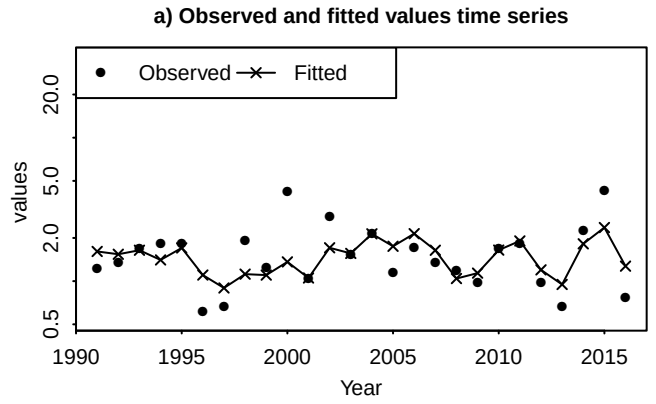
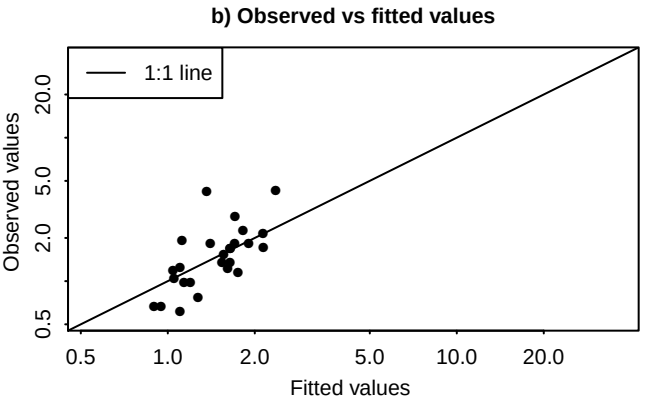
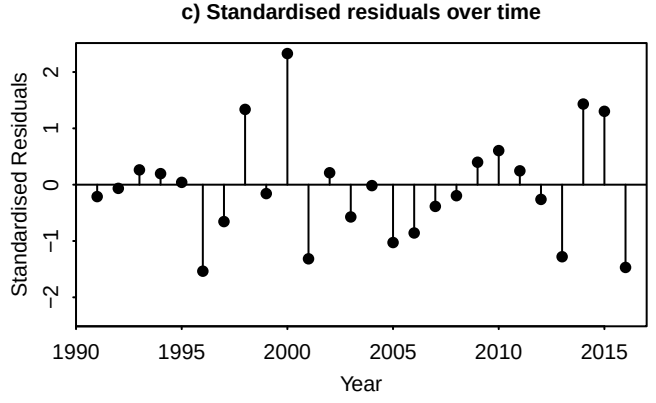
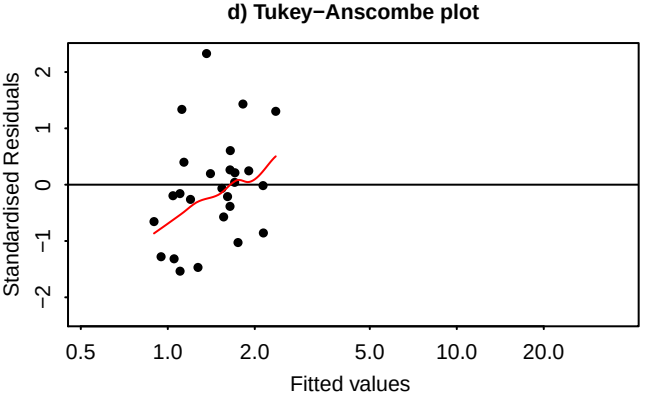
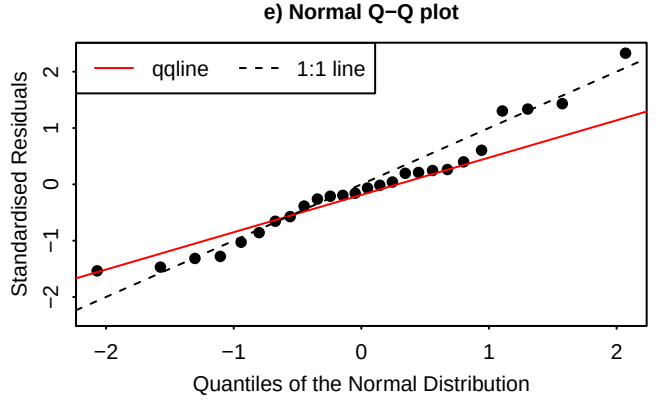
Turbot in IV pgSurvey 7 Diagnostics − BTS−ISIS, age 1

