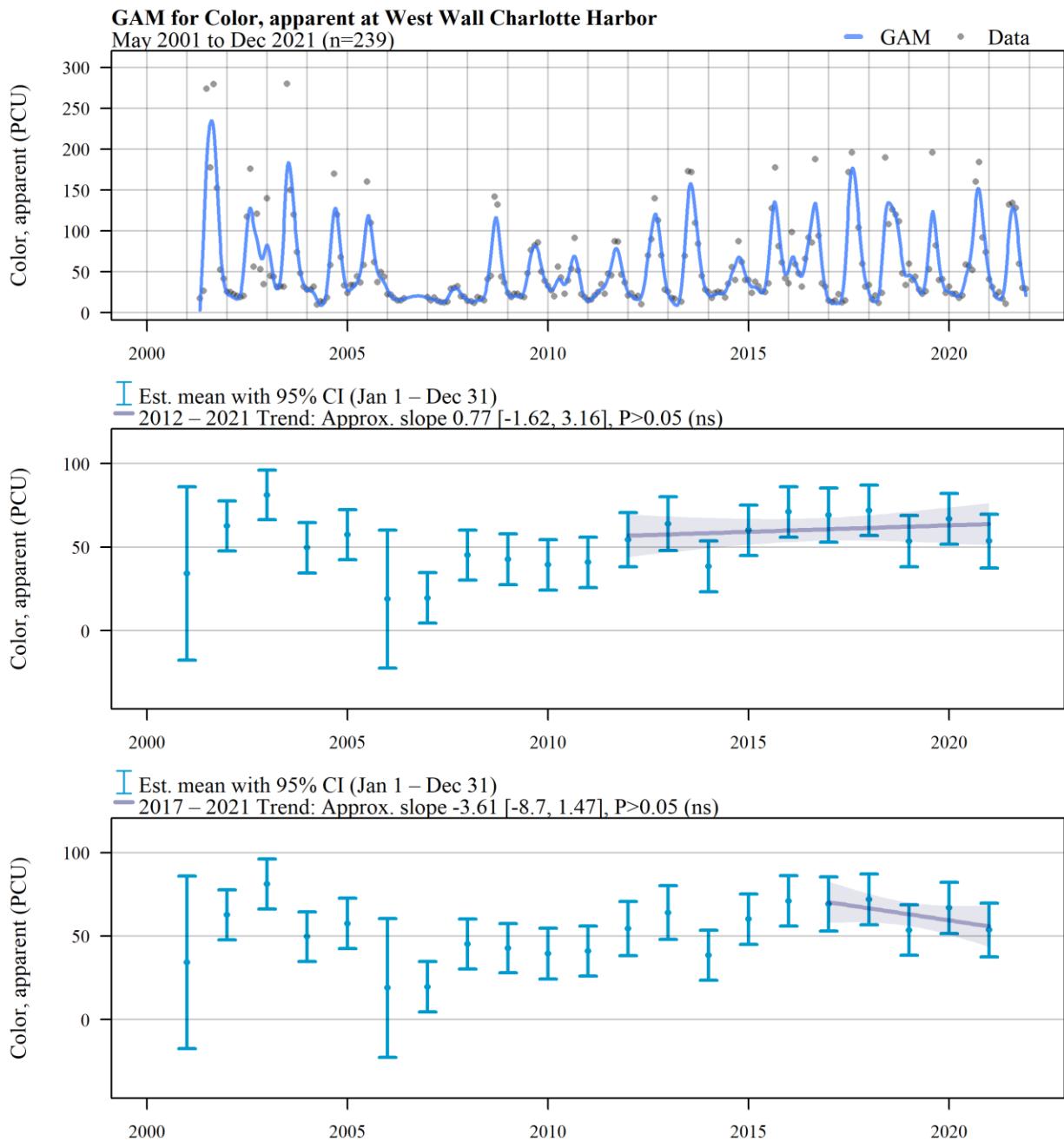
BOD at West Wall Charlotte Harbor

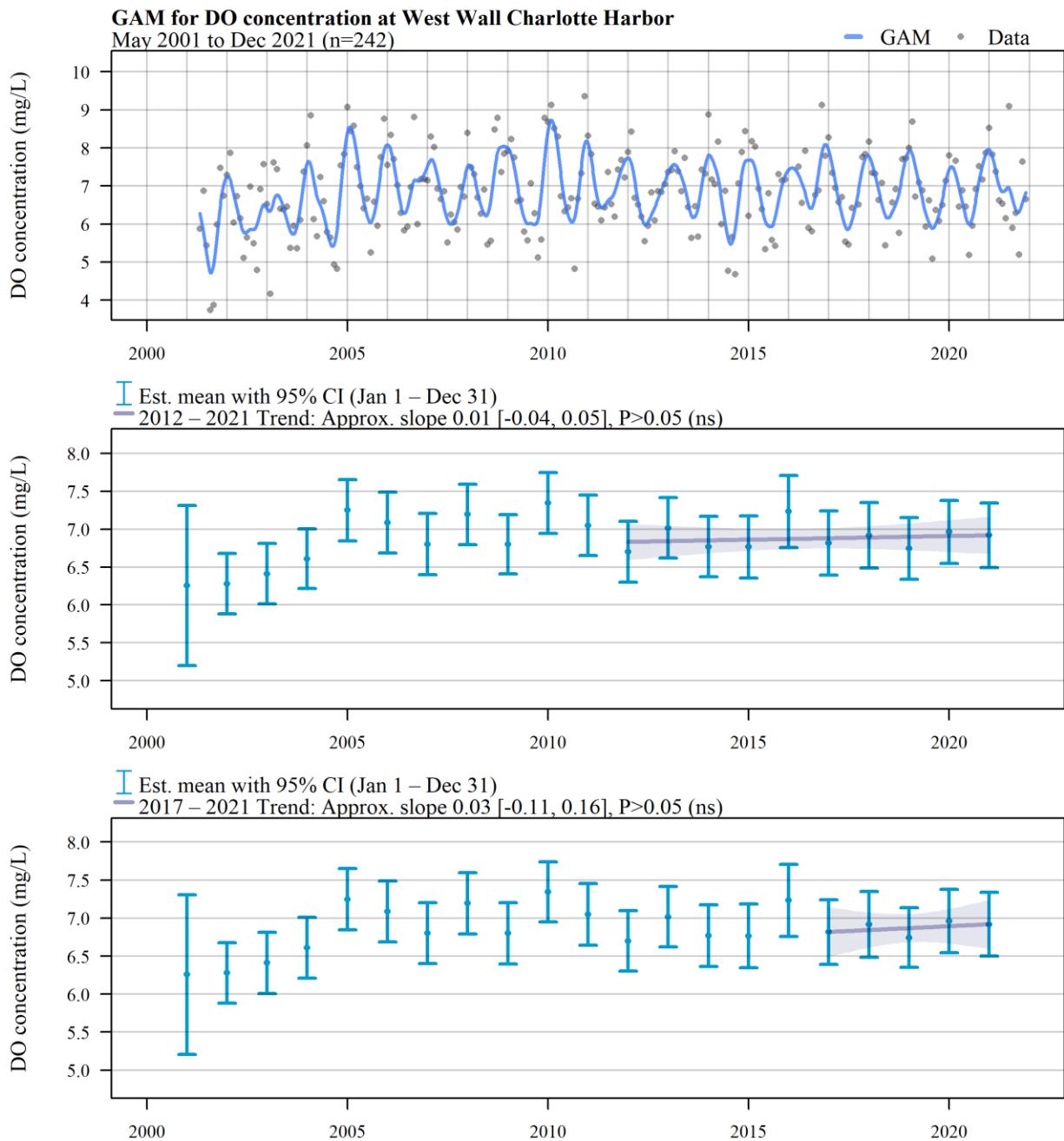
No data
(Jan 2000 to Dec 2021)

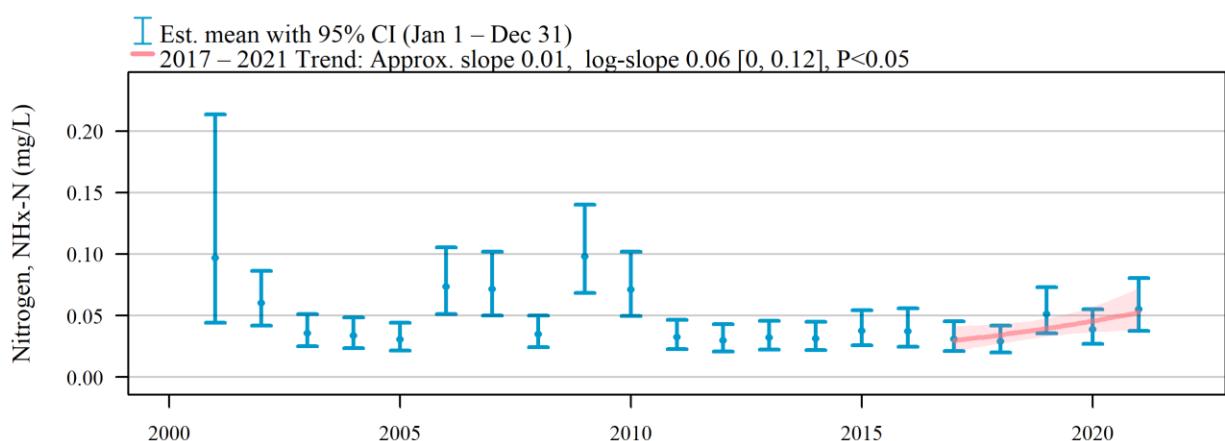
