Appendix D:

Klamath River Model Scenarios Summary

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Modeling Scenarios

Klamath River Model for TMDL Development

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Prepared for:
U.S. Environmental Protection Agency Region 9
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Introduction

The approach, calibration results, and corroboration results for the Klamath River Model for TMDL development are described in “Model Configuration and Results - Klamath River Model for TMDL Development” (Tetra Tech, Inc., 2009). After the Klamath River Model was fully tested, it was applied to evaluate a series of scenarios to support TMDL development. This document summarizes how each scenario was configured, associated assumptions, and results. The simulated scenarios include:

- Natural conditions baseline scenario (T1BSR)
- Oregon allocation scenario (TOD2RN)
- California allocation scenario (TCD2RN)
- With-dams TMDL scenario (T4BSRN)

Natural Conditions Baseline Scenario (T1BSR)

The natural conditions baseline scenario (T1BSR) was run in order to estimate water quality conditions under natural conditions, because some water quality standards for both Oregon Department of Environmental Quality (ODEQ) and California North Coast Regional Water Quality Control Board (RWQCB) are based on natural conditions. T1BSR involved running a version of the Klamath River Model that includes no dams, with the exception of Link Dam at the upper boundary to the model. The Lake Ewauna portion of the system was modeled using CE-QUAL-W2 due to the historical presence of the Keno Reef. The portion of the system from Turwar to the Pacific Ocean was modeled using EFDC due to the tidal influence. And, the remainder of the river was modeled using RMA-2 and RMA-11. Table 1 presents the models applied for this scenario.

Table 1. Model components applied to each Klamath River segment

Modeling segment	Segment type	Model(s)	Dimensions
Link River	River	RMA-2/RMA-11	1-D
Lake Ewauna-Keno Reef	Reservoir	CE-QUAL-W2	2-D
Keno Reef to Turwar	River	RMA-2/RMA-11	1-D
Turwar to Pacific Ocean	Estuary	EFDC	3-D

The overall approach to T1BSR included setting boundary conditions at Upper Klamath Lake (UKL) based on the existing UKL Drainage TMDLs (ODEQ, 2002), removing point source inputs, keeping Lost River and Klamath Straits Drain flows but with water quality and temperature the same as at UKL, and assigning natural or TMDL conditions for tributaries (which vary by tributary). UKL flow was set to be the same as the calibrated Klamath River Model (Tetra Tech, Inc. 2009), but the water quality and temperature were based on 1995 UKL TMDL model conditions. 1995 represents the median condition occurring in UKL (based on implementation of the UKL TMDL). The boundary condition for pH analysis was set based on the alkalinity (ALK) in the Klamath River Model and the pH under the TMDL condition. The scenario was performed for the year 2000.

Assumptions and Configuration

The following list presents key assumptions associated with configuration of the T1BSR scenario:

- The phosphorus TMDL for UKL was used to configure the upstream boundary conditions for the Klamath River Model. The UKL Model output provided monthly average phosphorus values – total phosphorus (TP), algal P and non-algal P, as well as chlorophyll-a. The UKL model and Klamath River model use different ratios of chlorophyll-a to algal biomass. For the translation between the two models, algal biomass was conserved but not necessarily chlorophyll-a concentrations. Although the UKL TMDL was developed based on only TP, it is assumed that phosphorus reductions would also produce reductions in nitrogen (N) and carbon (C), because C, N, and P are tightly bound together as organic matter. Any management practice that reduces organic P is also expected to reduce organic C and N. Based on this assumption, the boundary conditions for Link River were derived as follows:
    - Average ratios for TN:TP, soluble reactive phosphorus (SRP):TP, nitrate-nitrite (NO3/2)-N:TN and ammonia (NH3)-N:TN were calculated based on Pelican Marina, UKL monitoring data, and were 11.895, 0.245, 0.027, and 0.253, respectively (with a sample size of 15).
    - Based on the non-algal P TMDL results and the above TN:TP ratio, non-algal TN was derived.
    - Based on the SRP:TP ratio, orthophosphorus (PO4) and Organic P concentrations were calculated using the non-algal P data.
    - Based on Organic P concentrations, the Organic Matter boundary conditions were calculated using a ratio of OM:OP=180.
    - Based on the NO3/2-N:TN ratio, the NO2/NO3 boundary conditions were derived.
    - Based on the ammonium (NH4):TN ratio, the NH4 boundary condition was derived.
    - The algae biomass was calculated from the UKL model algal P results. An algae-to-Algae P ratio of 180 was determined in the model calibration and is used here to derive the algae biomass.
    - Based on the temperature, saturated DO concentration was calculated and used as the boundary condition.
    - Under TMDL conditions, it was assumed that the majority of OM would likely exist as dissolved phase, therefore, the OM was partitioned such that 90% is dissolved and 10% is particulate (typical reported ratio for lakes as reported in Thurman 1985).
- All the point sources and derived accretion/depletion flows for flow balance in the existing model were removed. Over the course of the year, the accretion/depletion flows average to near zero, so they likely do not represent an ungaged groundwater input. On shorter time scales, the accretion flows can be significant enough to alter the instream concentrations depending on assumptions about their concentrations. Out of concern that the accretion flows might influence allocations to point and discrete nonpoint sources, they were removed in the scenarios.
- The downstream boundary condition was configured to represent the Keno Reef based on the rating curve information provided by the U.S. Bureau of Reclamation – Klamath Basin Area Office (USBR). The rating curve was derived by the USBR hydrologist using historical data:

  $$Q=101.265(H-1244.5)^2-15.030(H-1244.5)+12.35$$

  where Q is the flow rate over the Keno Reef (cms); H is the water surface elevation (m); and 1244.5 m is the Keno Reef datum.
- The flows from Lost River Diversion Channel (LRDC) and KSD were kept the same as in the Klamath River Model, while the water quality and temperature condition were set to be the same as at UKL. LRDC and KSD flows were kept the same as in the Klamath River Model to make it possible to evaluate dam impacts directly (i.e., by representing a similar flow condition between the with-dam and without-dam conditions).

- Other Oregon tributaries and accretions/depletions between Keno Dam and Iron Gate Dam were kept the same as in PacifiCorp's Without Project Facilities Model (PacifiCorp, 2005). The accretion/depletion (A/D) flows included in the model between Keno Dam and Iron Gate Dam were the A/D flow at Keno River, the three springs downstream of J.C. Boyle Reservoir, the A/D flow at the Peaking Reach, and the Jenny Creek A/D flow. For all these A/D flows except for the three springs, the water quality concentrations and temperatures were set equal to the mainstem concentrations. The concentrations of the three springs were not changed from the calibration. The flows were configured as time series in the hydrodynamic model input data file. Jenny Creek flow was updated from the PacifiCorp model using estimated natural A/D flow in the area.
- pH simulation was implemented by running the pH simulation module in the updated RMA-11 model.
- Below Iron Gate Dam, the boundary conditions for flow, temperature and nutrients were specified as shown in Table 2 and subsequently discussed.

Table 2. T1BSR Boundary Conditions for Flow, Temperature and Nutrients below Iron Gate

Stream(s)	Temperature	Flow	Nutrients
Trinity	0.5 deg C reduction from current conditions model depiction[1], June 1 to Oct 15, see Appendix A	2000 gauge records, see below	Unchanged from current conditions model depiction
Salmon	Unchanged from current conditions model depiction	Unchanged from current conditions model depiction	Unchanged from current conditions model depiction, see Appendix A
Scott	RWQCB estimation of natural temperature, see Appendix A	RWQCB estimation of natural flow, Appendix A	Unchanged from current conditions model depiction
Shasta	RWQCB estimation of natural temperature, see Appendix A	RWQCB estimation of natural flow, Appendix A	Calculated OM and NH4 based on nitrogenous biochemical oxygen demand (NBOD) TMDL; PO4 was based on NH4 data, and it resulted in a level lower than current conditions
Minor Tributaries	2.0 deg C reduction from Flints'[2] 2002 data, June 1 - Oct. 15	Unchanged from current conditions model depiction	Unchanged from current conditions model depiction

- For the Shasta River, nutrient concentrations were calculated based on TMDL results for NBOD from the 2002 Shasta River TMDL model. Since the RMA model requires OM, the NBOD was converted to OM based on stoichiometric ratios. The conversions used to extrapolate the OM from the NBOD are as follows:
    - Total Kjeldahl Nitrogen (TKN)/ON = 1.13; using existing data for Shasta (stations used SH00 - Shasta River at Mouth and SHUS - Shasta River at USGS Gage)

[1] The current conditions model depiction is the model calibration run for the year 2000, as reported in "Model Configuration and Results - Klamath River Model for TMDL Development" (Tetra Tech, Inc. 2009).
[2] Flint, L.E. and Flint, A.L., 2008

  - NBOD = 4.57 (TKN) (Chapra, 1997)
  - Convert NBOD to TKN
  - TKN=NBOD/4.57
  - Convert TKN to ON
  - ON = TKN/1.13
  - Convert ON to OM
  - OM = ON/0.07 (Cole and Wells, 2003)
  - Derive NH4 using
  - NH4=TKN-ON
  - PO4=3.22(NH4); based on existing data
  - NO3=1.333(NH4); based on existing data
- Sediment Oxygen Demand (SOD) for the section between Keno Dam and Turwar was set equal to that in the calibration model, which ranges from 1.0 to 1.5 gram O^2/m^2/day. For the reach from Link Dam to Keno Dam, the SOD was set based on the monitored value in Shasta River. The average SOD value of 1.42 gram O^2/m^2/day was used.
- All the kinetic parameters were set equal to the calibrated Klamath River Model riverine sections.
- The DO boundary conditions for the tributaries downstream of Iron Gate Dam was set based on the rules that 100% saturation values are used for all the minor tributaries and Trinity River, and 95% saturation for Shasta, Scott, and Salmon Rivers.

Model Simulation and Results

The T1BSR scenario was simulated in a piece-wise manner. The reach from Link to Keno was simulated first, and the output at the last node was used as the upstream boundary condition for the Keno to Iron Gate reach. Similarly, the output from the Keno to Iron Gate reach was used as the upstream boundary condition for the reach from Iron Gate to Turwar. Results for T1BSR are presented at 30 locations from UKL to the Lower Estuary (Figures 1 through 3).

1. Klamath Falls WWTP
2. South Suburban STP
3. Lost River Diversion Channel (LRDC) - Columbia Plywood
4. Miller Island
5. Klamath Straits Drain (KSD)
6. Keno Bridge (Hwy 66)
7. Keno Dam
8. Keno Dam Downstream USGS site
9. J. C. Boyle Dam Downstream
10. Oregon/California State Line
11. Copco Dam Downstream
12. Iron Gate Dam Upstream
13. Iron Gate Dam Downstream
14. Shasta Upstream
15. Shasta Downstream
16. Scott Upstream
17. Scott Downstream
18. Seiad Valley
19. Indian Upstream
20. Indian Downstream
21. Salmon Upstream

22. Salmon Downstream
23. Hoopa
24. Trinity Upstream
25. Trinity Downstream
26. Youngsbar
27. Turwar
28. Upper Estuary
29. Middle Estuary
30. Lower Estuary

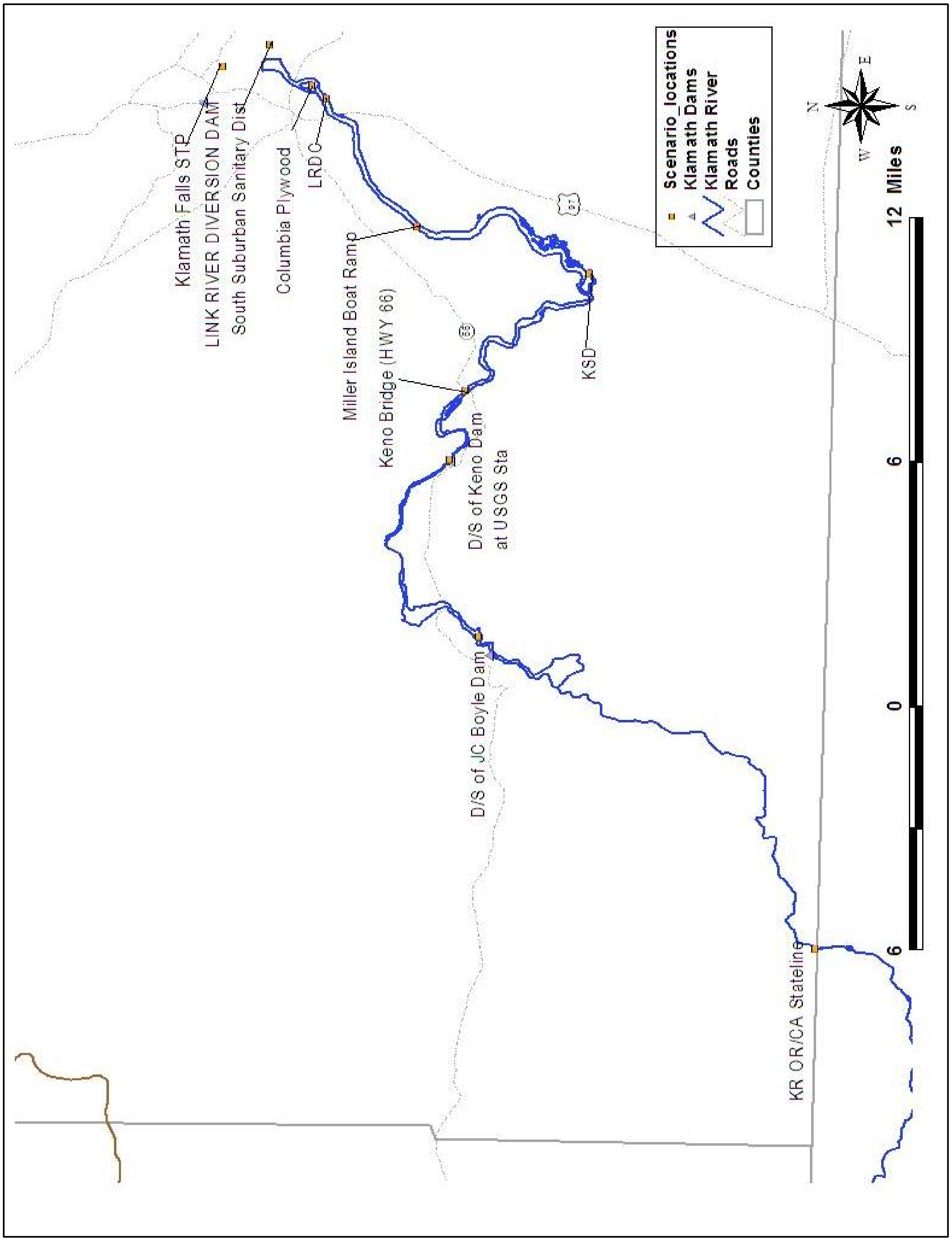

Figure 1. Model Output Locations from Link Dam to Stateline

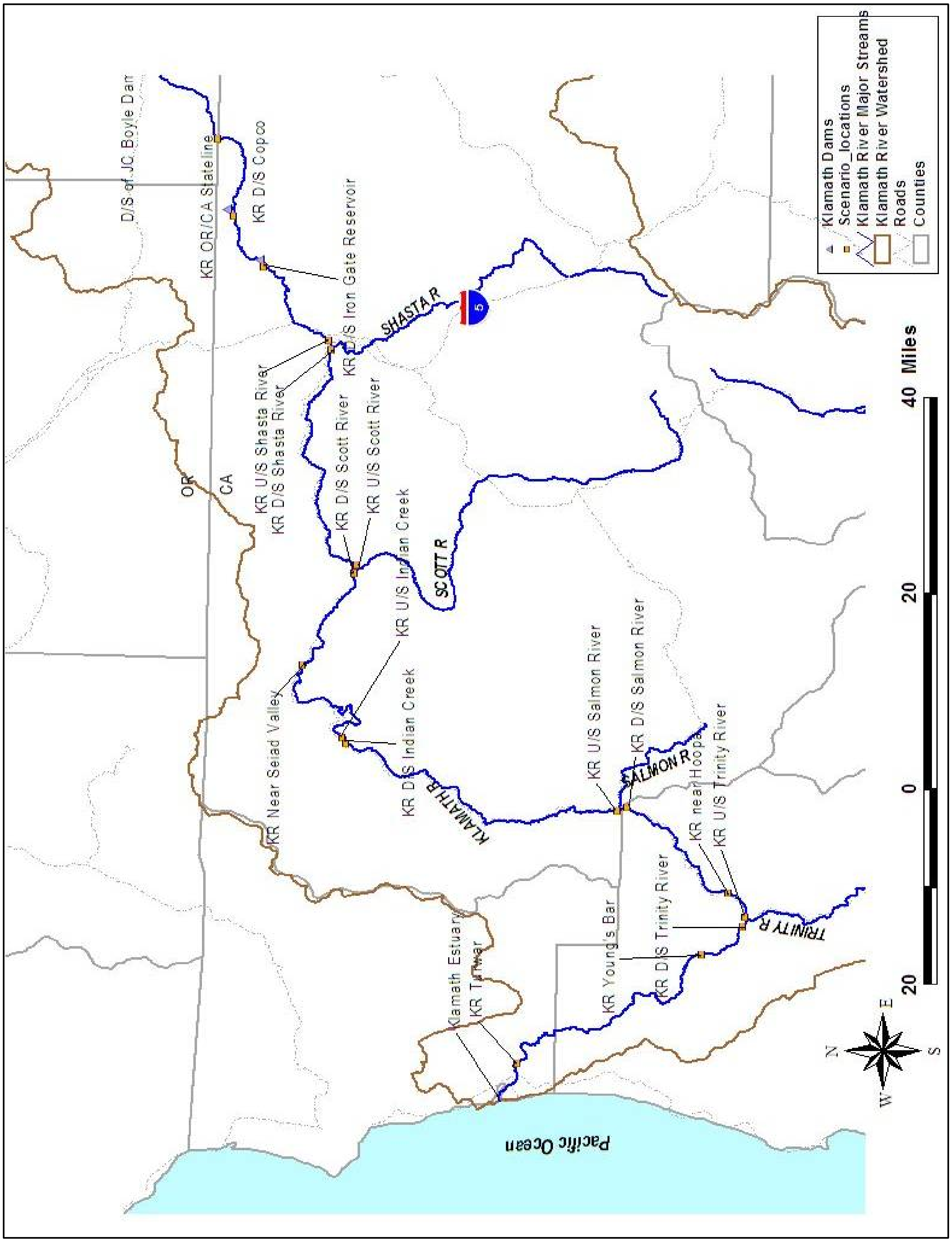

Figure 2. Model Output Locations from Stateline to Turwar

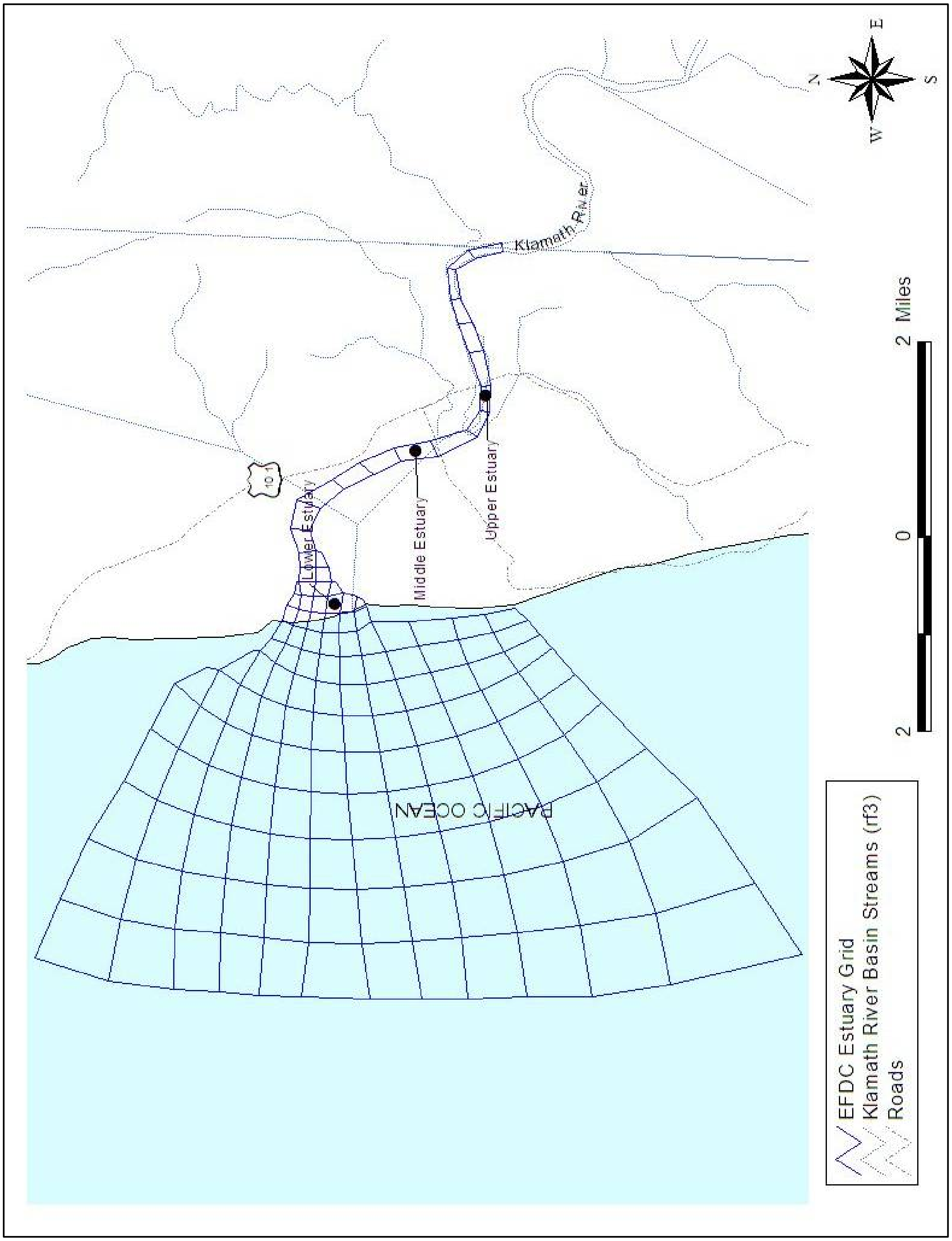

Figure 3. Model Output Locations in the Klamath Estuary

Appendix B shows the simulation results at the 30 locations from Link Dam to the Lower Estuary. Results are plotted together with the results of TOD2RN/TCD2RN, which are described below. Some general observations about the T1BSR results include:

- The simulated DO is higher than the Oregon instantaneous DO criterion of 4.0 mg/L and 7-day DO criterion of 5.0 mg/L for all the upstream locations above Keno Dam due to the relatively low organic matter loading from UKL under the median TMDL condition. The 30-day minimum mean DO criterion of 6.5 mg/L is slightly violated at downstream locations such as at the KSD and Hwy 66, and Keno Dam stations. Downstream of Keno Dam, the Oregon 30-day DO criterion of 8.0 mg/L is violated at all locations, while the instantaneous DO criterion of 6.0 mg/L is not violated at any locations. As for the 7-day DO criterion of 6.5 mg/L, it is only slightly violated at the upstream locations. DO tends to deteriorate with distance for the reach from Link Dam to Keno Dam, but this trend reverses for the reach from Keno Dam to Stateline, due to the accelerated flow velocity downstream of Keno Dam.
- The simulated pH generally meets the Oregon criterion, i.e., within the range of 6.5 to 9.0. The simulated pH, however, violates the California criterion of 8.5 consistently from upstream to downstream. The model results demonstrate that the diurnal fluctuation induced by periphyton activity is the major contributor to the pH violation.
- The ammonia toxicity criteria are satisfied at all the Oregon locations. The overall satisfaction of the ammonia toxicity standards is due to the significantly reduced ammonia loading from UKL under the median TMDL condition.
- The chlorophyll-a criterion of 15.0μg/L is violated at all locations upstream of the station D/S of Scott River due to the high concentration in the UKL boundary condition. With more dilution from tributaries, along with loss from respiration, die-off, and settling, phytoplankton concentration meets the criterion at locations downstream of the Scott River.
- Results indicate noncompliance with the Hoopa numeric criteria for DO, including a 8.0 mg/L moving weekly average of daily minima and 11.0 mg/L moving weekly average of daily minima during the spawning period. In addition, T1BSR indicates noncompliance with the 90% DO saturation criteria during the following months: June, July, August, September and October. July through September represent significant noncompliance."
- Simulated periphyton growth shows significant spatial variability. The simulated periphyton density can be close to zero at some locations but very high at other locations. The major reason for this spatial variability is likely the differences in nutrient concentrations, water depth, organic matter concentrations and phytoplankton concentrations.

Oregon and California Allocation Scenarios (TOD2RN/TCD2RN)

The Oregon and California allocation scenarios TOD2RN and TCD2RN represent compliance with water quality criteria in Oregon and California, respectively. The results of TOD2RN were applied as inputs to TCD2RN; therefore these scenarios are described as a single scenario. TOD2RN/TCD2RN involved running the Klamath River Model with no dams (except for Link Dam), as described above, setting boundary conditions at UKL based on the existing UKL TMDL, including point source inputs, keeping Lost River and Klamath Straits Drain flows but with higher nutrient concentrations and the same DO and temperature as UKL, and assigning natural or TMDL conditions for tributaries (which vary by tributary). UKL flow was set to be the same as the current condition, but the water quality and temperature were based on that of the natural baseline scenario T1BSR. The boundary condition for pH analysis is also set to be the same as that of the T1BSR. The modeling analysis was performed for the year 2000.

Criteria Interpretation

The following criteria were used in the evaluation:

- The numeric criteria for the reach upstream of Keno Dam that were used in this allocation analysis include the Oregon 30-day mean minimum and 7-day minimum mean criteria (6.50 mg/L and 5.0 mg/L, respectively). For the outfall of Keno Dam and the reach downstream of Keno Dam, these values change to 8.0 mg/L and 6.5 mg/L, respectively. There is also a DO resident trout spawning criteria of 11 mg/L or 95 % saturation that applies from January 1 to May 15, downstream of Keno Dam (not shown in graphics).
- The Upper Klamath Lake TMDL model predicts a range of conditions and the more extreme predicted water quality is not represented by T1BSR. Therefore, even when the natural condition baseline shows compliance with the numeric criteria, allocations are still calculated to protect against a quantified change from baseline conditions (i.e. a 0.2 mg/L digression).
- Upstream and downstream of Keno Dam, the cumulative point source and nonpoint source discharges should not cause a DO drop of greater than 0.20 mg/L (for the 7-day and 30-day criteria) during the entire year.
- In California, the DO must meet the proposed Site Specific Objectives (SSO) presented in Table 3.

Table 3. Proposed Site Specific Objectives (SSO) for DO in Mainstem Klamath River in California

Location	Percent DO Saturation	Time period
Stateline to Hoopa	90%	October 1 through March 31
	85%	April 1 through September 30
Hoopa to Turwar	85%	All year
Upper and Middle Estuary	80%	August 1 through August 31
	85%	September 1 through July 31
Lower Estuary	For the protection of estuarine habitat (EST), the dissolved oxygen content of enclosed bays and estuaries shall not be depressed to levels adversely affecting beneficial uses as a result of controllable water quality factors.	

Assumptions and Configuration

The following list presents key assumptions associated with configuration of the TOD2RN/TCD2RN scenario:

- The phosphorus TMDL for UKL was used to configure the upstream boundary conditions for the Klamath River Model as in the T1BSR scenario.
- A previous version of the model was used to develop the allocations through the process described below. These allocations were tested using the current version of model and found to achieve the DO and pH criteria.
- For the point sources, the configuration followed an iterative process:
  1. Initially, the 90th percentile of the existing nutrient concentrations were calculated for each of the point sources (including the Columbia Plywood and Collins Forest Product dischargers). These values were used to represent the baseline condition for the point sources.

   a. For the two minor discharges, Columbia and Collins, their concentrations were unchanged in the allocation runs. Their contribution to the overall load was minor compared with the two treatment plants.
   b. For the two treatment plants, the nutrient and DO concentrations were set based on the principle that they should have the same concentration in the TMDL analysis. Temperature was set based on earlier sensitivity analyses which would not result in temperature rise of greater than 0.075 ^{o}C for each individual point source. See Table 4 for current and derived concentrations of the effluent from the treatment plants. DO concentrations were set to 5.0 mg/L.
2. The models were run in a piece-wise manner from UKL to Stateline. First, the model was run from Link Dam to Keno Dam, and reductions were made until criteria were met. Then, the model was run from Keno Dam to Iron Gate Dam to evaluate the compliance down to Stateline.
3. Compliance was evaluated at 9 locations:
   a. Klamath Falls STP discharge point
   b. South Suburban STP discharge point
   c. Miller Island
   d. LRDC
   e. KSD
   f. Keno Dam
   g. Downstream of Keno Dam at the USGS station
   h. Downstream of the J.C. Boyle Dam
   i. Stateline
4. Compliance was evaluated by subtracting the 7-day moving average of daily minimum DO and the 30-day moving average of daily average DO from the corresponding natural condition baseline estimates. This is essentially a time series of DO deficit. If the DO deficit was greater than 0.20 mg/L at any of the nine evaluation locations, the nutrients at the two major point source dischargers were reduced. pH compliance was determined with comparison to the 9.0 criteria.
5. The reduction of nutrients was made in the following order: PO4 was first reduced until the pH target was achieved. Organic matter and NH4 was then reduced to achieve the DO target. The nitrogen reduction was a lower priority than reducing phosphorus because a phosphorus limitation was desired for ultimate control of periphyton in the Klamath River system.
6. After multiple iterations, the DO criteria for the point source allocation were achieved (Table 4). Corresponding point source discharge concentrations were:
   - PO4: 0.3 mg/L (as opposed to the starting value of 4.0 mg/L)
   - OM: 9.8 mg/L (as opposed to the starting value of 40.0 mg/L of OM)
   - NH4: 7.8 mg/L (as opposed to the starting value of 14.6 mg/L)
   - NO2/NO3: 14.3 mg/L (equivalent to the starting value)
   - DO: 5.0 mg/L (equivalent to the starting value)

Table 4. Comparison of South Suburban (S. Suburban) and Klamath Falls (K. Falls) Treatment Plant Concentrations Using Metrics Commonly Measured on Discharge Monitoring Reports (DMRs) and Used in the Model

		DMR Metrics								CE-QUAL-W2 metrics							
		Flow	TKN	NH4	NO3	BOD5	PO4	TP	TN	Flow	PO4	NH4	NO3	LDOM	LPOM	TP	TN
Source	Scenario	MGD	mg/L	mgN/L	mgN/L	mg/L	mg/L	mg/L	mg/L	cms	mgP/L	mgN/L	mgN/L	mg/L	mg/L	mg/L	mg/L
S. Suburban	DMR average	2.7	12.5	7.3	2	27	3.1	3.6	14	0.12	3.1	7.3	2	6.2	24.7	3.2	11.0
S. Suburban	DMR 90th P	3.2	21.4	13.0	4	41	4.0	4.5	25	0.14	4.0	13.0	4	9.3	37.2	4.2	20.1
S. Suburban	2000 average	2.1	14.2	9.2	2.0	12	3.1	3.5	16	0.09	3.1	9.2	2.0	14.2	56.6	3.5	16.2
S. Suburban	2000 90th P	2.8	22.1	14.6	3.3	18	4.0	4.6	25	0.12	4.0	14.6	3.3	21.4	85.5	4.6	25.4
K. Falls	DMR average	3.3	5.4	7.8	8	9	3.5	5.1	14	0.14	5.1	7.8	8	1.9	7.8	5.1	16.6
K. Falls	DMR 90th P	4.4	13.2	11.5	14	15	5.1	10.3	28	0.19	10.2	11.5	14.3	3.4	13.7	10.3	27.0
K. Falls	2000 average	3.2	3.3	1.5	1.5	14	3.3	3.5	4.8	0.14	3.3	1.5	1.5	5.4	21.4	3.5	4.8
K. Falls	2000 90th P	4.1	6.1	3.3	1.5	23	5.6	5.8	7.6	0.18	5.6	3.3	1.5	8	32.0	5.8	7.6
Both	TOD2RN	3.2	8.5	7.8	14	18	0.30	0.35	22.8	0.14	0.30	7.8	14.3	1.9	7.8	0.4	22.8

Note: DMRs were examined between 1995 and 2005. “2000” represents the year 2000 calibration. Blue shading indicates derived values (i.e., measurements on DMRs were converted into W2 metrics). “90th P” = 90th percentile. TOD2RN concentrations are constant so no averages are needed.

- The most sensitive location point source loading for pH compliance was just downstream of South Suburban WWTP. The most sensitive location for DO compliance was just downstream of Klamath Falls WWTP. It is suspected that the bathymetry of historic Lake Ewauna creates this sensitive location for DO because of deep, slow moving water.
- The most sensitive time period for point source loading was mid-September when flows from Link River were greatly reduced (170 cfs as opposed to a median 736 cfs). However, this flow is still greater than the 7Q10 of 94 cfs. This is also the period in which there was earlier than usual flow into the Klamath River from Lost River Diversion Channel.
- Once point source allocations were determined, the discrete nonpoint sources (KSD and LRDC) were analyzed as follows:
    1. Due to the geographic separation from the point source discharges and KSD / LRDC, there was available DO and pH capacity for discrete nonpoint sources.
    2. All other Oregon tributaries, including Jenny Creek, and other accretion/depletions between Keno Dam and Iron Gate Dam were kept the same as in the T1BSR scenario. The downstream boundary condition was configured to represent the Keno Reef as in T1BSR.
    3. The flows and temperature from Lost River Diversion Channel (LRDC) and KSD were kept the same as in T1BSR. Nutrients were initially the same as in T1BSR but were iteratively scaled up until the cumulative DO impairment exceeded 0.20 mg/L at the most sensitive location for the combined impact (when compared to T1BSR). Nutrient ratios were kept constant. DO compliance required lower nutrient concentrations than pH compliance.
    4. The most sensitive locations for combined (discrete NPS and point source) DO compliance were at Miller Island (in late summer) and Keno Dam (in spring).
    5. The Oregon combined allocations achieved California criteria at the state line.
- Once the discrete nonpoint sources were allocated, the analysis proceeded into California. Below Iron Gate Dam, the boundary conditions for flow, temperature and nutrients were specified as shown in Table 5 and described below.

Table 5. TCD2RN Boundary Conditions for Flow, Temperature and Nutrients below Iron Gate

	TCD2RN (2000)		
Stream(s)	**Temperature**	**Flow**	**Nutrients**
Trinity	Unchanged from T1BSR	2000 flows recalculated to reflect the ROD	Unchanged from current conditions model depiction
Salmon	Unchanged from current model depiction	Unchanged from current model depiction	Unchanged from current conditions model depiction
Scott	0.8 °C reduction from current model depiction, June 1 to October 15[3]	Unchanged from current model depiction	Unchanged from current conditions model depiction
Shasta	1.6 °C reduction from current model depiction, June 1 to October 15, consistent with Shasta River Temperature TMDL[4]	Current flow plus 45 cfs from June 1 to October 15, consistent with Shasta River Temperature TMDL[5].	Unchanged from T1BSR
Minor Tributaries	Unchanged from T1BSR	Unchanged from current model depiction	Unchanged from current conditions model depiction[6]

- SOD was set to be the same as in the T1BSR scenario.
- All the kinetic parameters were set equal to the T1BSR scenario.
- The DO boundary conditions for the tributaries downstream of Iron Gate Dam were set based on the rules that 100% saturation values are used for all the minor tributaries and Trinity River, and 95% saturation for Shasta, Scott, and Salmon Rivers.

Model Simulation and Results

The TOD2RN/TCD2RN scenarios were simulated in the same piece-wise manner as for the T1BSR scenario, and results are presented at the same locations (Figures 1 through 3). Simulation results are presented in Appendix B, along with results for T1BSR.

[3] The TCD2RN temperatures at the mouth of Scott River were depicted by RWQCB staff using the Heat Source temperature model. This analysis built upon the Scott River Temperature TMDL analysis (RWQCB, 2005) by including the effects of colder tributaries in the Scott River canyon. A 2 °C reduction of mean temperatures in the Scott River tributaries downstream of Canyon Creek were assumed, based on the results of an analysis of potential temperature reductions of minor Klamath River tributaries (Wilder, 2007). The results of this Heat Source modeling analysis indicated that the average temperature at the mouth of the Scott River could be reduced by as much as 0.8 °C. This 0.8 °C reduction from current stream temperatures at the mouth of the Scott River is applied from June 1 to October 15 for TCD2RN.

[4] The Shasta River Temperature TMDL modeling estimated that average temperatures at the mouth of the Shasta River would be reduced by 1.6 °C under TMDL compliance conditions (site potential riparian shade, no net increase in stream temperature from irrigation return flows, and 45 cfs increase in dedicated cold water flow) (RWQCB, 2006). This 1.6 °C reduction from current stream temperatures at the mouth of the Shasta River is applied from June 1 to October 15 for TCD2RN.

[5] The Shasta River Temperature TMDL includes a goal to increase flows by 45 cfs (RWQCB, 2006)

Tables 6 through 9 present the exceedance statistics for the Oregon reaches. As shown in Table 6, the maximum DO deficit for the reach upstream of Keno Dan is always less than 0.2 mg/L, exhibiting 0% violation of the criteria. Although Table 7 shows slight exceedance of pH, it was deemed acceptable by ODEQ in the context of overall model uncertainty. The maximum frequency of excursion was less than 2%, and the excursion is relatively isolated spatially. Table 8 indicates that the spawning period criteria are met under the TOD2RN condition. Table 9 shows that the Oregon DO criteria are met at the reach downstream of Keno Dam. Although the maximum DO deficit is 0.205 mg/L, which is slightly higher than the threshold of 0.20 mg/L, it was deemed acceptable by ODEQ (due to overall uncertainty and the small magnitude of the excursion).

Table 6. DO Exceedance Statistics for Upstream of Keno Dam

LOCATION	Min 30-day DO (mg/L)					Min 7-day DO (mg/L)				
	Min 30-day DO (mg/L)		Criteria (mg/L)	TOD2RN-T1BSR		Min 7-day DO (mg/L)		Criteria (mg/L)	TOD2RN-T1BSR	
	TOD2RN	T1BSR		max DO deficit between TOD2RN & T1BSR	% time this deficit is < 0.2 mg/L	TOD2RN	T1BSR		max DO deficit between TOD2RN & T1BSR	% time this deficit is < 0.2 mg/L
KFALLS WWTP	7.08	7.03	6.50	-0.05	0.00%	5.91	5.89	5.00	-0.108	0.00%
SOUTH SUBURBAN SANITARY	7.37	7.38	6.50	-0.06	0.00%	7.09	7.07	5.00	-0.070	0.00%
LRDC	7.36	7.32	6.50	-0.05	0.00%	7.36	7.13	5.00	-0.061	0.00%
MILLER ISLAND	6.99	6.82	6.50	-0.07	0.00%	6.63	6.46	5.00	-0.075	0.00%
KSD	6.48	6.43	6.50	-0.06	0.00%	6.13	6.08	5.00	-0.069	0.00%
HWY 66	6.37	6.31	6.50	-0.06	0.00%	6.05	6.01	5.00	-0.068	0.00%
KENO DAM	6.25	6.20	6.50	-0.06	0.00%	5.88	5.83	5.00	-0.067	0.00%

Table 7. pH Exceedance Statistics Upstream of Stateline

LOCATION	Number of times (hours over the year) the pH is >9 at surface 1m layer		% Exceedance		Max pH	
	TIBSR	TOD2RN	TIBSR	TOD2RN	TIBSR	TOD2RN
KFALLS WWTP	18	44	0.21%	0.50%	9.03	9.05
SOUTH SUBURBAN SANITARY	30	174	0.34%	1.98%	9.04	9.11
LRDC	0	136	0.00%	1.55%	8.99	9.07
MILLER ISLAND	0	4	0.00%	0.05%	8.91	9.01
KSD	0	0	0.00%	0.00%	8.60	8.74
HWY 66	0	0	0.00%	0.00%	8.52	8.68
KENO DAM	0	0	0.00%	0.00%	8.51	8.64
USGS DS_KENO	0	0	0.00%	0.00%	8.58	8.71
DS_JCB DAM	0	0	0.00%	0.00%	8.76	8.76
US_POWERHOUSE	0	0	0.00%	0.00%	8.89	8.89
DS_POWERHOUSE	0	0	0.00%	0.00%	8.88	8.88
STATELINE	0	4	0.00%	0.05%	8.91	9.02

Table 8. Spawning Period DO Exceedance Statistics Downstream of Keno Dam in Oregon

Location			TOD2RN-T1BSR	
	Min DO during Spawning Period (Jan to May) (mg/L)	Criteria (mg/L)	max DO deficit between TOD2RN & T1BSR	% time this deficit is < 0.20 mg/L
DS Keno Reservoir	8.47	11.00	-0.096	0.00%
DS_J. C. Boyle Dam	8.50	11.00	-0.089	0.00%
STATELINE	8.66	11.00	-0.050	0.00%

Table 9. General DO Exceedance Statistics Downstream of Keno Dam in Oregon

Location	Min 30-day DO (mg/L)					Min 7-day DO (mg/L)				
	Min 30-day DO (mg/L)		Criteria (mg/L)	TOD2RN-T1BSR		Min 7-day DO (mg/L)		Criteria (mg/L)	TOD2RN-T1BSR	
	TOD2RN	T1BSR		max DO deficit between TOD2RN & T1BSR	% time this deficit is < 0.2 mg/L	TOD2RN	T1BSR		max DO deficit between TOD2RN & T1BSR	% time this deficit is < 0.2 mg/L
DS Keno Reservoir	6.65	6.63	8.00	-0.060	0.00%	6.44	6.43	6.5	-0.086	0.00%
DS_J. C. Boyle Dam	6.83	6.84	8.00	-0.052	0.00%	6.43	6.43	6.5	-0.072	0.00%
STATELINE	7.79	7.84	8.00	-0.055	0.00%	7.16	7.37	6.50	-0.205	1.67%

Tables 10 through 14 show the exceedance statistics for the California reaches of the Klamath River under the TCD2RN scenario. The proposed SSO are met at all locations (with minor violations). The predicted violations were deemed acceptable by RWQCB staff in the context of overall uncertainty.

The simulated DO was also compared with the Hoopa criteria. The Hoopa Tribe has three types of DO targets, including a COLD DO criterion of 8 mg/L, a 90% saturation criterion, and a SPAWN DO criterion of 11 mg/L. Table 13 indicates that while the first two criteria were exceeded 5.87% of the year for the COLD criterion and 7.83% for the 90% saturation criterion, the SPAWN criterion was exceeded over 50% of the year. The SPAWN criterion was exceeded for such a high frequency of time because during the period from March to June when the SPAWN criterion applies, the saturated DO falls below the criterion of 11 mg/L. This suggests that the SPAWN criterion cannot be met under natural conditions. Table 14 shows the exceedance statistics for DO with regard to the Yurok criteria. These criteria are met at all times.
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In addition to the exceedance summaries, some general observations can be made based on the time series plots in Appendix B. Specifically:

- The simulated temperature in TOD2RN/TCD2RN is almost identical compared to T1BSR at locations from Lake Ewauna to upstream of Shasta River, indicating that the point sources have a negligible impact on the temperature. Downstream of Shasta River, the TCD2RN temperature differs slightly from the T1BSR temperature due to the different flow and temperature conditions assigned in the T1BSR and the TCD2RN scenarios. Overall, the difference in temperature is very minor. PO4 is generally slightly higher under TOD2RN than under T1BSR at the upper Klamath River locations due to the contributions from the point and nonpoint sources, but further downstream (such as at Iron Gate Dam), the PO4 becomes slightly lower under TCD2RN during the summer. This is due to the more intensive uptake by phytoplankton and periphyton. During the spring and winter, the PO4 under TCD2RN is still higher than under T1BSR at this location since biological activity of phytoplankton and periphyton is low during this period. The PO4, however, becomes lower in TCD2RN at locations further downstream for almost the entire year due to the influence of flow from the major tributaries. TP follows a similar trend.
- NH4 and NO3 are significantly higher at upstream locations due to the large loading from the point sources; however, this trend diminishes with distance downstream from the combined impact of phytoplankton and periphyton activity and the difference in flow from the major California tributaries. At the most downstream locations of the river, NH4 and NO3 are very similar between T1BSR and TCD2RN during the summer, although during the other seasons the TCD2RN concentrations are still considerably higher. TN follows a similar trend also.
- Chlorophyll-a is always higher under TOD2RN/TCD2RN than under T1BSR for all the locations, though the trend diminishes with distance downstream.
- In the upper riverine sections, such as D/S of Keno Dam and D/S of J.C. Boyle, due to severe P-limiting conditions, periphyton growth is highly depressed under both the TOD2RN and T1BSR conditions. Further downstream, due to the contribution of PO4 from the springs, the P-limiting condition is relieved and periphyton growth is stimulated. This results in higher periphyton biomass under TOD2RN/TCD2RN. This trend diminishes with distance, and finally at Seiad Valley, the peak periphyton biomass under T1BSR reaches a slightly higher level than under TCD2RN. TCD2RN also has a second peak which does not exist in the T1BSR scenario. From that point on, T1BSR tends to produce higher periphyton at most of the locations.

- In the upper Klamath River, e.g., in Lake Ewauna, the phytoplankton growth is generally P-limited under both T1BSR and TOD2RN, but further downstream, it appears that nitrogen can also become a co-limiting factor for periphyton growth.
- In the Klamath Estuary, the upstream water quality signal is reflected in the Upper Estuary location, but at the Lower Estuary location, the tidal impact becomes dominant such that the difference between T1BSR and TCD2RN becomes negligible.

Table 10. DO Exceedance Statistics for TCD2RN Based on Proposed California SSO – Stateline to Hoopa

Location	April 1 through September 30 (85% DO Saturation)	October 1 through March 31 (90% DO Saturation)
Stateline	0.00%	0.00%
DS_COPCO DAM	0.00%	0.00%
US_IG DAM	0.00%	0.00%
DS_IGDAM	0.49%	0.07%
US_SHASTA	0.00%	0.00%
DS_SHASTA	0.00%	0.83%
US_SCOTT	0.00%	0.07%
DS_SCOTT	0.00%	0.00%
SEIAD	0.00%	0.00%
US_INDIAN	0.00%	0.00%
DS_INDIAN	0.00%	0.00%
US_SALMON	0.00%	0.00%
DS_SALMON	0.00%	0.00%

Table 11. DO Exceedance Statistics for TCD2RN Based on Proposed California SSO – Hoopa to Turwar

Location	All year (85% DO Saturation)
US_TRINITY	0.00%
DS_TRINITY	0.00%
YOUNGSBAR	0.00%
TURWAR	0.00%

Table 12. DO Exceedance Statistics for TCD2RN Based on Proposed California SSO – Upper and Middle Estuary

Location	August 1 through August 31 (80% DO Saturation)	September 1 through July 31 (85% DO Saturation)
Upper Estuary	0.00%	0.11%
Middle Estuary - Top	0.00%	0.08%
Middle Estuary - Bottom	0.00%	0.04%

Table 13. Summary of Exceedance Frequency for Hoopa Tribe Standards

Location	% of time COLD Hoopa Tribe DO Criteria of *8 mg/L* is exceeded (year-round, based on 7-DAMin)	% of time *90%* of DO Saturation value is exceeded (year-round Hoopa Tribe Natural Conditions DO Criteria)	% of time SPAWN Hoopa Tribe DO Criteria of *11 mg/L* is exceeded (from September 14 to June 4, based on 7-DAMin)
HOOPA	5.87%	7.83%	52.14%

Table 14. Summary of Exceedance Frequency for Yurok Tribe Standards (year-round)

Location	% of time Absolute Minimum Yurok Tribe DO Criteria of *7 mg/L* is exceeded
DS_TRINITY	0.00%
YOUNGSBAR	0.00%
TURWAR	0.00%

Oregon and California With-Dams TMDL Scenario (T4BSRN)

This scenario involved running the Klamath River Model with all dams in place. Boundary water quality inputs were based on the final compliance scenarios for Oregon and California (TOD2RN and TCD2RN). The objective of the simulation was to provide a means of quantifying the impacts of the dams and appropriate allocations.

Assumptions and Configuration

The T4BSRN model was configured and implemented in a piece-wise manner from upstream to downstream. The existing condition model (S1), described in “Model Configuration and Results - Klamath River Model for TMDL Development,” was used as the basis for T4BSRN in terms of physical configuration only (alternating CE-QUAL-W2 and RMA models for the reservoirs and riverine segments, along with EFDC for the estuary). Boundary water quality conditions were the same as the allocation scenarios (TOD2RN and TCD2RN) with the Keno Reef representation, as described above. Configuration details are as follows:

- All the dams are present, therefore the model is divided into 9 domains (4 reservoirs, 4 riverine reaches, and the estuary).
- For the UKL boundary condition, flow is the same as in the current conditions model depiction and TOD2RN. Water quality and temperature boundary conditions are the same as in TOD2RN.
- For the Lake Ewauna/Keno Reservoir segment, all inputs from TOD2RN are kept.
- Downstream of Keno Dam, all the tributary flow boundary conditions in Oregon are set the same as in TOD2RN. In California they are all set the same as in TCD2RN.
- SOD throughout the system is set the same as in the compliance runs, i.e., TOD2RN and TCD2RN. The only exception is when SOD for the existing condition is lower than in the compliance run (due to a change in the waterbody type).
- All other water quality parameters are consistent with the compliance runs.
- At the location immediately upstream of Copco Reservoir, the PO4 and OM concentrations were reducedI iteratively (that is, from the initially simulated T4BSRN condition – which itself was based on TOD2RN boundary conditions), in order to achieve a California summer mean chlorophyll-a target of 10 ug/L within Copco and Iron Gate Reservoirs. The chlorophyll-a concentration coming into Copco Reservoir was set at the target concentration of 10 ug/L, and the PO4 and OM were iteratively reduced until the summer mean chlorophyll-a concentration at the surface (1 m depth) in both Copco and Iron Gate Reservoirs at the location immediately upstream of the dams was equal to or below 10 ug/L. The scenario arrived at summer mean surface (1 m depth) chlorophyll-a concentrations of 9.8 ug/L for Copco and 6.7 ug/L for Iron Gate. The resulting PO4 and OM loads upstream of Copco Reservoir are 30% lower than those under the initially simulated T4BSRN condition [which was based on the TOD2RN boundary conditions].

Model Simulation and Results

Simulation results are presented for T4BSRN along with TOD2RN/TCD2RN in Appendix C. Some general observations can be made:

- At locations upstream of Keno Dam, the presence of the dam is predicted to cause slightly different average nutrient, DO, and chlorophyll-a concentrations than the without-dam condition. The main reason is that under the with-dam condition, the outflow was regulated by the dam but under the without-dam condition the outflow was controlled simply by the discharge rating curve at the reef. As a result, the water depth and retention time is different under T4BSRN than under TOD2RN. This causes different deoxygenation, nutrient transformation, and algal activity. Additionally, the there is a difference in the volume of water used in the vertical averaging process. In general, DO is lower under T4BSRN when Keno Dam is present.
- For all the locations upstream of Keno Dam, temperature is very similar between T4BSRN and TOD2RN, suggesting that the difference in summer water depth has an insignificant impact on temperature.
- Downstream of Keno Dam at the USGS station, the summer DO for T4BSRN is slightly lower than that for TOD2RN. Temperature is generally very similar between the two scenarios (with the dam present, the fluctuation in temperature during the summer is smaller). Chlorophyll-a is slightly lower when the dam is present, while PO4 is slightly higher. It is hard to judge whether the inorganic nitrogen is higher or lower with the presence of the dam, but a shift in time can be observed in the model results at this location.

- Due to the presence of J.C. Boyle Dam, the temperature downstream of the dam is smooth and shows much less diurnal fluctuation in T4BSRN than in TOD2RN. DO for T4BSRN becomes significantly lower than for TOD2RN due to the vertical stratification in J.C. Boyle Reservoir when the dam is present. Phytoplankton is slightly lower under T4BSRN downstream of J.C. Boyle Dam because of diminished phytoplankton in deep water in the reservoir. This reduces the overall biomass of phytoplankton in the outflow from J.C. Boyle Reservoir (since the outlet draws water from both the surface and the bottom). PO4 and NO3 are slightly lower under T4BSRN than under TOD2RN at this location. This might be caused by the longer retention time in J.C. Boyle Reservoir that causes a loss of PO4 and NO3 from algal uptake while the benthic source is insufficient to compensate for this loss. NH4, however, appears to be slightly higher during the summer when J.C. Boyle Dam is present. This might be due to the benthic source.
- At Stateline, temperature is similar for T4BSRN and TOD2RN, although the temperature for T4BSRN shows a larger diurnal fluctuation due to the peaking operation. DO is lower for T4BSRN, and it shows more significant diurnal fluctuation due to the peaking operation. Overall, the most striking difference between T4BSRN and TOD2RN at the Stateline location is that for all the constituents except NH4 the concentration shows much more diurnal fluctuation under T4BSRN than under TOD2RN due to the peaking operation. NH4, however, has smaller diurnal fluctuation under T4BSRN due to the concentration from the springs. The springs' concentrations are not significantly different from the upstream incoming concentration. Periphyton is lower under T4BSRN most likely due to the relatively lower nutrient concentration.
- Downstream of Iron Gate Dam, a significant temporal shift is observed between the T4BSRN and TCD2RN results due to the change in retention time caused by the presence of the dams. In addition to the time shift, the temperature is much smoother under T4BSRN than under TCD2RN. DO and phytoplankton biomass are both significantly lower under T4BSRN than under TCD2RN due to vertical stratification in the upstream reservoirs when dams are present. In addition, the phytoplankton biomass is lower under T4BSRN because of the 30% reduction in PO4 and OM loading at the point entering Copco Reservoir.
- Downstream of Iron Gate Dam, the time shift in temperature becomes smaller, and finally becomes unidentifiable at the U/S Scott River location (and further downstream), because the signal from upstream has been dampened by solar radiation and air temperature impacts. Similarly, the difference in DO concentration also is reduced from upstream to downstream. Nutrient and phytoplankton differences also diminish with distance. The model results show that the periphyton dominant condition varies from site to site between T4BSRN and TCD2RN. At most locations, periphyton is higher under TCD2RN than under T4BSRN.
- In the Upper and Middle Estuary, a small but detectable difference between T4BSRN and TCD2RN is observed for the simulated nutrient and periphyton concentrations. DO and temperature, however, look almost identical in the Upper and Middle Estuary for T4BSRN and TCD2RN. In the Lower Estuary, the temperature and water quality parameters become even closer between T4BSRN and TCD2RN as the tidal signal dominates at this location.

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Appendix A: RWQCB Estimates of California Tributary Natural Temperatures and Flows

RWQCB staff provided estimates of temperatures and flows for the tributaries in California for the natural conditions baseline scenario, as described here.

Shasta River

The Tennessee Valley Authority's River Modeling System model (Hauser and Schohl 2002) was applied to depict natural flows and associated temperatures at the mouth of the Shasta River (Deas and Null 2007), building upon modeling for development of the Shasta River Temperature TMDL (RWQCB 2006). The Shasta River temperature TMDL model scenario represented Shasta River temperatures associated with potential riparian shade on the tributaries and mainstem, absence of thermal load from irrigation tailwater return flows, and estimated natural flows and temperatures from Big Springs Creek, a major spring-fed tributary. The Shasta River natural conditions model scenario added to the Shasta River TMDL scenario by representing full natural flows and associated temperatures for the Shasta River and all tributaries (Deas and Null 2007). The Shasta River is fully appropriated from May 1 through October 31, according to a statutory adjudication established in 1932. Since 1934 the California Department of Water Resources (CDWR) Watermaster Service has managed the delivery of the adjudicated water rights. Estimates of natural Shasta River flows were developed based on CDWR Watermaster Service records from 1930-1955. The watermaster service records used in estimating natural flows were from headwater locations of the Shasta River and its major tributaries, at locations upstream of significant water rights. No accretions were assumed between the tributary headwaters and the confluence with the Shasta River. Shasta River accretions were calculated based on water balancecalculations. Natural flows at the mouth of the Shasta River were calculated as the sum of Shasta River and tributary headwater flow records plus the calculated mainstem accretion flows. Corresponding temperatures were predicted, as described by Deas and Null (2007).

Scott River

For T1BSR, Regional Water Board staff developed a depiction of potential natural temperatures of the Scott River at its mouth using the Heat Source temperature model (Boyd and Kasper 2003). Unimpaired flows were assumed to be equivalent to natural flows for this analysis. For this analysis, unimpaired flow refers to the flow of a stream without regulation, control, diversion, or artificial additions; natural flow is the same as unimpaired flow, but also incorporates changes in process, such as changes in transpiration due to more dense vegetation in the uplands, or changes in runoff resulting from soil compaction, for instance. This modeling exercise built on previous model scenarios implemented as part of the Scott River TMDL (RWQCB 2005). Further model scenarios were implemented to evaluate the combined effects of potential riparian shade (in both the tributaries and mainstem Scott River) and unimpaired flows on temperatures at the mouth of the Scott River. Neither the temperature effect of these tributaries, nor the effects of unimpaired flows on Scott River temperatures had been previously evaluated in this way. The effects of unimpaired discharges were not evaluated previously because estimates of unimpaired flows were unavailable. The effects of natural Scott River temperatures and flows were evaluated for two time periods in 2000: July 28 – August 1 and August 12 – September 25. These time periods overlap with time periods analyzed as part of the Scott River TMDL development process (July 28 – August 1 and August 27 – September 10). The August –September time period was extended 28 days for this analysis.

Regional Water Board staff used a range of unimpaired flow estimates representing possible natural flows, and meteorological data from 2000, to evaluate the thermal effects of natural Scott River flows on the Klamath River. A range of flows was evaluated due to the uncertainty associated with unimpaired Scott River flow estimates. The flow estimates were developed based on simple water balance assumptions and estimated rates of consumptive water use.

The hydrology of the Scott River is complicated by the high degree of groundwater-surface water interaction in Scott Valley. In most years, the Scott Valley aquifer is replenished by infiltration of precipitation and stream flows from November to May, generally speaking. Once the height of the Scott River drops below the height of the surrounding water table, water drains from the aquifer back to the river. In this way the Scott Valley aquifer acts as a large sponge soaking up water when it is plentiful, and releasing it when it is scarce. This process occurs to such a degree that the Scott Valley aquifer accounts for the majority of the Scott River water leaving Scott Valley in the summer months. For instance, on August 9, 1972, the Scott River was flowing just 5 ft^3/s near the upstream end of Scott Valley (river mile 50), but was flowing at 61 ft^3/s at the downstream end of the valley (river mile 22), despite the surface diversion of 28 ft^3/s and minimal tributary inflows in between (State Water Board 1974). Similarly, on August 27, 2003 Regional Water Board staff measured 11 ft^3/s at river mile 50 and 34 ft^3/s at river mile 19, and estimated surface diversions and tributary inflows as 17 ft^3/s and 2 ft^3/s, respectively (Regional Water Board 2005b).

Extraction of Scott Valley groundwater can reduce the amount of groundwater discharging to the Scott River when the drawdown (or pressure wave in a confined setting) associated with extraction intersects the river. If the effects of groundwater extraction don't reach the river before the next season's replenishment begins, the amount of extracted groundwater volume will be replenished and there will be no decrease in surface flows. Similarly, due to their geomorphology, many of the Scott River tributaries historically percolated into alluvial fans at times of low flow. A portion of surface water used for irrigation in Scott Valley is diverted from those creeks that historically percolated into alluvial fans. The amount of water diverted from these creeks that would have resurfaced in the Scott River in the same season is unknown. A reduction in stream flow percolation would result in a reduction in Scott River flow if percolating water would have reached the river before the next season's replenishment. Otherwise, if replenishment refills the aquifer prior to the time that the diverted stream flow would have otherwise reached the river, the diversion resulting in reduced stream flow would not affect Scott River flow.

Given these complexities and uncertainties associated with Scott River hydrology, using water use data to estimate unimpaired Scott River flows is difficult. As a starting point, Regional Water Board staff used the full unimpaired Scott River flows estimated by US Bureau of Reclamation for 2000 (Hicks 2006). The USBR method for estimating Scott River full unimpaired flows is summarized here. The entire estimated seasonal evapotranspiration of applied water (ETAW) for Scott Valley (71,010 acre-ft) was assumed equal to the seasonal flow impairment (ETAW is the loss of applied irrigation water to evaporation and transpiration). The ETAW value was then distributed through the irrigation season, by month, using estimates of monthly percentage impairment from

USBR's Irrigation Training and Research Center, resulting in estimates of monthly unimpaired flow. Regional Water Board staff then distributed the monthly unimpaired flow estimates as groundwater inputs throughout Scott Valley in proportion to rates of groundwater accretion measured by the State Water Board (1974).

The USBR analysis assumes that any water irrigated in a particular month would have otherwise flowed out of Scott Valley down the Scott River in the same month. This assumption implies no travel time between the points of diversion or extraction. While this approach is grounded in water use estimates, it also relies on a simple model of a complicated hydrologic system that likely results in overestimated flows. For instance, approximately 50% of water irrigated in Scott Valley is pumped groundwater. However, given the complex nature of the Scott Valley hydrology described above, it is unlikely that the entire amount of water lost due to evapotranspiration of extracted groundwater would have otherwise discharged to the Scott River in the same month, or even same season, in the absence of water use. Any extracted water that would not have reached the river should not be routed to the river in the same month or season.

Based on this assessment of USBR's analysis, Regional Water Board staff developed two simple alternative depictions of unimpaired 2000 Scott River flows. The first alternative depiction was developed by simply reducing the groundwater accretion calculated for the USBR estimate by 50%, and the second alternative depiction was developed by reducing the groundwater accretion calculated for the USBR estimate by 75%. The rates of groundwater accretion were reduced in these depictions because surface water inflows to Scott Valley account for a small fraction of the total outflow leaving Scott Valley in the summer months. This resulted in natural flow depictions based on 100%, 50%, and 25% of ETAW added to the measured flow of the Scott River. The estimated flows at the USGS Scott River flow gauge (located just downstream of Scott Valley) for these three natural flow scenarios are presented in Table A.1. Table A.1 also includes monthly average measured flows from August and September of 2000, as well as the mean of the August and September monthly average flows for the 1942-1976 time period, for comparison purposes. The 1942-1976 time period is significant because it represents a period prior to the extensive use of groundwater for irrigation in the Scott Valley (SRWC 2004).

The three estimates of natural Scott River flows span a broad range, but provide reasonable estimates of the upper and lower bounds, as well as an intermediate estimate.
Comparison of the data presented in Table A.1 indicates that the 25% ETAW scenario results in flows that are only slightly higher than the mean of the average August flow from 1942-1976, and slightly lower than the mean of the average September flow from 1942-1976. Given that the flows from 1942-1976 time period reflect a time of extensive water use, the true unimpaired flows must be higher than those estimated in the 25% ETAW scenario.

Table A.1: Estimated and measured flows at USGS' "Scott River near Fort Jones" gauge.

Source	**Monthly average flow estimate, August (cfs)**	**Monthly average flow estimate, September (cfs)**
USBR estimated unimpaired flow	253	193
Modeled flows, 100% ETAW	277	188
Modeled flows, 50% ETAW	154	100
Modeled flows, 25% ETAW	94	59
Mean of measured monthly average, 1942-1976	77	62
Measured monthly average, 2000	19	24

This analysis is further complicated, however, by the fact that Van Kirk and Naman (2008) estimate that July 1 – October 22 Scott River flows have declined approximately 13% due to changes in the regional-scale climate, on average, since the 1942-1976 time period, based on an analysis of nearby streams. Van Kirk and Naman also estimated a 20% decrease in stream flow from the 1942-1976 period that isn't explained by changes in climate.

Based on the analysis and reasoning described above, Regional Water Board staff used the flow conditions based on the 50% ETAW estimate to evaluate the potential for the Scott River to affect the temperature of the Klamath River or provide thermal refugia during the summer months. While the 50% ETAW estimate is not a definitive estimate of unimpaired flows, it does provide a reasonable estimate for use in evaluating the possible effects of water use on the temperatures of the Scott and Klamath Rivers for the purposes of this TMDL analysis.

A second component of the natural Scott River temperature and flow analysis was the estimation of natural Scott River tributary temperatures. Regional Water Board staff simulated two natural tributary scenarios. The first scenario assumed a reduction of 1°C in all tributaries from Kidder Creek (river mile 32) to the mouth of the Scott River. The second scenario assumed a 2°C reduction of mean temperatures in the Scott River tributaries from Kidder Creek to the mouth of the Scott River. The assumptions were based on the results of an analysis of potential temperature reductions of Klamath tributaries conducted by Regional Water Board staff for minor tributaries of the Klamath River.

The Heat Source stream temperature model (Boyd and Kasper 2003) was used to integrate the results of the two analysis components of the natural Scott River temperature and flow analysis (natural flows and natural tributary temperatures). The Heat Source model was previously implemented in the Scott River as part of the Scott River TMDL development process. The original model development, described in detail in the *Staff Report for the Action Plan for the Scott River Sediment and Temperature Total Maximum Daily Loads* (RWQCB 2005a), was based on:

- comprehensive mapping of the Scott River channel and nearby vegetation using high-resolution aerial imagery,
- substrate and width-to-depth data from habitat typing surveys,
- measured water temperatures at all 11 tributaries with surface connection to the Scott River,
- measured air temperatures at 6 sites distributed along the longitudinal axis of the Scott River,
- measured relative humidity data at 5 sites distributed along the longitudinal axis of the Scott River,
- measured wind speeds at 3 sites distributed along the longitudinal axis of the Scott River,
- periodic flow measurements at 10 sites distributed along the longitudinal axis of the Scott River and the continuous flow record at the "Scott River near Fort Jones" USGS gauge, and
- a thermal infrared survey covering the entire modeled reach (Watershed Sciences, 2004).

The model was calibrated for the August 27 - September 10, 2003, time period using hourly temperature data from 21 sites distributed along the longitudinal axis of the Scott River, and validated using temperature data at 18 sites during the July 28 - August 1, 2003, time period (three sites were not deployed until after August 1, 2003, and were unavailable for validation). The mean absolute error for the validation period at the 18 sites ranged from 0.5 to 2.4 °C (0.9 to 4.3 °F), and averaged 1.1 °C (2.0 °F). The mean absolute error 0.5 miles upstream of the mouth of Scott River was 0.75 °C (hourly data). Average bias of the daily average error for the validation period at 18 sites ranged from –1.9 to 2.1 °C (3.4 to 3.8 °F), and averaged -0.2 °C (-0.36 °F). The average bias of the Scott River daily average temperature near the mouth (river mile 0.5) was 0.2 °C (0.36 °F). For a further discussion of Scott River temperature TMDL model calibration, including charts of observed and predicted temperatures at all locations, see the *Staff Report for the Action Plan for the Scott River Sediment and Temperature Total Maximum Daily Loads* (RWQCB 2005a).

Salmon River

The results of the Salmon River Temperature TMDL analysis indicate that temperature improvements in the Salmon River watershed are unlikely to result in changes at the mouth of the Salmon River (RWQCB 2005b). That analysis indicates that a 10% increase in effective shade would decrease daily average temperatures at the mouth of the Salmon River by 0.1 ^{o}C (0.18 ^{o}F). Effective shade levels at the mouth of the Salmon River are unlikely to significantly change given the width of the river and TMDL shade allocations. Further, surface water diversions from the Salmon River are quite small. Therefore, no alterations of the current Salmon River hydrograph or temperature boundary conditions are made for the natural conditions baseline scenario.

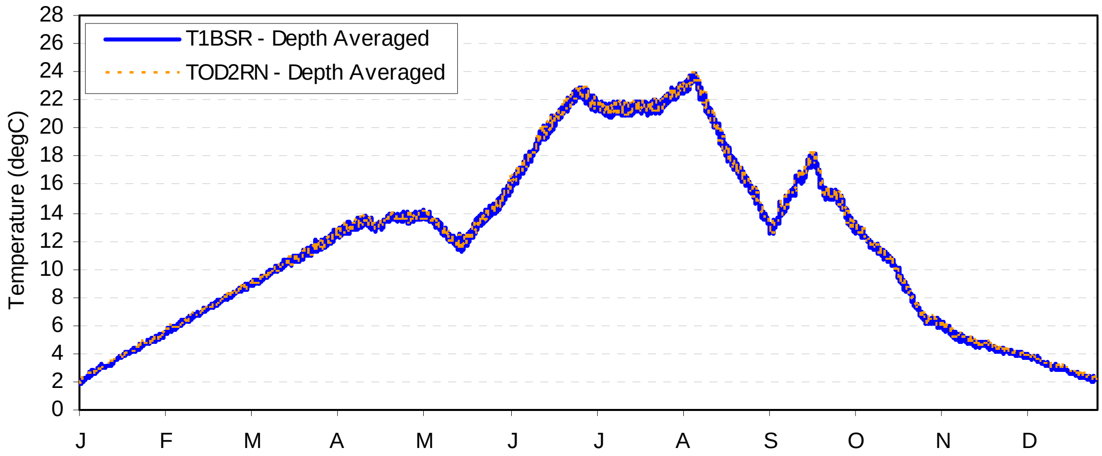
Trinity River

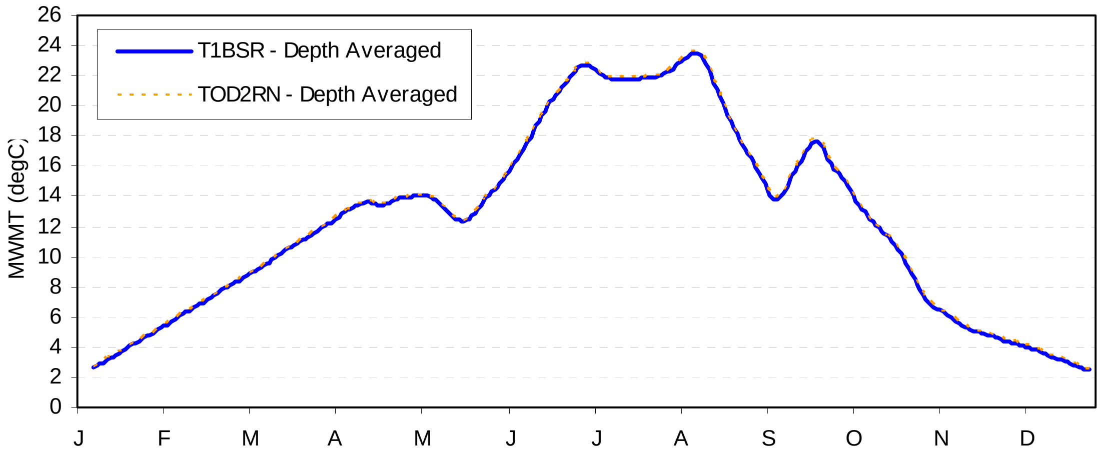
Regional Water Board staff developed estimates of natural Trinity River flows for 2000. The natural flow estimates are based on estimated full natural flows at Trinity Dam, gauged flows of Trinity River above Coffee Creek near Trinity Center (which is upstream of Clair Engle Lake), and gauged flows between Lewiston and Hoopa. The estimated full natural flows are based on a mass balance that takes into account inflows, outflows, diversions, evapotranspiration, and precipitation. The estimated full natural flows show great fluctuations during low flow conditions, therefore flows were estimated during this period by modifying gauged flows of Trinity River above Coffee Creek near Trinity Center. The Trinity River above Coffee Creek flows were multiplied by the ratio of the drainage area upstream of the gauge to the drainage area upstream of Lewiston. These data were used to represent natural flows at Lewiston for January 1 to January 10, and June 16 to December 31. The estimated full natural flows were used to represent natural flows at Lewiston for the January 11 – June 15 time period. The natural flow at the mouth of the Trinity River was estimated by adding the flow values discussed above to the difference in gauged flows between Hoopa and Lewiston. The accretion between Lewiston and Hoopa was added to the previous day's full natural flow at Trinity dam to account for time of travel between Lewiston and Hoopa (e.g. January 1st flow at Trinity Dam + January 2nd accretion = January 2 flow at Hoopa), based on Zedonis (2001).

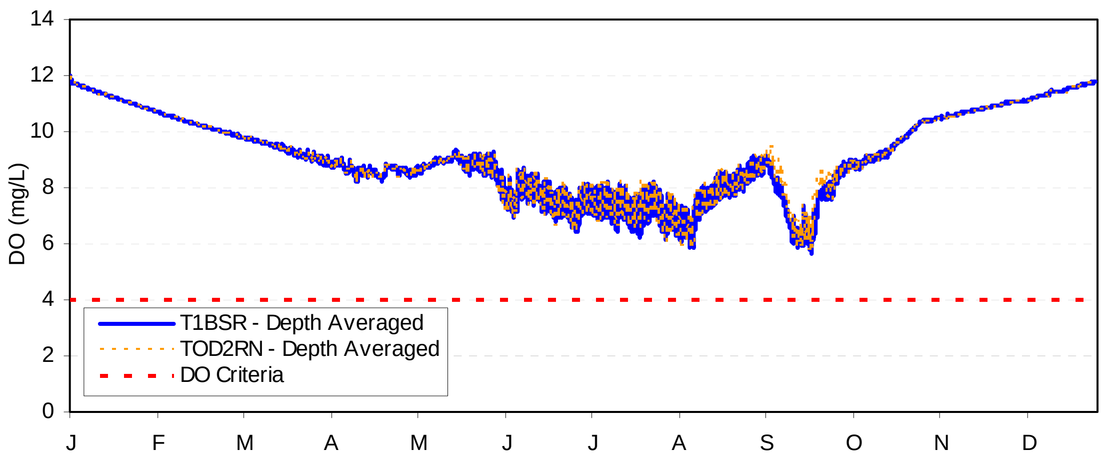
Corresponding temperatures at the mouth of the Trinity River under natural flows were estimated by Regional Water Board staff based on empirical analysis. The Trinity River Record of Decision (ROD) was implemented in 2005 and prescribes flows for a range of water year types, generally resulting in increased flows compared to pre-ROD flows. The expected change in temperature associated with increased flows (under natural conditions compared to current) was estimated by comparing the 2005 stream temperature and meteorological conditions with temperature and meteorological conditions of 2002-2004 (2005 was the first year of ROD flows). Regional Water Board staff also analyzed daily average Trinity River temperature data from the Hoopa gauge (RM 12.5) from both the 2000 and 2005 summer seasons to compare temperatures from two "normal" water year types with and without ROD flows (2005 and 2000, respectively). Neither of these comparisons indicated that a large temperature reduction at the mouth of the Trinity River would have occurred had ROD flows been implemented in 2000. Based on this comparison, Regional Water Board staff estimated stream temperatures would be reduced by 0.5 ^{o}C from June 1 to October 15 under natural conditions.

Appendix B: T1BSR and TOD2RN/TCD2RN Results

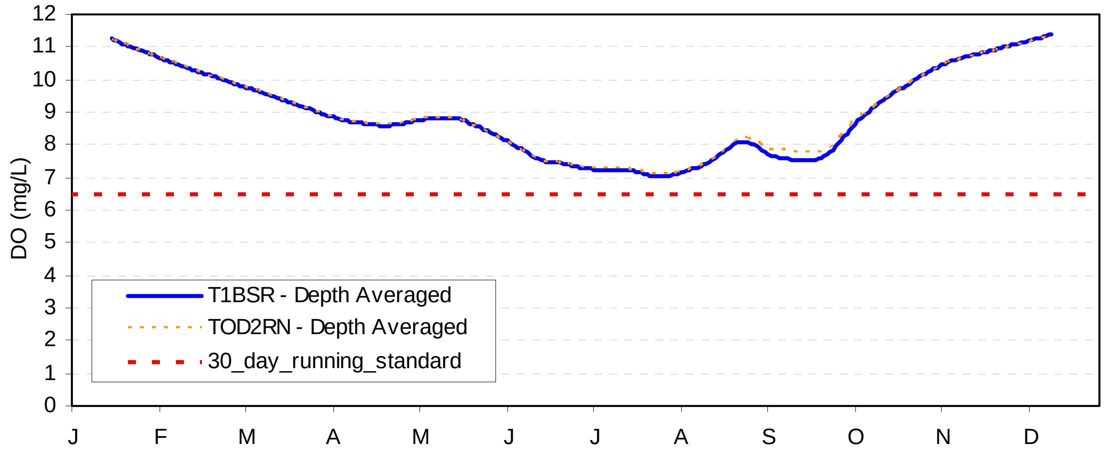
Klamath Falls STP

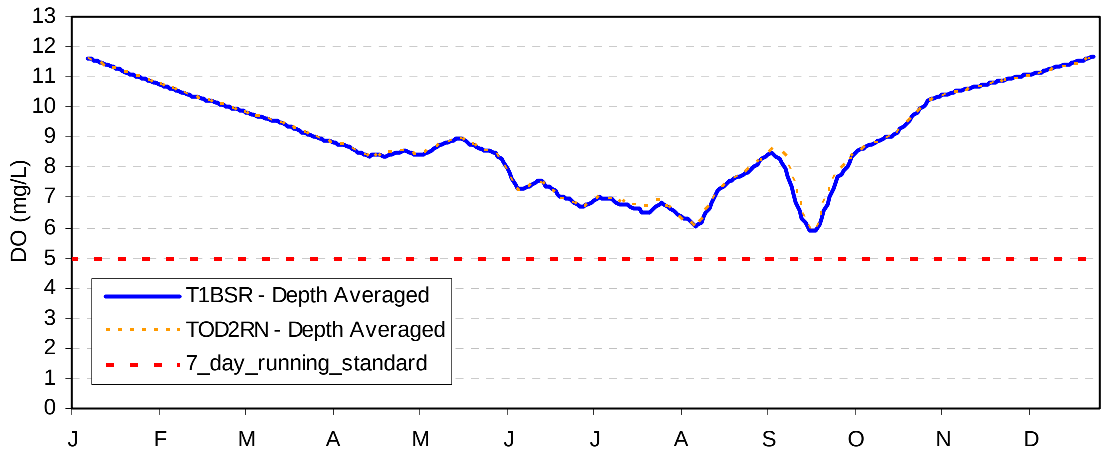


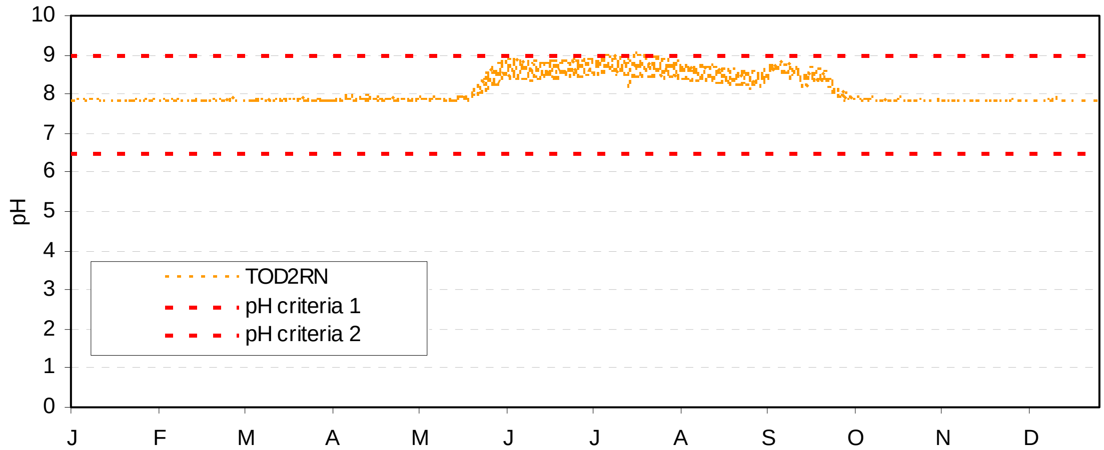




Klamath Falls STP







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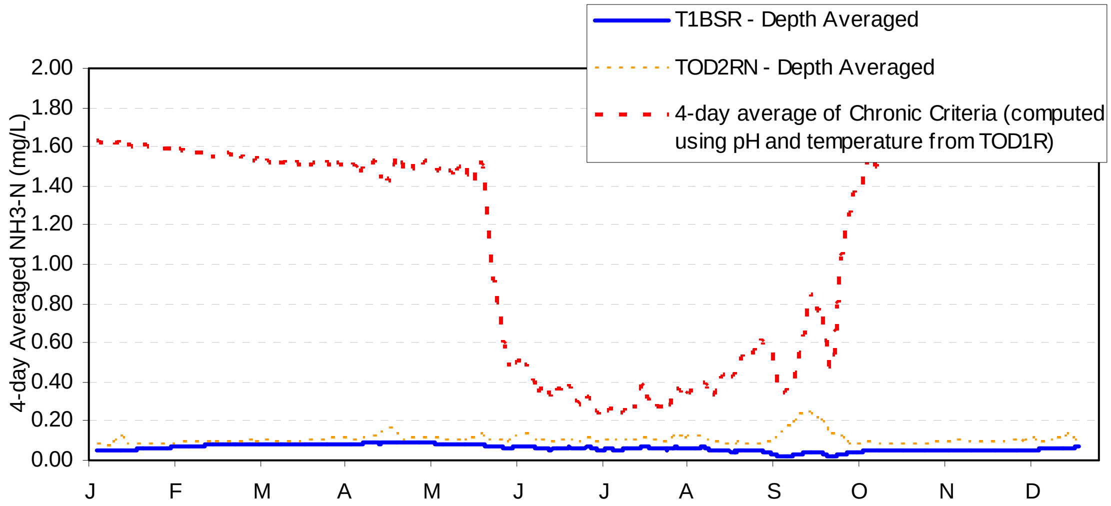

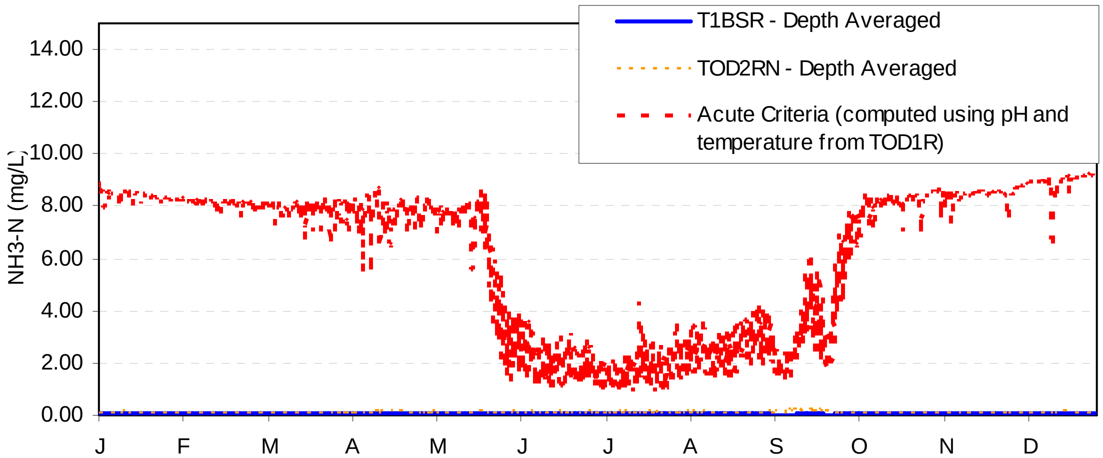

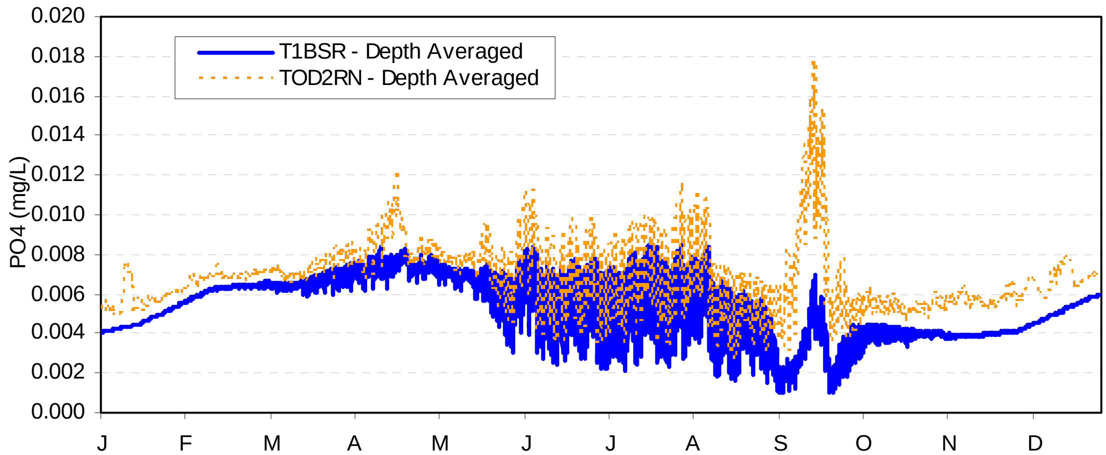

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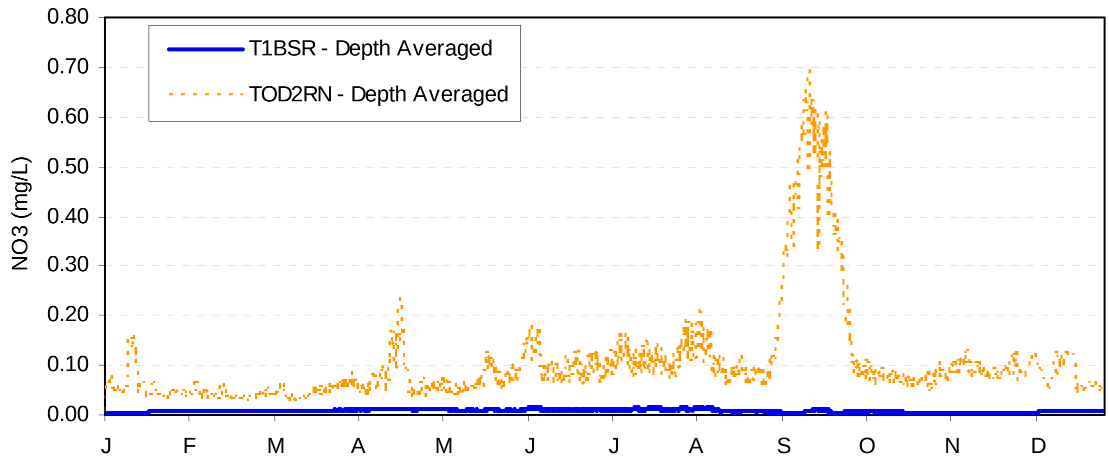

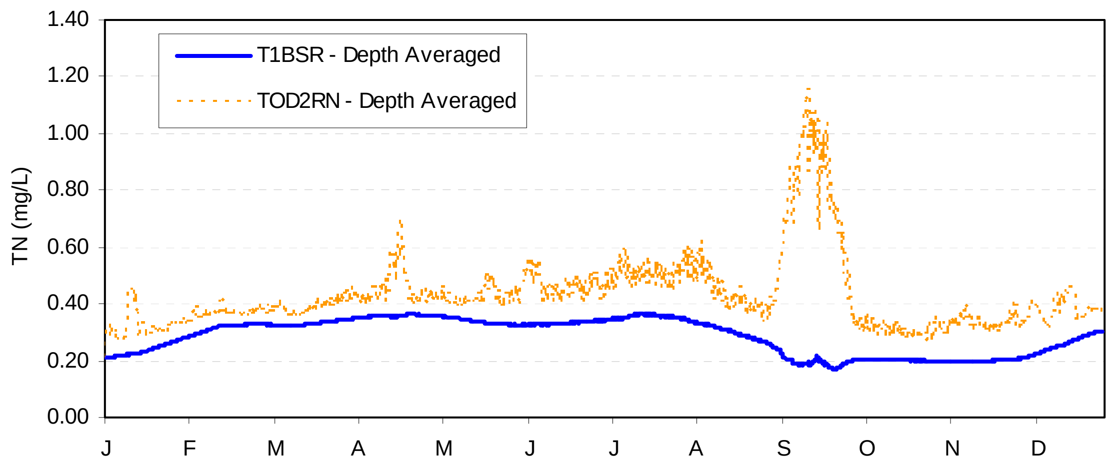

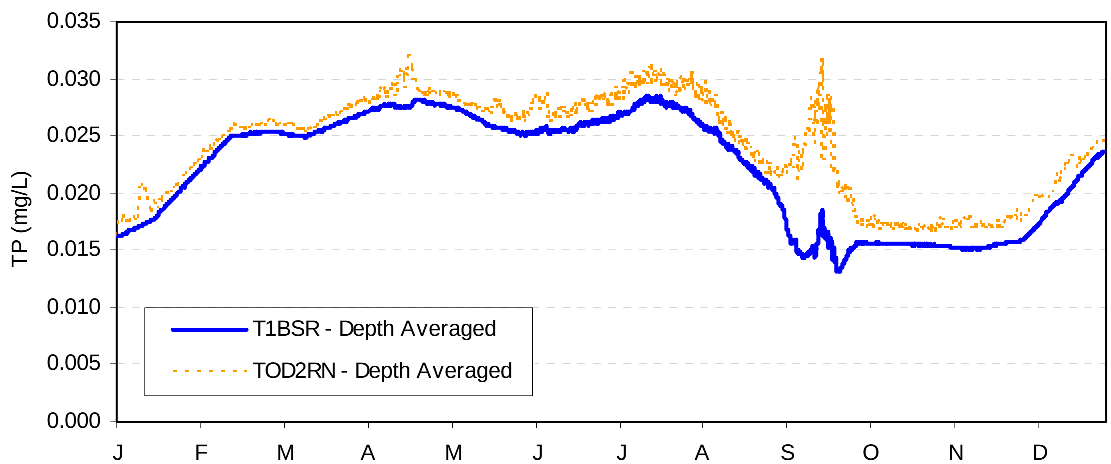

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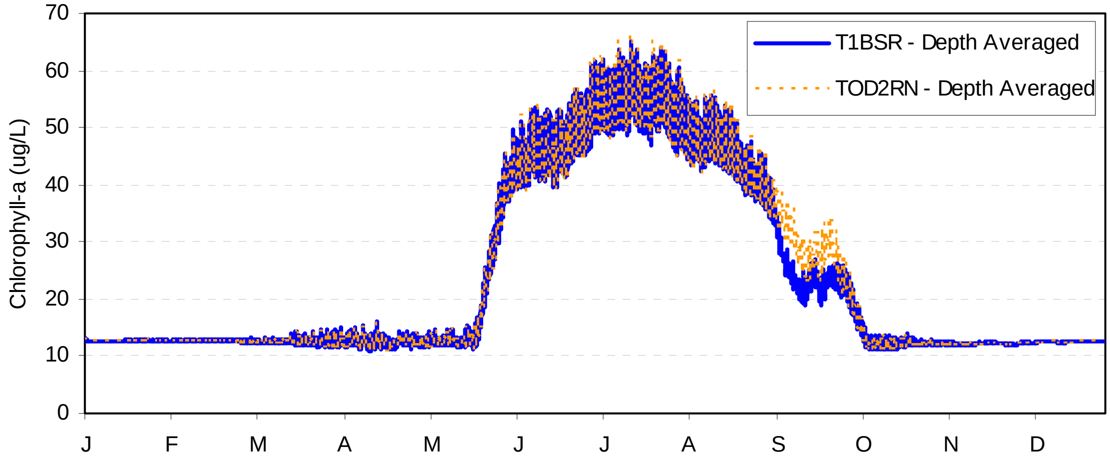
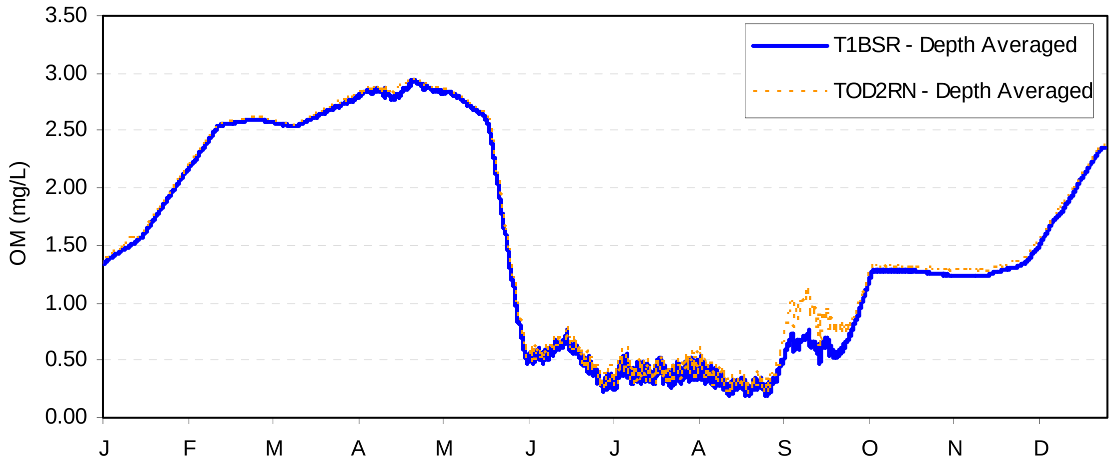
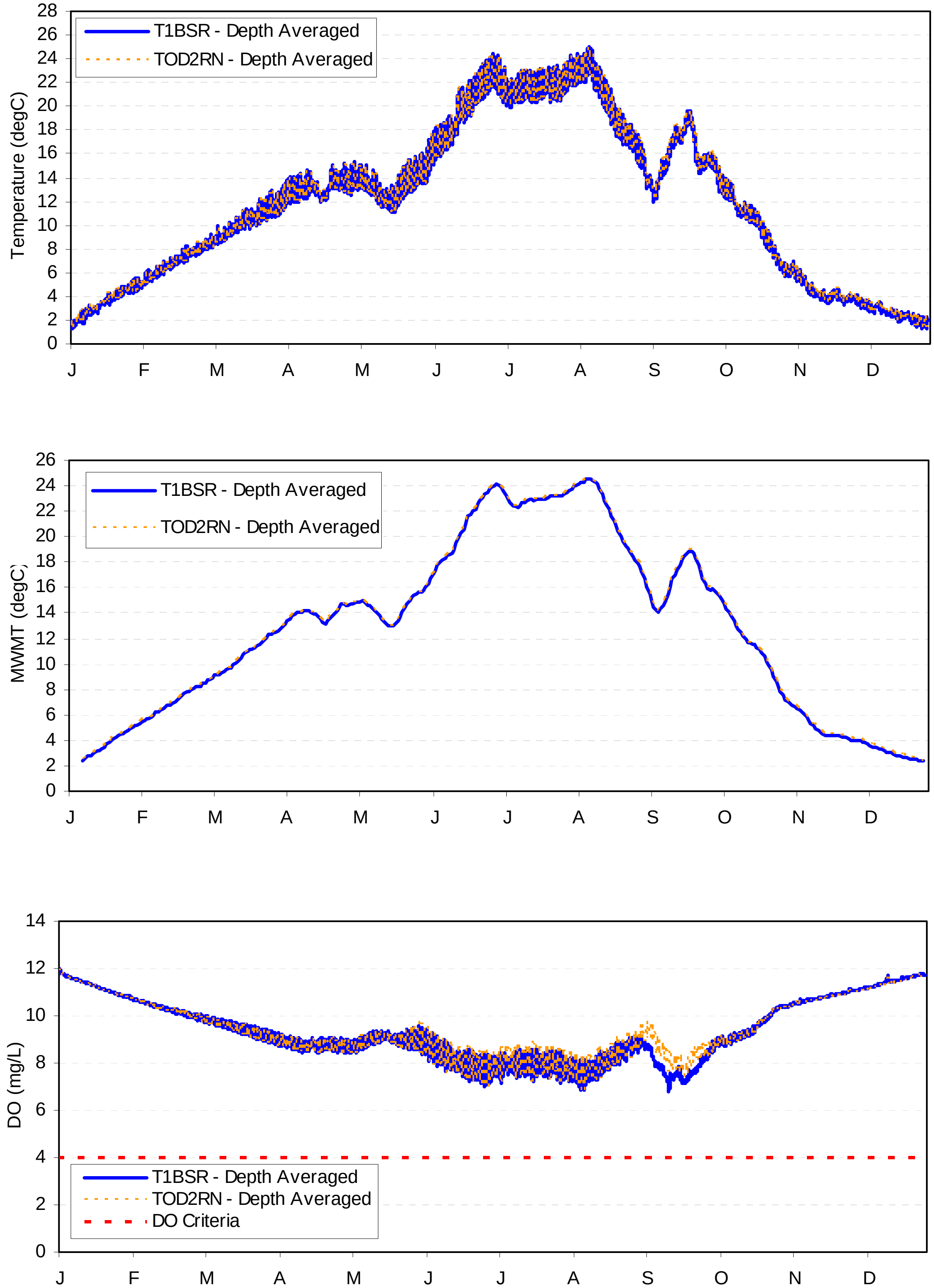
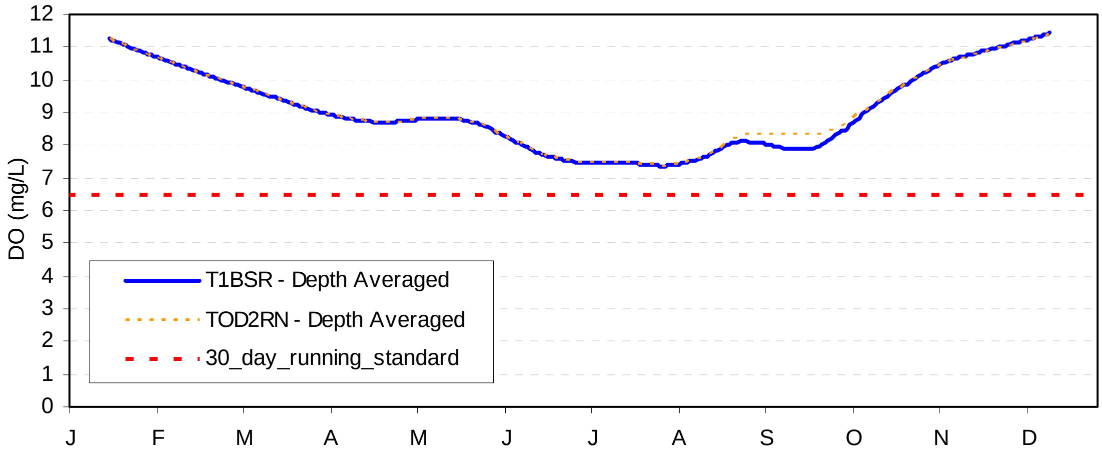


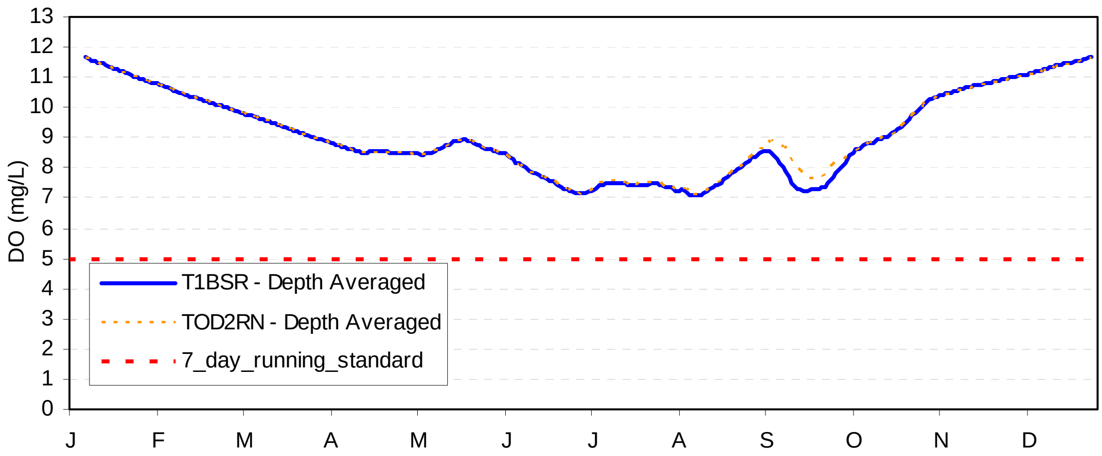


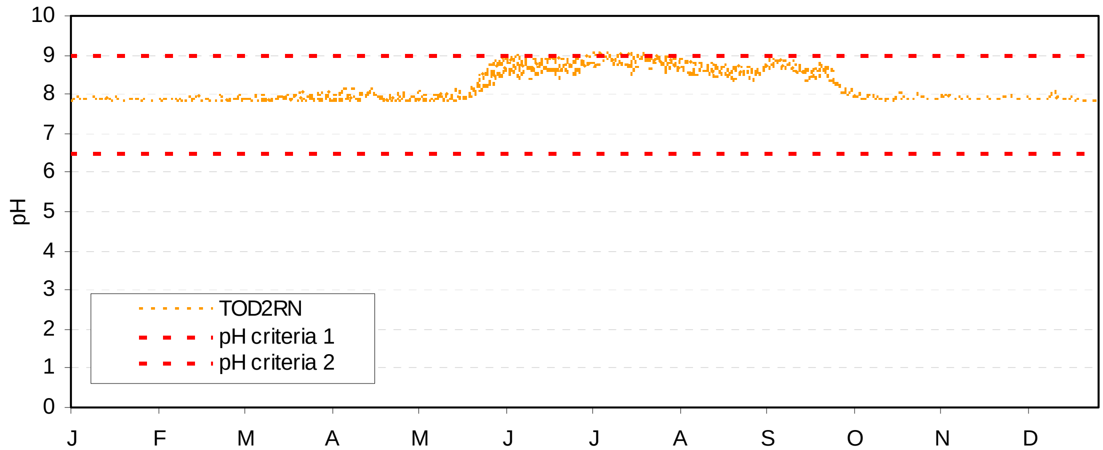
South Suburban Sanitary



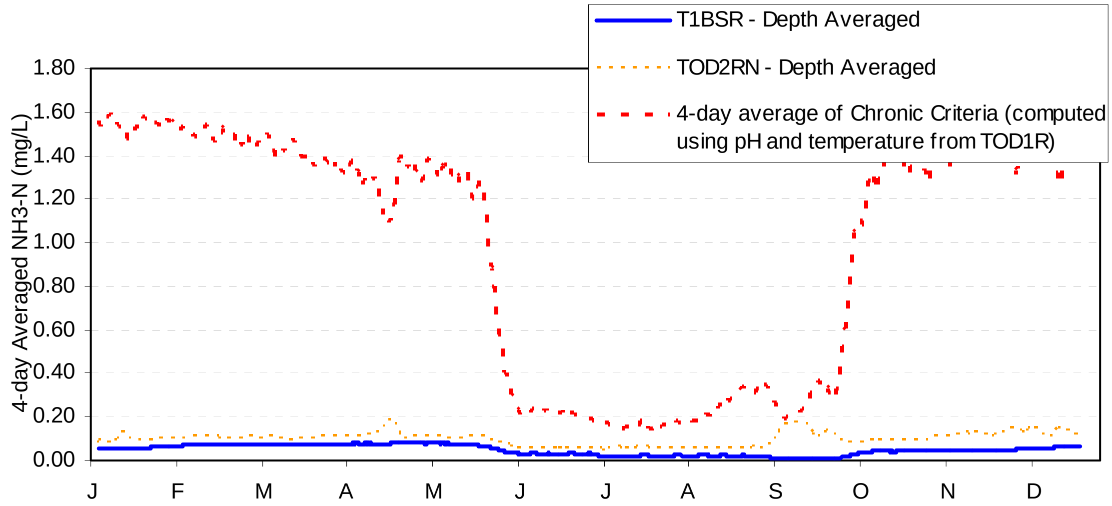
South Suburban Sanitary

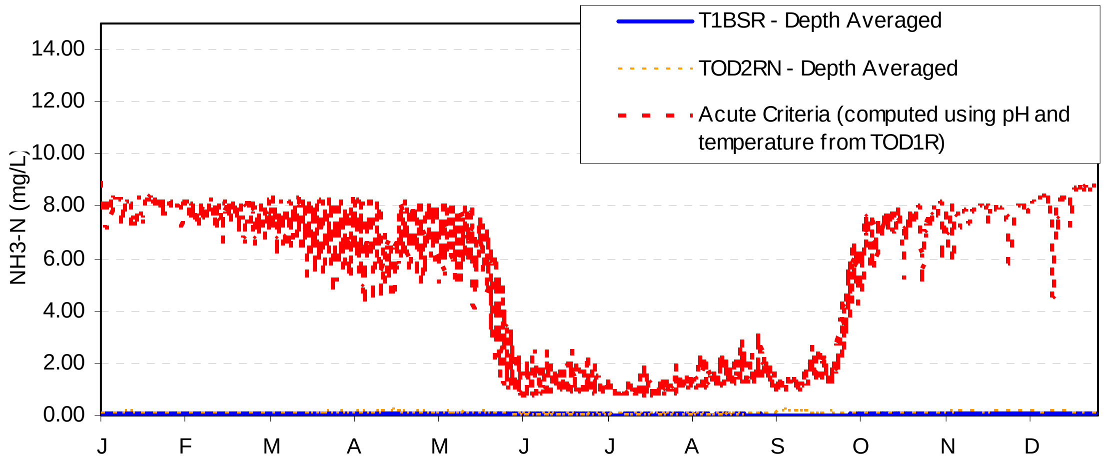


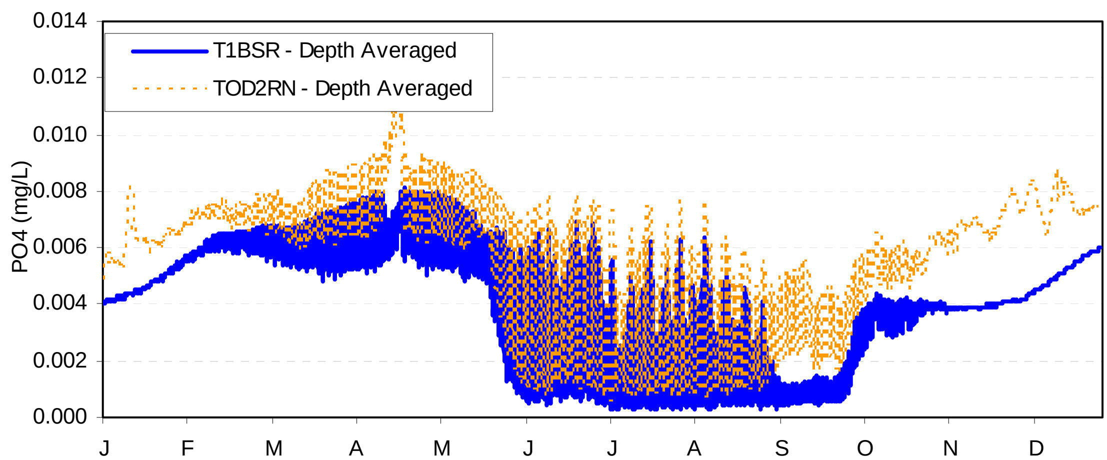




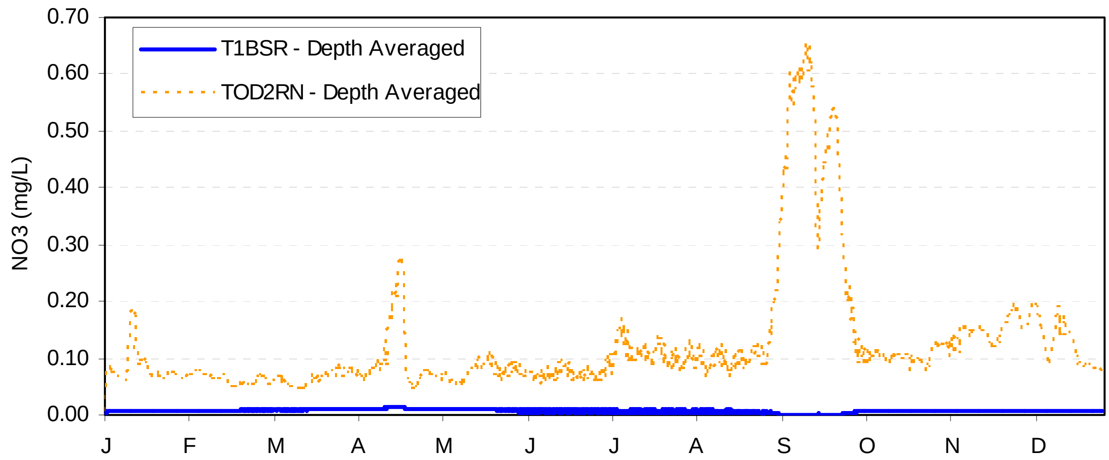
South Suburban Sanitary

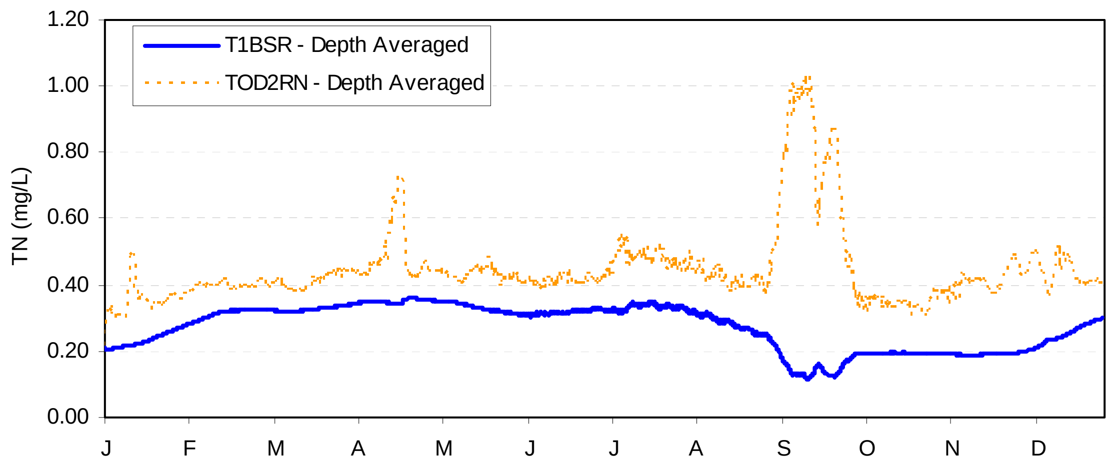


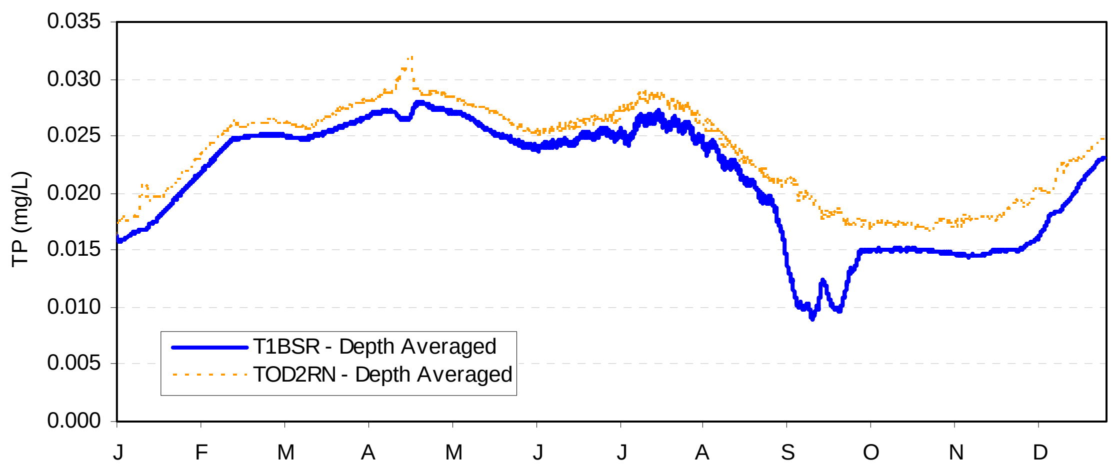




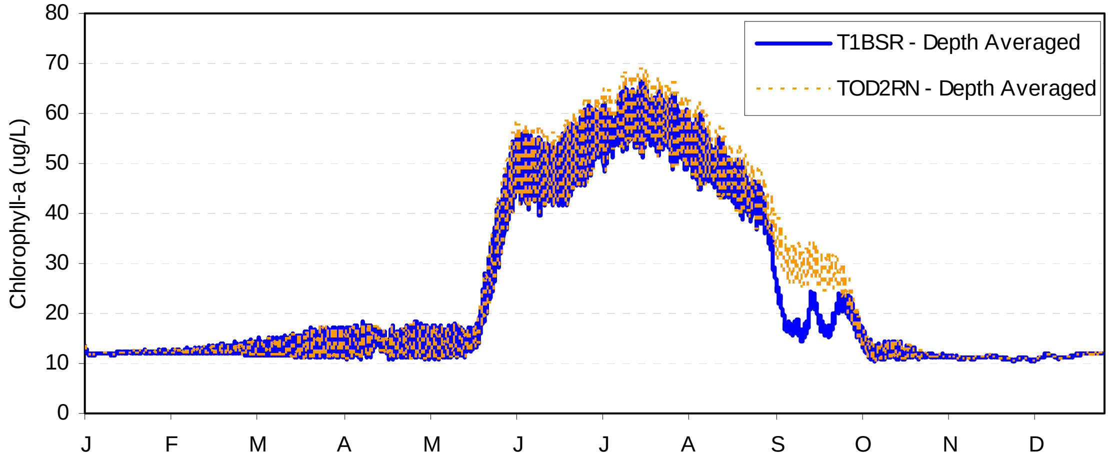
South Suburban Sanitary

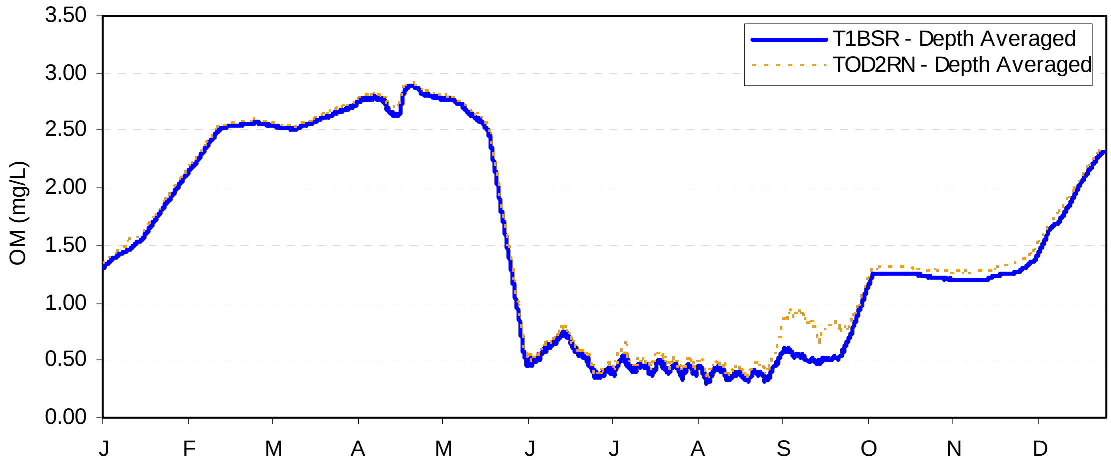




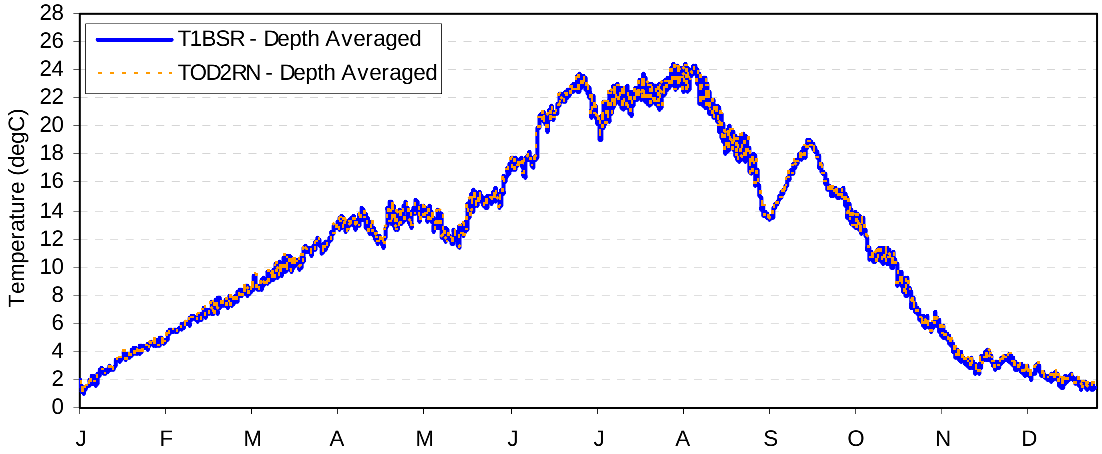


South Suburban Sanitary

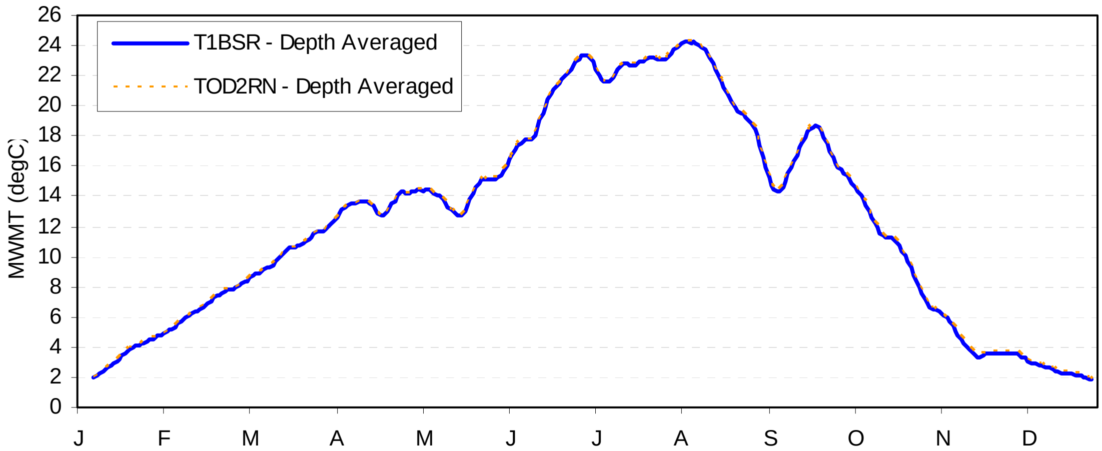




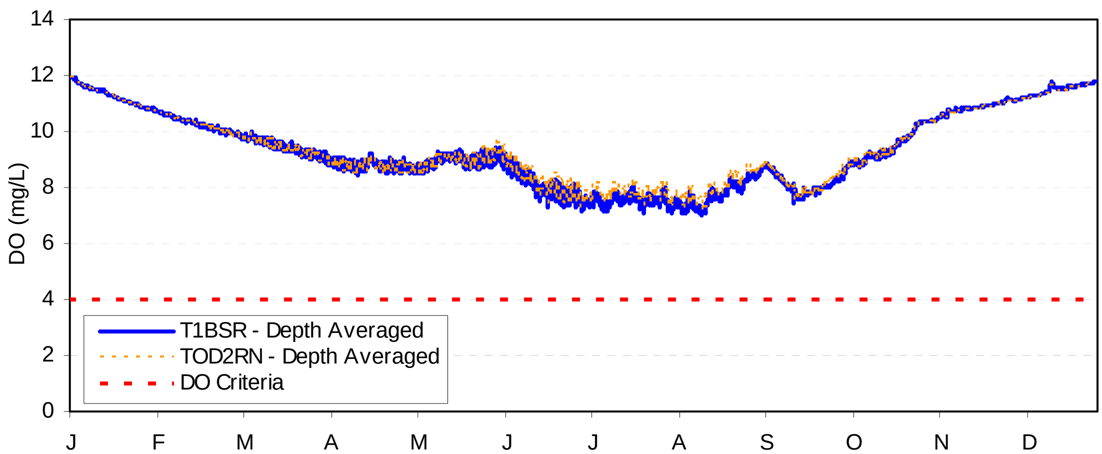
LRDC - CP



T1BSR - Depth Averaged
TOD2RN - Depth Averaged
Temperature (degC)
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28
J F M A M J J A S O N D

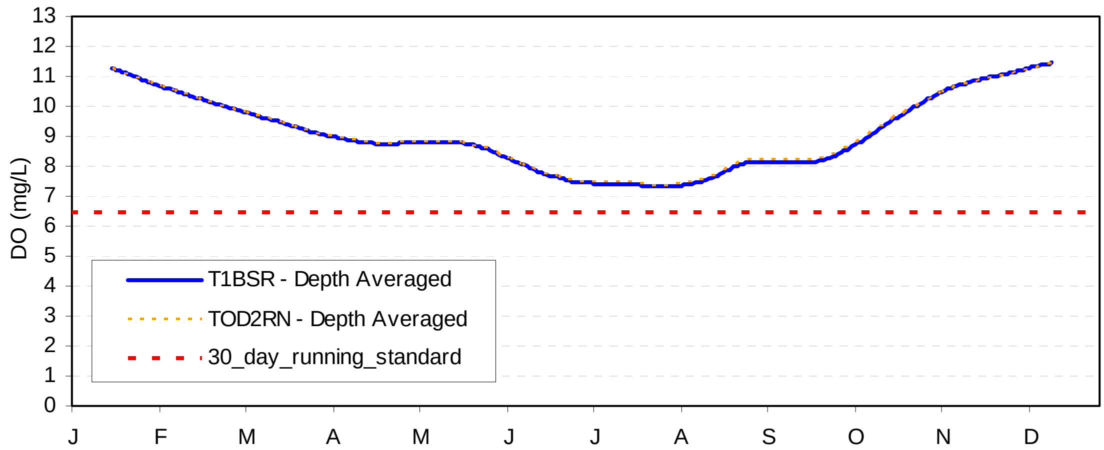


T1BSR - Depth Averaged
TOD2RN - Depth Averaged
MWMT (degC)
0 2 4 6 8 10 12 14 16 18 20 22 24 26
J F M A M J J A S O N D

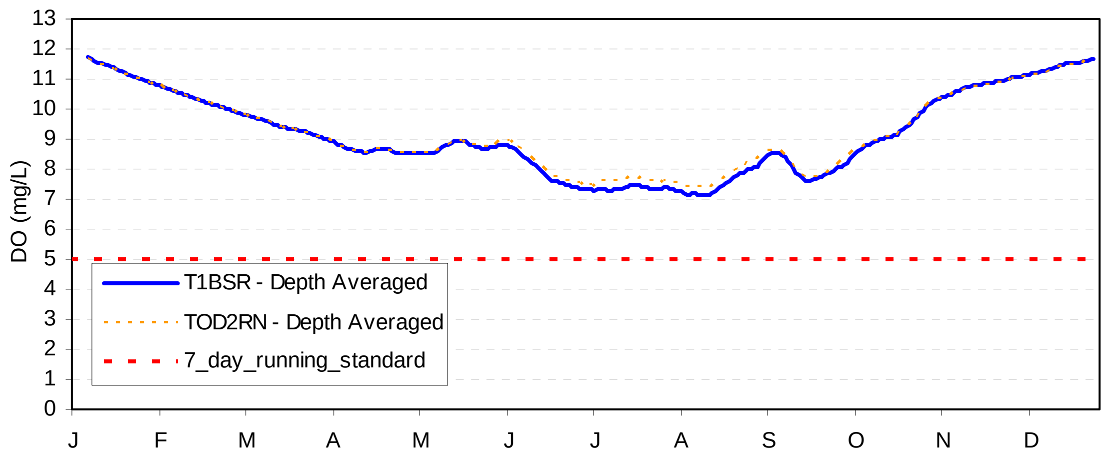


T1BSR - Depth Averaged
TOD2RN - Depth Averaged
DO Criteria
DO (mg/L)
0 2 4 6 8 10 12 14
J F M A M J J A S O N D

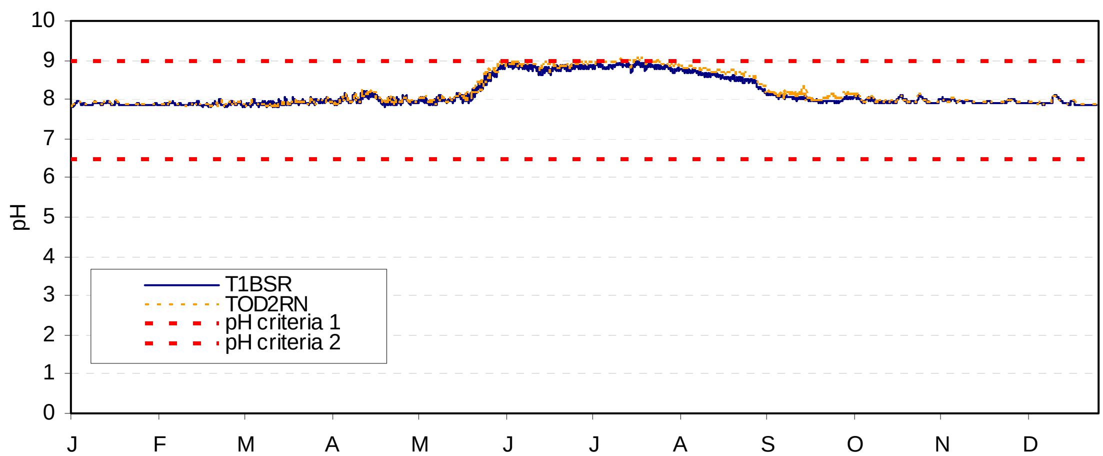
LRDC - CP



DO (mg/L)
13
12
11
10
9
8
7
6
5
4
3
2
1
0
J
F
M
A
M
J
J
A
S
O
N
D
T1BSR - Depth Averaged
TOD2RN - Depth Averaged
30_day_running_standard

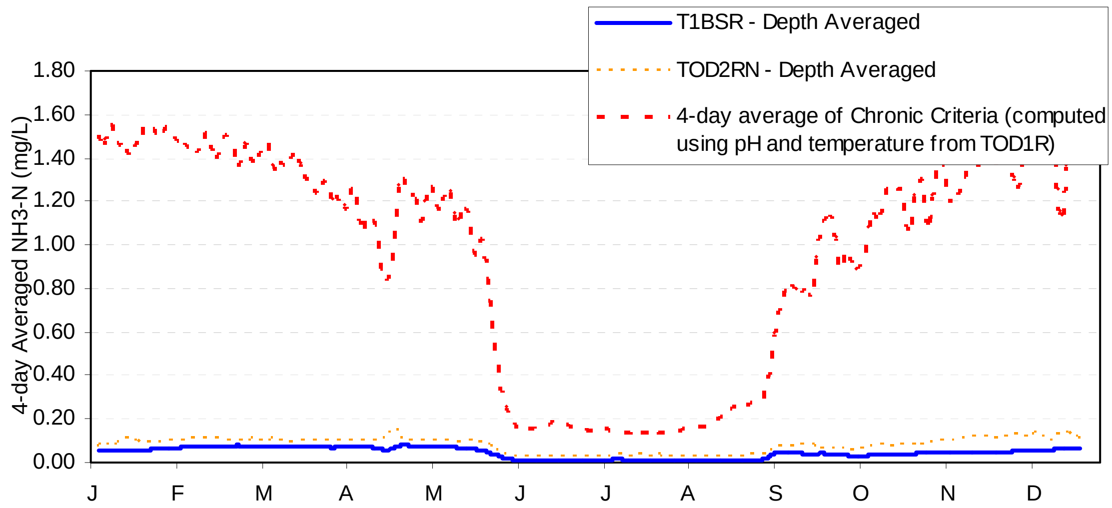


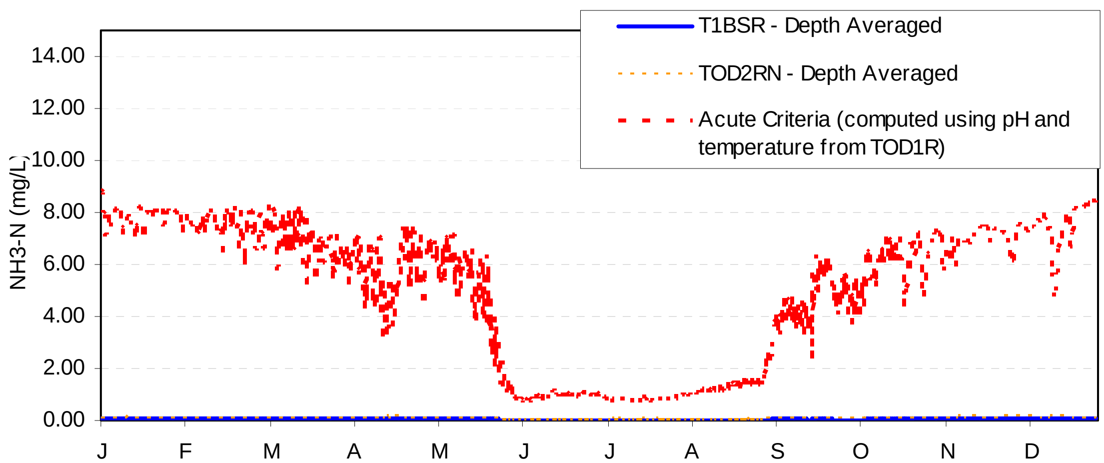
DO (mg/L)
13
12
11
10
9
8
7
6
5
4
3
2
1
0
J
F
M
A
M
J
J
A
S
O
N
D
T1BSR - Depth Averaged
TOD2RN - Depth Averaged
7_day_running_standard

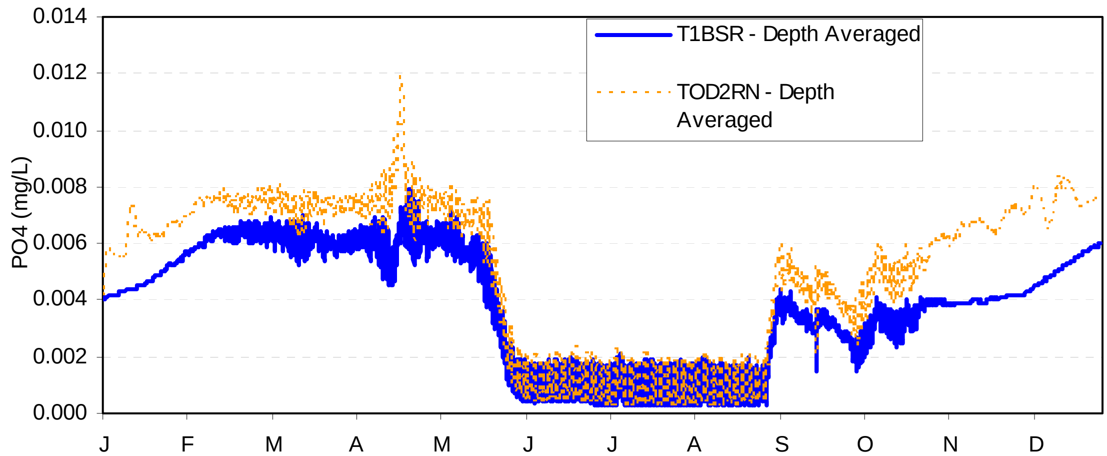


pH
10
9
8
7
6
5
4
3
2
1
0
J
F
M
A
M
J
J
A
S
O
N
D
T1BSR
TOD2RN
pH criteria 1
pH criteria 2

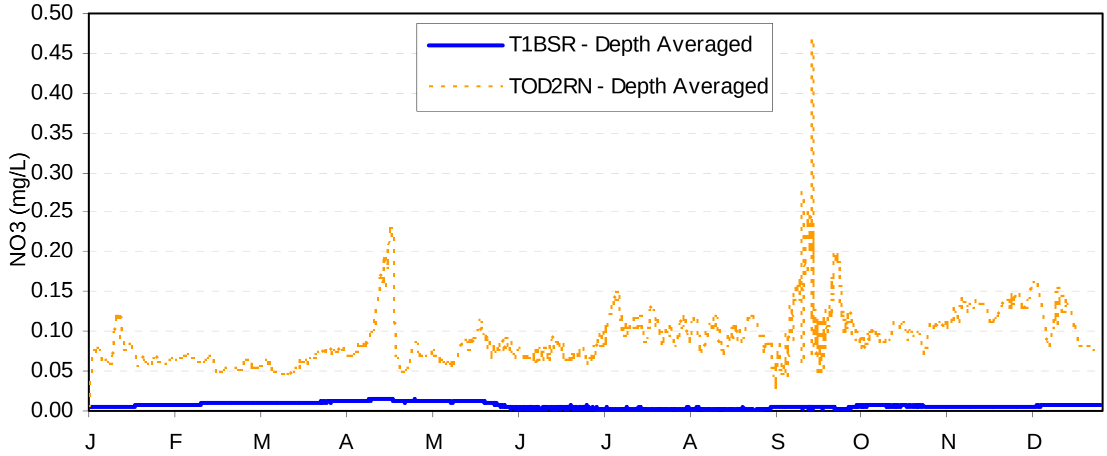
LRDC - CP

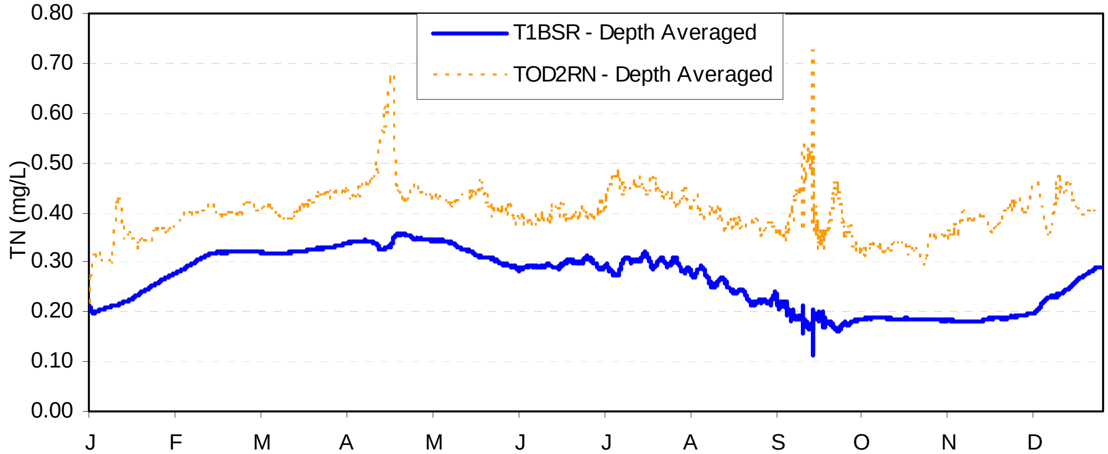

T1BSR - Depth Averaged
TOD2RN - Depth Averaged
4-day average of Chronic Criteria (computed using pH and temperature from TOD1R)
4-day Averaged NH3-N (mg/L)
1.80
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
J F M A M J J A S O N D

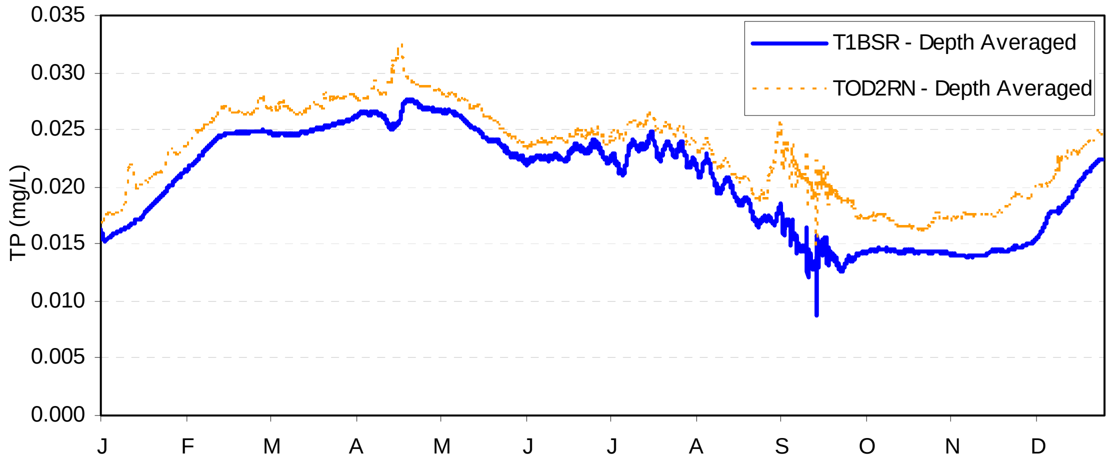

T1BSR - Depth Averaged
TOD2RN - Depth Averaged
Acute Criteria (computed using pH and temperature from TOD1R)
NH3-N (mg/L)
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
J F M A M J J A S O N D


T1BSR - Depth Averaged
TOD2RN - Depth Averaged
PO4 (mg/L)
0.014
0.012
0.010
0.008
0.006
0.004
0.002
0.000
J F M A M J J A S O N D

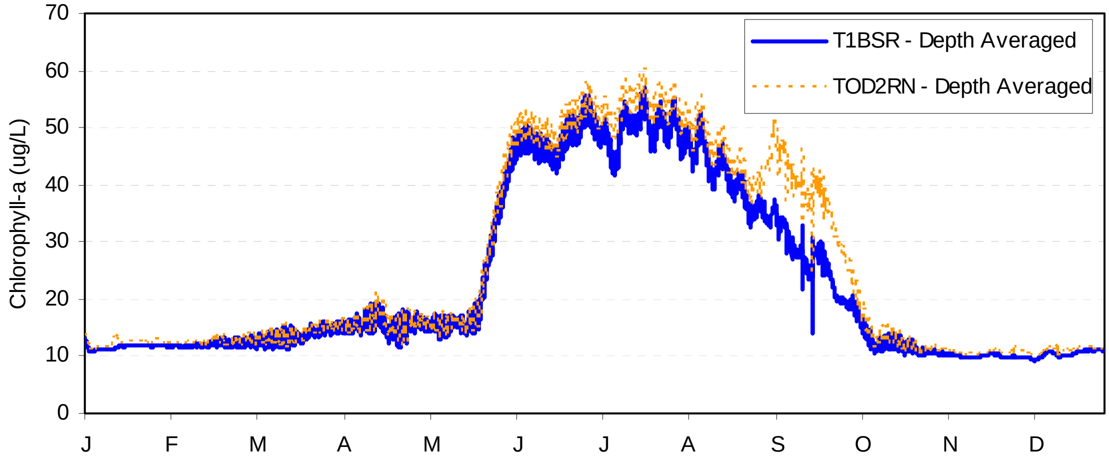
LRDC - CP


0.50
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
NO3 (mg/L)
T1BSR - Depth Averaged
TOD2RN - Depth Averaged
J
F
M
A
M
J
J
A
S
O
N
D

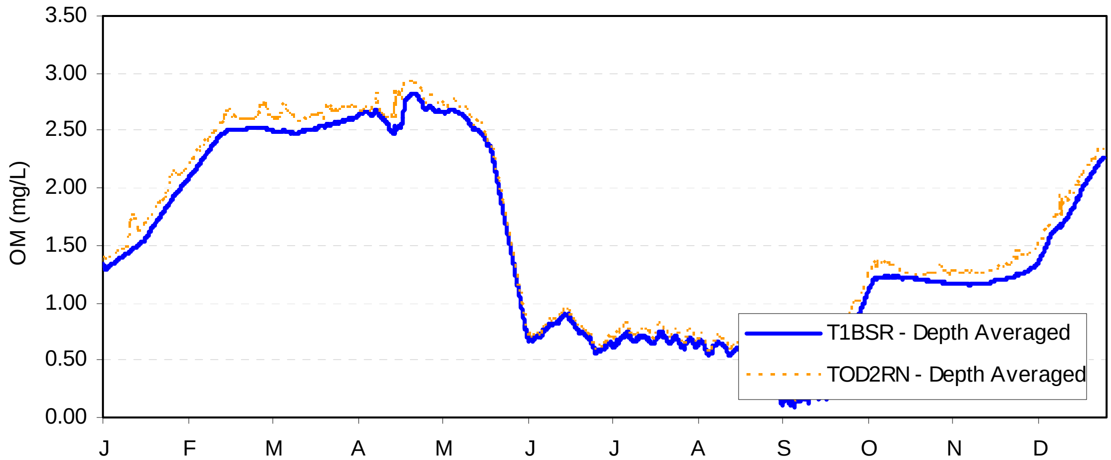

0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
TN (mg/L)
T1BSR - Depth Averaged
TOD2RN - Depth Averaged
J
F
M
A
M
J
J
A
S
O
N
D


0.035
0.030
0.025
0.020
0.015
0.010
0.005
0.000
TP (mg/L)
T1BSR - Depth Averaged
TOD2RN - Depth Averaged
J
F
M
A
M
J
J
A
S
O
N
D

LRDC - CP

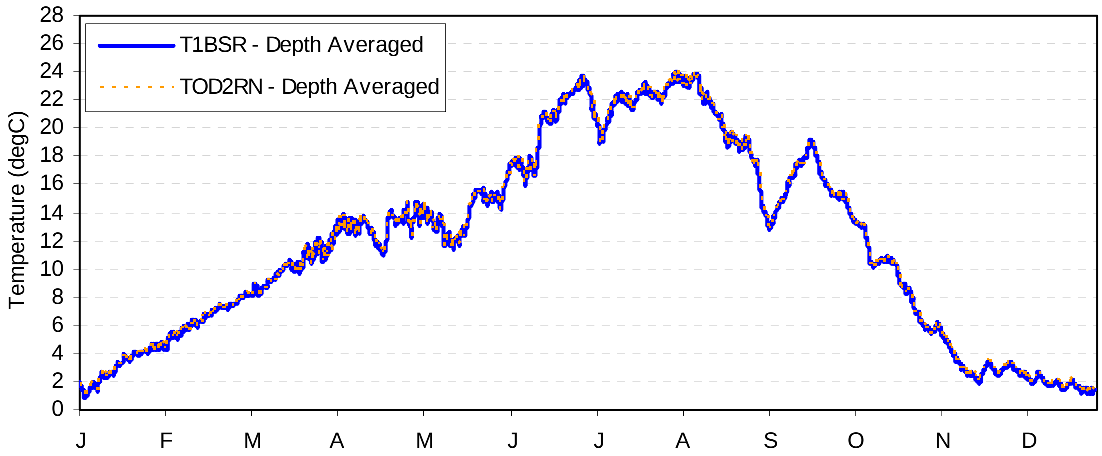


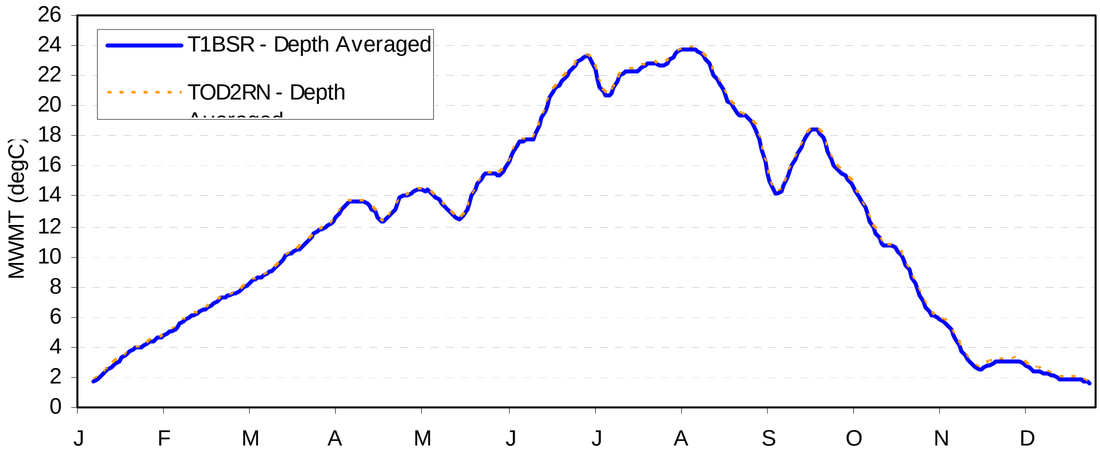
Chlorophyll-a (ug/L)
70
60
50
40
30
20
10
0
J
F
M
A
M
J
J
A
S
O
N
D
T1BSR - Depth Averaged
TOD2RN - Depth Averaged

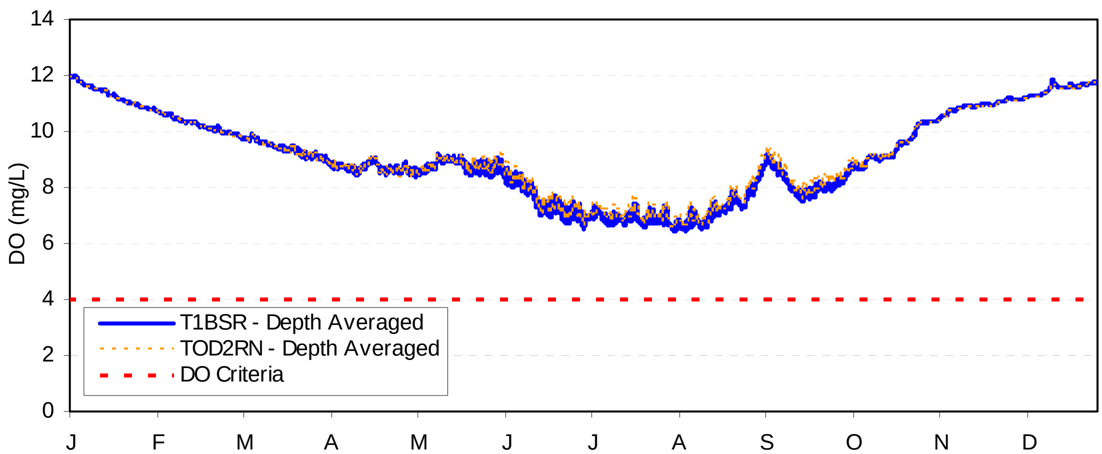


OM (mg/L)
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
J
F
M
A
M
J
J
A
S
O
N
D
T1BSR - Depth Averaged
TOD2RN - Depth Averaged

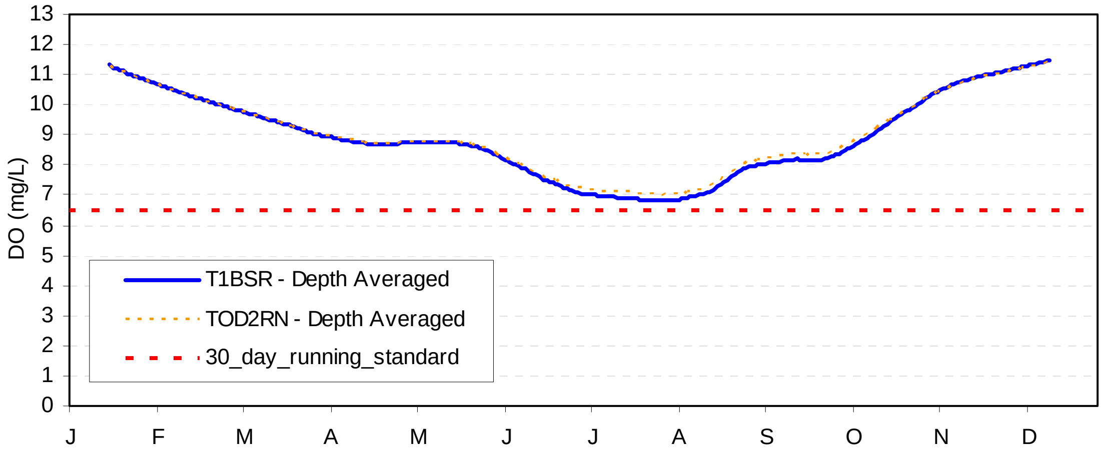
Miller Island

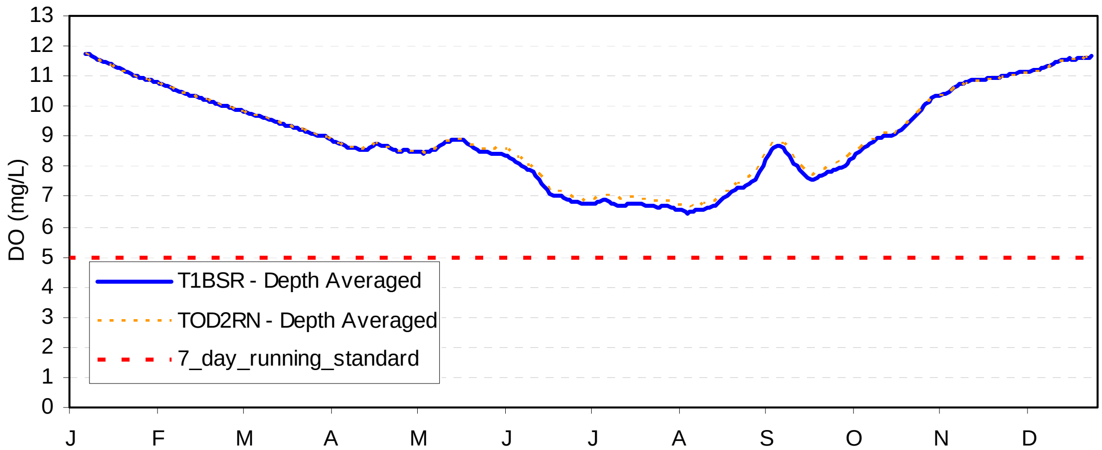


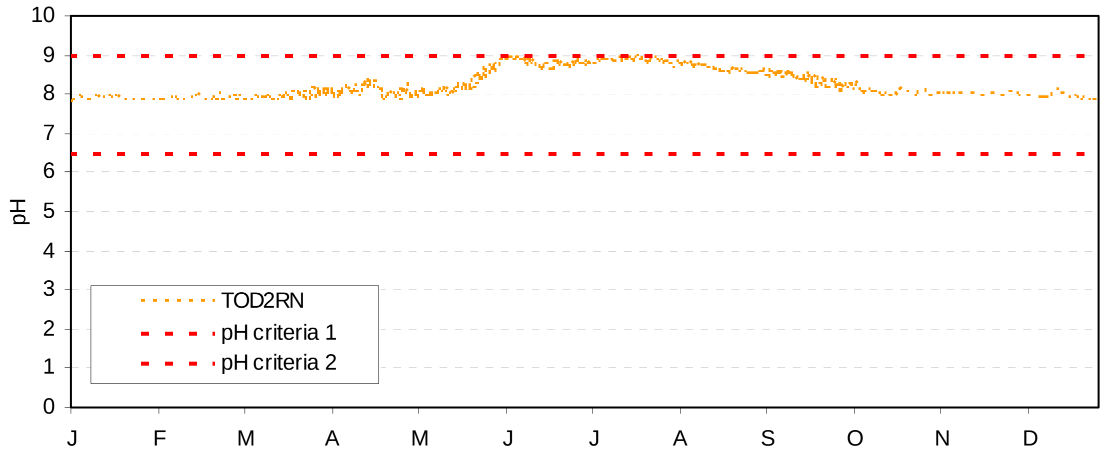




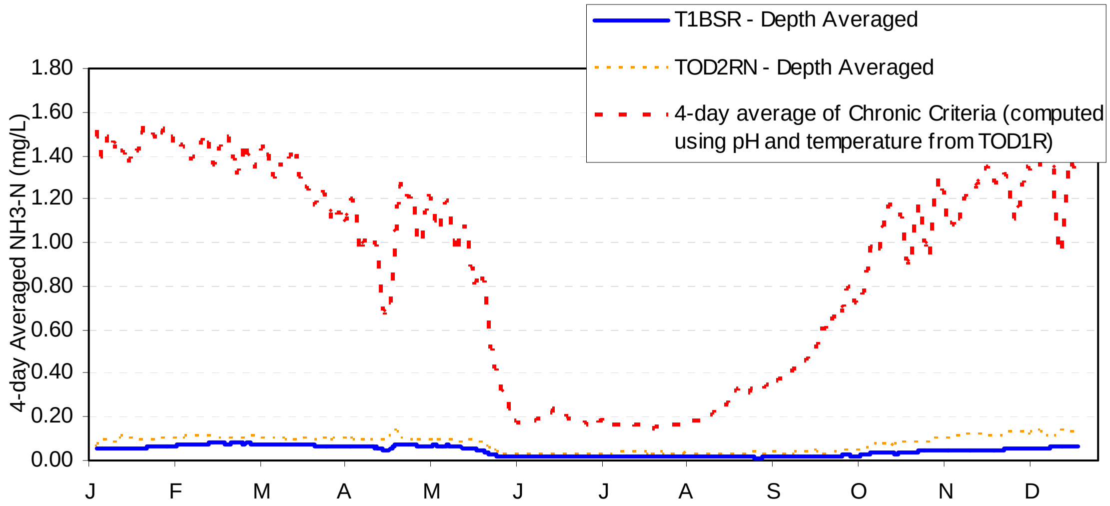
Miller Island

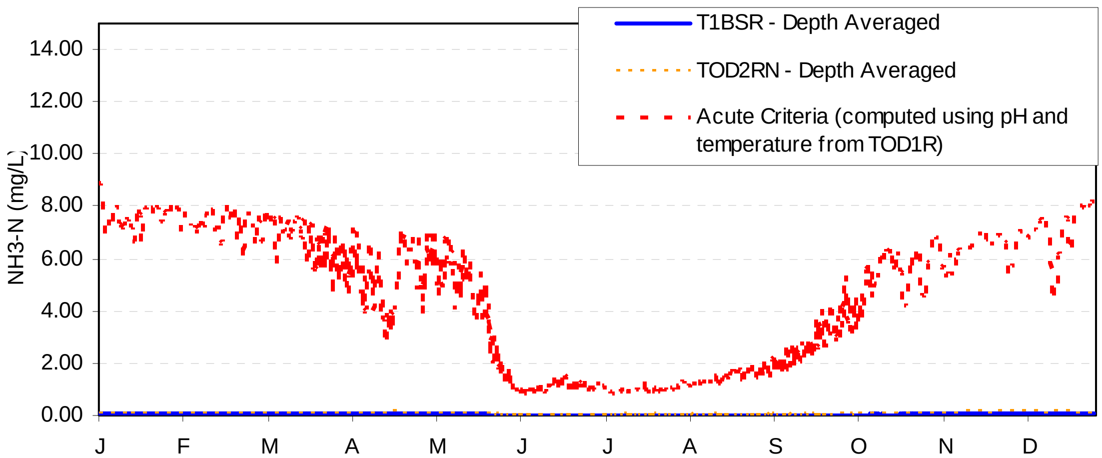


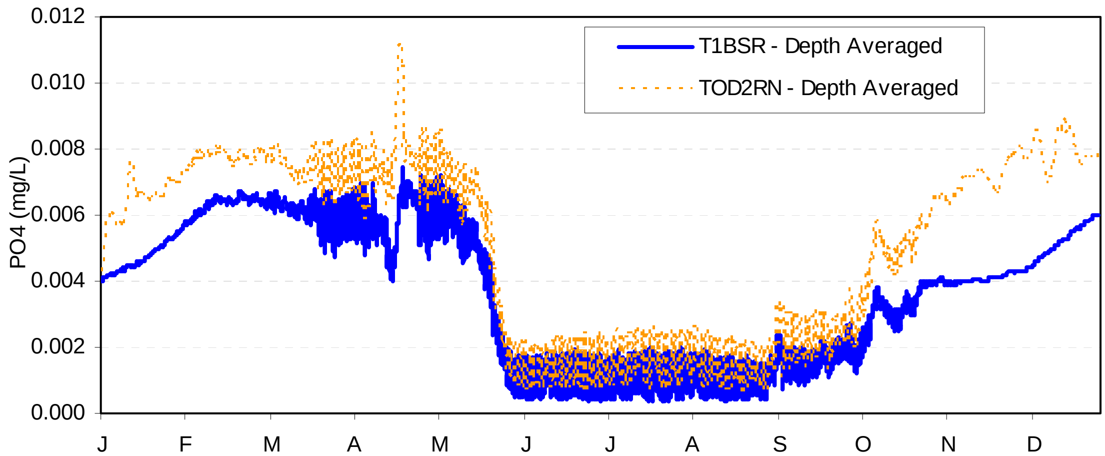




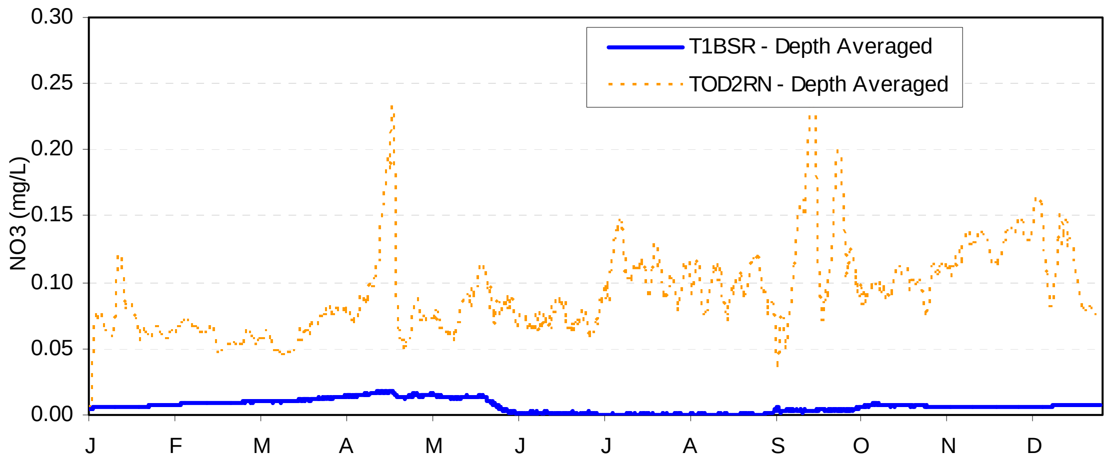
Miller Island

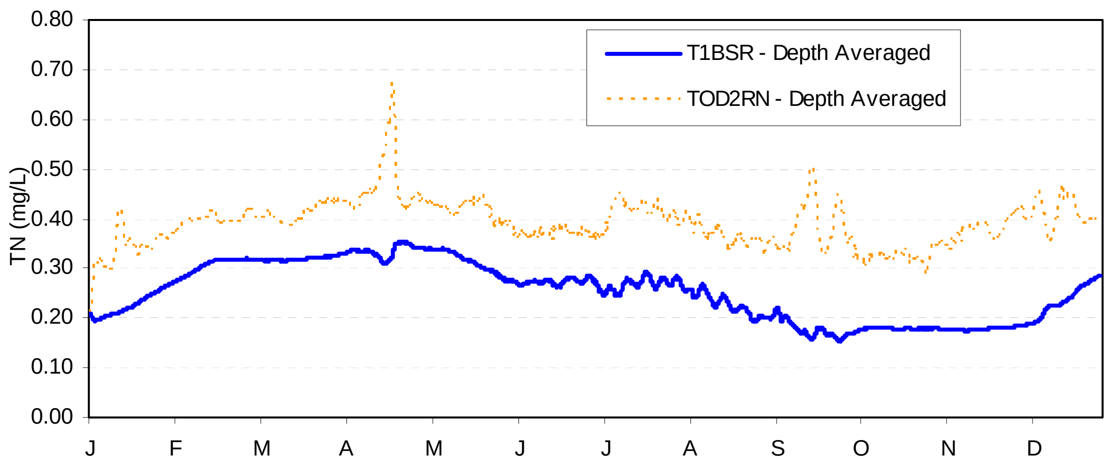


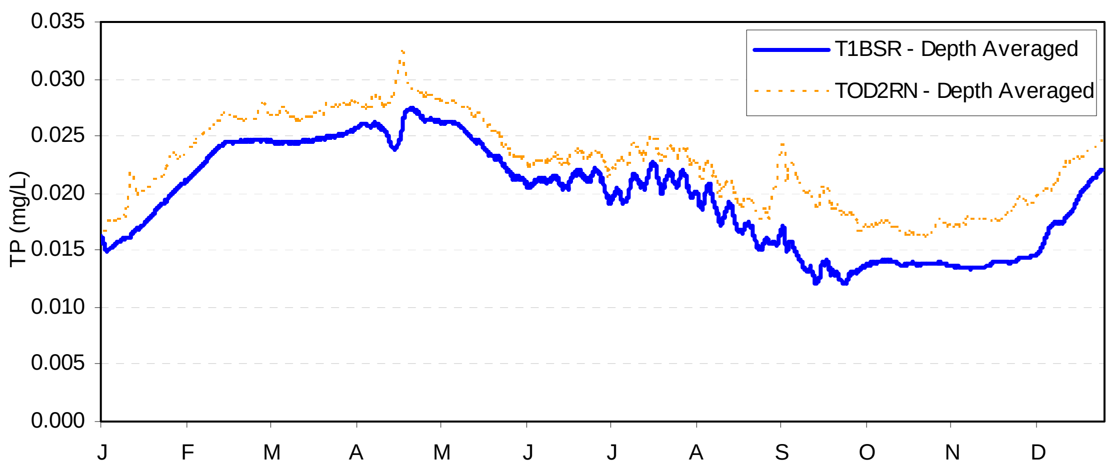




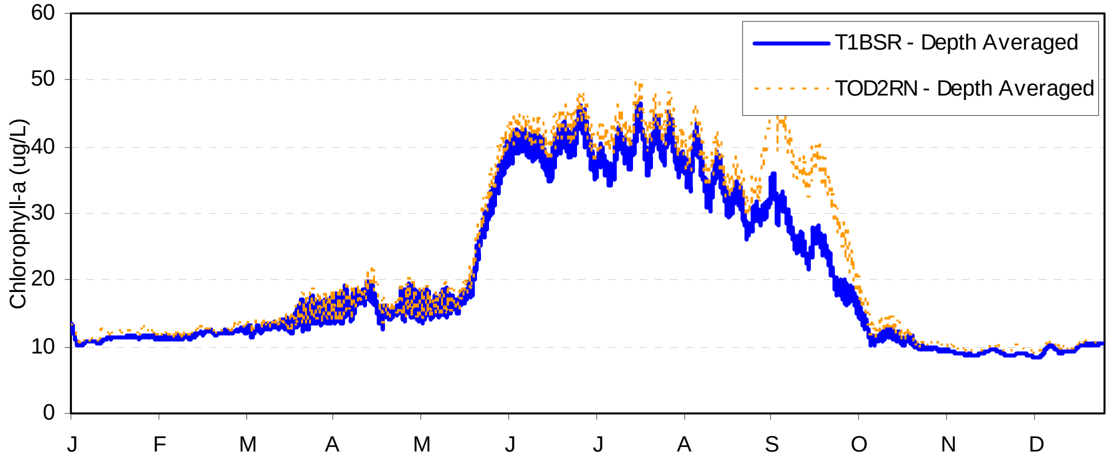
Miller Island

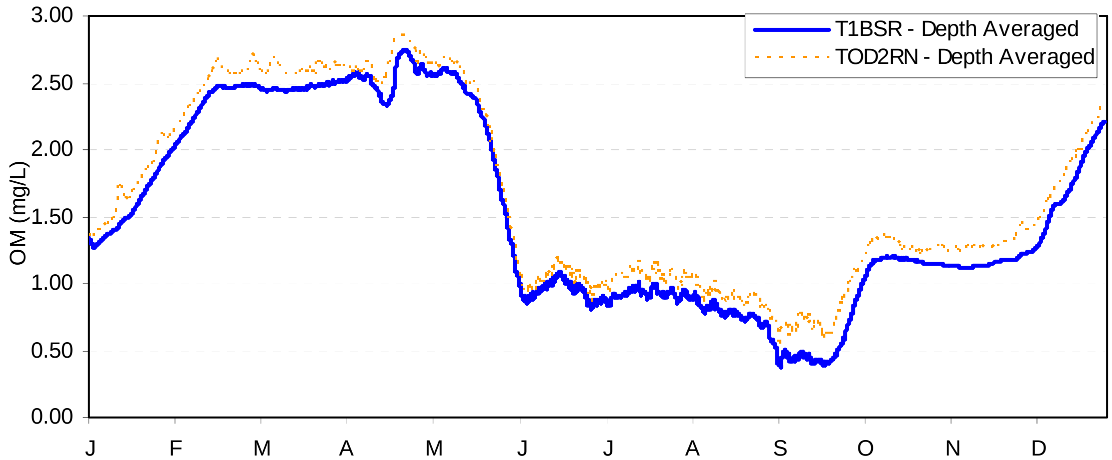




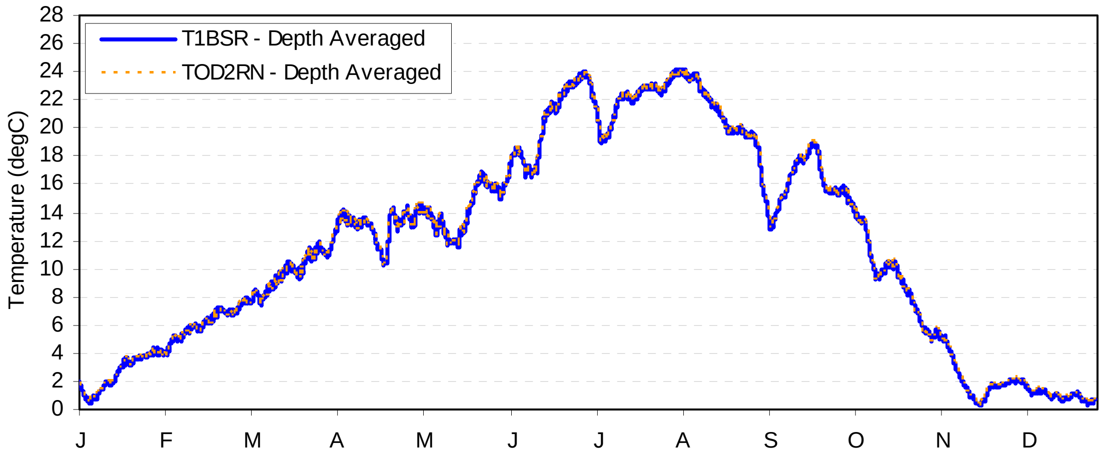


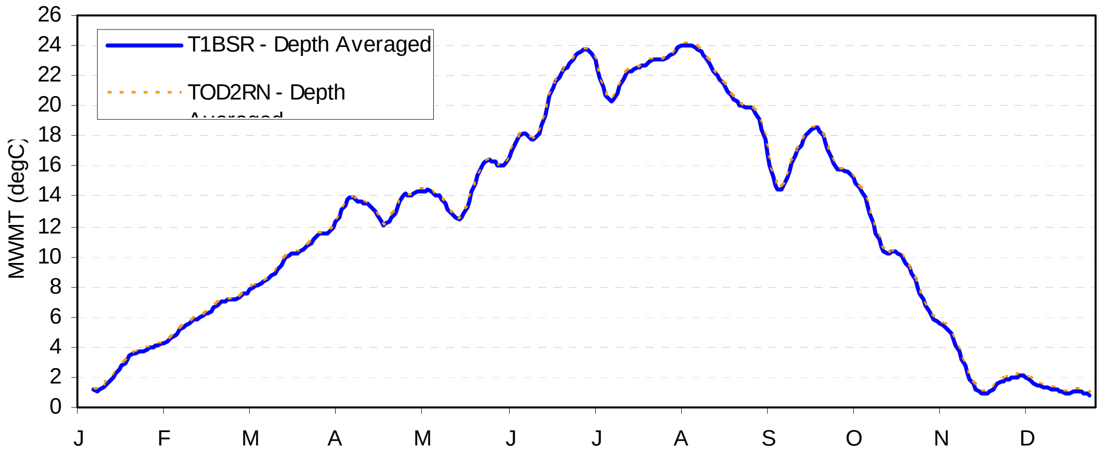
Miller Island

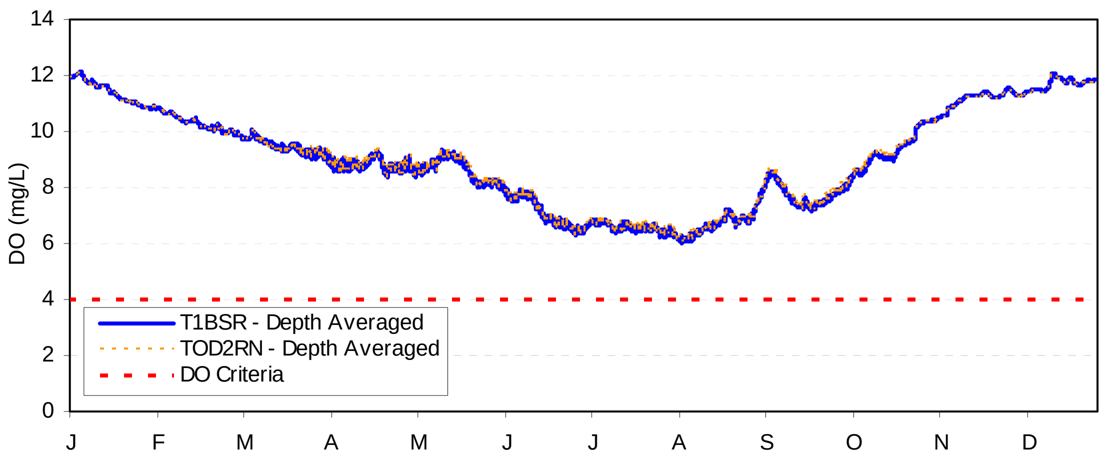




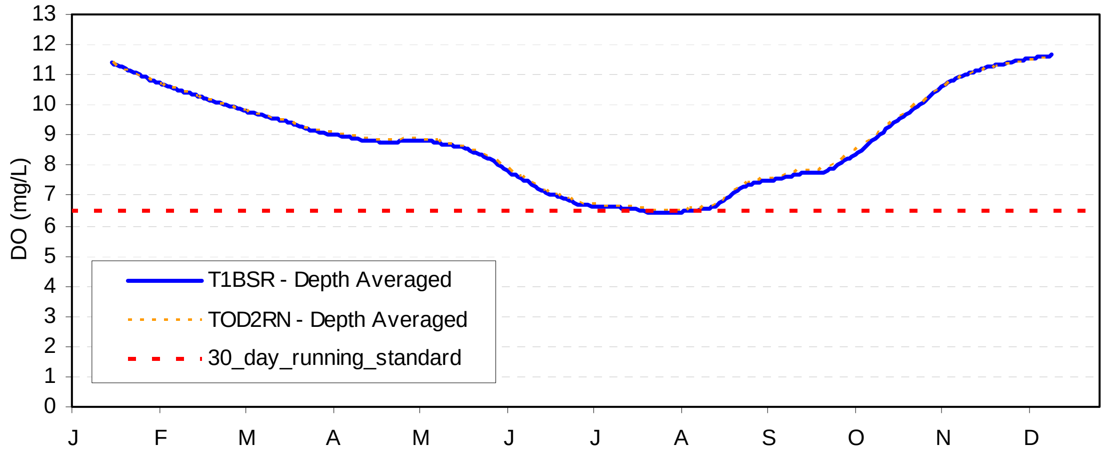
KSD


T1BSR - Depth Averaged
TOD2RN - Depth Averaged
Temperature (degC)
28
26
24
22
20
18
16
14
12
10
8
6
4
2
0
J
F
M
A
M
J
J
A
S
O
N
D