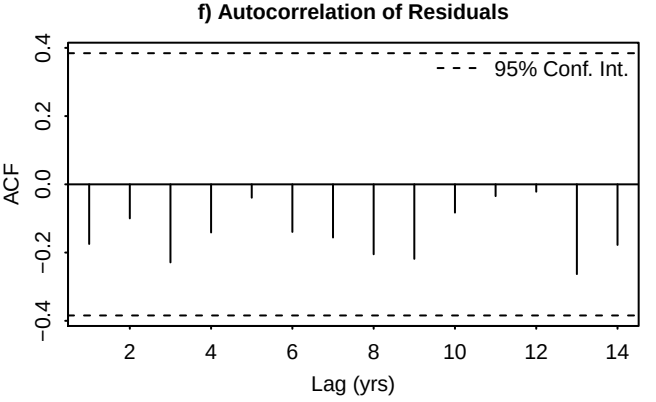


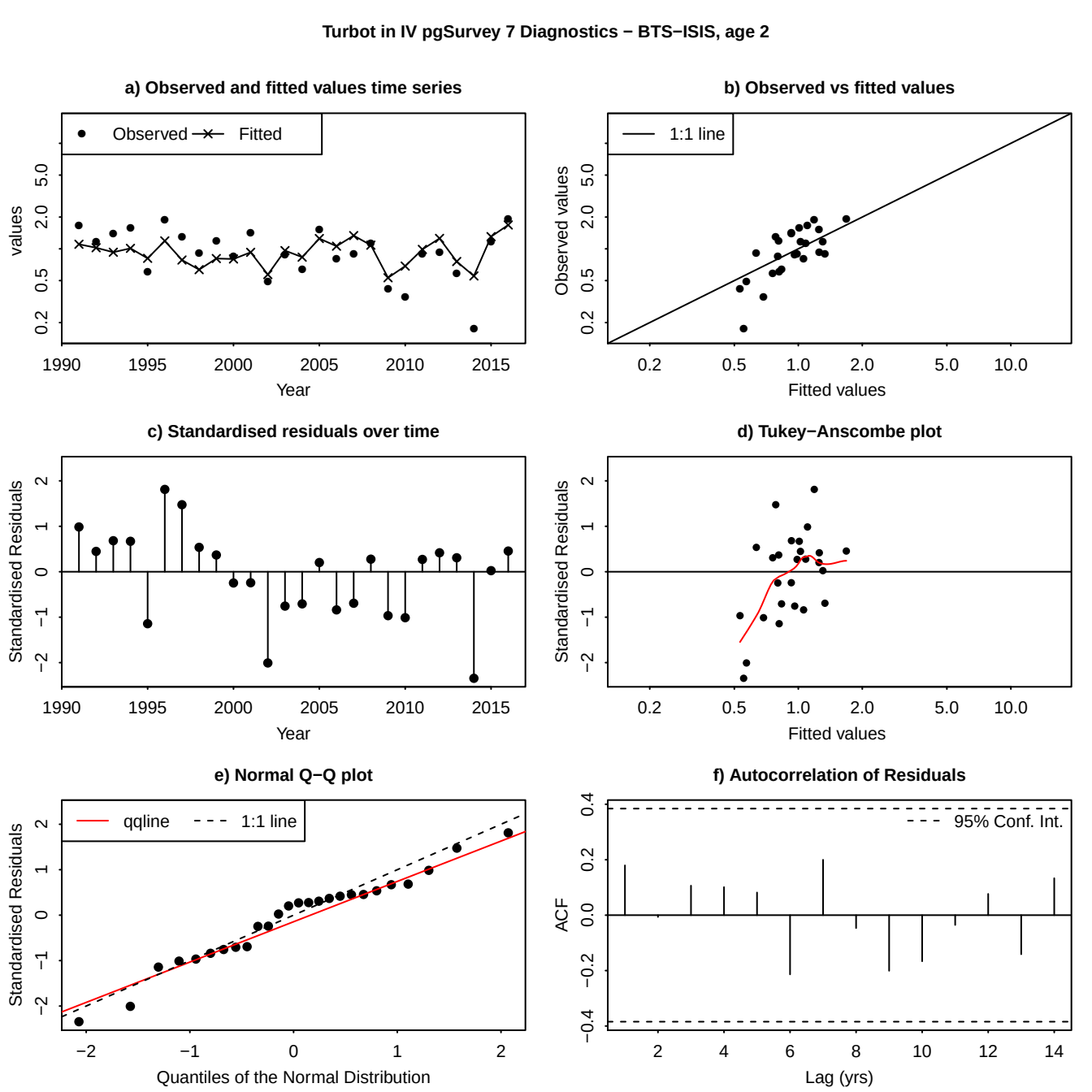


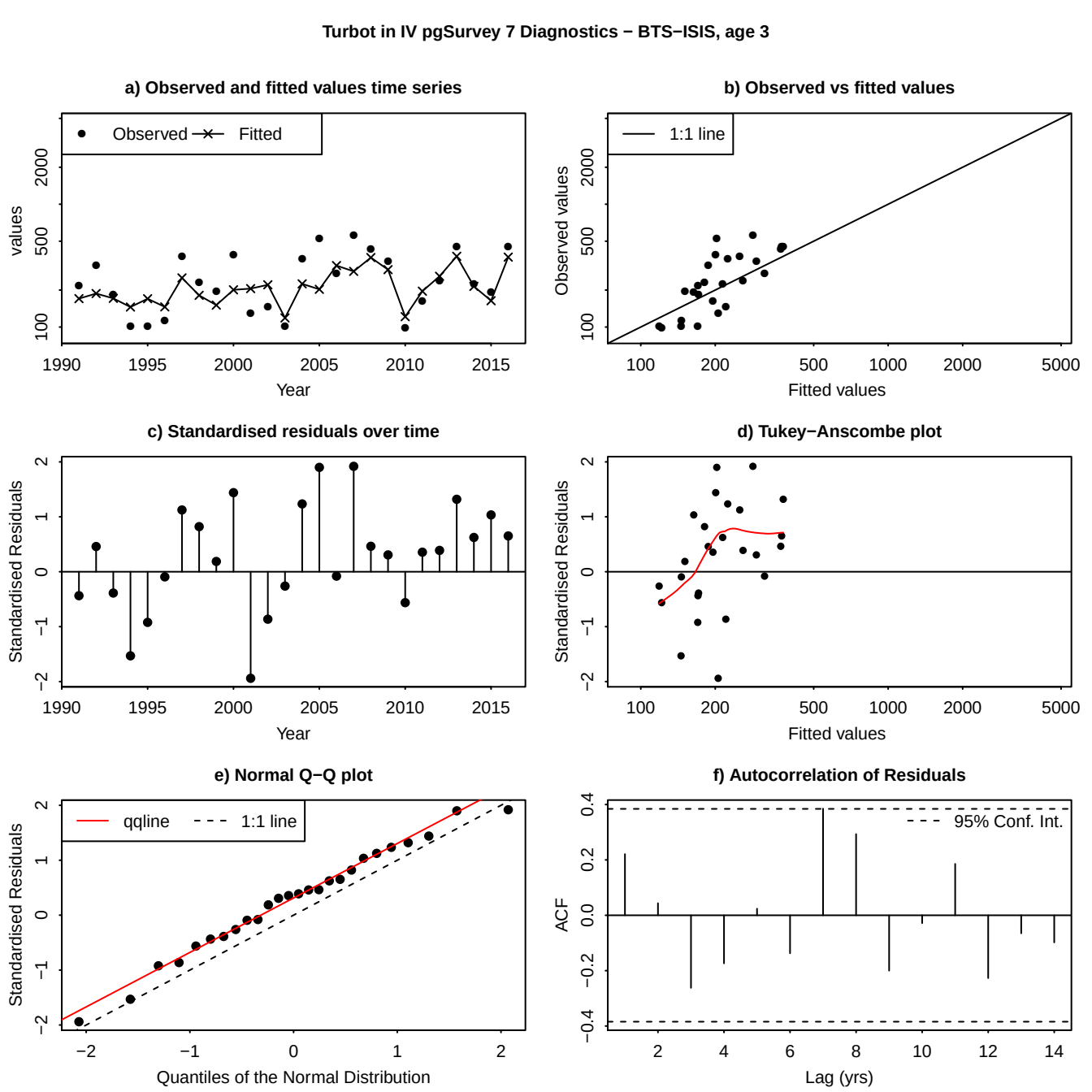


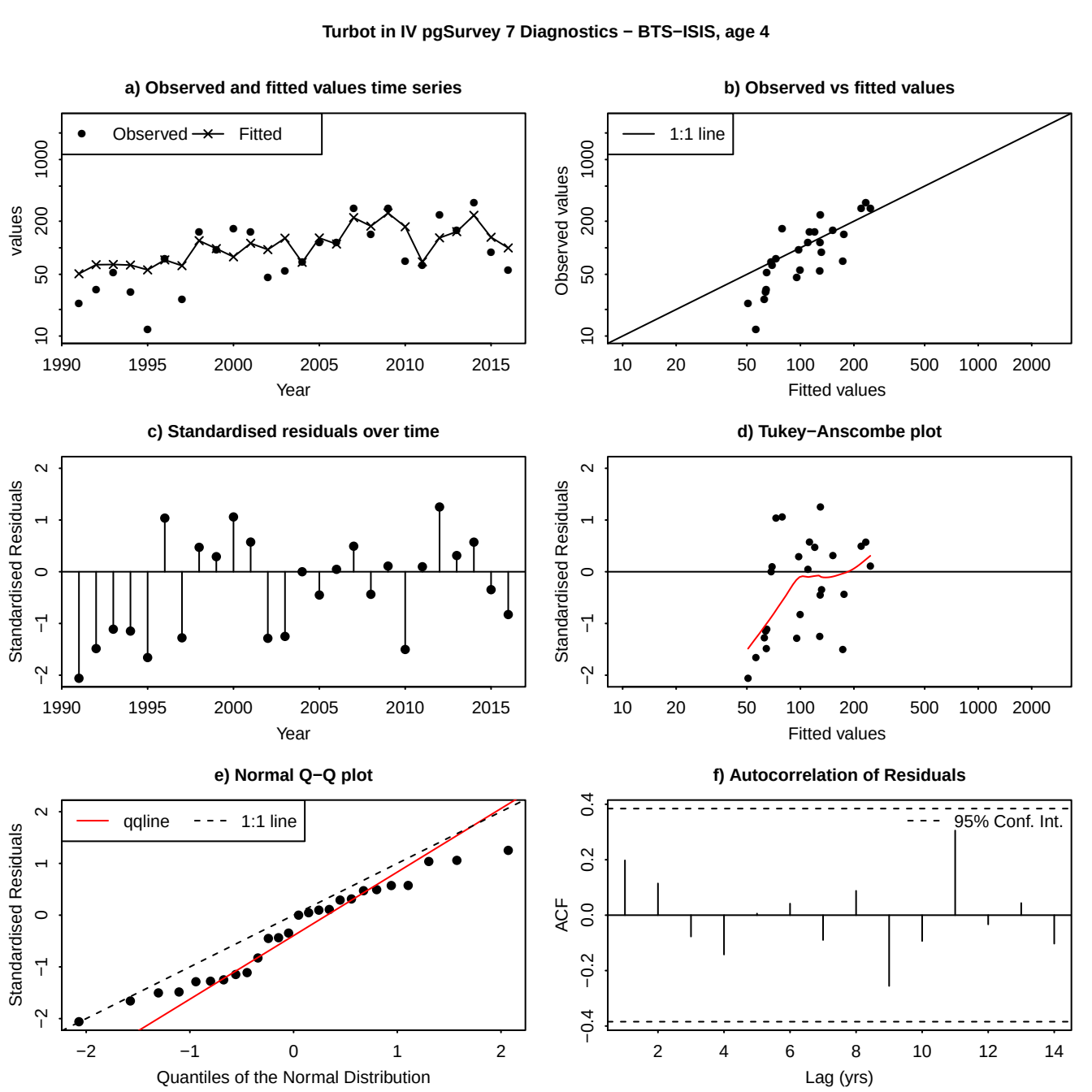


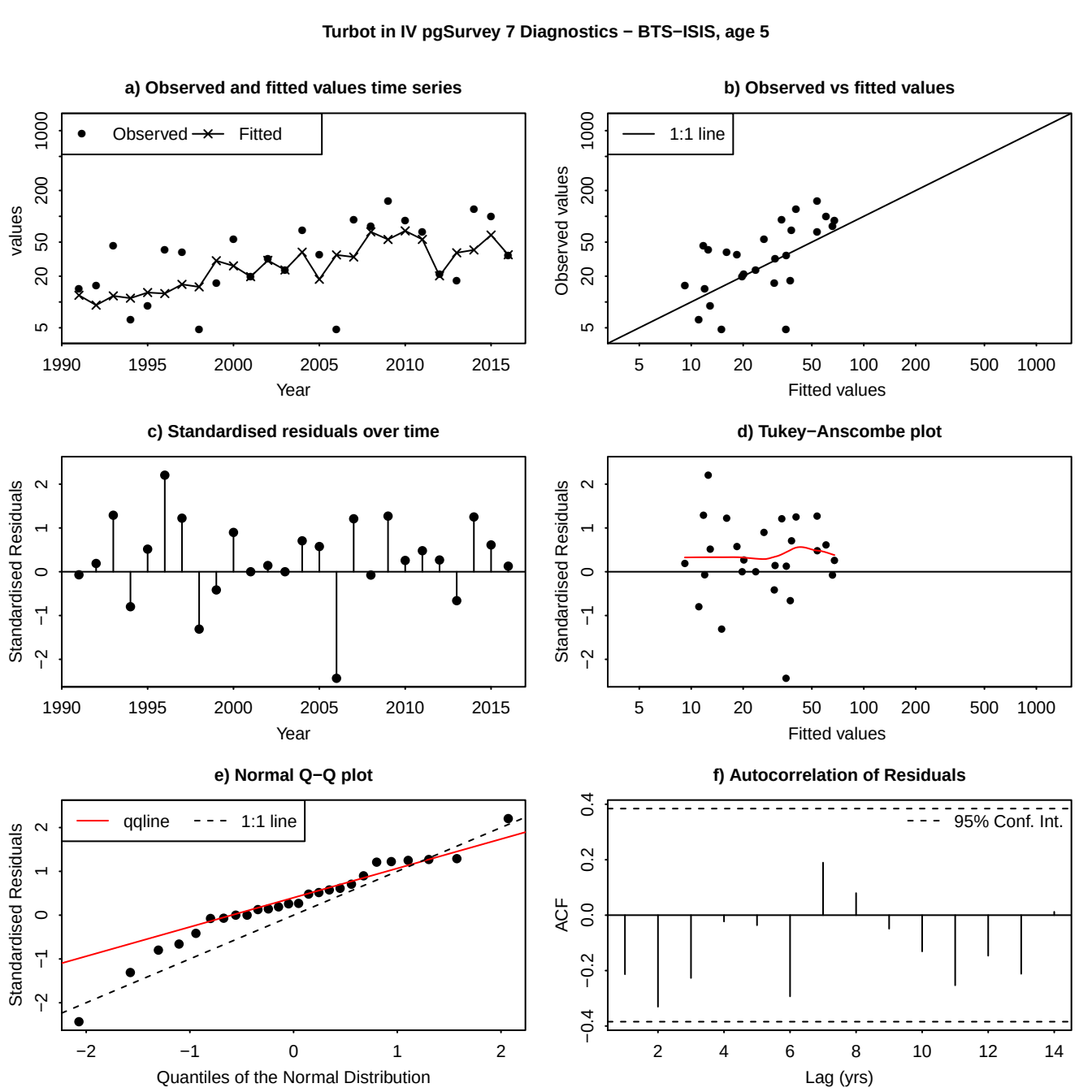


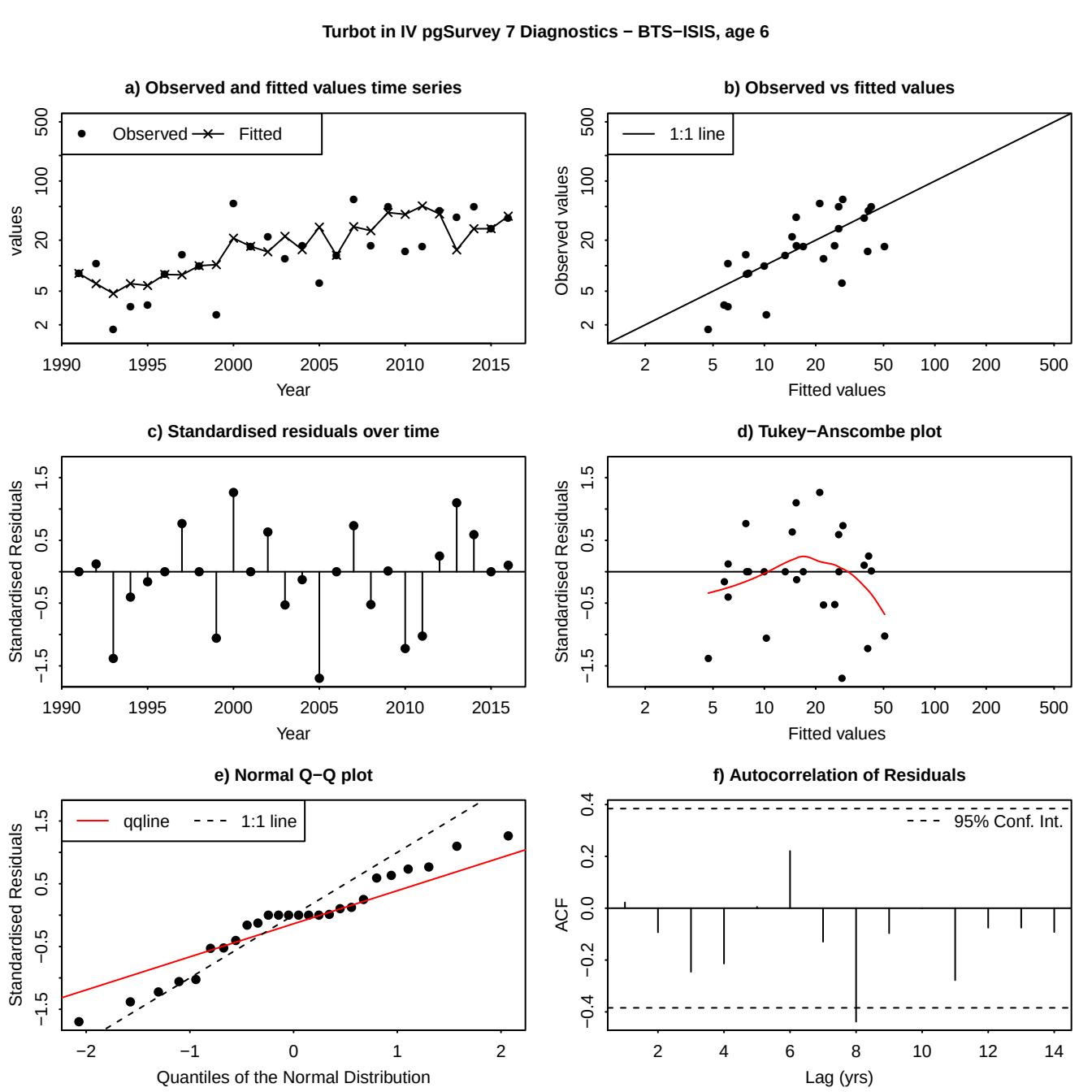


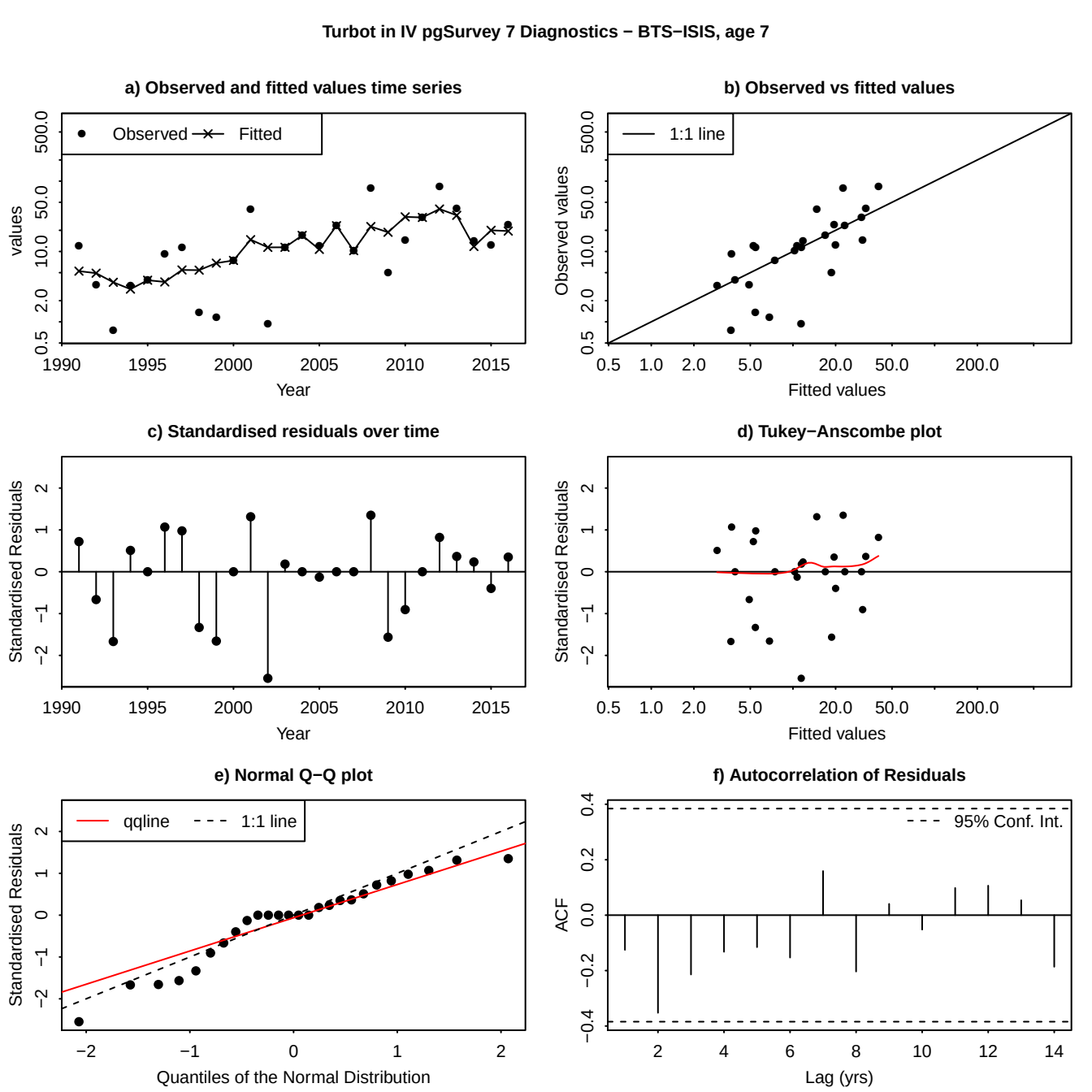

Turbot in IV pgSurvey 7 Diagnostics − BTS−ISIS, age 2
a) Observed and fitted values time series
Observed
Fitted
values
0.2
0.5
2.0
5.0
1990
1995
2000
2005
2010
2015
Year
b) Observed vs fitted values
1:1 line
Observed values
0.2
0.5
2.0
5.0
0.2
0.5
1.0
2.0
5.0
10.0
Fitted values
c) Standardised residuals over time
Standardised Residuals
−2
−1
0
1
2
1990
1995
2000
2005
2010
2015
Year
d) Tukey−Anscombe plot
Standardised Residuals
−2
−1
0
1
2
0.2
0.5
1.0
2.0
5.0
10.0
Fitted values
e) Normal Q−Q plot
qqline
1:1 line
Standardised Residuals
−2
−1
0
1
2
−2
−1
0
1
2
Quantiles of the Normal Distribution
f) Autocorrelation of Residuals
95% Conf. Int.
ACF
−0.4
−0.2
0.0
0.2
0.4
2
4
6
8
10
12
14
Lag (yrs)

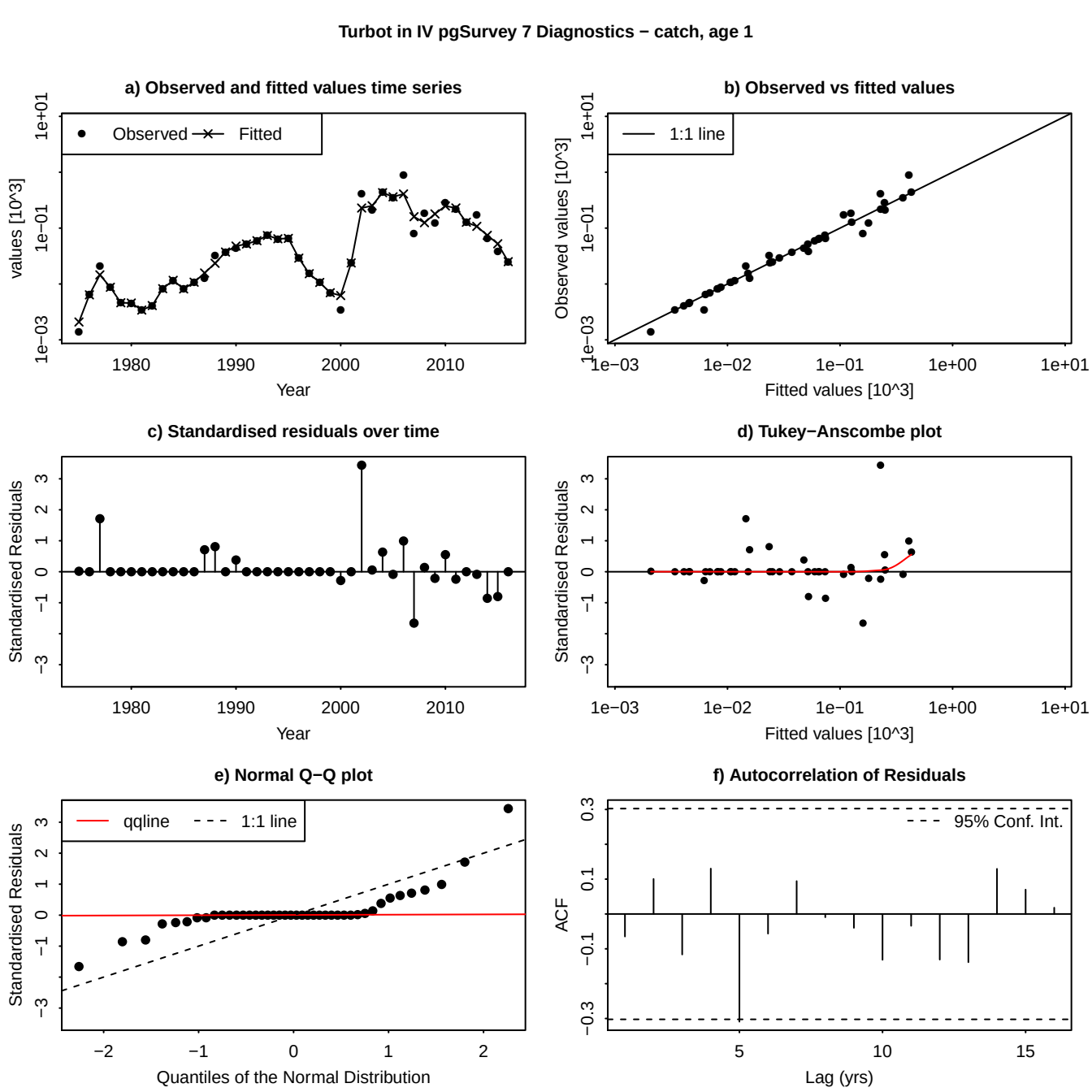

Turbot in IV pgSurvey 7 Diagnostics − BTS−ISIS, age 3
a) Observed and fitted values time series
Observed
Fitted
values
Year
b) Observed vs fitted values
1:1 line
Observed values
Fitted values
c) Standardised residuals over time
Standardised Residuals
Year
d) Tukey−Anscombe plot
Standardised Residuals
Fitted values
e) Normal Q−Q plot
qqline
1:1 line
Standardised Residuals
Quantiles of the Normal Distribution
f) Autocorrelation of Residuals
95% Conf. Int.
ACF
Lag (yrs)

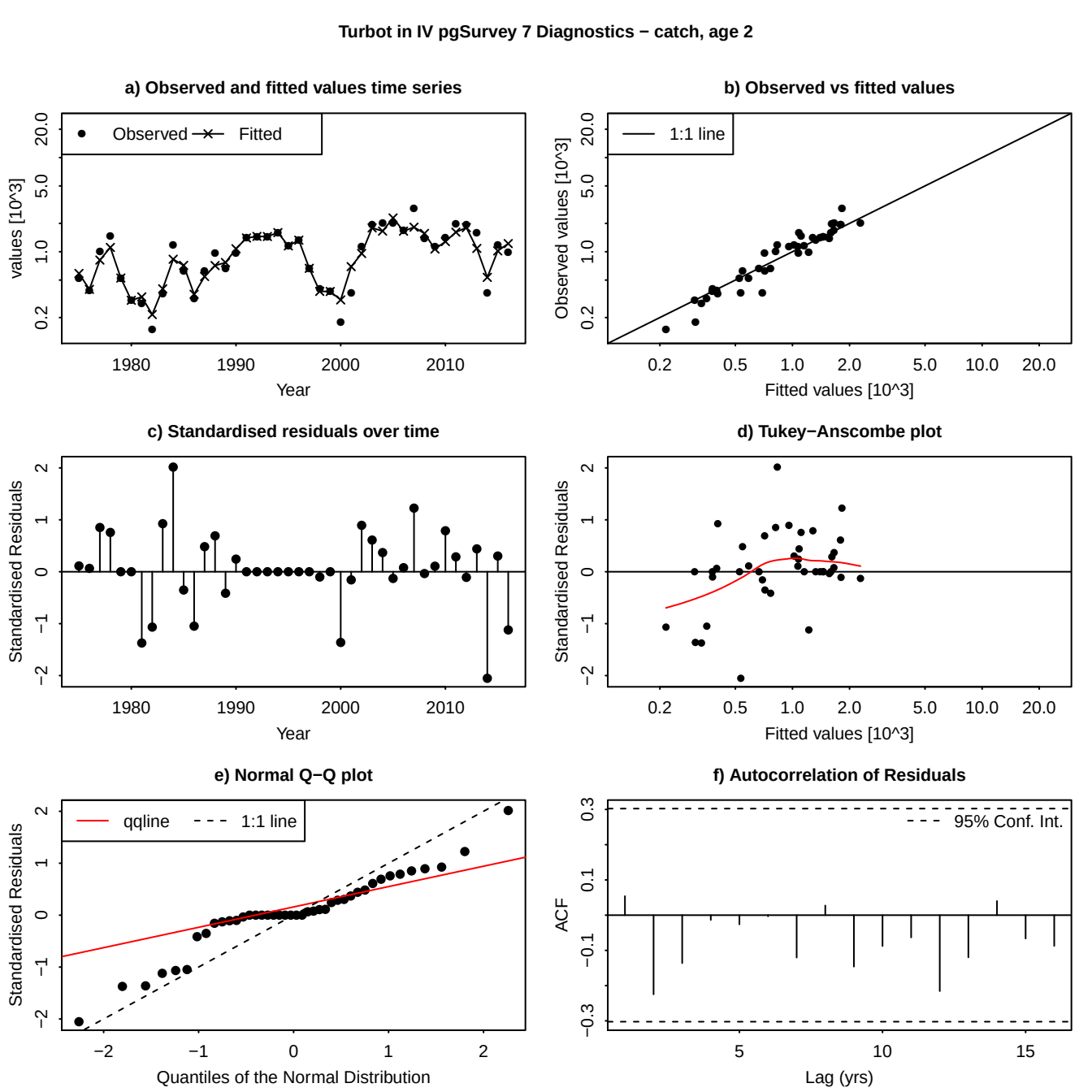

Turbot in IV pgSurvey 7 Diagnostics − BTS−ISIS, age 4
a) Observed and fitted values time series
Observed
Fitted
values
Year
b) Observed vs fitted values
1:1 line
Observed values
Fitted values
c) Standardised residuals over time
Standardised Residuals
Year
d) Tukey−Anscombe plot
Standardised Residuals
Fitted values
e) Normal Q−Q plot
qqline
1:1 line
Standardised Residuals
Quantiles of the Normal Distribution
f) Autocorrelation of Residuals
95% Conf. Int.
ACF
Lag (yrs)

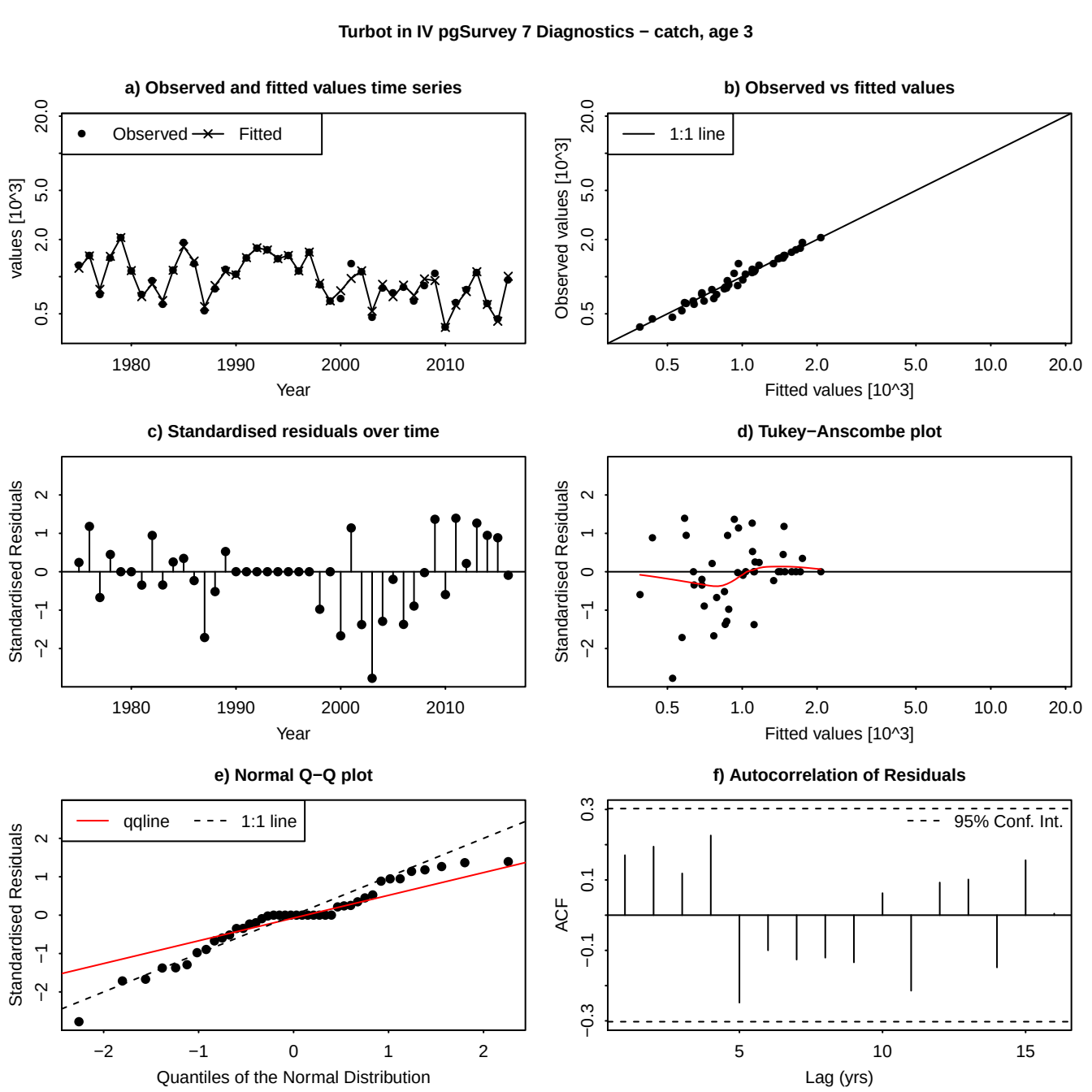

Turbot in IV pgSurvey 7 Diagnostics − BTS−ISIS, age 5
a) Observed and fitted values time series
Observed
Fitted
values
Year
b) Observed vs fitted values
1:1 line
Observed values
Fitted values
c) Standardised residuals over time
Standardised Residuals
Year
d) Tukey−Anscombe plot
Standardised Residuals
Fitted values
e) Normal Q−Q plot
qqline
1:1 line
Standardised Residuals
Quantiles of the Normal Distribution
f) Autocorrelation of Residuals
95% Conf. Int.
ACF
Lag (yrs)