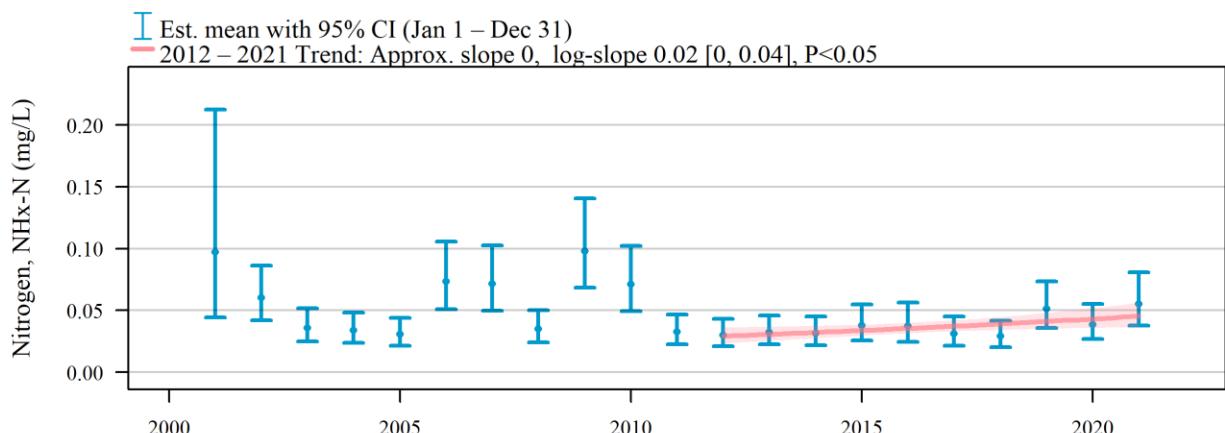
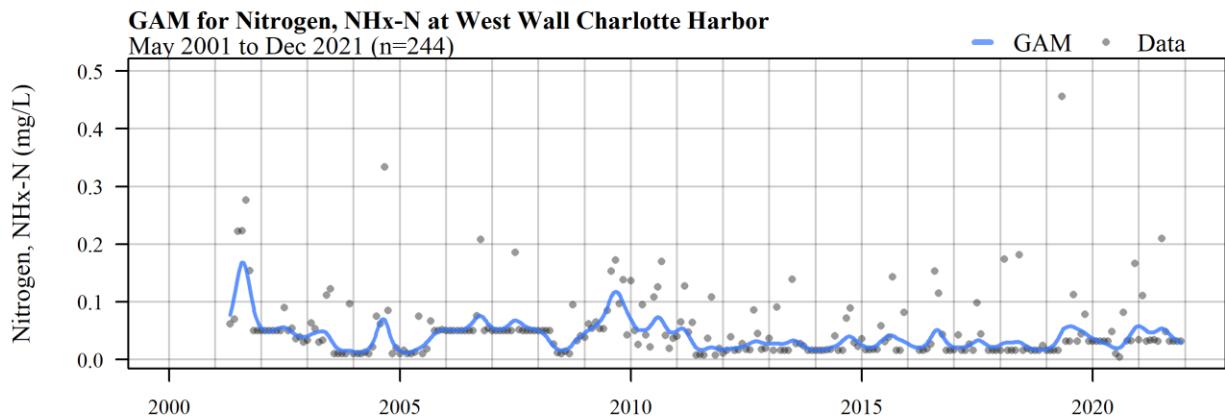
2000 2005 2010 2015 2020

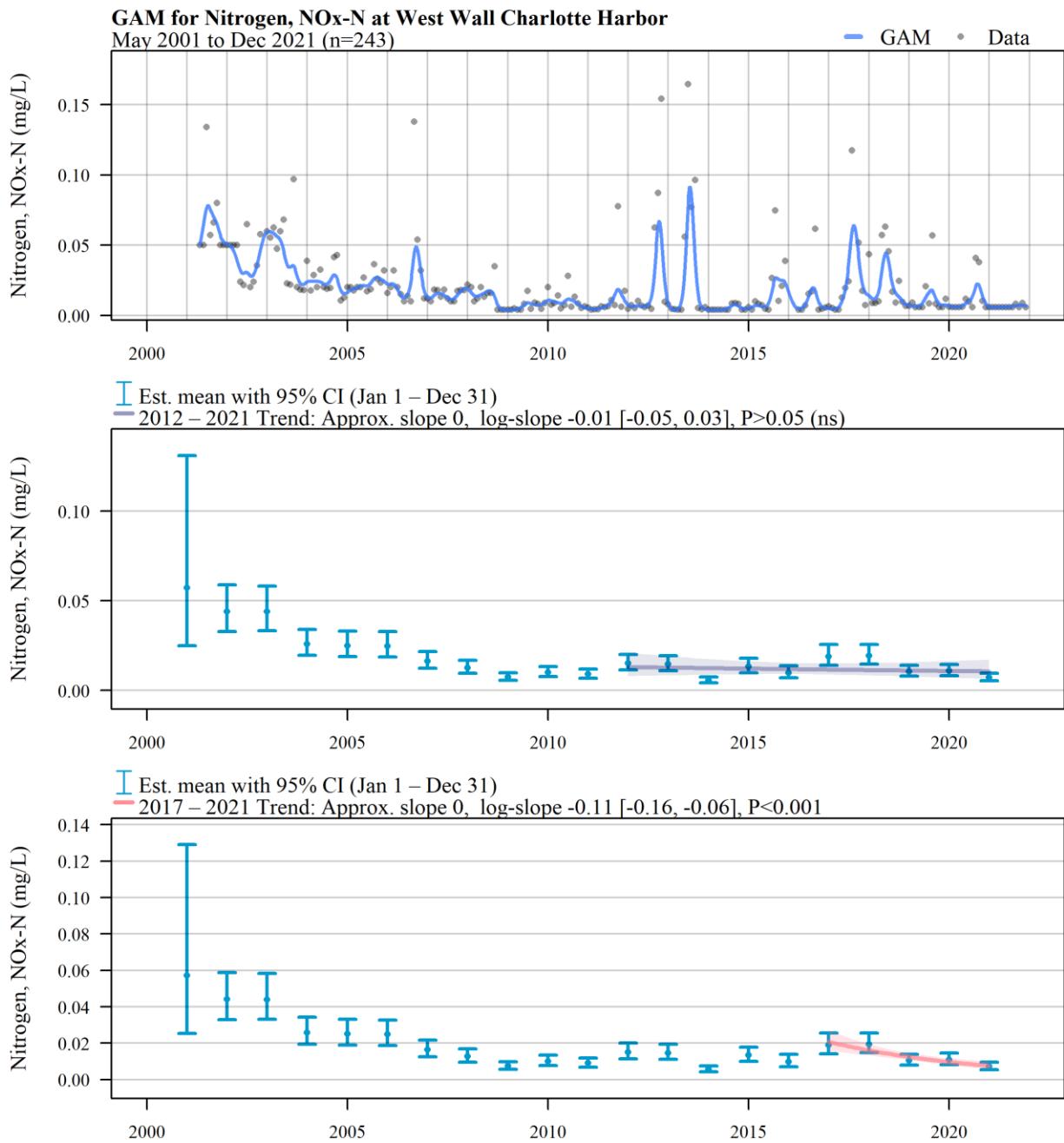