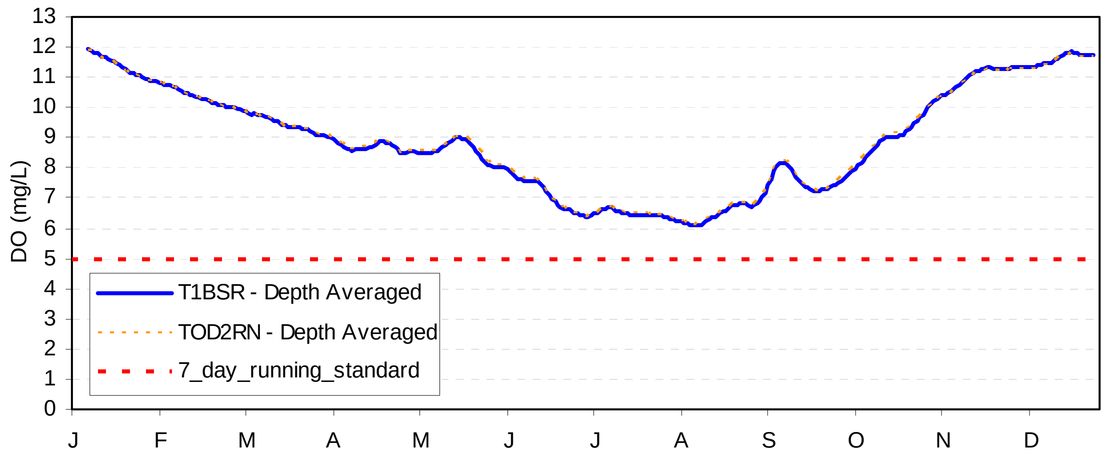

T1BSR - Depth Averaged
TOD2RN - Depth
MWMT (degC)
26
24
22
20
18
16
14
12
10
8
6
4
2
0
J
F
M
A
M
J
J
A
S
O
N
D


T1BSR - Depth Averaged
TOD2RN - Depth Averaged
DO Criteria
DO (mg/L)
14
12
10
8
6
4
2
0
J
F
M
A
M
J
J
A
S
O
N
D

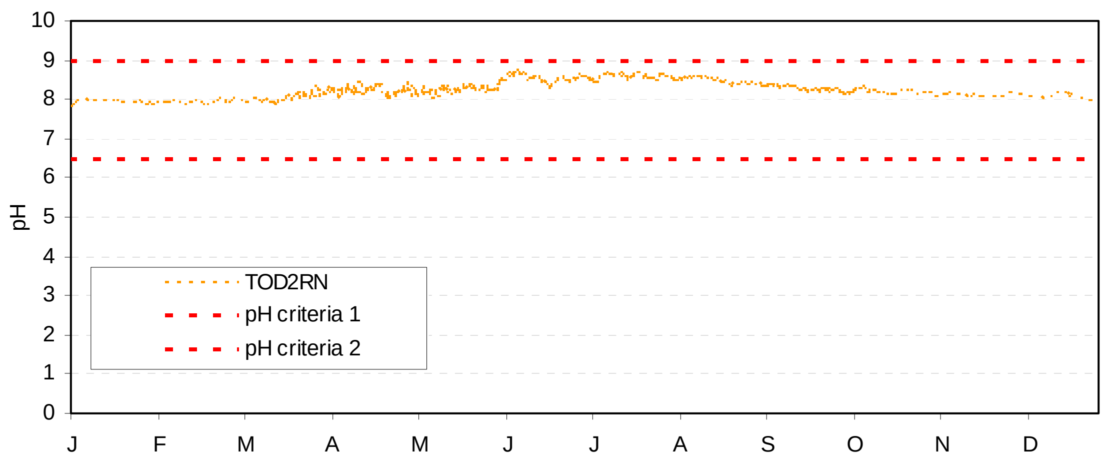
KSD



DO (mg/L)
13
12
11
10
9
8
7
6
5
4
3
2
1
0
T1BSR - Depth Averaged
TOD2RN - Depth Averaged
30_day_running_standard
J
F
M
A
M
J
J
A
S
O
N
D

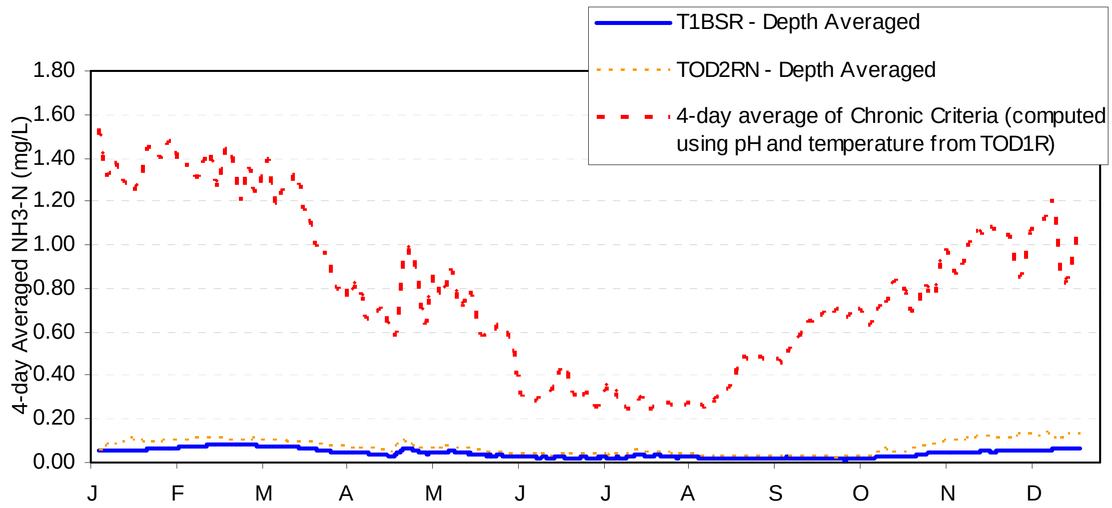


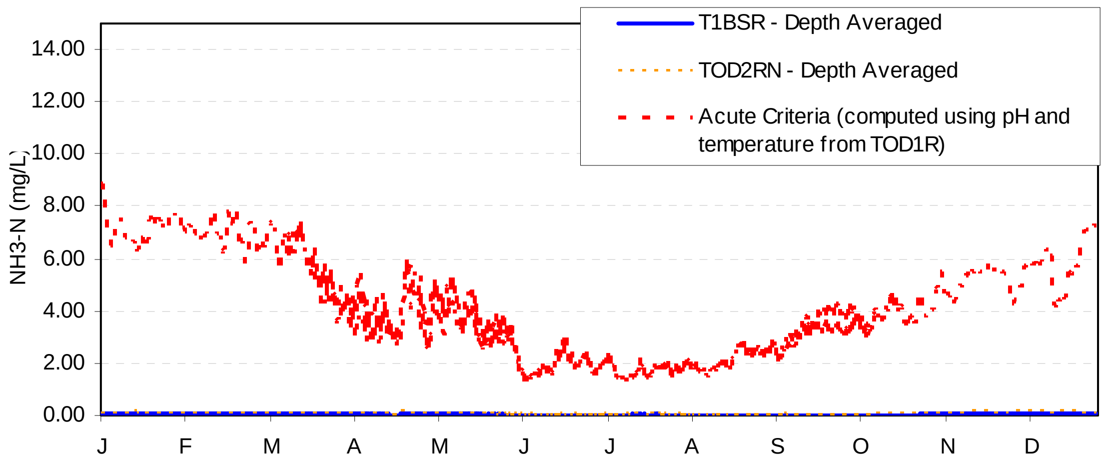
DO (mg/L)
13
12
11
10
9
8
7
6
5
4
3
2
1
0
T1BSR - Depth Averaged
TOD2RN - Depth Averaged
7_day_running_standard
J
F
M
A
M
J
J
A
S
O
N
D

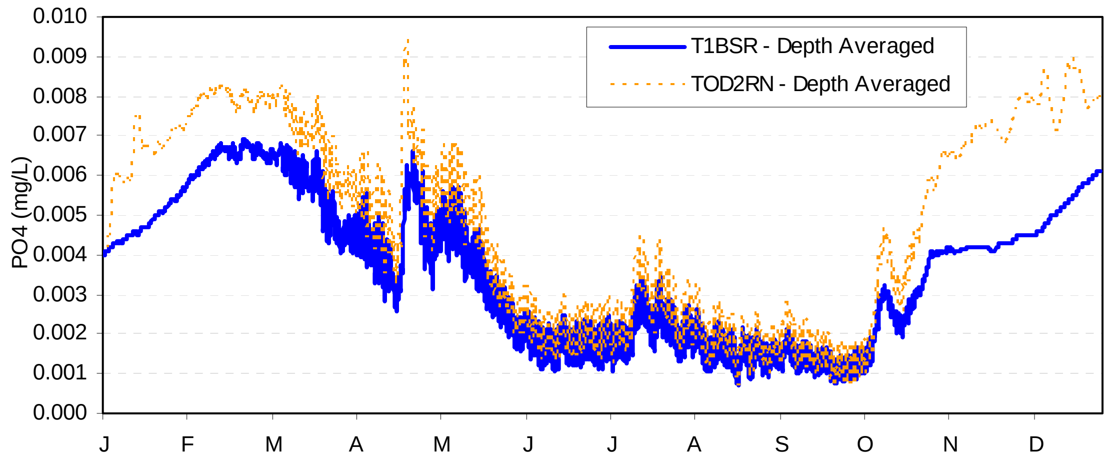


pH
10
9
8
7
6
5
4
3
2
1
0
TOD2RN
pH criteria 1
pH criteria 2
J
F
M
A
M
J
J
A
S
O
N
D

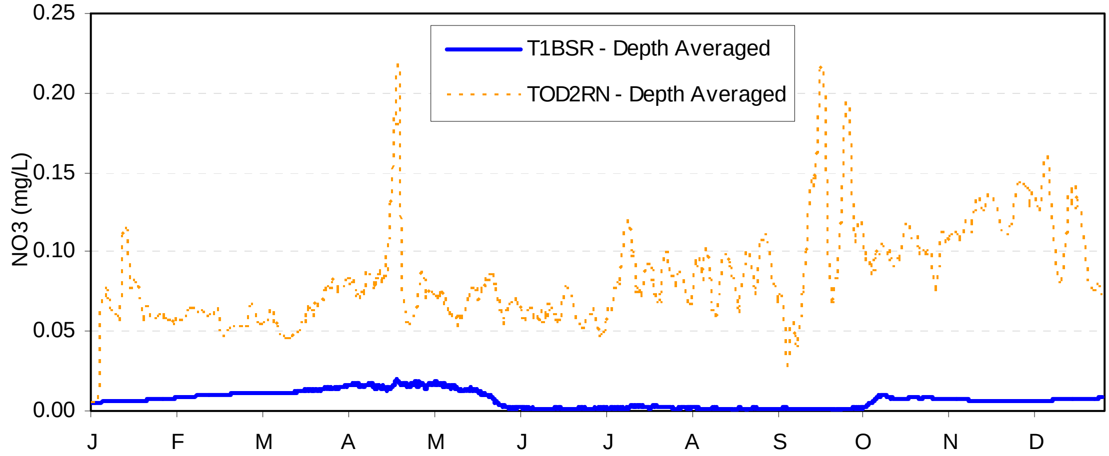
KSD

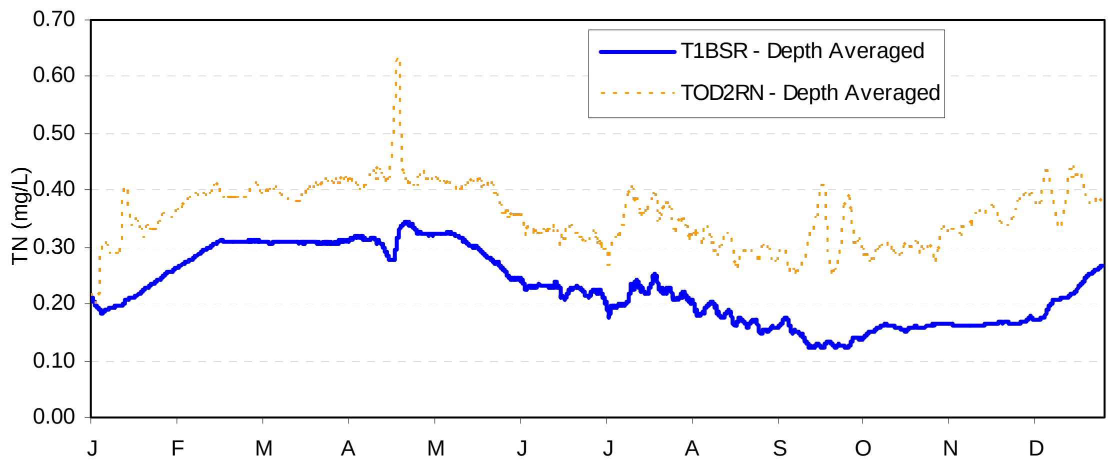

T1BSR - Depth Averaged
TOD2RN - Depth Averaged
4-day average of Chronic Criteria (computed using pH and temperature from TOD1R)
4-day Averaged NH3-N (mg/L)
1.80
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
J F M A M J J A S O N D

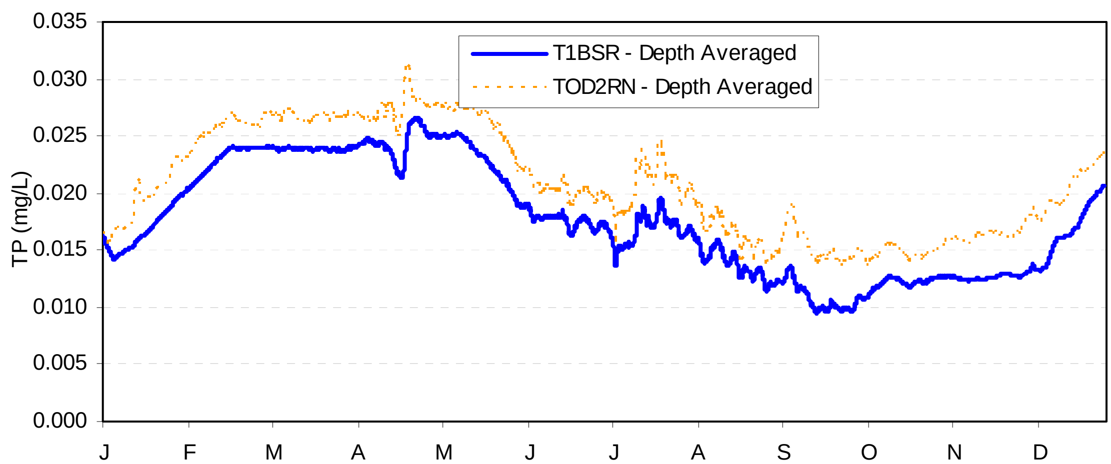

T1BSR - Depth Averaged
TOD2RN - Depth Averaged
Acute Criteria (computed using pH and temperature from TOD1R)
NH3-N (mg/L)
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
J F M A M J J A S O N D


T1BSR - Depth Averaged
TOD2RN - Depth Averaged
PO4 (mg/L)
0.010
0.009
0.008
0.007
0.006
0.005
0.004
0.003
0.002
0.001
0.000
J F M A M J J A S O N D

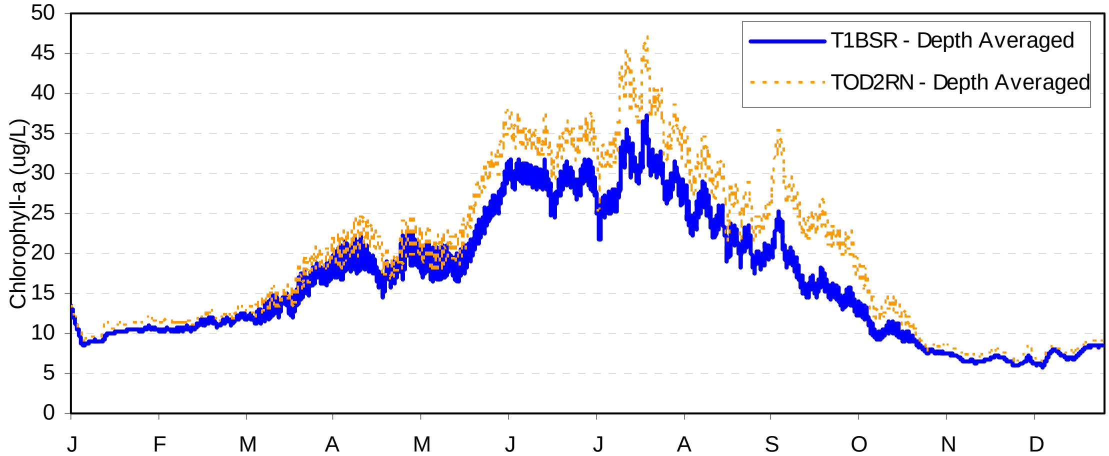
KSD


T1BSR - Depth Averaged
TOD2RN - Depth Averaged
NO3 (mg/L)
0.25
0.20
0.15
0.10
0.05
0.00
J F M A M J J A S O N D

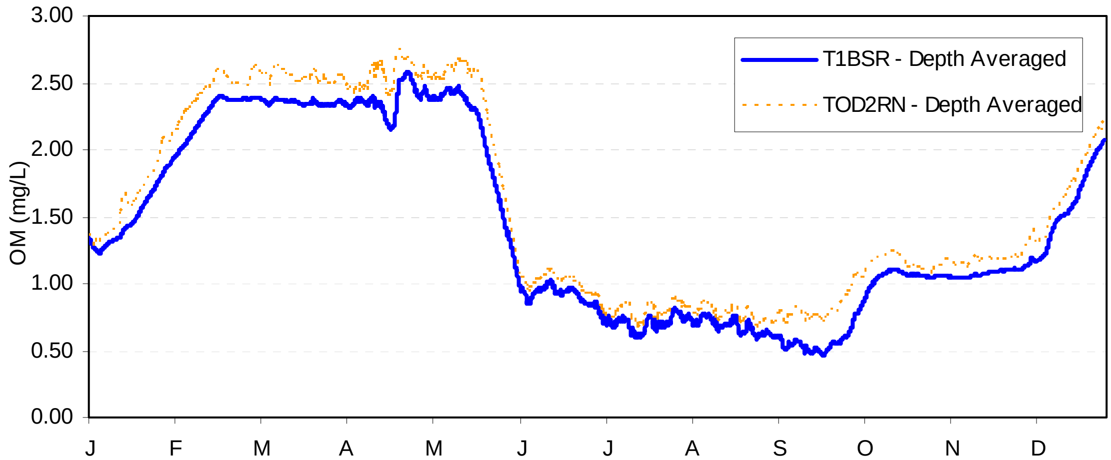

T1BSR - Depth Averaged
TOD2RN - Depth Averaged
TN (mg/L)
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
J F M A M J J A S O N D


T1BSR - Depth Averaged
TOD2RN - Depth Averaged
TP (mg/L)
0.035
0.030
0.025
0.020
0.015
0.010
0.005
0.000
J F M A M J J A S O N D

KSD

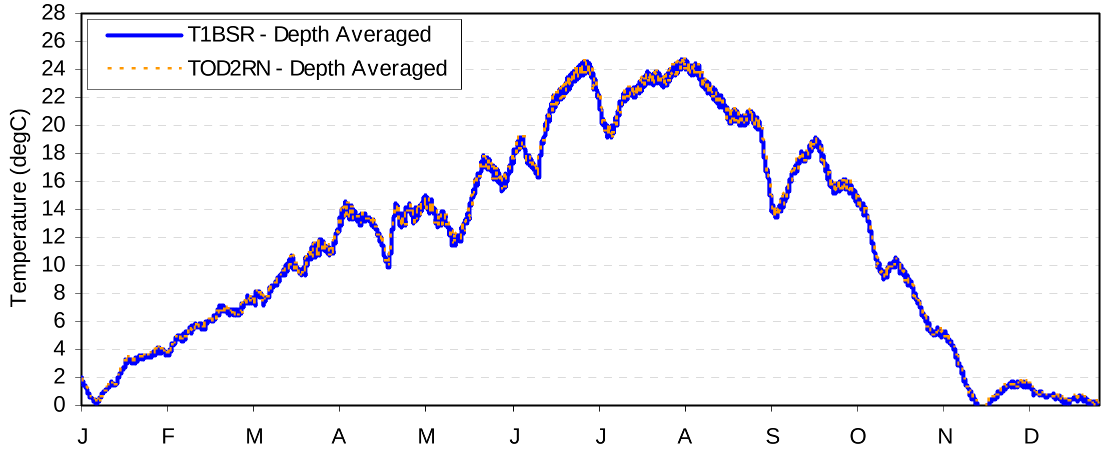


50
45
40
35
30
25
20
15
10
5
0
Chlorophyll-a (ug/L)
J F M A M J J A S O N D
T1BSR - Depth Averaged
TOD2RN - Depth Averaged

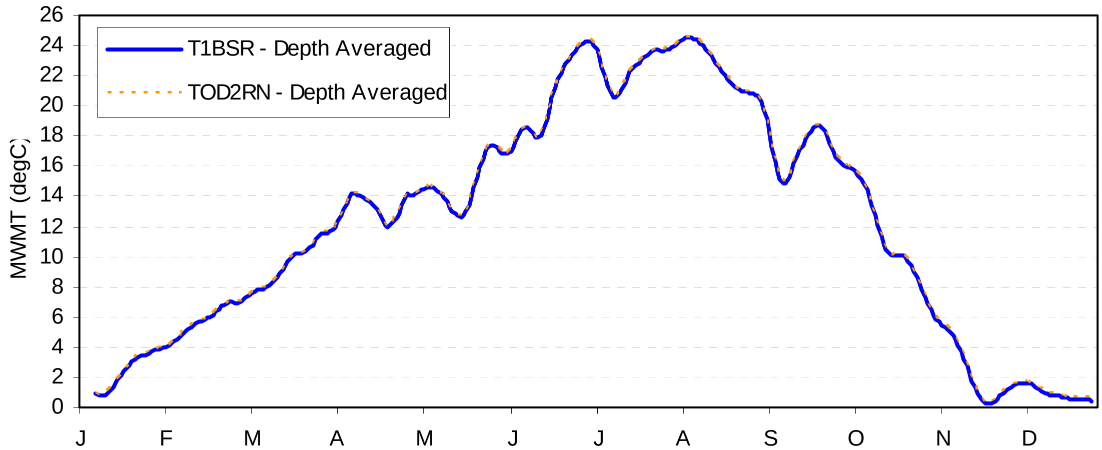


3.00
2.50
2.00
1.50
1.00
0.50
0.00
OM (mg/L)
J F M A M J J A S O N D
T1BSR - Depth Averaged
TOD2RN - Depth Averaged

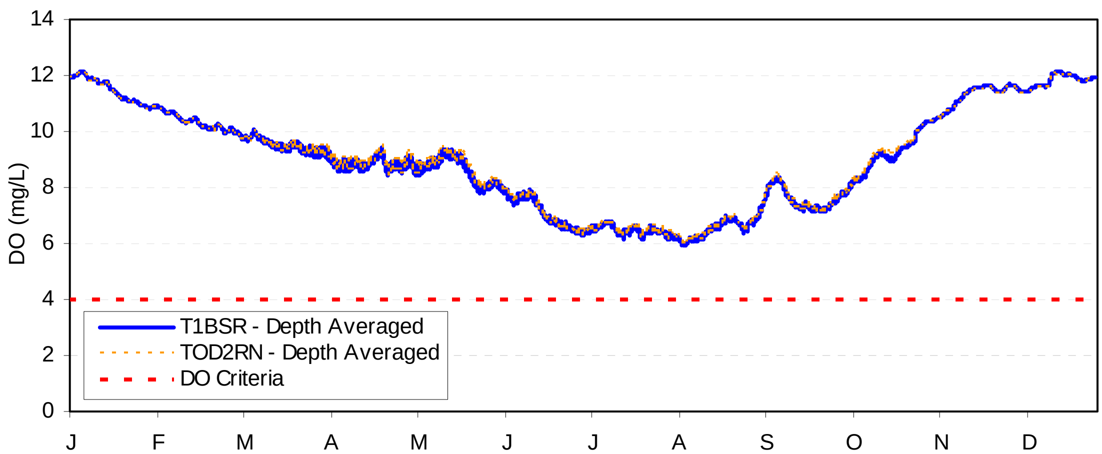
Hwy 66



Temperature (degC)
T1BSR - Depth Averaged
TOD2RN - Depth Averaged
28
26
24
22
20
18
16
14
12
10
8
6
4
2
0
J F M A M J J A S O N D

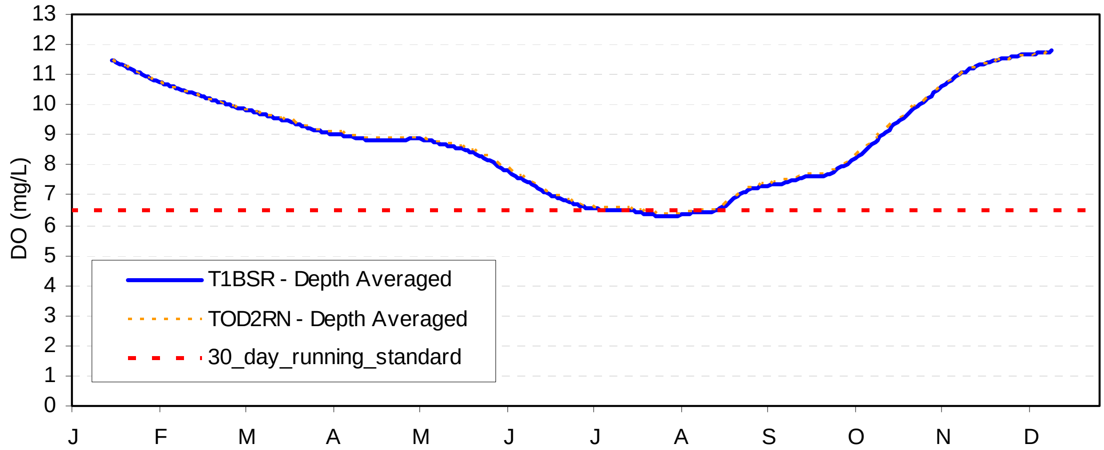


MWMT (degC)
T1BSR - Depth Averaged
TOD2RN - Depth Averaged
26
24
22
20
18
16
14
12
10
8
6
4
2
0
J F M A M J J A S O N D

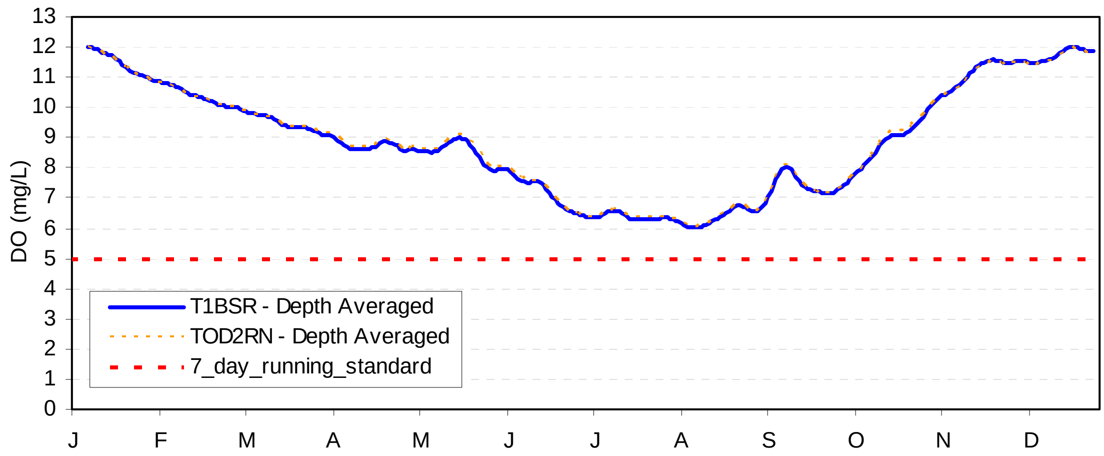


DO (mg/L)
T1BSR - Depth Averaged
TOD2RN - Depth Averaged
DO Criteria
14
12
10
8
6
4
2
0
J F M A M J J A S O N D

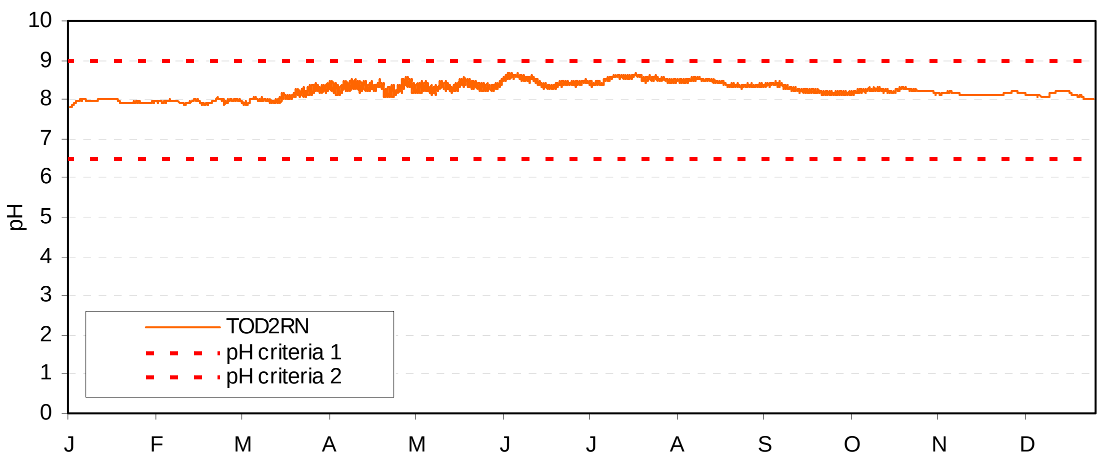
Hwy 66



DO (mg/L)
13
12
11
10
9
8
7
6
5
4
3
2
1
0
T1BSR - Depth Averaged
TOD2RN - Depth Averaged
30_day_running_standard
J
F
M
A
M
J
J
A
S
O
N
D

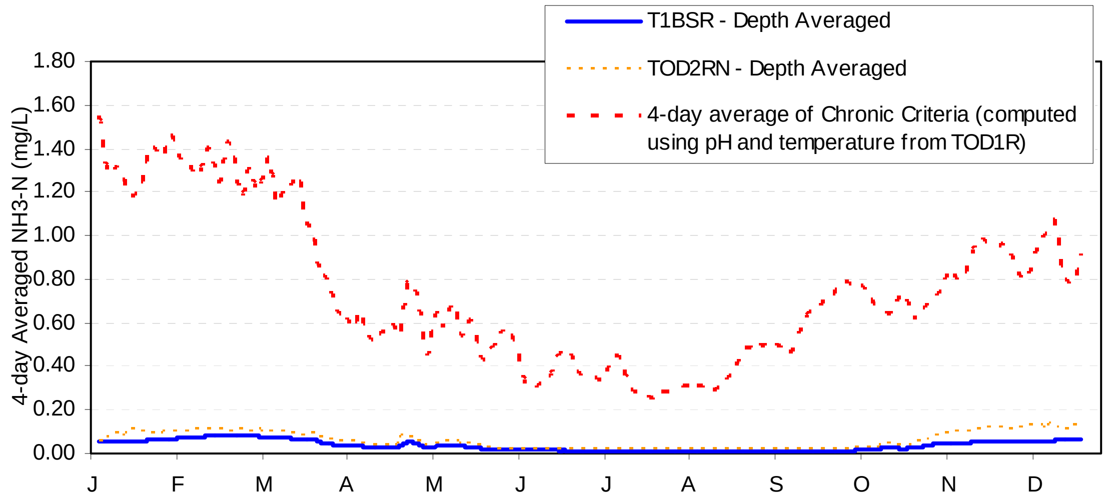


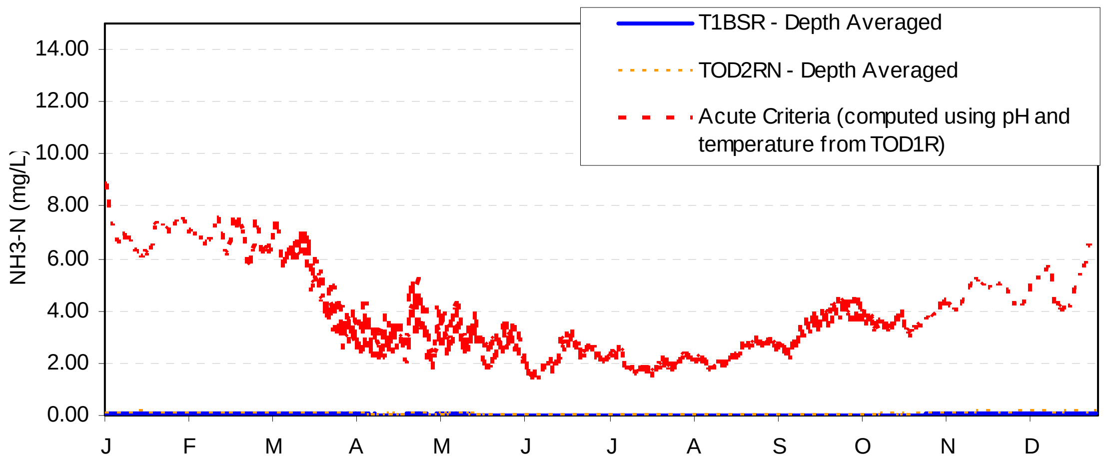
DO (mg/L)
13
12
11
10
9
8
7
6
5
4
3
2
1
0
T1BSR - Depth Averaged
TOD2RN - Depth Averaged
7_day_running_standard
J
F
M
A
M
J
J
A
S
O
N
D

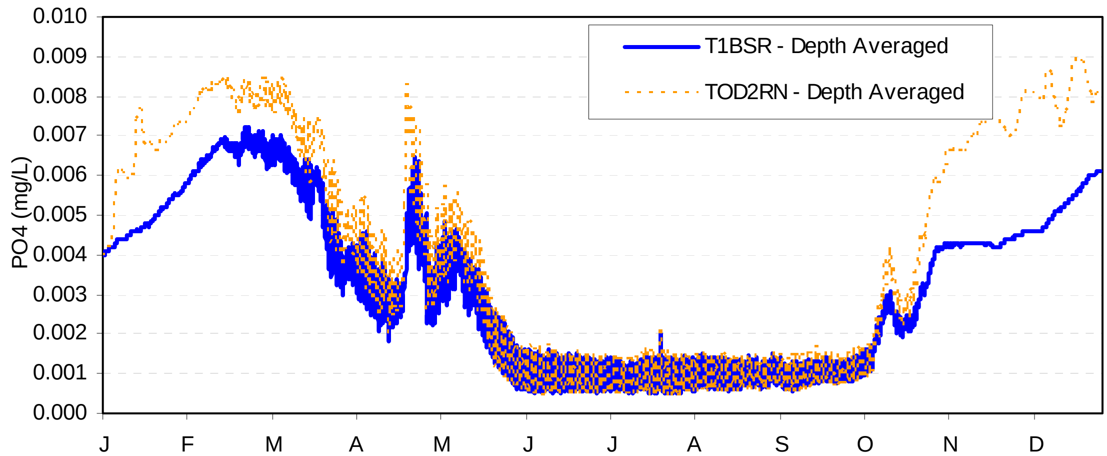


pH
10
9
8
7
6
5
4
3
2
1
0
TOD2RN
pH criteria 1
pH criteria 2
J
F
M
A
M
J
J
A
S
O
N
D

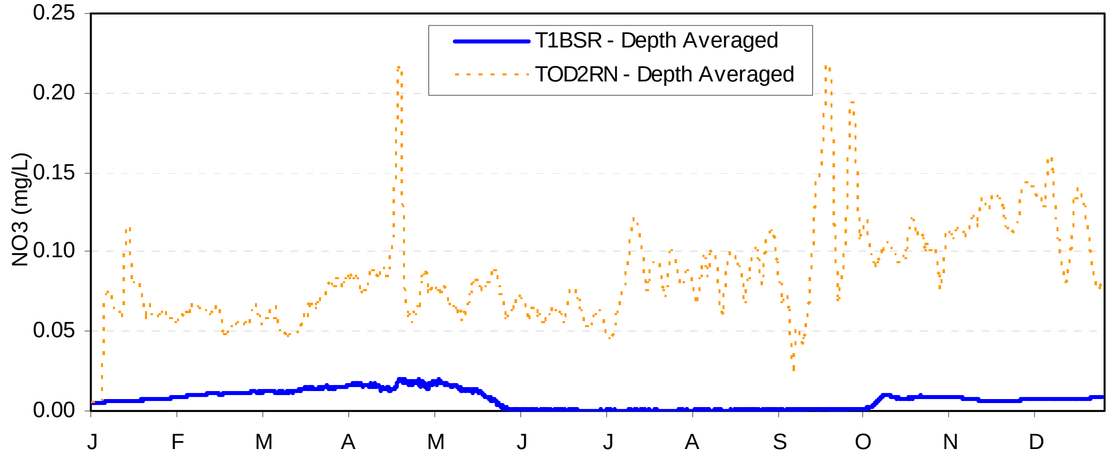
Hwy 66


T1BSR - Depth Averaged
TOD2RN - Depth Averaged
4-day average of Chronic Criteria (computed using pH and temperature from TOD1R)
4-day Averaged NH3-N (mg/L)
1.80
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
J F M A M J J A S O N D

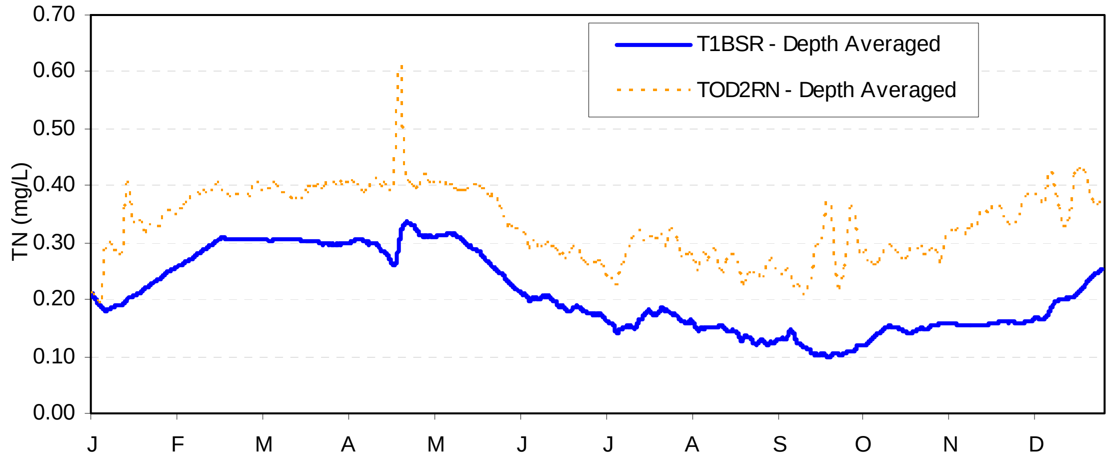

T1BSR - Depth Averaged
TOD2RN - Depth Averaged
Acute Criteria (computed using pH and temperature from TOD1R)
NH3-N (mg/L)
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
J F M A M J J A S O N D


T1BSR - Depth Averaged
TOD2RN - Depth Averaged
PO4 (mg/L)
0.010
0.009
0.008
0.007
0.006
0.005
0.004
0.003
0.002
0.001
0.000
J F M A M J J A S O N D

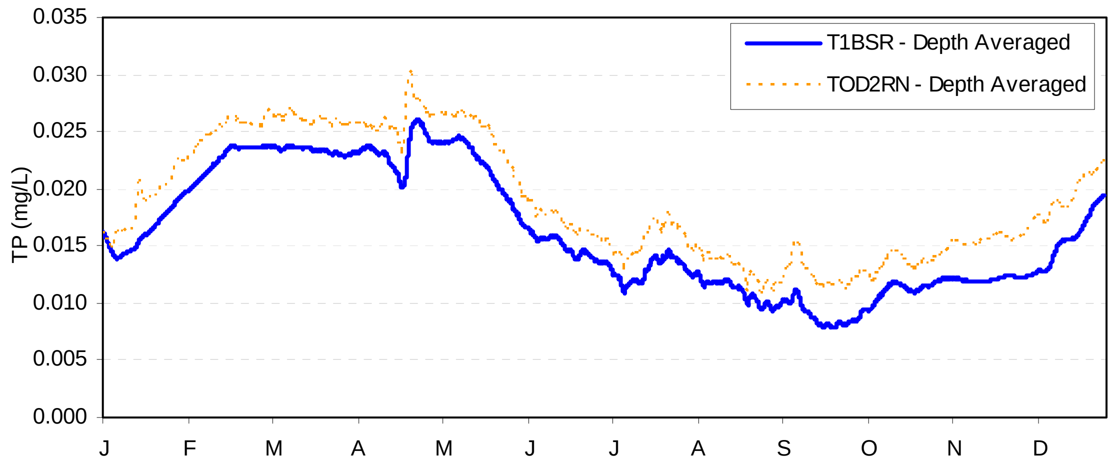
Hwy 66



0.25
0.20
0.15
0.10
0.05
0.00
NO3 (mg/L)
T1BSR - Depth Averaged
TOD2RN - Depth Averaged
J
F
M
A
M
J
J
A
S
O
N
D

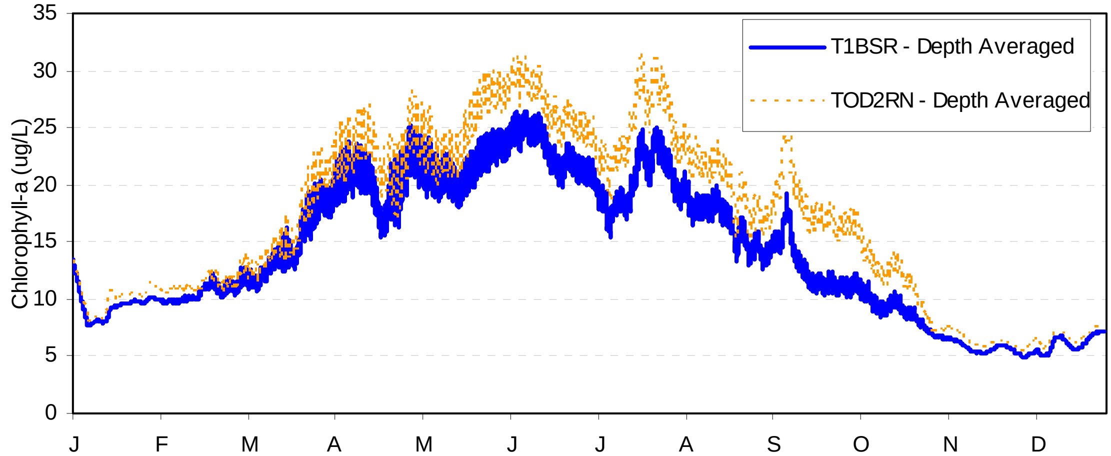


0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
TN (mg/L)
T1BSR - Depth Averaged
TOD2RN - Depth Averaged
J
F
M
A
M
J
J
A
S
O
N
D

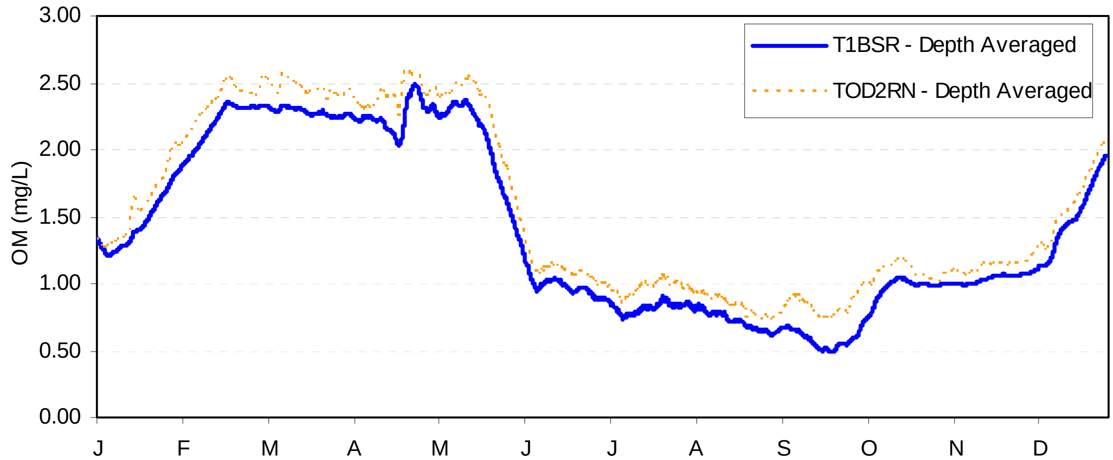


0.035
0.030
0.025
0.020
0.015
0.010
0.005
0.000
TP (mg/L)
T1BSR - Depth Averaged
TOD2RN - Depth Averaged
J
F
M
A
M
J
J
A
S
O
N
D

Hwy 66

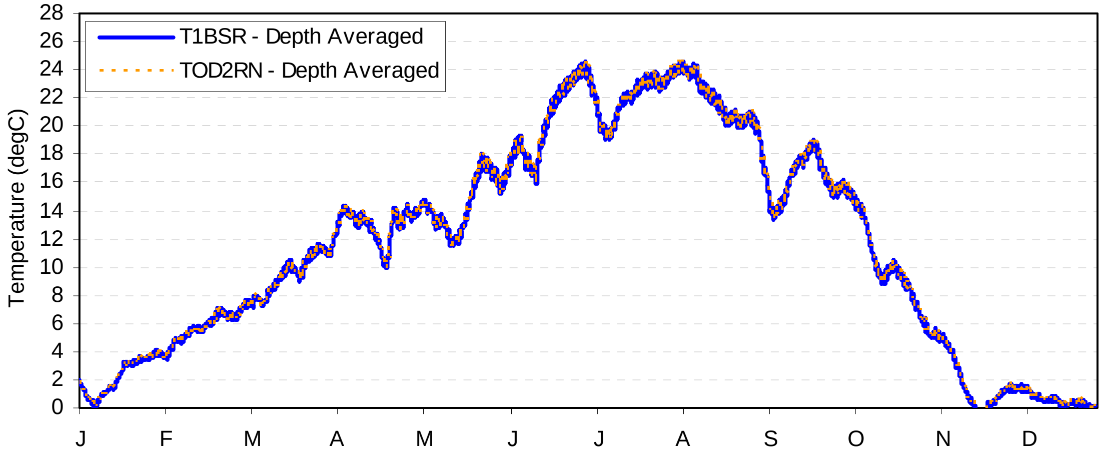


Chlorophyll-a (ug/L)
35
30
25
20
15
10
5
0
J
F
M
A
M
J
J
A
S
O
N
D
T1BSR - Depth Averaged
TOD2RN - Depth Averaged

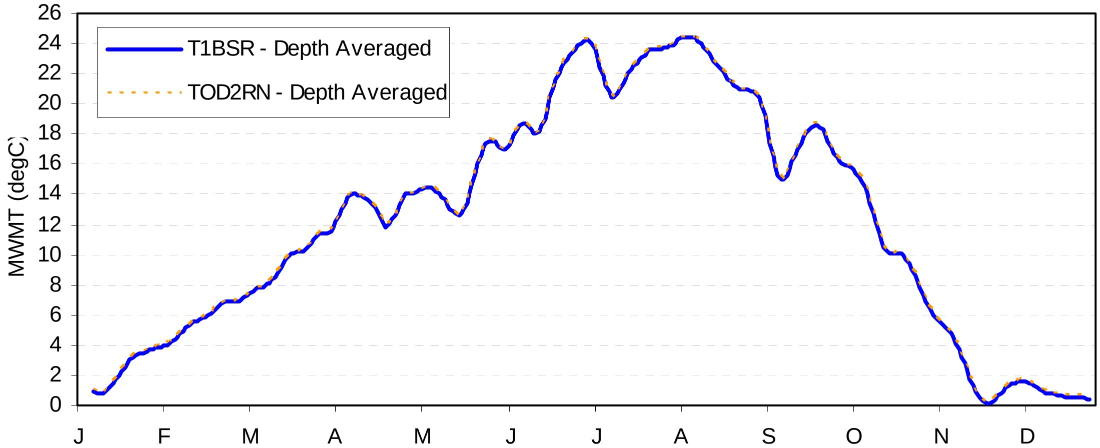


OM (mg/L)
3.00
2.50
2.00
1.50
1.00
0.50
0.00
J
F
M
A
M
J
J
A
S
O
N
D
T1BSR - Depth Averaged
TOD2RN - Depth Averaged

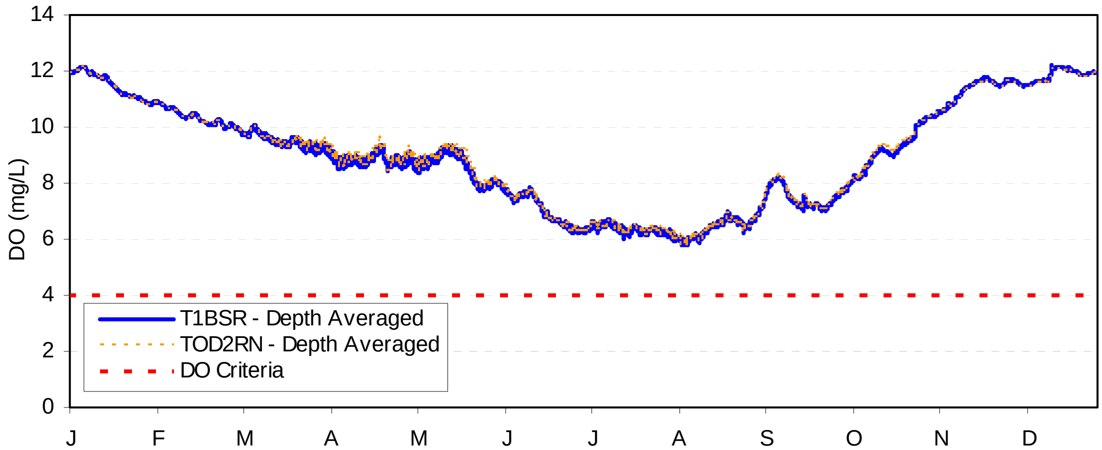
Keno Dam



Temperature (degC)
28
26
24
22
20
18
16
14
12
10
8
6
4
2
0
J F M A M J J A S O N D
T1BSR - Depth Averaged
TOD2RN - Depth Averaged

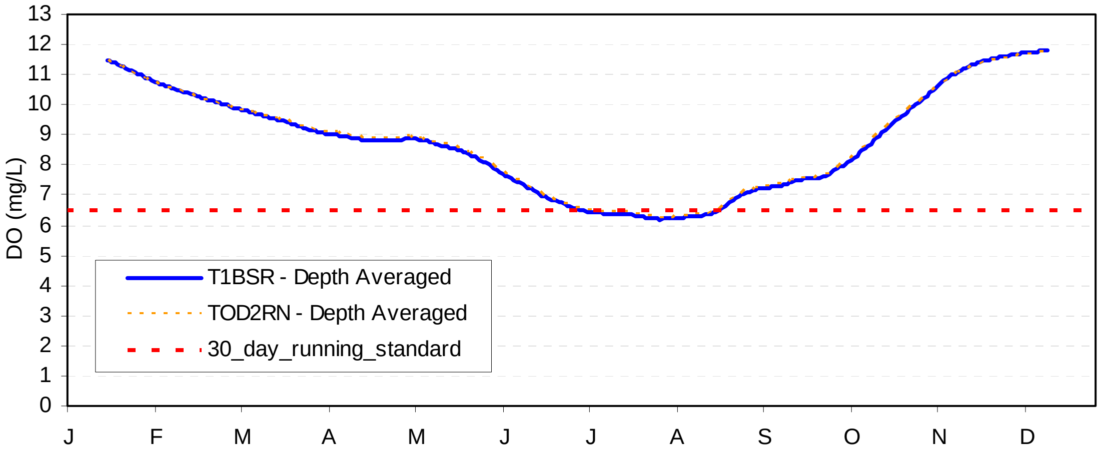


MWMT (degC)
26
24
22
20
18
16
14
12
10
8
6
4
2
0
J F M A M J J A S O N D
T1BSR - Depth Averaged
TOD2RN - Depth Averaged

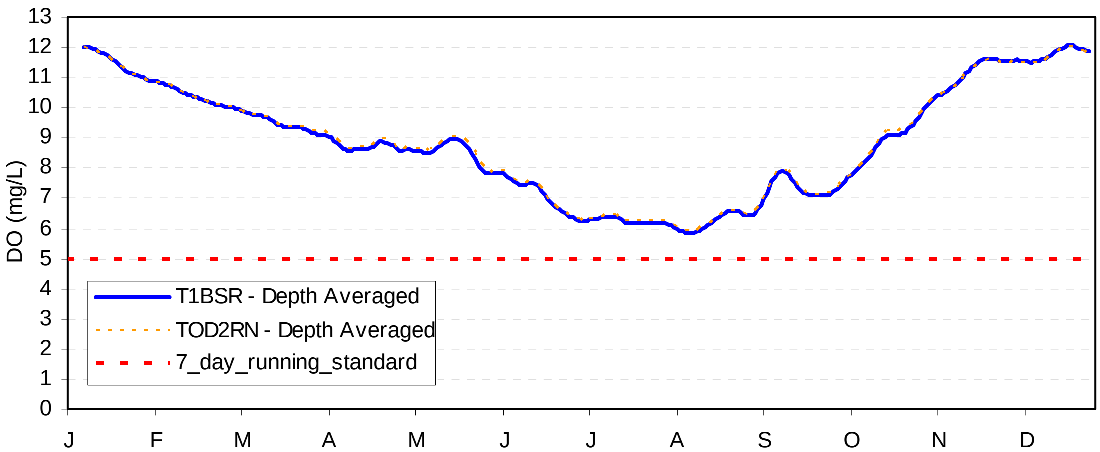


DO (mg/L)
14
12
10
8
6
4
2
0
J F M A M J J A S O N D
T1BSR - Depth Averaged
TOD2RN - Depth Averaged
DO Criteria

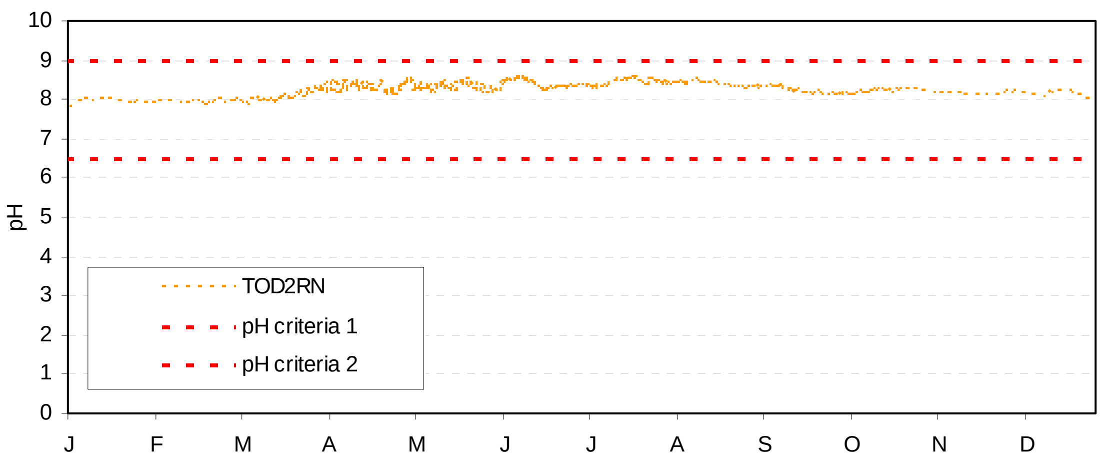
Keno Dam



13
12
11
10
9
8
7
6
5
4
3
2
1
0
DO (mg/L)
T1BSR - Depth Averaged
TOD2RN - Depth Averaged
30_day_running_standard
J
F
M
A
M
J
J
A
S
O
N
D

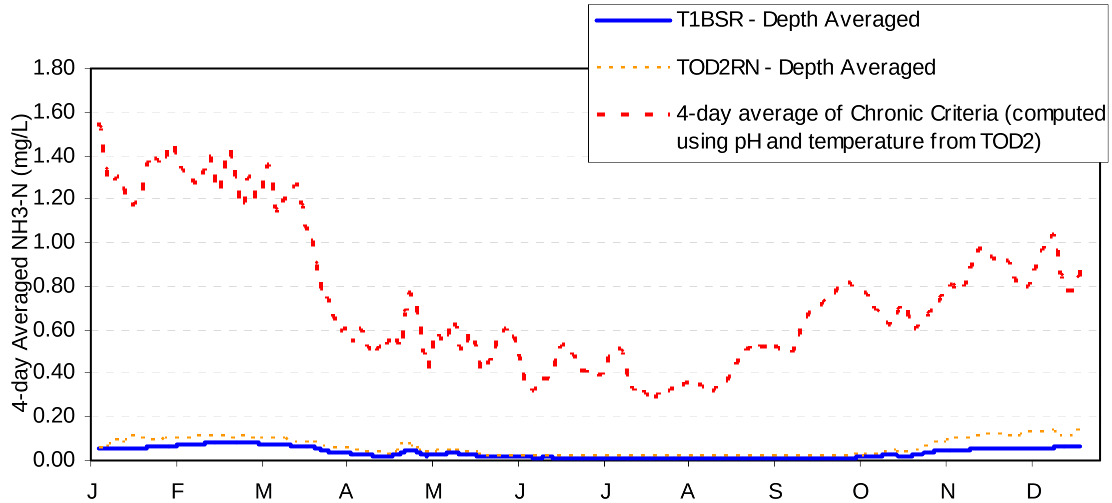


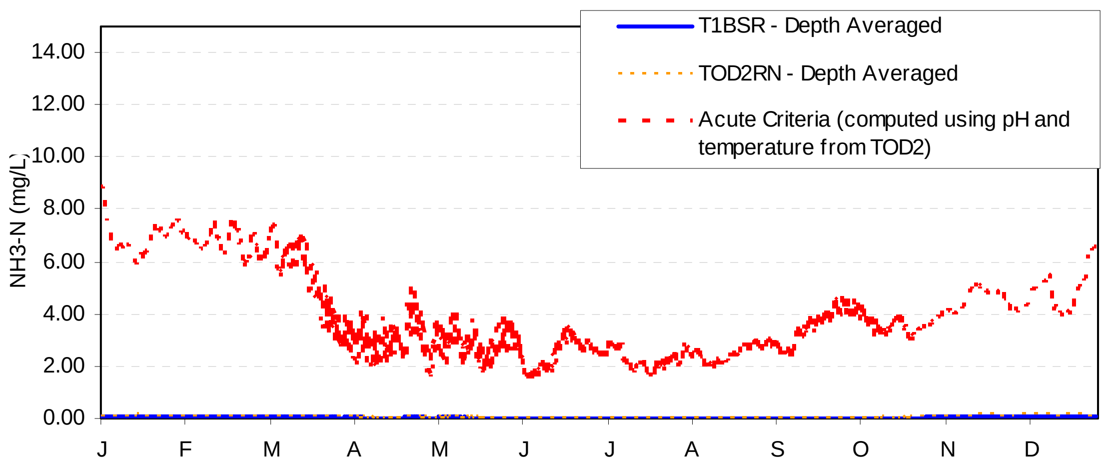
13
12
11
10
9
8
7
6
5
4
3
2
1
0
DO (mg/L)
T1BSR - Depth Averaged
TOD2RN - Depth Averaged
7_day_running_standard
J
F
M
A
M
J
J
A
S
O
N
D

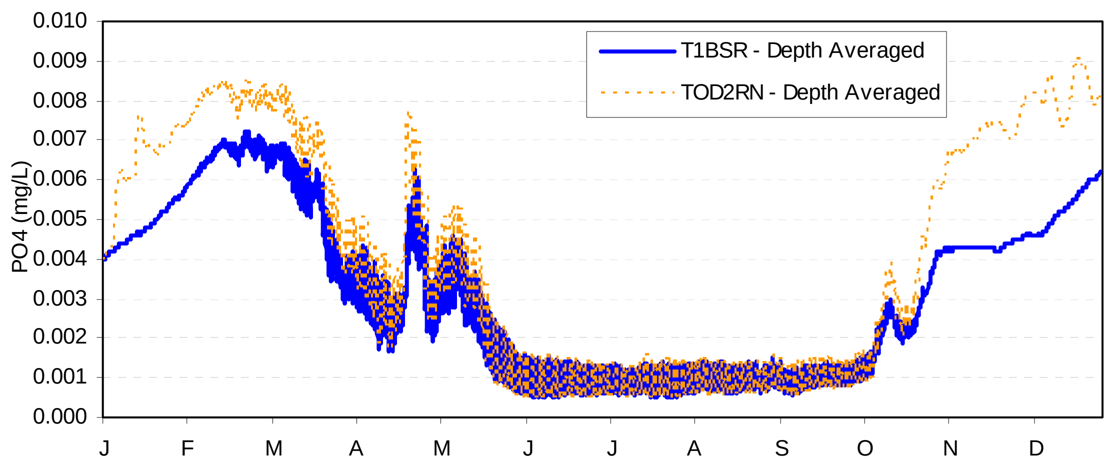


10
9
8
7
6
5
4
3
2
1
0
pH
TOD2RN
pH criteria 1
pH criteria 2
J
F
M
A
M
J
J
A
S
O
N
D

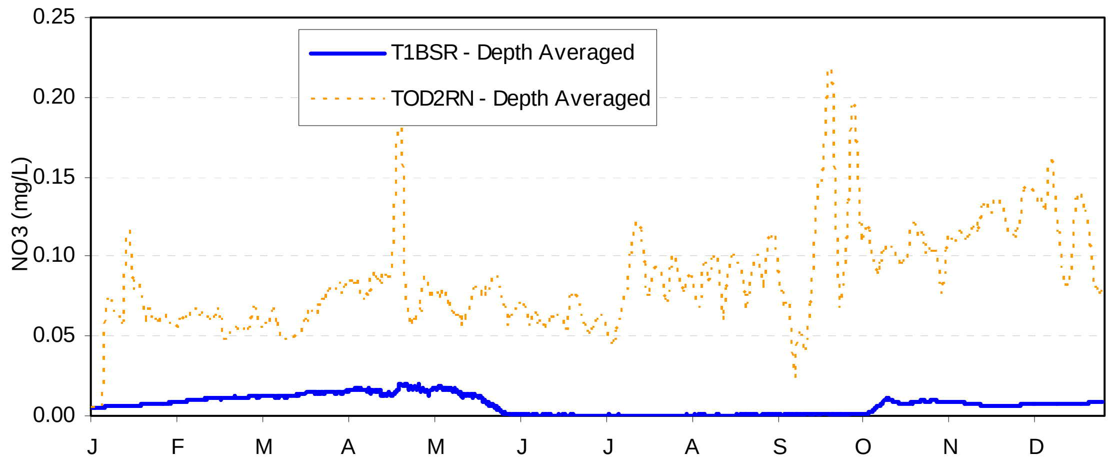
Keno Dam


T1BSR - Depth Averaged
TOD2RN - Depth Averaged
4-day average of Chronic Criteria (computed using pH and temperature from TOD2)
4-day Averaged NH3-N (mg/L)
1.80
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
J F M A M J J A S O N D

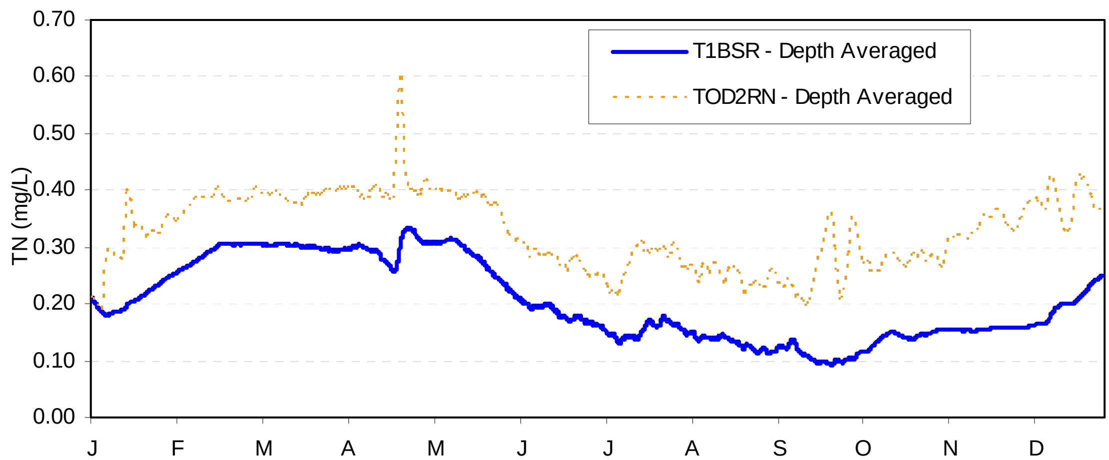

T1BSR - Depth Averaged
TOD2RN - Depth Averaged
Acute Criteria (computed using pH and temperature from TOD2)
NH3-N (mg/L)
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
J F M A M J J A S O N D


T1BSR - Depth Averaged
TOD2RN - Depth Averaged
PO4 (mg/L)
0.010
0.009
0.008
0.007
0.006
0.005
0.004
0.003
0.002
0.001
0.000
J F M A M J J A S O N D

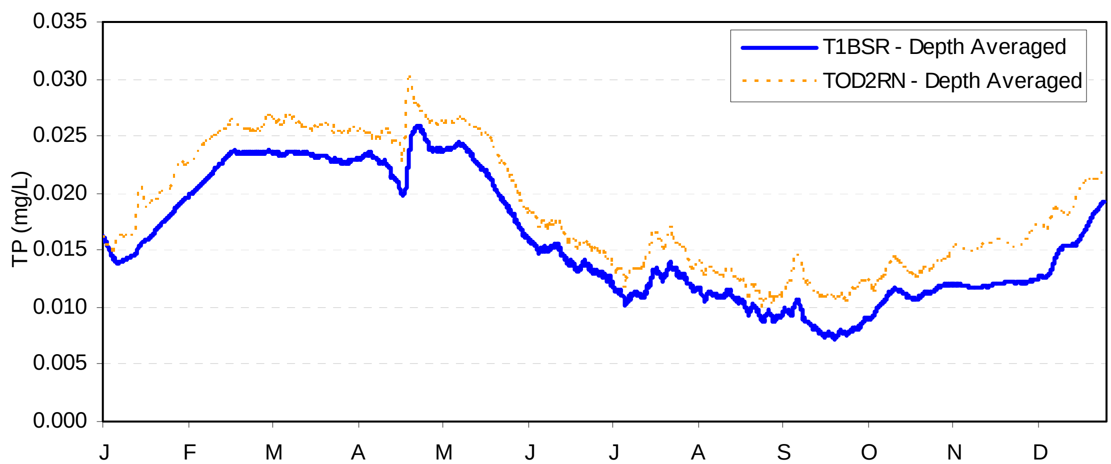
Keno Dam



NO3 (mg/L)
0.25
0.20
0.15
0.10
0.05
0.00
J
F
M
A
M
J
J
A
S
O
N
D
T1BSR - Depth Averaged
TOD2RN - Depth Averaged

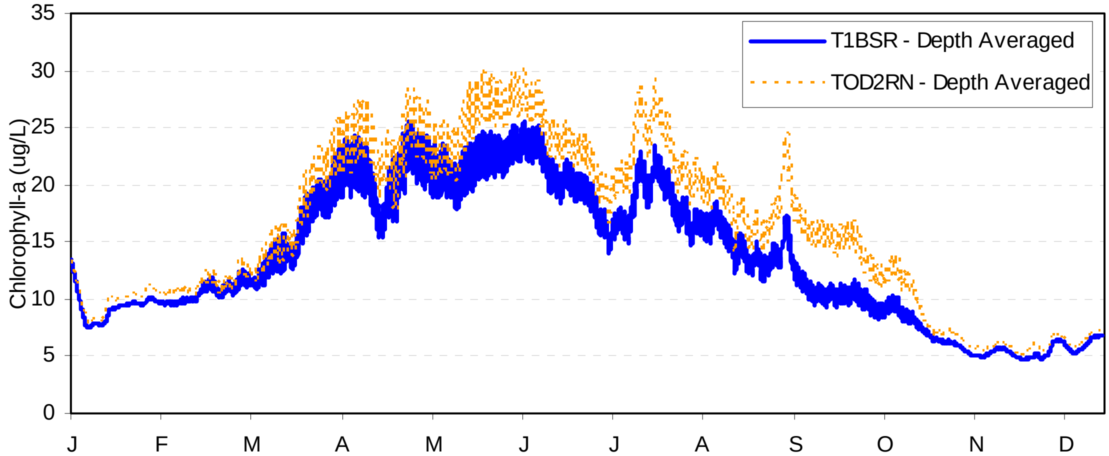


TN (mg/L)
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
J
F
M
A
M
J
J
A
S
O
N
D
T1BSR - Depth Averaged
TOD2RN - Depth Averaged

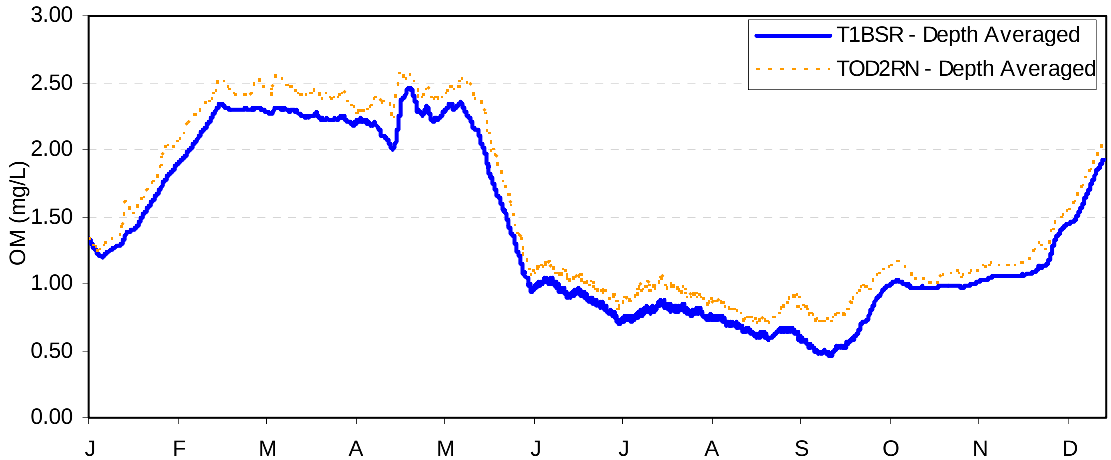


TP (mg/L)
0.035
0.030
0.025
0.020
0.015
0.010
0.005
0.000
J
F
M
A
M
J
J
A
S
O
N
D
T1BSR - Depth Averaged
TOD2RN - Depth Averaged

Keno Dam

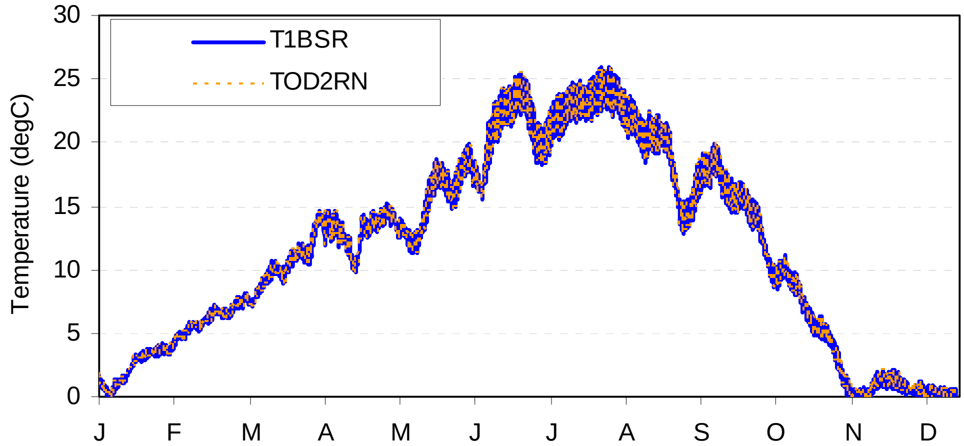


Chlorophyll-a (ug/L)
35
30
25
20
15
10
5
0
J
F
M
A
M
J
J
A
S
O
N
D
T1BSR - Depth Averaged
TOD2RN - Depth Averaged

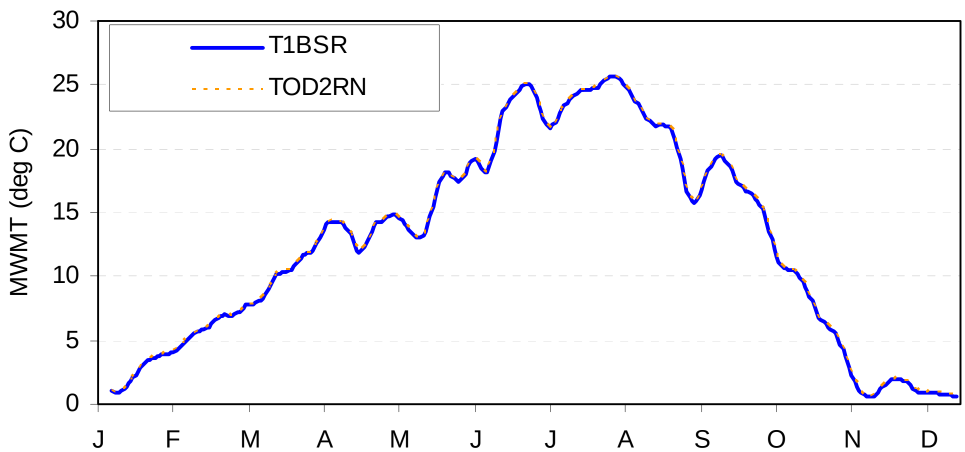


OM (mg/L)
3.00
2.50
2.00
1.50
1.00
0.50
0.00
J
F
M
A
M
J
J
A
S
O
N
D
T1BSR - Depth Averaged
TOD2RN - Depth Averaged

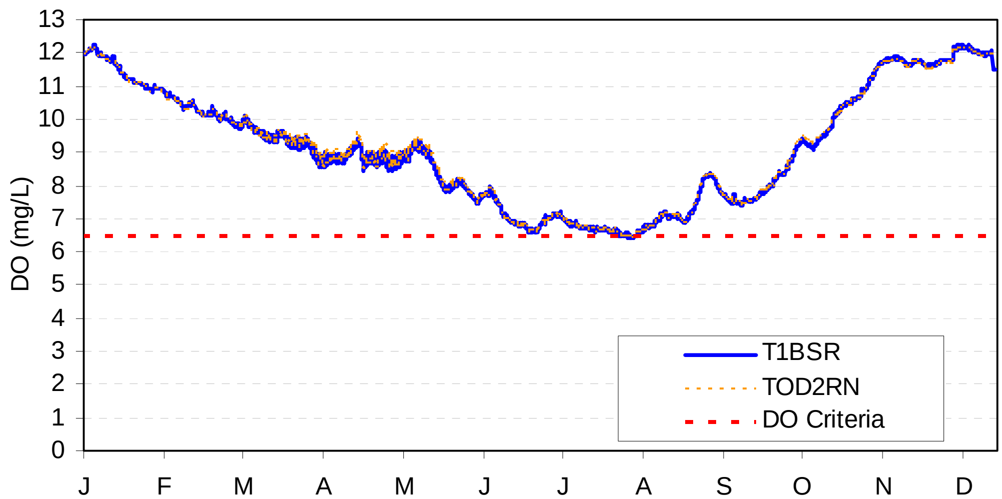
DS KENO USGS



T1BSR
TOD2RN
Temperature (degC)
30
25
20
15
10
5
0
J
F
M
A
M
J
J
A
S
O
N
D

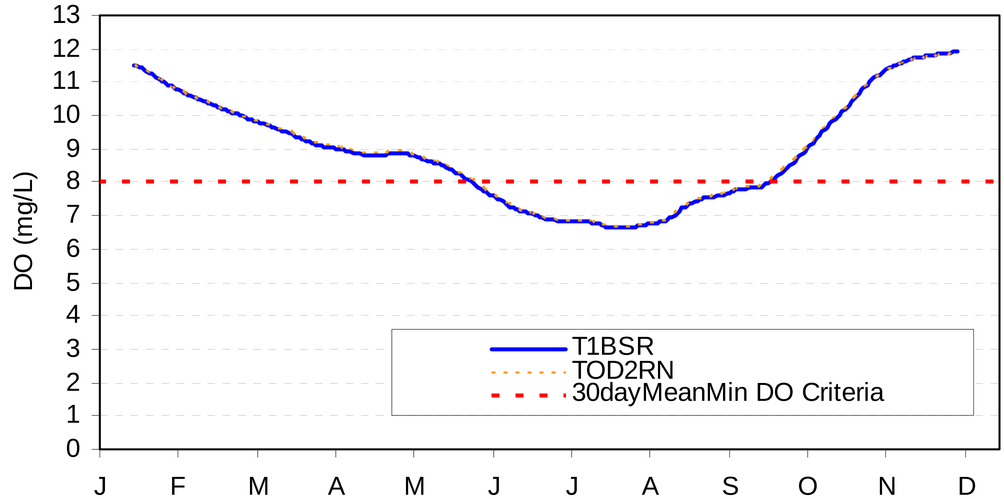


T1BSR
TOD2RN
MWMT (deg C)
30
25
20
15
10
5
0
J
F
M
A
M
J
J
A
S
O
N
D

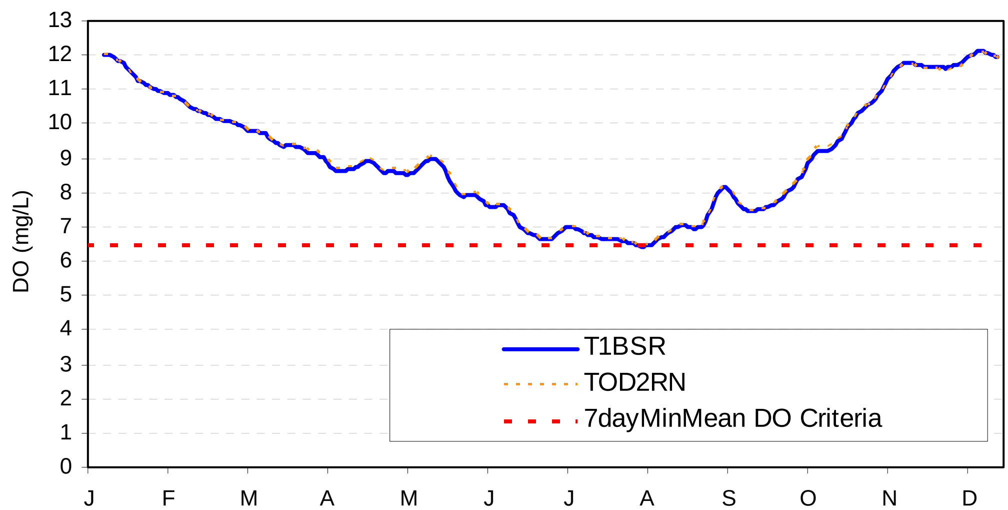


DO (mg/L)
13
12
11
10
9
8
7
6
5
4
3
2
1
0
T1BSR
TOD2RN
DO Criteria
J
F
M
A
M
J
J
A
S
O
N
D

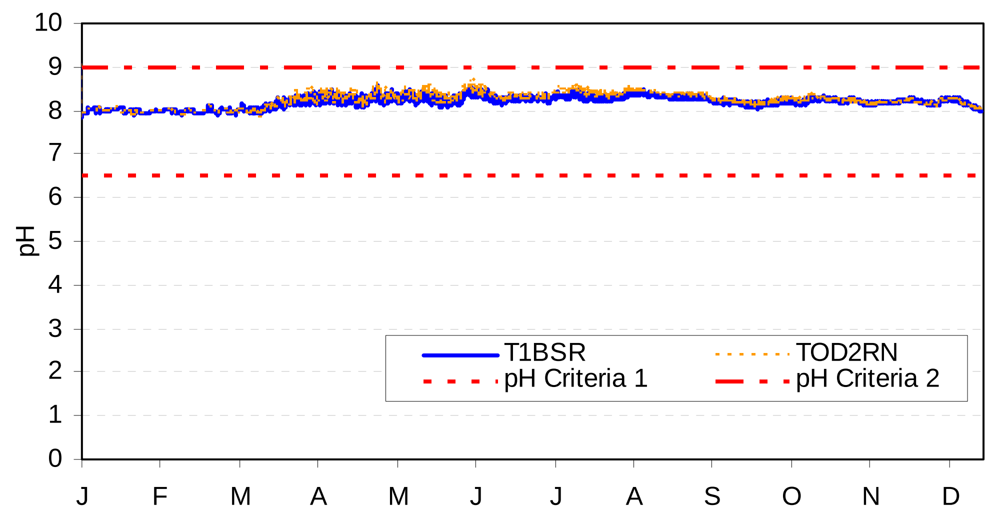
DS KENO USGS



13
12
11
10
9
8
7
6
5
4
3
2
1
0
DO (mg/L)
T1BSR
TOD2RN
30dayMeanMin DO Criteria
J
F
M
A
M
J
J
A
S
O
N
D

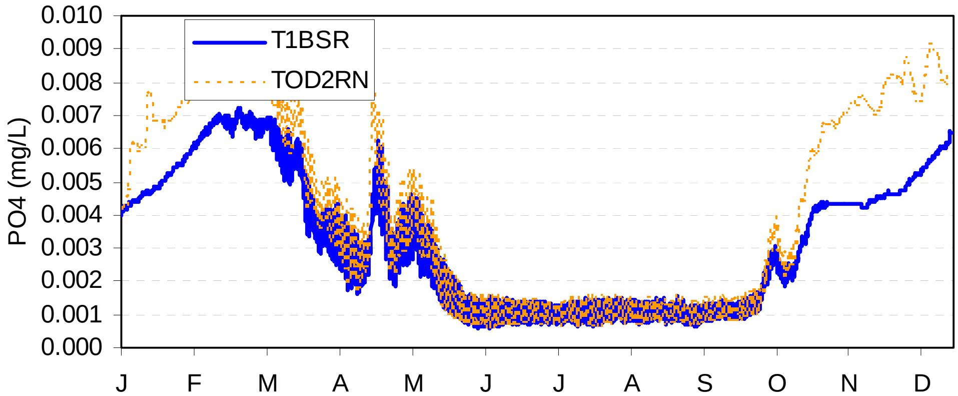


13
12
11
10
9
8
7
6
5
4
3
2
1
0
DO (mg/L)
T1BSR
TOD2RN
7dayMinMean DO Criteria
J
F
M
A
M
J
J
A
S
O
N
D

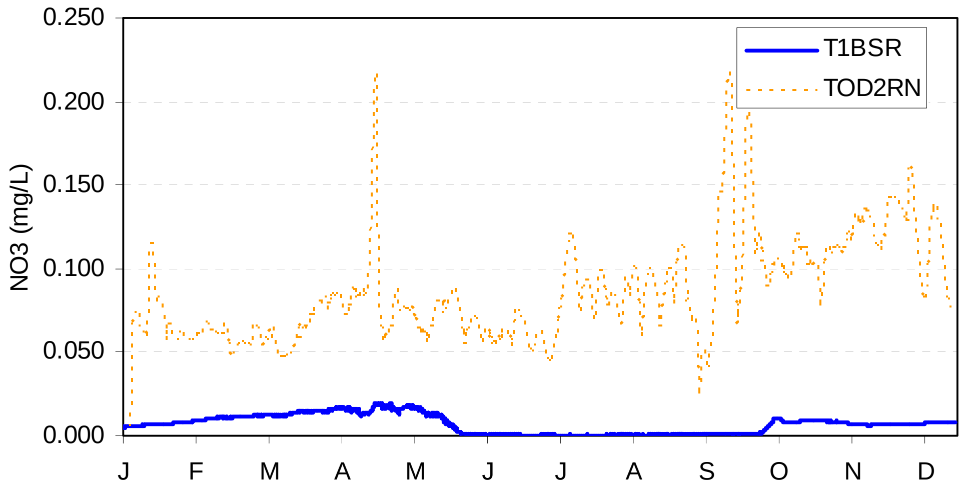


10
9
8
7
6
5
4
3
2
1
0
pH
T1BSR
TOD2RN
pH Criteria 1
pH Criteria 2
J
F
M
A
M
J
J
A
S
O
N
D

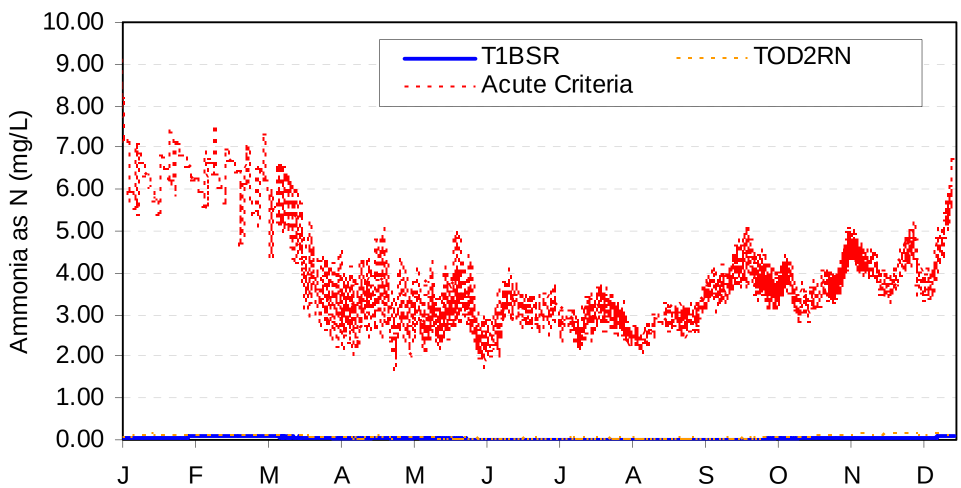
DS KENO USGS



0.010
0.009
0.008
0.007
0.006
0.005
0.004
0.003
0.002
0.001
0.000
PO4 (mg/L)
T1BSR
TOD2RN
J F M A M J J A S O N D

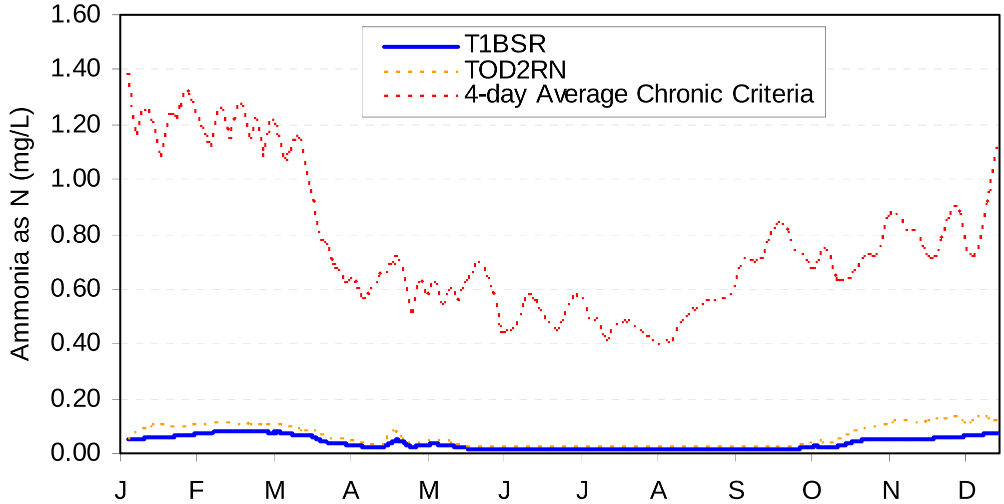


0.250
0.200
0.150
0.100
0.050
0.000
NO3 (mg/L)
T1BSR
TOD2RN
J F M A M J J A S O N D

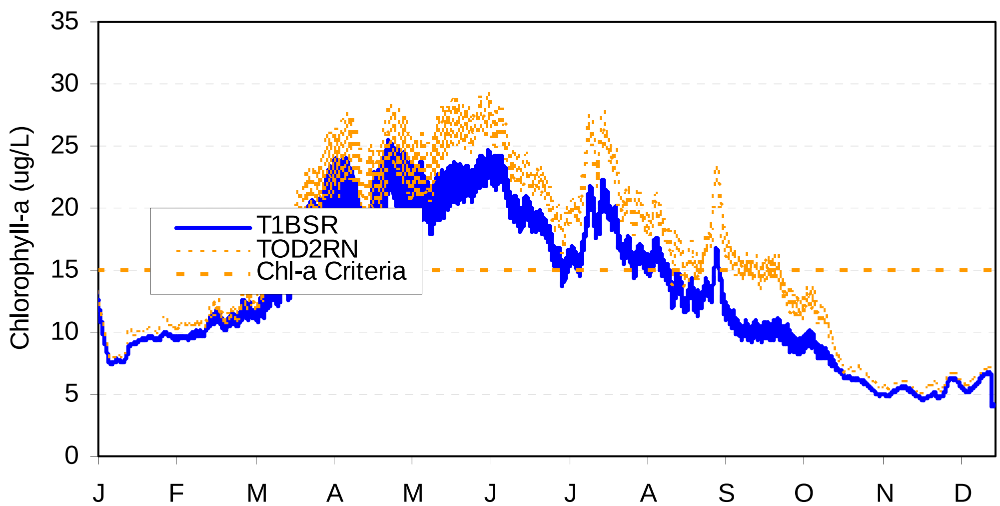


10.00
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
Ammonia as N (mg/L)
T1BSR
TOD2RN
Acute Criteria
J F M A M J J A S O N D

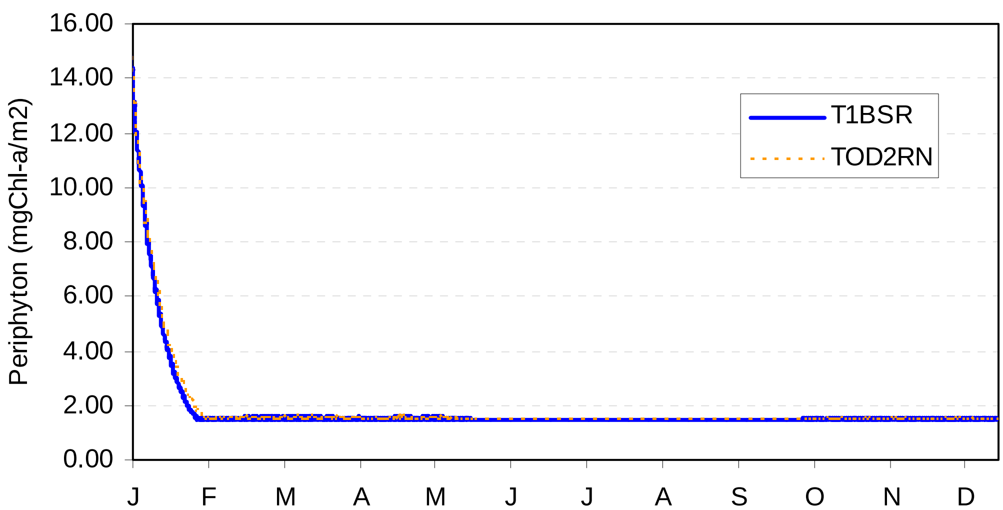
DS KENO USGS



1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
Ammonia as N (mg/L)
T1BSR
TOD2RN
4-day Average Chronic Criteria
J
F
M
A
M
J
J
A
S
O
N
D

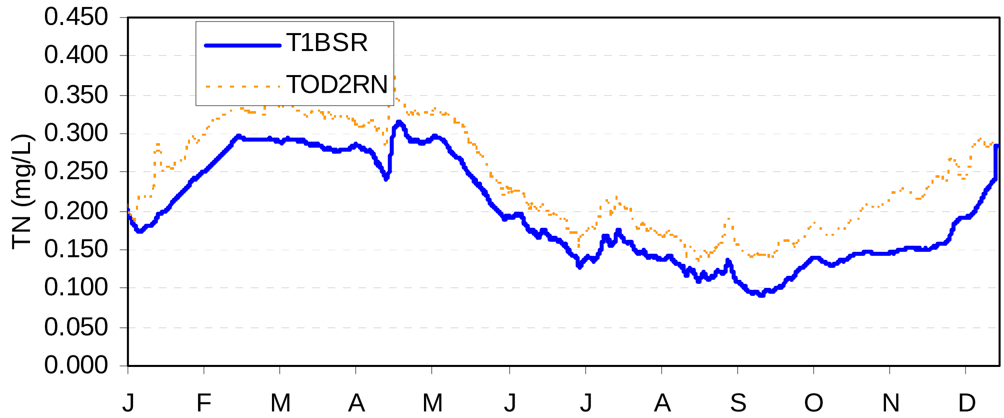


35
30
25
20
15
10
5
0
Chlorophyll-a (ug/L)
T1BSR
TOD2RN
Chl-a Criteria
J
F
M
A
M
J
J
A
S
O
N
D

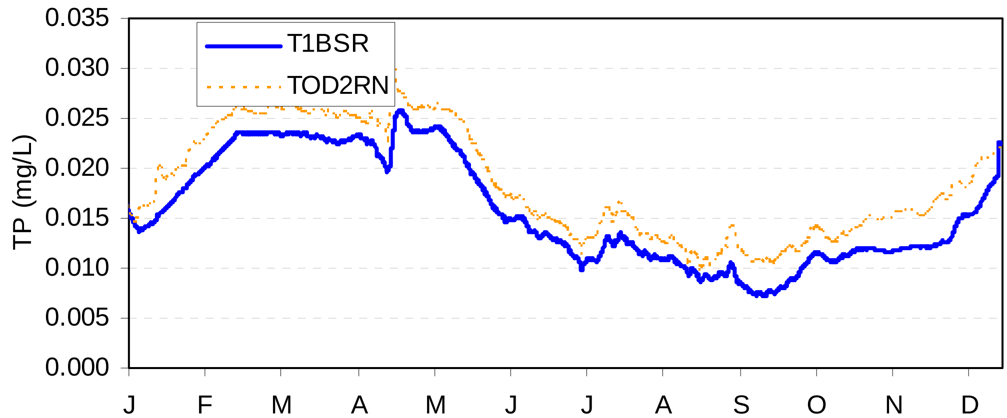


16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
Periphyton (mgChl-a/m2)
T1BSR
TOD2RN
J
F
M
A
M
J
J
A
S
O
N
D

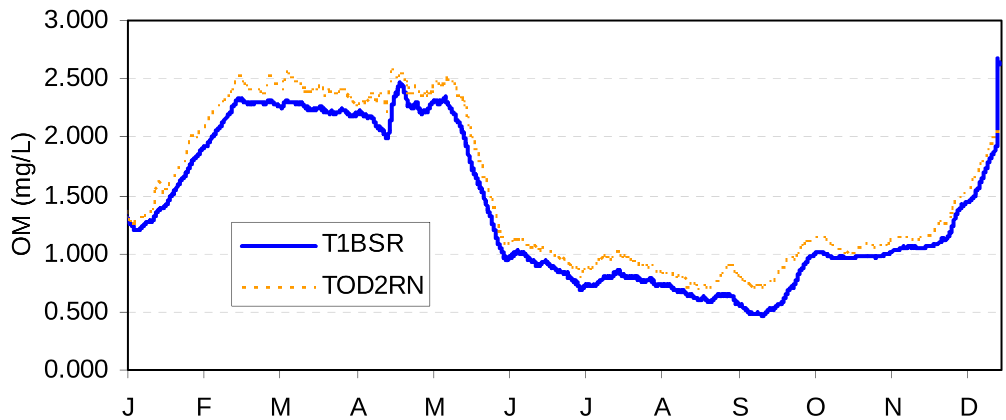
DS KENO USGS



0.450
0.400
0.350
0.300
0.250
0.200
0.150
0.100
0.050
0.000
TN (mg/L)
T1BSR
TOD2RN
J F M A M J J A S O N D

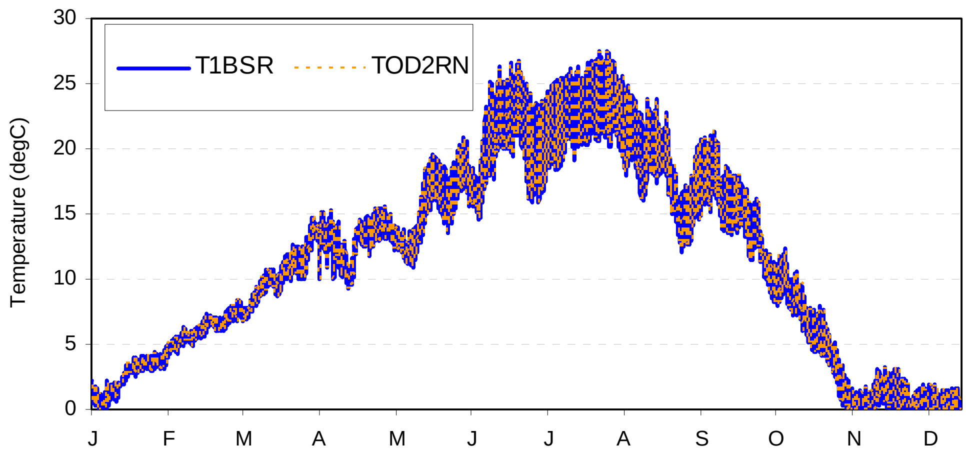


0.035
0.030
0.025
0.020
0.015
0.010
0.005
0.000
TP (mg/L)
T1BSR
TOD2RN
J F M A M J J A S O N D

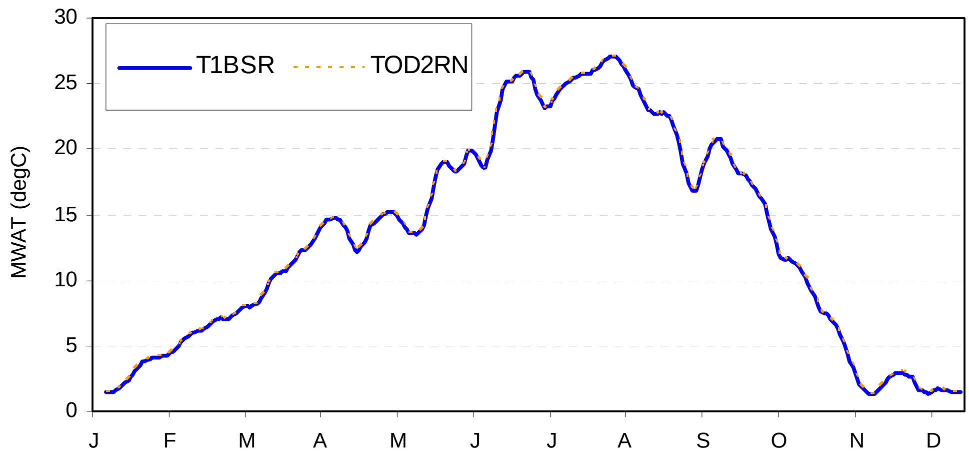


3.000
2.500
2.000
1.500
1.000
0.500
0.000
OM (mg/L)
T1BSR
TOD2RN
J F M A M J J A S O N D

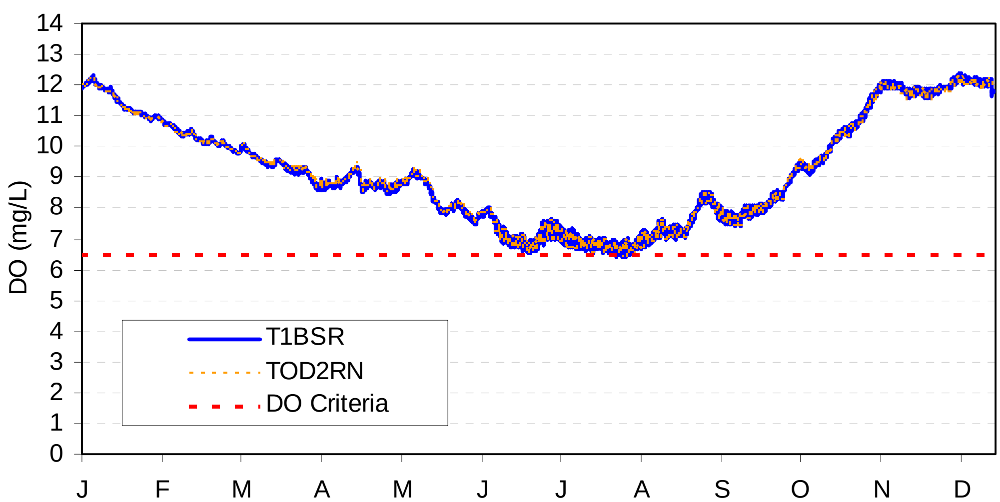
DS JCB DAM



Temperature (degC)
30
25
20
15
10
5
0
T1BSR
TOD2RN
J
F
M
A
M
J
J
A
S
O
N
D

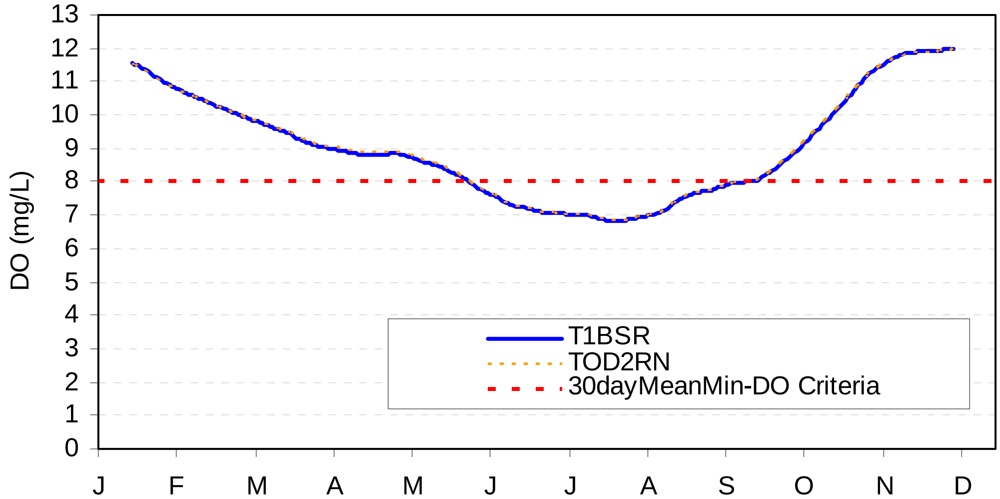


MWAT (degC)
30
25
20
15
10
5
0
T1BSR
TOD2RN
J
F
M
A
M
J
J
A
S
O
N
D

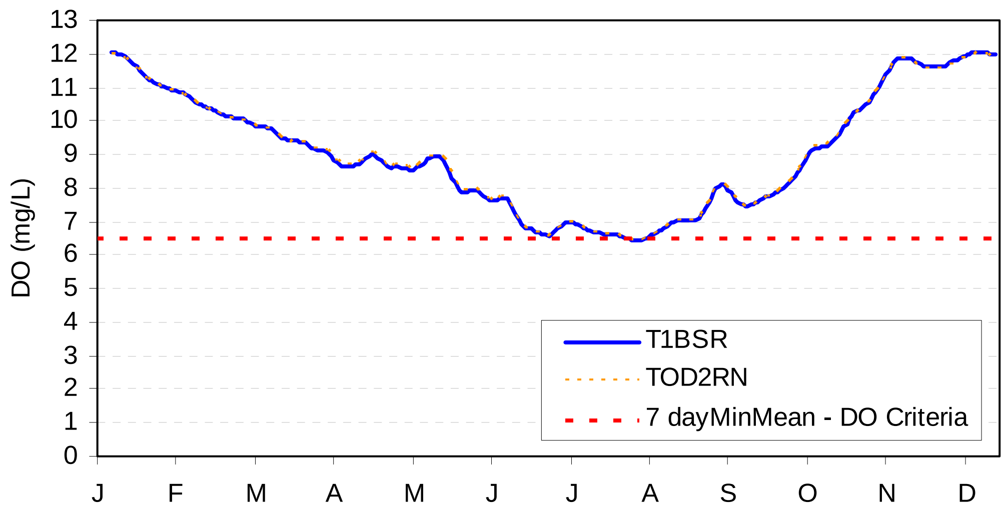


DO (mg/L)
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
T1BSR
TOD2RN
DO Criteria
J
F
M
A
M
J
J
A
S
O
N
D

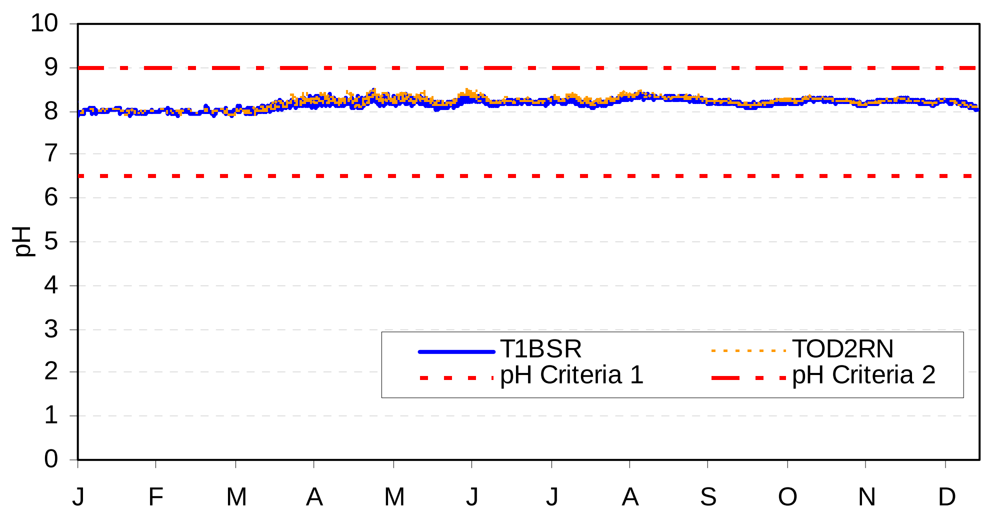
DS JCB DAM



DO (mg/L)
13
12
11
10
9
8
7
6
5
4
3
2
1
0
J
F
M
A
M
J
J
A
S
O
N
D
T1BSR
TOD2RN
30dayMeanMin-DO Criteria

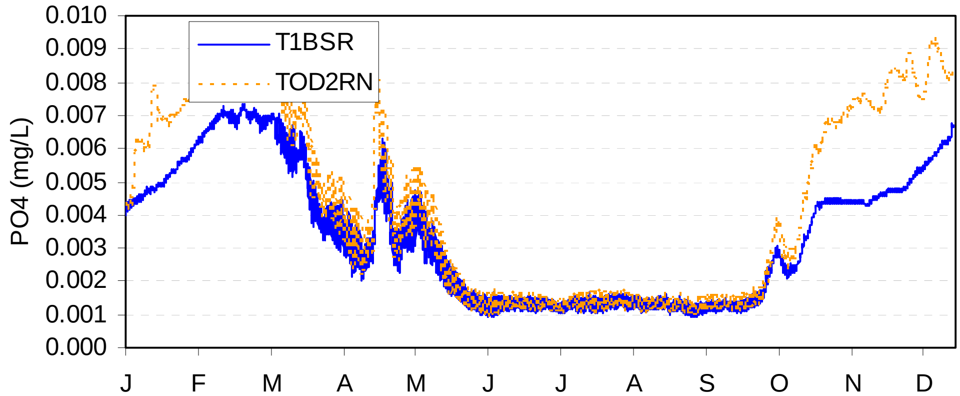


DO (mg/L)
13
12
11
10
9
8
7
6
5
4
3
2
1
0
J
F
M
A
M
J
J
A
S
O
N
D
T1BSR
TOD2RN
7 dayMinMean - DO Criteria

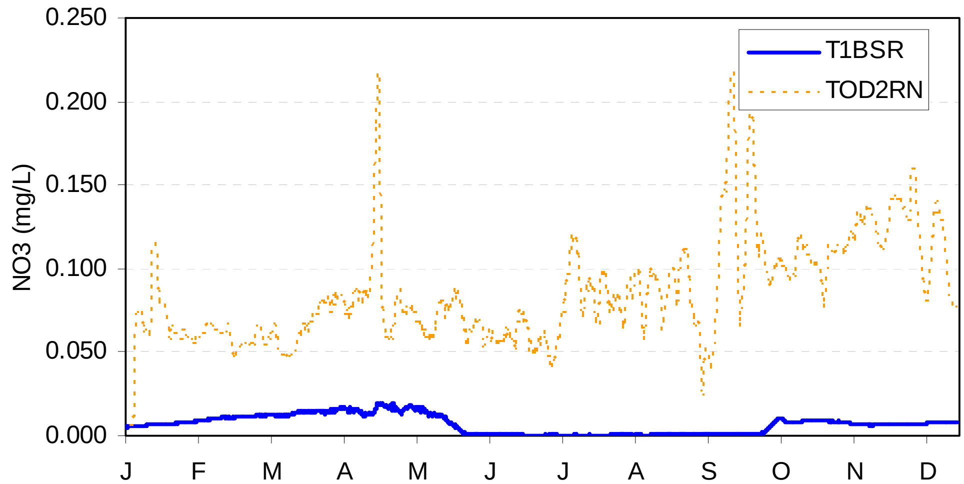


pH
10
9
8
7
6
5
4
3
2
1
0
J
F
M
A
M
J
J
A
S
O
N
D
T1BSR
TOD2RN
pH Criteria 1
pH Criteria 2

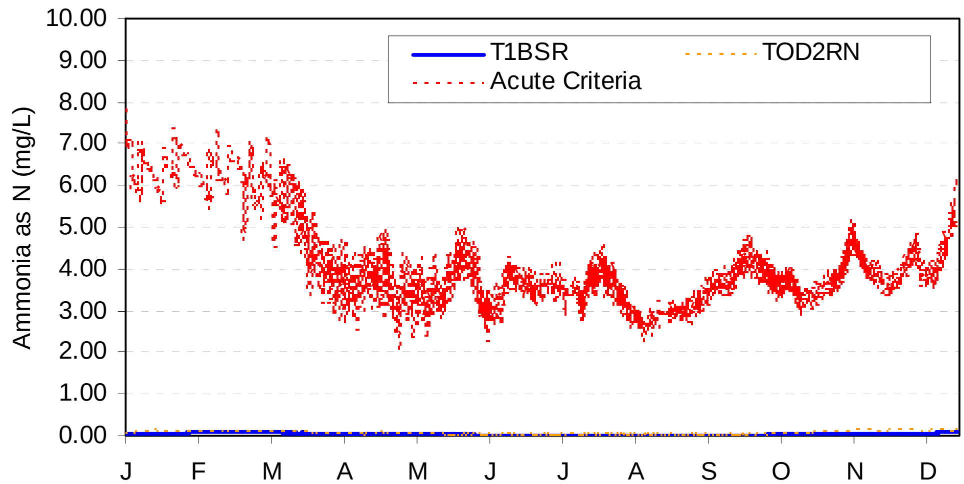
DS JCB DAM



T1BSR
TOD2RN
PO4 (mg/L)
0.010
0.009
0.008
0.007
0.006
0.005
0.004
0.003
0.002
0.001
0.000
J F M A M J J A S O N D

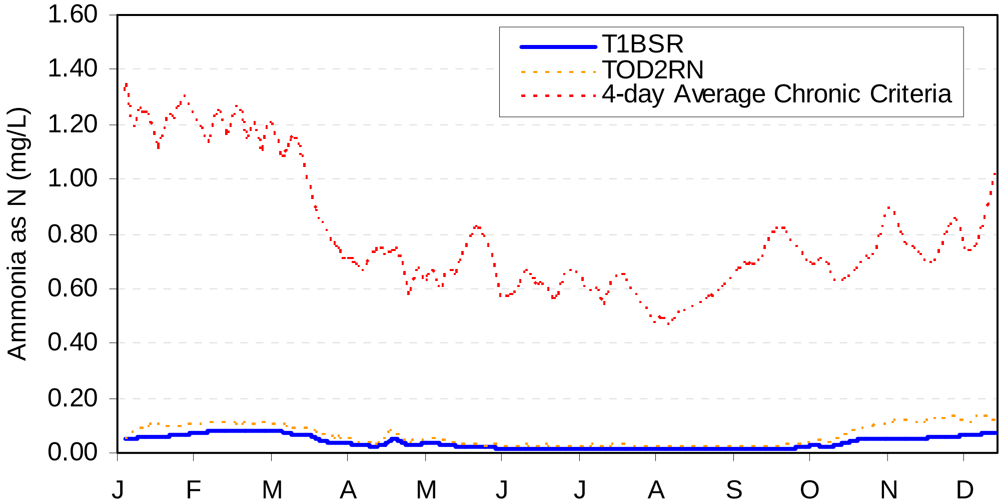


T1BSR
TOD2RN
NO3 (mg/L)
0.250
0.200
0.150
0.100
0.050
0.000
J F M A M J J A S O N D

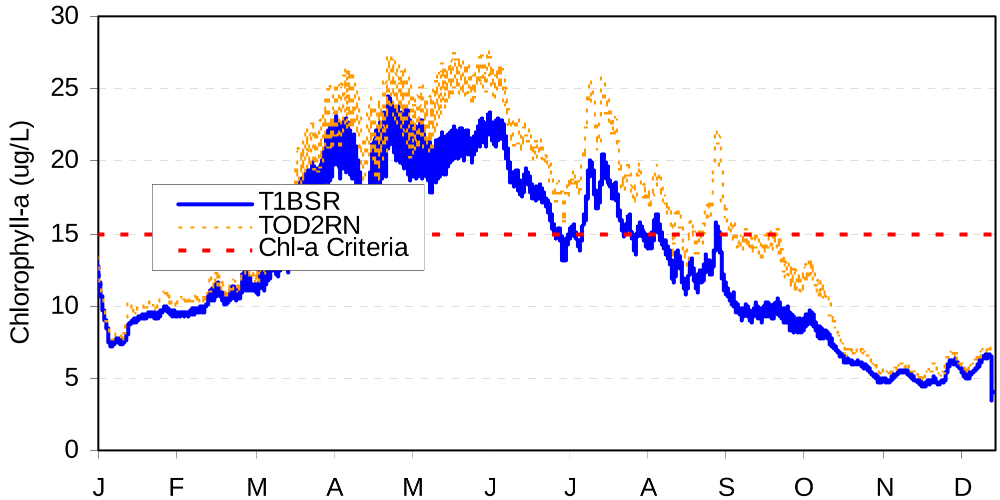


T1BSR
TOD2RN
Acute Criteria
Ammonia as N (mg/L)
10.00
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
J F M A M J J A S O N D

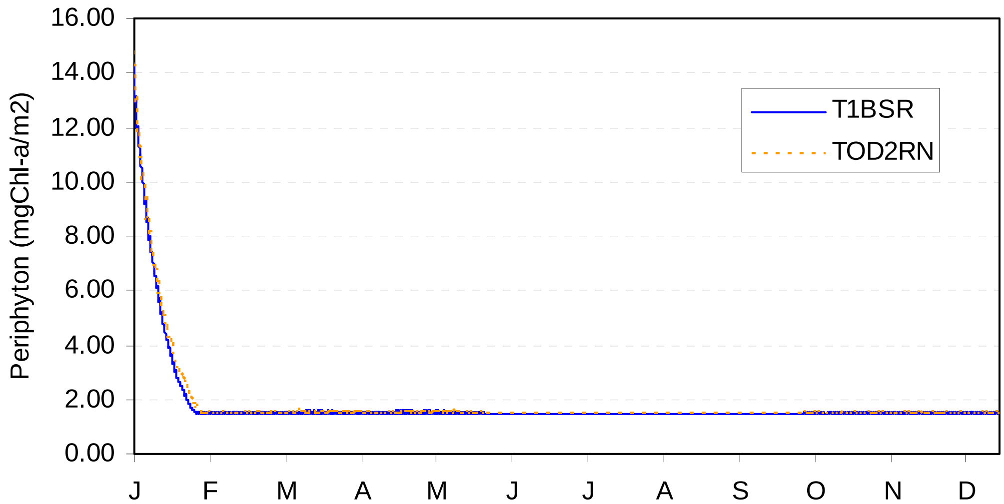
DS JCB DAM



T1BSR
TOD2RN
4-day Average Chronic Criteria
Ammonia as N (mg/L)
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
J F M A M J J A S O N D

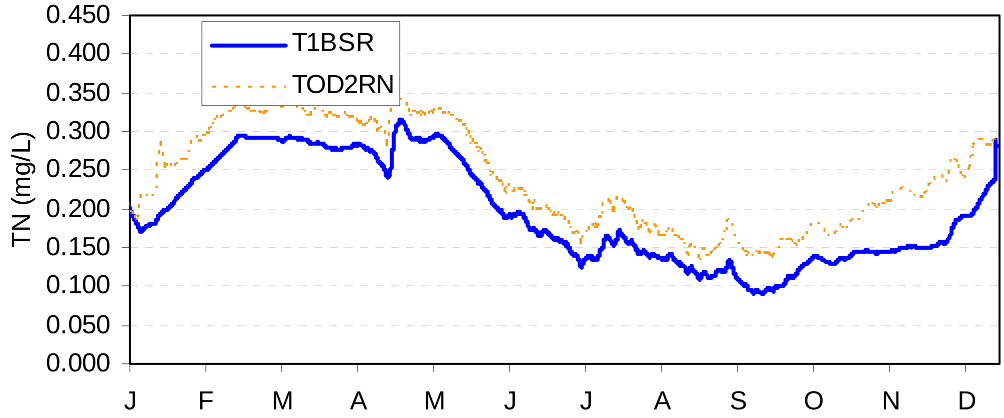


T1BSR
TOD2RN
Chl-a Criteria
Chlorophyll-a (ug/L)
30
25
20
15
10
5
0
J F M A M J J A S O N D

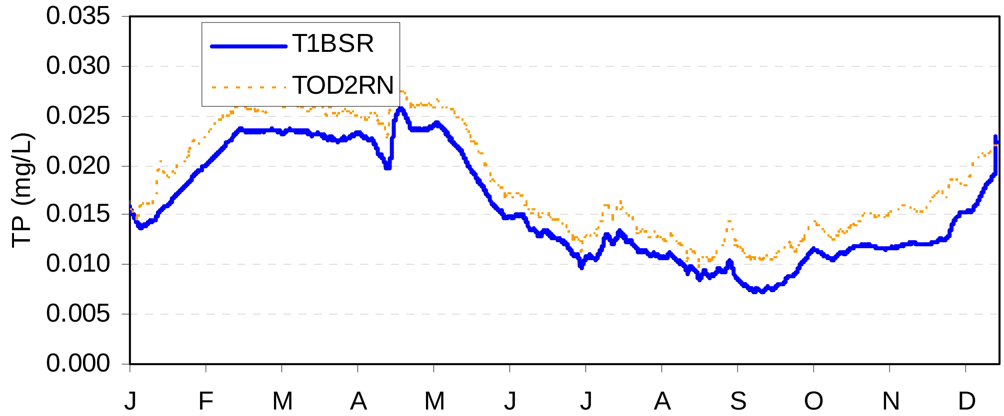


T1BSR
TOD2RN
Periphyton (mgChl-a/m2)
16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
J F M A M J J A S O N D

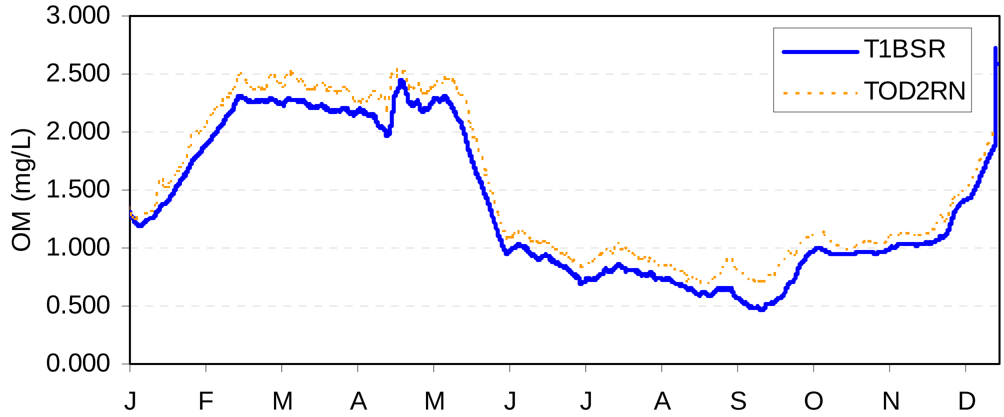
DS JCB DAM



TN (mg/L)
0.450
0.400
0.350
0.300
0.250
0.200
0.150
0.100
0.050
0.000
T1BSR
TOD2RN
J F M A M J J A S O N D

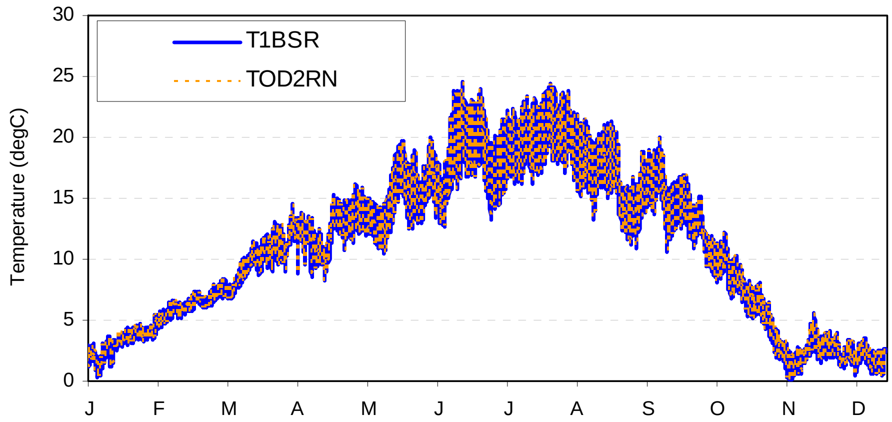


TP (mg/L)
0.035
0.030
0.025
0.020
0.015
0.010
0.005
0.000
T1BSR
TOD2RN
J F M A M J J A S O N D

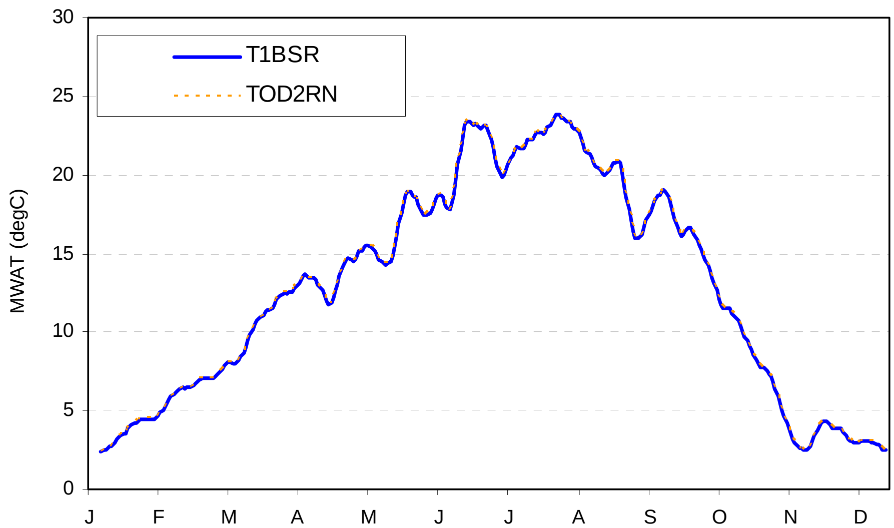


OM (mg/L)
3.000
2.500
2.000
1.500
1.000
0.500
0.000
T1BSR
TOD2RN
J F M A M J J A S O N D

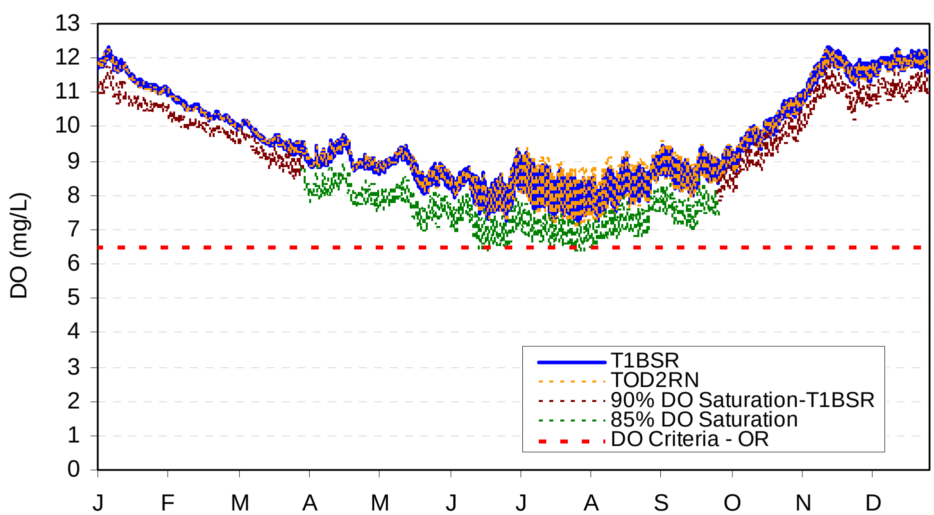
STATELINE



T1BSR
TOD2RN
Temperature (degC)
30
25
20
15
10
5
0
J
F
M
A
M
J
J
A
S
O
N
D

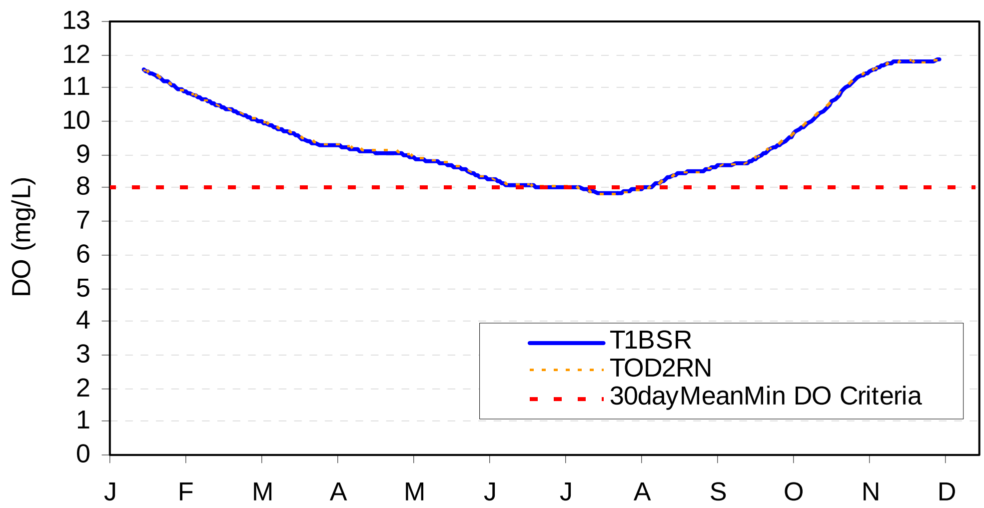


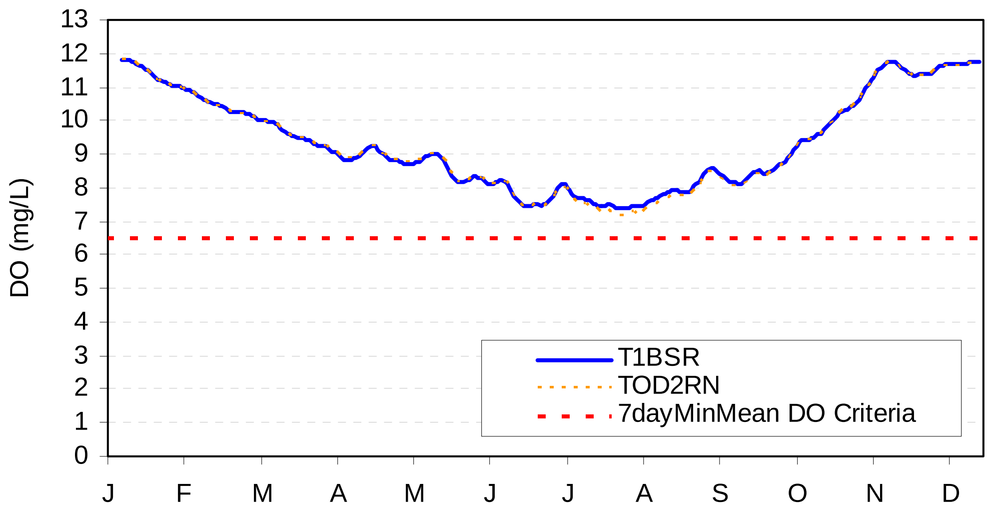
T1BSR
TOD2RN
MWAT (degC)
30
25
20
15
10
5
0
J
F
M
A
M
J
J
A
S
O
N
D

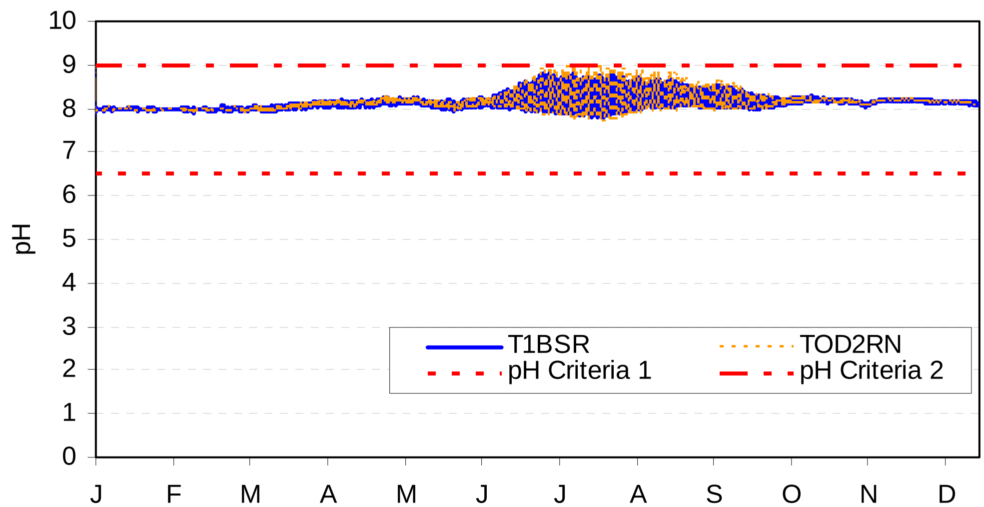


DO (mg/L)
13
12
11
10
9
8
7
6
5
4
3
2
1
0
T1BSR
TOD2RN
90% DO Saturation-T1BSR
85% DO Saturation
DO Criteria - OR
J
F
M
A
M
J
J
A
S
O
N
D

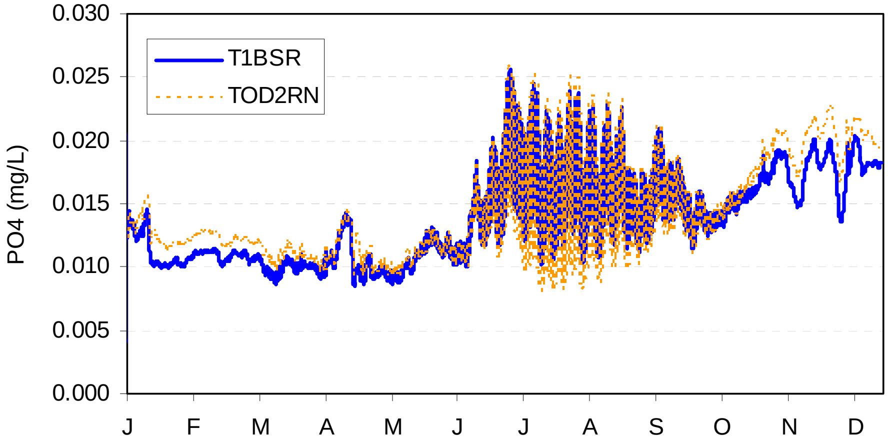
STATELINE


DO (mg/L)
13
12
11
10
9
8
7
6
5
4
3
2
1
0
J
F
M
A
M
J
J
A
S
O
N
D
T1BSR
TOD2RN
30dayMeanMin DO Criteria

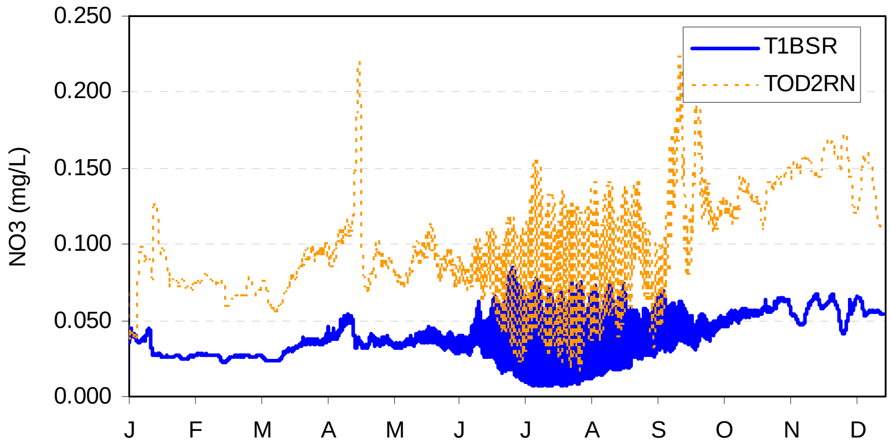

DO (mg/L)
13
12
11
10
9
8
7
6
5
4
3
2
1
0
J
F
M
A
M
J
J
A
S
O
N
D
T1BSR
TOD2RN
7dayMinMean DO Criteria


pH
10
9
8
7
6
5
4
3
2
1
0
J
F
M
A
M
J
J
A
S
O
N
D
T1BSR
TOD2RN
pH Criteria 1
pH Criteria 2

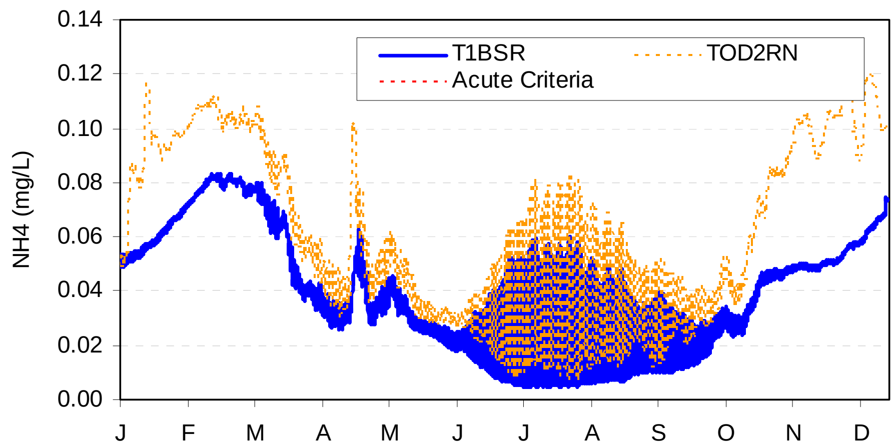
STATELINE



0.030
0.025
0.020
0.015
0.010
0.005
0.000
PO4 (mg/L)
T1BSR
TOD2RN
J F M A M J J A S O N D

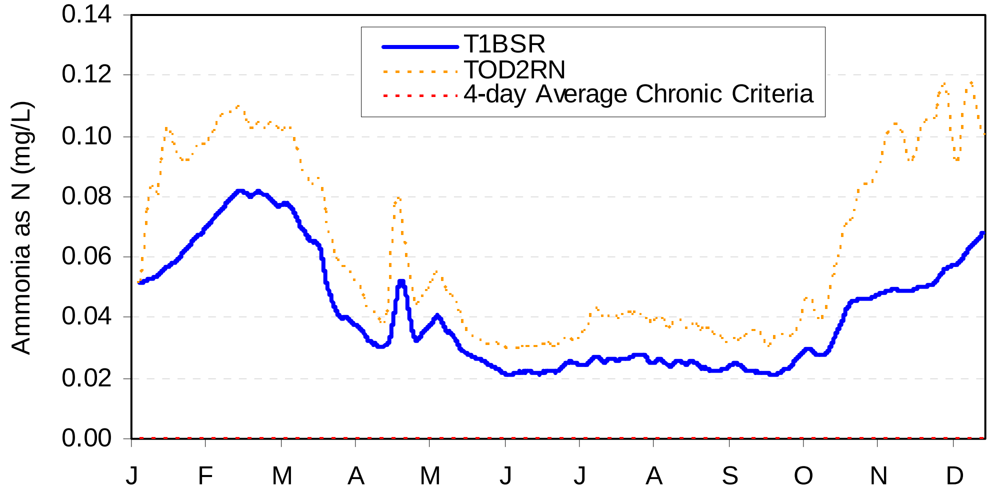


0.250
0.200
0.150
0.100
0.050
0.000
NO3 (mg/L)
T1BSR
TOD2RN
J F M A M J J A S O N D

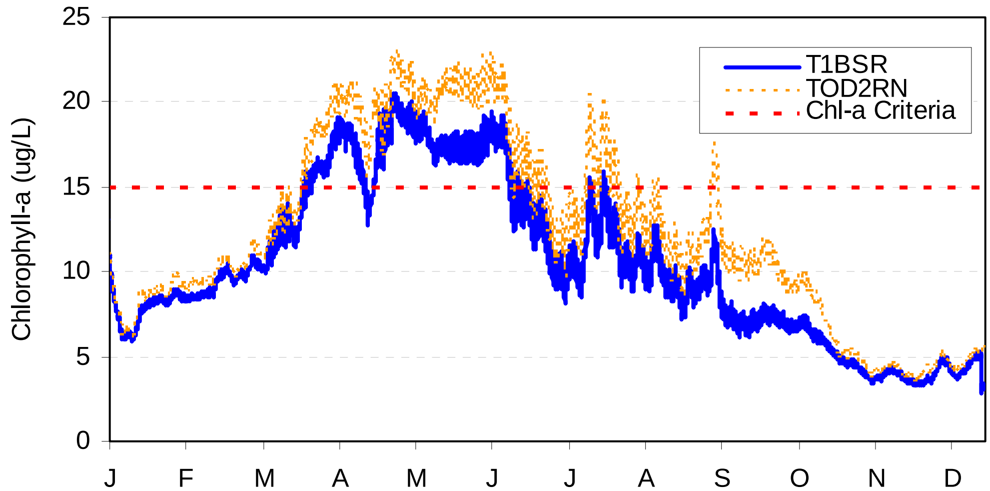


0.14
0.12
0.10
0.08
0.06
0.04
0.02
0.00
NH4 (mg/L)
T1BSR
TOD2RN
Acute Criteria
J F M A M J J A S O N D

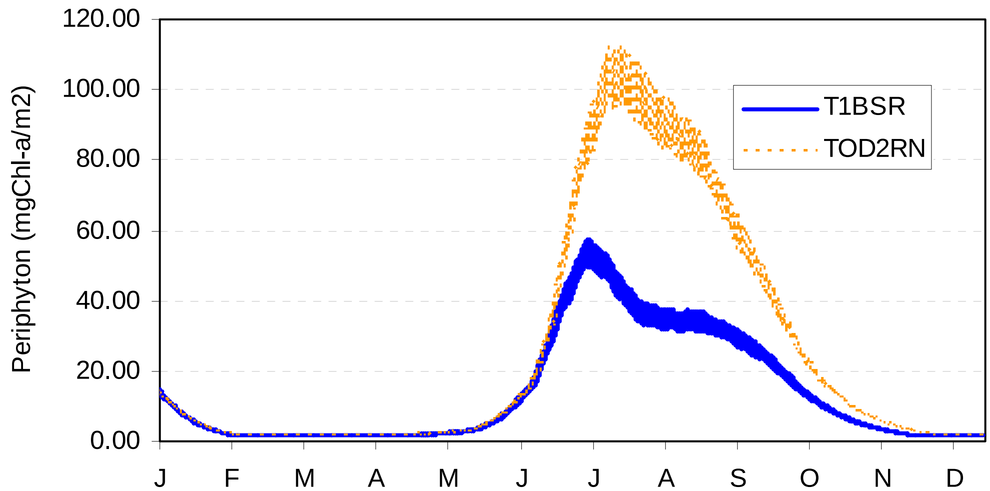
STATELINE



Ammonia as N (mg/L)
0.14
0.12
0.10
0.08
0.06
0.04
0.02
0.00
J F M A M J J A S O N D
T1BSR
TOD2RN
4-day Average Chronic Criteria

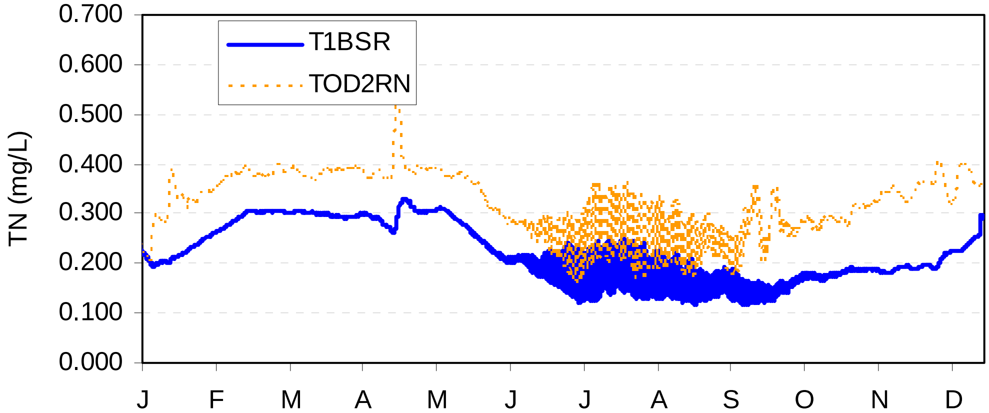


Chlorophyll-a (ug/L)
25
20
15
10
5
0
J F M A M J J A S O N D
T1BSR
TOD2RN
Chl-a Criteria

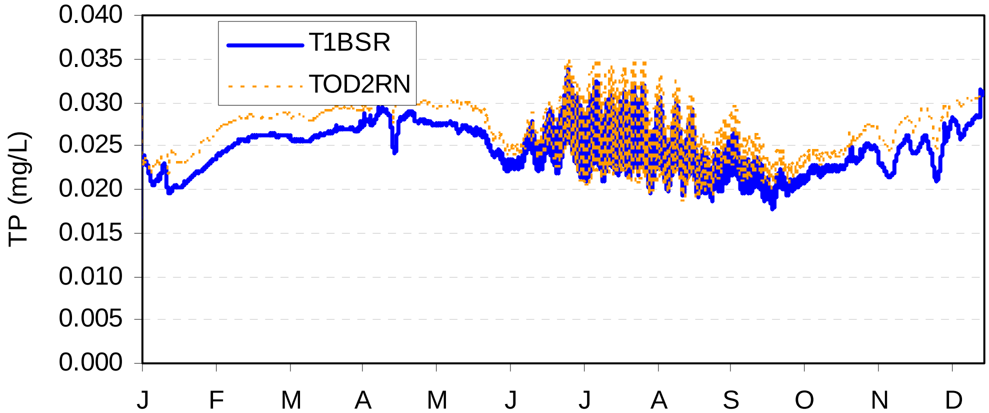


Periphyton (mgChl-a/m2)
120.00
100.00
80.00
60.00
40.00
20.00
0.00
J F M A M J J A S O N D
T1BSR
TOD2RN

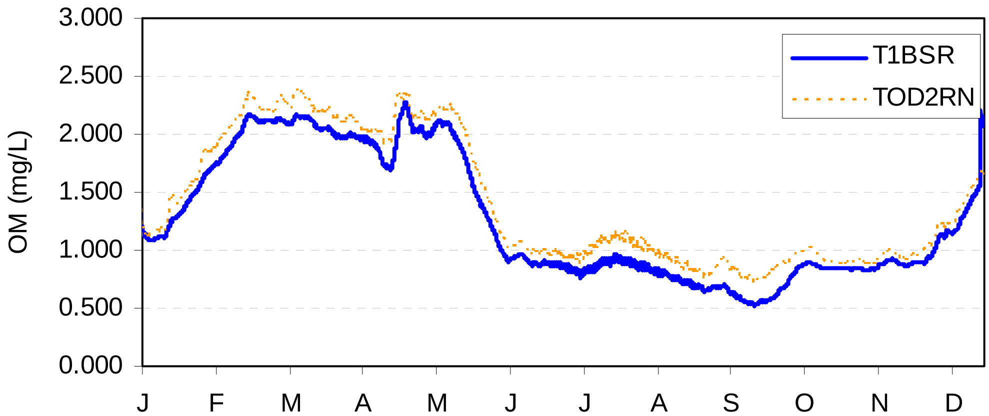
STATELINE



0.700
0.600
0.500
0.400
0.300
0.200
0.100
0.000
TN (mg/L)
T1BSR
TOD2RN
J F M A M J J A S O N D

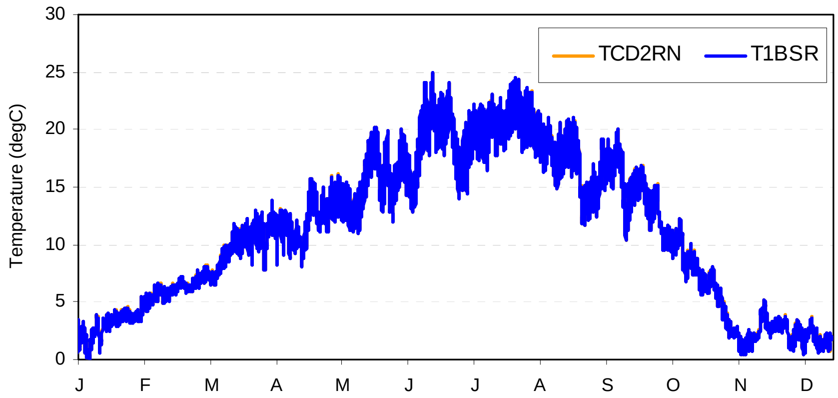


0.040
0.035
0.030
0.025
0.020
0.015
0.010
0.005
0.000
TP (mg/L)
T1BSR
TOD2RN
J F M A M J J A S O N D

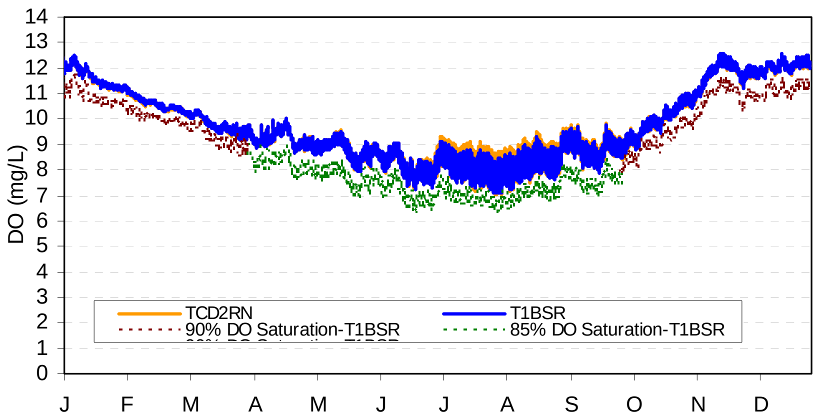


3.000
2.500
2.000
1.500
1.000
0.500
0.000
OM (mg/L)
T1BSR
TOD2RN
J F M A M J J A S O N D

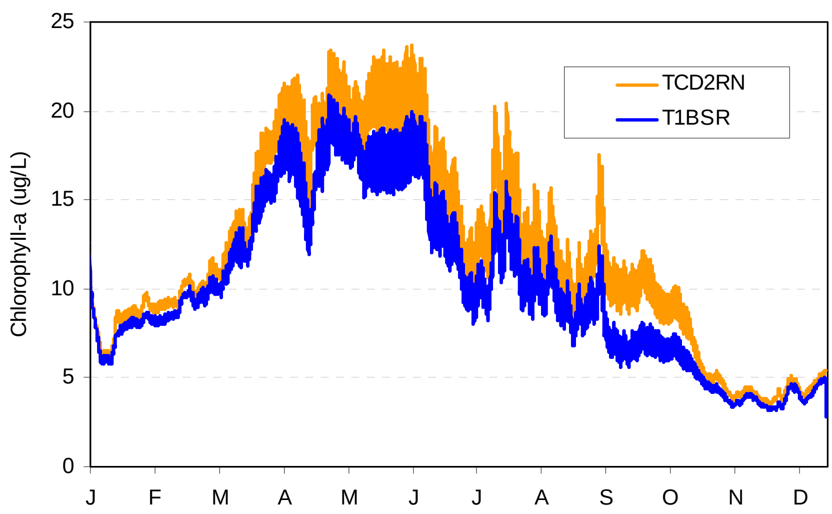
DS_COPCODAM



Temperature (degC)
TCD2RN
T1BSR
30
25
20
15
10
5
0
J F M A M J J A S O N D

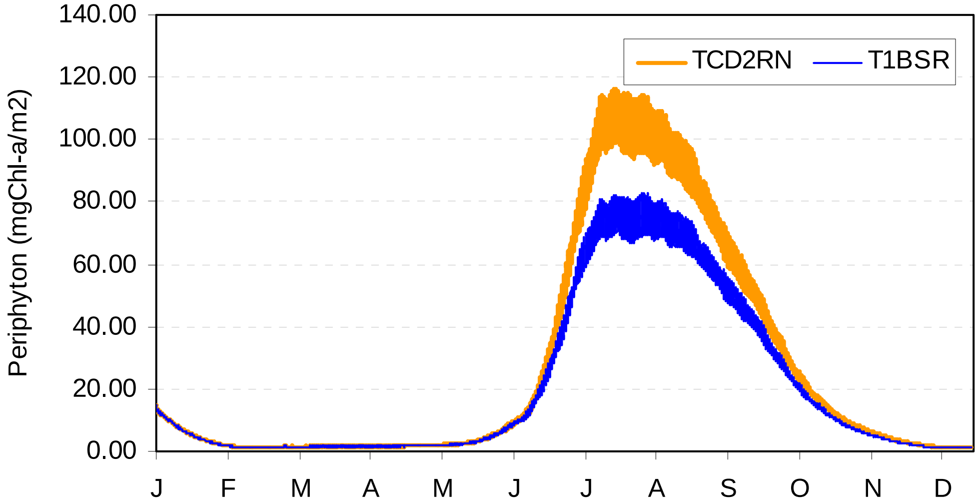


DO (mg/L)
TCD2RN
T1BSR
90% DO Saturation-T1BSR
85% DO Saturation-T1BSR
14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
J F M A M J J A S O N D

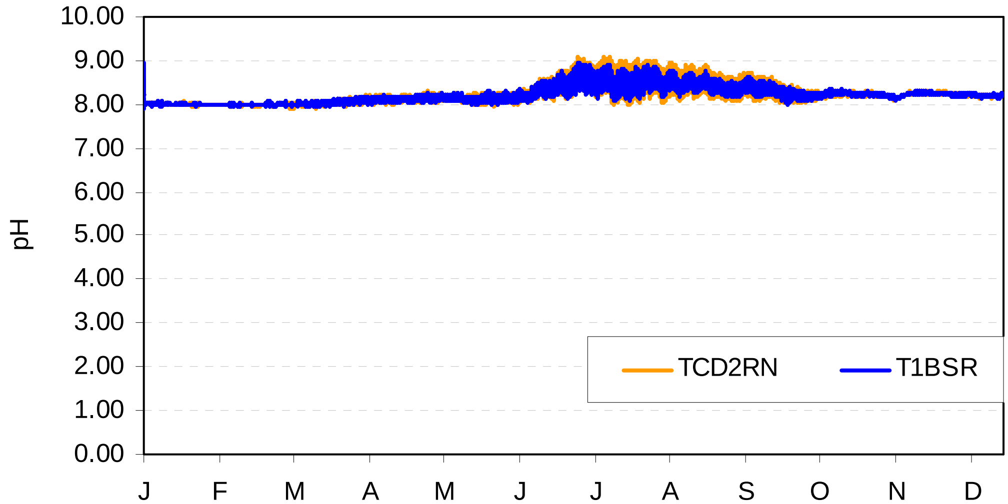


Chlorophyll-a (ug/L)
TCD2RN
T1BSR
25
20
15
10
5
0
J F M A M J J A S O N D

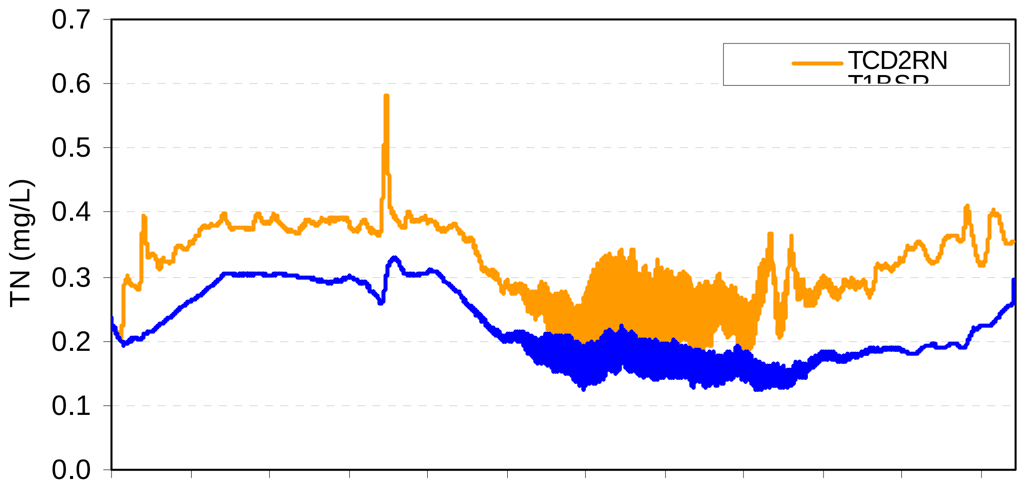
DS_COPCODAM



TCD2RN
T1BSR
Periphyton (mgChl-a/m2)
140.00
120.00
100.00
80.00
60.00
40.00
20.00
0.00
J
F
M
A
M
J
J
A
S
O
N
D

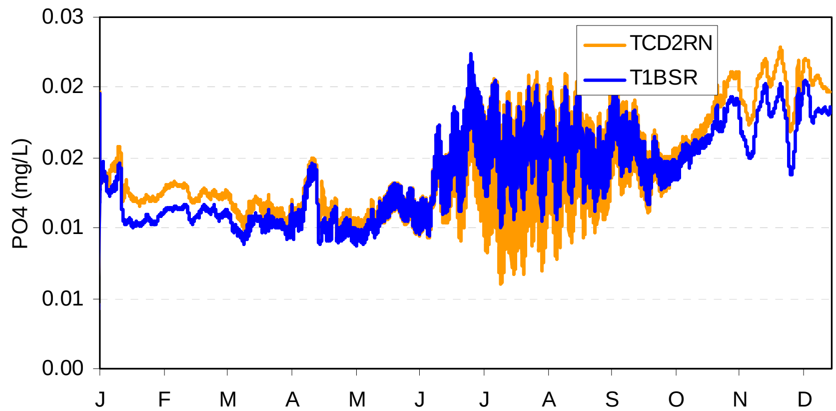


pH
10.00
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
TCD2RN
T1BSR
J
F
M
A
M
J
J
A
S
O
N
D

