# Development of an Estuarine Management Policy with Reference to Australia

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***Abstract*—** Estuarine programs in Australia are fragmented and tend to lack coordination between the responsible agencies in planning and managing these important areas. This paper examines whether Australia needs a new approach to planning and managing its estuaries by reporting on a comprehensive survey of practitioners. This study finds that the stakeholders are keen to see a change in present trends in estuarine management practice across Australia.

***Keywords*—**Australia, Estuary, Framework, Management, Policy.

## I. Introduction

THIS paper outlines the need for improved estuarine management in Australia. It reports selected results of a comprehensive survey of practitioners on their views of the estuarine management programs in Australia. The results described here highlight the situation of estuary management including legislative and institutional aspects. The paper concludes with suggestions, based on this survey, for the possible future direction of estuary planning and management in Australia.

Australia has over 1000 estuaries, and most Australians live in towns and cities sited on or near estuaries [1]. Estuaries are highly valued resources, not only from an ecological perspective, but also from the social and economic perspectives [2]. Australian estuaries and their geo-morphological units are the foundation of some of the most biologically rich and productive environments in the coastal zone [3-4]. Much of the estuarine area is consequently able to support seagrasses, algae, mangroves and saltmarshes in the intertidal areas and thus provides ideal conditions for wildlife habitats [5-7].

Australian estuaries and associated coastal plains also provide for a variety of uses including shipping, commercial and recreational fishing, diving, intertidal collection, sailing and boating, water skiing, surfing, swimming, educational and scientific studies, and domestic or industrial sewage and waste disposal. Estuaries are thus subject to a range of direct and indirect impacts [8], due to land use in the catchment, changes to hydrology and direct estuary use [1]. Hence, estuaries and their catchments require protection and careful management, if they are to be ecologically sustainable.

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Despite the importance of the estuaries and the need for careful management, past planning and management of these estuaries has not been coordinated or integrated in Australia [9] and sometimes is being ignored [1]. This lack of attention to estuarine issues reinforces the need for studies on estuarine management in Australia, its status and impending direction.

## II. The Need For Effective Management Of Estuaries

In Australia, the planning and management process of estuaries is complex due to the interactions of the underlying estuarine processes and the multiplicity of authorities involved in estuarine management [10]. For example, in New South Wales (NSW), the ownership and control of estuarine waterfront and submerged lands is spread across a spectrum of private land holders, local councils, trustees and other government authorities [10]. For estuary users, this complex estuary management structure may require dealing with a number of government authorities and complying with several different Acts of Parliament. For example, in NSW, 10 separate government departments have influence on estuary management programs, complying with more than 25 different Acts of the Parliament [10-11]; no particular piece of legislation is directed to estuary management. A large amount of legislation provides for management of many other ecosystems; however, it appears to be complex. The necessary generality in this type of legislation means that the interpretation and implementation of legislative responsibilities are at the discretion of government ministers and agencies. This means that overall responsibility for estuary management does not rest with any particular agency. This fragmentation of legislation and responsibility is a commonly noted problem in estuarine management [12]. Similarly in Victoria, the Department of Natural Resources and Environment (now Department of Primary Industries), Parks Victoria, Water Authorities, Catchment Management Authorities, the Environmental Protection Authority (EPA), Coastal Councils and Regional Coastal Boards and Local Councils, all have roles and responsibilities in rivers and estuary management and all operate under different Acts [9].

In the past, a range of initiatives at Local, State and Commonwealth government levels has addressed the planning and management needs of waterways, coast and oceans. Establishment of Catchment Management Authorities in Victoria, Catchment Management Committees in NSW, Coastal Councils in different states and the Marine Group of Environment Australia, adoption of various coastal management Acts, policies and regulations by different Australian states- all indicates the initiatives taken by different levels of governments.

However, none specifically addresses or concentrates on the needs of Australian estuaries [1]. Hence, Morrison and West [13] noted that almost all the documents discussing Australia's coastal environments do so in terms of the "coastal zone" "coastal area" and "offshore zone". Therefore, it is arguable that estuaries have not received clear recognition as a separate component in the Australian environment. Estuaries lie between the terrestrial and marine spheres of natural resources management and could be seen to have fallen between two pillows- catchments and coasts. As a consequence, the management of estuaries has often suffered from ambiguous roles and responsibilities within and between State and Local Governments and the community [9]. In biophysical terms, estuaries are the interface between the land and the sea. Any activity in a catchment, whether natural or human, has potential impact on estuaries and ultimately on coastal seas. Therefore a special attention is needed for estuaries. The health of estuaries is vital to the health of marine and coastal environments, and their resources. Catchment protection and management should ensure that land use does not deleteriously impact on waterways or estuaries. Estuaries require high quality management for the following purposes:

- Conservation and enhancement of the environmental quality of estuaries in order to sustain fish, wildlife, habitat and human uses;
- Preservation and advancement of an estuary's role as an integral part of a region's economic, social and cultural well being; and
- Encouragement of activities and development that enhances and protects the environmental quality of estuaries.

