Chapter 1

Introduction

Public awareness of the quality of coastal waters has been raised in recent years as a result of the information that has been disseminated on these systems. For example, Bolton *et al.* (1985) reported that environmental contamination in freshwater, estuarine, and marine ecosystems was widespread throughout North America. More recent data, collected by the National Oceanic and Atmospheric Administration (NOAA) National Status and Trends Program (NSTP), indicates that levels of contaminants, in general, have begun to decrease in coastal waters (O'Connor 1990). Nonetheless, many coastal waters continue to receive discharges of contaminants from non-point and point sources, resulting in elevated and biologically significant concentrations of many contaminants in urbanized estuaries throughout the United States.

Traditionally, the management of aquatic resources in coastal waters focused primarily on water quality. However, the importance of sediments in determining the fate and effects of a wide variety of contaminants has become more apparent in recent years (Long and Morgan 1990). In addition to providing a habitat for many organisms, sediments are important because many toxic substances found only in trace amounts in water may accumulate to elevated levels in them. As such, sediments serve both as reservoirs and as potential sources of contaminants to the water column. As well as their potential to degrade surface water quality, sediment-associated contaminants have the potential to affect benthic and other sediment-associated organisms directly (Chapman 1989). Therefore, sediment quality data provide essential information for evaluating ambient environmental quality conditions in aquatic ecosystems.

Over the past 10 years, Florida Department of Environmental Protection (FDEP) and others have collected a substantial quantity of information on the chemical composition of Florida coastal sediments. Preliminary assessment of these data indicates that numerous areas in Florida are contaminated by metals (such as lead, silver, and mercury) and organic substances (such as polycyclic aromatic hydrocarbons and pesticides). However, sediment chemistry data alone do not provide an adequate basis for identifying or managing potential sediment quality problems in the state. Biologically-based **sediment quality assessment guidelines** (SQAGs) also are required to interpret the significance of sediment chemistry data.

1.1 Purpose of the Report

The purpose of this report is to recommend a scientifically defensible framework for assessing the biological significance of sediment-associated contaminants. Numerical SQAGs are integral to this framework, providing the basis for assessing ***potential*** effects of sediment-associated contaminants. A variety of approaches for deriving sediment quality assessment values were reviewed to identify those that would be applicable to Florida coastal conditions. The results of this review indicate that each approach has deficiencies which limit its direct application in Florida. For this reason, an integrated strategy for deriving numerical SQAGs is recommended for the state of Florida. The recommended strategy is designed to provide relevant assessment tools in the near-term and allows for refining these guidelines as additional data become available.

Using the recommended approach, numerical SQAGs were developed for assessing sediment quality in Florida coastal waters. These guidelines were derived using information from numerous investigations of coastal sediment quality conducted in North America and are based on a weight of evidence that links contaminant concentrations with adverse biological effects. In this respect, the guidelines are a cost-effective response to a practical need for assessment tools. However, these guidelines are should be revised or refined depending on the results of field validation and other related studies conducted in Florida and elsewhere in North America. These guidelines should be used in conjunction with other interpretive tools to conduct comprehensive and reliable assessments.

1.2 Description of the Recommended Approach for Deriving Numerical Sediment Quality Assessment Guidelines

The recommended approach for deriving numerical SQAGs is described in Chapter 4. This approach is considered to be the most practical for use in Florida because:

- It can be implemented in the near-term;
- It can be implemented using existing data;
- It provides a ***weight of evidence*** from numerous biological effects-based approaches for determining associations between chemical quality and biological effects;
- It provides assessment tools or guidelines that define ***ranges of contaminant concentrations*** that can be used to evaluate sediment quality data. Specifically, these guidelines define ranges of concentrations that are usually or always, frequently, and rarely or

never associated with adverse biological effects. These ranges are considered to be more practical than single values for assessing sediment quality in the diverse conditions found along Florida's extensive coast;

- It provides summaries of the data that were used to derive the assessment guidelines. These summaries are useful for evaluating the biological significance of contaminant concentrations within these ranges; and,

- It has long-term applicability in Florida since it can be verified and refined with additional data, particularly with data from the southeast.

A detailed discussion of the strengths of this approach is provided in Section 5.4.