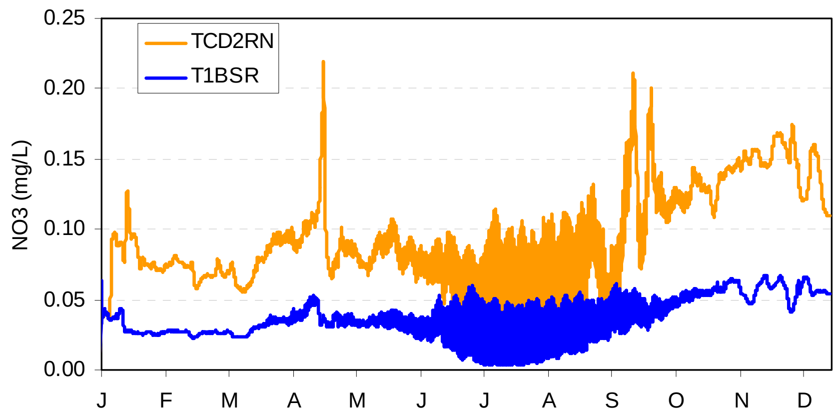


TN (mg/L)
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
TCD2RN

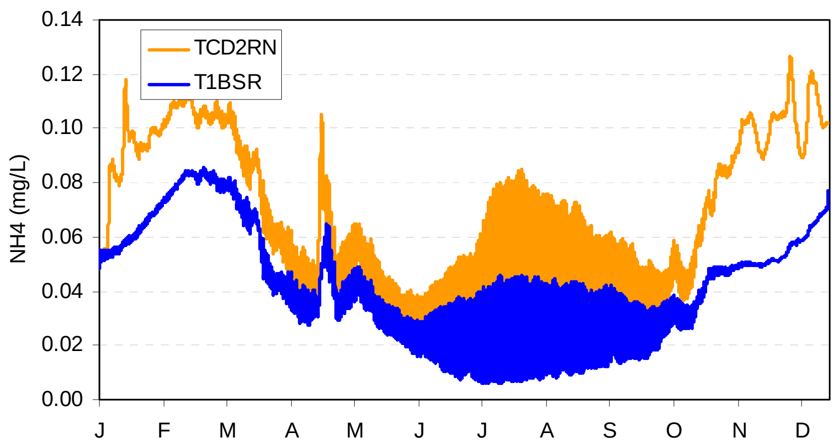
DS_COPCODAM



0.03
0.02
0.02
0.01
0.01
0.00
PO4 (mg/L)
TCD2RN
T1BSR
J
F
M
A
M
J
J
A
S
O
N
D

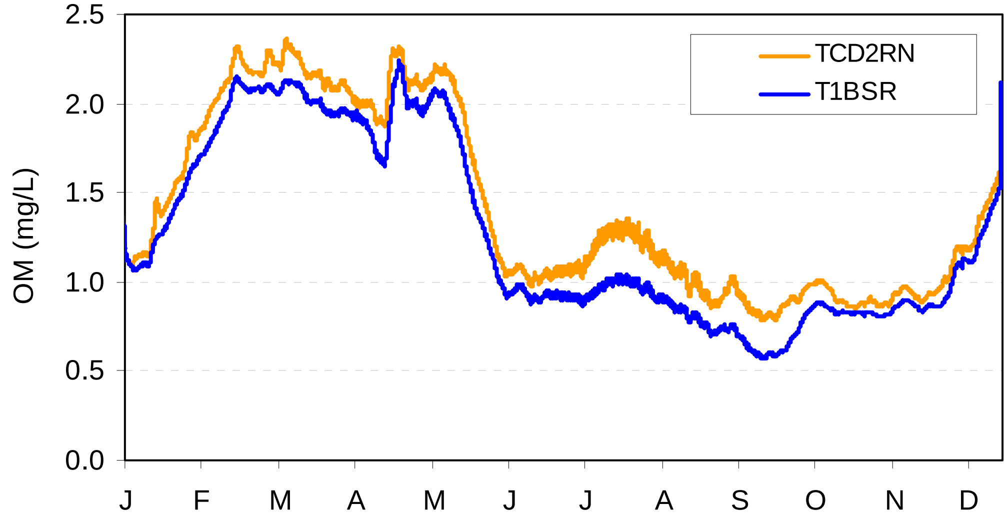


0.25
0.20
0.15
0.10
0.05
0.00
NO3 (mg/L)
TCD2RN
T1BSR
J
F
M
A
M
J
J
A
S
O
N
D

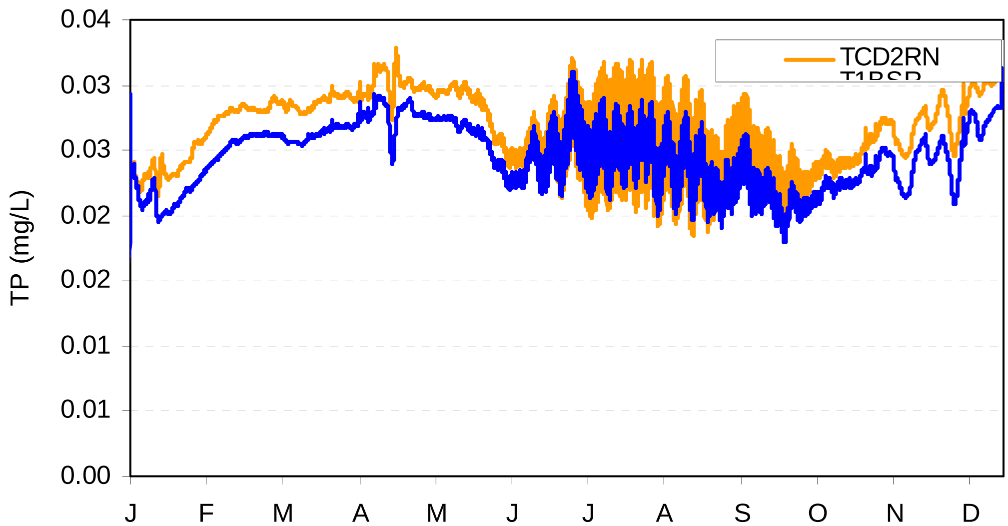


0.14
0.12
0.10
0.08
0.06
0.04
0.02
0.00
NH4 (mg/L)
TCD2RN
T1BSR
J
F
M
A
M
J
J
A
S
O
N
D

DS_COPCODAM

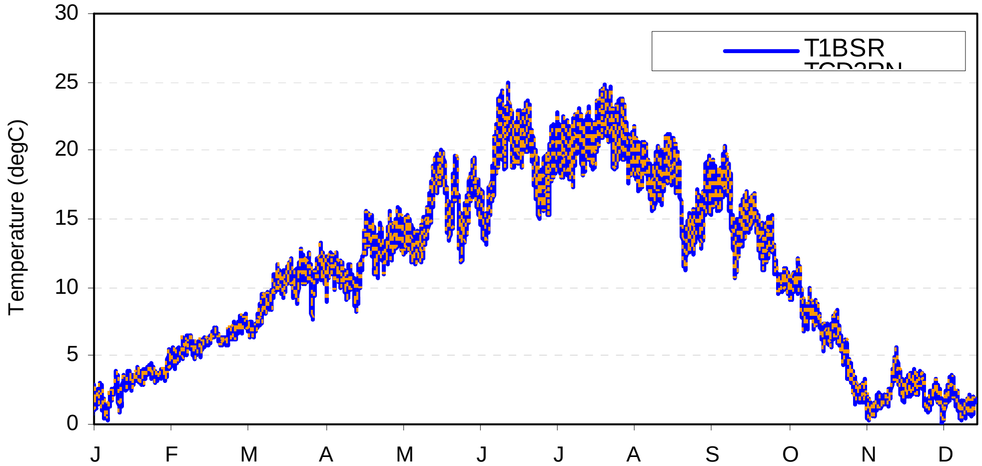


OM (mg/L)
2.5
2.0
1.5
1.0
0.5
0.0
J
F
M
A
M
J
J
A
S
O
N
D
TCD2RN
T1BSR

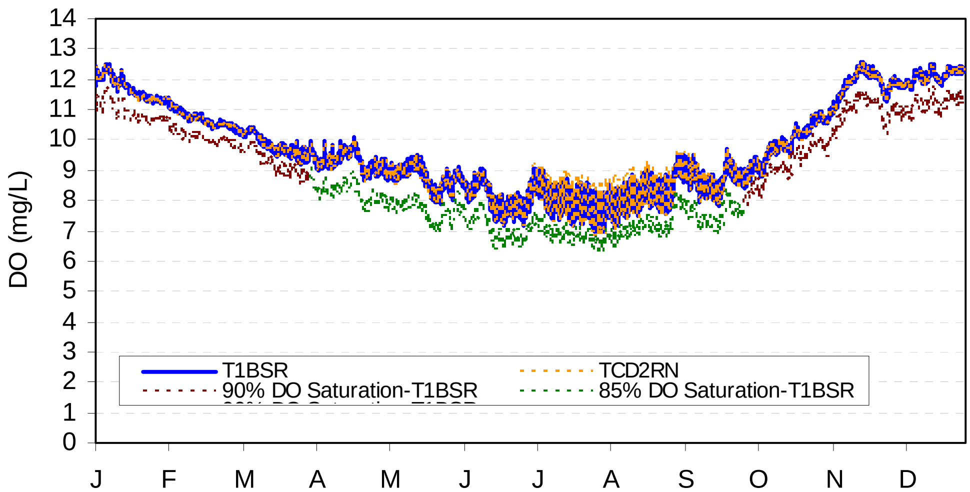


TP (mg/L)
0.04
0.03
0.03
0.02
0.02
0.01
0.01
0.00
J
F
M
A
M
J
J
A
S
O
N
D
TCD2RN

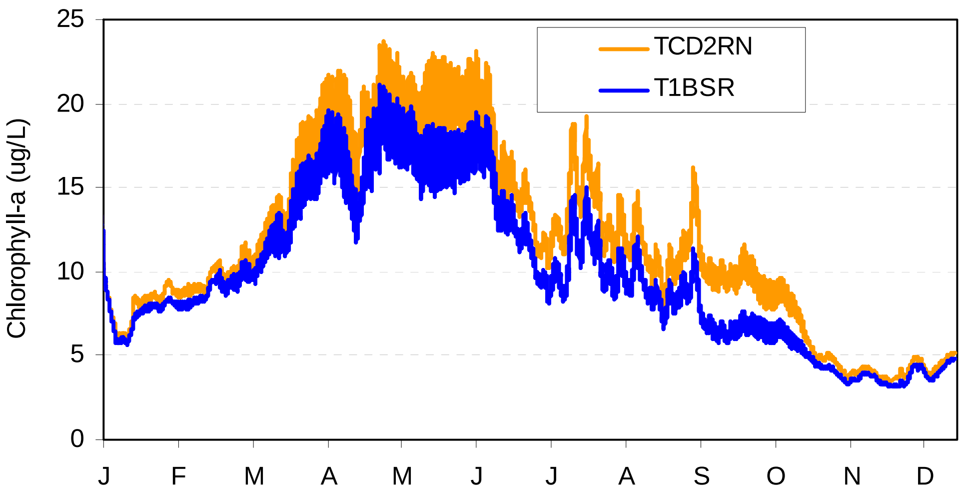
US_IG_DAM



30
25
20
15
10
5
0
Temperature (degC)
T1BSR
J
F
M
A
M
J
J
A
S
O
N
D

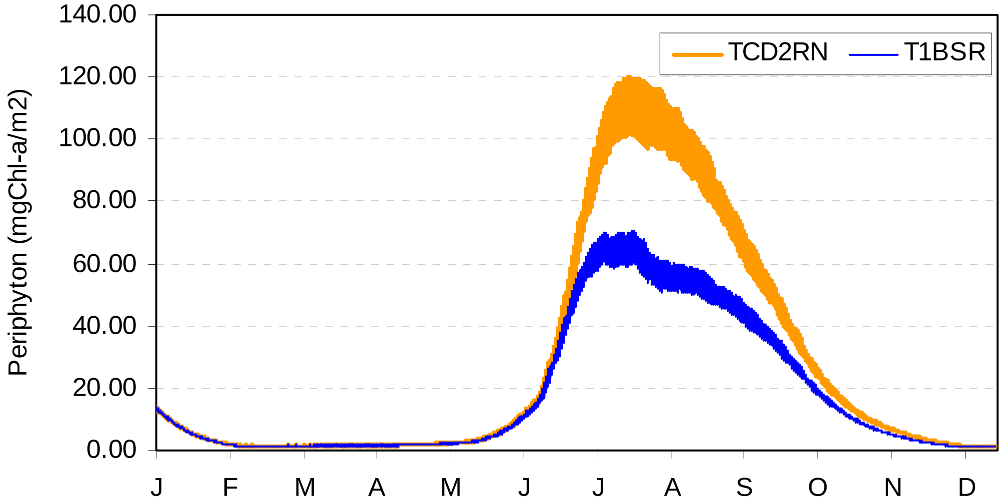


14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
DO (mg/L)
T1BSR
TCD2RN
90% DO Saturation-T1BSR
85% DO Saturation-T1BSR
J
F
M
A
M
J
J
A
S
O
N
D

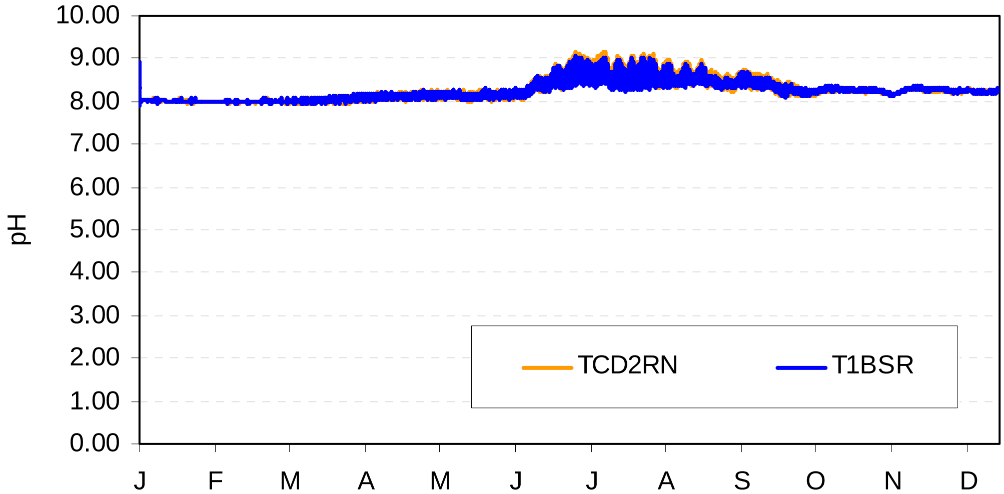


25
20
15
10
5
0
Chlorophyll-a (ug/L)
TCD2RN
T1BSR
J
F
M
A
M
J
J
A
S
O
N
D

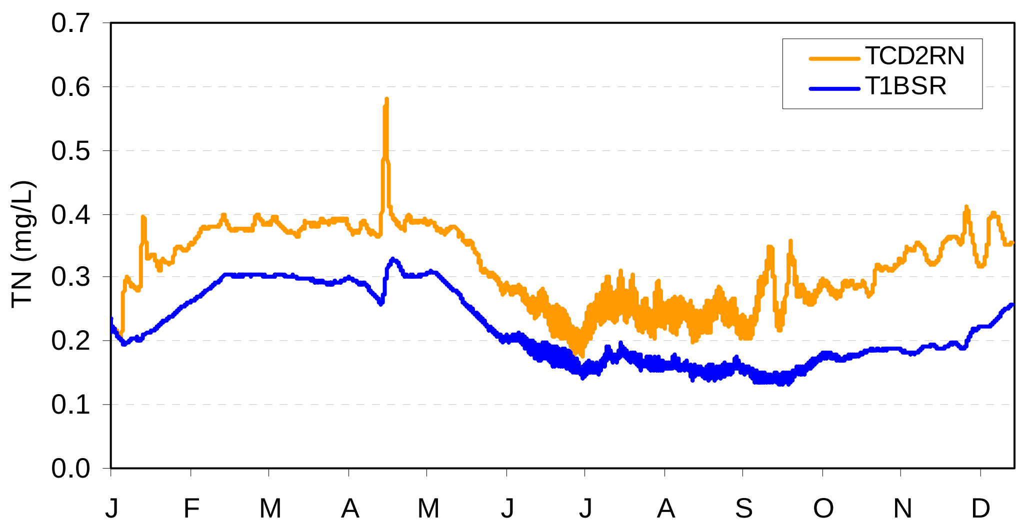
US_IG_DAM



TCD2RN
T1BSR
Periphyton (mgChl-a/m2)
140.00
120.00
100.00
80.00
60.00
40.00
20.00
0.00
J F M A M J J A S O N D

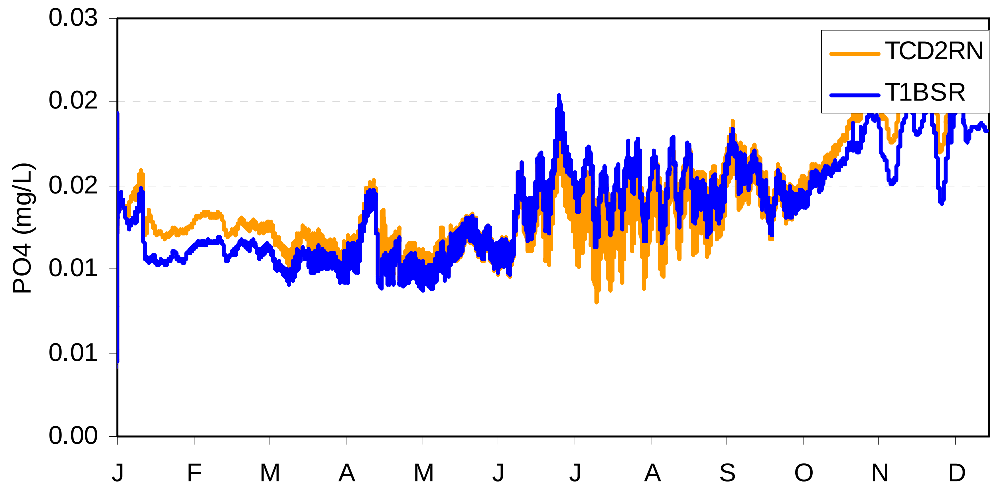


pH
10.00
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
TCD2RN
T1BSR
J F M A M J J A S O N D

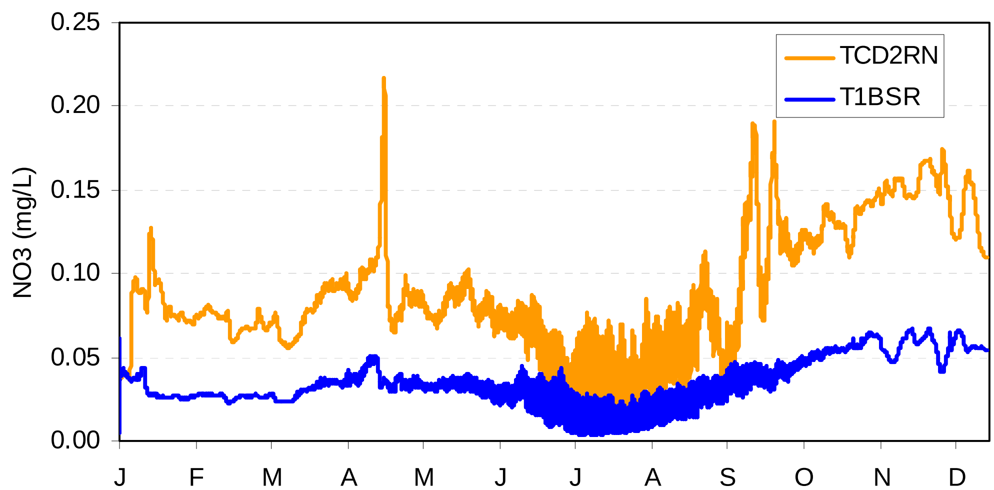


TCD2RN
T1BSR
TN (mg/L)
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
J F M A M J J A S O N D

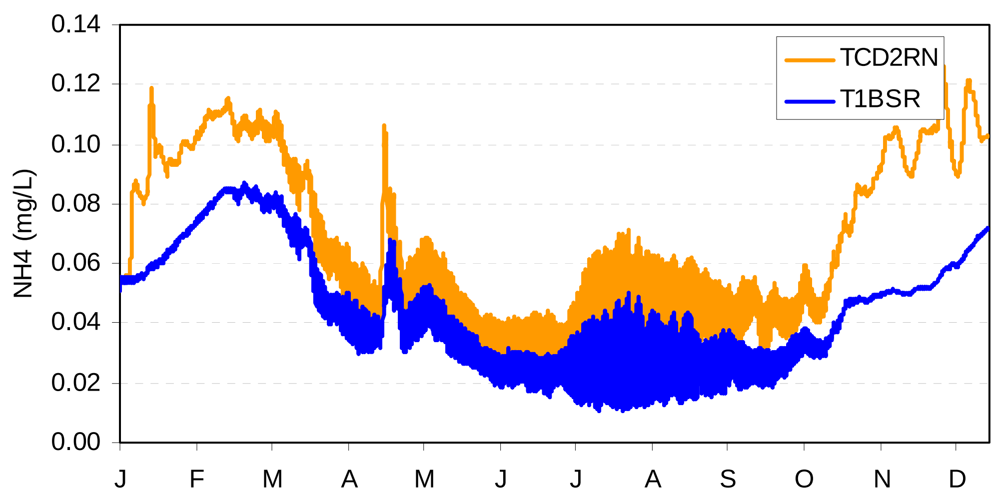
US_IG_DAM



0.03
0.02
0.02
0.01
0.01
0.00
PO4 (mg/L)
J F M A M J J A S O N D
TCD2RN
T1BSR

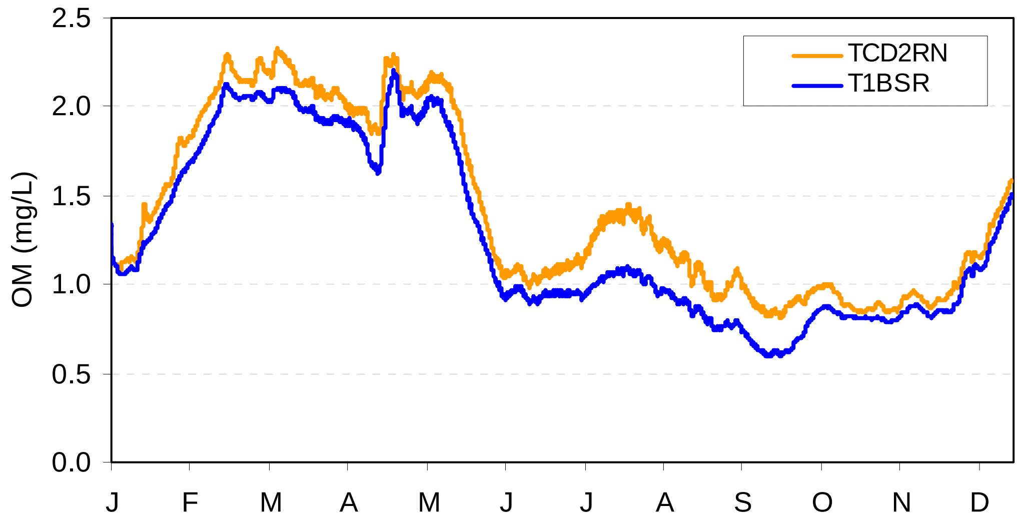


0.25
0.20
0.15
0.10
0.05
0.00
NO3 (mg/L)
J F M A M J J A S O N D
TCD2RN
T1BSR

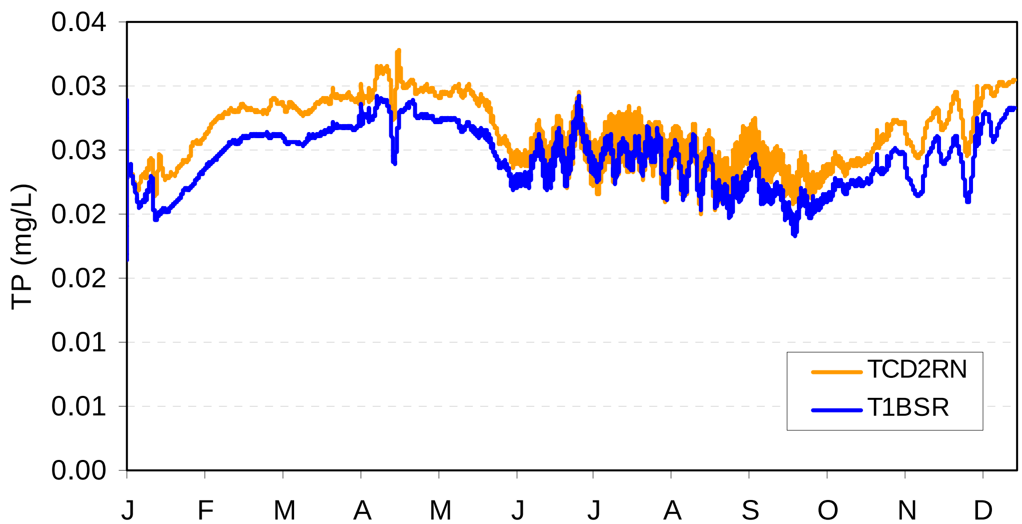


0.14
0.12
0.10
0.08
0.06
0.04
0.02
0.00
NH4 (mg/L)
J F M A M J J A S O N D
TCD2RN
T1BSR

US_IG_DAM

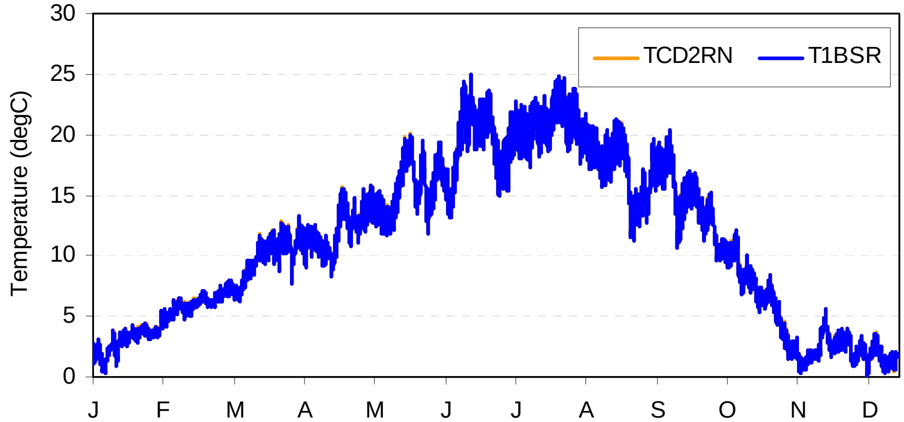


TCD2RN
T1BSR
OM (mg/L)
2.5
2.0
1.5
1.0
0.5
0.0
J
F
M
A
M
J
J
A
S
O
N
D

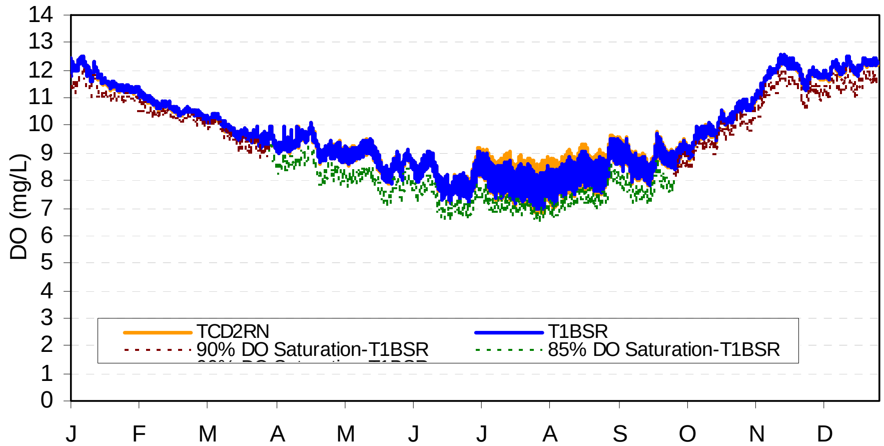


TCD2RN
T1BSR
TP (mg/L)
0.04
0.03
0.03
0.02
0.02
0.01
0.01
0.00
J
F
M
A
M
J
J
A
S
O
N
D

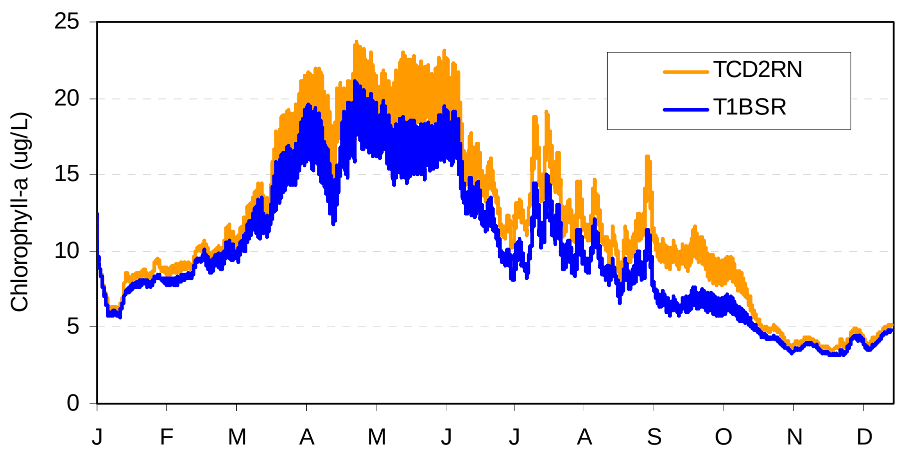
DS_IGDAM



TCD2RN
T1BSR
Temperature (degC)
30
25
20
15
10
5
0
J
F
M
A
M
J
J
A
S
O
N
D

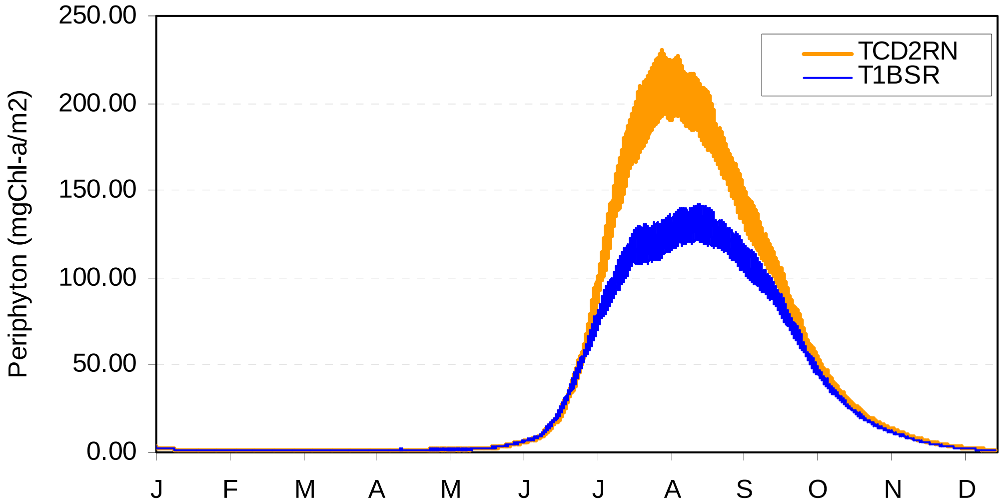


TCD2RN
T1BSR
90% DO Saturation-T1BSR
85% DO Saturation-T1BSR
DO (mg/L)
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
J
F
M
A
M
J
J
A
S
O
N
D

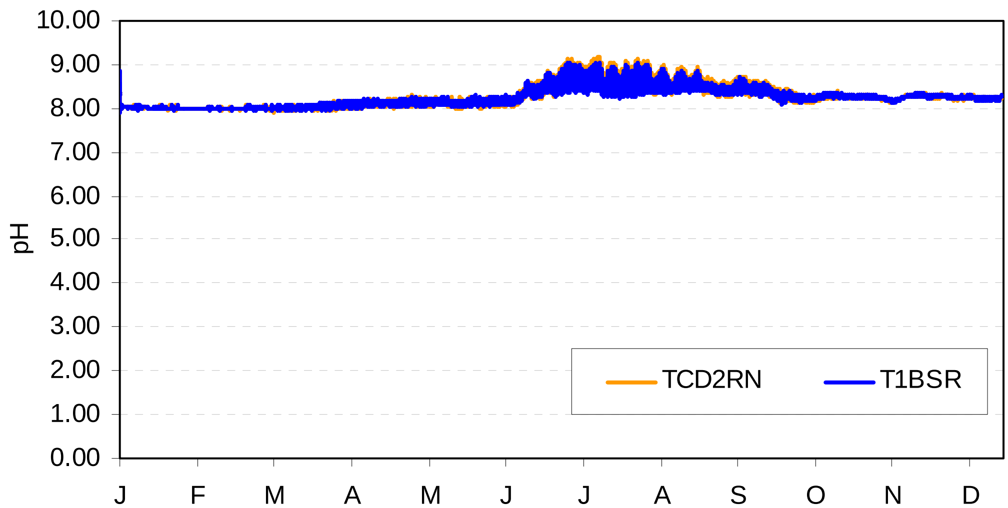


TCD2RN
T1BSR
Chlorophyll-a (ug/L)
25
20
15
10
5
0
J
F
M
A
M
J
J
A
S
O
N
D

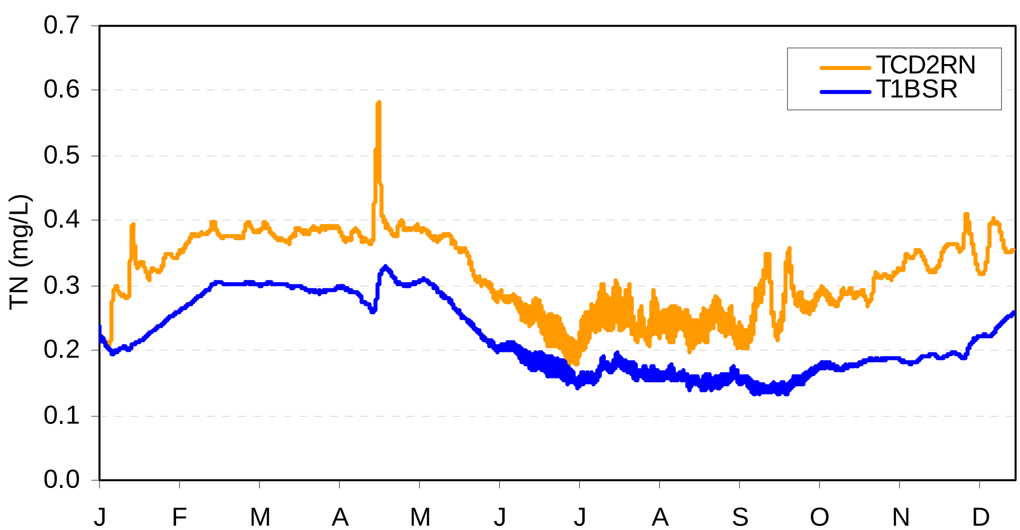
DS_IGDAM



250.00
200.00
150.00
100.00
50.00
0.00
Periphyton (mgChl-a/m2)
TCD2RN
T1BSR
J F M A M J J A S O N D

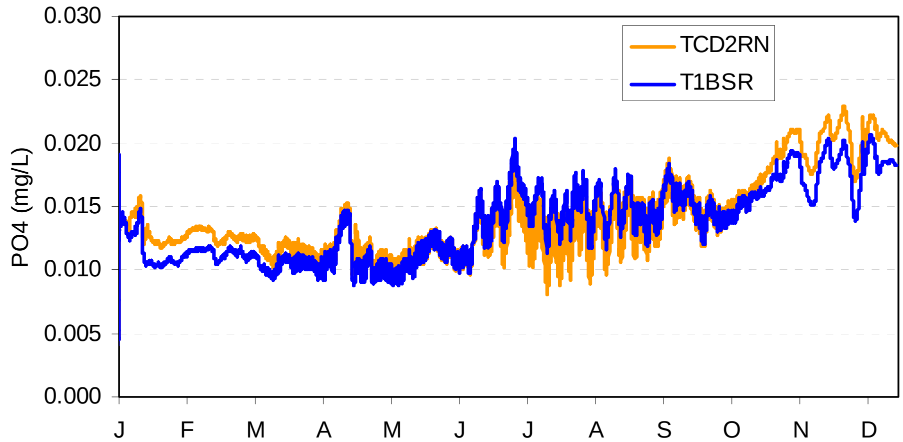


10.00
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
pH
TCD2RN
T1BSR
J F M A M J J A S O N D

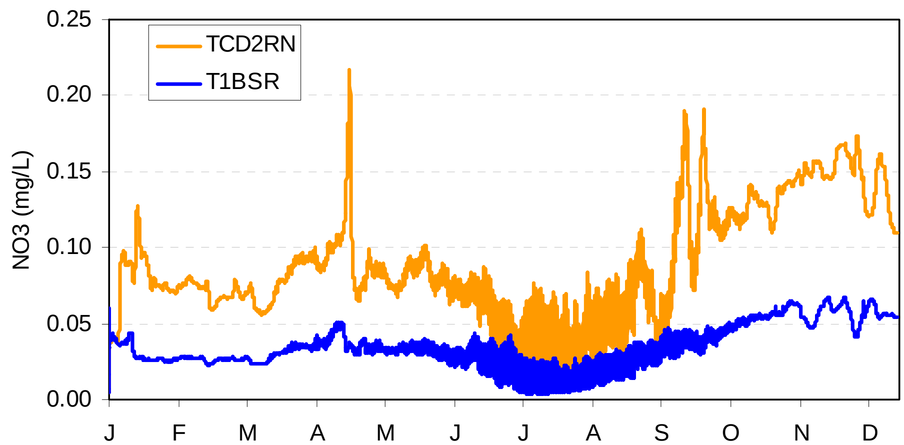


0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
TN (mg/L)
TCD2RN
T1BSR
J F M A M J J A S O N D

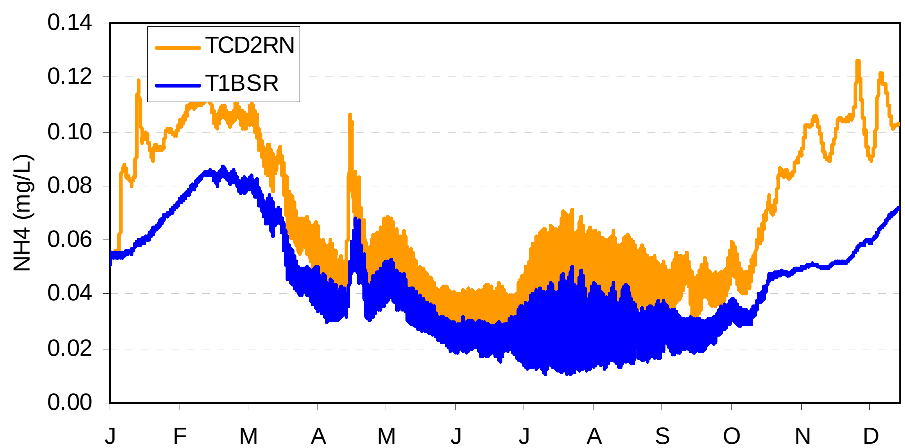
DS_IGDAM



0.030
0.025
0.020
0.015
0.010
0.005
0.000
PO4 (mg/L)
TCD2RN
T1BSR
J F M A M J J A S O N D

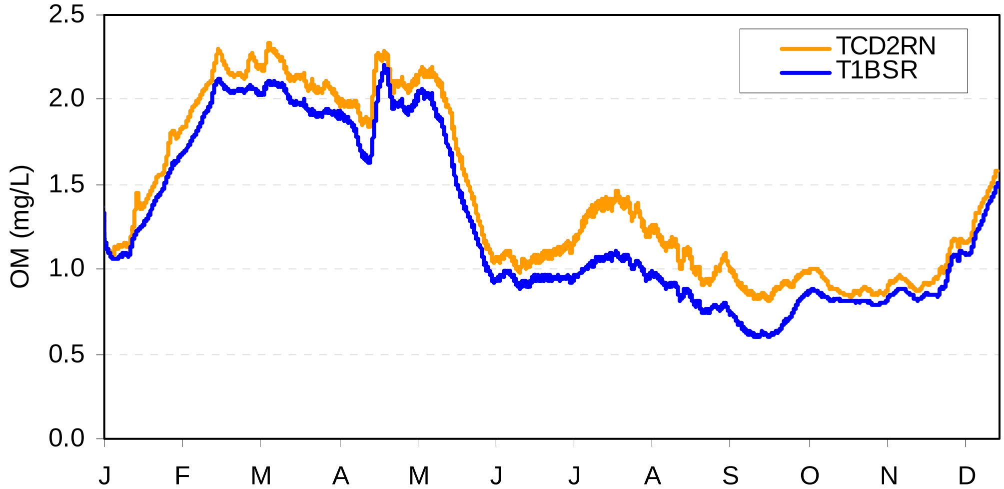


0.25
0.20
0.15
0.10
0.05
0.00
NO3 (mg/L)
TCD2RN
T1BSR
J F M A M J J A S O N D

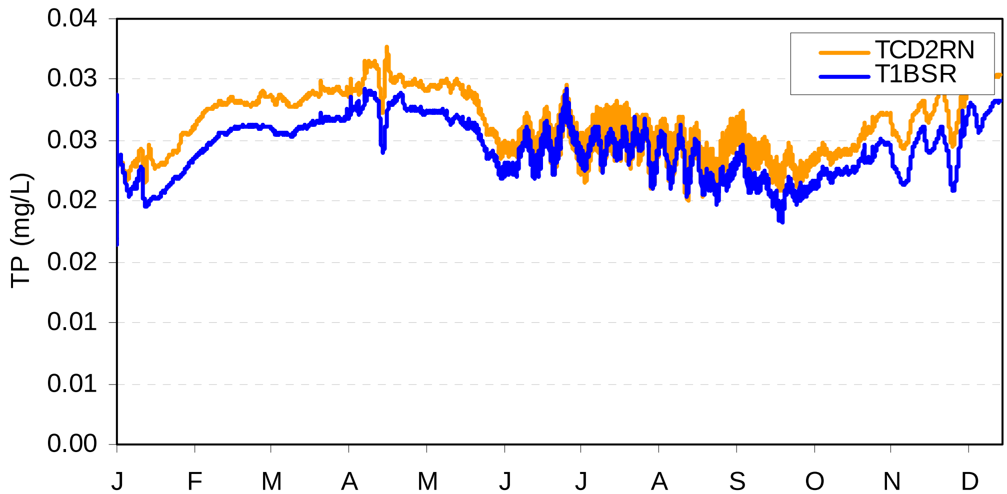


0.14
0.12
0.10
0.08
0.06
0.04
0.02
0.00
NH4 (mg/L)
TCD2RN
T1BSR
J F M A M J J A S O N D

DS_IGDAM

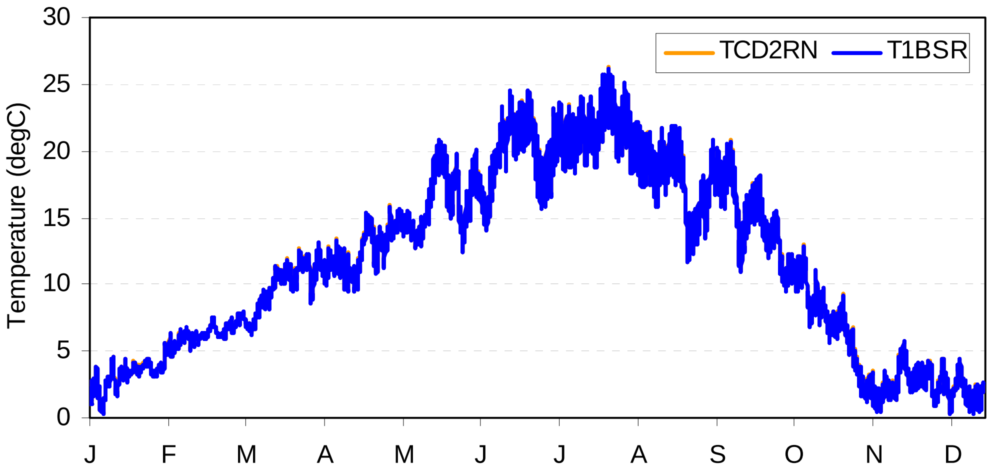


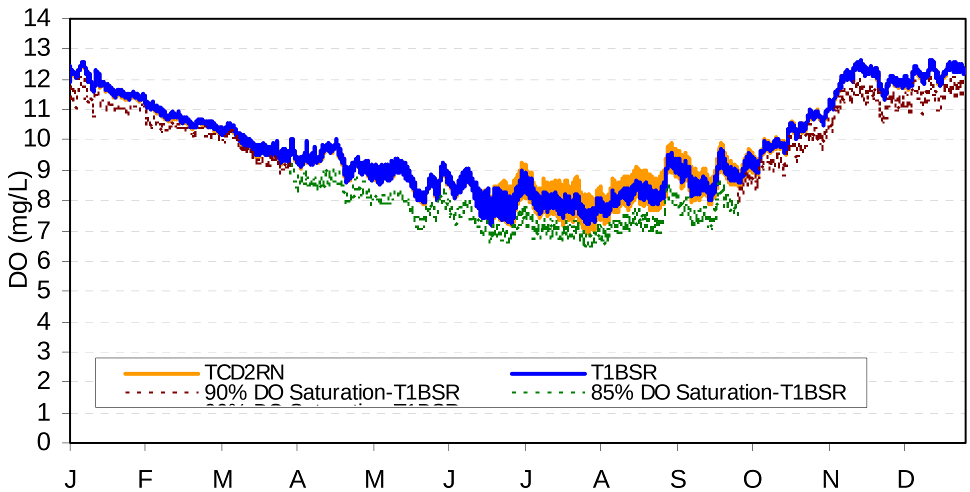
2.5
2.0
1.5
1.0
0.5
0.0
OM (mg/L)
J
F
M
A
M
J
J
A
S
O
N
D
TCD2RN
T1BSR

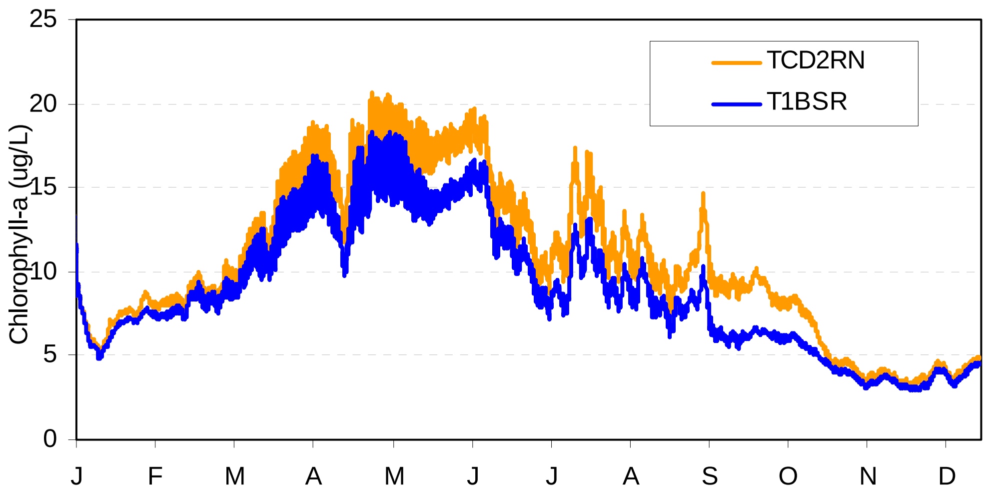


0.04
0.03
0.03
0.02
0.02
0.01
0.01
0.00
TP (mg/L)
J
F
M
A
M
J
J
A
S
O
N
D
TCD2RN
T1BSR

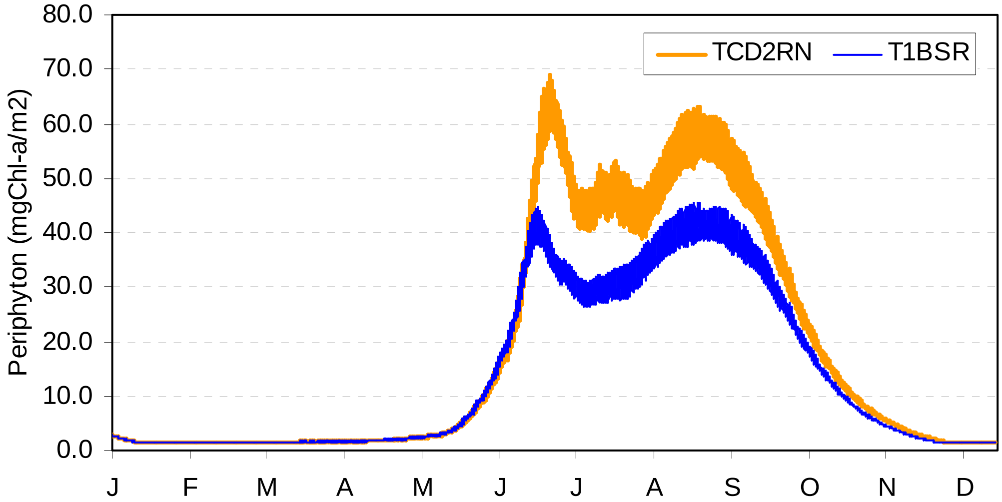
US_SHASTA


TCD2RN
T1BSR
Temperature (degC)
30
25
20
15
10
5
0
J F M A M J J A S O N D

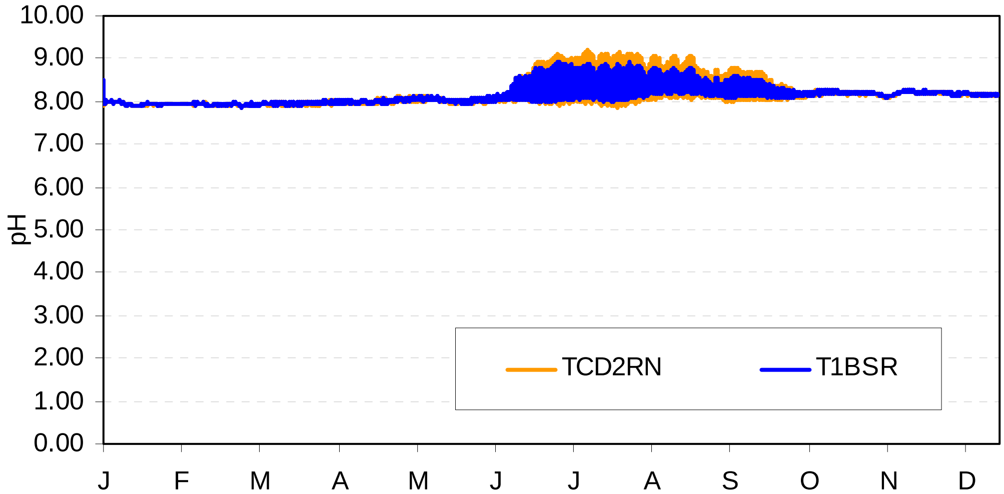

DO (mg/L)
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
TCD2RN
T1BSR
90% DO Saturation-T1BSR
85% DO Saturation-T1BSR
J F M A M J J A S O N D


TCD2RN
T1BSR
Chlorophyll-a (ug/L)
25
20
15
10
5
0
J F M A M J J A S O N D

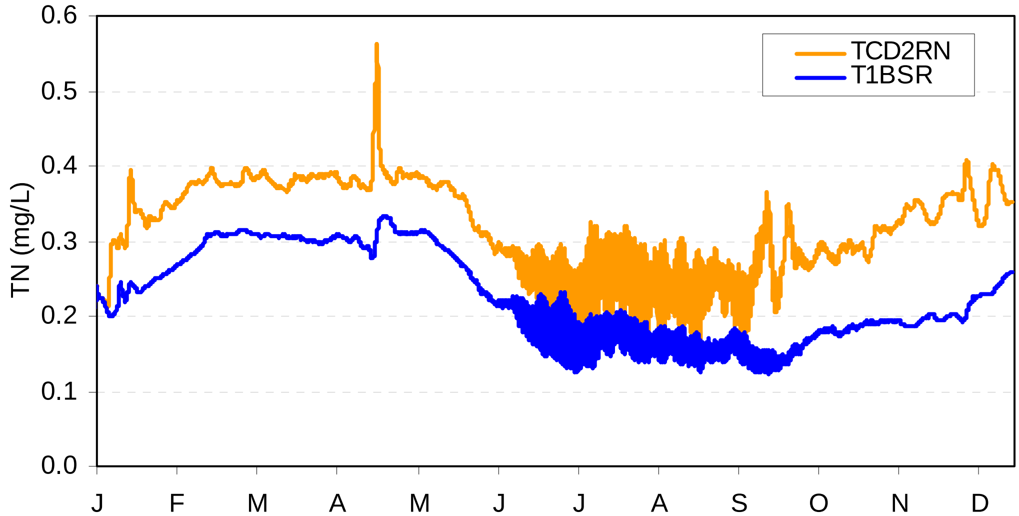
US_SHASTA



Periphyton (mgChl-a/m2)
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
TCD2RN
T1BSR
J F M A M J J A S O N D

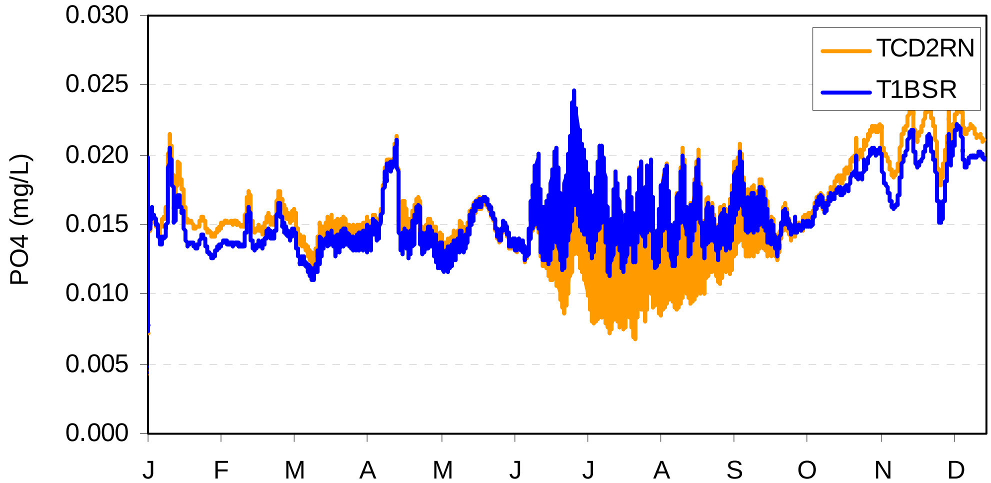


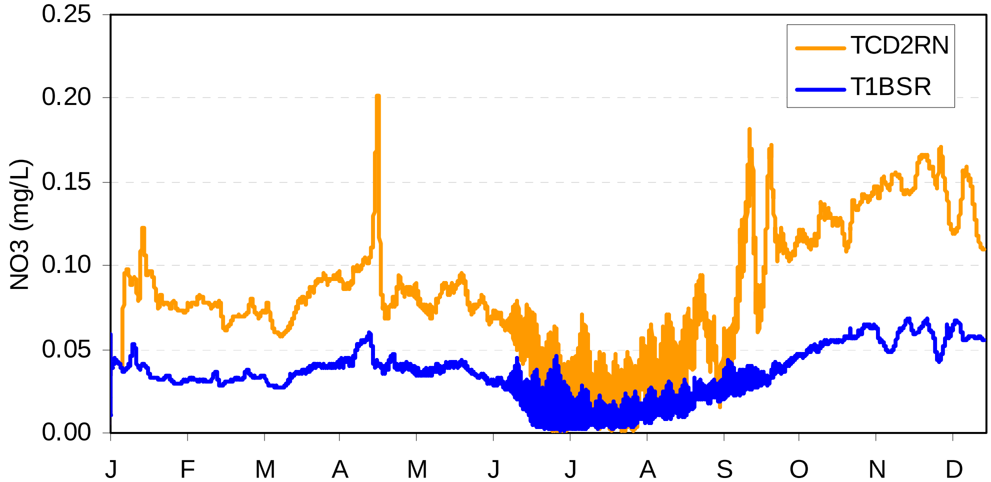
pH
10.00
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
TCD2RN
T1BSR
J F M A M J J A S O N D

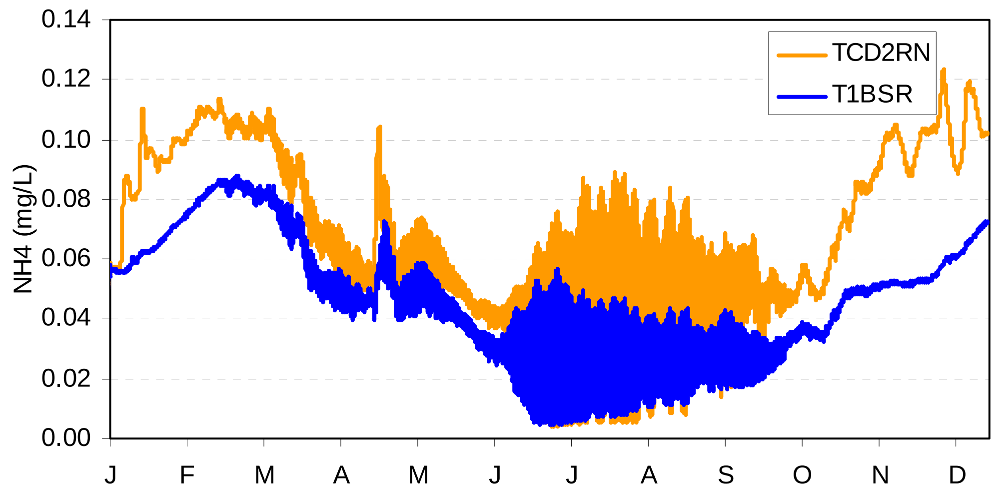


TN (mg/L)
0.6
0.5
0.4
0.3
0.2
0.1
0.0
TCD2RN
T1BSR
J F M A M J J A S O N D

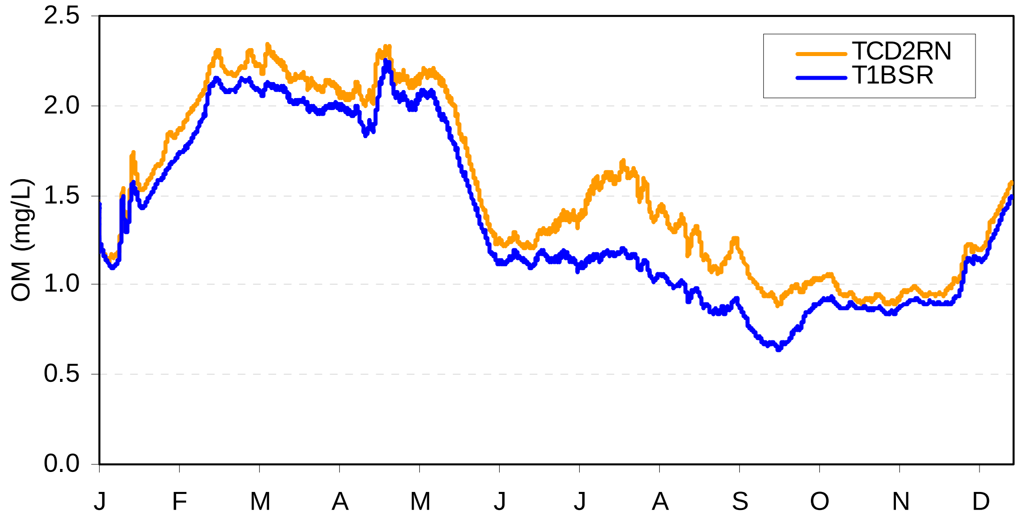
US_SHASTA


0.030
0.025
0.020
0.015
0.010
0.005
0.000
PO4 (mg/L)
J F M A M J J A S O N D
TCD2RN
T1BSR

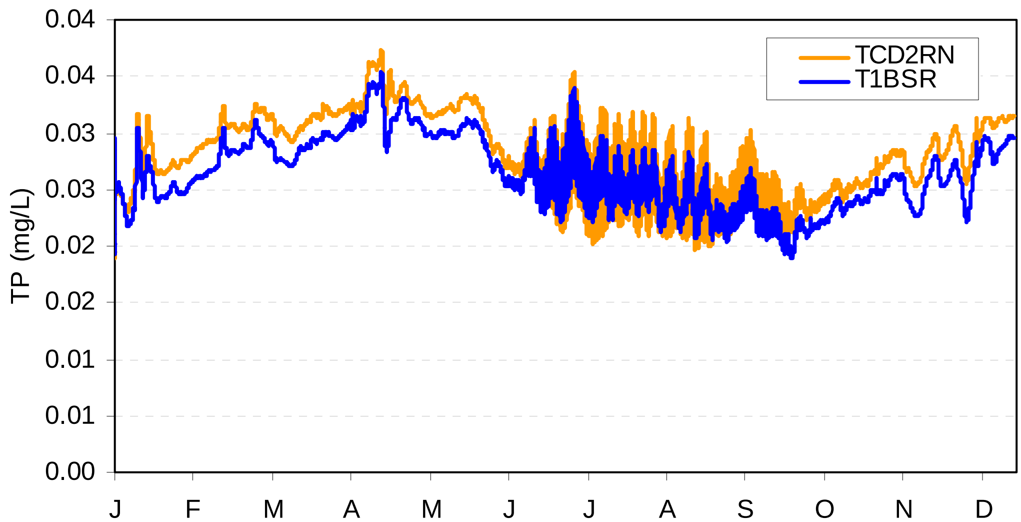

0.25
0.20
0.15
0.10
0.05
0.00
NO3 (mg/L)
J F M A M J J A S O N D
TCD2RN
T1BSR


0.14
0.12
0.10
0.08
0.06
0.04
0.02
0.00
NH4 (mg/L)
J F M A M J J A S O N D
TCD2RN
T1BSR

US_SHASTA

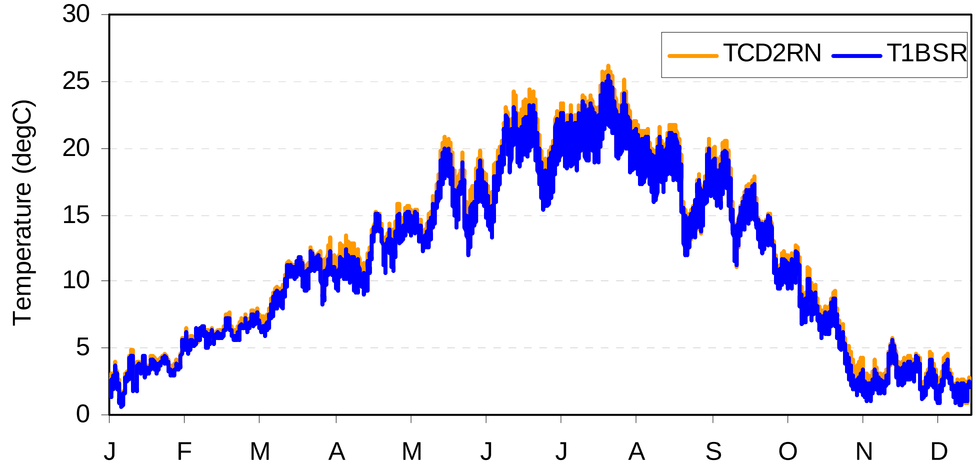


OM (mg/L)
2.5
2.0
1.5
1.0
0.5
0.0
J F M A M J J A S O N D
TCD2RN
T1BSR

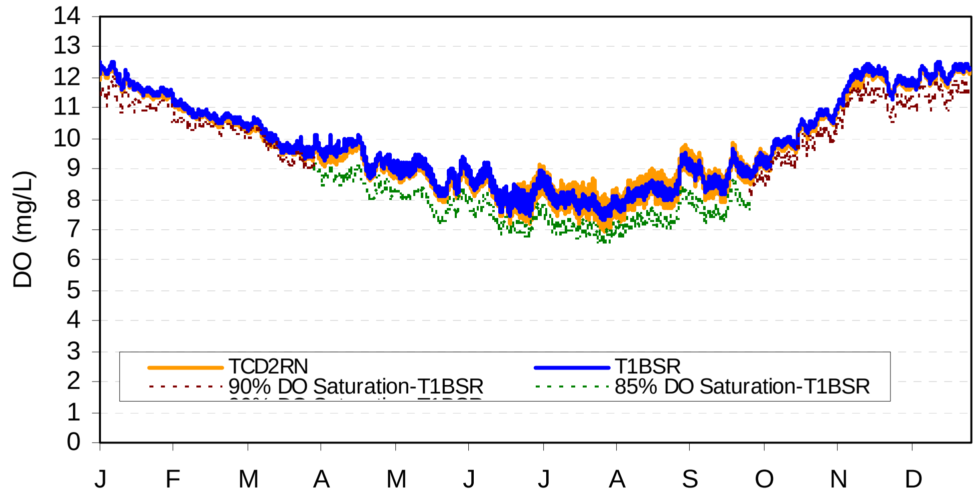


TP (mg/L)
0.04
0.04
0.03
0.03
0.02
0.02
0.01
0.01
0.00
J F M A M J J A S O N D
TCD2RN
T1BSR

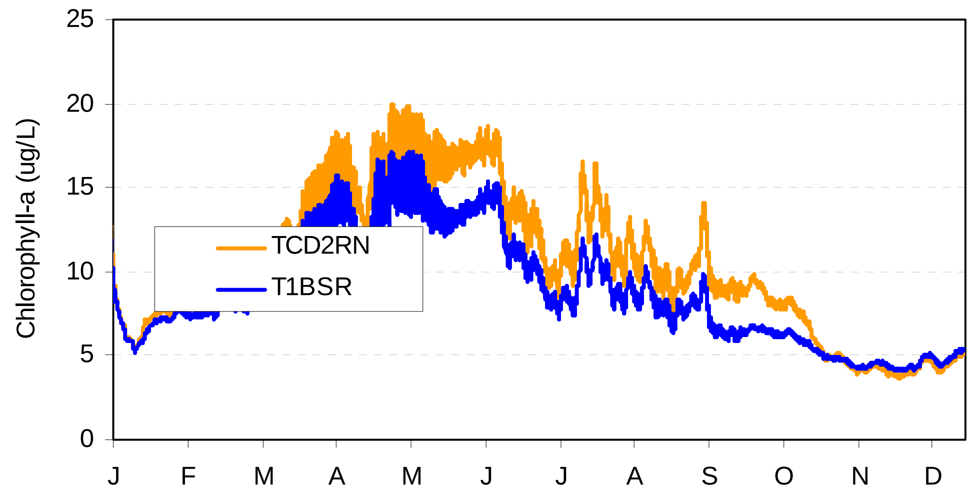
DS_SHASTA



Temperature (degC)
30
25
20
15
10
5
0
J F M A M J J A S O N D
TCD2RN
T1BSR

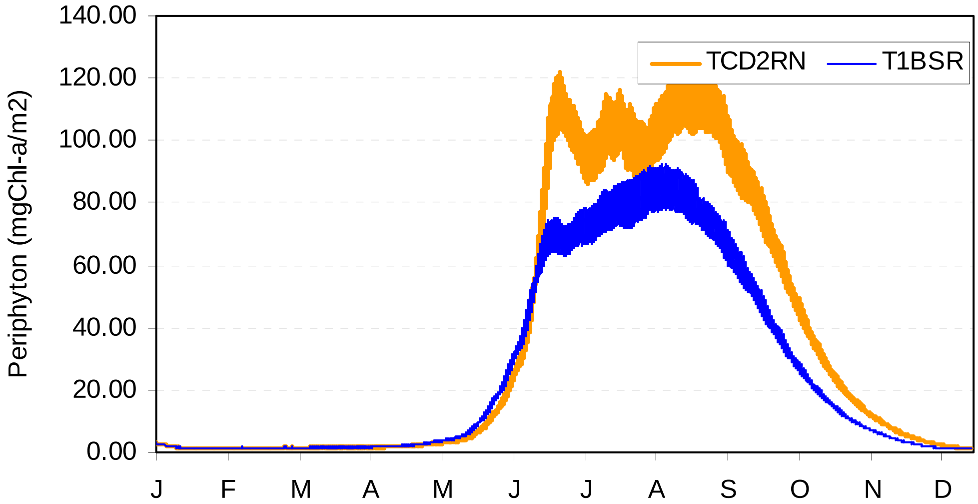


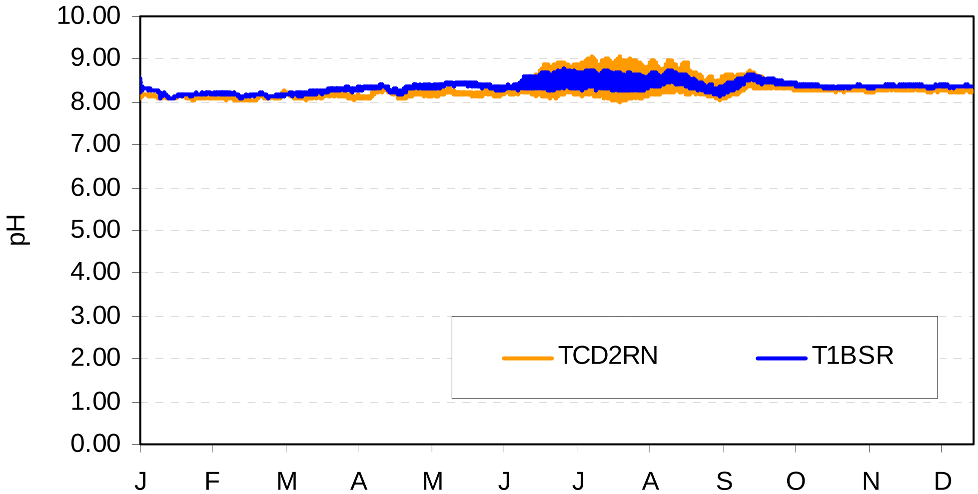
DO (mg/L)
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
J F M A M J J A S O N D
TCD2RN
T1BSR
90% DO Saturation-T1BSR
85% DO Saturation-T1BSR

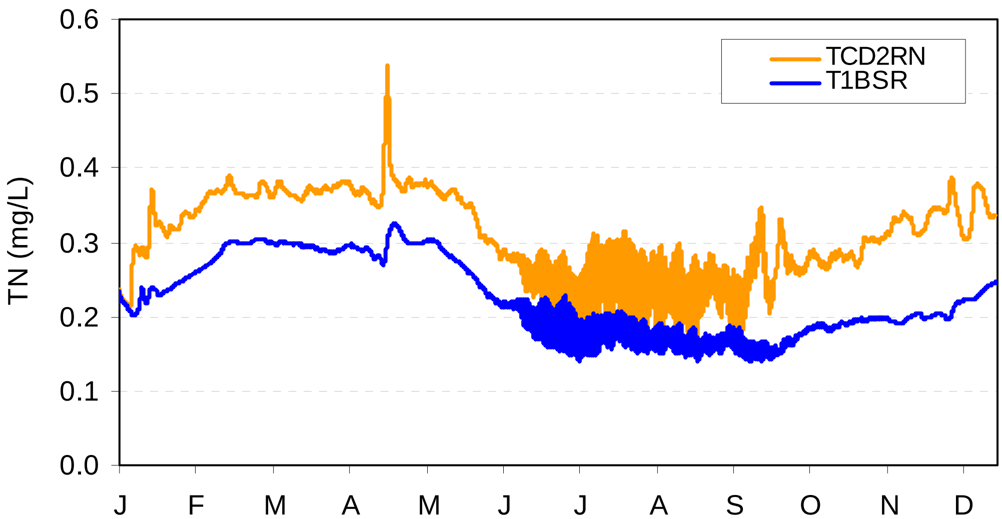


Chlorophyll-a (ug/L)
25
20
15
10
5
0
J F M A M J J A S O N D
TCD2RN
T1BSR

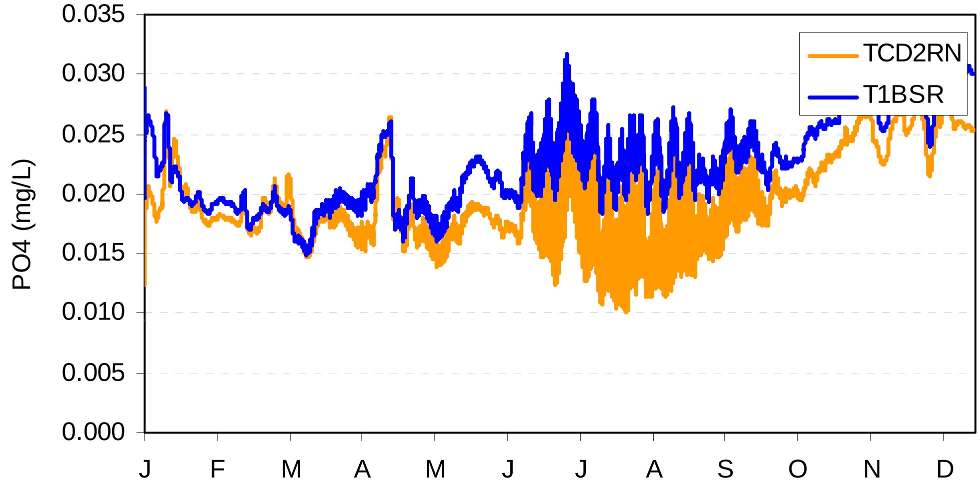
DS_SHASTA


Periphyton (mgChl-a/m2)
140.00
120.00
100.00
80.00
60.00
40.00
20.00
0.00
J F M A M J J A S O N D
TCD2RN
T1BSR

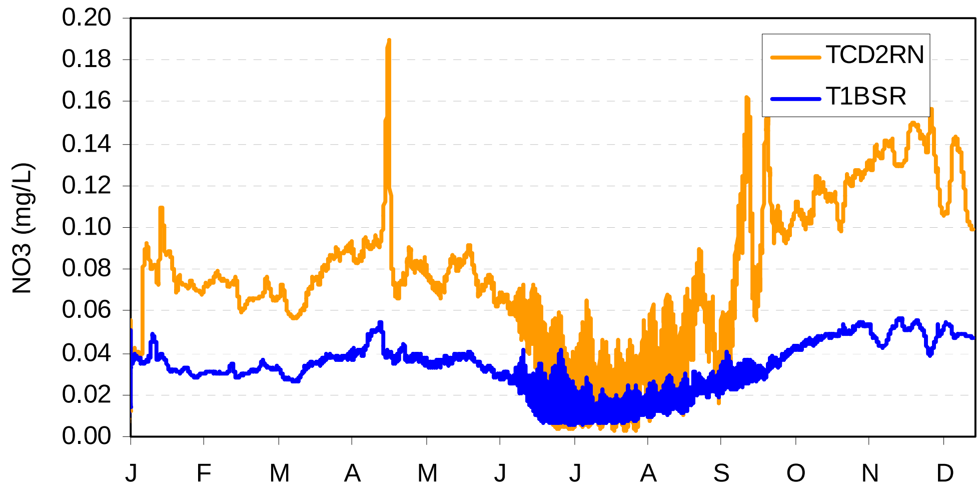

pH
10.00
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
J F M A M J J A S O N D
TCD2RN
T1BSR


TN (mg/L)
0.6
0.5
0.4
0.3
0.2
0.1
0.0
J F M A M J J A S O N D
TCD2RN
T1BSR

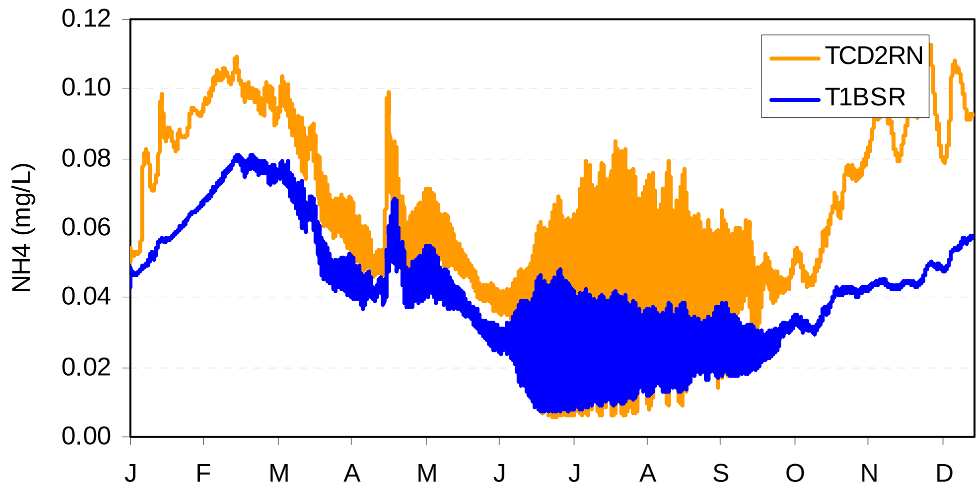
DS_SHASTA



PO4 (mg/L)
0.035
0.030
0.025
0.020
0.015
0.010
0.005
0.000
J F M A M J J A S O N D
TCD2RN
T1BSR

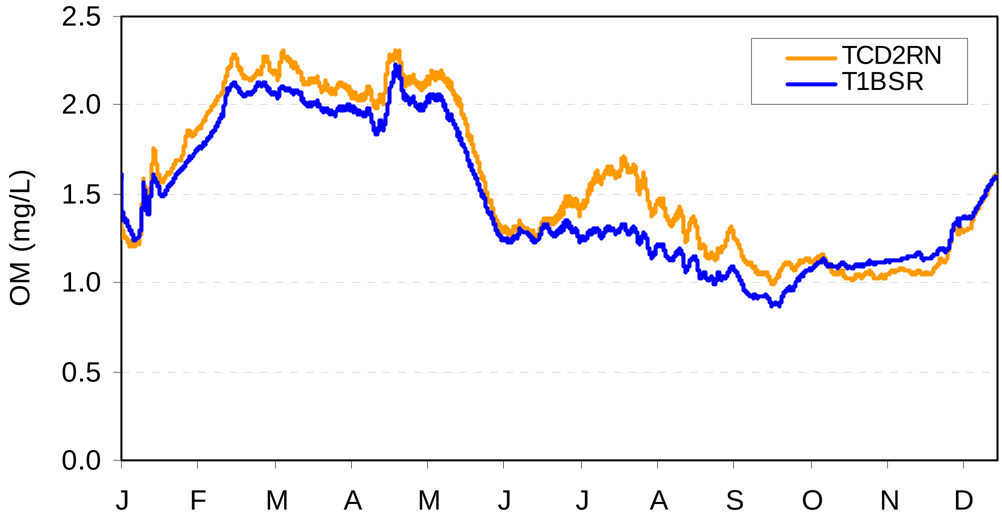


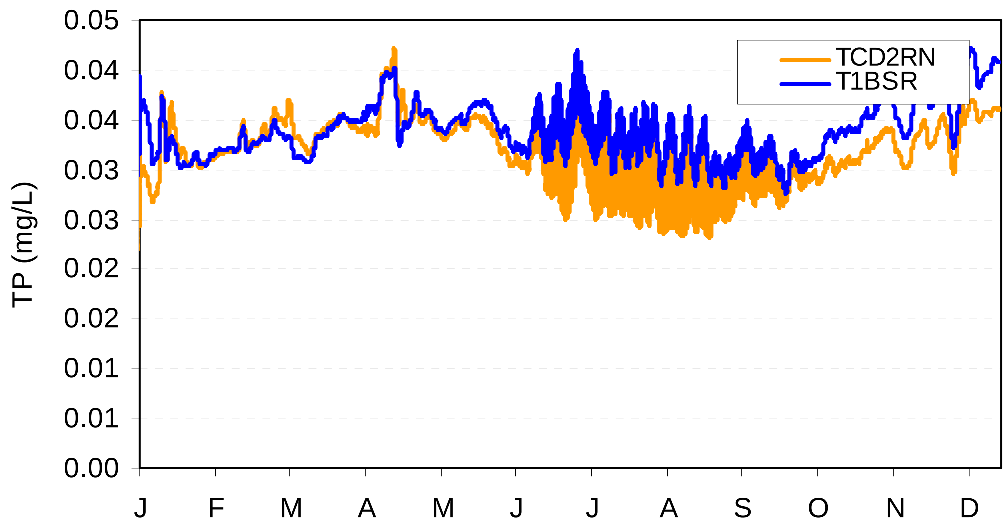
NO3 (mg/L)
0.20
0.18
0.16
0.14
0.12
0.10
0.08
0.06
0.04
0.02
0.00
J F M A M J J A S O N D
TCD2RN
T1BSR



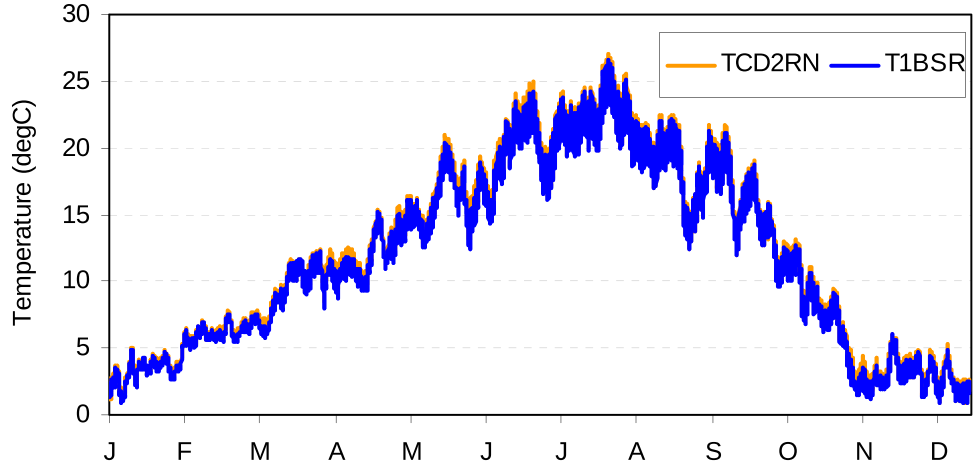
NH4 (mg/L)
0.12
0.10
0.08
0.06
0.04
0.02
0.00
J F M A M J J A S O N D
TCD2RN
T1BSR

DS_SHASTA

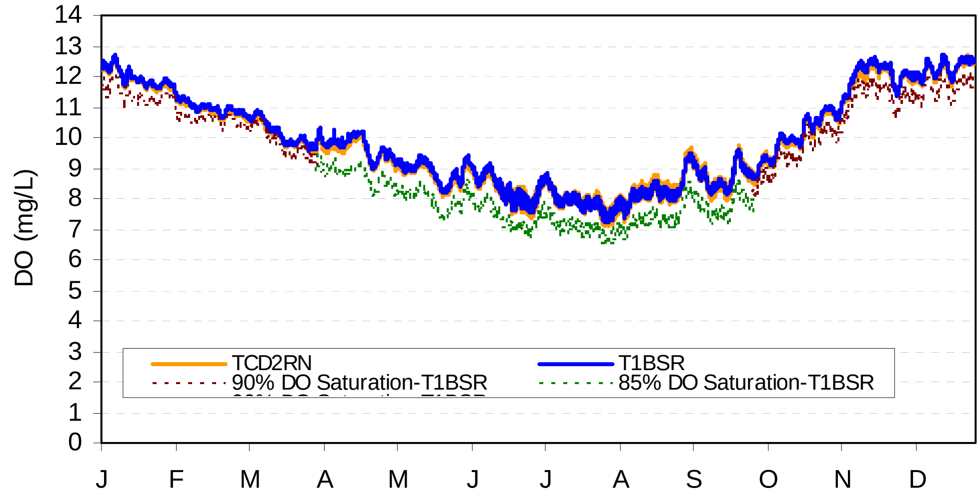

2.5
2.0
1.5
1.0
0.5
0.0
OM (mg/L)
TCD2RN
T1BSR
J
F
M
A
M
J
J
A
S
O
N
D


0.05
0.04
0.04
0.03
0.03
0.02
0.02
0.01
0.01
0.00
TP (mg/L)
TCD2RN
T1BSR
J
F
M
A
M
J
J
A
S
O
N
D

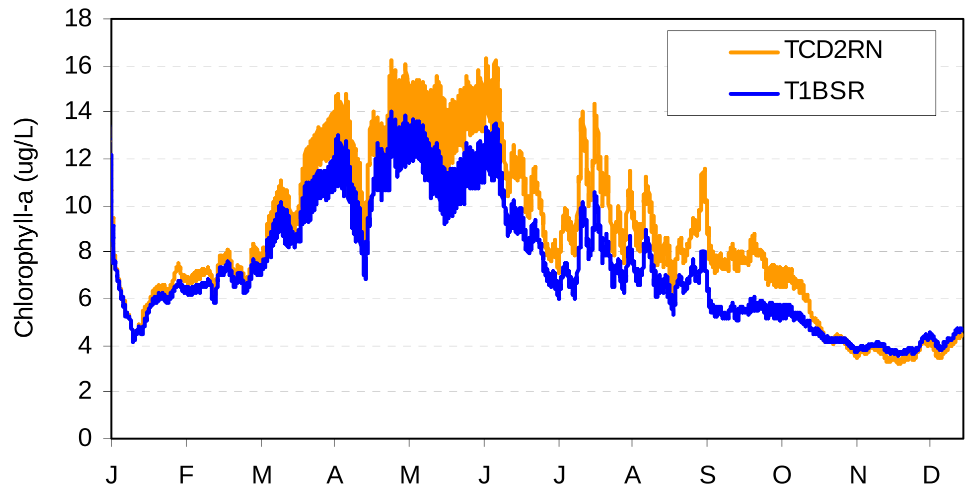
US_SCOTT



Temperature (degC)
0
5
10
15
20
25
30
J
F
M
A
M
J
J
A
S
O
N
D
TCD2RN
T1BSR

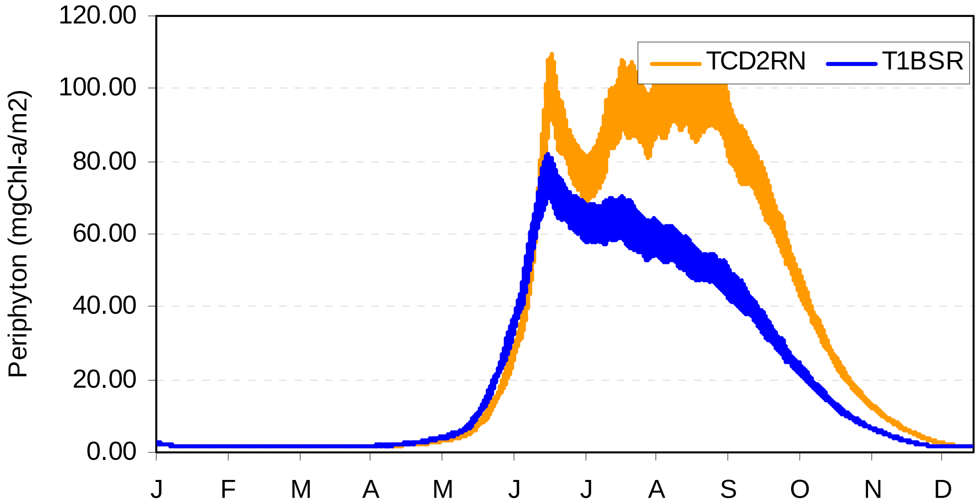


DO (mg/L)
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
J
F
M
A
M
J
J
A
S
O
N
D
TCD2RN
T1BSR
90% DO Saturation-T1BSR
85% DO Saturation-T1BSR

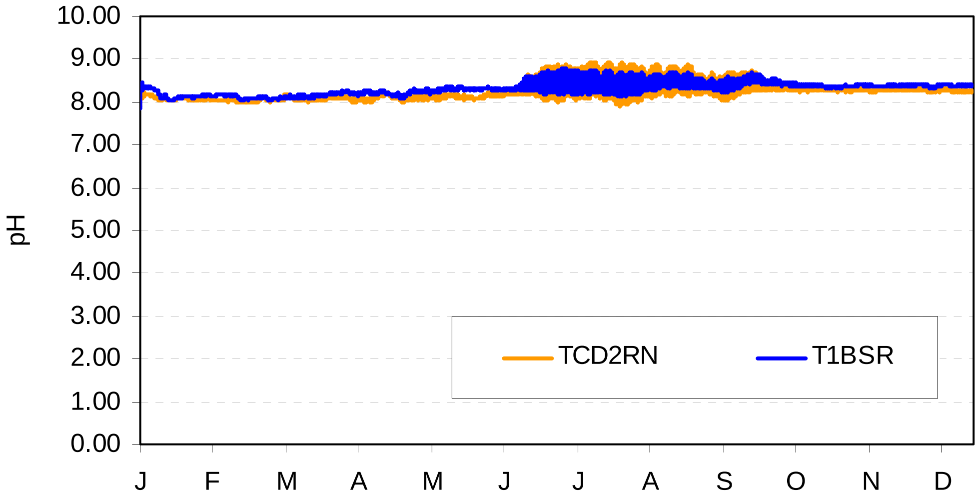


Chlorophyll-a (ug/L)
0
2
4
6
8
10
12
14
16
18
J
F
M
A
M
J
J
A
S
O
N
D
TCD2RN
T1BSR

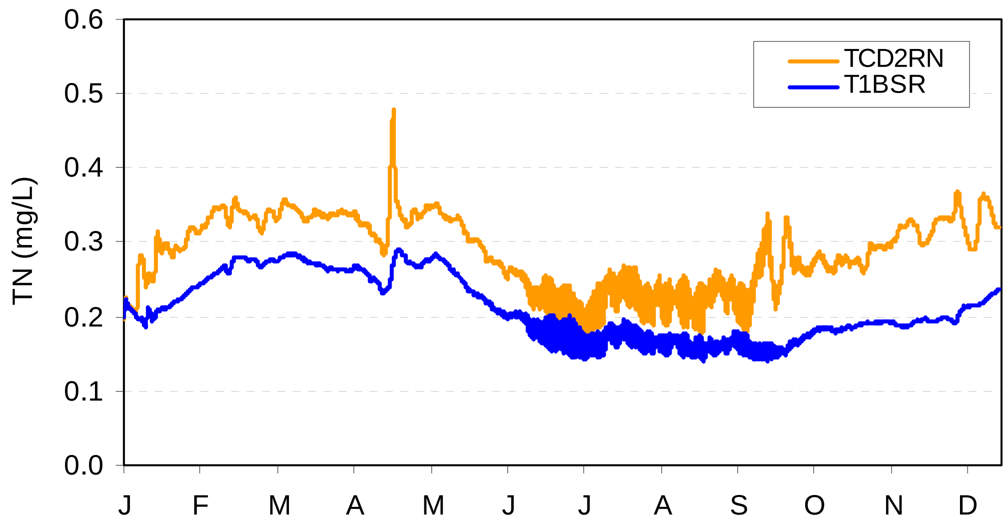
US_SCOTT



Periphyton (mgChl-a/m2)
120.00
100.00
80.00
60.00
40.00
20.00
0.00
TCD2RN
T1BSR
J F M A M J J A S O N D

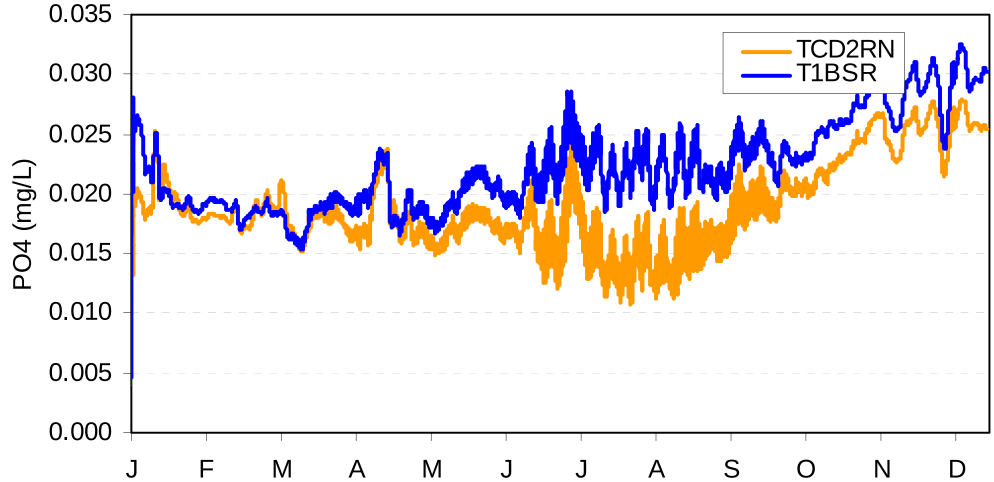


pH
10.00
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
TCD2RN
T1BSR
J F M A M J J A S O N D

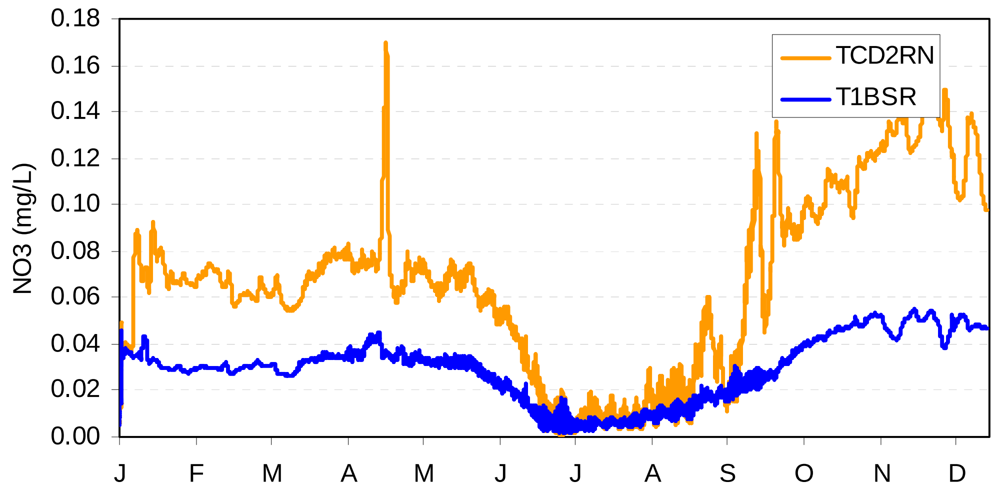


TN (mg/L)
0.6
0.5
0.4
0.3
0.2
0.1
0.0
TCD2RN
T1BSR
J F M A M J J A S O N D

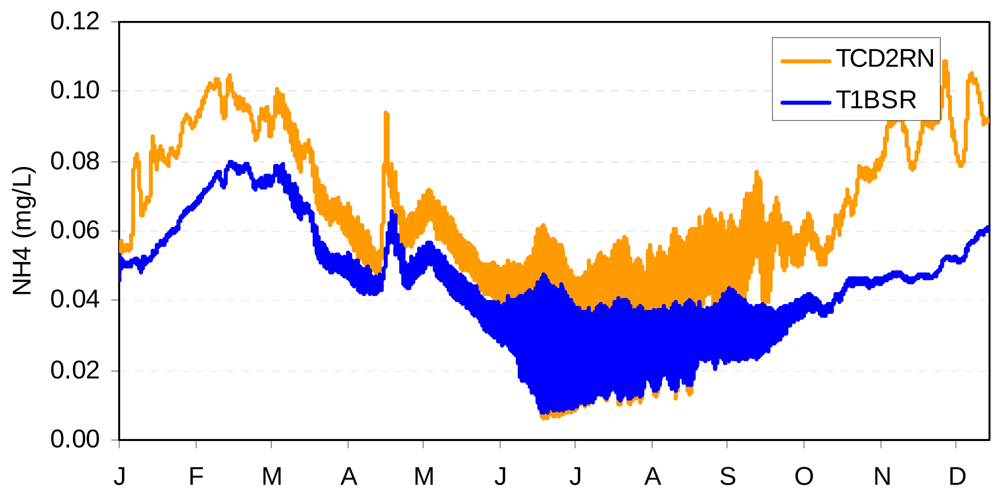
US_SCOTT



0.035
0.030
0.025
0.020
0.015
0.010
0.005
0.000
PO4 (mg/L)
J F M A M J J A S O N D
TCD2RN
T1BSR

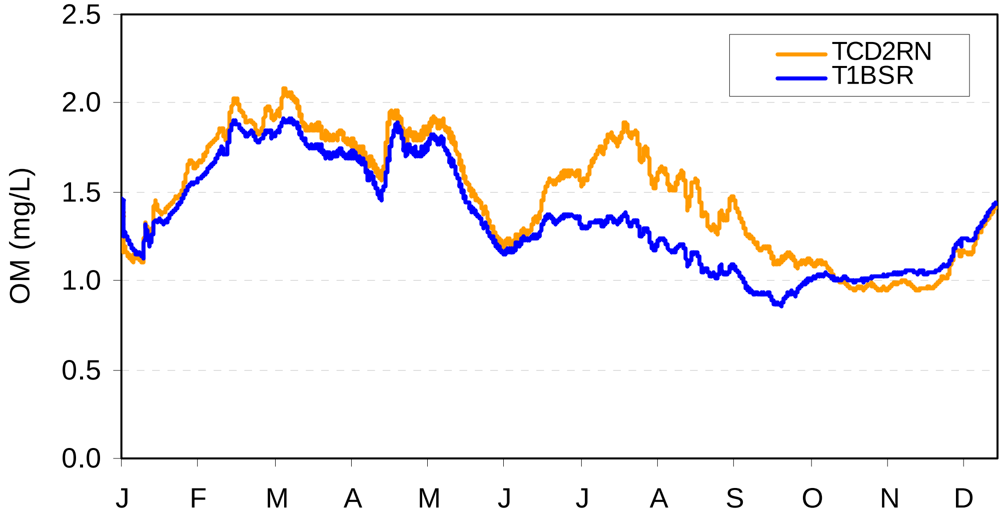


0.18
0.16
0.14
0.12
0.10
0.08
0.06
0.04
0.02
0.00
NO3 (mg/L)
J F M A M J J A S O N D
TCD2RN
T1BSR

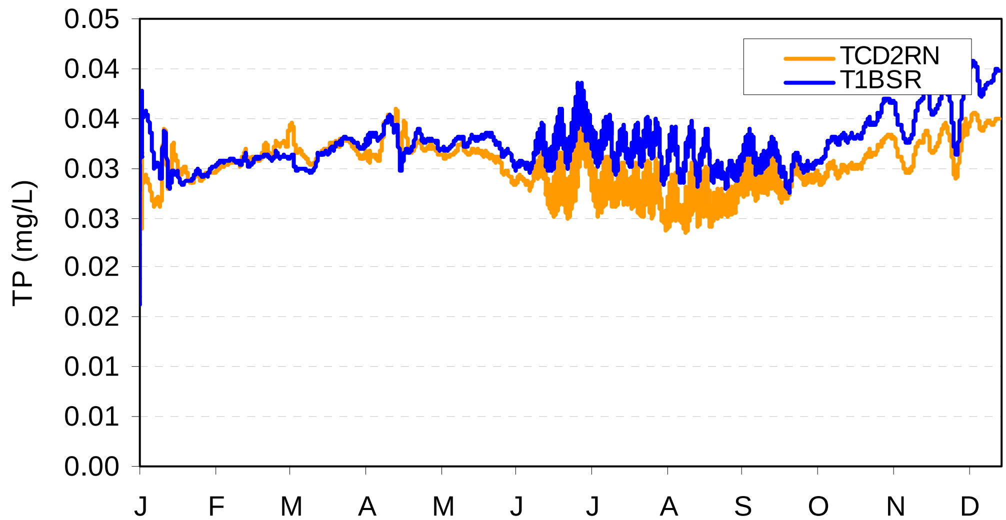


0.12
0.10
0.08
0.06
0.04
0.02
0.00
NH4 (mg/L)
J F M A M J J A S O N D
TCD2RN
T1BSR

US_SCOTT

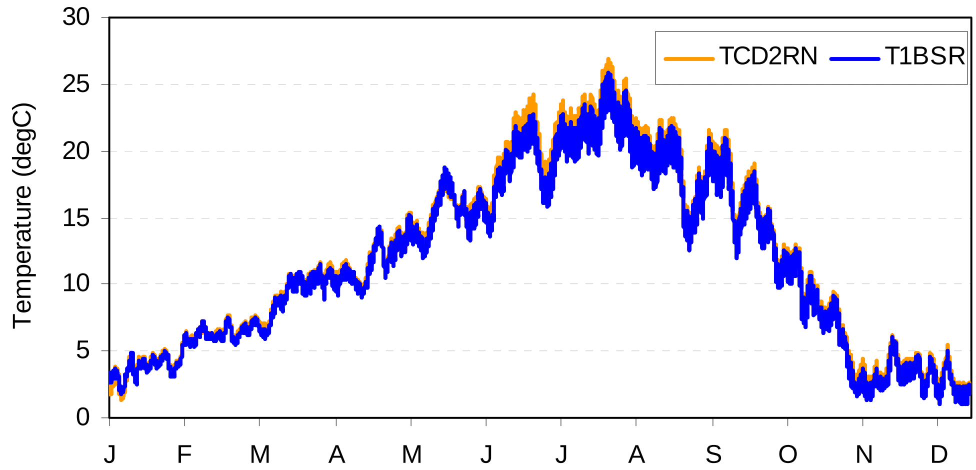


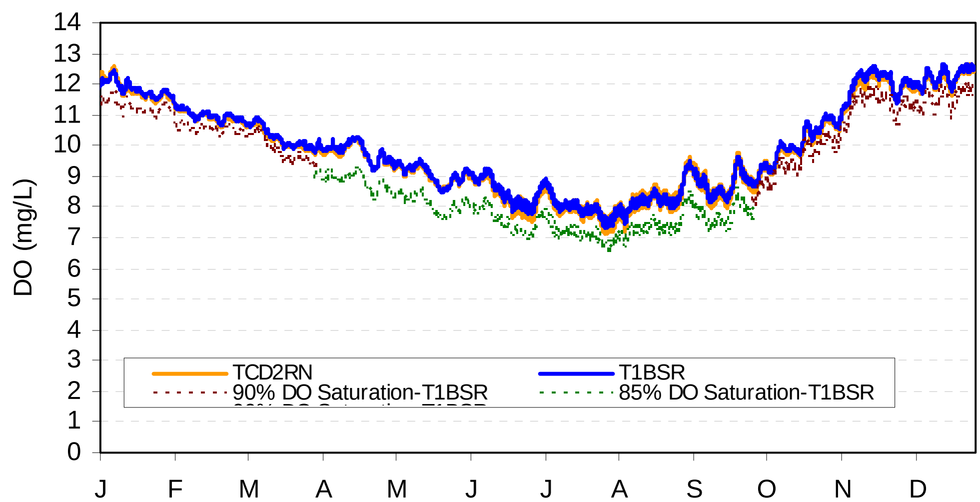
2.5
2.0
1.5
1.0
0.5
0.0
OM (mg/L)
J
F
M
A
M
J
J
A
S
O
N
D
TCD2RN
T1BSR

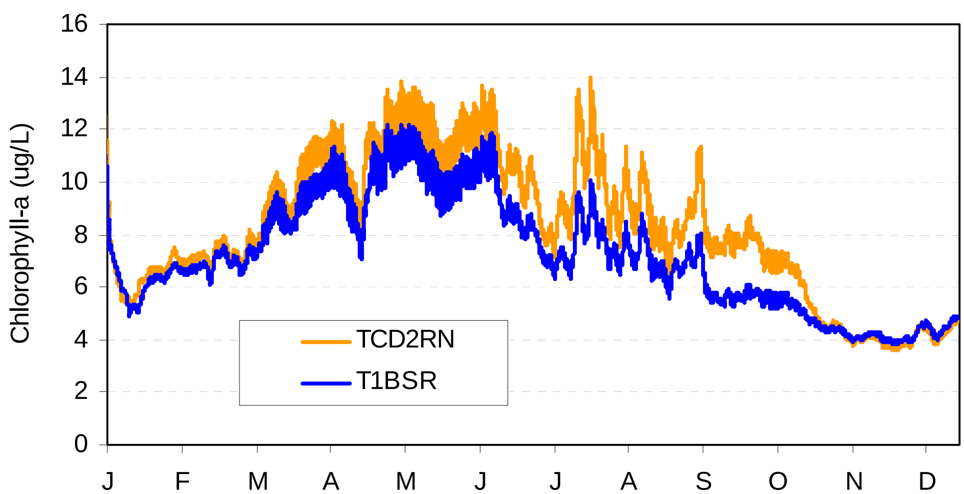


0.05
0.04
0.04
0.03
0.03
0.02
0.02
0.01
0.01
0.00
TP (mg/L)
J
F
M
A
M
J
J
A
S
O
N
D
TCD2RN
T1BSR

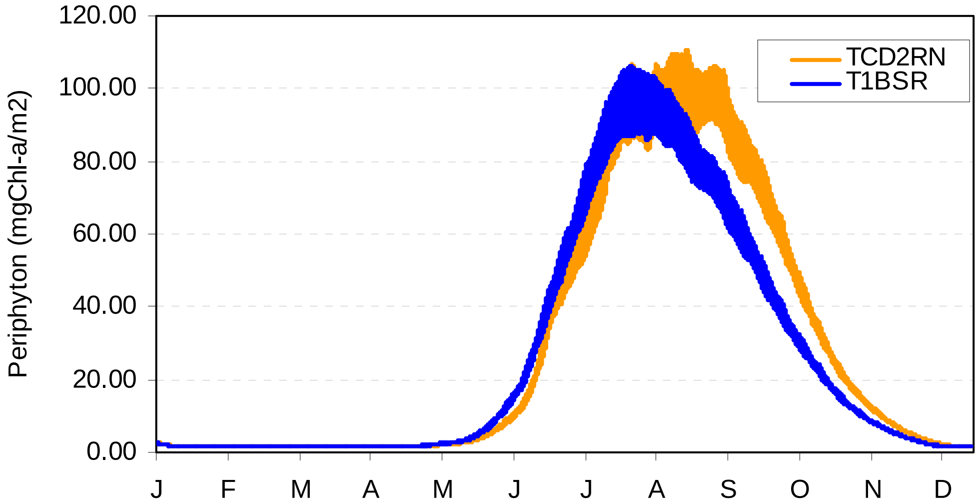
DS_SCOTT


TCD2RN
T1BSR
Temperature (degC)
30
25
20
15
10
5
0
J F M A M J J A S O N D

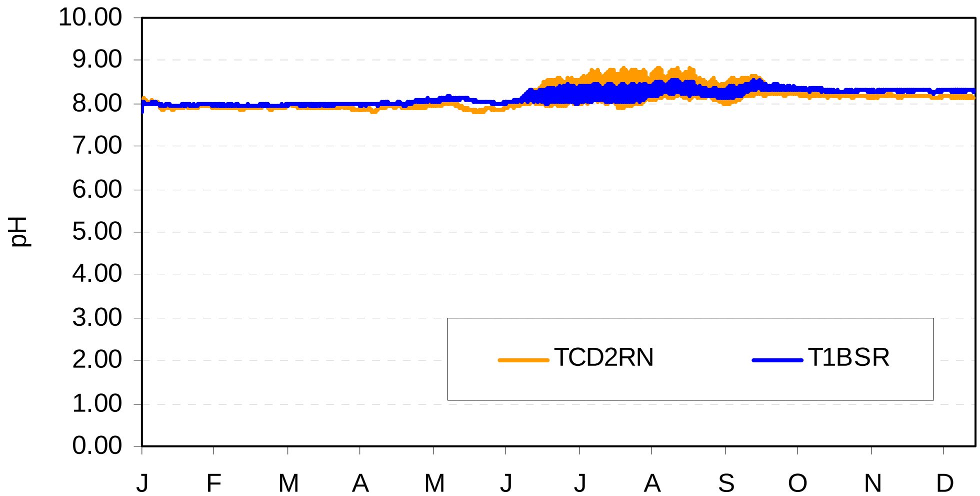

DO (mg/L)
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
TCD2RN
T1BSR
90% DO Saturation-T1BSR
85% DO Saturation-T1BSR
J F M A M J J A S O N D


Chlorophyll-a (ug/L)
16
14
12
10
8
6
4
2
0
TCD2RN
T1BSR
J F M A M J J A S O N D

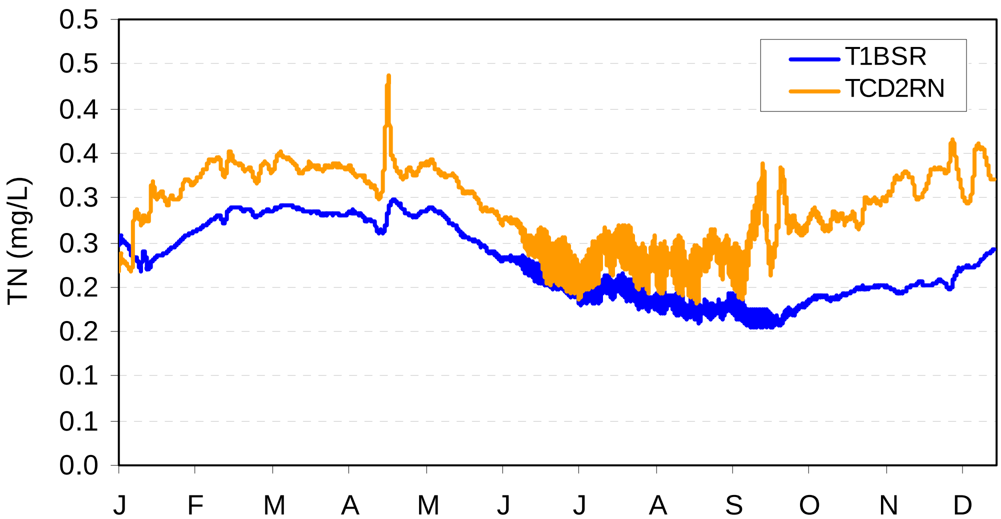
DS_SCOTT



120.00
100.00
80.00
60.00
40.00
20.00
0.00
Periphyton (mgChl-a/m2)
J F M A M J J A S O N D
TCD2RN
T1BSR

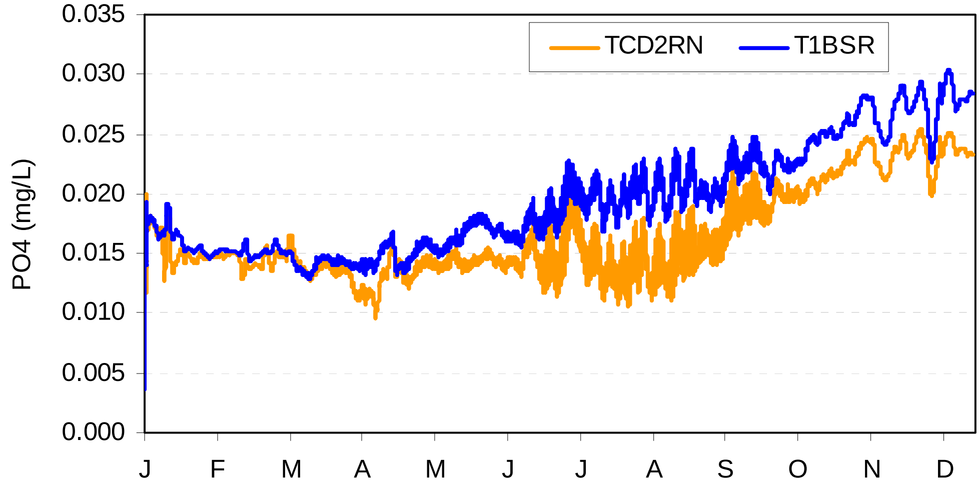


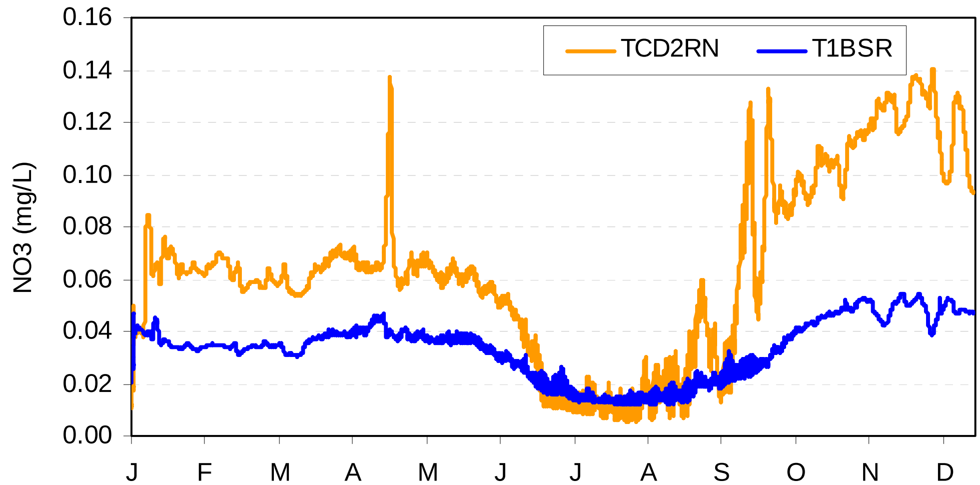
10.00
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
pH
J F M A M J J A S O N D
TCD2RN
T1BSR

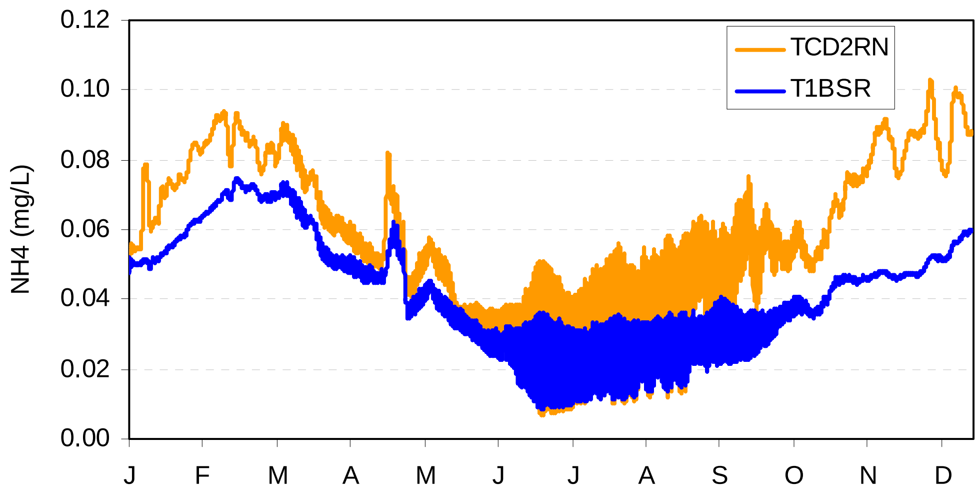


0.5
0.5
0.4
0.4
0.3
0.3
0.2
0.2
0.1
0.1
0.0
TN (mg/L)
J F M A M J J A S O N D
T1BSR
TCD2RN

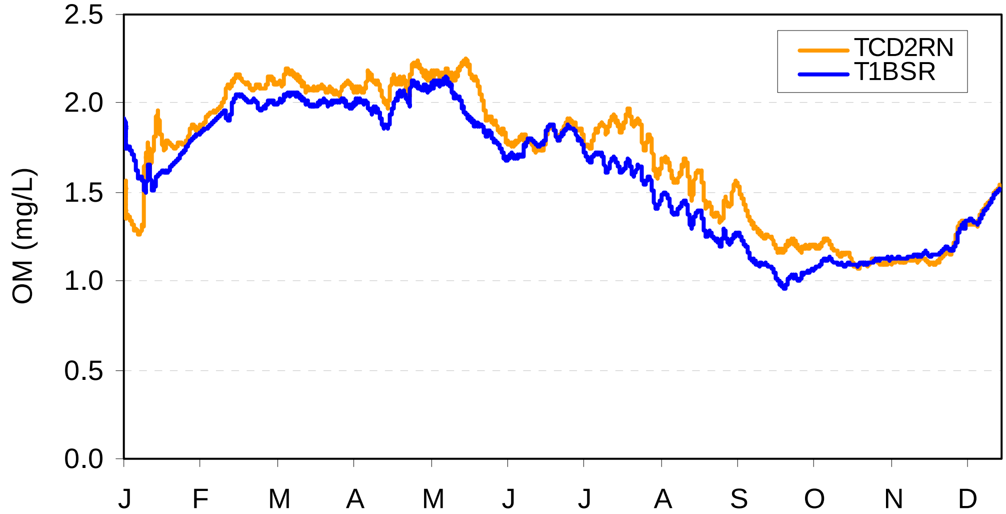
DS_SCOTT


TCD2RN
T1BSR
PO4 (mg/L)
0.035
0.030
0.025
0.020
0.015
0.010
0.005
0.000
J F M A M J J A S O N D

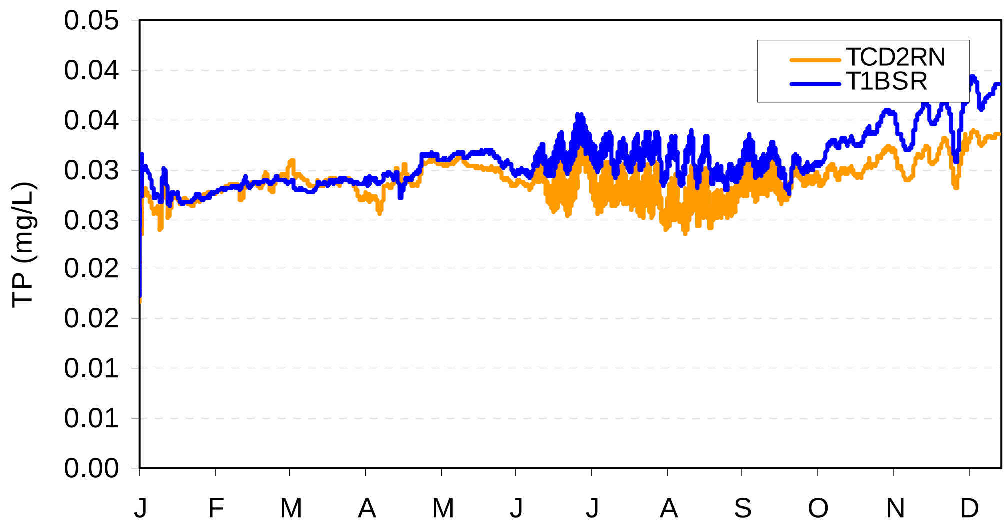

TCD2RN
T1BSR
NO3 (mg/L)
0.16
0.14
0.12
0.10
0.08
0.06
0.04
0.02
0.00
J F M A M J J A S O N D


TCD2RN
T1BSR
NH4 (mg/L)
0.12
0.10
0.08
0.06
0.04
0.02
0.00
J F M A M J J A S O N D

DS_SCOTT

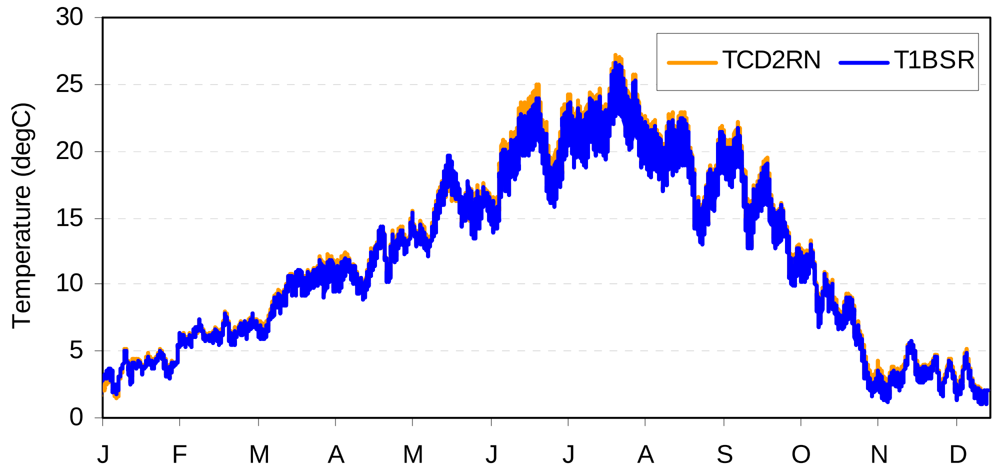


2.5
2.0
1.5
1.0
0.5
0.0
OM (mg/L)
TCD2RN
T1BSR
J F M A M J J A S O N D

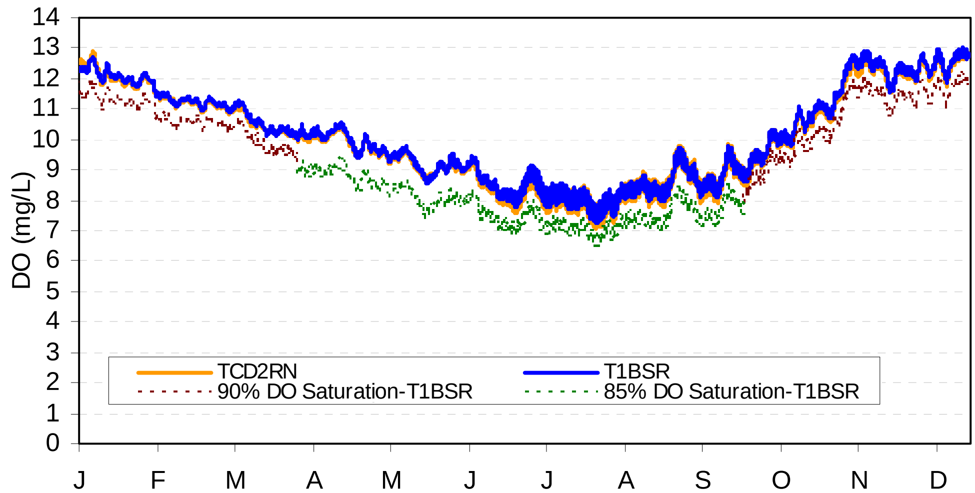


0.05
0.04
0.04
0.03
0.03
0.02
0.02
0.01
0.01
0.00
TP (mg/L)
TCD2RN
T1BSR
J F M A M J J A S O N D

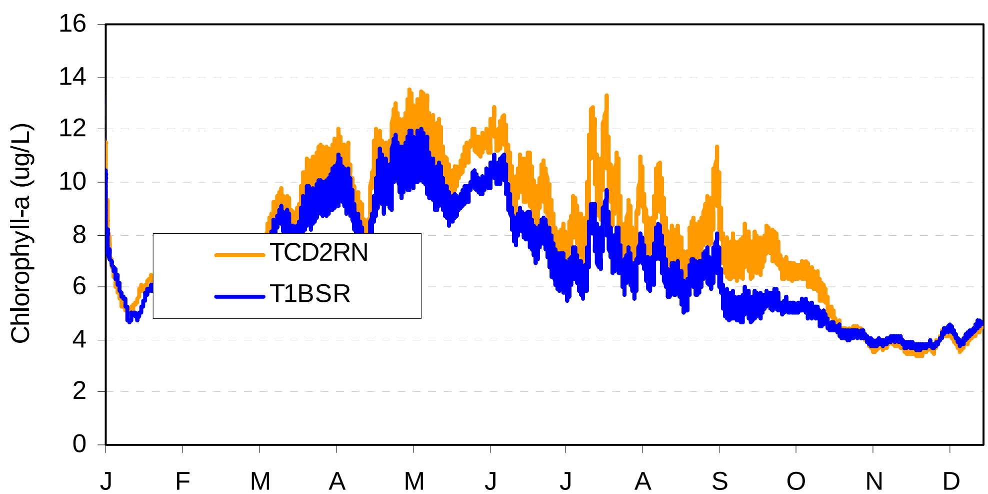
SEIAD



Temperature (degC)
30
25
20
15
10
5
0
TCD2RN
T1BSR
J
F
M
A
M
J
J
A
S
O
N
D

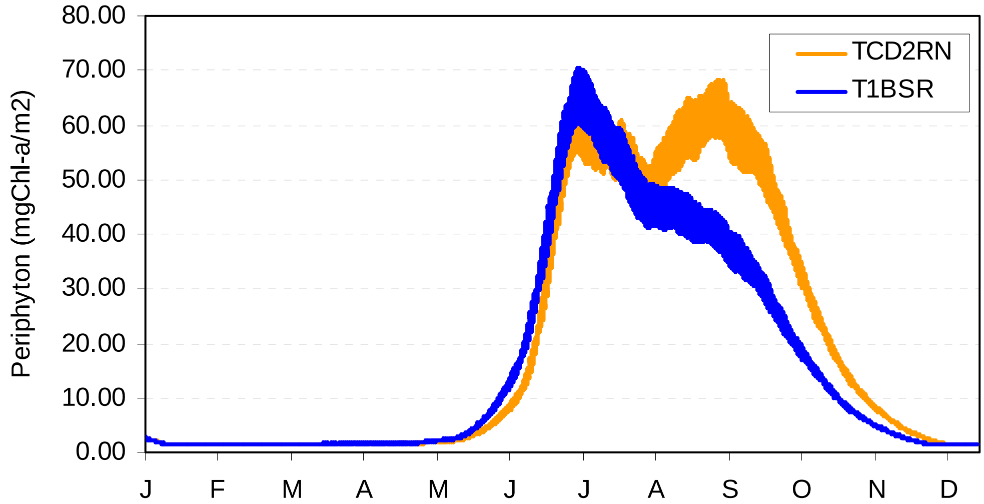


DO (mg/L)
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
TCD2RN
T1BSR
90% DO Saturation-T1BSR
85% DO Saturation-T1BSR
J
F
M
A
M
J
J
A
S
O
N
D

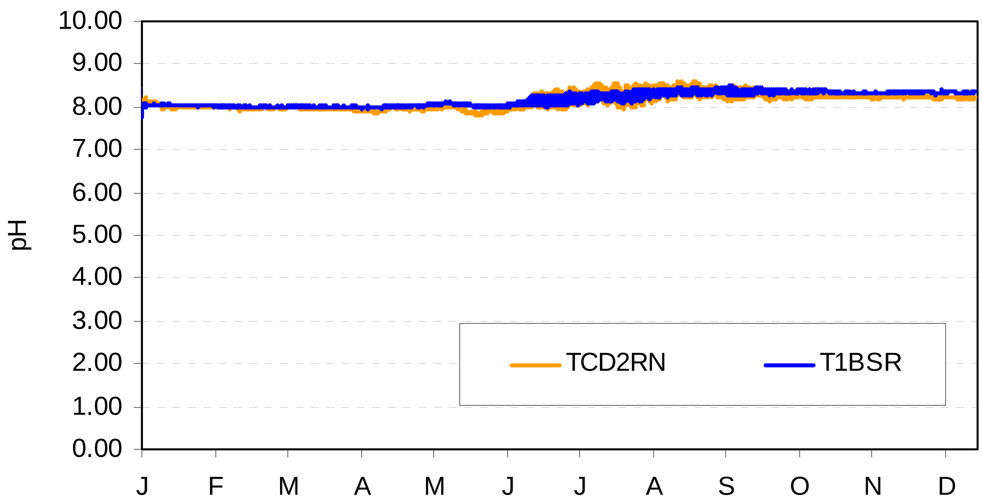


Chlorophyll-a (ug/L)
16
14
12
10
8
6
4
2
0
TCD2RN
T1BSR
J
F
M
A
M
J
J
A
S
O
N
D

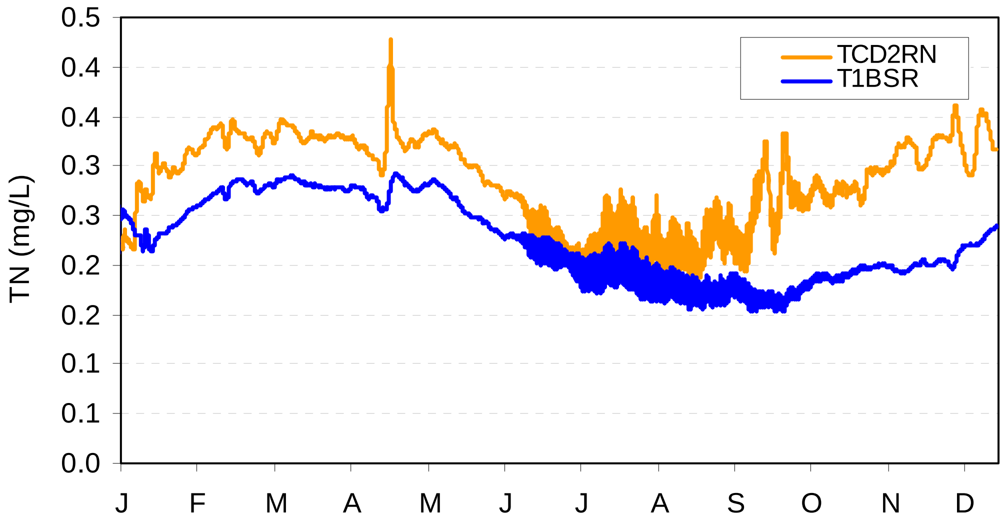
SEIAD



Periphyton (mgChl-a/m2)
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
J F M A M J J A S O N D
TCD2RN
T1BSR

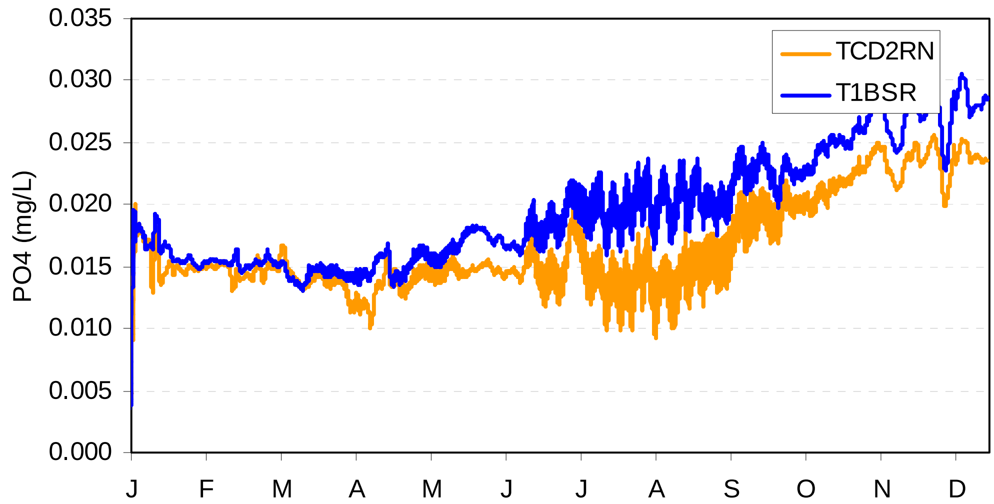


pH
10.00
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
J F M A M J J A S O N D
TCD2RN
T1BSR

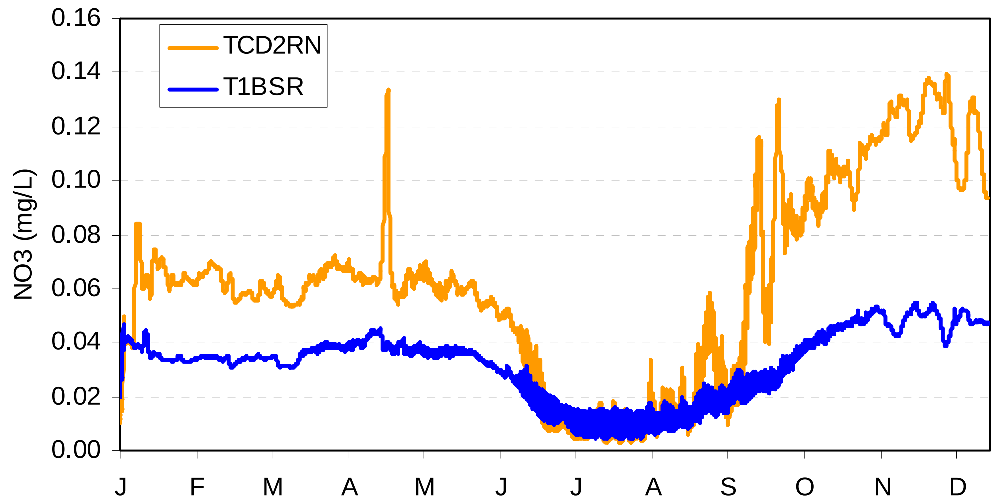


TN (mg/L)
0.5
0.4
0.4
0.3
0.3
0.2
0.2
0.1
0.1
0.0
J F M A M J J A S O N D
TCD2RN
T1BSR

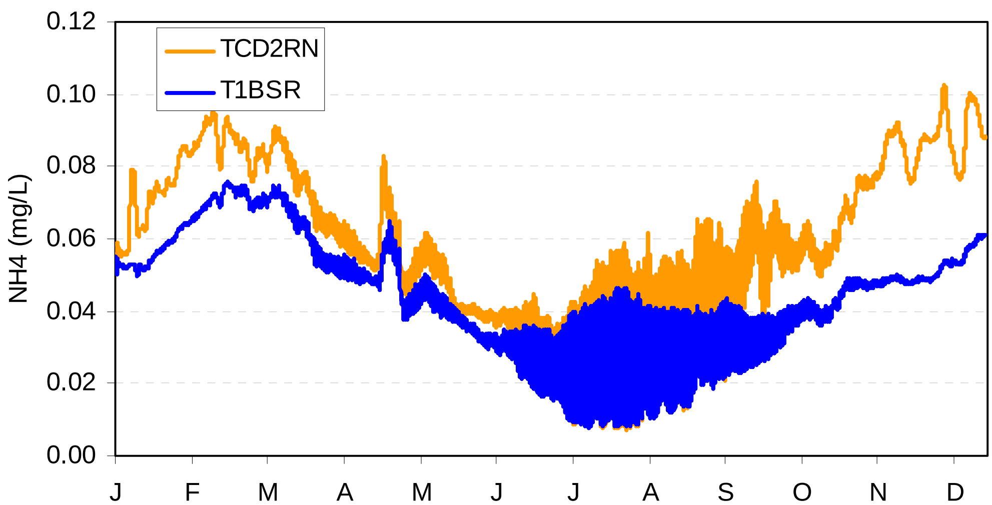
SEIAD



PO4 (mg/L)
0.035
0.030
0.025
0.020
0.015
0.010
0.005
0.000
J
F
M
A
M
J
J
A
S
O
N
D
TCD2RN
T1BSR

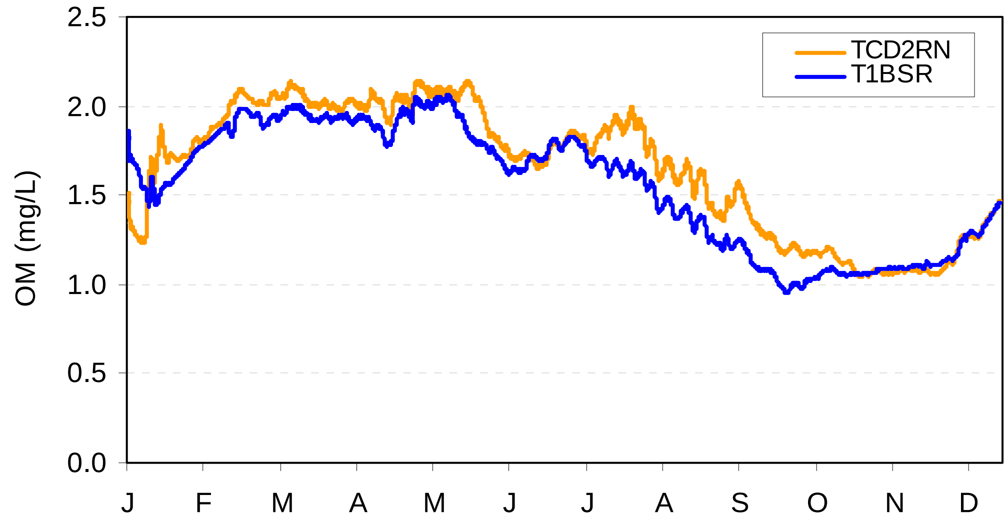


NO3 (mg/L)
0.16
0.14
0.12
0.10
0.08
0.06
0.04
0.02
0.00
J
F
M
A
M
J
J
A
S
O
N
D
TCD2RN
T1BSR

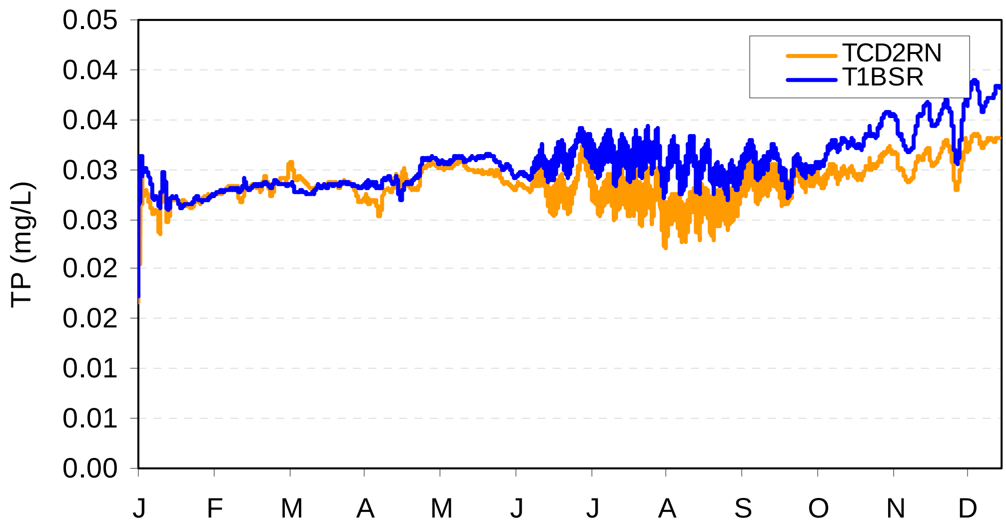


NH4 (mg/L)
0.12
0.10
0.08
0.06
0.04
0.02
0.00
J
F
M
A
M
J
J
A
S
O
N
D
TCD2RN
T1BSR

SEIAD

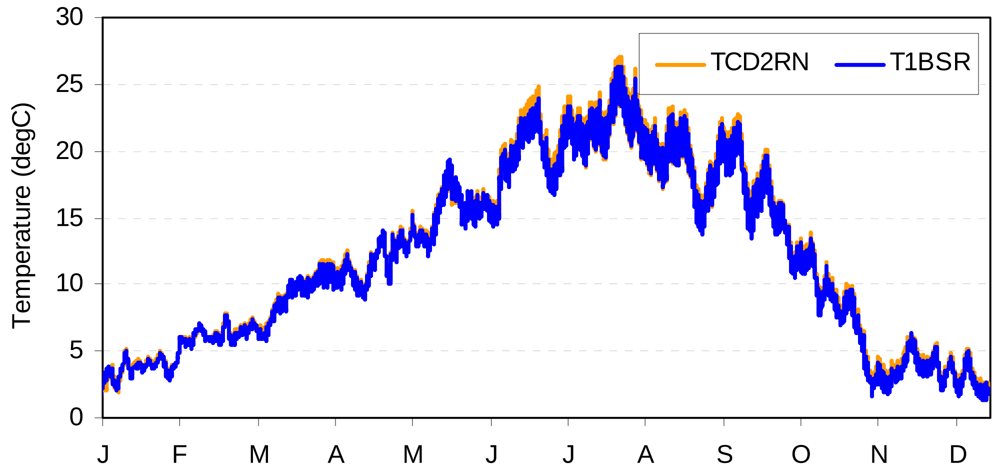


TCD2RN
T1BSR
OM (mg/L)
2.5
2.0
1.5
1.0
0.5
0.0
J
F
M
A
M
J
J
A
S
O
N
D

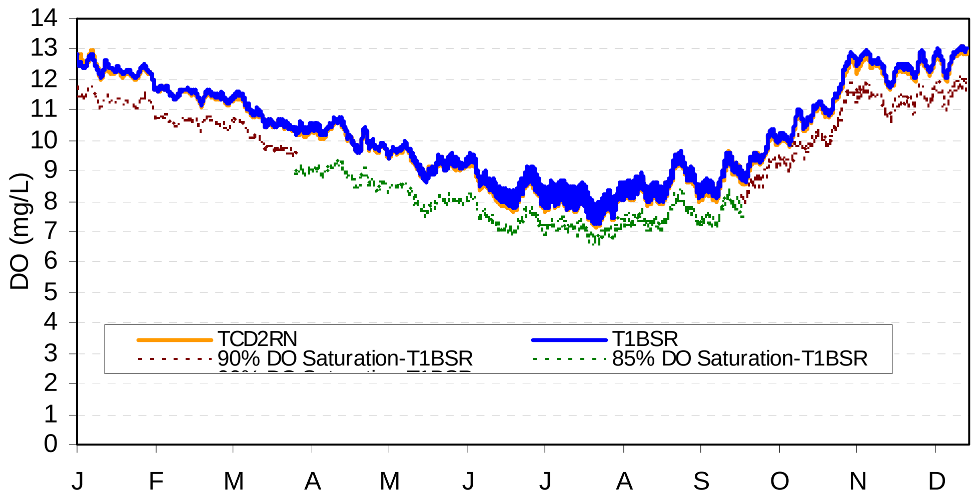


TCD2RN
T1BSR
TP (mg/L)
0.05
0.04
0.04
0.03
0.03
0.02
0.02
0.01
0.01
0.00
J
F
M
A
M
J
J
A
S
O
N
D

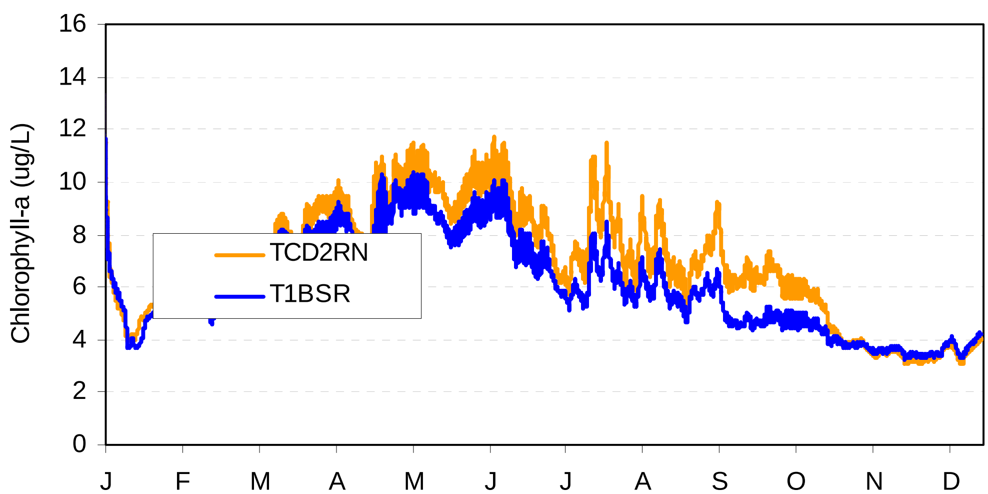
US_INDIAN



Temperature (degC)
30
25
20
15
10
5
0
J F M A M J J A S O N D
TCD2RN
T1BSR

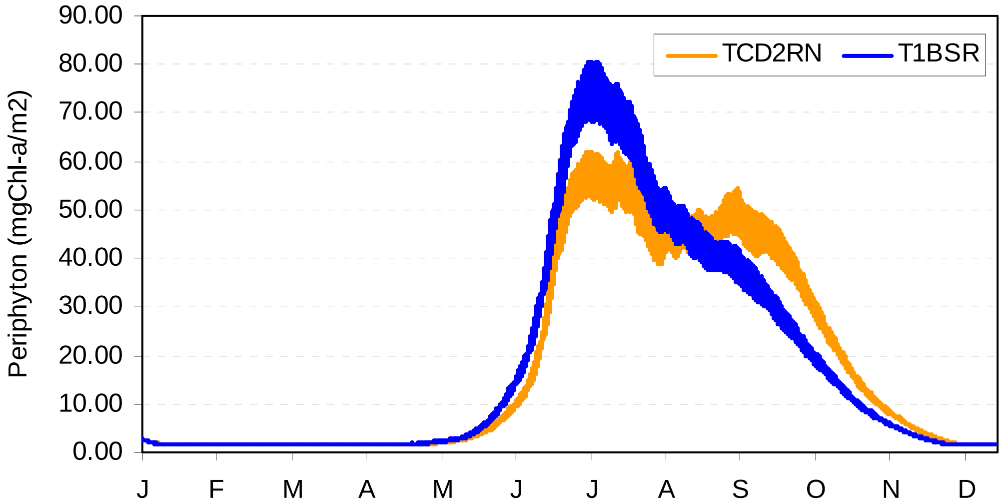


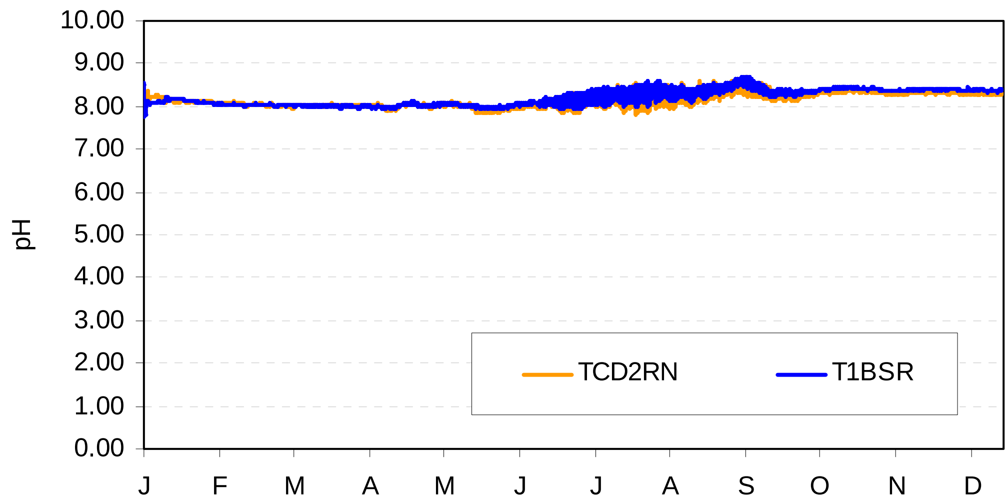
DO (mg/L)
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
J F M A M J J A S O N D
TCD2RN
T1BSR
90% DO Saturation-T1BSR
85% DO Saturation-T1BSR

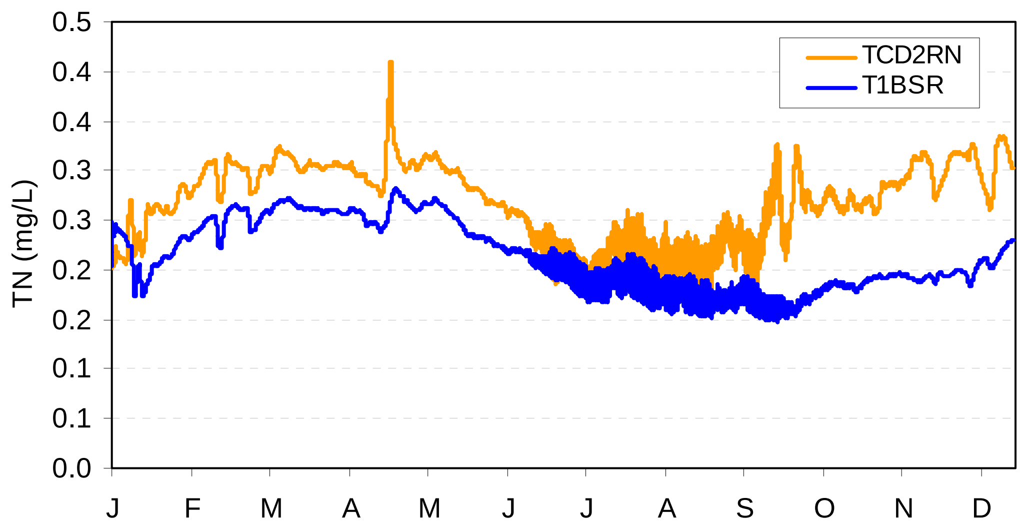


Chlorophyll-a (ug/L)
16
14
12
10
8
6
4
2
0
J F M A M J J A S O N D
TCD2RN
T1BSR

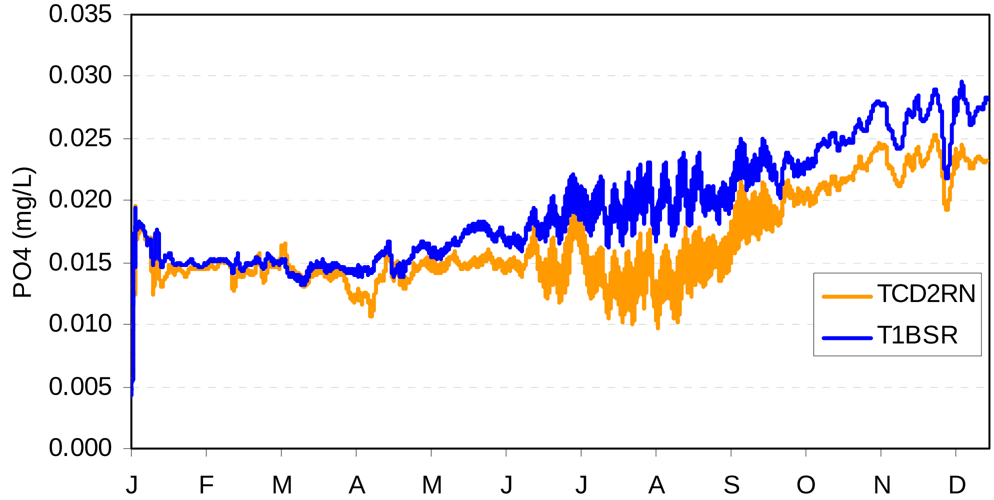
US_INDIAN


TCD2RN
T1BSR
Periphyton (mgChl-a/m2)
90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
J F M A M J J A S O N D

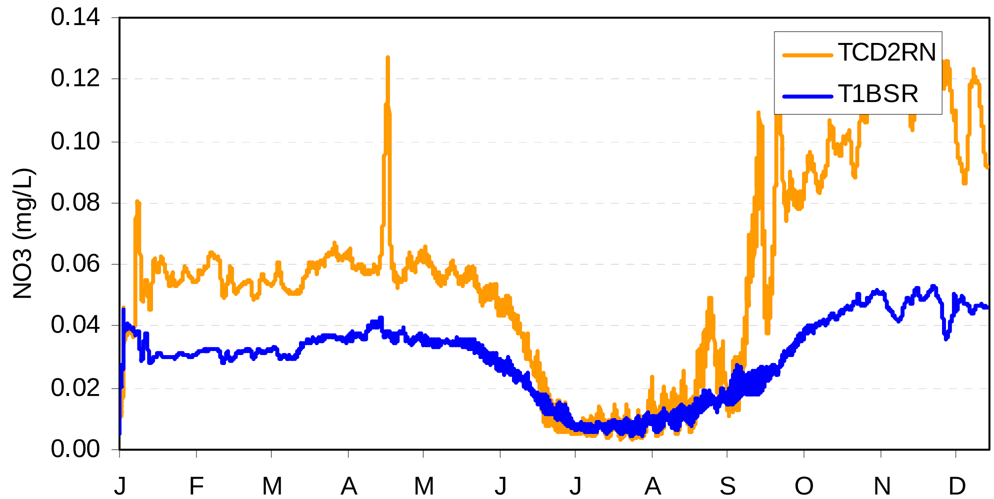

pH
10.00
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
TCD2RN
T1BSR
J F M A M J J A S O N D


TCD2RN
T1BSR
TN (mg/L)
0.5
0.4
0.4
0.3
0.3
0.2
0.2
0.1
0.1
0.0
J F M A M J J A S O N D

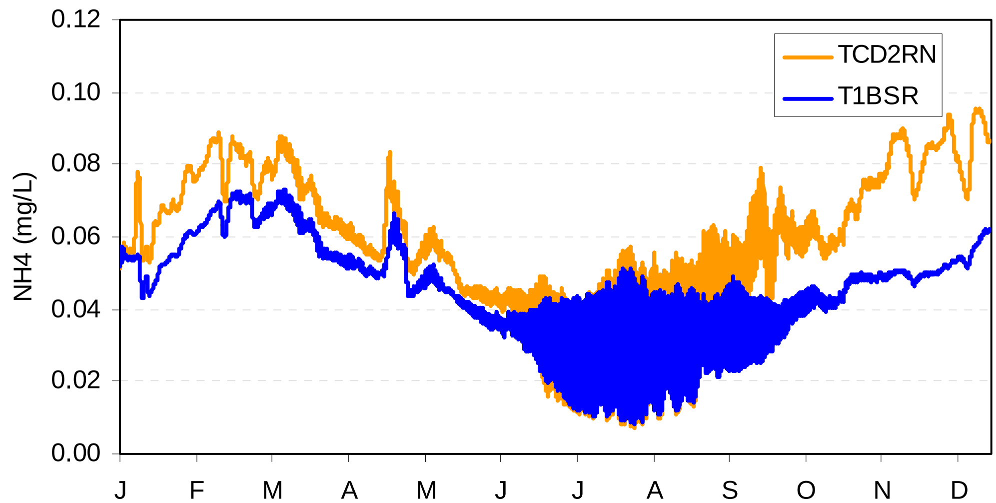
US_INDIAN



PO4 (mg/L)
0.035
0.030
0.025
0.020
0.015
0.010
0.005
0.000
J F M A M J J A S O N D
TCD2RN
T1BSR

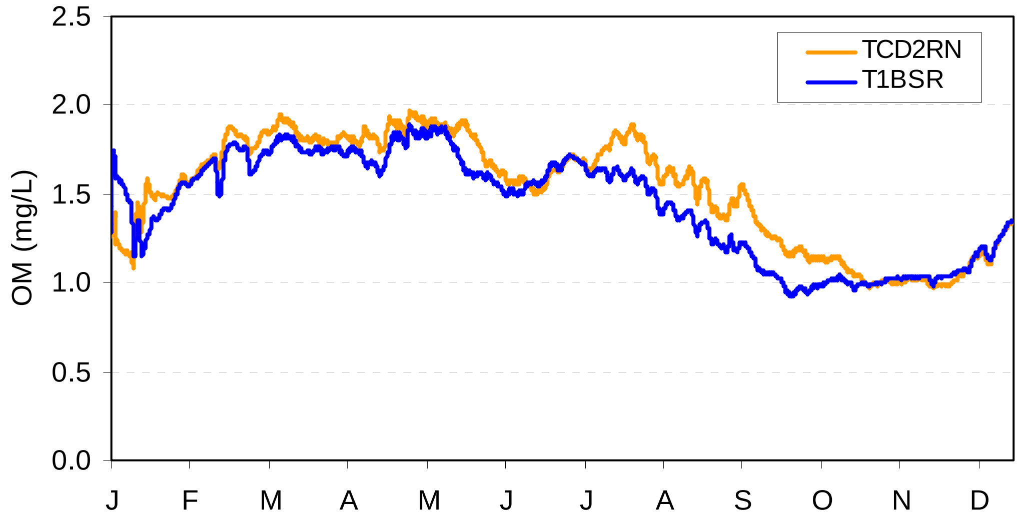


NO3 (mg/L)
0.14
0.12
0.10
0.08
0.06
0.04
0.02
0.00
J F M A M J J A S O N D
TCD2RN
T1BSR

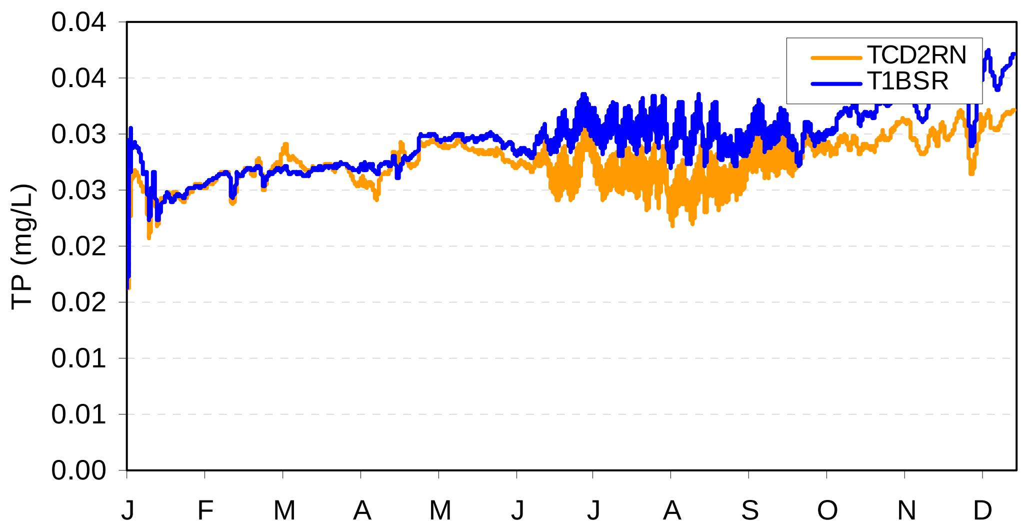


NH4 (mg/L)
0.12
0.10
0.08
0.06
0.04
0.02
0.00
J F M A M J J A S O N D
TCD2RN
T1BSR

US_INDIAN

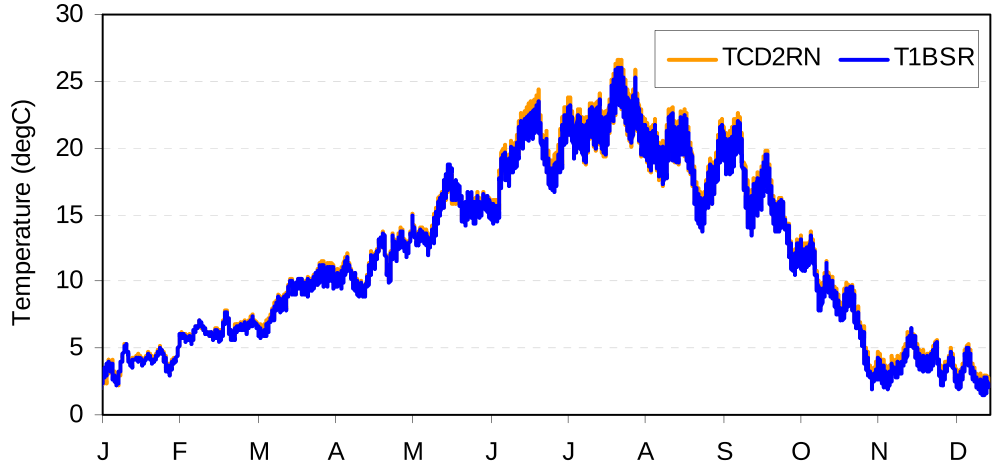


OM (mg/L)
2.5
2.0
1.5
1.0
0.5
0.0
TCD2RN
T1BSR
J
F
M
A
M
J
J
A
S
O
N
D

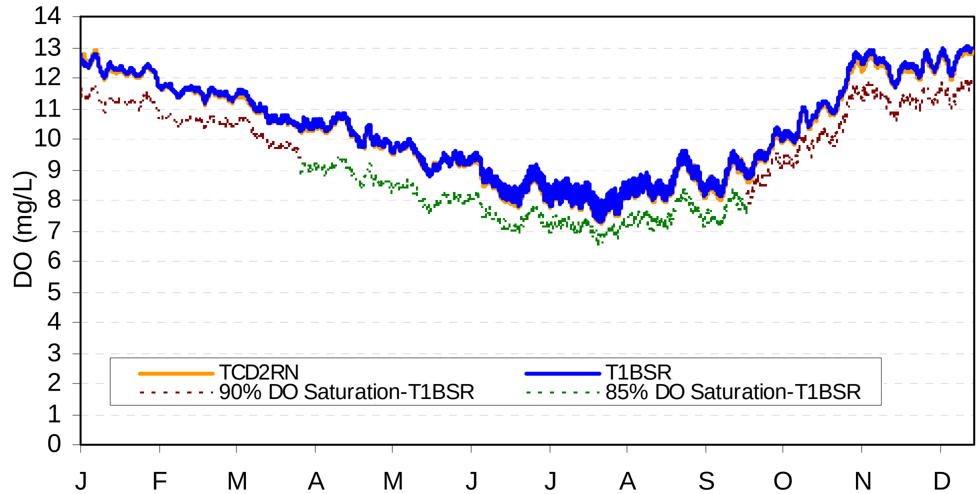


TP (mg/L)
0.04
0.04
0.03
0.03
0.02
0.02
0.01
0.01
0.00
TCD2RN
T1BSR
J
F
M
A
M
J
J
A
S
O
N
D

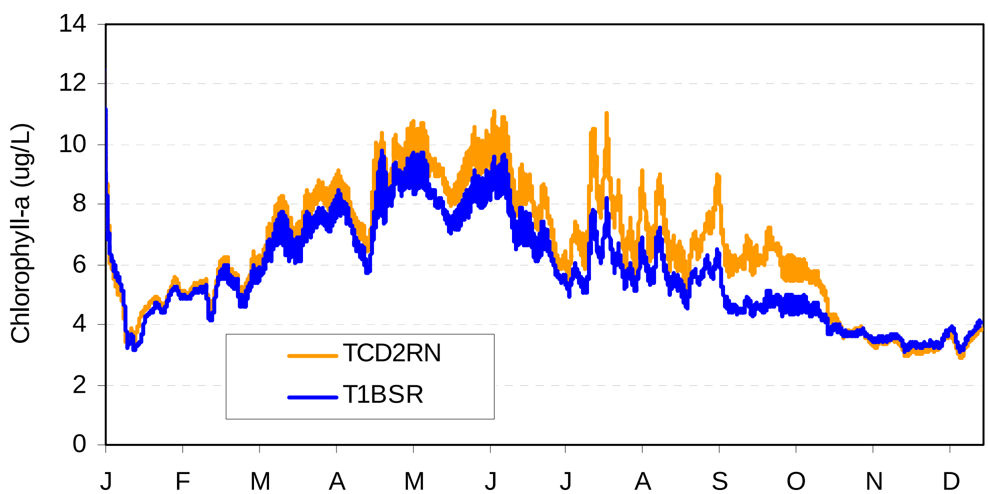
DS_INDIAN



Temperature (degC)
30
25
20
15
10
5
0
J
F
M
A
M
J
J
A
S
O
N
D
TCD2RN
T1BSR

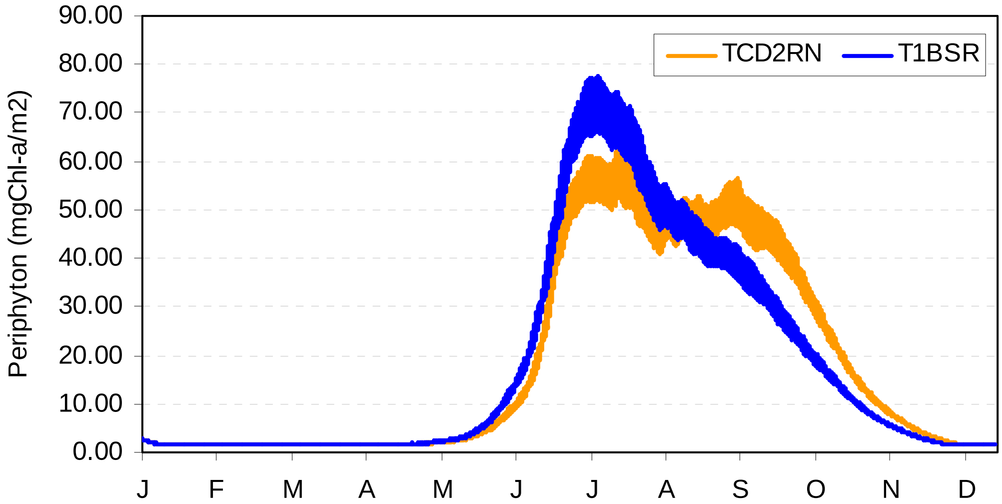


DO (mg/L)
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
J
F
M
A
M
J
J
A
S
O
N
D
TCD2RN
T1BSR
90% DO Saturation-T1BSR
85% DO Saturation-T1BSR

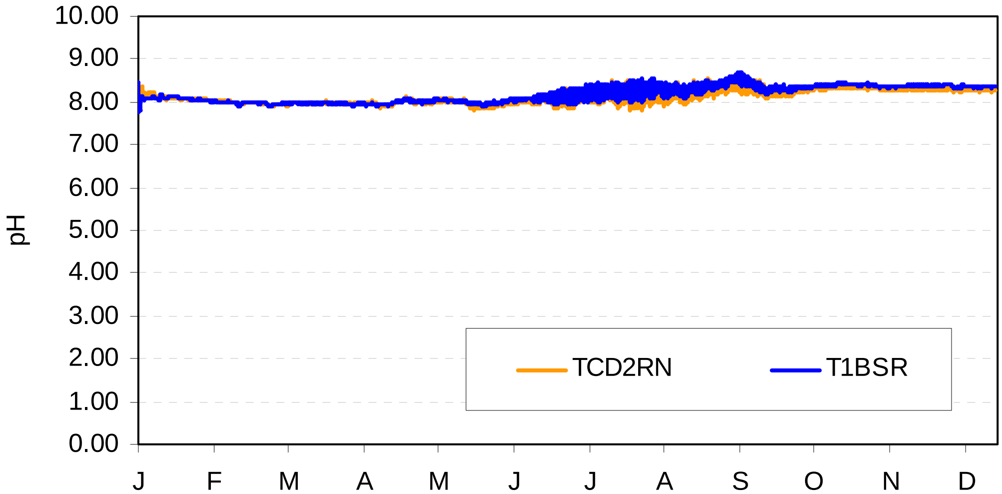


Chlorophyll-a (ug/L)
14
12
10
8
6
4
2
0
J
F
M
A
M
J
J
A
S
O
N
D
TCD2RN
T1BSR

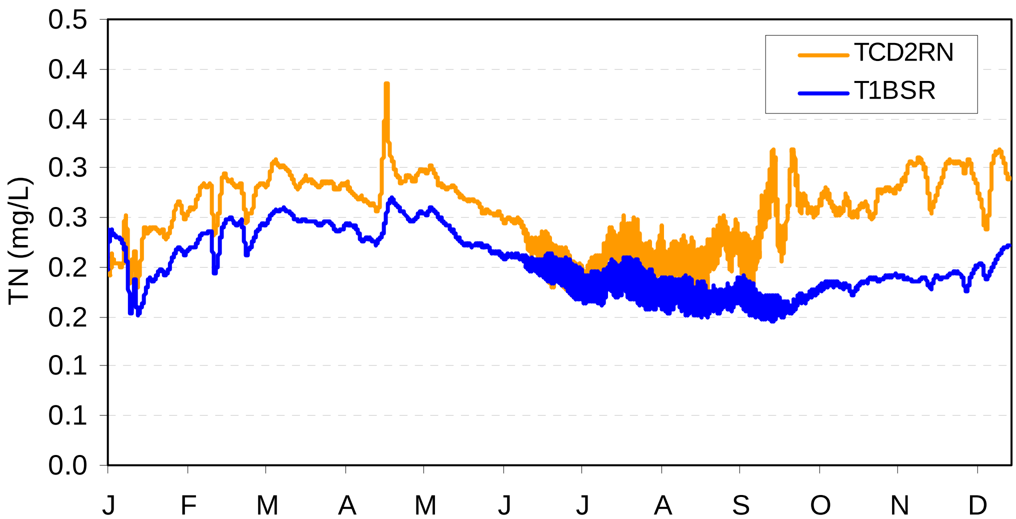
DS_INDIAN



Periphyton (mgChl-a/m2)
90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
J F M A M J J A S O N D
TCD2RN
T1BSR