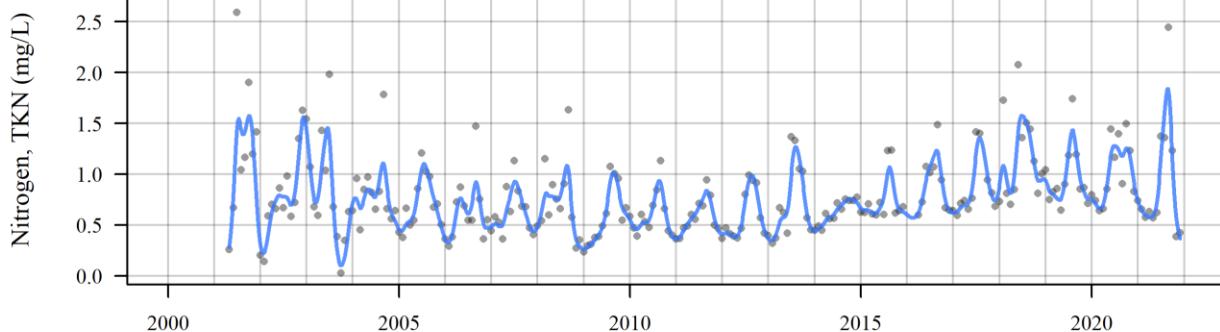




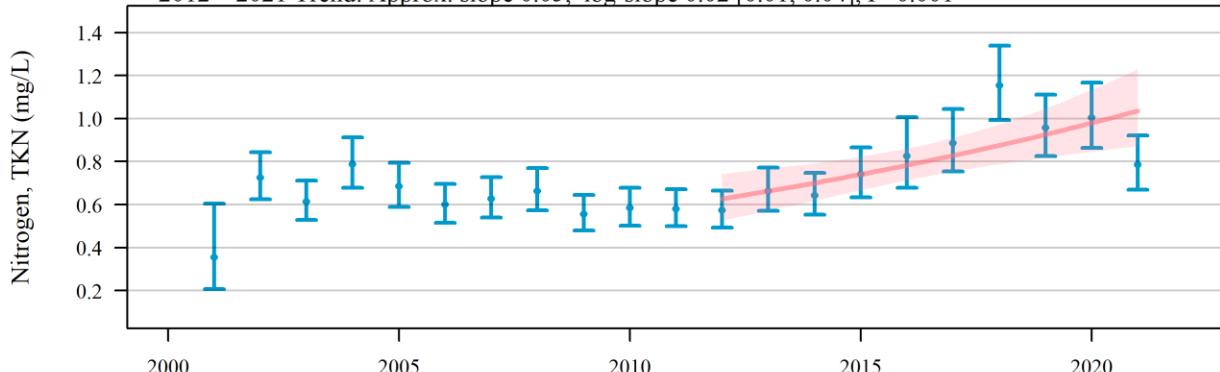


GAM for Nitrogen, TKN at West Wall Charlotte Harbor
May 2001 to Dec 2021 (n=244)