As stated by Good et al. [14], there are many social, institutional, legislative and environmental factors that contribute to the estuarine management issue for any given state and for the country as a whole. The relative importance of these factors varies from state to state, and these differences are largely responsible for differences in how states have responded to estuarine management issues. Although there has been a variety of information for coastal management in Australia [15-16] however, there has been a lack of comprehensive studies, informing the present status of estuary management in Australia. Knecht et al. [4] noted that in the absence of substantive indicators of program performance, typical alternative is to solicit perceptions of performance from samples of individuals knowledgeable of the programs being studied. In this regard, decision was taken to carry out a nation wide mailed questionnaire survey to solicit information on three aspects of Australian estuarine management:

- general situation of estuarine management;
- present context of legislative, institutional and administrative situation of estuarine management;
- whether a changed management system is needed for Australia.

## III. METHOD OF SURVEY

For this study, attitudinal, factual as well as personal opinions of the stakeholders were regarded as important. Similar questionnaire structures have been used elsewhere. For example, Knecht et al. [4] had completed a similar survey to measure the performance of coastal zone management program in the United States. Alder [17] measured the success of marine protected areas in a similar survey. Another survey was carried out by Cicin-Sain and Knecht [18] to ascertain patterns in Integrated Coastal Management (ICM) practice in different countries. Similarly, Krausse [19] examined the perception of harbour residents on tourism and water front re-development in Newport, USA. Coffen-Smout [20] carried out similar research using mail out questionnaires to analyse public perceptions of Canadian coastal and ocean management policy and practice. On the basis of that survey, fifty recommendations were made on Canadian coastal and ocean management policy and practice. Therefore, it is obvious that seeking opinions from the stakeholders for overall evaluation is a common practice in the field of coastal and estuarine management studies.

This survey was mailed to five different sectors all over Australia, namely, Commonwealth Government (ACT), State Government, Local Government, Environmental Groups and Academics/Researchers. Initial lists of potential respondents were compiled through communication with- the Marine Group of Environment Australia, State Government natural resources management departments, for example, Department of Land and Water (DLWC) New South Wales (NSW) (now Dept. of Infrastructure, Planning and Natural Resources of NSW), Department of Natural Resources and Environment (DNRE) Victoria (VIC)), the Marine and Coastal Community Networks (MCCN), Coastcare, States' Water Authorities, States' Environmental Protection Agencies (EPAs) and other catchment and coastal management groups/committees of different states of all Australian States and Territories namely Commonwealth Government (ACT), Tasmania (TAS), New South Wales (NSW), Queensland (QLD) Victoria (VIC), South Australia (SA), Western Australia (WA) and Northern Territory (NT). The list of potential respondents for the survey was relatively difficult to compile. The names and addresses of state government agency people were obtained from government directories, departmental newsletters, bulletins and other published materials. People in the agencies were also asked to provide further contact addresses of people who have been or are involved in estuarine management. For local government, it was particularly difficult to compile the lists of potential respondents, because of the lack of information about which Local Councils and who were directly involved in estuarine management. Therefore, the survey form was addressed to the Directors/Chief Executive Officers, and asked if there were any estuarine management activities in the Council. It was requested to pass the questionnaire to the relevant staff, if any, in the council. This approach to the collection of potential names and addresses is called "snowball sampling strategy" [21] and is useful in identifying participants in a difficult-to-find population. A similar approach was employed by Alder [17] to collect the respondent's names in her survey of marine protected areas.

Compilation of a list of academic and researcher groups also proved difficult, since there were no directories in which such lists could be found. Therefore, extensive efforts were made to obtain the name and addresses of academics and researchers from web pages using the internet, as well as from published literature.

