

# Nutrient Sources and Distributions in Cobscook Bay

## With Data Appendix

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### FOREWORD

The following technical report has been prepared to serve as an archive of data supporting the Northeastern Naturalist publication entitled "Nutrient Sources and Distributions in Cobscook Bay" by Chris and Jean Garside. It consists of the manuscript itself, supporting tables and figures and a summary table of data. Investigators needing more detailed information may contact Peter F. Larsen at the Bigelow Laboratory.

# Nutrient Sources and Distributions in Cobscook Bay

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## ABSTRACT

The nutrient distribution in the highly productive, macrotidal Cobscook Bay, located in the northern Gulf of Maine, was investigated through a series of spring-neap cruises during the spring, summer and fall of 1995. Sampling design included three, five station transects at major constrictions in the bay and 21 peripheral stations in the principal coves and sub-embayments. Results indicate that Cobscook Bay is nutrient rich throughout the year and is potentially eutrophic. Plots of salinity against nitrate show that this is a totally natural circumstance brought about by an abundant supply of nutrients, most importantly nitrate, from the adjacent Gulf of Maine. Predictive nutrient algorithms fitted with a hydrodynamic model emphasize the high nitrate water entering the bay from the seaward end and diminishing in concentration with distance from the mouth. The plant biomass produced is heavily grazed resulting in high ammonium concentrations from excretion and regeneration. The high ammonium concentrations and its incomplete re-utilization by the phytoplankton strongly suggest that plant biomass is controlled by grazing. In other words, despite a high natural nutrient loading, natural grazing processes serve to limit the accumulation of plant material and potential eutrophication. Comparing all potential nitrogen fluxes indicates that man-made contributions are not significant to the overall nutrient budget of Cobscook Bay, although they may have local impacts.

## INTRODUCTION

The same nutrients that are important for healthy growth of land plants, nitrogen and phosphorous, are also essential for the growth of marine plants. In the lighted upper portion of the sea, nitrogen may be available for plant growth as nitrate and ammonium, sometimes referred to as combined inorganic nitrogen. However, during the summer months it frequently becomes exhausted while other nutrients do not, so nitrogen is often considered the "limiting nutrient" (Ryther and Dunstan 1971). By limiting we mean that adding more nitrate or ammonium will cause an increase in plant growth rate and quantity (biomass), whereas adding other nutrients will cause little response. For this reason, in marine systems, study of combined inorganic nitrogen can tell us a lot about the health and productivity of a water body.

There is often a great deal of public concern about nutrients in both fresh and saltwater. They are, however, essential for marine life and healthy productive waters. Virtually all life in the oceans depends on a supply of nutrients to promote plant (phytoplankton and algal) growth. Herbivorous animals depend on the plants for their nutrition and become prey and food for larger animals. In the big picture, the amount of protein nitrogen that can be removed from a natural system, and this applies collectively to seaweed harvesting, shellfish digging and dragging, fishing, migratory bird feeding and a host of other activities, cannot exceed the supply of combined inorganic nitrogen to it, without depletion and ultimately detriment. Some of the most productive fisheries in the world are found in regions that have high natural rates of nutrient supply and high nutrient concentrations. The anchovy and similar fisheries of upwelling regions such as the coast of Chile are good examples, where high nutrient concentrations have direct economic value.

A frequent cause of concern when dealing with nutrients is that they may be present in excess. When this happens plant biomass increases dramatically and the process is called eutrophication. Eventually, biomass may reach such high concentrations that night-time respiration can use up all the dissolved oxygen in the water, causing anoxia that results in mass mortality of plants and animals alike. Generally, the problem leading to anoxic events is one of scale: that is, there is an enormous amount of nutrient producing activity, which is frequently human, and a limited, often inadequately flushed receiving water to absorb the nutrients. Anoxic events are actually quite rare and limited geographically. They can occur naturally, but they can occur as a result a variety of human activities. These include sources such as collected sewage discharge (Hudson Estuary / New York Bight), agricultural fertilizer and animal feed that is allowed to enter coastal waters without proper safeguard.

It is important to remember that high nutrient concentrations can be natural, do not necessarily lead to eutrophication, and can have tremendous ecological and economic value (Garside et al. 1978). Cobscook Bay is such a case.

## BACKGROUND

We are interested in the distribution of nutrients in Cobscook Bay because they can tell us a lot about how the Cobscook Bay ecosystem works. Our study obtained samples from many

locations within the Bay twice in May, twice in July, and in October and November of 1995. We chose these sample times to allow us to observe the start of the growing season for marine plants, its peak in the summer, and its decline in the fall. We hoped to see the nutrient distributions before plants started to use them, as they consumed them, when they were most utilized and then as use declined and ceased.

One problem with studying a region like Cobscook Bay is that a large volume of water moves in and out of the Bay on each tide on extremely strong currents. Indeed, tidal currents reach 2m/sec as a volume equal to the outflow of the Mississippi River passes through the narrow passages of Cobscook Bay on each ebb and flood tide (Brooks et al. 1999). A sample taken at a particular location half an hour ago came from water that is now miles away, and a sample taken from the same location now is from water that was elsewhere when the previous sample was taken. It too will be far away half an hour from now, and all the time water is mixing and changing as a result. In other words, trying to relate nutrient concentrations to geographical locations is not very meaningful unless we could sample all locations at the same moment, which is not possible. What we often do in estuaries is relate nutrient and other distributions to salt content, or salinity, which varies from 0 at the river inflow to 32 - 33ppt in the coastal sea. Mixing of fresh and seawater in the estuary provides waters with a range of salinities and related properties in between (Ketchum 1955). Instead of plotting measurements against geographical location or mile point along the estuary, we plot graphs of the measurements from a sample against the salinity of the same sample.