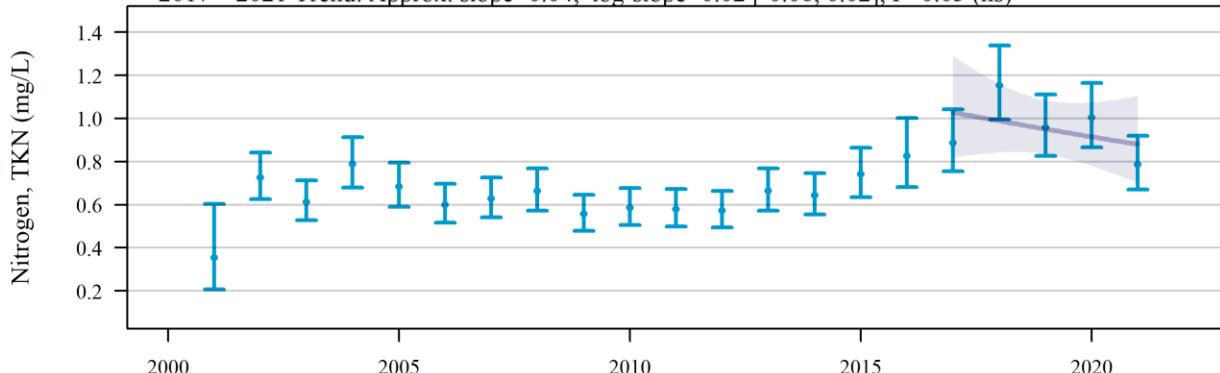
— GAM • Data

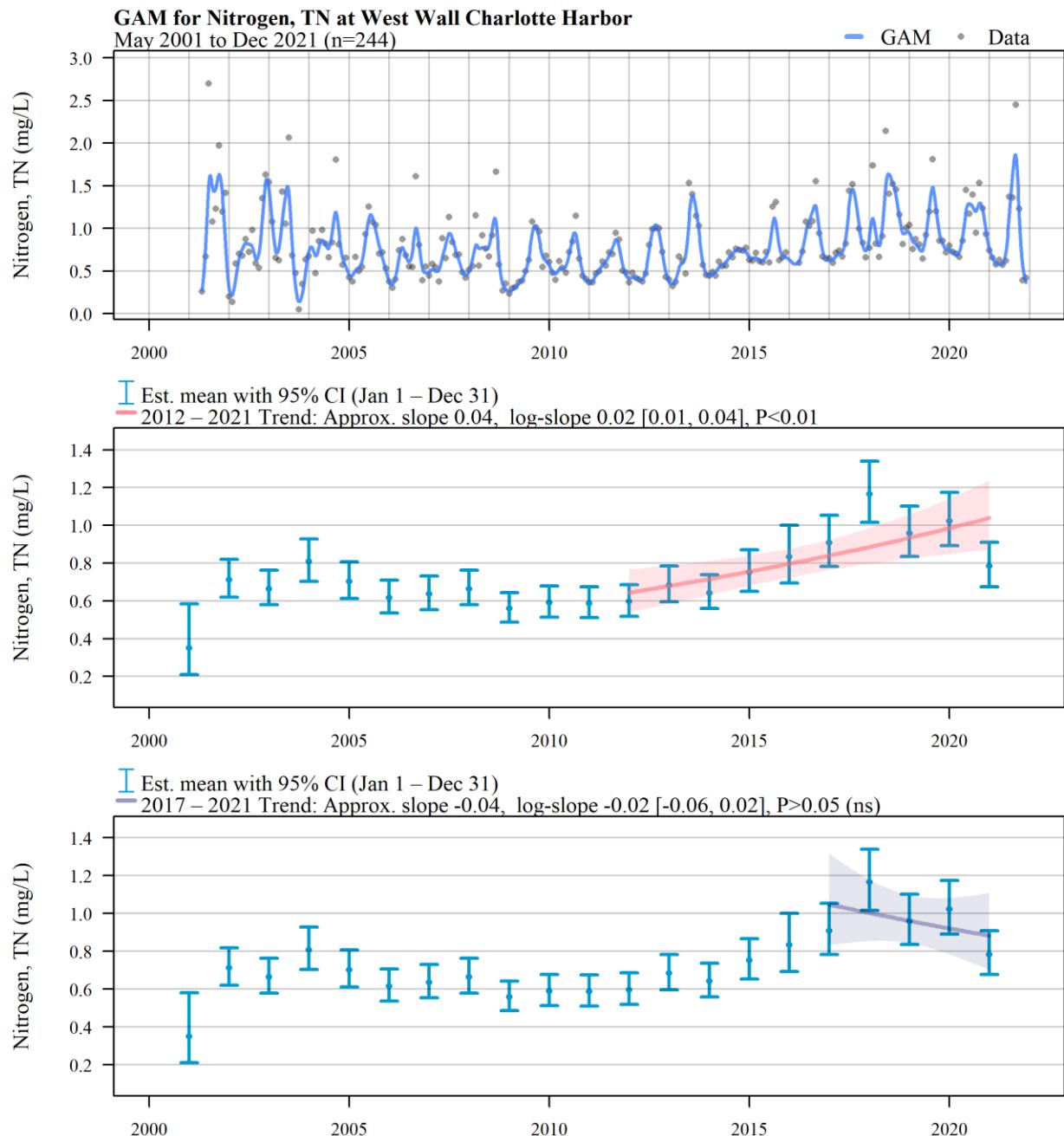


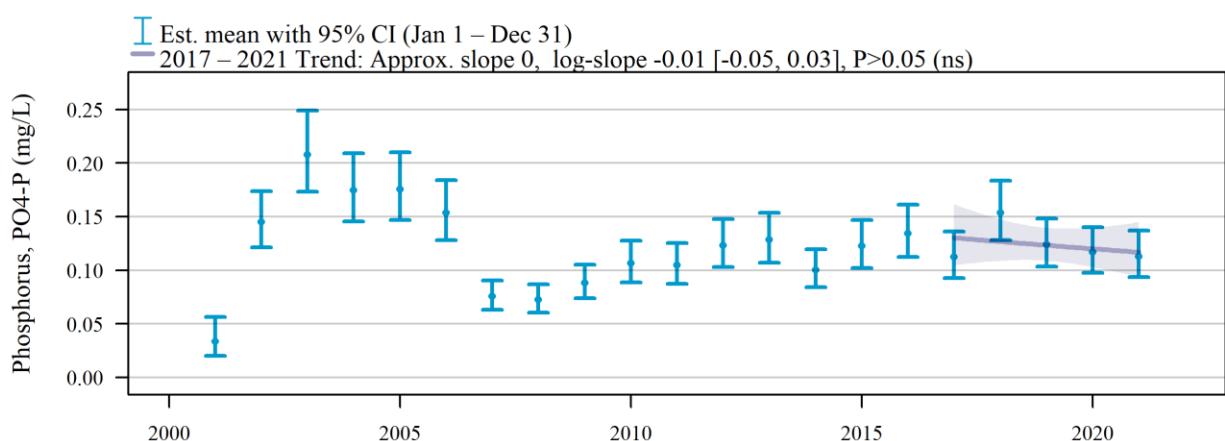
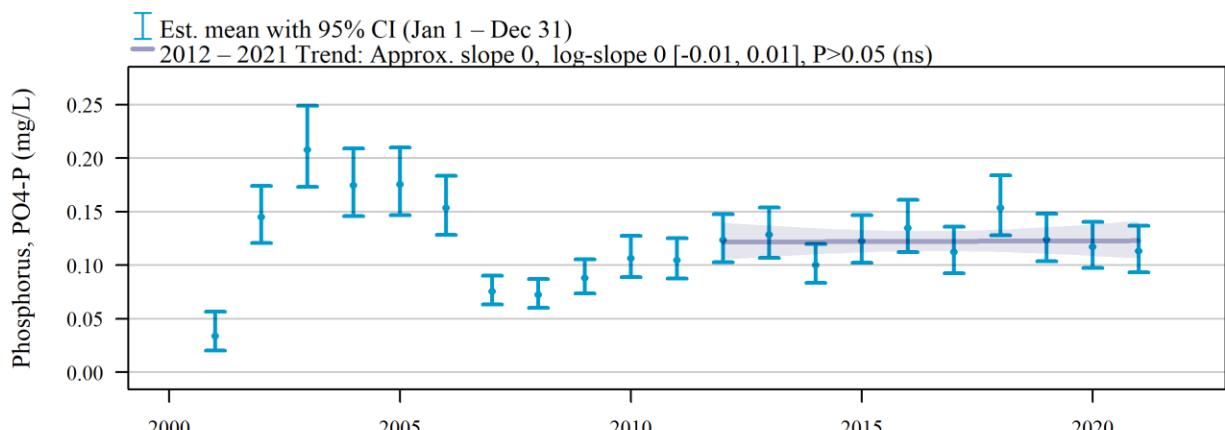