The distribution of the questionnaire across the states varied in number. For example, in the Northern Territory (NT) and Tasmania (TAS) there are few agency people who are directly involved in estuarine matters, therefore the number of potential respondents was significantly smaller than in NSW. The distribution of questionnaires was hence related to the number of people directly involved in estuarine management. The aim of the questionnaire survey was to obtain the views and opinions of stakeholders on current estuarine management programs in Australia. Hence, the survey was aimed at all levels of stakeholders, that is, from field level to managerial or executive level.

The overall questions were designed on the basis of three broad aspects of estuarine management as has been mentioned before. On each aspect, further questions were asked to derive the information. Therefore, based on the general situation of estuarine management aspect, questions were designed on the following issues:

- basic estuarine information;
- past planning and management information;
- institutions' responses to estuarine programs.

On the present context of legislative, institutional and administrative aspect of estuarine management, the questions were asked on the following issues:

- legislative base of estuarine management;
- institutional arrangements.

On the aspect of the need for a changed management system of Australian estuaries, the questions were asked whether the respondents want to see the changed management in Australia. All these issues in effect have acted as the guide for structuring the questionnaire. In total, 203 questionnaires were sent out among which, 122 questionnaires comprising of 62% were returned (Table 1).

**TABLE I**
STATE WIDE QUESTIONNAIRE RESPONSES

| State | Total number of questionnaires sent | Questionnaires returned | Response rates (%) |
|---|---|---|---|
| ACT | 14 | 09 | 64 |
| TAS | 07 | 04 | 57 |
| NSW | 71 | 41 | 57 |
| QLD | 29 | 19 | 66 |
| VIC | 46 | 26 | 57 |
| SA | 17 | 12 | 71 |
| WA | 11 | 07 | 64 |
| NT | 08 | 04 | 50 |
| **Total** | **203** | **122** | **62** |

Data collected from the survey were coded and entered into computer for statistical analysis, using the SPSS (Statistical Package for the Social Sciences) statistical package. As the scope of the research was to describe the present situation of Australian estuaries and determine its management situation, much of the data analysis was based on descriptive statistics [22] to organise, summarise and describe the data [23-25]. Frequencies were converted to percentages and the results recorded graphically using contemporary Microsoft Excel.

## IV. RESULTS AND DISCUSSION

### *a) General situation of estuarine management in Australia*

Overall the responses reflected that present databases of Australian estuaries and available information on estuaries are inadequate (Figure 1 and 2). The respondents from state to state did not respond to the questions in a similar fashion. Respondents from ACT, NSW, QLD, VIC and WA strongly indicated that the estuarine databases are inadequate in their states.

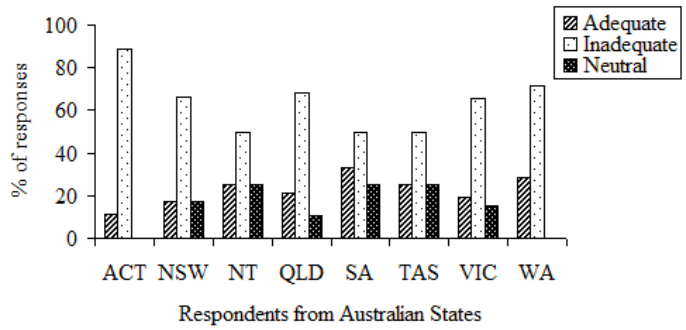


**Figure 1. Percentage of responses to question about estuarine databases in Australia**

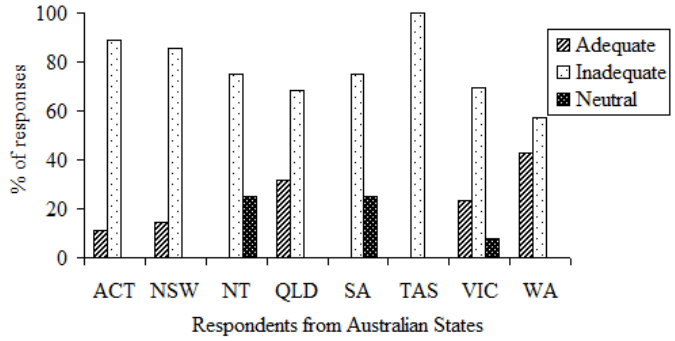


**Figure 2. Percentage of responses to question about available information on Australian estuaries**

Respondents were asked whether an effective estuarine management program (EMP) is yet to be implemented in Australia. Respondents to this question indicated a general agreement that effective estuarine management programs have not yet been implemented in Australia (Figure 3).