The reason for this way of looking at things is that properties that enter with freshwater will distribute with it, with higher concentrations in fresher water in the Bay, and those that enter from the sea will have higher concentrations in saltier water. In fact, if only mixing affects the concentration of a property, then concentration should be proportional to salinity forming a straight line between the freshwater concentrations and the saltwater concentration on the graph (Ketchum 1951). We may have only a general idea of where water with a particular salinity is in the Bay at any time, depending on the tide, but we can know what its properties such as nutrient concentration should be, and depending on its distribution with salinity, where the property originated. Often we find that the distribution is not proportional to salinity, which tells us that other processes have affected concentration, either removing or adding to what we would expect (Ketchum 1955). With nutrients, this can tell us a lot about processes such as uptake and regeneration.

## METHODS

Water samples for nutrient analysis were collected through a series of hydrographic cruises in Cobscook Bay during 1995. The three-day cruises were centered around the extremes of the spring-neap tidal cycles in spring (May), summer (July) and fall (October and November), i.e. six cruises. Stations consisted of three, five-station transects across the main flow axis of the prominent constrictions that separate Cobscook Bay into sub-basins (Fig. 1) and 21 peripheral stations generally situated in the center of subtidal areas of the principal coves and sub-embayments. The transects were sampled at high and low water in an effort to obtain synoptic

sections of physical, chemical and biological conditions across these constrictions. Peripheral stations were occupied at irregular times between high and low tide. Portions of the inner bays were inaccessible because of their shallowness. See Phinney et al. (2004) for detailed information on station locations.

Station activities related to nutrient chemistry and the development of the algorithm for the prediction of nutrient distribution included a Seabird SeaCAT19 CTD profile of temperature and salinity to within 1m of the bottom and collection of water samples using a Niskin bottle one meter from the surface and one meter from the bottom.

Water samples were vacuum (10cm Hg) filtered through Whatman GFF glass fiber filters into 20 ml. sample vials and frozen. Samples were thawed immediately prior to analysis at the Bigelow Laboratory. Analysis for nitrate (and nitrite, ammonium, phosphate and silicate) was done on a five channel continuous flow analyzer. The continuous flow analyzer is of our design and runs chemistries adapted from Strickland and Parsons (1972). Although samples do not always preserve well for some analyses, they do for nitrate, which is our principal interest here. Precision was +/- 0.05  $\mu\text{g-at. N l}^{-1}$  (Glibert et al. 1991).

Predictive algorithms relating nitrate concentrations to the temperature/salinity distribution were developed using the step-wise multi-variate polynomial regression techniques developed and described in Garside and Garside (1995).

A complete table of data is available in paper and digital format in Garside et al. (2004).

## RESULTS AND DISCUSSION

### Spring and Summer

Nitrate is plotted against salinity in the spring (May points marked 1 and 2) and summer (July points marked 3 and 4)(Fig. 2). There are differences between the two distributions, which we expect, but both show a rapid decline of nitrate with decreasing salinity. What this indicates is that the source of nitrate is in waters with the highest salinity, in other words the seawater end. In the spring the concentrations are generally higher than in the summer and greater than zero because plant growth is just starting and nitrate is not used entirely or as quickly as it is in the summer. Salinities are lower than in the summer because freshwater run-off is higher in the spring causing slightly more dilution of the seawater. However, the general pattern in both cases is unequivocal evidence that nitrate enters Cobscook Bay from the seaward end, and the distribution is dominated by this source.

A second feature of this distribution is that in both spring and summer, nitrate would be depleted before salinity reached zero (Fig. 2). This further reinforces the conclusion that the ocean and not the rivers provides the nitrate distribution in Cobscook Bay. It also tells us that nitrate is being utilized within the bay by plants, since if it were not, nitrate concentrations would decline much more gradually with salinity, reaching low values only when salinities approach zero.

There are several other lines of evidence that suggest that the coastal sea is the source of nitrate. A much more complicated analysis of the nitrate and temperature/salinity data allow us to create equations that can be used to predict nitrate from temperature and salinity (Garside and

Garside 1995). Since we have hydrodynamic models that can predict the distribution of salinity and temperature (Brooks et al. 1999), these models can also be used to describe nitrate distribution. Results (Fig. 3) indicate high nitrate water entering the Bay from the seaward end and diminishing in concentration into the bays and towards the rivers.

A second line of evidence can be obtained by comparing the potential nitrogen fluxes from other candidates with the nitrate transported in and out of the Bay on the tide each day (Table 1). These calculations show that all the other likely candidate sources of nitrogen to Cobscook Bay combined only represent about 3% of the nitrogen that is transported by the tide each day as nitrate, and 5% of what is utilized each day in the growing season by plants. Thus, although local impacts of the other sources cannot be discounted, in the bigger picture, only tidal exchange of nitrate is comparable to plant utilization of nitrogen, and the lesser sources are insignificant.

Ammonium is excreted by animals that consume plants, and also by bacterial breakdown of nitrogen-containing organic matter (Glibert et al. 1988). It is used preferentially over nitrate by most marine plants, and is also oxidized quite rapidly by bacteria to nitrate. As a result it is important in phytoplankton nutrition, and its presence tells us about recent herbivory and recycling. In ocean waters, its presence often indicates that plant production and herbivorous grazing are closely balanced, and this is observed as the ecosystem matures in the summer.