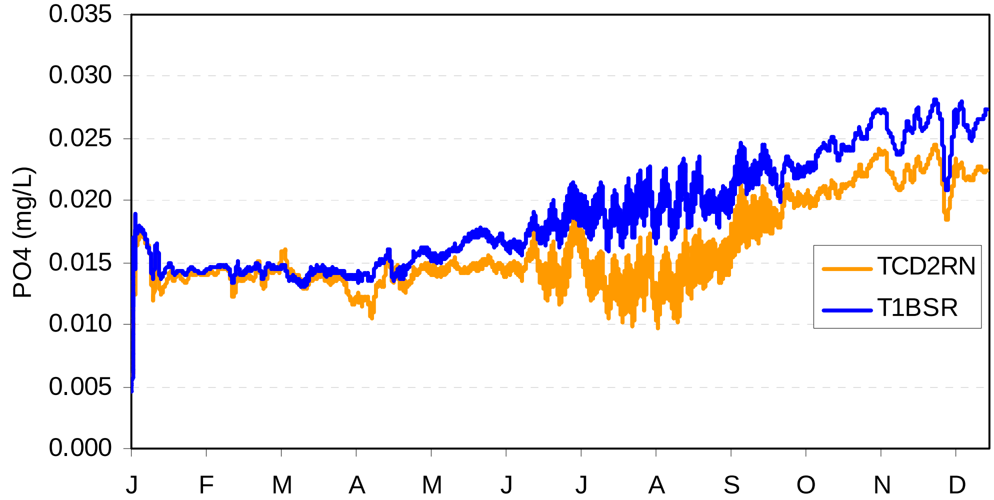


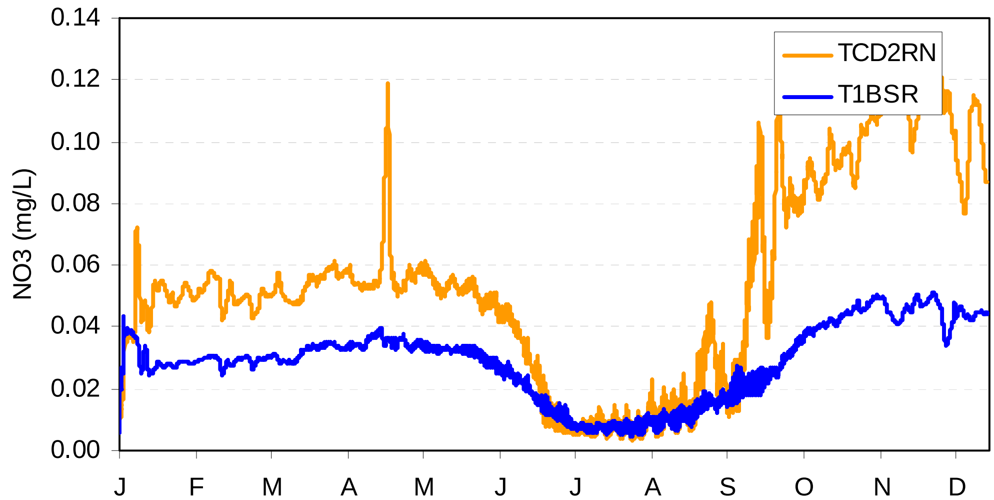
pH
10.00
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
J F M A M J J A S O N D
TCD2RN
T1BSR

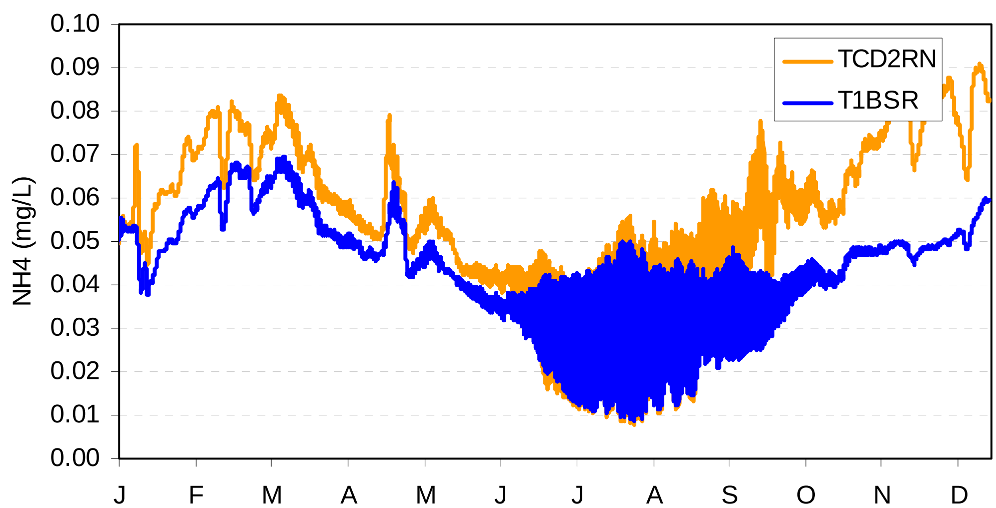


TN (mg/L)
0.5
0.4
0.4
0.3
0.3
0.2
0.2
0.1
0.1
0.0
J F M A M J J A S O N D
TCD2RN
T1BSR

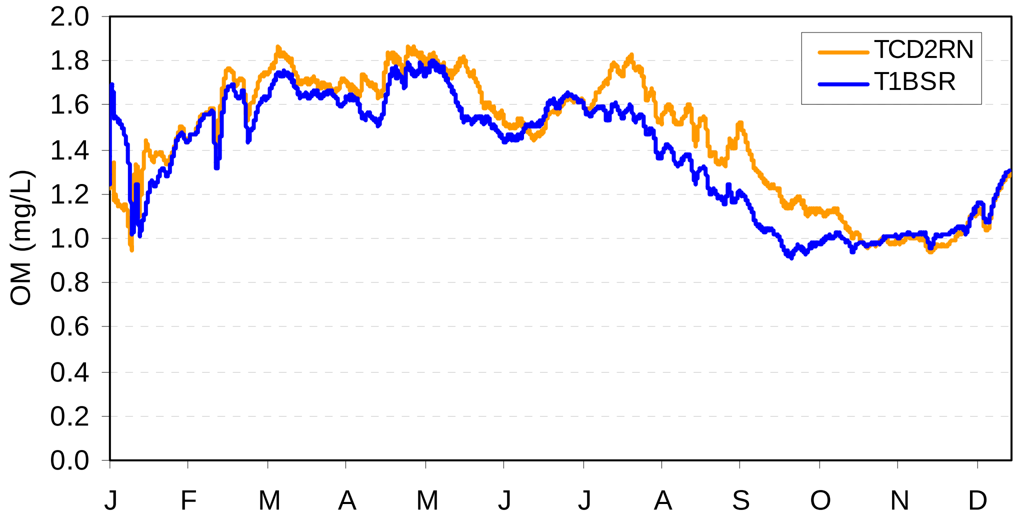
DS_INDIAN


0.035
0.030
0.025
0.020
0.015
0.010
0.005
0.000
PO4 (mg/L)
J F M A M J J A S O N D
TCD2RN
T1BSR

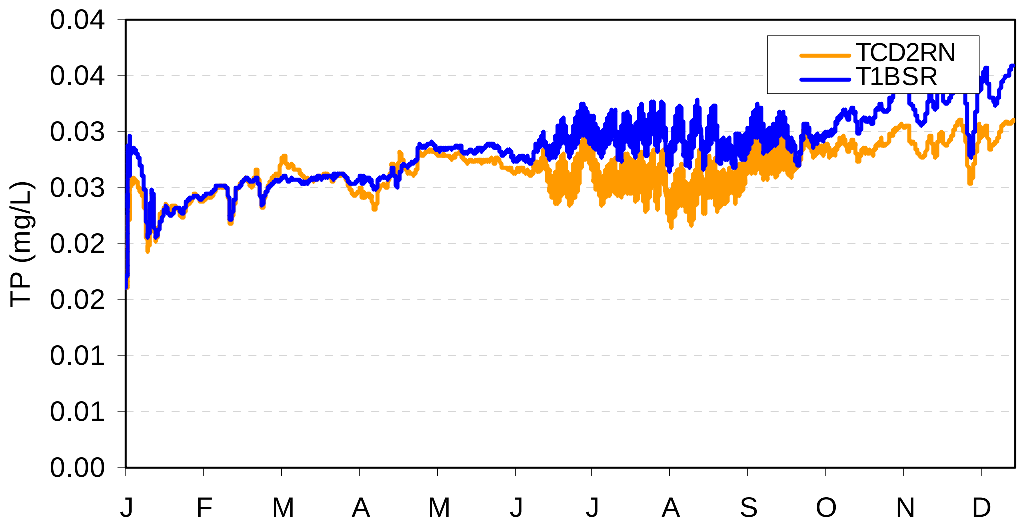

0.14
0.12
0.10
0.08
0.06
0.04
0.02
0.00
NO3 (mg/L)
J F M A M J J A S O N D
TCD2RN
T1BSR


0.10
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0.00
NH4 (mg/L)
J F M A M J J A S O N D
TCD2RN
T1BSR

DS_INDIAN

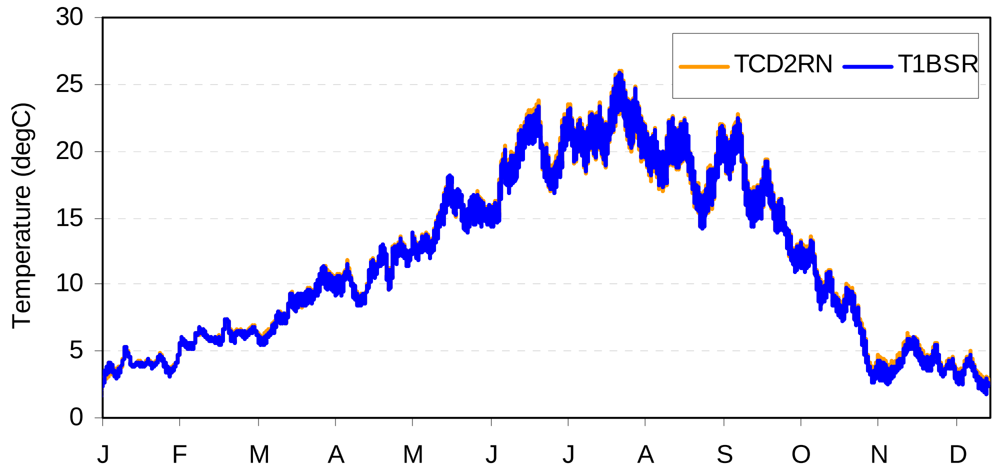


OM (mg/L)
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
J
F
M
A
M
J
J
A
S
O
N
D
TCD2RN
T1BSR

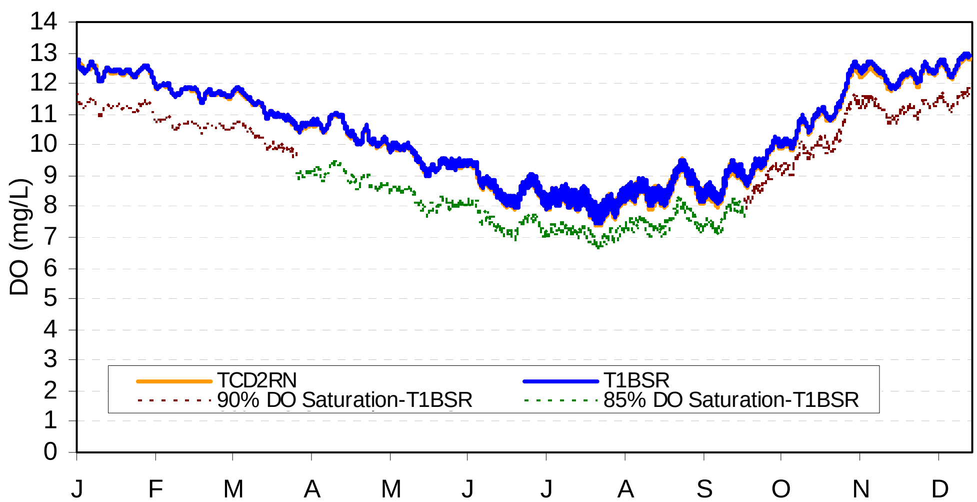


TP (mg/L)
0.04
0.04
0.03
0.03
0.02
0.02
0.01
0.01
0.00
J
F
M
A
M
J
J
A
S
O
N
D
TCD2RN
T1BSR

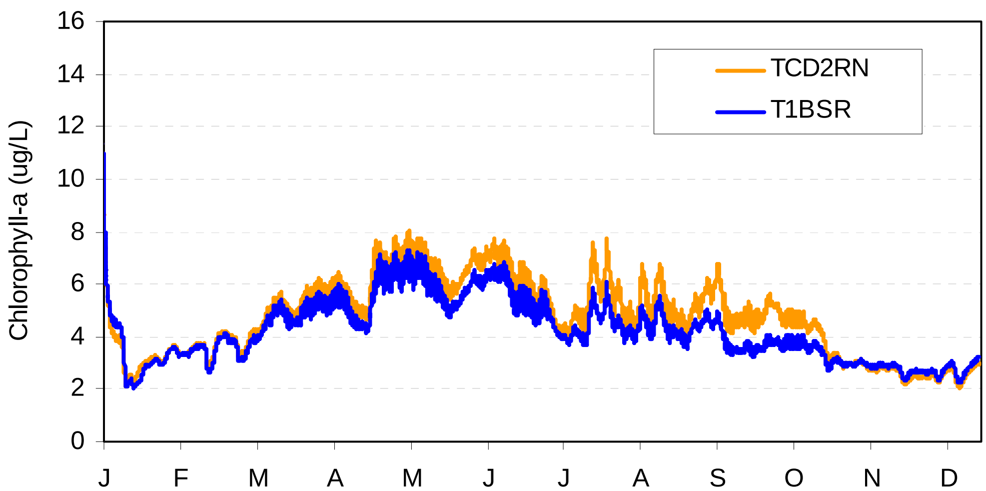
US_SALMON



30
25
20
15
10
5
0
Temperature (degC)
TCD2RN
T1BSR
J
F
M
A
M
J
J
A
S
O
N
D

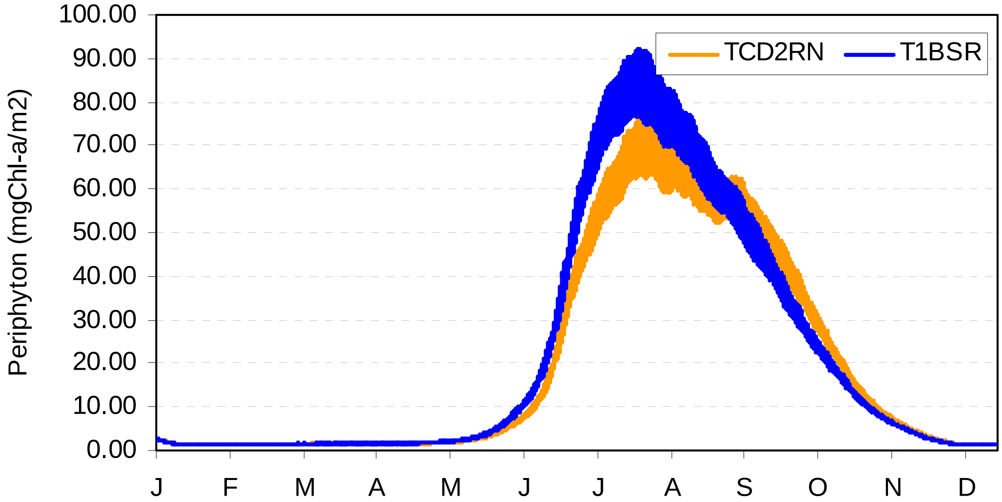


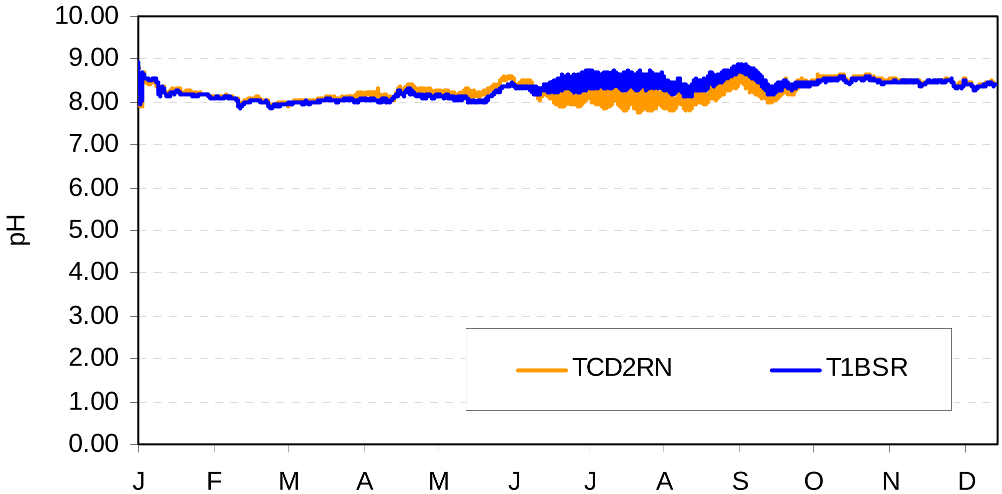
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
DO (mg/L)
TCD2RN
T1BSR
90% DO Saturation-T1BSR
85% DO Saturation-T1BSR
J
F
M
A
M
J
J
A
S
O
N
D

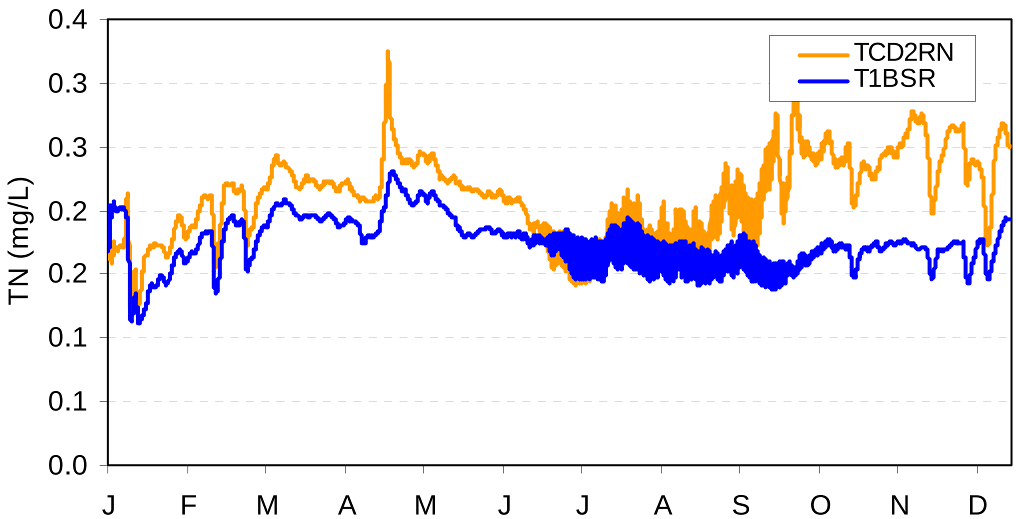


16
14
12
10
8
6
4
2
0
Chlorophyll-a (ug/L)
TCD2RN
T1BSR
J
F
M
A
M
J
J
A
S
O
N
D

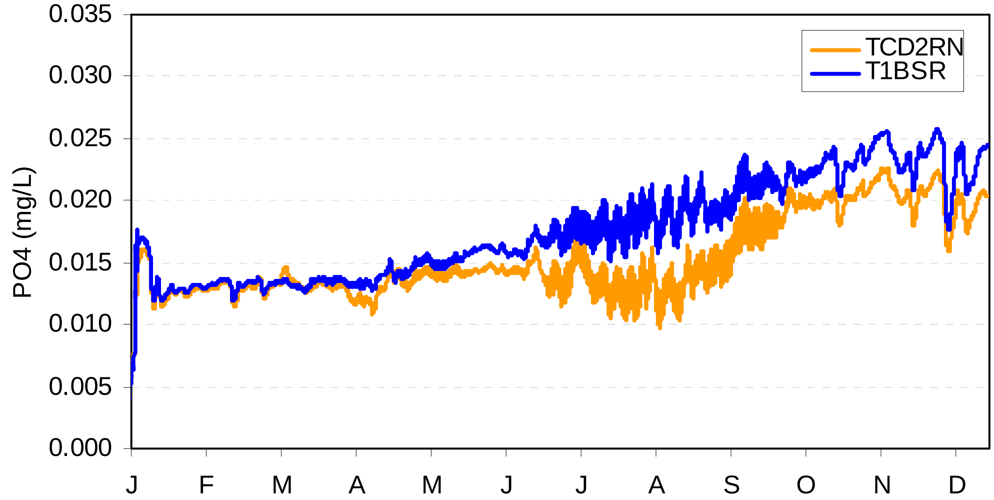
US_SALMON


TCD2RN
T1BSR
Periphyton (mgChl-a/m2)
100.00
90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
J F M A M J J A S O N D

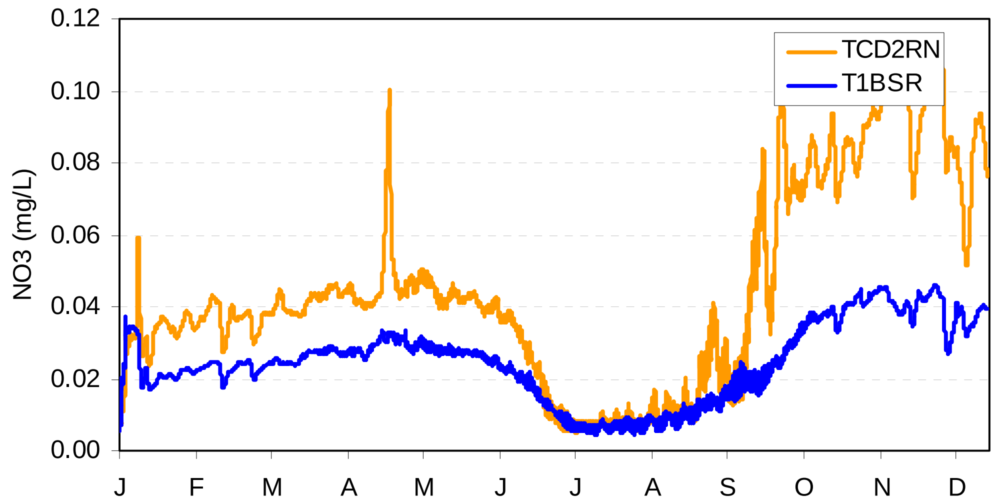

pH
10.00
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
TCD2RN
T1BSR
J F M A M J J A S O N D


TCD2RN
T1BSR
TN (mg/L)
0.4
0.3
0.3
0.2
0.2
0.1
0.1
0.0
J F M A M J J A S O N D

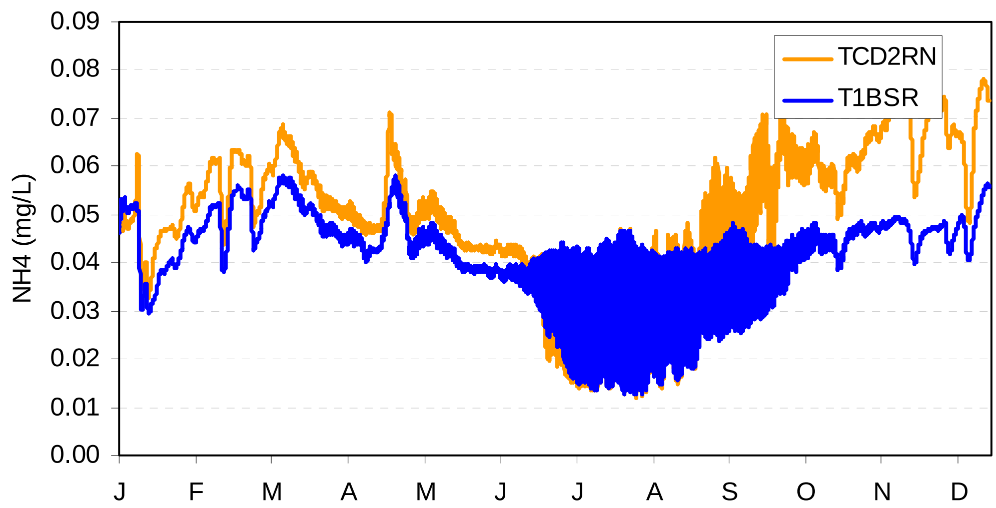
US_SALMON



PO4 (mg/L)
0.035
0.030
0.025
0.020
0.015
0.010
0.005
0.000
J F M A M J J A S O N D
TCD2RN
T1BSR

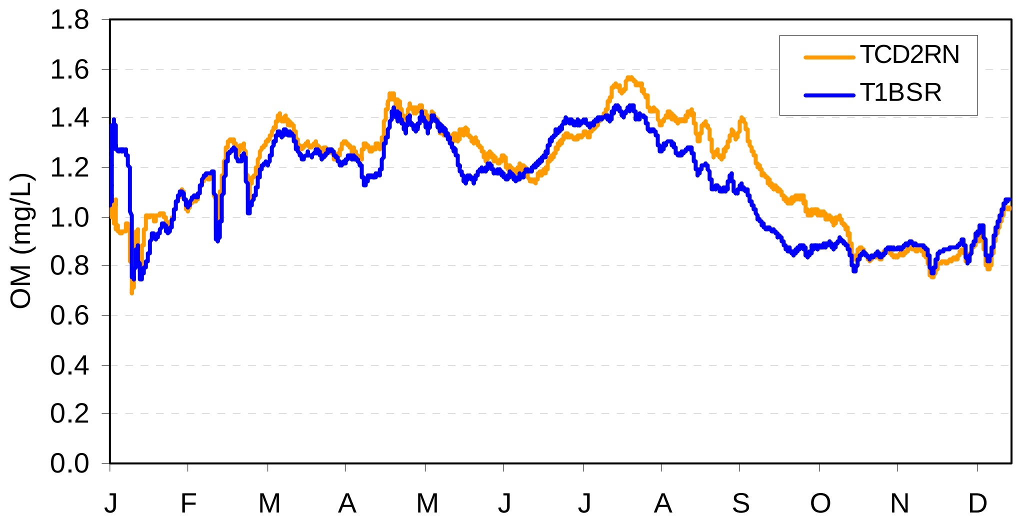


NO3 (mg/L)
0.12
0.10
0.08
0.06
0.04
0.02
0.00
J F M A M J J A S O N D
TCD2RN
T1BSR

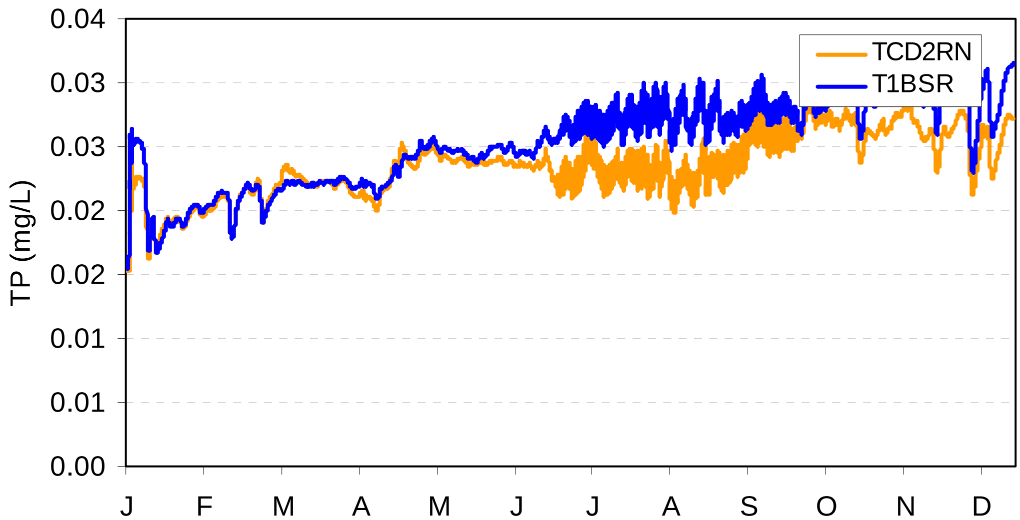


NH4 (mg/L)
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0.00
J F M A M J J A S O N D
TCD2RN
T1BSR

US_SALMON



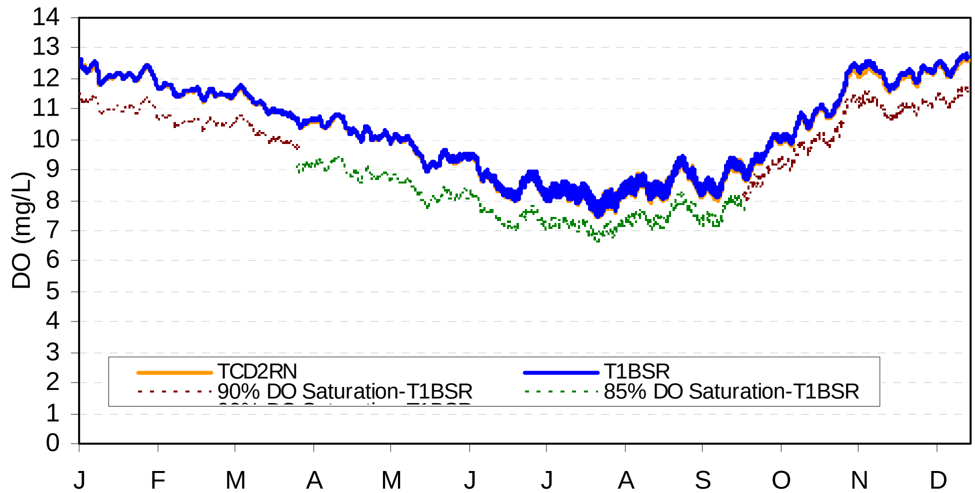
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
OM (mg/L)
TCD2RN
T1BSR
J
F
M
A
M
J
J
A
S
O
N
D



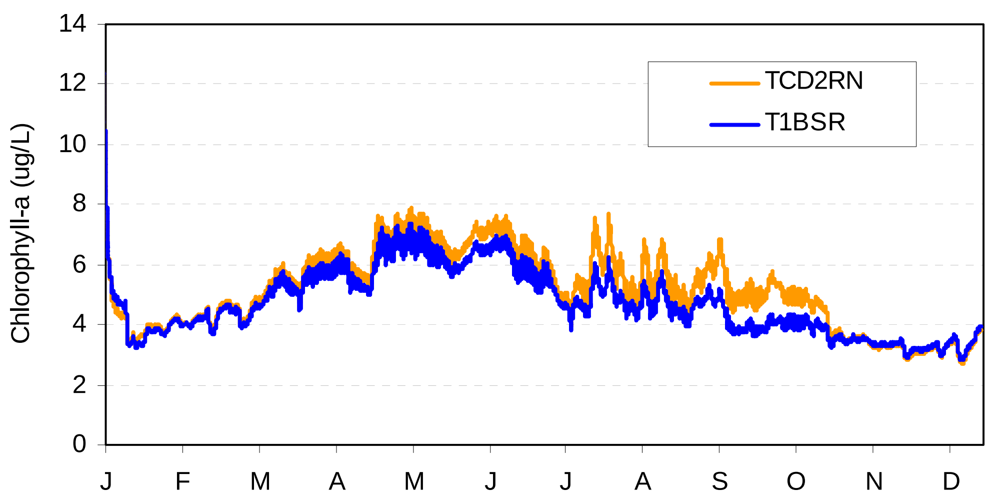
0.04
0.03
0.03
0.02
0.02
0.01
0.01
0.00
TP (mg/L)
TCD2RN
T1BSR
J
F
M
A
M
J
J
A
S
O
N
D

DS_SALMON

30
25
20
15
10
5
0
Temperature (degC)
TCD2RN
T1BSR
J F M A M J J A S O N D

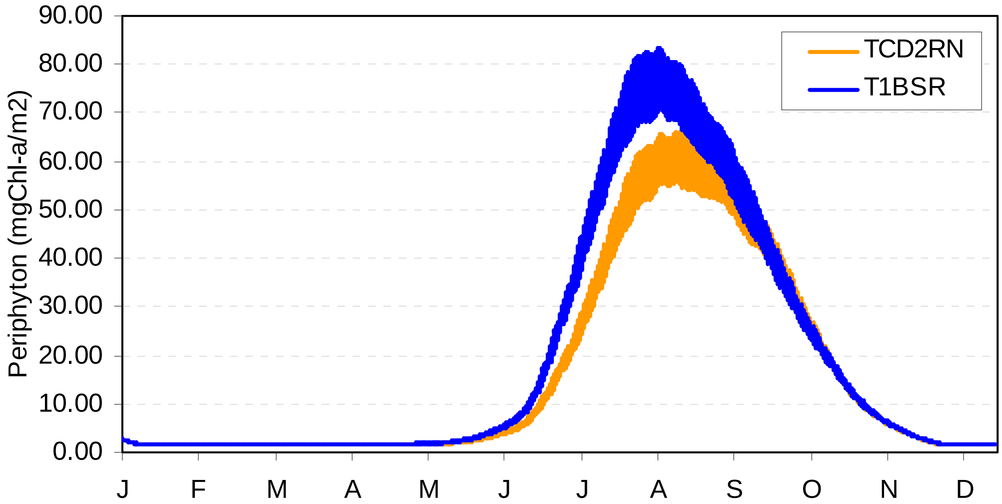


14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
DO (mg/L)
TCD2RN
T1BSR
90% DO Saturation-T1BSR
85% DO Saturation-T1BSR
J F M A M J J A S O N D

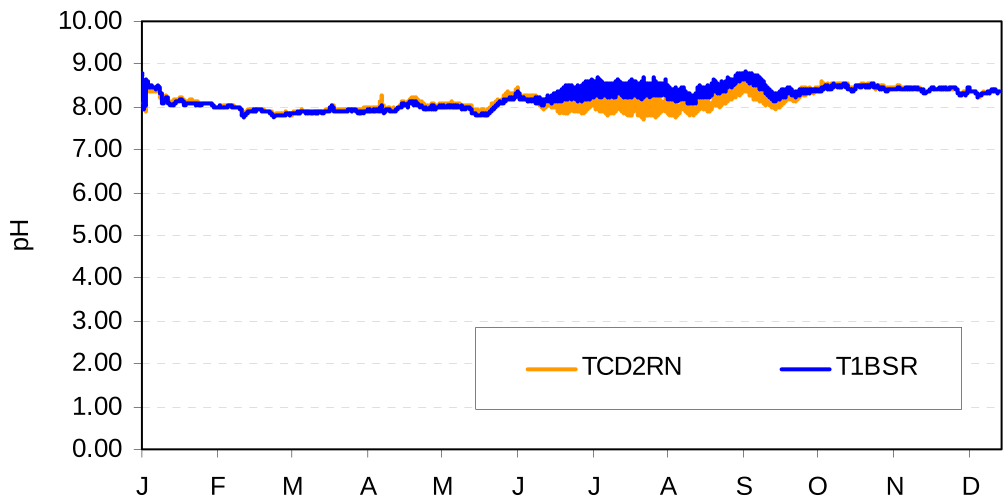


14
12
10
8
6
4
2
0
Chlorophyll-a (ug/L)
TCD2RN
T1BSR
J F M A M J J A S O N D

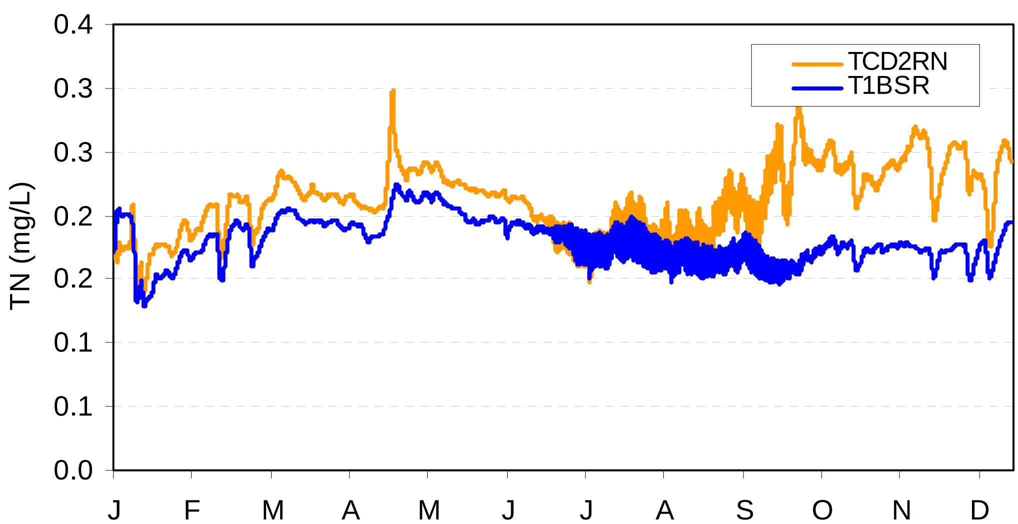
DS_SALMON



90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
Periphyton (mgChl-a/m2)
J F M A M J J A S O N D
TCD2RN
T1BSR

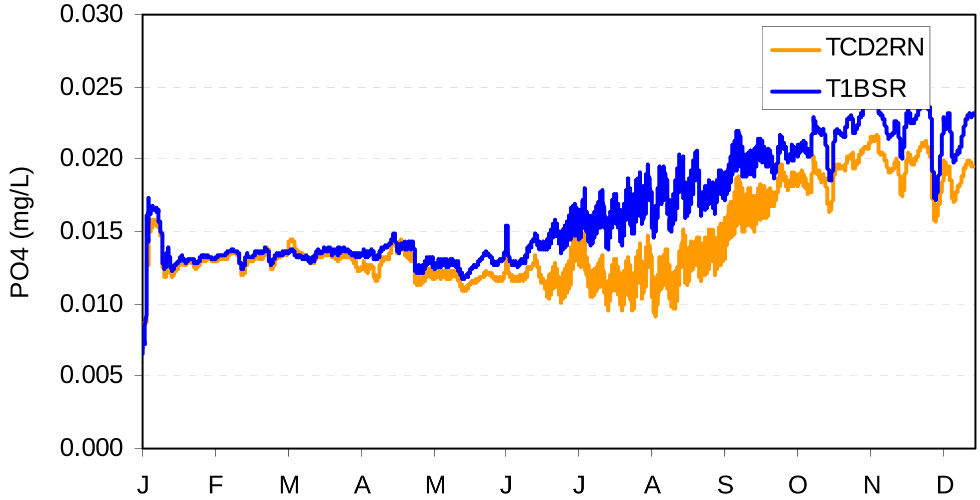


10.00
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
pH
J F M A M J J A S O N D
TCD2RN
T1BSR

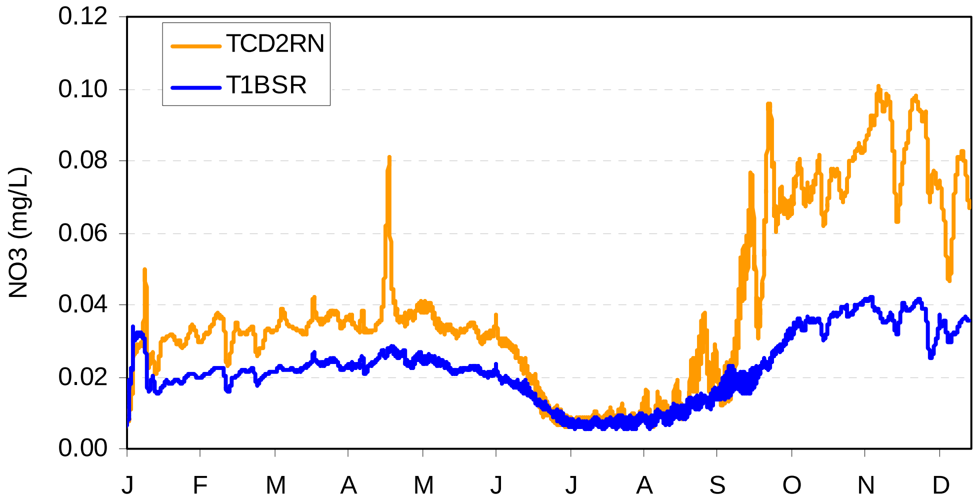


0.4
0.3
0.3
0.2
0.2
0.1
0.1
0.0
TN (mg/L)
J F M A M J J A S O N D
TCD2RN
T1BSR

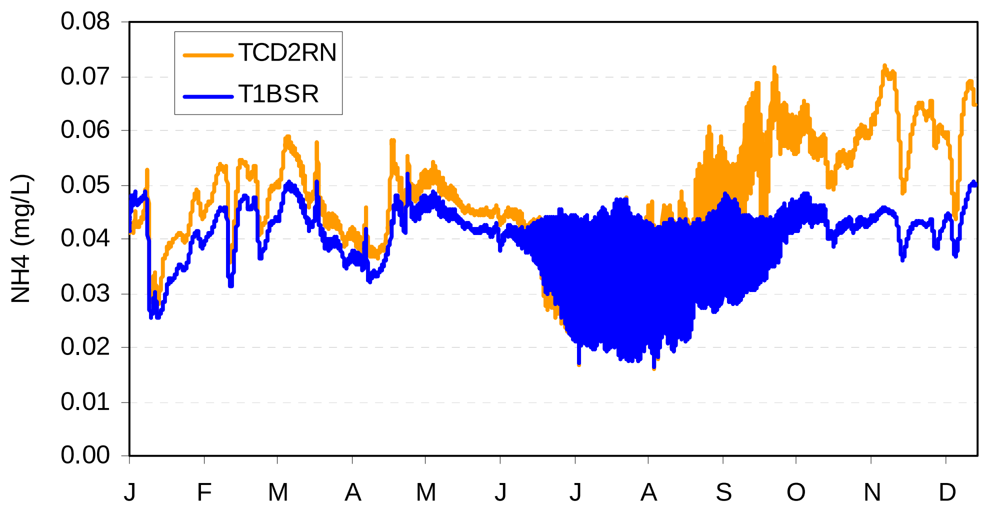
DS_SALMON



0.030
0.025
0.020
0.015
0.010
0.005
0.000
PO4 (mg/L)
TCD2RN
T1BSR
J
F
M
A
M
J
J
A
S
O
N
D

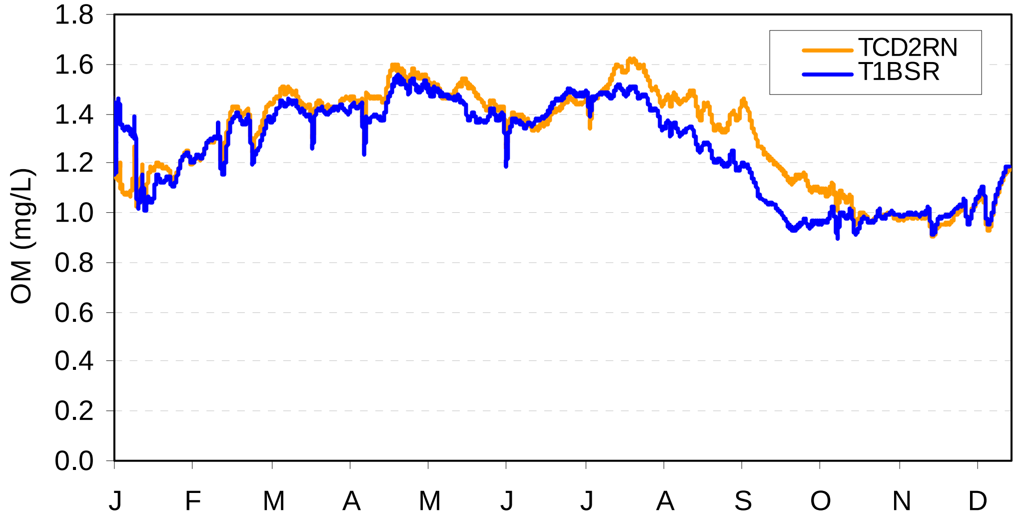


0.12
0.10
0.08
0.06
0.04
0.02
0.00
NO3 (mg/L)
TCD2RN
T1BSR
J
F
M
A
M
J
J
A
S
O
N
D

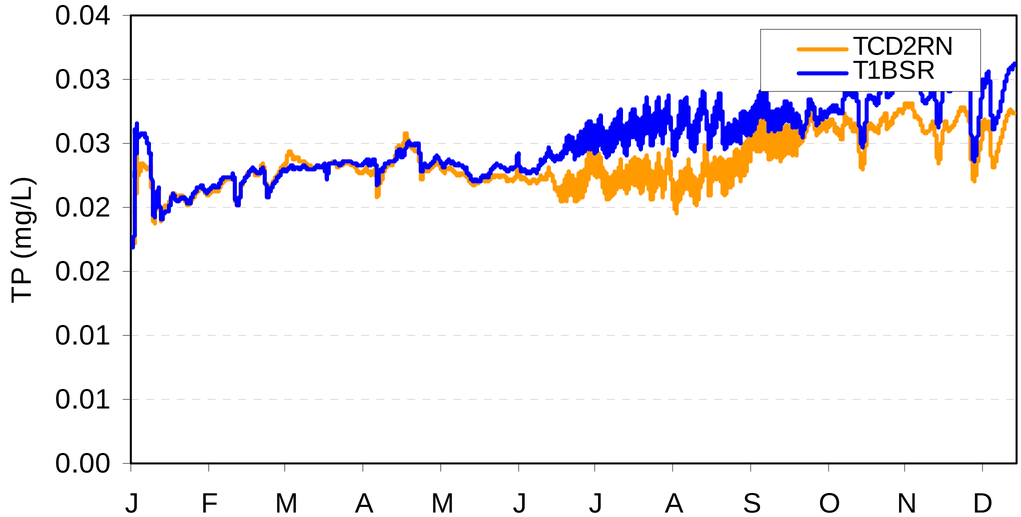


0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0.00
NH4 (mg/L)
TCD2RN
T1BSR
J
F
M
A
M
J
J
A
S
O
N
D

DS_SALMON

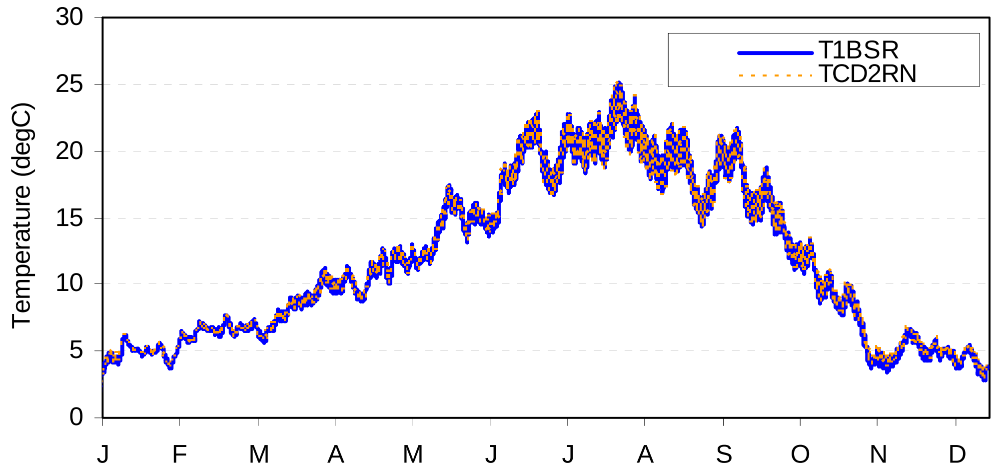


1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
OM (mg/L)
J F M A M J J A S O N D
TCD2RN
T1BSR

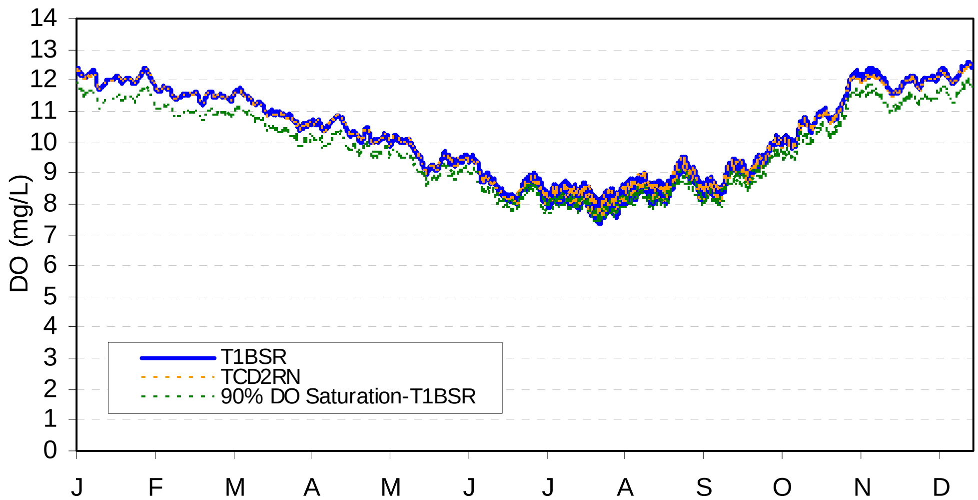


0.04
0.03
0.03
0.02
0.02
0.01
0.01
0.00
TP (mg/L)
J F M A M J J A S O N D
TCD2RN
T1BSR

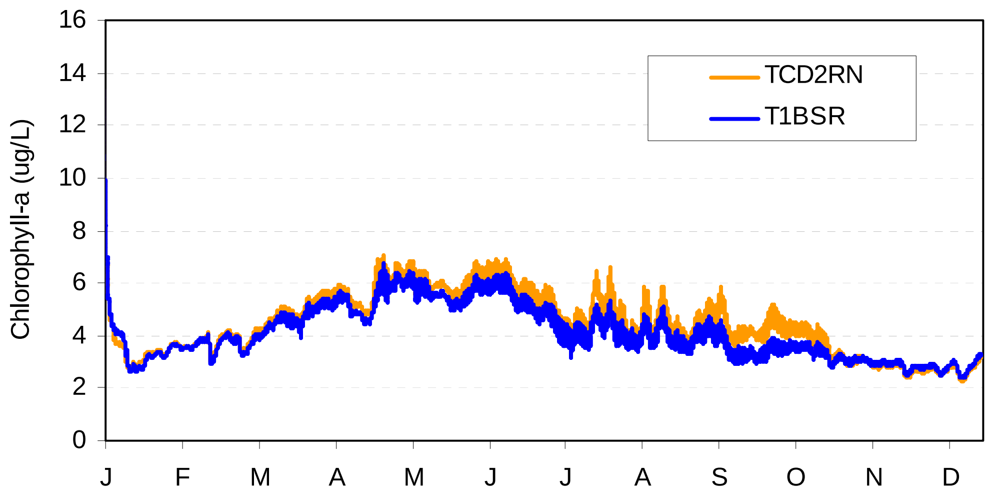
HOOPA



Temperature (degC)
30
25
20
15
10
5
0
T1BSR
TCD2RN
J
F
M
A
M
J
J
A
S
O
N
D

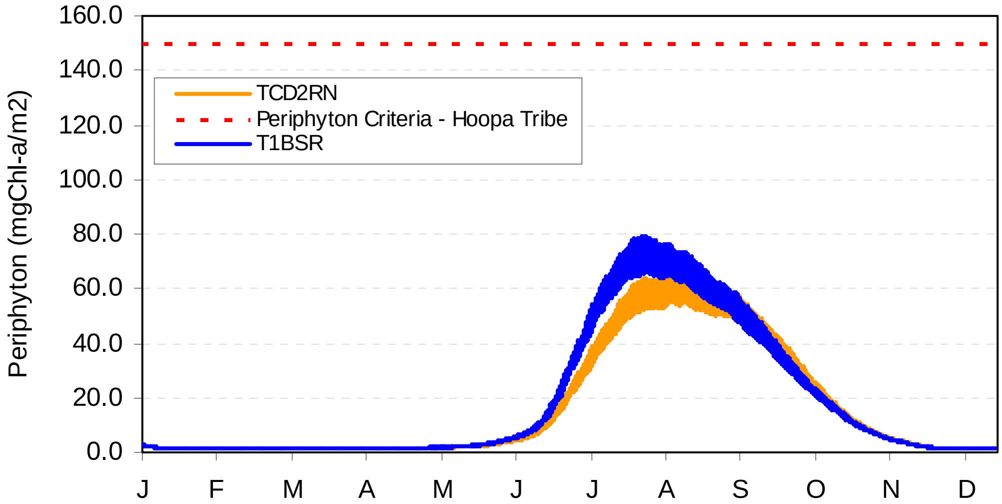


DO (mg/L)
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
T1BSR
TCD2RN
90% DO Saturation-T1BSR
J
F
M
A
M
J
J
A
S
O
N
D

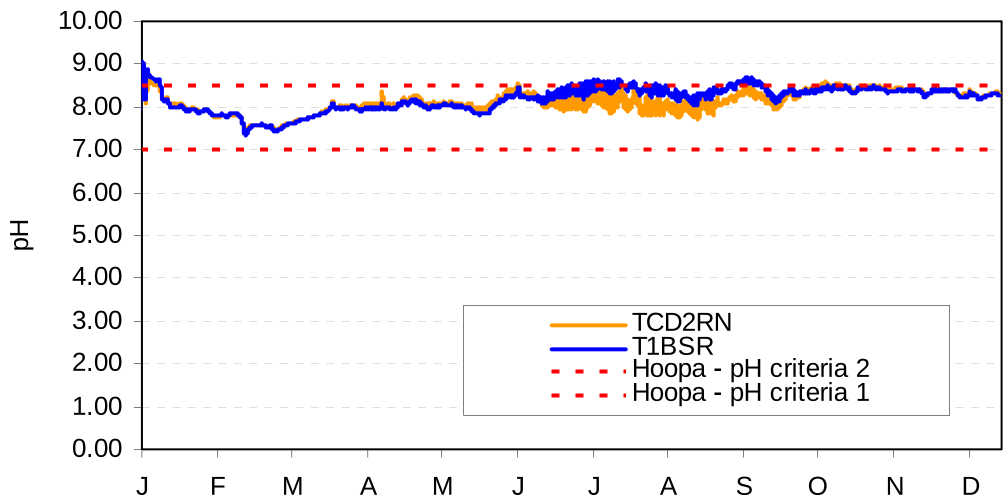


Chlorophyll-a (ug/L)
16
14
12
10
8
6
4
2
0
TCD2RN
T1BSR
J
F
M
A
M
J
J
A
S
O
N
D

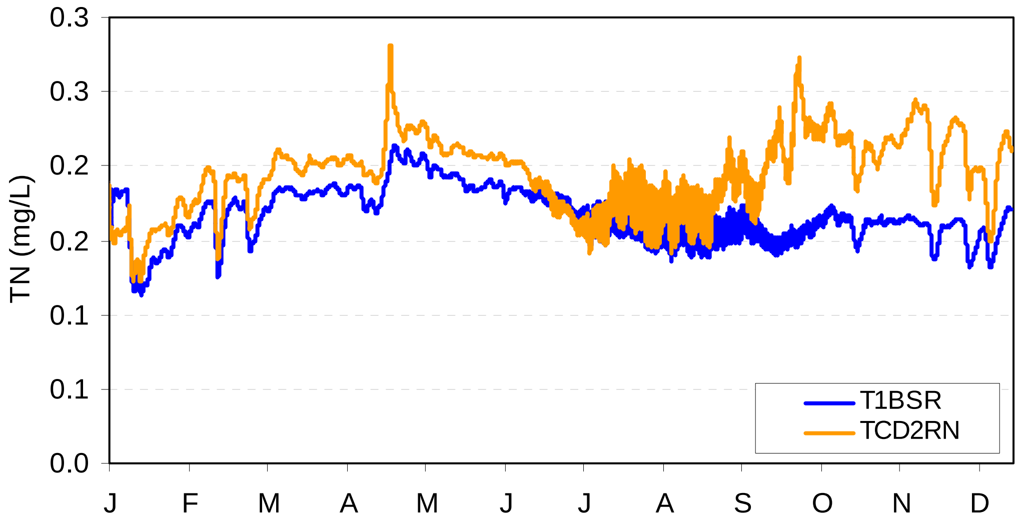
HOOPA



Periphyton (mgChl-a/m2)
160.0
140.0
120.0
100.0
80.0
60.0
40.0
20.0
0.0
TCD2RN
Periphyton Criteria - Hoopa Tribe
T1BSR
J F M A M J J A S O N D

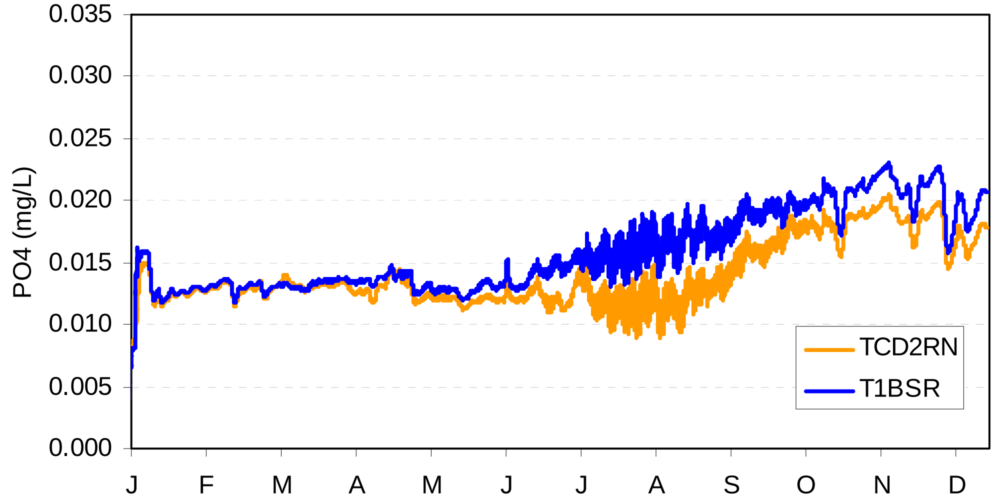


pH
10.00
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
TCD2RN
T1BSR
Hoopa - pH criteria 2
Hoopa - pH criteria 1
J F M A M J J A S O N D

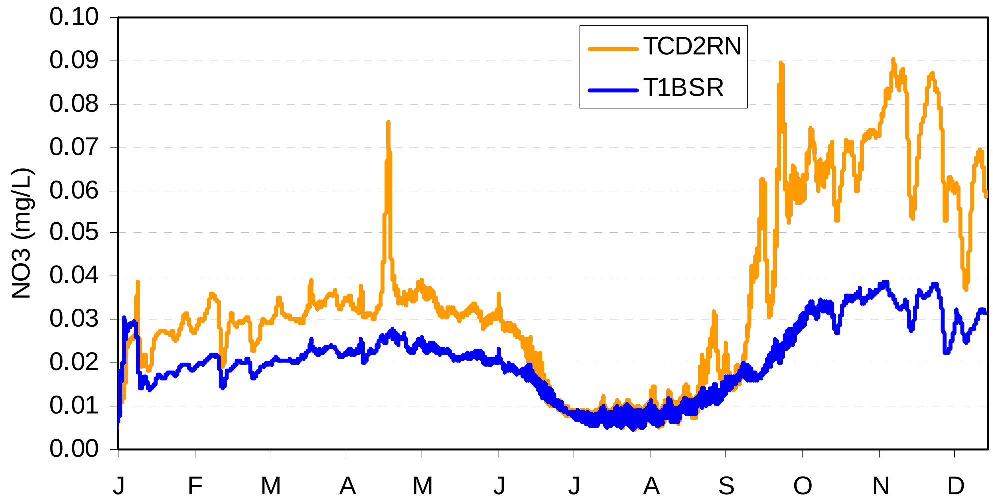


TN (mg/L)
0.3
0.3
0.2
0.2
0.1
0.1
0.0
T1BSR
TCD2RN
J F M A M J J A S O N D

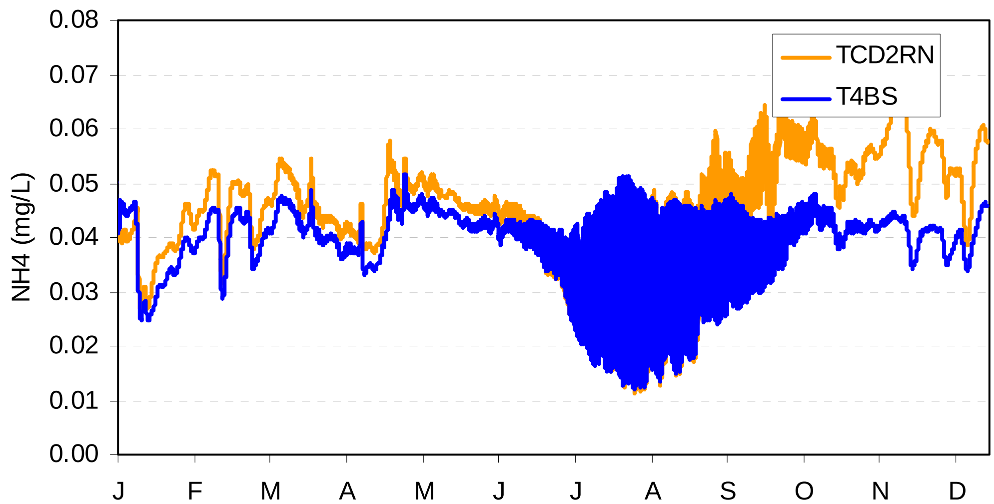
HOOPA



0.035
0.030
0.025
0.020
0.015
0.010
0.005
0.000
PO4 (mg/L)
J F M A M J J A S O N D
TCD2RN
T1BSR

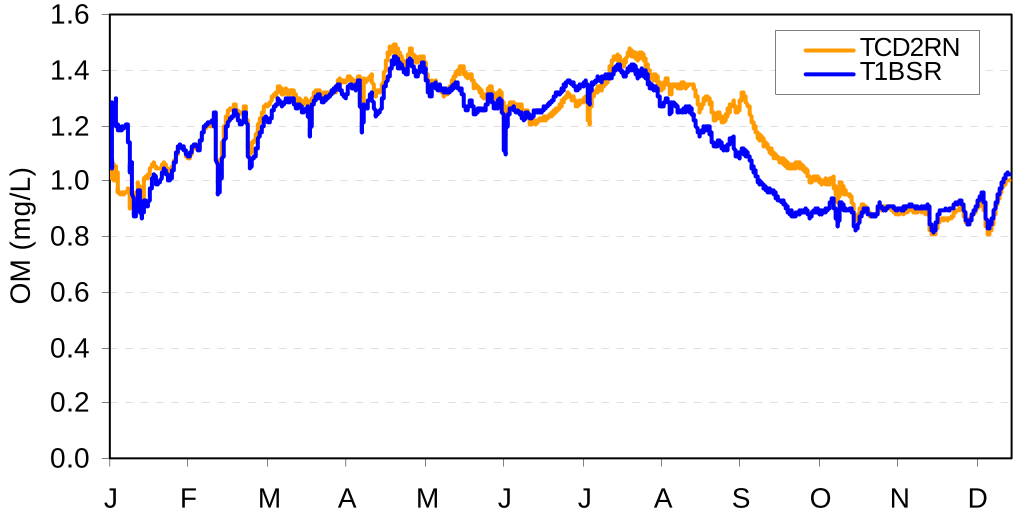


0.10
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0.00
NO3 (mg/L)
J F M A M J J A S O N D
TCD2RN
T1BSR

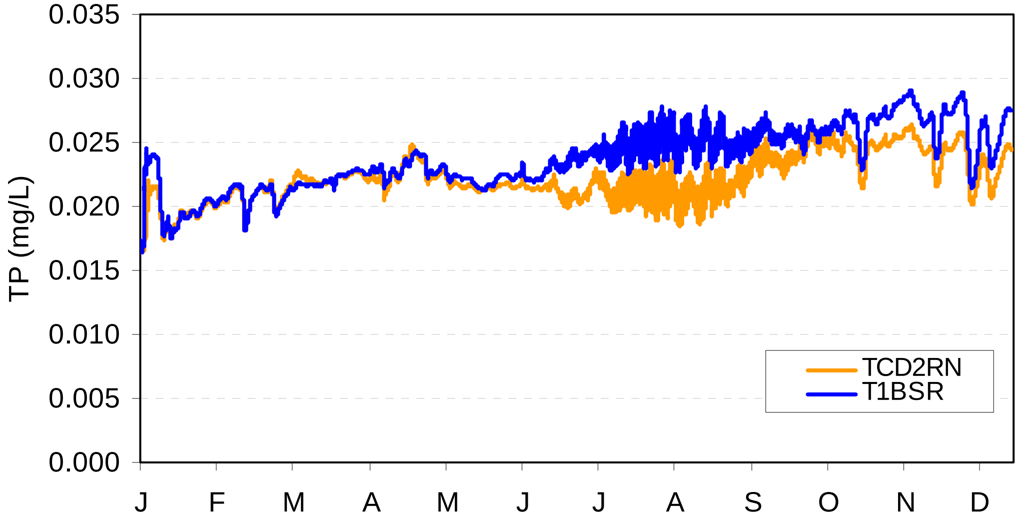


0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0.00
NH4 (mg/L)
J F M A M J J A S O N D
TCD2RN
T4BS

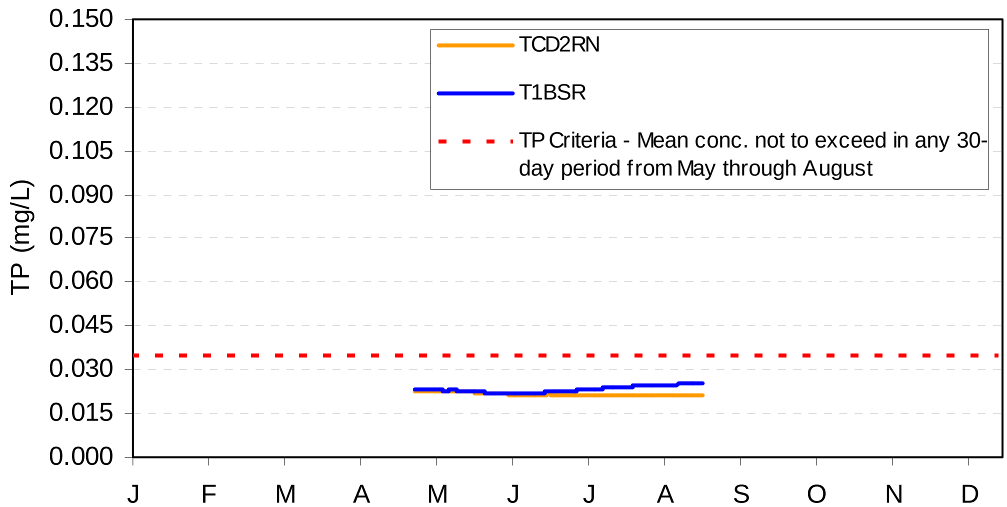
HOOPA



1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
OM (mg/L)
TCD2RN
T1BSR
J F M A M J J A S O N D

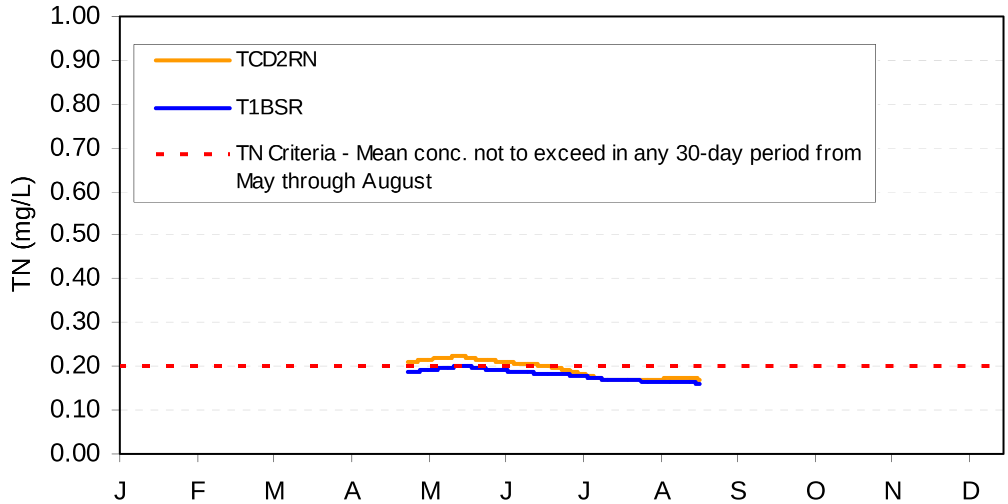


0.035
0.030
0.025
0.020
0.015
0.010
0.005
0.000
TP (mg/L)
TCD2RN
T1BSR
J F M A M J J A S O N D

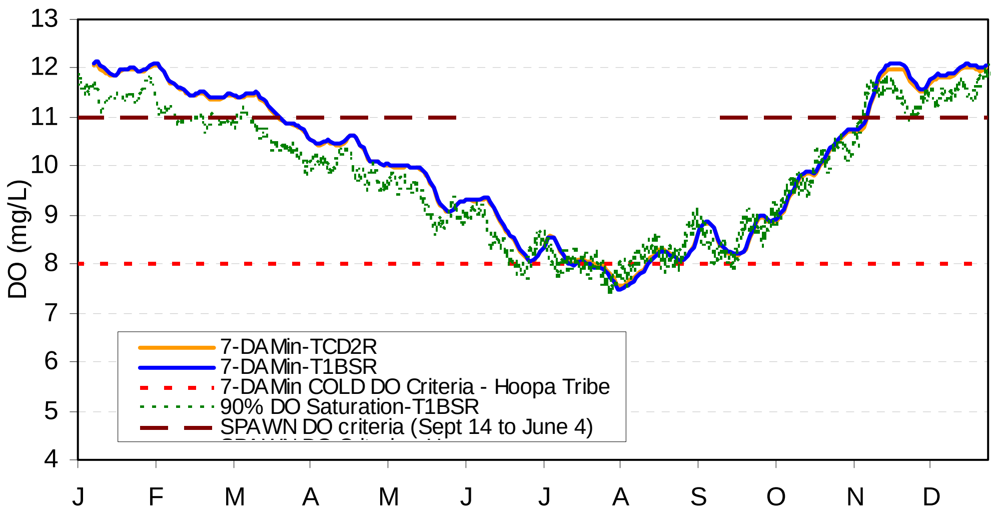


0.150
0.135
0.120
0.105
0.090
0.075
0.060
0.045
0.030
0.015
0.000
TP (mg/L)
TCD2RN
T1BSR
TP Criteria - Mean conc. not to exceed in any 30-day period from May through August
J F M A M J J A S O N D

HOOPA

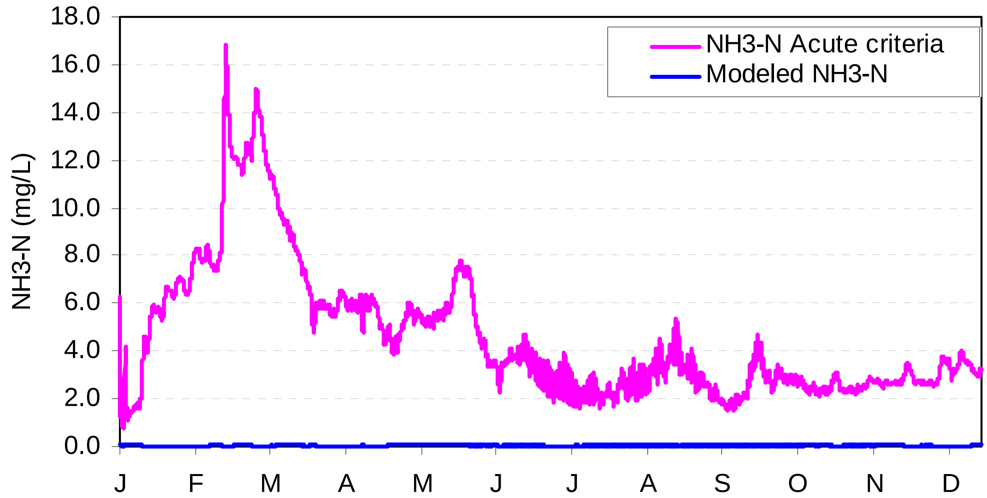


1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
TN (mg/L)
J F M A M J J A S O N D
TCD2RN
T1BSR
TN Criteria - Mean conc. not to exceed in any 30-day period from May through August

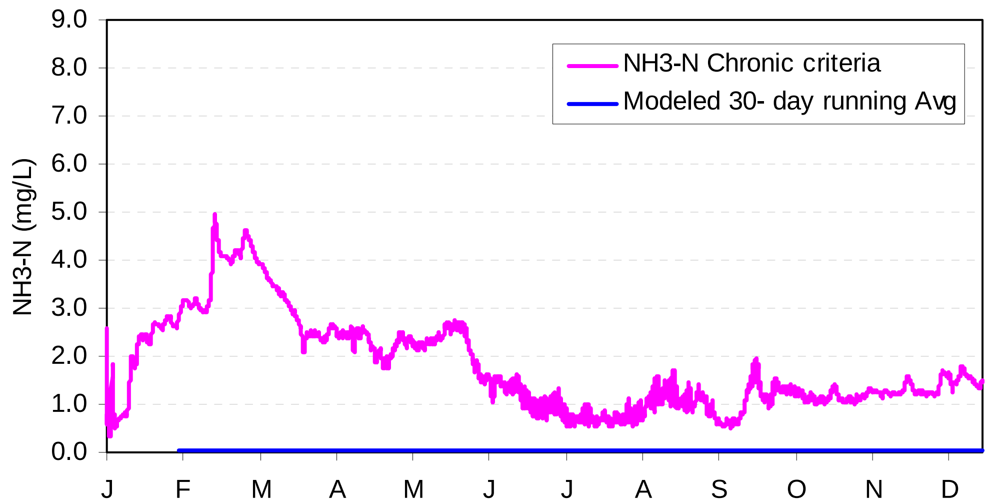


13
12
11
10
9
8
7
6
5
4
DO (mg/L)
J F M A M J J A S O N D
7-DAMin-TCD2R
7-DAMin-T1BSR
7-DAMin COLD DO Criteria - Hoopa Tribe
90% DO Saturation-T1BSR
SPAWN DO criteria (Sept 14 to June 4)

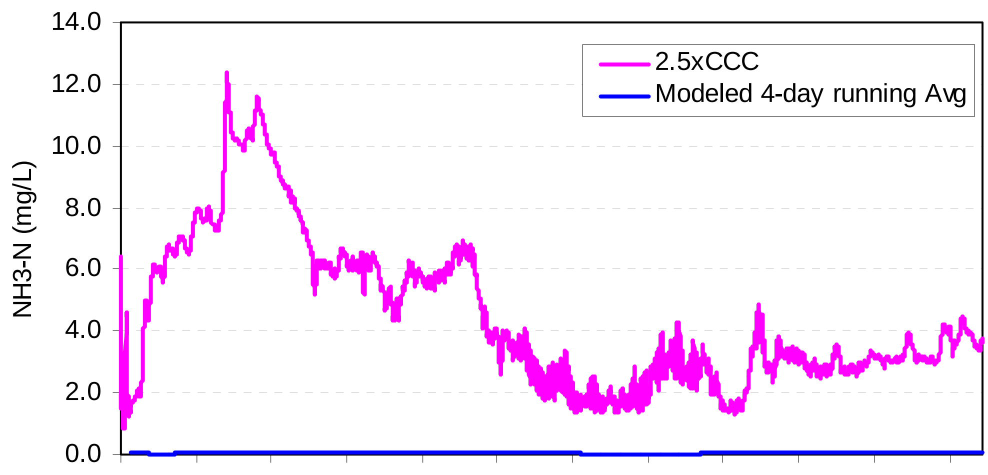
HOOPA



18.0
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
NH3-N (mg/L)
NH3-N Acute criteria
Modeled NH3-N
J F M A M J J A S O N D

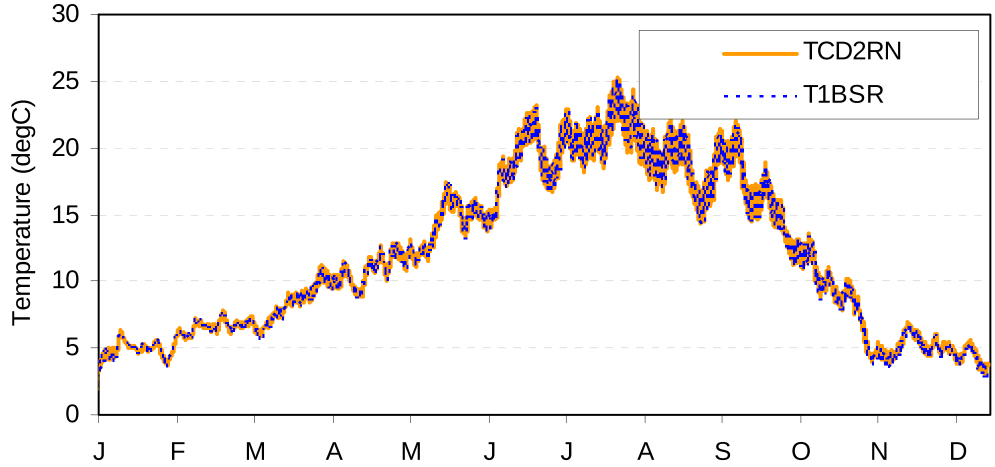


9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
NH3-N (mg/L)
NH3-N Chronic criteria
Modeled 30- day running Avg
J F M A M J J A S O N D

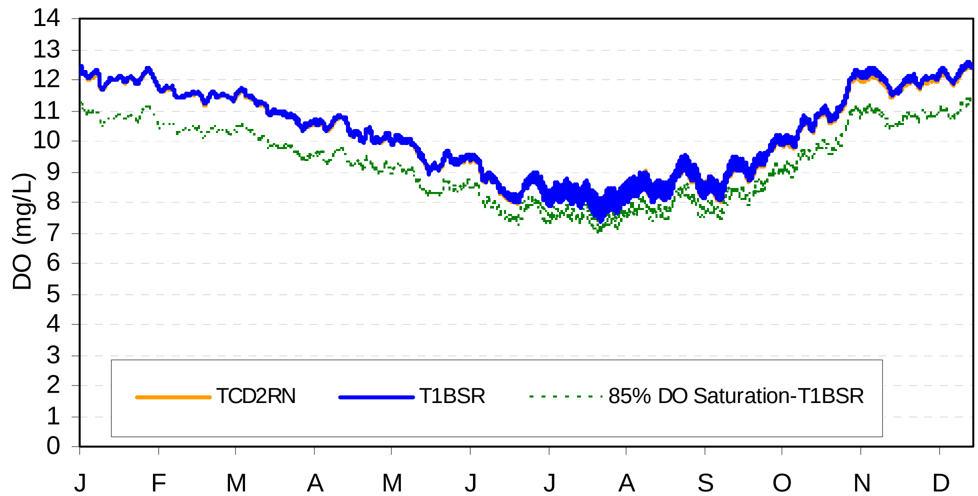


14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
NH3-N (mg/L)
2.5xCCC
Modeled 4-day running Avg

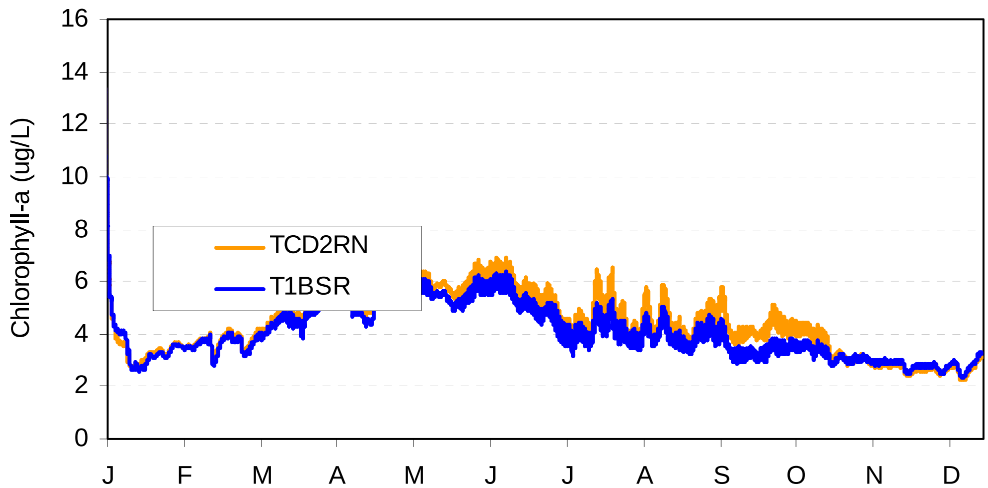
US_TRINITY



Temperature (degC)
30
25
20
15
10
5
0
TCD2RN
T1BSR
J
F
M
A
M
J
J
A
S
O
N
D

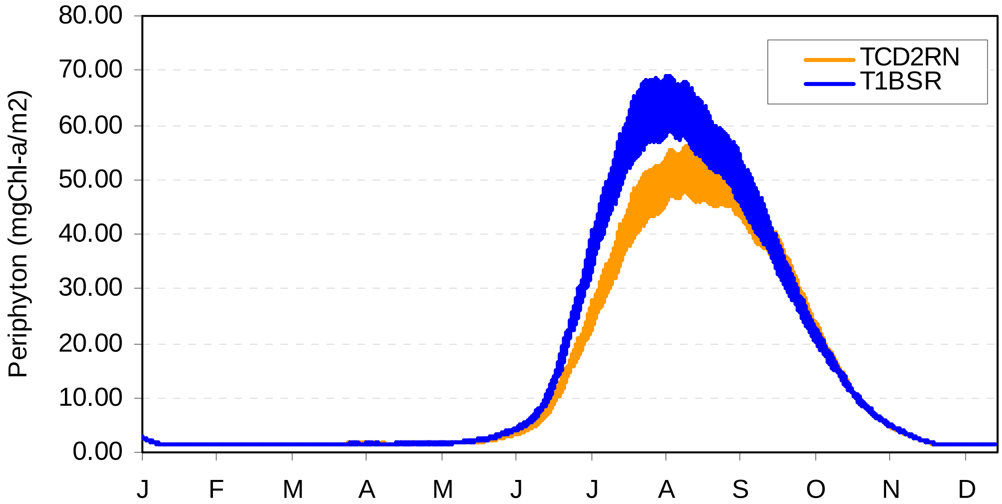


DO (mg/L)
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
TCD2RN
T1BSR
85% DO Saturation-T1BSR
J
F
M
A
M
J
J
A
S
O
N
D

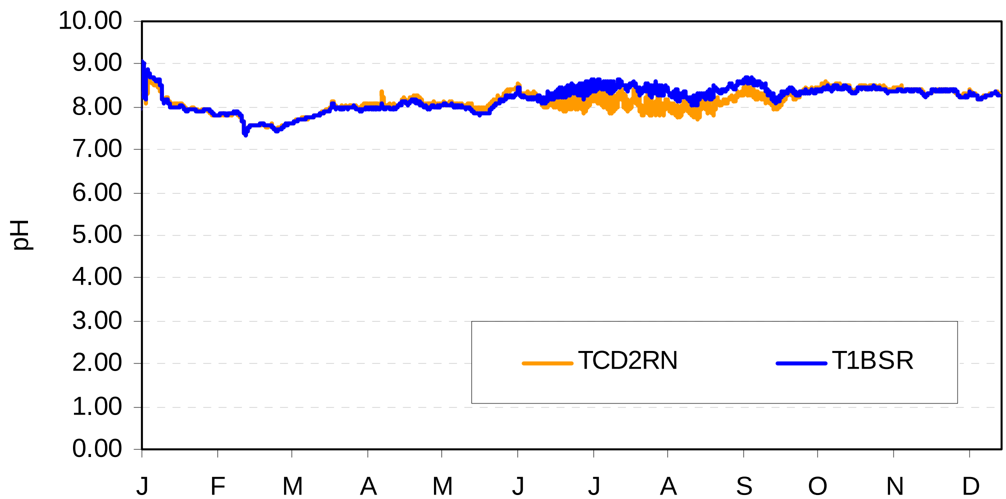


Chlorophyll-a (ug/L)
16
14
12
10
8
6
4
2
0
TCD2RN
T1BSR
J
F
M
A
M
J
J
A
S
O
N
D

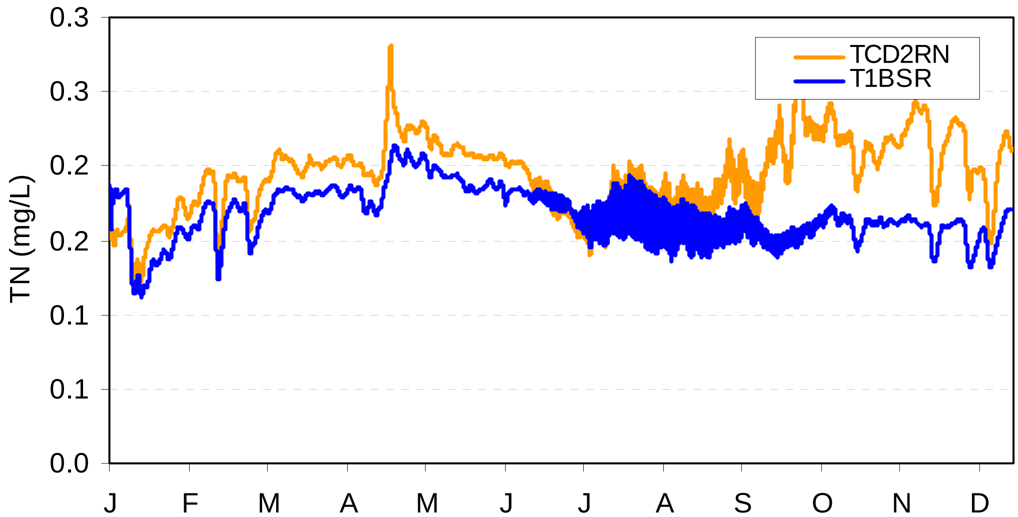
US_TRINITY



Periphyton (mgChl-a/m2)
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
J F M A M J J A S O N D
TCD2RN
T1BSR

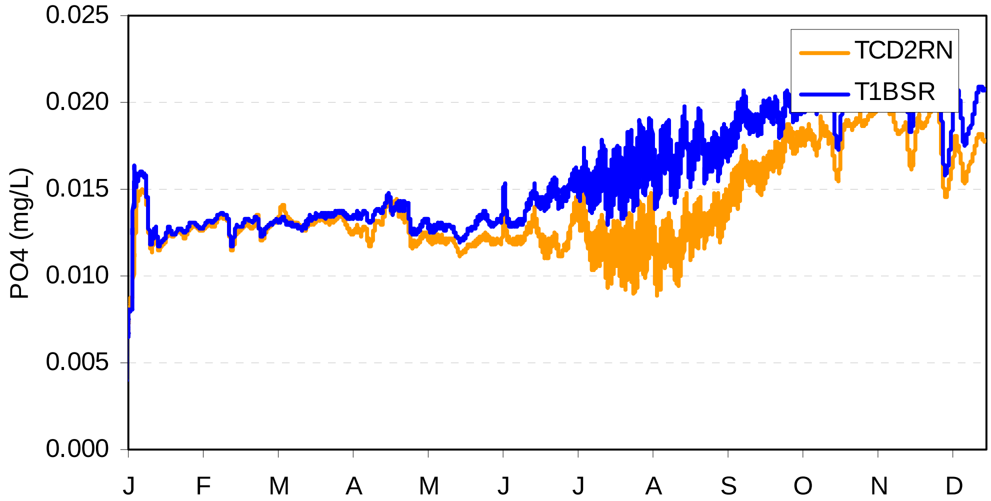


pH
10.00
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
J F M A M J J A S O N D
TCD2RN
T1BSR

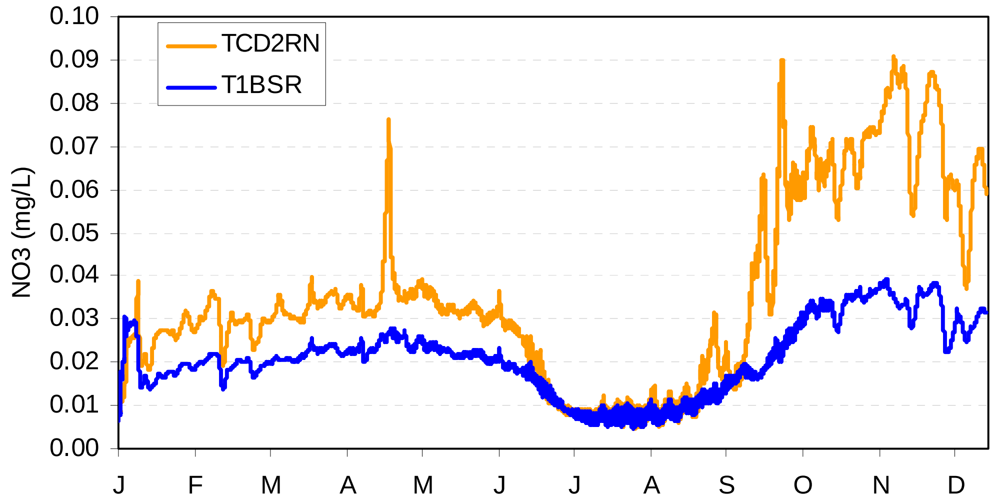


TN (mg/L)
0.3
0.3
0.2
0.2
0.1
0.1
0.0
J F M A M J J A S O N D
TCD2RN
T1BSR

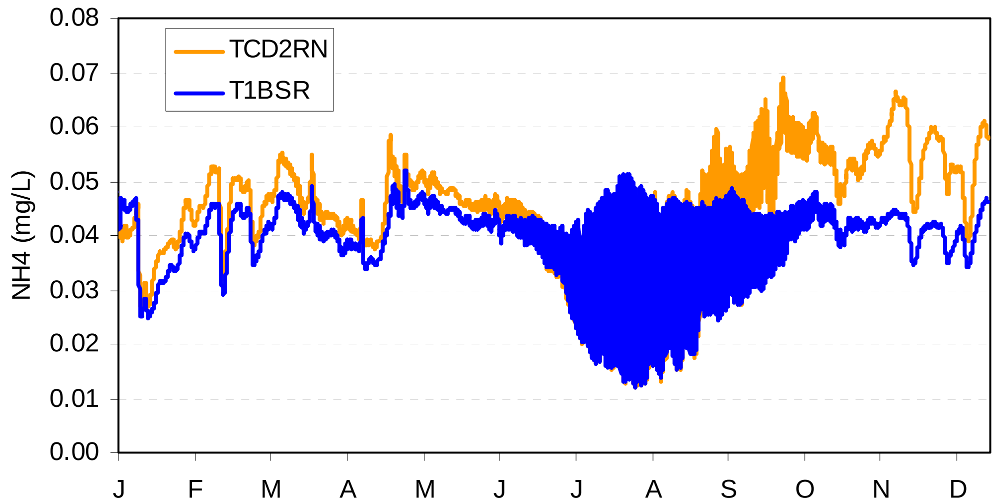
US_TRINITY



0.025
0.020
0.015
0.010
0.005
0.000
PO4 (mg/L)
TCD2RN
T1BSR
J
F
M
A
M
J
J
A
S
O
N
D

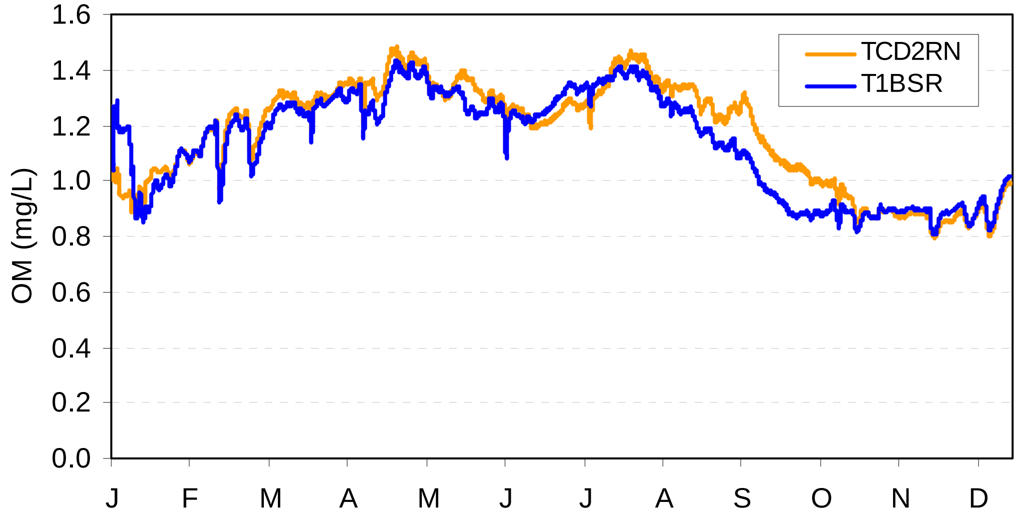


0.10
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0.00
NO3 (mg/L)
TCD2RN
T1BSR
J
F
M
A
M
J
J
A
S
O
N
D

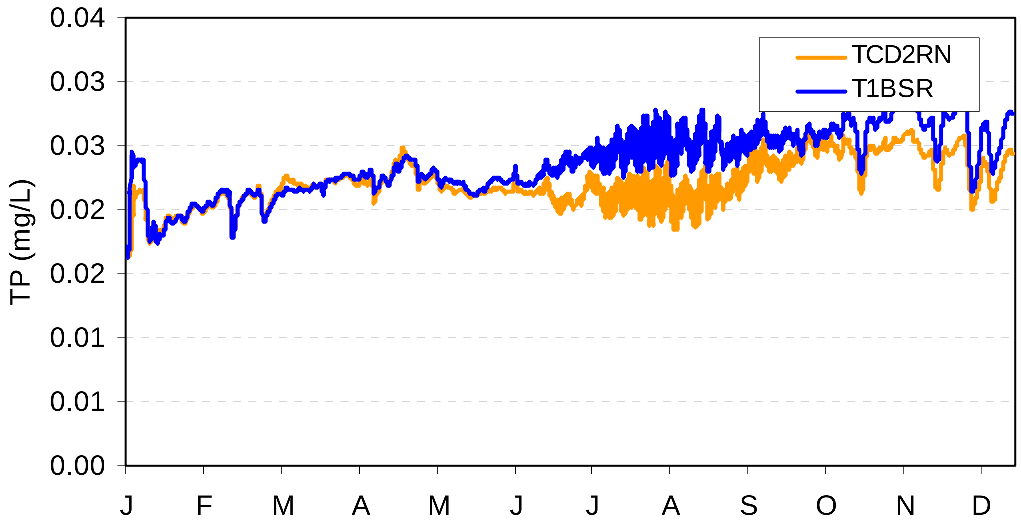


0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0.00
NH4 (mg/L)
TCD2RN
T1BSR
J
F
M
A
M
J
J
A
S
O
N
D

US_TRINITY

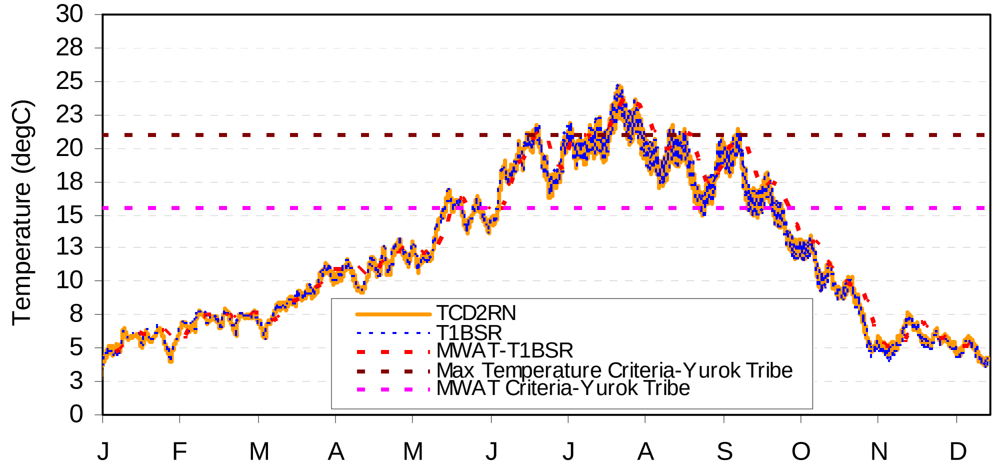


1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
OM (mg/L)
TCD2RN
T1BSR
J
F
M
A
M
J
J
A
S
O
N
D

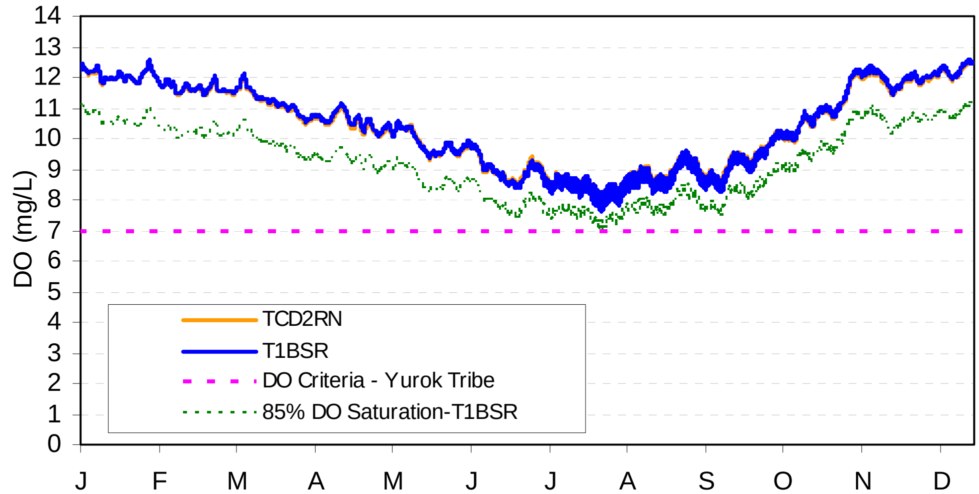


0.04
0.03
0.03
0.02
0.02
0.01
0.01
0.00
TP (mg/L)
TCD2RN
T1BSR
J
F
M
A
M
J
J
A
S
O
N
D

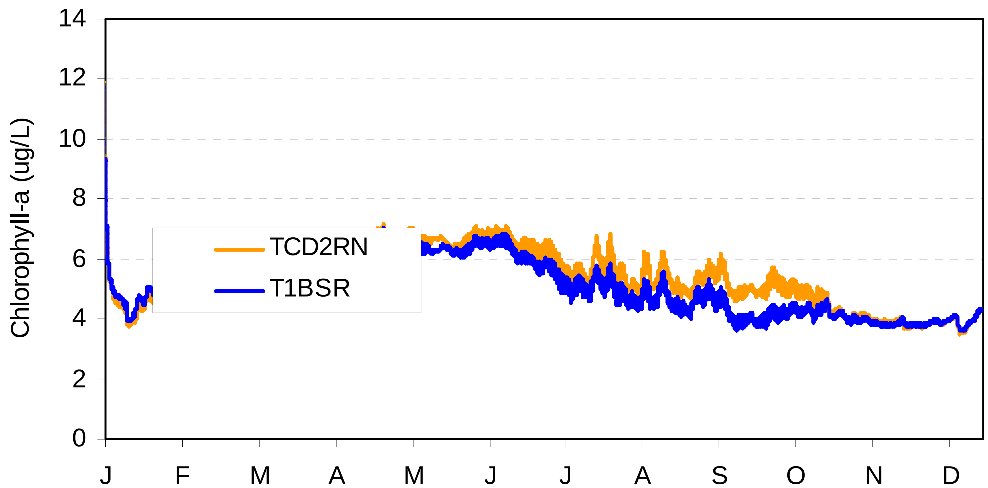
DS_TRINITY



Temperature (degC)
30
28
25
23
20
18
15
13
10
8
5
3
0
J
F
M
A
M
J
J
A
S
O
N
D
TCD2RN
T1BSR
MWAT-T1BSR
Max Temperature Criteria-Yurok Tribe
MWAT Criteria-Yurok Tribe

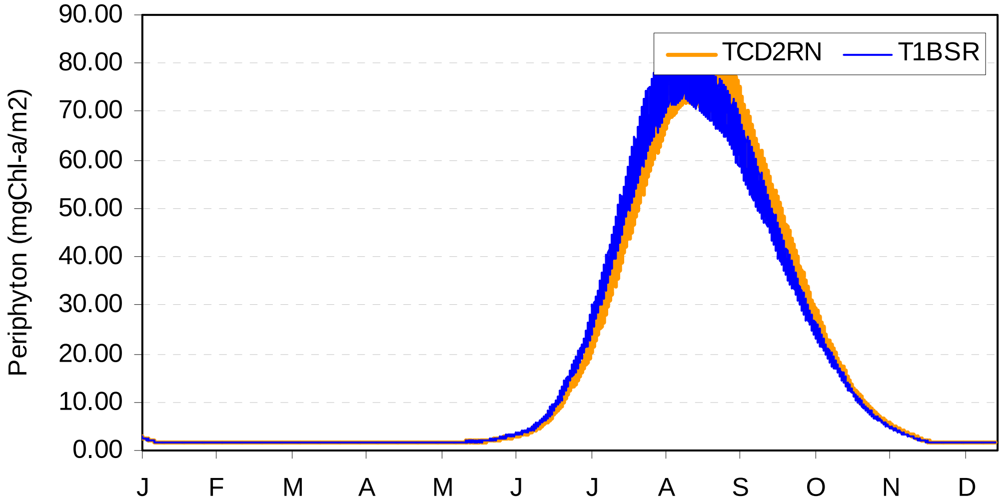


DO (mg/L)
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
J
F
M
A
M
J
J
A
S
O
N
D
TCD2RN
T1BSR
DO Criteria - Yurok Tribe
85% DO Saturation-T1BSR

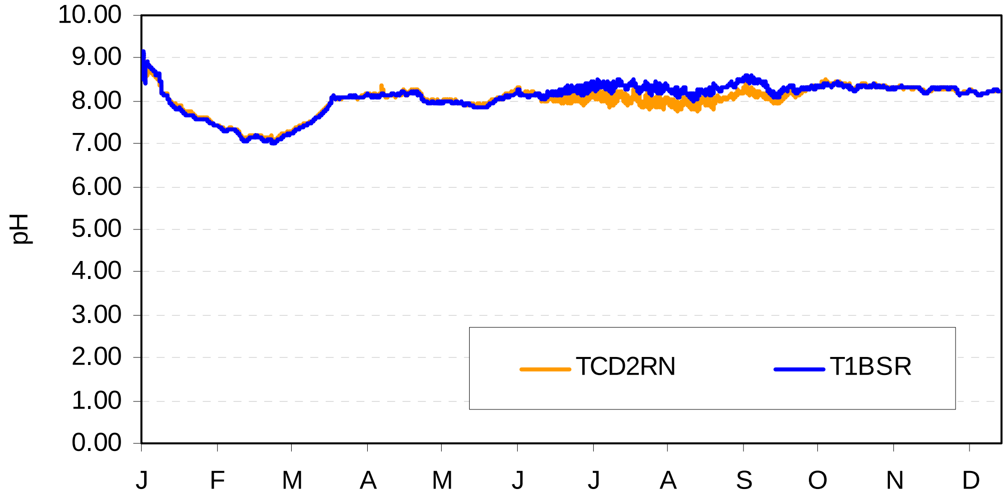


Chlorophyll-a (ug/L)
14
12
10
8
6
4
2
0
J
F
M
A
M
J
J
A
S
O
N
D
TCD2RN
T1BSR

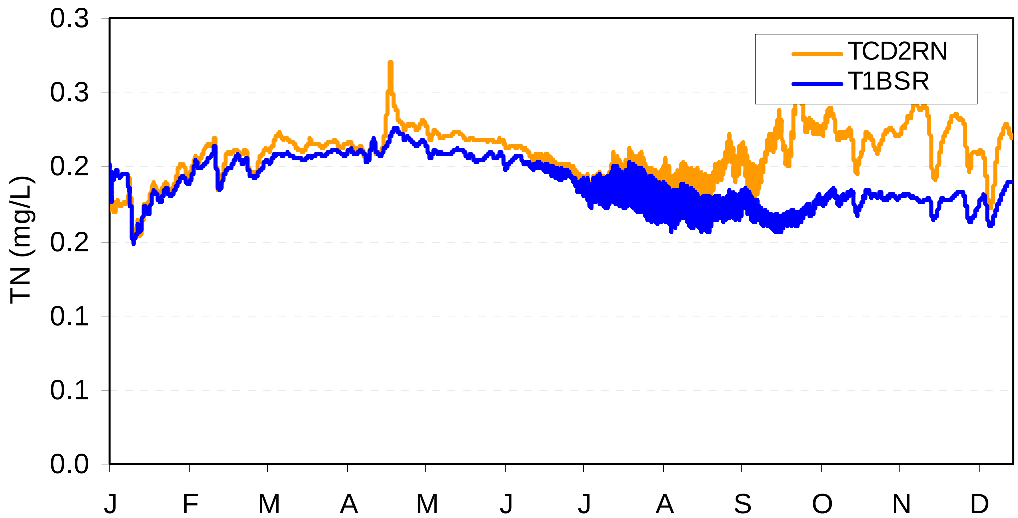
DS_TRINITY



Periphyton (mgChl-a/m2)
90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
TCD2RN
T1BSR
J F M A M J J A S O N D

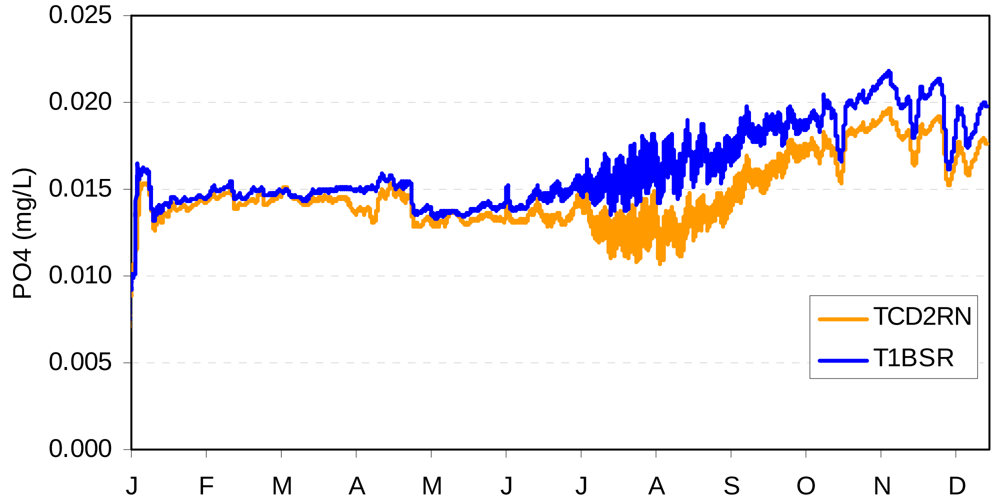


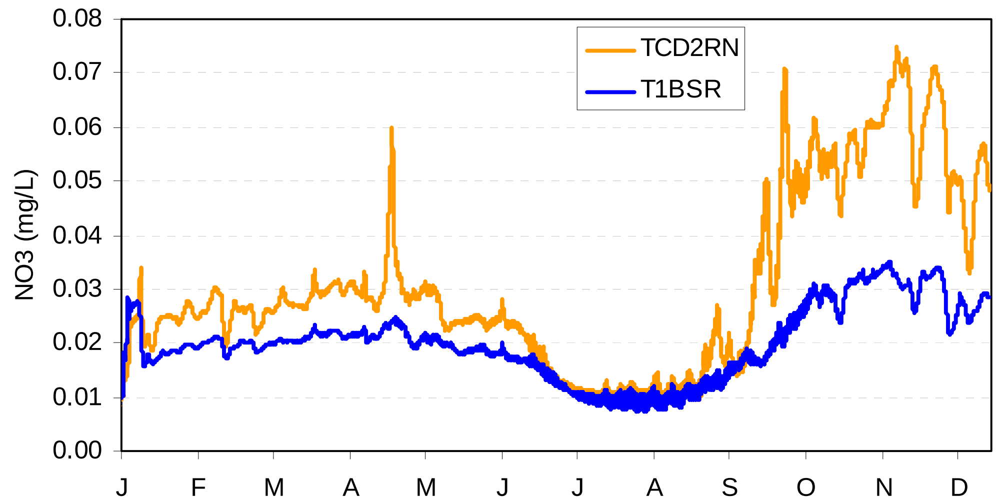
pH
10.00
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
TCD2RN
T1BSR
J F M A M J J A S O N D

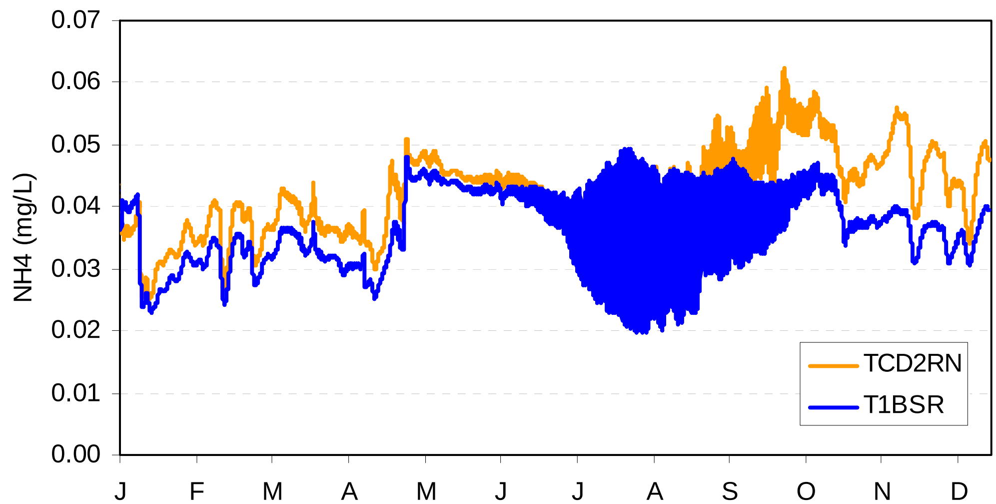


TN (mg/L)
0.3
0.3
0.2
0.2
0.1
0.1
0.0
TCD2RN
T1BSR
J F M A M J J A S O N D

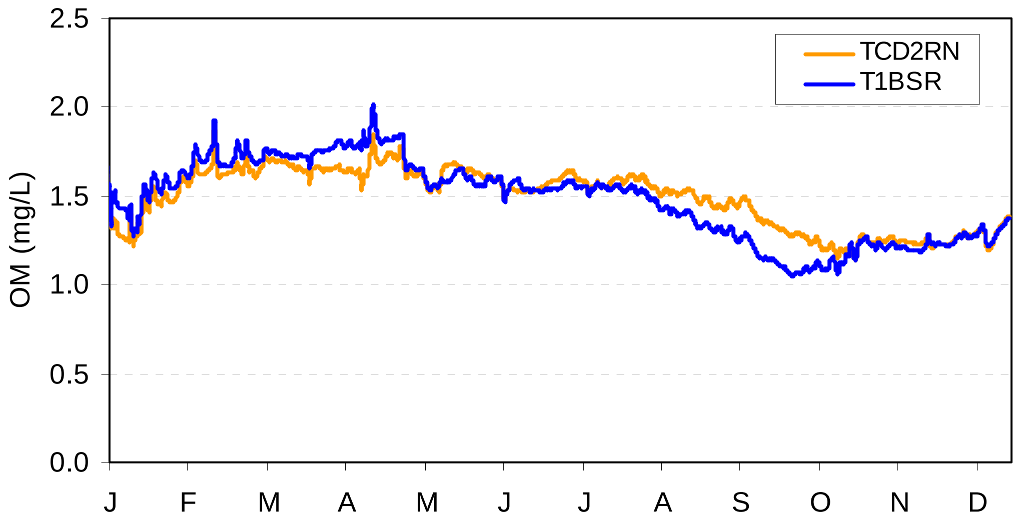
DS_TRINITY


0.025
0.020
0.015
0.010
0.005
0.000
PO4 (mg/L)
J F M A M J J A S O N D
TCD2RN
T1BSR

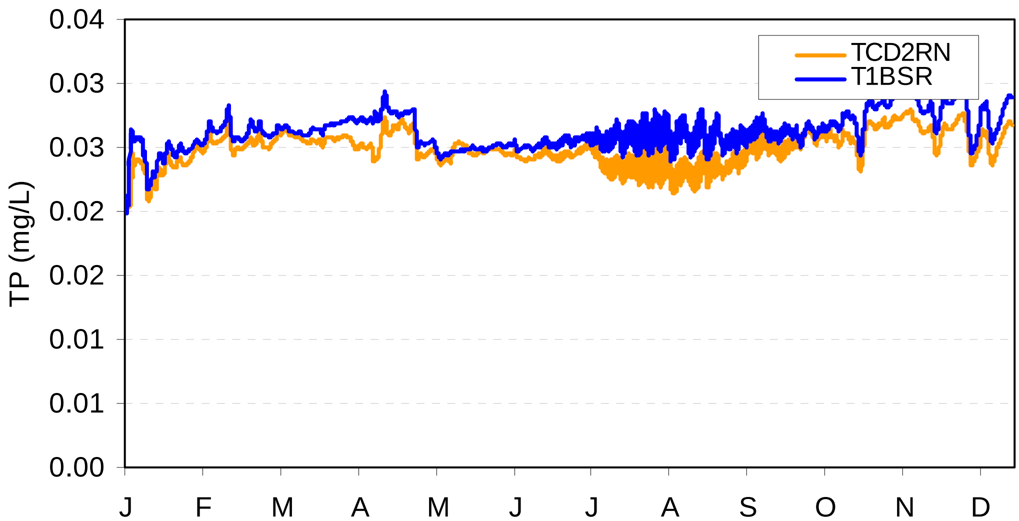

0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0.00
NO3 (mg/L)
J F M A M J J A S O N D
TCD2RN
T1BSR


0.07
0.06
0.05
0.04
0.03
0.02
0.01
0.00
NH4 (mg/L)
J F M A M J J A S O N D
TCD2RN
T1BSR

DS_TRINITY

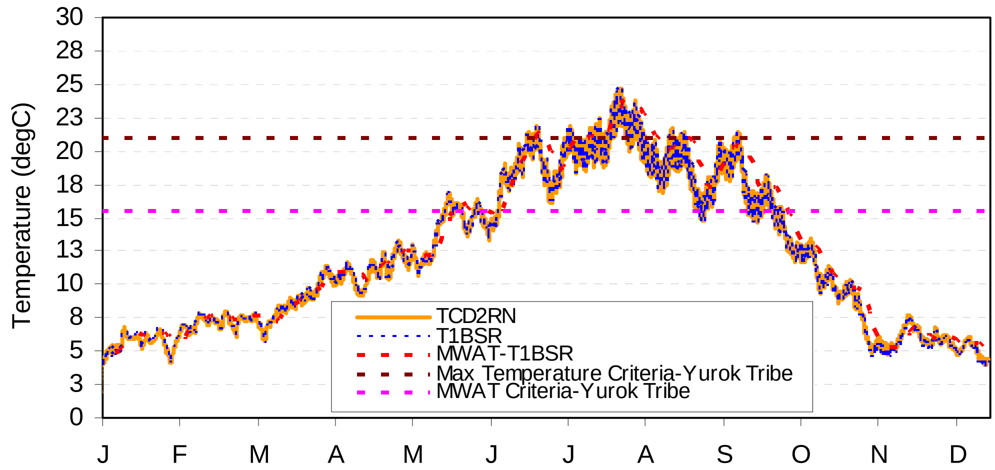


2.5
2.0
1.5
1.0
0.5
0.0
OM (mg/L)
TCD2RN
T1BSR
J
F
M
A
M
J
J
A
S
O
N
D

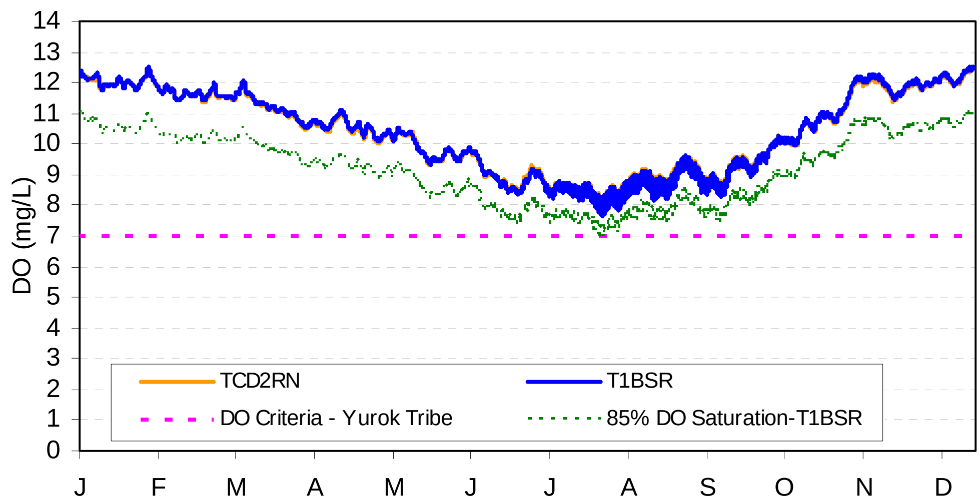


0.04
0.03
0.03
0.02
0.02
0.01
0.01
0.00
TP (mg/L)
TCD2RN
T1BSR
J
F
M
A
M
J
J
A
S
O
N
D

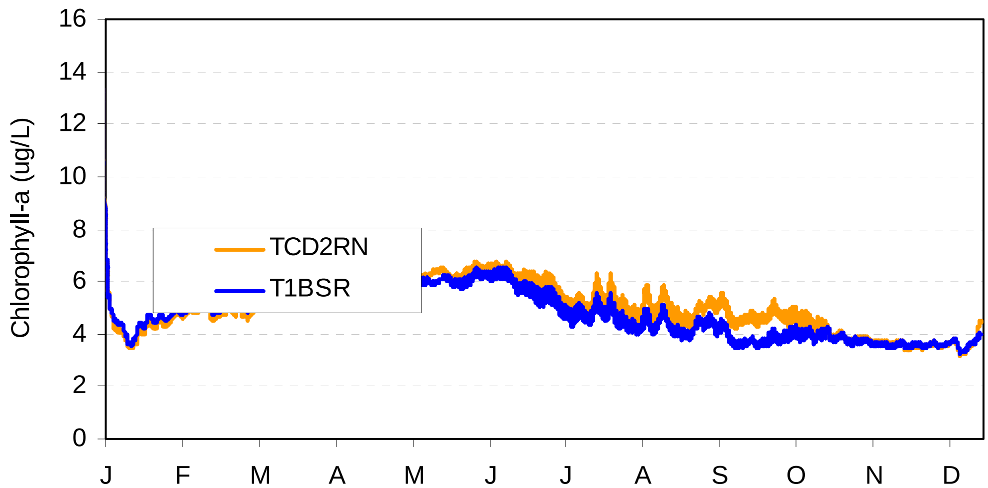
YOUNGSBAR



Temperature (degC)
30
28
25
23
20
18
15
13
10
8
5
3
0
J F M A M J J A S O N D
TCD2RN
T1BSR
MWAT-T1BSR
Max Temperature Criteria-Yurok Tribe
MWAT Criteria-Yurok Tribe

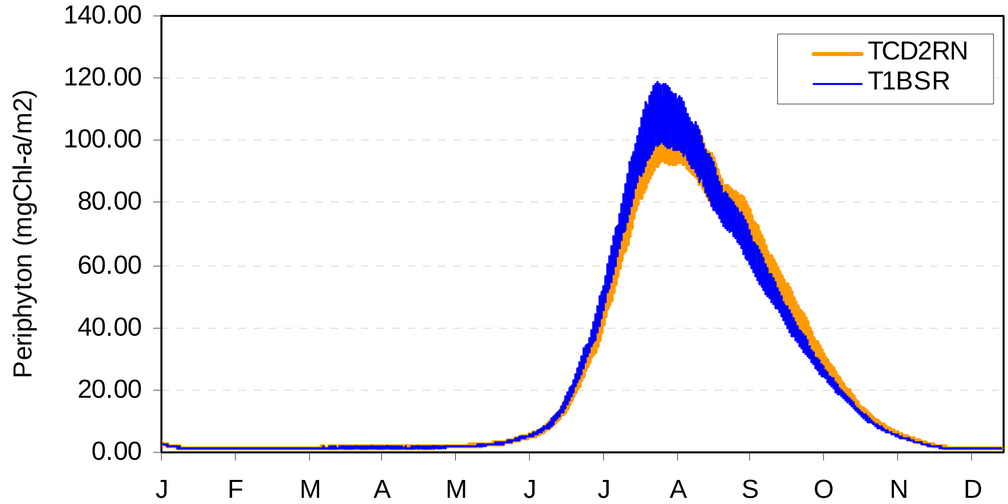


DO (mg/L)
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
J F M A M J J A S O N D
TCD2RN
T1BSR
DO Criteria - Yurok Tribe
85% DO Saturation-T1BSR

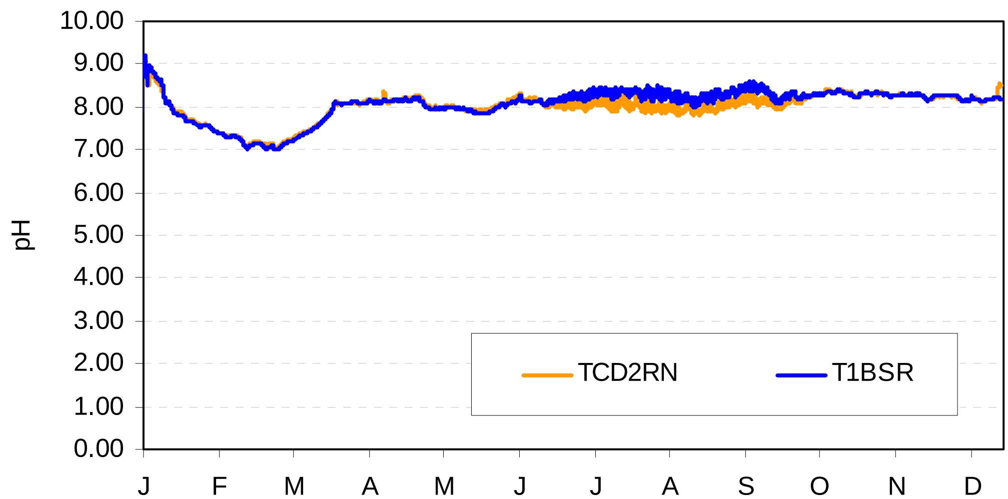


Chlorophyll-a (ug/L)
16
14
12
10
8
6
4
2
0
J F M A M J J A S O N D
TCD2RN
T1BSR

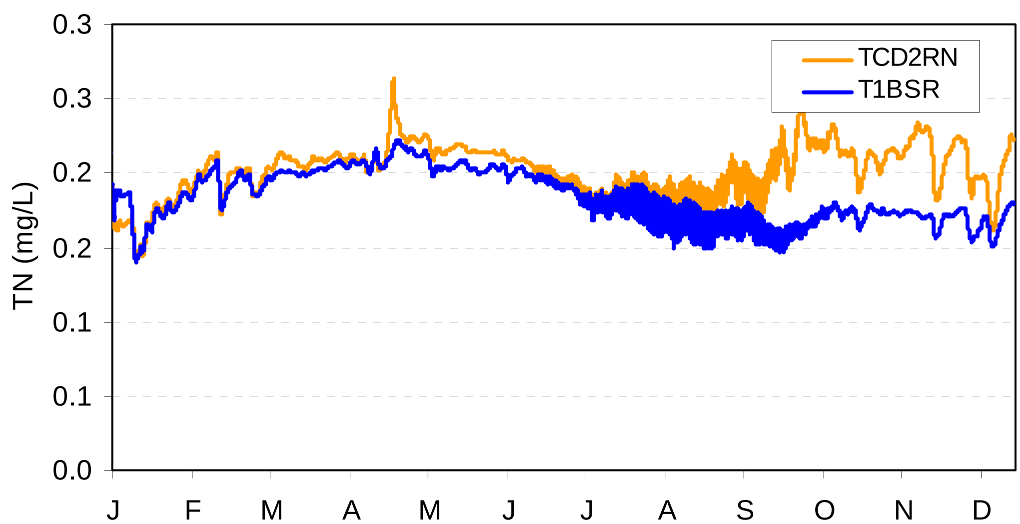
YOUNGSBAR



Periphyton (mgChl-a/m2)
140.00
120.00
100.00
80.00
60.00
40.00
20.00
0.00
J F M A M J J A S O N D
TCD2RN
T1BSR

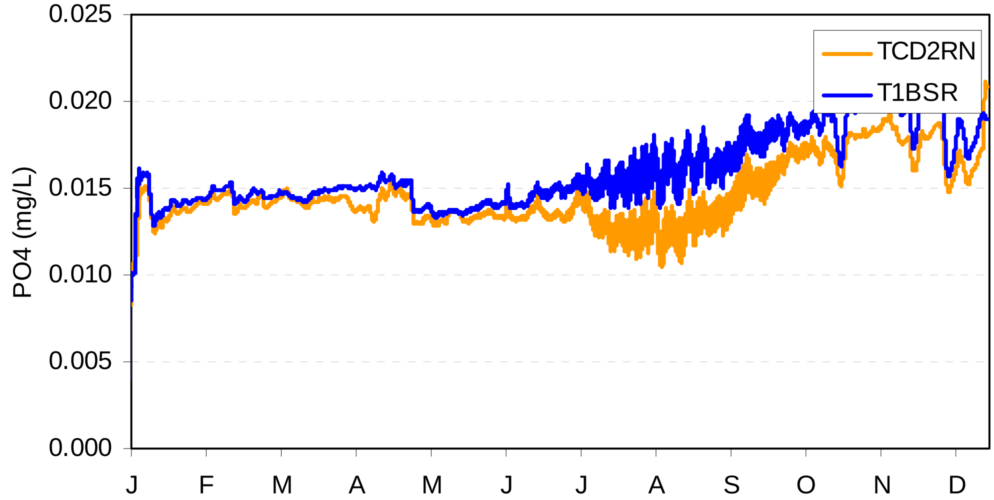


pH
10.00
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
J F M A M J J A S O N D
TCD2RN
T1BSR

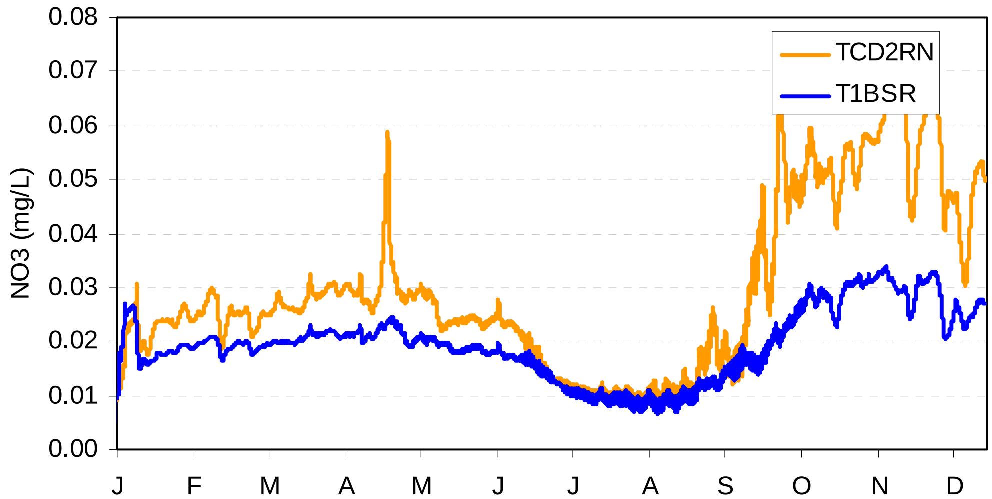


TN (mg/L)
0.3
0.3
0.2
0.2
0.1
0.1
0.0
J F M A M J J A S O N D
TCD2RN
T1BSR

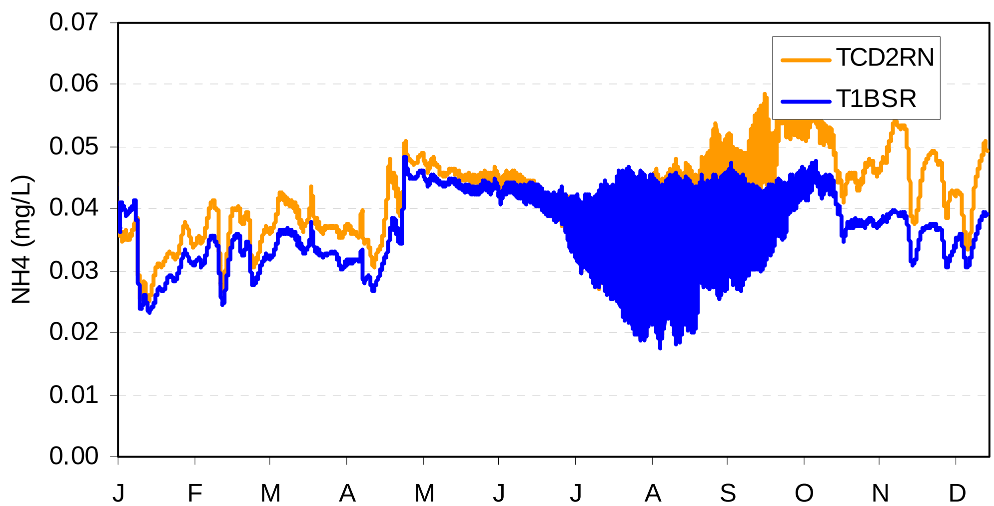
YOUNGSBAR



0.025
0.020
0.015
0.010
0.005
0.000
PO4 (mg/L)
J F M A M J J A S O N D
TCD2RN
T1BSR

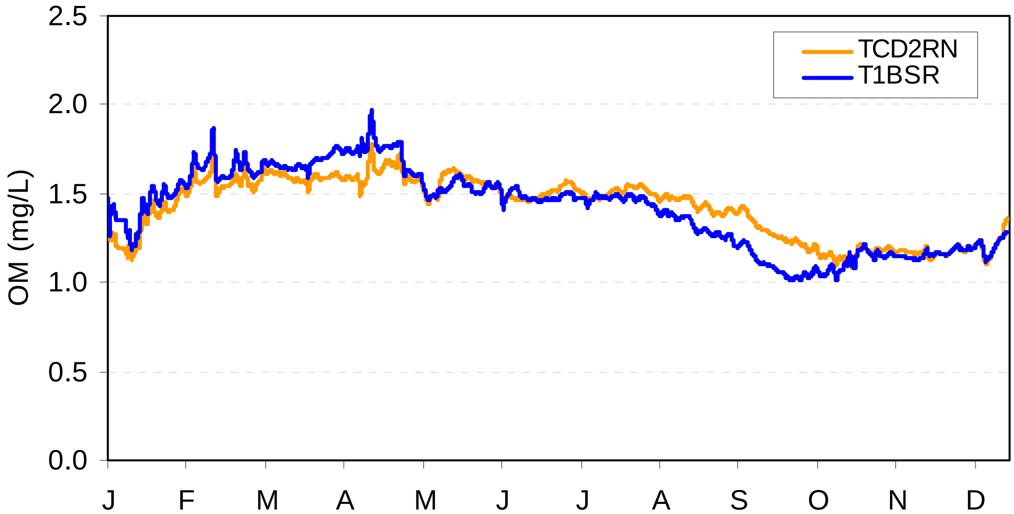


0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0.00
NO3 (mg/L)
J F M A M J J A S O N D
TCD2RN
T1BSR

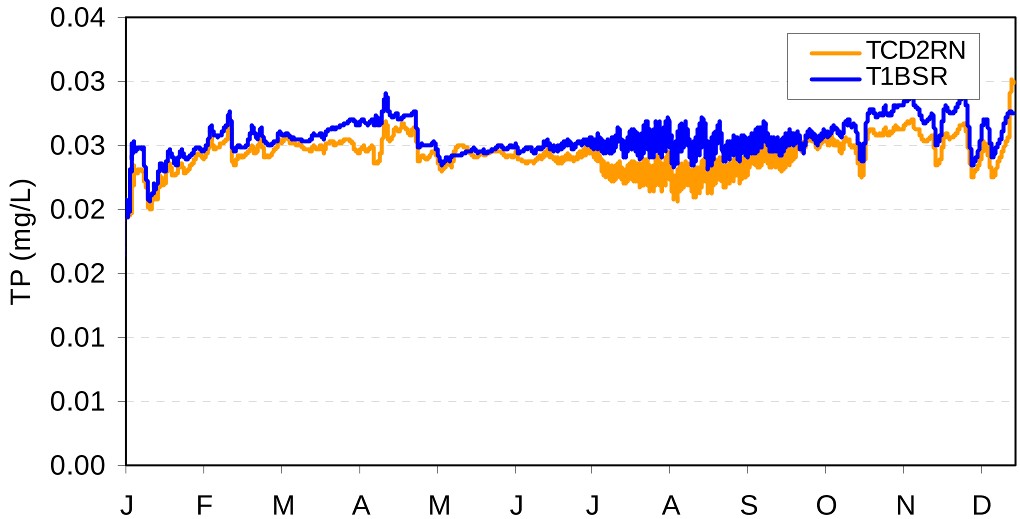


0.07
0.06
0.05
0.04
0.03
0.02
0.01
0.00
NH4 (mg/L)
J F M A M J J A S O N D
TCD2RN
T1BSR

YOUNGSBAR

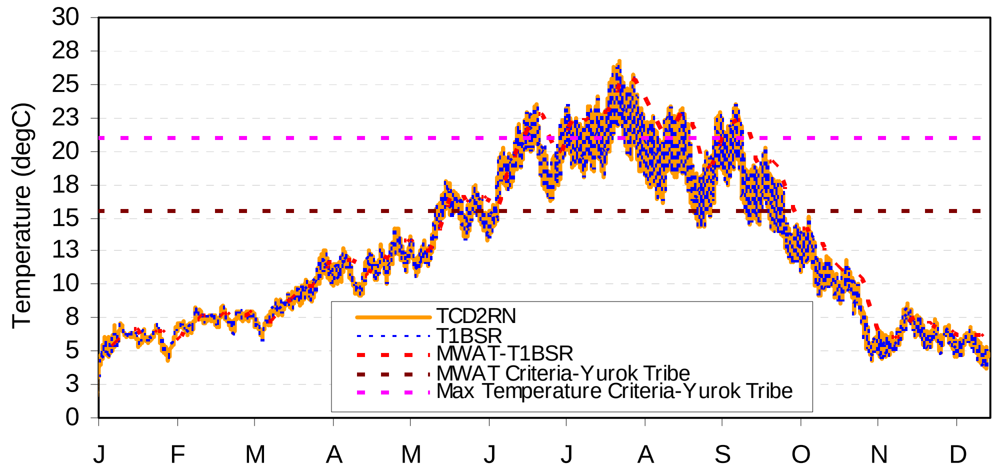


OM (mg/L)
2.5
2.0
1.5
1.0
0.5
0.0
J
F
M
A
M
J
J
A
S
O
N
D
TCD2RN
T1BSR

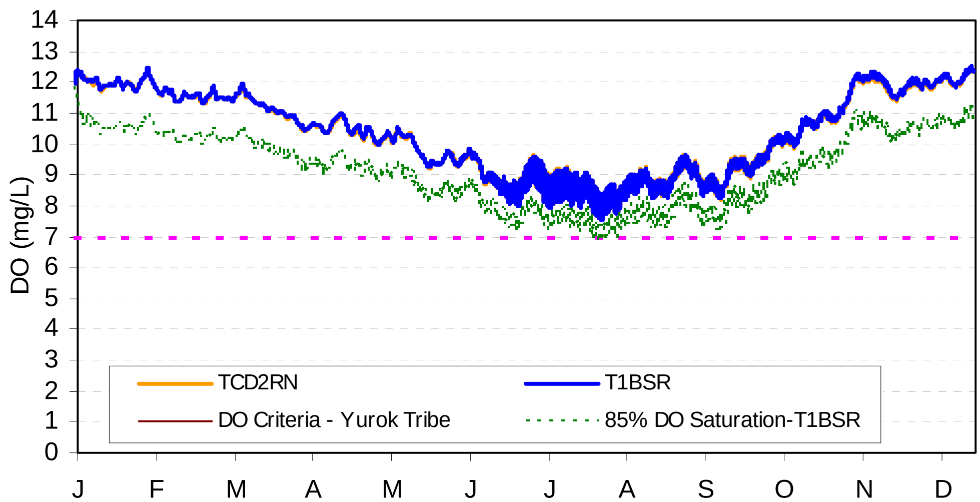


TP (mg/L)
0.04
0.03
0.03
0.02
0.02
0.01
0.01
0.00
J
F
M
A
M
J
J
A
S
O
N
D
TCD2RN
T1BSR

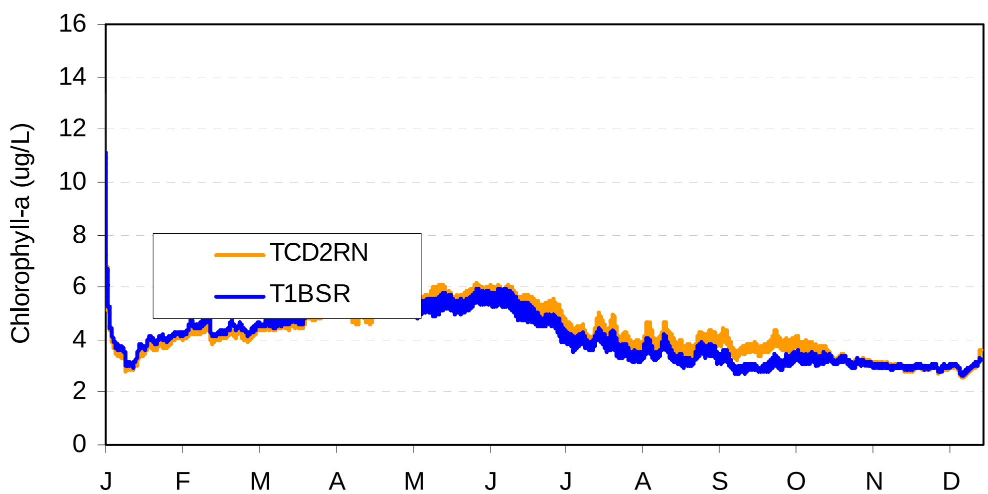
TURWAR



Temperature (degC)
30
28
25
23
20
18
15
13
10
8
5
3
0
J F M A M J J A S O N D
TCD2RN
T1BSR
MWAT-T1BSR
MWAT Criteria-Yurok Tribe
Max Temperature Criteria-Yurok Tribe

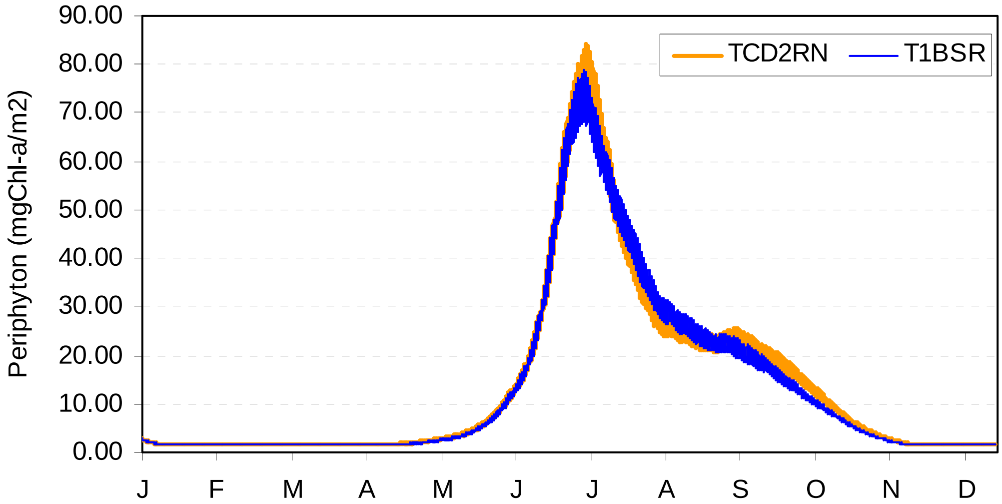


DO (mg/L)
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
J F M A M J J A S O N D
TCD2RN
T1BSR
DO Criteria - Yurok Tribe
85% DO Saturation-T1BSR

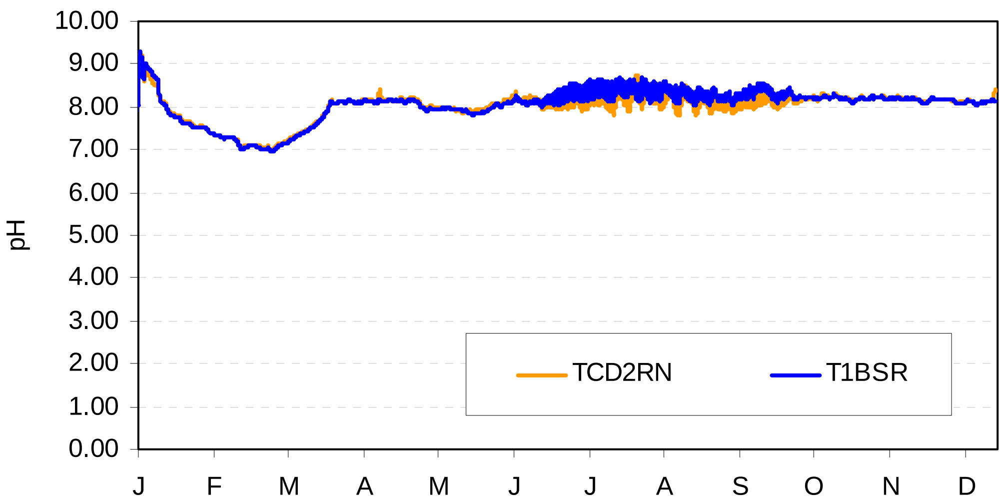


Chlorophyll-a (ug/L)
16
14
12
10
8
6
4
2
0
J F M A M J J A S O N D
TCD2RN
T1BSR

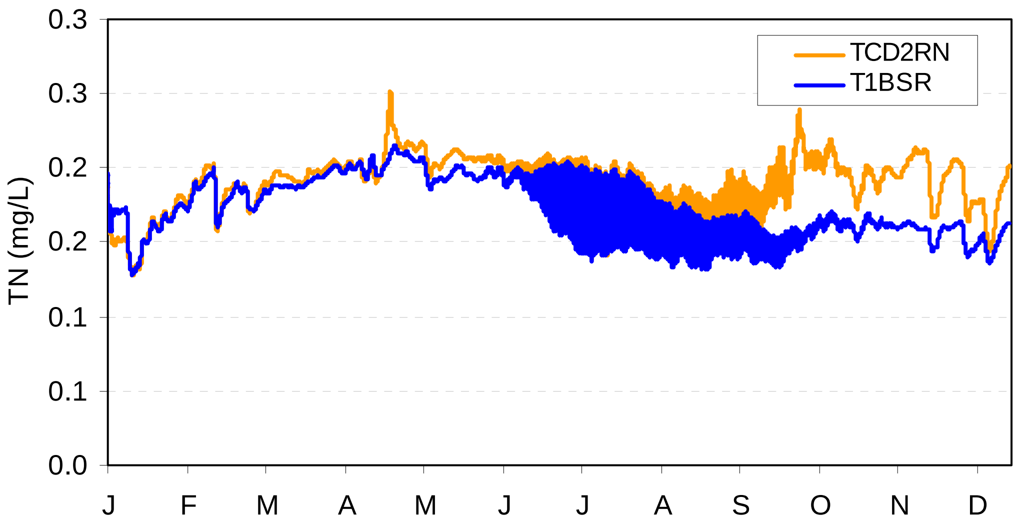
TURWAR



Periphyton (mgChl-a/m2)
90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
J F M A M J J A S O N D
TCD2RN
T1BSR

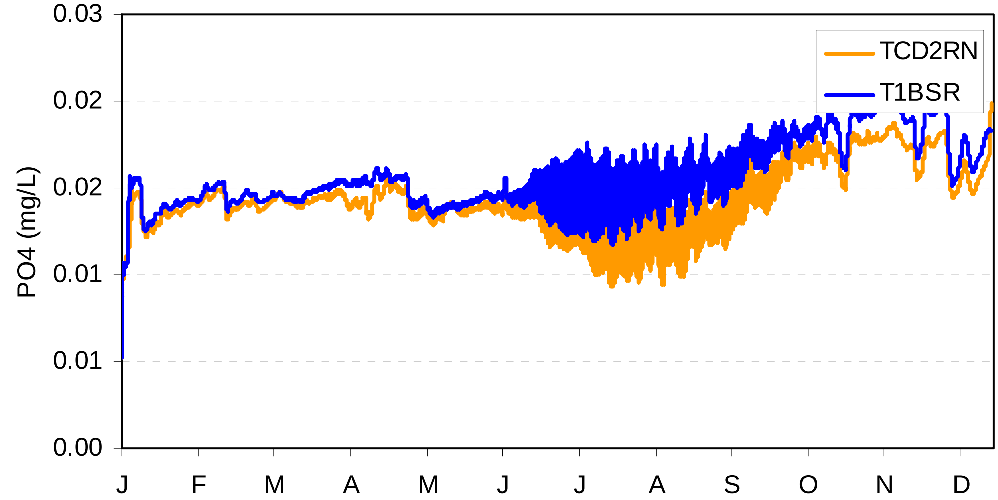


pH
10.00
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
J F M A M J J A S O N D
TCD2RN
T1BSR

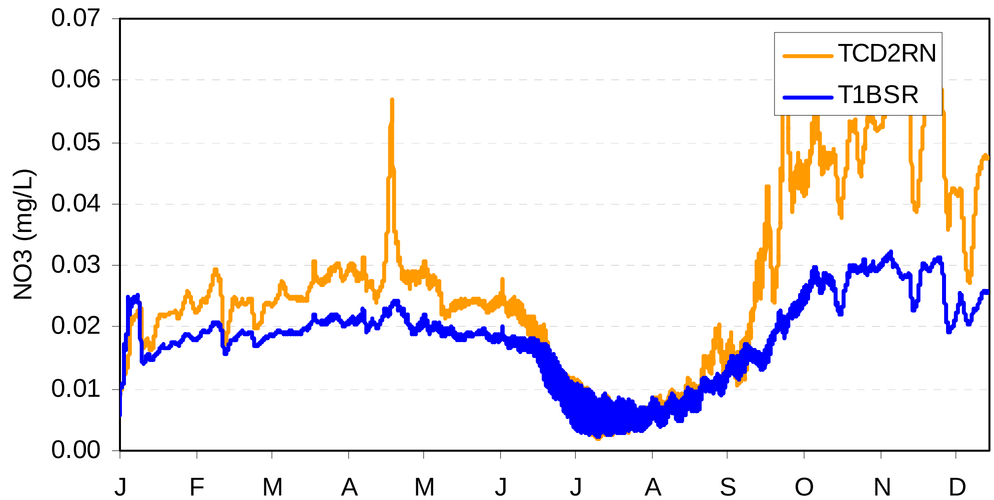


TN (mg/L)
0.3
0.3
0.2
0.2
0.1
0.1
0.0
J F M A M J J A S O N D
TCD2RN
T1BSR

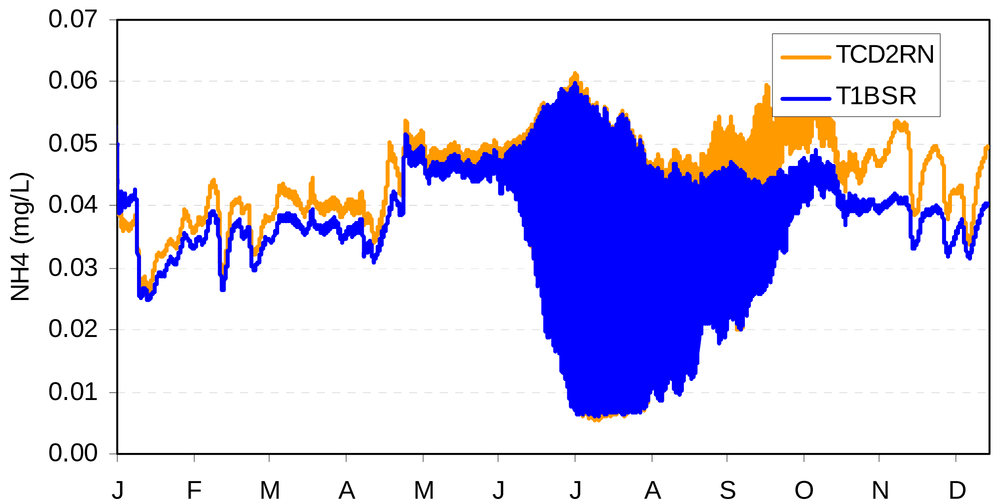
TURWAR



0.03
0.02
0.02
0.01
0.01
0.00
PO4 (mg/L)
J
F
M
A
M
J
J
A
S
O
N
D
TCD2RN
T1BSR

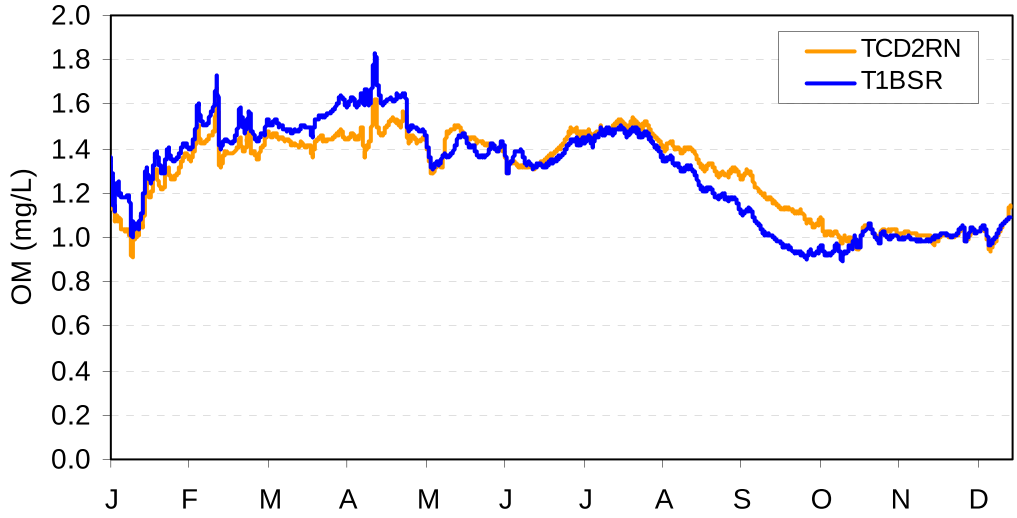


0.07
0.06
0.05
0.04
0.03
0.02
0.01
0.00
NO3 (mg/L)
J
F
M
A
M
J
J
A
S
O
N
D
TCD2RN
T1BSR

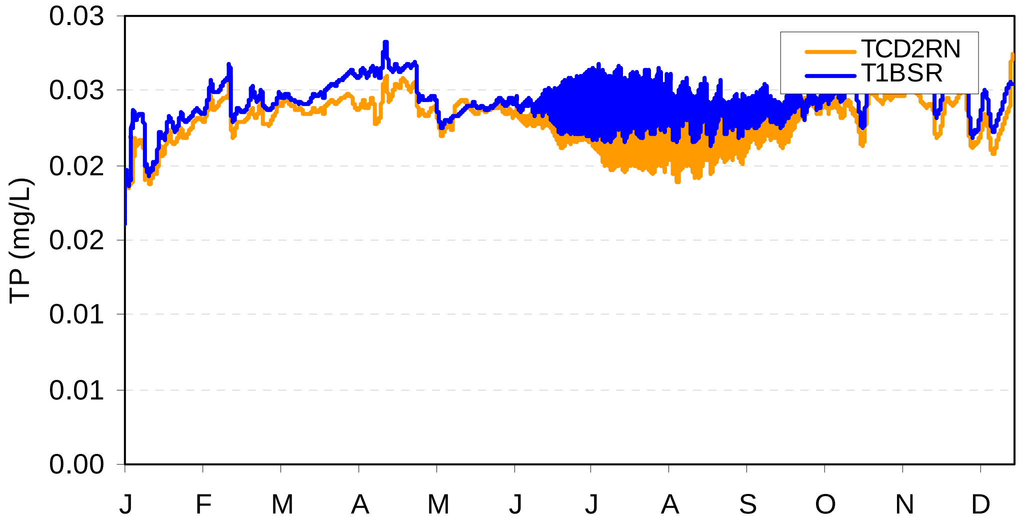


0.07
0.06
0.05
0.04
0.03
0.02
0.01
0.00
NH4 (mg/L)
J
F
M
A
M
J
J
A
S
O
N
D
TCD2RN
T1BSR

TURWAR

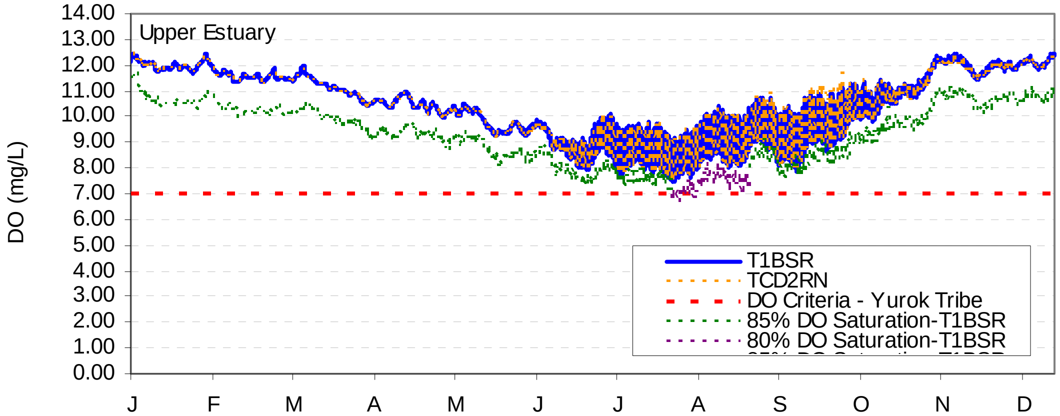


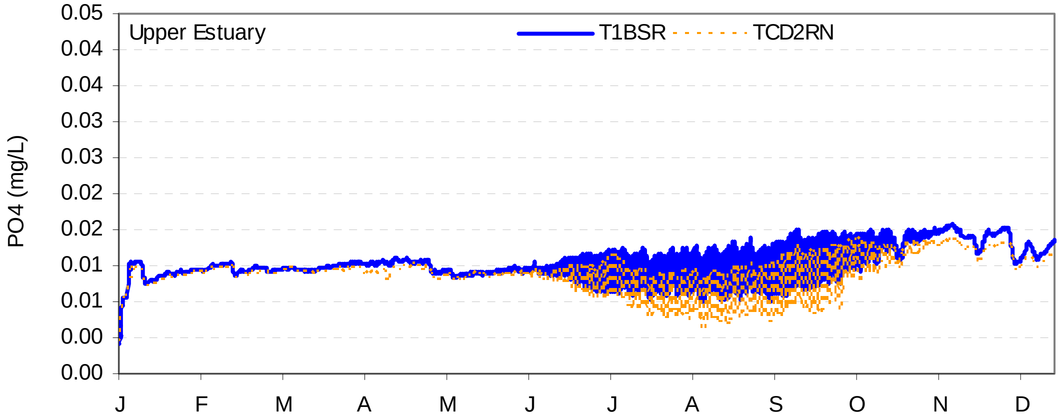
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
OM (mg/L)
J
F
M
A
M
J
J
A
S
O
N
D
TCD2RN
T1BSR

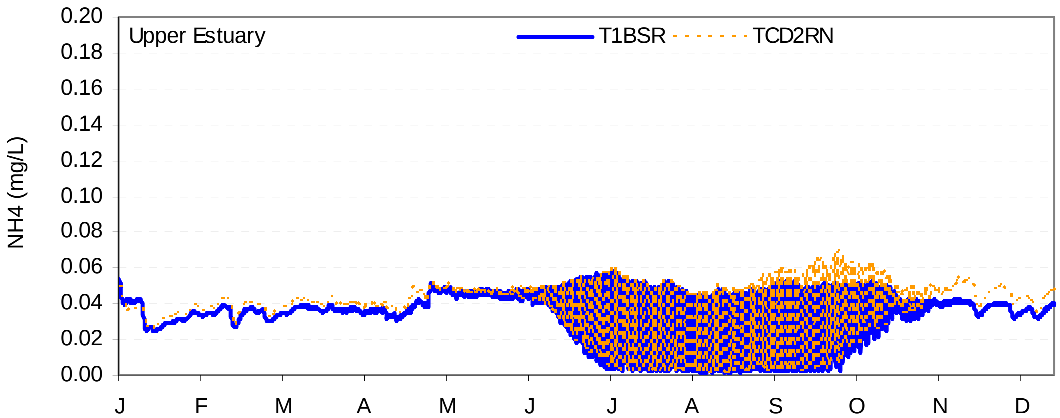


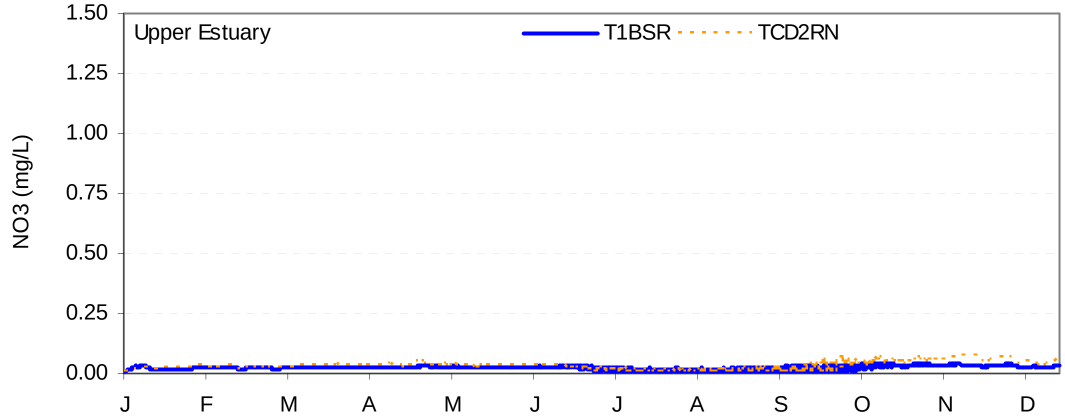
0.03
0.03
0.02
0.02
0.01
0.01
0.00
TP (mg/L)
J
F
M
A
M
J
J
A
S
O
N
D
TCD2RN
T1BSR

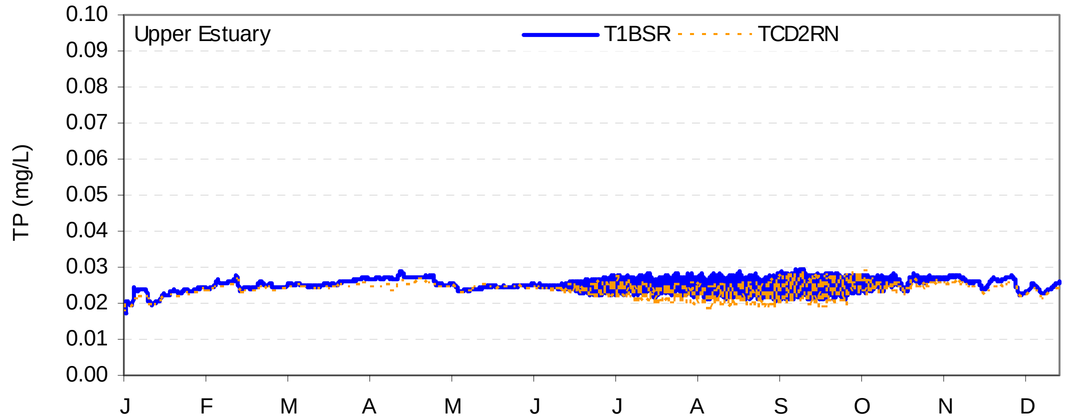
Upper Estuary

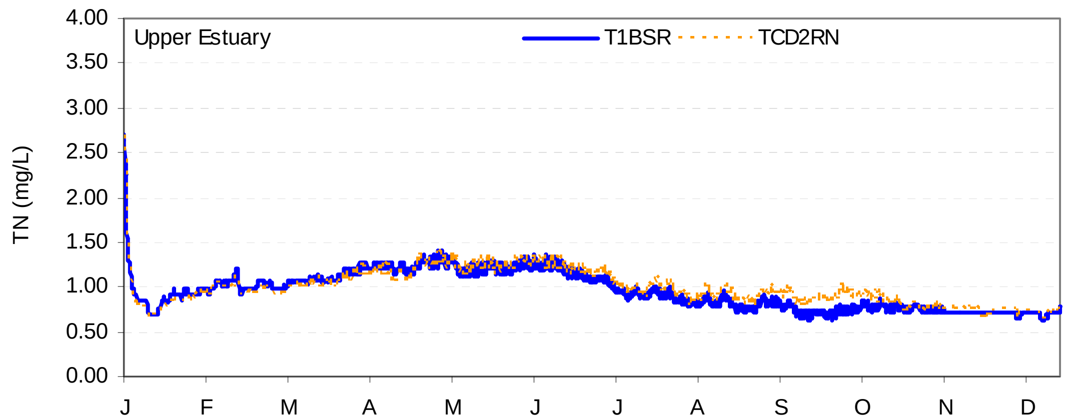


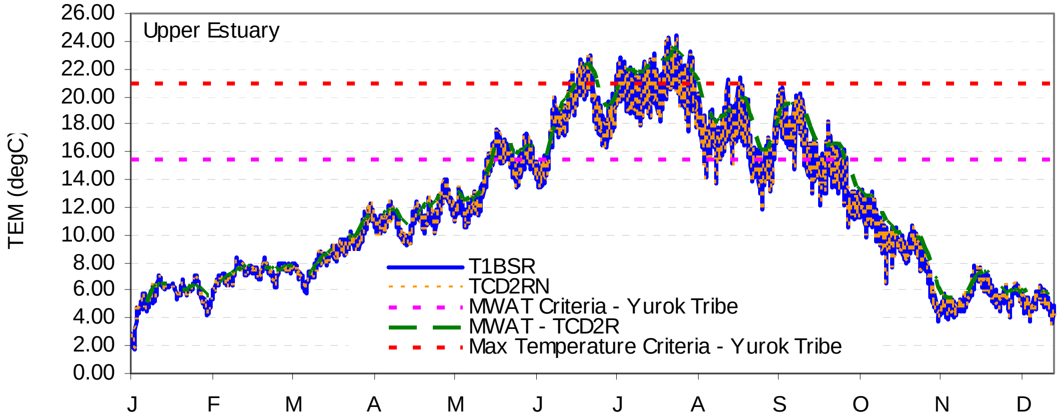


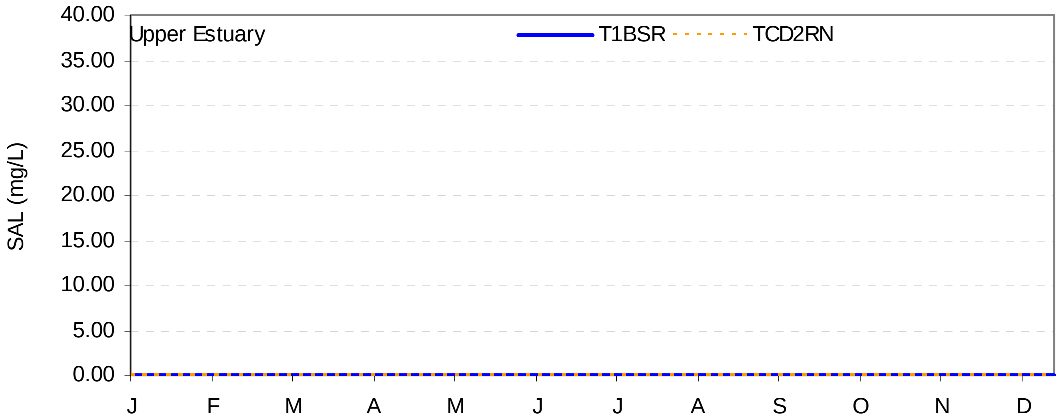


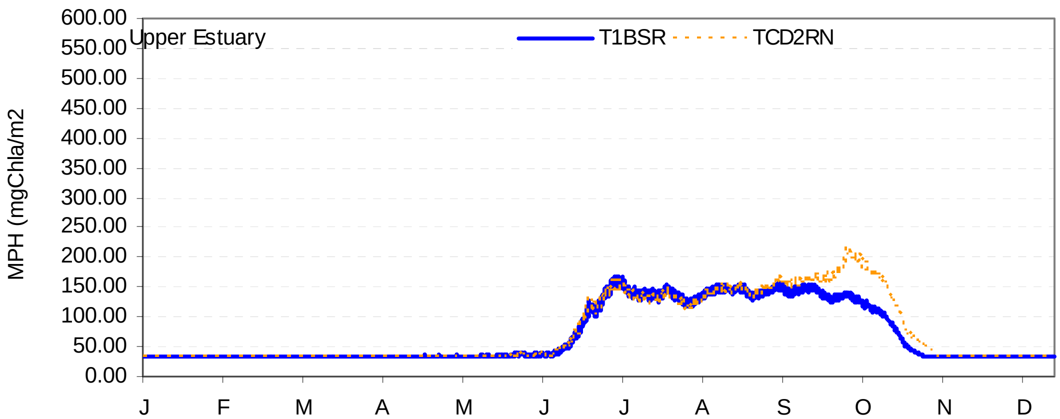

1.50
1.25
1.00
0.75
0.50
0.25
0.00
NO3 (mg/L)
Upper Estuary
T1BSR
TCD2RN
J F M A M J J A S O N D