Turbot in IV pgSurvey 7 Diagnostics − BTS−ISIS, age 6
a) Observed and fitted values time series
Observed
Fitted
values
Year
b) Observed vs fitted values
1:1 line
Observed values
Fitted values
c) Standardised residuals over time
Standardised Residuals
Year
d) Tukey−Anscombe plot
Standardised Residuals
Fitted values
e) Normal Q−Q plot
qqline
1:1 line
Standardised Residuals
Quantiles of the Normal Distribution
f) Autocorrelation of Residuals
95% Conf. Int.
ACF
Lag (yrs)

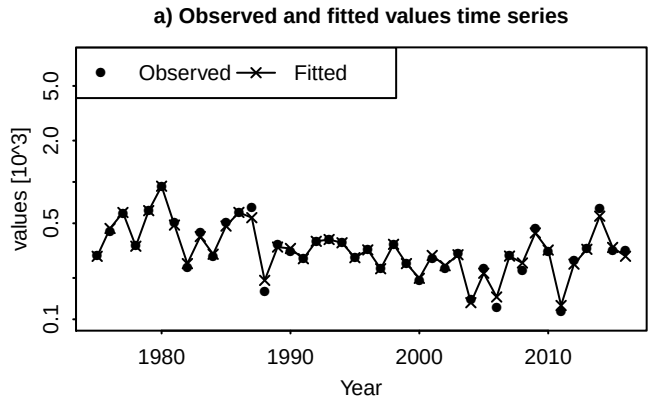

Turbot in IV pgSurvey 7 Diagnostics − BTS−ISIS, age 7
a) Observed and fitted values time series
Observed
Fitted
values
500.0
50.0
10.0
2.0
0.5
1990
1995
2000
2005
2010
2015
Year
b) Observed vs fitted values
1:1 line
Observed values
Fitted values
0.5
1.0
2.0
5.0
20.0
50.0
200.0
c) Standardised residuals over time
Standardised Residuals
2
1
0
−1
−2
Year
d) Tukey−Anscombe plot
e) Normal Q−Q plot
qqline
1:1 line
Quantiles of the Normal Distribution
f) Autocorrelation of Residuals
95% Conf. Int.
ACF
0.4
0.2
0.0
−0.2
−0.4
Lag (yrs)

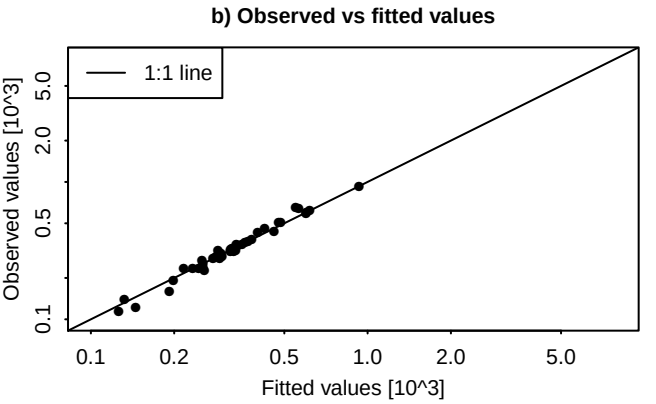

Turbot in IV pgSurvey 7 Diagnostics − catch, age 1
a) Observed and fitted values time series
Observed
Fitted
values [10^3]
1e+01
1e−01
1e−03
1980
1990
2000
2010
Year
b) Observed vs fitted values
1:1 line
Observed values [10^3]
Fitted values [10^3]
1e−03
1e−02
1e−01
1e+00
1e+01
c) Standardised residuals over time
Standardised Residuals
−3
−1
0
1
2
3
Year
d) Tukey−Anscombe plot
e) Normal Q−Q plot
qqline
1:1 line
Quantiles of the Normal Distribution
−2
−1
0
1
2
f) Autocorrelation of Residuals
95% Conf. Int.
ACF
0.3
0.1
−0.1
−0.3
5
10
15
Lag (yrs)

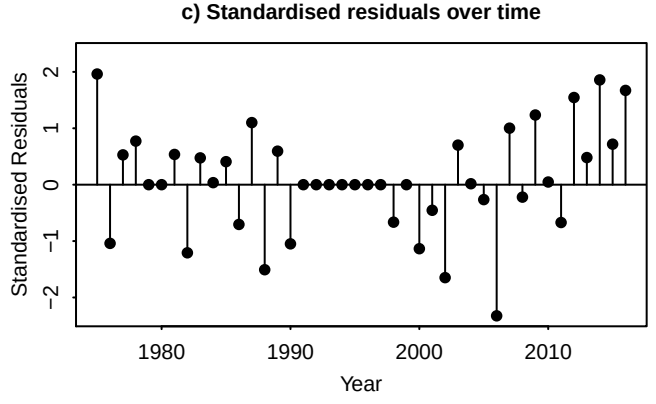

Turbot in IV pgSurvey 7 Diagnostics − catch, age 2
a) Observed and fitted values time series
Observed
Fitted
values [10^3]
Year
b) Observed vs fitted values
1:1 line
Observed values [10^3]
Fitted values [10^3]
c) Standardised residuals over time
Standardised Residuals
Year
d) Tukey−Anscombe plot
Standardised Residuals
Fitted values [10^3]
e) Normal Q−Q plot
qqline
1:1 line
Standardised Residuals
Quantiles of the Normal Distribution
f) Autocorrelation of Residuals
95% Conf. Int.
ACF
Lag (yrs)

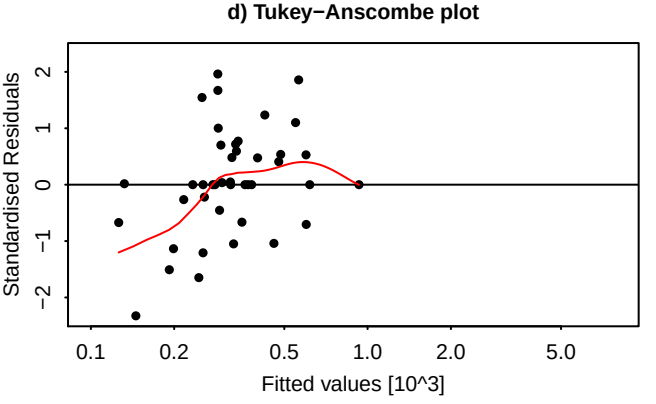

Turbot in IV pgSurvey 7 Diagnostics − catch, age 3
a) Observed and fitted values time series
Observed
Fitted
values [10^3]
20.0
5.0
2.0
0.5
1980
1990
2000
2010
Year
b) Observed vs fitted values
1:1 line
Observed values [10^3]
Fitted values [10^3]
0.5
1.0
2.0
5.0
10.0
20.0
c) Standardised residuals over time
Standardised Residuals
2
1
0
−1
−2
Year
d) Tukey−Anscombe plot
e) Normal Q−Q plot
qqline
1:1 line
Quantiles of the Normal Distribution
f) Autocorrelation of Residuals
95% Conf. Int.
ACF
0.3
0.1
−0.1
−0.3
5
10
15
Lag (yrs)

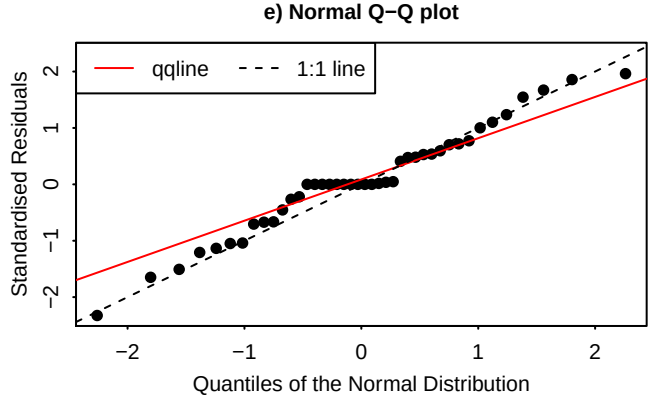
Turbot in IV pgSurvey 7 Diagnostics − catch, age 4