The distribution of ammonium in Cobscook Bay in the spring and summer is shown in Fig. 4. Unlike nitrate, ammonium is distributed quite randomly with respect to salinity in both the spring and the summer. Since ammonium is produced by regenerative processes and is relatively short lived, this strongly suggests that the ammonium is being regenerated within Cobscook Bay. What is most surprising is that ammonium concentrations are almost as high in the spring as they are in the summer. High concentrations in the summer and fall would be expected because the herbivore populations have had chance to respond to the available plant food and grow to match the supply. This is not normally the case in the spring. The implication is that at least some of the herbivore population is already in place in the Bay and starts to consume plankton as soon as they grow in the spring. This scenario is consistent with large populations of filter feeding animals that are resident in the Bay, such as clams, mussels and scallops.

This pool of nitrogen can be put in the same perspective as the other fluxes calculated above:

Ammonium tidal exchange (2uM  $\text{NH}_4$  in the Bay): 14.9 metric tons N per day

that may be lost if ebbing water is not returned on the next flood. Coincidentally, this helps balance the nitrogen budget for the Bay (not the purpose of this exercise) but more importantly, this flux is a factor of ten or more larger than any originating from current human activities based on inputs from agriculture and sewage (Table 1).

## **Fall**

In the fall we see nitrate utilization continuing into October (points labeled 5) and the distribution is still similar to summer conditions (Fig.5). By November, however, nitrate uptake

ceases or is very low and nitrate concentrations are both high and almost uniform over the salinity range sampled (points labeled 6). Despite the high nutrient concentrations there is reduced light to support plankton and algal growth, and phytoplankton populations decline while fixed algae respire more than they photosynthesize, which has implications for nitrogen regeneration.

Ammonium distributions in October are very similar to those in the summer, and for the same reasons: herbivores effectively crop the phytoplankton and regenerate ammonium within the Bay (Fig. 6). The same distribution persists into November but primary production has been inferred to have decreased, based on the nitrate distribution, and so the source of this ammonium must be different, at least in part.

Nutrient data alone are insufficient to elucidate the source of the regeneration that continued high ammonium concentrations imply. However, by the fall there are large reservoirs of organic nitrogen in seaweeds and algal mats. These break down and are grazed, resulting in direct regeneration and a continued supply of particles for filter feeders. In fact, for a variety of reasons other than the nutrient distribution, it seems very likely that grazing on fixed algae is at least as important as filter feeding on phytoplankton in the regeneration of nitrogen as ammonium throughout the growing season and into the fall (see Campbell 2004; Vadas et al. 2004).

### **The ultimate source of nitrate?**

A final comment on where the nitrate comes from, when much of the Gulf of Maine surface water is nutrient depleted throughout the summer, is in order. High nitrate concentrations build up in deeper waters where the products of excretion, death and decay accumulate and the nitrogen they contain is oxidized eventually to nitrate. In the absence of sufficient light this nitrate cannot be utilized until physical processes bring it to the surface where there is light, photosynthesis, plant growth and nutrient uptake. This occurs annually throughout the Gulf when winter cooling causes deep convection, water column overturn and mixing providing a nutrient supply supporting phytoplankton growth when days lengthen in the spring. Mixing is the key. Over much of the Gulf the spring warming results in warm, nutrient-depleted water at the surface separated by a thermocline from colder, nutrient-rich water below (Hopkins and Garfield 1979). Nutrients and high production are short lived in the surface layer.

In the Bay of Fundy two circumstances contribute to mixing of nutrients to the surface throughout the year. In moving from the Gulf into the Bay of Fundy tidal currents are compressed and accelerated by both a narrowing channel and shoaling of the bottom. At some point the increasing turbulence from increasingly faster currents acting on the bottom provides enough energy to destabilize the water column and break the thermocline. Cold nutrient rich water is mixed to the surface and it is this water that acts as a source of nutrients to Cobscook Bay. The large volume tidal exchange of the Bay throughout the year serves as the local transport mechanism (Brooks et al. 1999).

## **CONCLUSIONS**

Cobscook Bay is nutrient rich throughout the year, and is potentially eutrophic. This is a



totally natural circumstance brought about by an abundant supply of nutrients, most importantly nitrate, from the adjacent Gulf of Maine. These nutrients promote phytoplankton and fixed algal growth and the biomass produced is heavily grazed resulting in high ammonium concentrations from excretion and regeneration. The high ammonium concentrations and its incomplete re-utilization by the phytoplankton strongly suggest that plant biomass is controlled by grazing. In other words, despite a high natural nutrient loading, natural grazing processes serve to limit the accumulation of plant material and potential eutrophication. At least at the time these measurements were made, man-made contributions were not significant to the nutrient budget of the Bay, although they may have significant local impact. Consequently, the nutrient status of Cobscook Bay has probably changed little since the development of macrotidal ranges approximately 7,000 years BP (Scott and Greenberg 1983).

### ACKNOWLEDGEMENTS

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Field sampling was supervised by David Phinney ably assisted by Jeff Brown, Skip Erickson and Doug Phinney of the Bigelow Laboratory. Sampling was conducted from the research vessel *Otto Miller* operated by Tom Dyum of the Eastport Marine Trade School and Chris Bartlett of the Maine Sea Grant Office.