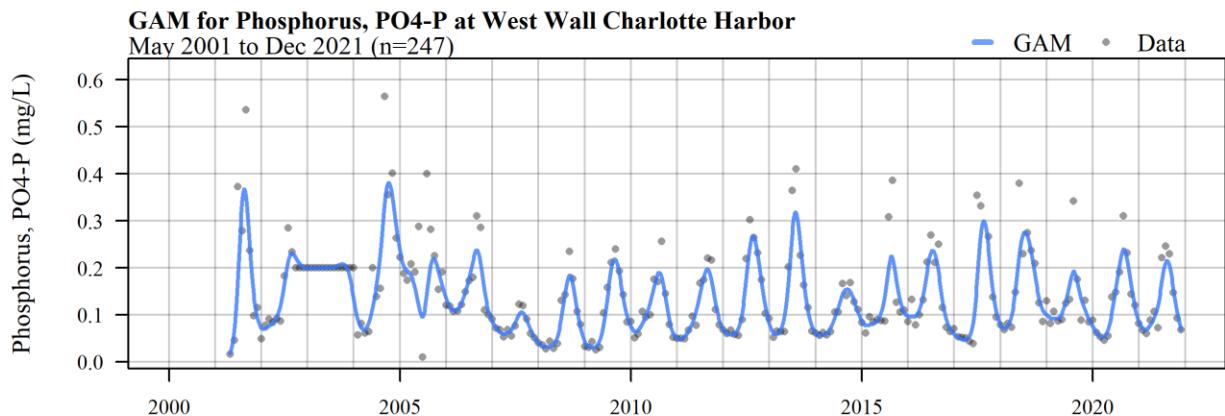
Est. mean with 95% CI (Jan 1 – Dec 31)
2012 – 2021 Trend: Approx. slope 0.05, log-slope 0.02 [0.01, 0.04], P<0.001