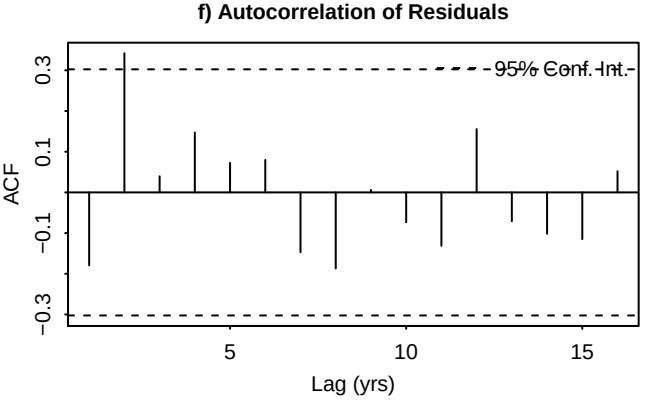


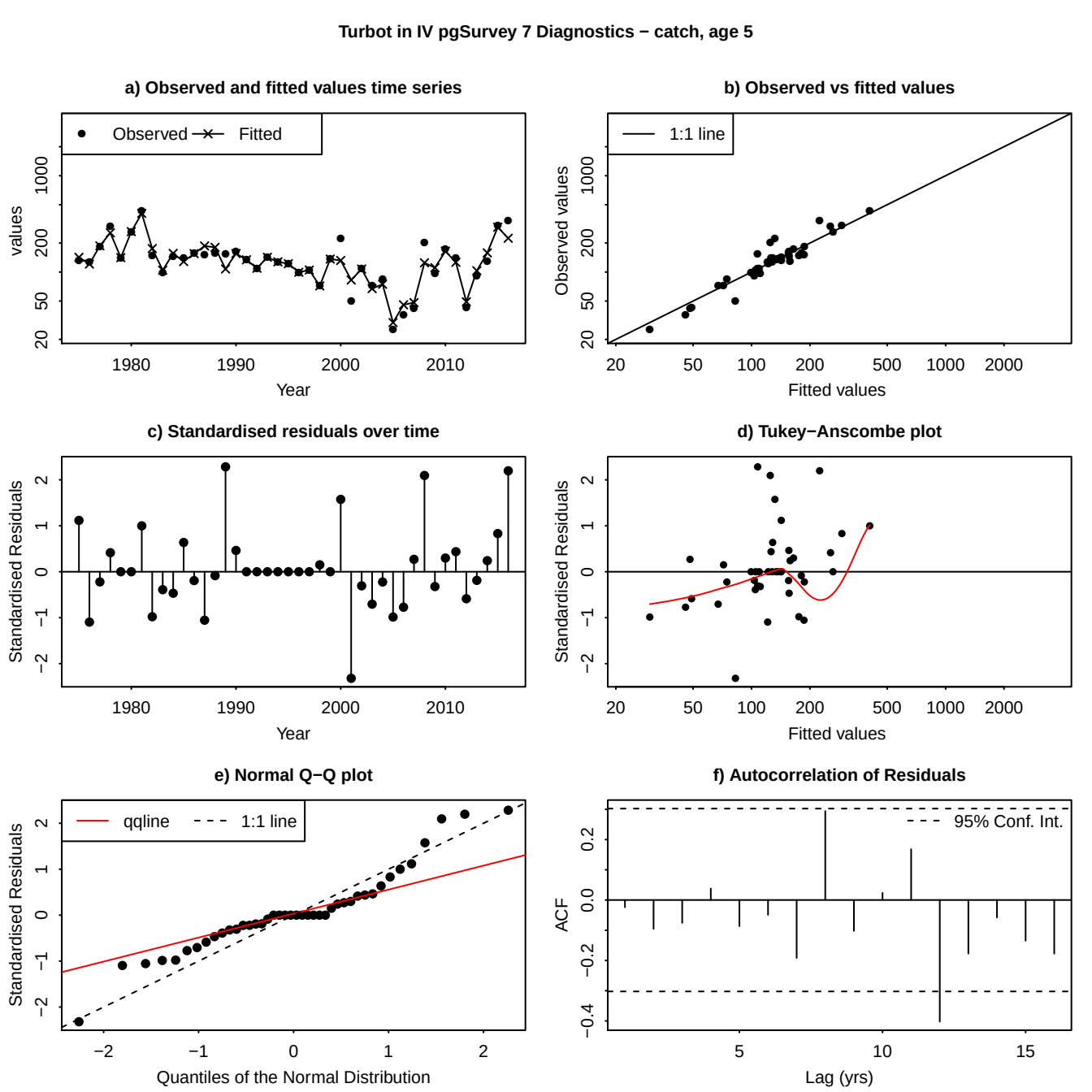


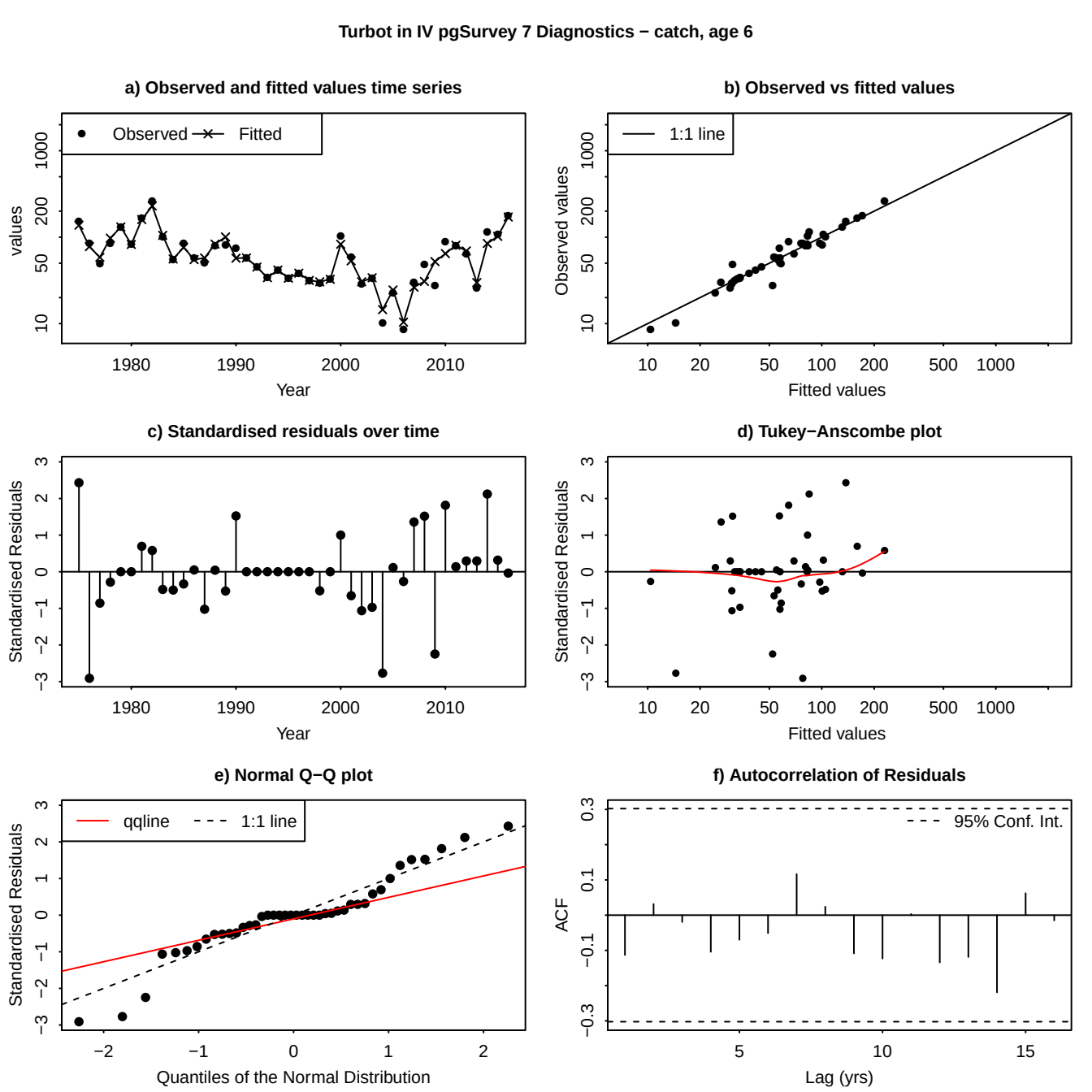


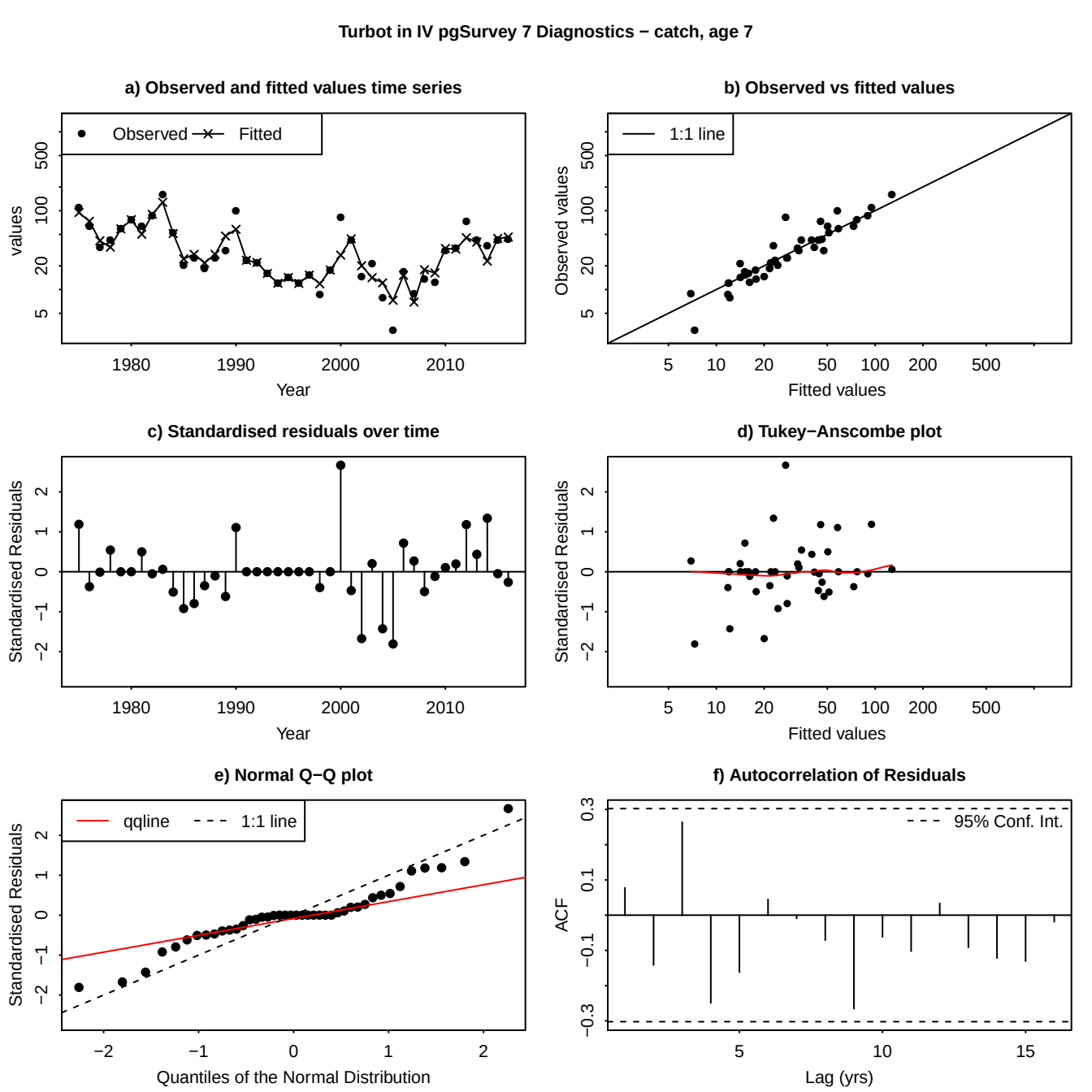


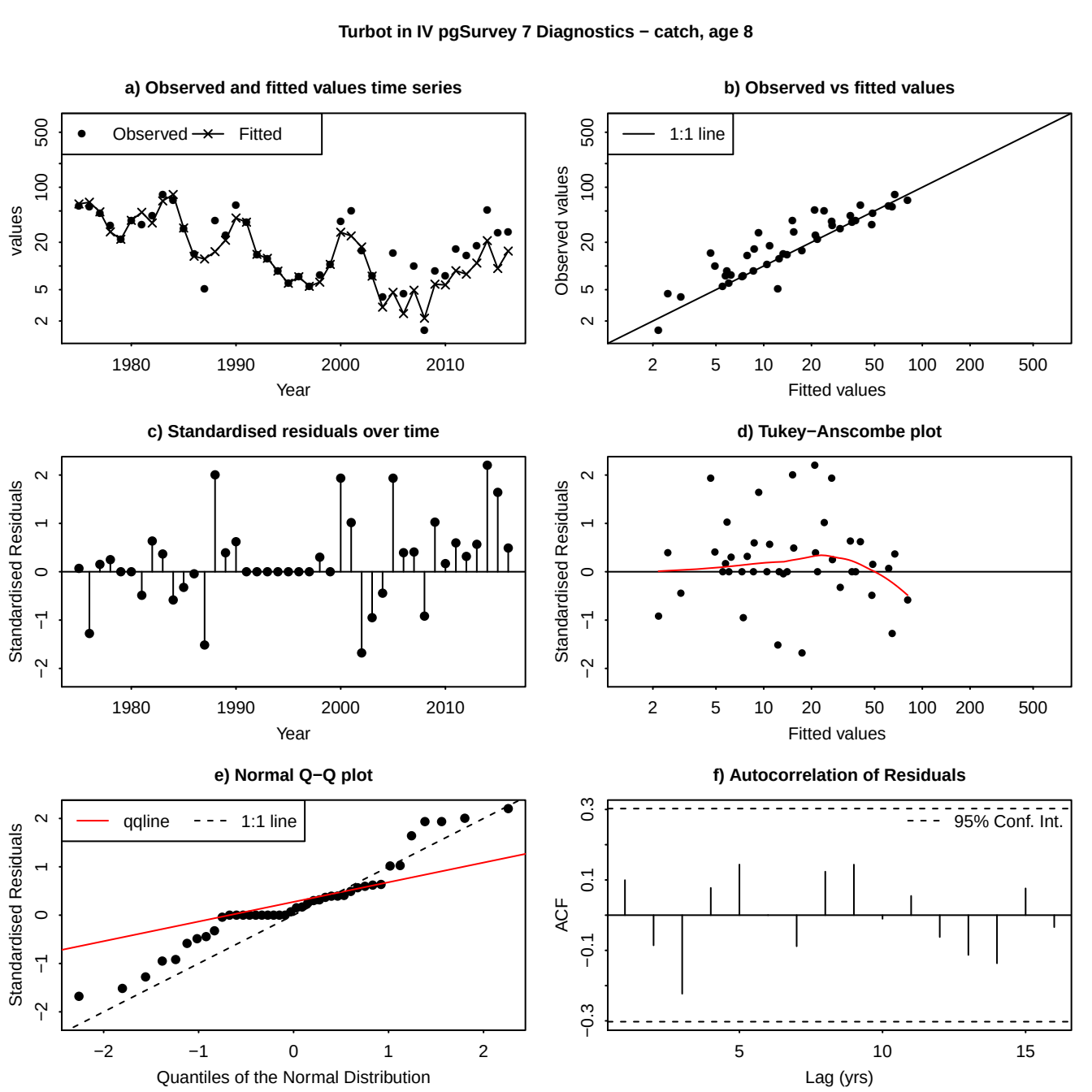


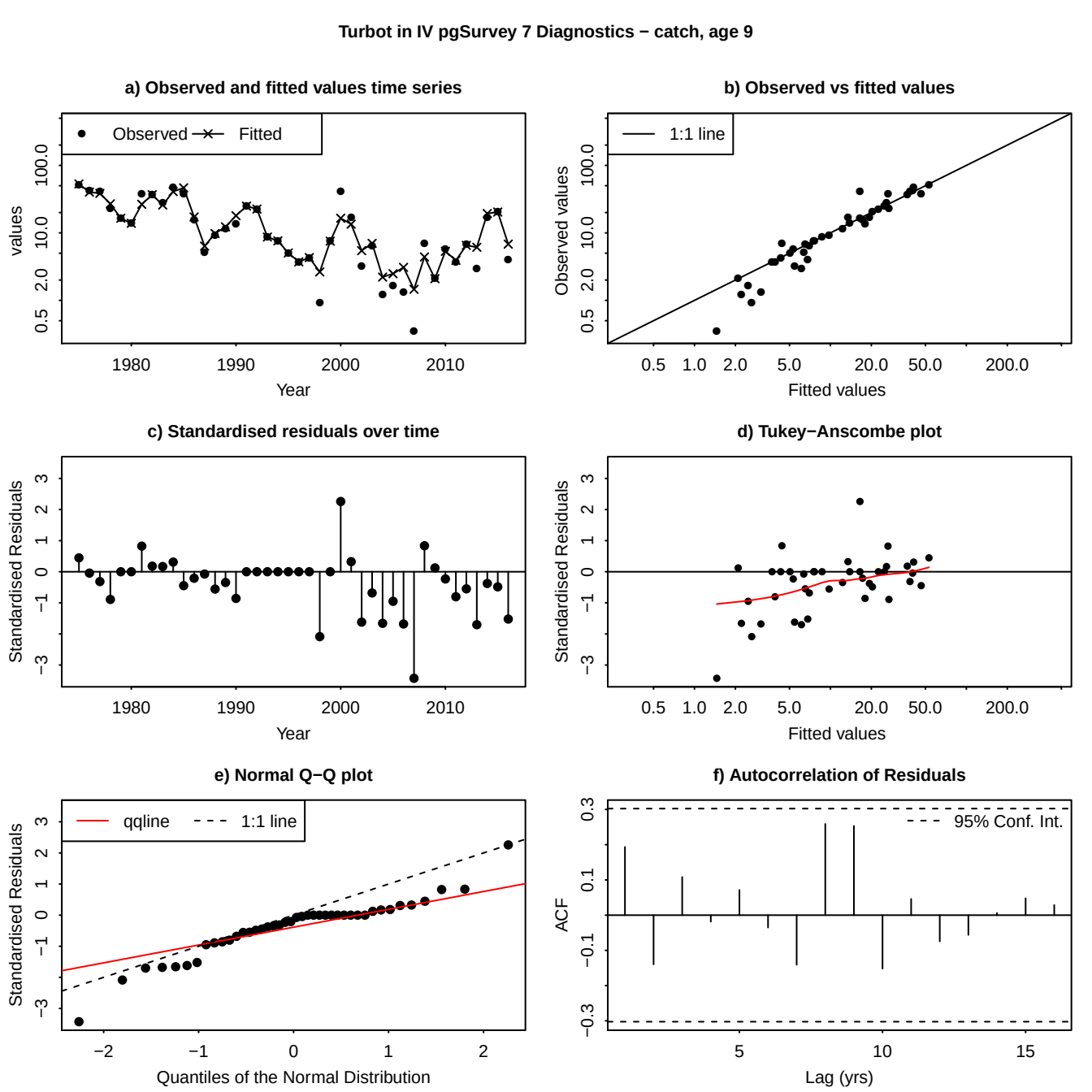



Turbot in IV pgSurvey 7 Diagnostics − catch, age 5
a) Observed and fitted values time series
Observed
Fitted
values
20
50
200
1000
1980
1990
2000
2010
Year
b) Observed vs fitted values
1:1 line
Observed values
Fitted values
c) Standardised residuals over time
Standardised Residuals
d) Tukey−Anscombe plot
e) Normal Q−Q plot
qqline
Quantiles of the Normal Distribution
f) Autocorrelation of Residuals
95% Conf. Int.
ACF
Lag (yrs)

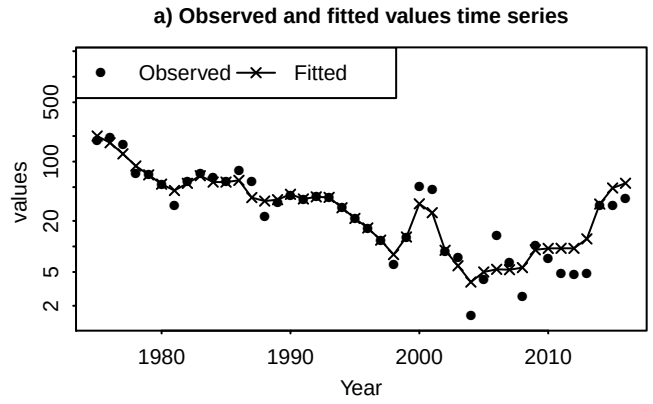

Turbot in IV pgSurvey 7 Diagnostics − catch, age 6
a) Observed and fitted values time series
Observed
Fitted
values
Year
b) Observed vs fitted values
1:1 line
Observed values
Fitted values
c) Standardised residuals over time
Standardised Residuals
Year
d) Tukey−Anscombe plot
Standardised Residuals
Fitted values
e) Normal Q−Q plot
qqline
1:1 line
Standardised Residuals
Quantiles of the Normal Distribution
f) Autocorrelation of Residuals
95% Conf. Int.
ACF
Lag (yrs)

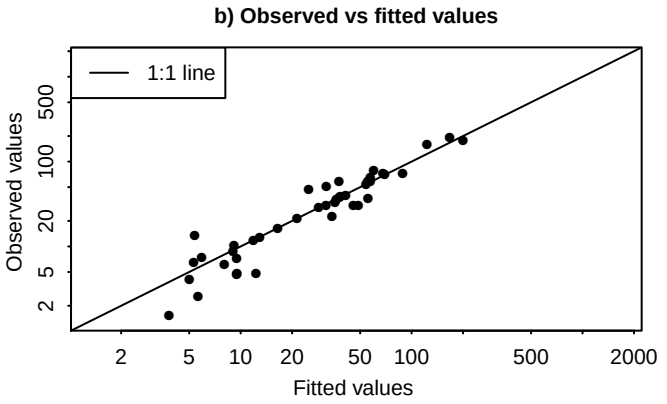

Turbot in IV pgSurvey 7 Diagnostics − catch, age 7
a) Observed and fitted values time series
Observed
Fitted
values
5
20
100
500
1980
1990
2000
2010
Year
b) Observed vs fitted values
1:1 line
Observed values
5
10
20
50
100
200
500
Fitted values
c) Standardised residuals over time
Standardised Residuals
−2
−1
0
1
2
1980
1990
2000
2010
Year
d) Tukey−Anscombe plot
Standardised Residuals
5
10
20
50
100
200
500
Fitted values
e) Normal Q−Q plot
qqline
1:1 line
Standardised Residuals
−2
−1
0
1
2
Quantiles of the Normal Distribution
f) Autocorrelation of Residuals
95% Conf. Int.
ACF
−0.3
−0.1
0.1
0.3
5
10
15
Lag (yrs)

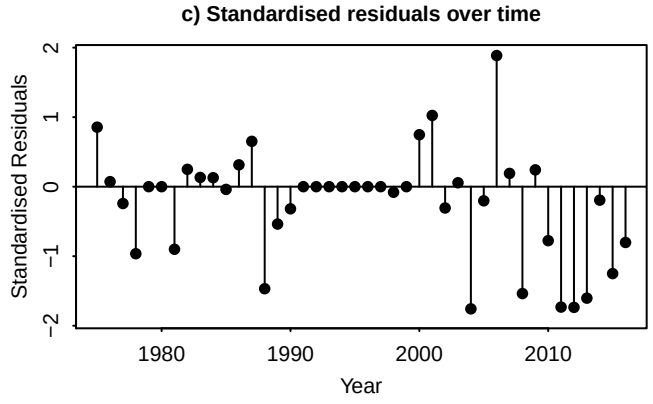

Turbot in IV pgSurvey 7 Diagnostics − catch, age 8
a) Observed and fitted values time series
Observed
Fitted
values
Year
b) Observed vs fitted values
1:1 line
Observed values
Fitted values
c) Standardised residuals over time
Standardised Residuals
Year
d) Tukey−Anscombe plot
Standardised Residuals
Fitted values
e) Normal Q−Q plot
qqline
1:1 line
Standardised Residuals
Quantiles of the Normal Distribution
f) Autocorrelation of Residuals
95% Conf. Int.
ACF
Lag (yrs)

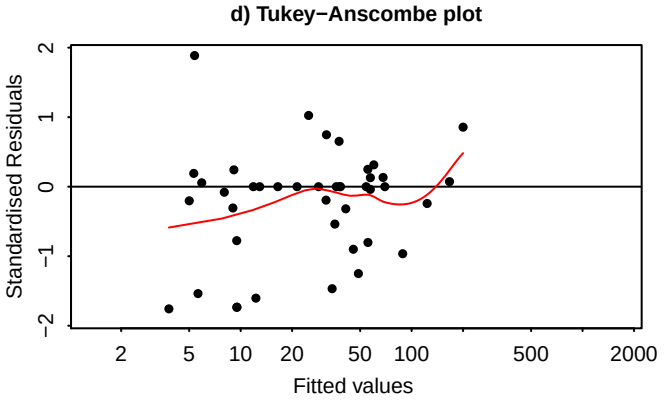

Turbot in IV pgSurvey 7 Diagnostics − catch, age 9
a) Observed and fitted values time series
Observed
Fitted
values
0.5
2.0
10.0
100.0
1980
1990
2000
2010
Year
b) Observed vs fitted values
1:1 line
Observed values
0.5
1.0
2.0
5.0
20.0
50.0
200.0
Fitted values
c) Standardised residuals over time
Standardised Residuals
−3
−1
0
1
2
3
Year
d) Tukey−Anscombe plot
Standardised Residuals
Fitted values
e) Normal Q−Q plot
qqline
1:1 line
Standardised Residuals
−2
−1
0
1
2
Quantiles of the Normal Distribution
f) Autocorrelation of Residuals
95% Conf. Int.
ACF
−0.3
−0.1
0.1
0.3
5
10
15
Lag (yrs)

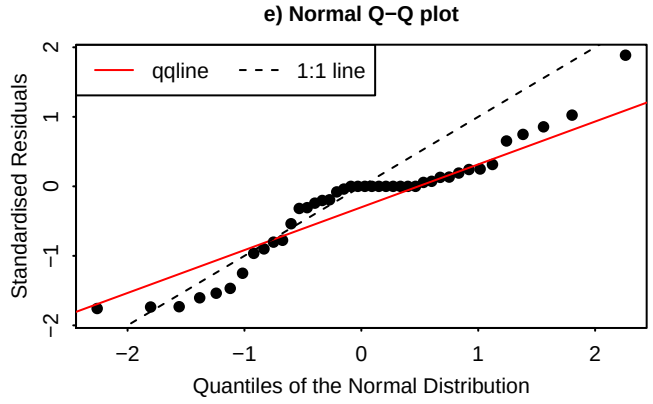
Turbot in IV pgSurvey 7 Diagnostics − catch, age 10