This contribution is the result of the elegant planning, analysis, interpretation and writing of Chris and Jean Garside. The document was converted to scientific manuscript format by Peter Larsen who accepts responsibility for any shortcomings. The process was assisted by David Brooks, David Phinney and other team members. Figures were prepared by Tracey Wysor. Special gratitude is due Sandy Shumway, Pat Glibert and Barbara Vickery for their thorough and constructive review of the manuscript.

### LITERATURE CITED

- Brooks, D.A., M.W. Baca and Y.-T Lo. 1999. Tidal circulation and residence time in a macrotidal estuary: Cobscook Bay, Maine. *Estuarine, Coastal and Shelf Science* 49:647-665.
- Campbell, D.E. 2004. Evaluation and Emergy Analysis of the Cobscook Bay Ecosystem. *Northeastern Naturalist*. In Press.
- Garside, C., and J.C. Garside. 1995. Euphotic-zone nutrient algorithms for the NABE and EqPac study sites. *Deep-Sea Research II* 42: 335-347.

- Garside, C., G. Hull and C.S. Yentsch. 1978. Coastal source waters and their role as a nitrogen source for primary production in an estuary in Maine. pp 565-575 in M.L. Wiley (Ed.). Estuarine Interactions. Academic Press, Inc.
- Glibert, P.M., M.R. Dennett and D.A. Canon. 1988. Nitrogen uptake and  $\text{NH}_4^+$  regeneration by pelagic microplankton and marine snow in the North Atlantic. *Journal of Marine Research* 46:837-852.
- Glibert, P.M., C. Garside, J.A. Fuhrman and M.R. Roman. 1991. Time-dependent coupling of inorganic and organic nitrogen uptake and regeneration in the plume of the Chesapeake Bay estuary and its regulation by large heterotrophs. *Limnology and Oceanography* 36: 895-909.
- Ketchum, B.H. 1951. The exchange of fresh and salt waters in tidal estuaries. *Journal of Marine Research* 10:18-38.
- Ketchum, B.H. 1955. Distribution of coliform bacteria and other pollutants in tidal estuaries. *Sewage and Industrial Wastes* 27:1288-1296.
- Hopkins, T.S., and N. Garfield. 1979. Gulf of Maine intermediate water. *Journal of Marine Research* 37:103-139.
- Phinney, D.A., C.S. Yentsch and D.I. Phinney. 2004. Primary productivity of phytoplankton and microphytobenthos in Cobscook Bay, Maine. *Northeastern Naturalist*. In Press.
- Ryther J. H and W. M. Dunstan 1971. Nitrogen, phosphorus and eutrophication in the coastal marine environment. *Science* 171:1008-1013.
- Scott, D.B. and D.A. Greenberg. 1983. Relative sea-level rise and tidal development in the Fundy tidal system. *Canadian Journal of Earth Sciences* 20:1554-1564.
- Strickland, J.D.H. and T.R. Parsons. 1972. A Practical Handbook of Seawater Analysis. Fisheries Research Board of Canada, Bulletin 167.
- Vadas, R.L., B. Beal, W. Wright, S. Nickl and S. Emerson. 2004. Macrophyte Productivity in Cobscook Bay: Intertidal Rockweeds (*Ascophyllum nodosum*). *Northeastern Naturalist*. In Press.

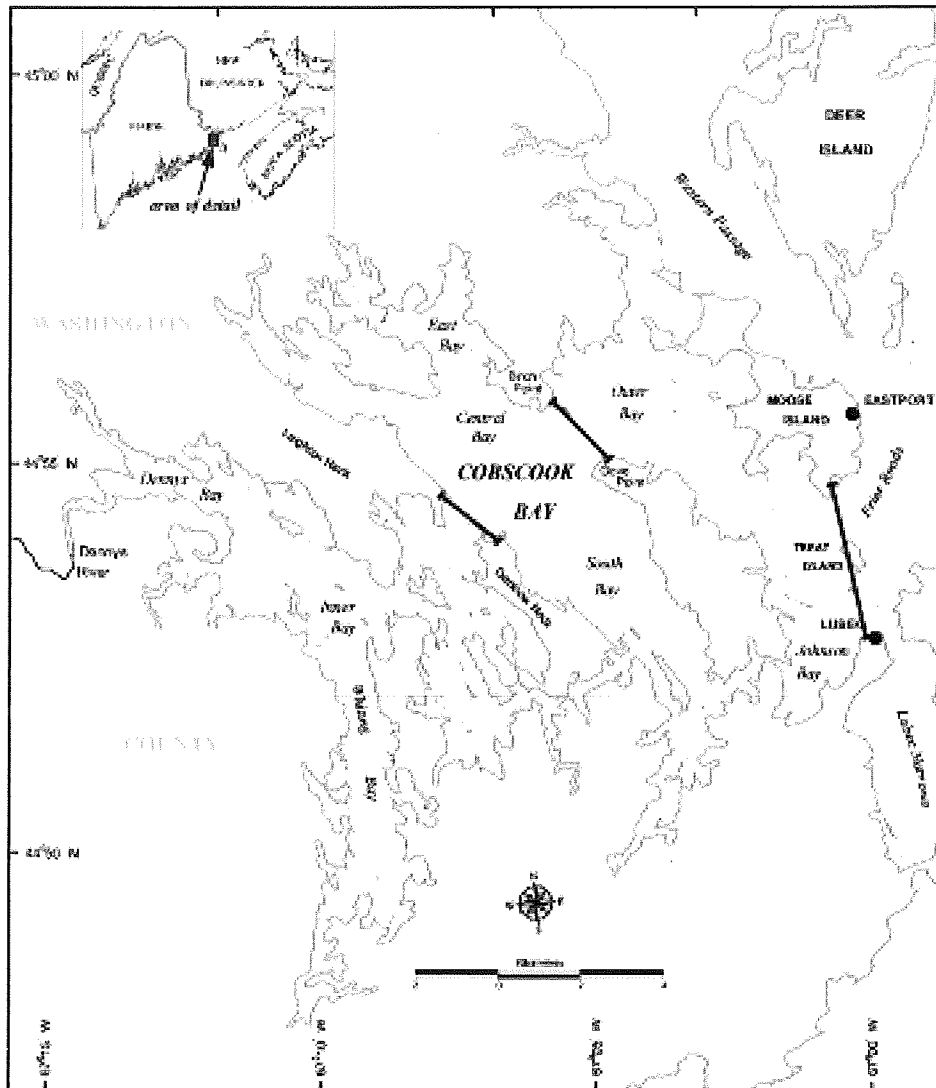
Table 1. Comparison of potential daily, tidal nitrogen fluxes, as nitrate, in and out of Cobscook Bay each day.