Sediment quality assessment guidelines derived using the recommended approach should be refined as new information becomes available. Several limitations and precautions in using this approach are identified as follows:

- The approach is designed to determine the potential for sediment-associated contaminants to induce biological effects. Direct cause and effect relationships should not be inferred when comparing chemical data to the recommended guidelines;

- The SQAGs are applicable to marine and estuarine waters only; they are not applicable to freshwater systems;

- The SQAGs are not expressed in terms of the factors that are thought to control the bioavailability of sediment-associated contaminants [i.e., total organic carbon (TOC) for non-polar organics and acid volatile sulfide (AVS) for divalent metals];

- The data that have been used to derive the SQAGs consist primarily of the results of acute toxicity studies. This reflects the general lack of data on the chronic responses of aquatic organisms to contaminants that are associated with sediments;

- The recommended guidelines should be used in conjunction with other assessment tools and protocols, such as the FDEP metals interpretive tool (Schropp and Windom 1988) and the Green Book (EPA and ACE 1991) to provide comprehensive evaluations of sediment quality; and,

- The recommended guidelines were developed using information from a variety of North American coastal locations. It is uncertain if these

data are representative of the wide range of sediment types that are present in Florida. For this reason, caution should be exercised in utilizing these guidelines, particularly in carbonate-dominated sediments.

A discussion of these limitations and considerations is provided in Section 5.4.

1.3 Applications of the Recommended Sediment Quality Assessment Guidelines

The recommended sediment quality assessment strategy is intended to provide a consistent basis for evaluating sediment quality in Florida. While the SQAGs represent an integral element of this strategy, they should be used in conjunction with other assessment tools to efficiently and cost-effectively evaluate ambient sediment quality conditions. The SQAGs may be used to:

- Interpret the results of sediment quality monitoring data. In this context, SQAGs may be used to assess the adverse biological effects that could, potentially, be associated with levels of sediment-associated contaminants;

- Support the design of sediment quality monitoring programs. In this context, SQAGs may be used to evaluate existing sediment chemistry data, and rank areas of concern and chemicals of concern in terms of their potential to be associated with adverse biological effects. As such, monitoring priorities may be more clearly and effectively identified;

- Identify the need for site-specific investigations to support regulatory decisions, including source control and other remedial measures. In this context, SQAGs may be used to evaluate existing data and to determine if additional testing (e.g., sediment toxicity bioassays, etc.) is needed to support regulatory decisions;

- Evaluate the hazards associated with increased levels of contaminants at specific sites. In this context, SQAGs may be used as early-warning tools to identify the need for regulatory action before contaminant levels become problematic;

- Support a preliminary assessment of the applicability of the sediment quality criteria currently under development by EPA. In this context,

the SQAGs may be used to assess the level of protection afforded to aquatic organisms by these criteria; and,

- Facilitate multi-jurisdictional agreements on sediment quality issues and concerns. In this context, SQAGs may be used to establish site-specific sediment quality objectives that will help define the responsibilities of affected agencies and other parties in preventing and remediating sediment contamination.

These guidelines were established to provide a consistent basis for evaluating sediment quality in Florida. However, these guidelines have certain limitations on their application. The SQAGs:

- Should not be used in lieu of water quality criteria. However, these guidelines may be used to evaluate the effectiveness of regulatory programs and to identify the need for more stringent regulations;

- Should not be used to define uniform values for sediment quality on a statewide basis (i.e., they should not be used as sediment quality criteria). Ambient environmental conditions may influence the applicability of these guidelines at specific locations;

- Should not be used as criteria for the disposal of dredged material and should not be used to replace formal assessment protocols established for the disposal of dredged material (EPA and ACE 1991); and,

- Should not be used directly as numerical clean-up levels at severely contaminated sites (e.g., Superfund sites).

There are a number of initiatives that are underway or under development in Florida and elsewhere in the United States that will provide relevant data for revising and refining these guidelines. These initiatives include spiked sediment bioassays, field surveys of sediment toxicity, and the development of sediment quality criteria that explicitly consider the bioavailability of sediment-associated contaminants. In the long-term, refinement of the guidelines should be pursued to ensure their broader applicability and utility within the state.