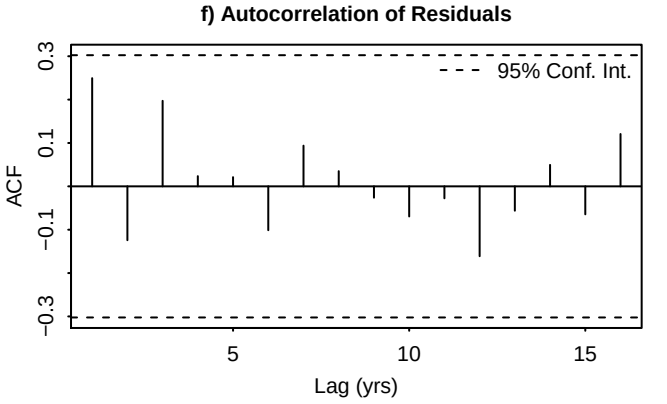


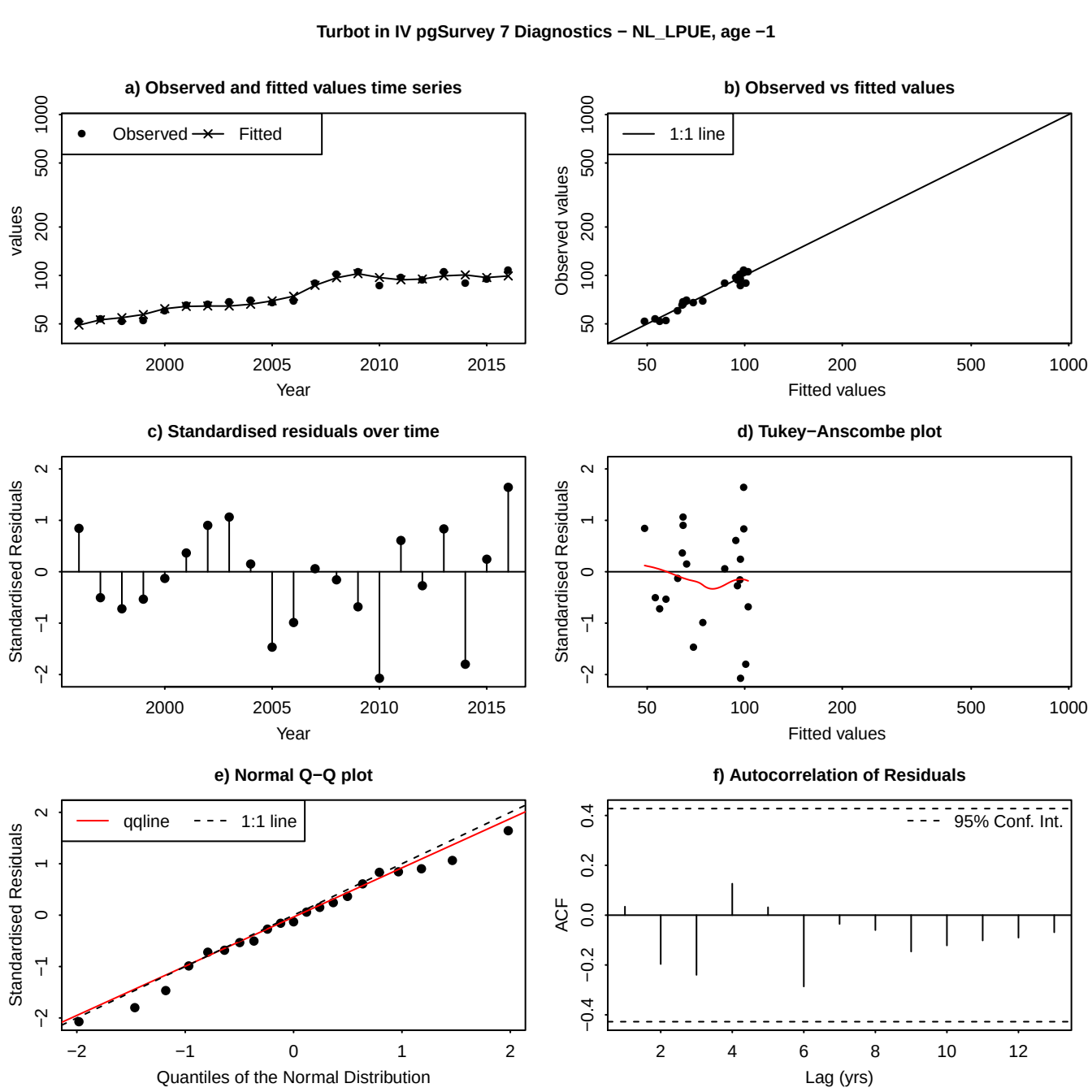


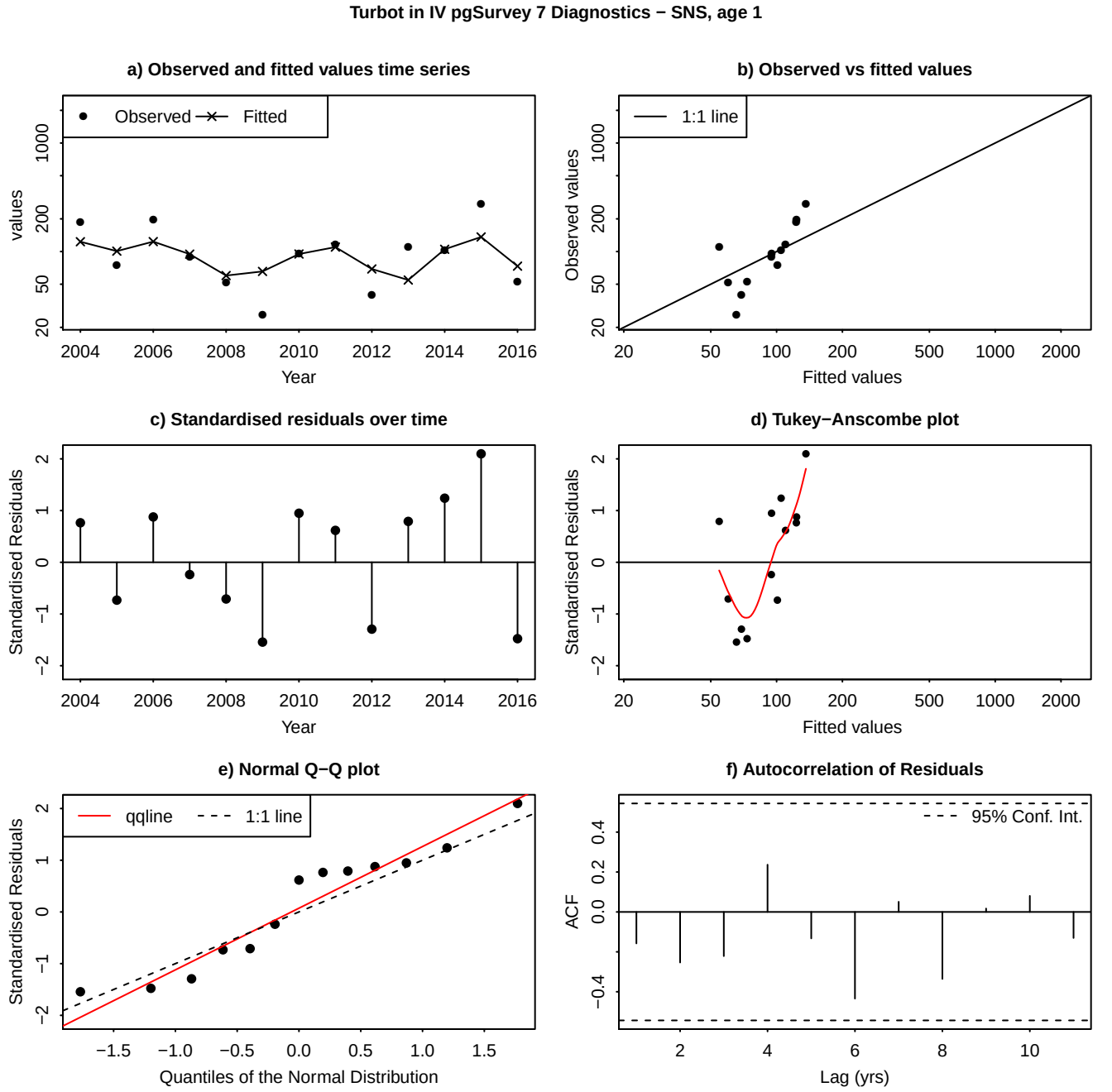


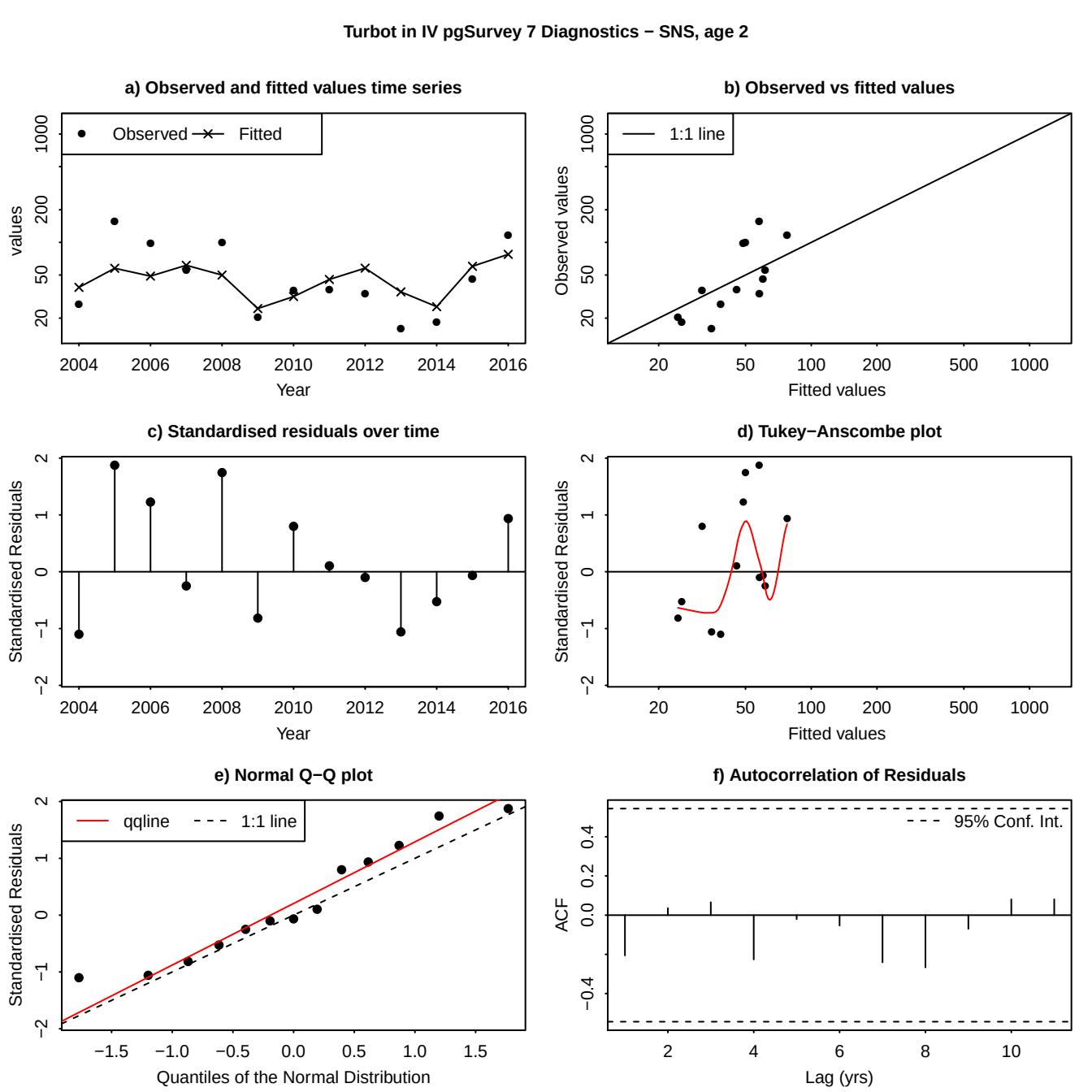


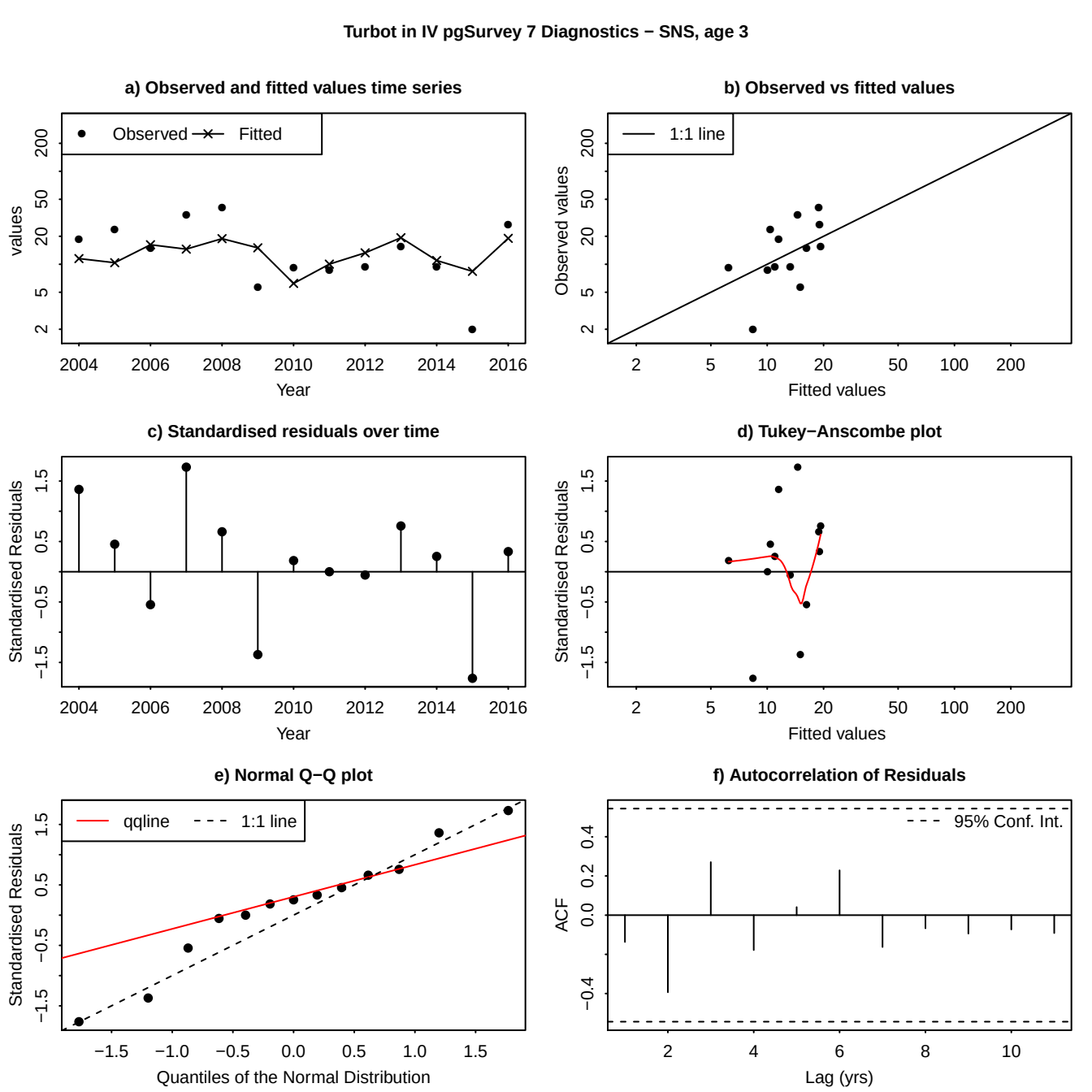


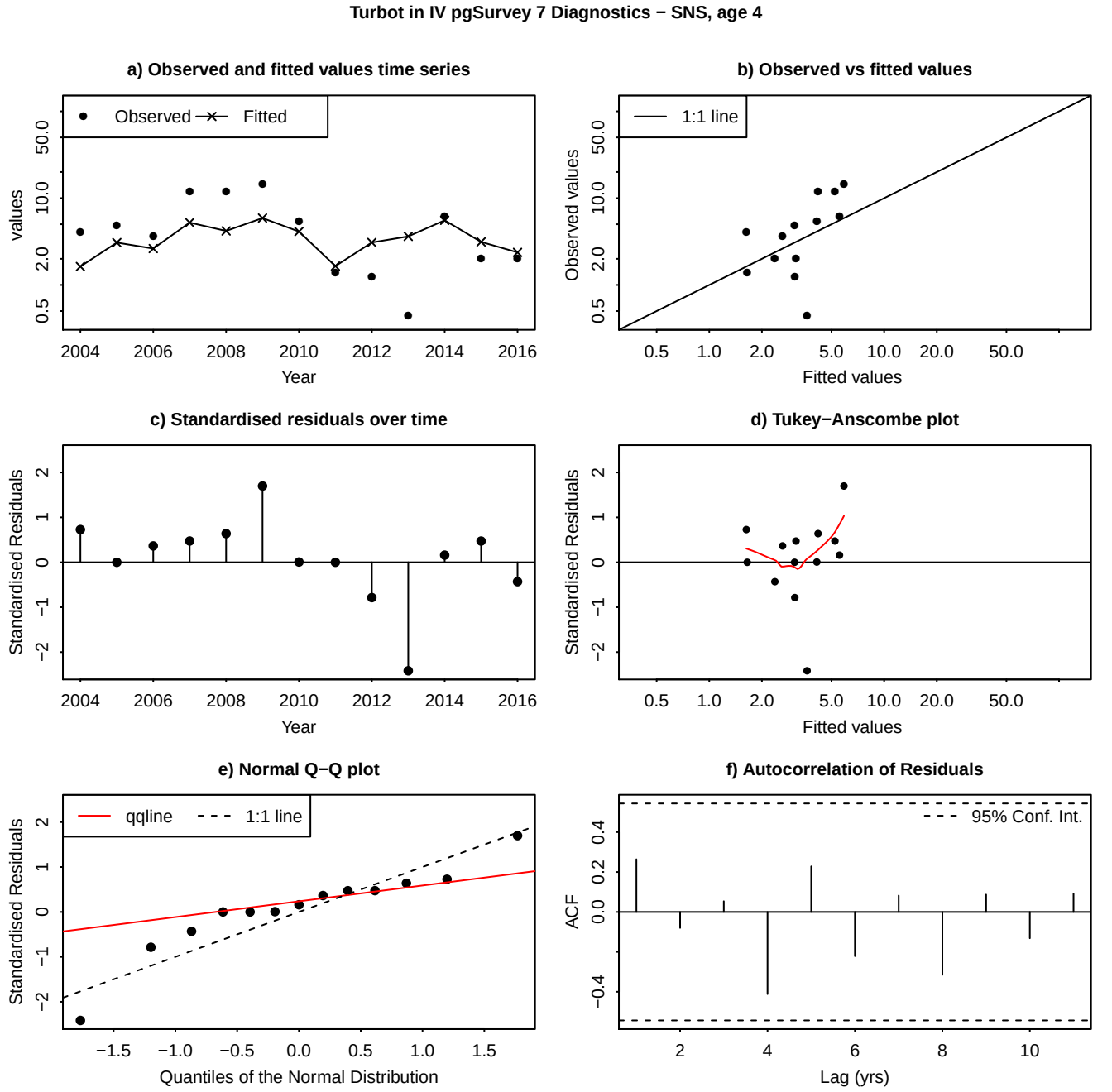



Turbot in IV pgSurvey 7 Diagnostics − NL_LPUE, age −1
a) Observed and fitted values time series
Observed
Fitted
values
Year
b) Observed vs fitted values
1:1 line
Observed values
Fitted values
c) Standardised residuals over time
Standardised Residuals
Year
d) Tukey−Anscombe plot
Standardised Residuals
Fitted values
e) Normal Q−Q plot
qqline
1:1 line
Standardised Residuals
Quantiles of the Normal Distribution
f) Autocorrelation of Residuals
95% Conf. Int.
ACF
Lag (yrs)

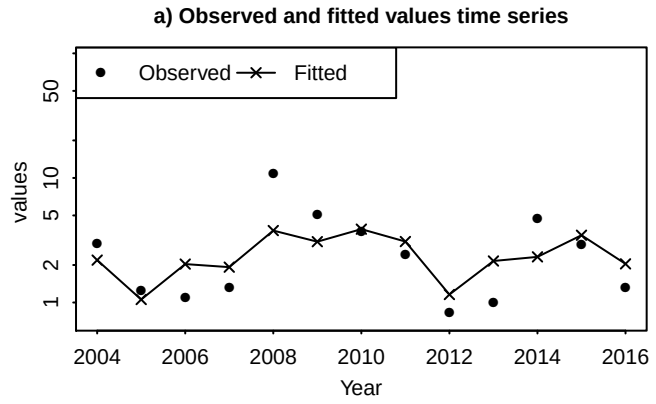

Turbot in IV pgSurvey 7 Diagnostics − SNS, age 1
a) Observed and fitted values time series
Observed
Fitted
values
Year
b) Observed vs fitted values
1:1 line
Observed values
Fitted values
c) Standardised residuals over time
Standardised Residuals
Year
d) Tukey−Anscombe plot
Standardised Residuals
Fitted values
e) Normal Q−Q plot
qqline
1:1 line
Standardised Residuals
Quantiles of the Normal Distribution
f) Autocorrelation of Residuals
95% Conf. Int.
ACF
Lag (yrs)

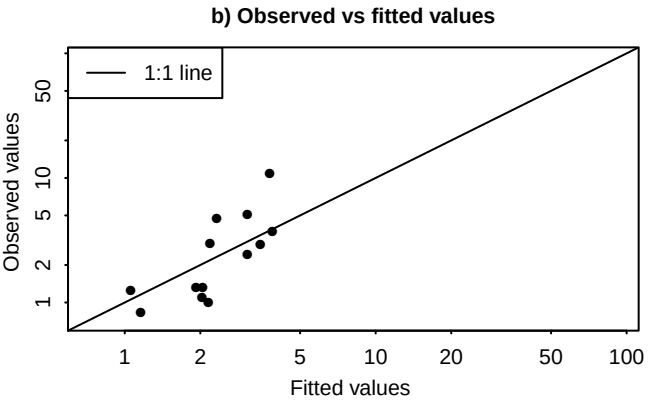

Turbot in IV pgSurvey 7 Diagnostics − SNS, age 2
a) Observed and fitted values time series
Observed
Fitted
values
1000
200
50
20
2004
2006
2008
2010
2012
2014
2016
Year
b) Observed vs fitted values
1:1 line
Observed values
Fitted values
20
50
100
200
500
1000
c) Standardised residuals over time
Standardised Residuals
2
1
0
−1
−2
Year
d) Tukey−Anscombe plot
e) Normal Q−Q plot
qqline
1:1 line
−1.5
−1.0
−0.5
0.0
0.5
1.0
1.5
Quantiles of the Normal Distribution
f) Autocorrelation of Residuals
95% Conf. Int.
ACF
0.4
0.2
0.0
−0.4
2
4
6
8
10
Lag (yrs)

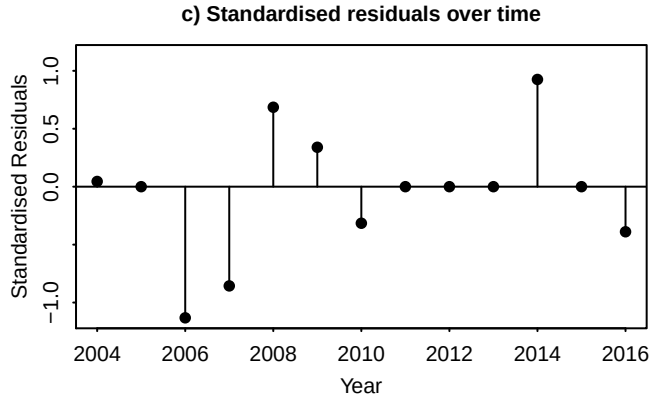

Turbot in IV pgSurvey 7 Diagnostics − SNS, age 3
a) Observed and fitted values time series
Observed
Fitted
values
2
5
20
50
200
2004
2006
2008
2010
2012
2014
2016
Year
b) Observed vs fitted values
1:1 line
Observed values
Fitted values
c) Standardised residuals over time
Standardised Residuals
−1.5
−0.5
0.5
1.5
Year
d) Tukey−Anscombe plot
e) Normal Q−Q plot
qqline
1:1 line
−1.5
−1.0
−0.5
0.0
0.5
1.0
1.5
Quantiles of the Normal Distribution
f) Autocorrelation of Residuals
95% Conf. Int.
ACF
−0.4
0.0
0.2
0.4
2
4
6
8
10
Lag (yrs)

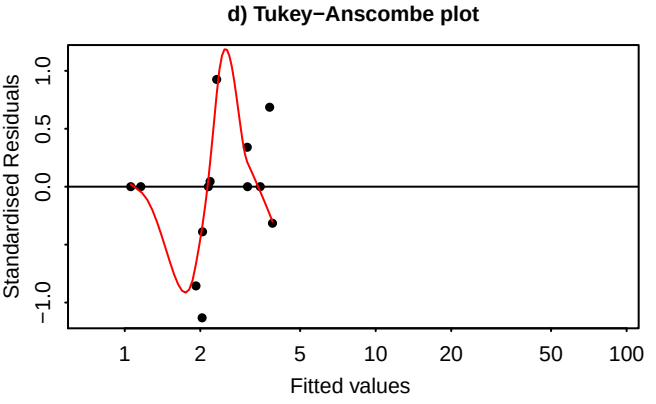

Turbot in IV pgSurvey 7 Diagnostics − SNS, age 4
a) Observed and fitted values time series
Observed
Fitted
values
0.5
2.0
10.0
50.0
2004
2006
2008
2010
2012
2014
2016
Year
b) Observed vs fitted values
1:1 line
Observed values
Fitted values
0.5
1.0
2.0
5.0
10.0
20.0
50.0
c) Standardised residuals over time
Standardised Residuals
−2
−1
0
1
2
Year
d) Tukey−Anscombe plot
e) Normal Q−Q plot
qqline
1:1 line
Quantiles of the Normal Distribution
−1.5
−1.0
−0.5
0.0
0.5
1.0
1.5
f) Autocorrelation of Residuals
95% Conf. Int.
ACF
−0.4
0.0
0.2
0.4
2
4
6
8
10
Lag (yrs)