Nitrate tidal exchange (5uM NO <sub>3</sub> source in spring) <sup>1</sup>	70.0 metric tons N per day
Nitrogen consumed by plants(400gCm <sup>-2</sup> y <sup>-1</sup> over 6 months) <sup>1</sup>	40.2 “ ” “
Nitrogen in salmon feed (1994/5 data) <sup>2</sup>	1.2 “ ” “
Total nitrogen in freshwater run-off <sup>2</sup>	0.9 “ ” “
Total nitrogen in rain and dust fallout <sup>2</sup>	0.2 “ ” “
Sewage nitrogen (10,000 people max.) <sup>3</sup>	0.01 “ ” “

Data from this <sup>1</sup> or other personal studies <sup>3</sup>. <sup>2</sup> Data provided by Dan Campbell, U.S. Environmental Protection Agency.

## FIGURES

Figure 1. Map of Cobscook Bay, Maine showing the locations of the principal transects.



# Cobscook Bay

May-July 1995

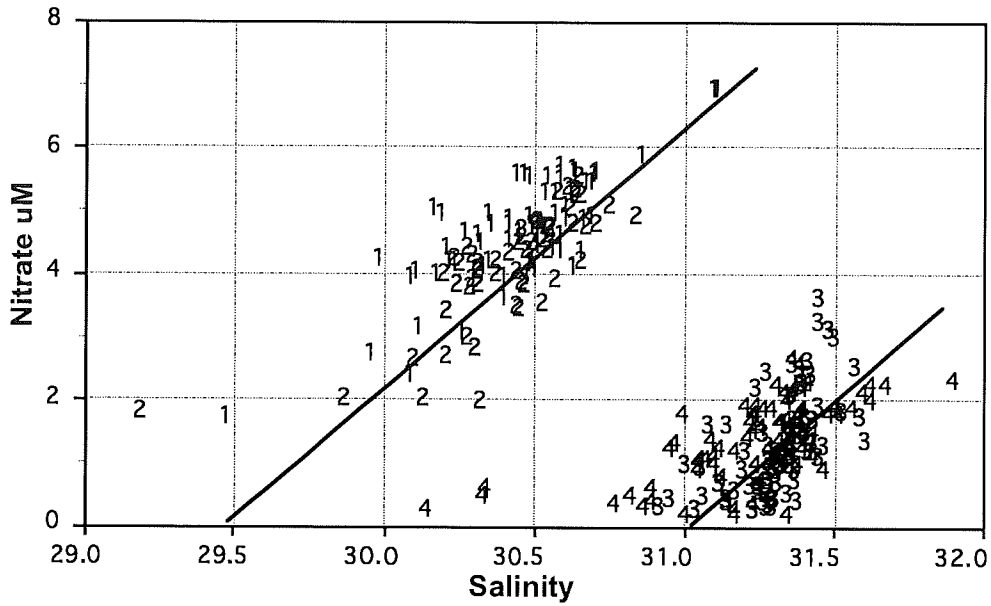


Figure 2. The relationship between nitrate and salinity in the spring (May points labeled 1 and 2) and summer (July points labeled 3 and 4). Points labeled 1 and 4 represent neap tides; 2 and 3 spring tides.