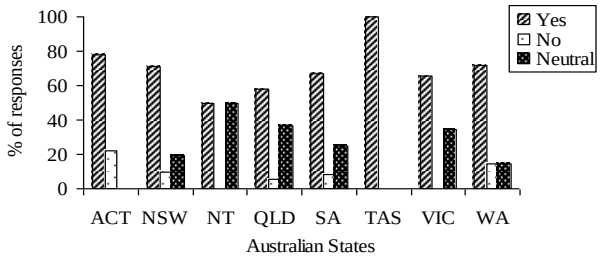


**Figure 3. Percentage of responses to question about whether effective EMP is yet to be implemented in Australia**

Respondents were asked whether any scientific research and monitoring have been conducted in any estuary by the

organizations and were also requested to specify the study. Varied responses came from different agencies in different states. This was an open question, hence an attempt was made, albeit rather simplistic, to put some order into these responses. The highly commented issues were marked and given frequency values. Some restraint had to be introduced regarding interpretation of what the respective frequencies meant. Table 2 shows the top 12 research/monitoring topics, on the basis of frequency values, that have been conducted in the past by different agencies, in different Australian states.

**TABLE II**

PAST RESEARCH AND MONITORING ISSUES ON AUSTRALIAN ESTUARIES

| Issues | Statewide responses as a whole | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | ACT | NSW | NT | QLD | SA | TAS | VIC | WA |
| Estuarine monitoring | ·· | ·· | · | ·· | ·· | ·· | ·· | · |
| Mapping | | ·· | | | | | · | |
| Water quality study | | ·· | ·· | | ·· | | ·· | · |
| Sedimentation study | | ·· | | · | · | | · | |
| Estuarine biota (including fish) | | · | | · | | · | | · |
| Estuarine process study | | · | | | | | · | · |
| Nutrient study | | ·· | | | | | · | |
| Seagrass | | · | | | · | | ·· | |
| Mangrove | | · | · | | | | | |
| Estuarine modelling | · | · | | | | | | |
| Catchment impacts | | · | | | | | · | · |

*Double dots indicate higher responses for the issue; single dot with lower responses for the issue. From Table 2, it has been found that most of the research/monitoring activities were in estuarine monitoring and water quality study.

**TABLE III**

TYPES OF SCIENTIFIC RESEARCH/MONITORING CURRENTLY BEING UNDERTAKEN

| (i) Issues | ***B. Statewide responses as a whole*** | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | ACT | NSW | NT | QLD | SA | TAS | VIC | WA |
| Water quality | | ·· | ·· | ·· | ·· | | ·· | ·· |
| Nutrient study | | ·· | | ·· | | | ·· | |
| Sediment study | | · | | ·· | · | | | ·· |
| Estuarine monitoring | · | | | | · | · | | |
| Survey of biota | | | | · | | | | |
| Estuarine process study | | ·· | | | | | | |
| Estuary mapping | | · | | | | | | |
| Mangrove and saltmarsh | | | · | | | | | |
| Seagrass | | | | | | | · | · |
| Institutional issues | | | | | | | | |
| National databases | ·· | | | | | | | |
| Catchment impact | ·· | | | | | | | · |

*Double dots indicate higher responses for the issue; single dot with lower responses for the issue.

Respondents were also asked whether their organizations were completing any research or monitoring in any estuary and requested to specify the research/monitoring if there was any. Similar to the previous one, this was an open question, hence the same procedure was followed to put the top marked issues on the frequency table (Table 3). The table 3 shows that water quality, sediment study and nutrient study are the top issues of estuarine management in NSW, QLD, VIC, SA, WA and NT. On the other hand national databases and catchment impact study are important issues in ACT.

**TABLE IV**

ESTUARY MANAGEMENT PLANS PRODUCED IN AUSTRALIAN STATES

| Name of the plans produced | Plans produced by Australian States |
|---|---|
| State Estuary Management Plan | NSW |
| Wetland Management Plan | NSW |
| Local Estuary Management Plan | NSW, QLD, SA, VIC, WA |
| Estuarine Habitat Management Plan | NSW |
| Estuarine Monitoring Plan | ACT |

In institution's responses to the estuarine management issues, respondents were asked whether any estuarine management plan had been produced their organization with a request to specify the nature of the plan if there was any. Table 4 shows the summary results of the responses. The most of the estuary management plans have been produced in NSW including a state estuary management plan, whereas in other states, except in Tasmania, estuary management plans have been produced at a local level.