0.10
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0.00
TP (mg/L)
Upper Estuary
T1BSR
TCD2RN
J F M A M J J A S O N D

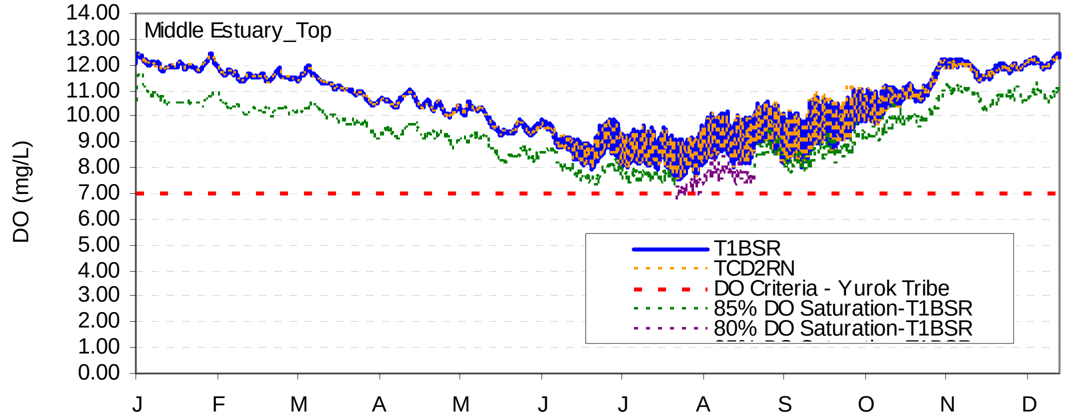

4.00
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
TN (mg/L)
Upper Estuary
T1BSR
TCD2RN
J F M A M J J A S O N D

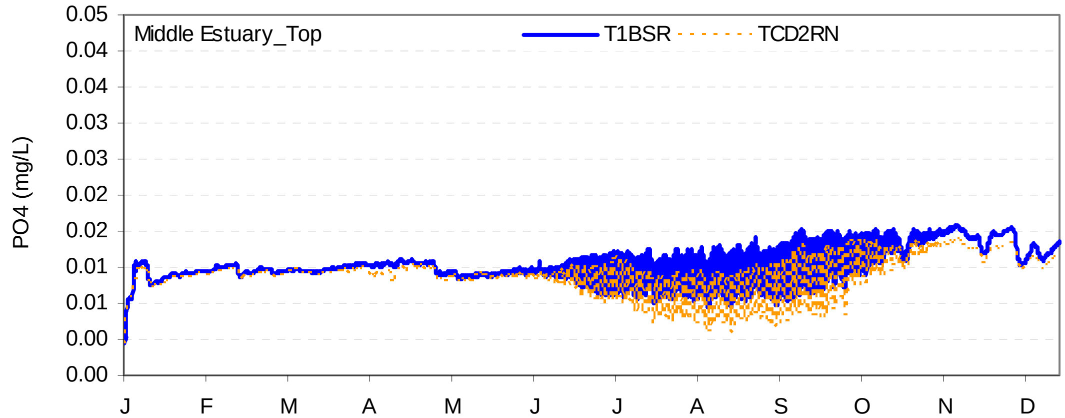

Upper Estuary
TEM (degC)
26.00
24.00
22.00
20.00
18.00
16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
T1BSR
TCD2RN
MWAT Criteria - Yurok Tribe
MWAT - TCD2R
Max Temperature Criteria - Yurok Tribe
J F M A M J J A S O N D

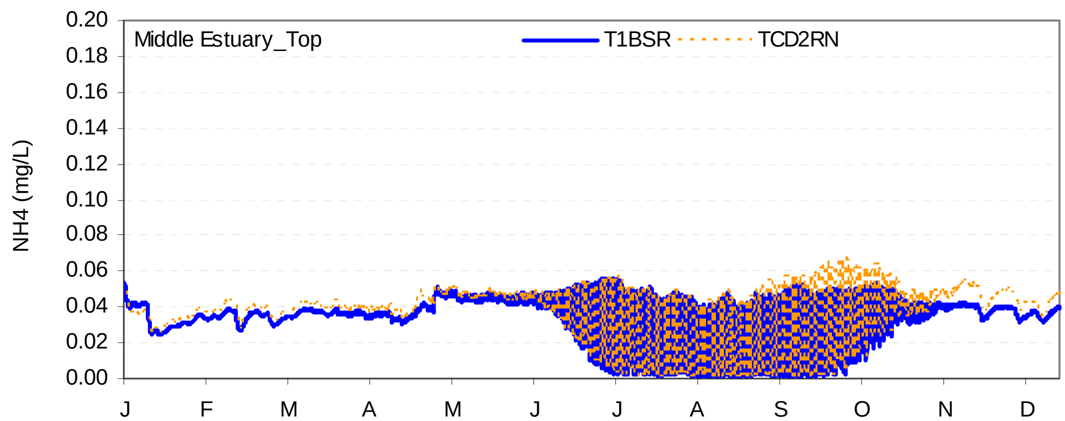

Upper Estuary
T1BSR
TCD2RN
SAL (mg/L)
40.00
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
J F M A M J J A S O N D

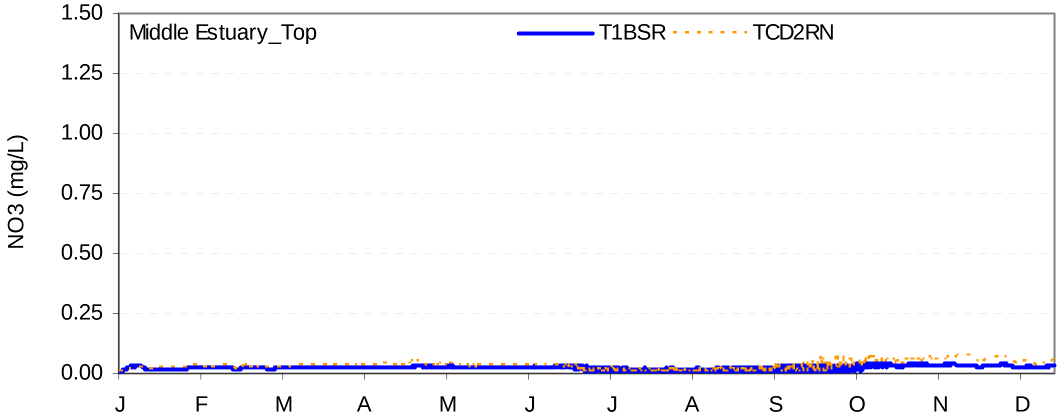

Upper Estuary
T1BSR
TCD2RN
MPH (mgChla/m2
600.00
550.00
500.00
450.00
400.00
350.00
300.00
250.00
200.00
150.00
100.00
50.00
0.00
J F M A M J J A S O N D

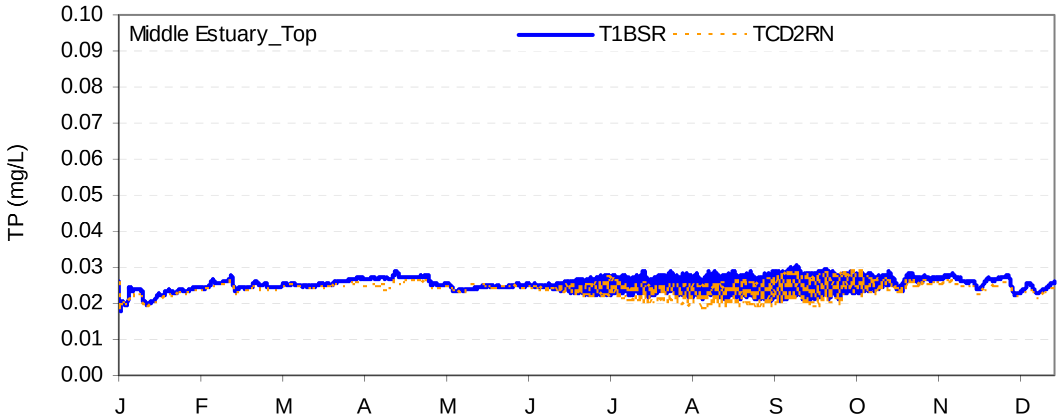
Middle Estuary - Top

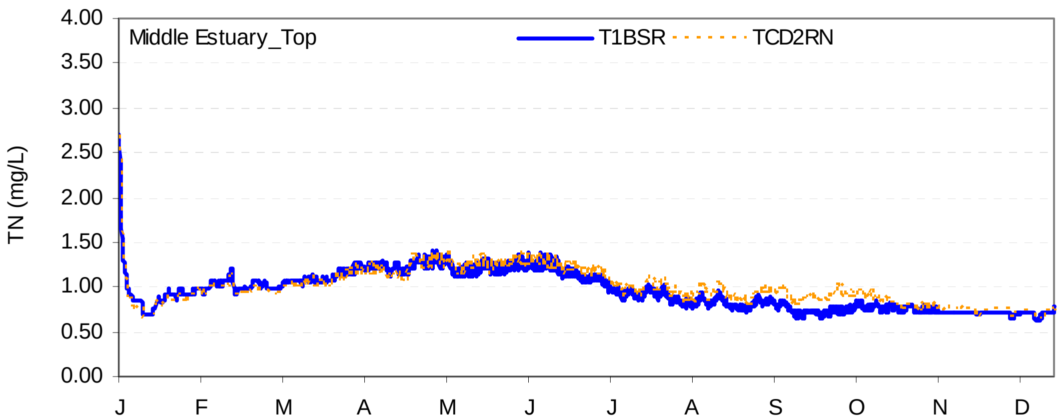


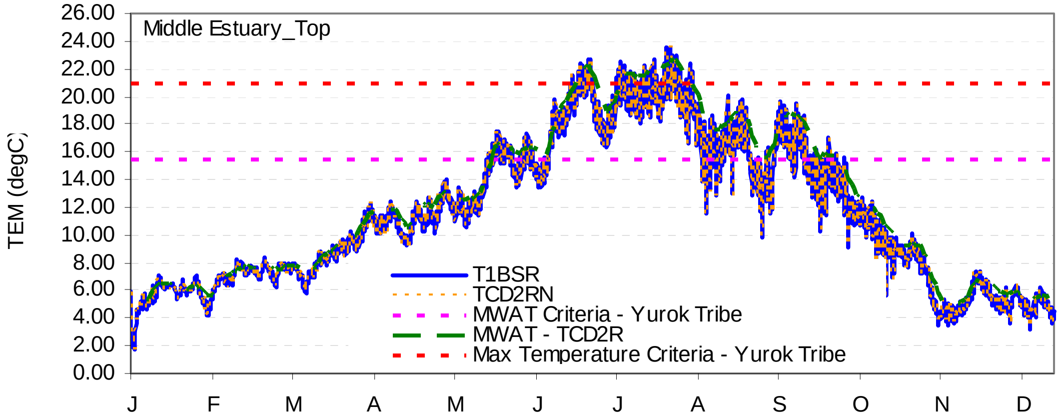




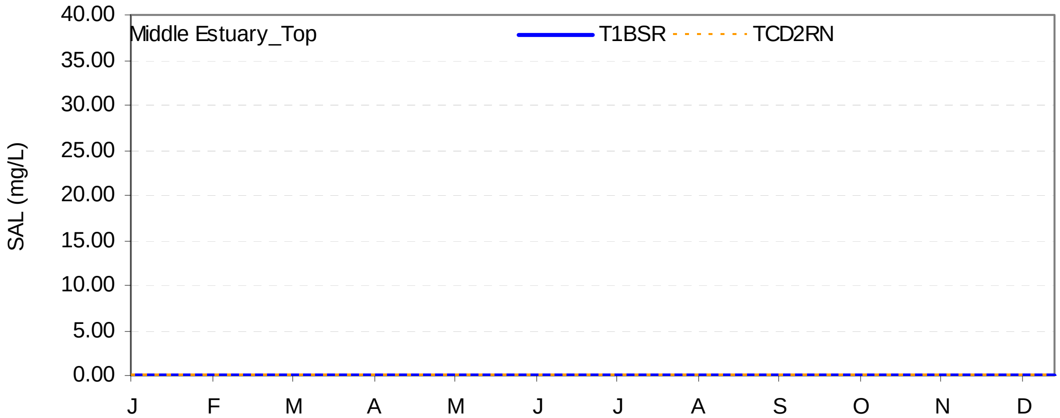

Middle Estuary_Top
T1BSR
TCD2RN
NO3 (mg/L)
1.50
1.25
1.00
0.75
0.50
0.25
0.00
J
F
M
A
M
J
J
A
S
O
N
D


Middle Estuary_Top
T1BSR
TCD2RN
TP (mg/L)
0.10
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0.00
J
F
M
A
M
J
J
A
S
O
N
D

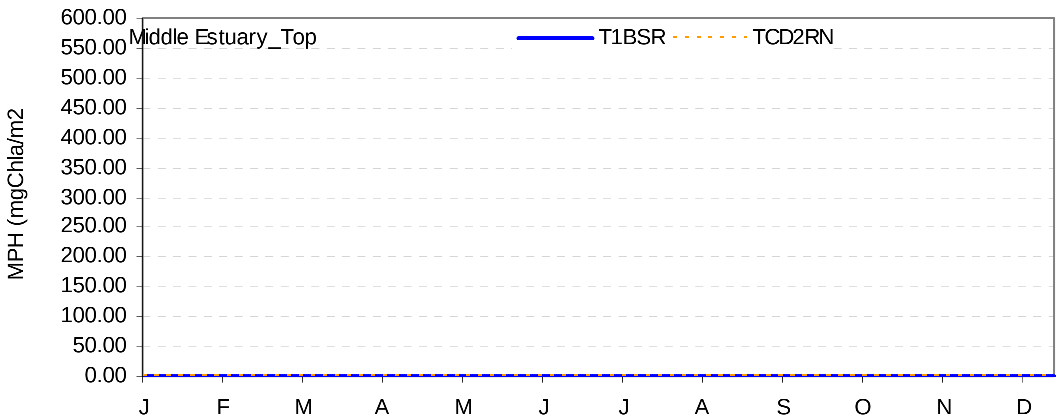

Middle Estuary_Top
T1BSR
TCD2RN
TN (mg/L)
4.00
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
J
F
M
A
M
J
J
A
S
O
N
D



Middle Estuary_Top
TEM (degC)
26.00
24.00
22.00
20.00
18.00
16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
T1BSR
TCD2RN
MWAT Criteria - Yurok Tribe
MWAT - TCD2R
Max Temperature Criteria - Yurok Tribe
J F M A M J J A S O N D

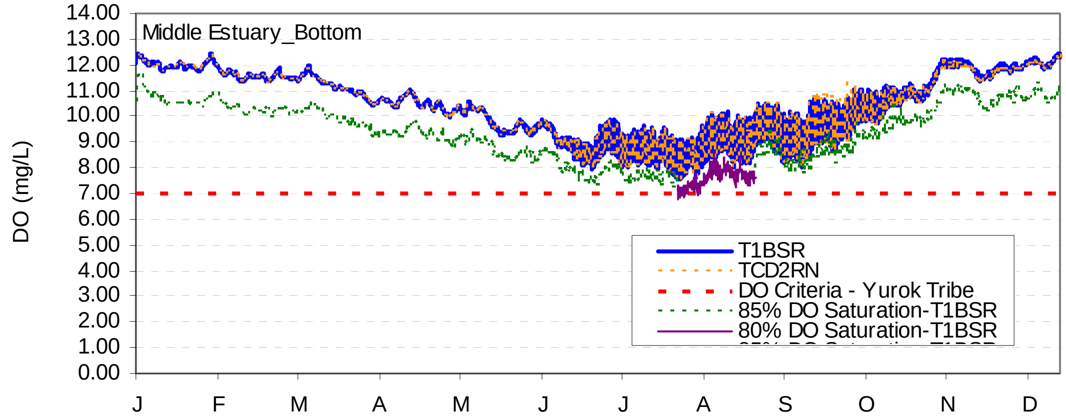


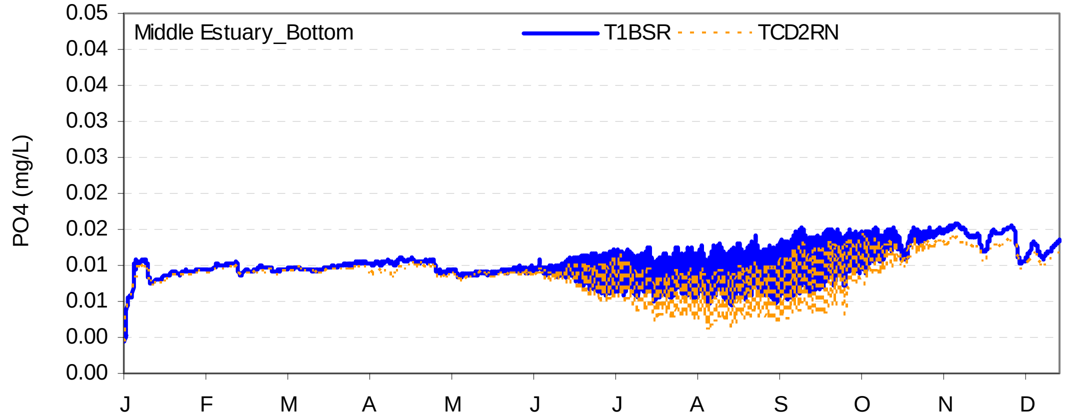
Middle Estuary_Top
T1BSR
TCD2RN
SAL (mg/L)
40.00
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
J F M A M J J A S O N D

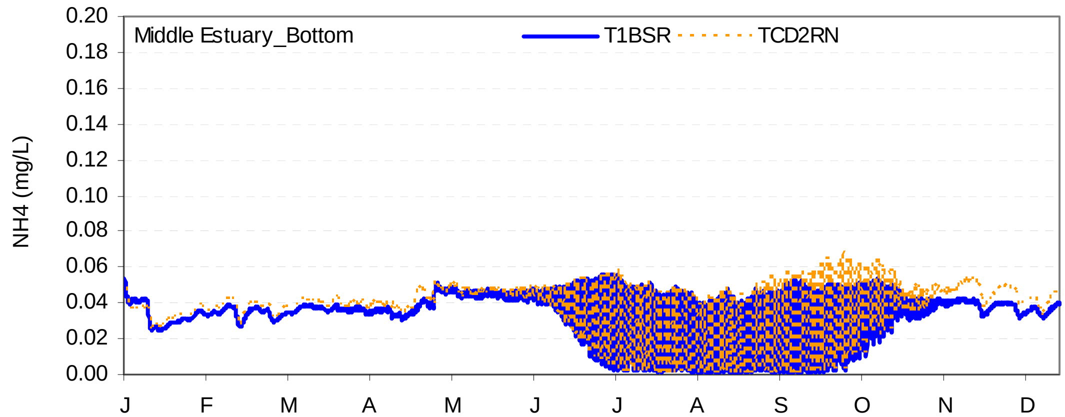


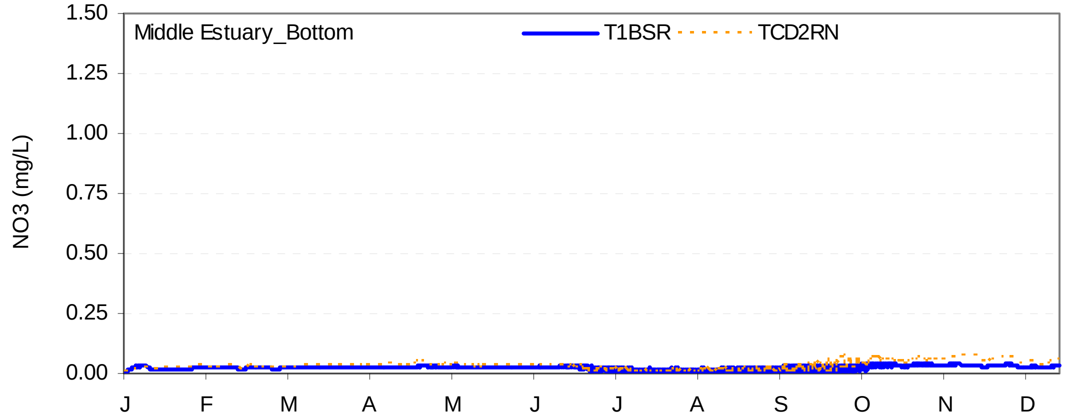
Middle Estuary_Top
T1BSR
TCD2RN
MPH (mgChla/m2
600.00
550.00
500.00
450.00
400.00
350.00
300.00
250.00
200.00
150.00
100.00
50.00
0.00
J F M A M J J A S O N D

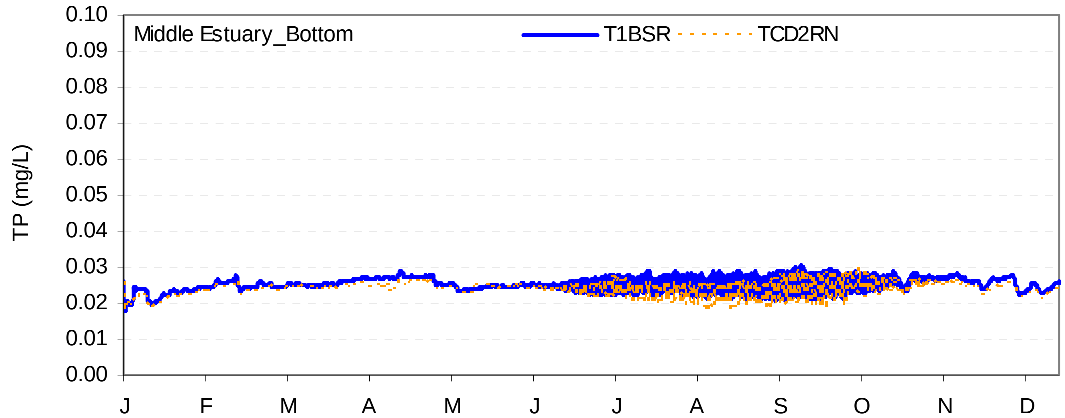
Middle Estuary - Bottom

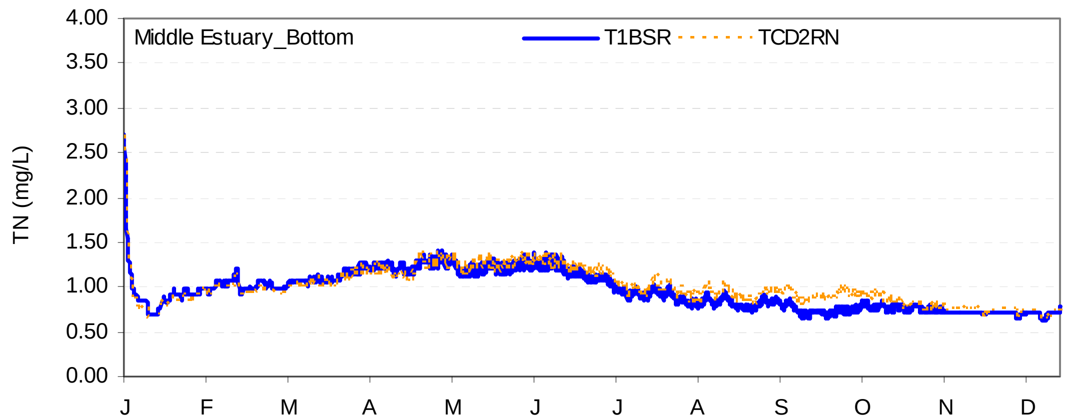


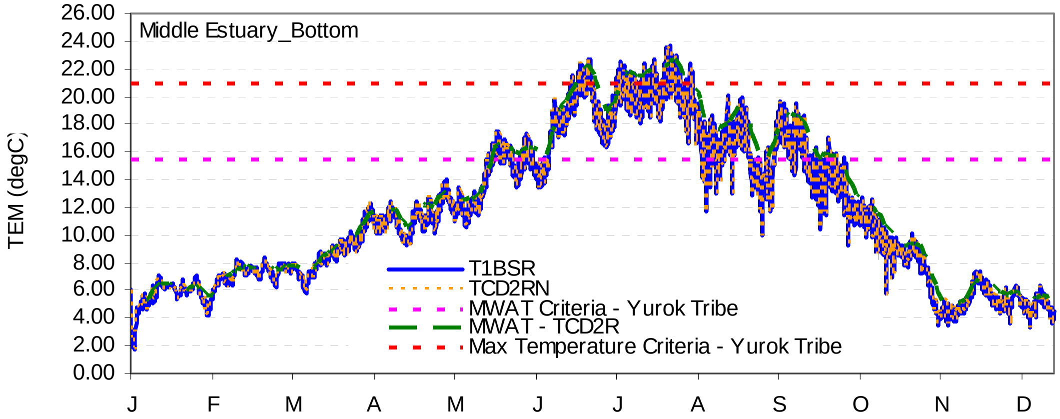


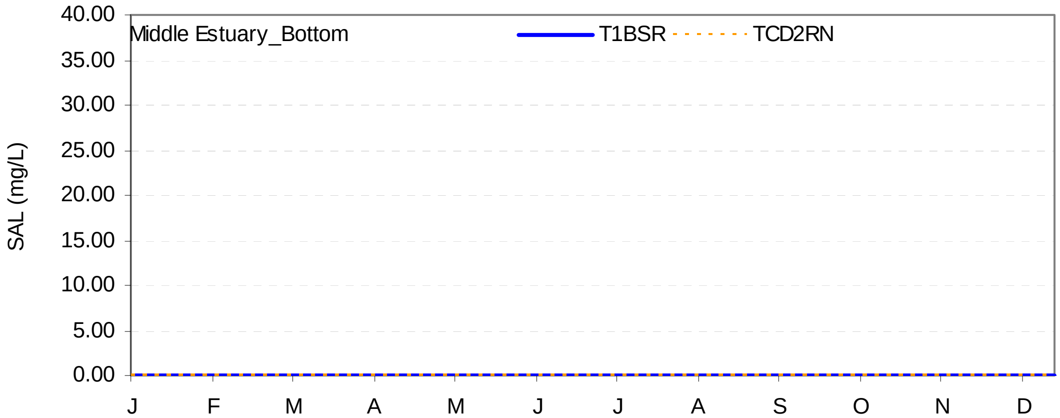


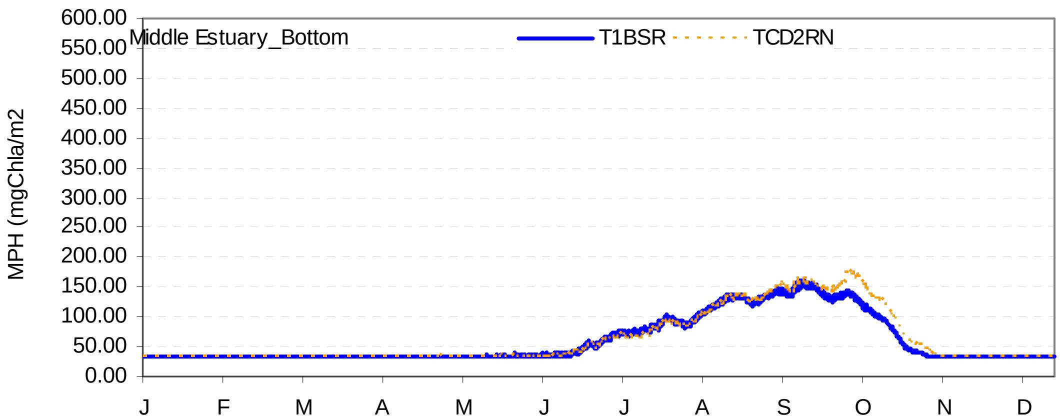

Middle Estuary_Bottom
T1BSR
TCD2RN
NO3 (mg/L)
1.50
1.25
1.00
0.75
0.50
0.25
0.00
J
F
M
A
M
J
J
A
S
O
N
D


Middle Estuary_Bottom
T1BSR
TCD2RN
TP (mg/L)
0.10
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0.00
J
F
M
A
M
J
J
A
S
O
N
D

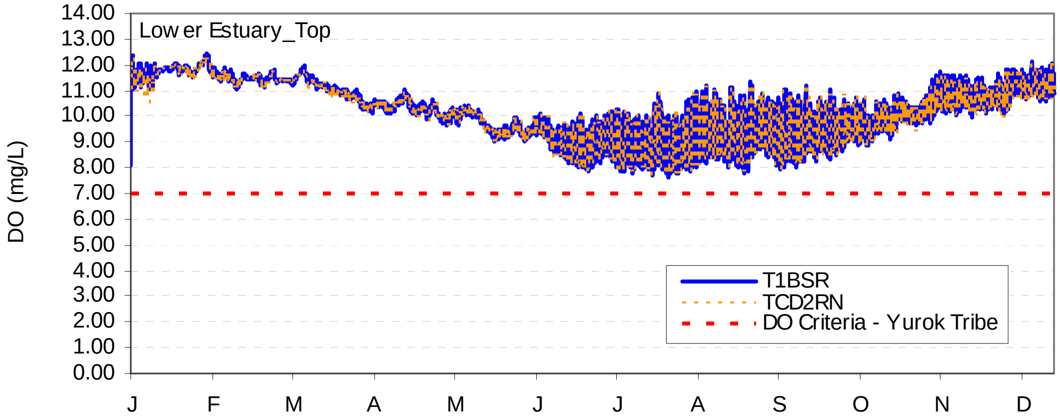

Middle Estuary_Bottom
T1BSR
TCD2RN
TN (mg/L)
4.00
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
J
F
M
A
M
J
J
A
S
O
N
D

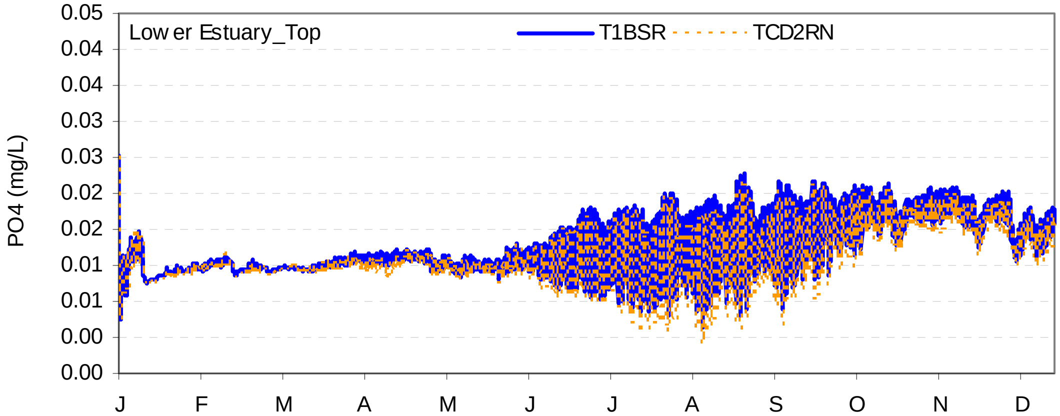

Middle Estuary_Bottom
TEM (degC)
26.00
24.00
22.00
20.00
18.00
16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
T1BSR
TCD2RN
MWAT Criteria - Yurok Tribe
MWAT - TCD2R
Max Temperature Criteria - Yurok Tribe
J F M A M J J A S O N D

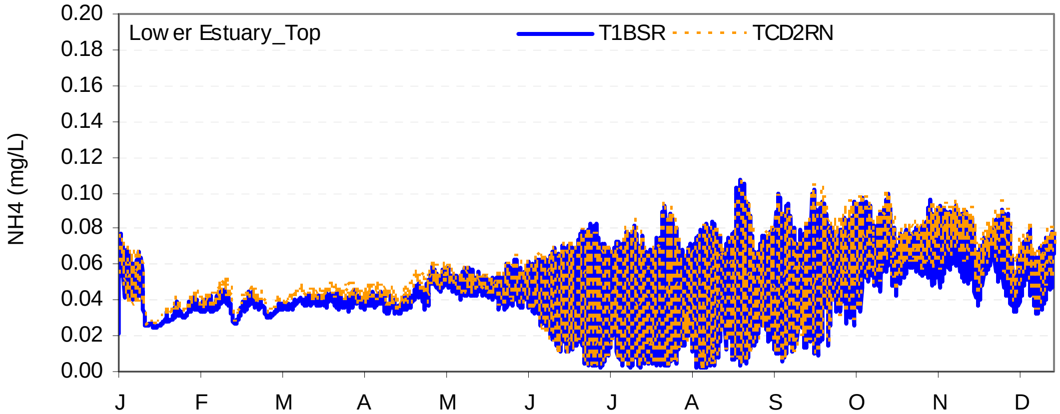

Middle Estuary_Bottom
T1BSR
TCD2RN
SAL (mg/L)
40.00
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
J F M A M J J A S O N D

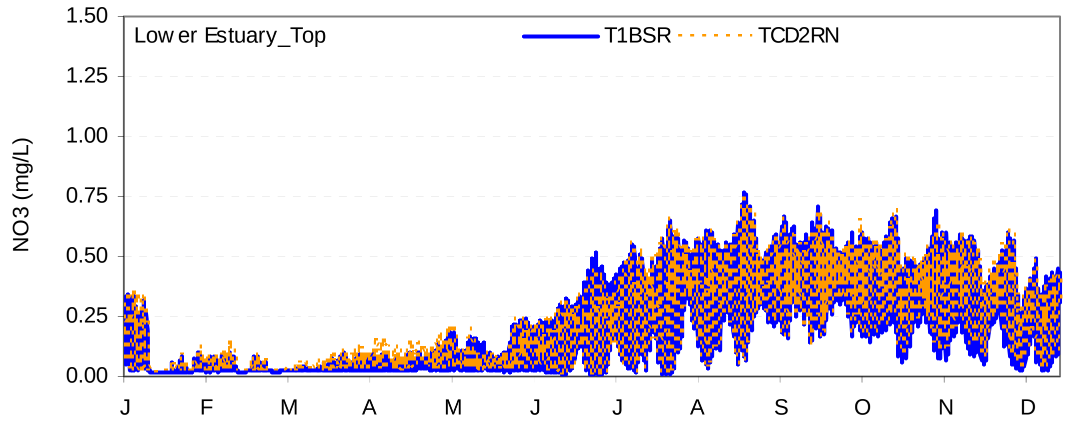

Middle Estuary_Bottom
T1BSR
TCD2RN
MPH (mgChla/m2
600.00
550.00
500.00
450.00
400.00
350.00
300.00
250.00
200.00
150.00
100.00
50.00
0.00
J F M A M J J A S O N D

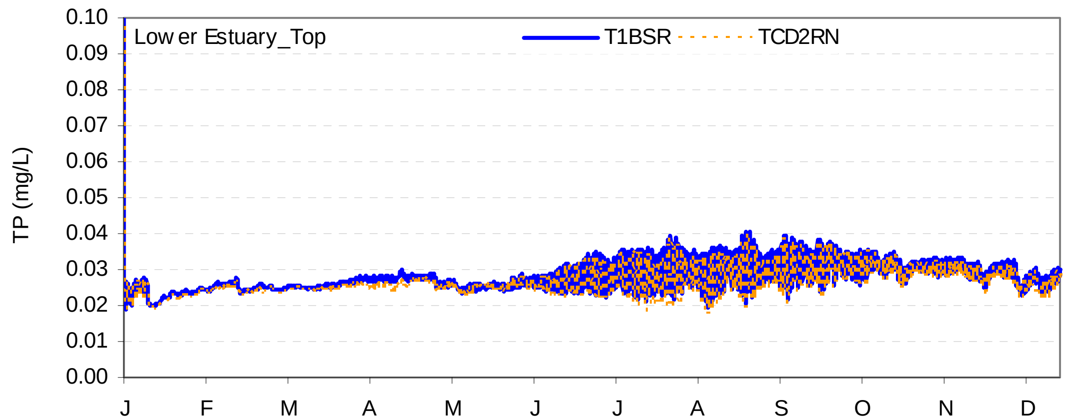
Lower Estuary - Top

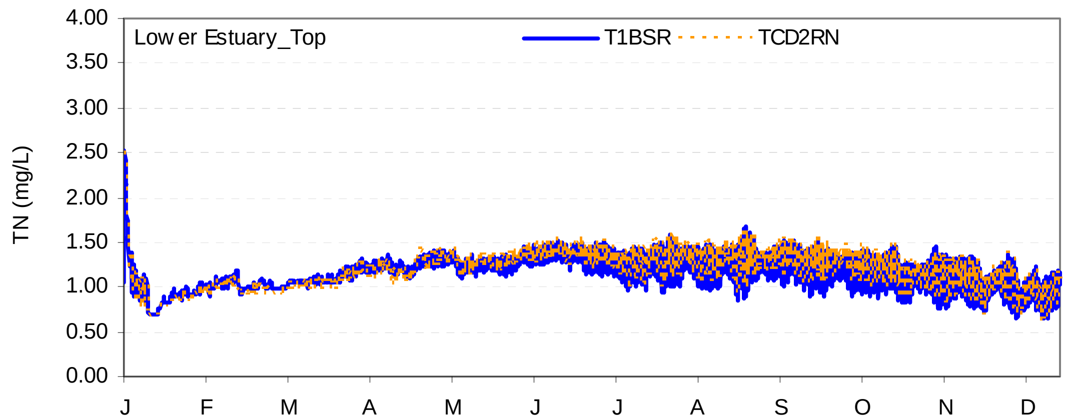


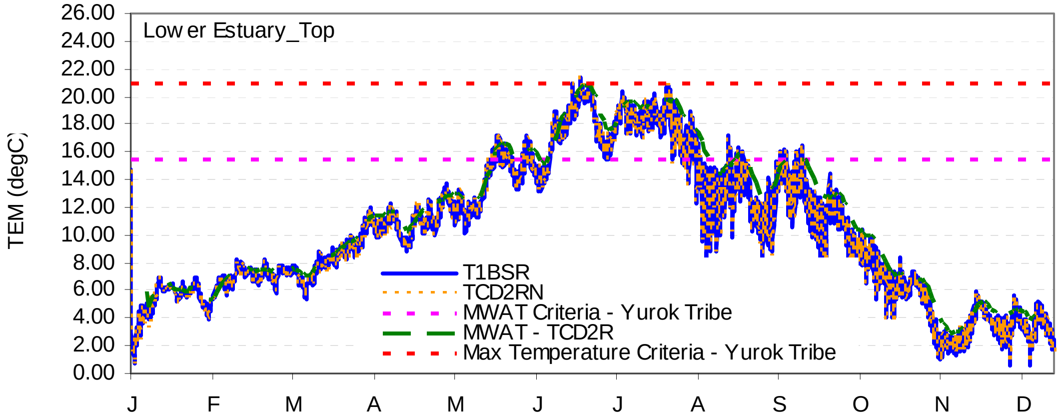


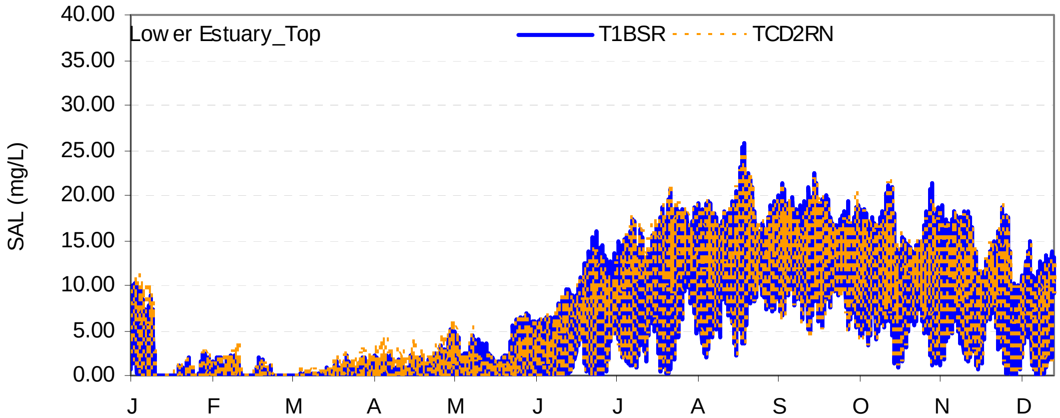


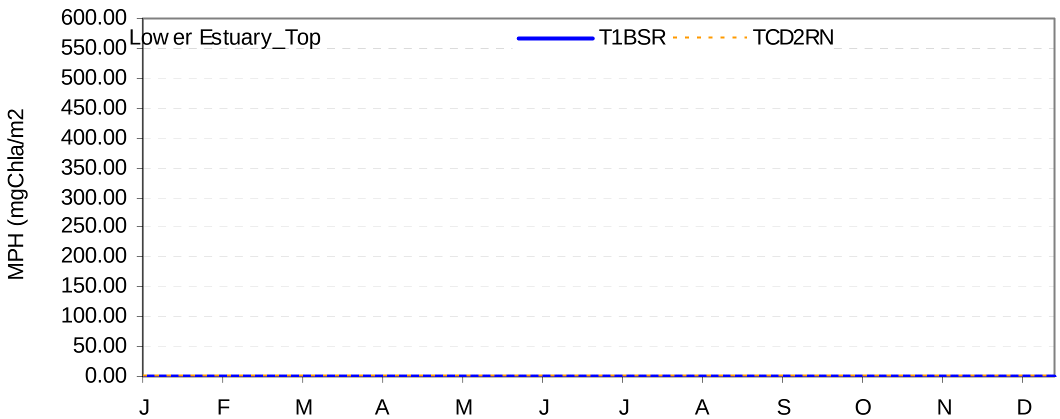

Low er Estuary_Top
T1BSR
TCD2RN
NO3 (mg/L)
1.50
1.25
1.00
0.75
0.50
0.25
0.00
J
F
M
A
M
J
J
A
S
O
N
D


Low er Estuary_Top
T1BSR
TCD2RN
TP (mg/L)
0.10
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0.00
J
F
M
A
M
J
J
A
S
O
N
D

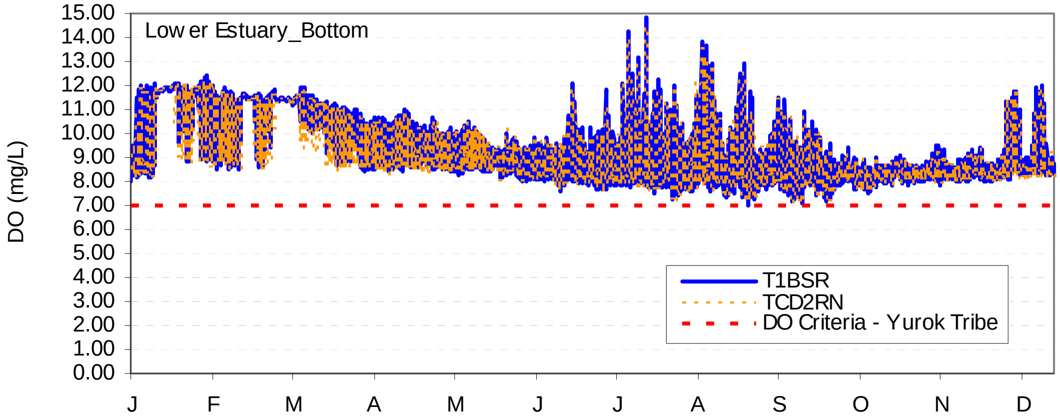

Low er Estuary_Top
T1BSR
TCD2RN
TN (mg/L)
4.00
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
J
F
M
A
M
J
J
A
S
O
N
D

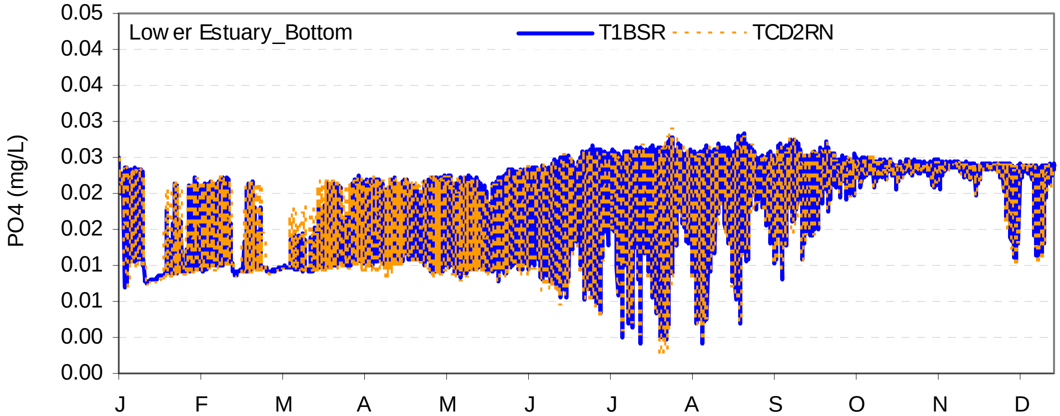

Low er Estuary_Top
TEM (degC)
26.00
24.00
22.00
20.00
18.00
16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
T1BSR
TCD2RN
MWAT Criteria - Yurok Tribe
MWAT - TCD2R
Max Temperature Criteria - Yurok Tribe
J F M A M J J A S O N D

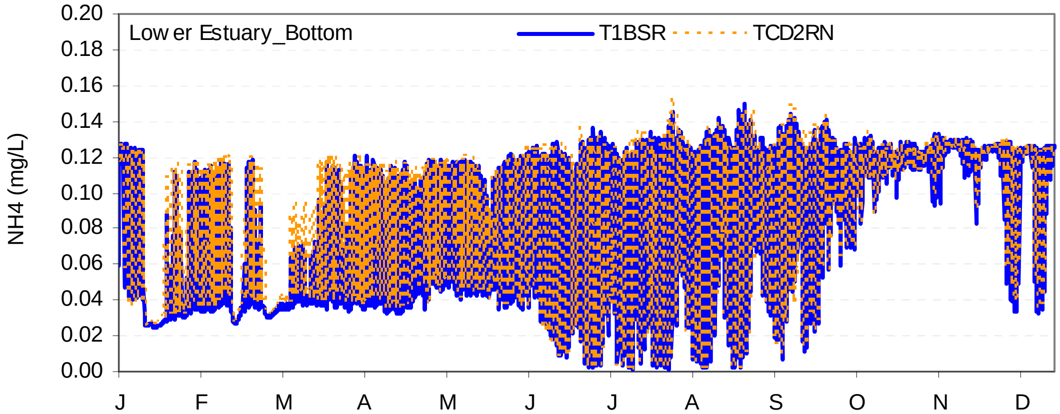

Low er Estuary_Top
T1BSR
TCD2RN
SAL (mg/L)
40.00
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
J F M A M J J A S O N D

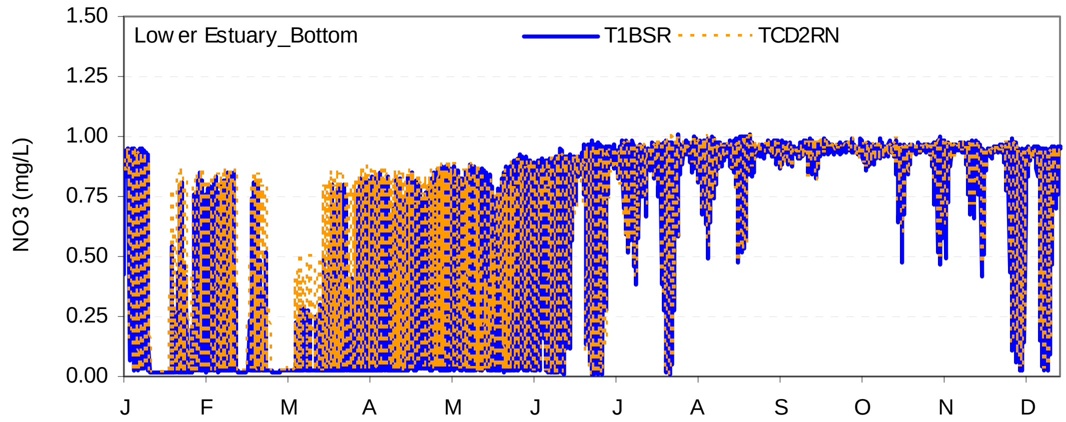

Low er Estuary_Top
T1BSR
TCD2RN
MPH (mgChla/m2
600.00
550.00
500.00
450.00
400.00
350.00
300.00
250.00
200.00
150.00
100.00
50.00
0.00
J F M A M J J A S O N D

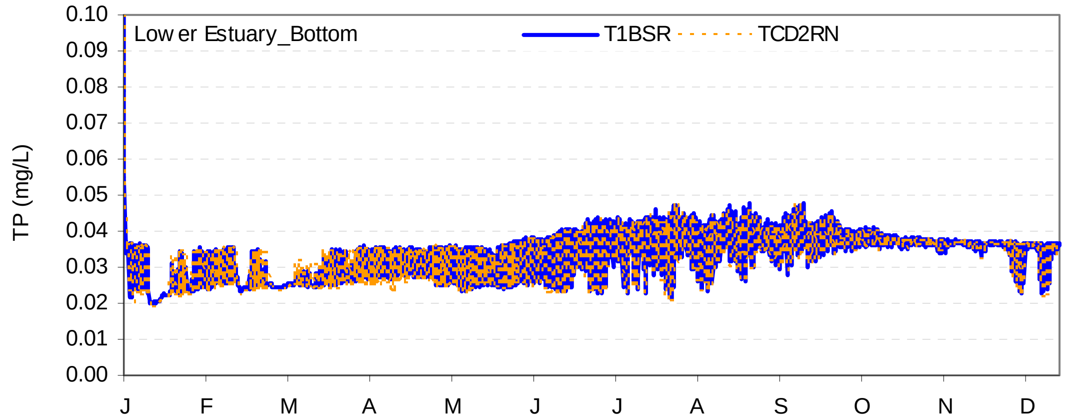
Lower Estuary - Bottom

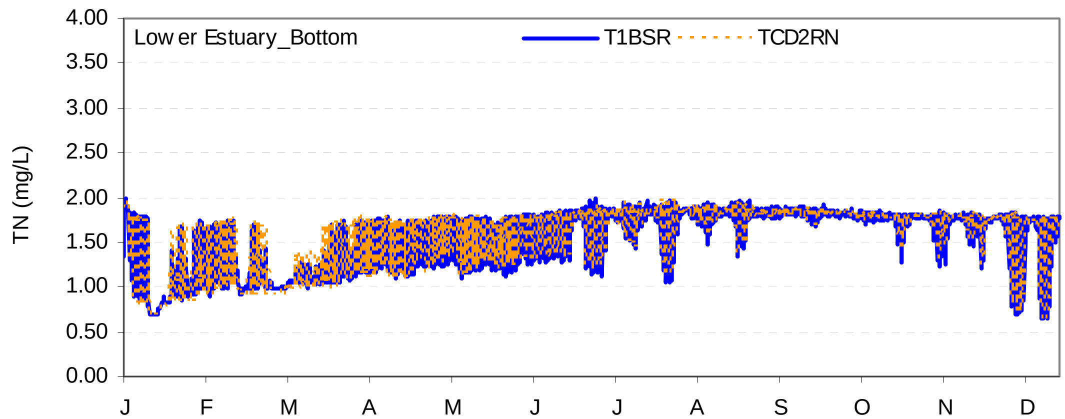


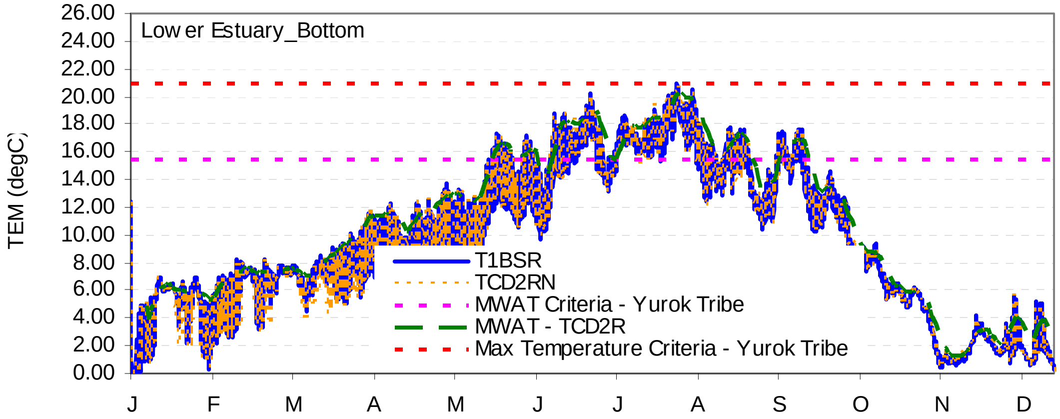


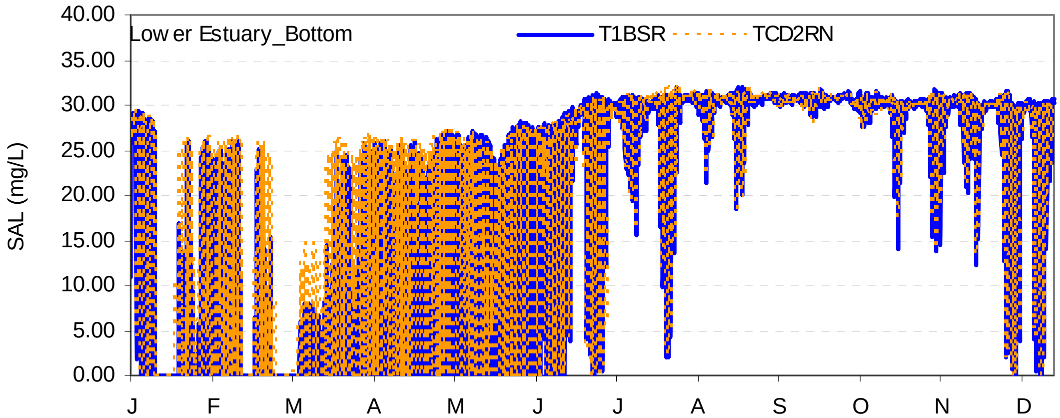


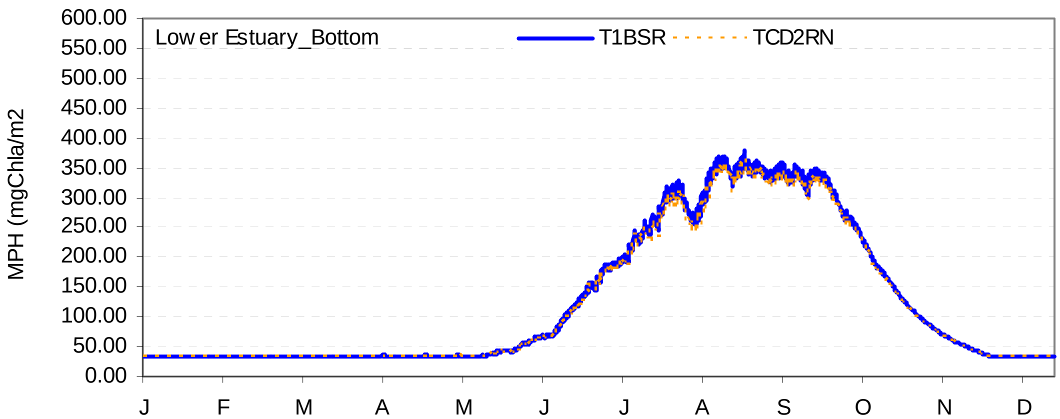

Low er Estuary_Bottom
T1BSR
TCD2RN
NO3 (mg/L)
1.50
1.25
1.00
0.75
0.50
0.25
0.00
J F M A M J J A S O N D


Low er Estuary_Bottom
T1BSR
TCD2RN
TP (mg/L)
0.10
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0.00
J F M A M J J A S O N D


Low er Estuary_Bottom
T1BSR
TCD2RN
TN (mg/L)
4.00
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
J F M A M J J A S O N D

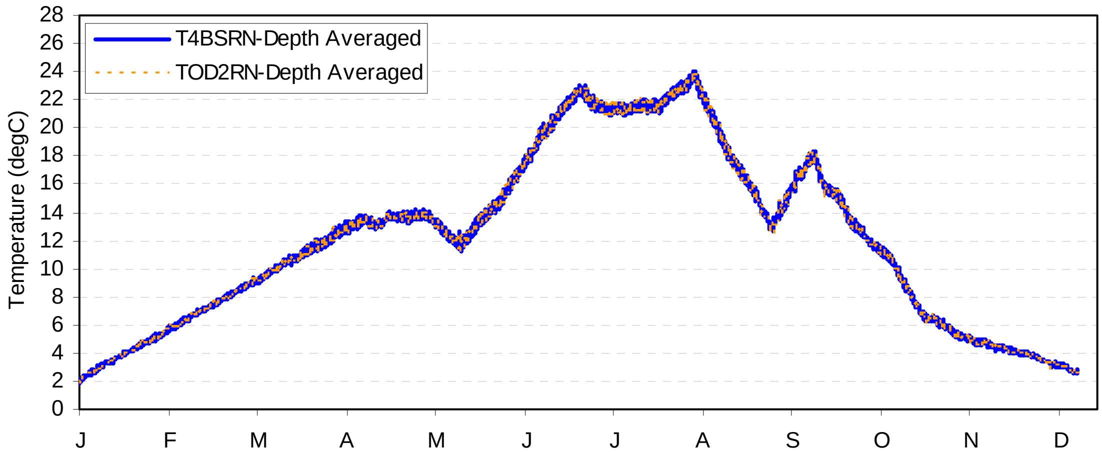

Low er Estuary_Bottom
TEM (degC)
26.00
24.00
22.00
20.00
18.00
16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
T1BSR
TCD2RN
MWAT Criteria - Yurok Tribe
MWAT - TCD2R
Max Temperature Criteria - Yurok Tribe
J F M A M J J A S O N D

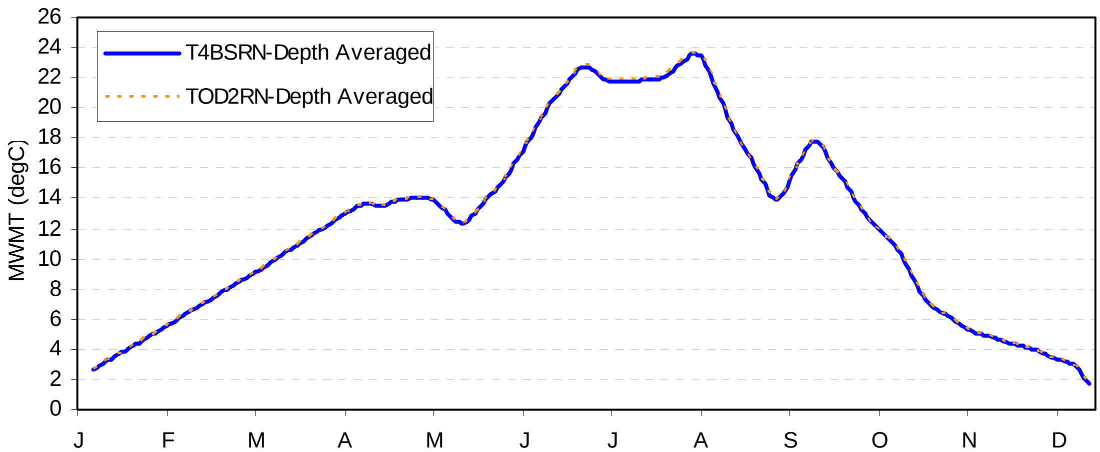

Low er Estuary_Bottom
T1BSR
TCD2RN
SAL (mg/L)
40.00
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
J F M A M J J A S O N D

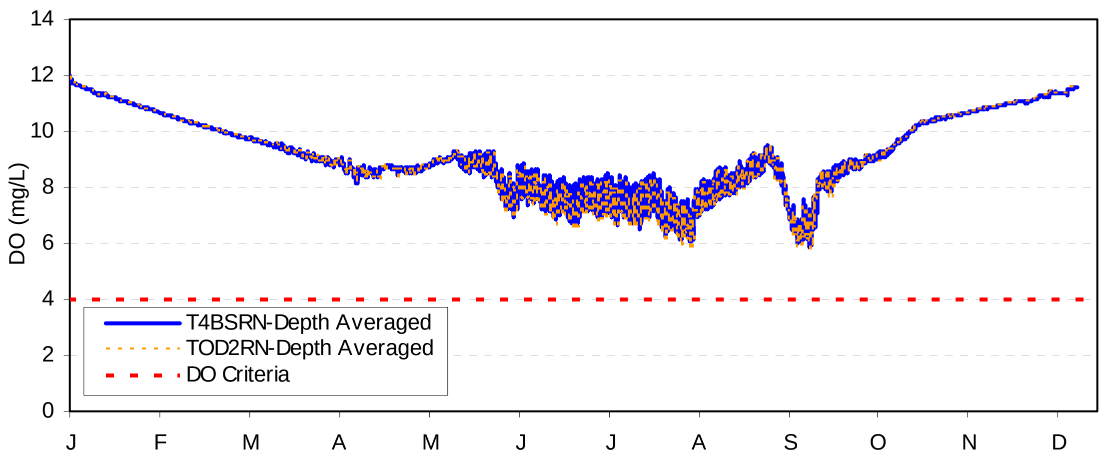

Low er Estuary_Bottom
T1BSR
TCD2RN
MPH (mgChla/m2
600.00
550.00
500.00
450.00
400.00
350.00
300.00
250.00
200.00
150.00
100.00
50.00
0.00
J F M A M J J A S O N D

Appendix C: T4BSRN and TOD2RN/TCD2RN Results

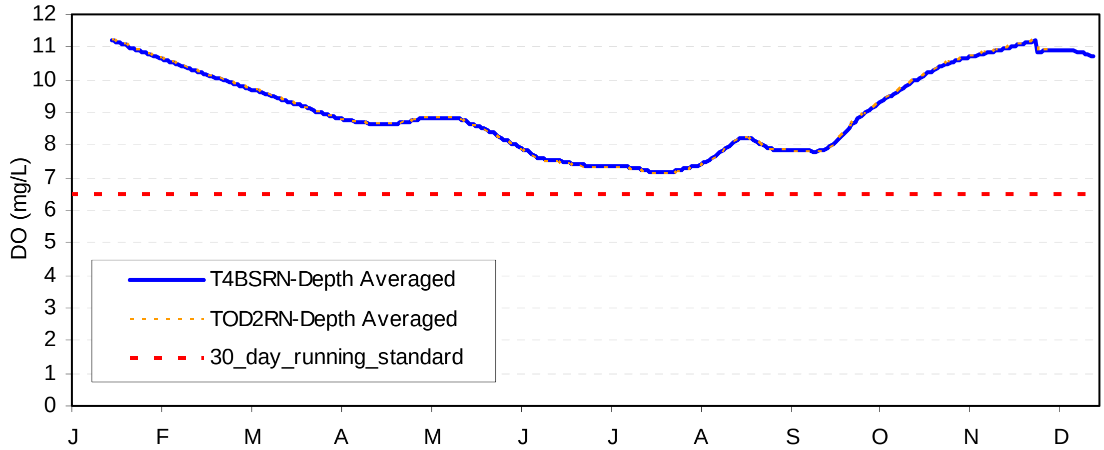
Klamath Falls STP

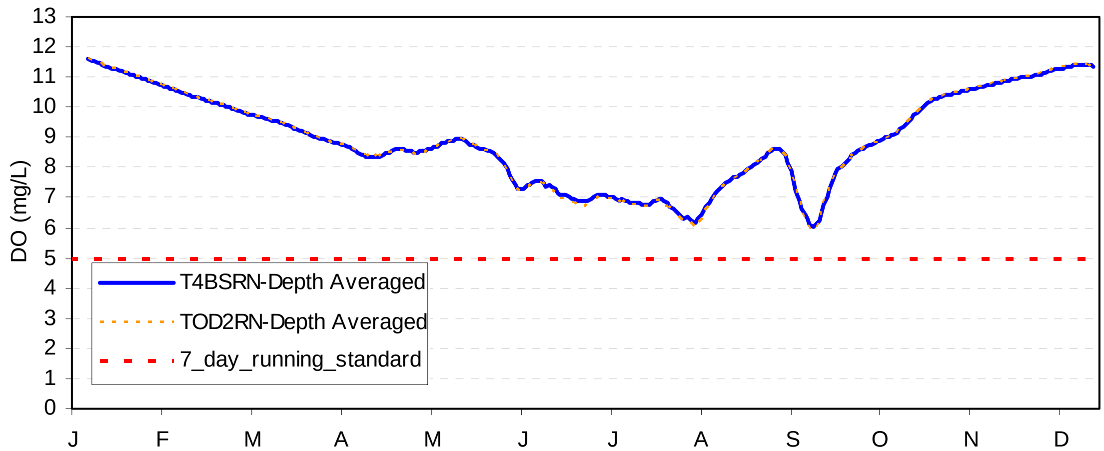


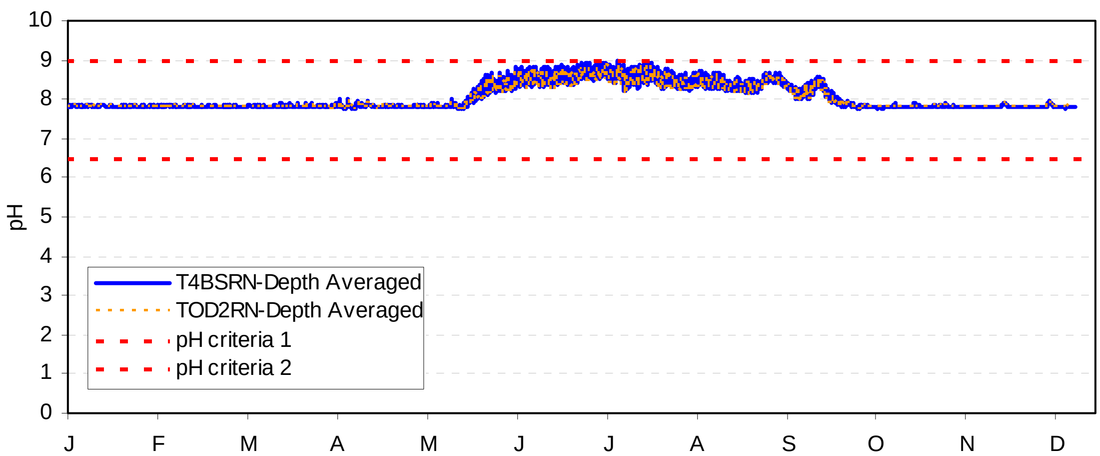




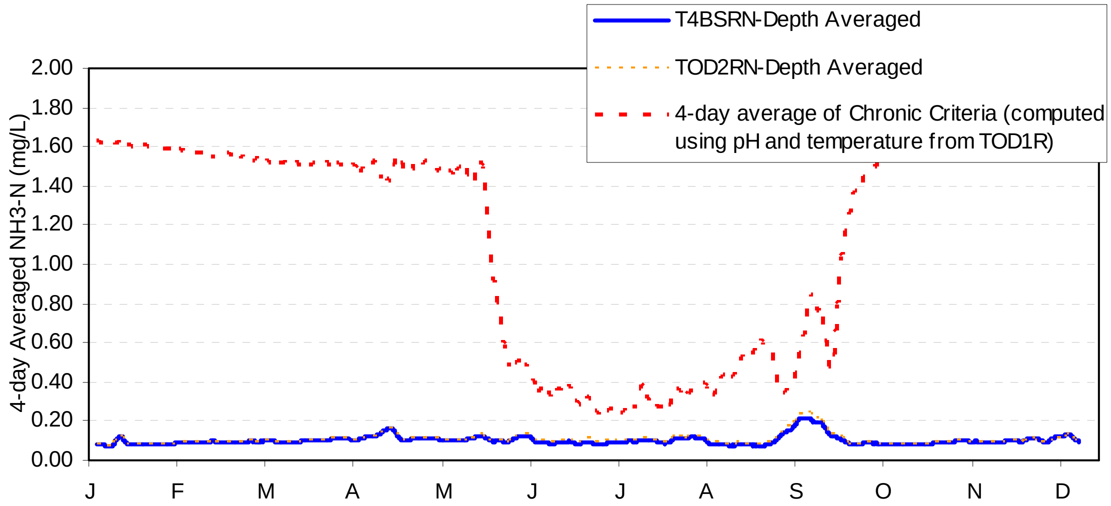
Klamath Falls STP

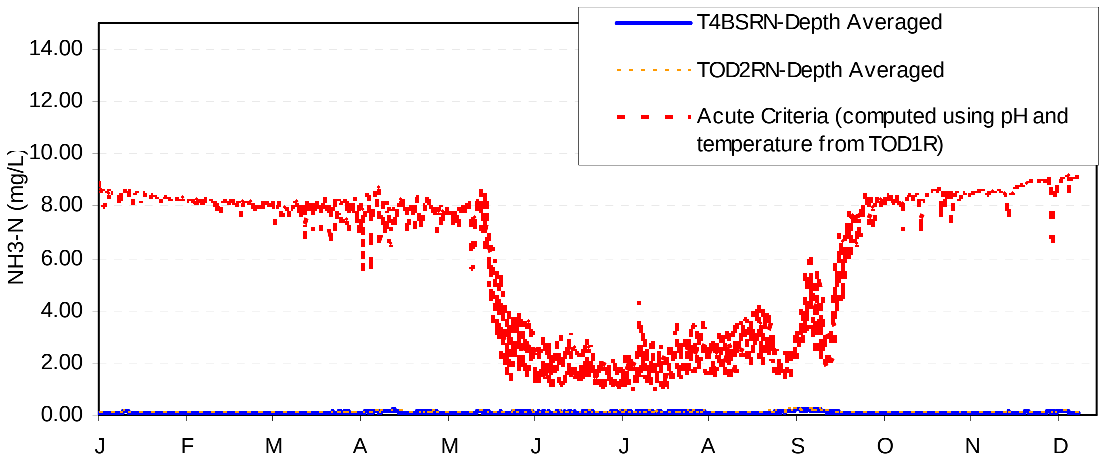


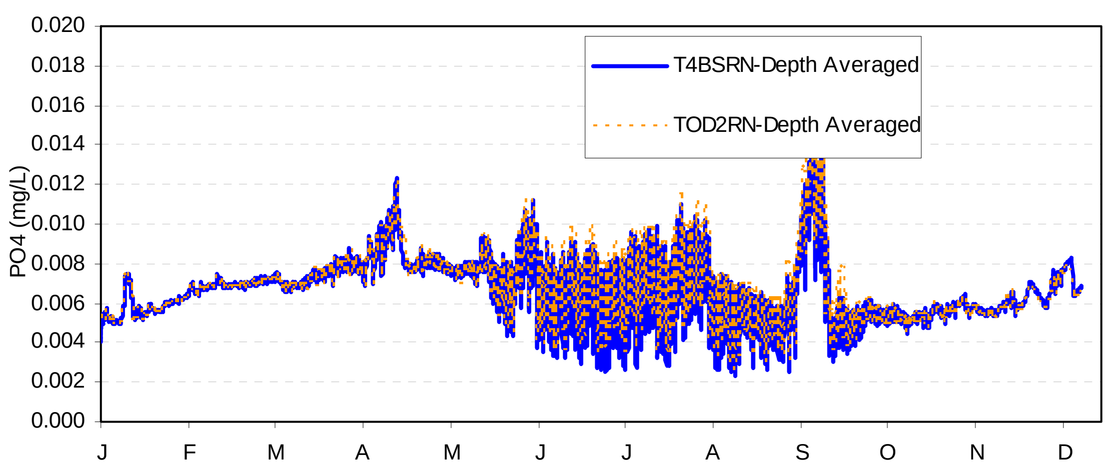




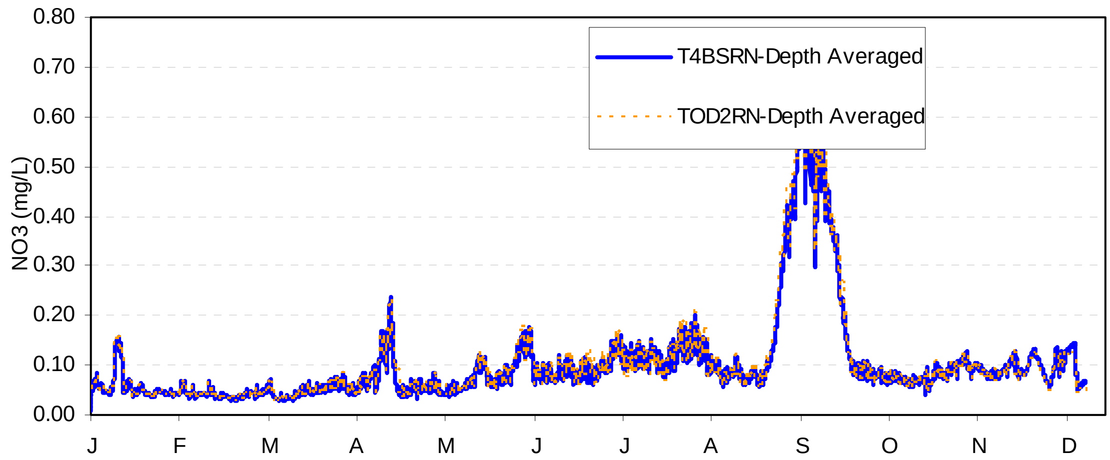
Klamath Falls STP

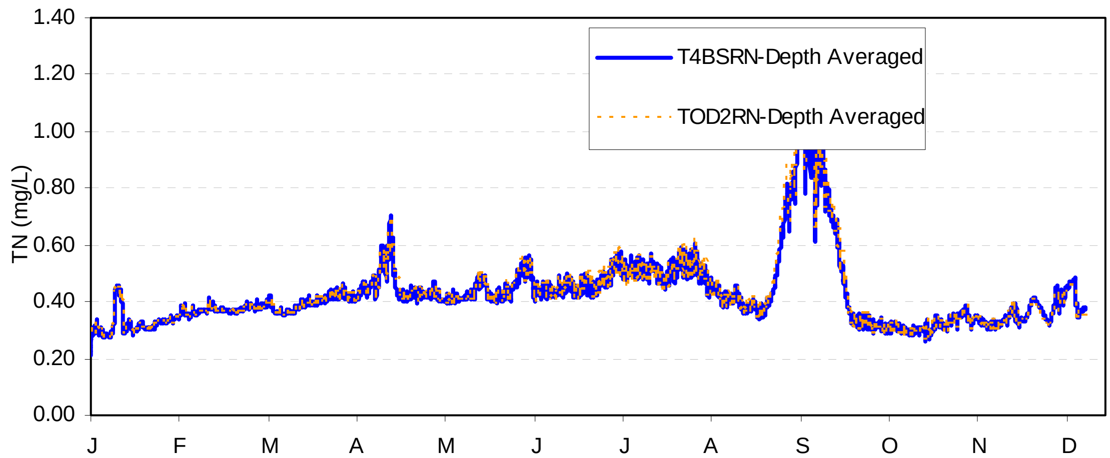


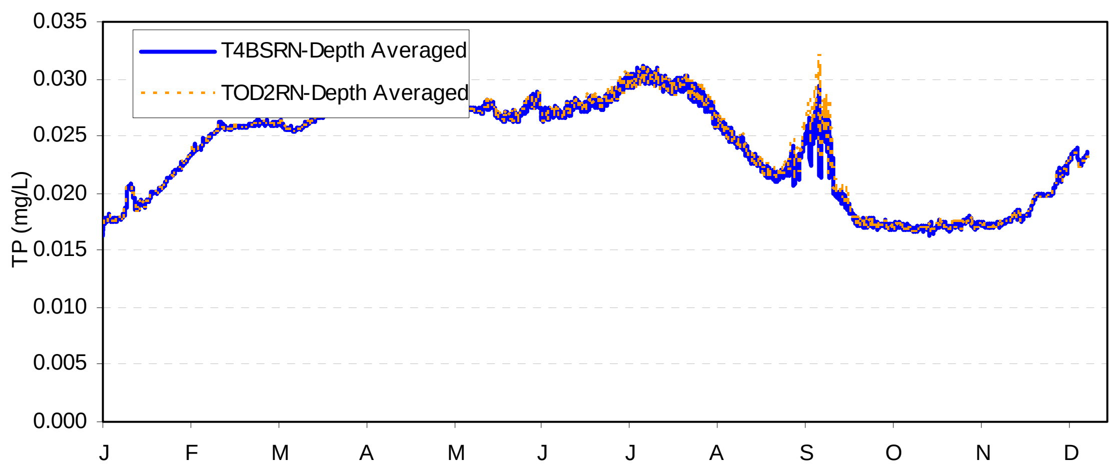




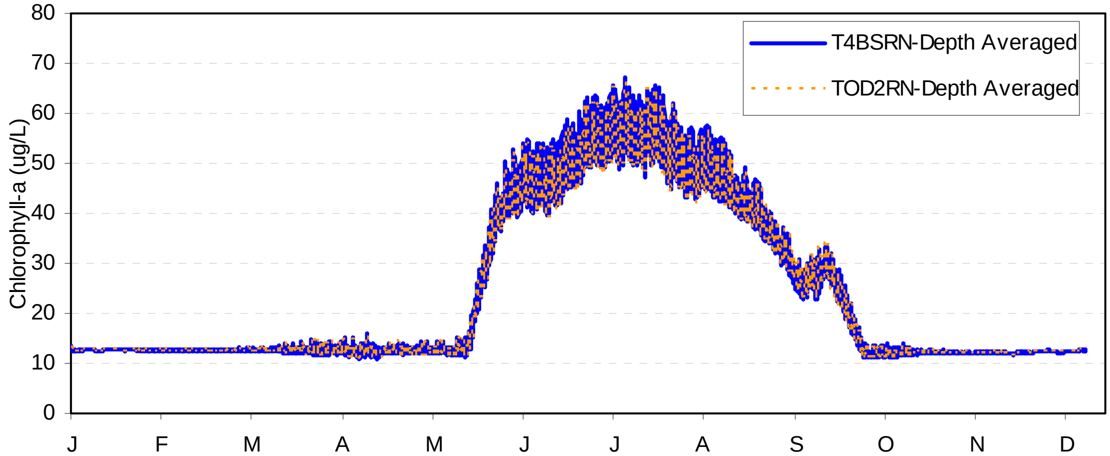
Klamath Falls STP

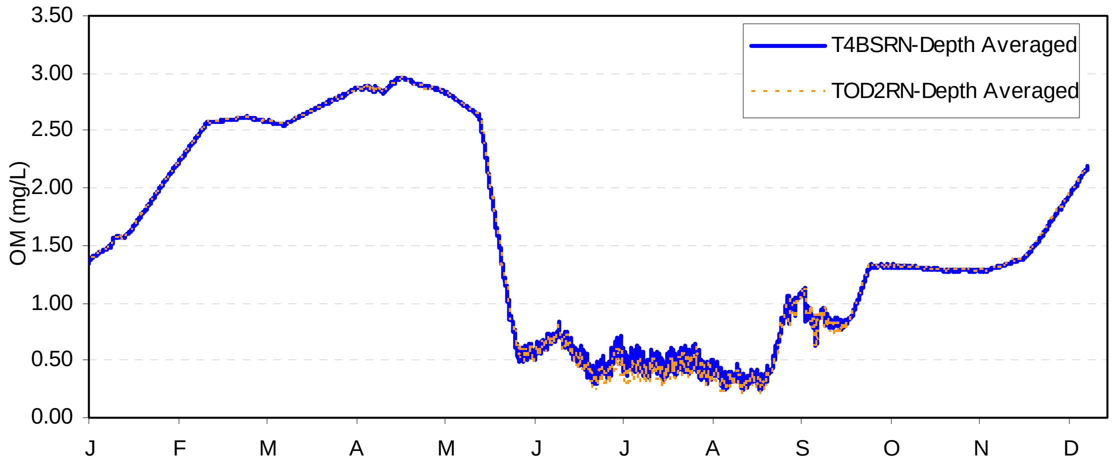




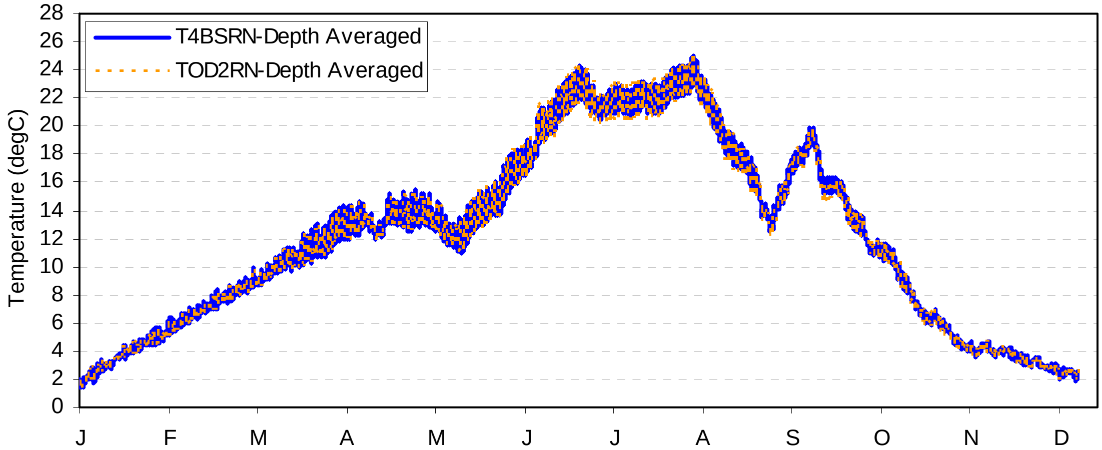


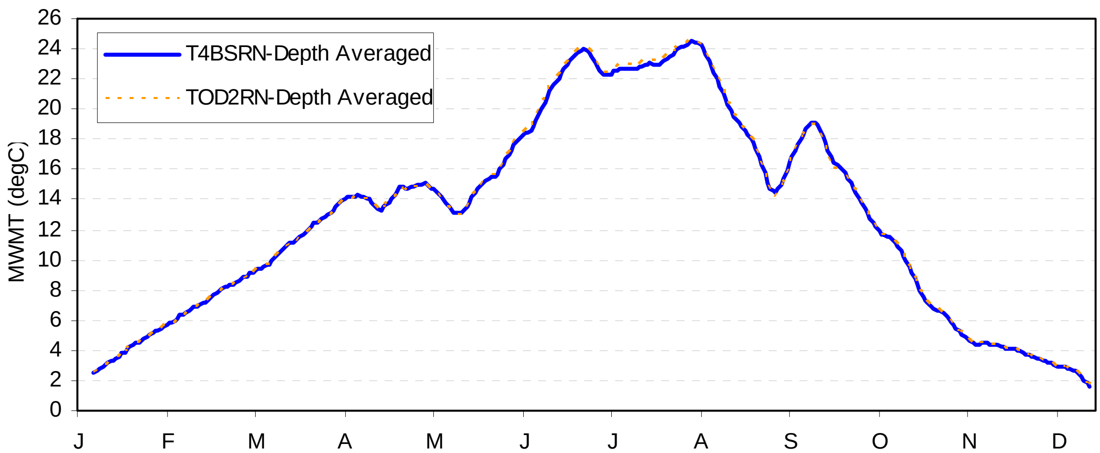
Klamath Falls STP

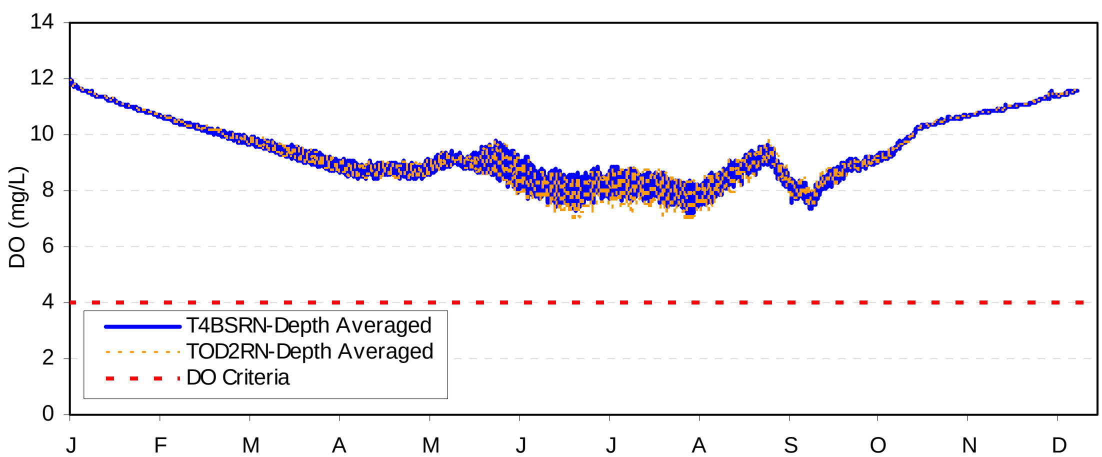




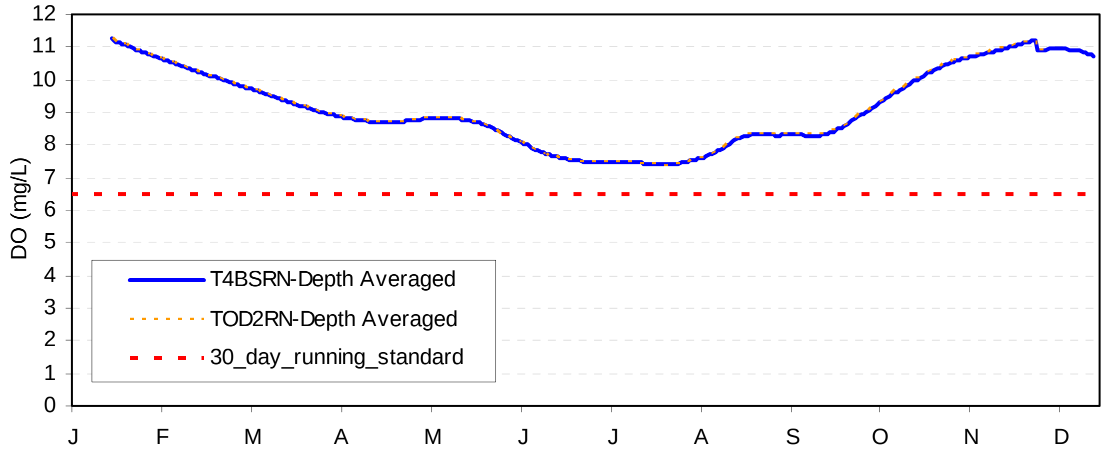
South Suburban Sanitary

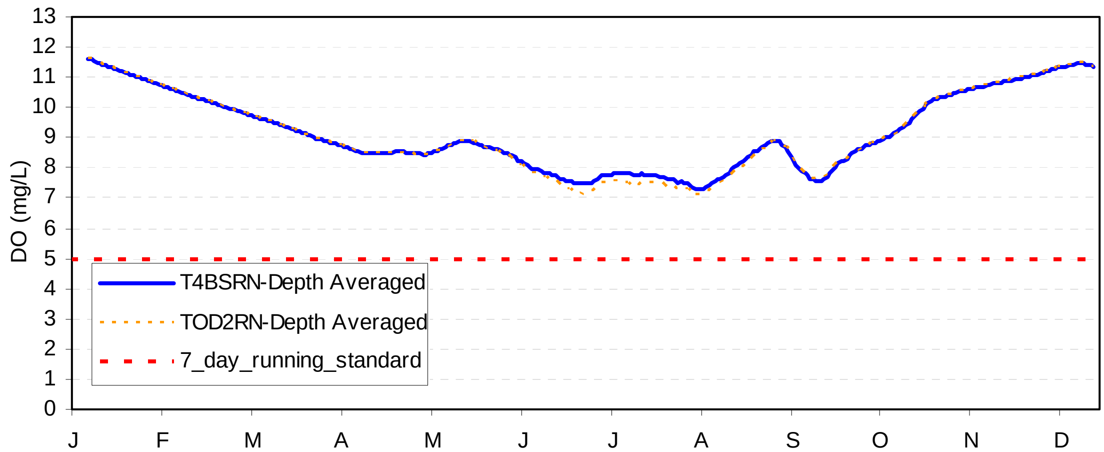


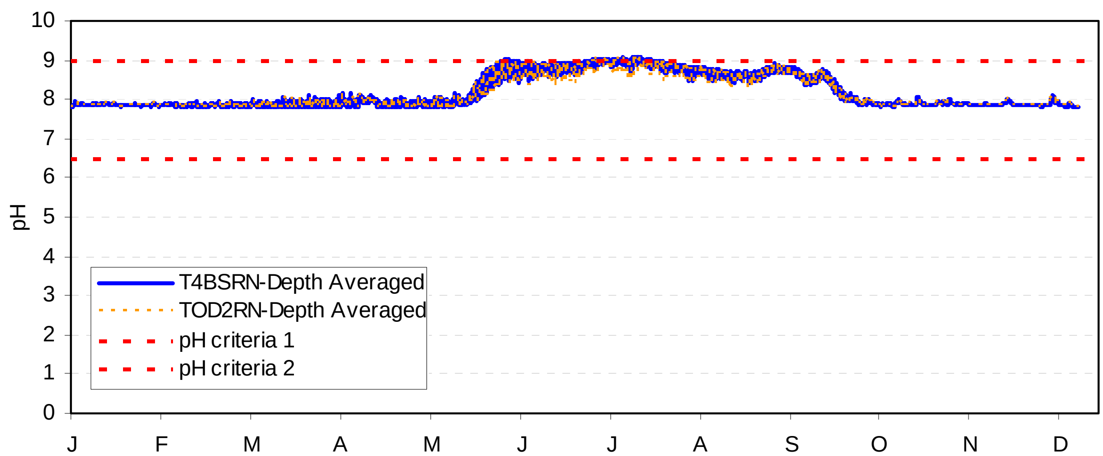




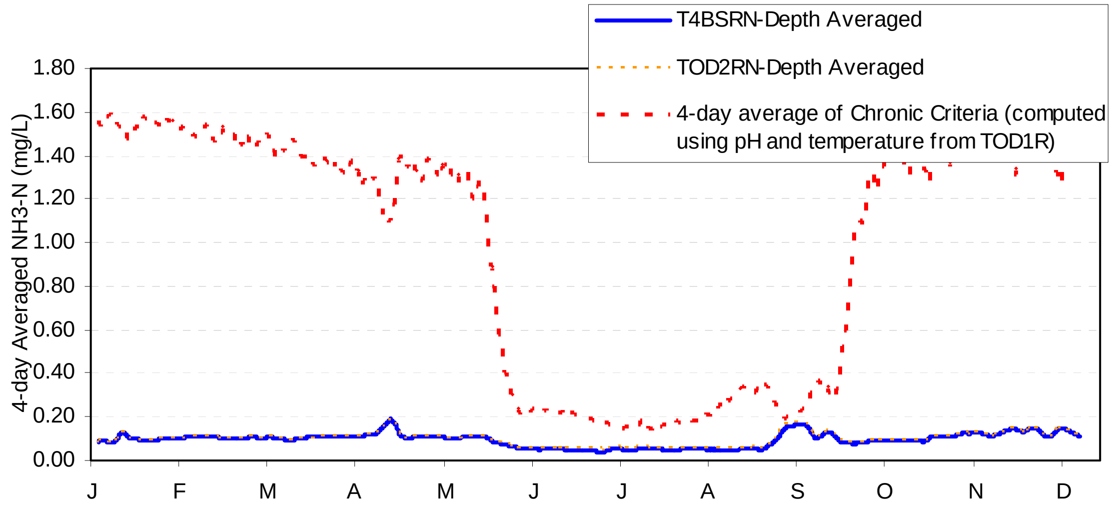
South Suburban Sanitary

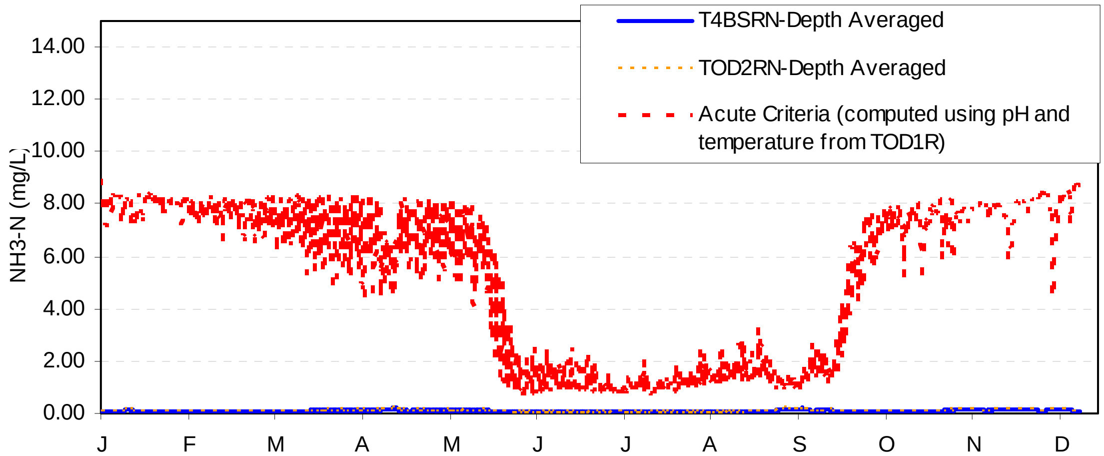


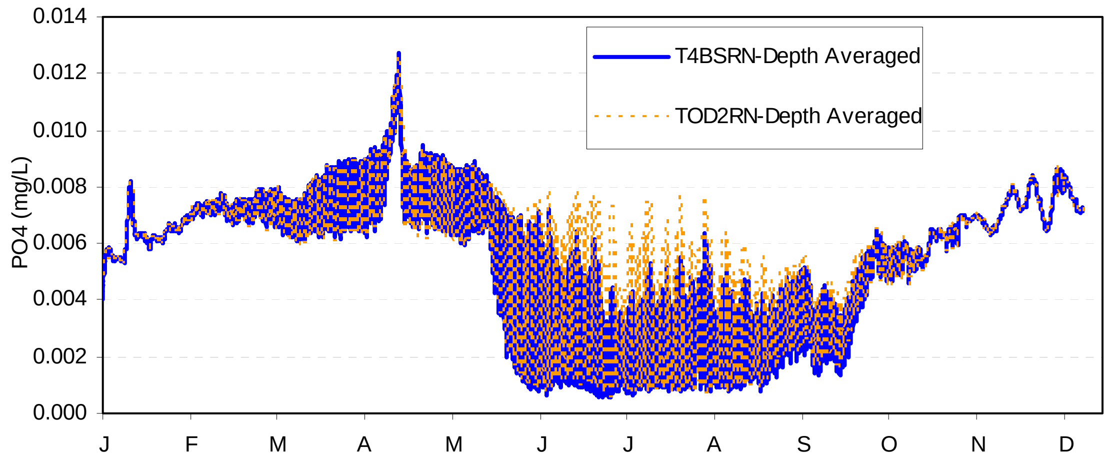




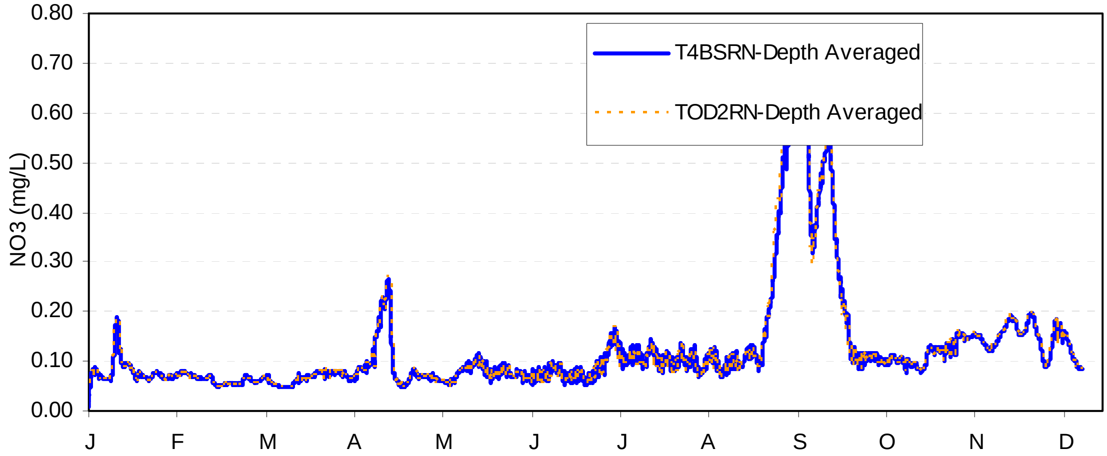
South Suburban Sanitary

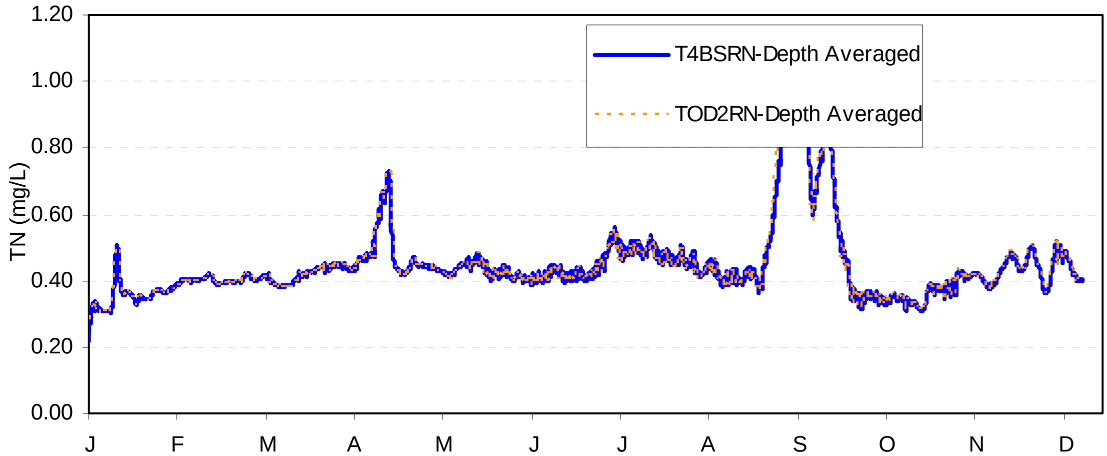


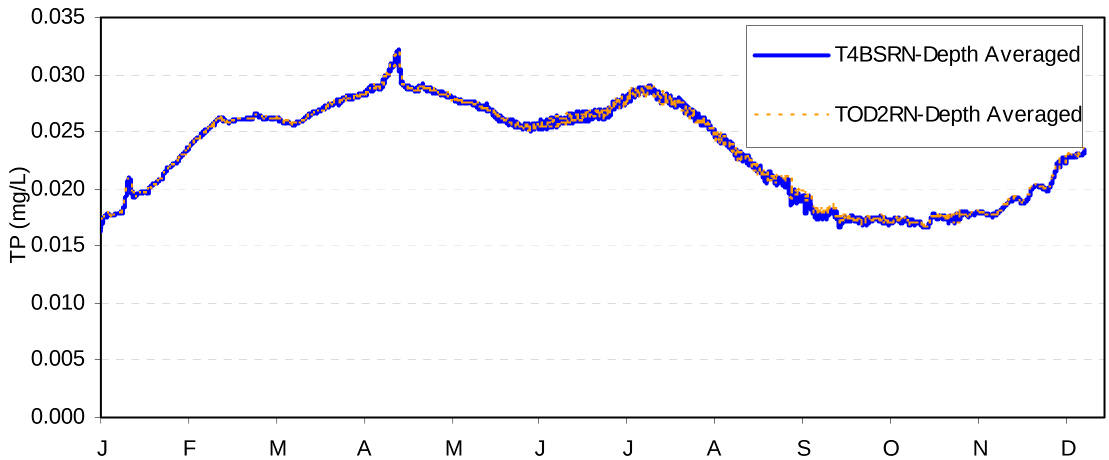




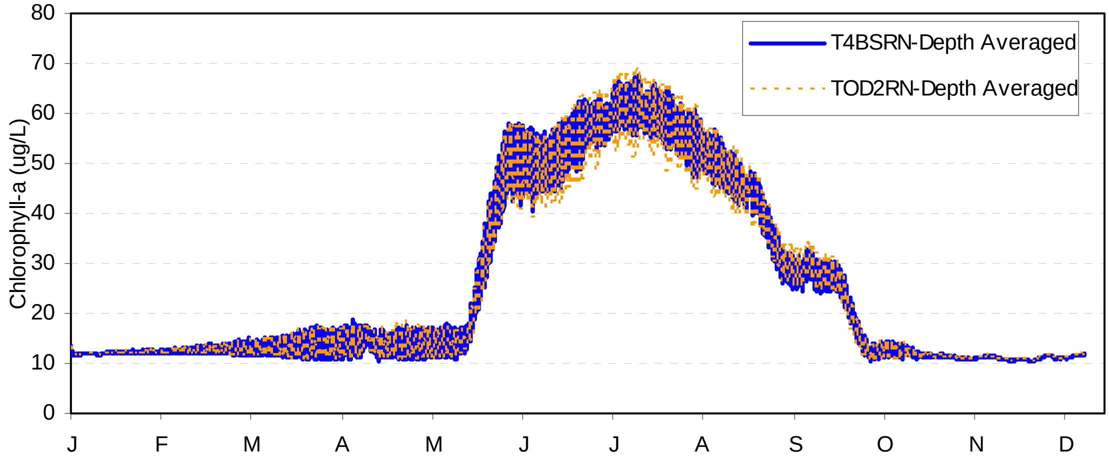
South Suburban Sanitary

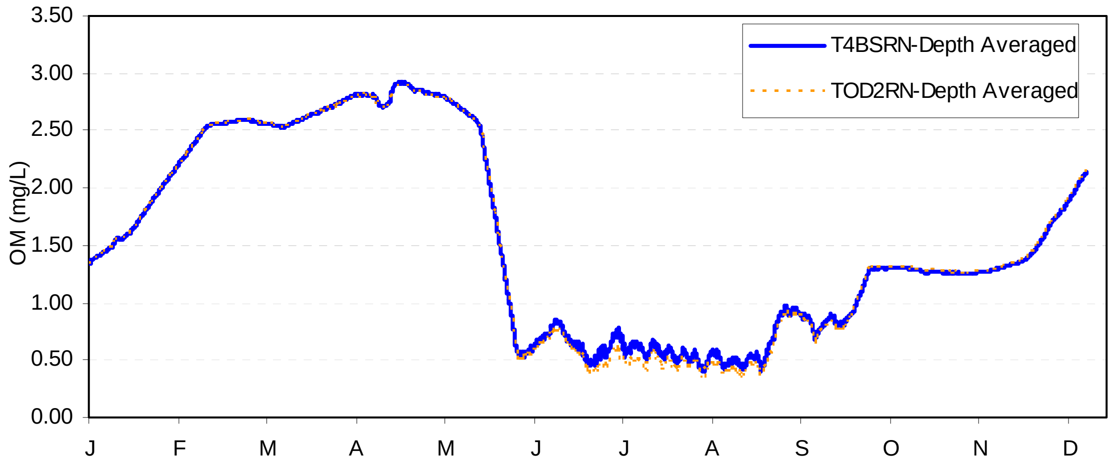




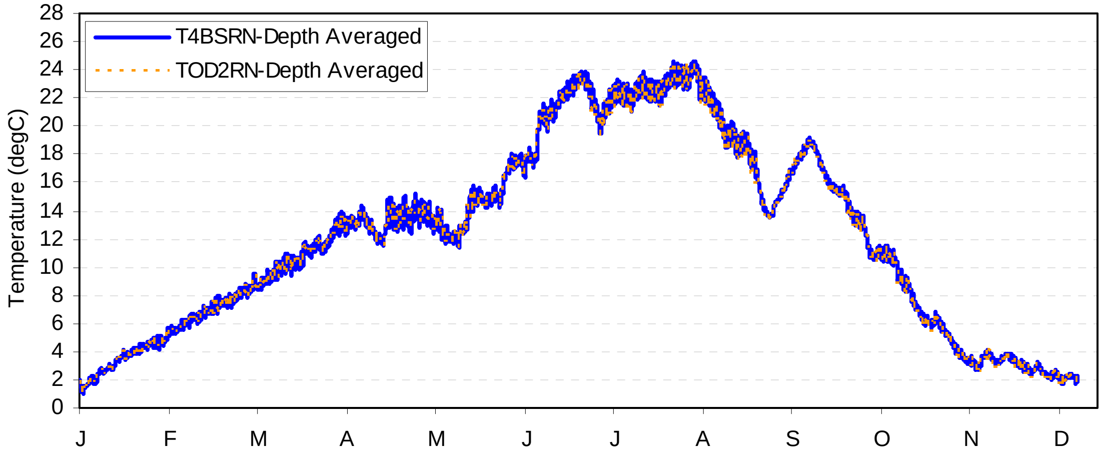


South Suburban Sanitary

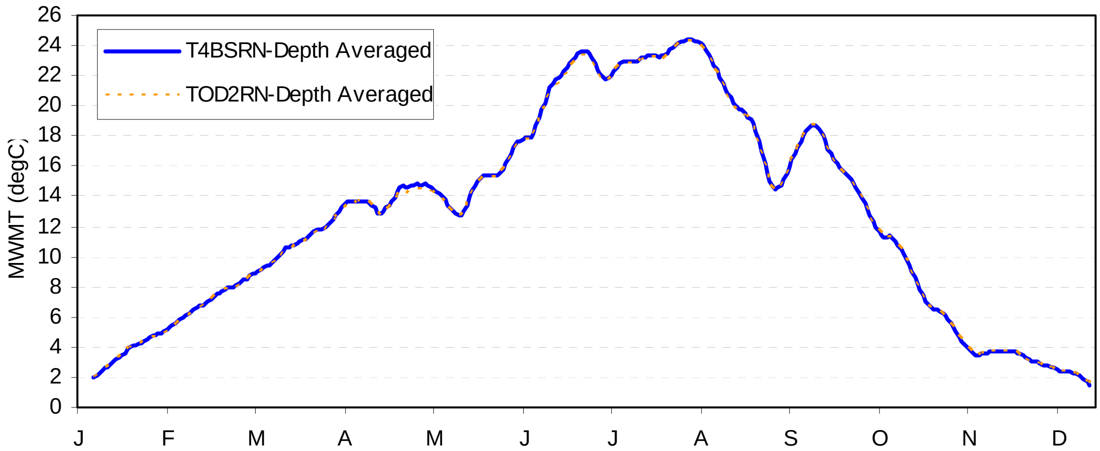




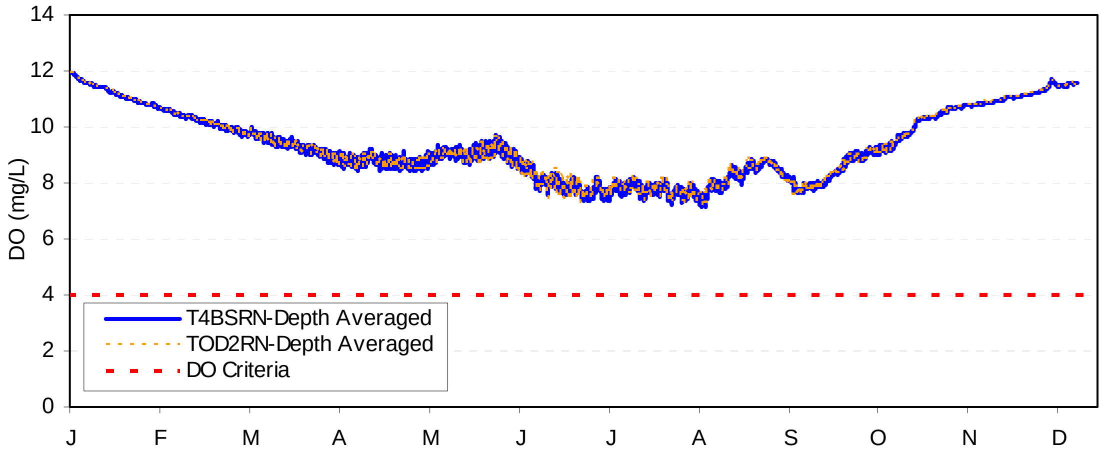
LRDC - CP



Temperature (degC)
28
26
24
22
20
18
16
14
12
10
8
6
4
2
0
T4BSRN-Depth Averaged
TOD2RN-Depth Averaged
J F M A M J J A S O N D

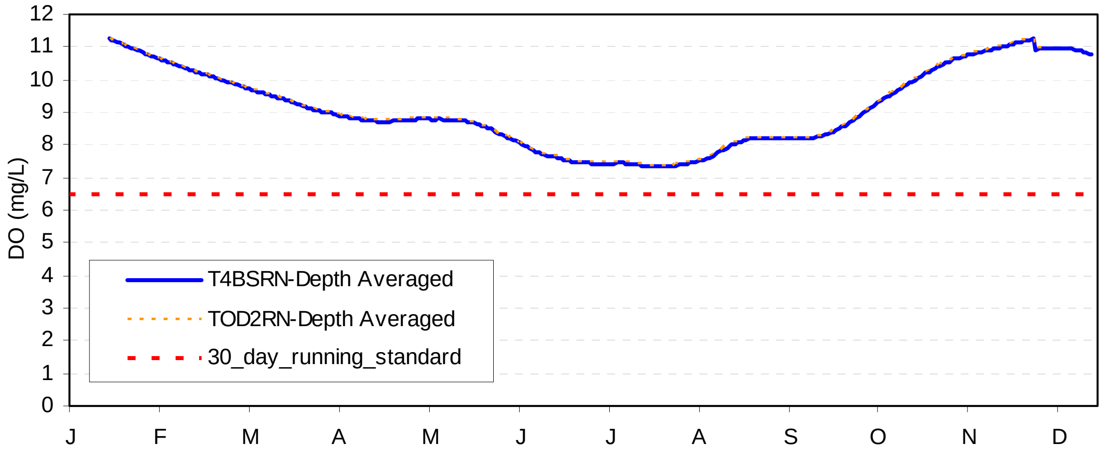


MWMT (degC)
26
24
22
20
18
16
14
12
10
8
6
4
2
0
T4BSRN-Depth Averaged
TOD2RN-Depth Averaged
J F M A M J J A S O N D

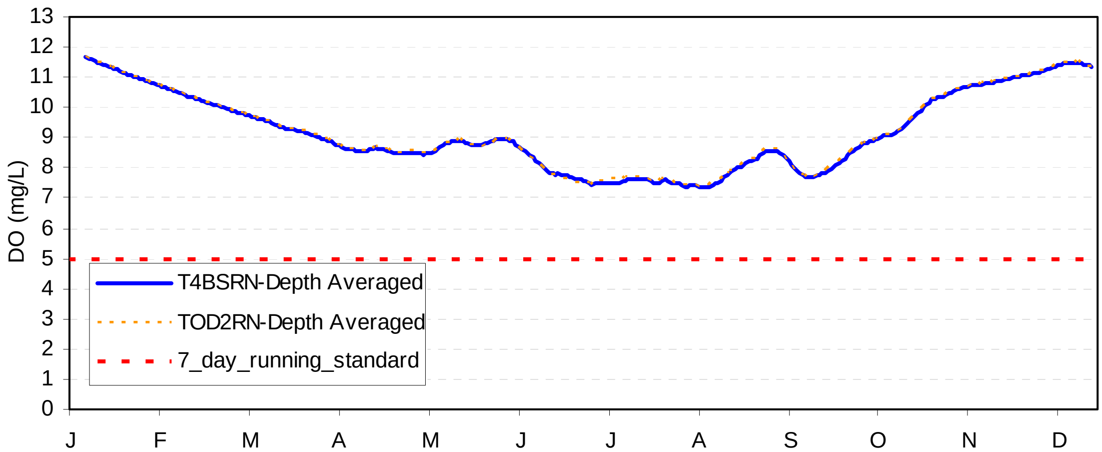


DO (mg/L)
14
12
10
8
6
4
2
0
T4BSRN-Depth Averaged
TOD2RN-Depth Averaged
DO Criteria
J F M A M J J A S O N D

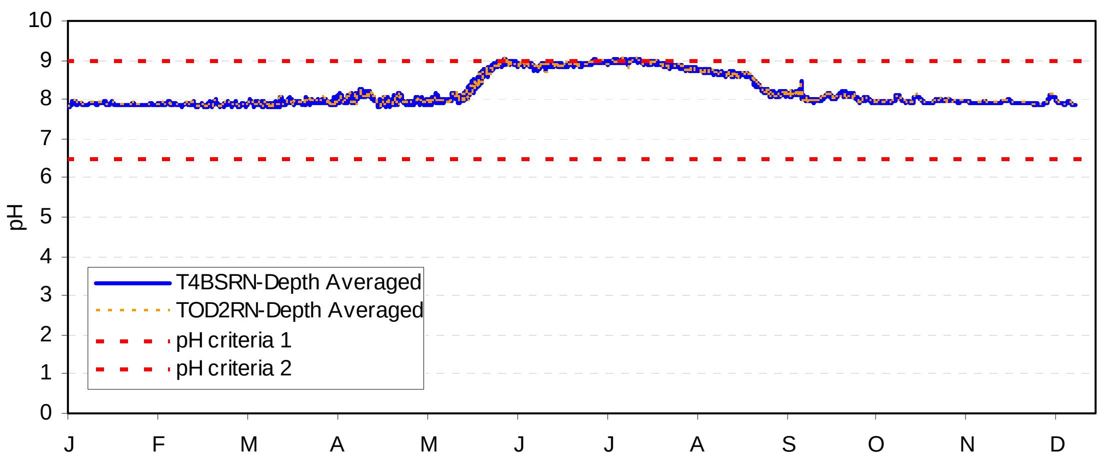
LRDC - CP



DO (mg/L)
12
11
10
9
8
7
6
5
4
3
2
1
0
T4BSRN-Depth Averaged
TOD2RN-Depth Averaged
30_day_running_standard
J
F
M
A
M
J
J
A
S
O
N
D

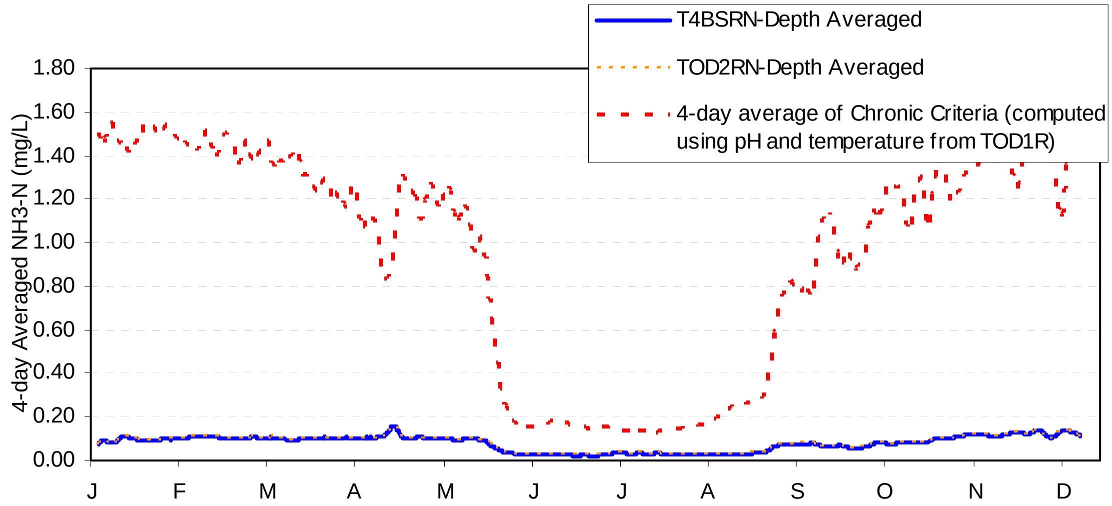


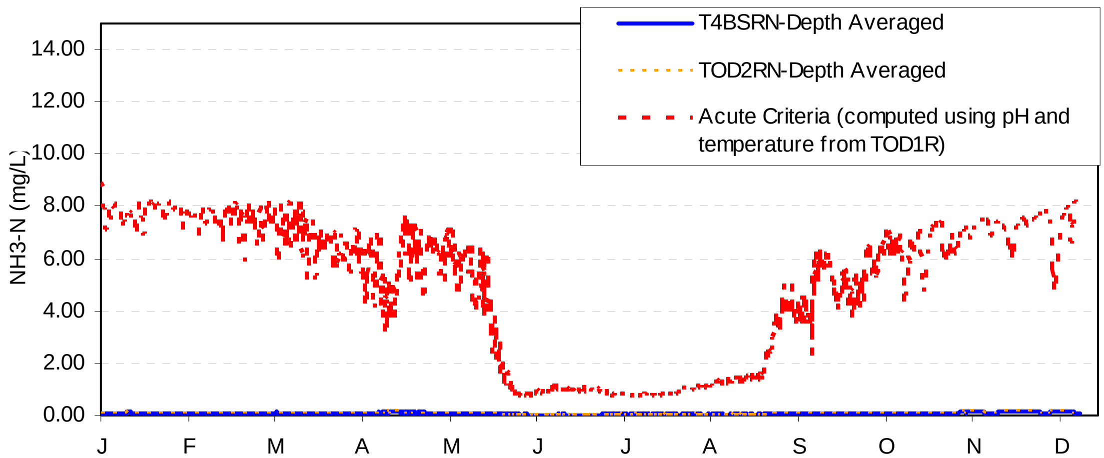
DO (mg/L)
13
12
11
10
9
8
7
6
5
4
3
2
1
0
T4BSRN-Depth Averaged
TOD2RN-Depth Averaged
7_day_running_standard
J
F
M
A
M
J
J
A
S
O
N
D

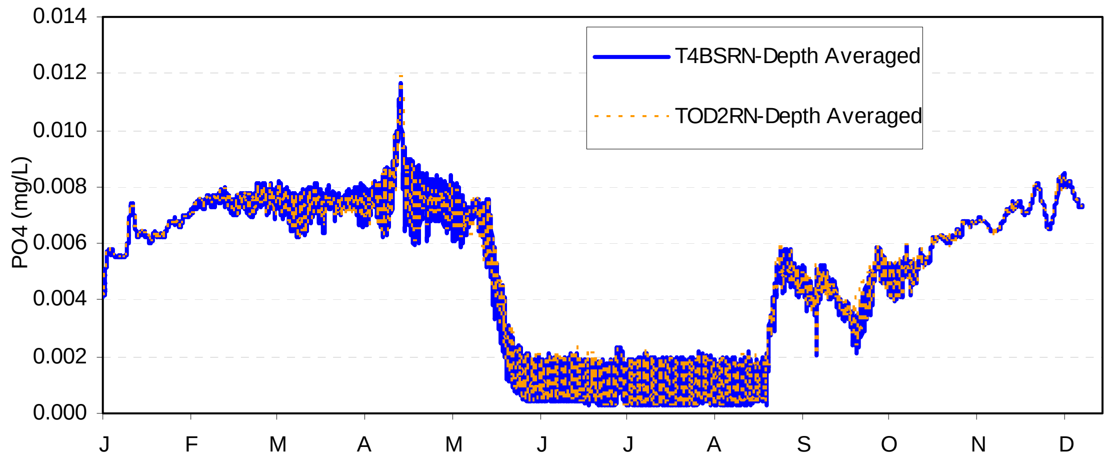


pH
10
9
8
7
6
5
4
3
2
1
0
T4BSRN-Depth Averaged
TOD2RN-Depth Averaged
pH criteria 1
pH criteria 2
J
F
M
A
M
J
J
A
S
O
N
D

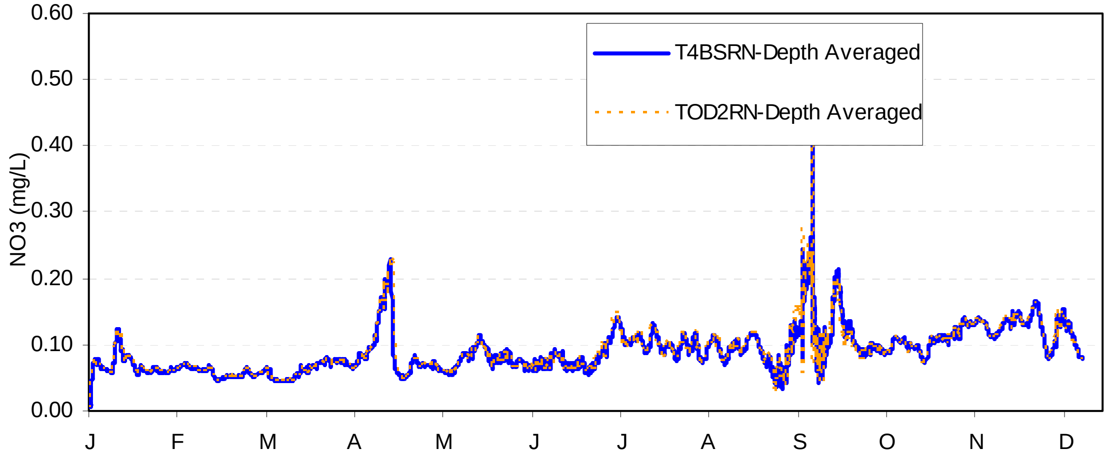
LRDC - CP


T4BSRN-Depth Averaged
TOD2RN-Depth Averaged
4-day average of Chronic Criteria (computed using pH and temperature from TOD1R)
4-day Averaged NH3-N (mg/L)
1.80
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
J F M A M J J A S O N D

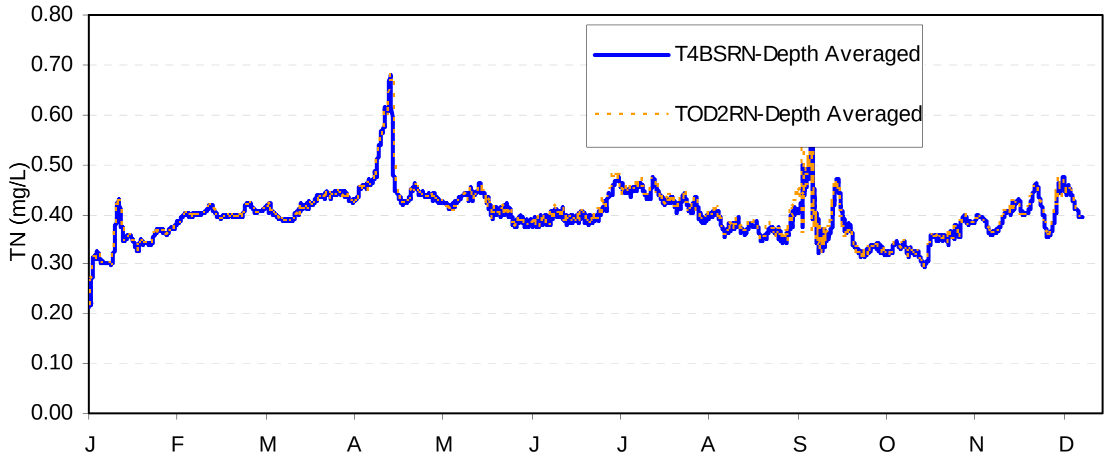

T4BSRN-Depth Averaged
TOD2RN-Depth Averaged
Acute Criteria (computed using pH and temperature from TOD1R)
NH3-N (mg/L)
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
J F M A M J J A S O N D


T4BSRN-Depth Averaged
TOD2RN-Depth Averaged
PO4 (mg/L)
0.014
0.012
0.010
0.008
0.006
0.004
0.002
0.000
J F M A M J J A S O N D

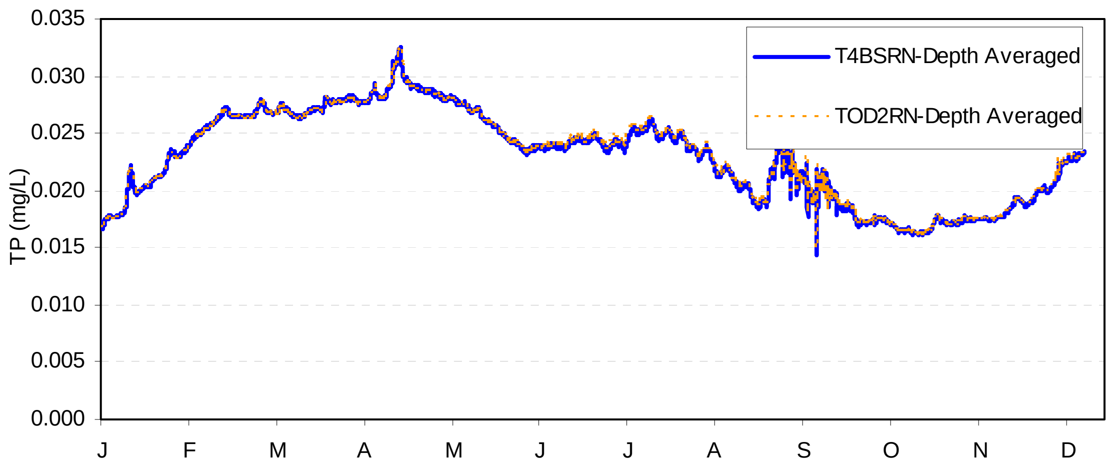
LRDC - CP



0.60
0.50
0.40
0.30
0.20
0.10
0.00
NO3 (mg/L)
J
F
M
A
M
J
J
A
S
O
N
D
T4BSRN-Depth Averaged
TOD2RN-Depth Averaged

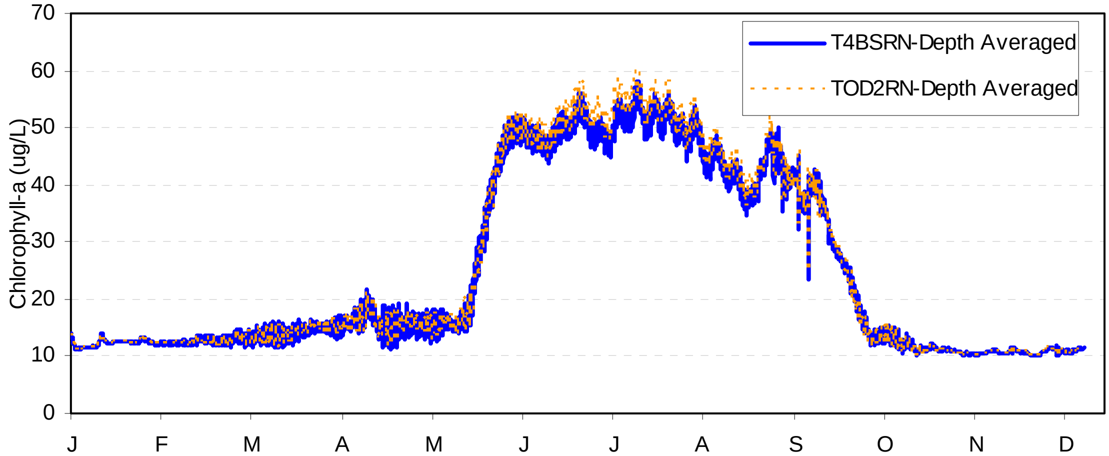


0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
TN (mg/L)
J
F
M
A
M
J
J
A
S
O
N
D
T4BSRN-Depth Averaged
TOD2RN-Depth Averaged

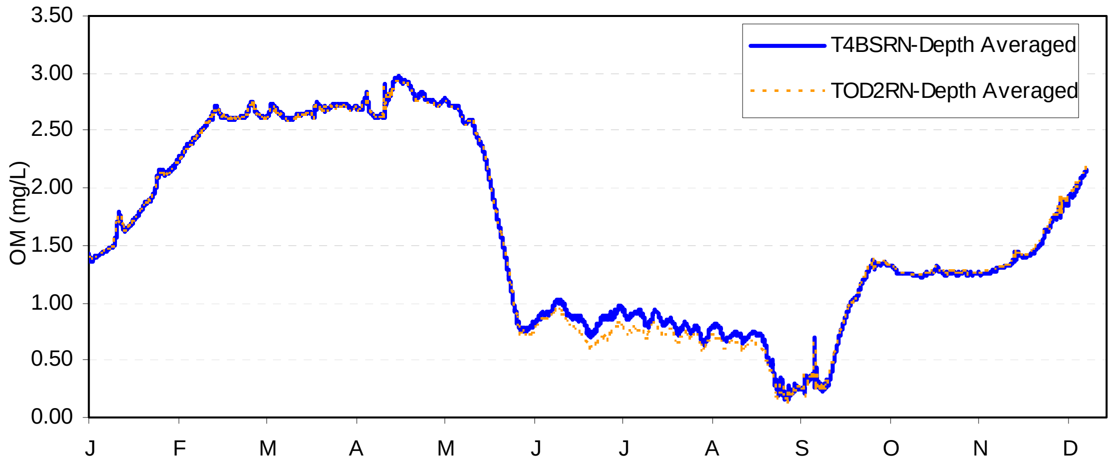


0.035
0.030
0.025
0.020
0.015
0.010
0.005
0.000
TP (mg/L)
J
F
M
A
M
J
J
A
S
O
N
D
T4BSRN-Depth Averaged
TOD2RN-Depth Averaged

LRDC - CP

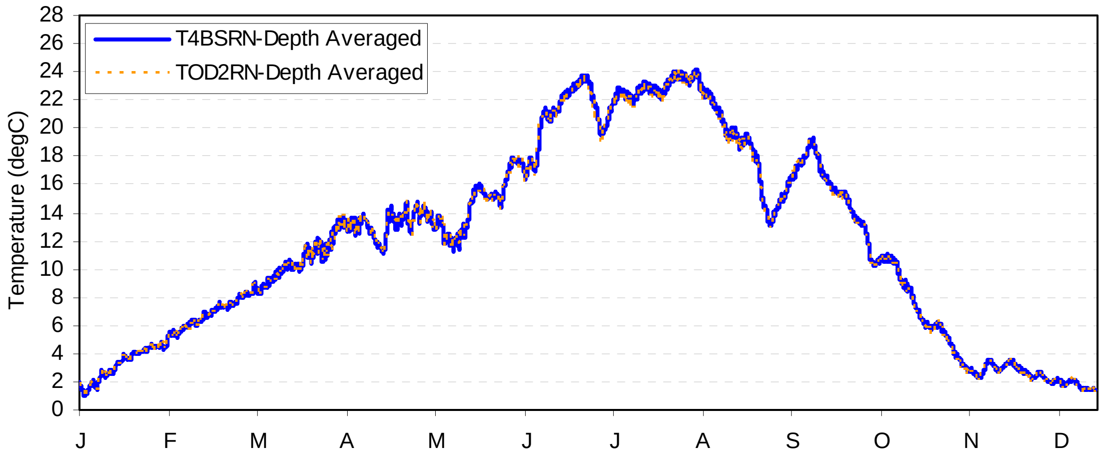


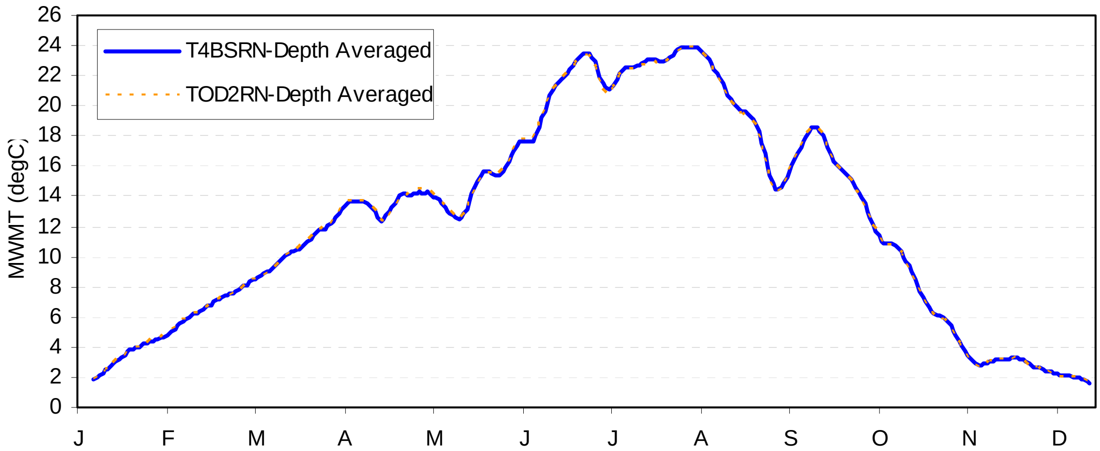
Chlorophyll-a (ug/L)
70
60
50
40
30
20
10
0
T4BSRN-Depth Averaged
TOD2RN-Depth Averaged
J
F
M
A
M
J
J
A
S
O
N
D

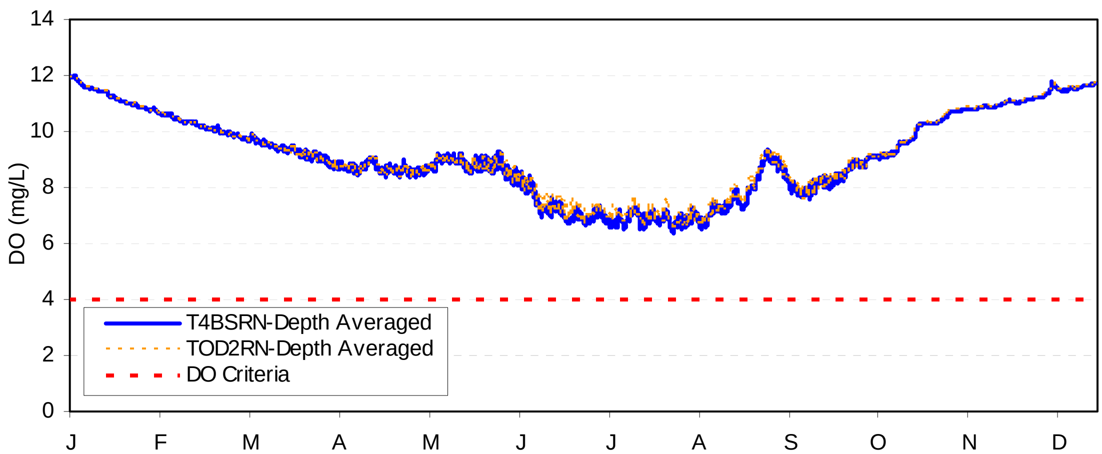


OM (mg/L)
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
T4BSRN-Depth Averaged
TOD2RN-Depth Averaged
J
F
M
A
M
J
J
A
S
O
N
D

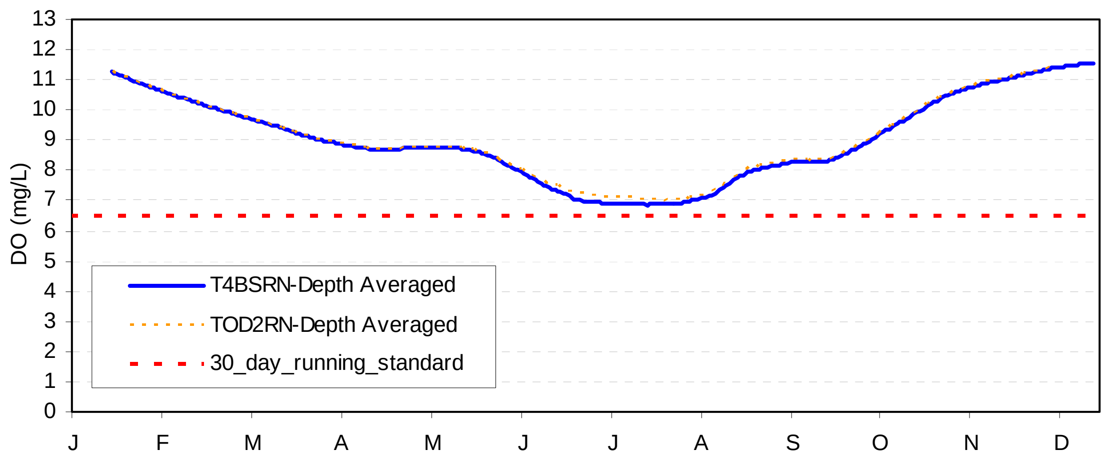
Miller Island

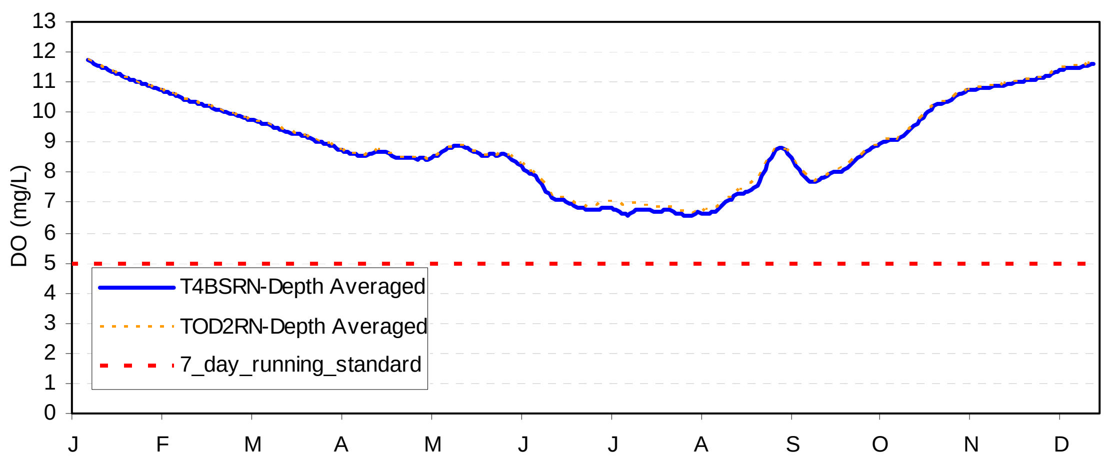


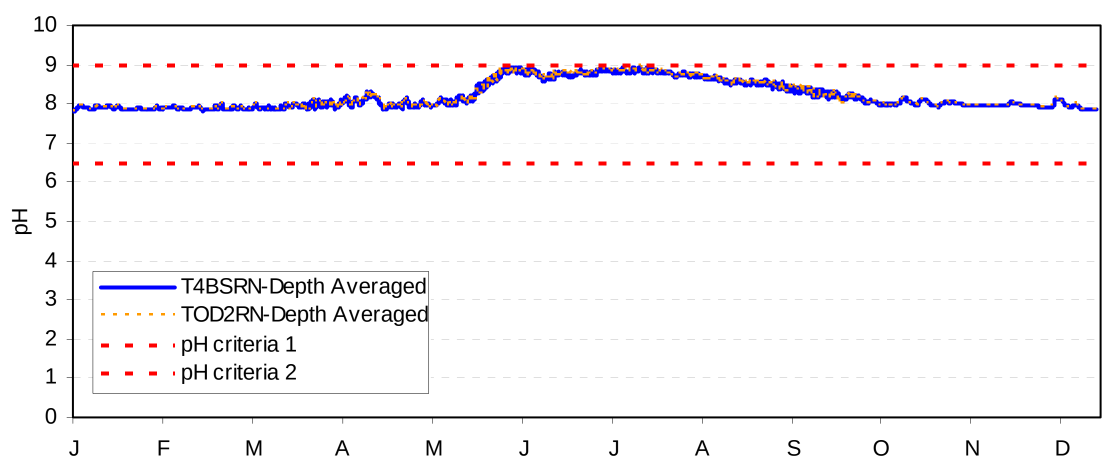




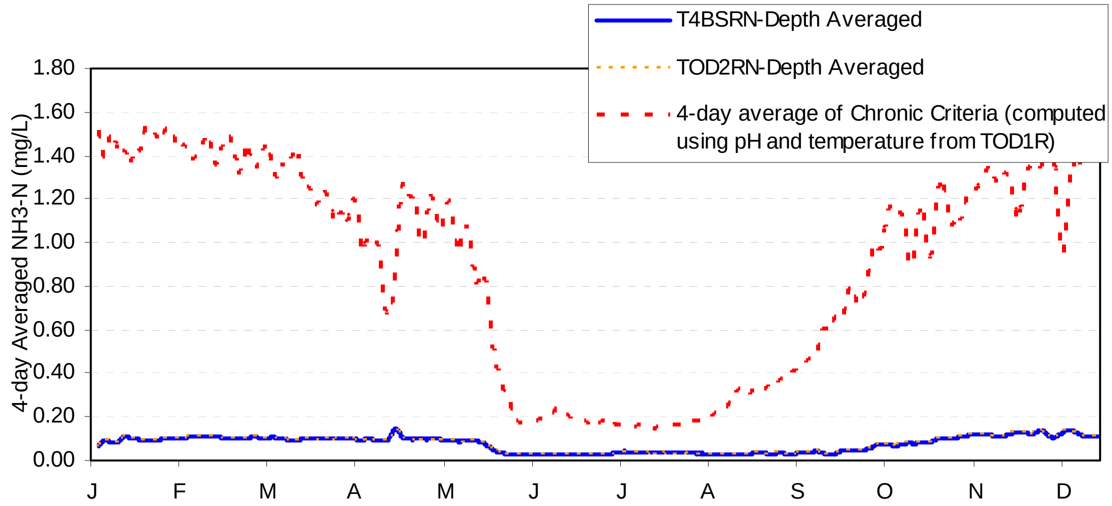
Miller Island

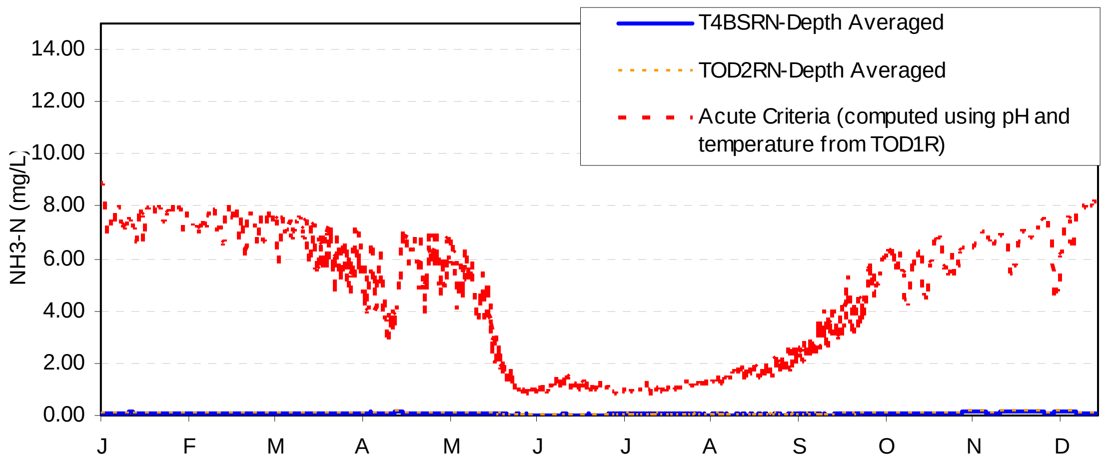


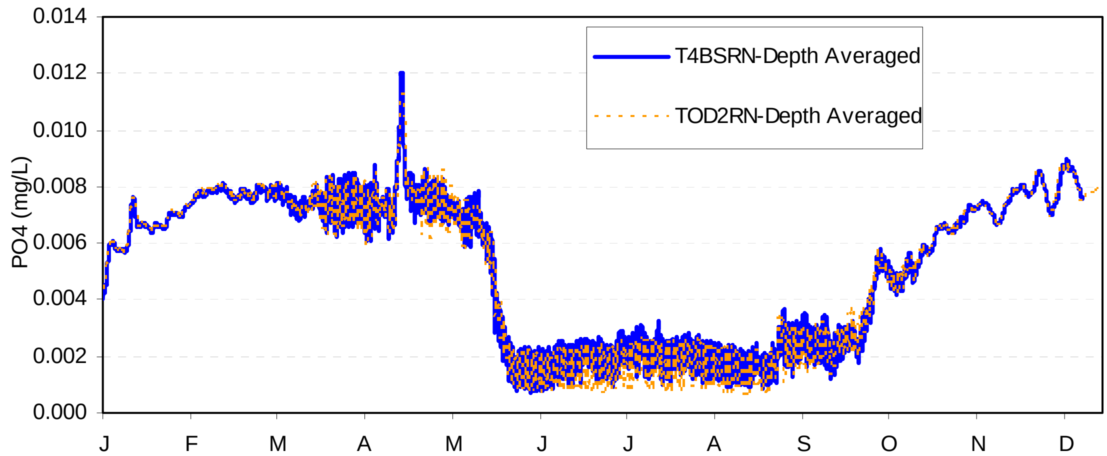




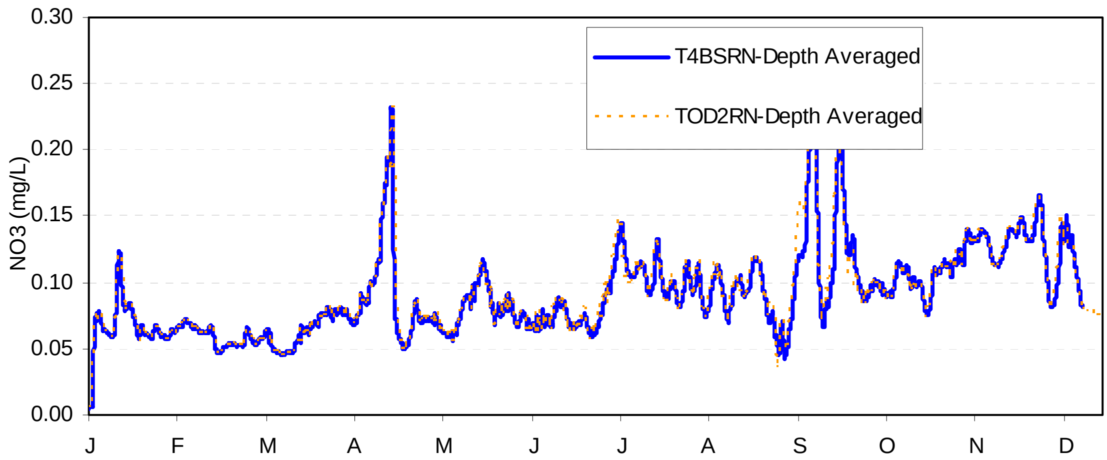
Miller Island

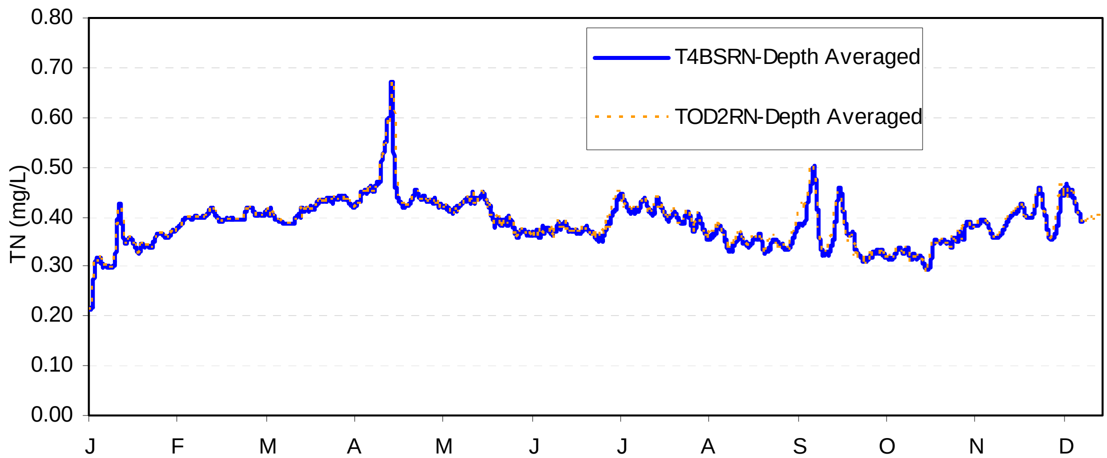


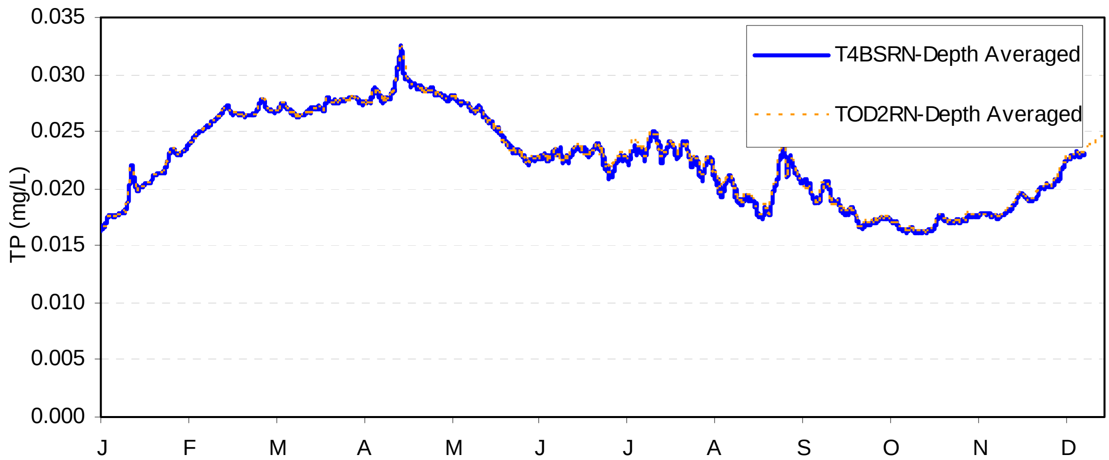




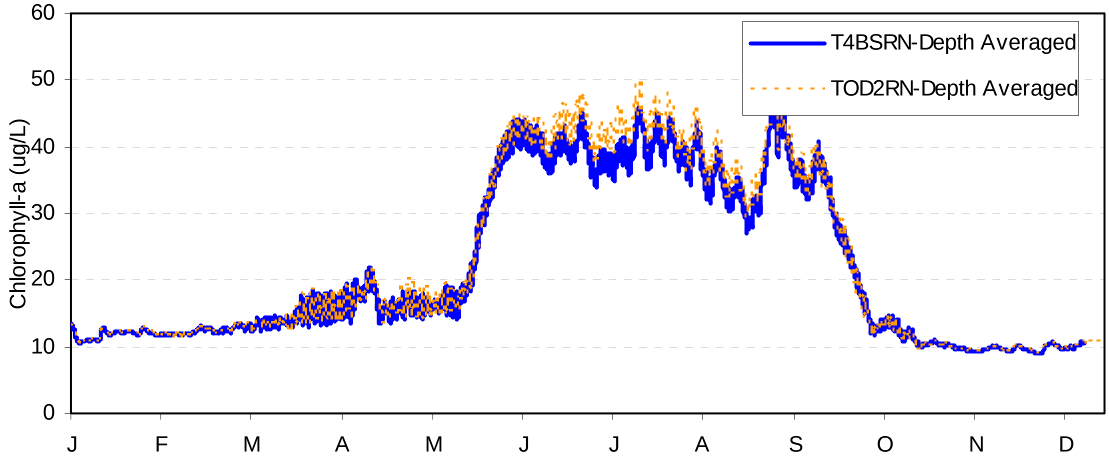
Miller Island

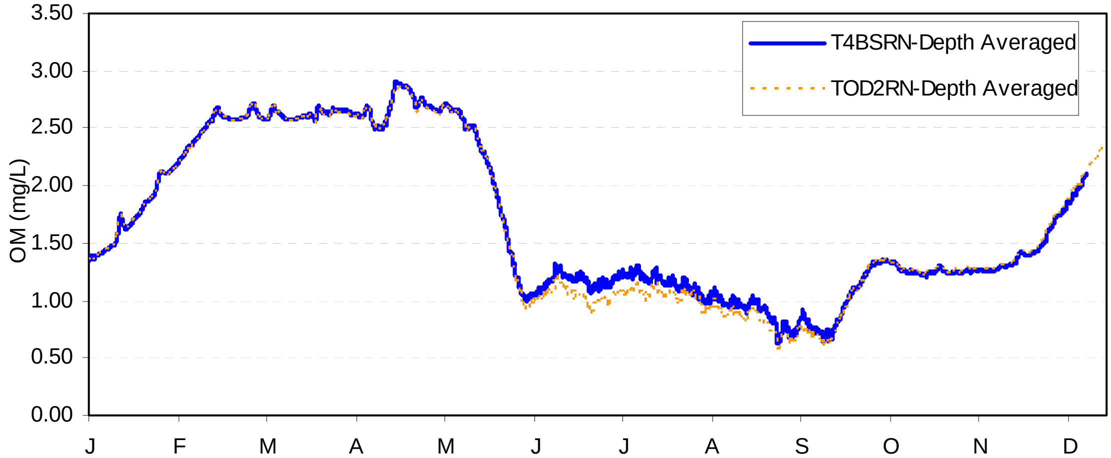




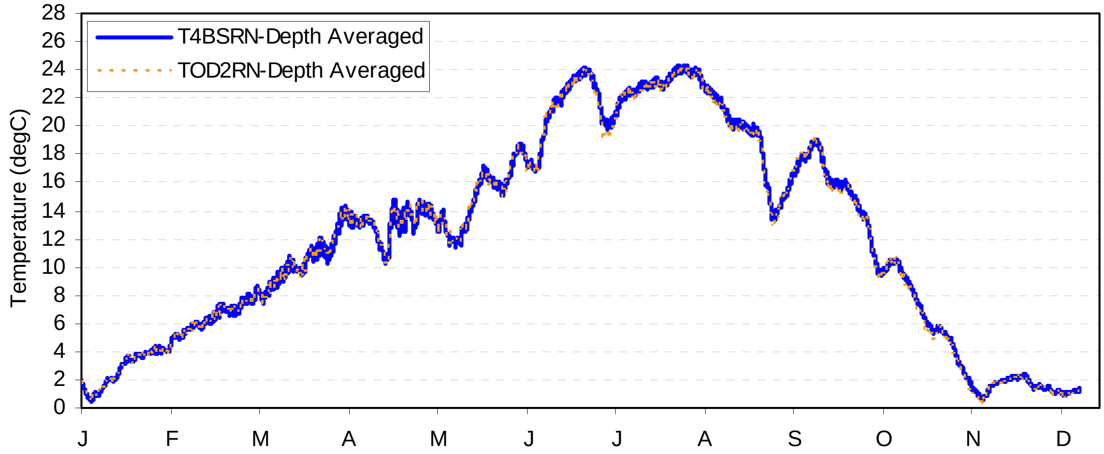


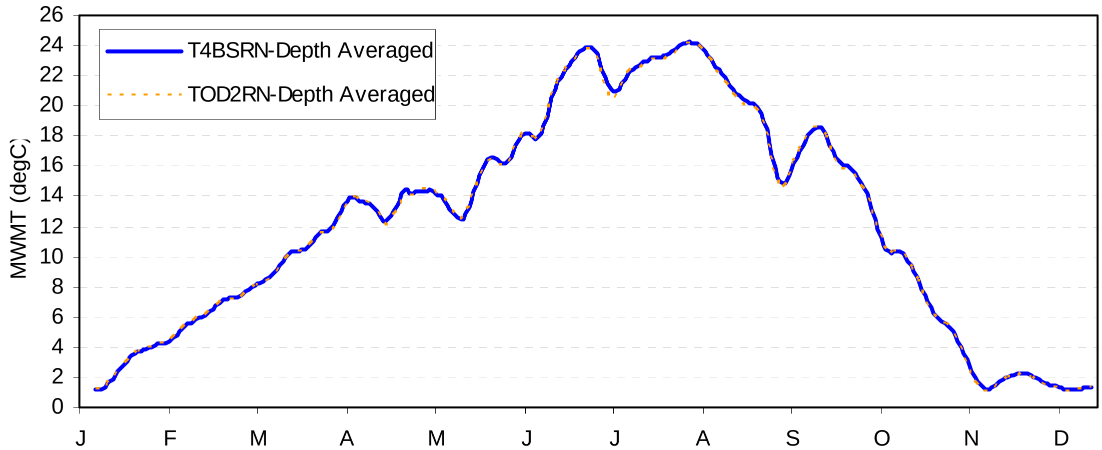
Miller Island

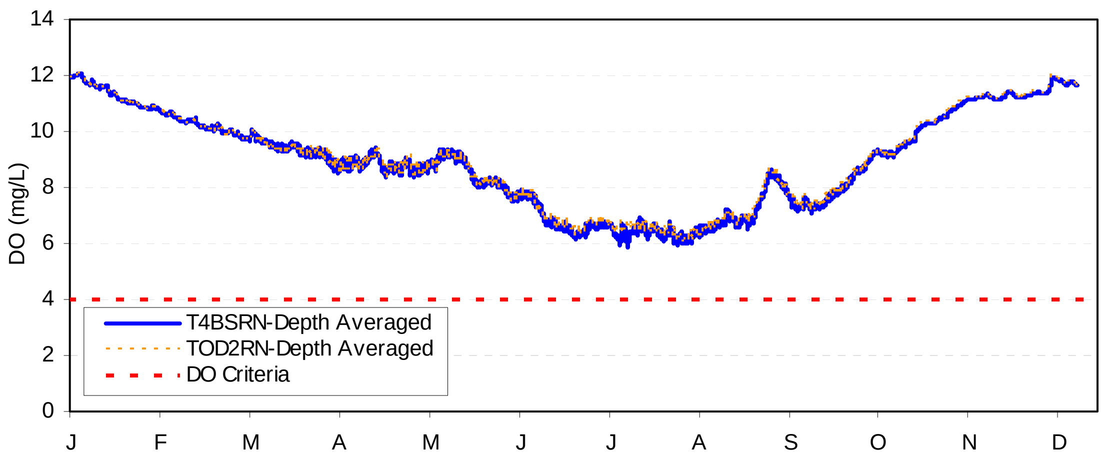




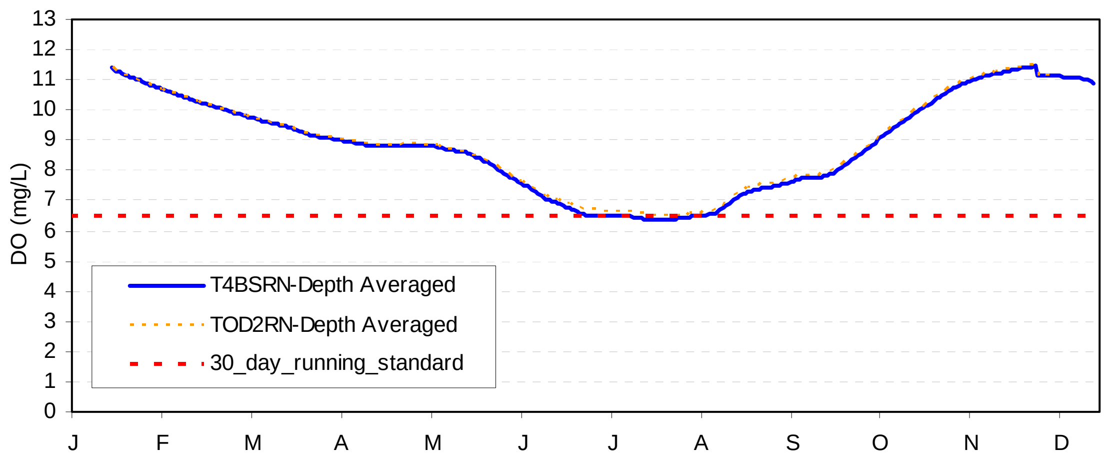
KSD


Temperature (degC)
28
26
24
22
20
18
16
14
12
10
8
6
4
2
0
T4BSRN-Depth Averaged
TOD2RN-Depth Averaged
J F M A M J J A S O N D

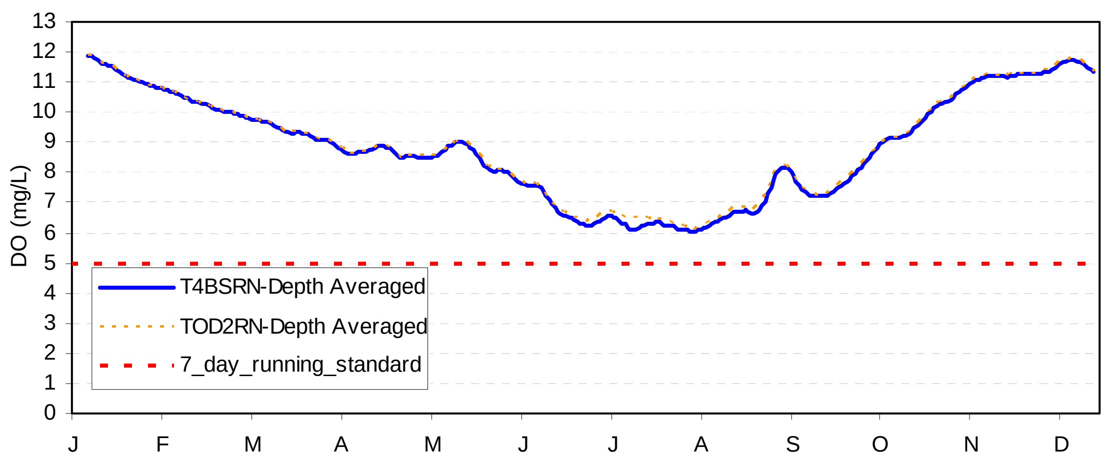

MWMT (degC)
26
24
22
20
18
16
14
12
10
8
6
4
2
0
T4BSRN-Depth Averaged
TOD2RN-Depth Averaged
J F M A M J J A S O N D


DO (mg/L)
14
12
10
8
6
4
2
0
T4BSRN-Depth Averaged
TOD2RN-Depth Averaged
DO Criteria
J F M A M J J A S O N D

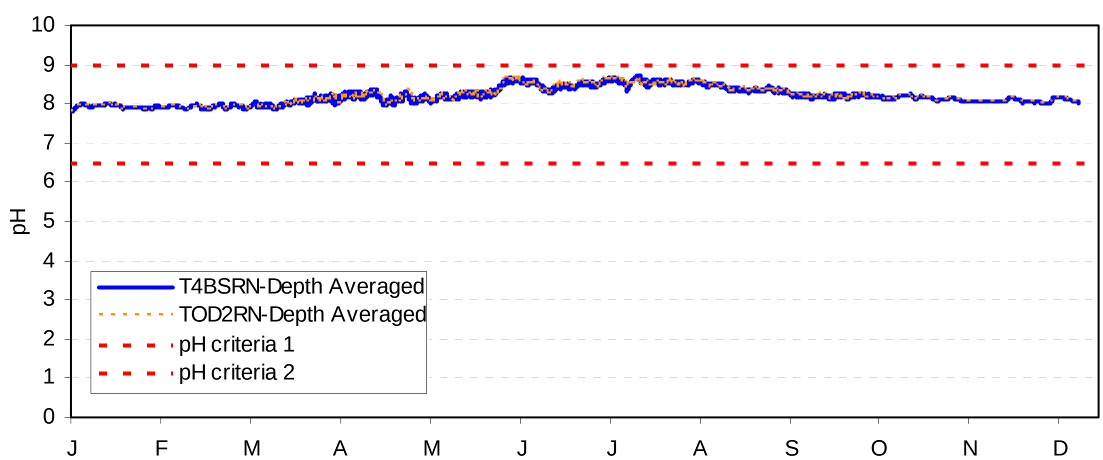
KSD



13
12
11
10
9
8
7
6
5
4
3
2
1
0
DO (mg/L)
T4BSRN-Depth Averaged
TOD2RN-Depth Averaged
30_day_running_standard
J
F
M
A
M
J
J
A
S
O
N
D