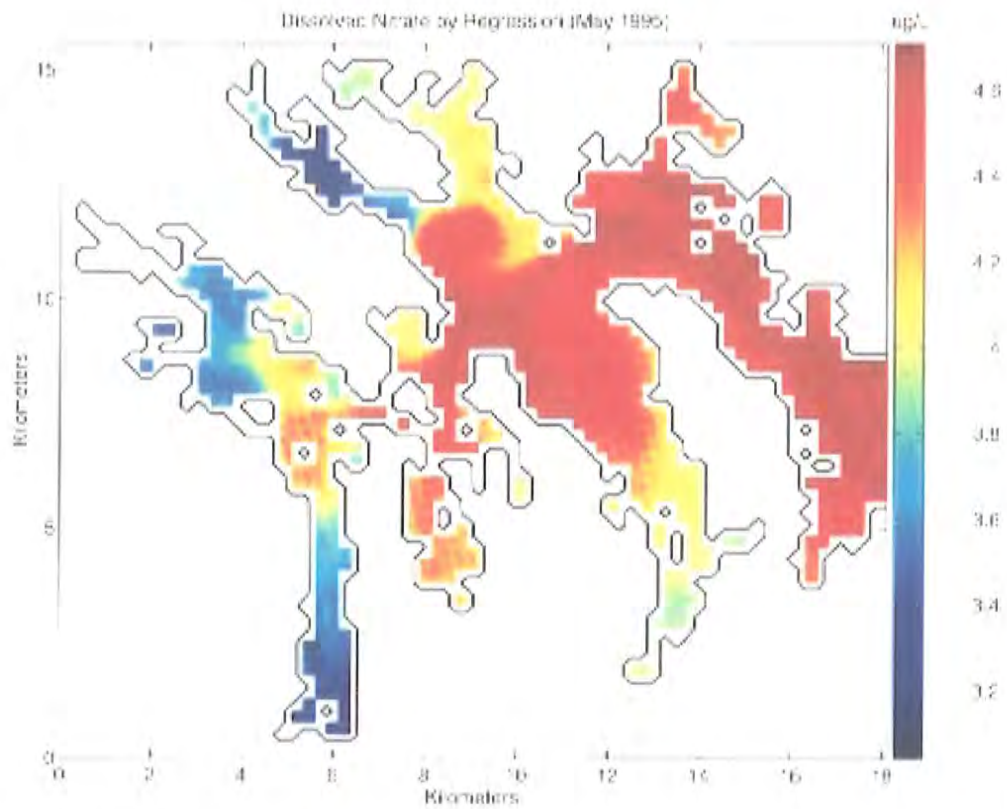


Figure 3. Spring nitrate distribution in Cobscook Bay determined by predictive algorithms and the three-dimensional numerical circulation model (Brooks, *et al.* 1999).

# Cobscook Bay May-July 1995

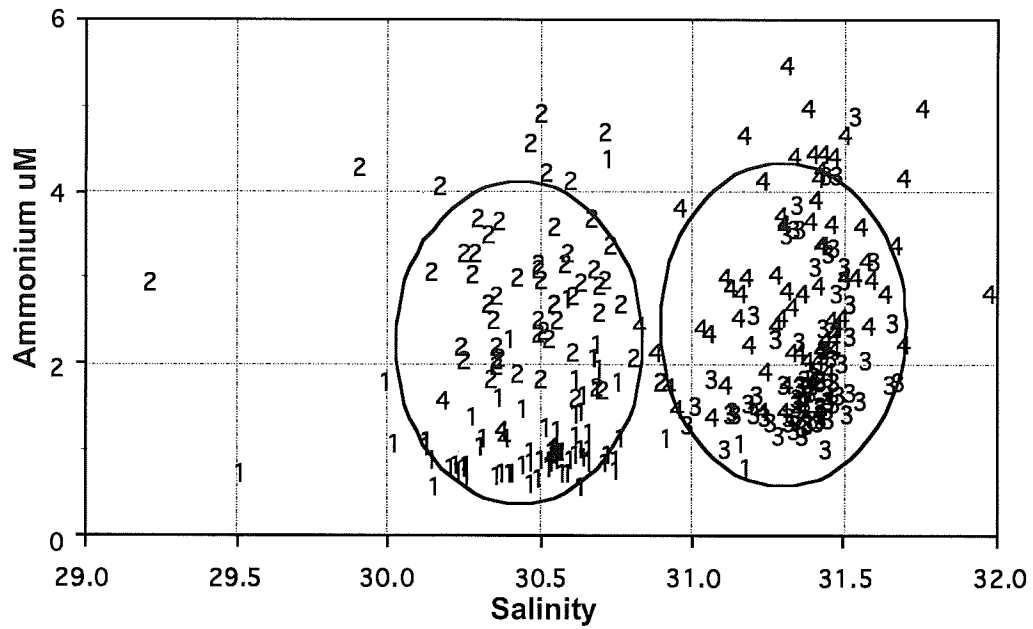


Figure 4. The relationship between ammonium and salinity in the spring (May points labeled 1 and 2) and summer (July points labeled 3 and 4). Points labeled 1 and 4 represent neap tides; 2 and 3 spring tides.

# Cobscook Bay

Oct-Nov 1995

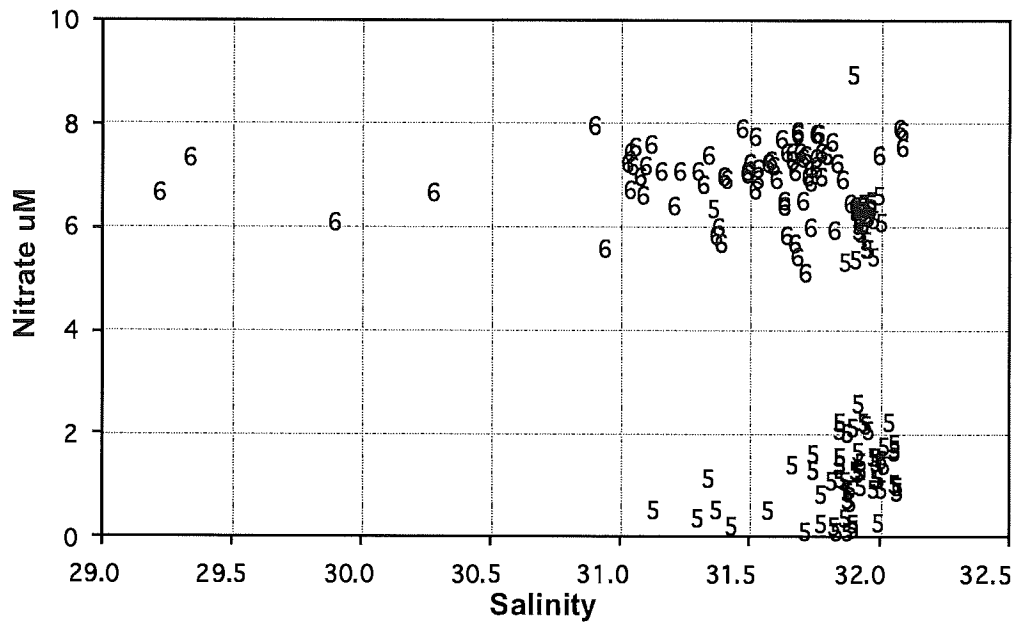


Figure 5. The relationship between nitrate and salinity in the fall (October points labeled 5 and November points labeled 6).



