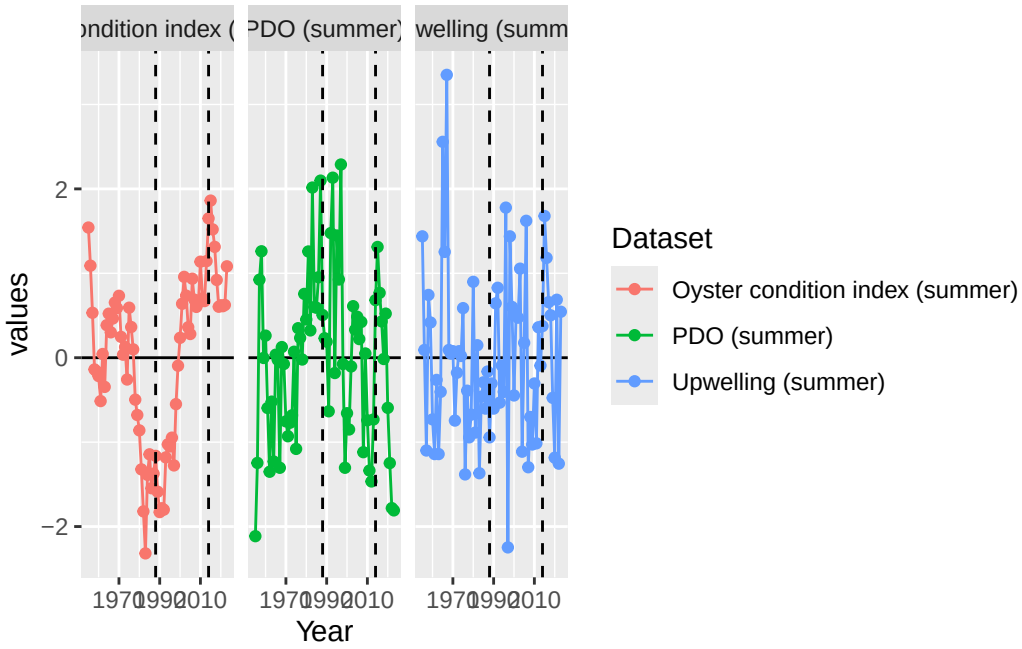
WA Oyster Condition Case Study

Approach for WA oyster condition data using linear regression models with time periods defined a-priori and temporally structured GAMs.

First we start with looking at three time periods using linear regression models:

1. Before 1998/1989
2. Between 1988/1989 and 2014/2015
3. After 2014/2015



To examine this we start by using intercept only models through time:

1. Oyster Condition Index
2. PDO
3. Upwelling

Variable	No.Period.AIC	Period.AIC
Oyster condition index (summer)	198.81	190.56
PDO (summer)	198.81	201.94
Upwelling (summer)	198.81	202.06

Covariates	Period	Interaction
PDO	254.44	246.73
Upwelling	268.19	270.12

We approach this by fitting a linear model with the a priori time periods as a factor and compare AIC to a single intercept model.