### *b) Framework of legislative, institutional and administrative aspects of estuarine management*

Respondents to this question about estuarine regulation indicated that legislation for estuarine management is inadequate across Australia (Figure 4). The majority of the respondents indicated that specific estuarine legislation is also inadequate (Figure 5).

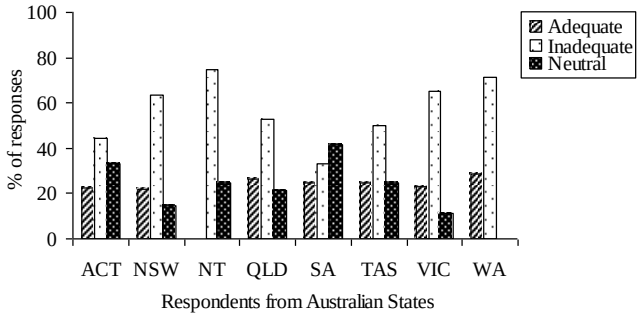


**Figure 4. Percentage of responses to question about estuarine legislation**

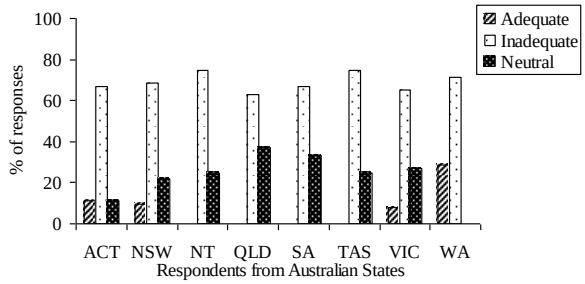


**Figure 5. Percentage of responses to question about specific estuarine legislation**

There were also additional comments from the respondents on overall legislative matter regarding estuarine management in Australia. The most important of them are cited in Box 1.

**Box 1. Summary of respondents' opinions on legislative aspects of estuary management in Australia**

- Number of estuaries covered by specific estuarine legislation is very inadequate.
- Integration of different legislation relating to estuary management is inadequate.
- Uniformity of legislation between states is lacking.
- Lack of application of existing legislation.
- Lack of linkage between the relevant legislation.
- Legal penalties for persons whose activity negatively impacts upon the estuarine environment are very inadequate.

For the institutional aspects of estuarine management, the responses indicated that in Australian states, coordination among the responsible agencies is inadequate (Figure 6). Similarly the respondents also revealed that coordination within the agencies is inadequate (Figure 7). The appropriateness of the responsible agencies for estuarine management, as indicated by the respondents, is inadequate as well (Figure 8).

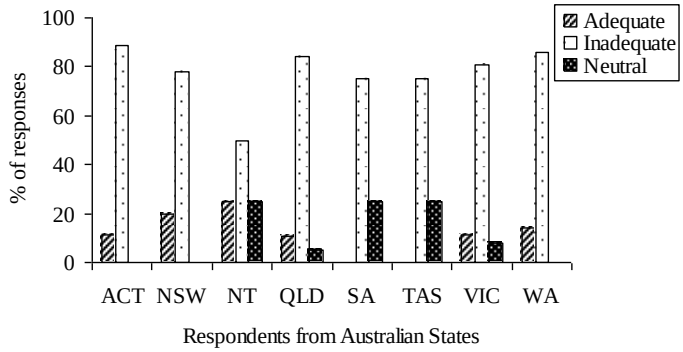


**Figure 6. Percentage of responses to question about coordination of responsible agencies**

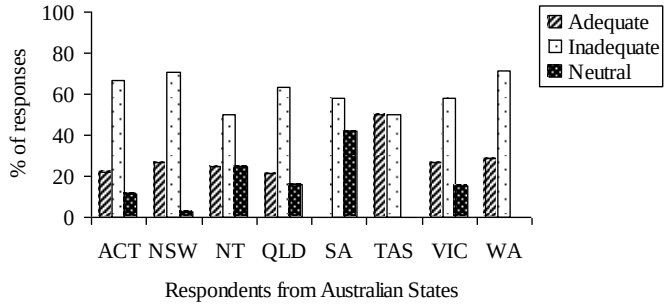


**Figure 7. Percentage of responses to question about coordination within the agencies**

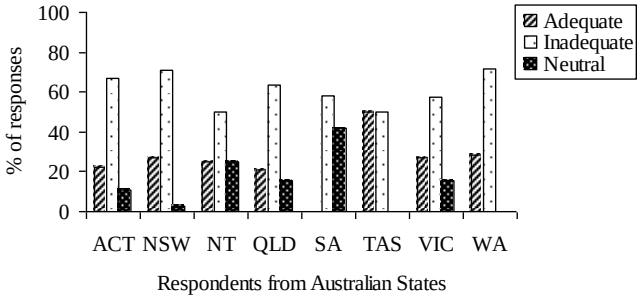


**Figure 8. Percentage of responses to question about appropriateness of responsible agencies**

There were also many relevant qualifying comments made by the respondents, the more important of which are summarized in Box 2.