# Cobscook Bay

Oct-Nov 1995

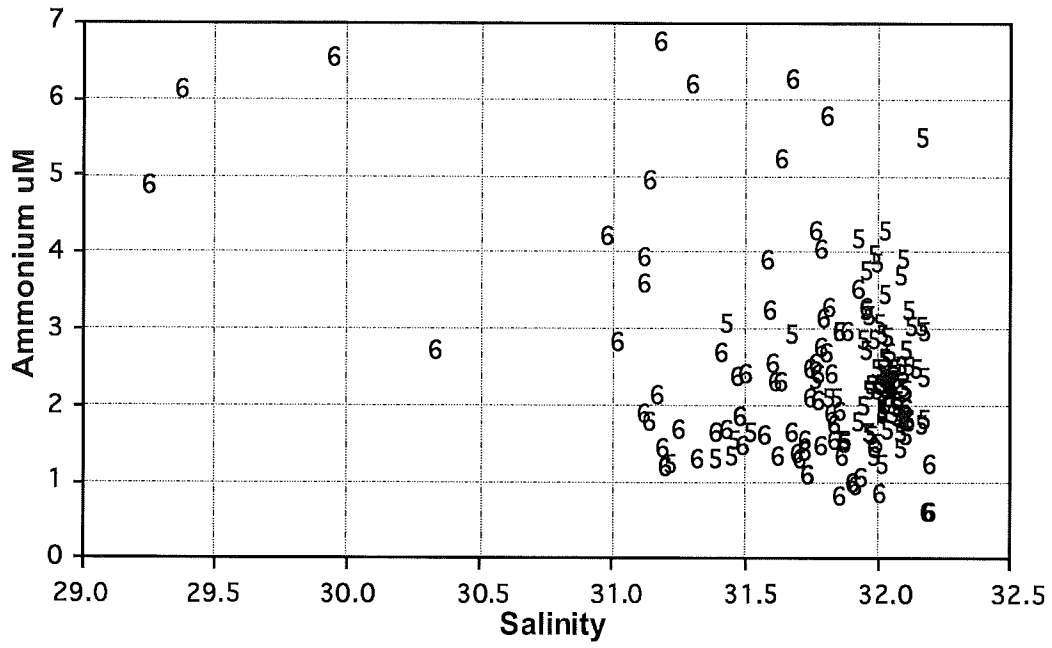


Figure 6. The relationship between ammonium and salinity in the fall (October spring tide points labeled 5 and November neap tide points labeled 6).