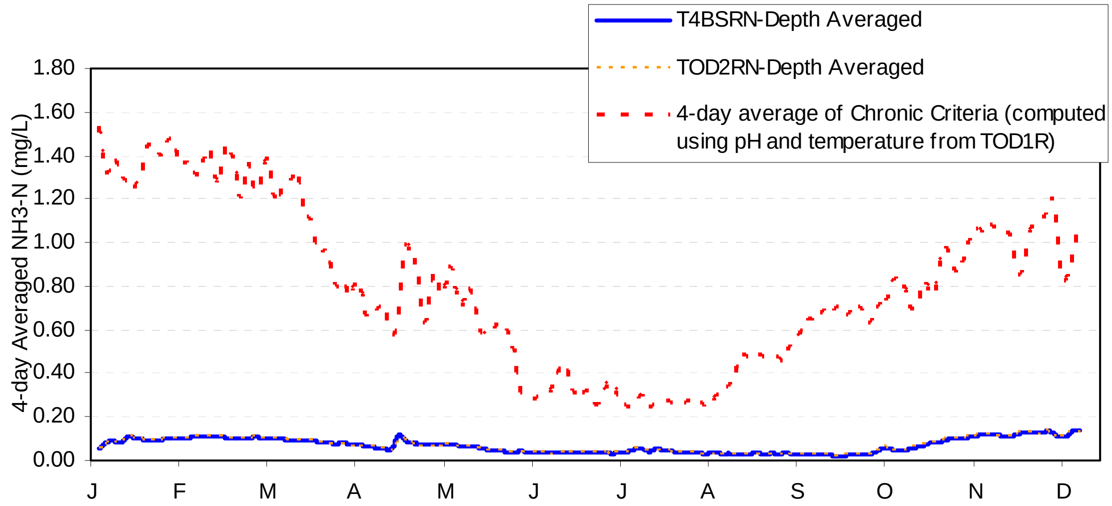


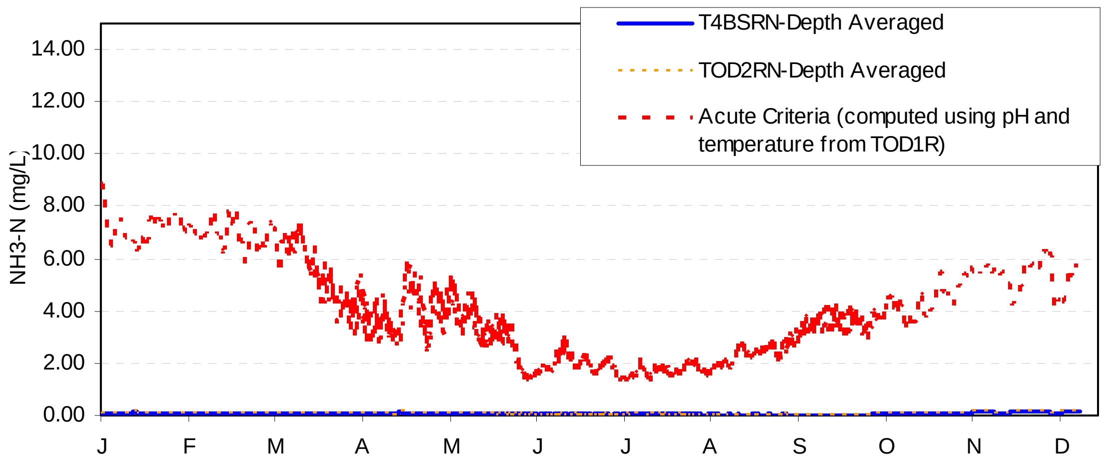
13
12
11
10
9
8
7
6
5
4
3
2
1
0
DO (mg/L)
T4BSRN-Depth Averaged
TOD2RN-Depth Averaged
7_day_running_standard
J
F
M
A
M
J
J
A
S
O
N
D

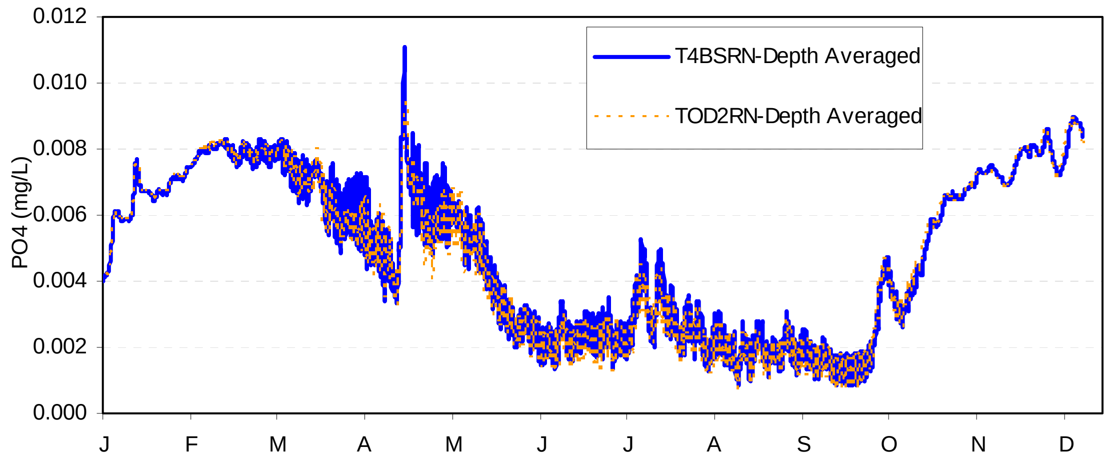


10
9
8
7
6
5
4
3
2
1
0
pH
T4BSRN-Depth Averaged
TOD2RN-Depth Averaged
pH criteria 1
pH criteria 2
J
F
M
A
M
J
J
A
S
O
N
D

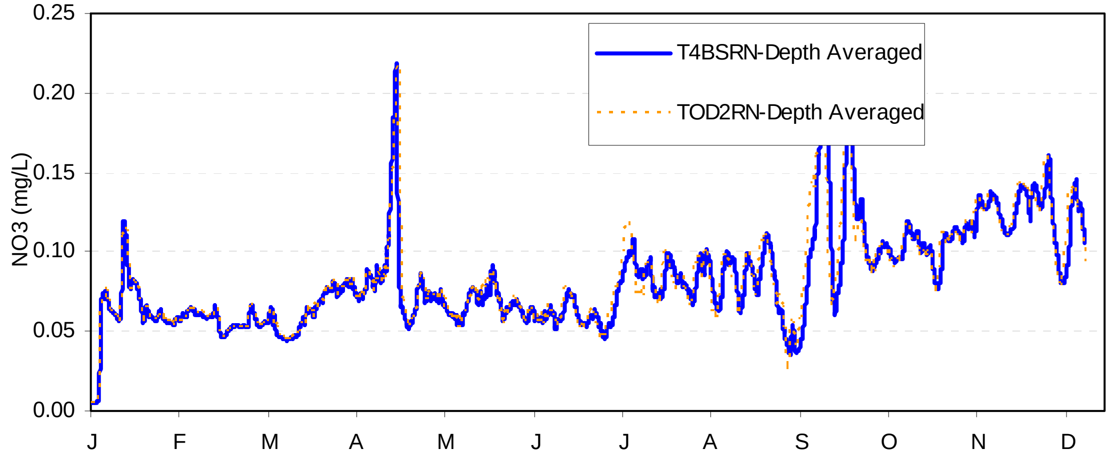
KSD


T4BSRN-Depth Averaged
TOD2RN-Depth Averaged
4-day average of Chronic Criteria (computed using pH and temperature from TOD1R)
4-day Averaged NH3-N (mg/L)
1.80
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
J F M A M J J A S O N D

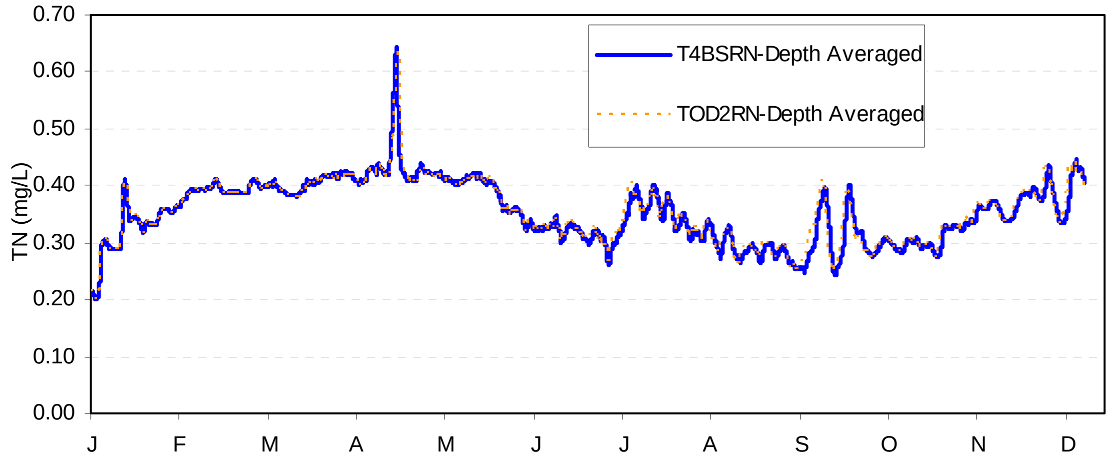

T4BSRN-Depth Averaged
TOD2RN-Depth Averaged
Acute Criteria (computed using pH and temperature from TOD1R)
NH3-N (mg/L)
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
J F M A M J J A S O N D


T4BSRN-Depth Averaged
TOD2RN-Depth Averaged
PO4 (mg/L)
0.012
0.010
0.008
0.006
0.004
0.002
0.000
J F M A M J J A S O N D

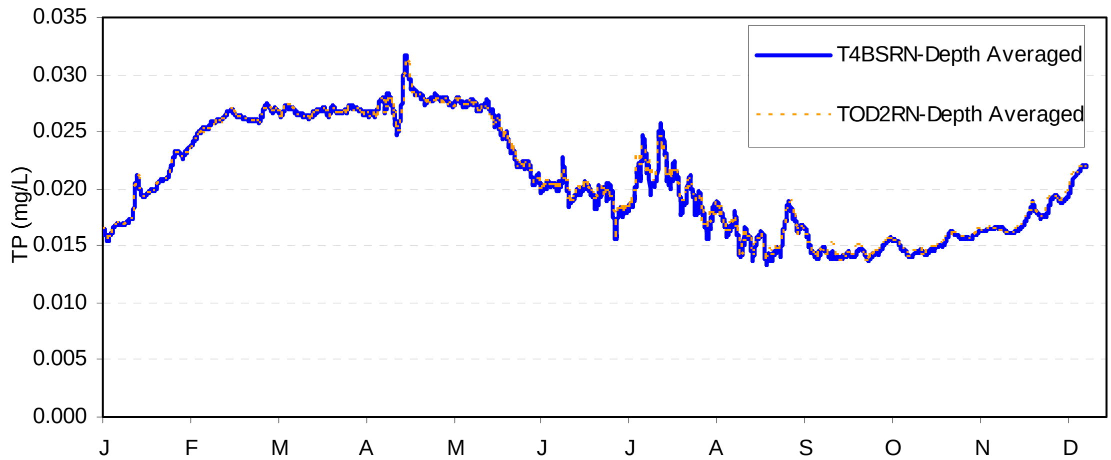
KSD



0.25
0.20
0.15
0.10
0.05
0.00
NO3 (mg/L)
J F M A M J J A S O N D
T4BSRN-Depth Averaged
TOD2RN-Depth Averaged

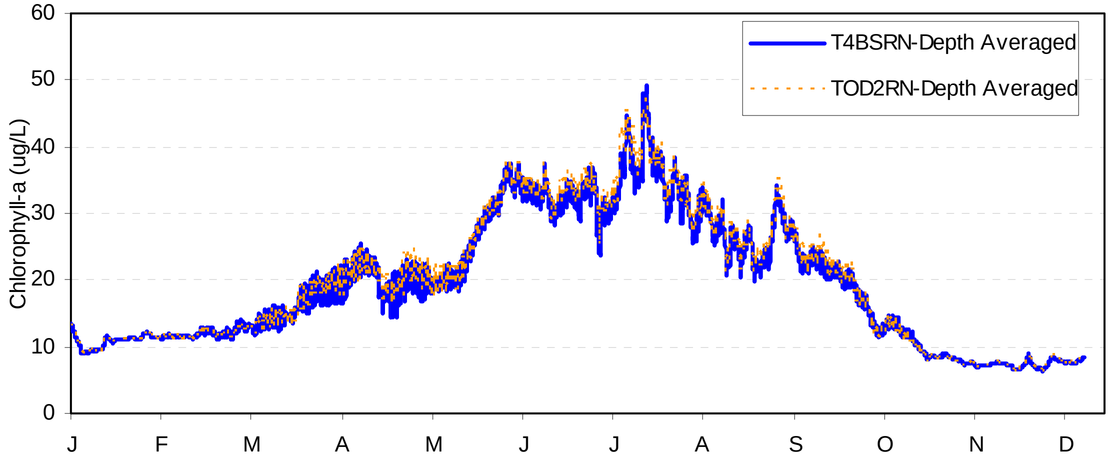


0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
TN (mg/L)
J F M A M J J A S O N D
T4BSRN-Depth Averaged
TOD2RN-Depth Averaged

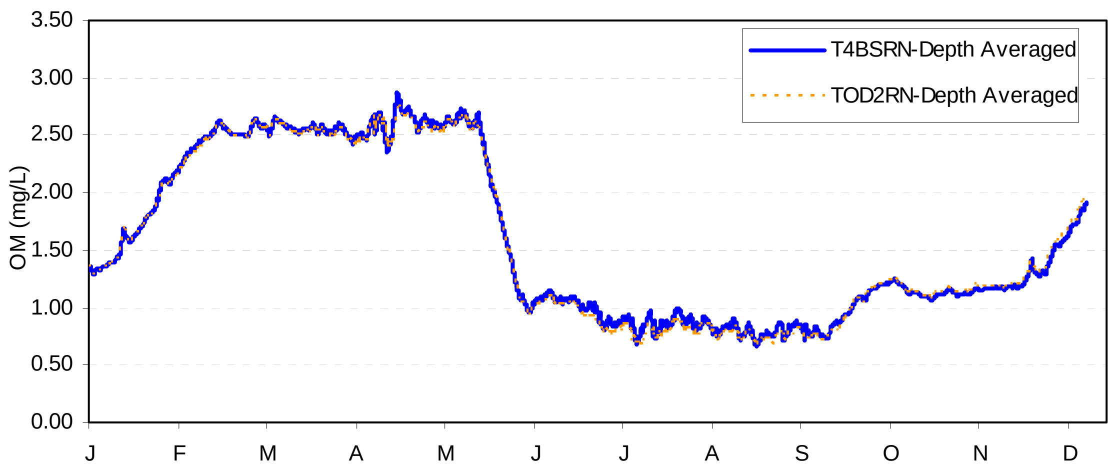


0.035
0.030
0.025
0.020
0.015
0.010
0.005
0.000
TP (mg/L)
J F M A M J J A S O N D
T4BSRN-Depth Averaged
TOD2RN-Depth Averaged

KSD

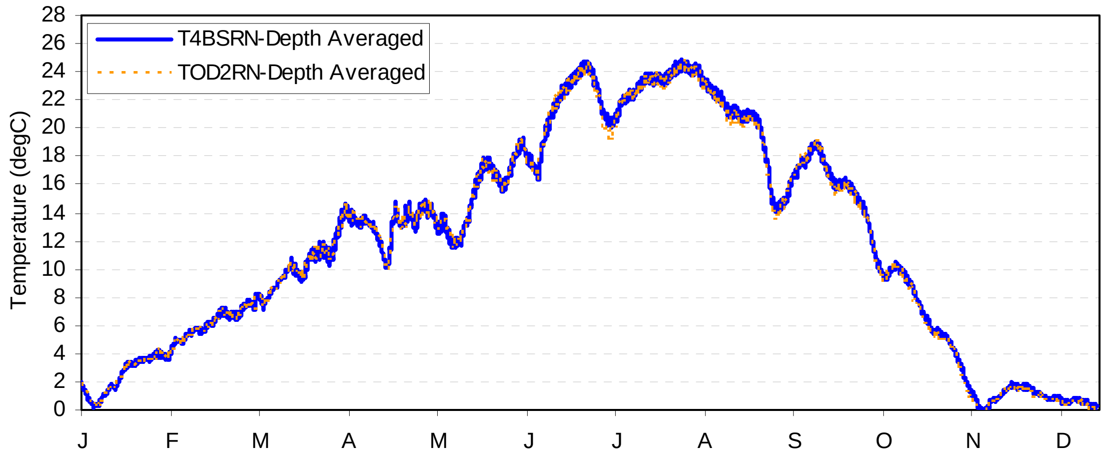


60
50
40
30
20
10
0
Chlorophyll-a (ug/L)
J
F
M
A
M
J
J
A
S
O
N
D
T4BSRN-Depth Averaged
TOD2RN-Depth Averaged

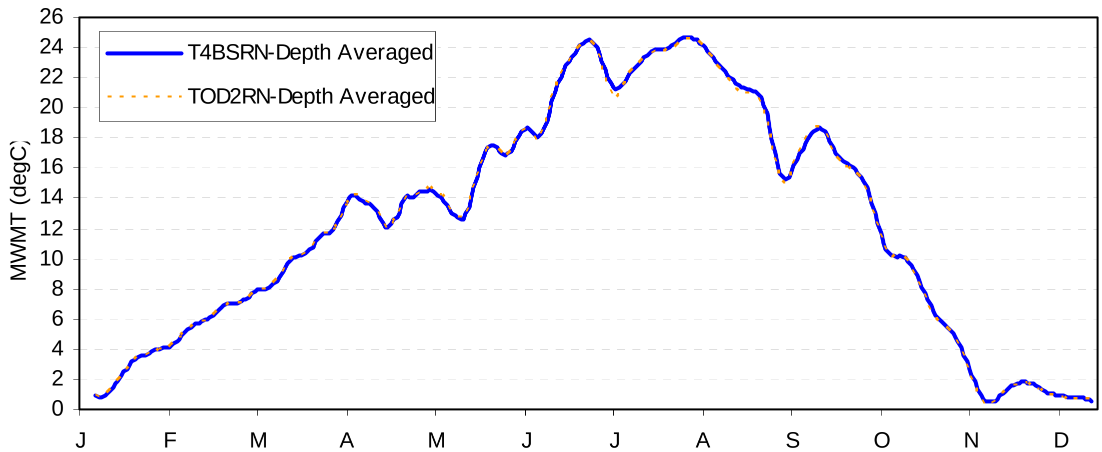


3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
OM (mg/L)
J
F
M
A
M
J
J
A
S
O
N
D
T4BSRN-Depth Averaged
TOD2RN-Depth Averaged

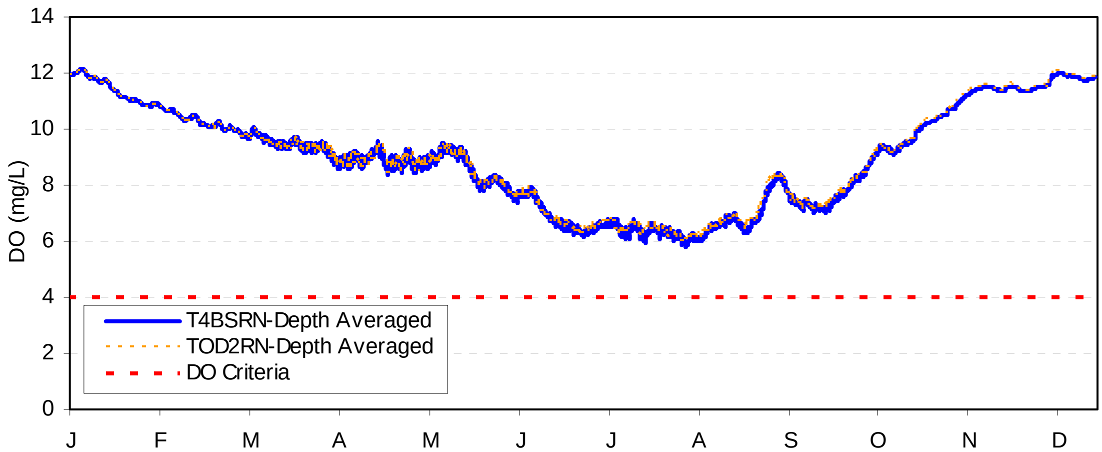
Hwy 66



T4BSRN-Depth Averaged
TOD2RN-Depth Averaged
Temperature (degC)
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
J
F
M
A
M
J
J
A
S
O
N
D

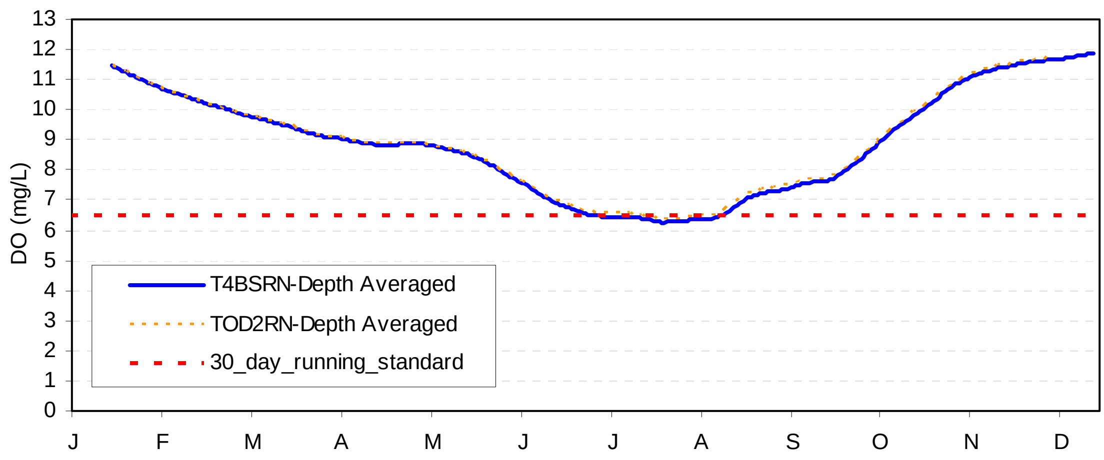


T4BSRN-Depth Averaged
TOD2RN-Depth Averaged
MWMT (degC)
0
2
4
6
8
10
12
14
16
18
20
22
24
26
J
F
M
A
M
J
J
A
S
O
N
D

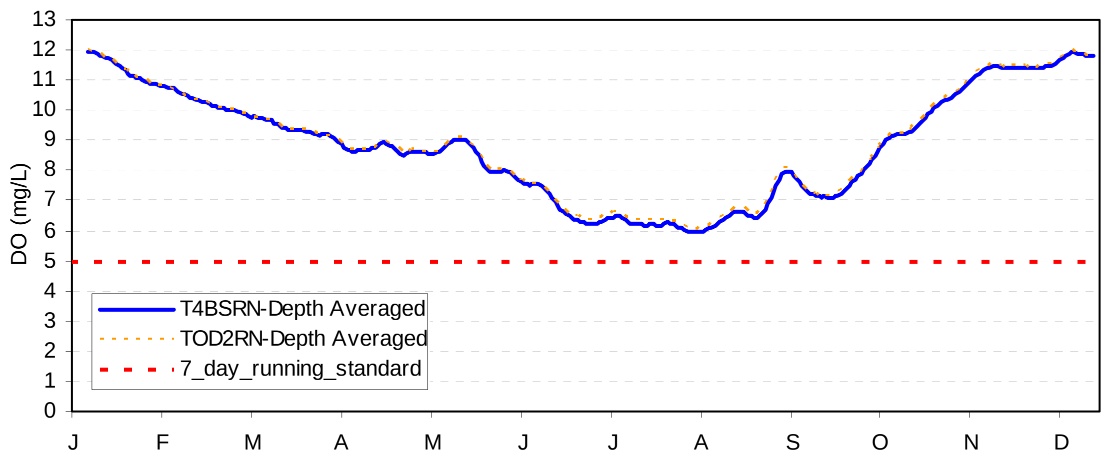


T4BSRN-Depth Averaged
TOD2RN-Depth Averaged
DO Criteria
DO (mg/L)
0
2
4
6
8
10
12
14
J
F
M
A
M
J
J
A
S
O
N
D

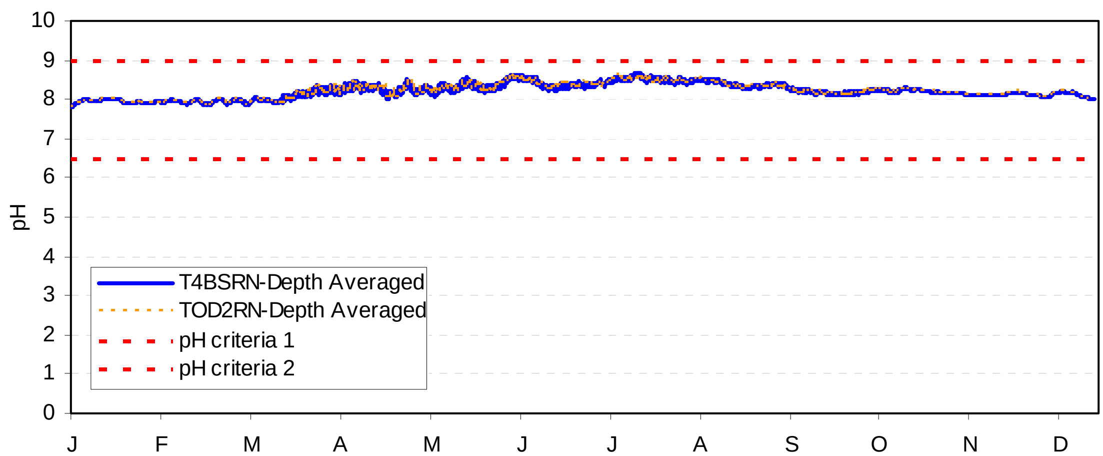
Hwy 66



13
12
11
10
9
8
7
6
5
4
3
2
1
0
DO (mg/L)
T4BSRN-Depth Averaged
TOD2RN-Depth Averaged
30_day_running_standard
J
F
M
A
M
J
J
A
S
O
N
D

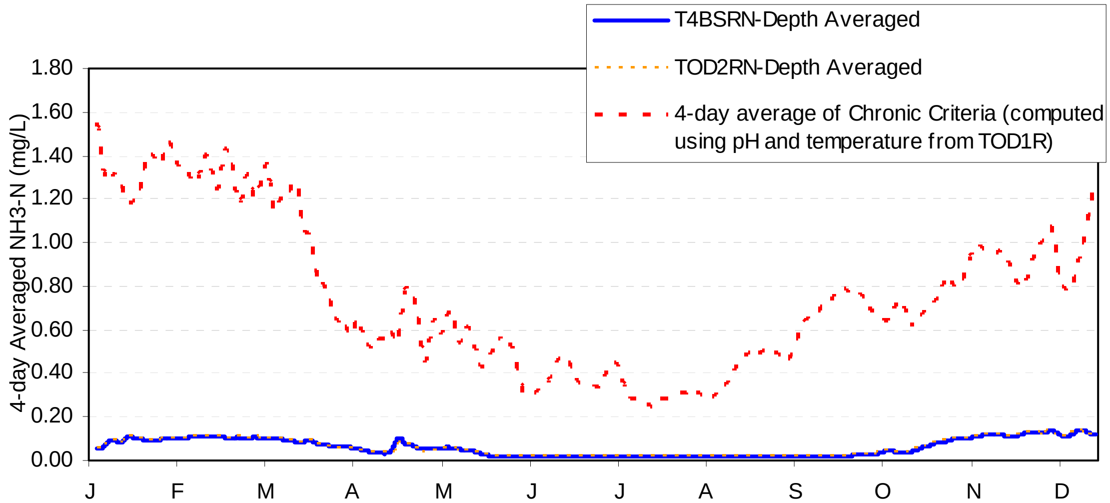


13
12
11
10
9
8
7
6
5
4
3
2
1
0
DO (mg/L)
T4BSRN-Depth Averaged
TOD2RN-Depth Averaged
7_day_running_standard
J
F
M
A
M
J
J
A
S
O
N
D

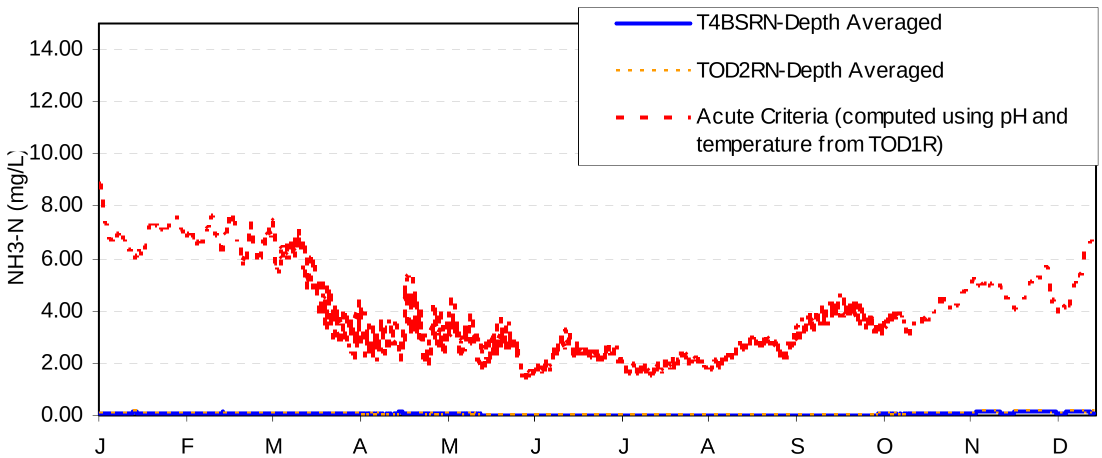


10
9
8
7
6
5
4
3
2
1
0
pH
T4BSRN-Depth Averaged
TOD2RN-Depth Averaged
pH criteria 1
pH criteria 2
J
F
M
A
M
J
J
A
S
O
N
D

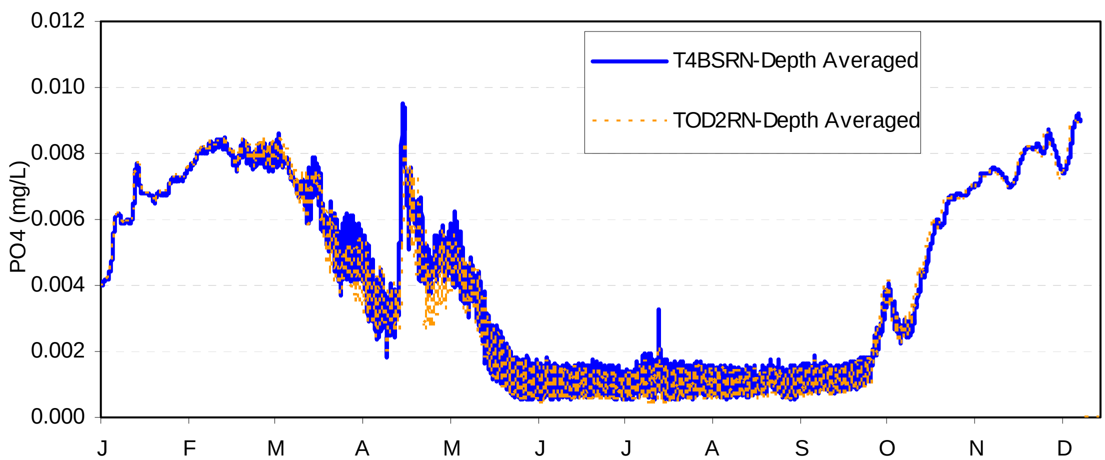
Hwy 66



T4BSRN-Depth Averaged
TOD2RN-Depth Averaged
4-day average of Chronic Criteria (computed using pH and temperature from TOD1R)
4-day Averaged NH3-N (mg/L)
1.80
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
J F M A M J J A S O N D

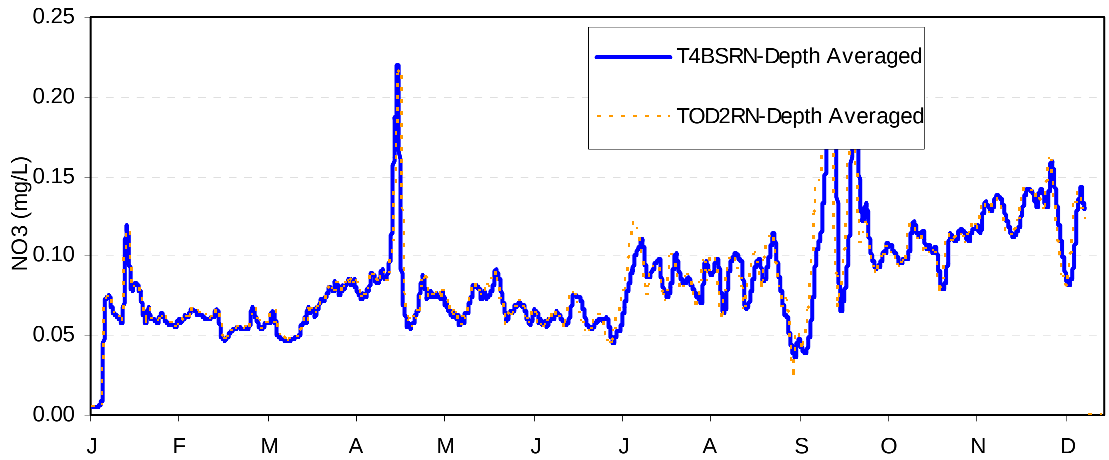


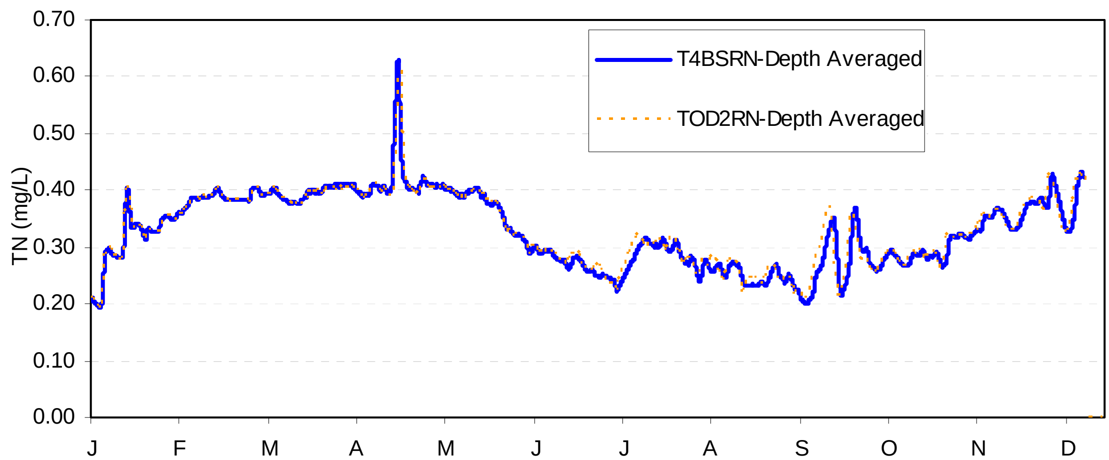
T4BSRN-Depth Averaged
TOD2RN-Depth Averaged
Acute Criteria (computed using pH and temperature from TOD1R)
NH3-N (mg/L)
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
J F M A M J J A S O N D

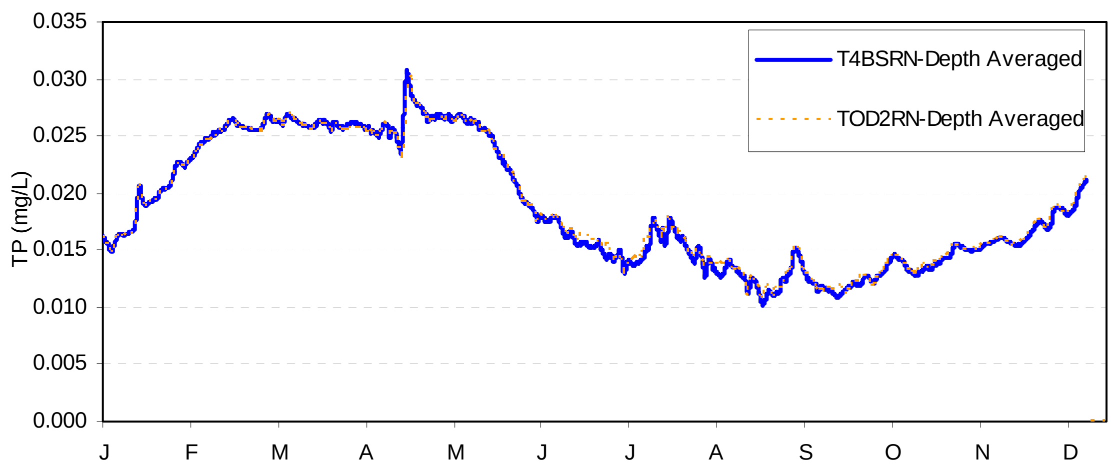


T4BSRN-Depth Averaged
TOD2RN-Depth Averaged
PO4 (mg/L)
0.012
0.010
0.008
0.006
0.004
0.002
0.000
J F M A M J J A S O N D

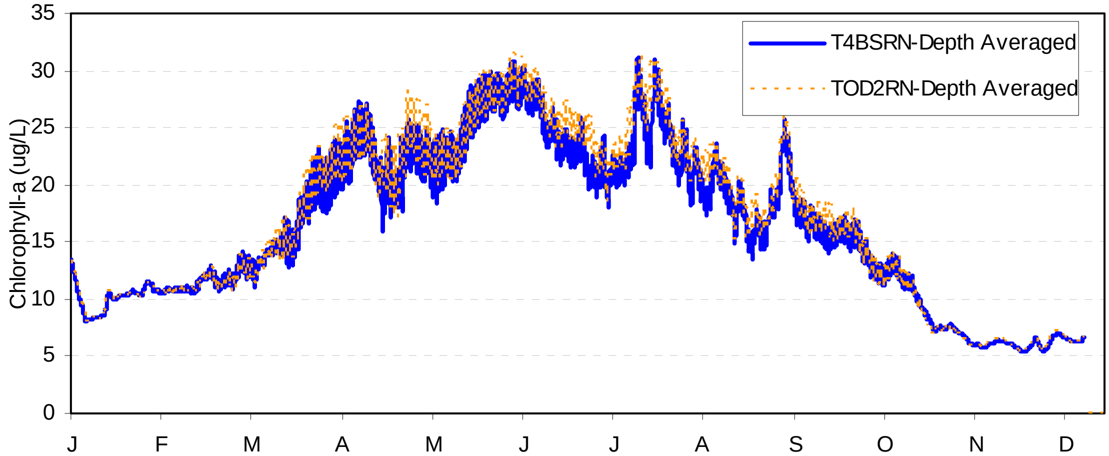
Hwy 66


NO3 (mg/L)
0.25
0.20
0.15
0.10
0.05
0.00
J F M A M J J A S O N D
T4BSRN-Depth Averaged
TOD2RN-Depth Averaged

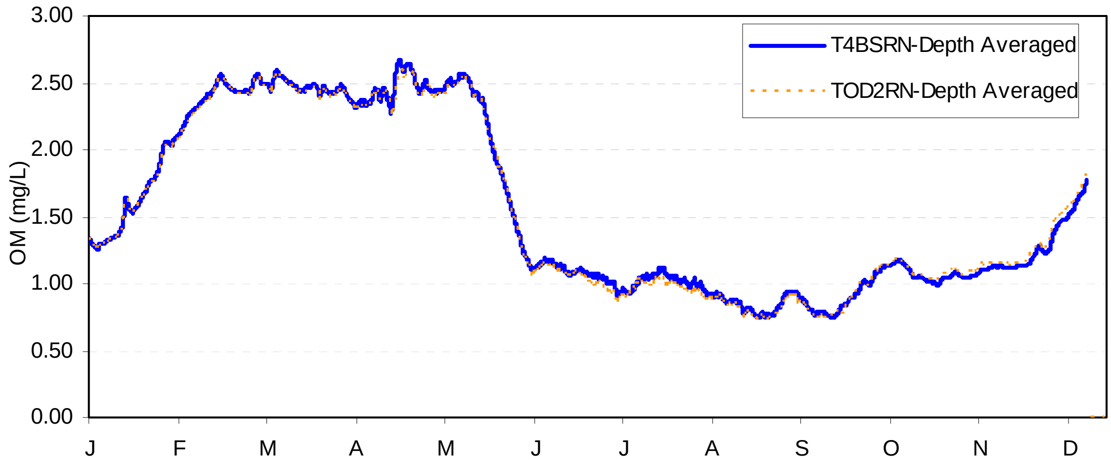

TN (mg/L)
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
J F M A M J J A S O N D
T4BSRN-Depth Averaged
TOD2RN-Depth Averaged


TP (mg/L)
0.035
0.030
0.025
0.020
0.015
0.010
0.005
0.000
J F M A M J J A S O N D
T4BSRN-Depth Averaged
TOD2RN-Depth Averaged

Hwy 66

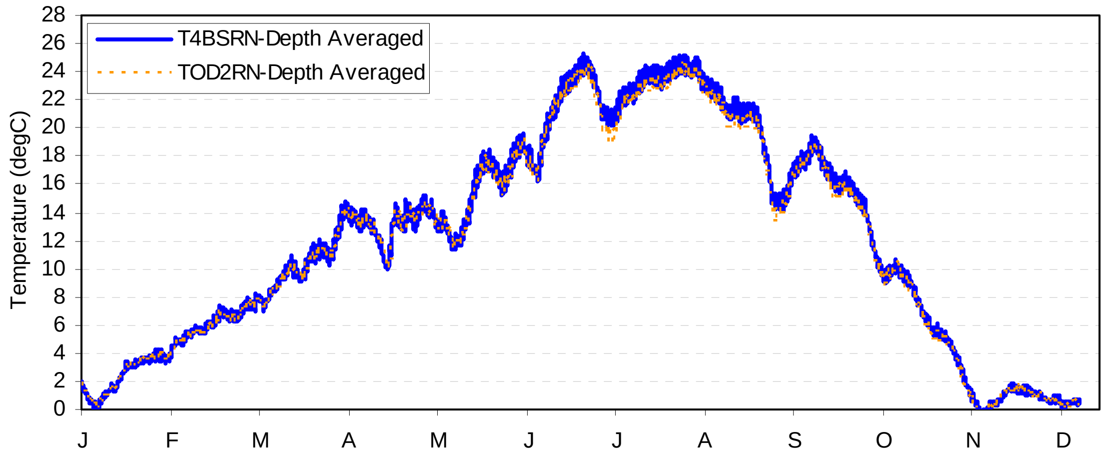


35
30
25
20
15
10
5
0
Chlorophyll-a (ug/L)
J
F
M
A
M
J
J
A
S
O
N
D
T4BSRN-Depth Averaged
TOD2RN-Depth Averaged

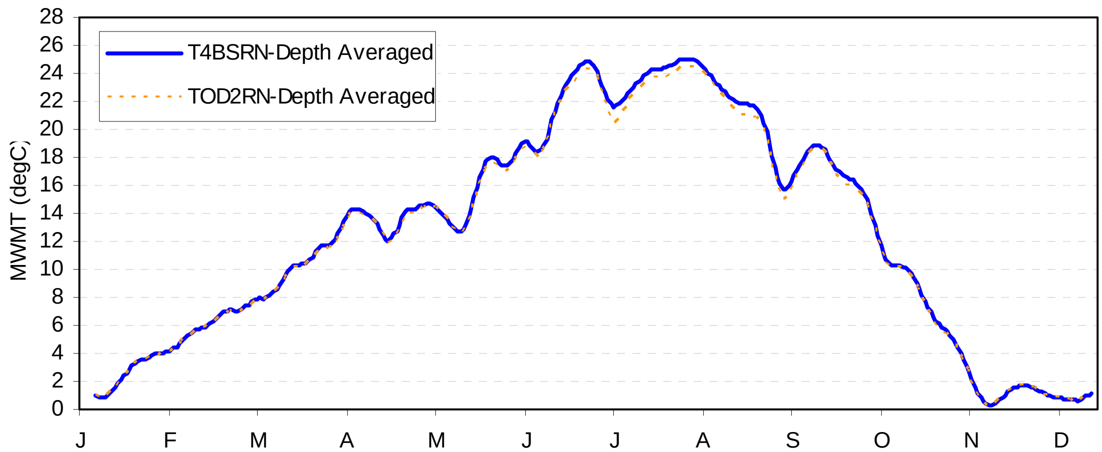


3.00
2.50
2.00
1.50
1.00
0.50
0.00
OM (mg/L)
J
F
M
A
M
J
J
A
S
O
N
D
T4BSRN-Depth Averaged
TOD2RN-Depth Averaged

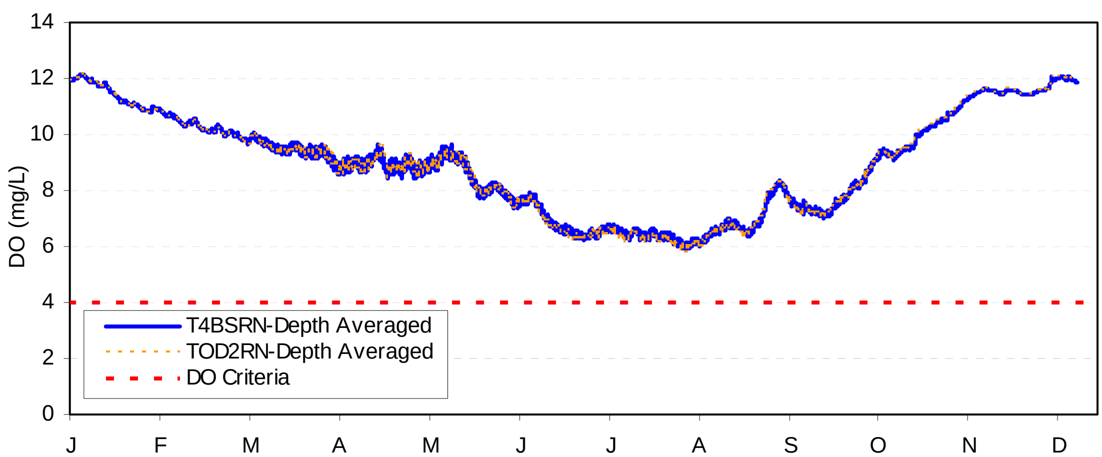
Keno Dam



Temperature (degC)
T4BSRN-Depth Averaged
TOD2RN-Depth Averaged
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
J F M A M J J A S O N D

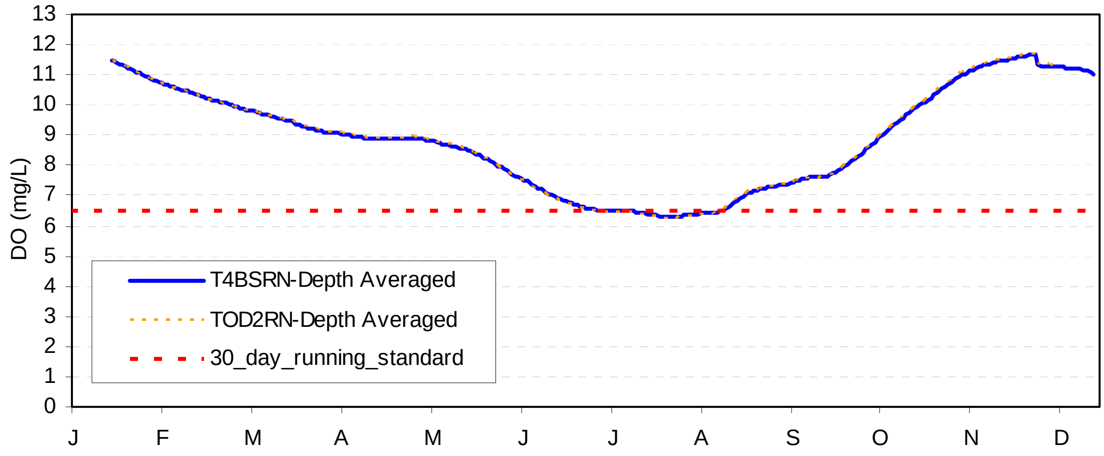


MWMT (degC)
T4BSRN-Depth Averaged
TOD2RN-Depth Averaged
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
J F M A M J J A S O N D

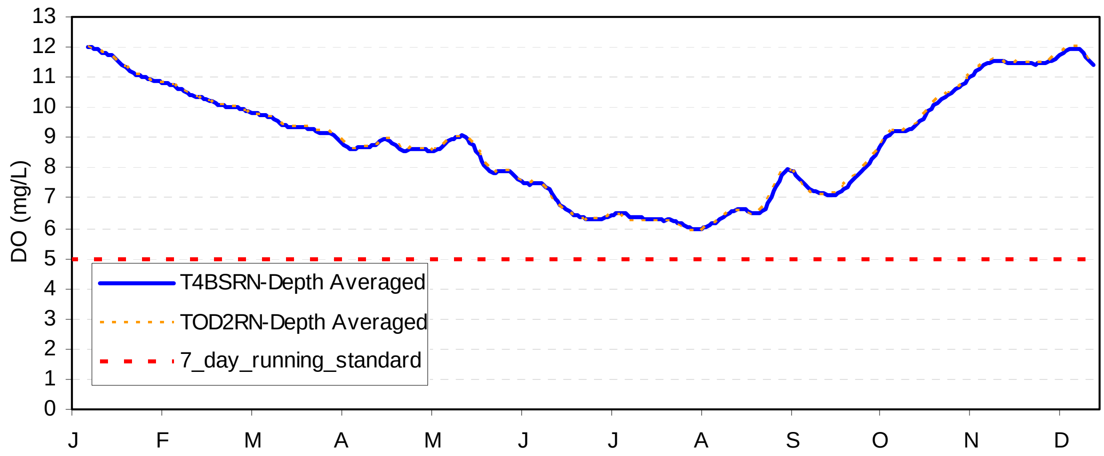


DO (mg/L)
T4BSRN-Depth Averaged
TOD2RN-Depth Averaged
DO Criteria
0
2
4
6
8
10
12
14
J F M A M J J A S O N D

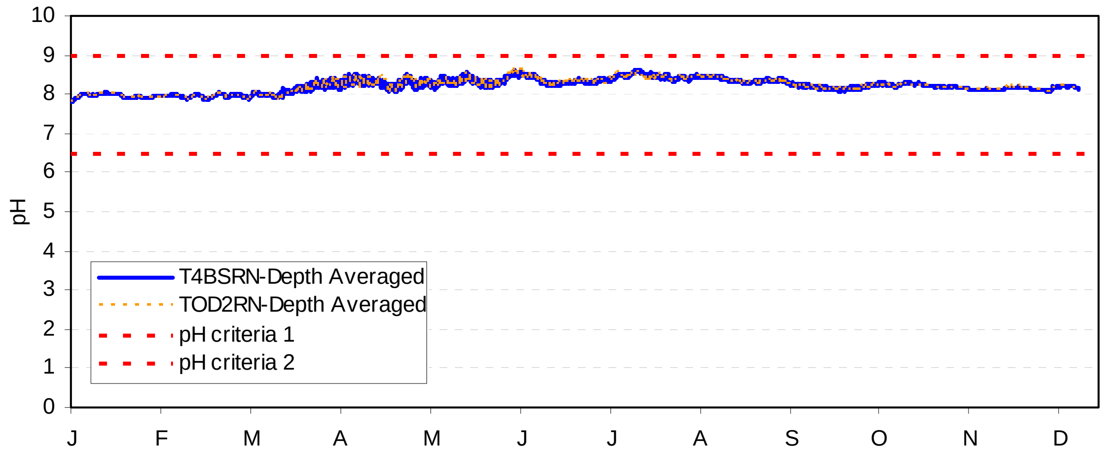
Keno Dam



13
12
11
10
9
8
7
6
5
4
3
2
1
0
DO (mg/L)
T4BSRN-Depth Averaged
TOD2RN-Depth Averaged
30_day_running_standard
J
F
M
A
M
J
J
A
S
O
N
D

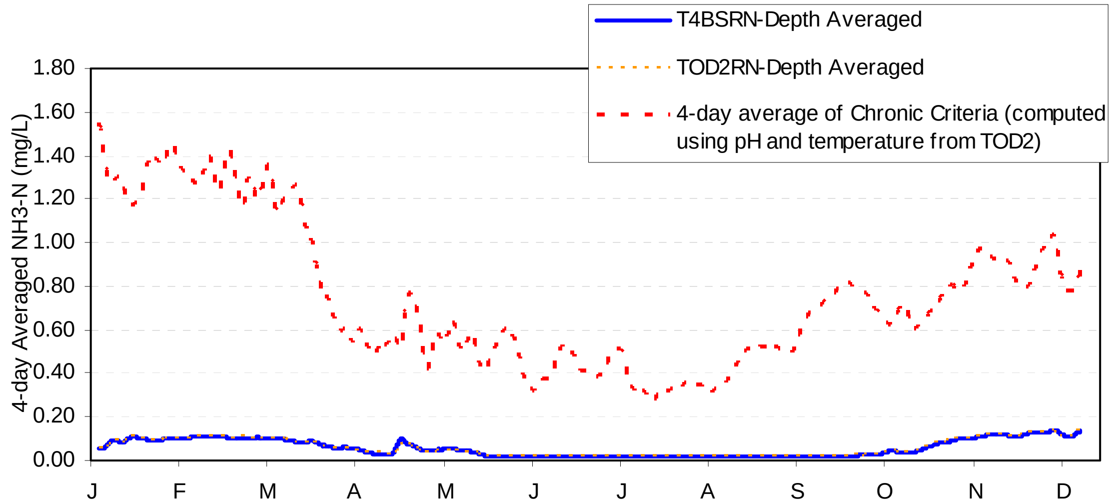


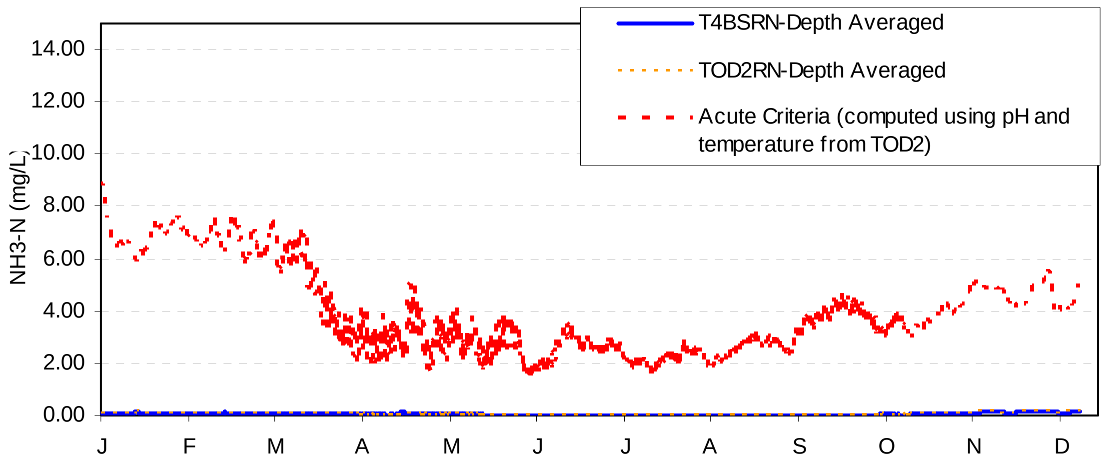
13
12
11
10
9
8
7
6
5
4
3
2
1
0
DO (mg/L)
T4BSRN-Depth Averaged
TOD2RN-Depth Averaged
7_day_running_standard
J
F
M
A
M
J
J
A
S
O
N
D

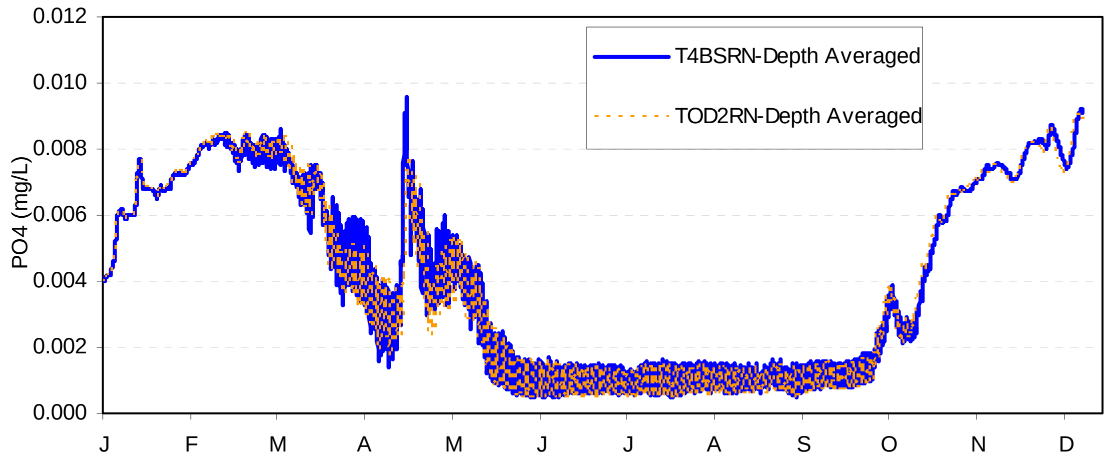


10
9
8
7
6
5
4
3
2
1
0
pH
T4BSRN-Depth Averaged
TOD2RN-Depth Averaged
pH criteria 1
pH criteria 2
J
F
M
A
M
J
J
A
S
O
N
D

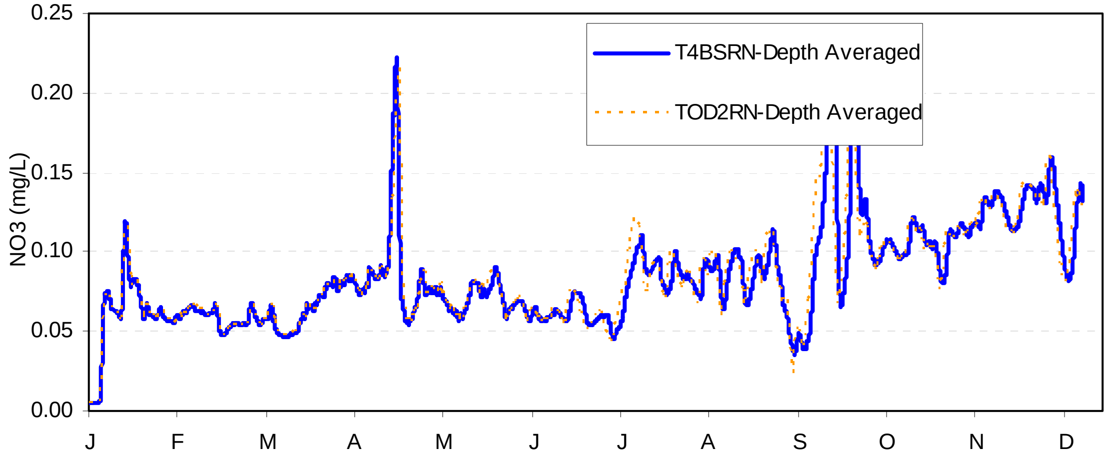
Keno Dam


T4BSRN-Depth Averaged
TOD2RN-Depth Averaged
4-day average of Chronic Criteria (computed using pH and temperature from TOD2)
4-day Averaged NH3-N (mg/L)
1.80
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
J F M A M J J A S O N D

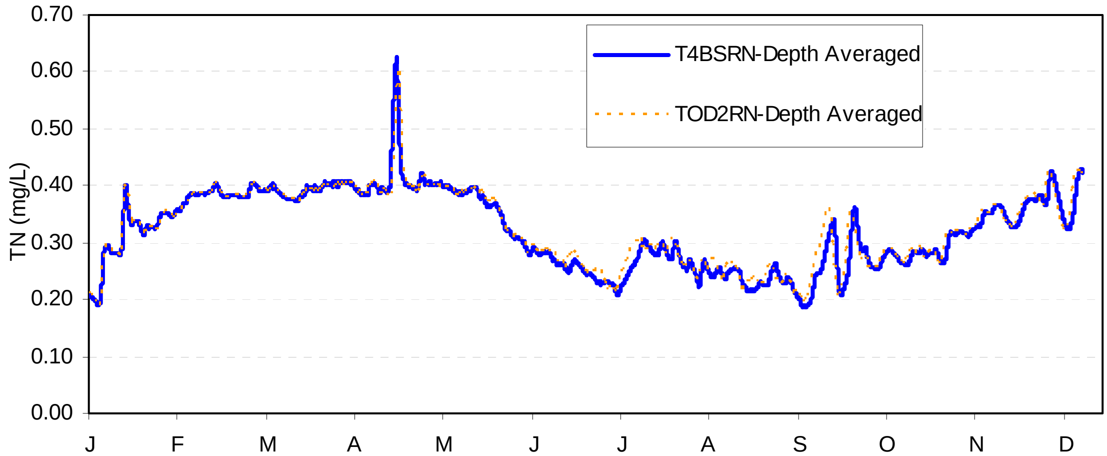

T4BSRN-Depth Averaged
TOD2RN-Depth Averaged
Acute Criteria (computed using pH and temperature from TOD2)
NH3-N (mg/L)
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
J F M A M J J A S O N D


T4BSRN-Depth Averaged
TOD2RN-Depth Averaged
PO4 (mg/L)
0.012
0.010
0.008
0.006
0.004
0.002
0.000
J F M A M J J A S O N D

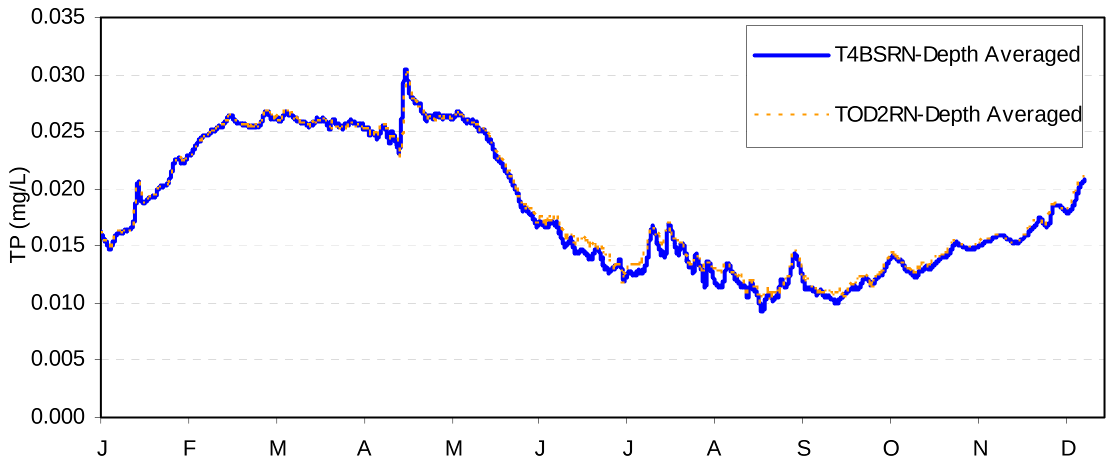
Keno Dam



0.25
0.20
0.15
0.10
0.05
0.00
NO3 (mg/L)
J
F
M
A
M
J
J
A
S
O
N
D
T4BSRN-Depth Averaged
TOD2RN-Depth Averaged

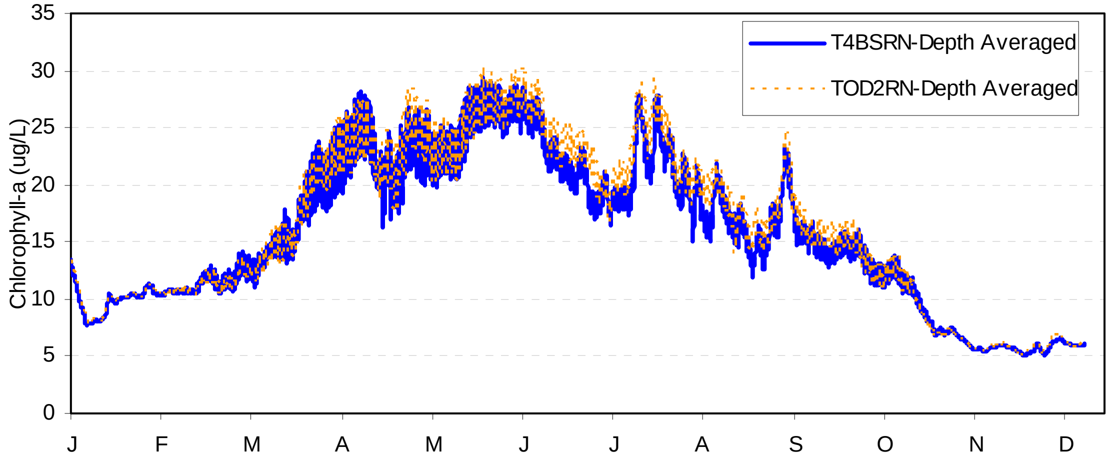


0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
TN (mg/L)
J
F
M
A
M
J
J
A
S
O
N
D
T4BSRN-Depth Averaged
TOD2RN-Depth Averaged

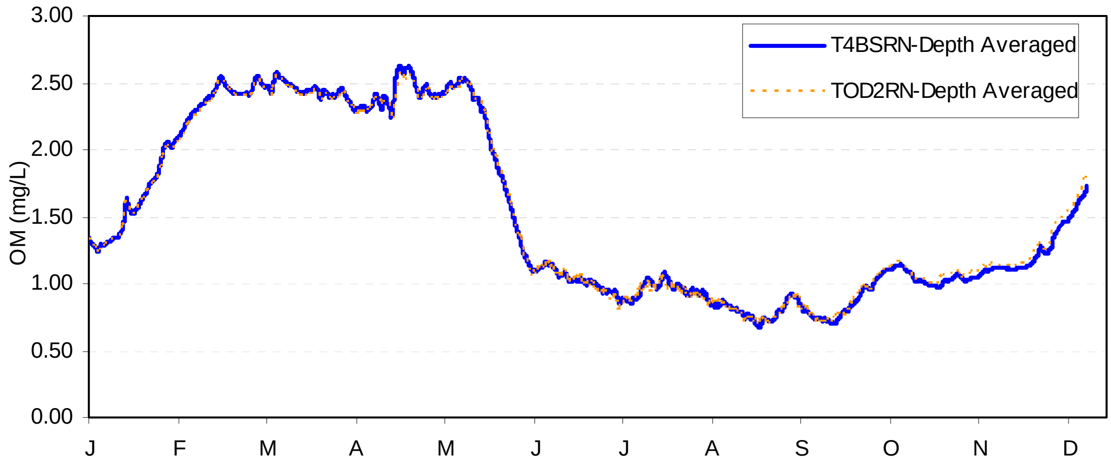


0.035
0.030
0.025
0.020
0.015
0.010
0.005
0.000
TP (mg/L)
J
F
M
A
M
J
J
A
S
O
N
D
T4BSRN-Depth Averaged
TOD2RN-Depth Averaged

Keno Dam

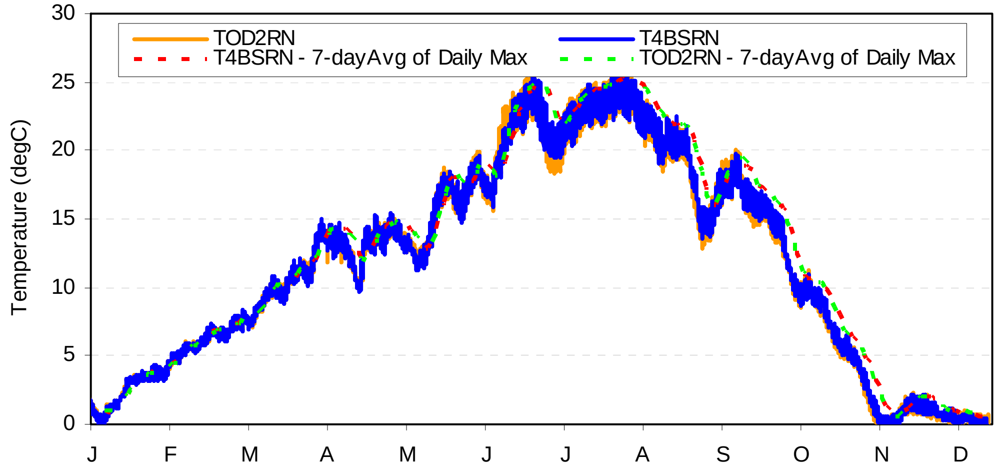


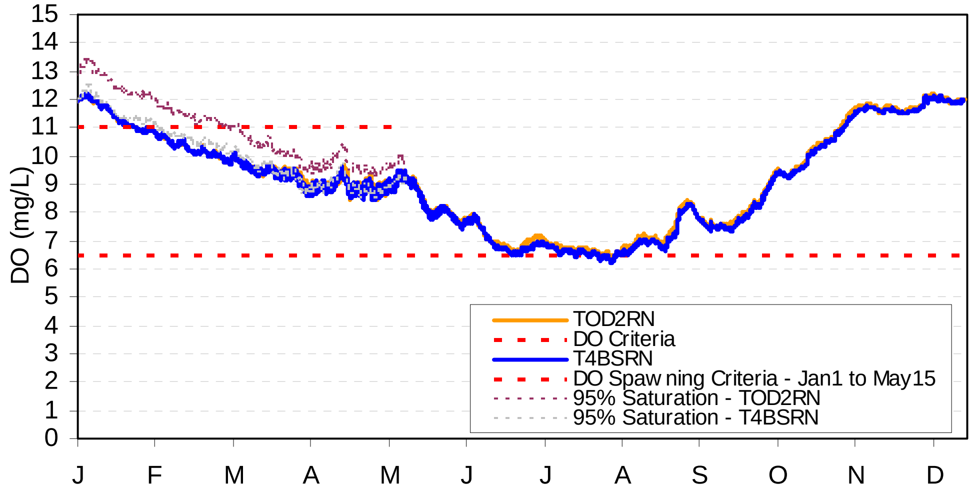
T4BSRN-Depth Averaged
TOD2RN-Depth Averaged
Chlorophyll-a (ug/L)
35
30
25
20
15
10
5
0
J F M A M J J A S O N D

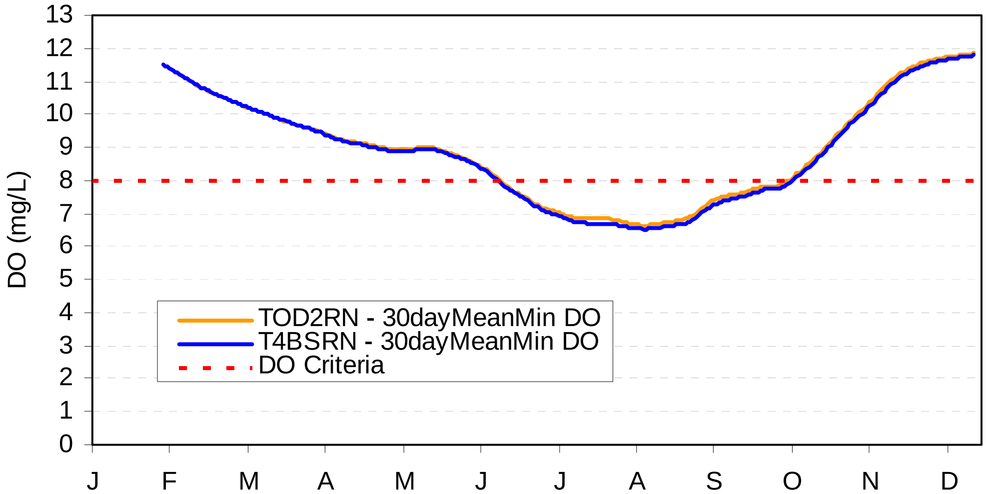


T4BSRN-Depth Averaged
TOD2RN-Depth Averaged
OM (mg/L)
3.00
2.50
2.00
1.50
1.00
0.50
0.00
J F M A M J J A S O N D

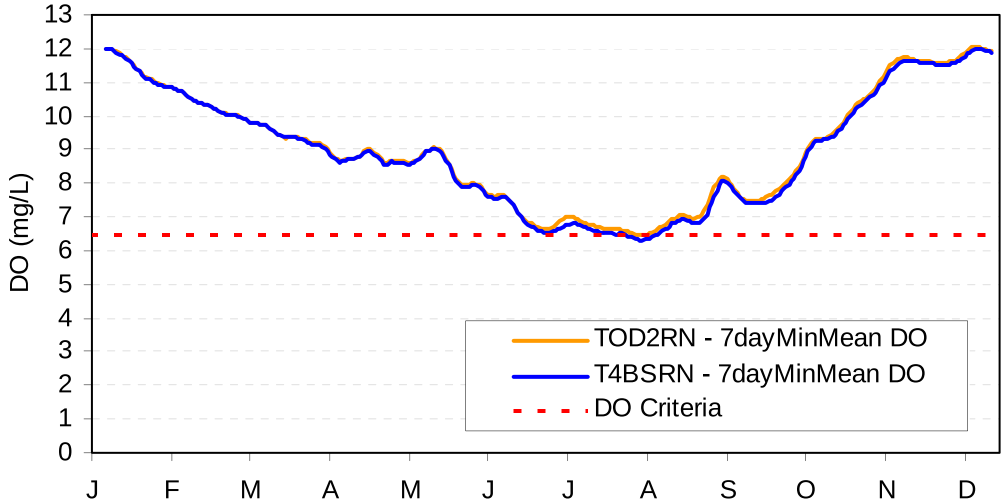
T4BSRN_USGS_DS_KENO

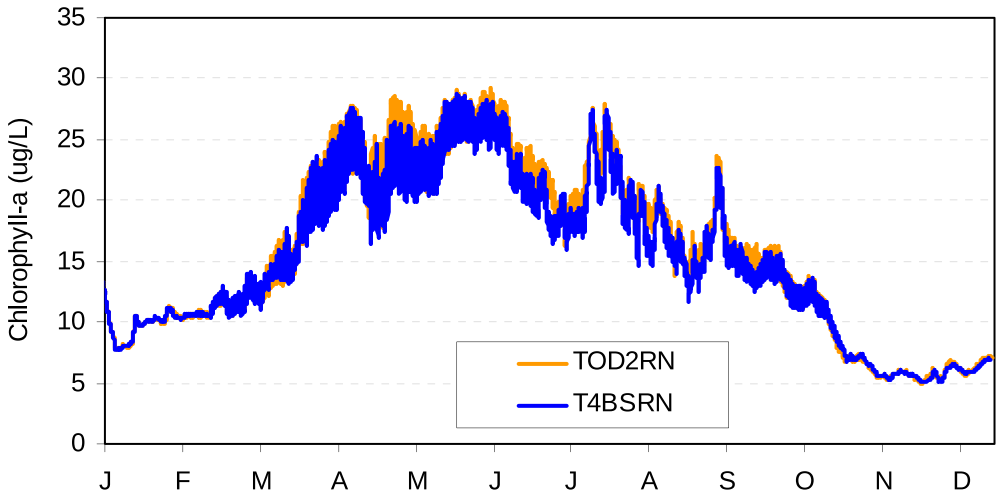


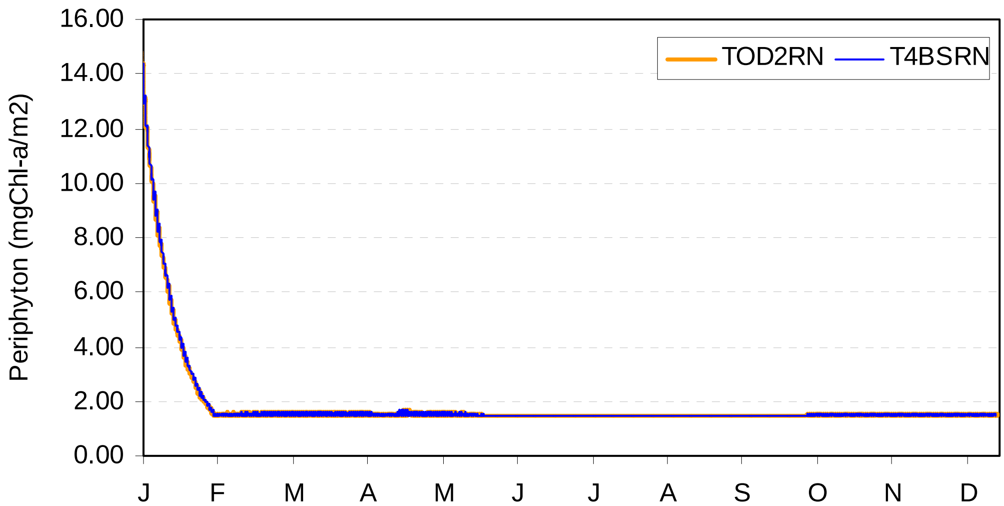




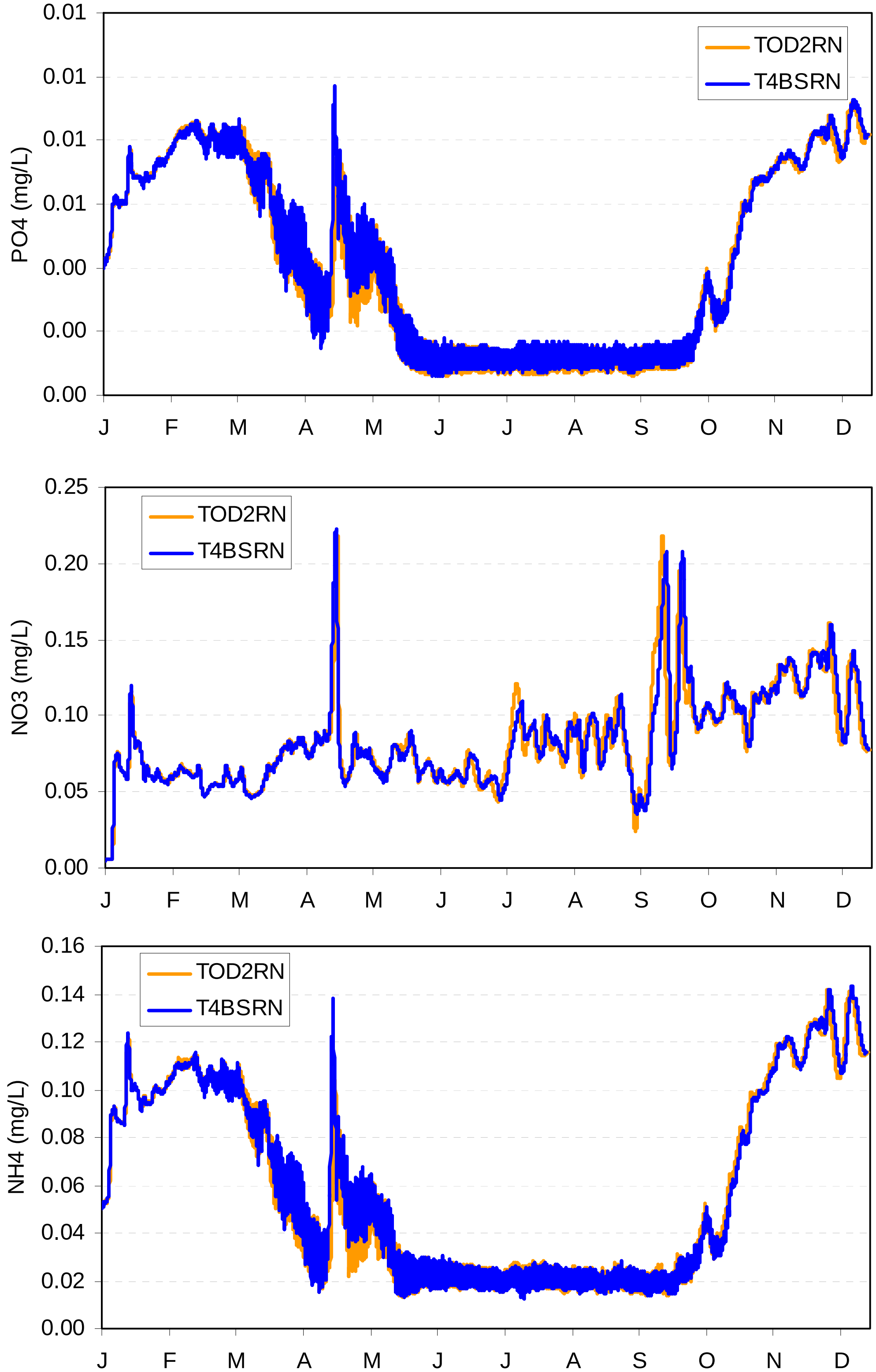
T4BSRN_USGS_DS_KENO



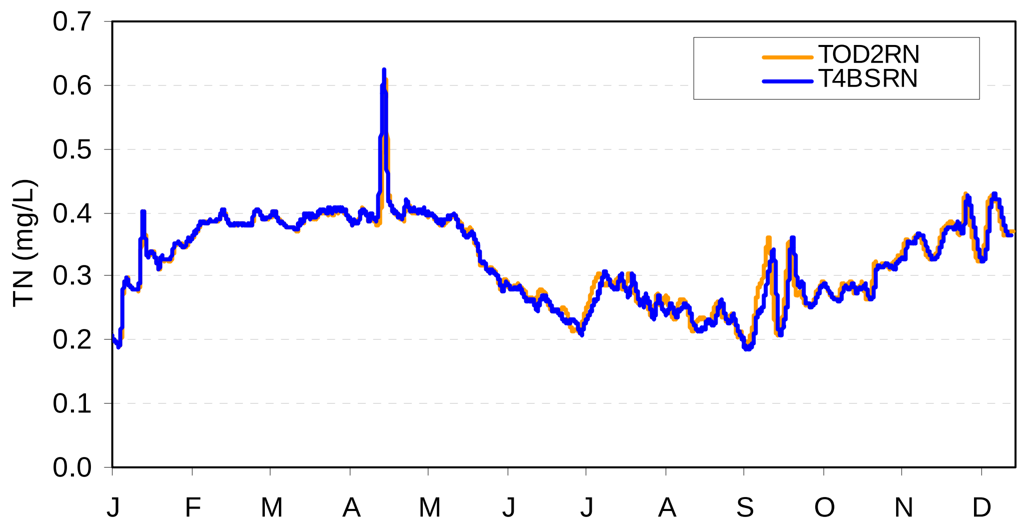




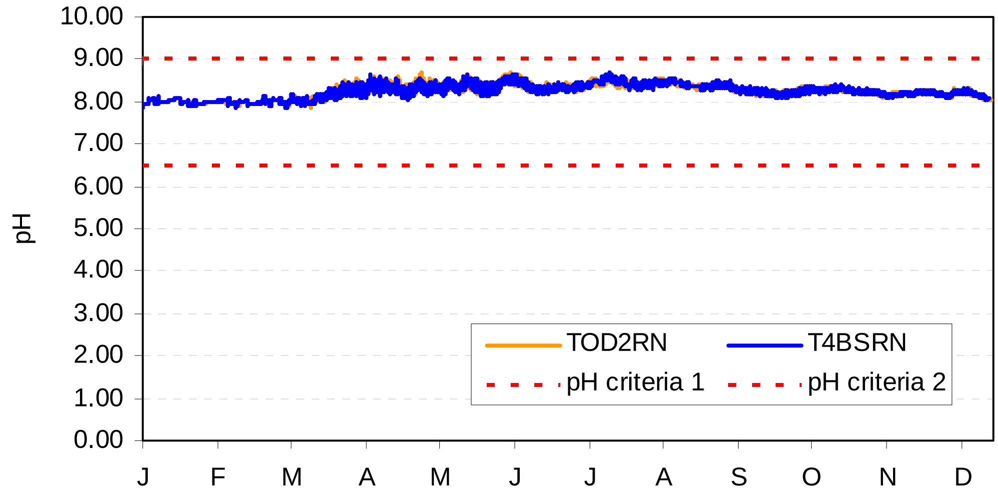
T4BSRN_USGS_DS_KENO

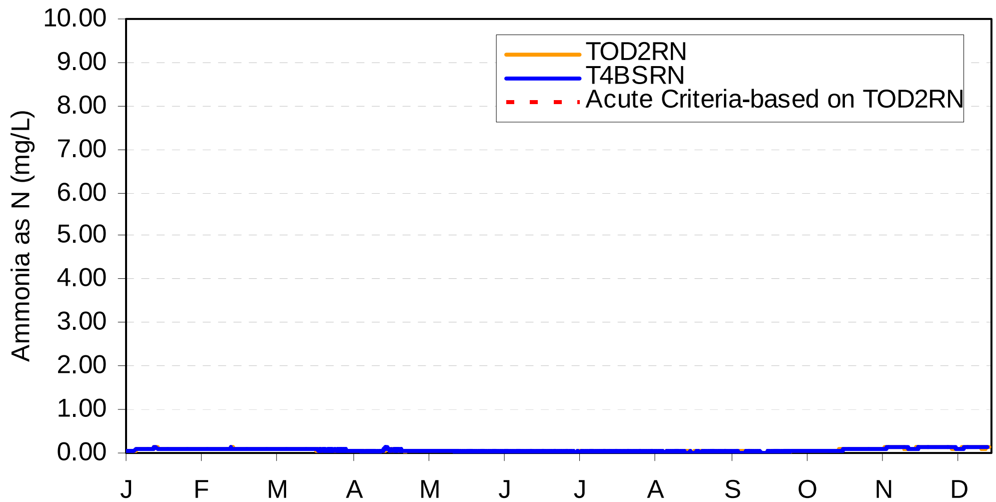


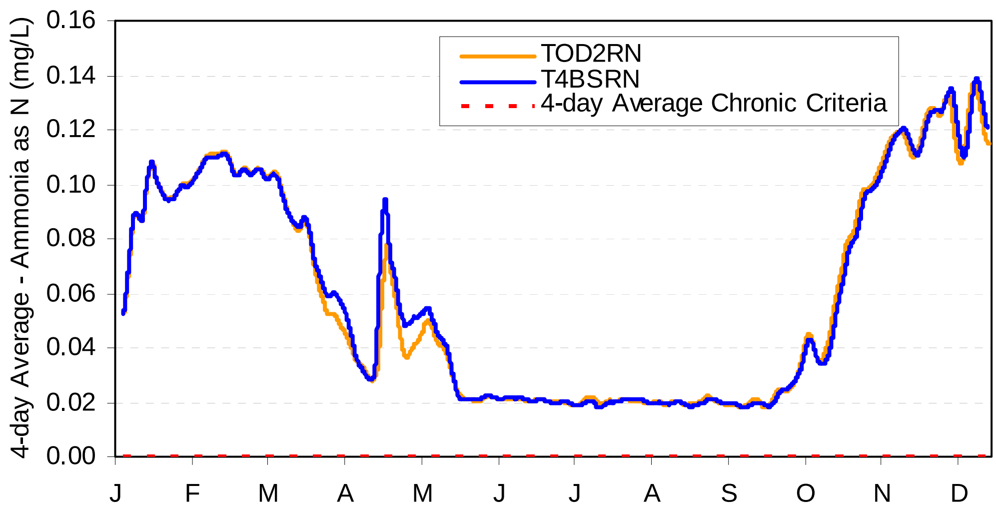
T4BSRN_USGS_DS_KENO



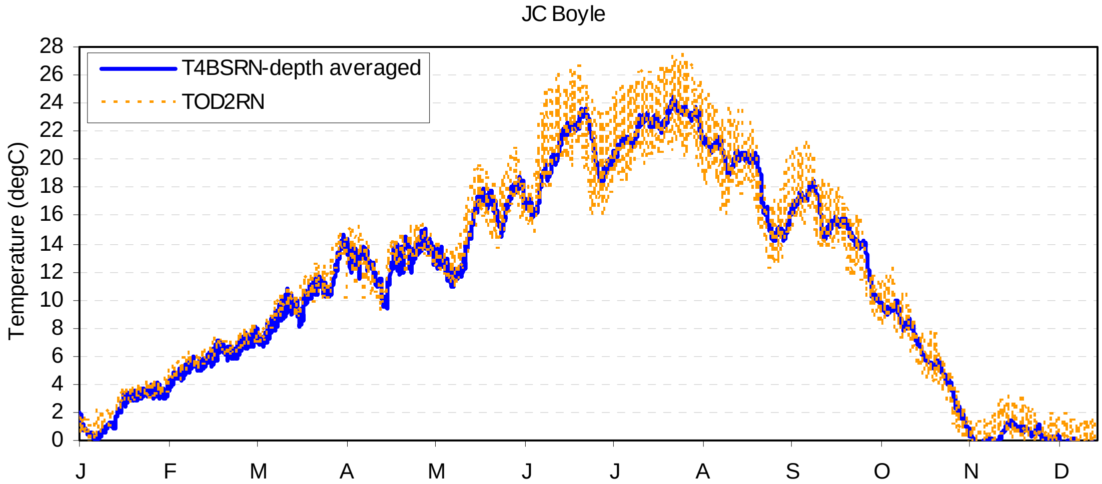
T4BSRN_USGS_DS_KENO

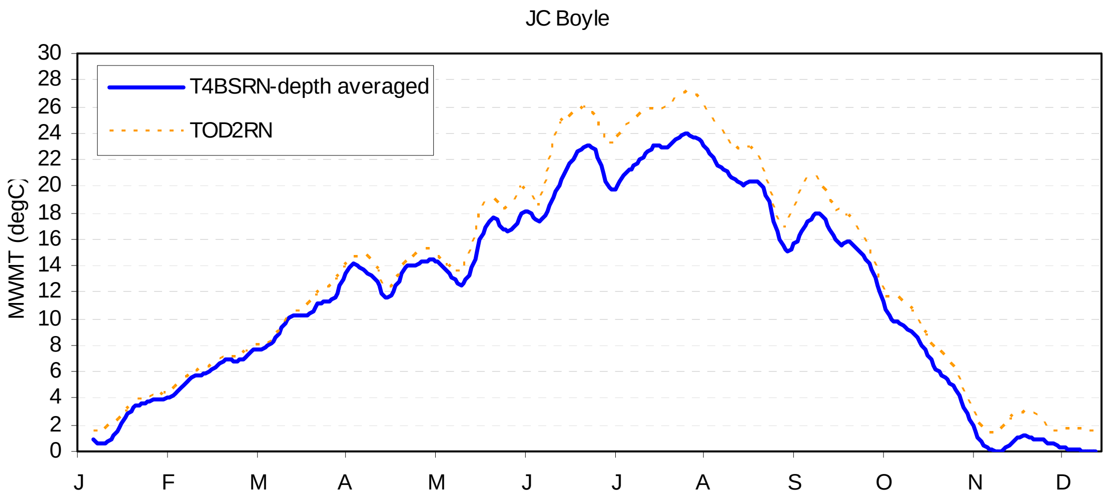


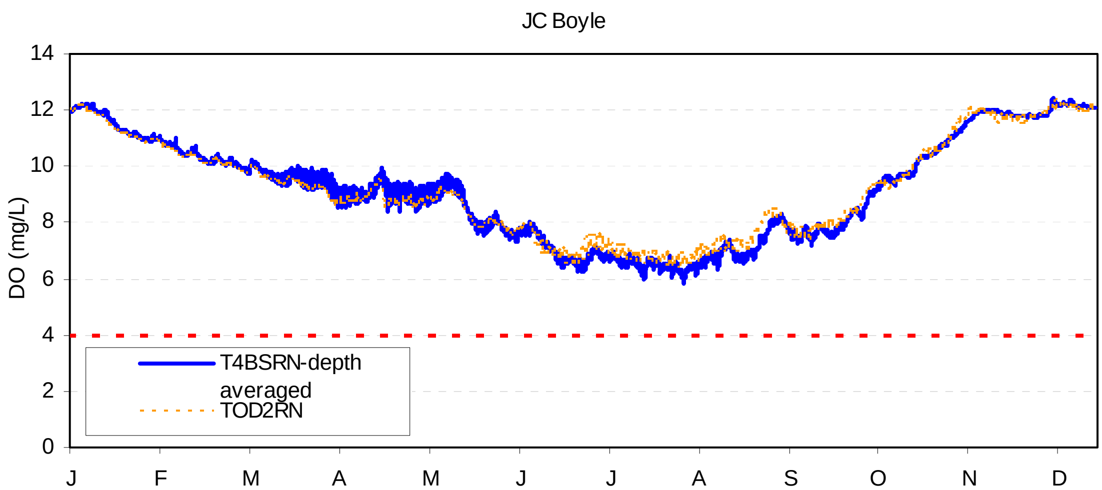




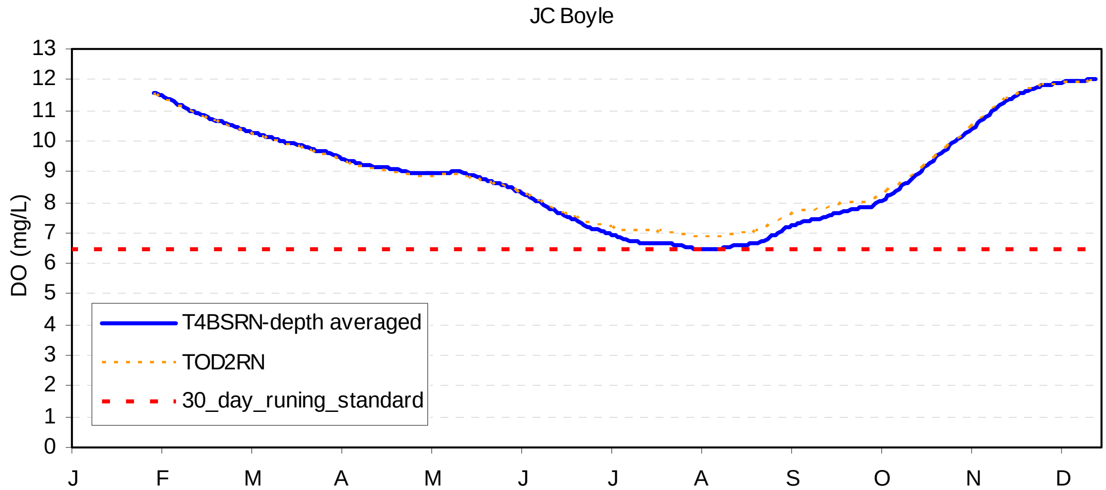
JC Boyle

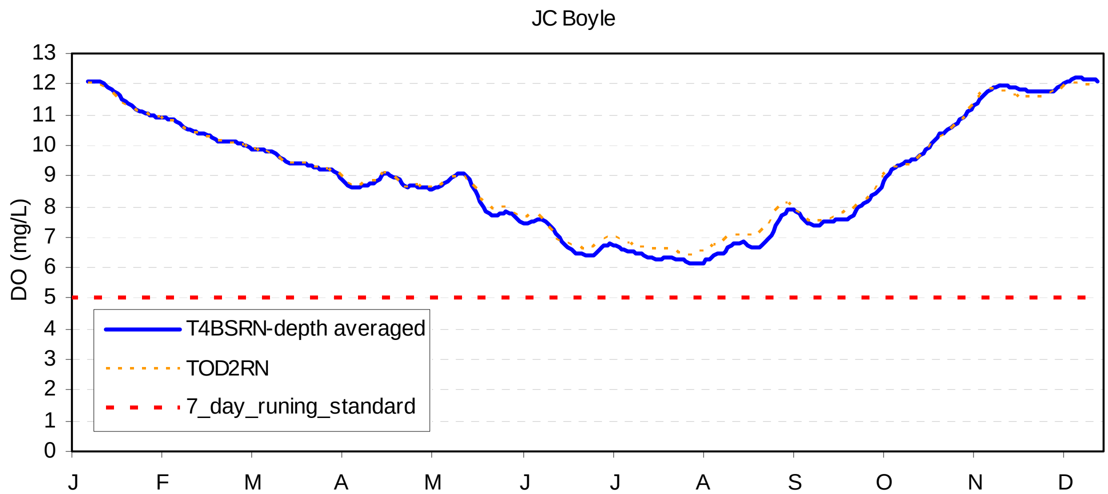

JC Boyle
T4BSRN-depth averaged
TOD2RN
Temperature (degC)
28
26
24
22
20
18
16
14
12
10
8
6
4
2
0
J F M A M J J A S O N D

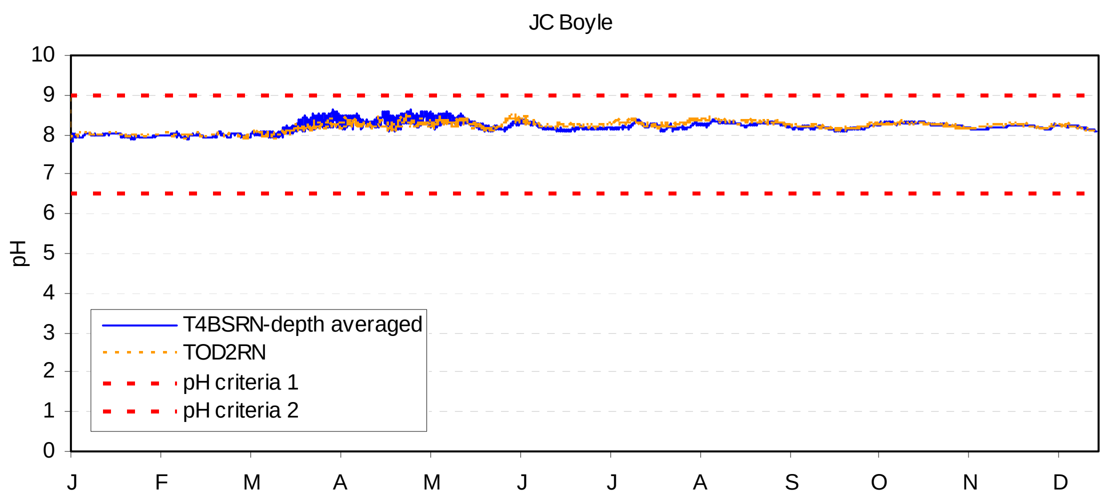

JC Boyle
T4BSRN-depth averaged
TOD2RN
MWMT (degC)
30
28
26
24
22
20
18
16
14
12
10
8
6
4
2
0
J F M A M J J A S O N D


JC Boyle
T4BSRN-depth averaged
TOD2RN
DO (mg/L)
14
12
10
8
6
4
2
0
J F M A M J J A S O N D

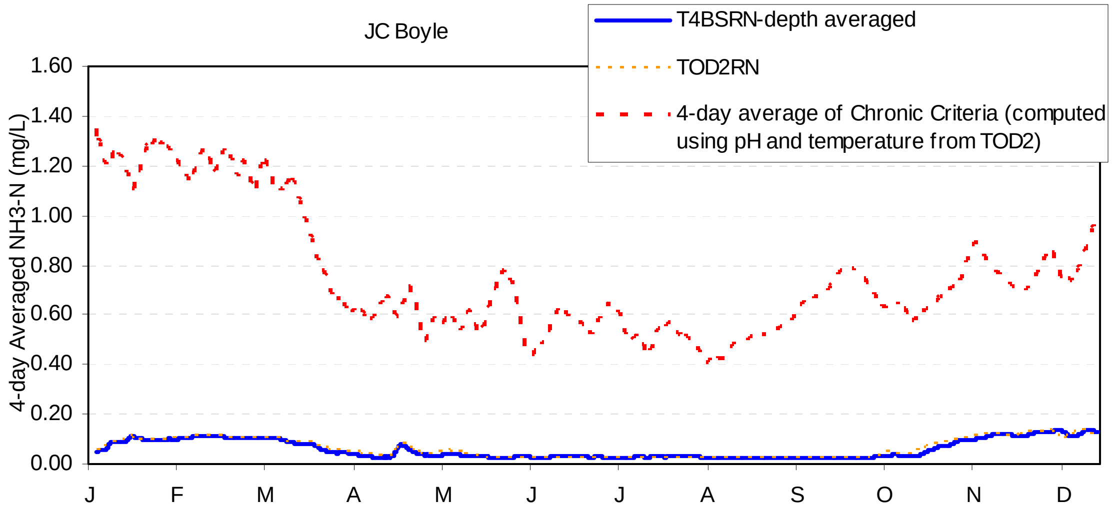
JC Boyle


JC Boyle
13
12
11
10
9
8
7
6
5
4
3
2
1
0
DO (mg/L)
T4BSRN-depth averaged
TOD2RN
30_day_runing_standard
J
F
M
A
M
J
J
A
S
O
N
D

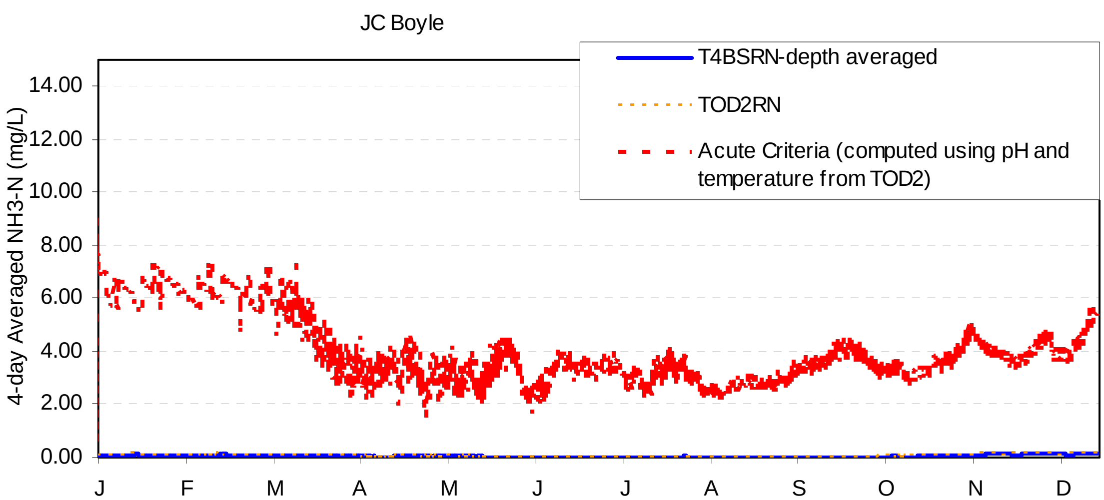

JC Boyle
13
12
11
10
9
8
7
6
5
4
3
2
1
0
DO (mg/L)
T4BSRN-depth averaged
TOD2RN
7_day_runing_standard
J
F
M
A
M
J
J
A
S
O
N
D


JC Boyle
10
9
8
7
6
5
4
3
2
1
0
pH
T4BSRN-depth averaged
TOD2RN
pH criteria 1
pH criteria 2
J
F
M
A
M
J
J
A
S
O
N
D

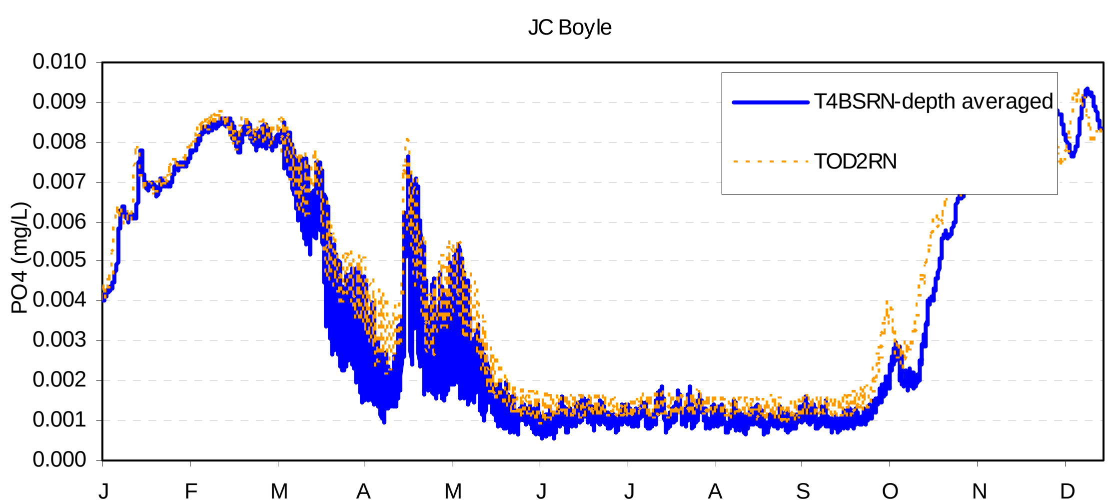
JC Boyle



JC Boyle
T4BSRN-depth averaged
TOD2RN
4-day average of Chronic Criteria (computed using pH and temperature from TOD2)
4-day Averaged NH3-N (mg/L)
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
J
F
M
A
M
J
J
A
S
O
N
D

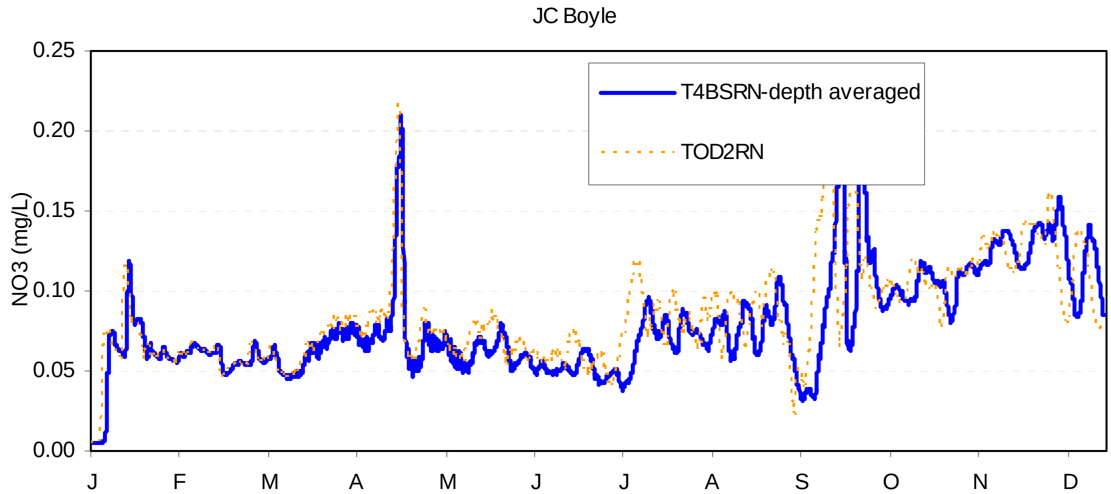


JC Boyle
T4BSRN-depth averaged
TOD2RN
Acute Criteria (computed using pH and temperature from TOD2)
4-day Averaged NH3-N (mg/L)
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
J
F
M
A
M
J
J
A
S
O
N
D

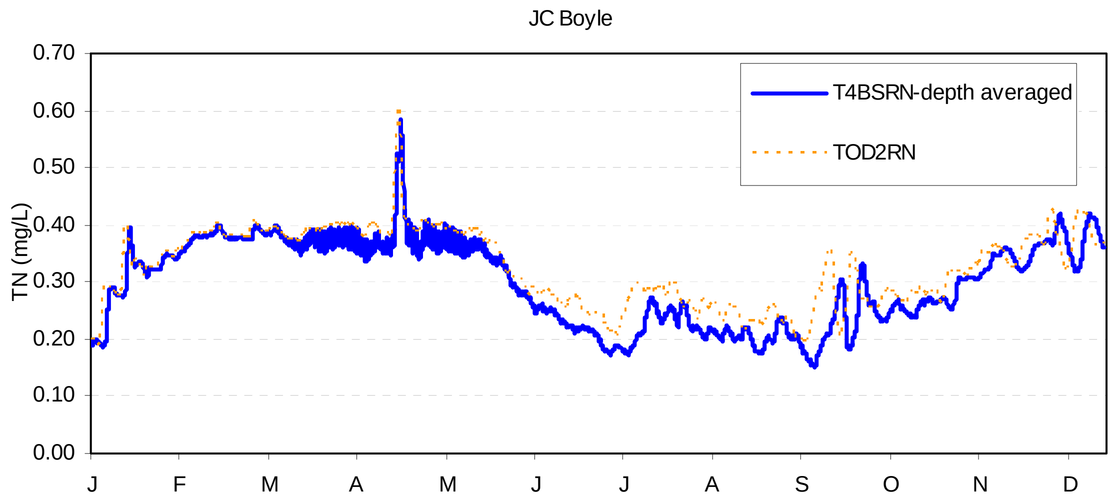


JC Boyle
T4BSRN-depth averaged
TOD2RN
PO4 (mg/L)
0.010
0.009
0.008
0.007
0.006
0.005
0.004
0.003
0.002
0.001
0.000
J
F
M
A
M
J
J
A
S
O
N
D

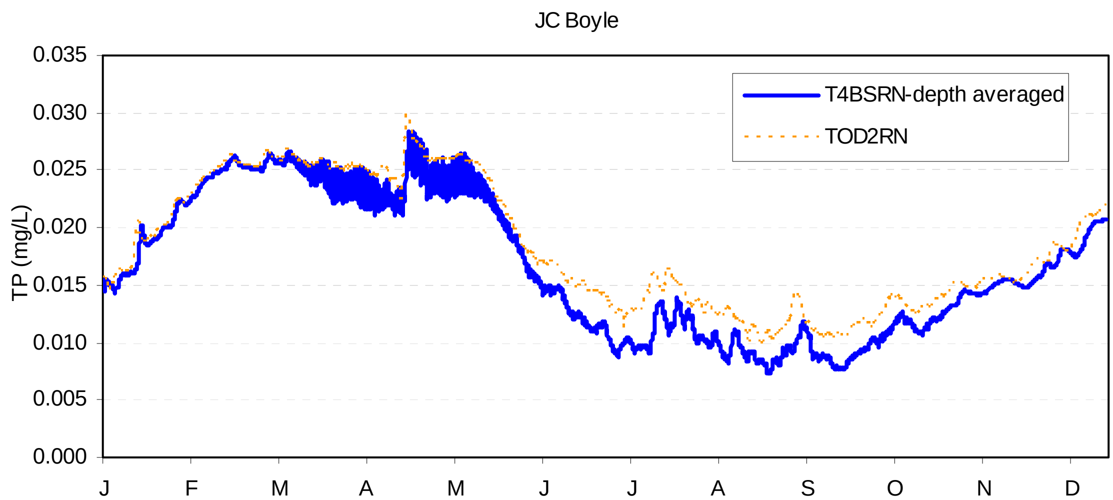
JC Boyle



JC Boyle
T4BSRN-depth averaged
TOD2RN
NO3 (mg/L)
0.25
0.20
0.15
0.10
0.05
0.00
J F M A M J J A S O N D

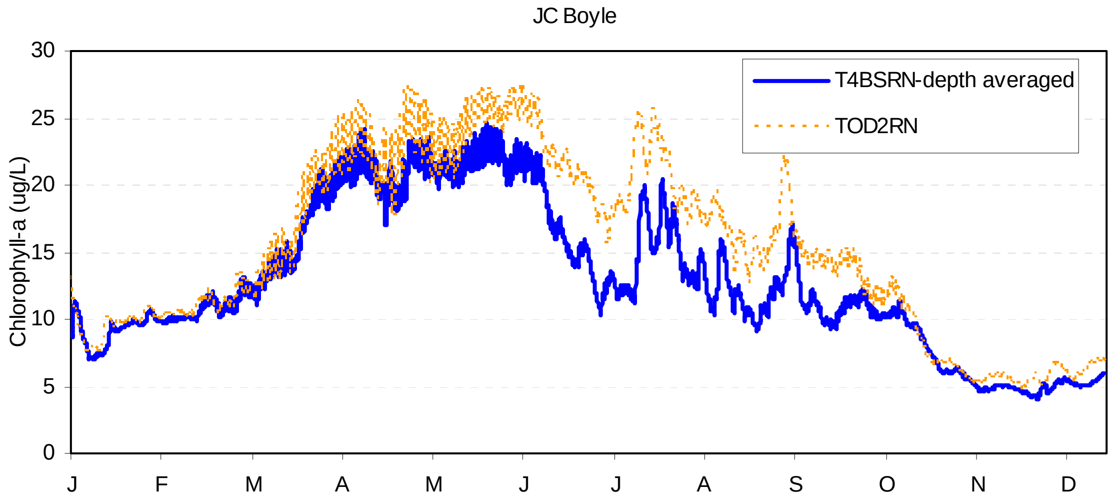


JC Boyle
T4BSRN-depth averaged
TOD2RN
TN (mg/L)
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
J F M A M J J A S O N D

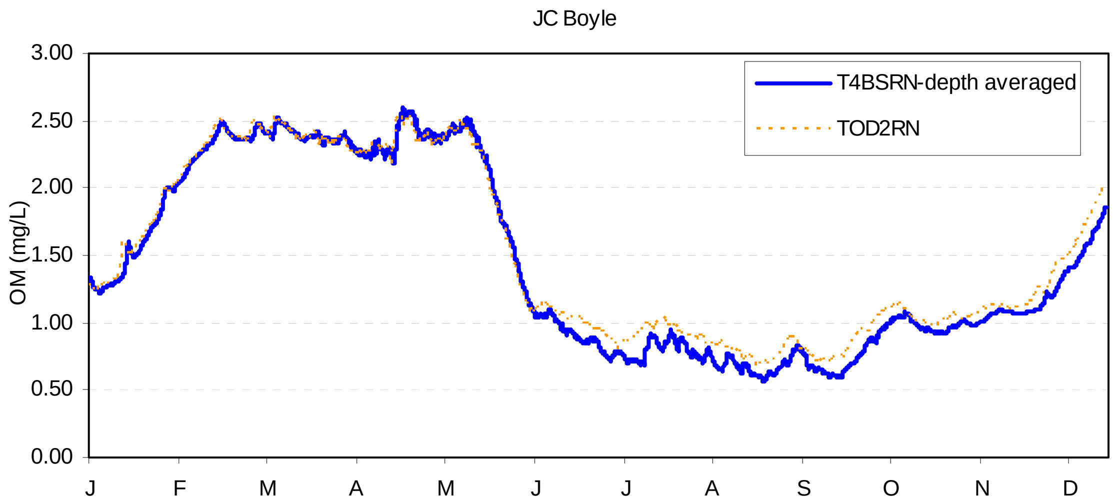


JC Boyle
T4BSRN-depth averaged
TOD2RN
TP (mg/L)
0.035
0.030
0.025
0.020
0.015
0.010
0.005
0.000
J F M A M J J A S O N D

JC Boyle

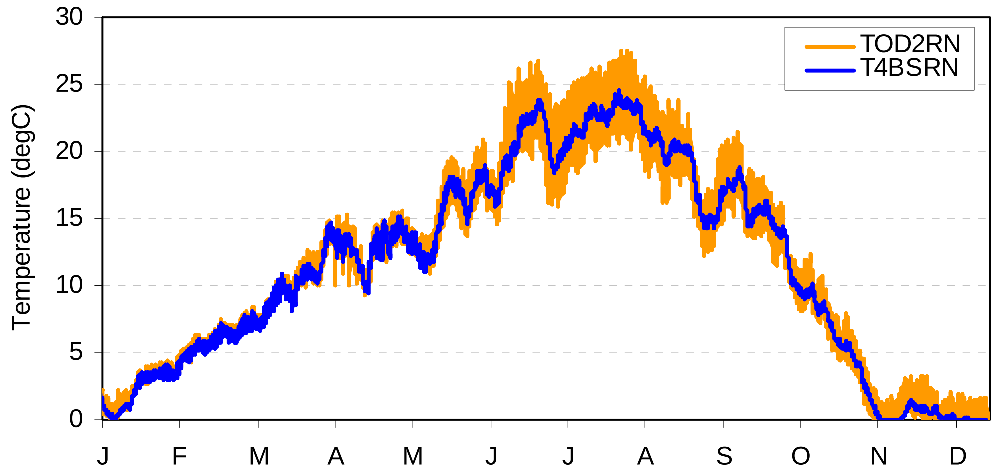


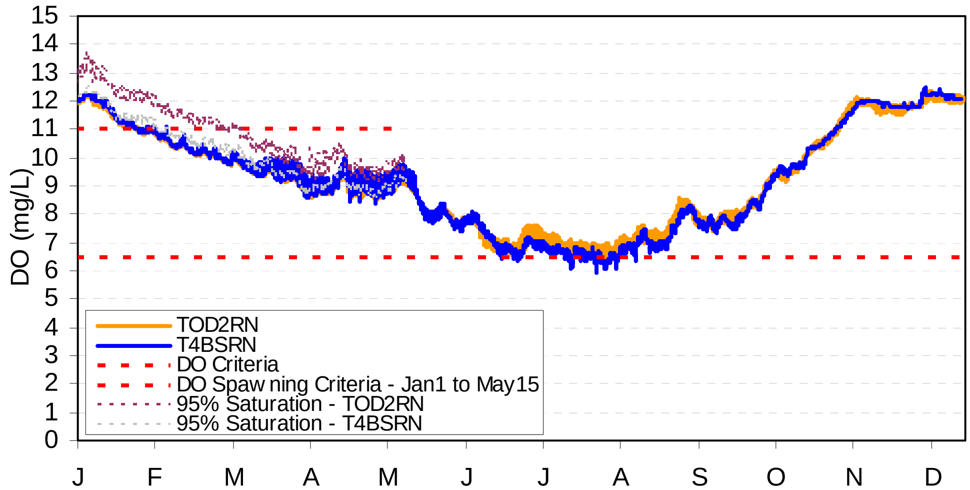
JC Boyle
T4BSRN-depth averaged
TOD2RN
Chlorophyll-a (ug/L)
30
25
20
15
10
5
0
J
F
M
A
M
J
J
A
S
O
N
D

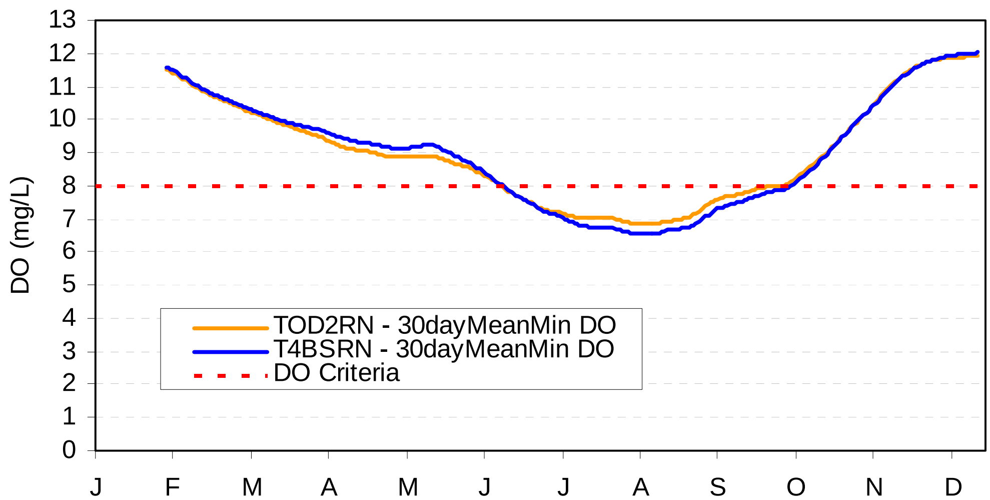


JC Boyle
T4BSRN-depth averaged
TOD2RN
OM (mg/L)
3.00
2.50
2.00
1.50
1.00
0.50
0.00
J
F
M
A
M
J
J
A
S
O
N
D

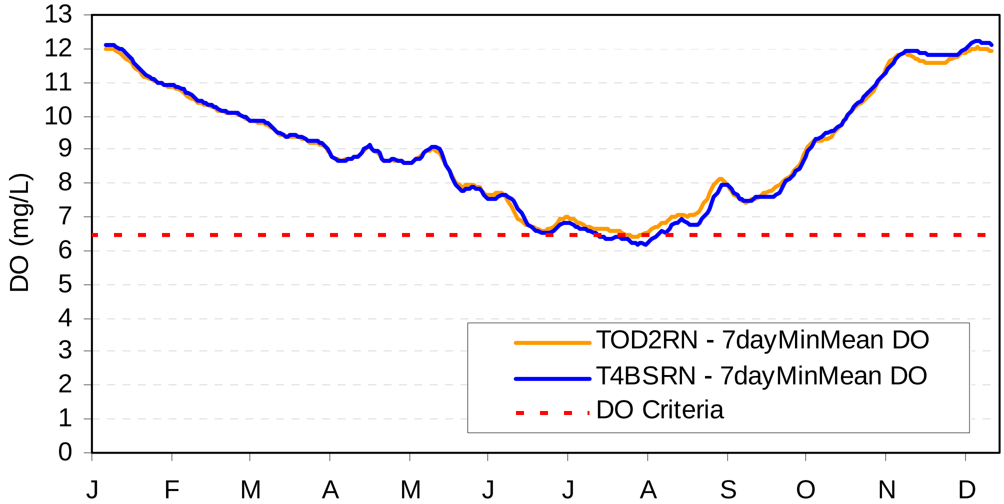
T4BSRN_ND1_DS_JCBDAM

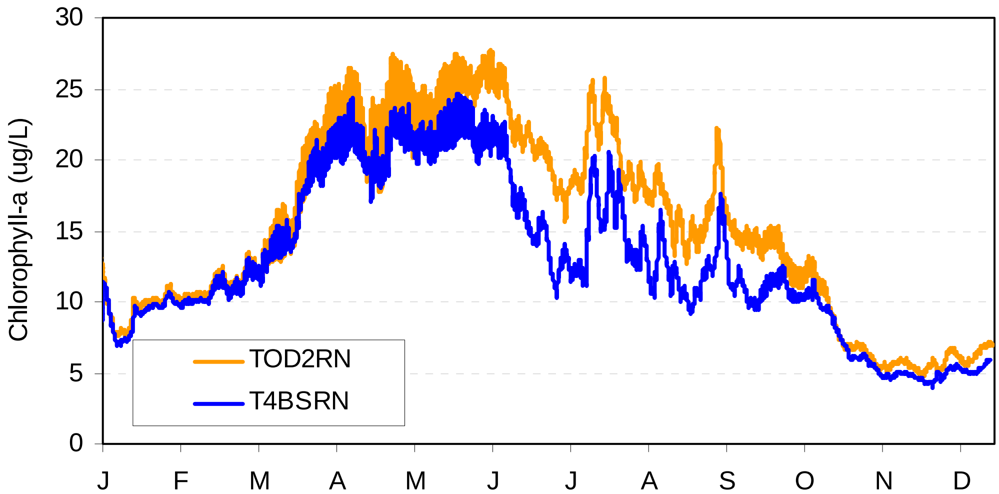


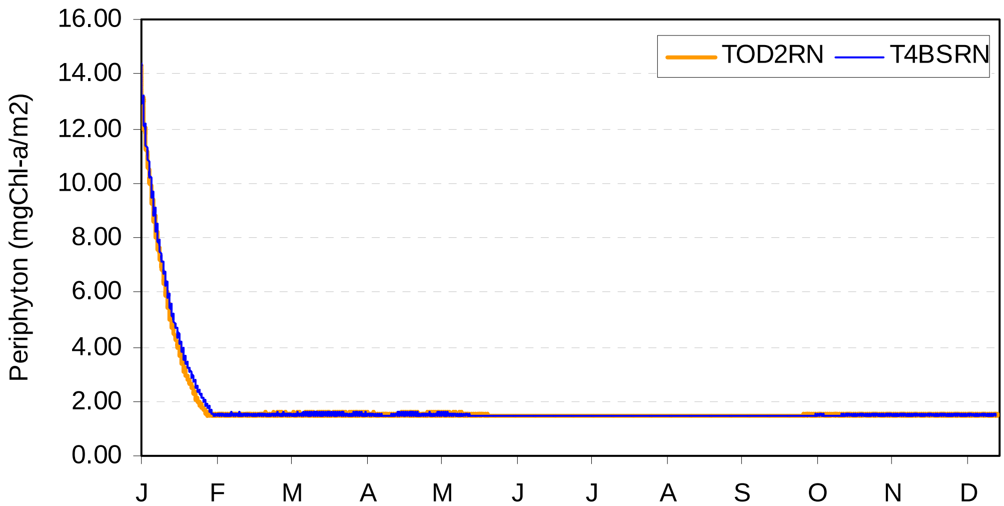




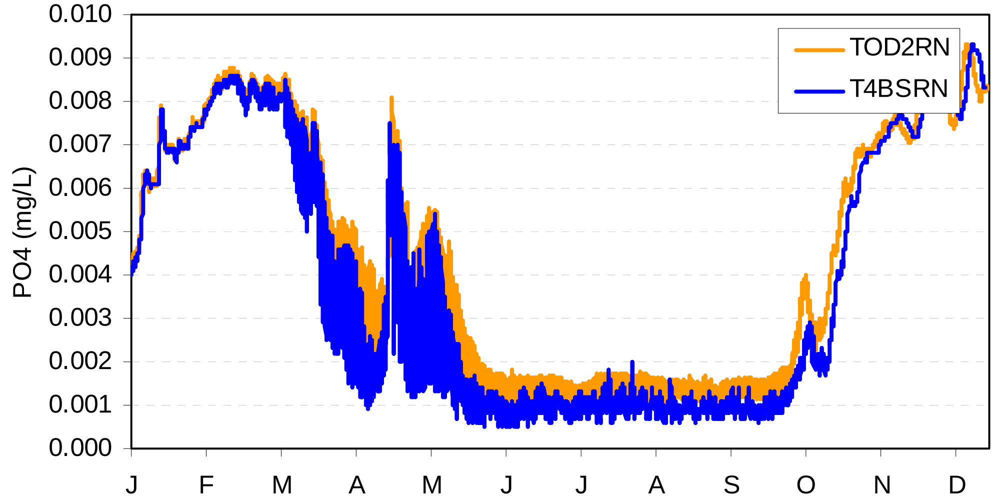
T4BSRN_ND1_DS_JCBDAM

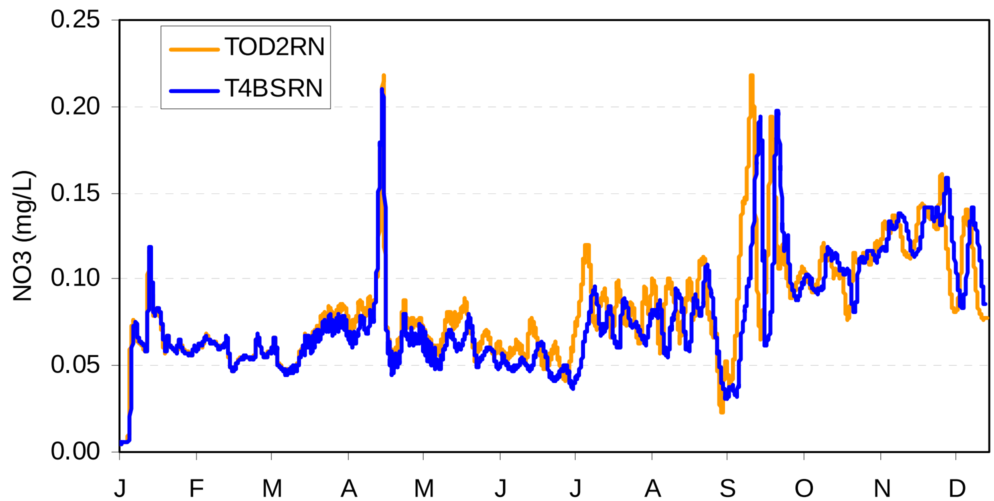


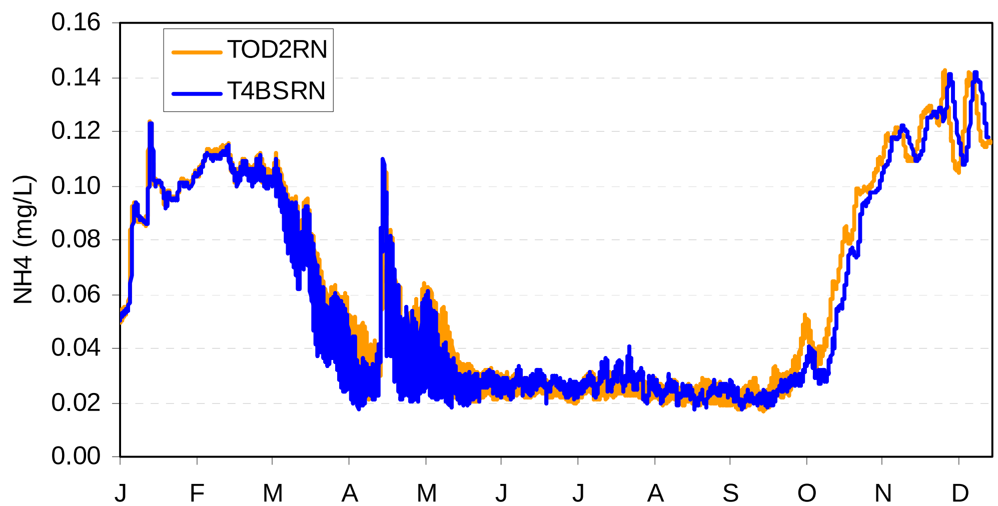




T4BSRN_ND1_DS_JCBDAM







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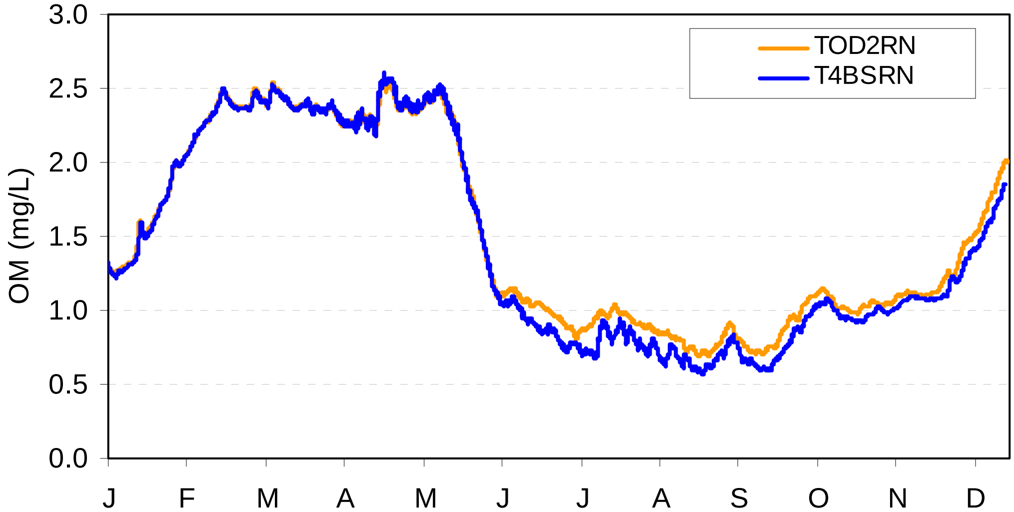

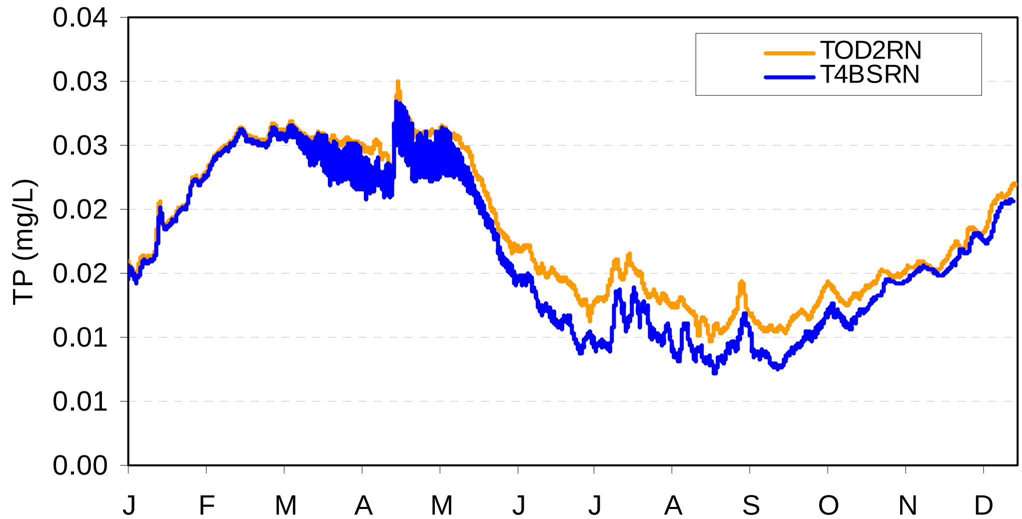

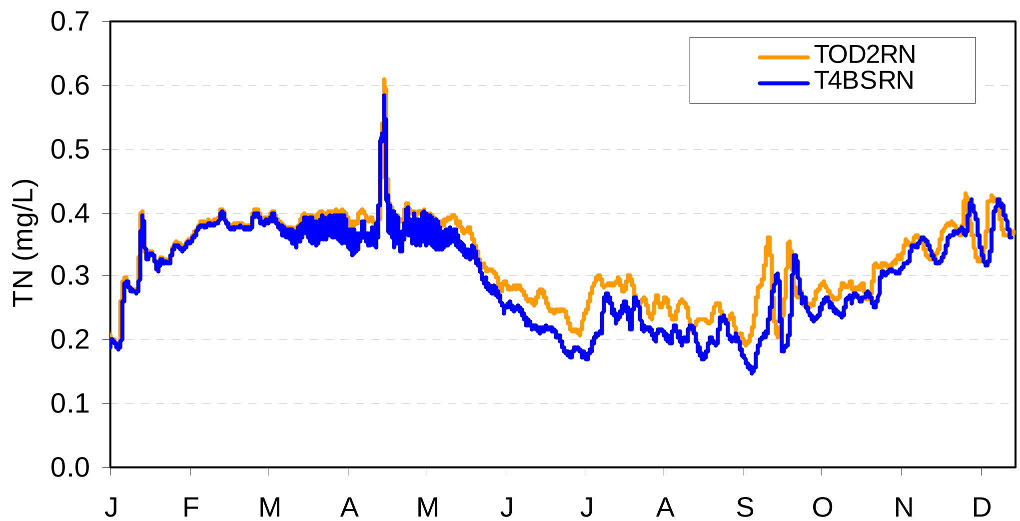

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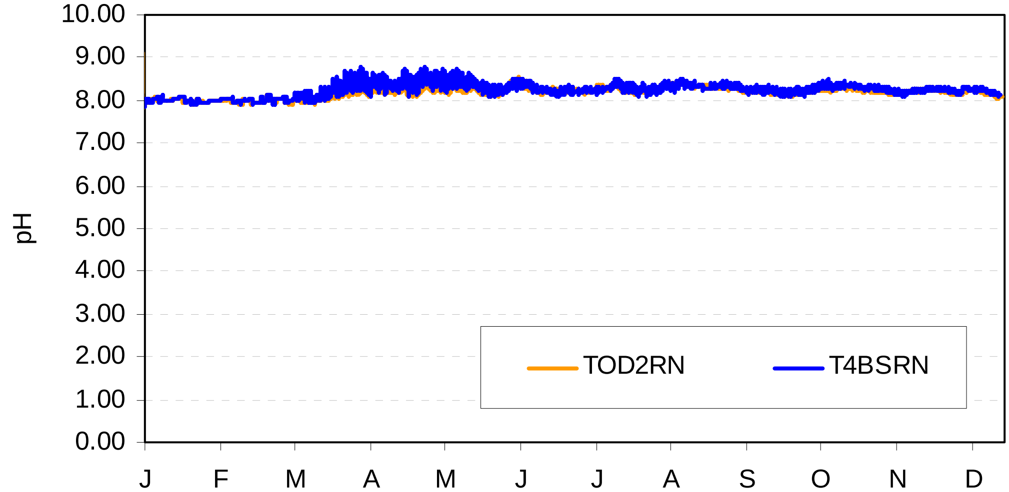
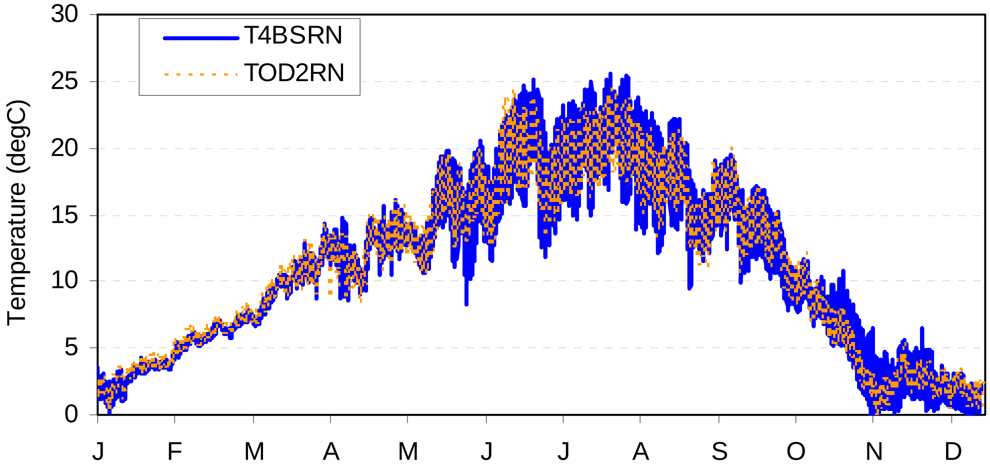
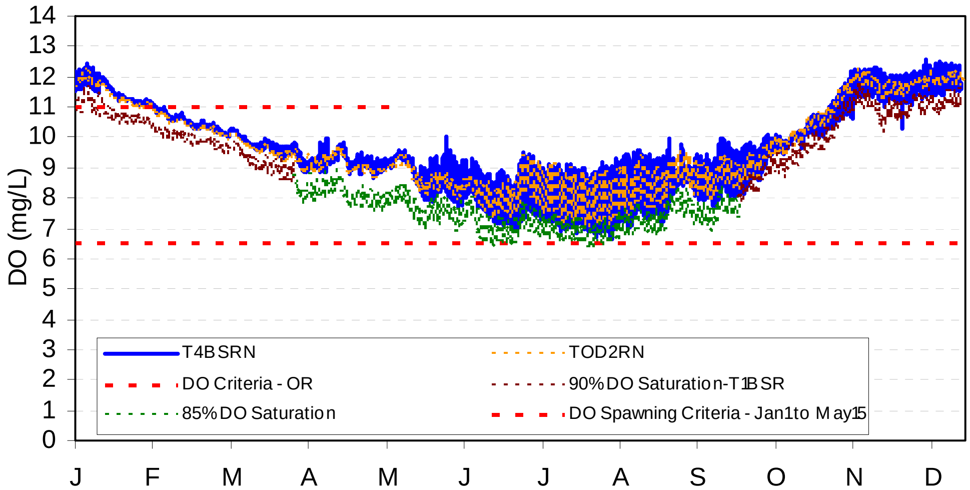
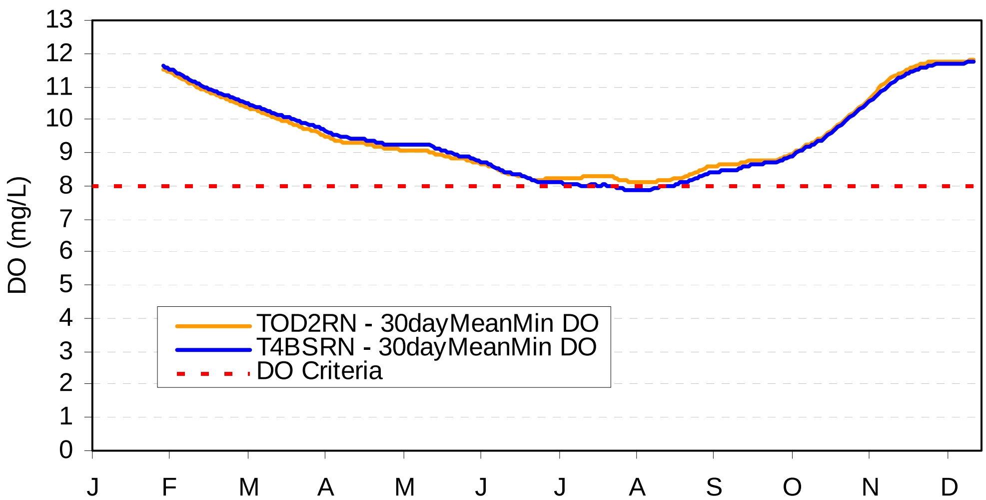


T4BSRN_ND331_STATELINE







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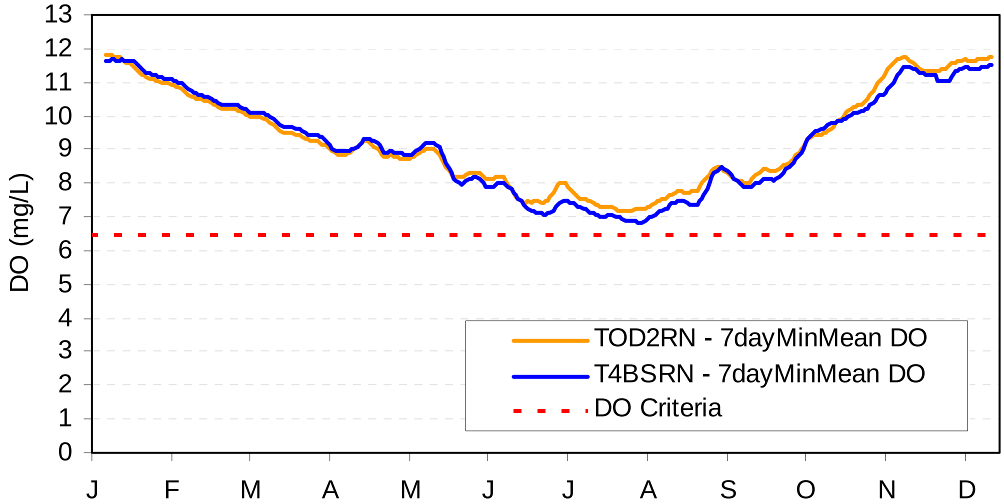

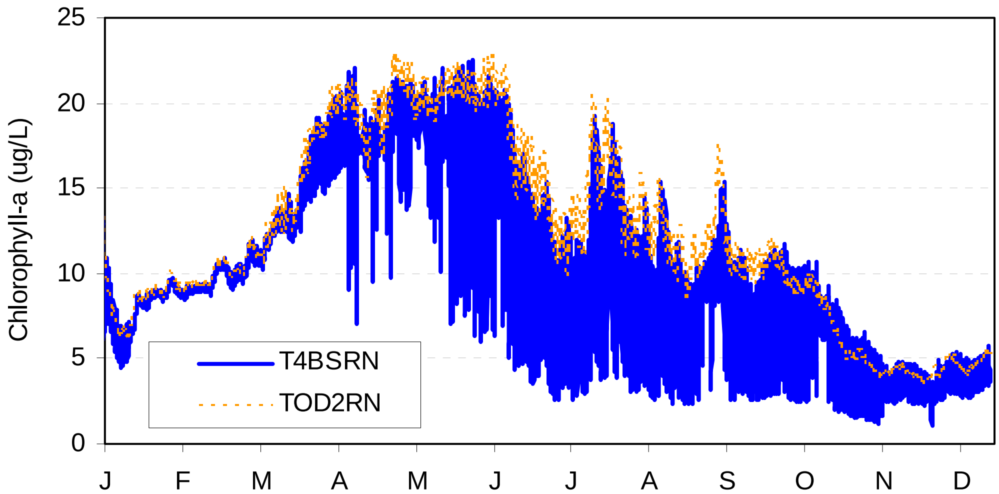

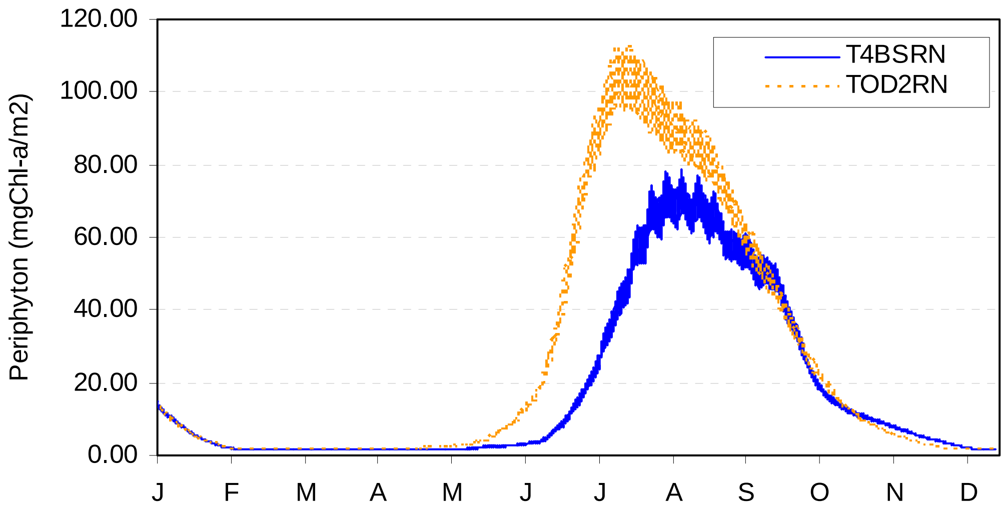

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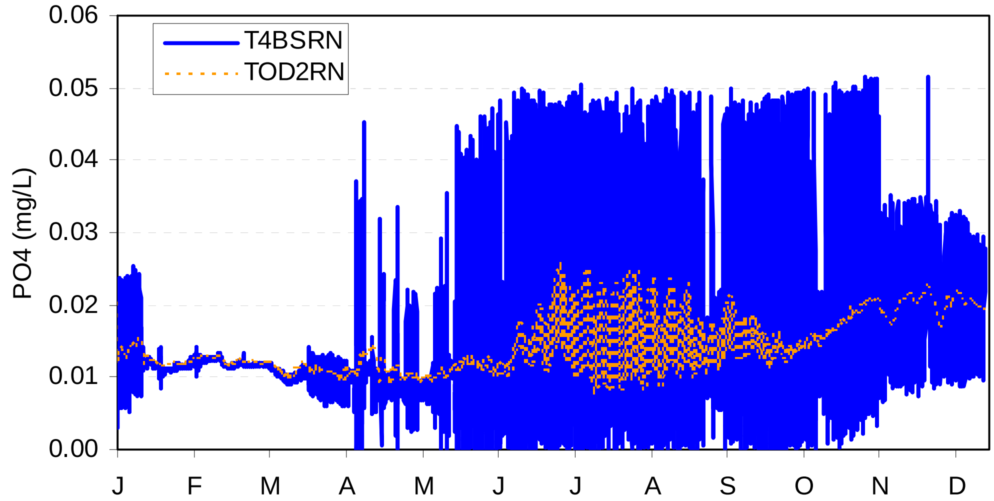

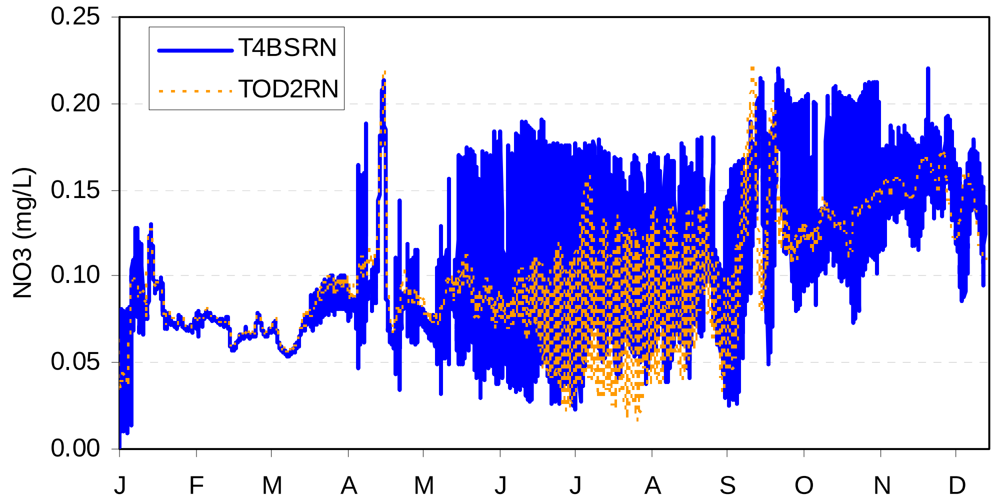

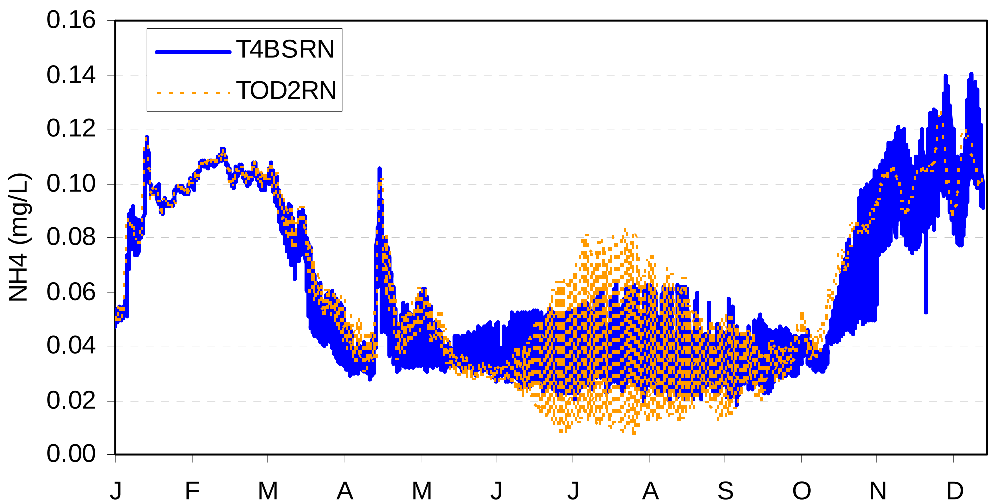

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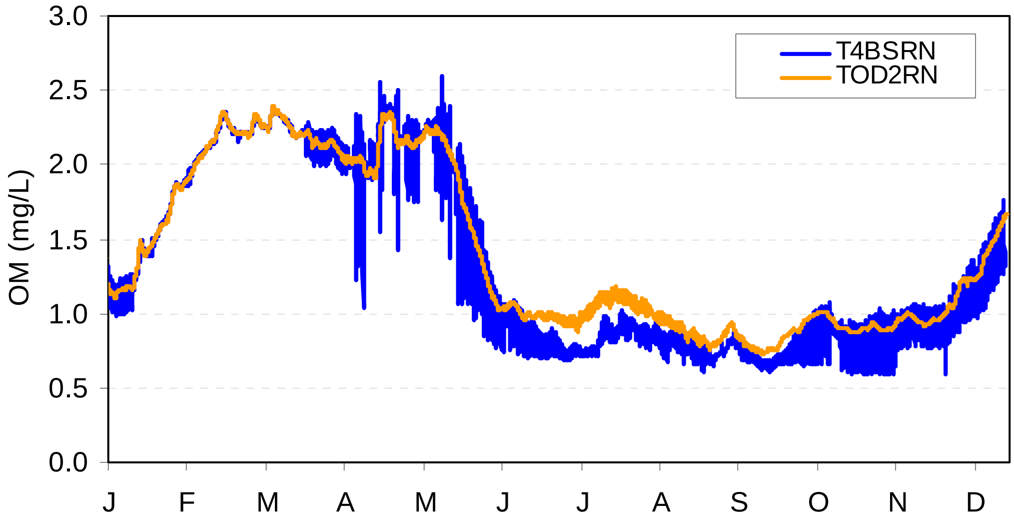

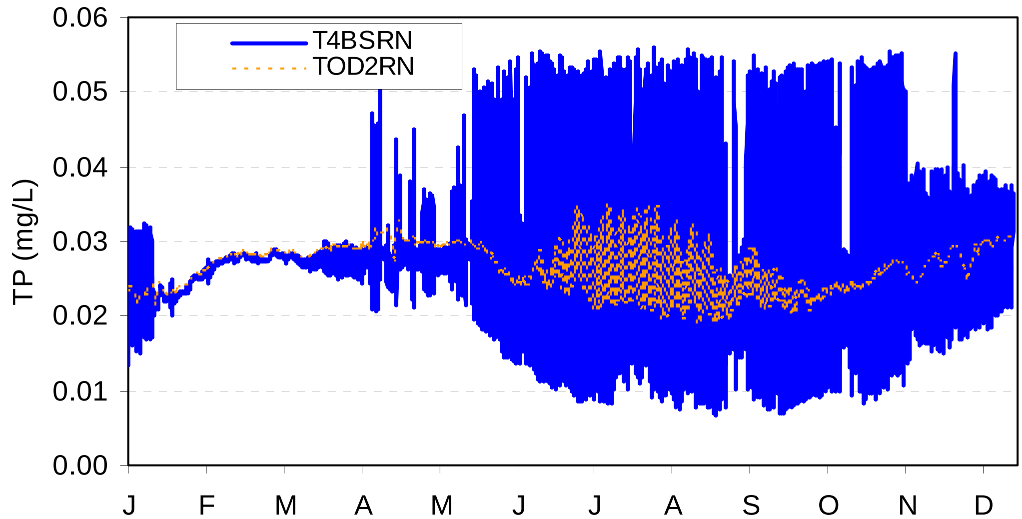

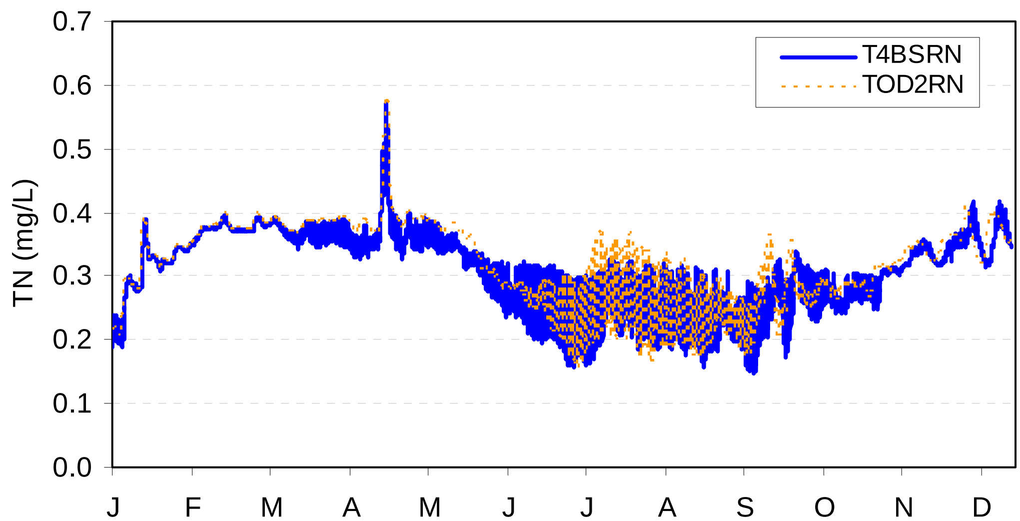

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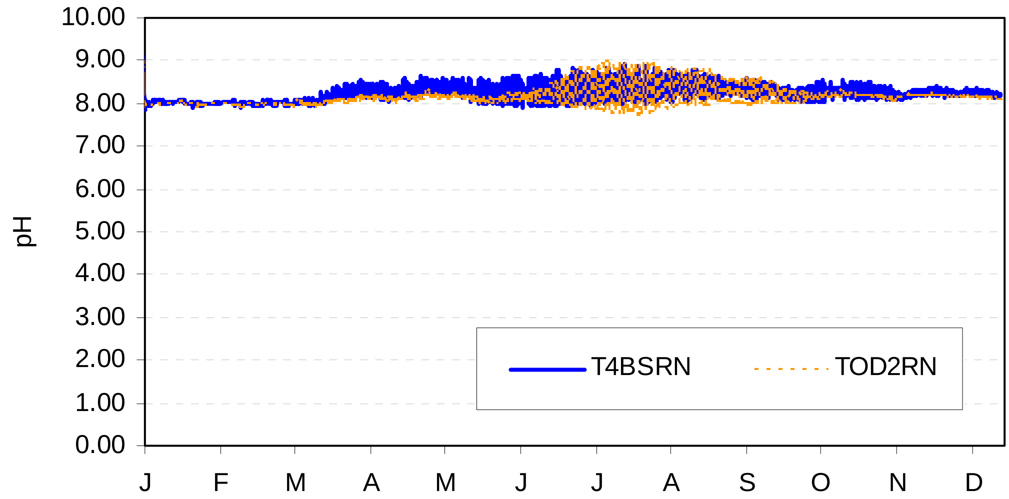

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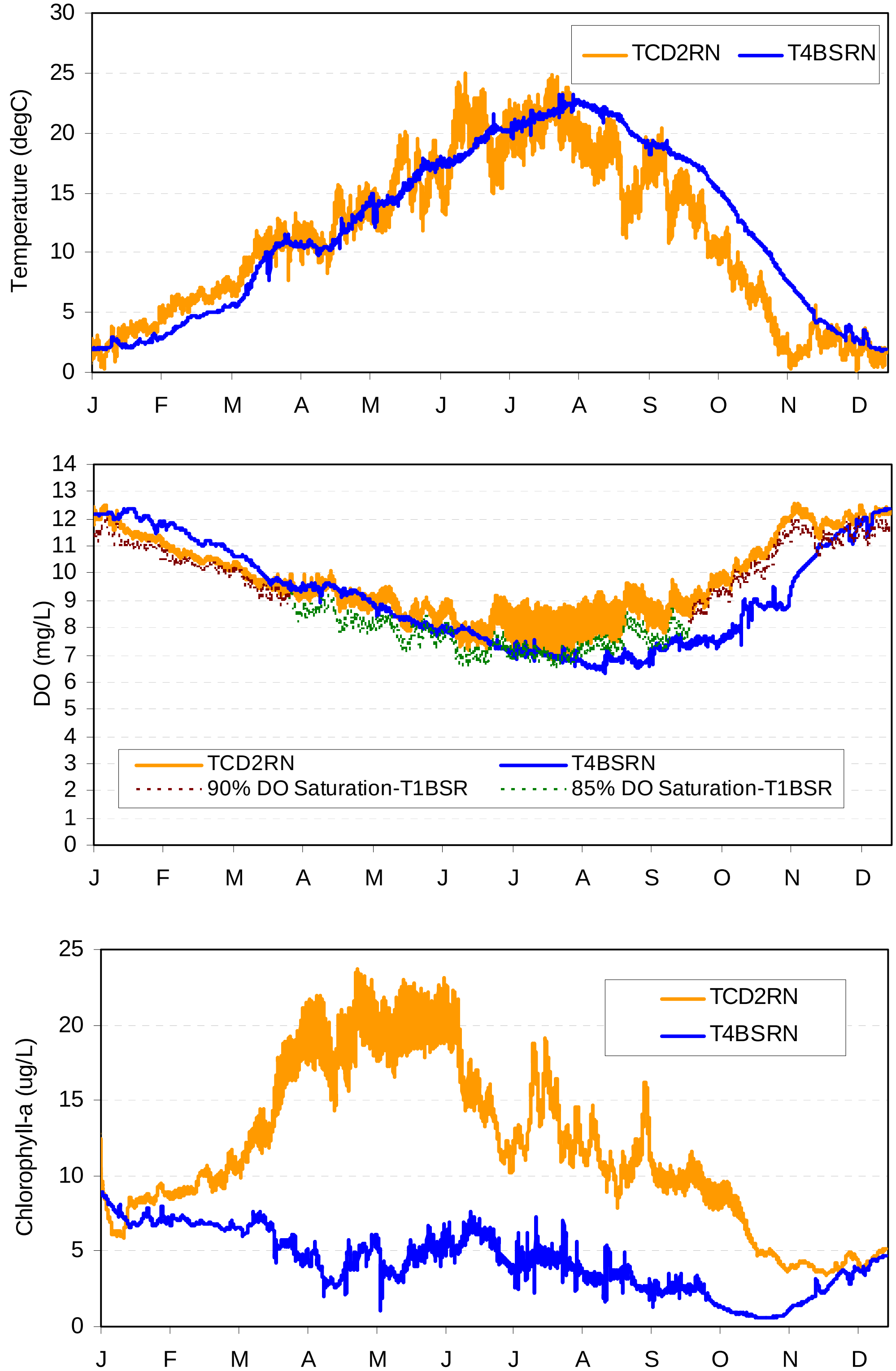

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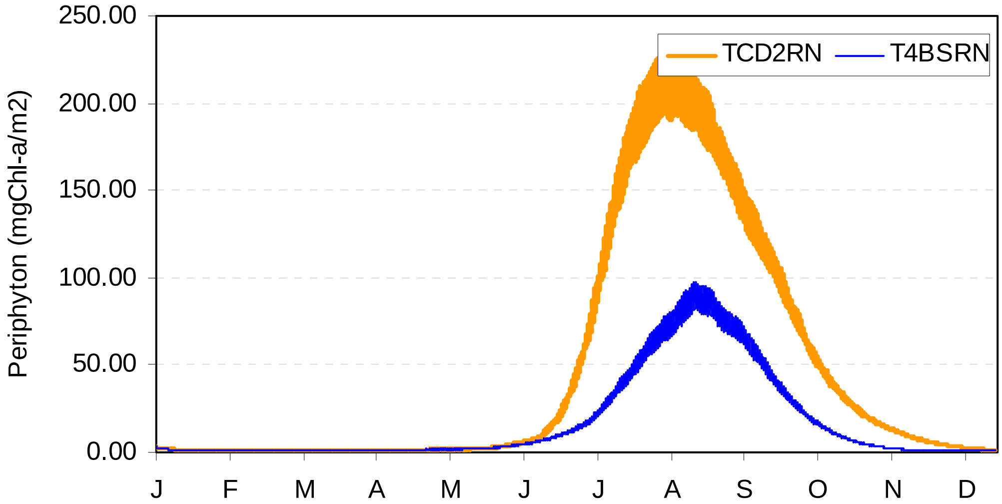