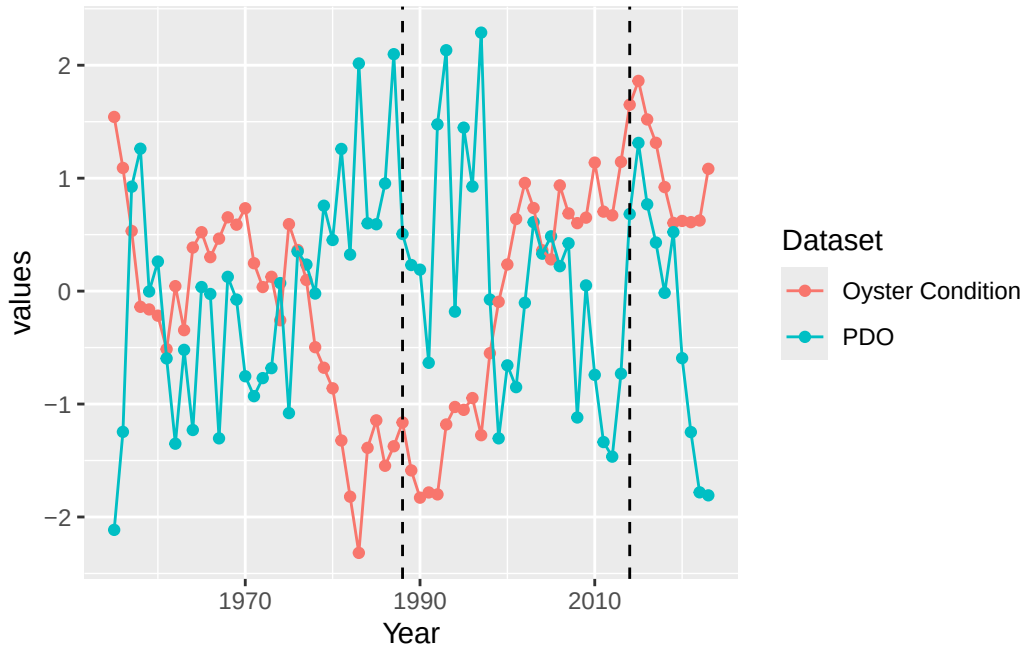
We find that oyster condition index is better explained by a model that includes apriori defined time periods improves model fit.

Next we consider whether there are changing relationships between oyster condition index and PDO by including a slope parameter and its interaction with time period.

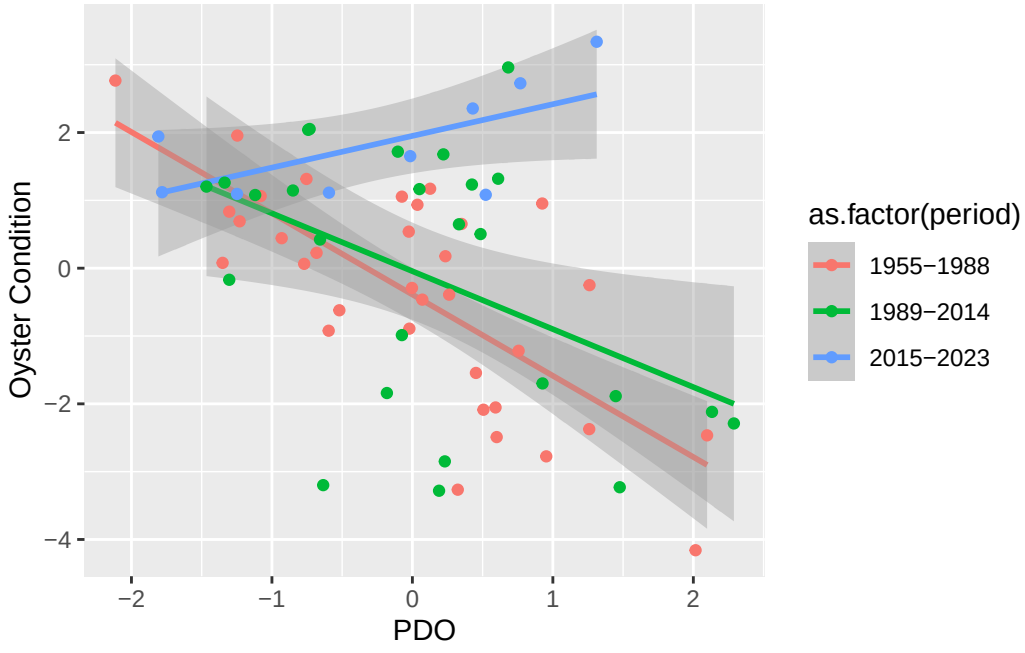
PDO best explains oyster condition index with a time varying relationship. We examine how this relationship changes through time.

```
[1] "PDO"
```