## DATA APPENDIX











BG1	312	10.50	High	CB513	44,8153	67,0715	15	0.15	1.05	10,244	31,739	31,885	1744	7.13	0.52	0.69	10.64	2.39
BG5	312	11.01	High	CB514	44,8073	67,0637	18	0.21	1.02	10,248	31,743	31,885	1745	7.27	0.60	0.75	10.64	2.55
BG5	312	11.01	High	CB514	44,9073	67,0637	18	0.22	1.02	10,232	31,704	31,885	1748	5.85	0.43	0.63	8.59	2.49
BG4	312	11.08	High	CB515	44,9102	67,0652	24	0.24	1.01	10,266	31,768	32,257	1747	6.53	0.42	0.59	8.61	2.67
BG3	312	11.14	High	CB516	44,8088	67,0688	24	0.2	1.01	10,404	31,847	32,098	1749	7.33	0.44	0.70	8.44	1.82
BG2	312	11.24	High	CB517	44,8117	67,0697	16	0.28	1.02	10,392	31,810	32,052	1750	7.44	0.25	0.68	8.54	1.96
W5B	312	12.00	High	CB518	44,8188	67,0715	13	0.24	1.04	10,114	31,619	31,863	1751	5.95	0.31	0.59	8.57	3.50
W5B	312	12.00	High	CB518	44,888	67,0668	10	0.34	1.08	9,978	31,431	31,685	1752	5.88	0.52	0.66	8.17	3.27
MSB	312	12.15	Low	CB519	44,8747	67,0568	9	0.4	1.05	9,909	31,457	31,693	1753	6.95	0.75	0.54	10.28	2.31
MSB	312	13.00	Low	CB520	44,8508	67,042	6	0.71	1.28	9,737	31,268	31,413	1754	6.75	0.35	0.70	10.61	0.82
LJ	312	13.00	Low	CB520	44,8508	67,042	6	0.85	1.34	9,771	31,268	31,413	1755	5.88	0.47	0.54	8.90	2.96
ESB	312	14.00	Low	CB521	44,8932	67,055	9	0.95	1.49	8,624	31,374	31,575	1756	5.61	0.51	0.71	10.24	1.84
ESB	312	14.00	Low	CB521	44,8932	67,055	9	0.94	1.51	10,011	31,594	31,838	1757	5.61	0.48	0.57	10.24	1.84
BG1	313	06.44	Low	CB522	44,9137	67,0715	10	0.44	1.36	8,748	31,859	31,871	1758	6.42	0.50	0.60	11.33	6.19
BG5	313	06.54	Low	CB523	44,907	67,0635	10	0.52	1.39	9,875	31,102	31,223	1759	6.85	0.75	0.66	11.25	2.70
BG4	313	07.00	Low	CB524	44,8067	67,0658	15	0.67	1.3	9,673	31,089	31,75	1760	7.17	0.46	0.70	9.99	0.00
BG4	313	07.00	Low	CB524	44,8067	67,0658	15	0.63	1.37	9,686	31,156	31,75	1761	6.44	0.51	0.63	10.07	1.40
BG3	313	07.08	Low	CB525	44,8068	67,0683	16	0.68	1.4	9,647	31,134	31,358	1762	7.20	0.44	0.61	10.48	1.35
BG2	313	07.15	Low	CB526	44,8115	67,0705	10	0.63	1.26	9,658	31,215	31,358	1763	7.20	0.35	0.73	11.86	1.90
BH	313	07.15	Low	CB527	44,8115	67,0705	10	0.62	1.46	8,688	31,456	31,51	1764	7.50	0.56	0.71	12.3	1.79
BH	313	08.00	Low	CB527	44,825	67,0585	1	0.27	1.1	8,775	31,111	31,51	1765	7.21	0.38	0.68	11.69	1.44
MI	313	08.55	Low	CB528	44,8143	67,0288	7	0.3	1.04	8,441	31,088	31,213	1766	7.12	0.51	0.81	11.85	1.69
MI	313	08.55	Low	CB528	44,8143	67,0288	7	0.2	1.04	9,77	31,524	31,627	1767	7.13	0.29	0.74	10.54	1.63
NI	313	08.55	Low	CB528	44,8143	67,0288	6	0.21	1.1	8,883	31,593	31,627	1768	7.13	0.38	0.79	12.34	4.84
DC	313	09.20	Low	CB529	44,8078	67,0187	7	0.26	1.04	8,726	31,395	31,93	1769	7.91	0.42	0.63	11.01	3.89
DC	313	09.20	Low	CB529	44,8078	67,0187	7	0.26	1.04	8,726	31,395	31,93	1770	7.91	0.42	0.63	11.01	3.89
CI	313	09.50	Low	CB530	44,8988	67,0275	5	0.1	0.91	8,951	31,654	31,884	1771	7.44	0.35	0.81	10.89	1.34
CI	313	09.50	Low	CB530	44,8988	67,0275	5	0.15	0.98	9,85	31,885	31,884	1772	7.44	0.26	0.58	8.07	1.46
BC	313	10.20	High	CB531	44,8018	67,0075	6	0.03	0.93	10,064	31,749	31,907	1773	6.52	0.22	0.64	8.78	1.10
BC	313	10.20	High	CB531	44,8018	67,0075	6	0.05	0.81	10,064	31,749	31,907	1774	6.52	0.22	0.64	8.78	1.10
JB	313	11.00	High	CB532	44,8545	67,0097	1	0.04	0.85	8,674	31,725	31,943	1775	6.97	0.31	0.67	8.71	1.28
LE1	313	11.00	High	CB532	44,8545	67,0097	1	0.05	0.82	10,06	31,745	31,943	1776	6.97	0.31	0.67	8.71	1.28
LE1	313	11.11	High	CB533	44,885	66,9927	16	0.84	1.1	9,56	31,177	31,907	1777	7.54	0.24	0.51	10.4	1.47
LE2	313	11.18	High	CB534	44,8937	66,9927	16	0.84	1.1	9,56	31,177	31,907	1778	7.54	0.24	0.51	10.4	1.47
LE3	313	11.27	High	CB535	44,8788	66,9975	16	0.84	1.1	9,56	31,177	31,907	1779	7.54	0.24	0.51	10.4	1.47
LE3	313	11.27	High	CB535	44,8788	66,9975	16	0.84	1.1	9,56	31,177	31,907	1780	7.54	0.24	0.51	10.4	1.47
LE4	313	11.35	High	CB536	44,8823	66,9987	15	0.16	1.08	10,036	31,884	32,033	1781	7.84	0.37	0.80	10.31	1.52
LE4	313	11.35	High	CB536	44,8823	66,9987	15	0.16	1.08	10,036	31,884	32,033	1782	7.84	0.37	0.80	10.31	1.52
LE5	313	11.43	High	CB537	44,8867	66,9975	33	0.24	1.44	10,881	32,157	32,157	1783	7.91	0.31	0.73	8.70	0.95
LE5	313	11.43	High	CB537	44,8867	66,9975	33	0.24	1.44	10,881	32,157	32,157	1784	7.91	0.31	0.73	8.70	0.95
LE6	313	11.51	High	CB538	44,8912	66,9975	3	0.34	1.25	10,243	31,885	32,296	1785	7.84	0.26	0.76	9.01	1.34
LE6	313	11.51	High	CB538	44,8912	66,9975	3	0.34	1.25	10,243	31,885	32,296	1786	7.84	0.26	0.76	9.01	1.34
LE6	313	11.51	High	CB538	44,8912	66,9975	28	0.38	1.56	10,39	32,155	32,292	1787	7.55	0.35	0.63	8.35	0.63
LE6	313	11.51	High	CB538	44,8912	66,9975	28	0.38	1.56	10,39	32,155	32,292	1788	7.55	0.35	0.63	8.35	0.63