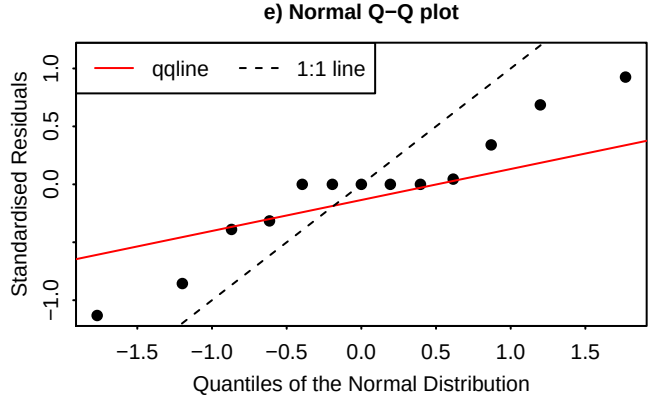
Turbot in IV pgSurvey 7 Diagnostics − SNS, age 5

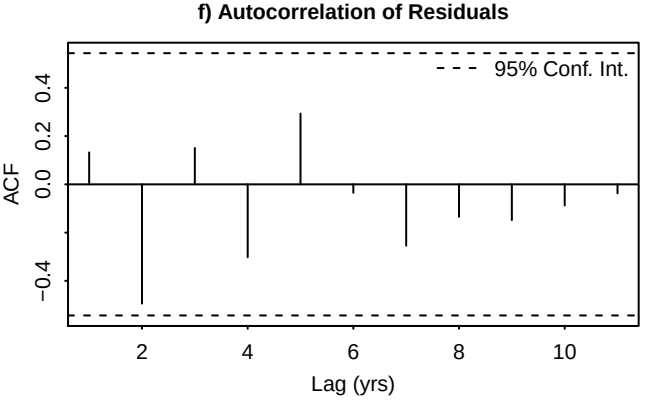


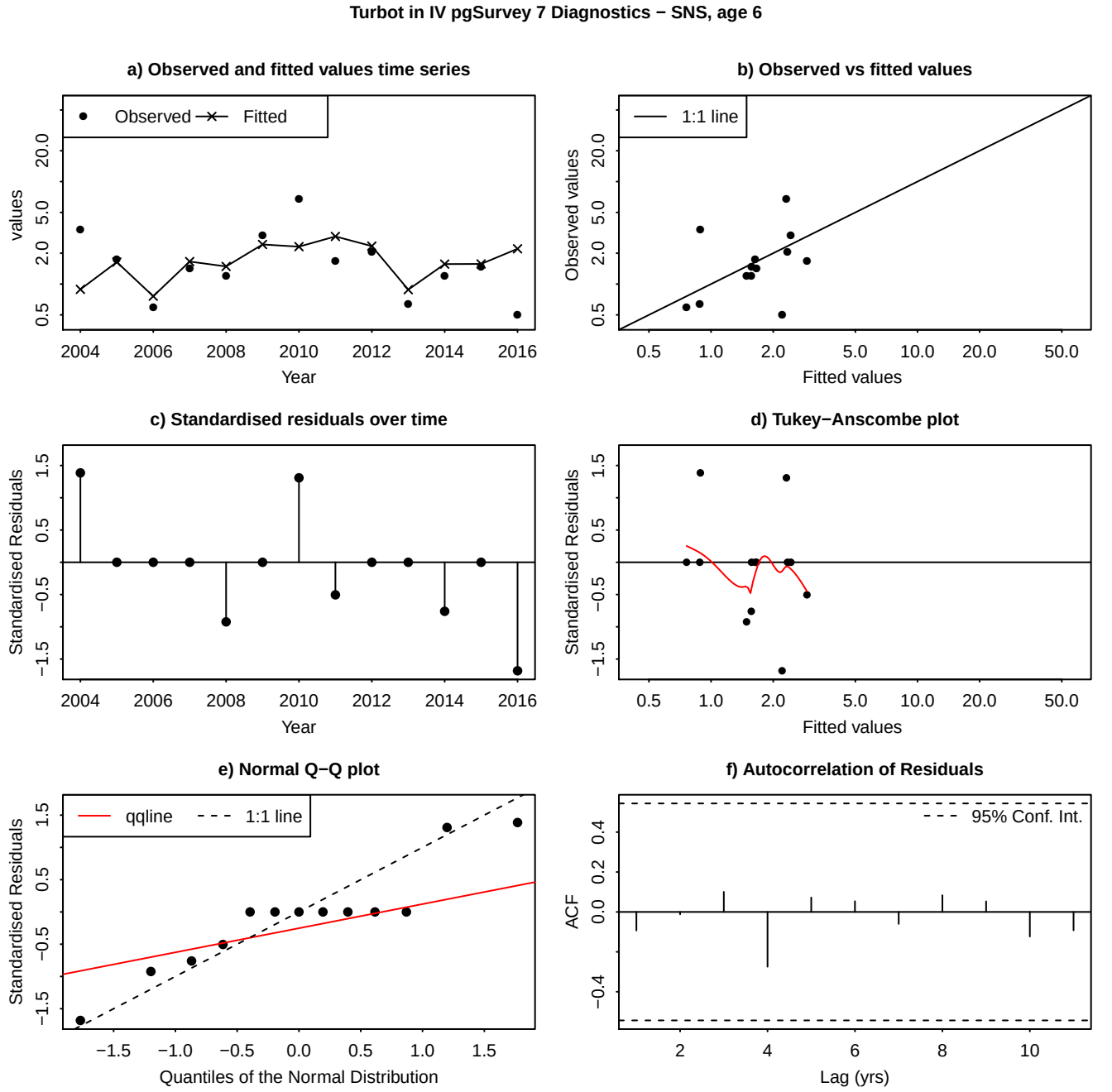




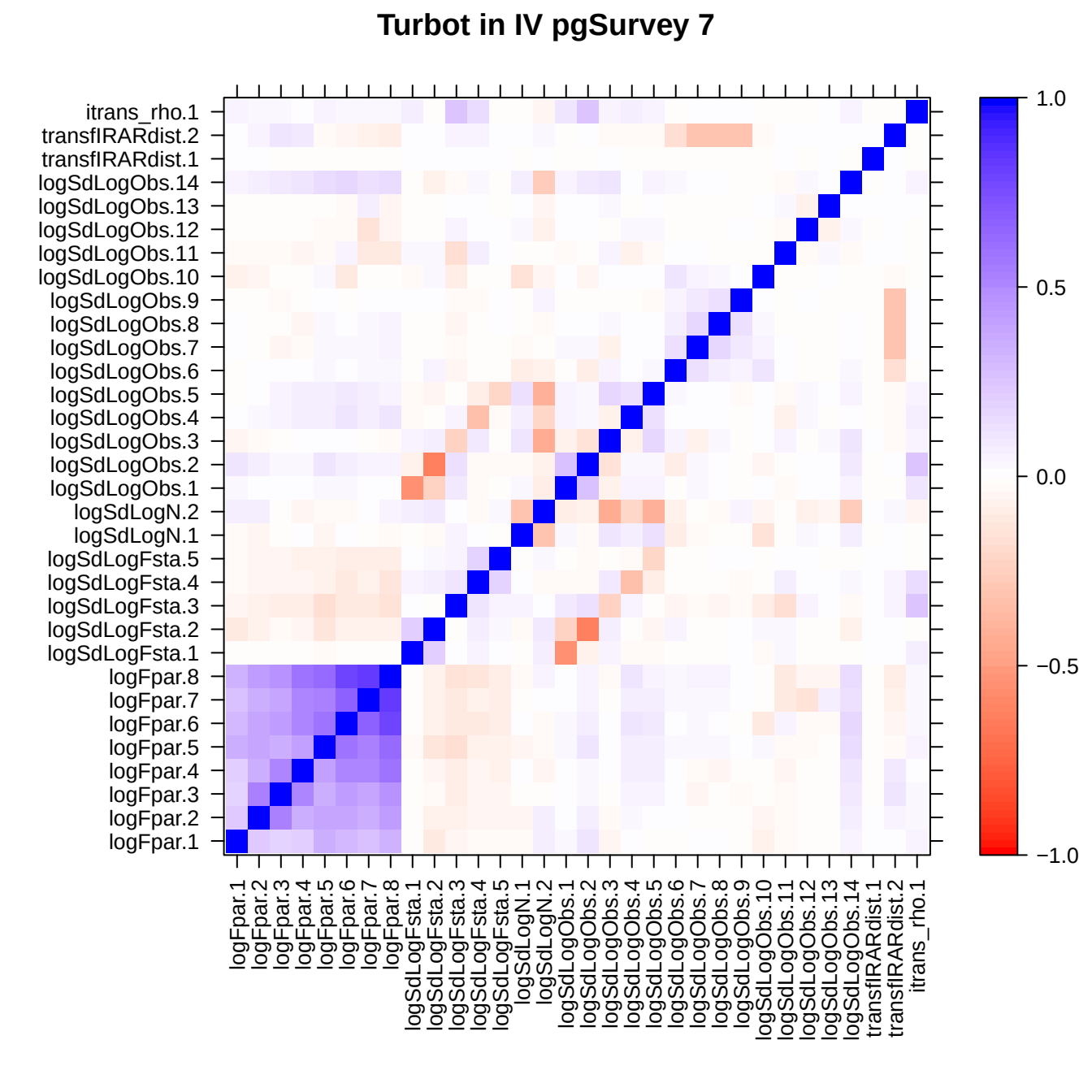


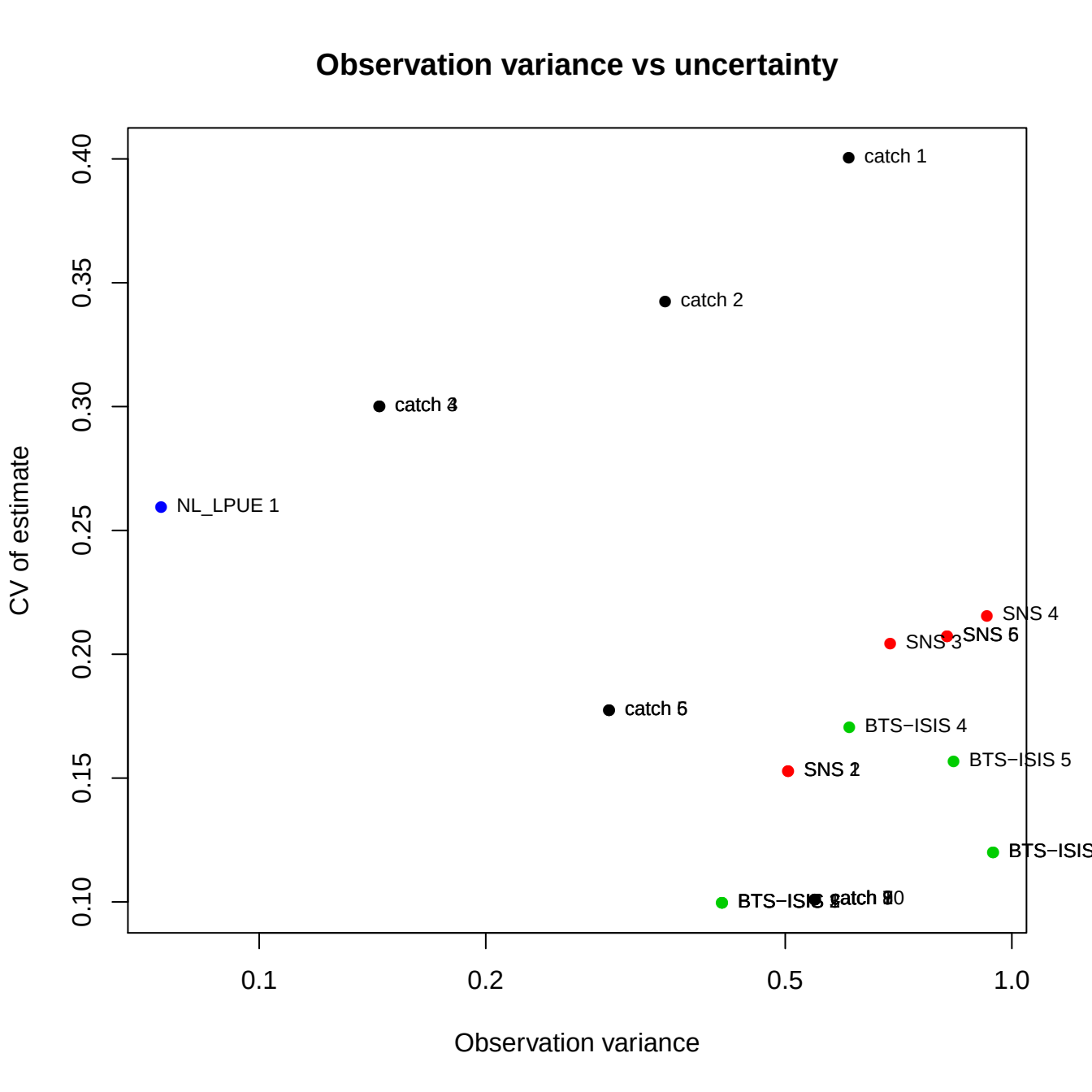


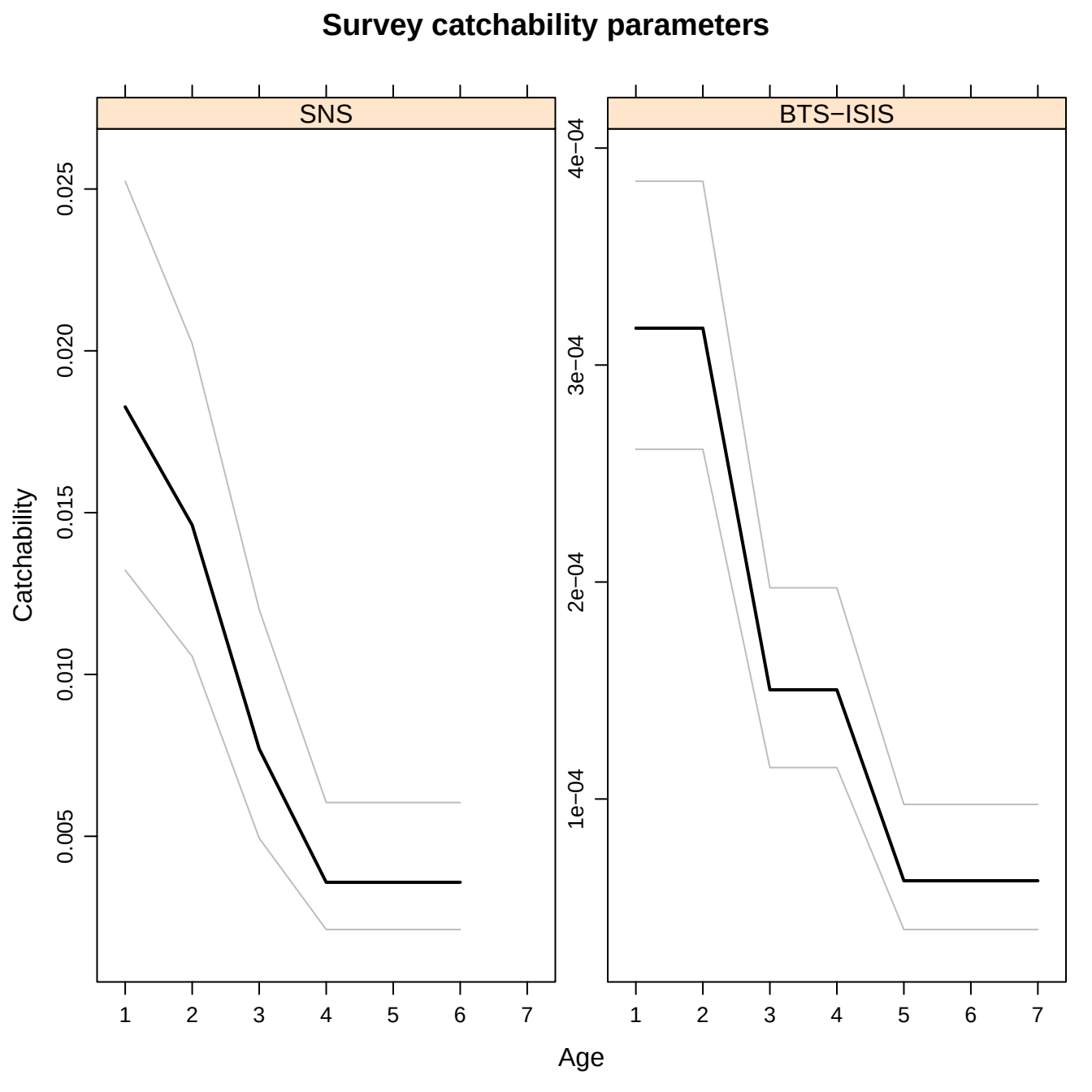


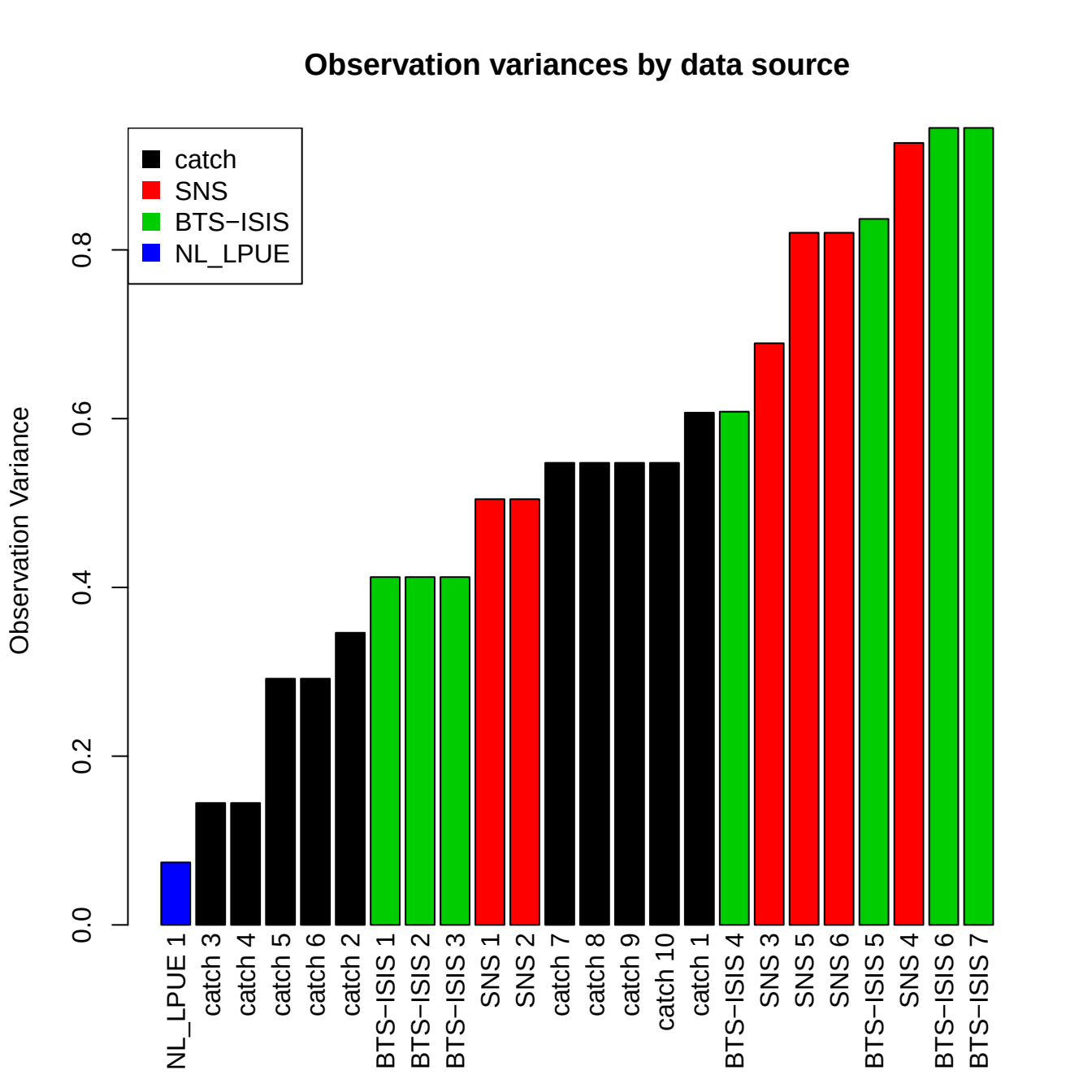


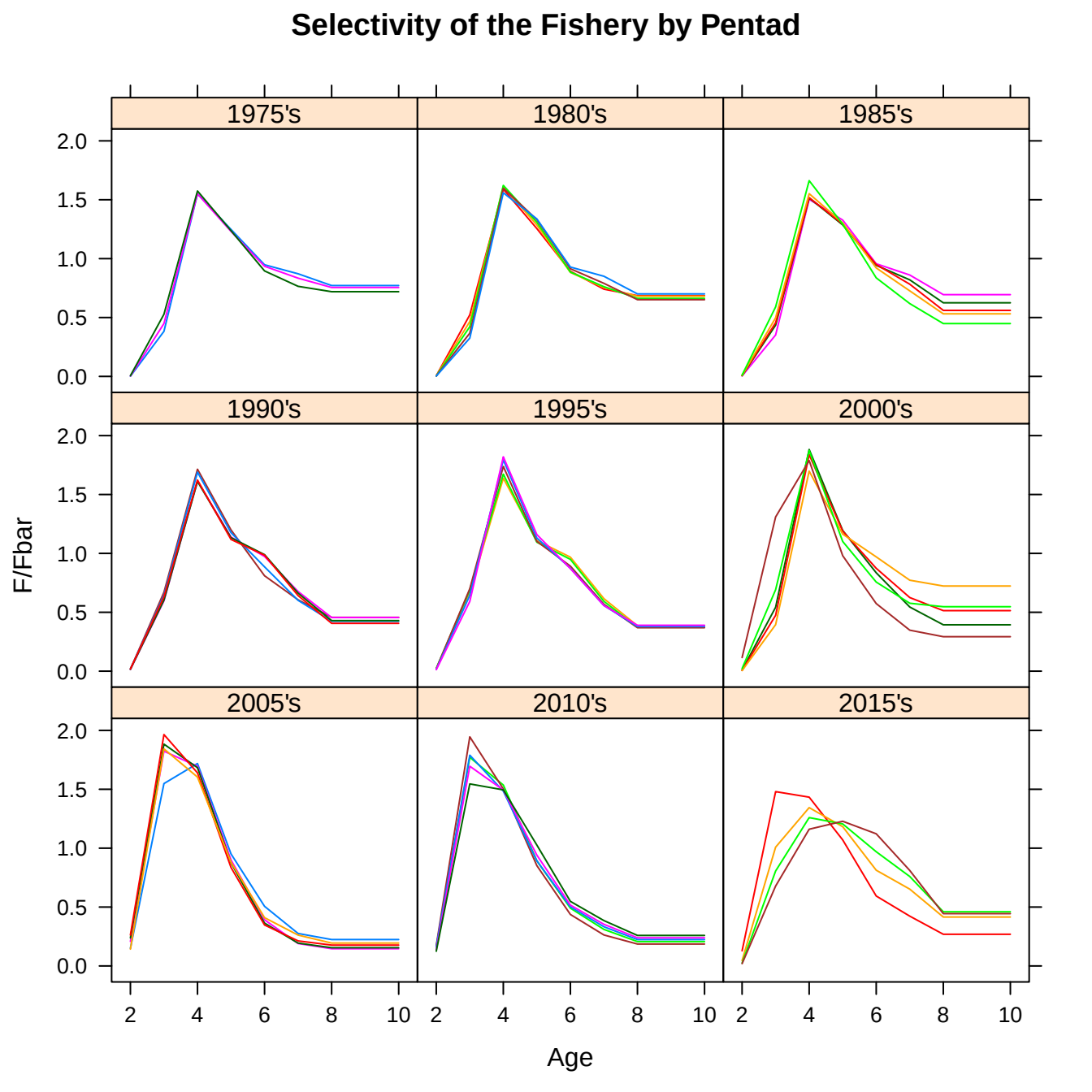
Turbot in IV pgSurvey 7 Diagnostics − SNS, age 6
a) Observed and fitted values time series
Observed
Fitted
values
Year
b) Observed vs fitted values
1:1 line
Observed values
Fitted values
c) Standardised residuals over time
Standardised Residuals
Year
d) Tukey−Anscombe plot
Standardised Residuals
Fitted values
e) Normal Q−Q plot
qqline
1:1 line
Standardised Residuals
Quantiles of the Normal Distribution
f) Autocorrelation of Residuals
95% Conf. Int.
ACF
Lag (yrs)

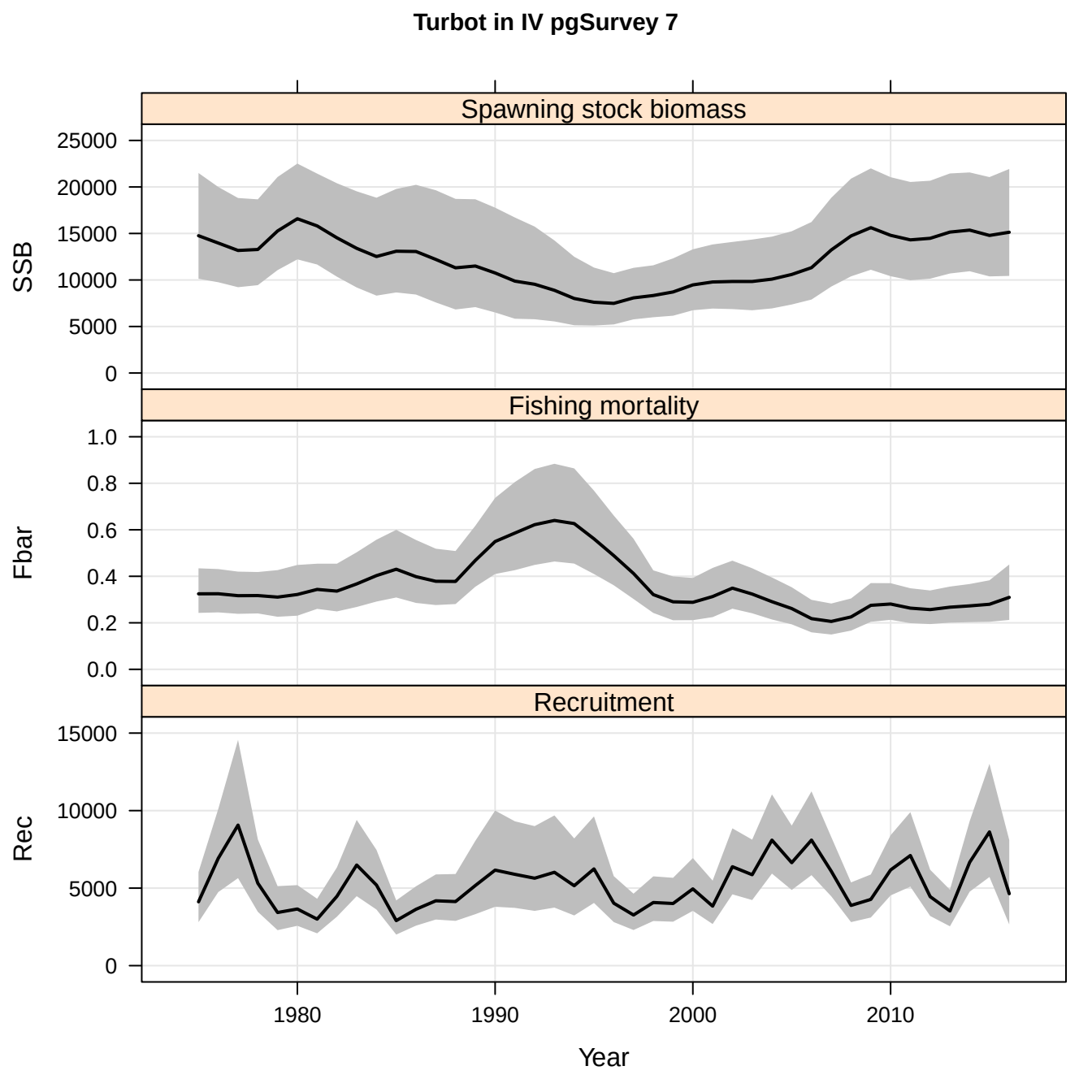

Turbot in IV pgSurvey 7
itrans_rho.1
transfIRARdist.2
transfIRARdist.1
logSdLogObs.14
logSdLogObs.13
logSdLogObs.12
logSdLogObs.11
logSdLogObs.10
logSdLogObs.9
logSdLogObs.8
logSdLogObs.7
logSdLogObs.6
logSdLogObs.5
logSdLogObs.4
logSdLogObs.3
logSdLogObs.2
logSdLogObs.1
logSdLogN.2
logSdLogN.1
logSdLogFsta.5
logSdLogFsta.4
logSdLogFsta.3
logSdLogFsta.2
logSdLogFsta.1
logFpar.8
logFpar.7
logFpar.6
logFpar.5
logFpar.4
logFpar.3
logFpar.2
logFpar.1