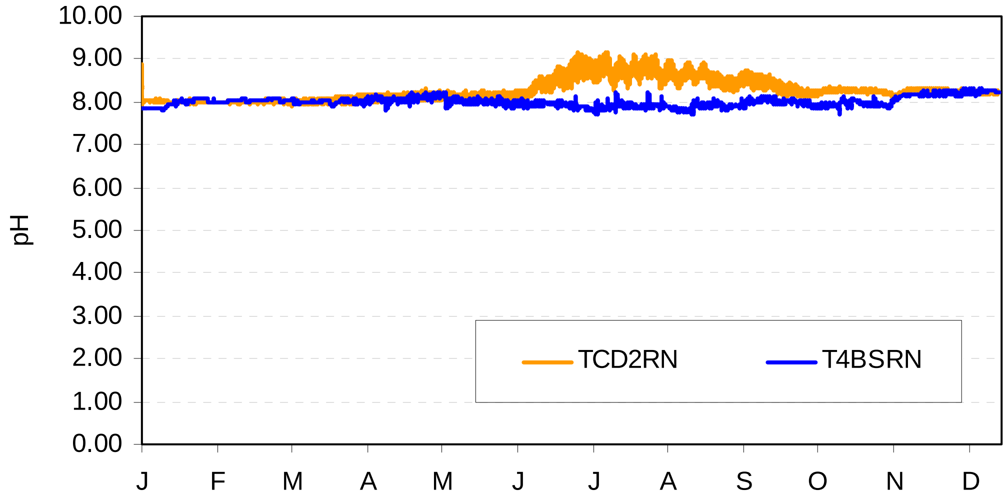

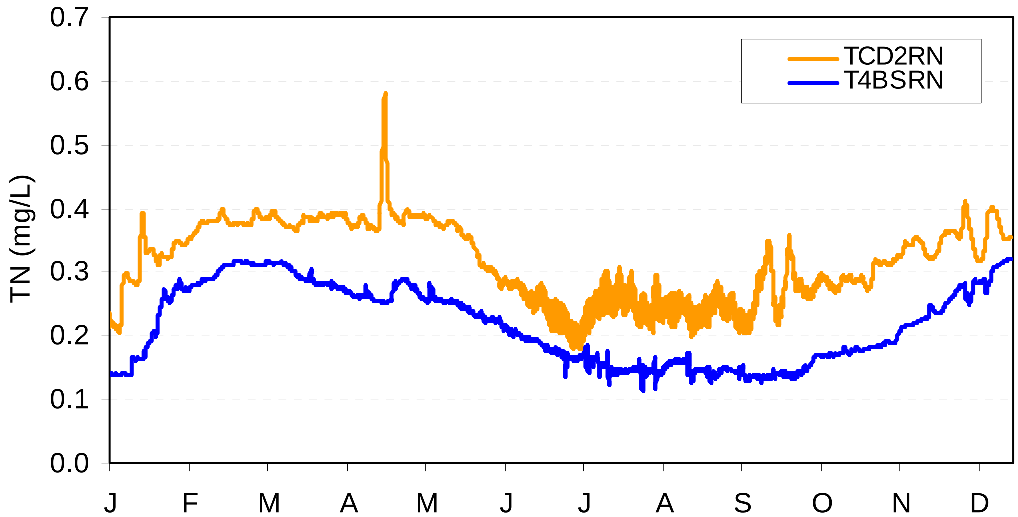

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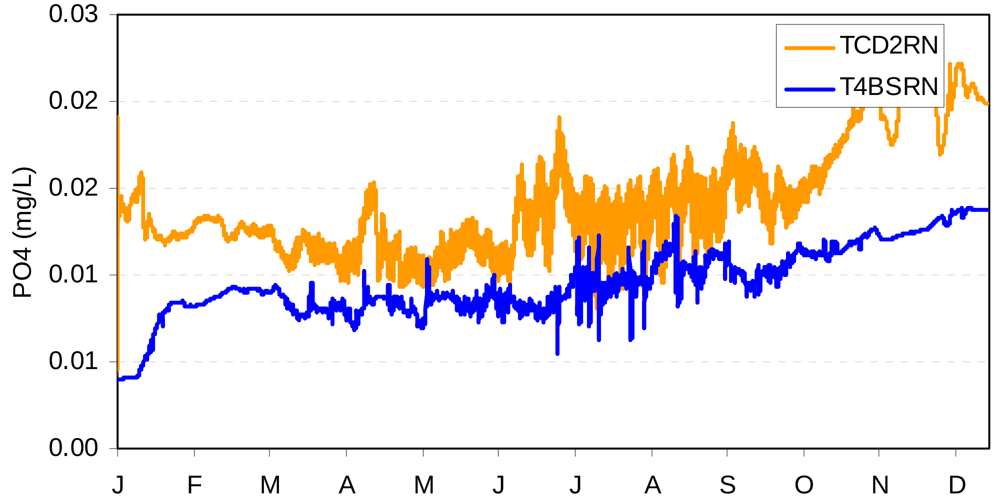

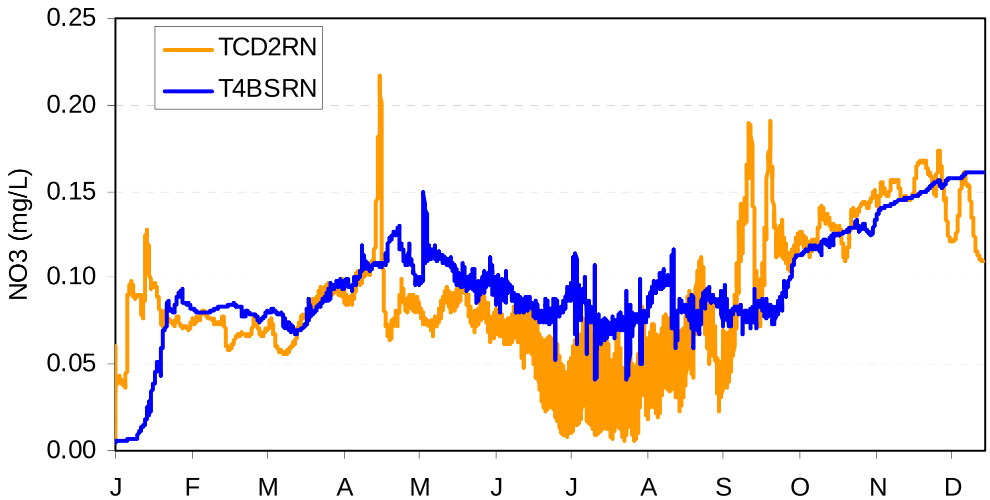

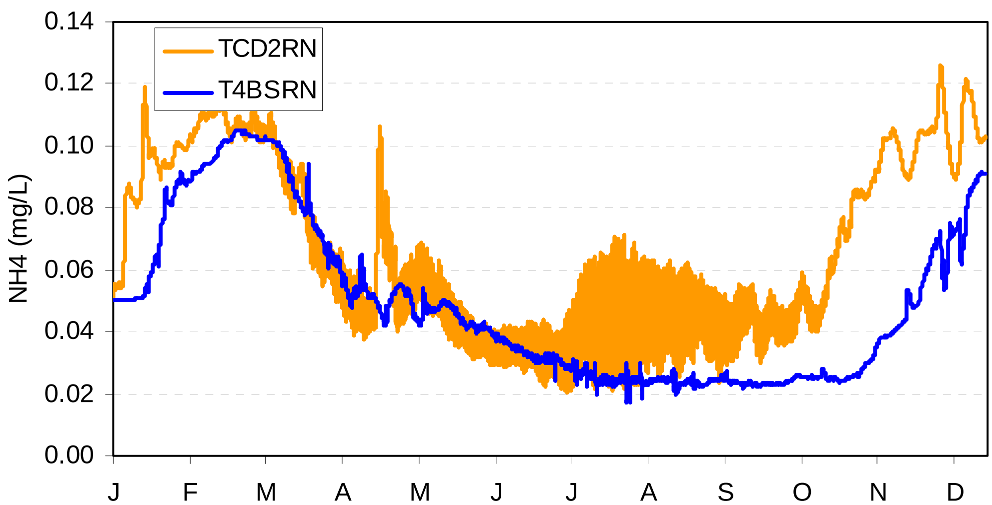

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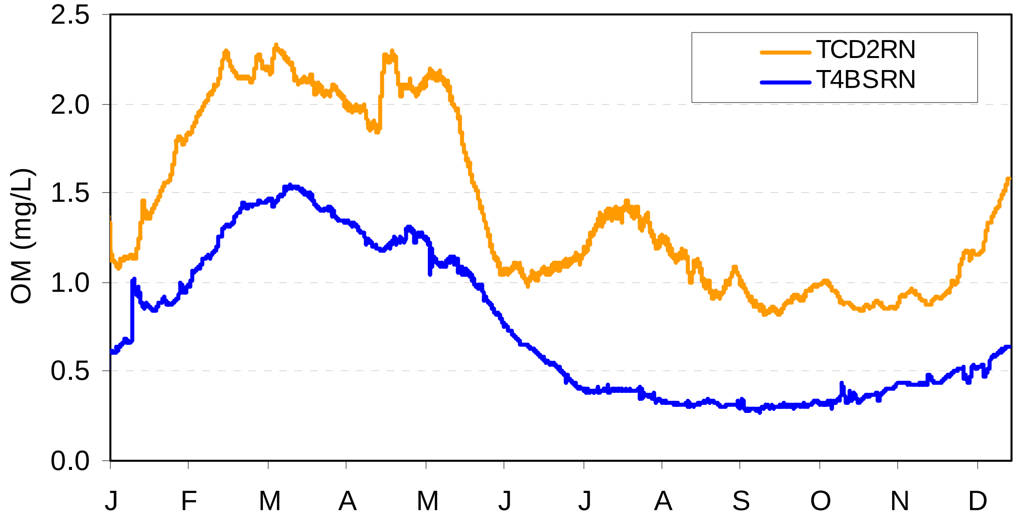

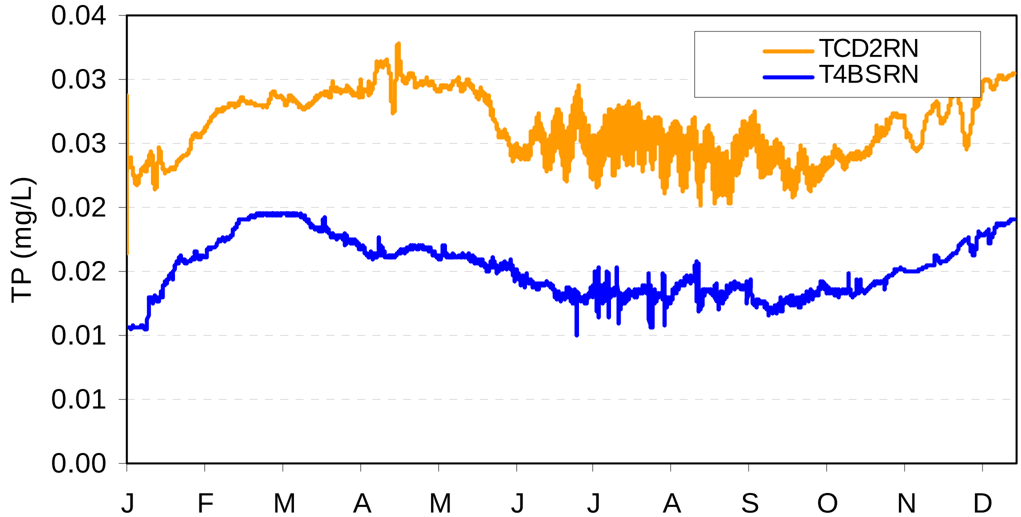

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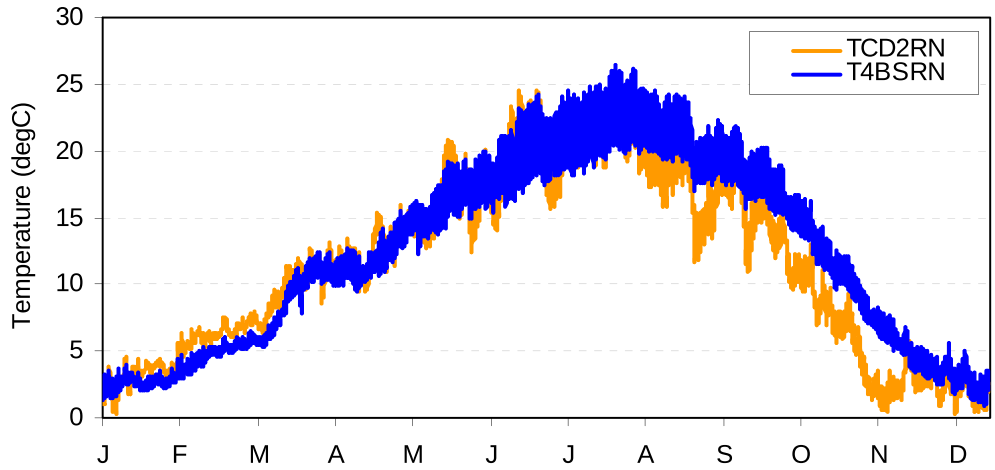

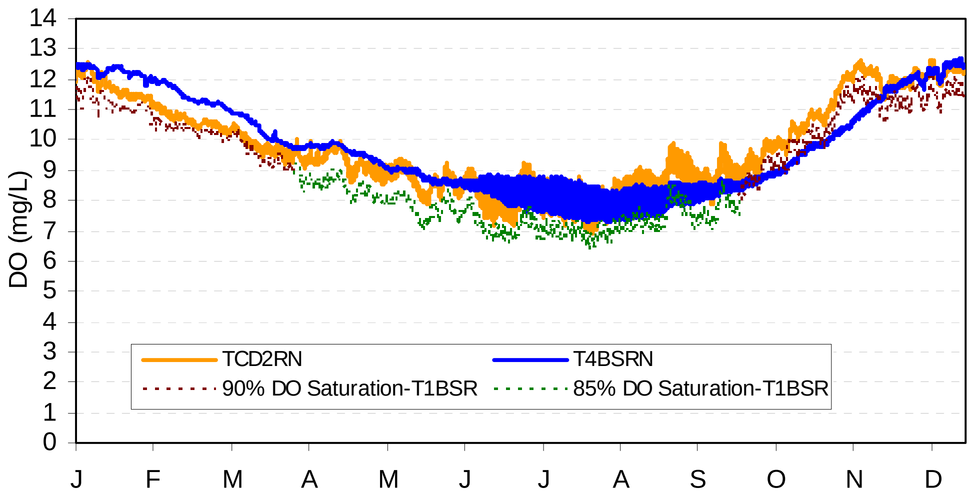

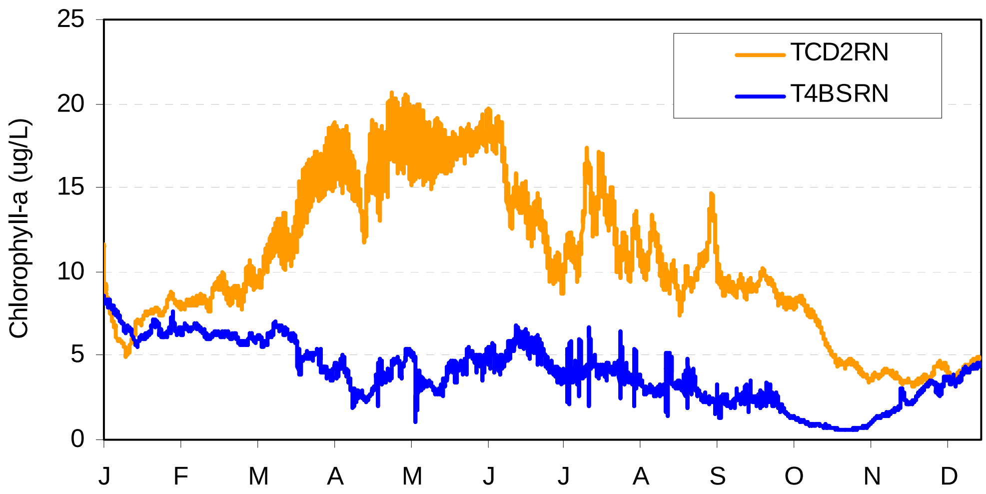

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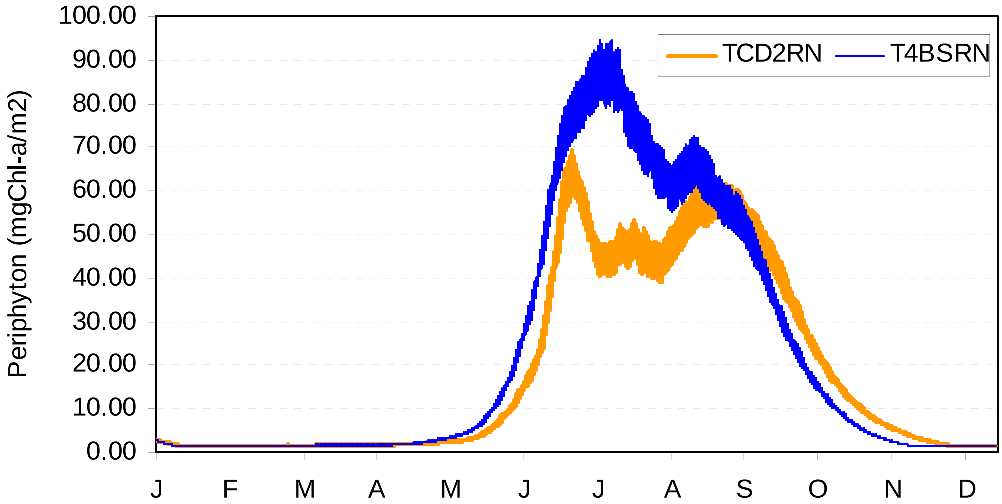

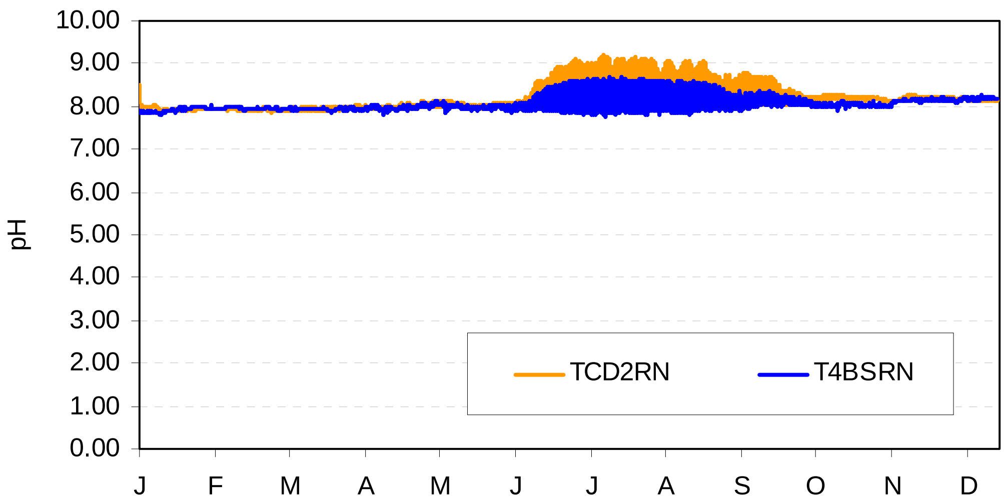

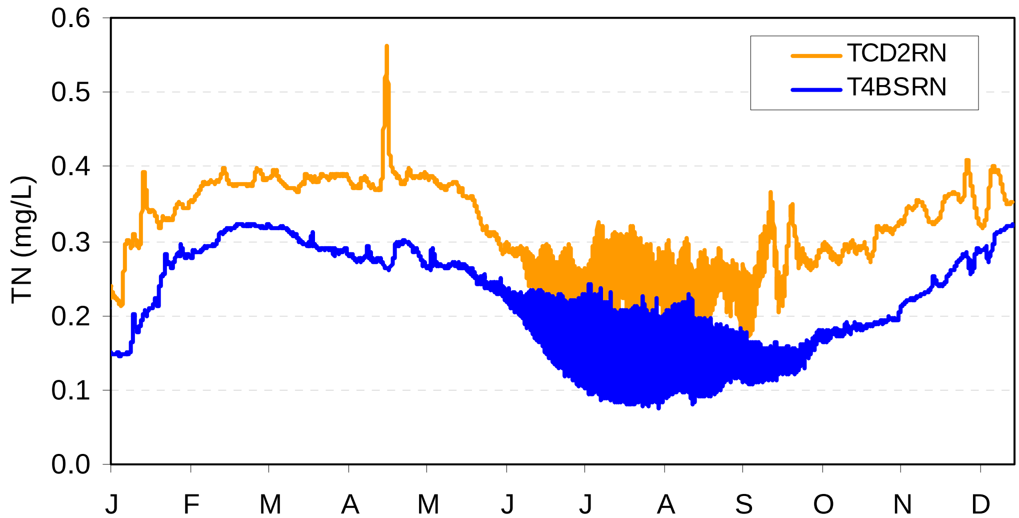

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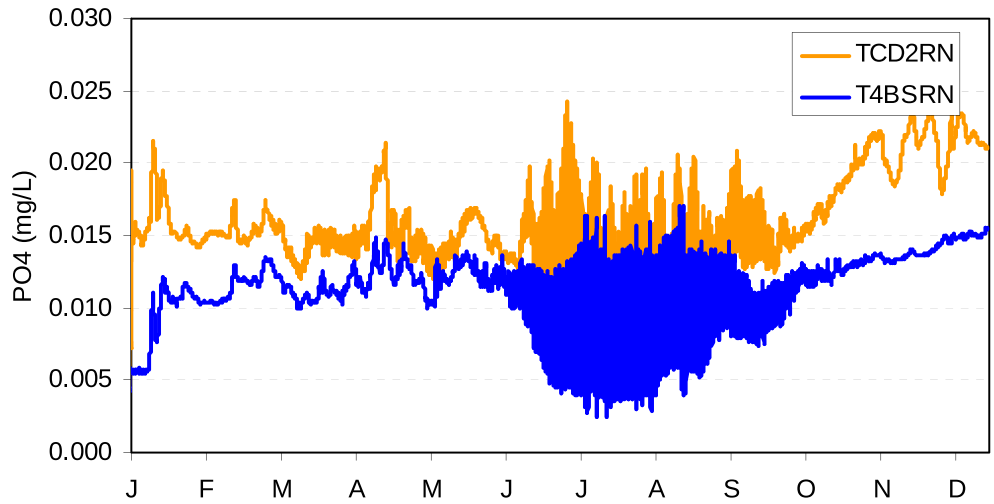

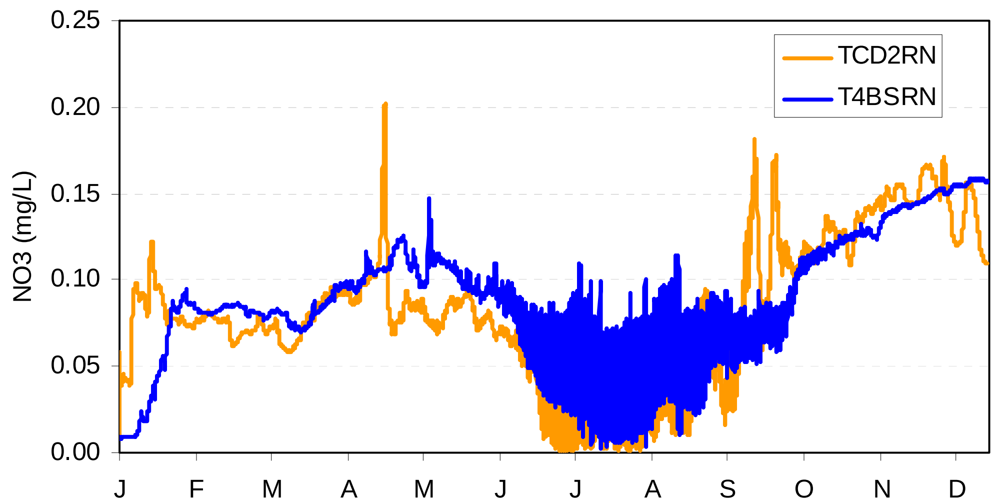

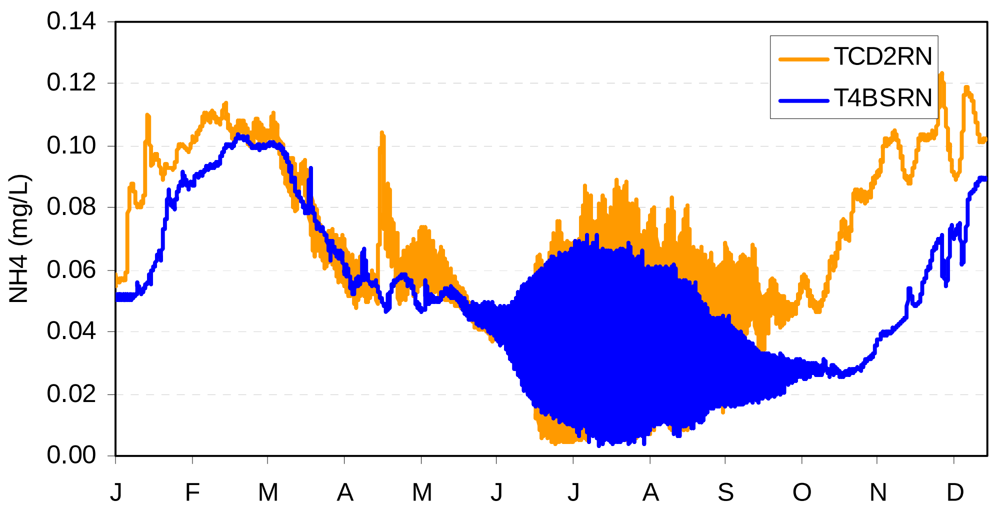

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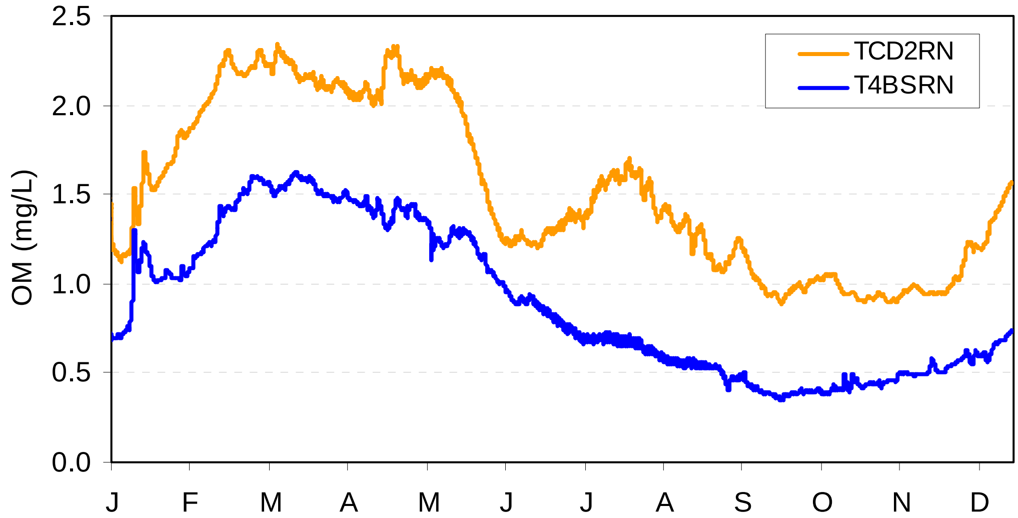

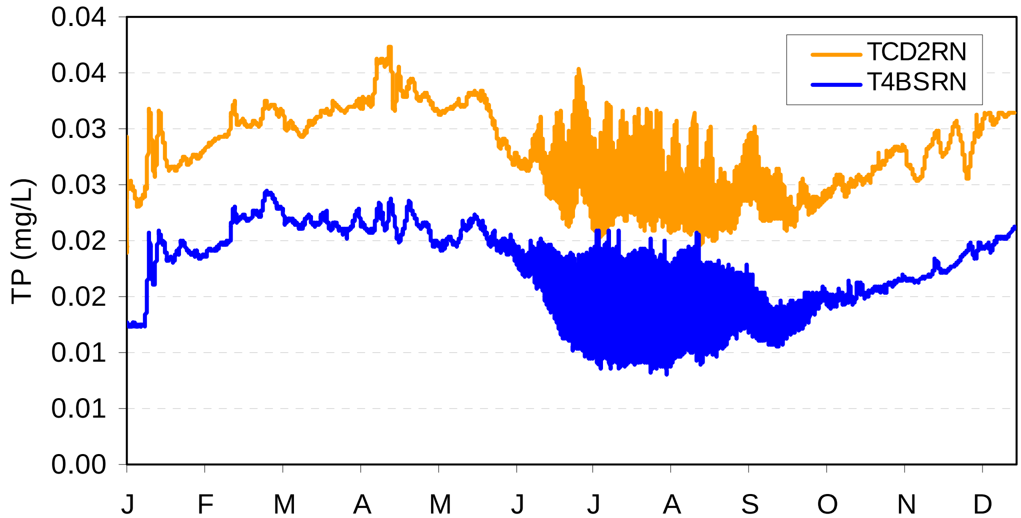

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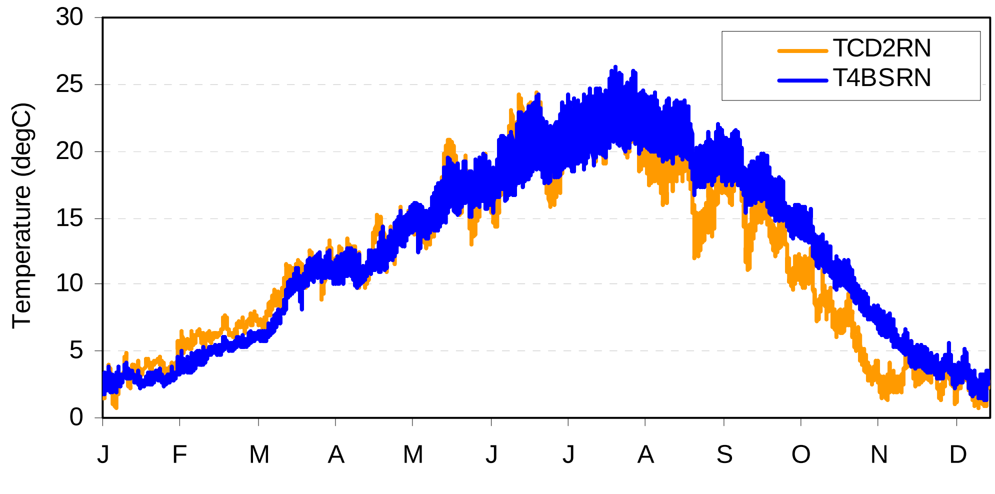

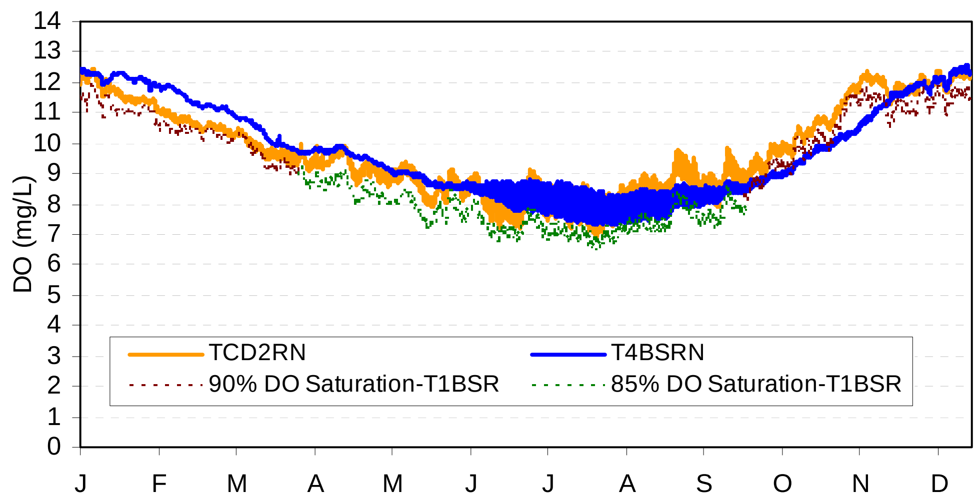

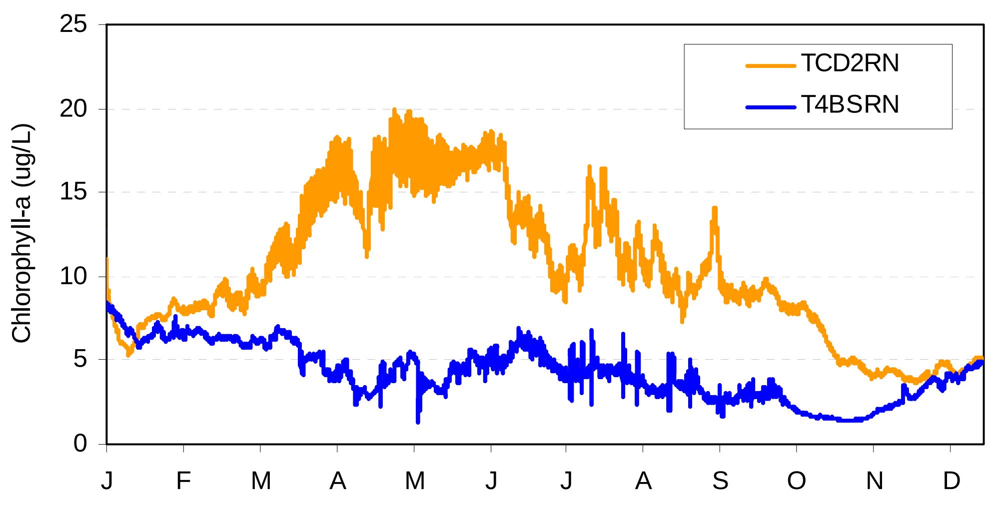

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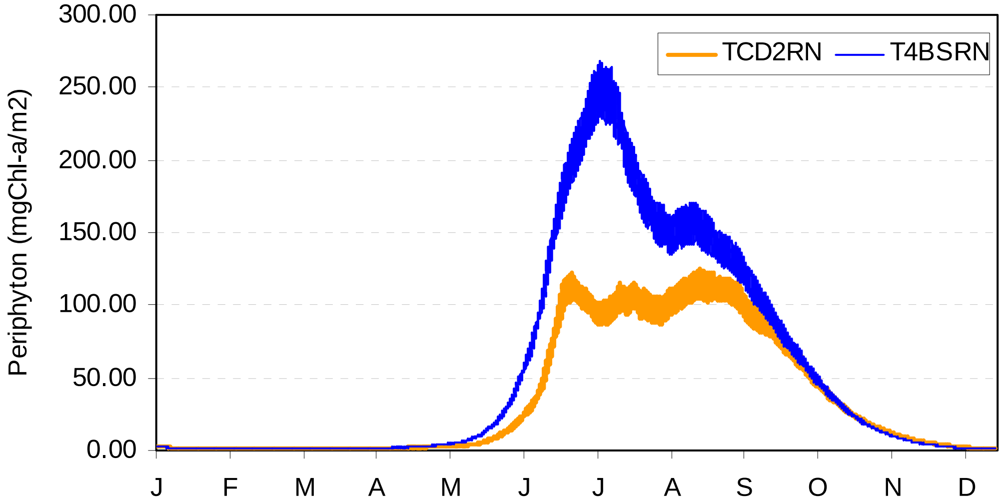

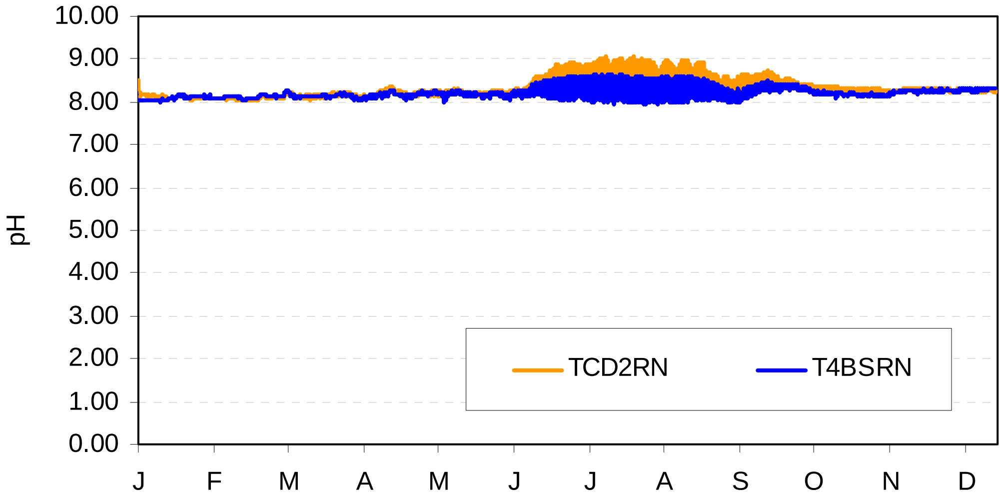

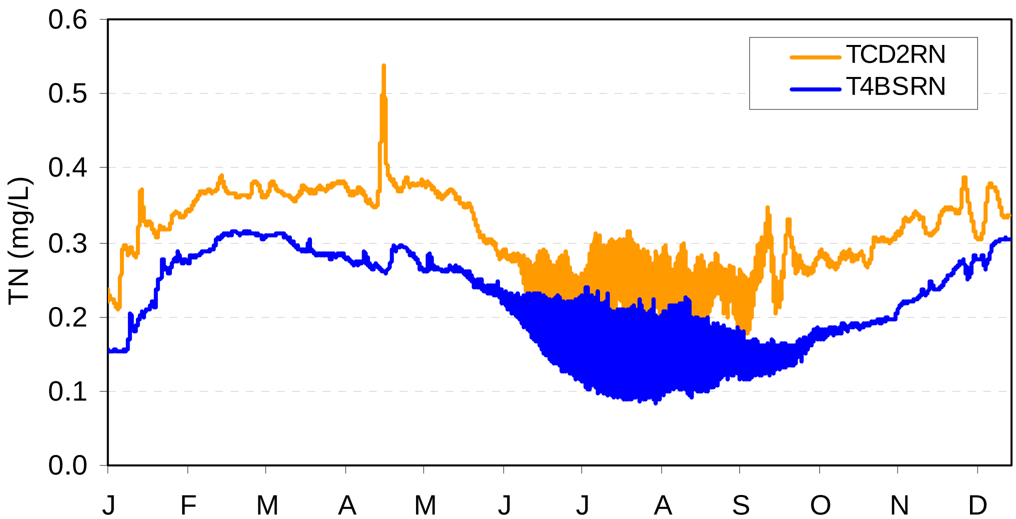

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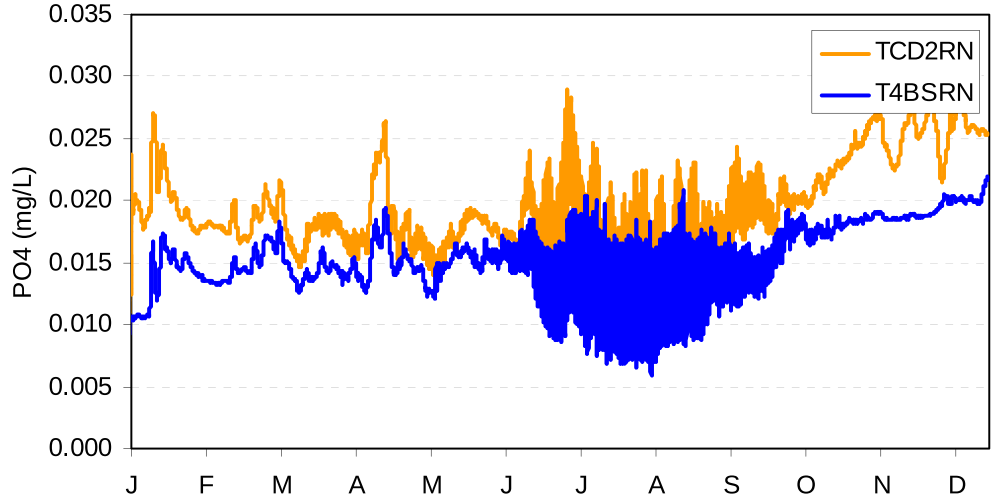

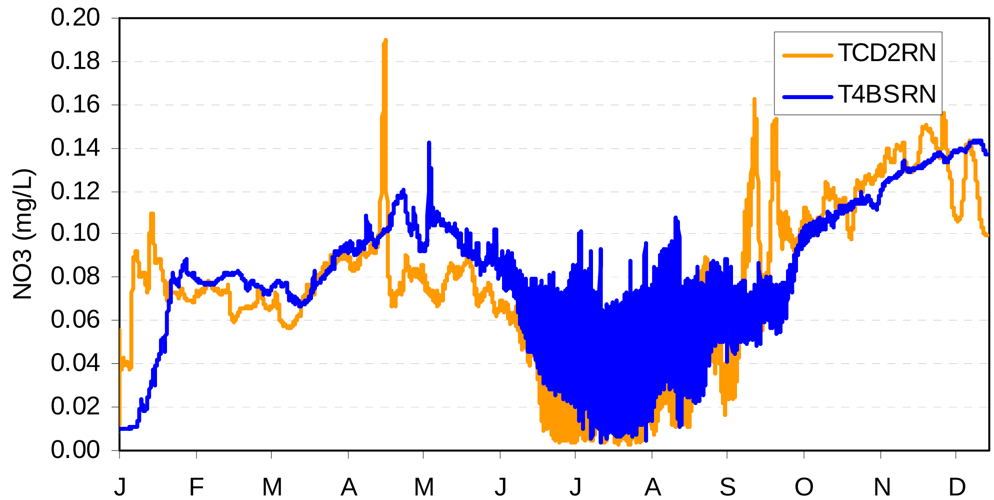

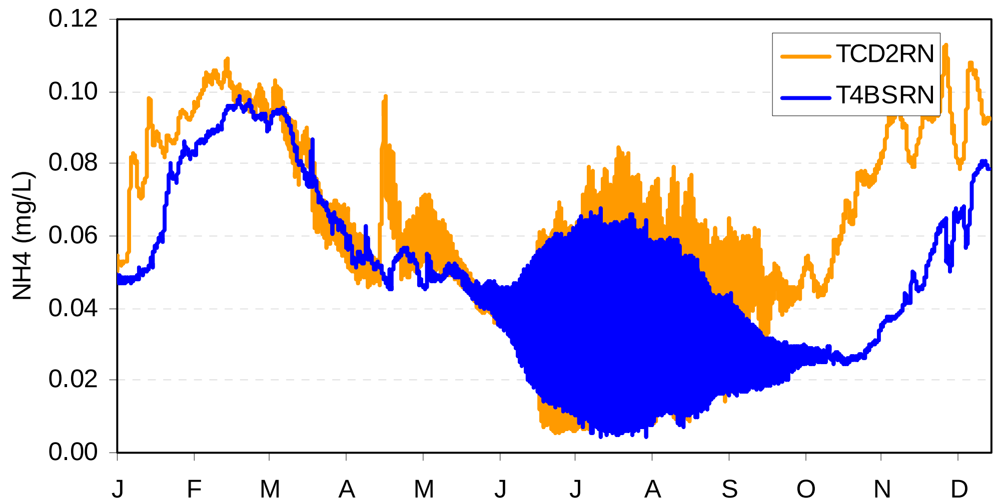

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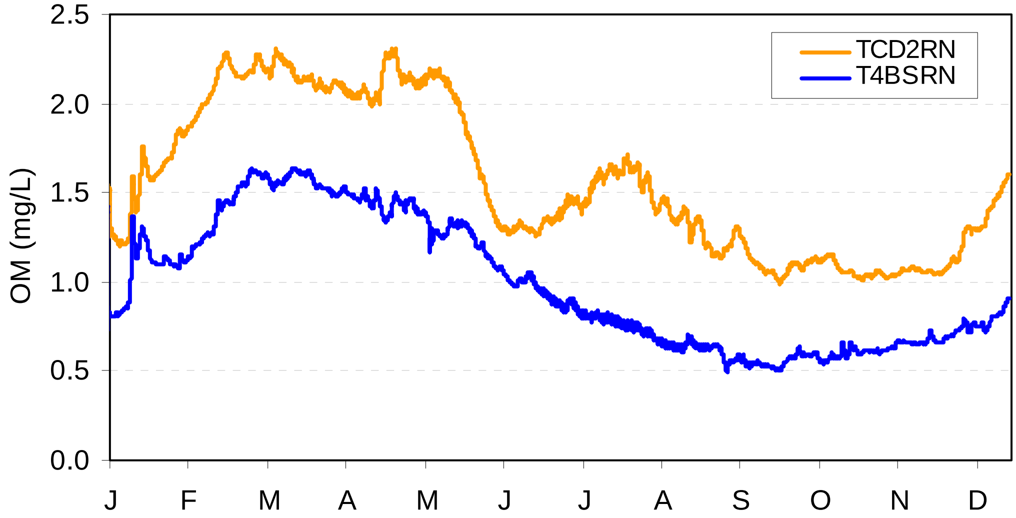
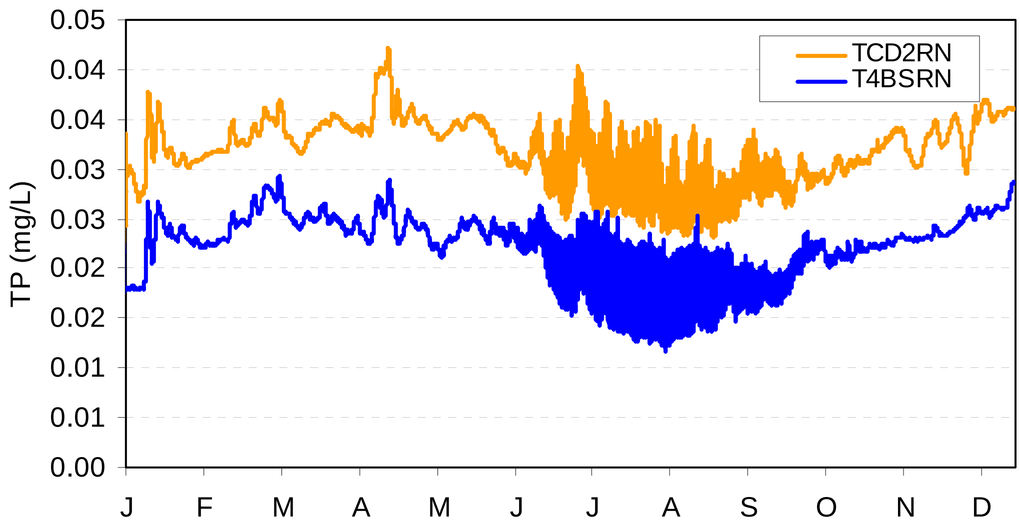
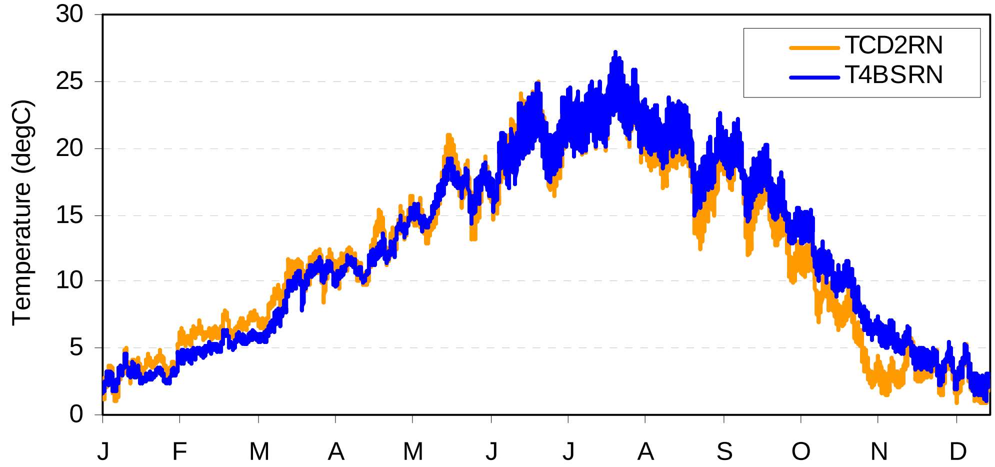
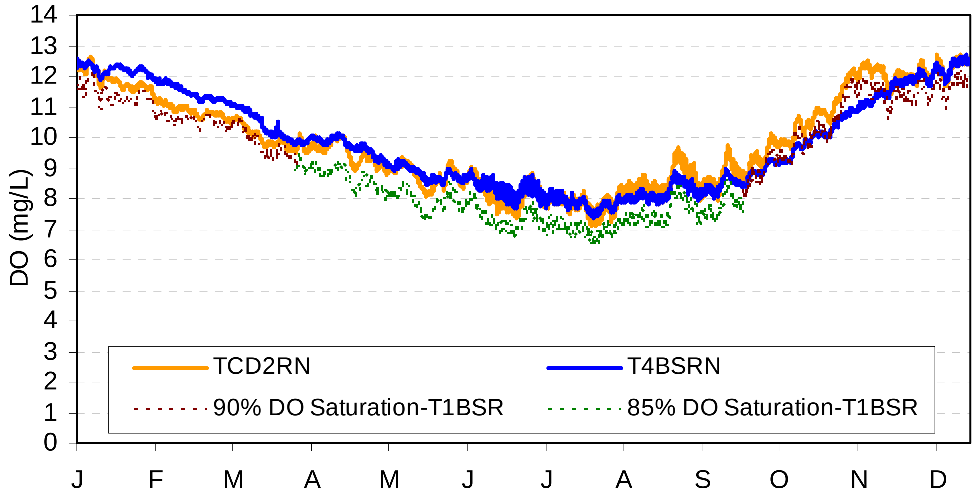
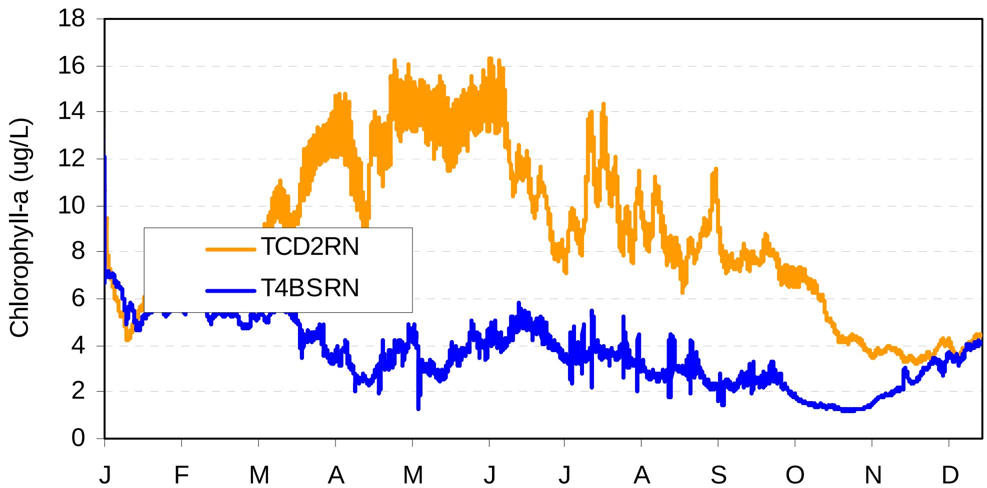




CT4BSRN_US_SCOTT







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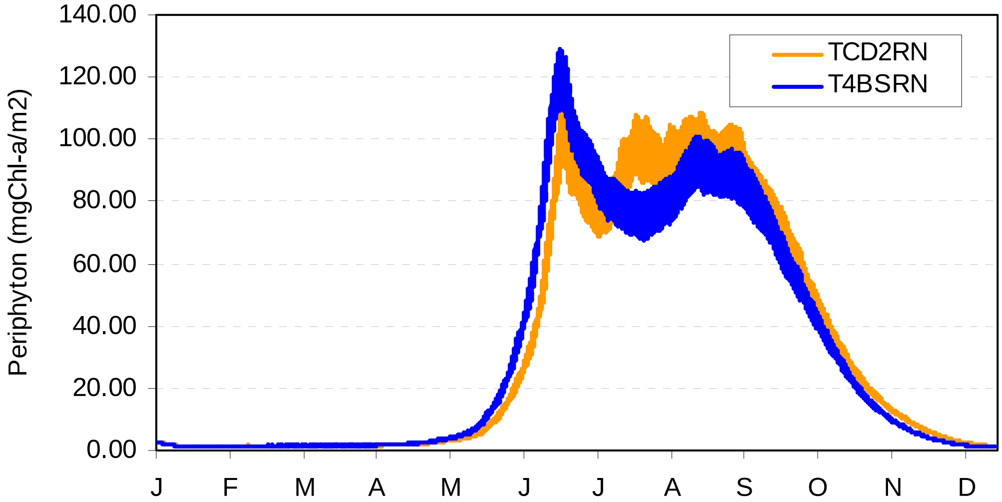

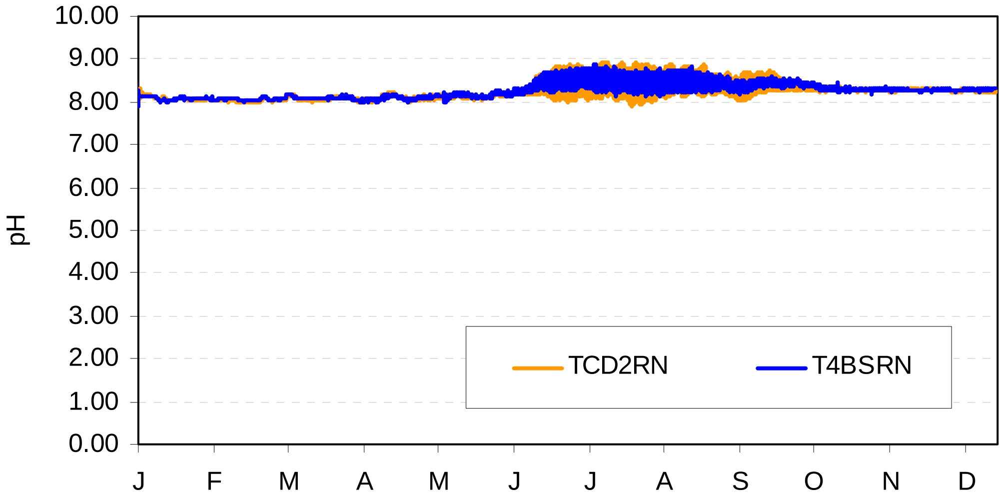

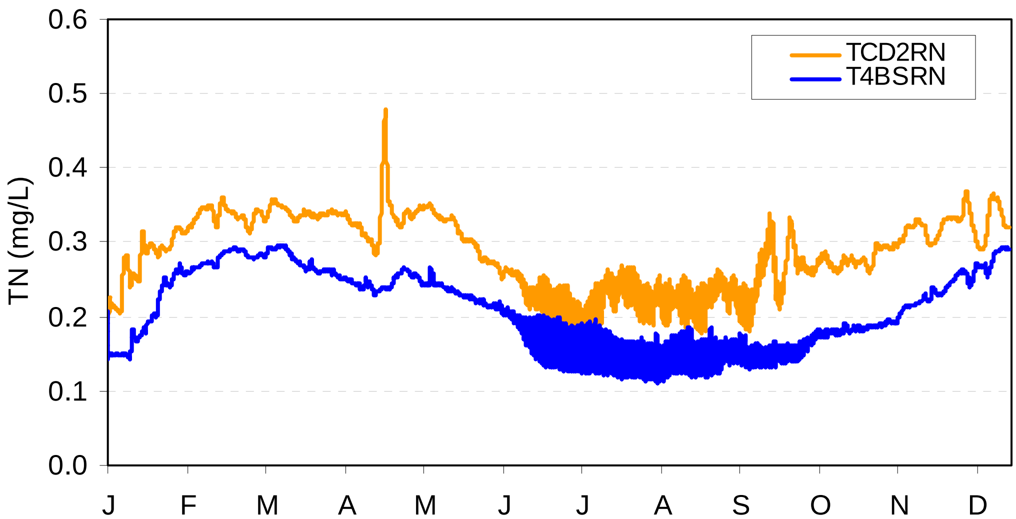

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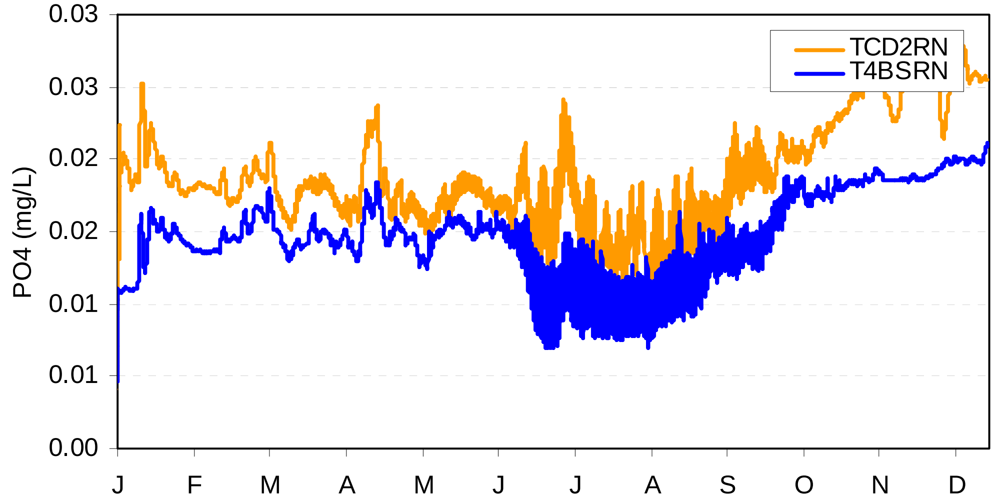

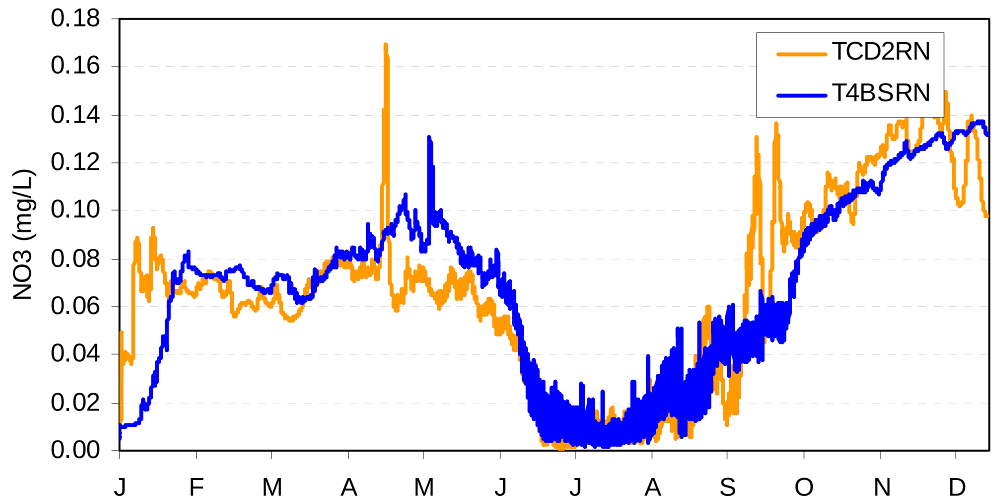

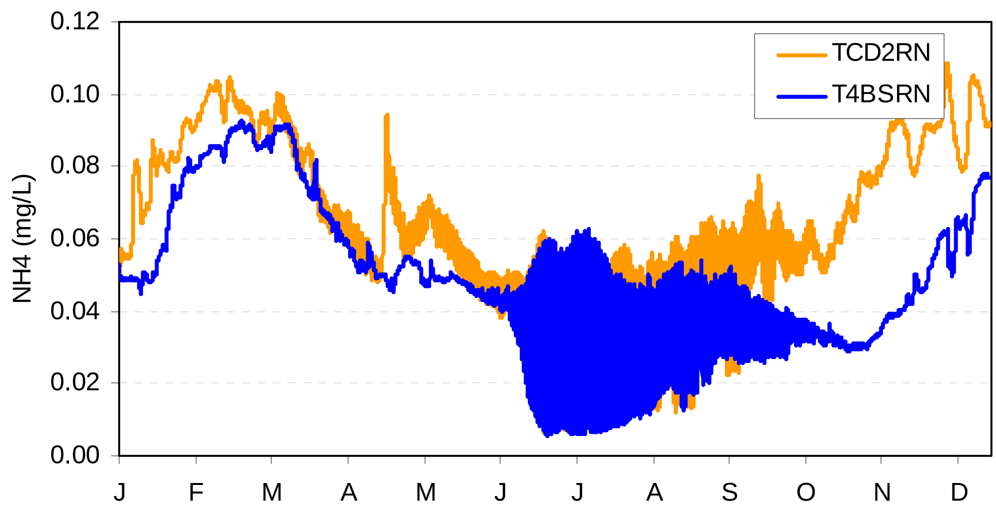

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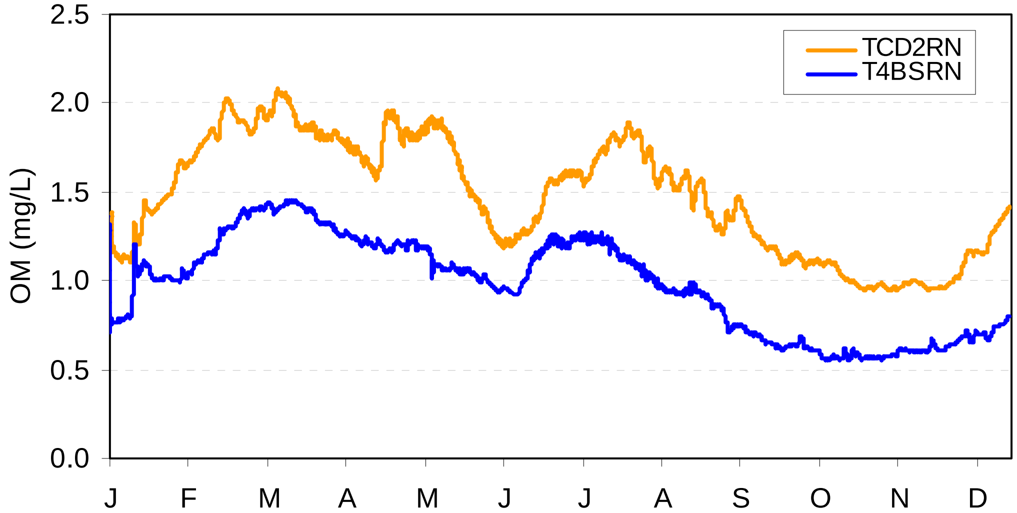

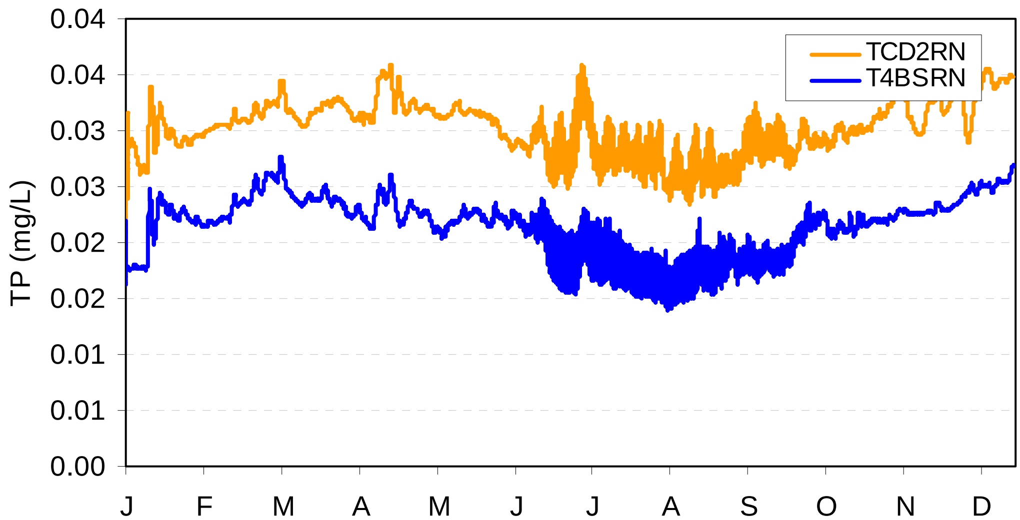

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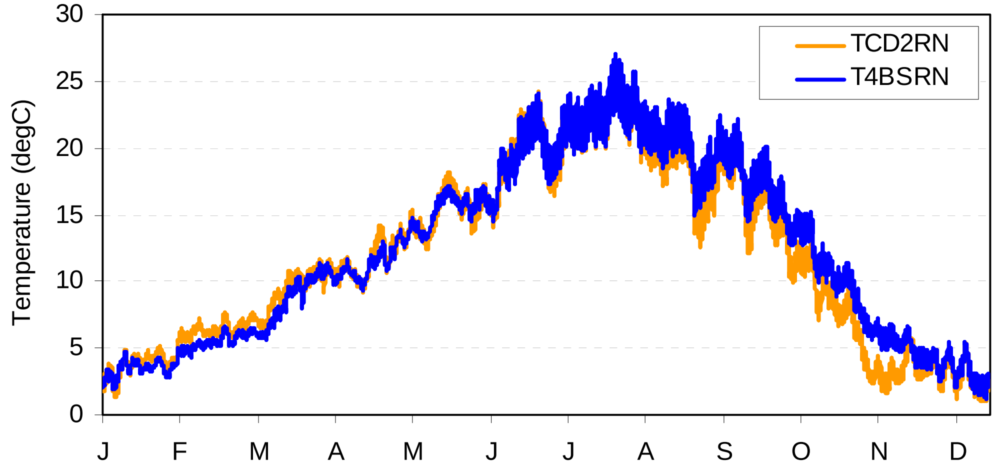

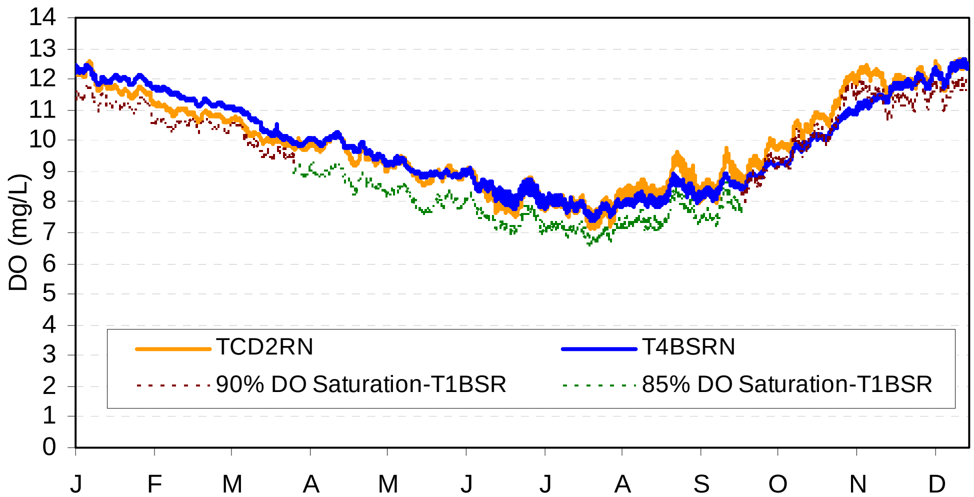

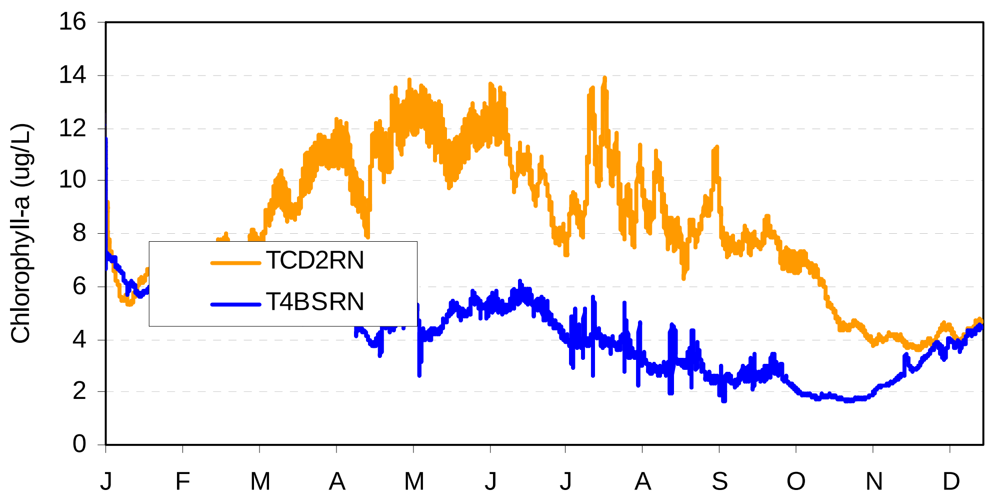

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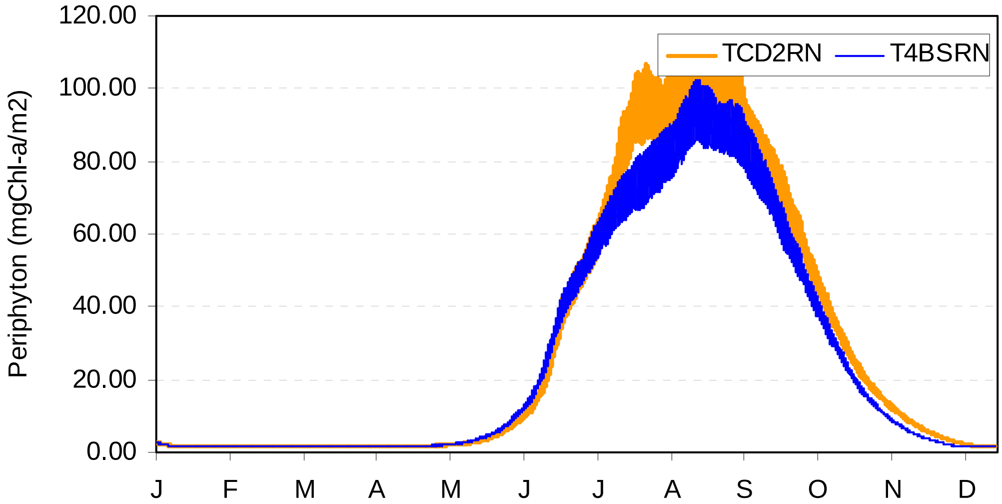

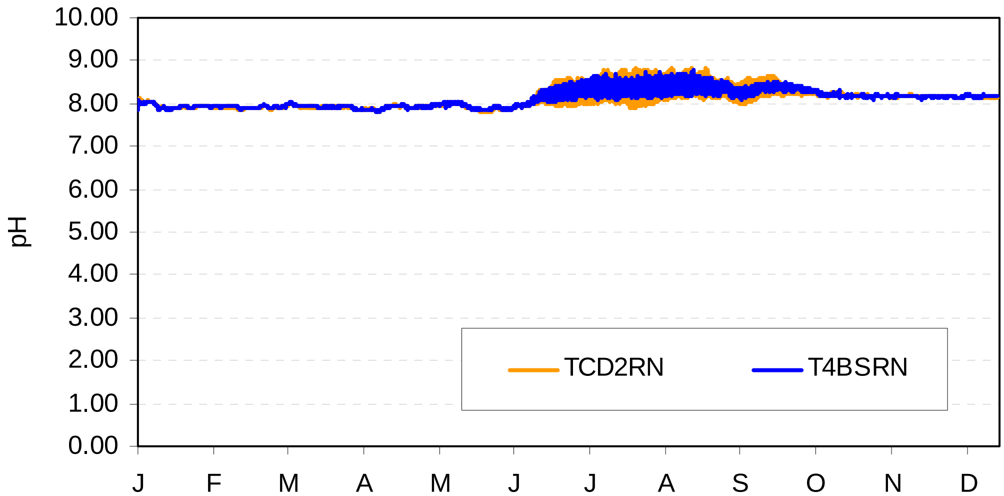

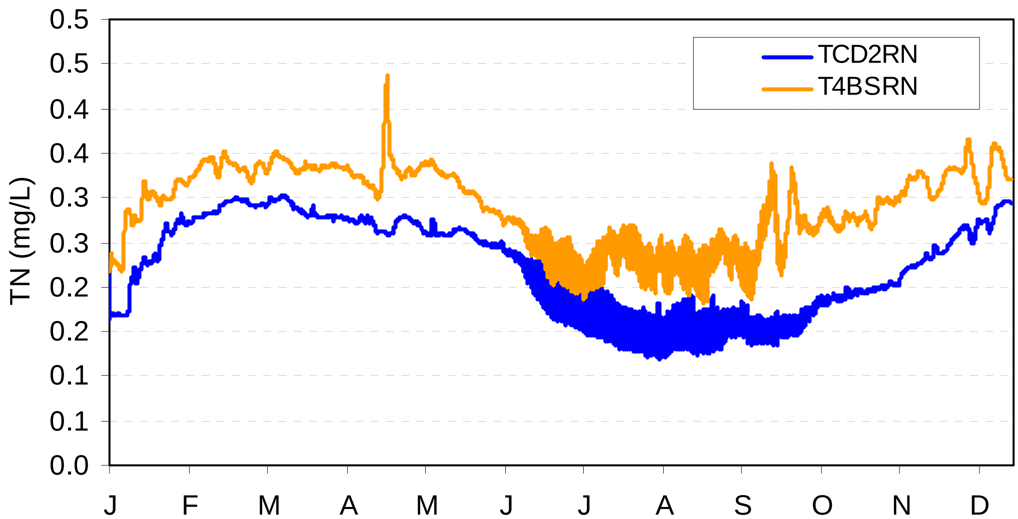

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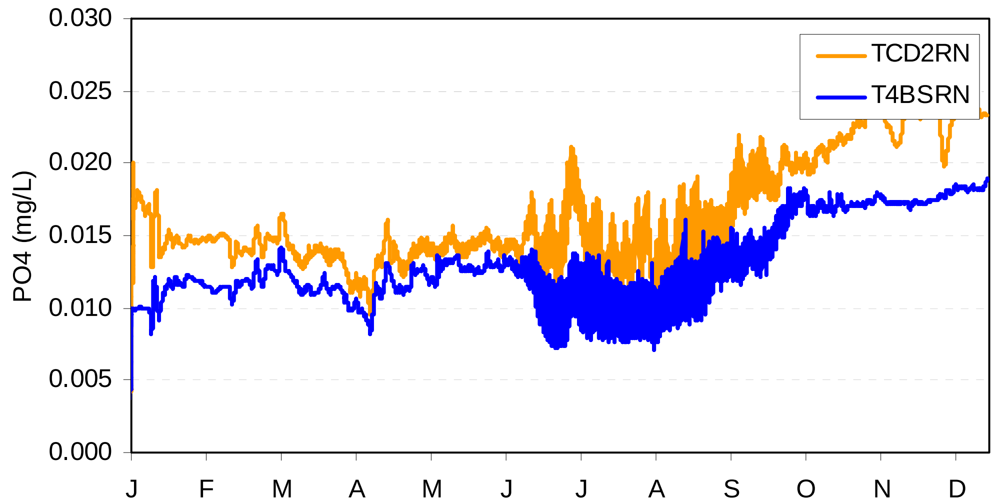

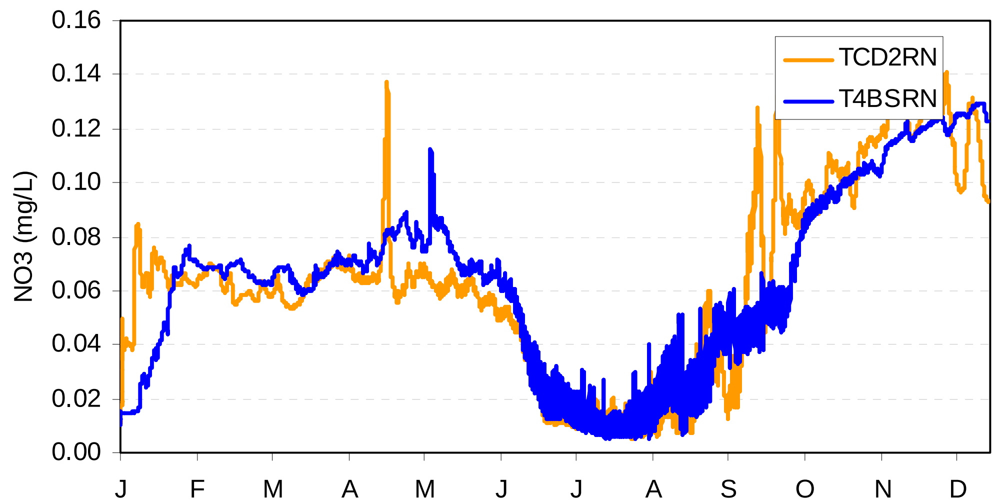

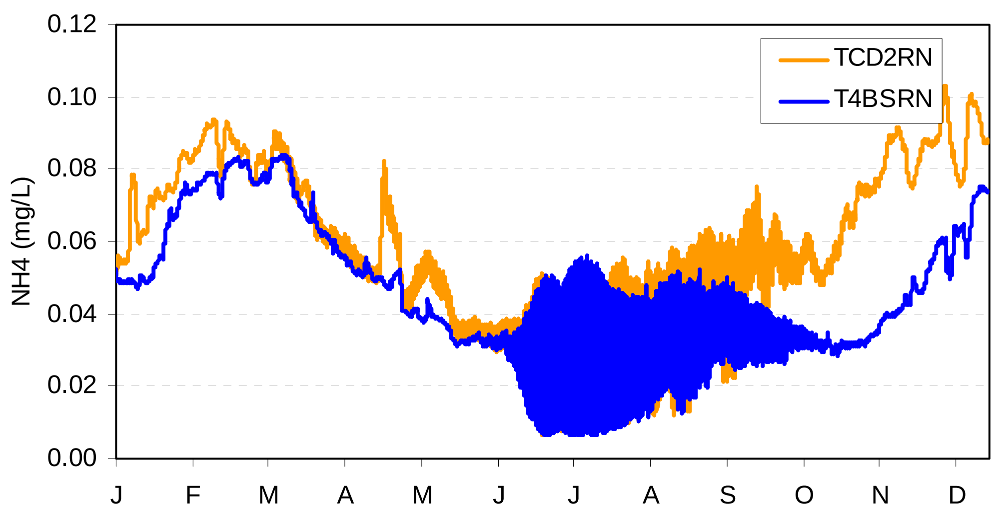

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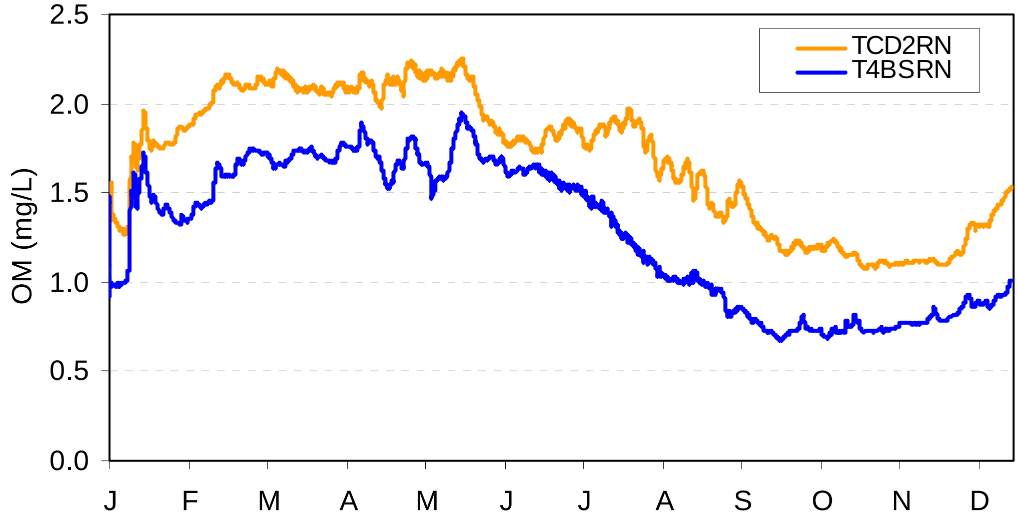

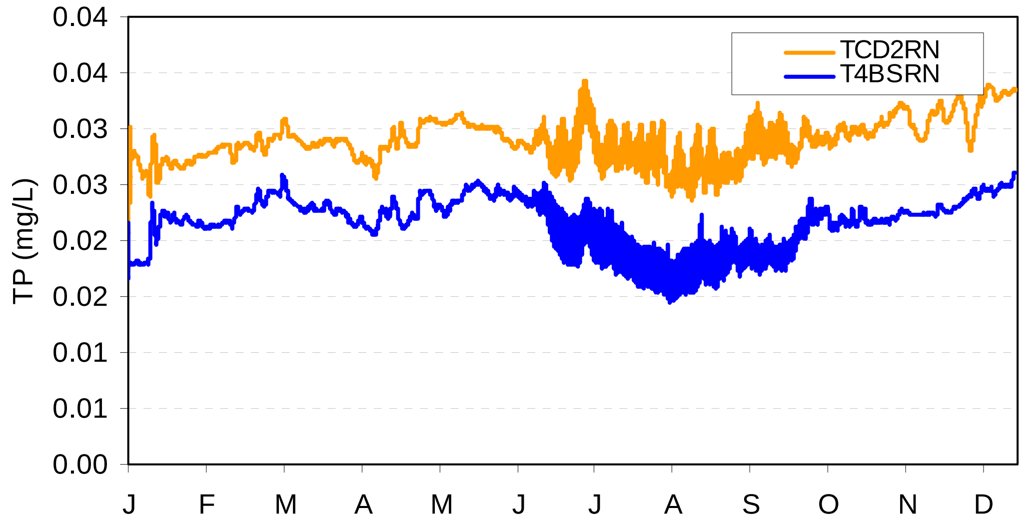

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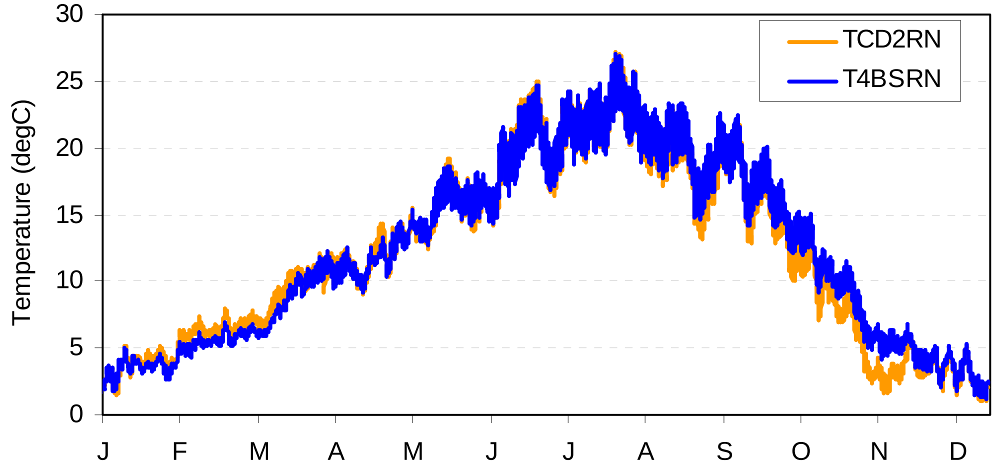

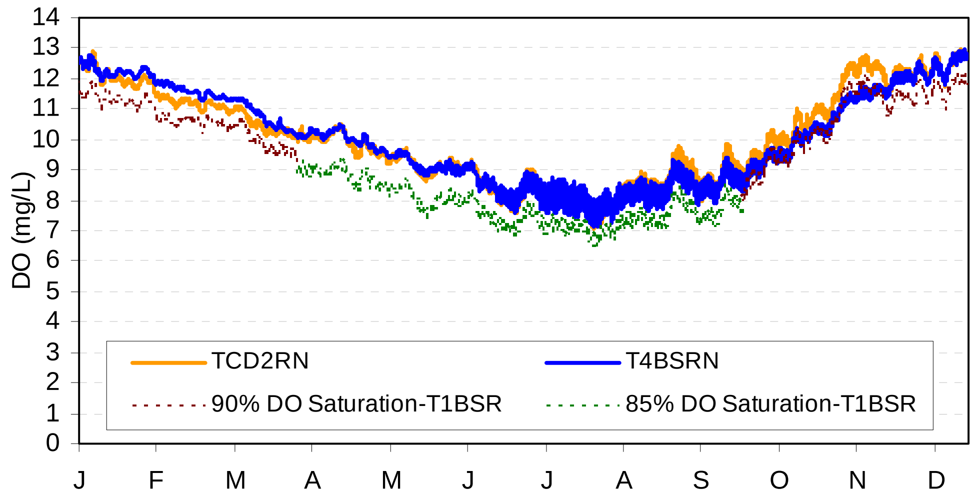

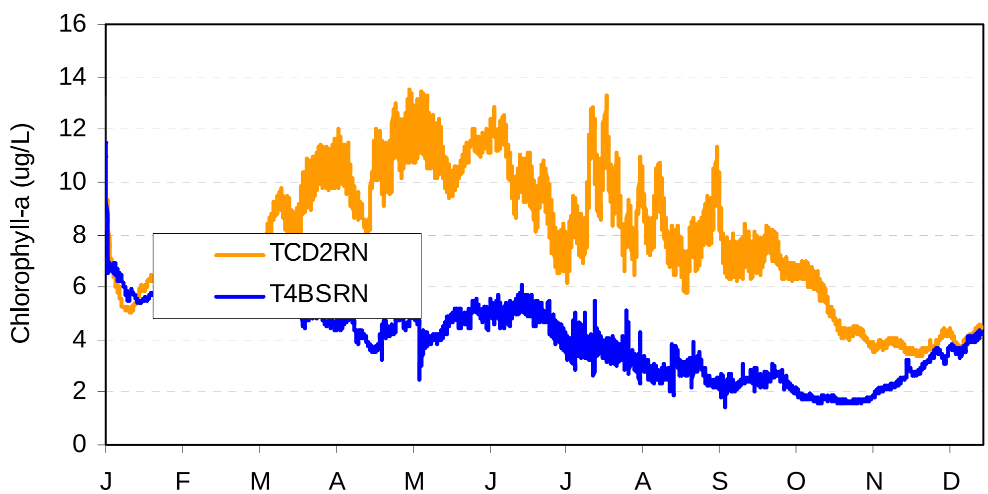

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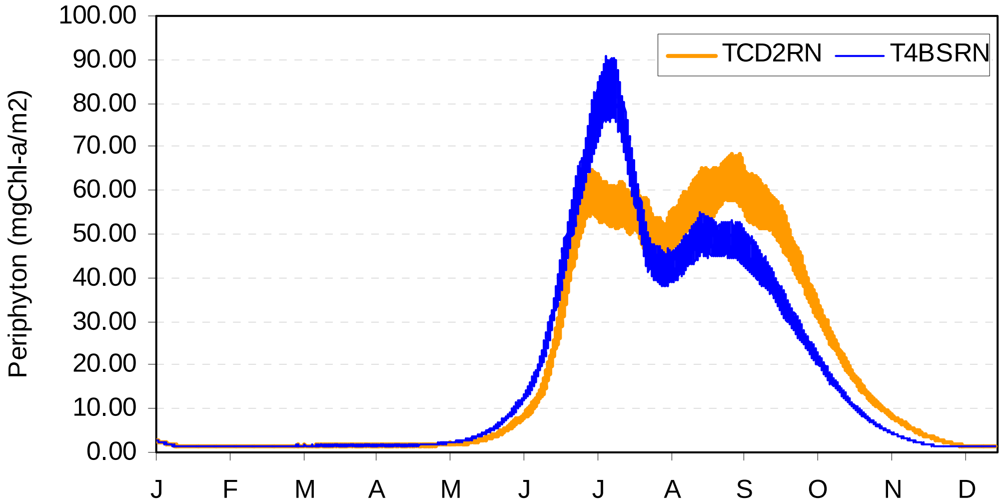

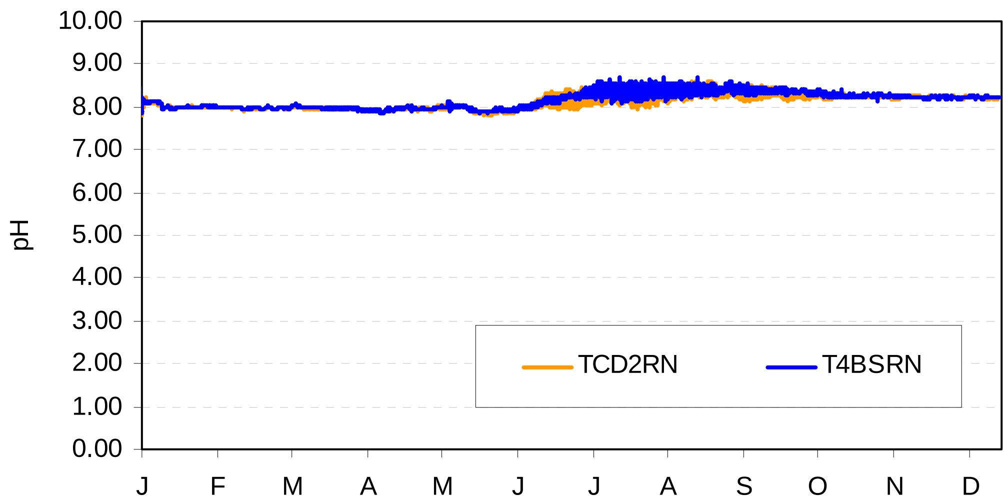

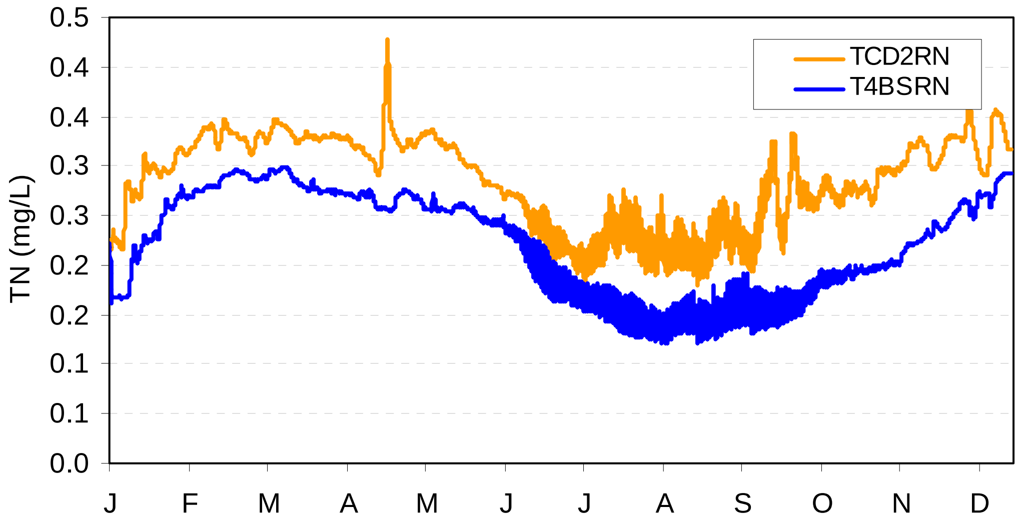

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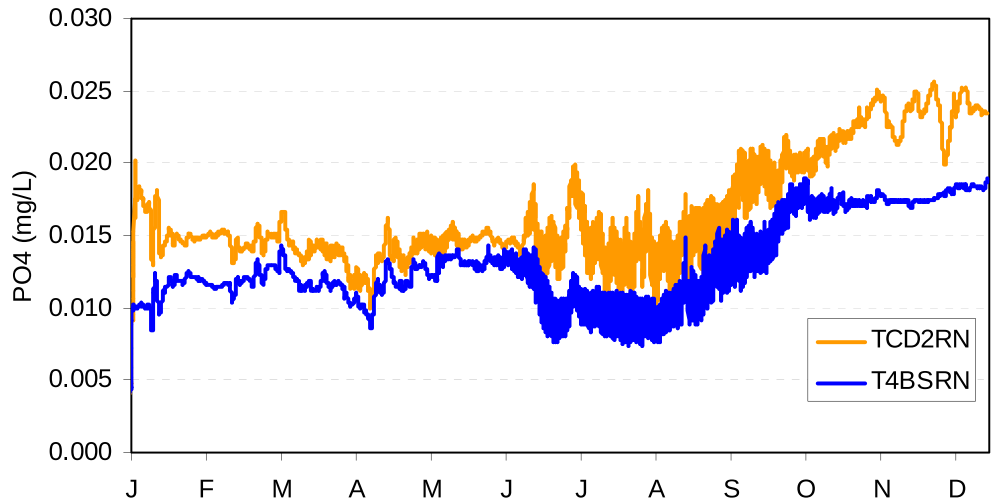

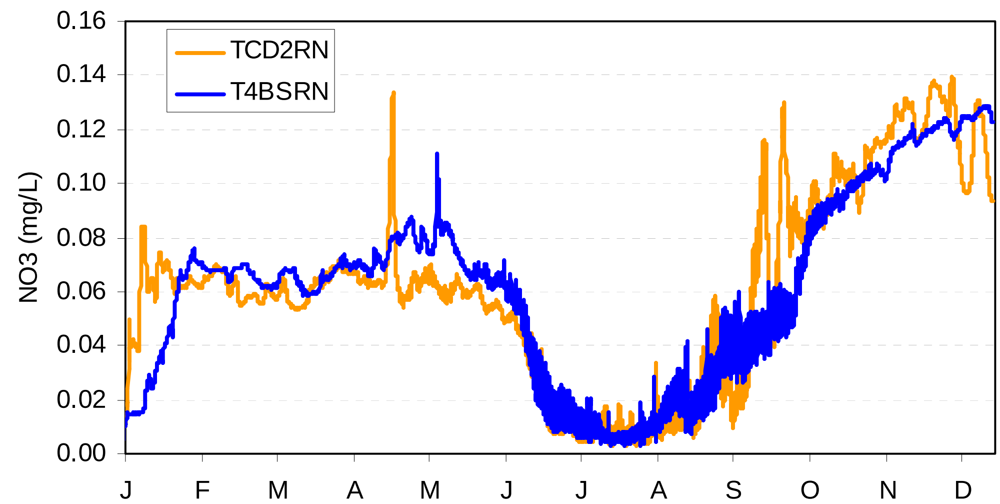

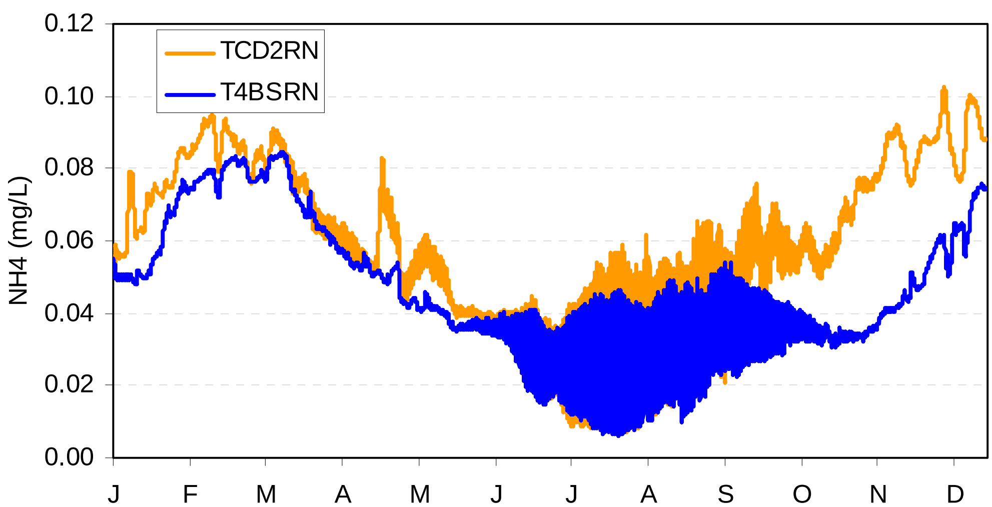

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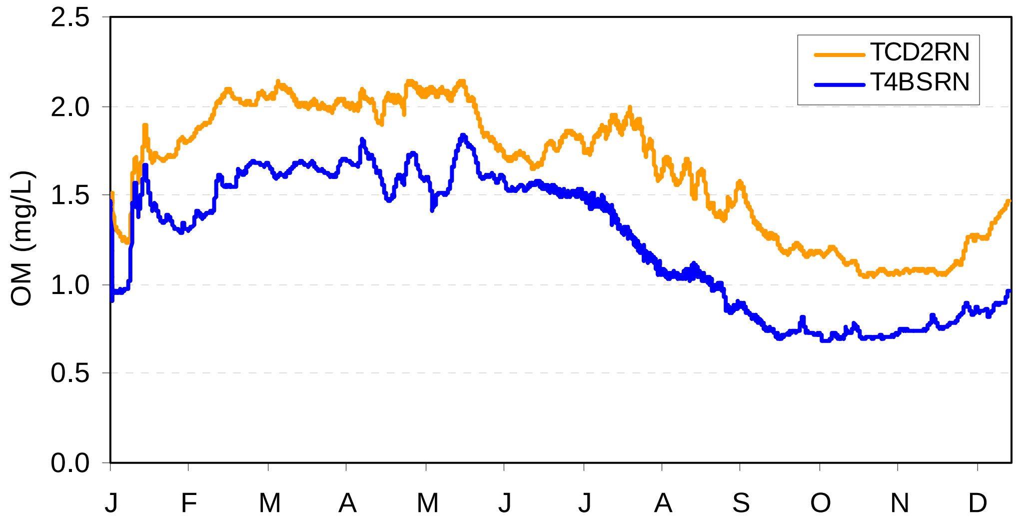

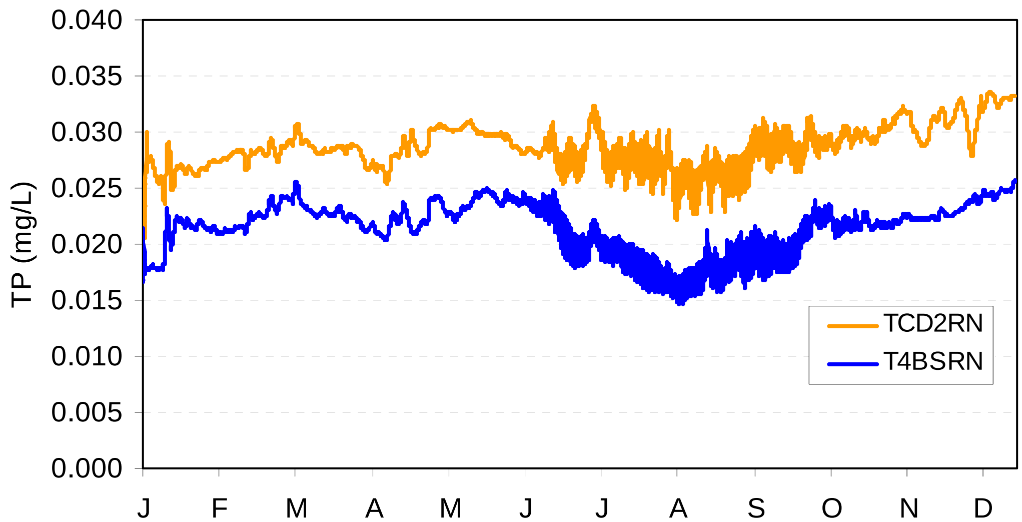

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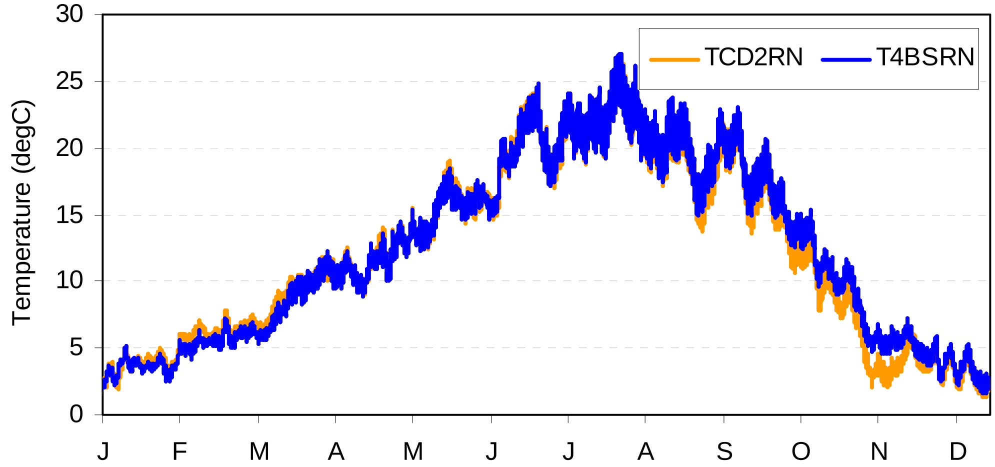

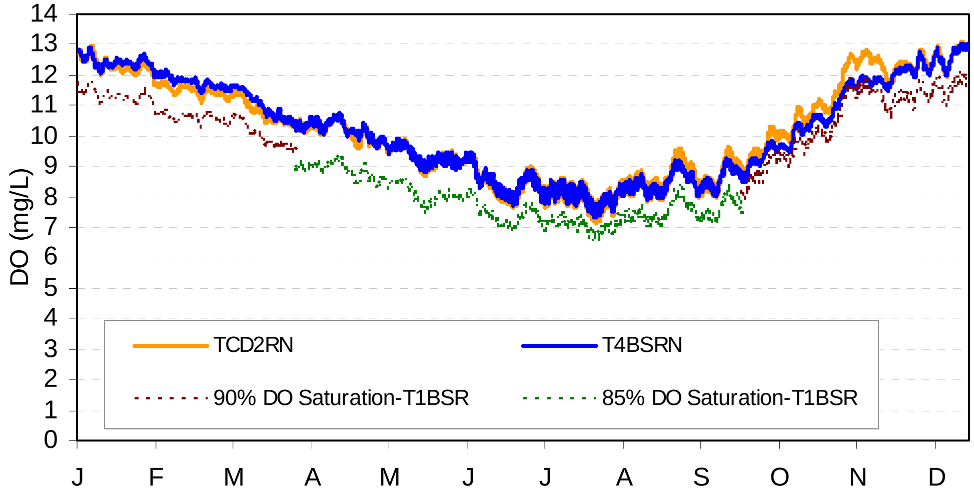

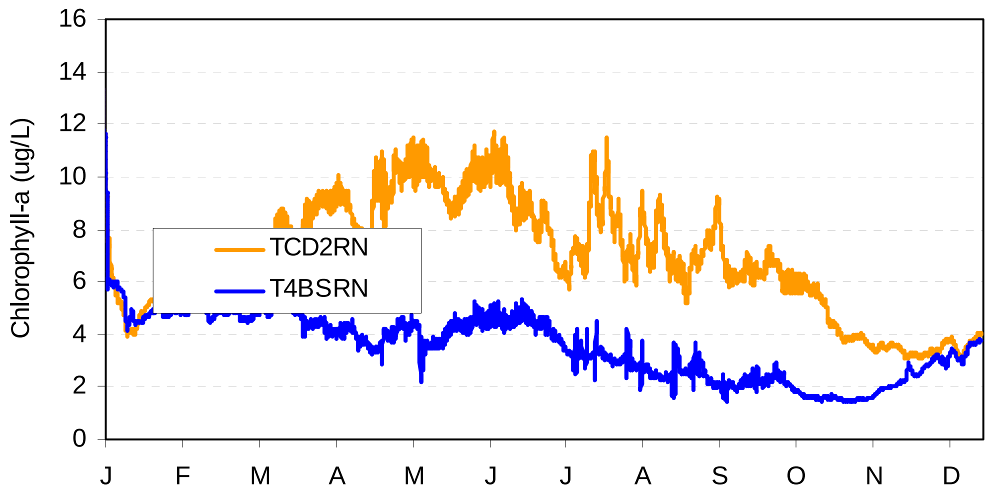

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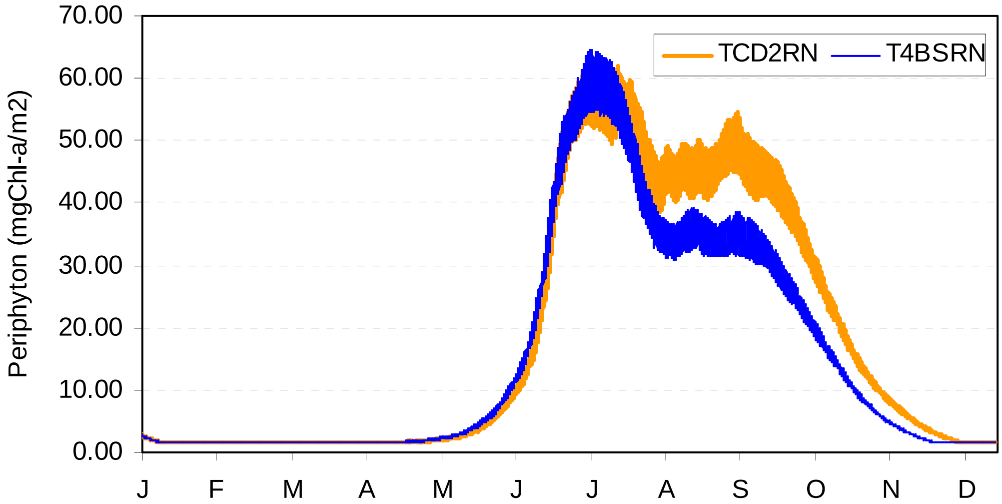

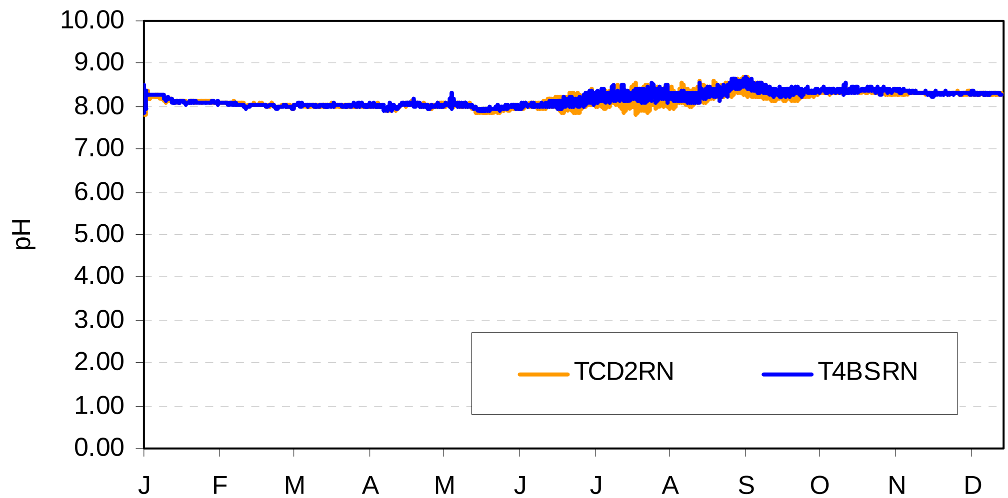

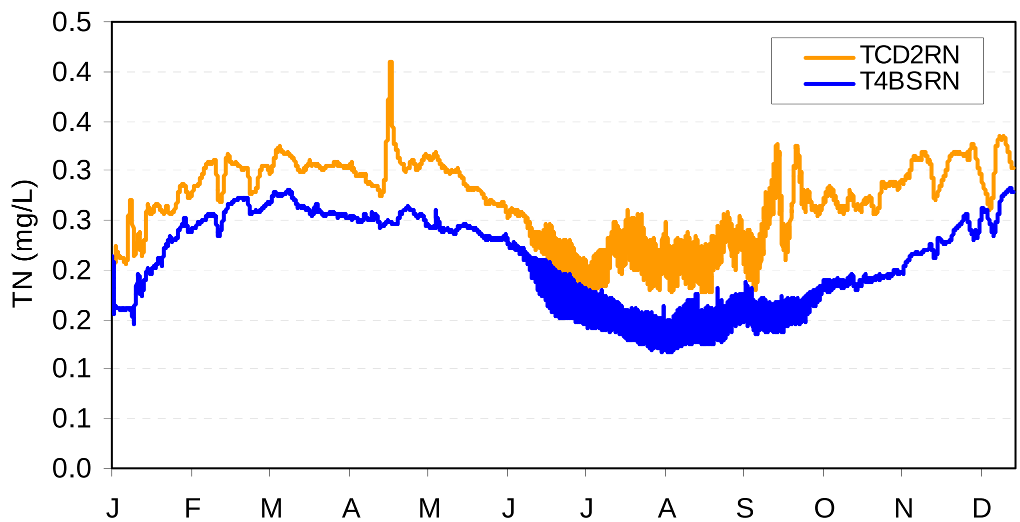

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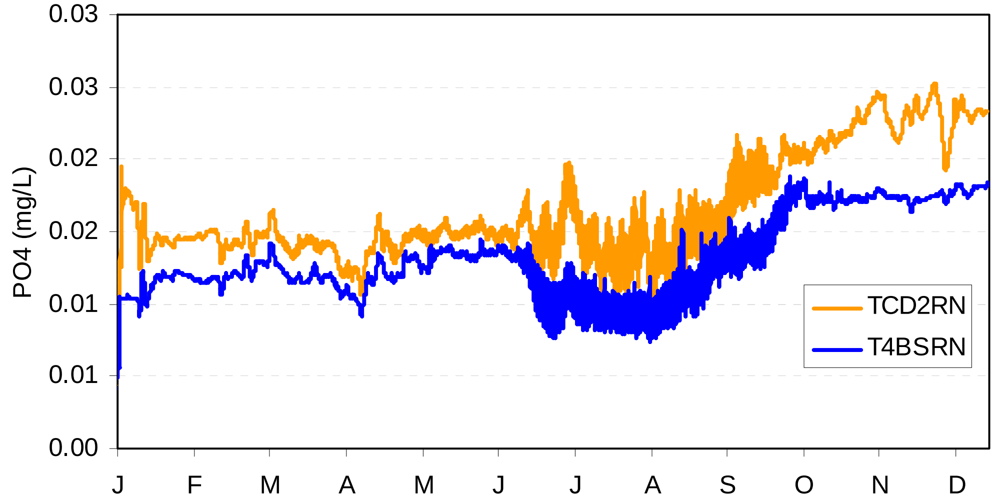

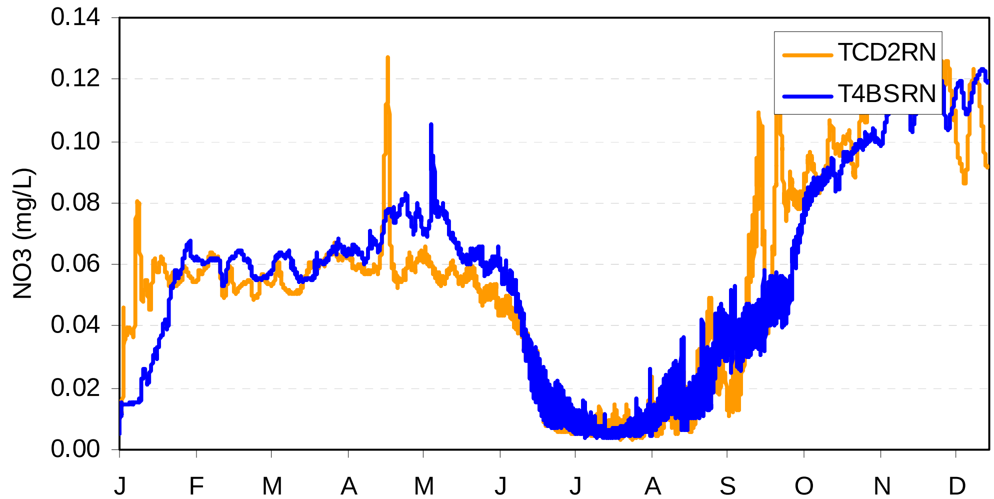

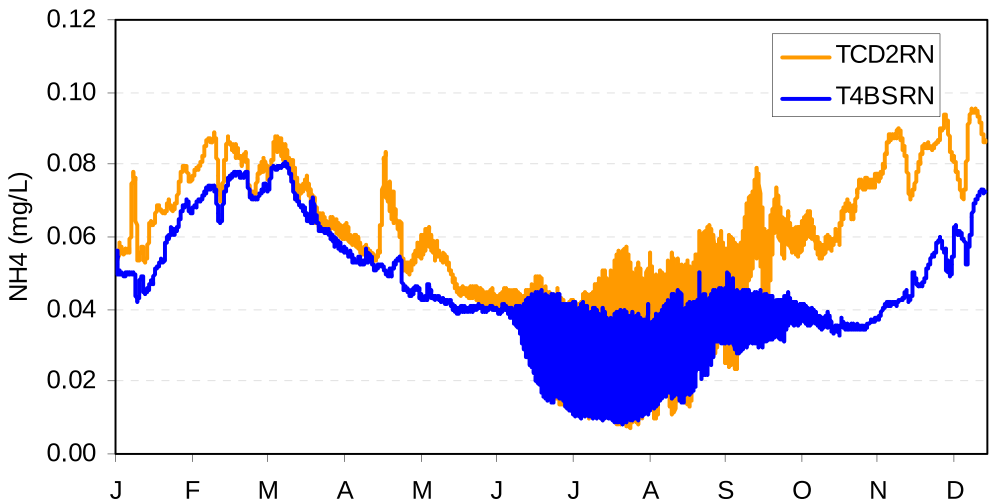

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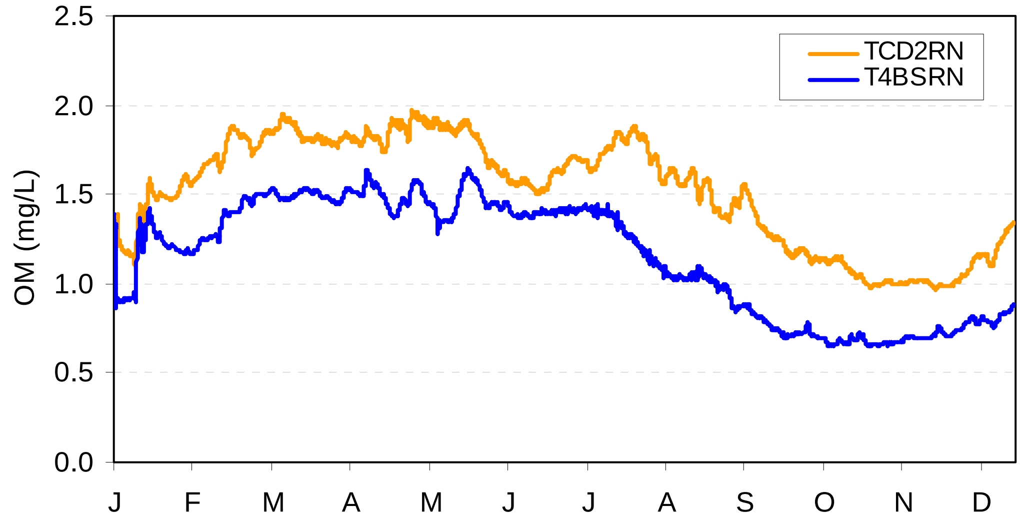

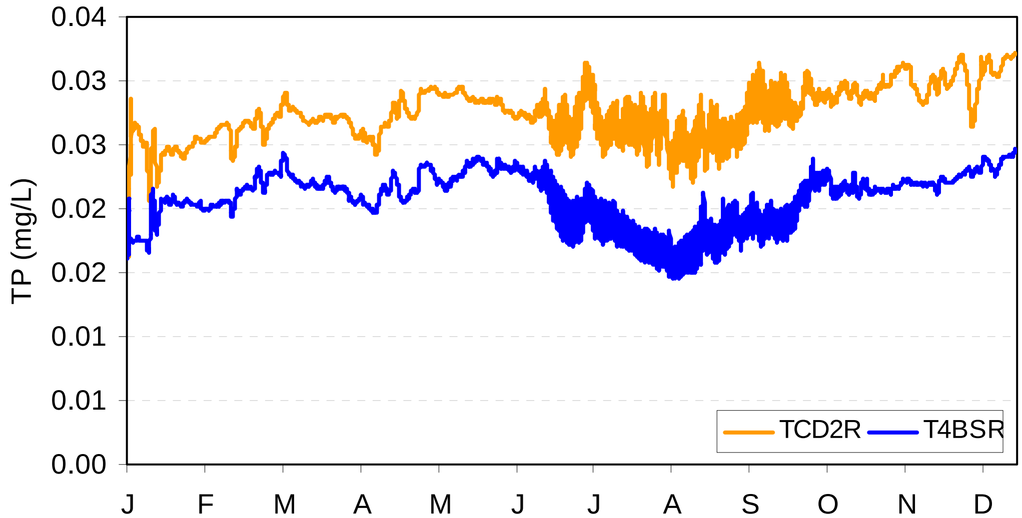

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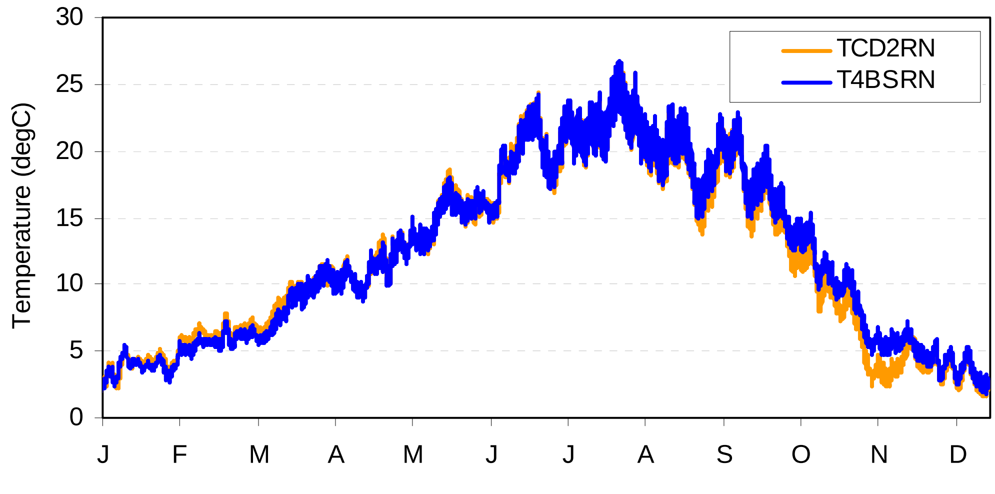

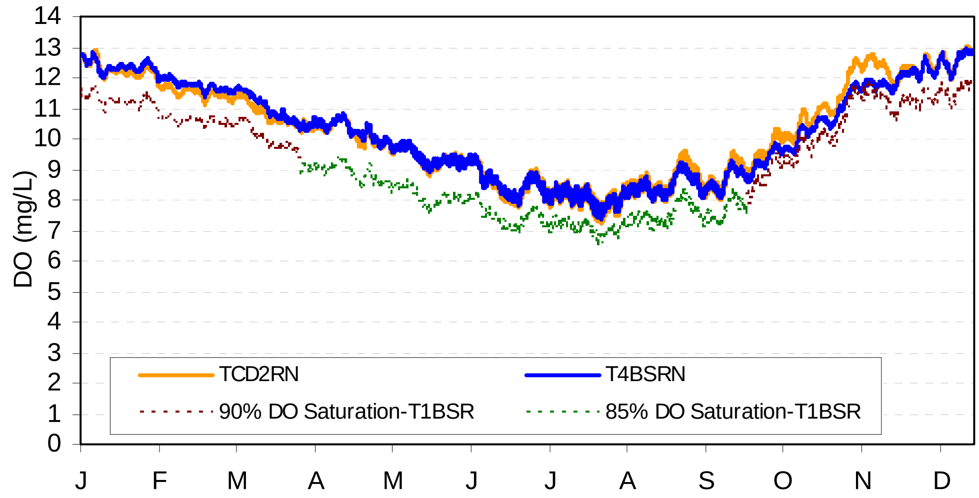

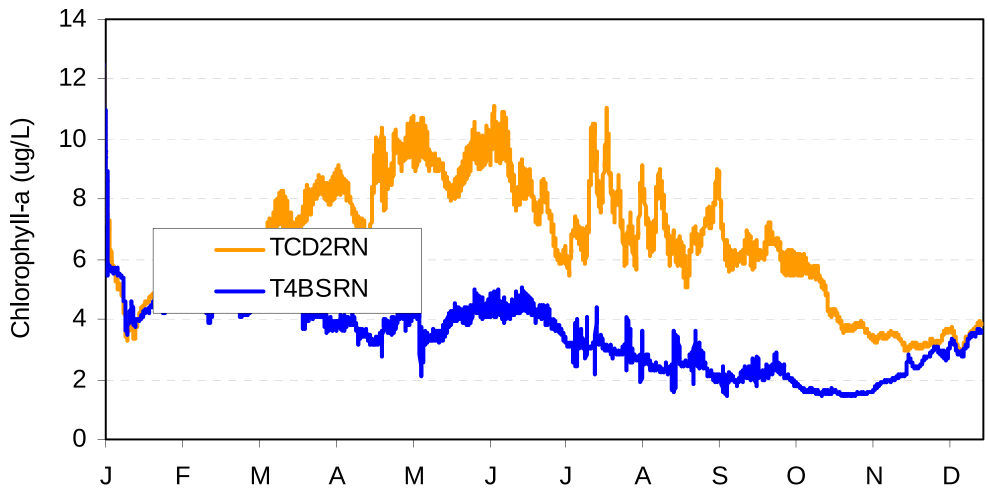

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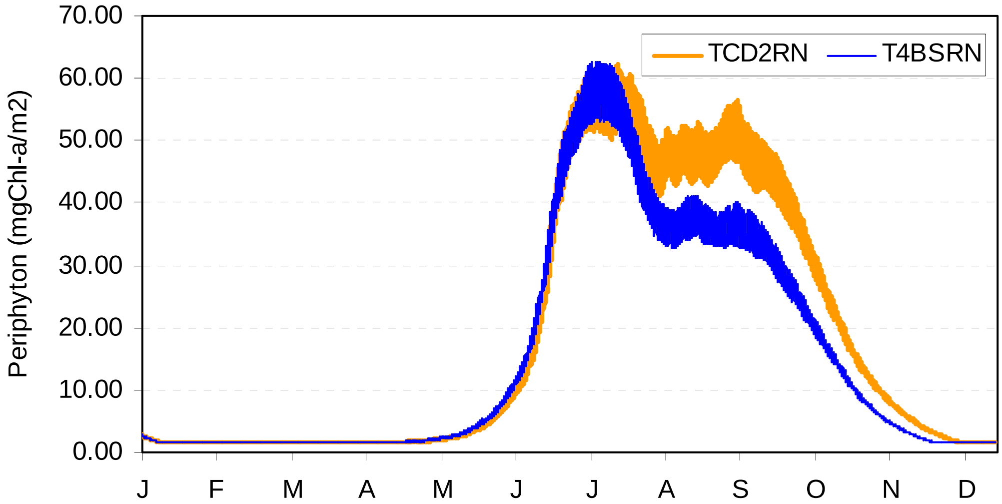

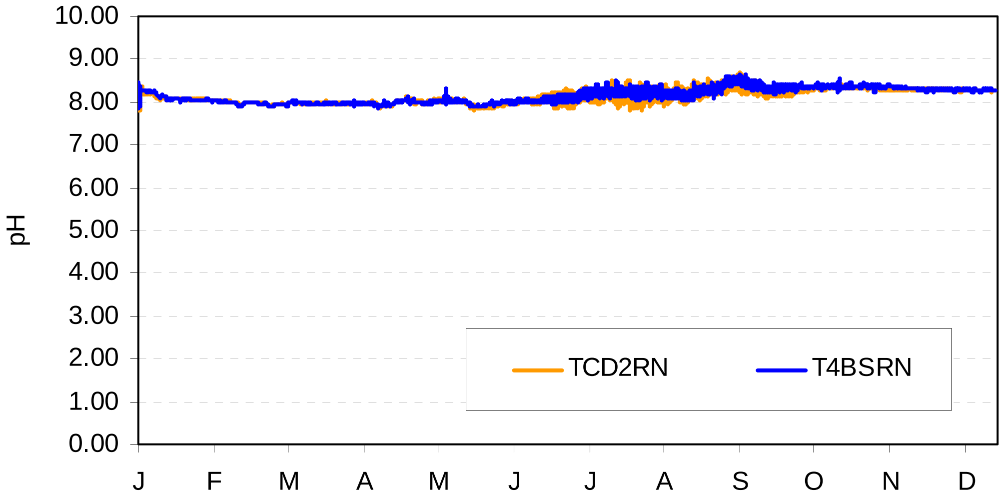

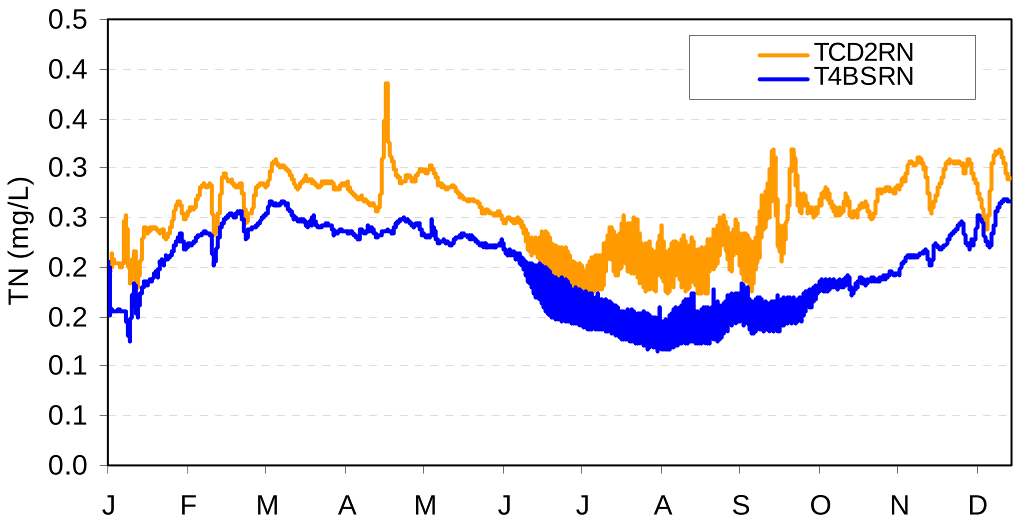

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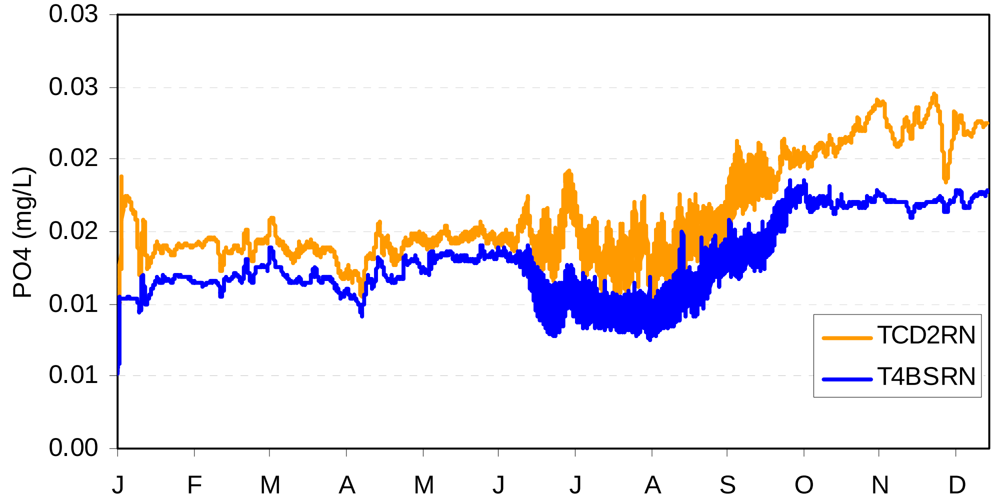

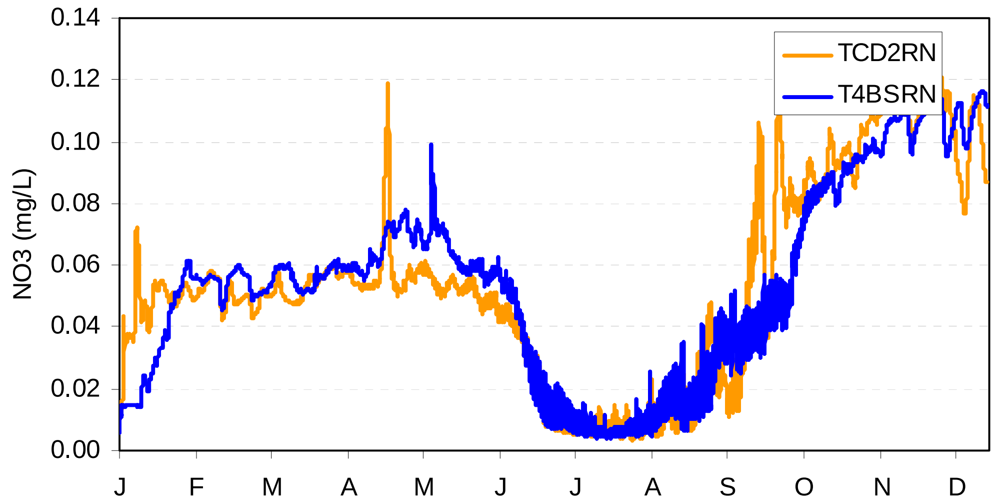

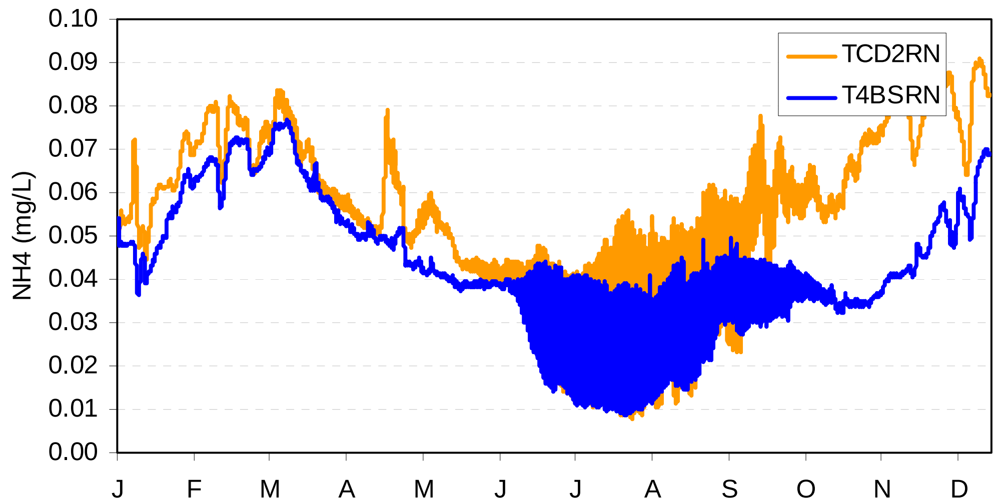

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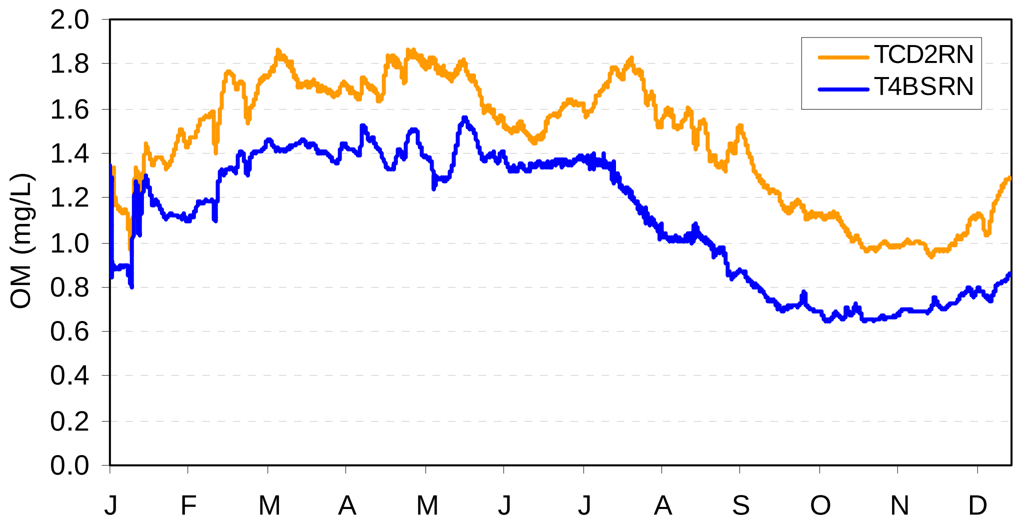

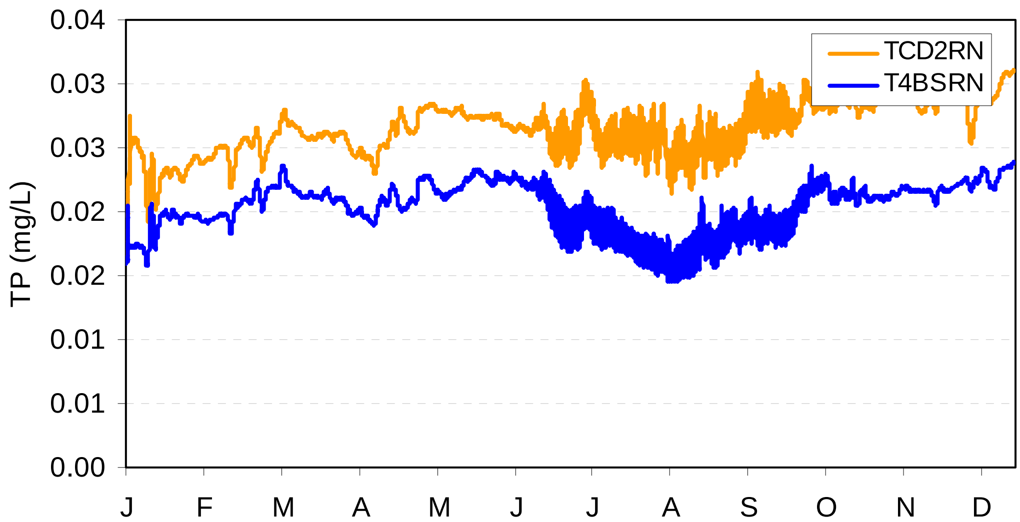

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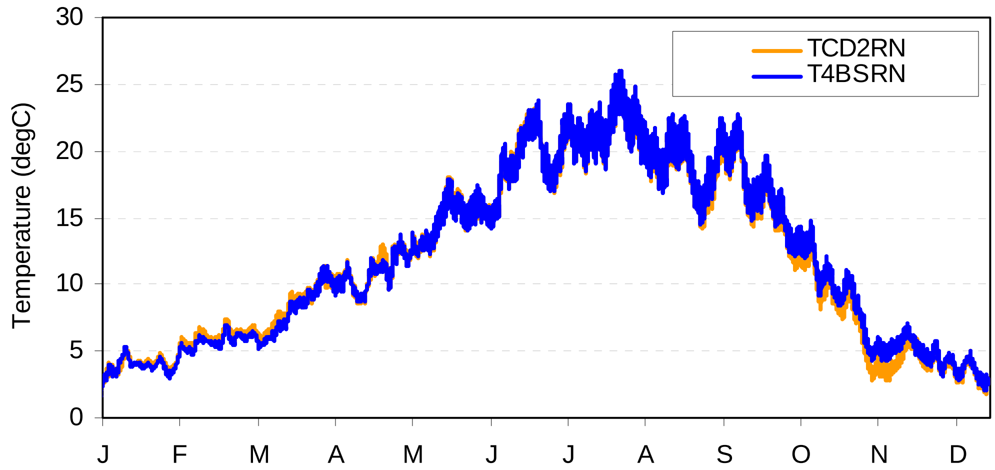

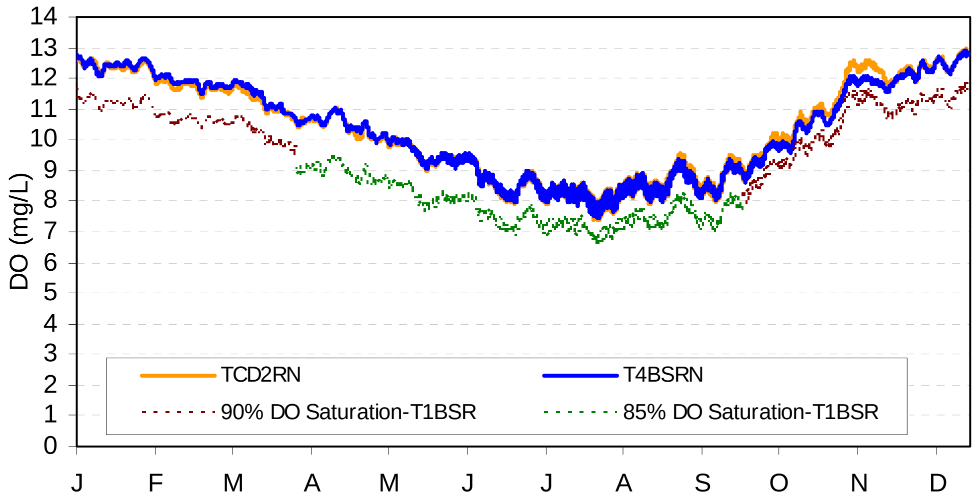

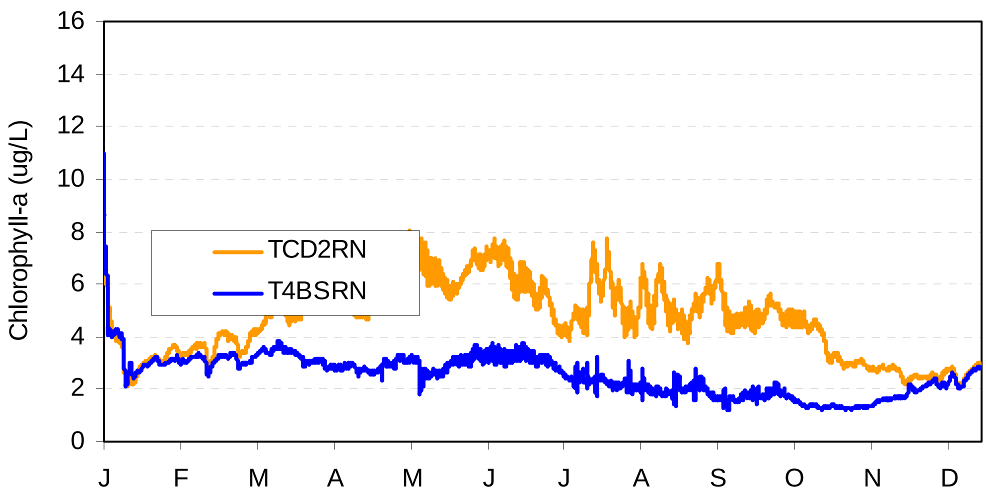

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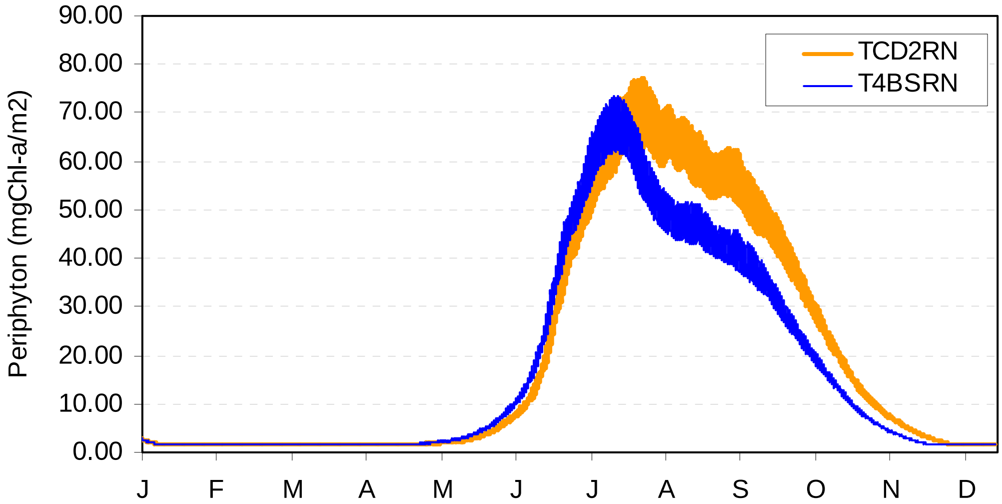

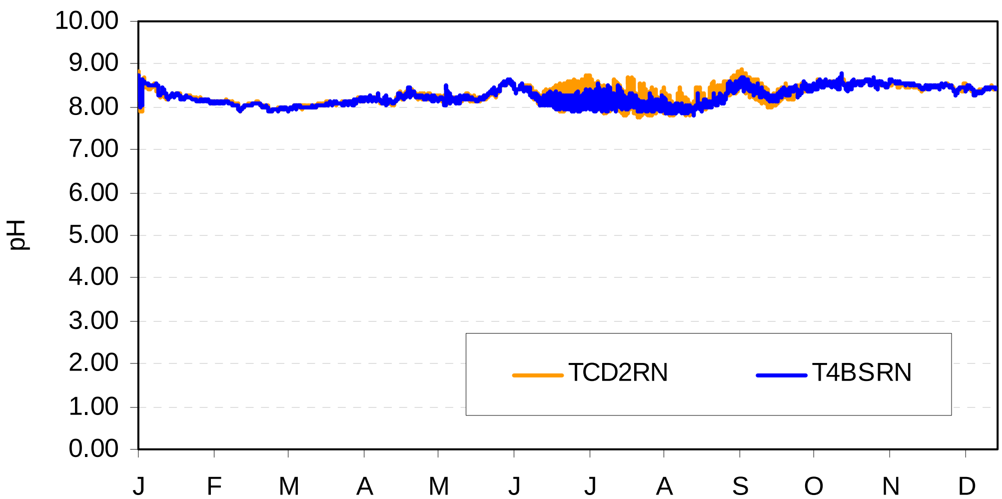

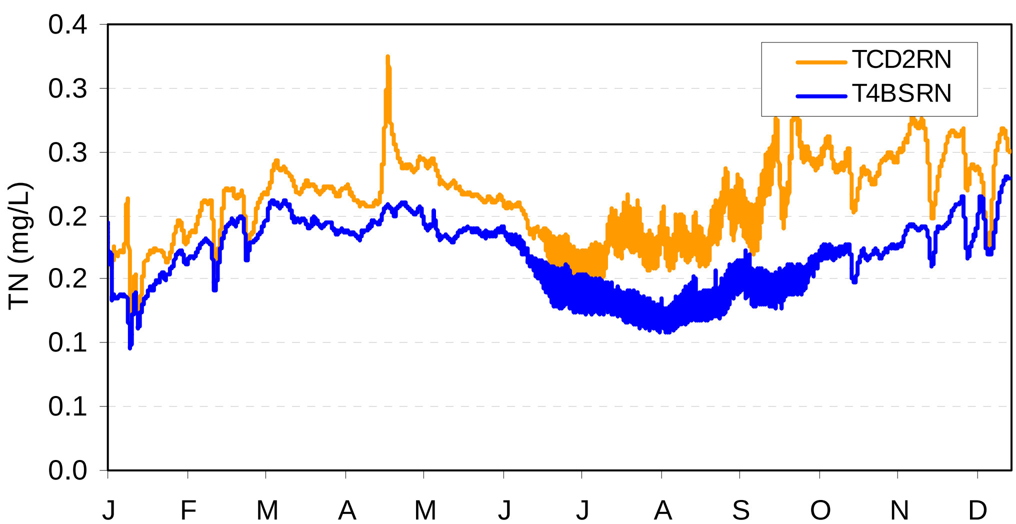

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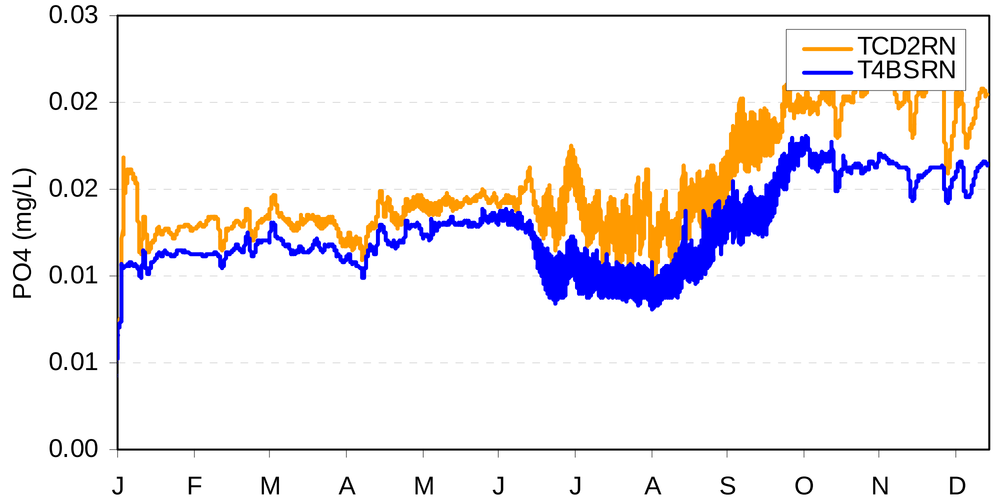

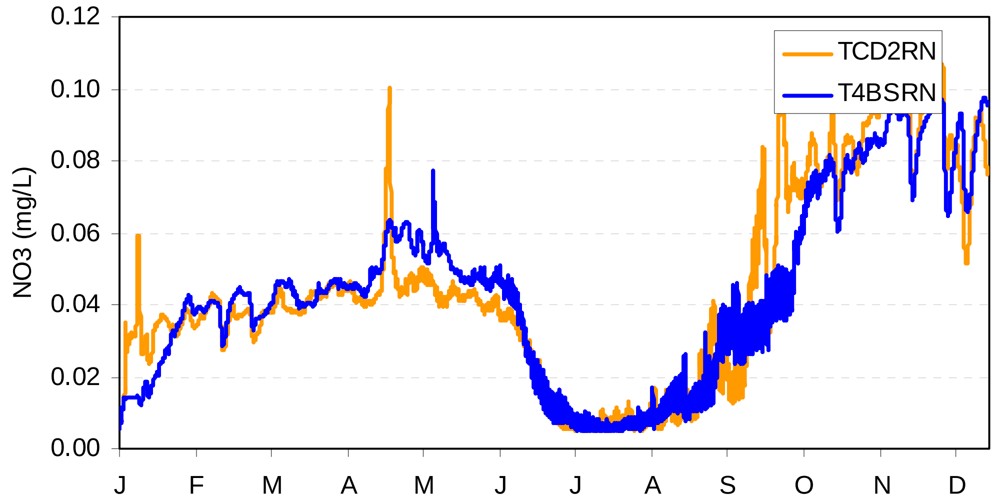

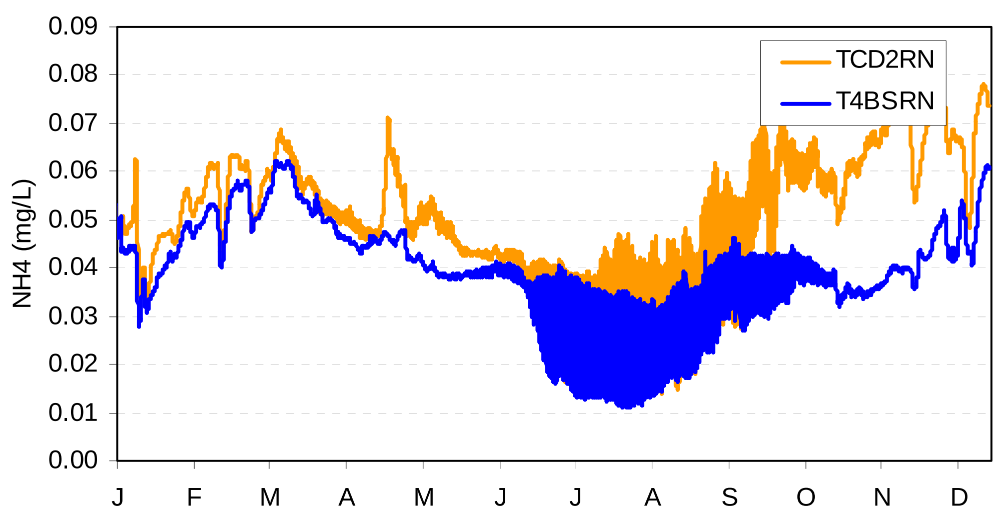

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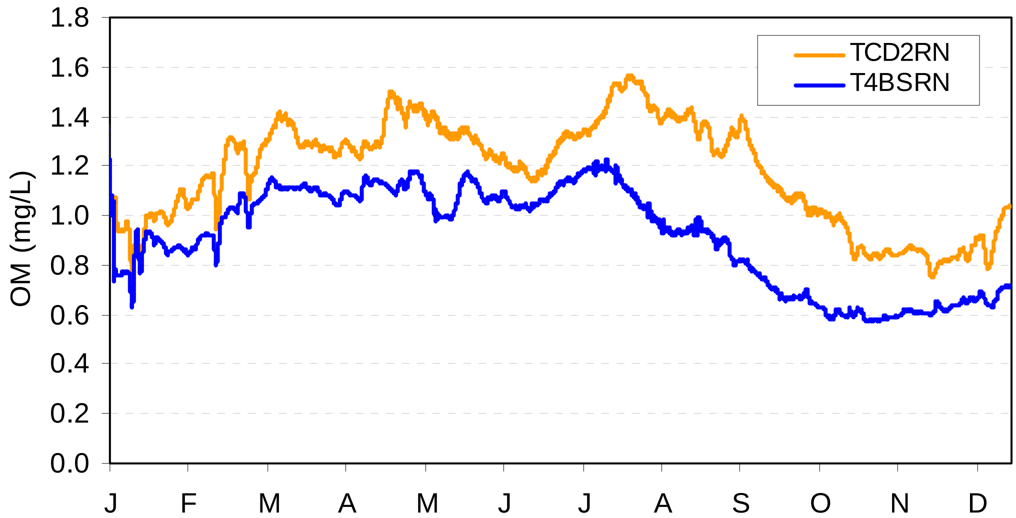

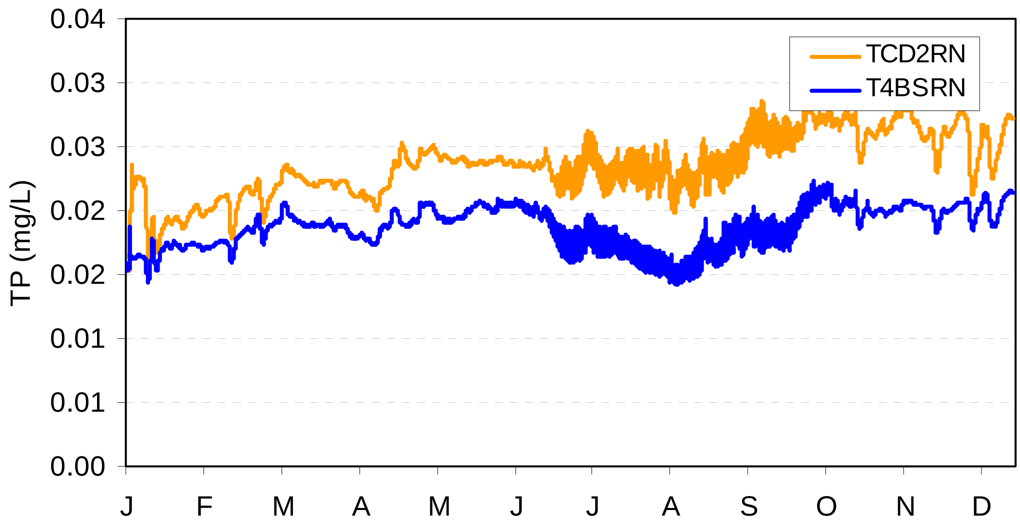

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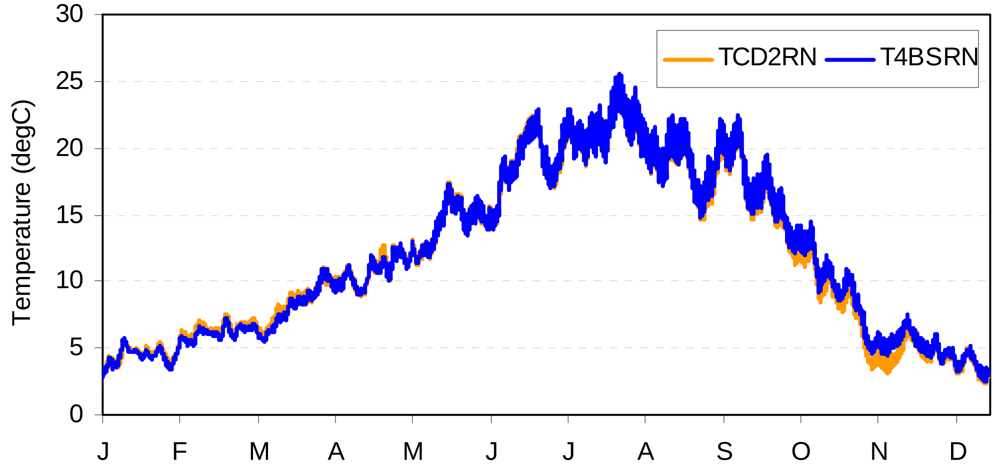

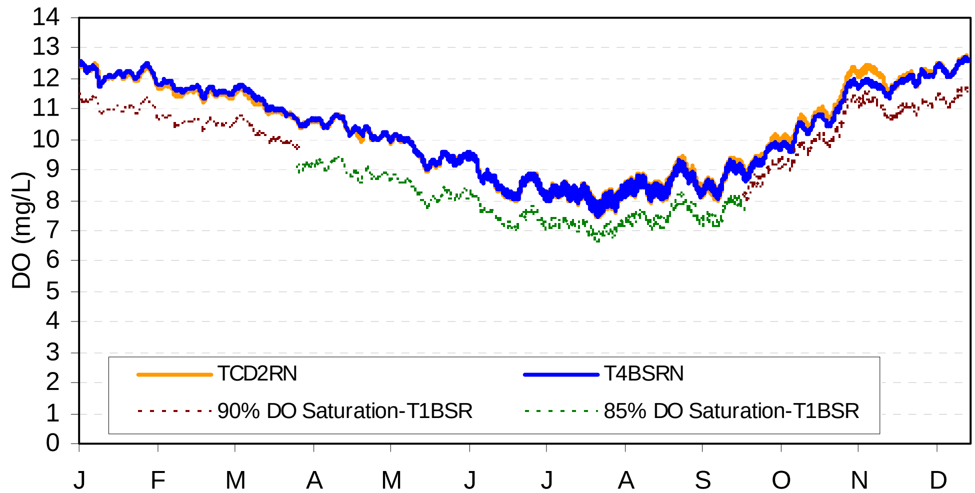

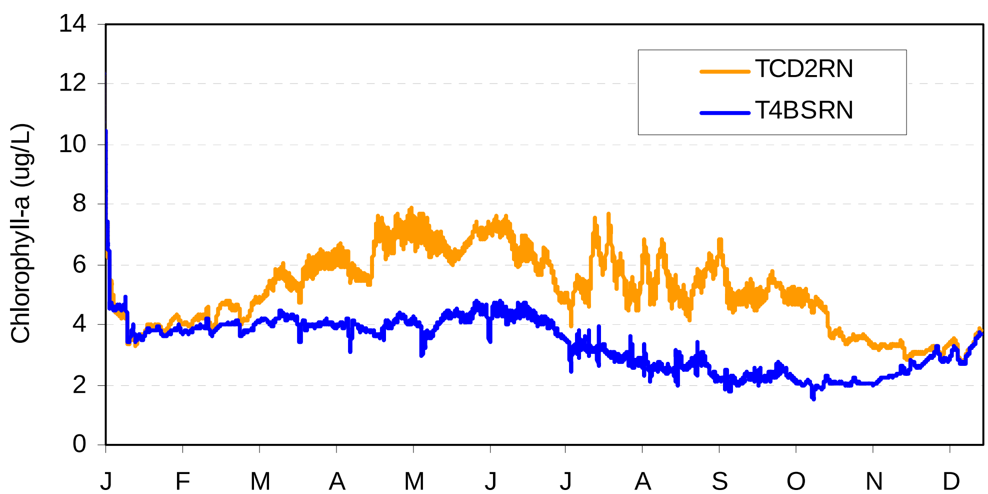

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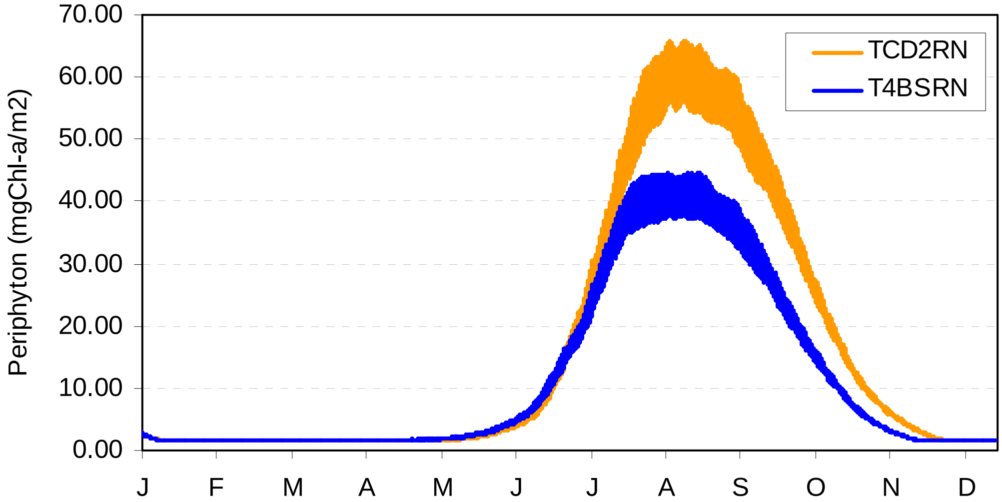

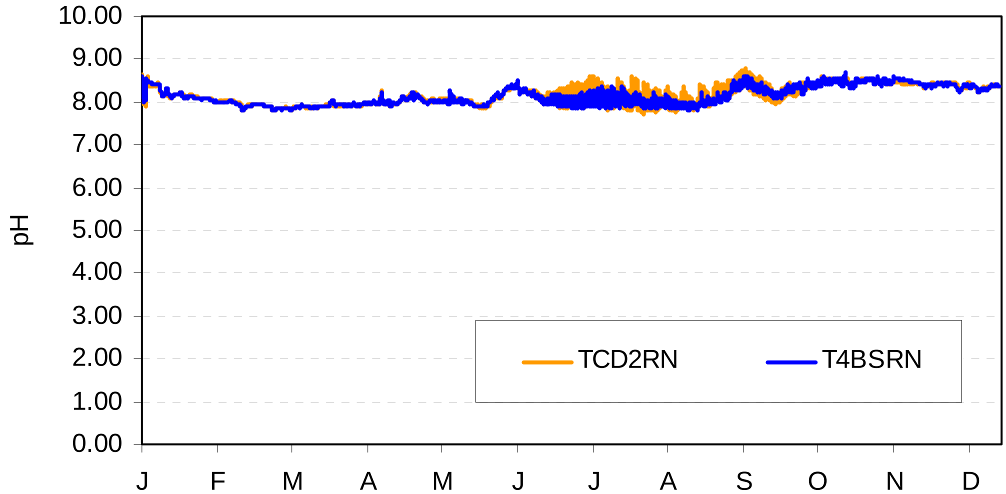

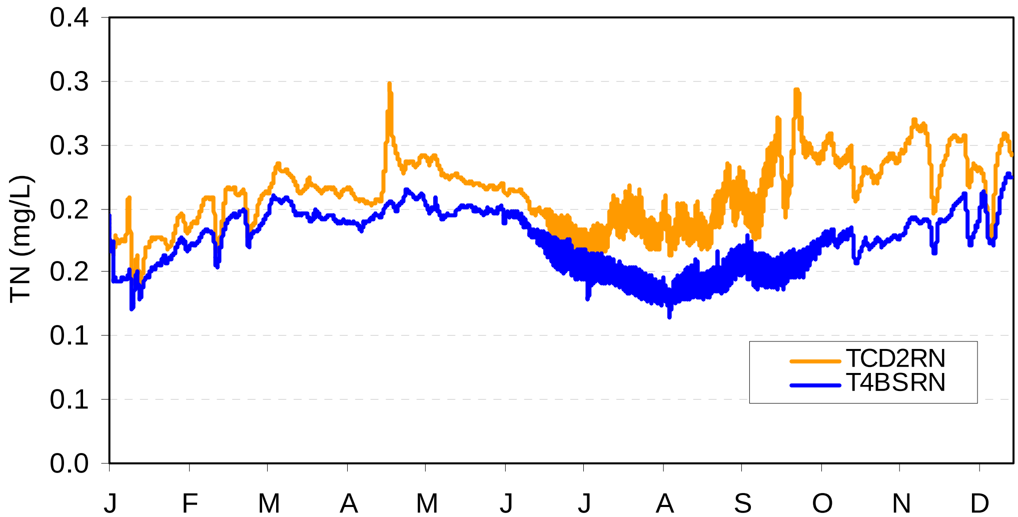

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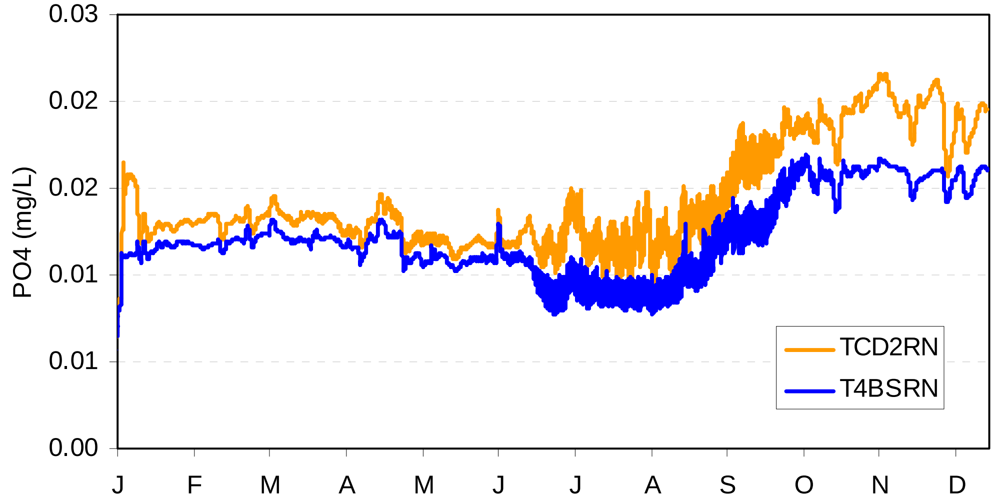

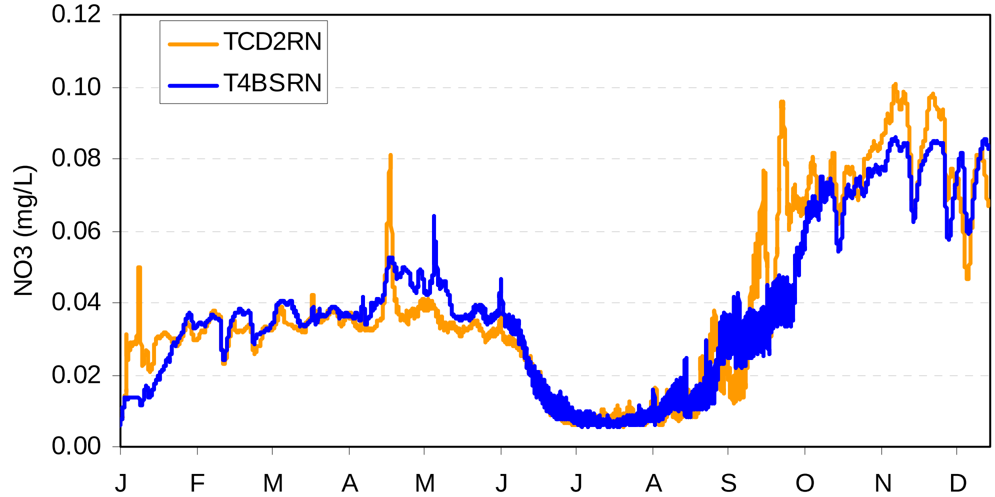

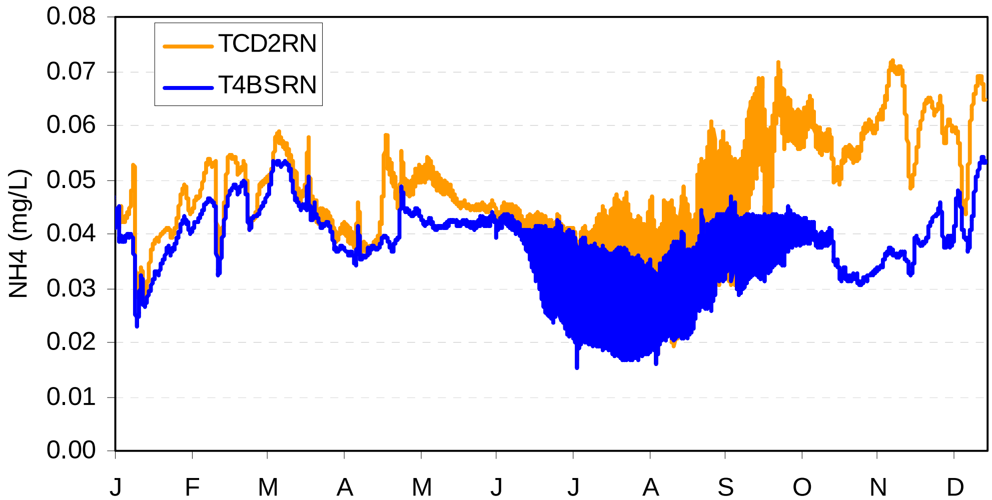

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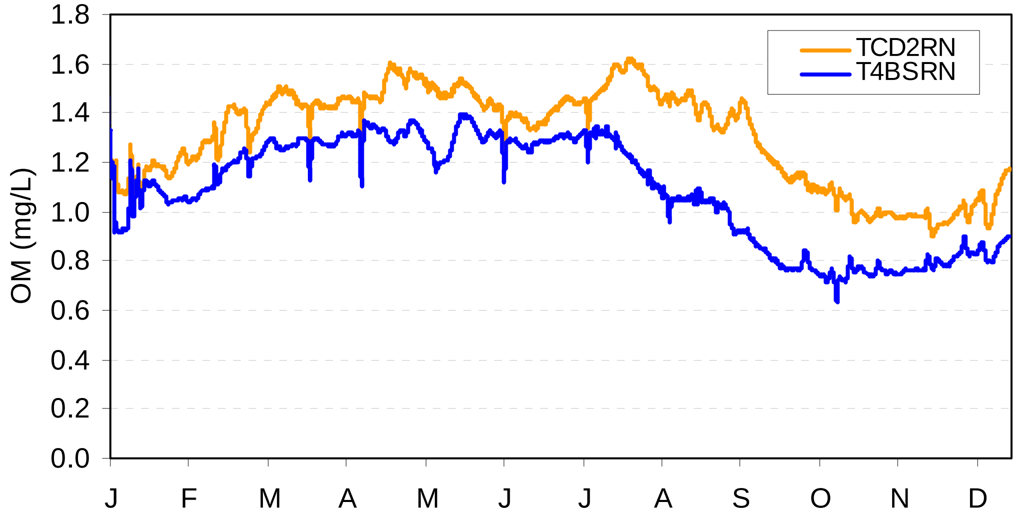