**Box 2. Summary of respondents' opinions on institutional arrangements for estuary management in Australia**

- Political constraints and poor management are barriers to institutional arrangements
- Uniformity of lead agency responsible across states is lacking
- Needs the political will to force department to work together
- Agencies are committed but prevented by resourcing
- Commitment of responsible agencies to education and compliance programs is lacking
- Nomination of lead agency with legislative authority over estuarine area

Respondents were also asked to name the main agencies concerned with estuarine management in their jurisdiction. Table 5 shows the number of agencies involved with estuarine management matters as indicated by the respondents. The responses showed that respondents believe estuarine management issues are divided/shared among numerous agencies. In NSW as much as 10 agencies are involved with estuarine management issues. However, the Department of Land and Water Conservation (DLWC) and local councils are the key players for estuarine matters. In Queensland, more than five department/agencies are involved in estuarine issues, but the Environment Protection Agency (EPA) and the Brisbane City Council have major roles. Respondents in South Australia indicated that as many as six departments/agencies are involved in estuarine management (Table 5), although the Department of Environment, Heritage, and Aboriginal Affairs (DEHAA) and Primary Industries and Resources of South Australia (PIRSA) are contributing major roles.

**TABLE V**
ORGANISATIONS INVOLVED IN ESTUARINE MANAGEMENT

| Australian States | Total number of organizations involved in estuarine management |
|---|---|
| ACT | 2 |
| NSW | 10 |
| NT | 2 |
| QLD | 7 |
| SA | 6 |
| TAS | 2 |
| VIC | 9 |
| WA | 6 |

As shown in Table 5, more than eight agencies are involved with estuarine matters in Victoria. However, the Department of Natural Resources and Environment (DNRE) (now the name of the Department has been changed to Department of Environment and Primary Industries (DEPI)), Parks Victoria and Environment Protection Authority (EPA) are the key players. A few written comments from the respondents of Victoria were very interesting. One respondent reported that "there are many agencies, involved in estuarine matters, but in fact no one were in charge". Another respondent noted that "no definite agencies are involved with estuarine matter, EPA and DNRE have a few roles only". Tasmanian respondents indicated that Department of Primary Industry, Water and Environment are the only agency involved in estuarine matters. Although, the CSIRO is not a management agency, however, the organisation has had a role in developing estuarine management plans in Tasmania.

Estuarine management responsibility is divided among the six agencies/departments in Western Australia, although the Water and River Commission and the Department of Environment Protection are the main agencies. Respondents from Northern Territory reported the Department of Land Planning and Environment as the main agency. However, other departments and agencies such as Parks and Wildlife Commission, Department of Primary Industry and Fisheries, Power and Water Authorities and Local governments have significant roles to play in estuaries.

As has been seen from the respondents' responses, in Australian states, coordination of responsible agencies was viewed as currently inadequate (Figure 6). In this context, respondents were asked to comment on how any perceived coordination problems could be minimized. There were many qualitative answers from all groups of respondents, and these are summarized in Figure 9. These comments focused on three main issues; "a single lead agency is required", "a coordinating committee is required" and "a reduction in the number of agencies involved in estuarine matters is required". The comments offered by the Commonwealth Government respondents commonly focused on the need for "centralized system such as the work that National Land and Water Resources Audit (NLWRA) is doing". Responses from the State and local government respondents were centered on need for "one accountable agency with head of power; while academic/researchers comments dwelled on the need for "formation of peak scientific advisory groups". Environmental groups comments were focused on the need for "uniformity of legislation across Australia". Clearly the need for at the best a lead agency was envisaged with some groups going further to suggest legislation was required whilst others were more concerned with simply a need for greater coordination.