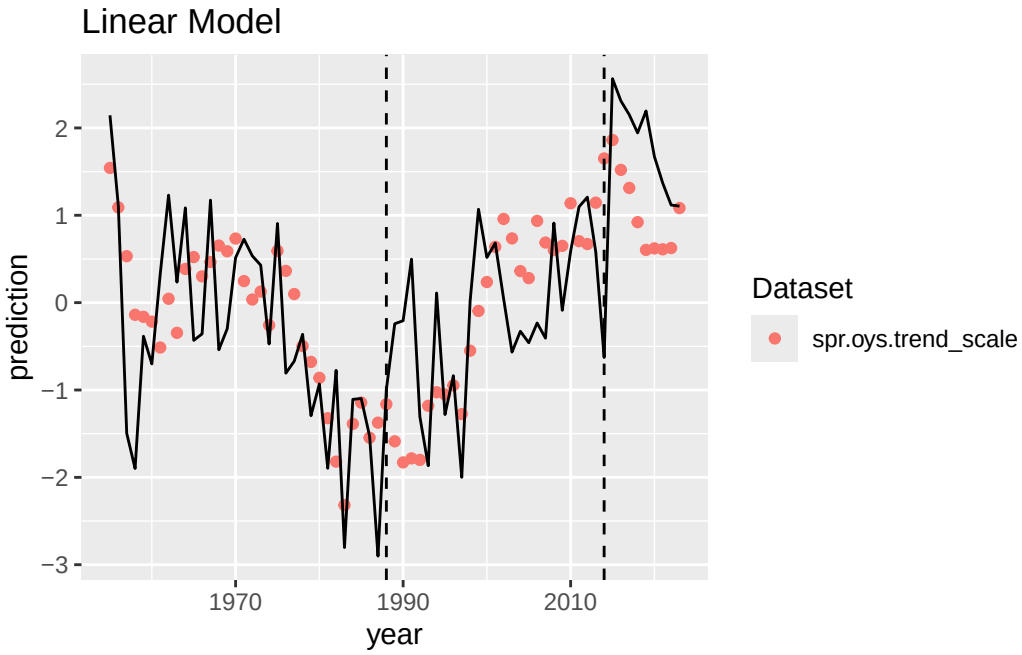
term	Estimate	Std. Error	t value	Pr(>|t|)
(Intercept)	-0.4952477	0.2354799	-2.1031426	0.0394534
spr.pdo	-1.2289395	0.2524940	-4.8672037	0.0000079
as.factor(period)2	0.3743244	0.3569023	1.0488148	0.2982703
as.factor(period)3	2.4874412	0.5348614	4.6506275	0.0000174
spr.pdo:as.factor(period)2	0.3526067	0.3742069	0.9422774	0.3496501
spr.pdo:as.factor(period)3	1.7085736	0.5015693	3.4064555	0.0011508




```
`geom_smooth()` using formula = 'y ~ x'
```



Now we compare the PDO-oyster condition relationship by fitting a linear model and comparing it to s temporally structured gam.




```
     Optimal (m+1)-segment partition:

Call:
breakpoints.formula(formula = y.ts ~ 1)

Breakpoints at observation number:

m = 1                  55
m = 2       21         53
m = 3       21     43  56
m = 4       21 33  43  56
m = 5    11 21 33  43  56

Corresponding to breakdates:

m = 1                  55
m = 2       21         53
m = 3       21     43  56
m = 4       21 33  43  56
```

```
m = 5   11 21 33 43 56

Fit:

m   0      1      2      3      4      5
RSS 101.01  67.70  57.13  46.39  44.82  44.70
BIC 230.58 211.44 208.19 202.29 208.39 216.67


    prediction year
55 -0.08762268 2009


   prediction year
21  0.9057433 1975


   prediction year
53 -0.4066078 2007
```


```
     Optimal (m+1)-segment partition:

Call:
```

```
breakpoints.formula(formula = y.ts ~ 1)

Breakpoints at observation number:

m = 1      21
m = 2      24    43
m = 3      24 34 44
m = 4   14 24 34 44
m = 5   14 24 34 44 59

Corresponding to breakdates:

m = 1      21
m = 2      24    43
m = 3      24 34 44
m = 4   14 24 34 44
m = 5   14 24 34 44 59

Fit:

m   0      1      2      3      4      5
RSS  70.97  62.29  39.36  37.89  37.78  37.71
BIC 206.23 205.69 182.48 188.32 196.60 204.93


   prediction year
21   1.575455 1975


   prediction year
24  0.3545659 1978


   prediction year
43  -1.844375 1997
```