logFpar.1
logFpar.2
logFpar.3
logFpar.4
logFpar.5
logFpar.6
logFpar.7
logFpar.8
logSdLogFsta.1
logSdLogFsta.2
logSdLogFsta.3
logSdLogFsta.4
logSdLogFsta.5
logSdLogN.1
logSdLogN.2
logSdLogObs.1
logSdLogObs.2
logSdLogObs.3
logSdLogObs.4
logSdLogObs.5
logSdLogObs.6
logSdLogObs.7
logSdLogObs.8
logSdLogObs.9
logSdLogObs.10
logSdLogObs.11
logSdLogObs.12
logSdLogObs.13
logSdLogObs.14
transfIRARdist.1
transfIRARdist.2
itrans_rho.1
1.0
0.5
0.0
−0.5
−1.0

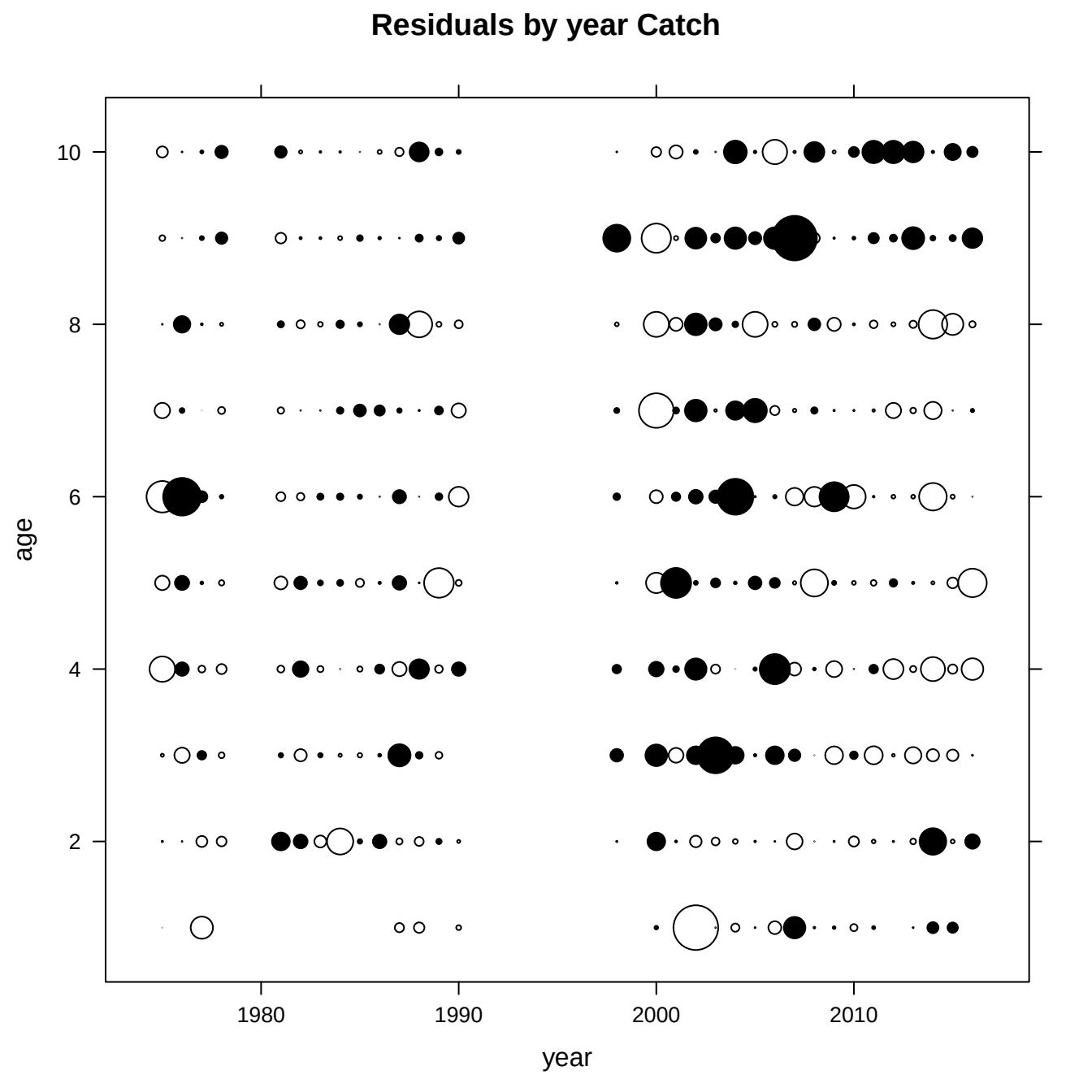

Observation variance vs uncertainty
CV of estimate
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.1
0.2
0.5
1.0
Observation variance
catch 1
catch 2
NL_LPUE 1
SNS 4
SNS 3
BTS−ISIS 4
BTS−ISIS 5

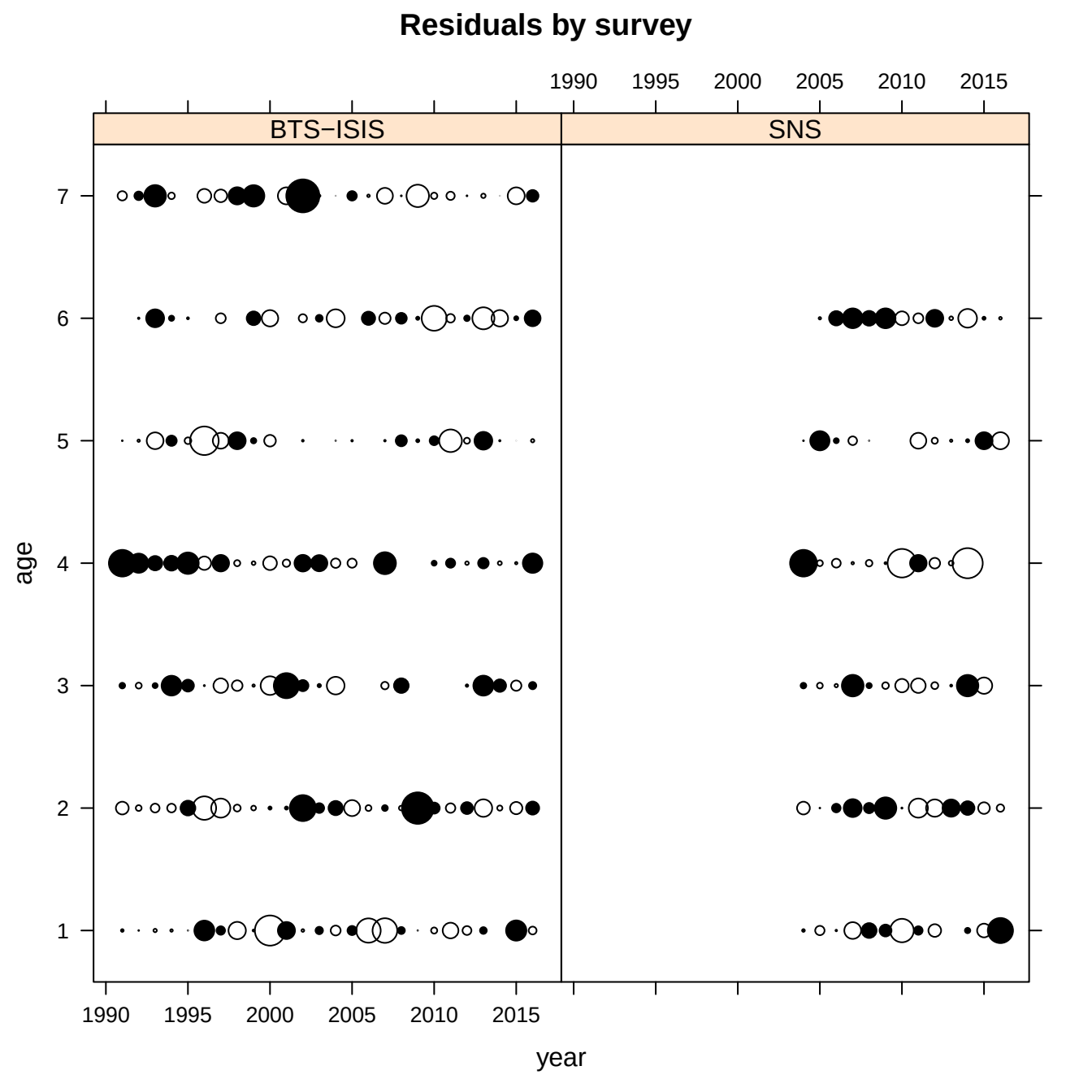

Survey catchability parameters
SNS
BTS−ISIS
Catchability
0.005
0.010
0.015
0.020
0.025
1e−04
2e−04
3e−04
4e−04
1
2
3
4
5
6
7
Age


Observation variances by data source
Observation Variance
0.0
0.2
0.4
0.6
0.8
catch
SNS
BTS−ISIS
NL_LPUE
NL_LPUE 1
catch 3
catch 4
catch 5
catch 6
catch 2
BTS−ISIS 1
BTS−ISIS 2
BTS−ISIS 3
SNS 1
SNS 2
catch 7
catch 8
catch 9
catch 10
catch 1
BTS−ISIS 4
SNS 3
SNS 5
SNS 6
BTS−ISIS 5
SNS 4
BTS−ISIS 6
BTS−ISIS 7

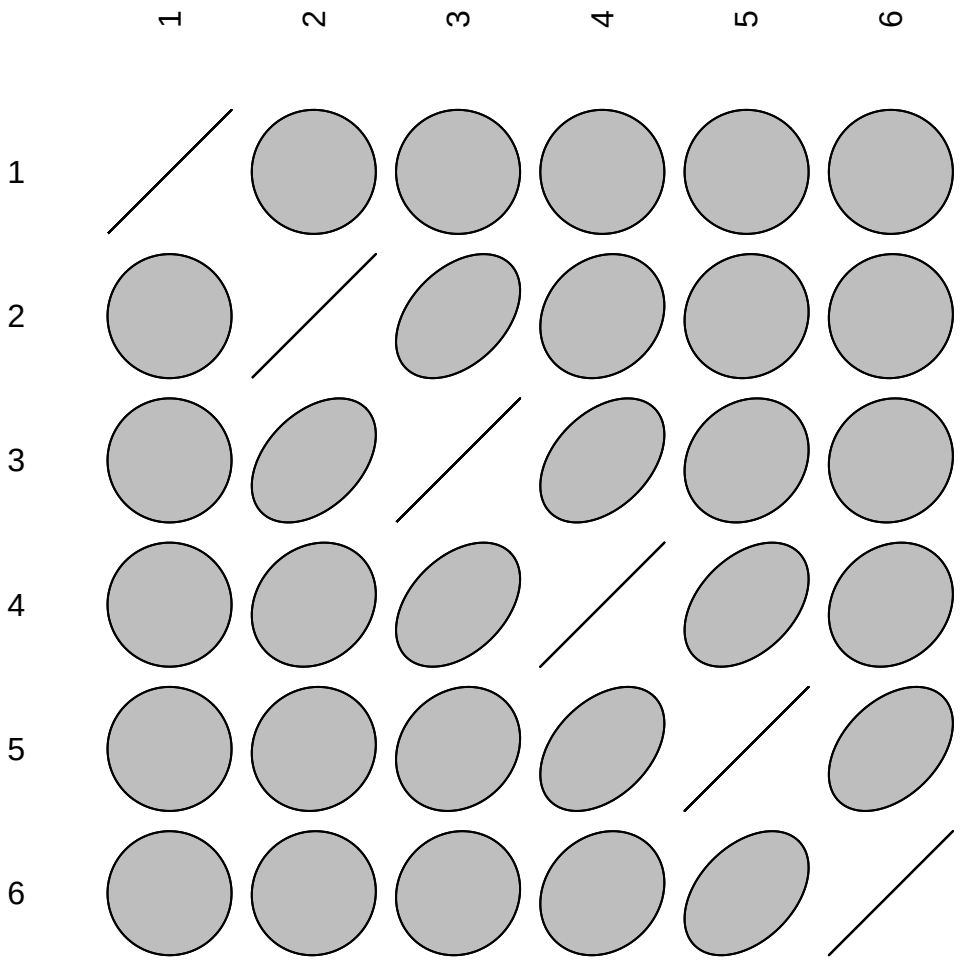

Selectivity of the Fishery by Pentad
1975's
1980's
1985's
1990's
1995's
2000's
2005's
2010's
2015's
F/Fbar
Age
0.0
0.5
1.0
1.5
2.0
2
4
6
8
10