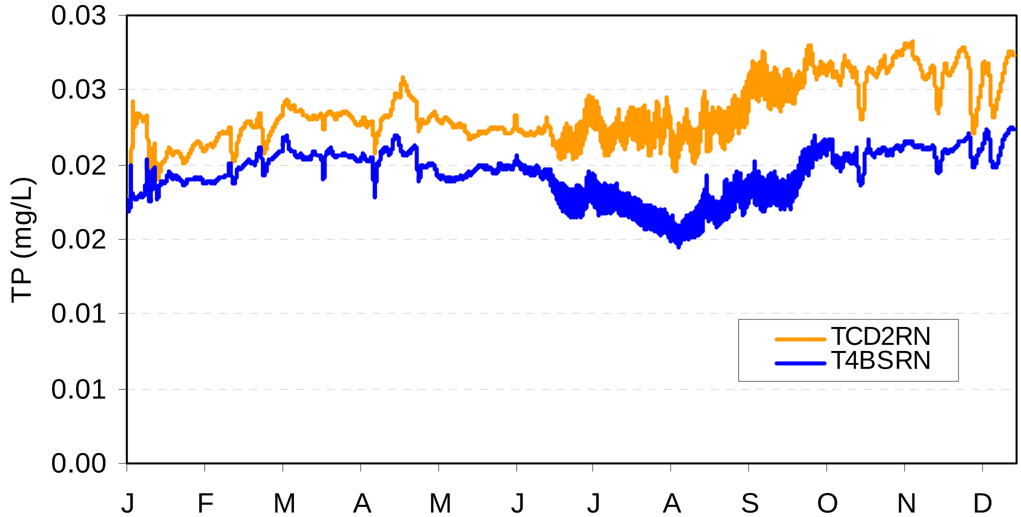

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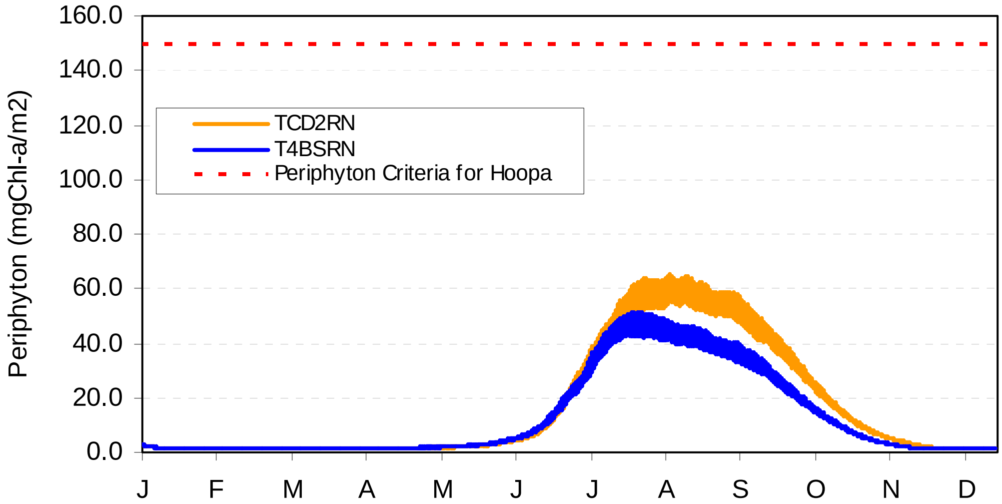

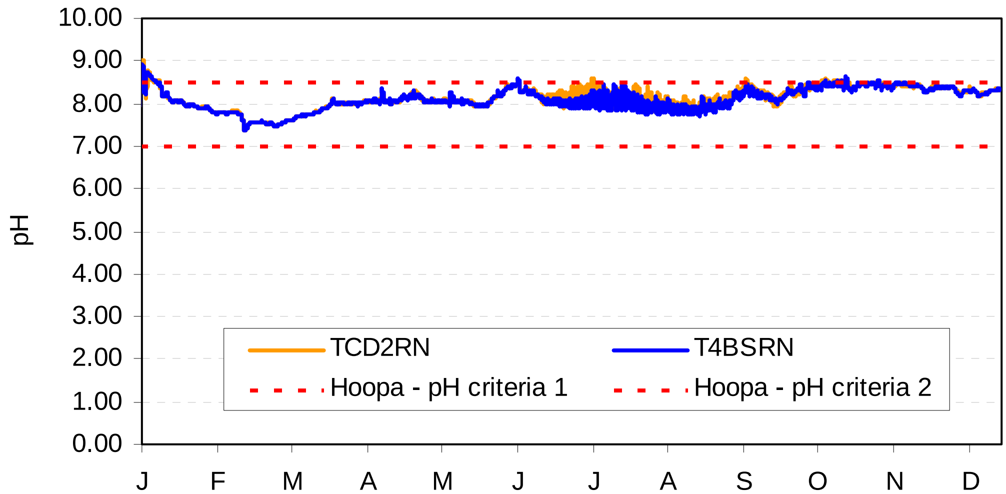

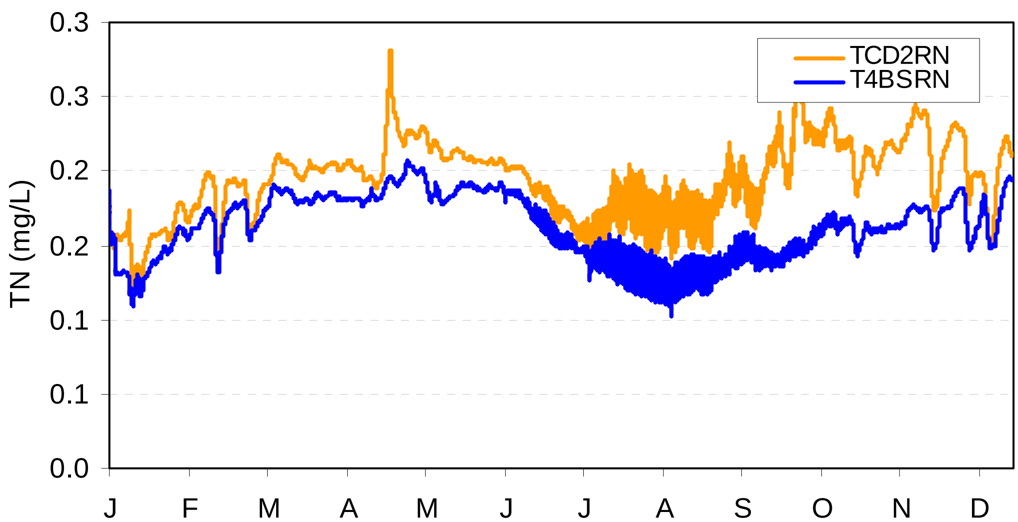

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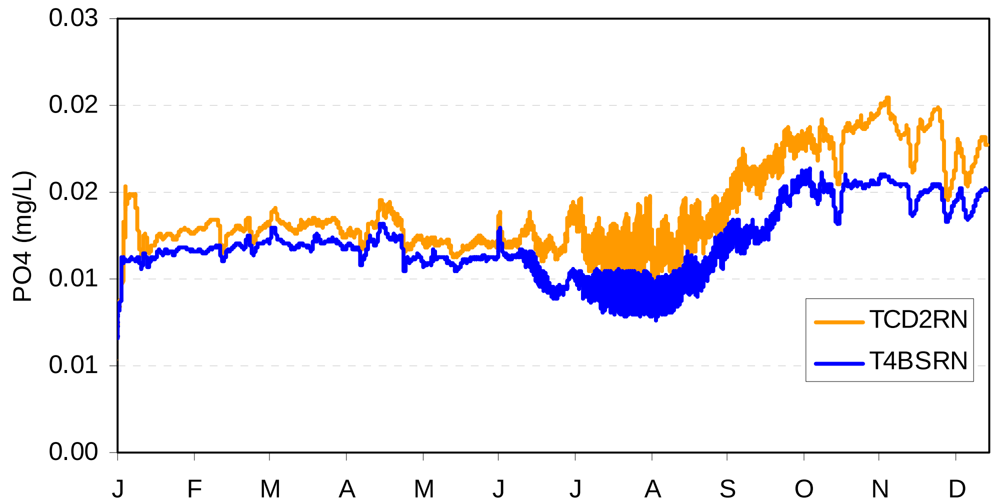

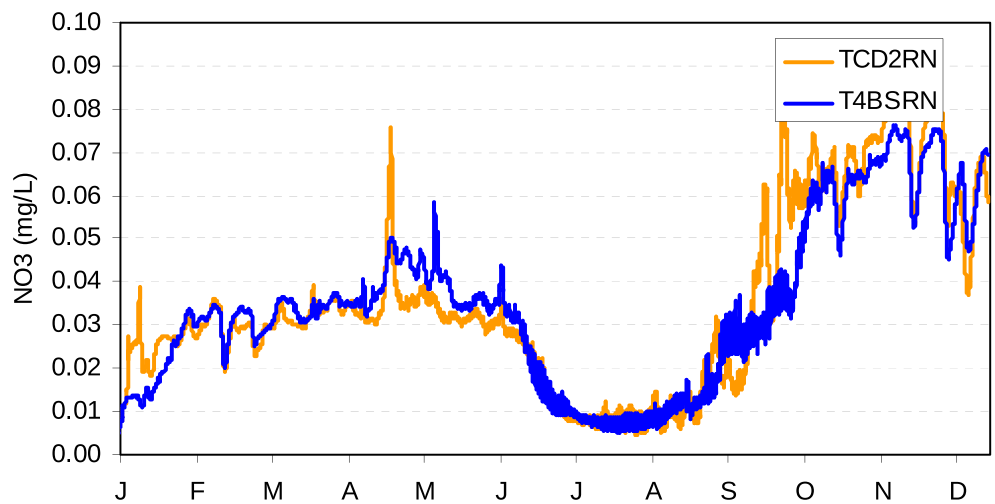

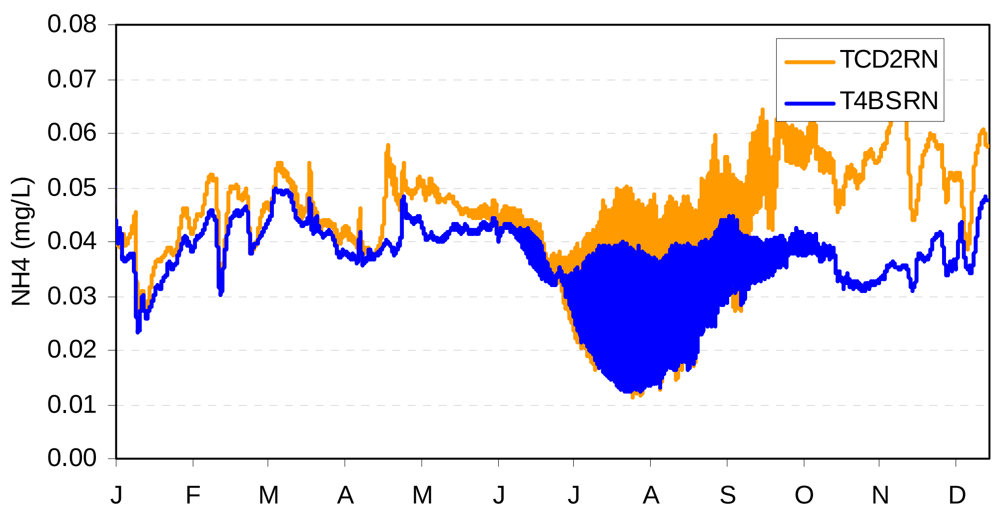

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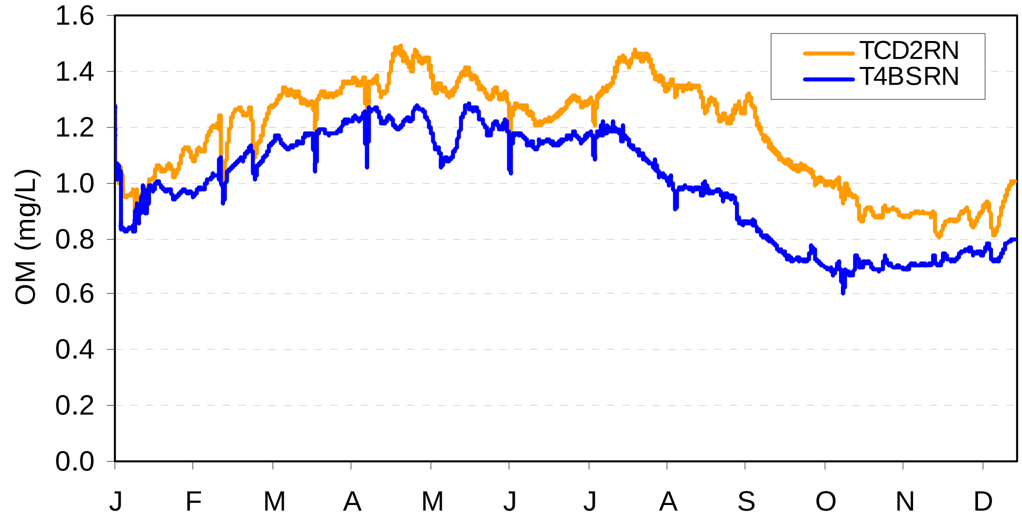

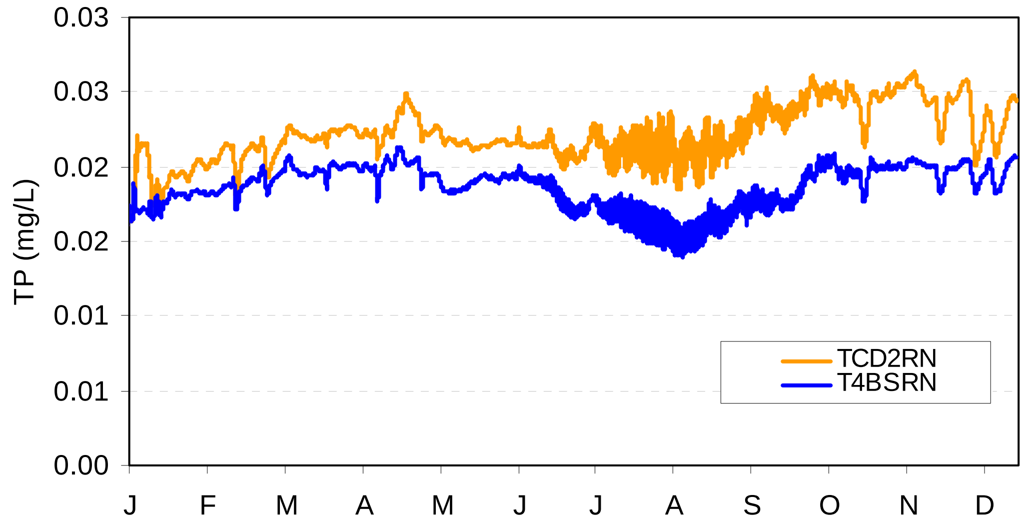

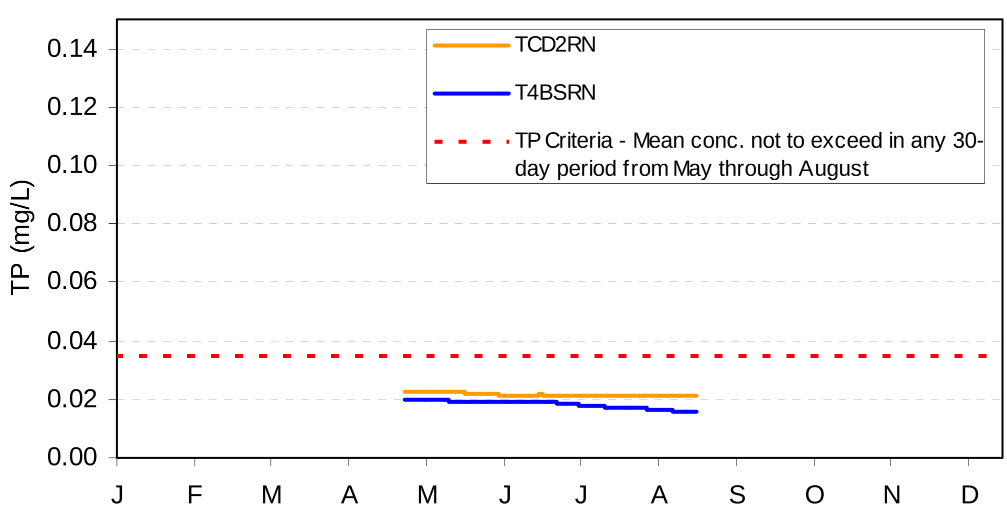

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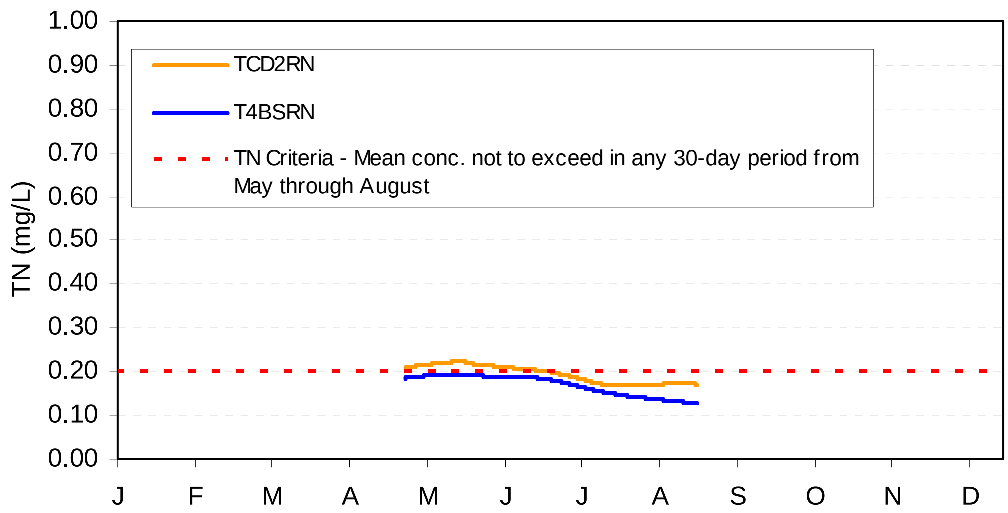

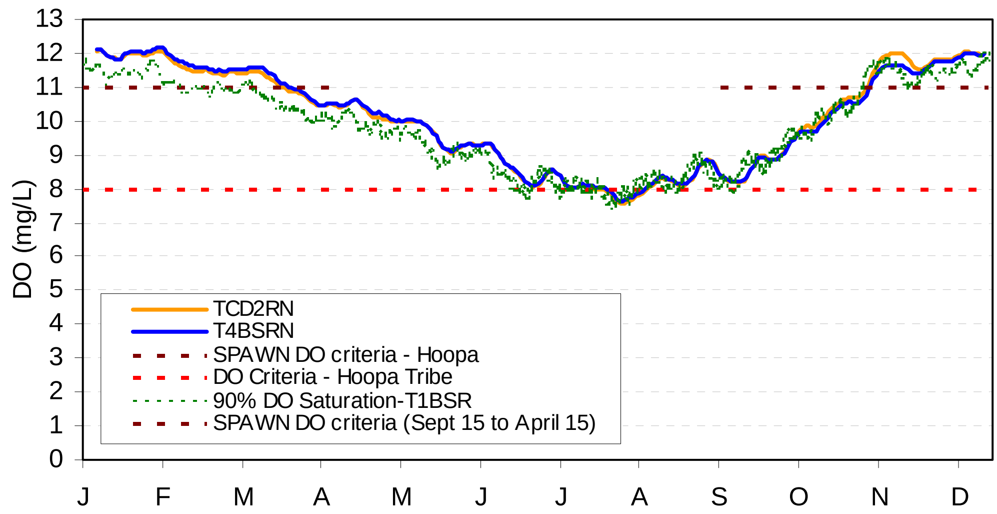

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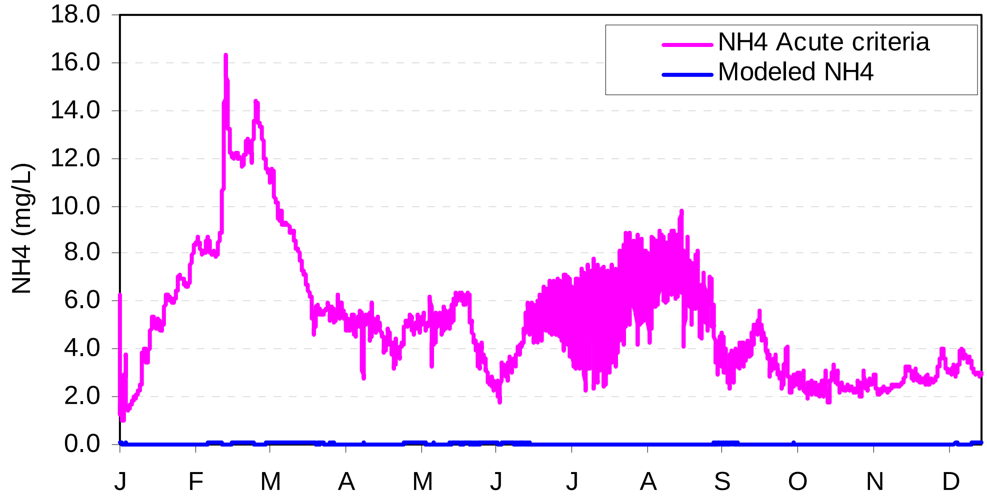

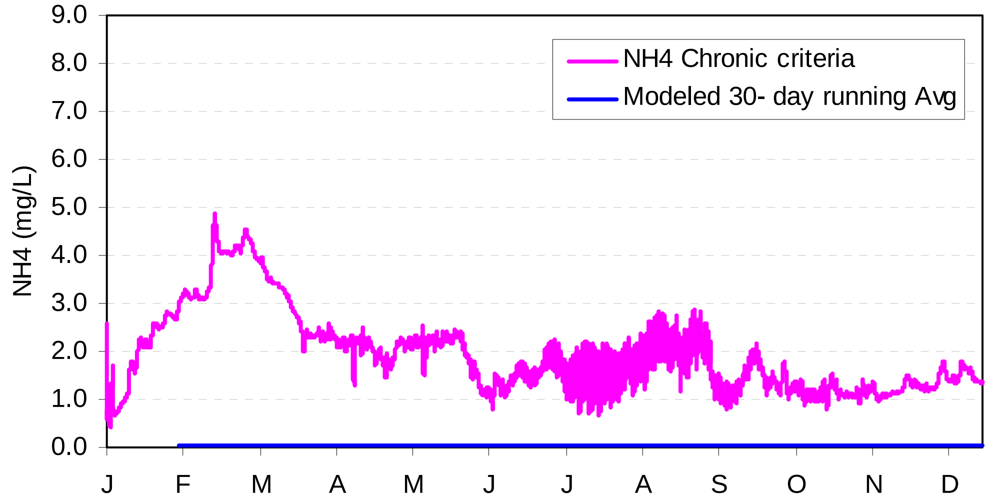

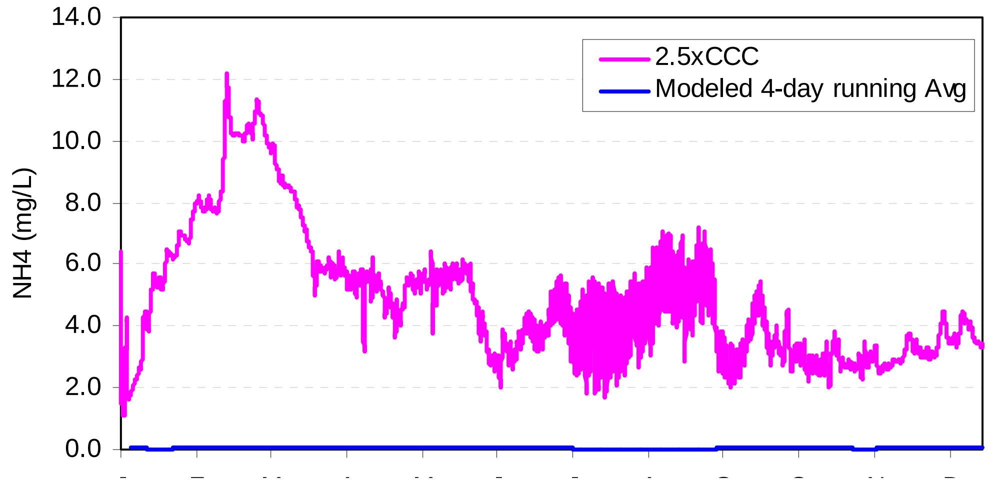

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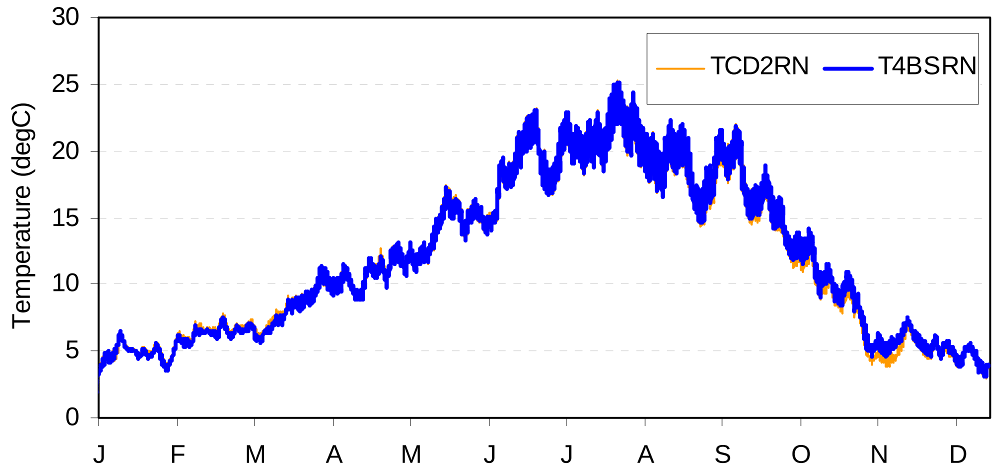

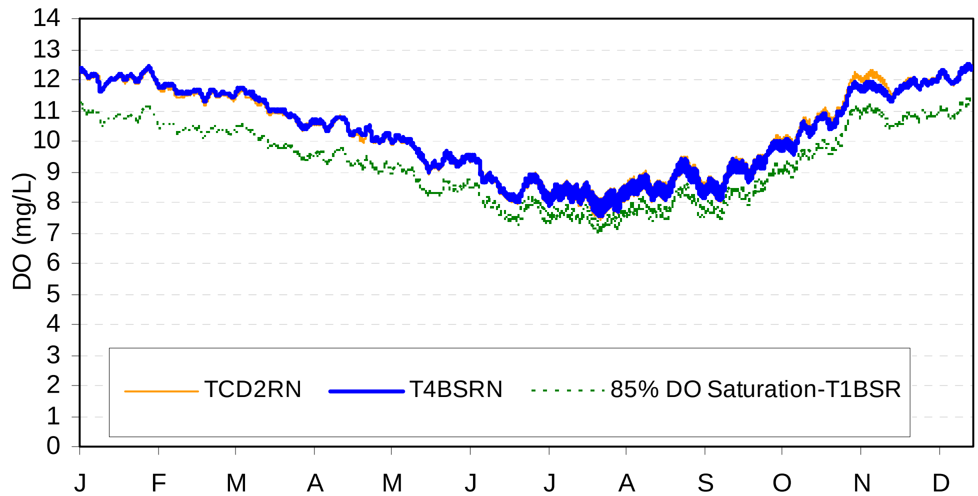

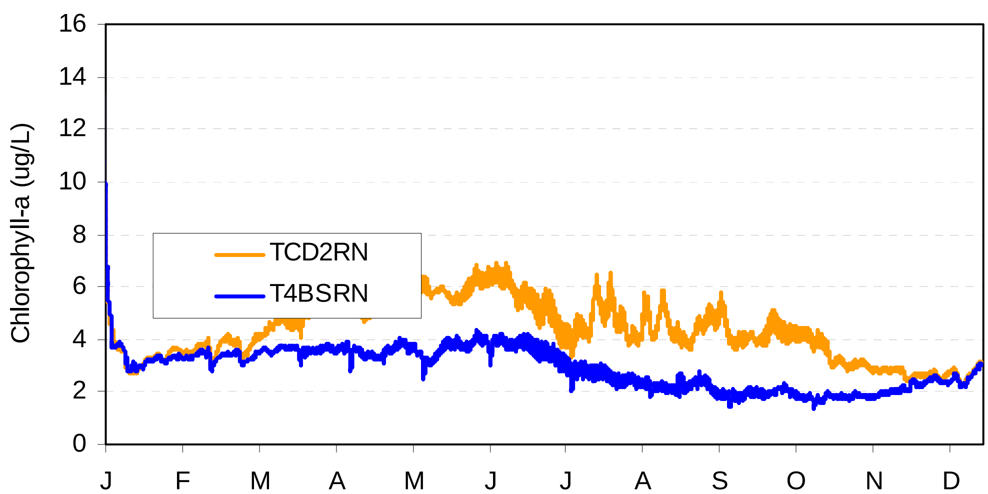

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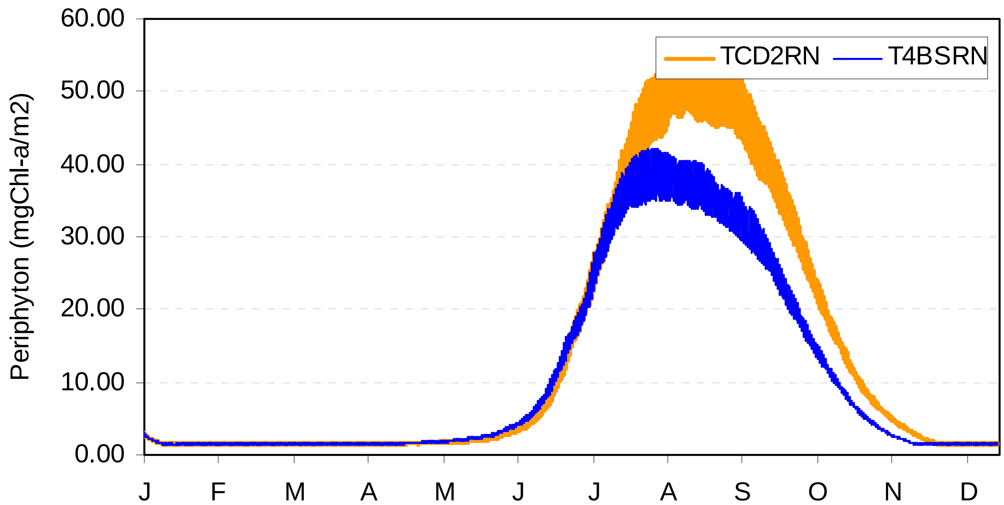

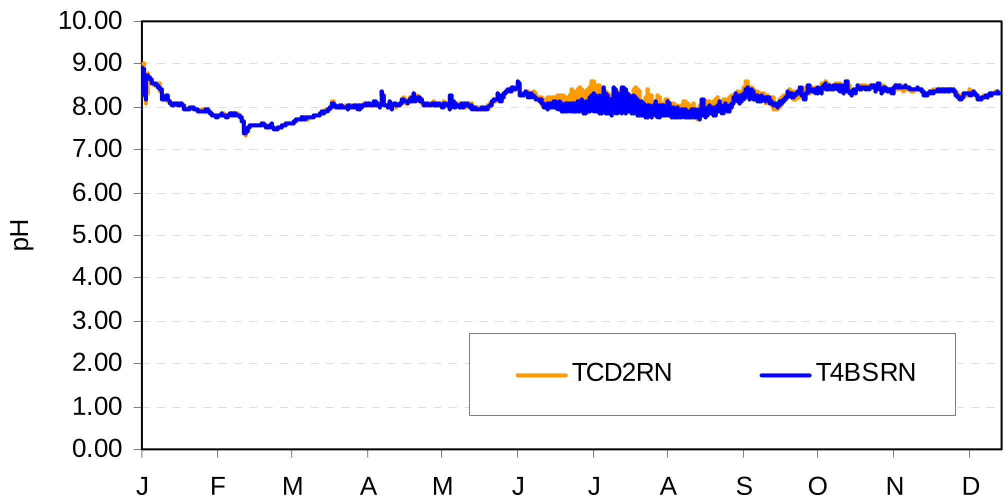

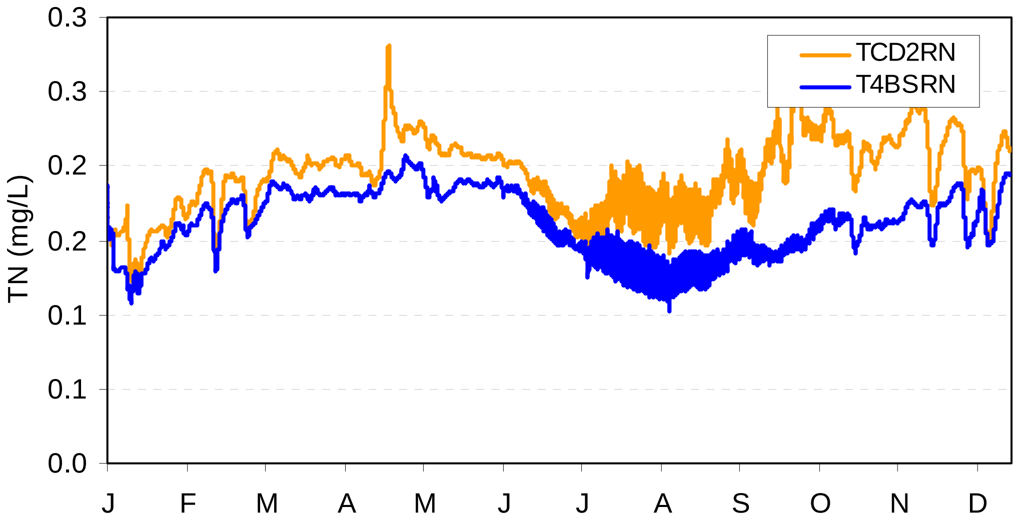

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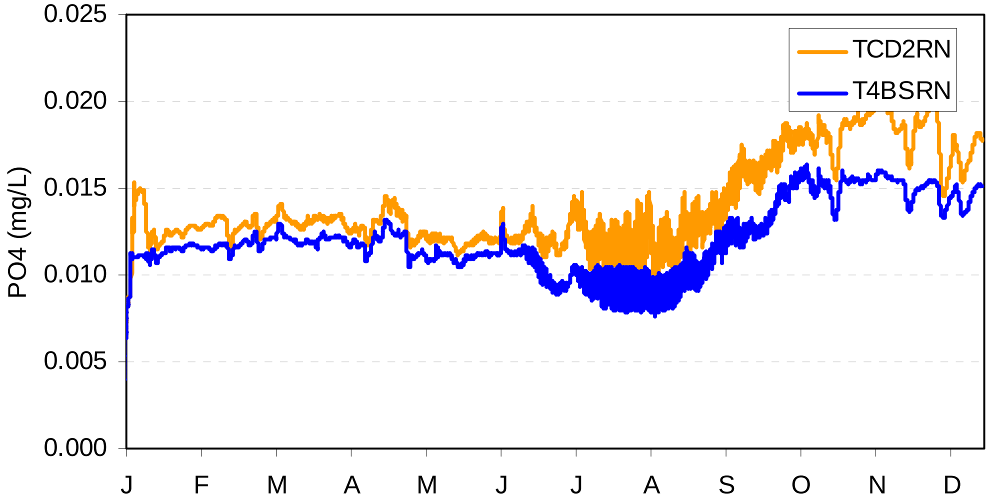

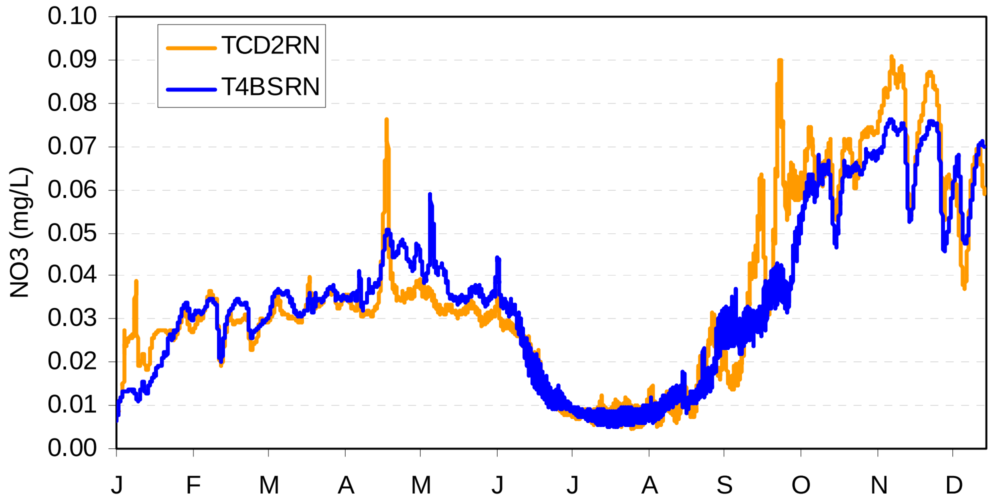

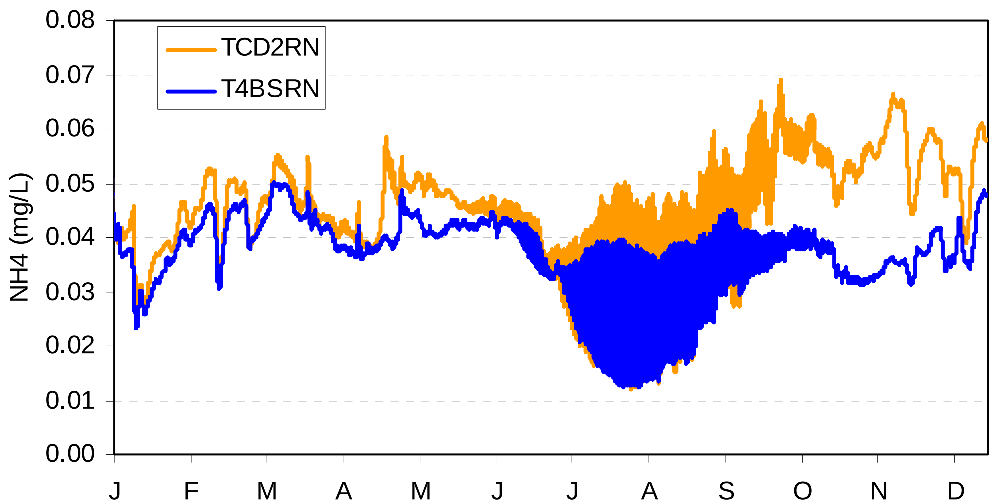

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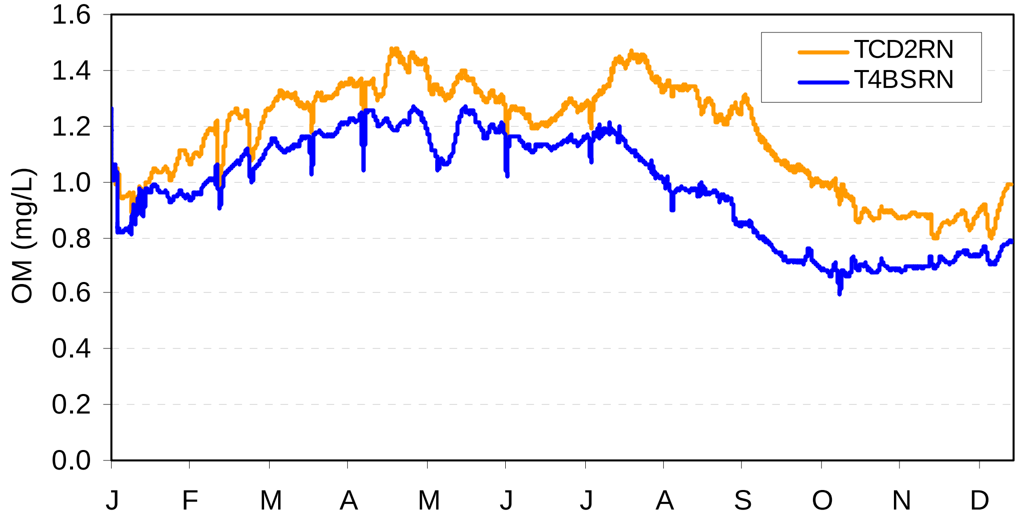

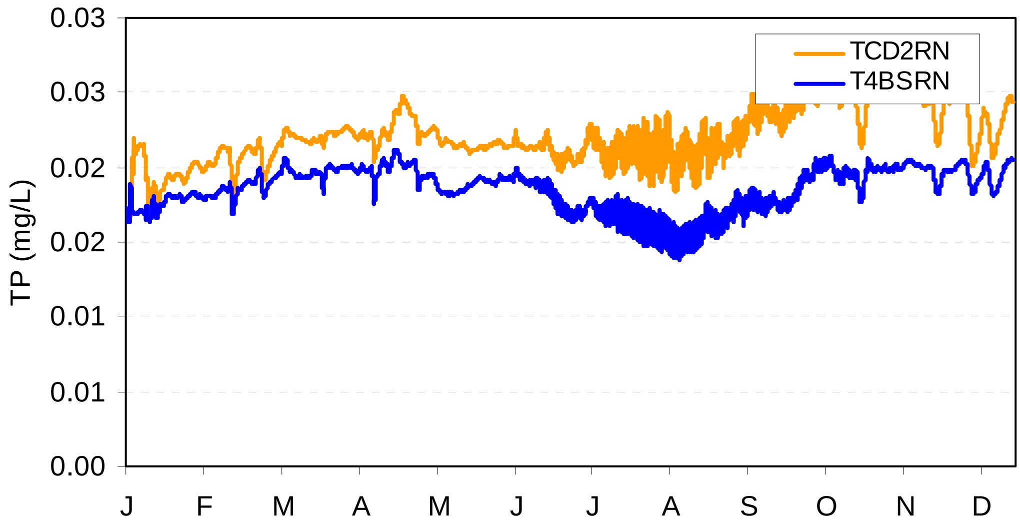

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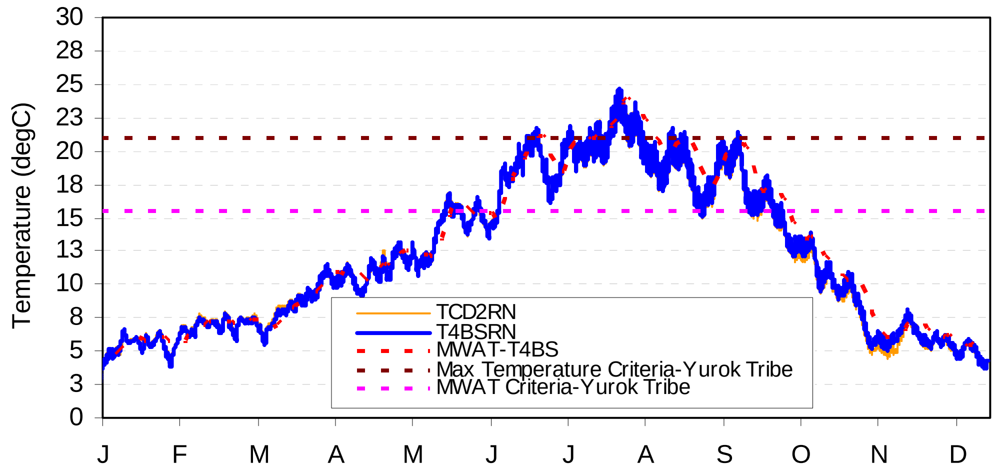

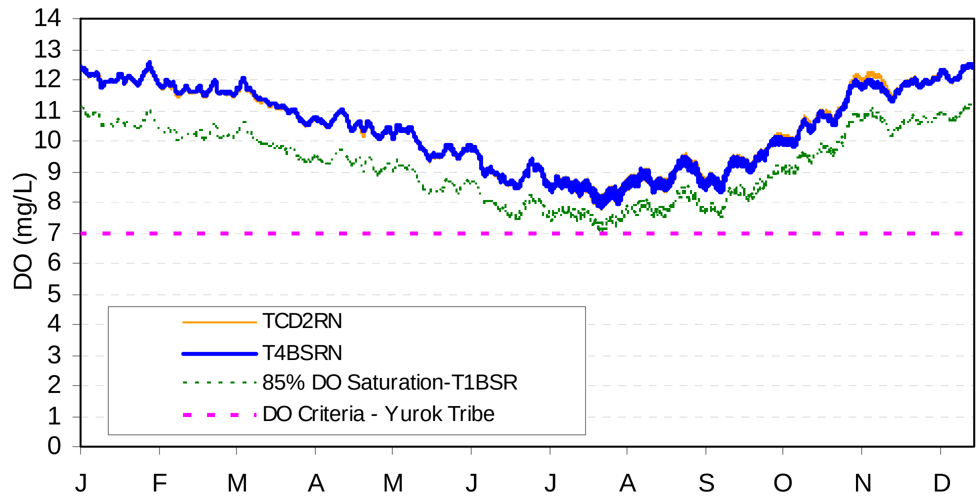

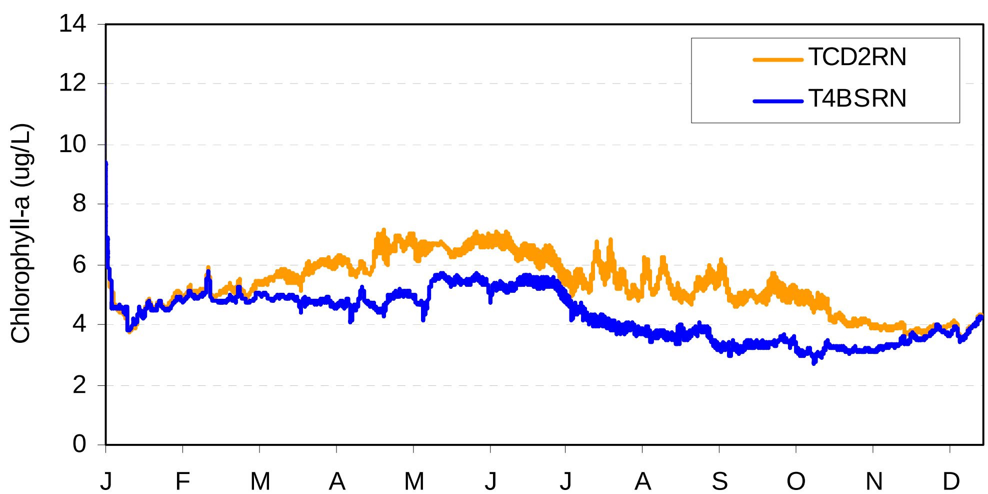

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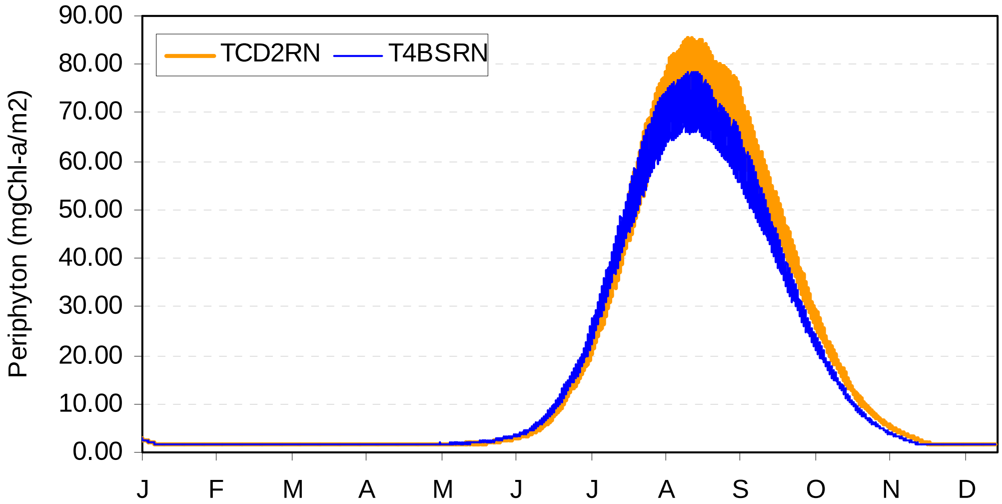

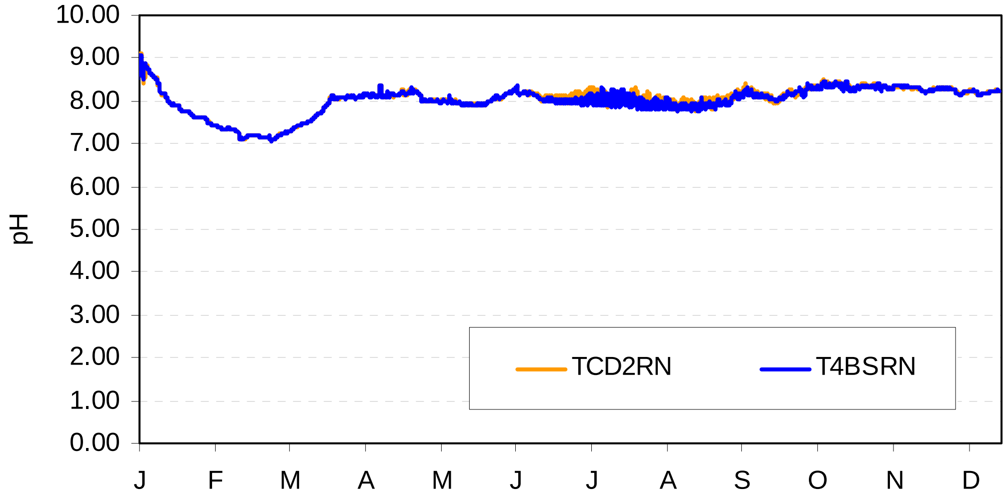

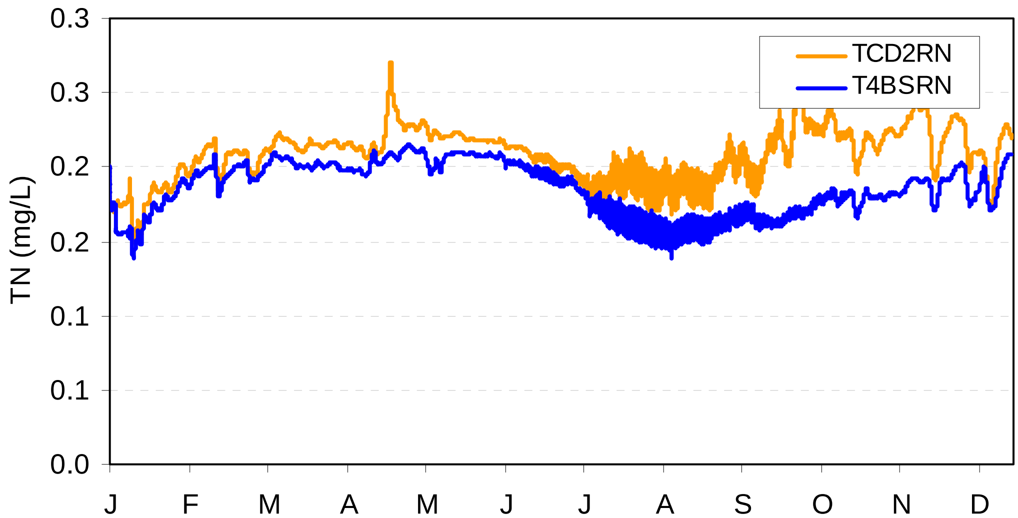

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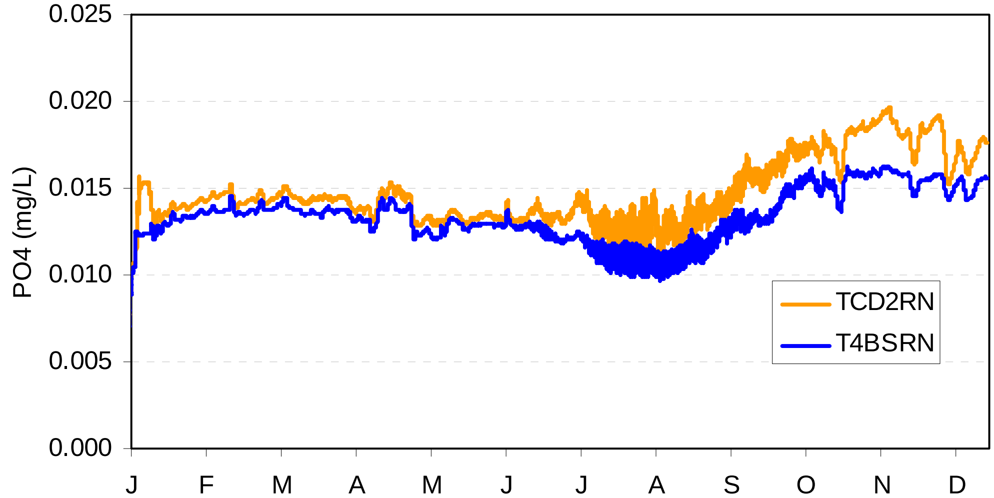

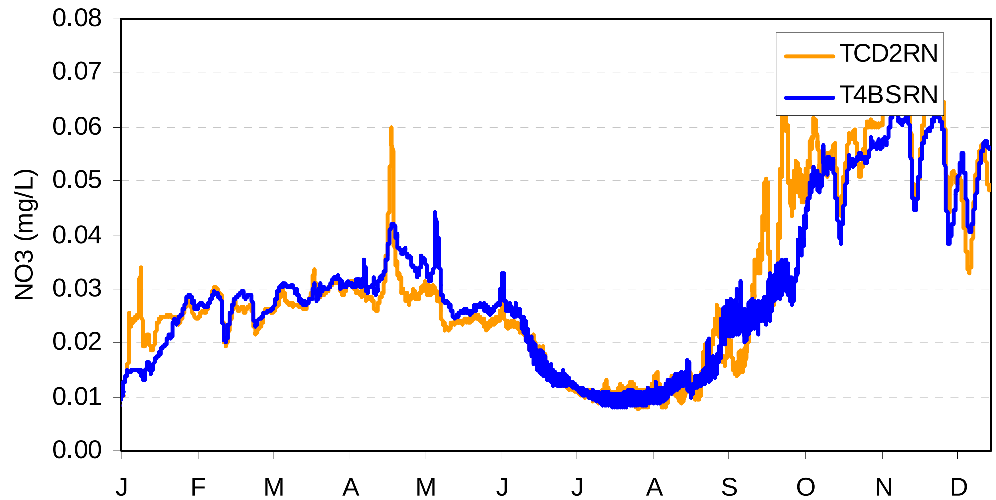

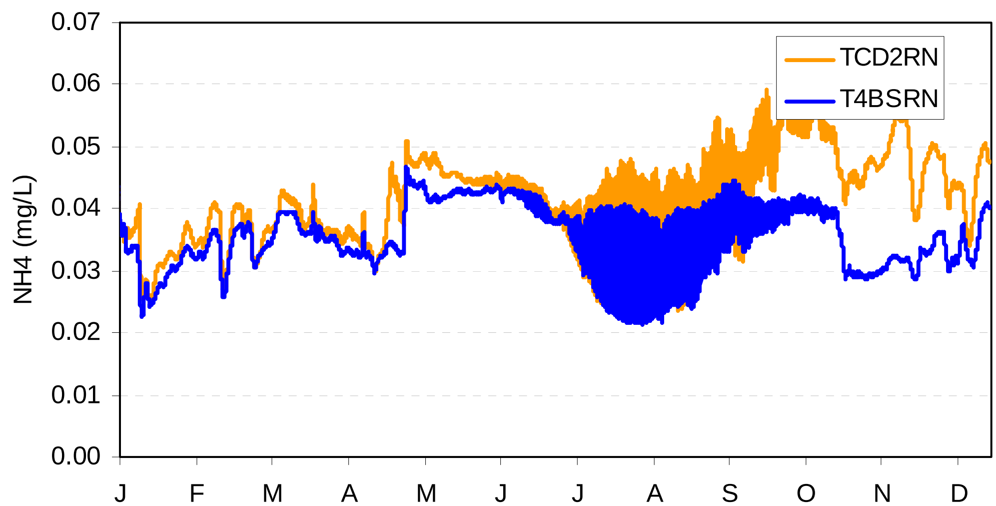

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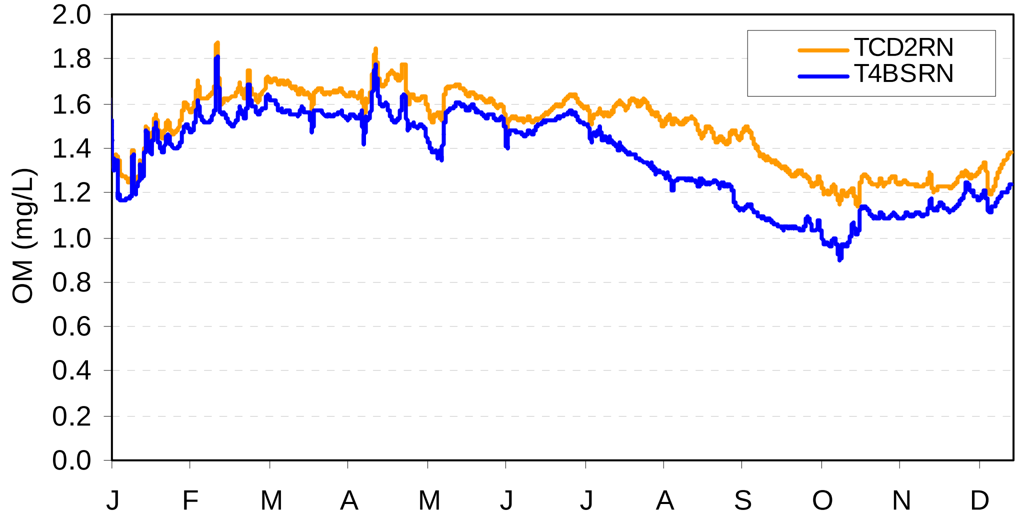

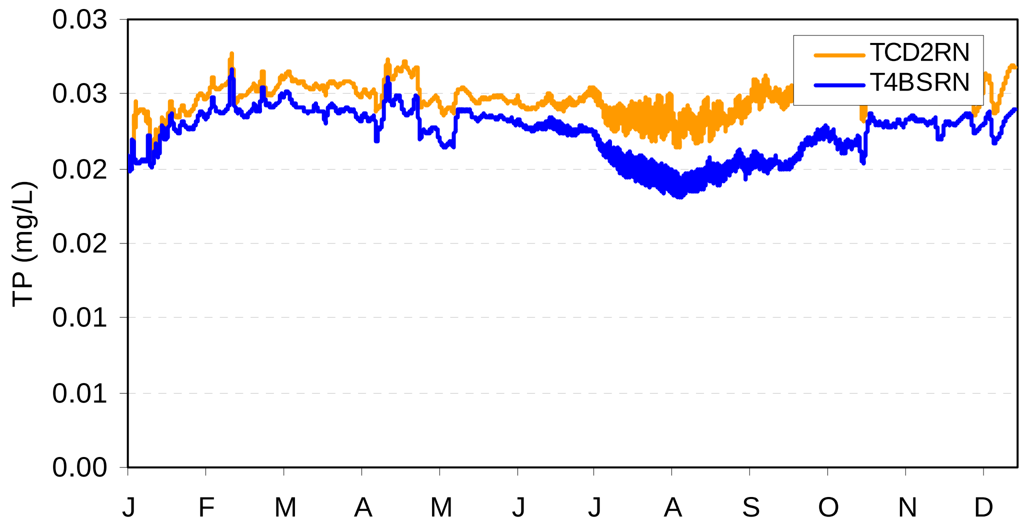

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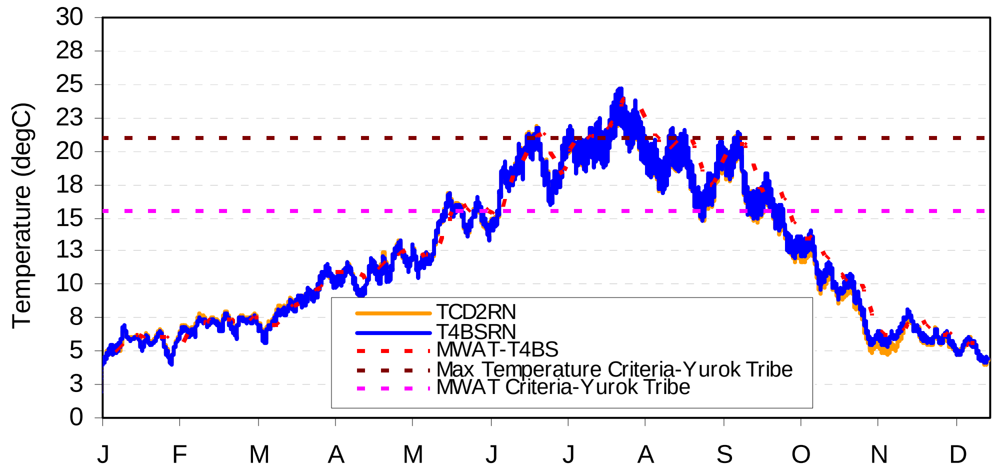

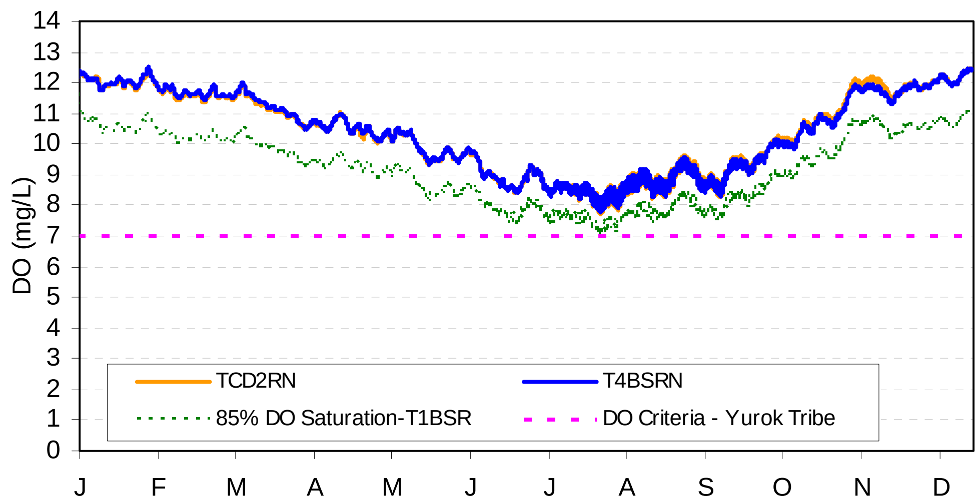

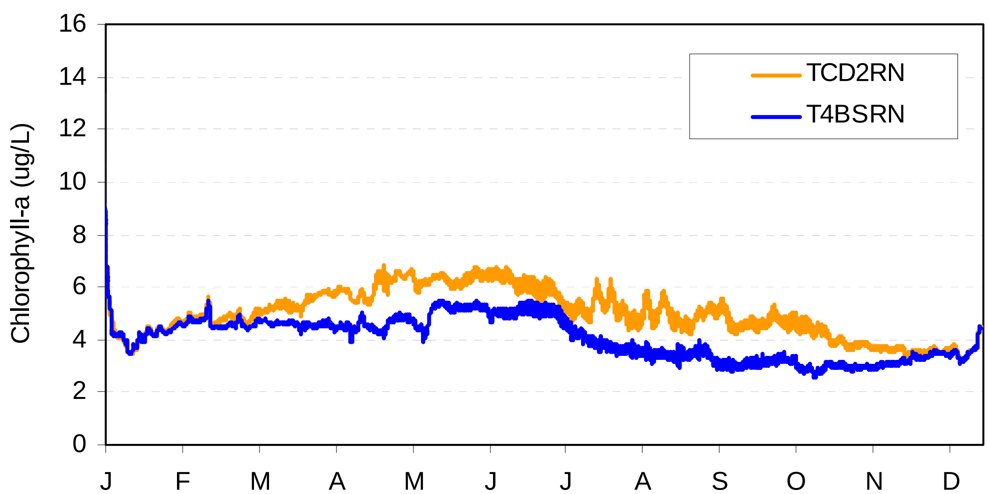

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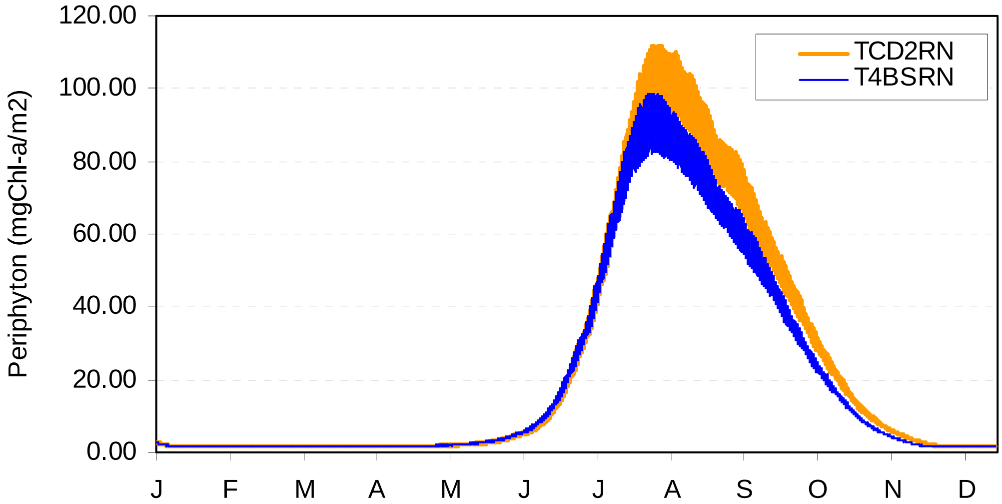

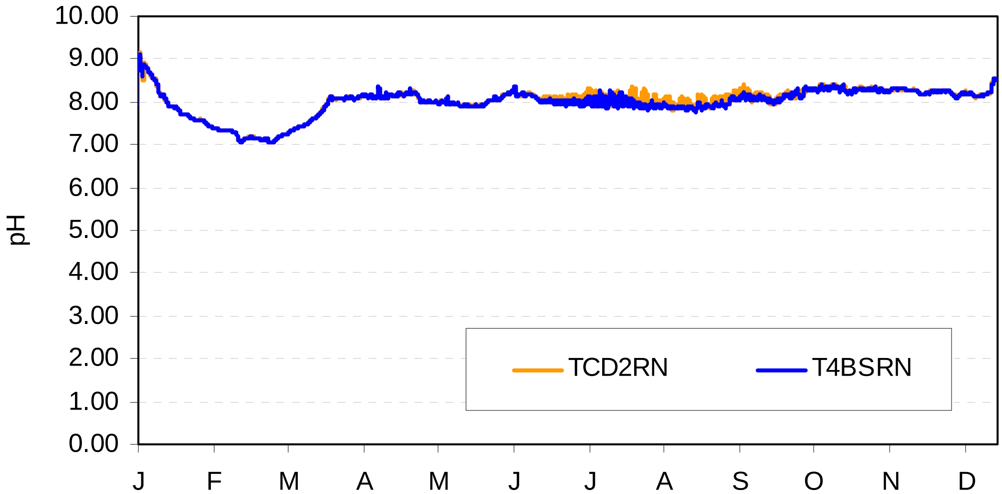

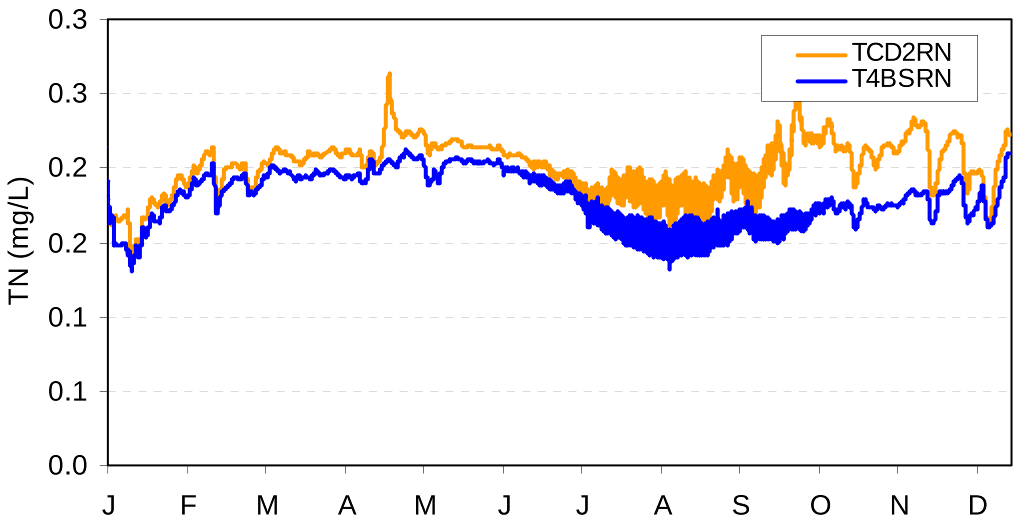

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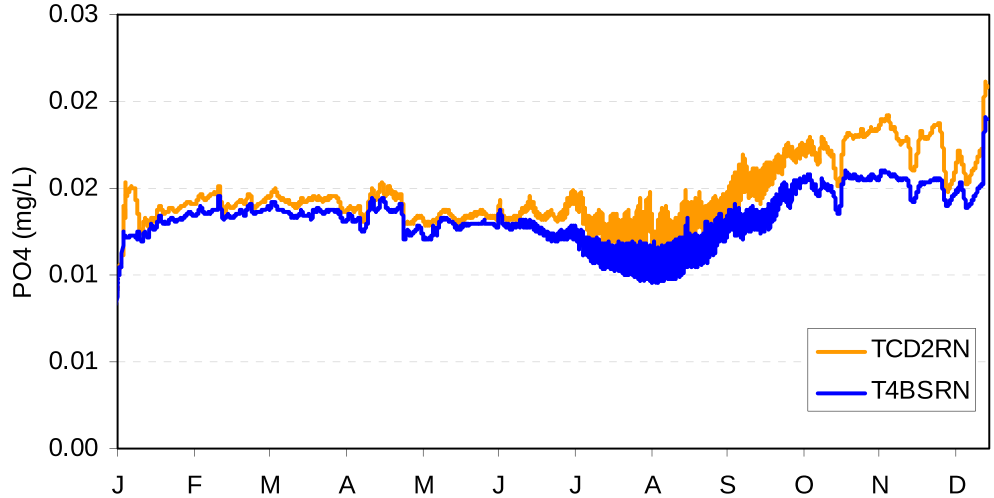

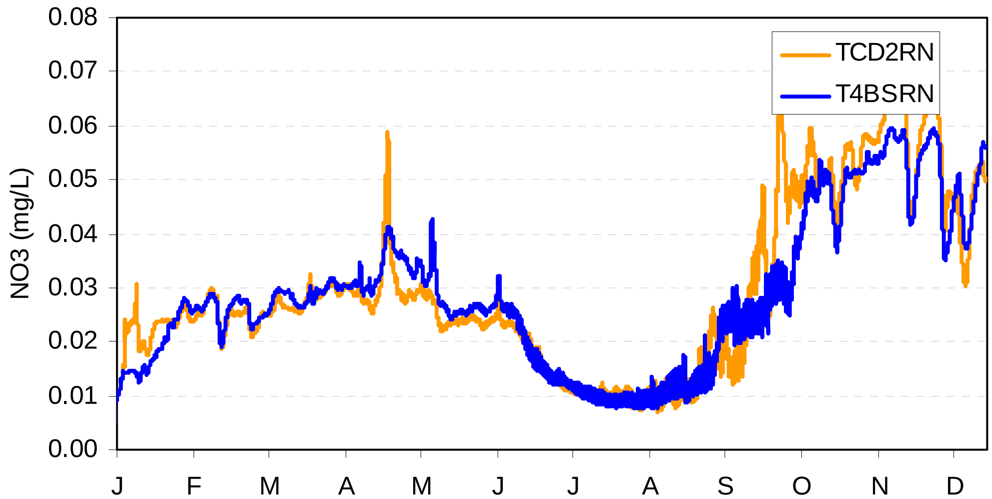

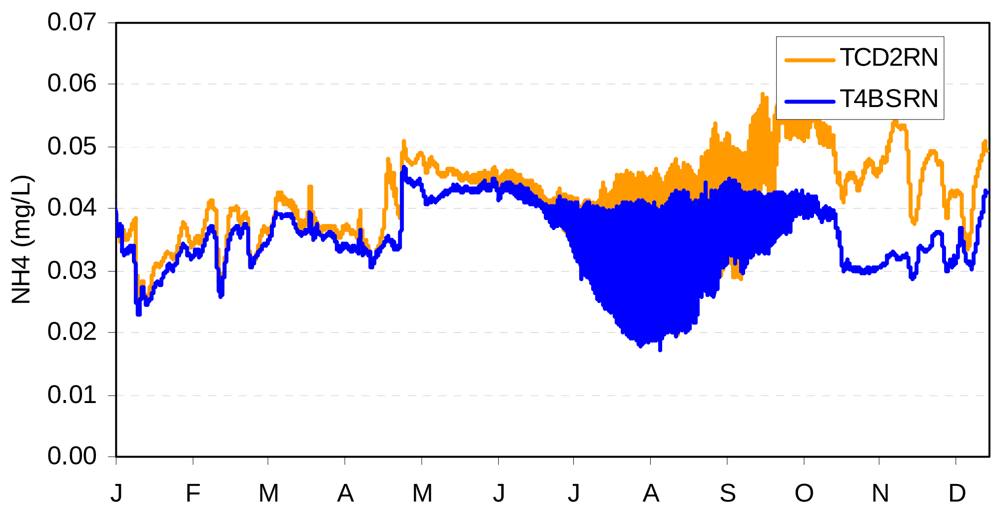

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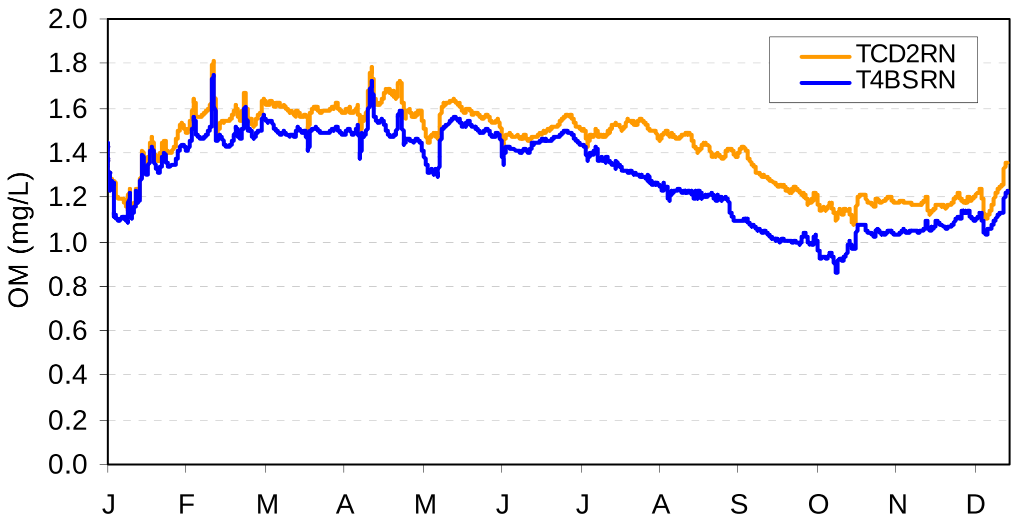

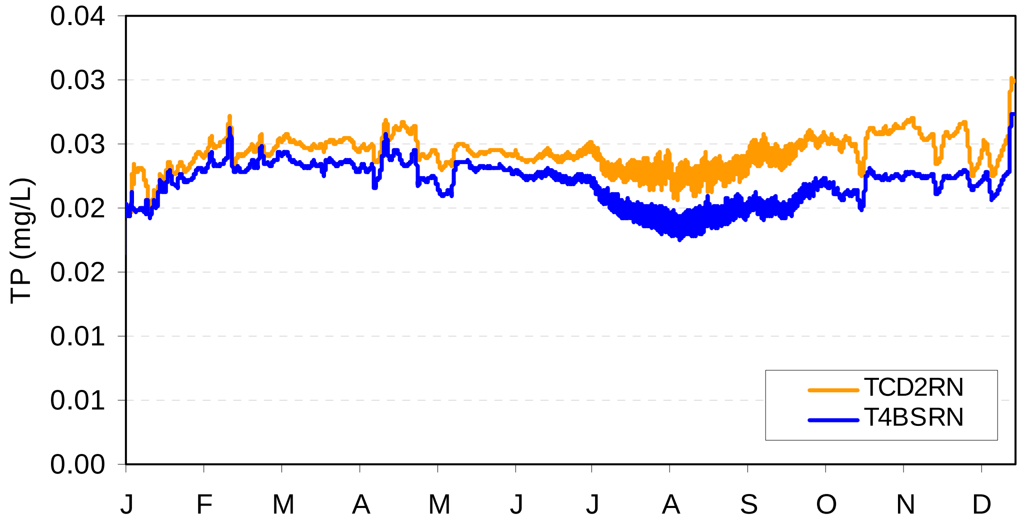

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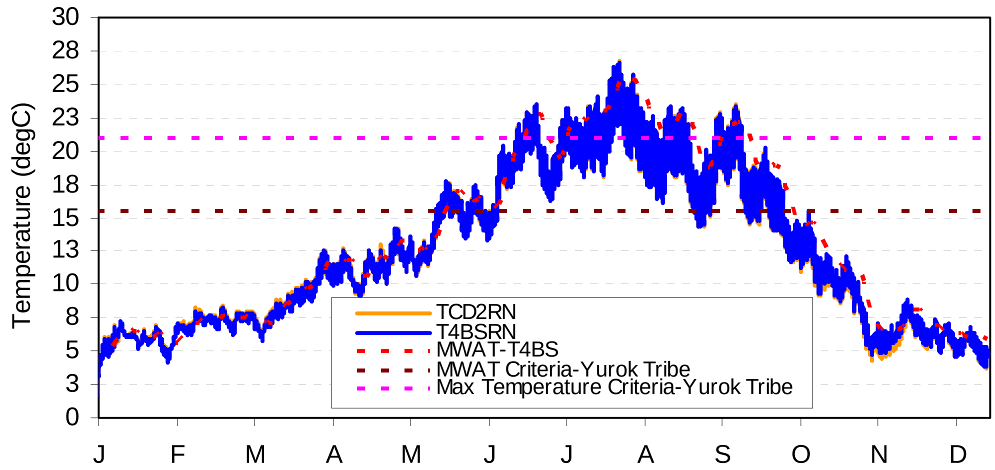

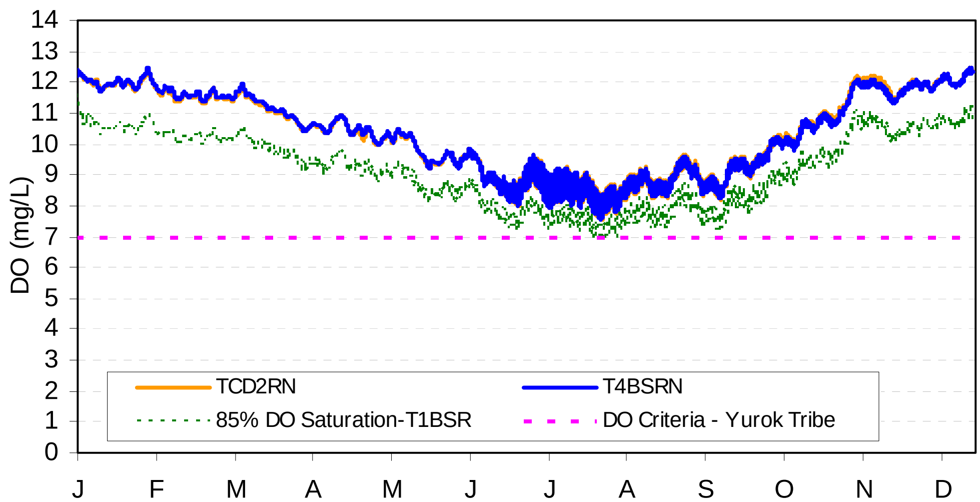

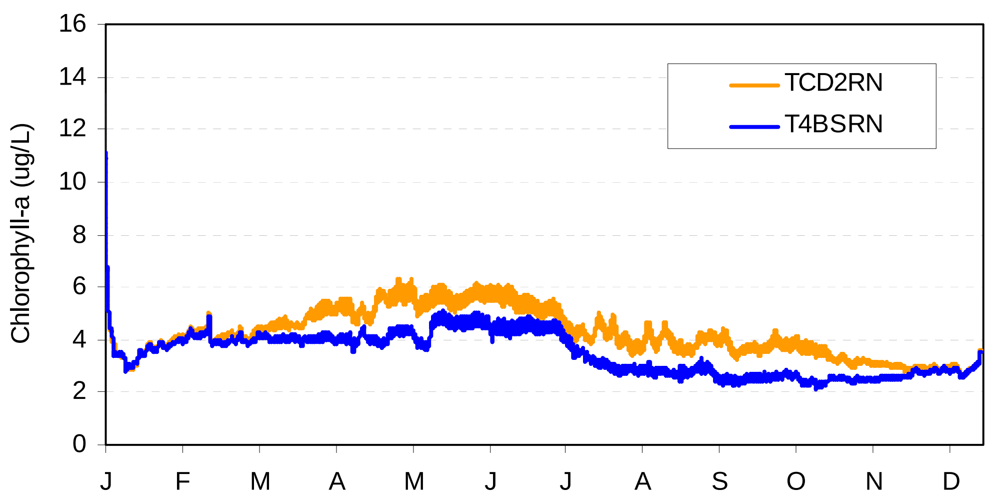

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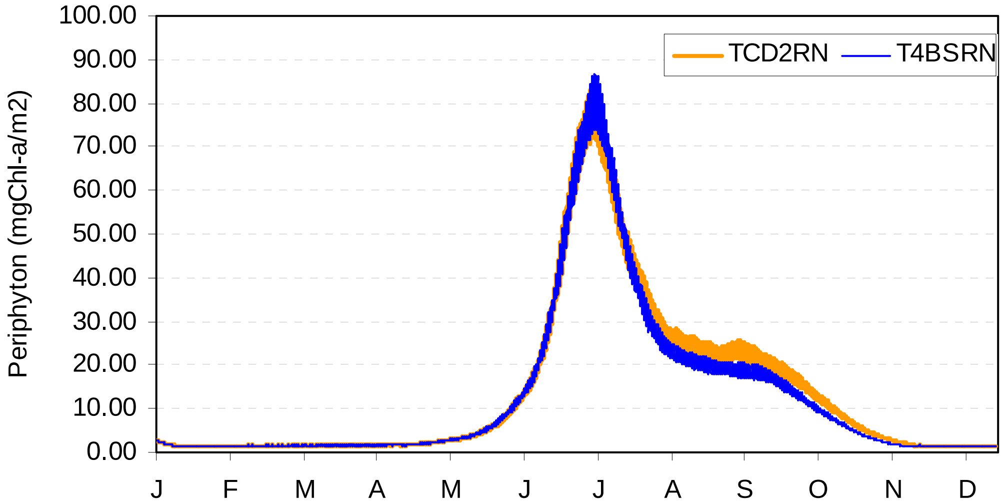

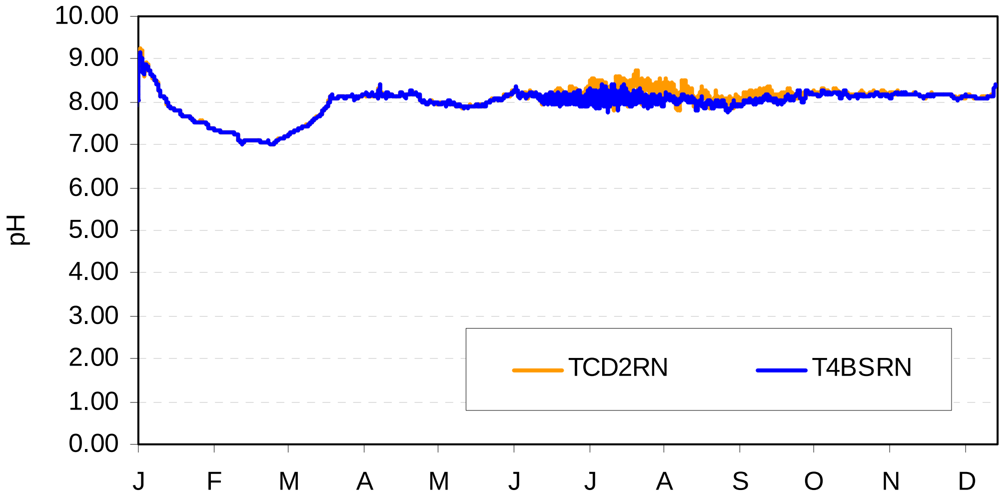

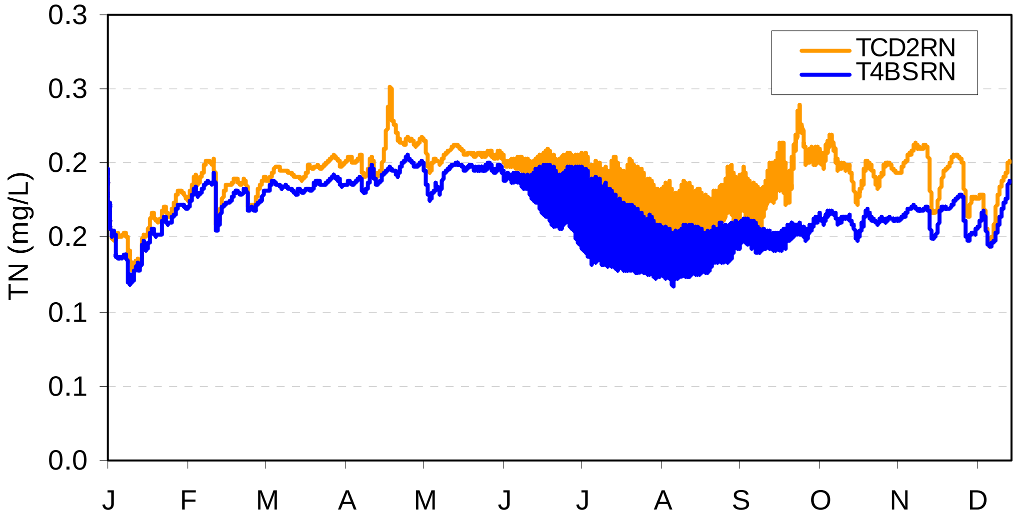

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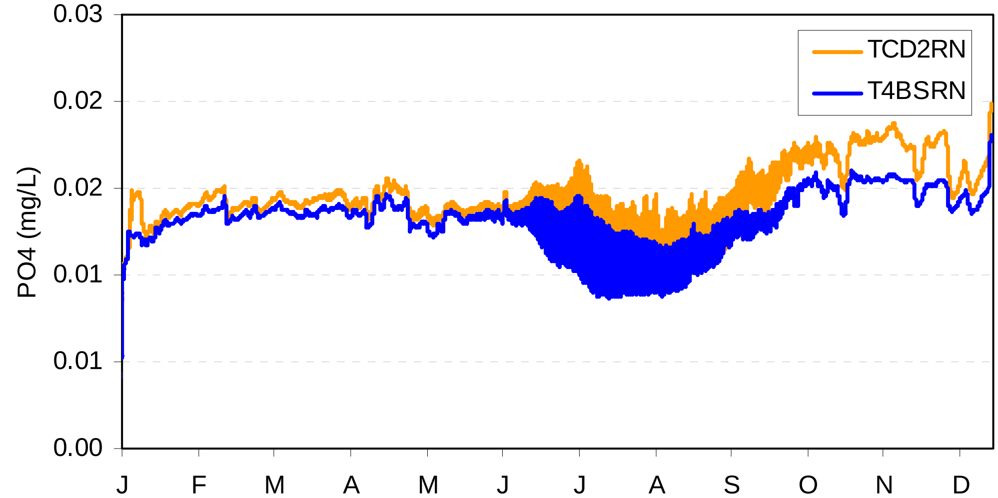

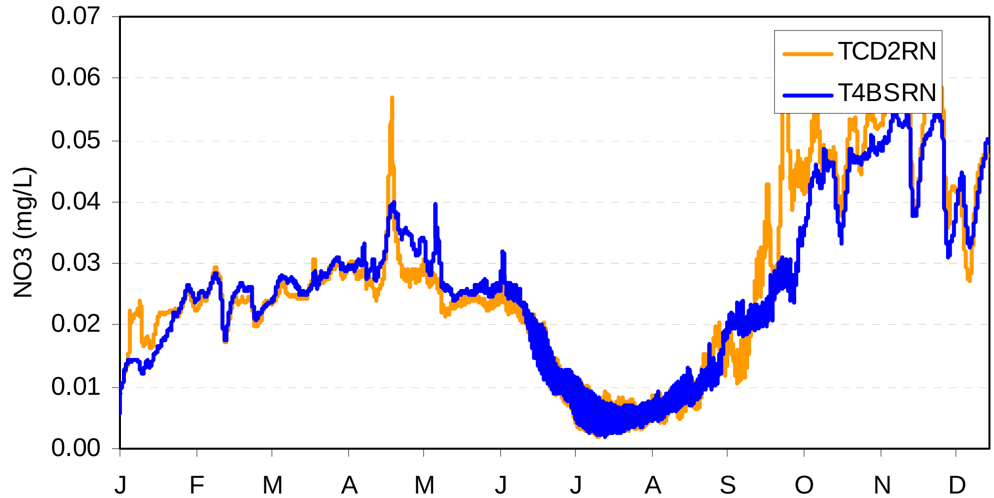

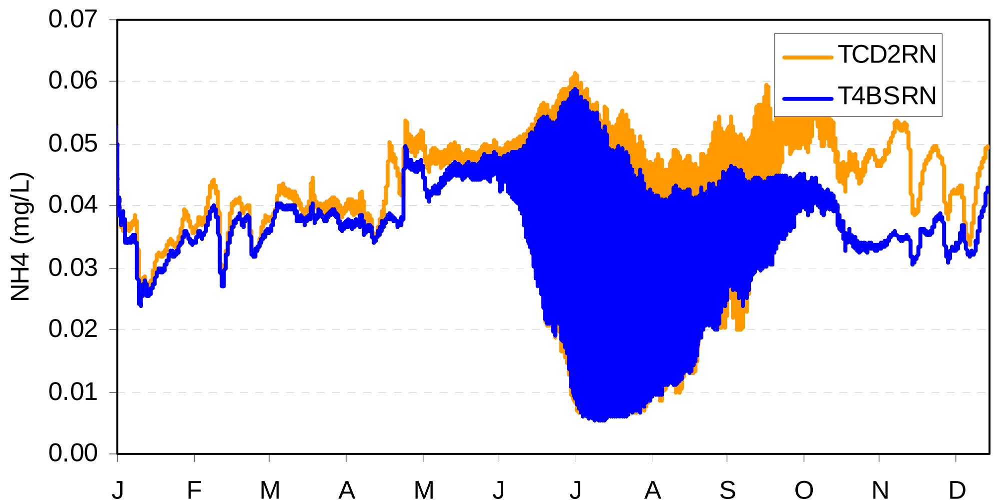

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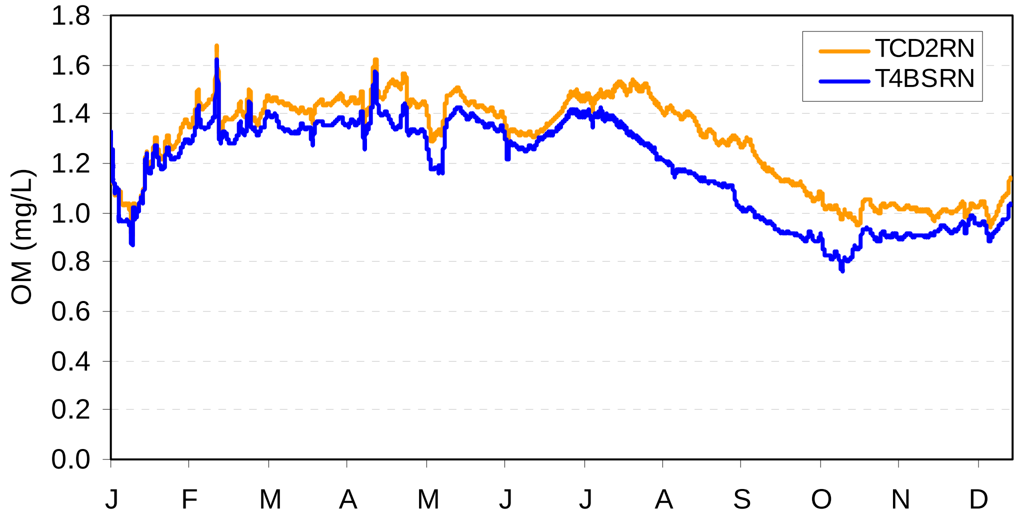
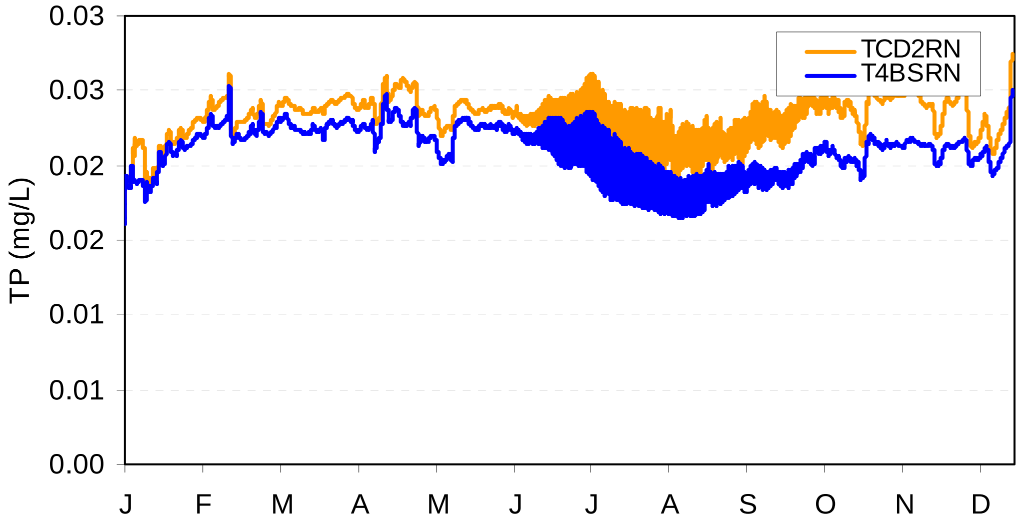
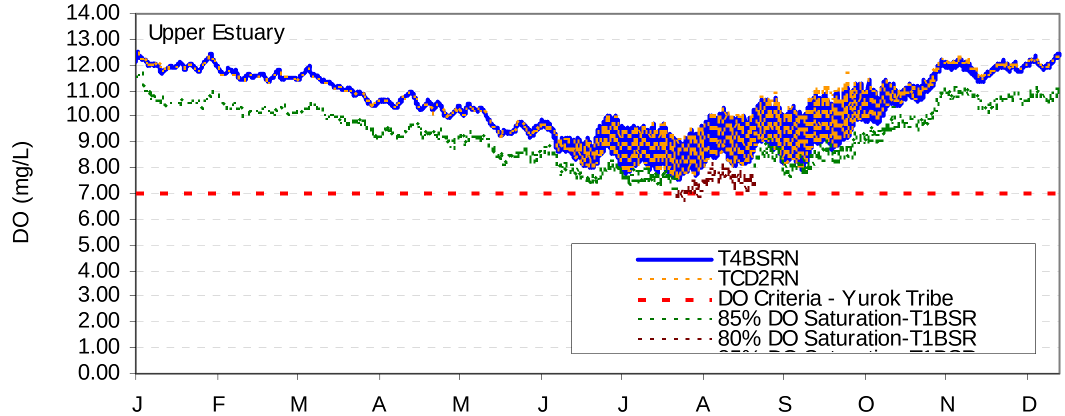
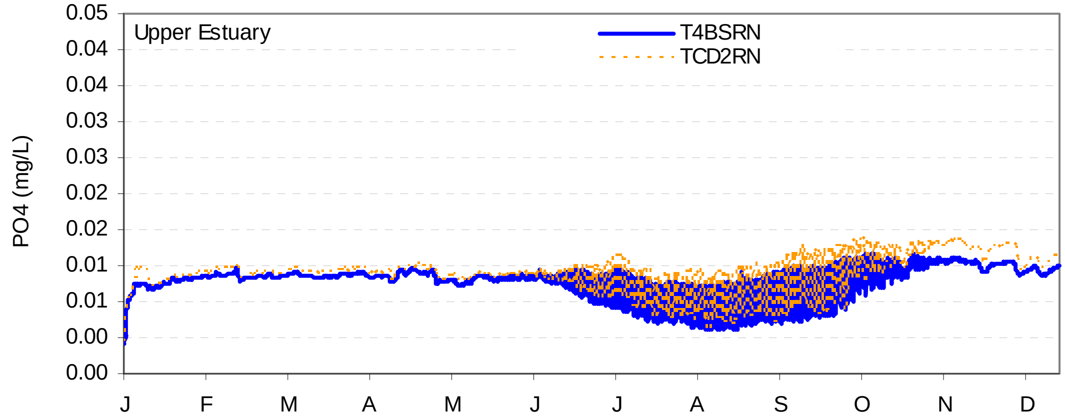
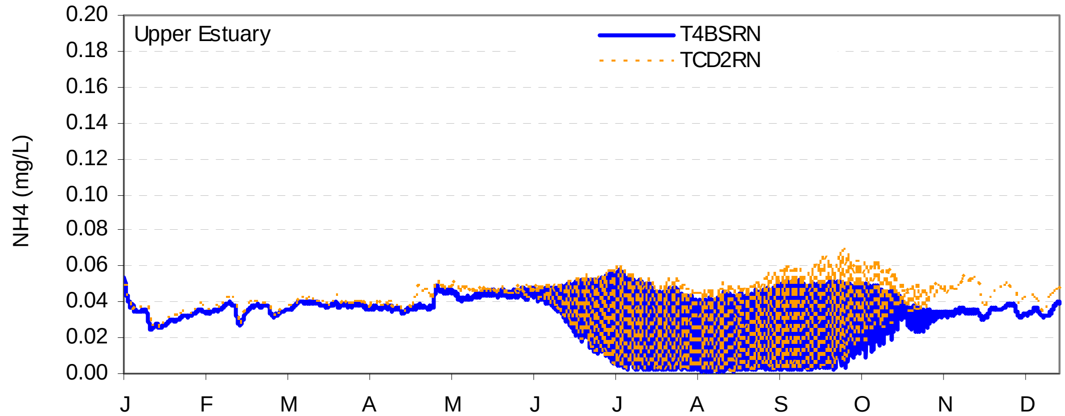


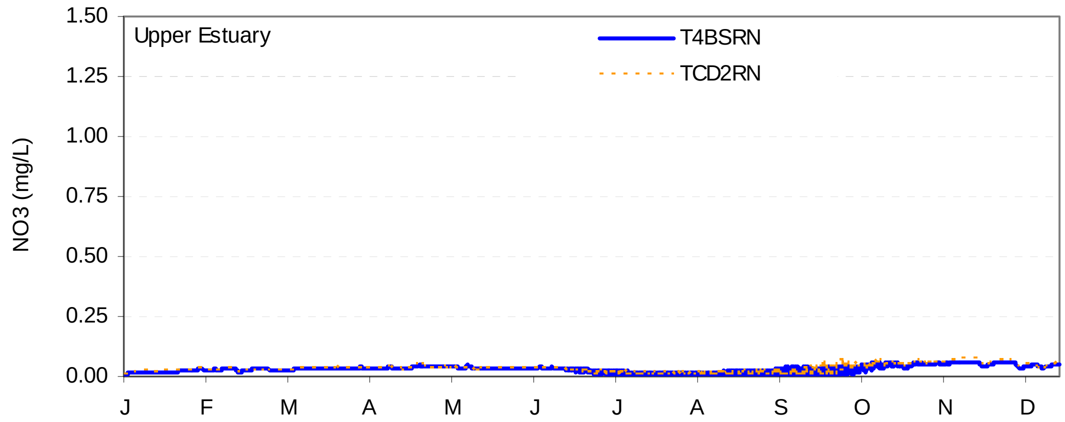


Upper Estuary

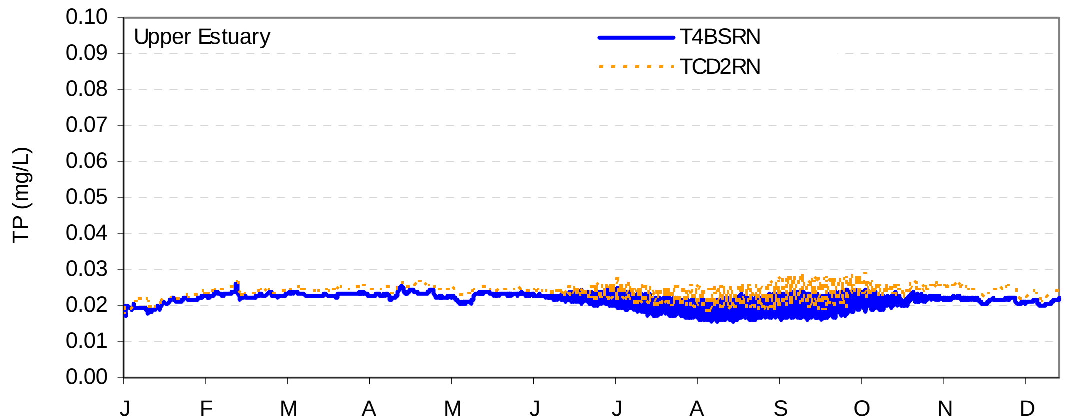




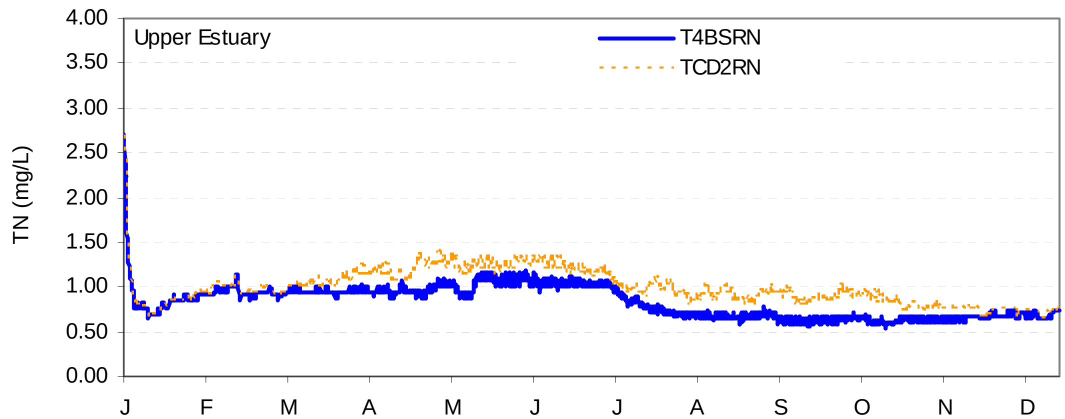




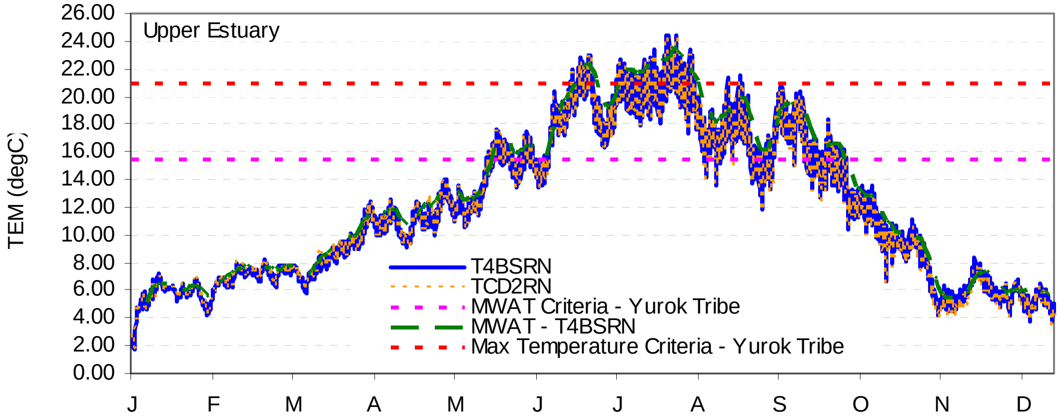
Upper Estuary
T4BSRN
TCD2RN
NO3 (mg/L)
1.50
1.25
1.00
0.75
0.50
0.25
0.00
J F M A M J J A S O N D

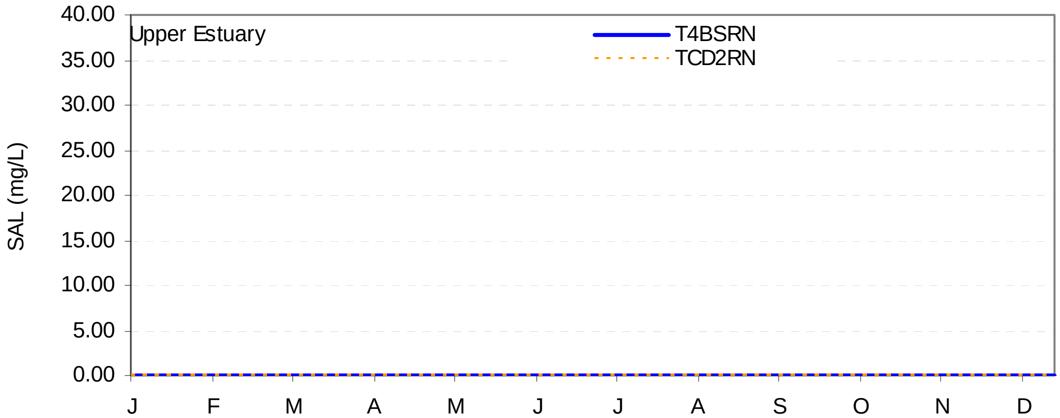


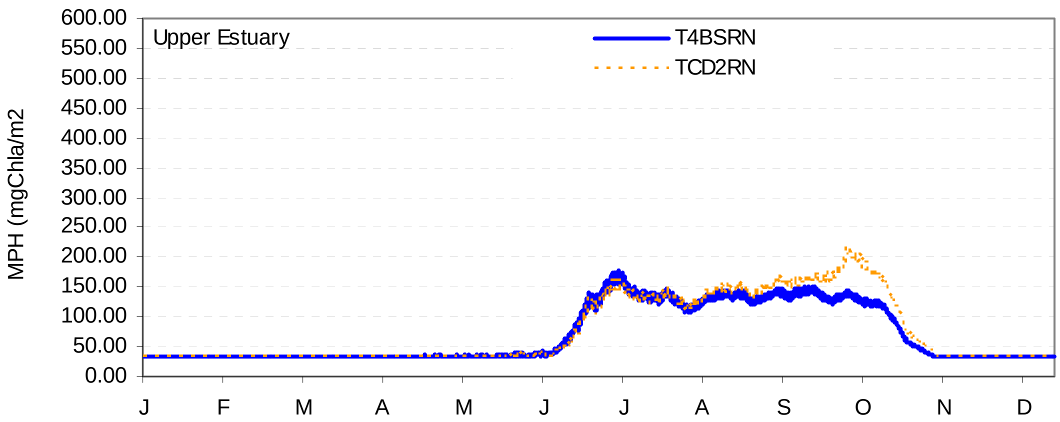
Upper Estuary
T4BSRN
TCD2RN
TP (mg/L)
0.10
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0.00
J F M A M J J A S O N D



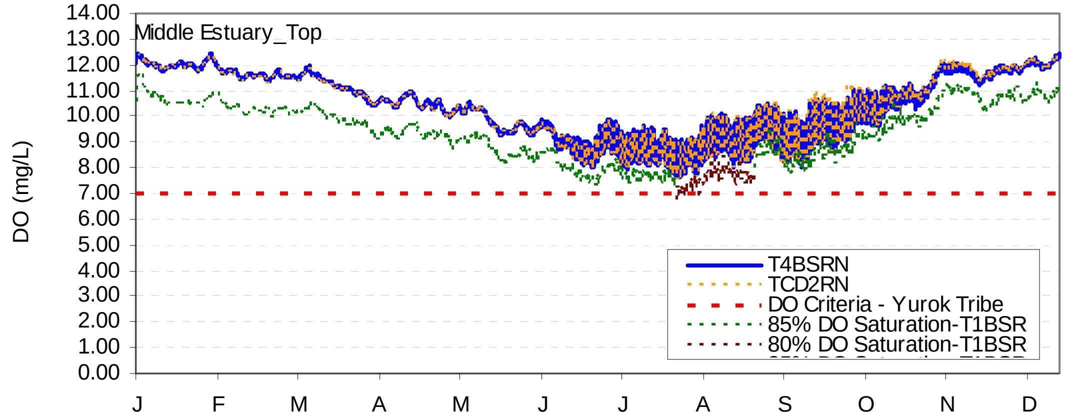
Upper Estuary
T4BSRN
TCD2RN
TN (mg/L)
4.00
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
J F M A M J J A S O N D

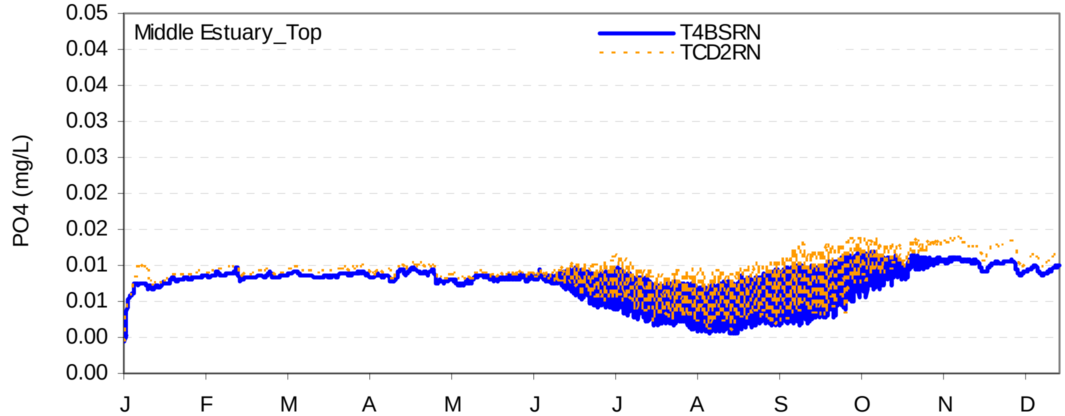

Upper Estuary
TEM (degC)
T4BSRN
TCD2RN
MWAT Criteria - Yurok Tribe
MWAT - T4BSRN
Max Temperature Criteria - Yurok Tribe
26.00
24.00
22.00
20.00
18.00
16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
J F M A M J J A S O N D

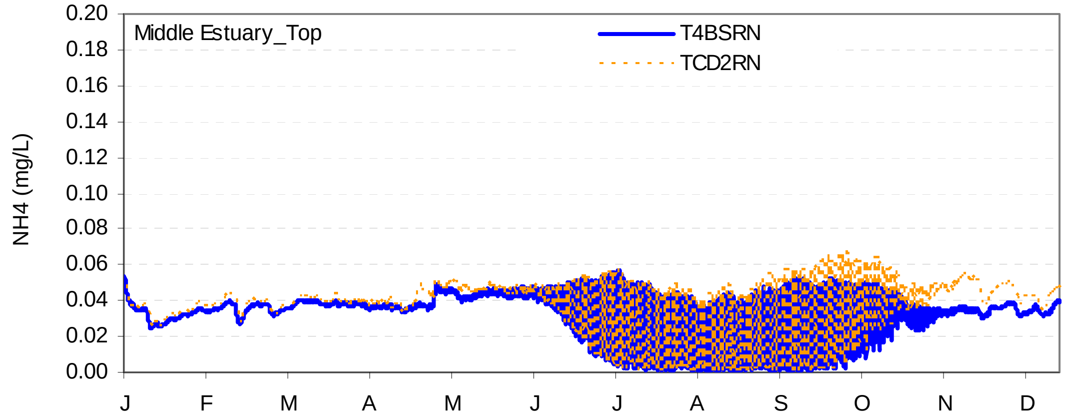

Upper Estuary
SAL (mg/L)
T4BSRN
TCD2RN
40.00
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
J F M A M J J A S O N D

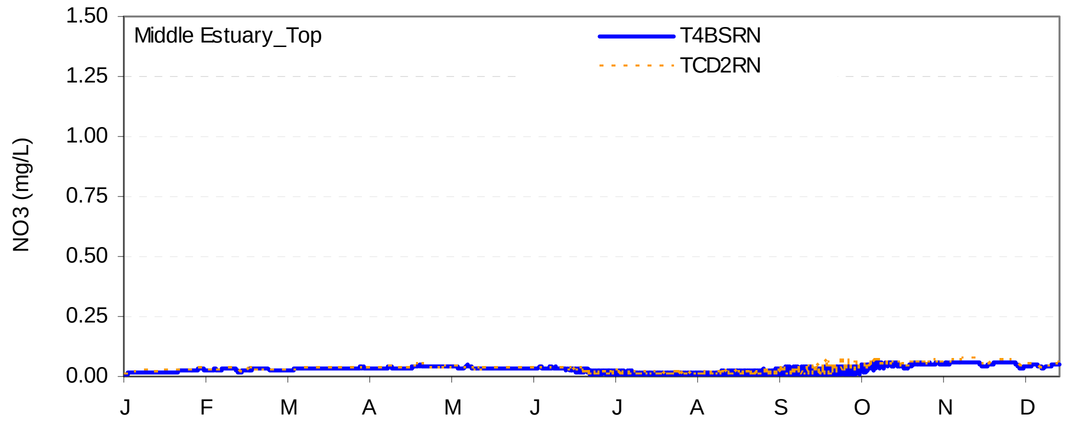

Upper Estuary
MPH (mgChla/m2
T4BSRN
TCD2RN
600.00
550.00
500.00
450.00
400.00
350.00
300.00
250.00
200.00
150.00
100.00
50.00
0.00
J F M A M J J A S O N D

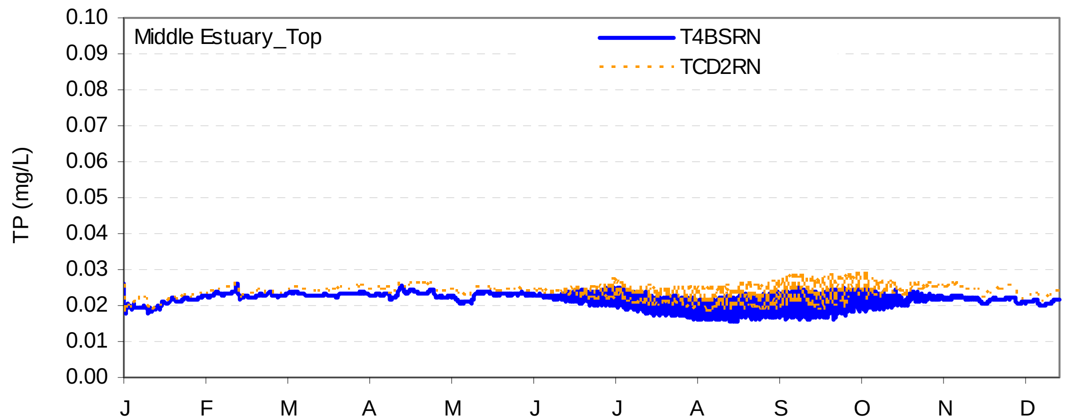
Middle Estuary - Top

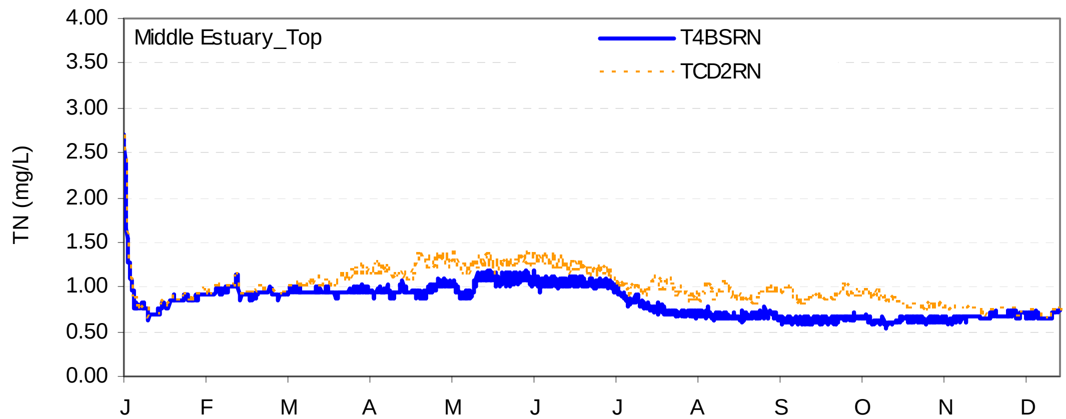


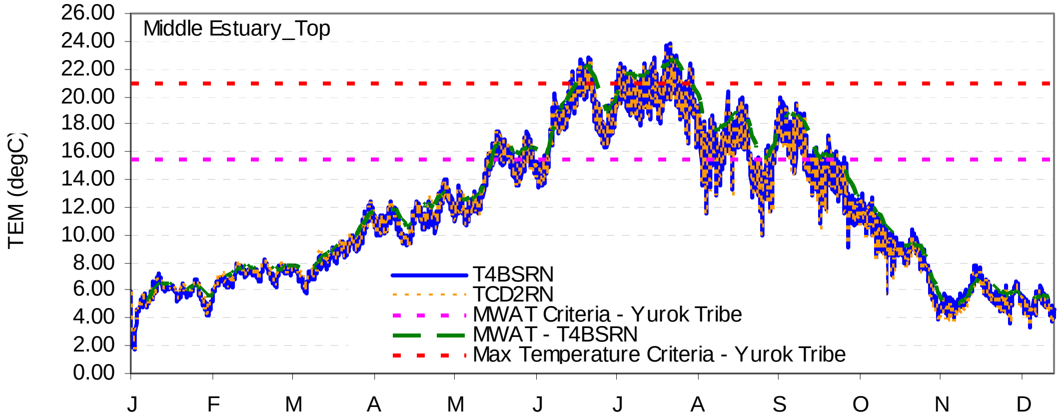




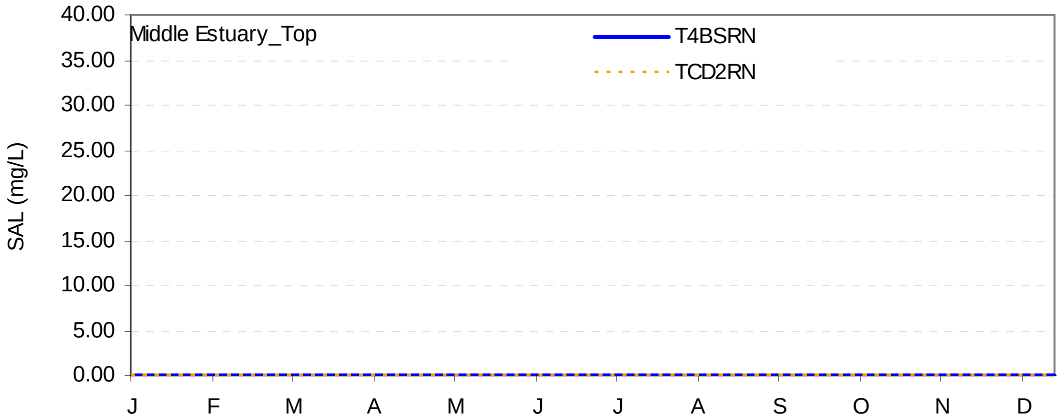

Middle Estuary_Top
T4BSRN
TCD2RN
NO3 (mg/L)
1.50
1.25
1.00
0.75
0.50
0.25
0.00
J
F
M
A
M
J
J
A
S
O
N
D


Middle Estuary_Top
T4BSRN
TCD2RN
TP (mg/L)
0.10
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0.00
J
F
M
A
M
J
J
A
S
O
N
D

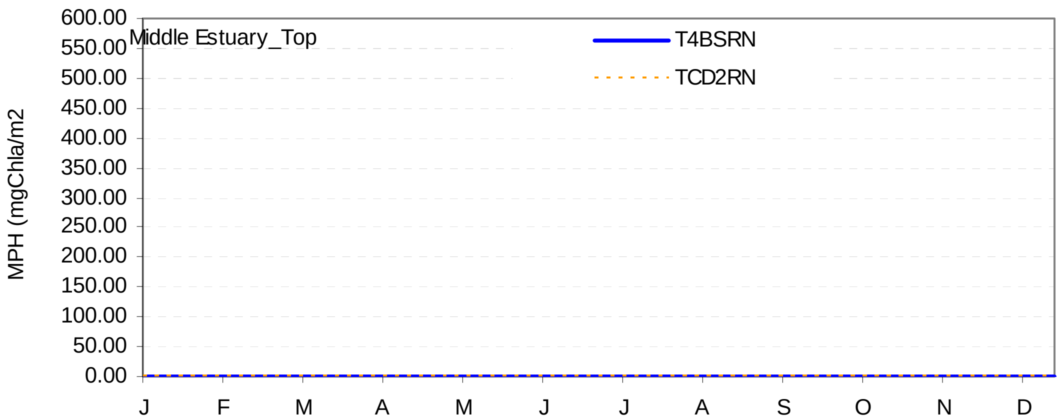

Middle Estuary_Top
T4BSRN
TCD2RN
TN (mg/L)
4.00
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
J
F
M
A
M
J
J
A
S
O
N
D



Middle Estuary_Top
TEM (degC)
26.00
24.00
22.00
20.00
18.00
16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
J
F
M
A
M
J
J
A
S
O
N
D
T4BSRN
TCD2RN
MWAT Criteria - Yurok Tribe
MWAT - T4BSRN
Max Temperature Criteria - Yurok Tribe

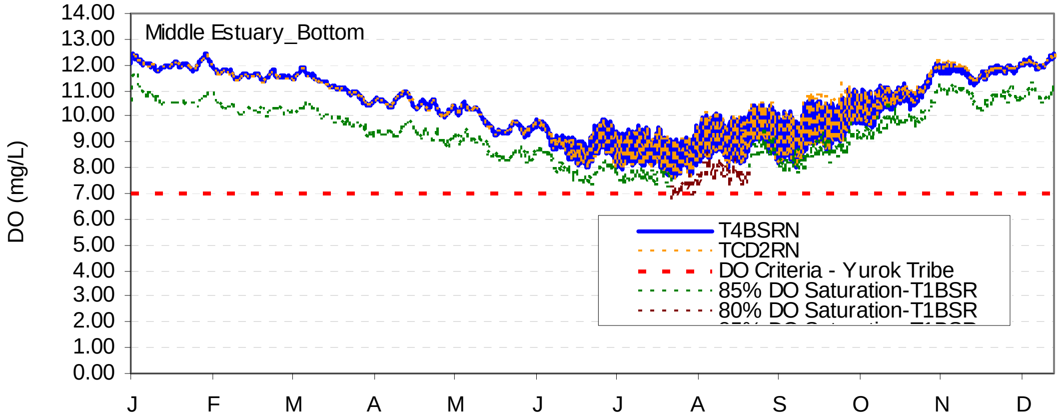


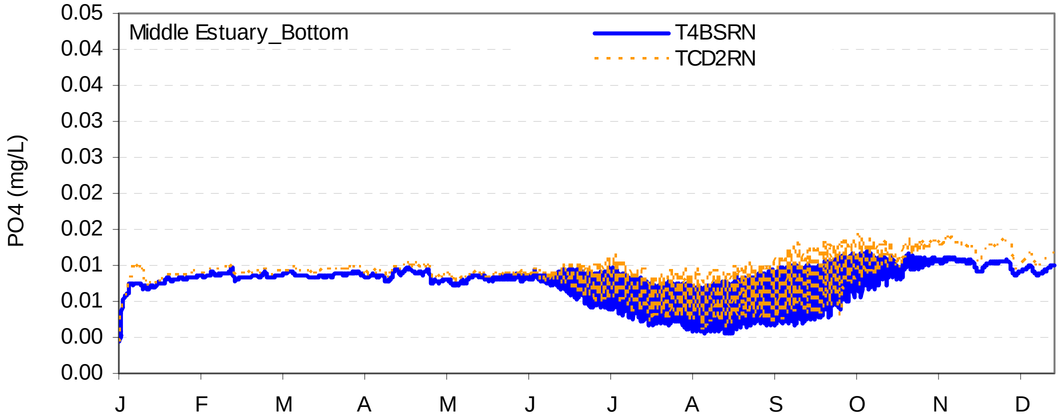
Middle Estuary_Top
SAL (mg/L)
40.00
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
J
F
M
A
M
J
J
A
S
O
N
D
T4BSRN
TCD2RN

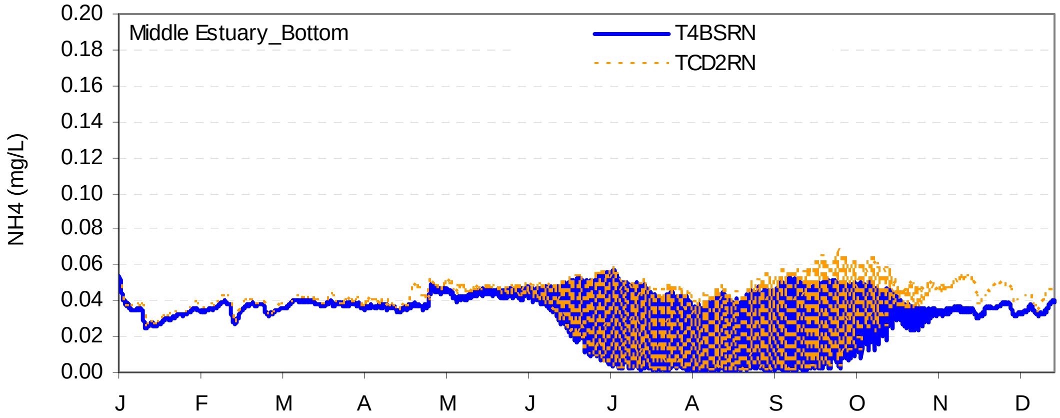


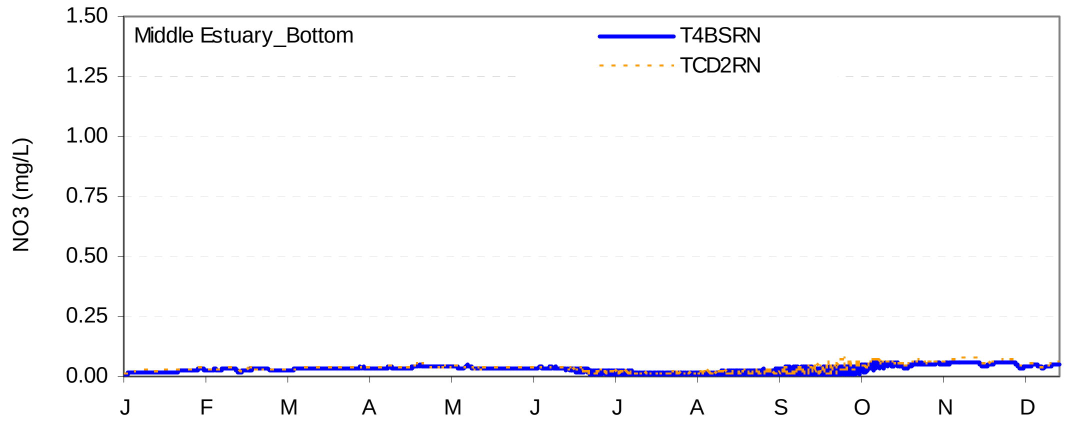
Middle Estuary_Top
MPH (mgChla/m2
600.00
550.00
500.00
450.00
400.00
350.00
300.00
250.00
200.00
150.00
100.00
50.00
0.00
J
F
M
A
M
J
J
A
S
O
N
D
T4BSRN
TCD2RN

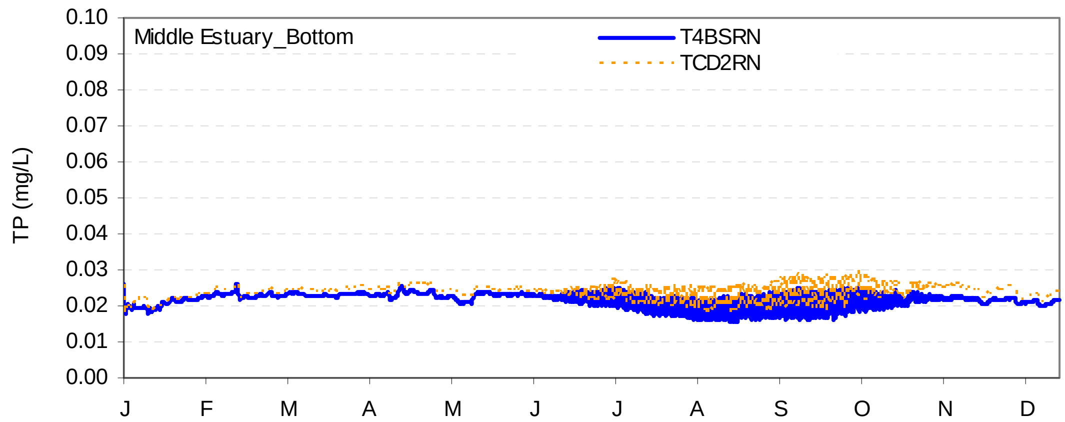
Middle Estuary - Bottom

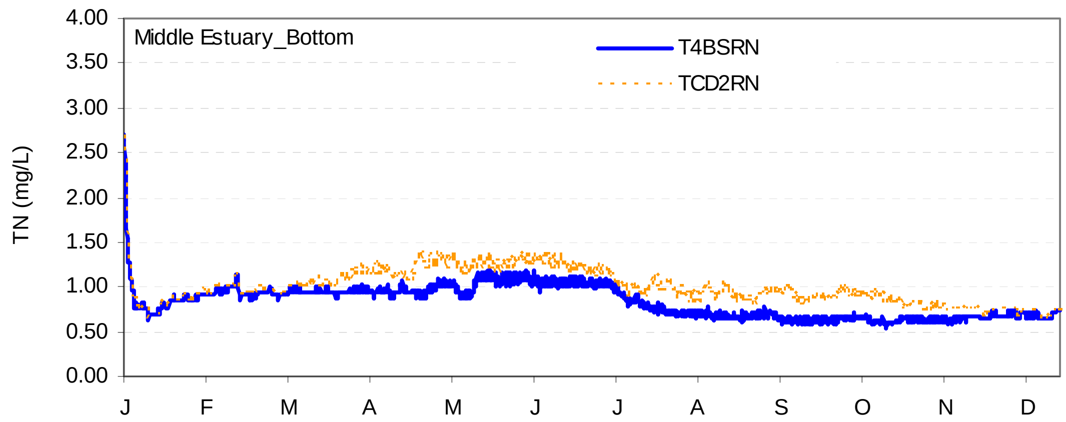


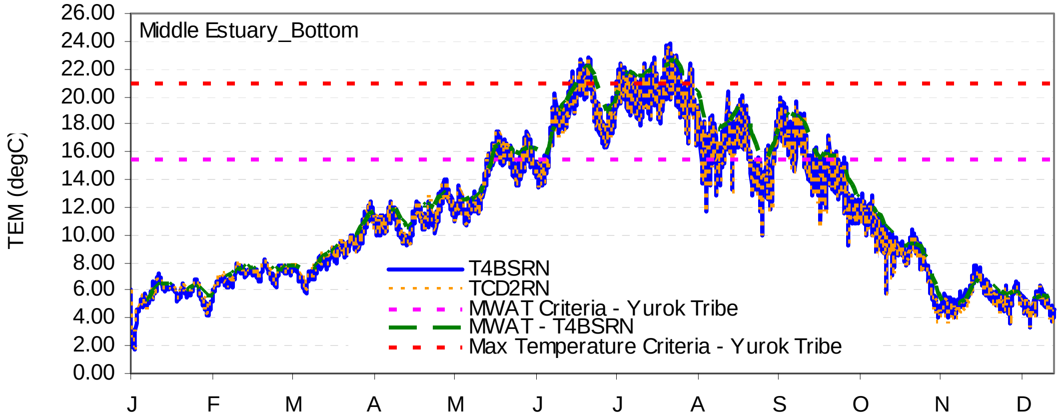


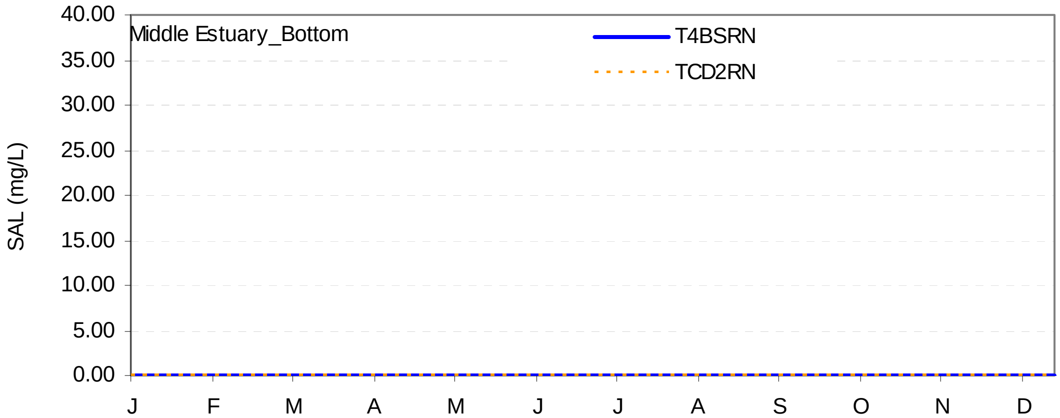


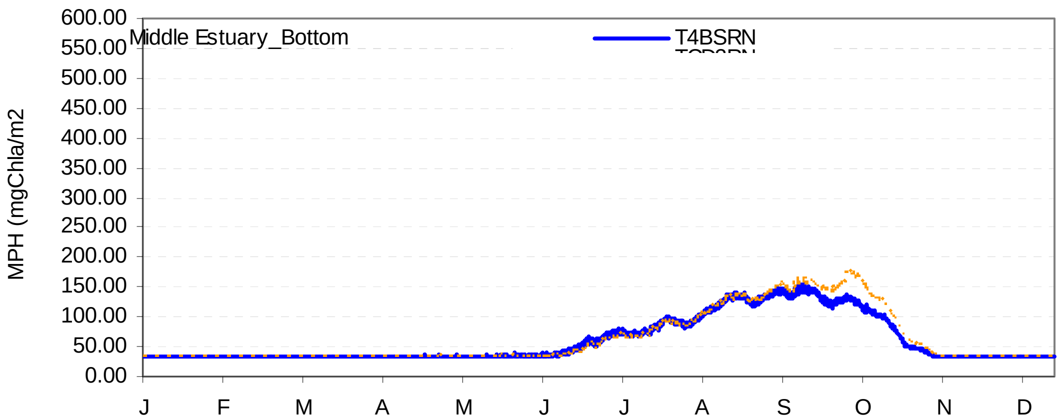

Middle Estuary_Bottom
T4BSRN
TCD2RN
NO3 (mg/L)
1.50
1.25
1.00
0.75
0.50
0.25
0.00
J
F
M
A
M
J
J
A
S
O
N
D


Middle Estuary_Bottom
T4BSRN
TCD2RN
TP (mg/L)
0.10
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0.00
J
F
M
A
M
J
J
A
S
O
N
D

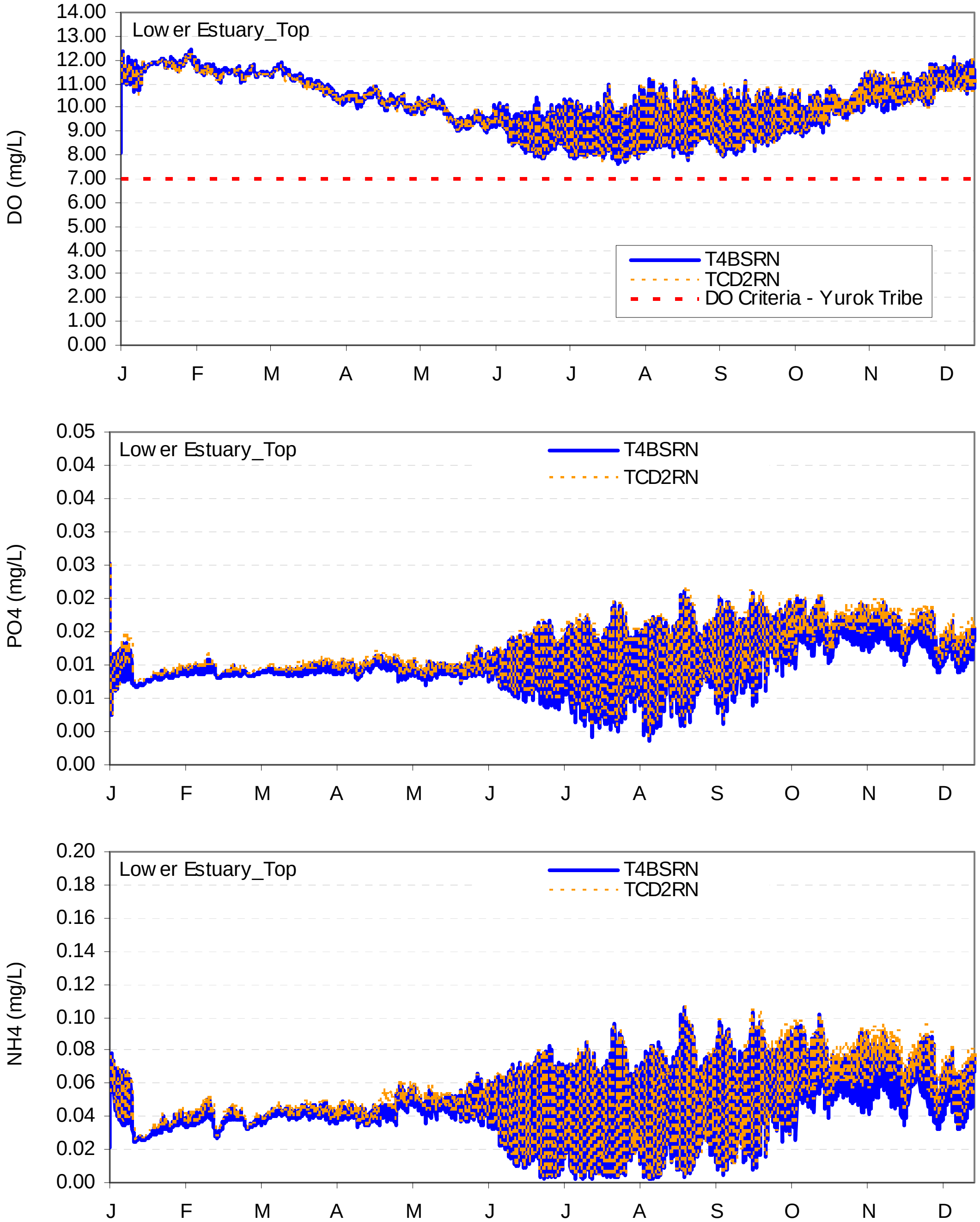

Middle Estuary_Bottom
T4BSRN
TCD2RN
TN (mg/L)
4.00
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
J
F
M
A
M
J
J
A
S
O
N
D

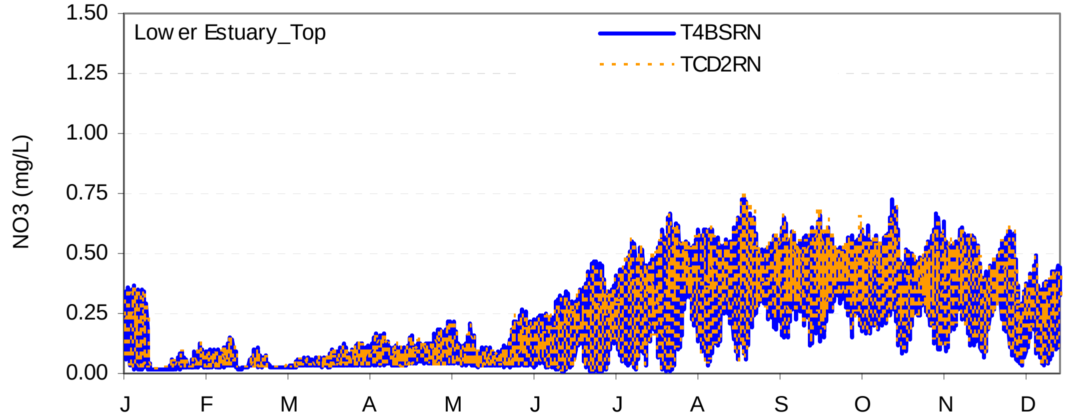

Middle Estuary_Bottom
TEM (degC)
26.00
24.00
22.00
20.00
18.00
16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
T4BSRN
TCD2RN
MWAT Criteria - Yurok Tribe
MWAT - T4BSRN
Max Temperature Criteria - Yurok Tribe
J F M A M J J A S O N D


Middle Estuary_Bottom
SAL (mg/L)
40.00
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
T4BSRN
TCD2RN
J F M A M J J A S O N D

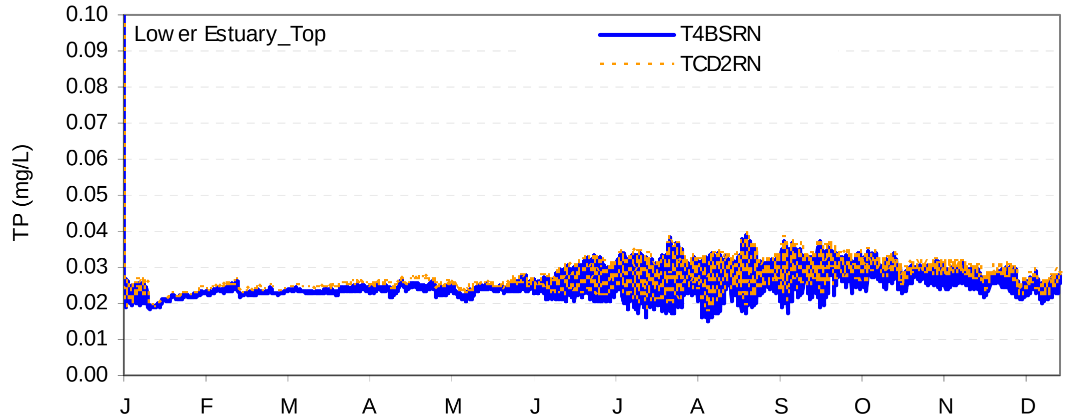

Middle Estuary_Bottom
MPH (mgChla/m2
600.00
550.00
500.00
450.00
400.00
350.00
300.00
250.00
200.00
150.00
100.00
50.00
0.00
T4BSRN
J F M A M J J A S O N D

Lower Estuary - Top

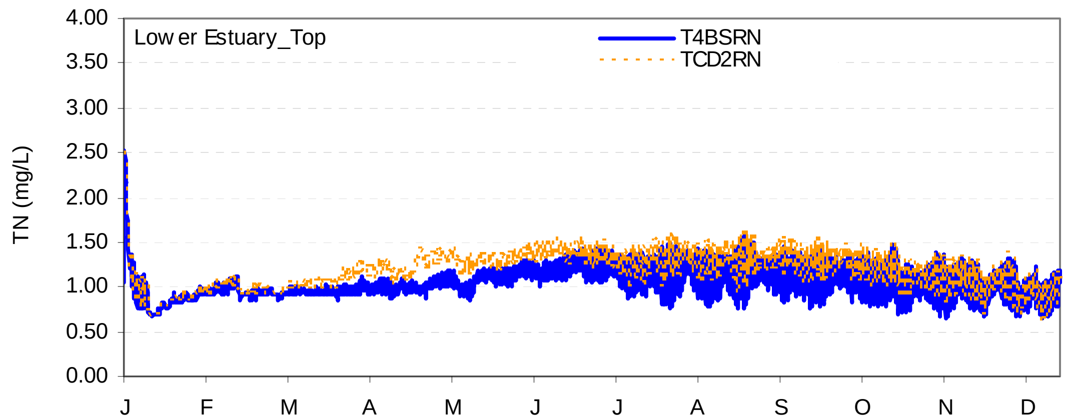




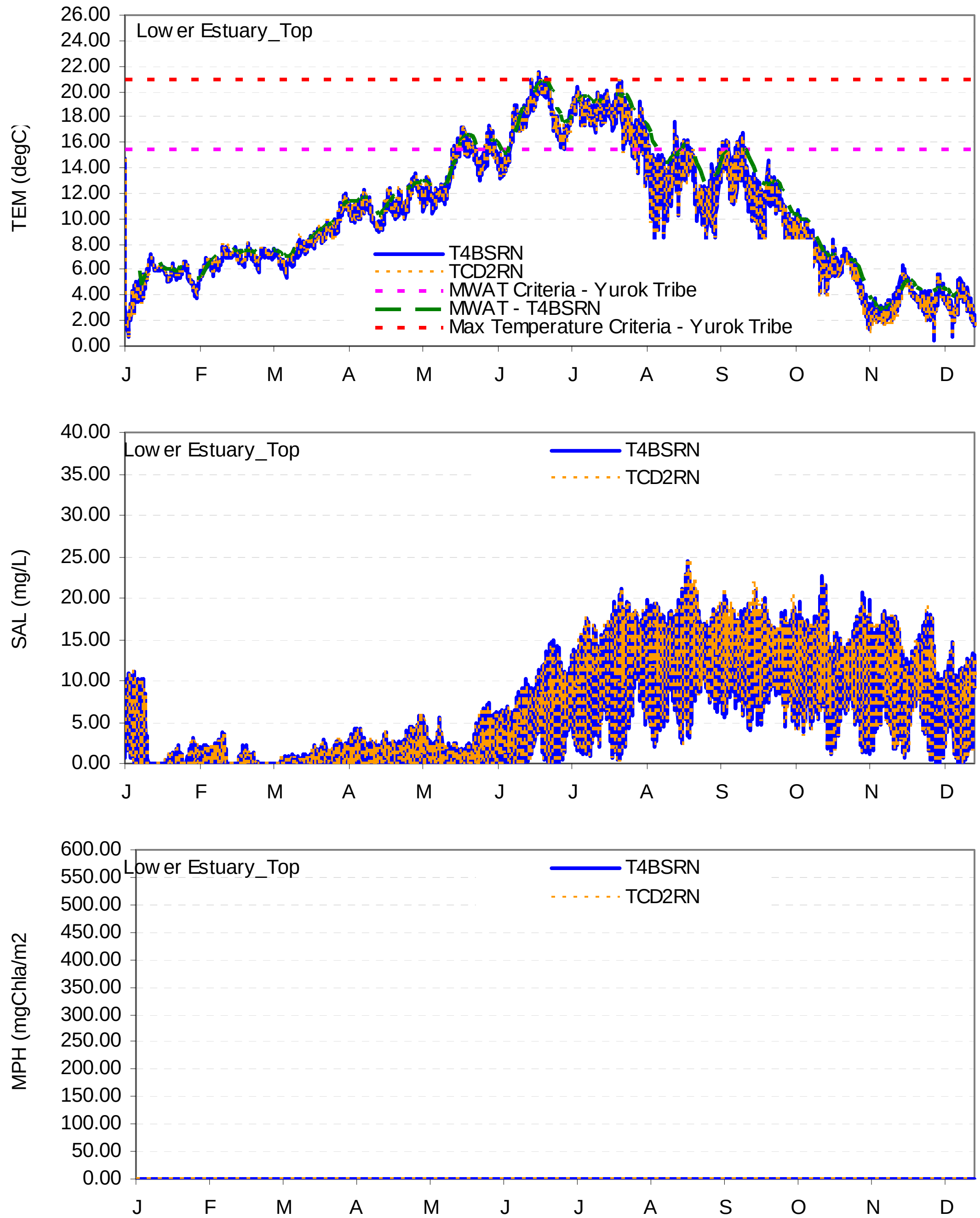
Low er Estuary_Top
T4BSRN
TCD2RN
NO3 (mg/L)
1.50
1.25
1.00
0.75
0.50
0.25
0.00
J F M A M J J A S O N D



Low er Estuary_Top
T4BSRN
TCD2RN
TP (mg/L)
0.10
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0.00
J F M A M J J A S O N D

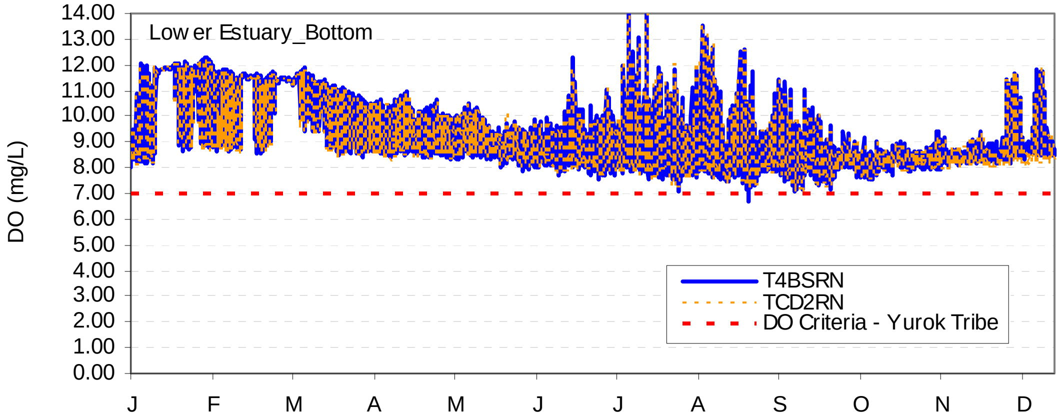


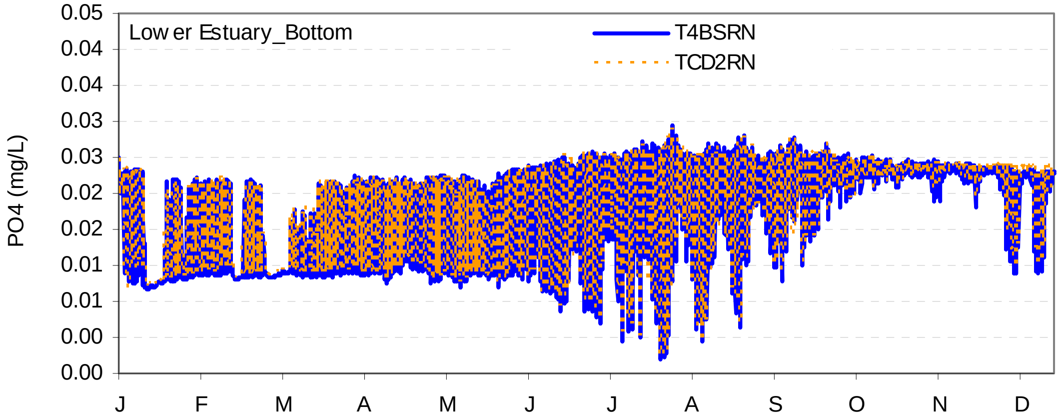
Low er Estuary_Top
T4BSRN
TCD2RN
TN (mg/L)
4.00
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
J F M A M J J A S O N D

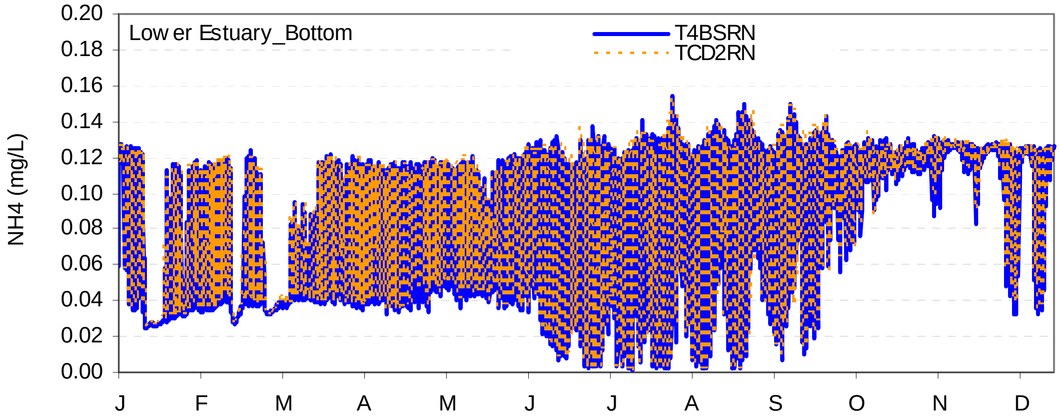


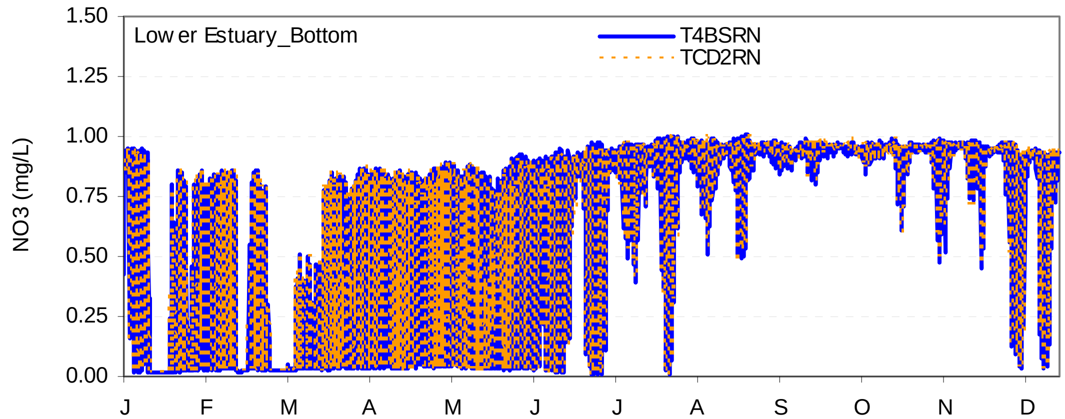
Low er Estuary_Top
TEM (degC)
T4BSRN
TCD2RN
MWAT Criteria - Yurok Tribe
MWAT - T4BSRN
Max Temperature Criteria - Yurok Tribe
SAL (mg/L)
MPH (mgChla/m2
J F M A M J J A S O N D

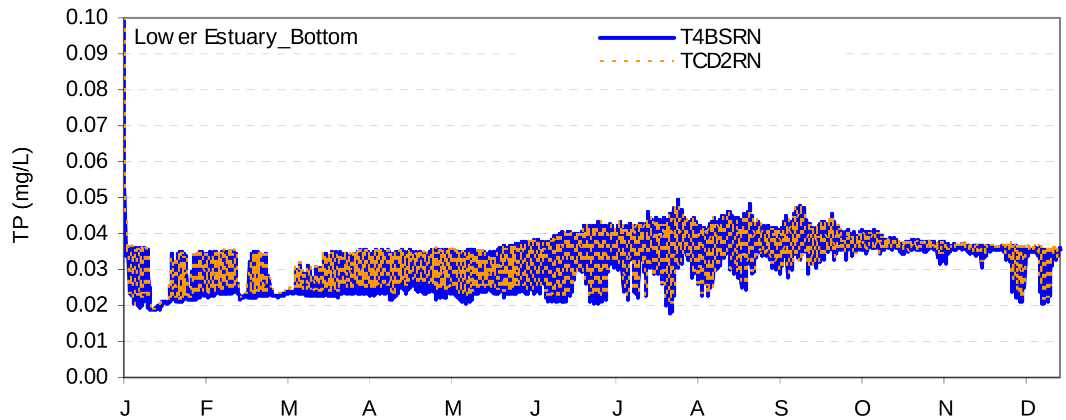
Lower Estuary - Bottom

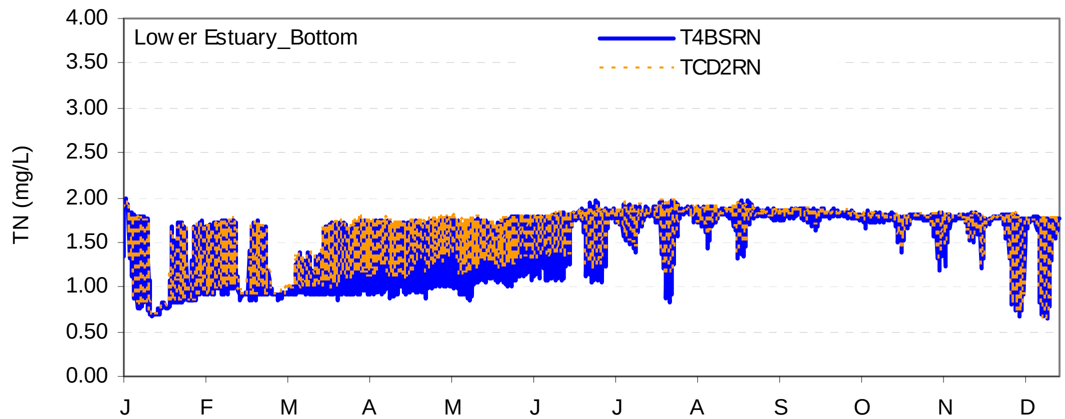


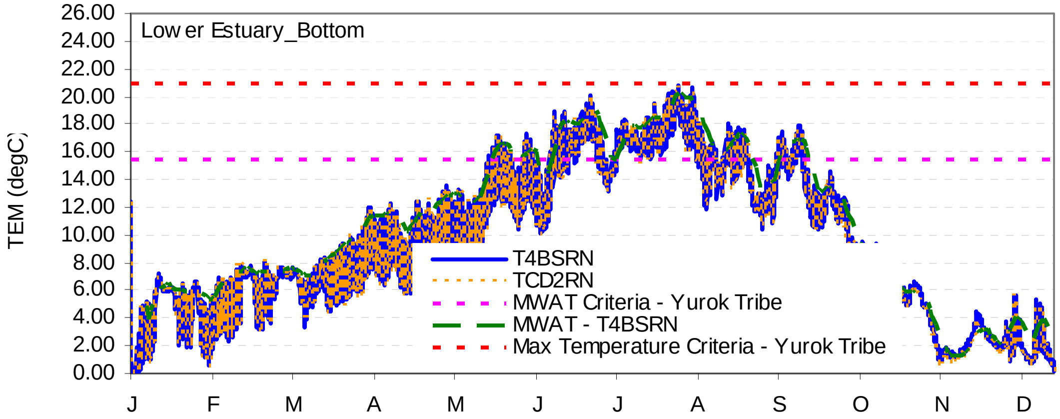


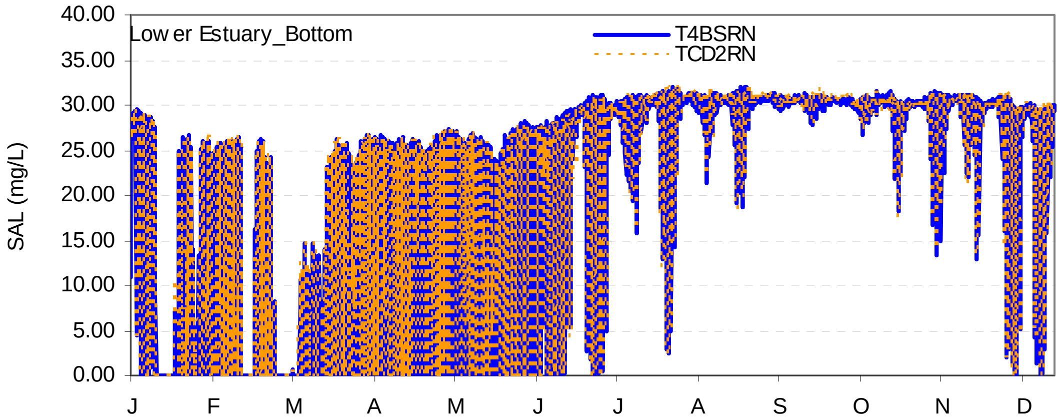


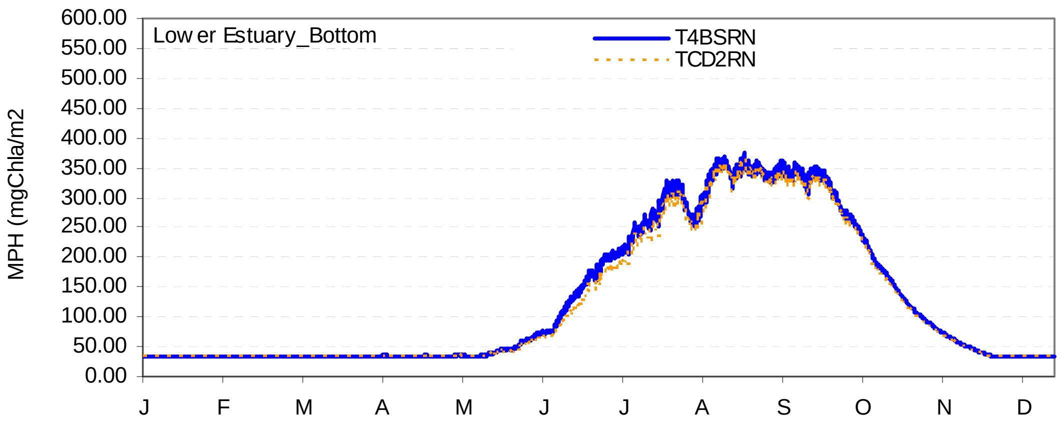

Low er Estuary_Bottom
T4BSRN
TCD2RN
NO3 (mg/L)
1.50
1.25
1.00
0.75
0.50
0.25
0.00
J
F
M
A
M
J
J
A
S
O
N
D


Low er Estuary_Bottom
T4BSRN
TCD2RN
TP (mg/L)
0.10
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0.00
J
F
M
A
M
J
J
A
S
O
N
D


Low er Estuary_Bottom
T4BSRN
TCD2RN
TN (mg/L)
4.00
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
J
F
M
A
M
J
J
A
S
O
N
D


Low er Estuary_Bottom
TEM (degC)
T4BSRN
TCD2RN
MWAT Criteria - Yurok Tribe
MWAT - T4BSRN
Max Temperature Criteria - Yurok Tribe
26.00
24.00
22.00
20.00
18.00
16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
J F M A M J J A S O N D


Low er Estuary_Bottom
SAL (mg/L)
T4BSRN
TCD2RN
40.00
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
J F M A M J J A S O N D


Low er Estuary_Bottom
MPH (mgChla/m2
T4BSRN
TCD2RN
600.00
550.00
500.00
450.00
400.00
350.00
300.00
250.00
200.00
150.00
100.00
50.00
0.00
J F M A M J J A S O N D