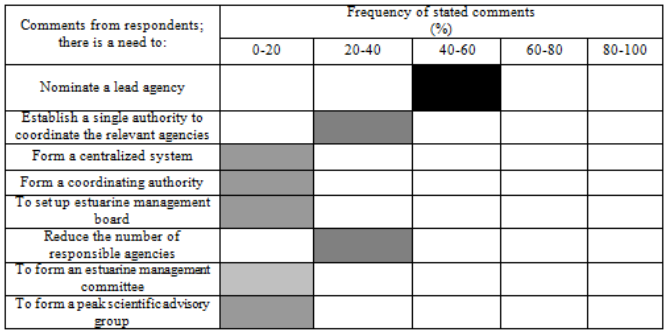


Fig. 9. Summary of respondents opinion about how the coordination problem could be improved for estuary management across Australia.

### *c) Whether a changed management system is needed for Australia*

In the United States of America, the National Estuary Program (NEP) was established in 1987 in recognition of a need for partnerships between, and within levels, of governments and between governments and the affected communities in the management of estuarine areas [26-27]. Therefore, the respondents were asked to assess whether a similar type of approach is needed by Australia. The majority across all states answered "yes" (62%), 22% replied "no" and 16% was "unknown". The statewide responses of the question are shown in Figure 10.

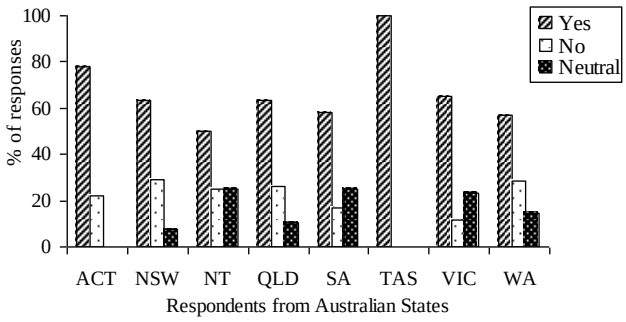


**Figure 10. Percentage of responses to the question about whether Australia needs NEP type approach**

The overall results showed that the existing system of estuary management across Australia is regarded by the practitioners as not adequate, and that it requires improved and strengthened planning, regulation and management to protect, enhance and restore the environmental well-being of estuaries. A large number of agencies are involved in estuaries, but it appears that no one has an overview or thorough understanding of all estuarine issues. The agencies are regarded as being not well coordinated. This is not surprising given that the survey reveals that the agencies have been suffering from lack of specific estuarine legislation, clear definition of responsibilities and power. Under these circumstances effective estuarine management is not possible. That is why, when the stakeholders were asked if Australia needs any alternative approach in planning and managing estuaries, the majority were positive in their responses. A large number of agencies, lack of coordination, lack of adequate legislation as well as lack of clearer definition of responsibilities have been tending stakeholders to have estuarine program "slips between the cracks of" state coastal and catchment management programs

## V. Conclusion

The critical importance of Australian estuaries has been recognized from long time. Respondents to this survey reported that the existing systems of estuarine planning and management are not properly addressing the estuarine issues. This study of the views of practitioners confirms that estuarine management programs are inadequate across Australia to meet the challenges of their use and abuse. As noted by Powell and Hershman [28], an essential ingredient for successful management and planning is assuring that a lead agency or delegated authority exists to implement estuarine planning and management [28]. However there is no dedicated lead agency for estuaries nationally or in most states. Therefore estuary management has been suffering from lack of an appropriate "guardian". Obviously the existing system of estuary management has to be changed to improve and strengthen environmental quality of estuaries. These improvements may require, among others, new policies, regulatory authority, institutional arrangement and political will. Many stakeholders, including the representatives of the Commonwealth Government, the State Government and Local Government have indicated that National Estuary Program (NEP) of USA may be the appropriate approach for Australia. On the other hand, the stakeholders have proposed several institutional arrangements for estuary management across Australia. The most important of them are: creation of a state level lead agency; coordinating authority; estuarine management committee and establishment of estuarine board. However, it is a matter of further investigation to assess which institutional arrangements would be the most appropriate for estuarine management in Australia.

## References

[1] NLWRA. 2000. Australia's Near Pristine Estuaries: Assets Worth Protecting, National Land and Water Resources Audit, Canberra, Australia.

[2] Anonymous, 2000. Australian State of the Environment Projects and Partnerships Spotlight on Australia's Estuaries. State of the Environment Reporting. The newsletter of National State of the Environment Reporting No. 10, April 2000. 3 pp.

[3] Viles, W. and Spencer, T. 1995. Coastal Problems: Geomorphology, Ecology and Society at the Coast. Edward Arnold, London, UK.