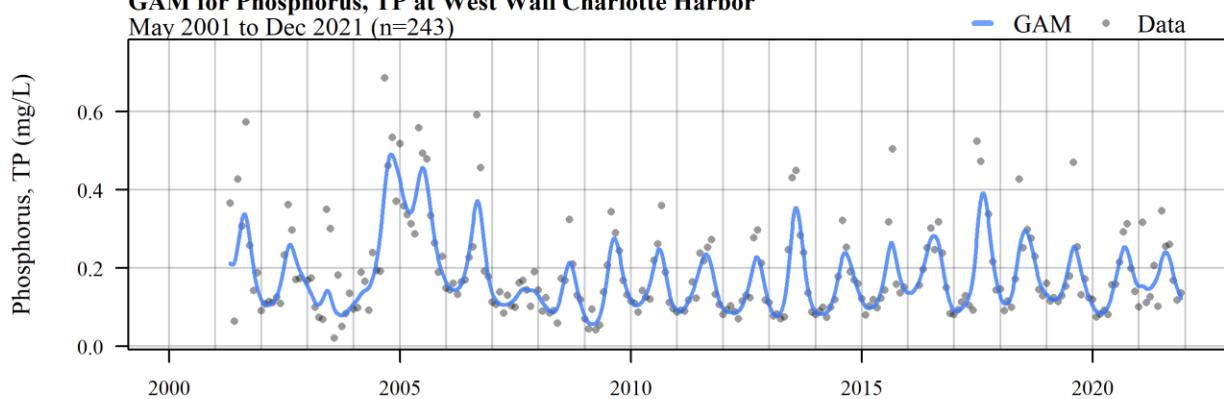
Est. mean with 95% CI (Jan 1 – Dec 31)
2017 – 2021 Trend: Approx. slope -0.04, log-slope -0.02 [-0.06, 0.02], P>0.05 (ns)



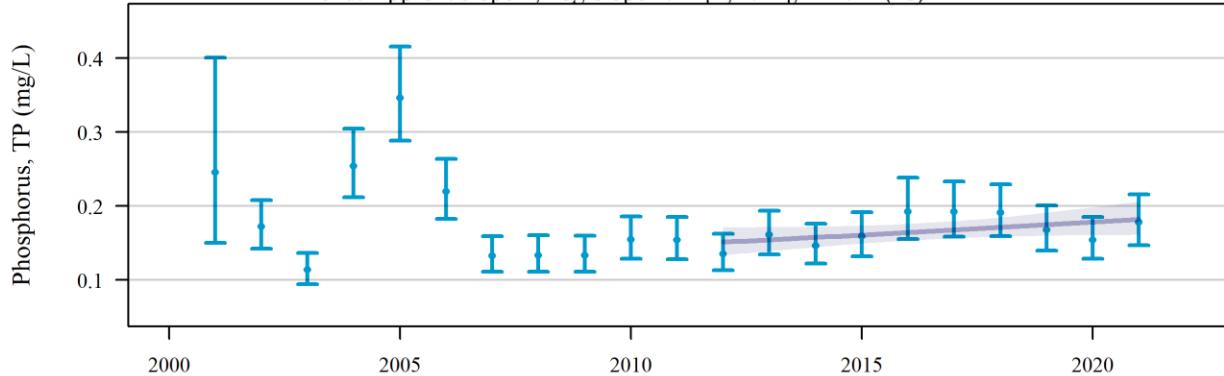




GAM for Phosphorus, TP at West Wall Charlotte Harbor
May 2001 to Dec 2021 (n=243)



Est. mean with 95% CI (Jan 1 – Dec 31)
 2012 – 2021 Trend: Approx. slope 0, log-slope 0.01 [0, 0.02], P>0.05 (ns)



Est. mean with 95% CI (Jan 1 – Dec 31)
 2017 – 2021 Trend: Approx. slope -0.01, log-slope -0.02 [-0.04, 0.01], P>0.05 (ns)