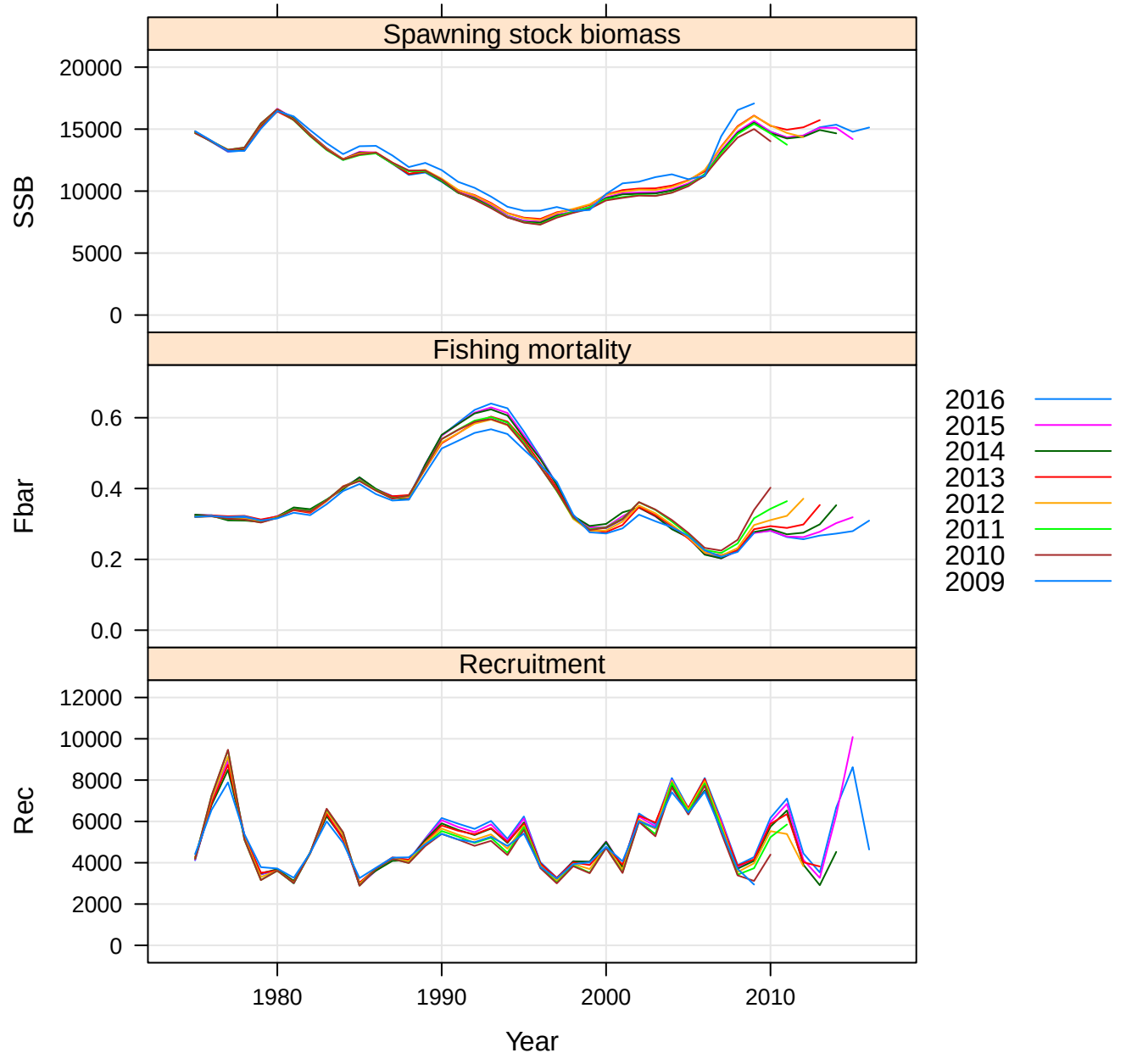

Turbot in IV pgSurvey 7
Spawning stock biomass
SSB
25000
20000
15000
10000
5000
0
Fishing mortality
Fbar
1.0
0.8
0.6
0.4
0.2
0.0
Recruitment
Rec
15000
10000
5000
0
1980
1990
2000
2010
Year

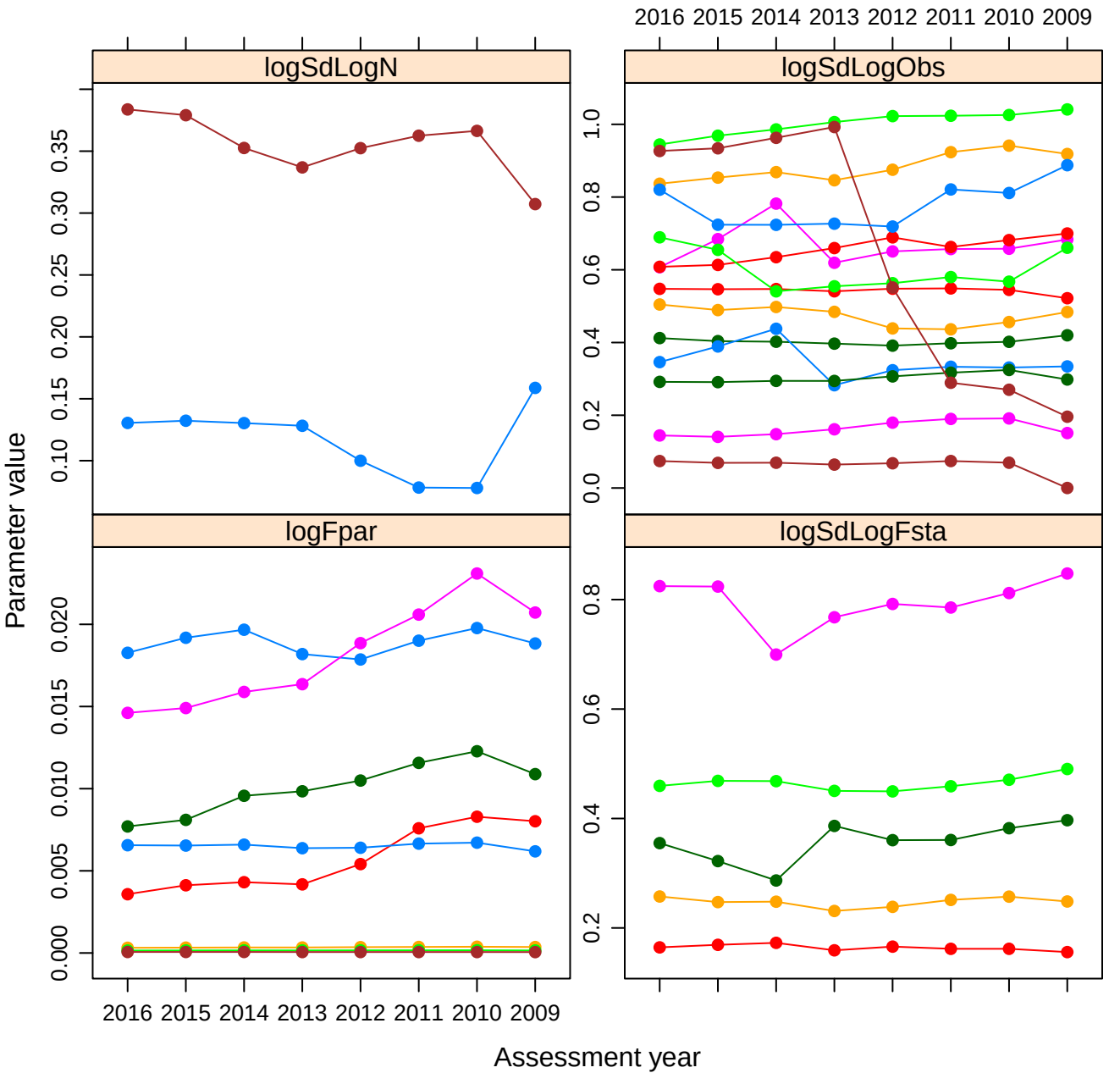

Residuals by year Catch
age
10
8
6
4
2
1980
1990
2000
2010
year

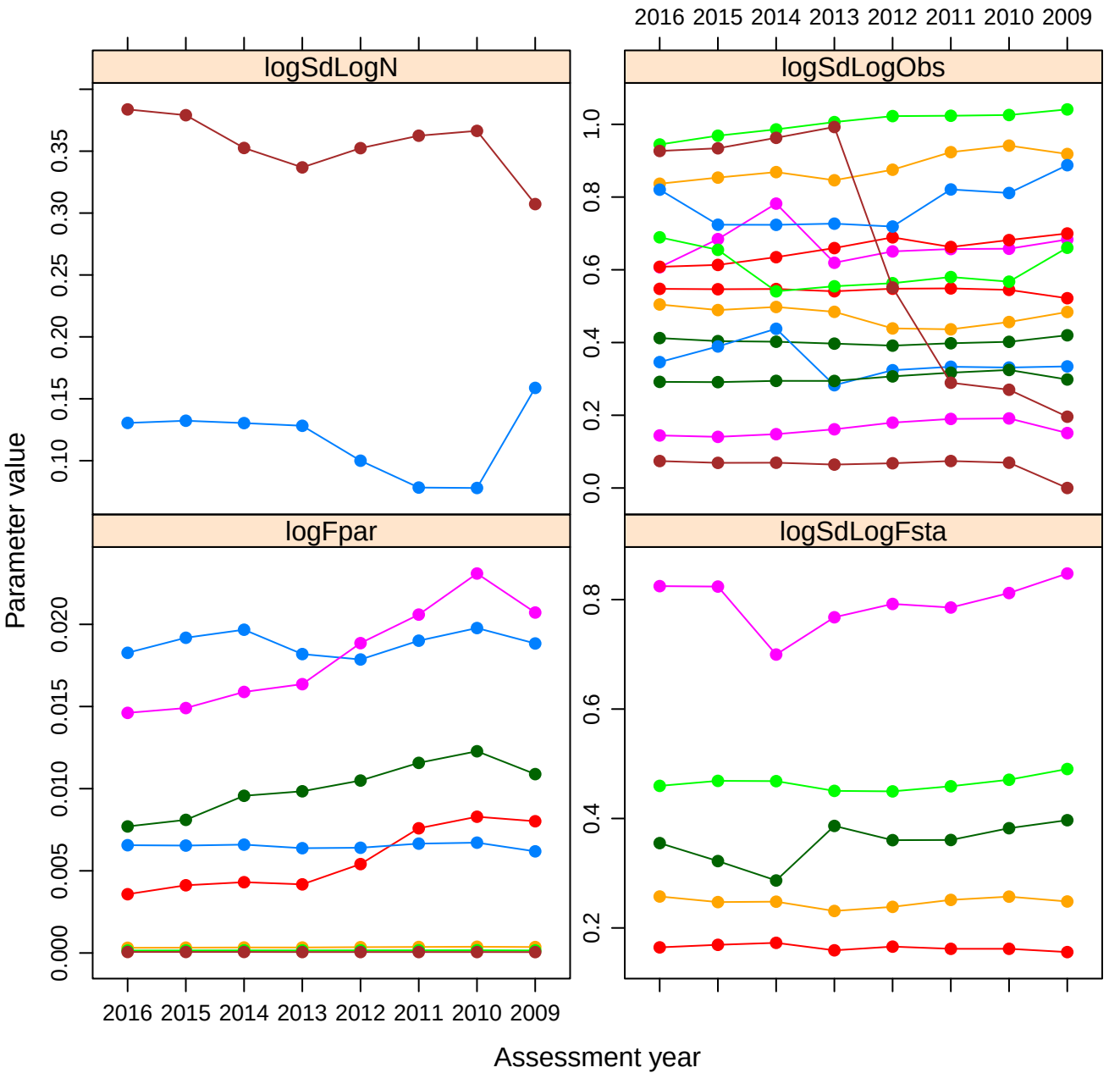

Residuals by survey
BTS−ISIS
SNS
1990
1995
2000
2005
2010
2015
7
6
5
4
3
2
1
age
year

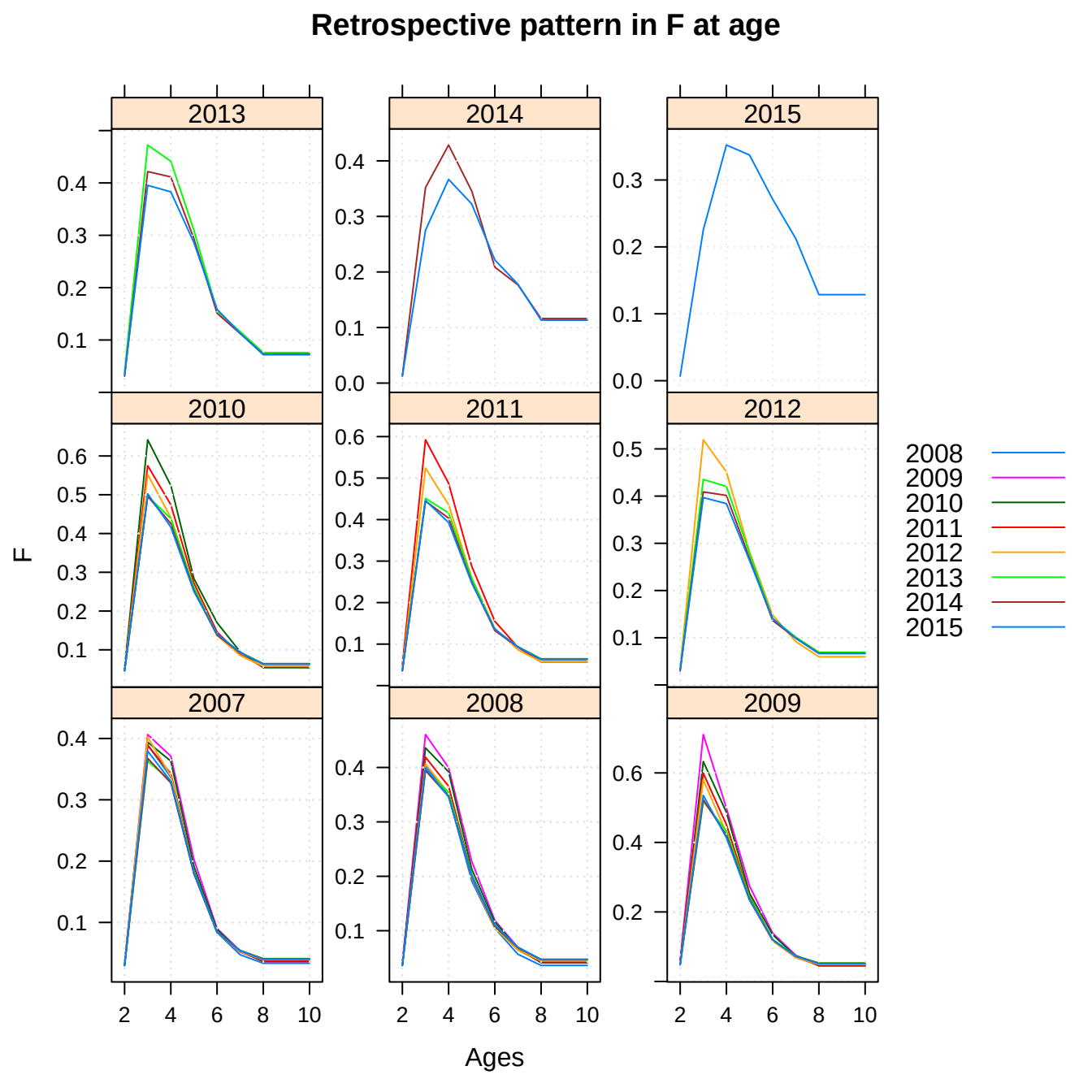
SNS

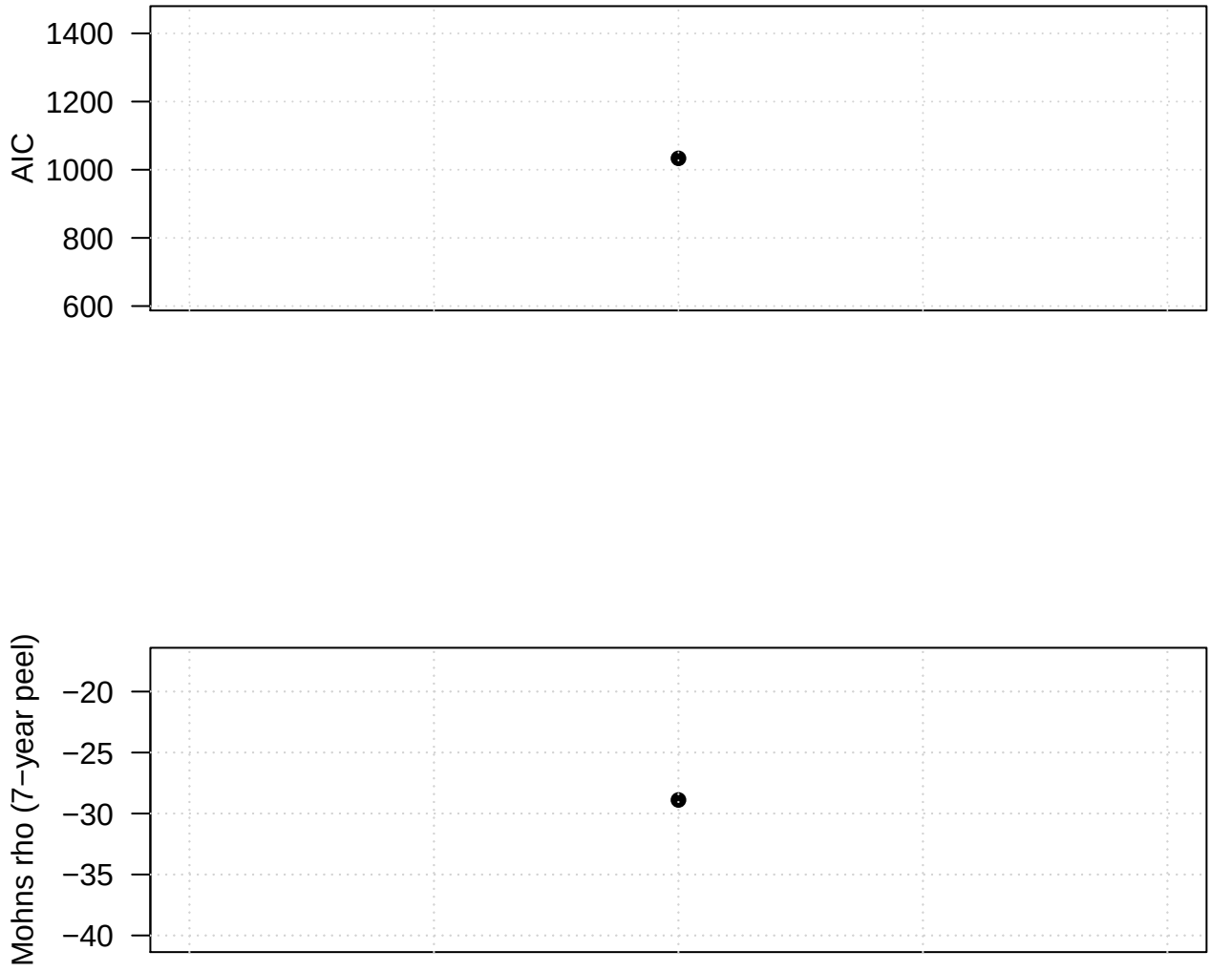



Spawning stock biomass
SSB
20000
15000
10000
5000
0
Fishing mortality
Fbar
0.6
0.4
0.2
0.0
Recruitment
Rec
12000
10000
8000
6000
4000
2000
0
1980
1990
2000
2010
Year
2016
2015
2014
2013
2012
2011
2010
2009


logSdLogN
logSdLogObs
logFpar
logSdLogFsta
Parameter value
Assessment year
2016 2015 2014 2013 2012 2011 2010 2009
0.10 0.15 0.20 0.25 0.30 0.35
0.0 0.2 0.4 0.6 0.8 1.0
0.000 0.005 0.010 0.015 0.020
0.2 0.4 0.6 0.8


logSdLogN
logSdLogObs
logFpar
logSdLogFsta
Parameter value
Assessment year
2016 2015 2014 2013 2012 2011 2010 2009
0.10 0.15 0.20 0.25 0.30 0.35
0.0 0.2 0.4 0.6 0.8 1.0
0.000 0.005 0.010 0.015 0.020
0.2 0.4 0.6 0.8


Retrospective pattern in F at age
2013
2014
2015
2010
2011
2012
2007
2008
2009
F
Ages
2008
2009
2010
2011
2012
2013
2014
2015


AIC
1400
1200
1000
800
600
Mohns rho (7−year peel)
−20
−25
−30
−35
−40