[4] Knecht, R.W., Cicin-Sain, B. and Fisk, G. 1996. Perceptions of the performance of state coastal zone management programs in the United States. *Coastal Management*, 24: 141-163.

[5] West, R.J., Thorogood, C., Walford, T. and Williams, R.J. 1985. An estuarine inventory for New South Wales, Australia. Fisheries Bulletin 2. Department of Agriculture, New South Wales, Australia.

[6] Bucher, D. and Saenger, P. 1994. A classification of tropical and subtropical Australian estuaries. *Aquatic Conservation*, 21: 1-19.

[7] Morrisey, D. 1995. Saltmarshes. In: Underwood, A.J. and Chapman, M.G. (Eds.), Coastal Marine Ecology of Temperate Australia. University of New South Wales Press, Sydney, Australia, pp.205-220.

[8] Eyre, B. 1998. Transport, retention and transformation of material in Australian estuaries. *Estuaries*, 21(4A): 540-551.

[9] Harty, C. 2000. Coastal and marine planning program. Draft South West Estuaries Coastal Action Plan. Western Coastal Board, Victoria, Australia.

[10] Government of NSW. 1992. Manual of Estuary Management. New South Wales Government, Sydney, Australia.

[11] James, R. 1998. Beach Environments: The Ecology, Use and Environmental Management of Beaches. Ph.D. Thesis, Graduate School of the Environment, Macquarie University, Australia.

[12] Hildreth, R.G. and Gale, M.K. 1995. Institutional and legal arrangements for coastal management in the Asia-Pacific region. In: Hotta, K. and Dutton, I.M. (Eds.), Coastal Management in the Asia-Pacific Region: Issues and Approaches, Japan International Marine Science and Technology Federation, Tokyo, Japan, pp. 21-37.

[13] Morrison, J. and West, R. 1996. Review of the State of the Environment 1996-Chapter 8: Estuaries and the Sea. *Australian Journal of Environmental Management*, 4: 175-177.

[14] Good, J.W., Weber, W.J. and Charland, W. J. 1999. Protecting estuaries and coastal wetlands through state coastal zone management programs. *Coastal Management*, 27:139-186.

[15] Thom, B. and Harvey, N. 2000. Triggers for late twentieth century reform of Australian coastal management. *Australian Geographical Studies*, 38(3): 275-290.

[16] Wescott, G. 2001. Integrated Coastal Zone Management in Australian States. In: Haward, M. (Ed), Integrated Ocean Management: Issues in Implementing Australia's Ocean Policy, by. Research Report No 26. CRC for Antarctica and the Southern Ocean, Hobart, Tasmania, Australia.

[17] Alder, J.1996. Have tropical marine protected areas worked? An initial analysis of their success. *Coastal Management*, 24: 97-114.

[18] Cicin-Sain, B. and Knecht, R.W. 1998. Integrated Coastal and cean Management: Concepts and Practice. Island press, Washington D.C., USA.

[19] Krausse, G.H. 1995. Tourism and waterfront renewal: assessing residential perception in Newport; Rhode Island, USA. *Ocean and Coastal Management*, 26(3): 179-203.
[20] Coffen-Smout, S.S. 1996. Final Report of the Canadian Ocean Assessment: a review of Canadian Ocean Policy and Practice. International Ocean Institute, Halifax, Canada.
[21] Bernard, H.B. 1988. Research Methods in Cultural Anthropology. London Sage.
[22] Coakes, S. and Steed, L. 1996. SPSS for Windows: Analysis Without Anguish. John Wiley and Sons, Milton, Queensland, Australia.
[23] Munro, B.H., Visintainer, M.A. and Page, E.B. 1986. Statistical Methods for Health Care Research. Lippincot, Philadelphia.
[24] Sarantakos, S. 1998. Social Research, 2nd edition. Macmillan Publishers, Melbourne, Australia.
[25] Argyrous, G. 1996. Statistics for Social Research. Macmillan Education Australia Pty. Ltd.
[26] Imperial, M.T., Robadu, D. Jr. and Hennessey, T. 1992. An evolutionary perspective on the development and assessment of the National Estuary Program. *Coastal Management*, 20:311-341.
[27] Bearden, D.M. 2001. National Estuary Program: A Collaborative Approach to Protecting Coastal Water Quality. Congressional Research Service, Report for Congress. The National Council for Science and the Environment, USA.
[28] Powell, S.L. and Hershman, M.J. 1991. Contribution of State CZM programs to improved Coastal Water Quality. *NCRI Publication No NCRI-T-91-012*.